REQUEST FOR PROPOSALS
("RFP")

FOR

PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT
CRRA HARTFORD LANDFILL

(RFP Number FY13-EN-003)

PROPOSAL DUE DATE – APRIL 23, 2013

Connecticut Resources Recovery Authority
100 Constitution Plaza, 6th Floor
Hartford, Connecticut 06103-1722

MARCH 18, 2013

REQUEST FOR PROPOSALS
For
PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT
CRRA HARTFORD LANDFILL

(RFP Number 13-EN-003)

Connecticut Resources Recovery Authority
100 Constitution Plaza, 6th Floor
Hartford, Connecticut 06103-1722

TABLE OF CONTENTS

REQUEST FOR PROPOSALS

FOR

PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT
CONNECTICUT RESOURCES RECOVERY AUTHORITY
HARTFORD LANDFILL

SECTION 1

NOTICE TO CONTRACTORS
REQUEST FOR PROPOSALS

CONNECTICUT RESOURCES RECOVERY AUTHORITY

NOTICE TO CONTRACTORS – REQUEST FOR PROPOSALS

CRRA is a quasi-public entity, a body politic and corporate, created pursuant to C.G.S. Chapter 446e, Section 22a-261, as a public instrumentality and political subdivision of the State of Connecticut (the "State"). CRRA has the responsibility for developing and implementing environmentally sound solutions and best practices for solid waste disposal and recycling on behalf of, and in the best interests of the municipalities and residents of the State of Connecticut.

CRRA is seeking proposals from qualified contractors to furnish all labor, materials, and equipment to complete the PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT-CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL (the "Work"), located at 180 Leibert Road (in the North Meadows off of Exit 33 on I-91) in Hartford, Connecticut 06120.

The work will be subject to the State of Connecticut's prevailing wage requirements.

Request For Proposal ("RFP") package documents may be obtained on the World Wide Web at http://www.crra.org under the "Business Opportunities" page beginning **Monday, March 18, 2013.** The documents will also be available Monday through Friday, from 8:30 a.m. to 5:00 p.m. at the offices of CRRA, 100 Constitution Plaza, 6th Floor, Hartford, Connecticut 06103-1722, beginning on the same date. Anyone intending to pick up the documents at CRRA's offices must contact Roger Guzowski [(860) 757-7703] at least 24 hours in advance. There is a charge of $200.00 for anyone picking up the documents at CRRA's office. Payment should be made by check payable to "Connecticut Resources Recovery Authority."

There will be a **mandatory pre-proposal conference and site tour for prospective proposers at the Hartford Landfill at 10am, Eastern Time, Tuesday, April 2, 2013. Any prospective proposer intending to participate in the mandatory pre-proposal conference and the site tour should notify CRRA by submitting the Notice of Interest Form (**Section 3 of the proposal package documents) to Roger Guzowski (rguzowski@crra.org or (860) 757-7703) by 3pm Eastern Time, Friday, March 29, 2013.

Sealed proposals will be received at the offices of CRRA, 100 Constitution Plaza, 6th Floor, Hartford, Connecticut 06103-1722 no later than 3pm Eastern Time on Tuesday, April 23, 2013. Proposals received after the time and date set forth above shall be rejected. All proposals shall remain open for ninety (90) days after the proposal due date.

Proposals will be opened at CRRA's convenience on or after the proposal due date. CRRA reserves the right to waive any informality or informalities in any proposal or the proposal process and to reject any or all of the proposals, or any part(s) thereof. Note that all information submitted by proposer is subject to the Freedom of Information Act.

CRRA is an Equal Opportunity and Affirmative Action employer and does not discriminate in its hiring, employment, contracting, or business practices. CRRA is committed to complying with the Americans with Disability Act of 1990 (ADA) and does not discriminate on the basis of disability in admission to, access to, or operation of its programs, services, or activities.

All questions regarding this RFP must be submitted **in writing** to Roger Guzowski, Contract and Procurement Manager, by e-mail (rguzowski@crra.org) by fax (860) 757-7742), or by correspondence (CRRA, 100 Constitution Plaza, 6th Floor, Hartford, Connecticut 06103) no later than 3:00pm on Tuesday, April 9, 2013**.** Any firm considering submitting a proposal is prohibited from having any communications about this RFP or any resulting contract with any CRRA staff member or CRRA Board member except Mr. Guzowski.

REQUEST FOR PROPOSALS

FOR

PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT
CONNECTICUT RESOURCES RECOVERY AUTHORITY
HARTFORD LANDFILL

SECTION 2

INSTRUCTIONS TO PROPOSERS

INSTRUCTIONS TO PROPOSERS

PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT
CONNECTICUT RESOURCES RECOVERY AUTHORITY
HARTFORD LANDFILL

(RFP Number FY13-EN-003)

CONTENTS

1. Introduction

CRRA is a quasi-public entity, a body politic and corporate, created pursuant to C.G.S. Chapter 446e, Section 22a-261, as a public instrumentality and political subdivision of the State of Connecticut (the "State"). CRRA has the responsibility for developing and implementing environmentally sound solutions and best practices for solid waste disposal and recycling on behalf of, and in the best interests of the municipalities and residents of the State of Connecticut.

CRRA is seeking Proposals from qualified contractors to furnish all labor, materials, and equipment to perform PHASE II CLOSURE AND SOLAR PV INSTALLATION for

CRRA's Hartford landfill (the "Work"), located at 180 Leibert Road (in the North Meadows off of Exit 33 on I-91) in Hartford, Connecticut 06120.

2. RFP Projected Timeline

The following is the projected timeline for the RFP process:

ITEM	DATE
RFP Documents Available	March 18, 2013
Mandatory Pre-Proposal Conference	10am, April 2, 2013
Deadline for Written Questions	3pm, April 9, 2013
Response to Written Questions	April 18, 2013
Proposals Due at CRRA	3pm, April 23, 2013

CRRA reserves the right at its sole and absolute discretion to extend any of the actual or proposed dates in the above Projected Timeline and further reserves the right to reject any and all Proposals and republish this RFP. CRRA also reserves the right at its sole and absolute discretion to terminate this RFP process at any time prior to the execution of any Agreement.

3. Definitions

As used in this Instructions To Proposers and in other Contract Documents (as defined herein), the following terms shall have the meanings as set forth below:

(a) **Addenda**: Written or graphic documents issued prior to the Proposal due date that clarify, correct or change any or all of the Contract Documents.

(b) **Contract Documents**:

(1) Agreement For PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT - CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL (the "Agreement");
(2) RFP Package Documents (defined below)
(3) Addenda;
(4) Contractor's Proposal (including all documentation attached to or accompanying such Proposal, all other documentation submitted in connection with such Proposal, and all post-Proposal documentation submitted prior to the Notice Of Award);
(5) Notice Of Award, with Contractor Certification Concerning Gifts, Affidavit Concerning Consulting Fees, and Affirmation Concerning The

State Of Connecticut State Ethics Lawattached [to be executed by successful Proposer]; and

(6) Any written amendments to the Agreement.

(c) **Landfill:** The CRRA Hartford Landfill.

(d) **Laws And Regulations**: Any and all applicable laws, rules, regulations, ordinances, codes, orders and permits of any and all federal, state and local governmental and quasi-governmental bodies, agencies, authorities and courts having jurisdiction.

(e) **Notice Of Award**: Written notification from CRRA to the apparent successful Proposer that states that CRRA has accepted such Proposer's Proposal and sets forth the remaining conditions that must be fulfilled by such Proposer before CRRA executes the Agreement.

(f) **Project**: The provision by the successful Proposer of PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT - CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL, in accordance with the Contract Documents.

(g) **Property**: The certain parcel of real property leased by CRRA located at 180 Leibert Road in Hartford, Connecticut, upon which property CRRA operates a certain sanitary landfill known as the Hartford Landfill (the "Hartford Landfill");

(h) **RFP Package Documents**:

1. Notice To Contractors – Request For Proposals;
2. Instructions To Proposers;
3. Notice of Interest Form
4. Proposal Bond Form;
5. Required Proposal Forms
   - 5.1. Proposal Form
   - 5.2. Payment Rate Schedule Form;
   - 5.3. Firm Background and Experience Form
   - 5.4. Personnel Background and Experience Form
   - 5.5. References Form;
   - 5.6. Subcontractor Identification Form;
   - 5.7. Questionnaire Concerning Affirmative Action, Small Business Contractors And Occupational Health And Safety;
   - 5.8. Affidavit Concerning Nondiscrimination;
   - 5.9. Proposer's Background Questionnaire;
   - 5.10. Business Disclosure Form
   - 5.11. Business Exception Form
   - 5.12. Affirmation Concerning The State Of Connecticut Ethics Law
   - 5.13. Guide To The Code Of Ethics For Current Or Potential State Contractors

5.14. SEEC Form 11, Notice To Executive Branch State Contractors And Prospective State Contractors Of Campaign Contribution And Solicitation Ban.

6. (Sample) Notices
   6.1. Notice Of Award
   6.2. Notice To Proceed
7. (Form of) Agreement PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT - CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL, including:
   - Exhibit A – Construction Drawings
   - Exhibit B – General Requirements
   - Exhibit C – Technical Specifications
   - Exhibit D – Project Schedule
   - Exhibit E – Compensation Schedule
   - Exhibit F – CRRA's Travel And Expense Reporting Policy And Procedure
   - Exhibit G – Performance Security (Performance Bond/LOC Forms)
   - Exhibit H – Payment Security (Payment Bond Form)
   - Exhibit I – Contractor's Wage Certification Form
   - Exhibit J – Schedule of Prevailing Wages
   - Exhibit K – Contracting Agency Certification Form
   - Exhibit L – SEEC Form 11, Notice To Executive Branch State Contractors And Prospective State Contractors Of Campaign Contribution And Solicitation Ban
   - Exhibit M – Affirmation Concerning The State Of Connecticut State Ethics Law
   - Exhibit N – Subcontractor Or Consultant's Affirmation Concerning The State Of Connecticut State Ethics Law
   - Exhibit O – Guide To The Code Of Ethics Concerning The State Of Connecticut State Ethics Law
   - Exhibit P – Affidavit Concerning Nondiscrimination [as submitted in proposal]
   - Exhibit Q – Affidavit Concerning Consulting Fees [to be executed by successful Proposer]
   - Exhibit R – Contractor's Certification Concerning Gifts [to be executed by successful proposer]
   - Exhibit S - CRRA President's Certification Concerning Gifts

(i) **Site**: Those areas of the Property upon which any of the Work is to be performed, furnished and completed by the successful Proposer in accordance with the Contract Documents.

Terms used, but not defined, in this Instructions To Proposers shall have the same respective meanings assigned to such terms in the Agreement.

4. Communications With CRRA Staff and Board Members

Except as otherwise authorized by this Instructions To Proposers, during the period while the RFP process is active (i.e., from the date CRRA issues the RFP until the date the successful Proposer accepts the Notice Of Award), contractors contemplating or preparing Proposals are prohibited from having any communications about this RPF or any resulting contract with any CRRA staff member or CRRA Board member. A contractor's RFP submission shall be rejected if any of the foregoing ex parte communications take place.

5. Scope Of Work

CRRA is seeking Proposals from qualified contractors to furnish all labor, materials, and equipment to perform PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT - CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL (the "Work"). Specific instructions about how the Work is to be performed are included in the RFP Package Documents.

The successful Proposer will be required to provide both a Performance Security and a Payment Security, each in the amount of 100% of the Proposal price, for the entire period of time that work is being performed under the Agreement. The ESTIMATED VALUE of the work is NINE MILLION ($9,000,000) dollars.

6. Availability of RFP Package Documents

Complete sets of the RFP Package Documents may be obtained on the World Wide Web beginning March 18, 2013 at: http://www.crra.org under the "Business Opportunities" page; select the "PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT - CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL" link.

The RFP Package Documents are in PDF format. All of the forms included in the documents are also available for downloading in Microsoft Word format at the same place on CRRA's web site where the PDF of the RFP is located. Prospective Proposers can fill the forms out by typing the answers on their computer's keyboard. The forms can then be printed and submitted with the Proposal. CRRA encourages firms to make use of the downloaded Word forms.

The RFP Package Documents are also available Monday through Friday, from 8:30 a.m. to 5:00 p.m. at CRRA's offices, 100 Constitution Plaza, 6th Floor, Hartford, Connecticut 06103-1722, beginning on the same date. Anyone intending to pick up the documents at CRRA's offices must contact Roger Guzowski [(860) 757-7703] at least 24 hours in advance. There is a charge of $200.00 for anyone picking up the documents at CRRA's office. Payment should be made by check payable to "Connecticut Resources Recovery Authority."

7. Mandatory Pre-Proposal Conference And Site Tour

There will be a mandatory pre-Proposal conference and site tour for all prospective Proposers. The mandatory pre-Proposal conference will be held at the Hartford Landfill, 180 Leibert Road, Hartford, Connecticut 06120 at 10:00 a.m., Tuesday, April 2, 2013. . Any prospective Proposer intending to participate in the pre-Proposal conference and the site tour should notify CRRA by submitting the Notice of Interest Form (section 3 of this RFP packet) to Roger Guzowski (rguzowski@crra.org or (860) 757-7703) **by 3:00pm, Friday, March 29, 2013.**

CRRA reserves the right to reschedule the mandatory pre-Proposal conference and site tour due to inclement weather, or any other reason, at the sole discretion of CRRA.

Proposals submitted by a Proposer who did not attend the mandatory pre-Proposal conference and site tour shall be rejected. Alternate times for visiting the Hartford Landfill, other than this mandatory pre-Proposal conference and site tour, will not be allowed.

8. Addenda And Interpretations

CRRA may issue Addenda to the RFP Package Documents that shall, upon issuance, become part of this package and binding upon all potential or actual Proposers for the Work. Such Addenda may be issued in response to requests for interpretation or clarification received from potential Proposers. Any request for interpretation or clarification of any documents included in the RFP Package Documents must be **submitted in writing to** Roger Guzowski (rguzowski@crra.org**), by fax ((860) 757-7742), or by correspondence (CRRA, 100 Constitution Plaza, 6th Floor, Hartford, Connecticut 06103-1722). To be given consideration, any such written request must be received by CRRA by 3:00 p.m., Tueday, April 9, 2013.**

Addenda, if any, issued prior to the mandatory pre-Proposal conference and site tour will be mailed and/or e-mailed to all persons have by that time submitted a Notice Of Interest Form to CRRA. Such addenda will also be posted on CRRA's web site (http://www.crra.org on the "Business Opportunities" page under the "PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT - CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL" heading).

Addenda issued after the mandatory pre-Proposal conference and site tour will be mailed and/or e-mailed to all persons who attended the pre-Proposal conference and site tour and will be posted on CRRA's web site (http://www.crra.org on the "Business Opportunities" page under the "PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT - CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL" heading). Such addenda will be mailed/e-mailed and posted on the web site no later than three (3) days before the submittal deadline.

Failure of any Proposer to receive any such Addenda shall not relieve such Proposer from any conditions stipulated in such Addenda. Only questions answered or issues addressed by formal written Addenda will be binding. **All oral and other written responses, state-**

ments, interpretations or clarifications shall be without legal effect and shall not be binding upon CRRA.

9. Proposal Submittal Procedures

Sealed Proposals shall be submitted no later than 3:00 p.m., Eastern Time, Tuesday, April 23, 2013 at the offices of CRRA, 100 Constitution Plaza, 6th Floor, Hartford, Connecticut 06103-1722, Attn: Roger Guzowski. Proposals received after the time and date set forth above shall be rejected.

Each Proposer must submit one (1) original and two (2) copies of its Proposal. The original Proposal shall be stamped or otherwise marked as such.

Each Proposal (the original and two copies) shall be enclosed in a sealed envelope that shall be clearly marked "PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT - CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL"

Proposals shall remain open and subject to acceptance for ninety (90) days after the Proposal due date.

The terms and conditions of the Agreement (Section 7 of the RFP Package Documents), as attached, are non-negotiable, other than as set forth on the Business Exception Form (Section 5.11 of the RFP Package Documents). Any potential Proposer that will be unable to execute the Agreement, substantially as attached, should not submit a Proposal.

Proposals may be modified or withdrawn by an appropriate document duly executed (in the manner that a Proposal must be executed) and delivered to the place where Proposals are to be submitted at any time prior to the Proposal due date.

10. Proposal Security

Each Proposal shall be accompanied by a Proposal Security. Any Proposal that does not contain a Proposal Security or any Proposal that contains a Proposal Security that does not comply with the following requirements shall be rejected as non-responsive.

10.1 Amount of Security

The Proposal Security shall be in the amount of **Five Percent of the Proposal Price**.

10.2 Type of Security

The following are the acceptable forms of Proposal Security:

(a) A cashier's check;

(b) A certified check; or

(c) A Proposal bond in the form included in Section 3 of the RFP Package Documents.

The Proposal Security shall be made payable to CRRA.

Any Proposal bond submitted as Proposal Security shall be in the form provided for such Proposal bond in Section 4 of the RFP Package Documents and such Proposal bond shall be executed and issued by a surety company acceptable to CRRA. Any Proposal that does not contain the above requisite Proposal Security or any Proposal that contains Proposal Security that does not comply with the foregoing requirements shall be rejected as non-responsive.

10.3 Disposition of Proposal Security

The Proposal Security of the successful Proposer will be retained until such Proposer has executed the Agreement, furnished the required contract security and satisfied all other conditions of the Notice of Award, including execution and submission of the Contractor's Certification Concerning Gifts, whereupon such Proposal Security will be returned.

If the successful Proposer fails to execute and deliver the Agreement, furnish the required contract security, or satisfy all other conditions of the Notice Of Award within ten (10) days after the issuance of such Notice Of Award, CRRA may annul the Notice Of Award and the Proposal Security of that Proposer shall be forfeited.

The Proposal Security of other Proposers whom CRRA believes to have a reasonable chance of receiving the award may be retained by CRRA until the earlier of the seventh (7^{th}) day after the Effective Date of the Agreement or ninety (90) days after the Proposal due date, whereupon the Proposal Security furnished by such Proposers will be returned. Proposal Security with Proposals that are not competitive will be returned within seven (7) days after the opening of such Proposals.

11. Proposal Contents

Proposals shall be submitted on forms provided by CRRA as part of this Proposal package, all of which forms must be completed with the appropriate information required and all blanks on such forms filled in.

A Proposal must consist of the following and must be in the following order:

(a) Title page, including the title of the project, the name of the Proposer and the date the Proposal is submitted;

(b) Cover letter, signed by a person authorized to commit the Proposer to the contractual arrangements with CRRA, which includes the following:

(1) The name of the Proposer;
(2) The legal structure of the Proposer (e.g., corporation, joint venture, etc.);
(3) A clear statement indicating that the attached Proposal constitutes a firm and binding offer by the Proposer to CRRA considering the terms and conditions outlined in the RFP and noting any technical exceptions taken thereto; and
(4) The Proposer's promise, if any, to set aside a portion of the contract for legitimate minority business enterprises (see Section 13.2 of this Instructions To Proposers);

(c) Table of Contents;

(d) Proposal Security (cashier's check, certified check or Proposal bond) (see Section 10 of this Instructions To Proposers);

(e) The Proposal Form (Section 5.1 of the RFP Package Documents), with Addenda, if any, listed in the appropriate place (Page 2), the name and address of the contact for Notices listed in the appropriate place (Page 7) and the completed agreement section (Page 7);

(f) The completed Proposal Payment Rate Schedule Form (Section 5.2 of the RFP Package Documents);

(g) The completed Firm Background And Experience Form (section 5.3 of the RFP Package Documents);

(h) The completed Personnel Background And Experience Form (section 5.4 of the RFP Package Documents);

(i) The completed References Form (Section 5.5 of the RFP Package Documents);

(j) The completed Subcontractor Identification Form (Section 5.6 of the RFP Package Documents);

(k) The completed Questionnaire Concerning Affirmative Action, Small Business Contractors And Occupational Health And Safety form (Section 5.7 of the RFP Package Documents), with the Proposer's most recent EEO-1 data attached if the Proposer wishes such data to be considered in the evaluation of its Proposal;

(l) The completed Affidavit Concerning Nondiscrimination (Section 5.8 of the RFP Package Documents), with the Proposer's nondiscrimination policies and procedures attached;

(m) The completed Proposer's Background Questionnaire (Section 5.9 of the RFP Package Documents);

(n) The completed Proposer's Disclosure Form (Section 5.10 of the RFP Package Documents);

(o) The completed Business Exception Form (Section 5.11 of the RFP Package Documents);

(p) The complete Affirmation Concerning The State Of Connecticut Ethics Law (Section 5.12 of the RFP Package Documents); and

(q) A copy of the Proposer's up-to-date certificate of insurance showing all current insurance coverage.

Proposers should not include in their Proposals other portions of the RFP Package Documents (e.g., this Instructions To Proposers or the Agreement).

A Proposer may include additional information as an addendum/appendix to its Proposal if the Proposer thinks that it will assist CRRA in evaluating the Proposer's Proposal. A Proposer should not include information that is not directly related to the subject matter of this solicitation.

12. Proposal Opening

All Proposals will be opened at CRRA's convenience on or after the Proposal due date.

CRRA reserves the right to reject any or all of the Proposals, or any part(s) thereof, and/or to waive any informality or informalities in any Proposal or the RFP process for this Project.

13. CRRA Reserved Rights

In addition to the other rights in this Request for Proposals, CRRA reserves, holds and may exercise at its sole discretion, the following rights and options:

(a) To supplement, amend, or otherwise modify or cancel this Request for Proposals with or without substitution of another Request for Proposals;
(b) To issue additional or subsequent solicitations for proposals;
(c) To conduct investigations of the proposers and their proposals;
(d) To clarify the information provided pursuant to this Request for Proposals;
(e) To request additional evidence or documentation to support the information included in any proposal;
(f) To enter into contract discussion with one or more entities having submitted a proposal; and
(g) To reject any and all proposals, or parts thereof, and/or to waive any informality or informalities in any of the proposals or the proposal process for the RFP, if such rejection or waiver is deemed in the best interests of CRRA.

14. Proposal Evaluation

The award of the contract for the Work will be made, if at all, to the Proposer(s) whose evaluation by CRRA results in CRRA determining that such award to such Proposer(s) is

in the best interests of CRRA. **However, the selection of a Proposer(s) and the award of such contract, while anticipated, are not guaranteed**.

CRRA is an Equal Opportunity and Affirmative Action employer and does not discriminate in its hiring, employment, contracting, or business practices. CRRA is committed to complying with the Americans with Disability Act of 1990 (ADA) and does not discriminate on the basis of disability in admission to, access to, or operation of its programs, services, or activities.

14.1 Evaluation Criteria

CRRA will base its evaluation of the Proposals on price, qualifications, demonstrated skill, ability and integrity of each Proposer to perform the Work required by the Contract Documents and any other factor or criterion that CRRA, in its sole discretion, deems or may deem relevant or pertinent for such evaluation. Evaluation criteria will include, but may not be limited to:

a. Price

   CRRA will evaluate Proposal prices based on the prices provided by the Proposer on the Payment Rate Schedule Form.

b. Landfill Cap and Photovoltaic System Construction Experience of Proposer and Subcontractors

   The Background and Experience Form includes questions regarding the experience and background of the Proposer. Proposals will be ranked based on the level of landfill cap and photovoltaic system construction experience of the Proposer/Subcontractors.

c. Long Term Operation and Maintenance Cost

   CRRA will evaluate the expected long term operation and maintenance costs of each proposers landfill capping and photovoltaic systems.

14.2 Affirmative Action Evaluation Criteria

Proposals will also be rated on the Proposer's demonstrated commitment to affirmative action. Sections 46a-68-1 to 46a-68-17 of the *Regulations of Connecticut State Agencies* require CRRA to consider the following factors when awarding a contract that is subject to contract compliance requirements:

(a) The Proposer's success in implementing an affirmative action plan (See Question 4 of the Questionnaire Concerning Affirmative Action, Small Business Contractors And Occupational Health And Safety (Section 5.7 of the RFP Package Documents));

(b) The Proposer's success in developing an apprenticeship program complying with Sections 46a-68-1 to 46a-68-17 of the *Regulations of Connecticut State Agencies*, inclusive (See Question 5 of the Questionnaire Concerning Affirmative Action, Small Business Contractors And Occupational Health And Safety (Section 5.7 of the RFP Package Documents));

(c) The Proposer's promise to develop and implement a successful affirmative action plan (See Question 4B of the Questionnaire Concerning Affirmative Action, Small Business Contractors And Occupational Health And Safety (Section 5.7 of the RFP Package Documents));

(d) The Proposer's submission of EEO-1 data indicating that the composition of its work force is at or near parity when compared to the racial and sexual composition of the work force in the relevant labor market area (See Section 11(k) of this Instructions To Proposers); and

(e) The Proposer's promise to set aside a portion of the contract for legitimate minority business enterprises (See Section 11(b) of this Instructions To Proposers).

15. Contract Award

If the contract is to be awarded, CRRA will issue to the successful Proposer(s) a Notice Of Award within one hundred (100) days after the Proposal due date.

CRRA reserves the right to correct inaccurate awards resulting from CRRA's errors. This may include, in extreme circumstances, revoking a Notice Of Award already made to a Proposer and subsequently awarding the Notice of Award to another Proposer. Such action by CRRA shall not constitute a breach of this RFP by CRRA since the Notice Of Award to the initial Proposer is deemed to be void ab initio and of no effect as if no Agreement ever existed between CRRA and the initial Proposer.

16. Affidavit Concerning Consulting Fees

Pursuant to *Connecticut General Statutes* Section 4a-81, the apparently successful proposer(s) must submit an affidavit stating that, except as specified in the affidavit, it has not entered into any contract with a consultant in connection with the RFP whereby any duties of the consultant pursuant to the contract require the consultant to pursue communications concerning the business of CRRA, whether or not direct contact with CRRA was expected or made. The affidavit is enclosed as Exhibit Q of the Form of the Agreement (Section 7 of the RFP Package Documents).

17. Contractor's Certification Concerning Gifts

Pursuant to *Connecticut General Statutes* Section 4-252, the apparently successful Proposer(s) must submit a document certifying that it has not given any gifts to certain individuals between the date CRRA started planning the RFP and the date the Agreement is executed. If the apparently successful Proposer does not execute the Certification, it will be disqualified for the Agreement. The dates between which the Proposer may not give gifts and the identities of those to whom it may not give gifts are specified in the attachment to the Notice Of Award included in the RFP Package Documents (see Exhibit R to Section 7 of the RFP Package Documents).

18. Prevailing Wage

The Work will be subject to the Prevailing Wage provisions of the *Connecticut General Statutes*. (See Section 8.7 of the Agreement.)

19. Proposer's Qualifications

CRRA may make any investigation deemed necessary to determine the ability of any Proposer to perform the Work required. Each Proposer shall furnish CRRA with all such information as may be required for this purpose.

20. Proposal Preparation And Other Costs

Each Proposer shall be solely responsible for all costs and expenses associated with the preparation and/or submission of its Proposal, or incurred in connection with any interviews and negotiations with CRRA, and CRRA shall have no responsibility or liability whatsoever for any such costs and expenses.

REQUEST FOR PROPOSALS

FOR

PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT
CONNECTICUT RESOURCES RECOVERY AUTHORITY
HARTFORD LANDFILL

SECTION 3

NOTICE OF INTEREST FORM

CONNECTICUT RESOURCES RECOVERY AUTHORITY

NOTICE OF INTEREST FORM

Individuals and firms that have an interest in attending the **MANDATORY** pre-proposal meeting and site tour for this RFP **on April 2, 2013** should submit this Notice of Interest Form to CRRA as early as they can. Forms should be submitted no later than the date specified below. Request For Bids/Proposals/ Qualifications documents and other information released by CRRA related to the solicitation will be directly provided to those firms that have submitted this Form to CRRA by the Form Due Date.

Solicitation:	**PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT-CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL**
RFB/P/Q Number:	**13-EN-003**
Form Due Time/Date:	**3:00 p.m., Friday, March 29, 2013** ***(Mandatory meeting and tour is 10am on Tuesday, April 2, 2013.)***

Provide the following information about the individual/firm and the contact person for the firm.

Name of Individual/Firm:	
Name of Contact Person:	
Title of Contact Person:	
Mailing Address 1:	
Mailing Address 2:	
City, State, Zip Code	
Telephone Number:	
Fax Number:	
E-Mail Address:	

Submit this form to the CRRA contact listed below via e-mail, fax or correspondence as listed below.

CRRA Contact:	**Roger Guzowski**
E-Mail Address:	**rguzowski@crra.org**
Fax Number:	**(860) 757-7742**
Correspondence Address:	Connecticut Resources Recovery Authority 100 Constitution Plaza, 6th Floor Hartford, CT 06103

REQUEST FOR PROPOSALS

FOR

PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT
CONNECTICUT RESOURCES RECOVERY AUTHORITY
HARTFORD LANDFILL

SECTION 4

PROPOSAL BOND FORM

BID/PROPOSAL BOND FORM

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable. The below addresses are to be used for giving required notice.

BIDDER/PROPOSER (Name and Address):	**SURETY** (Name and Address of Principal Place of Business):

OWNER (Name and Address):

Connecticut Resources Recovery Authority
100 Constitution Plaza, 6th Floor
Hartford, CT 06103-1722

BID/PROPOSAL

DUE DATE:	April 23, 2013
AMOUNT:	5% of Bid Price
PROJECT DESCRIPTION (Including Name and Location):	PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT- CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL Connecticut Resources Recovery Authority 100 Constitution Plaza, 6th Floor Hartford, Connecticut 06103

BOND

BOND NUMBER:	
DATE (Not later than Bid/Proposal Due Date):	
PENAL SUM:	DOLLARS ($)

IN WITNESS WHEREOF, Surety and Bidder/Proposer, intending to be legally bound hereby, subject to the terms printed on Page 2 hereof, do each cause this Bid/Proposal Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

BIDDER/PROPOSER		**SURETY**	
	(SEAL)		(SEAL)
Bidder's Name and Corporate Seal		Surety's Name and Corporate Seal	
SIGNATURE:		**SIGNATURE:**	
NAME AND TITLE:		**NAME AND TITLE:**	

TERMS AND CONDITIONS TO BID/PROPOSAL BOND

1. Bidder/Proposer and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to pay to Owner upon default of Bidder/Proposer any difference between the total amount of Bidder's/Proposer's bid/proposal and the total amount of the bid/proposal of the next lowest, responsible and responsive bidder/proposer as determined by Owner for the Work/Service required by the Contract Documents, provided that:
   1.1 If there is no such next lowest, responsible and responsive bidder/proposer, and Owner does not abandon the Project, then Bidder/Proposer and Surety shall pay to Owner the penal sum set forth on the face of this Bond, and
   1.2 In no event shall Bidder's/Proposer's and Surety's obligation hereunder exceed the penal sum set forth on the face of this Bond.
2. Default of Bidder/Proposer shall occur upon the failure of Bidder/Proposer to deliver within the time required by the Bid/Proposal Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement and related documents required by the Bid/Proposal Documents and any performance and payment bonds required by the Bid/Proposal Documents and Contract Documents.
3. This obligation shall be null and void if:
   3.1 Owner accepts Bidder's/Proposer's bid/proposal and bidder/proposer delivers within the time required by the Bid/Proposal Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement and related documents required by the Bid/Proposal Documents and any performance and payments bonds required by the Bid/Proposal Documents and Contract Documents, or
   3.2 All bids/proposals are rejected by Owner, or
   3.3 Owner fails to issue a notice of award to Bidder/ Proposer within the time specified in the Bid/Proposal Documents (or any extension thereof agreed to in writing by Bidder/Proposer and, if applicable, consented to by Surety when required by paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default by Bidder/Proposer and within 30 calendar days after receipt by Bidder/Proposer and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue notice of award agreed to in writing by Owner and Bidder/Proposer, provided that the total time for issuing notice of award including extensions shall not in the aggregate exceed 120 days from Bid/Proposal Due Date without Surety's written consent.
6. No suit or action shall be commenced under this Bond prior to 30 calendar days after the notice of default required in paragraph 4 above is received by Bidder/Proposer and Surety and in no case later than one year after Bid/Proposal Due Date.
7. Any suit or action under this Bond shall be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder shall be in writing and sent to Bidder/Proposer and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier or by United States Registered or Certified Mail, return receipt requested, postage pre-paid, and shall be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent or representative who executed this Bond on behalf of Surety to execute, seal and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond shall be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable provision of any applicable statute, then the provision of said statute shall govern and the remainder of this Bond that is not in conflict therewith shall continue in full force and effect.

REQUEST FOR PROPOSALS

FOR

PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT
CONNECTICUT RESOURCES RECOVERY AUTHORITY
HARTFORD LANDFILL

SECTION 5

REQUIRED PROPOSAL FORMS

CONNECTICUT RESOURCES RECOVERY AUTHORITY

PROPOSAL FORM

RFP NUMBER: FY13-EN-003

CONTRACT FOR: PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT-CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL

PROPOSAL SUBMITTED TO: Connecticut Resources Recovery Authority
100 Constitution Plaza, 6th Floor
Hartford, Connecticut 06103-1722

1. DEFINITIONS

Unless otherwise defined herein, all terms that are not defined and used in this Proposal Form (a "Proposal") shall have the same respective meanings assigned to such terms in the Contract Documents.

2. TERMS AND CONDITIONS

The undersigned (the "Proposer") accepts and agrees to all terms and conditions of the Request For Proposals, Instructions To Proposers, the Agreement and any Addenda to any such documents. This Proposal shall remain open and subject to acceptance for ninety (90) days after the Proposal due date.

If CRRA issues a Notice Of Award to Proposer, Proposer shall within ten (10) days after the date thereof:

(a) Execute and deliver to CRRA the required number of counterparts of the non-negotiable Agreement;

(b) Execute and deliver to CRRA the Contractor's Certification Concerning Gifts;

(c) Deliver to CRRA the requisite certificates of insurance;

(d) Execute and deliver to all other Contract Documents attached to the Notice Of Award along with any other documents required by the Contract Documents; and

(e) Satisfy all other conditions of the Notice Of Award.

3. PROPOSER'S OBLIGATIONS

Proposer proposes and agrees, if this Proposal is accepted by CRRA and CRRA issues a Notice Of Award to Proposer, to the following:

(a) To perform, furnish and complete all the Work as specified or indicated in the Contract Documents and Agreement at the rates specified in Proposal Payment Rate Schedule Price set forth in this Proposal, in accordance with the terms and conditions of the Contract Documents and Agreement and in accordance with any specific Request For Work entered into between the successful Proposer and CRRA; and

(b) At the request of CRRA and if the successful Proposer qualifies, to apply with the State of Connecticut Department Administrative Services, and do all that is necessary to make itself qualify, as a Small Contractor and/or Minority/Women/ Disabled Person Business Enterprise in accordance with Section 4a-60g of the *Connecticut General Statutes*.

4. PROPOSER'S REPRESENTATIONS CONCERNING NON-NEGOTIABILITY OF THE AGREEMENT

In submitting this Proposal, Proposer acknowledges and agrees that the terms and conditions of the Agreement (including all Exhibits thereto), as included in the RFP, are non-negotiable, other than as set forth on the Business Exception Form (Section 5.14 of the RFP Package Documents) and Proposer is willing to and shall, if CRRA accepts its Proposal for the Work and issues a Notice Of Award to Proposer, execute such Agreement. However, CRRA reserves the right to negotiate any items any responsive Proposer.

5. PROPOSER'S REPRESENTATIONS CONCERNING EXAMINATION OF CONTRACT DOCUMENTS

In submitting this Proposal, Proposer represents that:

(a) Proposer has thoroughly examined and carefully studied the RFP Package Documents and the following Addenda, receipt of which is hereby acknowledged (list Addenda by Addendum number and date):

Addendum Number	Date Issued

(b) Without exception the Proposal is premised upon performing, furnishing and completing the Work required by the Contract Documents and applying the specific means, methods, techniques, sequences or procedures (if any) that may be shown, indicated or expressly required by the Contract Documents;

(c) Proposer is fully informed and is satisfied as to all Laws And Regulations that may affect cost, progress, performance, furnishing and/or completion of the Work;

(d) Proposer has studied and carefully correlated Proposer's knowledge and observations with the Contract Documents and such other related data;

(e) Proposer has given CRRA written notice of all conflicts, errors, ambiguities and discrepancies that Proposer has discovered in the Contract Documents and the written resolutions thereof by CRRA are acceptable to Proposer;

(f) If Proposer has failed to promptly notify CRRA of all conflicts, errors, ambiguities and discrepancies that Proposer has discovered in the Contract Documents, such failure shall be deemed by both Proposer and CRRA to be a waiver to assert these issues and claims in the future;

(g) Proposer is aware of the general nature of work to be performed by CRRA and others that relates to the Work for which this Proposal is submitted; and

(h) The Contract Documents are generally sufficient to indicate and convey understanding by Proposer of all terms and conditions for performing, furnishing and completing the Work for which this Proposal is submitted.

6. PROPOSER'S REPRESENTATIONS CONCERNING SITE CONDITIONS

In submitting this Proposal, Proposer acknowledges and agrees that:

(a) All information and data included in the RFP Package Documents relating to the surface, subsurface and other conditions of the Sites are from presently available sources and are being provided only for the information and convenience of the Proposers;

(b) CRRA does not assume any responsibility for the accuracy or completeness of such information and data, if any, shown or indicated in the Contract Documents with respect to any surface, subsurface or other conditions of the Sites;

(c) Proposer is solely responsible for investigating and satisfying itself as to all actual and existing Site conditions, including surface conditions, subsurface conditions and underground facilities; and

(d) Proposer has become familiar with and is satisfied as to the general, local, and site conditions that may affect cost, progress, performance, furnishing and completion of the Work.

7. PROPOSER'S REPRESENTATIONS CONCERNING INFORMATION MADE AVAILABLE

In submitting this Proposal, Proposer acknowledges and agrees that Proposer shall not use any information made available to it or obtained in any examination made by it in connection with this RFP in any manner as a basis or grounds for a claim or demand of any nature against CRRA arising from or by reason of any variance which may exist between information offered or so obtained and the actual materials, conditions, or structures encountered during performance of any of the Work.

8. PROPOSER'S REPRESENTATIONS CONCERNING STATE OF CONNECTICUT TAXES

In submitting this Proposal, Proposer acknowledges and agrees that CRRA is exempt from all State of Connecticut taxes and assessments, including sales and use taxes. Accordingly, Proposer shall not charge CRRA any State of Connecticut taxes or assessments at any time in connection with Proposer's performance of this Agreement, nor shall Proposer include any State of Connecticut taxes or assessments in any rates, costs, prices or other charges to CRRA hereunder. Proposer represents and warrants that no State of Connecticut taxes or assessments were included in any rates, costs, prices or other charges presented to CRRA in any Proposal or other submittal to CRRA in connection with this RFP.

9. PROPOSER'S REPRESENTATIONS CONCERNING DISCLOSURE OF INFORMATION

In submitting this Proposal, Proposer:

(a) Recognizes and agrees that CRRA is subject to the Freedom of Information provisions of the *Connecticut General Statutes* and, as such, any information contained in or submitted with or in connection with Proposer's Proposal is subject to disclosure if required by law or otherwise; and

(b) Expressly waives any claim(s) that Proposer or any of its successors and/or assigns has or may have against CRRA or any of its directors, officers, employees or authorized agents as a result of any such disclosure.

10. PROPOSER'S REPRESENTATIONS CONCERNING NON-COLLUSION

By submission of this Proposal, the Proposer, together with any affiliates or related persons, the guarantor, if any, and any joint ventures, hereby represents that, under risk of termination of the Agreement, if awarded, to the best of its knowledge and belief:

(a) The prices in the Proposal have been arrived at as the result of an independent business judgment without collusion, consultation, communication, agreement or otherwise for the purpose of restricting competition, as to any matter relating to such prices and any other person or company;

(b) Unless otherwise required by law, the prices that have been quoted in this Proposal have not, directly or indirectly, been knowingly disclosed by the Proposer prior to "opening" to any other person or company;

(c) No attempt has been made or will be made by the Proposer to induce any other person, partnership of corporation to submit, or not to submit, a Proposal for the purpose of restricting competition;

(d) Proposer has not directly or indirectly induced or solicited any other Proposer to submit a false or sham Proposal; and

(e) Proposer has not sought by collusion to obtain for itself any advantage for the Work over any other Proposer for the Work or over CRRA.

11. PROPOSER'S REPRESENTATIONS CONCERNING RFP FORMS

By submission of this Proposal, the Proposer, together with any affiliates or related business entities or persons, the guarantor, if any, and any joint ventures, hereby represents that, under risk of termination of the Agreement, if awarded, all of the forms included in the RFP that are submitted to CRRA as part of its Proposal are identical in form and content to the preprinted forms in the RFP Package Documents except that information requested by the forms has been inserted in the spaces on the forms provided for the insertion of such requested information.

12. PROPOSAL SECURITY

Proposer acknowledges and agrees that the amount of the Proposal Security submitted with this Proposal fairly and reasonably represents the amount of damages CRRA will suffer in the event that Proposer fails to fulfill any of its obligations set forth in the Contract Documents.

13. PROPOSER'S WAIVER OF DAMAGES

Proposer and all its affiliates and subsidiaries understand that by submitting a Proposal, Proposer is acting at its and their own risk and Proposer does for itself and all its affiliates, subsidiaries, successors and assigns hereby waive any rights any of them may have to receive any damages for any liability, claim, loss or injury resulting from:

(a) Any action or inaction on the part of CRRA or any of its directors, officers, employees or authorized agents concerning the evaluation, selection, non-selection and/or rejection of any or all Proposals by CRRA or any of its directors, officers, employees or authorized agents;

(b) Any agreement entered into for the Work (or any part thereof) described in the Contract Documents; and/or

(c) Any award or non-award of a contract for the Work (or any part thereof) pursuant to the Contract Documents.

14. PROPOSER'S REPRESENTATION REGARDING THE CONNECTICUT CAMPAIGN CONTRIBUTION AND SOLICITATION BAN

With regard to a State contract as defined in P.A. 07-1 having a value in a calendar year of $50,000 or more or a combination or series of such agreement or contracts having a value of $100,000 or more, the authorized signatory to this submission in response to CRRA's solicitation expressly acknowledges receipt of the State Elections Enforcement Commission's notice advising prospective state contractors of state campaign contribution and solicitation prohibitions, and will inform its principals of the contents of the notice. See Section 5.14 [SEEC Form 11] of the Contract Documents.

15. ATTACHMENTS

The following documents are attached hereto and made a part of this Proposal:

(a) The properly executed Proposal Security;

(b) The completed Proposal Payment Rate Schedule Form (RFP exhibit 2);

(c) The completed Firm Background And Experience Form (RFP exhibit 3);

(d) The completed Personnel Background And Experience Form (RFP exhibit 4);

(e) The completed References Form (RFP exhibit 5);

(f) The completed Subcontractor Identification Form (RFP exhibit 6);

(g) Questionnaire Concerning Affirmative Action, Small Business Contractors And Occupational Health And Safety that has been completely filled out by the Proposer (RFP exhibit 7);

(h) Affidavit Concerning Nondiscrimination that has been completely filled out and signed by Proposer, with the Proposer's nondiscrimination policies and procedures attached (RFP exhibit 8);

(i) Background Questionnaire that has been completely filled out by the Proposer and signed before a Notary Public or Commissioner of the Superior Court (RFP exhibit 9);

(j) The completed Business Disclosure Form (RFP exhibit 10);

(k) The completed Business Exception Form (RFP exhibit 11);

(l) The completed Affirmation Concerning The State Of Connecticut Ethics Law (RFP exhibit 12); and

(m) A copy of the Proposer's up-to-date certificate of insurance showing all current insurance coverage.

16. NOTICES

Communications concerning this Proposal should be addressed to Proposer at the address set forth below.

Proposer Name:	
Proposer Contact:	
Title:	
Address:	
Telephone Number:	
Fax Number:	
E-Mail Address:	

17. ADDITIONAL REPRESENTATION

Proposer hereby represents that the undersigned is duly authorized to submit this Proposal on behalf of Proposer.

AGREED TO AND SUBMITTED ON

_____ 2013

Name of Proposer (Firm):	
Signature of Proposer Representative:	
Name (Typed/Printed):	
Title (Typed/Printed):	

PHASE II CLOSURE AND SOLAR PV INSTALLATION
CRRA HARTFORD LANDFILL
PROPOSAL PRICE FORM

Proposer will complete the Work as specified in the Contract Documents for the following proposal price (please use itemized table below):

OPTION 1A – CAP USING CLOSURE TURF™ AND 500KW AC RIGID BALLASTED PHOTOVOLTAIC SYSTEM

ITEM #	DESCRIPTION	UNIT	EST. QTY	UNIT PRICE	ITEM PRICE IN WORDS	ITEM PRICE IN FIGURES
1	Mobilization/Demobilization and Incidental Construction	LS	1	$_____	_____dollars and_____cents	$_____
2	Field Services	LS	1	$_____	_____dollars and_____cents	$_____
3	Temporary Erosion Control	LS	1	$_____	_____dollars and_____cents	$_____
4	General Fill (provided by Owner)	TON	15,000	$_____	_____dollars and_____cents	$_____
5	General Fill (provided by Contractor)	TON	15,000	$_____	_____dollars and_____cents	$_____

6	Subgrade Preparation	LS	1	$_____	_____dollars and_____cents	$_____
7	6" Cap Base Material (Owner Supplied)	SY	56,000	$_____	_____dollars and_____cents	$_____
8	6" Cap Base Material (Contractor Supplied)	SY	114,000	$_____	_____dollars and_____cents	$_____
9	Closure Turf™ Landfill Capping System	LS	1	$_____	_____dollars and_____cents	$_____
10	500kw Solar Photovoltaic Electric Generating and AC Distribution System	LS	1	$_____	_____dollars and_____cents	$_____
11	Penetration Sealing and Booting	EA	1	$_____	_____dollars and_____cents	$_____
12	Type "A" Cap Anchor	LF	45	$_____	_____dollars and_____cents	$_____

13	Type “B” Cap Anchor	LF	2,900	$_____	_____dollars and_____cents	$_____
14	Type “C” Cap Anchor	LF	2,100	$_____	_____dollars and_____cents	$_____
15	Type “D” Cap Anchor	LF	810	$_____	_____dollars and_____cents	$_____
16	Type “E” Cap Anchor	LF	200	$_____	_____dollars and_____cents	$_____
17	Type “F” Cap Anchor	LF	320	$_____	_____dollars and_____cents	$_____
18	Underdrain Trenches (Closure Turf™ Only)	LF	5,600	$_____	_____dollars and_____cents	$_____
19	Side Slope Diversions (Closure Turf™ Only)	LF	5,325	$_____	_____dollars and_____cents	$_____

20	Downchutes (Closure Turf™ Only)	LF	720	$_____	_____dollars and_____cents	$_____
21	Energy Dissipation System	LF	50	$_____	_____dollars and_____cents	$_____
22	Drainage Outfall Improvements	LS	1	$_____	_____dollars and_____cents	$_____
23	Supplemental Gas System	LS	1	$_____	_____dollars and_____cents	$_____
24	Landfill Limit Markers	EA	5	$_____	_____dollars and_____cents	$_____
25	Southeast Paved Area	LS	1	$_____	_____dollars and_____cents	$_____
26	500kw Solar Photovoltaic Electric Generating and AC Distribution System Maintenance Service	Year	5	$_____	_____dollars and_____cents	$_____

	Grand Total Option 1A		_____dollars and_____cents			$_____

OPTION 1B – CAP USING CLOSURE TURF™ AND 750KW AC RIGID BALLASTED PHOTOVOLTAIC SYSTEM

ITEM #	DESCRIPTION	UNIT	EST. QTY	UNIT PRICE	ITEM PRICE IN WORDS	ITEM PRICE IN FIGURES
1	Mobilization/Demobilization and Incidental Construction	LS	1	$_____	_____dollars and_____cents	$_____
2	Field Services	LS	1	$_____	_____dollars and_____cents	$_____
3	Temporary Erosion Control	LS	1	$_____	_____dollars and_____cents	$_____
4	General Fill (provided by Owner)	TON	15,000	$_____	_____dollars and_____cents	$_____
5	General Fill (provided by Contractor)	TON	15,000	$_____	_____dollars and_____cents	$_____

6	Subgrade Preparation	LS	1	$_____	_____dollars and_____cents	$_____
7	6" Cap Base Material (Owner Supplied)	SY	56,000	$_____	_____dollars and_____cents	$_____
8	6" Cap Base Material (Contractor Supplied)	SY	114,000	$_____	_____dollars and_____cents	$_____
9	Closure Turf™ Landfill Capping System	LS	1	$_____	_____dollars and_____cents	$_____
10	750kw Solar Photovoltaic Electric Generating and AC Distribution System	LS	1	$_____	_____dollars and_____cents	$_____
11	Penetration Sealing and Booting	EA	1	$_____	_____dollars and_____cents	$_____
12	Type "A" Cap Anchor	LF	45	$_____	_____dollars and_____cents	$_____

13	Type “B” Cap Anchor	LF	2,900	$_____	_____dollars and_____cents	$_____
14	Type “C” Cap Anchor	LF	2,100	$_____	_____dollars and_____cents	$_____
15	Type “D” Cap Anchor	LF	810	$_____	_____dollars and_____cents	$_____
16	Type “E” Cap Anchor	LF	200	$_____	_____dollars and_____cents	$_____
17	Type “F” Cap Anchor	LF	320	$_____	_____dollars and_____cents	$_____
18	Underdrain Trenches (Closure Turf™ Only)	LF	5,600	$_____	_____dollars and_____cents	$_____
19	Side Slope Diversions (Closure Turf™ Only)	LF	5,325	$_____	_____dollars and_____cents	$_____

20	Downchutes (Closure Turf™ Only)	LF	720	$_____	_____dollars and_____cents	$_____
21	Energy Dissipation System	LF	50	$_____	_____dollars and_____cents	$_____
22	Drainage Outfall Improvements	LS	1	$_____	_____dollars and_____cents	$_____
23	Supplemental Gas System	LS	1	$_____	_____dollars and_____cents	$_____
24	Landfill Limit Markers	EA	5	$_____	_____dollars and_____cents	$_____
25	Southeast Paved Area	LS	1	$_____	_____dollars and_____cents	$_____
26	750kw Solar Photovoltaic Electric Generating and AC Distribution System Maintenance Service	Year	5	$_____	_____dollars and_____cents	$_____

	Grand Total Option 1B		_____dollars and_____cents			$_____

OPTION 1C – CAP USING CLOSURE TURF™ AND 1,000KW AC RIGID BALLASTED PHOTOVOLTAIC SYSTEM

ITEM #	DESCRIPTION	UNIT	EST. QTY	UNIT PRICE	ITEM PRICE IN WORDS	ITEM PRICE IN FIGURES
1	Mobilization/Demobilization and Incidental Construction	LS	1	$_____	_____dollars and_____cents	$_____
2	Field Services	LS	1	$_____	_____dollars and_____cents	$_____
3	Temporary Erosion Control	LS	1	$_____	_____dollars and_____cents	$_____
4	General Fill (provided by Owner)	TON	15,000	$_____	_____dollars and_____cents	$_____

5	General Fill (provided by Contractor)	TON	15,000	$_____	_____dollars and_____cents	$_____
6	Subgrade Preparation	LS	1	$_____	_____dollars and_____cents	$_____
7	6” Cap Base Material (Owner Supplied)	SY	56,000	$_____	_____dollars and_____cents	$_____
8	6” Cap Base Material (Contractor Supplied)	SY	114,000	$_____	_____dollars and_____cents	$_____
9	Closure Turf™ Landfill Capping System	LS	1	$_____	_____dollars and_____cents	$_____
10	1,000kw Solar Photovoltaic Electric Generating and AC Distribution System	LS	1	$_____	_____dollars and_____cents	$_____
11	Penetration Sealing and Booting	EA	1	$_____	_____dollars and_____cents	$_____

12	Type “A” Cap Anchor	LF	45	$_____	_____dollars and_____cents	$_____
13	Type “B” Cap Anchor	LF	2,900	$_____	_____dollars and_____cents	$_____
14	Type “C” Cap Anchor	LF	2,100	$_____	_____dollars and_____cents	$_____
15	Type “D” Cap Anchor	LF	810	$_____	_____dollars and_____cents	$_____
16	Type “E” Cap Anchor	LF	200	$_____	_____dollars and_____cents	$_____
17	Type “F” Cap Anchor	LF	320	$_____	_____dollars and_____cents	$_____
18	Underdrain Trenches (Closure Turf™ Only)	LF	5,600	$_____	_____dollars and_____cents	$_____

19	Side Slope Diversions (Closure Turf™ Only)	LF	5,325	$_____	_____dollars and_____cents	$_____
20	Downchutes (Closure Turf™ Only)	LF	720	$_____	_____dollars and_____cents	$_____
21	Energy Dissipation System	LF	50	$_____	_____dollars and_____cents	$_____
22	Drainage Outfall Improvements	LS	1	$_____	_____dollars and_____cents	$_____
23	Supplemental Gas System	LS	1	$_____	_____dollars and_____cents	$_____
24	Landfill Limit Markers	EA	5	$_____	_____dollars and_____cents	$_____
25	Southeast Paved Area	LS	1	$_____	_____dollars and_____cents	$_____

26	1,000kw Solar Photovoltaic Electric Generating and AC Distribution System Maintenance Service	Year	5	$_____	_____dollars and_____cents	$_____
	Grand Total Option 1C		_____dollars and_____cents			$_____

OPTION 2A – CAP USING EXPOSED TPO AND 500KW AC RIGID BALLASTED PHOTOVOLTAIC SYSTEM

ITEM #	DESCRIPTION	UNIT	EST. QTY	UNIT PRICE	ITEM PRICE IN WORDS	ITEM PRICE IN FIGURES
1	Mobilization/Demobilization and Incidental Construction	LS	1	$_____	_____dollars and_____cents	$_____
2	Field Services	LS	1	$_____	_____dollars and_____cents	$_____
3	Temporary Erosion Control	LS	1	$_____	_____dollars and_____cents	$_____

4	General Fill (provided by Owner)	TON	15,000	$_____	_____dollars and_____cents	$_____
5	General Fill (provided by Contractor)	TON	15,000	$_____	_____dollars and_____cents	$_____
6	Subgrade Preparation	LS	1	$_____	_____dollars and_____cents	$_____
7	6” Cap Base Material (Owner Supplied)	SY	56,000	$_____	_____dollars and_____cents	$_____
8	6” Cap Base Material (Contractor Supplied)	SY	114,000	$_____	_____dollars and_____cents	$_____
9	Exposed TPO Landfill Capping System	LS	1	$_____	_____dollars and_____cents	$_____
10	500kw Solar Photovoltaic Electric Generating and AC Distribution System	LS	1	$_____	_____dollars and_____cents	$_____

11	Penetration Sealing and Booting	EA	1	$_____	_____dollars and_____cents	$_____
12	Type “A” Cap Anchor	LF	45	$_____	_____dollars and_____cents	$_____
13	Type “B” Cap Anchor	LF	2,900	$_____	_____dollars and_____cents	$_____
14	Type “C” Cap Anchor	LF	2,100	$_____	_____dollars and_____cents	$_____
15	Type “D” Cap Anchor	LF	810	$_____	_____dollars and_____cents	$_____
16	Type “E” Cap Anchor	LF	200	$_____	_____dollars and_____cents	$_____
17	Type “F” Cap Anchor	LF	320	$_____	_____dollars and_____cents	$_____

18	Underdrain Trenches (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
19	Side Slope Diversions (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
20	Downchutes (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
21	Energy Dissipation System	LF	2,900	$_____	_____dollars and_____cents	$_____
22	Drainage Outfall Improvements	LS	1	$_____	_____dollars and_____cents	$_____
23	Supplemental Gas System	LS	1	$_____	_____dollars and_____cents	$_____
24	Landfill Limit Markers	EA	5	$_____	_____dollars and_____cents	$_____

25	Southeast Paved Area	LS	1	$_____	_____dollars and_____cents	$_____
26	500kw Solar Photovoltaic Electric Generating and AC Distribution System Maintenance Service	Year	5	$_____	_____dollars and_____cents	$_____
	Grand Total Option 2A		_____dollars and_____cents			$_____

OPTION 2B – CAP USING EXPOSED TPO AND 750KW AC RIGID BALLASTED PHOTOVOLTAIC SYSTEM

ITEM #	DESCRIPTION	UNIT	EST. QTY	UNIT PRICE	ITEM PRICE IN WORDS	ITEM PRICE IN FIGURES
1	Mobilization/Demobilization and Incidental Construction	LS	1	$_____	_____dollars and_____cents	$_____
2	Field Services	LS	1	$_____	_____dollars and_____cents	$_____
3	Temporary Erosion Control	LS	1	$_____	_____dollars and_____cents	$_____
4	General Fill (provided by Owner)	TON	15,000	$_____	_____dollars and_____cents	$_____
5	General Fill (provided by Contractor)	TON	15,000	$_____	_____dollars and_____cents	$_____
6	Subgrade Preparation	LS	1	$_____	_____dollars and_____cents	$_____

7	6” Cap Base Material (Owner Supplied)	SY	56,000	$_____	_____dollars and_____cents	$_____
8	6” Cap Base Material (Contractor Supplied)	SY	114,000	$_____	_____dollars and_____cents	$_____
9	Exposed TPO Landfill Capping System	LS	1	$_____	_____dollars and_____cents	$_____
10	750kw Solar Photovoltaic Electric Generating and AC Distribution System	LS	1	$_____	_____dollars and_____cents	$_____
11	Penetration Sealing and Booting	EA	1	$_____	_____dollars and_____cents	$_____
12	Type “A” Cap Anchor	LF	45	$_____	_____dollars and_____cents	$_____
13	Type “B” Cap Anchor	LF	2,900	$_____	_____dollars and_____cents	$_____

14	Type “C” Cap Anchor	LF	2,100	$_____	_____dollars and_____cents	$_____
15	Type “D” Cap Anchor	LF	810	$_____	_____dollars and_____cents	$_____
16	Type “E” Cap Anchor	LF	200	$_____	_____dollars and_____cents	$_____
17	Type “F” Cap Anchor	LF	320	$_____	_____dollars and_____cents	$_____
18	Underdrain Trenches (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
19	Side Slope Diversions (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
20	Downchutes (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY

21	Energy Dissipation System	LF	2,900	$_____	_____dollars and_____cents	$_____
22	Drainage Outfall Improvements	LS	1	$_____	_____dollars and_____cents	$_____
23	Supplemental Gas System	LS	1	$_____	_____dollars and_____cents	$_____
24	Landfill Limit Markers	EA	5	$_____	_____dollars and_____cents	$_____
25	Southeast Paved Area	LS	1	$_____	_____dollars and_____cents	$_____
26	750kw Solar Photovoltaic Electric Generating and AC Distribution System Maintenance Service	Year	5	$_____	_____dollars and_____cents	$_____
	Grand Total Option 2B		_____dollars			$_____

			and_____cents	

OPTION 2C – CAP USING EXPOSED TPO AND 1,000KW AC RIGID BALLASTED PHOTOVOLTAIC SYSTEM

ITEM #	DESCRIPTION	UNIT	EST. QTY	UNIT PRICE	ITEM PRICE IN WORDS	ITEM PRICE IN FIGURES
1	Mobilization/Demobilization and Incidental Construction	LS	1	$_____	_____dollars and_____cents	$_____
2	Field Services	LS	1	$_____	_____dollars and_____cents	$_____
3	Temporary Erosion Control	LS	1	$_____	_____dollars and_____cents	$_____
4	General Fill (provided by Owner)	TON	15,000	$_____	_____dollars and_____cents	$_____
5	General Fill (provided by Contractor)	TON	15,000	$_____	_____dollars and_____cents	$_____

6	Subgrade Preparation	LS	1	$_____	_____dollars and_____cents	$_____
7	6” Cap Base Material (Owner Supplied)	SY	56,000	$_____	_____dollars and_____cents	$_____
8	6” Cap Base Material (Contractor Supplied)	SY	114,000	$_____	_____dollars and_____cents	$_____
9	Exposed TPO Landfill Capping System	LS	1	$_____	_____dollars and_____cents	$_____
10	1,000kw Solar Photovoltaic Electric Generating and AC Distribution System	LS	1	$_____	_____dollars and_____cents	$_____
11	Penetration Sealing and Booting	EA	1	$_____	_____dollars and_____cents	$_____
12	Type “A” Cap Anchor	LF	45	$_____	_____dollars and_____cents	$_____

13	Type “B” Cap Anchor	LF	2,900	$_____	_____dollars and_____cents	$_____
14	Type “C” Cap Anchor	LF	2,100	$_____	_____dollars and_____cents	$_____
15	Type “D” Cap Anchor	LF	810	$_____	_____dollars and_____cents	$_____
16	Type “E” Cap Anchor	LF	200	$_____	_____dollars and_____cents	$_____
17	Type “F” Cap Anchor	LF	320	$_____	_____dollars and_____cents	$_____
18	Underdrain Trenches (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
19	Side Slope Diversions (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY

20	Downchutes (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
21	Energy Dissipation System	LF	2,900	$_____	_____dollars and_____cents	$_____
22	Drainage Outfall Improvements	LS	1	$_____	_____dollars and_____cents	$_____
23	Supplemental Gas System	LS	1	$_____	_____dollars and_____cents	$_____
24	Landfill Limit Markers	EA	5	$_____	_____dollars and_____cents	$_____
25	Southeast Paved Area	LS	1	$_____	_____dollars and_____cents	$_____
26	1,000kw Solar Photovoltaic Electric Generating and AC Distribution System Maintenance Service	Year	5	$_____	_____dollars and_____cents	$_____

	Grand Total Option 2C		_____dollars and_____cents			$_____

OPTION 3A – CAP USING EXPOSED TPO AND 500KW AC THIN FILM FLEXIBLE PHOTOVOLTAIC SYSTEM

ITEM #	DESCRIPTION	UNIT	EST. QTY	UNIT PRICE	ITEM PRICE IN WORDS	ITEM PRICE IN FIGURES
1	Mobilization/Demobilization and Incidental Construction	LS	1	$_____	_____dollars and_____cents	$_____
2	Field Services	LS	1	$_____	_____dollars and_____cents	$_____
3	Temporary Erosion Control	LS	1	$_____	_____dollars and_____cents	$_____
4	General Fill (provided by Owner)	TON	15,000	$_____	_____dollars and_____cents	$_____

5	General Fill (provided by Contractor)	TON	15,000	$_____	_____dollars and_____cents	$_____
6	Subgrade Preparation	LS	1	$_____	_____dollars and_____cents	$_____
7	6” Cap Base Material (Owner Supplied)	SY	56,000	$_____	_____dollars and_____cents	$_____
8	6” Cap Base Material (Contractor Supplied)	SY	114,000	$_____	_____dollars and_____cents	$_____
9	Exposed TPO Landfill Capping System	LS	1	$_____	_____dollars and_____cents	$_____
10	500kw Solar Photovoltaic Electric Generating and AC Distribution System	LS	1	$_____	_____dollars and_____cents	$_____
11	Penetration Sealing and Booting	EA	1	$_____	_____dollars and_____cents	$_____

12	Type “A” Cap Anchor	LF	45	$_____	_____dollars and_____cents	$_____
13	Type “B” Cap Anchor	LF	2,900	$_____	_____dollars and_____cents	$_____
14	Type “C” Cap Anchor	LF	2,100	$_____	_____dollars and_____cents	$_____
15	Type “D” Cap Anchor	LF	810	$_____	_____dollars and_____cents	$_____
16	Type “E” Cap Anchor	LF	200	$_____	_____dollars and_____cents	$_____
17	Type “F” Cap Anchor	LF	320	$_____	_____dollars and_____cents	$_____
18	Underdrain Trenches (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY

19	Side Slope Diversions (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
20	Downchutes (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
21	Energy Dissipation System	LF	2,900	$_____	_____dollars and_____cents	$_____
22	Drainage Outfall Improvements	LS	1	$_____	_____dollars and_____cents	$_____
23	Supplemental Gas System	LS	1	$_____	_____dollars and_____cents	$_____
24	Landfill Limit Markers	EA	5	$_____	_____dollars and_____cents	$_____
25	Southeast Paved Area	LS	1	$_____	_____dollars and_____cents	$_____

26	500kw Solar Photovoltaic Electric Generating and AC Distribution System Maintenance Service	Year	5	$_____	_____dollars and_____cents	$_____
	Grand Total Option 3A		_____dollars and_____cents			$_____

OPTION 3B – CAP USING EXPOSED TPO AND 750KW AC THIN FILM FLEXIBLE PHOTOVOLTAIC SYSTEM

ITEM #	DESCRIPTION	UNIT	EST. QTY	UNIT PRICE	ITEM PRICE IN WORDS	ITEM PRICE IN FIGURES
1	Mobilization/Demobilization and Incidental Construction	LS	1	$_____	_____dollars and_____cents	$_____
2	Field Services	LS	1	$_____	_____dollars and_____cents	$_____
3	Temporary Erosion Control	LS	1	$_____	_____dollars and_____cents	$_____

4	General Fill (provided by Owner)	TON	15,000	$_____	_____dollars and_____cents	$_____
5	General Fill (provided by Contractor)	TON	15,000	$_____	_____dollars and_____cents	$_____
6	Subgrade Preparation	LS	1	$_____	_____dollars and_____cents	$_____
7	6” Cap Base Material (Owner Supplied)	SY	56,000	$_____	_____dollars and_____cents	$_____
8	6” Cap Base Material (Contractor Supplied)	SY	114,000	$_____	_____dollars and_____cents	$_____
9	Exposed TPO Landfill Capping System	LS	1	$_____	_____dollars and_____cents	$_____
10	750kw Solar Photovoltaic Electric Generating and AC Distribution System	LS	1	$_____	_____dollars and_____cents	$_____

11	Penetration Sealing and Booting	EA	1	$_____	_____dollars and_____cents	$_____
12	Type “A” Cap Anchor	LF	45	$_____	_____dollars and_____cents	$_____
13	Type “B” Cap Anchor	LF	2,900	$_____	_____dollars and_____cents	$_____
14	Type “C” Cap Anchor	LF	2,100	$_____	_____dollars and_____cents	$_____
15	Type “D” Cap Anchor	LF	810	$_____	_____dollars and_____cents	$_____
16	Type “E” Cap Anchor	LF	200	$_____	_____dollars and_____cents	$_____
17	Type “F” Cap Anchor	LF	320	$_____	_____dollars and_____cents	$_____

18	Underdrain Trenches (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
19	Side Slope Diversions (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
20	Downchutes (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
21	Energy Dissipation System	LF	2,900	$_____	_____dollars and_____cents	$_____
22	Drainage Outfall Improvements	LS	1	$_____	_____dollars and_____cents	$_____
23	Supplemental Gas System	LS	1	$_____	_____dollars and_____cents	$_____
24	Landfill Limit Markers	EA	5	$_____	_____dollars and_____cents	$_____

25	Southeast Paved Area	LS	1	$_____	_____dollars and_____cents	$_____
26	750kw Solar Photovoltaic Electric Generating and AC Distribution System Maintenance Service	Year	5	$_____	_____dollars and_____cents	$_____
	Grand Total Option 3B		_____dollars and_____cents			$_____

OPTION 3C – CAP USING EXPOSED TPO AND 1,000KW AC THIN FILM FLEXIBLE PHOTOVOLTAIC SYSTEM

ITEM #	DESCRIPTION	UNIT	EST. QTY	UNIT PRICE	ITEM PRICE IN WORDS	ITEM PRICE IN FIGURES
1	Mobilization/Demobilization and Incidental Construction	LS	1	$_____	_____dollars and_____cents	$_____
2	Field Services	LS	1	$_____	_____dollars and_____cents	$_____

3	Temporary Erosion Control	LS	1	$_____	_____dollars and_____cents	$_____
4	General Fill (provided by Owner)	TON	15,000	$_____	_____dollars and_____cents	$_____
5	General Fill (provided by Contractor)	TON	15,000	$_____	_____dollars and_____cents	$_____
6	Subgrade Preparation	LS	1	$_____	_____dollars and_____cents	$_____
7	6” Cap Base Material (Owner Supplied)	SY	56,000	$_____	_____dollars and_____cents	$_____
8	6” Cap Base Material (Contractor Supplied)	SY	114,000	$_____	_____dollars and_____cents	$_____
9	Exposed TPO Landfill Capping System	LS	1	$_____	_____dollars and_____cents	$_____

10	1,000kw Solar Photovoltaic Electric Generating and AC Distribution System	LS	1	$_____	_____dollars and_____cents	$_____
11	Penetration Sealing and Booting	EA	1	$_____	_____dollars and_____cents	$_____
12	Type “A” Cap Anchor	LF	45	$_____	_____dollars and_____cents	$_____
13	Type “B” Cap Anchor	LF	2,900	$_____	_____dollars and_____cents	$_____
14	Type “C” Cap Anchor	LF	2,100	$_____	_____dollars and_____cents	$_____
15	Type “D” Cap Anchor	LF	810	$_____	_____dollars and_____cents	$_____
16	Type “E” Cap Anchor	LF	200	$_____	_____dollars and_____cents	$_____

17	Type “F” Cap Anchor	LF	320	$_____	_____dollars and_____cents	$_____
18	Underdrain Trenches (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
19	Side Slope Diversions (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
20	Downchutes (Closure Turf™ Only)	LF	N/A	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY	N/A CLOSURE TURF™ ONLY
21	Energy Dissipation System	LF	2,900	$_____	_____dollars and_____cents	$_____
22	Drainage Outfall Improvements	LS	1	$_____	_____dollars and_____cents	$_____
23	Supplemental Gas System	LS	1	$_____	_____dollars and_____cents	$_____

24	Landfill Limit Markers	EA	5	$_____	_____dollars and_____cents	$_____
25	Southeast Paved Area	LS	1	$_____	_____dollars and_____cents	$_____
26	1,000kw Solar Photovoltaic Electric Generating and AC Distribution System Maintenance Service	Year	5	$_____	_____dollars and_____cents	$_____
	Grand Total Option 3C		_____dollars and_____cents			$_____

PROPOSAL PRICE SUMMARY

Note: Please summarize Proposal Pricing in the table below. Discrepancies between this table and pricing provided in the above tables will be decided in favor of the above tables. Proposer should write "No Proposal" in the row of each option it did not provide a proposal for.

OPTION	PRICE
1A	**$_____**

1B	**$_____**
1C	**$_____**
2A	**$_____**
2B	**$_____**
2C	**$_____**
3A	**$_____**
3B	**$_____**
3C	**$_____**

Notes:

1) Proposers may elect to submit a completed Proposal Price Form for as few as one, or, as many as all nine of the Options provided in this RFP. CRRA reserves the right, in its sole discretion, to award the contract based upon what it deems to be the best proposal. CRRA's decision to award the contract will consider proposal price, expected long term operation and maintenance costs, constructability, aesthetics, and any other criterion that it believes to be appropriate, in its sole discretion.

2) Proposal price will be determined for each option submitted by adding the total prices of each lump sum item and each unit price item.

3) Proposer affirms that the above lump sum and unit price costs represent the entire cost to complete the Work in accordance with the Contract Documents, and that no claim will be made on account of any increase in wage scales, material prices, delivery delays, taxes, insurance, cost indexes or any other rates affecting the construction industry or this Project, and that each and every such claim is hereby expressly waived by Proposer.

Name of Proposer (Firm):	
Signature of Proposer Representative:	
Name (Type/Print):	
Title:	
Date:	

CONNECTICUT RESOURCES RECOVERY AUTHORITY

FIRM BACKGROUND AND EXPERIENCE FORM

In the table below, summarize work performed and services provided by the firm that are of a nature similar to those specified in the Proposal Package Documents which will enable CRRA to evaluate the experience and professional capabilities of the Proposer and its Subcontractors related to such Category of Services. Include a detailed description of any experience bidder has installing synthetic membrane landfill caps and installing solar photovoltaic electricity producing systems.

BACKGROUND AND EXPERIENCE [attach additional pages if necessary]

CONNECTICUT RESOURCES RECOVERY AUTHORITY

PERSONNEL BACKGROUND AND EXPERIENCE FORM

In the tables on the following pages, identify individuals in your firm and your subcontractor's firm that have experience installing synthetic membrane landfill caps and individuals in your firm and your subcontractor's firm that have experience installing solar photovoltaic electricity producing systems.

In the tables on the following pages, identify individuals in your firm and your subcontractor's firm who have experience operating heavy equipment on landfills. Identify the number of years of experience, the types of equipment used, identify the landfill(s) where work was performed, and identify types of work performed.

In the tables on the following pages, identify individuals in your firm and your subcontractor's firm with training, certifications, or licenses in heavy equipment operation, construction methods, or safety programs. Provide details of such training, certifications, and licenses.

Attach additional pages as necessary.

PROFESSIONAL 1

Name:		Staff Level:	
Title:		% of Time Available:	
Probable Areas of Responsibility:			
Other Categories Of Services:			
Background:			

PROFESSIONAL 2

Name:		Staff Level:	
Title:		% of Time Available:	
Probable Areas of Responsibility:			
Other Categories Of Services:			
Background:			

PROFESSIONAL 3

Name:		Staff Level:	
Title:		% of Time Available:	
Probable Areas of Responsibility:			
Other Categories Of Services:			
Background:			

PROFESSIONAL 4

Name:		Staff Level:	
Title:		% of Time Available:	
Probable Areas of Responsibility:			
Other Categories Of Services:			
Background:			

PROFESSIONAL 5

Name:		Staff Level:	
Title:		% of Time Available:	
Probable Areas of Responsibility:			
Other Categories Of Services:			
Background:			

PROFESSIONAL 6

Name:		Staff Level:	
Title:		% of Time Available:	
Probable Areas of Responsibility:			
Other Categories Of Services:			
Background:			

PROFESSIONAL 7

Name:		Staff Level:	
Title:		% of Time Available:	
Probable Areas of Responsibility:			
Other Categories Of Services:			
Background:			

PROFESSIONAL 8

Name:		Staff Level:	
Title:		% of Time Available:	
Probable Areas of Responsibility:			
Other Categories Of Services:			
Background:			

PROFESSIONAL 9

Name:		Staff Level:	
Title:		% of Time Available:	
Probable Areas of Responsibility:			
Other Categories Of Services:			
Background:			

PROFESSIONAL 10

Name:		Staff Level:	
Title:		% of Time Available:	
Probable Areas of Responsibility:			
Other Categories Of Services:			
Background:			

CONNECTICUT RESOURCES RECOVERY AUTHORITY

REFERENCES FORM

In the tables below, provide the names of at least three (3) **non-CRRA** references who can attest to the quality of work performed/services provided by Proposer and (3) **non-CRRA** references who can attest to the quality of work performed/services provided by any Subcontractors that are comparable to those associated with this RFP. Include job title, the name, address and phone number of the business and a brief description of the work performed/services provided for each reference. Use multiple forms as necessary.

REFERENCE 1

Name of Person:	
Title:	
Name of Business:	
Address:	
Telephone Number:	
Brief Description Of Work Performed/ Services Provided:	

REFERENCE 2

Name of Person:	
Title:	
Name of Business:	
Address:	
Telephone Number:	
Brief Description Of Work Performed/ Services Provided:	

REFERENCE 3

Name of Person:	
Title:	
Name of Business:	
Address:	
Telephone Number:	
Brief Description Of Work Performed/ Services Provided:	

CONNECTICUT RESOURCES RECOVERY AUTHORITY

SUBCONTRACTOR IDENTIFICATION FORM

Proposer shall list below all subcontractor(s) Proposer intends to use in the performance of Services if Proposer is selected to perform the Services and awarded the Agreement. Proposer shall include a description of the Services to be provided by the subcontractor(s).

Subcontractor 1

Company Name	
Services To Be Provided	

Subcontractor 2

Company Name	
Services To Be Provided	

Subcontractor 3

Company Name	
Services To Be Provided	

Subcontractor 4

Company Name	
Services To Be Provided	

CONNECTICUT RESOURCES RECOVERY AUTHORITY

QUESTIONNAIRE CONCERNING AFFIRMATIVE ACTION, SMALL BUSINESS CONTRACTORS AND OCCUPATIONAL HEALTH AND SAFETY

Because CRRA is a political subdivision of the State of Connecticut, it is required by various statutes and regulations to obtain background information on prospective contractors prior to entering into a contract. The questions below are designed to assist CRRA in procuring this information. Many of the questions are required to be asked by RCSA 46a-68j-31. For the purposes of this form, "Contractor" means Bidder, Proposer or Statement of Qualifications Submitter, as appropriate.

	Yes	No
1. Is the Contractor an Individual? *If you answered "Yes" to Question 1, skip to Question 2.* *If you answered "No" to Question 1, proceed to Question 1A and then to Question 2.*	☐	☐
1A. How many employees does the Contractor have? ☐		
2. Is the Contractor a Small Business Enterprise based on the criteria in Schedule A? *If you answered "Yes" to Question 2, proceed to Question 2A and then to Question 3.* *If you answered "No" to Question 2, skip to Question 3.*	☐	☐
2A. Is the Contractor certified by DAS as a Small Business Enterprise?[1]	☐	☐
3. Is the Contractor a Minority Owned Business Enterprise based on the criteria in Schedule B? *If you answered "Yes" to Question 3, proceed to Question 3A and then to Question 4.* *If you answered "No" to Question 3, skip to Question 4.*	☐	☐
3A. Is the Contractor certified by DAS as a Minority Owned Business Enterprise?[1]	☐	☐
4. Does the Contractor have an Affirmative Action Plan?[2] *If you answered "Yes" to Question 4, proceed to Question 4A and then to Question 5.* *If you answered "No" to Question 4, skip to Question 4B and then to Question 5.*	☐	☐
4A. Has the Affirmative Action Plan been approved by the CHRO?	☐	☐
4B. Will the Contractor develop and implement an Affirmative Action Plan?	☐	☐
5. Does the Contractor have an apprenticeship program complying with RCSA 46a-68-1 through 46a-68-17?	☐	☐
6. Has the Contractor been cited for three or more willful or serious violations of any occupational safety and health act?	☐	☐
7. Has the Contractor received one or more criminal convictions related to the injury or death of any employee in the three-year period preceding the issuance of this Request For Bids/Proposals/Qualifications?	☐	☐
8. Has the Contractor been the recipient of one or more ethical violations from the State of Connecticut Ethics Commission during the three-year period preceding the issuance of this Request For Bids/Proposals/Qualifications?	☐	☐
9. Will subcontractors be involved? *If you answered "Yes" to Question 9, proceed to Question 9A.* *If you answered "No" to Question 9, you are finished with the questionnaire.*	☐	☐
9A. How many subcontractors will be involved? ☐		

LIST OF ACRONYMS

RCSA – Regulations of Connecticut State Agencies
CHRO – State of Connecticut Commission on Human Rights and Opportunities
DAS – State of Connecticut Department of Administrative Services

FOOTNOTES

[1] If the Contractor answered “yes” to Question 2A and/or 3A, Contractor must attach a copy of its DAS Set-Aside Certificate to this Questionnaire.

[2] If the Contract is a "public works contract" (as defined in Section 46a-68b of the Connecticut General Statutes), the dollar amount exceeds Fifty Thousand Dollars ($50,000.00) in any fiscal year, and the Contractor has fifty (50) or more employees, the Contractor, in accordance with the provisions of Section 46a-68c of the Connecticut General Statutes, shall develop and file an affirmative action plan with the Connecticut Commission on Human Rights and Opportunities.

SCHEDULE A
CRITERIA FOR A SMALL BUSINESS ENTERPRISE

Contractor must meet all of the following criteria to qualify as a Small Business Enterprise:

1. Has been doing business under the same ownership or management and has maintained its principal place of business in the Connecticut for at least one year immediately prior to the issuance of the Request For Bids/ Proposals/Qualifications;
2. Has had gross revenues not exceeding fifteen million dollars ($15,000,000) during its most recent fiscal year; and
3. At least 51% of the ownership of the Contractor is held by a person(s) who exercises the operational authority over daily affairs of the business and has the power to direct policies and management and receives beneficial interests of the business.

SCHEDULE B
CRITERIA FOR A MINORITY OWNED BUSINESS ENTERPRISE

Contractor must meet all of the following criteria to qualify as a Minority Owned Business Enterprise:

1. Satisfies all of the criteria in Schedule A for a Small Business Enterprise;
2. At least 51% of the ownership of the Contractor by one or more minority person(s) who exercises operational authority over daily affairs of the business, has the power to direct management and policies and receives the beneficial interests of the business;
3. A minority is a person(s) who is American Indian, Asian, Black, Hispanic, has origins in the Iberian Peninsula, a woman, or an individual with a disability.

CONNECTICUT GENERAL STATUTES SECTION 46a-68b

As used in this section and sections 4a-60, 4a-60a, 4a-60g, 4a-62, 46a-56 and 46a-68c to 46a-68k, inclusive: "Public works contract" means any agreement between any individual, firm or corporation and the state or any political subdivision of the state other than a municipality for construction, rehabilitation, conversion, extension, demolition or repair of a public building, highway or other changes or improvements in real property, or which is financed in whole or in part by the state, including, but not limited to, matching expenditures, grants, loans, insurance or guarantees.

CONNECTICUT RESOURCES RECOVERY AUTHORITY

AFFIDAVIT CONCERNING NONDISCRIMINATION

This Affidavit must be completed and properly executed under penalty of false statement by a chief executive officer, president, chairperson, member or other corporate officer duly authorized to adopt company, corporate or partnership policy of the business entity submitting a bid/proposal/statement of qualifications to the Connecticut Resources Recovery Authority that certifies such business entity complies with the nondiscrimination agreement and warranties contained in Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended, regarding nondiscrimination against persons on account of their race, color, religious creed, age, marital status, national origin, ancestry, sex, gender identity or expression, intellectual disability, mental disability, physical disability or sexual orientation.

I, the undersigned, am over the age of eighteen and understand and appreciate the obligation of an oath. I am _____ (title) of _____ (firm name), an entity duly formed and existing under the laws of _____ (name of state or commonwealth) ("Contractor").

I certify that I am authorized to execute and deliver this affidavit on behalf of Contractor, as follows:

1. Contractor seeks to enter into the "*PHASE II MSW AREA CLOSURE AND POTOVOLTAIC SYSTEM PROJECT CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL"* Agreement (the "Agreement") with the Connecticut Resources Recovery Authority; and

2. Contractor has in place a company or corporate policy that complies with the nondiscrimination agreements and warranties required under Connecticut General Statutes §§ 4a-60(a)(1) and 4a-60a(a)(1), as amended, and the said company or corporate policy is in effect as of the date hereof.

By (Signature): _____

Name (Print): _____

Title: _____

Sworn to before me this _____ day of _____ 20 ____

_____ _____

Notary Public/Commissioner of the Superior Court Commission Expiration Date

Sections 4a-60(a)(1) and 4a-60a(a)(1) of the Connecticut General Statutes follow.

Sec. 4a-60. (Formerly Sec. 4-114a). Nondiscrimination and affirmative action provisions in contracts of the state and political subdivisions other than municipalities.

(a) Every contract to which the state or any political subdivision of the state other than a municipality is a party shall contain the following provisions:

(1) The contractor agrees and warrants that in the performance of the contract such contractor will not discriminate or permit discrimination against any person or group of persons on the grounds of race, color, religious creed, age, marital status, national origin, ancestry, sex, gender identity or expression, intellectual disability, mental disability or physical disability, including, but not limited to, blindness, unless it is shown by such contractor that such disability prevents performance of the work involved, in any manner prohibited by the laws of the United States or of the state of Connecticut; and the contractor further agrees to take affirmative action to insure that applicants with job-related qualifications are employed and that employees are treated when employed without regard to their race, color, religious creed, age, marital status, national origin, ancestry, sex, gender identity or expression, intellectual disability, mental disability or physical disability, including, but not limited to, blindness, unless it is shown by such contractor that such disability prevents performance of the work involved;

Sec. 4a-60a. Contracts of the state and political subdivisions, other than municipalities, to contain provisions re nondiscrimination on the basis of sexual orientation.

(a) Every contract to which the state or any political subdivision of the state other than a municipality is a party shall contain the following provisions:

(1) The contractor agrees and warrants that in the performance of the contract such contractor will not discriminate or permit discrimination against any person or group of persons on the grounds of sexual orientation, in any manner prohibited by the laws of the United States or of the state of Connecticut, and that employees are treated when employed without regard to their sexual orientation;

CONNECTICUT RESOURCES RECOVERY AUTHORITY

BACKGROUND QUESTIONNAIRE

This Questionnaire must be completed and properly executed by an individual or business entity submitting a statement of qualifications to the Connecticut Resources Recovery Authority (such individual or business entity hereinafter referred to as the "Contractor").

Please answer the following questions by placing an "X" in the appropriate box.

	Yes	No
1. Has the Contractor or any of the following ever been the subject of a **criminal** investigation? (a) A principal of the Contractor; (b) An owner of the Contractor; (c) An officer of the Contractor; (d) A partner in the Contractor; (e) A director of the Contractor; or (f) A stockholder of the Contractor holding 50% or more of the stock of the Contractor. *If you answered "Yes" to Question 1, proceed to Question 1A and, on a separate sheet of paper, state the following: the court in which the investigation is taking or took place; the approximate date the investigation commenced and, if applicable, concluded; the subject matter of the investigation; and the identity of the person or entity involved.* *If you answered "No" to Question 1, proceed to Question 2.*	☐	☐
1A. Has any indictment arisen out of any such investigation? *If you answered "Yes" to Question 1A, proceed to Question 1B and, on a separate sheet of paper, state the following: the name of the person or entity indicted; and the status of any such indictment.* *If you answered "No" to Question 1A, proceed to Question 2.*	☐	☐
1B. Has any conviction arisen out of any such indictment? *If you answered "Yes" to Question 1B, proceed to Question 2 and, on a separate sheet of paper, state the following: the name of the person or entity convicted, the sentence imposed and whether or not an appeal of the conviction is pending.* *If you answered "No" to Question 1B, proceed to Question 2.*	☐	☐

2. Has the Contractor or any of the following ever been the subject of a **civil** investigation[1]? (a) A principal of the Contractor; (b) An owner of the Contractor; (c) An officer of the Contractor; (d) A partner in the Contractor; (e) A director of the Contractor; or (f) A stockholder of the Contractor holding 50% or more of the stock of the Contractor. *If you answered "Yes" to Question 2, proceed to Question 3 and, on a separate sheet of paper, state the following: the court or other forum in which the investigation took or is taking place; the approximate date the investigation commenced and, if applicable, concluded; the subject matter of the investigation; the identity of the person or entity involved; the status of the investigation; and the outcome of the investigation.* *If you answered "No" to Question 2, proceed to Question 3.*	☐	☐
3. Has any entity (e.g., corporation, partnership, etc.) in which any of the following has an ownership interest of 50% or more in such entity ever been the subject of a **criminal** investigation? (a) A principal of the Contractor; (b) An owner of the Contractor; (c) An officer of the Contractor; (d) A partner in the Contractor; (e) A director of the Contractor; or (f) A stockholder of the Contractor. *If you answered "Yes" to Question 3, proceed to Question 3A and, on a separate sheet of paper, state the following: the court in which the investigation is taking or took place; the approximate date the investigation commenced and, if applicable, concluded; the subject matter of the investigation; and the identity of the person or entity involved.* *If you answered "No" to Question 3, proceed to Question 4.*	☐	☐
3A. Has any indictment arisen out of any such investigation? *If you answered "Yes" to Question 3A, proceed to Question 3B and, on a separate sheet of paper, state the following: the name of the person or entity indicted; and the status of any such indictment.* *If you answered "No" to question 3A, proceed to Question 4.*	☐	☐
3B. Has any conviction arisen out of any such indictment? *If you answered "Yes" to Question 3B, proceed to Question 4 and, on a separate sheet of paper, state the following: the name of the person or entity convicted, the sentence imposed and whether or not an appeal of the conviction is pending.* *If you answered "No" to Question 3B, proceed to Question 4.*	☐	☐

[1] The phrase "civil investigation" means an investigation undertaken by a governmental entity (e.g., federal, state or municipal) that has investigative and enforcement authority (e.g., the Office of the Connecticut Attorney General, the Connecticut Ethics Commission, the Connecticut Elections Enforcement Commission, the federal Securities and Exchange Commission).

4. Has any entity (e.g., corporation, partnership, etc.) in which any of the following has an ownership interest of 50% or more in such entity ever been the subject of a **civil** investigation[1]? (a) A principal of the Contractor; (b) An owner of the Contractor; (c) An officer of the Contractor; (d) A partner in the Contractor; (e) A director of the Contractor; or (f) A stockholder of the Contractor. *If you answered "Yes" to Question 4, proceed to Question 5 and, on a separate sheet of paper state the following: the court in which the investigation is taking or took place; the approximate date the investigation commenced and, if applicable, concluded; the subject matter of the investigation; the identity of the person or entity involved; the status of the investigation; and the outcome of the investigation..* *If you answered "No" to question 4, proceed to Question 5.*	☐	☐
5. Has the Contractor or any of the following ever been debarred from bidding on, or otherwise applying for, any contract with the State of Connecticut or any other governmental authority? (a) A principal of the Contractor; (b) An owner of the Contractor; (c) An officer of the Contractor; (d) A partner in the Contractor; (e) A director of the Contractor; or (f) A stockholder of the Contractor holding 50% or more of the stock of the Contractor. *If you answered "Yes" to Question 5, proceed to the Certification on the following page and, on a separate sheet of paper please explain.* *If you answered "No" to question 5, proceed to the Certification on the following page.*	☐	☐

CERTIFICATION

Signature: _____

Name (print/type): _____

Title: _____

State Of: _____

County Of: _____

_____, being fully sworn, deposes and says that he/she is the _____ (Title) of _____ (Firm Name), the Contractor herein, that he/she has provided answers to the foregoing questions on the Contractor's background, and, under the penalty of perjury, certifies that each and every answer is true.

Sworn to before me this _____ day of _____ 20 **13**

_____
Notary Public/Commissioner of the Superior Court

CONNECTICUT RESOURCES RECOVERY AUTHORITY

BUSINESS DISCLOSURE FORM

Bidder/Proposer/Statement of Qualifications Submitter (hereinafter collectively referred to as "Contractor") must provide the information requested in the following sections/tables.

1. CONFLICTS OF INTEREST

In the table below, disclose any material assignments, relationships or other employment that the Contractor or any employee of the Contractor has with any member of CRRA's past or present Board of Directors, any CRRA employee, governmental entity, or other person or entities that may create a conflict of interest or the appearance of a conflict of interest in providing to CRRA the Services that are the subject of this solicitation.

[Attach Additional Pages If Necessary]

2. CONFLICT OF INTEREST MEASURES

In the table below, discuss any measures that the Contractor either has in place or would take to identify, disclose and resolve any possible conflicts of interest.

[Attach Additional Pages If Necessary]

3. BUSINESS WITH MAJOR CRRA CURRENT AND FORMER CONTRACTORS

In the table below, disclose any services similar to the Services that are the subject of this solicitation that the Consultant has provided to any of the following major CRRA current and former contractors. Place a check in the box for any such contractor for which the Consultant has provided the services. If the Consultant has provided any such services, provide a summary description of the services provided.

Having provided the services similar to the Services that are the subject of this solicitation to one or more of the contractors listed below does not disqualify a Consultant from consideration under this solicitation.

[Attach Additional Pages If Necessary]

Entity	Summary Description of Services Provided
☐ Covanta	
☐ Copes Rubbish Service	
☐ CWPM, LLC	
☐ The Metropolitan District	
☐ NAES Corporation	
☐ Wheelabrator (Waste Management)	
☐ ReCommunity/ FCR, LLC	

CONNECTICUT RESOURCES RECOVERY AUTHORITY

BUSINESS EXCEPTION FORM

Using this form (add additional sheets of paper as needed), Proposer (hereinafter collectively referred to as "Contractor") shall identify any portion of the Work required or described in the RFP Package Documents, or any provision of the Agreement that Contractor desires to take exception to, including insurance, if any.

Contractor shall be specific regarding any exceptions listed. Contractor shall describe in detail the portion(s) of the Work or Agreement terms that the Contractor is taking exception to and why. Contractor shall also describe what, if any, alternative services, terms, or conditions Contractor is willing to provide or accept as a substitution for the Service, terms, or conditions to which Contractor has taken exception, if any.

If Contractor does not take exception to any portion of the Work required or described in this RFP Package Documents or to any terms of the Agreement, Contractor shall simply indicate below that Contractor "takes no exceptions", and submit this form along with the other Proposal forms as part of its Proposal submittal.

Note that CRRA will negotiate with Contractor on only those items identified by Contractor on this Business Exception Form. Also note that revisions to the services or Agreement will be at CRRA's sole discretion. Also note that pursuant to State of Connecticut statutes and regulations, the Agreement contains a number of provisions that CRRA, as a quasi-public entity, is required to incorporate in all of its contracts and are, therefore, non-negotiable.

Description of Exception Item		Reason for Exception	Proposed Alternative
1.			
2.			

Description of Exception Item		Reason for Exception	Proposed Alternative
3.			
4.			
5.			
6.			
7.			

CONNECTICUT RESOURCES RECOVERY AUTHORITY

AFFIRMATION CONCERNING THE STATE OF CONNECTICUT ETHICS LAW

Pursuant to Section 1-101qq of the Connecticut General Statutes, this Affirmation shall be completed and properly executed by the chief official or other duly authorized representative of the business entity (the "Contractor") submitting a bid or proposal (a "Bid/Proposal") to the Connecticut Resources Recovery Authority for a large state construction or procurement contract, as defined in Section 1-101mm(3) of the Connecticut General Statutes.

I, the undersigned, am _____ (title) of _____ (firm name), an entity duly formed and existing under the laws of _____ (name of state or commonwealth) ("Contractor").

I affirm, as follows:

1. Contractor seeks to submit a Bid/Proposal for the "[NAME OF AGREEMENT]" (the "Agreement") with the Connecticut Resources Recovery Authority; and

2. Pursuant to Section 1-101qq(a) of the Connecticut General Statutes, Contractor hereby affirms (i) its receipt of the summary of state ethics laws entitled "Guide to the Code of Ethics for Current or Potential State Contractors – 2010" (the "Summary"), and (ii) that the key employees of Contractor listed in TABLE A below have read and understand the Summary, and agree to comply with the provisions of State of Connecticut ethics law; and

3. Pursuant to Section 1-101qq(b) of the Connecticut General Statutes, Contractor agrees that it (i) shall provide the Summary to each subcontractor (a "Subcontractor") or consultant (a "Consultant") of Contractor on the Agreement, (ii) shall obtain the written affirmation ("Affirmation") in the form attached hereto from each such Subcontractor or Consultant, and (iii) timely provide each such Affirmation to the Connecticut Resources Recovery Authority.

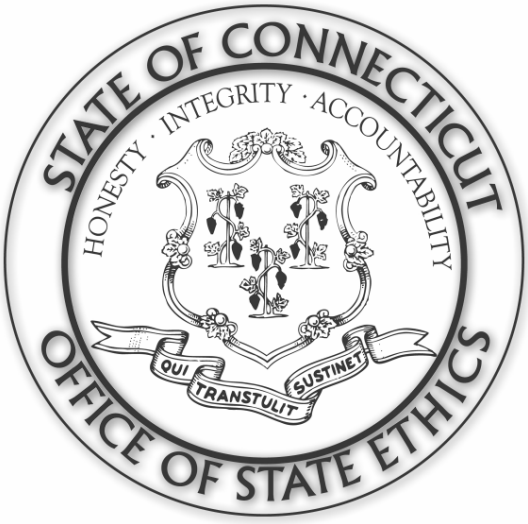
TABLE A:	**Key Employees (with Title) of Contractor that Have Read and Understand the Summary, and Agree to Comply with the Provisions of the State Ethics Law**

By (Signature): _____

Name (Print): _____

Title: _____

Guide to the Code of Ethics For Current or Potential State Contractors



2010

Guide for Current or Potential State Contractors

INTRODUCTION

The Connecticut Office of State Ethics (OSE) is an independent regulatory agency for the state of Connecticut, charged with administering and enforcing the Connecticut Codes of Ethics, located in the Connecticut General Statutes, Chapter 10.

The Ethics Codes under the OSE's jurisdiction are comprised of:

- The Code of Ethics for Public Officials (Part I);
- The Code of Ethics for Lobbyists (Part II); and
- Limited jurisdiction over Ethical Considerations Concerning Bidding and State Contracts (Part IV).

This guide provides general information only. The descriptions of the law and the OSE in this guide are not intended to be exhaustive. Please review the Advisory Opinions and Declaratory Rulings on our website or contact the Legal Division of the OSE with any questions regarding interpretation of the law.

For more information on the subjects discussed in this guide, call, write or visit:

Connecticut Office of State Ethics
18-20 Trinity Street
Suite 205
Hartford, CT 06106

860/263-2400
www.ct.gov/ethics

Citizen's Ethics Advisory Board:

G. Kenneth Bernhard, Chairperson (through September 2011)
Thomas H. Dooley, Vice Chairperson (through September 2012)
Ernest Abate (through September 2011)
Kathleen F. Bornhorst (through September 2012)
Rebecca M. Doty (through September 2011)
General David Gay, (ret.) (through September 2013)
Dennis Riley (through September 2013)
Winthrop Smith, Jr. (through September 2013)
Shawn T. Wooden (through September 2013)

Guide for Current or Potential State Contractors

CONTENTS

Guide for Current or Potential State Contractors

THE OFFICE OF STATE ETHICS (OSE)

The Connecticut Office of State Ethics (OSE) was officially created on July 1, 2005, by Public Act 05-183. The governing body of the OSE is the Citizen's Ethics Advisory Board (CEAB), nine members appointed by the Governor and legislative leadership. The CEAB holds monthly meetings that are open to the public and that are often covered by CT-N. A schedule of CEAB meeting dates, times and locations is available on the OSE's Web site, www.ct.gov/ethics.

The OSE is an independent watchdog agency for the state of Connecticut that administers Connecticut General Statutes, Chapter 10, Parts I and II, with limited jurisdiction over Part IV.

Simply put, the OSE educates all those covered by the law (the "regulated community"); provides information to the public; interprets and applies the codes of ethics; and investigates potential violations, and otherwise enforces the codes.

The OSE is made up of the following components:

- Citizen's Ethics Advisory Board
- Executive Director
- Legal Division
- Enforcement Division

THE BIG PICTURE

All state officials and employees (except judges) are covered by Part I of the Code of Ethics for Public Officials (henceforth, Part I, or the Code). It is important to remember that certain provisions of the Code also apply to public officials and state employees after they leave state service.

As you read through this guide, be aware that these laws were enacted to prevent individuals from using their public position or authority for personal, financial benefit.

Each state agency also has its own ethics policy, which in many cases may be more restrictive than what follows. Be sure to obtain a copy of the agency's policy before you attempt to provide any benefit to an agency official or employee.

Guide for Current or Potential State Contractors

GIVING BENEFITS TO STATE PERSONNEL

Gifts

As a current or potential state contractor, you are presumably doing business with or seeking to do business with a state agency, and are therefore considered to be a **restricted donor**. In general, public officials, state employees and candidates for public office may not accept gifts from restricted donors.

Restricted Donors

Restricted donors include:

- Registered lobbyists (a list is available on the OSE's Web site) or a lobbyist's representative;
- Individuals or groups doing business with a state department or agency;
- Individuals or groups seeking to do business with a state department or agency;
- Individuals or groups engaged in activities regulated by a state department or agency; or
- Contractors pre-qualified by the Connecticut Department of Administrative Services (Conn. Gen. Stat. § 4a-100).

A **gift** is defined as anything of value that is directly and personally received by a public official or state employee (or sometimes family members of those two categories) *unless* consideration of equal or greater value is provided. Conn. Gen. Stat. § 1-79 (e).

Gift Exceptions

There are, however, certain exceptions to this definition of gift. Not all exceptions are covered below; see Conn. Gen. Stat. § 1-79 (e) (1) – (17) for the complete list.

- *Token Items –* Restricted donors such as current or potential state contractors may provide any item of value that is not more than $10 (such as a pen, mug, or inexpensive baseball cap) to a public official or state employee, provided that the annual aggregate of such items from a single source is $50 or less. Conn. Gen. Stat. § 1-79 (e) (16).

- *Food and Beverage –* Restricted donors may also provide less than $50 worth of food and beverage in a calendar year to a public official or state employee, provided that the restricted donor or his/her representative is in attendance when the food and/or beverage is being consumed. Conn. Gen. Stat. § 1-79 (e) (9).

- *Training –* Vendors may provide public officials and state employees with training for a product purchased by a state or quasi-public agency provided such training is offered to all customers of that vendor. Conn. Gen. Stat. § 1-79 (e) (17).

Guide for Current or Potential State Contractors

- *Gifts to the State –* Restricted donors may provide what are typically referred to as "gifts to the state." These gifts are goods and services provided to a state agency or quasi-public agency for use on state or quasi-public agency property or that support an event, and which facilitate state or quasi-public action or functions. Conn. Gen. Stat. § 1-79 (e) (5).

- *Other Exceptions –* There are a total of 17 separate gift exceptions in the Code. Also exempt from the definition of gift are items such as informational materials germane to state action, ceremonial plaques or awards costing less than $100, or promotional items, rebates or discounts also available to the general public. See Conn. Gen. Stat. § 1-79 (e) (1) – (17).

Note: The popularly-cited exception for major life events does not apply to those who are regulated by, doing business with or seeking to do business with a state agency. The only restricted donor that can make use of this very narrow exception is a registered lobbyist.

Gift Provisions

Example: You are in the process of submitting a contracting bid to a state agency. You provide the agency head with a gift certificate for $45 to a popular West Hartford eatery for her to use on her own. You have not previously given anything of value to this individual.

Even though you are under the permissible $49.99 food and beverage limit, this gift is not allowed because you or your representative will not be in attendance while the food and beverage is being consumed.

Reporting Requirements

Should you or your representative give something of $10 or more in value to a public official or state employee, you must, within **10 days**, give the gift recipient and the head of that individual's department or agency a written report stating:

- Name of the donor;
- Description of item(s) given;
- Value of such item(s); and
- Total cumulative value of all items to date given to that recipient during the calendar year.

This helps both you and the state employee keep track of the gift exceptions noted above, so that permissible limits are not exceeded. Conn. Gen. Stat. § 1-84 (o). A courtesy form is available for this notification on the OSE's Web site, in the "Forms" section.

Guide for Current or Potential State Contractors

Necessary Expenses

You may provide necessary expenses to a public official or state employee ***only*** if the official or employee, in his/her official capacity, is actively participating in an event by giving a speech or presentation, running a workshop, or having some other active involvement.

Necessary expenses are limited to:

- Travel (coach or economy class);
- Lodging (standard cost of room for the nights before, of, and immediately following the event);
- Meals; and
- Related conference expenses.

Conn. Gen. Stat. § 1-79 (9).

Entertainment costs (tickets to sporting events, golf outings, night clubs, etc.) are ***not*** necessary expenses. Necessary expense payments also ***do not*** include payment of expenses for family members or other guests.

Fees/Honorariums

Public officials and state employees may ***not*** accept fees or honorariums for an article, appearance, speech or participation at an event in their official capacity.

Fees or honorariums for such activities, if offered based solely on expertise and without any regard to official capacity, may be acceptable. Contact the OSE before offering such payment to an official or employee. Conn. Gen. Stat. § 1-84 (k).

Necessary Expenses, Fees and Honorariums

Example: You invite a state employee to travel to New York City to give a speech to your managers on issues surrounding contracting with a state agency. You provide Amtrak fare for the employee as well as his spouse, who will spend the day in the city. The evening of the speech, you will treat the employee and his spouse with complimentary tickets to a Broadway show in lieu of a speaking fee.

You may provide coach class travel expenses only to the state employee who is actively participating in an event. In this case, you may only provide Amtrak fare for the employee giving the speech, not his spouse. Entertainment costs, such as tickets to a show, are not considered necessary expenses and may not be provided. Additionally, state employees may not accept fees or honorariums for a speech given in their official capacity.

HIRING STATE PERSONNEL

Post-state Employment (Revolving Door)

If you are considering hiring a *former* state employee, you should be aware of the Code's post-state employment, or revolving door, provisions.

Lifetime Bans

- Former state employees may **never** disclose any confidential information they learned during the course of their state service for anyone's financial gain. Conn. Gen. Stat. § 1-84a.

- A former state official or employee may **never** represent anyone other than the state regarding a particular matter in which he or she was personally or substantially involved while in state service and in which the state has a substantial interest. This prevents side-switching. Conn. Gen. Stat. § 1-84b (a).

One-year Bans

- If you hire or otherwise engage the services of a former state official or employee, he or she may not represent you before his or her former agency for a period of **one year** after leaving state service. Conn. Gen. Stat. § 1-84b (b). (See Advisory Opinion 2003-3, which provides a limited exception to this provision if the employee is providing purely technical expertise to help implement a previously-awarded contract. This exception applies to extremely limited circumstances; contact the OSE for guidance.)

- You are prohibited from hiring a former state official or employee for a period of **one year** after he or she leaves state service if that individual was substantially involved in, or supervised, the negotiation or award of a contract (that you or your business was a party to) valued at $50,000 or more, and the contract was signed within his or her last year of state service. Conn. Gen. Stat. § 1-84b (f).

- Employees who held certain specifically-designated positions (with significant decision-making or supervisory responsibility) at certain state regulatory agencies are prohibited from seeking or accepting employment with any business subject to regulation by the individual's agency within **one year** of leaving the agency. Likewise, such businesses may not hire those employees. Note that there is an exception for *ex-officio* board or commission members. Conn. Gen. Stat. § 1-84b (c).

Post-state Employment

Example: You run a hospital regulated by the Office of Health Care Access (OHCA). You would like to offer a job to the former Commissioner of OHCA, who has been out of state service for 5 months.

Because the hospital is regulated by a state agency whose Commissioner is specifically designated in 1-84b (c), the former head of such agency would not be permitted to accept employment with you for one full year after leaving state service. See Advisory Opinion 2003-19.

Outside Employment for Current Public Officials and State Employees

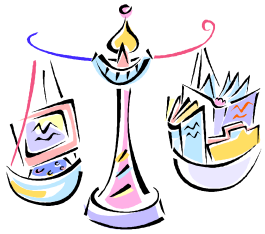
If you are considering hiring a *current* state employee, especially from a state agency with which you do business or by which you are regulated, you should be aware of the following rules regarding the employment of current state employees.

- A current state employee may not accept outside employment that impairs his or her independence of judgment regarding his or her state duties, or that encourages him or her to disclose confidential information learned in his or her state job. Conn. Gen. Stat. § 1-84 (b).

- A current state employee may not use his or her state position for his or her own financial gain or the gain of his or her family (spouse, child, child's spouse, parent, brother or sister) or an associated business, however inadvertent that use may be. Conn. Gen. Stat. § 1-84 (c).

Other Considerations

Business entities engaged in Indian gaming activities in the state should be aware of specific provisions that apply to present or former Gaming Policy Board or Division of Special Revenue public officials or employees. See Conn. Gen. Stat. §§ 1-84b (d) and (e).



Outside Employment

Example: Your small business occasionally receives grants or contracts from Agency X. You know that a particular contract manager with Agency X has the skills you need to help you grow your business. This employee has expressed interest in earning a little extra money for himself, while helping you with your business in the evenings and on weekends.

It would constitute an impermissible impairment of judgment for the employee of Agency X, who has contract management responsibilities, to accept outside employment with your business – a business that receives grants or contracts from Agency X.

OTHER PROVISIONS

Prohibited Activities for Consultants or Independent Contractors

If you are hired by the state as a consultant or independent contractor, you are prohibited from the following:

- Using your authority under the contract or any confidential information acquired during the course of the contract for your financial gain or the financial gain of your immediate family;
- Accepting another state contract that would impair your independence of judgment or your performance in your existing state contract; and
- Accepting anything of value based on the understanding that your actions on behalf of the state would be influenced.

Conn. Gen. Stat. § 1-86e (1) – (3); see also Conn. Gen. Stat. § 1-101nn.

Gift and/or Campaign Contribution Certifications

Contractors seeking large state contracts must provide certifications regarding gifts and/or campaign contributions made to certain state employees or public officials in the two-year period prior to the submission of a bid or proposal. Copies of these certifications and other updated information regarding state contractors can be found on the Web sites of the Department of Administrative Services (www.das.state.ct.us) and the Office of Policy and Management (www.opm.state.ct.us).

Investment Services and the Office of the Treasurer

If you or your business provides investment services, as defined in the Code, and you make a political contribution to the State Treasurer's campaign, you may be prohibited from contracting with the Office of the Treasurer. See Conn. Gen. Stat. § 1-84 (n).

Registering as a Lobbyist

If you or your business spends or receives over $2,000 in a calendar year for activities that constitute lobbying under Part II of the Code of Ethics (whether to affect legislation or the actions of an administrative state agency), you/your business may have to register as a lobbyist with the Office of State Ethics. Lobbyist registration information is available at www.ct.gov/ethics.

Contribution Ban for Communicator Lobbyists (Conn. Gen. Stat. § 9-610 (g) and (h).)

Registered communicator lobbyists, their affiliated political action committees (PACs), as well as members of their immediate families are banned from soliciting or donating political campaign contributions. Please contact the State Elections Enforcement Commission at 860-256-2940 for more information.

Guide for Current or Potential State Contractors

Sessional Contribution Ban for Client Lobbyists (Conn. Gen. Stat. § 9-610 (e).)

Registered lobbyists and their affiliated political action committees (PACs) are banned from soliciting or donating political campaign contributions. Specifically, there is a temporary ban while the General Assembly is in session that applies to all registered client lobbyists and their affiliated PACs. Please contact the State Elections Enforcement Commission at 860-256-2940 for more information.

Public Act 05-287

Public Act 05-287 prohibits anyone who is a party (or seeking to become a party) to a large state construction, procurement, or consultant services contract over $500,000 from:

- Soliciting information from a public official or state employee that is not available to other bidders for that contract, with the intent to obtain a competitive advantage;
- Intentionally or recklessly charging a state agency for work not performed or goods or services not provided;
- Falsifying invoices or bills; or
- Intentionally violating or circumventing state competitive bidding and ethics laws.

This Act also requires any prospective state contractor to affirm in writing that he or she has received a summary of the state's ethics laws and that his or her key employees have read and understood the summary and agree to comply with the applicable provisions. Conn. Gen. Stat. § 1-101qq.

An affirmation form is available through the Connecticut Office of Policy and Management.

Executive Orders

Executive Order 3

Under this Order, the Department of Administrative Services established and maintains on its Web site the State Contracting Portal for purposes of posting all contracting opportunities with state agencies and providing information on contracting processes and procedures.

Executive Order 7C

This Order covers the State Contracting Standards Board, established to conduct a comprehensive review of existing procurement and contracting laws and prepare a uniform code to govern all aspects of procurement and contracting.

The full text of these Executive Orders can be found on the Governor's Web site, www.ct.gov/governorrell/site/default.asp.

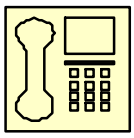
Guide for Current or Potential State Contractors

FOR MORE INFORMATION

This guide provides general information only. The descriptions of the law and the OSE in this guide are not intended to be exhaustive. For more information regarding the Code of Ethics as it pertains to current or potential state contractors, please contact the Legal Division of the Office of State Ethics, Monday – Friday, 8:30 a.m. to 5:00 p.m.

Office of State Ethics
18-20 Trinity Street
Hartford, CT 06106-1660

T: 860/263-2400
F: 860/263-2402
www.ct.gov/ethics



Specific Contacts:

Questions or advice regarding the Ethics Codes: Ethics.Code@ct.gov
Lobbyist filing/reporting questions: lobbyist.OSE@ct.gov
Public official filing/reporting questions: SFI.OSE@ct.gov
Enforcement questions: Ethics.Enforcement@ct.gov
All other inquiries: ose@ct.gov

January 2010

SEEC FORM 11

NOTICE TO EXECUTIVE BRANCH STATE CONTRACTORS AND PROSPECTIVE STATE CONTRACTORS OF CAMPAIGN CONTRIBUTION AND SOLICITATION BAN

This notice is provided under the authority of Connecticut General Statutes 9-612(g)(2), as amended by P.A. 07-1, and is for the purpose of informing state contractors and prospective state contractors of the following law (italicized words are defined on the following page):

Campaign Contribution and Solicitation Ban
No *state contractor*, *prospective state contractor*, *principal of a state contractor or principal of a prospective state contractor*, with regard to a *state contract* or *state contract solicitation* with or from a state agency in the executive branch or a quasi-public agency or a holder, or principal of a holder of a valid prequalification certificate, shall make a contribution to, or *solicit* contributions on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of Governor, Lieutenant Governor, Attorney General, State Comptroller, Secretary of the State or State Treasurer, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee;

In addition, no holder or principal of a holder of a valid prequalification certificate, shall make a contribution to, or solicit contributions on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of State senator or State representative, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee.

Duty to Inform
State contractors and prospective state contractors are required to inform their principals of the above prohibitions, as applicable, and the possible penalties and other consequences of any violation thereof.

Penalties for Violations
Contributions or solicitations of contributions made in violation of the above prohibitions may result in the following civil and criminal penalties:

Civil penalties--$2000 or twice the amount of the prohibited contribution, whichever is greater, against a principal or a contractor. Any state contractor or prospective state contractor which fails to make reasonable efforts to comply with the provisions requiring notice to its principals of these prohibitions and the possible consequences of their violations may also be subject to civil penalties of $2000 or twice the amount of the prohibited contributions made by their principals.

Criminal penalties—Any knowing and willful violation of the prohibition is a Class D felony, which may subject the violator to imprisonment of not more than 5 years, or $5000 in fines, or both.

Contract Consequences
Contributions made or solicited in violation of the above prohibitions may result, in the case of a state contractor, in the contract being voided.

Contributions made or solicited in violation of the above prohibitions, in the case of a prospective state contractor, shall result in the contract described in the state contract solicitation not being awarded to the prospective state contractor, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

The State will not award any other state contract to anyone found in violation of the above prohibitions for a period of one year after the election for which such contribution is made or solicited, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

Additional information and the entire text of P.A 07-1 may be found on the website of the State Elections Enforcement Commission, www.ct.gov/seec. Click on the link to “State Contractor Contribution Ban.”

Definitions:

"State contractor" means a person, business entity or nonprofit organization that enters into a state contract. Such person, business entity or nonprofit organization shall be deemed to be a state contractor until December thirty-first of the year in which such contract terminates. "State contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Prospective state contractor" means a person, business entity or nonprofit organization that (i) submits a response to a state contract solicitation by the state, a state agency or a quasi-public agency, or a proposal in response to a request for proposals by the state, a state agency or a quasi-public agency, until the contract has been entered into, or (ii) holds a valid prequalification certificate issued by the Commissioner of Administrative Services under section 4a-100. "Prospective state contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Principal of a state contractor or prospective state contractor" means (i) any individual who is a member of the board of directors of, or has an ownership interest of five per cent or more in, a state contractor or prospective state contractor, which is a business entity, except for an individual who is a member of the board of directors of a nonprofit organization**,** (ii) an individual who is employed by a state contractor or prospective state contractor, which is a business entity, as president, treasurer or executive vice president, (iii) an individual who is the chief executive officer of a state contractor or prospective state contractor, which is not a business entity, or if a state contractor or prospective state contractor has no such officer, then the officer who duly possesses comparable powers and duties, (iv) an officer or an employee of any state contractor or prospective state contractor who has *managerial or discretionary responsibilities with respect to a state contract,* (v) the spouse or a *dependent child* who is eighteen years of age or older of an individual described in this subparagraph, or (vi) a political committee established or controlled by an individual described in this subparagraph or the business entity or nonprofit organization that is the state contractor or prospective state contractor.

"State contract" means an agreement or contract with the state or any state agency or any quasi-public agency, let through a procurement process or otherwise, having a value of fifty thousand dollars or more, or a combination or series of such agreements or contracts having a value of one hundred thousand dollars or more in a calendar year, for (i) the rendition of services, (ii) the furnishing of any goods, material, supplies, equipment or any items of any kind, (iii) the construction, alteration or repair of any public building or public work, (iv) the acquisition, sale or lease of any land or building, (v) a licensing arrangement, or (vi) a grant, loan or loan guarantee. "State contract" does not include any agreement or contract with the state, any state agency or any quasi-public agency that is exclusively federally funded, an education loan or a loan to an individual for other than commercial purposes.

"State contract solicitation" means a request by a state agency or quasi-public agency, in whatever form issued, including, but not limited to, an invitation to bid, request for proposals, request for information or request for quotes, inviting bids, quotes or other types of submittals, through a competitive procurement process or another process authorized by law waiving competitive procurement.

“Managerial or discretionary responsibilities with respect to a state contract” means having direct, extensive and substantive responsibilities with respect to the negotiation of the state contract and not peripheral, clerical or ministerial responsibilities.

“Dependent child” means a child residing in an individual’s household who may legally be claimed as a dependent on the federal income tax of such individual.

“Solicit” means (A) requesting that a contribution be made, (B) participating in any fund-raising activities for a candidate committee, exploratory committee, political committee or party committee, including, but not limited to, forwarding tickets to potential contributors, receiving contributions for transmission to any such committee or bundling contributions, (C) serving as chairperson, treasurer or deputy treasurer of any such committee, or (D) establishing a political committee for the sole purpose of soliciting or receiving contributions for any committee. Solicit does not include: (i) making a contribution that is otherwise permitted by Chapter 155 of the Connecticut General Statutes; (ii) informing any person of a position taken by a candidate for public office or a public official, (iii) notifying the person of any activities of, or contact information for, any candidate for public office; or (iv) serving as a member in any party committee or as an officer of such committee that is not otherwise prohibited in this section.

REQUEST FOR PROPOSALS

FOR

PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT
CONNECTICUT RESOURCES RECOVERY AUTHORITY
HARTFORD LANDFILL

SECTION 6

NOTICE OF AWARD

CONNECTICUT RESOURCES RECOVERY AUTHORITY

NOTICE OF AWARD

TO: [NAME OF SUCCESSFUL PROPOSER'S CONTACT]
[NAME OF SUCCESSFUL PROPOSER]
[ADDRESS OF SUCCESSFUL PROPOSER]

PROJECT: CRRA HARTFORD LANDFILL

RFP NO.: FY13-EN-003

CONTRACT: PHASE II MSW AREA CLOSURE AND POTOVOLTAIC SYSTEM PROJECT - CRRA HARTFORD LANDFILL

The Connecticut Resources Recovery Authority ("CRRA") has considered the Proposal submitted by you dated [DATE OF PROPOSAL] in response to CRRA's Notice To Contractors – Request For Proposals for the above-referenced Work, which Work is more particularly described in the Agreement For PHASE II MSW AREA CLOSURE AND POTOVOLTAIC SYSTEM PROJECT - CRRA HARTFORD LANDFILL (the "Work").

You are hereby notified that your firm has been selected to perform the Work from time to time as may be requested by the Connecticut Resources Recovery Authority at its sole and absolute discretion. The rates at which CRRA will pay for the Work are as specified in **Exhibit E** of the Agreement.

Within ten (10) days from the date of this Notice of Award you are required to:

(a) Execute the two attached counterparts of the non-negotiable Agreement and deliver such executed counterparts to CRRA. Such execution includes:

(a) Preparing the Notice to CRRA of the proposed Contractor as specified in Entering the requested information in the "Notices" Section (Section 9.7, Page 23) of the Agreement,
(b) Signing the Agreement (Page 25),
(c) Printing the signer's name under the signature line (Page 25 and
(d) Printing the signer's title following the word "Its" (Page 25);

(b) Execute the attached Contractor's Certification Concerning Gifts and deliver such executed Certification to CRRA;

(c) Execute the attached Affidavit Concerning Consulting Fees and deliver such executed Affidavit to CRRA;

(d) Deliver to CRRA the requisite certificate(s) of insurance as specified in Section 6 of the Agreement [CRRA requires that the certificate submitted show evidence of exactly the insurance requirements specified in the Agreement.];

(e) Complete and deliver to CRRA the attached Form W-9, "Request for Taxpayer Identification Number and Certification;" and

(f) If the remittance address/contact information for the Services is different from the address/contact information indicated on Page 1 of this "Notice of Award," provide such remittance address/contact information in the following table;

Contractor Name:	
Remittance Contact:	
Title:	
Street Address:	
Street Address:	
City, State, Zip Code	
Telephone Number:	
Fax Number:	
E-Mail Address:	

(g) Satisfy all other conditions set forth herein.

As you have agreed, the terms and conditions of the Agreement, as attached, are non-negotiable.

If you fail within ten (10) days from the date of this Notice Of Award to perform and complete any of your obligations set forth in items (a) through (g) above, CRRA will be entitled to consider all your rights arising out of CRRA's acceptance of your Proposal as abandoned and terminated. CRRA will also be entitled to such other rights and remedies as may be granted at law or in equity.

You are required to acknowledge your receipt of this Notice Of Award by signing below and returning the same to CRRA at the following address:

Connecticut Resources Recovery Authority
100 Constitution Plaza, 6th Floor
Hartford, CT 06103
Attention: Roger Guzowski

Dated this [DAY] day of [MONTH], [YEAR].

Connecticut Resources Recovery Authority

By: _____
Roger Guzowski
Title: Contracts and Procurement Manager

ACCEPTANCE OF NOTICE

Receipt of this NOTICE OF AWARD is hereby acknowledged this _____ day of _____, 20___.

By:

Signature: _____

Name (print/type): _____

Title: _____

CONNECTICUT RESOURCES RECOVERY AUTHORITY

NOTICE TO PROCEED

TO: [NAME OF CONTRACTOR CONTACT
[NAME OF CONTRACTOR FIRM
[ADDRESS OF CONTRACTOR]

PROJECT: CRRA Hartford Landfill

CONTRACT NO.: [TO BE ADDED LATER BY CRRA]

CONTRACT: PHASE II MSW AREA CLOSURE AND POTOVOLTAIC SYSTEM PROJECT - CRRA HARTFORD LANDFILL

You are hereby notified to commence the Work related to PHASE II MSW AREA CLOSURE AND POTOVOLTAIC SYSTEM PROJECT - CRRA HARTFORD LANDFILL in accordance with the Agreement dated [DATE OF AGREEMENT], and that the Contract Time under the Agreement will commence to run on [DATE CONTRACT TIME STARTS]. By this date, you are to start performing the Work required by the Contract Documents. Pursuant to the Agreement, the date for completing all of the Work related to completion of the closure of the Phase 1 Ash Area at the Hartford Landfill and having such Work ready for CRRA's acceptance is as follows:

Completion Date: [COMPLETION DATE]

Furthermore, you are required to submit all documentation required by the Agreement within 30 days of the Completion Date.

You are required to acknowledge your receipt of this Notice To Proceed by signing below and returning such receipted Notice To Proceed to CRRA at the following address:

Connecticut Resources Recovery Authority
100 Constitution Plaza, 6th Floor
Hartford, CT 06103
Attention: [NAME OF CRRA OFFICIAL]

Dated this [DAY] day of [MONTH], 2013.

Connecticut Resources Recovery Authority

By: _____
[NAME OF CRRA OFFICIAL]
Title: [TITLE OF CRRA OFFICIAL]

ACCEPTANCE OF NOTICE

Receipt of this NOTICE TO PROCEED is hereby acknowledged this _____ day of _____, 2013.

By:

Signature: _____

Name (print/type): _____

Title: _____

REQUEST FOR PROPOSALS

FOR

PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT
CONNECTICUT RESOURCES RECOVERY AUTHORITY
HARTFORD LANDFILL

SECTION 7

FORM OF AGREEMENT AND EXHIBITS

AGREEMENT FOR
PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT
CONNECTICUT RESOURCES RECOVERY AUTHORITY
HARTFORD LANDFILL

CONTENTS

This **AGREEMENT FOR PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL** (the "Agreement") is made and entered into as of this _____ day of _____, 2013 by and between the **CONNECTICUT RESOURCES RECOVERY AUTHORITY**, a body politic and corporate, constituting a public instrumentality and political subdivision of the State of Connecticut, having its principal offices at 100 Constitution Plaza, 6th Floor, Hartford, Connecticut 06103 (hereinafter "CRRA" or "Owner") and **[NAME OF SUCCESSFUL BIDDER]**, having its principal offices at [ADDRESS OF SUCCESSFUL BIDDER] (hereinafter "Contractor").

PRELIMINARY STATEMENT

WHEREAS CRRA leases a certain parcel of real property located at 180 Leibert Road in Hartford, Connecticut, (the "Property").

WHEREAS, CRRA operates a certain sanitary landfill known as the "Hartford Landfill," (the "Landfill") upon the Property; and

WHEREAS CRRA now desires to enter into this Agreement with Contractor in order for Contractor to provide PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT at the Landfill within the boundary of the Property, and other related work, in accordance with the Contract Documents.

NOW, THEREFORE, in consideration of the mutual covenants, promises, and representations contained herein, and for other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties hereto agree as follows.

1. DEFINITIONS, CONSTRUCTION AND INTERPRETATION

1.1 Definitions

As used in this Agreement and in other Contract Documents (as defined herein) the following terms shall have the meanings as set forth below:

1.1.1 Addenda

"Addenda" means written or graphic documents issued prior to the bid due date, which clarify, correct or change any or all of the Contract Documents.

1.1.2 Acceptance Date

"Acceptance" shall occur when the CRRA signs as owner on the Final Application for Payment, as provided for under Section 01027(D) of the General Requrements

in Exhibit B. "Acceptance Date" is the date on which CRRA signs as owner of the Final Application for Payment.

1.1.3 Contract Documents

"Contract Documents" means this Agreement (including all exhibits attached hereto), the Notice To Proceed (as defined herein), any written amendments to any of the Contract Documents and any change order issued pursuant to Section 2.7 and/or 7.6 hereof.

1.1.4 Effective Date

"Effective Date" means the date set forth above in this Agreement.

1.1.5 Laws And Regulations

"Laws And Regulations" means any and all applicable current or future laws, rules, regulations, ordinances, codes, orders and permits of any and all federal, state and local governmental and quasi-governmental bodies, agencies, authorities and courts having jurisdiction.

1.1.6 Project

"Project" means all of the Work associated with this Agreement.

1.1.7 Site

"Site" means those areas of the Property upon which the Work is to be performed, furnished and completed by Contractor in accordance with the Contract Documents.

1.1.8 Work

The obligations of the Contractor under the Contract Documents including the requirements of items (a) through (d) of in Section 2.1 of the Agreement are hereinafter collectively referred to as the "work."

1.2 Construction And Interpretation

For purposes of this Agreement:

(a) Capitalized terms used herein shall have the meanings set forth herein;

(b) Whenever nouns or pronouns are used in this Agreement, the singular shall mean the plural, the plural shall mean the singular, and any gender shall mean all genders or any other gender, as the context may require;

(c) Words that have well-known technical or trade meanings are used herein in accordance with such recognized meanings unless otherwise specifically provided;

(d) All accounting terms not otherwise defined herein have the meanings assigned to them in accordance with "generally accepted accounting principles," and the term "generally accepted accounting principles" with respect to any computation required or permitted hereunder shall mean such accounting principles that are generally accepted as of the Effective Date of this Agreement;

(e) The words "herein", "hereof" and "hereunder" and words of similar import refer to this Agreement as a whole and not to any particular Article, Section or Subsection;

(f) Reference to any particular party shall include that party's employees and the authorized agents of that party;

(g) All references to agreements are references to the agreements as the provisions thereof that may be amended, modified or waived from time to time; and,

(h) The captions contained in this Agreement have been inserted for convenience only and shall not affect or be effective to interpret, change or restrict the terms of provisions of this Agreement.

(i) All Exhibits to this Agreement are incorporated into the body of this Agreement as part hereof.

2. SCOPE OF WORK

2.1 Contractor's Responsibilities

Contractor shall be responsible for:

(a) Mobilization and demobilization, grading of landfill in preparation for cap sub-base, installation of cap sub-base, installation of temporary erosion control measures, installation of capping system and associated drainage appurtenances, installation of solar photovoltaic electricity generation facility including PV panels, wires, connections, inverters, and performing all other work required for the Project; performing all of such activities is in accordance with and as required by the Contract Documents, including but not limited to, the plans set forth in Exhibit A (the "Plans" or "Construction Drawings"), the general requirements set forth in Exhibit B (the "General Requirements") and the technical specifications set forth in Exhibit C (the "Technical Specifications") all of which are attached hereto and made a part hereof;

(b) Furnishing all labor, materials, supplies, tools, equipment and other facilities and necessary appurtenances or property for or incidental to the Project and the performance and completion of the Work (as hereinafter defined);

(c) Restoring any part of the Property, the improvements thereon, or the Work (as hereinafter defined) that require restoration pursuant to the terms and conditions in Section 4.4 hereof; and

(d) Making all required notifications and obtaining all local, state, and federal permits and approvals necessary for the completion of the Work.

Items (a) through (d) above are hereinafter collectively referred to as the "Work."

2.2 Performance and Completion of the Work

All Work shall be performed and completed by Contractor in a good workmanlike manner consistent and in accordance with:

(a) Any and all instructions, guidance and directions provided by CRRA to Contractor;

(b) The Contract Documents;

(c) Sound equipment operation practices;

(d) The highest industry standards applicable to Contractor and its performance of the Work hereunder;

(e) The schedule for the Work set forth in Exhibit D attached hereto and made a part hereof; and

(f) All Laws And Regulations.

Items (a) through (f) above are hereinafter collectively referred to as the "Standards."

Contractor shall obtain any locally required building or other permits required for the Work, and Contractor shall also assist and fully cooperate with CRRA in obtaining any other applicable permits necessary to begin and complete the Work.

2.3 CRRA's Responsibilities

CRRA shall be responsible for administering this Agreement, accepting the Work that is performed and completed by Contractor in accordance with the Contract Documents, and receiving and paying invoices for such Work.

2.4 Direction of Work

CRRA may, where necessary or desired, provide Contractor with instructions, guidance and directions in connection with Contractor's performance of the Work hereunder. CRRA reserves the right to determine whether Contractor will, upon completion of any phase of the Work, proceed to any or all remaining phases of the Work. If CRRA determines that Con-

tractor shall not proceed with the remaining Work, CRRA shall terminate this Agreement in accordance with Section 4.3 hereof.

2.5 CRRA's Inspection Rights

Contractor's performance of the Work hereunder, as well as Contractor's work products resulting from such performance, are subject to inspection by CRRA. Inspections may be conducted at any time by CRRA. In the event of an inspection, Contractor shall provide to CRRA any documents or other materials that may be necessary in order for CRRA to conduct the inspection. If, after any such inspection, CRRA is unsatisfied with Contractor's performance of the Work hereunder or any of the work products resulting therefrom, Contractor shall, at the direction of CRRA, render such performance or work products satisfactory to CRRA at no additional cost or expense to CRRA and without any extension of or addition to any schedule included in a Request. For purpose of this Section 2.5, CRRA shall mean CRRA and/or its authorized agents.

2.6 Access

CRRA hereby grants to Contractor, during such times as directed by CRRA, access to only those areas of the Property necessary for Contractor to perform the Work hereunder, provided that:

(a) Contractor shall not interfere with any other operations or activities being conducted at such Landfill or on such Property by either CRRA or any other person or entity;

(b) Contractor directly coordinates with CRRA on such access and Contractor's storage of any equipment or materials on the Property; and

(c) Contractor is in compliance with all of the terms and conditions of this Agreement.

CRRA reserves the right to revoke the access granted to Contractor herein if Contractor fails to comply with any of the foregoing conditions of access.

2.7 CRRA Right to Exclude Certain Individuals

Without limitation of Operator's overall responsibility for the acts and omissions of all on-site personnel and other employees, CRRA reserves the right to exclude anyone from the site who CRRA reasonably believes is a danger to themselves or any other Person, or the Hartford Landfill.

2.8 Change in Scope of Work

In the event that CRRA determines during the term of this Agreement that any revisions, modifications or changes are necessary to the Scope of Work then pursuant to CRRA's re-

quest, Contractor shall promptly commence and perform the work required for such revisions, modifications or changes, which work shall be performed in accordance with the Standards unless otherwise specifically agreed to in writing by CRRA and Contractor. Changes in the Scope of Work shall be administered as outlined in Section 01035 of the General Requirements "Modification Procedures". If any adjustment(s) to the time and/or cost estimates are required as a result of such revisions, modifications or changes, CRRA and Contractor shall mutually agree in writing on the amount of such adjustment(s) provided that **Exhibit E**, to the extent applicable, shall be used to determine the appropriate increase or decrease in the quantity or cost of the materials or Work necessitated by such revisions, modifications or changes. Contractor shall promptly commence and perform any work required by such revisions, modifications or changes even if CRRA and Contractor cannot agree on the amount of such adjustment(s). If Contractor determines that a change in scope is necessary to complete the Work, Contractor shall notify CRRA in writing within three (3) business days.

2.9 Site and Subsurface Conditions

All information and data shown or indicated in the Contract Documents with respect to underground facilities, surface conditions, subsurface conditions or other conditions at or contiguous to the Landfill are furnished for information only and CRRA does not assume any responsibility for the accuracy or completeness of such information and data. Contractor acknowledges and agrees that CRRA does not assume any responsibility for such information and data and that Contractor is solely responsible for investigating and satisfying itself as to all actual and existing conditions at the Landfill, including but not limited to surface conditions, subsurface conditions and underground facilities. Contractor acknowledges and agrees that existing landfill materials it may handle or contact are consistent with materials that may have been disposed in the landfill since the 1940's, including materials approved as municipal solid waste or special waste by the State of Connecticut Department of Energy and Environmental Protection. Such materials handled or contacted by Contractor must be managed in accordance with all site specific permits, authorizations, operation and managment plans, and state and federal regulations. Contractor has carefully studied all such information and data and Contractor has obtained and carefully studied (or assumes responsibility for having done so) all such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (including but not limited to surface conditions, subsurface conditions and underground facilities) at or contiguous to the Landfill and all other conditions or factors which may affect cost, progress, performance, furnishing or completion of the Work or which relate to any aspect of the means, methods, techniques, sequences, and procedures of construction or performance of the Work to be employed by Contractor and safety precautions and programs incident thereto. Contractor does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for Contractor to conclusively determine, and Contractor has so determined, that the Work can be performed, furnished and completed in accordance with the terms and conditions of the Contract Documents. In the event that the information or data shown or indicated in the Contract Documents with respect to underground facilities or surface, subsurface or other conditions at or contiguous to the Landfill differs from conditions encountered by Contractor during performance of the Work, there shall be no increase in the Contract Prices (as defined in Section 3.1 below) and/or no extension of time to perform any

work requested by CRRA as a result of such differing conditions, unless CRRA, in its sole and absolute discretion, agrees to such increase and/or extension.

2.10 Methane Gases

Contractor acknowledges the presence of methane gases at the Property. Contractor covenants and agrees that it and its employees, agents, sub-contractors and materialmen shall take all necessary precautions with respect to the presence of methane gases at all times at the Properties, including, but not limited to, prohibiting the presence of any open flames, sparks, smoking or any other activity which might ignite any of the methane gases present at the Properties.

2.11 Proprietary Information

Contractor shall not use, publish, distribute, sell or divulge any information obtained from CRRA by virtue of this Agreement for Contractor's own purposes or for the benefit of any person, firm, corporation or other entity (other than CRRA) without the prior written consent of CRRA. Any report or other work product prepared by Contractor in connection with the performance of the Work hereunder shall be owned solely and exclusively by CRRA and cannot be used by Contractor for any purpose beyond the scope of this Agreement without the prior written consent of CRRA.

2.12 Books and Records

Contractor shall maintain proper books and records containing complete and correct information on all Work performed by Contractor pursuant to this Agreement in accordance with generally accepted accounting principles and practices. CRRA has the right to inspect and review all such books and records during Contractor's business hours.

2.13 Status of Contractor

CRRA and Contractor acknowledge and agree that Contractor is acting as an independent contractor in performing any Work for CRRA hereunder and that Contractor shall perform such Work in its own manner and method subject to the terms of this Agreement. Nothing in this Agreement shall be construed or interpreted as creating a partnership, a joint venture, an agency, a master-servant relationship, an employer-employee relationship or any other relationship between CRRA and Contractor other than that of an owner and an independent contractor. Contractor is expressly forbidden from transacting any business in the name of or on account of CRRA, and Contractor has no power or authority to assume or create any obligation or responsibility for or on behalf of CRRA in any manner whatsoever.

2.14 Subcontractors

Contractor shall consult with CRRA and obtain its approval before hiring any subcontractors to perform any Work hereunder. Contractor shall require all of its subcontractors to abide by the terms and conditions of this Agreement. Moreover, Contractor's subcontracts with such subcontractors shall specifically provide that, in the event of a default by Contractor thereun-

der or under this Agreement, CRRA may directly enforce such subcontracts and make payments thereunder. Contractor shall provide CRRA with all contracts, amendments, books, records, accounts, correspondence and other materials necessary to enforce such subcontracts. Also Contractor's subcontracts with its subcontractors shall specifically include CRRA as a third party beneficiary and shall provide that such subcontractors shall not be excused from any of their obligations under such subcontracts by reason of any claims, setoffs, or other rights whatsoever that they may have with or against Contractor other than through such subcontracts.

2.15 Contractor's Employees

All persons employed by Contractor shall be subject and responsible solely to the direction of Contractor and shall not be deemed to be employees of CRRA.

2.16 Notice of Damage or Theft

Operator shall immediately upon learning of an incident of damage to or theft of any CRRA equipment or property provide the CRRA with notice of the same, followed by an incident report. Such incident report shall be in a format acceptable to CRRA but shall at a minimum contain the date and time of the incident (if known), a description of the missing or damaged equipment or property, and the party(ies) responsible for such theft or damage.

2.17 Mechanic's Liens

Contractor shall claim no interest in the Properties or any equipment, fixtures or improvements located or to be located thereon, including but not limited to the Landfills or any part thereof. Contractor shall not file any mechanic's liens or other liens or security interests against CRRA or any of its properties, including but not limited to the Properties. Contractor shall defend, indemnify and hold harmless CRRA against all costs associated with the filing of such liens or interests by Contractor or any of its subcontractors or materialmen. Before any subcontractor or materialman of Contractor commences any Work hereunder, Contractor shall deliver to CRRA an original waiver of mechanic's liens properly executed by such subcontractor or materialman. If any mechanic's lien is filed against CRRA or any of its properties in connection with the Work hereunder, Contractor shall cause the same to be canceled and discharged of record within fifteen (15) days after the filing of such lien and, if Contractor fails to do so, CRRA may, at its option but without any obligation to do so, make any payment necessary to obtain such cancellation or discharge and the cost thereof, at CRRA's election, shall be either deducted from any payment due to Contractor hereunder or reimbursed to CRRA promptly upon demand by CRRA to Contractor.

3. COMPENSATION AND PAYMENT

3.1 Compensation

The total amount of compensation to be paid to Contractor by CRRA for the Work hereunder shall not exceed the amount set forth in **Exhibit E** attached hereto and made a part hereof (the "Contract Price"), which Contract Price shall be payable as set forth in Section 3.2 below. Contractor acknowledges and agrees that the Contract Price constitutes the full compensation to Contractor for the Work to be performed by Contractor hereunder and includes all expenses and costs to be incurred by Contractor in performing such Work and Contractor shall receive no other compensation from CRRA for its performance under this Agreement.

3.2 Payment Procedure

Within ten (10) days after execution of this Agreement, Contractor shall submit to CRRA a Schedule of Values, which itemizes all costs carried in each Proposal Item. The Schedule of Values will be used to track the cost of the project and shall be used as the basis for preparing monthly invoices.

Within ten (10) days after the end of each month during the term hereof, Contractor shall submit to CRRA a written request for payment for all the Work completed by Contractor during such month. Each written request for payment shall be submitted on AlA Forms G702 and G703 and in accordance with the General Requirements, and each such request shall include the name of the Project, the contract number, and all of the other information and documentation required by the General Requirements. The Schedule of Values shall be submitted with each monthly invoice.

If CRRA determines in its sole and absolute discretion that the Work for which Contractor is requesting payment has been properly performed and completed in conformance with the Standards, Contractor is not in default hereunder and CRRA does not dispute the amount of the payment requested, then CRRA shall pay Contractor ninety-five (95%) percent of the amount requested (the "Authorized Percentage Sum") within thirty (30) days after CRRA's receipt of such written request, and CRRA shall withhold the remaining five (5%) percent of such amount as retainage ("Retainage"). If, however, CRRA determines that any of the Work for which Contractor has requested payment is not in conformance with the Standards, then CRRA may in its sole and absolute discretion also withhold all or a portion of the Authorized Percentage Sum, and Contractor shall, if requested by CRRA, immediately take, at Contractor's sole cost and expense, all action necessary to render such Work in conformance with the Standards. CRRA shall have no obligation under this Agreement to pay for any Work that CRRA determines has not been performed and/or completed in conformance with the Standards.

Within ten (10) days after the Acceptance Date, Contractor shall submit to CRRA a written request for payment of all Retainage, and, provided Contractor is not in default hereunder and CRRA does not dispute the amount of such requested payment, CRRA shall pay Contractor such Retainage, less two (2%) percent of the total contract value, within thirty (30)

days after CRRA's receipt of such written request. The remaining two (2%) percent of the total value of the construction Contract will be held back from payment to the contractor until one year expires from the date the Acceptance Date. CRRA shall have no obligation to pay Contractor any amounts due Contractor under this Agreement if Contractor is in default hereunder.

Applications for Payment are further detailed in Section 01027 of the General Requirements "Application for Payment."

3.3 Accounting Obligations

Contractor shall maintain books and accounts of the costs incurred by Contractor in performing the Work pursuant to this Agreement by contract number and in accordance with generally accepted accounting principles and practices. CRRA, during normal business hours, for the duration of this Agreement, shall have access to such books and accounts to the extent required to verify such costs incurred.

3.4 Withholding Taxes And Other Payments

No FICA (social security) payroll tax, state or federal income tax, federal unemployment tax or insurance payments, state disability tax or insurance payments or state unemployment tax or insurance payments shall be paid or deposited by CRRA with respect to Contractor, nor be withheld from payment to Contractor by CRRA. No workers' compensation insurance has been or will be obtained by CRRA on account of the Work to be performed hereunder by Contractor, or any of Contractor's employees or subcontractors. Contractor shall be responsible for paying or providing for all of the taxes, insurance and other payments described or similar to those described in this Section 3.4 and Contractor hereby agrees to indemnify CRRA and hold CRRA harmless against any and all such taxes, insurance or payments, or similar costs which CRRA may be required to pay in the event that Contractor's status hereunder is determined to be other than that of an independent contractor.

3.5 State of Connecticut Taxes

Pursuant to Section 22a-270 of the *Connecticut General Statutes* (as the same may be amended or superceded from time to time), CRRA is exempt from all State of Connecticut taxes and assessments ("Connecticut Taxes"), and the payment thereof. Without limiting the generality of the preceding sentence, the sale of any services or tangible personal property to be incorporated into or otherwise consumed in the operation of a CRRA Project is exempt from Connecticut Taxes, including without limitation Connecticut sales and use taxes, wherever purchased. Accordingly, Contractor shall not include in the fees, and Contractor shall not charge or pass through any Connecticut Taxes to CRRA, including that portion of any combined tax or assessment representing any Connecticut Taxes, regardless of whether Contractor has incurred any Connecticut State Taxes in its performance of the Agreement.

CRRA expresses no opinion as to the eligibility for any tax exemption, or refund or other reimbursement, including without limitation any Connecticut Taxes, with respect to tangible

personal property purchased at any location for use in the performance of Work contemplated by this Agreement.

Contractor should consult with its tax advisor and/or its attorney, and the Connecticut Department of Revenue Services ("DRS") and any other applicable tax authority, with regard to such tax authorities' policies, procedures, recordkeeping and filing requirements for reimbursement of any taxes, including without limitation Connecticut Taxes, paid in the performance of Work contemplated by this Agreement, and whether or not there is a mechanism available to Contractor for the reimbursement of taxes, including without limitation Connecticut Taxes, paid on fuel purchased for use in the performance of the Work contemplated by this Agreement.

Contractor and CRRA agree that Contractor is and shall act as an independent contractor. Notwithstanding Contractor's status as an independent contractor, but without limiting Contractor's obligation hereunder to pay, and be solely responsible for, any Connecticut taxes levied, imposed or applicable to the Work, for the sole purpose of allowing CRRA to benefit from the aforesaid exemption, CRRA shall designate, and Contractor has agreed to act, as CRRA's agent in purchasing services and equipment, machinery, parts, materials, supplies, inventories, fuel, and other items necessary to perform the Work hereunder for the account of CRRA, and with funds provided as reimbursement therefor by CRRA.

4. TERM OF AGREEMENT

4.1 Term

The term of this Agreement shall commence upon the Effective Date and shall terminate, unless otherwise terminated or extended in accordance with the terms and provisions hereof, eighteen (18) months after Contractor's receipt of final payment made by CRRA.

Contractor shall retain and maintain accurate records and documents relating to the performance of Work under this Agreement for a minimum of three (3) years after final payment by CRRA for the Work hereunder and shall make them available for inspection and audit by CRRA. Contactor's obligations under this paragraph shall survive the termination or expiration of this Agreement.

4.2 Time is of the Essence

CRRA and Contractor hereby acknowledge and agree that time is of the essence with respect to Contractor's performance of the Work hereunder. Accordingly, upon CRRA's issuance to Contractor of a notice to proceed with the Work (the "Notice To Proceed"), which Notice To Proceed shall be issued after the parties hereto receive all of the local, state and federal permits required for the Work hereunder, Contractor shall immediately commence performance of the Work and continue to perform the same during the term of this Agreement in accordance with the schedule set forth in attached **Exhibit D** in order to complete all of the Work

and have such Work ready for CRRA's acceptance as specified in **Exhibit D** following the issuance of such Notice To Proceed (the "Completion Date").

CRRA and Contractor recognize the difficulties involved in proving actual damages and losses suffered by CRRA if the Work is not completed and ready for CRRA's acceptance by the Completion Date. Accordingly, instead of requiring any such proof, CRRA and Contractor agree that as liquidated damages for any such delay in completion or readiness for acceptance (but not as a penalty) Contractor shall pay CRRA one thousand dollars ($1,000.00) for each calendar day beyond the Completion Date that Contractor fails to complete all of the Work or have the same ready for CRRA's acceptance until all such Work is completed by Contractor and readied by Contractor for acceptance by CRRA. The parties further agree that liquidated damages in this Section 4.2 are reasonable and have been agreed upon and intended by the parties because the damages expected under this Section are uncertain and difficult to prove.

4.3 Termination

CRRA may terminate this Agreement at any time by providing Contractor with ten (10) days' prior written notice of such termination. Upon receipt of such written notice from CRRA, Contractor shall immediately cease performance of all Work, unless otherwise directed in writing by CRRA. Prior to any termination of this Agreement, Contractor shall remove all of its personnel and equipment associated with this Agreement from the Properties, restore any part of the Properties, any of the improvements located or to be located thereon, including but not limited to any access roads, or any of the Work that requires restoration pursuant to the terms and conditions of Section 4.4 hereof. Upon termination of this Agreement pursuant to this Section 4.3,

(a) CRRA shall pay Contractor for all Work performed and completed by Contractor prior to the termination date, provided:

(1) Such Work has been performed and completed by Contractor in conformance with the Standards;

(2) Payment for such Work has not been previously made or is not disputed by CRRA;

(3) Contractor is not in default hereunder; and,

(4) Contractor has performed and completed all its obligations under this Section 4.3 and Section 4.4 hereof to CRRA's satisfaction, and

(b) CRRA shall have no further liability hereunder.

Except for the payment that may be required pursuant to the preceding sentence, CRRA shall not be liable to Contractor in any other manner whatsoever in the event CRRA exercises its right to terminate this Agreement.

4.4 Restoration

Unless otherwise directed in writing by CRRA, Contractor shall:

(a) Restore any part of the Properties or any of the improvements located or to be located thereon, other than those areas of the Properties or such improvements improved by Contractor pursuant to this Agreement, disturbed or damaged by Contractor or any of its directors, officers, employees, agents, subcontractors or materialmen to the same condition existing immediately prior to such disturbance or damage; and

(b) Restore or repair any completed Work so disturbed or damaged to the condition required by the Contract Documents for acceptance of such Work by CRRA.

5. INDEMNIFICATION

5.1 Contractor's Indemnity

Contractor shall at all times defend, indemnify and hold harmless CRRA and its board of directors, officers, agents and employees from and against any and all claims, damages, losses, judgments, liability, workers' compensation payments and expenses (including but not limited to attorneys' fees) arising out of injuries to the person (including death), damage to property or any other damages alleged to have been sustained by: (a) CRRA or any of its directors, officers, agents, employees or other contractors, or (b) Contractor or any of its directors, officers, agents, employees, subcontractors or materialmen, or (c) any other person, to the extent any such injuries, damage or damages are caused or alleged to have been caused in whole or in part by the acts, omissions or negligence of Contractor or any of its directors, officers, agents, employees, subcontractors or materialmen. Contractor further undertakes to reimburse CRRA for damage to property of CRRA caused by Contractor or any of its directors, officers, agents, employees, subcontractors or materialmen, or by faulty, defective or unsuitable material or equipment used by it or any of them. The existence of insurance shall in no way limit the scope of this indemnification. Contractor's obligations under this Section 5.1 shall survive the termination or expiration of this Agreement.

6. INSURANCE

6.1 Insurance

At all times during the term of this Agreement, Contractor shall, at its sole cost and expense, procure and maintain the insurance coverages described below for claims which may arise from or in connection with the Work performed by the Contractor and those for whom they are legally responsible.

(a) Minimum Scope of Insurance

Coverage shall be at least as broad as:

1. Commercial General Liability insurance as specified by the most recent version of ISO Form Number CG 001 (occurrence).

2. Automobile Liability insurance as specified by the most recent edition of ISO Form Number CA 0001, Symbol 1 (any auto**).** An MCS 90 Endorsement and a CA 9948 Endorsement shall be attached **if any hazardous materials are transported by the Contractor during its performance of the Work.**

3. Workers' Compensation insurance as required by all states in which the Work is being done and Employer's Liability insurance.

4. Contractor's Pollution liability insurance.

5. Professional Liability insurance if the Contractor or any subcontractor to them is providing engineering, construction management, and/or design services. The Professional Liability insurance should include coverage for all professional services related to the Work (including design work that preceded this Agreement) and should be kept in force for a completed operations period of at least five years after final completion of the Work.

6.2 Minimum Limits of Insurance

Contractor shall maintain the following limits of liability for the insurance described above:

1. Commercial General Liability:
    a. $5,000,000 Each Occurrence for Bodily Injury & Property Damage.
    b. $5,000,000 General Aggregate
    c. $5,000,000 Products & Completed Operations Aggregate
    d. $5,000,000 Personal & Advertising Injury

2. Automobile Liability:
    a. $1,000,000 Combined Single Limit Each Accident for Bodily Injury and Property Damage.
    b. Include Owned, Hired and Non-Owned Auto Liability

3. Workers' Compensation: Statutory limits.

    Employer's Liability:

a. $1.000,000 Each Accident
b. $1,000,000 Disease – Policy Limit
c. $1,000,000 Disease – Each Employee

4. Contractor's Pollution Liability with a limit of $2,000,000.00

5. Professional liability insurance with a limit of $1,000,000.00

6. Contractor's Property Insurance covering 100% the actual cash value of Contractor's equilment (does not apply if CRRA equipment is used).

(a) Deductibles, Self-insured Retentions and Uninsured Losses

The Contractor shall be responsible for payment of all deductibles and self-insured retentions on any of the insurance policies required under this Agreement. The Contractor is also responsible for the payment of all losses arising out of its performance of the Work that may not be covered by the insurance policies required under this Agreement.

(b) Other Insurance Provisions

All policies required under this Agreement shall contain the following provisions:

1. CRRA, its subsidiaries, officials and employees are to be covered as additional insureds on a primary and non-contributing basis on the following insurance policies purchased by the Contractor:
   a. Commercial General Liability
   b. Automobile Liability
   c. Contractor's Pollution Liability

2. The Contractor agrees to notify CRRA at least thirty (30) days in advance of any cancellation or change to insurance coverages required under this Agreement. Notice of cancellation or change in coverage shall be provided to CRRA's Risk Manager by fax to 860-757-7740, or by e-mail to lmartin@crra.org, or by correspondence to CRRA, 100 Constitution Plaza, 6th Floor, Hartford, Connecticut 06103-1722.

3. The Contractor should waive (and require their insurers to waive) subrogation rights against CRRA for losses and damages incurred under the insurance policies required by this Agreement.

4. The Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

(c) Acceptability of Insurance

Insurance is to be placed with insurers with current A.M. Best ratings of not less than A-VIII, and be lawfully authorized to conduct business in the state(s) or jurisdiction(s) where the Work is being performed, unless otherwise approved by CRRA.

(d) Verification of Coverage

Contractor shall furnish CRRA with a Certificate of Insurance evidencing the coverages required under this Agreement. All certificates are to be received and approved by CRRA before the Work commences. Contractor shall provide new Certificates of Insurance upon renewal, replacement or addition of any insurance required under this Agreement.

(e) Subcontractors

Contractor shall either include all subcontractors as insureds under its insurance policies or shall require subcontractors to provide their own insurance subject to all of the requirements stated herein.

7. SECURITY FOR FAITHFUL PERFORMANCE

7.1 Required Security

Subsequent to the execution of this Agreement and prior to the commencement of the Work, Contractor shall procure and maintain in full force and effect, at its own cost and expense, throughout the term of the Agreement and any extensions thereof, the following:

(a) A performance bond or letter of credit (the "Performance Bond" or the "Performance Letter Of Credit") in the amount of one hundred percent of the Contract Price and such Performance Bond or Performance Letter Of Credit shall be in and drawn on the forms set forth in **Exhibit G** attached hereto and made a part hereof; and

(b) A payment bond or letter of credit (the "Payment Bond" or the "Payment Letter Of Credit") in the amount of one hundred percent of the Contract Price and such Construction Payment Bond or Payment Letter Of Credit shall be in and drawn on the forms set forth in **Exhibit H** attached hereto and made a part hereof.

7.2 Submission Of Security

Within ten (10) days after CRRA issues the Notice of Award and prior to the issuance of the Notice to Proceed, Contractor shall furnish CRRA with the following:

(a) The Performance Bond or the Performance Letter Of Credit; and

(b) The Payment Bond or the Payment Letter Of Credit.

7.3 Specific Requirements – Performance Bond and Payment Bond

If the surety on the Performance Bond and/or the Payment Bond furnished by Contractor is declared a bankrupt or becomes insolvent or its right to do business is terminated in the State of Connecticut or it ceases to meet the above requirements or the surety elects not to renew the Performance Bond and/or the Payment Bond due to no fault of Contractor, Contractor shall immediately substitute another bond and surety, subject to the requirements set forth in this Article 7.

7.4 Specific Requirements – Performance Letter Of Credit and Payment Letter Of Credit

The Performance Letter Of Credit and/or Payment Letter Of Credit required hereunder shall be automatically renewed by Contractor on an annual basis, unless not later than ninety (90) days prior to the then current expiration date of the Performance Letter Of Credit and/or Payment Letter Of Credit, Contractor notifies CRRA by registered mail that the issuer of the Performance Letter Of Credit and/or Payment Letter Of Credit elects not to renew such Performance Letter Of Credit and/or Payment Letter Of Credit. If the issuer of the Performance Letter Of Credit and/or Payment Letter Of Credit furnished by Contractor is declared a bankrupt or becomes insolvent or its right to do business is terminated in the State of Connecticut or it ceases to meet the above requirements or the issuer elects not to renew the Performance Letter Of Credit and/or the Payment Letter Of Credit due to no fault of Contractor, Contractor shall immediately substitute another letter of credit (or bond) and surety, subject to the requirements set forth in this Article 7.

7.5 Failure To Maintain The Security

Failure to maintain or renew the Performance Bond, the Performance Letter Of Credit, the Payment Bond and/or the Payment Letter Of Credit under the aforesaid terms shall constitute a default by Contractor of this Agreement.

7.6 Exercise Of Rights And Remedies

In the event Contractor fails to perform any of its obligations under this Agreement, CRRA shall have the right, in addition to all other rights and remedies available to CRRA hereunder or otherwise, to exercise any or all of CRRA's rights and remedies under the Performance Bond, the Performance Letter Of Credit, the Payment Bond and the Payment Letter Of Credit.

7.7 Issuing Companies

The Performance Bond and the Payment Bond shall be issued and executed by a surety company or companies acceptable to CRRA. The Performance Letter Of Credit and the Payment Letter Of Credit shall be issued and executed by a Connecticut Bank or by a national banking association acceptable to CRRA.

8. PREVAILING WAGES

8.1 Prevailing Wages

Contractor shall pay wages on an hourly basis to any mechanic, laborer or workman employed upon the Work herein and the amount of payment or contribution paid or payable on behalf of each such employee to an employee welfare fund, as defined in *Connecticut General Statutes* § 31-53(h), at rates equal to the rates customary or prevailing for the same work in the same trade or occupation in the town in which the Work is being conducted, which rates are more specifically set forth in **Exhibit J** attached hereto and made a part hereof.

If Contractor is not obligated by agreement to make payment or contribution on behalf of such employees to any such employee welfare fund, Contractor shall pay to each employee as part of his or her wages the amount of payment or contribution for his or her classification on each payday.

Contractor shall keep, maintain and preserve records relating to the wages and hours worked by each employee and a schedule of the occupation or work classification at which each mechanic, laborer, or workman under this Agreement is employed during each work day and week in such manner and form as the labor commissioner establishes to assure the proper payments due to such employees or employee welfare funds under *Connecticut General Statutes* §§ 31-53 and 31-54.

8.2 Contractor's Wage Certification Form

Contractor hereby represents that the Contractor's Wage Certification Form, as executed by Contractor and attached hereto as **Exhibit I** and made a part hereof, has been submitted by Contractor to the State of Connecticut's Department of Labor for Contractor's performance of the Work.

8.3 Payroll Certification Form

Pursuant to *Connecticut General Statutes*§ 31-53(f), Contractor shall complete and submit to CRRA on a weekly basis during the term of this Agreement and any extension thereof the payroll certification forms set forth in **Exhibit K** attached thereto and made a part hereof.

8.4 Training

(a) In accordance with *Connecticut General Statutes*§ 31-53(b), Contractor will furnish proof with the weekly certified payroll form for the first week each employee begins work on such project that any person performing the work of a mechanic, laborer or worker pursuant to the classifications of labor under section 31-53 on such public works project, pursuant to such contract, has completed a course of at least ten hours in duration in construction safety and health approved by the federal Occupational Safety and Health Administration or, has completed a new miner training program approved by the Federal Mine Safety and Health Administration in accordance with 30 CFR 48 or, in the case of

telecommunications employees, has completed at least ten hours of training in accordance with 29 CFR 1910.268.

(b) Any person required to complete a course or program under subsection (a) of this section who has not completed the course or program shall be subject to removal from the worksite if the person does not provide documentation of having completed such course or program by the fifteenth day after the date the person is found to be in noncompliance. The Labor Commissioner or said commissioner's designee shall enforce this section.

(c) The Labor Commissioner shall accept as sufficient proof of compliance with the provisions of subsection (a) or (b) of this section a student course completion card issued by the federal Occupational Safety and Health Administration Training Institute, or such other proof of compliance said commissioner deems appropriate, dated no earlier than five years before the commencement date of such public works project.

(d) This section 8.4 shall not apply to employees of public service companies, as defined in section 16-1, or drivers of commercial motor vehicles driving the vehicle on the public works project and delivering or picking up cargo from public works projects provided they perform no labor relating to the project other than the loading and unloading of their cargo.

8.5 No Violation

Contractor hereby represents and covenants that it is not now, and has not been for at least three (3) years previous to the date of this Agreement, listed by the labor commissioner as a person who has violated laws and regulations relating to prevailing wages.

9. MISCELLANEOUS

9.1 Non-Discrimination

Contractor agrees to the following:

(a) Contractor agrees and warrants that in the performance of the Services for CRRA Contractor will not discriminate or permit discrimination against any person or group of persons on the grounds of race, color, religious creed, age, marital status, national origin, ancestry, sex, sexual orientation, gender identity or expression, intellectual disability, mental disability, or physical disability, including, but not limited to, blindness, unless it is shown by Contractor that such disability prevents performance of the Services involved, in any manner prohibited by the laws of the United States or of the State of Connecticut. Contractor further agrees to take affirmative action to insure that applicants with job related qualifications are employed and that employees are treated when employed without regard to their race, color, religious creed, age, marital status, national origin, ancestry, sex, sexual orientation, gender identity or expression, intellectual disability, mental disability, or physical disability, including, but not limited to, blindness, unless it is shown by Contractor that such disabil-

ity prevents performance of the Services involved;

(b) Contractor agrees, in all solicitations or advertisements for employees placed by or on behalf of Contractor, to state that it is an "affirmative action-equal opportunity employer" in accordance with regulations adopted by the Connecticut Commission on Human Rights and Opportunities (The "Commission");

(c) Contractor agrees to provide each labor union or representative of workers with which Contractor has a collective bargaining agreement or other contract or understanding and each vendor with which Contractor has a contract or understanding, a notice to be provided by the Commission, advising the labor union, workers' representative and vendor of Contractor's commitments under Sections 4a-60 and 4a-60a of the *Connecticut General Statutes* and to post copies of the notice in conspicuous places available to employees and applicants for employment;

(d) Contractor agrees to comply with each applicable provision of Sections 4a-60, 4a-60a, 46a-68e, and 46a-68f, inclusive, of the *Connecticut General Statutes* and with each regulation or relevant order issued by the Commission pursuant to Sections 46a-56, 46a-68e, and 46a-68f of the *Connecticut General Statutes*; and

(e) Contractor agrees to provide the Commission with such information requested by the Commission, and permit access to pertinent books, records and accounts concerning the employment practices and procedures of Contractor as related to the applicable provisions of Sections 4a-60, 4a-60a and 46a-56 of the *Connecticut General Statutes*. If this Agreement is a public works contract, Contractor agrees and warrants that it will make good faith efforts to employ minority business enterprises as subcontractors and suppliers of materials in such public works project.

9.2 Entire Agreement

This Agreement constitutes the entire agreement and understanding between the parties hereto and concerning the subject matter hereof, and supersedes any previous agreements, written or oral, between the parties hereto and concerning the subject matter hereof.

9.3 Governing Law

This Agreement shall be governed by, and construed, interpreted and enforced in accordance with the laws of the State of Connecticut as such laws are applied to contracts between Connecticut residents entered into and to be performed entirely in Connecticut.

9.4 Assignment

This Agreement may not be assigned in whole or in part by either party without the prior written consent of the other party or such assignment shall be void.

9.5 No Waiver

Failure to enforce any provision of this Agreement or to require at any time performance of any provision hereof shall not be construed to be a waiver of such provision, or to affect the validity of this Agreement or the right of any party to enforce each and every provision in accordance with the terms hereof. No waiver of any provision of this Agreement shall affect the right of CRRA or Contractor thereafter to enforce such provision or to exercise any right or remedy available to it in the event of any other default involving such provision or any other provision. Making payment or performing pursuant to this Agreement during the existence of a dispute shall not be deemed to be and shall not constitute a waiver of any claims or defenses of the party so paying or performing.

9.6 Modification

This Agreement may not be amended, modified or supplemented except by a writing signed by the parties hereto that specifically refers to this Agreement. Any oral representations or letters by the parties or accommodations shall not create a pattern or practice or course of dealing contrary to the written terms of this Agreement unless this Agreement is formally amended, modified or supplemented.

9.7 Notices

All notices, requests, demands and other communications hereunder shall be in writing and shall be deemed to have been duly given if mailed via certified first class mail return receipt requested postage prepaid or overnight express mail service to the pertinent address below.

(a) If to CRRA:

Connecticut Resources Recovery Authority
100 Constitution Plaza, 6th Floor
Hartford, Connecticut 06103
Attention: David Bodendorf

With a copy to:

Connecticut Resources Recovery Authority
100 Constitution Plaza, 6th Floor
Hartford, Connecticut 06103
Attention: President

(b) If to Contractor:

_____
_____
_____
Attention: _____

9.8 Binding Effect

This Agreement shall inure to the benefit of and be binding upon the heirs, personal representatives, successors and assigns of the parties hereto.

9.9 Severability

CRRA and Contractor hereby understand and agree that if any part, term or provision of this Agreement is held by any court to be invalid, illegal or in conflict with any applicable law, the validity of the remaining portions of this Agreement shall not be affected, and the rights and obligations of the parties shall be construed and enforced as if this Agreement did not contain the particular part, term or provision held to be invalid, illegal or in conflict with any applicable law.

9.10 Whistleblower Protection

If any officer, employee or appointing authority of the Contractor takes or threatens to take any personnel action against any employee of the Contractor in retaliation for such employee's disclosure of information to the Auditors of Public Accounts or the Attorney General under the provisions of *Connecticut General Statutes* Section 4-61dd, the Contractor shall be liable for a civil penalty of not more than five thousand dollars for each offense, up to a maximum of twenty per cent of the value of the contract. Each violation shall be a separate and distinct offense and in the case of a continuing violation each calendar day's continuance of the violation shall be deemed to be a separate and direct offense. The Contractor shall post a notice in a conspicuous place which is readily available for viewing by employees of the provisions of *Connecticut General Statutes* Section 4-61dd relating to large state Contractors.

9.11 Counterparts

This Agreement may be executed in any number of counterparts by the parties hereto. Each such counterpart so executed shall be deemed to be an original and all such executed counterparts shall constitute but one and the same instrument.

9.12 Campaign Contribution And Solicitation Prohibitions

For all State contracts as defined in P.A. 07-1 having a value in a calendar year of $50,000 or more or a combination or series of such agreements or contracts having a value of $100,000 or more, the authorized signatory to this Agreement expressly acknowledges receipt of the State Elections Enforcement Commission's notice advising state contractors of state campaign contribution and solicitation prohibitions, and will inform its principals of the contents of the notice. See **Exhibit L** [SEEC Form 11].

9.13 Affirmation Concerning The State Of Connecticut Ethics Law

At the time the Contractor submitted its bid to CRRA, it simultaneously executed a document entitled Affirmation Concerning The State Of Connecticut Ethics Law and said document is attached hereto and made a part of this Agreement as **Exhibit M**.

9.14 Affidavit Concerning Nondiscrimination

At the time the Contractor submitted its bid to CRRA, it simultaneously executed a document entitled Affidavit Concerning Nondiscrimination and said document is attached hereto and made a part of this Agreement as **Exhibit N**.

9.15 Affidavit Concerning Consulting Fees

At the time of Contractor's execution of this Agreement, Contractor simultaneously executed a document entitled Affidavit Concerning Consulting Fees and said document is attached hereto and made a part of this Agreement as **Exhibit O**.

9.16 Contractor's Certification Concerning Gifts

At the time of Contractor's execution of this Agreement, Contractor simultaneously executed a document entitled Contractor's Certification Concerning Gifts and said document is attached hereto and made a part of this Agreement as **Exhibit P**.

9.17 President's Certification Concerning Gifts

At the time of the President of CRRA's execution of this Agreement, the President of CRRA simultaneously executed a document entitled President's Certification Concerning Gifts and said document is attached hereto and made a part of this Agreement as **Exhibit Q**.

[REMAINDER OF PAGE INTENTIONALLY LEFT BLANK]

[SIGNATURE PAGE FOLLOWS]

IN W-ITNESS WHEREOF, the parties hereto have set their hands and seals as of the day and year first written above.

CONNECTICUT RESOURCES RECOVERY AUTHORITY

By: _____
Thomas D. Kirk
Its President
Duly Authorized

[NAME OF CONTRACTOR]

By: _____

Its
Duly Authorized

EXHIBIT A

CONSTRUCTION DRAWINGS

The following Construction Drawings are hereby incorporated and made a part of this Agreement.

EXHIBIT B

GENERAL REQUIREMENTS
TABLE OF CONTENTS

01000 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Title

The project is entitled "PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT - CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LAND-FILL". The landfill is located in Hartford, Connecticut. It is to be completed and ready for use by the Owner within the Contract Time specified in Exhibit D of the Contract Documents.

B. The Project Description

1. Installation of the following Final Cover System components:
    a. Landfill Cap System
    b. Stormwater Control Structures
    c. Photovoltaic Electricity Generation System

01001 OWNER AND REGULATORY AUTHORITY

A. Owner

The Owner is the Connecticut Resources Recovery Authority (CRRA).

1. CRRA has the administrative authority for the facility and site where the work is being performed. The authorized representative for CRRA acts in matters involving revoking, altering, enlarging or relaxing any requirement of the contract documents.
2. The Owner's Representative is David Bodendorf, Senior Environmental Environmental Engineer. The Owner's Representative is located at 100 Constitution Plaza, 6th Floor, Hartford, CT 06103. Phone 860-757-7721; email dbodendorf@crra.org.

B. Property Owner

The current property owner is the City of Hartford. The City of Hartford has no authority over the work being performed under this contract.

C. Regulatory Authority

The Regulatory Authority is the Connecticut Department of Energy & Environmental Protection (CTDEEP).

01002 ENGINEER

A. The Engineer

1. Engineer Identification: The Drawings and Technical Specifications, dated March 2013, were prepared for the Project by Fuss & O'Neill, Inc. 146 Hartford Road, Manchester, CT 06040.
2. The Engineer or their accredited representative is referred to in the Contract Documents as "Engineer" or "Engineers" or by pronouns which imply them. As information for the Contractor, the Engineer's status is defined as follows:
    a. The Engineer will not make interpretations or decisions directly to the Contractor.
    b. As the authorized agent of CRRA, the Engineer is responsible for review of shop drawings, materials, and equipment intended for the work, in accordance with the "General Conditions", and the "Supplementary Conditions".
3. As information to the Contractor, the Engineer's status is defined as follows:
    a. The Engineer is the Owner's Agent who will, among other things, monitor the General Contractor's performance, scheduling and construction, process shop drawings, material,

and equipment submittals, review and process periodic billings, review and recommend cost changes.

b. The Engineer will process all requests for information, interpretations and decisions regarding the meaning and intent of the Contract Documents, consulting with appropriate parties prior to rendering the interpretations or decisions to the Contractor. All such requests and replies shall be in writing.

4. Limitations on Engineer's Authority and Responsibilities.

a. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

b. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

c. Engineer shall not authorize any deviation from the Contract Documents or substitution of materials or equipment, unless authorized by the Owner.

d. Engineer shall not undertake any of the responsibilities of Contractor, subcontractors or Contractor's superintendent.

e. Engineer shall not advise on, issue directions relative to or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction unless such advice or directions are specifically required by the Contract Documents.

f. Engineer shall not advise on, issue directions regarding or assume control over safety precautions and programs in connection with the Work.

g. Engineer shall not accept Shop Drawing or Sample submittals from anyone other than Contractor.

h. Engineer shall not participate in specialized field or laboratory tests or inspections conducted by others except as specifically authorized by the Engineer or Owner.

01010 SUMMARY OF WORK

A. Part 1 – General

1. Related Documents

a. Contract Documents and general provisions of the Contract, including the Agreement and all Exhibits, apply to this Section.

2. Site Conditions

a. Work is to be performed at a municipal solid waste landfill. Landfill gases, including methane, may be present in potentially combustible concentrations. Leachate may be generated by the landfill during the course of the Work.

1. Take necessary precautions to protect and ensure the health and safety of employees, agents, subcontractors, suppliers, including employees of the Owner and Engineer during the performance of the Work.

2. Prohibit the use of open flames, sparks, smoking or other activity which may ignite methane gas at the site.

b. The underground utilities and structures at the site have been located primarily from information furnished by others and the locations as depicted on the Drawings are considered approximate as to size and location. There may be additional underground utilities and structures that are not shown on the Drawings. Locate all existing utilities and structures and protect same from damage or harm. Restore utilities interfered with or damaged, at the expense of the CONTRACTOR, and to the satisfaction of its Owner.

c. Ensure that construction activities do not impact the activities or properties of the City of Hartford or the Owner and its agents without prior coordination and consent of these entities.

d. Immediately notify the Engineer upon encountering archaeological material, including "charcoal," "bone," "shell," "cultural objects" (e.g., fire cracked stones/stone flaking material), "middens," or any other artifacts or related items of historical significance.

3. Work Covered By Contract Documents

a. The Project is entitled, "PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT - CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL". The work involves mobilization and establishing temporary facilities, an initial survey of existing grades, preparation of the site, installing and maintaining sediment and erosion controls, construction stormwater management, earthwork, constructing the landfill cap system and drainage features, constructing a photovoltaic electricity generating system, and all work necessary to provide a finished stable site and grid-connected photovoltaic electricity generating system.

b. The CONTRACTOR shall include in its proposal, all items required in order to carry out the intent of the Work as described, shown, and implied in the Contract Documents.

c. It shall be the CONTRACTOR's responsibility upon discovery to immediately notify CRRA in writing, of errors, omissions, discrepancies, and instances of non-compliance with applicable codes and regulations within the documents. Any additional costs arising from the CONTRACTOR's failure to provide such notification shall be borne by the CONTRACTOR.

d. The CONTRACTOR shall include in its proposal all items required in order to carry out the intent of the Work as described, shown, and implied in the Contract Documents.

e. The CONTRACTOR shall follow the requirements of the Quality Assurance Plan (QAP), which is appended to these specifications.

f. The CONTRACTOR shall comply with terms of the CL&P interconnection agreement, which is appended to these specifications.

4. Work Sequence

a. Prior to mobilization, the CONTRACTOR shall provide CRRA with all the required testing and analytical data for materials and soils to be brought onsite for the construction of the landfill cap.

b. The CONTRACTOR shall mobilize all equipment, labor, tools, materials, and incidentals to the site. Temporary facilities shall include a construction trailer, sanitary facilities, and materials, equipment, and soil storage area as shown on the Contract Drawings. The CONTRACTOR shall demobilize following the completion of work and shall restore all storage areas to their condition prior to commencing work.

c. Prior to initiating any construction, the CONTRACTOR shall have a Connecticut licensed surveyor perform a survey to determine surface elevations within the area to be capped and provide this information to CRRA and the ENGINEER. At a minimum, the survey shall consist of cross-sections spaced every 100 feet and oriented east-west perpendicular to the east slope. Spot elevations shall be taken every 50 feet and at grade changes for every sec-

tion. The survey limits shall coincide with the cap limits plus 50 feet. The ENGINEER shall determine the final surface grades for the landfill and modify the drawings accordingly. A meeting will be held between CRRA, the ENGINEER, and the CONTRACTOR to discuss the changes in the final grades prior to commencing regrading work.

d. The CONTRACTOR shall prepare the site for construction by installing sediment and erosion controls as shown on the Contract Drawings prior to performing any work involving the removal of temporary cover materials or regrading.

e. The CONTRACTOR shall perform all grading of the materials within the Work Area to achieve the required subgrade surface. The CONTRACTOR will be responsible for regrading the surface to achieve the final grade. All grades prior to placement of sub base shall be no greater than 33%, nor less than 4%. CONTRACTOR shall remove all visible pieces of metal prior to placement of sub base.

f. The CONTRACTOR shall manage surface runoff from the work areas in strict accordance with the sediment and erosion control drawings and specifications. The CONTRACTOR shall be solely responsible for management of surface runoff as it impacts erosion of ash and cap materials. The CONTRACTOR shall include in its proposal pricing all means, methods, and materials that are necessary to prevent and minimize damage to ash and cap materials until a completely stabilized site condition is achieved. The CONTRACTOR shall not be entitled to any extra compensation to implement such measures and shall not be entitled to extra compensation for repairs to landfill materials resulting from erosion.

g. The CONTRACTOR shall furnish, place, and compact 6 inches of subbase soil in accordance with the provisions of the Contract Documents. The CONTRACTOR shall furnish and install the landfill cap system, drainage features, and photovoltaic electricity generation system in accordance with the provisions of the Contract Documents. The CONTRACTOR shall provide a final as-built survey of the limits of the liner showing topography and spot elevations of the landfill surface, location of the electricity generation system and location and elevations of the surface drainage control structures, prepared and sealed by a Connecticut licensed surveyor. Copies of all field notes shall accompany the as-built survey.

h. The CONTRACTOR shall reestablish drainage swales along the eastern perimeter as shown on the Contract Drawings and clean accumulated sediments from stormwater drainage pipes and other stormwater drainage features as shown on the Contract Drawings and described in the Specifications.

5. Miscellaneous Provisions

a. Examination of the Site:

1. It is not the intent of the Contract Documents to show all existing conditions. All contractors are required to attend the Pre-Proposal Conference prior to submitting their Proposal. This is the only opportunity to visit and examine the site with CRRA.

2. CONTRACTORs should investigate and satisfy themselves as to the conditions affecting the work, including but not restricted to those bearing upon transportation, handling, and storage of materials, availability of labor, water, electric power, uncertainties of weather, roads or similar physical conditions of the ground, and facilities needed preliminary to and during the prosecution of the Work. Any failure by the CONTRACTOR to acquaint itself with the available information shall not relieve him from the responsibility for estimating properly the difficulty and cost of successfully performing the Work.

b. Decontamination of Vehicles

1. The CONTRACTOR shall be responsible for decontaminating vehicles to minimize tracking of materials onto unvegetated surfaces. Dry decontamination methods will be allowed if sufficient.

6. Contractor Use Of Premises

a. General: The CONTRACTOR shall have full access to the Work Area. Except as delineated on the drawings, the CONTRACTOR shall not access areas already capped and will be responsible for repairing any damages to capped areas if due to actions of the CONTRACTOR. Access to other areas immediately surrounding the Work Area shall be prohibited unless prior approval is received from CRRA.

b. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. The CONTRACTOR shall confine its operations, including storage or materials, supplies, equipment, and incidentals to the areas specified in the Contract Documents.

2. Existing access roads, drives, walks, and parking areas are to be kept free and clear at all times. All deliveries for the project are to enter the Hartford Landfill property between 7 AM and 3 PM, Monday through Friday. All CONTRACTORs are to check all roadways for accessibility and clearances for deliveries of all large material and equipment. Only designated areas shall be used for parking and storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

3. The CONTRACTOR shall be responsible for keeping the work area clean and shall pick up rubbish and debris generated by the CONTRACTOR and promptly remove from the site.

4. CONTRACTOR's daily access to the site shall be as indicated on the Contract Documents. Parking for the CONTRACTOR's employees shall be limited to an area designated by CRRA and the CONTRACTOR may be required to provide identification stickers for all vehicles.

5. Special precautions shall be taken to protect all drainage systems near the Work Area. Prevent any and all sediment, debris, or other materials from getting into these systems. Should any sediment, debris, or other materials get into these systems or if any damage occurs to them, the CONTRACTOR shall immediately contact CRRA. The CONTRACTOR shall be fully responsible for all costs associated with additional cleaning and repairs caused by neglecting to protect the drainage systems.

6. No signs, other than those approved by CRRA, shall be visible on the premises.

7. Call Before You Dig

a. The Contractor shall be responsible for complying with all applicable Call Before You Dig Rules.

b. Contact Call Before You Dig at 1-800-922-4455 at least 2 working days prior to the start of construction (excluding weekends and holidays), to mark out the utility locations.

8. Safety

a. Comply with requirements of the most recent version of the Occupational Safety and Health Act (OSHA.)

b. When any support system is used that requires design by an engineer, copies of the design stamped by an engineer shall be submitted to the ENGINEER and OWNER.

c. The Contractor has full responsibility to comply with all provisions of State of Connecticut Public General Statutes, Title 31, Chapter 571 concerning Occupational Safety and Health. Any fines levied against for violations shall be the Contractor's responsibility.

B. Part 2 – Products

None

C. Part 3 - Execution

None

01012 PAY ITEMS

A. Part 1 - General

1. Summary

A. This Section includes measurement and payment paragraphs for

1. Proposal payment items (lump sum and unit price).

2. Definitions

A. **Approximate Quantities:** Engineer's Opinion of Quantities for Contract Lump Sum payment items provided for Contractor's information only. No guarantees are made as to the quantities of the listed elements.

1. No changes to the Contract Price will be made due to differences between the listed approximate quantities and actual quantities required to complete the Work for Lump Sum Payment Items. Unit Price Pay Items will be Paid based on the actual number of units complete and in-place.

B. **Proposal**: The proposal(s) of a Proposer submitted on the prescribed form setting forth the prices for the Work to be performed under any of the nine Options included in the Proposal Price Form.

1. **Option 1A:** Includes all costs to construct complete landfill capping system using the Closure Turf™ Alternative with interconnected 500kw AC Rigid, Ballasted Photovoltaic Electricity Generating System, ballasted racking and support systems, and appurtenant systems as described in the Contract Documents.
2. **Option 1B**: Includes all costs to construct complete landfill capping system using the Closure Turf™ Alternative with interconnected 750kw AC Rigid, Ballasted Photovoltaic Electricity Generating System, ballasted racking and support systems, and appurtenant systems as described in the Contract Documents.
3. **Option 1C**: Includes all costs to construct complete landfill capping system using the Closure Turf™ Alternative with interconnected 1,000kw AC Rigid, Ballasted Photovoltaic Electricity Generating System, ballasted racking and support systems, and appurtenant systems as described in the Contract Documents.
4. **Option 2A**: Includes all costs to construct complete landfill capping system using the TPO Alternative with interconnected 500kw AC Rigid, Ballasted Photovoltaic Electricity Generating System, ballasted racking and support systems, and appurtenant systems as described in the Contract Documents.
5. **Option 2B**: Includes all costs to construct complete landfill capping system using the TPO Alternative with interconnected 750kw AC Rigid, Ballasted Photovoltaic Electricity Generating System, ballasted racking and support systems, and appurtenant systems as described in the Contract Documents.
6. **Option 2C**: Includes all costs to construct complete landfill capping system using the TPO Alternative with interconnected 1,000kw AC Rigid, Ballasted Photovoltaic Electricity Generating System, ballasted racking and support systems, and appurtenant systems as described in the Contract Documents.

7. **Option 3A**: Includes all costs to construct complete landfill capping system using the TPO Alternative with interconnected 500kw AC Thin Film, Flexible Photovoltaic Electricity Generating System, ballasted racking and support systems, and appurtenant systems as described in the Contract Documents.

8. **Option 3B**: Includes all costs to construct complete landfill capping system using the TPO Alternative with interconnected 750kw AC Thin Film, Flexible Photovoltaic Electricity Generating System, ballasted racking and support systems, and appurtenant systems as described in the Contract Documents.

9. **Option 3C**: Includes all costs to construct complete landfill capping system using the TPO Alternative with interconnected 1,000kw AC Thin Film, Flexible Photovoltaic Electricity Generating System, ballasted racking and support systems, and appurtenant systems as described in the Contract Documents.

C. Payment Item: The Owner's distribution of the Contract Sum through listed work items.

1. Each payment item is specified to include a defined scope of services. However, not all incidental materials, labor, equipment, or services of a payment item required to complete the Work of the payment item is guaranteed to be listed or identified herein.

2. Include costs associated with items of work required to complete the defined scope of services within the appropriately specified payment item.

3. Include all necessary material, plus cost for delivery, installation, applicable taxes, overhead, and profit associated with each payment item.

3. List of Payment Items

A. Payment Item No. 1 – Mobilization/Demobilization and Incidental Construction:

1. The Work of this item shall be measured by the Contract lump sum price.

2. Work associated with this item will be paid for at the Contract Lump Sum price for site mobilization and demobilization, insurance, bonds, administrative and general requirements, and incidentals not covered by other Payment Items required to complete the work including materials, equipment, tools and labor incidental to the Work.

B. Payment Item No. 2 – Field Services:

1. The Work of this item shall be measured by the Contract lump sum price.

2. Work associated with this item will be paid for at the Contract Lump Sum price for field office and field survey and incidentals required to complete the work including materials, equipment, tools and labor incidental to the Work.

C. Payment Item No. 3 – Temporary Erosion Control:

1. The Work of this item shall be measured by the Contract lump sum price.

2. Work associated with this item will be paid for at the Contract Lump Sum price for silt fence, haybales, construction entrance, catch basin inserts, temporary sediment traps, polyacrylimide erosion control blocks, dust control, temporary diversions, temporary pipe slope drains, riprap aprons, and incidentals required to complete the work including materials, equipment, tools and labor incidental to the Work.

   a. Related Section includes Division 01 Section "Temporary Erosion and Sedimentation Control."

D. Pay Item No. 4 – General Fill (provided by owner)

1. The Work for this item will be paid for by the Contract per ton price.

2. Work associated with this item will be paid for at the Contract unit price for excavating owner supplied general fill from designated on-site stockpiles, transporting the general fill to appropriate locations, and placing, compacting, grading the general fill to the required subgrade elevations. This item also includes all incidentals, materials, equipment, tools, and labor required to complete the Work.

E. Pay Item No. 5 – General Fill (provided by contractor)

1. The Work for this item will be paid for by the Contract per ton price.
2. Work associated with this item will be paid for at the Contract unit price for procuring general fill from off-site source(s), transporting the material to the landfill, stockpiling the material if necessary, excavating and transporting the material from designated stockpile areas to appropriate locations, and placing, compacting, grading the general fill to the required subgrade elevations. This item also includes all incidentals, materials, equipment, tools, and labor required to complete the Work.

F. Payment Item No. 6 – Subgrade Preparation:

1. The Work of this item shall be measured by the Contract lump sum price.
2. Work associated with this item will be paid for at the Contract Lump Sum price for **removal and disposal of existing drainage improvements not required for the final construction**, fill, subgrade preparation, rough grading the site with on-site material, relocating chain link fences and gates, and incidental materials, equipment, tools and labor required to complete the Work.
    a. Related Sections include Division 02 Section "Landfill Earth Moving."

G. Payment Item No. 7 – 6" Cap Base Material (Owner Supplied):

1. The Work of this item shall be measured by the Contract per square yard price.
2. Work associated with this item will be paid for at the per Square Yard price for loading and transporting 6" Cap Base Material from Owner's on site stockpiles to the appropriate locations and also includes placement, compaction, material thickness testing, and incidentals materials, equipment, tools and labor required to complete the Work.
    a. Related Sections include Division 02 Section "Landfill Earth Moving."

H. Payment Item No. 8 – 6" Cap Base Material (Contractor Supplied):

1. The Work of this item shall be measured by the per square yard price.
2. Work associated with this item will be paid for at the per Square Yard price for providing 6" Cap Base Material including placement, compaction, material thickness testing, and materials, equipment, tools and labor incidental to completing the Work.
    a. Related Sections include Division 02 Section "Landfill Earth Moving."

I. Payment Item No. 9 – Landfill Capping System (Closure Turf™ or Exposed TPO):

1. The Work of this item shall be measured by the Contract lump sum price.
2. Work associated with this item will be paid for at the Contract Lump Sum price for a complete landfill Capping System which includes geomembrane, welding, testing and materials, equipment, tools and labor incidental to completing the Work.
    a. Related Sections include
        1) Division 02 Section "Landfill Earth Moving"
        2) Division 02 Section “Closure Turf™ Alternative”.

3) Division 02 Section “Exposed TPO Alternative”.

J. Payment Item No. 10 – Solar Photovoltaic (PV) Electric Generating and A/C Distribution System:

1. The Work of this item shall be measured by the Contract lump sum price for either:

   a. A 500kW AC (two 301.84 kW D/C sub arrays) Solar PV Electric Generating and AC Distribution System;

   b. A 750kW AC (three 301.84 kW D/C sub arrays) Solar PV Electric Generating and AC Distribution System;

   c. A 1,000kW AC (four 301.84 kW D/C sub arrays) Solar PV Electric Generating and AC Distribution System

   The size of the system chosen for installation will be at the discretion of the Owner and payment will be made based on the pricing of Pay Item 10 in the Price Form Option selected by the Owner.

2. Work associated with this item will be paid for at the Contract lump sum price for providing Solar PV Electric Generating and A/C Distribution System including site layout of PV components; design of required electrical and racking systems; providing Sub-Array packages; coordination with landfill geomembrane system; commissioning and testing of complete, interconnected and operational system; excavation and backfill required for miscellaneous site components associated with system, rigid metal conduit conductors, above ground conduit support utility pole, combiner boxes, disconnect switches, monitoring system, and service panel interconnection; fees and permits; and incidental materials, equipment, tools and labor required to complete the Work.

   a. Related Sections include Division 48 Section "Solar Photovoltaic Electric Generation System."

K. Payment Item No. 11 – Penetration Sealing and Booting:

1. The Work of this item shall be measured by the per Each price.

2. Work associated with this item will be paid for at the per Each price for geomembrane penetration sealing and booting for existing gas wells and markers, including materials, equipment, tools and labor incidental to the Work.

   a. Division 02 Section “Closure Turf™ Alternative”.

   b. Division 02 Section “Exposed TPO Alternative”.

L. Payment Item No. 12 – Type “A” Cap Anchor:

1. The Work of this item shall be measured by the per Linear Foot price.

2. Work associated with this item will be paid for at the per Linear Foot price for Type “A” Cap Anchor which includes all the work required the construct the anchor according to the Type “A” Cap Anchor (Typical Cap Anchor) detail as depicted on the plans. This work includes excavation, cap base sand within the anchor trench, geotextiles, geomembrane, liner system specific components, anchor trench, welding, testing, backfill, mowing strip, and incidental items required to complete the work including materials, equipment, tools and labor incidental to the Work.

   a. Related Sections include

      1) Division 02 Section "Landfill Earth Moving"

      2) Division 02 Section “Closure Turf™ Alternative”

      3) Division 02 Section “Exposed TPO Alternative”

M. Payment Item No. 13 – Type "B" Cap Anchor:

1. The Work of this item shall be measured by the per Linear Foot price.
2. Work associated with this item will be paid for at the per Linear Foot price for Type "B" Cap Anchor which includes all the work required the construct the anchor according to the Type "B" Cap Anchor (Typical Cap Anchor with Concrete) detail as depicted on the plans. This work includes excavation, cap base sand within the anchor trench, geotextiles, geomembrane, liner system specific components, anchor trench, welding, testing, backfill, concrete, and incidental items required to complete the work including materials, equipment, tools and labor incidental to the Work.
    a. Related Sections include
        1) Division 02 Section "Landfill Earth Moving"
        2) Division 02 Section "Closure Turf™ Alternative"
        3) Division 02 Section "Exposed TPO Alternative"
        4) Division 03 Section "Cast-in Place Concrete"

N. Payment Item No. 14 – Type "C" Cap Anchor:

1. The Work of this item shall be measured by the Contract linear foot price.
2. Work associated with this item will be paid for at the per Linear Foot price for Type "C" Cap Anchor which includes all the work required the construct the anchor according to the Type "C" Cap Anchor (Phase 1/2 Anchor) detail as depicted on the plans. This work includes excavation, cap base sand within the anchor trench, geotextiles, geomembrane, liner system specific components, connection to phase 1 liner, anchor trench, welding, testing, backfill, mowing strip, sand drainage layer, vegetative support material and required soil amendments, establishing and restoring vegetation, and incidental materials, equipment, tools and labor required to complete the Work.
    a. Related Sections include
        1) Division 02 Section "Landfill Earth Moving"
        2) Division 02 Section "Closure Turf™ Alternative"
        3) Division 02 Section "Exposed TPO Alternative"
        4) Division 02 Section "Landfill Vegetative Support Layer"

O. Payment Item No. 15 – Type "D" Cap Anchor:

1. The Work of this item shall be measured by the Contract per Linear Foot price.
2. Work associated with this item will be paid for at the per Linear Foot price for Type "D" Cap Anchor which includes all the work required the construct the anchor according to the Type "D" Cap Anchor (Typical Gravel Access Road & Anchor) detail as depicted on the plans. This work includes excavation, cap base sand within the anchor trench, geotextiles, geomembrane, liner system specific components, connection to phase 1 liner, anchor trench, welding, testing, backfill, mowing strip, gravel access road, sand drainage layer, vegetative support material and required soil amendments, establishing and restoring vegetation, and incidental materials, equipment, tools and labor required to complete the Work.
    a. Related Sections include
        1) Division 02 Section "Landfill Earth Moving"
        2) Division 02 Section "Closure Turf™ Alternative"

3) Division 02 Section “Exposed TPO Alternative”

4) Division 02 Section "Aggregate Surfacing"

5) Division 02 Section “Landfill Vegetative Support Layer”

P. Payment Item No. 16 – Type “E” Cap Anchor:

1. The Work of this item shall be measured by the Contract per Linear Foot price.

2. Work associated with this item will be paid for at the per Linear Foot price for Type “E” Cap Anchor which includes all the work required the construct the anchor according to the Type “E” Cap Anchor (Phase 2/Ash Liner Anchor) detail as depicted on the plans. This work includes excavation, cap base sand within the anchor trench, geotextiles, geomembrane, liner system specific components, connection to Ash liner, anchor trench, welding, testing, backfill, mowing strip, sand drainage layer, vegetative support material and required soil amendments, establishing and restoring vegetation, and incidental materials, equipment, tools and labor required to complete the Work.

   a. Related Sections include

      1) Division 02 Section "Landfill Earth Moving"

      2) Division 02 Section “Closure Turf™ Alternative”

      3) Division 02 Section “Exposed TPO Alternative”

      4) Division 02 Section “Landfill Vegetative Support Layer”

Q. Payment Item No. 17 – Type “F” Cap Anchor:

1. The Work of this item shall be measured by the Contract per Linear Foot price.

2. Work associated with this item will be paid for at the per Linear Foot price for Type “F” Cap Anchor which includes all the work required the construct the anchor according to the Type “F” Cap Anchor (Phase 2/Ash Liner Downchute Anchor) detail as depicted on the plans. This work includes excavation, cap base sand within the anchor trench, geotextiles, geomembrane, liner system specific components, connection to Ash liner, anchor trench, welding, testing, backfill, mowing strip, sand drainage layer, vegetative support material and required soil amendments, establishing and restoring vegetation, and incidental materials, equipment, tools and labor required to complete the Work.

   a. Related Sections include

      1) Division 02 Section "Landfill Earth Moving"

      2) Division 02 Section “Closure Turf™ Alternative”

      3) Division 02 Section “Exposed TPO Alternative”

      4) Division 02 Section “Landfill Vegetative Support Layer”

R. Payment Item No. 18 – Underdrain Trenches (Closure Turf™ only):

1. The Work of this item shall be measured by the Contract linear foot price.

2. Work associated with this item will be paid for at the Contract linear foot price for Underdrain Trenches associated with Closure Turf™ Alternative which includes trenching, perforated underdrain pipe and fittings, crushed stone, nonwoven geotextile, connection to downchute and incidental materials, equipment, tools and labor required to complete the Work.

   a. Related Sections include:

      1) Division 02 Section “Closure Turf™ Alternative”.

S. Payment Item No. 19 – Side Slope Diversion Swales (Closure Turf™ only):

1. The Work of this item shall be measured by the Contract linear foot price.
2. Work associated with this item will be paid for at the Contract linear foot price for Side Slope Diversion Swale associated with Closure Turf™ Alternative which includes grading landfill slopes, perforated underdrain pipe and fittings, crushed stone, nonwoven geotextile, connection to downchute, additional cost for replacing Closure Turf™ sand ballast with a cemented ballast, and incidental materials, equipment, tools and labor required to complete the Work.
    a. Related Sections include:
        1) Division 02 Section “Closure Turf™ Alternative”.
        2) Division 03 Section "Cast-in-Place Concrete."

T. Payment Item No. 20 – Downchutes (Closure Turf™ only):

1. The Work of this item shall be measured by the Contract linear foot price.
2. Work associated with this item will be paid for at the Contract linear foot price for Downchutes associated with Closure Turf™ Alternative which includes exception and grading of landfill surface, relocation of excavated material to an on-site location designated by The Owner, perforated underdrain pipe and fittings, crushed stone, nonwoven geotextile, perforated rub sheet, welding, additional cost for replacing Closure Turf™ sand ballast with a cemented ballast, and incidental materials, equipment, tools and labor required to complete the Work.
    a. Related Sections include:
        1) Division 02 Section “Closure Turf™ Alternative”.
        2) Division 03 Section "Cast-in-Place Concrete."

U. Payment Item No. 21 – Energy Dissipation System:

1. The Work of this item shall be measured by the Contract linear foot price.
2. Work associated with this item will be paid for at the Contract linear foot price for Energy Dissipation System at the toe of the Phase 2 landfill slope which includes another trench excavation, membrane installation, backfill with concrete processed aggregate base, cast-in-place concrete armoring, staggered precast concrete blocks, and incidental materials, equipment, tools and labor required to complete the Work.
    a. Related Sections include:
        1) Division 03 Section "Cast-in-Place Concrete."
        2) Division 31 Section "Site Earth Moving."

V. Payment Item No. 22 – Drainage Outfall Improvements:

1. The Work of this item shall be measured by the Contract lump sum price.
2. Work associated with this item will be paid for at the Contract Lump Sum price for the following:
    a. Riprap Lined Channel including excavation and disposal of excavated material on site; nonwoven geotextile; grading of subgrade, processed aggregate base, intermediate riprap and incidental materials, equipment, tools and labor required to complete the Work.
    b. Drainage Outfall Improvement including sawcutting and removing concrete from existing concrete swale, excavation and disposal of excavated material on

site; nonwoven geotextile; grading of subgrade, structural fill for headwall and wingwalls; reinforced cast-in-place concrete headwall and wingwalls; 36-inch HDPE pipes; backfill; processed aggregate base; flared precast concrete culvert ends; and incidental materials, equipment, tools and labor required to complete the Work.

c. Precast concrete block wall, bituminous concrete pavement millings and grading of levee crest road for sloping grade away from wall,

d. Chain Link Fence removal and re-installation including adjusting existing fencing and gate as required, and incidental materials, equipment, tools and labor required to complete the Work.

e. Concrete Lined Ditch including excavating and grading,backfilling and compaction as required, processed aggregate, welded-wire mesh, cast-in-place concrete, and incidental materials, equipment, tools and labor required to complete the Work.

f. Energy Dissipater at end of concrete lined ditch including excavation and disposal of excavated material on site; nonwoven geotextile; grading of subgrade, processed aggregate base, nonwoven geotextile, intermediate riprap and incidental materials, equipment, tools and labor required to complete the Work.

g. Gravel Access Road between the Southeast Paved Area and the existing dike access road, constructed the same as the Gravel Access Road detail for the "Type D Cap Anchor" but without the geomembrane or geomembrane anchor trench.

W. Payment Item No. 23 – Supplemental Gas System

1. The Work of this item shall be measured by the Contract lump sum price.

2. Work associated with this item will be paid for at the Contract Lump Sum price for the following:

   a. Supplemental Cap Base Collection System including perforated HDPE pipe with sock; solid wall PVC pipe; and tees, end caps, and couplings and incidental materials, equipment, tools and labor required to complete the Work.

   b. Sealing and booting of penetrations are not a part of this item and all costs associated with such Work are included under Payment Item No. 11.

   c. Related Sections include:

      1) Division 02 Section "Landfill Gas Vent System."

X. Payment Item No. 24 – Landfill Limit Markers and Bollards:

1. The Work of this item shall be measured by the Contract per Each price for landfill limit markers and bollards.

2. Work associated with this item will be paid for at the Contract per Each price for Landfill Limit Markers and Bollards which includes excavation and on-site disposal of excavated material, steel pipe, cast-in-place concrete pipe fill and foundation backfill, painting or covers for steel pipes, and incidental materials, equipment, tools and labor required to complete the Work.

   a. Related Sections include

      1) Division 02 Section "Landfill Limit Marker"

Y. Payment Item No. 25 – Southeast Paved Area

1. The Work of this item shall be measured by the Contract lump sum price.
2. Work associated with this item will be paid for at the Contract Lump Sum price for Southeast Paved Area which includes grading, cap base material, anchor trenching, geomembrane, geosynthetics, drainage materials, aggregate, bituminous concrete, cement concrete, jersey barriers, fasteners, vegetative support material and seeding to restore adjacent vegetated surfaces, incidental materials, equipment, tools and labor required to complete the Work. Please note that the anchor trench required in this area shall be included in the lump sum price for this pay item and will not be paid separately under any other bid item.
    a. Related Sections include:
        1) Division 02 Section “Closure Turf™ Alternative”.
        2) Division 02 Section “Exposed TPO Alternative”.
        3) Division 02 Section “Landfill Vegetative Support Layer”
        4) Division 02 Section “Bituminous Concrete Paving”
        5) Division 03 Section "Cast-in-Place Concrete."
        6) Division 31 Section "Site Earth Moving."

Z. Payment Item No. 26 – Photovoltaic Maintenance Service

1. The Work of this item shall be measured by the Contract lump sum price.
2. Work associated with this item will be paid for at the Contract Lump Sum price for PV Maintenance Service which includes inspecting and servicing the PV generation system on an annual basis, and incidental materials, equipment, tools and labor required to complete the Work. A detailed inspection list including consumable parts to be replaced (e.g. filters and missing washers nuts) is included in Division 48 section "Solar Energy Electrical Generation System". Replacement and/or repair of damaged components are not a part of this payment item.
    a. Related Sections include
        1) Division 48 Section " Solar Energy Electrical Generation System "

01015 OCCUPANCY REQUIREMENTS

A. Full Owner Occupancy During Construction

The Owner will occupy the site during the entire construction period. Cooperate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the Owner’s operations.

01019 CONTRACT CONSIDERATIONS

A. Allowances

1. None.

B. Measurement and Payment - General

1. Lump Sum Price and Unit Price Pay Items, refer to and are the same pay items listed in the Proposal Price Form. They constitute all of the pay items for the completion of the Work. No direct or separate payment will be made for providing miscellaneous temporary or accessory works, plant, services, Contractor’s or Contractor’s field offices, layout surveys, job signs, sanitary re-

quirements, testing, safety devices, approval and record drawings, water supplies, power, maintaining traffic, removal of waste, watchmen, bonds, insurance, and all other requirements of the General Conditions and Supplementary Conditions. Compensation for all such services, things and materials shall be included in the prices stipulated for the lump sum and unit price pay items listed on the Proposal Price Form.

2. Each lump sum and unit proposal price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item

01027 APPLICATION FOR PAYMENT

A. Schedule of Values

Submit the "Schedule of Values" to the Engineer at the earliest possible date but no later than (20) twenty Calendar Days after the Contract Start Date.

1. Format and Content: Use the Proposal Price Form as a guide to establish the format for the "Schedule of Values". Provide at least one line item for each line item on the Proposal Price Form. For appropriate lump sum bid items, (e.g., Landfill Capping System, Solar Photovoltaic Electric Generating and AC Distribution System, etc.), provide breakdown of bid item into subitems with associated values.
2. Identification: Project identification on the Schedule of Values shall include, but not be limited to, the following:
   a. Owner
   b. Project Number
   c. Project Name
   d. Project Location
   e. Contractor's name and address.
3. Arrange the "Schedule of Values" in tabular format as required by the Owner, containing separate columns including, but not limited to, the following Items:
   a. Item Number.
   b. Description of Work with Related Specification Section or Division Number.
   c. Scheduled Values broken down by description number, type material, units of each material.
   d. Name of subcontractor.
   e. Name of manufacturer or fabricator.
   f. Name of supplier.
   g. Retainage.
   h. Contract sum in sufficient detail.
4. Percentage of Contract Sum to nearest one percent, adjusted to total 100 percent.
5. Provide a breakdown of the Contract Sum in sufficient detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Break principal subcontract amounts down into several line items.
6. Round amounts to nearest whole dollar; the total shall equal the Contract Sum.

7. Unit-Cost Allowances: Show the line-item value of unit-cost allowances, as a product of the unit cost, multiplied by the measured quantity. Estimate quantities from the best indication in the Contract Documents.

8. General Conditions: Show line items for indirect costs and margins on actual costs only when such items are listed individually in Applications for Payment. Each item in the Schedule of Values and Applications for Payment shall be complete. Include the total cost and proportionate share of general overhead and profit margin for each item.

    a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the Schedule of Values or distributed as general overhead expense, at the Contractor's option.

B. Applications for Payment – General

Each Application for Payment shall be consistent with previous applications and payments as certified by the Engineer and paid for by the Owner. The initial "Application for Payment", the "Application for Payment", at time of "Substantial Completion", and the final "Application for Payment", involve additional requirements.

1. Payment-Application Terms: The Owner will process monthly progress payments. The Contractor shall submit applications for payment on a monthly basis.

2. Payment-Application Forms: Use the "Application for Payment" form as required by the Owner. Present the required information on electronic media printout or approved Owner Form, multiple pages should be used if required.

3. For each item, provide a column including but not limited to the following items:

    a. Item Number.

    b. Description of Work and Related Specification Section or Division.

    c. Scheduled Value, break down by units of material and units of labor.

    d. Work completed from previous application.

    e. Work completed this period.

    f. Materials presently stored.

    g. Total completed and stored to date of application,

    h. Percentage of Completion.

    i. Balance to Finish.

    j. Retainage.

4. Application Preparation: Complete every entry on the form. Include final payment only and execution by a person authorized to sign legal documents on behalf of the Contractor. The Engineer will return incomplete applications without action.

    a. Entries shall match data on the "Schedule of Values".

    b. Include amounts of Change Orders issued prior to the last day of the construction period covered by the application.

5. Transmittal: Submit 4 signed and notarized original copies of each Application for Payment to the Engineer by a method ensuring receipt. One copy shall be complete, including waivers of lien and similar attachments, when required.

    a. Transmit each copy with a transmittal form listing attachments and recording appropriate information related to the application, in a manner acceptable to the Engineer.

6. Applications for Payment: Administrative actions and submittals, that must precede or coincide with submittal of the first Application for Payment and all subsequent Application for Payments including, but not limited to, the following items:

    a. List of subcontractors and suppliers' name, FEIN/Social Security numbers, and Connecticut Tax Registration Numbers.

    b. List of principal suppliers and fabricators.

    c. Schedule of Values.

    d. Contractor's Construction Schedule (preliminary if not final).

    e. Schedule of principal products.

    f. Submittal Schedule (preliminary if not final).

    g. List of Contractor's staff assignments.

    h. List of Contractor's principal consultants.

    i. Copies of all applicable permits.

    j. Copies of authorizations and licenses from governing authorities for performance of the Work.

    k. Initial as-built survey and damage report, if required.

C. Application for Payment at Substantial Completion

Following issuance of the Certificate of Substantial Completion submit an Application for Payment form, use the form as required by the Owner. Present the required information on electronic media printout.

1. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

2. Administrative actions and submittals that shall precede or coincide with this application include, but are not limited to, the following:

    a. Occupancy permits and similar approvals.

    b. Warranties (guarantees) and maintenance agreements.

    c. Test/adjust/balance records.

    d. Maintenance instructions.

    e. Meter readings.

    f. Startup performance reports.

    g. Changeover information related to Owner's occupancy, use, operation, and maintenance,

    h. Final cleaning.

    i. Application for reduction of retainage and consent of surety.

    j. Advice on shifting insurance coverage.

    k. Final progress photographs.

    l. List of incomplete Work, recognized as exceptions to Engineer's Certificate of Substantial Completion.

    m. Ensure that incomplete Work is not accepted and will be completed without undue delay.

D. Final Payment Application

Administrative actions and submittals that must precede or coincide with submittal of the final Application for Payment include, but are not limited, to the following:

1. Completion of Project Closeout requirements.
2. Completion of list of items remaining to be completed as indicated on the attachment to the Certificate of Substantial Completion.
3. Transmittal of required Project construction records to the Owner.
4. Certified final as-built and topographic survey.
5. Proof that taxes, fees, and similar obligations were paid.
6. Removal of temporary facilities and services.
7. Removal of surplus materials, rubbish, and similar elements.
8. Change of locks to Owner's access.
9. The requirements of the Contract Documents for Final Acceptance, Final Completion, Final Inspection, and Final Payment.
10. Completion of "Building Contractor Reporting Form" as supplied by the Owner, for all Contractors, Subcontractors, Vendors, Suppliers, etc. who work on the Contract. The form includes the following information:
11. Contractor/Subcontractor name.
12. FEIN/Social Security Numbers.
13. Connecticut Tax Registration Numbers.
14. Type of work.
15. Name of business and address.
16. Remittance address.

Upon CRRA's determination that the requirements enumerated in this section are satisfied and that the Contractor has completed the Work in all other respects, the CRRA shall sign the Final Payment Application. That signature shall constitute "Acceptance" of the Work as provided in Section 1.1.2 of the Agreement.

01035 MODIFICATION PROCEDURES

A. Summary

This Section specifies administrative and procedural requirements for handling and processing contract modifications.

B. Minor Changes in the Work

The Engineer will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or Contract Time, on the "Supplemental Instructions" form as required by the Owner.

C. Proposal Request

1. Engineer/Owner-Initiated Requests For Proposals: The Engineer or Owner will issue a detailed description of proposed changes in the Work that will require adjustment to the Contract Sum or Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications. Such requests shall be on a "Proposal Request" form as required by the owner.
2. "Proposal Request" is issued for information only. Do not consider them as an instruction either to stop work in progress or to execute the proposed change.

3. Within Fourteen (14) Calendar Days of receipt of a "Proposal Request", submit a "Change Order Proposal" with the required information necessary to execute the change to the Engineer for the Engineer's/Owner's review.

4. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities.

    a. Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.

    b. Include a statement indicating the effect the proposed change in the Work will have on the Contract Time.

    c. As indicated in section 3.5 of the Agreement, The Owner is tax exempt. All Contractor and Subcontractor services provided under your contract may not be exempt from taxes. The Department of Revenue Services can guide you as to which services are exempt and which are not. Please contact the State of Connecticut, Department of Revenue Services at 1-800-382-9463 or 566-7033.

    d. Dollar values shown on the Schedule of Values shall not be the governing (or deciding) final amounts for change orders involving either additional charges or deletions.

D. Requests for Information

1. In the event that after the commencement of the Work, the contractor or subcontractor, at any tier, determines that some portion of the drawings, specifications, or other contract documents requires clarification or interpretation by the Engineer, the contractor shall submit a "Request for Information" in writing to the Engineer. "Requests for Information" may only be submitted by the contractor and shall only be submitted on the "Request for Information" forms as required by the owner. Such forms will be provided to the Contractor after the Commencement Date. In the "Request for Information", the contractor shall clearly and concisely set forth the issue for which clarification or interpretation is sought and why a response is needed from the Engineer.

    a. In the "Request for Information", the contractor shall set forth an interpretation or understanding of the requirement along with reasons why such an understanding was reached.

    b. The owner acknowledges that this is a complex project. Based upon the owner's past experience with projects of similar complexity, the owner anticipates that there will probably be some "Requests for Information" on this project.

    c. The Engineer will review all "Requests for Information" to determine whether they are "Requests for Information" within the meaning of this term. If it is determined that the document is not a "Request for Information", it will be returned to the contractor, unreviewed as to content, for resubmittal on the proper form and in the proper manner.

    d. A "Requests for Information Response" shall be issued within seven (7) Calendar Days of receipt of the request from the contractor unless the owner determines that a longer time is necessary to provide an adequate response. If a longer time is determined necessary by the Owner, the Owner will, within seven (7) Calendar Days of receipt of the request, notify the contractor of the anticipated response time. If the contractor submits a "Request for Information" on an activity with seven (7) Calendar Days or less of float on the current project schedule, the contractor shall not be entitled to any time extension due to the time it takes the Engineer to respond to the request provided that the Engineer responds within the seven (7) Calendar Days set forth above.

    e. A "Requests for Information Response" from Engineer will not change any requirement of the contract documents. In the event the contractor believes that the "Requests for Information Response" will cause a change to the requirements of the contract document, the contractor shall immediately give written notice to the Engineer stating that the contractor believes the "Requests for Information Response" will result in "Change Order" and the Contractor intends to submit a "Change Order Proposal" request. Failure to give such written notice immediately shall waive the contractor's right to seek additional time or cost under the requirement these Requirements.

E. Change Order Proposal

1. When either a "Request for Information" from the Contractor or a "Proposal Request" from the Engineer or Owner results in conditions that may require modifications to the Contract, the Contractor may propose changes by submitting a request for a "Change Order Proposal" to the Engineer on forms as required by the Owner. These forms shall also include "Change Order Proposal Worksheets" as required by the Owner.

    a. Include statements outlining the reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and Contract Time.

    b. Include a list of quantities of products required and unit costs, with the total amount of purchases to be made. Where requested, furnish survey data to substantiate quantities as directed by Article 13 of the General Conditions of the Contract for Construction.

    c. Indicate applicable delivery charges, equipment rental, and amounts of trade discounts.

    d. Comply with requirements in Section 01631 Equals and Substitutions if the proposed change requires an equal or substitution of one product or system for a product or system specified.

2. "Change Order Request" Forms: Use "Change Order Proposal" and "Change Order Proposal Worksheets" forms as required by Owner.

3. "Change Order Proposal" cannot be submitted without the Contractor either prior submission of a "Request for Information" from the Contractor or as a response to a "Proposal Request" submitted by the Engineer or Owner.

4. Any "Change Order Request" submitted without a prior submittal of a "Request for Information" or as a response to a "Proposal Request" will be immediately rejected and returned to the Contractor.

F. Construction Change Directive

1. "Construction Change Directive": When the Owner and the Contractor disagree on the terms of a "Change Order Proposal" resulting from either a "Request for Information" or "Proposal Request", then the Engineer may issue a "Construction Change Directive" on a "Construction Change Directive" as authorized by the Owner on the form required by the Owner. The "Construction Change Directive" instructs the Contractor to proceed with a change in the Work, for subsequent inclusion in a "Change Order".

    a. The "Construction Change Directive" contains a complete description of the change in the Work. It also designates the method to be followed to determine change in the Contract Sum or Contract Time.

2. Documentation: The Contractor shall maintain detailed records on a time and material basis of work required by the "Construction Change Directive".

    a. After completion of the change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

    b. The final value shall be negotiated based on the supporting data to determine the value of the work.

G. Change Order Procedures

1. Upon the Owner's approval of a Contractor's "Change Order Proposal", the Engineer will issue a "Change Order" for signatures of the Engineer, Owner and the Contractor on "Change Order" form as required by the Owner.

01040 COORDINATION

A. Construction Operations

Coordinate construction operations included in various Sections of these Specifications to assure efficient and orderly installation of each part of the Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.
3. Make provisions to accommodate items scheduled for later installation.

B. Special Procedures

Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Engineer, Owner and separate contractors where coordination of their work is required.

C. Administrative Procedures

Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and assure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of schedules.
2. Installation and removal of temporary facilities.
3. Delivery and processing of submittals.
4. Progress meetings.
5. Project closeout activities.

D. General Coordination Provisions

1. Inspection of Conditions: Require the Installer of each major component to inspect both the substrate and conditions under which Work is to be performed and coordinate such inspections with the Engineer and authorities having jurisdictions. If unsatisfactory conditions exist notify the Engineer immediately. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.
2. The Contractor shall coordinate temporary enclosures with required inspections and tests to minimize the necessity of uncovering completed construction for that purpose.

01045 CUTTING AND PATCHING

A. All cutting, coring and rough patching shall be performed by the Contractor or subcontractor requiring the opening. Finish patching shall be the responsibility of the Contractor and shall be performed by the trade associated with the application of the particular finish.

B. Provide cutting, coring, fitting and patching, including attendant excavation and backfill required to complete the Work, or to:

1. Remove and replace defective Work or Work not conforming to requirements of the Contract Documents.
2. Remove samples of installed Work as specified or required for testing.

3. Remove all constructions required to provide for specified alterations or addition to existing work.
4. Uncover Work to provide for Engineer's observation of covered Work or observation by regulatory agencies having jurisdiction.
5. Connect to completed Work that was not accomplished in the proper sequence.
6. Remove or relocate existing utilities and pipes which obstruct the Work in locations where connections must be made.
7. Make connections or alterations to existing or new facilities.

C. Replace, patch and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials in such a manner as to not void required or existing warranties.

D. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to fullest extent possible. If identical materials are unavailable or cannot be used, use materials whose installed performance will equal or surpass that of existing materials.

E. Perform all cutting and coring in such a manner as to limit the extent of patching.

F. Core drill all holes to be cut through concrete and masonry walls, slabs or arches, unless otherwise approved.

G. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed before cutting.

H. Report unsatisfactory or questionable conditions to Engineer in writing. Do not proceed with work until the Engineer has provided further instructions.

I. Provide temporary support as required to maintain structural integrity of Project, to protect adjacent Work from damage during cutting, and to support the work to be cut.

J. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that will be exposed during cutting and patching operations.

1. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
2. Do not cut existing pipe, conduit or ductwork serving facilities scheduled to be removed or relocated until provisions have been made to bypass them.

K. Cut existing construction using methods least likely to damage elements retained or adjoining construction, and that will provide proper surfaces to receive installation or repair.

1. In general, use hand or small power tools designed for sawing or grinding, not hammering and chopping.
2. Cut through concrete and masonry using a concrete wall saw with diamond saw blades.
    a. Provide for control, on both sides of walls, of slurry generated by sawing.

L. Patch construction by filling, repairing, refinishing, closing-up and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified, in other Sections of these Specifications.

01050 FIELD ENGINEERING

A. Provide field engineering services to establish and record grades, lines and elevations.

B. The Contractor shall retain a Professional Engineer or Land Surveyor registered by the State of Connecticut acceptable to the Contractor and the Owner to lay out the site work and installations and to establish and record the necessary elevations, at no additional cost to the Owner.

C. The Contractor shall forward a letter from its Land Surveyor or Professional Engineer stating that the control information furnished by the Owner, if any, is accurate or shall identify inaccuracies, if they exist. Such letter shall be submitted prior to the start of any construction activities. The Contractor shall not take advantage of errors, which may be included in the control information. Stakes and markings shall be preserved.

D. The Contractor shall:

1. Provide civil, structural or other professional engineering services specified, or required to execute Contractor's construction methods.
2. Develop and make all detail surveys and measurements needed for construction including slope stakes, batter boards, piling layouts and all other working lines, elevations and cut sheets.
3. Keep a transit and leveling instrument on the Site at all times and a skilled instrument man available whenever necessary for layout of the Work.
4. Provide all material required for bench marks, control points, batter boards, grade stakes, and other items.
5. Be solely responsible for all locations, dimensions and levels, and for all surveying done at the site. No data other than written orders of the Engineer shall justify departure from the dimensions and levels required by the Contract Documents.
6. Rectify all Work improperly installed because of not maintaining, not protecting or removing without authorization such established points, stakes, marks and monuments.
7. Provide such facilities and assistance as may be necessary for Engineer to check line and grade points placed by Contractor. Contractor shall not do any excavation or embankment work until all cross-sectioning necessary for determining pay quantities has been completed and checked by Engineer.
8. Contractor shall establish two (2) permanent benchmarks and three (3) survey control points located within and near the perimeter of the landfill in positions unlikely to be disturbed by vehicular traffic or construction operations.
9. Contractor shall take measures to protect site reference and survey control points prior to starting site work, and must preserve permanent reference points during construction. Site reference points may not be relocated without prior written notice to Owner.
10. The Owner shall be immediately notified of loss, damage or destruction of any reference point, or relocation required because of changes in grades or other reasons. Contractor shall replace disturbed survey control points based on original survey control at no extra cost.
11. X, Y, and Z coordinated of benchmarks and survey control points shall be determined (and recorded) with a maximum permissible error of 0.10 feet (±) in any coordinate direction. All X and Y coordinates are to be referred to the Connecticut State coordinate system (NAD 27). All Z coordinates are to be referred to nearest USGS benchmark with an accuracy of 0.10 feet (±) (NGVD 29).
12. Contractor shall reference survey and data reference points to permanent benchmarks and record locations of survey control points, with horizontal and vertical data, on Project Record Documents.

E. Employ and retain at the Site a field engineer with experience and capability of performing all engineering tasks required of the Contractor. Tasks included are:

1. Providing daily construction reports as specified in Section 01300.
2. Furnish all required lines and grades for construction operations.
3. Check all formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping, other materials and equipment.

4. Maintain field office files and drawings, Record Drawings, and coordinate engineering services with Subcontractors. Prepare layout and coordination drawings for construction operations.
5. Check and coordinate Work for conflicts and interferences and immediately advise Engineer of all discrepancies noted.
6. Cooperate with Engineer in field inspections as required.

F. Records: Maintain a complete, accurate log of all control and survey work as it progresses.

G. On completion of the project, prepare a Certified Final As-built and Topographic Survey showing all dimensions, locations, angles and elevations of construction. The certified survey shall be prepared at a scale of 1"=40' and be signed by a Land Surveyor licensed in the State of Connecticut. Contractor shall provide three (3) sets of signed and sealed final survey plans, one set of mylar signed and sealed final survey plans and one diskette with the electronic version of the final survey plans prepared in Autocad 2008 or latest version with site features on separate layers as appropriate. Detail of mapping shall include, but not be limited to, two (2) foot and ten (10) foot contour intervals of the entire work area, including all stormwater basins, landfill access roads, all stormwater drainage swales, down-chutes and other drainage improvements including all appropriate invert elevations.

H. Submittals:

1. Submit name and address of surveyor or engineer to Engineer.
2. On request of Engineer, submit documentation to verify accuracy of field engineering work.
3. When requested by Engineer, submit certificate signed by registered engineer or surveyor certifying that elevations and locations of Work are in conformance with Contract Documents. Explain all deviations.

01095 REFERENCE STANDARDS & DEFINITIONS

A. For products specified by association or trade standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. References to standard specifications and codes refer to the editions current at the proposal due date. An exception is, buildings exceeding the threshold limit must be in substantial compliance with the requirements of the effective code at the time of receipt of completed application to the Office of State Building Inspector (OSBI). References include their addenda and errata, if any, and shall be considered a part of these specifications as if they were printed herein in full.

C. The manufacturers' standard warranties or guarantees shall apply when their products are used on this project.

D. Flame Spread Ratings - all materials that are required or obligated to meet specified standards shall be submitted to the owner for their records as part of the shop drawing submittal process for their construction records.

01120 RENOVATION/DEMOLITION PROJECT PROCEDURES

A. Products For Patching And Extending Work

1. New materials: As specified in product sections; match existing Products and Work for patching and extending Work.
2. Type and Quality of Existing Products: Determine by inspecting and testing Products where necessary, referring to existing Work as a standard.

B. Inspection - General

1. Verify that demolition is complete and areas are ready for installation of new Work.
2. Beginning of restoration Work means acceptance of existing conditions.

C. Preparation

1. Cut, move, or remove items as are necessary for access to alterations and renovation Work. Replace and restore at completion.
2. Remove unsuitable material not marked for salvage, such as rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.
3. Remove debris and abandoned items from area and from concealed spaces.
4. Prepare surface and remove surface finishes to provide for proper installation of new Work and finishes.
5. Close openings in exterior surfaces to protect existing Work and salvage items from weather and extremes of temperature and humidity. Insulate ductwork and piping to prevent condensation in exposed areas.

D. Installation

1. Coordinate Work of alterations and renovations to expedite completion and if required sequence Work to accommodate Owner occupancy.
2. Remove, cut and patch Work in a manner to minimize damage and to provide restoring Products and finishes to original and or specified condition in accordance with Section 01045 “Cutting and Patching”.
3. In addition to specified replacement of equipment, restore existing plumbing, ventilation, and electrical systems to full operational condition.
4. Recover and refinish Work that exposes mechanical and electrical Work exposed accidentally during the Work.
5. Install Products as specified in individual sections.

E. Transitions

1. Where new Work abuts or aligns with existing, perform a smooth and even transition. Patch work to match existing adjacent Work in texture and appearance.
2. When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Engineer.

F. Adjustments

1. Fit Work at penetrations of surfaces as specified in Section 01045 “Cutting and Patching”.

G. Repair of Damaged Surfaces

1. Patch or replace portions of existing surfaces that are damaged, lifted, discolored, or showing imperfections.
2. Repair substrate prior to patching finish.

H. Finishes

1. Finish surfaces as specified in individual Product sections.
2. Finish patches to produce uniform finish and texture over entire area. When finish cannot be matched, refinish entire surface to nearest intersections.

01200 PROJECT MEETINGS

A. Pre-construction Conference:

1. The Contractor will attend a Pre-construction Conference before starting construction, as scheduled by the Engineer convenient to the Owner, the Engineer, and Contractor. This meeting will

take place within fourteen (14) Calendar Days after the written Notice to Proceed and before the Contract Start Date. Hold the conference at the Project Site or another convenient location as directed by the Engineer. The Engineer shall conduct the Pre-construction Conference to review the Contractor and Subcontractor responsibilities and personnel assignments.

2. Attendees: Authorized representatives of the Owner, Engineer, and their consultants: the Contractor and its superintendent; major subcontractors; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with the Project and authorized to conclude matters relating to the Work.

3. Agenda: Discuss items of significance that could affect progress, including the following:

   a. Tentative construction schedule.

   b. Critical work sequencing.

   c. Progress meeting schedule.

   d. Designation of responsible personnel.

   e. Subcontractors.

   f. Procedures for processing field decisions and Change Orders.

   g. Procedures for processing Applications for Payment.

   h. Distribution of Contract Documents.

   i. Insurance in force.

   j. Schedule of values.

   k. Submittal of Shop Drawings, Product Data, and Samples.

   l. Preparation of record documents.

   m. Use of the premises.

   n. Parking availability.

   o. Office, work, and storage areas.

   p. Equipment deliveries and priorities.

   q. Safety procedures.

   r. First aid.

   s. Security.

   t. Housekeeping.

   u. Working hours.

B. Progress Meetings

1. The Engineer will conduct progress meetings, bi-weekly, at the Project Site or at regular intervals as agreed upon at the Pre-construction Conference. The Engineer will notify the Owner, the Regulatory Authority, and the Contractor of the scheduled Progress Meeting dates. Coordinate dates of Progress Meetings with preparation of Application for Payment requests.

2. Attendees: In addition to representatives of the Contractor, Owner and the Engineer, subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities may be requested to attend these meetings on an as needed basis. All participants at the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work. The Contractor shall include the site superintendent as a minimum.

3. Agenda: Progress Meetings shall review and correct or approve minutes of the previous Progress Meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the status of the Project.

    a. Construction Schedule: Review progress since the last Progress Meeting. Determine where each activity is in relation to the required Contractor's "Construction Schedule" and whether each activity is on time or ahead or behind Schedule. Determine how Work that is behind Schedule will be expedited; secure commitments from parties involved to do so. Discuss whether Schedule revisions are required to insure that current and subsequent activities will be completed within the Contract Time. Determine if any Change Orders are needed, the status of existing Change Orders, and alterations to the project schedule due to Change Orders.

    b. Review the present and future needs of each entity present

4. Reporting: The Engineer will distribute minutes of the meeting to each party present, promptly and before the next scheduled meeting, and to parties who should have been present.

5. A schedule of regular Project Meetings will be established at the Pre-construction Conference.

01300 SUBMITTALS

A. Summary

1. This Section includes administrative and procedural requirements for submittals required for performance of the Work, including but not limited to the following:

    a. Submittal schedule.

    b. Shop Drawings.

    c. Product Data.

    d. Samples.

    e. Quality assurance submittals.

    f. Proposed "Substitutions Request" form.

    g. Warrantee samples.

    h. Coordination Drawings.

    i. O & M Manuals.

    j. Health and Safety Plan. Contractor shall prepare a Health and Safety Plan to address potential hazards to the on-site personnel and the surrounding community.

B. Administrative Submittals

Refer to other Division 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to, the following:

1. Permits.

2. Applications for Payment.

3. Performance and payment bonds.

4. Contractor's construction schedule.

5. Daily construction reports.

6. Construction Photographs.

7. Insurance certificates.

8. List of subcontractors.

9. Subcontractors/Suppliers FEIN #'s and Connecticut tax registration #.

C. Definitions

1. Coordination Drawings show the relationship and integration of different construction elements that require careful coordination during fabrication or installation to fit in the space provided or to function as intended and as identified in the Specifications.
    a. Preparation of Coordination Drawings is specified in Division 1 Section "Coordination" and may include components previously shown in detail on Shop Drawings or Product Data.
2. Field samples are full-size physical examples erected on-site to illustrate finishes, coatings, or finish materials. Field samples are used to establish the standard by which the Work will be judged.
3. Mockups are full-size assemblies for review of construction, coordination, testing, or operation; they are not Samples.

D. Submittal Procedures:

1. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delay.
2. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals. and related activities that requires sequential activity.
3. Coordinate transmittal of different types of submittals for related elements of the Work so processing will not be delayed by the need to review submittals concurrently for coordination.
4. The Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
5. The Engineer reserves the right to reject incomplete submitted packages.
6. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for resubmittals.
    a. Allow (2) two weeks for initial review. Allow additional time if the Engineer must delay processing to permit coordination with subsequent submittals.
    b. If an intermediate submittal is necessary, process the same as the initial submittal.
    c. Allow (2) two weeks for reprocessing each submittal.
    d. No extension of Contract Time will be authorized because of failure to transmit submittals to the Engineer sufficiently in advance of the Work to permit processing.

E. Submittal Preparation

Place a permanent label, title block or 8-1/2 inches x 11 inches cover page approved by the Engineer, on each submittal for identification. Indicate the name of the entity that prepared each submittal on the label or title block.

1. The minimum number of copies required for each submittal shall be at a minimum 4 copies or as determined otherwise at the pre-construction conference or by the Engineer.
2. Provide a space approximately 4 inches by 5 inches on the label, beside the title block or on the cover page on Shop Drawings to record the Contractor's review and approval markings and the action taken.
3. Include the following information on the label for processing and recording action taken.
    a. Project Name and Project Number.
    b. Date.

c. Name and address of the Engineer, and Owner Representative.

d. Name and address of the Contractor.

e. Name and address of the subcontractor.

f. Name and address of the supplier.

g. Name of the manufacturer.

h. Number and title of appropriate Specification Section.

i. Drawing number and detail references, as appropriate.

j. Indicate either initial or resubmittal.

k. Indicate deviations from Contract Documents.

l. Indicate if "equal" or "substitution".

F. Submittal Transmittal

Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Engineer using a transmittal form. The Engineer will return all submittals to the Contractor after action is taken with a complete copy of the submittal package and one complete copy of the submittal package. The Engineer will not accept submittals received from sources other than the Contractor.

1. On the transmittal, record relevant information and requests for data. On the form, or separate sheet, record deviations from Contract Document requirements, including variations and limitations. Include Contractor's certification that information complies with Contract Document requirements.

G. Submittal Schedule

1. After development and review by the Owner and Engineer acceptance of the Contractor's Construction Schedule prepare a complete schedule of submittals. Submit the schedule to the Engineer within 30 days of Contract Award.

2. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values, and the list of products as well as the Contractor's Construction Schedule

3. Prepare the schedule in chronological order. Provide the following information:

   a. Schedule date for the initial submittal.

   b. Related section number.

   c. Submittal category (Shop Drawings, Product Data, or Samples).

   d. Name of Subcontractor.

   e. Description of the part of Work covered.

   f. Scheduled date for resubmittal.

   g. Scheduled date for the Engineer's final release of approval.

H. Distribution

Following response to the initial submittal, print and distribute copies to the Engineer, Owner, subcontractors, and other parties required to comply with submittal dates indicated. Post copies in the Project meeting room and field office.

1. When revisions are made, distribute to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in construction activities.

I. Schedule Updating

Revise the schedule after each meeting or activity where revisions have been recognized or made. Issue the updated schedule concurrently with the report of each meeting.

J. Shop Drawings

1. Submit newly prepared information drawn accurately to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents. Do not reproduce Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
2. Shop Drawings include fabrication and installation Drawings, setting diagrams, schedules, patterns, templates and similar Drawings. Include the following information:
    a. Dimensions.
    b. Identification of products and materials included by sheet and detail number.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 36 by 48 inches.
    g. Submit one (1) reproducible media and seven (7) prints as directed by the Engineer. The Contractor's submittal shall identify the specification section and/or drawing number applicable to the submittal.
    h. Details shall be large scale and/or full size.
3. The Contractor shall review the Shop Drawings, stamp with this approval, and submit them with reasonable promptness and in orderly sequence so as to cause no delay in its Work or in the Work of any subcontractor. Shop Drawings shall be properly identified as specified for item, material, workmanship, and project number. At the submission, the Contractor shall inform the Engineer, in writing of any deviation in the shop drawings from the requirements of the Contract Documents.
4. The Engineer will review and comment on shop drawings with reasonable promptness so as to cause no delay, but only for conformance with the design concept of the project and with the information given in the Contract Documents. Refer to Article 5 of General Conditions. Shop Drawings received by the Engineer that indicate insufficient study of drawings and specifications, illegible portions or gross errors, will be rejected outright. Such rejections shall not constitute an acceptable reason for granting the Contractor additional time to perform the work.
5. The Contractor shall make any corrections required by the Engineer and shall resubmit the required number of corrected copies of shop drawings until fully reviewed.
6. Upon final review submit four (4) additional prints, same as submitted, to the Engineer for its use.
7. The Engineer's review and comments on shop drawings shall not relieve the Contractor of responsibility for any deviation from the requirements of the Contract Documents.
8. Only final reviewed shop drawings are to be used on the project site.
9. The Work installed shall be reviewed in accordance with the shop drawings and the drawings and specifications. Final Review of the shop drawings by the Engineer shall constitute acceptance by the Owner and the Engineer of a variation or departure that is clearly identified. Final reviewed shop drawings shall not replace or be used as a vehicle to issue or incorporate change orders.

K. Product Data

1. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, schedules, such as manufacturer's installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams, and performance curves.
2. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
    a. Manufacturer's printed recommendations.
    b. Compliance with trade association standards.
    c. Compliance with recognized testing agency standards.
    d. Application of testing agency labels and seals.
    e. Notation of dimensions verified by field measurement.
    f. Notation of coordination requirements.
3. Do not submit Product Data until compliance with requirements of the Contract Documents has been confirmed.
4. Preliminary Submittal: Submit a preliminary single copy of Product Data where selection of options is required.
5. Submittals: Submit 4 copies of each required submittal; submit 5 copies where required for maintenance manuals. The Engineer will retain one and will return the other marked with action taken and corrections or modifications required.
    a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.
6. 6. Distribution: Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities. Show distribution on transmittal forms.
    a. Do not proceed with installation until a copy of Product Data is in the Installer's possession.
    b. Do not permit use of unmarked copies of Product Data in connection with construction.

L. Samples

1. Submit full-size, fully fabricated Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
2. Store, mount or display Samples on site in the manner to facilitate review of qualities indicated. Prepare Samples to match the Engineer's sample. Include the following:
    a. Specification Section number and reference.
    b. Generic description of the Sample.
    c. Sample source.
    d. Product name or name of the manufacturer.
    e. Compliance with recognized standards.
    f. Availability and delivery time.

3. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.

    a. Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least three (3) multiple units that show approximate limits of the variations.

    b. Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.

    c. Refer to other Sections for Samples to be returned to the Contractor for incorporation in the Work. Such Samples must be undamaged at time of use. On the transmittal, indicate special requests regarding disposition of Sample submittals.

    d. Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Contractor and shall be removed from the site prior to Substantial Completion.

4. Preliminary Submittals: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices, unless otherwise noted in specification section.

    a. The Engineer will review and return preliminary submittals with the Engineer's notation, indicating selection and other action.

5. Submittals: Except for Samples illustrating assembly details, workmanship, fabrication techniques, connections, operation, and similar characteristics, submit three (3) sets. The Engineer will return one set marked with the action taken.

6. Maintain sets of Samples, as returned, at the Project Site, for quality comparisons throughout the course of construction.

    a. Unless noncompliance with Contract Document provisions is observed, the submittal may serve as the final submittal.

    b. Sample sets may be used to obtain final acceptance of the construction associated with each set.

7. Distribution of Samples: Prepare and distribute additional sets to subcontractors, manufacturers, fabricators, suppliers, installers, and others as required for performance of the Work. Show distribution on transmittal forms.

    a. Field samples are full-size examples erected on-site to illustrate finishes, coatings, or finish materials and to establish the Project standard.

M. Quality Assurance Submittals

1. Submit quality-control submittals, including design data, certifications, manufacturer's instructions, manufacturer's field reports, and other quality-control submittals as required under other Sections of the Specifications.

2. Certifications: Where other Sections of the Specifications require certification that a product, material, or installation complies with specified requirements, submit a notarized certification from the manufacturer certifying compliance with specified requirements.

    a. Signature: Certification shall be signed by an officer of the manufacturer or other individual authorized to sign documents on behalf of the company.

3. Inspection and Test Reports: Requirements for submittal of inspection and test reports from independent testing agencies are specified in Division 1 Section "Quality Control."

N. Engineer's Action

1. Except for submittals for the record or information, where action and return is required, the Engineer will review each submittal, mark to indicate action taken, and return promptly.
    a. Compliance with specified characteristics is the Contractor's responsibility.
2. Action Stamp: The Engineer will stamp each submittal with a uniform, action stamp. The Engineer will mark the stamp appropriately to indicate the action taken, as follows:
    a. Final Unrestricted Release: When the Engineer marks a submittal "Approved for fabrication," the Work covered by the submittal may proceed provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
    b. Final-But-Restricted Release: When the Engineer marks a submittal "Incorporate Notations," the Work covered by the submittal may proceed provided it complies with notations or corrections on the submittal and requirements of the Contract Documents. Submit corrected copies for record. Final payment depends on that compliance.
    c. Returned for Resubmittal: When the Engineer marks a submittal "Rejected, or Revise and Resubmit," do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery, or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
    d. Do not use, or allow others to use, submittals marked "Rejected, or Revise and Resubmit" at the Project Site or elsewhere where Work is in progress.
    e. Other Action: Where a submittal is for information or record purposes or special processing or other activity, the Engineer will return the submittal marked "Action Not Required."
3. Unsolicited Submittals: The Engineer will discard unsolicited submittals without action.

O. Cutting and Patching

1. Submit a written request to Engineer well in advance of executing any cutting or alteration which affects:
    a. Design function or intent of Project.
    b. Work of Owner or any other contractor.
    c. Structural value or integrity of any element of the Project.
    d. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
    e. Efficiency, operational life, maintenance or safety of operational elements.
    f. Visual qualities of sight-exposed elements.
2. Request shall include:
    a. Identification of Project.
    b. Description of affected Work of Contractor and work of others.
    c. Necessity for cutting.
    d. Effect on work of Owner or any other contractor, or on structural or weatherproof integrity of Project.
    e. Description of proposed Work, describing:
        1. Scope of cutting and patching.
        2. Trades who will be executing the work.
        3. Products proposed to be used.
        4. Extent of refinishing.

5. Schedule of operations.

f. Alternatives to cutting and patching, if any.

g. Designation of party responsible for cost of cutting and patching, when applicable,

h. Written permission of any other contractor whose work will be affected.

3. Should conditions of Work, or schedule, indicate a change of materials or methods, submit written recommendation to Engineer, including:

a. Conditions indicating change.

b. Recommendations for alternative materials or methods.

c. Submittals as required for substitutions.

01310 CONSTRUCTION SCHEDULE

A. Definitions

1. Construction Schedule: A method of planning and scheduling a construction project utilizing a horizontal bar chart with a separate bar for each major portion of the Work or operation to make the schedule an effective tool for planning and monitoring the progress of the work.

B. Format

1. Format: Utilize a horizontal bar chart (gantt) with a separate bar for each major portion of the Work or operation, identifying first work day of each week.
2. Program: Use Microsoft Project, latest version, or approved equal.
3. Sequence of Listings: Utilize the Table of Contents of this Project Manual and the chronological order of the start of each item of work.
4. Scale and Spacing: Provide space for notations and revisions.
5. Sheet Size: To be coordinated with Engineer.

C. Quality Assurance

The Contractor's Consultant: Retain a consultant to provide planning, evaluating, and reporting by CPM scheduling.

1. In-House Option: The Owner may waive the requirement to retain a consultant if the Contractor can demonstrate that:

a. The Contractor has the computer equipment required to produce construction schedules.

b. The Contractor employs skilled personnel with experience in construction scheduling and reporting techniques.

2. Program: Use "Microsoft Project" compatible, latest version, or approved equal.
3. Standards: Comply with procedures contained in AGC's "Construction Planning & Scheduling."

D. Content

1. Show complete sequence of construction by activity, with dates beginning and completion of each element of construction.
2. Identify each item by specification section number.
3. Identify work of separate phases other and other logically grouped activities.
4. Show accumulated percentages of completion of each item, and total percentage of Work completed, as of the first day of each month.

5. Provide separate schedule of submittal dates for shop drawings, product data, and samples, Owner furnished products and any products identified as under Allowances, and dates reviewed submittals will be required from Engineer. Indicate decision dates for selection of finishes.
6. Indicate delivery dates for Owner furnished products and any products identified as under Allowances.
7. Coordinate content with Schedule of Values specified in Section 01027.

E. Submittals and Revisions To Schedules

1. Indicate progress of each activity to date of submittal, and projected completion date of each activity.
2. Identify activities modified since previous submittal, major changes in scope, other identifiable changes.
3. Provide narrative report to define problem areas, anticipated delays, and impact on Schedule. Report corrective action taken, or proposed, and its effect.
4. An initial bar graph (gantt) schedule is to be prepared by the General Contractor and submitted to the Engineer within seven (7) calendar days of award of contract. This schedule is to cover all items of work from the start of the project up to the completion of the project. After review, resubmit required revised data within five (5) calendar days. This schedule must be revised monthly and when the actual schedule of significant items varies more than one (1) week from the proposed schedule.
5. Submit revised Construction Schedules each Application for Payment.
6. Submit four (4) copies of the Construction Schedule to the Engineer.

F. Distribution

1. Distribute copies of the Construction Schedules to Engineer, Owner, Subcontractors, suppliers, and other concerned parties.
2. Instruct recipients to promptly report, in writing, problem anticipated by projections indicated in schedules.

01400 QUALITY CONTROL

A. Independent Testing Agencies

Contractor shall select and employ and pay for independent testing agencies, approved by Owner, to perform all required analyses on proposed materials and other quality-control services specified elsewhere in the Contract Documents and required by authorities having jurisdiction. All field tests, inspections, sampling and testing required by the individual specification sections will be performed by an independent testing agency retained by the Contractor. The Contractor shall inform the Engineer 48 hours in advance of areas ready for field testing as applicable. Costs for these services are included in the Contract Sum. In addition to tests required to be performed by the Contractor's testing laboratory, the Owner reserves the right to hire their own testing laboratory and conduct any and all tests appropriate or necessary to check conformance of the Work with the Contract Documents.

1. Materials for this project will be tested and construction operations inspected as the work progresses. Failure to detect any defective work or material shall not in any way prevent later rejection when such defect is discovered nor shall it obligate the Owner for final acceptance.

B. Retesting

The Contractor is responsible for field retesting where results of inspections, tests, or other quality-control services provide unsatisfactory results and indicate noncompliance with Contract Document requirements.

1. The cost of retesting construction, revised or replaced by the Contractor, is the Contractor's responsibility where required tests performed on original construction indicated noncompliance with Contract Document requirements.
2. The Owner will issue a deduct change order to cover all costs incurred related to all re-tests/re-inspection due to non-compliance to the contract documents, including but not limited to the Owners costs and the Engineers costs.

C. Associated Services

Contractor shall cooperate with agencies performing required inspections, field tests, and similar services, and provide reasonable auxiliary services as requested. Notify the agency sufficiently in advance of operations to permit assignment of personnel. Auxiliary services required include but are not limited to, the following:

1. Provide access to the Work.
2. Furnish incidental labor and facilities necessary to facilitate inspections and tests.
3. Take adequate quantities of representative samples of materials that require testing or assist the agency in taking samples.
4. Provide facilities for storage and curing of test samples.
5. Deliver samples to testing laboratories, if requested by Owner.
6. Provide an approved design mix proposed for use for material mixes that require control by the testing agency.
7. Provide security and protection of samples and test equipment at the Project Site.

D. Duties of the Testing Agency

The independent field testing agency engaged by the Contractor to perform inspections, sampling, and testing of materials and construction specified in individual Sections shall cooperate with the Engineer and Contractor in performance of the testing agency's duties. The testing agency shall provide qualified personnel promptly to perform required inspections and tests.

1. The field testing agency shall notify the Owner, the Engineer and the Contractor promptly of any irregularities or deficiencies observed in the Work during performance of its services.
2. The field testing agency is not authorized to release, revoke, alter, or enlarge requirements of the Contract documents or approve or accept any portion of the Work.
3. The field testing agency shall not perform any duties of the Contractor.
4. The field testing agency shall perform specified inspections, sampling and testing of materials and methods of construction and ascertain compliance with requirements of the Contract Documents.
5. The field testing agency shall perform additional tests and services as required to assure compliance with the Contract Documents.

E. Payment

Owner will pay for the services of the Contractor's independent testing agency laboratory, to perform at the Owner's discretion, additional inspections, tests and other services beyond those required by the Specifications, in which case the Owner will issue a credit change order to cover the cost associated with these tests. The Owner will not pay for additional testing in the following cases.

1. When the Contractor notifies the Engineer and/or Testing Agency less than 24 hours before the expected time of testing.
2. When the Contractor requires testing for its own convenience.
3. When the Contractor schedules a test and is not ready for the required test.

F. Reports

Reports of test that are part of the submittal requirements which indicate compliance or non-compliance with the specified standard.

G. Submittals

1. The Contractor shall submit the name and qualifications of any independent testing agencies to be used on this project for approval by the Owner.
2. Unless the Contractor is responsible for this service, the independent testing agency shall submit a certified written report, in duplicate, of each inspection, test, or similar service to the Engineer. If the Contractor is responsible for the service, submit a certified written report, in duplicate, of each inspection, test, or similar service through the Contractor.
3. Submit additional copies of each written report directly to the governing authority, when the authority so directs.
4. Report Data: Written reports of each inspection, test, or similar service include, but are not limited to, the following:
    a. Date of issue.
    b. Project title and number.
    c. Name, address, and telephone number of testing agency.
    d. Dates and locations of samples and tests or inspections.
    e. Names of individuals making the inspection or test.
    f. Designation of the Work and test method.
    g. Identification of product and Specification Section,
    h. Complete inspection or test data.
    i. Test results and an interpretation of test results.
    j. Ambient conditions at the time of sample taking and testing.
    k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
    l. Name and signature of laboratory inspector.
    m. Recommendations on re-testing.

H. Quality Assurance

1. Qualifications for Service Agencies: Engage inspection and testing service agencies, including independent testing laboratories, that are pre-qualified as complying with the National Voluntary Laboratory Accreditation Program and that specialize in the types of inspections and tests to be performed.
    a. Each independent inspection and testing agency engaged on the Project shall be authorized by authorities having jurisdiction to operate in the state where the Project is located.
    b. Where applicable, meet ““Recommended Requirements for Independent Laboratory Qualification”, latest edition, published by American Council of Independent Laboratories and the basic requirements of ASTM E 329, “Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction”.
    c. Submit copy of report of inspection of facilities made by Materials Reference Laboratory of National Bureau of Standards during most recent tour of inspection; with memorandum of remedies of any deficiencies reported by inspection.
    d. Testing Equipment:

1. Calibrated at maximum 12 month intervals by devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.
2. Submit copy of certificate of calibration, made by accredited calibration agency.

I. Repair and Protection

1. General: Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes.
2. Protect constructions exposed by or for quality-control service activities, and protect repaired construction.
3. Repair and protection is Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing, or similar services.

01505 TEMPORARY ELECTRICITY AND LIGHTING

A. Power and lighting may be taken from the power company's nearest pole with temporary poles, if needed, to extend the line to project. If permanent power lines have been installed before beginning project, then temporary lines can be brought in from the last pole.

B. Provide service required for construction with branch wiring and distribution boxes located to provide power and lighting by construction-type extension cords. Meter shall be provided and installed by the Contractor.

C. All costs of temporary power and light shall be paid by the Contractor.

01515 TEMPORARY TELEPHONE

A. General Contractor shall provide telephone service in its office and a separate telephone in the Owner's Field Office, if provided. It is preferred the Contractor use a cellular phone. Local calls will be paid by the Contractor and toll calls by the respective users.

01520 TEMPORARY WATER

A. Water is not available on site. Transport water to the project. Cost shall be paid by the General Contractor.

01525 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide, where directed, chemical toilets with toilet tissue, plus wash basins with water, soap and paper towels. The Contractor shall maintain the facilities in a sanitary condition.

B. If women are employed in the work, provide separate, designated facilities for them of the same kind. Provide an adequate number of each kind of facility for each gender.

01530 FIRE PROTECTION

A. The Contractor, during construction, shall be responsible for loss or damage by fire to the work of the Contract until completion. Any fire used within the structure for working purposes shall be extinguished when not in use. Bitumen or tar shall be melted on the ground only. No flammable material shall be stored in the structure in excess of amounts allowed by the authorities. No gasoline shall be stored in or close to on-site buildings at any time. The Contractor shall assign a responsible employee to be in charge of fire protection measures.

01535 CONSTRUCTION EQUIPMENT

A. The Contractor shall furnish tools, apparatus and appliances, hoists and/or cranes and power for same, scaffolding, runways, ladders, temporary supports and bracing and similar work or material necessary to insure convenience and safety in the execution of the Contract except where this is otherwise specified in any Specification Section. All such items shall meet the approval of the Owner but responsibility for design, strength and safety shall remain with the Contractor. All such items shall comply with Federal OSHA regulations and applicable codes, statutes, rules and regulations, including compliance with the requirements of the current edition of the "Manual of Accident Prevention in Construction" published by the A.G.C. and the standards of the State Labor Department.

B. Staging, exterior and interior, required for the execution of this Contract, shall be furnished, erected, relocated if necessary and removed by the General Contractor. Staging shall be maintained in a safe condition without charge to and for the use of all trades as needed.

01540 BARRIERS AND ENCLOSURES

A. Provide barriers to prevent public entry into construction areas and to protect existing facilities from damage by construction operations.

B. Provide a fence around construction site; equip with vehicular and pedestrian gates with locks.

C. Provide covered walkways as required by governing authorities for public rights-of-way and for public access to existing buildings.

D. Provide barriers around trees and plants designated to remain. Protect against vehicular traffic, materials' dumping, chemically injurious materials, puddling or running water.

E. Provide temporary, insulated, weathertight closures at openings to the exterior to provide acceptable working conditions and protection for materials, to allow for temporary heating and to prevent entry of unauthorized persons. Provide doors with self-closing hardware and locks.

F. Barriers and enclosures shall be in conformance with code requirements. Do not block egress from occupied buildings unless necessary to further the work of the Contract. In this case, secure the Department's approval of an alternate egress plan.

01545 PROTECTION

A. Protect buildings, equipment, furnishings, grounds and plantings from damage. Any damage shall be repaired or otherwise made good at no expense to the Owner.

B. Provide protective coverings and barricades to prevent damage. The Contractor shall be held responsible for, and must make good at its own expense, any water or other type of damage due to improper coverings. Protect the public and building personnel from injury.

C. Provide temporary protection for installed products. Control traffic in immediate area to minimize damage.

D. Provide protective coverings for walls, projections, jambs, sills and soffits of openings. Protect finished floors and stairs from traffic, movement of heavy objects and storage. Prohibit traffic and storage on waterproofed and roofed surfaces and on lawn and landscaped areas.

E. Provide temporary partitions and ceilings to separate work areas from Owner-occupied areas to prevent penetration of dust and moisture into Owner-occupied areas and equipment. Erect framing and sheet materials with closed joints and sealed edges at intersections with existing surfaces.

01550 SECURITY

A. Provide security program and facilities to protect work, existing facilities and Owner's operations from unauthorized entry, vandalism and theft. Coordinate with Owner's security program.

B. The Contractor shall be solely responsible for damage, loss or liability due to theft or vandalism.

01555 TRAFFIC WAYS

A. The Contractor may use on-site paved roads and parking areas but shall not encumber same or their access. Public highways shall not be blocked by standing trucks, parked cars, material storage, construction operations or in any other manner.

B. Public roads and existing paved roads, drives and parking areas on Owner's property shall be kept free from scrap or debris due to construction operations and any damage to their surface caused by the Contractor shall be repaired by him at its own expense. The Contractor shall apply water and calcium chloride to unpaved areas and shall apply water and use vacuum sweeper on paved areas, or use other methods subject to the Engineer's approval for keeping airborne dust to a minimum

C. If the work of the Contract affects public use of any street, road, highway or thoroughfare, the General Contractor shall confer with the police authority having jurisdiction to determine if and how many police are needed for public safety in addition to any barriers and signals that may be needed. The General Contractor will be responsible for payment of any needed police services.

01570 CLEANING

A. Maintain areas under Contractor's control free of waste materials, debris and rubbish. Maintain in a clean and orderly condition.

B. Execute cleaning during progress of the Work, at completion of the Work, and as required by the General Conditions.

C. Control cleaning operations so that dust and other particulates will not adhere to wet or newly-coated surfaces and so that dust, wash water or other contaminants generated during such operations do not damage or mar painted or finished surfaces.

D. Remove waste materials, debris and rubbish from site daily and dispose of legally off-site. No scrap/debris shall remain inside the building or anywhere on site upon final acceptance of the project.

E. Requirements of Regulatory Agencies:

1. In addition to the requirements herein, maintain the cleanliness of the Work and surrounding premises within the Work limits so as to comply with federal, state, and local fire and safety laws, ordinances, codes and regulations.

2. Comply with all federal, state and local anti-pollution laws, ordinances, codes and regulations when disposing of waste materials, debris and rubbish.

F. Cleaning Materials:

1. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

2. Use each type of cleaning material on only those surfaces recommended by the cleaning material manufacturer.

3. Use only materials which will not create hazards to health or property.

G. During Construction:

1. Keep the Work and surrounding premises within work limits free of accumulations of dirt, dust, waste materials, debris and rubbish.

2. Keep dust generating areas wetted down.

3. Provide suitable containers for storage of waste materials, debris and rubbish until time of disposal.

4. Dispose of waste, debris and rubbish off site at legal disposal areas.

H. When Project is Completed:

1. Remove and dispose of all excess or waste materials, debris, rubbish, and temporary facilities from the site, structures and all facilities.
2. Repair pavement, roads, sod, and all other areas affected by construction operations and restore them to original condition or to minimum condition specified.
3. Remove spatter, grease, stains, fingerprints, dirt, dust, labels, tags, packing materials and other foreign items or substances from interior and exterior surfaces, equipment, signs and lettering.
4. Repair, patch and touch up chipped, scratched, dented or otherwise marred surfaces to match specified finish.
5. Remove paint, clean and restore all equipment and material nameplates, labels and other identification markings.
6. Wash and shine mirrors, glazing and polished surfaces.
7. Clean all floors, slabs, pavements, and ground surfaces.
8. Maintain cleaning until acceptance and occupation by Owner.

01575 PROJECT SIGNS

A. Project Signs: The Contractor shall not post any signs.

01580 FIELD OFFICES AND SHEDS ~

A. Field Offices

1. The Contractor shall provide an office for its own use which may be a trailer type facility with electric lighting, air conditioning, and heat. It shall have ample natural light, a table, chairs, counter, shelf, plan racks and file cabinets. Provide a 5 Ib. ABC fire extinguisher and an OSHA-approved first aid kit. If the contract amount is $2,500,000 or more, the Contractor shall provide a facsimile machine in its office and shall also provide its superintendent with a message beeper.
2. The Contractor shall provide a field office for the Engineer of not less than 150 sq. ft. which may be a trailer type facility. The field office shall have ample natural light, a heater of sufficient capacity to maintain 70 degrees (F) in winter and an air conditioner of sufficient capacity to maintain 75 degrees (F) in summer. The Contractor shall provide a 5-lb. ABC fire extinguisher, and an OSHA-approved first aid kit. The contractor shall furnish the following furniture, which will remain its property. Furniture may be used but shall be in good condition, as judged by the Engineer.
    a. (1) one two pedestal desk
    b. (1) One plan table.
    c. (3) Three chairs.
    d. (1) One file cabinet (lockable four drawer letter size).
    e. (1) One bookshelf w/10 L.F. of 12” wide shelving.
    f. (1) One large capacity waste receptacles.
    g. (1) One Fax Machine with telephone line,
    h. (1) One telephone with telephone line.
    i. (1) One Answering Machine with telephone line.
    j. (1) One Computer having PC with telephone line and internet connection capabilities using fastest connection capabilities locally available with latest versions of operating software,

including but not limited to, Windows, AutoCAD, Microsoft Office, Microsoft Project, or approved equal.

k. (1) One Laser printer with supplies.

l. (1) One Copy Machine with supplies.

01600 MATERIALS AND EQUIPMENT CONTROLS

A. Materials and Equipment

Shall be delivered, stored and handled to prevent intrusion of foreign matter and damage by weather or breakage. Packaged materials shall be delivered and stored in original, unbroken packages.

1. Promptly inspect shipments to assure that products comply with requirements, that quantities are correct and products are undamaged.
2. Packages, materials and equipment showing evidence of damage will be rejected and replaced at no additional cost to the Owner.

B. Storage and Protection

1. Store products in accordance with manufacturers' instructions with seals and labels intact and legible. Store sensitive products in weathertight enclosures; maintain within temperature and humidity range required by manufacturer.
2. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.
3. Store loose granular material on solid surfaces in a well-drained area; prevent mixing with foreign matter.
4. Arrange storage to provide access for inspection. Periodically inspect to insure products are undamaged and are maintained under required conditions. Keep log showing date, time and problems, if any.
5. Stone, masonry units and similar materials shall be stored on platforms or dry skids and shall be adequately covered and protected against damage.

01631 EQUALS AND SUBSTITUTIONS

A. Definitions

Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.

1. Equals or Substitutions General: Changes in products, materials, equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract.
2. Equal: Any deviation from the specification which is defined as follows: A replacement for the specified material, device, procedure, equipment, etc., which is recognized and accepted as substantially equal to the first listed manufacturer or first listed procedure specified, after review, by the Engineer and may be rejected or approved at the sole discretion of the owner. All equals must be substantially equivalent to the first manufacturer or first procedure listed in the Specifications with reference to all of the following areas: the substance and function considering quality, workmanship, economy of operation, durability and suitability for purposes intended; size, rating and cost. The equal does not constitute a modification in the scope of Work, the Schedule or Engineer's design intent of the specified material, device, procedure, equipment, etc.
3. Substitution: Any deviation from the specified requirements, which is defined as follows: A replacement for the specified material, device, procedure, equipment, etc., which is not recognized

or accepted as equal to the first manufacturer or procedure listed in the Specification after review by the Engineer and may be rejected or approved by the Owner. The Substitution is not equal to the specified requirement in comparison to the first manufacture or first procedure listed in the Specifications in one or more of the following areas: the substance and function considering quality, workmanship, economy of operation, durability and suitability for purposes intended; size; cost and rating. The Substitution constitutes a modification in the scope of Work, the Schedule or the Engineer's design intent of the specified material, device, procedure, equipment, etc.

4. The following are not considered to be requests for Equals or Substitutions:

   a. Revisions to the Contract Documents requested by the Owner or Engineer.

   b. Specified options of products and construction methods included in the Contract Documents.

   c. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities having jurisdiction.

B. Submittals

1. Equals and Substitution Request Submittals: The Owner will consider requests for equals or substitutions if received within time period designated in the General Conditions Article 15. Requests received more than the days specified in Article 15 after the start date of the contract will be rejected.

   a. The Contractor is required to prepare and submit 3 copies of the required data for the first manufacturer listed or procedure listed in the specifications section with reference to all of the following areas: the substance and function considering quality, workmanship, economy of operation, durability and suitability for purposes intended including the size, rating and cost. All submissions must include all the required data for the first listed manufacturer or procedure as specified, as well as the required data for the proposed Equal or Substitution. This will enable the Owner and Engineer to determine that the proposed Equal or Substitution is or is not substantially equal to the first listed manufacturer or procedure.

2. Identify the product or the fabrication or installation method to be replaced in each request. Include related Specification Section and Drawing numbers.

3. Provide complete documentation showing compliance with the requirements for equals or substitutions, and the following information, as appropriate on a "Substitution Request" form as required by the Owner:

   a. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and separate contractors, that will be necessary to accommodate the proposed Equal or Substitution.

   b. A detailed comparison chart of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.

   c. Product Data, including Shop Drawings and descriptions of products and fabrication and installation procedures.

   d. Samples, where applicable or requested.

   e. A statement indicating the effect on the Contractor's Construction Schedule or CPM Schedule compared to the schedule without approval of the Equal or Substitution. Indicate the effect on overall Contract Time.

   f. Cost information, broken down, including a proposal of the net change, if any in the Contract Sum.

g. The Contractor's certification that the proposed Equal or Substitution conforms to requirements in the Contract Documents in every respect and is appropriate for the applications indicated.

h. The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the Equal or Substitution to perform adequately.

4. Engineer's Action: If necessary, the Engineer will request additional information or documentation for evaluation within one week of receipt of the original request for equal or substitution request. The Engineer will notify the Owner of recommended acceptance or rejection of the proposed equal or substitution, within two (2) weeks of receipt of the request, or one (1) week of receipt of additional information or documentation, whichever is later. The Engineer will give final acceptance or rejection by the Owner not less than one (1) week after notification.

   a. Any request deemed an "Equal" and accepted by the Engineer, and Owner will result in written notification to the Contractor and will not be in the form of a change order for an "Equal".

   b. Any request deemed a "Substitution" and rejected or approved by Engineer and Owner may result in written notification to the Contractor and may be in the form of a change order if the "Substitution" is approved.

C. Equal or Substitutions

1. Conditions: The Engineer will consider the Contractor's request for Equal or Substitution of a product or method of construction when one or more of the following conditions are satisfied, as determined by the Engineer. If the following conditions are not satisfied, the Engineer will return the requests to the Engineer without action except to record noncompliance with these requirements.

   a. The proposed request does not require extensive revisions to the Contract Documents.

   b. The proposed request is in accordance with the general intent of the Contract Documents.

   c. The proposed request is timely, fully documented, and/or properly submitted.

   d. The proposed request can be provided within the Contract Time. However, the Engineer will not consider the proposed request if it is a result of the Contractor's failure to pursue the Work promptly or coordinate activities properly.

   e. The proposed request will offer the Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities the Owner must assume. However, if the proposed request requires the Owner to incur additional responsibilities, including but not limited to, additional compensation to the Engineer for redesign and evaluation services, increased cost of other construction by the Owner or similar considerations, then the Owner will have just cause to reject the request for Equal or Substitution.

   f. The proposed request can receive the necessary approvals, in a timely manner, required by governing authorities having jurisdiction.

   g. The proposed request can be provided in a manner that is compatible with the Work as certified by the Contractor.

   h. The proposed request can be coordinated with the Work as certified by the Contractor.

   i. The proposed request can uphold the warranties required by the Contract Documents as certified by the Contractor.

2. The Contractor's submission and the Engineer's review of Submittals, including but not limited to, Samples, Manufacturer's Data, Shop Drawings, or other such items, which are not clearly identified as a request for an Equal or Substitution, will not be considered or accepted as a valid request for an Equal or Substitution, nor does it constitute an approval.

01650 STARTING OF SYSTEMS

A. General:

1. Coordinate schedule for start-up of various equipment and systems.
2. Provide written notification the Engineer thirty (30) Calendar Days prior to start-up of each item.
3. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, and control sequence for other conditions that may cause damage.
4. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
5. Verify in wiring and support components are complete and tested.
6. Execute the start-up under supervision of manufacturer's representative, in accordance with manufacturer's instructions.
7. When referenced in individual specification sections, require manufacturer to provide an authorized representative to be present at the site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
8. Submit a written report in accordance Section 01400 "Quality Control" that the equipment or system has been properly installed and is functioning properly.

B. Demonstration and Instructions:

1. Demonstrate operation and maintenance of Products to Owner and Personnel two (2) weeks prior to substantial completion.
2. Demonstrate Project equipment and instruct in a classroom environment at location designated by the Engineer and instructed by a qualified manufacturer's representative who is knowledgeable about the project.
3. For equipment or systems requiring seasonal operation perform demonstration for season within six (6) months.
4. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner and Personnel in detail to explain all aspects of operation and maintenance.
5. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, and maintenance, and shutdown of each item at agreed upon scheduled time and at equipment or designated location.
6. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during demonstration.

C. Testing Adjusting, and Balancing

1. The Contractor will employ and pay for the testing services of an independent consultant to verify the testing, adjusting, and balancing.
2. Reports will be submitted by the independent testing consultant to the Engineer indicating observations and results of tests and indicating compliance or non-compliance with the requirements of the Contract Documents.
3. The Owner may employ and pay for the services of an independent consultant to verify testing, adjusting, and balancing which was performed by the Contractor.

01700 CONTRACT CLOSEOUT

A. Substantial Completion

1. Preliminary Procedures: Before requesting inspection for Certification of Substantial Completion, complete the following. List exceptions in the request.

a. In the Application for Payment that coincides with, or first follows, the date Substantial Completion is claimed, show 100 percent completion for the portion of the Work claimed as substantially complete.

1. Include supporting documentation for completion as indicated in these Contract Documents and a statement showing an accounting of changes to the Contract Sum.

2. If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.

b. Advise the Owner of pending insurance changeover requirements, if applicable.

c. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.

d. Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

e. Submit record drawings, maintenance manuals, damage or settlement surveys, property surveys, and similar final record information.

f. Deliver tools, spare parts, extra stock, and similar items.

g. Make final changeover of permanent locks and transmit keys to the Owner. Advise the Owner's personnel of changeover in security provisions.

h. Demonstration, through operation and testing, the functions of all systems and/or equipment to the satisfaction of the Owner for compliance to the contract. Complete testing of systems, and instruction of the Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the site, along with mockups, construction tools, and similar elements.

i. Complete final cleanup requirements, including touchup painting,

j. Touch up and otherwise repair and restore marred, exposed finishes.

2. Inspection Procedures: The Contract shall be ready and prepared when they request a Substantial Completion inspection. If the inspection reveals that the work is not complete, there are extensive punchlist items and as the items listed above are not complete, the Engineer and Owner will determine the inspection has failed.

3. The Contractor is responsible for all costs to re-inspect due to a failed inspection. The Owner will issue a deduct change order to cover all costs for re-inspection.

a. The Engineer will repeat inspection when requested and assured that the Work is substantially complete.

b. Results of the completed inspection will form the basis of requirements for final acceptance.

B. Final Acceptance

1. Preliminary Procedures: Before requesting final inspection for certification of final acceptance and final payment, complete the following. List exceptions in the request.

a. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.

b. Submit an updated final statement, accounting for final additional changes to the Contract Sum.

c. Submit a certified copy of the Engineer's final inspection list of items to be completed or corrected, endorsed and dated by the Engineer. The certified copy of the list shall state that

each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by the Engineer.

d. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion or when the Owner took possession of and assumed responsibility for corresponding elements of the Work.

e. Submit consent of surety to Final Payment.

f. Submit evidence of final, continuing insurance coverage complying with insurance requirements, if applicable.

2. Reinspection Procedure: The Inspection Group will re-inspect the Work upon receipt of notice from the Engineer that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to the Owner.

a. Upon completion of reinspection, the Engineer will prepare a certificate of final acceptance. If the Work is incomplete, the Engineer will advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.

C. Record Document Submittals

1. General

Do not use record documents for construction purposes. Protect Record Documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for the Engineer's reference during normal working hours. Keep documents current; do not permanently conceal any work until required information has been recorded. Failure to keep documents current is sufficient cause to withhold progress payments.

a. The Contractor shall also hire the services of a Surveyor registered in the State of Connecticut to conduct a final survey as specified in Section 01050, and to record the results, and update existing electronic media

b. The Record Drawings shall be prepared upon completion of the work and in accordance with Section 01050 and copies submitted to the Owner as required in Section 01700. The Record Drawings shall bear the seal of the Land Surveyor and a statement of accuracy.

2. Record Drawings

The Contractor shall maintain one clean, complete undamaged set of blue or black line whiteprints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation where the installation varies substantially from the Work as originally shown. Mark which drawing is most capable of showing conditions fully and accurately. Where Shop Drawings are used, record a cross-reference at the corresponding location on the Contract Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.

a. Mark record sets with erasable pencil to distinguish between variations in separate categories of the Work.

b. Mark all new information that is not shown on Contract Drawings.

c. Note related change-order numbers where applicable.

d. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.

e. Upon completion of the work, the Contractor shall submit Record Drawings to the Engineer and shall submit the Certified Final As-built and Topographic Survey (as detailed in Section 01050) to the Engineer for the Owner's Records. Contractor shall provide the Certified Final As-built and Topographic Survey on mylar and electronically as required in Section 01050.

f. Submit electronic format data of all revised drawings in AutoCAD (latest version) compatible format.

3. Record Specifications

The Contractor shall maintain one complete copy of the Project Manual, including Addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and modifications issued in printed form during construction.

a. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.

b. Give particular attention to equals and substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.

c. Note related record drawing information and Product Data.

d. Upon completion of the Work, submit record Specifications to the Engineer for the Owner's records.

4. Record Product Data

The Contractor shall maintain one copy of each Product Data submittal. Note related Change Orders and markup of record drawings and Specifications.

a. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site and from the manufacturer's installation instructions and recommendations.

b. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.

c. Upon completion of markup, submit complete set of Record Product Data to the Engineer for the Owner's records.

5. Record Sample Submitted

Immediately prior to Substantial Completion, the Contractor shall meet with the Engineer and the Owner's personnel at the Project Site to determine which Samples are to be transmitted to the Owner for record purposes. Comply with the Owner's instructions regarding delivery to the Owner's Sample storage area.

6. Miscellaneous Record Submittals

Refer to other Specification Sections for requirements of miscellaneous record keeping and submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to the Engineer for the Owner's records.

7. Maintenance Manuals

Organize operation and maintenance data into suitable sets of manageable size. Bind properly indexed data in individual, heavy-duty, 2-inch (51-mm), 3-ring, vinyl-covered binders, with pocket folders for folded sheet information. Mark appropriate identification on front and spine of each binder according to section 01730. Included but not limited to the following types of information:

a. Emergency instructions.

b. Spare parts list.

c. Copies of warranties.

d. Wiring diagrams.

e. Recommended "turn-around" cycles.

f. Inspection procedures.

g. Shop Drawings and Product Data.

h. Fixture lamping schedule.

D. Closeout Procedures

1. Operation and Maintenance Instructions: Arrange for each Installer of equipment that requires regular maintenance to meet with the Owner's personnel to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:

   a. Maintenance manuals.

   b. Record documents.

   c. Spare parts and materials.

   d. Tools.

   e. Lubricants.

   f. Fuels.

   g. Identification systems.

   h. Control sequences.

   i. Hazards.

   j. Cleaning.

   k. Warranties and bonds.

   l. Maintenance agreements and similar continuing commitments.

2. As part of instruction for operating equipment, demonstrate the following procedures:

   a. Startup.

   b. Shutdown.

   c. Emergency operations.

   d. Noise and vibration adjustments.

   e. Safety procedures.

   f. Economy and efficiency adjustments.

   g. Effective energy utilization.

E. Final Cleaning

1. General: The General Conditions requires general cleaning during construction. Regular site cleaning is included in Division 1 Section 01570 "Cleaning"".

2. Comply with manufacturer's instructions. Complete the following cleaning operations before requesting inspection for Certification of Substantial Completion.

3. Exterior:

   a. Clean the site, including landscape development areas, of rubbish, litter, and other foreign substances. Sweep paved areas broom clean; remove stains, spills, and other foreign deposits. Rake grounds that are neither paved nor planted, to a smooth, even-textured surface.

b. Clean exposed exterior hard-surfaced finishes to a dust-free condition, free of stains, films, and similar foreign substances

c. Clean roofs, gutters and downspouts.

d. Remove waste and surplus materials, rubbish and construction equipment and facilities from the site, and deposit it legally elsewhere.

e. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Remove paint spots; wash and polish glass.

4. Removal of Protection: Remove temporary protection and facilities installed for protection of the Work during construction.

5. Compliance: Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property, unless authorized by Owner. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of lawfully, unless authorized by Owner to leave on-site.

a. Where extra materials of value remain after completion of associated Work, they become the Owner's property. Dispose of these materials as directed by the Engineer.

b. If the Contractor fails to clean up, the Owner may do so, with the cost charged to the Contractor. The Owner will issue a credit change order to cover the costs.

01730 OPERATION AND MAINTENANCE DATA

A. The Contractor shall instruct the Owner's designated personnel in the operation of new equipment and shall provide manuals and if required, provide video tapes of this basic maintenance of the equipment for training purposes. Provide qualified personnel for as long as necessary to instruct the Owner's personnel.

B. Submit four (4) copies of the manuals in 3-ring, loose-leaf notebooks to the Engineer for approval. Manuals may consist of plain paper copies of approved shop drawings and catalog cuts. Upon completion and approval, 3 copies will be forwarded to the Owner and one copy retained by the Engineer.

C. Manuals shall include:

1. Operating Procedures:

a. Typewritten procedures for each mode of operation of each piece of equipment. Procedures shall indicate the status of each component of a system in each operating mode.

b. Procedures shall include names, symbols, valve tags, circuit numbers, schematic wiring diagrams, locations of thermostats, manual starters, control cabinets and other controls of each system.

c. Emergency shut-down procedures for each piece of equipment or system, both automatic and manual, as appropriate.

2. Maintenance Schedule:

a. Typewritten schedule describing manufacturers schedule of maintenance and maintenance procedures.

3. Catalog Cuts:

a. To illustrate each piece of installed equipment, including options.

b. Include equipment descriptions including physical, electrical and mechanical; performance characteristics; installation or erection diagrams.

c. Include spare parts numbers and names, address and phone number of manufacturer; name, address and phone number of local representative or service department.

d. Typewritten list of all subcontractors on the project, including name, address and phone number of local representative or service department.

4. Manuals shall be indexed with dividers indicating each system or piece of equipment.

01740 WARRANTIES AND GUARANTEES

A. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the Work that incorporates the products. Manufacturer's disclaimers and limitations on product warranties do not relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the Contractor.

B. Related Damages and Losses: When correcting failed or damaged warranted construction, remove and replace construction that has been damaged as a result of such failure or must be removed and replaced to provide access for correction of warranted construction.

C. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

D. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of the Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefited from use of the Work through a portion of its anticipated useful service life.

E. Owner's Recourse: Expressed warranties made to the Owner are in addition to implied warranties and shall not limit the duties, obligations, rights, and remedies otherwise available under the law. Expressed warranty periods shall not be interpreted as limitations on the time in which the Owner can enforce such other duties, obligations, rights, or remedies.

1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selection to products with warranties not in conflict with requirements of the Contract Documents.

F. Where the Contract Documents require a special warranty, or similar commitment on the Work or part of the Work, the Owner reserves the right to refuse to accept the Work, until the Contractor presents evidence that entities required to countersign such commitments are willing to do so.

G. The Contractor shall guarantee all materials and workmanship for a period of eighteen months from the Acceptance Date. In addition, the Contractor shall furnish the warranties listed below. Submit four (4) copies of each to the Engineer in the supplier's standard form or in the form given below if there is no standard form available.

1. Exhibit C – Division 02, Geomembranes, including pipe penetration seals and field seams. The warranty shall guarantee materials for a minimum of 20-year materials, and labor for a minimum period of 5-years.

2. Exhibit C – Division 48, Solar Energy Electricity Generating System: Manufacturer's Materials Warranties: (1) PV Modules: 25-year minimum, (2) Solar Inverters: 10 year minimum, (3) Racking System Components: 10 year minimum. The Owner will request that the selected bidder submit additional pricing for solar inverter warranty extensions to 20 years.

H. Submit certification that finish materials are fire rated as specified.

I. Form of Guarantees and Warranties:

Connecticut Resources Recovery Authority
100 Constitution Plaza, 6th Floor
Hartford, Connecticut 06103-1702
PHASE II MSW AREA CLOSURE AND PHOTOVOLTAIC SYSTEM PROJECT - CONNECTICUT RESOURCES RECOVERY AUTHORITY HARTFORD LANDFILL
Project Number [Insert No. Here])

I (We) hereby guarantee and warranty the work on the referenced project for a period of_____ years from_____, 20__ against failures of workmanship and materials in accordance with the requirements of Section __, Page __, Paragraph__, of the Specifications.

Signed _____

General Contractor (or authorized agent) _____

J. Bonds shall be by approved Surety Companies, made out to the Owner on company's standard form.

K. Guarantees, warranties or bonds supplied by Subcontractors, Suppliers or Manufacturers shall reference the project name, number, and location and be certified by the General Contractor to be for the product and installation on the project and must be countersigned by the General Contractor.

L. Submittals:

1. Submit written warranties prior to the date certified for Substantial Completion. If the Engineer's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Engineer.

2. Forms for special warranties are included in this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Submit a draft to the Owner, through the Engineer, for approval prior to final execution.

    a. Refer to Divisions the Technical Specifications for specific content requirements and particular requirements for submitting special warranties.

3. Form of Submittal: At Final Completion compile two (2) copies of each required warranty properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.

4. Bind warranties and bonds in heavy-duty, commercial-quality, durable 3-ring, vinyl-covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch (115-by-280-mm) paper.

    a. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address, and telephone number of the Installer.

    b. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project title or name, and name of the Contractor.

When warranted construction requires operation and maintenance manuals, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

EXHIBIT C

TECHNICAL SPECIFICATIONS

The following Technical Specifications are hereby incorporated into and made a part of this Agreement, including the following appendices hereto:

- Exhibit C: Technical Specifications (130 pages)
    - Appendix A to Exhibit C: Stormwater Pollution Control Plan (52 pages)
    - Appendix B to Exhibit C: Amendment to Stormwater Pollution Control Plan (154 pages)
    - Appendix C to Exhibit C: Interconnection Agreement (23 pages)
    - Appendix D1 to Exhibit C: Closure Turf and HydroTurf Installation Guidance Documents (34 pages)
    - Appendix D2 to Exhibit C: SGI Drivability Report (12 pages)
    - Appendix E to Exhibit C: Phase II MSW Area Closure And Photovoltaic System Project CRRA Hartford Landfill Quality Assurance Plan (20 pages)

Exhibit C

Technical Specifications
Phase II MSW Area Closure
& Photovoltaic System Project
Hartford Landfill

Connecticut Resources
Recovery Authority
Hartford, Connecticut

March 5, 2013

Fuss & O'Neill
146 Hartford Road
Manchester, CT 06040

THIS PAGE

IS

INTENTIONALLY

LEFT BLANK

EXHIBIT C
TECHNICAL SPECIFICATIONS
TABLE OF CONTENTS

EXHIBIT C
TECHNICAL SPECIFICATIONS
TABLE OF CONTENTS

END OF SECTION

SECTION 02 66 21 – LANDFILL EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Exhibit B General Requirements, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Preparing landfill subgrade including general fill where required.
2. Cap base material.
3. Sand Drainage layer which includes the following:
    a. Geocomposite (Geonet and non-woven geotextile cover)
    b. Drainage Sand.
4. Disposal of unsuitable material.
5. Disposal of surplus suitable material, if required.

B. Related Sections include the following:

1. Division 02 Section "Landfill Vegetative Support Material" for landfill topsoil.
2. Division 02 Section "Underdrains" for piped subdrainage systems.
3. Division 31 Section "Site Earth Moving" for miscellaneous earthwork materials and procedures for utility systems and locations beyond landfill limits.
4. Division 31 Section "Temporary Erosion and Sedimentation Control" for temporary site measures.
5. Division 31 Section "Permanent Erosion and Sedimentation Control" for riprap at cap anchors.

1.3 DEFINITIONS

A. ASTM: American Society for Testing and Materials.

B. ETPH: Extractable Total Petroleum Hydrocarbons.

C. HDPE: High Density Polyethylene

D. LLDPE: Linear Low Density Polyethylene

E. RCRA: Resource Conservation Recovery Act.

1.4 SUBMITTALS

A. Product Data and Material Certifications: For the following:

1. General fill
2. Cap Base material
3. Drainage Sand material. Each type.
4. Non-woven geotextile
5. Geocomposite

B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance with requirements indicated. Prepare separate reports for each type and application of soil material.

1. Gradation according to ASTM D 422 and classification according to ASTM D 2487, prior to delivery and at a rate of one per 5,000 cu. yd.
2. Modified Proctor Testing according to ASTM D 1557.
   a. General Fill, Cap Base and Sand Drainage Layer: prior to delivery and at a rate of one per 5,000 cu. yd.
3. Origin of material, prior to delivery.
4. Permeability Testing according to ASTM D 5084:
   a. Cap Base and Sand Drainage Layer: One prior to delivery and one per 5,000 cu. yd. delivered.
5. Interface Friction Angle Testing according to ASTM D5321:
   a. Cap Base: One prior to delivery and one per 5,000 cu. yd. delivered.
   b. Drainage Sand: One prior to delivery and one per 5,000 cu. yd. delivered.
6. Internal Friction Angle Testing according to ASTM D 3080:
   a. General Fill, Cap Base and Sand Drainage Layer: One prior to delivery and one per 5,000 cu. yd. delivered.
   b. Geocomposite: One per proposed geomembrane liner type prior to delivery
7. Soil Chemical Analysis Reports:
   a. RCRA 8 Metals (EPA Method 6010 / 7421 / 7470), Polychlorinated Biphenyls (EPA Method 8082), Total Volatile Organic Compounds (EPA Method 8260), Semi-Volatile Organic Compounds/Polyaromatic Hydrocarbons (EPA Method 8270), Pesticides (EPA Method 8081), and Total Petroleum Hydrocarbons (CTETPH method): prior to delivery and one report for each 10,000 cu. yd., or portion thereof, delivered. Owner reserves the right to disqualify the source based on the results of the chemical testing.
      1) Soil/material shall not exceed any GB pollutant mobility criteria (GB PMC) or residential direct exposure criteria (RES DEC) established in

Sections 22a-133k-1 through 22a-133k-3 of the regulations of Connecticut state agencies.

C. Field Test Reports

1. Depth Test Hole Drawing: Identify installed layer, locate field test holes on plan, and record depth of tested layer. Submit before proceeding with subsequent layer installation.

2. Compaction Testing: Submit reports generated from field compaction testing.

a. Refer to "Field Quality Control" for frequencies and locations of tests.

1.5 QUALITY ASSURANCE

A. Where "Form 816" is referenced, it shall mean "State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Form 816," and issued supplements.

B. Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials testing, as documented according to ASTM D 3740 and ASTM E 548.

1. Testing Agency performing tests involving geosynthetic materials shall also be accredited by the Geosynthetics Research Institute.

1.6 PROJECT CONDITIONS

A. Stage earthwork operations to minimize travel of vehicular traffic over the cap area.

1. Damage to the LLDPE geomembrane liner resulting from construction activities shall be repaired at the Contractor's expense.

2. No vehicular traffic shall be allowed to operate directly on the geomembrane liner.

a. Construction vehicles will not be allowed to travel over installed geomembrane liner without use of a sacrificial geosynthetic (e.g. strip of membrane or geotextile).

b. Limit construction vehicle loads to a maximum ground pressure approved by the manufacturer.

c. Sacrificial geosynthetic material shall not be incorporated into The Work.

PART 2 - PRODUCTS

2.1 GENERAL FILL

A. General Fill: Free from ice, snow, roots, sod, rubbish, and other deleterious or organic matter.

1. Use for general raises in landfill grade and waste cover.

2. Meet the following gradation:

U.S. Standard Sieve Size	Percent Finer By Weight
3-inch	100
No. 10	30-90
No. 40	10-70
No. 200	0-20

3. Minimum Internal Friction Angle: When tested in accordance with ASTM D 3080 shall be 29 degrees peak. Test shall be performed with general fill compacted to a dry density equal to a range between 85 and 90 percent of the maximum density, at a moisture content 3 percent wet of optimum moisture, obtained in accordance with ASTM D 1557 after soaking the prepared samples for a period of at least 24 hours to obtain uniform moisture content in the materials being tested. The specimens shall be sheared via the large scale direct shear method with 1 and 5 psi normal stresses.

4. Minimum Compacted Wet Unit Weight: When compacted to 90 percent of maximum dry density at a moisture content of 3 percent wet of optimum, obtained in accordance with ASTM D 1557, shall be 120 pounds per cubic foot.

2.2 CAP BASE

A. Cap Base Material. Naturally or artificially graded mixture of natural or crushed gravel free of sharp edges, and natural or crushed sand.

1. Use directly beneath landfill geomembrane liner.

2. Minimum Permeability: ASTM D 5084, 1.0 x 10^{-3} cm/sec when compacted at optimum to 3 percent of optimum moisture content, and 90 percent of maximum density in accordance with ASTM D 1557.

   a. Test samples at effective confining pressure of 3 psi, under hydraulic gradients ranging from 5 to 20.

3. Minimum Interface Friction Angle: Between the cap base material and geomembrane liner. Test shall be performed with cap base material compacted to a dry density equal to a range between 85 and 90 percent of the maximum density, at a moisture content 3 percent wet of optimum moisture, obtained in accordance with ASTM D 1557 and tested in accordance with ASTM D 5321 after soaking the prepared samples for a period of at least 24 hours to obtain uniform moisture content in the materials being tested. The specimens shall be sheared via the large scale direct shear method at a rate of 0.005 in/minute at 1, 3 and 5 psi normal stresses.

   a. Closure Turf ™ Liner: Minimum interface friction angle of 35 degrees peak.

   b. TPO Liner: Minimum interface friction angle of 8 degrees peak.

4. Minimum Internal Friction Angle: Shall be 35 degrees when tested in accordance with ASTM D 3080. Test shall be performed with cap base material compacted to a dry density equal to a range between 85 and 90 percent of the maximum density, at a

moisture content 3 percent wet of optimum moisture, obtained in accordance with ASTM D 1557 after soaking the prepared samples for a period of at least 24 hours to obtain uniform moisture content in the materials being tested. The specimens shall be sheared via the large scale direct shear method with 1, 3 and 5 psi normal stresses.

5. Minimum Compacted Wet Unit Weight: Shall be 110 pounds per cubic foot when compacted to 90 percent of maximum dry density at a moisture content of 3 percent wet of optimum, obtained in accordance with ASTM D 1557.

6. Meet the following gradation:

U.S. Standard Sieve Size	Percent Finer By Weight
1-inch	100
No. 10	30-90
No. 40	10-70
No. 200	0-10

2.3 DRAINAGE LAYER

A. Geocomposite (Bi-Planar or Tri-Planar): Drainage net with non-woven geotextile fabric bonded to each side. For use only where indicated on the plans.

1. Geonet: HDPE material.

Properties	Unit	Value	Test
Carbon Black Content	Percentage	2 to 3	ASTM D1603
Transmissivity	m^2/sec	$\geq 1.4 \times 10^{-3}$	GRI GC8
Polymer Specific Gravity		0.93	ASTM D1505
Polymer melt flow index	g/10 min	≤ 1.0	ASTM D1238
Thickness	millimeters	5.3	ASTM D5199

a. Perform transmissivity test with rigid platter or substratum and Ottowa Sand on super stratum. Test at gradient of 0.04 at a temperature of 68 degrees F and normal stress of 1,000 psf.

2. Non-Woven Geotextile:

Properties	Unit	Value	Test
Unit Weight per Area	$oz./yd^2$	6.0	N/A
Flow	gpm/sf	150	ASTM D4491
Grab Tensile	lbs.	120	ASTM D4632

3. Ties: Strings, plastic fasteners, or polymer braid used to secure adjacent sheets of drainage composite

   a. Metallic ties will not be allowed.

   b. Color: Yellow or white to facilitate inspection.

4. Minimum Interface Friction Angle: Between each type of proposed geomembrane liner and geocomposite geonet (with non-woven geotextile heat-bonded to each side). The specimens shall be sheared via the large scale direct shear method at a rate of 0.005 in/minute at 1, 5 and 12 psi normal stresses. .

   a. Material proposed for slopes >10%: Minimum interface friction angle of 29 degrees peak and 29 degrees residual.

   b. Material proposed for slopes ≤10%: Minimum interface friction angle of 8 degrees peak and 8 degrees residual.

B. Drainage Sand for Slopes Greater Than or Equal to 10 Percent.

1. Minimum Permeability: ASTM D 5084, 1.0 x 10^{-2} cm/sec when compacted at optimum to 3 percent of optimum moisture content, and 90 percent of maximum density in accordance with ASTM D 1557.

   a. Test samples at effective confining pressure of 3 psi, under hydraulic gradients ranging from 5 to 20.

2. Minimum Interface Friction Angle: Between the geomembrane liner and drainage sand. Test shall be performed with drainage sand compacted to a dry density equal to a range between 85 and 90 percent of the maximum density, at a moisture content 3 percent wet of optimum moisture, obtained in accordance with ASTM D 1557 and tested in accordance with ASTM D 5321 after soaking the prepared samples for a period of at least 24 hours to obtain uniform moisture content in the materials being tested. The specimens shall be sheared via the large scale direct shear method at a rate of 0.005 in/minute at 1, 3 and 5 psi normal stresses.

   a. Minimum interface friction angle of 32 degrees peak.

3. Minimum Internal Friction Angle: Between the gecomposite geonet and drainage sand. When tested in accordance with ASTM D 3080. Test shall be performed with drainage sand compacted to a dry density equal to a range between 85 and 90 percent of the maximum density, at a moisture content 3 percent wet of optimum moisture, obtained in accordance with ASTM D 1557 after soaking the prepared samples for a period of at least 24 hours to obtain uniform moisture content in the materials being tested. The specimens shall be sheared via the large scale direct shear method with 1, 3 and 5 psi normal stresses.

   a. Minimum internal friction angle of 32 degrees.

4. Minimum Compacted Wet Unit Weight: When compacted to 90 percent of maximum dry density at a moisture content of 3 percent wet of optimum, obtained in accordance with ASTM D 1557.

   a. Minimum of 110 pounds per cubic foot

5. In addition to the permeability requirements, all drainage sand shall be free of sharp edges and meet the following gradation requirement.

U.S. Standard Sieve Size	Percent Finer By Weight
1-inch	100
No. 10	30-90
No. 40	10-70
No. 200	0-10

C. Non-Woven Geotextile Cover: Placed between drainage sand and vegetative support material and between road embankment material and drainage sand.

1. Needle-punched fabric of polypropylene fibers, conforming with Form 816, Article M.08.01-26.

2. Geotextile shall have the following properties:

a. Minimum Mass per Unit Area of 8.0 oz/yd^2

b. Minimum Tensile strength of 90 lbs.

c. Minimum elongati on of 50 percent

d. Minimum flow rate of 150 gpm/sq.ft.

e. Minimum U.V. resistance of 70 percent at 150 hrs.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost.

3.2 LANDFILL SITE CLEARING

A. Strip existing vegetation to root depth to enable placement of cap base material directly on daily cover material. Collect and dispose of all vegetated material.

3.3 APPROVAL OF SUBGRADES

A. Notify Engineer when site has reached proposed landfill subgrade and each material level subgrade.

B. If Engineer determines that unsatisfactory conditions are present, remove and replace material to the satisfaction of the Engineer at no additional cost to the Owner.

1. Reconstruct subgrade damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer.

3.4 STORAGE OF SOIL MATERIALS

A. Stockpile materials and excavated soil materials meeting project specifications. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Prevent windblown dust.

3.5 FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 10 percent so fill material will bond with existing material.

1. Refuse Area Grades:

a. Maximum Slope: 3H:1V (33 percent) (except as indicated).

b. Minimum Slope: 25H:1V (4 percent).

3.6 CAP BASE MATERIAL

A. Place and compact cap base material in one layer or 6 inch maximum lifts, to the lines and grades indicated.

B. Perform depth test hole testing.

3.1 GEOCOMPOSITE

A. Installation:

1. Install geocomposite on top of geomembrane liner in accordance with manufacturer's requirements.

a. A manufacturer's Technical Service Representative shall be present during all geonet installation activities.

b. The Contractor shall bear the expense of this Technical Service Representative.

2. Placement of the geocomposite shall be done without damaging any underlining geosynthetic. The geocomposite shall be placed on the prepared surface in such a manner as to assure minimum handling. Any necessary surface preparation should be completed before installation begins.

3. Geocomposite shall be anchored in anchor trenches with the geomembrane cap as detailed on the approved shop drawings.

a. Only those rolls of geocomposite material which can be anchored and tied together that same day shall be unpackaged and placed in position.

4. Adjacent rolls shall be overlapped and plastic ties pushed through the geocomposite in the overlap area. Plastic ties shall be white or other bright color to allow easy

inspection and metallic ties shall not be allowed. Plastic ties shall be installed at 5 foot intervals. There shall be no slack in the geocomposite, but the material shall be installed in a relaxed condition.

5. In the corners of the side slopes where there is a gap between overlapping rolls of the geocomposite, an extra layer of material shall be installed from the top to the bottom of the slope.

B. Protection:

1. Materials, equipment, or other items shall not be dragged across the surface of the geocomposite and no materials shall be allowed to slide down the slopes on the geocomposite.

2. The Contractor shall place all cover materials in such a manner as to ensure the geocomposite is not damaged.

3.2 DRAINAGE SAND LAYER

A. Place sand drainage material in one continuous lift and spread using tracked equipment having a ground pressure less than or equal to 10 psi.

B. Immediately track sand after fine grading has been completed. Utilize tracked bulldozers with grousers of sufficient height to leave visible depressions in the subgrade. Operate equipment parallel to the direction of water flow, leaving track depressions that are perpendicular to the direction of water flow, which will reduce erosion potential until placement of Vegetative Support Material.

C. Perform depth test hole testing.

3.3 NON-WOVEN GEOTEXTILE

A. Installation:

1. Install non-woven geotextile where shown on the drawings in accordance with manufacturer's requirements.

a. The surface on which the geotextile is placed shall be maintained in a firm, clean, dry and smooth condition during installation.

b. The geotextile shall be placed over the prepared surface in a manner as to assure minimum handling.

c. The sheets shall be of such lengths and widths and shall be placed in such a manner as to minimize field seaming.

d. Horizontal field seams on the slopes shall be kept to a minimum.

2. Geotextile material shall be anchored as shown on the approved shop drawings, as shown on the plans or as directed by the Engineer.

a. Geotextile shall not be welded to the liner.

b. Only those sheets of material which can be anchored and sealed together that same day shall be unpackaged and placed in position.

c. The leading edge of the material shall be secured at all times with sandbags or other means sufficient to hold it down during high winds.

3. Adjacent rolls shall be overlapped a minimum of 12 inches to assure continuity or as specified by the manufacturer with approval of the Engineer.

a. The overlap shall be in the direction, such that the aggregate being spread does not push the fabric apart.

4. Installation of the geotextile shall be approved by the Engineer prior to placing cover material over the geotextile.

B. Patching:

1. If the geotextile is damaged during installation, it shall be immediately repaired.

a. A patch of fabric large enough to cover the damage, plus an 18 inch overlap shall be placed on top of the damaged section or as specified by the manufacturer.

3.4 MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill layer before compaction to no more than 1 percent dryer and 3 percent wetter than optimum.

B. Do not place fill material on surfaces that are muddy, frozen, or contain frost or ice.

C. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture and is too wet to compact to specified dry unit weight.

3.5 COMPACTION OF FILL

A. Place and compact fill materials in the presence of the Engineer.

B. Compact soil to not less than the following percentages of maximum dry density according to ASTM D1557:

1. General Fill: 90 percent minimum.

2. Cap Base Material: 90 percent minimum.

3. Drainage Soil: Two passes of a Caterpillar D-6 bulldozer, or equal.

4. Landfill Slopes: Scarify and recompact top 6 inches below subgrade.

3.6 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to prevent ponding. Finish subgrade to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch, however, not consistently in one direction.

3.7 FIELD QUALITY CONTROL

A. Allow testing agency to inspect and test subgrade and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

B. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Perform six tests per acre, minimum.

C. When testing agency reports that subgrade or fill has not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

D. Depth Test Hole. Confirm depth of cap base material and sand drainage layer before placement of subsequent membrane or cover material.

1. Hand excavate test holes at 100 feet on-center, maximum.
2. Record depth of layer at each test hole on site plan.
3. Refill test hole and compact material as required.
4. Engineer shall review depth readings and determine extent of areas that contain an insufficient depth of material. Provide additional material as required to meet minimum layer thickness at no additional cost. Repeat test hole process until satisfactory results are obtained.

3.8 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Transport waste material, including unsatisfactory soil, trash, and debris, to designated locations on Owner's property.

1. To minimize voids within on-site disposal areas, crush rocks and pieces of concrete-site improvements 6 inches and larger in size to a maximum size of 3 inches. At the Contractor's option, items of this nature may be:

a. Crushed for recycled fill.

b. Disposed of off-site.

B. Disposal: Transport surplus satisfactory soil to designated locations on Owner's property. Stockpile or spread satisfactory soil as directed by Engineer.

END OF SECTION

SECTION 02 66 52 –CLOSURE TURF™ ALTERNATIVE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Exhibit B General Requirements, apply to this Section.

1.2 SUMMARY

A. This Section includes a composite system of Linear Low-Density Polyethylene geomembrane and a synthetic turf protection layer.

B. Related Sections include the following:

1. Division 02 Section "Landfill Earth Moving" for general site earthwork requirements.
2. Division 48 Section "Solar Energy Electrical Generation System" for photovoltaic requirements.

1.3 REFERENCES

A. Geosynthetic Research Institute: GRI GM11, GRI GM12

B. ClosureTurf™ Quality Control Manual

1.4 DEFINITIONS

A. ClosureTurf™: Manufacturer's brand name for a proprietary system comprised of 50-mil LLDPE "Super Gripnet" liner, synthetic turf, and sand ballast.

B. Installer: Authorized installer of geomembrane manufacturer.

C. LLDPE: Linear Low Density Polyethylene

D. Manufacturer's Field Representative: Authorized and trained manufacturer representative.

E. Quality Assurance Consultant (QAC): Owner's representative that will review material, procedure, and testing submittals; and will observe on-site installation including seaming operations and repair work.

1.5 PROPOSAL SUBMITTALS

A. Installer name and qualifications, including Project experience descriptions.

B. Superintendent qualifications.

1.6 ACTION SUBMITTALS

A. As prepared by the Installer.

1. Product Data:

a. For each type of product indicated.

b. Include manufacturer's requirements for surface preparation, technical data, and tested physical and performance properties of geomembrane.

2. Qualification Data: For Installer and geomembrane manufacturer's Field Representative.

3. Shop Drawings: Indicate extent, panel sizes, panel identification number, panel orientation, and details of penetrations and seams for geomembrane and turf panels.

a. Assign each panel and seam a simple and logical identification number or letters. Correlate seam identification system with panel identification system.

b. Panel layout. Indicate seam orientation and roll sizes.

1) Design layout to utilize largest panel sizes possible, minimize seams, and to minimize horizontal field seams on slopes.

2) For turf panels, identify proposed direction of flipping panel after sewing of seams

c. Details

1) Termination of material at perimeter of panel areas.

2) Penetration sealing procedures.

3) Anchoring procedures.

4) Temporary Construction Access Roads.

d. Installer's preferred sequence of panel placement.

4. Installation Procedures: Include manufacturer's requirements and detailed quality control procedures.

B. Sand Ballast Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance with requirements indicated. Prepare separate reports for each type and application of soil material.

1. Gradation according to ASTM D 422 and classification according to ASTM D 2487, prior to delivery and at a rate of one per 5,000 cu. yd.

2. Origin of material, prior to delivery.

3. Permeability Testing according to ASTM D 5084; One prior to delivery and one per 5,000 cu. yd. delivered.

4. Soil Chemical Analysis Reports:

a. RCRA 8 Metals (EPA Method 6010 / 7421 / 7470), Polychlorinated Biphenyls (EPA Method 8082), Total Volatile Organic Compounds (EPA Method 8260),

Semi-Volatile Organic Compounds/Polyaromatic Hydrocarbons (EPA Method 8270), Pesticides (EPA Method 8081), and Total Petroleum Hydrocarbons (CTETPH method): prior to delivery and one report for each 10,000 cu. yd., or portion thereof, delivered. Owner reserves the right to disqualify the source based on the results of the chemical testing.

1) Soil/material shall not exceed any GB pollutant mobility criteria (GB PMC) or residential direct exposure criteria (RES DEC) established in Sections 22a-133k-1 through 22a-133k-3 of the regulations of Connecticut state agencies.

1.7 INFORMATIONAL SUBMITTALS

A. Material Quality Control Certificate: Provide for each geomembrane roll delivered to the site. List specified material properties. Clearly label with distinctive code number.

B. Manufacturer's Quality Control Test Data: Provide test data collected in accordance with the requirements of GRI Test Method GM17, dated June 2003, including test frequencies and physical/chemical properties listed in Tables 1(a) and 2(a) thereof.

C. Samples: As requested by the Quality Assurance Consultant.

D. Daily Examination Report: Before proceeding with membrane installation, complete and submit to Owner "Letter of Surface Confirmation," which states observation and acceptance of surface area to receive membrane, signed by Installer and QAC.

E. Trial Seam Test Report: Submit on a weekly basis. Installer shall record date, time, weather conditions, test results, operator, and equipment number for each trial seam tested.

1. Trial Seam Sample: Submit properly identified unused section of trial weld seam to Owner.

F. Sand Ballast Depth Test Locations: Locate field test holes on plan, and record depth of Sand Ballast.

G. Record Drawings: Include panel layout and identification, seam type and identification, repair locations and identifications, and destructive test sample locations and identification.

1. Record the roll number, location, and date of installation of each panel placed.
2. Submit working copies when requested by the Quality Assurance Consultant.
3. Submit final Record Drawings prior to demobilizing from the site.

H. Installation Certificate: Installer's Final "Certificate of Acceptance" stating that installation procedures and required testing have been completed in accordance with the specifications.

I. Warranties regarding quality of materials, workmanship, and long-term performance of the completed geomembrane system.

1.8 QUALITY ASSURANCE

A. Where "Form 816" is referenced, it shall mean "State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Form 816," and issued supplements.

B. Geomembrane Manufacturer's Field Representative Qualifications: Competent, field technical representative that has personally supervised and directed the installation of a minimum of 2,000,000 s.f. of the specified geomembrane product.

C. Installer: An experienced Installer that has successfully completed projects similar in size and scope but no less than 20 geomembrane landfill closures totaling a minimum of 2,000,000 s.f.

1. Installers must be certified by the liner system manufacturer for the installation of the ClosureTurf™ System.

2. Installers not currently certified will be expected to meet the certification criteria included as *Appendix D* of the Technical Specifications.

3. Seaming Personnel: Experienced in projects of similar nature, material, and installation method, with at least one seamer having a minimum of 1,000,000 s.f. installation experience.

D. Source Limitations:

1. Provide all components of the proprietary closure system from a single manufacturer.

2. The Installer shall promptly inform the Quality Assurance Consultant upon placing an order for materials so that arrangements may be made, if desired, for inspection before shipment from the place of manufacture.

E. Pre-Installation Conference: Conduct conference at Project site.

1. Review manufacturer requirements including surface condition, forecasted weather conditions, seam details, installation and repair procedures, testing and inspection procedures, and protection of installed geomembrane.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Upon delivery of geomembrane rolls to the site, assist QAC with inspection and provide labor, equipment, and incidentals as needed for inspection.

1. Folded geomembrane is not acceptable. Any evidence of folding or other shipping damage is cause for rejection of the material.

2. Geomembrane that does not have proper manufacturer's documentation must be stored at a separate location until documentation has been received, approved and accepted.

3. Immediately remove from the site damaged or defective material as directed by the QAC, and at no additional cost to the Owner.

a. Temporarily store rejected material at a location separate from accepted geomembrane.

B. Store membrane rolls on a prepared surface approved by the QAC, no more than 3 rolls high. Protect rolls from dirt, grease, water, abrasions, excessive heat or cold, or other damage.

C. Handle geomembrane rolls with appropriate equipment, designed to handle sheet materials. Use spreader bars and cloth chokers when loading and transporting to prevent damage or stressing of the geomembrane material.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit system to be installed according to manufacturer's written instructions and warranty requirements.

1. Install material when ambient air temperature is within the temperature range as specified and as required by the manufacturer.

B. Do not allow vehicular traffic directly on geomembrane panels without the prior approval of the Engineer. Only rubber tire/track ATV and trucks with ground pressure less than manufacture's recommendations will be allowed.

1. Small equipment such as generators must be placed on scrap geomembrane material (rub sheets) above geomembrane.

2. Prior to driving on geomembrane, check for sharp edges embedded rocks or other foreign materials stuck into or protruding from tires/tracks.

3. Path driven on geomembrane must be as straight as possible with no sharp turns, sudden stops or quick starts.

4. No equipment will be left running or unattended over the constructed geomembrane.

C. Do not allow personnel working with geomembrane panels to wear shoes that will damage the panels.

D. During installation of the Closure Turf™ system , the Installer shall provide facilities, access, time, labor, tools, equipment and other incidentals as necessary for the QAC and their representatives to perform installation inspection and testing of materials and equipment, all at no additional cost to the Owner.

1.11 WARRANTY

A. Manufacturer's Warranty: Provide written warranty as it relates to the quality of the material, for a period of not less than 20 years.

B. Installer: Provide written, standard general contractor's warranty as it relates to performance for a period of not less than 5 years.

PART 2 - PRODUCTS

2.1 LLDPE GEOMEMBRANE

A. Material: First quality LLDPE resin containing less than 2-percent clean recycled polymer.

Properties	Test Method	Minimum Value
Melt Index	(ASTM D1238, 190°C/2.16kg)	≤ 1 gram/10 min.
Oxidative Inductive Time	(ASTM D3895 1atm/200°C)	≥ 100

B. Membrane Properties: Unreinforced LLDPE containing 3 percent by weight maximum additives, fillers or extenders including carbon black; free of striations, pinholes, blisters, bubbles, undispersed raw materials, or signs of contamination by foreign matter on the material surface.

1. Super Gripnet® Structured LLDPE: Physical and Chemical properties meeting the requirements of the Geosynthetic Research Institute's "Test Method GM17", Table 2(a)

Properties	Test Method	Minimum Value
Sheet Thickness	(ASTM D 5594)	50 mils (+ 5 mil / - 0 mil)
Density	(ASTM D 792)	> 0.92 g/cm^3
Tensile Strength at Break	(ASTM D 6693)	> 100 lb/in of width
Elongation at Break	(ASTM D 6693)	≥ 300 percent
Tear Strength	(ASTM D 1004)	≥ 30 lbs.
Puncture Resistance	(ASTM D 4833)	≥ 55 lbs.
Carbon Black Content	(ASTM D4218)	2 % (minimum)
Carbon Black Dispersion	(ASTM D5596)	Category 1or 2 for 9 of 10 views Category 3 for 1 of 10 views (max)

C. Membrane Seams: Physical properties meeting the requirements of the Geosynthetic Research Institute's "Test Method GM19", Table 2(a)

Properties	Test Method	Minimum Value
Shear Strength	(ASTM D 6392)	90 lb/in

Properties	Test Method	Minimum Value
Shear Elongation at Break	(ASTM D 6392)	50 percent
Peel Strength	(ASTM D 6392)	75 lb/in 66 lb/in (extrusion weld)
Peel Separation	(ASTM D 6392)	25 percent

2.2 PENETRATIONS

A. Penetrations shall be made as depicted on the Drawings and in accordance with liner manufacturer's instructions.

1. Geomembrane liner boots shall be specifically manufactured by the liner manufacturer for such use or field fabricated of smooth LLDPE Geomembrane Liner material in accordance with manufacturer's instructions.
2. Banding: Stainless steel, Type 304, 3/4-inch wide, adjustable screw-type clasp, or approved equal.
3. Gasket: Neoprene, closed cell medium, 1/4-inch thick, 2-inches wide with adhesive on one side as supplied by geomembrane liner manufacturer, or approved equal.
4. Sealant: 100% Silicone Sealant

2.3 SYNTHETIC TURF SYSTEM

A. ClosureTurf™: Synthetic grass

Properties	Test Method	Minimum Value
Yarn Count	(ASTM D 1907)	8000 (min 7300) Denier
Tensile Grass at Break	(ASTM D 2256)	20 lbs plus/minus 5 lbs
Elongation at Break	(ASTM D 2256)	30 – 80 Percent
Yarn Weight Minimum	(ASTM D 5261)	19 oz/sy
Double 13/18 Pic Polybag	(ASTM D 5261)	6 oz/sy
Product Weight w/out ballast	(ASTM D 5261)	26 oz/sy ±1%
Pile Height, Minimum		1.25 in
Tufting Gage		3/4 inch plus/minus 1 percent
Transmissivity with underlying structured geomembrane, Minimum	(ASTM D 4716)	2.5E-03 m2/sec
Internal Friction of combined components, Minimum	(ASTM D 5321)	35 degrees

Properties	Test Method	Minimum Value
UV Resistance and Stability. Tensile testing after weathering, Minimum	(ASTM G 147-02) 200W/m2 30 years exposure	55% Retained Strength

B. Ballast and Infill:

1. Medium Sand Ballast: ASTM D2487, SW or SP, with 10 percent coarse and 10 percent fine sand.
2. Cemented Ballast
   a. Sand: See "Medium Sand" above.
   b. Lime: ASTM C207.
   c. Portland Cement: ASTM C 150, Types I or II or Type I/II.
   d. Water: Potable and complying with ASTM C 94.
   e. Pre-blended and packaged by the ClosureTurf™ system manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. Owner's QAC will observe the complete installation of the Closure Turf™ system including delivery to site, handling, deploying, seaming, testing, and repair work.

1. Do not install geomembrane without QAC being present.
2. No additional compensation will be provided for possible delays that may be caused due to inspection and testing of materials and workmanship.

B. Inform QAC on a daily basis of proposed work schedule, including changes.

C. Mark geomembrane panels by their identification number or letters.

D. The Installer shall be responsible for field handling, storing, placing, seaming, plus any other processes required to assemble a continuous secure geomembrane system.

3.2 PREPARATION

A. See Division 02 Section "Landfill Earthwork" for subgrade preparation and bedding placement.

1. Surfaces shall be smooth and free of rocks, stones, sticks, roots, sharp objects, and debris, and provide a firm, unyielding foundation for the geomembrane with no sudden, sharp or abrupt changes or break in grade.

3.3 EXAMINATION

A. Installer and QAC: On a daily basis, simultaneously inspect the prepared subgrade. Immediately inform the Contractor of unsatisfactory conditions and remedial work required for the subgrade to meet the specified criteria before placement of geomembrane.

1. Upon satisfactory subgrade condition, the Installer and QAC will issue a joint "Letter of Surface Confirmation."

3.4 GEOMEMBRANE INSTALLATION

A. Install and seam membrane panels when the ambient air temperature is between 40 degrees F and 104 degrees F, as measured 6 inches above subgrade surface elevation.

1. Do not install, seam, or repair membrane panels during precipitation, excessively high winds, or in areas of ponded water or excessive moisture.

2. Do not install and seam geomembrane panels in ambient temperatures below 40 degrees F unless approved by the Quality Assurance Consultant, and only if trial seams demonstrate the ability to meet seaming specifications.

B. Before deploying geomembrane panels, Installer shall repair subgrade or other underlying surface disturbed or damaged after issuance of "Letter of Surface Confirmation."

C. Place material over prepared subgrade with minimum handling. Place rolls in accordance with approved panel layout.

1. Install only rolls of material that can be anchored and sealed by end of each day's operation.

D. Properly secure geomembrane during installation with sandbags, rubber tires or other means approved by the QAC. Do not use large or sharp rocks, or other sharp objects.

E. Install geomembrane material in relaxed condition. Provide excess material for each panel as per requirements. Do not stretch material to fit area; keep material free from stress and tension during installation.

1. Unroll geomembrane panels in a manner that will not stretch, crimp, abrade, or otherwise damage panels. Place panels in a manner that minimizes wrinkles and differential wrinkles between adjacent panels.

F. Overlap geoemembrane panels to facilitate drainage of water. All panels deployed during a single day shall be seamed or tack welded together that same day to the extent practicable.

G. Anchor perimeter of geomembrane panels in trench as indicated on the Drawings.

3.5 GEOMEMBRANE FIELD SEAMING

A. Lay out the geomembrane seams parallel to the line of maximum slope.

1. Minimize the use of cross or butt seams on slopes, seams located in corners, and unusual geometric panel shapes.

B. The seam identification system shall be related to and compatible with the panel identification system.

C. Equipment: Include temperature gages and readout devices that allow continuous monitoring of apparatus temperatures during seaming. Electric generators shall be capable of providing constant voltage under load and shall be underlain with a splash pad to collect spilled fuel or oil when located on the membrane.

D. Overlap geomembrane surfaces a minimum of 4 inches and clean surfaces of moisture, grease, dust, dirt, debris and foreign material.

1. Do not use solvent or adhesive for seaming without approval from the manufacturer and the QAC.

2. Install a protective sheet of plastic below the geomembrane material being seamed when needed and where moisture or dirt causes seaming difficulty. As seaming progresses, pull the protective sheet along beneath the seaming apparatus.

a. Do not permanently leave the protective plastic sheet beneath the geomembrane.

3. For extrusion welding, clean surfaces to be seamed of oxidation by disc grinder not more than one hour before extruding the seam. Abrasion of the seam area with the disc grinder shall not extend more than one-half inch beyond the extrusion bead area. Tack welding of the panels to be seamed shall not damage the membrane or adversely affect the seaming operation. The top membrane of the seam overlap shall be beveled and the extrusion apparatus shall be purged of heat-degraded extrudant before seaming.

4. Fish mouths shall be cut along the ridge of the wrinkle and laid flat to overlap the edges of the cut. The overlap shall be extrusion-seamed and any portion of the seam with less than 3 inches of overlap shall be patched with a circular or oval patch extending a minimum of 6 inches beyond the cut in all directions.

E. The Installer shall log the ambient air temperature 6 inches above the membrane elevation, extruded temperatures in extruder barrels and nozzles, and operating temperatures of hot wedge seamers at intervals of 2 hours or less.

3.6 GEOMEMBANE CAP PENETRATIONS

A. Any penetrations in the liner required by a pipe, vent, utility pole, fence post, concrete structure or other constructed feature shall be connected to the liner as depicted on the drawings and in accordance with the geomembrane Manufacturer's recommendations as approved by the Engineer.

1. The connection to the geomembrane shall be made to assure the permeability of the liner at the connection has not been increased.

2. Test all penetrations for air tightness using procedures recommended by the Manufacturer.

3. Each penetration shall be inspected and approved by the Engineer prior to being covered.

4. Any damage to the liner materials shall be repaired in accordance with the specifications.

3.7 GEOMEMBRANE INSPECTION

A. Visually inspect seams and panels for holes, crimps, abrasions, or defects, and mark suspect locations. Clearly mark repair locations on the membrane panel and assign an appropriate identifying label

1. Clearly mark and record repair locations and non-destructive test data on the Record Drawings with swing ties to fixed improvements (wells, poles, buildings, etc.).

2. Do not cover repairs until passing results of non-destructive tests are achieved and accepted by the QAC.

B. Remove wrinkles in geomembrane panels larger than 3 inches. Cut wrinkle, reseam and test until an acceptable seam is obtained.

3.8 GEOMEMBRANE REPAIRS

A. Remove or repair damaged geomembrane panels damaged during installation at no additional cost to Owner.

B. Repair geomembrane panels as follows:

1. Preparation. Abrade surface of geomembrane in the seam/repair area no more than one hour before the repair is made. Keep repair/seam areas clean and dry at the time of the repair.

2. Spot weld small tears, pinholes or over-abraded areas where thickness of the geomembrane has been reduced by more than 4 mils (0.004 inches).

3. Abrade and reweld small sections of defective extrusion welds.

4. Remove defective seam and replace with a new strip of material. Defective hot wedge seams may be abraded and extrusion welded providing the top membrane overlap is carefully cut off.

5. Patch larger holes and defects. Extend patch material a minimum of 6 inches beyond the edges of the defect. Round corners of patches with a radius of at least 3 inches.

3.9 CLOSURE TURF™ SYSTEM INSTALLATION

A. Closure Turf™

1. Prior to turf installation, inspect geomembrane layer and determine that the geomembrane has been properly installed and completed, and the supporting surface does not contain stones or debris that could damage the Turf.
2. Deploy panels from the top of slope in a way that the leading edge of the roll stays at the top of the slope and with the grass filaments are downward.
    a. Anchor panel with sand bags at top of slope during installation to prevent movement by wind.
    b. Control the decent of the roll during deployment.
3. Seaming Operation.
    a. Provide 4-inch overlap and fasten with heavy-duty textile stitching machine (Nulong sewing machine or approved equal).
        1) Thread Material: Polyester
        2) Stitch Density: 4 stitches/inch
        3) Stitch Type: Type 401 Lock Stitch
        4) Seam Type: Single row prayer stitch.
    b. After sewing, cut excess flap before flipping the panel, to reduce likelihood of a ridge.
    c. Perform stitching operations so that woven geotextile base fabric is not exposed in the finished installation

B. Sand Ballast:

1. Spread sand using manufacturer's approved method for installation and broom as in-fill between synthetic yarn blades of Turf.
    a. Use low ground pressure equipment and pull-behind spreader bar or other approved manufacturer's methods for sand installation.
    b. For slopes 3H:1V or steeper, install sand infill using long reach conveyor belts or water or air express blower methods.
2. Lay sand with minimal compaction.
3. Place sand in front of deployment equipment to improve bearing capacity of cover system.
4. Install minimum thickness of 1/2-inches of sand before allowing lightweight vehicles on the Turf.

C. Cemented Ballast

1. Do not spread dry mix on wet or moist conditions, and if rain is anticipated within 24 hours of spreading process.
2. Spread dry blend of cement mix in accordance with "Sand Ballast" requirements specified herein.

3. After installation of dry mix, apply water at a rate prescribed by Turf manufacturer to hydrate cement mix.

4. Employ curing methods in accordance with Turf manufacturer's requirements.

3.10 CLOSURE TURF™ SYSTEM REPAIRS

A. Use hot glue gun to patch holes or tears in Turf by placing a patch 2 feet beyond edges of hole or tear.

1. If hole or tear width is more than 50 percent of the roll width, cut out damaged area across the entire roll and join two segments by stitching.

3.11 FIELD QUALITY CONTROL TESTING

A. Geomembrane Seam Testing. Record locations and results of seam tests on the Record Drawing. Keep records on site for inspection by the Owner and QAC.

B. Geomembrane Trial Seams

1. Sample Quantity: For each seaming apparatus, for the following instances.

a. At the beginning of each shift.

b. After apparatus has been turned off or disconnected from its power source.

c. When apparatus has been idle for 30 minutes (extrusion welder) or 60 minutes (hot wedge welder).

d. Change in operator personnel.

e. When deemed necessary by the QAC.

2. Sample Size: 3 feet long and 12 inches wide (perpendicular to the seam), minimum.

a. Cut 1-inch-wide samples perpendicular to the seam for testing. Provide at a minimum, six for peel test and three for shear test.

3. Shear (Bonded Seam Strength) and Peel (Adhesion) Tests: In accordance with ASTM D6392. Installer shall provide tensiometer, calibrated within one year from start of geomembrane installation.

4. Conduct trial seams under the same physical conditions as permanent seaming.

a. For double-fusion hot wedge seams, both seams in each sample shall be tested for peel adhesion.

b. All six peel tests and all three shear tests are required to pass for the trial seam to be acceptable.

c. Each sample failure must consist of a ductile break that is film tearing bond.

5. If either test sample fails (shear or peel), repeat trial seam test procedure. If any test seams fail on the second trial seam, the seaming apparatus shall not be used until it is repaired or faulty conditions are corrected, and two trial seams pass the destructive tests.

C. Geomembrane Non-destructive Seam Testing

1. Acceptable Methods. Vacuum box testing, air-pressure testing of double-fusion seams, or other methods approved by the manufacturer and QAC.

2. Perform non-destructive testing over the full length of each seam. Perform testing as work progresses. Do not wait to perform testing until the completion of large segments of field seaming.

3. Vacuum Box Testing: In accordance with ASTM D5641. Utilize vacuum box approved by the Quality Assurance Consultant. Vacuum box shall include rigid housing, transparent viewing window, a soft rubber gasket on the bottom edge, and a valve assembly with a vacuum gage.

   a. Mark geomembrane seamed areas when soap bubbles are visible in the viewing window.

   b. Repair marked locations and retest.

4. Air Pressure Testing: In accordance with ASTM D5820. Perform air –pressure test on double-fusion seams having an air channel between the seams. Mark results on the geomembrane adjacent to the test location.

5. If a seam is located where non-destructive testing cannot be performed, the seam shall, at the discretion of the QAC, be cap-stripped. Installer shall perform cap-stripping operation only in presence of QAC.

D. Geomembrane Destructive Seam Testing

1. Samples: The Installer shall cut and remove destructive test samples from the installed geomembrane material, assign the sample an identification number, and record the sample location on the Record Drawings.

   a. Perform one series of destructive seam tests per 1,000 l.f. of seam, minimum. One test must be performed per welding machine per day.

   b. Locations: As determined by the QAC.

   c. Sample Size: 12 inches wide and 40 inches long with the seam centered lengthwise.

   d. Perform destructive seam strength testing as work progresses in order to obtain test results before seams are covered.

   e. The Installer shall immediately repair the geomembrane at the destructive test sample location, and perform non-destructive test.

2. Destructive Seam Series Test: In accordance with ASTM D6392.

   a. Field Testing. Installer shall provide field tensiometer, calibrated within one year from start of geomembrane installation.

      1) Shear (Bonded Seam Strength)

         a) One 1-inch strip cut from sample.

      2) Peel (Adhesion) Tests:

a) Laboratory Test: Five 1-inch strips cut from samples.

b. Laboratory Testing. Coordinated by the Quality Assurance Consultant and performed by an independent geosynthetic testing laboratory paid for by the Owner.

1) Shear (Bonded Seam Strength)

a) Laboratory Test: Five 1-inch strips cut from samples.

2) Peel (Adhesion) Tests:

a) Laboratory Test: Five 1-inch strips cut from samples.

3) Double-fusion Hot Wedge Seams. Test both seams in each sample for peel. Testing shall include, but not necessarily be limited to, thickness (ASTM D 5199/D 5594)

E. Failure of Geomembrane Seam Tests.

1. If either field destructive test seams or laboratory test seams do not pass, reconstruct the seam between two passing test seam locations. Intermediate tests may be performed on each side of the failed test sample location to further isolate the defective seam area.

2. If intermediate field test seams pass, laboratory test seams shall be performed on samples from the same locations.

3. If laboratory test seams also pass, then the seam shall be reconstructed between the intermediate sample locations.

4. If the intermediate or laboratory test seams fail, repeat the process with intermediate samples located further away from the original failing seam area to determine the defective seam area.

F. Acceptable Geomembane Seams.

1. Each seam shall be bounded by two locations where samples passed the laboratory destructive tests.

2. Whenever a reconstructed seam exceeds 200 feet, an additional sample shall be obtained for destructive testing along the reconstructed seam.

3. At the QAC's discretion, the Installer may be directed to take additional samples from seams welded on the same day by a seaming apparatus that welded a failed seam, at no additional cost to the Owner.

G. Sand Infill Testing:

1. Field measure and verify minimum thickness of sand.

a. Frequency: 20 measurements per acre, randomly determined by Engineer.

3.12 TEMPORARY CONSTRUCTION ACCESS ROADS

A. Install Temporary Construction Access Roads whenever vehicular traffic must traverse any portion of the installed liner system.

B. Temporary Construction Access Road shall be installed in accordance with liner manufacturer's instructions and shall be capable of supporting vehicular and equipment loads of 60 psi.

C. Clearly delineate limits of roadways to prevent vehicles or equipment from travelling off roadway.

D. Remove all components of Temporary Construction Access Road and repair any damage caused by installation, use, and/or removal of roadway.

3.13 CLEANING

A. Clean the work area at the end of each work day of unnecessary scrap material, sand bags, tools and other materials used during geomembrane installation.

3.14 INSTALLER DEMOBILIZATION

A. Identified problem areas must be repaired by Installer and accepted by QAC before final inspection is performed by Installer, QAC, and Owner.

B. Installer will not demobilize capping crew or equipment from site until final "Certificate of Acceptance" has been completed.

END OF SECTION

SECTION 02 66 54 –EXPOSED TPO ALTERNATIVE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Exhibit B General Requirements, apply to this Section.

1.2 SUMMARY

A. This Section includes an exposed geomembrane cap (EGC) with the option of photovoltaic panel assemblies.

B. Related Sections include the following:

1. Division 02 Section "Landfill Earth Moving" for landfill cap materials.
2. Division 31 Section "Earth Moving" for general site earthwork requirements.
3. Division 48 Section "Solar Energy Electrical Generation System" for AC Distribution system and grid connection.

1.3 REFERENCES

A. Geosynthetic Research Institute: GRI GM11, GRI GM12

1.4 DEFINITIONS

A. Installer: Authorized installer of geomembrane manufacturer.

B. TPO: Thermoplastic Polyolefin

C. Manufacturer's Field Representative: Authorized and trained manufacturer representative.

D. Quality Assurance Consultant (QAC): Owner's representative that will review material, procedure, and testing submittals; and will observe on-site installation including seaming operations and repair work.

1.5 PROPOSAL SUBMITTALS

A. Installer name and qualifications, including Project experience descriptions.

B. Superintendent qualifications.

C. Geomembrane product data sheet.

D. Warranties regarding quality of materials, workmanship, and long-term performance of the completed geomembrane and photovoltaic system.

1.6 ACTION SUBMITTALS

A. Product Data: Include manufacturer's requirements for surface preparation, technical data, and tested physical and performance properties of geomembrane.

B. Qualification Data: For Installer and geomembrane manufacturer's Field Representative.

C. Delegated Design of System:

1. Shop Drawings: Indicate extent, panel sizes, panel identification number, panel orientation, details of penetrations and seams, anchorage method, materials and spacing as required to maintain warranty.

   a. Assign each geomembrane panel and seam a simple and logical identification number or letters. Correlate seam identification system with panel identification system.

   b. Panel layout. Indicate seam orientation and roll sizes.

      1) Design layout to utilize largest panel sizes possible, minimize seams, and to minimize horizontal field seams on slopes.

   c. Details

      1) Termination of material at perimeter of membrane areas.

      2) Penetration sealing procedures.

      3) Anchoring procedures and materials.

      4) Temporary Construction Access Roads.

   d. Installer's preferred sequence of panel placement.

2. Design Calculations: Document the adequacy of the proposed anchoring system to prevent uplift or shear displacement of geomembrane under sustained wind speeds of 120 mph.

3. Installation Procedures: Include manufacturer's requirements and detailed quality control procedures.

1.7 INFORMATIONAL SUBMITTALS

A. Material Quality Control Certificate: Provide for each geomembrane roll delivered to the site. List specified material properties. Clearly label with distinctive code number.

B. Manufacturer's Quality Control Test Data: Provide test data collected in accordance with the requirements of GRI Test Method GM17, dated June 2003, including test frequencies and physical/chemical properties listed in Tables 1(a) and 2(a) thereof.

C. Samples: As requested by the Quality Assurance Consultant.

D. Daily Examination Report: Before proceeding with membrane installation, complete and submit to Owner "Letter of Surface Confirmation," which states observation and acceptance of surface area to receive membrane, signed by Installer and QAC.

E. Trial Seam Test Report: Submit on a weekly basis. Installer shall record date, time, weather conditions, test results, operator, and equipment number for each trial seam tested.

1. Trial Seam Sample: Submit properly identified unused section of trial weld seam to Owner.

F. Record Drawings: Include panel layout and identification, seam type and identification, repair locations and identifications, and destructive test sample locations and identification.

1. Record the roll number, location, and date of installation of each panel placed.
2. Submit working copies when requested by the Quality Assurance Consultant.
3. Submit final Record Drawings prior to demobilizing from the site.

G. Installation Certificate: Installer's Final "Certificate of Acceptance" stating that installation procedures and required testing have been completed in accordance with the specifications.

1.8 QUALITY ASSURANCE

A. Geomembrane Manufacturer: Manufacturer that has successfully supplied a minimum of 10,000,000 s.f. of geomembrane for landfill applications.

B. Geomembrane Manufacturer's Field Representative Qualifications: Competent, field technical representative that has personally supervised and directed the installation of a minimum of 2,000,000 s.f. of the specified geomembrane product.

C. Installer: An experienced Installer that has successfully completed projects similar in size and scope but no less than 20 geomembrane landfill closures totaling a minimum of 2,000,000 s.f.

1. Also authorized or certified by system Manufacturer for installing product and system in accordance with Manufacturer's installation procedures.
2. Seaming Personnel: Experienced in projects of similar nature, material, and installation method, with at least one seamer having a minimum of 1,000,000 s.f. installation experience.

D. Source Limitations:

1. Obtain each type of geomembrane through one source from a single manufacturer.
2. If geomembrane and photovoltaic membrane/solar panel system materials are provided by two manufacturers, obtain approval and acceptance of each material from the other manufacturer.
    a. Provide warranty from single source.

E. Pre-installation Conference: Conduct conference at Project site.

1. Review manufacturer requirements including surface condition, forecasted weather conditions, seam details, installation and repair procedures, testing and inspection procedures, and protection of installed geomembrane.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Upon delivery of geomembrane rolls to the site, assist QAC with inspection and provide labor, equipment, and incidentals as needed for inspection.

1. Folded geomembrane is not acceptable. Any evidence of folding or other shipping damage is cause for rejection of the material.

2. Geomembrane that does not have proper manufacturer's documentation must be stored at a separate location until documentation has been received, approved and accepted.

3. Immediately remove from the site damaged or defective material as directed by the QAC, and at no additional cost to the Owner.

a. Temporarily store rejected material at a location separate from accepted geomembrane.

B. Store membrane rolls on a prepared surface approved by the QAC, no more than 3 rolls high. Protect rolls from dirt, grease, water, abrasions, excessive heat or cold, or other damage.

C. Handle geomembrane rolls with appropriate equipment, designed to handle sheet materials. Use spreader bars and cloth chokers when loading and transporting to prevent damage or stressing of the geomembrane material.

1.10 PROJECT CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit system to be installed according to manufacturer's written instructions and warranty requirements.

1. Install material when ambient air temperature is within the temperature range as specified and as required by the manufacturer.

B. Do not allow vehicular traffic directly on geomembrane panels without the prior approval of the Engineer. Only rubber tire/track ATV and trucks with ground pressure less than manufacture's recommendations will be allowed.

C. Do not allow personnel working with geomembrane panels to wear shoes that will damage the panels.

D. During installation of the geomembrane liner, the Installer shall provide facilities, access, time, labor, tools, equipment and other incidentals as necessary for the QAC and their representatives to perform installation inspection and testing of materials and equipment, all at no additional cost to the Owner.

1.11 WARRANTY

A. Manufacturer's Warranty: Provide written warranty as it relates to the quality of the material, for a period of not less than 20 years.

B. Installer: Provide written, standard general contractor's warranty as it relates to performance for a period of not less than 5 years.

PART 2 - PRODUCTS

2.1 LANDFILL MEMBRANE

A. TPO Geomembrane: conforms to ASTM D6878 and US EPA Toxic Leachate Test (40 CFR Part 16).

1. Thickness: 60-mil.

2. Color: As selected by Owner from manufacturer's full selection.

B. Membrane Seams

Properties	Requirement
Peal Adhesion ASTM D6392	25 lb/in (min.), 55 lb/in (average) and Film Tear Bond
Bonded Seam Strength ASTM D6392	25 lb/in (min.), 55 lb/in (average) and Film Tear Bond

C. Manufacturers:

1. Firestone Energy Solutions: Firestone Solar Geomembrane

2. Approved equal

2.1 GEOTEXTILE

1. Non-Woven Geotextile: Form 816, Section M.08.01-26.

2.2 WALKWAYS

A. Manufacturer's standard product manufactured of new or recycled TPO required to protect TPO membrane from vehicular and walking traffic, at the following locations.

a. Bench areas used to access the landfill.

b. Areas that will see consistent traffic such as servicing wells, leachate pipes, etc. Provide for both protection and increased traffic.

2.3 PENETRATIONS

A. Penetrations shall be made as shown on the Drawings and in accordance with liner manufacturer's instructions.

1. Geomembrane Liner Boots: Manufactured by the liner manufacturer for such use or field fabricated of Geomembrane Liner material in accordance with manufacturer's instructions.

2. Banding: Stainless steel, Type 304, 3/4-inches wide with adjustable screw-type clasp, or approved equal.

3. Gasket: Neoprene, closed cell medium, 1/4-inch thick, 2-inches wide with adhesive on one side as supplied by geomembrane liner manufacturer, or approved equal.

4. Sealant: 100 percent silicone.

PART 3 - EXECUTION

3.1 GENERAL

A. Owner's QAC will observe the complete installation of the geomembrane system including delivery to site, handling, deploying, seaming, testing, and repair work.

1. Do not install geomebrane without QAC being present.

2. No additional compensation will be provided for possible delays that may be caused due to inspection and testing of materials and workmanship.

B. Inform QAC on a daily basis of proposed work schedule, including changes.

C. Mark geomembrane panels by their identification number or letters.

D. The Installer shall be responsible for field handling, storing, placing, seaming, plus any other processes required to assemble a continuous secure geomembrane system.

3.2 PREPARATION

A. See Division 02 Section "Landfill Earthwork" for subgrade preparation and bedding placement.

1. Surfaces shall be smooth and free of rocks, stones, sticks, roots, sharp objects, and debris, and provide a firm, unyielding foundation for the geomembrane with no sudden, sharp or abrupt changes or break in grade.

3.3 EXAMINATION

A. Installer and QAC: On a daily basis, simultaneously inspect the prepared subgrade. Immediately inform the Contractor of unsatisfactory conditions and remedial work required for the subgrade to meet the specified criteria before placement of geomembrane.

1. Upon satisfactory subgrade condition, the Installer and QAC will issue a joint "Letter of Surface Confirmation."

3.4 GEOMEBRANE INSTALLATION

A. Install and seam membrane panels when the ambient air temperature is between 40 degrees F and 104 degrees F, as measured 6 inches above subgrade surface elevation.

1. Do not install, seam, or repair membrane panels during precipitation, excessively high winds, or in areas of ponded water or excessive moisture.

2. Do not install and seam geomembrane panels in ambient temperatures below 40 degrees F unless approved by the Quality Assurance Consultant, and only if trial seams demonstrate the ability to meet seaming specifications.

B. Before deploying geomembrane panels, Installer shall repair subgrade or other underlying surface disturbed or damaged after issuance of "Letter of Surface Confirmation."

C. Place material over prepared subgrade with minimum handling. Place rolls in accordance with approved panel layout.

1. Install only rolls of material that can be anchored and sealed by end of each day's operation.

D. Properly secure geomembrane during installation with sandbags, rubber tires or other means approved by the QAC. Do not use large or sharp rocks, or other sharp objects.

E. Install geomembrane material in relaxed condition. Provide excess material for each panel as per requirements. Do not stretch material to fit area; keep material free from stress and tension during installation.

1. Unroll geomembrane panels in a manner that will not stretch, crimp, abrade, or otherwise damage panels. Place panels in a manner that minimizes wrinkles and differential wrinkles between adjacent panels.

F. Overlap geomembrane panels to facilitate drainage of water. All panels deployed during a single day shall be seamed or tack welded together that same day to the extent practicable.

G. Anchor perimeter of geomembrane panels in trench as indicated on the Drawings.

3.5 GEOMEBRANE FIELD SEAMING

A. Lay out the geomembrane seams parallel to the line of maximum slope.

1. Minimize the use of cross or butt seams on slopes, seams located in corners, and unusual geometric panel shapes.

B. The seam identification system shall be related to and compatible with the panel identification system.

C. Equipment: Include temperature gages and readout devices that allow continuous monitoring of apparatus temperatures during seaming. Electric generators shall be capable of providing constant voltage under load and shall be underlain with a splash pad to collect spilled fuel or oil when located on the membrane.

D. Overlap geomembrane surfaces a minimum of 4 inches and clean surfaces of moisture, grease, dust, dirt, debris and foreign material.

1. Do not use solvent or adhesive for seaming without approval from the manufacturer and the QAC.

2. Install a protective sheet of plastic below the geomembrane material being seamed when needed and where moisture or dirt causes seaming difficulty. As seaming progresses, pull the protective sheet along beneath the seaming apparatus.

a. Do not permanently leave the protective plastic sheet beneath the geomembrane.

3. For extrusion welding, clean surfaces to be seamed of oxidation by disc grinder not more than one hour before extruding the seam. Abrasion of the seam area with the disc grinder shall not extend more than one-half inch beyond the extrusion bead area. Tack welding of the panels to be seamed shall not damage the membrane or adversely affect the seaming operation. The top membrane of the seam overlap shall be beveled and the extrusion apparatus shall be purged of heat-degraded extrudant before seaming.

4. Fish mouths shall be cut along the ridge of the wrinkle and laid flat to overlap the edges of the cut. The overlap shall be seamed and any portion of the seam with less than 3 inches of overlap shall be patched with a circular or oval patch extending a minimum of 6 inches beyond the cut in all directions.

E. The Installer shall log the ambient air temperature 6 inches above the membrane elevation, extruded temperatures in extruder barrels and nozzles, and operating temperatures of hot wedge seamers at intervals of 2 hours or less.

3.6 GEOMEBRANE CAP PENETRATIONS

A. Any penetrations in the liner required by a pipe, vent, utility pole, fence post, concrete structure or other constructed feature shall be connected to the liner as shown on the drawings and in accordance with the geomembrane Manufacturer's recommendations as approved by the Engineer.

1. The connection to the geomembrane shall be made to assure the permeability of the liner at the connection has not been increased.

2. Test all penetrations for air-tightness using methods recommended by the manufacturer.

3. Each penetration shall be inspected and approved by the Engineer prior to being covered.

4. Any damage to the liner materials shall be repaired in accordance with the specifications.

3.7 GEOMEBRANE INSPECTION

A. Visually inspect seams and panels for holes, crimps, abrasions, or defects, and mark suspect locations. Clearly mark repair locations on the membrane panel and assign an appropriate identifying label

1. Clearly mark and record repair locations and non-destructively test data on the Record Drawings.

2. Do not cover repairs until passing results of non-destructive tests are achieved and accepted by the QAC.

B. Remove large wrinkles in geomembrane panels. Cut wrinkle, reseam and test until an acceptable seam is obtained.

3.8 GEOMEBRANE REPAIRS

A. Remove or repair damaged geomembrane panels damaged during installation at no additional cost to Owner.

B. Repair geomembrane panels as follows:

1. Preparation. Abrade surface of geomembrane in the seam/repair area no more than one hour before the repair is made. Keep repair/seam areas clean and dry at the time of the repair.

2. Spot weld small tears, pinholes or over-abraded areas where thickness of the geomembrane has been reduced by more than 4 mils (0.004 inches).

3. Abrade and re-weld small sections of defective welds.

4. Remove defective seam and replace with a new strip of material. Defective hot wedge seams may be abraded and welded providing the top membrane overlap is carefully cut off.

5. Patch larger holes and defects. Extend patch material a minimum of 6 inches beyond the edges of the defect. Round corners of patches with a radius of at least 3 inches.

3.9 FIELD QUALITY CONTROL TESTING

A. Seam Testing. Record locations and results of seam tests on the Record Drawing. Keep records on site for inspection by the Owner and QAC.

B. Trial Seams

1. Sample Quantity: For each seaming apparatus, for the following instances.

a. At the beginning of each shift.

b. After apparatus has been turned off or disconnected from its power source.

c. When apparatus has been idle for 60 minutes (hot air wedge welder).

d. Change in operator personnel.

e. When deemed necessary by the QAC.

2. Sample Size: 3 feet long and 12 inches wide (perpendicular to the seam), minimum.

a. Cut 1-inch-wide samples perpendicular to the seam for testing. Provide at a minimum, six for peel test and three for shear test.

3. Shear (Bonded Seam Strength) and Peel (Adhesion) Tests: In accordance with ASTM D6392. Installer shall provide tensiometer, calibrated within one year from start of geomembrane installation.

4. Conduct trial seams under the same physical conditions as permanent seaming.

a. For double-fusion hot wedge seams, both seams in each sample shall be tested for peel adhesion.

b. All six peel tests and all three shear tests are required to pass for the trial seam to be acceptable.

c. Each sample failure must consist of a ductile break that is film tearing bond.

5. If either test sample fails (shear or peel), repeat trial seam test procedure. If any test seams fail on the second trial seam, the seaming apparatus shall not be used until it is repaired or faulty conditions are corrected, and two trial seams pass the destructive tests.

C. Non-destructive Seam Testing

1. Acceptable Methods. Vacuum box testing, air-pressure testing of double-fusion seams, or other methods approved by the manufacturer and QAC.

2. Perform non-destructive testing over the full length of each seam. Perform testing as work progresses. Do not wait to perform testing until the completion of large segments of field seaming.

3. Vacuum Box Testing: In accordance with ASTM D5641. Utilize vacuum box approved by the Quality Assurance Consultant. Vacuum box shall include rigid housing, transparent viewing window, a soft rubber gasket on the bottom edge, and a valve assembly with a vacuum gage.

a. Mark geomembrane seamed areas when soap bubbles are visible in the viewing window.

b. Repair marked locations and retest.

4. Air Pressure Testing: In accordance with ASTM D5820. Perform air –pressure test on double-fusion seams having an air channel between the seams. Mark results on the geomembrane adjacent to the test location.

5. If a seam is located where non-destructive testing cannot be performed, the seam shall, at the discretion of the QAC, be cap-stripped. Installer shall perform cap-stripping operation only in presence of QAC.

D. Destructive Seam Testing

1. Samples: The Installer shall cut and remove destructive test samples from the installed geomembrane material, assign the sample an identification number, and record the sample location on the Record Drawings.

a. Perform one series of destructive seam tests per 1,000 l.f. of seam, minimum. One test must be performed per welding machine per day.

b. Locations: As determined by the QAC.

c. Sample Size: 12 inches wide and 40 inches long with the seam centered lengthwise.

d. Perform destructive seam strength testing as work progresses in order to obtain test results before seams are covered.

e. The Installer shall immediately repair the geomembrane at the destructive test sample location, and perform non-destructive test.

2. Destructive Seam Series Test: In accordance with ASTM D6392.

a. Field Testing. Installer shall provide field tensiometer, calibrated within one year from start of geomembrane installation.

1) Shear (Bonded Seam Strength)

a) One 1-inch strip cut from sample.

2) Peel (Adhesion) Tests:

a) Laboratory Test: Five 1-inch strips cut from samples.

b. Laboratory Testing. Coordinated by the Quality Assurance Consultant and performed by an independent geosynthetic testing laboratory paid for by the Owner.

1) Shear (Bonded Seam Strength)

a) Laboratory Test: Five 1-inch strips cut from samples.

2) Peel (Adhesion) Tests:

a) Laboratory Test: Five 1-inch strips cut from samples.

3) Double-fusion Hot Wedge Seams. Test both seams in each sample for peel. Testing shall include, but not necessarily be limited to, thickness (ASTM D 5199/D 5594)

E. Failure of Seam Tests.

1. If either field destructive test seams or laboratory test seams do not pass, reconstruct the seam between two passing test seam locations. Intermediate tests may be

performed on each side of the failed test sample location to further isolate the defective seam area.

2. If intermediate field test seams pass, laboratory test seams shall be performed on samples from the same locations.

3. If laboratory test seams also pass, then the seam shall be reconstructed between the intermediate sample locations.

4. If the intermediate or laboratory test seams fail, repeat the process with intermediate samples located further away from the original failing seam area to determine the defective seam area.

F. Acceptable Seams.

1. Each seam shall be bounded by two locations where samples passed the laboratory destructive tests.

2. Whenever a reconstructed seam exceeds 200 feet, an additional sample shall be obtained for destructive testing along the reconstructed seam.

3. At the QAC's discretion, the Installer may be directed to take additional samples from seams welded on the same day by a seaming apparatus that welded a failed seam, at no additional cost to the Owner.

3.10 TEMPORARY CONSTRUCTION ACCESS ROADS

A. Install Temporary Construction Access Roads whenever vehicular traffic must traverse any portion of the installed liner system.

B. Temporary Construction Access Road shall be installed in accordance with liner manufacturer's instructions and shall be capable of supporting vehicular and equipment loads of 60 psi.

C. Clearly delineate limits of roadways to prevent vehicles or equipment from travelling off roadway.

D. Remove all components of Temporary Construction Access Road and repair any damage caused by installation, use, and/or removal of roadway.

3.11 CLEANING

A. Clean the work area at the end of each work day of unnecessary scrap material, sand bags, tools and other materials used during geomembrane installation.

3.12 INSTALLER DEMOBILIZATION

A. Identified problem areas must be repaired by Installer and accepted by QAC before final inspection is performed by Installer, QAC, and Owner.

B. Installer will not demobilize capping crew or equipment from site until final "Certificate of Acceptance" has been completed.

END OF SECTION

THIS PAGE

IS

INTENTIONALLY

LEFT BLANK

SECTION 02 66 73 - UNDERDRAINS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Exhibit B General Requirements, apply to this Section.

1.2 SUMMARY

A. This Section includes subdrainage systems for the following:

1. Landfills.

B. Related Sections include the following:

1. Division 02 Section "Landfill Earth Moving" for sand drainage layer material.

1.3 DEFINITIONS

A. PE: Polyethylene plastic.

B. PP: Polypropylene plastic.

C. Subdrainage: Drainage system that collects and removes subsurface or seepage water.

D. NPS: Nominal pipe size.

1.4 SUBMITTALS

A. Product Data and Certification: For the following:

1. Perforated-and Solid wall pipe and fittings.
2. Filter fabric sock.
3. Geotextile.

PART 2 - PRODUCTS

2.1 PERFORATED PIPES AND FITTINGS

A. Perforated and Solid Wall PE Pipe and Fittings:

1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
2. NPS 8 and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.

3. Couplings: Manufacturer's standard, band type.

2.2 SOIL MATERIALS

A. Drainage Sand Layer material is specified in Division 02 Section "Landfill Earth Moving."

2.3 STONE

A. Form 816, Section M.02.01

B. Grading as depicted on in Section M.01.01. "No. 4"

2.4 FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

1. Structure Type: Nonwoven, needle-punched continuous filament.

2. Style: Sock.

2.5 GEOTEXTILE

1. Geotextile: Form 816, Section M.08.01-26.

2.6 MISCELLANEOUS

A. Bird Screening: Galvanized steel, 1/2-inch-square mesh, 0.041-inch wire.

B. Underdrain Pipe Clamp for Bird Screening: Stainless steel.

C. Detectable warning tape: As specified in Section 31 22 03

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.

B. Locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PIPING APPLICATIONS

A. Landfill Subdrainage Piping:

1. Perforated PE pipe and fittings wrapped in filter fabric.

2. Solid wall pipe and fittings.

3.3 PIPING INSTALLATION, GENERAL

A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Install tees, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.

1. Lay perforated pipe with perforations down.

B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.

C. Install PE piping according to ASTM D 2321.

3.4 LANDFILL UNDERDRAIN INSTALLATION

A. Layout underdrain piping as shown on the drawings. Provide couplings and fittings where necessary.

B. Install stone drainage material over underdrain piping to indicated depth.

C. Install geotextiles and stone over underdrain piping in accordance with Division 2 Section "Landfill Earthwork."

D. Daylighting Requirements:

1. Extend underdrain piping horizontally a minimum of 6 inches beyond final grade elevation at invert of pipe.

2. Install bird screen on daylighted pipe and secure with pipe clamp.

3.5 IDENTIFICATION

A. Arrange for installation of detectable green warning tape directly over piping.

3.6 FIELD QUALITY CONTROL

A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

3.7 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION

THIS PAGE

IS

INTENTIONALLY

LEFT BLANK

SECTION 02 66 81 – LANDFILL GAS VENT SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Exhibit B General Requirements, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Supplemental gas venting system.

B. Related Sections include the following:

1. Division 02 Section "Closure Turf™ Alternative".
2. Division 02 Section "Exposed TPO Alternative".
3. Division 31 Section "Landfill Earth Moving" for earthwork associated with landfill subgrade preparation, and varying earth material layers for landfill cap and cover.

1.3 QUALITY ASSURANCE

A. This work may include, but is not limited to providing material, samples and revising work to meet the intent of the plans and specifications.

B. Coordinate and assist with testing and inspection performed by the Engineer as directed.

1. This work may include, but is not limited to, providing material samples, excavating and backfilling sections of pipe, and replacing pipe as required to assure that construction complies with these specifications.

1.4 SUBMITTALS

A. Material Certification. For each product, certifying material meets the Specification requirements. Materials include the following:

1. Piping,

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

A. Perforated and Solid Wall PE Pipe and Fittings:

1. NPS 6 and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.

2. NPS 8 and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.

3. Fernco couplings, adjustable, stainless steel.

B. PVC Pipe and Fittings: ASTM D3350, SDR 26 minimum.

1. Couplings: Manufacturer's standard, band type.

2.2 SOIL MATERIALS

A. Drainage Sand Layer material is specified in Division 02 Section "Landfill Earth Moving".

2.3 FILTER FABRICS

A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.

1. Structure Type: Nonwoven, needle-punched continuous filament.

2. Style: Sock.

PART 3 - EXECUTION

3.1 NEW VENT CONSTRUCTION AND EXISTING VENT EXTENSION

A. Install and extend pipes a minimum of 4 feet above proposed finish grade.

B. See Division 2 Section "Closure Turf Alternative" and "Exposed TPO Alternative" for installation of geomembrane liner and geomembrane boot for casing.

C. See Division 2 Sections "Landfill Earth Moving" and "Vegetative Support Material" for installation of earthwork over geomembrane liner/cap and geomembrane boot for steel casing.

END OF SECTION

SECTION 02 66 87 – LANDFILL LIMIT MARKER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Exhibit B General Requirements, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Concrete filled, metal posts to act as landfill limit markers delineating the lateral limits of the geomembrane liner at locations shown on the Contract Drawings.
2. Concrete filled steel post bollards.

1.3 SUBMITTALS

A. Material Certification. For each product, certifying material meets the Specification requirements. Materials include the following:

1. Steel posts.
2. Concrete components and mix.
3. Paint.
4. Vehicle guard cover.

1.4 QUALITY ASSURANCE

A. Where "Form 816 is referenced, it shall mean "State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Form 816," and issued supplements.

PART 2 - PRODUCTS

2.1 STEEL POST

A. Limit Marker Posts: Black steel; ANSI/ASME B36.10/19; Schedule 40.

1. Diameter: 6 inches or as indicated.

2.2 CONCRETE

A. General: Comply with ACI 301 for cast-in-place concrete.

B. Materials: Portland cement complying with ASTM C 150, aggregates complying with ASTM C 33, and potable water for ready-mixed concrete complying with ASTM C 94. Measure, batch, and mix Project-site-mixed concrete according to ASTM C 94.

1. Concrete Mixes: Normal-weight concrete air entrained with not less than 3,000 psi compressive strength (28 days), 3-inch slump, and 1-inch maximum size aggregate.

2. Maximum Water-Cementitious Materials Ratio: 0.45.

3. Air Content: 5.5 percent plus or minus 1.5 percent.

2.3 VEHICLE GUARD COVER

A. Polyethylene thermoplastic bumper post sleeve.

1. Available Manufacturer(s):

a. Ideal Shield, LLC, Detroit, MI or approved equal.

2. Color: As indicated or as selected by Owner from manufacturer's standard range.

2.4 PAINT

A. Enamel Paint System: Form 816, Article M.18.08.

1. Color: As indicated.

2. Coats:

a. Primer: One Coat

b. Finish Coat: Two coats.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Set edge of concrete footing adjacent to limit of landfill geomembrane cap.

B. Install landfill limit marker posts as indicated. Set posts plumb and fill with concrete. Rod concrete to remove air pockets.

C. Remove spilled concrete from post and adjacent surfaces and clean surface.

D. Use excess excavated material as fill or dispose of off-site.

3.2 PAINTING

A. Paint landfill limit marker post with one coat of primer and two finish coats.

END OF SECTION

SECTION 02 66 91 - LANDFILL VEGETATIVE SUPPORT LAYER

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Vegetative support soil
2. Soil amendments.
3. Seeding.

B. Related Sections include the following:

1. Division 02 Section "Landfill Cover Material" for cover material requirements.
2. Division 31 Section "Site Earth Moving" for excavation, filling and backfilling, and rough grading.

1.2 DEFINITIONS

A. Finish Grade: Elevation of finished surface of vegetative support soil.

B. Manufactured Soil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce vegetative support soil.

C. Vegetative Support soil: Imported or manufactured soil or surface soil modified to become vegetative support soil; mixed with soil amendments.

D. Subgrade: Top surface of a fill immediately beneath vegetative support soil.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name and percentage by weight of each species and variety, and percentage of purity, germination, and weed seed. Include the year of production and date of packaging.

C. Product Certificates: For soil amendments, fertilizers and mulch, signed by product manufacturer.

D. Material Test Reports: For vegetative support soil.

E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of seeded areas during a calendar year. Submit before expiration of required maintenance periods.

F. Hydroseed Procedure, including application rates.

1.4 QUALITY ASSURANCE

A. Soil-Testing Laboratory Qualifications: An independent laboratory, recognized by the State Department of Agriculture, with the experience and capability to conduct the testing indicated and that specializes in types of tests to be performed.

B. Vegetative Support Soil Analysis: Furnish soil analysis by a qualified soil-testing laboratory stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; and mineral and plant-nutrient content of soil. Obtain one composite soil sample for every 5,000 cu. yds. of material with at least one sample from each borrow source location.

1. Report suitability of soil for growth. State recommended quantities of nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce a satisfactory soil.

C. Vegetative Support Soil Chemical Analysis: Obtain one composite soil sample for every 10,000 cu. yds. of material with at least one sample from each borrow source location. Analyze each for RCRA 8 Metals (EPA Method 6010 / 7421 / 7470), Polychlorinated Biphenyls (EPA Method 8082), Total Volatile Organic Compounds (EPA Method 8260), Semi-Volatile Organic Compounds/Polyaromatic Hydrocarbons (EPA Method 8270), Pesticides (EPA Method 8081), Chlorinated Herbicides (EPA Method 8151), and Total Petroleum Hydrocarbons (CTETPH method). Owner reserves the right to disqualify the source based on the results of the chemical testing.

1. Soil/material shall not exceed any GB pollutant mobility criteria (GB PMC) or residential direct exposure criteria (RES DEC) established in Sections 22a-133k-1 through 22a-133k-3 of the regulations of Connecticut state agencies.

D. Organic Soil Amendment Chemical Analysis: Obtain one composite soil sample from each borrow source location. Analyze each for RCRA 8 Metals (EPA Method 6010 / 7421 / 7470), Polychlorinated Biphenyls (EPA Method 8082), Total Volatile Organic Compounds (EPA Method 8260), Semi-Volatile Organic Compounds/Polyaromatic Hydrocarbons (EPA Method 8270), Pesticides (EPA Method 8081), Chlorinated Herbicides (EPA Method 8151), and Total Petroleum Hydrocarbons (CTETPH method). Owner reserves the right to disqualify the source based on the results of the chemical testing.

1. Soil/material shall not exceed any GB pollutant mobility criteria (GB PMC) or residential direct exposure criteria (RES DEC) established in Sections 22a-133k-1 through 22a-133k-3 of the regulations of Connecticut state agencies.

E. Owner reserves the right to disqualify the source based on the results of the chemical testing.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Seed, Lime, and Fertilizer: Deliver in original sealed, labeled, and undamaged containers.

1.6 SCHEDULING

A. Planting Restrictions: Plant during one of the following periods. Perform seeding at other times when acceptable to the Engineer.

1. Spring Seeding: April 15 to June 15.

2. Fall Seeding: August 15 to October 15.

B. Weather Limitations: Proceed with seeding only when existing and forecasted weather conditions permit.

1.7 MAINTENANCE

A. Begin maintenance immediately after each area is planted and continue until acceptable turf area is established, but for not less than the following periods:

1. Seeded Areas: 365 days from the date of Substantial Completion.

a. When full maintenance period has not elapsed before end of planting season, or if lawn is not fully established, continue maintenance during next planting season.

B. Maintain and establish seeded areas by watering, fertilizing, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth lawn.

C. Mow seeded area when grass reaches a height of 10 inches. Repeat mowing to maintain specified height without cutting more than 40 percent of grass height. Remove no more than 40 percent of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Schedule initial and subsequent mowings to maintain the following grass height:

1. Mow grass to 6 inches high.

PART 2 - PRODUCTS

2.1 SEED

A. Grass Seed: Fresh, clean, dry, new-crop seed complying with AOSA's "Journal of Seed Technology; Rules for Testing Seeds" for purity and germination tolerances.

B. Seed Species: Seed of grass species as follows:

	Proportion by Weight (Percent)	Minimum Purity (Percent)	Minimum Germination (Percent)
Orchard Grass	30	85	75
Creeping Red Fescue	10	98	85
K.31 Tall Fescue	50	98	85

Domestic Ryegrass	10	98	90

2.2 SOIL

A. Vegetative Support Soil: ASTM D 5268, pH range of 6 to 7, a minimum of 6 percent and a maximum of 20 percent organic material content; free of stones 1-1/4 inch or larger in any dimension and other extraneous materials harmful to plant growth.

1. Minimum Internal Friction Angle: Shall be 29 degrees when tested in accordance with ASTM D 3080. Specimen shall be prepared with moderate compactive effort and moisture content as received from the source. Tests will be performed with normal stresses of 1 and 5 psi via the large scale direct shear method.

2. Minimum In-place Wet Unit Weight: Shall be 110 pounds per cubic foot when with a moisture content as received from the source.

3. Vegetative Support Soil Source: Reuse surface soil stockpiled on-site. Existing soil that does not meet the minimum internal friction angle and in-place wet unit weight requirements above can be used only on slopes less than 10% (i.e. top of the landfill). Verify suitability of stockpiled surface soil to produce vegetative support soil. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.

   a. Supplement with imported or manufactured topsoil from off-site sources when quantities are insufficient. Obtain topsoil displaced from naturally well-drained construction or mining sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes.

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 90 percent calcium carbonate equivalent and as follows:

1. Provide lime in form of dolomitic limestone, with a minimum of 95 percent passing a No. 100 sieve.

2. Liquid lime will not be allowed.

B. Perlite: Horticultural perlite, soil amendment grade.

C. Sand: Clean, washed, natural or manufactured, free of toxic materials.

2.4 ORGANIC SOIL AMENDMENTS

A. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve; soluble salt content of 5 to 10 decisiemens/m; not exceeding 0.5 percent inert contaminants and free of substances toxic to plantings.

1. Organic Matter Content: 50 to 60 percent of dry weight.

a. State of Connecticut, Department of Environmental Protection approved when derived from food and agricultural residues, animal manures, and sewage sludge.

2. Approved Products: Agresource, Inc., 100 Main Street, Amesbury, MA 01913 (1-800-313-3320), or equal.

B. Manure: Well-rotted, unleached, stable or cattle manure containing not more than 25 percent by volume of straw, sawdust, or other bedding materials; free of toxic substances, stones, sticks, soil, weed seed, and material harmful to plant growth.

2.5 FERTILIZER

A. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:

1. Composition: Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.6 MULCHES

A. Fiber Mulch: Biodegradable, dyed-wood, cellulose-fiber mulch; nontoxic; free of plant-growth or germination inhibitors; with maximum moisture content of 15 percent and a pH range of 4.5 to 6.5.

1. Product and Manufacturer:

a. Mat-Fiber by Mat, Inc. (formerly Silva-Fiber Mulch by Weyerhaueser).

b. Approved equal.

B. Straw Mulch: Air-dry, clean, mildew- and seed-free, hay or threshed straw of wheat, rye, oats, or barley; free of weeds, reeds, and twigs; maximum moisture content of 15 percent. Do not use salt hay.

C. Non-Asphalitic Tackifier:

1. Model and Manufacturer:

a. Soilmaster WR, by Environmental Soil Systems, Inc.

b. Approved equal.

2.7 WATER

A. Potable water will be supplied by the owner via an existing MDC hydrant meter in the vicinity of the landfill scalehouse.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive seed for compliance with requirements and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities, trees, shrubs, and plantings from damage caused by planting operations.

1. Protect adjacent and adjoining areas from hydroseeding overspray.

B. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

3.3 INSTALLATION

A. Place vegetative material in one continuous lift and spread using tracked equipment weighing equivalent to or less than that of a Caterpillar D-8 bulldozer, or equal. Equipment must have a ground pressure less than 15 psi.

3.4 SEEDED AREA PREPARATION

A. Limit subgrade preparation to areas to be planted.

B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 4 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

1. Spread planting soil mix to a depth of 6 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.

C. Finish Grading: Grade seeded areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.

D. Moisten prepared seeded areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

E. Restore areas if eroded or otherwise disturbed after finish grading and before planting.

3.5 SEEDING

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.

1. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Sow seed at the rate of 200 lb/1 acre.

C. Rake seed lightly into top 1/8 inch of topsoil, roll lightly, and water with fine spray.

D. Protect seeded areas with slopes exceeding 1:3 with erosion-control blankets installed and stapled according to manufacturer's written instructions.

E. Protect seeded areas with slopes not exceeding 1:10 by spreading straw mulch. Spread uniformly at a minimum rate of 2 tons/acre to form a continuous blanket 1-1/2 inches in loose depth over seeded areas. Spread by hand, blower, or other suitable equipment.

1. Bond straw mulch by spraying with non-asphaltic tackifier at manufacturer's recommended rate. Take precautions to prevent damage or staining of structures or other plantings adjacent to mulched areas. Immediately clean damaged or stained areas.

2. Install cellulose fiber mulch, erosion control blanket, or other stabilization measure, as directed by the Engineer, if straw mulch is does not provide adequate erosion protection to a disturbed area.

3.6 HYDROSEEDING

A. Hydroseeding: Mix specified seed, fertilizer, and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.

1. Mix slurry with tackifier.

2. Apply slurry uniformly to all areas to be seeded in a one-step process. Apply slurry at a minimum rate of 175-lb/acre dry weight but not less than the rate required to obtain specified seed-sowing rate.

3.7 SATISFACTORY SEEDED AREAS

A. Satisfactory Seeded Area: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 3 by 3 inches.

1. Replant areas and spots that do not show a prompt catch at 15 day intervals, or as directed by the Engineer.

B. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

3.8 IRRIGATION

A. Irrigate newly seeded areas as required to establish newly seeded lawn areas.

1. Owner shall incur no additional cost for the operation of irrigation systems.
2. Convey potable water to the temporary irrigation system using trucks suitable for this purpose.
3. Obtain potable water from approved source.

B. Operate the irrigation system during the maintenance period. The irrigation system shall provide a minimum of 1 inch of water per week, unless adequate rainfall occurs.

C. Monitor the system during operation and discontinue operation, as necessary, to prevent excess water from running off the landform or causing erosion.

D. Remove temporary irrigation system when vegetation has been established to the satisfaction of the engineer.

3.9 FIELD QUALITY CONTROL

A. Depth Test Hole. Confirm depth of vegetative support material after final grading.

1. Hand excavate test holes at 100 feet on-center, maximum.
2. Record depth of layer at each test hole on site plan.
3. Refill test hole and compact material as required.
4. Engineer shall review depth readings and determine extent of areas that contain an insufficient depth of material. Provide additional material as required to meet minimum layer thickness at no additional cost. Repeat test hole process until satisfactory results are obtained.

3.10 CLEANUP AND PROTECTION

A. Promptly remove soil and debris created by work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Erect barricades and warning signs as required to protect newly planted areas from traffic. Maintain barricades throughout maintenance period and remove after grass is established.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Exhibit B General Requirements, apply to this Section.

1.2 SUMMARY

A. This Section specifies cast-in-place concrete, including reinforcement, concrete materials, mix design, placement procedures, and finishes.

B. Cast-in-place concrete applications include the following:

1. Concrete lined ditches.
2. Fencepost, bollard and limit marker footing.
3. Utility pads.
4. Channel armoring.
5. Culvert headwall.

C. Related Sections include the following:

1. Division 31 Section "Site Earth Moving" for subgrade preparation, grading, and subbase course.

1.3 SUBMITTALS

A. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Design mixes.
2. Cementitious materials and aggregates.
3. Form materials and form-release agents.
4. Steel reinforcement and reinforcement accessories.
5. Admixtures.
6. Curing materials.
7. Bonding agents.
8. Joint-filler strips.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed concrete work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Source Limitations: Obtain each type of cement of the same brand from the same manufacturer's plant, each aggregate from one source, and each admixture from the same manufacturer.

D. Comply with ACI 301, "Specification for Structural Concrete," including the following, unless modified by the requirements of the Contract Documents.

1. General requirements, including quality assurance, acceptance of structure, and protection of in-place concrete.
2. Formwork and form accessories.
3. Steel reinforcement and supports.
4. Concrete mixtures.
5. Handling, placing, and constructing concrete.

E. Form 816: State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, and issued supplements.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle steel reinforcement to prevent bending and damage.

1.6 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 FORMWORK

A. Furnish formwork and form accessories according to ACI 301.

2.2 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

B. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.

2.3 CONCRETE MATERIALS

A. General: Use the same brand and type of cementitious material from the same manufacturer throughout the Project.

B. Portland Cement: ASTM C 150, Types I or II or Type I/II.

C. Normal-Weight Aggregate: ASTM C 33, uniformly graded, not exceeding 1-inch nominal size.

D. Water: Potable and complying with ASTM C 94.

2.4 ADMIXTURES

A. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures. Do not use admixtures containing calcium chloride.

B. Air-Entraining Admixture: ASTM C 260.

C. Water-Reducing Admixture: ASTM C 494, Type A.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. dry.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

F. Clear, Waterborne, Membrane-Forming Curing and Sealing Compound: ASTM C 1315, Type 1, Class A.

2.7 CONCRETE MIXES

A. Comply with ACI 301 requirements for concrete mixtures.

B. Prepare design mixes, proportioned according to ACI 211.1 and ACI 301, for each type and strength of normal-weight concrete determined by either laboratory trial mix or field test data bases, as follows:

1. Compressive Strength (28 Days): As indicted.
2. Slump: 4 inches.
3. Slope Paving: In accordance with Form 816, Section M.03.01, Slope Paving.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content of 5.0 percent within a tolerance of plus 1.0 or minus 1.5 percent.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Comply with ASTM C 94.

1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 PREPARATION

A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Proceed with pavement only after nonconforming conditions have been corrected and subgrade is ready to receive pavement.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.2 FORMWORK

A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.

B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

C. Construct forms tight enough to prevent loss of concrete mortar.

D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces.

Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical. Kerf wood inserts for forming keyways, reglets, recesses, and the like, for easy removal.

1. Do not use rust-stained steel form-facing material.

E. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required lines, grades, elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

F. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

G. Chamfer exterior corners and edges of permanently exposed concrete.

H. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.

I. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

J. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

K. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.3 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor bolts, accurately located, to elevations required.

3.4 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.

D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.5 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

1. When joining existing pavement, place transverse joints to align with previously placed joints, unless otherwise indicated.

B. Construction Joints: Locate and install so as not to impair strength or appearance of concrete, at locations indicated or as approved by Engineer.

C. Isolation (Expansion) Joints: Install joint-filler strips at junctions with slabs-on-grade and vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.

1. Extend joint fillers full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.

3.6 CONCRETE PLACEMENT

A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcement steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.

B. Remove snow, ice, or frost from subbase surface and reinforcement before placing concrete. Do not place concrete on frozen surfaces.

C. Moisten subbase to provide a uniform dampened condition at the time concrete is placed. Do not place concrete around manholes or other structures until they are at the required finish elevation and alignment.

D. Comply with recommendations in ACI 304R for measuring, mixing, transporting, and placing concrete.

E. Do not add water to concrete during delivery, at Project site, or during placement.

F. Consolidate concrete with mechanical vibrating equipment.

G. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation.

H. Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Place each layer while preceding layer is still plastic, to avoid cold joints.

1. Consolidate placed concrete with mechanical vibrating equipment. Use equipment and procedures for consolidating concrete recommended by ACI 309R.

2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the vibrator. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix constituents to segregate.

I. Deposit and consolidate concrete for slabs in a continuous operation, until placement is complete.

1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
2. Maintain reinforcement in position on chairs during concrete placement.
3. Screed slab surfaces with a straightedge and strike off to correct elevations.
4. Slope surfaces uniformly to drains where required.
5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, free of humps or hollows, before excess moisture or bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.

J. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When air temperature has fallen to or is expected to fall below 40 deg F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F and not more than 80 deg F at point of placement.
2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators, unless otherwise specified and approved in mix designs.

K. Hot-Weather Placement: Place concrete according to recommendations in ACI 305R and as follows, when hot-weather conditions exist:

1. Cool ingredients before mixing to maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off.

1. Apply to concrete surfaces not exposed to public view.

B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Completely remove fins and other projections.

1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, or painting.

2. Apply the following rubbed finish, defined in ACI 301, to smooth-formed finished concrete.

a. Smooth-rubbed finish.

C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.8 FINISHING UNFORMED SURFACES

A. General: Comply with ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Screed surfaces with a straightedge and strike off. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane before excess moisture or bleedwater appears on the surface.

1. Do not further disturb surfaces before starting finishing operations.

C. Float Finish: Begin the second floating operation when bleed-water sheen has disappeared and the concrete surface has stiffened sufficiently to permit operations. Float surface with power-driven floats, or by hand floating if area is small or inaccessible to power units. Finish surfaces to true planes. Cut down high spots, and fill low spots. Refloat surface immediately to uniform granular texture.

3.9 TOLERANCES

A. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

B. Comply with the additional requirements for pavements.

1. Elevation: 1/4 inch.

2. Thickness: Plus 3/8 inch, minus 1/4 inch.
3. Surface: Gap below 10-foot- long, unleveled straightedge not to exceed 1/4 inch.
4. Joint Spacing: 3 inches.
5. Contraction Joint Depth: Plus 1/4 inch, no minus.
6. Joint Width: Plus 1/8 inch, no minus.

3.10 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection, and follow recommendations in ACI 305R for hot-weather protection during curing.

B. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

C. Curing Methods: Cure formed and unformed concrete for at least seven days by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these as follows:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.
2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during concrete placement. Tests will be performed according to ACI 301.

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

3.12 REPAIRS AND PROTECTION

A. Remove and replace concrete that does not comply with requirements in this Section.

B. Remove and replace concrete pavement that is broken, damaged, or defective, or does not meet requirements in this Section.

C. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 31 22 03 – SITE EARTH MOVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Exhibit B General Requirements, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, and pavements.
2. Base course for drainage ditches, structures, and swales.
3. Base course for bituminous concrete paving.
4. Excavating and backfilling trenches for buried mechanical and electrical utilities and pits for buried utility structures.
5. Disposal of unsuitable material.
6. Disposal of surplus suitable material, if required.

B. Related Sections include the following:

1. Division 02 Section "Landfill Earth Moving" for earthwork associated with landfill subgrade preparation, and various earth material layers for landfill cap and cover.

1.3 DEFINITIONS

A. Backfill: Soil materials used to fill trench, structure or pit excavations.

B. Base Course:

1. Layer placed between the subgrade course and bituminous concrete paving.
2. Layer placed between subgrade and surface materials including riprap.

C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.

D. Excavation: Removal of material encountered above subgrade elevations.

1. Additional Excavation: Excavation below subgrade elevations as directed by Engineer. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated dimensions without direction by Engineer. Unauthorized excavation, as

well as remedial work directed by Engineer, shall be without additional compensation.

E. General Fill: Soil materials used to raise existing grades where indicated on the Drawings.

F. Structures: Utility appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base, drainage fill, or topsoil materials.

1.4 SUBMITTALS

A. Product Data:

1. Each type of warning tape listed in paragraph 2.2.B.

2. Material certifications for general fill, base material, bedding course material, and trench backfill.

B. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated. Prepare separate reports for each type and application of material.

1. General Fill

a. Refer to Division 02 Section "Landfill Earth Moving" for testing requirements.

2. Base, Bedding, Backfill Material

a. Classification according to ASTM D 2487, prior to delivery to the site and one per 5,000 CY delivered.

b. Gradation and particle size analysis according to ASTM D 422, prior to delivery to the site and one per 5,000 CY delivered.

c. Laboratory compaction test results according to ASTM D 1557, prior to delivery to the site and one per 5,000 CY delivered.

d. Soil Chemical Analysis Reports: RCRA 8 Metals (EPA Method 6010 / 7421 / 7470), Polychlorinated Biphenyls (EPA Method 8082), Total Volatile Organic Compounds (EPA Method 8260), Semi-Volatile Organic Compounds/Polyaromatic Hydrocarbons (EPA Method 8270), Pesticides (EPA Method 8081), Chlorinated Herbicides (EPA Method 8151), and Total Petroleum Hydrocarbons (CTETPH method): prior to delivery and one report for each 10,000 cu. yd., or portion thereof, delivered. Owner reserves the right to disqualify the source based on the results of the chemical testing.

1) Soil/material shall not exceed any GB pollutant mobility criteria (GB PMC) or residential direct exposure criteria (RES DEC) established in Sections 22a-133k-1 through 22a-133k-3 of the regulations of Connecticut state agencies.

e. On-Site Soil Material

1) Classification, gradation, and laboratory compaction curve in accordance with the requirements specified for General Fill material, when requested by the Engineer.

1.5 QUALITY ASSURANCE

A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil material testing, as documented according to ASTM D 3740 and ASTM E 548.

B. Where "Form 816" is referenced, it shall mean "State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Form 816," and issued supplements.

1.6 PROJECT CONDITIONS

A. Extent of trench excavation and excavated areas will be controlled by site conditions and Owner's requirements.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. All soil shall be free of debris, waste, frozen materials, vegetation, clay and other deleterious matter; adequately graded for satisfactory compaction.

C. General Fill: Refer to Division 02 Section "Landfill Earth Moving" for material requirements.

D. Base: Naturally or artificially graded mixture of natural or crushed gravel, broken or crushed stone:

1. Drainage Ditch and Swales: Form 816, Section M.02.03, Grading B.
2. Processed Aggregate Base: Form 816, Section M.05.01.

E. Bedding:

1. Sand: Form 816, Section M.03.01-2.
2. Stone: Form 816, Section M.01.01, No. 6.

F. Backfill:

1. Sand: Form 816, Section M.03.01-2.

2.2 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, minimum 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep.

B. Identifying Colors for Utilities:

1. Red: Electric.
2. Yellow: Gas, oil, steam, and dangerous materials.
3. Orange: Telephone and other communications.
4. Blue: Water systems.
5. Green: Sewer systems.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Protect subgrades and foundation soils against freezing temperatures or frost. Provide protective insulating materials as necessary.

3.2 DEWATERING

A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding or damaging Project site and surrounding area.

B. Protect excavations, backfills, fills and subgrades from softening, undermining, washout, and damage by rain or water accumulation.

1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches. Provide positive drainage of backfill and fill.

3.3 EXPLOSIVES

A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

A. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface and subsurface conditions encountered, including rock, soil materials, and obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.5 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated cross sections, elevations, and grades.

3.6 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide a working clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: 12 inches on each side of pipe or conduit.
2. Clearance: As indicated.

C. Trench Bottoms: Excavate trenches 6 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavate for bell of pipe.

1. Excavate trenches 12 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.7 APPROVAL OF SUBGRADE

A. Notify Engineer when excavations have reached required subgrade.

B. If Engineer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.

1. Additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.

C. Proof roll subgrade with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof roll wet or saturated subgrades.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Engineer.

3.8 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill may be used when approved by Engineer.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Engineer.

3.9 STORAGE OF SOIL MATERIALS

A. Stockpile borrow materials and satisfactory excavated soil materials. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Prevent windblown dust. Provide erosion control measures.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.10 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:

1. Construction below finish grade.
2. Inspecting and testing underground utilities.
3. Removing trash and debris.
4. Removing temporary shoring and bracing, and sheeting.

3.11 UTILITY TRENCH BACKFILL

A. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

B. Place and compact initial backfill of subbase material, free of particles larger than 1 inch, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact material under pipe haunches and bring backfill evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of utility system.

C. Coordinate backfilling with utilities testing.

D. Fill voids with approved backfill materials while shoring and bracing, and as sheeting is removed.

E. Place and compact final backfill of satisfactory soil material to final subgrade.

F. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

1. Install detectable warning tape over non-ferrous piping.

3.12 FILL

A. Preparation: Remove vegetation, topsoil, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface before placing fills.

B. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 3 horizontal so fill material will bond with existing material.

C. Place and compact fill material in layers to required elevations.

3.13 MOISTURE CONTROL

A. General Application: Uniformly moisten or aerate subgrade and each subsequent fill or backfill layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

2. Remove and replace, or scarify and air-dry, otherwise satisfactory soil material that exceeds optimum moisture content and is too wet to compact to specified dry unit weight.

3.14 COMPACTION OF BACKFILLS AND FILLS

A. Place fill material in loose lifts not exceeding 12 inches in depth for material compacted by heavy compaction equipment.

B. Place backfill and fill materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill material.

2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 95 percent.

3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill material at 85 percent.

3.15 GRADING

A. General: Uniformly grade areas to a smooth surface, free from irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

1. Provide a smooth transition between adjacent existing grades and new grades.
2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch, however, not consistently in one direction.
2. Walks: Plus or minus 1 inch.

3.16 SUBBASE AND BASE COURSES

A. Under pavements and walks, place and compact materials on prepared subgrade as follows:

1. Place and compact subbase and base courses at optimum moisture content to required grades, lines, cross sections, and thickness (within 3/4 inch, plus or minus) to not less than 95 percent of maximum dry unit weight according to ASTM D 1557.
2. Shape subbase and base to required crown elevations and cross-slope grades.
3. When thickness of compacted subbase or base course is 6 inches or less, place materials in a single layer.
4. When thickness of compacted subbase or base course exceeds 6 inches, place materials in equal layers, with no layer more than 6 inches thick or less than 3 inches thick when compacted.

3.17 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:

1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2000 square feet or less of paved area or building slab, but in no case fewer than three tests.
2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench length, but no fewer than two tests.

D. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.18 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

   1. Scarify or remove and replace soil material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

   1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

3.19 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Transport surplus satisfactory soil to designated storage areas on Owner's property. Stockpile or spread soil as directed by Engineer.

   1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

THIS PAGE

IS

INTENTIONALLY

LEFT BLANK

SECTION 31 25 01 – TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Exhibit B General Requirements, apply to this Section.

1.2 SUMMARY

A. This Section includes furnishing, placing, and maintaining sedimentation control measures as shown on the Drawings, as directed by the Engineer, and where necessary to reduce sediment content of runoff. Measures include the following:

1. Silt fence.
2. Erosion control haybales.
3. Construction entrance.
4. Catch basin inserts.
5. Temporary pipe slope drain with riprap apron.
6. Temporary erosion control blankets.
7. Temporary Sediment Traps
8. Polyacrylimide Erosion Control Blocks.
9. Dust control.

B. Related Sections include the following:

1. Division 31 Section "Site Earth Moving."
2. Division 31 Section "Permanent Erosion and Sedimentation Control" for permanent erosion control measures including permanent turf reinforcement matting.

1.3 SUBMITTALS

A. Product Data

1. Silt fence.
2. Catch basin inserts.
3. HDPE pipe.
4. Erosion control blanket.
5. Polyacrylimide Erosion Control Blocks.

6. Geotextile.

B. Certificate of Compliance

1. Erosion Control bales.
2. Riprap
3. Stone.
4. Calcium chloride.

C. Material Test Reports

1. Compost

1.4 QUALITY ASSURANCE

A. Where "Form 816" is referenced, it shall mean "State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Form 816," and issued supplements.

B. Connecticut Guidelines for Soil Erosion and Sediment Control by the Connecticut Council on Soil and Water Conservation.

C. Compost Chemical Analysis Reports: Obtain one composite soil sample for each source of material. Analyze for pesticides (EPA Method 8081), chlorinated herbicides (EPA Method 8151), Total Petroleum Hydrocarbons (CTETPH method), Total RCRA 8 Metals (EPA Method 6010 / 7421 / 7470).

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver calcium chloride to site in manufacturers sealed bags.

PART 2 - PRODUCTS

2.1 SILT FENCE

A. Synthetic Filter Fabric: Woven geotextile, 36 inches maximum height, conforming to the following:

Properties	Requirement	Unit
Grab Tensile Strength (ASTM D4632):	124	Lbs
Grab Tensile Elongation (ASTM D4632):	15	Percent
Puncture Strength (ASTM D4833):	65	Lbs
Flow Rate (ASTM D4491):	20	Gal/Min/Sq. Ft.

Properties	Requirement	Unit
UV Resistance(at 500 hours) (Retained strength) (ASTM D4355):	80	Percent

B. Posts

1. Hardwood Stakes: 1.5-inch by 1.5-inch by 42-inch minimum.

C. Product and Manufacturer:

1. Harris Silt Fence by Amoco Fabrics and Filters.
2. Mutual MISF 1855 by Mutual Industries, Inc.
3. Or equal.

2.2 HAY BALES

A. Bales: Hay, weighing 40 to 120 pounds per bale.

B. Stakes: Wood, 1.5-inch by 1.5-inch by 36-inch minimum.

2.3 CONSTRUCTION ENTRANCE

A. Stone: Article M1.01 of Form 816, size No.3 or as indicated.

2.4 DRAINAGE STRUCTURE PROTECTION

A. Catch Basin Inserts: Woven polypropylene fabric, prefabricated to a cone-shape, with loops for lifting the insert with reinforcing steel during removal, and the following.

Properties	Requirement	Unit
Grab Tensile Strength (ASTM D4632):	300	Lbs
Grab Tensile Elongation (ASTM D4632):	20	Percent
Puncture Strength (ASTM D4833):	120	Lbs
Mullen Burst (ASTM D3786):	800	PSI
Trapezoid Tear (ASTM D4533):	120	Lbs
Flow Rate (ASTM D4491):	40	Gal/Min/Sq. Ft.
Permittivity (ASTM D4491)	0.55	Sec-1
UV Resistance(at 500 hours) (Retained strength) (ASTM D4355):	80	Percent
Apparent Opening Size (ASTM D4751):	#40	US Sieve

1. Manufacturer: ACF Environmental, 1801-A Willis Road, Richmond, VA 23237 (800-844-9223), or equal.

a. Product: Silt Sack

B. Catch Basin Fabric: Geotextile filter fabric, meeting the requirements above, wrapped around non-standard size catch basin grates.

2.5 TEMPORARY SLOPE DRAIN

A. Corrugated HDPE Drainage Tubing and Fittings NPS 4 to NPS 10: AASHTO M 252, Type S, with smooth waterway for coupling joints.

B. Riprap: Broken, irregular size and shape, graded stone conforming to Form 816, Section M.12.02, size as indicated.

2.6 EROSION CONTROL BLANKET

A. Blanket: Minimum width of 6 feet.

1. Mat: Machine-produced of 100 percent coconut fiber with colored line or thread along outer edges to indicate material overlap limits.

a. Weight: 0.50 lb./sq.yd.

b. Overlap: Approximately 2 to 5 inches.

2. Top and Bottom Cover: Heavy-weight polypropylene netting with ultraviolet additives to delay breakdown.

a. Mesh Size: 0.625-inch by 0.625 inch.

b. Weight: 3 lbs/1000 sq. ft.

B. Sew blanket and covers together on 1.5 inch center at 50 stitches per roll width with UV stable polypropylene thread.

C. Blanket: North American Green S150, Bon Terra S2, or approved equal.

2.7 TEMPORARY SEDIMENT TRAP

A. Core (Riprap): Broken, irregular size and shape, graded stone conforming to Form 816, Section M.12.02, size as indicated.

B. Face (Stone): Article M1.01 of Form 816, size No.3 or as indicated.

2.8 POLYACRYLIMIDE EROSION CONTROL BLOCKS

A. APS 700 Series Floc Log, or approved equal

B. Formulation as recommended by the manufacturer.

2.9 DUST CONTROL

A. Water: Potable.

B. Calcium Chloride: ASTM D98, Type 1 or Type 2.

PART 3 - EXECUTION

3.1 GENERAL

A. Minimize environmental damage during construction. Prevent discharge of fuel, oil, lubricants, and other fluids. Mitigate effects of discharge.

B. Install erosion and sediment control measures prior to clearing, demolition or construction.

C. Construct erosion and sediment control measures in accordance with standards and specifications of the Owner, state regulations and guidelines, and the following.

1. Provide additional sedimentation and erosion controls as required by the Engineer to address field conditions at no additional cost.
2. Do not discharge turbid water from dewatering to inland wetlands or watercourses.
3. Inspect site weekly and prior to any anticipated rain event. Ensure that erosion controls are properly maintained and functioning.
4. Inspect site after any storm generating 0.1 inches of rain in a 24-hour period.
5. Supply a 24-hour contact name and telephone number as part of the erosion control plan.

D. Install additional control measures, if deemed necessary by the Owner, Engineer, or authorities having jurisdiction.

E. Protect catch basins with bale filters or inserts throughout construction until disturbed areas are stabilized.

1. Remove and dispose of sediment from control structures.

F. Control dust and wind erosion. Control dust to prevent a hazard to traffic on adjacent roadways. Dust control includes sprinkling of water or calcium chloride application.

G. Do not discharge directly into wetlands or watercourses where dewatering is necessary. Utilize methods and devices as permitted by authorities having jurisdiction and appropriate regulations to minimize and retain suspended solids including pumping water into a temporary sedimentation basin, providing surge protection at inlet and outlet of pumps, floating pump intake.

1. If pumping operation results in turbidity problems, stop pumping until means of controlling turbidity are determined and implemented.

H. Where control measures are required for longer than 60 days, use silt fence instead of hay bales.

I. Cut Areas

1. Establish an erosion control line (haybale check or filter fabric) at toe of slope in cut areas and slope stabilization with mulch or grass within 30 days of start of cut operations.

J. Fill Areas

1. Establish an erosion control line (silt fence) approximately 10 feet from toe of slope of proposed fill areas, or where indicated, prior to beginning fill installation.
2. Initiate slope stabilization with mulch or grass within 30 days of start of fill installation.

K. Within 7 days of completing slope construction, stabilize slopes with vegetation or matting to minimize exposure.

L. Stockpiles

1. Side Slopes: 2:1 maximum.
2. Surround stockpiles by a sediment barrier.
3. Stabilize stockpiles left bare for more than 15 days with temporary vegetation or mulch.

M. Final Grading

1. If final grading is delayed for more than 30 days after land disturbances cease, stabilize soils with temporary vegetation or mulch.

N. Planting Season for Temporary Vegetation

1. March 1 to June 15 and August 1 to October 1.
2. After September 15, stabilize areas with haybales or silt fence.

O. Areas to Be Left Bare Prior to Finished Grading and Seeding

1. Within Planting Seasons
   a. Temporarily seed with Perennial Ryegrass
   b. Apply at a rate of 2 pounds per 1000 sq. ft. at a depth of 1/2 inch.
   c. Where grass predominates, fertilize according to a soil test at a minimum application rate of one pound per acre.
2. Outside of Planting Seasons
   a. Apply air-dried wood chip mulch, free of coarse matter.
   b. Apply at a rate of 185 to 275 pounds per 1000 sq. ft.

3.2 CONTROL SYSTEMS

A. Prevent damage to geomembrane liner resulting from control system installation. Repair damaged geomembrane liner in accordance with manufacturer's requirements, at no additional cost to Owner.

B. Construct erosion and sediment control structures prior to site clearing and grubbing operations.

C. Silt Fence.

1. Install fencing at locations indicated or where directed by the Engineer. Maintain pitch of 2 to 20 degrees, with inclination toward potential silt source.
2. Install bottom 6 inches of fabric by trenching and burying the fabric into the notched ground.
3. Drive posts into ground a minimum of 12 inches. Additional care should be taken when installing posts above the geomembrane liner.
4. Locate fabric splices at posts only. Provide 6-inch overlap and seal.

D. Sedimentation Control Hay Bales.

1. Install bales at locations indicated or where directed by the Engineer. Place bales lengthwise with ends tight, abutting one another. Install bales with bindings located on the sides.
2. Entrench bales 4 inches and backfill. Place backfill toward potential silt source.
3. Secure in place with two stakes per bale and insert straw in voids between bales. Additional care should be taken when installing stakes above the geomembrane liner.

E. Catch Basin Insert

1. Inspect after each major precipitation event. Inspect every two weeks if no major rain events have occurred.
2. Remove, clean, and reinstall silt sack when sediment accumulates to half capacity of sack.

F. Pipe Slope Drains and Aprons

1. Install, relocate, and maintain as required to allow work to progress.

G. Temporary Sediment Trap

1. Install were indicated or as directed by the engineer
2. Remove and reinstall as required to allow installation of geomembrane liner and final cover material below trap.

H. Polyacrylimide Erosion Control Blocks

1. Install at locations, and in quantities recommended by the manufacturer.
2. Replace as needed during the duration of the project.

I. Dust Control.

1. Apply water uniformly over the surface when dust becomes a nuisance and when directed by the Engineer.
    a. Apply water from trucks capable of uniform distribution over the surface. Provide suitable devices for positive shut-off and for regulating flow of water.
2. Apply calcium chloride at locations only when directed by Engineer at no additional cost to Owner. Spread calcium chloride by approved devices and methods for uniform distribution.
    a. Engineer shall determine application rate based upon site conditions.
3. Provide sweeping equipment with provisions for water application ahead of sweeping brooms to prevent dusting.

3.3 MAINTENANCE

A. Silt Fence and Bale Control Systems

1. Inspect control system immediately after each rainfall and daily during prolonged rainfall. Make repairs immediately.
2. Remove and dispose of accumulated sediments when sediment reaches approximately one-third the height of the control system, or when directed by the Engineer.
3. Replace control system promptly if fabric decomposes or system becomes ineffective prior to the expected usable life.
4. Maintain or replace system until no longer necessary for the intended purpose.

B. Construction Entrance Pad

1. Maintain in good condition throughout construction period. Clean or replace stone when pad has accumulated sediment.

C. Erosion Control Blanket

1. Repair damaged portions of erosion control blanket until the area stabilizes with new growth or as directed by the Engineer.
2. Spray-Applied Bonded Fiber Mat Alternative: Reapply product to areas damaged by erosion until the area stabilizes with new growth or as directed by the Engineer.

D. Dust Control

1. Keep paved surfaces free of tracked sediment. Sweep adjacent paved areas throughout hauling operations, and at the end of each day's construction operation. Conduct sweeping at locations and times as directed by the Engineer at no additional cost.

3.4 REMOVAL

A. Remove and dispose of control systems off-site after area stabilizes with new growth or as directed by the Engineer.

1. After removal of system, restore disturbed areas to original condition or better.

END OF SECTION

THIS PAGE

IS

INTENTIONALLY

LEFT BLANK

SECTION 31 25 02 - PERMANENT EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Exhibit B General Requirements, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Riprap for swales and protection for drain inlets and outlets including stilling basins.

B. Related Sections include the following:

1. Division 02 Section "Landfill Earth Moving" for excavation and backfill.
2. Division 02 Section "Underdrains" for piped subdrainage systems.
3. Division 31 Section "Site Earth Moving" for excavation and backfill.
4. Division 31 Section "Temporary Erosion and Sedimentation Control" for temporary site measures.
5. Division 33 Section "Storm Drainage" for enclosed, piped drainage systems.

1.3 DEFINITIONS

A. HDPE: High-density polyethylene plastic.

B. NPS: Nominal pipe size.

1.4 SUBMITTALS

A. Product Data and Material Certifications: For the following:

1. Riprap
   a. Origin of material, prior to delivery.
   b. Sample
2. Pipe Outlet bedding material.
   a. Origin of material, prior to delivery.
   b. Gradation according to ASTM D 422 and classification according to ASTM D 2487, prior to delivery and at a rate of one per 5,000 cu. yd.
3. Geotextile fabric.

1.5 QUALITY ASSURANCE

A. Where "Form 816" is referenced, it shall mean "State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Form 816," and issued supplements.

PART 2 - PRODUCTS

2.1 PIPE OUTLETS

A. Riprap: Broken, irregular size and shape, graded stone conforming to Form 816, Section M.12.02, size as indicated.

B. Crushed Stone Bedding Material: Granular fill conforming to Form 816, Section M.02.01-1 or M.02.01-2.

2.2 MISCELLANEOUS

A. Geotextile: Form 816, Section M.08.01-26.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Site Earth Moving."

3.2 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawing plans and details indicate general location of permanent erosion and sedimentation control systems. Lengths are approximate.

3.3 RIPRAP INSTALLATION

A. Place bedding material and geotextile where indicated on accurately shaped subgrade.

B. Construct riprap of broken stone, to the lines and grades indicated. Prevent displacement of bedding material.

C. Place riprap to full course thickness in one layer. Rearrange individual stones by hand or equipment as required to produce a reasonably well-graded distribution of rock, free from pockets of small stones and clusters of larger stones.

D. Place bedding material and filter fabric where indicated on accurately shaped subgrade.

3.4 STORM DRAINAGE INLET AND OUTLET INSTALLATION

A. Construct inlet head walls, aprons, and sides of precast, or cast-in-place reinforced concrete, as indicated.

B. Construct riprap of broken stone, as indicated. Prevent displacement of base material.

C. Place riprap in one layer and rearrange individual stones by hand or equipment as required to produce a reasonably well-graded distribution of rock, free from pockets of small stones and clusters of larger stones.

D. Install outlets that spill onto grade, anchored with concrete, where indicated.

E. Install outlet flared end sections, where indicated.

END OF SECTION

THIS PAGE

IS

INTENTIONALLY

LEFT BLANK

SECTION 32 12 16 – BITUMINOUS CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Bituminous concrete paving.
2. Bituminous concrete patching.
3. Bituminous concrete paving overlay.
4. Bituminous concrete curbing.
5. Precast concrete wheel stops.
6. Pavement-marking paint.
7. Cold milling of existing bituminous concrete pavement.

B. Related Sections include the following:

1. Division 31 Section "Site Earth Moving" for aggregate subbase and base courses and for aggregate pavement shoulders.

1.2 DEFINITIONS

A. Bituminous Concrete Base Course: Asphalt-aggregate layer placed over subgrade, aggregate subbase course, or aggregate base course; and beneath bituminous concrete surface course.

B. Bituminous Concrete Surface Course: The asphalt-aggregate top course of a bituminous concrete pavement, sometimes called a wearing course.

C. DOT: Department of Transportation.

1.3 SYSTEM DESCRIPTION

A. Provide bituminous concrete paving according to materials, workmanship, and other applicable requirements of standard specifications of state or local DOT.

1. Standard Specification: State of Connecticut, Standard Specifications for Roads, Bridges and Incidental Construction, Form 816.
2. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.4 SUBMITTALS

A. Job-Mix Design Certification: For each job mix proposed for the Work, signed by the supplier.

B. Qualification Data: For bituminous concrete supplier.

C. Material Certificates: For each paving material, signed by manufacturers.

D. In-Place Density Testing Reports

1.5 QUALITY ASSURANCE

A. Supplier Qualifications: A qualified supplier, registered with and approved by CT DOT.

B. Regulatory Requirements: Comply with CT DOT Form 816 for bituminous concrete paving work.

C. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.

B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

C. Transport bituminous concrete mixture in tight body trucks that have been previously cleaned of foreign material.

1. Tightly cover trucks with waterproof canvas or other suitable covers.

D. Deliver mixture within 25 deg F of approved job mix formula temperature.

1.7 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum surface temperature of 60 deg F.

2. Bituminous Concrete Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.

3. Bituminous Concrete Surface Course: Minimum surface temperature of 60 deg F at time of placement.

B. Pavement-Marking Paint: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 50 deg F and not exceeding 95 deg F.

PART 2 - PRODUCTS

2.1 BITUMINOUS CONCRETE

A. Materials: Section M.04 and M.05.02 of Form 816.

B. Tack Coat: AASHTO M 140 Grade SS-1 or SS-1H, emulsified asphalt or AASHTO M 208 Grade CSS-1 or CSS-1H, cationic emulsified asphalt, slow setting, diluted in half with water.

2.2 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

B. Waterborne Pavement-Marking Paint:

1. Hot-Applied: Article M.07.21 of Form 816, with a 2 minute drying time.
2. Non-Heat-Applied: Article M.07.20 of Form 816, with a 15 minute drying time.
    a. Color: As indicated.

C. Wheel Stops: Precast, air-entrained concrete, 4000 psi minimum compressive strength. Provide chamfered corners and drainage slots on underside and holes for anchoring to substrate.

1. Dowels: Galvanized steel.

2.3 MIXES

A. Bituminous Concrete: Dense, hot-laid, bituminous concrete plant mixes approved by authorities having jurisdiction and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where Project is located.
2. Course Depth and Class: As indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surface to receive paving is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase or aggregate base course using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 COLD MILLING

A. Utility Structures: Identify, adjust and protect utility structure frames, grates and covers.

B. Clean existing pavement surface of loose and deleterious material immediately before cold milling. Prevent milled pavement particles from entering drainage system. Remove existing bituminous concrete pavement by cold milling to grades and cross sections indicated.

1. Mill to indicated depth.
2. Mill to a uniform finished surface free of gouges, grooves, and ridges.
3. Control rate of milling to prevent tearing of existing bituminous concrete course.
4. Repair or replace curbs, manholes, and other construction damaged during cold milling.
5. Excavate and trim unbound-aggregate base course, if encountered, and keep material separate from milled bituminous concrete.
6. Keep milled pavement surface free of loose material and dust.
7. Clean adjacent roads, parking areas, and grass areas of milled pavement particles.

3.3 REPAIRS

A. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, bituminous concrete paving at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying bituminous concrete paving.
2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

B. Temporary Repair: Fill excavated pavement area with bituminous concrete base mix to indicated thickness and, while still hot, compact flush with adjacent surface.

C. Permanent Repair: Partially fill excavated pavement area with bituminous concrete base mix and, while still hot, compact. Cover bituminous concrete base course with compacted, bituminous concrete surface layer finished flush with adjacent surfaces.

3.4 SURFACE PREPARATION

A. General: Immediately before placing bituminous concrete, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

B. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.05 to 0.15 gal./sq. yd.

1. Allow tack coat to cure undisturbed before applying bituminous concrete paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.5 BITUMINOUS CONCRETE PLACING

A. Machine place hot bituminous concrete on prepared surface, spread uniformly, and strike off. Place by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.

1. Place bituminous concrete base course in number of lifts and thicknesses indicated.

2. Place bituminous concrete surface course in single lift.

3. Spread mix at minimum temperature of 250 deg .

4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.

5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in bituminous concrete paving mat.

6. In areas inaccessible to pavers, use staked forms to maintain indicated line and grade. Prevent segregation of mix when placing mix by hand.

B. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of bituminous concrete base course before placing bituminous concrete surface course.

C. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot bituminous concrete to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 JOINTS

A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of bituminous concrete course.

1. Clean contact surfaces and apply tack coat to joints.

2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.

3. Offset transverse joints, in successive courses, a minimum of 24 inches

4. Construct transverse joints as described in AI MS-22, "Construction of Hot Mix Asphalt Pavements."

5. Compact joints as soon as bituminous concrete will bear roller weight without excessive displacement.

6. Compact material at joints to a density within 2 percent of specified course density.

3.7 COMPACTION

A. General: Begin compaction as soon as placed paving material will bear roller weight without excessive displacement. Compact material with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.

1. Complete compaction before mix temperature cools to 185 deg .

B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while bituminous concrete is still hot enough to achieve specified density. Continue rolling until course has been uniformly compacted to the following density:

1. Average Density: 95 percent of reference maximum theoretical density according to AASHTO T 209, but not less than 92 percent nor greater than 97 percent.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while bituminous concrete is still warm.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while material is still hot; compact thoroughly.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh material. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:

1. Base Course: Plus or minus 1/2 inch.

2. Surface Course: Plus 1/4 inch, no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:

1. Base Course:

a. Roadways and Parking Lots: 3/8 inch.

b. Sidewalks and Driveways: 1/4 inch.

2. Surface Course: 1/4 inch.

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

C. Variation from Design Elevation: 1/4 inch.

D. Curb Alignment: Place curbing to produce an alignment within 1/4 inch tolerance as determined by using a 10-foot straight edge along front face of curb.

3.9 BITUMINOUS CONCRETE CURBS

A. Construct bituminous concrete curbs over compacted pavement surfaces. Apply a light tack coat unless pavement surface is still tacky and free from dust. Spread mix at minimum temperature of 250 deg F.

B. Place bituminous concrete to curb cross section indicated or, if not indicated, to local standard shapes, by machine or by hand in wood or metal forms. Tamp hand-placed materials and screed to smooth finish. Remove forms after bituminous concrete has cooled.

C. Protect curbing for a minimum of 24 hours and until mixture has cooled so as not to become marked.

3.10 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Engineer.

B. Allow paving to age for 30 days before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings, of dimensions indicated, with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils.

3.11 WHEEL STOPS

A. Securely attach wheel stops into pavement with not less than two galvanized steel dowels embedded at one-quarter to one-third points. Securely install dowels into pavement and bond to wheel stop. Recess head of dowel beneath top of wheel stop.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements.

B. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

C. Thickness: In-place compacted thickness of bituminous concrete courses will be determined according to ASTM D 3549.

D. Surface Smoothness: Finished surface of each bituminous concrete course will be tested for compliance with smoothness tolerances.

E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to AASHTO T 168.

1. Reference maximum theoretical density will be determined by averaging results from four samples of bituminous concrete mixture delivered daily to site, prepared according to AASHTO T 209, and compacted according to job-mix specifications.

2. In-place density of compacted pavement will be determined by testing core samples according to ASTM D 1188 or ASTM D 2726.

a. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.

b. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.

F. Remove and replace or install additional bituminous concrete where test results or measurements indicate that it does not comply with specified requirements.

3.13 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an approved landfill.

1. Do not allow excavated materials to accumulate on-site.

END OF SECTION

SECTION 32 15 00 – AGGREGATE SURFACING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Exhibit B General Requirements, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. One course gravel wearing surface (Gravel Access Road).
2. Restoration of existing gravel road or drive as indicated or as directed by the Engineer.
3. Geogrid.

B. Related Sections include the following:

1. Division 02 Section "Landfill Earth Moving" for landfill cap material beneath roadway.

1.3 SUBMITTALS

A. Traffic Bound Gravel Surface Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance with requirements indicated. Prepare separate reports for each type and application of soil material.

1. Gradation according to ASTM D 422 and classification according to ASTM D 2487, prior to delivery and at a rate of one per 5,000 cu. yd.
2. Modified Proctor Testing according to ASTM D 1557, prior to delivery and at a rate of one per 5,000 cu. yd.
3. Origin of material, prior to delivery.
4. Soil Chemical Analysis Reports:

a. RCRA 8 Metals (EPA Method 6010 / 7421 / 7470), Polychlorinated Biphenyls (EPA Method 8082), Total Volatile Organic Compounds (EPA Method 8260), Semi-Volatile Organic Compounds/Polyaromatic Hydrocarbons (EPA Method 8270), Pesticides (EPA Method 8081), and Total Petroleum Hydrocarbons (CTETPH method): prior to delivery and one report for each 10,000 cu. yd., or portion thereof, delivered. Owner reserves the right to disqualify the source based on the results of the chemical testing.

1) Soil/material shall not exceed any GB pollutant mobility criteria (GB PMC) or residential direct exposure criteria (RES DEC) established in

Sections 22a-133k-1 through 22a-133k-3 of the regulations of Connecticut state agencies.

B. Geogrid

1. Material Certification: Signed by manufacturers or suppliers certifying that the material complies with requirements.

2. Shop Drawings: Indicate proposed roll layout and indicate direction of geogrid. Show roll sizes. Include details showing termination of the rolls at perimeter of lined areas; and methods of connecting, overlapping, and anchoring geogrid.

   a. Lay out geogrid to minimize field connections.

3. Sample: One per each lot of geogrid to be used. Label samples with manufacturer's name, product identification, lot number, and roll number.

4. Inventory tickets, roll numbers or batch identifications, packing papers, and invoices.

5. Installation Certification: By installer and manufacturer's Technical Representative, stating the geogrid was installed in an acceptable manner per manufacturer's requirements.

1.4 QUALITY ASSURANCE

A. Form 816: State of Connecticut, Department of Transportation, Standard Specifications for Roads, Bridges and Incidental Construction, Form 816.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Traffic Bound Gravel Surface: Form 816, Section M.02.03, Traffic Bound Gravel Surface.

1. Single Course: Form 816, Section M.02.06, Grading C.

B. Geogrid Reinforcement: Integrally formed bi-axial grid structure manufactured from first quality virgin high-density polyethylene.

Property	Test Method	Requirement
Carbon Black Content (min. percentage)	ASTM D4218	2
Tensile Strength (5% strain)	ASTM 6637	920 lb/ft machine direction
		1,350 lb/ft cross direction

PART 3 - EXECUTION

3.1 EXAMINATION

A. Confirm subgrade is in conformance with Division 31 Section "Site Earth Moving." Maintain subgrade or subbase true to line and grade.

B. Proof-roll subgrade or subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

C. Proceed with surfacing only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stabilization Geotextile: See Division 02 Section "Landfill Earth Moving" for requirements.

3.3 GEOGRID

A. Keep geogrid clean before installation. Unpackage, install and join together only enough geogrid material that can be completely installed in the same day.

B. Provide manufacturer's Technical Service Representative during start of geogrid installation activities.

C. Verify that subgrade is dry and in suitable condition to begin installation of geogrid.

D. Geogrid Installation

1. Install geogrid on prepared surface and in the presence of a manufacturer's Technical Representative. Minimize handling and movement of product. Overlap layers in accordance with manufacturer's requirements.
2. Do not allow materials or equipment to be dragged or travel over installed geogrid.
3. Place overlying materials to prevent damage to geogrid. Install 9 inch minimum layer over geogrid before allowing tracked vehicles to traverse over locations containing the geogrid.

3.4 GRAVEL SURFACE INSTALLATION

A. Spread surfacing material uniformly over geogrid.

B. Spread material to the lines, depth, and shape indicated. If required, wet material and blade, drag, or scrape to conform to typical cross section.

C. Compact to a firm and uniform surface satisfactory to the Engineer. Compact and bound each course of material with equipment specifically designed for compaction.

1. Rollers:

a. Weight: 10 tons minimum.

b. Ground Pressure: Not less than 300 pounds per linear inch of contact width.

2. Vibratory Units: Static weight of not less than 4 tons.

3. Water. Water may be used during compacting and binding operations when applied from an approved watering device. Direction and intensity of water stream shall be as ordered by the Engineer.

D. Perform compacting and binding operation at outside edges, overlapping for a distance not less than 6 inches, and progressing towards the middle of the surfacing area, parallel with the centerline of the road.

E. Remove areas of segregated coarse or fine materials and replace with well-graded material.

1. Provide additional material to fill irregularities in surface course. Evenly incorporate material with in-place gravel by scarifying, harrowing, or brooming.

3.5 RESURFACING

A. Confirm existing surface is in conformance with subgrade requirements in Division 31 Section "Site Earth Moving."

B. Pre-fill ruts with material before installing overlay.

C. Install overlay in conformance with installation requirements specified herein.

3.6 INSTALLATION TOLERANCES

A. Variation from Design Elevation

1. Traffic Bound Gravel Surface: 1 inch plus or minus.

3.7 FIELD QUALITY CONTROL

A. Surface Installation: Measure finished surface for compliance with Installation Tolerances.

1. Course Thickness.

a. Roads, Drives, Walks: Take measurements at intervals of 500 feet or less, along each edge of road lane.

2. If measurements indicate a deficient or excess thickness, take additional measurements to determine the longitudinal limits of the deficiency. Correct areas found to be deficient or in excess of Installation Tolerances.

3.8 REPAIRS AND PROTECTION

A. Protecting Gravel Surfacing Roads and Areas: Protect newly graded roads and areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace material to depth as directed by Engineer; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

END OF SECTION

THIS PAGE

IS

INTENTIONALLY

LEFT BLANK

SECTION 32 31 13.03 - CHAIN LINK FENCE

PART 1 - GENERAL

1.1 SUMMARY

A. Work under this Section shall consist of furnishing and installing woven wire fencing/gates, supported by metal posts, erected where indicated on the Drawings or as ordered, and in conformity with these Specifications.

1.2 QUALITY ASSURANCE

A. Where "Form 816" is used, it shall mean "State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Form 816"and issued supplements.

1.3 SUBMITTALS

A. Submit manufacturer's certification demonstrating compliance with specifications for Chain Link Fence and Gates.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials for this Work shall conform to the requirements of Form 816, Article M.10.05, and shall be aluminum coated steel fabric with galvanized posts, rails and hardware.

PART 3 - EXECUTION

3.1 GENERAL

A. Space posts as indicated.

1. Provide pull posts with two braces for changes in horizontal or vertical alignment of 10 degrees or more.

B. Fasten braces to posts by suitable connections, and truss from line post back to post requiring bracing with 3/8-inch round rod, having a turnbuckle adjustment.

C. Pass top rail through base of line post cap and form a continuous brace from end to end of fence. Provide rail with couplings approximately every 20 feet.

1. Couplings: Outside-sleeve type, 7 inches long minimum, with one in every five couplings having a heavy spring to take up expansion and contraction in top rail.

D. Fasten fabric to line posts with bands or wire clamps of No. 6 gage aluminized steel wire 4-3/4 inches long. Space bands approximately 14 inches apart.

1. Fasten fabric to top and bottom rail with tie wires, 6-1/4 inches long, spaced approximately 24 inches apart.

END OF SECTION

SECTION 33 41 23 - STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Exhibit B General Requirements, apply to this Section.

1.2 SUMMARY

A. This Section specifies enclosed storm drainage system for landfill closure and includes the following:

1. Enclosed, underground piping systems.

B. Related Sections include the following:

1. Division 02 Section "Underdrains" for subdrainage systems.
2. Division 31 Section "Site Earth Moving" for excavation and backfill.
3. Division 31 Section "Permanent Erosion and Sedimentation Control" for exposed drainage swales and outlets.

1.3 DEFINITIONS

A. HDPE: High-density polyethylene.

B. PVC: Polyvinyl chloride plastic.

C. RCP: Reinforced concrete pipe.

D. NPS: Nominal pipe size.

1.4 SUBMITTALS

A. Product Data and Material Certifications.

1. Piping.
2. Precast concrete manholes and other structures.
3. Structure frames, covers, and grates.

B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.5 QUALITY ASSURANCE

A. Where "Form 816" is referenced, it shall mean "State of Connecticut Department of Transportation Standard Specifications for Roads, Bridges and Incidental Construction, Form 816," and issued supplements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not store plastic structures, pipe, and fittings in direct sunlight.

B. Protect pipe, pipe fittings, and seals from dirt and damage.

C. Handle precast concrete manholes and other structures according to manufacturer's written rigging instructions.

1.7 PROJECT CONDITIONS

A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Engineer not less than 2 days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Engineer's written permission.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

A. HDPE: Corrugated PE Pipe and Fittings NPS 12 to NPS 48: AASHTO M 294M, Type S, with smooth waterway for coupling joints.

1. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.2 CONCRETE

A. General: Cast-in-place concrete according to ACI 318, ACI 350R, and the following:

1. Cement: ASTM C 150, Type II.
2. Fine Aggregate: ASTM C 33, sand.
3. Coarse Aggregate: ASTM C 33, crushed gravel.
4. Water: Potable.

B. Portland Cement Design Mix: 4,000 psi minimum, with 0.45 maximum water-cementitious ratio.

1. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

C. Ballast and Pipe Supports: Portland cement design mix, 4,000 psi minimum, with 0.58 maximum water-cementitious ratio.

1. Reinforcement Bars: ASTM A 615/A 615M, Grade 60, deformed steel.

2.3 MISCELLANEOUS

A. Grout: Form 816, Section M.03.01-14.

B. Filter Fabric: Form 816, Section M.08.01-26.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Division 31 Section "Site Earth Moving."

3.2 IDENTIFICATION

A. Materials and their installation are specified in Division 31 Section "Site Earth Moving." Arrange for installing green warning tapes directly over piping and at outside edges of underground structures.

1. Use warning tape or detectable warning tape over ferrous piping.

2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.3 INSTALLATION, GENERAL

A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take design considerations into account. Install piping as indicated, to extent practical.

B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line, and pull past each joint as it is completed.

C. Install gravity-flow piping and terminate piping as indicated.

1. Install piping pitched down in direction of flow, at minimum slope of 1 percent, unless otherwise indicated.

3.4 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. General: Join and install pipe and fittings according to installations indicated.

B. Corrugated PE Piping: Join according to CPPA 100.

C. System Piping Joints: Make joints using system manufacturer's couplings, unless otherwise indicated.

D. Join piping made of different materials or dimensions with couplings made for this application. Use couplings that are compatible with and that fit both systems' materials and dimensions.

3.5 CONCRETE PLACEMENT

A. Place cast-in-place concrete according to ACI 318 and ACI 350R.

3.6 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:
    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.
3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

3.7 CLEANING

A. Clear interior of piping and structures of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed.

1. In large, accessible piping, brushes and brooms may be used for cleaning.
2. Place plug in end of incomplete piping at end of day and when work stops.
3. Flush piping between manholes and other structures to remove collected debris, if required by authorities having jurisdiction.

B. Existing Piping, Culverts, Drainage Flows, and Structures. Clean interiors of drainage systems located within the limits of the Work of accumulated sediment and debris.

END OF SECTION

THIS PAGE

IS

INTENTIONALLY

LEFT BLANK

SECTION 48 14 15 – SOLAR ENERGY ELECTRICITY GENERATION SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Exhibit B General Requirements, apply to this Section.

1.2 SUMMARY

A. This Section includes designing, providing, commissioning and maintaining a complete and operational grid-connected Solar Photovoltaic (PV) electrical generation system as indicated herein and on the Drawings. This includes the following:

1. Designing a complete and operational Solar PV electrical generation system, including:
    a. Design and engineering of a PV Generation System
        1) Selection and integration of system components
        2) Configuration of Sub-array packages
        3) System layout.
        4) D/C electrical distribution system.
        5) Structural design of racking and support systems (as required).
        6) Racking system ballast (as required)
    b. Design and engineering of a "behind the meter" A/C Distribution System
        1) Connecting PV system to required on-site A/C electric distribution system.
        2) Monitoring system
        3) PV-backfed sub-panel.
        4) Main service panel.
        5) Overhead wiring connection.
        6) Above ground conduit with supports and wiring.
2. Providing a complete and operational Solar PV electrical generation system, including:
    a. A number of PV Sub-Arrays, as determined by the Owner
        1) Minimum number of Sub-Arrays: 2
        2) Maximum number of Sub-Arrays: 4

3) Owner shall notify Contractor of their elected number of Sub-Arrays upon issuing Notice to Proceed.

b. On-site A/C Electric Distribution System, including:

1) Above-ground conduit

2) Overhead electrical lines, and associated poles, strain relief, etc.

3) Conduit attached to existing site buildings, as required.

4) Connection of A/C Distribution System to utility interconnection point.

5) Coordination with Utility and compliance with Utility Interconnection requirements.

3. Commissioning and testing of new grid-tied PV generation system.

4. Solar PV System Operation and Maintenance Program

a. The PV System Installer will be expected to enter into a separate agreement with the Owner for the operation and maintenance of the system for a period of five years following system commissioning.

B. Related Sections:

1. Division 02 Section – Closure Turf™ Alternative.

2. Division 02 Section – Exposed TPO Alternative.

1.3 DEFINITIONS

A. A/C Distribution System: Includes but is not limited to the A/C combiner box, A/C disconnect switch, monitoring system components (DAS), and the required A/C service upgrades at the point of interconnection.

B. Delegated-Design Submittals: Documents, including drawings, calculations, and material and product specifications prepared as a responsibility of Contractor to obtain acceptance by Owner and authorities having jurisdiction.

C. PV: Photovoltaic.

D. Sub-Array Package: PV generation system capable of providing 301.84 kW D/C and required components up to the starting point of the A/C Distribution System at the proposed inverter location including but not limited to modules, racking, inverters, and wiring.

1.4 COORDINATION

A. Coordinate with geomembrane capping system manufacturer to ensure that geomembrane liner warranty coverage will be maintained subsequent to installation of PV.

B. Coordinate with Owner on the locations and appearance of all exposed equipment, including but not limited to PV modules, mounting structure, conduit, inverters, wire ways, and control and monitoring equipment.

1. All locations must be approved by Owner before final delegated-design drawings are completed.

2. Obtain Owner's approval of final delegated-design drawings and equipment specifications before ordering equipment.

C. Coordinate with trades needed for a complete installation including all required controls, electrical services, civil work, and clearances.

1.5 SUBMITTALS

A. Delegated-Design Submittal: For PV Generation System, structural support systems, and A/C Distribution System and grid connection, as indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Number of Copies for each element listed below: Six (6).

2. Submittal Contents

a. Design Drawings for construction of PV Generation system:

1) Schematic System Layout: Preliminary PV system configuration, indicating location of major system components.

a) Engineer will provide an electronic project base map in AutoCAD format for use in preparing Layout plans.

b) Obtain approval from Owner before proceeding with final design and layout.

2) Final System Layout: Equipment layout drawing showing location of all PV equipment and conduit runs.

a) Indicate distances, if applicable, of PV system equipment from the nearest property lines and setback lines.

b) Show locations and sizes of all PV equipment, wiring, and conduit

3) One-line Electrical Diagram: Showing all D/C and A/C wiring and related electrical equipment in the PV system.

4) Equipment Schedules: For all major system components.

5) Construction Details: Product specific construction details for the following components, at a minimum:

a) PV Racking system and module attachment

b) Racking system ballast

c) Above-ground conduit supports

d) Conduit connections and joints

e) Concrete-encased conduit duct bank

f) Inverter pad and mounting hardware

g) Utility Pole

h) Weather-head

i) Conduit brackets

j) Building envelope penetration

k) PV Panel configuration

l) System grounding details

b. Design Calculations and System Specifications:

1) Site-specific analysis of shading used to establish system layout

2) Calculation of anticipated system output based on cumulative losses from D/C electrical distribution, A/C electrical distribution, efficiency rating of selected equipment, system orientation and shading

3) Electrical distribution system design calculations for the following:

a) D/C electrical distribution system

b) A/C electrical distribution system

4) System grounding design calculations

5) Wiring requirements, including required conductors and cables and wiring methods

6) Structural design of racking and support systems

7) System Ballast design calculations

8) Structural analysis data and calculations used for pole selection.

c. Product Data: Manufacturer's specification and cut sheets for all equipment, accessories, and monitoring devices.

d. Additional Items: As required by Authorities Having Jurisdiction.

B. Operations and Maintenance Manual: Include operating and maintenance instructions for the system as a whole, performance curves, warranty information, approved shop drawings, recommended and complete parts lists, wiring diagrams, and all other bulletins and brochures pertinent to the operation and maintenance of equipment.

C. As-built Drawings: Include PV Generation System Components on the final project As-Built drawings, specified elsewhere.

1. Submit prior to Substantial Completion.

D. Qualification Data:

1. Professional Engineer: a Connecticut Licensed Professional Engineer with experience and knowledge in the engineering discipline required to perform the specific services required.
2. Testing agency: A testing Laboratory licensed and approved by a state agency to perform the specific quality assurance tests indicated.
3. Installer: Licensed solar or electrical contractor with a NABCEP-certified PV installer on staff.

1.6 QUALITY ASSURANCE

A. Regulatory Agencies:

1. Electric
   a. Comply with utility requirements for interconnection approval and system commissioning.
   b. An interconnection application has been submitted. Amend application as required to accommodate final approved design and equipment.

B. Engineering Responsibility: Preparation of delegated-design submittals and comprehensive engineering analysis by a qualified professional engineer.

C. Work shall comply with all applicable codes; standards; relevant local, state and federal regulations; local authorities; utilities; and manufacturer's instructions/recommendations.

1. All work, including equipment, materials, and installation, shall conform to CT State Building Code, CT State Fire Prevention Code, and CT State Fire Safety Code; editions currently adopted by the authorities having jurisdiction.
2. The minimum requirement of the more stringent code or standard shall govern where more than one code or standard is applicable to any component or condition.
3. Any work at variance with the applicable codes and completed without prior written approval of the Owner shall be corrected as required without additional cost to the Owner.

D. Comply with manufacturer specification, instructions, and recommendations for all equipment and materials.

1.7 WARRANTY

A. System Performance Warranty: Provide minimum 5-year system performance warranty, or longer if required by the state or federal incentive programs in effect at the time of application, against breakdown or degradation of electrical output.

1. System Performance Warranty shall cover all PV Generating System components with breakdown or degradation in electrical output of more than 10 percent of their originally rated electrical output.

2. Warranty shall include full cost to repair and/or replace defective components or systems.

3. The selected proposer is expected to correct any defective materials or workmanship during installation and/or the System Performance Warranty period to the satisfaction of CRRA and without additional cost.

B. Manufacturer's Materials Warranties:

1. PV Modules: 25-year minimum.

2. Solar Inverters: 10 year minimum.

a. The Owner will request that the selected proposer submit additional pricing for solar inverter warranty extensions to 20 years.

3. Racking System Components: 10 year minimum.

PART 2 - PRODUCTS

2.1 EQUIPMENT - GENERAL

A. All materials, fixtures, and equipment required for the work shall be new and shall be furnished, delivered, erected, connected, and finished in every detail, and shall be selected and arranged as to fit properly into the allocated spaces. Where no specific kind or quality of material is given, a first-class standard article as approved by CRRA shall be furnished.

B. All equipment shall be listed and labeled per recognized electrical testing laboratories and installed per the listing requirements and the manufacturer's instructions.

C. All equipment shall be properly grounded per the requirements of the National Electric Code, Article 250.

2.2 PV MODULES

A. Mono- or poly-crystalline 72 cell modules with a capacity rating of 280 watts or greater.

B. All modules shall be supplied by qualified PV manufacturers. Acceptable manufacturers include:

1. SolarWorld

2. Suntech

3. SunPower

4. Trina Solar

5. Yingli Solar

6. Canadian Solar

7. Or approved equal

C. Substitute module sizes and technologies (including flexible thin film) will be considered, so long as they meet the requirements of an investment grade technology.

2.3 SOLAR INVERTER

A. 250 kVA inverters with or without transformers that output at 480V. All inverters shall be IEEE 929 compliant, listed to UL Standard 1741, and inspected by utility before commissioning, testing, and operation of system.

B. Acceptable inverter manufacturers include (but are not limited to):

1. Advanced Energy (PV Powered and Solaron)
2. PowerOne
3. SMA
4. Or approved equal.

2.4 RACKING SYSTEM

A. Required for crystalline PV systems. Provide ballasted (non-penetrating) system with a nominal module tilt of 30 degrees.

1. Racking system design must be compliant with exposed geomembrane manufacturer's material and landfill design and grading.
   a. Constructed of galvanized structural steel or aluminum.
   b. The racking system design shall be adjustable to accommodate landfill settling overtime:
      1) Module tilt: adjustable over a range of 25-35 degrees from horizontal
      2) Vertical alignment: adjustable over a range of minus two 2 inches to plus two inches from initial installation.
      3) Provide a minimum 0.5-inch spacing between PV array modules.
   c. A sacrificial geotextile is required under racking system touch points to satisfy geomembrane manufacturer requirements.
2. Acceptable racking system manufacturers include:
      1) Panel Claw
      2) PV Hardware
      3) Schletter
      4) Sunlink
      5) Unirack
      6) Or approved equal

3. Additional tilts and racking configurations such as flexible thin-film laminates will also be considered.

2.5 MONITORING SYSTEM

A. Inverter-level monitoring components, including a weather station, and a 5-year renewable subscription providing web-based performance data on the PV system.

1. Monitor the following system parameters, at a minimum:
   a. Current System Status
   b. Instantaneous system output ($kW_{A/C}$)
   c. Cumulative system output (kWh)
   d. Graphical representation of daily, weekly, monthly and yearly system output
   e. Cumulative system environmental benefits: Avoided emissions of CO_2, NOx and SO_2
   f. Current ambient temperature
   g. Current solar irradiance levels
2. Acceptable monitoring system manufacturers include:
   a. Deck
   b. Draker Labs
   c. Energy Recommerce
   d. Solar Magic
3. Display Monitor: Provide and install a minimum 42-inch high-definition (1080p), energy star certified, LCD computer display in the CRRA Trash Museum showing real-time data from the monitoring system.
   a. Panasonic TH-42LF25U
   b. Sharp LC42D69U
   c. LG 42LV5500
   d. Sony KDL-42V4100
4. A computer capable of running a web interface for the selected monitoring solution shall also be provided and installed as inconspicuously as possible.
5. Provide all equipment and connections for PV system monitoring, including a 5-year renewable subscription providing web-based performance date on the PV system. A weather station must also be included in the monitoring package.

2.6 A/C DISTRIBUTION SYSTEM

A. Includes but is not limited to the A/C combiner box, A/C disconnect switch, conduit, conductors, and the required A/C service upgrades at the point of interconnection.

B. Provide conduit(s) between the main electrical service panel location and the PV array site.

1. Conduit shall be minimum 2" rigid metal
2. Installed with pull wires, fittings and weatherproof caps that facilitate easy pulling of wires in the future when the PV system is serviced.

C. Provide a PV backfed breaker in an oversized main service panel

D. Include the installation of ground fault protection devices suitable for PV systems.

PART 3 - EXECUTION

3.1 LINER SYSTEM PROTECTION

A. Prevent damage to the geomembrane cap system during installation of the PV System.

1. Geomembrane Installer shall inspect geomembrane system with in the presence of the PV Installer prior to commencement and after the completion of the PV System installation.
   a. Take photographs of any areas in questions and document each location with suspected damage.
2. The Contractor shall be responsible for all damage from leaks or breaks in equipment, ductwork, pipes or fixtures caused by their work on site during construction. The Contractor will also be responsible for all damages caused by leaks or breaks in new materials installed under this specification for the duration of the System Performance Warranty period.

B. Correct damages to the satisfaction of Owner at no additional cost.

3.2 PERMITS, FEES, TRANSPORTATION AND INSPECTIONS

A. The selected proposer shall give all necessary notices, obtain all permits, and pay all government sales taxes, fees and other costs, including utility connections or extensions, in connection with this work; file all necessary plans, prepare all documents and obtain all necessary approvals of all governmental departments having jurisdiction; obtain all required certificates of inspection for this work and deliver same to the Owner before request for acceptance and final payment for the work. Construction cannot begin until the proper permits and approvals have been obtained and posted.

B. The selected proposer shall include in the work, without additional cost to CRRA, any labor, materials, services, transportation, disposal, apparatus, and drawings needed, in order to comply with all applicable laws, ordinances, rules and regulations, whether or not shown on drawings or specified.

3.3 INCENTIVE PROGRAMS

A. As necessary and upon receipt of final inspection approval, the selected proposer shall assist CRRA in immediately filing all forms and paperwork required to claim any relevant state and local incentives.

3.4 PV SYSTEM DESIGN CRITERIA

A. General

1. The Drawings indicate the general equipment locations and sizes for the major PV system equipment. Comply with these criteria and incorporate these parameters into the proposed design. Obtain approval before altering any of the criteria set forth in these performance specifications or the Drawings.
2. Provide access to equipment for maintenance and service as required by the manufacturer's instructions and/or applicable codes.
3. The following components shall comply with NEC Article 690:
    a. Over-current protection
    b. Interconnection to the utility grid
    c. Panel bussing
    d. Labeling
    e. Conductors
4. If equipment cannot be properly concealed, notify CRRA. Any patching and cutting done as a result of error or neglect on the part of the Contractor shall be done at the expense of the Contractor.
5. Attachments: Support all work adequately and per code. All equipment shall be securely attached to structures in an approved manner. Attachments shall be of a strong and durable nature.
6. Shoring: Provide permanent and temporary shoring, anchoring and bracing required by the nature of this work in order to make all parts absolutely stable and rigid, even when shoring, anchoring and bracing are not explicitly called for.
7. Training: Instruct the Owner's personnel regarding operation and maintenance of PV equipment and apparatus.
8. Keep work areas in a clean and safe condition. Remove all equipment, tools, vehicles, rubbish, waste, and debris from the site upon completion of the job. Pay fees for recycling and disposal.

B. System Operation

1. When sufficient sunlight and the electrical grid are both present and the solar array is thus operational and generating power, solar power output is used to run A/C loads on site and provide excess generation to the grid (in this order of priority).

2. Any serviced electrical loads will be powered directly by the solar array with any excess power flowing back to the grid, spinning the bidirectional meter backwards, and crediting the respective electric account via net metering regulations (as per the State of Connecticut's net metering laws). Any net excess generation accumulated on an annual basis will be treated as per these same regulations.

3. When the electrical load on site exceeds the solar output, then the grid supplies the balance seamlessly.

4. The PV system shall be anti-islanding. If the utility grid fails, the solar power output also ceases. No power is available until grid power returns. When utility power returns, the system automatically switches back to normal grid-intertie mode, and solar power production resumes.

C. Individual PV System Sub-Array Packages. Each package includes the following:

1. PV Modules

a. 280-Watt D/C STC rated, 72 cell, PV crystalline modules tilted at 30 degrees, arranged in a grid as approved by the Owner, with the long dimensions of the modules parallel with long dimensions of the array (i.e. landscape).

b. Other module arrangements, tilts, and sizes, including laminate thin-film modules, will be considered.

c. Locate the PV array approximately as indicated on the Drawings on the graded landfill plateau.

d. Measure shading effects from any potential sources of shade and evaluate in order to determine optimum location for modules.

1) Group strings and arrange system components so that no modules are shaded between the hours of 9 am – 3 pm solar time on the winter solstice.

e. Arrange in appropriate series strings for optimum inverter performance.

f. Independently protect each series string of PV modules with an isolation fuse or breaker before it is connected in parallel with other string(s) on that PV output circuit.

1) The current rating of this isolation fuse or breaker shall be less than the de-rated ampacity of the wiring that it is protecting and greater than 1.56 times the short circuit current rating of the PV modules in that PV source circuit.

2) Isolation fuses shall also be rated no greater than the modules series fuse rating.

2. Solar Inverter: 250 kVA rated solar inverter, installed on a concrete pad adjacent to the landfill service road as indicated.

3. Wiring:

a. All D/C conductors shall be sized such that there is a maximum of 1.5% voltage drop measured at the short circuit current rating of that circuit over the entire length of each circuit from PV module to inverter and back to PV module.

b. Hide wiring from view and locate wiring beneath modules where possible.

D. A/C Distribution System

1. All A/C conductors shall be sized for a maximum of 2% voltage drop measured at the continuous A/C current rating of the inverter between the inverter and the point of interconnection with the grid.

3.5 TESTING AND INSPECTION

A. Inspection of Concealed Work. Notify Owner a minimum of 5 days before covering work that will be concealed.

1. Do not proceed with covering of work until Owner has completed inspection.

B. Before starting or operating system, check continuity of all conductors and grounding conductors to verify that there are no faults and that all equipment has been properly installed. Check factory instructions to see that installations have been made accordingly. Check equipment for any damage that may have occurred during shipment, after delivery, or during installation; repair damaged equipment or replace with new equipment of like kind. Megger testing on the insulation of all conductors must also be performed prior to system operation.

C. Before starting or operating the system, obtain a final inspection approval from the local Building Department and final inspection approval from the interconnecting utility. Coordinate and attend both of these inspections.

D. Once building department and interconnecting utility final approvals have been received, the Contractor shall test all equipment to ensure specified capacity and performance of the system. The Contractor shall notify CRRA a minimum of 5 days prior to the test so that a representative may witness the test. The Contractor shall replace or revise any equipment, systems, or work found deficient during the test.

E. Make final adjustments to all inverters and monitoring equipment for acceptable operating condition. Adjustable parameters shall be set so that the PV system will produce the maximum possible amount of energy on an annual basis.

3.6 OPERATION AND MAINTENANCE (O&M) SERVICE

A. Provide ongoing O&M service for the installed solar system for a total of 5-years. Include the following services:

1. PV Modules & Mounting System:

a. Visually inspect modules for damage and corrosion

b. Inspect tightness of modules and fasteners in mounting system

c. Visually inspect mounting system (including ballast and synthetic turf area) for signs of damage and/or degradation

d. Note any shading issues or concerns

2. Inverters:

a. Perform IR/temperature checks on all breakers, fuses, connections, and associated controls

b. Tighten all connections as necessary

c. Check condition of A/C and D/C surge suppressors

d. Test operation of all safety devices

e. Physically exercise all switches and disconnects for proper operation and position

f. Clean interior of inverters removing dust and debris from heat sinks and air vents

g. Replace air filter elements (according to Manufacturer's Specifications)

h. Visually inspect fittings and cables for tightness and corrosion

i. Visually inspect all internally mounted equipment

j. Conduct other inverter maintenance per manufacturer requirements

3. Combiner Boxes:

a. Visually inspect fuses

b. Check the tightness of all wiring connections as well as the fuse holder and grounding buss

c. Check tightness of conduit fittings and combiner enclosure

4. Wiring:

a. Visually inspect all wiring for wear, corrosion, and strain

b. Check all connections, both A/C and D/C, for tightness

c. Verify all labeling for correctness

d. Measure and record positive and negative D/C connections with reference to neutral

e. Check polarity of each home run circuit

5. Monitoring System & Weather Station:

a. Visually inspect all sensors and meters for signs of damage and/or corrosion

b. Physically exercise all switches and disconnects for proper operation and position

c. Check all outdoor enclosures for weather tightness

6. Full System:

a. A re-commissioning test should be completed once per year

B. All Operations and Maintenance tasks listed above shall be conducted by a qualified and licensed electrical contractor or solar professional.

C. After annual inspection, provide written report with results of tests and with photographs documenting areas of potential concern and areas requiring immediate action/repair.

END OF SECTION

Stormwater Pollution Control Plan

Connecticut Resources Recovery Authority
Hartford Landfill
Hartford, Connecticut

July 2006

Revised January 2007

FUSS & O'NEILL
Disciplines to Deliver

146 Hartford Road
Manchester, CT 06040

STORMWATER POLLUTION CONTROL PLAN
Connecticut Resources Recovery Authority
Hartford Landfill - Hartford, Connecticut
July 2006

TABLE OF CONTENTS

FIGURES

ATTACHMENTS

1.0 INTRODUCTION

The Connecticut Resources Recovery Authority (CRRA) is performing landfill closure activities for the Municipal Solid Waste/Interim Ash Disposal Area (the "MSW Area") of the Hartford Landfill located at 185 Liebert Road in Hartford, Connecticut. This project is a "construction activity" in accordance with the "General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities," dated October 1, 2002 (modified on April 8, 2004). A copy of this general permit and registration is included in Attachment A. This stormwater pollution control plan was prepared as required by the general permit. The purpose of this plan is to specify the erosion and sedimentation control requirements, both during and after construction. Erosion and sedimentation control requirements are also shown on the Drawings for this project.

During construction, the contractor shall be responsible for implementing all elements of the erosion and sedimentation control measures as defined on the Drawings and in this stormwater pollution control plan. After construction, the Owner shall be responsible for maintaining these erosion and sedimentation control measures. Throughout the construction process, the Owner or Owner's agent shall periodically inspect all erosion control measures. A copy of the inspection form to be used is provided in Attachment B. This project will not be considered complete until all disturbed areas have been satisfactorily stabilized, all erosion has been repaired, and all temporary erosion control measures have been removed.

The general contractor and subcontractor will be required to sign the certification statement provided in Attachment C of this plan.

2.0 SITE DESCRIPTION

2.1 Project Description

The MSW Area of the Hartford Landfill occupies approximately 80 acres of an approximately 124 acre parcel in the north meadows section of Hartford, Connecticut (Figure 1). Sixteen acres of the parcel, located immediately north of the 80-acre MSW Area, was developed as a lined ash landfill in 1998 (Phase I Ash Disposal Area). The remaining area is occupied by site facilities (e.g., Scale House, Maintenance Garage, etc.) on the southerly portion of the parcel and undisturbed land to the north of the Phase I Ash Disposal Area.

Access to the landfill is off of Jennings Road (Exit 33 off of Interstate 91) with a turn onto Leibert Road, heading north, into the south end of the landfill. The landfill parcel is bounded on the south by the City of Hartford Department of Public Works facility; on the west by Interstate 91; on the north by Weston Street and the Army Corps of Engineers (USACE) Flood Control Dike (herein referred to as the "USACE Dike"); and on the east by the USACE Dike.

Buildings and structures located on the site include the scale house, vehicle maintenance facility, leachate pre-treatment facility, vehicle wheel wash facility, groundwater pumping system control building, leachate storage tank and landfill gas blower/flare station. Site utilities include:

- Storm sewers along the southern boundary of the landfill
- Water lines servicing the onsite buildings and fire hydrants

- Overhead and underground electric lines servicing the onsite buildings and the landfill gas-to-energy plant, the ash leachate collection and treatment system and the groundwater flow control system

- A 36-inch water main that enters the site from the south near the vehicle maintenance facility and then heads west across the south side of the site and crossing Interstate 91.

- A sanitary sewer line servicing the on-site buildings at the south end of the site that also crosses Interstate 91

- Leachate force main piping from the ash disposal area to the leachate storage tank at the southeast corner of the site and from the tank to the leachate pre-treatment facility

- Wastewater conveyance piping from the vehicle wheel wash facility to the leachate storage tank

- Sanitary sewer piping from the leachate pre-treatment facility to the sanitary sewer in the cul-de-sac of Leibert Road

- Two below grade sediment settling tanks, two oil water separators, and three condensate storage tanks

- Above ground fuel tanks near the leachate pre-treatment facility and the vehicle wheel wash facility

- A condensate force main and air line from the landfill gas flare running along the southerly slope of the landfill to a condensate pump station near the Leibert Road cul-de-sac

CRRA is currently finalizing a Closure Plan for the landfill that assumes closure will occur in three phases. A tentative closure construction schedule has been estimated assuming CTDEP authorization is received and construction documents can be prepared during 2006. In the spring of 2007, Phase I construction is expected to begin and to be completed before winter 2007-2008. While Phase I construction is taking place, waste will continue to be received on the east slopes of the landfill. The Phase II area is expected to be ready for closure for the 2008 construction season and should be completed during the 2008 construction season. Waste will no longer be received at the landfill after December 31, 2008. Therefore, closure construction of Phase III is expected to take place during the 2009 construction season.

This construction schedule is tentative. There are many factors, such as weather conditions, which may affect the proposed schedule. CTDEP will be kept apprised of changes in schedule as they become necessary.
Erosion control measures were designed in accordance with the 2002 edition of the "Connecticut Guidelines for Soil Erosion and Sediment Control" (CT DEP bulletin 34) as published by The Connecticut Council on Soil and Water Conservation in cooperation with the Connecticut Department of Environmental Protection. We have provided installation details

and detailed erosion and sediment control notes in the plans. These notes are in accordance with DEP Bulletin 34.

2.2 Area of Disturbance

The general intent of the landfill closure grading plan is to promote rapid runoff of stormwater while simultaneously preventing erosion. On the top of the landform, stormwater is allowed to run off as sheet flow. This sheet flow is intercepted and channelized on the steeper side slopes in order to minimize erosion. The end result is the creation of a stable, mounded landform that will maximize surface water run-off and minimize infiltration, which, in turn, reduces the potential for leachate generation.

The total disturbed area within the project site will be approximately 80 acres. The following table summarizes the disturbed areas and their drainage characteristics:

Description	Drainage Characteristics	Area
Western Side of Landform	Sheet flow until intercepted by swales, then conveyed by channels and culverts to ConnDOT drainage channel.	41 Acres
Eastern Side of Landform	Sheet flow until intercepted by swales, then conveyed by channels and culverts to USACE Dike drainage ditch.	46 Acres
Northern End of Landform	Sheet flow until intercepted by swales, then conveyed by channels to the wetlands area North of the landform.	1.5 Acres

2.3 Landfill Cap Underdrain

The landfill final cover has been designed pursuant to State of Connecticut Solid Waste Regulations. The cap structure consists of a cap base material layer, a barrier layer, and a drainage /barrier protection layer. The structure is discussed in detail in the Closure Plan, and details of the drainage layer are reproduced herein.

The composite drainage layer, consisting of a bi-planar high-density polyethylene (HDPE) drainage net with a non-woven polyester or polypropylene geotextile bonded to both sides of the net, will be placed over geomembrane on 3H:1V slopes to serve as the drainage medium for water that infiltrates through the overlying layers of the landfill cap. At the cross-slope diversion swales, spaced at approximately 100-foot intervals on the 3H:1V side slopes, four-inch slotted polyethylene tubing will be installed directly below the centerline of the swales to intercept subsurface water flowing on top of the geomembrane. This pipe system will further protect against destabilizing head build-up on top of the geomembrane. Due to the importance of maintaining the stability of the 3H:1V slopes, both the Hydrologic Evaluation of Landfill Performance (HELP) model and additional subsurface drainage composite flow calculations were performed to assess whether or not unconfined flow conditions will be maintained on the steep side slopes.

2.4 Stormwater Discharge Information

Currently, precipitation that falls on the landfill property flows in three general directions as described below:

- Stormwater falling on the western half of the landfill flows west to the western toe of slope. It is then conveyed south and discharges to a rectangular concrete channel owned by the Connecticut Department of Transportation (ConnDOT). Flow within the channel continues generally south, eventually reaching North Meadows Pond. The total upland area discharging to the ConnDOT channel is approximately 41 acres.

- Precipitation falling on the Eastern half of the landfill flows east until it is intercepted by one of several existing riprap and concrete channels. These various channels convey the stormwater toward the southeast corner of the property where it discharges to a vegetated drainage ditch that ultimately enters North Meadows Pond. The total upland area discharging to the vegetated ditch is approximately 46 acres.

- A very small area in the northwestern portion of the landfill drains to the north and into a heavily vegetated wetlands area. Flow from this wetlands area outlets to Weston Brook where it is conveyed to North Meadows Pond via MDC storm piping. The total upland area discharging to the wetlands is approximately 1.5 acres.

The proposed final landform will not substantially alter the drainage patterns described above. Only slight adjustments to the relative drainage areas will result from closure. However, due to the improved drainage characteristics of the proposed cap, total runoff volume and peak flow rates are expected to increase. Several existing drainage features will be replaced or upgraded during closure in order to accommodate these increased flows and several new permanent drainage features such as underdrains, swales, and storm piping will be added. All proposed drainage features have been engineered to safely convey a 25-year/24-hour storm event.

Because closure of the landfill will affect the volume of stormwater discharged to off-site drainage systems, Fuss & O'Neill analyzed the capacity of these systems to receive the additional flow. Both the ConnDOT drainage channel and the vegetated ditch are designed with significant storm storage capacity. Hydraulic analysis of these structures indicates that they would fully contain the total run-off volume from a 25-year/24-hour storm event from the landfill even if the outfalls were completely blocked. Therefore, the increased flow from the landfill will not adversely affect off-site drainage.

Drainage calculations used to size permanent stormwater drainage features are provided in Appendix D.

2.5 Receiving Waters

All stormwater runoff from the Landfill eventually flows into North Meadows Pond. The North Meadows Pond and Pump Station is part of the Greater Hartford Flood Control System. Under normal conditions, the pond drains by gravity to the Connecticut River. During flood events, the pump station pumps water from the pond into the Connecticut River to prevent flooding inside the USACE Dike.

The Connecticut River located to the east of the subject site is classified as SC/SB. Decker's Brook and Meadow Brook are both located north and upgradient of the landfill. Decker's Brook classification status is not shown on the maps likely because it is too small to classify. It is therefore assumed to be SA. Meadow Brook is classified as SC/SB.

The North Meadows Pond that is located south of the landfill, is a tributary to a much larger watershed than just the landfill, and is classified as B/A.

3.0 CONSTRUCTION SEQUENCE

While the majority of the landfill has reached final elevations and is ready for capping, the southeast corner and east side of the landfill will continue to receive waste until final grades are achieved. Therefore, the closure will be phased to allow closure of portions of the landfill while other portions continue to receive waste. The west and south sides of the landfill will be closed first as Phase I. Because the access road to the top of the landfill must remain open through construction, the new proposed access road will be constructed on the Phase I area prior to completing closure construction. This will allow construction and landfill traffic to continue with minimal interruption. A road construction detail is included in the project Drawings. Phase II will then be closed and tied into the completed Phase I cap system. The Ash Disposal Area is not a part of the closure plan for the MSW Area and will be closed under a separate closure plan. An estimated construction timeline is presented below:

Description	Estimated Start Date	Estimated Completion Date
Receive CTDEP Permits	4/1/07	4/1/07
Phase I Construction	7/1/07	6/30/08
Phase II Construction	7/1/08	6/30/09

Within each phase of construction, three main activities will occur in a sequential fashion:

- rough grading and cap base preparation
- geomembrane liner installation
- and cover soil placement and stabilization

Area of disturbance associated with rough grading and base preparation will be limited to no more than 10 acres prior to placement of geomembrane liner. Similarly, area of installed cover soil will be limited to no more than 10 acres prior to installation of stabilization measures (e.g. erosion control blanket or straw mulch).

4.0 CONTROLS

The following paragraphs address the controls and measures to be implemented on this site both during and after construction to minimize stormwater pollution to the waters of the State of Connecticut.

4.1 Erosion and Sediment Controls

The goal of this plan is to control erosion on the site and to control movement of sediment into adjacent wetlands, watercourses or storm sewer systems. Note that erosion and sediment

controls shall conform to the requirements of the "Connecticut Guidelines for Soil Erosion and Sediment Control," dated May 2002, which will hereafter be referred to as the "Guidelines."

Permanent on-site retention/detention of stormwater is not proposed for this landfill for two primary reasons. First, upland areas are almost exclusively vegetated. Only the paved access road and existing parking areas will be impermeable. Once vegetation has been established, down-gradient sediment migration will be minimal. Second, site constraints limit the available space to locate a basin. Construction of a basin on the property would require either taking of wetlands, relocation of substantial quantities of waste, or altering the drainage of the adjacent USACE Dike. None of these alternatives are deemed to be prudent or practicable.

Stormwater flows from impervious surfaces will be treated with "best management practices" during construction (e.g., silt sacks, hay bales, etc.). When construction is complete, sediment from impervious areas is expected to be negligible and additional treatment should not be required. CRRA will continue to monitor stormwater discharges as required by the "General Permit for the Discharge of Stormwater from Industrial Activities". If monitoring results indicate additional treatment is required to meet applicable stormwater quality standards, appropriate measures will be taken.

To meet the goals of stabilization, structural and maintenance practices shall be implemented by the Contractor as outlined below.

4.1.1 Stabilization Practices

Both temporary and permanent stabilization practices shall be implemented throughout the project to minimize erosion of soil from the disturbed site. Temporary and permanent stabilization measures are proposed to provide protection against erosion both during and after construction. When construction activities have permanently ceased or have been temporarily suspended for more than thirty days, or when final grades are reached in any portion of the site, stabilization practices shall be implemented within seven days.

The stabilization practices to be implemented during the construction of the proposed development are as follows:

- **Grading sequence** - Construction activities will generally commence from a point on the landfill furthest from the final stormwater discharge. This process will allow sediment to be transported downgradient by stormwater to be controlled within the existing drainage features. In addition, newly installed features will not be subject to heavy siltation because up-gradient surfaces will have been stabilized.

- **Limitation of Disturbance** – Disturbed earth surfaces will be limited to no more than ~~10~~ 5 acres before liner installation and no more than ~~10~~ 5 acres of un-stabilized final cover soil.

- **Temporary Vegetative Cover** – All exposed areas that will be inactive for more than 30 days, or 15 days for stockpiles, and have not yet reached finished grades shall receive a temporary vegetative cover during the planting season of March 15 to October 1. Note that planting between June 15 and August 1 will require watering as necessary to

promote growth. This temporary vegetative cover shall consist of perennial rye grass. The rye grass shall be planted at a rate of 1 pound per 1,000 square feet. Also, fertilizer shall be applied at a rate of 7.5 pounds per 1,000 square feet of 10-10-10 or equivalent and limestone shall be applied at a rate of 45 pounds per 1,000 square feet. Seed bed preparation and seeding shall be conducted as outlined in the "Guidelines."

- **Temporary Mulching –** Temporary mulching shall be used to temporarily stabilize areas that will be inactive for 30 days or more, or 15 days for stockpiles, and cannot be seeded within the recommended planting dates. In addition, temporary mulching shall be conducted immediately following temporary or permanent seeding in order to aid the growth of vegetation. Temporary mulch shall consist of straw or hay overlay applied at a rate of 70 to 90 pounds per 1,000 square feet (two tons per acre). This mulch shall be spread uniformly by hand or mulch blower and shall be bonded with a non-asphalitic tackifier or other approved method immediately after spreading.

- **Permanent Vegetative Cover** – Once the planting season begins, temporary stabilization measures shall be removed and slopes shall be prepared and seeded. Seeding shall only occur between April 1 and June 1 and August 15 and October 15.

- **Vegetative Cover Irrigation –** A temporary irrigation system shall be installed on side slopes to allow watering without operating equipment on steep areas. The contractor will be responsible for designing, installing, and maintaining the temporary irrigation system throughout the duration of the project. The contractor must also monitor the system and shut it down, as necessary, to prevent excess water from running off the landform or causing erosion.

4.1.2 Structural Practices

Structural practices shall be implemented to control the movement of sediment and minimize any discharge of pollutants from the site. The structural practices to be implemented during construction are as follows:

- **Filtration barriers** - Silt fence or hay bales will be installed at the base of incomplete or disturbed slopes. Silt fence is generally recommended for this application, but hay bales may be used in lieu of silt fence when areas are to be disturbed for less than sixty days. The silt fence and hay bales will reduce down gradient siltation by acting as sediment filters. These filters will remove sediment transported by sheet flow from stormwater runoff.

- **Alternative Filtration Barrier –** If conventional filtration barriers discussed above and depicted on the project drawings prove impractical or infeasible to install, alternative filtration barriers may be installed. These alternative systems may include Ecoberm™, SiltSoxx®, or other products.

- **Anti-Tracking Aprons**: To prevent soil or sediment from being carried off site by construction equipment, anti-tracking aprons will be installed before construction traffic into and out of the project area begins. The width of the anti-tracking apron shall not

be less than the width of any ingress or egress. Adjacent roadways shall be swept daily to remove any material that may be tracked onto pavement.

- **Diversion Swales** - Earthen swales will be constructed on the side slopes of the landfill to intercept sheet flow. These channels are graded with a slope of four percent to allow rapid drainage without developing erosive velocities. The swales have been sized to maintain freeboard in accordance with the "Guidelines" while conveying the peak discharge from the design storm.

- **Permanent Erosion Control Matting** - This non-biodegradable, flexible channel lining will be installed in diversion swales to reinforce vegetative cover and minimize the potential for erosion.

- **Erosion control blankets** - Erosion control blankets, or equivalent protection, will be installed on all landfill side slopes exceeding 10%, after placement of final cover, to minimize erosion and allow growth of permanent vegetative cover. These controls also retain soil moisture and modify soil temperature to further enhance growth.

- **Mulch for Seed –** Straw mulch will be installed on all disturbed surfaces with slopes not exceeding 10%, after placement of final cover, to minimize erosion and allow growth of permanent vegetative cover.

- **Grouted Riprap Downchutes** - Downchutes will collect the flow from diversion swales and underdrains and convey it down the side slopes of the landfill.

- **Impact Basins** - Cast-in-place concrete impact basins will be constructed at the bottom of each downchute to safely dissipate the energy of the rapidly flowing water. The impact basins serve the same function as the more commonly used energy dissipater, but will fit within the restricted space available on-site.

- **Temporary Diversions and Slope Drain** - In order to minimize the volume of runoff flowing over the steeper side slopes of the landfill, a temporary diversion and slope drain system will be placed at the top-of-slope to minimize surface run-on to disturbed areas. The temporary diversions will include silt fence backed by haybales and sandbag diversion berms for installation directly on top of the liner. These diversions will be relocated and replaced as necessary during various stages of construction to permit installation of the proposed cap. Diverted stormwater will be conveyed to the toe of the slope through temporary slope drains.

- **Temporary Sediment Traps** – Temporary Sediment Traps (TST) shall be installed at the downstream ends within the toe-of-slope drainage ditches located on both the east and west sides of the landfill.

- **Flocculation Enhancing Polyacrylimide Blocks – Floc-**Logs® or similar products will be installed in toe of slope drainage ditches to assist in the treatment of suspended solids and pollutants. Block formulation will be specified based on site specific stormwater chemistry.

4.1.3 Maintenance

The erosion and sediment controls must be maintained in a condition that will protect the resource areas from pollution during site construction. The Contractor shall conduct the following maintenance to ensure the proper performance of erosion and sediment control measures.

- **Temporary and Permanent Vegetation**: At any eroded areas, repair by filling to finished grades, replace vegetative support material and seed, fertilize and lime, as specified for temporary and permanent stabilization. Add additional mulch as required.

- **Temporary Mulching**: Where erosion is observed additional mulch should be applied. If it is determined that straw mulch is not providing adequate erosion protection to a disturbed area, the Engineer will direct the contractor to install cellulose fiber mulch, erosion control blanket, or other stabilization measure.

- **Filtration Barriers**: Inspect silt fence and haybales immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately. Should the barrier decompose or become ineffective while it is still needed, the barrier shall be replaced promptly.

  Sediment deposits should be removed when they reach approximately one-half the height of the barrier. Sediment shall be disposed of on-site as non-structural fill. Any sediment deposits remaining in place after the barrier is no longer required shall be removed and placed in a stockpile surrounded by silt fence in a location suitable to the Owner.

- **Swales, Downchutes, and Impact Basins**: Remove accumulated sediment from the affected area when sediment reaches a depth of 6 inches. Use removed sediment to complete non-structural fill areas during project. Once the site has been stabilized, sediment removed at the end of construction shall be stockpiled on-site, surrounded by silt fence, in a location approved by the Owner.

4.2 Dewatering Wastewaters

Should excavation dewatering become necessary for this project, there shall be no discharge directly into wetlands, watercourse, or storm sewer structures. Proper methods and devices shall be utilized to the extent permitted by law, such as pumping water into a temporary pumping settling basin, providing surge protection at the inlet and outlet of pumps, floating the intake of the pump, or other methods to minimize and retain the suspended solids. If a pumping operation causes turbidity problems, the operation shall cease until feasible means of controlling turbidity (e.g. discharge to the sanitary sewer) are determined and implemented.

4.3 Post-Construction Stormwater Management

At the end of construction, all areas disturbed by construction activities shall be stabilized. As a result, the potential for erosion at this site after construction is minimal. Grassed areas will also

serve as a filter to remove any sediment from runoff if permanently stabilized areas are properly maintained.

The goal of the post-construction stormwater management is to remove 80% of the total suspended solids from the stormwater runoff.

After all areas are stabilized, catch basin inserts will be cleaned and reinstalled. Periodic inspection of the inserts will be done in conjunction with the inspections performed in accordance with the existing General Permit for the Discharge of Stormwater Associated with Industrial Activities (No . GSI000500).

4.4 Other Controls

4.4.1 Vehicle Tracking and Dust Control

As shown on the plans, two temporary anti-tracking aprons shall be installed and maintained to prevent vehicles from tracking sediments onto city roads. The Contractor shall provide water or calcium chloride as necessary to control dust from construction activities.

5.0 INSPECTION

The Owner or the Owner's agent shall inspect disturbed areas of the construction activity that have not been permanently stabilized, structural control measures, drainage control facilities including diversion and perimeter drainage ditches, and locations where vehicles enter or exit the site at least once every seven calendar days and within 24 hours of the end of a storm that generated 0.1 inches during a twenty-four hour period. Where sites have been temporarily or finally stabilized, inspection shall be conducted at least once every month for three months.

Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures identified in the plan shall be observed to ensure that they are operating correctly. Where discharge locations or points are accessible, they shall be visually inspected to ascertain whether erosion control measures are effective in preventing significant impacts, such as turbidity to receiving waters. Locations where vehicles enter or exit the site shall be inspected for evidence of off-site sediment tracking.

Based on the results of the inspection, the description of potential sources and pollution prevention measures identified in the plan shall be revised as appropriate by the Owner or his agent as soon as practicable after such inspection.

A report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the storm water pollution control plan, and actions taken shall be made and retained as part of the storm water pollution control plan for at least three years after the date of inspection. A blank copy of the inspection report is provided in Attachment B.

In addition to the inspections required by this plan, the Closure Plan requires periodic inspection to assess the integrity of the access roads, slopes, and cover material. Qualified personnel will conduct inspections at a minimum of once per quarter. Roadway and access

gates will be maintained to control access to the landfill for maintenance and emergency vehicles. Although it is not anticipated that leachate seeps will be found once the geomembrane cap is in place, the site walkovers will look for and identify any problems of this nature. If erosion of slopes is noted, the affected areas will be re-graded and re-vegetated as soon as possible to prevent additional erosion.

6.0 CONTRACTORS

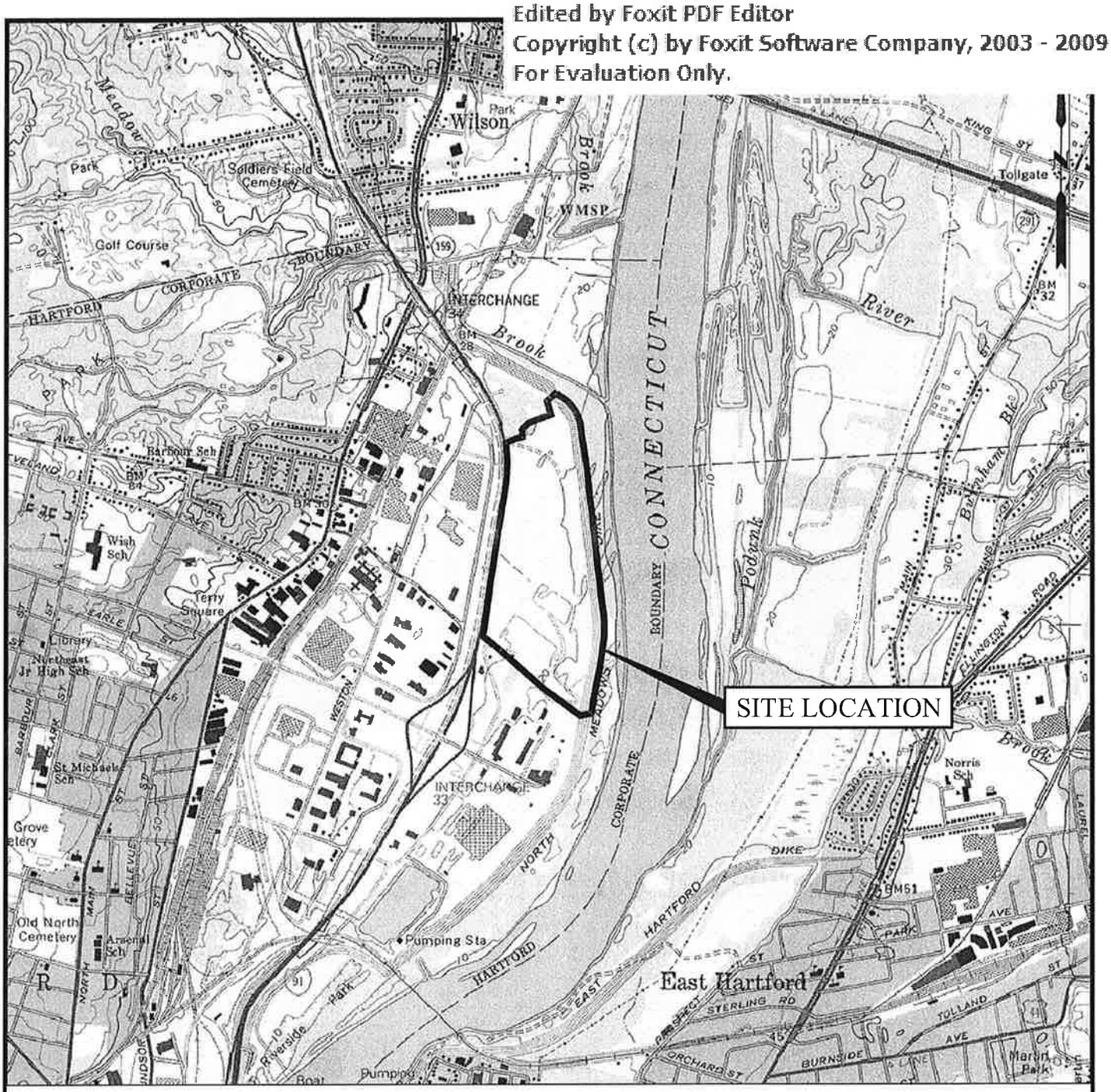
6.1 General

All contractors and subcontractors who will perform actions on site that may reasonably be expected to cause or have the potential to cause pollution of the waters of the State are identified in Attachment C.

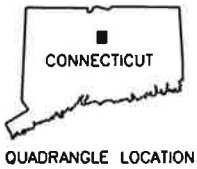
6.2 Certification Statement

All contractors and subcontractors must sign the certification included in Attachment C. All certifications will be included in this Stormwater Pollution Control Plan.

FIGURES



MAP REFERENCE:
THIS MAP WAS PREPARED FROM THE FOLLOWING 7.5 MINUTE SERIES TOPOGRAPHIC MAP:
HARTFORD NORTH, CONN. 1964, PHOTOREVISED 1992.



QUADRANGLE LOCATION

SCALE:
HORZ. 1" = 2,000'
VERT.:
DATUM:
HORZ.:
VERT.:
0 1000 2000
GRAPHIC SCALE

FUSS & O'NEILL
Disciplines to Deliver
146 HARTFORD ROAD, MANCHESTER, CONNECTICUT 06040
860.646.2469 www.FandO.com

CONNECTICUT RESOURCES RECOVERY AUTHORITY
SITE LOCATION MAP
HARTFORD LANDFILL
HARTFORD CONNECTICUT

PROJ. No.: 2004.0174.H10
DATE: 2006/06/15

FIG.1

ATTACHMENT A

General Permit

General Permit Registration Form for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities

Please complete this form in accordance with the general permit (DEP-PERD-GP-015) in order to ensure the proper handling of your registration. Print or type unless otherwise noted. You must submit the *Permit Application Transmittal Form* (DEP-APP-001) and the registration fee along with this form.

DEP USE ONLY
Application No.
Permit No.
Facility I.D.

Part I: Registration Type

Enter a check mark in the appropriate box identifying the registration type.

This registration is for (check one):	Please identify any existing permit number in the space provided:
☒ A *new* general permit registration	Existing permit number:
☐ A *modification* of an existing general permit	***GSN*** **N/A**

Part II: Fee Information

☐ ***Registration only***	A registration fee of $500.00 is to be submitted with *each* registration that you are submitting at least 30 days before the initiation of construction activities.
☒ ***Registration and Plan Review***	All construction projects that result in the disturbance of ten or more acres require the submittal of a Stormwater Pollution Control Plan and a $500.00 plan review fee. The plan and the fee must be submitted 30 days prior to initiation of the construction activity. $500.00 registration fee + $500.00 review fee = $1,000.00 total fee

For municipalities, a 50% discount applies. The registration will not be processed without the fee. The fee shall be non-refundable and shall be paid by certified check or money order payable to the Department of Environmental Protection.

Part III: Registrant Information

1. Fill in the name of the registrant(s) as indicated on the *Permit Application Transmittal Form* (DEP-APP-001):

   Registrant: **Connecticut Resources Recovey Authority**

   Phone: **860-775-7721** ext. Fax:

   ☐ Enter a check mark if there are co-registrants. If so, label and attach additional sheet(s) with the required information as supplied above.

Part III: Registrant Information (cont.)

2. List primary contact for departmental correspondence and inquiries, if different than the registrant.

   Name: **Connecticut Resources Recovery Authority**

   Mailing Address: **100 Constitution Plaza, 6th Floor**

   City/Town: **Hartford** State: **CT** Zip Code: **06103**

   Business Phone: **860-757-7721** ext. Fax:

   Site Phone: **860-548-1468** Emergency Phone:

   Contact Person: **Mr. David Bodendorf** Title: **Sr Environmental Engineer**

   Association (e.g. developer, general or site contractor, etc.):

3. List owner of the property on which the activity will take place, if different from registrant:

   Name: **City of Hartford**

   Mailing Address: **550 Main Street**

   City/Town: **Hartford** State: **CT** Zip Code: **06103**

   Business Phone: **860-522-4888** ext. **6535** Fax:

   Contact Person: **Bhupen Patel** Title: **Director of Public Works**

4. List developer, if different from registrant or primary contact:

   Name: **Same as Registrant**

   Mailing Address:

   City/Town: State: Zip Code:

   Business Phone: ext. Fax:

   Contact Person: Title:

5. Name and address of general contractor:

   Name: **To be determined**

   Mailing Address:

   City/Town: State: Zip Code:

   Business Phone: ext. Fax:

   Site Phone: Off-hours Phone:

   Contact Person: Title:

6. List any engineer(s) or other consultant(s) employed or retained to assist in preparing the registration and Stormwater Pollution Plan.

   ☐ Please enter a check mark if additional sheets are necessary, and label and attach them to this sheet.

   Name: **Fuss & O'Neill, Inc.**

   Mailing Address: **146 Hartford Road**

   City/Town: **Manchester** State: **CT** Zip Code: **06040**

   Business Phone: **860-646-2469** ext. **5258** Fax: **860-533-5133**

   Contact Person: **Craig M. Lapinski, P.E.** Title: **Senior Project Manager**

   Service Provided: **Landfill Closure Plan, Drainage Calculations, SWPCP**

Part IV: Site Information

1. Site or Project Name (if any): **Hartford Landfill**
   Street Address or Description of Location: **185 Liebert Road**
   City/Town: **Hartford** State: **CT** Zip Code: **06120**
2. Brief description of construction activity: **Landfill Closure**
3. Start Date: **2007** Anticipated Completion Date: **2009**
4. Estimated total number of acres to be disturbed: **80**

Part V: Stormwater Discharge Information

1. Where does stormwater discharge to:
   ☐ Municipal Separate Storm System? ☐ Yes ☒ No (Name):
   ☒ Surface water body or wetlands? ☒ Yes ☐ No (Name): **North Meadows Pond**
2. Is the discharge located less than 500 feet from a tidal wetland, which is not a fresh-tidal wetland?
   ☐ Yes ☒ No
3. Name of the watershed where the site is located OR nearest waterbody to which it discharges:
   North Meadows Pond
4. Is construction in accordance with the Guidelines established under Section 22a-329 of the Soil Erosion and Sedimentation Act? ☒ Yes ☐ No
5. Is construction in accordance with local soil erosion and sediment ordinances? ☒ Yes ☐ No
   Note: A copy of this registration and the Stormwater Pollution Control Plan must be available to the town wetlands enforcement officials, wetlands commission, or their equivalent.
6. Will the construction project disturb over ten acres? ☒ Yes ☐ No
   If yes, enclose a copy of the Stormwater Pollution Control Plan and plan review fee.
7. Has the construction project been reviewed for compliance with the following DEP programs?
   a. Coastal Management Act (Section 22a-92 of the Connecticut General Statutes) ☐ Yes ☒ No
   b. Endangered and Threatened Species (Section 26-306 of the Connecticut General Statutes) ☐ Yes ☒ No
   c. State and Federal Historic Preservation statutes? ☐ Yes ☒ No

Part VI: Supporting Documents

Please enter a check mark by the attachments as verification that *all* applicable attachments have been submitted with this registration form. When submitting any supporting documents, please label the documents as indicated in this part (e.g., Attachment A, etc.) and be sure to include the registrant's name as indicated on the *Permit Application Transmittal Form*.

☒	Attachment A:	An 8 1/2" x 11" copy of the relevant portion or a full-sized original of a USGS Quadrangle Map indicating the exact location of the facility or site. Indicate the quadrangle name on the map. (To obtain a copy of the relevant USGS Quadrangle Map, call your town hall or DEP Maps and Publications Sales at 860-424-3555.)
☒	Attachment B:	A copy of the Stormwater Pollution Control Plan and plan review fee of $500.00, if the construction project disturbs over 10 acres

Part VII: Environmental Professional Certification

The following certification must be signed by a professional engineer, licensed to practice in Connecticut.

"I certify that I have thoroughly and completely reviewed the Stormwater Pollution Control Plan for the site. I further certify, based on such review and in my professional judgment, that the Stormwater Pollution Control Plan has been prepared in accordance with the Connecticut Guidelines for Soil Erosion and Sediment Control, as amended, and the conditions for the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities and the controls required for such Plan are appropriate for the site. I am aware that there are significant penalties for false statements in this certification, including the possibility of fine and imprisonment for knowingly making false statements."

Richard D. Jones

Signature of Professional Engineer

6/20/06

Date

Richard D. Jones, P.E.

Name of Professional Engineer (print or type)

19393

P. E. Number (if applicable)

Affix P. E. Stamp Here

Part VIII: Registrant Certification

The registrant *and* the individual(s) responsible for actually preparing the registration must sign this part. A registration will be considered incomplete unless all required signatures are provided.

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that, based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I certify that this general permit registration is on complete and accurate forms as prescribed by the commissioner without alteration of the text. I understand that a false statement made in the submitted information may be punishable as a criminal offense, in accordance with Section 22a-6 of the Connecticut General Statutes, pursuant to Section 53a-157b of the Connecticut General Statutes, and in accordance with any other applicable statute.

I also certify under penalty of law that I have read and understand all conditions of the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities, that all conditions for eligibility for authorization under the general permit are met, all terms and conditions of the general permit are being met for all discharges which have been initiated and are the subject of this registration, and that a system is in place to ensure that all terms and conditions of this general permit will continue to be met for all discharges authorized by this general permit at the site. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowingly making false statements."

Signature of Registrant	Date
Peter W. Egan Name of Registrant (print or type)	**Dir. of Environmental Affairs** Title (if applicable)
Signature of Preparer (if different than above)	6/20/06 Date
Richard D. Jones, P.E. Name of Preparer (print or type)	**Senior Vice President** Title (if applicable)

☐ Please enter a check mark if additional signatures are necessary.
If so, please reproduce this sheet and attach signed copies to this sheet.

Note: Please submit the *Permit Application Transmittal Form*, the Registration Form, Fee(s), and all Supporting Documents to:

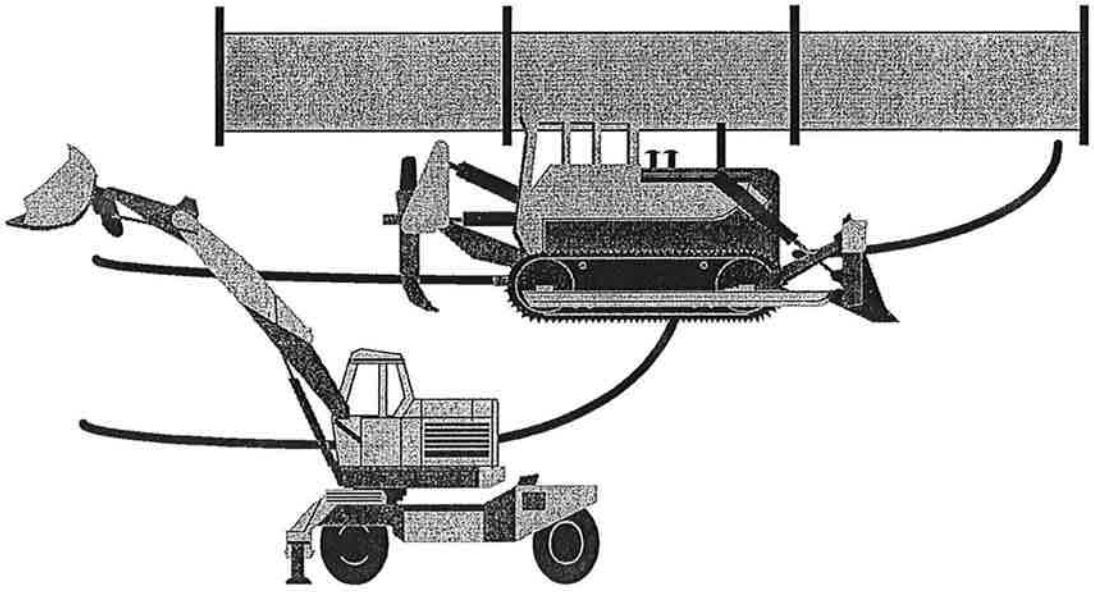
CENTRAL PERMIT PROCESSING UNIT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

Note: If discharging to municipal separate storm sewer, send a copy of this completed registration form to the owner or operator of that system.

If discharging to a public drinking water supply watershed or aquifer area, send a copy of this completed registration form to the appropriate water company.

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER MANAGEMENT
PERMITTING, ENFORCEMENT AND REMEDIATION DIVISION
860-424-3018

General Permit for the Discharge of Stormwater and Dewatering Wastewaters Associated with Construction Activities



Issuance Date: October 1, 2002
Modified: April 8, 2004

General Permit for Discharge of Stormwater and Dewatering Wastewaters from Construction Activities

Table of Contents

General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities

Section 1. Authority

This general permit is issued under the authority of Section 22a-430b of the Connecticut General Statutes.

Section 2. Definitions

The definitions of terms used in this general permit shall be the same as the definitions contained in Section 22a-423 of the Connecticut General Statutes and Section 22a-430-3(a) of the Regulations of Connecticut State Agencies. As used in this general permit, the following definitions shall apply:

"*Authorized activity*" means any activity authorized under this general permit.

"*Coastal area*" means coastal area as defined in Section 22a-93(5) of the Connecticut General Statutes.

"*Coastal waters*" means coastal waters as defined in Section 22a-29 of the Connecticut General Statutes.

"*Commissioner*" means commissioner as defined in Section 22a-2(b) of the Connecticut General Statutes.

"*Construction activities*" means activities including but not limited to clearing and grubbing, grading, excavation, and dewatering.

"*Department*" means the department of environmental protection.

"*Developer*" means a person who or municipality which is responsible, either solely or through contract, for the design and construction of a project site.

"*Dewatering wastewater*" means wastewater generated from the lowering of the groundwater table, the pumping of accumulated stormwater from an excavation, or the pumping of surface water from a cofferdam, or pumping of other surface water that has been diverted into a construction site.

"*Disturbance*" means the execution of any of the construction activities defined above.

"*Erosion*" means the detachment and movement of soil or rock fragments by water, wind, ice and gravity.

"*Fresh-tidal wetland*" means a tidal wetland with an average salinity level of less than 0.5 parts per thousand.

"Guidelines" means the Connecticut Guidelines for Soil Erosion and Sediment Control, as amended, or as may be amended, established pursuant to Section 22a-328 of the Connecticut General Statutes.

"High tide line" means high tide line as defined in Section 22a-359(c) of the Connecticut General Statutes.

"Individual permit" means a permit issued to a named permittee under Section 22a-430 of the Connecticut General Statutes.

"Inland wetland" means wetlands as defined in Section 22a-38 of the Connecticut General Statutes.

"Municipal separate storm sewer" means conveyances for stormwater (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels or storm drains) owned or operated by any municipality and discharging directly to surface waters of the state.

"Municipality" means municipality as defined in Section 22a-423 of the Connecticut General Statutes.

"Permittee" means any person who or municipality which initiates, creates or maintains a discharge in accordance with Section 3 of this general permit.

"Person" means person as defined in Section 22a-423 of the Connecticut General Statutes.

"Point Source" means any discernible, confined and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel or other floating craft from which pollutants are or may be discharged.

"Registrant" means a person who or municipality which files a registration.

"Registration" means a registration form filed with the commissioner pursuant to Section 4 of this general permit.

"Retain" means to permanently hold on-site with no subsequent point-source release as in a detention system where there is a temporary holding or delaying of the delivery of stormwater downstream.

"Sediment" means solid material, either mineral or organic, that is in suspension, is transported, or has been moved from its site of origin by erosion.

"Site" means geographically contiguous land or water on which an authorized activity takes place or on which an activity for which authorization is sought under this general permit is proposed to take place. Non-contiguous land or water owned by the same person and connected by a right-of-way, which such person controls, and to which the public does not have access shall be deemed the same site.

"Soil" means any unconsolidated mineral and organic material of any origin.

"Stabilize" means the use of pavement, establishment of vegetation, use of geotextile materials, use of organic or inorganic mulching materials, or retention of existing vegetation to prevent erosion.

"Stormwater" means waters consisting of precipitation runoff.

"Tidal wetland" means a wetland as defined in Section 22a-29(2) of the Connecticut General Statutes.

"Total disturbance" means the total area on a site that will be exposed or susceptible to erosion during the course of a project.

"Total sediment load" means the total amount of sediment carried by stormwater runoff on an annualized basis.

"Upland soils" means soils which are not designated as poorly drained, very poorly drained, alluvial, or flood plain by the National Cooperative Soils Survey, as may be amended from time to time, of the Soil Conservation Service of the United States, Department of Agriculture, and/or the Inland Wetlands Commission of the community in which the project will take place.

"Water company" means water company as defined in Section 25-32a of the Connecticut General Statutes.

Section 3. Authorization Under This General Permit

(a) Eligible Activities

The following activity is authorized by this general permit, provided the requirements of subsection (b) of this section are satisfied:

The discharge of stormwater and dewatering wastewater from construction activities which result in the disturbance of one or more total acres of land area on a site regardless of project phasing. In the case of a larger plan of development (such as a subdivision), the estimate of total acres of site disturbance shall include, but is not limited to, road and utility construction, individual lot construction (i.e., house, driveway, septic system, etc.), and all other construction associated with the overall plan, regardless of the individual parties responsible for construction of these various elements.

(b) Requirements for Authorization

This general permit authorizes the activity listed in subsection (a) of this section provided:

(1) Coastal Management Act

Such activity must be consistent with all applicable goals and policies in Section 22a-92 of the Connecticut General Statutes, and must not cause adverse impacts to coastal resources as defined in Section 22a-93(15) of the Connecticut General Statutes.

(2) Endangered and Threatened Species

Such activity must not threaten the continued existence of any species listed pursuant to Section 26-306 of the Connecticut General Statutes as endangered or threatened and must not result in the destruction or adverse modification of habitat designated as essential to such species.

(3) Historic Places

Such activity must at all times be in compliance with State and Federal Historic Preservation statutes, regulations and policies including identification of any potential impacts on property listed or eligible for listing on the State and/or National Registers of Historic Places and a description of measures necessary to avoid or minimize those impacts.

(4) The stormwater is *not* discharged to a Publicly Owned Treatment Works or to ground water;

(5) The discharge shall *not* cause pollution due to acute or chronic toxicity to aquatic and marine life, impair the biological integrity of aquatic or marine ecosystems, or result in an unacceptable risk to human health.

(6) Any construction site that is registered under the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities renewed on October 1, 1997, modified on December 20, 2000, and renewed on October 1, 2002, is authorized by this general permit provided that the site continues to meet the conditions listed in Section 6 of this general permit.

(c) Registration

Pursuant to Section 4 of this general permit, a completed registration with respect to the construction activity shall be filed with the commissioner thirty (30) days prior to the commencement of the activity unless exempted by Section 3(d) of this general permit.

(d) Small Construction

For construction projects with a total disturbed area (regardless of phasing) of between one and five acres, the permittee shall agree to adhere to the erosion and sediment control land use regulations of the town in which the construction activity is conducted. No registration pursuant to Section 4 of this general permit shall be required for such construction activity as long as it receives town review and written approval of its erosion and sediment control measures and follows the Guidelines. If no review is conducted by the town, the permittee must register and comply with Section 6 of this general permit.

(e) Geographic Area

This general permit applies throughout the State of Connecticut.

(f) Effective Date and Expiration Date of this General Permit

The modification of this general permit is effective on April 8, 2004, and expires on October 1, 2007.

(g) Effective Date of Authorization

Any activity is authorized by this general permit on the date the general permit becomes effective or on the date the activity is initiated, whichever is later.

(h) Revocation of an Individual Permit

If an activity is eligible for authorization under this general permit and such activity is presently authorized by an individual permit, the existing individual permit may be revoked by the commissioner upon a written request by the permittee. If the commissioner revokes such individual permit in writing, such revocation shall take effect on the effective date of authorization of such activity under this general permit.

(i) Issuance of an Individual Permit

If the commissioner issues an individual permit under Section 22a-430 of the Connecticut General Statutes, authorizing an activity authorized by this general permit, this general permit shall cease to authorize that activity beginning on the date such individual permit is issued.

Section 4. Registration Requirements

(a) Who Must File a Registration

With the exception noted below or in Section 3(d) of this general permit, any person who or municipality which initiates, creates, originates or maintains a discharge described in Section 3(a) of this general permit shall file with the commissioner a registration form that meets the requirements of Section 4 of this general permit, along with the applicable fee, at least thirty (30) days before the initiation of construction activities.

If a site has been previously registered under the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities renewed on October 1, 1997, modified on December 20, 2000, and renewed on October 1, 2002, the permittee does *not* need to submit a new registration under this general permit, unless the ownership of the site has been transferred.

If the site for which a registration is submitted under this general permit is owned by one person or municipality but is leased or, in some other way, the legal responsibility of another person or municipality (the developer), the developer is responsible for submitting the registration required by this general permit. The registrant is responsible for compliance with all conditions of this general permit.

(b) Scope of Registration

A registrant shall register on one registration form every activity at a single site for which activity the registrant seeks authorization under this general permit. Activities at more than a single site may not be registered on one registration form.

(c) Contents of Registration

(1) Fees

(A) The registration fee of $500.00 shall be submitted with a registration form, provided that the registration fee for a municipality shall be $250.00. A registration shall not be deemed complete and no activity shall be authorized by this general permit (with the exception of activities previously registered under the general permit renewed on October 1, 1997, modified on December 20, 2000, and renewed on October 1, 2002), unless the registration fee has been paid in full.

(B) Registrants required to submit a stormwater pollution control plan (Plan) in accordance with Section 6(b)(3)(C) of this general permit shall pay an additional plan review fee of $500.00 with the submittal of the Plan, the registration form and registration fee, provided that the plan review fee for a municipality shall be $250.00.

(C) The registration fee and plan review fee shall be paid by check or money order payable to the **Department of Environmental Protection**.

(D) The registration fee and plan review fee are non-refundable.

(2) Registration Form

A registration shall be filed on forms prescribed and provided by the commissioner and shall include the following:

(A) Legal name, address, and telephone number of the registrant. If the registrant is a person transacting business in Connecticut and is registered with the Connecticut Secretary of the State, provide the exact name as registered with the Connecticut Secretary of the State.

(B) Legal name, address and telephone number of the owner of the property on which the activity will take place.

(C) Legal name, address and telephone number of the primary contact for departmental correspondence and inquiries, if different from the registrant.

(D) Legal name, address and telephone number of the developer of the property on which the subject activity is to take place.

(E) Legal name, address and daytime and off-hours telephone numbers of the general contractor or other representative, if different from the developer.

(F) Legal name, address and telephone number of any consultant(s) or engineer(s) retained by the permittee to prepare the registration and Stormwater Pollution Control Plan.

(G) Location address or description of the site with respect to which the registration is submitted.

(H) The estimated duration of the construction activity.

(I) A brief description of the construction activity, including, but not limited to:

(i) Number of acres disturbed.

(ii) Assurance that construction is in accordance with the Guidelines and local erosion and sediment control ordinances.

(iii) A determination of whether or not a coastal consistency review is necessary for the activity.

(iv) Assurance that there are no endangered or threatened species suspected or known to be impacted by the activity.

(J) A brief description of the stormwater discharge, including:

(i) The name of the municipal separate storm sewer system or immediate surface water body or wetland to which the stormwater runoff discharges, and whether or not the site discharges within 500 feet of a tidal wetland.

(ii) The name of the watershed or nearest waterbody to which the site discharges.

(K) An 8 ½" by 11" copy of the relevant portion or a full-sized original of a United States Geological Survey (USGS) quadrangle map, with a scale of 1:24,000, showing the exact location of the site and the area within a one mile radius of the site. Identify the quadrangle name on such copy.

(L) For all sites that will disturb 10 acres or more (regardless of phasing), a copy of the Stormwater Pollution Control Plan shall be submitted (with the $500 plan review fee) in accordance with Section 6(b)(3)(C) of this general permit.

(M) The signature of the registrant and of the individual or individuals responsible for actually preparing the registration, each of whom shall certify in writing as follows:

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that, based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I certify that this general permit registration is on complete and accurate forms as prescribed by the commissioner without alteration of the text. I understand that a false statement made in the submitted information may be punishable as a criminal offense, in accordance with Section 22a-6 of the Connecticut General Statutes, pursuant to Section 53a-157b of the Connecticut General Statutes, and in accordance with any other applicable statute.

I also certify under penalty of law that I have read and understand all conditions of the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities, that all conditions for eligibility for authorization under the general permit are met, all terms and conditions of the general permit are being met for all discharges which have been initiated and are the subject of this registration, and that a system is in place to ensure that all terms and conditions of this general permit will continue to be met for all discharges authorized by this general permit at the site. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowingly making false statements."

(N) The following certification must be signed by a professional engineer, licensed to practice in Connecticut:

"I certify that I have thoroughly and completely reviewed the Stormwater Pollution Control Plan for the site. I further certify, based on such review and in my professional judgment, that the Stormwater Pollution Control Plan has been prepared in accordance with the Connecticut Guidelines for Soil Erosion and Sediment Control, as amended, and the conditions for the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities and the controls required for such Plan are appropriate for the site. I am aware that there are significant penalties for false statements in this certification, including the possibility of fine and imprisonment for knowingly making false statements."

(d) Where to File a Registration

A registration shall be filed with the commissioner at the following address:

CENTRAL PERMIT PROCESSING UNIT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

(e) Additional Information

The commissioner may require a registrant to submit additional information that the commissioner reasonably deems necessary to evaluate the consistency of the subject activity with the requirements for authorization under this general permit.

(f) Additional Notification

For discharges through a municipal separate storm sewer system authorized by this general permit, a copy of the registration shall also be submitted to the owner and operator of that system.

For discharges within a public drinking water supply watershed or aquifer area, a copy of the registration and the Plan described in Section 6(b) of this general permit shall be submitted to the water company.

In addition, a copy of this registration and the Plan shall be available upon request to the local wetlands agency or its equivalent, or its duly authorized agent.

(g) Action by Commissioner

(1) The commissioner may reject without prejudice a registration if he determines that it does not satisfy the requirements of Section 4(c) of this general permit or more than thirty (30) days have elapsed since the commissioner requested that the registrant submit additional information or the required fee and the registrant has not submitted such information or fee. Any registration refiled after such a rejection shall be accompanied by the fee specified in Section 4(c)(1) of this general permit.

(2) The commissioner may disapprove a registration if he finds that the subject activity is inconsistent with the requirements for authorization under Section 3(b) of this general permit, or for any other reason provided by law.

(3) Disapproval of a registration under this subsection shall constitute notice to the registrant that the subject activity must be authorized under an individual permit.

(4) Rejection or disapproval of a registration shall be in writing.

Section 5. Termination Requirements

(a) Notice of Termination

At the completion of a construction project registered pursuant to Section 4 of this general permit, a Notice of Termination must be filed with the commissioner. A project shall be considered complete after the site has been stabilized for at least three months following the cessation of construction activities. A site is not considered stabilized until there is no active erosion or sedimentation present and no disturbed areas remain exposed.

(b) Termination Form

A termination notice shall be filed on forms prescribed and provided by the commissioner and shall include the following:

(1) The general permit number as provided to the permittee on the general permit certificate.

(2) The name of the registrant as reported on the General Permit Registration Form for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities (DEP-PED-REG-015).

(3) The address of the completed construction site.

(4) The date all storm drainage structures were cleaned of construction debris pursuant to Section 6(b)(6)(C)(iv) of this general permit, the date of completion of construction, and the date of the final inspections pursuant to Section 6(b)(6)(D) of this general permit.

(5) A description of the post-construction activities at the site.

(6) Signature of the permittee.

(c) Where to File a Termination Form

A termination form shall be filed with the commissioner at the following address:

PERMIT COORDINATOR
BUREAU OF WATER MANAGEMENT
DEPARTMENT OF ENVIRONMENTAL PROTECTION
79 ELM STREET
HARTFORD, CT 06106-5127

Section 6. Conditions of this General Permit

The permittee shall at all times continue to meet the requirements for authorization set forth in Section 3 of this general permit. In addition, a permittee shall assure that authorized activities are conducted in accordance with the following conditions:

(a) Conditions Applicable to Certain Discharges

(1) Any person who or municipality which discharges stormwater into coastal tidal waters for which a permit is required under either the Structures and Dredging Act in accordance with Section 22a-361 of the Connecticut General Statutes or the Tidal Wetlands Act in accordance with Section 22a-32 of the Connecticut General Statutes, shall obtain such permit(s) from the commissioner. A tidal wetland permit is required for the placement of any sediment upon tidal wetland, whether it is deposited directly or indirectly.

(2) Any site which has a post-construction stormwater discharge that is located less than 500 feet from a tidal wetlands which is not a fresh-tidal wetland, shall discharge such stormwater through a system designed to retain the volume of stormwater runoff generated by 1 inch of rainfall on the site.

(b) Stormwater Pollution Control Plan

A registrant shall develop a Stormwater Pollution Control Plan ("Plan") for each site authorized by this general permit. Once the construction activity begins, the permittee shall perform all actions required by such Plan and shall maintain compliance with the Plan thereafter. The Plan shall be designed to address two components of stormwater pollution: (1) pollution caused by soil erosion and sedimentation during and after construction; and (2) stormwater pollution caused by use of the site after construction is completed, including, but not limited to, parking lots, roadways and the maintenance of grassed areas.

(1) Development of Plan

(A) The registrant shall develop a Plan for the site. Plans shall be prepared in accordance with sound engineering practices. The Plan shall ensure and demonstrate compliance with the Guidelines.

(B) For any stormwater discharges that were permitted under the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities renewed on October 1, 1997, modified on December 20, 2000, and renewed on October 1, 2002, the existing Plan shall be updated in accordance with subsection (b)(6) of this section. The permittee shall maintain compliance with such Plan thereafter.

(2) Deadlines for Plan Preparation and Compliance

For construction activities authorized by this general permit that are initiated after the date of issuance of this general permit, the registrant shall prepare the Plan no later than thirty days before the date of initiation of the construction activity.

(3) Signature and Plan Review

(A) The Plan shall be signed by the registrant in accordance with Section 6(h) of this general permit. The Plan shall be certified by all contractors and subcontractors in accordance with subsection (b)(6)(E) of this section.

(B) The registrant shall provide a copy of the Plan, and the registration form required in Section 4 of this general permit to the following persons immediately upon request:

(i) the commissioner;

(ii) the local agency approving sediment and erosion plans, grading plans, or stormwater management plans, and the local official responsible for enforcement of such plans;

(iii) in the case of a stormwater discharge through a municipal separate storm sewer system, the municipal operator of the system;

(iv) in the case of a stormwater discharge located within a public drinking water supply watershed or aquifer area, the water company.

The registrant shall also provide a copy of the Plan to all contractors or developers conducting construction activities on individual lots or buildings within the overall plan of development, regardless of ownership. These additional contractors or developers shall sign the certification in Section 6(b)(6)(E)(iii).

For all registrants or permittees submitting a Plan in accordance with subsection (b)(3)(B)(i) of this section, a plan review fee of $500.00 shall be submitted with the Plan.

(C) For construction activities that result in the disturbance of ten or more total acres of land area on a site (regardless of phasing), the Plan shall be submitted to the commissioner no later than thirty days before the initiation of construction activities. Plans shall be submitted in conjunction

with the registration submitted in compliance with Section 4 of this general permit.

(D) The commissioner may notify the registrant at any time that the Plan and/or the site do not meet one or more of the minimum requirements of this general permit. Within seven (7) days of such notice, or such other time as the commissioner may allow, the registrant shall make the required changes to the Plan and perform all actions required by such revised Plan. Within fifteen (15) days of such notice, or such other time as the commissioner may allow, the registrant shall submit to the commissioner a written certification that the requested changes have been made and implemented and such other information as the commissioner requires, in accordance with Sections 6(g) and 6(h) of this general permit.

(4) Keeping Plans Current

The permittee shall amend the Plan whenever there is a change in contractors or subcontractors at the site, or a change in design, construction, operation, or maintenance at the site which has the potential for the discharge of pollutants to the waters of the state and which has not otherwise been addressed in the Plan or if the actions required by the Plan fail to prevent pollution.

(5) Failure to Prepare, Maintain or Amend Plan

In no event shall failure to complete, maintain or update a Plan in accordance with subsections (b)(1) and (b)(4) of this section relieve a permittee of responsibility to implement any actions required to protect the waters of the state and to comply with all conditions of the general permit, including but not limited to installation and maintenance of all controls and management measures described in subsection (b)(6)(C) of this section and in the Guidelines.

(6) Contents of the Plan

The Plan shall include, at a minimum the following items:

(A) Site Description

(i) A description of the nature of the construction activity;

(ii) Estimates of the total area of the site and the total area of the site that is expected to be disturbed by construction activities;

(iii) An estimate, including calculations if any, of the average runoff coefficient of the site after construction activities are completed and existing data describing the soil or the quality of any discharge from the site;

(iv) A site map indicating drainage patterns and approximate slopes anticipated after major grading activities, areas of soil disturbance, the location of major structural and non-structural controls identified in the Plan, the location of areas where stabilization practices are expected to occur, areas which will be vegetated following construction, surface waters (including inland wetlands, tidal

wetlands, and fresh-tidal wetlands), and locations where stormwater is discharged to a surface water (both during and post-construction); and

(v) The name of the immediate receiving water(s) and the ultimate receiving water(s) of the discharges authorized by this general permit and areal extent of wetland acreage on the site.

(B) Construction Sequencing

Each Plan shall clearly identify the expected sequence of major construction activities on the site, including but not limited to installation of erosion and sediment control measures, clearing, grubbing, grading, cut and fill operations, drainage and utility installation, and paving and stabilization operations. This section shall include an estimated timetable for all activities which shall be revised in accordance with subdivision (4) of this section as necessary. Wherever possible, the site shall be phased to avoid the disturbance of over five acres at one time. The Plan shall clearly show the limits of disturbance for the entire activity and for each phase. Any Plan that shows a site disturbance of over ten acres total (regardless of phasing) requires submittal of the Plan to the department, in accordance with subsection (b)(3)(C) of this section.

(C) Controls

Each Plan shall include a description of appropriate controls and measures that will be performed at the site to prevent pollution of the waters of the state. The Plan shall clearly describe for each major activity identified in subsection (b)(6)(B) of this section, the appropriate control measures and the timing during the construction process that the measures would be implemented. (For example, perimeter controls for one portion of the site will be installed after the clearing and grubbing necessary for installation of the measure, but before the clearing and grubbing for the remaining portions of the site. Perimeter controls will be actively maintained until final stabilization of those portions of the site upgradient of the perimeter control. Temporary perimeter controls will be removed after final stabilization.) Controls shall be designed in accordance with the Guidelines. Use of controls to comply with subsection (b)(6)(C)(i) of this section that are not included in the Guidelines must be approved by the commissioner or his designated agent. The description of controls shall address the following minimum components:

(i) Erosion and Sediment Controls

1) Stabilization Practices

The Plan shall include a description of interim and permanent stabilization practices, including a schedule for implementing the practices. Site plans shall ensure that existing vegetation is preserved where attainable and that disturbed portions of the site are stabilized. Stabilization practices may include but not be limited to: silt fences, temporary seeding, permanent seeding, mulching, geotextiles, sod stabilization, vegetative

buffer strips, protection of trees, preservation of mature vegetation, and other vegetative and non-structural measures as may be identified by the Guidelines. Where construction activities have permanently ceased or have temporarily been suspended for more than seven days, or when final grades are reached in any portion of the site, stabilization practices shall be implemented within three days. Areas that will remain disturbed but inactive for at least thirty days shall receive temporary seeding in accordance with the Guidelines. Areas that will remain disturbed beyond the planting season, shall receive long-term, non-vegetative stabilization sufficient to protect the site through the winter. In all cases, stabilization measures shall be implemented as soon as possible in accordance with the Guidelines. Areas to be graded with slopes steeper than 3:1 (horizontal:vertical) and higher than fifteen (15) feet shall be graded with appropriate slope benches in accordance with the Guidelines.

2) Structural Practices

The Plan shall include a description of structural practices to divert flows away from exposed soils, store flows or otherwise limit runoff and the discharge of pollutants from the site. Such practices include but may not be limited to earth dikes (diversions), drainage swales, sediment traps, check dams, subsurface drains, pipe slope drains, level spreaders, storm drain inlet protection, outlet protection, reinforced soil retained systems, gabions, and temporary or permanent sediment basins and chambers. Unless otherwise specifically approved in writing, structural measures shall be installed on upland soils.

At a minimum, for discharge points that serve an area with between two (2) and five (5) disturbed acres at one time, a sediment basin, sediment trap, or other control as may be defined in the Guidelines for such drainage area, designed in accordance with the Guidelines, shall be designed and installed. All sediment traps or basins shall provide a minimum of 134 cubic yards of water storage per acre drained and shall be maintained until final stabilization of the contributing area. This requirement shall not apply to flows from off-site areas and flows from the site that are either undisturbed or have undergone final stabilization where such flows are diverted around the sediment trap or basin. Any exceptions must be approved in writing by the commissioner.

For discharge points that serve an area with more than five (5) disturbed acres at one time, a sediment basin designed in accordance with the Guidelines, shall be designed and installed, which basin shall provide a minimum of 134 cubic yards of water storage per acre drained and which basin shall

be maintained until final stabilization of the contributing area. This requirement shall not apply to flows from off-site areas and flows from the site that are either undisturbed or have undergone final stabilization where such flows are diverted around the sediment basin. Outlet structures from sedimentation basins shall not encroach upon a wetland. Any exceptions must be approved in writing by the commissioner.

3) Maintenance

Maintenance shall be performed in accordance with the Guidelines, provided that, if additional maintenance is required to protect the waters of the state from pollution, the Plan shall include a description of the procedures to maintain in good and effective operating conditions all erosion and sediment control measures, including vegetation, and all other protective measures identified in the site plan.

(ii) Dewatering Wastewaters

Where feasible and appropriate, dewatering wastewaters shall be infiltrated into the ground. Dewatering wastewaters discharged to surface waters shall be discharged in a manner that minimizes the discoloration of the receiving waters. Each plan shall include a description of the operational and structural practices that will be used to ensure that all dewatering wastewaters will not cause scouring or erosion or contain suspended solids in amounts that could reasonably be expected to cause pollution of waters of the State.

(iii) Post Construction Stormwater Management

Each plan must include a description of measures that will be installed during the construction process to control pollutants in stormwater discharges that will occur after construction operations have been completed. Unless otherwise specifically provided by the commissioner in writing, structural measures shall be placed on upland soils. This general permit only addresses the installation of stormwater management measures, and not the ultimate operation and maintenance of such structures included in such measures after the construction activities have been completed and the site has undergone final stabilization. The following measures must be implemented:

1) For construction activities initiated after October 1, 1992, the permittee shall install post-construction stormwater management measures designed to remove suspended solids and floatables (i.e., oil and grease, other floatable liquids, floatable solids, trash, etc.) from stormwater. A goal of 80 percent removal of total sediment load from the stormwater discharge shall be used in designing and installing stormwater management measures. Such measures may include but are not

limited to: stormwater detention structures (including wet ponds); stormwater retention structures; flow attenuation by use of open vegetated swales and natural depressions; infiltration of runoff on-site; vegetated buffer strips; sediment removal chambers or structures; and sequential systems (which combine several practices). Provisions shall be included to address the maintenance of any system installed.

2) Velocity dissipation devices shall be placed at discharge locations and along the length of any outfall channel as necessary to provide a non-erosive velocity flow from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected (e.g., maintenance of hydrologic conditions, such as the hydrodynamics present prior to the initiation of construction activities).

3) Any site which has a post-construction stormwater discharge located less than 500 feet from a tidal wetlands which is not a fresh-tidal wetland, shall discharge such stormwater through a system designed to retain the volume of stormwater runoff generated by 1 inch of rainfall on the site.

(iv) Other Controls

A description of other controls used at the site. The following controls must be implemented:

1) Waste Disposal

A description of best management practices to be performed at the site, which practices shall ensure that no litter, debris, building materials, or similar materials are discharged to waters of the State.

2) Off-site vehicle tracking of sediments and the generation of dust shall be minimized.

3) All post-construction stormwater structures shall be cleaned of construction sediment and any remaining silt fence shall be removed prior to filing of a termination notice pursuant to Section 5 of this general permit.

(D) Inspection

A description of the inspection procedures that must be addressed and implemented in the following manner:

Qualified personnel (provided by the permittee) shall inspect disturbed areas of the construction activity that have not been finally stabilized, structural control measures, and locations where vehicles enter or exit the site at least once every seven calendar days and within twenty-four (24)

hours of the end of a storm that is 0.1 inches or greater. Where sites have been temporarily or finally stabilized, such inspection shall be conducted at least once every month for three months.

(i) Disturbed areas and areas used for storage of materials that are exposed to precipitation shall be inspected for evidence of, or the potential for, pollutants entering the drainage system. Erosion and sediment control measures shall be observed to ensure that they are operating correctly. Where discharge locations or points are assessable, they shall be inspected to ascertain whether erosion control measures are effective in preventing significant impacts to receiving waters. Locations where vehicles enter or exit the site shall be inspected for evidence of off-site sediment tracking.

(ii) Based on the results of the inspection, the description of potential sources and pollution prevention measures identified in the Plan shall be revised as appropriate as soon as practicable after such inspection. Such modifications shall provide for timely implementation of any changes to the site within twenty-four (24) hours and implementation of any changes to the Plan within three (3) calendar days following the inspection. The Plan shall be revised and the site controls updated in accordance with sound engineering practices, the Guidelines, and subdivisions (4) and (6)(C)(i) 3) of this section.

(iii) A report summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the Plan, and actions taken shall be made and retained as part of the Plan for at least three years after the date of inspection. The report shall be signed by the permittee or his/her authorized representative in accordance with the requirements of Section 6(h) of this general permit.

(E) Contractors

(i) The Plan shall clearly identify each contractor and subcontractor that will perform actions on the site which may reasonably be expected to cause or have the potential to cause pollution of the waters of the State, and shall include a copy of the certification statement shown below signed by each such contractor and subcontractor. All certifications shall be included in the Plan.

(ii) Subdivisions

Where individual lots in a subdivision or other common plan of development are conveyed or otherwise the responsibility of another contractor, those individual lot contractors shall be required to comply with the provisions of this general permit and shall sign the certification statement below regardless of lot size or disturbed area.

The permittee shall provide a copy of the Plan to each of these contractors.

(iii) Certification Statement

The Plan shall include the following certification signed by each contractor and subcontractor identified in the Plan as described above:

"I certify under penalty of the law that I have read and understand the terms and conditions of the General Permit for the Discharge of Stormwater and Dewatering Wastewaters from Construction Activities. I understand that as a contractor or subcontractor at the site, I am authorized by this general permit, and must comply with the terms and conditions of this general permit, including but not limited to the requirements of the Stormwater Pollution Control Plan prepared for the site."

The certification shall include the name and title of the person providing the signature; the name, address and telephone number of the contracting firm; the address (or other identifying description) of the site; and the date the certification is made.

(c) Reporting and Record Keeping Requirements

(1) The permittee shall retain copies of the Plan and all reports required by this general permit, and records of all data used to complete the registration to be authorized by this general permit, for a period of at least three years from the date that construction at the site is completed unless the commissioner specifies another time period in writing.

(2) The permittee shall retain an updated copy of the Plan required by this general permit at the construction site from the date construction is initiated at the site until the date construction at the site is completed.

(3) Upon completion of construction for sites authorized by the General Permit for the Discharge of Stormwater Associated with Commercial Activity or the General Permit for the Discharge of Stormwater Associated with Industrial Activity, the Plan shall be kept as an appendix to the Stormwater Management Plan or Stormwater Pollution Prevention Plan (as applicable) for a period of at least three years from the date of completion of construction.

(d) Regulations of Connecticut State Agencies Incorporated into this General Permit

The permittee shall comply with the following Regulations of Connecticut State Agencies which are hereby incorporated into this general permit, as if fully set forth herein:

(1) Section 22a-430-3:

Subsection (b) General - subparagraph (1)(D) and subdivisions (2),(3),(4) and (5)
Subsection (c) Inspection and Entry
Subsection (d) Effect of a Permit - subdivisions (1) and (4)

Subsection (e) Duty to Comply
Subsection (f) Proper Operation and Maintenance
Subsection (g) Sludge Disposal
Subsection (h) Duty to Mitigate
Subsection (I) Facility Modifications, Notification - subdivisions (1) and (4)
Subsection (j) Monitoring, Records and Report Requirements - subdivisions (1), (6), (7), (8), (9) and (11) (except subparagraphs (9) (A) (2) and (9) (c)
Subsection (k) Bypass
Subsection (m) Effluent Limitation Violations
Subsection (n) Enforcement
Subsection (p) Spill Prevention and Control
Subsection (q) Instrumentation, Alarms, Flow Recorders
Subsection (r) Equalization

(2) Section 22a-430-4

Subsection (t) Prohibitions
Subsection (p) Revocation, Denial, Modification
Appendices

(e) Reliance on Registration

In evaluating the registrant's registration, the commissioner has relied on information provided by the registrant. If such information proves to be false or incomplete, the registrant's authorization may be suspended or revoked in accordance with law, and the commissioner may take any other legal action provided by law.

(f) Duty to Correct and Report Violations

Upon learning of a violation of a condition of this general permit, a permittee shall immediately take all reasonable action to determine the cause of such violation, correct and mitigate the results of such violation, prevent further such violation, and report in writing such violation and such corrective action to the commissioner within five (5) days of the permittee's learning of such violation. Such information shall be filed in accordance with the certification requirements prescribed in Section 6(h) of this general permit.

(g) Duty to Provide Information

If the commissioner requests any information pertinent to the authorized activity or to compliance with this general permit or with the permittee's authorization under this general permit, the permittee shall provide such information within fifteen (15) days of such request. Such information shall be filed in accordance with the certification requirements prescribed in Section 6(h) of this general permit.

(h) Certification of Documents

Any document, including but not limited to any notice, information or report, which is submitted to the commissioner under this general permit shall be signed by the permittee, or a duly authorized representative of the permittee, and by the individual or individuals responsible for actually preparing such document, each of whom shall certify in writing as follows:

"I have personally examined and am familiar with the information submitted in this document and all attachments thereto, and I certify that, based on reasonable investigation, including my inquiry of those individuals responsible for obtaining the information, the submitted information is true, accurate and complete to the best of my knowledge and belief. I understand that a false statement made in this document or its attachments may be punishable as a criminal offense, in accordance with Section 22a-6 of the Connecticut General Statutes, pursuant to Section 53a-157b of the Connecticut General Statutes, and in accordance with any other applicable statute."

(i) Date of Filing

For purposes of this general permit, the date of filing with the commissioner of any document is the date such document is received by the commissioner. The word "day" as used in this general permit means the calendar day; if any date specified in the general permit falls on a Saturday, Sunday, or legal holiday, such deadline shall be the next business day thereafter.

(j) False Statements

Any false statement in any information submitted pursuant to this general permit may be punishable as a criminal offense, in accordance with Section 22a-6 of the Connecticut General Statutes, pursuant to Section 53a-157b of the Connecticut General Statutes.

(k) Correction of Inaccuracies

Within fifteen (15) days after the date a permittee becomes aware of a change in any information in any material submitted pursuant to this general permit, or becomes aware that any such information is inaccurate or misleading or that any relevant information has been omitted, such permittee shall correct the inaccurate or misleading information or supply the omitted information in writing to the commissioner. Such information shall be filed in accordance with the certification requirements prescribed in Section 6(h) of this general permit.

(l) Transfer of Authorization

Authorizations under this general permit are non-transferable. However, any person or municipality registering a discharge that has previously been registered under this general permit may adopt by reference the Plan developed by the previous permittee. The new permittee shall amend the Plan as required pursuant to Section 6(b)(4) prior to submitting a new registration.

(m) Other Applicable Law

Nothing in this general permit shall relieve the permittee of the obligation to comply with any other applicable federal, state and local law, including but not limited to the obligation to obtain any other authorizations required by such law.

(n) Other Rights

This general permit is subject to and does not derogate any present or future rights or powers of the State of Connecticut and conveys no rights in real or personal property nor any exclusive privileges, and is subject to all public and private rights and to any federal, state, and local laws pertinent to the property or activity affected by such general permit. In conducting any activity authorized hereunder, the permittee may not cause pollution, impairment, or destruction of the air, water, or other natural resources of this state. The issuance of this general permit shall not create any presumption that this general permit should or will be renewed.

Section 7. Commissioner's Powers

(a) Abatement of Violations

The commissioner may take any action provided by law to abate a violation of this general permit, including but not limited to penalties of up to $25,000 per violation per day under Chapter 446k of the Connecticut General Statutes, for such violation. The commissioner may, by summary proceedings or otherwise and for any reason provided by law, including violation of this general permit, revoke a permittee's authorization hereunder in accordance with Sections 22a-3a-2 through 22a-3a-6, inclusive, of the Regulations of Connecticut State Agencies. Nothing herein shall be construed to affect any remedy available to the commissioner by law.

(b) General Permit Revocation, Suspension, or Modification

The commissioner may, for any reason provided by law, by summary proceedings or otherwise, revoke or suspend this general permit or modify to establish any appropriate conditions, schedules of compliance, or other provisions which may be necessary to protect human health or the environment.

(c) Filing of an Individual Application

If the commissioner notifies a permittee in writing that such permittee must obtain an individual permit if he wishes to continue lawfully conducting the authorized activity, the permittee must file an application for an individual permit within thirty (30) days of receiving the commissioner's notice. While such application is pending before the commissioner, the permittee shall comply with the terms and conditions of this general permit and the subject approval of registration. Nothing herein shall affect the commissioner's power to revoke a permittee's authorization under this general permit at any time.

Issued Date: April 8, 2004

ARTHUR J. ROCQUE, JR.
Commissioner

This is a true and accurate copy of the general permit modified on April 8, 2004 by the Commissioner of the Department of Environmental Protection.

ATTACHMENT B

Inspection Report Form

INSPECTION REPORT FORM

CONNECTICUT RESOURCES RECOVERY AUTHORITY
HARTFORD LANDFILL
HARTFORD, CONNECTICUT

Date of Inspection _____

Inspector's Name _____

Employed By _____

Circle Type of Inspection: Monthly / Weekly / Within 24 hrs of Storm

Major Observations or Deficiencies	Actions Taken	Date Completed

_____ _____

Signature of Inspector Date

_____ _____

Signature of Owner Date

ATTACHMENT C

Identification of Contractors And Certification Statements

CONNECTICUT RESOURCES RECOVERY AUTHORITY
HARTFORD LANDFILL
HARTFORD, CONNECTICUT

General Contractor	Point of Contact	Phone

Sub-Contractors	Point of Contact	Phone

CONNECTICUT RESOURCES RECOVERY AUTHORITY
HARTFORD LANDFILL
HARTFORD, CONNECTICUT

GENERAL CONTRACTOR

"I certify under penalty of law that I have read and understand the terms and conditions of the general permit for the discharge of stormwater associated with construction activity. I understand that as a contractor on the project, I am covered by this general permit, and must comply with the terms and conditions of this permit, including, but not limited to, the requirements of the stormwater pollution control plan prepared for this project."

Signed:_____ Date:_____

Printed Name: _____ Telephone:_____

Title: _____

Firm:_____

Address:_____

_____

_____

_____

CONNECTICUT RESOURCES RECOVERY AUTHORITY
HARTFORD LANDFILL
HARTFORD, CONNECTICUT

SUBCONTRACTOR

"I certify under penalty of law that I have read and understand the terms and conditions of the general permit for the discharge of stormwater associated with construction activity. I understand that as a contractor on the project, I am covered by this general permit, and must comply with the terms and conditions of this permit, including, but not limited to, the requirements of the stormwater pollution control plan prepared for this project."

Signed:_____ Date:_____

Printed Name: _____ Telephone:_____

Title: _____

Firm:_____

Address:_____

_____

_____

_____

Amendment to
Stormwater Pollution Control Plan

Connecticut Resources Recovery Authority
Hartford Landfill
Hartford, Connecticut

December 2011

FUSS & O'NEILL

146 Hartford Road
Manchester, CT 06040

FUSS & O'NEILL

Table of Contents

STORMWATER POLLUTION CONTROL PLAN
Connecticut Resources Recovery Authority
Hartford Landfill - Hartford, Connecticut
Amended December 2011

FUSS&O'NEILL

Table of Contents

STORMWATER POLLUTION CONTROL PLAN
Connecticut Resources Recovery Authority
Hartford Landfill - Hartford, Connecticut
Amended December 2011

SHEETS **SEPARATELY BOUND**

1 INTRODUCTION

This Amendment to the Hartford Landfill Stormwater Pollution Control Plan (SWPCP) is being submitted by the Connecticut Resources Recovery Authority (CRRA) in support of the amendment to the Hartford Landfill Closure Plan submitted to the Connecticut Department of Energy and Environmental Protection (CT DEEP), Waste Engineering and Enforcement Division (WEED) in July 2011. The proposed Closure Plan amendment includes two alternate final cover system designs intended to facilitate the installation of a grid-connected solar photovoltaic (PV) renewable energy system. Pending approval of the alternate cover systems by the CT DEEP, CRRA will close the Phase II (eastern) area with either the previously approved traditional capping system or one of the two alternate capping systems described below.

- *Closure Turf™ Alternate* – a proprietary synthetic turf system manufactured by Agru-America, Inc. The turf is placed above a liner and sand ballast is installed to hold the turf in place. This system would allow for the use of rigid PV panels affixed to a ground mounted racking system. Manufacturer's product information is provided as *Appendix A.*
- *Exposed TPO Alternate* – an exposed geomembrane cap using Thermoplastic Polyolefin (TPO). This system would include flexible, thin-film PV panels adhered to the membrane. Manufacturer's product information is provided as *Appendix B.*

This plan is intended to supplement the previously approved SWPCP dated July 2006, revised January 2007. As such, only the relevant, modified sections are included in this submission. Taken in its entirety (i.e., the approved SWPCP plus this amendment), the SWPCP is intended to address the erosion and sedimentation control requirements both during and after construction. Erosion and sedimentation control requirements are also shown on the Drawings for this project (separately bound). In addition, drainage calculations for both alternates are included in this report.

2 SITE DESCRIPTION

2.1 Project Description

The MSW Area of the Hartford Landfill occupies approximately 80 acres of an approximately 124 acre parcel in the north meadows section of Hartford, Connecticut (Figure 1). Sixteen acres of the parcel, located immediately north of the 80-acre MSW Area, was developed as a lined ash landfill in 1998 (Phase I Ash Disposal Area). The remaining area is occupied by site facilities (e.g., Scale House, Maintenance Garage, etc.) on the southerly portion of the parcel and undisturbed land to the north of the Phase I Ash Disposal Area.

Access to the landfill is off of Jennings Road (Exit 33 off of Interstate 91) with a turn onto Leibert Road, heading north, into the south end of the landfill. The landfill parcel is bounded on the south by the City of Hartford Department of Public Works facility; on the

west by Interstate 91; on the north by Weston Street and the Army Corps of Engineers (USACE) Flood Control Dike (herein referred to as the "USACE Dike"); and on the east by the USACE Dike.

CRRA closed approximately 46 acres of the MSW disposal area using a traditional geomembrane cap system. This system consists of a six inch bedding layer of sand overlain by a polyethylene membrane, overlain with a nine inch drainage layer and a 9 inch topsoil layer.

The proposed amendment to the Landfill Closure plan would allow CRRA to close the remaining 34 acres of the MSW disposal area using an alternative capping system as part of a "Phase II" construction project. The remainder of this SWPCP Amendment will focus on the Phase II work. The proposed alternative systems are more particularly described below.

2.2 Existing Conditions

Currently precipitation falling on the Eastern half of the landfill flows east over un-capped portions of the landfill until it is intercepted by one of several existing riprap and concrete drainage channels. These various channels convey the stormwater toward the southeast corner of the property where it discharges to a vegetated drainage ditch that ultimately enters North Meadows Pond. The total upland area discharging to the vegetated ditch is approximately 44.4 acres. Approximately 6.3 acres of this drainage area was capped under the Phase I construction project, and will not be disturbed during the Phase II construction.

2.3 Proposed Conditions

The proposed final landform will not substantially alter the drainage patterns described above. Only slight adjustments to the relative drainage areas will result from closure. However, due to the improved drainage characteristics of both alternates, total runoff volume and peak flow rates are expected to increase (refer to *Table 1* in *Section 2.4*). . Several existing drainage features will be replaced or upgraded during closure in order to accommodate these increased flows and new permanent drainage features will be added.

In accordance with state solid waste regulations, proposed drainage features have been engineered to safely convey at least a 25-year storm event. However, due to the possible adverse impact to the levee from larger storm events, key components of the drainage system have been designed to convey a 100-year storm event.

2.3.1 Proposed Southeastern Culvert

As depicted in *Sheets C-1.23* thru *C-1.34* (bound separately), both alternates use the same general methods of conveying stormwater. The critical design point for both alternates is a proposed culvert at the southeast corner of the landfill. This culvert conveys stormwater from the eastern portion of the landfill under an access drive to the vegetated drainage ditch. Water flows from the culvert to the swale via an existing concrete-lined downchute. The southeast culvert was designed based on peak flows for the 100-year storm. The design contemplates the development of headwater condition upstream of the culvert during the

design storm; thus the eastern swale provides a modest amount of detention. Three 36" pipes were selected to convey flows. Based on the results of peak flows flowing through the culvert, elevations were determined for headwalls to prevent water from over-topping the emergency overflow. Design calculations demonstrate that the system shall function as intended even if one of the three culvert barrels is completely obstructed. Should more than one barrel be completely blocked during a major storm event, the access drive has been designed to function as an emergency overflow weir.

The proposed design incorporates improvements to this swale, which includes rehabilitation of existing concrete as well as new concrete armoring to achieve increased capacity and a consistent cross section. Once water passes through the southeast culvert, it is conveyed via the vegetated drainage ditch to the North Meadows Storage Pond. The major difference in stormwater management between the two alternates is how runoff is conveyed from the landfill to the eastern swale.

2.3.2 Closure Turf™ Alternate

The Closure Turf™ alternate incorporates side slope diversion swales to intercept runoff running down the sides of the landfill. Based on manufacturer's recommendations, these swales were placed at a maximum 40 vertical feet spacing (120 feet horizontal) on the 3H:1V slopes. This allows stormwater to collect before flow depths become excessive. Two such diversion swales will be constructed on the eastern side of the landfill. The diversion swales convey water to reinforced downchutes which in turn convey water to the eastern swale. Energy dissipaters are located at the base of each downchute. Grading and drainage features specific to this alternate are shown on *Sheets C-1.23* thru *C-1.24*. Construction details are provided on *Sheet C-5.02*.

2.3.3 Exposed TPO Alternate

Since the TPO liner is exposed with no erosive overlying components, stormwater runoff will be conveyed directly to the eastern swale via sheet flow over the surface of the TPO. Therefore, the exposed TPO alternate does not have any side slope diversion swales or downchutes. Runoff will sheet flow down the landfill and pass through an energy dissipation system that runs the entire length of the eastern toe of slope. Grading and drainage features specific to this alternate are shown on *Sheets C-1.33* thru *C-1.34*. Construction details are provided on *Sheet C-5.03*.

2.4 Stormwater Discharge Information

Several calculations were performed for each alternate. For both alternates, a detailed watershed analysis was completed to determine peak flows for the 25-year design storm. The calculated total runoff and peak discharge for each alternate was compared to both the existing conditions and previously approved capping system. The following table provides a summary of the discharge characteristics for each scenario. As expected, the proposed alternates will result in modest increases in both peak and total discharges when compared to the previously approved cover system.

Table 1 – Comparison of Discharge Characteristics

Closure Method	Total Runoff (ac-ft)	Peak Flow (cfs)
Existing Conditions*	10.3	111.6
Traditional Soil Cap*	16.1	104.7
Closure Turf™ Alternate	15.4	126.4
Exposed TPO Alternate	16.4	127.5

*Calculations for Original Conditions and Traditional Soil Cap were performed using Bentley's Pond Pack

Calculations were also prepared to determine the flow depths in the eastern swale and the vegetated drainage ditch. An analysis of the southeast culvert was performed to determine the maximum water surface elevation. Additional calculations were completed for the Closure Turf™ alternate to determine the flow depths in the side slope diversion swales and the downchutes. These calculations demonstrate that the proposed design is within the manufacturer's recommended limitations for shear stress.

The watershed analysis for the Closure Turf™ alternate can be found in *Appendix C.* The swale and culvert calculations for the Closure Turf™ alternate can be found in *Appendix D.* The watershed analysis for the exposed TPO alternate can be found in *Appendix E.* The swale and culvert calculations for the exposed TPO alternate can be found in *Appendix F.*

3 CONSTRUCTION SEQUENCE

The Phase II area is expected to be ready for closure by September 2012 and should be completed during the 2013 construction season.

This construction schedule is tentative. There are many factors, such as weather conditions, shaping of landfill subgrades, etc. which may affect the proposed schedule. CT DEEP will be kept apprised of changes in schedule as new information becomes available.

4 CONTROLS

4.1 Temporary Controls

Temporary Erosion control measures were designed in accordance with the 2002 edition of the "Connecticut Guidelines for Soil Erosion and Sediment Control" (CT DEP bulletin 34) as published by The Connecticut Council on Soil and Water Conservation in cooperation with the Connecticut Department of Environmental Protection. Temporary measures for this project include:

- Construction Entrance
- Silt Fence
- Temporary Pipe Slope Drain
- Temporary Sediment Trap
- Temporary Diversions
- Catch Basin Inserts

We have provided installation details and detailed erosion and sediment control notes in the plans (refer to *Sheets C-1.53, C-1.54* and *C-5.01*). These notes are in accordance with DEP Bulletin 34.

4.2 Permanent Controls

4.2.1 Closure Turf™ Alternate

Permanent erosion control measures incorporated into the design of the Closure Turf™ alternate include:

- Side slope diversion swales
- Reinforced downchutes
- Energy dissipaters

These features are shown on *Sheets C-1.23* thru *C-1.24*. Construction details are provided on *Sheet C-3.01* and *C-5.02*.

4.2.2 Exposed TPO Alternate

The only permanent erosion control measure incorporated into the TPO Alternate design is the proposed energy dissipation system that runs the entire length of the eastern toe of slope.

4.2.3 Permanent Off-Cap Control

Off-cap drainage features, such as the concrete lined swale, riprap stilling basin, etc. will be as described in the original project SWPCP.

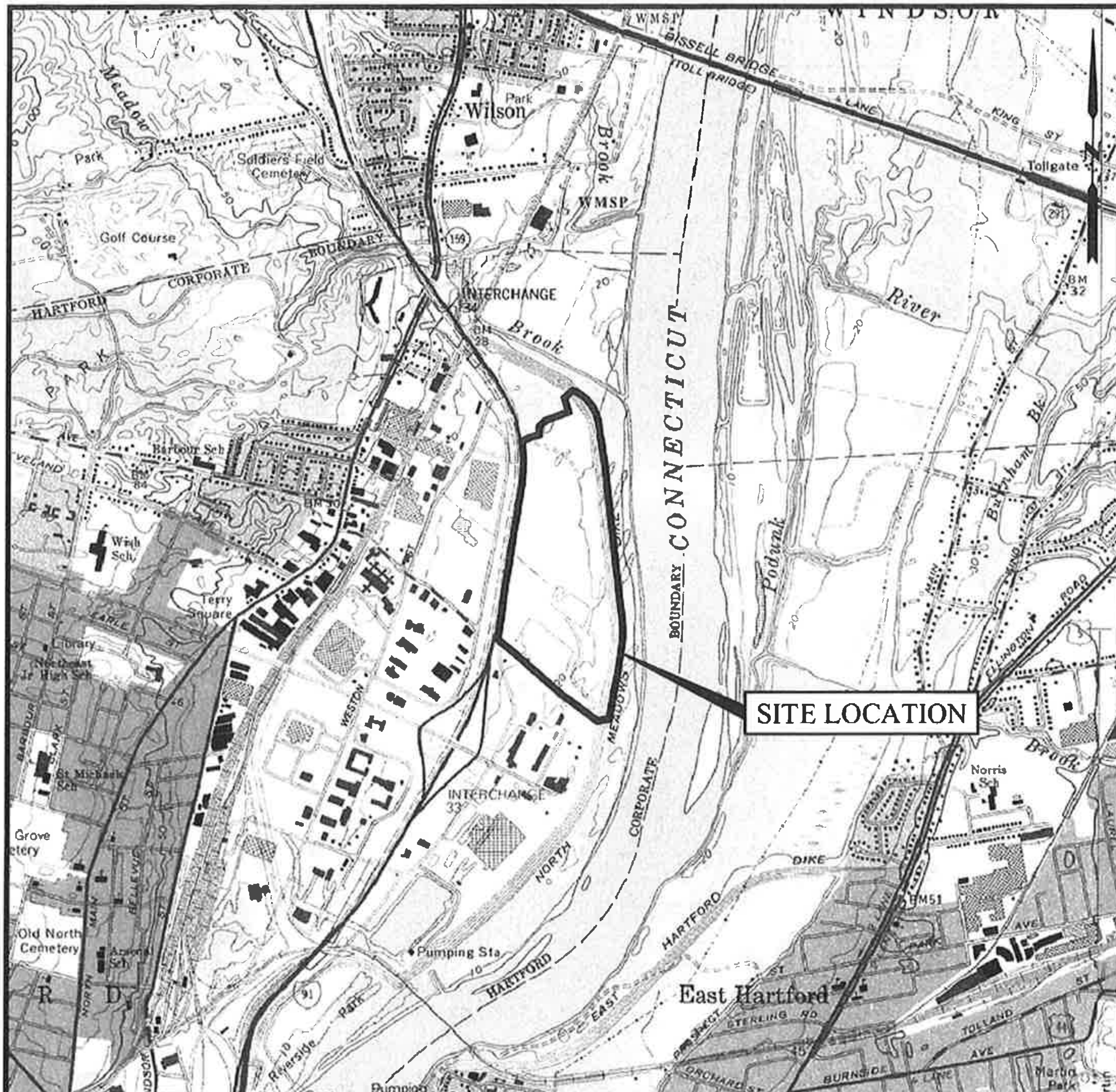
5 INSPECTION

Inspection shall occur in the same manner as described in the original SWPCP.

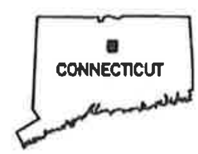
FUSS & O'NEILL

Figures

Site Location Map



MAP REFERENCE:
THIS MAP WAS PREPARED FROM THE FOLLOWING
7.5 MINUTE SERIES TOPOGRAPHIC MAP:
HARTFORD NORTH, CONN. 1964, PHOTOREVISED
1992.



QUADRANGLE LOCATION

SCALE: HORZ.: 1" = 2,000' VERT.: DATUM: HORZ.: VERT.: 0 1000 2000 GRAPHIC SCALE	FUSS & O'NEILL *Disciplines to Deliver* 146 HARTFORD ROAD, MANCHESTER, CONNECTICUT 06040 860.646.2469 www.FandO.com	CONNECTICUT RESOURCES RECOVERY AUTHORITY SITE LOCATION MAP HARTFORD LANDFILL HARTFORD CONNECTICUT	PROJ. No.: 2004 0174.H10 DATE: 2006/06/15 FIG.1

FUSS & O'NEILL

Appendix A

Closure Turf™ Manufacturer's Product Data

Product Advantages

- Rapid closure for odor control & gas management compliance.
- Provides a solution to soil cover failures due to gas pressure buildup and/or seismic events.
- Eliminates expensive soil cover and borrow source issues while providing additional airspace.
- Significant reduction of annual operation/maintenance costs.
- Excellent in arid regions because no irrigation is needed.
- Reduces the cost of post-closure maintenance.
- Superior and reliable aesthetics.
- Eliminates common erosion issues.
- The friction characteristics of the product allows for installation on slopes steeper than 2H:1V.
- Minimizes infiltration due to no head build-up on the geomembrane.
- Reduce or eliminate riprap channels and drainage benches.
- Prevent erosion or siltation problems, even during severe weather events.
- Reduction of leachate generation due to faster closures.
- Allows for future "piggyback" areas or vertical expansions without having to remove the existing cover soils.
- Provides required transmissivity if post-closure use or exit closure requires a soil cap.
- Improved Vector control.

Sand is applied as a ballast eliminating the need for anchoring.

The Agru America plant in Georgetown, South Carolina.

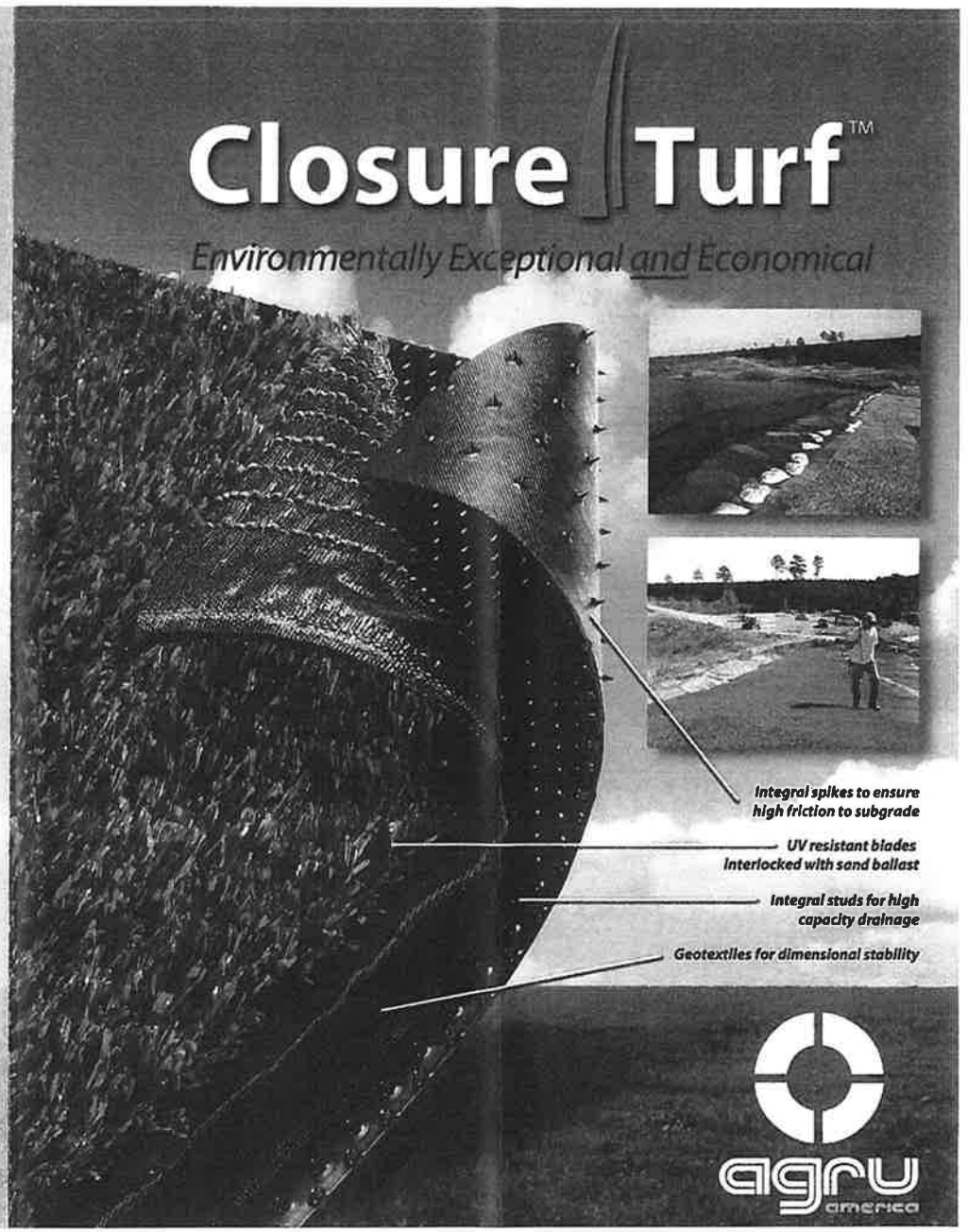
The Agru America plant in Fernley, Nevada.

agru america

800-373-2478 • www.agruamerica.com

Closure Turf™

Environmentally Exceptional and Economical



agru america

Take a Closer Look at Closure Turf™

Closure Turf ™ is an impermeable synthetic grass for an economical and environmentally sound closure of landfills, mine spoils and hazardous sites.

It can dramatically reduce construction and long-term maintenance costs, while providing improved stability, erosion protection, emission control and leachate reduction.

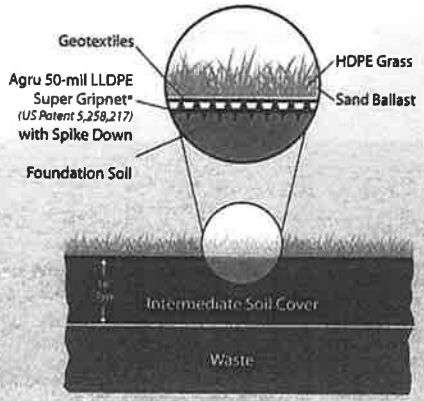
Combines a drainage system and a geomembrane barrier with a durable synthetic turf for a long life of superior performance and aesthetics with Closure Turf™.

agru america

Product Features

- Allows faster capping during the operational life of the landfill. Faster capping reduces odors, improves gas collection efficiency and enhances compliance with Title V air quality rules.
- Significant savings in soil cover. The product will eliminate the need for final soil cover and natural vegetation and give increased waste quantity potential. The resulting savings can be significant based on the location and availability of soil cover.
- Better for landfills in sensitive areas where soil erosion and sedimentation are a major concern. Soil loss is non-existent during operations and post closure.
- Eliminates the need for borrow sources, siltation ponds and associated environmental construction impacts.
- Allows for steeper waste slopes since there will not be soil stability problems either thru earthquakes or gas pressure build-up.

Closure Turf™ cross-section



Installation of the drainage membrane.

- Landfill
- Mining
- Coal Ash
- Brownfield
- Superfund

Rapid installation of 2 acres per day.

- Internal ballast system withstands hurricane force winds.
- The five durable components of this system provide for a long-life of protection against operational and natural forces while maintaining an excellent appearance with minimal maintenance.
- Reduces wildlife impacts and bird attraction by minimizing organic matter and food sources. This is important in landfills located in coastal areas or those facilities located near airports.

Consistent aesthetics with no maintenance required after major storm events.

Closure Turf™

Linear Low Density Polyethylene Super Gripnet® Liner

Product Data

Property	Test Method	Values			
Thickness (min. ave.), mil (mm)	ASTM D5994*	50 (1.25)	60 (1.5)	80 (2.0)	100 (2.5)
Thickness (lowest indiv.), mil (mm)	ASTM D5994*	50 (1.25)	54 (1.35)	72 (1.8)	90 (2.25)
*The thickness values may be changed due to project specifications (i.e., absolute minimum thickness)					
Drainage Stud Height (min. ave.), mil (mm)	GRI GM12/ASTM D7466	145 (3.68)	145 (3.68)	145 (3.68)	145 (3.68)
Friction Spike Height (min. ave.), mil (mm)	GRI GM12/ASTM D7466	175 (4.45)	175 (4.45)	175 (4.45)	175 (4.45)
Density, g/cc, maximum	ASTM D792, Method B	0.939	0.939	0.939	0.939
Tensile Properties (ave. both directions)	ASTM D6693, Type IV				
Strength @ Break (min. ave.), lb/in width (N/mm)	2 in/minute	105 (18.4)	126 (22.1)	168 (29.4)	210 (36.8)
Elongation @ Break (min. ave.), % (GL=2.0in)	5 specimens in each direction	300	300	300	300
Tear Resistance (min. ave.), lbs. (N)	ASTM D1004	30 (133)	40 (178)	53 (236)	67 (298)
Puncture Resistance (min. ave.), lbs. (N)	ASTM D4833	55 (245)	70 (311)	90 (400)	110 (489)
Carbon Black Content (range in %)	ASTM D4218	2 - 3	2 - 3	2 - 3	2 - 3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates for 10 views: 9 views in Cat. 1 or 2, and 1 view in Cat. 3			
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O_2	≥100	≥100	≥100	≥100
Melt Flow Index, g/10 minutes	ASTM D1238, 190°C, 2.16kg	≤1.0	≤1.0	≤1.0	≤1.0
Oven Aging	ASTM D5721	60	60	60	60
with HP OIT, (% retained after 90 days)	ASTM D5885, 150°C, 500psi O_2				
UV Resistance	GRI GM11	20hr. Cycle @ 75°C/4 hr. dark condensabon @ 60°C			
with HP OIT, (% retained after 1600 hours)	ASTM D5885, 150°C, 500psi O_2	35	35	35	35
2% Secant Modulus (max.), lb/in. (N/mm)	ASTM D5323	3000 (520)	3600 (630)	4800 (840)	6000 (1050)
Axi-Symmetric Break Resistance Strain, % (min.)	ASTM D5617	30	30	30	30

These product specifications meet or exceed GRI's GM17

Supply Information (Standard Roll Dimensions)

Thickness		Width		Length		Area (approx.)		Weight (average)*	
mil	mm	ft	m	ft	m	ft^2	m^2	lbs	kg
50	1.25	23	7	300	91.435	6,900	640.05	2,800	1,270.06
60	1.5	23	7	300	91.435	6,900	640.05	2,900	1,315.42
80	2.0	23	7	300	91.435	6,900	640.05	3,100	1,406.14
100	2.5	23	7	300	91.435	6,900	640.05	4,000	1,814.40

Notes:

All rolls are supplied with two slings. All rolls are wound on a 6 inch core. Special lengths are available on request. All roll lengths and widths have a tolerance of ±1%
**The weight values may change due to project specifications (i.e. absolute minimum thickness or special roll lengths) or shipping requirements (i.e. international containerized shipments).*

500 Garrison Road, Georgetown, South Carolina 29440 843-546-0600 800-373-2478 Fax: 843-527-2738
email: salesmkg@agruamerica.com www.agruamerica.com

Closure Turf™

Product Data

Property (50 mil Super Gripnet)	Test Method	LLDPE Values	HDPE
Thickness (min. ave.), mil (mm)	ASTM D5994	50 (1.25)	50 (1.25)
Drainage Stud Height (min. ave.), mil (mm)	ASTM D7466	145 (3.68)	145 (3.68)
Friction Spike Height (min. ave.), mil (mm)	ASTM D7466	175 (4.45)	175 (4.45)
Density, g/cc	ASTM D792, Method B	0.939 (max.)	0.94 (min.)
Tensile Properties (ave. both directions)	ASTM D6693, Type IV		
Strength @ Yield (min. ave.), lb/in width (N/mm)	2 in/minute	N/A	110 (19.3)
Strength @ Break (min. ave.), lb/in width (N/mm)	2 in/minute	110 (19.3)	110 (19.3)
Elongation @ Break (min. ave.), % (GL=2.0in)	5 specimens in each direction	300	200
Tear Resistance (min. ave.), lbs. (N)	ASTM D1004	30 (133)	38 (169)
Puncture Resistance (min. ave.), lbs. (N)	ASTM D4833	55 (245)	80 (356)
Carbon Black Content (range in %)	ASTM D4218	2 - 3	2 - 3
Carbon Black Dispersion (Category)	ASTM D5596	Only near spherical agglomerates for 10 views: 9 views in Cat. 1 or 2, and 1 view in Cat. 3	
Stress Crack Resistance (Single Point NCTL), hours	ASTM D5397, Appendix	N/A	300
Oxidative Induction Time, minutes	ASTM D3895, 200°C, 1 atm O_2	≥100	≥100
Melt Flow Index, g/10 minutes	ASTM D1238, 190°C, 2.16kg	≤1.0	≤1.0
Oven Aging	ASTM D5721	60	80
with HP OIT, (% retained after 90 days)	ASTM D5885, 150°C, 500psi O_2		
UV Resistance	GRI GM11	20hr. Cycle @ 75°C/4 hr. dark condensation @ 60°C	
with HP OIT, (% retained after 1600 hours)	ASTM D5885, 150°C, 500psi O_2	35	50
2% Secant Modulus (max.), lb/in. (N/mm)	ASTM D5323	3000 (520)	N/A
Axi-Symmetric Break Resistance Strain, % (min.)	ASTM D5617	30	N/A

Property (Turf Component)	Test Method	Values
Yarn count (Denier)	ASTM D1907	8,000 (min. 7300)
Tensile Grass @ Break lbs. (N)	ASTM D2256	20 lbs. (88) ±5 lbs.
Elongation @ Break %	ASTM D2256	30-80%
Shrinkage @ 90°C	N/A	N/A
Tape Thickness (micron)	ASTM D3218	100 (Varies based on client request)
Width (mm)	N/A	9±1%
Coating Temp.	N/A	N/A
Yarn Weight Minimum (grams per sq. cm)	ASTM D5261	19 oz./sy (0.063)
Double 13/18 Pic Polybag (grams per sq. cm)	ASTM D5261	6 oz./sy (0.020)
Product Weight w/o ballast (grams per sq. cm)	ASTM D5261	23 oz./sy (0.080)±1%
Pile Height Minimum (cm)	Varies on client request	1.25 in. (3.17)
Tufting Gauge (cm)	N/A	.75 in. (1.9)±1%
CBR Puncture	ASTM D6241	650lb., Min.
Tensile Product	ASTM D4595	1,000 lb./ft., Min.
Transmissivity with underlying structured geomembrane Normal stress 50 psf and 0.33 gradient (m_2/sec)	ASTM D4716	2.5E-03 m_2/sec., Min.
Internal Friction of combined components	ASTM D5321	35°, Min.
UV Resistance & Stability. Tensile testing after weathering Climate Zone 200W/m_2 30 years exposure – accelerated or projected	ASTM G147 (02)	55% Retained Strength, Min.
Sand in-fill Gradation and Ballast	ASTM D 6913	SP/SW at a minimum of .5" thick of source material & ballast weight to be determined based on site specific conditions.

Supply Information (Standard Roll Dimensions)

Thickness	Thickness mil	Thickness mm	Width ft	Width m	Length ft	Length m	Area (approx.) ft^2	Area (approx.) m^2	Weight (average) lbs	Weight (average) kg
Super Gripnet	50	1.25	23	7	300	91.44	6,900	640	2,855	1,300
Turf Component	N/A	N/A	15	4.6	300	91.44	4,500	418	840	381

Notes:

All liner and turf roll lengths and widths have a tolerance of ±1%. All liner rolls are supplied with 2 slings. Both liner and turf rolls are wound on a 6 inch core. Turf rolls are strapped and wrapped for shipment. Special roll lengths are available on request.

500 Garrison Road, Georgetown, South Carolina 29440 843-546-0600 800-373-2478 Fax: 843-527-2738
email: salesmkg@agruamerica.com www.agruamerica.com

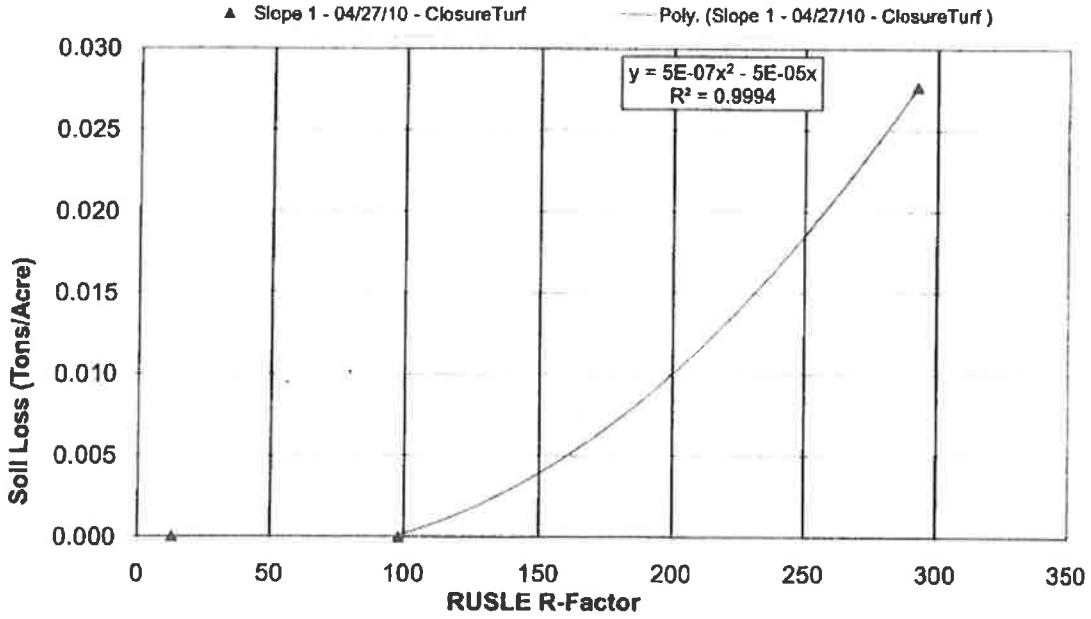
TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

Project: ASTM D 6459
Client: RPH
Test Date: 4/26/2010
Rainfall Rates: 2,4,6 in/hr (target); 20 minutes at each intensity (60 min. total)
Bed Size & Slope: 8-ft wide x 40-ft long; 3H:1V
Sand Ballast Layer, lbs: 1130 (approximately 1/2-inch thick, hand spread)

Plot	Intensity (in/hr)	Runoff (gallons)	Cumm. R-Factor	Soil Loss (lbs/slope)	Sediment Yield (tons/acre)	% of Ballast in Runoff/Seepage
ClosureTurf	2.36	93	13.13	0.00	0.00	0.04%
	4.65	258	97.99	0.00	0.00	
	6.57	360	292.43	0.41	0.03	

Time (min)	Cumm. Rainfall (in)	Cumm. Runoff (in)	Peak Runoff (cfs)	CN[1]	Rational "C"[2]
20	0.79	0.46	0.013	96.2	0.74
40	2.34	1.76	0.026	94.5	0.76
60	4.53	3.56	0.038	91.3	0.78

Soil Loss vs RUSLE R-Factor

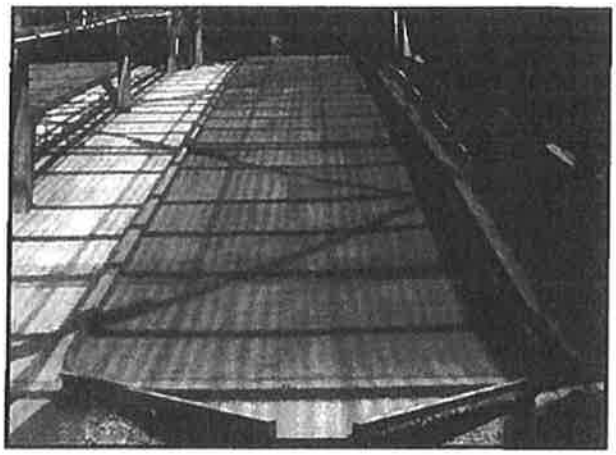


1. The effective runoff curve number was determined by solving for S in the equation Q = [(P-0.2S)2/(P+0.8S)] where Q is the depth of runoff (in) and P is the rainfall depth (in). Then, CN = 1000/(S+10).

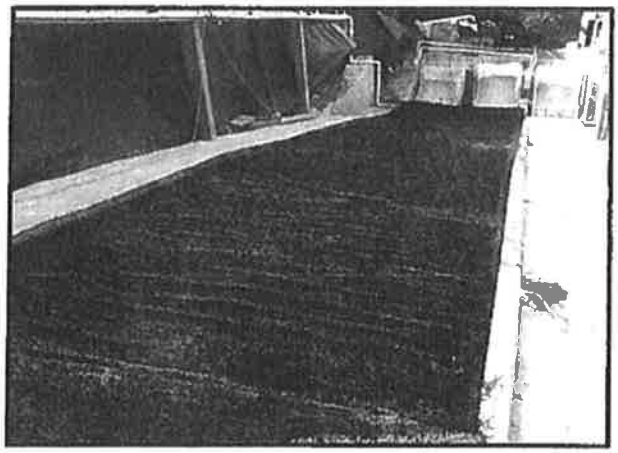
2. The rational "C" coefficient was determined by solving for C in Q = C I A where Q is the peak discharge rate (cfs), I is the peak rainfall intensity (in/hr) and A is the drainage area (acre).

Note: The testing is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose

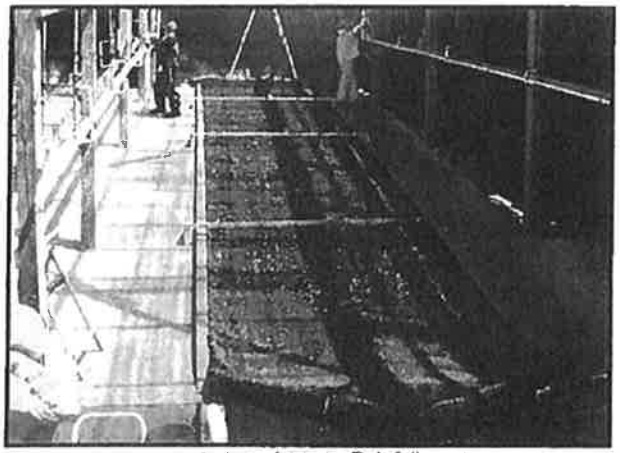
CJS 5/5/10
Quality Review / Date



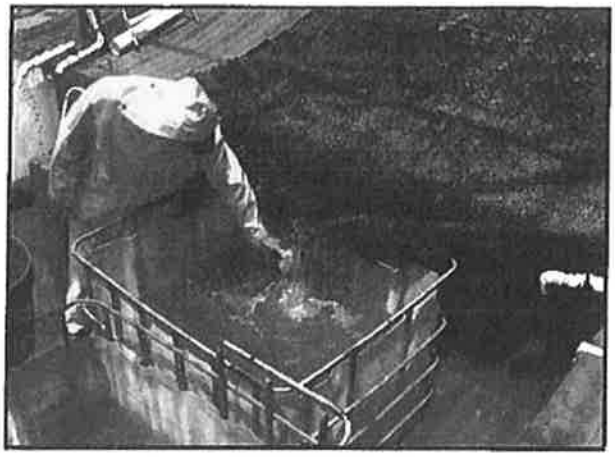

Test Slope Prepared and Liner Installed

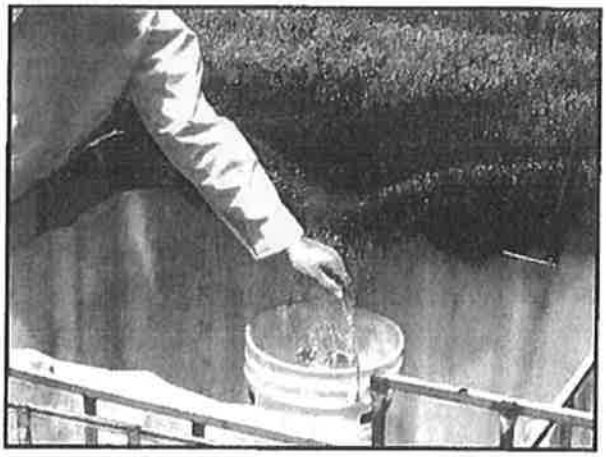



Synthetic Turf Deployed and Sand Ballast Layer Hand-Applied



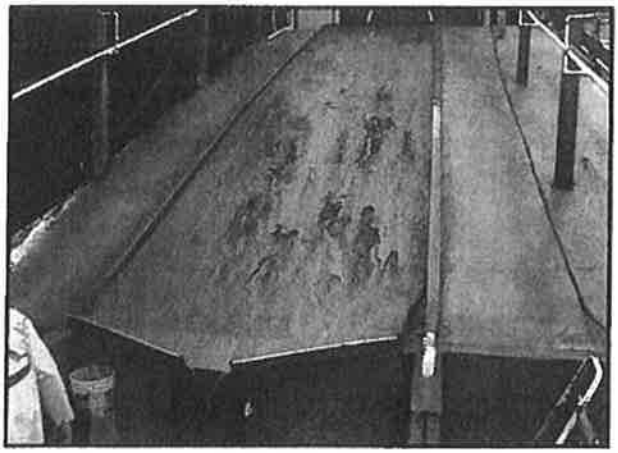

2, 4, and 6 in/hr Rainfall Applied in Succession and Substantial In-Plane Drainage Observed

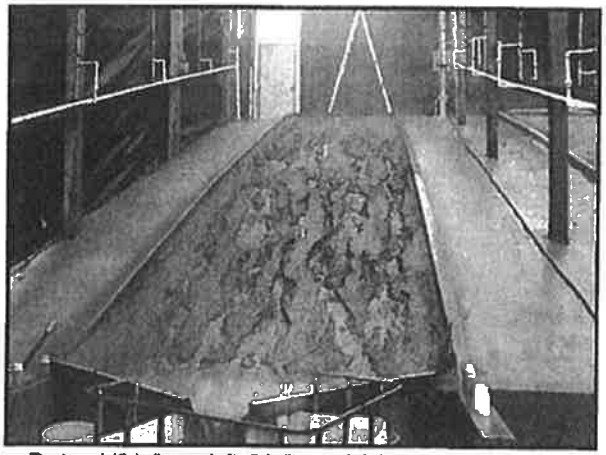




Bottle Grab Samples and Flow Rate Measurements Taken During Testing

Only Small Amounts of Sand Migrated Within the Drainage Layer and Little Sand Movement Was Observed On Surface





Typical Unprotected Slope Erosion from Testing Protocol (2 in/hr on left; 6 in/hr on right)

APPENDIX - DATA

DDRF Rainfall Testing

Slope #: 1 | **Target Rain: 2 in/hr**

Date: 4/26/2010 | Start Rain: 12:25 PM | Sampling interval: 0:03 | End Rain: 12:45 PM | End Runoff: 12:47 PM

Rain Time (min): 20.00 | Test Time (min): 22.00

Product: ClosureTurf | Descr:. Membrane and Synthetic Turf Capping System

Lot #: n/a | Anchors: Sand | Anchorage: 1/2-Inch Thick

TOP OF SLOPE

(circle "x" for open valves)

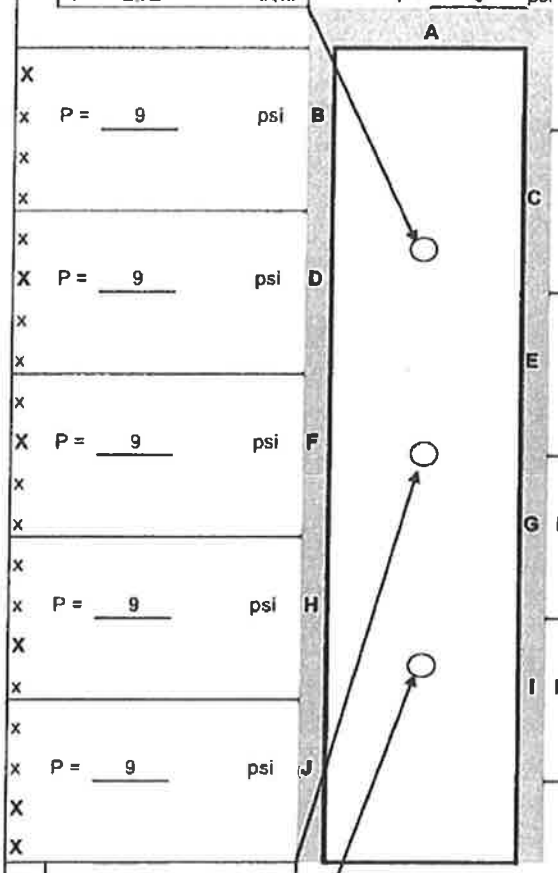
Set valves to 9 psi.

w_{c1} = 17.7%

d = 23 mm
i = 2.72 in/hr

x x x X

P = 9 psi



B: P = 9 psi
C: P = 9 psi
D: P = 9 psi
E: P = 9 psi
F: P = 9 psi
G: P = 9 psi
H: P = 9 psi
I: P = 9 psi
J: P = 9 psi

d = 18 mm
i = 2.13 in/hr

w_{c2} = 17.4%

d = 19 mm
i = 2.24 in/hr

w_{c3} = 18.6%

Temp. 78 deg

Hum. 78 %

Average Depth: 20.00 mm

Avg Rainfall Intensity: 2.36 in/hr

Sediment Concentration Grab Samples Followed by Runoff Rate Measurements

#	Time	
1	12:28	
2	12:31	
3	12:34	
4	12:37	
5	12:40	
6	12:43	
7		
8		
9		
10		
11		
12		
13		
14		
15		
12		
13		
14		
15		

Runoff Rate Measurements

#	Time	Time to Collect 1 Gallon, Seconds
1	2	180
2	6	31
3	10	15
4	14	10
5	18	10
6	20	9
7		
8		
9		
10		
11		
12		
13		
14		
15		
12		
13		
14		
15		

Notes:

0 mph breeze.

Approx 92 gal collected.

DDRF Rainfall Testing

Slope #: 1 | **Target Rain: 4 in/hr**

Date: 4/26/2010 | Start Rain: 12:53 PM | End Rain: 1:13 PM

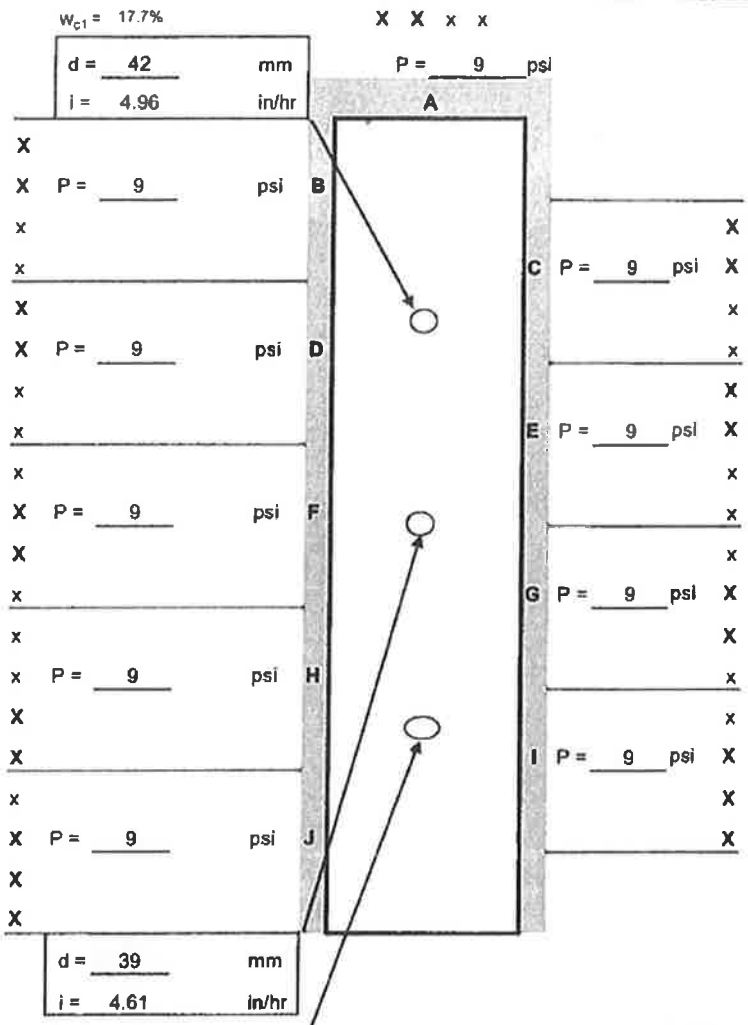
Sampling interval: 0:02 | End Runoff: 1:17 PM

Rain Time (min): 20.00 | Test Time (min): 24.00

Product: ClosureTurf | Descr:. Membrane and Synthetic Turf Capping System

Lot #: n/a | Anchors: Sand | Anchorage: 1/2-Inch Thick

TOP OF SLOPE | **Set valves to 9 psi.**



Temp. 77 deg

Hum. 86 %

Average Depth: 39.33 mm

Avg Rainfall Intensity: 4.65 in/hr

Notes:

0 mph breeze.

Approx 260 gal collected.

Sediment Concentration Grab Samples Followed by Runoff Rate Measurements

#	Time	
1	12:55	
2	12:57	
3	12:59	
4	13:01	
5	13:03	
6	13:05	
7	13:07	
8	13:09	
9	13:11	
10	13:13	
11		
12		
13		
14		
15		
12		
13		
14		
15		

Runoff Rate Measurements

#	Time	Time to Collect 1 Gallon, Seconds
1	2	8
2	4	6
3	6	6
4	8	6
5	10	6
6	12	6
7	14	5
8	16	5
9	18	5
10	20	5
11		
12		
13		
14		
15		
12		
13		
14		
15		

DDRF Rainfall Testing

Slope #: 1 | **Target Rain: 6 in/hr**

Date: 4/26/2010 | Start Rain: 12:53 PM | End Rain: 1:13 PM

Sampling interval: 0:02 | End Runoff: 1:17 PM

Rain Time (min): 20.00 | Test Time (min): 24.00

Product: ClosureTurf | Descr:. Membrane and Synthetic Turf Capping System

Lot #: n/a | Anchors: Sand | Anchorage: 1/2-Inch Thick

TOP OF SLOPE

(circle "x" for open valves) **Set valves to 9 psi.**

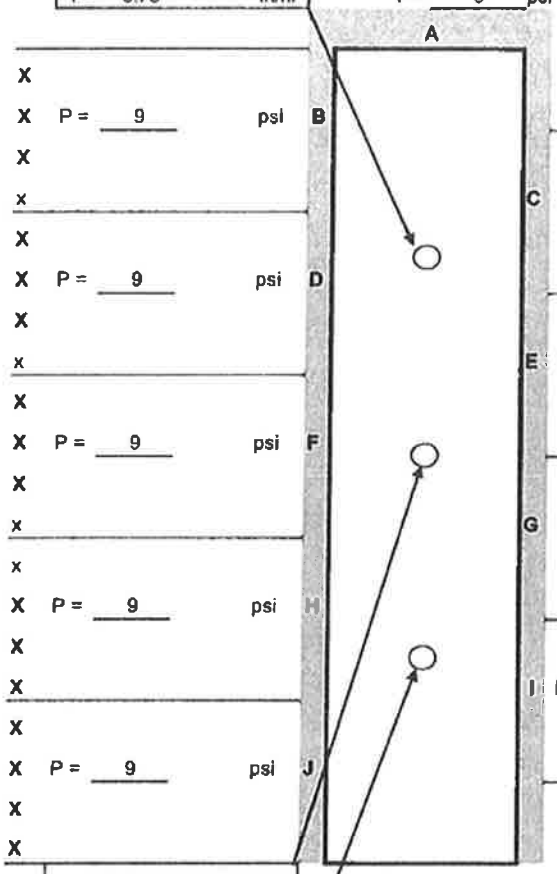
w_{c1} = 17.7%

d = 57 mm

i = 6.73 in/hr

x X X X

P = 9 psi



B: P = 9 psi

C: P = 9 psi

D: P = 9 psi

E: P = 9 psi

F: P = 9 psi

G: P = 9 psi

H: P = 9 psi

I: P = 9 psi

J: P = 9 psi

d = 58 mm

i = 6.85 in/hr

w_{c2} = 17.4%

d = 52 mm

i = 6.14 in/hr

w_{c3} = 18.6%

Temp. 69 deg

Hum. 88 %

Average Depth: 55.67 mm

Avg Rainfall Intensity: 6.57 in/hr

Sediment Concentration Grab Samples Followed by Runoff Rate Measurements

#	Time	
1	12:55	
2	12:57	
3	12:59	
4	13:01	
5	13:03	
6	13:05	
7	13:07	
8	13:09	
9	13:11	
10	13:13	
11		
12		
13		
14		
15		
12		
13		
14		
15		

Runoff Rate Measurements

#	Time	Time to Collect 1 Gallon, Seconds
1	2	4
2	4	4
3	6	4
4	8	4
5	10	4
6	12	4
7	14	4
8	16	4
9	18	4
10	20	4
11		
12		
13		
14		
15		
12		
13		
14		
15		

Notes:

0 mph breeze.

Approx 360 gal collected.

0-Jan-00

Slope #1

Sample Number	Test Time, minutes	Time per Gallon, sec	Interval Time, min	Total Time, min	Collection Mid-Time, min	Runoff Rate, gal/min	Associated Runoff, gal	Cumulative Runoff, gal	
2.36 in/hr									
2	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	
2-1	2.00	180	5.00	5.00	3.50	0.33	1.67	1.67	
2-2	6.00	31	1.52	6.52	6.26	1.94	2.94	4.60	
2-3	10.00	15	3.73	10.25	10.13	4.00	14.93	19.54	
2-4	14.00	10	3.92	14.17	28.17	6.00	23.50	43.04	
2-5	18.00	10	4.00	18.17	36.17	6.00	24.00	67.04	
2-6	20.00	9	1.98	20.15	40.15	6.67	13.22	80.26	
2-end	22.00		1.85	22.00			12.33	**92.59**	**Total Collected Runoff (approx)**
4.65 in/hr									
4	0	0	0.00	0.00	0.00	0.00	0.00	0.00	
4-1	2	8	2.13	2.13	2.07	7.50	16.00	16.00	
4-2	4	6	1.97	4.10	4.05	10.00	19.67	35.67	
4-3	6	6	2.00	6.10	6.05	10.00	20.00	55.67	
4-4	8	6	2.00	8.10	8.05	10.00	20.00	75.67	
4-5	10	6	2.00	10.10	10.05	10.00	20.00	95.67	
4-6	12	6	2.00	12.10	12.05	10.00	20.00	115.67	
4-7	14	5	1.98	14.08	14.04	12.00	23.80	139.47	
4-8	16	5	2.00	16.08	16.04	12.00	24.00	163.47	
4-9	18	5	2.00	18.08	18.04	12.00	24.00	187.47	
4-10	20	5	2.00	20.08	20.04	12.00	24.00	211.47	
4-end	24.00		3.92	24.00			47.00	**258.47**	**Total Collected Runoff (approx)**
5.90 in/hr									
6	0	0	0.00	0.00	0.00	0.00	0.00	0.00	
6-1	2	4	2.07	2.07	2.03	15.00	31.00	31.00	
6-2	4	4	2.00	4.07	4.03	15.00	30.00	61.00	
6-3	6	4	2.00	6.07	6.03	15.00	30.00	91.00	
6-4	8	4	2.00	8.07	8.03	15.00	30.00	121.00	
6-5	10	4	2.00	10.07	10.03	15.00	30.00	151.00	
6-6	12	4	2.00	12.07	12.03	15.00	30.00	181.00	
6-7	14	4	2.00	14.07	14.03	15.00	30.00	211.00	
6-8	16	4	2.00	16.07	16.03	15.00	30.00	241.00	
6-9	18	4	2.00	18.07	18.03	15.00	30.00	271.00	
6-10	20	4	2.00	20.07	20.03	15.00	30.00	301.00	
6-end	24.00		3.93	24.00			59.00	**360.00**	**Total Collected Runoff (approx)**

Slope #1 - Sediment Concentration

	Sample Number	Test Time, minutes	Total Weight, g	Decanted Weight, g	Dry Weight, g	Bottle Weight, g	Dry Sediment Weight, mg	Total Collected Water Wt., g	Total Collected Volume of Water, l	Sediment Concentration, mg/l	Runoff Sampling Time	Time to Collect 1 gal	Associated Runoff, gal	Associated Sediment Conc, mg/l	Associated Solids Loss, lbs
#DIV/0! in/hr	avg														
0-Jan-00	2-1	3.00	300.51	32.92	32.92	32.92	0.00	267.59	0.27	0.00	2.00	180	1.67	0.00	0.00
	2-2	6.00	310.76	32.92	32.92	32.92	0.00	277.84	0.28	0.00	6.00	31	2.94	0.00	0.00
	2-3	9.00	305.13	32.92	32.92	32.92	0.00	272.21	0.27	0.00	10.00	15	14.93	0.00	0.00
	2-4	12.00	311.56	32.92	32.92	32.92	0.00	278.64	0.28	0.00	14.00	10	23.50	0.00	0.00
	2-5	15.00	298.63	32.92	32.92	32.92	0.00	265.71	0.27	0.00	18.00	10	24.00	0.00	0.00
	2-6	18.00	304.77	32.92	32.92	32.92	0.00	271.85	0.27	0.00	20.00	9	13.22	0.00	0.00
									AVG =	0.00	22.00	0	12.33	0.00	0.00
4.24 in/hr	avg												Total Solids Lost:		0.00
11/5/2009	4-1	2.00	311.17	32.92	32.92	32.92	0.00	278.25	0.28	0.00	2.00	8	16.00	0.00	0.00
	4-2	4.00	308.34	32.92	32.92	32.92	0.00	275.42	0.28	0.00	4.00	6	19.67	0.00	0.00
	4-3	6.00	290.56	32.92	32.92	32.92	0.00	257.64	0.26	0.00	6.00	6	20.00	0.00	0.00
	4-4	8.00	313.40	32.92	32.92	32.92	0.00	280.48	0.28	0.00	8.00	6	20.00	0.00	0.00
	4-5	10.00	313.35	32.92	32.92	32.92	0.00	280.43	0.28	0.00	10.00	6	20.00	0.00	0.00
	4-6	12.00	310.89	32.92	32.92	32.92	0.00	277.97	0.28	0.00	12.00	6	20.00	0.00	0.00
	4-7	14.00	314.63	32.92	32.92	32.92	0.00	281.71	0.28	0.00	14.00	5	23.80	0.00	0.00
	4-8	16.00	317.22	32.92	32.92	32.92	0.00	284.30	0.28	0.00	16.00	5	24.00	0.00	0.00
	4-9	18.00	315.58	32.92	32.92	32.92	0.00	282.66	0.28	0.00	18.00	5	24.00	0.00	0.00
	4-10	20.00	313.87	32.92	32.92	32.92	0.00	280.95	0.28	0.00	20.00	5	24.00	0.00	0.00
									AVG =	0.00	24.00	0	47.00	0.00	0.00
5.90 in/hr	avg												Total Solids Lost:		0.00
6/11/2009	6-1	2.00	317.68	32.92	32.92	32.92	0.00	284.76	0.28	0.00	2.00	4.00	31.00	0.00	0.00
	6-2	4.00	315.42	32.92	32.92	32.92	0.00	282.50	0.28	0.00	4.00	4.00	30.00	0.00	0.00
	6-3	6.00	314.68	32.92	32.92	32.92	0.00	281.76	0.28	0.00	6.00	4.00	30.00	0.00	0.00
	6-4	8.00	312.89	32.92	32.92	32.92	0.00	279.97	0.28	0.00	8.00	4.00	30.00	0.00	0.00
	6-5	10.00	313.42	32.92	32.92	32.92	0.00	280.50	0.28	0.00	10.00	4.00	30.00	0.00	0.00
	6-6	12.00	309.16	32.92	32.92	32.92	0.00	276.24	0.28	0.00	12.00	4.00	30.00	0.00	0.00
	6-7	14.00	313.41	32.92	32.92	32.92	0.00	280.49	0.28	0.00	14.00	4.00	30.00	0.00	0.00
	6-8	16.00	315.77	32.92	32.92	32.92	0.00	282.85	0.28	0.00	16.00	4.00	30.00	0.00	0.00
	6-9	18.00	309.69	32.92	32.92	32.92	0.00	276.77	0.28	0.00	18.00	4.00	30.00	0.00	0.00
	6-10	20.00	310.70	32.92	32.92	32.92	0.00	277.78	0.28	0.00	20.00	4.00	30.00	0.00	0.00
									AVG =	0.00	24.00	0.00	59.00	0.00	0.00
													Total Solids Lost:		0.00

SLOPE #1 - Sediment Weights

Total Dry Sediments: 0.00

2 in/hr	Collected	Typ. TSS in Decanted Collected Runoff, lb/gal
Wt. Of pan + wet soil, g	0	
Wt. Of pan + dry soil, g	0	
Wt. Of pan, g	0	
Wt. Of dry soil, g	0	0
Wt. Of water, g		Collected Runoff, gal
Water Content, w%		
Total Wet Sediments,g		
% dry solids		92.6
Dry Collected Sediments, g	0.00	0.00

Total Dry Sediments: 0.00

4 in/hr	Collected	Typ. TSS in Decanted Collected Runoff, lb/gal
Wt. Of pan + wet soil, g	0	
Wt. Of pan + dry soil, g	0	
Wt. Of pan, g	0	
Wt. Of dry soil, g	0	0
Wt. Of water, g		Collected Runoff, gal
Water Content, w%		
Total Wet Sediments, g		
% dry solids		258.5
Dry Collected Sediments, g	0.00	0.00

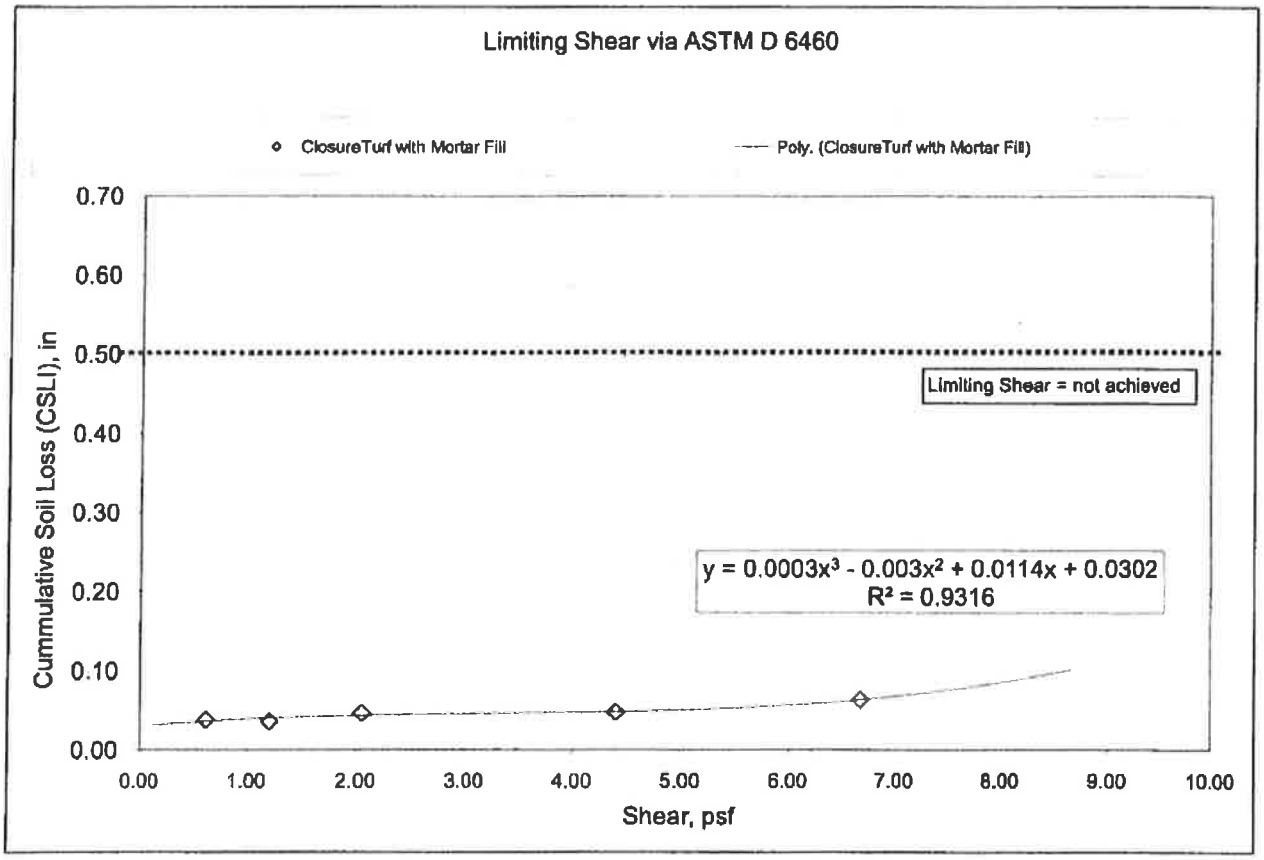
Total Dry Sediments, lbs: 0.41

6 in/hr	Collected	Typ. TSS in Decanted Collected Runoff, lb/gal
Wt. Of pan + wet soil, g	402.35	
Wt. Of pan + dry soil, g	400.76	
Wt. Of pan, g	216.31	
Wt. Of dry soil, g	184.45	0
Wt. Of water, g	1.59	Collected Runoff, gal
Water Content, w%	0.9	
Total Wet Sediments, g		
% dry solids		360.0
Dry Collected Sediments, g	184.45	0.00

TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

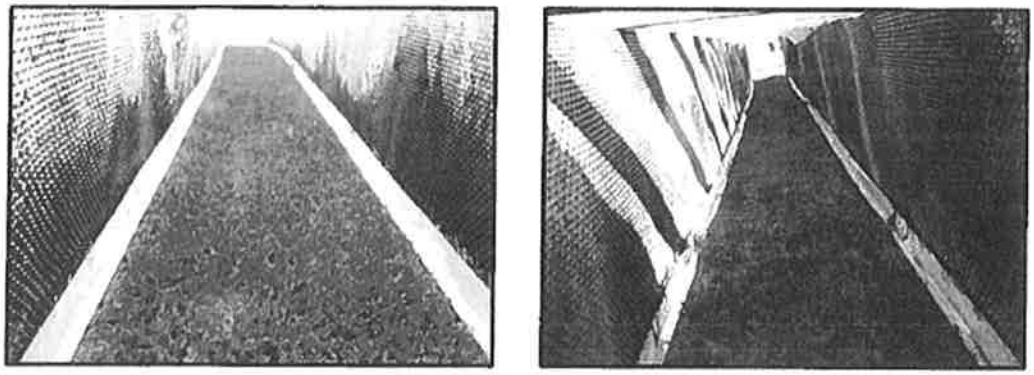
Project: ASTM D 6460: Large-scale Channel Testing (Single Replicate Results)
ClosureTurf with Mortar (3 parts sand; 2 parts powdered lime; 1 part cement)
Client: ClosureTurf
Test Date: 2/2/2011
Shear Range: 0.5 - 7.0 psf (target)
Flume Size & Slope: 2-ft wide x 40-ft long; 10% Bed
Event: 30 minutes at each shear

Shear Level	Flow depth (in)	Flow velocity (fps)	Flow (cfs)	Manning's roughness, n	Max Bed Shear Stress (psf)	CSLI (in)	Cumm. CSLI, (in)
1	1.20	2.01	0.41	0.052	0.62	0.04	0.04
2	2.34	5.53	2.16	0.029	1.21	0.00	0.04
3	3.95	8.40	5.52	0.027	2.05	0.01	0.05
4	8.49	14.52	20.53	0.026	4.41	0.00	0.05
5	12.85	19.24	41.12	0.026	6.67	0.02	0.06

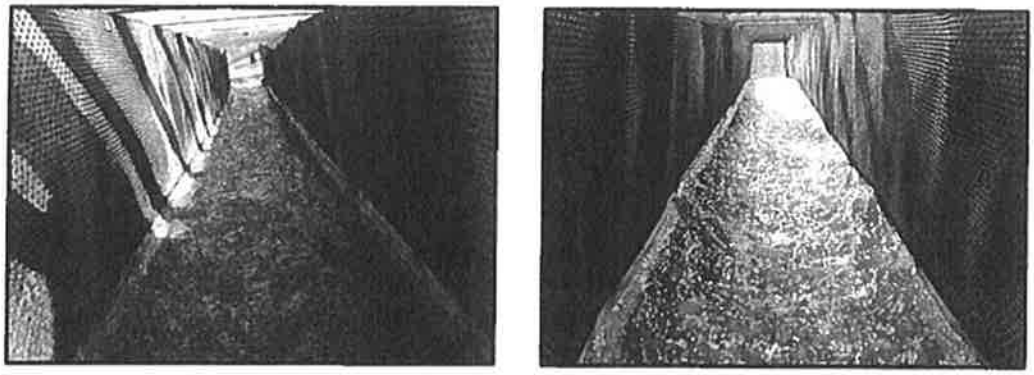


The testing is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose

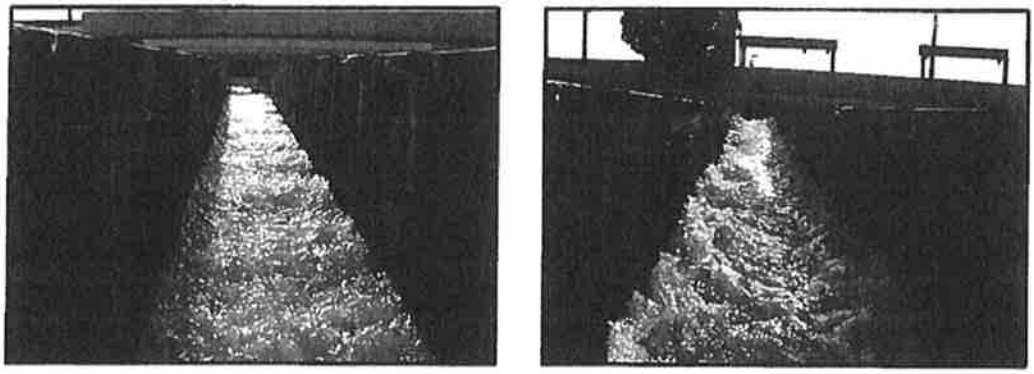
CJS 2/14/11
Quality Review / Date



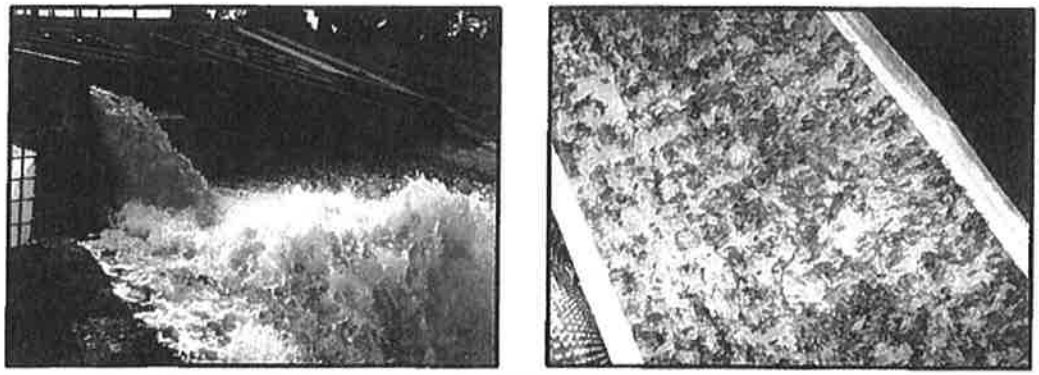
ClosureTurf Before & After Mortar Mix Applied



Low Shear Flows



Increasing Shear Flows

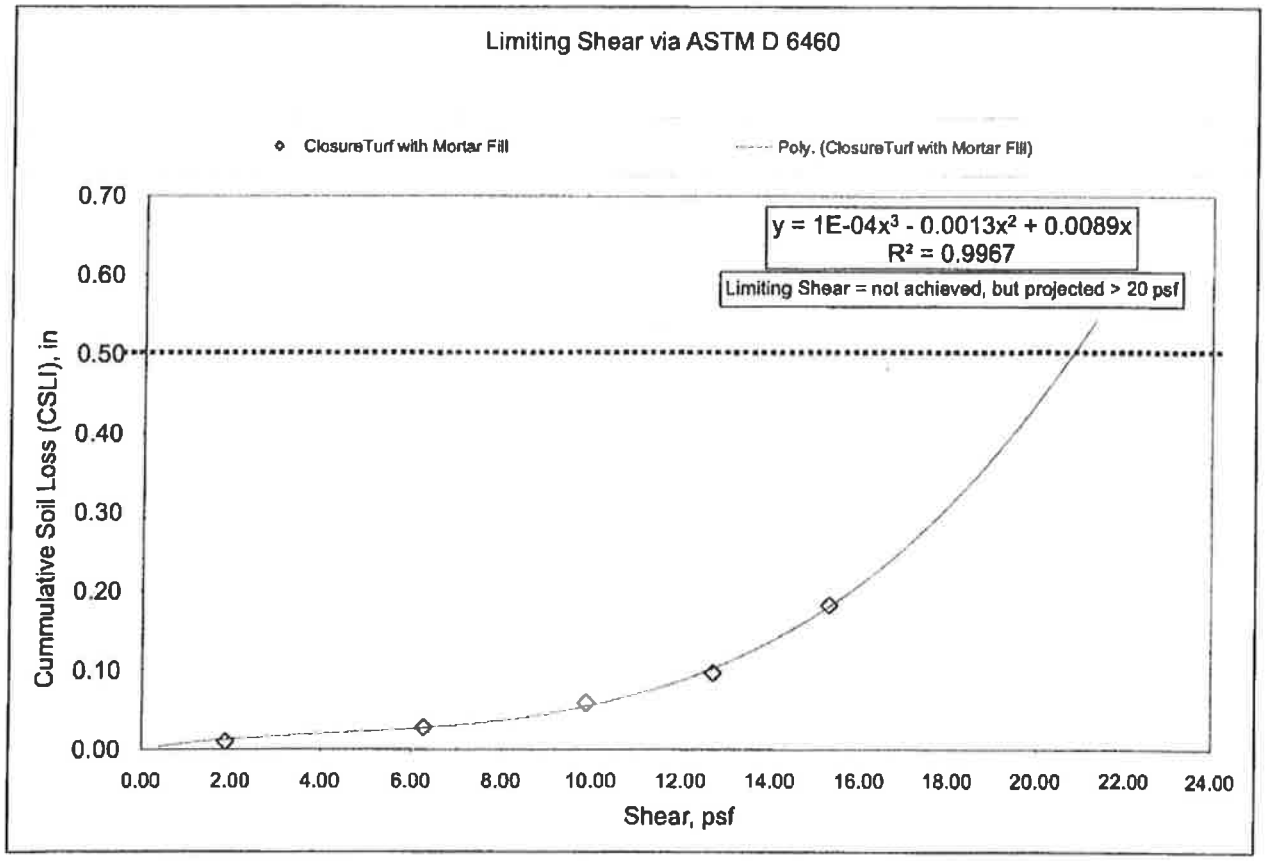


Highest Flow and Final Channel Condition after Testing (no significant loss of mortar mix)

TRI/ENVIRONMENTAL, INC.
A Texas Research International Company

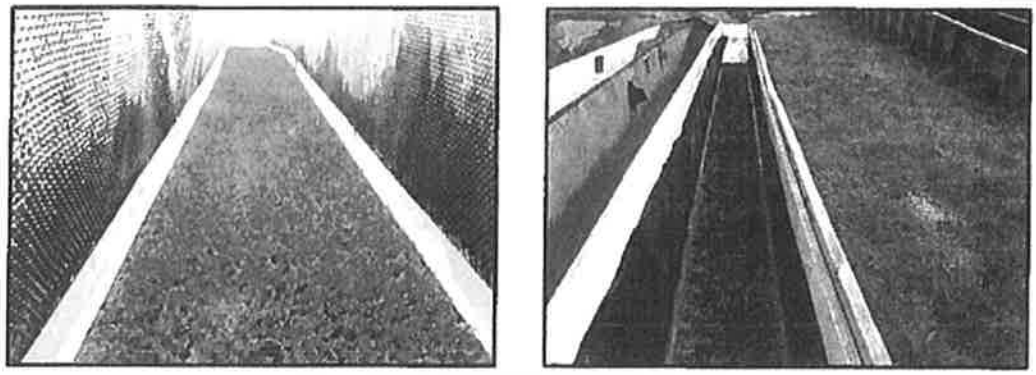
Project: ASTM D 6460: Large-scale Channel Testing (Single Replicate Results)
ClosureTurf with Mortar (3 parts sand; 2 parts powdered lime; 1 part cement)
Client: ClosureTurf
Test Date: 2/16&18/2011
Shear Range: 2.0 - 16.0 psf (target)
Flume Size & Slope: 2-ft wide x 40-ft long; 30% Bed
Event: 30 minutes at each shear

Shear Level	Flow depth (in)	Flow velocity (fps)	Flow (cfs)	Manning's roughness, n	Max Bed Shear Stress (psf)	CSLI (in)	Cumm. CSLI, (in)
1	1.22	4.90	0.99	0.036	1.87	0.01	0.01
2	4.08	12.35	8.39	0.032	6.27	0.02	0.03
3	6.44	18.23	19.54	0.030	9.89	0.03	0.06
4	8.27	21.59	29.73	0.029	12.70	0.04	0.10
5	9.96	24.55	40.73	0.029	15.30	0.09	0.18

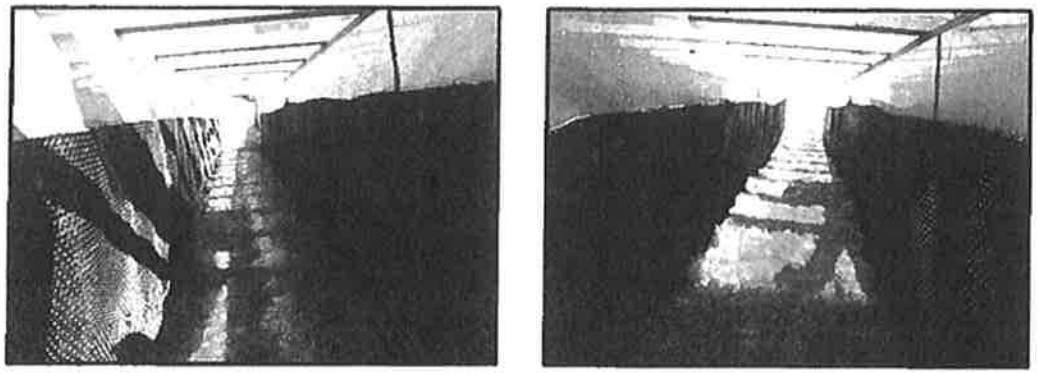


The testing is based upon accepted industry practice as well as the test method listed. Test results reported herein do not apply to samples other than those tested. TRI neither accepts responsibility for nor makes claim as to the final use and purpose

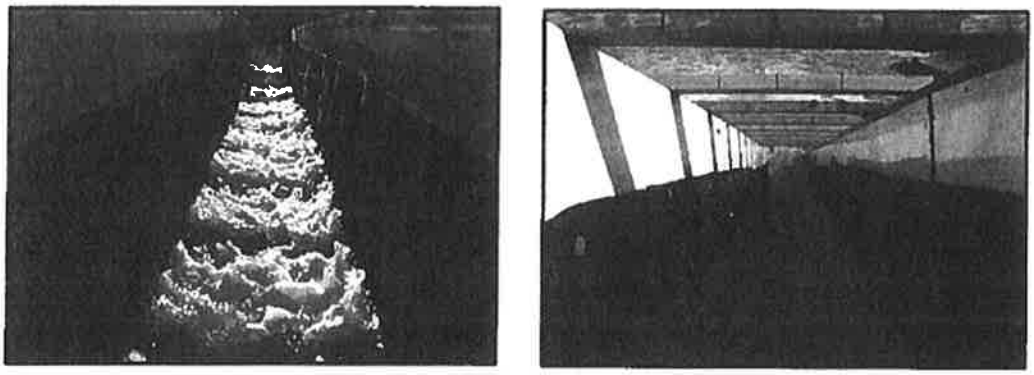
CJS 2/21/11
Quality Review / Date



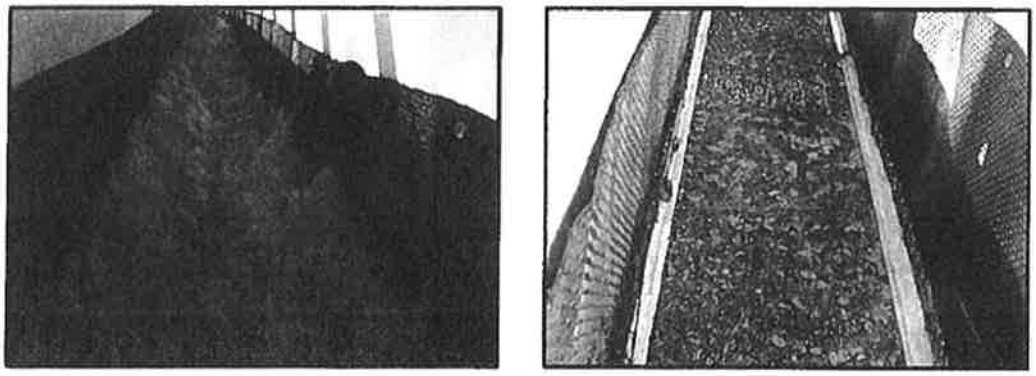
ClosureTurf Before & After Mortar Mix Applied



Low Shear Flows



Increasing Shear Flows



Highest Flow and Final Channel Condition after Testing (mortar mix showing cracks, some spalling at end)

FUSS & O'NEILL

Appendix B

Exposed TPO Manufacturer's Product Data

TPO vs. HDPE Geomembrane Performance

Designed for exposed geomembrane applications on landfills, Carlisle's GeoTPO provides enhanced, long-term performance especially when compared to traditional geomembranes, such as high-density polyethylene (HDPE). The superior performance characteristics of GeoTPO are portrayed in the chart below, which compares its performance to that of HDPE geomembrane.

Property or Characteristic	Test Frequency	Test Method (If Applicable)	Minimum Requirements	Carlisle TPO 60-Mil Geomembrane	Leading NR 60-Mil Smooth HDPE Geomembrane
Roll Length, ft (m)				480 (146.6)	560 (171)
Roll Length Tolerance, inches (mm)				-0, +1%	+/-1%
Roll Width, ft (m)				12 (3.7)	22.5 (6.9)
Roll Width Tolerance, inches (mm)				-0, +1%	+/-1%
Roll Area, ft² (m²)				5,760 (535.3)	12,600 (1,171)
Membrane Thickness, inches (mm)				.060, .072, .080 (1.5, 1.8, 2)	.060 (1.5)
Membrane Thickness Tolerance	Every roll			+/-10%	+/-10%
Roll Length/Width Tolerance					+/-1%
Fabric Internal Reinforcement				Yes, high strength polyester	None
Plasticizer Free				Yes	Yes
Melt Index (g/10min)	Resin Batch	ASTM D1238		N/A	<0.5
Melt Flow Index		ASTM D1238		1.3	N/A
Weathering Package Content (%)				4	None Listed
Carbon Black Content (%)	100,000 ft	ASTM D1603		0.5	2.0-3.0
Notched Constant Load ESCR		ASTM D5397		N/A	300 hours
Flex Modulus, PSI		D790		11,600	Not listed
Heat Seamable				Yes	Yes
Weld Method				Lap Joint, Single Weld with Wedge Welder	Double Wedge Weld
Seam Strength Inspection Method				Air Lance	Air Lance
Field Seam Strength, lbf/in (kN/m) Seam tested in peel mode after weld		ASTM D4437 1 in. wide		Shear Strength (PPI) - 100 (17.7) Fusion Peel (PPI) - 30 (5.3) N/A	Shear Strength (PPI) - 121 Fusion Peel (PPI) - 98 Extrusion Peel (PPI) - 78
Tensile Properties (each direction) **Strength at Break, lb/in-width (N/mm)** **Strength at Yield, lb/in-width (N/mm)**		ASTM D6693, Type IV Dumbell, 2 ipm		N/A	243 (42) 132 (23)
Breaking Strength, lbf (kN) - 60-mil - 72-mil - 80-mil		ASTM D751 grab method ASTM D4885 (8 by 8 in. sample)		Machine Direction/Cross Machine 360 (1.6) 150 (26.3) 400 (1.8) 170 (29.8) 425 (1.9) 180 (931.5)	N/A
Elongation at Yield, %		G.L. 1.3 in (33 mm)		N/A	13
Elongation at Break, % (sheet)		G.L. 2.0 in (51 mm)		25	700
Elongation at Break,% (fabric)		ASTM D6693 or ASTM D751		25	N/A
Elongation at Break, % (compound)		ASTM D6693 or ASTM D751		800	700
Density, g/cm³	200,000 lb	ASTM D 1505		1	0.94
Strength at Break, lbf/in. (N/mm)		ASTM D6693 or ASTM D751		250 (44)	243 (42)
Strength at Yield, lbf/in. (N/mm)		ASTM D6693 or ASTM D751		No yield due to fabric reinforcement	132 (23)
Tear Resistance, lbf (N)	45,000 lb	ASTM D1004 or ASTM D751		55 (245)	42 (186)
Puncture Resistance, lbf (N)	45,000 lb	ASTM D4833		120 (534)	125 (556)
Puncture Resistance, lbf (N)		FTM 101C, M2031		300 (1334)	Not listed
Linear Dimensional Change, %		ASTM D1204		±1 max	±2
Water Absorption Resistance, mass % top surface only		ASTM D471 166 h @ 158°F		3.0 max	Not listed
Hydrostatic Resistance, lbf/in² (MPa)		ASTM D751 Procedure A		350 (2.4)	Not listed
Resistance to Xenon-arc Weathering (UV, heat, water spray, etc.) 20,160 kJ/m² (8000 hours)		ASTM G155 0.70 W/m2 80 oC B.P.T.		No cracks No loss of strength	No comparable heat aging test listed
Resistance to Heat Aging (oxidation)		ASTM D573 8 weeks at 275 0f		No visible cracks after bending aged specimen around 0.25 in. diameter mandrel	No comparable heat aging test listed
Brittle Point		ASTM D2137		-50°F (-46°C)	Not listed
Resistance to Ozone		ASTM D1149 100 pphm, 168 hours		No visible cracks under 7X magnification	No comparable ozone test listed

CARLISLE Energy Services®

The Power of Your Landfill Cap

www.CarlisleEnergy.com · info@CarlisleEnergy.com · 1275 Ritner Highway · Carlisle, PA 17013 · Toll Free: +1-877-269-7183 · Fax: +1-888-841-9666

Technical Data Bulletin

CARLISLE'S

REINFORCED GEOTPO

General

Carlisle's GeoTPO is a premium heat-weldable single-ply thermoplastic polyolefin (TPO) sheet designed for geomembrane exposed applications particularly municipal solid waste (MSW) landfill caps. It is ideal as a base for attached (fully adhered) photovoltaic (PV) flexible panels.

GeoTPO with OctaGuard XT™ weathering package technology withstands extreme durability testing intended to simulate exposure to severe climates. (See Extreme Testing section for specific information). GeoTPO membrane is based on advanced polymerization technology that combines the flexibility of ethylene-propylene (EP) rubber with the heat weldability of polypropylene.

Physical properties of the membrane are enhanced by a strong, polyester fabric that is encapsulated between the TPO-based top and bottom plies. The combination of the fabric and TPO plies provide GeoTPO with high breaking strength, tearing strength and puncture resistance. The relatively smooth surface of GeoTPO membrane produces a total surface fusion-weld that creates a consistent, watertight monolithic assembly. The membrane is also environmentally friendly and safe to install.

GeoTPO products are available in white (highly reflective), tan and gray at 60-, 72- and 80-mil nominal thicknesses. Sixteen special colors including Dark Ivy are also available (see color palette on last page). Standard width is 12 feet and custom-size lengths of up to 500 feet are available in one continuous sheet without seams.

Features

- Wide window of weldability
- Outstanding puncture resistance
- Chlorine free with no halogenated flame retardants
- Plasticizer free - does not contain liquid or polymeric plasticizers
- Excellent low-temperature impact resistance
- Excellent chemical resistance to acids and bases
- Exceptional resistance to solar UV, ozone and oxidation
- Low water-vapor permeance and water absorption
- Hot-melt extrusion processed for complete scrim encapsulation
- Warp knitted fabric (non woven) for smooth surface and greater thickness over scrim
- Polyester reinforcing fabric is resistant to degradation by bacteria, mildew and fungi
- GeoTPO is 100% recyclable (refer to Carlisle's Recyclability Statement)

Technical Data Bulletin

Installation

Contact Carlisle for the specific design requirements and installation procedures for this system.

Typical Weights

60-mil - 0.30 lb/ft² (1.46 kg/m²)
72-mil - 0.35 lb/ft² (1.71 kg/m²)
80-mil - 0.40 lb/ft² (1.95 kg/m²)

Carlisle Reinforced GeoTPO
Basic Properties and Characteristics

Physical Property	ASTM D6878 Requirement	60-MIL	72-MIL	80-MIL
Tolerance on nominal thickness, % **- ASTM D751 test method**	+15, -10	± 10	± 10	± 10
Thickness over scrim, in. (mm) **- ASTM D6878 optical method, average of 3 areas**	0.012 min (0.305)	0.024 typical (0.610)	0.030 typical (0.762)	0.034 typical (0.864)
Breaking strength, lbf (kN) **- ASTM D751 grab method** **- ASTM D4885 lbf/in. (kN/m)**	220 (976 N) min none	250 (1.1) min 360 (1.6) typ 150 (26.3) typ	350 (1.6) min 400 (1.8) typ 170 (29.8) typ	350 (1.6) min 425 (1.9) typ 180 (31.5) typ
Elongation break of reinforcement, % **- ASTM D751 grab method** **- ASTM D4885 (8 by 8 in. sample)**	15 min	15 min 25 typ	15 min 25 typ	15 min 25 typ
Tearing strength, lbf (N) **- ASTM D751 proc. B 8 by 8 in.**	55 (245) min	55 (245) min 130 (578) typ	55 (245) min 130 (578) typ	55 (245) min 130 (578) typ
Brittleness point, °F (°C) **- ASTM D2137**	-40 (-40) max	-40 (-40) max -50 (-46) typ	-40 (-40) max -50 (-46) typ	-40 (-40) max -50 (-46) typ
Linear dimensional change, % **- ASTM D1204, 6 hours at 158°F**	± 1 max	± 1 max -0.2 typ	± 1 max -0.2 typ	± 1 max -0.2 typ
Ozone resistance, no cracks 7X **- ASTM D1149, 100 pphm, 168 hrs**	Pass	Pass	Pass	Pass
Water absorption resistance, mass % **- ASTM D471 top surface only 166 hours at 158°F water**	± 3.0 max	3.0 max 1.0 typ	3.0 max 1.0 typ	3.0 max 1.0 typ
Field seam strength, lbf/in. (kN/m) **- ASTM D1876 tested in peel**	No requirement	25 (4.4) min 60 (10.5) typ	40 (7.0) min 65 (11.4) typ	40 (7.0) min 70 (12.3) typ
Water vapor permeance, Perms **- ASTM E96 proc. B**	No requirement	0.10 max 0.05 typ	0.10 max 0.05 typ	0.10 max 0.05 typ
Puncture resistance, lbf (kN) **- FTM 101C, method 2031** **(see supplemental section)**	No requirement	300 (1.3) min 350 (1.6) typ	350 (1.6) min 400 (1.8) typ	400 (1.8) min 450 (2.0) typ
Properties after heat aging **- ASTM D573, 670 hrs at 240°F** **- Breaking strength, % retained** **- Elongation reinf., % retained** **- Tearing strength, % retained** **- Weight change, %**	 90 min 90 min 60 min ± 1.0 max	 90 min 90 min 60 min ± 1.0 max	 90 min 90 min 60 min ± 1.0 max	 90 min 90 min 60 min ± 1.0 max

Extreme Testing For Severe Climates

ASTM Standard D6878 is the material specification for Thermoplastic Polyolefin Based Sheet. It covers material property requirements for TPO sheet and includes initial and aged properties after heat and xenon-arc exposure. As stated in the Scope of the standard, "the tests and property limits used to characterize the sheet are values intended to ensure minimum quality for the intended purpose". Carlisle's goal is to produce TPO that ensures maximum performance for the intended purpose of geomembrane. Maximum performance requires the membrane to far exceed the requirements of ASTM D6878. For severe climates like Miami, FL and Phoenix, AZ, EXTREME testing is required.

Heat Aging to accelerate oxidation rate that roughly doubles for each 18°F (10°C) increase in membrane temperature. Oxidation (reaction with oxygen) is one of the primary chemical degradation mechanisms of polymeric construction materials.

ASTM requirement – 670 hours (about 28 days) at 240°F (116°C)
Carlisle EXTREME test – 8 weeks (56 days) at 275°F (135°C)
Comparable to 32 weeks (224 days) at 240°F or 1024 weeks (20 years) at 185°F for 6 hours per day

- Test specimen is 1 by 4 inch piece of 60-mil membrane, un-backed, placed in circulating hot-air oven
- Criteria – no visible cracks after bending aged test specimen around 0.25-inch-diameter mandrel

Xenon-Arc exposes the membrane samples to the combined affect of ultraviolet, visible and infrared radiation as well as ozone, heat and water spray to greatly accelerate the affects of outdoor weathering. The radiation dose is measured in kilojoules per square meter (kJ/m^2) at 340 nm machine UV wavelength. The irradiance power of the xenon-arc lamp is measured in Watts per square meter (W/m^2).

	ASTM D6878 Requirement	45-MIL	60-MIL	72-MIL	80-MIL
kJ/m^2 at 340 nm	10,080	17,640	20,160	25,200	27,720
Hours at 0.35 W/m^2	8,000	14,000	16,000	20,000	22,000
Hours at 0.70 W/m^2	4,000	7,000	8,000	10,000	11,000
Total UV in MJ/m^2 (300 to 400 nm)	1210	2118	2420	3025	3328

- Test specimen is 2.75 by 5.5 inch piece of membrane, un-backed, weathering side facing arc lamp
- Criteria – no visible cracks viewed under 10X magnification while wrapped around 3-inch-diameter mandrel

Environmental Cycling subjects the membrane to repeated cycles of heat aging, hot-water immersion or acid fog followed by xenon-arc exposure. The acid fog accelerates acid etching that may be caused by acid rain if the membrane is not resistant to acidic conditions.

ASTM requirement – none
Carlisle EXTREME test – one cycle is represented by the series below:

- 10 days heat aging at 240°F (116°C) followed by;
- 5 days water immersion at 158°F (70°C) or with another specimen set;
- 5 eight-hour cycles in Kesternich sulfur dioxide chamber (sulfurous acid fog) followed by;
- 5040 kJ/m^2 (2000 hrs at 0.70 W/m^2 irradiance) xenon-arc exposure
- Test specimen is 2.75 by 5.5 inch piece of membrane with edges sealed
- Criteria – after 3 completed cycles, test specimens shall remain flexible and not have any cracking under 10X magnification while wrapped around a 3-inch-diameter mandrel.

Cautions and Warnings:
(GeoTPO White has very high sunlight reflectance)

- Sunglasses that filter out ultraviolet light are strongly recommended as tan and white surfaces are highly reflective to sunlight. Technicians should dress appropriately and wear sunscreen to protect skin from the sun.
- Surfaces may be slippery due to frost and ice buildup. Exercise caution during cold conditions to prevent falls. Membrane may be slippery when wet. Exercise caution when walking on wet membrane.
- Care must be exercised when working close to an edge when surrounding area is snow covered as the edge may not be clearly visible.
- Use proper stacking procedures to ensure sufficient stability of the rolls.
- Store GeoTPO membrane in the original undisturbed plastic wrap in a cool, shaded area and cover with light-colored, breathable, waterproof tarpaulins. GeoTPO membrane that has been exposed to the weather for approximately 7 days or longer must be prepared with Weathered Membrane Cleaner prior to hot-air welding. Rolls should be elevated above the ground so they are not resting directly on soil, vegetation or water ponds.

Technical Data Bulletin

Supplemental Approvals, Statements And Characteristics:

1. GeoTPO meets or exceeds the requirements of **ASTM D6878**[1] Standard Specification for Thermoplastic Polyolefin Based Sheet

2. GeoTPO membranes conform to requirements of the U.S.E.P.A. **Toxic Leachate Test** (40 CFR part 136) performed by an independent analytical laboratory.

3. Reinforced GeoTPO was tested for **dynamic puncture resistance** per ASTM D5635-04 using the most recently modified impact head. 60-mil membrane was watertight after an impact energy of 22.5 J (16.6 ft-lbf). Both 72-mil and 80-mil products were watertight after an impact energy of 30.0 J (22.1 ft-lbf).

[1] *Copyright © ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, USA.*

GeoTPO Color Pallete

CARLISLE
Carlisle SynTec

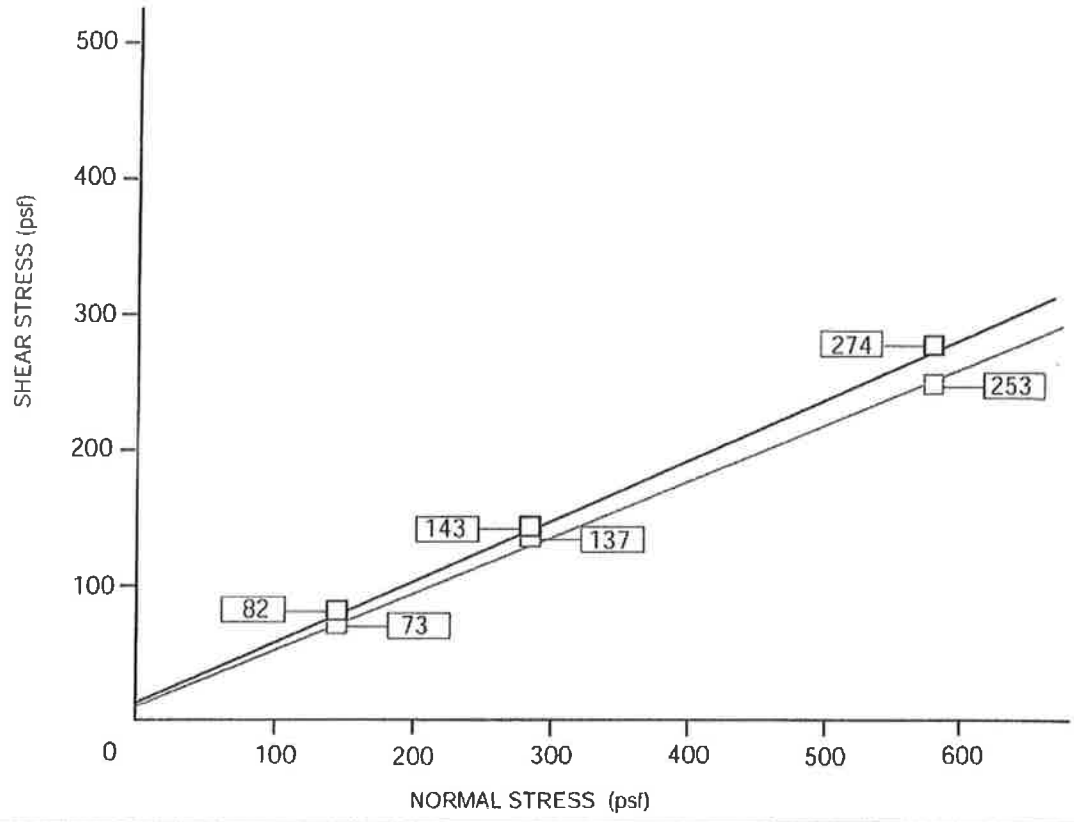
CUMBERLAND GEOSCIENCE CONSULTANTS
A Division of Duffield Associates

801 Belvedere Street
Carlisle, PA 17013-4002
(717) 245-9100
Fax (717) 245-9656
www.cumberlandgeo.com

Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method ASTM Test Method D 5321

Test No. 1

Interface Shear: TPO Geomembrane / Skaps 16 oz. Nonwoven Geotextile



TEST RESULTS

Shear Strength	
Peak Friction Angle:	24.0°
Adhesion:	16.5 psf
Residual Friction Angle:	22.5°
Adhesion:	15.0 psf

Project No. 08317.ZA
Carlisle Syntech
TPO Geomembrane Laboratory Testing
Carlisle, Pennsylvania
March 19, 2010

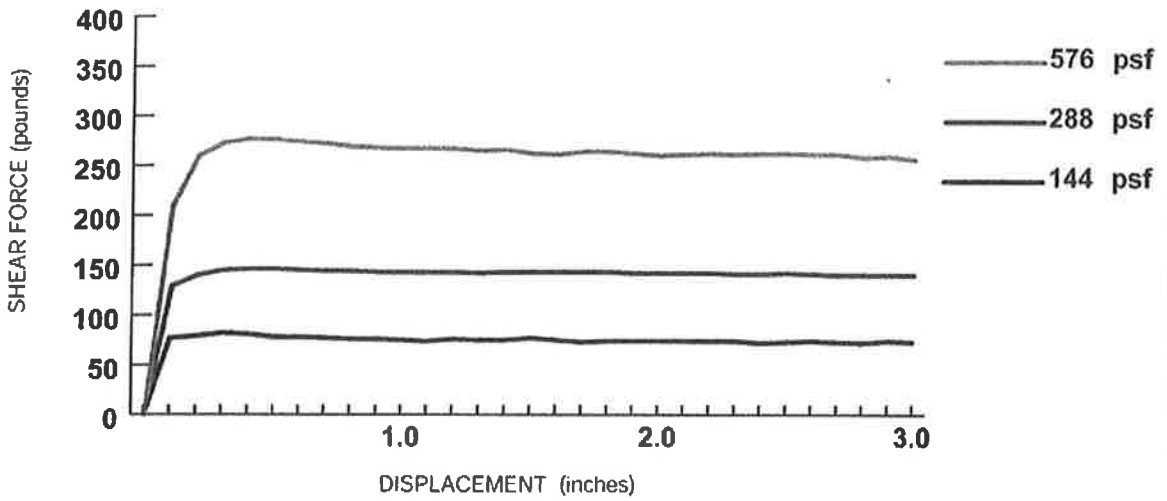
CGC CUMBERLAND GEOSCIENCE CONSULTANTS
A Division of Duffield Associates

801 Belvedere Street
Carlisle, PA 17013-4002
(717) 245-9100
Fax (717) 245-9656
www.cumberlandgeo.com

Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method ASTM Test Method D 5321

Test No. 1

Interface Shear Test: TPO geomembrane / Skaps 16 oz. Nonwoven Geotextile



Components in S hear Box

Material	Material Description
Superstrata	Rigid steel support, Normal load
Geomembrane	TPO Geomembrane (Green side up)
Shear P lane	
Geotextile	Skaps 16 oz. Nonwoven Geotextile (wet)
Substrata	Rigid steel, wood support

Traveling Box (12" x 12" x 3")

Stationary Box (12"x12" x 3")

Speed of Displacement = 0.2 inch/minute

Project No. 08317.ZA
Carlisle Syntech
TPO Geomembrane Laboratory Testing
Carlsile, Pennsylvania
March 19, 2010

FUSS & O'NEILL

Appendix C

Closure Turf™ Watershed Analysis

SCALE: HORZ. 1" = 200'
GRAPHIC SCALE 0 100 200

FUSS & O'NEILL
146 HARTFORD ROAD
MANCHESTER, CONNECTICUT 06040

CONNECTICUT RESOURCES RECOVERY AUTHORITY

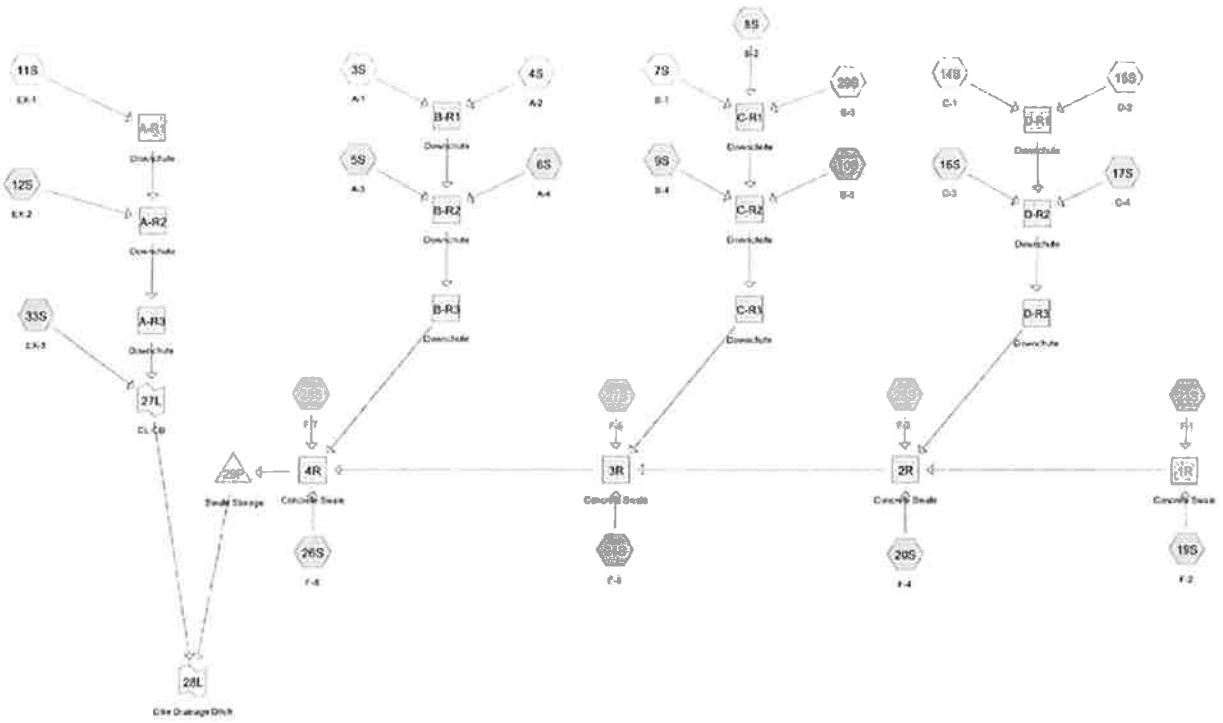
PROPOSED DRAINAGE AREAS
CLOSURE TURF ALTERNATIVE

AMENDMENT TO THE
HARTFORD LANDFILL CLOSURE PLAN

HARTFORD | CONNECTICUT

PROJ. No.: 2010.0123.H20
DATE: JULY 2011

DRA-10



Subcat | Reach | Pond | Link

Drainage Diagram for Proposed_Agru_Turf
Prepared by Fuss & O'Neill Inc., Printed 12/7/2011

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.650	77	Existing Landfill (11S, 12S, 33S)
3.100	89	Gravel roads, HSG C (19S, 20S, 24S, 26S)
35.060	95	AgruTURF (3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 14S, 15S, 16S, 17S, 23S, 25S, 27S, 28S, 29S)
41.810		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.100	HSG C	19S, 20S, 24S, 26S
0.000	HSG D	
38.710	Other	3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S, 11S, 12S, 14S, 15S, 16S, 17S, 23S, 25S, 27S, 28S, 29S, 33S
41.810		**TOTAL AREA**

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 3S: A-1 Runoff Area=1.510 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=7.99 cfs 0.589 af

Subcatchment 4S: A-2 Runoff Area=1.730 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=9.16 cfs 0.674 af

Subcatchment 5S: A-3 Runoff Area=1.310 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=6.94 cfs 0.511 af

Subcatchment 6S: A-4 Runoff Area=0.880 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=4.66 cfs 0.343 af

Subcatchment 7S: B-1 Runoff Area=1.430 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=7.57 cfs 0.557 af

Subcatchment 8S: B-2 Runoff Area=2.730 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=14.45 cfs 1.064 af

Subcatchment 9S: B-4 Runoff Area=0.920 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=4.87 cfs 0.359 af

Subcatchment 10S: B-5 Runoff Area=1.090 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=5.77 cfs 0.425 af

Subcatchment 11S: EX-1 Runoff Area=0.380 ac 0.00% Impervious Runoff Depth>2.84"
Tc=5.0 min CN=77 Runoff=1.36 cfs 0.090 af

Subcatchment 12S: EX-2 Runoff Area=0.440 ac 0.00% Impervious Runoff Depth>2.84"
Tc=5.0 min CN=77 Runoff=1.57 cfs 0.104 af

Subcatchment 14S: C-1 Runoff Area=3.880 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=20.54 cfs 1.512 af

Subcatchment 15S: C-2 Runoff Area=5.420 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=28.69 cfs 2.112 af

Subcatchment 16S: C-3 Runoff Area=1.130 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=5.98 cfs 0.440 af

Subcatchment 17S: C-4 Runoff Area=1.950 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=10.32 cfs 0.760 af

Subcatchment 19S: F-2 Runoff Area=0.790 ac 0.00% Impervious Runoff Depth>4.02"
Tc=5.0 min CN=89 Runoff=3.82 cfs 0.265 af

Subcatchment 20S: F-4 Runoff Area=0.790 ac 0.00% Impervious Runoff Depth>4.02"
Tc=5.0 min CN=89 Runoff=3.82 cfs 0.265 af

Subcatchment 23S: F-1 Runoff Area=2.100 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=11.12 cfs 0.818 af

Subcatchment 24S: F-6 Runoff Area=0.670 ac 0.00% Impervious Runoff Depth>4.02"
Tc=5.0 min CN=89 Runoff=3.24 cfs 0.225 af

Subcatchment 25S: F-3 Runoff Area=1.840 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=9.74 cfs 0.717 af

Subcatchment 26S: F-8 Runoff Area=0.850 ac 0.00% Impervious Runoff Depth>4.02"
Tc=5.0 min CN=89 Runoff=4.11 cfs 0.285 af

Subcatchment 27S: F-5 Runoff Area=1.470 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=7.78 cfs 0.573 af

Subcatchment 28S: F-7 Runoff Area=2.280 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=12.07 cfs 0.889 af

Subcatchment 29S: B-3 Runoff Area=3.390 ac 0.00% Impervious Runoff Depth>4.68"
Tc=5.0 min CN=95 Runoff=17.95 cfs 1.321 af

Subcatchment 33S: EX-3 Runoff Area=2.830 ac 0.00% Impervious Runoff Depth>2.84"
Tc=5.0 min CN=77 Runoff=10.12 cfs 0.670 af

Reach 1R: Concrete Swale Avg. Flow Depth=0.60' Max Vel=3.45 fps Inflow=14.94 cfs 1.083 af
n=0.013 L=785.0' S=0.0031 '/' Capacity=785.22 cfs Outflow=13.02 cfs 1.078 af

Reach 2R: Concrete Swale Avg. Flow Depth=1.78' Max Vel=4.06 fps Inflow=86.81 cfs 6.883 af
n=0.013 L=806.0' S=0.0011 '/' Capacity=456.44 cfs Outflow=79.46 cfs 6.856 af

Reach 3R: Concrete Swale Avg. Flow Depth=2.16' Max Vel=4.58 fps Inflow=123.31 cfs 11.378 af
n=0.013 L=673.0' S=0.0010 '/' Capacity=453.30 cfs Outflow=120.14 cfs 11.346 af

Reach 4R: Concrete Swale Avg. Flow Depth=2.49' Max Vel=4.40 fps Inflow=145.22 cfs 14.635 af
n=0.013 L=628.0' S=0.0008 '/' Capacity=396.60 cfs Outflow=142.75 cfs 14.595 af

Reach A-R1: Downchute Avg. Flow Depth=0.03' Max Vel=4.17 fps Inflow=1.36 cfs 0.090 af
n=0.017 L=101.0' S=0.2178 '/' Capacity=881.84 cfs Outflow=1.35 cfs 0.090 af

Reach A-R2: Downchute Avg. Flow Depth=0.05' Max Vel=5.77 fps Inflow=2.91 cfs 0.194 af
n=0.017 L=157.0' S=0.2357 '/' Capacity=917.26 cfs Outflow=2.87 cfs 0.194 af

Reach A-R3: Downchute Avg. Flow Depth=0.05' Max Vel=5.98 fps Inflow=2.87 cfs 0.194 af
n=0.017 L=48.0' S=0.2708 '/' Capacity=983.31 cfs Outflow=2.86 cfs 0.194 af

Reach B-R1: Downchute Avg. Flow Depth=0.18' Max Vel=8.84 fps Inflow=17.15 cfs 1.263 af
n=0.030 L=67.0' S=0.3284 '/' Capacity=613.54 cfs Outflow=17.00 cfs 1.263 af

Reach B-R2: Downchute Avg. Flow Depth=0.25' Max Vel=10.81 fps Inflow=28.59 cfs 2.116 af
n=0.030 L=121.8' S=0.3366 '/' Capacity=621.21 cfs Outflow=28.22 cfs 2.115 af

Reach B-R3: Downchute Avg. Flow Depth=0.25' Max Vel=10.78 fps Inflow=28.22 cfs 2.115 af
n=0.030 L=42.0' S=0.3333 '/' Capacity=618.17 cfs Outflow=28.16 cfs 2.115 af

Reach C-R1: Downchute Avg. Flow Depth=0.31' Max Vel=12.17 fps Inflow=39.97 cfs 2.943 af
n=0.030 L=67.0' S=0.3284 '/' Capacity=613.54 cfs Outflow=39.70 cfs 2.942 af

Reach C-R2: Downchute Avg. Flow Depth=0.35' Max Vel=13.34 fps Inflow=50.34 cfs 3.726 af
n=0.030 L=121.8' S=0.3366 '/' Capacity=621.21 cfs Outflow=49.75 cfs 3.725 af

Reach C-R3: Downchute Avg. Flow Depth=0.35' Max Vel=13.30 fps Inflow=49.75 cfs 3.725 af
n=0.030 L=42.0' S=0.3333 '/' Capacity=618.17 cfs Outflow=49.67 cfs 3.724 af

Reach D-R1: Downchute Avg. Flow Depth=0.35' Max Vel=13.15 fps Inflow=49.24 cfs 3.625 af
n=0.030 L=67.0' S=0.3284 '/' Capacity=613.54 cfs Outflow=48.93 cfs 3.624 af

Reach D-R2: Downchute Avg. Flow Depth=0.41' Max Vel=14.65 fps Inflow=65.23 cfs 4.825 af
n=0.030 L=121.8' S=0.3366 '/' Capacity=621.21 cfs Outflow=64.47 cfs 4.824 af

Reach D-R3: Downchute Avg. Flow Depth=0.41' Max Vel=14.62 fps Inflow=64.47 cfs 4.824 af
n=0.030 L=42.0' S=0.3333 '/' Capacity=618.17 cfs Outflow=64.38 cfs 4.823 af

Pond 29P: Swale Storage Peak Elev=45.20' Storage=0.975 af Inflow=142.75 cfs 14.595 af
Primary=121.51 cfs 14.581 af Secondary=0.00 cfs 0.000 af Outflow=121.51 cfs 14.581 af

Link 27L: CL-CB Inflow=12.91 cfs 0.864 af
Primary=12.91 cfs 0.864 af

Link 28L: Dike Drainage Ditch Inflow=126.38 cfs 15.446 af
Primary=126.38 cfs 15.446 af

Total Runoff Area = 41.810 ac Runoff Volume = 15.568 af Average Runoff Depth = 4.47"
100.00% Pervious = 41.810 ac 0.00% Impervious = 0.000 ac

Summary for Subcatchment 3S: A-1

[49] Hint: Tc<2dt may require smaller dt

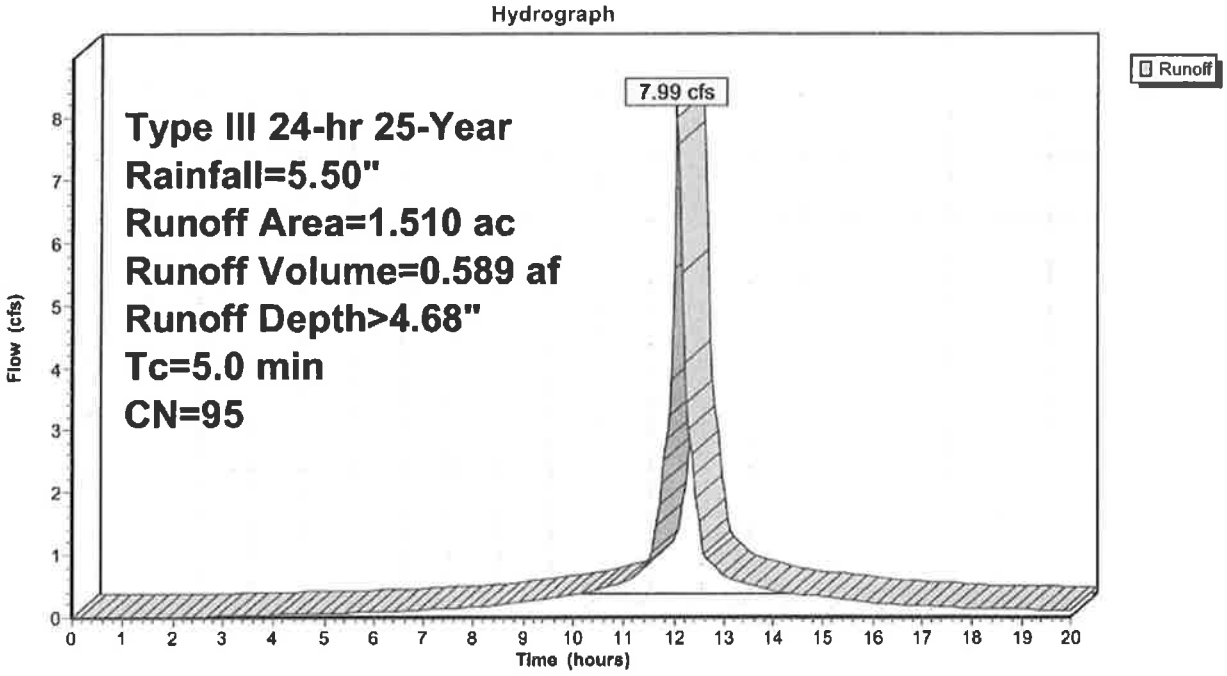
Runoff = 7.99 cfs @ 12.07 hrs, Volume= 0.589 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	1.510	95	AgruTURF
	1.510		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 3S: A-1



Summary for Subcatchment 4S: A-2

[49] Hint: Tc<2dt may require smaller dt

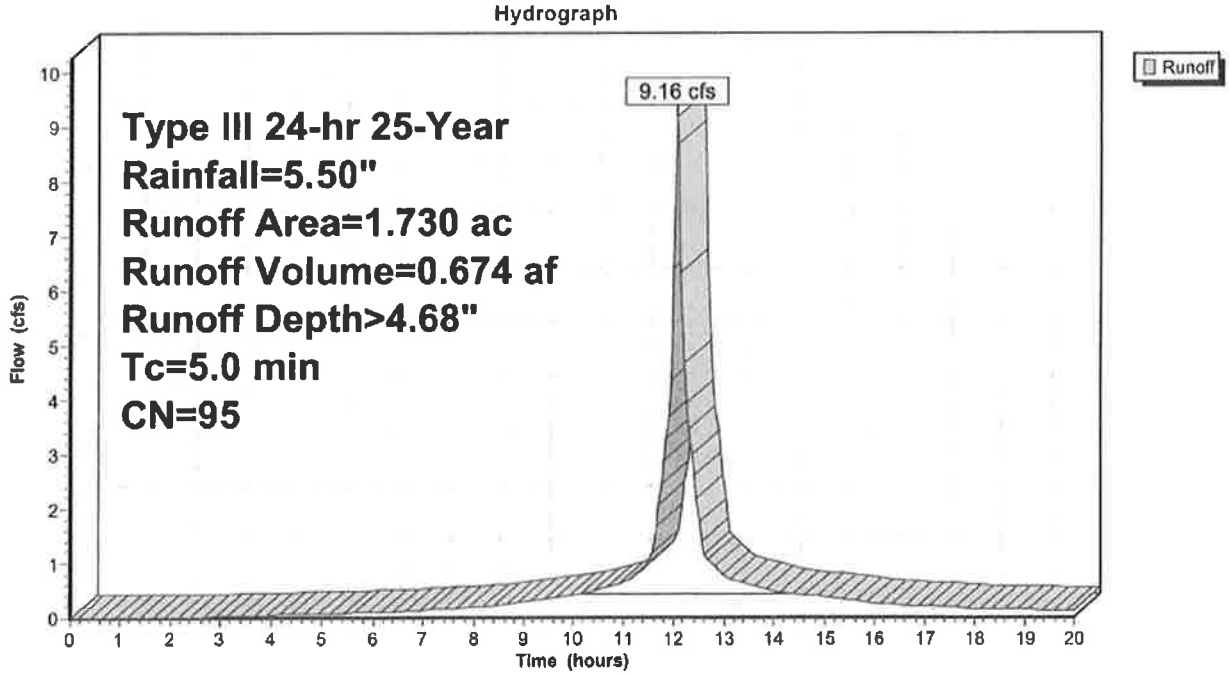
Runoff = 9.16 cfs @ 12.07 hrs, Volume= 0.674 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	1.730	95	AgruTURF
	1.730		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 4S: A-2



Summary for Subcatchment 5S: A-3

[49] Hint: Tc<2dt may require smaller dt

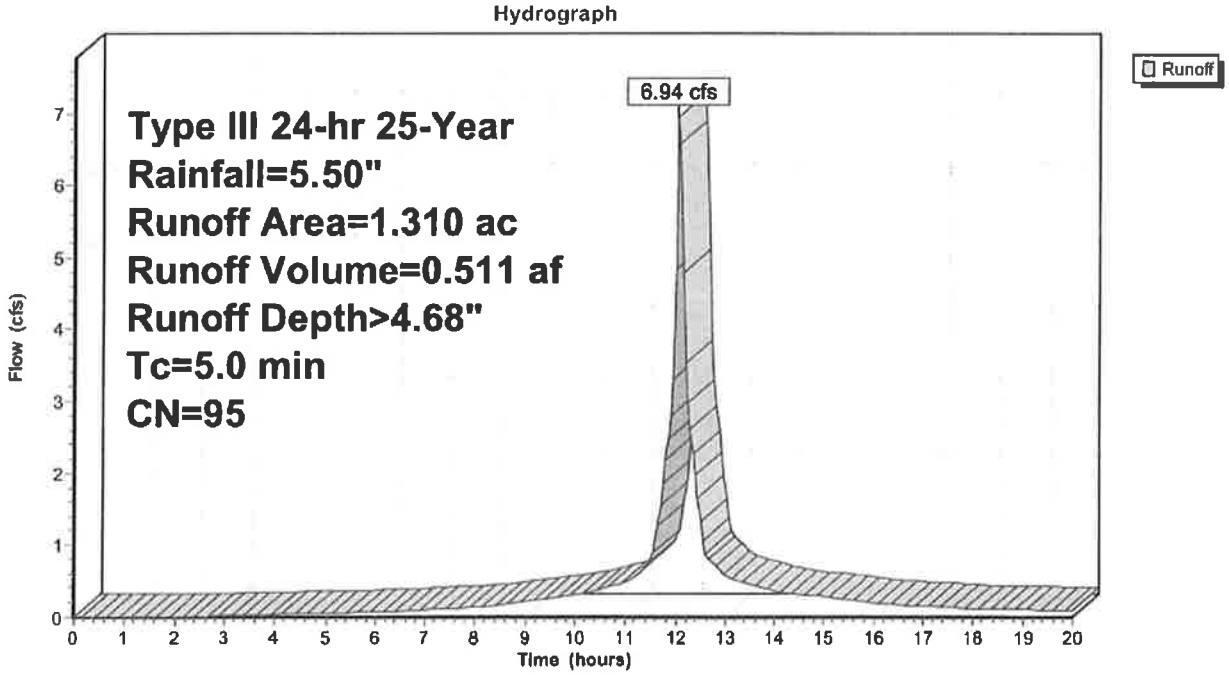
Runoff = 6.94 cfs @ 12.07 hrs, Volume= 0.511 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	1.310	95	AgruTURF
	1.310		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 5S: A-3



Summary for Subcatchment 6S: A-4

[49] Hint: Tc<2dt may require smaller dt

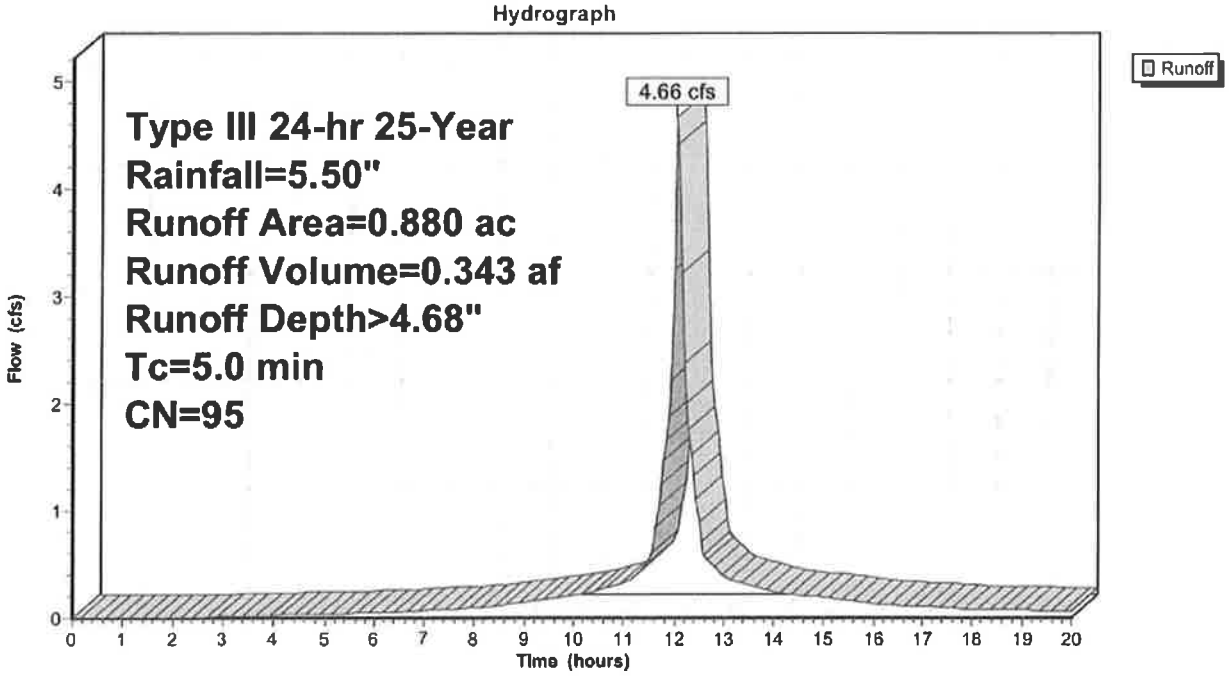
Runoff = 4.66 cfs @ 12.07 hrs, Volume= 0.343 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	0.880	95	AgruTURF
	0.880		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 6S: A-4



Summary for Subcatchment 7S: B-1

[49] Hint: Tc<2dt may require smaller dt

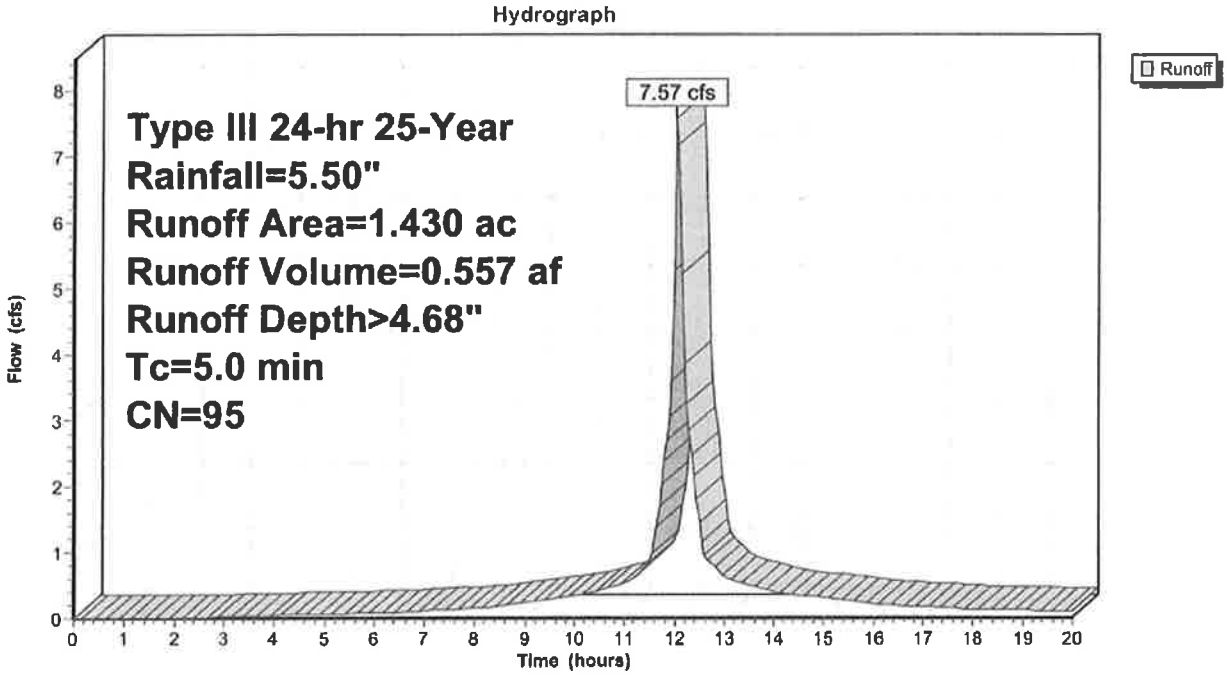
Runoff = 7.57 cfs @ 12.07 hrs, Volume= 0.557 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	1.430	95	AgruTURF
	1.430		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 7S: B-1



Summary for Subcatchment 8S: B-2

[49] Hint: Tc<2dt may require smaller dt

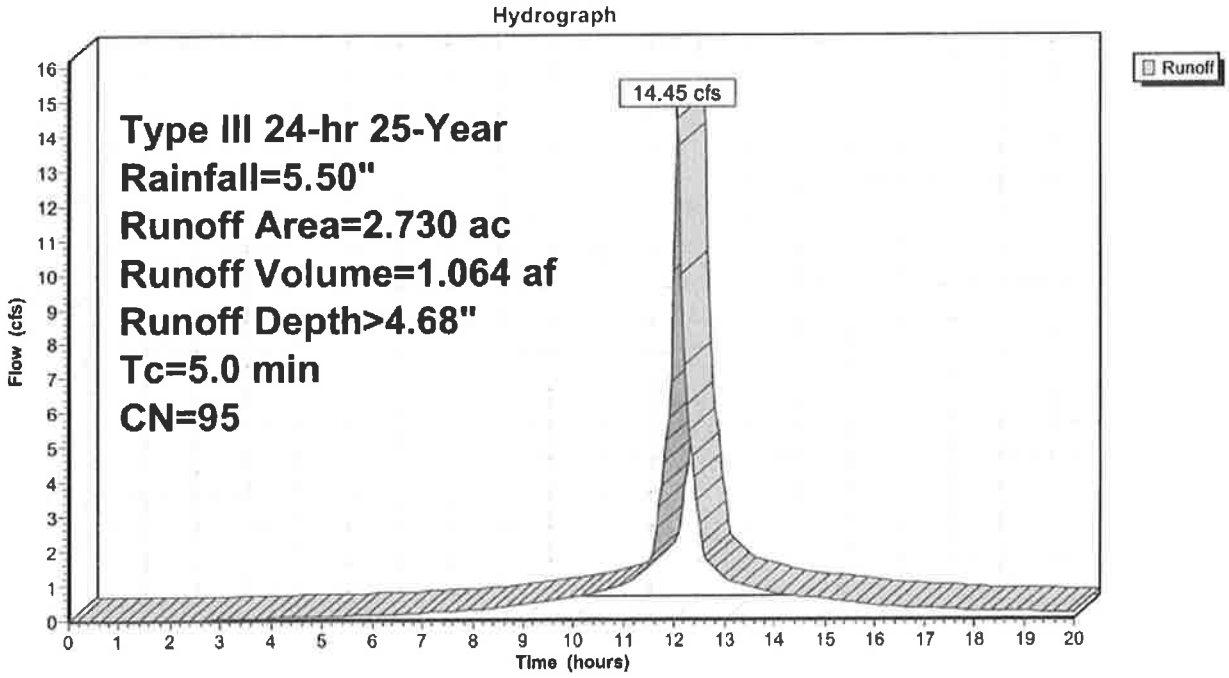
Runoff = 14.45 cfs @ 12.07 hrs, Volume= 1.064 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	2.730	95	AgruTURF
	2.730		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 8S: B-2



Summary for Subcatchment 9S: B-4

[49] Hint: Tc<2dt may require smaller dt

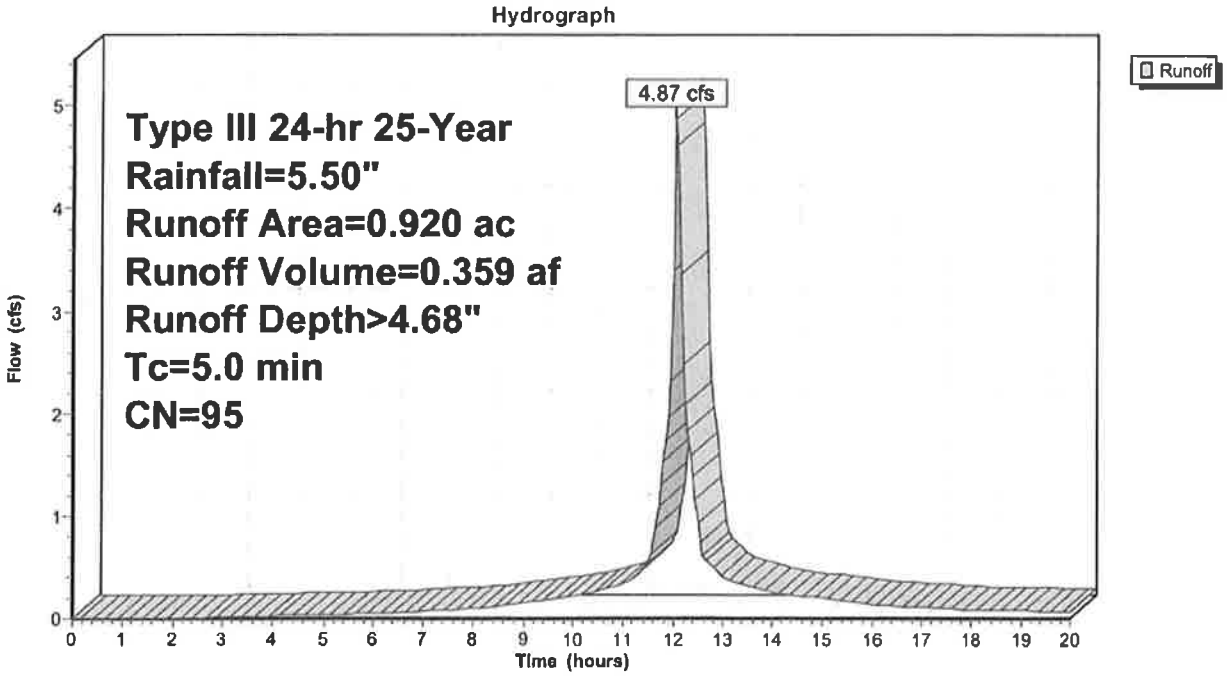
Runoff = 4.87 cfs @ 12.07 hrs, Volume= 0.359 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	0.920	95	AgruTURF
	0.920		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 9S: B-4



Summary for Subcatchment 10S: B-5

[49] Hint: Tc<2dt may require smaller dt

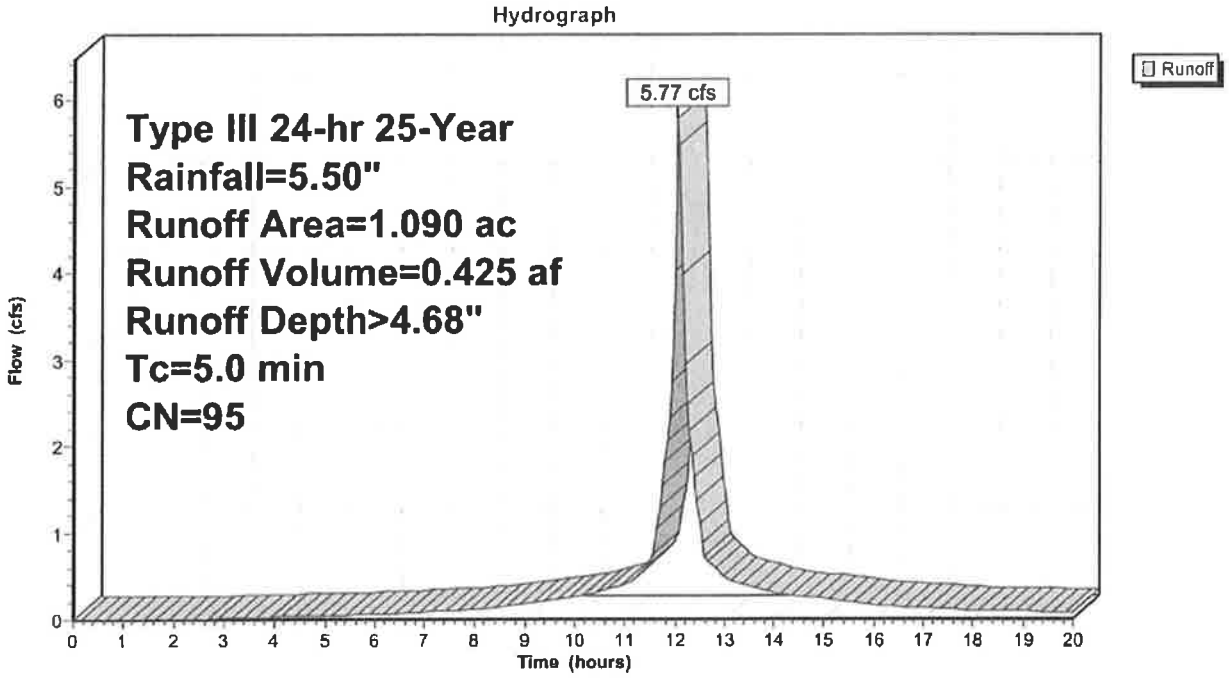
Runoff = 5.77 cfs @ 12.07 hrs, Volume= 0.425 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	1.090	95	AgruTURF
	1.090		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 10S: B-5



Summary for Subcatchment 11S: EX-1

[49] Hint: Tc<2dt may require smaller dt

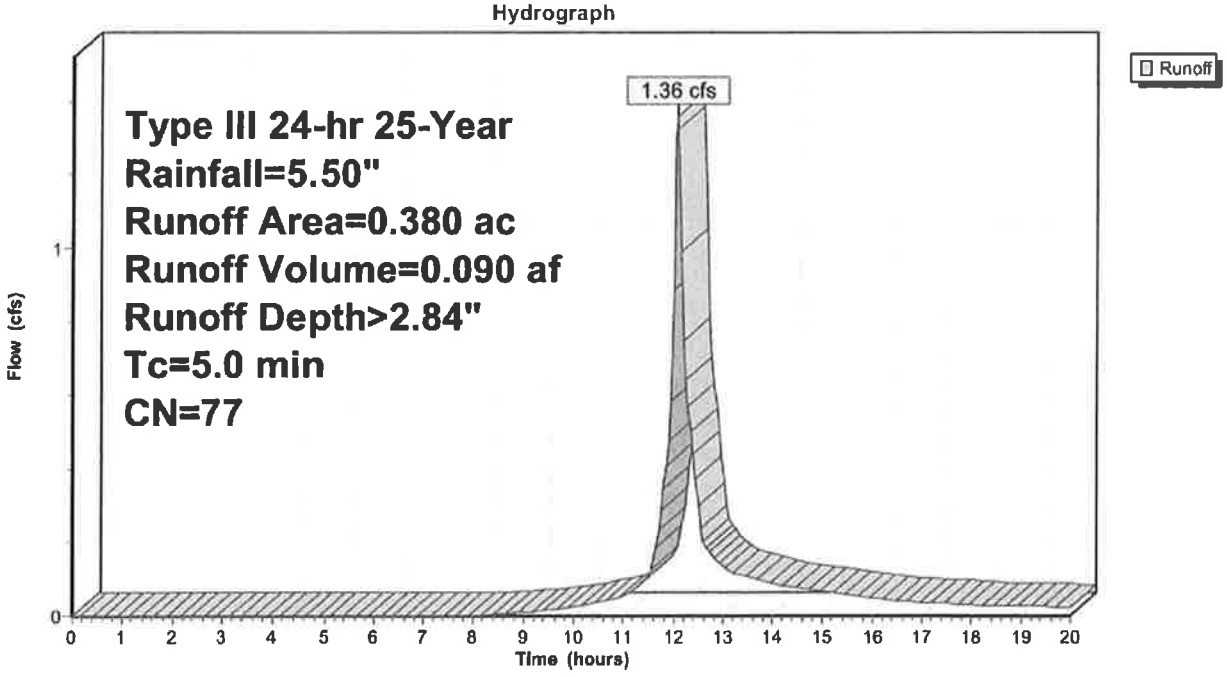
Runoff = 1.36 cfs @ 12.08 hrs, Volume= 0.090 af, Depth> 2.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	0.380	77	Existing Landfill
	0.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 11S: EX-1



Summary for Subcatchment 12S: EX-2

[49] Hint: Tc<2dt may require smaller dt

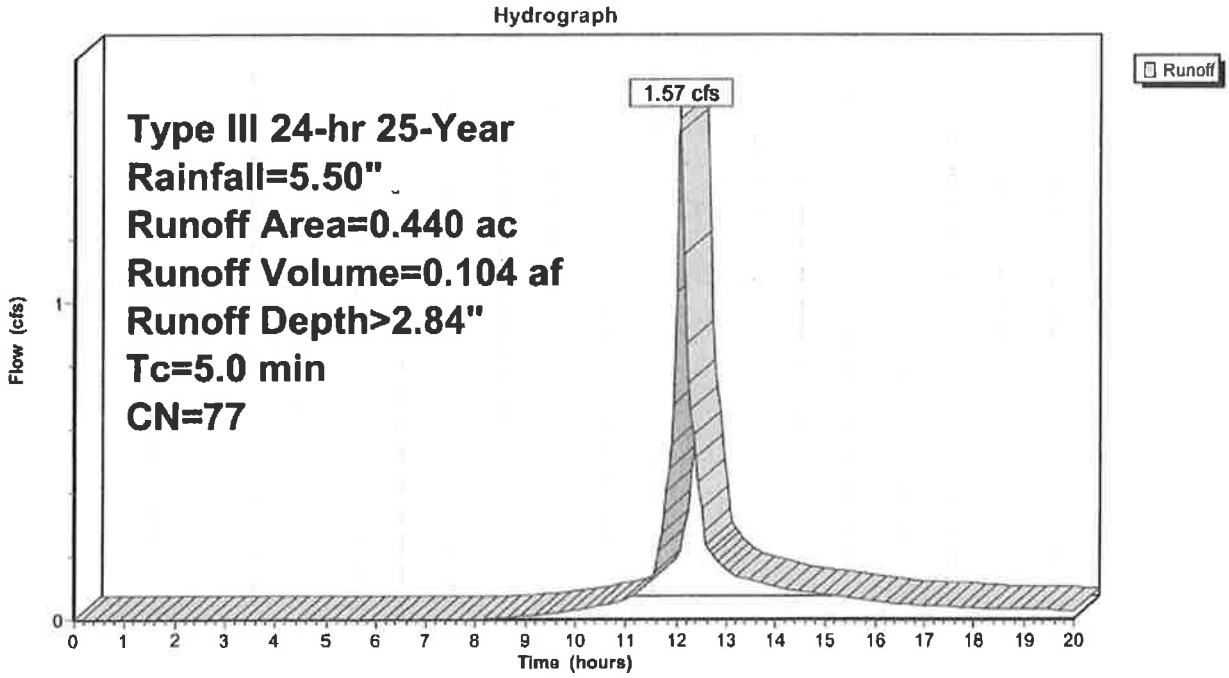
Runoff = 1.57 cfs @ 12.08 hrs, Volume= 0.104 af, Depth> 2.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	0.440	77	Existing Landfill
	0.440		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 12S: EX-2



Summary for Subcatchment 14S: C-1

[49] Hint: Tc<2dt may require smaller dt

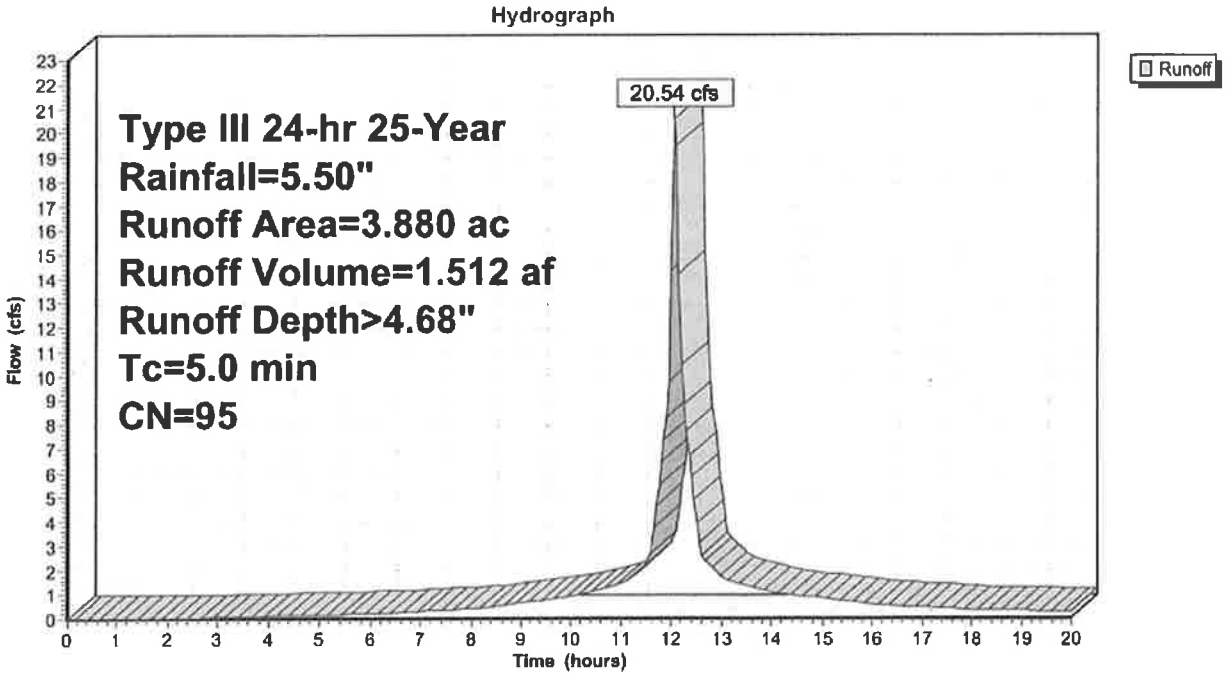
Runoff = 20.54 cfs @ 12.07 hrs, Volume= 1.512 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	3.880	95	AgruTURF
	3.880		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 14S: C-1



Summary for Subcatchment 15S: C-2

[49] Hint: Tc<2dt may require smaller dt

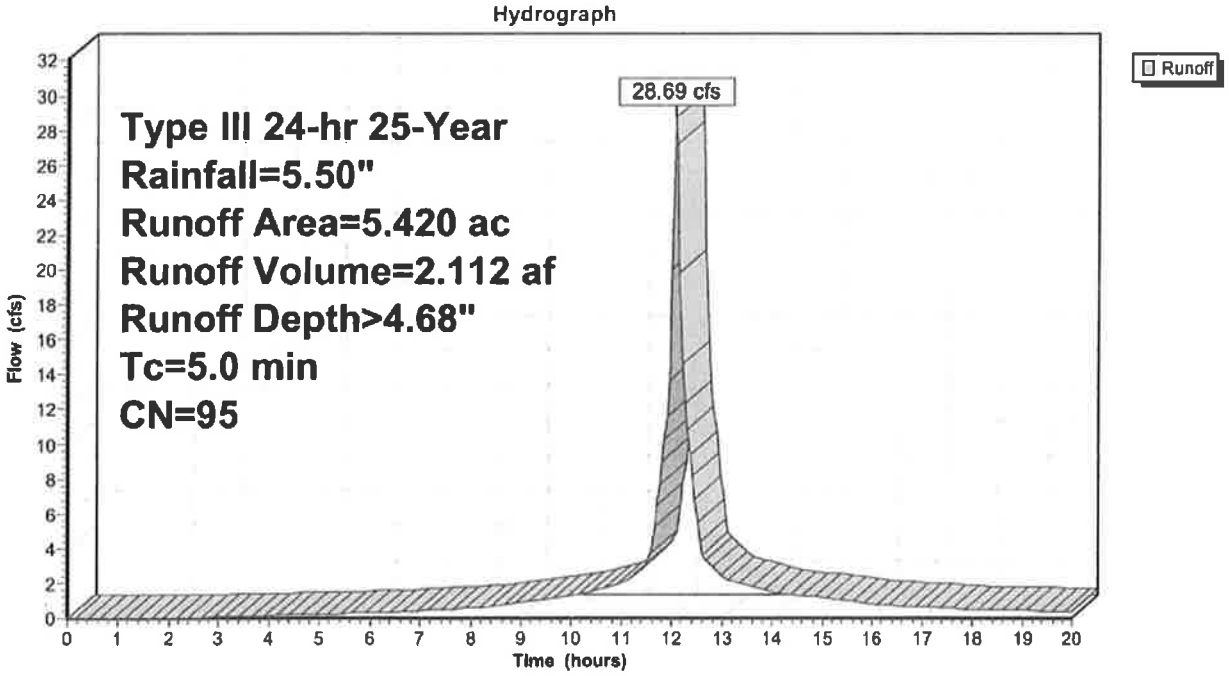
Runoff = 28.69 cfs @ 12.07 hrs, Volume= 2.112 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	5.420	95	AgruTURF
	5.420		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 15S: C-2



Summary for Subcatchment 16S: C-3

[49] Hint: Tc<2dt may require smaller dt

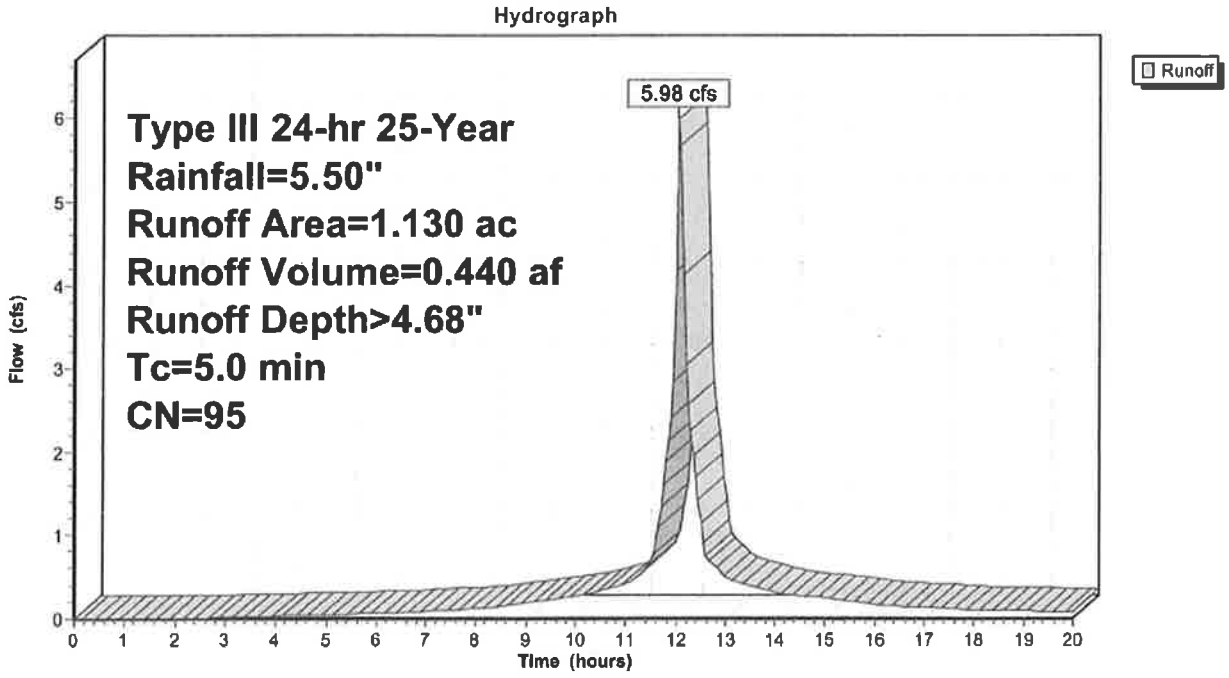
Runoff = 5.98 cfs @ 12.07 hrs, Volume= 0.440 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	1.130	95	AgruTURF
	1.130		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 16S: C-3



Summary for Subcatchment 17S: C-4

[49] Hint: Tc<2dt may require smaller dt

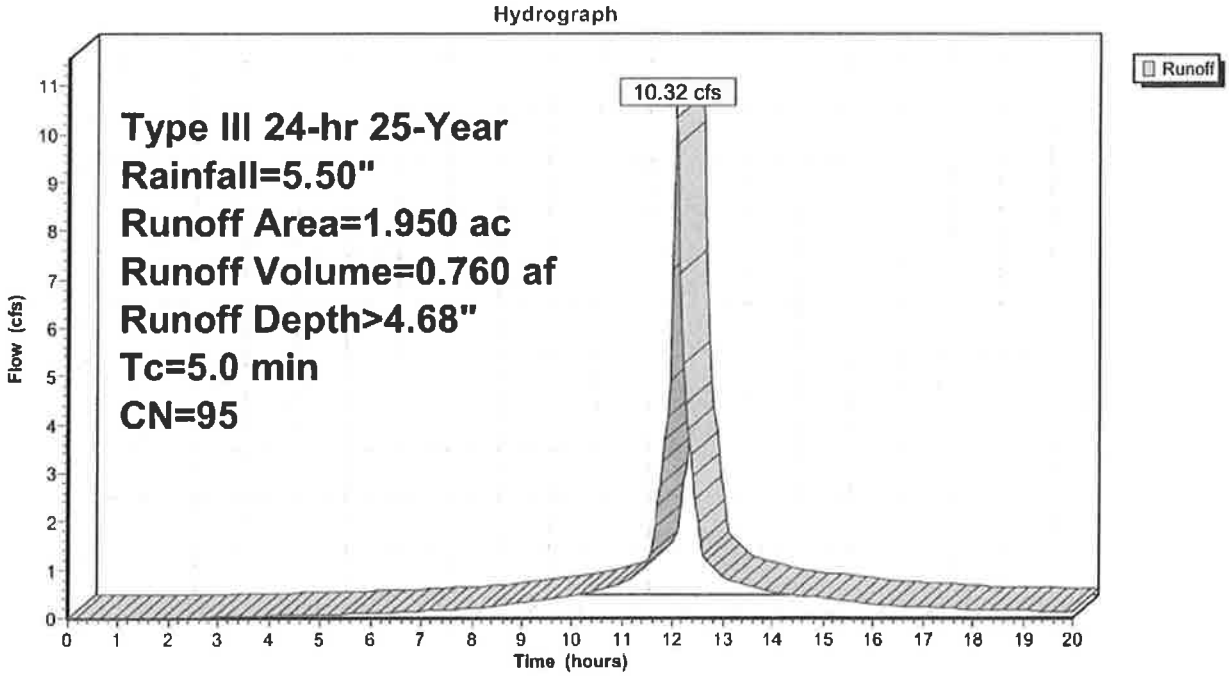
Runoff = 10.32 cfs @ 12.07 hrs, Volume= 0.760 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	1.950	95	AgruTURF
	1.950		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 17S: C-4



Summary for Subcatchment 19S: F-2

[49] Hint: Tc<2dt may require smaller dt

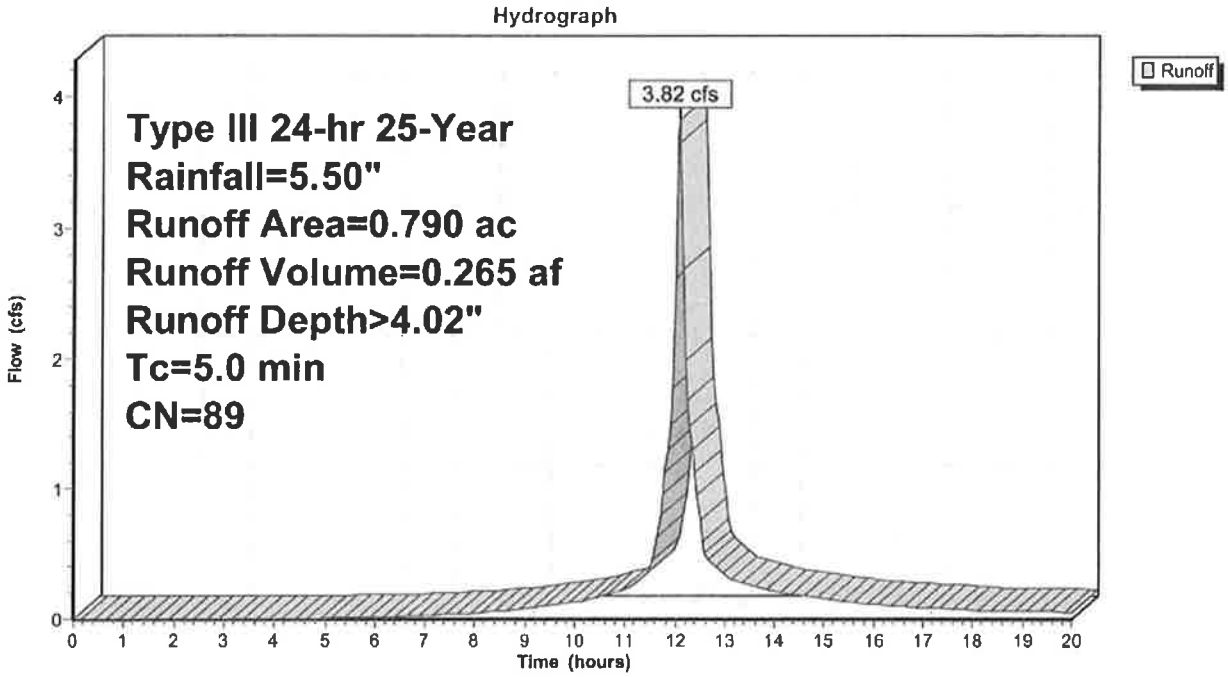
Runoff = 3.82 cfs @ 12.07 hrs, Volume= 0.265 af, Depth> 4.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (ac)	CN	Description
0.790	89	Gravel roads, HSG C
0.790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 19S: F-2



Summary for Subcatchment 20S: F-4

[49] Hint: Tc<2dt may require smaller dt

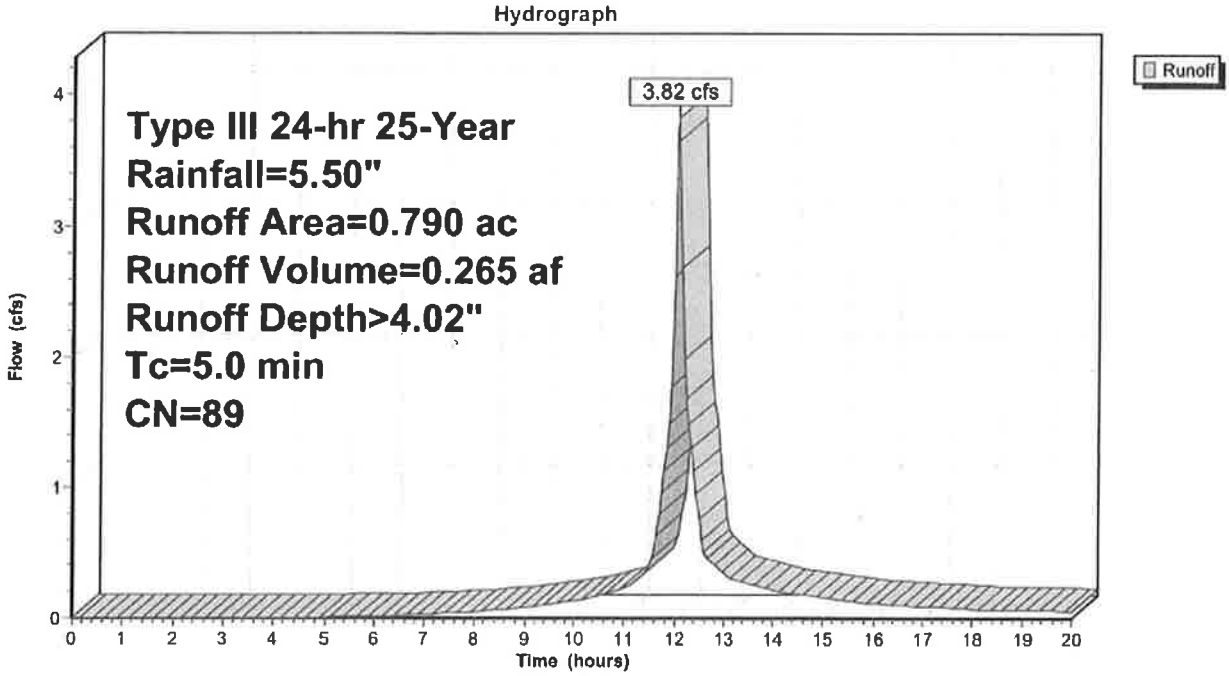
Runoff = 3.82 cfs @ 12.07 hrs, Volume= 0.265 af, Depth> 4.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (ac)	CN	Description
0.790	89	Gravel roads, HSG C
0.790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 20S: F-4



Summary for Subcatchment 23S: F-1

[49] Hint: Tc<2dt may require smaller dt

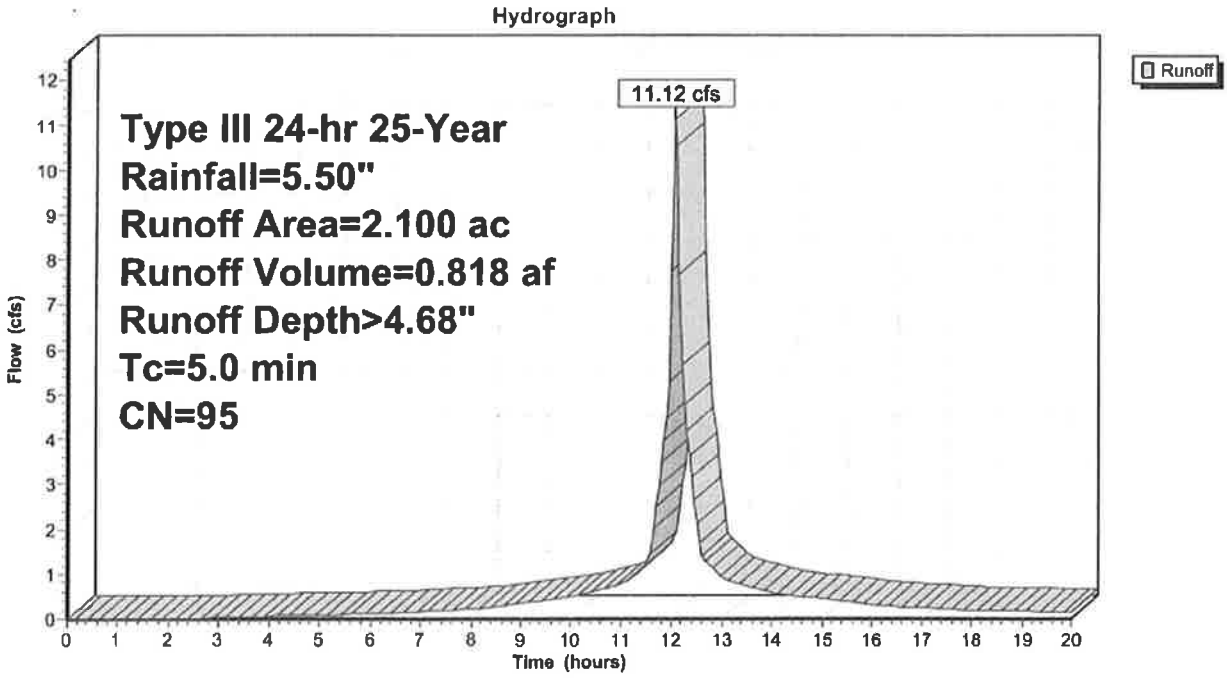
Runoff = 11.12 cfs @ 12.07 hrs, Volume= 0.818 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	2.100	95	AgruTURF
	2.100		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 23S: F-1



Summary for Subcatchment 24S: F-6

[49] Hint: Tc<2dt may require smaller dt

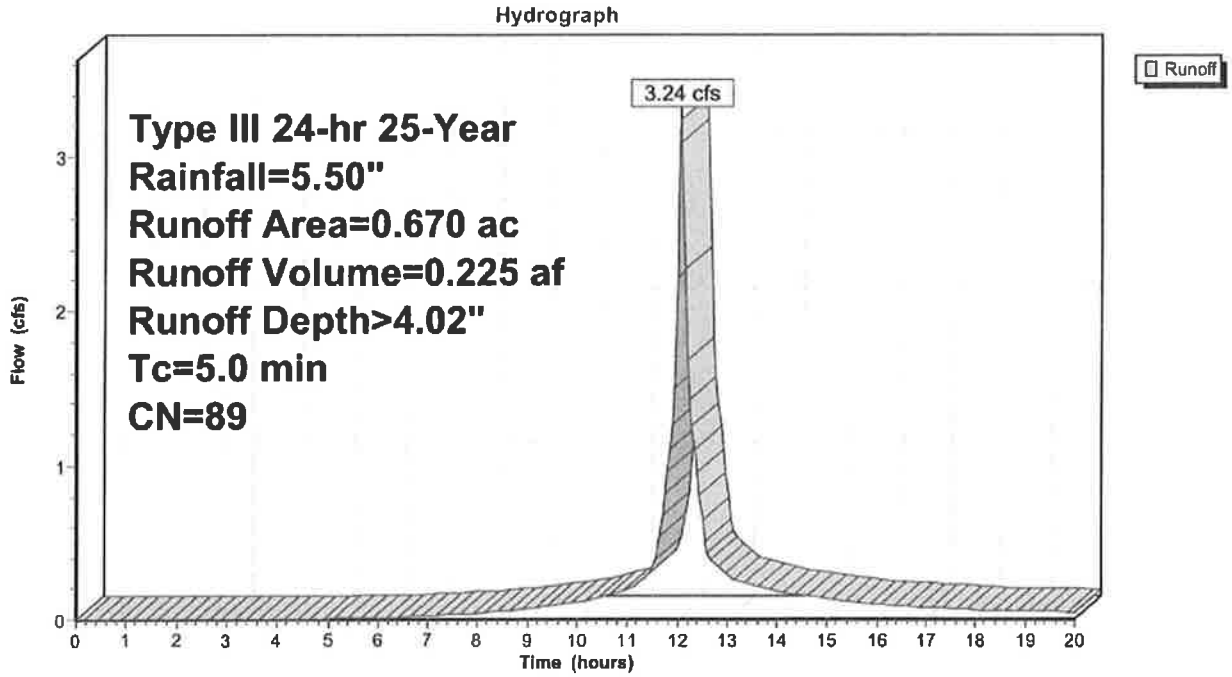
Runoff = 3.24 cfs @ 12.07 hrs, Volume= 0.225 af, Depth> 4.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (ac)	CN	Description
0.670	89	Gravel roads, HSG C
0.670		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 24S: F-6



Summary for Subcatchment 25S: F-3

[49] Hint: Tc<2dt may require smaller dt

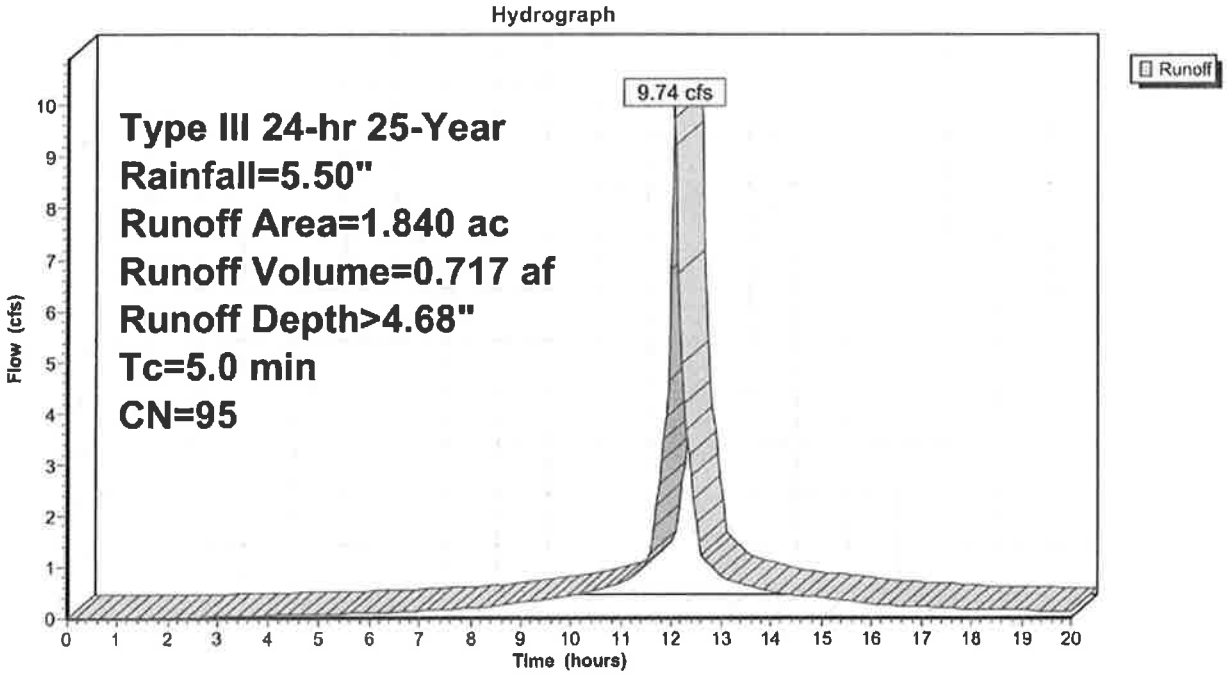
Runoff = 9.74 cfs @ 12.07 hrs, Volume= 0.717 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	1.840	95	AgruTURF
	1.840		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 25S: F-3



Summary for Subcatchment 26S: F-8

[49] Hint: Tc<2dt may require smaller dt

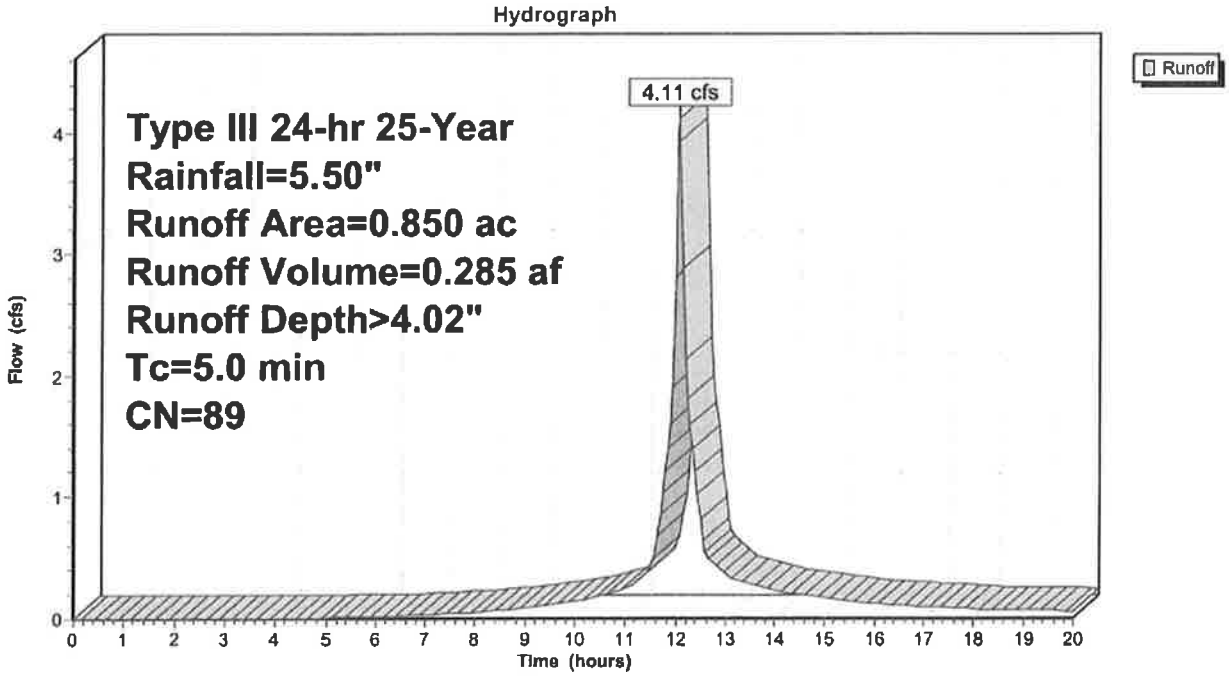
Runoff = 4.11 cfs @ 12.07 hrs, Volume= 0.285 af, Depth> 4.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (ac)	CN	Description
0.850	89	Gravel roads, HSG C
0.850		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 26S: F-8



Summary for Subcatchment 27S: F-5

[49] Hint: Tc<2dt may require smaller dt

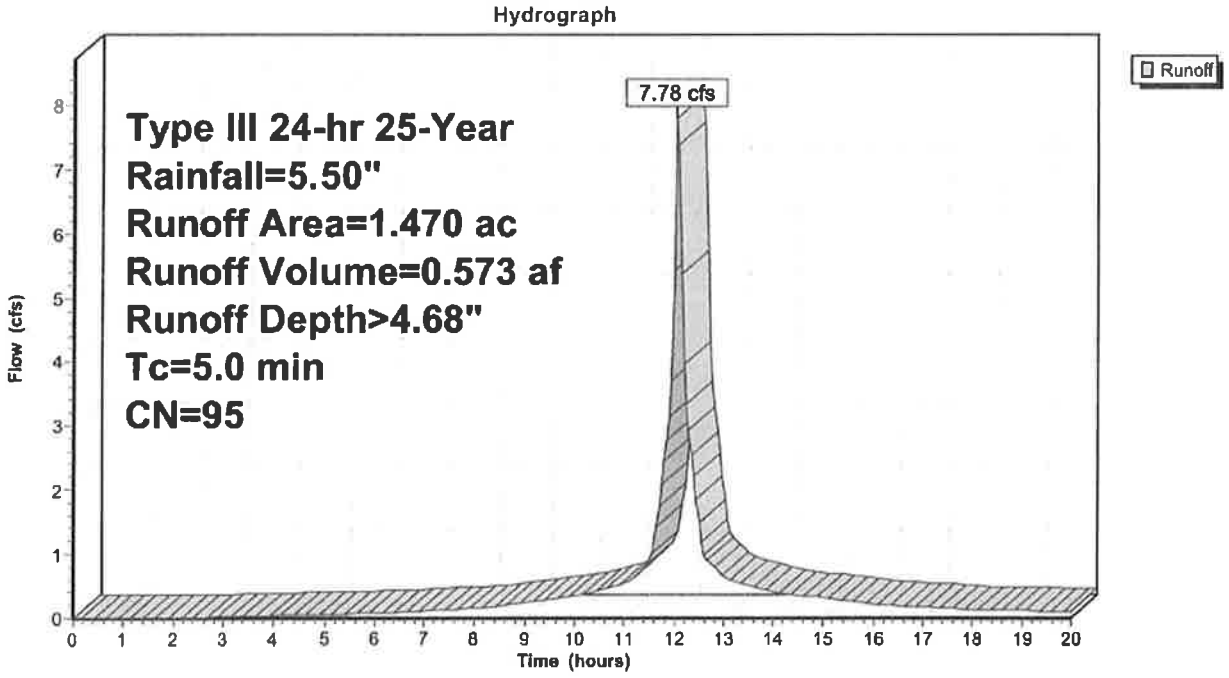
Runoff = 7.78 cfs @ 12.07 hrs, Volume= 0.573 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	1.470	95	AgruTURF
	1.470		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 27S: F-5



Summary for Subcatchment 28S: F-7

[49] Hint: Tc<2dt may require smaller dt

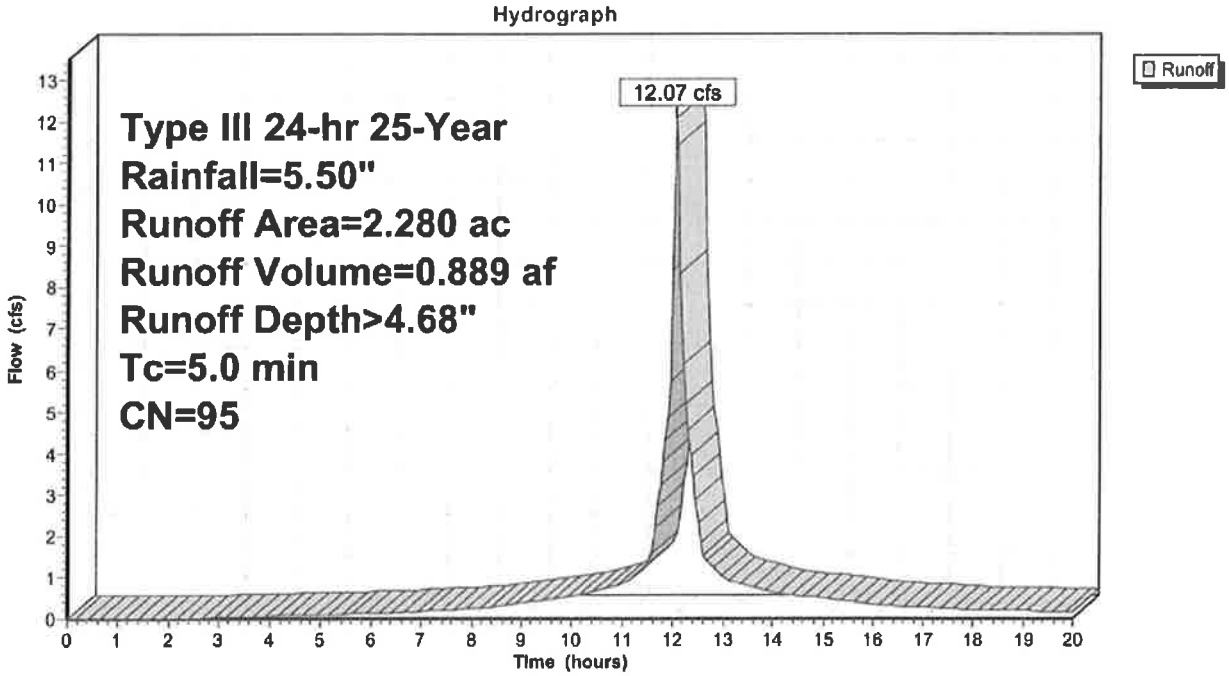
Runoff = 12.07 cfs @ 12.07 hrs, Volume= 0.889 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	2.280	95	AgruTURF
	2.280		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 28S: F-7



Summary for Subcatchment 29S: B-3

[49] Hint: Tc<2dt may require smaller dt

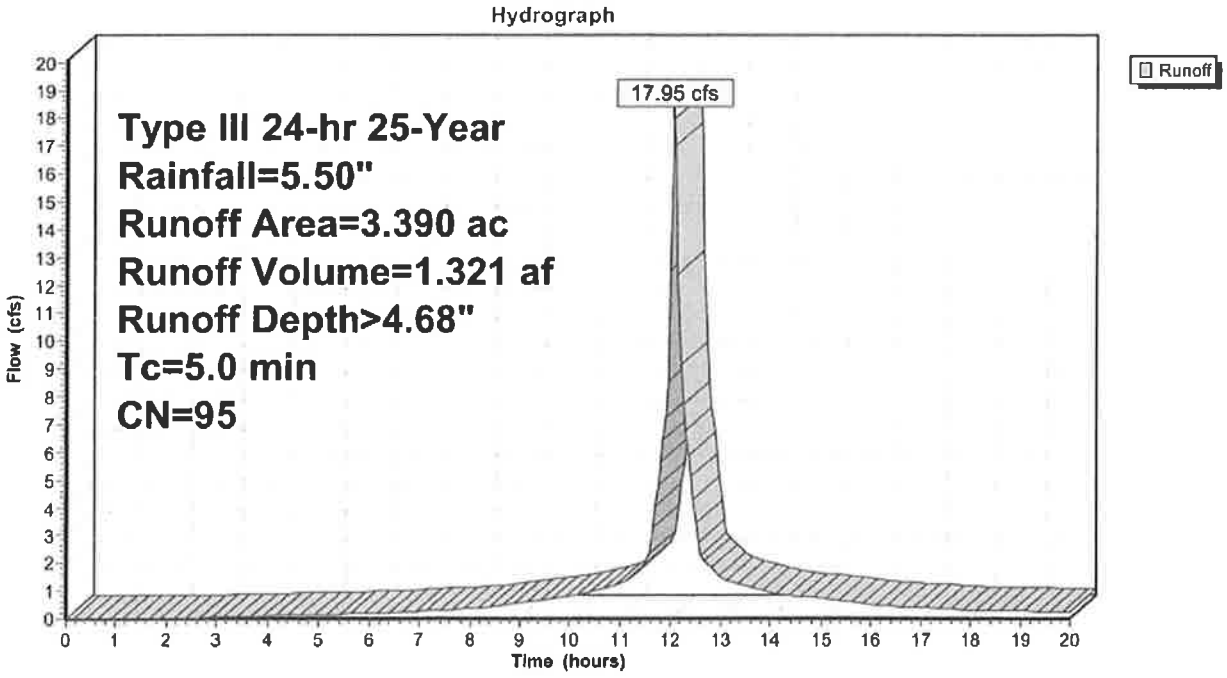
Runoff = 17.95 cfs @ 12.07 hrs, Volume= 1.321 af, Depth> 4.68"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	3.390	95	AgruTURF
	3.390		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 29S: B-3



Summary for Subcatchment 33S: EX-3

[49] Hint: Tc<2dt may require smaller dt

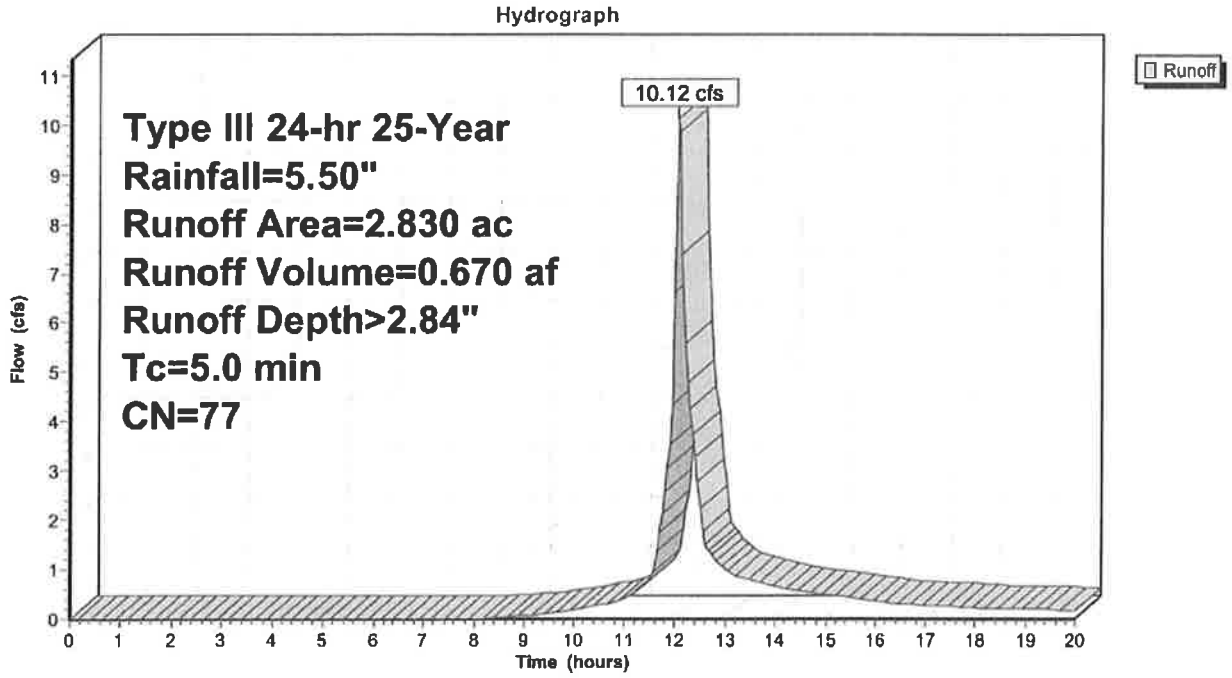
Runoff = 10.12 cfs @ 12.08 hrs, Volume= 0.670 af, Depth> 2.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	2.830	77	Existing Landfill
	2.830		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 33S: EX-3



Summary for Reach 1R: Concrete Swale

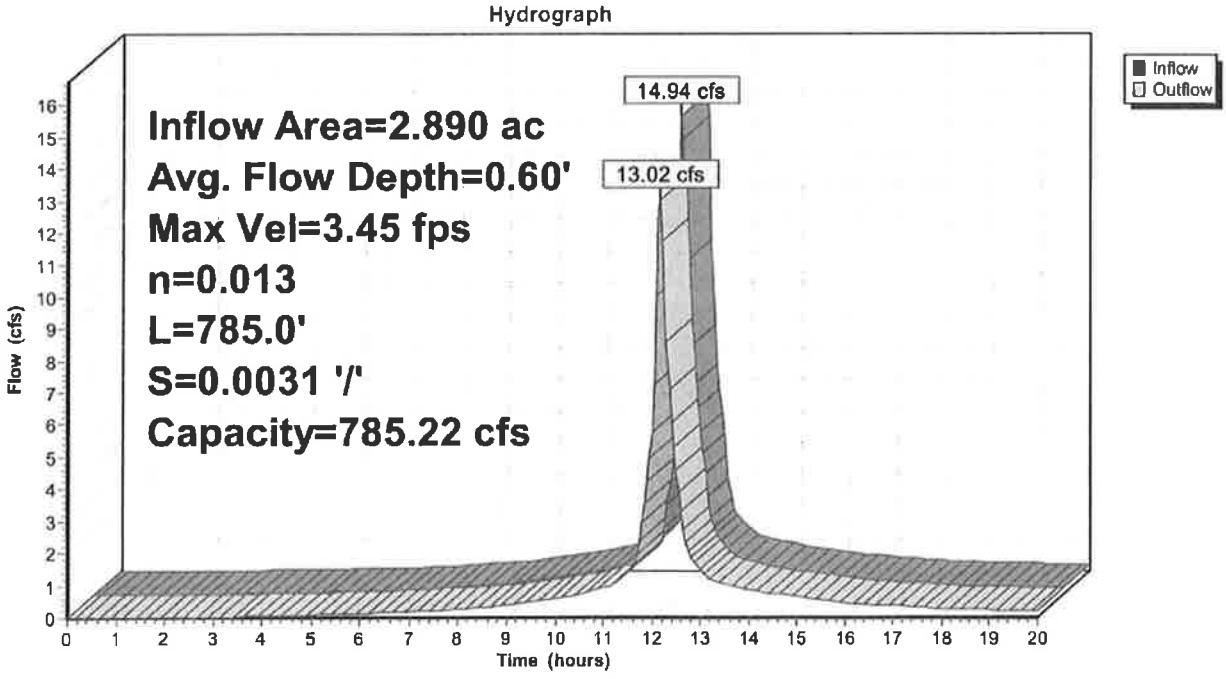
Inflow Area = 2.890 ac, 0.00% Impervious, Inflow Depth > 4.50" for 25-Year event
Inflow = 14.94 cfs @ 12.07 hrs, Volume= 1.083 af
Outflow = 13.02 cfs @ 12.18 hrs, Volume= 1.078 af, Atten= 13%, Lag= 6.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 3.45 fps, Min. Travel Time= 3.8 min
Avg. Velocity = 1.18 fps, Avg. Travel Time= 11.1 min

Peak Storage= 3,062 cf @ 12.11 hrs
Average Depth at Peak Storage= 0.60'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 785.22 cfs

25.00' x 4.00' deep Parabolic Channel, n= 0.013 Concrete, trowel finish
Length= 785.0' Slope= 0.0031 '/'
Inlet Invert= 46.80', Outlet Invert= 44.35'

Reach 1R: Concrete Swale



Summary for Reach 2R: Concrete Swale

[62] Hint: Exceeded Reach 1R OUTLET depth by 1.17' @ 12.15 hrs

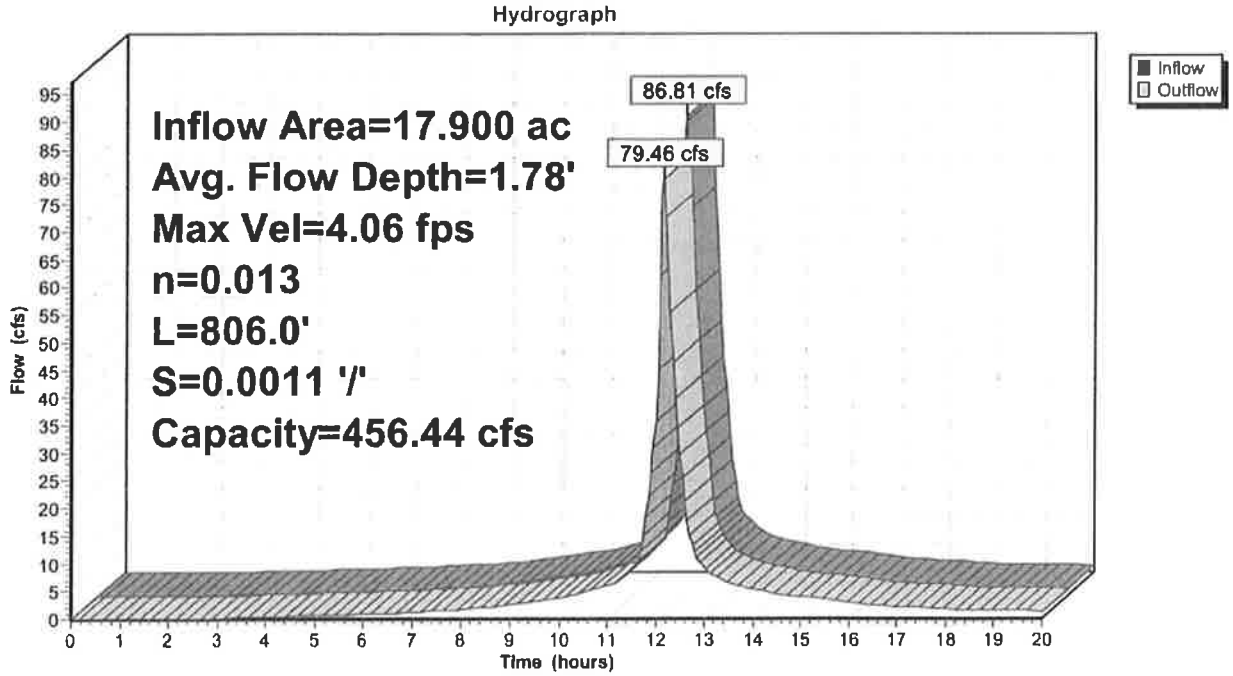
Inflow Area = 17.900 ac, 0.00% Impervious, Inflow Depth > 4.61" for 25-Year event
Inflow = 86.81 cfs @ 12.08 hrs, Volume= 6.883 af
Outflow = 79.46 cfs @ 12.18 hrs, Volume= 6.856 af, Atten= 8%, Lag= 5.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.06 fps, Min. Travel Time= 3.3 min
Avg. Velocity = 1.40 fps, Avg. Travel Time= 9.6 min

Peak Storage= 15,974 cf @ 12.12 hrs
Average Depth at Peak Storage= 1.78'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 456.44 cfs

25.00' x 4.00' deep Parabolic Channel, n= 0.013 Concrete, trowel finish
Length= 806.0' Slope= 0.0011 '/'
Inlet Invert= 44.35', Outlet Invert= 43.50'

Reach 2R: Concrete Swale



Summary for Reach 3R: Concrete Swale

[62] Hint: Exceeded Reach 2R OUTLET depth by 0.53' @ 12.25 hrs

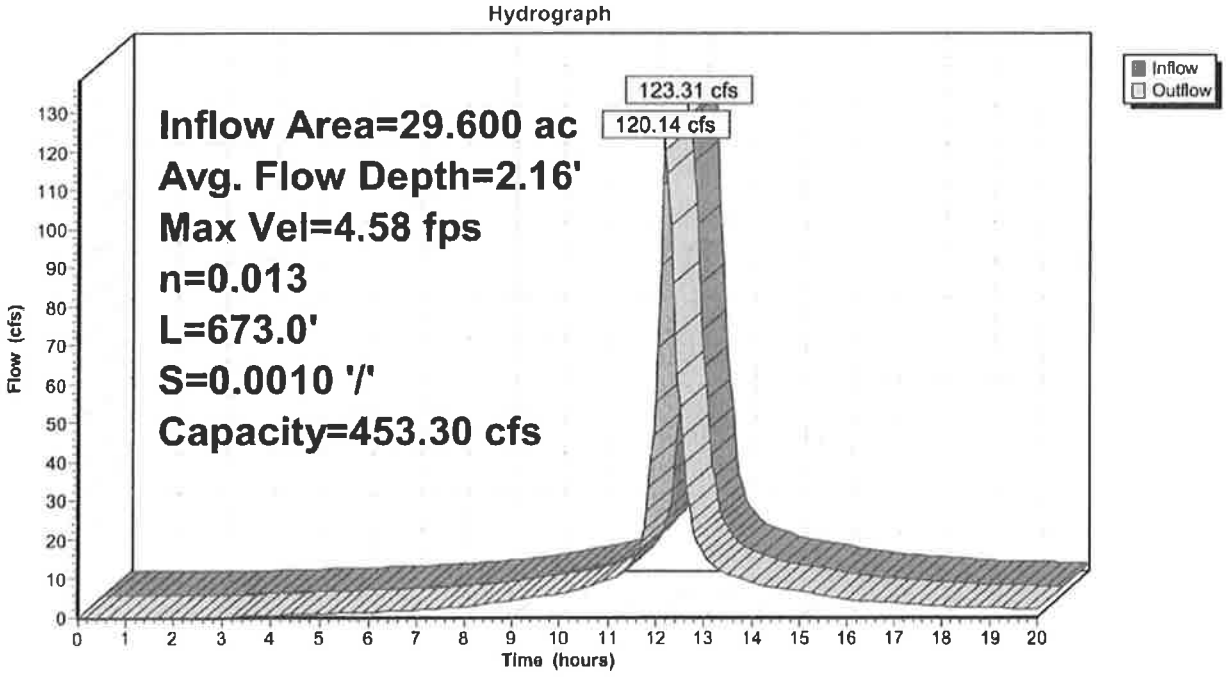
Inflow Area = 29.600 ac, 0.00% Impervious, Inflow Depth > 4.61" for 25-Year event
Inflow = 123.31 cfs @ 12.13 hrs, Volume= 11.378 af
Outflow = 120.14 cfs @ 12.21 hrs, Volume= 11.346 af, Atten= 3%, Lag= 4.5 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.58 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 6.9 min

Peak Storage= 17,778 cf @ 12.16 hrs
Average Depth at Peak Storage= 2.16'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 453.30 cfs

25.00' x 4.00' deep Parabolic Channel, n= 0.013 Concrete, trowel finish
Length= 673.0' Slope= 0.0010 '/'
Inlet Invert= 43.50', Outlet Invert= 42.80'

Reach 3R: Concrete Swale



Summary for Reach 4R: Concrete Swale

[62] Hint: Exceeded Reach 3R OUTLET depth by 0.49' @ 12.30 hrs

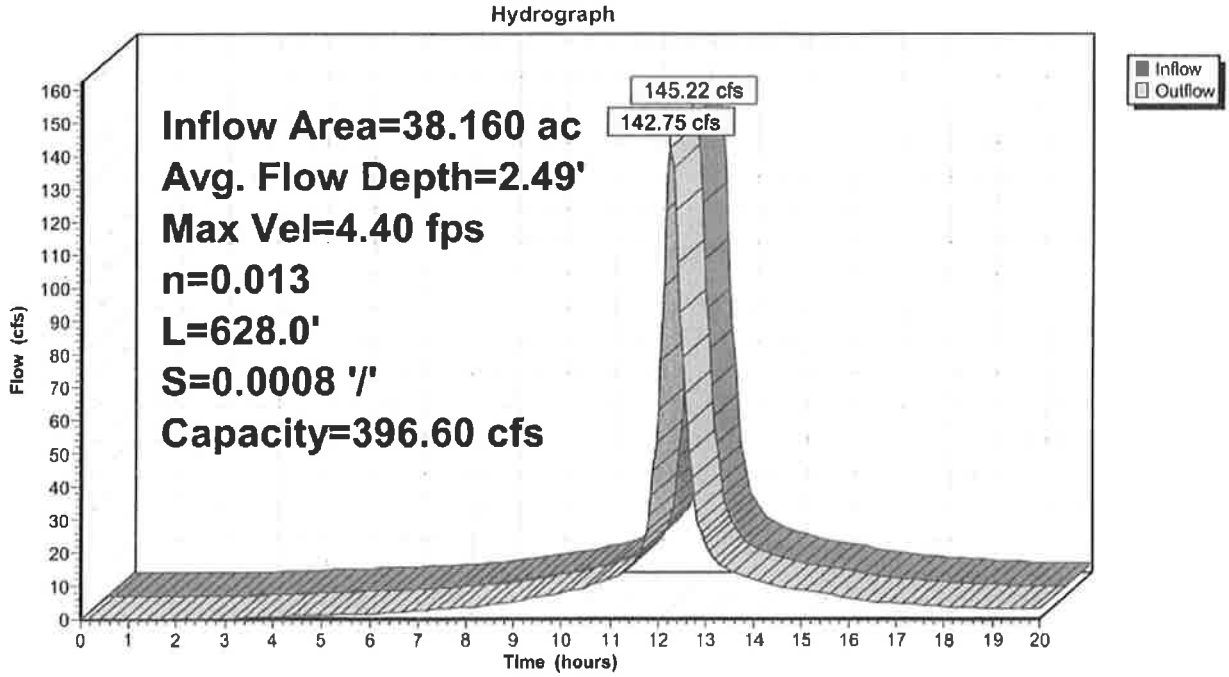
Inflow Area = 38.160 ac, 0.00% Impervious, Inflow Depth > 4.60" for 25-Year event
Inflow = 145.22 cfs @ 12.17 hrs, Volume= 14.635 af
Outflow = 142.75 cfs @ 12.24 hrs, Volume= 14.595 af, Atten= 2%, Lag= 4.2 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.40 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 1.59 fps, Avg. Travel Time= 6.6 min

Peak Storage= 20,509 cf @ 12.20 hrs
Average Depth at Peak Storage= 2.49'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 396.60 cfs

25.00' x 4.00' deep Parabolic Channel, n= 0.013 Concrete, trowel finish
Length= 628.0' Slope= 0.0008 '/'
Inlet Invert= 42.80', Outlet Invert= 42.30'

Reach 4R: Concrete Swale



Summary for Reach A-R1: Downchute

Inflow Area = 0.380 ac, 0.00% Impervious, Inflow Depth > 2.84" for 25-Year event
Inflow = 1.36 cfs @ 12.08 hrs, Volume= 0.090 af
Outflow = 1.35 cfs @ 12.09 hrs, Volume= 0.090 af, Atten= 1%, Lag= 0.8 min

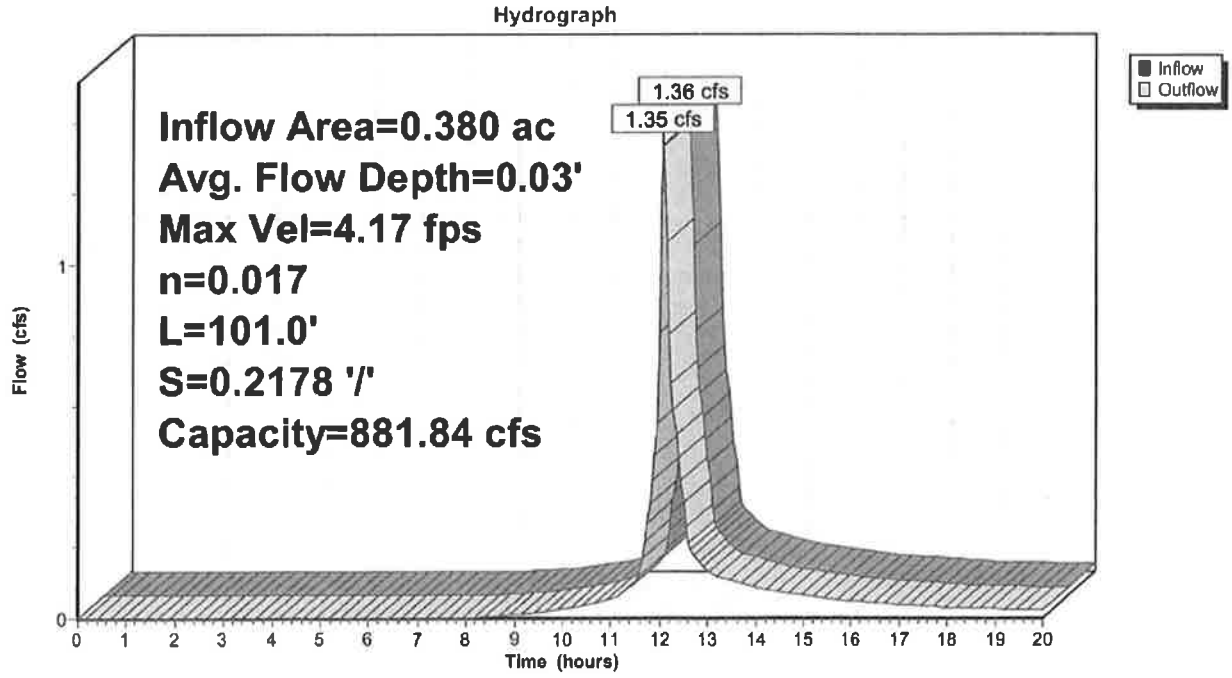
Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.17 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.51 fps, Avg. Travel Time= 0.7 min

Peak Storage= 33 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.03'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 881.84 cfs

10.00' x 1.50' deep channel, n= 0.017 Concrete, unfinished
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 101.0' Slope= 0.2178 '/'
Inlet Invert= 131.00', Outlet Invert= 109.00'

‡

Reach A-R1: Downchute



Summary for Reach A-R2: Downchute

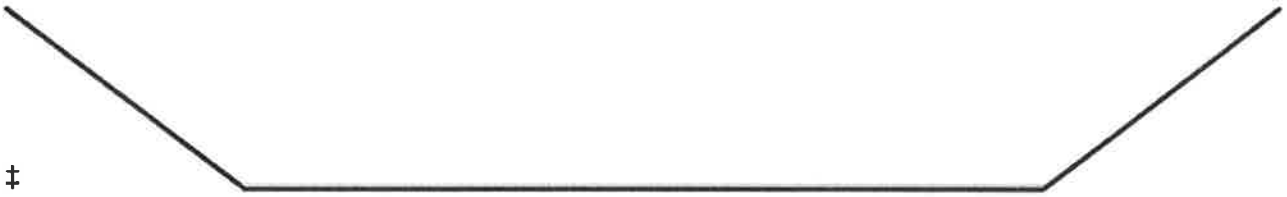
[62] Hint: Exceeded Reach A-R1 OUTLET depth by 0.02' @ 12.10 hrs

Inflow Area = 0.820 ac, 0.00% Impervious, Inflow Depth > 2.84" for 25-Year event
Inflow = 2.91 cfs @ 12.08 hrs, Volume= 0.194 af
Outflow = 2.87 cfs @ 12.10 hrs, Volume= 0.194 af, Atten= 1%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.77 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.69 fps, Avg. Travel Time= 1.0 min

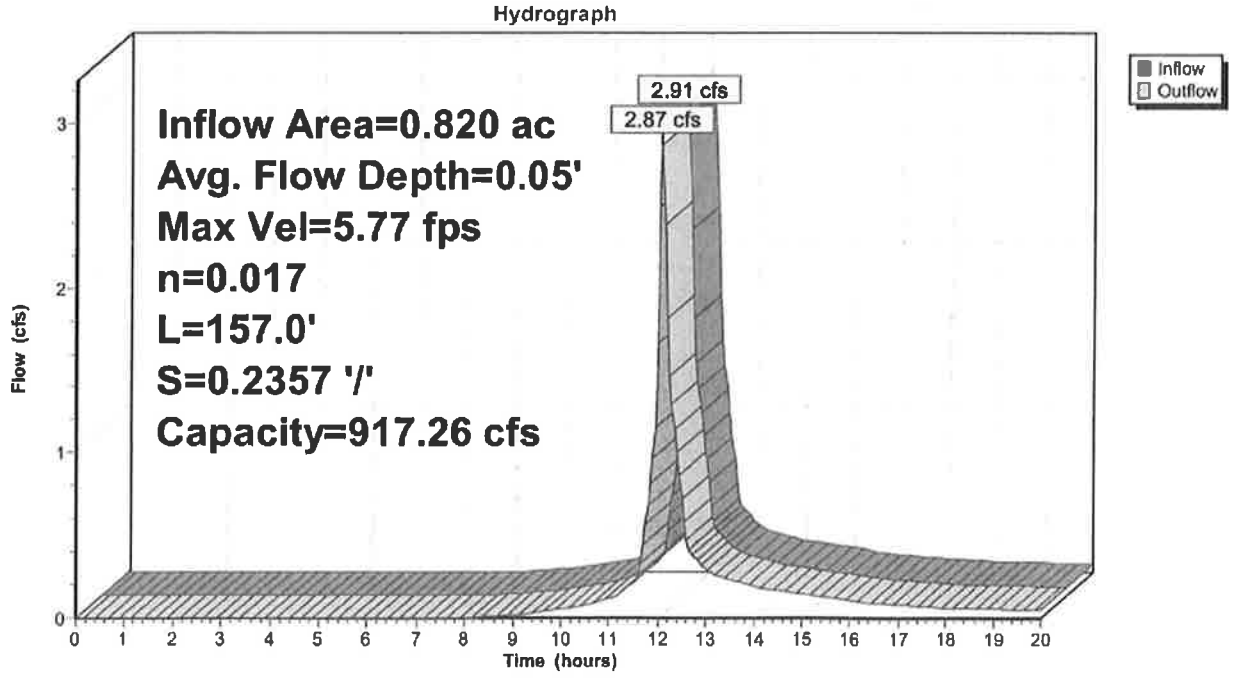
Peak Storage= 80 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 917.26 cfs

10.00' x 1.50' deep channel, n= 0.017 Concrete, unfinished
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 157.0' Slope= 0.2357 '/'
Inlet Invert= 109.00', Outlet Invert= 72.00'



‡

Reach A-R2: Downchute



Summary for Reach A-R3: Downchute

[61] Hint: Exceeded Reach A-R2 outlet invert by 0.05' @ 12.10 hrs

Inflow Area = 0.820 ac, 0.00% Impervious, Inflow Depth > 2.84" for 25-Year event
Inflow = 2.87 cfs @ 12.10 hrs, Volume= 0.194 af
Outflow = 2.86 cfs @ 12.10 hrs, Volume= 0.194 af, Atten= 1%, Lag= 0.2 min

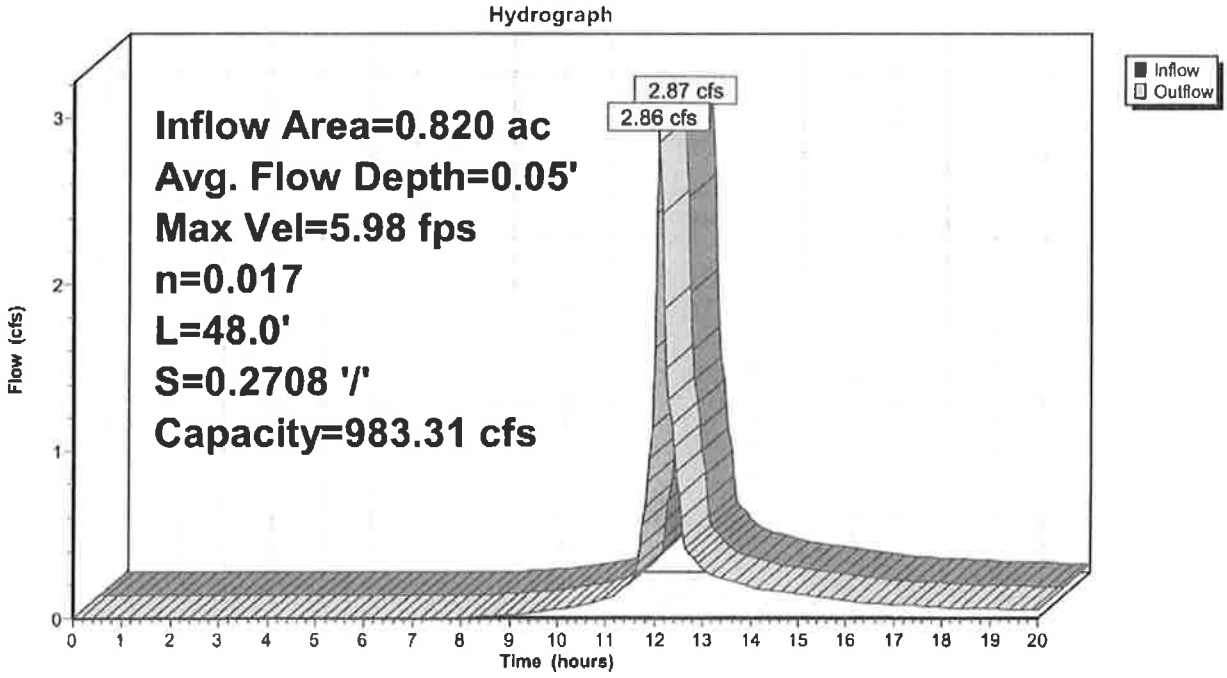
Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.98 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.87 fps, Avg. Travel Time= 0.3 min

Peak Storage= 23 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 983.31 cfs

10.00' x 1.50' deep channel, n= 0.017 Concrete, unfinished
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 48.0' Slope= 0.2708 '/'
Inlet Invert= 72.00', Outlet Invert= 59.00'

‡

Reach A-R3: Downchute



Summary for Reach B-R1: Downchute

Inflow Area = 3.240 ac, 0.00% Impervious, Inflow Depth > 4.68" for 25-Year event
Inflow = 17.15 cfs @ 12.07 hrs, Volume= 1.263 af
Outflow = 17.00 cfs @ 12.07 hrs, Volume= 1.263 af, Atten= 1%, Lag= 0.2 min

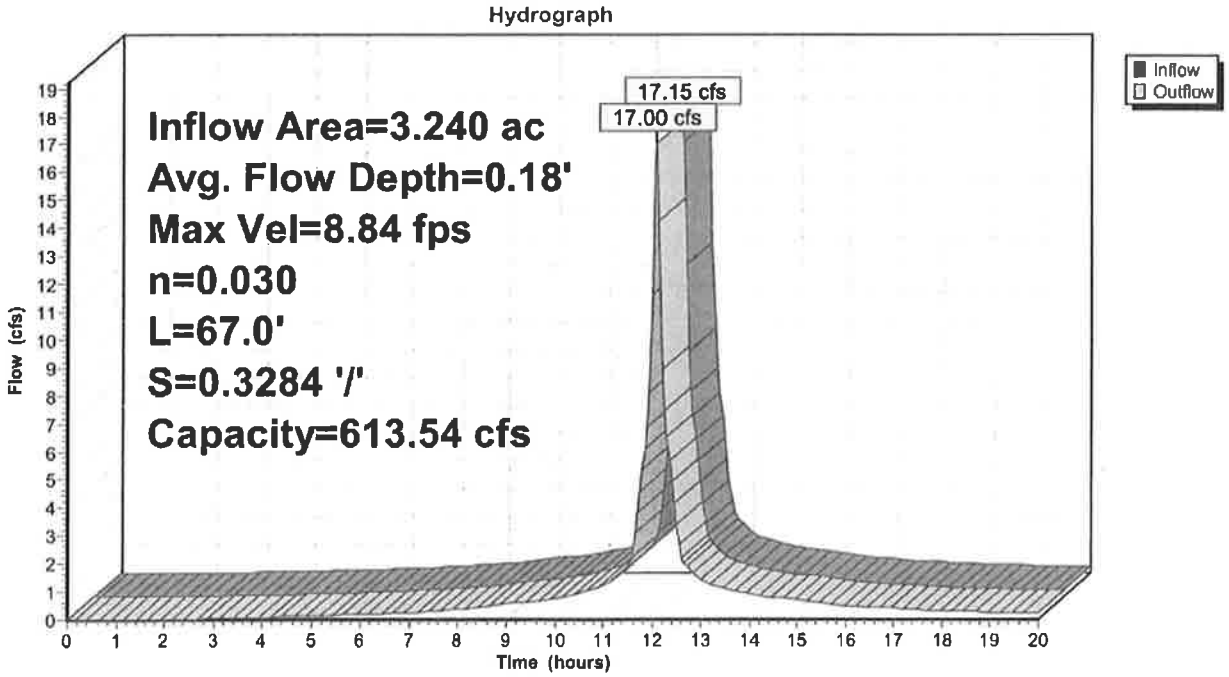
Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 8.84 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.42 fps, Avg. Travel Time= 0.5 min

Peak Storage= 129 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.18'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 613.54 cfs

10.00' x 1.50' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 67.0' Slope= 0.3284 '/'
Inlet Invert= 128.00', Outlet Invert= 106.00'

‡

Reach B-R1: Downchute



Summary for Reach B-R2: Downchute

[62] Hint: Exceeded Reach B-R1 OUTLET depth by 0.06' @ 12.10 hrs

Inflow Area = 5.430 ac, 0.00% Impervious, Inflow Depth > 4.68" for 25-Year event
Inflow = 28.59 cfs @ 12.07 hrs, Volume= 2.116 af
Outflow = 28.22 cfs @ 12.08 hrs, Volume= 2.115 af, Atten= 1%, Lag= 0.4 min

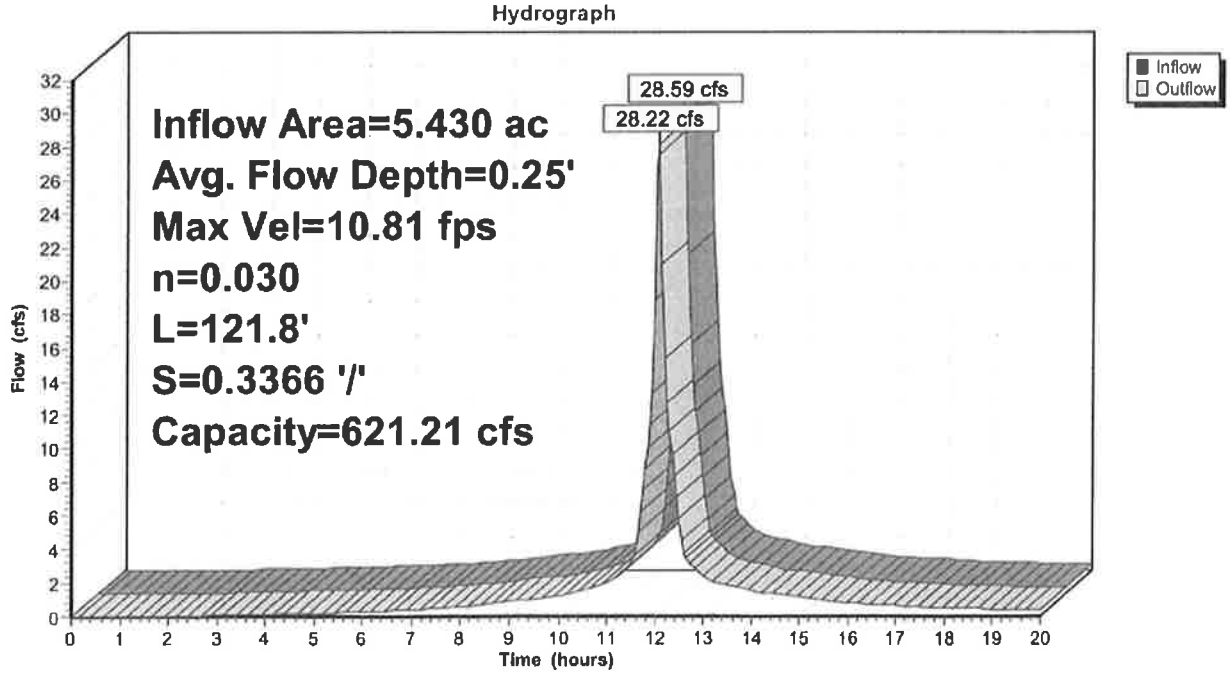
Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.81 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 2.90 fps, Avg. Travel Time= 0.7 min

Peak Storage= 317 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 621.21 cfs

10.00' x 1.50' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 121.8' Slope= 0.3366 '/'
Inlet Invert= 106.00', Outlet Invert= 65.00'

‡

Reach B-R2: Downchute



Summary for Reach B-R3: Downchute

[61] Hint: Exceeded Reach B-R2 outlet invert by 0.24' @ 12.10 hrs

Inflow Area = 5.430 ac, 0.00% Impervious, Inflow Depth > 4.68" for 25-Year event
Inflow = 28.22 cfs @ 12.08 hrs, Volume= 2.115 af
Outflow = 28.16 cfs @ 12.08 hrs, Volume= 2.115 af, Atten= 0%, Lag= 0.1 min

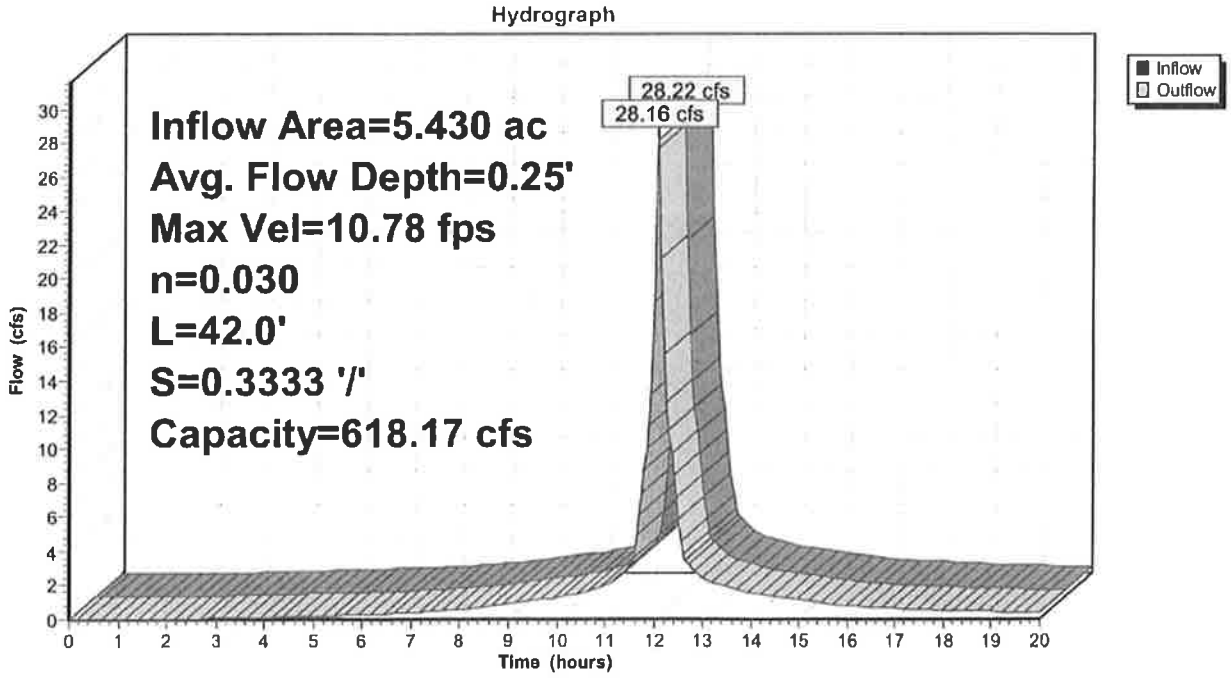
Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 10.78 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.89 fps, Avg. Travel Time= 0.2 min

Peak Storage= 109 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.25'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 618.17 cfs

10.00' x 1.50' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 42.0' Slope= 0.3333 '/'
Inlet Invert= 65.00', Outlet Invert= 51.00'

‡

Reach B-R3: Downchute



Summary for Reach C-R1: Downchute

Inflow Area = 7.550 ac, 0.00% Impervious, Inflow Depth > 4.68" for 25-Year event
Inflow = 39.97 cfs @ 12.07 hrs, Volume= 2.943 af
Outflow = 39.70 cfs @ 12.07 hrs, Volume= 2.942 af, Atten= 1%, Lag= 0.2 min

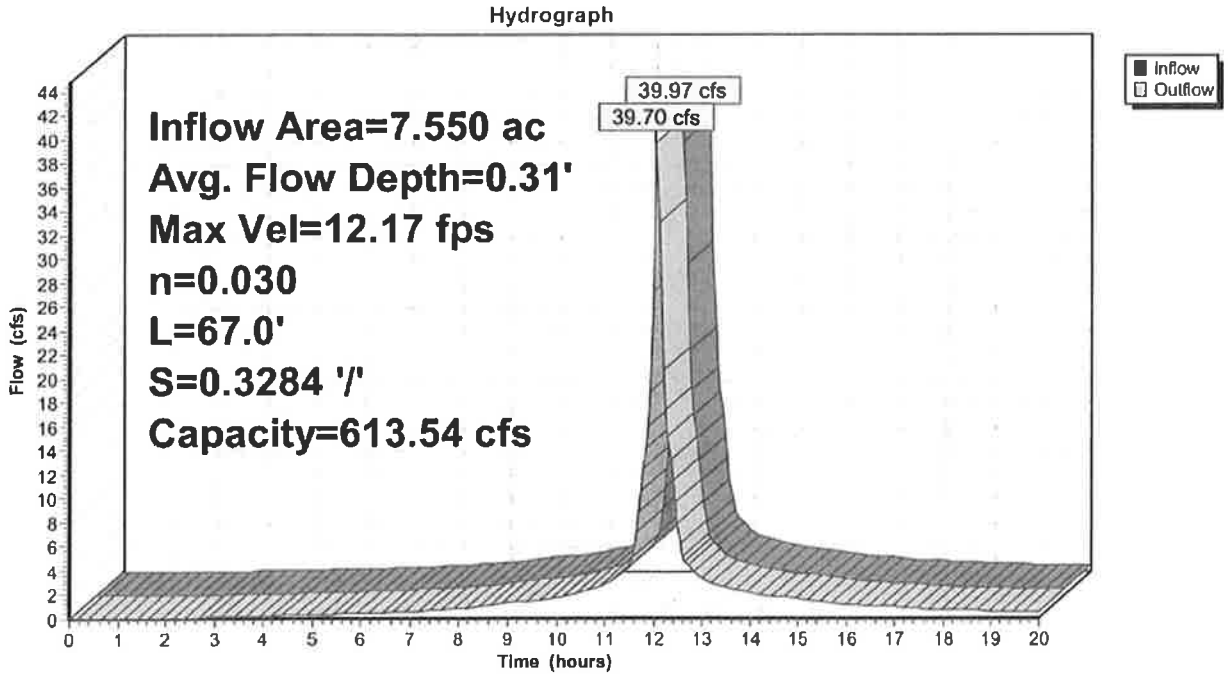
Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 12.17 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.22 fps, Avg. Travel Time= 0.3 min

Peak Storage= 218 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.31'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 613.54 cfs

10.00' x 1.50' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 67.0' Slope= 0.3284 '/'
Inlet Invert= 128.00', Outlet Invert= 106.00'

‡

Reach C-R1: Downchute



Summary for Reach C-R2: Downchute

[62] Hint: Exceeded Reach C-R1 OUTLET depth by 0.04' @ 12.10 hrs

Inflow Area = 9.560 ac, 0.00% Impervious, Inflow Depth > 4.68" for 25-Year event
Inflow = 50.34 cfs @ 12.07 hrs, Volume= 3.726 af
Outflow = 49.75 cfs @ 12.08 hrs, Volume= 3.725 af, Atten= 1%, Lag= 0.3 min

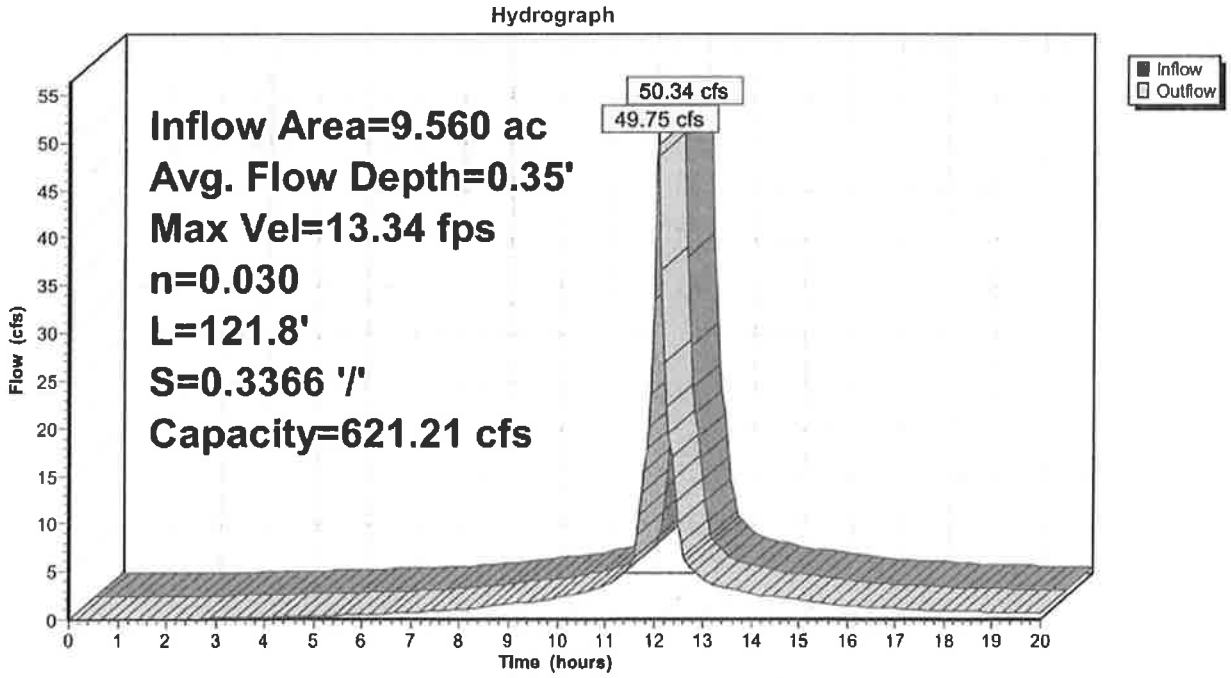
Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 13.34 fps, Min. Travel Time= 0.2 min
Avg. Velocity = 3.53 fps, Avg. Travel Time= 0.6 min

Peak Storage= 453 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 621.21 cfs

10.00' x 1.50' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 121.8' Slope= 0.3366 '/'
Inlet Invert= 106.00', Outlet Invert= 65.00'

‡

Reach C-R2: Downchute



Summary for Reach C-R3: Downchute

[61] Hint: Exceeded Reach C-R2 outlet invert by 0.34' @ 12.10 hrs

Inflow Area = 9.560 ac, 0.00% Impervious, Inflow Depth > 4.68" for 25-Year event
Inflow = 49.75 cfs @ 12.08 hrs, Volume= 3.725 af
Outflow = 49.67 cfs @ 12.08 hrs, Volume= 3.724 af, Atten= 0%, Lag= 0.1 min

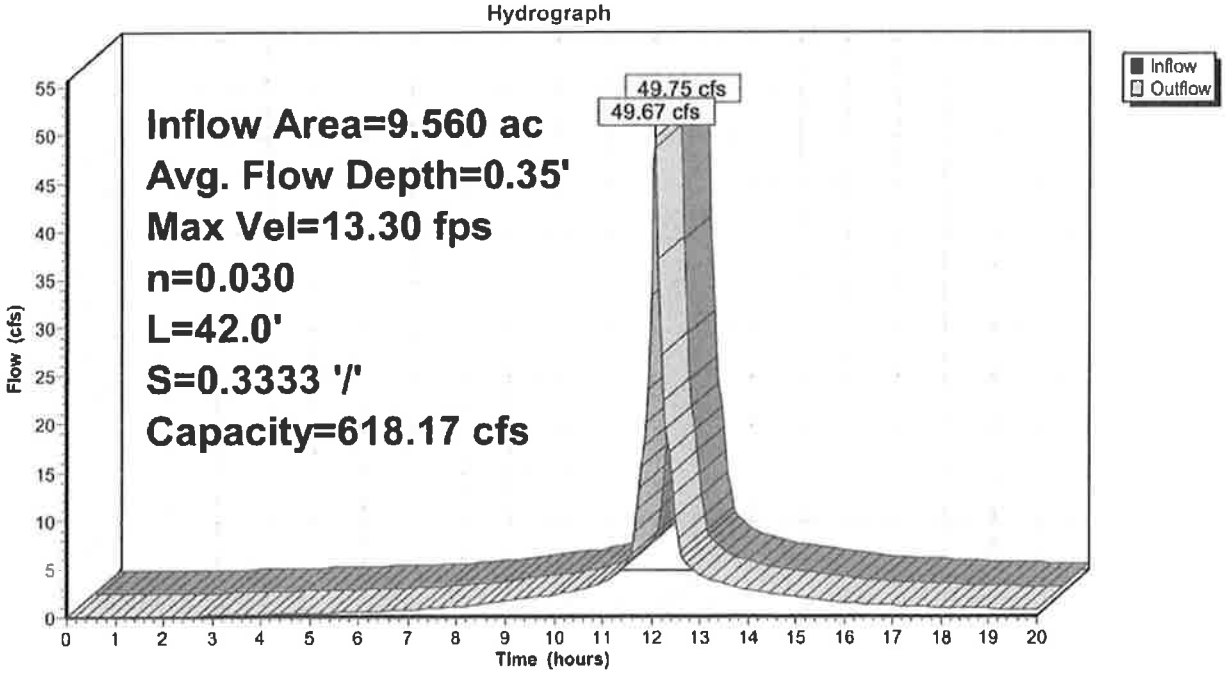
Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 13.30 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.52 fps, Avg. Travel Time= 0.2 min

Peak Storage= 156 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 618.17 cfs

10.00' x 1.50' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 42.0' Slope= 0.3333 '/'
Inlet Invert= 65.00', Outlet Invert= 51.00'

‡

Reach C-R3: Downchute



Summary for Reach D-R1: Downchute

Inflow Area = 9.300 ac, 0.00% Impervious, Inflow Depth > 4.68" for 25-Year event
Inflow = 49.24 cfs @ 12.07 hrs, Volume= 3.625 af
Outflow = 48.93 cfs @ 12.07 hrs, Volume= 3.624 af, Atten= 1%, Lag= 0.2 min

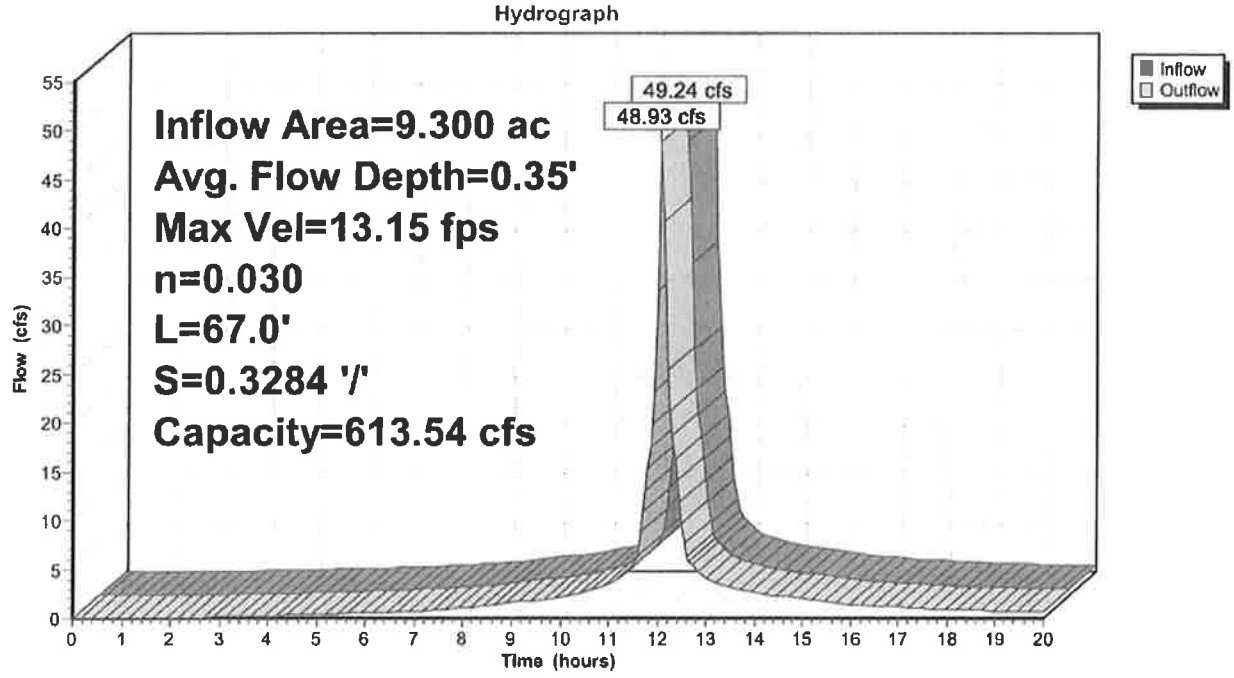
Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 13.15 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.47 fps, Avg. Travel Time= 0.3 min

Peak Storage= 248 cf @ 12.07 hrs
Average Depth at Peak Storage= 0.35'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 613.54 cfs

10.00' x 1.50' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 67.0' Slope= 0.3284 '/'
Inlet Invert= 128.00', Outlet Invert= 106.00'

‡

Reach D-R1: Downchute



Summary for Reach D-R2: Downchute

[62] Hint: Exceeded Reach D-R1 OUTLET depth by 0.06' @ 12.10 hrs

Inflow Area = 12.380 ac, 0.00% Impervious, Inflow Depth > 4.68" for 25-Year event
Inflow = 65.23 cfs @ 12.07 hrs, Volume= 4.825 af
Outflow = 64.47 cfs @ 12.08 hrs, Volume= 4.824 af, Atten= 1%, Lag= 0.3 min

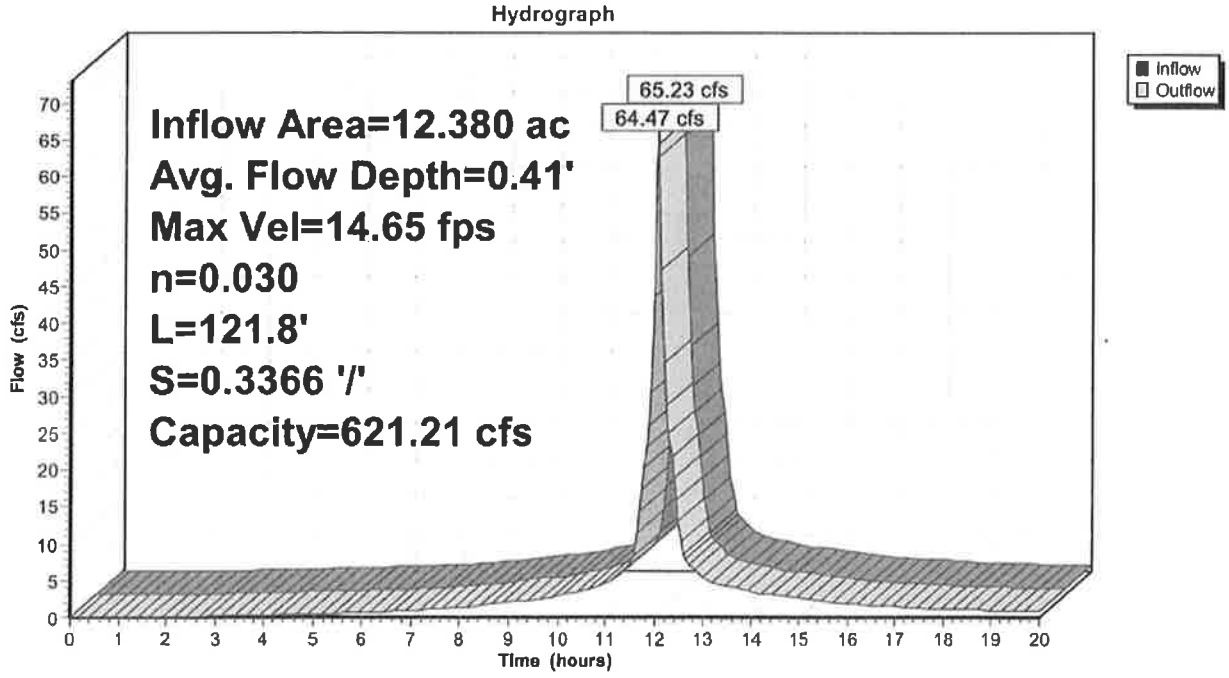
Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 14.65 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 3.88 fps, Avg. Travel Time= 0.5 min

Peak Storage= 533 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.41'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 621.21 cfs

10.00' x 1.50' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 121.8' Slope= 0.3366 '/'
Inlet Invert= 106.00', Outlet Invert= 65.00'

‡

Reach D-R2: Downchute



Summary for Reach D-R3: Downchute

[61] Hint: Exceeded Reach D-R2 outlet invert by 0.40' @ 12.10 hrs

Inflow Area = 12.380 ac, 0.00% Impervious, Inflow Depth > 4.68" for 25-Year event
Inflow = 64.47 cfs @ 12.08 hrs, Volume= 4.824 af
Outflow = 64.38 cfs @ 12.08 hrs, Volume= 4.823 af, Atten= 0%, Lag= 0.1 min

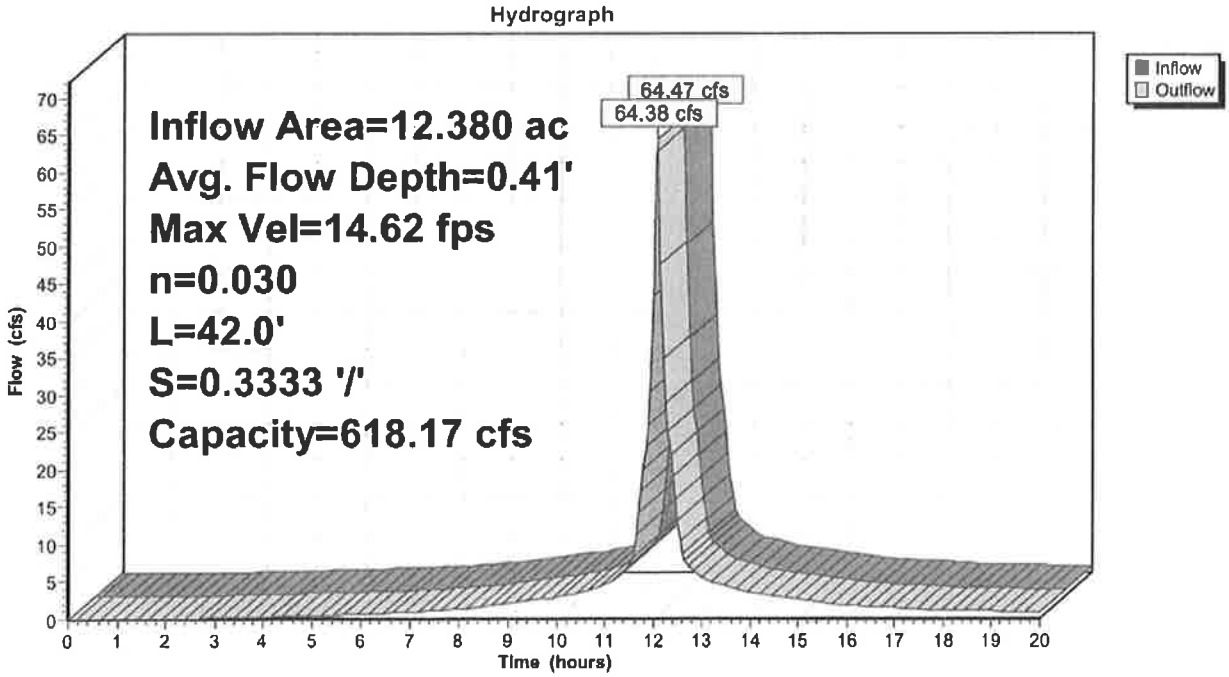
Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 14.62 fps, Min. Travel Time= 0.0 min
Avg. Velocity = 3.87 fps, Avg. Travel Time= 0.2 min

Peak Storage= 184 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.41'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 618.17 cfs

10.00' x 1.50' deep channel, n= 0.030
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 42.0' Slope= 0.3333 '/'
Inlet Invert= 65.00', Outlet Invert= 51.00'

‡

Reach D-R3: Downchute



Summary for Pond 29P: Swale Storage

[63] Warning: Exceeded Reach 4R INLET depth by 0.36' @ 12.45 hrs

Inflow Area = 38.160 ac, 0.00% Impervious, Inflow Depth > 4.59" for 25-Year event
Inflow = 142.75 cfs @ 12.24 hrs, Volume= 14.595 af
Outflow = 121.51 cfs @ 12.36 hrs, Volume= 14.581 af, Atten= 15%, Lag= 6.8 min
Primary = 121.51 cfs @ 12.36 hrs, Volume= 14.581 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 45.20' @ 12.36 hrs Surf.Area= 0.792 ac Storage= 0.975 af

Plug-Flow detention time= 4.1 min calculated for 14.581 af (100% of inflow)
Center-of-Mass det. time= 3.7 min (757.1 - 753.5)

Volume	Invert	Avail.Storage	Storage Description
#1	42.30'	4.485 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

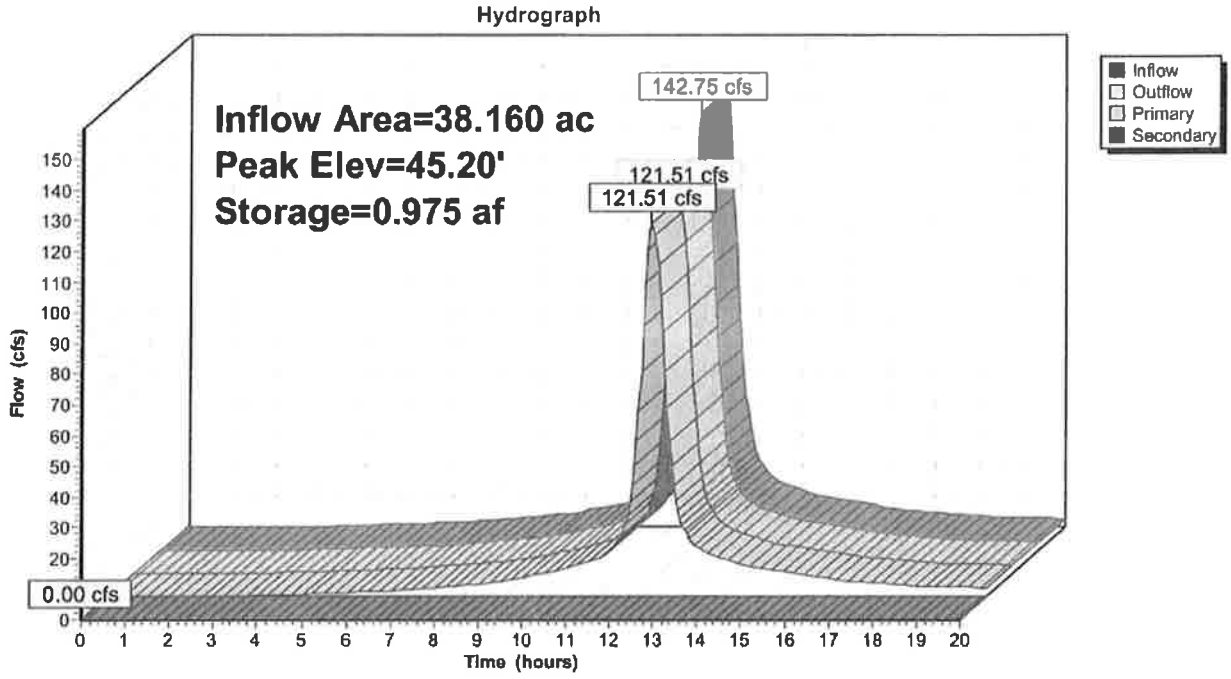
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
42.30	0.001	0.000	0.000
44.00	0.346	0.295	0.295
46.00	1.092	1.438	1.733
48.00	1.660	2.752	4.485

Device	Routing	Invert	Outlet Devices
#1	Primary	42.30'	**36.0" Vert. Orifice/Grate X 3.00** C= 0.600
#2	Secondary	47.00'	**25.0' long x 12.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=121.31 cfs @ 12.36 hrs HW=45.19' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 121.31 cfs @ 5.79 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=42.30' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 29P: Swale Storage

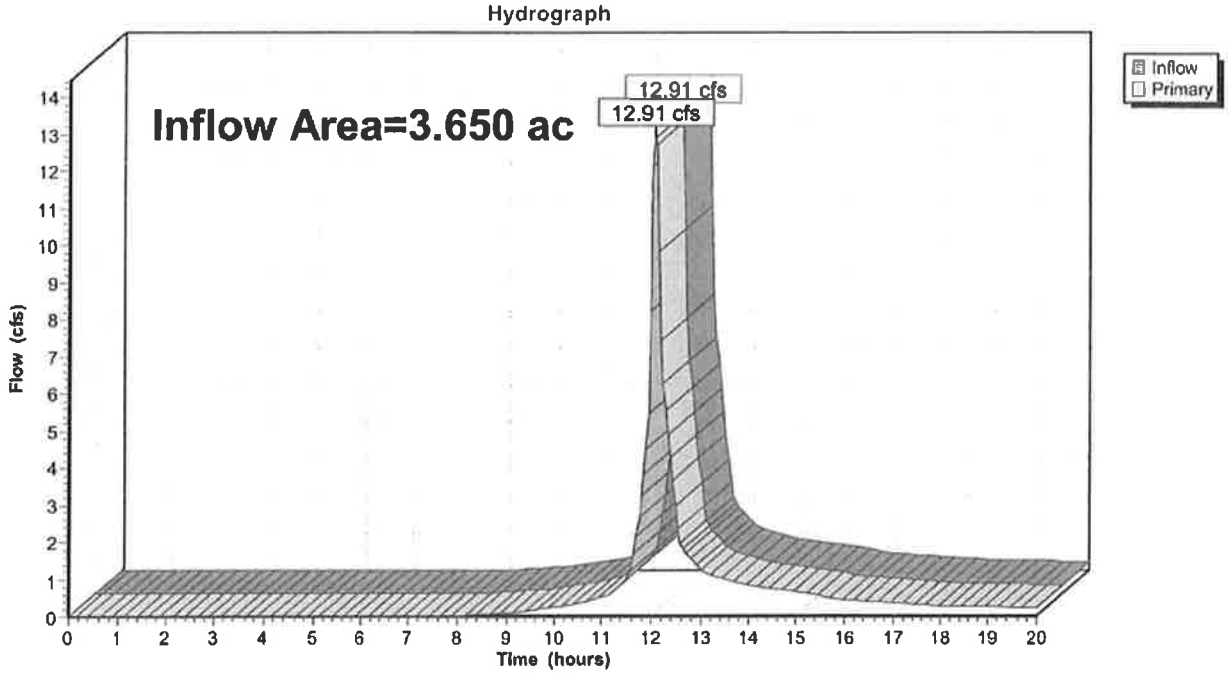


Summary for Link 27L: CL-CB

Inflow Area = 3.650 ac, 0.00% Impervious, Inflow Depth > 2.84" for 25-Year event
Inflow = 12.91 cfs @ 12.08 hrs, Volume= 0.864 af
Primary = 12.91 cfs @ 12.08 hrs, Volume= 0.864 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link 27L: CL-CB

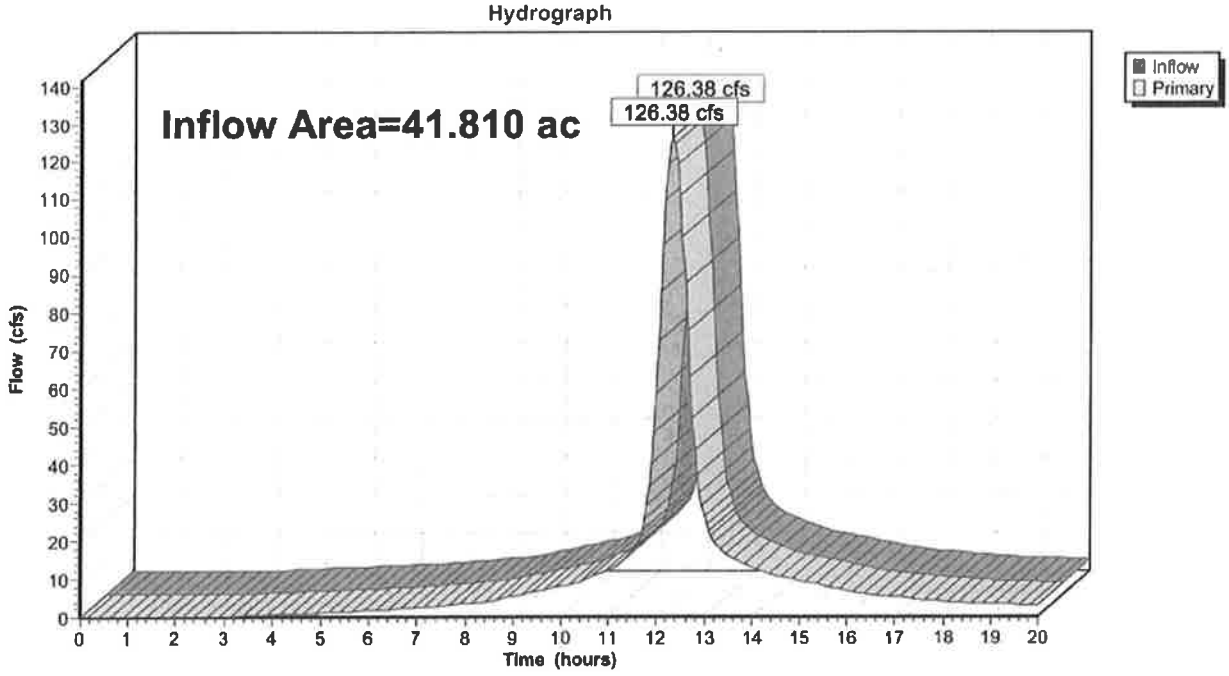


Summary for Link 28L: Dike Drainage Ditch

Inflow Area = 41.810 ac, 0.00% Impervious, Inflow Depth > 4.43" for 25-Year event
Inflow = 126.38 cfs @ 12.35 hrs, Volume= 15.446 af
Primary = 126.38 cfs @ 12.35 hrs, Volume= 15.446 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link 28L: Dike Drainage Ditch



FUSS & O'NEILL

Appendix D

Closure Turf™ Swale and Culvert Calculations

Worksheet for Alternative A - Upper Side Slope Diversion Swale

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.05000	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	28.69	ft^3/s

Results

Normal Depth	0.72	ft
Flow Area	3.90	ft^2
Wetted Perimeter	7.21	ft
Hydraulic Radius	0.54	ft
Top Width	6.87	ft
Critical Depth	0.98	ft
Critical Slope	0.01564	ft/ft
Velocity	7.35	ft/s
Velocity Head	0.84	ft
Specific Energy	1.56	ft
Froude Number	1.72	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.72	ft
Critical Depth	0.98	ft
Channel Slope	0.05000	ft/ft

Worksheet for Alternative A - Upper Side Slope Diversion Swale

GVF Output Data

Critical Slope	0.01564	ft/ft

Messages

Notes

Roughness coefficient of 0.030 provided by manufacturer.
Discharge taken from HydraCAD output.

Cross Section for Alternative A - Upper Side Slope Diversion Swale

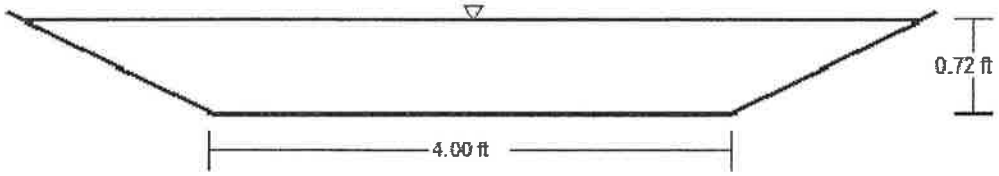
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.05000	ft/ft
Normal Depth	0.72	ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	28.69	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for Alternative A - Lower Side Slope Diversion Swale

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.05000	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	10.32	ft^3/s

Results

Normal Depth	0.40	ft
Flow Area	1.94	ft^2
Wetted Perimeter	5.80	ft
Hydraulic Radius	0.33	ft
Top Width	5.61	ft
Critical Depth	0.54	ft
Critical Slope	0.01814	ft/ft
Velocity	5.33	ft/s
Velocity Head	0.44	ft
Specific Energy	0.84	ft
Froude Number	1.60	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.40	ft
Critical Depth	0.54	ft
Channel Slope	0.05000	ft/ft

Worksheet for Alternative A - Lower Side Slope Diversion Swale

GVF Output Data

Critical Slope	0.01814 ft/ft

Messages

Notes

Roughness coefficient of 0.030 provided by manufacturer.
Discharge taken from HydraCAD output.

Cross Section for Alternative A - Lower Side Slope Diversion Swale

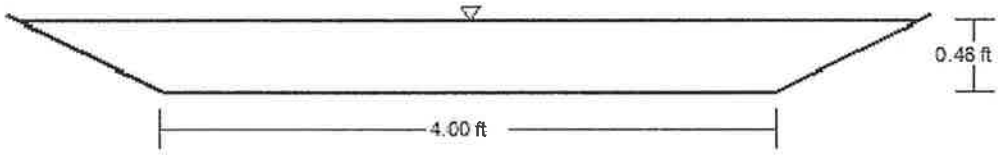
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.05000	ft/ft
Normal Depth	0.46	ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	13.08	ft^3/s

Cross Section Image



V: 1
H: 1

Worksheet for Alternative A - Side Slope Diversion Underdrain (Full

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.05000	ft/ft
Normal Depth	0.33	ft
Diameter	0.33	ft
Discharge	0.54	ft^3/s

Results

Discharge	0.54	ft^3/s
Normal Depth	0.33	ft
Flow Area	0.09	ft^2
Wetted Perimeter	1.04	ft
Hydraulic Radius	0.08	ft
Top Width	0.00	ft
Critical Depth	0.33	ft
Percent Full	100.0	%
Critical Slope	0.04587	ft/ft
Velocity	6.30	ft/s
Velocity Head	0.62	ft
Specific Energy	0.95	ft
Froude Number	0.00	
Maximum Discharge	0.58	ft^3/s
Discharge Full	0.54	ft^3/s
Slope Full	0.05000	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

Worksheet for Alternative A - Side Slope Diversion Underdrain (Full

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.33	ft
Critical Depth	0.33	ft
Channel Slope	0.05000	ft/ft
Critical Slope	0.04587	ft/ft

Messages

Notes

Full flow for side slope diversion underdrain

Worksheet for Alternative A - Downchute

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.33000	ft/ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	10.00	ft
Discharge	64.38	ft^3/s

Results

Normal Depth	0.41	ft
Flow Area	4.38	ft^2
Wetted Perimeter	11.81	ft
Hydraulic Radius	0.37	ft
Top Width	11.62	ft
Critical Depth	1.01	ft
Critical Slope	0.01438	ft/ft
Velocity	14.70	ft/s
Velocity Head	3.36	ft
Specific Energy	3.76	ft
Froude Number	4.22	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.41	ft
Critical Depth	1.01	ft
Channel Slope	0.33000	ft/ft

Worksheet for Alternative A - Downchute

GVF Output Data

Critical Slope	0.01438	ft/ft

Messages

Notes

Roughness coefficient of 0.030 provided by manufacturer.
Discharge taken from HydraCAD output.

Cross Section for Alternative A - Downchute

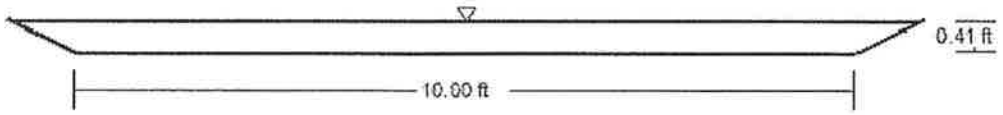
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.030	
Channel Slope	0.33000	ft/ft
Normal Depth	0.41	ft
Left Side Slope	2.00	ft/ft (H:V)
Right Side Slope	2.00	ft/ft (H:V)
Bottom Width	10.00	ft
Discharge	64.38	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for Alternative A - Downchute Underdrain (Full Flow)

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Diameter

Input Data

Roughness Coefficient	0.010	
Channel Slope	0.33333	ft/ft
Normal Depth	0.39	ft
Diameter	0.39	ft
Discharge	2.16	ft^3/s

Results

Diameter	0.39	ft
Normal Depth	0.39	ft
Flow Area	0.12	ft^2
Wetted Perimeter	1.22	ft
Hydraulic Radius	0.10	ft
Top Width	0.00	ft
Critical Depth	0.39	ft
Percent Full	100.0	%
Critical Slope	0.33405	ft/ft
Velocity	18.17	ft/s
Velocity Head	5.13	ft
Specific Energy	5.52	ft
Froude Number	0.00	
Maximum Discharge	2.32	ft^3/s
Discharge Full	2.16	ft^3/s
Slope Full	0.33405	ft/ft
Flow Type	Critical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

Worksheet for Alternative A - Downchute Underdrain (Full Flow)

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.39	ft
Critical Depth	0.39	ft
Channel Slope	0.33333	ft/ft
Critical Slope	0.33405	ft/ft

Messages

Notes

Discharge taken from the sum of 4 full side slope underdrains

Worksheet for Alternative A - Eastern Dike Swale

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.016	
Channel Slope	0.00080	ft/ft
Constructed Depth	4.00	ft
Constructed Top Width	25.00	ft
Discharge	142.75	ft^3/s

Results

Normal Depth	2.73	ft
Flow Area	37.55	ft^2
Wetted Perimeter	21.57	ft
Hydraulic Radius	1.74	ft
Top Width	20.65	ft
Critical Depth	1.92	ft
Critical Slope	0.00324	ft/ft
Velocity	3.80	ft/s
Velocity Head	0.22	ft
Specific Energy	2.95	ft
Froude Number	0.50	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.73	ft
Critical Depth	1.92	ft
Channel Slope	0.00080	ft/ft
Critical Slope	0.00324	ft/ft

Worksheet for Alternative A - Eastern Dike Swale

Messages

Notes

Discharge taken from HydraCAD output.

Cross Section for Alternative A - Eastern Dike Swale

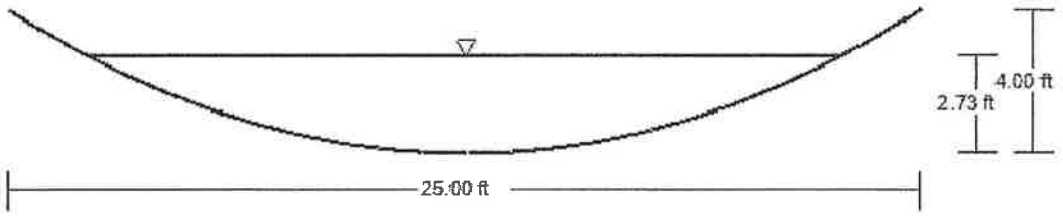
Project Description

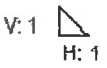
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.016	
Channel Slope	0.00080	ft/ft
Constructed Depth	4.00	ft
Normal Depth	2.73	ft
Constructed Top Width	25.00	ft
Discharge	142.75	ft³/s

Cross Section Image





Culvert Calculator Report
Alternative A - Eastern Dike Swale Culvert

Comments: Discharge taken from HydraCAD output.

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	47.00	ft	Headwater Depth/Height	1.19	
Computed Headwater Eleva	45.86	ft	Discharge	142.75	cfs
Inlet Control HW Elev.	45.81	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	45.86	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	42.30	ft	Downstream Invert	42.00	ft
Length	30.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	1.99	ft
Slope Type	Steep		Normal Depth	1.87	ft
Flow Regime	Supercritical		Critical Depth	2.25	ft
Velocity Downstream	9.55	ft/s	Critical Slope	0.006141	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	45.86	ft	Upstream Velocity Head	1.09	ft
Ke	0.20		Entrance Loss	0.22	ft

Inlet Control Properties					
Inlet Control HW Elev.	45.81	ft	Flow Control	Transition	
Inlet Type	Groove end w/headwall		Area Full	21.2	ft²
K	0.00180		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Worksheet for Alternative A - Vegetated Drainage Ditch

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.06000	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	126.38	ft^3/s

Results

Normal Depth	1.57	ft
Flow Area	16.14	ft^2
Wetted Perimeter	16.95	ft
Hydraulic Radius	0.95	ft
Top Width	16.56	ft
Critical Depth	1.85	ft
Critical Slope	0.02933	ft/ft
Velocity	7.83	ft/s
Velocity Head	0.95	ft
Specific Energy	2.52	ft
Froude Number	1.40	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.57	ft
Critical Depth	1.85	ft
Channel Slope	0.06000	ft/ft

Worksheet for Alternative A - Vegetated Drainage Ditch

GVF Output Data

Critical Slope	0.02933	ft/ft

Messages

Notes

Roughness coefficient of 0.030 provided by manufacturer.
Discharge taken from HydraCAD output.

Cross Section for Alternative A - Vegetated Drainage Ditch

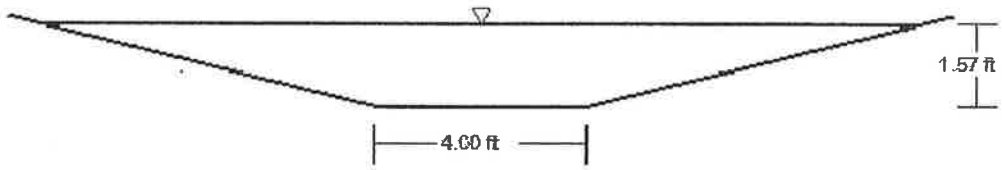
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.06000	ft/ft
Normal Depth	1.57	ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	126.38	ft³/s

Cross Section Image

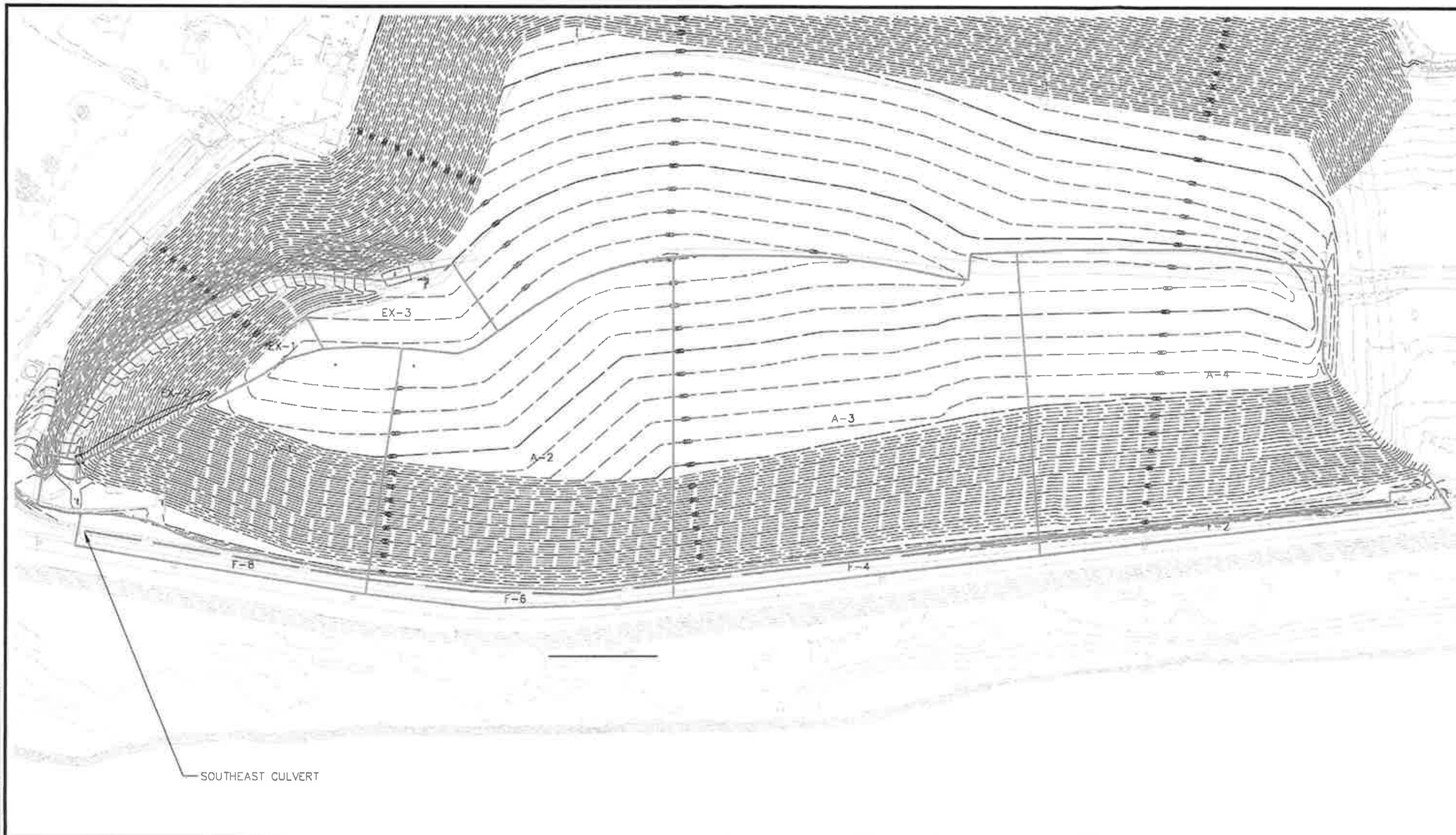


V: 1
H: 1

FUSS & O'NEILL

Appendix E

Exposed TPO Watershed Analysis



No.	DATE	DESCRIPTION	DESIGNER	REVIEWER
1			XX/XX	XX

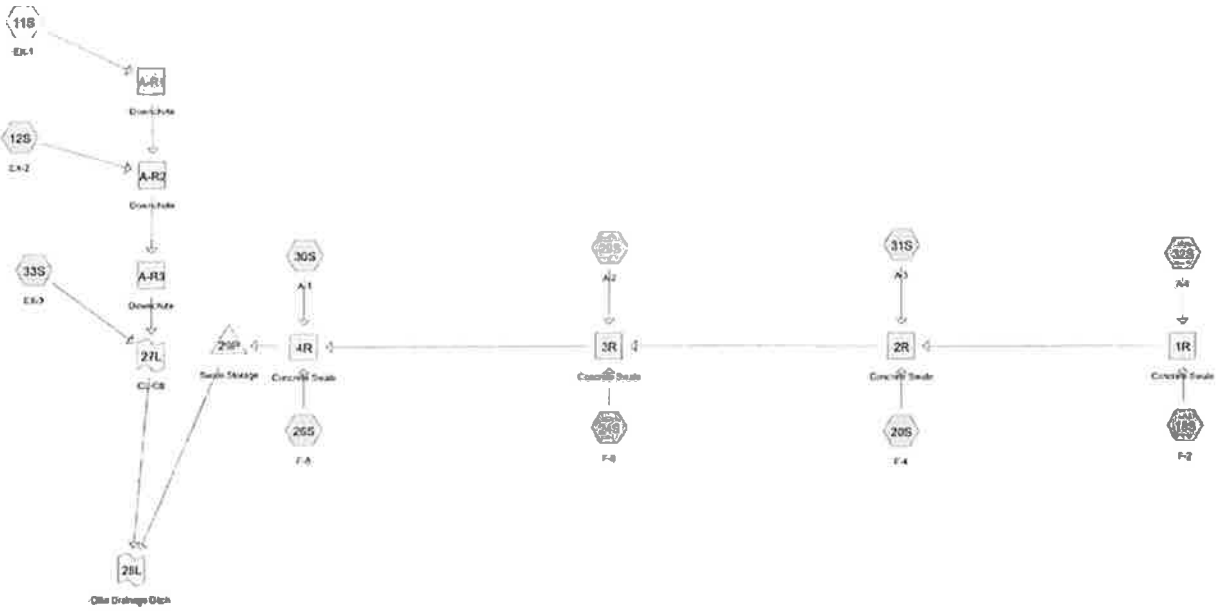
SCALE: HORZ. 1" = 200' VERT. DATUM: HORZ. VERT. GRAPHIC SCALE 0 100 200

FUSS & O'NEILL
146 HARTFORD ROAD
MANCHESTER, CONNECTICUT 06040
860.646.2469
www.fando.com

CONNECTICUT RESOURCES RECOVERY AUTHORITY
PROPOSED DRAINAGE AREAS
EXPOSED TPO ALTERNATIVE
AMENDMENT TO THE
HARTFORD LANDFILL CLOSURE PLAN
HARTFORD CONNECTICUT

PROJ. No.: 20100123.H00
DATE: JULY 2011

DRA-11



Subcat Reach Pond Link

Drainage Diagram for Proposed_Exposed_TPO
Prepared by Fuss & O'Neill Inc., Printed 12/7/2011
HydroCAD® 9.10 s/n 06397 © 2009 HydroCAD Software Solutions LLC

Area Listing (all nodes)

Area (acres)	CN	Description (subcatchment-numbers)
3.650	77	Existing Landfill (11S, 12S, 33S)
3.100	89	Gravel roads, HSG C (18S, 20S, 24S, 26S)
35.060	98	(29S, 30S, 31S, 32S)
41.810		**TOTAL AREA**

Soil Listing (all nodes)

Area (acres)	Soil Group	Subcatchment Numbers
0.000	HSG A	
0.000	HSG B	
3.100	HSG C	18S, 20S, 24S, 26S
0.000	HSG D	
38.710	Other	11S, 12S, 29S, 30S, 31S, 32S, 33S
41.810		**TOTAL AREA**

Time span=0.00-20.00 hrs, dt=0.05 hrs, 401 points
Runoff by SCS TR-20 method, UH=SCS
Reach routing by Stor-Ind+Trans method - Pond routing by Stor-Ind method

Subcatchment 11S: EX-1 Runoff Area=0.380 ac 0.00% Impervious Runoff Depth>2.84"
Tc=5.0 min CN=77 Runoff=1.36 cfs 0.090 af

Subcatchment 12S: EX-2 Runoff Area=0.440 ac 0.00% Impervious Runoff Depth>2.84"
Tc=5.0 min CN=77 Runoff=1.57 cfs 0.104 af

Subcatchment 18S: F-2 Runoff Area=0.790 ac 0.00% Impervious Runoff Depth>4.02"
Tc=5.0 min CN=89 Runoff=3.82 cfs 0.265 af

Subcatchment 20S: F-4 Runoff Area=0.800 ac 0.00% Impervious Runoff Depth>4.02"
Tc=5.0 min CN=89 Runoff=3.87 cfs 0.268 af

Subcatchment 24S: F-6 Runoff Area=0.660 ac 0.00% Impervious Runoff Depth>4.02"
Tc=5.0 min CN=89 Runoff=3.20 cfs 0.221 af

Subcatchment 26S: F-8 Runoff Area=0.850 ac 0.00% Impervious Runoff Depth>4.02"
Tc=5.0 min CN=89 Runoff=4.11 cfs 0.285 af

Subcatchment 29S: A-2 Runoff Area=8.730 ac 100.00% Impervious Runoff Depth>5.02"
Tc=5.0 min CN=98 Runoff=47.32 cfs 3.654 af

Subcatchment 30S: A-1 Runoff Area=5.220 ac 100.00% Impervious Runoff Depth>5.02"
Tc=5.0 min CN=98 Runoff=28.30 cfs 2.185 af

Subcatchment 31S: A-3 Runoff Area=11.580 ac 100.00% Impervious Runoff Depth>5.02"
Tc=5.0 min CN=98 Runoff=62.77 cfs 4.847 af

Subcatchment 32S: A-4 Runoff Area=9.530 ac 100.00% Impervious Runoff Depth>5.02"
Tc=5.0 min CN=98 Runoff=51.66 cfs 3.989 af

Subcatchment 33S: EX-3 Runoff Area=2.830 ac 0.00% Impervious Runoff Depth>2.84"
Tc=5.0 min CN=77 Runoff=10.12 cfs 0.670 af

Reach 1R: Concrete Swale Avg. Flow Depth=1.13' Max Vel=5.23 fps Inflow=55.49 cfs 4.253 af
n=0.013 L=785.0' S=0.0031 '/' Capacity=785.22 cfs Outflow=51.49 cfs 4.241 af

Reach 2R: Concrete Swale Avg. Flow Depth=1.99' Max Vel=4.38 fps Inflow=108.97 cfs 9.356 af
n=0.013 L=806.0' S=0.0011 '/' Capacity=456.44 cfs Outflow=102.75 cfs 9.324 af

Reach 3R: Concrete Swale Avg. Flow Depth=2.24' Max Vel=4.69 fps Inflow=133.11 cfs 13.199 af
n=0.013 L=673.0' S=0.0010 '/' Capacity=453.30 cfs Outflow=130.22 cfs 13.165 af

Reach 4R: Concrete Swale Avg. Flow Depth=2.49' Max Vel=4.40 fps Inflow=145.52 cfs 15.635 af
n=0.013 L=628.0' S=0.0008 '/' Capacity=396.60 cfs Outflow=143.27 cfs 15.594 af

Reach A-R1: Downchute Avg. Flow Depth=0.03' Max Vel=4.17 fps Inflow=1.36 cfs 0.090 af
n=0.017 L=101.0' S=0.2178 '/' Capacity=881.84 cfs Outflow=1.35 cfs 0.090 af

Reach A-R2: Downchute Avg. Flow Depth=0.05' Max Vel=5.77 fps Inflow=2.91 cfs 0.194 af
n=0.017 L=157.0' S=0.2357 '/' Capacity=917.26 cfs Outflow=2.87 cfs 0.194 af

Reach A-R3: Downchute Avg. Flow Depth=0.05' Max Vel=5.98 fps Inflow=2.87 cfs 0.194 af
n=0.017 L=48.0' S=0.2708 '/' Capacity=983.31 cfs Outflow=2.86 cfs 0.194 af

Pond 29P: Swale Storage Peak Elev=45.23' Storage=1.004 af Inflow=143.27 cfs 15.594 af
Primary=122.88 cfs 15.581 af Secondary=0.00 cfs 0.000 af Outflow=122.88 cfs 15.581 af

Link 27L: CL-CB Inflow=12.91 cfs 0.864 af
Primary=12.91 cfs 0.864 af

Link 28L: Dike Drainage Ditch Inflow=127.46 cfs 16.445 af
Primary=127.46 cfs 16.445 af

Total Runoff Area = 41.810 ac Runoff Volume = 16.577 af Average Runoff Depth = 4.76"
16.14% Pervious = 6.750 ac 83.86% Impervious = 35.060 ac

Summary for Subcatchment 11S: EX-1

[49] Hint: Tc<2dt may require smaller dt

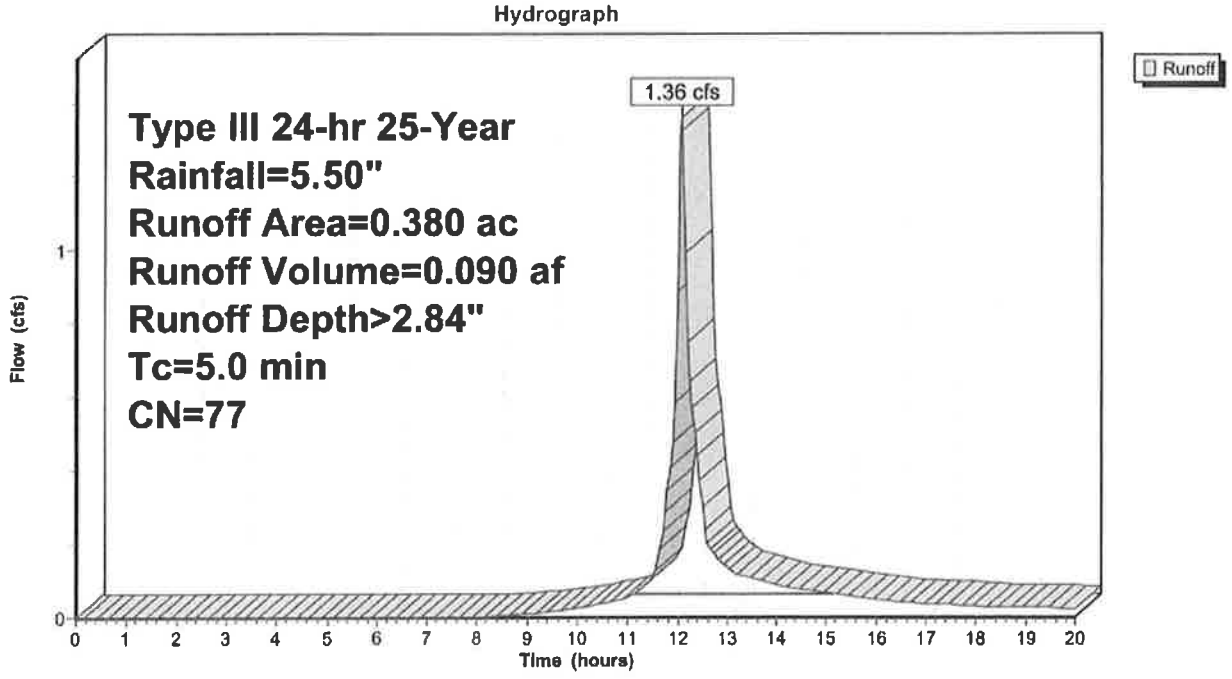
Runoff = 1.36 cfs @ 12.08 hrs, Volume= 0.090 af, Depth> 2.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	0.380	77	Existing Landfill
	0.380		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 11S: EX-1



Summary for Subcatchment 12S: EX-2

[49] Hint: Tc<2dt may require smaller dt

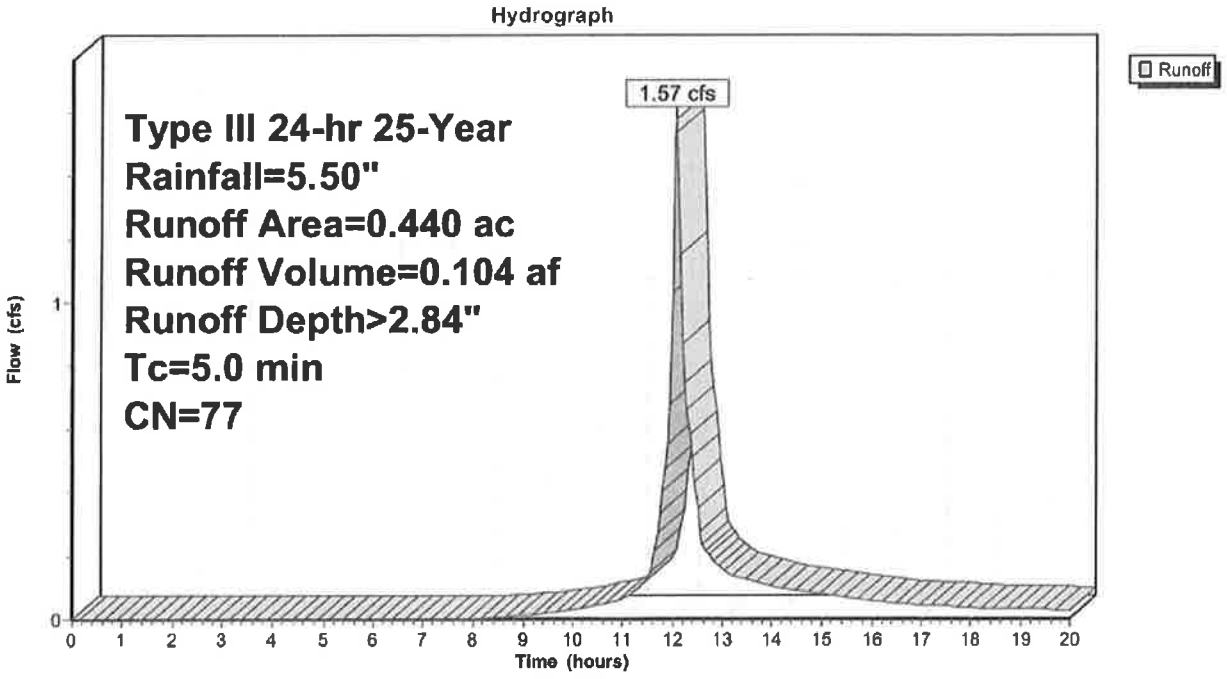
Runoff = 1.57 cfs @ 12.08 hrs, Volume= 0.104 af, Depth> 2.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	0.440	77	Existing Landfill
	0.440		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 12S: EX-2



Summary for Subcatchment 18S: F-2

[49] Hint: Tc<2dt may require smaller dt

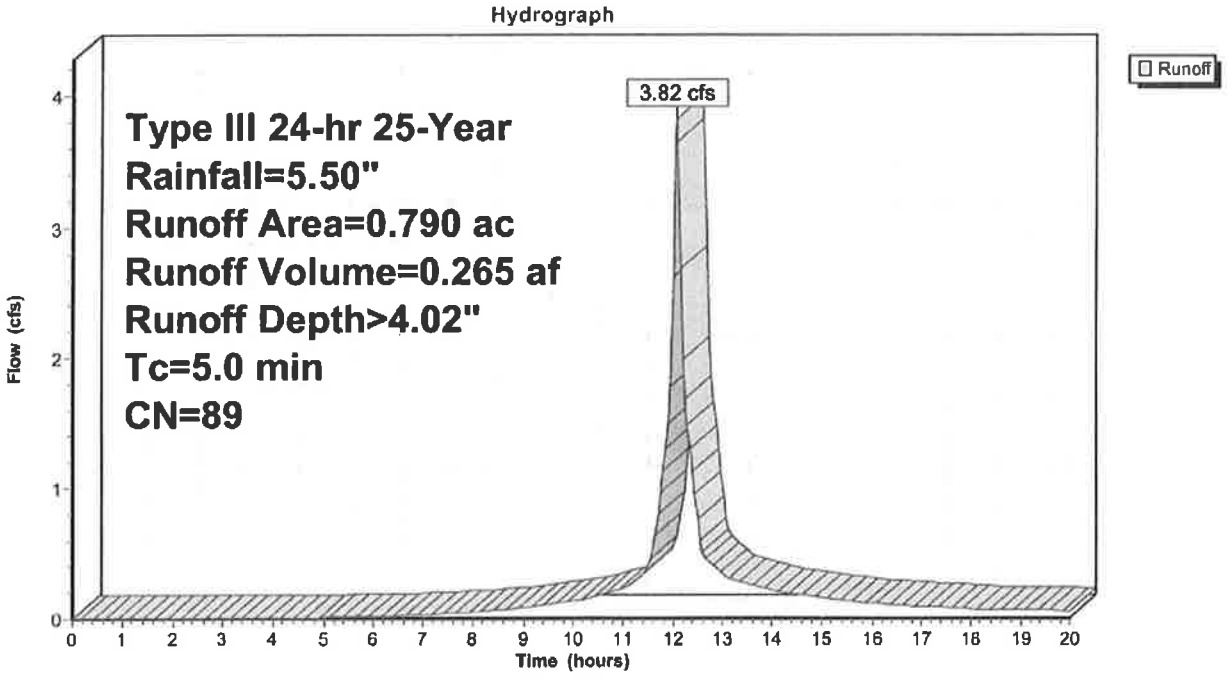
Runoff = 3.82 cfs @ 12.07 hrs, Volume= 0.265 af, Depth> 4.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (ac)	CN	Description
0.790	89	Gravel roads, HSG C
0.790		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 18S: F-2



Summary for Subcatchment 20S: F-4

[49] Hint: Tc<2dt may require smaller dt

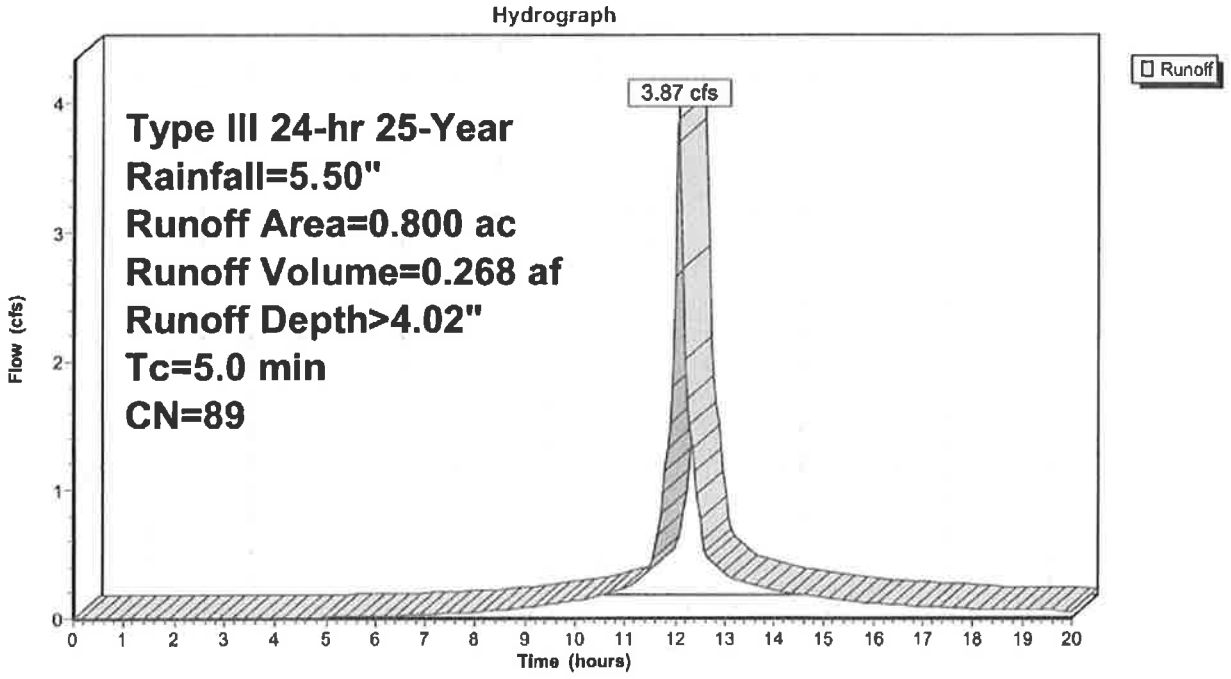
Runoff = 3.87 cfs @ 12.07 hrs, Volume= 0.268 af, Depth> 4.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (ac)	CN	Description
0.800	89	Gravel roads, HSG C
0.800		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 20S: F-4



Summary for Subcatchment 24S: F-6

[49] Hint: Tc<2dt may require smaller dt

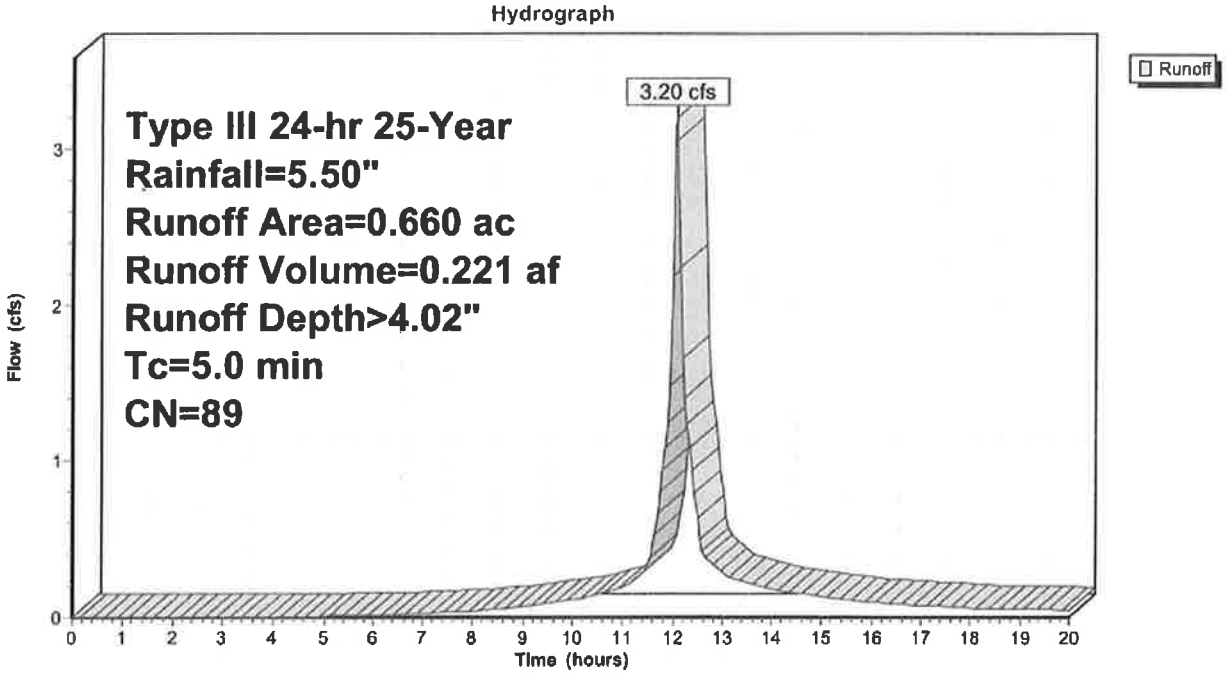
Runoff = 3.20 cfs @ 12.07 hrs, Volume= 0.221 af, Depth> 4.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (ac)	CN	Description
0.660	89	Gravel roads, HSG C
0.660		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 24S: F-6



Summary for Subcatchment 26S: F-8

[49] Hint: Tc<2dt may require smaller dt

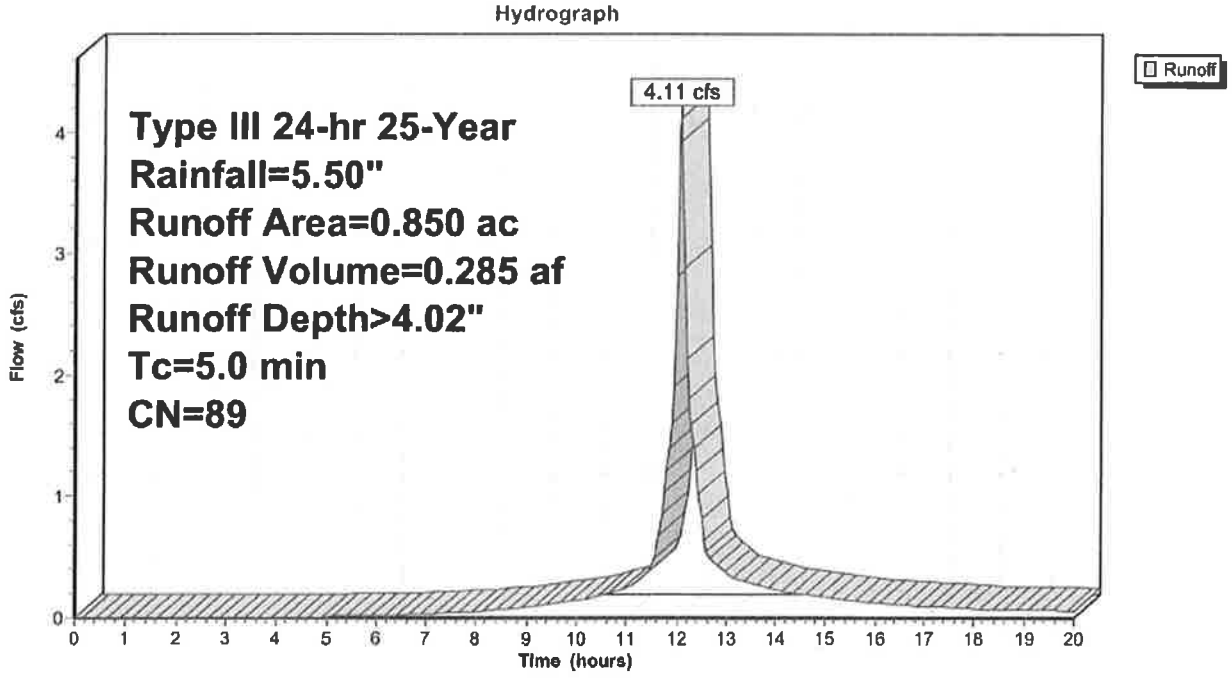
Runoff = 4.11 cfs @ 12.07 hrs, Volume= 0.285 af, Depth> 4.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

Area (ac)	CN	Description
0.850	89	Gravel roads, HSG C
0.850		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 26S: F-8



Summary for Subcatchment 29S: A-2

[49] Hint: Tc<2dt may require smaller dt

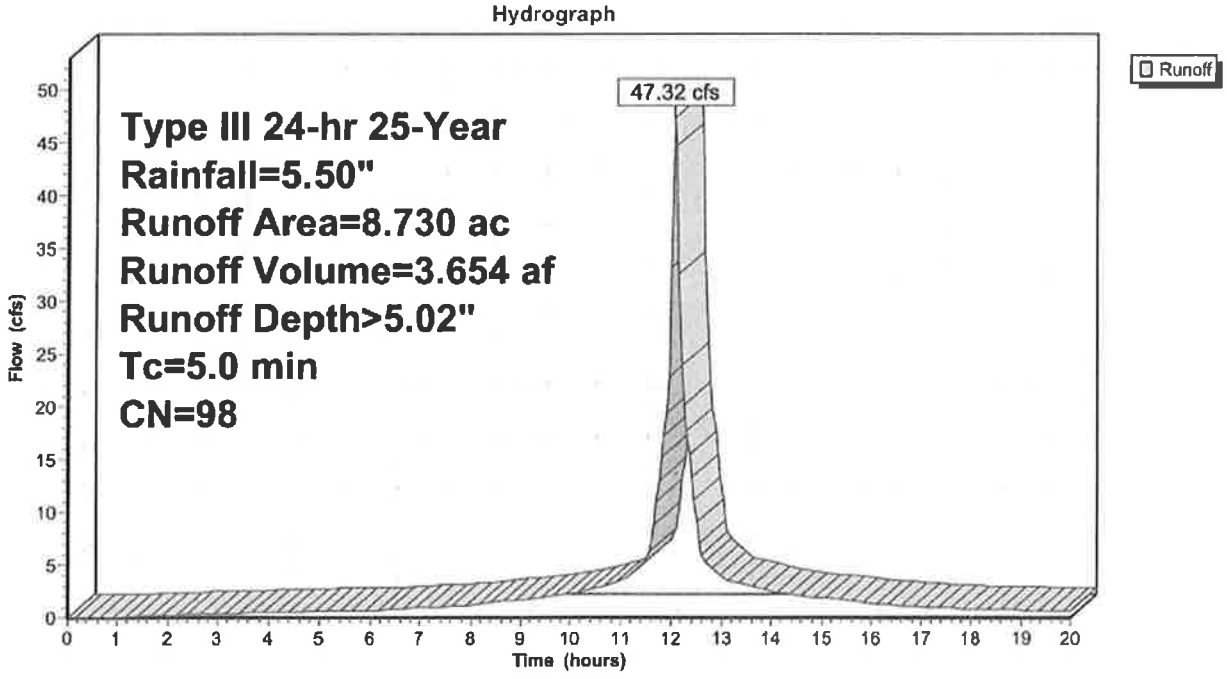
Runoff = 47.32 cfs @ 12.07 hrs, Volume= 3.654 af, Depth> 5.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	8.730	98	
	8.730		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 29S: A-2



Summary for Subcatchment 30S: A-1

[49] Hint: Tc<2dt may require smaller dt

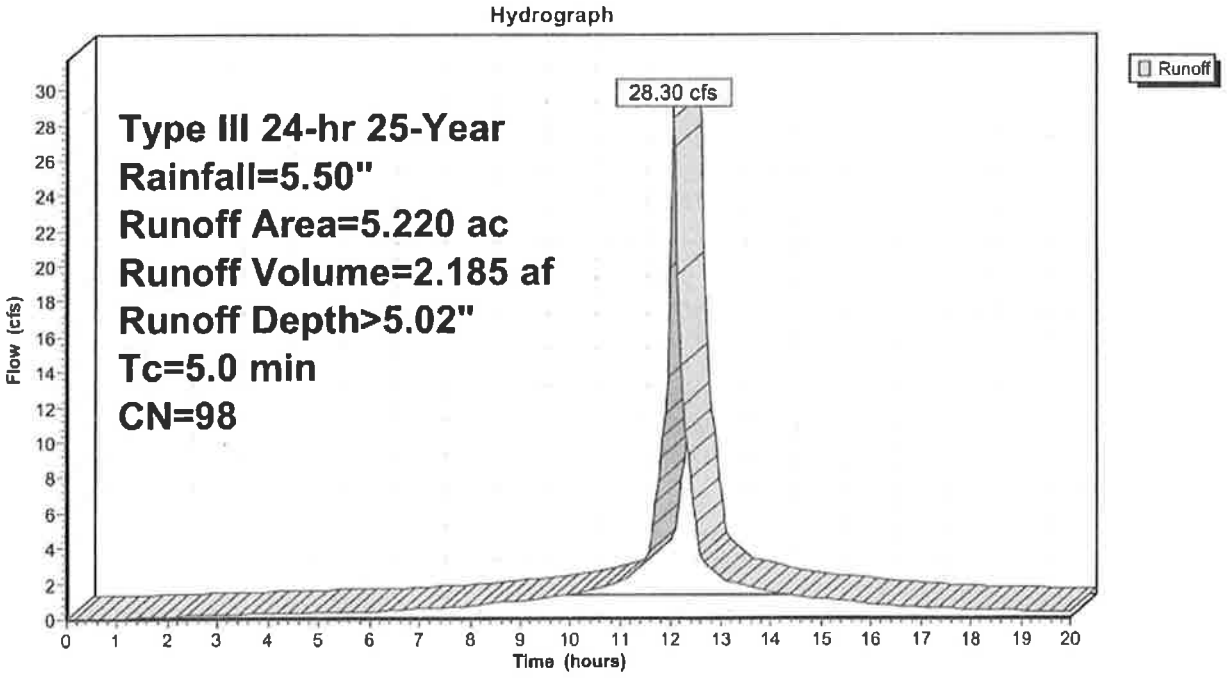
Runoff = 28.30 cfs @ 12.07 hrs, Volume= 2.185 af, Depth> 5.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	5.220	98	
	5.220		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 30S: A-1



Summary for Subcatchment 31S: A-3

[49] Hint: Tc<2dt may require smaller dt

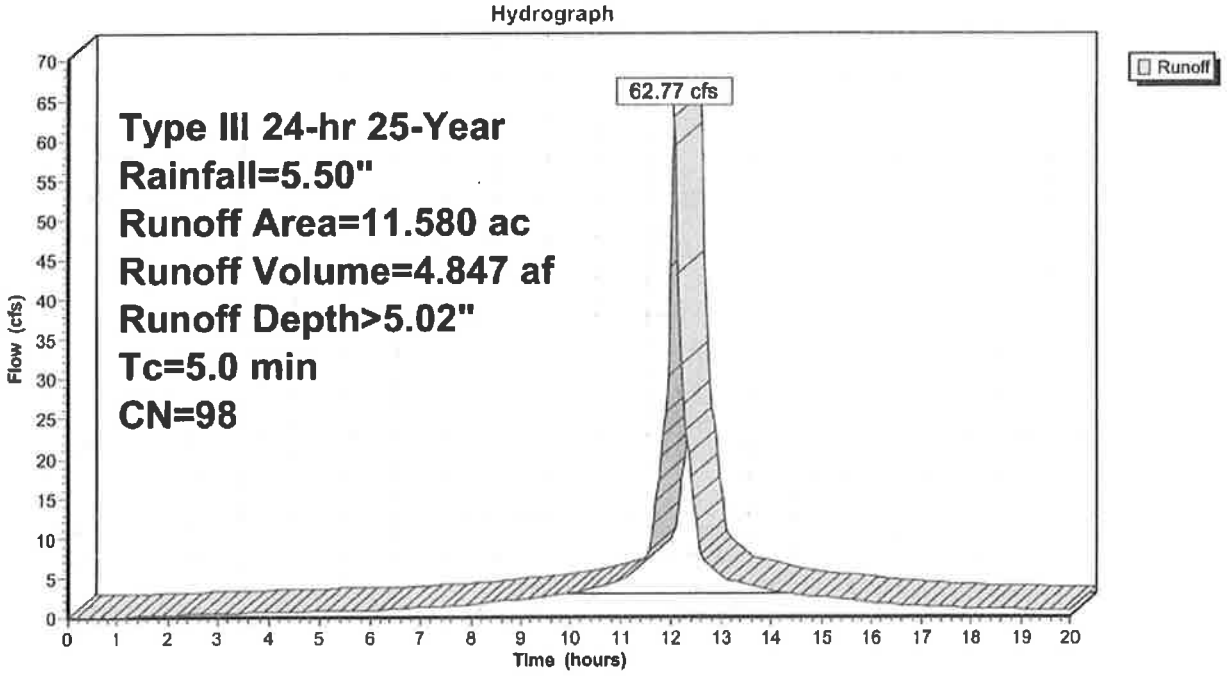
Runoff = 62.77 cfs @ 12.07 hrs, Volume= 4.847 af, Depth> 5.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	11.580	98	
	11.580		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 31S: A-3



Summary for Subcatchment 32S: A-4

[49] Hint: Tc<2dt may require smaller dt

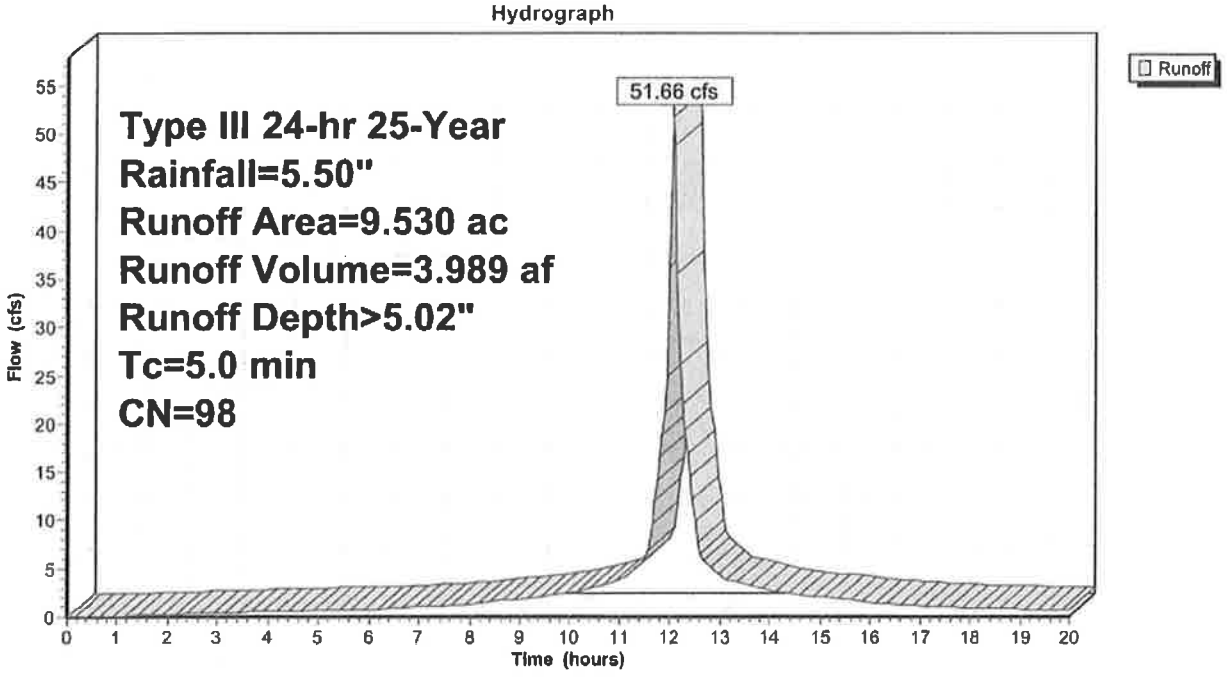
Runoff = 51.66 cfs @ 12.07 hrs, Volume= 3.989 af, Depth> 5.02"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	9.530	98	
	9.530		100.00% Impervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 32S: A-4



Summary for Subcatchment 33S: EX-3

[49] Hint: Tc<2dt may require smaller dt

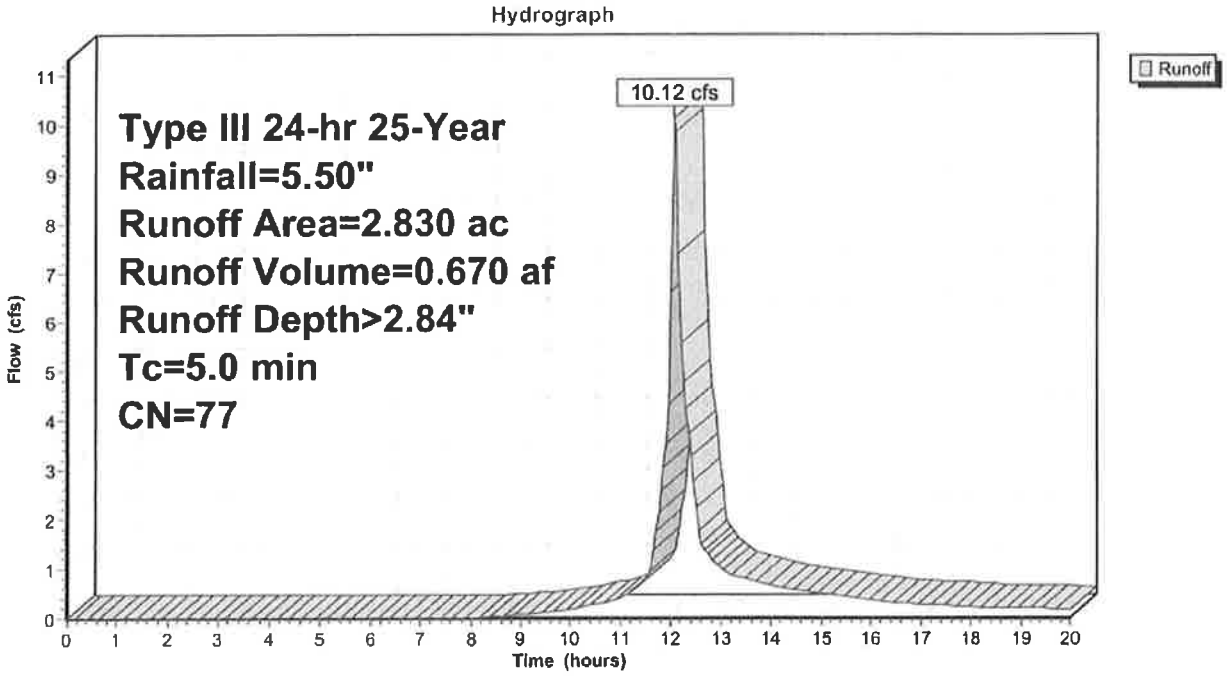
Runoff = 10.12 cfs @ 12.08 hrs, Volume= 0.670 af, Depth> 2.84"

Runoff by SCS TR-20 method, UH=SCS, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Type III 24-hr 25-Year Rainfall=5.50"

	Area (ac)	CN	Description
*	2.830	77	Existing Landfill
	2.830		100.00% Pervious Area

Tc (min)	Length (feet)	Slope (ft/ft)	Velocity (ft/sec)	Capacity (cfs)	Description
5.0					**Direct Entry,**

Subcatchment 33S: EX-3



Summary for Reach 1R: Concrete Swale

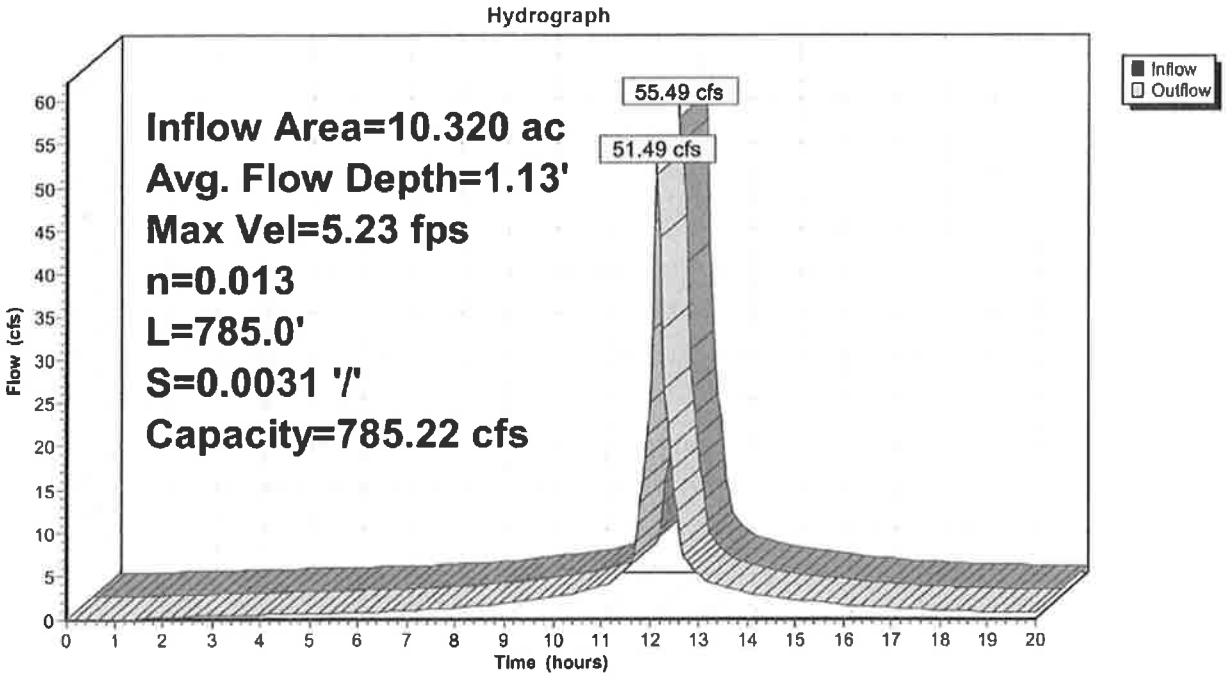
Inflow Area = 10.320 ac, 92.34% Impervious, Inflow Depth > 4.95" for 25-Year event
Inflow = 55.49 cfs @ 12.07 hrs, Volume= 4.253 af
Outflow = 51.49 cfs @ 12.15 hrs, Volume= 4.241 af, Atten= 7%, Lag= 4.6 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.23 fps, Min. Travel Time= 2.5 min
Avg. Velocity = 1.77 fps, Avg. Travel Time= 7.4 min

Peak Storage= 7,889 cf @ 12.10 hrs
Average Depth at Peak Storage= 1.13'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 785.22 cfs

25.00' x 4.00' deep Parabolic Channel, n= 0.013 Concrete, trowel finish
Length= 785.0' Slope= 0.0031 '/'
Inlet Invert= 46.80', Outlet Invert= 44.35'

Reach 1R: Concrete Swale



Summary for Reach 2R: Concrete Swale

[62] Hint: Exceeded Reach 1R OUTLET depth by 0.94' @ 12.20 hrs

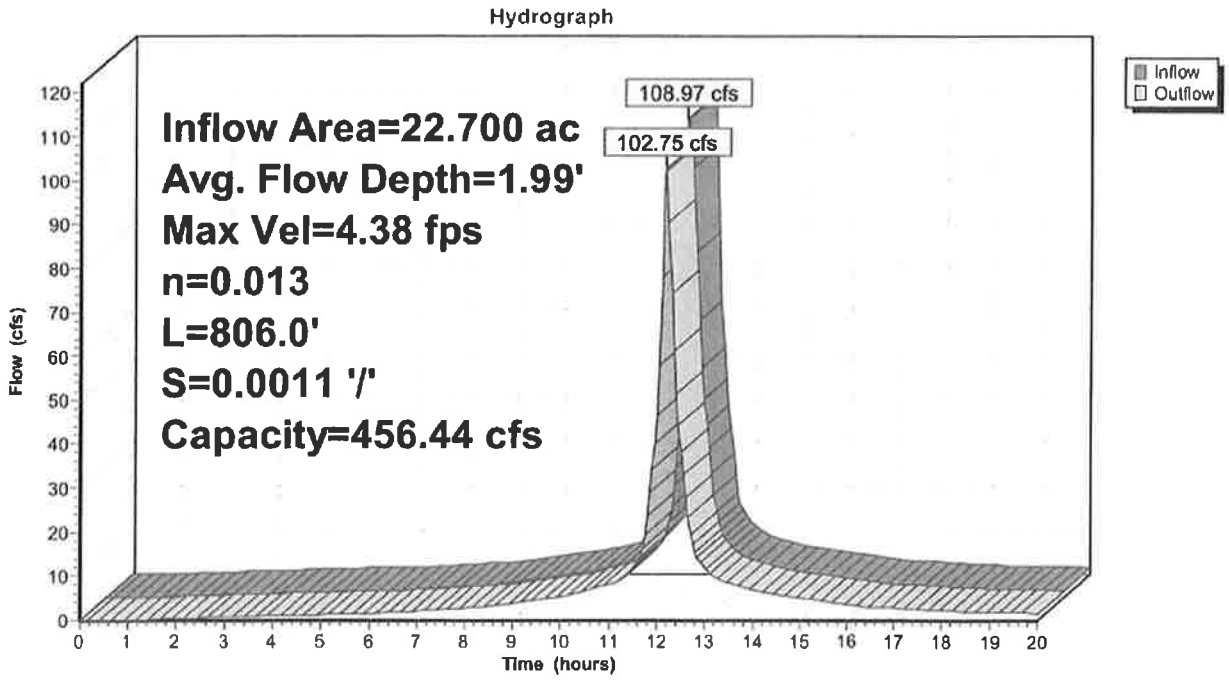
Inflow Area = 22.700 ac, 93.00% Impervious, Inflow Depth > 4.95" for 25-Year event
Inflow = 108.97 cfs @ 12.10 hrs, Volume= 9.356 af
Outflow = 102.75 cfs @ 12.19 hrs, Volume= 9.324 af, Atten= 6%, Lag= 5.3 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.38 fps, Min. Travel Time= 3.1 min
Avg. Velocity = 1.54 fps, Avg. Travel Time= 8.7 min

Peak Storage= 18,898 cf @ 12.14 hrs
Average Depth at Peak Storage= 1.99'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 456.44 cfs

25.00' x 4.00' deep Parabolic Channel, n= 0.013 Concrete, trowel finish
Length= 806.0' Slope= 0.0011 '/'
Inlet Invert= 44.35', Outlet Invert= 43.50'

Reach 2R: Concrete Swale



Summary for Reach 3R: Concrete Swale

[62] Hint: Exceeded Reach 2R OUTLET depth by 0.45' @ 12.30 hrs

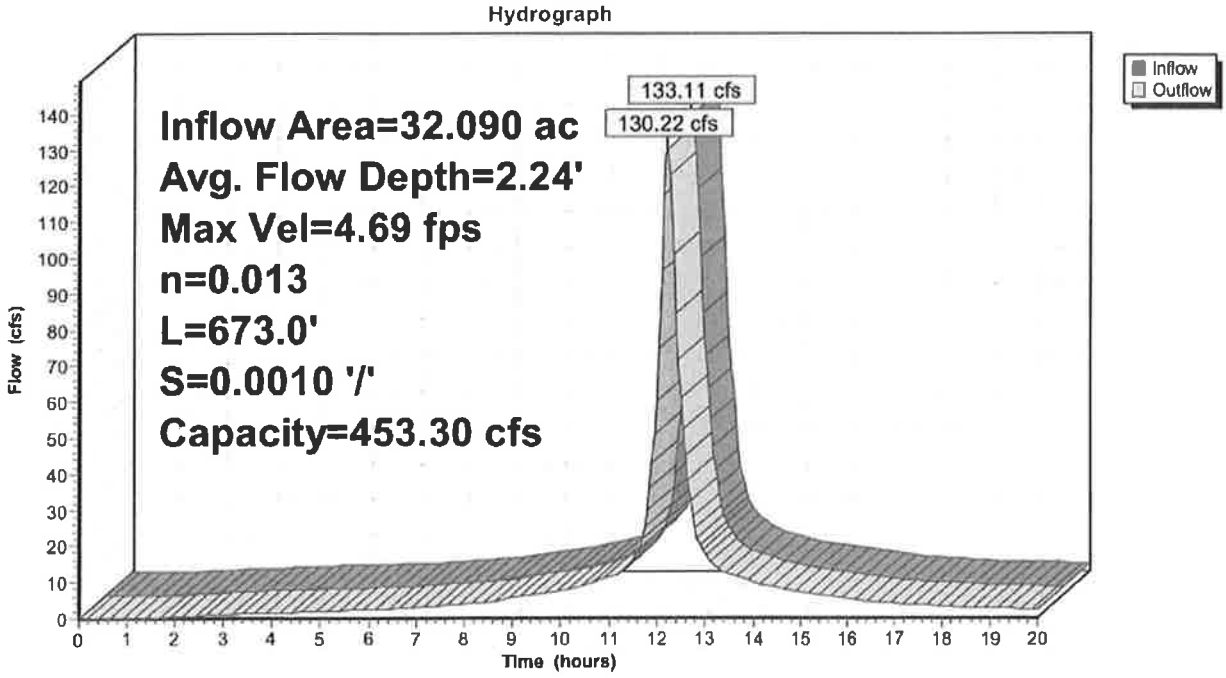
Inflow Area = 32.090 ac, 92.99% Impervious, Inflow Depth > 4.94" for 25-Year event
Inflow = 133.11 cfs @ 12.15 hrs, Volume= 13.199 af
Outflow = 130.22 cfs @ 12.22 hrs, Volume= 13.165 af, Atten= 2%, Lag= 4.1 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.69 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 1.70 fps, Avg. Travel Time= 6.6 min

Peak Storage= 18,776 cf @ 12.18 hrs
Average Depth at Peak Storage= 2.24'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 453.30 cfs

25.00' x 4.00' deep Parabolic Channel, n= 0.013 Concrete, trowel finish
Length= 673.0' Slope= 0.0010 '/'
Inlet Invert= 43.50', Outlet Invert= 42.80'

Reach 3R: Concrete Swale



Summary for Reach 4R: Concrete Swale

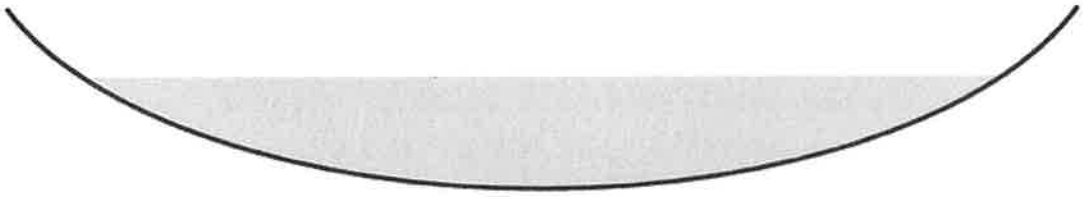
[62] Hint: Exceeded Reach 3R OUTLET depth by 0.45' @ 12.35 hrs

Inflow Area = 38.160 ac, 91.88% Impervious, Inflow Depth > 4.92" for 25-Year event
Inflow = 145.52 cfs @ 12.21 hrs, Volume= 15.635 af
Outflow = 143.27 cfs @ 12.27 hrs, Volume= 15.594 af, Atten= 2%, Lag= 4.0 min

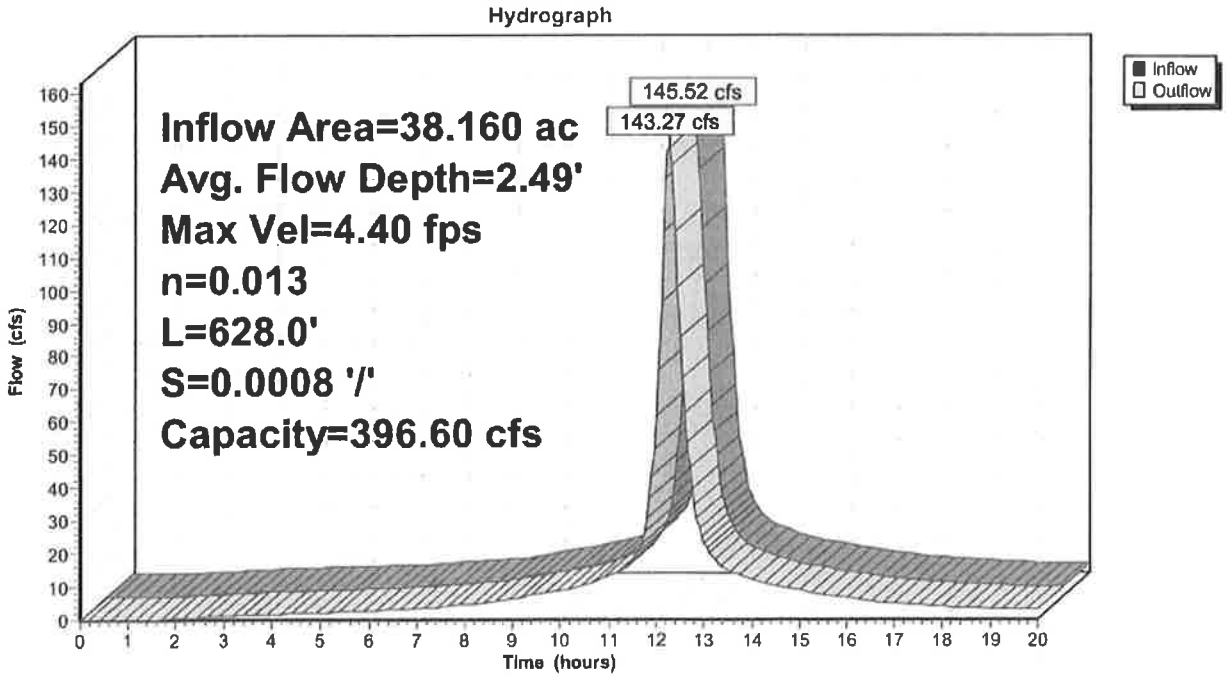
Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.40 fps, Min. Travel Time= 2.4 min
Avg. Velocity = 1.62 fps, Avg. Travel Time= 6.5 min

Peak Storage= 20,563 cf @ 12.24 hrs
Average Depth at Peak Storage= 2.49'
Bank-Full Depth= 4.00', Capacity at Bank-Full= 396.60 cfs

25.00' x 4.00' deep Parabolic Channel, n= 0.013 Concrete, trowel finish
Length= 628.0' Slope= 0.0008 '/'
Inlet Invert= 42.80', Outlet Invert= 42.30'



Reach 4R: Concrete Swale



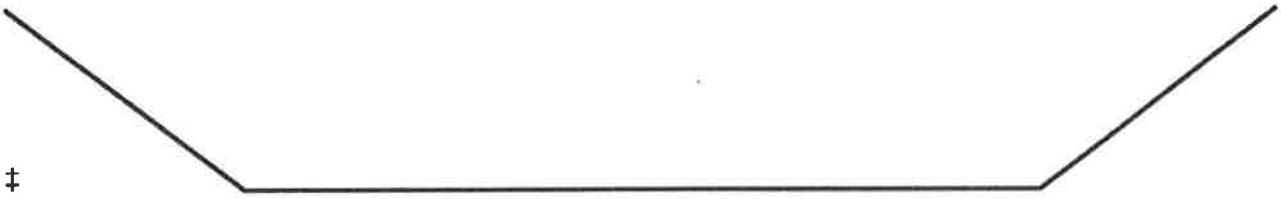
Summary for Reach A-R1: Downchute

Inflow Area = 0.380 ac, 0.00% Impervious, Inflow Depth > 2.84" for 25-Year event
Inflow = 1.36 cfs @ 12.08 hrs, Volume= 0.090 af
Outflow = 1.35 cfs @ 12.09 hrs, Volume= 0.090 af, Atten= 1%, Lag= 0.8 min

Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 4.17 fps, Min. Travel Time= 0.4 min
Avg. Velocity = 2.51 fps, Avg. Travel Time= 0.7 min

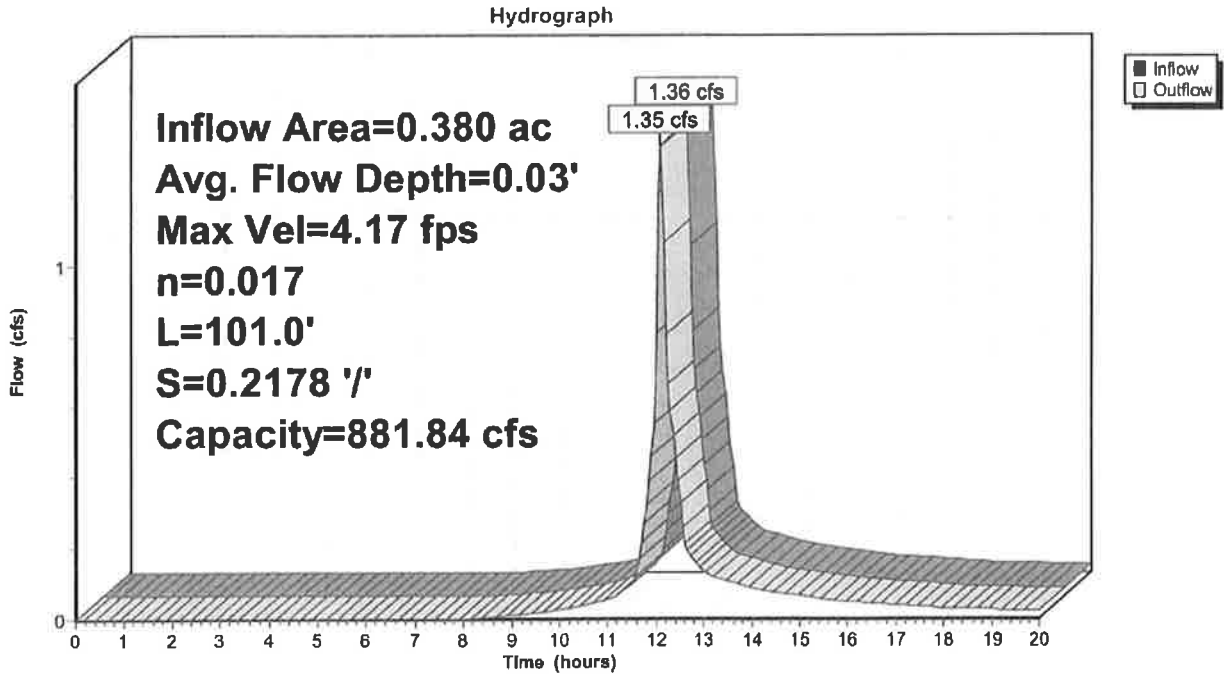
Peak Storage= 33 cf @ 12.08 hrs
Average Depth at Peak Storage= 0.03'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 881.84 cfs

10.00' x 1.50' deep channel, n= 0.017 Concrete, unfinished
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 101.0' Slope= 0.2178 '/'
Inlet Invert= 131.00', Outlet Invert= 109.00'



‡

Reach A-R1: Downchute



Summary for Reach A-R2: Downchute

[62] Hint: Exceeded Reach A-R1 OUTLET depth by 0.02' @ 12.10 hrs

Inflow Area = 0.820 ac, 0.00% Impervious, Inflow Depth > 2.84" for 25-Year event
Inflow = 2.91 cfs @ 12.08 hrs, Volume= 0.194 af
Outflow = 2.87 cfs @ 12.10 hrs, Volume= 0.194 af, Atten= 1%, Lag= 0.8 min

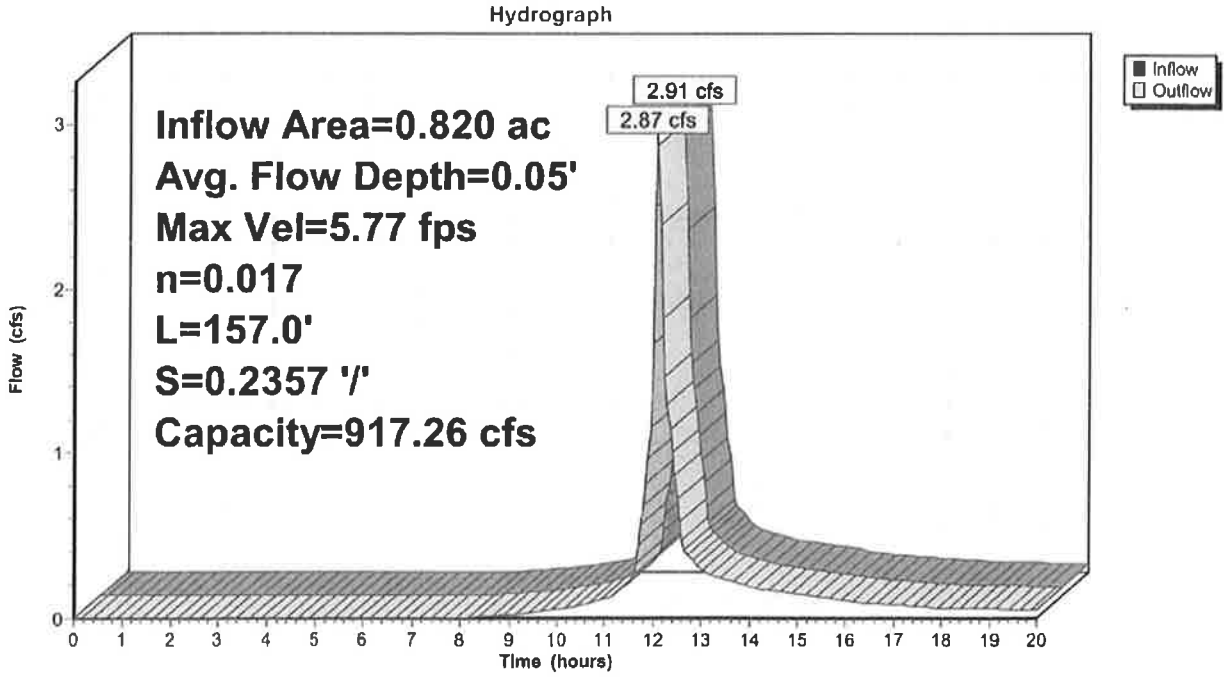
Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.77 fps, Min. Travel Time= 0.5 min
Avg. Velocity = 2.69 fps, Avg. Travel Time= 1.0 min

Peak Storage= 80 cf @ 12.09 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 917.26 cfs

10.00' x 1.50' deep channel, n= 0.017 Concrete, unfinished
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 157.0' Slope= 0.2357 '/'
Inlet Invert= 109.00', Outlet Invert= 72.00'

‡

Reach A-R2: Downchute



Summary for Reach A-R3: Downchute

[61] Hint: Exceeded Reach A-R2 outlet invert by 0.05' @ 12.10 hrs

Inflow Area = 0.820 ac, 0.00% Impervious, Inflow Depth > 2.84" for 25-Year event
Inflow = 2.87 cfs @ 12.10 hrs, Volume= 0.194 af
Outflow = 2.86 cfs @ 12.10 hrs, Volume= 0.194 af, Atten= 1%, Lag= 0.2 min

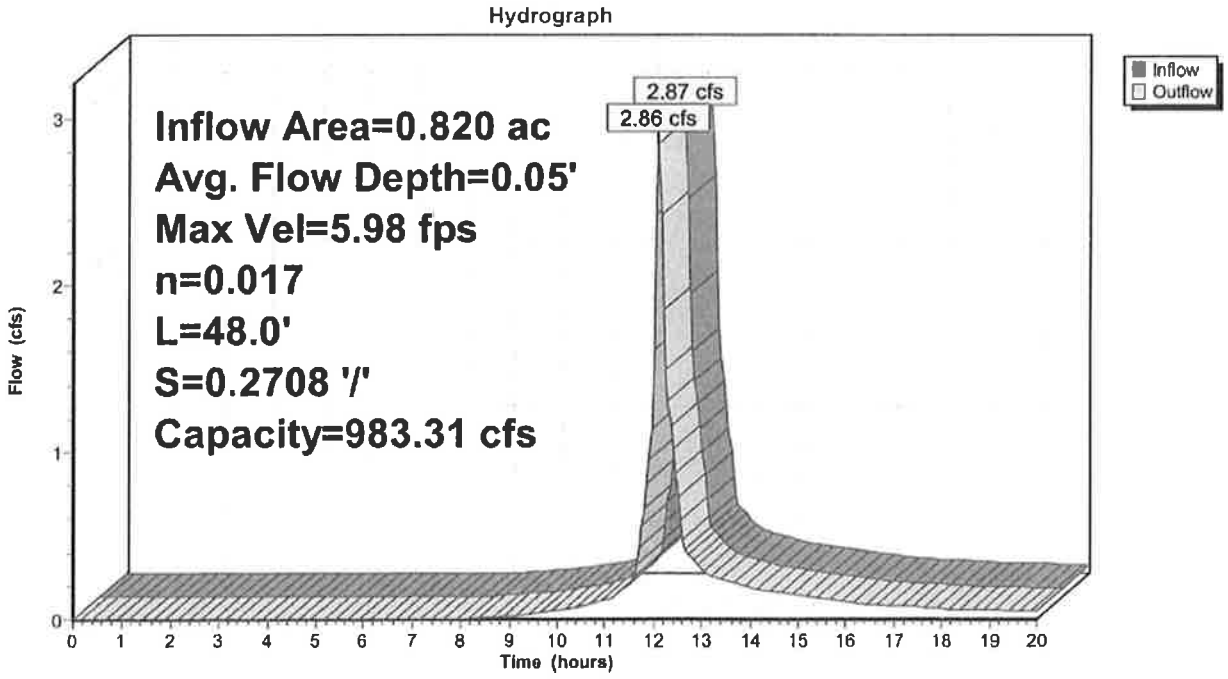
Routing by Stor-Ind+Trans method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Max. Velocity= 5.98 fps, Min. Travel Time= 0.1 min
Avg. Velocity = 2.87 fps, Avg. Travel Time= 0.3 min

Peak Storage= 23 cf @ 12.10 hrs
Average Depth at Peak Storage= 0.05'
Bank-Full Depth= 1.50', Capacity at Bank-Full= 983.31 cfs

10.00' x 1.50' deep channel, n= 0.017 Concrete, unfinished
Side Slope Z-value= 2.0 '/' Top Width= 16.00'
Length= 48.0' Slope= 0.2708 '/'
Inlet Invert= 72.00', Outlet Invert= 59.00'

‡

Reach A-R3: Downchute



Summary for Pond 29P: Swale Storage

[63] Warning: Exceeded Reach 4R INLET depth by 0.40' @ 12.50 hrs

Inflow Area = 38.160 ac, 91.88% Impervious, Inflow Depth > 4.90" for 25-Year event
Inflow = 143.27 cfs @ 12.27 hrs, Volume= 15.594 af
Outflow = 122.88 cfs @ 12.38 hrs, Volume= 15.581 af, Atten= 14%, Lag= 6.6 min
Primary = 122.88 cfs @ 12.38 hrs, Volume= 15.581 af
Secondary = 0.00 cfs @ 0.00 hrs, Volume= 0.000 af

Routing by Stor-Ind method, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs
Peak Elev= 45.23' @ 12.39 hrs Surf.Area= 0.805 ac Storage= 1.004 af

Plug-Flow detention time= 4.1 min calculated for 15.581 af (100% of inflow)
Center-of-Mass det. time= 3.7 min (741.4 - 737.8)

Volume	Invert	Avail.Storage	Storage Description
#1	42.30'	4.485 af	**Custom Stage Data (Prismatic)** Listed below (Recalc)

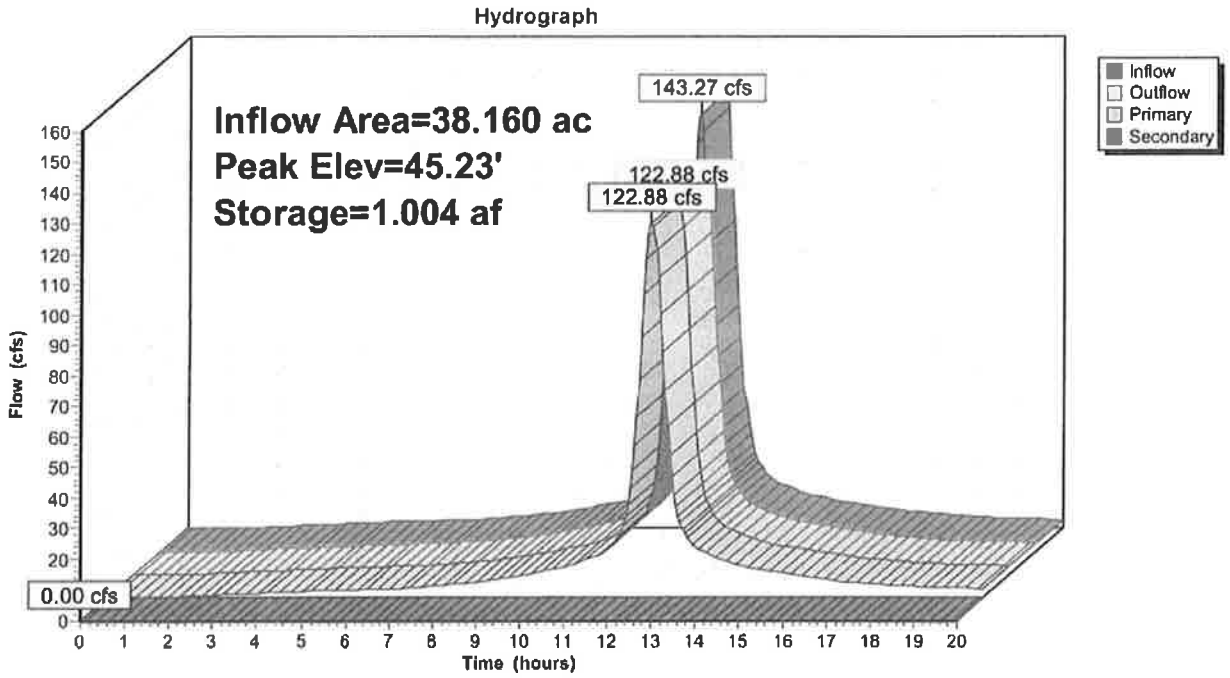
Elevation (feet)	Surf.Area (acres)	Inc.Store (acre-feet)	Cum.Store (acre-feet)
42.30	0.001	0.000	0.000
44.00	0.346	0.295	0.295
46.00	1.092	1.438	1.733
48.00	1.660	2.752	4.485

Device	Routing	Invert	Outlet Devices
#1	Primary	42.30'	**36.0" Vert. Orifice/Grate X 3.00** C= 0.600
#2	Secondary	47.00'	**25.0' long x 12.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60
			Coef. (English) 2.57 2.62 2.70 2.67 2.66 2.67 2.66 2.64

Primary OutFlow Max=122.59 cfs @ 12.38 hrs HW=45.22' (Free Discharge)
↑—**1=Orifice/Grate** (Orifice Controls 122.59 cfs @ 5.82 fps)

Secondary OutFlow Max=0.00 cfs @ 0.00 hrs HW=42.30' (Free Discharge)
↑—**2=Broad-Crested Rectangular Weir** (Controls 0.00 cfs)

Pond 29P: Swale Storage

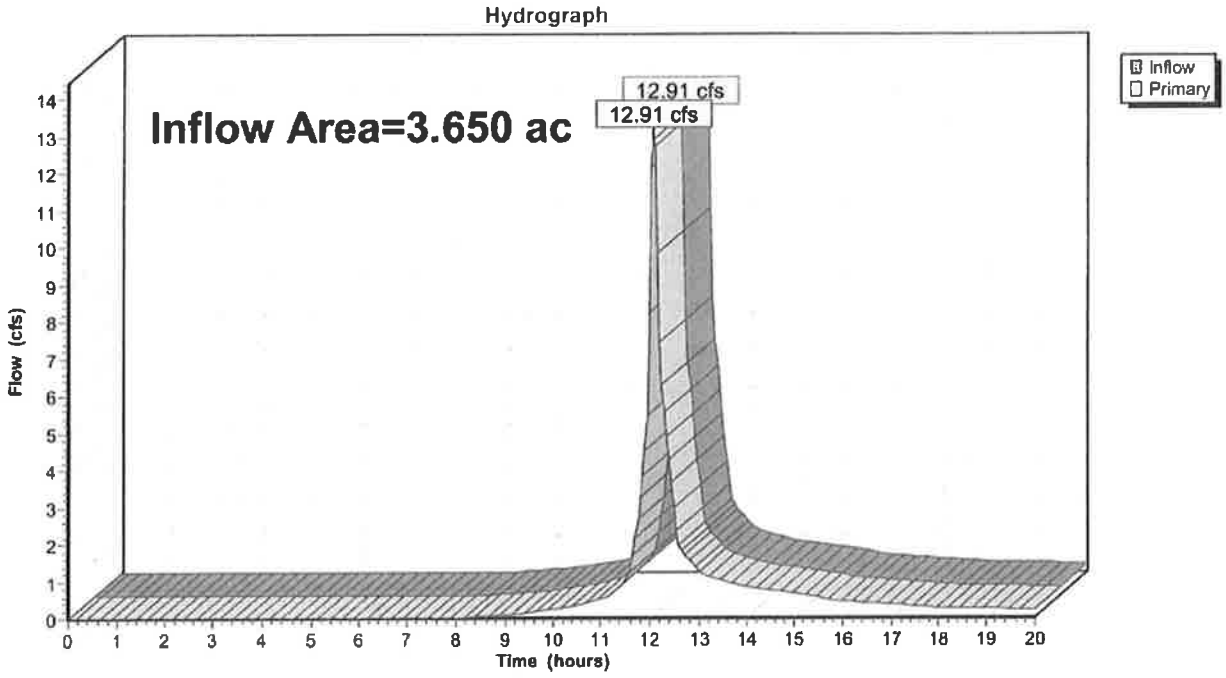


Summary for Link 27L: CL-CB

Inflow Area = 3.650 ac, 0.00% Impervious, Inflow Depth > 2.84" for 25-Year event
Inflow = 12.91 cfs @ 12.08 hrs, Volume= 0.864 af
Primary = 12.91 cfs @ 12.08 hrs, Volume= 0.864 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link 27L: CL-CB

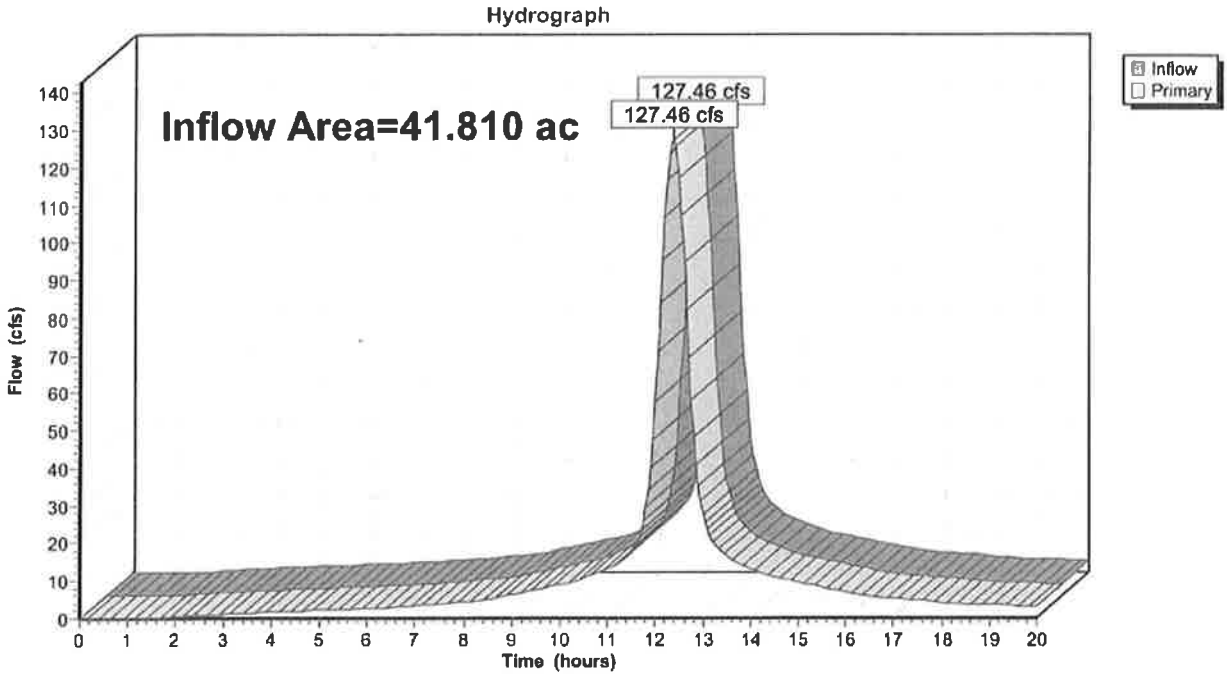


Summary for Link 28L: Dike Drainage Ditch

Inflow Area = 41.810 ac, 83.86% Impervious, Inflow Depth > 4.72" for 25-Year event
Inflow = 127.46 cfs @ 12.37 hrs, Volume= 16.445 af
Primary = 127.46 cfs @ 12.37 hrs, Volume= 16.445 af, Atten= 0%, Lag= 0.0 min

Primary outflow = Inflow, Time Span= 0.00-20.00 hrs, dt= 0.05 hrs

Link 28L: Dike Drainage Ditch



FUSS & O'NEILL

Appendix F

Exposed TPO Swale and Culvert Calculations

Worksheet for Alternative B - Eastern Dike Swale

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.016	
Channel Slope	0.00080	ft/ft
Constructed Depth	4.00	ft
Constructed Top Width	25.00	ft
Discharge	143.27	ft^3/s

Results

Normal Depth	2.73	ft
Flow Area	37.65	ft^2
Wetted Perimeter	21.59	ft
Hydraulic Radius	1.74	ft
Top Width	20.66	ft
Critical Depth	1.93	ft
Critical Slope	0.00324	ft/ft
Velocity	3.81	ft/s
Velocity Head	0.23	ft
Specific Energy	2.96	ft
Froude Number	0.50	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.73	ft
Critical Depth	1.93	ft
Channel Slope	0.00080	ft/ft
Critical Slope	0.00324	ft/ft

Worksheet for Alternative B - Eastern Dike Swale

Messages

Notes

Discharge taken from HydraCAD output.

Cross Section for Alternative B - Eastern Dike Swale

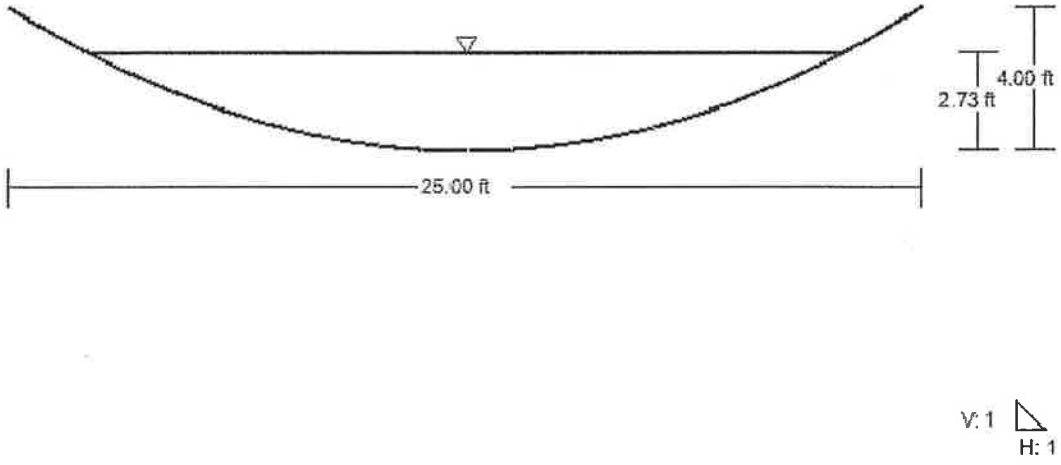
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.016	
Channel Slope	0.00080	ft/ft
Constructed Depth	4.00	ft
Normal Depth	2.73	ft
Constructed Top Width	25.00	ft
Discharge	143.27	ft³/s

Cross Section Image



Culvert Calculator Report
Alternative B - Eastern Dike Swale Culvert

Comments: Discharge taken from HydraCAD output.

Solve For: Headwater Elevation

Culvert Summary					
Allowable HW Elevation	47.00	ft	Headwater Depth/Height	1.19	
Computed Headwater Eleva	45.87	ft	Discharge	143.27	cfs
Inlet Control HW Elev.	45.82	ft	Tailwater Elevation	0.00	ft
Outlet Control HW Elev.	45.87	ft	Control Type	Entrance Control	

Grades					
Upstream Invert	42.30	ft	Downstream Invert	42.00	ft
Length	30.00	ft	Constructed Slope	0.010000	ft/ft

Hydraulic Profile					
Profile	S2		Depth, Downstream	2.00	ft
Slope Type	Steep		Normal Depth	1.88	ft
Flow Regime	Supercritical		Critical Depth	2.25	ft
Velocity Downstream	9.56	ft/s	Critical Slope	0.006161	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	3				

Outlet Control Properties					
Outlet Control HW Elev.	45.87	ft	Upstream Velocity Head	1.10	ft
Ke	0.20		Entrance Loss	0.22	ft

Inlet Control Properties					
Inlet Control HW Elev.	45.82	ft	Flow Control	Transition	
Inlet Type	Groove end w/headwall		Area Full	21.2	ft²
K	0.00180		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	2	
C	0.02920		Equation Form	1	
Y	0.74000				

Worksheet for Alternative B - Vegetated Drainage Ditch

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.06000	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	127.46	ft^3/s

Results

Normal Depth	1.58	ft
Flow Area	16.24	ft^2
Wetted Perimeter	17.00	ft
Hydraulic Radius	0.96	ft
Top Width	16.61	ft
Critical Depth	1.86	ft
Critical Slope	0.02930	ft/ft
Velocity	7.85	ft/s
Velocity Head	0.96	ft
Specific Energy	2.53	ft
Froude Number	1.40	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.58	ft
Critical Depth	1.86	ft
Channel Slope	0.06000	ft/ft

Worksheet for Alternative B - Vegetated Drainage Ditch

GVF Output Data

Critical Slope	0.02930	ft/ft

Messages

Notes

Roughness coefficient of 0.030 provided by manufacturer.
Discharge taken from HydraCAD output.

Cross Section for Alternative B - Vegetated Drainage Ditch

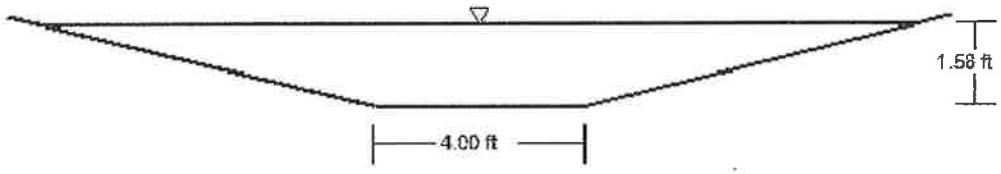
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.06000	ft/ft
Normal Depth	1.58	ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	4.00	ft
Discharge	127.46	ft^3/s

Cross Section Image



V: 1
H: 1

STANDARD FAST TRACK AND STUDY PROCESS GENERATOR INTERCONNECTION AGREEMENT

This Interconnection Agreement (this "***Agreement***"), dated as of May 08, 2012 (the "***Effective Date***"), is entered into by and between Connecticut Light and Power, a specially chartered Connecticut corporation with a principal place of business at 107 Selden St, Berlin, CT, 06037 (the "***Electric Distribution Company***" or "***EDC***"), and Connecticut Resources Recovery Authority (CRRA) with a principal place of business at 100 Constitution Plaza, 6th Floor, Hartford, CT 06103 (the "***Generator***"). The EDC and the Generator are collectively referred to herein as the "***Parties***" and individually as a "***Party***." Any capitalized term used but not defined in this Agreement shall have the meaning ascribed to such term in the Guidelines for Generator Interconnection attached hereto as Appendix A, as may be amended from time to time (the "***Guidelines***").

1. Basic Understandings.

The Generator owns and/or operates or plans to construct a Generating Facility at 180 Leibert Road, Hartford, CT Billing Account 51252842018**,** as depicted in Appendix H (the "***Facility***"). A description of the Facility as studied, and incorporating any design changes approved in accordance with Section 0, is attached hereto as Appendix B (the "***Facility Description***").

The subject matter of this Agreement pertains to the Interconnection of the Facility to the EPS. This Agreement does not relate to any other obligation of the Generator unrelated to the Interconnection of the Facility. Apart from this Agreement, the Generator is responsible for (a) all arrangements to effect any deliveries of electric energy from the Facility in accordance with the appropriate retail or FERC-jurisdictional tariffs and (b) arranging for its purchase of retail power (such as back-up or stand-by power).

This Agreement does not cover sales of power, capacity, energy or market products generated from the Facility. If the Generator intends to sell energy or ancillary services from the Facility, it must provide written notice to the EDC of such intention at least sixty (60) days prior to the effectuation of such sale. Furthermore, the EDC may require the Generator to enter into a new Interconnection agreement prior to such sale which may or may not require approval from FERC.

Any changes to the design of the Facility as it is described and specified in the application submitted by the Generator to the EDC with respect to such Facility (the "***Application***") must be approved by the EDC in writing prior to the implementation of such design changes. Only design changes approved in accordance with this Section 0 shall be implemented.

The Generator may not operate the Facility in parallel with the EPS until: (a) the conditions for initial parallel operation of the Facility set forth in Appendix C have been met; (b) commissioning and testing of the Facility has been completed in accordance with the Guidelines and to the satisfaction of the EDC; (c) the Generator has paid the EDC all funds due pursuant to paragraphs 5.3.1 and 5.3.2 of this Agreement; and (d) the EDC has provided formal written authorization in accordance with the Guidelines stating that operation of the Facility in parallel with the EPS is authorized by the EDC (the "***Authorization Date***"). Such written authorization will not be effective unless accompanied by a description of the Facility that incorporates all design changes to the Facility since the Application was submitted to the EDC (and not specified therein), including all design changes made during construction.

The Generator shall obtain each consent, approval, authorization, order or acceptance from FERC necessary for the Generator or any entity that, directly or indirectly, through one or more

intermediaries, controls, or is controlled by, or is under common control with the Generator (each, an "***Affiliate***") to sell any power, capacity, energy or market products from the Facility into the wholesale power market (collectively, "***Wholesale Sales***") prior to making any such sales. If the Generator intends to make Wholesale Sales, then the Generator shall provide written notice to the EDC at least sixty (60) days prior to making any Wholesale Sales. The Generator shall indemnify, defend and hold harmless the EDC, its trustees, directors, officers, employees, agents and affiliates from any costs, damages, fines or penalties, including reasonable attorneys' fees, directly resulting from Generator's or its Affiliate's non-compliance with any provision of this Section 0; provided, however, that the such indemnification obligation shall be subject to the limitation of liability set forth in Section 14.

2. Entire Agreement.

This Agreement, including any attachments or appendices, is entered into pursuant to the Guidelines.

This Agreement, the Guidelines, and the relevant EDC Tariffs, Terms and Conditions represent the entire understanding between the Parties as to the subject matter of this Agreement.

Each Party hereby represents that in entering into this Agreement, it has not relied on any promise, inducement, representation, warranty, agreement or other statement not set forth in this Agreement, the Tariffs, Terms and Conditions, or the Guidelines.

In the event of a conflict between this Agreement, the Guidelines and/or the Tariffs, Terms and Conditions, the Tariffs, shall take first precedent, followed by the Terms and Conditions, followed by the Guidelines, and lastly this Agreement.

3. Term.

This Agreement is effective as of the Effective Date. The Agreement shall continue in full force and effect until terminated pursuant to Section 4.

4. Termination.

This Agreement may be terminated under the following conditions:

4.1.1. The Parties may mutually terminate this Agreement at any time upon the execution of an agreement to terminate this Agreement.

4.1.2. The Generator may terminate this Agreement at any time by providing sixty (60) days written notice to EDC.

4.1.3. Either Party may terminate this Agreement immediately upon the occurrence of an Event of Default (as such term is defined in Section 20.1) by the other Party, subject to the notice requirement set forth in Section 20.2(c).

4.1.4. The EDC may terminate this Agreement if the Generator: (a) operates the Facility in parallel with the EPS prior to the Authorization Date; (b) fails within six months of testing to receive authorization from the EDC to operate in parallel with the EPS; (c) does not construct the Facility in accordance with the Facility Description; (d) modifies the Facility without the written approval of the EDC; (e) fails to energize the Facility within twelve months of the Authorization Date; or (f) permanently abandons the Facility. For the purposes of this Agreement, the Generator's failure to operate the Facility for any consecutive twelve month period after the Authorization Date shall be deemed a permanent abandonment.

4.1.5. The EDC may terminate this Agreement if the Generator fails to correct an Emergency Condition (as such term is defined in Section 7.1.1) or a Non-Emergency Adverse Operating Effect (as such term is defined in Section 7.1.4) within ninety (90) days from the date on which the EDC disconnected the Facility due to such event.

Survival of Obligations. The termination of this Agreement shall not relieve either Party of its liabilities and obligations, owed or continuing at the time of termination.

Related Agreements. Any agreement attached to and incorporated into this Agreement shall terminate concurrently with this Agreement unless the Parties have agreed otherwise in writing.

5. General Payment Terms.

Interconnection Costs. The Generator is responsible for paying all costs associated with Interconnection of the Facility, including (a) testing costs, (b) costs associated with installing, testing and maintaining the communications infrastructure necessary to provide protection and/or monitoring of the Generating Facility (collectively, the "***Communications Costs***"), (c) construction, modification or upgrade costs necessary to accommodate the Interconnection (collectively, the "***Construction Costs***"), and (d) any ongoing maintenance costs and other charges deemed necessary by the EDC to maintain the Interconnection (all such costs described in this sentence, the "***Interconnection Costs***"). The EDC shall notify the Generator in the event the Construction Costs exceed 110% of the estimate of such costs provided by the EDC to the Generator in the Construction Agreement (as such term is defined below), facility study report or other written understanding of the Parties.

Initial Cost Estimate. Attached hereto as Appendix D is a good-faith estimate of the initial Interconnection Costs (the "***Initial Cost Estimate***").

Billing and Payment Procedures for Initial Interconnection Costs.

5.1.1. The Generator shall pay the EDC the amount set forth in the Initial Cost Estimate (the "***Initial Payment***") within thirty (30) days of the Effective Date.

5.1.2. Within thirty (30) days following the date on which the Facility is first connected to the EPS (the "***Initial Interconnection***"), the EDC shall provide the Generator with a final accounting report detailing any Underpayment (as such term is defined below) or Overpayment (as such term is defined below) made by the Generator with respect to the Initial Payment. To the extent that the actual Interconnection Costs accrued up to the date of the Initial Interconnection exceed the Initial Payment (an "***Underpayment***"), the EDC shall invoice the Generator for an amount equal to the Underpayment and the Generator shall pay such amount to the EDC within thirty (30) days of such invoice. To the extent that the Initial Payment exceeds the actual Interconnection Costs accrued up to the date of the Initial Interconnection (an "***Overpayment***"), the EDC shall refund to the Generator an amount equal to the Overpayment within thirty (30) days of the provision of such final accounting report.

Billing and Payment Procedures for Ongoing Interconnection Costs. All Interconnection Costs incurred following the Initial Interconnection shall hereinafter be referred to as the "***Ongoing Costs***," and shall include maintenance, testing and Communications Costs, as well as any Construction Costs not included in either (a) the Construction Agreement by and between the Generator and the Company, dated as of [N/A], a copy of which is attached hereto as Appendix E (the "***Construction Agreement***"), or (b) the Initial Cost Estimate. The EDC shall invoice the Generator for all Ongoing Costs as such costs are incurred, and the Generator shall pay each such invoice within thirty (30) days of receipt, or as otherwise agreed to by the Parties.

Milestones. The Parties shall agree on milestones for which each Party is responsible and list them in Appendix F of this Agreement. A Party's obligations under this provision may be extended by agreement. If a Party anticipates that it will be unable to meet a milestone for any reason other than a Force Majeure Event (as such term is defined in Section 18.1), it shall immediately notify the other Party of the reason(s) for not meeting the milestone and (a) propose the earliest reasonable alternate date by which it can attain this and future milestones, and (b) requesting appropriate amendments to Appendix F. The Party affected by the failure to meet a milestone shall not unreasonably withhold agreement to such an amendment unless (i) it will suffer significant uncompensated economic or operational harm from the delay, (ii) attainment of the same milestone has previously been delayed, or (iii) it has reason to believe that the delay in meeting the milestone is intentional or unwarranted notwithstanding the circumstances explained by the Party proposing the amendment.

Distribution Upgrades. The EDC shall design, procure, construct, install, and own the upgrades described in Appendix G of this Agreement (the "***Upgrades***"). If the EDC and the Generator agree, the Generator may construct Upgrades that are located on land owned by the Generator. The actual cost of the Upgrades, including overheads, shall be directly assigned to the Generator. The Generator shall be responsible for its share of all reasonable expenses, associated with operating, maintaining, repairing, and replacing such Upgrades, except to the extent that a retail tariff of, or an agreement with, the EDC provides otherwise.

Taxes. The Parties shall comply with all applicable federal and state tax laws.

6. Operating Requirements.

General Operating Requirements. The Generator shall construct, interconnect, operate, and maintain the Facility and all accompanying and necessary facilities in accordance with (a) all applicable laws and requirements, Good Utility Practice, the Guidelines, Tariffs, and the Terms and Conditions; (b) applicable specifications that meet or exceed those provided by the National Electrical Safety Code, the American National Standards Institute, IEEE, Underwriter's Laboratory and ISO-NE operating requirements in effect at the time of construction and other

applicable national and state codes and standards. Following the initial Interconnection of the Facility, the Generator shall comply with all special operating requirements set forth in Appendix C. In the event that the EDC believes that the cause of any problem to the EPS originates from the Facility, the EDC has the right to install monitoring equipment at a mutually agreed upon location to determine the exact cause of the problem. The cost of such monitoring equipment shall be borne by the EDC, unless such problem or problems are demonstrated to be caused by the Facility or if the test was performed at the request of the Generator in which case the costs of the monitoring equipment shall be borne by the Generator. If the operation of the Facility interferes with the EDC's or its customers' operations, the Generator must immediately take corrective action to stop such interference and shall not operate the Facility until such time as such interference is stopped. If the Generator fails to take immediate corrective action pursuant to the preceding sentence, then the EDC may disconnect the Facility as set forth in the Guidelines.

No Adverse Effects; Non-interference.

6.1.1. The EDC shall notify the Generator if the EDC has evidence that the operation of the Facility could cause disruption or deterioration of service to other customers served from the EPS or if operation of the Facility could cause damage to the EPS or other affected systems. (For example, deterioration of service could be caused by, among other things, harmonic injection in excess of IEEE STD 519, as well as voltage fluctuations caused by large step changes in loading at the Facility.) The Generator shall cease operation of the Facility until such time as the Facility can operate without causing disruption or deterioration of service to other customers served from the EPS or causing damage to the EPS or other affected systems. Each Party shall promptly notify the other Party in writing of any condition or occurrence relating to such Party's equipment or facilities which, in such Party's reasonable judgment, could adversely affect the operation of the other Party's equipment or facilities.

6.1.2. The EDC shall operate the EPS in such a manner so as to not unreasonably interfere with the operation of the Facility. The Generator shall protect itself from normal disturbances propagating through the EPS in accordance with Good Utility Practice. Examples of such disturbances include single-phasing events, voltage sags from remote faults on the EPS, and outages on the EPS.

Safe Operations and Maintenance.

6.1.3. General. The Generator shall operate, maintain, repair, and inspect, and shall be fully responsible for, the Facility or facilities that it now or hereafter may own unless otherwise specified in this Agreement. Each Party shall be responsible for the maintenance, repair and condition of its respective lines and appurtenances on such Party's respective side of the Point of Interconnection. The EDC and the Generator shall each provide equipment on its respective side of the Point of Interconnection that adequately protects the EPS, personnel, and other persons from damage and injury. If the EDC has constructed or owns facilities that are identified at the time of Interconnection as specifically required by or as a result of such Interconnection, then the Generator shall reimburse the EDC for the costs of maintaining and repairing such facilities.

6.1.4. Ongoing Maintenance; Testing of the Facility. The Parties hereby acknowledge and agree that maintenance testing of the Facility's protective relaying is imperative for safe, reliable operation of the Facility. The test cycle for such protective relaying shall not be less frequent than once every sixty (60) calendar months or the manufacturer's recommended test cycle, whichever is more frequent. The Generator shall provide copies of these test records to the EDC within thirty (30) days of the completion of such maintenance testing. The EDC may disconnect the Facility from the EPS if the Generator fails to adhere to this Section 6.3.2. The Generator is responsible for all ongoing maintenance costs associated with the Facility.

Access.

6.1.5. Emergency Contact Information. Each Party shall provide to the other Party and shall update as necessary a telephone number that can be used at all times to allow the other Party to report an emergency.

6.1.6. EDC Right to Access EDC-Owned Facilities and Equipment. The Generator shall allow the EDC access to the EDC's equipment and the EDC's facilities located on the Facility's premises (the "***EDC Property***"). To the extent that the Generator does not own all or part of the real property on which the EDC is required to locate EDC Property in order to serve the Facility, the Generator shall procure and provide to the EDC all necessary rights, including easements, for access to the EDC Property.

6.1.7. Isolation Device. The EDC shall have access to the Isolation Device of the Facility at all times. Generator is responsible for obtaining any and all property rights, including easements, which will permit the EDC access to such Isolation Device.

6.1.8. Right to Review Information. The EDC shall have the right to review and obtain copies of the Generator's operations and maintenance records, logs, or other information such as unit availability, maintenance outages, circuit breaker operation requiring manual reset, relay targets and unusual events pertaining to the Facility or its Interconnection with the EPS. The EDC shall treat such information as confidential and shall use such information solely for the purposes of determining compliance with the operating requirements set forth in this Section 6.

7. Disconnection.

7.1 Temporary Disconnection.

7.1.1 Emergency Conditions. The EDC may immediately and temporarily disconnect the Facility from the EPS without prior notification in cases where, in the reasonable judgment of the EDC, the continued connection of the Facility is imminently likely to (a) endanger persons or damage property or (b) cause an adverse effect on the integrity or security of, or damage to, the EPS or to other electric power systems to which the EPS is directly connected (each, an "***Emergency Condition***"). Upon becoming aware of an Emergency Condition, the Generator shall (i) immediately suspend operation of the Facility and (ii) promptly provide written notice to the EDC of such Emergency Condition and suspension (an "***Emergency Condition Notice***"). The Emergency Condition Notice shall describe (A) such Emergency Condition, (B) the extent of any damage or deficiency, (C) the expected effect on the operation of each Party's facilities and operations, (D) the anticipated duration of such Emergency Condition and (E) the necessary corrective action.

After temporary disconnection or suspension pursuant to this Section 7.1.1, the Facility may not be reconnected or resume operation until the EDC and Generator are both satisfied that the cause of such Emergency Condition has been corrected. If the Generator fails to correct the Emergency Condition within ninety (90) days from the time that the EDC has temporarily disconnected the Facility due to such an event, the EDC may elect to terminate this Agreement in accordance with Section 4.1.5 and/or permanently disconnect the Facility in accordance with Section 7.2.2.

7.1.2 Routine Maintenance, Construction and Repair. The EDC shall have the right to disconnect the Facility from the EPS when necessary for routine maintenance, construction and repairs to the EPS. The EDC shall provide the Generator with a minimum of seven (7) days prior written notice of such disconnection, consistent with the EDC's planned outage notification protocols. If the Generator requests disconnection by the EDC at the Point of Common Interconnection, the Generator will provide a minimum of seven (7) days prior written notice to the EDC. The EDC shall make reasonable efforts to work with Generator to schedule a mutually convenient time or times to temporarily disconnect the Facility pursuant to this Section 7.1.2.

7.1.3 Forced Outages. During any forced outage, the EDC shall have the right to temporarily disconnect the Facility from the EPS in order to effect immediate repairs to the EPS. The EDC shall use reasonable efforts to provide the Generator with prior notice of such temporarily disconnection; provided, however, the EDC may temporarily disconnect the Facility from the EPS without such notice pursuant to this Section 7.1.2 in the event circumstances do not permit such prior notice to the Generator.

7.1.4 Non-Emergency Adverse Operating Effects. The EDC may temporarily disconnect the Facility if it is having a non-emergency adverse operating effect on the EPS or on other customers (a "***Non-Emergency Adverse Operating Effect***") if the Generator fails to correct such Non-Emergency Adverse Operating Effect within forty-five (45) days of the EDC's written notice to the Generator requesting correction of such Non-Emergency Adverse Operating Effect. If the Generator fails to correct a Non-Emergency Adverse Operating Effect within ninety (90) days from the time that the EDC has temporarily disconnected the Facility due to such an event, the EDC may elect to terminate this Agreement in accordance with Section 4.1.5 and/or permanently disconnect the Facility in accordance with Section 7.2.2.

7.1.5 Modification of the Facility. The EDC has the right to immediately suspend Interconnection service and temporarily disconnect the Facility in the event any material modification to the Facility or the Generator's Interconnection facilities has been implemented without prior written authorization from the EDC.

7.1.6 Re-connection. Any temporary disconnection pursuant this Section 7.1 shall continue only for so long as is reasonably necessary. The Generator and the EDC shall cooperate with each other to restore the Facility and the EPS, respectively, to their normal operating states as soon as reasonably practicable following the correction of the event that led to the temporary disconnection.

7.2 Permanent Disconnection.

7.2.1 The Generator may permanently disconnect the Facility at any time upon thirty (30) days prior written notice to the EDC.

7.2.2 The EDC may permanently disconnect the Facility upon termination of this Agreement in accordance with Section 4.

7.2.3 The EDC may permanently disconnect the Facility in the event the Generator is unable to correct an Emergency Condition or a Non-Emergency Adverse Operating Effect in accordance with Section 7.1.1 or Section 7.1.4, respectively.

8. Metering.

Metering of the output from the Facility shall be conducted pursuant to the terms of the Guidelines.

9. Assignments.

9.1 Except as provided herein, the Generator shall not voluntarily assign its rights or obligations, in whole or in part, under this Agreement without the EDC's prior written consent, which consent shall not be unreasonably withheld or delayed. Any assignment the Generator purports to make without the EDC's prior written consent shall not be valid. Notwithstanding the foregoing, the EDC's consent shall not be required for any assignment made by the Generator to an Affiliate with an equal or greater credit rating and with the legal authority and operational ability to satisfy the obligations of the Generator under this Agreement; provided that that Generator promptly notifies the EDC of any such assignment. In all events, the Generator shall not be relieved of its obligations under this Agreement unless, and until, the permitted assignee assumes in writing all obligations of this Agreement and notifies the EDC of such assumption.

10. Confidentiality.

10.1 The EDC shall maintain the confidentiality of information provided from the Generator to the EDC if such information is clearly marked and labeled "Confidential" (the "***Confidential Information***"). Confidential Information shall not include information that (a) is or hereafter becomes part of the public domain, (b) previously was in the possession of the EDC, or (c) the EDC is required to disclose pursuant to a valid order of a court or other governmental body or any political subdivision thereof; provided, however, that to the extent that it may lawfully do so, the EDC shall first have given notice to the Generator and given the Generator a reasonable opportunity to interpose an objection or obtain a protective order requiring that the Confidential Information and/or documents so disclosed be used only for the purpose for which the order was issued; provided further that if such Confidential Information is requested or required by the DPUC, the EDC shall seek protective treatment of such Confidential Information.

11. Insurance Requirements.

11.1 General Liability. In connection with the Generator's performance of its duties and obligations under this Agreement, the Generator shall maintain, during the term of this Agreement, general liability insurance with a combined single limit of not less than:

11.1.1 Three hundred thousand dollars ($300,000) per occurrence and in the aggregate for bodily injury and/or property damage claims where the gross nameplate rating of the Facility is less than or equal to an aggregate of 100 kW;

11.1.2 One million dollars ($1,000,000) per occurrence and in the aggregate for bodily injury and/or property damage claims where the gross nameplate rating of the Facility is greater than 100 kW and less than or equal to an aggregate of 1MW;

11.1.3 Two million dollars ($2,000,000) per occurrence and in the aggregate for bodily injury and/or property damage claims where the gross nameplate rating of the Facility is greater than 1MW and less than or equal to an aggregate of 5MW; or

11.1.4 Five million dollars ($5,000,000) per occurrence and in the aggregate for bodily injury and/or property damage claims where the gross nameplate rating of the Facility is greater than 5MW and less than or equal to an aggregate of 20MW.

11.2 Insurer Requirements and Endorsements. All insurance required pursuant to this Section 11 shall be carried by insurers qualified to underwrite insurance in Connecticut with an A.M. Best rating of A- or better. In addition, all insurance shall: (a) include the EDC as an additional insured; (b) contain a severability of interest clause or cross-liability clause unless the Generator is a residential customer; (c) provide that the EDC shall not be liable to the insurance carrier with respect to the payment of premium for such insurance; and (d) provide for written notice to the EDC thirty (30) days prior to cancellation, termination, or material change of such insurance.

11.3 Evidence of Insurance.

11.3.1 Evidence of the insurance required pursuant to this Section 11 shall state that the coverage provided is primary, and is not excess of or contributing with any insurance or self-insurance maintained by the EDC.

11.3.2 The Generator is responsible for providing the EDC with evidence of insurance on an annual basis as set forth in the Guidelines.

11.3.3 Prior to the EDC commencing any work on system modifications, the Generator shall have its insurer provide to the EDC certificates of insurance evidencing the insurance coverage required pursuant to this Section 11. Such certificates shall clearly indicate whether such insurance policy is written on a "claims-made" basis.

11.3.4 The EDC may, at its discretion, require the Generator to maintain tail coverage with respect to any policy written on a "claims-made" basis for a period of three years after expiration or termination of such policy.

11.3.5 All insurance certificates, statements of self insurance, endorsements, cancellations, terminations, alterations, and material changes of such insurance shall be issued and submitted to the appropriate EDC Facilitator.

12. Performance Assurance.

12.1 If the EDC reasonably expects that any Interconnection Costs necessary to accommodate the Facility will be in excess of fifty thousand dollars ($50,000) in the aggregate in any calendar year, the EDC may require that the Generator provide to the EDC a guarantee, a surety bond, letter of credit or other form of security that is reasonably acceptable to the EDC at least twenty (20) Business Days prior to the commencement of the related work. Such security for payment shall be in an amount sufficient to cover such Interconnection Costs. In addition:

12.1.1. Any guarantee provided by the Generator pursuant to this Section 12 shall be made by an entity that meets the creditworthiness requirements of the EDC, and contain terms and conditions that guarantee payment of any amount that may be due from the Generator, up to an agreed-to maximum amount; and

12.1.2. Any letter of credit or surety bond provided by the Generator pursuant to this Section 12.1.2 shall be issued by a financial institution or insurer reasonably acceptable to the EDC and must specify an expiration date reasonably acceptable to the EDC.

13. Indemnification.

13.1 Indemnification of the EDC. Subject to the limitation of liability set forth in Section 14, the Generator shall indemnify, defend and hold harmless the EDC and its trustees, directors, officers, employees and agents (including affiliates, contractors and their employees) from and against any liability, damage, loss, claim, demand, complaint, suit, proceeding, action, audit, investigation, obligation, cost, judgment, adjudication, arbitration decision, penalty (including fees and fines), or expense (including court costs and attorneys' fees) relating to, arising from or connected to this Agreement.

13.2 Indemnification of the Generator. Subject to the limitation of liability set forth in Section 14, the EDC agrees to indemnify, defend and hold harmless the Generator, its trustees, directors, officers, employees and agents (including Affiliates, contractors and their employees), from and against any and all damages for personal injury (including death) or property damage to unaffiliated third parties arising from any and all actions relating to or arising out of any material failure by the EDC to perform any of its obligations pursuant to Section 6.2.2 of this Agreement.

13.3 Survival of Indemnification. The indemnification obligations of each Party set forth in this Section 13 shall continue in full force and effect regardless of whether this Agreement has expired or been terminated, defaulted or cancelled and shall not be limited in any way by any limitation on insurance.

14. Limitation of Liability.

14.1 Except with respect to a Party's fraud or willful misconduct, and except with respect to damages sought by a third party in connection with a third party claim: (a) neither Party shall be liable to the other Party, for any damages other than direct damages; and (b) each Party agrees that it is not entitled to recover and agrees to waive any claim with respect to, and will not seek, consequential, punitive or any other special damages as to any matter under, relating to, arising from or connected to this Agreement.

15. Amendments and Modifications.

15.1 No amendment or modification of this Agreement shall be binding unless in writing and duly executed by both Parties.

16. Permits and Approvals.

16.1 The Generator is responsible for obtaining all environmental and other permits required by governmental authorities for the construction and operation of the Facility (each, a "***Required Permit***"). The EDC assumes no responsibility for obtaining any Required Permit, advising the Generator with respect to Required Permits, or assuring that all Required Permits have been obtained by the Generator. Upon written request of the EDC, the Generator shall promptly provide to the EDC a copy of any Required Permit.

17. Environmental Releases.

17.1 Each Party shall immediately notify the other Party, first orally and then in writing, of any of the following events related to the Facility upon becoming aware of such event: (a) the release of any hazardous substances; (b) any asbestos or lead abatement activities; or (c) any type of remediation activities. The Party having the responsibility for reporting such an event to appropriate governmental authorities shall promptly furnish to the other Party copies of any publicly available reports filed with such authorities.

18. Force Majeure.

18.1 For purposes of this Agreement, "***Force Majeure Event***" means any event or circumstance that (a) is beyond the reasonable control of the affected Party and (b) the affected Party is unable to prevent or provide against by exercising commercially reasonable efforts. Force Majeure Events include the following events or circumstances, but only to the extent they satisfy the foregoing requirements: (i) acts of war or terrorism, public disorder, insurrection, or rebellion; (ii) floods, hurricanes, earthquakes, lighting, storms, and other natural calamities; (iii) explosions or fire; (iv) strikes, work stoppages, or labor disputes; (v) embargoes; and (vi) sabotage. In no event shall the lack of funds or the inability to obtain funds constitute a Force Majeure Event.

18.2 If a Force Majeure Event prevents a Party from fulfilling any obligations under this Agreement, such Party will promptly notify the other Party in writing, and will keep the other Party informed on a continuing basis of the scope and duration of the Force Majeure Event. The affected Party shall specify in reasonable detail the circumstances of the Force Majeure Event, its expected duration, and the steps that the affected Party is taking to mitigate the effects of the event on its performance. The affected Party may suspend or modify its performance of obligations under this Agreement, other than the obligation to make payments then due or becoming due under this Agreement, but only to the extent that the effect of the Force Majeure Event cannot be mitigated by the use of commercially reasonable efforts. The affected Party shall use commercially reasonable efforts to resume its performance as soon as possible. Without limiting this section, the Generator shall immediately notify the EDC verbally if the failure to fulfill the Generator's obligations under this Agreement may impact the safety or reliability of the EPS.

19. Notices.

19.1 All notices, demands and other communications to be given or delivered under or by reason of the provisions of this Agreement shall be in writing and shall be deemed to have been given: (a) immediately when personally delivered; (b) when received by first class mail, return receipt requested; (c) one day after being sent for overnight delivery by Federal

Express or other overnight delivery service; or (d) when receipt is acknowledged, either electronically or otherwise, if sent by facsimile, telecopy or other electronic transmission device. Notices, demands and communications to the other Parties shall, unless another address is specified by such Parties in writing, be sent to the addresses indicated below:

If to the EDC:

The Connecticut Light and Power Company
107 Selden Street, Berlin, CT 06037
Attention: Supervisor, Distributed Resources
Phone: 866-324-2437

If to the Generator:

Connecticut Resources Recovery Authority (CRRA)
100 Constitution Plaza, 6th Floor, Hartford, CT 06103
Attention: Thomas D. Kirk, President
Phone 860-757-7700

19.2 Each Party may designate operating representatives to conduct daily communications between the Parties, which may be necessary or convenient for the administration of this Agreement. The names, addresses, and phone numbers of each Party's representatives shall be provided in writing by such Party to the other Party.

20. Default and Remedies.

20.1 Defaults. Each of the following shall constitute an "***Event of Default***;"

20.1.1. A Party fails to pay any bill or invoice for charges incurred pursuant to this Agreement or any other amount due from such Party to the other Party as and when due, any such failure shall continue for a period of thirty (30) days after written notice of nonpayment from the affected Party to the defaulting Party; provided, however, if such Party disputes such bill, invoice or other amount due in good faith, then such failure to pay shall not constitute an Event of Default and the Parties shall resolve such dispute in accordance with Section 21;

20.1.2. A Party (a) fails to comply with any other provision of this Agreement or breaches any representation or warranty in any material respect and (b) fails to cure or remedy such failure or breach within sixty (60) days after notice and written demand by the other Party to cure the same or such longer period reasonably required to cure the same (not to exceed an additional ninety (90) days unless otherwise mutually agreed upon, provided that the failing or breaching Party diligently continues to cure until such failure or breach is fully cured). This provision pertains only to cure periods not specifically addressed elsewhere in this Agreement;

20.1.3. A Generator modifies the Facility or any part of the Interconnection without the prior written approval of the EDC; or

20.1.4. A Party fails to perform any obligation hereunder in accordance with (a) applicable laws and regulations, (b) the ISO-NE operating documents, procedures, and reliability standards, and (c) Good Utility Practice.

20.2 Remedies. Upon the occurrence of an Event of Default, the non-defaulting Party may, at its option, in addition to any remedies available under any other provision herein, do any, or any combination, as appropriate, of the following: (a) continue to perform and enforce this Agreement; (b) recover damages from the defaulting Party except as limited by this Agreement; (c) by written notice to the defaulting Party terminate this Agreement; or (d) pursue any other remedies it may have under this Agreement or under applicable law or in equity.

21. Dispute Resolution Procedures.

21.1 Each Party shall agree to attempt to resolve all disputes promptly, equitably and in good faith. If the Parties are unable to informally resolve any dispute, the Parties shall follow the dispute resolution process set forth in the Guidelines.

22. Subcontractors.

22.1 Nothing in this Agreement shall prevent a Party from utilizing the services of any subcontractor as it deems appropriate to perform its obligations under this Agreement; provided, however, that the hiring Party shall require such subcontractor to comply with all applicable terms and conditions of this Agreement in providing such subcontracting

services and the hiring Party shall remain primarily liable to the other Party for the performance of such subcontractor.

22.2 The creation of any subcontract relationship shall not relieve the hiring Party of any of its obligations under this Agreement. The hiring Party shall be fully responsible to the other Party for the acts or omissions of any subcontractor hired by the hiring Party to perform its obligations under this Agreement. Any applicable obligation imposed by this Agreement upon the hiring Party shall be equally binding upon, and shall be construed as having application to, any subcontractor of such Party.

22.3 The obligations under this Section 22 will not be limited in any way by any limitation of subcontractor's insurance.

23. Miscellaneous.

23.1 Governing Law. This Agreement and the legal relations between the Parties will be governed by and construed in accordance with the laws of the State of Connecticut applicable to contracts made and performed in such State and without regard to conflicts of law doctrines.

23.2 Non-waiver. No failure on the part of any Party to exercise or delay in exercising any right hereunder shall be deemed a waiver thereof, nor shall any single or partial exercise of any right hereunder preclude any further or other exercise of such or any other right.

23.3 No Third Party Beneficiaries. This Agreement is made solely for the benefit of the Parties. Nothing in the Agreement shall be construed to create any rights in or duty to, or standard of care with respect to, or any liability to, any person not a party to or otherwise bound by this Agreement.

23.4 Severability. If any provision of this Agreement is held to be unenforceable for any reason, such provision shall be adjusted rather than voided, if possible, to achieve the intent of the Parties. If no such adjustment is possible, such provision shall be fully severable and severed, and all other provisions of this Agreement will be deemed valid and enforceable to the extent possible.

23.5 No Partnership. Nothing in this Agreement shall constitute or be construed to be or create an association, joint venture, agency relationship, or partnership between the Parties or to impose any partnership obligation or partnership liability upon either Party. No Party shall have any right, power or authority to enter into any agreement or undertaking for, or act on behalf of, or to act as or be an agent or representative of, or to otherwise bind, the other Parties.

23.6 Headings. All headings in this Agreement are included solely for convenient reference, are not intended to be full and accurate descriptions of the contents of this Agreement, will not be deemed a part of this Agreement, and will not affect the meaning or interpretation of this Agreement.

23.7 Changes in State Regulations or Law. Upon thirty (30) days prior written notice, EDC may terminate this Agreement if there are any changes in DPUC regulations or Connecticut law that affects the EDC's ability to perform its obligations under this Agreement.

23.8 General Rules of Construction. For all purposes of this Agreement: (a) all terms defined herein or in the Guidelines shall have the meanings assigned to them herein or in the Guidelines, as the case may be, and shall include the plural as well as the singular; (b) all references in this Agreement to designated "Sections" and other subdivisions are to the designated Sections and other subdivisions of the body of this Agreement; (c) pronouns of

either gender or neuter will include, as appropriate, the other pronoun forms; (d) the words "herein," "hereof" and "hereunder" and other words of similar import refer to this Agreement as a whole and not to any particular Section or other subdivision; (e) "or" is not exclusive; (f) "including" and "includes" will be deemed to be followed by "but not limited to" and "but is not limited to," respectively; (g) any definition of or reference to any law, agreement, instrument or other document herein will be construed as referring to such law, agreement, instrument or other document as from time to time amended, supplemented or otherwise modified; (h) any definition of or reference to any law or statute will be construed as referring also to any rules and regulations promulgated thereunder; and (i) as used herein, "days" shall mean "calendar days."

23.9 Counterparts. This Agreement may be executed in counterparts, each of which shall be deemed an original, and all counterparts so executed shall constitute one agreement binding on all of the Parties hereto, notwithstanding that all of the Parties are not signatories to the same counterpart. Facsimile counterparts may be delivered by any Party, with the intention that they shall have the same effect as an original counterpart hereof.

23.10 Signatures. Each Party hereby signifies its agreement to the all of the terms of this Agreement by its signatures hereto. Each Party represents that it has carefully reviewed this Agreement individually and with counsel and that it has knowingly and willingly executed this Agreement.

[*Signature Page Follows*]

IN WITNESS HEREOF, the Parties have caused this INTERCONNECTION AGREEMENT to be executed on the day and year first written above.

THE EDC

By: _____

Name: _____

Title: _____

Duly Authorized

THE GENERATOR

By: _____

Name: _____

Title: _____

Duly Authorized

Appendix A

Guidelines for Generator Interconnection

(Intentionally Omitted)

Appendix B

Description of the Facility as studied, and incorporating any approved design changes

Customer to provide description of facility. (kW rating, etc..)

A ___ MW Photovoltaic system with ____ PVP 250 kW inverters.
The system will be allowed to export excess power on the distribution system.

Appendix C

Conditions for Parallel Operation of Generating Facility, Special Operating Requirements

Installing a receiver and a dedicated phone line at your own expense to support transfer trip operation system installed by CL&P.

Appendix D

Initial Cost Estimate

Witness Test **$2000**
Meter Programing **$320**
New Service Cost **Not part of this contract work with CL&P New Service to secure price**
Transfer trip receiver: By customer

Appendix E

Construction Agreement

Appendix F

Milestones

In-Service Date:

Critical milestones and responsibility as agreed to by the Parties:

Milestone/Date	**Responsible Party**
Proof of insurance	Customer
Submit Test Plan	Customer / Installer
Coordinate Transfer Trip Requirements	CL&P + Customer / Installer
Submit ISO-NE notification form	Customer / Installer
Coordinate requirement for new service	Customer / Installer
Sign IA	Customer
Provide payment for Witness test and meter	Customer / Installer
Proof of Municipal Approval	Installer
Scheduling Witness test	CL&P
Final Approval	CL&P

Agreed to by:

For the Generator: _____ Date: _____

For the EDC: _____ Date: _____

Appendix G

EDC's Description of its Upgrades and Best Estimate of Upgrade Costs

CL&P has not identified any billable upgrade.
A new service will be required at customer expense but not part of this agreement.

Appendix H

One line diagram depicting the Generating Facility, Interconnection, Metering Equipment and Upgrades

Add copy of application submittal to appendix

CLOSURE TURF™ AND HYDROTURF™ INSTALLATION GUIDANCE DOCUMENTS

November 2012

CONTENTS

TABLES

1.0 INTRODUCTION

1.1 Purpose

This Construction Quality Assurance (CQA) Plan has been prepared to provide the Owner, Operator, Design Engineer, Construction Quality Assurance Professional of Record (POR), and the Contractor the means to govern the construction quality and to satisfy the environmental protection requirements under current State regulations. More specifically, the CQA Plan addresses the soil and geosynthetic components of the final cover system for the closure area. This installation manual addresses both the ClosureTurf™ and HydroTurf™ products.

This CQA Plan is divided into the following parts:

- Section 1 – Introduction
- Section 2 – Construction Quality Assurance for Geosynthetics
- Section 3 – Sand Installation
- Section 4 – HydroTurf™ Installation
- Section 5 – Reporting

1.2 Definitions

Whenever the terms listed below are used, the intent and meaning will be interpreted as indicated.

ASTM

American Society for Testing and Materials.

Construction Quality Assurance (CQA)

A planned system of activities that provides the Operator and permitting agency assurance that the facility was constructed as specified in the design. Construction quality assurance includes observations and evaluations of materials, and workmanship necessary to determine and document the quality of the constructed facility. Construction quality assurance (CQA) refers to measures taken by the CQA organization to assess if the installer or contractor is in compliance with the plans and specifications for a project.

Construction Quality Assurance (CQA) Monitors

These are representatives of the POR who work under direct supervision of the POR. The CQA monitor is responsible for quality assurance monitoring and performing onsite tests and observations. The CQA monitor is on site full-time during construction and reports directly to the POR. The CQA monitor performing daily QA/QC observation and testing shall be NICET-certified in geotechnical engineering technology at level two or higher for soils and FML testing; a CQA monitor with a minimum of four years of directly related experience; or a graduate engineer or geologist with one year of directly related experience. Field observations, testing, or other activities associated with CQA may be performed by the CQA monitor(s) under the direction of the POR. Additional CQA monitors may be used. If working under the direction of a CQA monitor, the second CQA monitor will have a minimum of one year of directly related experience.

Construction Quality Assurance Professional of Record (POR)

The POR is an authorized representative of the Operator and has overall responsibility for construction quality assurance and confirming that the facility was constructed in general accordance with plans and specifications approved by the permitting agency and contract documents. The POR must be licensed as a Professional Engineer where the project is located and experienced in geosynthetics testing and its interpretations. Experience and education should include geotechnical engineering, engineering geology, soil mechanics, geotechnical laboratory testing, construction quality assurance, and quality control testing, and hydrogeology. The POR must show competency and experience in certifying like installations, and be approved by the permitting agency, and be presently employed by or practicing as a geotechnical engineer in a recognized geotechnical/environmental engineering organization. The credentials of the POR must meet or exceed the minimum requirements of the permitting agency. Any references to monitoring, testing, or observations to be performed by the POR should be interpreted to mean the POR or CQA monitors working under the POR's direction. The POR or his designated representative will be on-site during all final cover system construction.

The POR may also be known in applicable regulations and guidelines as the CQA Engineer, Resident Project Representative, or the Geotechnical Professional (GP).

Contract Documents

These are the official set of documents issued by the owner or operator. The documents include bidding requirements, contract forms, contract conditions, specifications, contract drawings, addenda, and contract modifications.

Contract Specifications

These are the qualitative requirements for products, materials, and workmanship upon which the contract is based.

Contractor

This is the person or persons, firm, partnership, corporation, or any combination, private or public, who, as an independent contractor, has entered into a contract with the Operator and who is referred to throughout the contract documents by singular number and masculine gender.

Design Engineer

These individuals or firms are responsible for the design and preparation of the project construction drawings and specifications. Also referred to as "designer" or "engineer."

Earthwork

This is a construction activity involving the use of soil materials as defined in the construction drawings and specifications.

Final Cover System Evaluation Report (FCSER)

Upon completion of closure activities, the certification will be in the form of the FCSER which will be signed by the POR and include all the documentation necessary for certification closure.

Film Tear Bond (FTB)

A failure in the geomembrane sheet material on either side of the seam and not within the seam itself.

Fish Hook

A semi-conical opening of the seam that is formed by an edge wrinkle in one sheet of the geomembrane.

Geomembrane Liner (GM)

This is a synthetic lining material, also referred to as geomembrane, membrane liner, or sheet. The term Flexible Membrane Liner (FML) is also used for GM.

Turf

This is a synthetic structured material consisting of one or more geotextiles tufted with polyethylene yarns that resemble grass blades.

Geosynthetics Contractor

This individual is also referred to as the "contractor" or “installer”, and is the person or firm responsible for geosynthetic construction. This definition applies to any person installing FML or other geosynthetic materials, even if not his primary function.

Independent Testing Laboratory

A laboratory that is independent of ownership or control by the permittee or any party to the construction of the final cover or the manufacturer of the final cover products used.

Manufacturing Quality Assurance (MQA)

A planned system of activities that provides assurance that the raw materials were constructed (manufactured) as specified.

Manufacturing Quality Control (MQC)

A planned system of inspection that is used to directly monitor and control the manufacture of a material.

Nonconformance

This is a deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate. Examples of non-conformances include, but are not limited to, physical defects, test failures, and inadequate documentation.

Operator

The organization that will operate the disposal unit.

Operator's Representative

This is the person that is an official representative of the operator responsible for planning, organizing, and controlling the design and construction activities.

Panel

This is a unit area of the GM or FML or Turf, which will be seamed in the field.

Quality Assurance

This is a planned and systematic pattern of procedures and documentation to ensure that items of work or services meet the requirements of the contract documents. Quality assurance includes quality control. The POR and CQA monitor will perform quality assurance.

Quality Control

These actions provide a means to measure and regulate the characteristics of an item or service to comply with the requirements of the contract documents. The contractor will perform quality control.

Representative Sample

A representative sample of FML or Turf material consists of 1 or more specimens (commonly referred to as coupons) from the same rectangular portion of FML or Turf material, oriented along a seam that is removed for field or laboratory testing purposes.

Specimen

(With respect to FML destructive testing) – A specimen is the individual test strip (sometimes called coupon) from a sample location. A sample location usually consists of many specimens.

2.0 CONSTRUCTION QUALITY ASSURANCE FOR GEOSYNTHETICS

2.1 Introduction

This section describes CQA procedures for the installation of geosynthetic components of the Closure Turf ™.

The scope of geosynthetic-related construction quality assurance includes the following elements:

- Geomembrane Liner Component
  - 50-mil Structured Linear Low-Density Polyethylene (LLDPE) or High Density Polyethylene (HDPE) – Agru Super Grip Net (or equivalent) with the spikes placed on the landfill surface on top slopes and side slopes. Minimum required material properties for the geomembrane are listed in Table 2.2.
- Synthetic Turf Component
  - Woven polypropylene geotextiles tufted with polyethylene yarns. The required material properties are shown in Table 2.3.

The overall goal of the geosynthetics quality assurance program is to assure that proper construction techniques and procedures are used, the geosynthetic contractor implements his quality control plan in accordance with this CQA Plan, the construction and testing of all elements of the final cover are performed in accordance with this CQA Plan and the Closure Plan, and that the project is built in accordance with the project construction drawings and technical specifications. The quality assurance program is intended to identify and define problems that may occur during construction and to observe that these problems are avoided and/or corrected before construction is complete. The final documentation, prepared after project completion, will confirm that the construction meets design intent and specifications and that all final cover construction and Quality Assurance/Quality Control (QA/QC) testing are performed in accordance with this CQA Plan.

2.2 Geosynthetics Quality Assurance

A structured geomembrane is the geosynthetic component for the final cover system. All testing requirements and minimum required properties are listed in Tables 2.1 and 2.2. Construction quality control for the geosynthetic installation will be performed by the geosynthetic installation contractor. Construction quality assurance for the geosynthetic installation will be performed by the POR to assure the geosynthetic is constructed as specified in the design. Construction must be conducted in accordance with the project

construction drawings, which will be developed in accordance with this CQA Plan and in accordance with specifications outlined in this CQA Plan. To monitor compliance, a quality assurance program will include the following:

- A review of the manufacturer's quality control submittals;
- Material conformance testing;
- Field and construction testing; and
- Construction monitoring.

The manufacturer's quality control submittals will include resin and physical material testing. Conformance testing refers to verification tests conducted by an independent third party laboratory to confirm the material meets the required specification prior to acceptance of the geosynthetic from the manufacturer. Field and construction testing includes testing that occurs during geosynthetics installation.

Quality assurance testing will be conducted in accordance with this CQA Plan, the project construction drawings, and specifications. The CQA monitor will observe field-testing. Documentation must meet the requirements of this CQA Plan.

2.3 Geomembrane Component

This section describes handling, testing, and installation of geomembrane. Agru 50-mil LLDPE Super Grip Net (or equivalent HDPE) with the spikes placed on the landfill or soil subgrade surface will be used on top slopes and side slopes.

2.3.1 Delivery

Upon delivery of the geomembrane, the CQA monitor will observe that:

- The geomembrane is delivered in rolls and is not folded. Folded geomembrane is not acceptable because the highly crystalline structure of the geomembrane will be damaged if it is folded. Any evidence of folding (other than from the manufacturing process) or other shipping damage is cause for rejection of the material.
- Equipment used to unload and store the rolls or pallets does not damage the geomembrane.
- The geomembrane is stored in an acceptable location in accordance with the specifications and stacked not more than five rolls high. The geomembrane is protected from puncture, dirt, grease, water, moisture, mud, mechanical abrasions, excessive heat, or other damage.
- Manufacturing documentation required by the specifications has been received and reviewed for compliance with the specifications. This documentation will be included in the FCSER.
- The geosynthetics receipt log form has been completed for materials received.

Damaged geomembrane may be rejected and removed from the site or stored at a location separate from accepted geomembrane. Geomembrane that does not have proper manufacturer's documentation must be stored at a separate location until documentation has been received, reviewed, and accepted.

Table 2.1

Required Testing for Structured LLDPE Geomembrane Component

Responsible Party	Type of Test		Standard Test Method	Frequency of Testing
Resin Manufacturer	Resin	Density	ASTM D 1505	Per manufacturer quality control and every resin lot
		Melt Flow Index	ASTM D 1238 (90/2.16 and 190/21.6)	
	Resin/Compound Quality Evaluation		Per manufacturer's quality control specifications	Per manufacturer's quality control specifications
Geomembrane Manufacturer	Manufacturer's Quality Control		Testing per GRI Standard, GRI Test Method GM17 for 50 mil LLDPE[1]	
Conformance Testing by 3rd Party Independent Laboratory	Thickness[2]		ASTM D 5994	Per manufacturer quality control requirements and every resin lot
	Drainage Stud Height		GRI GM12 ASTM D7466	
	Friction Spike Height		GRI GM12 ASTM D7466	
	Specific Gravity/Density		ASTM D 792, Method B	
	Carbon Black Content		ASTM D 4218	
	Carbon Black Dispersion		ASTM D 5596[3]	
	Tensile Properties		ASTM D 6693 Type IV Specimen	
3rd Party CQA	Destructive Seam Field Testing[4]	Shear & Peel	ASTM D 6392	Various for field, lab, and archive
3rd Party CQA	Non-Destructive Seam Field Testing	Air Pressure	GRI GM6	All dual-track fusion weld seams
		Vacuum	ASTM D 4437	All non-air pressure tested seams when possible
		Other		Concurrence of State

[1] UV Resistance testing not required for geomembrane, which is to be immediately covered.

[2] Field thickness measurements for each panel must be conducted. Use ASTM D 5994 and perform 1 series of measurements among the leading edge of each panel, with individual measurements no greater than 5 feet apart. No single measurement will be less than the required nominal thickness in order for the panel to be acceptable.

[3] Only near spherical agglomerates for 10 views: 9 views in category 1 or 2, and 1 view in category 3.

[4] Break elongation calculated using 2-inch initial gauge length.

[5] Passing criteria for seams are listed in Table 2.2.

Table 2.2
Minimum Required Properties of the Structured LLDPE Geomembrane Component

Property	Test Method	Minimum Required Property
Thickness, mils Minimum average Lowest individual reading Lowest individual of 8 of 10 readings	ASTM D 5994	 47.5 42.5 45
Density, g/cc (maximum)	ASTM D 792, Method B	0.939
Drainage Stud Height (min. ave.)	GRI GM12	130
Friction Spike Height (min. ave.)	GRI GM12	175
Tensile Properties[1] Break Strength, lb./in (min. ave.) Break Elongation, % (min. ave.)	ASTM D 6693, Type IV	 105 300
Tear Resistance, lb. (min. ave.)	ASTM D 1004	30
Puncture Resistance, lb. (min. ave.)	ASTM D 4833	55
Break Resistance Strain, % (min)	ASTM D 5617	30
Carbon Black Content[2], %	ASTM D 1603	2.0 – 3.0
Oxidative Induction Time (OIT) (min. ave.) Standard OIT, minutes	ASTM D 3895	≥100
Carbon Black Dispersion[3], Category	ASTM D 5596	1 or 2 and 3
Oven Aging at 85ºC Standard OIT – % retained after 90 days or High Pressure OIT – % retained after 90 days	ASTM D 5721 ASTM D 3895 ASTM D 5885	 35 60
Seam Properties Shear Strength, lb./in Peel Strength, lb./in	ASTM D 6392	 100 76 (65, Extrusion Weld)

[1] Machine direction (MD) and cross machine direction (XMD) average values should be on the basis of 5 test specimens each direction. Break elongation is calculated using a gauge length of 2.0 inches.
[2] Other methods such as ASTM D 4218 or microwave methods are acceptable if an appropriate correlation can be established.
[3] Only near spherical agglomerates for 10 views: 9 views in Category 1 or 2, and 1 view in Category 3.
[4] The condition of the test should be 20 hr. UV cycle at 75ºC followed by 4 hr. condensation at 60ºC.
[5] UV resistance is based on percent-retained value regardless of the original HP-OIT value.

2.3.2 Conformance Testing

One geomembrane sample will be obtained for every resin lot of material supplied and for each 100,000 square feet of geomembrane. The material will be sampled at the manufacturer plant by the CQA monitor before the rolls are shipped to the site. The samples will be forwarded to the third-party laboratory for the following conformance tests:

- Density (ASTM D 792, Method B)
- Carbon black content (ASTM D 4218)
- Carbon black dispersion (ASTM D 5596)
- Thickness (ASTM D 5994)
- Tensile properties (ASTM D 6693/Type IV Specimen)

No material shall be delivered to the site until all the independent laboratory analysis conforms to the material specifications.

The density of the geomembrane must be less than 0.939 g/cc; the carbon black content must be between 2 percent and 3 percent; and recycled or reclaimed material must not be used in the manufacturing process.

The design engineer may require additional test procedures and will inform the third party laboratory in writing. The POR must review all test results and report any nonconformance to the design engineer prior to product installation. In addition to the conformance thickness tests shown above, field thickness measurements must be taken at maximum 5-foot intervals along the leading edge of each geomembrane panel. No single measurement may be less than 10 percent below the required nominal thickness for the panel to be accepted (i.e., for 50-mil geomembrane a minimum thickness of 45 mils is required), and the average must be at least 47.5 mils.

Sampling Procedure. Samples will be taken across the entire roll width. Unless otherwise specified, samples should be approximately 15 inches long by the roll width. The CQA monitor must mark the machine direction and the manufacturer's roll identification number on the sample. The CQA monitor must also assign a conformance test number to the sample and mark the sample with that number.

2.3.3 Anchor Trench Backfill

General fill material placed in anchor trenches will be placed in uniform lifts, which do not exceed 12 inches in loose thickness and are compacted. In-place moisture/density tests may be taken at the discretion of the CQA monitor to evaluate the quality of the backfill. The test results will not be required as part of the final documentation. Slightly rounded corners will be provided in anchor trenches where the geomembrane enters the trench so as to avoid sharp bends in the geomembrane. No loose soil (e.g., excessive water content) will be allowed to underlie the anchored components of final cover system. Vertical anchor trenches as well as anchor trenches along the toe shall not be backfilled until sand infill of the synthetic turf is in place.

2.3.4 Geomembrane Installation

Surface Preparation. Prior to any geomembrane installation, the subgrade (e.g., intermediate cover soil) should be inspected by the CQA and geosynthetics contractor. The POR or CQA monitor must observe the following:

Prior to deployment of the geomembrane the subgrade shall be inspected by the CQA monitor to insure that the final grades on the slopes as well as benches dimension and grades conforms with the design grades of the closure. Survey shots as well as drawings as-built shall be carefully reviewed and evaluated to insure the surface grades will drain as intended in the design drawings. As built drawings shall show the slope and with dimensions of the drainage benches and down chute details

- The intermediate cover soil is free of surface irregularities and protrusions.
- The intermediate cover soil surface does not contain stones or other objects that could damage the geomembrane. The surface will be smooth and free of foreign and organic material, sharp objects, stones greater than 3/8 inches, or other deleterious material.
- The anchor trench dimensions have been checked, and the trenches are free of sharp objects and stones.
- The geomembrane will not be placed during inclement weather such as rain or high winds.
- Construction stakes and hubs have been removed and the resultant holes have been backfilled. There are no rocks, debris, or any other objects on the foundation soil surface.
- The geosynthetics contractor, POR or his representative, and the permittee or his representative have certified in writing that the surface on which the geomembrane will be installed is acceptable.

Panel Placement. Prior to the installation of the geomembrane, the contractor must submit drawings showing the panel layout, indicating panel identification number, both fabricated (if applicable) and field seams, as well as details not conforming to the drawings. The POR must review field conditions and approve revised panel layout plan if the field conditions vary from the original plan layout.

The CQA monitor must maintain an up-to-date panel layout drawing showing panel numbers that are keyed to roll numbers on the placement log. The panel layout drawing will also include seam numbers and destructive test locations.

During panel placement, the POR or CQA monitor must:

- Observe that the geomembrane is placed in direct and uniform contact with underlying intermediate cover soil or subgrade soil.

- Record roll numbers, panel numbers, and dimensions on the panel or seam logs. Measure and record thickness of leading edge of each panel at 5-foot maximum intervals. No single thickness measurement can be less than the required nominal thickness.
- Observe the sheet surface, as it is deployed and record panel defects and repair of the defects (panel rejected, patch installed, extradite placed over the defect, etc.) on the repair sheet. Repairs must be made in accordance with the specifications and located on a repair drawing.
- Observe that support equipment is not allowed on the geomembrane during handling (See Section 2.3.9).
- Observe that the surface beneath the geomembrane has not deteriorated since previous acceptance.
- Observe that there are no stones, construction debris, or other items beneath the geomembrane that could cause damage to the geomembrane.
- Observe that the geomembrane is not dragged across a surface that could damage the material. If the geomembrane is dragged across an unprotected surface, the geomembrane must be inspected for scratches and repaired or rejected, as necessary.
- Record weather conditions including temperature, wind, and humidity. The geomembrane must not be deployed in the presence of excess moisture (fog, dew, mist, etc.). In addition, geomembrane seaming operation should not be performed when the air temperature is less than 35°F or greater than 104°F, or when standing water or frost is on the ground, unless these requirements are waived by the design engineer. Excessive wind is that which can lift and move the geomembrane panels.
- The CQA monitor may consider welding at temperatures outside the recommended values only after demonstration by the welding crew that the weld trials can accomplished the required welding specifications.
- Observe that people working on the geomembrane do not smoke, wear shoes that could damage the liner, or engage in activities that could damage the liner.
- Observe that the method used to deploy the sheet minimizes wrinkles but does not cause bridging and that the sheets are anchored to prevent movement by the wind (the contractor is responsible for any damage to or from windblown geomembrane). Excessive wrinkles should be walked-out or removed at the discretion of the CQA monitor as described in section 2.3.7 and 2.3.8.
- Observe that no more panels are deployed than can be seamed on the same day.
- Observe that horizontal or cross seams on the side slope are staggered in order not to produce a long horizontal seam across the slope. Adjacent panels should be continuous in as much as possible on both sides of the horizontal seam.

Field Seaming. The contractor must provide the POR with a seam and panel layout drawing and update this drawing daily as the job proceeds. No panels should be seamed until the panel layout drawing has been accepted by the POR. A seam numbering system must provide a unique number for each seam and be agreed to by the POR and contractor prior to the start of seaming operations. One procedure is to identify the seam by adjacent panels. For example, the seam located between Panels 306 and 401 would be Seam No. 306/401.

Prior to geomembrane welding, each welder and welding apparatus (both wedge and extrusion welder) must be tested, at a minimum, at daily start-up and immediately after any break, and/or anytime the machine is turned off for more than 30 minutes in accordance with the specifications to determine if the equipment is functioning properly. The final documentation should include the names for each seamer and the time and the temperatures for each seaming apparatus used each day. One trial weld will be taken prior to the start of work. In addition, a trial weld will also be obtained prior to seaming the tie-in. The trial weld sample must be 3 feet long and 12 inches wide, with the seam centered lengthwise. The minimum number of specimens per trial weld test must be two coupons for shear and two coupons for peel. Both the inner and outer welds of dual track fusion welds must be tested for each peel test coupon (or additional coupons will be required). Trial weld samples must comply with "Passing Criteria for Welds" included in Section 2.3.5 – Construction Testing. The CQA monitor must observe welding operations, quantitative testing of each trial weld for peel and shear, and recording of the results on the trial weld form. The trial weld will be completed under conditions similar to those under which the panels will be welded. Regarding the locus-of-break patterns of the different seaming methods in shear and peel, the following are unacceptable break codes per their description in ASTM D 6392:

Hot Wedge:	AD and AD-Brk>25%
Extrusion Fillet:	AD1, AD2, AD-WLD (unless strength is achieved)

Additionally, there should be no apparent weld separation (i.e., greater than 1/8 inch). The third party strength tests must meet the manufacturer's specifications for the sample sheets, or percentage of the manufacturer's parent sheet strength as determined by the manufacturer. For dual-track fusion welds, both sides (the inner and outer weld) must meet the minimum requirements for a satisfactory peel test. If, at any time, the CQA monitor believes that an operator or welding apparatus is not functioning properly, a weld test must be performed. If there are wide changes in temperature (±30° Fahrenheit), humidity, or wind speed, the test weld should be repeated. The test weld must be allowed to cool to ambient temperature before testing. If a weld test fails the shear or peel test, the length of the non-passing weld will be identified at a 10-foot interval, and the failed area will be patched. Patching will be performed by placing additional geomembrane material over the failed area or removing the failed geomembrane weld and patching it with additional geomembrane per POR's direction. The welding for patches must comply with the welding passing criteria requirements outlined in this section.

Construction quality assurance documentation of trial seam procedures will include, at a minimum, the following:

- Documentation that trial seams are performed by each welder and welding apparatus prior to commencement of welding and prior to commencement of the second half of the workday.
- The welder, the welding apparatus number, time, date, ambient air temperature, and welding machine temperatures.

During geomembrane welding operations, the CQA monitor must observe the following:

- The contractor has the number of welding apparatuses and spare parts necessary to perform the work.
- Equipment used for welding will not damage the geomembrane.
- The extrusion welder is purged prior to beginning a weld until the heat degraded extradite is removed (extrusion welding only).
- Seam grinding has been completed less than one hour before seam welding, and the upper sheet is beveled (extrusion welding only).
- The ambient temperature, measured 6 inches above the geomembrane surface, is between 35°F and 104°F, or manufacturer's recommended temperature limits if they are more stringent.
- The end of old welds, more than five minutes old, are ground to expose new material before restarting a weld (extrusion welding only).
- The contact surfaces of the sheets are clean, free of dust, grease, dirt, debris, and moisture prior to welding.
- The weld is free of dust, rocks, and other debris.
- The seams are overlapped a minimum of 3 inches for extrusion and hot wedge welding, or in accordance with manufacturer's recommendations, whichever is more stringent. Panels should be overlapped (shingled) in the downgrade direction.
- No solvents or adhesives are present in the seam area.
- The procedure used to temporarily hold the panels together does not damage the panels and does not preclude CQA testing.
- The panels are being welded in accordance with the plans and specification. Seams should be oriented parallel to the line of maximum slope with no horizontal seams on side slopes. In corners and odd-shaped geometric locations, the number of field seams should be minimized.
- There is no free moisture in the weld area.
- Measure surface sheet temperature every two hours.

- Observe that at the end of each day or installation segment, unseamed edges are anchored with sandbags or other approved device. Penetration anchors will not be used to secure the geomembrane.

2.3.5 Construction Testing

Nondestructive Seam Testing. The purpose of nondestructive testing is to detect discontinuities or holes in the seam. It also indicates whether a seam is continuous and non-leaking. Nondestructive tests for geomembrane include vacuum testing for extrusion welds and air pressure testing for dual-track fusion welds. Nondestructive testing must be performed over the entire length of the seam.

Nondestructive testing is performed entirely by the contractor. The CQA monitor's responsibility is to observe and document that testing performance is in compliance with the specifications and document any seam defects and their repairs.

Nondestructive testing procedures are described below.

- For welds tested by vacuum method, the weld is placed under suction utilizing a vacuum box made of rigid housing with a transparent viewing window, a soft neoprene rubber gasket attached to the open bottom perimeter, a vacuum gauge on the inside, and a valve assembly attached to the vacuum hose connection. The box is placed over a seam section that has been thoroughly saturated with a soapy water solution (1 oz. soap to 1 gallon water). The rubber gasket on the bottom perimeter of the box must fit snugly against the soaped seam section of the liner, to ensure a leak-tight seal. The vacuum pump is energized, and the vacuum box pressure is reduced to approximately 3 to 5 psi gauge. Any pinholes, porosity, or non-bonded areas are detected by the appearance of soap bubbles in the vicinity of the defect. Dwell time must not be less than ten seconds.
- Air pressure testing is used to test double seams with an enclosed air space. Both ends of the air channel should be sealed. The pressure feed device, usually a needle equipped with a pressure gauge, is inserted into the channel. Air is then pumped into the channel to a minimum pressure of 30 psi. The air chamber must sustain the pressure for five minutes without losing more than 4 psi. Following a passed pressure test, the opposite end of the tested seam must be punctured to release the air. The pressure gauge must return to zero; if not, a blockage is most likely present in the seam channel. Locate the blockage and test the seam on both sides of the blockage. The penetration holes must be sealed after testing.

During nondestructive testing, the CQA monitor must perform the following work:

- Review technical specifications regarding test procedures.
- Observe that equipment operators are fully trained and qualified to perform their work.
- Observe that test equipment meets project specifications.

- Observe that the entire length of each seam is tested in accordance with the specifications.
- Observe all continuity testing and record results on the appropriate log.
- Observe that testing is completed in accordance with the project specifications.
- Identify the failed areas by marking the area with a waterproof marker compatible with the geomembrane and inform the contractor of any required repairs, then record the repair area on the repair log.
- Observe that repairs are completed and tested in accordance with the project specifications.
- Record completed and tested repairs on the repair log and the repair drawing.

Destructive Seam Testing. Destructive seam tests for geomembrane seams will be performed at a frequency of at least one test for each 500 linear feet of seam length. At a minimum, a destructive test will be completed for each welding machine used for seaming. A destructive test will also be completed for individual repairs (or additional seaming for the failed welds) of more than 10 feet of seam length. The CQA monitor must perform additional tests if he suspects a seam does not meet specification requirements. Reasons for performing additional tests may include, but are not limited to the following:

- Wrinkling in seam area
- Non-uniform weld
- Excess crystallinity
- Suspect seaming equipment or techniques
- Weld contamination
- Insufficient overlap
- Adverse weather conditions
- Possibility of moisture, dust, dirt, debris, and other foreign material in the seam
- Failing tests

There are two types of destructive testing required for the geomembrane installation: peel adhesion (peel) and bonded seam strength (shear) in accordance with ASTM D 6392. The purpose of peel and shear tests is to evaluate seam strength and to evaluate long-term performance. Shear strength measures the continuity of tensile strength through the seam and into the parent material. Peel strength determines weld quality. Test welds must be allowed to cool naturally to ambient temperature prior to testing.

The CQA monitor selects locations where seam samples will be cut for laboratory testing. Select these locations as follows:

- A minimum of one stratified location for every 500 feet of field seam length or major fraction thereof.

- Sample locations should not be disclosed to the contractor prior to completion of the seam.
- A maximum frequency must be agreed to by the contractor, POR, and the Operator at the pre-construction meeting. However, if the number of failed samples exceeds 5 percent of the tested samples, this frequency may be increased at the discretion of the POR. Samples taken as the result of failed tests do not count toward the total number of required tests.

Sampling Procedures. The contractor will remove samples at locations identified by the CQA monitor. The CQA monitor must:

- Observe sample cutting.
- Mark each sample with an identifying number that contains the seam number and destructive test number.
- Record sample location on the panel layout drawing and destructive seam log.
- Record the sample location, weather conditions, and reason sample was taken (e.g., random sample, visual appearance, result of a previous failure, etc.).

For each destructive test obtain one sample approximately 45 inches long by 12 inches wide, with the weld centered along the length. Cut two 1-inch-wide coupons from each end of the sample (a total of 4 coupons). The contractor must test two of these coupons in shear and two in peel (one shear and one peel from each end) using a tensiometer capable of quantitatively measuring the seam strengths. For double wedge welding, both sides of the air channel will be tested in peel. The CQA monitor must observe the tests and record the results on the destructive seam test log. A geomembrane seam sample passes the field testing when the break is a film tear bond (FTB) and the seam strength meets the required strength values for peel and shear given previously in Table 2.2 and below in the subsection "Passing Criteria for Welds" for both field testing and third party laboratory testing. As previously discussed, both welds have to pass for dual-track welds. Also, it is recommended that additional samples be obtained as discussed in the following paragraph if there is apparent separation of the weld (i.e., greater than 1/8 inch) during peel testing.

If one or both of the 1inch specimens fail in either peel or shear, the contractor can, at his discretion: (1) reconstruct the entire seam between passed test locations, or (2) take two additional test samples 10 feet or more in either direction from the point of the failed test and repeat this procedure. For tracking purposes the additional samples should be identified by assigning an identifying letter to the initial destructive test sample number (e.g., DS-6A and B). Only satisfactory tests count toward the required minimum number, and additional tests (i.e., A and B) count as one test, if passing. If the second set of tests pass, the contractor can reconstruct or cap-strip the seam between the two passed test locations. If subsequent tests fail, the sampling and testing procedure is repeated until the length of the poor quality seam is established. Repeated failures indicate that either the seaming equipment or operator is not performing properly, and appropriate corrective action must be taken immediately.

If the field test coupons are satisfactory, divide the remaining sample into three parts: one 12inch by 12inch section for the contractor, one 12inch by 16inch section for the third party laboratory for testing, and one 12inch by 12inch section for the Operator to archive. The laboratory sample will be shipped to the third party laboratory for delivery and subsequent testing.

If the laboratory test fails in either peel or shear, the contractor must either reconstruct the entire seam between passing test locations or recover additional samples at least 10 feet on either side of the failed sample for retesting. Sample size and disposition must be as described in the preceding paragraph. This process is repeated until passed tests bracket the failed seam section. Seams must be bounded by locations from which passing laboratory tests have been taken. Laboratory testing governs seam acceptance. In no case can field-testing of repaired seams be used for final acceptance.

Third Party Laboratory Testing. Destructive samples can be shipped to a third party laboratory for seam testing or tested at the site with the installer equipment tensiometer under the supervision of the CQA monitor. Testing for each sample will include five bonded seam shear strength tests and five peel adhesion tests (ten for dual-track welds). For dual-track welds each peel test specimen (coupon) will be tested on both sides of the air channel (i.e., the inner and outer welds). At least four of the five specimens tested in peel and shear will meet the minimum strength requirements. The minimum peel strength and the minimum shear strength values must meet the manufacturer's specifications. Additionally, 4 of 5 of the peel test coupons must have no greater than 25 percent seam separation. For dual-track welds if either weld exhibits greater than 25 percent separation or does not meet the required strength, that coupon is considered out of compliance and two out of compliance coupons cause the weld to fail. The third party laboratory must provide test results in timely manner, in writing or via telephone, to the POR. Certified test results are to be provided within five days. The CQA monitor must immediately notify the POR in the event of a calibration discrepancy or failed test results.

Passing Criteria for Welds. Passing criteria are established by Geosynthetic Institute GRI Test Method GM-19 for geomembrane seams. A passing extrusion or fusion-welded seam will be achieved when the following values are tested. The following values listed for shear and peel strengths are for 4 out of 5 test specimens (the 5th specimen can be as low as 80 percent of the listed values) for 50-mil LLDPE geomembrane. Elongation measurements should be omitted for field-testing.

- Shear strength (lb./in) 100
- Shear elongation at break (%) 50
- Peel strength (lb./in) 76 (65 extrusion weld)
- Peel separation (%) 25

2.3.6 Repairs

Any portion of the geomembrane with a detected flaw, or which fails a nondestructive or destructive test, or where destructive tests were cut, or where nondestructive tests left cuts or holes, must be repaired in accordance with the specifications developed for each

phase of final cover construction and consistent with application parts (e.g., material requirements, installation, testing, etc.) of Section 2 of this CQA Plan. The CQA monitor must locate and record all repairs on the repair sheet and panel layout drawing. Repair techniques include the following:

- Patching – used to repair large holes, tears, large panel defects, undispersed raw materials, contamination by foreign matter, and destructive sample locations.
- Extrusion – used to repair small defects in the panels and seams. In general, this procedure should be used for defects less than 3/8-inch in the largest dimension.
- Capping – used to repair failed welds or to cover seams where welds or bonded sections cannot be nondestructively tested.
- Removal – used to replace areas with large defects where the preceding methods are not appropriate. Also used to remove excess material (wrinkles, fish mouths, intersections, etc.) from the installed geomembrane. Areas of removal will be patched or capped.

Repair procedures include the following:

- Abrade geomembrane surfaces to be repaired (extrusion welds only) no more than one hour prior to the repair.
- Clean and dry surfaces at the time of repair.
- Extend patches or caps at least 6 inches beyond the edge of the defect, and round corners of material to be patched and the patches to a radius of at least 3 inches. Bevel the top edges of patches prior to extrusion welding.
- Perform testing on repair seams consistent with Section 2.3.5 – Construction Testing.

2.3.7 Wrinkles

Wrinkles must be walked-out or removed as much as possible prior to field seaming. Any wrinkles which can fold over must be repaired either by cutting out excess material or, if possible, by allowing the liner to contract by temperature reduction. In no case can material be placed over the geomembrane, which could result in the geomembrane folding. The CQA monitor must monitor geomembrane for wrinkles and notify the contractor if wrinkles are being formed above the maximum tolerance level as described below. The CQA monitor is then responsible for documenting corrective action to remove the wrinkles.

Wrinkles occur during the geomembrane installation due to changes in liner temperatures and deployment methods. The wrinkles may interfere with the installation of the synthetic turf layer as well as the final appearance of the closure turf cover.

Minimizing wrinkles through a formal CQA wrinkle management program can greatly reduce problems resulting from geomembrane wrinkles and bridging. The program should provide specific guidance to the CQA monitors. Large wrinkles typically start at the welding seams and extend from that point across the geomembrane width. For this

reason after each panel welding the sheet should be hand pull in order to avoid the formation of ridging along the vertical seams. This technique is typically referred to as "snapping" and shall be implemented after welding every geomembrane panel. Additionally, slightly pretension pulling may be necessary at certain lower areas of the geomembrane panel to reduce diagonal wrinkles. The CQA monitor shall implement a wrinkle management program to include the following guidelines:

- Enforce snapping procedures after welding or seaming every panel as described above.
- After panel deployment and before welding, any horizontal wrinkles must be walked down or wiggled down the slope to minimize wrinkles after welding.
- Limit maximum wrinkle height to 4 inches during warmer ambient temperatures and potentially less wrinkle height of 2 to 3 inches in cooler temperatures.
- No geomembrane wrinkle should be folded over. See next section
- Ensure snapping techniques are implemented after each panel is welded.
- Physically remove wrinkles by walking them or by pretension pulling on the sheet after welding each panel.
- Avoid backfilling the anchor trenches until the synthetic grass and sand infill placement of the closure turf component. This will allow to make correction in the field during the deployment of both the geomembrane and the synthetic grass component. Note that wrinkles will travel down the slopes and cannot be redistributed up slopes, so is important that both top and bottom anchor trenches remain open so that pulling adjustments can be made.
- Mechanically remove fish mouths larger than 5 inches in height by cutting, overlapping, flattening, and extrusion welding a patch over the affected geomembrane.

Avoid backfilling the anchor trenches until the synthetic grass and sand infill placement of the closure turf component. This will allow making correction in the field during the deployment of both the geomembrane and the synthetic grass component. Note that wrinkles will travel down the slopes and cannot be redistributed up slopes, so it is important that bottom anchor trenches remain open so that pulling adjustments can be made.

2.3.8 Folded Material

Folded geomembrane must be removed. Remnant folds evident after deployment of the roll that are due to manufacturing process are acceptable.

2.3.9. Equipment on Geomembrane Materials

Construction equipment on the final cover system will be minimized to reduce the potential for geosynthetics liner material puncture. The CQA monitor will verify that small equipment such as generators are placed on scrap geomembrane material (rub sheets) above geosynthetic materials in the final cover system.

Unless otherwise specified by the POR, rubber tire/track equipment over geosynthetics proposed by contractor shall be approved by the engineer. No equipment will be left running and unattended over the constructed geomembrane. Rubber tired / tracked ATV's and trucks are acceptable if wheels pressure is less than 5 psi.

Driver shall check for sharp edges embedded rocks, or other foreign materials stuck into or protruding from tires/track prior to driving on the geomembrane. Path driven on geomembrane shall be as straight as possible with no sharp turns, sudden stops or quick starts.

2.3.10 Geomembrane Anchor Trench

The geomembrane anchor trench will be left open until seaming and placement of the synthetic grass and sand infill placement have been completed. Expansion and contraction of the geomembrane should be accounted for in the geomembrane placement. Prior to backfilling, the depth of penetration of the geomembrane into the anchor trench must be verified by the CQA monitor at a minimum of 100foot spacing along the anchor trench. The anchor trench should be filled in the morning when temperatures are coolest to reduce bridging of the geomembrane.

2.3.11 Geomembrane Acceptance

The contractor retains all ownership and responsibility for the geomembrane until acceptance by the Operator. In the event the contractor is responsible for placing cover over the geomembrane, the contractor retains all ownership and responsibility for the geomembrane until all required documentation is complete, and the cover material is placed. After panels are placed, seamed, tested successfully, and any repairs are made, the completed installation will be walked by the operator's and contractor's representatives. Any damage or defect found during this inspection will be repaired properly by the installer. The installation will not be accepted until it meets the requirements of both representatives. In addition, the geomembrane will be accepted by the POR only when the following has been completed:

- The installation is finished.
- Seams have been inspected and verified to be acceptable.

- Required laboratory and field tests have been completed and reviewed.
- Required contractor-supplied documentation has been received and reviewed.
- As built record drawings have been completed and verified by the POR. The as built drawings show the true panel dimensions, the location of seams, trenches, pipes, appurtenances, and repairs.

2.4 Turf Component

The turf layer installation consists of the placement and seaming of the synthetic grass component (two woven geotextiles made of polypropylene 13 and 18 pic tufted with polyethylene yarns) overlying the geomembrane drain liner on the top slopes and side slopes. The CQA monitor will provide on-site observation of the installation. The POR will make sufficient site visits during the drainage layer installation to document the installation in the final documentation. The Turf will meet the material property requirements listed in Table 2.3.

2.4.1 Delivery

Upon delivery the CQA monitor must observe the following:

- The turf is wrapped in rolls with protective covering.
- The rolls are not stacked more than 3 high.
- The rolls are not damaged during unloading.
- Protect the turf from mud, soil, dirt, dust, debris, cutting, or impact forces.
- Each roll must be marked or tagged with proper identification.

Any damaged rolls will be rejected and removed from the site or stored at a location separate from accepted rolls, designated by the Operator. Rolls that do not have proper manufacturer's documentation will also be stored at a separate location until documentation has been received and approved.

2.4.2 Testing

The turf manufacturer (or supplier) will conduct quality control testing and certify that materials delivered to the site comply with project specifications for each phase of final cover construction.

Table 2.3
Typical Values Turf Component

Property Turf Component	Test Method	Minimum Required Property
Yarn count (Denier)	ASTM D 1907	8000 (min 7300)
Tensile Grass @ Break lbs. (N)	ASTM D 2256	15 lbs (MARV)
Elongation @ Break %	ASTM D 2256	30-80%
CBR Puncture	ASTM D6241	900 LBs (MARV)
Tape thickness (micron)	ASTM D 3218	100 Varies based on client request
Width (mm)	N/A	1 to 2 mm
Tensile Product	ASTM D4595	1000 Lb/ft. (MARV)
Coating Temp	N/A	N/A
Yarn Weight Minimum (grams per sq. cm)	ASTM D 5261	19 oz./sy (0.063) (MARV)
Double 13/18 Pic Polybag (grams per sq. cm)	ASTM D 5261	6 oz./sy (0.023) (MARV)
Product Weight w/o ballast (grams per sq. cm)	ASTM D 5261	25 oz./sy (0.091) ±1oz/sy
Pile Height Minimum (cm)	Varies on client request	1.25 in (3.17)
Tufting Gauge (cm)	N/A	0.5 (1.27) to 3/4 inch (1.9)
Transmissivity with underlying structured geomembrane Normal stress 50 psf and 0.33 gradient (m2/sec)	ASTM D 4716	2.5E-03 m^2/sec, Minimum
Internal Friction of combined components	ASTM D 5321	35 degrees, Minimum
UV Resistance and Stability. Tensile testing after weathering Climate Zone 200W/m^2 30 years exposure –accelerated or projected	ASTM G 147 (02)	55% Retained Strength, Minimum 30 year exposure
Sand in-fill Gradation and Ballast	ASTM D 6913	SP/SW at a minimum of half inch as ballast weight to be approved by Engineer-of-Record prior to installation

2.4.3 Manufacturer Quality Control

Turf manufacturer shall provide inspection records of the tufting procedures for the Turf material. These will include visual inspection records of the following properties every 150,000 sq. ft:

- Tufting Gauge
- Pile height
- Roll Length and roll numbers.

ClosureTurf™ Patent #7,682,105 and other Patents
HydroTurf™: Patent Pending

Manufacturer shall also provide documentation on the geotextile product and yarn manufacturer minimum properties.

2.4.4 Conformance Testing

One Turf sample will be obtained for every 400,000 sq. ft of material supplied to the site. The material will be sampled at the site or at the plant by a CQA representative. The samples will be forwarded to the third-party laboratory for the following conformance tests:

- Yarn Weight ASTM D5261
- CBR Puncture ASTM D6241
- Tensile Product ASTM D 4595
- Tensile Strength of Yarn ASTM D2256

2.4.5 Turf Installation

Surface Preparation. Prior to turf installation, the CQA monitor must observe the following:

- The bottom liner has been prepared in accordance with the specifications and the geomembrane has been installed as outlined in Section 2.3.4.
- The geomembrane installation documentation has been completed over the areas that will be covered by the synthetic turf.
- The supporting surface (i.e., the geomembrane) does not contain stones or debris that could damage the turf.

Turf Placement. Prior to the installation of the turf, the contractor shall submit drawings showing the panel layout, indicating panel lengths, direction of deployment and the sequence proposed for flipping the panels after seaming. The POR must review field conditions and approve the panel sequencing placement and the proposed direction of flipping after sewing as well as any revision to the panel layout. During panel placement, the POR or CQA monitor must.

- Observe the Turf as it is deployed and record defects and disposition of the defects (panel rejected, patch installed, etc.). Repairs are to be made in accordance with the specifications.
- Verify that equipment used does not damage the turf or underlying geomembrane by handling, trafficking, leakage of hydrocarbons, or by other means.

- Verify that all panels are deployed from the top of the slope in a way that the leading edge of the roll stays at the top of the slope with the grass filaments always pointing upwards.
- Verify that the turf is anchored to prevent movement by the wind (the contractor is responsible for any damage resulting to or from windblown turf.
- Verify that the turf remains free of contaminants such as soil, grease, fuel, etc.
- Observe that the turf is laid smooth and free of tension, stress, folds, wrinkles, or creases.
- Observe that on slopes the turf is secured with sand bag anchoring at the top of the slope and then rolled down the slope.
- Observe the deployment of the panels to insure proper flipping in order to exposed the grass surface up after seaming operations. Deployement should be done on the adjacent turf panel to avoid damage.
- Observe that the seaming operation is performed using a 4-inch overlap and fastened with heavy-duty textile stitching machine. A single stitch prayer type seam is constructed using Nulong sewing machine or equivalent. The thread shall be 207 Polyester or equivalent. Sewing should occur between the 1st and 2nd row of stiches to avoid exposure of the black geotextile after flipping the panel.
- The CQA monitor shall review the specifications of the thread to be used for sewing the turf.
- Observe that after seaming operations, the ends of the Synthetic Turf panels are permanently anchored in the perimeter anchor trenches and covered with a minimum of two feet of soil.

2.4.6 Turf Repair Procedure:

- All turf repairs will be completed by using a heatbonded seam. This can be accomplished by using a hand held leister or a Varimat V2 leistering machine.
- All seams with considerable length should use the Varimat V2 leistering machine. This gives consistent pressure (77 lbs) throughout the seam. Seam strength is a combination between weight and temperature. The temperature of the Varimat V2 leistering machine should be discussed prior to use because temperature control is a variable that can be increased/decreased depending on weather conditions.
- A hand held leister should be used in smaller/concentrated areas. This may include areas around well heads or patches where turf was cut.

2.4.7 Equipment on the Turf:

No equipment shall be allowed on slopes exceeding 15% until the sand infill is in place. In flatter slopes, such as top decks, ATV and vehicles will be allowed prior to infill placement if the tire pressure is less than 30 psi. Post construction drivability tire pressures should be limited on the slopes to 30 to 60 psi based on slope angle. Allowable tire pressures may be increased to 80 psi depending on subgrade conditions and engineer of record approval.

3.0 SAND INSTALLATION

The sand layer will be of ½-inch thick nominal. The sand will be worked into the Turf layer as in-fill between the synthetic yarn blades. The physical characteristics of the sand layer will be evaluated through visual observation (and laboratory testing if deemed necessary by the POR) before construction and visual observation during construction. Additional testing during construction will be at the discretion of the POR.

The sand layer may be placed using any appropriate equipment capable of completing the work and should only receive minimal compaction required for stability. No equipment shall be allowed on slopes exceeding 15% until the sand infill is in place. In flatter slopes, such as top decks, ATV and vehicles will be allowed prior to infill placement if the tire pressure is less than 15 psi.

Conveyor Systems and or Express Blowers can be used to spread and place the sand in-fill. Contractor shall explain in detail in the pre-construction meeting the method of sand deployment to be used. The method shall be approved by the Engineer. For slopes 3H:1V or steeper the sand infill shall be placed using long reach conveyors belts or using water or air express blower methods.

The CQA monitor will verify that the geosynthetics are not displaced while the sand layer is being placed.

The sand aggregate to be used shall consist of highly permeable sand with an SW or SP curve specification. The curve should indicate the material consisting of medium sand having approximately 10% coarse and 10% fine sand.

The minimum initial lift of sand infill will be determined based on the type of placement equipment, and the slope and geometry considerations of the slope. An average of 0.5 to 0.75 inches is recommended for equipment with light ground pressure of less than 30 psi.

The sand placement shall be done in front of the deployment equipment to improve the bearing capacity of the cover system below.

An average thickness of ½ inch of sand infill shall be applied before allowing lightweight vehicles on the turf. This is particularly important on slopes steeper than 3H to 1V where light rubber or tracked vehicles could start pulling on the turf before the sand infill is in place.

Let it be noted that sand placement cannot occur with snow or ice on turf. Rain or wet conditions do not hamper the placement of sand (ballast) onto the turf, however wet sand or turf conditions severely hinder the ability to broom the sand in correctly. The sand will dry very quickly when spread evenly and exposed to atmospheric conditions conducive to drying the material. The sand can then be broomed into the sand correctly.

During construction the CQA monitor will:

- Verify that grade control is performed prior to work.
- Verify that underlying geosynthetic installations are not damaged during placement operations. Mark damaged geosynthetics and verify that damage is repaired.
- Verify that average thickness of ½ inch (nominal) of sand is placed on the synthetic turf. Frequency will be 20 measurements per acre of final cover installed.

4.0 HydroBinder Installation

HydroTurf™ installation for down chutes requires placement of the geomembrane panel through the channel surface and into the adjacent vertical trenches designed for anchoring the system. If the panel is not wide enough to cover the channel additional panels should be seamed in accordance with the regulatory approval method and be secure into the vertical anchor trenches at the edges of the panels. Do not backfill until turf has been installed.

Once the membrane is placed, any noticeable wrinkles should be pulled to the toe of channel or the adjacent vertical anchor trenches. The membrane should lay flat and be free of measureable wrinkles before the turf is placed. If the turf roll is not wide enough to cover the channel and be secured into the vertical anchor trenches, a sewn seam must be performed to ensure the turf seam is wide enough. All noticeable turf wrinkles should also be pulled to the toe of the channel or the adjacent anchor trenches. Once the membrane and turf are placed into the down chute the top horizontal anchor trench should be backfilled and compacted.

Infill should be placed in between the synthetic grass. The material will be blown or spread with mechanical equipment. The infill layer may be placed using any appropriate equipment capable of completing the work and should only receive minimal compaction required for stability. The infill is to be spread using low ground pressure equipment and 3 point spreader or a pull-behind spreader. Alternative Conveyor Systems and or Express Blowers can be used to spread and place the in-fill. Contractor shall explain in detail in the pre-construction meeting the method of infill deployment to be used. The Engineer shall approve the method.

The cement sand mix shall comprise of either a Quickcrete product (Sand Topping Mix) or a Sackcrete product (Sand Mix). These are the only two approved products to be used as infill for the HydroTurf™ system. Both products can be delivered in either pallet form of 60 lb. bags or 2000 lbs. super sac. The cement product should be installed into the turf while it is in a dry state. The cement shall be worked into the tufts so the tufts are in an upright position with the infill at a measurable ½ to ¾ inch nominal depth. This is achieved with common shop broom and yard rakes. Once the cemented infill is installed as described, the cemented infill must then be hydrated. The hydration process must occur the day of the cemented infill placement. The cemented infill is hydrated thoroughly with a ‘misted’ spray type to avoid displacement of the non-hydrated infill.

The installer must also be aware not to overhydrate the in-fill so that water begins to runoff and cause loss of cemented infill during the process. The general objective is to soak the area to start the hydration process but not to inundate with water beyond saturation.

Once hydration is completed as described, backfill and compaction of the vertical anchor trenches should be backfilled. The HydroTurf™ channel will be at minimum performance levels within 24 hours and continue to increase in strength over the next few weeks.

5.0 Reporting

The POR on behalf of the Operator will submit to the State a final documentation for record of the constructed final cover system.

The quality assurance plan depends on thorough monitoring and documentation of construction activities. Therefore, the POR and CQA monitor will document that quality assurance requirements have been addressed and satisfied. Documentation will consist of daily record keeping, testing and installation reports, nonconformance reports, progress reports, photographic records, and design and specification revisions. The appropriate documentation will be included the FCSER.

Preparation of Final Documentation

The POR, on behalf of the Operator, will submit to the State Regulatory Agencies a FCSER for record of finale cover system constructed.

Testing, evaluation, and submission of the FCSER for the final cover system during construction will be in accordance with this CQA Plan. The construction methods and test procedures documented in the FCSER will be consistent with this CQA Plan.

At a minimum, the documentation will contain:

- A summary of all construction activities.
- All laboratory and field-test results.
- Manufacturer's certifications for all geosynthetics.
- Documentation of thickness verification of sand layer.
- Sampling and testing location drawings.
- A description of significant construction problems and the resolution of these problems.
- A statement of compliance with the permit CQA plan and construction plans.
- The reports will be signed and sealed by a professional engineer(s) licensed in the State where the work is performed.

The as-built record drawings will accurately site the constructed location of work items, including the anchor trenches. The POR will review and verify that as built drawings are correct. As built drawings will be included in the final documentation.

The FCSER will be signed and sealed by the POR, signed by the site operator, and submitted to the MSW Permits Section of the Waste Permits Division of the State for approval.

ClosureTurf™ Patent #7,682,105 and other Patents
HydroTurf™: Patent Pending

SGI TESTING SERVICES
A GEORGIA LIMITED LIABILITY COMPANY

8 July 2010

Mr. Jose Urrutia
Closure Turf, LLC
3005 Breckinridge Blvd., Suite 240
Duluth, Georgia 3096

Subject: Evaluation of Drivability
Light Weight Construction Equipment on
Closure Turf™ System

Dear Mr. Urrutia,

DEFINITION OF CLOSURE TURF™ SYSTEM

As shown in Figure 1, the installed Closure Turf™ system from top to bottom consists of:

- A thin sand layer;
- Artificial grass with geotextile down;
- Agru 50-mil Super Gripnet with spike sides down; and
- Subgarde (foundation) soil.

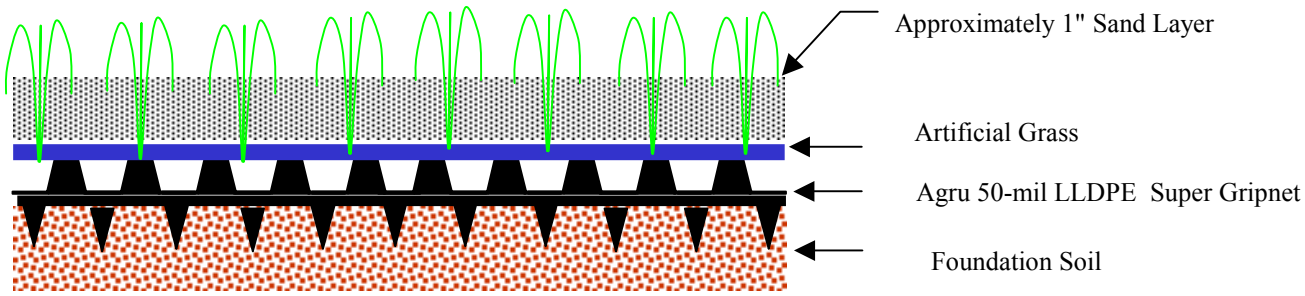


Figure 1. Cross-section of the Closure Turf system

MAIL TO: SGI TESTING SERVICES, LLC
P.O. BOX 2427
LILBURN, GA 30048-2427

FACILITY LOCATION
4405 INTERNATIONAL BLVD., SUITE B-117
NORCROSS, GA 30093

WEB SITE: WWW.INTERACTIONSPECIALISTS.COM

PHONE: 770.931.8222 FAX: 770.931.8240

DEFINITION OF POST-CONSTRUCTION DRIVABILITY

Drivability of rubber-tired construction equipment (RTCE) on the Closure Turf™ system is a rather broad subject including: (i) stability - potential sliding (shear failure) within the Turf Closure system; (ii) bearing capacity of the subgrade soil; (iii) localized settlement after construction due to waste decomposing and compression under gravity force; and (iv) rut depth. The purpose of this report is to evaluate the stability within the Turf Closure system and bearing capacity of the subgrade soil.

STABILITY

As shown in Figure 2, when a RTCE moves at a constant speed on the Closure Turf system, its gravity load is transferred to the Closure Turf system through the tire-soil contact.

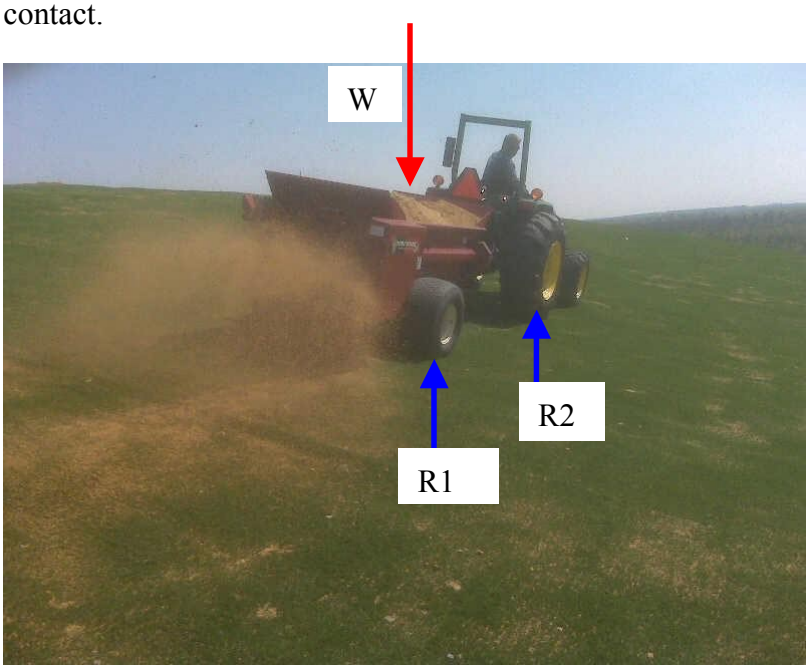


Figure 2. Rubber-tired construction equipment on the Closure Turf system.

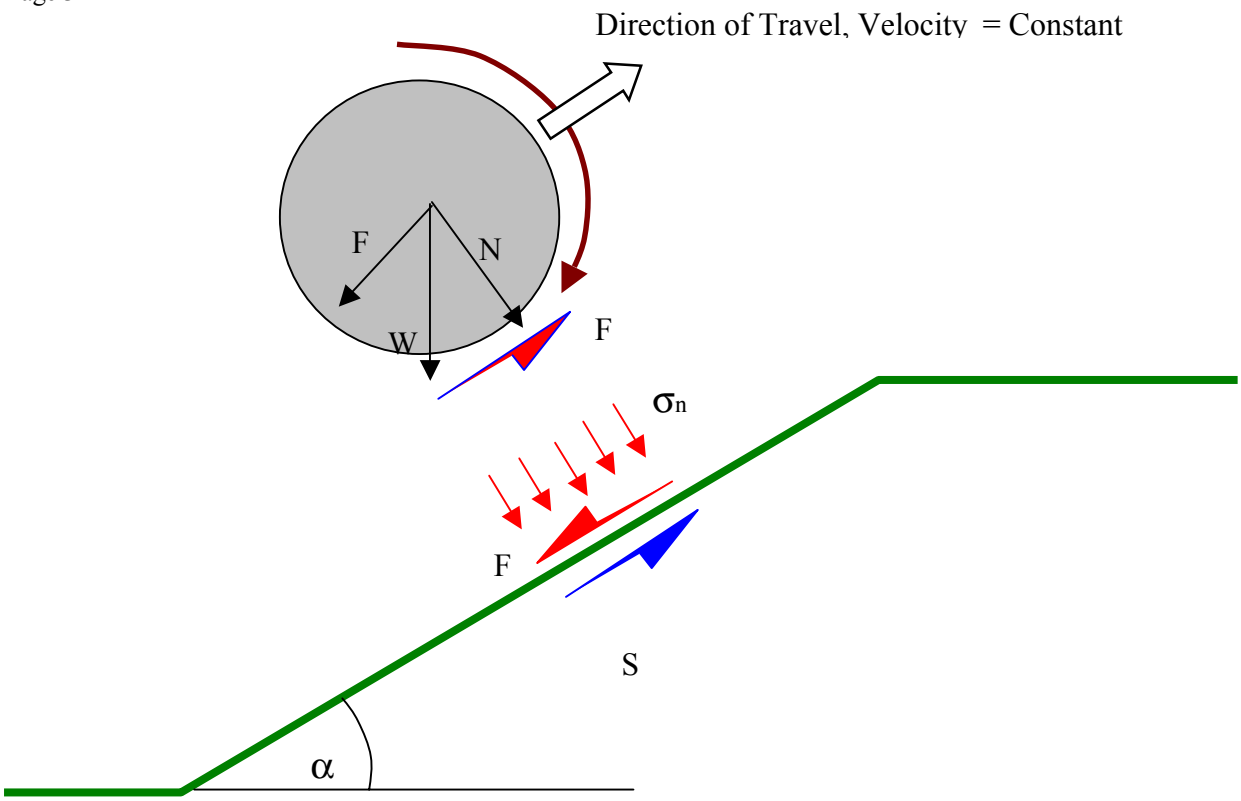


Figure 3. Tire-soil contact loading conditions on a slope. (NOTE: not to scale).

Assuming the gravity force of RTCE is evenly distributed to four tires, the contact normal stress at the tire-sand contact area as shown in Figure 3 can be estimated by the following equation:

$$\sigma_n = \frac{W \cos\alpha}{4A} \qquad (1)$$

where:

α = the slope angle;

σ_n = contact normal stress between the tire and sand;

W = total gravity force of equipment; and

A = contact area between a tire and sand layer.

Assuming: (i) the tire-soil contact area is approximately equivalent to a 10 inch diameter circular area and (ii) the total weight of a RTCE is 8000 lbs, then the contact normal stress in the unit of psi is:

$$\sigma_n = \frac{8000\cos\alpha}{4(3.14)(5^2)} = 25.5\cos\alpha \qquad (2)$$

Equation (2) is also applicable to a level surface by setting α = 0. This gives the maximum contact normal stress of 25.5 psi. It is noted that the tire-sand contact normal stress over a 10-inch diameter area is much higher than the overburden pressure of 1 inch thick cover sand. Therefore, it is necessary to evaluate the stability of the Closure Turf system in the tire-sand contact area under the high normal stress conditions. The shear strength parameters for this localized stability analysis should be determined from the interface direct shear tests at high normal stresses (2000 to 5000 psf). Based on the test results in Attachment 1, the peak friction angle and adhesion of the sand/artificial grass/Agru 50-mil Super Gripnet LLDPE geomemebrane system is 34 degree and 39 psf, respectively for the normal stress range of 2000 to 5000 psf. Under the drained conditions (i.e., no pore pressure induced by RTCE), neglecting the adhesion for the conservative reason, the safety factor (FS) against the localized shear failure within the tire-soil contact area is:

$$FS = \frac{A\sigma_n \tan\delta}{0.25(W)\sin\alpha} \qquad (3)$$

where:

α = the slope angle;

σ_n = contact normal stress between the tire and sand;

δ = the peak friction angle of the Closure Turf system;

W = total gravity force of equipment; and

A = contact area between a tire and sand layer.

Substituting Equation (1) into (3), Equation (3) is reduced to:

$$FS = \frac{\tan \delta}{\tan \alpha} \tag{4}$$

For the given Closure Turf system, the peak friction angle is constant. It is obvious that FS decreases with increasing the slope angle. Based on the information provided by Closure Turf LLC, the maximum allowable slope angle is 18 degree (3:1 slope).

At $\alpha = 18.4$ degree,

$$FS = \frac{\tan 34}{\tan 18} = 2.0 \tag{5}$$

This indicates that there is sufficient shear resistance in the Closure Turf system against the localized shear failure within the tire-soil area. It is not expected the localized internal shear failure to occur within the tire-soil contact area of Closure Turf system when it subjected to the gravity force from a typical lightweight RTCE traveling at a constant velocity.

BEARING CAPACITY

For a given RTCE, W and A are constant, therefore the maximum contact normal stress occurs when the RTCE travels on the level surface (Equation 1). The contact normal stress is transferred to the subgade soil as shown in Figure 4.

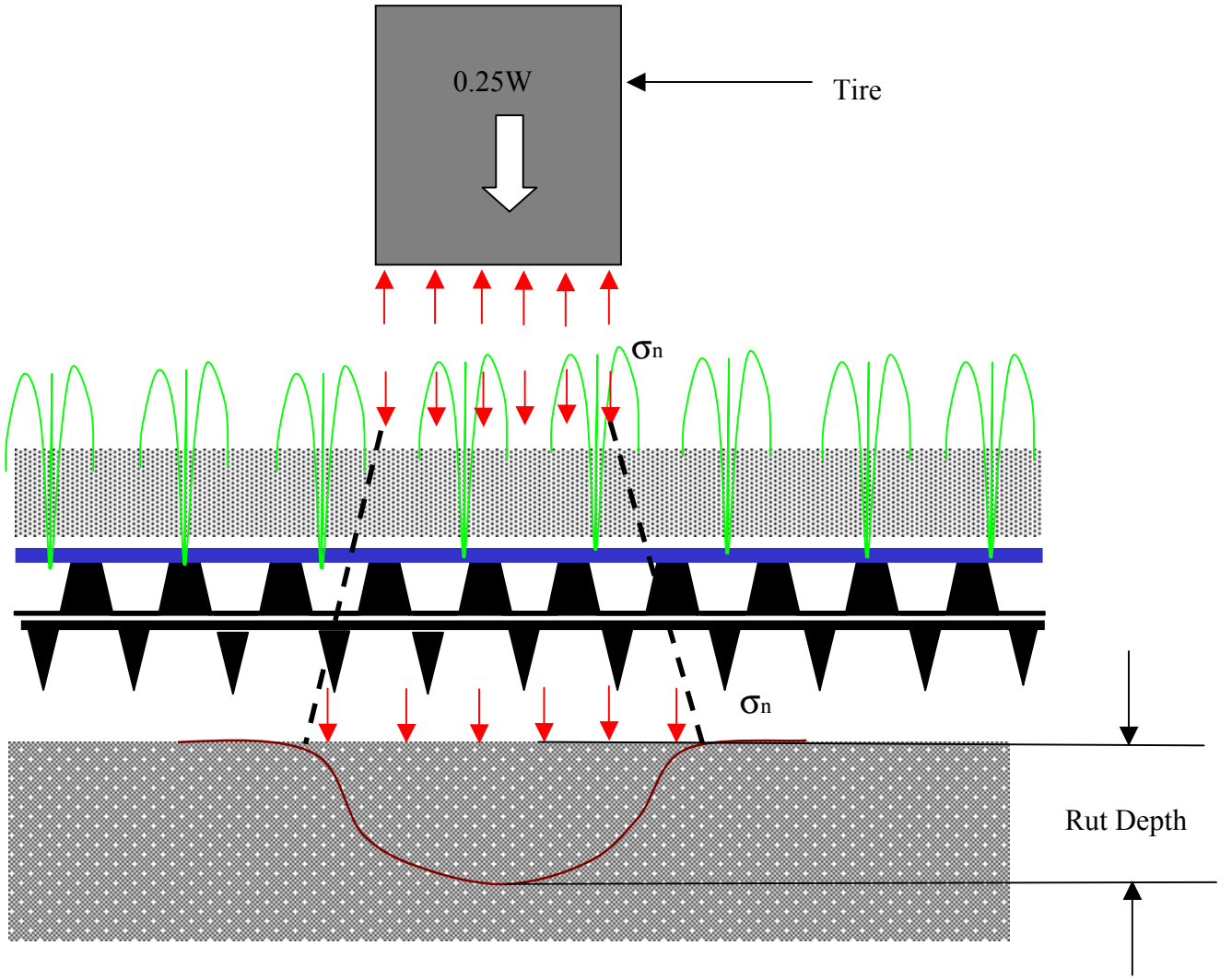


Figure 4. Normal stress acting on top of the subgrade (foundation) soil

Based on soil mechanics, the contact load (0.25W) distributes to a larger area as depth increases (depth starting from the top surface of the cover sand). However, due to the fact that the cover sand layer is only 1 inch thick, and the artificial grass and geomembrane are flexible, the load spreading angle (factor) is insignificant. The normal stress transferred to the top of subgrade soil is considered the same as the tire-sand contact stress for the conservative reason.

As shown previously (Equation 2), assuming (i) the tire-soil contact area is approximately a 10 inch diameter circular area and (ii) the total weight of a RTCE is 8000 lbs, then the maximum contact normal stress is:

$$\sigma_n = \frac{8000\cos\alpha}{4(3.14)(5^2)} = 25.5\,psi \qquad (6)$$

Under the action of tire-sand contact normal stress over the contact area (10 in diameter), there are two major concerns:

- Excessive rut depth, which is not defined for the Closure Turf system at the present time. Generally speaking, the subgrade soil settles and rut forms when it is subjected a normal stress. As number of vehicle passes increases, the rut depth increases. Eventually the surface may reach such a condition that driving is difficult if the accumulated pass is larger than some critical number. Therefore, for the given type of equipment (W and A are fixed), one way to reduce rut depth is to limit the number of passes. This may be achieved by not driving over the same area when a significant rut depth is already developed. The other way is to compact subgrade soil to high density to improve the stiffness for the subgrade soil.

- Bearing capacity failure because the contact normal stress is greater than the bearing capacity of the subgrade soil.

In the case of soft subgrade soil (worst case), the bearing capacity is estimated by the following equation:

$$q_u = c_u N_C \qquad (7)$$

where:

c_u = undrained shear strength of soft subgrade soil

N_c = bearing capacity factor (6.2 for a circular loading area)

$$q_u = 6.2c_u \tag{8}$$

For the soft subgrade soil, the safety factor against bearing capacity failure is:

$$FS = \frac{6.2c_u}{\sigma_n} \tag{9}$$

Typically, the acceptable bearing capacity safety factor is 2.0. The required undrained shear strength for the subgrade soil is,

$$c_u \geq \frac{2(25.5)}{6.2} = 8.2\,psi \tag{10}$$

The value of c_u can be estimated from the widely used CBR value for soft subgrade soil with CBR < 5 using the following equation (Giroud and Noiray 1981):

$$c_u = 4.3CBR \tag{11}$$

Substituting Equation 11 into 10 gives the following equation:

$$CBR \geq 1.9 \tag{12}$$

Therefore, under the action of the gravity force from a typical RTCE (W = 8000 lbs, A = 79 square inch), the required minimum CBR value for the subgrade is 2. In reality, a well-compacted subgarde soil for the Closure Turf system should have a CBR value significantly higher than 2. It is expected that a well-compacted subgarde soil layer (SM or SC, typically used as subgarde soil for the landfill cover system) should have sufficient bearing capacity to support the lightweight RTCE.

CLOSURE

SGI appreciates the opportunity to provide technical services to Closure Turf, LLC. Should you have any questions regarding the attached document(s), or if you require additional information, please do not hesitate to contact the undersigned.

Sincerely,

Zehong Yuan, Ph.D., P.E.
Laboratory Manager

REFERENCES

Giroud, J.P., and Noiray, L. (1981) "Geotextile-reinforced unpaved road design." Journal of Geotechnical Engineering 107(9), 1233-1254.

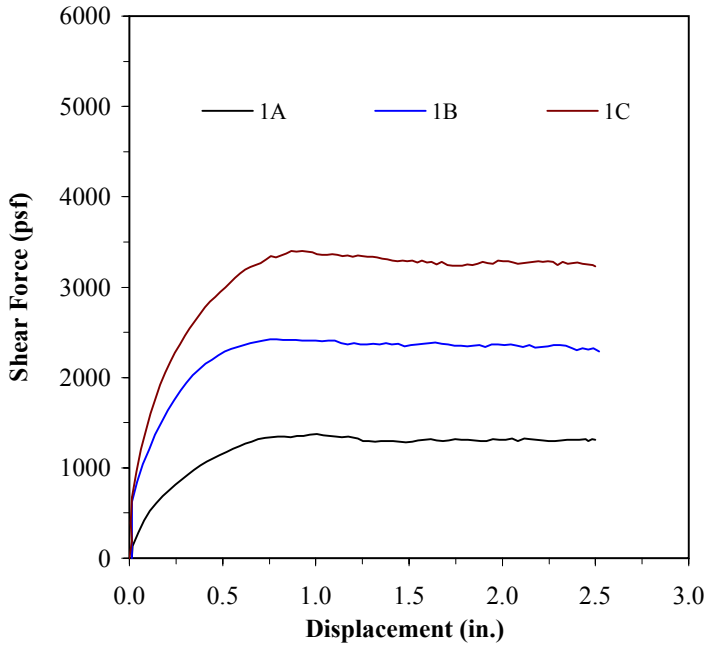
NOTES:
(1) Unless otherwise noted in the test results the sample(s)/specimen(s) were prepared in accordance with the applicable test standards or generally accepted sampling procedures.
(2) Contaminated/chemical samples and all related laboratory generated waste (i.e., test liquids, PPE, absorbents, etc.) will be returned to the client or designated representative(s), at the client's cost, within 60 days following the completion of the testing program, unless special arrangements for proper disposal are made with SGI.
(3) Materials that are not contaminated will be discarded after test specimens and archived specimens are obtained. Archived specimens will be discarded 30 days after the completion of the testing program, unless long-term storage arrangements are specifically made with SGI.
(4) The reported results apply only to the materials and test conditions used in the laboratory testing program. The results do not necessarily apply to other materials or test conditions. The test results should not be used in engineering analysis unless the test conditions model the anticipated field conditions. The testing was performed in accordance with general engineering testing standards and requirements. The reported results are submitted for the exclusive use of the client to whom they are addressed.

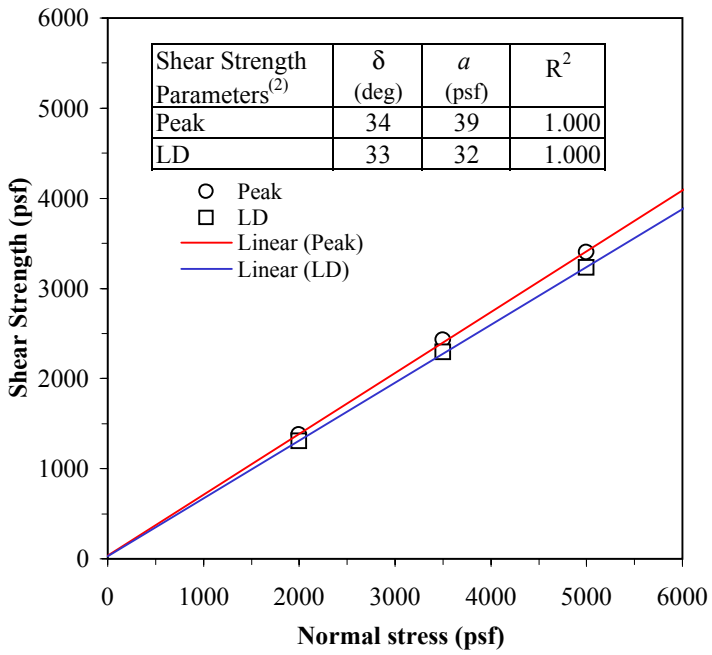
ATTACHMENT 1

INTERFACE DIRECT SHEAR TEST RESULTS

CLOSURETURF LLC -LANDFILL COVER SYSTEM
INTERFACE DIRECT SHEAR TESTING (ASTM D 5321)

Upper Shear Box: Concrete sand nominally compacted
Artificial grass with grass side (green yarns) up/
Agru 50 mil LLDPE Super Gripnet geomembrane with studs side up/
Lower Shear Box: Concrete sand





Test No.	Shear Box Size (in. x in.)	Normal Stress (psf)	Shear Rate (in./min)	Soaking Stress (psf)	Soaking Time (hour)	Consolidation Stress (psf)	Consolidation Time (hour)	Lower Soil γ_d (pcf)	Lower Soil ω_i (%)	Lower Soil ω_f (%)	Upper Soil γ_d (pcf)	Upper Soil ω_i (%)	Upper Soil ω_f (%)	GCL ω_i (%)	GCL ω_f (%)	Shear Strengths τ_P (psf)	Shear Strengths τ_{LD} (psf)	Failure Mode
1A	12 x 12	2000	0.04	10	24	-	-	-	-	-	-	-	-	-	-	1376	1308	(1)
1B	12 x 12	3500	0.04	20	24	-	-	-	-	-	-	-	-	-	-	2425	2291	(1)
1C	12 x 12	5000	0.04	50	24	-	-	-	-	-	-	-	-	-	-	3400	3233	(1)

NOTES:
(1) Sliding (i.e., shear failure) occurred at the interface between the cover (upper) sand and artificial grass.
(2) The reported total-stress parameters of friction angle and adhesion were determined from a best-fit line drawn through the test data. Caution should be exercised in using these strength parameters for applications involving normal stresses outside the range of the stresses covered by the test series. The large-displacement (LD) shear strength was calculated using the shear force measured at the end of the test.

DATE OF TEST: 6/21/2010

SGI TESTING SERVICES, LLC

FIGURE NO.	C-1
PROJECT NO.	SGI10007
DOCUMENT NO.	
FILE NO.	

Quality Assurance Plan

Phase II MSW Area Closure
& Photovoltaic System Project
Hartford Landfill

Connecticut Resources
Recovery Authority
Hartford, Connecticut

March 14, 2013

Fuss & O'Neill
146 Hartford Road
Manchester, CT 06040

QUALITY ASSURANCE PLAN
Phase II MSW Area Closure & PV System Project
Hartford Landfill
Hartford, Connecticut

TABLE OF CONTENTS

QUALITY ASSURANCE PLAN
Phase II MSW Area Closure & PV System Project
Hartford Landfill
Hartford, Connecticut

TABLE OF CONTENTS

1.0 INTRODUCTION

The Connecticut Resources Recovery Authority (CRRA) intends on closing the Municipal Solid Waste/Interim Ash Disposal Area (the "MSW Area") of the Hartford Landfill located at 180 Leibert Road in Hartford, Connecticut. This document serves as a Quality Assurance Plan (QAP) specifically developed for the proposed closure construction activities of the Phase II (eastern) area at the landfill. This document accompanies and is consistent with the Closure Plan (last revised January 2007) and subsequent amendment (dated July 2011) for this landfill.

In general, closure construction activities will consist of constructing an impermeable barrier with associated access roads and storm water control features. To facilitate the desire to incorporate a grid-connected solar photovoltaic "PV" renewable energy system into the planned closure of the Hartford Landfill, CRRA undertook a far-reaching review of available technologies. At the conclusion of this comprehensive review, CRRA determined that an alternative capping system had the best potential to support a renewable energy system. The two alternative capping systems selected for detailed analysis included:

- *Closure Turf™ Alternate* – a proprietary synthetic turf system manufactured by Agru-America, Inc. This system would allow for the use of rigid PV panels affixed to a ground mounted racking system.
- *Exposed TPO Alternate* – an exposed geomembrane cap using Thermoplastic Polyolefin (TPO). This system would allow for the use of rigid PV panels affixed to a ground mounted racking system or flexible, thin-film PV panels chemically adhered to the membrane.

One of these alternative capping systems, which have been approved by the Connecticut Department of Environmental Protection (CTDEEP), will be used to close the Phase II (eastern) portion of the Hartford landfill.

This QAP is intended to provide guidance for control of construction quality aspects of the proposed landfill closure activities. This document outlines specific duties of the Quality Assurance Consultant (QAC) and construction contractor, and procedures for documenting and reporting that the closure activities have been conducted in general conformance with the CT DEEP-approved plans, specifications, and applicable regulations. Specific details of proposed construction quality assurance/quality control activities will be presented in the general requirements, technical specifications and final design drawings included in the Request for Proposals (RFP). These sections will comprise the "contract documents" for the project. These documents should be consulted should questions arise or omissions be discovered in this QAP. *Table 1* summarizes the reporting and testing requirements for the major tasks and materials for this project.

2.0 RESPONSIBILITY AND AUTHORITY

2.1 General

Quality assurance consists of implementing a planned system of activities to assure closure construction occurs as specified in the contract documents. Implementing quality assurance activities for this project involves applying standards and procedures outlined in the contract documents to assure the closure construction meets or exceeds the performance criteria. The

following paragraphs outline the organization of the project participants and their responsibilities, meetings, and testing/submittal requirements.

2.2 Project Organization and Responsibilities

The construction phase of the project involves coordination between five participants:

- CT DEEP
- CRRA
- Engineer
- Quality Assurance Consultant
- Construction Contractor

Each participant has a responsible role in implementing the proposed closure activities. A project organization chart has been provided as *Figure 1* and shows the general lines of communication between the parties as described below:

2.2.1 Connecticut Department of Energy and Environmental Protection

The role of the CT DEEP in this project is to review and approve, as appropriate, documents submitted in connection with the closure contract, and assess whether or not the closure is being constructed in conformance with the Connecticut General Statutes (CGS) Section 22a-208 and RSCA Section 22a-209.

The closure of the landfill is to be completed in accordance with the terms and conditions established in the Authorization for Closure (Authorization). It is anticipated that the terms and conditions of the Authorization will reference the CT DEEP-approved landfill closure plan and engineering drawings, and require the CRRA to submit this QAP for CT DEEP approval on or before sixty days prior to commencing the construction activities. No closure construction activities will be undertaken until the CT DEEP issues approval of the QAP.

2.2.2 CRRA

CRRA will be the Authorization Holder. Therefore, CRRA is responsible for completing construction activities in accordance with the terms and conditions of the Authorization. Closure activities will be substantially completed by the date specified in the Authorization. CRRA will solicit bids and ultimately hire a qualified contractor who will complete the construction work. Alternatively, CRRA may act as the Contractor for all or part of the closure activities. CRRA will also retain the services of a Quality Assurance Consultant who will oversee the implementation of the Quality Assurance Plan.

2.2.3 Engineer

The Engineer for the project will be an experienced civil engineer, licensed by the State of Connecticut. The responsibilities of the Engineer during construction will be detailed in the contract documents. Generally, the Engineer will make visits to the site at intervals appropriate to the various stages of construction in order to observe the progress and quality of the work completed by the Contractor. The Engineer will provide clarifications and interpretations of the contract documents, have the responsibility to authorize minor variations

in the work that are compatible with the CT DEEP-approved closure plans, and have the authority to reject defective work. The Engineer may, at his or her discretion, test materials at random or observe quality control testing as it is being performed.

CRRA retained Fuss & O'Neill as Engineer to prepare the closure plan including draft technical specifications, engineering drawings and the QAP. After receiving the Authorization, Fuss & O'Neill will finalize the technical specifications, construction drawings and assemble the Contract Documents. Fuss & O'Neill will function as the Engineer and report to CRRA at least during the bidding phase of the construction.

2.2.4 Quality Assurance Consultant

The Quality Assurance Consultant (QAC) for the project will be an experienced civil engineer, licensed by the State of Connecticut. The individual or firm serving as the QAC will have a track record of successful landfill closures within the state. The QAC is responsible for coordinating the activities as presented in this QAP and will report to CRRA. The responsibilities of the QAC include:

- Providing written certification to the CT DEEP that sedimentation and erosion controls have been installed (provided prior to initiating construction)
- Reviewing and approving submittals made by the construction contractor
- Documenting construction and QAC activities
- Coordinating independent testing services where applicable
- Preparing a final closure certification report upon completion of the landfill closure activities

The QAC and the Engineer may be filled by one and the same entity.

2.2.5 Construction Contractor

The Construction Contractor is the individual or entity who will complete the proposed closure construction work. Pursuant to the contract documents, the Construction Contractor is referred to as the "Contractor" who will enter into an agreement with the Owner to successfully complete the work.

The Contractor is responsible for supervising and directing the work and solely responsible for the means, methods, techniques, sequences and procedures of construction in accordance with the contract documents. The Contractor is responsible for maintaining and supervising all safety precautions and programs and compliance with all applicable laws. The Contractor also maintains the record documentation, including those annotations made to the construction documents that reflect minor changes to the proposed work.

The Contractor is responsible for providing material submittals to the QAC in a timely manner for review prior to installation. He or she is also responsible for performing soil and geomembrane testing on capping materials as required to determine compliance with the

project specifications. A soil testing laboratory and a geomembrane testing laboratory approved by the QAC will be retained by the Contractor to provide the Contractor testing and reporting services. These documents will be submitted to the QAC to review for conformance with the requirements of the Contract Documents.

2.2.6 Land Surveyor

The Land Surveyor retained by the Construction Contractor will be a professional land surveyor who is legally qualified to practice in the State of Connecticut and who is experienced in providing land-surveying services of the kind required. The selected Land Surveyor will have a minimum of two years experience in construction surveying layout and preparation of as-built surveys in accordance with the specified horizontal and vertical control requirements.

2.3 Project Meetings

Project meetings are proposed throughout the course of the project. Meetings may or may not involve all the parties listed in the QAP. The intent of the meetings will be to establish lines of communication to report, control and resolve problems that could affect the quality of the work. The following meetings are proposed as part of this project.

2.3.1 Pre-Construction Meeting

Prior to any work being undertaken at the site, a meeting with the Owner, Contractor, Engineer, QAC, and CT DEEP will be held to establish a working understanding among the parties and to discuss the schedules listed in the contract documents (e.g., progress schedule and schedule of shop drawings). Other topics that will be discussed include the procedures for handling shop drawings, processing of applications for payment, and maintaining project record documents.

2.3.2 Project Progress Meetings

Progress meetings will be held bi-weekly (or more frequently as needed) at the site with the Owner, Contractor, Engineer, QAC and CT DEEP, as necessary, for the purposes of understanding the project's construction and administration progress. Meeting notes will be prepared and distributed to the attendees within five days.

2.3.3 Daily Meetings

Contractor will conduct daily "tailgate meetings" with the crew leaders, subcontractors, QAC, and owner, as required, for the purpose of reviewing daily construction schedule and resolving outstanding construction issues.

2.3.4 Corrective Action Meetings

Significant conditions adverse to quality may be identified during the course of the construction work by one or more of the parties involved with the project. The condition reported to be adverse will be analyzed by the reporting party to determine if it represents a significant condition adverse to quality. If determined to be significant, the Owner will then perform an analysis to determine if corrective action is required, and if necessary, hold a

meeting with the QAC, Contractor and others, as appropriate, to discuss the proper course of action.

3.0 OBSERVATION AND TESTING

3.1 General

Quality control includes testing and final observation of materials and workmanship before and during construction to assess compliance of the materials and workmanship with the final engineering design plans and specifications.

Detailed descriptions of the character and quality of material submittals, workmanship, and observation of the work will be presented in the contract documents. Technical specifications presented in the contract documents detail submittals, specific testing requirements and laboratory testing protocols in accordance with the American Society of Testing Materials (ASTM), the Connecticut Department of Transportation (ConnDOT) Standard Specifications for Roads, Bridges and Incidental Construction (Form 816), and other recognized standards. The Contractor's, QAC's and Owner's responsibilities concerning tests and observations, as well as correction, removal or acceptance of defective work will be presented in the Standard General Conditions of the Construction Contract presented in the contract documents.

3.1.1 Project Submittals

The Contractor will provide the QAC project submittals for review and approval in accordance with the contract documents. Before providing the project submittals, the Contractor will have determined and verified that the items contained in the submittal are acceptable for its intended use. The QAC will perform a timely review of the material submittal. Submittals determined to be deficient will be returned to the Contractor for corrections. Approved submittals will be returned to the Contractor for his use in maintaining the project record documents. Project record documents, which include a compilation of approved submittals and marked-up (i.e., red-lined) copies of the construction drawings and specifications, will be furnished to the QAC and Owner in connection with final payment at the time of contract closeout.

3.1.2 Testing and Reporting Requirements

There are testing and reporting requirements to verify the chemical and physical characteristics of materials and statements supporting the quality control of workmanship. Refer to the technical specifications for more detailed descriptions of the work to be performed and the testing/submittals required.

3.2 Disruption and Grading of Landfill Materials

This work will consist of the excavation, deposition, and compaction of existing on-site materials within the limits of the landfill necessary to prepare a suitable base for constructing the cap. The Contractor will provide odor control measures as needed including limiting areas of disturbance, covering exposed waste in a timely fashion, and/or applying odor control agents.

The Contractor will notify the QAC in writing one week prior to any excavation, disruption, or removal of deposited material, and submit an Odor Control Plan which will describe in narrative form proposed procedures in the event that odor control is required.

3.3 Cap Base Material

The following submittals, required for cap base material imported by the Contractor, will be made part of the quality control program prior to placing the cap base material layer:

A materials certificate stating that cap base material meets the technical specification prior to delivery of soil to the site. If material is obtained from more than one source, then a materials certificate will be submitted from each source.

- A grain size analysis (gradation), modified proctor test report, permeability test report, interface friction angle test report (for cap base/liner interface) and internal friction angle test report.

- RCRA 8 metals, PCB's, VOC's, SVOC's, Chlorinated Pesticides, ETPH analyses analytical testing reports.

The following testing, required of the Contractor, will be made part of the quality control program during placement of the cap base material layer:

- Compaction test reports immediately following field testing of material. Field testing will be measured with a Nuclear Density Gauge at a frequency of six tests per acre.

- Measurements of the cap base material thickness taken following compaction every 100 feet on center via Depth Test Holes.

- Grain size, modified proctor, permeability, interface friction angle(for cap base/liner interface), and internal friction angle test reports at a rate of at least once per 5,000 cubic yards of material delivered.

- Submit RCRA 8 metals, PCB's, VOC's, SVOC's, Chlorinated Pesticides, ETPH analyses analytical testing reports for Cap Base Material obtained at the source prior to delivery of the material to the landfill, and at a rate of at least once per 10,000 cubic yards delivered.

3.4 Geomembrane

This section is applicable for the installation of TPO geomembrane as well as the installation of Super Gripnet® geomembrane, which is a part of the Closure Turf™ system. The following submittals, required for geomembrane supplied by the Contractor, will be made part of the quality control program prior to placing the geomembrane:

- Brand information and Manufacturer Literature, including manufacturer's quality control test results for the batch and lot numbers of material supplied to the project.

- Product data, shop drawings, samples, calculations and details for each product or material used.
- Warranties for geomembrane material and installation workmanship.
- Installation contractor's name, qualifications, and project descriptions.
- Installation construction contractor superintendent's name and qualifications.
- Proposed panel layout drawing.
- Quality Control Plan

The following submittals shall be provided on a daily basis during the course of geomembrane installation:

- Cap base material layer surface conformation form signed by the installation contractor and the QAC representative.
- Trial seam test results.
- Destructive seam testing results.
- Vacuum testing results.
- Air testing results.

The following submittal shall be provided at the completion of the project.

- As-built panel layout record drawing indicating panel locations, numbers and repair locations.
- Installation Certificate from the installer documenting that the closure system has been installed in accordance with the manufacturer's instructions and warranty requirements.

3.5 Geocomposite

The following submittals, required for geocomposite supplied by the Contractor, will be made part of the quality control program at least 10 days prior to delivery of materials to the site:

- A sample of the proposed geocomposite
- Certification that the material meets the required specifications

3.6 Underdrains

The Contractor shall submit to the Engineer product data sheet and certification that the materials (perforated and solid-wall pipe and fittings, filter fabric sock, geotextile) meet the required specifications at least 10 days prior to delivery of materials to the site.

3.7 Geotextiles

The Contractor shall submit to the Engineer samples of the proposed geotextiles, and certification that the material meets the required specifications, at least 10 days prior to delivery of materials to the site.

3.8 Sand Ballast

The Contractor shall submit to the Engineer samples of the proposed sand ballast, and certification that the material meets the required specifications, at least 10 days prior to delivery of materials to the site.

The following testing, required of the Contractor, will be made part of the quality control program during placement of the cap base material layer:

- Submit measurements of the Sand Ballast thickness taken following installation, at a frequency of 20 measurements per acre, randomly determined by the Engineer.

- Submit RCRA 8 metals, PCB's, VOC's, SVOC's, Chlorinated Pesticides, ETPH analyses analytical testing reports for Sand Ballast obtained at the source prior to delivery of the material to the landfill, and at a rate of at least once per 10,000 cubic yards delivered.

3.9 Drainage Sand Layer

The following submittals, required for Barrier Protection Soil supplied by the Contractor, will be made part of the quality control program prior to and during placement of the Barrier Protection Soil:

- A materials certificate stating that cover material meets the technical specification as well as a grain size, permeability, modified proctor, interface friction(for sand/geocomposite interface) and internal friction angle test analysis prior to delivery of soil to the site. If material is obtained from more than one source, then the items will be submitted from each source.

- Grain size analysis (gradation), permeability analysis, modified proctor, interface friction angle and internal friction angle test reports at a rate of at least once per 5,000 cubic yards of material delivered.

- Submit RCRA 8 metals, PCB's, VOC's, SVOC's, Chlorinated Pesticides and ETPH analytical testing reports for Drainage Sand obtained at the source prior to delivery of the material to the landfill, and at a rate of at least once per 10,000 cubic yards delivered.

- Measurements of the barrier protection sand thickness taken following compaction (Two passes with a Caterpillar D-6 bulldozer) every 100 feet on center.

- Compaction test reports immediately following field testing of material. Field testing will be measured with a Nuclear Density Gauge at a frequency of six tests per acre. (Note: this testing is for record purposes only)

3.10 Vegetative Support Material

The following submittals, required of the Contractor, will be made part of the quality control program prior to and during placement of the vegetative support soil:

- For each source prior to delivery of the material to the site, a certified test report and certificate of conformance with the technical specification for vegetative support material, including grain size, organic content, deleterious material, cation exchange capacity, pH, mineral and plant-nutrient contentpesticide analysis, herbicide analysis, RCRA 8 metals analysis, and ETPH analysis.

- Submit certified test reports with grain size and organic content, deleterious material analyses, cation exchange capacity, mineral and plant-nutrient content, and pH at a rate of at least one per 5,000 cubic yards of material delivered.

- Submit RCRA 8 metals, PCB's, VOC's, SVOC's, Chlorinated Pesticides, Herbicides and ETPH analytical testing reports for vegetative support material at a rate of at least one per 10,000 cubic yards delivered or one per source if less than 10,000 cubic yards is obtained from any one source.

- Submit a certificate of conformance and product information for the fertilizer prior to delivery to the site.

- Submit a certificate of conformance and product information for the mulch prior to delivery to the site.

- Measurements of the vegetative support material thickness taken following final grading every 100 feet on center.

3.11 Turf Establishment

The following submittals, required of the Contractor, will be made part of the quality control program prior to commencement of turf establishment activities:

- A materials certification and copies of catalog cut sheets for review and acceptance for Inorganic Soil Amendments, Organic Soil Amendments, Seed, and erosion control blankets reflecting that they comply with the specifications.

- A hydroseed procedure and application rates for approval that includes the number of pounds of wood fiber mulch and tackifier to be used per one hundred (100) gallons

water. This statement will also specify the number of square feet of seeding that can be covered with the quantity of solution in the hydroseeder.
- Full and complete written maintenance instructions for proper care and development of seeded areas.

The following testing, required of the Contractor, will be made part of the quality control program during placement of the cap base material layer:

- Submit RCRA 8 metals, PCBs, VOCs, SVOCs, Chlorinated Pesticide, herbicide, and ETPH analytical testing reports for Organic Soil Amendments at a rate of at least one per 10,000 cubic yards delivered or one per source if less than 10,000 cubic yards is obtained from any one source.

3.12 Riprap

Prior to delivery of the riprap to the site, material certification of conformance with the specifications and one riprap sample per source meeting the requirements in the specification will be submitted.

3.13 Crushed Stone

A material certification of conformance with the specifications and a grain size analysis (gradation), one per source, will be submitted prior to delivery of the material to the site.

3.14 Gravel Surfacing, Bituminous Concrete Base and Subbase Materials

The following submittals, required for gravel surfacing, road base and subbase materials imported by the Contractor, will be made part of the quality control program prior to placing the material:

- A materials certificate stating that material meets the technical specification prior to delivery of soil to the site. If material is obtained from more than one source, then a materials certificate will be submitted from each source.

- A soil classification, grain size analysis (gradation), and modified proctor test results.

- RCRA 8 metals, PCB's, VOC's, SVOC's, Chlorinated Pesticides, ETPH analyses.

The following testing, required of the Contractor, will be made part of the quality control program during placement of the gravel surfacing, road base and subbase material layers:

- Soil classification, grain size analysis, and modified proctor test reports at a rate of at least once per 5,000 cubic yards of material delivered.

- Submit RCRA 8 metals, PCB's, VOC's, SVOC's, Chlorinated Pesticides, ETPH analytical testing reports for each material obtained at the source prior to delivery of the material to the landfill, and at a rate of at least once per 10,000 cubic yards delivered.

- Compaction test reports immediately following field testing of material. Field testing will be measured with a Nuclear Density Gauge at a frequency of one per 2,000 square feet of roadway per layer.

3.15 Bituminous Concrete

The Contractor shall submit job-mix design and material certification for each type of bituminous concrete and auxiliary material indicated to the Engineer at least 10 days prior to delivery of materials to the site.

Submit In-place density test results to the Engineer at a rate of one per 1,000 square yards of bituminous pavement installed.

3.16 Portland Cement Concrete

The Contractor shall submit job-mix design and material certification for each type of Portland cement concrete and product indicated to the Engineer at least 10 days prior to delivery of materials to the site.

Obtain one composite sample for each day's pour of each concrete mix exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof. Submit to the Engineer for testing.

3.17 General Fill

The following submittals, required of the Contractor, will be made part of the quality control program prior to delivery of the material to the site:

- A material certification of conformance with the specifications, a grain size analysis (gradation), classification, and a modified proctor analysis, one per source, internal friction angle test reports.

- RCRA 8 metals, PCB's, VOC's, SVOC's, Chlorinated Pesticides, ETPH analyses analysis, one per source.

The following testing, required of the Contractor, will be made part of the quality control program during placement of General Fill:

- Grain size analysis, classification, modified proctor analysis, and internal friction angle testing, one per 5,000 CY delivered to the site.

- Submit RCRA 8 metals, PCB's, VOC's, SVOC's, Chlorinated Pesticides, ETPH analytical testing reports, one per 10,000 CY delivered to the site.

- Compaction test results at a frequency of six per acre per lift, reported daily as placed and compacted.

3.18 Geogrid

The Contractor shall submit to the Engineer product data sheet, shop drawings, samples, and certification that the materials) meet the required specifications at least 10 days prior to delivery of materials to the site.

- Submit inventory tickets for each source and each batch delivered to the site.
- Installation Certificate from the installer documenting that the closure system has been installed in accordance with the manufacturer's instructions and warranty requirements.

3.19 Miscellaneous

The Contractor shall submit to the Engineer product data sheet and certification that the materials meet the required specifications at least 10 days prior to delivery of materials to the site (including silt fence, catch basin inserts, Floc Logs, warning tape, landfill limit marker, chain link fence and gates, Landfill Gas Piping).

4.0 REPORTING AND DOCUMENTATION

4.1 General

Documentation consists of the design drawings, approved submittals, addenda, change orders, written clarifications, and all other data required by the contract documents. In addition, documentation prepared by the QAC will include daily field reports, independent laboratory test results (where applicable), and photographs of pertinent phases of the construction.

4.2 Project Record Documents

As specified in the contract documents, record documents will be maintained by the Contractor in a safe place at the site and will be annotated to show changes made during construction. The documents will be made available to the Owner and QAC for reference during construction. Upon final completion of the work, the project record documents will be delivered to the QAC for the Owner in connection with final payment.

4.3 Final Certification Report

The QAC will prepare a report that documents the closure was conducted in general conformance with the approved plans and specifications. The report will include copies of daily field reports, testing results and as-built plans. The report will be submitted to the CT DEEP upon completion of the landfill closure activities.

4.4 As-Built Drawings

In accordance with RCSA 22a-209-13(f), the CRRA will submit to the CT DEEP as-built site drawings certified by a professional engineer licensed in the State of Connecticut that grading and closure have been completed as specified in the approved closure plan. The as-built drawings will be submitted to the CT DEEP within ninety (90) days of completing the landfill closure. The drawings and a detailed description of the landfill will be recorded in the land records of the City of Hartford and a certified copy of the recording will be forwarded to the CT DEEP.

TABLES

TABLE 1
TESTING/REPORTING SUMMARY

Construction Task/Product	Test/Submittal	Frequency
Landfill Disruption/ Regrading	Odor Control Plan	Once: one week prior to disruption
Cap Base Material	Materials certification & Origin	One per source: prior to delivery
	Gradation, classification permeability, modified proctor interface friction angle and internal friction angle reports	One per source prior to delivery & one per 5,000 CY delivered
	RCRA 8 metals, PCBs, VOCs, SVOCs, Chlorinated Pesticides & ETPH analyses	One per source prior to delivery & one per 10,000 CY delivered
	Compaction test results	6 per acre
	Cap base Depth Test Holes	100' on center
Geomembrane	Material Quality Control Certificates and Manufacturer's factory QC results	Per delivery: Prior to installation
	Product Data, Shop Drawings, Calculations & Details (each product/material)	Prior to installation
	Warranties: Material and Workmanship	Prior to installation
	Installation contractor qualifications	Prior to installation
	Installation superintendent qualifications	Prior to installation
	Proposed panel layout drawing	Prior to installation
	Cap base surface conformation form	Daily prior to work
	Samples	As requested by the QAC
	Trial seam test results	Daily
	Destructive seam test results	One per 1,000 linear feet
	Daily Examination Reports	Daily
	Vacuum test results	Daily
	Air test results	Daily
	Installation Certificate & Record Drawings	Subsequent to Installation
Geocomposite	Material sample, certification	Prior to delivery
Underdrains	Product data sheet and material certification (Perforated and soild-wall pipe and fittings, filter fabric sock, geotextile)	Prior to installation
Geotextiles	Material certification and sample	One per geotextile specified: Prior to installation
Sand Ballast	Gradation, classification & permeability	One per source prior to delivery & one per 5,000 CY delivered
	RCRA 8 metals, PCBs, VOCs, SVOCs, Chlorinated Pesticides & ETPH analyses	One per source prior to delivery & one per 10,000 CY delivered
	Materials certification & Product Information	One per source: prior to delivery
	Sand ballast thickness	20 per acre; randomly determined by Engineer
Drainage Sand	Grain Size (Gradation), classification, permeability, modified proctor, interface friction angle and internal friction angle reports	One per source prior to delivery & one per 5,000 CY delivered
	Compaction test results	6 per acre
	RCRA 8 metals, PCBs, VOCs, SVOCs, Chlorinated Pesticides & ETPH analyses	One per source prior to delivery & one per 10,000 CY delivered
	Drainage Sand Depth Test Holes thickness	100' on center
	Material Certification for soil	One per source: prior to delivery
Vegetative Support Material	RCRA 8 metals, PCBs, VOCs, SVOCs, Chlorinated Pesticides, Herbicides & ETPH	One per source prior to delivery and one per 10,000 CY delivered

Construction Task / Product	Test / Submittal	Frequency
	Grain size analysis, organic content, deleterious material, pH, cation exchange cap., mineral and plant-nutrient content and internal friction angle test report	One per source prior to delivery, and one per 5,000 CY delivered
	Fertilizer Certification	Prior to delivery
	Mulch Certification	Prior to delivery
	Vegetative Support Material thickness	100' on center
	Material certification and catalog cuts for Inorganic Soil Amendments, Organic Soil Amendments, Seed, erosion control blankets	Prior to installation
Turf Establishment	Hydroseed procedure, application rates	Prior to application
	Organic Soil Amendment RCRA 8 metals, PCBs, VOCs, SVOCs, Chlorinated Pesticides, Herbicides & ETPH analyses	One per source prior to delivery
	Maintenance instructions	Prior to installation
	Material certification and sample	Prior to installation
Riprap	Material certification, Origin, Sample & Grain Size (Gradation)	One per source: prior to delivery, and one per 5,000 CY delivered prior to installation
Crushed Stone	Material certification, grain size analysis (Gradation), Classification, modified proctor analysis	For each type of material, one per source: prior to delivery, and one per 5,000 CY delivered
Gravel Surfacing, Bituminous Concrete Base, and Subbase Material	RCRA 8 metals, PCBs, VOCs, SVOCs, Chlorinated Pesticides & ETPH analyses	One per source prior to delivery and one per 10,000 CY delivered
	Compaction test results	One per 2,000 square feet per layer
	Job Mix Design	Prior to installation
Bituminous Concrete	Material Certificates (Bituminous Concrete, Auxiliary Materials including Pavement Marking Paint)	Prior to installation
	In-place density test results	One per 1,000 square yards
	Job Mix Design	Prior to installation
Portland Cement Concrete	Material Certificates for each product used.	Prior to installation
	Composite Samples of each day's pour	One per daily pour.
	Material certification & Origin, grain size analysis (gradation), modified proctor analysis, internal fiction angle reports	One per source: prior to delivery, and one per 5,000 CY delivered
General Fill	Grain size analysis (Gradation), classification, modified proctor analysis, and internal friction angle testing	One per source prior to delivery & one per 5,000 CY delivered
	RCRA 8 metals, PCBs, VOCs, SVOCs, Chlorinated Pesticides & ETPH analyses	One per source prior to delivery & one per 10,000 CY delivered
	Compaction test results	6 per acre
	Material certification, Shop Drawings, Sample, Inventory Tickets, Installation Certification)	One per source: prior to Delivery
Geogrid	Product Data, Manufacturer Certificates of Compliance, and sample	Prior to installation
Miscellaneous	Product Data & Manufacturer Certificates of Compliance (Silt Fence, Catch Basin Inserts, Floc Logs, Warning tape, Landfill Limit Marker, Chain Link Fence & Gates, Landfill Gas Piping)	Prior to installation

FIGURES

Project Organization Chart

Quality Assurance Plan
Phase II MSW Area Closure
& Photovoltaic System Project
Hartford Landfill
Hartford, Connecticut
March 2013

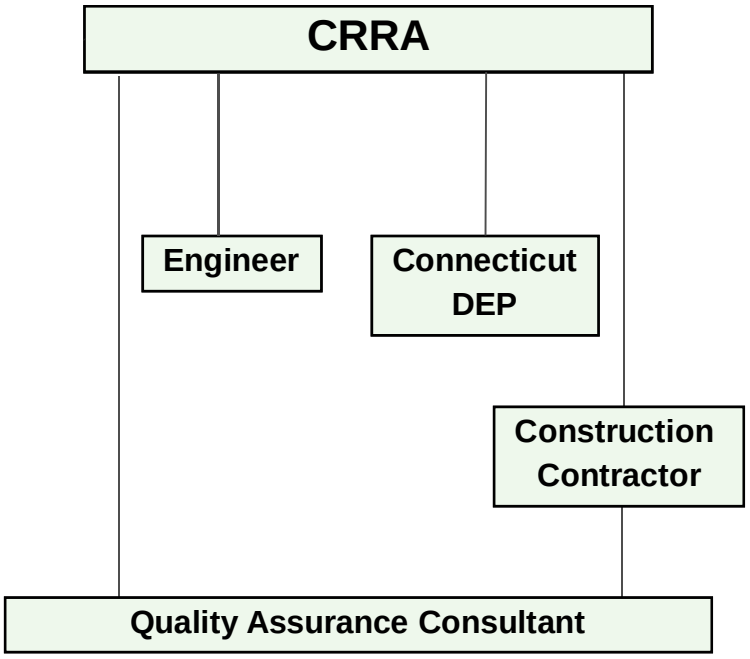


Figure 1

FUSS & O'NEILL
Disciplines to Deliver

EXHIBIT D

PROJECT SCHEDULE

Completion Date: A total of one hundred (100) days are allowed to complete the Work and have such Work ready for acceptance by CRRA. Contractor shall commence performance of the Work upon CRRA's issuance to Contractor of the Notice To Proceed pursuant to Section 4.2 of the Agreement. Substantial completion of the work shall include: complete installation of the membrane cap and associated drainage systems and complete installation, approval by CL&P, and interconnection of the solar photovoltaic system.

After work is substantially complete, within 30 days Contractor shall furnish CRRA with all documents required by the Agreement, including but not limited to, As-Built Drawings, Warranties, Operation and Maintenance Manuals, and any other document required by the Agreement.

COMPENSATION SCHEDULE

[The Proposer's "Proposal Payment Rate Schedule Form" that was submitted to CRRA by the Proposer with its Proposal, as such Form may be modified based on negotiations between CRRA and Proposer over prices, will be added by CRRA.]

CONNECTICUT RESOURCES RECOVERY AUTHORITY

TRAVEL POLICY AND EXPENSE REPORTING

BOARD OF DIRECTORS POLICY AND PROCEDURE NUMBER 032

APPROVED BY CRRA BOARD OF DIRECTORS SEPTEMBER 29, 2005

TABLE OF CONTENTS

CONNECTICUT RESOURCES RECOVERY AUTHORITY
TRAVEL POLICY AND EXPENSE REPORTING

1. GENERAL STATEMENT

This Travel Policy and Expense Reporting guide presents the policies that all CRRA employees (hereafter "employee(s)") must adhere to in the planning and conducting of their business travel and their reimbursement requests. CRRA requires that all travel expenditures and their accountings meet the Internal Revenue Service requirements of "ordinary, necessary and reasonable" and should be conservative and consistent with the nature of the business assignment. These policies safeguard CRRA and protect the employee from being assessed additional taxable income. All employees are expected to fully comply with the policies and instructions in this guide. Reimbursements for actual and necessary expenses made to Directors of CRRA shall be made consistent with the provisions of this Travel Policy And Expense Reporting guide; however, as stated in the Connecticut General Statutes, Directors shall not be required to obtain pre-approval from the President for any expenses.

2. APPROVALS

Prior written approval by the President or the employee's Division Head at least one (1) week in advance is required for all overnight trips out of state, except in an emergency. It is the obligation of the employee to obtain this prior approval and no reimbursement will be made without this approval.

Prior written approval by the President or the employee's Division Head at least one (1) week in advance is required for all employee trips that are for educational seminars, professional conferences, vendor-initiated field trips, and industry organization events.

To obtain written approval, the employee must complete the overnight travel form, and, if a cash advance is requested, complete a cash advance form that estimates the out-of-pocket expenses, and submit the competed form(s) to the appropriate Division Head or President in as far in advance as possible of departure date.

3. TRANSPORTATION

Transportation expenses should be kept to a minimum. The most direct and practical route should be selected.

3.1 Rental Automobile

Rental car expenses will be paid by CRRA and whenever possible should be billed directly to CRRA to take advantage of CRRA's tax-exempt status and any other discounts available to CRRA.

3.1.1 Insurance

3.1.1.1 Business Use Of A Rental Automobile

Employees on business do not need to purchase additional insurance coverage (collision damage waiver or excess liability) from the rental company. The Corporate Insurance Program covers these risks. Please note that all vehicles must be rented in CRRA's name to have CRRA's policy cover the employee.

3.1.1.2 Personal Use Of A Rental Automobile

Employees are prohibited from using a CRRA rental automobile for personal use. Personal use that is incidental to CRRA business use will be covered by the CRRA insurance policy as long as the vehicle was rented in CRRA's name. Incidental usage is defined as usage of the vehicle that is directly related to business usage (e.g. mileage to get meals on a business trip).

3.2 Business Use Of Employee's Car

3.2.1 Reimbursement Rate

The reimbursement rate for an employee's use of their personal automobile for CRRA business is the IRS approved rate, as adjusted from time to time by the IRS, for employee use of their personal car on business. The above mileage reimbursement allowance for business use of an employee's vehicle is calculated in a manner that takes into account all auto-related expenses, including the cost of carrying insurance (without a deductible). Therefore, CRRA will not reimburse an employee for vehicle damage or personal liability that occurs while a personal automobile is being used on CRRA business if the employee drives their personal vehicle 2,500 miles per year or more. This includes any deductible that may apply. However, if an employee's vehicle is driven on company business 2,500 miles or less annually, and is involved in a motor vehicle accident, CRRA will reimburse the employee through the normal expense reimbursement process for their physical damage deductible up to a maximum of $500.00 per accident. Evidence of the payment of the deductible by the employee must be provided to CRRA in order to receive reimbursement. (Traveling on business does not include any travel involved in commuting to or from work, lunch time errands or anything other than authorized business use). Before an employee seeks the foregoing reimbursement for the use of his personal automobile, the

employee shall provide CRRA with written evidence of his personal automobile insurance with limits as required by the Connecticut General Statutes. The foregoing written proof shall be kept on file in the CRRA Finance Division.

3.2.2 Mileage Calculation

In all travel away from the CRRA office, the employee will be reimbursed using the shortest distance between points. For travel from Hartford to a CRRA facility, the President shall cause the shortest distance to be determined and the President shall cause such determination to be made available to employees. Unless approved by an employee's Division Head, employees shall use the distances determined by the President in all requests for reimbursement for travel from Hartford to a CRRA facility. An employee may request and the employee's Division Head may approve distances other than those determined by the President in extraordinary circumstances when, for reasons beyond the control of the employee, the route of the shortest distance was not reasonably available for use.

In calculating mileage, the normal commute mileage to and from the employee's home to the employee's assigned place of work must be deducted from the total trip mileage. For example, if the total trip mileage equals 100 miles, and normal commute mileage equals 20 miles, CRRA will reimburse the employee for 80 miles. This is in accordance with Internal Revenue Service and State of Connecticut policy.

3.2.3 Tolls/Parking

No receipts are necessary for tolls or parking unless they exceed five ($5.00) dollars.

3.3 Air Travel

All air travel requires prior approval from the CRRA President. For approved travel, CRRA will reimburse employees only for coach accommodations. Employees are encouraged to inquire about discount packages and to take advantage of the least costly route whenever possible. When an employee plans a trip, the reservations should be made as far in advance as practical to obtain the lowest rate. All approved air travel for the previous month shall be reported to the CRRA Board of Directors at its next Board Meeting.

3.4 Taxis

Taxi service may be used when no other form of public transportation is available or when the cost of a taxi is close to the cost of public transportation. Employees are encouraged to use courtesy cars, airport limousines, or buses whenever possible. Since some taxi services do not provide receipts, you should have the back of your business card signed, dated, and the amount of the fare indicated by the driver.

3.5 CRRA Owned Automobiles

Please refer to the CRRA Vehicle Usage Policy adopted by the CRRA Board of Directors at its November 21, 2003, Board of Directors Meeting.

4. MEALS

Permissible expenditures for meals and tips depend on location and circumstances. Only reasonable and customary charges will be allowed and reimbursed by CRRA. An exception may be granted by the President in unusual circumstances. In-state breakfast, lunch, and dinner will not be reimbursed unless they involve a business meeting.

5. LODGING

Lodging accommodations in reasonable and economically priced single occupancy rooms, including customary tips, are reimbursable if the employee has to stay away from home overnight because of unfinished business or an early morning business meeting.

Employees should request government rates at the time of making reservations.

6. INCIDENTALS

The incidentals allowance encompasses such things as gratuities and one telephone call a day of reasonable duration to the employee's home. It is anticipated that the cost of such calls generally will appear on the employee's hotel bill.

7. PERSONAL EXPENSES

Some travel expenses are considered personal and CRRA will not reimburse them. The following, while not all inclusive, lists examples of such personal expenses that are not reimbursable expenses: amusements, athletic events, barbers, books for personal reading, athletic court or gym costs, damage to luggage, fines, hair stylists, magazines, newspapers, movies, and saunas.

8. OTHER BUSINESS EXPENSES

With prior approval of the President, CRRA will reimburse an employee for the incidental costs necessary to further an important CRRA business purpose. Any foregoing expense must be reported to the Board at the Board's next Board of Directors meeting. Any such expense must be documented by showing the following:

- The name(s) of the person or persons and the location and nature of the expense.
- The business relationship with CRRA.
- The specific business reason for the expense.
- The actual business conducted.

CRRA will not reimburse the cost of home entertaining.

9. EXPENSE REPORTING

All expense reporting must be submitted to CRRA using the CRRA expense reimbursement form(s) within twenty working days after the day the employee returns from his/her trip.

10. RECEIPTS

Employees shall obtain receipts for all travel expenses, exclusive of mileage reimbursement. This includes receipts for all meals, airfare, bus fare, taxi, toll or parking charges in excess of $5.00 dollars, limousine, hotel, and registration fees. Travel expenses in excess of the stated guidelines herein will be reimbursed only if all receipts accompany expense vouchers. Expenses submitted without a receipt, except for gratuity and certain transfer charges, may not be reimbursed.

Original receipts are required for all entertainment.

11. EXCEPTIONS

Exceptions to these travel and expense guidelines will be authorized only upon the prior authorization of President when the circumstances warrant. Any such exception to these travel and expense guidelines should be documented and the President should notify the CRRA Board of Directors of such exception at the Board's next Board Meeting.

ORIGINAL

Approved by: Board of Directors
Effective Date: 05/20/04

REVISION 1

Prepared by: Jim Bolduc, Chief Financial Officer
Approved by: Board of Directors
Effective Date: 09/29/05

PERFORMANCE BOND

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable. The below addresses are to be used for giving required notice.

CONTRACTOR (Name and Address):	**SURETY** (Name and Principal Place of Business):

OWNER (Name and Address):

Connecticut Resources Recovery Authority
100 Constitution Plaza, 6th Floor
Hartford, CT 06103-1722

AGREEMENT

DATE:	
AGREEMENT NUMBER:	
AMOUNT:	$
PROJECT DESCRIPTION (Including Name and Location):	PHASE II MSW AREA CLOSURE AND POTOVOLTAIC SYSTEM PROJECT - CRRA HARTFORD LANDFILL Connecticut Resources Recovery Authority 100 Constitution Plaza, 6th Floor Hartford, Connecticut 06103

BOND

BOND NUMBER:	
DATE: (Not earlier than Agreement Date)	
AMOUNT:	DOLLARS ($)

IN WITNESS WHEREOF, Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on Pages 2 and 3 hereof, do each cause this Performance Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL		**SURETY**	
	(SEAL)		(SEAL)
Contractor's Name and Corporate Seal		Surety s Name and Corporate Seal	
SIGNATURE:		**SIGNATURE:**	
NAME AND TITLE:		**NAME AND TITLE:**	

TERMS AND CONDITIONS TO PERFORMANCE BOND

1. The Contractor and the Surety jointly and severally bind themselves, their heirs, executors, administrators, successors and assigns to the Owner for the performance of the foregoing Agreement, the terms of which are incorporated herein by reference. Any singular reference to the Contractor, the Surety, the Owner or any other party herein shall be considered plural where applicable.

2. If the Contractor performs the Agreement, the Surety and the Contractor shall have no obligation under this Bond, except to participate in conferences as provided in Subparagraph 3.1.

3. If there is no Owner Default (as hereinafter defined), the Surety's obligation under this Bond shall arise after:

   3.1 The Owner has notified the Contractor and the Surety at its address described in Paragraph 10 below, that the Owner is considering declaring a Contractor Default (as hereinafter defined) and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than fifteen (15) days after the receipt of such notice to discuss methods of performing the Agreement. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Agreement, but such an agreement shall not waive the Owner's right, if any, to subsequently declare a Contractor Default; and

   3.2 The Owner has declared a Contractor Default (as hereinafter defined) and formally terminated the Contractor's right to complete the Agreement. Such Contractor Default shall not be declared earlier than twenty (20) days after the Contractor and the Surety have received notice as provided in Subparagraph 3.1.

   3.3 The Owner has agreed to pay the Balance of the Agreement Price to the Surety in accordance with the terms of the Agreement or to a contractor selected to perform the Agreement in accordance with the terms of the agreement with the Owner.

4. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:

   4.1 Arrange for the Contractor, with the consent of the Owner, to perform and complete the Agreement; or

   4.2 Undertake to perform and complete the Agreement itself, through its agents or through independent contractors; or

   4.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Agreement, arrange for a contract to be prepared for execution by the Owner and the contractor selected with the Owner's concurrence, to be secured with a performance bond executed by a qualified surety equivalent to the bond issued on the Agreement, and pay to the Owner the amount of damages described in Paragraph 6; or

   4.4 Waive its right to perform and complete, arrange for completion or obtain a new contractor and with reasonable promptness under the circumstances:

      4.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, tender payment therefor to the Owner; or

      4.4.2 Deny liability in whole or in part and notify the Owner citing reasons therefor.

5. If the Surety does not proceed as provided in Paragraph 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond fifteen (15) days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Subparagraph 4.4 and the Owner refuses the payment tendered or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

6. After the Owner has terminated the Contractor's right to complete the Agreement, and if the Surety elects to act under Subparagraph 4.1, 4.2 or 4.3 above, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Agreement, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Agreement. To the limit of the amount of this Bond, the Surety is obligated without duplication for:

   6.1 The responsibilities of the Contractor for correction of defective work and completion of the Agreement;

   6.2 Additional legal and delay costs resulting from the Contractor's Default and resulting from the actions or failure to act of the Surety under Paragraph 4; and

   6.3 Liquidated damages, or if no liquidated damages are specified in the Agreement, actual damages caused by delayed performance or non-performance of the Contractor.

7. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Agreement. No right of action shall accrue on this Bond to any person or entity other than the Owner or its successors and assigns.

8. The Surety hereby waives notice of any change, including changes of time, to the Agreement or to

related subcontracts, purchase orders and other obligations.

9. Any proceeding, legal or equitable, under this Bond may be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and shall be instituted within two (2) years after Contractor Default or within two (2) years after the Contractor ceased working or within two (2) years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

10. Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page of this Bond.

11. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the Agreement was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted here from and provisions confirming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

12. Definitions.

    12.1 Balance of the Agreement Price: The total amount payable by the Owner to the Contractor under the Agreement after all proper adjustments have been made, including allowance to the Contactor of any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Agreement.

    12.2 Agreement: The agreement between the Owner and the Contractor identified on the signature page, including all Agreement Documents and changes thereto.

    12.3 Contractor Default: Failure of the Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with any of the terms of the Agreement, including any failure of the Contractor to perform its warranty obligations.

    12.4 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Agreement or to perform and complete or comply with the other terms hereof.

13. Notwithstanding anything to the contrary, including any limitations that would otherwise apply under Paragraph 9 above, this bond shall apply to the Contractor's warranty obligations under Specification Section 01740.G for a period of five (5) years from the acceptance date.

LETTER OF CREDIT

To Be Issued By a Connecticut Bank Or By a National Banking Association

Irrevocable Standby Letter Of Credit No.	**[Letter Of Credit #]**		
Issuance Date:	**[Date]**	Expiration Date:	**[Date]**
Beneficiary:	Connecticut Resources Recovery Authority 100 Constitution Plaza, 6th Floor Hartford, CT 06103		

Gentlemen:

We hereby establish our Irrevocable Standby Letter Of Credit No. **[Letter Of Credit #]** in favor of the "Beneficiary," Connecticut Resources Recovery Authority ("CRRA"), at the request and for the account of **[Name of Contractor]**, for the sum or sums up to the aggregate amount of $_____(_____ Dollars) available for payment against your draft(s) at sight on us.

Drafts must be drawn and presented to us at this office not later than our close of business on **[Date]** or any duly extended expiration date, and each draft must bear the following clause: "Drawn Under Letter Of Credit No. **[Letter Of Credit #]**."

Drafts must be accompanied by a certified statement from the Beneficiary that **[name of Contractor]** has failed to satisfy or perform one or more of its obligations or breached one or more of its covenants or representations under a certain Agreement For PHASE II MSW AREA CLOSURE AND POTOVOLTAIC SYSTEM PROJECT - CRRA HARTFORD LANDFILL Work For Connecticut Resources Recovery Authority Landfills between **[name of Contractor]** and CRRA, dated as of **[Date]**.

Partial drawings hereunder are permitted.

We hereby agree with you that drafts drawn under and in compliance with the above terms of this Letter Of Credit shall be duly and promptly honored on due presentation and delivery to us on or before the above-referenced expiration date or any duly extended expiration date.

The term "Beneficiary" includes any successor by operation of law of the named Beneficiary including, without limitation, any liquidator, rehabilitator, receiver or conservator.

Except as expressly stated herein, this undertaking is not subject to any agreement, condition or qualification. The obligation of **[name of the issuing Connecticut Bank or National Banking Association]** under this Letter of Credit is the individual obligation of **[name of the issuing Connecticut Bank or National Banking Association]** and is in no way contingent upon reimbursement with respect thereto.

It is a condition of this Letter Of Credit that it is deemed to be automatically extended without amendment for one (1) year from the expiration date stated above, or any future expiration date, unless not later than ninety (90) days prior to the expiration date stated above or the then current expiration date we notify you by registered mail that we elect not to renew this Letter Of Credit for any such additional period.

We hereby agree that all drafts drawn under and in compliance with the terms of this Letter Of Credit shall be duly honored by us at your first demand, notwithstanding any contestation or dispute between you and **[name of Contractor]**, if presented to us in accordance with the provisions hereof.

This Letter of Credit is subject to and governed by the laws of the State of Connecticut, the decisions of the courts of that state, and the Uniform Customs and Practice for Documentary Credits (1993 Revision) International Chamber of Commerce Publication No. 500 and in the event of any conflict, the laws of the State of Connecticut and the decisions of the courts of that state will control. If this Letter Of Credit expires during an interruption of business of this bank as described in Article 17 of said Publication 500, **[name of issuing Connecticut Bank or National Banking Association**] hereby specifically agrees to effect payment if this Letter of Credit is drawn against within thirty (30) days after the resumption of business from such interruption.

Very truly yours,

_____

Authorized Signature for
[name of issuing Connecticut Bank or National Banking Association]

CONSTRUCTION PAYMENT BOND

Any singular reference to Contractor, Surety, Owner or other party shall be considered plural where applicable. The below addresses are to be used for giving required notice.

CONTRACTOR (Name and Address):	**SURETY** (Name and Principal Place of Business):

OWNER (Name and Address):

Connecticut Resources Recovery Authority
100 Constitution Plaza, 6th Floor
Hartford, CT 06103-1722

AGREEMENT

DATE:	
AGREEMENT NUMBER:	
AMOUNT:	$
PROJECT DESCRIPTION (Including Name and Location):	PHASE II MSW AREA CLOSURE AND POTOVOLTAIC SYSTEM PROJECT - CRRA HARTFORD LANDFILL Connecticut Resources Recovery Authority 100 Constitution Plaza, 6th Floor Hartford, Connecticut 06103

BOND

BOND NUMBER:	
DATE: (Not earlier than Agreement Date)	
AMOUNT:	DOLLARS ($)

IN WITNESS WHEREOF, Surety and Contractor, intending to be legally bound hereby, subject to the terms printed on Pages 2 and 3 hereof, do each cause this Payment Bond to be duly executed on its behalf by its authorized officer, agent, or representative.

CONTRACTOR AS PRINCIPAL		**SURETY**	
	(SEAL)		(SEAL)
Contractor's Name and Corporate Seal		Surety s Name and Corporate Seal	
SIGNATURE:		**SIGNATURE:**	
NAME AND TITLE:		**NAME AND TITLE:**	

TERMS AND CONDITIONS TO CONSTRUCTION PAYMENT BOND

1. The Contractor and the Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors and assigns to the Owner to pay for labor, materials and equipment furnished for use in the performance of the Agreement, which is incorporated herein by reference.

2. With respect to the Owner, this obligation shall be null and void if the Contractor:

   2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and

   2.2 Defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity whose claim, demand, lien or suit is for the payment for labor, materials or equipment furnished for use in the performance of the Agreement, provided the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety, and provided there is no Owner Default.

3. With respect to Claimants, this obligation shall be null and void if the Contractor promptly makes payment, directly or indirectly, for all sums due.

4. The Surety shall have no obligation to Claimants under this Bond until:

   4.1 Claimants who are employed by or have a direct contract with the Contractor have given notice to the Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

   4.2 Claimants who do not have a direct contract with the Contractor:

      4.2.1 Have furnished written notice to the Contractor and sent a copy, or notice thereof to the Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and

      4.2.2 Have either received a rejection in whole or in part from the Contractor, or not received within 30 days of furnishing the above notice any communication from the Contractor by which the Contractor has indicated the claim will be paid directly or indirectly; and

      4.2.3 Not having been paid within the above 30 days, have sent a written notice to the Surety (at the address described in Paragraph 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to the Contractor.

5. If a notice required by Paragraph 4 is given by the Owner to the Contractor or to the Surety, that is sufficient compliance.

6. When the Claimant has satisfied the conditions of Paragraph 4, the Surety shall promptly and at the Surety's expense take the following actions:

   6.1 Send an answer to the Claimant, with a copy to the Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

   6.2 Pay or arrange for payment of any undisputed amounts.

7. The Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

8. Amounts owed by the Owner to the Contractor under the Agreement shall be used for the performance of the Agreement and to satisfy claims, if any, under any Performance Bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Agreement are dedicated to satisfy obligations of the Contractor and the Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.

9. The Surety shall not be liable to the Owner, Claimants or others for obligations of the Contractor that are unrelated to the Agreement. The Owner shall not be liable for payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligations to make payments to, give notices on behalf of, or otherwise have obligations to Claimants under this Bond.

10. The Surety hereby waives notice of any change, including changes of time, to the Agreement or to related subcontracts, purchase orders and other obligations.

11. No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the work or part of the work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Subparagraph 4.1 or Clause 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Agreement, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by

law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

12. Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page. Actual receipt of notice by Surety, the Owner or the Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement shall be deemed deleted herefrom and provisions conforming to such statutory or other legal requirement shall be deemed incorporated herein. The intent is that this Bond shall be construed as a statutory bond and not as a common law bond.

14. Upon request by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor shall promptly furnish a copy of this Bond or shall permit a copy to be made.

15. Definitions

    15.1 Claimant: An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Agreement. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Agreement, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished,

    15.2 Agreement: The agreement between the Owner and the Contractor identified on the signature page, including all Agreement Documents and changes thereto.

    15.3 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Agreement or to perform and complete or comply with the other terms thereof.

CONNECTICUT DEPARTMENT OF LABOR
WAGE AND WORKPLACE STANDARDS DIVISION

CONTRACTORS WAGE CERTIFICATION FORM

I,_____ of _____
Officer, Owner, Authorized Rep. Company Name

do hereby certify that the _____
Company Name

_____
Street

_____
City

and all of its subcontractors will pay all workers on the

_____
Project Name and Number

_____
Street and City

the wages as listed in the schedule of prevailing rates required for such project (a copy of which is attached hereto).

_____
Signed

Subscribed and sworn to before me this _____ day of _____, 20___ .

_____
Notary Public

Return to:

Connecticut Department of Labor
Wage & Workplace Standards Division
200 Folly Brook Blvd.
Wethersfield, CT 06109

Project: Phase II MSW Area Closure And Photovoltaic System

Minimum Rates and Classifications for Heavy/Highway Construction

Connecticut Department of Labor
Wage and Workplace Standards Division

ID#: **H** 17474

By virtue of the authority vested in the Labor Commissioner under provisions of Section 31-53 of the General Statutes of Connecticut, as amended, the following are declared to be the prevailing rates and welfare payments and will apply only where the contract is advertised for bid within 20 days of the date on which the rates are established. Any contractor or subcontractor not obligated by agreement to pay to the welfare and pension fund shall pay this amount to each employee as part of his/her hourly wages.

Project Number:
FAP Number:
Project Town Hartford
State Number:
Project: Phase II MSW Area Closure And Photovoltaic System

CLASSIFICATION	Hourly Rate	Benefits
01) Asbestos/Toxic Waste Removal Laborers: Asbestos removal and encapsulation (except its removal from mechanical systems which are not to be scrapped), toxic waste removers, blasters. **See Laborers Group 5 and 7**		
1) Boilermaker	33.79	34% + 8.96
1a) Bricklayer, Cement Masons, Cement Finishers, Plasterers, Stone Masons	32.50	24.55
2) Carpenters, Piledrivermen	29.65	21.00

As of: Monday, February 25, 2013

Project: Phase II MSW Area Closure And Photovoltaic System

2a) Diver Tenders	29.65	21.00
3) Divers	38.11	21.00
4) Painters: (Bridge Construction) Brush, Roller, Blasting (Sand, Water, etc.), Spray	42.75	16.90
4a) Painters: Brush and Roller	30.22	16.90
4b) Painters: Spray Only	33.22	16.90
4c) Painters: Steel Only	30.47	15.40
4d) Painters: Blast and Spray	33.22	16.90

As of: Monday, February 25, 2013

Project: Phase II MSW Area Closure And Photovoltaic System

4e) Painters: Tanks, Tower and Swing	32.22	16.90
5) Electrician (Trade License required: E-1,2 L-5,6 C-5,6 T-1,2 L-1,2 V-1,2,7,8,9)	37.10	22.12
6) Ironworkers: (Ornamental, Reinforcing, Structural, and Precast Concrete Erection)	33.50	27.98 + a
7) Plumbers (Trade License required: (P-1,2,6,7,8,9 J-1,2,3,4 SP-1,2) and Pipefitters (Including HVAC Work) (Trade License required: S-1,2,3,4,5,6,7,8 B-1,2,3,4 D-1,2,3,4 G-1, G-2, G-8, G-9)	38.67	25.56

----LABORERS---- - Last updated 4/11/12

8) Group 1: Laborer (Unskilled), Common or General, acetylene burner, concrete specialist	25.80	16.45
9) Group 2: Chain saw operators, fence and guard rail erectors, pneumatic tool operators, powdermen, air tool operator	26.05	16.45

As of: Monday, February 25, 2013

Project: Phase II MSW Area Closure And Photovoltaic System

10) Group 3: Pipelayers	26.30	16.45
11) Group 4: Jackhammer/Pavement breaker (handheld); mason tenders (cement/concrete), catch basin builders, asphalt rakers, air track operators, block pavers and curb setters	26.30	16.45
12) Group 5: Toxic waste removal (non-mechanical systems)	27.80	16.45
13) Group 6: Blasters	27.55	16.45
Group 7: Asbestos Removal, non-mechanical systems (does not include leaded joint pipe)	26.80	16.45
Group 8: Traffic control signalmen	16.00	16.45

----LABORERS (TUNNEL CONSTRUCTION, FREE AIR). Shield Drive and Liner Plate Tunnels in Free Air.---- Last updated 4/11/12----

As of: Monday, February 25, 2013

13a) Miners, Motormen, Mucking Machine Operators, Nozzle Men, Grout Men, Shaft & Tunnel Steel & Rodmen, Shield & Erector, Arm Operator, Cable Tenders	31.28	16.45 + a
13b) Brakemen, Trackmen	30.37	16.45 + a
14) Concrete Workers, Form Movers, and Strippers	30.37	16.45 + a
15) Form Erectors	30.68	16.45 + a

----ROCK SHAFT LINING, CONCRETE, LINING OF SAME AND TUNNEL IN FREE AIR:----Last updated 4/11/12----

16) Brakemen, Trackmen, Tunnel Laborers, Shaft Laborers	30.37	16.45 + a
17) Laborers Topside, Cage Tenders, Bellman	30.26	16.45 + a

As of: Monday, February 25, 2013

18) Miners	31.28	16.45 + a
----TUNNELS, CAISSON AND CYLINDER WORK IN COMPRESSED AIR: ----Last updated 4/11/12----		
18a) Blaster	37.41	16.45 + a
19) Brakemen, Trackmen, Groutman, Laborers, Outside Lock Tender, Gauge Tenders	37.22	16.45 + a
20) Change House Attendants, Powder Watchmen, Top on Iron Bolts	35.35	16.45 + a
21) Mucking Machine Operator	37.97	16.45 + a
----TRUCK DRIVERS----(*see note below)		

Two axle trucks	27.88	17.22 + a
Three axle trucks; two axle ready mix	27.98	17.22 + a
Three axle ready mix	28.03	17.22 + a
Four axle trucks, heavy duty trailer (up to 40 tons)	28.08	17.22 + a
Four axle ready-mix	28.13	17.22 + a
Heavy duty trailer (40 tons and over)	28.33	17.22 + a
Specialized earth moving equipment other than conventional type on-the road trucks and semi-trailer (including Euclids)	28.13	17.22 + a

As of: Monday, February 25, 2013

Project: Phase II MSW Area Closure And Photovoltaic System

----POWER EQUIPMENT OPERATORS----

Group 1: Crane handling or erecting structural steel or stone, hoisting engineer (2 drums or over), front end loader (7 cubic yards or over), Work Boat 26 ft. & Over. (Trade License Required)	35.50	20.50 + a
Group 2: Cranes (100 ton rate capacity and over); Backhoe/Excavator over 2 cubic yards; Piledriver ($3.00 premium when operator controls hammer). (Trade License Required)	35.18	20.50 + a
Group 3: Excavator/Backhoe under 2 cubic yards; Cranes (under 100 ton rated capacity), Gradall; Master Mechanic; Hoisting Engineer (all types of equipment where a drum and cable are used to hoist or drag material regardless of motive power of operation), Rubber Tire Excavator (Drott-1085 or similar);Grader Operator; Bulldozer Fine Grade (slopes, shaping, laser or GPS, etc.). (Trade License Required)	34.44	20.50 + a
Group 4: Trenching Machines; Lighter Derrick; Concrete Finishing Machine; CMI Machine or Similar; Koehring Loader (Skooper)	34.05	20.50 + a
Group 5: Specialty Railroad Equipment; Asphalt Paver; Asphalt Spreader; Asphalt Reclaiming Machine; Line Grinder; Concrete Pumps; Drills with Self Contained Power Units; Boring Machine; Post Hole Digger; Auger; Pounder; Well Digger; Milling Machine (over 24" Mandrell)	33.46	20.50 + a
Group 5 continued: Side Boom; Combination Hoe and Loader; Directional Driller.	33.46	20.50 + a

As of: Monday, February 25, 2013

Project: Phase II MSW Area Closure And Photovoltaic System

Group 6: Front End Loader (3 up to 7 cubic yards); Bulldozer (rough grade dozer).	33.15	20.50 + a
Group 7: Asphalt Roller; Concrete Saws and Cutters (ride on types); Vermeer Concrete Cutter; Stump Grinder; Scraper; Snooper; Skidder; Milling Machine (24" and Under Mandrel).	32.81	20.50 + a
Group 8: Mechanic, Grease Truck Operator, Hydroblaster, Barrier Mover, Power Stone Spreader; Welder; Work Boat under 26 ft.; Transfer Machine.	32.41	20.50 + a
Group 9: Front End Loader (under 3 cubic yards), Skid Steer Loader regardless of attachments (Bobcat or Similar); Fork Lift, Power Chipper; Landscape Equipment (including hydroseeder).	31.98	20.50 + a
Group 10: Vibratory Hammer, Ice Machine, Diesel and Air Hammer, etc.	29.94	20.50 + a
Group 11: Conveyor, Earth Roller; Power Pavement Breaker (whiphammer), Robot Demolition Equipment.	29.94	20.50 + a
Group 12: Wellpoint Operator.	29.88	20.50 + a

As of: Monday, February 25, 2013

Project: Phase II MSW Area Closure And Photovoltaic System

Group 13: Compressor Battery Operator.	29.30	20.50 + a
Group 14: Elevator Operator; Tow Motor Operator (Solid Tire No Rough Terrain).	28.16	20.50 + a
Group 15: Generator Operator; Compressor Operator; Pump Operator; Welding Machine Operator; Heater Operator.	27.75	20.50 + a
Group 16: Maintenance Engineer/Oiler	27.10	20.50 + a
Group 17: Portable asphalt plant operator; portable crusher plant operator; portable concrete plant operator.	31.41	20.50 + a
Group 18: Power Safety Boat; Vacuum Truck; Zim Mixer; Sweeper; (minimum for any job requiring CDL license).	28.99	20.50 + a

**NOTE: SEE BELOW

As of: Monday, February 25, 2013

Project: Phase II MSW Area Closure And Photovoltaic System

----LINE CONSTRUCTION----(Railroad Construction and Maintenance)----Last updated 9/3/2010----

20) Lineman, Cable Splicer, Dynamite Man	44.36	3% + 13.70
21) Heavy Equipment Operator	39.92	3% + 13.70
22) Equipment Operator, Tractor Trailer Driver, Material Men	37.71	3% + 13.70
23) Driver Groundmen	33.27	3% + 13.70

----LINE CONSTRUCTION----Last updated 4/17/09----

24) Driver Groundmen	30.92	6.5% + 9.70

As of: Monday, February 25, 2013

Project: Phase II MSW Area Closure And Photovoltaic System

25) Groundmen	22.67	6.5% + 6.20
26) Heavy Equipment Operators	37.10	6.5% + 10.70
27) Linemen, Cable Splicers, Dynamite Men	41.22	6.5% + 12.20
28) Material Men, Tractor Trailer Drivers, Equipment Operators	35.04	6.5% + 10.45

As of: Monday, February 25, 2013

Welders: Rate for craft to which welding is incidental.

**Note: Hazardous waste removal work receives additional $1.25 per hour for truck drivers.*

***Note: Hazardous waste premium $3.00 per hour over classified rate*

Crane with 150 ft. boom (including jib) - $1.50 extra
Crane with 200 ft. boom (including jib) - $2.50 extra
Crane with 250 ft. boom (including jib) - $5.00 extra
Crane with 300 ft. boom (including jib) - $7.00 extra
Crane with 400 ft. boom (including jib) - $10.00 extra

All classifications that indicate a percentage of the fringe benefits must be calculated at the percentage rate times the "base hourly rate".

Apprentices duly registered under the Commissioner of Labor's regulations on "Work Training Standards for Apprenticeship and Training Programs" Section 31-51-d-1 to 12, are allowed to be paid the appropriate percentage of the prevailing journeymen hourly base and the full fringe benefit rate, providing the work site ratio shall not be less than one full-time journeyperson instructing and supervising the work of each apprentice in a specific trade.

~~Connecticut General Statute Section 31-55a: Annual Adjustments to wage rates by contractors doing state work ~~

The Prevailing wage rates applicable to this project are subject to annual adjustments each July 1st for the duration of the project.

Each contractor shall pay the annual adjusted prevailing wage rate that is in effect each July 1st, as posted by the Department of Labor.

It is the contractor's responsibility to obtain the annual adjusted prevailing wage rate increases directly from the Department of Labor's website.

The annual adjustments will be posted on the Department of Labor's Web page: www.ct.gov/dol.

The Department of Labor will continue to issue the initial prevailing wage rate schedule to the Contracting Agency for the project.

All subsequent annual adjustments will be posted on our Web Site for contractor access.

As of: Monday, February 25, 2013

Project: Phase II MSW Area Closure And Photovoltaic System

Effective October 1, 2005 - Public Act 05-50: any person performing the work of any mechanic, laborer, or worker shall be paid prevailing wage

All Person who perform work ON SITE must be paid prevailing wage for the appropriate mechanic, laborer, or worker classification.

All certified payrolls must list the hours worked and wages paid to All Persons who perform work ON SITE regardless of their ownership i.e.: (Owners, Corporate Officers, LLC Members, Independent Contractors, et. al)

Reporting and payment of wages is required regardless of any contractual relationship alleged to exist between the contractor and such person.

~~Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clause (29 CFR 5.5 (a) (1) (ii)).

Please direct any questions which you may have pertaining to classification of work and payment of prevailing wages to the Wage and Workplace Standards Division, telephone (860)263-6790.

As of: Monday, February 25, 2013

Connecticut Department of Labor
Wage and Workplace Standards Division
FOOTNOTES

Please Note: If the "Benefits" listed on the schedule for the following occupations includes a letter(s) (+ a or + a+b for instance), refer to the information below.

Benefits to be paid at the appropriate prevailing wage rate for the listed occupation.

If the "Benefits" section for the occupation lists only a dollar amount, disregard the information below.

Bricklayers, Cement Masons, Cement Finishers, Concrete Finishers, Stone Masons
(Building Construction) and
(Residential- Hartford, Middlesex, New Haven, New London and Tolland Counties)

a. Paid Holiday: Employees shall receive 4 hours for Christmas Eve holiday provided the employee works the regularly scheduled day before and after the holiday. Employers may schedule work on Christmas Eve and employees shall receive pay for actual hours worked in addition to holiday pay.

Elevator Constructors: Mechanics

a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day, Christmas Day, plus the Friday after Thanksgiving.

b. Vacation: Employer contributes 8% of basic hourly rate for 5 years or more of service or 6% of basic hourly rate for 6 months to 5 years of service as vacation pay credit.

Glaziers

a. Paid Holidays: Labor Day and Christmas Day.

Power Equipment Operators
(Heavy and Highway Construction & Building Construction)

a. Paid Holidays: New Year's Day, Good Friday, Memorial day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day, provided the employee works 3 days during the week in which the holiday falls, if scheduled, and if scheduled, the working day before and the working day after the holiday. Holidays falling on Saturday may be observed on Saturday, or if the employer so elects, on the preceding Friday.

Ironworkers

a. Paid Holiday: Labor Day provided employee has been on the payroll for the 5 consecutive work days prior to Labor Day.

Laborers (Tunnel Construction)

a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day. No employee shall be eligible for holiday pay when he fails, without cause, to work the regular work day preceding the holiday or the regular work day following the holiday.

Roofers

a. Paid Holidays: July 4th, Labor Day, and Christmas Day provided the employee is employed 15 days prior to the holiday.

Sprinkler Fitters

a. Paid Holidays: Memorial Day, July 4th, Labor Day, Thanksgiving Day and Christmas Day, provided the employee has been in the employment of a contractor 20 working days prior to any such paid holiday.

Truck Drivers

(Heavy and Highway Construction & Building Construction)

a. Paid Holidays: New Year's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, Christmas day, and Good Friday, provided the employee has at least 31 calendar days of service and works the last scheduled day before and the first scheduled day after the holiday, unless excused.

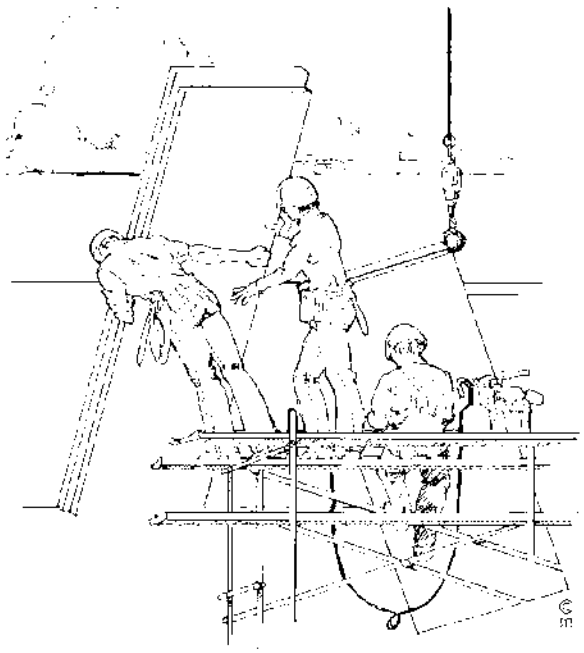
~NOTICE~

TO ALL CONTRACTING AGENCIES

Please be advised that Connecticut General Statutes Section 31-53, requires the contracting agency to certify to the Department of Labor, the total dollar amount of work to be done in connection with such public works project, regardless of whether such project consists of one or more contracts.

Please find the attached "Contracting Agency Certification Form" to be completed and returned to the Department of Labor, Wage and Workplace Standards Division, Public Contract Compliance Unit.

✎ Inquiries can be directed to (860)263-6543.



CONNECTICUT DEPARTMENT OF LABOR
WAGE AND WORKPLACE STANDARDS DIVISION
CONTRACT COMPLIANCE UNIT

CONTRACTING AGENCY CERTIFICATION FORM

I, _____, acting in my official capacity as _____,
authorized representative title

for _____, located at _____,
contracting agency address

do hereby certify that the total dollar amount of work to be done in connection with

_____, located at _____,
project name and number address

shall be $_____, which includes all work, regardless of whether such project

consists of one or more contracts.

CONTRACTOR INFORMATION

Name:_____

Address:_____
Authorized Representative:_____
Approximate Starting Date: _____

Approximate Completion Date:_____

_____ _____
Signature Date

Return To: Connecticut Department of Labor
Wage & Workplace Standards Division
Contract Compliance Unit
200 Folly Brook Blvd.
Wethersfield, CT 06109

Date Issued: _____

SEEC FORM 11

NOTICE TO EXECUTIVE BRANCH STATE CONTRACTORS AND PROSPECTIVE STATE CONTRACTORS OF CAMPAIGN CONTRIBUTION AND SOLICITATION BAN

This notice is provided under the authority of Connecticut General Statutes 9-612(g)(2), as amended by P.A. 07-1, and is for the purpose of informing state contractors and prospective state contractors of the following law (italicized words are defined on the following page):

Campaign Contribution and Solicitation Ban
No *state contractor*, *prospective state contractor*, *principal of a state contractor or principal of a prospective state contractor*, with regard to a *state contract* or *state contract solicitation* with or from a state agency in the executive branch or a quasi-public agency or a holder, or principal of a holder of a valid prequalification certificate, shall make a contribution to, or *solicit* contributions on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of Governor, Lieutenant Governor, Attorney General, State Comptroller, Secretary of the State or State Treasurer, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee;

In addition, no holder or principal of a holder of a valid prequalification certificate, shall make a contribution to, or solicit contributions on behalf of (i) an exploratory committee or candidate committee established by a candidate for nomination or election to the office of State senator or State representative, (ii) a political committee authorized to make contributions or expenditures to or for the benefit of such candidates, or (iii) a party committee.

Duty to Inform
State contractors and prospective state contractors are required to inform their principals of the above prohibitions, as applicable, and the possible penalties and other consequences of any violation thereof.

Penalties for Violations
Contributions or solicitations of contributions made in violation of the above prohibitions may result in the following civil and criminal penalties:

Civil penalties--$2000 or twice the amount of the prohibited contribution, whichever is greater, against a principal or a contractor. Any state contractor or prospective state contractor which fails to make reasonable efforts to comply with the provisions requiring notice to its principals of these prohibitions and the possible consequences of their violations may also be subject to civil penalties of $2000 or twice the amount of the prohibited contributions made by their principals.

Criminal penalties—Any knowing and willful violation of the prohibition is a Class D felony, which may subject the violator to imprisonment of not more than 5 years, or $5000 in fines, or both.

Contract Consequences
Contributions made or solicited in violation of the above prohibitions may result, in the case of a state contractor, in the contract being voided.

Contributions made or solicited in violation of the above prohibitions, in the case of a prospective state contractor, shall result in the contract described in the state contract solicitation not being awarded to the prospective state contractor, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

The State will not award any other state contract to anyone found in violation of the above prohibitions for a period of one year after the election for which such contribution is made or solicited, unless the State Elections Enforcement Commission determines that mitigating circumstances exist concerning such violation.

Additional information and the entire text of P.A 07-1 may be found on the website of the State Elections Enforcement Commission, www.ct.gov/seec. Click on the link to “State Contractor Contribution Ban.”

Definitions:

"State contractor" means a person, business entity or nonprofit organization that enters into a state contract. Such person, business entity or nonprofit organization shall be deemed to be a state contractor until December thirty-first of the year in which such contract terminates. "State contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Prospective state contractor" means a person, business entity or nonprofit organization that (i) submits a response to a state contract solicitation by the state, a state agency or a quasi-public agency, or a proposal in response to a request for proposals by the state, a state agency or a quasi-public agency, until the contract has been entered into, or (ii) holds a valid prequalification certificate issued by the Commissioner of Administrative Services under section 4a-100. "Prospective state contractor" does not include a municipality or any other political subdivision of the state, including any entities or associations duly created by the municipality or political subdivision exclusively amongst themselves to further any purpose authorized by statute or charter, or an employee in the executive or legislative branch of state government or a quasi-public agency, whether in the classified or unclassified service and full or part-time, and only in such person's capacity as a state or quasi-public agency employee.

"Principal of a state contractor or prospective state contractor" means (i) any individual who is a member of the board of directors of, or has an ownership interest of five per cent or more in, a state contractor or prospective state contractor, which is a business entity, except for an individual who is a member of the board of directors of a nonprofit organization**,** (ii) an individual who is employed by a state contractor or prospective state contractor, which is a business entity, as president, treasurer or executive vice president, (iii) an individual who is the chief executive officer of a state contractor or prospective state contractor, which is not a business entity, or if a state contractor or prospective state contractor has no such officer, then the officer who duly possesses comparable powers and duties, (iv) an officer or an employee of any state contractor or prospective state contractor who has *managerial or discretionary responsibilities with respect to a state contract,* (v) the spouse or a *dependent child* who is eighteen years of age or older of an individual described in this subparagraph, or (vi) a political committee established or controlled by an individual described in this subparagraph or the business entity or nonprofit organization that is the state contractor or prospective state contractor.

"State contract" means an agreement or contract with the state or any state agency or any quasi-public agency, let through a procurement process or otherwise, having a value of fifty thousand dollars or more, or a combination or series of such agreements or contracts having a value of one hundred thousand dollars or more in a calendar year, for (i) the rendition of services, (ii) the furnishing of any goods, material, supplies, equipment or any items of any kind, (iii) the construction, alteration or repair of any public building or public work, (iv) the acquisition, sale or lease of any land or building, (v) a licensing arrangement, or (vi) a grant, loan or loan guarantee. "State contract" does not include any agreement or contract with the state, any state agency or any quasi-public agency that is exclusively federally funded, an education loan or a loan to an individual for other than commercial purposes.

"State contract solicitation" means a request by a state agency or quasi-public agency, in whatever form issued, including, but not limited to, an invitation to bid, request for proposals, request for information or request for quotes, inviting bids, quotes or other types of submittals, through a competitive procurement process or another process authorized by law waiving competitive procurement.

“Managerial or discretionary responsibilities with respect to a state contract” means having direct, extensive and substantive responsibilities with respect to the negotiation of the state contract and not peripheral, clerical or ministerial responsibilities.

“Dependent child” means a child residing in an individual’s household who may legally be claimed as a dependent on the federal income tax of such individual.

“Solicit” means (A) requesting that a contribution be made, (B) participating in any fund-raising activities for a candidate committee, exploratory committee, political committee or party committee, including, but not limited to, forwarding tickets to potential contributors, receiving contributions for transmission to any such committee or bundling contributions, (C) serving as chairperson, treasurer or deputy treasurer of any such committee, or (D) establishing a political committee for the sole purpose of soliciting or receiving contributions for any committee. Solicit does not include: (i) making a contribution that is otherwise permitted by Chapter 155 of the Connecticut General Statutes; (ii) informing any person of a position taken by a candidate for public office or a public official, (iii) notifying the person of any activities of, or contact information for, any candidate for public office; or (iv) serving as a member in any party committee or as an officer of such committee that is not otherwise prohibited in this section.

EXHIBIT M

AFFIRMATION CONCERNING THE STATE OF CONNECTICUT STATE ETHICS LAW

[The Contractor's "Affirmation Concerning The State Of Connecticut State Ethics Law" that was submitted to CRRA by the Contractor with the Contractor's Proposal will be added by CRRA.]

CONNECTICUT RESOURCES RECOVERY AUTHORITY

SUBCONTRACTOR'S or CONSULTANT'S AFFIRMATION CONCERNING THE STATE OF CONNECTICUT ETHICS LAW

Pursuant to Section 1-101qq of the Connecticut General Statutes, this Affirmation shall be completed and properly executed by the chief official or other duly authorized representative of the business entity (the "Subcontractor or Consultant").

I, the undersigned, am _____ (title) of _____ (firm name), an entity duly formed and existing under the laws of _____ (name of state or commonwealth) ("Subcontractor or Consultant").

I affirm, as follows:

1. Pursuant to Section 1-101qq(a) of the Connecticut General Statutes, Subcontractor or Consultant hereby affirms (i) its receipt of the summary of state ethics laws entitled "Guide to the Code of Ethics for Current or Potential State Contractors – 2010" (the "Summary"), and (ii) that the key employees of Subcontractor or Consultant listed in TABLE A below have read and understand the Summary, and agree to comply with the provisions of State of Connecticut ethics law.

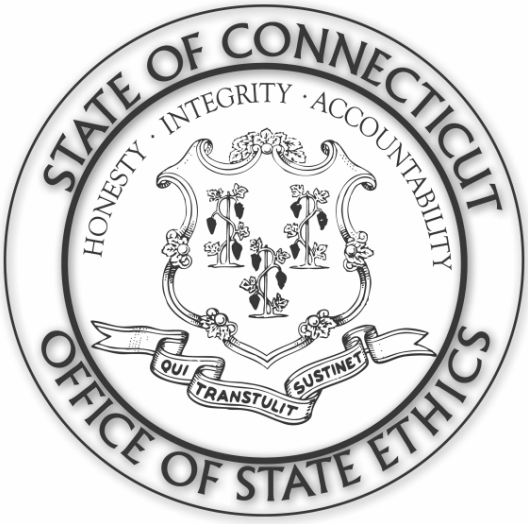
TABLE A:	**Key Employees (with Title) that Have Read and Understand the Summary, and Agree to Comply with the Provisions of the State Ethics Law**

By (Signature): _____

Name (Print): _____

Title: _____

Guide to the Code of Ethics For Current or Potential State Contractors



2010

Guide for Current or Potential State Contractors

INTRODUCTION

The Connecticut Office of State Ethics (OSE) is an independent regulatory agency for the state of Connecticut, charged with administering and enforcing the Connecticut Codes of Ethics, located in the Connecticut General Statutes, Chapter 10.

The Ethics Codes under the OSE's jurisdiction are comprised of:

- The Code of Ethics for Public Officials (Part I);
- The Code of Ethics for Lobbyists (Part II); and
- Limited jurisdiction over Ethical Considerations Concerning Bidding and State Contracts (Part IV).

This guide provides general information only. The descriptions of the law and the OSE in this guide are not intended to be exhaustive. Please review the Advisory Opinions and Declaratory Rulings on our website or contact the Legal Division of the OSE with any questions regarding interpretation of the law.

For more information on the subjects discussed in this guide, call, write or visit:

Connecticut Office of State Ethics
18-20 Trinity Street
Suite 205
Hartford, CT 06106

860/263-2400
www.ct.gov/ethics

Guide for Current or Potential State Contractors

CONTENTS

Guide for Current or Potential State Contractors

THE OFFICE OF STATE ETHICS (OSE)

The Connecticut Office of State Ethics (OSE) was officially created on July 1, 2005, by Public Act 05-183. The governing body of the OSE is the Citizen's Ethics Advisory Board (CEAB), nine members appointed by the Governor and legislative leadership. The CEAB holds monthly meetings that are open to the public and that are often covered by CT-N. A schedule of CEAB meeting dates, times and locations is available on the OSE's Web site, www.ct.gov/ethics.

The OSE is an independent watchdog agency for the state of Connecticut that administers Connecticut General Statutes, Chapter 10, Parts I and II, with limited jurisdiction over Part IV.

Simply put, the OSE educates all those covered by the law (the "regulated community"); provides information to the public; interprets and applies the codes of ethics; and investigates potential violations, and otherwise enforces the codes.

The OSE is made up of the following components:

- Citizen's Ethics Advisory Board
- Executive Director
- Legal Division
- Enforcement Division

THE BIG PICTURE

All state officials and employees (except judges) are covered by Part I of the Code of Ethics for Public Officials (henceforth, Part I, or the Code). It is important to remember that certain provisions of the Code also apply to public officials and state employees after they leave state service.

As you read through this guide, be aware that these laws were enacted to prevent individuals from using their public position or authority for personal, financial benefit.

Each state agency also has its own ethics policy, which in many cases may be more restrictive than what follows. Be sure to obtain a copy of the agency's policy before you attempt to provide any benefit to an agency official or employee.

Guide for Current or Potential State Contractors

GIVING BENEFITS TO STATE PERSONNEL

Gifts

As a current or potential state contractor, you are presumably doing business with or seeking to do business with a state agency, and are therefore considered to be a **restricted donor**. In general, public officials, state employees and candidates for public office may not accept gifts from restricted donors.

Restricted Donors

Restricted donors include:

- Registered lobbyists (a list is available on the OSE's Web site) or a lobbyist's representative;
- Individuals or groups doing business with a state department or agency;
- Individuals or groups seeking to do business with a state department or agency;
- Individuals or groups engaged in activities regulated by a state department or agency; or
- Contractors pre-qualified by the Connecticut Department of Administrative Services (Conn. Gen. Stat. § 4a-100).

A **gift** is defined as anything of value that is directly and personally received by a public official or state employee (or sometimes family members of those two categories) *unless* consideration of equal or greater value is provided. Conn. Gen. Stat. § 1-79 (e).

Gift Exceptions

There are, however, certain exceptions to this definition of gift. Not all exceptions are covered below; see Conn. Gen. Stat. § 1-79 (e) (1) – (17) for the complete list.

- *Token Items –* Restricted donors such as current or potential state contractors may provide any item of value that is not more than $10 (such as a pen, mug, or inexpensive baseball cap) to a public official or state employee, provided that the annual aggregate of such items from a single source is $50 or less. Conn. Gen. Stat. § 1-79 (e) (16).

- *Food and Beverage –* Restricted donors may also provide less than $50 worth of food and beverage in a calendar year to a public official or state employee, provided that the restricted donor or his/her representative is in attendance when the food and/or beverage is being consumed. Conn. Gen. Stat. § 1-79 (e) (9).

- *Training –* Vendors may provide public officials and state employees with training for a product purchased by a state or quasi-public agency provided such training is offered to all customers of that vendor. Conn. Gen. Stat. § 1-79 (e) (17).

Guide for Current or Potential State Contractors

- *Gifts to the State –* Restricted donors may provide what are typically referred to as "gifts to the state." These gifts are goods and services provided to a state agency or quasi-public agency for use on state or quasi-public agency property or that support an event, and which facilitate state or quasi-public action or functions. Conn. Gen. Stat. § 1-79 (e) (5).

- *Other Exceptions –* There are a total of 17 separate gift exceptions in the Code. Also exempt from the definition of gift are items such as informational materials germane to state action, ceremonial plaques or awards costing less than $100, or promotional items, rebates or discounts also available to the general public. See Conn. Gen. Stat. § 1-79 (e) (1) – (17).

Note: The popularly-cited exception for major life events does not apply to those who are regulated by, doing business with or seeking to do business with a state agency. The only restricted donor that can make use of this very narrow exception is a registered lobbyist.

Gift Provisions

Example: You are in the process of submitting a contracting bid to a state agency. You provide the agency head with a gift certificate for $45 to a popular West Hartford eatery for her to use on her own. You have not previously given anything of value to this individual.

Even though you are under the permissible $49.99 food and beverage limit, this gift is not allowed because you or your representative will not be in attendance while the food and beverage is being consumed.

Reporting Requirements

Should you or your representative give something of $10 or more in value to a public official or state employee, you must, within **10 days**, give the gift recipient and the head of that individual's department or agency a written report stating:

- Name of the donor;
- Description of item(s) given;
- Value of such item(s); and
- Total cumulative value of all items to date given to that recipient during the calendar year.

This helps both you and the state employee keep track of the gift exceptions noted above, so that permissible limits are not exceeded. Conn. Gen. Stat. § 1-84 (o). A courtesy form is available for this notification on the OSE's Web site, in the "Forms" section.

Guide for Current or Potential State Contractors

Necessary Expenses

You may provide necessary expenses to a public official or state employee ***only*** if the official or employee, in his/her official capacity, is actively participating in an event by giving a speech or presentation, running a workshop, or having some other active involvement.

Necessary expenses are limited to:

- Travel (coach or economy class);
- Lodging (standard cost of room for the nights before, of, and immediately following the event);
- Meals; and
- Related conference expenses.

Conn. Gen. Stat. § 1-79 (9).

Entertainment costs (tickets to sporting events, golf outings, night clubs, etc.) are ***not*** necessary expenses. Necessary expense payments also ***do not*** include payment of expenses for family members or other guests.

Fees/Honorariums

Public officials and state employees may ***not*** accept fees or honorariums for an article, appearance, speech or participation at an event in their official capacity.

Fees or honorariums for such activities, if offered based solely on expertise and without any regard to official capacity, may be acceptable. Contact the OSE before offering such payment to an official or employee. Conn. Gen. Stat. § 1-84 (k).

Necessary Expenses, Fees and Honorariums

Example: You invite a state employee to travel to New York City to give a speech to your managers on issues surrounding contracting with a state agency. You provide Amtrak fare for the employee as well as his spouse, who will spend the day in the city. The evening of the speech, you will treat the employee and his spouse with complimentary tickets to a Broadway show in lieu of a speaking fee.

You may provide coach class travel expenses only to the state employee who is actively participating in an event. In this case, you may only provide Amtrak fare for the employee giving the speech, not his spouse. Entertainment costs, such as tickets to a show, are not considered necessary expenses and may not be provided. Additionally, state employees may not accept fees or honorariums for a speech given in their official capacity.

Guide for Current or Potential State Contractors

HIRING STATE PERSONNEL

Post-state Employment (Revolving Door)

If you are considering hiring a *former* state employee, you should be aware of the Code's post-state employment, or revolving door, provisions.

Lifetime Bans

- Former state employees may **never** disclose any confidential information they learned during the course of their state service for anyone's financial gain. Conn. Gen. Stat. § 1-84a.

- A former state official or employee may **never** represent anyone other than the state regarding a particular matter in which he or she was personally or substantially involved while in state service and in which the state has a substantial interest. This prevents side-switching. Conn. Gen. Stat. § 1-84b (a).

One-year Bans

- If you hire or otherwise engage the services of a former state official or employee, he or she may not represent you before his or her former agency for a period of **one year** after leaving state service. Conn. Gen. Stat. § 1-84b (b). (See Advisory Opinion 2003-3, which provides a limited exception to this provision if the employee is providing purely technical expertise to help implement a previously-awarded contract. This exception applies to extremely limited circumstances; contact the OSE for guidance.)

- You are prohibited from hiring a former state official or employee for a period of **one year** after he or she leaves state service if that individual was substantially involved in, or supervised, the negotiation or award of a contract (that you or your business was a party to) valued at $50,000 or more, and the contract was signed within his or her last year of state service. Conn. Gen. Stat. § 1-84b (f).

- Employees who held certain specifically-designated positions (with significant decision-making or supervisory responsibility) at certain state regulatory agencies are prohibited from seeking or accepting employment with any business subject to regulation by the individual's agency within **one year** of leaving the agency. Likewise, such businesses may not hire those employees. Note that there is an exception for *ex-officio* board or commission members. Conn. Gen. Stat. § 1-84b (c).

Post-state Employment

Example: You run a hospital regulated by the Office of Health Care Access (OHCA). You would like to offer a job to the former Commissioner of OHCA, who has been out of state service for 5 months.

Because the hospital is regulated by a state agency whose Commissioner is specifically designated in 1-84b (c), the former head of such agency would not be permitted to accept employment with you for one full year after leaving state service. See Advisory Opinion 2003-19.

Guide for Current or Potential State Contractors

Outside Employment for Current Public Officials and State Employees

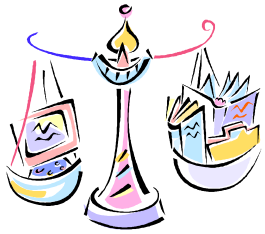
If you are considering hiring a *current* state employee, especially from a state agency with which you do business or by which you are regulated, you should be aware of the following rules regarding the employment of current state employees.

- A current state employee may not accept outside employment that impairs his or her independence of judgment regarding his or her state duties, or that encourages him or her to disclose confidential information learned in his or her state job. Conn. Gen. Stat. § 1-84 (b).

- A current state employee may not use his or her state position for his or her own financial gain or the gain of his or her family (spouse, child, child's spouse, parent, brother or sister) or an associated business, however inadvertent that use may be. Conn. Gen. Stat. § 1-84 (c).

Other Considerations

Business entities engaged in Indian gaming activities in the state should be aware of specific provisions that apply to present or former Gaming Policy Board or Division of Special Revenue public officials or employees. See Conn. Gen. Stat. §§ 1-84b (d) and (e).



Outside Employment

Example: Your small business occasionally receives grants or contracts from Agency X. You know that a particular contract manager with Agency X has the skills you need to help you grow your business. This employee has expressed interest in earning a little extra money for himself, while helping you with your business in the evenings and on weekends.

It would constitute an impermissible impairment of judgment for the employee of Agency X, who has contract management responsibilities, to accept outside employment with your business – a business that receives grants or contracts from Agency X.

OTHER PROVISIONS

Prohibited Activities for Consultants or Independent Contractors

If you are hired by the state as a consultant or independent contractor, you are prohibited from the following:

- Using your authority under the contract or any confidential information acquired during the course of the contract for your financial gain or the financial gain of your immediate family;
- Accepting another state contract that would impair your independence of judgment or your performance in your existing state contract; and
- Accepting anything of value based on the understanding that your actions on behalf of the state would be influenced.

Conn. Gen. Stat. § 1-86e (1) – (3); see also Conn. Gen. Stat. § 1-101nn.

Gift and/or Campaign Contribution Certifications

Contractors seeking large state contracts must provide certifications regarding gifts and/or campaign contributions made to certain state employees or public officials in the two-year period prior to the submission of a bid or proposal. Copies of these certifications and other updated information regarding state contractors can be found on the Web sites of the Department of Administrative Services (www.das.state.ct.us) and the Office of Policy and Management (www.opm.state.ct.us).

Investment Services and the Office of the Treasurer

If you or your business provides investment services, as defined in the Code, and you make a political contribution to the State Treasurer's campaign, you may be prohibited from contracting with the Office of the Treasurer. See Conn. Gen. Stat. § 1-84 (n).

Registering as a Lobbyist

If you or your business spends or receives over $2,000 in a calendar year for activities that constitute lobbying under Part II of the Code of Ethics (whether to affect legislation or the actions of an administrative state agency), you/your business may have to register as a lobbyist with the Office of State Ethics. Lobbyist registration information is available at www.ct.gov/ethics.

Contribution Ban for Communicator Lobbyists (Conn. Gen. Stat. § 9-610 (g) and (h).)

Registered communicator lobbyists, their affiliated political action committees (PACs), as well as members of their immediate families are banned from soliciting or donating political campaign contributions. Please contact the State Elections Enforcement Commission at 860-256-2940 for more information.

Guide for Current or Potential State Contractors

Sessional Contribution Ban for Client Lobbyists (Conn. Gen. Stat. § 9-610 (e).)

Registered lobbyists and their affiliated political action committees (PACs) are banned from soliciting or donating political campaign contributions. Specifically, there is a temporary ban while the General Assembly is in session that applies to all registered client lobbyists and their affiliated PACs. Please contact the State Elections Enforcement Commission at 860-256-2940 for more information.

Public Act 05-287

Public Act 05-287 prohibits anyone who is a party (or seeking to become a party) to a large state construction, procurement, or consultant services contract over $500,000 from:

- Soliciting information from a public official or state employee that is not available to other bidders for that contract, with the intent to obtain a competitive advantage;
- Intentionally or recklessly charging a state agency for work not performed or goods or services not provided;
- Falsifying invoices or bills; or
- Intentionally violating or circumventing state competitive bidding and ethics laws.

This Act also requires any prospective state contractor to affirm in writing that he or she has received a summary of the state's ethics laws and that his or her key employees have read and understood the summary and agree to comply with the applicable provisions. Conn. Gen. Stat. § 1-101qq.

An affirmation form is available through the Connecticut Office of Policy and Management.

Executive Orders

Executive Order 3

Under this Order, the Department of Administrative Services established and maintains on its Web site the State Contracting Portal for purposes of posting all contracting opportunities with state agencies and providing information on contracting processes and procedures.

Executive Order 7C

This Order covers the State Contracting Standards Board, established to conduct a comprehensive review of existing procurement and contracting laws and prepare a uniform code to govern all aspects of procurement and contracting.

The full text of these Executive Orders can be found on the Governor's Web site, www.ct.gov/governorrell/site/default.asp.

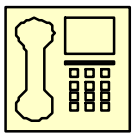
Guide for Current or Potential State Contractors

FOR MORE INFORMATION

This guide provides general information only. The descriptions of the law and the OSE in this guide are not intended to be exhaustive. For more information regarding the Code of Ethics as it pertains to current or potential state contractors, please contact the Legal Division of the Office of State Ethics, Monday – Friday, 8:30 a.m. to 5:00 p.m.

Office of State Ethics
18-20 Trinity Street
Hartford, CT 06106-1660

T: 860/263-2400
F: 860/263-2402
www.ct.gov/ethics



Specific Contacts:

Questions or advice regarding the Ethics Codes: Ethics.Code@ct.gov
Lobbyist filing/reporting questions: lobbyist.OSE@ct.gov
Public official filing/reporting questions: SFI.OSE@ct.gov
Enforcement questions: Ethics.Enforcement@ct.gov
All other inquiries: ose@ct.gov

January 2010

EXHIBIT P

AFFIDAVIT CONCERNING NONDISCRIMINATION

[The Contractor's "Affidavit Concerning Nondiscrimination" that was submitted to CRRA by the Contractor with the Contractor's Proposal will be added by CRRA.]

CONNECTICUT RESOURCES RECOVERY AUTHORITY

AFFIDAVIT CONCERNING CONSULTING FEES

Pursuant to Section 4a-81 of the Connecticut General Statutes, this Affidavit must be completed and properly executed under penalty of false statement by a chief official of the successful proposer for an Agreement (the "Contractor"). Such chief official of the Contractor must be the person who is properly authorized to execute the Agreement on behalf of the Contractor. This Affidavit must be properly executed at the same time that the Contractor executes the Agreement. If the Contractor fails to execute this Affidavit, the Contractor shall be disqualified for the Agreement.

I, the undersigned, am over the age of eighteen and understand and appreciate the obligation of an oath. I am _____ (title) of _____ (firm name), an entity duly formed and existing under the laws of _____ (name of state or commonwealth) ("Contractor").

I certify that I am authorized to execute and deliver this affidavit on behalf of Contractor, as follows:

1. Contractor seeks to enter into the "PHASE II MSW AREA CLOSURE AND POTOVOLTAIC SYSTEM PROJECT - CRRA HARTFORD LANDFILL Agreement" (the "Agreement") with the Connecticut Resources Recovery Authority ("CRRA");

2. Except as disclosed in Table 1 below and except for a consulting agreement that is with a consultant who is registered under the provisions of Chapter 10 of the Connecticut General Statutes[1] as of the date this Affidavit is submitted, Contractor has not entered into any consulting agreement[2] in connection with the Agreement whereby any duties of the consultant pursuant to said consulting agreement[2] require that consultant pursue communications concerning business of CRRA, whether or not direct contact with CRRA, a CRRA official, a CRRA employee, a state agency, a state or public official, or a state employee was expected or made;

3. Contractor shall amend this Affidavit whenever Contractor enters into any new consulting agreement[2] during the term of the Agreement; and

4. The statements set forth herein are true, to the best of my knowledge and belief, subject to the penalties of false statement.

[1] Pursuant to Section 1-94 of Chapter 10 the Connecticut General Statutes, a lobbyist as defined in the Chapter is required to register with the Office of State Ethics.

[2] Pursuant to Section 41-81 of the Connecticut General Statutes, for the purposes of this Affidavit, "consulting agreement" means "any written or oral agreement to retain the services, for a fee, of a consultant for the purposes of (A) providing counsel to a contractor, vendor, consultant or other entity seeking to conduct, or conducting, business with the state, (B) contacting, whether in writing or orally, any executive, judicial, or administrative office of the state, including any department, institution, bureau, board, commission, authority, official or employee for the purpose of solicitation, dispute resolution, introduction, requests for information, or (C) any other similar activity related to such contract. Consulting agreement does not include any agreements entered into with a consultant who is registered under the provisions of chapter 10 as of the date such affidavit is submitted in accordance with the provisions of this section.

TABLE 1: Disclosure of Consulting Agreements

(If Contractor has not entered into any consulting agreements[2] in connection with the Agreement, Contractor should enter "None" in the space provided for the "Name of Consultant.")

Name of Consultant:		
Name of Consultant's Firm:		
Description of the Basic Terms of the Consulting Agreement:		
Brief Description of the Services Provided:		
Is the Consultant a Former State Employee or Public Official?	☐ Yes	☐ No
If the answer to the question above concerning whether or not the consultant is a former state employee or public official is "Yes," the following information must be provided.		
Name of Former Agency:		
Date Employment Terminated:		

By (Signature): _____

Name (Print): _____

Title: _____

Sworn to before me this _____ day of _____ 20 ____

_____ _____

Notary Public/Commissioner of the Superior Court Commission Expiration Date

CONNECTICUT RESOURCES RECOVERY AUTHORITY

CONTRACTOR'S CERTIFICATION CONCERNING GIFTS

PHASE II MSW AREA CLOSURE AND POTOVOLTAIC SYSTEM PROJECT - CRRA HARTFORD LANDFILL
(This CERTIFICATION is to be signed by an authorized officer of the Contractor or the Contractor's managing general partner.)

Section 4-252 of the *Connecticut General Statutes* requires that a Contractor (i.e., the successful proposer for an Agreement) complete and properly execute this Certification Concerning Gifts at the same time that the Contractor executes the Agreement. If the Contractor fails to make the required certifications, the Contractor shall be disqualified for the Agreement.

I, _____, a duly authorized officer and/or representative of _____ (firm name) (the "Contractor"), being duly sworn, hereby depose and say that:

1. I am over eighteen (18) years of age and believe in the obligations of an oath; and

2. The Contractor has submitted a proposal for the "PHASE II MSW AREA CLOSURE AND POTOVOLTAIC SYSTEM PROJECT - CRRA HARTFORD LANDFILL" (the "Agreement") to the Connecticut Resources Recovery Authority ("CRRA"), has been selected by CRRA as the successful proposal submitter for the Agreement and is prepared to enter into the Agreement with CRRA; and

3. No gifts were made between January 1, 2013 and the date of execution of the Agreement, by

   (a) The Contractor,

   (b) Any principals and key personnel of the Contractor who participated substantially in preparing the Contractor's proposal for or the negotiation of the Agreement, or

   (c) Any agent of the Contractor or principals and key personnel who participated substantially in preparing the Contractor's proposal for or the negotiation of the Agreement

   to

   (1) Any public official or employee of CRRA who participated substantially in the preparation of the proposal solicitation for or the negotiation or award of the Agreement (such CRRA employees are listed in Table 2 below), or

   (2) Any public official or state employee of any state agency who has supervisory or appointing authority over CRRA (such public officials and state employees are listed in Table 3 below); and

4. No such principals and key personnel of the Contractor or agent of the Contractor or principals and key personnel knows of any action by Contractor to circumvent the prohibition on gifts by providing for any other principals and key personnel, official, employee or agent of the Contractor to provide a gift to any such public official or state employee; and

5. The Contractor made the proposal for the Agreement without fraud or collusion with any person;

6. The information set forth herein is true, to the best of my knowledge and belief, subject to the penalties of false statement.

TABLE 2: CRRA Substantial Participants in the Preparation of the Request for Bids/Proposals for the Agreement

David Bodendorf, Senior Environmental Engineer
Roger Guzowski, Contract and Procurement Manager
Peter Egan, Director of Operations and Environmental Affairs

TABLE 3: Public Officials and State Employees of State Agencies Who Have Supervisory or Appointing Authority over CRRA

Governor Dannel P. Malloy
Senator Donald E. Williams, Jr., President Pro Tempore of the Senate
Senator John McKinney, Minority Leader of the Senate
Representative J. Brendan Sharkey, Speaker of the House of Representatives
Representative Lawrence F. Cafero, Jr., Minority Leader of the House of Representatives

Signature: _____

Name (type/print): _____

Title: _____

State Of: _____

County Of: _____

_____, being fully sworn, deposes and says that he/she is the _____ (Title) of _____ (Firm Name), the Contractor herein, that he/she has read the foregoing statement concerning gifts, and, under the penalty of perjury, certifies that each and every part of said statement is true to his/her best knowledge and belief.

Sworn to before me this _____ day of _____ 20 ___

_____
Notary Public/Commissioner of the Superior Court

For the purposes of this Certification Concerning Gifts, the following terms are defined as follows:

"Gift" means anything of value, which is directly and personally received, unless consideration of equal or greater value is given in return. "Gift" shall **not** include:

(1) A political contribution otherwise reported as required by law or a donation or payment as described in subdivision (9) or (10) of subsection (b) of section 9-333b of the *Connecticut General Statutes*;

(2) Services provided by persons volunteering their time, if provided to aid or promote the success or defeat of any political party, any candidate or candidates for public office or the position of convention delegate or town committee member or any referendum question;

(3) A commercially reasonable loan made on terms not more favorable than loans made in the ordinary course of business;

(4) A gift received from (A) an individual's spouse, fiance or fiancee, (B) the parent, brother or sister of such spouse or such individual, or (C) the child of such individual or the spouse of such child;

(5) Goods or services (A) which are provided to the state (i) for use on state property, or (ii) to support an event or the participation by a public official or state employee at an event, and (B) which facilitate state action or functions. As used in this Affidavit Concerning Gifts, "state property" means (i) property owned by the state, or (ii) property leased to an agency in the Executive or Judicial Department of the state;

(6) A certificate, plaque or other ceremonial award costing less than one hundred dollars;

(7) A rebate, discount or promotional item available to the general public;

(8) Printed or recorded informational material germane to state action or functions;

(9) Food or beverage or both, costing less than fifty dollars in the aggregate per recipient in a calendar year, and consumed on an occasion or occasions at which the person paying, directly or indirectly, for the food or beverage, or his representative, is in attendance;

(10) Food or beverage or both, costing less than fifty dollars per person and consumed at a publicly noticed legislative reception to which all members of the General Assembly are invited and which is hosted not more than once in any calendar year by a lobbyist or business organization. For the purposes of such limit, (A) a reception hosted by a lobbyist who is an individual shall be deemed to have also been hosted by the business organization which he owns or is employed by, and (B) a reception hosted by a business organization shall be deemed to have also been hosted by all owners and employees of the business organization who are lobbyists. In making the calculation for the purposes of such fifty-dollar limit, the donor shall divide the amount spent on food and beverage by the number of persons whom the donor reasonably expects to attend the reception;

(11) Food or beverage or both, costing less than fifty dollars per person and consumed at a publicly noticed reception to which all members of the General Assembly from a region of the state are invited and which is hosted not more than once in any calendar year by a lobbyist or business organization. For the purposes of such limit, (A) a reception hosted by a lobbyist who is an individual shall be deemed to have also been hosted by the business organization which he owns or is employed by, and (B) a reception hosted by a business organization shall be deemed to have also been hosted by all owners and employees of the business organization who are lobbyists. In making the calculation for the purposes of such fifty-dollar limit, the donor shall divide the amount spent on food and beverage by the number of persons whom the donor reasonably expects to attend the reception. As used in this subdivision, "region of the state" means the established geographic service area of the organization hosting the reception;

(12) Gifts costing less than one hundred dollars in the aggregate or food or beverage provided at a hospitality suite at a meeting or conference of an interstate legislative association, by a person who is not a registrant or is not doing business with the state of Connecticut;

(13) Admission to a charitable or civic event, including food and beverage provided at such event, but excluding lodging or travel expenses, at which a public official or state employee participates in his official capacity, provided such admission is provided by the primary sponsoring entity;

(14) Anything of value provided by an employer of (A) a public official, (B) a state employee, or (C) a spouse of a public official or state employee, to such official, employee or spouse, provided such benefits are customarily and ordinarily provided to others in similar circumstances; or

(15) Anything having a value of not more than ten dollars, provided the aggregate value of all things provided by a donor to a recipient under this subdivision in any calendar year shall not exceed fifty dollars.

“Participated substantially” means participation that is direct, extensive and substantive, and not peripheral, clerical or ministerial.

“Principals and key personnel” means officers, directors, shareholders, members, partners and managerial employees.

CONNECTICUT RESOURCES RECOVERY AUTHORITY

PRESIDENT'S CERTIFICATION CONCERNING GIFTS

PHASE II MSW AREA CLOSURE AND POTOVOLTAIC SYSTEM PROJECT - CRRA HARTFORD LANDFILL

Awarded To
[NAME OF CONTRACTOR/CONSULTANT]

(This CERTIFICATION is to be signed by the President of CRRA
at the time the Agreement is executed by him/her.)

By submission of this Certification, the President of the Connecticut Resources Recovery Authority ("CRRA") hereby certifies that the selection of the most qualified or highest ranked person, firm or corporation for the "Agreement for PHASE II MSW AREA CLOSURE AND POTOVOLTAIC SYSTEM PROJECT - CRRA HARTFORD LANDFILL" was not the result of collusion, the giving of a gift or the promise of a gift, compensation, fraud or inappropriate influence from any person.

Signature: _____

Name: **Thomas D. Kirk**

Title: **President**

State Of: **Connecticut**

County Of: **Hartford**

Thomas D. Kirk, being fully sworn, deposes and says that he is the President of the Connecticut Resources Recovery Authority, that he has read the forgoing statement concerning collusion, the giving of gifts or the promise of gifts, compensation, fraud or inappropriate influence and, under the penalty of perjury, certifies that each and every part of said statement is true.

Sworn to before me this _____ day of _____ 2013__

_____
Notary Public/Commissioner of the Superior Court