

PROJECT MANUAL

Roger Williams Complex Phase 2 Generators

**University of Rhode Island
Kingston Campus**

February 23, 2024
100% Construction Documents Issued for Bid

TCI #248-111
KC.U.MISC.2015.002

Owner: University of Rhode Island Board of Trustees

In care of: Office of Capital Projects
University of Rhode Island
60 Tootell Road - Sherman Building, Kingston, RI 02881
Attn: Ken Burke (401) 874-5015

Design Agent: Thompson Consultants, Inc.
525 Mill Street, Marion, MA 02738
Attn: Devin Hurson, (508) 748-2620

Consultants: Bryant Associates, Inc.
640 George Washington Highway, Building C, Suite 100, Lincoln, RI 02865
Attn: Todd Brayton (401) 834-1063

Landscape Elements, LLC
3288 Post Road, Suite 2c, Warwick, RI 02886
Attn: Elena Pascarella (401) 773-4088

DBVW
111 Chestnut St.#2, Providence, RI 02903
Attn: Michael Viveiros (401) 832-1240

Brewster Thornton Group Architects, LLP
317 Iron Horse Way, Suite 202, Providence, RI 02908
Attn: John Dye (401) 861-1600

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Roger Williams Complex Phase 2 Generators

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Dwg. No.	Drawing Title	Date
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END OF DOCUMENT

DOCUMENT 00 5200 – AGREEMENT FORM

PART 1 – GENERAL

- 1.1 The Agreement Form to be utilized on this project is AIA Document A101-2017 as amended, a copy of which follows this page.

END OF DOCUMENT

AIA[®] Document A101[™] – 2017

Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum

AGREEMENT made as of the day of in the year
(In words, indicate day, month and year.)

BETWEEN the Owner:
(Name, legal status, address, telephone and facsimile numbers, and website)

The University of Rhode Island Board of Trustees
35 Campus Avenue, Green Hall
Kingston, Rhode Island 02881
acting by and through,
The University of Rhode Island Purchasing Department
10 Tootell Road
Kingston, Rhode Island 02881
401.874.2171 (telephone); 401.874.2306 (facsimile)
Ntp://web.uri.edu/purchasing/

on behalf of the User Agency:
(Name, legal status, address, telephone and facsimile numbers, and website)

The University of Rhode Island
Office of Capital Projects
60 Tootell Road – Sherman Building
Kingston, Rhode Island 02881
401.874.2725 (telephone)

and the Contractor:
(Name, legal status, address, telephone and facsimile numbers, and website)

for the following Project:
(Name, location and detailed description)

The Design Agent:
(Name, legal status, address, telephone and facsimile numbers, and website)

ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

The parties should complete A101[™]–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201[™]–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

The Owner and Contractor agree as follows.

Init.

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User Notes:

(3B9ADA33)

(Paragraph Deleted)

The Owner and Contractor agree as follows.

TABLE OF ARTICLES

- 1 THE CONTRACT DOCUMENTS
- 2 THE WORK OF THIS CONTRACT
- 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION
- 4 CONTRACT SUM
- 5 PAYMENTS
- 6 DISPUTE RESOLUTION
- 7 TERMINATION OR SUSPENSION
- 8 MISCELLANEOUS PROVISIONS
- 9 ENUMERATION OF CONTRACT DOCUMENTS

EXHIBIT A INSURANCE AND BONDS

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General Conditions, Supplementary Conditions (if any), and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others. No part of the Work shall be performed by Subcontractors without the Owner's prior written consent.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall

be the later of: (i) the issuance of the Purchase Order by the Owner; and (ii) the
(Paragraph Deleted)

date set forth in a notice to proceed issued by the User Agency.

(Paragraphs Deleted)

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:

(Check one of the following boxes and complete the necessary information.)

☐ Not later than () calendar days from the date of commencement of the Work.

Init.

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User Notes:

(3B9ADA33)

[] By the following date:

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work

Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. Subject to additions and deductions as provided in the Contract Documents, the Contract Sum shall be: \$_____.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item

Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement. *(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)*

Item

Price

Conditions for Acceptance

§ 4.3 Allowances, if any, are specified in the Bid Proposal Form and are included in the Contract Sum.

(Table Deleted)

§ 4.4 Unit prices, if

any, are specified in the Bid Proposal Form and include all costs, including without limitation, labor, materials, services, regulatory compliance, overhead, and profit necessary for the completion of the Work. Unit prices shall be used for both additions to, and deletions from the Work.

(Table Deleted)

§ 4.5 Liquidated damages, if any:

(Insert terms and conditions for liquidated damages, if any.)

.1 In the event that there is one date for Substantial Completion of the Work, the Contractor shall pay the Owner the sum stipulated in this Section 4.5.1 as liquidated damages, and not as a penalty, for each calendar day of delay until the Work is substantially complete: \$_____.

.2 In the event that the Project is scheduled to be completed in phases, and there is more than one date for Substantial Completion of the Work, the Contractor shall pay the Owner an aggregate amount equal to the sums stipulated in this Section 4.5.2 as liquidated damages, and not as a penalty, for each calendar day of delay until the Work for each phase is substantially complete:

Init.

Phase	Liquidated Damages Sum
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.3 The Owner and the Contractor have reasonably determined the sums set forth in this Section 4.5 to be a fair estimate of the Owner' actual damages which are difficult to ascertain in the event of delay.

§ 4.6 Other:

(Paragraph Deleted)

The Owner shall not be liable to the Contractor or any Subcontractor for claims or damages of any nature caused by or arising out of any delays. The sole remedy against the Owner for delays shall be the allowance of additional time for completion of the Work.

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Design Agent by the Contractor and Certificates for Payment issued by the Design Agent and approved by the Owner in writing, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

§ 5.1.3 The Owner shall make payment of the certified amount, less retainage, to the Contractor not later than the 30th working day following written approval by the Owner.

(Paragraph Deleted)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor and approved by the Design Agent and the Owner in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Design Agent and the Owner may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2007, General Conditions of the Contract for Construction as modified by the Owner, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

- .1 That portion of the Contract Sum properly allocable to completed Work;
- .2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and
- .3 That portion of Construction Change Directives that the Design Agent determines, in the Design Agent's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

- .1 The aggregate of any amounts previously paid by the Owner;
- .2 The amount, if any, for Work that remains uncorrected and for which the Design Agent has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2007 as modified by the Owner;

Init.

- .3 For Work performed or defects discovered since the last payment application, any amount for which the Design Agent may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2007 as modified by the Owner; and
- .4 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due: five (5%) percent.

(Paragraph Deleted)

§ 5.1.7.1.1 Deleted.

(Paragraph Deleted)

§ 5.1.7.2 Deleted.

(Paragraph Deleted)

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:

(Paragraph Deleted)

The amount of five (5%) percent shall be retained by the Owner through the date of Substantial Completion of the Work and then after the date of Substantial Completion of the Work in accordance with R.I. Gen. Laws § 37-12-10.1.

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2007 as modified by the Owner.

§ 5.1.9 Except with the Owner's prior written approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.1.10 Within 10 working days of receipt of any progress payment from the Owner, the Contractor must pay its Subcontractors the full amount included for each such Subcontractor within the Contractor's Application for Payment in accordance with the provisions of AIA A201 – 2007, General Conditions of the Contract for Construction as modified by the Owner.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, less the amount withheld pursuant to § 5.1.7.3, shall be made by the Owner to the Contractor when:

- .1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2007 as modified by the Owner, and to satisfy other requirements, if any, which extend beyond final payment; and
- .2 a final Certificate for Payment has been issued by the Design Agent and approved in writing by the Owner;
- .3 the Contractor has submitted its final release and final releases from all of its Subcontractors and suppliers in a form acceptable to the Owner; and
- .4 the Contractor has submitted to the Owner all close-out documents, including without limitation, all as-built plans, warranties, manuals, and other materials set forth in the Contract Documents.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 working days after the issuance of the Design Agent's final Certificate for Payment and written approval by the Owner.

Init.

§ 5.3 Interest

Payments due and unpaid under the Contract shall bear interest from the date payment is due in accordance with the provisions of “Prompt Payment by Department of Administration,” R.I. Gen. Laws §§ 42-11.1-1 et seq.

§ 5.4 Owner's Rights

§ 5.4.1 The Owner shall have the right to deduct from any payments due to the Contractor the amount of any unpaid obligations owed to the State of Rhode Island by the Contractor, including without limitation, any and all unpaid taxes, the amount of any claim against the Contractor arising out of this Agreement, or any amount on account of any other reason permitted by applicable law.

§ 5.5 Pursuant to R.I. Gen. Laws § 44-1-6, the Owner shall withhold payment from the Contractor if the Contractor does not maintain a regular place of business in Rhode Island in the amount of three (3%) percent of the Contract Sum until 30 calendar days after Final Completion and compliance by the Contractor with the requirements of such section. The three (3%) percent withheld pursuant to R.I. Gen. Laws § 44-1-6 is not considered retainage which is held pursuant to § 5.1.7.

(Paragraph Deleted)

ARTICLE 6 DISPUTE RESOLUTION

§ 6.1 Initial Decision Maker

Claims shall be referred to the Initial Decision Maker for initial decision. The URI Director of Purchasing, as the Purchasing Agent appointed pursuant to the Procurement Regulations of the Board of Governors for Higher Education, will serve as the Initial Decision

Maker in accordance with the provisions of the State Purchases Act, Procurement Regulations of the Board of Governors for Higher Education, and this Section 6.1. An initial decision shall be required as a condition precedent to binding dispute resolution pursuant to Section 6.3 of any Claim arising prior to the date final payment is due.

§ 6.2 Mediation

For any Claim not resolved by the Initial Decision Maker procedures set forth in Section 6.1, and prior to the implementation of the binding dispute resolution procedures set forth in Section 6.3, the Contractor shall have the

option to pursue mediation, exercisable by written notice to the Owner within 30 calendar days of an Initial Decision. In the event of the exercise of

such option by the Contractor, the Owner and the Contractor shall attempt to select a mediator, and in the event that the Owner and the Contractor cannot agree on a mediator, either party may apply in writing to the Presiding Justice of the Providence County Superior Court, with a copy to the other, with a request for the court to appoint a mediator, and the costs of the mediator shall be borne equally by both parties.

(Paragraph Deleted)

§ 6.3 Binding Dispute Resolution

For any Claim not resolved by the Initial Decision Maker procedures set forth in Section 6.1, or mediation at the option of the Contractor pursuant to Section 6.2, the method of binding dispute resolution shall be determined in accordance with the provisions of the “Public Works Arbitration Act,” R.I. Gen. Laws §§ 37-16-1 et seq. and the Procurement Regulations of the Board of Governors for Higher Education.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2007, as modified by the Owner. The Contract may also be terminated by the Owner: (i) in the event of the unavailability of appropriated funds; (ii) in the absence of a determination of continued need; or (iii) as otherwise provided in the State of Rhode Island Procurement Regulations General Conditions of Purchase or other applicable law.

§ 7.1.1 **Deleted.**

§ 7.2 The Work may be suspended by the Owner as provided in: (i) the Procurement Regulations of the Board of Governors For Higher Education or other applicable law; or (ii) Article 14 of AIA Document A201–2007 as modified by the Owner.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2007 or another Contract Document, the reference refers to: (i) the AIA Document A201 – 2007 or other Contract Document as modified by the Owner; and (ii) that provision in the AIA Document A201 – 2007 as modified by the Owner or other Contract Document as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 Representatives for the Owner

§ 8.2.1 The Owner’s representative:

(Name, title, address, email address, and other information for the preferred methods of contact)

**The University of Rhode Island Board of Trustees, acting by and through the University of Rhode Island
Purchasing Department
10 Tootell Road
Kingston, Rhode Island 02881
Name
401.874. (telephone)**

§ 8.2.2 The User Agency’s representative:

(Name, title, address, email address, and other information for the preferred methods of contact)

**The University of Rhode Island
Office of Capital Projects
60 Tootell Road – Sherman Building
Kingston, Rhode Island 02881
Paul M. DePace, PE
401.874.2725 (telephone)**

§ 8.2.3 The Design Agent’s representative:

(Name, title, address, email address, and other information for the preferred methods of contact)

§ 8.3 The Contractor’s representative:

(Name, title, address, email address, and other information for the preferred methods of contact)

§ 8.4 Neither the Owner’s nor the Contractor’s representative nor the Design Agent’s representative shall be changed without 10 working days’ prior notice to the other party.

Init.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in the Solicitation and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in the Solicitation and elsewhere in the Contract Documents.

§ 8.6 Deleted.

§ 8.7 Other provisions:

§ 8.7.1 **The Contractor represents and warrants to the Owner, in addition to any other representations and warranties of the Contractor elsewhere in the Contract Documents:**

.1 The Contractor and its Subcontractors are each financially solvent, able to pay their debts as they mature, and possess sufficient working capital to perform their obligations under the Contract Documents.

.2 The Contractor and its Subcontractors are each able to furnish the tools, materials, equipment, and labor required to complete the Project as required under the Contract Documents.

.3 *The Contractor and each Subcontractor are authorized to do business in the State of Rhode Island and are properly licensed by all necessary governmental authorities having jurisdiction over them and over the Work and the Project.*

.4 The execution of this Agreement and its performance is within its duly authorized powers.

.5 The Contractor has visited the site of the Project, familiarized itself with the local and special conditions under which the Work is to be performed, and correlated its observations with the requirements of the Contract Documents.

.6 The Contractor possesses the requisite level of experience and expertise in the business administration, construction, and superintendence of projects of the size, complexity, and nature of the Project, and it will perform the Work with the care, skill, and diligence of a contractor possessing such experience and expertise.

§ 8.7.2 The representations and warranties of the Contractor in this Section 8.7 and elsewhere in the Contract Documents will survive the execution and delivery of this Agreement, any termination of this Agreement, and the final completion of the Work.

§ 8.7.3 Any Change Orders or other Modifications must be approved in writing by the Owner.

§ 8.7.4 The Owner is the University of Rhode Island Board of Trustees, acting by and through the University of Rhode Island Purchasing Department, and therefore, pursuant to the provisions of R.I. Gen. Laws § 34-28-31, mechanics liens may not be placed against the Project.

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, as modified by the Owner

.2 **Deleted.**

.3 AIA Document A201™–2007, General Conditions of the Contract for Construction, as modified by the Owner.

.4 **Deleted.**

.5 Drawings

(Table Deleted)

The Drawings are included in the Solicitation and are available on the Division of Purchases website at www.purchasing.ri.gov.

.6 Specifications

Init.

(Table Deleted)

The Specifications are included in the Solicitation and are available on the Division of Purchases website at www.purchasing.ri.gov.

.7 Addenda, if
(Table Deleted)

any, issued pursuant to the Solicitation form a part of the Solicitation and are available on the Division of Purchases website at www.purchasing.ri.gov.

.8
Supplementary and other Conditions of the Contract, including without limitation, the State of Rhode Island General Conditions of Purchase Regulation.

.9 Other documents listed below:

(Paragraph Deleted)

.1 The Solicitation, issued by the Owner, including without limitation, the Invitation to Bid, the Instructions to Bidders, the Specifications and Drawings, any Addenda, and the Bid Checklist.

(Paragraph Deleted)

.2 The Bid Proposal, including without limitation, the Bid Form and the Bidder Certification Cover Form.

(Table Deleted)

.3 The Purchase Order issued by the Owner.

§ 9.2 This Agreement and the Contract Documents are subject to, and governed by, the laws of the State of Rhode Island, including all procurement statutes and regulations (available at www.purchasing.ri.gov), and applicable federal and local law, all of which are fully incorporated into this Agreement by this reference.

(Table Deleted)

(Paragraph Deleted)

§ 9.3 In the event of any conflict between or among the Contract Documents, or any Contract Documents and any provision of the State of Rhode Island Procurement Regulations and/or any other provision of the Rhode Island General Laws, the State of Rhode Island Procurement Regulations and the Rhode Island General Laws shall control.

ARTICLE 10 BENEFITS OF AGREEMENT

§ 10.1 The User Agency is a disclosed third-party beneficiary of this Agreement and shall have all of the rights and benefits hereunder to which such a party is entitled. Nothing contained in this Agreement shall create a contractual relationship with, or a cause of action in favor of, any other third party against the Owner or the User Agency.

§ 10.2 This Agreement shall be binding on the Contractor and its successors and assigns; provided, however, that the Contractor may not assign its rights nor delegate its responsibilities under this Agreement without the Owner's prior written consent.

Init.

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User Notes:

(3B9ADA33)

This Agreement is entered into as of the day and year first written above; provided, however, that this Agreement shall not become a valid, binding, and enforceable contract unless and until the Owner shall have issued a Purchase Order.

**THE UNIVERSITY OF RHODE ISLAND
BOARD OF TRUSTEES,
acting by and through
THE UNIVERSITY OF RHODE ISLAND
PURCHASING DEPARTMENT**

OWNER (*Signature*)

Abigail Rider Vice President, Division of
Administration and Finance, University of Rhode
Island

(*Printed name and title*)

CONTRACTOR (*Signature*)

(*Printed name and title*)

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DOCUMENT 00 6140 - WAIVER OF LIEN FORM

U. R. I. Document Waiver of Lien Form is included, following this page, as an integral part of the Contract documents. A copy with completed information must be submitted with the second and each succeeding Application for Payment.

UNIVERSITY OF RHODE ISLAND

Construction Project Title: _____

General Contractor: _____

Subcontractor/Supplier: _____

DUNS No.: _____

Application and Certificate for Payment No: _____
(prior to Application accompanying this form)

Schedule of Values Line Item No.: _____

DESCRIPTION OF WORK Heading: _____

Total payment Received, Including Current Payment: \$ _____

The undersigned Representative of the above Subcontractor/Supplier has been contracted by the above General Contractor to furnish materials, or labor, or both, as included in the approved Schedule of Values under the Line Item No.____, and DESCRIPTION OF WORK heading indicated above, for the Construction Project listed above.

The undersigned acknowledges receipt of payment, under this Line Item No., and DESCRIPTION OF WORK heading, and hereby waives and releases any and all lien, or claim or right to lien, on the Construction Project listed above, and premises, under the statutes of the State of Rhode Island, relating to Mechanics Liens, on account of materials, or labor, or both, furnished, or which may be furnished, by the undersigned to, or on account of, the above numbered Application and Certificate for Payment.

Signed on this _____ day of _____, 20__.

(signature)_____
(firm name)**END OF DOCUMENT**

DOCUMENT 00 7000 – GENERAL CONDITIONS

PART 1 – GENERAL

- 1.1 The General Conditions to be utilized on this project is AIA Document A201-2007 as amended, a copy of which follows this page.

END OF DOCUMENT



AIA[®] Document A201[™] – 2007

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

THE OWNER:

(Name, legal status and address)

The University of Rhode Island Board of Trustees
35 Campus Avenue
Kingston, Rhode Island 02881
acting by and through,
The University of Rhode Island Purchasing Department
10 Tootell Road
Kingston, Rhode Island, 02881
(401) 874-2171 (telephone)
(401) 874-2306 (facsimile)
On behalf of the User Agency

THE USER AGENCY

(Name, address, telephone and facsimile numbers, and web address)

The University of Rhode Island
Office of Capital Projects
60 Tootell Road – Sherman Building
Kingston, Rhode Island 02881
(401) 874-2725 (telephone)

THE Design Agent:

(Name, legal status, address, telephone and facsimile numbers, and web address)

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ADDITIONS AND DELETIONS:

The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed. A vertical line in the left margin of this document indicates where the author has added necessary information and where the author has added to or deleted from the original AIA text.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

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8	TIME
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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 BASIC DEFINITIONS

§ 1.1.1 THE CONTRACT DOCUMENTS

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (the Agreement) and consist of the Agreement (and the documents enumerated therein), Conditions of the Contract (General Conditions, Supplementary Conditions, if any, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive or (4) a written order for a minor change in the Work issued by the Design Agent.

§ 1.1.2 THE CONTRACT

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Design Agent or the Design Agent's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Design Agent or the Design Agent's consultants or (4) between any persons or entities other than the Owner and the Contractor. The Design Agent shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Design Agent's duties.

§ 1.1.3 THE WORK

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 THE PROJECT

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by separate contractors.

§ 1.1.5 THE DRAWINGS

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location, and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 THE SPECIFICATIONS

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 INSTRUMENTS OF SERVICE

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Design Agent and the Design Agent's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 INITIAL DECISION MAKER

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2 and certify termination of the Agreement under Section 14.2.2.

§ 1.2 CORRELATION AND INTENT OF THE CONTRACT DOCUMENTS

§ 1.2.1 The intent of the Contract Documents is to include all items and services necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; the Contractor shall perform all work reasonably inferable from the Contract Documents as being necessary to produce the indicated results.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.2.4 In the event of any conflicts or discrepancies among the Contract Documents, the provisions of the Contract Documents will be interpreted in the order of priority set forth in Rhode Island Procurement Regulation 220-RICR-30-00-13.4(B).

§ 1.2.5 In the event of any conflicts or discrepancies between the Contract Documents and the State of Rhode Island Procurement Regulations or any provision of the Rhode Island General Laws, the State of Rhode Island Procurement Regulations and the Rhode Island General Laws will control.

§ 1.2.6 In the event of any inconsistency between the Drawings and Specifications, the better quality or greater quantity of Work shall be provided.

§ 1.2.7 The Owner will be the final decision maker for any and all interpretations.

§ 1.3 CAPITALIZATION

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 INTERPRETATION

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 OWNERSHIP AND USE OF DRAWINGS, SPECIFICATIONS AND OTHER INSTRUMENTS OF SERVICE

§ 1.5.1 The Owner and the User Agency shall have a perpetual license to utilize the Drawings, Specifications, and other documents, including electronic or digital documents, prepared by the Design Agent and the Design Agent's consultants, for the execution of the Project and shall have and retain all rights to use them and reproduce them for the production and maintenance of the Work described therein. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Design Agent's or Design Agent's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the Instruments of Service provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the Instruments of Service on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Design Agent and the Design Agent's consultants.

§ 1.6 TRANSMISSION OF DATA IN DIGITAL FORM

If the parties intend to transmit Instruments of Service or any other information or documentation in digital form, they shall endeavor to establish necessary protocols governing such transmissions, unless otherwise already provided in the Agreement or the Contract Documents.

ARTICLE 2 OWNER

§ 2.1 GENERAL

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Design Agent does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 Deleted.

§ 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

§ 2.2.1 Deleted.

§ 2.2.2 The Contractor shall secure and pay for permits and fees, necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.2.3 If required for the Work in the discretion of the Owner, the Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of any information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.2.4 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.2.5 Deleted.

§ 2.3 OWNER'S RIGHT TO STOP THE WORK

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a 10 working-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Design Agent's additional services made necessary by such default, neglect, or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Design Agent. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

ARTICLE 3 CONTRACTOR

§ 3.1 GENERAL

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Design Agent, or by tests, inspections, or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.2.3, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Owner and the Design Agent any errors, inconsistencies, or omissions discovered by or made known to the Contractor or additional Drawings, Specifications, or instructions required to define the Work in greater detail to permit the proper progress of the Work as a request for information in such form as the Design Agent may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Design Agent and the Owner any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Design Agent or Owner may require.

§ 3.2.3.1 Omissions from the Drawings and Specifications of items obviously needed to perform the Work properly, such as attachments, bolts, hangers, and other fastening devices, shall not relieve the Contractor from the obligation to furnish and install such items.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Design Agent issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall make Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2, 3.2.3, or 3.2.3.1, the Contractor shall pay such costs and damages to the Owner as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Design Agent for damages resulting from errors, inconsistencies, or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.2.4.1 The Contractor shall not make any changes without prior written authorization from the Design Agent and the Owner.

§ 3.2.5 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Design Agent for evaluating and responding to the Contractor's requests for information that are not prepared in accordance with the Contract Documents or where the requested information is available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.

§ 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless the Contract Documents give other specific instructions concerning these matters. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall evaluate the jobsite safety thereof and, except as stated below, shall be fully and solely responsible for the jobsite safety of such means, methods, techniques, sequences or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to the Owner and Design Agent and shall not proceed with that portion of the Work without further written instructions from the Design Agent. If the Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by the Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 LABOR AND MATERIALS

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work. Whenever the Contractor has an obligation to provide labor and materials under the Agreement, the Contractor, at a minimum, shall provide the labor for, and furnish and install and place in operation all items, including without limitation, all proper connections.

§ 3.4.2 Except in the case of minor changes in the Work authorized by the Design Agent in accordance with Sections 3.12.8 or 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Design Agent and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

§ 3.5 WARRANTY

The Contractor warrants to the Owner and the Design Agent that materials and equipment furnished under the Contract will be of first quality, prime manufacture, and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements, including substitutions not properly authorized, may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Design Agent, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.6 TAXES

§ 3.6.1 The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.6.2 The University of Rhode Island is exempt from payment of any federal or state excise, transportation, or sales tax. The University of Rhode Island Purchasing Department will furnish Exemption Certificates upon request.

§ 3.7 PERMITS, FEES, NOTICES AND COMPLIANCE WITH LAWS

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections required by the Rhode Island State Building Code necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded. The Contractor shall be responsible for obtaining the Certificate of Occupancy from the appropriate governmental authorities.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 The Contractor shall promptly notify the Design Agent and the Owner if the Contractor becomes aware that the Contract Documents are not in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities. If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions. If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Design Agent before conditions are disturbed and in no event later than 21 working days after first observance of the conditions. The Design Agent will promptly investigate such conditions and, if the Design Agent determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Design Agent determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Design Agent shall promptly notify the Owner and Contractor in writing, stating the reasons. If either party disputes the Design Agent's determination or recommendation, that party may proceed as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Design Agent. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

§ 3.8 ALLOWANCES

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 Allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 Whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 SUPERINTENDENT

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Design Agent the name and qualifications of a proposed superintendent. The Design Agent may reply within 14 working days to the Contractor in writing stating (1) whether the Owner or the Design Agent has reasonable objection to the proposed superintendent or (2) that the Design Agent requires additional time to review. Failure of the Design Agent to reply within the 14 working-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Design Agent has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES

§ 3.10.1 The Contractor, within 20 working days after the issuance of the Purchase Order, shall prepare and submit for the Owner's and Design Agent's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals, not less frequently than monthly, as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work. The Contractor shall certify on the initial schedule and all revised schedules that they comply with the Contract Documents.

§ 3.10.2 The Contractor shall prepare a submittal schedule, within 20 working days after the issuance of the Purchase Order, and thereafter as necessary to maintain a current submittal schedule, and shall submit the schedule(s) for the Owner's and the Design Agent's approval. The Owner's and the Design Agent's approval shall not unreasonably be delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Owner and the Design Agent reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Design Agent.

§ 3.11 DOCUMENTS AND SAMPLES AT THE SITE

The Contractor shall maintain at the site for the Owner one copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and one copy of approved Shop Drawings, Product Data, Samples and similar required submittals. These shall be available to the Design Agent and shall be delivered to the Design Agent for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. Their purpose is to demonstrate the way by which the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Design Agent is subject to the limitations of Section 4.2.7. Informational submittals upon which the Design Agent is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Design Agent without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve and submit to the Design Agent Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents in accordance with the submittal schedule approved by the Owner and the Design Agent or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of separate contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents to the Owner and Design Agent that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Design Agent.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Design Agent's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Design Agent in writing of such deviation at the time of submittal and (1) the Design Agent has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Design Agent's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Design Agent on previous submittals. In the absence of such written notice, the Design Agent's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. The Contractor shall not be required to provide professional services in violation of applicable law. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Design Agent will specify all performance and design criteria that such services must satisfy. The Contractor shall cause such services or certifications to be provided by a properly licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Design Agent. The Owner and the Design Agent shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Design Agent have specified to the Contractor all performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Design Agent will review, approve, or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Contractor shall not be responsible for the adequacy of the performance and design criteria specified in the Contract Documents.

§ 3.12.11 The Owner shall be entitled to reimbursement from the Contractor for amounts paid to the Design Agent for evaluation of resubmittals.

§ 3.13 USE OF SITE

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, and any restrictions imposed by the User Agency or the Owner, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 CUTTING AND PATCHING

§ 3.14.1 The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting and patching shall be restored to the condition existing prior to the cutting, fitting and patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or separate contractors by cutting, patching or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter such construction by the Owner or a separate contractor except with written consent of the Owner and of such separate contractor; such consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold from the Owner or a separate contractor the Contractor's consent to cutting or otherwise altering the Work.

§ 3.15 CLEANING UP

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 ACCESS TO WORK

The Contractor shall provide the Owner and Design Agent access to the Work in preparation and progress wherever located.

§ 3.17 ROYALTIES, PATENTS AND COPYRIGHTS

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Design Agent harmless from loss on account thereof, but shall not be responsible for such defense or loss when a particular design, process or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications or other documents prepared by the Owner or Design Agent. However, if the Contractor has reason to believe that the required design, process or product is an infringement of a copyright or a patent, the Contractor shall be responsible for such loss unless such information is promptly furnished to the Design Agent and the Owner.

§ 3.18 INDEMNIFICATION

§ 3.18.1 To the fullest extent permitted by law the Contractor shall indemnify and hold harmless the Owner, the User Agency and the State of Rhode Island in accordance with Rhode Island Procurement Regulation 220-RICR-30-00-13.21.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

§ 3.18.3 Without limiting the generality of the foregoing, the defense and indemnity set forth in this Section 3.18 includes, without limitation, all liabilities, damages, losses, claims, demands, and actions on account of bodily injury, death, or property loss to a person or entity indemnified hereunder or any other persons or entities, whether based upon statutory (including, without limitation, workers compensation), contractual, tort, or other liability of any person or entity so indemnified.

§ 3.18.4 The remedies set forth herein shall not deprive any person indemnified hereunder of any other indemnity action, right, or remedy otherwise available to any such person or entity at common law or otherwise.

§ 3.18.5 The Contractor will include the indemnity set forth in this Section 3.18, without modification, in each Subcontract with any Subcontractor.

§ 3.18.6 Notwithstanding any other language in the Contract Documents to the contrary, the indemnity hereunder shall survive Final Completion of the Work and final payment under the Agreement and shall survive any termination of the Agreement.

ARTICLE 4 DESIGN AGENT

§ 4.1 GENERAL

§ 4.1.1 The Design Agent is the person lawfully licensed to practice his or her profession in the State of Rhode Island or an entity lawfully practicing its profession in the State of Rhode Island and identified in the Contract Documents as the Design Agent. The term "Design Agent" means the Design Agent or the Design Agent's authorized representative.

§ 4.1.2 Duties, responsibilities and limitations of authority of the Design Agent as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner, Contractor and Design Agent. Consent shall not be unreasonably withheld.

§ 4.1.3 If the employment of the Design Agent is terminated, the Owner shall employ a successor Design Agent as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Design Agent.

§ 4.2 ADMINISTRATION OF THE CONTRACT

§ 4.2.1 The Owner with assistance from the Design Agent will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction through the date the Design Agent issues the final Certificate for Payment and continuing until the expiration of the one-year period following Final Completion. The Design Agent will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Design Agent will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Design Agent will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Design Agent will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents, except as provided in Section 3.3.1.

§ 4.2.2.1 The Owner is entitled to reimbursement from the Contractor for amounts paid to the Design Agent for site visits made necessary by the fault of the Contractor or by defects and deficiencies in the Work.

§ 4.2.3 On the basis of the site visits, the Design Agent will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (1) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (2) defects and deficiencies observed in the Work. The Design Agent will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Design Agent will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 COMMUNICATIONS FACILITATING CONTRACT ADMINISTRATION

Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate with each other through the Design Agent about matters arising out of or relating to the Contract. Communications by and with the Design Agent's consultants shall be through the Design Agent. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

§ 4.2.5 Based on the Design Agent's evaluations of the Contractor's Applications for Payment, the Design Agent will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Design Agent has authority to reject Work that does not conform to the Contract Documents. Whenever the Design Agent considers it necessary or advisable, the Design Agent will have authority to require inspection or testing of the Work in accordance with Sections 13.5.2 and 13.5.3, whether or not such Work is fabricated, installed or completed. However, neither this authority of the Design Agent nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Design Agent to the Contractor, Subcontractors, material and equipment suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Design Agent will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Design Agent's action will be taken in accordance with the submittal schedule approved by the Design Agent or, in the absence of an approved

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submittal schedule, with reasonable promptness while allowing sufficient time in the Design Agent's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Design Agent's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5 and 3.12. The Design Agent's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Design Agent, of any construction means, methods, techniques, sequences or procedures. The Design Agent's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Design Agent will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Section 7.4. The Design Agent will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Design Agent will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Design Agent agree, the Design Agent will provide one or more project representatives to assist in carrying out the Design Agent's responsibilities at the site. The duties, responsibilities and limitations of authority of such project representatives shall be as set forth in an exhibit to be incorporated in the Contract Documents.

§ 4.2.11 The Design Agent will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Design Agent's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Design Agent will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Design Agent will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Design Agent's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents and approved by the Owner.

§ 4.2.14 The Design Agent will review and respond to requests for information about the Contract Documents. The Design Agent's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Design Agent will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 DEFINITIONS

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK

§ 5.2.1 Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner and the Design Agent the names of

persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each portion of the Work. The Owner may reply within 14 working days to the Contractor in writing stating (1) whether the Owner or the Design Agent has reasonable objection to any such proposed person or entity or (2) that the Owner or Design Agent requires additional time for review.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Design Agent has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Design Agent has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Design Agent has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person or entity previously selected if the Owner or Design Agent makes reasonable objection to such substitution.

§ 5.2.5 MANUFACTURERS AND FABRICATORS

§ 5.2.5.1 Not later than 10 working days after the date of commencement of the Work, the Contractor shall furnish in writing to the Owner and the Design Agent the names of the manufacturers or fabricators for certain products, equipment, and systems identified in the Specifications and, where applicable, the name of the installing Subcontractor. The Owner may reply within 14 working days to the Contractor in writing, stating: (i) whether the Owner or the Design Agent has reasonable objection to any such proposed person manufacturer or fabricator; or (ii) whether the Owner or Design Agent requires additional time to review.

§ 5.2.5.2 The Contractor shall not contract with a proposed manufacturer, fabricator, or Subcontractor to whom the Owner or Design Agent has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.5.3 If the Owner or Design Agent has an objection to a manufacturer, fabricator, or Subcontractor proposed by the Contractor, the Contractor shall propose another to whom the Owner or Design Agent has no objection.

§ 5.2.5.4 The Contractor shall not substitute a manufacturer, fabricator, or Subcontractor previously selected if the Owner or Design Agent makes reasonable objection to such substitution.

§ 5.3 SUBCONTRACTUAL RELATIONS

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work, which the Contractor, by these Documents, assumes toward the Owner and Design Agent. Upon the request of the User Agency and/or the Owner, the Contractor shall provide the User Agency and/or the Owner with copies of each subcontract agreement. Each subcontract agreement shall preserve and protect the rights of the Owner and Design Agent under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

(Paragraph deleted)

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 working days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon such assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 OWNER'S RIGHT TO PERFORM CONSTRUCTION AND TO AWARD SEPARATE CONTRACTS

§ 6.1.1 The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each separate contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with other separate contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to the construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, separate contractors and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces, the Owner shall be deemed to be subject to the same obligations and to have the same rights that apply to the Contractor under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6 and Articles 10, 11 and 12.

§ 6.2 MUTUAL RESPONSIBILITY

§ 6.2.1 The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a separate contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly report to the Design Agent apparent discrepancies or defects in such other construction that would render it unsuitable for such proper execution and results. Failure of the Contractor so to report shall constitute an acknowledgment that the Owner's or separate contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work, except as to defects not then reasonably discoverable.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a separate contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a separate contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or separate contractors as provided in Section 10.2.5.

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§ 6.2.5 The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 OWNER'S RIGHT TO CLEAN UP

If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 GENERAL

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement between the Owner and the Contractor; a Construction Change Directive requires agreement by the Owner and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Design Agent alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or order for a minor change in the Work.

§ 7.2 CHANGE ORDERS

§ 7.2.1 A Change Order is a written instrument prepared by the Contractor and signed by the Owner, Contractor and Design Agent stating their agreement upon all of the following:

- .1 The change in the Work;
- .2 The amount of the adjustment, if any, in the Contract Sum; and
- .3 The extent of the adjustment, if any, in the Contract Time.

§ 7.2.2 Subsequent to the approval of a Change Order as provided in § 7.1.2, whether such Change Order changes the Contract Sum or Contract Time or both, no additional claim related to such Change Order will be considered by the Owner. Any change, once incorporated into a Change Order, is all inclusive, and includes all factors that could have been considered at the time of the Change Order such as Project impact or schedule "ripple" effect.

§ 7.3 CONSTRUCTION CHANGE DIRECTIVES

§ 7.3.1 A Construction Change Directive is a written order prepared by the Design Agent and signed by the Owner, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.7.

§ 7.3.4 Deleted.

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§ 7.3.5 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Design Agent of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.6 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.7 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Design Agent shall determine the method and the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in Section 7.3.1. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Design Agent may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.7 shall be limited to the following:

- .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
- .2 Costs of materials, supplies and equipment, including cost of delivery;
- .3 Rental costs of machinery and equipment, exclusive of hand tools; or
- .4 Costs of premiums for all bonds and insurance and permit fees related to the Work..

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Design Agent. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Design Agent will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Design Agent determines, in the Design Agent's professional judgment, to be reasonably justified. The Design Agent's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Design Agent concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Contractor will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.3.11 The combined overhead and profit included in the total cost to the Owner for a change in the Work shall be based on the following schedule:

- .1 For the Contractor, for work performed by the Contractor's own forces, an amount not to exceed ten (10%) percent of the cost.
- .2 For the Contractor, for work performed by the Contractor's Subcontractors, an amount not to exceed five (5%) of the amount due to the Subcontractors.
- .3 For each Subcontractor, for work performed by the Subcontractor's own forces, an amount not to exceed ten (10%) percent of the cost.
- .4 Where the Work represents both additions and deletions and results in a net increase, the allowable overhead and profit shall be in accordance with this Section 7.3.11, but in no event shall the amount exceed fifteen (15%) percent of the net increase in the cost of the Work.

§ 7.3.12 All proposals with an aggregate cost equal to or in excess of \$500.00 shall be accompanied by a detailed itemization of costs, including labor, materials (quantities and prices), and Subcontracts, in a form acceptable to the Owner. In no event will a change order request reflecting an aggregate cost equal to or in excess of \$500.00 be approved without such itemization.

§ 7.4 MINOR CHANGES IN THE WORK

The Design Agent with the prior written approval of the Owner has authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such changes will be affected by written order signed by the Design Agent and shall be binding on the Owner and Contractor.

ARTICLE 8 TIME

§ 8.1 DEFINITIONS

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

The date of commencement of the Work is the date established in Section 3.1 of the Agreement..

(Paragraph deleted)

§ 8.1.3 The date of Substantial Completion is the date certified by the Design Agent in accordance with Section 9.8.

§ 8.1.4 **Deleted.**

§ 8.2 PROGRESS AND COMPLETION

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor and Owner. The date of commencement of the Work shall not be changed by the effective date of such insurance.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 DELAYS AND EXTENSIONS OF TIME

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by an act or neglect of the Owner or Design Agent, or of an employee of either, or of a separate contractor employed by the Owner; or by changes ordered in the Work; or by labor disputes, fire, unusual delay in deliveries, unavoidable casualties or other causes beyond the Contractor's control, then the Contract Time shall be extended by Change Order for such reasonable time as the Owner may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

(Paragraph deleted)

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 CONTRACT SUM

The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.2 SCHEDULE OF VALUES

Within 20 working days of the issuance of the Purchase Order, and promptly if revision is necessary from time to time as a result of a Change Order, the Contractor shall submit to the Owner, before the first Application for Payment, a schedule of values allocating the entire Contract Sum to the various portions of the Work and prepared in such form and supported by such data to substantiate its accuracy as the Design Agent and the Owner may require. This schedule, if and when approved by the Design Agent and the Owner in writing, shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 9.3 APPLICATIONS FOR PAYMENT

§ 9.3.1 At least 10 working days before the date established for each progress payment, the Contractor shall submit to the Design Agent and the Owner for approval an itemized Application for Payment prepared in accordance with the schedule of values for completed portions of the Work. Such application shall be notarized, if required, and supported

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by such data substantiating the Contractor's right to payment as the Owner or the Design Agent may require, such as copies of requisitions from Subcontractors and material suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 All Applications for Payment for Change Orders must be accompanied by a Notice of Change in Purchase Order issued by the Owner, and if directed by the Owner, by the User Agency.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or material supplier, unless such Work has been performed by others whom the Contractor intends to pay.

§ 9.3.1.3 The form of Application for Payment shall be AIA Document G702, Application and Certification for Payment, supported by AIA Document G702A, Continuation Sheet.

§ 9.3.1.4 Until Substantial Completion, the Owner shall pay ninety-five (95%) percent of the amount due the Contractor on account of progress payments.

§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage and transportation to the site for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall be free and clear of liens, claims, security interests or encumbrances in favor of the Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to the Work. The Contractor shall immediately satisfy any lien, claim, or encumbrance against the site where the Project is located and indemnify the Owner from and against all resulting costs and expenses, including without limitation, attorneys' fees.

§ 9.4 CERTIFICATES FOR PAYMENT

§ 9.4.1 The Design Agent will, within 7 working days after receipt of the Contractor's Application for Payment, either issue to the Owner a Certificate for Payment, with a copy to the Contractor, for such amount as the Design Agent determines is properly due, or notify the Contractor and Owner in writing of the Design Agent's reasons for withholding certification in whole or in part as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Design Agent to the Owner, based on the Design Agent's evaluation of the Work and the data comprising the Application for Payment, that, the Work has progressed to the point indicated and that the quality of the Work is in accordance with the Contract Documents. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion and to specific qualifications expressed by the Design Agent. The issuance of a Certificate for Payment will further constitute a representation that the Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that the Design Agent has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (2) reviewed construction means, methods, techniques, sequences or procedures, (3) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by the Owner to substantiate the Contractor's right to payment, or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.4.3 The Contractor must submit all product literature, material and color samples with each Application for Payment, or as otherwise required by the Owner.

§ 9.5 DECISIONS TO WITHHOLD CERTIFICATION

§ 9.5.1 The Design Agent will withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Design Agent's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Design Agent is unable to certify payment in the amount of the Application, the Design Agent will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Design Agent cannot agree on a revised amount, the Design Agent will promptly issue a Certificate for Payment for the amount for which the Design Agent is able to make such representations to the Owner. The Design Agent may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Design Agent's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of:

- .1 defective Work not remedied;
- .2 third party claims filed or reasonable evidence indicating probable filing of such claims unless security acceptable to the Owner is provided by the Contractor;
- .3 failure of the Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a separate contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay;
- .7 failure to carry out the Work in accordance with the Contract Documents; or
- .8 any other failure to comply with the obligations of the Contractor under the Contract Documents.

§ 9.5.2 When the above reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.3 The Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or material or equipment suppliers to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Design Agent and the Design Agent will reflect such payment on the next Certificate for Payment.

§ 9.6 PROGRESS PAYMENTS

§ 9.6.1 After the Design Agent has issued a Certificate for Payment and the Owner has approved the Certificate for Payment in writing, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Design Agent.

§ 9.6.2 The Contractor shall pay each Subcontractor no later than 10 working days after receipt of payment from the Owner the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Design Agent will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Design Agent and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and material and equipment suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within 7 working days, the Owner shall have the right to contact Subcontractors to ascertain whether they have been properly paid. The Owner shall have the right to withhold payment(s) to the Contractor in the event that any Subcontractors or material and equipment suppliers have not been properly paid. Neither the Owner nor Design Agent shall have an obligation to pay or to see to the payment of money to a Subcontractor, except as may otherwise be required by law.

§ 9.6.5 Contractor payments to material and equipment suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors and suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, shall create any fiduciary liability or tort liability on the part of the Contractor for breach of trust or shall entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.7 FAILURE OF PAYMENT

If the Design Agent does not issue a Certificate for Payment, through no fault of the Contractor, within 7 working days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within 7 working days after the date established in the Contract Documents the amount certified by the Design Agent or awarded by binding dispute resolution, then the Contractor may, upon 7 additional working days' written notice to the Owner and Design Agent, make a claim for payment as provided under the provisions of applicable law.

§ 9.8 SUBSTANTIAL COMPLETION

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Design Agent a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Design Agent will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Design Agent's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Design Agent. In such case, the Contractor shall then submit a request for another inspection by the Design Agent to determine Substantial Completion. The Design Agent will perform no more than 2 inspections to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Design Agent for any additional inspections.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Design Agent will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. Upon such acceptance and consent of surety, if any, the Owner shall make payment less the amount of five (5%) percent to be retained by the Owner in accordance with R.I. Gen. Laws § 37-12-10.1. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 PARTIAL OCCUPANCY OR USE

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Section 11.3.1.5 and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments,

retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Design Agent as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Design Agent.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor and Design Agent shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

§ 9.10 FINAL COMPLETION AND FINAL PAYMENT

§ 9.10.1 Upon receipt of the Contractor's written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Design Agent will promptly make such inspection and, when the Design Agent finds the Work acceptable under the Contract Documents and the Contract fully performed, the Design Agent will promptly issue a final Certificate for Payment stating that to the best of the Design Agent's knowledge, information and belief, and on the basis of the Design Agent's on-site visits and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Design Agent's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled. The Design Agent will perform no more than 2 inspections to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner is entitled to reimbursement from the Contractor for amounts paid to the Design Agent for any additional inspections.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Design Agent (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 working days' prior written notice has been given to the Owner, (3) a written statement that the Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5), if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner, and (6) all other close-out documents required by the Owner, including without limitation, all as-built plans, warranties, manuals, and other materials set forth in the Contract Documents. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, Final Completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting Final Completion, and the Design Agent so confirms, the Owner shall, upon application by the Contractor and certification by the Design Agent, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Design Agent prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

- .1 liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;

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- .2 failure of the Work to comply with the requirements of the Contract Documents;
- .3 terms of special warranties required by the Contract Documents; or
- .4 claims permitted under the State of Rhode Island General Conditions of Purchase Regulation.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

§ 9.11 The Contractor and the Contractor's surety shall be liable for and shall pay the Owner as liquidated damages the sums specified in the Solicitation and Bid Form, or if completed, the amount set forth in Section 3.4 of the Agreement.

§ 9.12 Warranties required by the Contract Documents shall commence on the date of Final Completion of the Work.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 SAFETY PRECAUTIONS AND PROGRAMS

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 SAFETY OF PERSONS AND PROPERTY

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury or loss to:

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of the Contractor or the Contractor's Subcontractors or Sub-subcontractors; and
- .3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

§ 10.2.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.

§ 10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel and in consultation with the appropriate governmental authorities.

§ 10.2.4.1 When use or storage of explosives, or other hazardous materials, substances or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall give the User Agency and the Owner reasonable advance notice.

§ 10.2.4.2 If the Contract Documents require the Contractor to handle materials or substances that under certain circumstances may be designated as hazardous, the Contractor shall handle such materials in an appropriate manner.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3, except damage or loss attributable to acts or omissions of the Owner or Design Agent or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Design Agent.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 INJURY OR DAMAGE TO PERSON OR PROPERTY

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 HAZARDOUS MATERIALS

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Design Agent in writing.

§ 10.3.2 Upon receipt of the Contractor's written notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Design Agent the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance. The Contractor and the Design Agent will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Design Agent has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Design Agent have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up.

§ 10.3.3 To the extent permitted by the provisions of R.I. Gen. Laws §§ 9-31-1 et seq., the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Design Agent, Design Agent's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall indemnify the Owner for the cost and expense the Owner incurs (1) for remediation of a material or substance the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

§ 10.4 EMERGENCIES

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 CONTRACTOR'S LIABILITY INSURANCE

§ 11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located such insurance as is specified in the Solicitation and as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations and completed operations under the Contract and for which the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 Claims under workers' compensation, disability benefit and other similar employee benefit acts that are applicable to the Work to be performed;
- .2 Claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 Claims for damages insured by usual personal injury liability coverage;
- .5 Claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 Claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle;
- .7 Claims for bodily injury or property damage arising out of completed operations; and
- .8 Claims involving contractual liability insurance applicable to the Contractor's obligations under Section 3.18.

§ 11.1.1.2 The Contractor's liability insurance shall include all major coverages and be on a comprehensive general liability basis.

§ 11.1.2 The insurance required by Section 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from the date of commencement of the Work until the date of final payment and termination of any coverage required to be maintained after final payment, and, with respect to the Contractor's completed operations coverage, until the expiration of the period for correction of Work or for such other period for maintenance of completed operations coverage as specified in the Contract Documents.

§ 11.1.3 Certificates of insurance as specified in the Solicitation and as otherwise acceptable to the Owner shall be filed with the Owner and the User Agency prior to commencement of the Work and thereafter upon renewal or replacement of each required policy of insurance. These certificates and the insurance policies required by this Section 11.1 shall contain a provision that coverages afforded under the policies will not be canceled or allowed to expire until at least 30 working days' prior written notice has been given to the Owner and the User Agency. An additional certificate evidencing continuation of liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment as required by Section 9.10.2 and thereafter upon renewal or replacement of such coverage until the expiration of the time required by Section 11.1.2. Information concerning reduction of coverage on account of revised limits or claims paid under the General Aggregate, or both, shall be furnished by the Contractor with reasonable promptness.

§ 11.1.4 The Contractor shall cause the commercial liability coverage required by the Contract Documents to include (1) the Owner, the User Agency, and their elected and appointed officials, members, employees, and agents, the Design Agent and the Design Agent's consultants as additional insureds for claims caused in whole or in part by the Contractor's acts or omissions during the Contractor's operations; and (2) the Owner, the User Agency, and their

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elected and appointed officials, members, employees, and agents, as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's completed operations.

§ 11.1.5 The Contractor shall be responsible for the prompt payment to the Owner of any deductible amounts under any insurance policies required under the Contract Documents for claims made pursuant to such policies.

§ 11.2 OWNER'S LIABILITY INSURANCE.

§ 11.2.1 The Contractor shall furnish the Owner and the User Agency, through the Design Agent, an insurance certificate providing Owner's Protective Liability extended to include the interests of the Design Agent, and to protect the Owner, User Agency, and Design Agent from any liability which might be incurred against any of them as a result of any operation of the Contractor or Subcontractors or their employees or anyone for whom either the Contractor or Subcontractors are responsible. Such insurance shall be written for the same limits as the Contractor's commercial general liability insurance and shall include the same coverage.

§ 11.2.2 If the Owner engages separate contractors to perform work for, or in or around, the Project, it shall require in its contracts with each separate contractor that Contractor and its officers, directors, partners, members, employees, and agents shall be: (i) named as additional insureds on a primary, noncontributory basis to any commercial general liability, pollution liability, and excess liability insurance policies; and (ii) provided a waiver of subrogation on all workers compensation and professional liability insurance policies.

§ 11.3 PROPERTY INSURANCE

§ 11.3.1 The Contractor shall purchase and maintain, in a company or companies lawfully authorized to do business in the state of Rhode Island, property insurance written on a builder's risk "all-risk" or equivalent policy form in the amount of the initial Contract Sum, plus value of subsequent Contract Modifications and cost of materials supplied or installed by others, comprising total value for the entire Project at the site on a replacement cost basis without optional deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Section 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Section 11.3 to be covered, whichever is later. This insurance shall include interests of the Owner, the User Agency, the Contractor, Subcontractors and Sub-subcontractors in the Project. If the Owner and/or the User Agency incur any damages by failure of the Contractor to maintain such insurance, then the Contractor shall bear all reasonable cost resulting from such failure.

§ 11.3.1.1 Property insurance shall be on an "all-risk" or equivalent policy form and shall include, without limitation, insurance against the perils of fire (with extended coverage) and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief, collapse, earthquake, flood, windstorm, falsework, testing and startup, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Design Agent's and Contractor's services and expenses required as a result of such insured loss.

§ 11.3.1.2 Deleted.

§ 11.3.1.3 If the property insurance requires deductibles, the Owner shall pay costs not covered because of such deductibles.

§ 11.3.1.4 This property insurance shall cover portions of the Work stored off the site, and also portions of the Work in transit.

§ 11.3.1.5 Partial occupancy or use in accordance with Section 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

§ 11.3.2 Deleted.

§ 11.3.3 Deleted.

§ 11.3.4 Deleted.

§ 11.3.5 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Section 11.3.7 for damages caused by fire or other causes of loss covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

§ 11.3.6 Before an exposure to loss may occur, the Contractor shall file with the Owner a copy of each policy that includes insurance coverages required by this Section 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be canceled or allowed to expire, and that its limits will not be reduced, until at least 30 working days' prior written notice has been given to the Owner and the User Agency.

§ 11.3.7 WAIVERS OF SUBROGATION

The Contractor waives all rights against the Owner and the User Agency and any of their subcontractors, sub-subcontractors, agents and employees, and (2) the Design Agent, Design Agent's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other causes of loss to the extent covered by property insurance obtained pursuant to this Section 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Design Agent, Design Agent's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

§ 11.3.8 A loss insured under this property insurance shall be adjusted by the Contractor as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

§ 11.3.9 If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Contractor's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Contractor shall deposit in a separate account proceeds so received, which the Contractor shall distribute in accordance with such agreement as the parties in interest may reach, or as determined in accordance with the method of binding dispute resolution selected in the Agreement between the Owner and Contractor. If after such loss no other special agreement is made and unless the Owner terminates the Contract for convenience, replacement of damaged property shall be performed by the Contractor after notification of a Change in the Work in accordance with Article 7.

§ 11.3.10 The Contractor as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within 5 working days after occurrence of loss to the Contractor's exercise of this power; if such objection is made, the dispute shall be resolved in the manner selected by the Owner and Contractor as the method of binding dispute resolution in the Agreement.

§ 11.4 PERFORMANCE BOND AND PAYMENT BOND

§ 11.4.1 The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in the Solicitation.

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§ 11.4.2 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 UNCOVERING OF WORK

§ 12.1.1 If a portion of the Work is covered contrary to the Design Agent's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Design Agent, be uncovered for the Design Agent's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Design Agent has not specifically requested to examine prior to its being covered, the Design Agent may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be at the Owner's expense. If such Work is not in accordance with the Contract Documents, such costs and the cost of correction shall be at the Contractor's expense unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

§ 12.2 CORRECTION OF WORK

§ 12.2.1 BEFORE OR AFTER SUBSTANTIAL COMPLETION

The Contractor shall promptly correct Work rejected by the Design Agent or failing to conform to the requirements of the Contract Documents, whether discovered before or after Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Design Agent's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 AFTER SUBSTANTIAL COMPLETION

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Final Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. If the Contractor fails to correct nonconforming Work within a reasonable time after receipt of notice from the Owner or Design Agent, the Owner may correct it in accordance with Section 2.4.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.2.4 Upon request by the Owner and prior to the expiration of one year from the date of Final Completion, the Design Agent will conduct and the Contractor shall attend 2 meetings with the Owner to review the facility operations and performance.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be

sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 ACCEPTANCE OF NONCONFORMING WORK

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 GOVERNING LAW

The Contract shall be governed by the law of the State of Rhode Island.

§ 13.2 SUCCESSORS AND ASSIGNS

§ 13.2.1 The Owner and Contractor respectively bind themselves, their successors, assigns and legal representatives to covenants, agreements and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to any executive, legislative, judicial, regulatory, or administrative body of the state, or any political subdivision thereof, including without limitation, any department, division, agency, commission, board, office, bureau, authority, school, water, or fire district, or other agency of Rhode Island state or local government that exercises governmental functions, any other governmental authority, and any quasi-public corporation and/or body corporate and politic. The Contractor shall execute all consents reasonably required to facilitate such assignment.

§ 13.3 WRITTEN NOTICE

Written notice shall be deemed to have been duly served if delivered in person to the individual, to a member of the firm or entity, or to an officer of the corporation for which it was intended; or if delivered at, or sent by registered or certified mail or by courier service providing proof of delivery to, the last business address known to the party giving notice, or when received, if manually delivered or transmitted by electronic mail or facsimile to the last such address known to the party giving notice.

§ 13.4 RIGHTS AND REMEDIES

§ 13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

§ 13.4.2 No action or failure to act by the Owner, Design Agent or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach there under, except as may be specifically agreed in writing.

§ 13.5 TESTS AND INSPECTIONS

§ 13.5.1 Tests, inspections and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Design Agent timely notice of when and where tests and inspections are to be made so that the Design Agent may be present for such procedures. The Owner shall bear costs of (1) tests, inspections or approvals that do not become requirements until after bids are received or negotiations concluded, and (2) tests, inspections or approvals where building codes or applicable laws or regulations prohibit the Owner from delegating their cost to the Contractor.

§ 13.5.2 If the Design Agent, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Section 13.5.1, the Design Agent will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Design

Agent of when and where tests and inspections are to be made so that the Design Agent may be present for such procedures. Such costs, except as provided in Section 13.5.3, shall be at the Owner's expense.

§ 13.5.3 If such procedures for testing, inspection or approval under Sections 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure including those of repeated procedures and compensation for the Design Agent's services and expenses shall be at the Contractor's expense.

§ 13.5.4 Required certificates of testing, inspection or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Design Agent.

§ 13.5.5 If the Design Agent is to observe tests, inspections or approvals required by the Contract Documents, the Design Agent will do so promptly and, where practicable, at the normal place of testing.

§ 13.5.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.6 INTEREST

No interest shall be due or payable on account of any payment due or unpaid under the Contract Documents except in accordance with the provisions of "Prompt Payment by Department of Administration," R.I. Gen. Laws §§ 42-11.1-1 et seq.

§ 13.7 TIME LIMITS ON CLAIMS

The Owner and Contractor shall commence all claims and causes of action, whether in contract, tort, breach of warranty or otherwise, against the other arising out of or related to the Contract in accordance with the requirements of the final dispute resolution method selected in the Agreement within the time period specified by applicable law. The Owner and Contractor waive all claims and causes of action not commenced in accordance with this Section 13.7.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 TERMINATION BY THE CONTRACTOR

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 calendar days through no act or fault of the Contractor or a Subcontractor, Sub-subcontractor or their agents or employees or any other persons or entities performing portions of the Work under direct or indirect contract with the Contractor, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency that requires all Work to be stopped; or
- .3 Because the Design Agent has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1

§ 14.1.2 Deleted.

§ 14.1.3 If one of the reasons described in Section 14.1.1 exists, the Contractor may, upon 7 working days' written notice to the Owner and Design Agent, terminate the Contract and recover from the Owner payment for Work executed.

§ 14.1.4 If the Work is stopped for a period of 60 calendar days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon 7 additional days' written notice to the Owner and the Design Agent, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 TERMINATION BY THE OWNER FOR CAUSE

§ 14.2.1 The Owner may terminate the Contract if the Contractor:

- .1 refuses or fails to supply enough properly skilled workers or proper materials;

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- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 disregards or fails to comply with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority;
- .4 otherwise is guilty of breach of a provision of the Contract Documents; or
- .5 cancels or the Contractor or the Owner receives notice of cancellation or nonrenewal of any insurance required under the Contract Documents.

§ 14.2.2 When any of the above reasons exist, the Owner, upon certification by the Initial Decision Maker that sufficient cause exists to justify such action, may without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, 7 working days' written notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Design Agent's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The
(Paragraphs deleted)

Owner shall not be liable to the Contractor or any Subcontractor for claims or damages of any nature caused by or arising out of any delays. The sole remedy against the Owner for delays shall be the allowance of additional time for completion of the Work in accordance with the provisions of Section 8.3.1.

§ 14.4 TERMINATION BY THE OWNER FOR CONVENIENCE

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

- .1 cease operations as directed by the Owner in the notice;
- .2 take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- .3 except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment for Work executed, and costs incurred by reason of such termination.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 CLAIMS

§ 15.1.1 DEFINITION

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim.

§ 15.1.2 NOTICE OF CLAIMS

Claims by either the Owner or Contractor must be initiated by written notice to the other party. Such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly serviced if delivered in person, by mail, by courier, or by electronic transmission. Claims by either party must be initiated within 21 working days after occurrence of the event giving rise to such Claim or within 21 working days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3 CONTINUING CONTRACT PERFORMANCE

Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents. The Design Agent will prepare Change Orders and issue Certificates for Payment in accordance with the decisions of the Initial Decision Maker.

§ 15.1.4 CLAIMS FOR ADDITIONAL COST

If the Contractor wishes to make a Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.5 CLAIMS FOR ADDITIONAL TIME

§ 15.1.5.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.5.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated and had an adverse effect on the scheduled construction.

§ 15.1.5.3 Claims for increase in the Contract Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. The Contractor shall provide such supporting documentation as the Owner may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.

§ 15.1.5.4 The Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of the Contractor.

§ 15.1.6 The Contractor waives Claims against the Owner for consequential damages arising out of or relating to this

(Paragraphs deleted)

Contract. This waiver includes damages incurred by the Contractor for principal office expenses, including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit. This waiver is applicable, without limitation, to all consequential damages due to the Contractor's termination in accordance with Article 14. Nothing in this Section 15.1.6 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 INITIAL DECISION

§ 15.2.1 Claims shall be referred to the Initial Decision Maker for initial decision. The URI Purchasing Department as the Purchasing Agent appointed pursuant to the Procurement Regulations of the Board of Governors for Higher Education made in accordance with the provisions of the "State Purchases Act," R.I. Gen. Laws § 37-2-1 et seq., will serve as the Initial Decision Maker in accordance with the provisions of the State Purchases Act, Procurement Regulations of the Board of Governors for Higher Education, and this Section 15.2.1. An initial decision shall be required as a condition precedent to binding dispute resolution pursuant to Section 15.3.1 of any Claim arising prior to the date final payment is due.

§ 15.2.2 Deleted.

§ 15.2.3 Deleted.

§ 15.2.4 Deleted.

§ 15.2.5 Deleted.

§ 15.2.6 Deleted.

§ 15.2.6.1 Deleted.

§ 15.2.7 Deleted.

§ 15.2.8 Deleted.

§ 15.3 MEDIATION

§ 15.3.1 For any Claim not resolved by the Initial Decision Maker procedures set forth in Section 15.2.1, and prior to the implementation of the binding dispute resolution procedures set forth in Section 15.4.1, the Contractor or the Design Agent shall have the option to pursue mediation, exercisable by written notice to the Owner within 30 calendar days of an Initial Decision. In the event of the exercise of such option by the Contractor or the Design Agent, the Owner and the Contractor or the Design Agent shall attempt to select a mediator, and in the event that the Owner and the Contractor or the Design Agent cannot agree on a mediator, either party may apply in writing to the Presiding Justice of the Providence County Superior Court, with a copy to the other, with a request for the court to appoint a mediator, and the costs of the mediator shall be borne equally by both parties.

§ 15.3.2 Deleted.

§ 15.3.3 Deleted.

§ 15.4 BINDING DISPUTE RESOLUTION

§ 15.4.1 For any Claim not resolved by the Initial Decision Maker procedures set forth in Section 15.2.1, or mediation at the option of the Contractor pursuant to Section 15.3.1, the method of binding dispute resolution shall be determined in accordance with the provisions of the "Public Works Arbitration Act," R.I. Gen. Laws §§ 37-16-1 et seq.

(Paragraphs deleted)

§ 15.4.4 Deleted.

§ 15.4.4.1 Deleted.

§ 15.4.4.2 Deleted.

§ 15.4.4.3 Deleted.

§ 16 COMPLIANCE WITH APPLICABLE LAW

The Contractor and its Subcontractors shall comply with all applicable federal, state, and local laws.

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DOCUMENT 00 7200 – URI STANDARD DOCUMENTS

PART 1 – GENERAL

- 1.1 The latest version of the following documents, available on the URI Capital Projects website, <http://web.uri.edu/capitalprojects/manual-for-construction-project-safety-procedures/>, will apply to all of the work of this project and are hereby incorporated by reference:

- URI Sexual Harassment Policy
- Manual for Construction Project Safety Procedures
- Access Box Keys
- Residential Sprinkler Protection
- Hot Work Permitting
- Fire Protection System Impairment
- Fire Watches
- URI Water System Regulations/Policies
- URI Contractor Attestation Related to COVID-19 Pandemic

END OF DOCUMENT

SECTION 01 1000 - SUMMARY

PART 1 - GENERAL

1.01 PROJECT

- A. See Bid Form for official Project Information.
- B. The Project consists of the construction of the following types of work:
 - 1. The project main objective is to provide optional standby power for the Roger Williams Complex dormitories with two medium voltage generators in parallel operation with an automatic transfer when utility power is lost.
 - 2. The new generators and paralleling equipment will be located in custom, exterior enclosures/wall located at the intersection of West Alumni Road and Butterfield Road; the former location of Substation 1 and 2.
 - 3. The new optional standby power will intercept existing medium voltage feeders 2-2 and 2-3. New electrical ductbanks will be provided beneath the project site for the electrical feeder modifications.
 - 4. Removal of unsuitable soils (if applicable) as provided for in Allowance #3. Refer to Attachment C, at the end of this section for additional reference information on previous investigatory and remedial work on the site.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 5200 - Agreement.

1.03 DESCRIPTION OF WORK

- A. Scope of demolition and removal work is shown on drawings.
- B. Scope of alterations work is shown on drawings and/or as specified herein.

1.04 OWNER OCCUPANCY/SCHEDULE

- A. Owner intends to vacate the work area for the duration of the Project. Work areas will be made available as mutually agreed to during project scheduling. See Attachment A at the end of this section for availability and restrictions on access to spaces.
- B. Work to begin within 7 days of receipt of Purchase Order unless otherwise defined in Attachment A at the end of this section.
- D. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

1.05 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings. Coordinate with Attachment A following this section. Include all costs of this coordination, including all premium time wages that may be required to meet these requirements, in the Base bid.

- B. Arrange use of site and premises to allow:
 - 1. Adjacent projects to progress as planned for the Owner.
 - 2. Use of street and adjacent properties by the Public.
 - 3. Continued operation of the facility in accordance with Attachment A.
- C. Provide access to and from site as required by law and by Owner:
 - 1. Maintain appropriate egress for workforce and users of the facility.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit. Provide necessary signage and barriers to direct pedestrians around work areas.
- D. Time Restrictions:
 - 1. Limit conduct of especially noisy work when events are in process.
 - 2. Night and weekend work may be allowed, pending prior approval from the Owner.
 - 3. Refer to Attachment A following this section for building specific scheduling restrictions
- E. Utility Outages and Shutdown:
 - 1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
 - 2. Prevent accidental disruption of utility services to other facilities.
 - 3. Contractor to provide written notification on Fire Sprinkler and Alarm System Impairment Notification Form following this section as Attachment B.

1.06 ITEMS TO BE SALVAGED

- A. None.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION – NOT USED

END OF MAIN SECTION – See Attachments A, B, and C following.

01 1010 SUMMARY – Attachment A

NOTE:

Unrestricted = Contractor to plan and schedule work and submit for review by Owner

Limited Restriction = Contractor to meet with Owner and coordinate access to these areas

Restricted = Contractor to perform work on dates provided in this document

Contractor will have unrestricted access to the work area.

Contractor is responsible for coordinating with the Owner for exterior hoisting, with respect to timing, crane placement, temporary road closures, etc, and is responsible for any and all associated costs.

Contractor is responsible for coordinating with URI and authorities having jurisdiction on utility work, possible impacts on dorms for noise and generator testing, access to dormitory facilities, road access, emergency response access and interruptions as follows:

Points of Contact:

- URI Utilities – Bob Bozikowski
- Dormitory impacts – Tom Cooley
- Road impacts – URI Public Safety Office
- Emergency response – Kingston Fire District

Parking is restricted to areas designated by the University. Additional parking needs may be coordinated via URI Parking Services.

END OF DOCUMENT



Fire Sprinkler and Alarm System Impairment Notification Form

To: URI Office of Capital Projects

Date _____

Start of Planned Impairment: _____

End of Planned Impairment: _____

Building occupied during impairment: Yes: _____ No: _____

Any hot work to be performed: Yes: _____ No: _____

Description of Work to be performed:

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on its right side, suggesting it's resting on a surface.

URI Manager of Alarms, Mike Suriani, can also be directly contacted at 401-639-2268.

Contractor supervisory personnel shall remain in the building for the entire duration of the impairment.

Name: _____

Company: _____

Phone: _____

01 1030 SUMMARY - Attachment C

Previous Investigatory and Remedial Work on the Project Site

The documents following this page are provided to the contractor for reference pertaining to the scope of work covered in Allowance #3 – Unsuitable Soils (if applicable).

Documents Included:

1. Site Investigation Report (dated April 2017)
2. Remedial Action Work Plan (dated July 2017)
3. RIDEM Remedial Approval Letter (dated August 18, 2017)
4. RIDEM Letter of Compliance (dated July 6, 2018)

SITE INVESTIGATION REPORT

University of Rhode Island
Butterfield Road Substation
South Kingstown, Rhode Island

April 2017

Prepared for:

University of Rhode Island
Office of Capital Projects
60 Tootell Road – Sherman Building
Kingston, Rhode Island 02881

Prepared by:

Gordon R. Archibald, Inc.
200 Main Street
Pawtucket, Rhode Island

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Butterfield Road Substation Site Investigation Plan	
Butterfield Road Substation Sampling Locations Plan	

Appendices

APPENDIX A – Butterfield Road Substation Investigation Plan
APPENDIX B – Laboratory Analytical Data Sheets
APPENDIX C – Analytical Testing Requirements for Imported Soil

Gordon R. Archibald Inc. (GRA) provides the following Limited Subsurface Investigation Report conducted at the University of Rhode Island (URI) Butterfield Road Substation located in South Kingston, Rhode Island (project area). The site's location is shown on **Figure 1**. **Figure 2** is an aerial photograph of the property.

1.0 Site Information

1.1 Scope of Work

GRA completed the following scope of work to satisfy the Rhode Island Department of Environmental Management – Office of Waste Management (RIDEM-OWM) Remediation regulations requirements.

- **Task A – Sampling Design Plan and Quality Assurance Project Plan.** A Sampling Design Plan in accordance with the EPA PCB release investigation and remediation guidance documents and a Quality Assurance Project Plan (QAPP) was prepared and submitted for URI review.
- **Task B – Site Investigation.** Site investigation points were pre-marked and Dig Safe was notified prior to initiating the site investigation work. Soil samples were collected from a sampling grid that complies with the EPA requirements. The first included soil sampling at one-foot intervals to a depth of three feet below grade at 37 sampling points and at a 38th point where there was potential impact as the result of site activities within the fenced enclosure. The soil sampling results from the initial sampling round were reviewed and it was determined that additional sampling was not required. Concrete pad coring was attempted but due to the concrete pad thicknesses the soil samples were collected immediately adjacent to the concrete pad. Soil samples were field screened for VOCs and laboratory analyzed for PCBs and TPH. TPH analysis was completed on one third of the soil samples. Four composite soil samples were analyzed for disposal parameters. The following report summarizing the site investigation findings and proposed remedial alternatives was prepared.

1.2 Historic Site Information

1.2.1 Historic Release

GRA was informed by URI that there had been a release and response action related to release from a transformer previously located on the southwest concrete pad. URI was not able to provide additional information on the release and response actions. URI did not provide any environmental assessments for the project area.

1.2.2 Historic Ownership

The University of Rhode Island was established in 1892 and has occupied the campus area since that time. GRA is not aware of the purchase date of the land known as the Butterfield Road Substation. GRA reviewed the Historic Aerials for additional information.

1.2.3 Historic Environmental Use / Reports

GRA reviewed the available historic use of the University of Rhode Island's Butterfield Road Substation and found the following.

- The project area was identified as a transformer substation in the 1962 aerial.
- GRA was informed by the URI that the northwest portion of the project area was previously used to store lead paint coated materials.
- GRA was informed by Mr. Dave Lamb, URI – Assistant Director of Facilities Management that no documentation of any past incidents, releases, or investigations was available for the Butterfield Substation. No environmental reports were provided to GRA as part of this Limited Subsurface Investigation Report.

1.2.4 Historic Aerial Information

GRA reviewed the historic aerial photographs for the years 1939, 1951-1952, 1962, 1972, 1981, 1988, 1997, 2003-2004, 2008, and 2016 utilizing the Rhode Island Department of Environmental Management (RIDEM)s online ArcGIS database. The following information is summarized from the aerial photographs of the project area and surrounding land.

1939

- Area of the Butterfield Substation is identified as undeveloped woodland.
- A roadway is identified traversing from west to east. This roadway is in the location of the currently identified West Alumni Avenue.
- No structures are identified in the immediate vicinity of the project area. The surrounding area appears undeveloped.

1951-1952

- No change is identified from the 1939 aerial at the project area and surrounding locations.

1962

- Development at the project area is first identified in this aerial photograph. The area appears to be utilized as an electrical substation. No structures are identified.
- A roadway is identified from the south and ending at the previously identified West Alumni Avenue. The identified roadway is currently identified as Butterfield Road.
- Several dormitories are identified to the southeast of the project area.

1972

- The project area appears to be fully developed and utilized as an electrical substation area.
- A parking lot is identified to the immediate west of the project area. This parking lot appears consistent with the current western abutting parking lot.
- The northern abutting dormitory building is first identified in this aerial.
- The previously identified Butterfield Road has been continued in a northerly direction and is consistent with the current condition.
- Parking lots are first identified at the northeast and southeast portions of the intersection at Butterfield Road and West Alumni Avenue.
- Dormitories located to the south, across West Alumni Avenue are first identified in this aerial.

1981, 1988, 1997, 2003-2004, 2008

- No major changes to the project or surrounding areas were identified since the 1972 aerial.

2016

- The transformers are no longer identified within the project area. This is consistent with the areas current condition.
- The eastern abutting parking lot has been converted to the new substation area.

1.2.5 Historic Site Plans

No historic site plans or documents were provided to GRA as part of this subsurface investigation.

1.2.6 Underground Storage Tanks

GRA is not aware of any historic underground store tank (UST) or aboveground storage tank (AST) located at the project area.

1.3 General Characterization

The University of Rhode Island is serviced by a Public Drinking Water Wells No. 2, 3, and 4 located approximately 3,700 feet west of the project area. The Butterfield Road Substation is located within a Community Wellhead Protection Area (CWHPA).

Potable water is not provided to the substation. No drinking water wells are located within the project area.

No surface water is located within the project area. Outside of the fence and project area, the area slopes to the west towards White Horn Brook. According to the FEMA FIRM map, the project is not located in a designated flood zone.

1.3.1 Environmentally Sensitive Areas

The Rhode Island Department of Environmental Management defines an Environmentally Sensitive Area as any of the following:

- Areas which provide habitat for Federally endangered or threatened species as determined by the U.S. Department of Fish and Wildlife;
- Areas which provide habitat for State endangered or threatened species as determined by the Department through the National Heritage Program;
- Surface Water classified A, B or C by the Department or Wetlands;
- Coastal areas designated as Type 1 Conservation Areas or Type 2 Low-Intensity Use by the Rhode Island Coastal Resources Management Council;
- Tidal waters classified SA by the Department;
- State parts, management areas, wildlife areas or marine sanctuaries; or
- Natural areas owned or operated by government agencies or not-for-profit organizations for the purpose of preserving the natural character of the property.

GRA's review of the project area indicates that one Environmentally Sensitive Area was identified within 500 feet of the project area utilizing the RIDEM Online ArcGIS Environmental Resource Map.

One wetland area, located to the west of the project area, is within 500 feet of the site. The area is identified by the RIDEM as Scrub-Shrub Swamp. This wetland area is located to the immediate west of the project area.

1.3.2 State and Federal Listed Sites

According to the RIDEM Environmental Resource Map, two listed sites were identified within 500 feet of the project area.

- One site, identified as Hope Dining Hall located along Butterfield Road, is a listed Aboveground Storage Tank (AST) site. This site is located approximately 500 feet south and side-gradient of the project site.
- One site, identified as the URI Dairy Barn is a listed Leaking Underground Storage Tank (LUST) site. This site is located approximately 500 feet west and down-gradient of the project site.

It is GRA's opinion, based on the location and distance that these sites are not likely to have impacted the soil quality at the subject property.

1.4 Current Site Conditions

The Butterfield Road Substation project area is shown on **Figure 1**. A site plan showing the project area, included in the Butterfield Road Substation Site Investigation Plan, can be found attached.

The project area's extent is defined by a chain link and wooden fence on all sides. The Substation is located at the northwest corner at the intersection of Butterfield Road and West Alumni Avenue. Dormitories are located to the immediate north and south, across West Alumni Avenue. An asphalt paved parking lot is located to the immediate west of the project area.

The substation topography is generally level. The Butterfield Road existing grade to the east is higher than the substation. The grade gradually slopes down from Butterfield Road to the northwest to the substation's fenced enclosure. The grade then slopes downward to the north and west outside of the substation.

Site utilities are shown on **Figure 2** URI GIS Utility Map. No structures are identified within the project area. The transformers, switch gear, and other associated electrical equipment have been previously removed. Several concrete pads, previously used for mounting the utility equipment are located throughout the area, as seen on the attached Site Investigation Plan. The surface of the area is primarily crushed stone, and sparse vegetation is identified throughout the area. No asphalt pavement is identified within the area.

1.4.1 RIDEM ArcGIS Mapping

The on-line RIDEM Environmental Resource Map app was utilized to obtain the following maps showing for the information requested in the SIR Checklist 7.03 I. The images can be found in the attached **Figures**.

1.4.2 Observed Conditions

No free liquids were identified at the project area or within the general sample location vicinity. No Light Non-Aqueous Phase Liquid or Dense Non-Aqueous Phase Liquids were present.

No odors, or stressed vegetation was identified at the project area. No man-made structures are identified at the project except for the concrete pads. No hazardous substances were identified at the project area.

Minor staining was identified at the southwest concrete slab and surrounding surface area. A white staining was identified at the northwest concrete slab and surrounding surface area.

A small soil stockpile, approximately 0.5 cubic yards, was identified adjacent to the northeast concrete pedestal. No excavated areas were identified within the project area.

1.4.3 Site Utilities

URI provided a GIS utility map for the substation and surrounding area. GRA was informed prior to the subsurface exploration that an active subsurface electric utility line is present in the southeast project area. Sanitary sewer, stormwater, and electric subsurface utilities are located to the south of the substation. A stormwater drainage pipe is located to the west and north of the substation. The utility is shown on the attached Site Investigation Plan.

2.0 Site Regulatory Information

URI is an institution of higher learning. The RIDEM Remediation Regulations school definition does not include institutions of higher learning. The site investigation area is surrounded roadway, parking lots, and dormitories. The northern abutting area, utilized as dormitories by the URI, is considered a dwelling and falls under residential use. The current use of this area is consistent with the RIDEM Remediation Regulations industrial/commercial use definition.

GRA was informed by the University of Rhode Island that the planned development of the project area is as a temporary construction related parking area prior to the final construction of a roundabout at the intersection of Butterfield Road and West Alumni Avenue. The planned future use of the project area is consistent with the RIDEM Remediation Regulations industrial/commercial use definition.

The groundwater at the subject property is classified as GAA. According to the RIDEM on-line Environmental resource map the subject property is located in a Community Well Head Protection Area (WHPA). The groundwater reportable concentrations that apply to the subject property would be GA groundwater standards. The CWHPA is shown on **Figure 3**.

The site investigation was designed to evaluate the potential for impact associated with the former use of transformers in the substation. Transformer oil with PCBs was previously utilized in the substation. Grab soil samples were collected from discrete depths as part of the site investigation. The soil sample laboratory data is used to evaluate compliance with the RIDEM Remediation Regulations soil residential direct exposure criteria (R-DEC), the industrial/commercial direct exposure criteria (I/C-DEC), and the GA leachability criteria (GA-L).

The URI's Butterfield Road Substation has not previously been and is not currently under the jurisdiction or any program within the Department of Environmental Protection Agency or the Department of Environmental Management.

Surface water bodies located in the area of the Butterfield Road Substation are shown on **Figures 4 and 5**. None of the surface water bodies are located at or adjacent to the site.

3.0 Site Investigation

3.1 Sampling Grid Plan

GRA designed the soil sampling grid in accordance with the (USEPA) *Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup*. As requested by URI, GRA assumed the entire area inside the substation's chain link fence was the PCB spill area. Using the Section 5.0 Sample Design methodology the center of the sampling circle was located and the sampling radius determined to be 51 feet. Utilizing the Section 5.4 Determine the Number of Grid Sample Points to Use Table 1 it was determined 37 samples would be required. A 37 sample point hexagonal sampling grid was prepared. The spacing between adjacent sampling points, 15.3 feet, and successive sampling rows, 13.3 feet, was determined using Table 2. The hexagonal sampling grid was plotted on the site plan in accordance with Figure 8 Location of Sampling Points in a 37-point Grid. Seven sampling points are located outside the design spill area. The sampling grid diagram is attached.

3.2 Boring Installation

GRA was onsite on January 12, 2017 to collect concrete chip samples and stone wipe samples from the designated sample locations. On January 13, 2017 GRA collected 0'-6" below grade samples (interval 'A') using a steel spade.

Soil borings were advanced on January 16 and 17, 2017 with a GeoProbe. Soil samples were collected in sleeves by sample interval. Due to the shallow subsurface investigation, no boring logs were completed as part of this work. The soil boring locations are shown on the attached Site Investigation Plan.

The following summary of the site investigation work is provided:

Boring Locations

After field review of the Butterfield Road Substation project area, it was determined an additional sample should be collected. This sample is identified in the LSIR as sample location 40. The original 37 sample locations were not revised or relocated. No boring exceeded three (3) feet below grade and no groundwater was encountered as a result of the shallow investigation. No monitoring wells were installed as part of this investigation. The sample locations can be found attached in the attached plan.

- January 12, 2017
 - GRA was onsite to collect three concrete chip samples and one duplicate sample. A total of four (4) concrete samples were submitted for PCB analysis.
 - Concrete samples were collected from locations: 12 12 is sown off the concrete pad, 30, 32
 - Note: Sample location 12 was originally located at the northeast concrete pad. Field observations indicated the eastern pads were not correct on the provided site plan. Sample location 12 was revised and located adjacent to the concrete pad, in accordance with the EPA grid sampling. The provided Sampling Locations Plan shows the location of sample 12 and the adjacent concrete chip sample location.
 - The duplicate concrete chip (CN) sample was collected from location 12 and submitted as sample 39.

- GRA was onsite to collect four crushed stone wipe samples and one duplicate sample. A total of five (5) wipe samples were submitted for PCB analysis.
 - Stone wipe samples collected from locations: 2, 24, 25, and 27
 - The duplicate crushed stone wipe (W) sample was collected from location 25 and submitted as sample 38.
- January 13, 2017
 - GRA was onsite to collect 0'-6" below grade (interval 'A') soil samples.
- January 16 and 17, 2017
 - GRA and PAL Environmental Services (PAL) were onsite to collect the remaining subsurface soil samples.
 - Three samples were located in the general location of an active subsurface electric utility service. These samples were collected manually using a steel spade. Interval 'C' soil samples were not obtained from these locations due to a subsurface refusal, believed to be the electric utility bank line.
 - These sample locations are identified as numbers 6, 27, and 37.
- Soil Sampling
 - All soil samples were submitted for laboratory analysis for PCBs by EPA 8082. Selective soil sample locations at intervals 'A' and 'B' were collected and submitted for TPH analysis by EPA 8100.
 - Four composite soil samples, CS-1, CS-2, CS-3, and CS-4 were prepared in accordance with the *Sampling Plan*.
 - The composite soil samples were collected in the following process:
 - A boring was advanced to three feet below grade level after all sampling intervals were collected for the individual location.
 - The composite boring was located adjacent to the sample location.
 - The soil was collected in a 1-gallon zip-lock bag to avoid cross contamination.
 - The same process continued until all locations were represented in the zip-lock bag.
 - Once all composite borings were collected in the bag, the soil was mixed (shaken) to represent the construction and disposal characteristics.
 - The composite soil samples were collected from the bag as described below.
- Groundwater Gauging
 - Groundwater was not encountered as part of this limited subsurface investigation report. No groundwater samples were collected or analyzed.

3.3 Soil Sample Laboratory Analysis

The collected crushed stone wipe samples, concrete chip samples, and soil samples from all intervals (A, B, and C) were submitted for PCB analysis by EPA method 8082. Select soil samples at intervals A and B were also submitted for TPH analysis by EPA 8100 as listed in **Table 1**.

The CS-1, CS-2, CS-3, and CS-4 composite soil samples were submitted for the following analyses:

- VOCs by EPA Method 8260
- SVOCs (totals) by EPA Method 8270

- PCBs by EPA method 8082
- Total Metals by EPA method 6010
- TPH by EPA Method 8100 modified
- pH by EPA Method 9045
- Water Content by EPA Method 9025B
- Free Liquids by EPA Method 9095B

Table 1 Butterfield Road Substation Sample Summary Table	
Type of Sample	Number of Samples
Soil Samples – Sample Interval A (0 - 6" bg)	38 samples for PCB analysis
Soil Samples – Sample Interval B (1' - 1'6" bg)	38 samples for PCB analysis
Soil Samples – Sample Interval C (2' - 2'6" bg)	35 samples for PCB analysis
Soil Sample Locations 1, 2, 3, 23, 24, 25, 31, 32, 33, 34, 35 – Sampling Interval A (0 – 6" bg)	12 samples for TPH analysis
Soil Sample Locations 1, 2, 3, 23, 24, 25, 31, 32, 33, 34, 35 – Sampling Interval B (1' – 1'6" bg)	12 samples for TPH analysis
Concrete Chip Sample (CN) Locations: 12, 30, and 32	3 samples for PCB analysis
Crushed Stone Wipe Sample (W) Locations: 2, 24, 25, and 27	4 samples for PCB analysis
Composite Sample (CS-1) (Composite from sample locations 24, 25, and 32)	1 Sample for Disposal Characterization
Composite Sample (CS-2) (Composite from sample locations 2, 9, and 10)	1 Sample for Disposal Characterization
Composite Sample (CS-3) (Composite from sample locations 26 and 27)	1 Sample for Disposal Characterization
Composite Sample (CS-4) (Composite from sample locations 17, 18, and 19)	1 Sample for Disposal Characterization

Table 2 Butterfield Road Substation QA/QC Sample Summary Table			
Type of Sample	Number of Samples	Sample ID	Original Sample ID
Equipment Blank – GeoProbe Sampler	1 Sample	EQ-GP-1/17	--
Equipment Blank – Steel Spade	1 Sample	EQ-SH-1/13	--
Trip Blank	3 Samples	Trip – 1/13 Trip – 1/16 Trip – 1/17	--
Field Duplicates – Concrete Chip	1 Sample	39-CN	12-CN
Field Duplicates – Crushed Stone	1 Sample	38-W	25-W
Field Duplicates – Soil Samples	3 Samples	38-A (PCB and TPH) 38-B (PCB and TPH) 38-C	25-A (PCB and TPH) 25-B (PCB and TPH) 25-C

The laboratory data has been summarized and is provided in the attached **Tables**. The laboratory analytical data sheets can be found in **Appendix B**.

The attached tables are separated as follows:

Table 3 – Soil, Concrete, and Crushed Stone Wipe Samples.

Table 4 – Duplicate Soil, Concrete, and Crushed Stone Wipe Samples.

Table 5 – Equipment and Trip Blank Samples

Table 6 – Composite Soil Sample

3.3.1 Soil Sample Laboratory Analytical Data – Regulatory Compliance

The soil sample laboratory analytical data was compared to the RIDEM Remediation Regulations for Residential Direct Exposure Criteria (R-DEC), Industrial/Commercial Direct Exposure Criteria (I/C-DEC) and GA Groundwater Leachability (GA-L). The following regulatory compliance summary is provided.

All soil PCB samples were compliant with the RIDEM R-DEC, I/D-DEC, and GA-L criteria.

All Total Petroleum Hydrocarbon (TPH) samples were compliant with the RIDEM criteria except for the following:

- Soil sample 32-B exceeded the TPH regulatory criteria for GA-L and R-DEC.
- Soil sample 31-A exceeded the TPH criteria for GA-L, GB-L, R-DEC, and I/D-DEC.

Composite soil samples CS-1, CS-2, and CS-3 PP13 target metal analytes were compliant with their respective R-DEC and I/C-DEC except arsenic. The reported arsenic concentrations for samples CS-1, CS-2, and CS-3 range from 7.6 to 45.0 mg/kg which exceeds the Arsenic R-DEC and I/C-DEC of 7.0 mg/kg. All other composite soil sample objectives were below the RIDEM criteria.

It is not possible to use the CS-1, CS-2, or CS-3 composite samples to determine the compliance/non-compliance of individual sampling intervals. The CS-1 and CS-2 samples were collected to characterize soils from the area where soil samples 31-A and 32-B were collected. The sample's laboratory analytical data was intended to evaluate soil management options during potential remedial work. Additional sampling would be required to evaluate the compliance of individual soil sampling intervals. However, additional sampling is not recommended. The areas where non-compliant composite soil samples were collected will be remediated to achieve compliance.

PCBs were not detected in the crushed stone wipe samples and the concrete chip samples. The wipe and concrete samples' laboratory analytical data indicates these surfaces have not been impacted by a release of PCB containing dielectric fluid.

3.4 QA/QC Laboratory Analytical Data

The Equipment Blank samples were submitted for PCB analysis by EPA 8082A. Both Equipment Blank samples' PCB concentrations were reported below the detection limit.

The Trip Blank samples were submitted for PCB analysis by EPA 8082A. All Trip Blank samples' PCB concentrations were reported below the detection limit.

As part of this Limited Subsurface Investigation, GRA collected duplicate samples to confirm consistency from both the field and the laboratory. Duplicate soil and crushed stone wipe samples were collected from sample location 25 (25-A, 25-B, 25-C, and 25-W) and submitted as sample 38 (38-A, 38-B, 38-C,

and 38-W). A duplicate concrete chip sample was collected from sample location 12 (12-CN) and submitted as sample 39 (39-CN). The duplicate soil, wipe, and concrete chip samples' laboratory analytical data was consistent with the corresponding sample results.

3.5 Site Compliance Evaluation

Thirty-eight (38) soil borings were advanced from January 13 through January 17, 2017. The soil boring locations are shown on the attached Site Investigation Plan.

The subsurface investigation indicated the following parameters were not compliant with the RIDEM's Remediation Regulations.

Table 8A University of Rhode Island - Butterfield Road Substation Non-Compliant Soil Sample Summary Soil Samples Collected January 2017			
Sample ID	Sample Media	Sample Type	Non-Compliant Compound
31-A	Soil	Grab/Unfiltered	TPH
32-B	Soil	Grab/Unfiltered	TPH
CS-1	Soil	Composite	Arsenic
CS-2	Soil	Composite	Arsenic
CS-3	Soil	Composite	Arsenic

Table 8B University of Rhode Island - Butterfield Road Substation Non-Compliant Soil Sample Summary Soil Samples Collected January 2017				
Sample ID	Non-Compliant Compound	Laboratory Reported Result	Exceeded Criteria	Criteria Objective
31-A	TPH	4,480 mg/kg	GA-L R-DEC I/C-DEC	500 mg/kg 500 mg/kg 2,500 mg/kg
32-B	TPH	565 mg/kg	GA-L R-DEC	500 mg/kg 500 mg/kg
CS-1	Arsenic	7.64 mg/kg	R-DEC I/C-DEC	7 mg/kg 7 mg/kg
CS-2	Arsenic	10.1 mg/kg		
CS-3	Arsenic	45.0 mg/kg		

3.5.1 Release Characterization

Grab soil samples 31-A and 32-B TPH concentrations were not compliant with the RIDEM Remediation Regulations TPH R-DEC, I/C-DEC and GA-L. These samples were collected from areas adjacent to the southeast and southcentral concrete pads. Soil samples collected to the north, south, east, and west of the soil sample 31 and 32 locations were compliant with the Remediation Regulations TPH R-DEC, I/C-DEC and GA-L. The laboratory analytical data indicates the horizontal extent of the TPH non-compliance was defined with the samples collected in January 2017.

Composite samples CS-1, CS-2, and CS-3 arsenic concentrations were not compliant with the Remediation Regulations arsenic R-DEC and I/C-DEC. GRA recognizes that RIDEM does not allow composite samples to be used for compliance determinations. These composite samples were collected to evaluate excavated soil management options and were not intended to be used for compliance determination. Grab compliance samples will be collected as part of the confirmatory soil sampling program implemented during the remedial work.

The non-compliant soil arsenic and TPH have a low potential to volatilize.

The areas where noncompliant soils were identified are covered with crushed stone. There is a very limited potential for the non-compliant soils to be entrained by wind or erosion actions.

4.0 Hydrogeological Properties

4.1 Depth to Groundwater

Monitoring wells were not installed as part of this subsurface investigation. Groundwater was not encountered during the sampling procedure. The subsurface investigation did not exceed three feet (3') below grade level.

The bedrock underlying the College of Engineering is identified as Avalon terrane and Esmond-Dedham sub-terrane. The bedrock is also identified as Esmond Igneous group suite and is noted as intrusive

4.2 Groundwater Flow Direction

Groundwater was not encountered or monitored as part of this subsurface investigation. It is assumed the groundwater flows in a westerly direction, towards White Horn Brook.

4.3 Surface Water Flow Direction

A portion of the USGS topographical map for the project area is provided in the attached **Figures**. The surface topography at the project area generally slopes to the west toward the White Horn Brook. Surface water run-off would be expected to generally flow to the west toward the Brook. Grading completed as part of the campus infrastructure projects would influence the surface water runoff direction.

4.4 Public Involvement

Public Involvement is required in accordance with Rule 7.07 of the RIDEM Remediation Regulations. The surrounding areas are owned by the University of Rhode Island, and used as a higher education facility. There are no abutting land owners to the substation location.

5.0 Feasibility Study

5.1 Overview

GRA contacted URI to determine the future use for the substation area. URI has indicated the substation location will be loamed and seeded for the immediate future. URI indicated that the long term transportation plan for this area is to potentially construct a traffic roundabout at the intersection of West Alumni Avenue and Butterfield Road. However, the transportation study is in the preliminary phase and has not advanced to the point where roundabout construction plans are available.

The active subsurface utilities within the Butterfield Substation will not be removed or relocated as part of the remedial work. The electric conduit shown on the Sampling Location Plan enters into the substation's southeast corner, connects to an electric manhole, and then exits the substation's east side. This electric conduit is a main electric line for the University. The electric manhole is located in a concrete pad that will not be removed as part of the remedial work.

5.2 Non-Compliant Soil

5.2.1 Non-Compliant Soil Area

The site is located in an industrial/commercial use area. Samples 31 and 32 TPH concentrations were not compliant with the Remediation Regulations TPH R-DEC, I/C-DEC (sample 32 only), and GA-L. Composite soil samples CS-1, CS-2, and CS-3 arsenic concentrations were not compliant with the Remediation Regulations arsenic R-DEC and I/C-DEC. The assumed non-compliant soil area is overlaid on the attached Butterfield Road Substation Sampling Locations Plan.

5.2.2 Remedial Goals

The proposed immediate use for the substation is as a landscaped area. The remedial goal is to achieve compliance with the TPH R-DEC and GA-L and the arsenic R-DEC.

The long-term future use of this area is currently being evaluated. There are preliminary plans for the construction of a traffic roundabout in this location. The long-term future use would be consistent with the arsenic and TPH R-DEC and GA-L remedial goal.

5.3 Soil Remedial Alternatives

5.3.1 Soil Remedial Alternative #1 – Soil Capping and an Environmental Land Usage Restriction

The proposed scope of work for capping the non-compliant soil areas within the substation's outer fenced enclosure would include the following:

- Removal of the interior chain link fence
- Removal of the crushed stone surface material and stockpile on-site for reuse
- Removal of concrete pads as identified by URI and off-site disposal of the concrete
- Soil sampling to document the TPH and RCRA 8 metal concentrations in the exposed subsurface soils. Soil samples would be collected at a frequency of one sample per 200 square feet of exposed subsurface soils. The proposed soil sampling grid would be overlaid on the Sampling Location Plan. The soil samples would be submitted for RCRA 8 metals and TPH analysis. Soil

samples collected in areas where the January 13, 2017 soil samples were analyzed for TPH would not be analyzed for TPH.

- Installation of clean fill material as required to backfill the removed concrete slab locations and provide a suitable surface for the geotextile
- Place a geotextile over the exposed subsurface area
- Place the stockpiled crushed stone over the geotextile along with imported crushed stone to create a 12-inch thick cap over the geotextile.

Concrete slabs that would be left in place would serve as the cap in those areas. The soil capping detail is provided on the attached Butterfield Road Substation Site Investigation Plan.

An Environmental Land Usage Restriction (ELUR) and a Soil Management Plan (SMP) will be required as part of the proposed remedial alternative #1. The ELUR would require that the capped area be inspected annually and be maintained as required to preserve the cap's integrity, restrict the site's future usage to industrial/commercial use, and require RIDEM notification if the cap is disturbed in the future. A metes and bounds survey description of the capped would be prepared as ELUR Attachment A. The Soil Management Plan included as ELUR Attachment B would be prepared using the RIDEM Soil Management Plan template. Soil management practices for future on-site work will be included in the SMP. The SMP will be appended to the ELUR. The draft ELUR and SMP will be submitted to the RIDEM for review when the project is completed. The draft ELUR and SMP will be revised as required. After RIDEM review and approval the ELUR will be filed in the Town of South Kingstown land evidence records and a copy of the filing submitted to the RIDEM-OWM.

Soil Capping and an ELUR are not recommended as the proposed remedial alternative due to the following:

- This remedial option does not achieve compliance with the Remediation Regulations
- This remedial alternative would require an ELUR. This would potentially restrict the future use of this area.

5.3.2 Soil Remedial Alternative #2 – Soil Excavation and Off-Site Disposal

Non-compliant soil excavation and off-site recycling/disposal is the second proposed remedial alternative. The proposed scope of work for soil excavation and off-site recycling/disposal would include the following:

- Removal of the two perimeter chain link fences.
- Removal of the crushed stone surface material and off-site disposal/reuse
- Removal of concrete pads as identified by URI and off-site disposal of the concrete
- Soil excavation to a depth of two feet below the bottom of crushed stone grade within the soil excavation area overlaid on the Sampling Locations plan.
- Stockpile excavated non-compliant soils and transport for off-site disposal. The soil stockpile would be sampled in accordance with the off-site recycling/disposal facility's requirements and characterized for disposal. The excavated soils would be transported for off-site disposal after they are accepted by the recycling/disposal facility.
- As an alternative the excavated soils could be loaded and hauled for off-site disposal during excavation thus eliminating the need for a soil stockpile. The load and haul option would require pre-characterization for disposal and approval for disposal from the receiving facility prior to beginning the excavation.

- Confirmatory soil sampling to document the TPH and RCRA 8 metals concentrations in the excavation sidewalls and bottom. Soil samples would be collected at a frequency of one sample per 200 square feet of bottom area and one sample per 50 linear feet of excavation sidewall. The soil samples would be submitted for RCRA 8 metals and TPH analysis.
- The excavation's sidewall and bottom confirmatory soil sample laboratory analytical data would be used to evaluate compliance with the Remediation Regulations R-DEC and GA/L. Additional soil excavation would be required in areas where compliance was not achieved. Additional confirmatory sampling and analysis would then be completed. This process would be repeated until the area achieves compliance with the Remediation Regulations R-DEC and GA/L.
- Common borrow that is compliant with the Remediation Regulations R-DEC and GA/L would then be used to backfill the excavated areas to 4-inches below the proposed finish grade.
- Place 4-inches of loam that is compliant with the Remediation Regulations R-DEC and GA/L.
- Seed the area to establish a vegetated cover

Soil Remedial Alternative #2 - Soil Excavation and Off-Site Disposal is the proposed remedial alternative and is recommended based on the following:

- This remedial alternative's goal would be to achieve compliance with the Remediation Regulations and would not require an ELUR.
- The future use of this area would not be restricted

The concrete pad with the active electric manhole and the active electric line would remain in place if this option is used. Soil excavation may not be possible in the area of the active electric line. This has the potential to prevent achieving compliance with the Remediation Regulations R-DEC and GA/L in the area of the electric conduit and concrete pad with the electric manhole. The soil capping detail that would be utilized in the area of the concrete pad and electric line is provided on the attached Butterfield Road Substation Site Investigation Plan.

There is the potential that an Environmental Land Usage Restriction (ELUR) and a Soil Management Plan (SMP) will be required as part of the proposed remedial alternative #2. An ELUR would be required if the soil excavation cannot achieve compliance with the Remediation Regulations R-DEC and GA/L. The ELUR would require that the capped area be inspected annually and be maintained as required to preserve the cap's integrity, restrict the site's future usage to industrial/commercial use, and require RIDEM notification if the cap is disturbed in the future. A metes and bounds survey description of the capped would be prepared as ELUR Attachment A. The Soil Management Plan included as ELUR Attachment B would be prepared using the RIDEM Soil Management Plan template. Soil management practices for future on-site work will be included in the SMP. The SMP will be appended to the ELUR. The draft ELUR and SMP will be submitted to the RIDEM for review when the project is completed. The draft ELUR and SMP will be revised as required. After RIDEM review and approval the ELUR will be filed in the Town of South Kingstown land evidence records and a copy of the filing submitted to the RIDEM-OWM.

5.3.3 Soil Remedial Alternative #3 – Limited Soil Excavation, Off-Site Disposal, and an ELUR

This remedial alternative is a limited version of Soil Remedial Alternative #2. The following scope of work would be implemented.

- Removal of the two perimeter chain link fences
- Removal of the crushed stone surface material and off-site disposal/reuse

- Removal of concrete pads as identified by URI and off-site disposal of the concrete
- Soil excavation to a depth of two feet below the bottom of crushed stone grade. The soil excavation area would be limited to the soil excavation area overlaid on the Butterfield Road Substation Sampling Locations plan attached to this document.
- Stockpile excavated non-compliant soils and transport for off-site disposal. The soil stockpile would be sampled in accordance with the off-site recycling/disposal facility's requirements and characterized for disposal. The excavated soils would be transported for off-site disposal after they are accepted by the recycling/disposal facility.
- As an alternative the excavated soils could be loaded and hauled for off-site disposal during excavation thus eliminating the need for a soil stockpile. The load and haul option would require pre-characterization for disposal and approval for disposal from the receiving facility prior to beginning the excavation.
- Confirmatory soil sampling to document the TPH and RCRA 8 metals concentrations in the excavation sidewalls and bottom. Soil samples would be collected at a frequency of one sample per 200 square feet of bottom area and one sample per 50 linear feet of excavation sidewall. The soil samples would be submitted for RCRA 8 metals and TPH analysis.
- The excavation's bottom confirmatory soil sample laboratory analytical data would be used to document conditions at the bottom of the excavation and evaluate compliance with the Remediation Regulations R-DEC and GA/L. Additional soil excavation would not be completed.
- The excavation's sidewall confirmatory soil sample laboratory analytical data would be used to evaluate compliance with the Remediation Regulations R-DEC and GA/L. Additional soil excavation would be required in the sidewalls where compliance was not achieved. Additional confirmatory sampling and analysis would then be completed. This process would be repeated until the sidewalls achieve compliance with the Remediation Regulations R-DEC and GA/L.
- Place a geotextile over the exposed subsurface area
- Common borrow that is compliant with the Remediation Regulations R-DEC and GA/L would then be used to backfill over the geotextile to 4-inches below the proposed finish grade.
- Place 4-inches of loam that is compliant with the Remediation Regulations R-DEC and GA/L.
- Seed the area to establish a vegetated cover.

The soil capping detail is provided on the attached Butterfield Road Substation Site Investigation Plan.

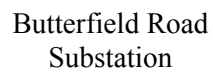
The Limited Soil Excavation and Off-Site Disposal remedial option is not recommended due to the following:

- This option has the potential to not achieve regulatory compliance. The confirmatory soil sampling is limited to the excavation areas shown on the Butterfield Road Substation Sampling Locations plan
- An ELUR may be required if the proposed excavation does not achieve compliance. This limits the area's future use.

5.4 Non-Compliant Soil Excavation Area – Off-Site Fill Requirements

All off-site fill material used to backfill URI's Butterfield Road Substation's non-compliant soil excavation area will be subject to testing to confirm their compliance with the RIDEM Remediation Regulations R-DEC and GA-L. . GRA's Specification Section for Analytical Testing Requirements for Imported Soil will be included in the project specifications. A copy of the Specification is included in **Appendix C**.

FIGURES



Gordon R. Archibald, Inc.
Civil and Environmental Engineers

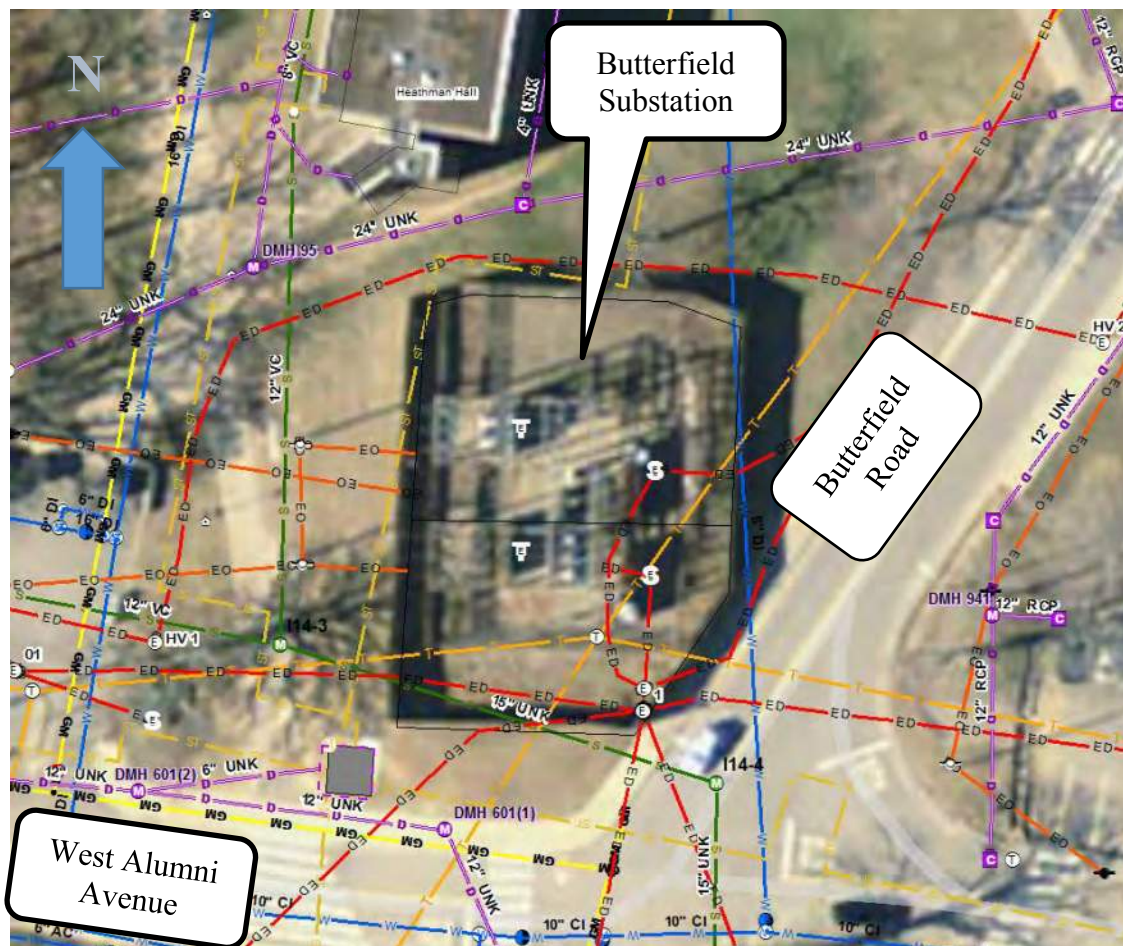


Figure 2
URI GIS Utility Plan
University of Rhode Island
Butterfield Road Substation Area
Not to Scale

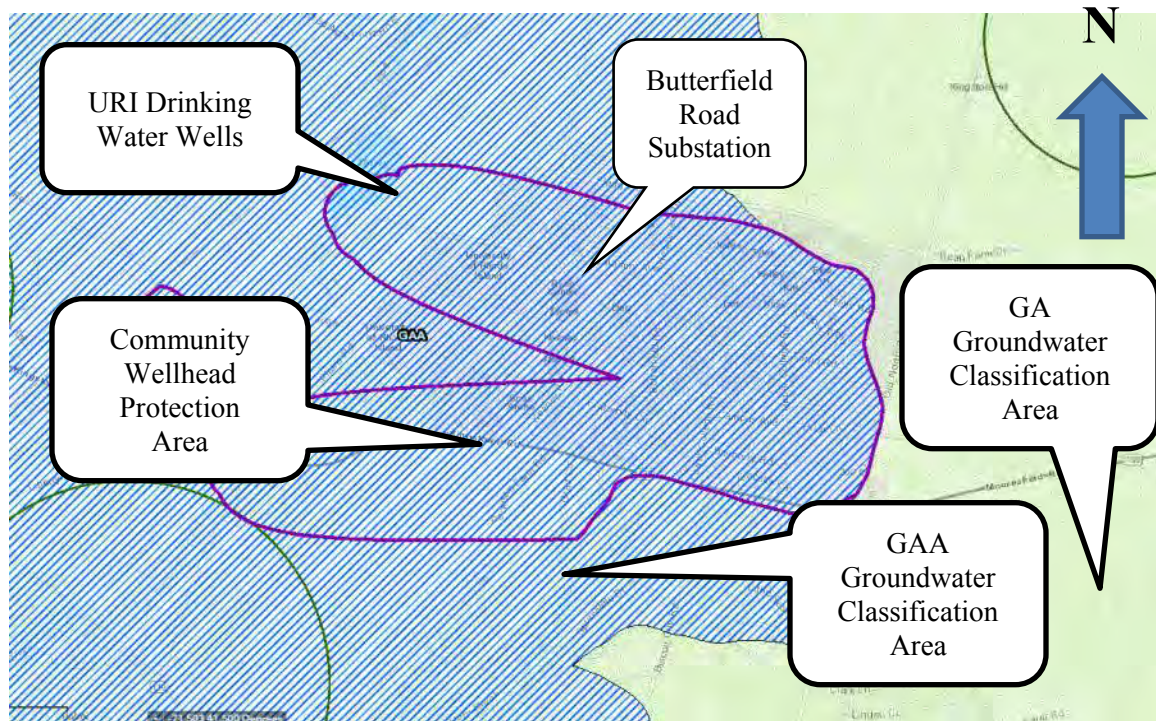


Figure 3
Ground Water Resources
University of Rhode Island
Butterfield Road Substation
Source: RIDEM Environmental Resource Map
Not to Scale

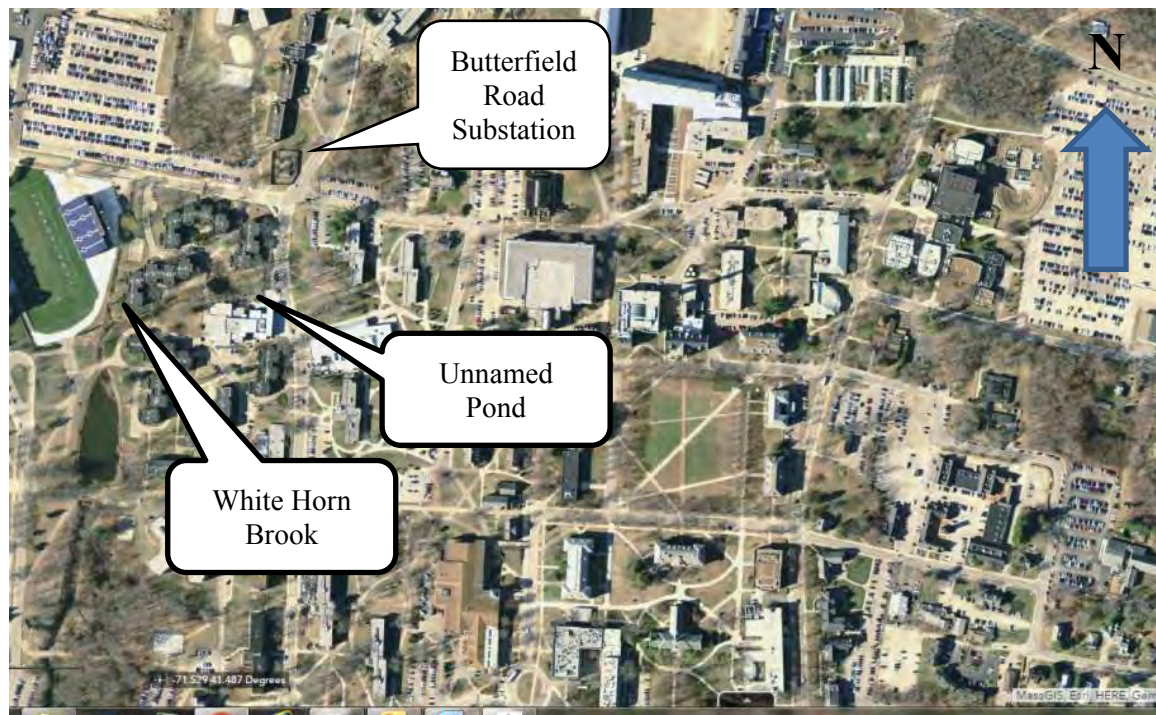


Figure 4
Surface Water Bodies - Aerial
University of Rhode Island
Butterfield Road Substation
Source: RIDEM Environmental Resource Map
Not to Scale

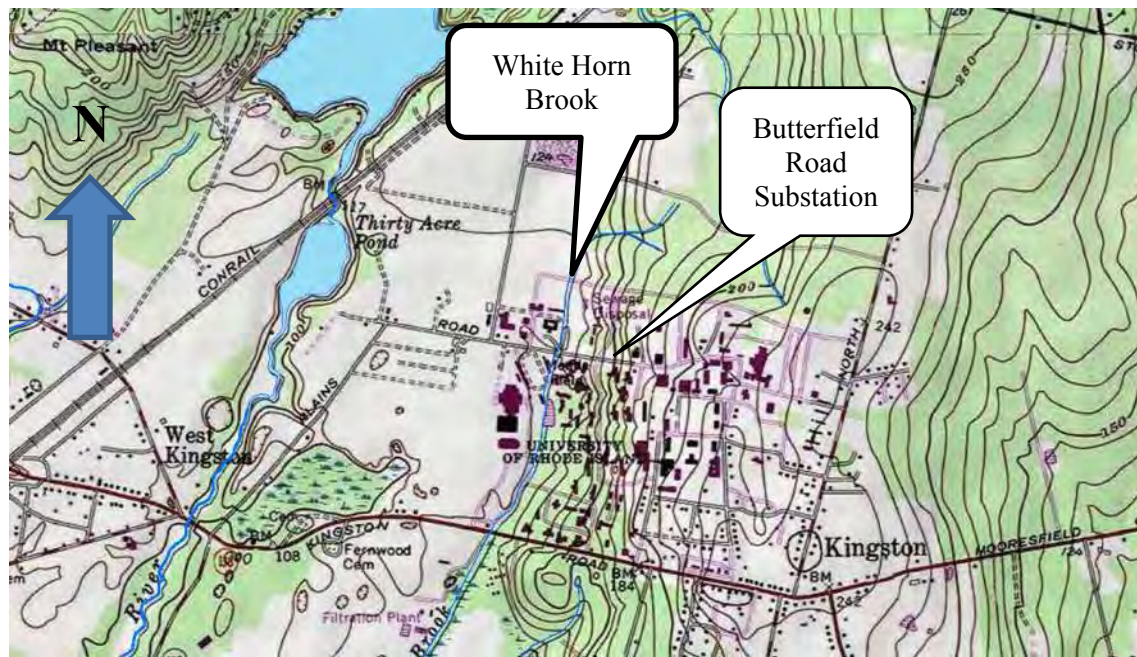
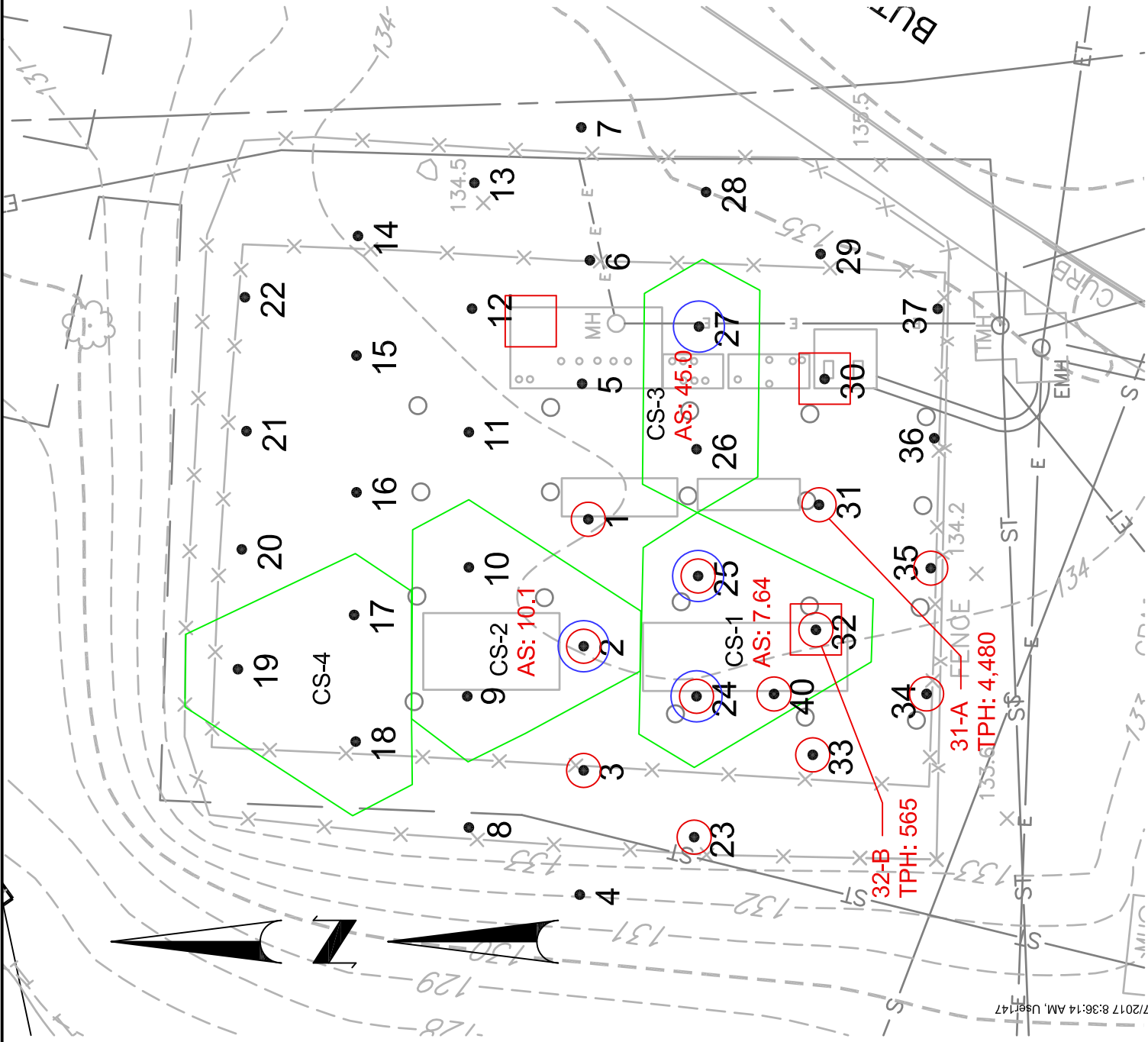


Figure 5
Surface Water Bodies – USGS
University of Rhode Island
Butterfield Road Substation
Source: RIDEM Environmental Resource Map
Not to Scale

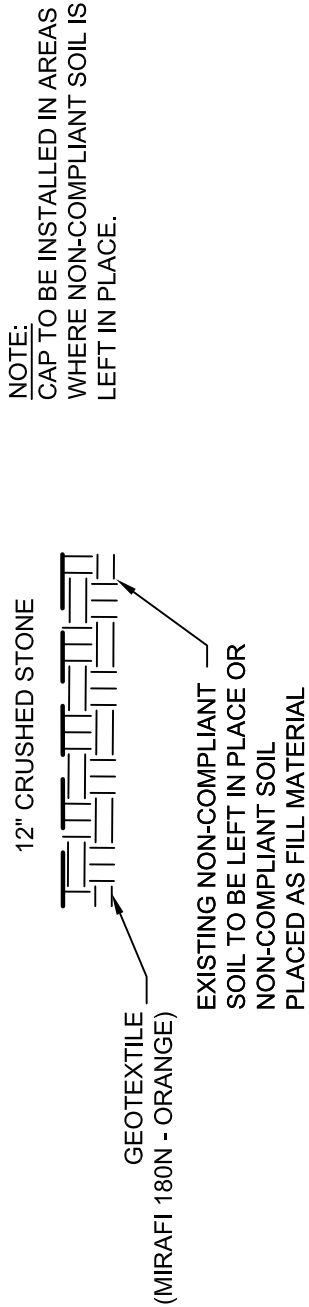
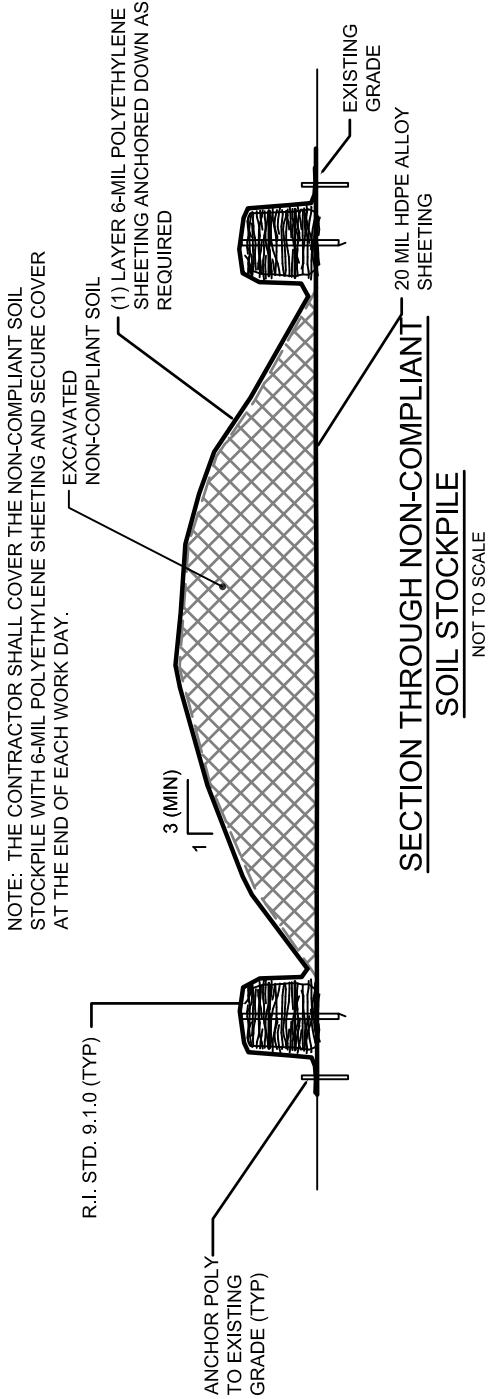


LEGEND

- SAMPLE LOCATION
- SAMPLES SUBMITTED FOR TPH
- CRUSHED STONE WIPE SAMPLE SUBMITTED
- COMPOSITE SOIL SAMPLE COLLECTED FROM INTERIOR SAMPLES
- CONCRETE CORING SAMPLE SUBMITTED

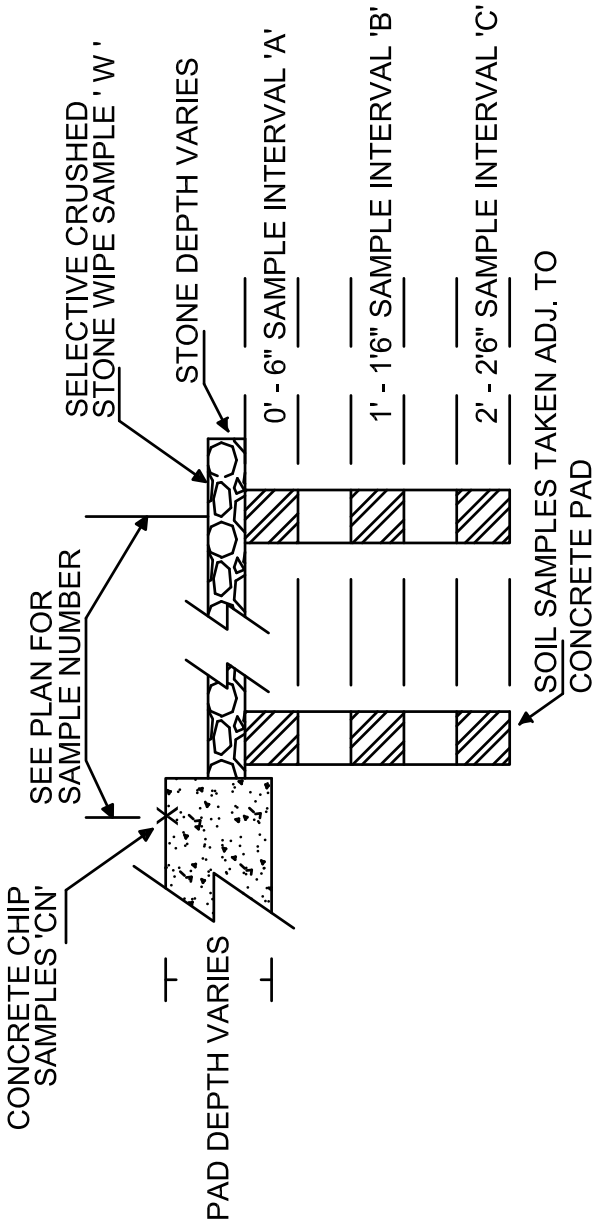
SAMPLING LOCATIONS

SCALE: 40'



NON-COMPLIANT SOIL CAP

NOT TO SCALE



SAMPLING DETAIL

NOT TO SCALE

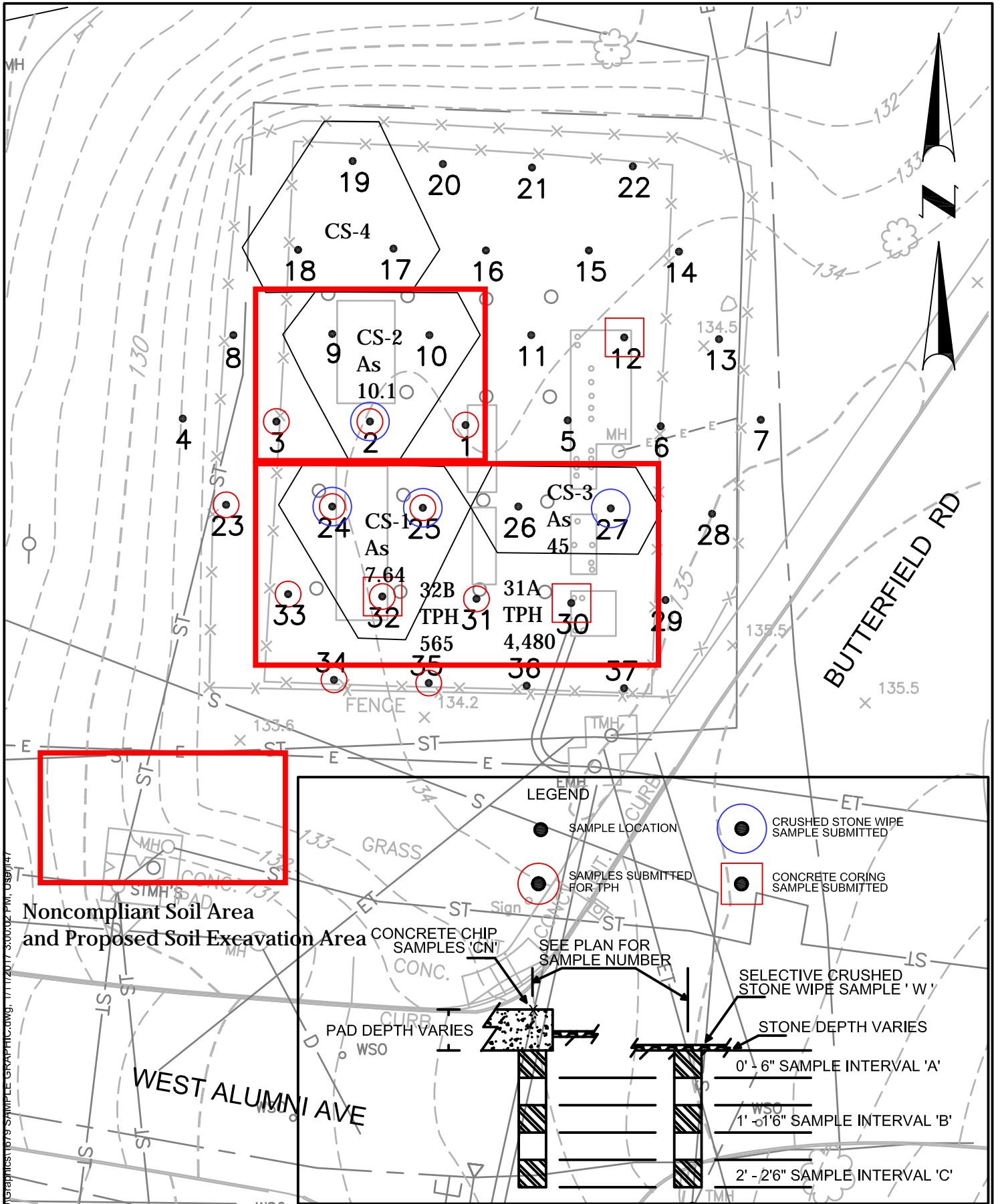
UNIVERSITY OF RHODE ISLAND

Gordon R. Archibald, Inc.
Civil and Environmental Engineers
Pawtucket, Rhode Island

BUTTERFIELD ROAD SUBSTATION
SITE INVESTIGATION PLAN
KINGSTON, RHODE ISLAND

SCALE : AS SHOWN

APRIL 2017



UNIVERSITY OF RHODE ISLAND



Gordon R. Archibald, Inc.
Civil and Environmental Engineers
Pawtucket, Rhode Island

**BUTTERFIELD ROAD SUBSTATION
SAMPLING LOCATIONS
KINGSTON, RHODE ISLAND**

SCALE 1"=20'

NOVEMBER 2016

TABLES

URI - Former Butterfield Road Substation Soil Samples											
Laboratory Analytical Data: EPA 8082A & 8100M											
Concentrations reported as Milligram per Kilogram, Wipe Sample as mg/100 cm ²											
Sample ID	1-A	1-B	1-C	2-A	2-B	2-C	2-W	GA-L	GB-L	R-DEC	I/C-DEC
Sample Date	13-Jan-17	16-Jan-17	16-Jan-17	13-Jan-17	16-Jan-17	16-Jan-17	12-Jan-17				
Sample Depth (inches bgl)	0"-6"	12" - 18"	24" - 30"	0"-6"	12" - 18"	24" - 30"	0"	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
EPA 8100 (mg/kg)	288	54	-	< 28	< 26	-	-	500	2,500	500	2,500
EPA 8082A PCBs100 (mg/kg)											
Arochlor-1016	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.001				
Arochlor-1221	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.001				
Arochlor-1232	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.001				
Arochlor-1242	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.001				
Arochlor-1248	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.001				
Arochlor-1254	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.001				
Arochlor-1260	0.52	<0.20	<0.20	<0.20	<0.20	<0.20	<0.001				
Arochlor-1262	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.001				
Arochlor-1268	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.001				
NS: No Standard											
Bold: Samples not compliant with the RIDEM Remediation Regulations GA Groundwater Leachability (GA-L) Objective											
<i>Italics:</i> Samples not compliant with the RIDEM Remediation Regulations Residential-Direct Exposure Criteria (R-DEC) Objective											
<u>Underlined:</u> Samples not compliant with the RIDEM Remediation Regulations Industrial/Commercial - Direct Exposure Criteria (I/C) Objective											

Sample ID	3-A	3-B	3-C	4-A	4-B	4-C	GA-L	GB-L	R-DEC	I/C-DEC
Sample Date	16-Jan-17	16-Jan-17	16-Jan-17	13-Jan-17	13-Jan-17	13-Jan-17				
Sample Depth (inches bgl)	0"-6"	12" - 18"	24" - 30"	0"-6"	12" - 18"	24" - 30"	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
EPA 8100 (mg/kg)	< 27	-	-	-	-	500	2,500	500	2,500	
EPA 8082A PCBs100 (mg/kg)										
Arochlor-1016	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	10	10	10	10
Arochlor-1221	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1232	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1242	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1248	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1254	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1260	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1262	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1268	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				

Sample ID	5-A	5-B	5-C	6-A	6-B	GA-L	GB-L	R-DEC	I/C-DEC
Sample Date	13-Jan-17	16-Jan-17	16-Jan-17	13-Jan-17	17-Jan-17				
Sample Depth (inches bgl)	0"-6"	12" - 18"	24" - 30"	0"-6"	12" - 18"	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
EPA 8100 (mg/kg)	-	-	-	-	-	500	2,500	500	2,500
EPA 8082A PCBs100 (mg/kg)									
Arochlor-1016	<0.20	<0.20	<0.20	<0.20	<0.20	10	10	10	10
Arochlor-1221	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1232	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1242	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1248	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1254	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1260	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1262	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1268	<0.20	<0.20	<0.20	<0.20	<0.20				

Sample ID	7-A	7-B	7-C	8-A	8-B	8-C	GA-L	GB-L	R-DEC	I/C-DEC
Sample Date	13-Jan-17	13-Jan-17	13-Jan-17	16-Jan-17	16-Jan-17	16-Jan-17	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Sample Depth (inches bgl)	0"-6"	12" - 18"	24" - 30"	0"-6"	12" - 18"	24" - 30"				
EPA 8100 (mg/kg)	-	-	-	-	-	-	500	2,500	500	2,500
EPA 8082A PCBs100 (mg/kg)										
Arochlor-1016	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	10	10	10	10
Arochlor-1221	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1232	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1242	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1248	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1254	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1260	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1262	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1268	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				

Sample ID	11-A	11-B	11-C	12-A	12-B	12-C	12-CN	GA-L	GB-L	R-DEC	I/C-DEC
Sample Date	13-Jan-17	16-Jan-17	16-Jan-17	13-Jan-17	16-Jan-17	16-Jan-17	12-Jan-17				
Sample Depth (inches bgl)	0"-6"	12" - 18"	24" - 30"	0"-6"	12" - 18"	24" - 30"	0"	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
EPA 8082A PCBs100 (mg/kg)											
Arochlor-1221	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	10	10	10	10
Arochlor-1232	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1016	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1242	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1248	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1254	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1260	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1262	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1268	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
NS: No Standard											
Bold: Samples not compliant with the RIDEM Remediation Regulations GA Groundwater Leachability (GA-L) Objective											
<i>Italics:</i> Samples not compliant with the RIDEM Remediation Regulations Residential-Direct Exposure Criteria (R-DEC) Objective											
<u>Underlined:</u> Samples not compliant with the RIDEM Remediation Regulations Industrial/Commercial - Direct Exposure Criteria (I/C) Objective											

Table 3									
URI - Former Butterfield Road Substation Soil Samples									
Laboratory Analytical Data: EPA 8082A & 8100M									
Concentrations reported as Milligram per Kilogram									
Sample ID	15-A	15-B	15-C	16-A	16-B	16-C	GA-L	GB-L	I/C-DEC
Sample Date	13-Jan-17	16-Jan-17	16-Jan-17	13-Jan-17	16-Jan-17	16-Jan-17			
Sample Depth (inches bgl)	0"-6"	12" - 18"	24" - 30"	0"-6"	12" - 18"	24" - 30"	(mg/kg)	(mg/kg)	(mg/kg)
EPA 8082A PCBs100 (mg/kg)									
Arochlor-1221	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	10	10	10
Arochlor-1232	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20			
Arochlor-1016	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20			
Arochlor-1242	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20			
Arochlor-1248	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20			
Arochlor-1254	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20			
Arochlor-1260	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20			
Arochlor-1262	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20			
Arochlor-1268	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20			
NS: No Standard									
Bold: Samples not compliant with the RIDEM Remediation Regulations GA Groundwater Leachability (GA-L) Objective									
<i>Italics:</i> Samples not compliant with the RIDEM Remediation Regulations Residential-Direct Exposure Criteria (R-DEC) Objective									
<u>Underlined:</u> Samples not compliant with the RIDEM Remediation Regulations Industrial/Commercial - Direct Exposure Criteria (I/C) Objective									

NS: No Standard

Laboratory Analytical Data: EPA 8082A & 8100M

Sample ID	23-A	23-B	23-C	24-A	24-B	24-C	24-W	GA-L	GB-L	R-DEC	I/C-DEC
Sample Date	16-Jan-17	16-Jan-17	16-Jan-17	13-Jan-17	16-Jan-17	16-Jan-17	12-Jan-17				
Sample Depth (inches bgl)	0"-6"	12" - 18"	24" - 30"	0"-6"	12" - 18"	24" - 30"	0"	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)

NS: No Standard

Italics: Samples not compliant with the RIDEM Remediation Regulations Residential-Direct Exposure Criteria (R-DEC) Objective

Underlined: Samples not compliant with the RIDEM Remediation Regulations Industrial/Commercial - Direct Exposure Criteria (I/C) Objective

Laboratory Analytical Data: EPA 8082A & 8100M

Sample ID	25-A	25-B	25-C	25-W	26-A	26-B	26-C	GA-L	GB-L	R-DEC	I/C-DEC
Sample Date	13-Jan-17	16-Jan-17	16-Jan-17	12-Jan-17	13-Jan-17	16-Jan-17	16-Jan-17				
Sample Depth (inches bgl)	0"-6"	12" - 18"	24" - 30"	0"	0"-6"	12" - 18"	24" - 30"	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)

NS: No Standard

Italics: Samples not compliant with the RIDEM Remediation Regulations Residential Criteria (R-DEC) Objective

Underlined: Samples not compliant with the RIDEM Remediation Regulations Industrial/Commercial - Direct Exposure Criteria (I/C) Objective

NS: No Standard

Italics: Samples not compliant with the RIDEEM Remediation Regulations Residential-Direct Exposure Criteria (R-DEC) Objective

Underlined: Samples not compliant with the RIDEM Remediation Regulations Industrial/Commercial - Direct Exposure Criteria (I/C) Objective

Table 3

Laboratory Analytical Data: EPA 8082A & 8100M

Concentrations reported as Milligram per Kilogram

[illegible]

NS: No Standard

Bold: Samples not compliant with the RIDEM Remediation Regulations GA Groundwater Leachability (GA-L) Objective

Italics: Samples not compliant with the RIDEM Remediation Regulations Residential Criteria (R-DEC) Objective

Underlined: Samples not compliant with the RIDEM Remediation Regulations Industrial/Commercial - Direct Exposure Criteria (I/C) Objective

Soil Sample Laboratory Analytical Data
University of Rhode Island - Former Butterfield Road Substation
Kingston Campus, Rhode Island

Table 3

URI - Butterfield Road Substation Soil Samples
Laboratory Analytical Data: EPA 8082A & 8100M
Concentrations reported as Milligram per Kilogram

Sample ID	33-A	33-B	33-C	34-A	34-B	34-C	GA-L	GB-L	R-DEC	I/C-DEC
Sample Date	13-Jan-17	16-Jan-17	16-Jan-17	13-Jan-17	16-Jan-17	16-Jan-17				
Sample Depth (inches bgl)	0"-6"	12" - 18"	24" - 30"	0"-6"	12" - 18"	24" - 30"	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
EPA 8100 (mg/kg)	< 29	< 26	-	< 30	< 27	-	500	2,500	500	2,500
EPA 8082A PCBs100 (mg/kg)										
Arochlor-1221	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	10	10	10	10
Arochlor-1232	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1016	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1242	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1248	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1254	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1260	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1262	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1268	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				

NS: No Standard

Bold: Samples not compliant with the RIDEM Remediation Regulations GA Groundwater Leachability (GA-L) Objective

Italics: Samples not compliant with the RIDEM Remediation Regulations Residential-Direct Exposure Criteria (R-DEC) Objective

Underlined: Samples not compliant with the RIDEM Remediation Regulations Industrial/Commercial - Direct Exposure Criteria (I/C) Objective

Table 3

URI - Butterfield Road Substation Soil Samples
Laboratory Analytical Data: EPA 8082A & 8100M
Concentrations reported as Milligram per Kilogram

Sample ID	37-A	37-B	40-A	40-B	40-C	GA-L	GB-L	R-DEC	I/C-DEC
Sample Date	13-Jan-17	17-Jan-17	13-Jan-17	16-Jan-17	16-Jan-17				
Sample Depth (inches bgl)	0"-6"	12" - 18"	0"-6"	12" - 18"	24" - 30"	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
EPA 8100 (mg/kg)	-	-	< 28	40	-	500	2,500	500	2,500
EPA 8082A PCBs100 (mg/kg)									
Arochlor-1221	<0.20	<0.20	<0.20	<0.20	<0.20	10	10	10	10
Arochlor-1232	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1016	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1242	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1248	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1254	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1260	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1262	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1268	<0.20	<0.20	<0.20	<0.20	<0.20				

NS: No Standard

Bold: Samples not compliant with the RIDEM Remediation Regulations GA Groundwater Leachability (GA-L) Objective

Italics: Samples not compliant with the RIDEM Remediation Regulations Residential-Direct Exposure Criteria (R-DEC) Objective

Underlined: Samples not compliant with the RIDEM Remediation Regulations Industrial/Commercial - Direct Exposure Criteria (I/C)

Table 4

URI - Butterfield Road Substation Duplicate Soil Samples

Laboratory Analytical Data: EPA 8082A & 8100M

Concentrations reported as Milligram per Kilogram, Wipe Sample reported as mg/100 cm²

Sample ID	38-A	25-A	38-B	25-B	38-C	25-C	GA-L	GB-L	R-DEC	I/C-DEC
Sample Date	13-Jan-17	16-Jan-17	16-Jan-17	16-Jan-17	12-Jan-17	12-Jan-17				
Sample Depth (inches bgl)	0"-6"	0"-6"	12" - 18"	12" - 18"	24" - 30"	24" - 30"	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
EPA 8100 (mg/kg)	< 28	< 27	< 27	< 26	-	-	500	2,500	500	2,500
EPA 8082A PCBs100 (mg/kg)										
Arochlor-1221	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	10	10	10	10
Arochlor-1232	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1016	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1242	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1248	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1254	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1260	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1262	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
Arochlor-1268	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20				
NS: No Standard										
Bold: Samples not compliant with the RIDEM Remediation Regulations GA Groundwater Leachability (GA-L) Objective										
<i>Italics:</i> Samples not compliant with the RIDEM Remediation Regulations Residential-Direct Exposure Criteria (R-DEC) Objective										
<u>Underlined:</u> Samples not compliant with the RIDEM Remediation Regulations Industrial/Commercial -Direct Exposure Criteria (I/D-DEC) Objective										

Duplicate Samples.

Duplicate Sample ID 38 was collected from Sample location 25

The duplicate samples are consistent with the corresponding samples.

Duplicate Sample Laboratory Analytical Data
University of Rhode Island - Former Butterfield Road Substation
Kingston Campus, Rhode Island

<p style="text-align: center;">Table 4</p> <p style="text-align: center;">URI - Butterfield Road Substation Duplicate Soil Samples</p> <p style="text-align: center;">Laboratory Analytical Data: EPA 8082A & 8100M</p> <p style="text-align: center;">Concentrations reported as Milligram per Kilogram, Wipe Sample reported as mg/100 cm²</p>										
Sample ID	38-W	25-W	39-CN	12-CN		GA-L	GB-L	R-DEC	I/C-DEC	
Sample Date	12-Jan-17	12-Jan-17	12-Jan-17	12-Jan-17						
Sample Depth (inches bgl)	0"	0"	0"	0"		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)	
EPA 8100 (mg/kg)	-	-	-	-	-	500	2,500	500	2,500	
EPA 8082A PCBs100 (mg/kg)										
Unit	mg/100cm ²	mg/100cm ²	mg/kg	mg/kg		NS	NS	NS	NS	NS
Arochlor-1221	<0.001	<0.001	<0.20	<0.20						
Arochlor-1232	<0.001	<0.001	<0.20	<0.20						
Arochlor-1016	<0.001	<0.001	<0.20	<0.20						
Arochlor-1242	<0.001	<0.001	<0.20	<0.20						
Arochlor-1248	<0.001	<0.001	<0.20	<0.20						
Arochlor-1254	<0.001	<0.001	<0.20	<0.20						
Arochlor-1260	<0.001	<0.001	<0.20	<0.20						
Arochlor-1262	<0.001	<0.001	<0.20	<0.20						
Arochlor-1268	<0.001	<0.001	<0.20	<0.20						
NS: No Standard										
Bold: Samples not compliant with the RIDEM Remediation Regulations GA Groundwater Leachability (GA-L) Objective										
<i>Italics:</i> Samples not compliant with the RIDEM Remediation Regulations Residential-Direct Exposure Criteria (R-DEC) Objective										
<u>Underlined:</u> Samples not compliant with the RIDEM Remediation Regulations Industrial/Commercial -Direct Exposure Criteria (I/D-DEC) Objective										

Duplicate Samples.

Duplicate Sample ID 38 was collected from Sample location 25

Duplicate Sample ID 39 was collected from Sample location 12

The duplicate samples are consistent with the corresponding samples.

Kingston Campus, Rhode Island

Concentrations reported as Milligram per Liter

Sample ID	EQ-SH-1/13	EQ-GP-1/17		GA-L	GB-L	R-DEC	I/C-DEC
Sample Date	13-Jan-17	17-Jan-17					
Sample Depth (inches bgl)	C	C		(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)

EPA 8082A PCBs100 (mg/L)				10	10	10	10
Arochlor-1221	<0.0002	<0.0004		NS	NS	NS	NS
Arochlor-1232	<0.0002	<0.0004					
Arochlor-1016	<0.0002	<0.0004					
Arochlor-1242	<0.0002	<0.0004					
Arochlor-1248	<0.0002	<0.0004					
Arochlor-1254	<0.0002	<0.0004					
Arochlor-1260	<0.0002	<0.0004					
Arochlor-1262	<0.0002	<0.0004					
Arochlor-1268	<0.0002	<0.0004					

C - Composite Sample

Concentrations reported as Milligram per Kilogram

Sample ID	Trip - 1/13	Trip - 1/16	Trip - 1/17	GA-L	GB-L	R-DEC	I/C-DEC
Sample Date	13-Jan-17	16-Jan-17	17-Jan-17				
Sample Depth (inches bgl)	-	-	-	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)

EPA 8082A PCBs100 (mg/kg)				10	10	10	10
Arochlor-1221	<0.2	<0.2	<0.2				
Arochlor-1232	<0.2	<0.2	<0.2				
Arochlor-1016	<0.2	<0.2	<0.2				
Arochlor-1242	<0.2	<0.2	<0.2				
Arochlor-1248	<0.2	<0.2	<0.2				
Arochlor-1254	<0.2	<0.2	<0.2				
Arochlor-1260	<0.2	<0.2	<0.2				
Arochlor-1262	<0.2	<0.2	<0.2				
Arochlor-1268	<0.2	<0.2	<0.2				

Underlined: Samples not compliant with the RIDEM Remediation Reulations Industrial/Commerical -Direct Exposure Criteria (I/D-DEC) Objective

Table 6
URI - Butterfield Road Substation Equipment Blank
Composite Soil Samples

Sample ID	CS-1	CS-2	CS-3	CS-4	GA-L	GB-L	R-DEC	I/C-DEC
Sample Date	16-Jan-17	16-Jan-17	17-Jan-17	16-Jan-17	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Sample Depth (inches bgl)	C	C	C	C				

EPA Method 9045, 9025B, and 9095B

Paint Filter	No Free Liq.	No Free Liq.	No Free Liq.	No Free Liq.				
Percent Solids %	95.33	93.33	93.64	93.90				
pH, S.U.	5.58	5.28	6.96	5.21				

Total Petroleum Hydrocarbons by EPA 8100 (mg/kg)	
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22
23	23
24	24
25	25
26	26
27	27
28	28
29	29
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45	45
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73	73
74	74
75	75
76	76
77	77
78	78
79	79
80	80
81	81
82	82
83	83
84	84
85	85
86	86
87	87
88	88
89	89
90	90
91	91
92	92
93	93
94	94
95	95
96	96
97	97
98	98
99	99
100	100

TPH	171	52	< 26	< 26	500	2,500	500	2,500
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Total Metals by EPA 6010 (mg/kg)	
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Arsenic	7.64	10.1	45.00	1.35			7	7
Barium	11.5	9.42	15.70	6.14			5,500	10,000
Cadmium	0.69	0.54	0.71	0.43			39	1,000
Chromium	1.99	2.14	2.12	1.92			390	10,000
Lead	5.09	7.26	10.50	3.76			150	500
Mercury	<0.070	<0.067	<0.069	<0.067			23	610
Selenium	<0.70	<0.68	<0.68	<0.70			390	10,000
Silver	<0.35	<0.34	<0.34	<0.35			200	10,000

EPA 8082A PCBs100 (mg/kg)	10	10	10	10
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Arochlor-1221	<0.1	<0.1	<0.1	<0.1				
Arochlor-1232	<0.1	<0.1	<0.1	<0.1				
Arochlor-1016	<0.1	<0.1	<0.1	<0.1				
Arochlor-1242	<0.1	<0.1	<0.1	<0.1				
Arochlor-1248	<0.1	<0.1	<0.1	<0.1				
Arochlor-1254	<0.1	<0.1	<0.1	<0.1				
Arochlor-1260	<0.1	<0.1	<0.1	<0.1				
Arochlor-1262	<0.1	<0.1	<0.1	<0.1				
Arochlor-1268	<0.1	<0.1	<0.1	<0.1				

EPA 8270 SVOCs (mg/kg)

Napthalene	<0.14	<0.14	<0.13	<0.14		54	10,000
2-Methylnaphthalene	<0.14	<0.14	<0.13	<0.14		123	10,000
Acenaphthylene	<0.14	<0.14	<0.13	<0.14		23	10,000
Acenaphthene	<0.14	<0.14	<0.13	<0.14		43	10,000
Dibenzofuran	<0.14	<0.14	<0.13	<0.14			
Fluorene	<0.14	<0.14	<0.13	<0.14		28	10,000
Phenanthrene	<0.14	<0.14	<0.13	<0.14		40	10,000
Anthracene	<0.14	<0.14	<0.13	<0.14		35	10,000
Fluoranthene	<0.14	0.27	<0.13	<0.14		20	10,000
Pyrene	<0.14	0.29	<0.13	<0.14		13	10,000
Benzo(a)anthracene	<0.14	<0.14	<0.13	<0.14		0.9	7.8
Chrysene	<0.14	0.18	<0.13	<0.14		0.4	780
Benzo(b)fluoranthene	<0.14	<0.14	<0.13	<0.14		0.9	7.8
Benzo(k)fluoranthene	<0.14	<0.14	<0.13	<0.14		0.9	7.8
Benzo(a)pyrene	<0.14	<0.14	<0.13	<0.14	240	0.4	0.8
Indeno(1,2,3-cd)pyrene	<0.14	<0.14	<0.13	<0.14		0.9	7.8
Dibenz(a,h)anthracene	<0.14	<0.14	<0.13	<0.14		0.4	0.8
Benzo(g,h,i)perylene	<0.14	<0.14	<0.13	<0.14		0.8	10,000

C - Composite Sample

NS: No Standard

Bold: Samples not compliant with the RIDEM Remediation Regulations GA Groundwater Leachability (GA-L) Objective

Italics: Samples not compliant with the RIDEM Remediation Regulations Residential-Direct Exposure Criteria (R-DEC) Objective

Underlined: Samples not compliant with the RIDEM Remediation Reulations Industrial/Commerical -Direct Exposure Criteria (I/D-DEC)

Table 6
 URI - Butterfield Road Substation Equipment Blank
 Composite Soil Samples

Sample ID	CS-1	CS-2	CS-3	CS-4	GA-L	GB-L	R-DEC	I/C-DEC
Sample Date	16-Jan-17	16-Jan-17	17-Jan-17	16-Jan-17	(mg/kg)	(mg/kg)	(mg/kg)	(mg/kg)
Sample Depth (inches bgl)	C	C	C	C				
VOCs by EPA 8260 (mg/kg)								
Acetone	<0.25	<0.23	<0.12	<0.39			7,800	10,000
Benzene	<0.025	<0.023	<0.024	<0.039			2.5	200
Bromodichloromethane	<0.025	<0.023	<0.024	<0.039			10	92
Bromoform	<0.025	<0.023	<0.024	<0.039			81	720
Bromomethane	<0.025	<0.023	<0.024	<0.039			0.8	2,900
Carbon tetrachloride	<0.025	<0.023	<0.024	<0.039			1.5	44
Chlorobenzene	<0.025	<0.023	<0.024	<0.039			210	10,000
Chloroform	<0.025	<0.023	<0.024	<0.039			1.2	940
1,2-Dibromo-3-chloropropane (DBCP)	<0.025	<0.023	<0.024	<0.039			0.5	4
1,1-Dichloroethane	<0.025	<0.023	<0.024	<0.039			920	10,000
1,2-Dichloroethane	<0.025	<0.023	<0.024	<0.039			0.9	63
1,1-Dichloroethene	<0.025	<0.023	<0.024	<0.039			0.2	10
cis-1,2-Dichloroethene	<0.025	<0.023	<0.024	<0.039			630	10,000
Trans-1,2-Dichloroethene	<0.025	<0.023	<0.024	<0.039			1,100	10,000
1,2-Dichloropropane	<0.025	<0.023	<0.024	<0.039			1.9	84
Ethylbenzene	<0.025	<0.023	<0.024	<0.039			71	10,000
Ethylene dibromide (EDB)	<0.025	<0.023	<0.024	<0.039			0.01	0.07
Isopropyl benzene	<0.025	<0.023	<0.024	<0.039			27	10,000
Methyl teriary-butyl ether (MTBE)	<0.025	<0.023	<0.024	<0.039			390	10,000
Methylene chloride	<0.12	<0.12	<0.024	<0.20			45	760
Styrene	<0.025	<0.023	<0.024	<0.039			13	190
1,1,1,2-Tetrachloroethane	<0.025	<0.023	<0.024	<0.039			2.2	220
1,1,2,2-Tetrachloroethane	<0.025	<0.023	<0.024	<0.039			1.3	29
Tetrachloroethene	<0.025	<0.023	<0.024	<0.039			12	110
Toluene	<0.025	<0.023	<0.024	<0.039			190	10,000
1,1,1-Trichloroethane	<0.025	<0.023	<0.024	<0.039			540	10,000
1,1,2-Trichloroethane	<0.025	<0.023	<0.024	<0.039			3.6	100
Trichloroethene	<0.025	<0.023	<0.024	<0.039			13	520
Vinyl chloride	<0.025	<0.023	<0.024	<0.039			0.02	3
Xylenes (Total)	<0.050	<0.047	<0.048	<0.078			110	10,000

C - Composite Sample

NS: No Standard

Bold: Samples not compliant with the RIDEM Remediation Regulations GA Groundwater Leachability (GA-L) Objective

Italics: Samples not compliant with the RIDEM Remediation Regulations Residential-Direct Exposure Criteria (R-DEC) Objective

Underlined: Samples not compliant with the RIDEM Remediation Regulations Industrial/Commercial -Direct Exposure Criteria (I/D-DEC) Objective

Site Investigation Report

The University of Rhode Island – Butterfield Rd. Substation
South Kingstown, Rhode Island

APPENDICES

APPENDIX A

SUBSURFACE INVESTIGATION PLAN

SAMPLING PLAN



**Butterfield Road Substation
University of Rhode Island – Kingston Campus
South Kingstown, Rhode Island**

**October 2016
Revised January 2017**

Prepared for:

University of Rhode Island
Office of Capital Projects
60 Tootell Road - Sherman Building
Kingston, RI 02881

Prepared by:

Gordon R. Archibald, Inc.
200 Main Street
Pawtucket, Rhode Island

**Sampling Plan
Butterfield Road Substation
University of Rhode Island – Kingston Campus
Kingston, Rhode Island
October 2016, Revised January 2017**

Gordon R. Archibald, Inc. (GRA) has prepared the following Sampling Plan for the Butterfield Road Substation on the University of Rhode Island (URI) – Kingston Campus in Kingston, Rhode Island. The Sampling Plan was prepared in accordance with the United States Environmental Protection Agency's (USEPA) *Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup* dated May 1986.

1.0 Background

GRA met with Dave Lamb, URI - Assistant Director of Facilities Management on July 14, 2016 to review the following:

- Previous reports/investigations of the area
 - No previous site investigation reports were available for the Butterfield Substation
- RIDEM involvement including, but not limited to, any RIDEM notification of a release at the Butterfield Substation
 - URI had contacted Mr. Tom Campbell of the Rhode Island Department of Environmental Management (RIDEM) Office of Emergency Response and had limited correspondence with him.
 - Mr. Lamb did not have any written correspondence available in the URI files
- Site plan
 - Mr. Lamb provided a URI GIS system plan showing utilities superimposed on an aerial photo
 - URI does not have a site plan of the Butterfield Road Substation
- Site visit
 - GRA visited the Butterfield Road Substation with Mr. Lamb to look at the former transformer and associated equipment locations/concrete pads.
 - The substation is completely enclosed within a chain link fence.
 - The area inside the fenced enclosure consists of concrete pads surrounded by a crushed stone surface. The transformers were formerly located on two concrete pads on the west side of the enclosure. Two concrete pads are located in the substation's center and an additional concrete pad is located on the substation's east side.
 - PCB containing dielectric fluid is believed to have been used in the transformers removed from the southwest concrete pad and from the southeastern concrete pad.
 - During the walkthrough Mr. Lamb indicated the investigation would include the entire area inside the fenced Butterfield Road Substation.

Sampling Plan
Butterfield Road Substation
University of Rhode Island – Kingston Campus
Kingston, Rhode Island
October 2016, Revised January 2017

GRA completed a survey on July 29, 2016 of the transformer area. The survey located the existing site features both inside and outside of the substation's chain link fence. The existing concrete pads where equipment was formerly located were located. A Site plan with grading to an assumed datum was prepared. The utilities from the URI GIS aerial were superimposed on the site plan. After the site plan was completed a field edit was performed and the plan was revised as required.

2.0 Sampling Grid Design

GRA designed the soil sampling grid in accordance with the (USEPA) *Field Manual for Grid Sampling of PCB Spill Sites to Verify Cleanup*. As requested by URI, GRA assumed the entire area inside the substation's chain link fence was the PCB spill area. Using the Section 5.0 Sample Design methodology the center of the sampling circle was located and the sampling radius determined to be 51 feet. Utilizing the Section 5.4 Determine the Number of Grid Sample Points to Use Table 1 it was determined 37 samples would be required. A 37 sample point hexagonal sampling grid was prepared. The spacing between adjacent sampling points, 15.3 feet, and successive sampling rows, 13.3 feet, was determined using Table 2. The hexagonal sampling grid was plotted on the site plan in accordance with Figure 8 Location of Sampling Points in a 37-point Grid. Seven sampling points are located outside the design spill area. Three of the sampling points (12, 30 and 31) are located on the existing concrete pads. The sampling grid diagram is attached to the Sample Plan.

3.0 Sample Collection, Handling, and Preservation

Samples of the media present at each sample point will be collected and analyzed for PCBs. The sampling will include soil samples collected from three intervals at each of the 37 sample locations. The following sample collection method summary is provided.

3.1 Crushed Stone Sampling

The surface is primarily covered with crushed stone. Wipe samples will be collected at sample locations 2, 24, 25, and 27 (adjacent to the pad sample), placed in a clean, labeled glass jar, and then stored in a cooler to keep the sample temperature at 4 °C.

3.2 Porous Surface Sampling

Three of the sampling points are located on the existing concrete pads (sample points 12, 30 and 31). Concrete samples will be collected in accordance with the USEPA Region 1 Standard Operating Procedure for Sampling Porous Surfaces for Polychlorinated Biphenyls (PCBs) dated May 2011. Sampling equipment will be decontaminated in accordance with the decontamination procedure found in the SOP.

**Sampling Plan
Butterfield Road Substation
University of Rhode Island – Kingston Campus
Kingston, Rhode Island
October 2016, Revised January 2017**

3.3 Surficial Soil Sampling

The crushed stone will be removed to expose the soil surface. A GeoProbe will be used to collect a soil sample from the surface to six-inches below grade. If required, a steel spatula will be used to transfer the soil sample from the sampler to the sample container. The sample will be placed in a clean, labeled glass jar, and then stored in a cooler to keep the sample temperature at 4 °C.

3.4 Below Grade Soil Sampling

The Geoprobe will be used to collect subsurface soil samples from the two intervals; one-foot to one-foot six inches below grade and two-feet to two-feet six inches below grade. If required, a steel spatula will be used to transfer the soil sample from the sampler to the sample container. The sample will be placed in a clean, labeled glass jar, and then stored in a cooler to keep the sample temperature at 4 °C.

3.5 Composite Soil Sampling – Disposal Characterization

Soil samples from the three soil sampling intervals will be composited to create the disposal characterization sample. Based on the available historic use information the following composite samples will be created:

- Soil sample locations 24, 25, and 32 will be composited to create composite sample 1 (CS-1).
- Soil sample locations 2, 9, and 10 will be composited to create composite sample 2 (CS-2).
- Soil sample locations 26 and 27 will be composited to create composite sample 3 (CS-3).
- Soil sample locations 17, 18, and 19 will be composited to create composite sample 4 (CS-4).

3.6 Sampling Equipment Decontamination

Dedicated sampling equipment and materials will be utilized to the maximum extent possible. Disposable personal protection equipment (PPE) including disposable gloves will be used by sampling personnel.

The steel spatula (if used) and GeoProbe sampler will be decontaminated after each sampling interval. The steel spatula and sampler will be decontaminated using the following method:

- Non-phosphate detergent (Alconox, Liquinox, or equivalent) and tap water (or distilled water) rinse;

Sampling Plan
Butterfield Road Substation
University of Rhode Island – Kingston Campus
Kingston, Rhode Island
October 2016, Revised January 2017

- Distilled water rinse;
- Solvent rinse (acetone);
- Triple distilled water rinse

3.6 Soil Sample Summary Table

The following table summarizes the soil samples that will be collected:

Type of Sample	Number of Samples
Soil Samples – Sampling Interval A (0 – 6” bg)	37 samples for PCB analysis
Soil Samples – Sampling Interval B (1’ – 1’6” bg)	37 samples for PCB analysis
Soil Samples – Sampling Interval C (2’ – 2’6” bg)	37 samples for PCB analysis
Soil Sample Locations 1, 2, 3, 23, 24, 25, 31, 32, 33, 34, and 35 - Sampling Interval A (0 – 6” bg)	11 samples for TPH analysis
Soil Sample Locations 1, 2, 3, 23, 24, 25, 31, 32, 33, 34, and 35 - Sampling Interval B (1’ – 1’6” bg)	11 samples for TPH analysis
Composite sample 1 (CS-1)	1 sample for Disposal Characterization
Composite sample 2 (CS-2)	1 sample for Disposal Characterization
Composite sample 3 (CS-3)	1 sample for Disposal Characterization
Composite sample 4 (CS-4)	1 sample for Disposal Characterization

4.0 Quality Assurance/Quality Control

The number and type of Quality Assurance and Quality Control (QA/QC) samples submitted to the laboratory will be project specific. QA/QC samples submitted to the laboratory will include equipment blanks, trip blanks and field duplicates. The purpose of these samples is to confirm that laboratory results reflect the PCB concentrations in the crushed stone, porous surface, surficial soils and subsurface soil samples and are not the result of incorrect sampling techniques or laboratory analytical errors. Duplicate samples will be collected at a frequency of one sample per 20 sample locations.

Each QA/QC sample will be given its own sample code. The identity of these samples will be withheld from the laboratory conducting the analysis. When more than one QA/QC sample is submitted with a set of samples, they will be interspersed within those samples so that they are not easily identifiable by the laboratory.

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4.1 Equipment Blanks

Equipment blanks will be collected for the non-dedicated sampling equipment being used, the steel spade and the GeoProbe sampler. The steel spade will be decontaminated between sample locations. Blanks are prepared in the field during the sampling event. Distilled water will be poured over the steel spade and the GeoProbe sampler after decontamination. This water will then be transferred to the sample container. The steel spade equipment blank and the GeoProbe sampler blank will be analyzed for PCBs. The frequency of equipment blank collection will be a minimum of one per 20 sample locations by piece of equipment. Two equipment blank samples will be collected for both the steel spade and the GeoProbe sampler.

One field blank will be prepared for the wipe samples. Filter paper used for the wipe samples will be wetted with the sampling solvent and then placed in a clean sample jar. The filter paper and reagent will be obtained from the laboratory.

4.2 Trip Blanks

One trip blank will be obtained for each day of sampling to determine whether samples have been exposed to contamination as a result of sample container handling or transport. Trip blanks will be submitted and analyzed for PCBs. The blank will be prepared by the laboratory and will accompany the sample containers from the time they leave the lab until the time it will be returned to the lab as a sample. The trip blank sample is labeled as a sample and submitted blind to the laboratory for analysis. If more than one cooler contains samples then one trip blank will be submitted in each cooler.

4.3 Duplicate Samples

Duplicate samples will be collected at two of the soil sample locations, one crushed stone wipe sample location, and one concrete chip sample location in order to check the laboratory precision. The original and duplicate samples will be collected at the same time. The duplicate samples will be assigned a different sample number so the lab cannot determine that the duplicate sample pair. The original and duplicate samples will be analyzed for PCBs.

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4.4 QA/QC Sample Summary Table

The following table summarizes the QA/QC samples that will be collected:

Type of Sample	Number of Samples
Equipment Blank – GeoProbe sampler	2 samples
Equipment Blank – Steel spade	2 samples
Trip Blank	1 trip blank per sampling day
Field Duplicates – Crushed Stone	1 sample
Field Duplicates – Concrete Chip	1 sample
Field Duplicates – Soil Samples	2 samples

4.5 Sample Chain of Custody

Chain of Custody (COC) forms will be obtained from the laboratory. Each sample will be given unique sample identification. The samples will be logged onto the Chain of Custody form when they are collected in the field. Sample name, sample date, sample time, type of sample, and sample preservative will be recorded on the COC. This will establish initial sample possession. The samples will then be transported back to laboratory. The COC will document the transfer of the samples from GRA to the laboratory.

4.6 Control Limits

The following control limits will be utilized to evaluate the trip blank, equipment blank, and field duplicate laboratory analytical data.

Quality Control Sample	Control Limit
Trip Blank	Less than the detection limit*
Equipment Blank	Less than the detection limit*
Field Duplicates	± 30% Percent Difference for Water; Acceptable Percent Difference will be equal to Matrix Spike Recovery Values for Matrices other than Water**
<p>* With the exception of common laboratory contaminants of acetone, 2-butanone, methylene chloride, phthalates and toluene which will have a control limit of 5X detection limit.</p> <p>** Discrepancies will be addressed on a case-by-case basis.</p>	

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5.0 Sample Analysis

5.1 Sample Analysis – Field Screening

The following field screening will be used to evaluate the presence of volatile organic compounds (VOCs) and total petroleum hydrocarbons (TPH):

- The 111 soil samples collected from the three sampling intervals at the 37 soil sample locations will be field screened with a photoionization detector for volatile organic compounds.
- The zero to six-inches below grade soil samples and the one-foot to one-foot six inches below grade at soil sample locations 1, 2, 3, 23, 24, 25, 31, 32, 33, 34, and 35 will be field screened for TPH by using a PetroFlag and EPA Method 9074.

5.2 Sample Analysis – Soil Samples

The following laboratory analytical analyses will be performed on the grab soil samples:

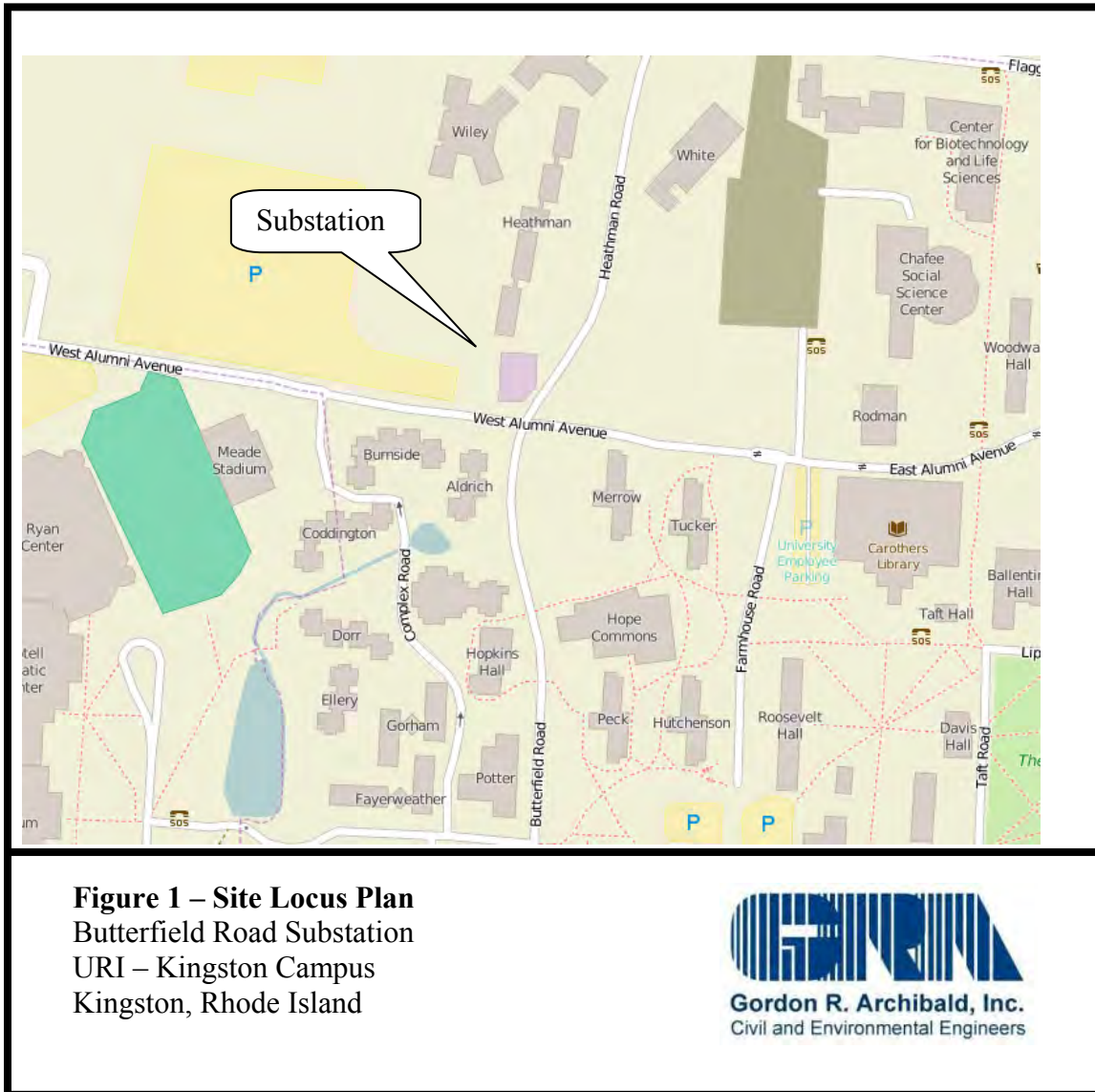
- The 111 soil samples collected from the three sampling intervals at the 37 soil sample locations, the three concrete chip samples, and the four crushed stone wipe samples will be submitted to a Rhode Island certified analytical laboratory for PCB analysis by EPA Method 8082A or other applicable analytical method.
- The zero to six-inches below grade soil samples and the one-foot to one-foot six inches below grade at soil sample locations 1, 2, 3, 23, 24, 25, 31, 32, 33, 34, and 35 will be submitted for TPH analysis by EPA Method 8100 modified.

5.3 Sample Analysis – Composite Soil Samples

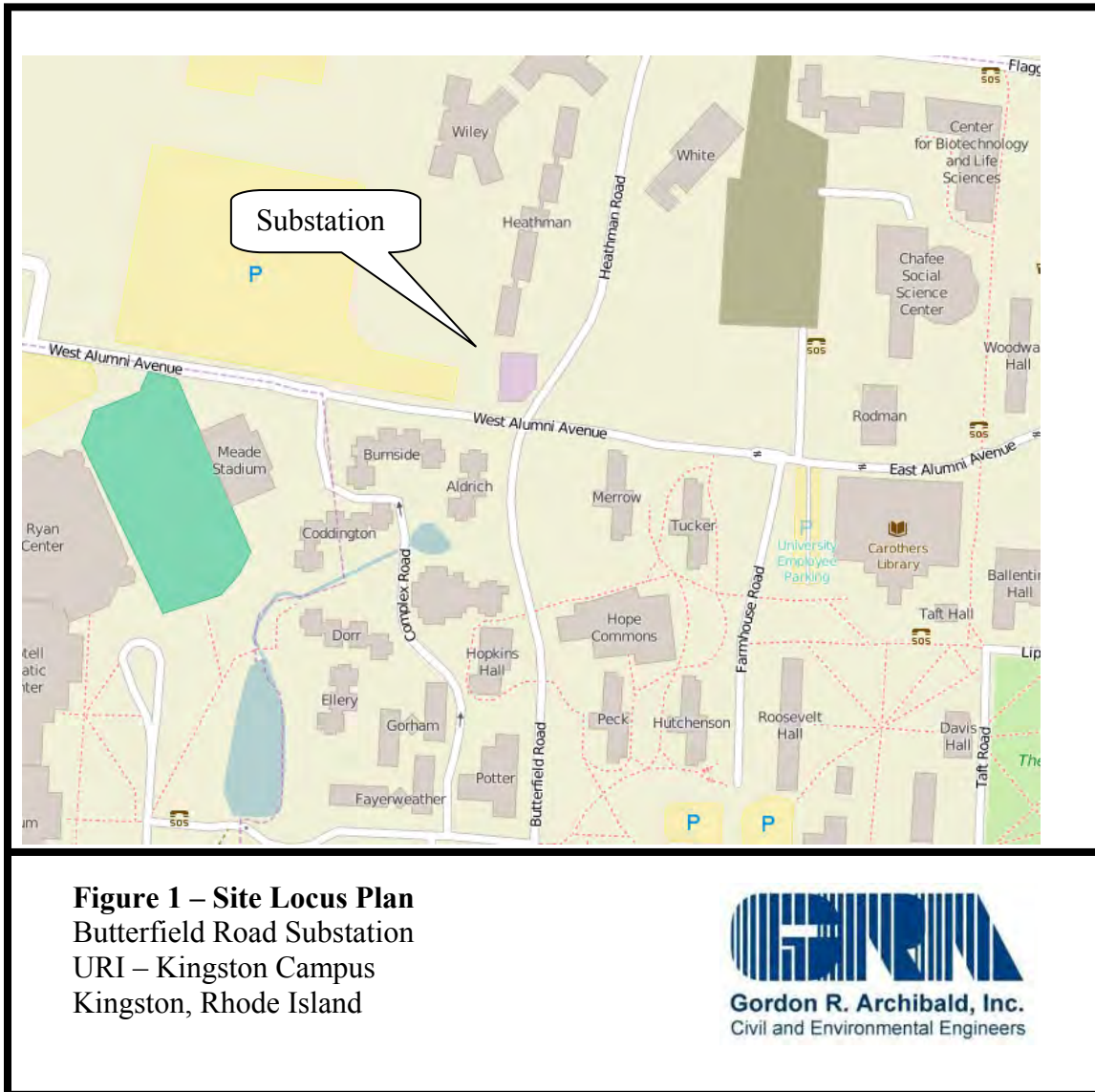
The following laboratory analytical analyses will be performed on the four composite soil samples for disposal characterization in accordance with the Rhode Island Resource Recovery Corporation (RIRRC) Alternate Cover Policy Table 1 Testing Requirements:

- VOCs by EPA Method 8260
- SVOCs (totals) by EPA Method 8270
- PCBs by EPA Method 8082
- Total Metals by EPA Method 6010
- TPH by EPA Method 8100 modified
- pH by EPA Method 9045
- Water Content by EPA Method 9025B
- Free Liquids by EPA Method 9095B

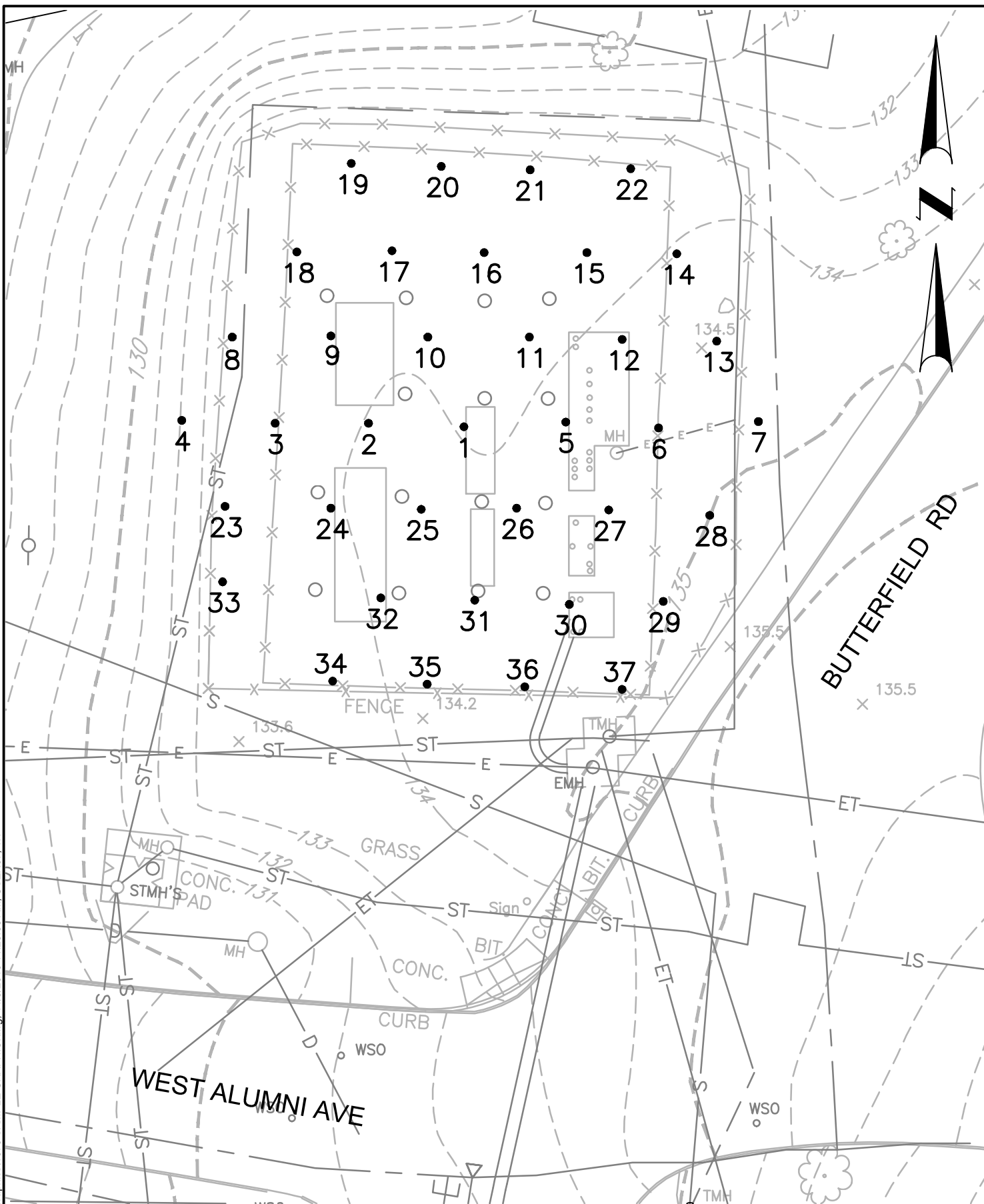
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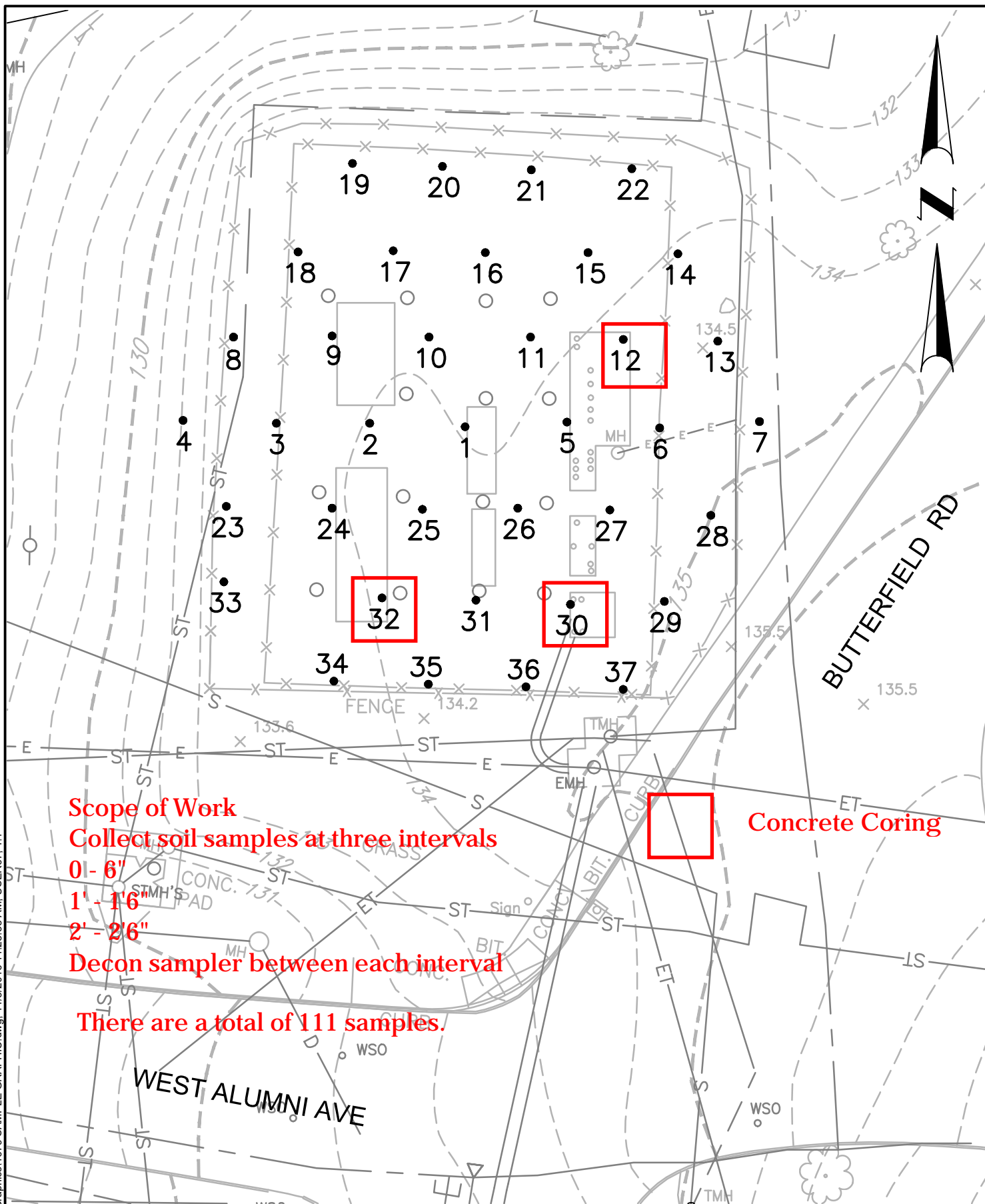


Gordon R. Archibald, Inc.
Civil and Environmental Engineers
Pawtucket, Rhode Island

**BUTERFIELD ROAD SUBSTATION
SAMPLING LOCATIONS
KINGSTON, RHODE ISLAND**

SCALE 1"=20'

NOVEMBER 2016



Scope of Work
 Collect soil samples at three intervals
 0' - 6"
 1' - 1'6"
 2' - 2'6"
 Decon sampler between each interval
 There are a total of 111 samples.

Concrete Coring

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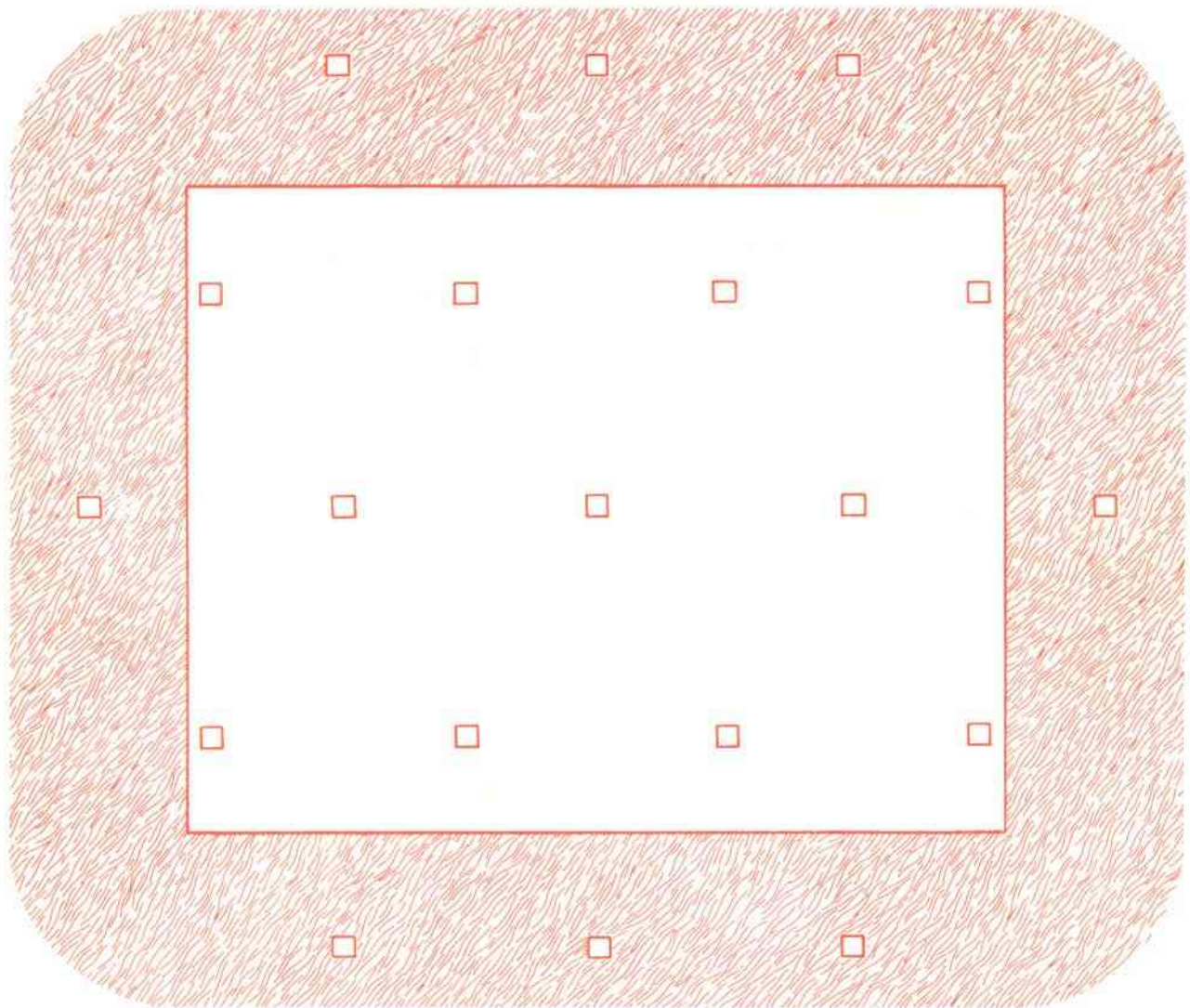
**BUTERFIELD ROAD SUBSTATION
 SAMPLING LOCATIONS
 KINGSTON, RHODE ISLAND**

SCALE 1"=20'

NOVEMBER 2016



FIELD MANUAL FOR GRID SAMPLING OF PCB SPILL SITES TO VERIFY CLEANUP



FIELD MANUAL FOR GRID SAMPLING OF PCB
SPILL SITES TO VERIFY CLEANUP

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INTERIM REPORT NO. 3
WORK ASSIGNMENT 37

EPA Contract No. 68-02-3938
MRI Project No. 8501-A(37)

and

EPA Contract No. 68-01-6721
WCG Subcontract to Battelle Columbus Laboratories
No. F4138(8149)435

Prepared for

U.S. Environmental Protection Agency
Office of Toxic Substances
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DISCLAIMER

This document has been reviewed and approved for publication by the Office of Toxic Substances, Office of Pesticides and Toxic Substances, U.S. Environmental Protection Agency. The use of trade names or commercial products does not constitute Agency endorsement or recommendation for use.

PREFACE

This Interim Report was prepared for the Environmental Protection Agency under EPA Contract No. 68-02-3938, Work Assignment 37. The work assignment was directed by Mitchell D. Erickson. This report was prepared by Gary Kelso and Dr. Erickson of Midwest Research Institute (MRI). David C. Cox of the Washington Consulting Group, 1625 I Street, N.W., Washington, D.C. 20006, contributed to the sampling design (Section 5.0) and compositing strategies (Appendix) sections under subcontract to Battelle Columbus Laboratories, Subcontract No. F4138(8149)435, EPA Contract No. 68-01-6721 with the Design and Development Branch, Exposure Evaluation Division.

This report is a revision of a previous draft report entitled "Field Manual for Verification of PCB Spill Cleanup" (Draft Interim Report No. 3, Task 37, EPA Prime Contract No. 68-02-3938, June 27, 1985). Both English and metric units are used in this document, where appropriate. EPA field inspectors will most commonly measure the site in English units; therefore these units were used for the site measurements in this report.

The EPA Work Assignment Managers, Daniel T. Heggem, Richard A. Levy, and John H. Smith, as well as Joseph J. Breen and Cindy Stroup of the Office of Toxic Substances, provided helpful guidance. Ms. Joan Westbrook and Mr. Ted Harrison of MRI and Mr. David Phillippi and Mr. Robert Jackson of EPA Region VII assisted in the field validation of this manual.

MIDWEST RESEARCH INSTITUTE


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Approved:


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Chemical Sciences Department

May 1986

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1.0 SCOPE AND APPLICATION

The purpose of this manual is to provide detailed, step-by-step guidance to EPA staff for using hexagonal grid sampling at a PCB spill site. Emphasis is placed on sampling sites which have already been cleaned, although the sampling methods presented may also be used at PCB spill sites which have not been cleaned. Guidance is given for preparing the sample design; collecting, handling, and preserving the samples taken; maintaining quality assurance and quality control; and documenting and reporting the sampling procedures used. An optional strategy for compositing samples is given in the appendix.

This is a companion document to the report "Verification of PCB Spill Cleanup by Sampling and Analysis" (EPA 560/5-85-026, August 1985, Second Printing). That report provides an overview of PCB spill cleanup activities and guidelines for sampling and analysis including: sampling designs, sampling techniques, analytical techniques, selection of appropriate analytical methods, quality assurance, documentation and records, and reporting results. The previous report provided the rationale and background for the techniques selected and describes many options in greater detail.

This "how-to" report concentrates on detailed guidance for field sampling personnel and does not attempt to provide background information on the techniques presented. This manual addresses field sampling only and does not provide information on laboratory procedures, including sample analysis, data reduction and laboratory data reporting. The types of field sampling situations discussed in this manual are those typically found when a PCB spill results from a PCB article, PCB container, or PCB equipment spill. Unusual PCB spill situations, such as elongated spills on highways from a moving vehicle, large spills in waterways, and large, catastrophic spills, are not addressed.

2.0 SUMMARY

This manual is divided into the following sections:

- Safety
- Sampling Equipment and Materials
- Sample Design
- Sample Collection, Handling, and Preservation
- Quality Assurance
- Quality Control
- Documentation and Records
- Validation of the Manual

Safety aspects of field sampling include wearing proper protective equipment, practicing good hygiene, using safe work practices, and training field inspectors in safety procedures. Sampling equipment and materials include personnel equipment, sampling equipment, and documentation materials. Prior to making the field sampling trip, the EPA inspector should ensure that all sampling equipment and materials are available, and that all sampling containers and equipment have been properly precleaned.

The sample design is based on a hexagonal grid of 7, 19, or 37 sample points. A step-wise method describes how to construct a diagram of the PCB spill site on graph paper; determine the radius and center of the sampling circle; determine which grid size to use; lay out the grid on the diagram; and then lay out the sampling grid on the site.

After the sampling grid has been laid out on the site, a sample must be taken at each grid point. Methods to collect, handle, and preserve different types of samples, including surface soil samples, soil core samples, surface and subsurface water samples, wipe samples from nonporous hard surfaces, destructive samples from porous hard surfaces, and vegetation samples, are suggested. For each type of sample to be taken, methods are recommended to prevent cross-contamination between samples.

Quality assurance (QA) and quality control (QC) must be an integral part of any sampling scheme. A quality assurance plan must be developed by appropriate EPA offices according to EPA guidelines and be submitted to the regional QA officer or other appropriate QA official for approval prior to sampling PCB spill sites. Each EPA office must operate a formal QC program and all QC measures should be stipulated in the QA plan. Some of the requirements of quality control are discussed in this report, including field blanks, sampling without cross-contamination, sample custody, and documentation of the field sampling activities.

All sampling activities should be thoroughly documented and reported as a part of the verification process. Each EPA office is responsible for preparing and maintaining complete records, including an equipment preparation log book, a field log book, site description forms, chain-of-custody forms, sample analysis request forms, and field trip reports.

Section 10.0 briefly describes a field study which was conducted to test and validate the sample design given in this manual. The study showed that the sampling design is easy to follow and understood by those unfamiliar with the manual prior to reading it, and that the grid sample points can be correctly laid out in a relatively short period of time.

The appendix gives strategies that may be used to composite the samples taken at a PCB spill site when compositing is deemed to be desirable.

3.0 SAFETY

A PCB spill site which has been cleaned up should have very low levels of PCBs present. The EPA inspector(s) who sample the site to verify that the site has been properly cleaned up should, however, take some precautions to minimize any exposure to PCBs or other potential hazards at the site.

In order to ensure that the inspectors understand and practice good safety procedures, a training and education program should be established and a health and safety manual provided by the responsible EPA officer. The program should inform inspectors of the potential hazards of exposure to PCBs, and the proper safety procedures to follow when sampling PCB spill sites.

4.0 SAMPLING EQUIPMENT AND MATERIALS

The equipment and materials required to sample a PCB spill site will vary with the types of samples to be taken. The general lists of equipment and materials given below must be adjusted for the specific requirements of each spill. The lists include personnel equipment, sampling equipment and materials, and documentation materials which should be taken to the spill site by the EPA inspector. These equipment and materials must be assembled prior to making the site visit, and all sampling containers and sampling equipment must be precleaned.

4.1 Personnel Equipment

The inspector should take the following personnel equipment to the spill site:

- Disposable rubber gloves
- Plastic overshoes
- Safety glasses
- Impervious paper-like coveralls
- Hardhat
- Safety shoes
- First-aid kit
- Other safety equipment specified by safety officer

4.2 Sampling Equipment and Materials

Since the types of samples to be taken at a spill site may vary from site to site, the following sampling equipment and materials should be taken:

- Precleaned glass sample jars with Teflon-lined caps
- Aluminum foil (solvent-rinsed)
- Container of reagent-grade solvent (isooctane is recommended)
- Box of 11 cm filter paper (e.g., Whatman 40 ashless or Whatman 50 smear tabs)
- Gauze pads
- Stainless steel forceps
- Stainless steel templates (10 cm x 10 cm square)
- Stainless steel trowels, Teflon scoops, or laboratory spatulas (precleaned)
- Soil coring devices (such as King-tube samplers or piston corers)
- Hammer and chisel
- Hole saw and drill
- Pruning shears
- Stainless steel buckets
- Disposable wiping cloths
- Plastic disposable bags
- Sample bags and seals
- Survey stakes
- 100 ft tape measure
- Ice chests containing ice or ice packs and secured with padlocks
- Compass and maps
- Duct tape
- Subsurface water sampling equipment (such as pumps, siphons, glass sampling jars with attachments, etc.)
- Container of distilled water
- Stainless steel mixing bowls and spoons

4.3 Documentation Materials

The following documentation materials should be taken to the field site:

- Field log book
- Chain-of-custody forms
- Site description forms
- Sample analysis request forms
- Sample bottle labels
- Camera with film
- Yellow TSCA PCB marks

4.4 Trip Preparation

The EPA field inspector must assemble all the necessary equipment and materials prior to making the field sampling trip. Special attention should be given to assuring that all of the equipment and materials are available, and that the sample containers and sampling equipment have been properly precleaned. The equipment preparation should be documented in a log book (Section 9.1) prior to making the trip.

5.0 SAMPLE DESIGN

The methods to be used for determining the sample point locations at a PCB spill site are given in this section, and are based upon a hexagonal grid sample design which was recommended in the report "Verification of PCB Spill Cleanup by Sampling and Analysis." Although the grid design involves more samples and a more complicated layout than the usual grab sampling methods, the grid design is essential to obtaining a representative sample of the site and greatly increases the chance of detecting high levels of PCB contamination when they exist. For example, when 4% of the PCB spill site remains contaminated at 50 ppm after cleanup, analysis of samples from a 37-point

grid has a 98% chance of detection of this contamination level, while analysis of six random grab samples from the site has only a 3% chance of detection (Boomer et al. 1985).

The hexagonal grid sampling design is to be laid out within a sample circle centered on the spill site, and extending just beyond its boundaries. Preparation of the design requires the following steps:

- Step 1: Diagram the Cleanup Site
- Step 2: Diagram All Cleanup Surfaces in the Same Plane
- Step 3: Find the Center and Radius of the Sampling Circle
- Step 4: Determine the Number of Grid Sample Points to Use
- Step 5: Lay Out the Sampling Points on the Diagram Constructed in Step 2
- Step 6: Lay Out the Sampling Locations on the Site
- Step 7: Consider Special Cases and Use Judgment for Sample Points

The discussion which follows gives the methods to be used in accomplishing each step of the hexagonal grid sampling design, using a three-dimensional spill surface as an example. Following this discussion, a simple example of laying out the sample design on a rectangular two-dimensional surface is given.

5.1 Step 1: Diagram the Cleanup Site

Draw a scale diagram of the cleanup site on graph paper, including vertical surfaces (walls, fences, etc.), noting important dimensions and different types of surfaces (sod, cement, asphalt, etc.). Such a diagram may sometimes be found in records of the cleanup. If not, site measurements should be taken. Great accuracy (e.g., using surveying instruments) is not necessary, however; the use of a tape measure and pacing should be adequate. An example diagram is shown in Figure 1 on a scale of 1 in. = 4 ft.

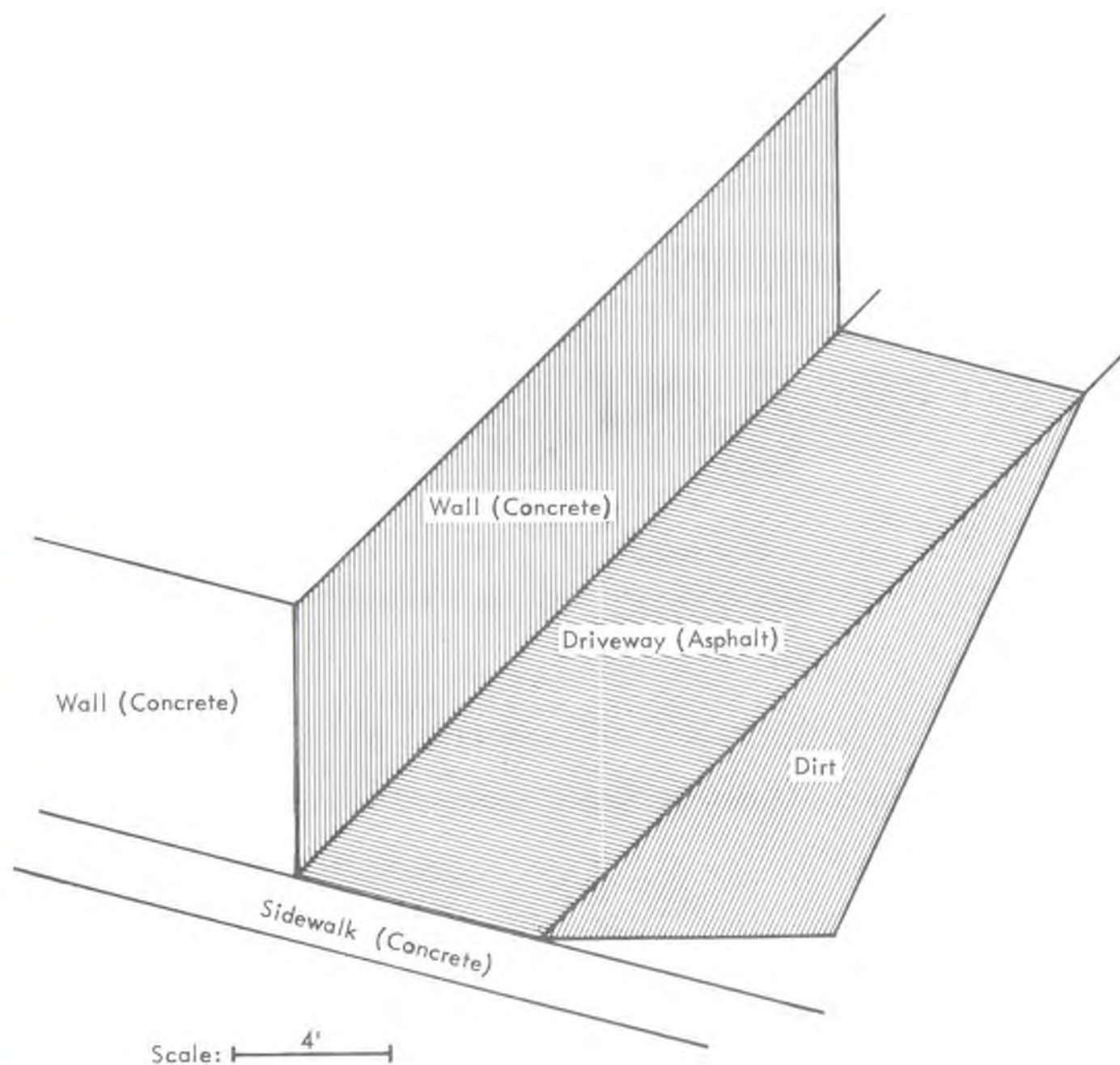


Figure 1. Example PCB spill site diagram.

The site diagram should include as many reference points as necessary to relocate the spill area in the future, if necessary. For example, a spill site in an open field should be located with respect to nearby structures such as roads, telephone poles, buildings, etc. The direction of north should be indicated on the diagram.

If available, a detailed drawing or a survey plot of the spill site should be obtained from the individual(s) that cleaned the site.

5.2 Step 2: Diagram All Cleanup Surfaces in the Same Plane

The purpose of this second diagram is to determine and show the dimensions of the total cleanup area, including vertical surfaces, so that the required sample size can be found. The diagram also facilitates the determination of sampling locations on vertical surfaces. Constructing the diagram is analogous to flattening a cardboard box. All vertical surfaces are placed in the same plane as the adjoining horizontal surfaces. Figure 2, also on a scale of 1 in. = 4 ft, shows the example spill cleanup site diagrammed in the same plane. The actual site dimensions are shown in feet.

5.3 Step 3: Find the Center and Radius of the Sampling Circle

In practice, the contaminated area from a spill will be irregular in shape. In order to standardize sample design and layout in the field, samples are collected within a circular area surrounding the contaminated area. The sampling circle is, approximately, the smallest circle containing all cleanup surfaces diagrammed in Step 2.

A recommended procedure for finding the center and radius of the sampling circle is illustrated in Figure 3 and is described below:

1. Draw the longest dimension, L_1 , of the site diagram in Step 2.
2. Find the midpoint, P , of L_1 .

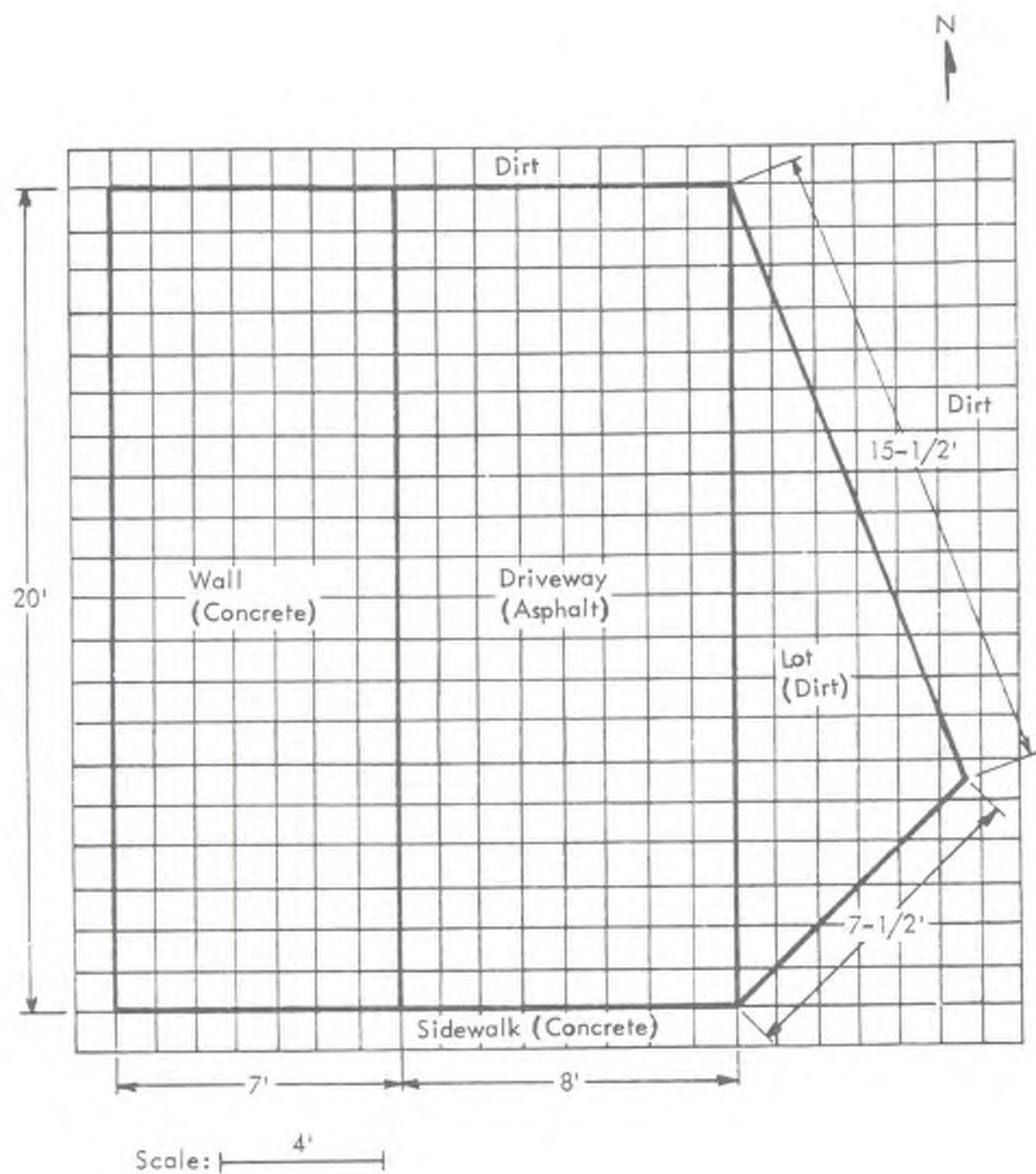


Figure 2. Example spill cleanup site diagrammed in the same plane.

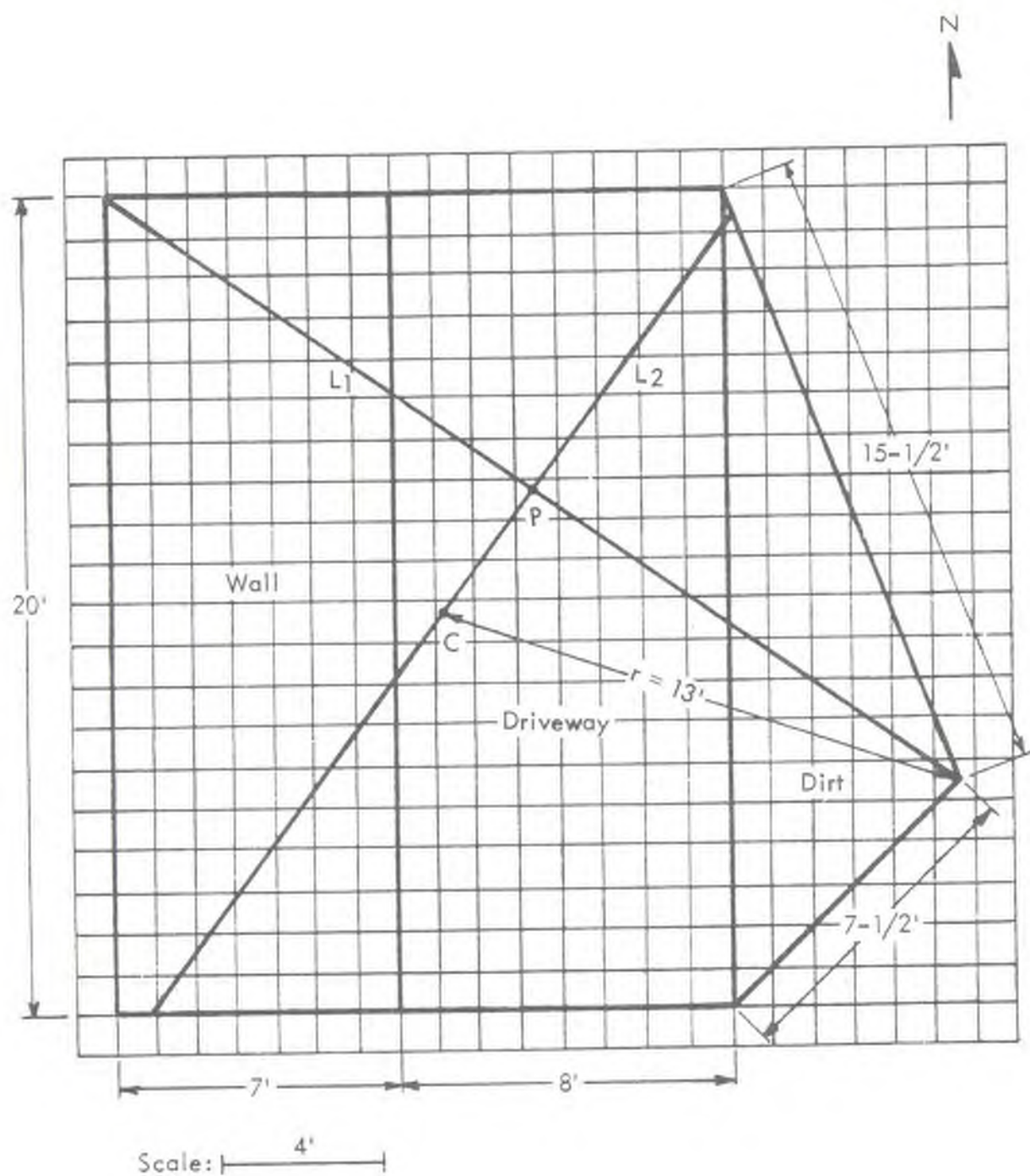


Figure 3. Locating the center and sampling radius of the example spill cleanup site.

3. Draw a second dimension, L_2 , through P perpendicular to L_1 . L_2 extends to the boundaries of the site diagram.
4. The midpoint, C, of L_2 is the center of the sampling circle.
5. The distance from C to either end of the longest dimension, L_1 , is the sampling radius, r .

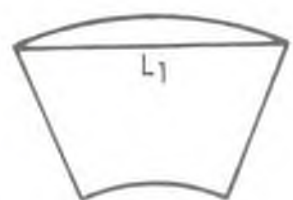
Figure 4 illustrates the application of this procedure to a site with an irregular shape, and Figure 5 shows the procedure for a variety of irregularly shaped areas. These figures show that the center and radius determined are generally reasonable.

5.4 Step 4: Determine the Number of Grid Sample Points to Use

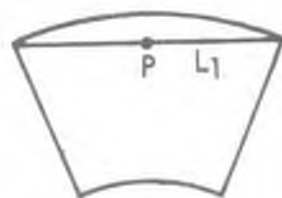
The number of grid samples to be taken at a site depends upon the radius of the sampling circle, which is determined from the scale diagram shown in Figure 3. The number of samples to be taken at a spill site should increase as the radius of the sample circle increases. The reason for this is that the probability of detecting residual PCB contamination at a given site increases as the number of grid samples increases. Table 1 shows the required number of grid samples for sampling circles with a radius of 4 ft or less (seven samples); greater than 4 ft to 11 ft (19 samples); and greater than 11 ft (37 samples).

Table 1. Required Number of Grid Samples Based on the Radius of the Sampling Circle

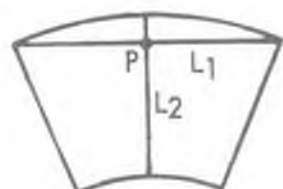
Sampling radius, r (ft)	Number of Samples
≤ 4	7
$> 4 - 11$	19
> 11	37



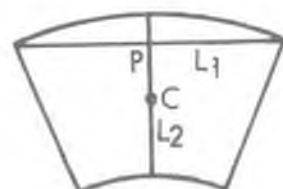
- (a) Draw longest dimension, L_1 , on site diagram.



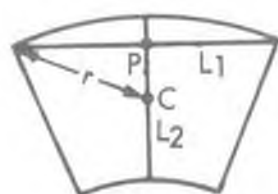
- (b) Find midpoint, P , of L_1 .



- (c) Draw line, L_2 , through P perpendicular to L_1 .



- (d) The midpoint, C , of L_2 is the center of the sampling circle.



- (e) The distance from C to the end of L_1 is the sampling radius, r .

Figure 4. Method to find center and radius of the sampling circle.

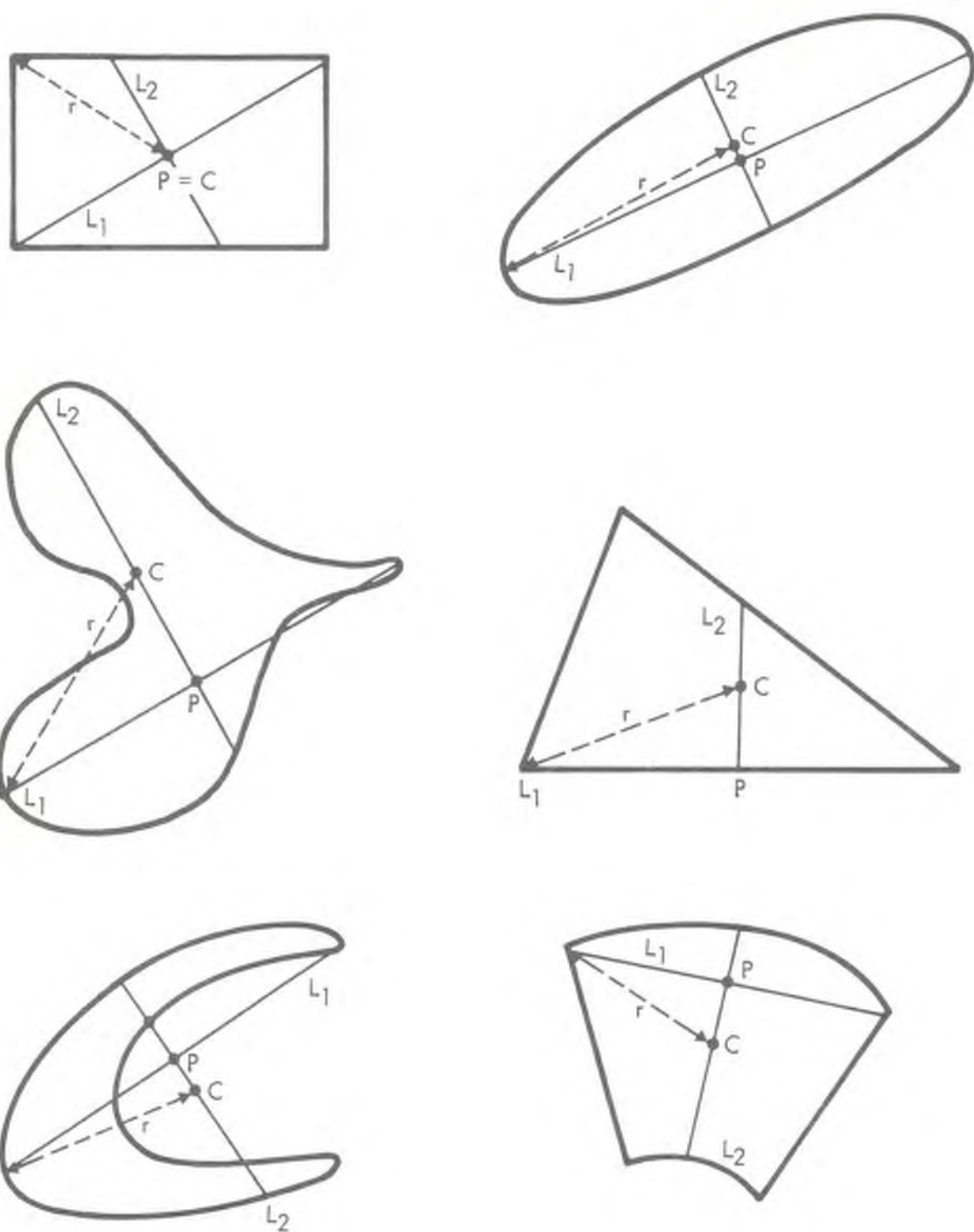


Figure 5. Locating the center and sampling circle radius of irregularly shaped spill areas.

The radius, r , for the example site is 3-1/4 in. in Figure 3. Thus, the actual site sampling radius is 13 ft (3-1/4 in. x 4 ft/in.) and the number of grid samples required is 37.

Figures 6, 7, and 8 illustrate the hexagonal grid sampling design for the three sample sizes given in Table 1, for a sampling radius of 4, 10, and 20 ft, respectively.

5.5 Step 5: Lay Out the Sampling Points on the Diagram Constructed in Step 2

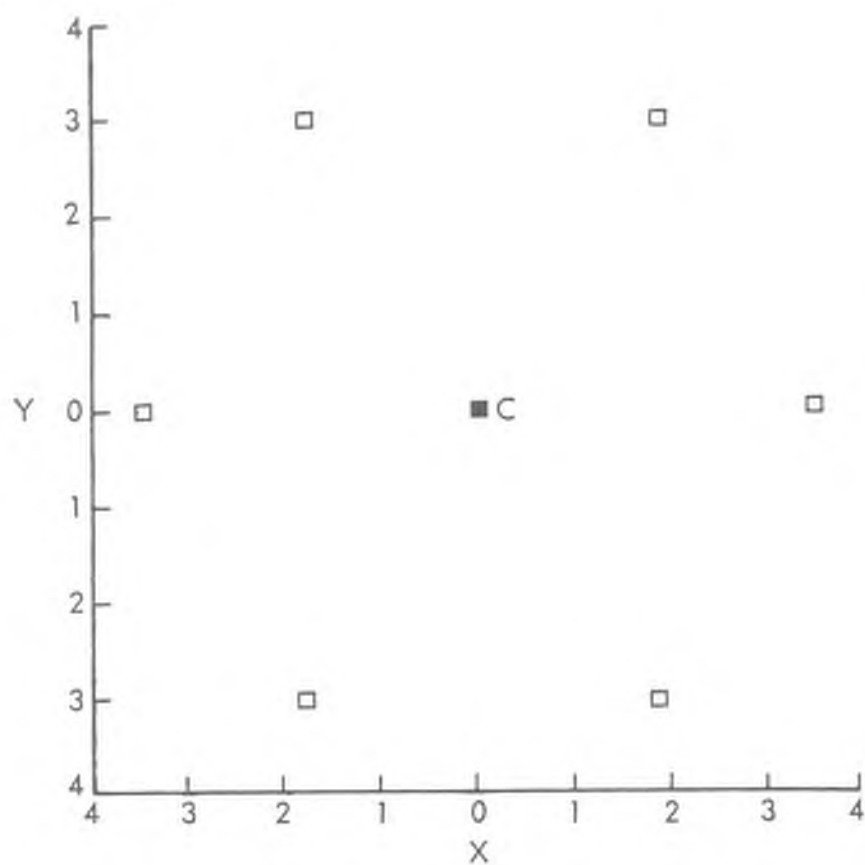
The geometric properties of the hexagonal designs can be used in many ways to lay out the sampling points. Perhaps the simplest way to proceed is as follows. Define s to be the distance between adjacent points and u to be the distance between successive rows of the design. The distances s and u are given in terms of the sampling radius, r , in Table 2 below for the given number of samples defined by the radius rule and listed in Table 1.

Table 2. Geometric Parameters of the Hexagonal Grid Designs, for Sampling Radius r

Number of samples	Distance, s , between adjacent sample points	Distance, u , between successive rows
7	$0.87r$	$0.75r$
19	$0.48r$	$0.42r$
37	$0.30r$	$0.26r$

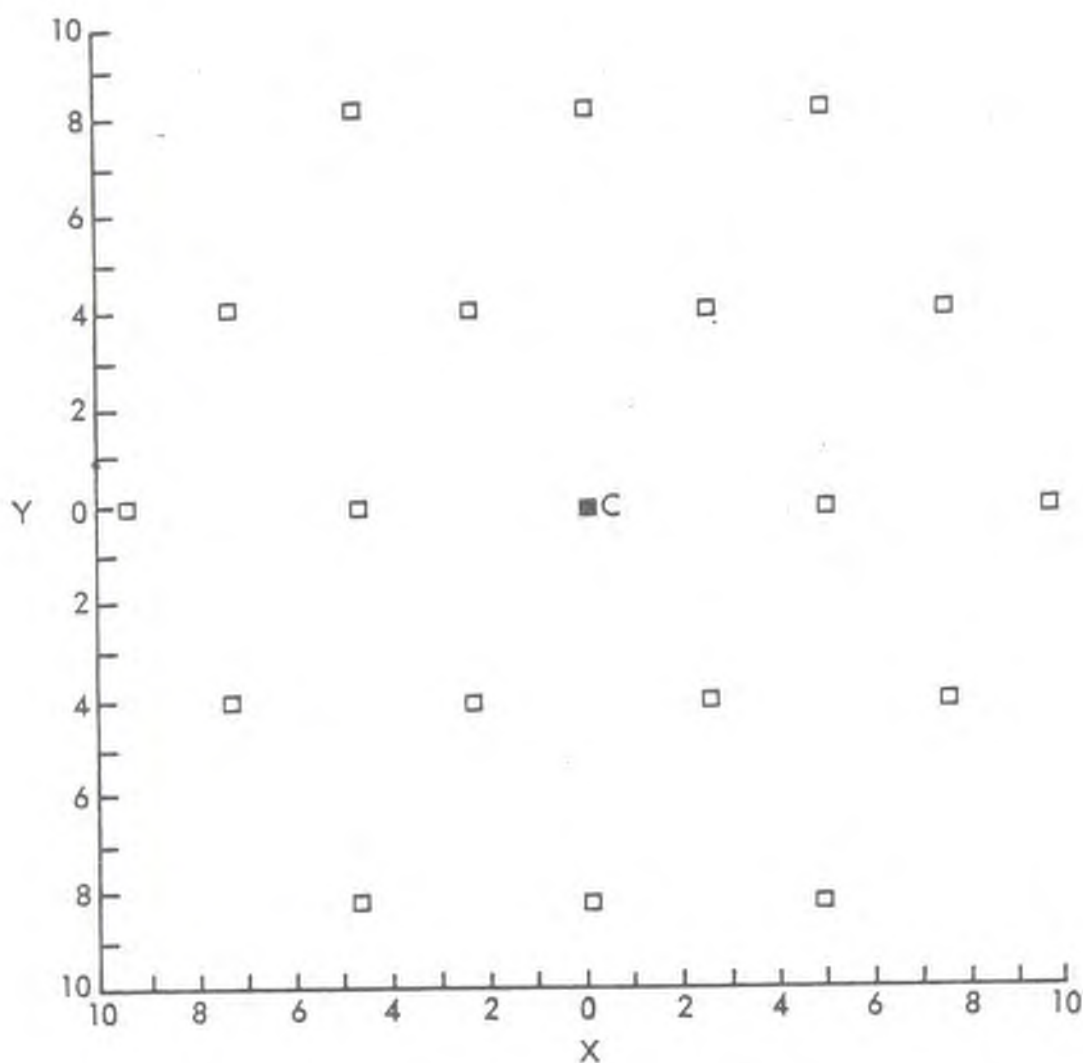
The recommended method for laying out the sample points of the hexagonal grid on the scale diagram is illustrated in Figure 9 and is described below.

1. Draw a diameter of the sampling circle on the scale diagram. The orientation of the diameter (e.g., east-west) should be chosen to maximize the number of sample points which fall within the spill area, when practical.



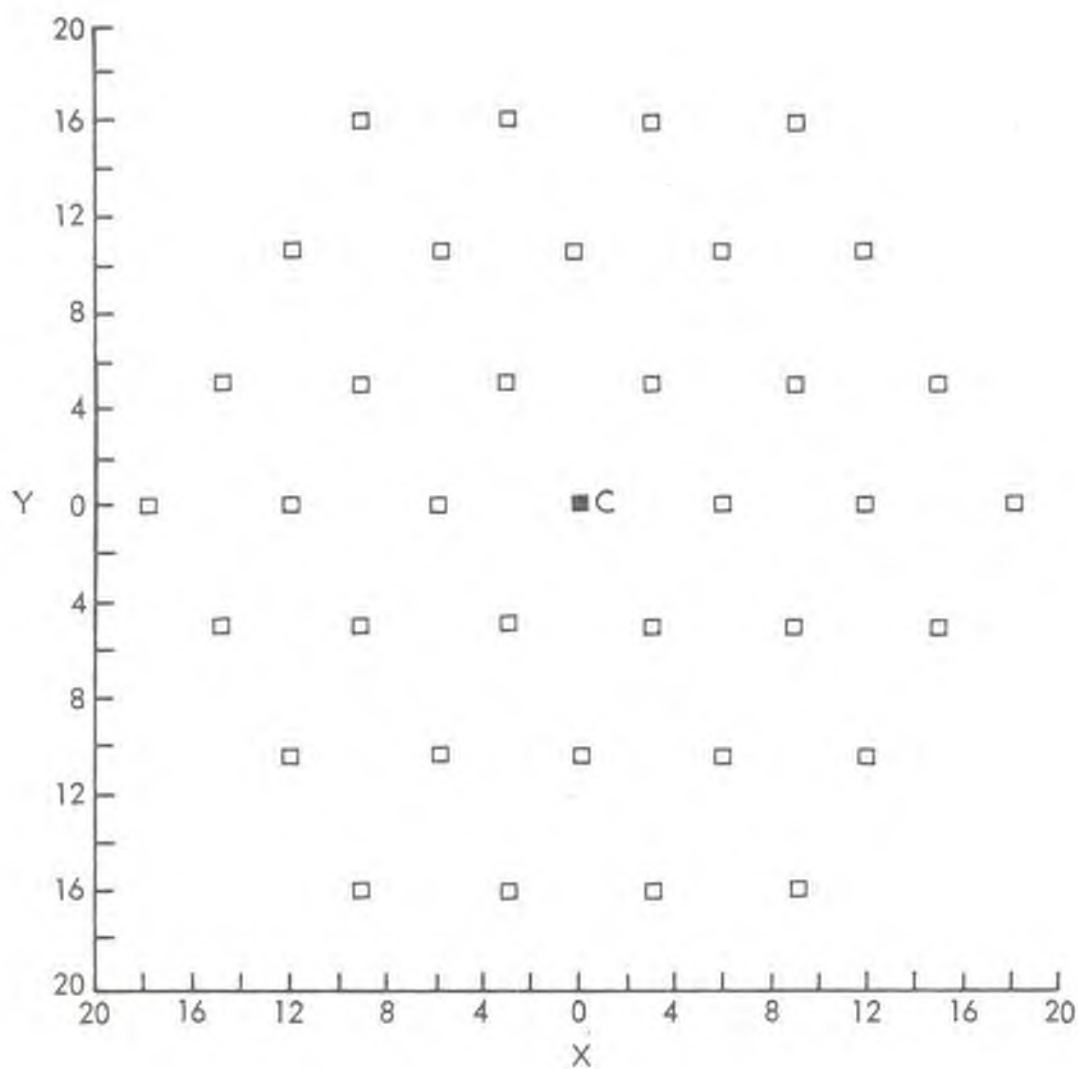
The outer boundary of the contaminated area is assumed to be 4 feet from the center (C) of the spill site.

Figure 6. Location of sampling points in a 7-point grid.



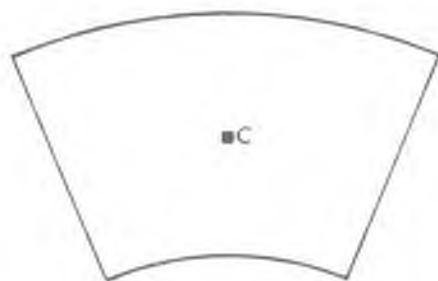
The outer boundary of the contaminated area is assumed to be 10 feet from the center (C) of the spill site.

Figure 7. Location of sampling points in a 19-point grid.

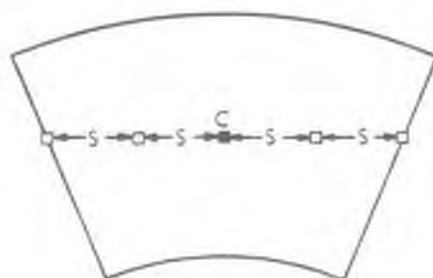


The outer boundary of the contaminated area is assumed to be 20 feet from the center (C) of the spill site.

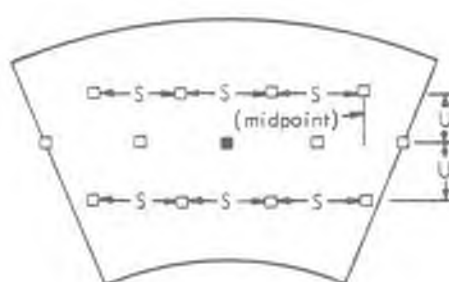
Figure 8. Location of sampling points in a 37-point grid.



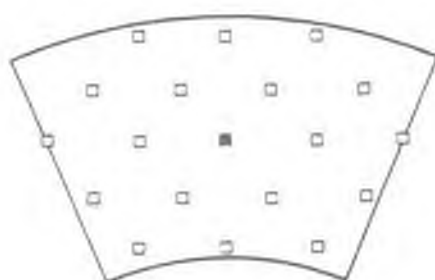
(a) Center of cleanup area, C.



(b) Middle row of grid points located distance, s , apart.



(c) Next two grid rows perpendicular distance, u , from middle row.



(d) Completed 19 sample point grid.

Figure 9. Construction of sampling grid on a site diagram.

A transparent overlay like Figures 6, 7 and 8 (using the appropriate scale) may be helpful in determining the orientation of the diameter.

2. Place the center point of the hexagonal design at the center (C) of the sampling circle. Lay out the middle row of the design along the diameter with successive points a distance, s , apart.

3. To lay out the next row, find the midpoint between the last two sample points of the middle row and move a distance, u , perpendicular to the middle row as shown in Figure 9. This is the first sample point of the next row. Now lay out the remaining points at distance s from each other. By systematically following this plan, the entire design can be laid out.

Figure 10 shows the sample point locations for the 37 grid points for the example PCB spill site diagrammed previously in Figures 1, 2, and 3. On the diagram, $r = 3\text{--}1/4$ in. so from Table 2 the grid spacing is $s = 0.30r = 1$ in. and the distance between the rows is $u = 0.26r = 7/8$ in.

In Figure 10, a horizontal diameter is drawn through C. Sampling locations 1 through 7 are marked 1 in. apart. To lay out the next row of the design, we first find location 8. Point D is the midpoint between locations 3 and 4. Then, as described, location 8 is a vertical distance $u = 7/8$ in. (3 ft 6 in. on the site) above D. Now locations 9 through 13 are laid out 1 in. apart. In the same way, locations 14 through 18 are found. Continuing so, the entire grid is marked on the diagram.

All of the sample points in Figure 10 are numbered (1 to 37). Any type of numbering system can be used, but the points must each be identified so that the location of the samples taken can be identified by reference to the diagram points.

Note that sampling locations 4, 7, 8, 13, 23, 34, 35, 36, and 37 are outside the cleanup area. Of these, locations 4, 8, 23, 34, and 35 do not correspond to a physical location--all are in "thin air," so to speak--and samples cannot be collected at these locations. Locations 36 and 37 are concrete samples; locations 7 and 13 are dirt samples (from Figure 2).

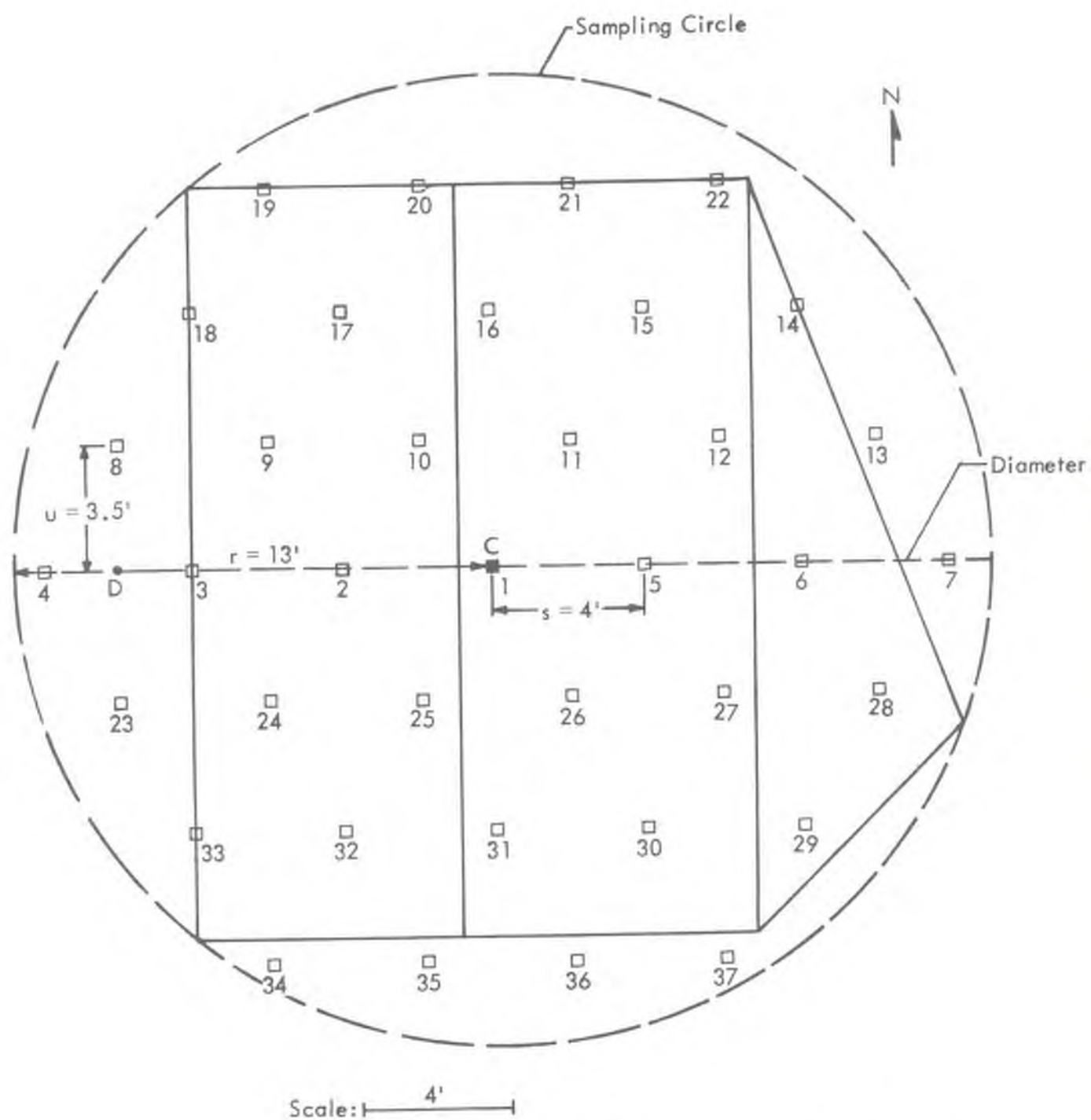


Figure 10. Sampling locations on the example PCB spill site.

The orientation of the sample circle diameter shown does not actually maximize the number of points falling within the spill area, since a 45° clockwise rotation would result in only 8 points lying outside the spill area instead of the 9 points shown. However, a 45° orientation would make the sample points very difficult to locate on the actual site with little to gain by the addition of one more sample point within the spill area.

5.6 Step 6: Lay Out the Sampling Locations on the Site

To locate the sample points on the site, use the same procedure as was used to construct the diagram of the sample points in Step 5, but use a tape measure or pacing, as appropriate, to measure distance. Since $s = 1$ in. in the diagram (Figure 10), then $s = 4$ ft on the site. Similarly, $u = 3$ ft 6 in. on the site. It may be helpful to show the actual distances (in ft) on the diagram before laying out the site sample points. For example, the samples on the wall are most easily found by measuring the distance on the scaled diagram from one end of the wall and the height above the driveway, and then converting these measurements to find the actual location on the wall. Consider point 32, for example. On Figure 10, it is located approximately $3/4$ in. above the driveway and $5/8$ in. from the left edge of the wall. On the site, then, this point is 3 ft above the driveway and $2\text{-}1/2$ ft from the left edge of the wall.

The PCB spill site should be considered contaminated until laboratory analyses of the samples taken verify the site is clean. Therefore, caution should be exercised when marking the sample points on the site to prevent possible cross-contamination. The inspector should make minimum contact with the spill surfaces. One method for accomplishing this would be to cover the surfaces with plastic sheeting.

5.7 Step 7: Consideration of Special Cases

5.7.1 Sample Points Outside the Spill Cleanup Area

Samples from points outside the spill area should generally be collected, although taking these samples is at the discretion of the inspector. Collection of these samples permits the EPA to check the contamination of samples outside the spill area designated by the party responsible for the cleanup. This provides a mechanism for assessing whether the spill area was underestimated by the cleanup crew.

In cases where the contaminated area is very different from a circle (e.g., a very elongated ellipse) the sampling circle may be a poor approximation of the contaminated area, and a moderate to large percentage of the sampling points may fall outside the contaminated area. If the sampler is certain that the spill boundaries truly represent the contaminated area (i.e., there is definitely no contamination outside of this area), then it is permissible to disregard those sampling points falling outside the contaminated area. However, it is still good practice to collect such samples because the effort required to return to the site and sample again (should these samples be needed for any reason) is much greater than the effort required while on site.

5.7.2 Sample Locations Which Do Not Physically Exist

The grid can also indicate sample locations which do not physically exist on the real site. These locations are in "thin air" so to speak and cannot be sampled. The number of samples to be collected is adjusted downward for these samples; replacement locations are not needed.

5.7.3 Judgmental Samples

The inspector's best judgment should be used to collect samples where residual PCB contamination is suspected. These samples would be collected in addition to those from the sampling grid. Examples of extra

sampling points include suspicious stains outside the spill area, cracks or crevices, or any area where the inspector suspects inadequate cleanup.

5.7.4 Sampling Small Areas

The grid sample design specifies that seven samples should be taken in areas which have a sample circle radius of less than 4 ft. In cases where the spill area is very small, fewer than seven samples can be taken at the discretion of the EPA inspector.

5.8 Example of Laying Out the Sample Design

This section summarizes the step-wise procedures required to determine the locations of the grid sample points at a PCB spill site. The example used is a simple 8 x 10 ft rectangular spill site.

Steps 1 and 2: Measure and Diagram the PCB Spill Cleanup Site

The PCB spill cleanup site must first be measured (usually with a tape measure). Then the site should be drawn to scale on graph paper. In this example, the site is assumed to be an 8 x 10 ft rectangle, as shown in Figure 11. A scale of 1 in. = 2 ft is used.

Step 3: Determine the Center and Radius of the Sampling Circle

The center and radius of the sampling circle is determined on a separate diagram as follows, and is illustrated in Figure 12:

1. Draw the site diagram to scale (same as Figure 11).
2. Draw a line representing the longest dimension, L_1 , of the site diagram.
3. Find the midpoint, P , of L_1 .

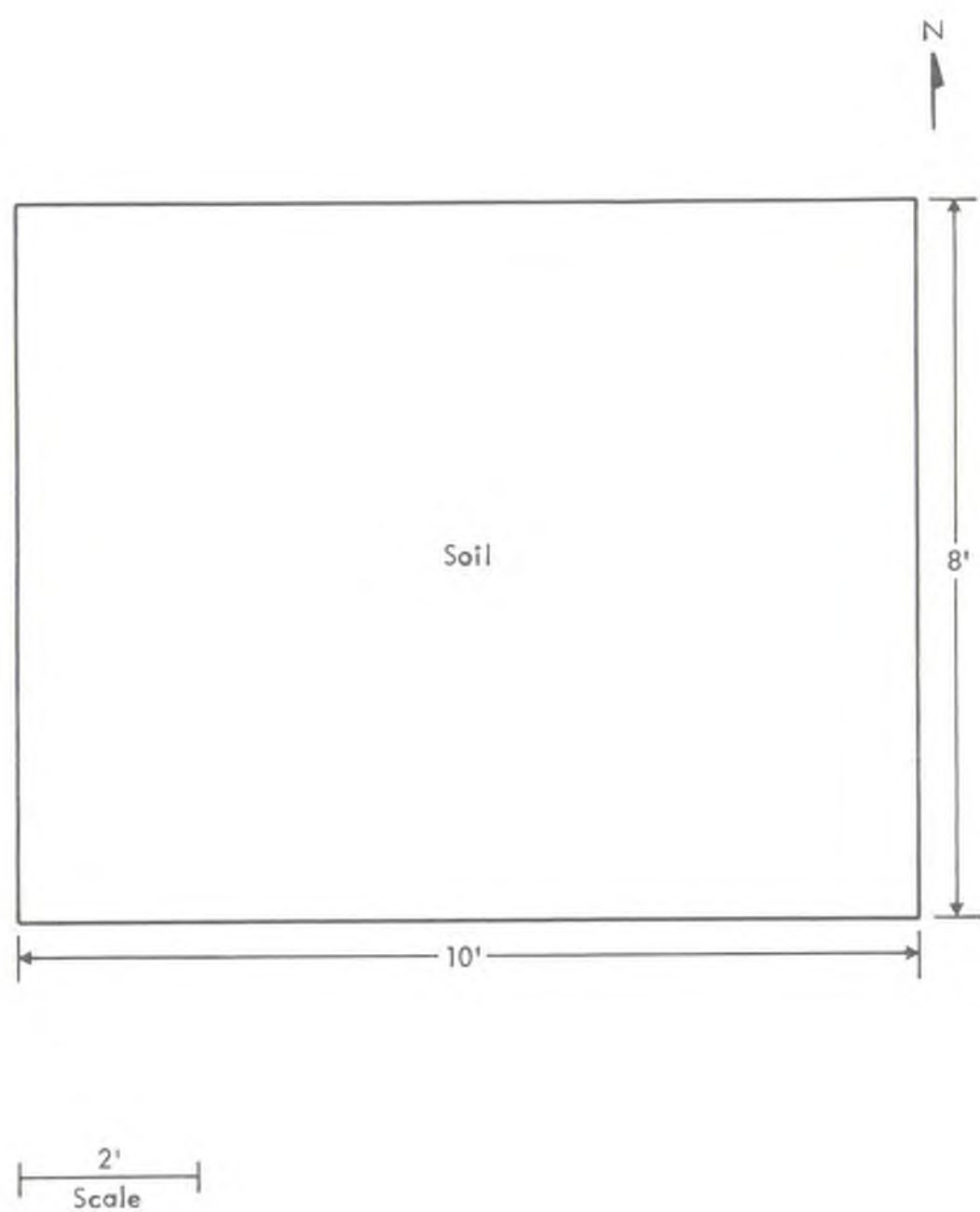


Figure 11. Scale diagram of PCB spill site.

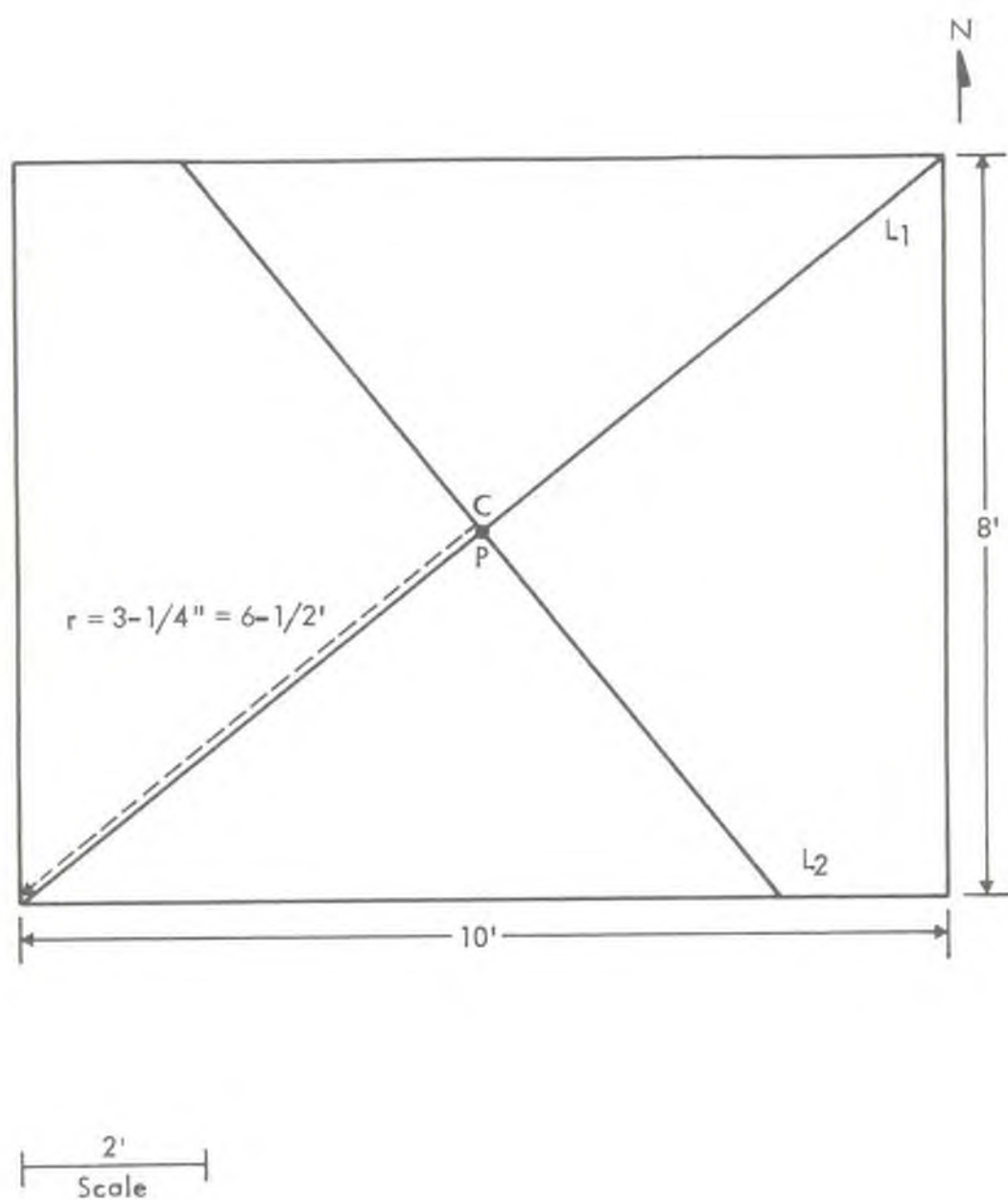


Figure 12. Determining center (C) and sampling radius (r) of sampling circle.

4. Draw a second line, L_2 , perpendicular to L_1 , through point P. Line L_2 must extend to the boundaries of the site.
5. Find the midpoint, C, of line L_2 . Point C is the center of the sampling circle. (In this example, points P and C coincide, but will not coincide for many other types of configurations.)
6. Measure the distance from point C to either end of L_1 , which is the sampling radius, r . The distance, r , should be measured to the nearest 1/16 in.
7. Scale radius, r , up to actual size. In this example, the radius, r , is 3-1/4 in. on a scale of 1 in. = 2 ft, or 6-1/2 ft (3-1/4 in. \times 2 ft/in.).

Step 4: Find the Number of Grid Samples to be Used

The number of samples to be taken in a hexagonal grid depends upon the length of the sampling radius, as shown in Table 1 and repeated here.

<u>Sampling Radius, r (ft)</u>	<u>Number of Samples</u>
≤ 4	7
$> 4 - 11$	19
> 11	37

Since the radius in this example is 6-1/2 ft, the number of sampling points would be 19.

Step 5: Plot the Sampling Points on the Site Diagram

The sampling points in a grid row are a distance, s , apart; and the grid rows are a distance, u , apart. The distances s and u are determined from the following table.

<u>Number of Samples</u>	<u>Distance, s, Between Adjacent Sample Points</u>	<u>Distance, u, Between Adjacent Rows</u>
7	0.87 r	0.75 r
19	0.48 r	0.42 r
37	0.30 r	0.26 r

In this example, the distance, s, between the points in a row is 1-9/16 in. [(0.48) x (3.25 in.)] on the diagram, or about 3 ft 2 in. [(1-9/16 in.) x (2 ft/in.)] on the actual site. The distance, u, between rows is 1-3/8 in. [(0.42) x (3.25 in.)] on the diagram, or about 2 ft 9 in. [(1-3/8 in.) x (2 ft/in.)] on the actual site.

The center point of the grid lies on the center, C, of the sampling circle. Construct the hexagonal grid and superimpose it over the site diagram (constructed on a third piece of graph paper), as illustrated in Figure 13 for this example. The middle row of the grid (points 1 through 5) should be oriented to maximize the number of sample points which lie within the boundaries of the spill cleanup site.

It should be noted that adjacent rows are staggered, and that the sample points of one row are located midway (horizontally) between the sample points of the other row.

Step 6: Mark the Sample Points on the Site

Starting at the center, C, of the spill cleanup site, mark the middle row points a distance of 3 ft 2 in. apart. Locate the adjacent rows a distance (u) of 2 ft 9 in. from the middle row, and mark the four sample points in each of these rows a distance of 3 ft 2 in. apart. Complete the site sampling grid with the other two rows of sample points.

6.0 SAMPLE COLLECTION, HANDLING AND PRESERVATION

After the sampling grid has been diagrammed on the site description forms and laid out on the site, a sample must be taken at each grid point.

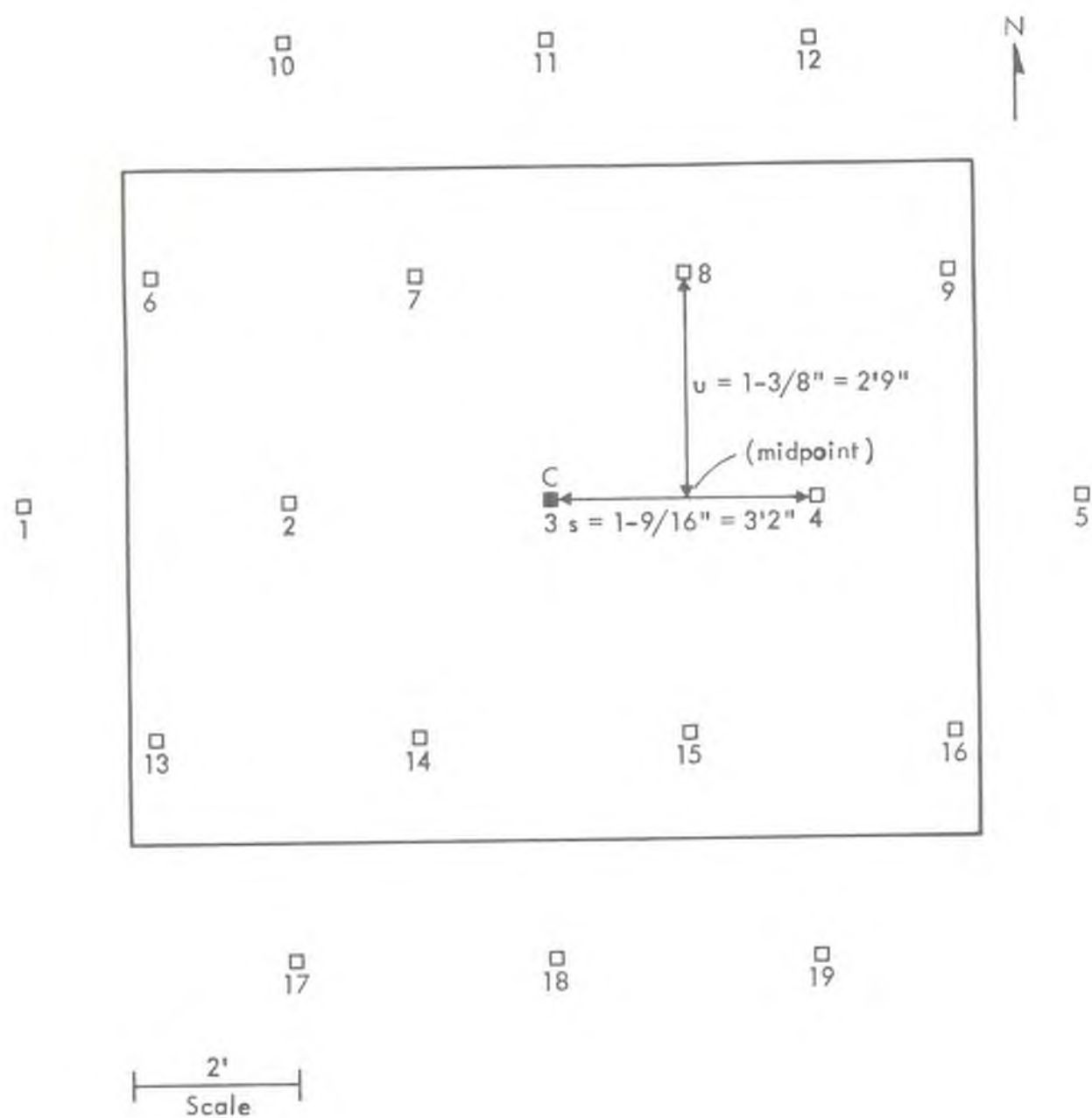


Figure 13. Diagram of 19-point grid superimposed on the PCB spill site.

Until the samples have been analyzed, the entire area must be assumed to be contaminated with residual PCBs. Therefore, appropriate measures must be taken to protect workers and the general public, prevent cross-contamination of samples, and prevent contamination of the surrounding area during sampling. Detailed contamination prevention procedures should be given in the staff training (Section 3.0 and 8.2).

PCB spill sites will vary widely in nature, and the types of media to be sampled may include soil, sod, water, hard surfaces, and vegetation. This section presents some general methods that can be used to sample these different media. These sample collection, handling and preservation techniques are provided for information; other techniques may also be used. Additional sample collection guidance documents are also available (Mason 1982; USEPA 1981).

6.1 Surface Soil Sampling

When surface soil (or sand) is to be sampled, the sample area should be marked by a 10 cm x 10 cm (100 cm²) template. The soil should be scraped to a depth of about 1 cm with a stainless steel trowel, scoop, or spatula to yield about 100 g of soil. If more soil is required, the area should be expanded without increasing the depth of soil obtained. The soil sample should be placed in a precleaned glass bottle, the bottle capped, the sample bottle label filled out and attached, and a yellow TSCA PCB mark affixed. The bottle should be sealed in a plastic sample bag and placed in an ice chest containing ice (to keep the sample at about 4°C). If samples are to be analyzed soon, the cold storage requirements may be relaxed as long as sample integrity is maintained. The sample collection data should be entered in the field log book and on the chain-of-custody form.

The template used to mark surface soil samples, the scoop or spatula used to take the sample, and the rubber gloves worn by the inspector are all sources of cross-contamination between samples. Ideally, a different template, scoop, and pair of rubber gloves should be used to take each sample. The

template and scoop may then be placed in a plastic bag to be taken back to the laboratory to be cleaned for the next field sampling job. The rubber gloves should be discarded into a plastic bag which will be disposed of as PCB-contaminated material if any samples exhibit PCB contamination.

If a sufficient number of templates or scoops are not available to use only one item per sample, then each of these equipment items must be thoroughly cleaned between samples. The template and scoop should be thoroughly rinsed with solvent and wiped with a disposable wiping cloth (which should be discarded into the plastic bag intended for disposal of PCB-contaminated materials).

6.2 Soil Core-Sampling

When core samples of sod or soil are needed, the samples may be taken using a coring device such as a piston corer or King-tube sampler. Core samples should be taken to a depth of about 5 cm. The soil core can be pushed out into a precleaned glass bottle and capped, or the tube containing the sample can be wrapped in solvent-rinsed aluminum foil, depending upon the type of coring device used. The sample should be properly labeled, a yellow TSCA PCB mark affixed, and placed in an ice chest (to keep the sample about 4°C). If samples are to be analyzed soon, the cold storage requirements may be relaxed as long as sample integrity is maintained. The sample collection data should be entered in the field log book and on the chain-of-custody form.

Core samples of soil or sod should be taken with individual core tubes for each sample. If this is not possible, then the coring device should be rinsed with solvent and wiped with a disposable wipe cloth to remove any visible particles before taking another sample. After each sample, rubber gloves and wipe cloth should be discarded into a plastic bag intended for disposal of PCB-contaminated materials.

6.3 Water Sampling

PCB spills on water may result in a surface film (particularly when the PCBs are dissolved in hydrocarbon oils) or sink to the bottom (particularly when the PCBs are in askarel or other heavier-than-water matrix). When a surface film is suspected (or visible), the water surface should be sampled. Otherwise, a water sample should be taken near the bottom of the body of water.

6.3.1 Surface Sampling

Surface water samples should be collected by lowering an open, pre-cleaned glass sample bottle horizontally into the water at the designated sample collection point. As water begins to run into the bottle, slowly turn the bottle upright, keeping the lip just under the surface so that only surface water is collected. Lift the bottle out of the water, wipe the outside with a disposable wiping cloth, and cap the bottle. Label the bottle, affix a yellow TSCA PCB mark, and put the bottle in an ice chest (to keep the sample at about 4°C). If samples are to be analyzed soon, the cold storage requirements may be relaxed as long as sample integrity is maintained. The sample collection data should be entered in the field log book and on the chain-of-custody form. The wiping cloth and rubber gloves should be discarded into a plastic bag used for disposal of PCB-contaminated materials.

6.3.2 Subsurface Sampling

Water near the bottom of the body of water should be sampled by lowering a sealed sampler bottle to the required depth, removing the bottle top, allowing the bottle to fill, and removing the bottle from the water. Transfer the subsurface sample into a precleaned glass bottle and cap. Wipe the bottle with a disposable wiping cloth, fill out and label the sample bottle, affix a yellow TSCA PCB mark, and put the sample bottle in an ice chest. If samples are to be analyzed soon, the cold storage requirements may be relaxed as long as sample integrity is maintained. The sample collection data should be entered into the field log book and on the chain-of-custody form.

The wiping cloth and rubber gloves should be discarded into a plastic bag used for disposal of PCB-contaminated materials.

To prevent cross-contamination of samples, separate sampler bottles should be used to take the samples. Alternatively, the sampler bottle can be rinsed three times with distilled water, solvent-rinsed, and air-dried between samples.

Sometimes the above approaches to water sampling are not feasible. In these cases, other equipment such as siphons, pumps, dippers, tubes, etc., may be used to collect a water sample and transfer it to a precleaned glass sample bottle. The sampling system should be constructed of glass, stainless steel, Teflon, or other inert, impervious, and noncontaminated materials. Water samples taken with siphons, dippers, tubes, pumps, etc., may become cross-contaminated if the equipment is not cleaned between samples. Equipment cleaning may be achieved in most cases by flushing the equipment with distilled water and solvent.

6.4 Surface Sampling

Samples of hard surfaces may be taken by two methods: (a) wipe sampling and (b) destructive sampling. Wipe samples are taken of any smooth surface which is relatively nonporous (such as rain gutters, automobiles, and aluminum siding), while destructive samples are taken of hard porous surfaces (such as concrete, brick, asphalt, and wood). Both wipe and destructive samples may be taken if it is not known whether the surface is porous or not.

6.4.1 Wipe Sampling

A wipe sample is taken by first applying a suitable solvent (such as isooctane) to a piece of 11 cm filter paper (e.g., Whatman 40 ashless or Whatman 50 smear tabs) or gauze pad. The moistened filter paper or gauze pad is then held with a pair of stainless steel forceps or rubber gloves and

rubbed thoroughly over a 100-cm² area (delineated by a template) of the sample surface to obtain the sample. The filter or pad is placed in a precleaned sample bottle, which is then capped, labeled, affixed with a yellow TSCA PCB mark, and placed in an ice chest (to keep the sample at about 4°C). If samples are to be analyzed soon, the cold storage requirements may be relaxed as long as sample integrity is maintained. The sample collection data are entered into the field log book and on the chain-of-custody form.

The template should be thoroughly rinsed with solvent and wiped with a disposable wiping cloth. The rubber gloves worn when taking wipe samples and the wiping cloth should be discarded into a plastic bag for disposal of PCB-contaminated materials.

6.4.2 Destructive Sampling

Wipe sampling is not appropriate on some porous surfaces, such as wood, asphalt, concrete, and brick, which will absorb the PCBs. In some cases, these surfaces can be sampled by taking a discrete sample such as a piece of wood or paving brick. Otherwise, chisels, drills, hole saws, etc., can be used to remove sufficient sample for analysis. Samples less than 1 cm deep should be taken and placed in a glass sample bottle or solvent-rinsed aluminum foil. Each sample container should be labeled, affixed with a yellow TSCA PCB mark, and placed in an ice chest. If samples are to be analyzed soon, the cold storage requirements may be relaxed as long as sample integrity is maintained. Sample collection data should be entered into the field log book and on the chain-of-custody form.

Equipment used to take samples of wood, asphalt, etc., should be cleaned with solvent and wiped between samples. Also, rubber gloves and wipe cloths should be discarded into a plastic disposal bag intended for PCB-contaminated materials.

6.5 Vegetation Sampling

The sample design or visual observation may indicate that samples of vegetation, such as tree leaves, bushes, and flowers, are required. In this case, the sample may be taken with pruning shears, a saw, or other suitable tool, and placed in a precleaned glass bottle, which should be capped, labeled, affixed with a yellow TSCA PCB mark, and placed in an ice chest. If samples are to be analyzed soon, the cold storage requirements may be relaxed as long as sample integrity is maintained. The sample collection data should be entered into the field log book and on the chain-of-custody form.

After each sample is taken, the pruning shears should be rinsed with solvent and wiped with a disposable wipe cloth to prevent cross-contamination between samples. Also, rubber gloves and wipe cloths should be discarded into a plastic disposal bag intended for PCB-contaminated materials.

6.6 Compositing Strategies

Compositing is the pooling of several samples to form one sample for chemical analysis. In many circumstances it may be desirable to composite samples to reduce the number of (often costly) analyses needed. The suggested strategies for compositing samples are given in the appendix.

7.0 QUALITY ASSURANCE

Quality assurance must be applied throughout the entire sampling program, including sample design and sample collection, handling, and preservation. Each EPA office must develop a quality assurance plan (QAP) according to EPA guidelines (USEPA 1980). The QAP must be submitted to the regional QA officer or other appropriate QA official for approval prior to sampling PCB spill sites.

The elements of a QAP (USEPA 1980) include:

- Title page
- Table of contents
- Project description
- Project organization and responsibility
- QA objectives for measurement data in terms of precision, accuracy, completeness, representativeness, and comparability
- Sampling procedures
- Sample tracking and traceability
- Calibration procedures and frequency
- Analytical procedures
- Data reduction, validation, and reporting
- Internal quality control checks
- Performance and system audits
- Preventive maintenance
- Specific routine procedures used to assess data precision, accuracy, and completeness
- Corrective action
- Quality assurance reports to management

Each EPA inspector who will sample PCB spill sites should understand and conform with all elements of the QAP.

8.0 QUALITY CONTROL

Each EPA office that samples PCB spill sites must operate a formal quality control (QC) program. The minimum requirements of this program consist of preparing field blanks for the laboratory; sampling without contamination of samples; maintaining a rigid chain-of-custody procedure for the samples; and fully documenting the entire sampling program and maintaining records of the documentation.

The quality control measures taken by each EPA office should be stipulated in the QA plan. The QC measures discussed below are given as examples only. EPA offices must decide which of the following measures, and additional measures, will be required for each situation.

8.1 Field Blanks

Field blanks are given to the laboratory to demonstrate that the sampling equipment has not been contaminated. A field blank may be generated by using the sampling equipment to obtain a clean sample of solids or water. For example, the scoop or soil coring device can be used to obtain a clean solids blank sample. The water sampling equipment can be used to collect a blank sample using laboratory reagent grade water. These field blanks should be obtained both before and after field sampling.

Field blanks for wipe samples should be obtained in the field by wetting a clean filter paper with the solvent and storing the wetted paper in a clean sample jar.

One empty glass sample bottle and one filled with solvent should also be given to the laboratory as field blanks.

8.2 Sampling Without Contamination

Samples collected from PCB spill sites which have been cleaned up may become contaminated in two ways: (a) dirty sample containers, and (b) cross-contamination of samples from the use of contaminated sampling equipment. The first type of contamination can be eliminated by properly pre-cleaning all sample containers prior to making the sampling trip. All glass jars should be washed with soap and water, rinsed three times with distilled water, rinsed with solvent (isooctane is recommended), baked in an oven at 350°C for 1 h, and sealed with a Teflon-lined cap. All aluminum foil used should be rinsed with solvent.

The sampling equipment should be precleaned before the site visit by rinsing with solvent and thoroughly wiping the equipment down. Cross-contamination during sampling can be avoided by using a separate sampler (such as a scoop, spatula, corer, etc.) for each sample, or cleaning the sample equipment between samples. Methods that can be used to clean the equipment between samples are given in the sample collection, handling, and preservation discussion (Section 6.0).

8.3 Sample Custody

As part of the quality assurance plan, the chain-of-custody protocol must be described. A chain-of-custody provides defensible proof of the sample, and data integrity. The less rigorous sample traceability documentation merely provides a record of when operations were performed, and by whom. Sample traceability is not acceptable for enforcement activities.

Chain-of-custody is required for analyses which may result in legal proceedings, and when the data must be subject to legal scrutiny. Chain-of-custody provides conclusive written proof that samples are taken, transferred, prepared, and analyzed in an unbroken line as a means to maintain sample integrity. A sample is in custody if:

- It is in the possession of an authorized individual.
- It is in the field of vision of an authorized individual.
- It is in a designated secure area.
- It has been placed in a locked container by an authorized individual.

A typical chain-of-custody protocol contains the following elements:

1. Unique sample identification numbers.

2. Records of sample container preparation and integrity prior to sampling.

3. Records of the sample collection, such as:

- Specific location of sampling.
- Date of collection.
- Exact time of collection.
- Type of sample taken (e.g., water, soil).
- Initialing each entry.
- Entering pertinent information on chain-of-custody record.
- Maintaining the samples in one's possession or under lock and key.
- Transporting or shipping the samples to the analytical laboratory.
- Filling out the chain-of-custody records:
- Chain-of-custody records accompanying the samples.

4. Unbroken custody during shipping. Complete shipping records must be retained; samples must be shipped in locked or sealed (evidence tape) containers. The addressee should be notified and prepared to receive the samples from the shipper.

8.4 Documentation of Field Sampling

In order to assure that the field sampling project has been thoroughly documented, the documents described in the next section should be used to maintain the quality of the project.

9.0 DOCUMENTATION AND RECORDS

Each EPA office is responsible for preparing and maintaining complete records of the field sampling operations. A detailed documentation plan should be prepared as a part of the QAP, and should be strictly followed. The following written records should be maintained for each field sampling operation:

- Equipment preparation log book
- Sample codes
- Field log book
- Site description forms
- Chain-of-custody forms
- Sample analysis request forms
- Field trip report

9.1 Equipment Preparation Log Book

A log book should be maintained which lists the sampling equipment taken to each spill site. A detailed description of the cleaning and preparation procedures used for the sample collection equipment (templates, scoops, glass bottle, etc.) should be recorded.

9.2 Sample Codes

Each sample should be assigned a unique sample code and labeled accordingly when collected. The sample code should contain information on the site and which sampling point the sample represents. This sample code must be used to identify all sample records.

Each sample must also be labeled with a yellow TSCA PCB mark as described in 40 CFR 761.45 until it is determined to be PCB free.

9.3 Field Log Book

The EPA inspector should maintain a field log book which contains all information pertinent to the field sampling program. The notebook should be bound and entries be made in ink by the field inspector. All entries should be signed by the inspector.

At a minimum, the log book should include the following entries:

- Owner of spill site
- Location of spill site
- Date(s) of sample collection
- Exact times of sample collection
- Type of samples taken and sample identification numbers
- Number of samples taken
- Description of sampling methodology
- Field observations
- Name and address of field contact
- Cross-reference of sample identification numbers to grid sample points (shown on site description forms)

Since sampling situations will vary widely, no specific guidelines can be given as to the extent of information which should be entered into the field log book. Enough information should be recorded, however, so that someone can reconstruct the sampling program in the absence of the field inspector.

The field log book should be maintained in a secure place.

9.4 Site Description Forms

Serialized site description forms should be used to record the conditions of the site, provide sketches of the site, and show the location of the grid sampling points. The grid sampling points should be shown on dimensioned drawings and numbered. These forms should be accompanied by

photographs (preferably Polaroid-type photographs) of the site. Each form and photograph should be signed and dated by the EPA inspector.

9.5 Chain-of-Custody Forms

Chain-of-custody forms should be completed and accompany the samples. These forms should contain the following information:

- Project site
- Sample identification number
- Date and time of sample collection
- Location of sample site
- Type of sample (soil, water, etc.)
- Signature of sample collector
- Signatures of those who relinquish and those who receive the samples, and date and time that samples change possession
- Inclusive dates of possession

9.6 Sample and Analysis Request Forms

A sample analysis request form should accompany the samples delivered to the laboratory. The field inspector should enter the following information on the form:

- Project site
- Name of sample collector
- Sample identification numbers
- Types of samples (soil, water, etc.)
- Location of sample site for each sample
- Analysis requested [analyte (i.e., total PCBs), method, desired method detection limit, etc.]
- QC requirements (replicates, lab blanks, lab spikes, etc.)
- Special handling and storage requirements

The laboratory personnel receiving the samples should enter the following information on the form:

- Name of person receiving the samples
- Laboratory sample numbers
- Date of sample receipt
- Sample allocation
- Analyses to be performed

9.7 Field Trip Report

The EPA inspector should prepare a brief field trip report to be maintained on file. The report should provide information such as the project site, date(s) of sampling, types and number of samples collected, any problems encountered, any notable events, and specific reference to the other documents listed above.

10.0 VALIDATION OF THE MANUAL

A previous draft of this manual entitled "Field Manual for Verification of PCB Spill Cleanup" (Draft Interim Report No. 3, Task 37, EPA Prime Contract No. 68-02-3938, June 27, 1985) was used in a brief field validation study. The primary purposes of the study were to: (1) determine the degree of difficulty of understanding the grid sampling designs in the field manual; (2) determine the amount of time and degree of difficulty required to lay out the sampling grids on simulated PCB spill sites; and (3) identify any concerns or problems that may arise in implementing the field manual. To achieve these goals, simulated PCB spill sites were constructed for the exercise. Four persons (Mr. David Phillippi and Mr. Robert Jackson of the EPA Region VII Office and Ms. Joan Westbrook and Mr. Ted Harrison of MRI) were selected to lay out the sampling grids on the spill sites after they had read the field manual. These four persons had no prior association with developing the field manual. Other persons from EPA and MRI acted as observers since they were intimately familiar with the field manual.

Four simulated spill sites having the following characteristics were laid out:

- A rectangle (3 ft x 6 ft)
- A parallelogram (about 3 ft on a side)
- A circle (about 12 ft diameter)
- A square (6 ft on a side)

The first two sites required seven grid sample points, and the other two required 19 grid sample points.

Each of the four "inspectors" laid out the grid sample points on two of the four sites after constructing the designs on graph paper. In all cases the sample points were laid out correctly with little or no difficulty in 30 min or less. Each inspector commented that there was little or no difficulty in performing the exercises.

As a final exercise, a large irregular simulated PCB spill site was constructed, and all attendees participated in laying out the 37 grid sample points. The spill site was designed so that some sample points were located on the floor and two adjacent walls to make the exercise relatively difficult. The 37 grid sample points were laid out correctly with relative ease in about 45 min. Some discussions were required to decide how to treat sampling points which fell in the overlap where the two walls intersected.

It was concluded from the exercise and discussions which followed that: (1) the field manual is easy to follow and understood by people unfamiliar with the manual prior to reading it; (2) the grid sample points are never "perfectly" laid out (with the sample points precisely aligned) so that some degree of randomness is built into the sample designs; (3) the time required to lay out the grid sample points after the boundaries of the spill site have been determined is relatively short (less than 1 h); and (4) using this manual, the grid sample points can be correctly laid out by inexperienced people.

11.0 REFERENCES

Boomer BA, Erickson MD, Swanson SA, Kelso GL, Cox DC, Schultz BD. 1985 (August). Verification of PCB spill cleanup by sampling and analysis (second printing). Interim report. Washington, DC: Office of Toxic Substances, U.S. Environmental Protection Agency. EPA-560/5-85-026.

Mason BJ. 1982 (October). Preparation of soil sampling protocol: techniques and strategies. ETHURA, McLean, VA, under subcontract to Environmental Research Center, University of Nevada, for U.S. Environmental Protection Agency, Las Vegas.

USEPA. 1980. U.S. Environmental Protection Agency. Guidelines and specifications for preparing quality assurance project plans. Office of Monitoring Systems and Quality Assurance, QAMS-005/80.

USEPA. 1981 (March). U.S. Environmental Protection Agency. TSCA Inspection Manual.

APPENDIX

STRATEGIES FOR COMPOSITING SAMPLES

APPENDIX

This appendix gives suggested strategies for compositing samples taken from PCB spill sites which are sampled using the grid sampling methods described in the text of the report. Compositing may result in a savings of analysis time and cost. Sample compositing is not required and should be used only if time or cost savings may result. The strategies for forming composites are as follows:

1. Composite only samples of the same type (i.e., all soil or all water). Since the composite must be thoroughly mixed to ensure homogeneity, certain types of samples such as asphalt, wipe samples, wood samples and other hard-to-mix matrices should not be composited.
2. Do not form a composite with more than 10 samples, since in some situations compositing a greater number of samples may lead to such low PCB levels in the composite that the recommended analytical method approaches its limit of detection and becomes less reliable.
3. For each type of sample, determine the number of composites to be formed using the table below.

Number of samples	Number of composites
2-10	1
11-20	2
21-30	3
31-37	4

As much as possible, try to form composites of equal size. For example, if 37 soil samples are taken, then four composites could be formed using 9, 9, 9, and 10 samples apiece.

4. To the extent possible, composite adjacent samples. If residual contamination is present, it is likely that high PCB levels will be found in some samples taken close together.

Because of the large number of situations that may be encountered in practice, it is not possible to specify compositing strategies more precisely. The laboratory and field staff should exercise judgment in all cases.

APPENDIX B

LABORATORY ANALYTICAL DATA SHEETS



REPORT OF ANALYTICAL RESULTS

NETLAB Case Number D0117-29

Prepared for:

Gordon R. Archibald, Inc.
200 Main Street
Pawtucket, RI 02860

Report Date: January 30, 2017

Director
New England Testing Laboratory, Inc.
Lab # RI010

NEW ENGLAND TESTING LABORATORY, INC.

59 Greenhill Street, West Warwick, RI 02893

(401) 353-3420

SAMPLES SUBMITTED and REQUEST FOR ANALYSIS:

The samples listed in Table I were submitted to New England Testing Laboratory on January 17, 2017. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the samples provided to us by the client which are indicated on the custody record. The case number for this sample submission is D0117-29.

Custody records are included in this report.

Site: URI – Butterfield Substation

TABLE I, Samples Submitted

Sample ID	Date Sampled	Matrix	Analysis Requested
6-B	1/17/2017	Soil	Table II
13-A	1/17/2017	Soil	Table II
13-B	1/17/2017	Soil	Table II
13-C	1/17/2017	Soil	Table II
14-A	1/17/2017	Soil	Table II
14-B	1/17/2017	Soil	Table II
14-C	1/17/2017	Soil	Table II
27-B	1/17/2017	Soil	Table II
28-A	1/17/2017	Soil	Table II
28-B	1/17/2017	Soil	Table II
28-C	1/17/2017	Soil	Table II
29-A	1/17/2017	Soil	Table II
29-B	1/17/2017	Soil	Table II
29-C	1/17/2017	Soil	Table II
37-B	1/17/2017	Soil	Table II
Trip-1/17	1/17/2017	Soil	Table II

TABLE II, Analysis and Methods

ANALYSIS	PREPARATION METHOD	DETERMINATIVE METHOD
PCB's	3540C	8082A

These methods are documented in:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, USEPA/OSW.

CASE NARRATIVE:

Sample Receipt

The samples were all appropriately cooled and preserved upon receipt. The samples were received in the appropriate containers. The chain of custody was adequately completed and corresponded to the samples submitted.

PCBs

All samples were extracted and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

RESULTS: PCBs

The presence of the NETLAB LOGO in the top right corner of each page in this section indicates:

The Technical Manager of the Organics Analysis Department certifies that the samples included in this section have been prepared and analyzed using the procedures cited and that the results have been reviewed and approved. Any exceptions or qualifications of substance have been reported in the case narrative.

Sample: 6-B		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	88	30-129
DCBP	102	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 13-A		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	93	30-129
DCBP	105	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 13-B		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	82	30-129
DCBP	96	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 13-C		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	94	30-129
DCBP	103	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 14-A		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	89	30-129
DCBP	101	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 14-B		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	93	30-129
DCBP	103	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 14-C		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	84	30-129
DCBP	105	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 27-B		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	100	30-129
DCBP	111	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 28-A		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	100	30-129
DCBP	105	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 28-B		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	103	30-129
DCBP	106	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 28-C		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	100	30-129
DCBP	103	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 29-A		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	99	30-129
DCBP	101	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 29-B		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	78	30-129
DCBP	98	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 29-C		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	97	30-129
DCBP	97	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 37-B		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	100	30-129
DCBP	101	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: Trip-1/17		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	94	30-129
DCBP	101	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: Method Blank		Analyst's Initials: BJ
Case No.: D0117-29		
Date Collected: NA		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	91	30-129
DCBP	105	37-126

N.D. = Not Detected

* = Dry Weight Basis

PCB Laboratory Control Spike

Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3540C	1/25/17			1/27/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/kg	Result mg/kg	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.483	97	72-118
Aroclor 1260	0.500	0.518	104	73-131
Surrogates:				
Compound	% Recovery	Limits		
TCMX	90	30-129		
DCBP	96	37-126		

NEW ENGLAND TESTING LABORATORY, INC.
 59 Greenhill Street
 West Warwick, RI 02893
 1-888-863-8522

CHAIN OF CUSTODY RECORD

00117-29

PROJ. NO.		PROJECT NAME/LOCATION		TESTS**				REMARKS	
CLIENT		NO. OF CONTAINERS		OTHER		SOL		ADJUDIC	
REPORT TO:		INVOICE TO:		DATE		TIME		SAMPLE I.D.	
GORDON R. ARCHIBALD INC.		STEVE CADORETTE, GRA		11		11		11	
DATE		TIME		C O M P		G R A B		DATE	
1/17/17	AM			X				6-B	Non
								13-A	
								13-B	
								13-C	
								14-A	
								14-B	
								14-C	
								27-B	
								28-A	
								28-B	
								28-C	
								29-A	
								29-B	
								29-C	
Sampled by: (Signature)		Date/Time		Received by: (Signature)		Date/Time		Laboratory Remarks:	
Brien Neelan		1/17/17 1530						Temp. received: _____	
Relinquished by: (Signature)		Date/Time		Received by: (Signature)		Date/Time		Cooled <input type="checkbox"/>	
R. J. N. L.		1/17/17 1535							
Relinquished by: (Signature)		Date/Time		Received for Laboratory by: (Signature)		Date/Time		Turnaround (Business Days)	
				[Signature]		1/17/17 1535			

**Netlab subcontracts the following tests: Radiologicals, Radon, Asbestos, UCMRs, Perchlorate, Bromate, Bromide, Sieve, Salmonella, Carbamates

59 Greenhill Street

West Warwick, RI 02893

1-888-863-8522

CHAIN OF CUSTODY RECORD

2017-20

[illegible]

***Nellab subcontracts the following tests: Radiologicals, Radon, Asbestos, UCMIRs, Perchlorate, Bromate, Bromide, Sieve, Salmonella, Carbamates



REPORT OF ANALYTICAL RESULTS

NETLAB Case Number D0117-27

Prepared for:

Gordon R. Archibald, Inc.
200 Main Street
Pawtucket, RI 02860

Report Date: January 26, 2017

Director
New England Testing Laboratory, Inc.
Lab # RI010

NEW ENGLAND TESTING LABORATORY, INC.

59 Greenhill Street, West Warwick, RI 02893

(401) 353-3420

SAMPLES SUBMITTED and REQUEST FOR ANALYSIS:

The samples listed in Table I were submitted to New England Testing Laboratory on January 17, 2017. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the samples provided to us by the client which are indicated on the custody record. The case number for this sample submission is D0117-27.

Custody records are included in this report.

Site: URI – Butterfield Substation

TABLE I, Samples Submitted

Sample ID	Date Sampled	Matrix	Analysis Requested
EQ-GP-1/17	1/17/2017	Water	Table II

TABLE II, Analysis and Methods

ANALYSIS	PREPARATION METHOD	DETERMINATIVE METHOD
PCB's	3510C	8082A

These methods are documented in:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, USEPA/OSW.

CASE NARRATIVE:

Sample Receipt

The samples were all appropriately cooled and preserved upon receipt. The samples were received in the appropriate containers. The chain of custody was adequately completed and corresponded to the samples submitted.

PCBs

All samples were extracted and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

The sample was reported with surrogate values that are below control limits due to matrix interference during extraction.

RESULTS: PCBs

The presence of the NETLAB LOGO in the top right corner of each page in this section indicates:

The Technical Manager of the Organics Analysis Department certifies that the samples included in this section have been prepared and analyzed using the procedures cited and that the results have been reviewed and approved. Any exceptions or qualifications of substance have been reported in the case narrative.

Sample: EQ-GP-1/17		Analyst's Initials: BJ
Case No. D0117-27		
Date Collected: 1/17/2017		
Sample Matrix: Water		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3510C	1/25/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/l (ppb)	Reporting Limit ug/l (ppb)
Aroclor-1016	N.D.	0.4
Aroclor-1221	N.D.	0.4
Aroclor-1232	N.D.	0.4
Aroclor-1242	N.D.	0.4
Aroclor-1248	N.D.	0.4
Aroclor-1254	N.D.	0.4
Aroclor-1260	N.D.	0.4
Aroclor-1262	N.D.	0.4
Aroclor-1268	N.D.	0.4
Surrogates:		
Compound	% Recovery	Limits
TCMX	5	30-129
DCBP	16	30-126

N.D. = Not Detected

Sample: Method Blank		Analyst's Initials: BJ
Case No. D0117-27		
Date Collected: NA		
Sample Matrix: Water		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3510C	1/25/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/l (ppb)	Reporting Limit ug/l (ppb)
Aroclor-1016	N.D.	0.4
Aroclor-1221	N.D.	0.4
Aroclor-1232	N.D.	0.4
Aroclor-1242	N.D.	0.4
Aroclor-1248	N.D.	0.4
Aroclor-1254	N.D.	0.4
Aroclor-1260	N.D.	0.4
Aroclor-1262	N.D.	0.4
Aroclor-1268	N.D.	0.4
Surrogates:		
Compound	% Recovery	Limits
TCMX	79	30-129
DCBP	75	30-126

N.D. = Not Detected

PCB Laboratory Control Spike

Sample Matrix: Water				
Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3510C	1/25/17			1/25/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/l	Result mg/l	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.480	96	40-130
Aroclor 1260	0.500	0.473	95	40-130
Surrogates:				
Compound	% Recovery	Limits		
TCMX	87	30-129		
DCBP	86	30-126		

2017-27

CHAIN OF CUSTODY RECORD

[illegible]

***Netlab subcontractors the following tests: Radiologicals, Radon, Asbestos, UCMHs, Perchlorate, Bromate, Bromide, Sieve Salmonella, Carbamates



REPORT OF ANALYTICAL RESULTS

NETLAB Case Number D0117-28

Prepared for:

Gordon R. Archibald, Inc.
200 Main Street
Pawtucket, RI 02860

Report Date: January 26, 2017

Director
New England Testing Laboratory, Inc.
Lab # RI010

NEW ENGLAND TESTING LABORATORY, INC.

59 Greenhill Street, West Warwick, RI 02893

(401) 353-3420

SAMPLES SUBMITTED and REQUEST FOR ANALYSIS:

The samples listed in Table I were submitted to New England Testing Laboratory on January 17, 2017. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the samples provided to us by the client which are indicated on the custody record. The case number for this sample submission is D0117-28.

Custody records are included in this report.

Site: URI – Butterfield Substation

TABLE I, Samples Submitted

Sample ID	Date Sampled	Matrix	Analysis Requested
CS-3	1/17/2017	Soil	Table II

TABLE II, Analysis and Methods

ANALYSIS	PREPARATION METHOD	DETERMINATIVE METHOD
Paint Filter	NA	9095B
% Solids	NA	2540G
pH	NA	9045
Total Metals		
Arsenic	3050B	6010C
Barium	3050B	6010C
Cadmium	3050B	6010C
Chromium	3050B	6010C
Lead	3050B	6010C
Mercury	NA	7471B
Selenium	3050B	6010C
Silver	3050B	6010C
PCB's	3546	8082A
Total Petroleum Hydrocarbons	3546	8100M
Semi-Volatile Organic Compounds	3546	8270D
Volatile Organic Compounds	5030	8260C

These methods are documented in:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, USEPA/OSW.

CASE NARRATIVE:

Sample Receipt

The samples were all appropriately cooled and preserved upon receipt. The samples were received in the appropriate containers. The chain of custody was adequately completed and corresponded to the samples submitted.

Metals

All analyses were performed according to NETLAB's documented Standard Operating Procedures, within all required holding times, and with appropriate quality control measures. All QC was within laboratory established acceptance criteria. The samples were received, processed, and reported with no anomalies.

PCBs

All samples were extracted and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

Semi-volatile Compounds

All samples were extracted and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

Total Petroleum Hydrocarbons

All samples were extracted and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

Volatile Organic Compounds

All samples were analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

Wet Chemistry

All samples were analyzed within method specified holding times and according to NETLAB's documented standard operating procedures.

CS-3

Parameter	Result	Reporting Limit	Date Analyzed
Paint Filter	No Free Liquids	NA	1/19/2017
Percent Solids, %	93.64	NA	1/20/2017
pH, S.U.	6.96	NA	1/20/2017

ND = Not Detected

NA = Not Applicable

*Dry Weight Basis

METALS RESULTS

The presence of the NETLAB LOGO in the top right corner of each page in this section indicates:

The Technical Manager of the Metals Analysis Department certifies that the results included in this section have been reviewed and approved. Any exceptions or qualifications of substance have been reported in the case narrative.

METALS RESULTS



Case Number: D0117-28
 Sample ID: CS-3
 Date collected: 1/17/17
 Matrix: SOLID
 Solids, %: 93.64
 Sample Type: Total

NC/NB/DC

		Preparative	Analytical		Reporting		Date of	Date
Parameter	CAS Number	Method	Method	Result	Limit	Units	Preparation	Analyzed
Arsenic	7440-38-2	3050B	6010C	45.0	0.68	mg/kg	1/19/17	1/24/17
Barium	7440-39-3	3050B	6010C	15.7	0.34	mg/kg	1/19/17	1/24/17
Cadmium	7440-43-9	3050B	6010C	0.71	0.34	mg/kg	1/19/17	1/24/17
Chromium	7440-47-3	3050B	6010C	2.12	0.34	mg/kg	1/19/17	1/24/17
Lead	7439-92-1	3050B	6010C	10.5	0.34	mg/kg	1/19/17	1/24/17
Mercury	7439-97-6	NA	7471B	ND	0.069	mg/kg	1/19/17	1/24/17
Selenium	7782-49-2	3050B	6010C	ND	0.68	mg/kg	1/19/17	1/24/17
Silver	7440-22-4	3050B	6010C	ND	0.34	mg/kg	1/19/17	1/24/17

ND indicates Not Detected.

NA indicates Not Applicable

All results are reported on a dry weight basis.

METALS RESULTS



Sample ID: Preparation Blank
 Matrix SOIL
 Solids, % 100
 Sample Type: Total

NC/NB/DC

		Preparative	Analytical		Reporting		Date of	Date
Parameter	CAS Number	Method	Method	Result	Limit	Units	Preparation	Analyzed
Arsenic	7440-38-2	3050B	6010C	ND	0.67	mg/kg	1/19/17	1/20/17
Barium	7440-39-3	3050B	6010C	ND	0.33	mg/kg	1/19/17	1/20/17
Cadmium	7440-43-9	3050B	6010C	ND	0.33	mg/kg	1/19/17	1/20/17
Chromium	7440-47-3	3050B	6010C	ND	0.33	mg/kg	1/19/17	1/20/17
Lead	7439-92-1	3050B	6010C	ND	0.33	mg/kg	1/19/17	1/20/17
Mercury	7439-97-6	NA	7471B	ND	0.033	mg/kg	1/19/17	1/19/17
Selenium	7782-49-2	3050B	6010C	ND	0.67	mg/kg	1/19/17	1/20/17
Silver	7440-22-4	3050B	6010C	ND	0.33	mg/kg	1/19/17	1/20/17

ND indicates Not Detected.

NA indicates Not Applicable

All results are reported on a dry weight basis.

LABORATORY CONTROL SAMPLE RECOVERY

Parameter	True Value	Result	Units	Recovery, %	Internal		Date Analyzed
					LCL, %	UCL, %	
Arsenic	13.3	13.8	mg/kg	104	85	115	1/20/17
Barium	66.7	71.9	mg/kg	108	85	115	1/20/17
Cadmium	66.7	68.0	mg/kg	102	85	114	1/20/17
Chromium	66.7	69.9	mg/kg	105	85	115	1/20/17
Lead	66.7	67.6	mg/kg	101	85	115	1/20/17
Mercury	0.133	0.1	mg/kg	100	85	115	1/19/17
Selenium	13.3	12.4	mg/kg	93	85	115	1/20/17
Silver	26.6	24.7	mg/kg	93	85	115	1/20/17

RESULTS: PCBs

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The Technical Manager of the Organics Analysis Department certifies that the samples included in this section have been prepared and analyzed using the procedures cited and that the results have been reviewed and approved. Any exceptions or qualifications of substance have been reported in the case narrative.

Sample: CS-3		Analyst's Initials: BJ
Case No.: D0117-28		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3546	1/25/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1221	N.D.	100
Aroclor-1232	N.D.	100
Aroclor-1016	N.D.	100
Aroclor-1242	N.D.	100
Aroclor-1248	N.D.	100
Aroclor-1254	N.D.	100
Aroclor-1260	N.D.	100
Aroclor-1262	N.D.	100
Aroclor-1268	N.D.	100
Surrogates:		
Compound	% Recovery	Limits
TCMX	79	45-125
DCBP	95	42-131

*Dry Weight Basis

N.D. = Not Detected

Sample: Method Blank		Analyst's Initials: BJ
Case No.: D0117-28		
Date Collected: NA		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3546	1/25/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg (ppb)	Reporting Limit ug/kg (ppb)
Aroclor-1221	N.D.	100
Aroclor-1232	N.D.	100
Aroclor-1016	N.D.	100
Aroclor-1242	N.D.	100
Aroclor-1248	N.D.	100
Aroclor-1254	N.D.	100
Aroclor-1260	N.D.	100
Aroclor-1262	N.D.	100
Aroclor-1268	N.D.	100
Surrogates:		
Compound	% Recovery	Limits
TCMX	84	45-125
DCBP	89	42-131

N.D. = Not Detected

PCB Laboratory Control Spike

Sample Matrix: Soil				
Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3546	1/25/17			1/25/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/kg	Result mg/kg	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.467	93	55-131
Aroclor 1260	0.500	0.539	108	63-133
Surrogates:				
Compound	% Recovery	Limits		
TCMX	81	45-125		
DCBP	98	42-131		

Sample: CS-3		Analyst's Initials: BJ
Case No.: D0117-28		
Date Collected: 1/17/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/23/17	1/23/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	26
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	99	62-151

ND = Not Detected

*Dry Weight Basis

RESULTS: SEMIVOLATILE ORGANIC COMPOUNDS

The presence of the NETLAB LOGO in the top right corner of each page in this section indicates:

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1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.



CS-3

Lab Name: New England Testing Laboratory Contract: URI Butterfi
 Lab Code: RI010 Case No.: D0117-28 SAS No.: Gordon SDG No.: Gordon Ar
 Matrix: (soil/water) SOIL Lab Sample ID: CS-3
 Sample wt/vol: 15.885 (g/ml) G Lab File ID: B012407.D
 Level: (low/med) LOW Date Received: 1/17/2017
 % Moisture: 6.36 decanted:(Y/N) N Date Extracted: 1/23/2017
 Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/24/2017
 Injection Volume: 1.0 (uL) Dilution Factor: 1.0
 GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO. COMPOUND (ug/L or ug/Kg) UG/KG Q

91-20-3	Naphthalene	130	U
91-57-6	2-Methylnaphthalene	130	U
208-96-8	Acenaphthylene	130	U
83-32-9	Acenaphthene	130	U
132-64-9	Dibenzofuran	130	U
86-73-7	Fluorene	130	U
85-01-8	Phenanthrene	130	U
120-12-7	Anthracene	130	U
206-44-0	Fluoranthene	130	U
129-00-0	Pyrene	130	U
56-55-3	Benzo(a)anthracene	130	U
218-01-9	Chrysene	130	U
205-99-2	Benzo(b)fluoranthene	130	U
207-08-9	Benzo(k)fluoranthene	130	U
50-32-8	Benzo(a)pyrene	130	U
193-39-5	Indeno(1,2,3-cd)pyrene	130	U
53-70-3	Dibenz(a,h)anthracene	130	U
191-24-2	Benzo(g,h,i)perylene	130	U

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

BSS012317

Lab Name: New England Testing Laboratory Contract: URI Butterfi
 Lab Code: RI010 Case No.: D0117-28 SAS No.: Gordon SDG No.: Gordon Ar
 Matrix: (soil/water) SOIL Lab Sample ID: BSS012317
 Sample wt/vol: 15 (g/ml) G Lab File ID: B012403.D
 Level: (low/med) LOW Date Received: 1/17/2017
 % Moisture: 0 decanted:(Y/N) N Date Extracted: 1/23/2017
 Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/24/2017
 Injection Volume: 1.0 (uL) Dilution Factor: 1.0
 GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO. COMPOUND (ug/L or ug/Kg) UG/KG Q

91-20-3	Naphthalene	130	U
91-57-6	2-Methylnaphthalene	130	U
208-96-8	Acenaphthylene	130	U
83-32-9	Acenaphthene	130	U
132-64-9	Dibenzofuran	130	U
86-73-7	Fluorene	130	U
85-01-8	Phenanthrene	130	U
120-12-7	Anthracene	130	U
206-44-0	Fluoranthene	130	U
129-00-0	Pyrene	130	U
56-55-3	Benzo(a)anthracene	130	U
218-01-9	Chrysene	130	U
205-99-2	Benzo(b)fluoranthene	130	U
207-08-9	Benzo(k)fluoranthene	130	U
50-32-8	Benzo(a)pyrene	130	U
193-39-5	Indeno(1,2,3-cd)pyrene	130	U
53-70-3	Dibenz(a,h)anthracene	130	U
191-24-2	Benzo(g,h,i)perylene	130	U

SOIL SEMIVOLATILE SURROGATE RECOVERY

Lab Name: New England Testing Laboratory Contract: URI ButterfieldLab Code: RI010 Case No.: D0117-28 SAS No.: Gordon SDG No.: Gordon ArLevel: (low/med) LOW

	EPA SAMPLE NO.	S1 #	S2 #	S3 #	TOT OUT
01	BSS012317	79	81	116	0
02	LSS012317	98	99	118	0
03	CS-3	85	89	122	0

QC LIMITS

S1	=	Nitrobenzene-d5	(30-130)
S2	=	2-Fluorobiphenyl	(30-130)
S3	=	Terphenyl-d14	(30-130)

Column to be used to flag recovery values

* Values outside of contract required QC limits

D Surrogate diluted out

Semivolatile Soil Laboratory Control Spike

Date Extracted: 1/23/2017

Date Analyzed: 1/24/2017

	Amount Spiked	Result,	Recovery	Lower Recovery	Upper Recovery
	ug/Kg	ug/Kg	%	Limit	Limit
Naphthalene	3333	3272	98	40	140
2-Methylnaphthalene	3333	3159	95	40	140
Acenaphthylene	3333	3499	105	40	140
Acenaphthene	3333	3155	95	40	140
Dibenzofuran	3333	3264	98	40	140
Fluorene	3333	3433	103	40	140
Phenanthrene	3333	3526	106	40	140
Anthracene	3333	3556	107	40	140
Fluoranthene	3333	3531	106	40	140
Pyrene	3333	3833	115	40	140
Benzo(a)anthracene	3333	3475	104	40	140
Chrysene	3333	3497	105	40	140
Benzo(b)fluoranthene	3333	3726	112	40	140
Benzo(k)fluoranthene	3333	3711	111	40	140
Benzo(a)pyrene	3333	3647	109	40	140
Indeno(1,2,3-cd)pyrene	3333	2881	86	40	140
Dibenz(a,h)anthracene	3333	2777	83	40	140
Benzo(g,h,i)perylene	3333	2676	80	40	140

RESULTS: VOLATILE ORGANIC COMPOUNDS

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The Technical Manager of the Organics Analysis Department certifies that the samples included in this section have been prepared and analyzed using the procedures cited and that the results have been reviewed and approved. Any exceptions or qualifications of substance have been reported in the case narrative.

VOLATILE ORGANICS ANALYSIS DATA SHEET

Case No.: D0117-28 Client Name: Gordon R. Archibald
 Method: 8260 Lab Sample ID: CS-3
 Matrix: (soil/water) SOIL Lab File ID: E011747.D
 Sample wt/vol: 22.0 (g/ml) G Date Sampled: 1/17/2017
 % Moisture 6.36 Date Analyzed: 1/18/2017
 Soil Extract Volume: (uL) Dilution Factor: 1.0
 Analyst's Initials: KC Soil Aliquot Volume: (uL)

CAS NO.	COMPOUND	UNITS: <u>UG/KG</u>	Q
75-01-4	Vinyl Chloride	24	U
74-83-9	Bromomethane	24	U
75-00-3	Chloroethane	24	U
67-64-1	Acetone	120	U
75-35-4	1,1-Dichloroethene	24	U
75-15-0	Carbon Disulfide	24	U
75-09-2	Methylene Chloride	24	U
1634-04-4	tert-Butyl methyl ether	24	U
156-60-5	trans-1,2 Dichloroethene	24	U
75-34-3	1,1-Dichloroethane	24	U
78-93-3	2-Butanone	120	U
594-20-7	2,2-Dichloropropane	24	U
156-59-2	cis-1,2-Dichloroethene	24	U
67-66-3	Chloroform	24	U
74-97-5	Bromochloromethane	24	U
71-55-6	1,1,1-Trichloroethane	24	U
563-58-6	1,1-Dichloropropene	24	U
56-23-5	Carbon Tetrachloride	24	U
71-43-2	Benzene	24	U
107-06-2	1,2-Dichloroethane	24	U
79-01-6	Trichloroethene	24	U
78-87-5	1,2-Dichloropropane	24	U
75-27-4	Bromodichloromethane	24	U
74-95-3	Dibromomethane	24	U
108-10-1	4-Methyl-2-pentanone	120	U
106-93-4	Ethylene Dibromide	24	U
108-88-3	Toluene	24	U
10061-01-5	cis-1,3-Dichloropropene	24	U
10061-02-6	Trans-1,3-Dichloropropene	24	U
79-00-5	1,1,2-Trichloroethane	24	U
591-78-6	2-Hexanone	120	U
127-18-4	Tetrachloroethene	24	U
124-48-1	Chlorodibromomethane	24	U
108-90-7	Chlorobenzene	24	U
630-20-6	1,1,1,2-Tetrachloroethane	24	U

U=not detected, D=diluted, E=over range (another data sheet is included), J=below limit, B=found in blank

New England Testing Laboratory, Inc.

VOLATILE ORGANICS ANALYSIS DATA SHEET

Case No.: D0117-28 Client Name: Gordon R. Archibald
 Method: 8260 Lab Sample ID: CS-3
 Matrix: (soil/water) SOIL Lab File ID: E011747.D
 Sample wt/vol: 22.0 (g/ml) G Date Sampled: 1/17/2017
 % Moisture 6.36 Date Analyzed: 1/18/2017
 Soil Extract Volume: _____ (uL) Dilution Factor: 1.0
 Analyst's Initials: KC Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	UNITS: <u>UG/KG</u>	Q
100-41-4	Ethylbenzene	24	U
1330-20-7	m & p-Xylene	48	U
95-47-6	o-Xylene	24	U
100-42-5	Styrene	24	U
75-25-2	Bromoform	24	U
98-82-8	Isopropylbenzene	24	U
79-34-5	1,1,2,2-Tetrachloroethane	24	U
108-86-1	Bromobenzene	24	U
96-18-4	1,2,3-Trichloropropane	24	U
95-49-8	2-Chlorotoluene	24	U
103-65-1	n-Propylbenzene	24	U
108-67-8	1,3,5-Trimethylbenzene	24	U
106-43-4	4-Chlorotoluene	24	U
98-06-6	tert-Butylbenzene	24	U
95-63-6	1,2,4-Trimethylbenzene	24	U
135-98-8	sec-Butylbenzene	24	U
99-87-6	p-Isopropyltoluene	24	U
75-87-3	Chloromethane	24	U
75-65-0	tert butyl alcohol	120	U
541-73-1	1,3-Dichlorobenzene	24	U
109-99-9	Tetrahydrofuran	24	U
106-46-7	1,4-Dichlorobenzene	24	U
60-29-7	Diethyl Ether	24	U
104-51-8	n-Butylbenzene	24	U
95-50-1	1,2-Dichlorobenzene	24	U
96-12-8	1,2-Dibromo-3-chloropropane	24	U
120-82-1	1,2,4-Trichlorobenzene	24	U
87-68-3	Hexachlorobutadiene	24	U
91-20-3	Naphthalene	24	U
87-61-6	1,2,3-Trichlorobenzene	24	U
994-05-8	Tert-amyl Methyl Ether	24	U
75-71-8	Dichlorodifluoromethane	24	U
142-28-9	1,3-Dichloropropane	24	U
75-69-4	Trichlorofluoromethane	24	U
637-92-3	Ethyl Tert-butyl ether	24	U

U=not detected, D=diluted, E=over range (another data sheet is included), J=below limit, B=found in blank

New England Testing Laboratory, Inc.

VOLATILE ORGANICS ANALYSIS DATA SHEET

Case No.: D0117-28 Client Name: Gordon R. Archibald
 Method: 8260 Lab Sample ID: CS-3
 Matrix: (soil/water) SOIL Lab File ID: E011747.D
 Sample wt/vol: 22.0 (g/ml) G Date Sampled: 1/17/2017
 % Moisture 6.36 Date Analyzed: 1/18/2017
 Soil Extract Volume: _____ (uL) Dilution Factor: 1.0
 Analyst's Initials: KC Soil Aliquot Volume: _____ (uL)

CAS NO.	COMPOUND	UNITS: <u>UG/KG</u>	Q
<u>108-20-3</u>	<u>Diisopropyl Ether</u>	<u>24</u>	<u>U</u>
<u>123-91-1</u>	<u>1,4-Dioxane</u>	<u>12000</u>	<u>U</u>

U=not detected, D=diluted, E=over range (another data sheet is included), J=below limit, B=found in blank

New England Testing Laboratory, Inc.

VOLATILE ORGANICS ANALYSIS DATA SHEET

Case No.: D0117-28 Client Name: Gordon R. Archibald
 Method: 8260 Lab Sample ID: VBLANK 011717 B
 Matrix: (soil/water) SOIL Lab File ID: E011731.D
 Sample wt/vol: 10.0 (g/ml) G Date Sampled: 1/17/2017
 % Moisture 0 Date Analyzed: 1/18/2017
 Soil Extract Volume: (uL) Dilution Factor: 1.0
 Analyst's Initials: KC Soil Aliquot Volume: (uL)

CAS NO.	COMPOUND	UNITS: <u>UG/KG</u>	Q
75-01-4	Vinyl Chloride	50	U
74-83-9	Bromomethane	50	U
75-00-3	Chloroethane	50	U
67-64-1	Acetone	250	U
75-35-4	1,1-Dichloroethene	50	U
75-15-0	Carbon Disulfide	50	U
75-09-2	Methylene Chloride	50	U
1634-04-4	tert-Butyl methyl ether	50	U
156-60-5	trans-1,2 Dichloroethene	50	U
75-34-3	1,1-Dichloroethane	50	U
78-93-3	2-Butanone	250	U
594-20-7	2,2-Dichloropropane	50	U
156-59-2	cis-1,2-Dichloroethene	50	U
67-66-3	Chloroform	50	U
74-97-5	Bromochloromethane	50	U
71-55-6	1,1,1-Trichloroethane	50	U
563-58-6	1,1-Dichloropropene	50	U
56-23-5	Carbon Tetrachloride	50	U
71-43-2	Benzene	50	U
107-06-2	1,2-Dichloroethane	50	U
79-01-6	Trichloroethene	50	U
78-87-5	1,2-Dichloropropane	50	U
75-27-4	Bromodichloromethane	50	U
74-95-3	Dibromomethane	50	U
108-10-1	4-Methyl-2-pentanone	250	U
106-93-4	Ethylene Dibromide	50	U
108-88-3	Toluene	50	U
10061-01-5	cis-1,3-Dichloropropene	50	U
10061-02-6	Trans-1,3-Dichloropropene	50	U
79-00-5	1,1,2-Trichloroethane	50	U
591-78-6	2-Hexanone	250	U
127-18-4	Tetrachloroethene	50	U
124-48-1	Chlorodibromomethane	50	U
108-90-7	Chlorobenzene	50	U
630-20-6	1,1,1,2-Tetrachloroethane	50	U

U=not detected, D=diluted, E=over range (another data sheet is included), J=below limit, B=found in blank

New England Testing Laboratory, Inc.

VOLATILE ORGANICS ANALYSIS DATA SHEET

Case No.: D0117-28 Client Name: Gordon R. Archibald
 Method: 8260 Lab Sample ID: VBLANK 011717 B
 Matrix: (soil/water) SOIL Lab File ID: E011731.D
 Sample wt/vol: 10.0 (g/ml) G Date Sampled: 1/17/2017
 % Moisture 0 Date Analyzed: 1/18/2017
 Soil Extract Volume: (uL) Dilution Factor: 1.0
 Analyst's Initials: KC Soil Aliquot Volume: (uL)

CAS NO.	COMPOUND	UNITS: <u>UG/KG</u>	Q
100-41-4	Ethylbenzene	50	U
1330-20-7	m & p-Xylene	100	U
95-47-6	o-Xylene	50	U
100-42-5	Styrene	50	U
75-25-2	Bromoform	50	U
98-82-8	Isopropylbenzene	50	U
79-34-5	1,1,2,2-Tetrachloroethane	50	U
108-86-1	Bromobenzene	50	U
96-18-4	1,2,3-Trichloropropane	50	U
95-49-8	2-Chlorotoluene	50	U
103-65-1	n-Propylbenzene	50	U
108-67-8	1,3,5-Trimethylbenzene	50	U
106-43-4	4-Chlorotoluene	50	U
98-06-6	tert-Butylbenzene	50	U
95-63-6	1,2,4-Trimethylbenzene	50	U
135-98-8	sec-Butylbenzene	50	U
99-87-6	p-Isopropyltoluene	50	U
75-87-3	Chloromethane	50	U
75-65-0	tert butyl alcohol	250	U
541-73-1	1,3-Dichlorobenzene	50	U
109-99-9	Tetrahydrofuran	50	U
106-46-7	1,4-Dichlorobenzene	50	U
60-29-7	Diethyl Ether	50	U
104-51-8	n-Butylbenzene	50	U
95-50-1	1,2-Dichlorobenzene	50	U
96-12-8	1,2-Dibromo-3-chloropropane	50	U
120-82-1	1,2,4-Trichlorobenzene	50	U
87-68-3	Hexachlorobutadiene	50	U
91-20-3	Naphthalene	50	U
87-61-6	1,2,3-Trichlorobenzene	50	U
994-05-8	Tert-amyl Methyl Ether	50	U
75-71-8	Dichlorodifluoromethane	50	U
142-28-9	1,3-Dichloropropane	50	U
75-69-4	Trichlorofluoromethane	50	U
637-92-3	Ethyl Tert-butyl ether	50	U

U=not detected, D=diluted, E=over range (another data sheet is included), J=below limit, B=found in blank

New England Testing Laboratory, Inc.

VOLATILE ORGANICS ANALYSIS DATA SHEET

Case No.: D0117-28 Client Name: Gordon R. Archibald
 Method: 8260 Lab Sample ID: VBLANK 011717 B
 Matrix: (soil/water) SOIL Lab File ID: E011731.D
 Sample wt/vol: 10.0 (g/ml) G Date Sampled: 1/17/2017
 % Moisture 0 Date Analyzed: 1/18/2017
 Soil Extract Volume: (uL) Dilution Factor: 1.0
 Analyst's Initials: KC Soil Aliquot Volume: (uL)

CAS NO.	COMPOUND	UNITS: <u>UG/KG</u>	Q
108-20-3	Diisopropyl Ether	50	U
123-91-1	1,4-Dioxane	25000	U

U=not detected, D=diluted, E=over range (another data sheet is included), J=below limit, B=found in blank

New England Testing Laboratory, Inc.

WATER VOLATILE SYSTEM MONITORING COMPOUND RECOVERY

Lab Name: New England Testing Laboratory Contract: **Butterfield Substation**
 Lab Code: RI010 Case No.: D0117-28 SAS No.: **Gordon R. Archibald**

EPA SAMPLE NO.	SMC1 #	SMC2 #	SMC3 #	TOT OUT
01 LCS 011717	107	104	114	0
02 VBLANK 011717 B	109	106	104	0
03 CS-3	109	105	107	0

\

SMC1	=	4-Bromofluorobenzene (S)	(70-130)
SMC2	=	Toluene-d8 (s)	(70-130)
SMC3	=	1,2-Dichloroethane-d4 (s)	(70-130)

Column to be used to flag recovery values
 * Values outside of contract required QC limits
 D System Monitoring Compound diluted out

New England Testing Laboratory,

Volatile Organics Laboratory Control Spike

Date Analyzed: 01/17/2017

Sample ID: LCS 011717 B

Compound	Spike Added	Spike Result	Recovery, %	Lower Control Limit, %	Upper Control Limit, %
1,1-Dichloroethene	50.0	54.9	110	70	129
Benzene	50.0	50.2	100	73	129
Trichloroethene	50.0	55.0	110	77	122
Toluene	50.0	50.6	101	75	123
Chlorobenzene	50.0	53.8	108	73	125

NEW ENGLAND TESTING LABORATORY, INC.
59 Greenhill Street
West Warwick, RI 02893
1-888-863-8522

CHAIN OF CUSTODY RECORD

2017-28

[illegible]

Netlab subcontractors the following tests: Radiologicals, Radon, Asbestos, UCMRs, Perchlorate, Bromate, Bromide, Sieve, Salmonella, Carbamates



REPORT OF ANALYTICAL RESULTS

NETLAB Case Number D0116-05

Prepared for:

Gordon R. Archibald, Inc.
200 Main Street
Pawtucket, RI 02860

Report Date: January 27, 2017

Director
New England Testing Laboratory, Inc.
Lab # RI010

NEW ENGLAND TESTING LABORATORY, INC.

59 Greenhill Street, West Warwick, RI 02893

(401) 353-3420

SAMPLES SUBMITTED and REQUEST FOR ANALYSIS:

The samples listed in Table I were submitted to New England Testing Laboratory on January 16, 2017. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the samples provided to us by the client which are indicated on the custody record. The case number for this sample submission is D0116-05.

Custody records are included in this report.

Site: URI – Butterfield Substation

TABLE I, Samples Submitted

Sample ID	Date Sampled	Matrix	Analysis Requested
1-B	1/16/2017	Soil	Table II, III
1-C	1/16/2017	Soil	Table II
2-B	1/16/2017	Soil	Table II, III
2-C	1/16/2017	Soil	Table II
3-A	1/16/2017	Soil	Table II, III
3-B	1/16/2017	Soil	Table II, III
3-C	1/16/2017	Soil	Table II
5-B	1/16/2017	Soil	Table II
5-C	1/16/2017	Soil	Table II
8-A	1/16/2017	Soil	Table II
8-B	1/16/2017	Soil	Table II
8-C	1/16/2017	Soil	Table II
9-B	1/16/2017	Soil	Table II
9-C	1/16/2017	Soil	Table II
10-B	1/16/2017	Soil	Table II
10-C	1/16/2017	Soil	Table II
11-B	1/16/2017	Soil	Table II
11-C	1/16/2017	Soil	Table II
12-B	1/16/2017	Soil	Table II
12-C	1/16/2017	Soil	Table II
15-B	1/16/2017	Soil	Table II
15-C	1/16/2017	Soil	Table II
16-B	1/16/2017	Soil	Table II
16-C	1/16/2017	Soil	Table II
17-B	1/16/2017	Soil	Table II
17-C	1/16/2017	Soil	Table II
18-B	1/16/2017	Soil	Table II
18-C	1/16/2017	Soil	Table II
19-B	1/16/2017	Soil	Table II
19-C	1/16/2017	Soil	Table II
20-B	1/16/2017	Soil	Table II
20-C	1/16/2017	Soil	Table II
21-B	1/16/2017	Soil	Table II

TABLE I, Samples Submitted, Cont.

Sample ID	Date Sampled	Matrix	Analysis Requested
21-C	1/16/2017	Soil	Table II
22-B	1/16/2017	Soil	Table II
22-C	1/16/2017	Soil	Table II
23-A	1/16/2017	Soil	Table II, III
23-B	1/16/2017	Soil	Table II, III
23-C	1/16/2017	Soil	Table II
24-B	1/16/2017	Soil	Table II, III
24-C	1/16/2017	Soil	Table II
25-B	1/16/2017	Soil	Table II, III
25-C	1/16/2017	Soil	Table II
26-B	1/16/2017	Soil	Table II
26-C	1/16/2017	Soil	Table II
30-B	1/16/2017	Soil	Table II
30-C	1/16/2017	Soil	Table II
31-B	1/16/2017	Soil	Table II, III
31-C	1/16/2017	Soil	Table II
32-B	1/16/2017	Soil	Table II, III
32-C	1/16/2017	Soil	Table II
33-B	1/16/2017	Soil	Table II, III
33-C	1/16/2017	Soil	Table II
34-B	1/16/2017	Soil	Table II, III
34-C	1/16/2017	Soil	Table II
35-A	1/16/2017	Soil	Table II, III
35-B	1/16/2017	Soil	Table II, III
35-C	1/16/2017	Soil	Table II
36-B	1/16/2017	Soil	Table II
36-C	1/16/2017	Soil	Table II
38-B	1/16/2017	Soil	Table II, III
38-C	1/16/2017	Soil	Table II
40-B	1/16/2017	Soil	Table II, III
40-C	1/16/2017	Soil	Table II
TRIP-1/16	1/16/2017	Soil	Table II

TABLE II, Analysis and Methods

ANALYSIS	PREPARATION METHOD	DETERMINATIVE METHOD
PCB's	3540C	8082A

TABLE III, Analysis and Methods

ANALYSIS	PREPARATION METHOD	DETERMINATIVE METHOD
Total Petroleum Hydrocarbons	3546	8100M

These methods are documented in:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, USEPA/OSW.

CASE NARRATIVE:

Sample Receipt

The samples were all appropriately cooled and preserved upon receipt. The samples were received in the appropriate containers. The chain of custody was adequately completed and corresponded to the samples submitted.

PCBs

All samples were extracted and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

Total Petroleum Hydrocarbons

All samples were extracted and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

Sample: 1-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	54	26
Surrogates:		
Compound	% Recovery	Limits
Chloroctadecane	96	62-151

Sample: 2-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	26
Surrogates:		
Compound	% Recovery	Limits
Chloroctadecane	97	62-151

ND = Not Detected

*Dry Weight Basis

Sample: 3-A		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/21/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	262	26
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	100	62-151

Sample: 3-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	27
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	78	62-151

ND = Not Detected

*Dry Weight Basis

Sample: 23-A		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	37	30
Surrogates:		
Compound	% Recovery	Limits
Chloroctadecane	73	62-151

Sample: 23-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	28	26
Surrogates:		
Compound	% Recovery	Limits
Chloroctadecane	74	62-151

ND = Not Detected

*Dry Weight Basis

Sample: 24-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	25
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	104	62-151

Sample: 25-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	26
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	90	62-151

ND = Not Detected

*Dry Weight Basis

Sample: 31-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	27
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	85	62-151

Sample: 32-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	565	25
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	76	62-151

ND = Not Detected

*Dry Weight Basis

Sample: 33-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	26
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	82	62-151

Sample: 34-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	27
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	86	62-151

ND = Not Detected

*Dry Weight Basis

Sample: 35-A		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	27
Surrogates:		
Compound	% Recovery	Limits
Chloroctadecane	104	62-151

Sample: 35-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	27
Surrogates:		
Compound	% Recovery	Limits
Chloroctadecane	98	62-151

ND = Not Detected

*Dry Weight Basis

Sample: 38-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	27
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	111	62-151

Sample: 40-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/19/17	1/20/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	40	27
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	99	62-151

ND = Not Detected

*Dry Weight Basis

RESULTS: PCBs

The presence of the NETLAB LOGO in the top right corner of each page in this section indicates:

The Technical Manager of the Organics Analysis Department certifies that the samples included in this section have been prepared and analyzed using the procedures cited and that the results have been reviewed and approved. Any exceptions or qualifications of substance have been reported in the case narrative.

Sample: 1-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	85	30-129
DCBP	96	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 1-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	82	30-129
DCBP	94	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 2-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	84	30-129
DCBP	90	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 2-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	80	30-129
DCBP	90	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 3-A		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	76	30-129
DCBP	86	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 3-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	76	30-129
DCBP	93	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 3-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	84	30-129
DCBP	89	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 5-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	88	30-129
DCBP	90	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 5-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	82	30-129
DCBP	94	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 8-A		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	71	30-129
DCBP	79	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 8-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	80	30-129
DCBP	85	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 8-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	89	30-129
DCBP	85	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 9-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	78	30-129
DCBP	88	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 9-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	80	30-129
DCBP	90	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 10-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	84	30-129
DCBP	89	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 10-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	80	30-129
DCBP	91	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 11-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	83	30-129
DCBP	93	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 11-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	78	30-129
DCBP	86	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 12-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	87	30-129
DCBP	93	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 12-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	90	30-129
DCBP	89	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 15-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	78	30-129
DCBP	87	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 15-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	87	30-129
DCBP	93	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 16-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	82	30-129
DCBP	88	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 16-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	80	30-129
DCBP	90	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 17-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	89	30-129
DCBP	94	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 17-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	83	30-129
DCBP	94	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 18-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	82	30-129
DCBP	92	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 18-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	81	30-129
DCBP	94	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 19-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	87	30-129
DCBP	95	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 19-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	77	30-129
DCBP	87	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 20-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	83	30-129
DCBP	94	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 20-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	90	30-129
DCBP	92	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 21-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	86	30-129
DCBP	97	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 21-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	87	30-129
DCBP	94	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 22-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	83	30-129
DCBP	95	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 22-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	80	30-129
DCBP	89	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 23-A		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	93	30-129
DCBP	92	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 23-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	85	30-129
DCBP	94	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 23-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	86	30-129
DCBP	97	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 24-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	94	30-129
DCBP	98	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 24-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	92	30-129
DCBP	100	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 25-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	95	30-129
DCBP	98	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 25-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	96	30-129
DCBP	103	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 26-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	89	30-129
DCBP	96	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 26-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	96	30-129
DCBP	103	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 30-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	84	30-129
DCBP	93	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 30-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	83	30-129
DCBP	92	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 31-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	93	30-129
DCBP	103	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 31-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	84	30-129
DCBP	87	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 32-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	81	30-129
DCBP	89	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 32-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	260	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	70	30-129
DCBP	84	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 33-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	85	30-129
DCBP	90	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 33-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	87	30-129
DCBP	97	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 34-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	88	30-129
DCBP	97	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 34-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	85	30-129
DCBP	97	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 35-A		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	88	30-129
DCBP	94	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 35-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	85	30-129
DCBP	93	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 35-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	83	30-129
DCBP	97	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 36-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	86	30-129
DCBP	99	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 36-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	82	30-129
DCBP	90	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 38-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	79	30-129
DCBP	94	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 38-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	90	30-129
DCBP	96	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 40-B		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	85	30-129
DCBP	95	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: 40-C		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	73	30-129
DCBP	93	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: TRIP-1/16		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	94	30-129
DCBP	108	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: Method Blank		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: NA		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg (ppb)	Reporting Limit ug/kg (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	77	30-129
DCBP	89	37-126

N.D. = Not Detected

Sample: Method Blank		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: NA		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg (ppb)	Reporting Limit ug/kg (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	78	30-129
DCBP	89	37-126

N.D. = Not Detected

Sample: Method Blank		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: NA		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/20/17	1/25/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg (ppb)	Reporting Limit ug/kg (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	80	30-129
DCBP	86	37-126

N.D. = Not Detected

Sample: Method Blank		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: NA		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/23/17	1/26/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg (ppb)	Reporting Limit ug/kg (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	82	30-129
DCBP	78	37-126

N.D. = Not Detected

Sample: Method Blank		Analyst's Initials: BJ
Case No.: D0116-05		
Date Collected: NA		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg (ppb)	Reporting Limit ug/kg (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	91	30-129
DCBP	105	37-126

N.D. = Not Detected

PCB Laboratory Control Spike

Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3540C	1/18/17			1/20/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/kg	Result mg/kg	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.436	87	72-118
Aroclor 1260	0.500	0.469	94	73-131
Surrogates:				
Compound	% Recovery	Limits		
TCMX	81	30-129		
DCBP	90	37-126		

PCB Laboratory Control Spike

Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3540C	1/19/17			1/23/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/kg	Result mg/kg	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.496	99	72-118
Aroclor 1260	0.500	0.508	102	73-131
Surrogates:				
Compound	% Recovery	Limits		
TCMX	87	30-129		
DCBP	90	37-126		

PCB Laboratory Control Spike

Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3540C	1/20/17			1/25/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/kg	Result mg/kg	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.449	90	72-118
Aroclor 1260	0.500	0.500	100	73-131
Surrogates:				
Compound	% Recovery	Limits		
TCMX	83	30-129		
DCBP	90	37-126		

PCB Laboratory Control Spike

Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3540C	1/23/17			1/26/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/kg	Result mg/kg	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.406	81	72-118
Aroclor 1260	0.500	0.433	87	73-131
Surrogates:				
Compound	% Recovery	Limits		
TCMX	80	30-129		
DCBP	86	37-126		

PCB Laboratory Control Spike

Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3540C	1/25/17			1/27/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/kg	Result mg/kg	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.483	97	72-118
Aroclor 1260	0.500	0.518	104	73-131
Surrogates:				
Compound	% Recovery	Limits		
TCMX	90	30-129		
DCBP	96	37-126		

New England Testing Laboratory

59 Greenhill Street
West Warwick, RI 02893
1-888-863-8522

Chain of Custody Record

D0116-05

Project No.		Project Name/Location:		Matrix		Preservative		Tests**											
		URI - Butterfield Substation																	
Client:		Gordon R. Archibald Inc.		Aqueous		Other		No. of Containers											
Report To:		Steve Cadorette, GRA																	
Invoice To:		Steve Cadorette, GRA																	
Date	Time	Comp	Grab	Sample I.D.															
1/16/17			X	1-B					2										
				1-C					1										
				2-B					2										
				2-C					1										
				3-A					2										
				3-B					2										
				3-C					1										
				5-B					1										
				5-C					1										
				8-A					1										
				8-B					1										
				8-C					1										
				9-B					1										
				9-C					1										
Sampled By:		Received By:		Date/Time	Date/Time	Laboratory Remarks:		Special Instructions:											
Baer Negan				1/16/17	1415														
Relinquished By:		Received By:		Date/Time	Date/Time	Temp. Received:													
Bjorn				1/16/17	1445	1445													
**Netlab Subcontracts the following tests: Radiologicals, Radon, TOC, Asbestos, UCMRs, Perchlorate, Bromate, Bromide, Sieve, Salmonella, Carbamates																			
Turnaround Time [Business Days]: 5 Days																			

New England Testing Laboratory

59 Greenhill Street
West Warwick, RI 02893
1-888-863-8522

Chain of Custody Record

20116-05

Project No.		Project Name/Location: URI - Butterfield Substation				Matrix		Preservative		Tests**					
Client: Gordon R. Archibald Inc.		Report To: Steve Cadorette, GRA				Aqueous		No. of Containers		PLB TPH					
Invoice To: Steve Cadorette, GRA						Soil									
Date	Time	Comp	Grab	Sample I.D.											
1/16/17		X		10-B		X		1		X					
				10-C				1		X					
				11-B				1		X					
				11-C				1		X					
				12-B				1		X					
				12-C				1		X					
				15-B				1		X					
				15-C				1		X					
				16-B				1		X					
				16-C				1		X					
				17-B				1		X					
				17-C				1		X					
				18-B				1		X					
				18-C				1		X					
Sampled By: Brett Nelson		Date/Time 1/16/17	Received By:		Date/Time 1/16/17	Laboratory Remarks:		Date/Time 1/16/17		Special Instructions:					
Relinquished By: Brett Nelson		Date/Time 1/16/17	Received By:		Date/Time 1/16/17	Temp. Received:		Date/Time 1/16/17							
**Netlab Subcontracts the following tests: Radiologicals, Radon, TOC, Asbestos, UCMRs, Perchlorate, Bromate, Bromide, Sieve, Salmonella, Carbamates														Turnaround Time [Business Days]: 5 Days	

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1-888-863-8522

05-01-05

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New England Testing Laboratory

59 Greenhill Street
West Warwick, RI 02893
1-888-863-8522

Chain of Custody Record

2016-05

Project No.		Project Name/Location: URI - Butterfield Substation		Matrix		Preservative		Tests**						
Client: Gordon R. Archibald Inc.														
Report To: Steve Cadorette, GRA														
Invoice To: Steve Cadorette, GRA														
Date	Time	Comp	Grab	Sample I.D.	Aqueous	Soil	Other	No. of Containers						
1/16/17			X	25-C	X	X		1	PCB	TPH				
				26-B				1						
				26-C				1						
				30-B				1						
				30-C				1						
				31-B				2						
				31-C				2						
				32-B				2						
				32-C				2						
				33-B				2						
				33-C				2						
				34-B				2						
				34-C				2						
				35-A				2						
Sampled By: Baeri Nassim		Date/Time 1/16/17 1415	Received By:	Date/Time		Laboratory Remarks:		Special Instructions:						
Relinquished By: [Signature]		Date/Time 1/16/17 1445	Received By: [Signature]	Date/Time 1/16/17 1445		Temp. Received:								
**Netlab Subcontracts the following tests: Radionuclides, Radon, TOC, Asbestos, UCMRs, Perchlorate, Bromate, Bromide, Sieve, Salmonella, Carbamates													Turnaround Time [Business Days]: 5 Days	

1-888-863-8522

Chain of Custody Record

Page 93 of 93



REPORT OF ANALYTICAL RESULTS

NETLAB Case Number D0116-04

Prepared for:

Gordon R. Archibald, Inc.
200 Main Street
Pawtucket, RI 02860

Report Date: January 25, 2017

Director
New England Testing Laboratory, Inc.
Lab # RI010

NEW ENGLAND TESTING LABORATORY, INC.

59 Greenhill Street, West Warwick, RI 02893

(401) 353-3420

SAMPLES SUBMITTED and REQUEST FOR ANALYSIS:

The samples listed in Table I were submitted to New England Testing Laboratory on January 16, 2017. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the samples provided to us by the client which are indicated on the custody record. The case number for this sample submission is D0116-05.

Custody records are included in this report.

Site: URI – Butterfield Substation

TABLE I, Samples Submitted

Sample ID	Date Sampled	Matrix	Analysis Requested
CS-1	1/16/2017	Soil	Table II
CS-2	1/16/2017	Soil	Table II
CS-4	1/16/2017	Soil	Table II

TABLE II, Analysis and Methods

ANALYSIS	PREPARATION METHOD	DETERMINATIVE METHOD
Paint Filter	NA	9095B
% Solids	NA	2540G
pH	NA	9045
Total Metals		
Arsenic	3050B	6010C
Barium	3050B	6010C
Cadmium	3050B	6010C
Chromium	3050B	6010C
Lead	3050B	6010C
Mercury	NA	7471B
Selenium	3050B	6010C
Silver	3050B	6010C
PCB's	3546	8082A
Total Petroleum Hydrocarbons	3546	8100M
Semi-Volatile Organic Compounds	3546	8270D
Volatile Organic Compounds	5035	8260C

These methods are documented in:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, USEPA/OSW.

CASE NARRATIVE:

Sample Receipt

The samples were all appropriately cooled and preserved upon receipt. The samples were received in the appropriate containers. The chain of custody was adequately completed and corresponded to the samples submitted.

Metals

All analyses were performed according to NETLAB's documented Standard Operating Procedures, within all required holding times, and with appropriate quality control measures. All QC was within laboratory established acceptance criteria. The samples were received, processed, and reported with no anomalies.

PCBs

All samples were extracted and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

Semi-volatile Compounds

All samples were extracted and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

Total Petroleum Hydrocarbons

All samples were extracted and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

Volatile Organic Compounds

All samples were analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

Wet Chemistry

All samples were analyzed within method specified holding times and according to NETLAB's documented standard operating procedures.

CS-1

Parameter	Result	Reporting Limit	Date Analyzed
Paint Filter	No Free Liquids	NA	1/19/2017
Percent Solids, %	95.33	NA	1/19/2017
pH, S.U.	5.58	NA	1/20/2017

CS-2

Parameter	Result	Reporting Limit	Date Analyzed
Paint Filter	No Free Liquids	NA	1/19/2017
Percent Solids, %	93.33	NA	1/19/2017
pH, S.U.	5.28	NA	1/20/2017

CS-4

Parameter	Result	Reporting Limit	Date Analyzed
Paint Filter	No Free Liquids	NA	1/19/2017
Percent Solids, %	93.90	NA	1/19/2017
pH, S.U.	5.21	NA	1/20/2017

ND = Not Detected

NA = Not Applicable

*Dry Weight Basis

METALS RESULTS

The presence of the NETLAB LOGO in the top right corner of each page in this section indicates:

The Technical Manager of the Metals Analysis Department certifies that the results included in this section have been reviewed and approved. Any exceptions or qualifications of substance have been reported in the case narrative.

METALS RESULTS



Case Number: D0116-04
 Sample ID: CS-1
 Date collected: 1/16/17
 Matrix: SOLID
 Solids, %: 95.33
 Sample Type: Total

NC/NB/DC

		Preparative	Analytical		Reporting		Date of	Date
Parameter	CAS Number	Method	Method	Result	Limit	Units	Preparation	Analyzed
Arsenic	7440-38-2	3050B	6010C	7.64	0.70	mg/kg	1/17/17	1/18/17
Barium	7440-39-3	3050B	6010C	11.5	0.35	mg/kg	1/17/17	1/18/17
Cadmium	7440-43-9	3050B	6010C	0.69	0.35	mg/kg	1/17/17	1/18/17
Chromium	7440-47-3	3050B	6010C	1.99	0.35	mg/kg	1/17/17	1/18/17
Lead	7439-92-1	3050B	6010C	5.09	0.35	mg/kg	1/17/17	1/18/17
Mercury	7439-97-6	NA	7471B	ND	0.070	mg/kg	1/18/17	1/18/17
Selenium	7782-49-2	3050B	6010C	ND	0.70	mg/kg	1/17/17	1/18/17
Silver	7440-22-4	3050B	6010C	ND	0.35	mg/kg	1/17/17	1/18/17

ND indicates Not Detected.

NA indicates Not Applicable

All results are reported on a dry weight basis.

METALS RESULTS



Case Number: D0116-04
 Sample ID: CS-2
 Date collected: 1/16/17
 Matrix: SOLID
 Solids, %: 93.33
 Sample Type: Total

NC/NB/DC

		Preparative	Analytical		Reporting		Date of	Date
Parameter	CAS Number	Method	Method	Result	Limit	Units	Preparation	Analyzed
Arsenic	7440-38-2	3050B	6010C	10.1	0.68	mg/kg	1/17/17	1/18/17
Barium	7440-39-3	3050B	6010C	9.42	0.34	mg/kg	1/17/17	1/18/17
Cadmium	7440-43-9	3050B	6010C	0.54	0.34	mg/kg	1/17/17	1/18/17
Chromium	7440-47-3	3050B	6010C	2.14	0.34	mg/kg	1/17/17	1/18/17
Lead	7439-92-1	3050B	6010C	7.26	0.34	mg/kg	1/17/17	1/18/17
Mercury	7439-97-6	NA	7471B	ND	0.067	mg/kg	1/18/17	1/18/17
Selenium	7782-49-2	3050B	6010C	ND	0.68	mg/kg	1/17/17	1/18/17
Silver	7440-22-4	3050B	6010C	ND	0.34	mg/kg	1/17/17	1/18/17

ND indicates Not Detected.

NA indicates Not Applicable

All results are reported on a dry weight basis.

METALS RESULTS



Case Number: D0116-04
 Sample ID: CS-4
 Date collected: 1/16/17
 Matrix: SOLID
 Solids, %: 93.9
 Sample Type: Total

NC/NB/DC

		Preparative	Analytical		Reporting		Date of	Date
Parameter	CAS Number	Method	Method	Result	Limit	Units	Preparation	Analyzed
Arsenic	7440-38-2	3050B	6010C	1.35	0.70	mg/kg	1/17/17	1/18/17
Barium	7440-39-3	3050B	6010C	6.14	0.35	mg/kg	1/17/17	1/18/17
Cadmium	7440-43-9	3050B	6010C	0.43	0.35	mg/kg	1/17/17	1/18/17
Chromium	7440-47-3	3050B	6010C	1.92	0.35	mg/kg	1/17/17	1/18/17
Lead	7439-92-1	3050B	6010C	3.76	0.35	mg/kg	1/17/17	1/18/17
Mercury	7439-97-6	NA	7471B	ND	0.067	mg/kg	1/18/17	1/18/17
Selenium	7782-49-2	3050B	6010C	ND	0.70	mg/kg	1/17/17	1/18/17
Silver	7440-22-4	3050B	6010C	ND	0.35	mg/kg	1/17/17	1/18/17

ND indicates Not Detected.

NA indicates Not Applicable

All results are reported on a dry weight basis.

METALS RESULTS



Sample ID: Preparation Blank
 Matrix SOIL
 Solids, % 100
 Sample Type: Total

NC/NB/DC

		Preparative	Analytical		Reporting		Date of	Date
Parameter	CAS Number	Method	Method	Result	Limit	Units	Preparation	Analyzed
Arsenic	7440-38-2	3050B	6010C	ND	0.67	mg/kg	1/17/17	1/18/17
Barium	7440-39-3	3050B	6010C	ND	0.33	mg/kg	1/17/17	1/18/17
Cadmium	7440-43-9	3050B	6010C	ND	0.33	mg/kg	1/17/17	1/18/17
Chromium	7440-47-3	3050B	6010C	ND	0.33	mg/kg	1/17/17	1/18/17
Lead	7439-92-1	3050B	6010C	ND	0.33	mg/kg	1/17/17	1/18/17
Mercury	7439-97-6	NA	7471B	ND	0.033	mg/kg	1/18/17	1/18/17
Selenium	7782-49-2	3050B	6010C	ND	0.67	mg/kg	1/17/17	1/18/17
Silver	7440-22-4	3050B	6010C	ND	0.33	mg/kg	1/17/17	1/18/17

ND indicates Not Detected.

NA indicates Not Applicable

All results are reported on a dry weight basis.

LABORATORY CONTROL SAMPLE RECOVERY

Parameter	True Value	Result	Units	Recovery, %	Internal		Date Analyzed
					LCL, %	UCL, %	
Arsenic	13.3	12.1	mg/kg	91	85	115	1/18/17
Barium	66.7	62.0	mg/kg	93	85	115	1/18/17
Cadmium	66.7	61.4	mg/kg	92	85	114	1/18/17
Chromium	66.7	61.5	mg/kg	92	85	115	1/18/17
Lead	66.7	62.8	mg/kg	94	85	115	1/18/17
Mercury	0.133	0.1	mg/kg	93	85	115	1/18/17
Selenium	13.3	11.5	mg/kg	86	85	115	1/18/17
Silver	26.6	29.5	mg/kg	111	85	115	1/18/17

New England Testing Laboratory, Inc.

RESULTS: PCBs

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The Technical Manager of the Organics Analysis Department certifies that the samples included in this section have been prepared and analyzed using the procedures cited and that the results have been reviewed and approved. Any exceptions or qualifications of substance have been reported in the case narrative.

Sample: CS-1		Analyst's Initials: BJ
Case No.: D0116-04		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3546	1/23/17	1/24/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1221	N.D.	100
Aroclor-1232	N.D.	100
Aroclor-1016	N.D.	100
Aroclor-1242	N.D.	100
Aroclor-1248	N.D.	100
Aroclor-1254	N.D.	100
Aroclor-1260	N.D.	100
Aroclor-1262	N.D.	100
Aroclor-1268	N.D.	100
Surrogates:		
Compound	% Recovery	Limits
TCMX	77	45-125
DCBP	89	42-131

*Dry Weight Basis
N.D. = Not Detected

Sample: CS-2		Analyst's Initials: BJ
Case No.: D0116-04		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3546	1/23/17	1/24/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1221	N.D.	100
Aroclor-1232	N.D.	100
Aroclor-1016	N.D.	100
Aroclor-1242	N.D.	100
Aroclor-1248	N.D.	100
Aroclor-1254	N.D.	100
Aroclor-1260	N.D.	100
Aroclor-1262	N.D.	100
Aroclor-1268	N.D.	100
Surrogates:		
Compound	% Recovery	Limits
TCMX	78	45-125
DCBP	93	42-131

*Dry Weight Basis

N.D. = Not Detected

Sample: CS-4		Analyst's Initials: BJ
Case No.: D0116-04		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3546	1/23/17	1/24/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1221	N.D.	100
Aroclor-1232	N.D.	100
Aroclor-1016	N.D.	100
Aroclor-1242	N.D.	100
Aroclor-1248	N.D.	100
Aroclor-1254	N.D.	100
Aroclor-1260	N.D.	100
Aroclor-1262	N.D.	100
Aroclor-1268	N.D.	100
Surrogates:		
Compound	% Recovery	Limits
TCMX	87	45-125
DCBP	94	42-131

*Dry Weight Basis
N.D. = Not Detected

Sample: Method Blank		Analyst's Initials: BJ
Case No.: D0116-04		
Date Collected: NA		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3546	1/23/17	1/24/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg (ppb)	Reporting Limit ug/kg (ppb)
Aroclor-1221	N.D.	100
Aroclor-1232	N.D.	100
Aroclor-1016	N.D.	100
Aroclor-1242	N.D.	100
Aroclor-1248	N.D.	100
Aroclor-1254	N.D.	100
Aroclor-1260	N.D.	100
Aroclor-1262	N.D.	100
Aroclor-1268	N.D.	100
Surrogates:		
Compound	% Recovery	Limits
TCMX	71	45-125
DCBP	92	42-131

N.D. = Not Detected

PCB Laboratory Control Spike

Sample Matrix: Soil				
Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3546	1/23/17			1/24/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/kg	Result mg/kg	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.454	91	55-131
Aroclor 1260	0.500	0.491	98	63-133
Surrogates:				
Compound	% Recovery	Limits		
TCMX	96	45-125		
DCBP	96	42-131		

Sample: CS-1		Analyst's Initials: BJ
Case No.: D0116-04		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/23/17	1/23/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	171	26
Surrogates:		
Compound	% Recovery	Limits
Chloroctadecane	91	62-151

Sample: CS-2		Analyst's Initials: BJ
Case No.: D0116-04		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/23/17	1/23/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	52	27
Surrogates:		
Compound	% Recovery	Limits
Chloroctadecane	113	62-151

ND = Not Detected

*Dry Weight Basis

Sample: CS-4		Analyst's Initials: BJ
Case No.: D0116-04		
Date Collected: 1/16/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/23/17	1/23/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	26
Surrogates:		
Compound	% Recovery	Limits
Chloroctadecane	104	62-151

ND = Not Detected

*Dry Weight Basis

RESULTS: SEMIVOLATILE ORGANIC COMPOUNDS

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1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.



CS-1

Lab Name: New England Testing Laboratory Contract: URI Butterfi
 Lab Code: RI010 Case No.: D0116-04 SAS No.: Gordon SDG No.: Gordon R
 Matrix: (soil/water) SOIL Lab Sample ID: CS-1
 Sample wt/vol: 15.183 (g/ml) G Lab File ID: B011906.D
 Level: (low/med) LOW Date Received: 1/16/2017
 % Moisture: 4.67 decanted:(Y/N) N Date Extracted: 1/18/2017
 Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/19/2017
 Injection Volume: 1.0 (uL) Dilution Factor: 1.0
 GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO. COMPOUND (ug/L or ug/Kg) UG/KG Q

91-20-3	Naphthalene	140	U
91-57-6	2-Methylnaphthalene	140	U
208-96-8	Acenaphthylene	140	U
83-32-9	Acenaphthene	140	U
132-64-9	Dibenzofuran	140	U
86-73-7	Fluorene	140	U
85-01-8	Phenanthrene	140	U
120-12-7	Anthracene	140	U
206-44-0	Fluoranthene	140	U
129-00-0	Pyrene	140	U
56-55-3	Benzo(a)anthracene	140	U
218-01-9	Chrysene	140	U
205-99-2	Benzo(b)fluoranthene	140	U
207-08-9	Benzo(k)fluoranthene	140	U
50-32-8	Benzo(a)pyrene	140	U
193-39-5	Indeno(1,2,3-cd)pyrene	140	U
53-70-3	Dibenz(a,h)anthracene	140	U
191-24-2	Benzo(g,h,i)perylene	140	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.



CS-2

Lab Name: New England Testing Laboratory Contract: URI Butterfi
 Lab Code: RI010 Case No.: D0116-04 SAS No.: Gordon SDG No.: Gordon R
 Matrix: (soil/water) SOIL Lab Sample ID: CS-2
 Sample wt/vol: 15.519 (g/ml) G Lab File ID: B011907.D
 Level: (low/med) LOW Date Received: 1/16/2017
 % Moisture: 6.67 decanted:(Y/N) N Date Extracted: 1/18/2017
 Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/19/2017
 Injection Volume: 1.0 (uL) Dilution Factor: 1.0
 GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO. COMPOUND (ug/L or ug/Kg) UG/KG Q

91-20-3	Naphthalene	140	U
91-57-6	2-Methylnaphthalene	140	U
208-96-8	Acenaphthylene	140	U
83-32-9	Acenaphthene	140	U
132-64-9	Dibenzofuran	140	U
86-73-7	Fluorene	140	U
85-01-8	Phenanthrene	140	U
120-12-7	Anthracene	140	U
206-44-0	Fluoranthene	270	
129-00-0	Pyrene	290	
56-55-3	Benzo(a)anthracene	140	U
218-01-9	Chrysene	180	
205-99-2	Benzo(b)fluoranthene	140	U
207-08-9	Benzo(k)fluoranthene	140	U
50-32-8	Benzo(a)pyrene	140	U
193-39-5	Indeno(1,2,3-cd)pyrene	140	U
53-70-3	Dibenz(a,h)anthracene	140	U
191-24-2	Benzo(g,h,i)perylene	140	U

1B
SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

EPA SAMPLE NO.



CS-4

Lab Name: New England Testing Laboratory Contract: URI Butterfi
 Lab Code: RI010 Case No.: D0116-04 SAS No.: Gordon SDG No.: Gordon R
 Matrix: (soil/water) SOIL Lab Sample ID: CS-4
 Sample wt/vol: 15.261 (g/ml) G Lab File ID: B011908.D
 Level: (low/med) LOW Date Received: 1/16/2017
 % Moisture: 6.1 decanted:(Y/N) N Date Extracted: 1/18/2017
 Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/19/2017
 Injection Volume: 1.0 (uL) Dilution Factor: 1.0
 GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO. COMPOUND (ug/L or ug/Kg) UG/KG Q

91-20-3	Naphthalene	140	U
91-57-6	2-Methylnaphthalene	140	U
208-96-8	Acenaphthylene	140	U
83-32-9	Acenaphthene	140	U
132-64-9	Dibenzofuran	140	U
86-73-7	Fluorene	140	U
85-01-8	Phenanthrene	140	U
120-12-7	Anthracene	140	U
206-44-0	Fluoranthene	140	U
129-00-0	Pyrene	140	U
56-55-3	Benzo(a)anthracene	140	U
218-01-9	Chrysene	140	U
205-99-2	Benzo(b)fluoranthene	140	U
207-08-9	Benzo(k)fluoranthene	140	U
50-32-8	Benzo(a)pyrene	140	U
193-39-5	Indeno(1,2,3-cd)pyrene	140	U
53-70-3	Dibenz(a,h)anthracene	140	U
191-24-2	Benzo(g,h,i)perylene	140	U

SEMIVOLATILE ORGANICS ANALYSIS DATA SHEET

BSS011817

Lab Name: New England Testing Laboratory Contract: URI Butterfi
 Lab Code: RI010 Case No.: D0116-04 SAS No.: Gordon SDG No.: Gordon R
 Matrix: (soil/water) SOIL Lab Sample ID: BSS011817
 Sample wt/vol: 15 (g/ml) G Lab File ID: B011903.D
 Level: (low/med) LOW Date Received: 1/16/2017
 % Moisture: 0 decanted:(Y/N) N Date Extracted: 1/18/2017
 Concentrated Extract Volume: 1000 (uL) Date Analyzed: 1/19/2017
 Injection Volume: 1.0 (uL) Dilution Factor: 1.0
 GPC Cleanup: (Y/N) N pH:

CONCENTRATION UNITS:

CAS NO. COMPOUND (ug/L or ug/Kg) UG/KG Q

91-20-3	Naphthalene	130	U
91-57-6	2-Methylnaphthalene	130	U
208-96-8	Acenaphthylene	130	U
83-32-9	Acenaphthene	130	U
132-64-9	Dibenzofuran	130	U
86-73-7	Fluorene	130	U
85-01-8	Phenanthrene	130	U
120-12-7	Anthracene	130	U
206-44-0	Fluoranthene	130	U
129-00-0	Pyrene	130	U
56-55-3	Benzo(a)anthracene	130	U
218-01-9	Chrysene	130	U
205-99-2	Benzo(b)fluoranthene	130	U
207-08-9	Benzo(k)fluoranthene	130	U
50-32-8	Benzo(a)pyrene	130	U
193-39-5	Indeno(1,2,3-cd)pyrene	130	U
53-70-3	Dibenz(a,h)anthracene	130	U
191-24-2	Benzo(g,h,i)perylene	130	U

SOIL SEMIVOLATILE SURROGATE RECOVERY

Lab Name: New England Testing Laboratory Contract: URI ButterfieldLab Code: RI010 Case No.: D0116-04 SAS No.: Gordon SDG No.: Gordon RLevel: (low/med) LOW

	EPA SAMPLE NO.	S1 #	S2 #	S3 #	TOT OUT
01	BSS011817	70	74	118	0
02	LSS011817	71	71	110	0
03	CS-1	72	79	118	0
04	CS-2	49	49	127	0
05	CS-4	75	75	116	0

QC LIMITS

S1	=	Nitrobenzene-d5	(30-130)
S2	=	2-Fluorobiphenyl	(30-130)
S3	=	Terphenyl-d14	(30-130)

Column to be used to flag recovery values

* Values outside of contract required QC limits

D Surrogate diluted out

Semivolatile Soil Laboratory Control Spike

Date Extracted: 1/18/2017

Date Analyzed: 1/19/2017

	Amount Spiked	Result,	Recovery	Lower Recovery	Upper Recovery
	ug/Kg	ug/Kg	%	Limit	Limit
Naphthalene	3333	2161	65	40	140
2-Methylnaphthalene	3333	2214	66	40	140
Acenaphthylene	3333	2599	78	40	140
Acenaphthene	3333	2472	74	40	140
Dibenzofuran	3333	2597	78	40	140
Fluorene	3333	2876	86	40	140
Phenanthrene	3333	2893	87	40	140
Anthracene	3333	2919	88	40	140
Fluoranthene	3333	2993	90	40	140
Pyrene	3333	3229	97	40	140
Benzo(a)anthracene	3333	3014	90	40	140
Chrysene	3333	3061	92	40	140
Benzo(b)fluoranthene	3333	3133	94	40	140
Benzo(k)fluoranthene	3333	3153	95	40	140
Benzo(a)pyrene	3333	3146	94	40	140
Indeno(1,2,3-cd)pyrene	3333	3002	90	40	140
Dibenz(a,h)anthracene	3333	2903	87	40	140
Benzo(g,h,i)perylene	3333	2984	90	40	140

RESULTS: VOLATILE ORGANIC COMPOUNDS

The presence of the NETLAB LOGO in the top right corner of each page in this section indicates:

The Technical Manager of the Organics Analysis Department certifies that the samples included in this section have been prepared and analyzed using the procedures cited and that the results have been reviewed and approved. Any exceptions or qualifications of substance have been reported in the case narrative.

VOLATILE ORGANICS ANALYSIS DATA SHEET

CS-1

Lab Name: New England Testing Laboratory Contract: URI
 Lab Code: RI010 Case No.: D0116-04 SAS No.: Gordon SDG No.: Gordon Ar
 Matrix: (soil/water) SOIL Lab Sample ID: CS-1
 Sample wt/vol: 21.1 (g/ml) G Lab File ID: E011517.D
 Level: (low/med) MED Date Received: 1/16/2017
 % Moisture: not dec. 4.67 Date Analyzed: 1/16/2017
 GC Column: _____ ID: _____ (mm) Dilution Factor: 1.0
 Soil Extract Volume: 10000 (uL) Soil Aliquot Volume: 100 (uL)

CONCENTRATION UNITS:

CAS NO. COMPOUND (ug/L or ug/Kg) UG/KG Q

75-71-8	Dichlorodifluoromethane	25	U
75-87-3	Chloromethane	50	U
75-01-4	Vinyl Chloride	25	U
74-83-9	Bromomethane	25	U
75-00-3	Chloroethane	25	U
75-69-4	Trichlorofluoromethane	25	U
60-29-7	Diethyl Ether	25	U
75-35-4	1,1-Dichloroethene	25	U
75-15-0	Carbon Disulfide	25	U
75-09-2	Methylene Chloride	120	U
67-64-1	Acetone	250	U
156-60-5	Trans-1,2-dichloroethene	25	U
1634-04-4	Tert-butyl Methyl Ether	25	U
108-20-3	Diisopropyl Ether	25	U
75-34-3	1,1-Dichloroethane	25	U
637-92-3	Ethyl Tert-butyl Ether	25	U
156-59-2	Cis-1,2-dichloroethene	25	U
594-20-7	2,2-Dichloropropane	25	U
74-97-5	Bromochloromethane	25	U
67-66-3	Chloroform	25	U
56-23-5	Carbon Tetrachloride	25	U
109-99-9	Tetrahydrofuran	25	U
71-55-6	1,1,1-Trichloroethane	25	U
78-93-3	2-Butanone	120	U
563-58-6	1,1-Dichloropropene	25	U
71-43-2	Benzene	25	U
75-65-0	Tert-butyl Alcohol	120	U
994-05-8	Tert-amyl Methyl Ether	25	U
107-06-2	1,2-Dichloroethane	25	U
79-01-6	Trichloroethene	25	U
74-95-3	Dibromomethane	25	U
78-87-5	1,2-Dichloropropane	25	U
75-27-4	Bromodichloromethane	25	U
123-91-1	1,4-Dioxane	6200	U
10061-01-5	Cis-1,3-dichloropropene	25	U
108-88-3	Toluene	25	U
108-10-1	4-Methyl-2-Pentanone	120	U
127-18-4	Tetrachloroethene	25	U
10061-02-6	Trans-1,3-Dichloropropene	25	U

VOLATILE ORGANICS ANALYSIS DATA SHEET

CS-1

Lab Name: New England Testing Laboratory Contract: URI
 Lab Code: RI010 Case No.: D0116-04 SAS No.: Gordon SDG No.: Gordon Ar
 Matrix: (soil/water) SOIL Lab Sample ID: CS-1
 Sample wt/vol: 21.1 (g/ml) G Lab File ID: E011517.D
 Level: (low/med) MED Date Received: 1/16/2017
 % Moisture: not dec. 4.67 Date Analyzed: 1/16/2017
 GC Column: _____ ID: _____ (mm) Dilution Factor: 1.0
 Soil Extract Volume: 10000 (uL) Soil Aliquot Volume: 100 (uL)

CONCENTRATION UNITS:

CAS NO. COMPOUND (ug/L or ug/Kg) UG/KG Q

79-00-5	1,1,2-Trichloroethane	25	U
124-48-1	Dibromochloromethane	25	U
142-28-9	1,3-Dichloropropane	25	U
106-93-4	1,2-Dibromoethane	25	U
591-78-6	2-Hexanone	120	U
108-90-7	Chlorobenzene	25	U
100-41-4	Ethylbenzene	25	U
1330-20-7	m,p-Xylene	50	U
630-20-6	1,1,1,2-Tetrachloroethane	25	U
95-47-6	o-Xylene	25	U
100-42-5	Styrene	25	U
75-25-2	Bromoform	25	U
92-82-8	Isopropylbenzene	25	U
108-86-1	Bromobenzene	25	U
103-65-1	n-Propylbenzene	25	U
79-34-5	1,1,2,2-Tetrachloroethene	25	U
95-49-8	2-Chlorotoluene	25	U
96-18-4	1,2,3-Trichloropropane	25	U
108-67-8	1,3,5-Trimethylbenzene	25	U
106-43-4	4-Chlorotoluene	25	U
98-06-6	Tert-butylbenzene	25	U
95-63-6	1,2,4-Trimethylbenzene	25	U
135-98-8	Sec-butylbenzene	25	U
99-87-6	p-Isopropyltoluene	25	U
541-73-1	1,3-Dichlorobenzene	25	U
106-46-7	1,4-Dichlorobenzene	25	U
104-51-8	n-Butyl Benzene	25	U
95-50-1	1,2-Dichlorobenzene	25	U
96-12-8	1,2-Dibromo-3-chloropropane	25	U
87-68-3	Hexachlorobutadiene	25	U
120-82-1	1,2,4-Trichlorobenzene	25	U
91-20-3	Naphthalene	120	U
87-61-6	1,2,3-Trichlorobenzene	25	U

VOLATILE ORGANICS ANALYSIS DATA SHEET

CS-2

Lab Name: New England Testing Laboratory Contract: URI
 Lab Code: RI010 Case No.: D0116-04 SAS No.: Gordon SDG No.: Gordon Ar
 Matrix: (soil/water) SOIL Lab Sample ID: CS-2
 Sample wt/vol: 23.1 (g/ml) G Lab File ID: E011519.D
 Level: (low/med) MED Date Received: 1/16/2017
 % Moisture: not dec. 6.67 Date Analyzed: 1/16/2017
 GC Column: _____ ID: _____ (mm) Dilution Factor: 1.0
 Soil Extract Volume: 10000 (uL) Soil Aliquot Volume: 100 (uL)

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg)	UG/KG	Q
75-71-8	Dichlorodifluoromethane	23	U	
75-87-3	Chloromethane	47	U	
75-01-4	Vinyl Chloride	23	U	
74-83-9	Bromomethane	23	U	
75-00-3	Chloroethane	23	U	
75-69-4	Trichlorofluoromethane	23	U	
60-29-7	Diethyl Ether	23	U	
75-35-4	1,1-Dichloroethene	23	U	
75-15-0	Carbon Disulfide	23	U	
75-09-2	Methylene Chloride	120	U	
67-64-1	Acetone	230	U	
156-60-5	Trans-1,2-dichloroethene	23	U	
1634-04-4	Tert-butyl Methyl Ether	23	U	
108-20-3	Diisopropyl Ether	23	U	
75-34-3	1,1-Dichloroethane	23	U	
637-92-3	Ethyl Tert-butyl Ether	23	U	
156-59-2	Cis-1,2-dichloroethene	23	U	
594-20-7	2,2-Dichloropropane	23	U	
74-97-5	Bromochloromethane	23	U	
67-66-3	Chloroform	23	U	
56-23-5	Carbon Tetrachloride	23	U	
109-99-9	Tetrahydrofuran	23	U	
71-55-6	1,1,1-Trichloroethane	23	U	
78-93-3	2-Butanone	120	U	
563-58-6	1,1-Dichloropropene	23	U	
71-43-2	Benzene	23	U	
75-65-0	Tert-butyl Alcohol	120	U	
994-05-8	Tert-amyl Methyl Ether	23	U	
107-06-2	1,2-Dichloroethane	23	U	
79-01-6	Trichloroethene	23	U	
74-95-3	Dibromomethane	23	U	
78-87-5	1,2-Dichloropropane	23	U	
75-27-4	Bromodichloromethane	23	U	
123-91-1	1,4-Dioxane	5800	U	
10061-01-5	Cis-1,3-dichloropropene	23	U	
108-88-3	Toluene	23	U	
108-10-1	4-Methyl-2-Pentanone	120	U	
127-18-4	Tetrachloroethene	23	U	
10061-02-6	Trans-1,3-Dichloropropene	23	U	

VOLATILE ORGANICS ANALYSIS DATA SHEET

CS-2

Lab Name: New England Testing Laboratory Contract: URI
 Lab Code: RI010 Case No.: D0116-04 SAS No.: Gordon SDG No.: Gordon Ar
 Matrix: (soil/water) SOIL Lab Sample ID: CS-2
 Sample wt/vol: 23.1 (g/ml) G Lab File ID: E011519.D
 Level: (low/med) MED Date Received: 1/16/2017
 % Moisture: not dec. 6.67 Date Analyzed: 1/16/2017
 GC Column: _____ ID: _____ (mm) Dilution Factor: 1.0
 Soil Extract Volume: 10000 (uL) Soil Aliquot Volume: 100 (uL)

CONCENTRATION UNITS:

CAS NO. COMPOUND (ug/L or ug/Kg) UG/KG Q

79-00-5	1,1,2-Trichloroethane	23	U
124-48-1	Dibromochloromethane	23	U
142-28-9	1,3-Dichloropropane	23	U
106-93-4	1,2-Dibromoethane	23	U
591-78-6	2-Hexanone	120	U
108-90-7	Chlorobenzene	23	U
100-41-4	Ethylbenzene	23	U
1330-20-7	m,p-Xylene	47	U
630-20-6	1,1,1,2-Tetrachloroethane	23	U
95-47-6	o-Xylene	23	U
100-42-5	Styrene	23	U
75-25-2	Bromoform	23	U
92-82-8	Isopropylbenzene	23	U
108-86-1	Bromobenzene	23	U
103-65-1	n-Propylbenzene	23	U
79-34-5	1,1,2,2-Tetrachloroethene	23	U
95-49-8	2-Chlorotoluene	23	U
96-18-4	1,2,3-Trichloropropane	23	U
108-67-8	1,3,5-Trimethylbenzene	23	U
106-43-4	4-Chlorotoluene	23	U
98-06-6	Tert-butylbenzene	23	U
95-63-6	1,2,4-Trimethylbenzene	23	U
135-98-8	Sec-butylbenzene	23	U
99-87-6	p-Isopropyltoluene	23	U
541-73-1	1,3-Dichlorobenzene	23	U
106-46-7	1,4-Dichlorobenzene	23	U
104-51-8	n-Butyl Benzene	23	U
95-50-1	1,2-Dichlorobenzene	23	U
96-12-8	1,2-Dibromo-3-chloropropane	23	U
87-68-3	Hexachlorobutadiene	23	U
120-82-1	1,2,4-Trichlorobenzene	23	U
91-20-3	Naphthalene	120	U
87-61-6	1,2,3-Trichlorobenzene	23	U

VOLATILE ORGANICS ANALYSIS DATA SHEET

CS-4

Lab Name: New England Testing Laboratory Contract: URI
 Lab Code: RI010 Case No.: D0116-04 SAS No.: Gordon SDG No.: Gordon Ar
 Matrix: (soil/water) SOIL Lab Sample ID: CS-4
 Sample wt/vol: 13.6 (g/ml) G Lab File ID: E011521.D
 Level: (low/med) MED Date Received: 1/16/2017
 % Moisture: not dec. 6.1 Date Analyzed: 1/16/2017
 GC Column: _____ ID: _____ (mm) Dilution Factor: 1.0
 Soil Extract Volume: 10000 (uL) Soil Aliquot Volume: 100 (uL)

CONCENTRATION UNITS:

CAS NO. COMPOUND (ug/L or ug/Kg) UG/KG Q

75-71-8	Dichlorodifluoromethane	39	U
75-87-3	Chloromethane	78	U
75-01-4	Vinyl Chloride	39	U
74-83-9	Bromomethane	39	U
75-00-3	Chloroethane	39	U
75-69-4	Trichlorofluoromethane	39	U
60-29-7	Diethyl Ether	39	U
75-35-4	1,1-Dichloroethene	39	U
75-15-0	Carbon Disulfide	39	U
75-09-2	Methylene Chloride	200	U
67-64-1	Acetone	390	U
156-60-5	Trans-1,2-dichloroethene	39	U
1634-04-4	Tert-butyl Methyl Ether	39	U
108-20-3	Diisopropyl Ether	39	U
75-34-3	1,1-Dichloroethane	39	U
637-92-3	Ethyl Tert-butyl Ether	39	U
156-59-2	Cis-1,2-dichloroethene	39	U
594-20-7	2,2-Dichloropropane	39	U
74-97-5	Bromochloromethane	39	U
67-66-3	Chloroform	39	U
56-23-5	Carbon Tetrachloride	39	U
109-99-9	Tetrahydrofuran	39	U
71-55-6	1,1,1-Trichloroethane	39	U
78-93-3	2-Butanone	200	U
563-58-6	1,1-Dichloropropene	39	U
71-43-2	Benzene	39	U
75-65-0	Tert-butyl Alcohol	200	U
994-05-8	Tert-amyl Methyl Ether	39	U
107-06-2	1,2-Dichloroethane	39	U
79-01-6	Trichloroethene	39	U
74-95-3	Dibromomethane	39	U
78-87-5	1,2-Dichloropropane	39	U
75-27-4	Bromodichloromethane	39	U
123-91-1	1,4-Dioxane	9800	U
10061-01-5	Cis-1,3-dichloropropene	39	U
108-88-3	Toluene	39	U
108-10-1	4-Methyl-2-Pentanone	200	U
127-18-4	Tetrachloroethene	39	U
10061-02-6	Trans-1,3-Dichloropropene	39	U

VOLATILE ORGANICS ANALYSIS DATA SHEET

CS-4

Lab Name: New England Testing Laboratory Contract: URI
 Lab Code: RI010 Case No.: D0116-04 SAS No.: Gordon SDG No.: Gordon Ar
 Matrix: (soil/water) SOIL Lab Sample ID: CS-4
 Sample wt/vol: 13.6 (g/ml) G Lab File ID: E011521.D
 Level: (low/med) MED Date Received: 1/16/2017
 % Moisture: not dec. 6.1 Date Analyzed: 1/16/2017
 GC Column: _____ ID: _____ (mm) Dilution Factor: 1.0
 Soil Extract Volume: 10000 (uL) Soil Aliquot Volume: 100 (uL)

CONCENTRATION UNITS:

CAS NO. COMPOUND (ug/L or ug/Kg) UG/KG Q

79-00-5	1,1,2-Trichloroethane	39	U
124-48-1	Dibromochloromethane	39	U
142-28-9	1,3-Dichloropropane	39	U
106-93-4	1,2-Dibromoethane	39	U
591-78-6	2-Hexanone	200	U
108-90-7	Chlorobenzene	39	U
100-41-4	Ethylbenzene	39	U
1330-20-7	m,p-Xylene	78	U
630-20-6	1,1,1,2-Tetrachloroethane	39	U
95-47-6	o-Xylene	39	U
100-42-5	Styrene	39	U
75-25-2	Bromoform	39	U
92-82-8	Isopropylbenzene	39	U
108-86-1	Bromobenzene	39	U
103-65-1	n-Propylbenzene	39	U
79-34-5	1,1,2,2-Tetrachloroethene	39	U
95-49-8	2-Chlorotoluene	39	U
96-18-4	1,2,3-Trichloropropane	39	U
108-67-8	1,3,5-Trimethylbenzene	39	U
106-43-4	4-Chlorotoluene	39	U
98-06-6	Tert-butylbenzene	39	U
95-63-6	1,2,4-Trimethylbenzene	39	U
135-98-8	Sec-butylbenzene	39	U
99-87-6	p-Isopropyltoluene	39	U
541-73-1	1,3-Dichlorobenzene	39	U
106-46-7	1,4-Dichlorobenzene	39	U
104-51-8	n-Butyl Benzene	39	U
95-50-1	1,2-Dichlorobenzene	39	U
96-12-8	1,2-Dibromo-3-chloropropane	39	U
87-68-3	Hexachlorobutadiene	39	U
120-82-1	1,2,4-Trichlorobenzene	39	U
91-20-3	Naphthalene	200	U
87-61-6	1,2,3-Trichlorobenzene	39	U

VOLATILE ORGANICS ANALYSIS DATA SHEET

VBLANK 011517

Lab Name: New England Testing Laboratory Contract: URI
 Lab Code: RI010 Case No.: D0116-04 SAS No.: Gordon SDG No.: Gordon Ar
 Matrix: (soil/water) SOIL Lab Sample ID: VBLANK 011517
 Sample wt/vol: 10.0 (g/ml) G Lab File ID: E011507.D
 Level: (low/med) MED Date Received: 1/16/2017
 % Moisture: not dec. 0 Date Analyzed: 1/16/2017
 GC Column: _____ ID: _____ (mm) Dilution Factor: 1.0
 Soil Extract Volume: 10000 (uL) Soil Aliquot Volume: 100 (uL)

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg)	UG/KG	Q
75-71-8	Dichlorodifluoromethane	50	U	
75-87-3	Chloromethane	100	U	
75-01-4	Vinyl Chloride	50	U	
74-83-9	Bromomethane	50	U	
75-00-3	Chloroethane	50	U	
75-69-4	Trichlorofluoromethane	50	U	
60-29-7	Diethyl Ether	50	U	
75-35-4	1,1-Dichloroethene	50	U	
75-15-0	Carbon Disulfide	50	U	
75-09-2	Methylene Chloride	250	U	
67-64-1	Acetone	500	U	
156-60-5	Trans-1,2-dichloroethene	50	U	
1634-04-4	Tert-butyl Methyl Ether	50	U	
108-20-3	Diisopropyl Ether	50	U	
75-34-3	1,1-Dichloroethane	50	U	
637-92-3	Ethyl Tert-butyl Ether	50	U	
156-59-2	Cis-1,2-dichloroethene	50	U	
594-20-7	2,2-Dichloropropane	50	U	
74-97-5	Bromochloromethane	50	U	
67-66-3	Chloroform	50	U	
56-23-5	Carbon Tetrachloride	50	U	
109-99-9	Tetrahydrofuran	50	U	
71-55-6	1,1,1-Trichloroethane	50	U	
78-93-3	2-Butanone	250	U	
563-58-6	1,1-Dichloropropene	50	U	
71-43-2	Benzene	50	U	
75-65-0	Tert-butyl Alcohol	250	U	
994-05-8	Tert-amyl Methyl Ether	50	U	
107-06-2	1,2-Dichloroethane	50	U	
79-01-6	Trichloroethene	50	U	
74-95-3	Dibromomethane	50	U	
78-87-5	1,2-Dichloropropane	50	U	
75-27-4	Bromodichloromethane	50	U	
123-91-1	1,4-Dioxane	12000	U	
10061-01-5	Cis-1,3-dichloropropene	50	U	
108-88-3	Toluene	50	U	
108-10-1	4-Methyl-2-Pentanone	250	U	
127-18-4	Tetrachloroethene	50	U	
10061-02-6	Trans-1,3-Dichloropropene	50	U	

VOLATILE ORGANICS ANALYSIS DATA SHEET

VBLANK 011517

Lab Name: New England Testing Laboratory Contract: URI
 Lab Code: RI010 Case No.: D0116-04 SAS No.: Gordon SDG No.: Gordon Ar
 Matrix: (soil/water) SOIL Lab Sample ID: VBLANK 011517
 Sample wt/vol: 10.0 (g/ml) G Lab File ID: E011507.D
 Level: (low/med) MED Date Received: 1/16/2017
 % Moisture: not dec. 0 Date Analyzed: 1/16/2017
 GC Column: _____ ID: _____ (mm) Dilution Factor: 1.0
 Soil Extract Volume: 10000 (uL) Soil Aliquot Volume: 100 (uL)

CONCENTRATION UNITS:

CAS NO. COMPOUND (ug/L or ug/Kg) UG/KG Q

79-00-5	1,1,2-Trichloroethane	50	U
124-48-1	Dibromochloromethane	50	U
142-28-9	1,3-Dichloropropane	50	U
106-93-4	1,2-Dibromoethane	50	U
591-78-6	2-Hexanone	250	U
108-90-7	Chlorobenzene	50	U
100-41-4	Ethylbenzene	50	U
1330-20-7	m,p-Xylene	100	U
630-20-6	1,1,1,2-Tetrachloroethane	50	U
95-47-6	o-Xylene	50	U
100-42-5	Styrene	50	U
75-25-2	Bromoform	50	U
92-82-8	Isopropylbenzene	50	U
108-86-1	Bromobenzene	50	U
103-65-1	n-Propylbenzene	50	U
79-34-5	1,1,2,2-Tetrachloroethene	50	U
95-49-8	2-Chlorotoluene	50	U
96-18-4	1,2,3-Trichloropropane	50	U
108-67-8	1,3,5-Trimethylbenzene	50	U
106-43-4	4-Chlorotoluene	50	U
98-06-6	Tert-butylbenzene	50	U
95-63-6	1,2,4-Trimethylbenzene	50	U
135-98-8	Sec-butylbenzene	50	U
99-87-6	p-Isopropyltoluene	50	U
541-73-1	1,3-Dichlorobenzene	50	U
106-46-7	1,4-Dichlorobenzene	50	U
104-51-8	n-Butyl Benzene	50	U
95-50-1	1,2-Dichlorobenzene	50	U
96-12-8	1,2-Dibromo-3-chloropropane	50	U
87-68-3	Hexachlorobutadiene	50	U
120-82-1	1,2,4-Trichlorobenzene	50	U
91-20-3	Naphthalene	250	U
87-61-6	1,2,3-Trichlorobenzene	50	U

2B

SOIL VOLATILE SYSTEM MONITORING COMPOUND RECOVERY

Lab Name: New England Testing Laboratory Contract: URI
 Lab Code: RI010 Case No.: D0116-04 SAS No.: Gordon SDG No.: Gordon Ar
 Level: (low/med) MED

	EPA SAMPLE NO.	SMC1 #	SMC2 #	SMC3 #	TOT OUT
01	LCS 011517	109	109	113	0
02	VBLANK 01151	107	108	104	0
03	CS-1	106	108	105	0
04	CS-2	106	109	104	0
05	CS-4	107	109	105	0

QC LIMITS

SMC1 = 1,2-Dichloroethane-d4 (s) (70-130)
 SMC2 = Toluene-d8 (s) (70-130)
 SMC3 = 4-Bromofluorobenzene (S) (70-130)

Column to be used to flag recovery values
 * Values outside of contract required QC limits
 D System Monitoring Compound diluted out

Volatile Organics Laboratory Control Spike

Date Analyzed: 01/15/2017

Sample ID: LCS 011517

Compound	Spike Added	Spike Result	Recovery, %	Lower Control Limit, %	Upper Control Limit, %
1,1-Dichloroethene	50.0	54.8	110	70	129
Benzene	50.0	48.8	98	73	129
Trichloroethene	50.0	55.5	111	77	122
Toluene	50.0	50.9	102	75	123
Chlorobenzene	50.0	50.9	102	73	125

1-888-863-8522

DO116-04

Chain of Custody Record

[illegible]



REPORT OF ANALYTICAL RESULTS

NETLAB Case Number D0113-34

Prepared for:

Gordon R. Archibald, Inc.
200 Main Street
Pawtucket, RI 02860

Report Date: January 27, 2017

Director
New England Testing Laboratory, Inc.
Lab # RI010

NEW ENGLAND TESTING LABORATORY, INC.

59 Greenhill Street, West Warwick, RI 02893

(401) 353-3420

CASE NARRATIVE:

Sample Receipt

The samples were all appropriately cooled and preserved upon receipt. The samples were received in the appropriate containers. The chain of custody was adequately completed and corresponded to the samples submitted.

PCBs

All samples were extracted and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

Total Petroleum Hydrocarbons

All samples were extracted and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

The profile of the sample "BF-31-A" prevented the quantification of the associated surrogate, which was reported as 'Obscured'.

SAMPLES SUBMITTED and REQUEST FOR ANALYSIS:

The samples listed in Table I were submitted to New England Testing Laboratory on January 13, 2017. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the samples provided to us by the client which are indicated on the custody record. The case number for this sample submission is D0113-34.

Custody records are included in this report.

Site: URI – Butterfield Substation

TABLE I, Samples Submitted

Sample ID	Date Sampled	Matrix	Analysis Requested
BF-1-A	1/13/2017	Soil	Table II, III
BF-2-A	1/13/2017	Soil	Table II, III
BF-4-A	1/13/2017	Soil	Table II
BF-4-B	1/13/2017	Soil	Table II
BF-4-C	1/13/2017	Soil	Table II
BF-5-A	1/13/2017	Soil	Table II
BF-6-A	1/13/2017	Soil	Table II
BF-7-A	1/13/2017	Soil	Table II
BF-7-B	1/13/2017	Soil	Table II
BF-7-C	1/13/2017	Soil	Table II
BF-9-A	1/13/2017	Soil	Table II
BF-10-A	1/13/2017	Soil	Table II
BF-11-A	1/13/2017	Soil	Table II
BF-12-A	1/13/2017	Soil	Table II
BF-15-A	1/13/2017	Soil	Table II
BF-16-A	1/13/2017	Soil	Table II
BF-17-A	1/13/2017	Soil	Table II
BF-18-A	1/13/2017	Soil	Table II
BF-19-A	1/13/2017	Soil	Table II
BF-20-A	1/13/2017	Soil	Table II
BF-21-A	1/13/2017	Soil	Table II
BF-22-A	1/13/2017	Soil	Table II
BF-24-A	1/13/2017	Soil	Table II, III
BF-25-A	1/13/2017	Soil	Table II, III
BF-26-A	1/13/2017	Soil	Table II
BF-27-A	1/13/2017	Soil	Table II
BF-30-A	1/13/2017	Soil	Table II
BF-31-A	1/13/2017	Soil	Table II, III
BF-32-A	1/13/2017	Soil	Table II, III
BF-33-A	1/13/2017	Soil	Table II, III
BF-34-A	1/13/2017	Soil	Table II, III
BF-36-A	1/13/2017	Soil	Table II
BF-37-A	1/13/2017	Soil	Table II

TABLE I, Samples Submitted, Cont.

Sample ID	Date Sampled	Matrix	Analysis Requested
BF-38-A	1/13/2017	Soil	Table II, III
BF-40-A	1/13/2017	Soil	Table II, III
TRIP-1/13	1/13/2017	Soil	Table II

TABLE II, Analysis and Methods

ANALYSIS	PREPARATION METHOD	DETERMINATIVE METHOD
PCB's	3540C	8082A

TABLE III, Analysis and Methods

ANALYSIS	PREPARATION METHOD	DETERMINATIVE METHOD
Total Petroleum Hydrocarbons	3546	8100M

These methods are documented in:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, USEPA/OSW.

Sample: BF-1-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/16/17	1/17/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	288	28
Surrogates:		
Compound	% Recovery	Limits
Chloroctadecane	83	62-151

Sample: BF-2-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/16/17	1/17/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	28
Surrogates:		
Compound	% Recovery	Limits
Chloroctadecane	110	62-151

ND = Not Detected

*Dry Weight Basis

Sample: BF-24-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/16/17	1/16/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	27
Surrogates:		
Compound	% Recovery	Limits
Chloroctadecane	92	62-151

Sample: BF-25-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/16/17	1/17/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	27
Surrogates:		
Compound	% Recovery	Limits
Chloroctadecane	99	62-151

ND = Not Detected

*Dry Weight Basis

Sample: BF-31-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/16/17	1/17/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	4480	149
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	Obscured	62-151

Sample: BF-32-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/16/17	1/16/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	29
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	96	62-151

ND = Not Detected

*Dry Weight Basis

Sample: BF-33-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/16/17	1/16/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	29
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	96	62-151

Sample: BF-34-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/16/17	1/16/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	30
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	102	62-151

ND = Not Detected

*Dry Weight Basis

Sample: BF-38-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/16/17	1/17/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	28
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	89	62-151

Sample: BF-40-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: TPH		
Prep Method: EPA 3546	Date Extracted	Date Analyzed
Analytical Method: EPA 8100 M	1/16/17	1/17/17
Compound	Concentration, mg/kg* (ppm)	Reporting Limit mg/kg* (ppm)
Total Petroleum Hydrocarbons	ND	28
Surrogates:		
Compound	% Recovery	Limits
Chlorooctadecane	92	62-151

ND = Not Detected

*Dry Weight Basis

RESULTS: PCBs

The presence of the NETLAB LOGO in the top right corner of each page in this section indicates:

The Technical Manager of the Organics Analysis Department certifies that the samples included in this section have been prepared and analyzed using the procedures cited and that the results have been reviewed and approved. Any exceptions or qualifications of substance have been reported in the case narrative.

Sample: BF-1-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	524	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	78	30-129
DCBP	96	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-2-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	84	30-129
DCBP	94	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-4-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	93	30-129
DCBP	99	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-4-B		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	92	30-129
DCBP	95	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-4-C		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	78	30-129
DCBP	91	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-5-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	78	30-129
DCBP	83	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-6-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	82	30-129
DCBP	89	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-7-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	84	30-129
DCBP	93	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-7-B		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	89	30-129
DCBP	94	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-7-C		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	82	30-129
DCBP	93	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-9-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	85	30-129
DCBP	91	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-10-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	85	30-129
DCBP	90	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-11-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	92	30-129
DCBP	98	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-12-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	85	30-129
DCBP	92	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-15-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	96	30-129
DCBP	96	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-16-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	80	30-129
DCBP	90	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-17-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	84	30-129
DCBP	84	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-18-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	94	30-129
DCBP	99	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-19-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	82	30-129
DCBP	94	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-20-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	91	30-129
DCBP	97	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-21-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	90	30-129
DCBP	104	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-22-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	86	30-129
DCBP	111	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-24-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	80	30-129
DCBP	88	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-25-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	81	30-129
DCBP	88	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-26-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	80	30-129
DCBP	88	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-27-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	81	30-129
DCBP	90	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-30-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	73	30-129
DCBP	90	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-31-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	79	30-129
DCBP	92	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-32-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	85	30-129
DCBP	91	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-33-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	85	30-129
DCBP	95	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-34-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	84	30-129
DCBP	94	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-36-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	82	30-129
DCBP	92	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-37-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	80	30-129
DCBP	84	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-38-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	85	30-129
DCBP	86	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: BF-40-A		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	80	30-129
DCBP	86	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: Trip-1/13		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: 1/13/2017		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	91	30-129
DCBP	96	37-126

N.D. = Not Detected

* = Dry Weight Basis

Sample: Method Blank		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: NA		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/17/17	1/19/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	87	30-129
DCBP	90	37-126

N.D. = Not Detected

Sample: Method Blank		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: NA		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/18/17	1/20/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	77	30-129
DCBP	89	37-126

N.D. = Not Detected

Sample: Method Blank		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: NA		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/19/17	1/23/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	78	30-129
DCBP	89	37-126

N.D. = Not Detected

Sample: Method Blank		Analyst's Initials: BJ
Case No.: D0113-34		
Date Collected: NA		
Sample Matrix: Soil		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/25/17	1/27/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg* (ppb)	Reporting Limit ug/kg* (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	91	30-129
DCBP	105	37-126

N.D. = Not Detected

PCB Laboratory Control Spike

Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3540C	1/17/17			1/19/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/kg	Result mg/kg	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.508	102	72-118
Aroclor 1260	0.500	0.493	99	73-131
Surrogates:				
Compound	% Recovery	Limits		
TCMX	88	30-129		
DCBP	89	37-126		

PCB Laboratory Control Spike

Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3540C	1/18/17			1/20/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/kg	Result mg/kg	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.436	87	72-118
Aroclor 1260	0.500	0.469	94	73-131
Surrogates:				
Compound	% Recovery	Limits		
TCMX	81	30-129		
DCBP	90	37-126		

PCB Laboratory Control Spike

Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3540C	1/19/17			1/23/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/kg	Result mg/kg	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.496	99	72-118
Aroclor 1260	0.500	0.508	102	73-131
Surrogates:				
Compound	% Recovery	Limits		
TCMX	87	30-129		
DCBP	90	37-126		

PCB Laboratory Control Spike

Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3540C	1/25/17			1/27/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/kg	Result mg/kg	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.483	97	72-118
Aroclor 1260	0.500	0.518	104	73-131
Surrogates:				
Compound	% Recovery	Limits		
TCMX	90	30-129		
DCBP	96	37-126		

New England Testing Laboratory

59 Greenhill Street
West Warwick, RI 02893
1-888-863-8522

D0113-34

Chain of Custody Record

Project No.		Project Name/Location: URI - Butterfield Substation		Matrix		Preservative		Tests**	
Client: Gordon R. Archibald Inc.		Report To: Steve Cadorette, GRA		No. of Containers					
Invoice To: Steve Cadorette, GRA									
Date	Time	Comp	Grab	Sample I.D.	Aqueous	Soil	Other	No. of Containers	Preservative
1/13/17			X	BF-1-A	X			2	None
				BF-2-A	X			2	None
				BF-4-A				1	None
				BF-4-B				1	None
				BF-4-C				1	None
				BF-5-A				1	None
				BF-6-A				1	None
				BF-7-A				1	None
				BF-7-B				1	None
				BF-7-C				1	None
				BF-9-A				1	None
				BF-10-A				1	None
				BF-11-A				1	None
				BF-12-A				1	None
Sampled By: DREW NEUAS		Date/Time 1/13/17 1330	Received By:		Date/Time	Laboratory Remarks:		Special Instructions:	
Relinquished By:		Date/Time 1/13/17 1615	Received By:		Date/Time 1/13/17 1615	Temp. Received:			
<p>**Netlab Subcontracts the following tests: Radiologicals, Radon, TOC, Asbestos, UCMRs, Perchlorate, Bromate, Bromide, Sieve, Salmonella, Carbamates</p>									
Turnaround Time [Business Days]: 5 Days									

59 Greenhill Street
West Warwick, RI 02893
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2013-34

Project No.	Project Name/Location:	Project Name/Location:	Matrix	Preservative		Tests**											
Client:	Report To:	Invoice To:	Aqueous	Soil	Other	No. of Containers											
Date	Time	Sample I.D.	Comp	Grab													
1/13/17		BF-15-A	X	X		1	Non										
		BF-16-A				1											
		BF-17-A				1											
		BF-18-A				1											
		BF-19-A				1											
		BF-20-A				1											
		BF-21-A				1											
		BF-22-A				1											
		BF-24-A				2											
		BF-25-A				2											
		BF-26-A				1											
		BF-27-A				1											
		BF-30-A				1											
		BF-31-A				2											
Sampled By:	Received By:	Date/Time	Date/Time	Date/Time	Laboratory Remarks:												
Brent Neuman		1/13/17	1330	1/13/17													
Relinquished By:	Received By:	Date/Time	Date/Time	Date/Time	Special Instructions:												
Brent Neuman		1/13/17	1615	1/13/17													
					Temp. Received: 16.5												

**Netlab Subcontracts the following tests: Radiologicals, Radon, TOC, Asbestos, UCMRs, Perchlorate, Bromate, Bromide, Sieve, Salmonella, Carbamates

Turnaround Time [Business Days]: 5 Days

***Netlab Subcontracts the following tests: Radiologicals, Radon, TOC, Asbestos, UCMRs, Perchlorate, Bromate, Bromide, Sieve, Salmonella, Carbamates

New England Testing Laboratory

59 Greenhill Street
West Warwick, RI 02893
1-888-863-8522

Chain of Custody Record

Do113-34

Project No.		Project Name/Location: URI - Butterfield Substation				Matrix		Preservative		Tests**					
Client:		Gordon R. Archibald Inc.				Aqueous		No. of Containers							
Report To:		Steve Cadorette, GRA				Soil									
Invoice To:		Steve Cadorette, GRA				Other									
Date	Time	Comp	Grab	Sample I.D.											
1/13/17		X		BF-32-A				Non		PCB					
				BF-33-A						XXX					
				BF-34-A						XXX					
				BF-36-A						XXX					
				BF-37-A						XXX					
				BF-38-A						XXX					
				BF-40-A						XXX					
				TRIP - 1/13				Non		XXX					
Sampled By:		Date/Time		Received By:		Date/Time		Laboratory Remarks:		Special Instructions:					
Breen Newman		1/13/17 1330													
Relinquished By:		Date/Time		Received By:		Date/Time		Temp. Received:							
Breen Newman		1/13/17 1615				1/13/17		1615							
**Netlab Subcontracts the following tests: Radiologicals, Radon, TOC, Asbestos, UCMRs, Perchlorate, Bromate, Bromide, Sieve, Salmonella, Carbamates														Turnaround Time [Business Days]: 5 Days	



REPORT OF ANALYTICAL RESULTS

NETLAB Case Number D0113-33

Prepared for:

Gordon R. Archibald, Inc.
200 Main Street
Pawtucket, RI 02860

Report Date: January 18, 2017

Director
New England Testing Laboratory, Inc.
Lab # RI010

NEW ENGLAND TESTING LABORATORY, INC.

59 Greenhill Street, West Warwick, RI 02893

(401) 353-3420

SAMPLES SUBMITTED and REQUEST FOR ANALYSIS:

The samples listed in Table I were submitted to New England Testing Laboratory on January 13, 2017. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the samples provided to us by the client which are indicated on the custody record. The case number for this sample submission is D0113-33.

Custody records are included in this report.

Site: URI – Butterfield Substation

TABLE I, Samples Submitted

Sample ID	Date Sampled	Matrix	Analysis Requested
EQ-SH-1/13	1/13/2017	Water	Table II

TABLE II, Analysis and Methods

ANALYSIS	PREPARATION METHOD	DETERMINATIVE METHOD
PCB's	3510C	8082A

These methods are documented in:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, USEPA/OSW.

CASE NARRATIVE:

Sample Receipt

The samples were all appropriately cooled and preserved upon receipt. The samples were received in the appropriate containers. The chain of custody was adequately completed and corresponded to the samples submitted.

PCBs

All samples were extracted and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

The sample has one surrogate outside quality control limits due to matrix interference during the extraction process.

RESULTS: PCBs

The presence of the NETLAB LOGO in the top right corner of each page in this section indicates:

The Technical Manager of the Organics Analysis Department certifies that the samples included in this section have been prepared and analyzed using the procedures cited and that the results have been reviewed and approved. Any exceptions or qualifications of substance have been reported in the case narrative.

Sample: EQ-SH-1/13		Analyst's Initials: BJ
Case No. D0113-33		
Date Collected: 1/13/2017		
Sample Matrix: Water		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3510C	1/17/17	1/17/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/l (ppb)	Reporting Limit ug/l (ppb)
Aroclor-1016	N.D.	0.2
Aroclor-1221	N.D.	0.2
Aroclor-1232	N.D.	0.2
Aroclor-1242	N.D.	0.2
Aroclor-1248	N.D.	0.2
Aroclor-1254	N.D.	0.2
Aroclor-1260	N.D.	0.2
Aroclor-1262	N.D.	0.2
Aroclor-1268	N.D.	0.2
Surrogates:		
Compound	% Recovery	Limits
TCMX	44	30-129
DCBP	11	30-126

N.D. = Not Detected

Sample: Method Blank		Analyst's Initials: BJ
Case No. D0113-33		
Date Collected: NA		
Sample Matrix: Water		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3510C	1/17/17	1/17/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/l (ppb)	Reporting Limit ug/l (ppb)
Aroclor-1016	N.D.	0.2
Aroclor-1221	N.D.	0.2
Aroclor-1232	N.D.	0.2
Aroclor-1242	N.D.	0.2
Aroclor-1248	N.D.	0.2
Aroclor-1254	N.D.	0.2
Aroclor-1260	N.D.	0.2
Aroclor-1262	N.D.	0.2
Aroclor-1268	N.D.	0.2
Surrogates:		
Compound	% Recovery	Limits
TCMX	66	30-129
DCBP	84	30-126

N.D. = Not Detected

PCB Laboratory Control Spike

Sample Matrix: Water				
Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3510C	1/17/17			1/17/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/l	Result mg/l	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.504	101	40-130
Aroclor 1260	0.500	0.526	105	40-130
Surrogates:				
Compound	% Recovery	Limits		
TCMX	86	30-129		
DCBP	80	30-126		

**59 Greenhill Street
West Warwick, RI 02893
1-888-863-8522**

2013-33

Chain of Custody Record

[illegible]



REPORT OF ANALYTICAL RESULTS

NETLAB Case Number D0113-32

Prepared for:

Gordon R. Archibald, Inc.
200 Main Street
Pawtucket, RI 02860

Report Date: January 20, 2017

Director
New England Testing Laboratory, Inc.
Lab # RI010

NEW ENGLAND TESTING LABORATORY, INC.

59 Greenhill Street, West Warwick, RI 02893

(401) 353-3420

SAMPLES SUBMITTED and REQUEST FOR ANALYSIS:

The samples listed in Table I were submitted to New England Testing Laboratory on January 13, 2017. The group of samples appearing in this report was assigned an internal identification number (case number) for laboratory information management purposes. The client's designations for the individual samples, along with our case numbers, are used to identify the samples in this report. This report of analytical results pertains only to the samples provided to us by the client which are indicated on the custody record. The case number for this sample submission is D0113-32.

Custody records are included in this report.

Site: URI – Butterfield Station

TABLE I, Samples Submitted

Sample ID	Date Sampled	Matrix	Analysis Requested
BF-12-CN	1/12/2017	Concrete	Table II
BF-30-CN	1/12/2017	Concrete	Table II
BF-32-CN	1/12/2017	Concrete	Table II
BF-39-CN	1/12/2017	Concrete	Table II
BF-2-W	1/12/2017	Wipe	Table II
BF-24-W	1/12/2017	Wipe	Table II
BF-25-W	1/12/2017	Wipe	Table II
BF-27-W	1/12/2017	Wipe	Table II
BF-38-W	1/12/2017	Wipe	Table II

TABLE II, Analysis and Methods

ANALYSIS	PREPARATION METHOD	DETERMINATIVE METHOD
PCB's	3540C	8082A

These methods are documented in:

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, USEPA/OSW.

CASE NARRATIVE:

Sample Receipt

The samples were all appropriately cooled and preserved upon receipt. The samples were received in the appropriate containers. The chain of custody was adequately completed and corresponded to the samples submitted.

PCBs

All samples were extracted and analyzed within method specified holding times and according to NETLAB's documented standard operating procedures. The results for the associated calibration, method blank and laboratory control sample (LCS) were within method specified quality control criteria.

RESULTS: PCBs

The presence of the NETLAB LOGO in the top right corner of each page in this section indicates:

The Technical Manager of the Organics Analysis Department certifies that the samples included in this section have been prepared and analyzed using the procedures cited and that the results have been reviewed and approved. Any exceptions or qualifications of substance have been reported in the case narrative.

Sample: BF-12-CN		Analyst's Initials: BJ
Case No.: D0113-32		
Date Collected: 1/12/2017		
Sample Matrix: Solid		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/16/17	1/18/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg (ppb)	Reporting Limit ug/kg (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	108	30-129
DCBP	104	37-126

N.D. = Not Detected

Sample: BF-30-CN		Analyst's Initials: BJ
Case No.: D0113-32		
Date Collected: 1/12/2017		
Sample Matrix: Solid		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/16/17	1/18/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg (ppb)	Reporting Limit ug/kg (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	51	30-129
DCBP	72	37-126

N.D. = Not Detected

Sample: BF-32-CN		Analyst's Initials: BJ
Case No.: D0113-32		
Date Collected: 1/12/2017		
Sample Matrix: Solid		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/16/17	1/18/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg (ppb)	Reporting Limit ug/kg (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	79	30-129
DCBP	93	37-126

N.D. = Not Detected

Sample: BF-39-CN		Analyst's Initials: BJ
Case No.: D0113-32		
Date Collected: 1/12/2017		
Sample Matrix: Solid		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/16/17	1/18/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg (ppb)	Reporting Limit ug/kg (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	96	30-129
DCBP	104	37-126

N.D. = Not Detected

Sample: Method Blank		Analyst's Initials: BJ
Case No.: D0113-32		
Date Collected: NA		
Sample Matrix: Solid		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/16/17	1/18/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/kg (ppb)	Reporting Limit ug/kg (ppb)
Aroclor-1016	N.D.	200
Aroclor-1221	N.D.	200
Aroclor-1232	N.D.	200
Aroclor-1242	N.D.	200
Aroclor-1248	N.D.	200
Aroclor-1254	N.D.	200
Aroclor-1260	N.D.	200
Aroclor-1262	N.D.	200
Aroclor-1268	N.D.	200
Surrogates:		
Compound	% Recovery	Limits
TCMX	81	30-129
DCBP	92	37-126

N.D. = Not Detected

PCB Laboratory Control Spike

Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3540C	1/16/17			1/18/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/kg	Result mg/kg	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.471	94	72-118
Aroclor 1260	0.500	0.500	100	73-131
Surrogates:				
Compound	% Recovery	Limits		
TCMX	81	30-129		
DCBP	90	37-126		

RESULTS: PCBs

The presence of the NETLAB LOGO in the top right corner of each page in this section indicates:

The Technical Manager of the Organics Analysis Department certifies that the samples included in this section have been prepared and analyzed using the procedures cited and that the results have been reviewed and approved. Any exceptions or qualifications of substance have been reported in the case narrative.

Sample: BF-2-W		Analyst's Initials: BJ
Case No.: D0113-32		
Date Collected: 1/12/2017		
Sample Matrix: Wipe		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/16/17	1/18/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/100cm ²	Reporting Limit ug/100cm ²
Aroclor-1016	N.D.	1.0
Aroclor-1221	N.D.	1.0
Aroclor-1232	N.D.	1.0
Aroclor-1242	N.D.	1.0
Aroclor-1248	N.D.	1.0
Aroclor-1254	N.D.	1.0
Aroclor-1260	N.D.	1.0
Aroclor-1262	N.D.	1.0
Aroclor-1268	N.D.	1.0
Surrogates:		
Compound	% Recovery	Limits
TCMX	86	30-129
DCBP	85	37-126

N.D. = Not Detected

Sample: BF-24-W		Analyst's Initials: BJ
Case No.: D0113-32		
Date Collected: 1/12/2017		
Sample Matrix: Wipe		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/16/17	1/18/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/100cm ²	Reporting Limit ug/100cm ²
Aroclor-1016	N.D.	1.0
Aroclor-1221	N.D.	1.0
Aroclor-1232	N.D.	1.0
Aroclor-1242	N.D.	1.0
Aroclor-1248	N.D.	1.0
Aroclor-1254	N.D.	1.0
Aroclor-1260	N.D.	1.0
Aroclor-1262	N.D.	1.0
Aroclor-1268	N.D.	1.0
Surrogates:		
Compound	% Recovery	Limits
TCMX	86	30-129
DCBP	88	37-126

N.D. = Not Detected

Sample: BF-25-W		Analyst's Initials: BJ
Case No.: D0113-32		
Date Collected: 1/12/2017		
Sample Matrix: Wipe		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/16/17	1/18/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/100cm ²	Reporting Limit ug/100cm ²
Aroclor-1016	N.D.	1.0
Aroclor-1221	N.D.	1.0
Aroclor-1232	N.D.	1.0
Aroclor-1242	N.D.	1.0
Aroclor-1248	N.D.	1.0
Aroclor-1254	N.D.	1.0
Aroclor-1260	N.D.	1.0
Aroclor-1262	N.D.	1.0
Aroclor-1268	N.D.	1.0
Surrogates:		
Compound	% Recovery	Limits
TCMX	82	30-129
DCBP	85	37-126

N.D. = Not Detected

Sample: BF-27-W		Analyst's Initials: BJ
Case No.: D0113-32		
Date Collected: 1/12/2017		
Sample Matrix: Wipe		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/16/17	1/18/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/100cm ²	Reporting Limit ug/100cm ²
Aroclor-1016	N.D.	1.0
Aroclor-1221	N.D.	1.0
Aroclor-1232	N.D.	1.0
Aroclor-1242	N.D.	1.0
Aroclor-1248	N.D.	1.0
Aroclor-1254	N.D.	1.0
Aroclor-1260	N.D.	1.0
Aroclor-1262	N.D.	1.0
Aroclor-1268	N.D.	1.0
Surrogates:		
Compound	% Recovery	Limits
TCMX	84	30-129
DCBP	87	37-126

N.D. = Not Detected

Sample: BF-38-W		Analyst's Initials: BJ
Case No.: D0113-32		
Date Collected: 1/12/2017		
Sample Matrix: Wipe		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/16/17	1/18/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/100cm ²	Reporting Limit ug/100cm ²
Aroclor-1016	N.D.	1.0
Aroclor-1221	N.D.	1.0
Aroclor-1232	N.D.	1.0
Aroclor-1242	N.D.	1.0
Aroclor-1248	N.D.	1.0
Aroclor-1254	N.D.	1.0
Aroclor-1260	N.D.	1.0
Aroclor-1262	N.D.	1.0
Aroclor-1268	N.D.	1.0
Surrogates:		
Compound	% Recovery	Limits
TCMX	87	30-129
DCBP	91	37-126

N.D. = Not Detected

Sample: Method Blank		Analyst's Initials: BJ
Case No.: D0113-32		
Date Collected: NA		
Sample Matrix: Wipe		
Subject: PCBs	Date Extracted	Date Analyzed
Prep Method: EPA 3540C	1/16/17	1/18/17
Analytical Method: EPA 8082A		
Compound	Concentration ug/100cm ²	Reporting Limit ug/100cm ²
Aroclor-1016	N.D.	1.0
Aroclor-1221	N.D.	1.0
Aroclor-1232	N.D.	1.0
Aroclor-1242	N.D.	1.0
Aroclor-1248	N.D.	1.0
Aroclor-1254	N.D.	1.0
Aroclor-1260	N.D.	1.0
Aroclor-1262	N.D.	1.0
Aroclor-1268	N.D.	1.0
Surrogates:		
Compound	% Recovery	Limits
TCMX	88	30-129
DCBP	95	37-126

N.D. = Not Detected

NA = Not Applicable

PCB Laboratory Control Spike

Subject: PCB	Date Extracted			Date Analyzed
Prep Method: EPA 3540C	1/16/17			1/18/17
Analytical Method: EPA 8082A				
Compound	Amount Spiked mg/kg	Result mg/kg	Recovery %	Recovery Limits
Aroclor 1016	0.500	0.471	94	72-118
Aroclor 1260	0.500	0.500	100	73-131
Surrogates:				
Compound	% Recovery	Limits		
TCMX	81	30-129		
DCBP	90	37-126		

New England Testing Laboratory

59 Greenhill Street
West Warwick, RI 02893
1-888-863-8522

Chain of Custody Record

D0113-32

Project No.		Project Name/Location: URI - Butterfield Substation				Matrix		Preservative		Tests**					
Client: Gordon R. Archibald Inc.		Report To: Steve Cadorette, GRA		Invoice To: Steve Cadorette, GRA		Aqueous		No. of Containers		STONE WIDE (PCB)		CONCRETE (PCB)			
Date	Time	Comp	Grab	Sample I.D.		Soil									
1/12/17	AM	X	X	BF-12-CN		X		1		Non		X			
				BF-30-CN		X		1							
				BF-32-CN		X		1							
				BF-39-CN		X		1							
	PM	X	X	BF-21-W		X		1		CGHM		X			
				BF-24-W		X		1							
				BF-25-W		X		1							
				BF-27-W		X		1							
				BF-38-W		X		1							
Sampled By:		Date/Time	Received By:	Date/Time		Laboratory Remarks:		Special Instructions:							
BETTY NEUMAN		1/12/17	1430	1/13/17		Temp. Received:									
Relinquished By:		Date/Time	Received By:	Date/Time		Temp. Received:									
BETTY NEUMAN		1/12/17	1615	1/13/17		1615									
**Netlab Subcontracts the following tests: Radiologicals, Radon, TOC, Asbestos, UCMRs, Perchlorate, Bromate, Bromide, Sieve, Salmonella, Carbamates														Turnaround Time [Business Days]: 5 Days	

APPENDIX C

ANALYTICAL TESTING REQUIREMENTS FOR IMPORTED SOIL

SECTION 312312

ANALYTICAL TESTING REQUIREMENTS FOR IMPORTED SOIL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Obtaining and screening soil samples from soil sources to be imported and incorporated into the Project areas where non-compliant soils have been identified.
- B. Related Documents: The Contract Documents, as defined in the Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
 - 1. Site Investigation Report, University of Rhode Island, Butterfield Road Substation, South Kingstown, Rhode Island, dated April 2017 prepared by Gordon R. Archibald, Inc.
- C. Related Sections:
 - 1. Section 312300 Excavation and Backfilling
 - 2. Section 312310 Contaminated Soil Excavation

1.2 REFERENCES

- A. Rhode Island Department of Environmental Management
 - 1. State of Rhode Island and Providence Plantations Department of Environmental Management Hazardous Materials Rules and Regulations for Hazardous Waste Management, Regulation #DEM OWM –HW 01-14, including all amendments and revisions.
- B. Rhode Island Department of Transportation
 - 1. Standard Specifications for Road and Bridge Construction, dated 2010, including all amendments and revisions.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Prior to commencing construction, the Contractor shall submit to the Owner a list of soil sources for each classification of soil to be imported and incorporated into the Project areas where non-compliant soils have been identified.
 - b. The list for each soil classification shall state the location of material, Owner, anticipated quantity of soil to be imported, material state (in situ, stockpiled), material condition (virgin, processed, reclaimed, recycled from another Project) and any known environmental history associated with material conditions.
 - 2. Samples:
 - a. Prior to commencing construction, the Contractor shall submit to the Owner a Sampling and Analytical Work Plan (SAWP) outlining the methodology used to collect, preserve, analyze and report soil sample results. As minimum, the SAWP shall include:
 - 1) Sample collection methods including a description of sampling equipment, grab sample size and how representative grab samples will be obtained from in situ undeveloped and developed borrow sources and/or from stockpiled processed, reclaimed and/or recycled borrow sources;

- 2) Procedures for decontamination of sampling equipment prior to and between obtaining successive samples;
 - 3) Sample container, storage and preservation procedures and holding times;
 - 4) Sample handling, packaging, and transportation protocols;
 - 5) Sample documentation (labeling, chain-of custody, log book); and
 - 6) Sampling and analysis quality assurance/quality control procedures.
- b. The Contractor shall provide third party soil sampling with all samples analyzed at an analytical laboratory who meets the minimum requirements and guidelines to conduct chemical analysis, as developed by the EPA. The analytical laboratory shall be approved/certified by the Rhode Island Department of Environmental Management. The detection limit for all analytical results shall be below the acceptance criteria outlined in this Special Provision.
 - c. The soil sampling frequency (which is dependent on soil borrow source and contaminant) and a list of contaminants to be analyzed for each soil classification are as outlined in this special Provision. The Contractor shall submit to the Owner two copies of a report that includes soil analytical results, applicable QA/QC data and chains of custody a minimum of one month prior to importing each classification of soil outlined in these Special Provisions to be imported and incorporated into the Project. The submittal shall include an opinion authored by a professional engineer registered in the State of Rhode Island and Providence Plantations who has a minimum of 10 years of experience evaluating soil compliance with the RIDEM's Remediation Regulations Method 1 soil direct exposure criteria and leachability criteria that the soil classification is compliant with the Project Specification requirements for that soil classification. The Owner shall review this submittal. The soil classification shall not be imported into the Project Limits until the Owner has provided written concurrence that the soil classification meets the Specification requirements for the soil classification.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The Contractor shall be responsible for furnishing all equipment, personnel and subcontractors required to complete and submit soil testing required in this Special Provisions.
- B. All materials to be used shall be in accordance with all appropriate sections of the Rhode Island Standard Specifications for Road and Bridge Construction, Amended 2010, with all revisions.

PART 3 - EXECUTION

3.1 TESTING

- A. Soil imported to the Project for use as Common Borrow, Gravel Borrow, Fill Gravel Borrow Under Structures, Pervious Fill, or Offsite Material Used for Soil Blending (Gravel Borrow only) used up to a non-impervious surface shall be shown to have an average contaminant level below the Rhode Island Department of Environmental Management (RIDEM) Method 1 RIDEM Residential Direct Exposure Criteria (RDEC) for TPH, VOC, SVOCs (16 PAH priority pollutants only) and RCRA 8 Metals prior to delivery to the Project.

Soil imported from a non-developed borrow source shall be tested at a frequency of 1 sample for every 5,000 cubic yards of in situ soil with a minimum of 2 samples per borrow source. Soil imported from another project or development borrow source shall be tested at a frequency of 1 sample for every

2,000 cubic yards with a minimum of 2 samples per borrow source. Contaminants to be tested, the test methods and acceptance shall be as outlined in the following table:

Constituent	Test Method	Minimum Detection Level
TPH	EPA Method 8100M	Below RIDEM Method 1 R-DEC
VOC	EPA Method 8260B	Below RIDEM Method 1 R-DEC
Semi-VOCs (16 PAHs only)	EPA Method 8270C	Below RIDEM Method 1 R-DEC
RCRA Eight Metals	EPA Methods 6010 and 7471A	Below RIDEM Method 1 R-DEC

Notes:

1. Item Gravel Borrow Subbase shall not require testing.
 2. The only exception is Arsenic, wherein the acceptance and sampling frequency criteria include the following:
 - a. No individual sample result shall be greater than 15 mg/kg;
 - b. A minimum of 10 soil samples per first 2,000 cubic yards with 2 additional soil samples per each additional 2,000 cubic yards of borrow source;
 - c. No greater than 10% of sample results shall exceed 7.0 mg/kg; and
 - d. The average of all sample results shall be 7.0 mg/kg or less.
- B. Soil imported to the Project for use as Loam Borrow or Plantable Soil in Project areas where non-compliant soils have been identified shall be shown to have an average contaminant level below the RIDEM Residential Direct Exposure Criteria (RDEC) for TPH, VOC, SVOCs (16 PAH priority pollutants only) and RCRA Eight Metals prior to delivery to the Project. Soil shall be tested at a frequency of 1 sample for every 2,000 cubic yards with a minimum of 2 samples per borrow source. Contaminants to be tested, the test methods and acceptance shall be as outlined in the following table:

Constituent	Test Method	Minimum Detection Level
TPH	EPA Method 8100M	Below RIDEM Method 1 R-DEC
VOC	EPA Method 8260B	Below RIDEM Method 1 R-DEC
Semi-VOCs (16 PAHs only)	EPA Method 8270C	Below RIDEM Method 1 R-DEC
RCRA Eight Metals	EPA Methods 6010 and 7471A	Below RIDEM Method 1 R-DEC

Notes:

1. The only exception is Arsenic, wherein the acceptance and sampling frequency criteria include the following:
 - a. No individual sample result shall be greater than 15 mg/kg;
 - b. A minimum of 10 soil samples per first 2,000 cubic yards with 2 additional soil samples per each additional 2,000 cubic yards of borrow source;
 - c. No greater than 10% of sample results shall exceed 7.0 mg/kg; and
 - d. The average of all sample results shall be 7.0 mg/kg or less.
- C. Soil imported to the Project for use as Special Graded Aggregate for Shaping and Trimming Driveways or Shoulders or Crushed Stone Surface Treatment used in top 2 feet of final grades in Project areas where non-compliant soils have been identified shall be shown to have an average contaminant level below the Rhode Island Department of Environmental Management (RIDEM) Method 1 Residential Direct Exposure Criteria (RDEC) for TPH, VOC, SVOCs (16 PAH priority pollutants only) and RCRA Eight Metals 1 prior to delivery to the Project. Soil shall be tested at a frequency of 1 sample for every 2,000 cubic yards with a minimum of 2 samples per borrow source. Contaminants to be tested, the test methods and acceptance shall be as outlined in the following table:

Constituent	Test Method	Minimum Detection Level
TPH	EPA Method 8100M	Below RIDEM Method 1 RDEC
VOC	EPA Method 8260B	Below RIDEM Method 1 RDEC
Semi-VOCs (16 PAHs only)	EPA Method 8270C	Below RIDEM Method 1 RDEC
RCRA Eight Metals	EPA Methods 6010 and 7471A	Below RIDEM Method 1 RDEC

Notes:

1. The only exception is Arsenic, wherein the acceptance and sampling frequency criteria include the following:
 - a. No individual sample result shall be greater than 15 mg/kg;
 - b. A minimum of 10 soil samples per first 2,000 cubic yards with 2 additional soil samples per each additional 2,000 cubic yards of borrow source;
 - c. No greater than 10% of sample results shall exceed 7.0 mg/kg; and
 - d. The average of all sample results shall be 7.0 mg/kg or less.

3.2 ACCEPTANCE CRITERIA

Contaminant	RDEC (mg/kg)	I/C-DEC (mg/kg)	Contaminant	RDEC (mg/kg)	I/C-DEC (mg/kg)
Volatiles					
Acetone	7,800	10,000	Ethylene dibromide	0.01	0.07
Benzene	2.5	200	Isopropyl benzene	27	10,000
Bromodichloromethane	10	92	Methyl ethyl ketone	10,000	10,000
Bromoform	81	720	Methyl isobutyl ketone	1,200	10,000
Bromomethane	0.8	2,900	Methyl tertiary-butyl ether (MTBE)	390	10,000
Carbon tetrachloride	1.5	44	Methylene chloride	45	760
Chlorobenzene	210	10,000	Styrene	13	190
Chloroform	1.2	940	1,1,1,2-Tetrachloroethane	2.2	220
Dibromochloromethane	7.6	68	1,1,2,2-Tetrachloroethane	1.3	29
1,2- Dibromo-3-chloropropane (DBCP)	0.5	41	Tetrachloroethene	12	110
1,1-Dichloroethane	920	10,000	Toluene	190	10,000
1,2-Dichloroethane	0.9	63	Trichloroethane	540	10,000
1,1-Dichloroethene	0.2	9.5	1,1,2-Trichloroethane	3.6	100
cis-1,2-Dichloroethene	630	10,000	Trichloroethene	13	520
Trans-1,2-Dichloroethene	1,100	10,000	Vinyl chloride	0.02	3.0
1,2-Dichloropropane	1.9	84	Xylenes (Total)	110	10,000
Ethylbenzene	71	10,000			
Semi-Volatiles					
Acenaphthene	43	10,000	Chrysene	0.4	780
Acenaphthylene	23	10,000	Dibenz(a,h)anthracene ^a	0.4	0.8
Anthracene	35	10,000	Fluoranthene	20	10,000
Benzo(a)anthracene	0.9	7.8	Fluorene	28	10,000
Benzo(a)pyrene	0.4	0.8	Indeno(1,2,3-cd)pyrene	0.9	7.8
Benzo(b)fluoranthene	0.9	7.8	Naphthalene	54	10,000
Benzo(g,h,i)perylene	0.8	10,000	Phenanthrene	40	10,000
Benzo(k)fluoranthene	0.9	7.8	Pyrene	13	10,000
RCRA 8 Metals					
Arsenic ^b	7.0	7.0	Lead ^c	150	500
Barium	5,500	10,000	Mercury	23	610
Cadmium	39	1,000	Selenium	390	10,000
Chromium III (Trivalent)	1,400	10,000	Silver	200	10,000
Chromium VI (Hexavalent)	390	10,000			

Soil Criteria as presented is based on the RI DEM Method 1 Criteria. See notes below for qualifiers

^a Estimated quantitation limits

^b Background Levels of Priority Pollutant Metals In Rhode Island Soils, T. O'Connor, RIDEM. For arsenic, see Section 12.0

^c Direct exposure criteria for Lead consistent with the Rhode Island Department of Health Rules and Regulations for Lead Poisoning Prevention [R23-24.6-PB], as amended

END OF SECTION

REMEDIAL ACTION WORK PLAN

University of Rhode Island
Butterfield Road Substation
South Kingstown, Rhode Island
RIDEM File Number SR-32-1841

July 2017

Prepared for:

University of Rhode Island
Office of Capital Projects
60 Tootell Road – Sherman Building
Kingston, Rhode Island 02881

Prepared by:

Gordon R. Archibald, Inc.
200 Main Street
Pawtucket, Rhode Island

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Figures

Figure 1 Site Locus Plan

Appendices

APPENDIX A – Abutter Notification
APPENDIX B – Butterfield Road Substation Plan Set
APPENDIX C – RIDEM Environmental Land Use Restriction Template
APPENDIX D – RIDEM Soil Management Plan Template
APPENDIX E – Analytical Testing Requirements for Imported Soil

Gordon R. Archibald Inc. (GRA) provides the following Remedial Action Work Plan (RAWP) for the Butterfield Road Substation at the University of Rhode Island (URI) in South Kingstown, Rhode Island (project area). The Rhode Island Department of Environmental Management – Office of Waste Management (RIDEM-OWM) identifies the site as SR-32-1841. RIDEM issued a Program Letter for the above project dated May 19, 2017 approving the proposed remedial alternative, soil excavation with off-site disposal. URI completed the public notification on June 13, 2017. Copies of the abutter notification letter and certified mail receipt are provided in **Appendix A**.

1.0 Proposed Project

The University of Rhode Island (URI) is currently in the final design phase of a project to remove the remaining Butterfield Road Substation infrastructure and convert the area to landscaped space. URI indicated that the long term transportation plan for this area is to potentially construct a traffic roundabout at the intersection of West Alumni Avenue and Butterfield Road. However, the transportation study is in the preliminary phase and has not advanced to the point where roundabout construction plans are available.

The active subsurface utilities within the Butterfield Substation will not be removed or relocated as part of the remedial work. The electric conduit shown on the Sampling Location Plan enters into the substation's southeast corner, connects to an electric manhole, and then exits the substation's east side. This electric conduit is a main electric line for the University. The electric manhole is located in a concrete pad that will not be removed as part of the remedial work.

2.0 Site Regulatory Information

URI is an institution of higher learning. The RIDEM Remediation Regulations school definition does not include institutions of higher learning. The site investigation area is surrounded roadway, parking lots, and dormitories. The northern abutting area, utilized as dormitories by the URI, is considered a dwelling and falls under residential use. The current use of this area is consistent with the RIDEM Remediation Regulations industrial/commercial use definition.

GRA was informed by the University of Rhode Island that the planned development of the project area is as a temporary construction related parking area prior to the final construction of a roundabout at the intersection of Butterfield Road and West Alumni Avenue. The planned future use of the project area is consistent with the RIDEM Remediation Regulations industrial/commercial use definition.

The groundwater at the subject property is classified as GAA. According to the RIDEM on-line Environmental resource map the subject property is located in a Community Well Head Protection Area (WHPA). The groundwater reportable concentrations that apply to the subject property would be GA groundwater standards.

3.0 Remedial Objectives

The site use is defined as industrial/commercial in the RIDEM's Remediation Regulations. The proposed immediate use for the substation is as a landscaped area. Due to the potential use as a recreational area the remedial goal is to achieve compliance with the R-DEC.

Groundwater at the site is classified as GAA. The site is located in a wellhead protection area for the University's drinking water wells. The soil remedial goal is compliance with the GA-L.

There is no groundwater remedial work proposed as part of this project.

4.0 Proposed Remedy - Soils

The recommended remedial measure that was approved in the Program Letter is Soil Excavation and Off-Site Disposal. Soil excavation and off-site disposal was recommended based on the following:

- This remedial alternative's goal would be to achieve compliance with the Remediation Regulations and would not require an ELUR.
- The future use of this area would not be restricted

A detailed description of the proposed remedial measure follows.

4.1 Non-Compliant Soil Management Classification

The site investigation soil sample laboratory analytical data was used to develop soil management classifications for the project. The following soil management classifications will be used for this project:

- A. Type 1
 - a. Soils in which levels of TPH, VOCs, and SVOCs (PAHs only), and Priority Pollutant Metals are found to be above the RIDEM R-DEC, but within the limits of the I/C-DEC. Type 1 soils shall be disposed at a licensed facility. Concentrations are within disposal parameter limits allowed by the Rhode Island Resource Recovery Corporation for materials disposition at the Central Landfill as landfill cover.
- B. Type 2
 - a. Soils in which levels of TPH, VOCs, SVOCs (PAHs only), and Priority Pollutant Metals have been observed above the RIDEM I/C-DEC. Excess Type 2 soil shall be accepted for out-of-state landfill cover, landfilling without pretreatment at disposal facilities licensed to accept the material or recycled for asphalt batching.
- C. Type 3
 - a. Concentrations exceed the EPA and/or RIDEM hazardous waste characteristics necessitating disposal as hazardous waste. These soils cannot be reused within the project limits. These soils shall be transported for off-site disposal at a licensed disposal facility in accordance with the Plan and Specification requirement.

4.2 Soil Remediation – Soil Excavation and Off-Site Disposal

Non-compliant soil excavation and off-site recycling/disposal is the proposed remedial alternative. The proposed scope of work for soil excavation and off-site recycling/disposal would include the following:

- Removal of the two perimeter chain link fences.
- Removal of the crushed stone surface material and off-site disposal/reuse
- Removal of concrete pads as identified by URI and off-site disposal of the concrete
- Soil excavation to a depth of two feet below the bottom of crushed stone grade within the soil excavation area overlaid on the Sampling Locations plan.
- Stockpile excavated non-compliant soils and transport for off-site disposal. The soil stockpile would be sampled in accordance with the off-site recycling/disposal facility's requirements and characterized for disposal. The excavated soils would be transported for off-site disposal after they are accepted by the recycling/disposal facility.

- As an alternative the excavated soils could be loaded and hauled for off-site disposal during excavation thus eliminating the need for a soil stockpile. The load and haul option would require pre-characterization for disposal and approval for disposal from the receiving facility prior to beginning the excavation.
- Confirmatory soil sampling to document the TPH and RCRA 8 metals concentrations in the excavation sidewalls and bottom. Soil samples would be collected at a frequency of one sample per 200 square feet of bottom area and one sample per 50 linear feet of excavation sidewall. The soil samples would be submitted for RCRA 8 metals, leachable RCRA 8 metals, and TPH analysis.
- The excavation's sidewall and bottom confirmatory soil sample laboratory analytical data would be used to evaluate compliance with the Remediation Regulations R-DEC and GA/L. Additional soil excavation would be required in areas where compliance was not achieved. Additional confirmatory sampling and analysis would then be completed. This process would be repeated until the area achieves compliance with the Remediation Regulations R-DEC and GA/L.
- Common borrow that is compliant with the Remediation Regulations R-DEC and GA/L would then be used to backfill the excavated areas to 4-inches below the proposed finish grade.
- Place 4-inches of loam that is compliant with the Remediation Regulations R-DEC and GA/L.
- Seed the area to establish a vegetated cover

4.2.1 Soil Remediation – Soil Capping

The concrete pad with the active electric manhole and the active electric line, and concrete pads selected by the URI will remain in place. Soil excavation may not be possible in the area of the active utility lines. This has the potential to prevent achieving compliance with the Remediation Regulations R-DEC and GA/L in the area of the electric conduit and concrete pad with the electric manhole. The soil capping detail that would be utilized in the area of the concrete pad and electric line is provided on the attached Butterfield Road Substation Site Investigation Plan.

4.2.2 Soil Remediation – ELUR / SMP

There is the potential that an Environmental Land Usage Restriction (ELUR) and a Soil Management Plan (SMP) will be required as part of the proposed remedial alternative. An ELUR would be required if the soil excavation cannot achieve compliance with the Remediation Regulations R-DEC and GA/L. The ELUR would require that the capped area be inspected annually and be maintained as required to preserve the cap's integrity, restrict the site's future usage to industrial/commercial use, and require RIDEM notification if the cap is disturbed in the future. A metes and bounds survey description of the capped would be prepared as ELUR Attachment A. The Soil Management Plan included as ELUR Attachment B would be prepared using the RIDEM Soil Management Plan template. Soil management practices for future on-site work will be included in the SMP. The SMP will be appended to the ELUR. The draft ELUR and SMP will be submitted to the RIDEM for review when the project is completed. The draft ELUR and SMP will be revised as required. After RIDEM review and approval the ELUR will be filed in the Town of South Kingstown land evidence records and a copy of the filing submitted to the RIDEM-OWM.

A copy of the current RIDEM draft SMP is appended to this document. The SMP describes soil management procedures and requirements for engineered cap disturbance and soil excavation during routine soil maintenance work. A copy of the current RIDEM draft ELUR can be found in **Appendix B**, a copy of the current RIDEM SMP template can be found in **Appendix C**.

4.3 Non-Compliant Soil Excavation Area – Off-Site Fill Requirements

All off-site fill material used to backfill URI's Butterfield Road Substation's non-compliant soil excavation area will be subject to testing prior to delivery to the site to confirm their compliance with the RIDEM Remediation Regulations R-DEC and GA-L. GRA's Specification Section for Analytical Testing Requirements for Imported Soil is included in the project specifications and is appended to the RAWP.

5.0 Points of Compliance

Confirmatory soil sampling is proposed to demonstrate compliance with the RIDEM Regulations.

5.1 Confirmatory Soil Sampling

Confirmatory soil sampling is proposed to document the TPH and RCRA 8 metals concentrations in the excavation sidewalls and bottom. Soil samples will be collected at a frequency of one sample per 200 square feet of bottom area and one sample per 50 linear feet of excavation sidewall with a minimum of one confirmatory soil sample collected from each sidewall and the bottom of excavation. The soil samples would be submitted for RCRA 8 metals, leachable RCRA 8 metals by SPLP, and TPH laboratory analysis.

The excavation's sidewall and bottom confirmatory soil sample laboratory analytical data would be used to evaluate compliance with the Remediation Regulations R-DEC and GA/L. Additional soil excavation would be required in areas where compliance was not achieved. Additional confirmatory sampling and analysis would then be completed. This process would be repeated until the area achieves compliance with the Remediation Regulations R-DEC and GA/L.

6.0 Proposed Schedule for Remediation

The project schedule has not been finalized. The final project schedule including project advertising and bid package distribution, bid submittal date, project award date, project start-up date, and project completion date will be provided to the RIDEM-OWM when it becomes available.

7.0 Contractors and/or Consultants

The URI will issue an Invitation to Bid for this project. The project's contractor will be selected after the bidding process is complete. The contractor will then be required to submit a project schedule to URI. Remedial activities will be included in the schedule.

The project's contractor will be responsible for completing the remedial measures and compliance sampling outlined in the RAWP. Remedial measures and compliance sampling requirements spelled out in the RAWP have been made included in the contract specifications and plans.

GRA will serve as the URI's environmental consultant. GRA will assist the URI in reviewing all submittals related to RAWP related activities. The URI resident engineer and GRA will oversee the implementation of the RAWP remedial measures. The URI resident engineer and GRA will complete the compliance sampling activities. GRA, on behalf of the URI, will prepare the RAWP status report and closure report submittals and forward those documents to URI for submittal to the RIDEM.

8.0 Site Plan

The Non-Complaint Soil Area is identified on the project's plan set. The project plan set depicts the proposed non-compliant soil excavation areas, site access for the Contractor, and the limit of disturbance.

9.0 Contingency Plan

The Contractor shall alert the URI personnel if an unexpected incident involving hazardous materials occurs. These types of incidents could include but are not be limited to encountering non-compliant soils and/or groundwater in areas other than those defined in the project specifications and plans, a hazardous material release from on-site equipment, and an accidental petroleum release from the on-site construction equipment station. If no URI personnel are on-site then the contractor will alert the URI Office of Capital Projects at the following phone number:

URI Office of Capital Projects

Paul DePace, P.E.
Director
401.874.2725

Appropriate regulatory agency personnel must also be notified. Prior to this project commencing URI will identify Department personnel that will be responsible for regulatory agency notification. The regulatory contact information is provided below.

- Rhode Island Department of Environmental Management 24-hour response number 401-222-3070
- National Response Center (NRC) at 1-800-424-8802 or 1-202-426-2675
- Kingston Fire Department 911 / 401-783-6830
- Kingston Police Department 911 / 401-783-3321

The following information shall be communicated when reporting to outside agencies:

- a. Name, title, telephone number and address of reporter;
- b. Name, telephone number and address of the site/spill;
- c. Time, type and amount of material involved;
- d. Extent of injuries/illnesses, if known;
- e. Possible hazards to human health and the environment;
- f. Any body of water involved;
- g. The cause of the accident/spill; and
- h. The action taken or proposed by the site personnel.

The URI Office of Capital Projects will contact and coordinate emergency response action its emergency response contractor if required.

10.0 Operating Log and Remedial Status Reports

An Operating Log which clearly and completely records activities on-site and shows how the implementation and operation of the Remedial Action is progressing will be maintained at the site by URI's environmental consultant and its resident engineer. This Operating Log shall include, at a minimum, the following information:

- A. Time periods of operation of the remedial unit;
- B. Records of any analyses conducted as part of the Remedial Action;
- C. Instances of implementation of the Contingency Plan; and
- D. An inspection plan designed to insure the proper operation of the proposed remediation.

Documentation of these inspections and any problems found and/or repairs made shall be included.

The Operating Log shall be readily available at the Site during implementation of the Remedial Action. A copy of this log shall be submitted to the Department as part of the quarterly remedial action status report.

Fugitive dust control measures will be instituted during development activities. Fugitive dust control measure implementation will be recorded in a logbook maintained by a person designated by the consultant/contractor.

The Operating Log shall be kept for at least three (3) years following completion of the Remedial Action.

11.0 Certification Statements

Statement of Certification by the Remedial Action Work Plan Preparer
Remedial Action Work Plan
University of Rhode Island – Butterfield Road Substation
South Kingstown, Rhode Island

I prepared this Remedial Action Work Plan and certify the information contained in the Remedial Action Work Plan is accurate to the best of my knowledge.



Steven P. Cadorette, P.E., Senior Civil Engineer
Gordon R. Archibald, Inc.
200 Main Street
Pawtucket, Rhode island 02860



Statement of Certification by the Performing Party Authorized Representative
Remedial Action Work Plan
University of Rhode Island – Butterfield Road Substation
South Kingstown, Rhode Island
URI - Environmental Resources & Road Design

I certify that this Remedial Action Work Plan is a complete and accurate representation of the contaminated-site and the release and contains all known facts surrounding the release to the best of my knowledge.



Paul M. DePace, P.E.,
Director Office of Capital Projects
60 Tootell Road, Sherman Building
Kingston, Rhode Island 02881

FIGURES

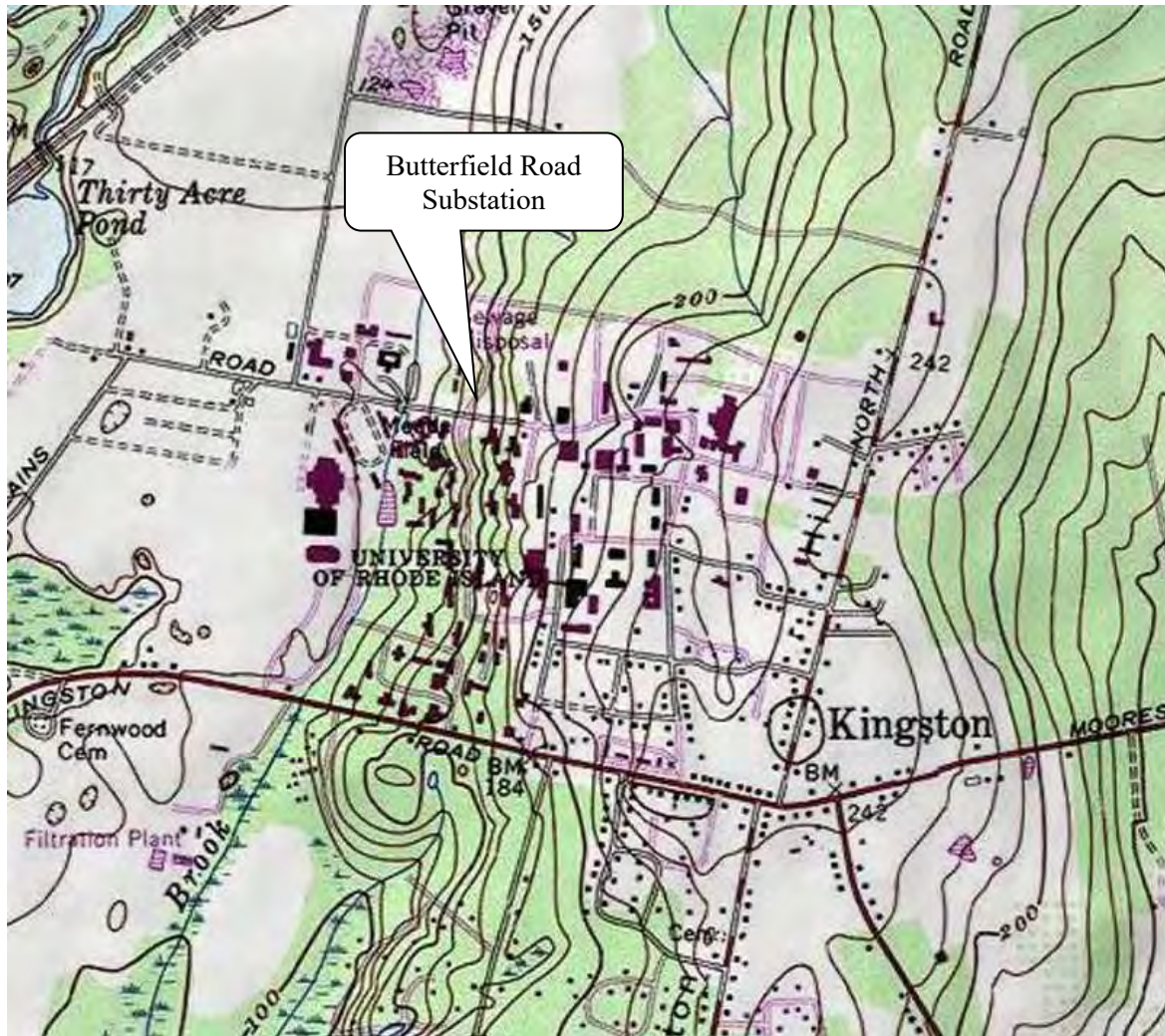


Figure 1
Site Location Plan
University of Rhode Island
Butterfield Road Substation
South Kingstown, Rhode Island

Remedial Action Work Plan

The University of Rhode Island – Butterfield Rd. Substation
South Kingstown, Rhode Island

APPENDICES

APPENDIX A

ABUTTER NOTIFICATION



Gordon R. Archibald, Inc.

Civil and Environmental Engineers

July 20, 2017

Jeffrey Crawford, Project Manager
Principal Environmental Scientist
Rhode Island Department of Environmental Management – Office of Waste Management
235 Promenade Street
Providence, Rhode Island 02908

Re: Public Notification Documentation
University of Rhode Island – Butterfield Road Substation
Kingston Campus, South Kingstown, Rhode Island

Dear Mr. Crawford:

Gordon R. Archibald, Inc. (GRA), on behalf of the University of Rhode Island, submits the attached documentation for the completion of the public notification requirements found in the RIDEM's May 19, 2017 Program Letter.

Please contact the undersigned with any questions.

Very truly yours,
GORDON R. ARCHIBALD, INC.

Steven Cadorette, P.E.
Senior Civil Engineer

cc: Paul M. DePace PE, Director Office of Capital Projects University of Rhode Island

Attachments

Abutter Notification – Submitted 2017-06-13
Certified Mail Receipt 2017-06-16



Gordon R. Archibald, Inc.
Civil and Environmental Engineers

June 13, 2017

**Stephen A. Alfred
Town Manager
Town of South Kingstown
180 High Street
Wakefield, Rhode Island 02879**

Mr. Alfred:

The University of Rhode Island provides the attached public notification letter for the Butterfield Road Substation project on the Kingston campus.

Please call with any questions.

**Sincerely
Gordon R. Archibald, Inc.**

**Steve Cadorette, P. E.
Senior Civil Engineer**

Notification To Abutters
Site Investigation
URI Butterfield Road Substation
Butterfield Road, South Kingston, Rhode Island

June 13, 2017

In accordance with the Rhode Island Department of Environmental Management's (RIDEM's) Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (the Remediation Regulations), and the **Industrial Property Remediation and Reuse Act (Rhode Island General Law 23-19.14, Section 11)** if applicable, the University of Rhode Island is providing notice to abutters that a Site Investigation for the above mentioned property has been completed. The property is further designated as Plat 15-4 Lot 7 of the **South Kingston** Tax Assessor's plat maps. The goal of the investigation was to determine the extent to which any historical activities at the property may have resulted in any exceedances of the RIDEM's promulgated soil criteria. The investigation involved sampling and analysis of **subsurface soil**. The results of the investigation indicate that soil arsenic and total petroleum hydrocarbons (TPH) concentrations that are not compliant with the Remediation Regulations soil standards. The proposed soil remedial alternative for the property is non-compliant soil excavation and off-site recycling/disposal. The future use of the property will be for URI educational activities that are consistent with the Remediation Regulations industrial/**commercial use definition**. RIDEM has determined that the investigation has adequately assessed the nature and extent of the contamination at the property and addressed all concerns in accordance with the Remediation Regulations.

There is a 14 calendar day comment period, commencing with the date of this notice, during which the public may review RIDEM records pertaining to this property and submit written comments regarding the technical feasibility of the preferred remedial alternative. Should you require additional time for review, a request for an extension of the comment period may be made to the Department. Requests must be received by the Department before 4:00 PM on the final day of the comment period, and may be made in writing to the address below or by calling the telephone number listed below. RIDEM will consider all substantive written comments prior to issuing its final approval of the proposed remedial alternative.

Written comments should be submitted to:

Jeffrey Crawford
R.I. Department of Environmental Management
Office of Waste Management
235 Promenade Street
Providence, RI 02908-5767
Phone: (401) 222-2797 ext. 7102

Arrangements to review RIDEM records may be made by calling Angela Spadoni, Office of Customer and Technical Assistance, (401) 222-4700 ext. 7307.

SENDER: COMPLETE THIS SECTION

- Complete items 1, 2, and 3.
- Print your name and address on the reverse so that we can return the card to you.
- Attach this card to the back of the mailpiece, or on the front if space permits.

1. Article Addressed to:

Steven A. Alfred
Town Manager, Town of S. Kingston
180 High Street
Wakefield, RI 02879



9590 9403 0226 5146 1833 44

2. Article Number (Transfer from outside label)

7015 0640 0007 6089 0623

(over \$500)

COMPLETE THIS SECTION ON DELIVERY

A. Signature *Harry L. A. Parker* ☐ Agent ☐ Addressee

B. Received by (Printed Name) C. Date of Delivery *6-16-17*

D. Is delivery address different from item 1? ☐ Yes ☐ No
If YES, enter delivery address below:

3. Service Type
- ☒ Adult Signature
 - ☐ Adult Signature Restricted Delivery
 - ☐ Certified Mail®
 - ☐ Certified Mail Restricted Delivery
 - ☐ Collect on Delivery
 - ☐ Collect on Delivery Restricted Delivery
 - ☐ Restricted Delivery
 - ☐ Priority Mail Express®
 - ☐ Registered Mail™
 - ☐ Registered Mail Restricted Delivery
 - ☐ Return Receipt for Merchandise
 - ☐ Signature Confirmation™
 - ☐ Signature Confirmation Restricted Delivery

Domestic Return Receipt

PS Form 3811, April 2015 PSN 7530-02-000-8053

UNITED STATES POSTAL SERVICE

RI 028

25 JUN '17



First-Class Mail
Postage & Fees Paid
USPS
Permit No. G-10

• Sender: Please print your name, address, and ZIP+4® in this box•

Gordon R. Archibald, Inc.
Civil and Environmental Engineers
200 Main Street
Pawtucket, RI 02860



USPS TRACKING#



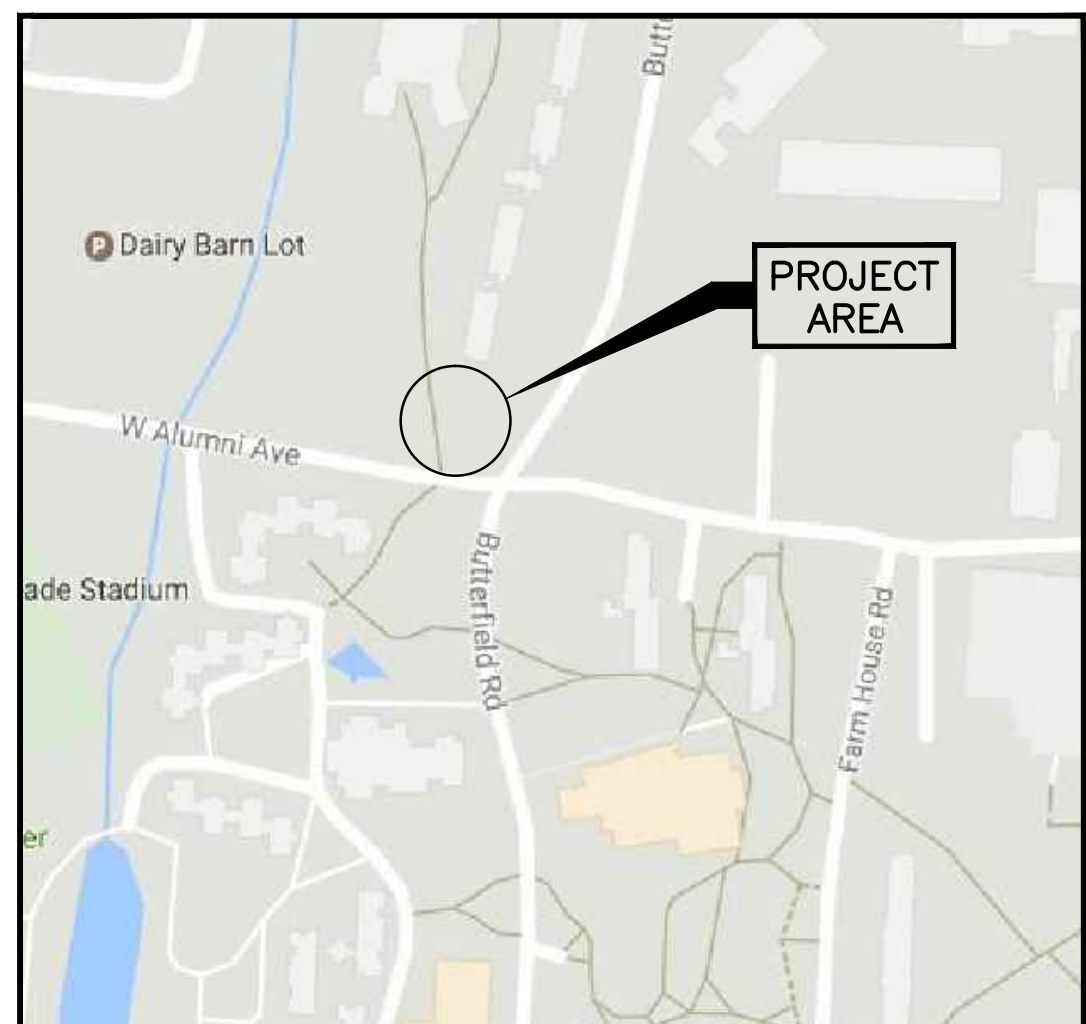
9590 9403 0226 5146 1633 44

APPENDIX B

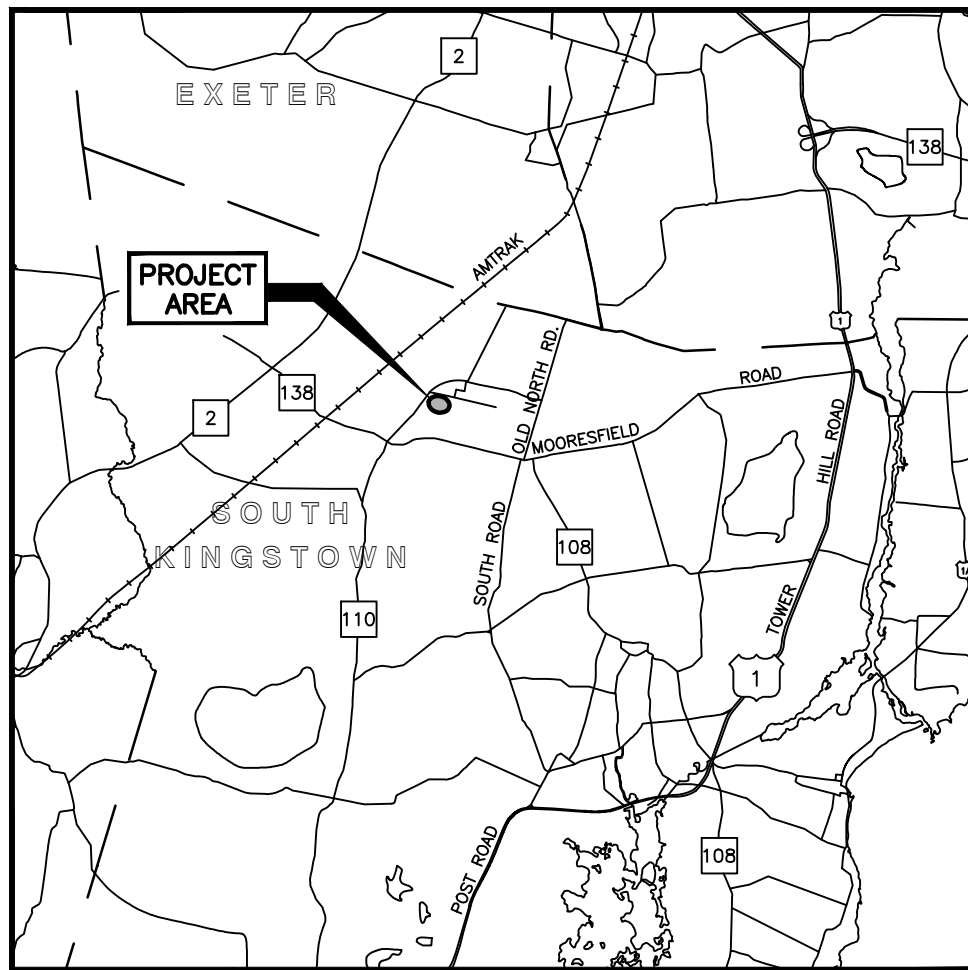
BUTTERFIELD ROAD SUBSTATION PLAN SET

UNIVERSITY OF RHODE ISLAND
Office of Capital Projects

PLANS AND DETAILS OF PROPOSED
BUTTERFIELD SUB STATION REMEDIATION DESIGN
KINGSTON, RHODE ISLAND
URI Project No. KC.M.ENBT.2016.001



LOCATION MAP
NOT TO SCALE



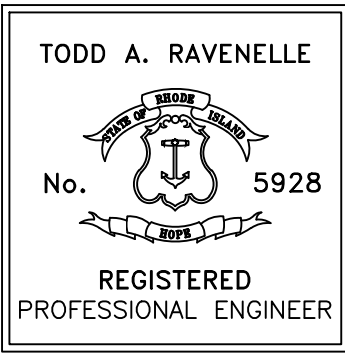
LOCATION MAP
SCALE: 1" = 2 Miles

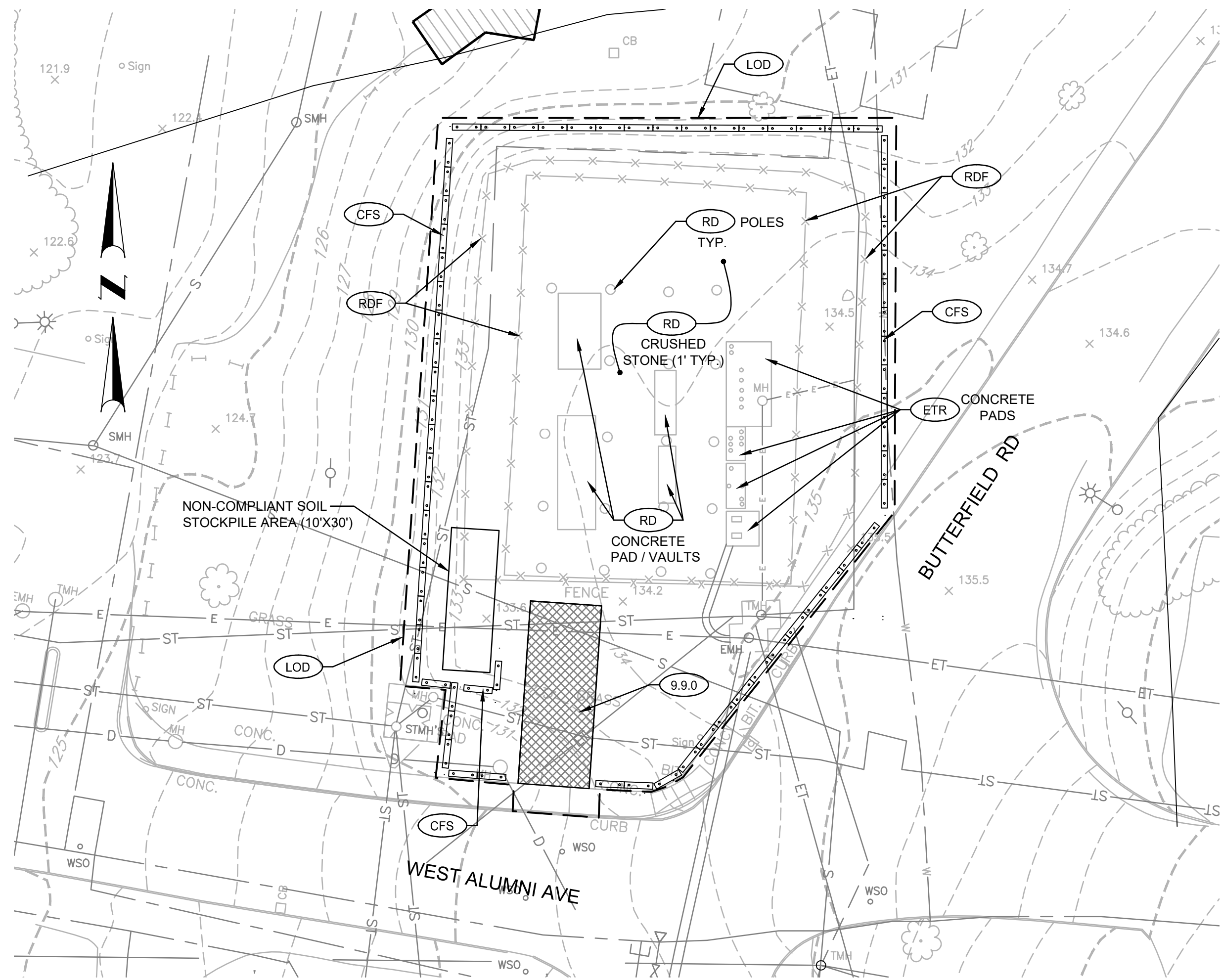
INDEX

SHEET NO.	DESCRIPTION
1	COVER SHEET
2	GENERAL NOTES & LEGEND
3	DEMOLITION SITE PLAN AND PROPOSED SITE PLAN
4	PROPOSED SOIL EXCAVATION PLAN



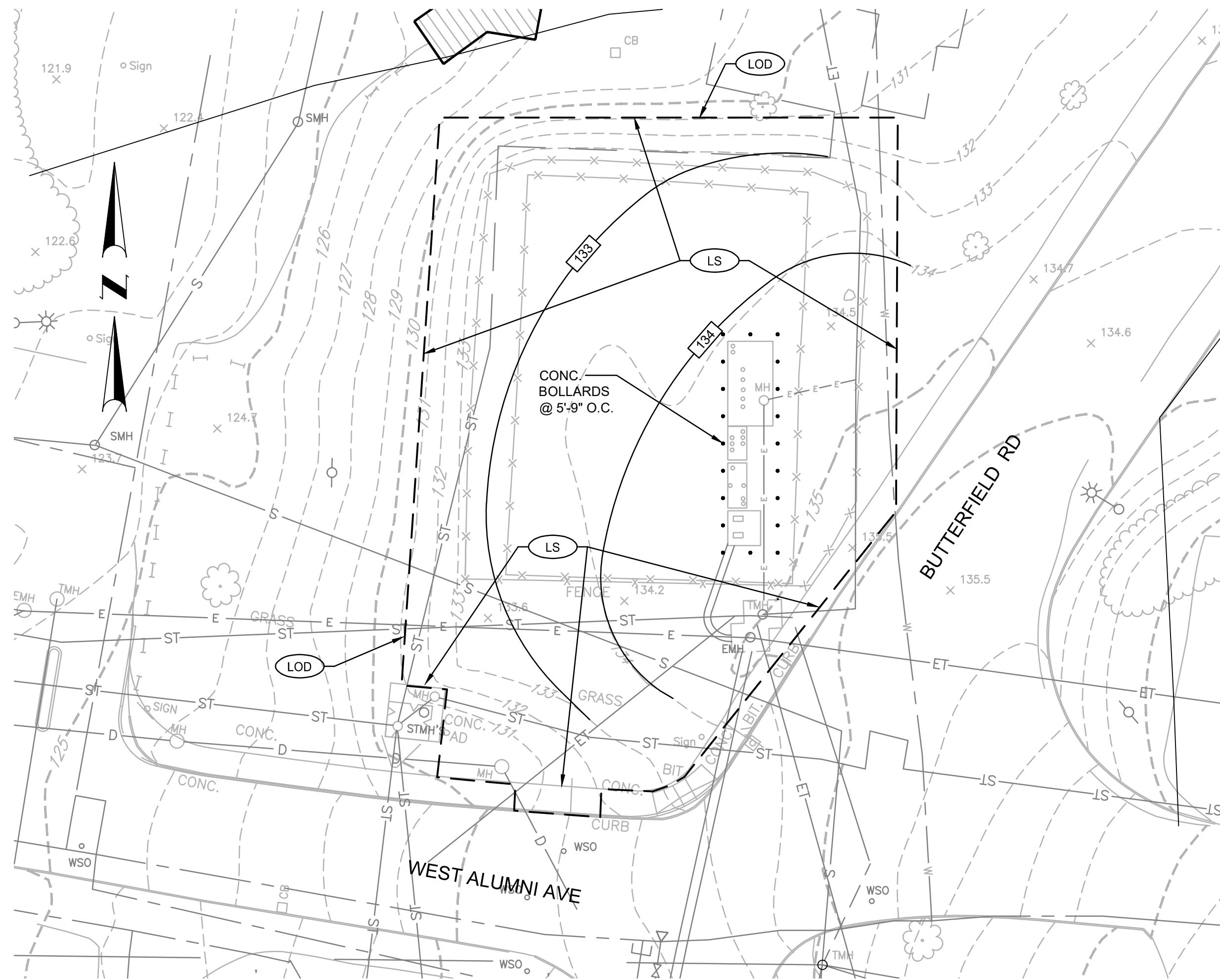
JULY 2017



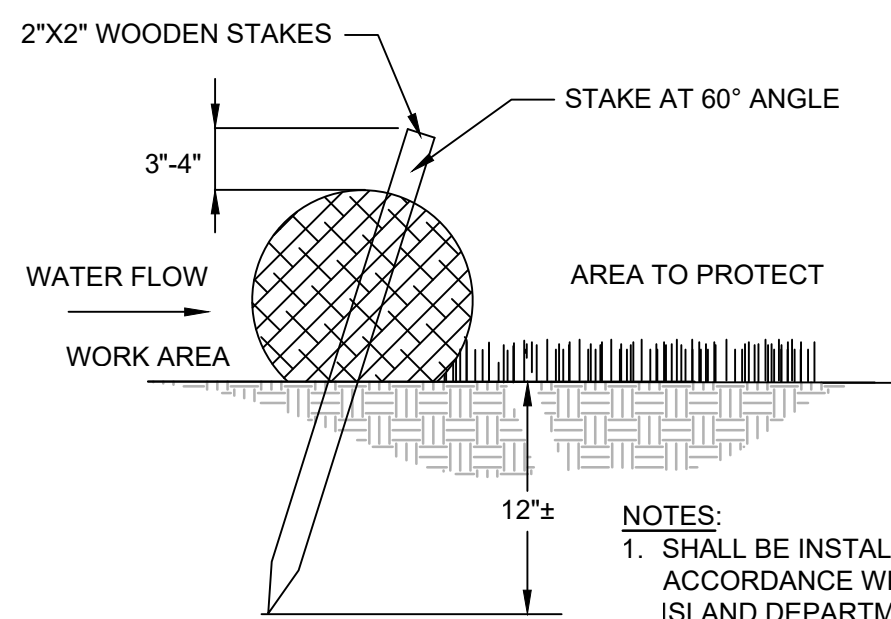


DEMOLITION SITE PLAN
SCALE: 1" = 20'

NOTE:
THE CRUSHED STONE SURFACE LAYER SHALL BE REMOVED AND TRANSPORTED
OFFSITE FOR DISPOSAL / REUSE.

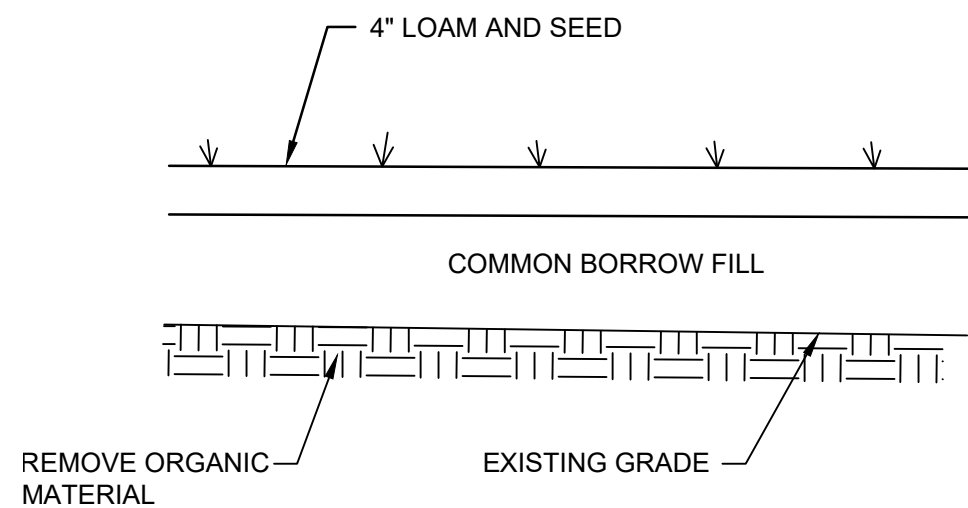


PROPOSED SITE PLAN
SCALE: 1" = 20'

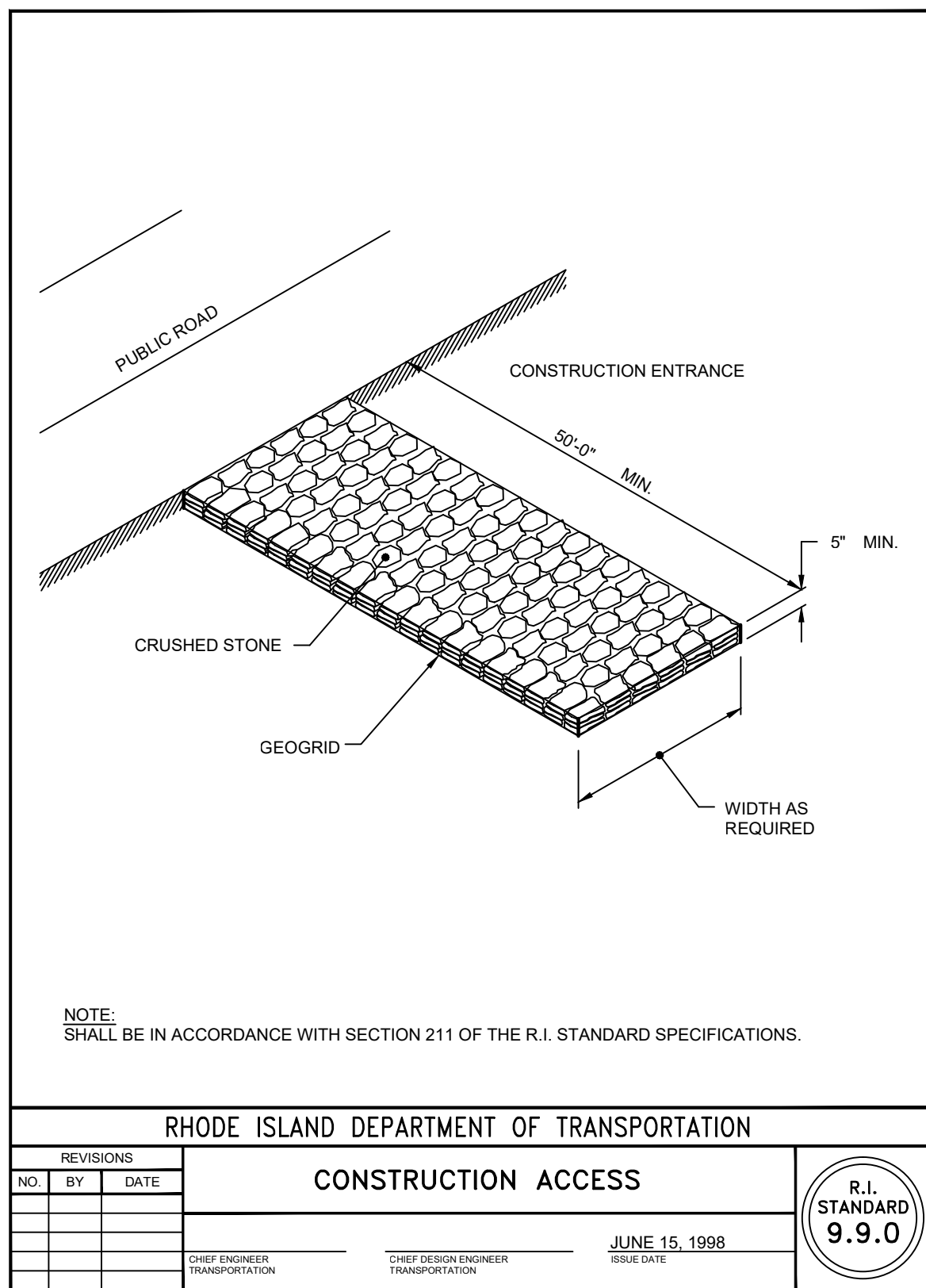


8-INCH COMPOST FILTER SOCK
NOT TO SCALE

NOTES:
1. SHALL BE INSTALLED AND MAINTAINED IN
ACCORDANCE WITH SECTION 206 OF THE RHODE
ISLAND DEPARTMENT OF TRANSPORTATION
STANDARDS SPECIFICATIONS FOR ROAD AND
BRIDGE CONSTRUCTION, LATEST EDITION.



LOAM & SEED DETAIL

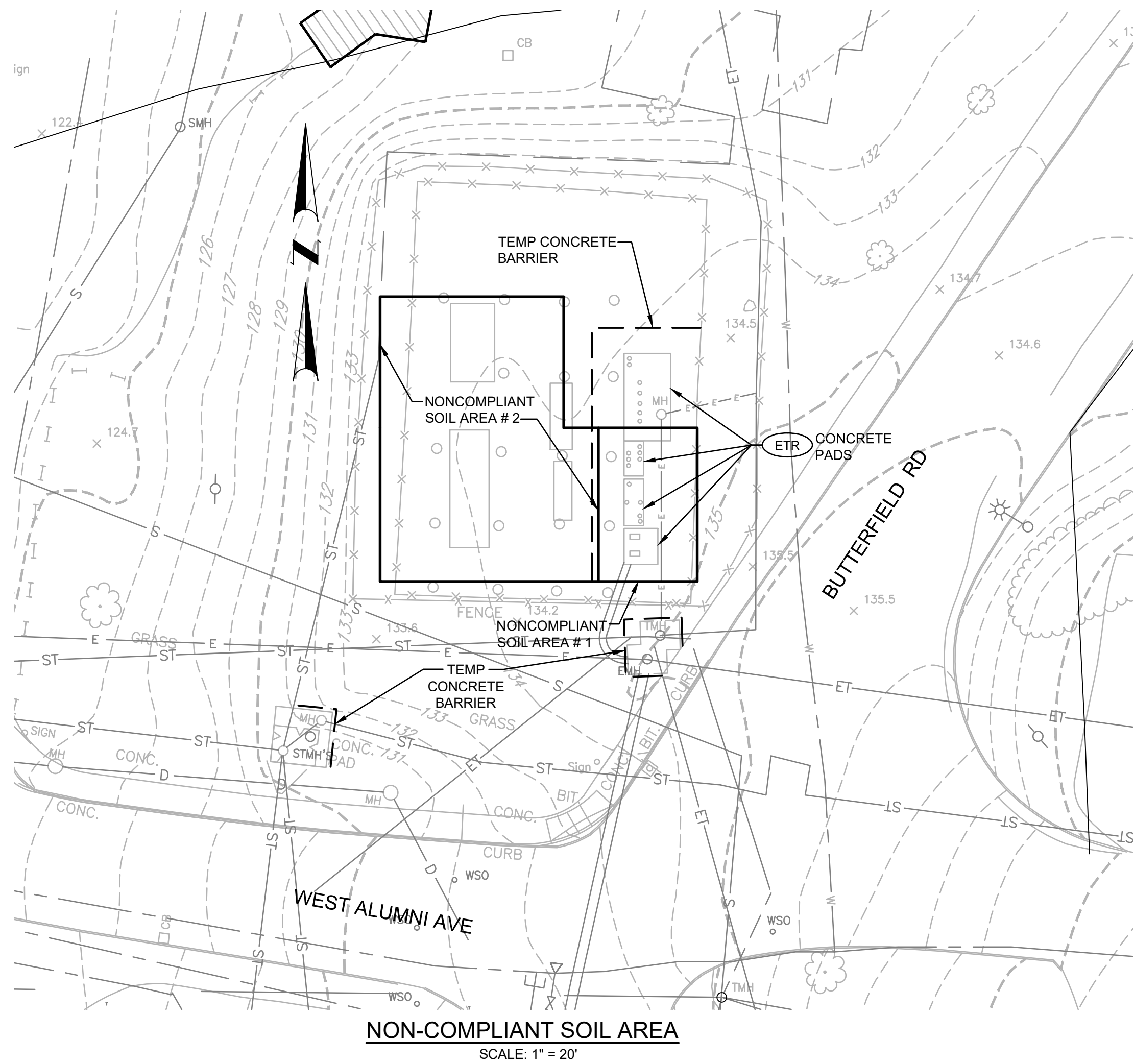


NOTE:
SHALL BE IN ACCORDANCE WITH SECTION 211 OF THE R.I. STANDARD SPECIFICATIONS.

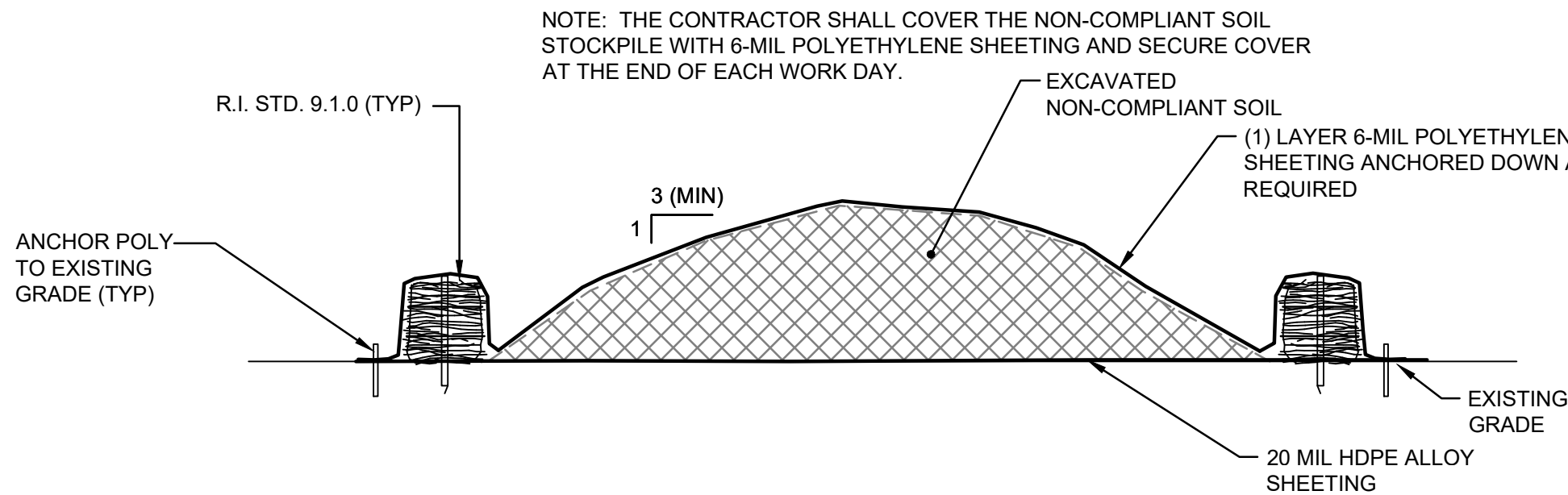
RHODE ISLAND DEPARTMENT OF TRANSPORTATION									
REVISIONS				CONSTRUCTION ACCESS				<div>R.I. STANDARD 9.9.0</div>	
NO.	BY	DATE							

SEQUENCE OF CONSTRUCTION

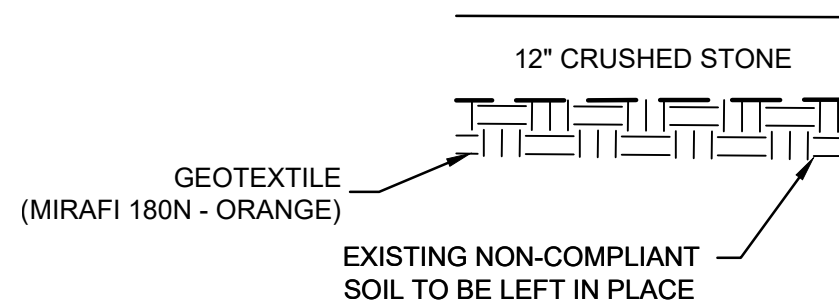
1. PLACE EROSION AND SEDIMENT CONTROLS AS SHOWN ON THE PLAN, PROVIDE CONCRETE BARRIERS AT UTILITIES OUTSIDE OF FENCE.
2. REMOVE AND DISPOSE FENCE AS REQUIRED TO CONDUCT CONSTRUCTION
3. CLEAR AND GRUB EXISTING VEGETATION WITHIN LIMIT OF DISTURBANCE
4. PROVIDE CONCRETE BARRIERS TO ISOLATE THE CONCRETE PADS TO REMAIN IN PLACE.
5. REMOVE CRUSHED STONE SURFACE LAYER FROM PROJECT AREA
6. PREPARE NON-COMPLIANT SOIL STOCKPILE AREA
7. REMOVE UTILITY POLES FROM AREA #1 AND AREA #2
8. EXCAVATE THE AREA DESIGNATED AS 'NON-COMPLIANT SOIL AREA #1' BY HAND OR BY VACUUM.
9. ENGINEER TO COLLECT CONFIRMATORY SOIL SAMPLES FROM 'AREA #1'
10. FILL THE 'NON-COMPLIANT SOIL AREA #1' AND RELOCATE THE CONCRETE BARRIERS
11. EXCAVATE THE SOILS FROM THE AREA DESIGNATED AS 'NON-COMPLIANT SOIL AREA #2'. REMOVE CONCRETE PADS / VAULTS FROM AREA #2.
12. ENGINEER TO COLLECT CONFIRMATORY SOIL SAMPLES FROM AREA #2
13. PLACE FILL MATERIAL IN AREA #2 EXCAVATION.
14. INSTALL CONCRETE BOLLARDS / REMOVE CONCRETE BARRIERS
15. REMOVE AND DISPOSE REMAINING FENCE
16. PLACE 4-INCH OF LOAM AND SEED



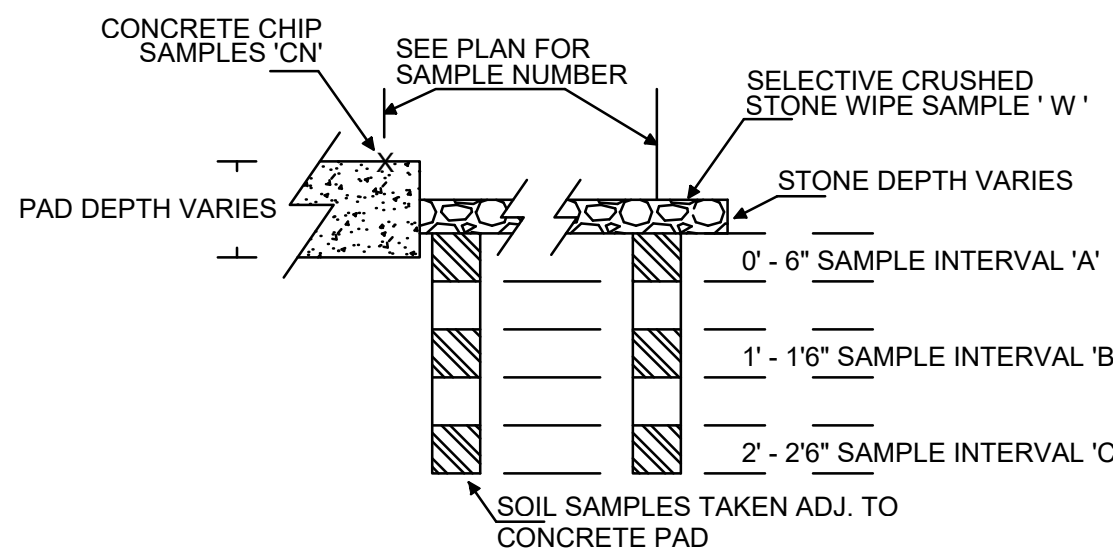
NON-COMPLIANT SOIL AREA
SCALE: 1" = 20'



SECTION THROUGH NON-COMPLIANT SOIL STOCKPILE
NOT TO SCALE



NON-COMPLIANT SOIL CAP
NOT TO SCALE



SAMPLING DETAIL
NOT TO SCALE

NOTES:

- DEMOLITION:
1. CONTRACTOR SHALL BE RESPONSIBLE FOR REMOVING AND DISPOSING OF MATERIALS NOTED ON THE CONTRACT SPECIFICATIONS AND PLANS.
 2. CONTRACTOR SHALL BE RESPONSIBLE FOR OFF-SITE DISPOSAL IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL LAWS AND REGULATIONS

NON-COMPLIANT SOIL EXCAVATION:

1. NON-COMPLIANT SOIL EXCAVATION SHALL BE REQUIRED IN THE NON-COMPLIANT SOIL EXCAVATION AREAS SHOWN ON THE CONTRACT PLANS.
2. INITIALLY THE NON-COMPLIANT SOIL SHALL BE EXCAVATED TO A DEPTH OF TWO FEET BELOW THE BOTTOM OF CRUSHED STONE GRADE.
3. THE CONTRACTOR SHALL ASSIST THE ENGINEER WITH THE COLLECTION OF CONFIRMATORY SOIL SAMPLES IN ACCORDANCE WITH THE RIDEM APPROVED REMEDIAL ACTION WORK PLAN.
4. THERE SHALL BE A TWO-WEEK PERIOD BETWEEN THE CONFIRMATORY SOIL SAMPLE COLLECTION AND THE NOTICE TO THE CONTRACTOR THAT ADDITIONAL NON-COMPLIANT SOIL EXCAVATION SHALL BE REQUIRED. THE TWO-WEEK PERIOD SHALL NOT BE CAUSE FOR THE CONTRACTOR TO CLAIM A DELAY.
5. THE CONTRACTOR SHALL COMMENCE WITH THE ADDITIONAL NON-COMPLIANT SOIL EXCAVATION WITHIN 10 WORKING DAYS OF RECEIVING NOTICE FROM THE ENGINEER THAT ADDITIONAL NON-COMPLIANT SOIL EXCAVATION IS REQUIRED.
6. SOIL EXCAVATION IN THE AREA OF SUBSURFACE UTILITIES SHALL BE COMPLETED BY VACUUM EXTRACTION OR BY HAND.
7. ALL SOILS WITHIN THREE (3) FEET OF THE CONCRETE PADS TO REMAIN IN PLACE SHALL BE REMOVED BY VACUUM EXTRACTION OR BY HAND.
8. ALL SOILS REMOVED FROM NON-COMPLIANT SOIL AREA #1 SHALL BE REMOVED BY VACUUM EXTRACTION OR BY HAND.

EXCAVATED NON-COMPLIANT SOIL MANAGEMENT

1. EXCAVATED NON-COMPLIANT SOIL SHALL BE STOCKPILED ON-SITE AT THE LOCATION DESIGNATED ON THE CONTRACT PLANS.
2. THE SOIL STOCKPILE SHALL BE SAMPLED BY THE CONTRACTOR IN ACCORDANCE WITH THE OFF-SITE RECYCLING/DISPOSAL FACILITY'S REQUIREMENTS AND CHARACTERIZED FOR DISPOSAL.
3. EXCAVATED NON-COMPLIANT SOILS SHALL BE TRANSPORTED FOR OFF-SITE DISPOSAL AT THE APPROVED RECYCLING/DISPOSAL FACILITY. THE CONTRACTOR SHALL SUBMIT TO THE UNIVERSITY A COPY OF THE DISPOSAL DOCUMENTS WITHIN 10 WORKING DAYS OF THE RECYCLING/DISPOSAL.
4. AS AN ALTERNATIVE THE CONTRACTOR MAY LOAD AND HAUL EXCAVATED SOILS FROM THE NON-COMPLIANT SOIL AREA FOR OFFSITE RECYCLING/DISPOSAL. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PRE-CHARACTERIZING THE SOIL FOR RECYCLING/DISPOSAL AND RECEIVE APPROVAL FROM THE RECEIVING RECYCLING/DISPOSAL FACILITY PRIOR TO BEGINNING EXCAVATION.

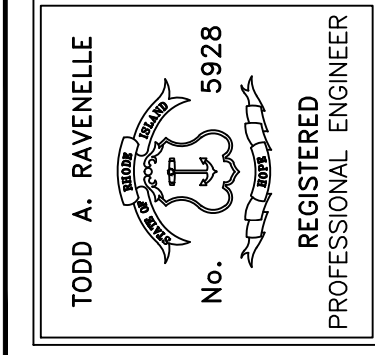
GENERAL:

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREPARING A SITE SPECIFIC HEALTH AND SAFETY PLAN FOR ITS WORKERS AND SUBCONTRACTED PERSONNEL AND CERTIFYING THAT ALL OF ITS WORKERS AND SUBCONTRACTED PERSONNEL WORKING AT THE SITE HAVE MET THE APPLICABLE FEDERAL TRAINING REQUIREMENTS FOUND IN OSHA 1910.120 AND OSHA 1910.126 AND ANY OTHER APPLICABLE LOCAL, STATE, AND FEDERAL REGULATIONS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING DIGSAFE AS REQUIRED BY LAW PRIOR TO COMMENCING THE EXCAVATION.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR CONTACTING THE URI FACILITIES SERVICES A MINIMUM OF FIVE DAYS PRIOR TO COMMENCING WORK AND REQUESTING URI FACILITIES SERVICES TO MARK UTILITY LOCATIONS WITHIN THE PROJECT'S LIMIT OF DISTURBANCE.
4. THE CONTRACTOR SHALL INSTALL SOIL EROSION AND SEDIMENT CONTROLS PRIOR TO COMMENCING WITH THE ON-SITE WORK.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SECURING THE NON-COMPLIANT SOIL EXCAVATION AREAS WHEN NO WORK IS TAKING PLACE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING BARRIERS INCLUDING BUT NOT LIMITED TO TEMPORARY FENCING TO SECURE THESE AREAS. AS AN ALTERNATIVE THE CONTRACTOR MAY LEAVE THE EXISTING CHAIN LINK FENCE IN PLACE TO SECURE THE NON-COMPLIANT SOIL EXCAVATION AREAS.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SWEEPING ANY SOIL FROM THE ADJACENT THE ROAD WAY THAT WAS DEPOSITED AS THE RESULT OF ITS WORK AT THE END OF EACH WORK DAY.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR FUGITIVE DUST CONTROL TO MAINTAIN COMPLIANCE WITH THE RIDEM FUGITIVE DUST CONTROL REGULATIONS. THIS REQUIREMENT INCLUDES ANY AND ALL REQUIRED MONITORING, FIELD SCREENING, AND LABORATORY ANALYSIS REQUIRED TO DEMONSTRATE COMPLIANCE WITH THE RIDEM FUGITIVE DUST CONTROL REGULATIONS.
8. CONCRETE PADS SHALL REMAIN IN PLACE AS SHOWN ON THE CONTRACT PLANS.
9. AT NO TIME SHALL VEHICLES OR CONSTRUCTION MATERIALS BE LOCATED ON THE CONCRETE PADS TO REMAIN.
10. CONCRETE BARRIERS SHALL BE PLACED AS SHOWN ON THE PLANS TO PREVENT VEHICLE ACCESS. PROTECTIVE MEASURES SHALL BE TAKEN TO THE GREATEST EXTENT TO ENSURE THE CONDITION OF THE CONCRETE PADS TO REMAIN IN PLACE AT ALL TIMES.
11. ADDITIONAL CONCRETE BARRIERS SHALL BE PLACED AS REQUIRED SHOULD THE ADJACENT FENCE BE REMOVED.
12. CONCRETE BOLLARDS SHALL BE INSTALLED AROUND THE EXTERIOR OF THE CONCRETE PADS TO REMAIN IN PLACE AS SHOWN ON THE PLAN OR AS DIRECTED BY THE UNIVERSITY.
13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR SAMPLING, TESTING, AND PROVIDING A REPORT PREPARED BY A RHODE ISLAND PROFESSIONAL ENGINEER CERTIFYING THAT ALL IMPORTED COMMON BORROW AND OTHER IMPORTED SOIL FILL MATERIALS ARE COMPLIANT WITH THE REMEDIATION REGULATIONS' RDEC AND GAI OBJECTIVES A MINIMUM OF 10 WORKING DAYS PRIOR TO COMMENCING ON-SITE ACTIVITIES.
14. THE CONTRACTOR'S TESTING OF IMPORTED COMMON BORROW AND OTHER IMPORTED SOIL FILL MATERIAL SHALL BE COMPLETED IN ACCORDANCE WITH THE IMPORTED SOIL TESTING REQUIREMENTS INCLUDED IN THE PROJECT SPECIFICATIONS.

PROJECT

BUTTERFIELD SUB STATION
REMEDATION DESIGN

KINGSTON, RHODE ISLAND



CLIENT

UNIVERSITY OF RHODE ISLAND

Gordon R. Archibald, Inc.
Civil and Environmental Engineers
Pawtucket, Rhode Island



DRAWING TITLE

PROPOSED SOIL EXCAVATION AREA

NO.	DATE	REVISIONS	BY

PROJECT NO.: 1679

DATE: JUNE 2017

SCALE: AS NOTED

DRAWN BY: JLH

CHECKED BY: TAR

DRAWING NUMBER

4

SHEET 4 OF 4

APPENDIX C

RIDEM ENVIRONMENTAL LAND USE RESTRICTION (ELUR) TEMPLATE

Appendix G
ENVIRONMENTAL LAND USAGE RESTRICTION

This Declaration of Environmental Land Usage Restriction (“Restriction”) is made on this _____ day of _____, 20__ by **[property owner]**, and its successors and/or assigns (hereinafter, the “Grantor”).

WITNESSETH:

WHEREAS, the Grantor _____ (name) is the Owner in fee simple of certain real property identified as **[specify Plat, Lot(s), address and Town or City]** Rhode Island (the “Property”), more particularly described in Exhibit A (Legal Description) which is attached hereto and made a part hereof;

WHEREAS, the Property (or portion thereof identified in the Class I survey which is attached hereto as Exhibit 2A and is made a part hereof) has been determined to contain soil and/or groundwater which is contaminated with certain Hazardous Materials and/or petroleum in excess of applicable **[residential or industrial/commercial Direct Exposure Criteria, and/or applicable groundwater objective]** criteria pursuant to the Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (“Remediation Regulations”);

WHEREAS, the Grantor has determined that the environmental land use restrictions set forth below are consistent with the regulations adopted by the Rhode Island Department of Environmental Management (“Department”) pursuant to R.I.G.L. § 23-19.14-1;

WHEREAS, the Department's written approval of this Restriction is contained in the document entitled: **[Remedial Decision Letter/ Settlement Agreement/ Order of Approval/ Remedial Approval Letter]** issued pursuant to the Remediation Regulations;

WHEREAS, to prevent exposure to or migration of Hazardous Substances and to abate hazards to human health and/or the environment, and in accordance with the **[Remedial Decision Letter/ Remedial Agreement/ Order of Approval/ Remedial Approval Letter]**, the Grantor desires to impose certain restrictions upon the use, occupancy, and activities of and at the **[Property/Contaminated-Site]**;

WHEREAS, the Grantor believes that this Restriction will effectively protect public health and the environment from such contamination; and

WHEREAS, the Grantor intends that such restrictions shall run with the land and be binding upon and enforceable against the Grantor and the Grantor’s successors and assigns.
NOW, THEREFORE, Grantor agrees as follows:

A. Restrictions Applicable to the [Property/Contaminated-Site]: In accordance with the **[Remedial Decision Letter/ Remedial Agreement/ Order of Approval/ Remedial Approval Letter]**, the use,

occupancy and activity of and at the **[Property/ Contaminated-Site]** is restricted as follows:

- i. No residential use of the **[Property/Contaminated-Site]** shall be permitted that is contrary to Department approvals and restrictions contained herein;
- ii. No groundwater at the **[Property/Contaminated-Site]** shall be used as potable water;
- iii. No soil at the **[Property/Contaminated-Site]** shall be disturbed in any manner without written permission of the Department's Office of Waste Management, except as permitted in the Remedial Action Work Plan (RAWP) or Soil Management Plan (SMP) approved by the Department in a written approval letter dated _____(date) Exhibit B and attached hereto;
- [iv. Humans engaged in activities at the **[Property/Contaminated-Site]** shall not be exposed to soils containing Hazardous Materials and/or petroleum in concentrations exceeding the applicable Department approved Direct Exposure Criteria set forth in the Remediation Regulations;
- [v. Water at the **[Property/Contaminated-Site]** shall be prohibited from infiltrating soils containing Hazardous Materials and/or petroleum in concentrations exceeding the applicable Department approved leachability criteria set forth in the Remediation Regulations;
- [vi. No subsurface structures shall be constructed on the **[Property/Contaminated-Site]** over groundwater containing Hazardous Materials and/or petroleum in concentrations exceeding the applicable Department approved GB Groundwater Objectives set forth in the Remediation Regulations;
- [vii. The engineered controls at the **[Property/ Contaminated-Site]** described in the **[RAWP or SMP]** contained in Exhibit B attached hereto shall not be disturbed and shall be properly maintained to prevent humans engaged in **[residential or industrial/commercial]** activity from being exposed to soils containing Hazardous Materials and/or petroleum in concentrations exceeding the applicable Department-approved **[residential or industrial/commercial]** Direct Exposure Criteria in accordance with the Remediation Regulations; and
- [viii. The engineered controls at the **[Property/ Contaminated-Site]** described in the **[RAWP or Soil Management Plan SMP]** contained in Exhibit B attached hereto shall not be disturbed and shall be properly maintained so that water does not infiltrate soils containing Hazardous Materials and/or petroleum in concentrations exceeding the applicable Department-approved leachability criteria set forth in the Remediation Regulations.

B. No action shall be taken, allowed, suffered, or omitted at the [Property/ Contaminated-Site] if such action or omission is reasonably likely to:

- i. Create a risk of migration of Hazardous Materials and/or petroleum;

- ii. Create a potential hazard to human health or the environment; or
- iii. Result in the disturbance of any engineering controls utilized at the **[Property/Contaminated-Site]**, except as permitted in the Department-approved **[RAWP or SMP]** contained in Exhibit B.

C. Emergencies: In the event of any emergency which presents a significant risk to human health or to the environment, including but not limited to, maintenance and repair of utility lines or a response to emergencies such as fire or flood, the application of Paragraphs A (iii.-viii.) and B above may be suspended, provided such risk cannot be abated without suspending such Paragraphs and the Grantor complies with the following:

- i. Grantor shall notify the Department's Office of Waste Management in writing of the emergency as soon as possible but no more than three (3) business days after Grantor's having learned of the emergency. (This does not remove Grantor's obligation to notify any other necessary state, local or federal agencies.);
- ii. Grantor shall limit both the extent and duration of the suspension to the minimum period reasonable and necessary to adequately respond to the emergency;
- iii. Grantor shall implement reasonable measures necessary to prevent actual, potential, present and future risk to human health and the environment resulting from such suspension;
- iv. Grantor shall communicate at the time of written notification to the Department its intention to conduct the Emergency Response Actions and provide a schedule to complete the Emergency Response Actions;
- v. Grantor shall continue to implement the Emergency Response Actions, on the schedule submitted to the Department, to ensure that the **[Property/Contaminated-Site]** is remediated in accordance with the Remediation Regulations (or applicable variance) or restored to its condition prior to such emergency. Based upon information submitted to the Department at the time the ELUR was recorded pertaining to known environmental conditions at the **[Property/Contaminated-Site]**, emergency maintenance and repair of utility lines shall only require restoration of the **[Property/Contaminated-Site]** to its condition prior to the maintenance and repair of the utility lines; and
- vi. Grantor shall submit to the Department, within ten (10) days after the completion of the Emergency Response Action, a status report describing the emergency activities that have been completed.

D. Release of Restriction; Alterations of Subject Area: The Grantor shall not make, or allow or suffer to be made, any alteration of any kind in, to, or about any portion of the **[Property/Contaminated-Site]** inconsistent with this Restriction unless the Grantor has received the Department's prior written approval for such alteration. If the Department determines that the proposed alteration is significant, the Department may require the amendment of this Restriction. Alterations deemed insignificant by the

Department will be approved via a letter from the Department. The Department shall not approve any such alteration and shall not release the **[Property/Contaminated-Site]** from the provisions of this Restriction unless the Grantor demonstrates to the Department's satisfaction that Grantor has managed the **[Property/Contaminated-Site]** in accordance with applicable regulations.

- E. Notice of Lessees and Other Holders of Interests in the [Property/Contaminated-Site]:** The Grantor, or any future holder of any interest in the **[Property/Contaminated-Site]**, shall cause any lease, grant, or other transfer of any interest in the **[Property/Contaminated-Site]** to include a provision expressly requiring the lessee, grantee, or transferee to comply with this Restriction. The failure to include such provision shall not affect the validity or applicability of this Restriction to the **[Property/Contaminated-Site]**.
- F. Enforceability:** If any court of competent jurisdiction determines that any provision of this Restriction is invalid or unenforceable, the Grantor shall notify the Department in writing within fourteen (14) days of such determination.
- G. Binding Effect:** All of the terms, covenants, and conditions of this Restriction shall run with the land and shall be binding on the Grantor, its successors and assigns, and each Owner and any other party entitled to control, possession or use of the **[Property/Contaminated-Site]** during such period of Ownership or possession.
- H. Inspection & Non-Compliance:** It shall be the obligation of the Grantor, or any future holder of any interest in the **[Property/Contaminated-Site]**, to provide for annual inspections of the **[Property/Contaminated-Site]** for compliance with the ELUR in accordance with Department requirements.

[An officer or Director of the company with direct knowledge of past and present conditions of the [Property/Contaminated-Site] (the "Company Representative"), or] A qualified environmental professional will, on behalf of the Grantor or future holder of any interest in the **[Property/Contaminated-Site]**, evaluate the compliance status of the **[Property/Contaminated-Site]** on an annual basis. Upon completion of the evaluation, the **[Company Representative or]** environmental professional will prepare and simultaneously submit to the Department and to the Grantor or future holder of any interest in the **[Property/Contaminated-Site]** an evaluation report detailing the findings of the inspection, and noting any compliance violations at the **[Property/Contaminated-Site]**. If the **[Property/Contaminated-Site]** is determined to be out of compliance with the terms of the ELUR, the Grantor or future holder of any interest in the **[Property/Contaminated-Site]** shall submit a corrective action plan in writing to the Department within ten (10) days of receipt of the evaluation report, indicating the plans to bring the **[Property/Contaminated-Site]** into compliance with the ELUR, including, at a minimum, a schedule for implementation of the plan.

In the event of any violation of the terms of this Restriction, which remains uncured more than ninety (90) days after written notice of violation, all Department approvals and agreements relating to the **[Property/Contaminated-Site]** may be voided at the sole discretion of the Department.

I. Terms Used Herein: The definitions of terms used herein shall be the same as the definitions contained in Section 3 (DEFINITIONS) of the Remediation Regulations.

IN WITNESS WHEREOF, the Grantor has hereunto set (his/her) hand and seal on the day and year set forth above.

[Name of Person(s), company, LLC or LLP]

By: _____
Grantor (signature) _____ Grantor (typed name) _____

STATE OF RHODE ISLAND
COUNTY OF _____

In (CITY/TOWN), in said County and State, on the _____ day of _____, 20____, before me Personally appeared _____, to me known and known by me to be the party executing the foregoing instrument and (he/she) acknowledged said instrument by (him/her) executed to be (his/her) free act and deed.

Notary Public: _____

My Comm. Expires: _____

APPENDIX D

RIDEM SOIL MANAGEMENT PLAN (SMP) TEMPLATE

Post Remediation Soil Management Plan **Site Name, Address, Plat & Lot**

This Soil Management Plan (SMP) has been prepared to establish procedures that will be followed should future construction/maintenance activities at the **(Site Name)** property require the need to manage soils **(ground water if applicable)** excavated from the subsurface or when existing site surfaces / Department approved engineered controls (asphalt, concrete, landscaping and/or foundations) are disturbed. The plan serves to supplement, and will be initiated by, the RIDEM notification requirement established by the Environmental Land Use Restriction (ELUR) for the property.

Background

The Property, located at **(address)**, was formerly **(background info / history)**. The property was found to contain **(contamination info)** during a site investigation performed at the property. More recently, the site has been **(remediated or)** developed with a **(current use)**. The Department approved remedy included (...**brief remedy description**). The regulated site soils are covered with Department approved engineered controls, consisting of building foundations, asphalt pavement, and landscaping **(or other as applicable)** in order to prevent direct exposure to regulated soils and/or infiltration through soils which exceed the Department's Method 1 (GA or GB) Leachability Criteria.

Applicable Area

This SMP and affiliated ELUR, which restricts the property to **(Residential or Industrial/Commercial)** use, pertains to the **(entire or portions)** Property. See attached site figure.

Soil Management

The direct exposure pathway is the primary concern at the site. Individuals engaged in activities at the site may be exposed through incidental ingestion, dermal contact, or inhalation of vapors or entrained soil particles if proper precautions are not taken. Therefore, the following procedures will be followed to minimize the potential of exposure.

During site work, the appropriate precautions will be taken to restrict unauthorized access to the property.

During all site/earth work, dust suppression (e.g. watering, etc) techniques must be employed at all times. If it is anticipated due to the nature of the contaminants of concern that odors may be generated during site activities, air monitoring and means to control odors will be utilized, as appropriate (e.g. odor-suppressing foam, etc).

In the event that an unexpected observation or situation arises during site work, such activities will immediately stop. Workers will not attempt to handle the situation themselves but will contact the appropriate authority for further direction.

In the event that certain soils on site were not previously characterized, these soils are presumed to be regulated until such time that it is demonstrated to the Department, through sampling and laboratory analysis that they are not regulated. (For example, presumptive remedies or locations of previously inaccessible soil.)

If excess soil is generated / excavated from the Property, the soil is to remain on-site for analytical testing, to be performed by an environmental professional, in order to determine the appropriate disposal and/or management options. The soil must be placed on and covered with polyethylene/plastic sheeting during the entire duration of its staging and secured with appropriate controls to limit the loss of the cover and protect against storm-water and / or wind erosion (e.g. hay bales, silt fencing, rocks, etc).

Excavated soils will be staged and temporarily stored in a designated area of the property. Within reason, the storage location will be selected to limit the unauthorized access to the materials (e.g., away from public roadways/walkways). No regulated soil will be stockpiled on-site for greater than 60 days without prior Department approval.

In the event that stockpiled soils pose a risk or threat of leaching hazardous materials, a proper leak-proof container (e.g. drum or lined roll-off) or secondary containment will be utilized.

Soils excavated from the site may not be re-used as fill on residential property. Excavated fill material shall not be re-used as fill on commercial or industrial properties unless it meets the Department's Method 1 Residential Direct Exposure Criteria for all constituents listed in Table 1 of the Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (Remediation Regulations). Copies of the laboratory analysis results shall be maintained by the site owner and included in the annual inspection report for the site, or the closure report if applicable. In the event that the soil does not meet any of these criteria, the material must be properly managed and disposed of off site at a licensed facility.

Site soils, which are to be disposed of off-site, must be done so at a licensed facility in accordance with all local, state, and federal laws. Copies of the material shipping records associated with the disposal of the material shall be maintained by the site owner and included in the annual inspection report for the site.

Best soil management practices should be employed at all times and regulated soils should be segregated into separate piles (or cells or containers) as appropriate based upon the results of analytical testing, when multiple reuse options are planned (e.g. reuse on-site, reuse at a Department approved Industrial/Commercial property, or disposal at a Department approved licensed facility).

All non-disposable equipment used during the soil disturbance activities will be properly decontaminated as appropriate prior to removal from the site. All disposable equipment used during the soil disturbance activities will be properly containerized and disposed of following

completion of the work. All vehicles utilized during the work shall be properly decontaminated as appropriate prior to leaving the site.

At the completion of site work, all exposed soils are required to be recapped with Department approved engineered controls (2 ft of clean fill or equivalent: building foundations, 4 inches of pavement/concrete underlain with 6 inches of clean fill, and/or 1 foot of clean fill underlain with a geotextile liner) consistent or better than the site surface conditions prior to the work that took place. These measures must also be consistent with the Department approved ELUR recorded on the property. Any clean fill material brought on site is required to meet the Department's Method 1 Residential Direct Exposure Criteria or be designated by an Environmental Professional as Non-Jurisdictional under the Remediation Regulations. The Annual Inspection Report for the site, or Closure Report if applicable, should include either analytical sampling results from the fill demonstrating compliance or alternatively include written certification by an Environmental Professional that the fill is not jurisdictional.

Groundwater Management (if applicable)

Worker Health and Safety

To ensure the health and safety of on-site workers, persons involved in the excavation and handling of the material on site are required to wear a minimum of Level D personal protection equipment, including gloves, work boots and eye protection. Workers are also required to wash their hands with soap and water prior to eating, drinking, smoking, or leaving the site.

Department Approval

In accordance with Section A iii of the ELUR, no soil at the property is to be disturbed in any manner without prior written permission of the Department's Office of Waste Management, except for minor inspections, maintenance, and landscaping activities that do not disturb the contaminated soil at the Site. As part of the notification process, the site owner shall provide a brief written description of the anticipated site activity involving soil excavation. The notification should be submitted to the Department no later than 60 days prior to the proposed initiation of the start of site activities. The description shall include an estimate of the volume of soil to be excavated, a list of the known and anticipated contaminants of concern, a site figure clearly identifying the proposed areas to be excavated/disturbed, the duration of the project and the proposed disposal location of the soil.

Following written Notification, the Department will determine the post closure reporting requirements. Significant disturbances of regulated soil will require submission of a Closure Report for Department review and approval documenting that the activities were performed in accordance with this SMP and the Department approved ELUR. Minor disturbances of regulated soil may be documented through the annual certification submitted in accordance with Section H (Inspection & Non-Compliance) of the Department approved ELUR. The Department will also make a determination regarding the necessity of performing Public Notice to abutting property owners/tenants concerning the proposed activities. Work associated with the Notification will not commence until written Department approval has been issued. Once

Department approval has been issued, the Department will be notified a minimum of two (2) days prior to the start of activities at the site. Shall any significant alterations to the Department approved plan be necessary, a written description of the proposed deviation, will be submitted to the Department for review and approval prior to initiating such changes.

APPENDIX E

ANALYTICAL TESTING REQUIREMENTS FOR IMPORTED SOIL

SECTION 31 2312

ANALYTICAL TESTING REQUIREMENTS FOR IMPORTED SOIL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Obtaining and screening soil samples from soil sources to be imported and incorporated into the Project areas where non-compliant soils have been identified.
- B. Related Documents: The Contract Documents, as defined in Section 01 1000 Summary, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.
 - 1. Site Investigation Report, University of Rhode Island, Butterfield Road Substation, South Kingstown, Rhode Island, dated April 2017 prepared by Gordon R. Archibald, Inc.
- C. Related Sections:
 - 1. Section 31 2300 - Excavation and Fill
 - 2. Section 31 2310 - Contaminated Soil Excavation

1.2 REFERENCES

- A. Rhode Island Department of Environmental Management
 - 1. State of Rhode Island and Providence Plantations Department of Environmental Management Hazardous Materials Rules and Regulations for Hazardous Waste Management, Regulation #DEM OWM –HW 01-14, including all amendments and revisions.
- B. Rhode Island Department of Transportation
 - 1. Standard Specifications for Road and Bridge Construction, dated 2004, including all amendments and revisions.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Procedures for submittals.
 - 1. Product Data:
 - a. Prior to commencing construction, the Contractor shall submit to the Owner a list of soil sources for each classification of soil to be imported and incorporated into the Project areas where non-compliant soils have been identified.
 - b. The list for each soil classification shall state the location of material, Owner, anticipated quantity of soil to be imported, material state (in situ, stockpiled), material condition (virgin, processed, reclaimed, recycled from another Project) and any known environmental history associated with material conditions.
 - 2. Samples:
 - a. Prior to commencing construction, the Contractor shall submit to the Owner a Sampling and Analytical Work Plan (SAWP) outlining the methodology used to collect, preserve, analyze and report soil sample results. As minimum, the SAWP shall include:
 - 1) Sample collection methods including a description of sampling equipment, grab sample size and how representative grab samples will be obtained from in situ

- undeveloped and developed borrow sources and/or from stockpiled processed, reclaimed and/or recycled borrow sources;
- 2) Procedures for decontamination of sampling equipment prior to and between obtaining successive samples;
 - 3) Sample container, storage and preservation procedures and holding times;
 - 4) Sample handling, packaging, and transportation protocols;
 - 5) Sample documentation (labeling, chain-of custody, log book); and
 - 6) Sampling and analysis quality assurance/quality control procedures.
- b. The Contractor shall provide third party soil sampling with all samples analyzed at an analytical laboratory who meets the minimum requirements and guidelines to conduct chemical analysis, as developed by the EPA. The analytical laboratory shall be approved/certified by the Rhode Island Department of Environmental Management. The detection limit for all analytical results shall be below the acceptance criteria outlined in this Special Provision.
- c. The soil sampling frequency (which is dependent on soil borrow source and contaminant) and a list of contaminants to be analyzed for each soil classification are as outlined in this special Provision. The Contractor shall submit to the Owner two copies of a report that includes soil analytical results, applicable QA/QC data and chains of custody a minimum of one month prior to importing each classification of soil outlined in these Special Provisions to be imported and incorporated into the Project. The submittal shall include an option authored by a professional engineer registered in the State of Rhode Island and Providence Plantation who has a minimum of 10 years of experience evaluating soil compliance with the RIDEM's Remediation Regulations Method 1 soil direct exposure criteria and leachability criteria that the soil classification is compliant with the Project Specification requirements for that soil classification. The Owner shall review this submittal. The soil classification shall not be imported into the Project Limits until the Owner has provided written concurrence that the soil classification meets the Specification requirements for the soil classification.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The Contractor shall be responsible for furnishing all equipment, personnel and subcontractors required to complete and submit soil testing required in this Special Provisions.
- B. All materials to be used shall be in accordance with all appropriate sections of the Rhode Island Standard Specifications for Road and Bridge Construction, Amended 2010, with all revisions.

PART 3 - EXECUTION

3.1 TESTING

- A. Soil imported to the Project for use as Common Borrow, Gravel Borrow, Fill Gravel Borrow Under Structures, Pervious Fill, or Offsite Material Used for Soil Blending (Gravel Borrow only) used up to a non-impervious surface shall be shown to have an average contaminant level below the Rhode Island Department of Environmental Management (RIDEM) Method 1 RIDEM Residential Direct Exposure Criteria (RDEC) for TPH, VOC, SVOCs (16 PAH priority pollutants only) and RCRA 8 Metals prior to delivery to the Project.

Soil imported from a non-developed borrow source shall be tested at a frequency of 1 sample for every 5,000 cubic yards of in situ soil with a minimum of 2 samples per borrow source. Soil imported from another project or development borrow source shall be tested at a frequency of 1 sample for every 2,000 cubic yards with a minimum of 2 samples per borrow source. Contaminants to be tested, the test methods and acceptance shall be as outlined in the following table:

Constituent	Test Method	Minimum Detection Level
TPH	EPA Method 8100M	Below RIDEM Method 1 R-DEC
VOC	EPA Method 8260B	Below RIDEM Method 1 R-DEC
Semi-VOCs (16 PAHs only)	EPA Method 8270C	Below RIDEM Method 1 R-DEC
RCRA Eight Metals	EPA Methods 6010 and 7471A	Below RIDEM Method 1 R-DEC

Notes:

1. Item Gravel Borrow Subbase shall not require testing.
 2. The only exception is Arsenic, wherein the acceptance and sampling frequency criteria include the following:
 - a. No individual sample result shall be greater than 15 mg/kg;
 - b. A minimum of 10 soil samples per first 2,000 cubic yards with 2 additional soil samples per each additional 2,000 cubic yards of borrow source;
 - c. No greater than 10% of sample results shall exceed 7.0 mg/kg; and
 - d. The average of all sample results shall be 7.0 mg/kg or less.
- B. Soil imported to the Project for use as Loam Borrow or Plantable Soil in Project areas where non-compliant soils have been identified shall be shown to have an average contaminant level below the RIDEM Residential Direct Exposure Criteria (RDEC) for TPH, VOC, SVOCs (16 PAH priority pollutants only) and RCRA Eight Metals prior to delivery to the Project. Soil shall be tested at a frequency of 1 sample for every 2,000 cubic yards with a minimum of 2 samples per borrow source. Contaminants to be tested, the test methods and acceptance shall be as outlined in the following table:

Constituent	Test Method	Minimum Detection Level
TPH	EPA Method 8100M	Below RIDEM Method 1 R-DEC
VOC	EPA Method 8260B	Below RIDEM Method 1 R-DEC
Semi-VOCs (16 PAHs only)	EPA Method 8270C	Below RIDEM Method 1 R-DEC
RCRA Eight Metals	EPA Methods 6010 and 7471A	Below RIDEM Method 1 R-DEC

Notes:

1. The only exception is Arsenic, wherein the acceptance and sampling frequency criteria include the following:
 - a. No individual sample result shall be greater than 15 mg/kg;
 - b. A minimum of 10 soil samples per first 2,000 cubic yards with 2 additional soil samples per each additional 2,000 cubic yards of borrow source;
 - c. No greater than 10% of sample results shall exceed 7.0 mg/kg; and
 - d. The average of all sample results shall be 7.0 mg/kg or less.
- C. Soil imported to the Project for use as Special Graded Aggregate for Shaping and Trimming Driveways or Shoulders or Crushed Stone Surface Treatment used in top 2 feet of final grades in Project areas where non-compliant soils have been identified shall be shown to have an average contaminant level below the Rhode Island Department of Environmental Management (RIDEM) Method 1 Residential Direct Exposure Criteria (RDEC) for TPH, VOC, SVOCs (16 PAH priority pollutants only) and RCRA Eight Metals 1 prior to delivery to the Project. Soil shall be tested at a frequency of 1 sample for every

2,000 cubic yards with a minimum of 2 samples per borrow source. Contaminants to be tested, the test methods and acceptance shall be as outlined in the following table:

Constituent	Test Method	Minimum Detection Level
TPH	EPA Method 8100M	Below RIDEM Method 1 RDEC
VOC	EPA Method 8260B	Below RIDEM Method 1 RDEC
Semi-VOCs (16 PAHs only)	EPA Method 8270C	Below RIDEM Method 1 RDEC
RCRA Eight Metals	EPA Methods 6010 and 7471A	Below RIDEM Method 1 RDEC

Notes:

1. The only exception is Arsenic, wherein the acceptance and sampling frequency criteria include the following:
 - a. No individual sample result shall be greater than 15 mg/kg;
 - b. A minimum of 10 soil samples per first 2,000 cubic yards with 2 additional soil samples per each additional 2,000 cubic yards of borrow source;
 - c. No greater than 10% of sample results shall exceed 7.0 mg/kg; and
 - d. The average of all sample results shall be 7.0 mg/kg or less.

3.2 ACCEPTANCE CRITERIA

Contaminant	RDEC (mg/kg)	I/C-DEC (mg/kg)	Contaminant	RDEC (mg/kg)	I/C-DEC (mg/kg)
Volatiles					
Acetone	7,800	10,000	Ethylene dibromide	0.01	0.07
Benzene	2.5	200	Isopropyl benzene	27	10,000
Bromodichloromethane	10	92	Methyl ethyl ketone	10,000	10,000
Bromoform	81	720	Methyl isobutyl ketone	1,200	10,000
Bromomethane	0.8	2,900	Methyl tertiary-butyl ether (MTBE)	390	10,000
Carbon tetrachloride	1.5	44	Methylene chloride	45	760
Chlorobenzene	210	10,000	Styrene	13	190
Chloroform	1.2	940	1,1,1,2-Tetrachloroethane	2.2	220
Dibromochloromethane	7.6	68	1,1,2,2-Tetrachloroethane	1.3	29
1,2- Dibromo-3-chloropropane (DBCP)	0.5	41	Tetrachloroethene	12	110
1,1-Dichloroethane	920	10,000	Toluene	190	10,000
1,2-Dichloroethane	0.9	63	Trichloroethane	540	10,000
1,1-Dichloroethene	0.2	9.5	1,1,2-Trichloroethane	3.6	100
cis-1,2-Dichloroethene	630	10,000	Trichloroethene	13	520
Trans-1,2-Dichloroethene	1,100	10,000	Vinyl chloride	0.02	3.0
1,2-Dichloropropane	1.9	84	Xylenes (Total)	110	10,000
Ethylbenzene	71	10,000			
Semi-Volatiles					
Acenaphthene	43	10,000	Chrysene	0.4	780
Acenaphthylene	23	10,000	Dibenz(a,h)anthracene ^a	0.4	0.8
Anthracene	35	10,000	Fluoranthene	20	10,000
Benzo(a)anthracene	0.9	7.8	Fluorene	28	10,000
Benzo(a)pyrene	0.4	0.8	Indeno(1,2,3-cd)pyrene	0.9	7.8
Benzo(b)fluoranthene	0.9	7.8	Naphthalene	54	10,000
Benzo(g,h,i)perylene	0.8	10,000	Phenanthrene	40	10,000
Benzo(k)fluoranthene	0.9	7.8	Pyrene	13	10,000
RCRA 8 Metals					
Arsenic ^b	7.0	7.0	Lead ^c	150	500
Barium	5,500	10,000	Mercury	23	610
Cadmium	39	1,000	Selenium	390	10,000
Chromium III (Trivalent)	1,400	10,000	Silver	200	10,000
Chromium VI (Hexavalent)	390	10,000			

Soil Criteria as presented is based on the RI DEM Method 1 Criteria. See notes below for qualifiers

^a Estimated quantitation limits

^b Background Levels of Priority Pollutant Metals In Rhode Island Soils, T. O'Connor, RIDEM. For arsenic, see Section 12.0

^c Direct exposure criteria for Lead consistent with the Rhode Island Department of Health Rules and Regulations for Lead Poisoning Prevention [R23-24.6-PB], as amended

END OF SECTION

ANALYTICAL TESTING REQUIREMENTS
FOR IMPORTED SOILS



RHODE ISLAND

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

235 Promenade Street, Providence, RI 02908-5767

TDD 401-222-4462

REMEDIAL APPROVAL LETTER

File No. SR-32-1841

August 18, 2017

Paul DePace, Director
Office of Capital Projects
University of Rhode Island
Sherman Building
60 Tootell Road
Kingston, R.I. 02881

RE: Butterfield Road Substation – Remedial Action Work Plan (dated July 2017) by GRA, Inc.
Plat 15-4, Lot -7 (received August 3, 2017).

Dear Mr. DePace:

On November 9, 2011, the Rhode Island Department of Environmental Management's (the Department) Office of Waste Management (OWM) amended the Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (the Remediation Regulations). The purpose of these regulations is to create an integrated program requiring reporting, investigation and remediation of contaminated sites in order to eliminate and/or control threats to human health and the environment in a timely and cost-effective manner. A Remedial Approval Letter (RAL) is a document used by the Department to approve remedial actions at contaminated sites that do not involve the use of complex engineered systems or techniques (e.g. groundwater pump and treat systems, soil vapor extraction systems, etc.).

In the matter of the above-referenced property (the Site), the Department's OWM is in receipt of the following documentation submitted pursuant to the Remediation Regulations in response to the reported release at the Site:

1. Remedial Action Work Plan, received by the Department on August 3, 2017, and prepared by Gordon R. Archibald, Inc.

This document fulfills the requirements of Section 8.00 (Risk Management) and Section 9.00 (Remedial Action Work Plan (RAWP)) of the Remediation Regulations.

The preferred remedial alternative involves: **Soil Remedial Alternative #2- Soil Excavation with Off-Site Disposal**

Based upon review and consideration of the above referenced documents, the Department approves the Remedial Action Work Plan (RAWP) through this RAL provided that:

1. All work must be performed in accordance with all applicable regulations and the Department approved RAWP.
2. Start of the work described in the Department approved RAWP must be initiated within six (6) months of issuance of this RAL.

3. Prior to initiating any remedial activities, the Department shall be provided with a list of all contractors, and their respective contact information, that will be used on Site to complete the remedial work described in the Department approved RAWP. The Department shall be notified, when feasible, a minimum of five (5) working days in advance of any changes in contractors and/or consultants involved with the remedial work on this Site. The notification must be promptly supplied in writing with complete contact information for each new contractor or consultant (including but not limited to company name and address, contact name and address, contact telephone number and e-mail address).
4. All excavated regulated soil, if not approved for encapsulation onsite, shall be disposed of off-site at an appropriately licensed disposal facility in accordance with all local, State, and Federal laws. Copies of the material shipping records and manifests associated with the disposal of the material shall be included along with the Closure Report.
5. Areas of the site where contaminated soils are to be excavated must be staged and temporarily stored in a designated area, as proposed in the RAWP, of the site with proper polyethylene covers. Any stockpiled materials, including clean fill, must be underlain and covered with polyethylene sheeting and be secured at the end of each day with all appropriate erosion and sediment controls to limit the loss of the cover and protect against storm-water and wind erosion (i.e. hay bales, rocks, silt fencing). These appropriate sedimentation and erosion controls must be in place and in proper working order at all times until all disturbed areas are stabilized and capped as proposed. Within reason, the storage location will be selected to limit the unauthorized access to the materials (i.e. away from public roadways/walkways). No regulated soil will be stockpiled on-site for greater than thirty (30) days. In the event that stockpiled soils pose a risk or threat of leaching hazardous materials, a proper leak-proof container (i.e. drum or lined roll-off) or secondary containment will be required and utilized.
6. The OWM no longer requires the submittal of analytical data prior to clean fill being brought to a Site. It is the sole responsibility of the Performing Party and their consultant to analyze the material, certify that the material meets the Department's Residential Direct Exposure Criteria (RDEC), as defined by the Remediation Regulations, for all constituents, and is suitable for use on the Site. The OWM strongly suggests that enough representative samples of the clean fill are collected prior to moving the material to the Site to satisfy the Performing Party and their consultant that the material meets the RDEC. Please note that the OWM reserves its rights to sample the fill, if suspect, to confirm compliance with the RDEC.
7. All regulated soil remaining onsite shall be encapsulated by an engineered control consistent with those described in the Department approved RAWP.
8. Dust suppression techniques (i.e. watering) must be employed at all times during all soil disturbing/handling activities at the site in order to minimize the generation of fugitive dust.
9. Compliance sampling for the excavation in the location of soil exceedances shall be laboratory analyzed for Total Petroleum Hydrocarbons (TPH) and RCRA 8 Metals. Please note that if soil exceeding the Department's Residential Direct Exposure Criteria (RDEC) is to remain onsite then a draft Environmental Land Usage Restriction (ELUR) and Soil Management Plan (SMP) must be submitted to the OWM for review and approval prior to recording.
10. Within sixty (60) days of completion of the work described in the Department approved RAWP, a

Closure Report detailing the remedial action and including any disposal documentation shall be submitted to the OWM. Upon completion and approval of the Closure Report, and the ELUR and SMP if warranted, the Department will issue a Letter of Compliance for the Site.

11. Any changes in the activities detailed in the RAWP shall be reported to the OWM by telephone within one (1) working day and in writing within five (5) business days.
12. The OWM shall be notified forty-eight (48) hours prior to initiating the remedial activities at the site associated with the Department approved RAWP.
13. The OWM shall be immediately notified of any site or operation condition that results in non-compliance with this RAL.

At this time, the OWM offers its concurrence with the proposed remedial action for the property. The Department approves the RAWP provided that all activities and procedures detailed in the RAWP are strictly adhered to. Furthermore, this letter continues to place primary responsibility for the construction, operation, maintenance, and monitoring of the approved RAWP and its associated implementation on the University of Rhode Island. As the Responsible and Performing Party, the University of Rhode Island is expected to implement the RAWP in an expeditious and professional manner that prevents non-compliance with this RAL and said RAWP, and is protective of human health and the environment.

This RAL does not remove your obligation to obtain any other necessary permits from other local, State, or Federal agencies.

If you have any questions regarding this letter or would like the opportunity to meet with Department personnel, please contact me by telephone at (401) 222-2797, ext. 7102, or by E-mail at jeff.crawford@dem.ri.gov.

Sincerely,



Jeffrey Crawford, Project Manager
Principal Environmental Scientist
Office of Waste Management

Cc: Kelly Owens, Supervising Engineer
Steve Cadorette, GRA



RHODE ISLAND

DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

235 Promenade Street, Providence, RI 02908-5767

TDD 401-222-4462

LETTER OF COMPLIANCE

File No. SR-32-1841

July 6, 2018

Paul DePace, Director
Office of Capital Projects
University of Rhode Island
Sherman Building
60 Tootell Road
Kingston, R.I. 02881

RE: Butterfield Road Substation – Remedial Closure Report (dated May 2018) by GRA, Inc.
Plat 15-4, Lot -7 (received July 5, 2018).

Dear Mr. DePace:

On November 9, 2011, the Rhode Island Department of Environmental Management (the Department) enacted the amended Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (the Remediation Regulations). The purpose of these regulations is to create an integrated program requiring reporting, investigation, and remediation of contaminated sites in order to eliminate and/or control threats to human health and the environment.

In the matter of the above-referenced property (the Site), the Department's Office of Waste Management (OWM) is in receipt of the following documentation submitted pursuant to the Remediation Regulations in response to the reported release at the Site:

1. **Remedial Closure Report**, received by the Department on July 5, 2018, and prepared by Gordon R. Archibald, Inc.

Based upon the information and representations in the aforementioned document, the OWM concurs that the property is in compliance with the Remediation Regulations at this time.

Please be advised, however, that the Department reserves the right to require additional actions at the subject Site pursuant to the Remediation Regulations should any of the following occur:

- Conditions at the property previously unknown to the Department are discovered;
- Information previously unknown to the Department becomes available;
- Policy or regulatory requirements change.

Finally, please be advised that nothing in this Letter of Compliance relieves any Responsible Party, or the Site, from compliance with all other applicable local, State, or Federal rules, regulations, and requirements.

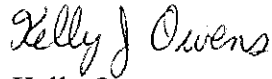
If you have any questions regarding this letter or would like the opportunity to meet with Department personnel, please contact me by telephone at (401) 222-2797, ext. 7102, or by E-mail at jeff.crawford@dem.ri.gov.

Sincerely,



Jeffrey Crawford, Project Manager
Principal Environmental Scientist
Office of Waste Management

Authorized by,



Kelly Owens
Supervising Engineer
Office of Waste Management

cc: Steve Cadorette, GRA

SECTION 01 2000 - PRICE AND PAYMENT PROCEDURES**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Allowances.
- B. Testing and inspection allowances.
- C. Schedule of values.
- D. Applications for payment.
- E. Warranty inspection retainage.
- F. Sales tax exemption.
- G. Change procedures.
- H. Defect assessment.
- I. Unit prices.
- J. Alternates.

1.02 ALLOWANCES

- A. See General Conditions Article 3.8 for Allowance provisions.
- B. Design Agent Responsibility:
 - 1. Consult with Contractor for consideration and selection of products, suppliers, and Installers.
 - 2. Select products in consultation with Owner and transmit decision to Contractor.
 - 3. Prepare Change Order to adjust final cost.
- C. Contractor Responsibility:
 - 1. Assist Design Agent or its Consultants in selection of products, suppliers and installers.
 - 2. Obtain proposals from suppliers and installers, and offer recommendations.
 - 3. On notification on selection by Design Agent, execute purchase agreement with designated supplier and installer.
 - 4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
 - 5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
- D. Schedule of Allowances: See Attachment A.

1.03 TESTING AND INSPECTION ALLOWANCE

- A. All costs of regularly scheduled testing are included in the Base Bid. See Attachment A for allowance to cover costs of additional testing to be provided when directed by the Owner.
- B. See Section 01 4000 and its attachment for testing requirements.

1.04 SCHEDULE OF VALUES

- A. Submit Schedule of Values in duplicate, one copyrighted original and one copy.
- B. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the major specification Section. Identify site mobilization, bonds, insurance and closeout.
- C. Include in each line item, the amount of Allowances specified in this Section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
- D. Include separately for each line item, a direct proportional amount of Contractor's overhead and profit.
- E. Revise schedule to list approved Change Orders, with each Application for Payment.

1.05 APPLICATIONS FOR PAYMENT

- A. Submit each application on an original AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet, accompanied by three copies.
 - 1. Prepare a draft version "pencil copy" of each application and distribute via email 5 days prior to due date for review by Design Agent and Owner's representative.
 - 2. After making agreed revisions, individually sign and notarize and emboss with notary's official seal, the original and each of the three copies. Deliver to Owner's representative for further processing and distribution.
 - 3. Applications not including original copyrighted AIA G702, and G703 Forms, will be rejected, and returned for re-submittal.
 - 4. Applications not properly signed and notarized will be rejected, and returned for re-submittal.
 - 5. Applications submitted without the following items described in this section and its attachments will be returned for resubmittal.
- B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.
- C. Provide one hard copy and one copy in disc form of the updated construction schedule with each Application for Payment submission, prepared per Section 01 3300.

1. Provide a statement signed by the Contractor's firm principal certifying that there are no unidentified outstanding claims for delay.
- D. Include with each monthly Application for Payment, following the first application, Certified Monthly Payroll Records with proper compliance cover sheet for the previous month's pay period. Identify MBE/DBE subcontractors and hours worked in a format acceptable to URI. See Attachment A this section for current State and Federal requirements.
- E. Submit with transmittal letter as specified for Submittals in Section 01 3300.
- F. Beginning with the second Application for Payment, Contractor's right to payment must be substantiated by documenting, on a copy of the URI Waiver of Lien Form included in Document 00 6140 - Waiver of Lien Form in this Project Manual, that payment monies due, less retainage not exceeding ten percent, have been paid in full to subcontractor and suppliers for work, materials, or rental of equipment billed for under specific line item numbers in the immediately preceding application.
- G. Substantiating Data: When the Owner or Design Agent requires additional substantiating information from the review of the "pencil copy", submit data justifying dollar amounts in question.
- H. In addition to the items above, include the following with the Application for Payment :
 1. Record Documents as specified in Section 01 7800, for review by the Owner which will be returned to the Contractor.
 2. Affidavits attesting to off-site stored products with insurance certificates as requested.
 3. Digital Photographs as specified in Section 01 3300. Include on same disc with construction schedule.
- I. Payment Period: Submit at monthly intervals unless stipulated otherwise in the Supplemental General Conditions.

1.06 WARRANTY INSPECTION RETAINAGE

- A. A percentage of job cost as defined in Attachment A will be retained from Final Payment for a duration of ten months. If, after ten months, all systems including mechanical and electrical, are determined by the Owner to be properly functioning, the Warranty Inspection Retainage will be released.
- B. If, after ten months, there are found to be modifications, adjustments, or corrections necessary to be made to address any system or product malfunction, in order to fulfill specified performance or requirements of such systems or products, release of the warranty inspection retainage will be delayed until such malfunctions are rectified.
- C. If, after twelve months from the date of Final Completion, all systems have not been fully addressed, the Owner may utilize the Warranty Inspection Retainage to hire others to execute necessary modifications, adjustments, or corrections.

1.07 SALES TAX EXEMPTION

- A. Owner is exempt from sales tax on products permanently incorporated in Work of the Project.
 - 1. Obtain sales tax exemption certificate number from Owner.
 - 2. Place exemption certificate number on invoice for materials incorporated in the Work of the Project.
 - 3. Furnish copies of invoices to Owner.
 - 4. Upon completion of Work, file a notarized statement with Owner that all purchases made under exemption certificate were entitled to be exempt.
 - 5. Pay legally assessed penalties for improper use of exemption certificate number.

1.08 CHANGE PROCEDURES

- A. Submittals: Submit name of the individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.
- B. The Design Agent will advise of minor changes in the Work not involving an adjustment to Contract Sum or Contract Time by issuing supplemental instructions on AIA Form G710.
- C. The Design Agent may issue a Proposal Request which includes a detailed description of a proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required, and the period of time during which the requested price will be considered valid. Contractor will prepare and submit an estimate within 15 days.
- D. The Contractor may propose changes by submitting a request for change to the Design Agent, describing the proposed change and its full effect on the Work. Include a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation, and a statement describing the effect on Work by separate or other Contractors. Document any requested substitutions in accordance with Section 01 6000.
- E. Stipulated Sum Change Order: Based on Proposal Request, and Contractor's fixed price quotation, or Contractor's request for a Change Order as approved by Design Agent.
- F. Unit Price Change Order: For contract unit prices and quantities, the Change Order will be executed on a fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, execute the Work under a Construction Change Directive. Changes in the Contract Sum or Contract Time will be computed as specified for a Time and Material Change Order.
- G. Construction Change Directive: Design Agent may issue a directive, on AIA Form G713 Construction Change Directive signed by the Owner, instructing the Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in the Contract Sum or Contract Time. Promptly execute the change.

- H. Time and Material Change Order: Submit an itemized account and supporting data after completion of the change, including timeslips signed by Owner's representative, within the time limits indicated in the Conditions of the Contract. The Design Agent will determine the change allowable in the Contract Sum and Contract Time as provided in the Contract Documents. Only Owner-representative-signed timeslips will be considered.
 - I. Maintain detailed records of work done on a Time and Material basis. Submit timeslips daily for verification and sign-off by Owner's representative on-site. Provide full information required for an evaluation of the proposed changes, and to substantiate costs for the changes in the Work.
 - J. Document each quotation for a change in cost or time with sufficient data to allow an evaluation of the quotation. Provide detailed breakdown of costs and estimates for labor and materials including a detailed breakdown for subcontractor's or vendor's Work. Include copies of written quotations from subcontractors or vendors.
 - K. Change Order Forms: AIA G701 Change Order.
 - L. Execution of Change Orders: The Design Agent will issue Change Orders for signatures of the parties as provided in the Conditions of the Contract.
 - M. Correlation Of Contractor Submittals:
 - 1. Promptly revise the Schedule of Values and the Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum. Promptly revise progress schedules to reflect any change in the Contract Time, revise sub-schedules to adjust times for any other items of work affected by the change, and resubmit.
 - 2. Promptly enter changes in the Project Record Documents.
- 1.09 DEFECT ASSESSMENT
- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
 - B. If, in the opinion of the Design Agent, it is not practical to remove and replace the Work, the Design Agent will direct an appropriate remedy or adjust payment.
 - C. The defective Work may remain, but the unit sum will be adjusted to a new sum at the discretion of the Design Agent.
 - D. The defective Work will be partially repaired to the instructions of the Design Agent, and the unit sum will be adjusted to a new sum at the discretion of the Design Agent.
 - E. The individual Specification Sections may modify these options or may identify a specific formula or percentage sum reduction.

- F. The authority of the Design Agent to assess the defect and identify a payment adjustment, is final.
- G. Non-Payment for Rejected Products: Payment will not be made for rejected products for any of the following:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined as unacceptable before or after placement.
 - 3. Products not completely unloaded from the transporting vehicle.
 - 4. Products placed beyond the lines and levels of the required Work.
 - 5. Products remaining on hand after completion of the Work.
 - 6. Loading, hauling, and disposing of rejected products.

1.10 UNIT PRICES

- A. See Attachment A.

1.11 ALTERNATES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in the Purchase Order.
- B. Coordinate related work and modify surrounding work as required.
- C. Schedule of Alternates: See Attachment A.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

01 2010 PRICE AND PAYMENT PROCEDURES - Attachment A

A. Allowances

1. **Screen Wall & Landscaping:** One Million Five Hundred Fifty Thousand dollars (\$1,550,000.00) to cover the design, procurement and installation of a ground mounted perimeter screen wall enclosure for the generator station; including foundations (piers) to support vertical posts to carry the screen wall panels and rock filled gabion base.
2. **Unanticipated Utilities:** Fifty Thousand dollars (\$50,000.00) to cover any discrepancies between existing utilities configuration and what is shown in the project documents that involves additional materials, labor, or reconfiguration to complete the work.
3. **Unanticipated Ledge Removal:** Twenty-Five Thousand dollars (\$25,000.00) to cover the cost to break up and remove any ledge encountered underground.
4. **MEP Coordination:** Twenty-Five Thousand dollars (\$25,000.00) to cover the cost associated with additional MEP scope not identified in the contract documents required to ensure a fully operational and code compliant installation.
5. **Security Cameras:** Twenty Thousand Dollars (\$20,000.00) to cover the cost associated with the procurement and installation of security camera(s) for plant monitoring in accordance with URI's standards.

B. Testing Allowance

1. None. Include all testing in Base Bid amount as part of the Work.

C. Unit Prices

1. Install 4" PVC Schedule 40 Conduit in accordance with the Contract Documents. Unit of Measurement: Linear Foot.
2. Install 2" PVC Schedule 40 Conduit in accordance with the Contract Documents. Unit of Measurement: Linear Foot.
3. Removal of Trench Rock per Specification Section 310000. Unit of Measurement: Cubic Yards.
4. Removal of Unanticipated Soils per Specifications Section 310000. Unit of Measurement: Cubic Yards

5. Removal of Unanticipated Unsuitable Soils per Specifications Section 310000. Unit of Measurement: Cubic Yards
6. Furnish and Install Handhole in accordance with the Contract Documents. Unit of Measurement: Each.

D. Alternates

Alternates may be selected to the limit of funds available and will be added to the Project in the order listed. All alternate work selected will be completed within the same schedule as the Base Bid work. The following Add Alternates shall be priced on the Bid Form:

Add Alternate #1: Provide new medium voltage transfer switch VFI-ATS1 with a solid dielectric medium in lieu of a fluid-filled dielectric tank.

E. Payroll Reporting

1. Forms for the submission of Certified Payroll Records may be found from the Rhode Island [Prevailing Wage Website](#) in either PDF or Excel formats. These forms must be used on monthly submittals.
2. Identify Apprenticeship hours required under RIGL 37-13-3.1 for all contracts over \$1 million in value.
3. A Minority Utilization Report for minority subcontractors must be included. Use the form provided as Attachment B.

F. Warranty Inspection Retainage

1. One-half of one percent of the cost of the Work will be retained from Final Payment for this purpose.

G. Liquidated Damages

1. See Bid Form for Liquidated Damages requirements.

END OF ATTACHMENT

MBE Compliance Office
1 Capitol Hill, 2nd Floor
Providence, RI 02908
401-574-8670, 401-574-8387 (fax)

01 2020 PRICE AND PAYMENT PROCEDURES - Attachment B

www.mbe.ri.gov (website)

Pursuant to RIGL 37-14.1 as well as the regulations promulgated thereto, the MBE Compliance Office requires that you complete the following table. Please note that these figures will be verified with the MBEs identified. If there are outstanding issues, such as retainage or a dispute, please indicate and attach supporting documentation for same. Also note that copies of invoice and cancelled checks for payment to all MBE subcontractors and suppliers are required.

Contractor/Vendor Name:

Project Name & Location:

Original Prime Contract Amount: \$ _____ **Current Prime Contract Amount:** _____

MBE/WBE Subcontractor	Original Contract Amount	Change Orders	Revised Contract Value	% Completed To Date	Amount Paid To Date	Amount Due	Retainage %	Retainage Amount	Explanation

I declare, under penalty of perjury, that the information provided in this verification form and supporting documents is true and correct.

Signature

Date

Printed Name

Notary Certificate:

Sworn before me this _____ day of _____, 201_____.

Notary Signature

Commission Expires

SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Site administration
- B. Coordination and project conditions.
- C. Preconstruction meeting.
- D. Site mobilization meeting.
- E. Progress meetings.
- F. Pre-installation meetings.

1.02 SITE ADMINISTRATION

- A. Maintain a daily attendance log to include the names of all project employees and guests to the site regardless of project size. Each guest signing the log should indicate a brief description of the reason for the visit, the guest's employer or organization. The log sheet, or sheets, must clearly indicate the Project Name, and the name of the Prime contractor. Each line in the log should allow for the name of that employee, the employee's job title (use terminology used by prevailing wage job title), the name of that employee's employer and the employee's contact information. This log shall be kept on a uniform form prescribed by the Director of Labor and Training. Such log shall be available for inspection on the site at all times by the Purchaser, Owner, and/or the Director of the Department of Labor and Training and his or her designee. Provide copies when requested. The log shall comply with requirements of RIGL 37-12-12(c.).

1.03 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate the scheduling, submittals, and the Work of the various Sections of the Project Manual to ensure an efficient and orderly sequence of the installation of interdependent construction elements.
- B. Verify that the utility requirements and characteristics of the operating equipment are compatible with the building utilities. Coordinate the Work of the various Sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- C. Coordinate the space requirements, supports and installation of the mechanical and electrical Work, which are indicated diagrammatically on the Drawings. Follow the routing shown for the pipes, ducts, and conduit, as closely as practicable; place runs parallel with the lines of the building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

- D. Coordinate the completion and clean up of the Work of the separate Sections in preparation for Substantial Completion and for portions of the Work designated for the Owner's partial occupancy.
- E. After the Owner's occupancy of the premises, coordinate access to the site for correction of defective Work and the Work not in accordance with the Contract Documents to minimize disruption of the Owner's activities.

1.04 PRECONSTRUCTION MEETING

- A. The Design Agent will schedule a meeting after a Purchase Order is issued to the Contractor.
- B. Attendance Required: Owner's Representative, Design Agent, and Contractor.
- C. Agenda:
 - 1. Distribution of the Contract Documents.
 - 2. Submission of a list of Subcontractors, a list of products, schedule of values, and a progress schedule.
 - 3. Designation of the personnel representing the parties in the Contract and the Design Agent.
 - 4. The procedures and processing of the field decisions, submittals, substitutions, applications for payments, proposal requests, Change Orders, and Contract closeout procedures.
 - 5. Scheduling.
- D. Contractor shall record the minutes and distribute copies within two days after the meeting to the participants, with copies to the Design Agent, Owner, other participants, and those consultants affected by the decisions made.

1.05 SITE MOBILIZATION MEETING

- A. The Design Agent will schedule a meeting at the Project site prior to the Contractor's occupancy and may occur at the same time as the Preconstruction meeting noted above.
- B. Attendance Required: The Owner, Design Agent, Contractor, the Contractor's Superintendent, and major Subcontractors.
- C. Agenda:
 - 1. Use of the premises by the Owner and the Contractor.
 - 2. The Owner's requirements and partial occupancy.
 - 3. Construction facilities and controls provided by the Owner.
 - 4. Temporary utilities provided by the Owner.
 - 5. Security and housekeeping procedures.
 - 6. Schedules.
 - 7. Application for payment procedures.
 - 8. Procedures for testing.

9. Procedures for maintaining the record documents.
10. Requirements for the start-up of equipment.
11. Inspection and acceptance of the equipment put into service during the construction period.

- D. Contractor shall record the minutes and distribute the copies within two days after the meeting to the participants, with copies to the Design Agent, Owner, other participants, and those consultants affected by the decisions made.

1.06 PROGRESS MEETINGS

- A. Schedule and administer the meetings throughout the progress of the Work at weekly intervals while work is in process.
- B. Make arrangements for the meetings, prepare the agenda with copies for the participants, and preside at the meetings.
- C. Attendance Required: The job superintendent, major subcontractors and suppliers, the Owner, Design Agent, and Consultants as appropriate to agenda topics for each meeting.
- D. Agenda:
 1. Review the minutes of previous meetings.
 2. Review of the Work progress.
 3. Field observations, problems, and decisions.
 4. Identification of the problems which impede the planned progress.
 5. Review of the submittals schedule and status of the submittals.
 6. Review of delivery schedules.
 7. Maintenance of the progress schedule.
 8. Corrective measures to regain the projected schedules.
 9. Planned progress during the succeeding work period.
 10. Coordination of the projected progress.
 11. Maintenance of the quality and work standards.
 12. Effect of the proposed changes on the progress schedule and coordination.
 13. Other business relating to the Work.
- E. Contractor shall record the minutes and distribute the copies within two days after the meeting to the participants, with copies to the Design Agent, Consultants, Owner, participants, and others affected by the decisions made.

1.07 PREINSTALLATION MEETINGS

- A. When required in the individual specification Sections, convene a pre-installation meeting at the site prior to commencing the Work of the Section.
- B. Require attendance of the parties directly affecting, or affected by, the Work of the specific Section.

- C. Notify the Design Agent four days in advance of the meeting date.
- D. Prepare an agenda and preside at the meeting:
 - 1. Review the conditions of installation, preparation and installation procedures.
 - 2. Review coordination with the related work.
- E. Record the minutes and distribute the copies within two days after the meeting to the participants, with copies to the Design Agent, Owner, participants, and those Consultants affected by the decisions made.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

01 3010 ADMINISTRATIVE REQUIREMENTS - Attachment A

A. Pre-installation Meetings

1. Refer to technical specification sections for required pre-installation meetings.

END OF ATTACHMENT

SECTION 01 3300 - SUBMITTAL PROCEDURES**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Submittal procedures.
- B. Construction progress schedules.
- C. Proposed products list.
- D. Product data.
- E. Shop drawings.
- F. Design Data.
- G. Samples.
- H. Test reports.
- I. Certificates.
- J. Manufacturer's instructions.
- K. Manufacturer's field reports.
- L. Digital Photographs.
- M. Erection drawings.
- N. Construction photographs.

1.02 SUBMITTAL PROCEDURES

- A. Master List Submittal:
 - 1. Submit a master list of the required submittals with a proposed date for each item to be submitted. See Attachment A for initial minimum list on which to base master.
 - 2. Show the date submittal was sent, days since submittal was sent, status of submittal, date submittal was received in return, and any date associated with resubmittals.
 - 3. Up date master list with each submission and response.
 - 4. Issue copy of master list at least monthly to the Design Agent.

- B. Transmit each submittal with a dated Design Agent-accepted transmittal form.
- C. Transmit printed copies and electronic PDF copy of each submittal to the Design Agent for review and comment as outlined in each section below.
- D. Sequentially number the transmittal form. Mark revised submittals with an original number and a sequential alphabetic suffix.
- E. Identify the Project, Contractor, subcontractor and supplier; the pertinent drawing and detail number, and the specification Section number, appropriate to the submittal.
- F. Apply a Contractor's electronic stamp certifying that the review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of the information is in accordance with the requirements of the Work and the Contract Documents.
- G. Schedule submittals to expedite the Project, and deliver to the Design Agent's FTP site. Coordinate the submission of related items.
- H. For each submittal, allow 15 days for review.
- I. Identify all variations from the Contract Documents and any Product or system limitations which may be detrimental to a successful performance of the completed Work.
- J. Allow space on the submittals for the Contractor's, Design Agent's, and Consultant's electronic review stamps.
- K. When revised for resubmission, identify the changes made since the previous submission.
- L. Distribute copies of the reviewed submittals as appropriate. Reproduce as necessary to inform subcontractors without internet download capabilities. Instruct the parties to promptly report any inability to comply with the Contract requirements.
- M. Produce additional copies as required for the Record Document purposes as described in Section 01 7800.

1.03 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial progress schedule in duplicate within 20 days after Date of Commencement for Design Agent to review. After a review, submit detailed schedules within 15 days modified to accommodate the revisions recommended by the Design Agent and Owner.

- B. Distribute copies of the reviewed schedules to the Project site file, subcontractors, suppliers, and other concerned parties. Instruct the recipients to promptly report, in writing, the problems anticipated by the projections indicated in the schedules
- C. Submit updated schedules with each Application for Payment, identifying changes since previous version as follows:
 - 1. Indicate the progress of each activity to the date of submittal, and the projected completion date of each activity.
 - 2. Identify the activities modified since the previous submittal, major changes in the scope, and other identifiable changes.
 - 3. Provide a narrative report to define the problem areas, the anticipated delays, and impact on the Schedule. Report the corrective action taken, or proposed, and its effect including the effect of changes on the schedules of separate contractors.
- D. Submit a computer-generated horizontal bar chart with separate line for each major portion of the Work or operation, identifying the first work day of each week.
- E. Show a complete sequence of construction by activity, identifying the Work of separate stages and other logically grouped activities. Indicate the early and late start, the early and late finish, float dates, and duration.
- F. Indicate an estimated percentage of completion for each item of the Work at each submission.
- G. Provide a separate schedule of submittal dates for shop drawings, product data, and samples, including Owner-furnished Products and Products identified under Allowances, if any, and the dates reviewed submittals will be required from the Design Agent. Indicate the decision dates for selection of the finishes.
- H. Indicate the delivery dates for Owner furnished Products, and for Products identified under Allowances.

1.04 PROPOSED PRODUCTS LIST

- A. Within 20 days after the Date of Commencement, submit a list of major products proposed for use, with the name of the manufacturer, the trade name, and the model number of each product.
- B. For the products specified only by reference standards, give the manufacturer, trade name, model or catalog designation, and reference standards.
- C. With each product listed, indicate the submittal requirements specified to be adhered to, and an indication of relevant "long-lead-time" information , when appropriate.

1.05 PRODUCT DATA

- A. Product Data: Submit to the Design Agent for review for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents. Provide copies and distribute in accordance with the SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01 7800.
- B. Submit one (1) printed copy and one (1) electronic PDF copy for review. The Design Agent will retain the reviewed printed copy for record and return the reviewed electronic PDF copy to the Contractor for distribution.
- C. Mark each copy to identify the applicable products, models, options, and other data. Supplement the manufacturers' standard data to provide the information specific to this Project.
- D. Indicate the product utility and electrical characteristics, the utility connection requirements, and the location of utility outlets for service for functional equipment and appliances.
- E. After a review distribute in accordance with the Submittal Procedures article above and provide copies for record documents described in Section 01 7800.

1.06 SHOP DRAWINGS

- A. Shop Drawings: Submit to the Design Agent for review for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents. Produce copies and distribute in accordance with the SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01 7800.
- B. Submit two (2) printed copies and one (1) electronic PDF copy for review. The Design Agent and /or Consultants will retain the reviewed printed copies for record and return the reviewed electronic PDF copy to the Contractor for distribution.
- C. Indicate the special utility and electrical characteristics, the utility connection requirements, and the location of utility outlets for service for functional equipments and appliances.

1.07 SAMPLES

- A. Samples: Submit to the Design Agent for review for the limited purpose of checking for conformance with the information given and the design concept expressed in the Contract Documents. Produce duplicates and distribute in accordance with the

SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01 7800.

- B. Samples for Selection as Specified in Product Sections:
 - 1. Submit to the Design Agent for aesthetic, color, or finish selection.
 - 2. Submit samples of the finishes in the colors selected for the Design Agent's records.
 - 3. After review, produce duplicates and distribute in accordance with the SUBMITTAL PROCEDURES article and for the record documents purposes described in Section 01 7800.
- C. Submit samples to illustrate the functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate the sample submittals for interfacing Work.
- F. Include identification on each sample, with the full Project information.
- G. Submit at least the number of samples specified in the individual specification Sections; the Design Agent will retain two samples.
- H. Reviewed samples, which may be used in the Work, are indicated in the individual specification Sections.
- I. Samples will not be used for testing purposes unless they are specifically stated to be in the specification Section.

1.08 TEST REPORTS

- A. Submit (1) printed and (1) electronic PDF lab reports in accordance with Section 01 4000.
- B. Submit test reports for information for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

1.09 DESIGN DATA

- A. Submit (1) printed and (1) electronic PDF data for the Design Agent's knowledge as contract administrator for the Owner.
- B. Submit information for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

1.10 CERTIFICATES

- A. When specified in the individual specification Sections, submit (1) printed and (1) electronic PDF certification by the manufacturer, installation/application subcontractor, or the Contractor to the Design Agent in the quantities specified for the Product Data.
- B. Indicate that the material or product conforms to or exceeds the specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- A. Certificates may be recent or previous test results on the material or product, but must be acceptable to the Design Agent and its Consultants.

1.10 MANUFACTURER'S INSTRUCTIONS

- A. When specified in the individual specification Sections, submit (1) printed and (1) electronic PDF copy of instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to the Design Agent for delivery to the Owner in the quantities specified for Product Data.
- B. Indicate the special procedures, and the perimeter conditions requiring special attention, and the special environmental criteria required for application or installation.

1.11 MANUFACTURER'S FIELD REPORTS

- A. Submit (1) printed and (1) electronic PDF of reports for the Design Agent's benefit as contract administrator for the Owner.
- B. Submit the report within 30 days of observation to the Design Agent for the limited purpose of assessing conformance with the information given and the design concept expressed in the Contract Documents.

1.12 DIGITAL PHOTOGRAPHS

- A. Submit minimum 12 digital photographs of construction progress each month on the same CD as the project schedule submittal. Include both jpg. and reduced-size PDF versions for email use.
- B. Include an additional minimum of 12 photographs documenting underground utilities when installed in relationship to visible site features.
- C. Include photographs of important in-wall or ceiling utilities before close-in at appropriate stages of construction.
- D. See Section 01 7800 for close-out copy requirements of these files.

1.13 ERECTION DRAWINGS

- A. When specified in the individual Specification sections, the trade contractors shall submit (1) printed and (1) electronic PDF copy of erection drawings for review prior to proceeding with fabrication and/or construction.
- B. Erection drawings shall be prepared in accordance with the latest edition of the respective trades' codes of standard practice.
- C. All erection drawings shall be fully developed by the trade contractors or by agents of the contractors. CAD files, photocopies, or other reproductions of the contract drawings in whole or in part shall not be used by the trade contractors or their agents for the preparation and development of erections drawings without the expressed written consent of the Design Agent.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

01 3310 SUBMITTAL PROCEDURES - Attachment A

A. Submittal List

1. Refer to technical specification sections for required submittals.

END OF ATTACHMENT

SECTION 01 4000 – QUALITY REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Quality control and control of installation.
- B. Verification of Credentials and Licenses.
- C. Tolerances
- D. References.
- E. Testing and inspection services.
- F. Manufacturers' field services.
- G. Mock-up Requirements.

1.02 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. Monitor a quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of the specified quality.
- B. Comply with all manufacturers' instructions and recommendations, including each step in sequence.
- C. When the manufacturers' instructions conflict with the Contract Documents, request a clarification from the Design Agent before proceeding.
- D. Comply with the specified standards as a minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform the Work by persons qualified to produce the required and specified quality.
- F. Verify that field measurements are as indicated on the Shop Drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.03 VERIFICATION OF CREDENTIALS AND LICENSES

- A. The Owner has implemented a project management oversight process and is applying it to current construction projects at URI.
- B. An element of this oversight process is the verification that persons employed on the project site have appropriate and current credentials and licenses in their possession, at the project site, for the work they are performing.
- C. Be forewarned that state resident inspectors will be checking for verification of credentials and licenses of both union and non-union persons, in their onsite inspections.
- D. State resident inspectors will also be reviewing Contractor's Certified Monthly Payroll Records for conformance with RI State Prevailing Wage Rate requirements.
- E. Those persons without the appropriate credentials and licenses will be subject to dismissal from the project site.

1.04 TOLERANCES

- A. Monitor the fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with the manufacturers' tolerances. When the manufacturers' tolerances conflict with the Contract Documents, request a clarification from the Design Agent before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.05 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by the date of issue current on the date of the Contract Documents, except where a specific date is established by code.
- C. Obtain copies of the standards where required by the product specification Sections.
- D. When the specified reference standards conflict with the Contract Documents, request a clarification from the Design Agent before proceeding.
- E. Neither the contractual relationships, duties, or responsibilities of the parties in the Contract, nor those of the Design Agent, shall be altered from the Contract Documents by mention or inference otherwise in reference documents.

1.06 TESTING AND INSPECTION SERVICES

- A. The Contractor will submit the name of an independent firm to the Design Agent for approval by the Owner, to perform the testing and inspection services. The Contractor shall pay for all the services required in the Base Bid as described in Attachment A. Contractor shall coordinate any Owner-authorized testing also described in Attachment A, to be paid for from Testing Allowance.
- B. The independent firm will perform the tests, inspections and other services specified in the individual specification Sections and as required by the Design Agent or its Consultants.
 - 1. Laboratory: Authorized to operate in the location in which the Project is located.
 - 2. Laboratory Staff: Maintain a full time registered Engineer on staff to review the services.
 - 3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to either the National Bureau of Standards or to the accepted values of natural physical constants.
- C. Testing, inspections and source quality control may occur on or off the project site. Perform off-site testing as required by the Design Agent or the Owner.
- D. Reports will be submitted by the independent firm to the Design Agent, the Consultant for that trade, and the Contractor, in duplicate, indicating the observations and results of tests and indicating the compliance or non-compliance with Contract Documents.
- E. Cooperate with the independent firm; furnish samples of the materials, design mix, equipment, tools, storage, safe access, and the assistance by incidental labor as requested.
 - 1. Notify the Design Agent and Engineer and the independent firm 24 hours prior to the expected time for operations requiring services.
 - 2. Make arrangements with the independent firm and pay for additional samples and tests required for the Contractor's use.
- F. Testing and employment of the testing agency or laboratory shall not relieve the Contractor of an obligation to perform the Work in accordance with the requirements of the Contract Documents.
- G. Re-testing or re-inspection required because of a non-conformance to the specified requirements shall be performed by the same independent firm on instructions by the Design Agent or its Consultant. Payment for the re-testing or re-inspection will be charged to the Contractor by deducting the testing charges from the Contract Sum.
- H. Agency Responsibilities:
 - 1. Test samples of mixes submitted by the Contractor.
 - 2. Provide qualified personnel at the site. Cooperate with the Design Agent or its Consultant and the Contractor in performance of services.
 - 3. Perform specified sampling and testing of the products in accordance with the specified standards.
 - 4. Ascertain compliance of the materials and mixes with the requirements of the Contract

Documents.

5. Promptly notify the Design Agent, Consultant and the Contractor of observed irregularities or non-conformance of the Work or products.
 6. Perform additional tests required by the Design Agent or its Consultants.
 7. Attend the preconstruction meetings and the progress meetings.
- I. Agency Reports: After each test, promptly submit two copies of the report to the Design Agent, appropriate Consultant, and to the Contractor. When requested by the Design Agent, provide an interpretation of the test results. Include the following:
1. Date issued.
 2. Project title and number.
 3. Name of inspector.
 4. Date and time of sampling or inspection.
 5. Identification of product and specifications section.
 6. Location in the Project.
 7. Type of inspection or test.
 8. Date of test.
 9. Results of tests.
 10. Conformance with Contract Documents.
- J. Limits On Testing Authority:
1. Agency or laboratory may not release, revoke, alter, or enlarge on the requirements of the Contract Documents.
 2. Agency or laboratory may not approve or accept any portion of the Work.
 4. Agency or laboratory may not assume any duties of the Contractor.
 5. Agency or laboratory has no authority to stop the Work.
- 1.08 MANUFACTURERS' FIELD SERVICES
- A. When specified in the individual specification Sections, require the material or Product suppliers, or manufacturers, to provide qualified staff personnel to observe the site conditions, the conditions of the surfaces and installation, the quality of workmanship, the start-up of equipment, or test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Submit the qualifications of the observer to the Design Agent 30 days in advance of the required observations. Observer is subject to approval of the Design Agent.
- C. Report the observations and the site decisions or instructions given to the applicators or installers that are supplemental or contrary to the manufacturers' written instructions.
- D. Refer to Section 01 3300 - SUBMITTAL PROCEDURES, MANUFACTURERS' FIELD REPORTS article.

1.09 MOCK-UP REQUIREMENTS

- A. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.
- B. Accepted mock-ups shall be a comparison standard for the remaining Work.
- C. Where mock-up has been accepted by Design Agent and is no longer needed, remove mock-up and clear area when directed to do so.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not used.

END OF SECTION

01 4010 QUALITY REQUIREMENTS – Attachment A

A. Base Bid Testing Requirements List

1. Refer to technical specification sections for testing requirements.

B. Additional Owner-Authorized Testing Requirements List

1. None.

END OF ATTACHMENT

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Temporary Utilities:
 - 1. Temporary electricity.
 - 2. Temporary lighting for construction purposes.
 - 3. Temporary heating.
 - 4. Temporary cooling.
 - 5. Temporary ventilation.
 - 6. Telephone service.
 - 7. Temporary water service.
 - 8. Temporary sanitary facilities.
- B. Construction Facilities:
 - 1. Field offices and sheds.
 - 2. Hoisting.
 - 3. Parking/Traffic.
 - 4. Progress cleaning and waste removal.
 - 5. Project identification.
 - 6. Traffic regulation.
- C. Temporary Controls:
 - 1. Barriers.
 - 2. Enclosures and fencing.
 - 3. Security.
 - 4. Fire detection.
 - 5. Water control.
 - 6. Dust control.
 - 7. Erosion and sediment control.
 - 8. Noise control.
 - 9. Pest control.
 - 10. Pollution control.
 - 11. Rodent control.
- D. Removal of utilities, facilities, and controls with reseeding and repair of grounds.
- E. See Attachment A for any modifications.

1.02 TEMPORARY ELECTRICITY

- A. The Owner will pay the cost of energy used. Exercise measures to conserve energy. Utilize the Owner's existing power service.
- B. Complement the existing power service capacity and characteristics as required for construction operations.

- C. Provide power outlets, with branch wiring and distribution boxes located at each floor or as required for construction operations. Provide flexible power cords as required for portable construction tools and equipment. All flexible power cords shall be suspended with hangers to eliminate trip hazards.
- D. Provide main service disconnect and over-current protection at a convenient location, or a feeder switch at the source distribution equipment or meter.
- E. Permanent convenience receptacles may not be utilized during construction.
- F. Provide distribution equipment, wiring, and outlets to provide single-phase branch circuits for power. Provide 20-ampere duplex outlets, single-phase circuits for power tools.

1.03 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain incandescent lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft (21 watt/sq m).
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Maintain lighting and provide routine repairs.
- D. Permanent building lighting may be utilized during construction where not removed.

1.04 TEMPORARY HEATING

- A. Existing facilities will be occupied and heated by the University when temperatures require. Take care to avoid leaving doors open in exterior walls that could compromise heating operations. For new construction, the cost of energy will be borne by the Contractor. Provide temporary heating as necessary for construction operations.
- B. Supplement with temporary heat devices if needed to maintain the specified conditions for construction operations even in existing buildings.
- C. Maintain a minimum ambient temperature of 50 degrees F in the areas where construction is in progress, unless indicated otherwise in the product Sections.
- D. In areas of work with mechanical hot-air heating, clean units and replace filters after Substantial Completion.
- E. Do not use new equipment for heating after replacement during construction.

1.05 TEMPORARY COOLING

- A. Existing cooling facilities are typically not available.
- B. Provide and pay for cooling devices and cooling as needed to maintain the specified conditions for construction operations.

- C. Maintain a maximum ambient temperature of 80 degrees F in the areas where construction is in progress, unless indicated otherwise in the specifications.

1.06 TEMPORARY VENTILATION

- A. Ventilate enclosed areas to achieve a curing of materials, to dissipate humidity, and to prevent the accumulation of dust, fumes, vapors, or gases.
- B. If existing ventilation fans are used during construction, clean fans in areas of work after Substantial Completion.

1.07 TELEPHONE SERVICE

- A. Provide, maintain, and pay for cell phone service to the field supervisor at the time of project mobilization and until project Final Completion.

1.08 TEMPORARY WATER SERVICE

- A. The Owner will pay the cost of temporary water. Exercise measures to conserve energy. Utilize the Owner's existing water system, extend and supplement with temporary devices as needed to maintain the specified conditions for construction operations.
- B. Extend branch piping with outlets located so that water is available by hoses with threaded connections. Provide temporary pipe insulation if needed to prevent freezing.

1.09 TEMPORARY SANITARY FACILITIES

- A. Contractor shall provide and maintain temporary toilet facilities for use by all construction personnel. Trades people will not be permitted to use existing facilities within the building.

1.10 FIELD OFFICES AND SHEDS

- A. Do not use existing facilities for storage. Job meetings will be held on campus at a location to be chosen by the University.
- B. Storage Areas and Sheds: Size to the storage requirements for the products of the individual Sections, allowing for access and orderly provision for the maintenance and for the inspection of Products to the requirements of Section 01 6000. Containers will be permitted within the project limit line. Coordinate with URI for storage areas.
- C. Preparation: Fill and grade the sites for the temporary structures to provide drainage away from the buildings.
- D. Removal: At the completion of the Work remove the buildings, foundations, utility services, and debris. Restore the areas.

1.11 HOISTING

- A. Contractor is responsible for all hoisting required to facilitate, serve, stock, clean, and complete the Work. Include all costs for Operating Engineers, fuel, delivery and removal, mobilization, staging, protection of grades and surfaces, and equipment.

1.12 PARKING/TRAFFIC

- A. Workers must park in lots assigned by the University with daily permits. See Site Utilization Plan.
- B. Use of designated existing on-site streets and driveways for construction traffic is permitted. Tracked vehicles are not allowed on paved areas.
- C. Do not allow heavy vehicles or construction equipment in parking areas.
- D. Do not allow vehicle parking on existing sidewalks.
- E. Provide and maintain access to fire hydrants and control valves free of obstructions.
- F. Remove mud from construction vehicle wheels before entering streets. Cleanup dirt, rocks, and debris left on street from construction vehicles.
- G. Use designated existing on-site roads for construction traffic.
- H. Maintenance:
 - 1. Maintain the traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
 - 2. Maintain existing and permanent paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain the paving and drainage in original, or specified, condition.
- I. Removal, Repair:
 - 1. Remove temporary materials and at Substantial Completion.
 - 2. Remove underground work and compacted materials to a depth of 2 feet; fill and grade the site as specified.
 - 3. Repair existing and permanent facilities damaged by use, to the original or specified condition.

1.13 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain the site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other remote spaces, prior to enclosing the space.

- C. Broom and vacuum clean the interior areas prior to the start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and rubbish from the site daily, as necessary to prevent an on-site accumulation of waste material, debris, and rubbish, and dispose off-site.
- E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.14 PROJECT IDENTIFICATION

- A. Project Identification Sign: One painted sign, 32 sq ft area, bottom 6 feet above the ground.
 - 1. Content:
 - a. Project title, and name of the Owner as indicated on the Contract Documents.
 - b. Names and titles of the authorities.
 - c. Names and titles of the Design Agent and Consultants.
 - d. Name of the Design Agent Contractor.
 - 2. Graphic Design, Colors, and Style of Lettering: 3 colors, as designated by the Design Agent during construction.
- B. Project Informational Signs:
 - 1. Painted informational signs of same colors and lettering as the Project Identification sign, or standard products; size lettering to provide legibility at 100-foot distance.
 - 2. Provide sign at each field office, storage shed, and directional signs to direct traffic into and within site. Relocate as the Work progress requires.
 - 3. No other signs are allowed without the Owner's permission except those required by law.
- C. Design all signs and their structures to withstand a 60-miles/hr-wind velocity.
- D. Sign Painter: Experienced as a professional sign painter for a minimum of three years.
- E. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for the duration of construction.
- F. Show content, layout, lettering, color, foundation, structure, sizes, and grades of members.
- G. Installation:
 - 1. Install the project identification sign within 15 days after the date of receipt of the Purchase Order from State of Rhode Island Department of Administration, Division of Purchases.
 - 2. Erect at the designated location.
 - 3. Erect the supports and framing on a secure foundation, rigidly braced and framed to resist wind loadings.
 - 4. Install the sign surface plumb and level, with butt joints. Anchor securely.
 - 5. Paint exposed surfaces of the sign, supports, and framing.
- H. Maintenance: Maintain the signs and supports clean, repair deterioration and damage.

- I. Removal: Remove the signs, framing, supports, and foundations at the completion of the Project and restore the area.

1.15 TRAFFIC REGULATION

- A. Signs, Signals, and Devices:
 - 1. Post Mounted and Wall Mounted Traffic Control and Informational Signs: As approved by local jurisdictions.
 - 2. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.
 - 3. Flag person Equipment: As required by local jurisdictions.
 - 4. Police Details: Provide all police details as required by local jurisdictions, including payment directly to officers.
- B. Flag Persons: Provide trained and equipped flag persons to regulate the traffic when construction operations or traffic encroach on the public traffic lanes.
- C. Flares and Lights: Use flares and lights during the hours of low visibility to delineate the traffic lanes and to guide traffic.
- D. Haul Routes:
 - 1. Consult with the authority having jurisdiction, establish the public thoroughfares to be used for haul routes and site access.
- E. Traffic Signs and Signals:
 - 1. At approaches to the site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct the construction and affected public traffic.
 - 2. Install and operate automatic traffic control signals to direct and maintain the orderly flow of traffic in areas under the Contractor's control, and areas affected by the Contractor's operations.
 - 3. Relocate as the Work progresses, to maintain effective traffic control.
- F. Removal:
 - 1. Remove equipment and devices when no longer required.
 - 2. Repair damage caused by installation.
 - 3. Remove post settings to a depth of 2 feet .

1.16 BARRIERS

- A. Provide barriers to allow for the Owner's use of the site and to protect existing facilities and adjacent properties from damage from the construction operations, or demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way, or for public access to the building.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.17 ENCLOSURES AND FENCING

- A. Construction: Provide 6-ft. high commercial grade chain link fence around on-site equipment or areas of site disturbance for the period required to protect work and the public. Equip with vehicular and pedestrian gates with locks. Provide one set of keys to all gates and door locks to the Owner.
- A. Perform adjustment to the proposed layout as may be directed by the Owner.
- B. Interior Enclosures:
 - 1. Provide temporary partitions and ceilings as indicated to separate the work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to the existing materials and equipment.
 - 2. Construction: Framing and reinforced polyethylene, plywood, or gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces, as agreed with the Owner:
 - a. Maximum flame spread rating of 75 in accordance with ASTM E84.

1.18 SECURITY

- A. Security Program:
 - 1. Protect the Work, the existing premises, or the Owner's operations from theft, vandalism, and unauthorized entry.
 - 2. Initiate the program in coordination with the Owner's existing security system at mobilization.
 - 3. Maintain the program throughout the construction period until Owner occupancy of each designated area.
- B. Entry Control: Coordinate the access of the Owner's personnel to the site in coordination with the Owner's security forces.

1.19 FIRE DETECTION

- A. Before beginning any construction operation that can potentially trigger the existing fire alarm detection system, notify the Owner through use of the form provided in Section 01 1020.
- B. Failure to so notify the Owner will subject the Contractor to a monetary fine for each occurrence, should the fire detection system be activated inadvertently by a construction activity.
- C. Comply with FM Global insurance underwriting standards and insurer recommendations for Hot Work, sprinkler impairment, and site maintenance.

1.20 WATER CONTROL

- A. Grade the site to drain. Maintain excavations free of water. Provide, operate, and maintain the pumping equipment.
- B. Protect the site from puddling or running water. Provide water barriers as required to protect the site from soil erosion.

1.21 DUST CONTROL

- A. Execute the Work by methods to minimize raising dust from construction operations.
- B. Provide positive means to prevent air-borne dust from dispersing into the atmosphere.

1.22 EROSION AND SEDIMENT CONTROL

- A. Plan and execute construction by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
- B. Minimize the amount of bare soil exposed at one time.
- C. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
- D. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
- E. Periodically inspect the earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.23 NOISE CONTROL

- A. Provide methods, means, and facilities to minimize noise produced by the construction operations.

1.24 PEST CONTROL

- A. Provide methods, means, and facilities to prevent pests and insects from damaging the Work, or entering the facility.

1.25 POLLUTION CONTROL

- A. Provide methods, means, and facilities to prevent the contamination of soil, water, and the atmosphere from discharge of noxious, toxic substances, and pollutants produced by the construction operations.

1.26 RODENT CONTROL

- A. Provide methods, means, and facilities to prevent rodents from accessing or invading the premises.

1.27 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, and materials, prior to Substantial Completion.
- B. Remove the underground installations to a minimum depth of 2 feet. Grade the site as indicated.
- C. Clean and repair the damage caused by installation or use of temporary work.
- D. Restore the existing and new facilities used during construction to their original condition.
- E. Restore any temporary exterior laydown or storage areas to the original condition. After each use, regrade and reseed as required to meet this requirement.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

01 5010 TEMPORARY FACILITIES AND CONTROLS - Attachment A

1.01 SECTION INCLUDES

- A. Replace Paragraph 1.02.A with the following:
 - A. Contractor to coordinate with URI Utilities to provide metered temporary electric drop into site for construction use. Contractor to include all costs of drop, electricity, and removal in Base Bid
- B. Modify Paragraph 1.03.A to remove the word: “incandescent”.
- C. Delete Paragraph 1.03.D.
- D. For purposes of Paragraph 1.04, this work is considered new. Contractor to pay for any heating or fuel required.
- E. Replace 1.08.A with the following:
 - A. Contractor to provide water tanker and arrange to purchase water from URI for use at the site. All costs associated including water to be included in the Base Bid.
- F. Amend Paragraph 1.14 to exclude Contractor identification signs. Project sign will be required as specified, but no separate GC or subcontractor signs will be allowed.
- G. Delete Paragraph 1.17.B.

END OF ATTACHMENT

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Products.
- B. Product delivery requirements.
- C. Product storage and handling requirements.
- D. Product options.
- E. Product substitution procedures.

1.02 PRODUCTS

- A. Products: Means new material, machinery, components, fixtures, or systems forming the Work; but does not include the machinery or equipment used for the preparation, fabrication, conveying, or erection of the Work. Products may include the existing materials or components required or specified for reuse.
- B. Furnish products of qualified manufacturers suitable for the intended use. Furnish products of each type by a single manufacturer unless specified otherwise.
- C. Do not use materials and equipment removed from the existing premises, except as specifically permitted by the Contract Documents.
- D. Furnish interchangeable components of the same manufacturer for the components being replaced.

1.03 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with the manufacturer's instructions.
- B. Promptly inspect shipments to ensure that the products comply with the requirements, the quantities are correct, and the products are undamaged.
- C. Provide equipment and personnel to handle the products by methods to prevent soiling, disfigurement, or damage.

1.04 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect the products in accordance with the manufacturers' instructions.

- B. Store with seals and labels intact and legible.
- C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to the product.
- D. For exterior storage of fabricated products, place on sloped supports above the ground.
- E. Provide bonded off-site storage and protection when the site does not permit on-site storage or protection.
- F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent the condensation and degradation of products.
- G. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- H. Provide equipment and personnel to store the products by methods to prevent soiling, disfigurement, or damage.
- I. Arrange storage of the products to permit access for inspection. Periodically inspect to verify that the products are undamaged and are maintained in acceptable condition.

1.05 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any Product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of one of the manufacturers named and meeting the specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named in accordance with the following article.

1.06 PRODUCT SUBSTITUTION PROCEDURES

- A. Instructions to Bidders specify the time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.
- B. Substitutions may be considered after the bid only in the following circumstances:
 - 1. when a product becomes no longer in production following the date of receipt of the Purchase Order for this Contract. Submit certification both that specified product was carried in Bid, and is no longer obtainable. Provide cost change documentation.
 - 2. there is a significant cost savings offered to the Owner. Provide price comparison of both bid and offered substitution products as well as all collateral costs of the change.

3. Code changes or site conditions require a different item from that bid. Submit as for 2 above.
- C. Document each request with complete data substantiating the compliance of a proposed Substitution with the Contract Documents.
- D. A request constitutes a representation that the Bidder:
 1. Has investigated the proposed Product and determined that it meets or exceeds the quality level of the specified product.
 2. Will provide the same warranty for the Substitution as for the specified Product.
 3. Will coordinate the installation and make changes to other Work which may be required for the Work to be complete with no additional cost to the Owner, including redesign.
 4. Waives claims for additional costs or time extension which may subsequently become apparent.
 5. Will reimburse the Owner and the Design Agent for review or redesign services, including those associated with re-approval by the authorities having jurisdiction.
- E. Substitutions will not be considered when they are indicated or implied on the Shop Drawing or Product Data submittals, without a separate written request, or when acceptance will require revision to the Contract Documents.
- F. Substitution Submittal Procedure, If Permitted Following Contract Award:
 1. Submit three copies of a request for Substitution for consideration, no later than 20 working days following date of receipt of the Purchase Order for this Contract. Limit each request to one proposed Substitution.
 2. Submit the Shop Drawings, Product Data, and the certified test results attesting to the proposed product equivalence. The burden of proof is on the proposer.
 3. The Design Agent will notify the Contractor in writing of a decision to accept or reject the request. Costs for review time on unsuccessful requests will be included in the next change order.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

01 6010 PRODUCT REQUIREMENTS - Attachment A

A. No variations in this section for this Project.

END OF ATTACHMENT

SECTION 01 7000 - EXECUTION REQUIREMENTS**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Examination.
- B. Preparation.
- C. Field Engineering.
- D. Protection of adjacent construction.
- E. Cutting and patching.
- F. Special procedures.
- G. Starting and adjusting of systems.
- H. Demonstration and Instructions.
- I. Testing, adjusting and balancing.
- J. Protecting Installed Construction.

1.02 EXAMINATION

- A. Acceptance of Conditions:
 - 1. Verify that existing applicable site conditions, substrates, or substrate surfaces are acceptable or meet specific requirements of individual specifications Sections, for subsequent Work to proceed.
 - 2. Verify that existing substrate is capable of structural support or attachment of new Work being applied or attached.
 - 3. Examine and verify specific conditions described in individual specifications Sections.
 - 4. Verify that utility services are available, of correct characteristics, and in correct locations.
 - 5. Beginning of new Work, that relies upon the quality and proper execution of Work of a preceding trade, means acceptance of that preceding Work as appropriate for the proper execution of subsequent Work.
 - 6. Acceptance of preceding Work that can be shown later to have adversely affected proper performance of new Work may result in removal and repeat performance of all Work involved at no cost to the Owner.

1.03 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply substrate primer, sealer, or conditioner, required or recommended by manufacturer, prior to applying any new material or substance in contact or bond.
- D. Prior to the application, installation, or erection of any products and product components, perform any other preparatory operations, or surface or substrate modifications, as may be specified or directed by product manufacturers.

1.04 FIELD ENGINEERING

- A. Employ a Land Surveyor registered in the State of Rhode Island and acceptable to Design Agent and the Owner if required by subgrade work.
- B. Locate and protect survey control and reference points. Promptly notify Design Agent of any discrepancies discovered.
- C. Control Datum for survey is to be agreed to with the Design Agent.
- D. Verify setbacks and easements, if any; confirm drawing dimensions and elevations.
- E. Provide field-engineering services. Establish elevations, lines, and levels, utilizing recognized engineering survey practices.
- F. Submit a copy of site drawings and certificate signed by the Land Surveyor that the elevations and locations of the Work are in conformance with the Contract Documents.
- G. Maintain a complete and accurate log of control and survey work as it progresses.
- H. If required by the Owner, on completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.
- I. Protect survey control points prior to starting site work; preserve permanent reference point during construction.
- J. Promptly report to Design Agent the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- K. Replace dislocated survey control point based on original survey control. Make no changes without prior written notice to Design Agent.

1.05 PROTECTION OF ADJACENT CONSTRUCTION

- A. Protect existing adjacent properties and provide special protection where specified in individual Specification Sections.
- B. Provide protective coverings at wall, projections, jambs, sills, and soffits of existing openings.
- C. Protect existing finished floors, stairs, and other existing surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- D. Cover and protect furnishings, materials and equipment within the spaces receiving new work. Move items as necessary to install new work and return them to original locations at the close of construction in that area.
- E. Repair adjacent properties damaged by construction operations to original condition to the satisfaction of the Owner.
- F. Prohibit unnecessary traffic from existing landscaped areas.
- G. Restore grassed landscaped areas damaged by construction operations to full healthy growth, by installing loam and sod to the requirements, and under the supervision of, the University's Associate Director of Lands and Grounds.

1.06 CUTTING AND PATCHING

- A. Employ skilled and experienced installers to perform cutting and patching.
- B. Submit written request in advance of cutting or altering elements which affect:
 - 1. Structural integrity of element.
 - 2. Integrity of weather-exposed or moisture-resistant elements.
 - 3. Efficiency, maintenance, or safety of element.
 - 4. Visual qualities of sight-exposed elements.
 - 5. Existing construction, or Work of separate contractor.
- C. Execute cutting, fitting, and patching including excavation and fill, to complete Work, and to:
 - 1. Fit the several parts together, to integrate with other Work.
 - 2. Uncover Work to install or correct ill-timed Work.
 - 3. Remove and replace defective and non-conforming Work.
 - 4. Remove samples of installed Work for testing.
 - 5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

- D. Execute Work by methods that will avoid damage to other Work, and provide proper surfaces to receive patching and finishing.
- E. Cut masonry, concrete, and other rigid materials using masonry saw or core drill.
- F. Remove ceiling tiles as necessary to access areas of work. Store and replace carefully to avoid damage. Replace all ceiling tiles damaged during the work with new tiles to match. Repair ACT grid damaged during the work in accordance with this section.
- G. Restore Work with new Products in accordance with requirements of Contract Documents.
- H. Fit Work tight to pipes, sleeves, ducts, conduits, and other penetrations through surfaces.
- I. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.
- J. At penetration of fire rated partitions, ceiling, or floor construction, completely seal voids with fire rated or fire resistant material in accordance with Specifications, to full thickness of the penetrated element.
- K. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for an assembly, refinish entire unit.
- L. Identify any hazardous substance or conditions exposed during the Work to the Owner and Design Agent for decision or remedy.
- M. See General Conditions for additional requirements.

1.07 SPECIAL PROCEDURES

- A. Materials: As specified in product Sections; match existing with new products, or salvaged products as appropriate, for patching and extending work.
- B. Employ skilled and experienced installer to perform alteration work.
- C. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.
- D. 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.
- E. Remove debris and abandoned items from area and from concealed spaces.

- F. Prepare surface and remove surface finishes to provide installation of new Work and finishes.
- G. Close openings in exterior surfaces to protect existing Work from weather and extremes of temperature and humidity.
- H. Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring products and finishes to original or specified condition.
- I. Refinish existing visible surfaces to remain in renovated rooms and spaces to specified condition for each material, with a neat transition to adjacent finishes.
- J. Where new Work abuts or aligns with existing, provide a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.
- K. 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 submit recommendation to Design Agent for review.
- L. Where a change of plane of 1/4 inch or more occurs, submit recommendation for providing a smooth transition to Design Agent for review.
- M. Trim existing doors as necessary to clear new floor finish. Refinish trim as required.
- N. Patch or replace portions of existing surfaces which are damaged, or showing other imperfections.
- O. Finish surfaces as specified in individual product Sections, or as indicated on the Drawings.

1.08 STARTING AND ADJUSTING OF SYSTEMS

- A. Coordinate schedule for starting and adjusting of various equipment and systems.
- B. Notify Design Agent and Owner seven days prior to starting and adjusting of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.
- D. Verify that tests, meter readings and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.

- F. Execute starting and adjusting under supervision of responsible Contractor's personnel or manufacturer's representative, in accordance with manufacturer's instructions.
- G. Adjust operating Products and equipment to ensure smooth and unhindered operation.
- H. When specified in individual specifications Section, require manufacturer to provide authorized representative to be present at the site to inspect, check, and approve equipment or system installation prior to starting, and to supervise placing of equipment or system in operation.
- I. Submit a written report in accordance with Section 01400 that equipment or system has been properly installed and is functioning correctly.

1.09 DEMONSTRATION AND INSTRUCTIONS

- A. Demonstrate operation and maintenance of Products to Owner's personnel two weeks prior to date of Substantial Completion.
- B. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- C. Utilize operation and maintenance manuals as basis for instruction. Review contents of manuals with Owner's personnel in detail to explain all aspects of operation and maintenance.
- D. Demonstrate start-up, operation, control, adjustment, trouble shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled or agreed upon times, at equipment or system location.
- E. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

1.10 TESTING, ADJUSTING, AND BALANCING

- A. Submit, for the Owner's approval, the name of an independent firm to perform testing of fire systems. The independent firm's services will be paid for by the Contractor.
- B. The independent firm will perform services specified in individual specifications Sections.
- C. Reports will be submitted by the independent firm to the Design Agent and the Owner indicating observations and test results, indicating compliance or non-compliance with specified requirements and with the requirements of the Contract Documents.

1.11 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual specification sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- E. Repair or replace installed Work damaged by construction operations, as directed by the Design Agent.

PART 2 - PRODUCTS

Not Used.

PART 3 - EXECUTION

Not Used.

END OF SECTION

01 7010 EXECUTION REQUIREMENTS - Attachment A

A. Daily Attendance Form

1. Maintain Daily Attendance Form acceptable to the Department of Labor and Training for all projects with a contract value over \$1 Million. Submit as requested.

B. Delete Paragraphs 1.05, B-D.

C. Delete Paragraph 1.06.F.

D. Delete Paragraphs 1.06, I-K.

E. Delete Paragraphs 1.07, G-O.

F. Delete Paragraphs 1.11, C-E.

END OF ATTACHMENT

SECTION 01 7320**WASTE MANAGEMENT****PART 1 GENERAL****1.01 WASTE MANAGEMENT REQUIREMENTS**

- A. Owner requires that this project generate the least amount of trash and waste possible.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Required Recycling, Salvage, and Reuse: The following may not be disposed of in landfills or by incineration:
 - 1. Aluminum and plastic beverage containers.
 - 2. Corrugated cardboard.
 - 3. Wood pallets.
 - 4. Clean dimensional wood: May be used as blocking or furring.
 - 5. Land clearing debris, including brush, branches, logs, and stumps.
 - 6. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - 7. Glass.
 - 8. Gypsum drywall and plaster.
 - 9. Plastic buckets.
 - 10. Paper, including wrapping, newsprint, and office.
- E. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports. Submit in accordance with Section 01 3300.
- F. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.
- G. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
- H. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.02 RELATED REQUIREMENTS

- A. Section 01 3000 - Administrative Requirements: Additional requirements for project meetings, reports, submittal procedures, and project documentation.
- B. Section 01 5000 - Temporary Facilities and Controls: Additional requirements related to trash/waste collection and removal facilities and services.
- C. Section 01 6000 - Product Requirements: Waste prevention requirements related to delivery, storage, and handling.
- D. Section 01 7000 - Execution Requirements: Trash/waste prevention procedures related to

demolition, cutting and patching, installation, protection, and cleaning.

1.03 DEFINITIONS

- A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.
- B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- I. Return: To give back reusable items or unused products to vendors for credit.
- J. Reuse: To reuse a construction waste material in some manner on the project site.
- K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- N. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.04 SUBMITTALS

- A. See Section 01 3300 for submittal procedures.
- B. Waste Management Plan: Include the following information:
 - 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
 - 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
 - 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 - 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.

5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
 6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
- C. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 2. Submit Report on a form acceptable to Owner.
 3. Landfill Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 4. Incinerator Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.
 - c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 5. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.
 6. Material Reused on Project: Include the following information for each:
 - a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards.
 - c. Include weight tickets as evidence of quantity.
 7. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

PART 2 PRODUCTS (not used)**PART 3 EXECUTION****3.01 WASTE MANAGEMENT PROCEDURES**

- A. See Section 01 1000 for list of items to be salvaged from the existing building for relocation in project or for Owner.

- B. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.
- C. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.
- D. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.
- E. See Section 01 7000 for trash/waste prevention procedures related to demolition, cutting and patching, installation, protection, and cleaning.

3.02 WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.
- B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, Owner's Recycling and Solid Waste Coordinator, and Design Agent.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1. Pre-bid meeting.
 - 2. Pre-construction meeting.
 - 3. Regular job-site meetings.
- E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. Provide containers as required.
 - 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 - 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
- H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.
- I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

01 7330 WASTE MANAGEMENT - Attachment A

A. No variations in this section for this Project.

END OF ATTACHMENT

SECTION 01 7800 - CLOSEOUT REQUIREMENTS**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Closeout procedures.
- B. Quality assurance.
- C. Maintenance service.
- D. Operations and maintenance manuals.
- E. Materials and finishes manuals.
- F. Equipment and systems manuals.
- G. Spare parts and maintenance materials.
- H. Product warranties and product bonds.
- I. Project Record documents.

1.02 CLOSEOUT PROCEDURES

- A. Submit a written certification that the Contract Documents have been reviewed, the Work has been inspected, and that the Work is complete in accordance with the Contract Documents and is ready for the Owner's review.
- B. Provide submittals to Design Agent that are required by governing or other authorities, including abatement invoices correctly prepared as proscribed in the abatement plan. Failure to include correctly prepared abatement invoices will delay issuing of final payment.
- C. Provide submittals to Design Agent that are required by the governing or other authorities, including the following closeout documents:
 - 1. AIA Document G706 - Contractor's Affidavit of Payment of Debts and Claims
 - 2. AIA Document G706A - Contractor's Affidavit of Release of Liens
 - 3. AIA Document G707 - Consent of Surety to Final payment
- D. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

- E. The Owner will occupy all portions of the building after Substantial Completion as specified in Section 01 1000.

1.03 QUALITY ASSURANCE

- A. Employ personnel assembling submittals experienced in the maintenance and the operation of the described products and systems.

1.04 MAINTENANCE SERVICE

- A. Submit a contract for furnishing service and maintenance of the components indicated in the specification Sections for one year from date of Substantial Completion, or during the warranty period, whichever period of time is the longest.
- B. Provide for an examination of the system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- C. Include a systematic cleaning, examination, adjustment, and lubrication of the components. Repair or replace the parts whenever required. Use the parts produced by the manufacturer of the original component.
- D. Do not assign or transfer the maintenance service to an agent or Subcontractor without the prior written consent of the Owner.

1.05 OWNER'S MANUALS

- A. Submit the data for Operations and Maintenance, Materials and Finishes, and Equipment and Systems Manuals bound in 8-1/2 x 11 inch text pages, in minimum 2 inch size three D side ring commercial quality binders with durable cleanable plastic covers.
- B. Prepare binder covers with the printed title of the manual, title of the project, and the subject matter of binder. Label each spine with the following: Building, project or facility name, OCP project number, submission date.
- C. Internally subdivide the binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Drawings: Provide with reinforced punched binder tab. Bind in with the text; fold the larger drawings to the size of the text pages.
- E. Submit two copies of a preliminary draft of the proposed formats and outline of the contents before the start of work. The Design Agent and its consultants will review drafts and return one copy with comments.

- F. Submit one copy of the completed volumes 15 days prior to final inspection for final review. This copy will be reviewed and returned after final inspection, with the Design Agent's comments. Revise the content of the document sets as required prior to final submission.
- G. Submit three sets of revised final volumes plus electronic copy in final form within ten days after final inspection.

1.06 OPERATIONS AND MAINTENANCE MANUALS

- A. Contents: Prepare the Table of Contents for each volume, with each product or system description identified, in three parts as follows:
 - 1. **Part 1:** Directory, listing the names, addresses, and telephone numbers of the Design Agent, its Consultants, Contractor, Subcontractors, and major equipment suppliers.
 - 2. **Part 2:** Operation and maintenance instructions, arranged by system and subdivided by the specification Section. For each category, identify the names, addresses, and telephone numbers of the Subcontractors and suppliers. Identify the following:
 - a. Significant design criteria.
 - b. List of equipment.
 - c. Parts list for each component.
 - d. Operating instructions.
 - e. Maintenance instructions for equipment and systems.
 - f. Maintenance instructions for [special] finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - 3. **Part 3:** Project documents and certificates, including the following:
 - a. Shop drawings and product data.
 - b. Air and water balance reports.
 - c. Certificates.
 - d. Originals of warranties and bonds.
 - 4. **Part 4:** Scan entire manual and provide 3 copies on disc in electronic PDF format.

1.07 MATERIALS AND FINISHES MANUALS

- A. Building Products, Applied Materials, and Finishes: Include product data, with the catalog number, size, composition, and the color and texture designations. Include information for re-ordering custom manufactured products.
- B. Instruction for Care and Maintenance: include manufacturer's instructions for cleaning agents and methods, precautions against detrimental agents and methods, and a recommended schedule for cleaning and maintenance.
- C. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.
- D. Additional Requirements: As specified in the individual product specification Sections.

- E. Include a listing in the Table of Contents for design data, with a tabbed flysheet and a space for the insertion of data.

1.08 EQUIPMENT AND SYSTEMS MANUALS

- A. For equipment, or component parts of equipment put into service during construction and operated by the Owner, submit documents within 10 days after acceptance.
- B. Each Item of Equipment and Each System: Include a description of the unit or system, and the component parts. Identify the function, normal operating characteristics, and limiting conditions. Include performance curves, with priming data and tests, and complete nomenclature and model number of replaceable parts.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.
- D. Include color-coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shutdown, and emergency instructions. Include summer, winter, and special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and troubleshooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- G. Include a servicing and lubricating schedule, and a list of lubricants required.
- H. Include the manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by the controls manufacturer.
- J. Include the original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Include control diagrams by the controls manufacturer as installed.
- L. Include the Contractor's coordination drawings, with color-coded piping diagrams as installed.
- M. Include charts of valve tag numbers, with the location and function of each valve, keyed to the flow and control diagrams.
- N. Include a list of the original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports as specified in Section 01400.

- P. Additional Requirements: As specified in the individual product specification Sections.

1.09 SPARE PARTS AND MAINTENANCE PRODUCTS

- A. Furnish spare parts, maintenance, and extra products (attic stock) in the quantities specified in the individual specification Sections.
- B. Deliver to the Project site and place in a location as directed by the Owner; obtain a receipt prior to final payment.

1.10 PRODUCT WARRANTIES AND PRODUCT BONDS

- A. Obtain warranties and bonds executed in duplicate by the responsible subcontractors, suppliers, and manufacturers, within 10 days after the completion of the applicable item of work.
- B. Execute and assemble the transferable warranty documents and bonds from the subcontractors, suppliers, and manufacturers.
- C. Verify that the documents are in the proper form, contain full information, and are notarized.
- D. Co-execute the submittals when required.
- E. Include in the Operations and Maintenance Manuals within the appropriate material specification section.
- F. Submit prior to the final Application for Payment. For items of Work for which acceptance is delayed beyond the Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty or bond period.

1.11 PROJECT RECORD DOCUMENTS

- A. Maintain on the site one set of the following record documents; record actual revisions of the Work for all trades:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed Shop Drawings, Product Data, and Samples.
 - 6. Manufacturer's instructions for assembly, installation, and adjusting.
- B. Ensure the entries are complete and accurate, enabling future reference by the Owner.
- C. Store the record documents separate from the documents used for construction.

- D. Record information concurrent with the construction progress, not less than weekly.
- E. Specifications: Legibly mark and record at each product Section description of the actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record the actual construction including:
 - 1. Measured horizontal and vertical locations of the underground utilities and appurtenances, referenced to permanent surface improvements. Include the locations and description of any existing utility lines and other existing installations of any kind or description encountered during construction. Note all changes in size, material, location, and elevation of all new or abandoned underground utility lines and pertinent work, including site grading. Document topography and drainage changes. Show the location of all valves, manholes, etc. and include dimensions to permanent features such as building corners. Note direction of each new valve opening. Show clearances between new utilities and existing crossed lines. Locate all bends, thrust blocks, and other restraints.
 - 2. The placement, size, and type of any fire extinguishers.
 - 3. Measured locations of internal utilities and appurtenances concealed in the construction.
 - 4. Field changes of dimension and detail.
 - 5. Details not on the original Contract drawings.
- G. Legibly marked Specifications, and legibly marked Record Drawings and Shop Drawings shall constitute the Project Record Documents in paper form.
- H. At completion of the Work of the Contract, the Contractor shall retain competent drafting personnel to transfer the information from the Project Record Documents in paper form to editable electronic formats to create "As-Built" Documents on base files provided by the Design Agent. The record construction drawings shall be produced in both AutoCAD format plus a record PDF copy of each drawing. AutoCAD files shall include all XREF, font, image, shape, and plot files. PDF files shall be saved full sheet size. The record Project Manual shall be in Microsoft Word form plus a record PDF of the entire manual. The electronic media containing this information will constitute the Project Record Documents in digital form, sometimes referred to as the "As-Built" Documents. Acceptable media are write-protected CD-R format discs or flash drives. Submit one full size printed set of drawings and specifications on 20 lb. white bond made from the As-Built files in addition to the electronic media.
- I. Associated materials including but not limited to the following are also required to be submitted at project close-out: shop drawings and cut sheets, RFIs, correspondence and meeting minutes, LEED scorecards, construction progress photographs, DEM permits including generator permits, certificates including Final Certificate of Occupancy, boiler and elevator certificates, easement rights, National Grid Rebate Applications, test and inspection documentation including fire pump test data, asbestos abatement plans and manifests. These materials may be

submitted in either paper or PDF digital format, organized by specification number, and clearly labeled. If paper copies are submitted, each box must be clearly labeled as to specific contents.

- J. If the project required geotechnical, archeological, or other miscellaneous studies or other reports, these shall also be submitted as Record Document in either paper or digital format.
- K. Labeling: In all cases, paper or digital submissions must contain the following information: Building, project or facility name, OCP Project number, submission date, and specific content index.
- L. No review or receipt of Project Record Documents by the Design Agent or the Owner shall be interpreted as a waiver of any deviation from the Contract Documents or Shop Drawings, or in any way relieve the Contractor from responsibility to perform the Work in accordance with the Contract Documents and the Shop Drawings.
- M. Update the on-site Project Record Documents on a regular basis. Monthly payments will not be processed if Project Record Documents are not maintained up to date.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

01 7810 CLOSEOUT REQUIREMENTS - Attachment A

- A. For all references to electronic copies, provide on labeled flash drive, not CD or DVD disc.
- B. As-built utility records must include surveyed elevations and plan locations from an identified permanent benchmark for all buried items.

END OF ATTACHMENT

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SECTION 260100 - ELECTRICAL GENERAL CONDITIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 DESCRIPTION OF WORK

- A. Carefully examine all of the Contract Documents, criteria sheets and all other Sections of the specifications for requirements which affect work under this Section, whether or not such work is specifically mentioned in this Section.
- B. The work under this Contract shall include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation, of all systems as indicated on the drawings and specified herein.
- C. The specifications and drawings describe the minimum requirements that must be met by the Electrical Contractor for the installation of all work as shown on the drawings and as specified hereunder.
- D. Coordinate work with that of all other trades affecting or affected by the work of this Section. Cooperate with such Trades to assure the steady progress of all work under the Contract.

1.3 REGULATORY REQUIREMENTS

- A. All materials and workmanship shall comply with all applicable Codes, Specifications, Local and State Ordinances, Industry Standards and Utility Company Regulations, latest editions.
- B. In case of difference between Building Codes, State Laws, Local Ordinances, Industry Standards and Utility Company Regulations and the Contract Documents, the Electrical Contractor shall promptly notify the Engineer in writing of any such difference.

- C. In case of conflict between the Contract Documents and the requirements of any Code or Authorities Having Jurisdiction (AHJ), the most stringent requirements of the aforementioned shall govern. The Electrical Contractor shall promptly notify the Engineer in writing of any such conflicts.
- D. Should the Electrical Contractor perform any work that does not comply with the requirements of the applicable Building Codes, State Laws, Local Ordinances, Industry Standards and Utility Company Regulations, he shall bear all costs arising in correcting the deficiencies, as approved by the Engineer / Owner.
- E. Applicable Codes and Standards shall include all State Laws, Local Ordinances, Utility Company Regulations, and the applicable requirements of the latest adopted edition of the following Codes and Standards, without limiting the number, as follows:
 - 1. NFPA 70: National Electrical Code (as amended by RI State Electrical Code)
 - 2. NFPA 101: Life Safety Code
 - 3. NFPA 110 Standard for Emergency and Standby Power
 - 4. Occupational Safety and Health Standards
 - 5. Environmental Protection Agency
 - 6. National Fire Protection Association
 - 7. International Building Code IBC-2015 (as amended by RI State Building Code)
 - 8. Department of Environmental Protection
 - 9. Rhode Island State Building Code
 - 10. Rhode Island State Electrical Code
 - 11. Rhode Island State Life Safety Code
 - 12. Inspectional Services Department
 - 13. National Electrical Safety Code
- F. In these specifications, references made to the following Industry Standards and Code Bodies are intended to indicate the latest volume or publication of the Standard. All equipment, materials and details of installation shall comply with the requirements and latest revisions of the following Bodies, as applicable:
 - 1. ANSI: American National Standards Institute
 - 2. ASTM: American Society of Testing Materials
 - 3. AWG: American Wire Gauge
 - 4. FM: Factory Mutual
 - 5. IEEE: Institute of Electrical and Electronics Engineers
 - 6. NEMA: National Electrical Manufacturers Association
 - 7. UL: Underwriters' Laboratories
- G. Electrical Contractor shall give all necessary notices, obtain all permits, pay all governmental taxes, fees and other costs in connection with his work; file for necessary approvals with the jurisdiction under which the work is to be performed. Electrical Contractor shall obtain all required Certificates of Inspection for his respective work and deliver same to the Architect before request for acceptance of his portion of work is made and before final payment.

1.4 QUALITY ASSURANCE

- A. Attention is directed to the provisions of the general requirements of the Contract Document Specifications regarding quality requirements for the work under this Contract. The Electrical Contractor shall review the requirements and assure all components are in compliance.
- B. The manufacturers listed within these specifications have been preselected for use on this project. No submittal will be accepted from a manufacturer other than specified, without written approval from the Engineer.
- C. Electrical Contractor shall furnish and install all equipment, accessories, connections and incidental items necessary to fully complete the work under his Contract for use, occupancy and operation by the Owner.
- D. Where equipment of an approved substitute manufacturer differ from that specified and require different arrangement or connections from those shown, it shall be the responsibility of the Subcontractor responsible for the substitution to modify the installation of the equipment / systems to operate properly and in harmony with the original intent of the drawings and specifications.
- E. When directed by the Architect, the Electrical Contractor shall submit drawings showing the proposed, substitute installation. If the proposed installation is accepted, the Electrical Contractor shall make all necessary changes in all affected related work provided under his and other Sections including location of roughing-in connections by other Trades, conduit, supports, etc. All changes shall be made at no increase in the Contract amount or additional cost to the Owner. The Construction Manager shall be responsible to assure that the Subcontractor responsible for the substitution bears the cost arising to all other Trades as a result of the substitution.
- F. Unless specifically indicated otherwise, all equipment and materials required for installation under these specifications shall be new, unused and without blemish or defect. Equipment and materials shall be products which will meet with the acceptance of the Authorities having jurisdiction over the work and as specified hereinbefore. Where such acceptance is contingent upon having the products listed and/or labeled by FM or UL or another testing laboratory, the products shall be so listed and/or labeled. Where no specific indication as to the type or quality of material or equipment is indicated, a first class standard article shall be provided.

1.5 WARRANTY

- A. Attention is directed to the provisions of the General Requirements and Supplementary General Requirements regarding guarantees and warranties for work under this Contract.
- B. All warranties shall begin on the Date of Substantial Completion of the entire project or the Owner's acceptance of the workmanship and/or material covered by the warranty, whichever is later. The warranty coverage shall continue for the specified period. Refer to individual specification sections for warranty period. If no specific warranty period is specified, the warranty shall extend for a minimum of 365 days.

- C. Manufacturers shall provide their standard warranties for work under the Electrical Trades. However, such warranties shall be in addition to, and not in lieu of, all other liabilities which the manufacturer and Electrical Contractor may have by law or by other provisions of the Contract Documents.
- D. All materials, items of equipment and workmanship furnished under the Electrical Section shall carry the standard warranty against all defects in material and workmanship. Any fault due to defective or improper material, equipment, workmanship or design which may develop shall be made good, forthwith, by and at the expense of the Electrical Contractor for the work under his Contract, including all other damage done to areas, materials and other systems resulting from this failure.
- E. The Electrical Contractor shall warranty that all elements of the systems which are to be provided under his Contract, are of sufficient capacity to meet the specified performance requirements as set forth herein or as indicated.
- F. Upon receipt of notice from the Owner or Architect of failure of any part of the systems or equipment during the warranty period, the affected part or parts shall be replaced by the Electrical Contractor for his work or any other work affected by the failure(s).
- G. Electrical Contractor shall furnish, before the final payment is made, a written warranty covering the above requirements in accordance with the General Requirements.

1.6 DEFINITIONS

- A. ATC: Automatic temperature controls.
- B. Emergency Systems: Loads defined by NFPA 70, Article 700 "Emergency Systems". Those systems intended to supply egress lighting.
- C. Legally Required Standby Systems: Loads defined by NFPA 70, Article 701 "Legally Required Standby Systems". Those systems classified as legally required intended to supply loads such as smoke exhaust systems.
- D. Optional Standby Systems: Loads defined by NFPA 70, Article 702 "Optional Standby Systems". Those systems intended to supply loads such as shelter in place power.
- E. Feeder: All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit overcurrent. Feeders may be identified in the "Legend of Feeder Sizes" identified on the drawings. All feeders are required to be in conduit. MC Cable is not permitted unless specifically approved by the Engineer via an RFI or substitution request form. Submittal reviews of product does not permit use of MC cable for feeders.
- F. Branch Circuit: The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s) device. Branch circuits may be identified in the "Branch Circuit Schedule" on the drawings.

- G. Words in the singular shall also mean and include the plural, wherever the context so indicates, and words in the plural shall mean the singular, wherever the context so indicates.
- H. Wherever the terms "shown on drawings" are used in the specifications, they shall mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.
- I. Wherever the term "provide" is used in the specifications it shall mean "furnish" and "install", "connect", "apply", "erect", "construct", or similar terms, unless otherwise indicated in the specifications. Unless noted otherwise "provide" shall indicate "furnish & install as part of the base contract cost".
- J. Wherever the term "material" is used in the specifications it shall mean any "product", "equipment", "device", "assembly", or "item" required under the Contract, as indicated by trade or brand name, manufacturer's name, standard specification reference or other description.
- K. Wherever the term "promptly" is used it shall mean within two working days.
- L. The terms "approved", or "approval" shall mean the written approval of the Architect.
- M. The term "Contract" or "Contract Documents" shall mean the entire set of Drawings and Specifications as listed in the Table of Contents of the General Conditions including all bound and unbound material and all items officially issued to date such as addenda, bulletins, job modifications, etc.
- N. The term "specification" shall mean all information contained in the bound or unbound volume, including all "Contract Documents" defined therein, except for the drawings.
- O. The terms "directed", "required", "permitted", "ordered", "designated", "prescribed", and similar words shall mean the direction, requirement, permission, order, designation or prescription of the Architect; the terms "approved", "acceptable", "satisfactory", and similar words shall mean approved by, acceptable or satisfactory to the Architect; and, the terms "necessary", "reasonable", "proper", "correct", and similar words shall mean necessary, reasonable, proper or correct in the judgment of the Architect.
- P. "Accessible" indicates ease of access with or without the use of ladders and without requiring extensive removal of other equipment, such as ductwork, piping, etc. to gain access. "Accessible ceiling" indicates acoustic tile type hung ceilings. Concealed spline or sheetrock ceilings with access panels shall not be considered accessible ceilings.
- Q. "Concealed" means hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction or in crawl spaces.
- R. "Exposed" means not installed underground or "concealed" as defined above.
- S. "Medium voltage" refers to all equipment operating above 600 volts AC.
- T. "Electrical Contractor" refers to the Subcontractor responsible for furnishing and installation of all work indicated on the Electrical drawings and in the Electrical specifications.

- U. "Architect" shall refer to the Architect and/or the Engineer.
- V. "Engineer" shall refer to the Engineer of Record responsible for these Contract Documents.
- W. "Owner" shall refer to the Owner "University of Rhode Island" or his designated representative.
- X. "Other Work Contractor" (O.W.C.) refers to the Contractor(s), or Subcontractor(s) performing work under other Sections of the Contract Documents.
- Y. "Extended Storage" shall refer to any storage period that extends beyond 90 calendar days.
- Z. "OCPD" shall refer to Overcurrent Protective Device as defined in the NFPA 70, National Electric Code.

1.7 GENERAL RESPONSIBILITIES

- A. The Electrical Contractor shall visit the site of the proposed renovations and base his bids from his own site examinations and estimates. The Electrical Contractor shall not hold the Architect, Engineer, Owner or their agents or employees responsible for, or bound by, any schedule, estimate or of any plan thereof.
- B. The Electrical Contractor shall study the Contract Documents included under this Contract to determine exactly the extent of work provided under this Contract, as well as to ascertain the difficulty to be encountered in performing the work, in installing new equipment and systems and coordinating the work with the other Trades and existing building conditions.
- C. The Electrical Contractor shall faithfully execute his work according to the terms and conditions of the Contract and specifications, and shall take all responsibility for and bear all losses resulting to him in the execution of his work.
- D. The Electrical Contractor shall be responsible for the location and performance of work provided under his Contract as indicated on the Contract Documents. All parties employed directly or indirectly by the Electrical Contractor shall perform their work according to all the conditions as set forth in these specifications.
- E. The Electrical Contractor shall furnish all materials and do all work in accordance with these specifications, and any supplementary documents provided by the Architect. The work shall include everything shown on the drawings and/or required by the specifications as interpreted by the Architect, regardless of where such information is indicated in the Contract Documents (Architectural, HVAC, Plumbing, Fire Protection, etc.). Unless specifically indicated otherwise, all work and materials furnished and installed shall be new, unused and of the best quality and workmanship.
- F. The Electrical Contractor shall cooperate with the Architect so that no error or discrepancy in the Contract Documents shall cause defective materials to be used or poor workmanship to be performed.
- G. Where discrepancies in scope of work as to what Trade provides items, such as starters, disconnects, flow switches, etc. exist, such conflicts shall be reported to the Architect during

bidding and prior to signing of the Contract. If such action is not taken, the Electrical Contractor shall furnish such items as part of his work as necessary, for complete and operable systems and equipment, as determined by the Architect.

- H. Where drawing, details, plans, specification requirements and/or scheduled equipment capacities are in conflict and where feeders, branch circuits or equipment are shown to be different between plans and/or between plans and riser diagrams, details or specifications, the most stringent requirement will be included in the Contract. Electrical systems and equipment called in the specification and/or shown on the drawings shall be provided under this Contract as if it were required by both the drawings and specifications. However, prior to ordering or installation of any portion of work which appears to be in conflict, such work shall be brought to Architect's attention for direction as to what is to be provided. Electrical systems and equipment called for in the specification and/or shown on the drawings shall be provided under this Contract as if it were required by both the drawings and specifications. Prior to ordering or installation of any portion of work which appears to be in conflict, such works shall be brought to Architect's attention for direction as to what is to be provided. Any and all costs associated with any work necessitated by failure to adhere to this requirement, shall be the sole responsibility of the Electrical Contractor. These costs will not be reimbursed by the Owner in any manner.

1.8 COORDINATION OF WORK

- A. The Electrical Contractor shall compare his drawings and specifications with those of other Trades as well as the Architectural drawings and specifications, and report any discrepancies between them to the Architect and obtain from the Architect written instructions for changes necessary in the electrical work.
- B. The Electrical Contractor shall be responsible for coordinating their work with that of all other Trades. The Electrical Contractor shall cooperate with all other Trades to assure the steady progress of all work under the Contract.
- C. The Electrical Contractor shall make proper provisions to avoid interferences in a manner approved by the Architect. All changes required in the work of the Electrical Contractor or that of any other trade caused by the Electrical Contractor's neglect, shall be made by him at his own expense, to the Architect's satisfaction. Any and all costs associated with any additional work necessitated by failure to adhere to this requirement, shall be the sole responsibility of the Electrical Contractor. These costs will not be reimbursed by the Owner in any manner.
- D. The Electrical Contractor must include in his bid sufficient dollar amounts to coordinate the scope of work of this Contract. Any and all costs associated with any additional work necessitated by failure to adhere to this requirement, shall be the sole responsibility of the Electrical Contractor. These costs will not be reimbursed by the Owner in any manner.
- E. Locations of conduits, boxes, distribution equipment, systems, etc, shall be adjusted to accommodate the work with interferences anticipated and encountered. The Electrical Contractor shall determine the exact routing and location of his systems prior to fabrication or installation of any system.

- F. Lines which pitch shall have the right-of-way over those which do not pitch. For example, steam piping shall normally have the right-of-way. Lines whose elevations cannot be changed shall have the right-of-way over lines whose elevations can be changed.
- G. Offsets, transitions and changes of direction in all systems shall be made as required to maintain proper headroom and pitch of sloping lines whether or not indicated on the drawings. The Electrical Contractor shall provide such fittings / offsets in busway or raceway as required for his work to affect these offsets, transitions and changes in direction.
- H. All work shall be installed in a way to permit removal of pull and junction box covers, wiring, lighting fixtures, and all other system components provided under this Contract requiring periodic replacement or maintenance. All pull and junction boxes shall be arranged in a manner to clear the openings of swinging overhead access doors as well as ceiling tiles. Any items in the field discovered to be in non-compliance shall be removed and relocated, as required, and as directed by the Architect. Any and all costs associated with any additional work necessitated by failure to adhere to this requirement, shall be the sole responsibility of the Electrical Contractor. These costs will not be reimbursed by the Owner in any manner
- I. The Contract Drawings are diagrammatic only intending to show general runs and locations of conduits, distribution equipment, lighting fixtures, systems equipment, etc, and not necessarily showing all required offsets, details and accessories and equipment to be connected. It is the Electrical Contractors responsibility as part of this contract to insure that all work is accurately laid out with other Trades to avoid conflicts and to obtain a neat and workmanlike installation which will afford maximum accessibility for operation, maintenance and headroom.
- J. The Electrical Contractor shall coordinate the installation of all equipment and any catwalks or service platforms provided under this Contract.
- K. Final location of all electrical equipment provided as part of this Contract including, but not necessarily limited to; lighting fixtures, smoke detectors, exit signs, switches, receptacles, fire alarm devices, etc., shall be coordinated with the Architectural reflected ceiling plans, architectural elevations, and/or other Architectural details, as applicable and shall not be scaled from locations indicated on the electrical drawings.
- L. The Electrical Contractor shall obtain approval of locations of all devices from Architect in the field. The Owner/Architect reserves the right to relocate any receptacle, device, lighting fixture, etc. 10'-0" in any direction prior to installation at no additional cost to the Project.
- M. The Electrical Contractor shall coordinate his work with other Trades' work so that all equipment and systems can be easily, safely and properly serviced and maintained. It is imperative that service personnel can safely access all equipment. Provide safety rails, steps, ladders, valve chains, handle extensions, etc. as required, in addition to the ones shown on the drawings, to ensure safe and easy access to all equipment is provided in a manner approved by the Architect.
- N. Autoclaves, fume hoods or other type equipment shown on the Electrical and/or Architectural drawings to be provided with services, shall be included under this Contract as applicable, including all conduit and wiring connections to systems, to make equipment complete and operable. Additional wiring, equipment, etc., shall be provided to accomplish the above requirement, as required, all as part of this Contract, at no extra cost to the Owner. This

requirement necessitates that the Electrical Subcontractor review the Architectural drawings and the drawings of other Trades during bidding to ascertain the extent of all requirements, and interface between the Trades and scope of work.

1.9 EXCHANGE OF INFORMATION

- A. Electrical Contractor shall keep himself fully informed as to the shape, size and position of all openings required for his equipment and shall give information to the Construction Manager and other Subcontractors sufficiently in advance of the work so that all openings may be built in advance. Any and all costs associated with any additional work necessitated by failure to adhere to this requirement, shall be the sole responsibility of the Electrical Contractor. These costs will not be reimbursed by the Owner in any manner.

1.10 EQUIPMENT AND MATERIALS

- A. Equipment and materials shall be delivered to the site and stored in original sealed containers, suitably sheltered from the elements, but readily accessible for inspection by the Architect until installed. All equipment or the component of equipment such as controls, subject to moisture damage shall be stored in dry, heated spaces. Equipment such as switchgear with heater elements installed shall have the heater elements energized after the equipment is received by the Electrical Contractor.
- B. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury and theft. At the completion of the work, equipment and materials shall be cleaned and turned over to the Owner in a condition satisfactory to the Architect. Damage or defective equipment or installations shall be replaced or repaired by the Electrical Contractor's to the satisfaction of the Architect at no additional cost to the Owner.
- C. The Electrical Contractor shall make necessary field measurements to ascertain space requirements, for equipment and connections to be provided under his respective Trade and shall furnish and install such sizes and shapes of equipment to allow for the final installation to conform to the drawings and specifications.
- D. Manufacturer's directions shall be followed completely in the delivery, storage, protection and installation. Promptly notify the Architect in writing of any conflict between any requirements of the Contract Documents and the manufacturer's directions.
- E. Any special tools provided by the manufacturer required for the operation or maintenance of equipment shall be supplied by the Electrical Contractor.
- F. Obtain the Architect's written instructions before proceeding with the work. Should Electrical Contractor perform any work that does not comply with the manufacturer's directions or written instructions from the Architect, he shall bear all costs arising in correcting any deficiencies that should arise.
- G. All equipment of one type (such as distribution equipment, cable, wiring devices, fire alarm system, etc.) shall be the products of one manufacturer.

- H. Equipment pre-purchased by the Construction Manager on behalf of the Owner or by the Owner himself, if assigned to the Electrical Contractor, shall be received, installed, tested, etc., as if the equipment was purchased by the Electrical Contractor. All guarantees, service contracts, etc., shall be the same as for all other equipment provided under this Contract.
- I. All equipment and materials shall be delivered and stored in accordance with the Manufacturer's published requirements. Any equipment or material damage or degradation resulting from the failure to adhere to this requirement shall be the sole responsibility of the Electrical Contractor. Any costs associated with the repair or replacement of said equipment and material (to the satisfaction of the Architect) will not be reimbursed by the Owner in any manner.
- J. Equipment delivery from the manufacturer to the riggers yard/job site shall be coordinated with installation schedule. "Extended Storage" shall not be permitted without written permission of the Architect.
- K. Where permitted, conditions of "Extended Storage" such as temporary heating storage location, weather proofing insurance, extended warranty, etc. shall be provided to the satisfaction of the Architect. All such measures shall be provided at no additional cost to the Owner.

1.11 CABLE TERMINATION TEMPERATURE RATINGS

- A. All equipment terminations connecting to wire and cable, rated 600V or less shall be rated for 75°C for conductors 1 AWG and smaller and/or where conductor ampacities are 100 A or less.

1.12 USE OF PREMISES

- A. The Electrical Contractor shall confine all apparatus, storage of materials and construction to the limits as directed by the Owner's designated representative and he shall not encumber the premises with his materials. The Electrical Contractor shall be held responsible for repairs, patching, or cleaning arising from any unauthorized use of premises.
- B. Notwithstanding any approvals or instructions which must be obtained by the Electrical Contractor from the Architect in connection with the use of the premises, the responsibility for the safe working conditions at the site shall remain that of the Electrical Contractor. The Architect, Engineer or Owner shall not be deemed to have any responsibility or liability in connection with safe working conditions at the site.

1.13 PHASING, DEMOLITION AND MAINTAINING EXISTING SERVICES

- A. During the execution of the work, required relocation, rerouting, etc., of existing equipment and systems on the site or where new work is to be installed or new connections are scheduled to be made, shall be performed by the Electrical Subcontractor, as indicated on the drawings, and/or as required by job conditions and as determined by the Owner in the field, to facilitate the installation of the new systems.

- B. The Owner will require the continuous operation of the existing systems, while demolition, relocation work or new tie-ins will be performed. Outages required for construction purposes shall be scheduled for the shortest practical periods of time, in coordination with the Owner's designated representative, for specified, mutually agreeable periods of time, after each of which the interruption shall cease and the service shall be restored. This procedure shall be repeated to suit the Owner's working schedule, as many times as required until all work is completed. Any outages of service shall be approved by the Owner, prior to commencing the work. No outages or shutdowns of service shall occur without the written authorization of the Owner, prior to commencing the work. Give notice of any scheduled shutdowns, a minimum of two (2) weeks in advance. The Owner shall make their best efforts to meet this request without adversely affecting services to the site. Unless the Architect, Construction Manager and Owner approve, shutdowns shall not be scheduled during normal business hours (i.e., shutdowns shall be from 6:00 PM to 6:00 AM). Maximum duration of each shutdown shall be eight (8) hours. Not more than one shutdown per twenty-four 24 hour period.
- C. The Electrical Subcontractor shall submit with his bid, a preliminary shutdown schedule for review by the Owner and General Contractor. Shutdown schedule shall be finalized with the successful Electrical Subcontractor.
- D. Prior to any deactivation and relocation or demolition work, consult the drawings and arrange a conference with the Owner's representative in the field to inspect each of the items to be deactivated, removed or relocated. Care shall be taken to protect all equipment designated to be relocated and reused or to remain in operation and be integrated with the new systems.
- E. All deactivation, relocation and temporary tie-ins shall be provided by the Electrical Subcontractor. All demolition, removal and the legal disposal of demolished materials of system designated to be demolished shall be provided by the General Contractor.
- F. The Owner reserves the right to inspect the material scheduled for removal, and salvage any items he deems usable as spare parts.
- G. Phasing:
1. The Electrical Subcontractor shall construct the subject project in phases as directed by the Architect and General Contractor to suit the project progress schedule, as well as the completion date of the project.
 2. For additional information related to phasing, review the General Conditions.
- H. Electrical Contractor shall de-energize and remove all conductors, raceways and devices scheduled for demolition to their point of origin. Items identified for demolition shall not be abandoned in place. Raceways scheduled for demolition that enter masonry walls and or floors which are to remain shall be cut flush at the surface for patching by the General Contractor. All overcurrent protective devices feeding circuits scheduled for demolition shall be de-energized and labeled as "spare".
- I. Maintain continuity of all wiring and system to areas beyond scope of work that are to remain but are effected by either the demolition or new construction.

- J. Where existing conduits and equipment are embedded in concrete walls, ceilings or floors, the conduit shall be cut back flush to the surface, all wiring shall be disconnected and removed and equipment shall be removed for the General Contractor to patch the existing opening.
- K. The construction phasing provided as part of this contract are diagrammatic only and are intended to show a general outline of the proposed installation phasing. The Electrical Contractor shall be responsible for and shall provide final installation sequencing plans to the satisfaction of the Architect, Construction Manager, Owner and any authorities having jurisdiction as part of the base bid to this Contract.
- L. Before the commencement of any work, the Contractor shall verify the existing facility phase rotation and document phase rotation at each panel. This arrangement shall then be maintained during installation and verified at completion of project. The Electrical Contractor shall be responsible for maintaining proper phase rotation to new and existing equipment throughout the project.

1.14 PROTECTION

- A. Existing and new equipment and systems shall be properly protected during construction and all conduit openings shall be temporarily closed so as to prevent obstruction and damage. The Electrical contractor shall post notices prohibiting the use of all systems provided under the Electrical Contract, prior to completion of work and acceptance of all systems by the Owner (or the Owner's designated representative). The Electrical Contractor shall take any and all necessary precautions to protect materials and equipment furnished under this Contract from damage and theft.
- B. The Electrical Contractor shall furnish, place and maintain proper safety guards for the prevention of accidents that might be caused by the workmanship, materials, equipment or electrical systems provided under his Contract.

1.15 DAMAGE TO OTHER WORK

- A. The Electrical Contractor shall be held responsible and shall pay for all damages caused by his work to the building structures including but not necessarily limited to; equipment, conduits, wall, doors, ceilings, floors, windows, ductwork, piping, systems, etc., and all other work and finishes installed under this Contract. Repair of such damage shall be done by the Construction Manager at the expense of the Electrical Contractor, to the Architect's satisfaction. Any and all costs associated with any additional work necessitated to make such repairs, shall be the sole responsibility of the Electrical Contractor. These costs will not be reimbursed by the Owner in any manner

1.16 CORRECTION OF WORK

- A. The Electrical Contractor shall be responsible for the correction of all work installed as part of this contract that is deemed defective or otherwise not in accordance with the Contract documents by the Architect.

1.17 EXTRA WORK

- A. No claim for extra work will be allowed unless it is authorized in writing by the Architect prior to the commencement of work.

1.18 EQUIPMENT ALLOWANCES

- A. In addition to all equipment indicated on the electrical drawings, the Electrical Subcontractor shall carry allowances to furnish and install the following equipment in locations to be determined:
 - 1. (2) 1-pole switches including conduit and wire with an average length of 30'-0" connected to the normal electrical distribution system.
 - 2. (2) 3-way switches including conduit and wire with an average length of 30'-0" connected to the normal electrical distribution system.
 - 3. (2) Duplex receptacles including conduit and wire with an average length of 30'-0".
 - 4. Lighting fixtures:
 - a. (2) Additional exterior wall mounted fixtures, for each type on project, including underground direct-buried conduit and #10 AWG wire with an average length of 30'-0".

1.19 COORDINATION DRAWINGS

- A. Before materials are purchased, fabricated or work is begun, The Electrical Subcontractor shall prepare and obtain approval of coordination drawings, and sections for all floors/areas, including buried system/services, resulting in one (1) set of all-Trade-composite at 3/8" scale drawings, showing the size and location of all equipment, in the manner described hereinunder General Requirements. The Electrical Contractor shall obtain approval of coordination drawings prior to any fabrication or installation of any equipment or systems.
- B. The coordination drawings shall be generated from a computer CAD program compatible with AutoCAD Release 2014, in DWG or DXF format. The Electrical Contractor shall take the lead, supervise, and coordinate production of coordinated layout drawings, to show and coordinate all equipment. These drawings shall then be circulated to the HVAC Subcontractor so that he can indicate all his work as directed by the Construction Manager and Architect and as required, to result in a fully coordinated installation.
- C. The Electrical Contractor shall indicate all electrical equipment, conduit and raceway provided by as part of the project on the coordination drawings. These drawings shall include all raceway and systems provided by any and all subcontractors. This equipment and raceway depicted on the coordination drawings shall include, but not necessarily be limited to, the following:
 - 1. All electrical distribution equipment, drawn to scale with clearance requirements. (Substations, switchboards, busway, transformers, panelboards, etc.)
 - 2. All panelboard feeder conduits.
 - 3. All conduits for all systems over 2-1/2" in diameter.

4. Conduit routing and rack locations for all conduits regardless of conduit size when more than 4 conduits are grouped in a rack.
 5. All pull and splice boxes over 8" in any direction.
 6. Lighting fixture housings and supports that interfere with other system and furnishings.
- D. All costs associated with all aspects of coordination drawings, regardless as to how long they take to produce and how many times they have to be redrawn, shall be the responsibility of the Electrical Contractor.
- E. The Electrical Contractor is expected to produce the coordination using internal resources. If a vendor or sub-consultant is used to produce these documents the Electrical Contractor shall be held responsible for the coordination product of the vendor or sub-consultant. Any and all costs associated with any additional or unnecessary project scope derived as a result of the vendor or sub-consultant's work shall be the sole responsibility of the Electrical Contractor. These costs will not be reimbursed by the Owner in any manner.
- F. The Electrical Contractor may request the electrical AutoCAD computer drawing files from the Electrical Contract drawings from the Engineer. The Electrical Contractor will be required to sign a release form and upon receipt of the form, the Engineer will provide files on electronic media within 3-5 business days. The Electrical Contractor will be responsible for verification of dimensions and installation of equipment.
- G. The Engineer may provide these files as a courtesy for the Electrical Contractors use. The use of these files will be at the Electrical Contractors risk. The Engineer makes no guarantee as to the completeness or accuracy of the files.
- H. The Electrical Contractor shall be responsible for coordinating the Electrical AutoCAD coordination drawings, including, but not limited to, the drawing lists, layering system, producing copies of the drawings for the Engineer as directed, etc.

1.20 SUBMITTALS

- A. Prepare and submit shop drawings in accordance with the requirements of the General Requirements specified in these Contract Documents, and with the Shop Drawings, Product Data and Samples Section of the Contract Specification in the manner described therein, modified as noted hereinafter.
- B. The following requirements shall apply to all electrical submittals in addition to the requirements outlined in the Division 1:
1. All shop drawings shall have clearly marked the appropriate specification number of drawing designation, for identification of the submittal.
 2. The Electrical Contractor shall be responsible for seeking reconciliation of any deviations between the Contract Drawings or Specifications, by submitting a letter itemizing or calling attention to such deviations prior to the issuance of the Contract submittal(s) to secure approval from the Architect.
 3. Specifications Compliance Statement

- a. The manufacturer shall submit a point by point statement of compliance with the specifications.
- b. The statement of compliance shall consist of a list of all paragraphs (line by line).
- c. Where the proposed system complies fully, such shall be indicated by placing the word "comply" opposite the paragraph number.
- d. Where the proposed system does not comply, or accomplishes the stated function in a manner different from that described, a full description of the deviation shall be provided.
- e. Where a full description of a deviation is not provided, it shall be assumed that the proposed system does not comply with the paragraph in question.
- f. Submissions which do not include a point by point statement of compliance as specified shall be disqualified.
- g. Where submittal cut sheets or product data contain multiple items, the products included as part of the Contract submitted for review shall be clearly delineated from other product information via highlighting, arrows or underscores or by similar such markings. Product data submittals that do not meet this requirement will be returned to the Electrical Contractor for revision.

1.21 MANUFACTURER'S REPRESENTATIVE

- A. Where directed in the Contract Documents, the Electrical Contractor shall provide for startup and testing, the on-site services of a competent factory trained manufacturer's technician of the manufacturer of specific equipment to inspect, test, adjust and place in proper operating condition any and all items of the same manufacturer. A written report shall be with the results of the startup and testing. These services shall be provided as part of the Contract. Any and all costs associated with additional startup or testing necessitated by equipment failure or non-performance shall be the sole responsibility of the Electrical Contractor. These costs will not be reimbursed by the Owner in any manner.

1.22 TOUCH-UP AND REPAIRS

- A. The Electrical Contractor shall paint, re-finish or repair any equipment provided under this Contract that is blemished, scratched, dented, racked, etc. during the installation process. All such repairs shall be made to the satisfaction of the Architect. Any and all additional costs associated with any repair work shall be the sole responsibility of the Electrical Contractor. These costs will not be reimbursed by the Owner in any manner.

1.23 PARTS LIST AND INSTRUCTIONS FOR OPERATION AND MAINTENANCE

- A. Prepare Operations and Maintenance submittals in accordance with the requirements of the General Requirements specified in these Contract Documents, and in the manner described therein, modified as noted hereinafter.
- B. The Electrical Contractor shall thoroughly instruct the Owner in the proper operation of all systems and equipment provided under this Contract.

- C. Documentation, instructive training on equipment operation and maintenance shall be completed to the satisfaction of the Engineer before final payments are provided. The Engineer reserves the right to withhold retention payments until instructions and training are complete in accordance with the requirements of the Contract.
- D. The Electrical Contractor shall be responsible for providing full instructive training sessions on multiple occasions as required to fully familiarize the Owner's operation and maintenance staff with the equipment and systems provided under this Contract. Until such training is complete, the Electrical Contractor shall be responsible for providing troubleshooting technical assistance from a manufacturers trained technician 24 hours a day 365 days of the year to assist with emergency troubleshooting.
- E. Electrical Contractor shall submit to the Engineer for approval, the required typed sets (see General Conditions and Division 01) bound neatly in loose-leaf binders, of all instructions for the installation, operation, emergency operation, start-up, care and maintenance of all equipment and systems (including instructions for the ordering and stocking of spare parts for all equipment installed under this Contract). The lists shall include part numbers and suggested supplier. Each set shall also include an itemized list of component parts that should be kept on hand and where such parts can be purchased.
- F. Information shall indicate possible problems with equipment and suggested corrective action. The manuals shall be indexed for each type of equipment. Each section shall be clearly divided from the other sections. A sub-index for each section shall also be provided. The methodology of setting-up the manuals shall be submitted to the Engineer and Owner for review prior to final submission of manuals.
- G. The instructions shall contain information on equipment and systems provided as part of this Contract. Documentation shall include (but not necessarily be limited to) the following:
 - 1. Cover Sheet
 - a. Project Name
 - b. Project Location
 - c. Name of installing Electrical Contractor
 - d. Name of installing Electrical Contractor project foreman
 - e. Phone number of installing Electrical Contractor project foreman
 - f. Date
 - 2. Table of Contents / index
 - 3. Introduction
 - a. Explanation of Manual and its use
 - b. Summary description of each Electrical system
 - c. Purpose of each system
 - 4. Systems / Equipment Information
 - a. Detailed description of each system / piece of equipment (separated by labeled tabs)
 - b. Equipment / device manufacturer cut sheets

- c. Equipment / device manufacturer instructional bulletins
 - d. Illustrations, schematics, block diagrams, catalog cuts, and other exhibits
5. Operations
- a. Complete detailed, walk-through, with step-by-step, sequential description of all phases of operation for all portions of the systems, including start-up, shutdown, testing and adjusting. Include all posted instruction charts
6. Maintenance
- a. Parts list and part numbers.
 - b. Maintenance, and replacement charts and Manufacturer's recommendations for preventive maintenance
 - c. Troubleshooting charts for systems and components
 - d. Instructions for testing each type of part
 - e. Recommended list of on-hand spare parts
 - f. General or miscellaneous maintenance notes
 - g. List of local Manufacturer factory trained and manufacturer authorized service organizations with 24 hour a day / 365 day a year contact phone numbers for emergency services.
7. Manufacturer's Literature
- a. Any pertinent brochures, illustrations, drawings, cuts, bulletins, technical data, certified performance charts and other literature with the model actually furnished to be clearly and conspicuously identified.
 - b. Internal wiring diagrams and engineering data sheets for all items and/or equipment to be furnished.
8. Start Up Acceptance Testing and Commissioning Reports
- a. Copy of test reports for any and all Contract required tests performed on equipment / systems
 - b. Copy of commissioning testing reports provide by the Owner's designates representative as part of this Contract.
9. Guarantee and warranty data.
- 1.24 RECORD DRAWINGS/AS-BUILT DRAWINGS
- A. Prepare Record Drawing submittals in accordance with the requirements of the General Requirements specified in these Contract Documents, and in the manner described therein, modified as noted hereinafter.
 - B. The Electrical Contractor shall maintain a current set of drawings at the site which accurately show the actual installation of all work provided under the Contract. These drawings shall clearly indicate any variation from the Contract Drawings, in accordance with the General Conditions. Changes, whether resulting from formal change orders or other instructions issued

by the Architect, shall be recorded. These drawings shall also clearly include any and all changes in sizes, location, and dimensions of conduit, switchgear, lighting fixtures, fire alarm equipment, wiring devices, etc.

- C. The Electrical Contractor shall indicate progress by coloring-in various conduits, equipment and associated appurtenances exactly as they are erected. This process shall incorporate both the changes noted above and all other deviations from the original drawings whether resulting from job conditions encountered or from any other causes.
- D. The marked-up and colored-up prints will be used as a guide for determining the progress of the work installed. They shall be inspected periodically by the Engineer and Owner and they shall be corrected immediately if found either inaccurate or incomplete. The Architect reserves the right to use these drawings as a basis to track construction completeness and authorize payments.
- E. At the completion of the job, these prints shall be submitted to the Construction Manager and then to the Architect for final review and comment. The prints will be returned with appropriate comments and recommendations. These corrected prints, together with corrected prints indicating all the revisions, additions and deletions of work, shall form the basis for preparing a set of As-built Record Drawings.
- F. The Subcontractor shall be responsible for generating as-built Record Drawings utilizing CAD based documents in AutoCAD Release 2014 DWG or DXF format. A bound set of plans, as well as the computer files, on disk, shall be turned over to the Engineer for review. After acceptance of the as-built documents by the Engineer, the Electrical Contractor shall make any corrections necessary to the as-built documents and prepare at a minimum two bound print sets for distribution to the Owner via the Engineer. The Engineer reserved the right to request additional sets as necessary to suit the needs of the Project.
- G. The Electrical Contractor may use the computer drawing files used for coordination drawings or may request the Engineers most recently updated computer drawing files. The Engineer may provide these files as a courtesy for the Electrical Contractors use, however the updated drawings may not include all changes made during the course of construction. It shall be the Electrical Contractors responsibility to update the as-built documents to include all changes brought forth to the project resulting from bulletins, request for information (RFI's), change orders, etc. The Electrical Contractor may review the Engineers latest computer files for completeness prior to use, however the Engineer will not be responsible for updating the computer files. The use of these files will be at the Electrical Contractors risk.
- H. Included with the above shall be a complete drawing list and a standard layering system, which shall be required to be maintained within the as-built Record CAD documents.
- I. The Subcontractor shall be issued bulletins in the same manner as the original Design Documents described above.
- J. The as-built CAD documents required shall be in addition to other requirements stated elsewhere.

1.25 CERTIFICATION OF SYSTEM COMPLETENESS

A. Certification of Completeness

1. Where required, the Electrical Contractor shall provide all required documentation, materials & labor for the Engineer's satisfaction to verify completion of installation start up, testing & commissioning of systems such as but not necessarily limited to:
 - a. Egress Signage and Lighting Systems
2. In order for the Engineer of Record to provide affidavits certifying completeness of installed systems the following conditions shall be met:
 - a. No further work is required to satisfy the requirements specified in the drawings, specifications and applicable codes and standards.
 - b. Systems shall be fully operational with power to components, valves open, status indicators in "normal" condition and otherwise ready "as-is" to perform required functions.
 - c. Required product data and shop drawing submittals have been submitted and returned with a "REVIEWED" status.
 - d. Test certificates as required in these contract documents have been submitted and returned with a "Reviewed" status.
 - e. Project visit report observations and "punch lists" items have been addressed and/or corrected.
 - f. "O&M" documentation and "as-built" plans have been submitted and returned with a "REVIEWED" status.
 - g. Completed manufacturer start-up, testing and commissioning reports.
 - h. Signed letter attesting complete installation and functionality of the subject system in accordance with the contract documents and amendments from:
 - 1) The subject system equipment manufacturer
 - 2) The installing sub-contractor
 - 3) The installing Electrical Contractor
 - 4) The General Contractor

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 COOPERATION AND WORK PROGRESS

- A. The Electrical work shall be carried on under the usual construction conditions, in conjunction with all other work at the site. The Electrical Contractor shall cooperate with the Engineer, Construction Manager, all other Subcontractors and equipment suppliers working at the site.
- B. The Electrical Contractor shall coordinate his work with the progress of the building and other Trades so that he will complete his work as soon as conditions permit and such that

interruptions of the building functions will be at a minimum. Any overtime hours worked or additional costs incurred due to lack of or improper coordination with other Trades or the Owner by the Electrical Contractor shall be the sole responsibility of the Electrical Contractor. These costs will not be reimbursed by the Owner in any manner.

- C. The Electrical Contractor shall furnish information on all equipment that is furnished under this Section but installed under another Section to the installing Subcontractor as specified herein.
- D. The Electrical Contractor shall provide all materials, equipment and workmanship to provide for adequate protection of all electrical equipment during the course of construction of the project. This shall also include protection from moisture and all foreign matter. The Electrical Contractor shall also be responsible for damage which he causes to the work of other Trades, and he shall remedy such injury at his own expense.
- E. Waste materials shall be removed promptly from the premises. All material and equipment stored on the premises shall be kept in a neat and orderly fashion. Material or equipment shall not be stored where exposed to the weather. The Electrical Contractor shall be responsible for the security, safekeeping and damages, including acts of vandalism, of all material and equipment stored at the job site.
- F. The Electrical Contractor shall be responsible for storing all materials and equipment in accordance with the Manufacturer's recommendations to the satisfaction of the Engineer. Any and all costs associated with equipment and material replacements or repairs required by the failure to adhere to proper storage procedures shall be the sole responsibility of the Electrical Contractor. These costs will not be reimbursed by the Owner in any manner.
- G. The Electrical Contractor shall be responsible for unloading all electrical equipment and materials delivered to the site. This shall also include all large and heavy items or equipment which require hoisting. Consult with the Construction Manager for hoisting/crane requirements. During construction, the Electrical Contractor shall provide additional protection against moisture, dust accumulation and physical damage of the equipment provided under this Contract. This protection shall include, but not necessarily limited to, furnishing and installing temporary heaters within these units, as approved, to evaporate excessive moisture and ventilate it from the room, as may be required.
- H. It shall be the responsibility of the Electrical Contractor to coordinate the delivery of the electrical equipment to the project prior to the time installation of equipment will be required; but he shall also make sure such equipment is not delivered too far in advance of such required installation, to ensure that possible damage and deterioration of such equipment will not occur. Such equipment stored for an excessively long period of time (as determined in the opinion of the Architect) on the project site prior to installation may be subject to rejection by the Architect.
- I. The Electrical Contractor shall erect and maintain, at all times, necessary safeguards for the protection of life and property of the Owner, Workmen, Staff and the Public.
- J. Prior to installation, the Electrical Contractor has the responsibility to coordinate the exact mounting arrangement and location of electrical equipment to allow proper space requirements as indicated in the NEC. Particular attention shall be given in the field to group installations. If it is questionable that sufficient space, conflict with the work of other Subcontractors,

architectural or structural obstructions will result in an arrangement which will prevent proper access, operation or maintenance of the indicated equipment, the Electrical Contractor shall immediately notify the Contractor and not proceed with this part of the Contract work until definite instructions have been given to him by the Engineer.

- K. The Electrical Contractor shall not allow any equipment or piping foreign to the electrical installation to be installed or pass through any room in which electrical systems or equipment are located, such as electric rooms, electric closets, telephone or data closets. The Electrical Contractor shall notify the Contractor of such violations and request immediate removal.
- L. The Electrical Contractor shall obtain from the Plumbing and HVAC Subcontractors copies of all shop drawing prints showing the ductwork and piping installation as they will be put in place on the project. These drawings shall be thoroughly checked by the Electrical Contractor and the routing of all conduits and installation of all outlets and electrical equipment shall be coordinated with the ductwork and piping so as to prevent any installation conflict. Such coordination shall be done prior to roughing in conduits, outlets and electrical equipment.

3.2 INSTALLATION

A. General

- 1. Unless specifically noted or indicated otherwise, all equipment and material specified in Division 26 of this specification or indicated on the drawings shall be installed under this Contract whether or not specifically itemized herein. This Section covers particular installation methods and requirements peculiar to certain items and classes or material and equipment.
- 2. The Electrical Contractor shall obtain detailed information from manufacturers of equipment as to proper methods of installation.
- 3. The Electrical Contractor shall obtain final roughing dimensions and other information as needed for complete installation of items furnished under other Sections or furnished by the Owner.
- 4. The Electrical Contractor shall keep fully informed of size, shape and position of openings required for material and equipment provided under this and other Sections. Ensure that openings required for work of this Section are coordinated with work of other Sections. Provide cutting and patching as necessary.
- 5. All miscellaneous hardware and support accessories, including support rods, nuts, bolts, screws and other such items, shall be of a galvanized or cadmium plated finish or of another approved rust-inhibiting coating.
- 6. Throughout the Electrical Documents where reference is made to steel channel supports, it shall be understood to mean that the minimum size shall be 1 5/8" mild strip steel with minimum wall thickness of 0.105", similar to Unistrut P1000 or equal products manufactured by Kindorf or Husky Products Co.

3.3 MATERIALS AND WORKMANSHIP

- A. Except as specified otherwise, material and equipment shall be new, factory tested and delivered ready for field installation. Provide supplies, accessories and connections necessary for complete and operational installation. Provide components required or recommended by

OSHA and applicable NFPA documents. Equipment damaged during installation shall be repaired to new condition or replaced with new material. The contractor shall be responsible for all costs associated with testing, replacing to repair, including but not limited to, all replacement or repair costs, preparations prior to testing, all testing costs, extended warranties, re-commissioning of the equipment, etc. with no additional cost to the contract.

- B. Despite references in the specifications or on the drawings to materials or pieces of equipment by name, make or catalog number, such references shall be interpreted as establishing standards of quality for materials and performance.
- C. Finish of materials, components and equipment shall not be less than Industry good practice. When material or equipment is visible or subject to corrosive or atmospheric conditions, the finish shall be as approved by the Architect.
- D. Provide proper access to material or equipment that requires inspection, replacement, repair or service. If proper access cannot be provided, confer with the Architect as to the best method of approach to minimize effects of reduced access.
- E. All work shall be installed in a neat, rectilinear and workmanlike manner and shall be done in accordance with all Local and State Codes.
- F. The Owner will not be responsible for material, equipment or the installation of same before final testing and acceptance.
- G. Install material and equipment in accordance with manufacturers written instructions. Installation shall operate safely and without noise, vibration or corrosion. Work shall be properly and effectively protected, and raceway openings shall be temporarily closed to prevent obstruction and damage before completion.
- H. The contractor shall take steps necessary to ensure that all materials and equipment can be delivered and installed in sections sufficiently small to fit within openings in the building and that the weight and size of all equipment pieces so not exceed the capacity of the hoisting and/or elevator system.

3.4 CLEANING

- A. This Section of the specifications shall include the cleaning of all equipment on a day-to-day basis and final cleaning of all electrical equipment prior to turning building over to the Owner. All necessary cleaning referred to herein shall be cleaned to the satisfaction of the Architect.
- B. Electrical Distribution Equipment
 - 1. All electrical distribution equipment shall be completely cleaned and dried inside and out prior to initial energizing,
 - 2. Cleaning shall consist of vacuuming all busses, windings, enclosures (inside and out), etc, After vacuuming is complete, all equipment shall be wiped down,
 - 3. If equipment is wet or contains moisture, it shall be thoroughly dried and inspected by the manufacturer's representative before energizing,

C. Raceways and Junction Boxes

1. All raceways and junction boxes shall be blown out and dried prior to installation of feeder conductors and branch circuit conductors,

D. Low Tension Systems

1. All cabinets and panels for low tension systems shall be thoroughly cleaned and dried prior to system start-up,

E. Electric Rooms

1. Upon completion of cleaning electrical equipment as described in Paragraph B, above, but before energizing equipment, the entire room shall be swept clean and material storage and garbage shall be removed from the room, At this time, equipment may be energized,
2. Once equipment and room are cleaned and energized, the area shall remain clean and doors shall remain closed and locked until completion of job. Electric rooms shall not be used to store material after equipment is energized.
3. If rooms and equipment are subject to dust and moisture after energizing equipment, the equipment shall be de-energized and re-cleaned to the same specifications.

F. Final Cleaning

1. All lighting fixtures, devices, device plates, etc" shall be cleaned and left in "like new" condition to the satisfaction of the Architect, prior to project completion.
2. All rubbish and discarded materials shall be disposed of and removed from the site on a day-to-day basis,
3. All equipment, whether part of the Electrical Contractor's Contract or not, which must be cleaned due to the Electrical Contractor's work, shall be cleaned by the Electrical Contractor to the satisfaction of the Architect

3.5 FINAL INSPECTION

- A. When all Electrical work on the project has been completed and is ready for final inspection, in accordance with the Contract requirements, the Electrical Contractor shall notify the Engineer. Acceptance of contract work demonstrated in final acceptance will be contingent on Engineer's satisfaction that the project work has in fact been completed in conformance the Contract Documents.

END OF SECTION

SECTION 260500 - COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 SUMMARY

- A. Section Includes:
 - 1. Electrical equipment coordination and installation.
 - 2. Sleeves for raceways and cables.
 - 3. Sleeve seals.
 - 4. Grout.
 - 5. Common electrical installation requirements.

1.3 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

- A. Product Data: For sleeve seals.

1.5 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 - 1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.

2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 3. To allow right of way for piping and conduit installed at required slope.
 4. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

1.6 MATERIALS AND WORKMANSHIP

- A. Work shall be neat and rectilinear. Install material and equipment in accordance with manufacturers written instructions. Installation shall operate safely and without noise, vibration or corrosion. Work shall be properly and effectively protected, and raceway openings shall be temporarily closed to prevent obstruction and damage before completion.
- B. Except as specified otherwise, material and equipment shall be new, factory tested and delivered ready for field installation. Provide supplies, accessories and connections necessary for complete and operational installation. Provide components required or recommended by OSHA and applicable NFPA documents. Equipment damaged during installation shall be repaired to new condition or replaced with new material. The contractor shall be responsible for all costs associated with testing, replacing to repair, including but not limited to, all replacement or repair costs, preparations prior to testing, all testing costs, extended warranties, re-commissioning of the equipment, etc. with no additional cost to the contract.
- C. The contractor shall take steps necessary to ensure that all materials and equipment can be delivered and installed in sections sufficiently small to fit within openings in the building and that the weight and size of all equipment pieces so not exceed the capacity of the hoisting and/or elevator system.
- D. Owner will not be responsible for material and equipment before testing, commissioning, and acceptance.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral water stop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
1. Minimum Metal Thickness:

- A. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
- B. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - A. Advance Products & Systems, Inc.
 - B. Calpico, Inc.
 - C. Metraflex Co.
 - D. Pipeline Seal and Insulator, Inc.
 - 2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
 - 3. Pressure Plates: Stainless steel. Include two for each sealing element.
 - 4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Avoid interference with structure and with work of other trades, preserving adequate headroom and clearing doors and passageways, to satisfaction of Engineer and in accordance with code requirements. Installation shall permit clearance for access to equipment for repair, servicing and replacement.
- C. Install equipment so as to properly distribute equipment loads on building structural members provided for equipment support under other Sections. Roof-mounted equipment shall be installed and supported on structural steel provided under other Sections.

- D. Provide suspended platforms, strap hangers, brackets, shelves, stands or legs as necessary for floor, wall or ceiling mounting of equipment as required.
- E. Provide steel supports and hardware for proper installation of hangers, anchors, guides, etc.
- F. Provide cuts, weights, and other pertinent data required for proper coordination of equipment support provisions and installation.
- G. Structural steel and hardware shall conform to Standard Specifications of ASTM; use of steel and hardware shall conform to requirements of Section Five of Code of Standard Practice for Steel Buildings and Bridges.
- H. Verify site conditions and dimensions of equipment to ensure access for proper installation of equipment without disassembly which may void warrantee. Report in writing to Engineer, prior to purchase or shipment of equipment involved, on conditions which may prevent proper installation.
- I. Coordinate location of motor control centers, panelboards, and transformers installed in mechanical rooms with the HVAC, Plumbing and Fire Protection subcontractors. No piping, ductwork or other mechanical equipment shall be allowed to pass through the area of the electrical equipment equal to the width and depth of the electrical equipment extending from floor to structural ceiling above. A hung or gypsum board ceiling is not considered structure.
- J. Give right of way to piping systems installed at a required slope and/or specific mounting height or elevation.
- K. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- L. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- M. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- N. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials.
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly.

END OF SECTION

SECTION 260513 - MEDIUM-VOLTAGE CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 SUMMARY

- A. Section includes cables and related cable splices, terminations, and accessories for medium-voltage (2001 to 35,000 V) electrical distribution systems.

1.3 DEFINITIONS

- A. Jacket: A continuous nonmetallic outer covering for conductors or cables.
- B. NETA ATS: Acceptance Testing Specification.
- C. Sheath: A continuous metallic covering for conductors or cables.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of cable. Include splices and terminations for cables and cable accessories.

1.5 INFORMATIONAL SUBMITTALS

- A. Material Certificates: For each type of cable and accessory.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Installer: Engage a cable splicer, trained and certified by splice material manufacturer, to install, splice, and terminate medium-voltage cable.
- B. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 FIELD CONDITIONS

- 1.8 Interruption of Existing Electric Service: Interruption of electrical service shall follow the requirements of Section 1.13 PHASING, DEMOLITION AND MAINTAINING EXISTING SERVICES in Specification 26 01 00. Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
- 1. Notify Owner no fewer than two weeks+ in advance of proposed interruption of electric service.
 - 2. Do not proceed with interruption of electric service without the Owner's written permission.
 - 3. Assume that work will be performed during off hours.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements provide products by the following:
 - 1. Cables:
 - a. Okonite Company (The).
 - b. Southwire Company.
 - c. USA Wiring and Cable.
 - 2. Cable Splicing and Terminating Products and Accessories:
 - a. 3M; Electrical Markets Division.
 - b. RTE Components; Cooper Power Systems, Inc.
 - c. Thomas & Betts Corporation/Elastimold.
 - d. Tyco Electronics; Raychem Products.
- B. Source Limitations: Obtain cables and accessories from single source from single manufacturer.

2.2 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with IEEE C2 and NFPA 70.

2.3 CABLES

- A. Cable Type: Type MV 105.
- B. Comply with UL 1072, AEIC CS8, ICEA S-93-639/NEMA WC 74, and ICEA S-97-682, and ICEA S-94-649.
- C. Conductor: Copper.
- D. Conductor Stranding: Compact round, concentric lay, Class B.
- E. Conductor Insulation: Ethylene-propylene rubber.
 - 1. Voltage Rating: 5 kV for 4160V systems, 35 kV for 34.5 kV systems.
 - 2. Insulation Thickness: 133 percent insulation level.
- F. Shielding: Copper tape, helically applied over semiconducting insulation shield.
- G. Cable Jacket: Sunlight-resistant PVC.

2.4 CONNECTORS

- A. Comply with ANSI C119.4 for connectors between aluminum conductors or for connections between aluminum to copper conductors.
- B. Copper-Conductor Connectors: Copper barrel crimped connectors.

2.5 SOLID TERMINATIONS

- A. Multiconductor Cable Sheath Seals: Type recommended by seal manufacturer for type of cable and installation conditions, including orientation.
 - 1. Cold-shrink sheath seal kit with preformed sleeve openings sized for cable and insulated conductors.
- B. Shielded-Cable Terminations: Comply with the following classes of IEEE 48. Insulation class shall be equivalent to that of cable. Include shield ground strap for shielded cable terminations.
 - 1. Class 1 Terminations: Modular type, furnished as a kit, with stress-relief tube; multiple, molded-silicone-rubber, insulator modules; shield ground strap; and compression-type connector.

2.6 SEPARABLE INSULATED CONNECTORS

- A. Description: Modular system, complying with IEEE 386, with disconnecting, single-pole, cable terminators and with matching, stationary, plug-in, dead-front terminals designed for cable voltage and for sealing against moisture.
- B. Terminations at Distribution Points: Modular type, consisting of terminators installed on cables and modular, dead-front, terminal junctions for interconnecting cables.
- C. Dead-Break Cable Terminators: Elbow-type unit with 600-A continuous-current rating; designed for de-energized disconnecting and connecting; coordinated with insulation diameter, conductor size, and material of cable being terminated. Include test point on terminator body that is capacitance coupled.
- D. Tool Set: Shotgun hot stick with energized terminal indicator, fault-indicator test tool, and carrying case.

2.7 SPLICE KITS

- A. Splice Kits: Comply with IEEE 404; type as recommended by cable or splicing kit manufacturer for the application.
- B. Equal to 3M QS4.

2.8 MEDIUM-VOLTAGE TAPES

- A. Provide tape as per recommendations of splicing technology used.

2.9 ARC-PROOFING MATERIALS

- A. Tape for First Course on Metal Objects: 10-mil- thick, corrosion-protective, moisture-resistant, PVC pipe-wrapping tape.
- B. Arc-Proofing Tape: Fireproof tape, flexible, conformable, intumescent to 0.3 inch thick, and compatible with cable jacket.
- C. Glass-Cloth Tape: Pressure-sensitive adhesive type, 1 inch wide.

2.10 SOURCE QUALITY CONTROL

- A. Test and inspect cables in accordance with applicable standard before shipping.
- B. Test strand-filled cables for water-penetration resistance according to ICEA T-31-610, using a test pressure of 5 psig.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install cables according to IEEE 576.
- B. Proof conduits prior to conductor installation by passing a wire brush mandrel and then a rubber duct swab through the conduit. Separate the wire brush and the rubber swab by 48 to 72 inches on the pull rope.
 - 1. Wire Brush Mandrel: Consists of a length of brush approximately the size of the conduit inner diameter with stiff steel bristles and an eye on each end for attaching the pull ropes. If an obstruction is felt, pull the brush back and forth repeatedly to break up the obstruction.
 - 2. Rubber Duct Swab: Consists of a series of rubber discs approximately the size of the conduit inner diameter on a length of steel cable with an eye on each end for attaching the pull ropes. Pull the rubber duct swab through the duct to extract loose debris from the duct.
- C. Pull Conductors: Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
 - 1. Where necessary, use manufacturer-approved pulling compound or lubricant that does not deteriorate conductor or insulation.
 - 2. Use pulling means, including fish tape, cable, rope, and basket-weave cable grips, that do not damage cables and raceways. Do not use rope hitches for pulling attachment to cable.
 - 3. Use pull-in guides, cable feeders, and draw-in protectors as required to protect cables during installation.
 - 4. Do not pull cables with ends unsealed. Seal cable ends with rubber tape.
- D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- E. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."
- F. Install "buried-cable" warning tape 12 inches above duct bank.
- G. In manholes, handholes, pull boxes, junction boxes, and cable vaults, train cables around walls by the longest route from entry to exit; support cables at intervals adequate to prevent sag.
- H. Install sufficient cable length to remove cable ends under pulling grips. Remove length of conductor damaged during pulling.
- I. Install cable splices where indicated; use 3M SW4 kit or equal kit. Use dead-front separable watertight connectors where indicated.
- J. Install terminations at ends of conductors, and seal multiconductor cable ends with standard kits.
- K. Install separable insulated-connector components as follows:

1. Protective Cap: At each terminal junction, with one on each terminal to which no feeder is indicated to be connected.
 2. Portable Feed-Through Accessory: At each terminal junction, with one on each terminal.
 3. Standoff Insulator: At each terminal junction, with one on each terminal.
- L. Arc Proofing: Unless otherwise indicated, arc proof medium-voltage cable at locations not protected by conduit, cable tray, direct burial, or termination materials. In addition to arc-proofing tape manufacturer's written instructions, apply arc proofing as follows:
1. Clean cable sheath.
 2. Wrap metallic cable components with 10-mil pipe-wrapping tape.
 3. Smooth surface contours with electrical insulation putty.
 4. Apply arc-proofing tape in one half-lapped layer with coated side toward cable.
 5. Band arc-proofing tape with two layers of 1-inch- wide half-lapped, adhesive, glass-cloth tape at each end of the arc-proof tape.
- M. Ground shields of shielded cable at terminations, splices, and separable insulated connectors. Ground metal bodies of terminators, splices, cable and separable insulated-connector fittings, and hardware.
- N. Ground shields of shielded cable at one point only. Maintain shield continuity and connections to metal connection hardware at all connection points.
- O. Identify cables according to Section 26 05 53 "Identification for Electrical Systems." Identify phase and circuit number of each conductor at each splice, termination, pull point, and junction box. Arrange identification so that it is unnecessary to move the cable or conductor to read the identification.

3.2 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters.
 2. After installing medium-voltage cables and before electrical circuitry has been energized, test for compliance with requirements.
 3. Perform direct-current High Potential test of each new conductor according to NETA ATS, Ch. 7.3.3. Do not exceed cable manufacturer's recommended maximum test voltage.
 4. Perform Partial Discharge test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
 5. Perform Dissipation Factor test of each new conductor according to NETA ATS, Ch. 7.3.3 and to test equipment manufacturer's recommendations.
- B. Medium-voltage cables will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 SUMMARY

- A. Section Includes:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
 - 1. Section 26 05 13 "Medium-Voltage Cables" for single-conductor and multiconductor cables, cable splices, and terminations for electrical distribution systems with 2001 to 35,000 V.

1.3 DEFINITIONS

- A. Feeder: All circuit conductors between the service equipment, the source of a separately derived system, or other power supply source and the final branch-circuit overcurrent device.
- B. Branch Circuit: the circuit conductors between the final overcurrent device protecting the circuit and the outlet(s).

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Field quality-control reports.

1.6 COORDINATION

- A. Set sleeves in cast-in-place concrete, masonry walls and other structural components as they are constructed

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Insulated Wire Corp.; a Leviton Company
 - 2. General Cable Technologies Corporation.
 - 3. Southwire Incorporated.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN-2-THWN-2.

2.2 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.
 - 3. Ideal Industries, Inc.
 - 4. Ilsco; a branch of Bardes Corporation.
 - 5. NSi Industries LLC.
 - 6. O-Z/Gedney; a brand of the EGS Electrical Group.
 - 7. 3M; Electrical Markets Division.
 - 8. Tyco Electronics.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

2.3 CABLE SUPPORTS

A. Available Manufacturers:

1. The design is based on O.Z./Gedney to establish standards of quality for materials and performance. The naming of a specific manufacturer or catalog number does not waive any requirements or performance of individual components described in the specification.
2. Acceptable alternate manufacturers are Cross Hinds, Kellem or the Engineer's approved equal.

B. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits. Provide plugs with number and size of conductor gripping holes as required to suit individual risers. Construct body of malleable-iron casting with hot-dip galvanized finish.

C. Provide split wedge cable supports with clamps for cable without metallic sheath. Provide basket weave or approved equal cable supports approved by cable manufacturer for cable with metallic sheath.

2.4 SYSTEM DESCRIPTION

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Comply with NFPA 70.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger, except VFC cable, which shall be extra flexible stranded.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Exposed Feeders: Type THHN-2-THWN-2, single conductors in raceway.
- B. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-2-THWN-2, single conductors in raceway.
- C. Exposed Branch Circuits, Including in Crawlspace: Type THHN-2-THWN-2, single conductors in raceway.

- D. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-2-THWN-2, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."
- G. Complete cable tray systems installation according to Section 26 05 36 "Cable Trays for Electrical Systems" prior to installing conductors and cables.

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material.
 - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- C. Test and Inspection Reports: Prepare a written report to record the following:
 - 1. Procedures used.
 - 2. Results that comply with requirements.
 - 3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION

SECTION 260526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 SUMMARY

- A. Section Includes: Grounding systems and equipment.
- B. Section includes grounding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Informational Submittals: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Test wells.
 - 2. Ground rods.
 - 3. Ground rings.
 - 4. Concrete encased electrodes
 - 5. Grounding arrangements and connections for separately derived systems.
- B. Qualification Data: For qualified testing agency and testing agency's field supervisor.
- C. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 26 01 00 "Electrical General Conditions," include the following:
 - 1. Instructions for periodic testing and inspection of grounding features at test wells ground rings grounding connections for separately derived systems based on NETA MTS.
 - a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - b. Include recommended testing intervals.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Conductor: No. 4 AWG, stranded conductor.
- C. Bare Grounding Conductor and Conductor Protector for Wood Poles:
 - 1. No. 4 AWG minimum, soft-drawn copper.
 - 2. Conductor Protector: Half-round PVC or wood molding; if wood, use pressure-treated fir, cypress, or cedar.

- D. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches in cross section, minimum 24 inch length unless otherwise indicated, with 9/32-inch holes spaced 1-1/8 inches apart.
1. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V. Lexan or PVC, impulse tested at 5000 V.
 2. Field modification or cut bus shall not be acceptable.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Mechanical Connectors: Provide mechanical connectors of the two-bolt type, listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
1. Pipe Connectors: Clamp type, sized for pipe.
 2. Materials: The mechanical connector bodies shall be manufactured from high strength, high conductivity cast copper alloy material. Bolts, nuts, washers and lockwashers shall be made of Silicon Bronze and supplied as a part of the connector body and shall be of the two bolted pressure type. Split bolt connector types shall NOT be accepted.
 3. The connectors shall meet or exceed UL 467 and be clearly marked with the catalog number, conductor size and manufacturer.
- C. Welded Connectors: Provide exothermic connections for copper to copper and copper to steel connections to ground rods, ground buses, ground wires, steel beams, rebar, etc.
1. The supplier of the equipment shall provide with no additional charge and information or supervision required for the proper installation of the equipment and training of operating personnel
 2. Materials: Conductors spliced with an exothermic welded connection shall be considered as a continuous conductor, as stated in the notes accompanying NEC articles 250.50, 250.64 and IEEE Standard 80 (latest edition).
 - a. Procedures outlined in the Manufacturer's installation instruction shall be followed. Molds shall not be modified during installation in field applications.
 - b. Weld metal shall be a mixture of copper oxide and aluminum. Only one weld metal mixture shall be required for each grounding connection.
 - c. Grounding connections shall be tested and certified in accordance with IEEE 837, UL 486A and UL 467.
- D. Bus-bar Connectors: Mechanical type, cast silicon bronze, solderless exothermic-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

2.3 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad Stainless steel; 5/8 by 96 inches in diameter.

2.4 TEST WELLS

- A. Polymer Concrete Inspection Wells
 - 1. Constructed of polymer concrete reinforced with heavy weave fiberglass resulting in high strength and minimal weight
 - 2. Enclosures and covers are rated for 10,000 lbs maximum load
 - 3. Bolt down cover, skid resistant surface

PART 3 - EXECUTION

3.1 GENERAL

- A. Install Products in accordance with manufacturer's instructions.
- B. Mechanical connections shall be accessible for inspection and checking. No insulation shall be installed over mechanical ground connections.
- C. Ground connection surfaces shall be cleaned prior to connections.
- D. Attach grounds permanently before building service is energized.
- E. Provide bonding to meet Regulatory Requirements.
- F. Examine raceway equipment or area to receive grounding to provide adequate sizes, placement and materials for a complete installation.
- G. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.
- H. Determine numbers and sizes of screw terminals for equipment grounding bars in panelboards and other electrical equipment. Provide screw terminals for active circuits, spares and spaces.
- I. Provide equipment ground conductor in same raceway with associated phase conductors.

3.2 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.

1. Bury at least 24 inches below grade.
- C. Grounding Bus: Install in 4160 switchgear enclosures/buildings.
1. Install bus on insulated spacers 2 inches minimum from wall, 6 inches above finished floor unless otherwise indicated.
 2. Where indicated on both sides of doorways, route bus up to top of door frame, across top of doorway, and down to specified height above floor; connect to horizontal bus.
- D. Conductor Terminations and Connections:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 2. Underground Connections: Exothermic welded connectors except at test wells and as otherwise indicated.
 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 4. Connections to Structural Steel: Welded connectors.

3.3 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Manholes and Handholes: Install a driven ground rod through manhole or handhole floor, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.
- C. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- D. Pad-Mounted Equipment - Includes Transformers, Generators and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 4/0 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 24 inches from the foundation. Below grade connections shall be made with Exothermic weld.
1. Bond pad mounted equipment ground system to building grounding electrode system.

3.4 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.

- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
1. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 8. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.

3.5 MEDIUM VOLTAGE SYSTEM GROUNDING

A. General

1. Provide grounding conductor with each medium voltage feeder.
2. Bond all conduits containing medium voltage conductors or using grounding bushing and No. 4 AWG copper conductor.
3. Bond all conduits carrying individual grounding or grounding electrode conductors with grounding bushing and separate No. 4 AWG copper grounding conductor to ground bus.

B. 4160V Housing/Building Grounding

1. Provide and install a ground bus 18" above finished floor with insulated standoffs 36" on center, completely around the perimeter of the room (vault) containing the medium voltage switchgear. Route bus over doors. All connections to bus shall be bolted with Belleville washers and compression (tool applied) spade lugs or Exothermic. Under no circumstances shall this impinge on NEC required work clearances.
2. Bond each enclosure containing medium voltage parts (switches, fuses, transformers, all junction boxes, etc.) to the perimeter ground bus with No. 4/0 copper conductor.
3. Provide separate No. 4/0 copper conductor from ground bus to:
 - a. XO terminal of each transformer.
 - b. Each medium voltage switch ground bus.
 - c. Secondary service equipment ground bus.
 - d. Transformer primary grounded terminal (if required).

C. Equipment Ground Conductor

1. Provide full size 600V, copper THHN/ THWN minimum #2 grounding conductor in each conduit, raceway or enclosure which contains medium voltage conductors. Terminate at ground bus of equipment containing medium voltage terminations. Connect to ground rod and present grounding conductors in manhole.

D. Exterior Pad Mounted Equipment

1. Provide ground rods around medium voltage switchgear as indicated on drawings. Connect to ground bus with copper conductor. Exothermic connection shall be made between conductor, ground rod and ground bus.
2. Connections used for exterior substations shall be tested per IEEE 837.

E. Shield Ground

1. Provide No. 10 AWG stranded wire from each termination shield drain wire to ground bus within enclosure. Connect to nearest grounded conductor if ground bus is not within 24". Route shield drains away from energized parts. Make connections with "Sta-Kon" type terminals or tool applied tap connectors.]

3.6 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches deep, with cover.
 1. Test Wells: Install at least one test well for each service unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.

3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.
- G. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each indicated item, extending around the perimeter of area or item indicated.
 1. Install tinned-copper conductor not less than No. 4/0 AWG for ground ring and for taps to building steel.
 2. Bury ground ring not less than 24 inches from building's foundation.
 3. The perimeter ground wire shall be bonded to each ground rod with an exothermic connection. Provide a No. 4/0 AWG copper ground wire connections from the grounding loop to columns via exothermic connections.
 4. Drive ground rods until tops are 24" below final grade unless installed in ground test well.
 5. Ground rods shall be driven to achieve resistance required by this Section. Provide additional rods as required to achieve specified resistance. Where geological conditions dictate, ground wire mesh may be provided or additional rods shall be driven in compacted earth areas as require to meet resistance requirement.
 6. Connections to ground loop system shall be made with Exothermic weld.
 7. Verify that final backfill and compaction has been completed before driving ground rod electrodes.

3.7 LABELING

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems" for instruction signs. The label or its text shall be green.

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural

drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.

- b. Perform tests by fall-of-potential method according to IEEE 81.
- 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
 - 2. Power and Lighting Equipment or System with Capacity of 500 to 1000 kVA: 5 ohms.
 - 3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - 4. Power Distribution Units or Panelboards Serving Electronic Equipment: 3 ohm(s).
 - 5. Substations and Pad-Mounted Equipment: 5 ohms.
 - 6. Manhole Grounds: 10 ohms.
- F. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

SECTION 260529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.
- B. Related Sections include the following:
 - 1. Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

1.3 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. IMC: Intermediate metal conduit.
- C. RMC: Rigid metal conduit.
- D. NECA National Electrical Contractors Association

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design supports for multiple raceways, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Steel slotted support systems.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following:
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Equipment supports.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- B. Comply with NFPA 70.

1.8 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified together with concrete Specifications.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 5. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 05 50 00 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and RMC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted [**or other**] support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with two-bolt conduit clamps.

- D. Spring-steel clamps designed for supporting single conduits without bolts may be used for 1-1/2-inch and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches thick.
 - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

- B. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 6 inches larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi, 28-day compressive-strength concrete.
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

END OF SECTION

SECTION 260533 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 SUMMARY

- A. Section Includes:
 - 1. Metal conduits, tubing, and fittings.
 - 2. Nonmetal conduits, tubing, and fittings.
 - 3. Boxes and enclosures.
- B. Related Requirements:
 - 1. Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

1.3 DEFINITIONS

- A. EMT: Electrical metallic conduit.
- B. FMC: Flexible metal conduit
- C. LFMC: Liquid tight flexible metal conduit.
- D. RNC: Rigid nonmetallic conduit

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
 - 1. Structural members in paths of conduit groups with common supports.
 - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Source quality-control reports.

PART 2 - PRODUCTS

2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. AFC Cable Systems, Inc.
 - 2. Allied Tube & Conduit; a Tyco International Ltd. Co.
 - 3. Anamet Electrical, Inc.
 - 4. Electri-Flex Company.
 - 5. O-Z/Gedney; a brand of EGS Electrical Group.
 - 6. Republic Conduit.
 - 7. Robroy Industries.
 - 8. Southwire Company.
 - 9. Thomas & Betts Corporation.
 - 10. Western Tube and Conduit Corporation.
 - 11. Wheatland Tube Company; a division of John Maneely Company.
- B. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. GRC(RGS): Comply with ANSI C80.1 and UL 6.
- D. EMT: Comply with ANSI C80.3 and UL 797.
- E. FMC: Comply with UL 1; zinc-coated steel.
- F. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- G. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.

1. Fittings for EMT:
 - a. Material: Steel
 - b. Type: Setscrew
 2. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- H. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
1. AFC Cable Systems, Inc.
 2. Anamet Electrical, Inc.
 3. CANTEX Inc.
 4. CertainTeed Corp.
 5. Condux International, Inc.
 6. Electri-Flex Company.
 7. Kraloy.
 8. Lamson & Sessions; Carlon Electrical Products.
 9. RACO; a Hubbell company.
 10. Thomas & Betts Corporation.
- B. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- D. LFNC: Comply with UL 1660.

2.3 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
1. Cooper B-Line, Inc.
 2. Hoffman; a Pentair company.
 3. Mono-Systems, Inc.
 4. Square D; a brand of Schneider Electric.

- B. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
 - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Fittings and Accessories: Include covers, couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- D. Wireway Covers: Screw-cover type unless otherwise indicated.
- E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES AND ENCLOSURES

- A. Manufacturers: Subject to compliance with requirements provide products by one of the following:
 - 1. Adalet.
 - 2. Cooper Technologies Company; Cooper Crouse-Hinds.
 - 3. EGS/Appleton Electric.
 - 4. Hoffman; a Pentair company.
 - 5. Hubbell Incorporated; Killark Division.
 - 6. Kraloy.
 - 7. Milbank Manufacturing Co.
 - 8. Mono-Systems, Inc.
 - 9. O-Z/Gedney; a brand of EGS Electrical Group.
 - 10. RACO; a Hubbell Company.
 - 11. Robroy Industries.
 - 12. Spring City Electrical Manufacturing Company.
 - 13. Stahlin Non-Metallic Enclosures; a division of Robroy Industries.
 - 14. Thomas & Betts Corporation.
- B. General Requirements for Boxes and Enclosures: Boxes and enclosures installed in wet locations shall be listed for use in wet locations.
- C. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- D. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing 50 lb. Outlet boxes designed for attachment of luminaires weighing more than 50 lb shall be listed and marked for the maximum allowable weight.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- G. Device Box Dimensions: 4 inches square by 2-1/8 inches deep.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed Conduit: GRC.
 2. Concealed Conduit, Aboveground: GRC.
 3. Underground Conduit: Concrete encased only RNC, Type EPC-40-PVC,
 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R, Type 4.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
1. Exposed, Not Subject to Physical Damage: EMT.
 2. Exposed, Not Subject to Severe Physical Damage: EMT.
 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 4. Damp or Wet Locations: GRC.
 5. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 stainless steel in institutional and commercial kitchens and damp or wet locations.
- C. Minimum Raceway Size: 3/4-inch trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with this type of conduit. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 3. EMT: Use compression, fittings. Comply with NEMA FB 2.10.
 4. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.

3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter.
- B. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

- C. Complete raceway installation before starting conductor installation.
- D. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- E. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- F. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within 12 inches of changes in direction.
- G. Support conduit within 12 inches of enclosures to which attached.
- H. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support. Secure raceways to reinforcement at maximum 10-foot intervals.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 - 3. Arrange raceways to keep a minimum of 2 inches of concrete cover in all directions.
 - 4. Change from ENT to RNC above grade.
- I. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- J. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- K. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- L. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- M. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- N. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- P. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a

blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings according to NFPA 70.

- Q. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 2. Where an underground service raceway enters a building or structure.
 3. Where otherwise required by NFPA 70.
- R. Expansion-Joint Fittings:
1. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 2. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 4. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- S. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
- T. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
- U. Locate boxes so that cover or plate will not span different building finishes.
- V. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
- W. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.

3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.4 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

SECTION 260543 - UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks.
 - 2. Handholes and boxes.
 - 3. Manholes.

1.3 DEFINITION

- A. RNC: Rigid nonmetallic conduit.
- B. RSC: Rigid steel conduit

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Duct-bank materials, including separators and miscellaneous components.
 - 2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
 - 3. Accessories for manholes, handholes, boxes.
 - 4. Warning tape.
 - 5. Warning planks.

- B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.
 - 2. Reinforcement details.
 - 3. Frame and cover design and manhole frame support rings.
 - 4. Ladder details.
 - 5. Grounding details.
 - 6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
 - 7. Joint details.
- C. Shop Drawings for Factory-Fabricated Handholes and Boxes Other Than Precast Concrete: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.
 - 2. Frame and Cover design.
 - 3. Grounding details.
 - 4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.
 - 5. Joint details

1.5 INFORMATIONAL SUBMITTALS

- A. Duct-Bank Coordination Drawings: Show duct profiles and coordination with other utilities and underground structures.
 - 1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
 - 2. Drawings shall be signed and sealed by a qualified professional engineer.
- B. Product Certificates: For concrete and steel used in precast concrete manholes and handholes, as required by ASTM C 858.

1.6 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

- B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.
- C. Lift and support precast concrete units only at designated lifting or supporting points.

1.8 PROJECT CONDITIONS

- A. Interruption of Existing Electrical Service: As per specification 26 01 00 do not proceed with interruption of electrical service without the Engineer's and Owner's written permission.

1.9 COORDINATION

- A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.
- B. Coordinate elevations of ducts and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of ducts and duct banks as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations from those indicated as required to suit field conditions and to ensure that duct runs drain to manholes and handholes, and as approved by Engineer.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ARNCO Corp.
 - 2. Beck Manufacturing.
 - 3. Cantex, Inc.
 - 4. CertainTeed Corp.; Pipe & Plastics Group.
 - 5. Condux International, Inc.
 - 6. ElecSys, Inc.
 - 7. Electri-Flex Company.
 - 8. IPEX Inc.

9. Lamson & Sessions; Carlon Electrical Products.
10. Manhattan/CDT; a division of Cable Design Technologies.
11. Spiraduct/AFC Cable Systems, Inc.

B. Underground Plastic Utilities Duct: NEMA TC 6 & 8, Type EB-20-PVC, ASTM F 512, UL 651A, with matching fittings by the same manufacturer as the duct, complying with NEMA TC 9.

C. Duct Accessories:

1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
2. Warning Tape: Underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."
3. Concrete Warning Planks: Nominal 12 by 24 by 3 inches in size, manufactured from 6000-psi concrete.
 - a. Color: Red dye added to concrete during batching.
 - b. Mark each plank with "ELECTRIC" in 2-inch- high, 3/8-inch- deep letters.

2.3 POLYMER CONCRETE HANDHOLES

A. Description:

1. Comply with SCTE 77. Color: Green
2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC.", "COMMUNICATIONS" As appropriate for each service.
6. 12 inches wide by 24 inches long

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Quazite
 - b. [Armorcast Products Company.](#)
 - c. [Carson Industries LLC.](#)

2.4 PRECAST MANHOLES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carder Concrete Products.
 2. Christy Concrete Products.
 3. Elmhurst-Chicago Stone Co.
 4. Oldcastle Precast Group.
 5. Riverton Concrete Products; a division of Cretex Companies, Inc.
 6. Utility Concrete Products, LLC.
 7. Utility Vault Co.
 8. Wausau Tile, Inc.
- B. Comply with ASTM C 858, with structural design loading as specified in Part 3 "Underground Enclosure Application" Article and with interlocking mating sections, complete with accessories, hardware, and features.
1. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
 - a. Windows shall be located no less than 6 inches from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
 - b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
 - c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
 2. Duct Entrances in Manhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
 - a. Type and size shall match fittings to duct or conduit to be terminated.
 - b. Fittings shall align with elevations of approaching ducts and be located near interior corners of manholes to facilitate racking of cable.
- C. Concrete Knockout Panels: 1-1/2 to 2 inches thick, for future conduit entrance and sleeve for ground rod.
- D. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.5 UTILITY STRUCTURE ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bilco Company (The).
 2. Campbell Foundry Company.
 3. Carder Concrete Products.
 4. Christy Concrete Products.
 5. East Jordan Iron Works, Inc.
 6. Elmhurst-Chicago Stone Co.
 7. McKinley Iron Works, Inc.
 8. Neenah Foundry Company.
 9. NewBasis.
 10. Oldcastle Precast Group.
 11. Osburn Associates, Inc.
 12. Pennsylvania Insert Corporation.
 13. Riverton Concrete Products; a division of Cretex Companies, Inc..
 14. Strongwell Corporation; Lenoir City Division.
 15. Underground Devices, Inc.
 16. Utility Concrete Products, LLC.
 17. Utility Vault Co.
 18. Wausau Tile, Inc.
- B. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.
1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, 29 inches.
 - a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
 2. Cover Legend: Cast in. Selected to suit system.
 - a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
 - b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.
 - c. Legend: "SIGNAL" for communications, data, and telephone duct systems.
 3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
 - a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. where packaged mix complying with ASTM C 387, Type M, may be used.
- C. Manhole Sump Frame and Grate: ASTM A 48/A 48M, Class 30B, gray cast iron.
- D. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- diameter eye, and 1-by-4-inch bolt.
1. Working Load Embedded in 6-Inch, 4000-psi Concrete: 13,000-lbf minimum tension.

- E. Pulling Eyes in Nonconcrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch- diameter eye, rated 2500-lbf minimum tension.
- F. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
 - 1. Ultimate Yield Strength: 40,000-lbf shear and 60,000-lbf tension.
- G. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch ID by 2-3/4 inches deep, flared to 1-1/4 inches minimum at base.
 - 1. Tested Ultimate Pullout Strength: 12,000 lbf minimum.
- H. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch bolt, 5300-lbf rated pullout strength, and minimum 6800-lbf rated shear strength.
- I. Cable Rack Assembly: Steel, hot-dip galvanized, except insulators.
 - 1. Stanchions: T-section or channel; 2-1/4-inch nominal size; punched with 14 holes on 1-1/2-inch centers for cable-arm attachment.
 - 2. Arms: 1-1/2 inches wide, lengths ranging from 3 inches with 450-lb minimum capacity to 18 inches with 250-lb minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
 - 3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.
- J. Cable Rack Assembly: Nonmetallic. Components fabricated from nonconductive, fiberglass-reinforced polymer.
 - 1. Stanchions: Nominal 36 inches high by 4 inches wide, with minimum of 9 holes for arm attachment.
 - 2. Arms: Arranged for secure, drop-in attachment in horizontal position at any location on cable stanchions, and capable of being locked in position. Arms shall be available in lengths ranging from 3 inches with 450-lb minimum capacity to 20 inches with 250-lb minimum capacity. Top of arm shall be nominally 4 inches wide, and arm shall have slots along full length for cable ties.
- K. Duct-Sealing Compound: Nonhardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F. Capable of withstanding temperature of 300 deg F without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.
- L. Fixed Manhole Ladders: Arranged for attachment to wall of manhole. Ladder and mounting brackets and braces shall be fabricated from hot-dip galvanized steel.
- M. Cover Hooks: Heavy duty, designed for lifts 60 lbf and greater. Two required.

2.6 SOURCE QUALITY CONTROL

- A. Test and inspect precast concrete utility structures according to ASTM C 1037.
 - 1. Strength tests of complete boxes and covers shall be by either an independent testing agency or the manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
 - 2. Testing machine pressure gages shall have current calibration certification complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT APPLICATION

- A. Ducts for Electrical Cables Over 600 V: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.
- B. Ducts for Electrical Feeders 600 V and Less: RNC, NEMA Type EPC-40-PVC, in concrete-encased duct bank, unless otherwise indicated.
- C. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40-PVC, installed in concrete-encased duct bank, unless otherwise indicated.
- D. Underground Ducts Crossing Paved Paths Walks and Driveways Roadways: RNC, NEMA Type EPC-40-PVC, encased in reinforced concrete.

3.2 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less, Including Telephone, Communications, and Data Wiring:
 - 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
 - 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 structural load rating.
 - 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 8 structural load rating.
 - 4. Units Subject to Light-Duty Pedestrian Traffic Only: Fiberglass-reinforced polyester resin, structurally tested according to SCTE 77 with 3000-lbf vertical loading.
- B. Manholes: Precast or cast-in-place concrete.
 - 1. All Units: H-20 structural load rating according to AASHTO HB 17.

3.3 EARTHWORK

- A. Excavation and Backfill: Comply with Section 31 00 00 "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching.
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to civil documents and specifications.

3.4 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 12.5 feet, both horizontally and vertically, at other locations, unless otherwise indicated.
- C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.
- D. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch ducts, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell without reducing duct line slope and without forming a trap in the line.
 - 2. Grout end bells into structure walls from both sides to provide watertight entrances.
- E. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- F. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- G. Pulling Cord: Install 100-lbf- test nylon cord in ducts, including spares.

H. Concrete-Encased Ducts: Support ducts on duct separators.

1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing rod dowels extending 18 inches into concrete on both sides of joint near corners of envelope.
3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
4. Reinforcement: Reinforce concrete-encased duct banks where they cross disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
5. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
6. Minimum Space between Ducts: 3 inches between ducts and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
8. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
9. Stub-Ups: Use manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. Stub-Ups to Equipment: For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
10. Warning Tape: Bury warning tape approximately 12 inches above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches of the centerline of duct

bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

I. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Section 312000 "Earth Moving" for pipes less than 6 inches in nominal diameter.
4. Install backfill as specified in Section 312000 "Earth Moving."
5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Section 312000 "Earth Moving."
6. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.
11. Warning Planks: Bury warning planks approximately 12 inches above direct-buried ducts and duct banks, placing them 24 inches o.c. Align planks along the width and along the centerline of duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

3.5 INSTALLATION OF CONCRETE MANHOLES

A. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891, unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:

1. Manhole Roof: Install with rooftop at least 15 inches below finished grade.
2. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch above finished grade.
3. Install handholes with bottom below the frost line, 40" below grade.
4. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
5. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Manhole Access: Circular opening in manhole roof; sized to match cover size.

1. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
2. Install chimney, constructed of precast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.

D. Waterproofing: Apply waterproofing to exterior surfaces of manholes after concrete has cured at least three days. After ducts have been connected and grouted, and before backfilling, waterproof joints and connections and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

E. Dampproofing: Apply dampproofing to exterior surfaces of manholes after concrete has cured at least three days. Dampproofing materials and installation are specified in Section 07 11 13 "Bituminous Dampproofing." After ducts have been connected and grouted, and before backfilling, dampproof joints and connections and touch up abrasions and scars. Dampproof exterior of manhole chimneys after mortar has cured at least three days.

F. Hardware: Install removable hardware, including pulling eyes, cable stanchions, and cable arms, as required for installation and support of cables and conductors and as indicated.

G. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.

H. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

- I. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install handholes and boxes with bottom below the frost line, 40" below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.
- F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.
- G. For enclosures installed in asphalt paving and/or are subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
 1. Concrete: 3000 psi, 28-day strength, complying with Section 03 30 00 "Cast-in-Place Concrete," with a troweled finish.

3.7 GROUNDING

- A. Ground underground ducts and utility structures according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

3.8 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections and prepare test reports:
 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.

2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
3. Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 26 05 26 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.9 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION

SECTION 260544 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
 - 2. Sleeve-seal systems.
 - 3. Sleeve-seal fittings.
 - 4. Grout.
 - 5. Silicone sealants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.

- b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 - f. Link Seal
- 2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Carbon steel.
 - 4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.2 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Presealed Systems.

2.3 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

2. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION

SECTION 260548 - VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Isolation pads.
 - 2. Spring isolators.
 - 3. Restrained spring isolators.
 - 4. Channel support systems.
 - 5. Restraint cables.
 - 6. Hanger rod stiffeners.
 - 7. Anchorage bushings and washers.
- B. Related Sections include the following:
 - 1. Section 26 05 29 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

1.3 DEFINITIONS

- A. The IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.

1.4 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Risk category: II

2. Seismic importance factor: 1.0
3. Site class: D
4. Seismic design category: B

1.5 ACTION SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.

1.7 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the Rhode Island State Building Code.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- C. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ace Mountings Co., Inc.
 2. Amber/Booth Company, Inc.
 3. California Dynamics Corporation.
 4. Isolation Technology, Inc.
 5. Kinetics Noise Control.
 6. Mason Industries.
 7. Vibration Eliminator Co., Inc.
 8. Vibration Isolation.
 9. Vibration Mountings & Controls, Inc.
- B. Pads Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel baseplates, and factory cut to sizes that match requirements of supported equipment.
1. Resilient Material: Oil- and water-resistant neoprene.
- C. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- D. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 2. Restraint: Seismic or limit-stop as required for equipment and authorities having jurisdiction.
 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.

6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.2 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Amber/Booth Company, Inc.
 2. California Dynamics Corporation.
 3. Cooper B-Line, Inc.; a division of Cooper Industries.
 4. Hilti Inc.
 5. Loos & Co.; Seismic Earthquake Division.
 6. Mason Industries.
 7. TOLCO Incorporated; a brand of NIBCO INC.
 8. Unistrut; Tyco International, Ltd.
- B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod. Do not weld stiffeners to rods.
- F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchors and studs.
- G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices.
- H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength

required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.

- J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
 - 1. Install restrained isolators on electrical equipment.
 - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.
 - 6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
 - 2. Schedule test with Owner, through Engineer, before connecting anchorage device to restrained component (unless post-connection testing has been approved), and with at least seven days' advance notice.
 - 3. Obtain Engineer's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 - 4. Test at least four of each type and size of installed anchors and fasteners selected by Engineer.
 - 5. Test to 90 percent of rated proof load of device.
 - 6. Measure isolator restraint clearance.
 - 7. Measure isolator deflection.

8. Verify snubber minimum clearances.
9. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust isolators after isolated equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Adjust active height of spring isolators.
- D. Adjust restraints to permit free movement of equipment within normal mode of operation.

END OF SECTION 260548

SECTION 260553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels.
 - 8. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.4 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.

1.5 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL RACEWAY IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway size.
- B. Colors for Raceways Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage.
- C. Colors for Raceways Carrying Circuits at More Than 600 V:
 - 1. Black letters on an orange field.
 - 2. Legend: "DANGER CONCEALED HIGH VOLTAGE WIRING."
- D. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- E. Snap-Around Labels for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- F. Snap-Around, Color-Coding Bands for Raceways Carrying Circuits at 600 V or Less: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.
- G. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.

1. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.

2.2 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each cable size.
- B. Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing ends of legend label.
- C. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the cable diameter such that the clear shield overlaps the entire printed legend.
- D. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around cable it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.
- E. Metal Tags: Brass or aluminum, 2 by 2 by 0.05 inch, with stamped legend, punched for use with self-locking cable tie fastener.
- F. Marker for Tags: Machine-printed, permanent, waterproof, black ink marker recommended by printer manufacturer.
- G. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.
- H. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve, 2 inches long, with diameter sized to suit diameter of cable it identifies and to stay in place by gripping action.

2.3 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive, Self-Laminating Polyester Labels: Preprinted, 3-mil- thick flexible label with acrylic pressure-sensitive adhesive that provides a clear, weather- and chemical-resistant, self-laminating, protective shield over the legend. Labels sized to fit the conductor diameter such that the clear shield overlaps the entire printed legend.
- C. Snap-Around Labels: Slit, pretensioned, flexible, preprinted, color-coded acrylic sleeve, with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.
- D. Snap-Around, Color-Coding Bands: Slit, pretensioned, flexible, solid-colored acrylic sleeve with diameter sized to suit diameter of conductor it identifies and to stay in place by gripping action.

- E. Heat-Shrink Preprinted Tubes: Flame-retardant polyolefin tube with machine-printed identification label. Sized to suit diameter of and shrinks to fit firmly around conductor it identifies. Full shrink recovery at a maximum of 200 deg F. Comply with UL 224.
- F. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.
- G. Write-On Tags: Polyester tag, 0.015 inch thick, with corrosion-resistant grommet and cable tie for attachment to conductor or cable.
 - 1. Labels for Tags: Self-adhesive label, machine-printed with permanent, waterproof, black ink recommended by printer manufacturer, sized for attachment to tag.

2.4 FLOOR MARKING TAPE

- A. 2-inch- wide, 5-mil pressure-sensitive vinyl tape, with yellow and black stripes and clear vinyl overlay.

2.5 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
 - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
 - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE, ACTUAL VOLTAGE.
 - 3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE, ACTUAL VOLTAGE.

2.6 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch grommets in corners for mounting.
3. Nominal size, 10 by 14 inches.

D. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR "X", WHERE "X" SHALL BE VALUE AS PER NEC ARTICLE 110 CLEARANCE REQUIREMENTS."

2.7 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. inches and 1/8 inch thick for larger sizes.
1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.
- B. Adhesive Film Label with Clear Protective Overlay: Machine printed, in black, by thermal transfer or equivalent process. Minimum letter height shall be 3/8 inch. Overlay shall provide a weatherproof and UV-resistant seal for label.

2.8 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.9 CABLE TIES

- A. General-Purpose Cable Ties: Fungus inert, self extinguishing, one piece, self locking, Type 6/6 nylon.
1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.
 3. Temperature Range: Minus 40 to plus 185 deg F.
 4. Color: Black except where used for color-coding.
- B. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self extinguishing, one piece, self locking, Type 6/6 nylon.
1. Minimum Width: 3/16 inch.
 2. Tensile Strength at 73 deg F, According to ASTM D 638: 12,000 psi.

3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black.

2.10 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.
- E. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- F. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape with adhesive appropriate to the location and substrate.
- G. System Identification Color-Coding Bands for Raceways and Cables: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- H. Aluminum Wraparound Marker Labels and Metal Tags: Secure tight to surface of conductor or cable at a location with high visibility and accessibility.
- I. Cable Ties: For attaching tags. Use general-purpose type, except as listed below:
 1. Outdoors: UV-stabilized nylon.
 2. In Spaces Handling Environmental Air: Plenum rated.
- J. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use

multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

- K. Painted Identification: Comply with requirements in painting Sections for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Concealed Raceways, Duct Banks, More Than 600 V, within Buildings: Tape and stencil 4-inch-wide black stripes on 10-inch centers over orange background that extends full length of raceway or duct and is 12 inches wide. Stencil legend "DANGER CONCEALED HIGH VOLTAGE WIRING" with 3-inch-high black letters on 20-inch centers. Stop stripes at legends. Apply to the following finished surfaces:
1. Floor surface directly above conduits running beneath and within 12 inches of a floor that is in contact with earth or is framed above unexcavated space.
 2. Wall surfaces directly external to raceways concealed within wall.
 3. Accessible surfaces of concrete envelope around raceways in vertical shafts, exposed in the building, or concealed above suspended ceilings.
- B. Accessible Raceways, Armored and Metal-Clad Cables, More Than 600 V: Snap-around labels. Install labels at 10-foot maximum intervals.
- C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits More Than 30 A, and 120 V to ground: Identify with self-adhesive vinyl tape applied in bands. Install labels at 10-foot maximum intervals.
- D. Accessible Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels with the wiring system legend and system voltage. System legends shall be as follows:
1. Emergency Power.
 2. Power.
 3. UPS.
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG, if authorities having jurisdiction permit.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.

- c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
- d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- F. Power-Circuit Conductor Identification, More than 600 V: For conductors in vaults, pull and junction boxes, manholes, and handholes, use nonmetallic plastic tag holder with adhesive-backed phase tags, and a separate tag with the circuit designation.
- G. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- H. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive, self-laminating polyester labels with the conductor or cable designation, origin, and destination.
- I. Control-Circuit Conductor Termination Identification: For identification at terminations provide self-adhesive, self-laminating polyester labels with the conductor designation.
- J. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.
- K. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- L. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
 - 1. Limit use of underground-line warning tape to direct-buried cables.
 - 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- M. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- N. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs.

1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
- O. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- P. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.
 - b. Outdoor Equipment: Stenciled legend 4 inches high.
 - c. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Switchgear.
 - e. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - f. Substations.
 - g. Emergency system boxes and enclosures.
 - h. Enclosed switches.
 - i. Enclosed circuit breakers.
 - j. Enclosed controllers.
 - k. Push-button stations.
 - l. Power transfer equipment.
 - m. Battery racks.
 - n. Power-generating units.
 - o. Monitoring and control equipment.
 - p. UPS equipment.
 - q. Pad-mounted switchgear.

END OF SECTION 260553

SECTION 260573 - OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 SUMMARY

- A. This Section includes the requirements for computer-based, fault-current and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.
- B. These studies shall be submitted and approved by the Design Engineer prior to his final approval of all distribution equipment shop drawings. If formal completion of the studies is deemed to delay the project deadline due to delays in equipment manufacture, approval from the Engineer may be obtained for a preliminary submittal with sufficient study data to ensure that the selection of device ratings and characteristics will be satisfactory.

1.3 ACTION SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Other Action Submittals: The following submittals shall be made after the approval process for system protective devices has been completed. Submittals shall be in digital form.
 - 1. Coordination-study input data, including completed computer program input data sheets.
 - 2. Study and Equipment Evaluation Reports.
 - 3. Coordination-Study Report.
 - 4. Short Circuit Report.
 - 5. Arc Flash Analysis Report
- C. Studies shall include the following components:
 - 1. Table of Contents

2. Executive Summary
3. Calculation methods and tabulations.
4. System input Data
5. One-line diagrams and impedance diagrams.
6. Results of the study.
7. Conclusions and recommendations

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For coordination-study specialist.
- B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

1.5 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.
- B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
 1. Professional engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of this engineer.
- C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.
- D. Comply with IEEE 399 for general study procedures.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

- A. Comply with IEEE 399.
- B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Optional Features:
 - a. Arcing faults.
 - b. Simultaneous faults.
 - c. Explicit negative sequence.
 - d. Mutual coupling in zero sequence.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance.
 1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

- A. Gather and tabulate the following input data to support coordination study:
 1. Product Data for overcurrent protective devices specified in other electrical Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 2. Impedance of utility service entrance.
 3. Electrical Distribution System Diagram: In hard-copy and electronic-copy formats, showing the following:
 - a. Circuit-breaker and fuse-current ratings and types.
 - b. Relays and associated power and current transformer ratings and ratios.
 - c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
 - d. Generator kilovolt amperes, size, voltage, and source impedance.
 - e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.
 - f. Busway ampacity and impedance.
 - g. Motor horsepower and code letter designation according to NEMA MG 1.
 4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
 - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.

- c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
- d. Generator thermal-damage curve.
- e. Ratings, types, and settings of utility company's overcurrent protective devices.
- f. Special overcurrent protective device settings or types stipulated by utility company.
- g. Time-current-characteristic curves of devices indicated to be coordinated.
- h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
- i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
- j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes rms symmetrical.
- k. Relevant data for all overcurrent protection devices and adding one level above and one level below equipment being provided under this contract.

3.3 FAULT-CURRENT STUDY

- A. Calculate the maximum available short-circuit current in amperes rms symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:
 - 1. Switchgear and switchboard bus.
 - 2. Medium-voltage controller.
 - 3. Branch circuit panelboard.
- B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions.
- C. Calculate momentary and interrupting duties on the basis of maximum available fault current.
- D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 242.
 - 1. Transformers:
 - a. ANSI C57.12.10.
 - b. ANSI C57.12.22.
 - c. ANSI C57.12.40.
 - d. IEEE C57.12.00.
 - e. IEEE C57.96.
 - 2. Medium-Voltage Circuit Breakers: IEEE C37.010.
 - 3. Low-Voltage Circuit Breakers: IEEE 1015 and IEEE C37.20.1.
 - 4. Low-Voltage Fuses: IEEE C37.46.
- E. Study Report:

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
2. Show interrupting (5-cycle) and time-delayed currents (6 cycles and above) on medium-**[and high]** voltage breakers as needed to set relays and assess the sensitivity of overcurrent relays.

F. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.4 COORDINATION STUDY

- A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.
1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
 2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
 3. Calculate the maximum and minimum ground-fault currents.
- B. Comply with IEEE 242 recommendations for fault currents and time intervals.
- C. Transformer Primary Overcurrent Protective Devices:
1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
- D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

- E. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:
1. Tabular Format of Settings Selected for Overcurrent Protective Devices:
 - a. Device tag.
 - b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
 - c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
 - d. Fuse-current rating and type.
 - e. Ground-fault relay-pickup and time-delay settings.
 2. Coordination Curves: Prepare coordination curves to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
 - a. Device tag.
 - b. Voltage and current ratio for curves.
 - c. Three-phase and single-phase damage points for each transformer.
 - d. No damage, melting, and clearing curves for fuses.
 - e. Cable damage curves.
 - f. Transformer inrush points.
 - g. Maximum fault-current cutoff point.
- F. Completed data sheets for setting of overcurrent protective devices.

3.5 ACH FLASH STUDY

- A. Provide an electrical arc flash hazard analysis for all applicable distribution equipment (600V and under) on the project to determine incident energy, arc flash protection boundaries, and required personal protection equipment (PPE) for all electrical equipment in the facility. The calculations shall comply with NFPA-70E 2004, and IEEE-1584-2002. Labels shall also be provided for equipment as outlined
- B. The purpose of this study is to provide a comprehensive software model of the Facility electrical distribution system, which will document facility compliance with NFPA 70E mandates as described below. This model will serve as an integral part of an ongoing safety program by providing integral work permits and arc flash calculations in compliance with NFPA-70E 2004 Article 130.1(A)(2) for each electrical equipment in the facility.
- C. The analysis and procedures shall comply with the following standards and recommended practices for power system studies.
- NFPA-70E, 2004 Standard for Electrical Safety in the Workplace
IEEE-1584-2002
IEEE-242 "Buff Book" Protection and Coordination of Industrial Power Systems

IEEE-399 “Brown Book” Power System Analysis

IEEE-141 “Red Book” Electric Power Distribution for Industrial Plants

D. Method

1. A detailed arc flash study shall be performed to determine potential arc flash incident energies, arc flash boundaries, shock hazard boundaries and proper personal protective equipment (PPE) for all energized electrical system equipment tasks for the electrical system studied. The calculations shall comply with NFPA-70E 2004, and IEEE-1584. Bolted short circuit calculations used in the above standards shall comply with ANSI C37.010, C37.13, C37.5, IEEE-141, and IEEE-399. The purpose of this study is to determine arc flash hazards in conformance with NFPA-70E, and to provide a comprehensive software model of the electrical distribution system, which provides integral work permits and arc flash calculations in compliance with NFPA 70E Article 130.1(A)(2) for all equipment in the facility. The software program used in this study shall comply with the above standards. No substitutions in calculation methods will be allowed.
2. The arc flash study shall determine the following results. The results shall be provided in spreadsheet format for each mode and electrical system location to provide easy viewing and comparison. Worst-case arc flash energy levels shall be flagged and the spreadsheet comparison table shall be capable of providing its output directly to high quality vinyl label printers. The calculations shall, as a minimum, include a comparison of both 100% and 85% arcing currents for low voltage equipment for each electrical system configuration or operating mode, indicating worst-case arc flash hazards. The spreadsheet results shall include:
 - a. Equipment name and voltage.
 - b. Upstream equipment device name and ANSI function, i.e. 51/50, etc.
 - c. Equipment type, i.e. switchgear, MCC, Panel, VFD, etc.
 - d. Equipment arc gap.
 - e. Bolted and estimated arcing fault current at the fault point (equipment) in symmetrical amperes. The estimated arcing current should be based on the arcing current equations used.
 - f. Trip time, opening time, and total clearing time (total Arc time) of the protective device.
 - g. Worst-case arc flash boundary for each bus/equipment in the model.
 - h. Worst-case arc flash hazard incident energy in cal/cm² for each bus/equipment in the model.
 - i. Worst-case personal protective equipment (PPE) for each bus/equipment in the model.
 - j. Working distances for up to five different distances showing items worst-case arc flash boundary, worst-case arc flash hazard incident energy, and worst-case personal protective equipment (PPE) for each distance.
 - k. Indicate “Danger/Hazardous” areas where incident energy is greater than 40 cal/cm² and provide recommendations to reduced arc flash energy levels for these areas.
3. Flag results where 85% arcing current provided worst-case results.
4. Each mode of operation shall include a detailed write-up indicating areas where incident energy calculations and PPE requirements are higher than calculated in the normal operating mode.

E. Provide a detailed arc flash analysis report including as a minimum:

1. Introduction.
2. Methodology.
3. Information Sources.
4. Key Assumptions.
5. Arc Flash Energy and other consideration for various System Modes of Operation (maintenance mode, bus-tie, co-gen on/off, etc.).
6. Arc Energy at 100% and reduced currents.
7. IEEE 1584-2002 Considerations.
8. Overcurrent Protective Device Changes, Replacements or Setting Changes implemented in study to reduce arc flash hazard exposure.
9. Explanation of Data in Arc Flash Hazard Report Tables.
10. NFPA 70E Information.
11. Shock Hazards with covers removed.
12. Shock Hazard Approach Boundaries.
13. Limited Approach Boundary.
14. Restricted Approach Boundary.
15. Prohibited Approach Boundary.
16. Arc Flash Hazard Boundaries.
17. Results of Arc flash Hazard Analysis for high voltage, medium voltage and low voltage systems, including:
 - a. Working distances.
 - b. Energy Levels.
 - c. PPE Requirements.
 - d. Recommendations to reduce arc flash hazard energy and exposure.
 - e. Arc Flash Hazard Report.
 - f. Electronic Copy in Adobe Acrobat format (6.0 or later)

3.6 ADJUSTMENTS, SETTINGS AND MODIFICATIONS

- A. Provide necessary field settings, adjustments, minor modifications, for conformance with the study, without any additional cost to owner. Examples of minor modifications would be trip sizes within the same frame, the time curve characteristics of inductions relays, CT ranges, etc.
- B. Proposed corrective modifications will be taken under advisement and the Construction Manager will be given further instructions.

END OF SECTION

SECTION 260913 – POWER MANAGEMENT SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the contract, including Division 00, Bidding and Contract Requirements and Division 01, General Requirements.

1.2 SUMMARY

- A. Section includes the following for monitoring of electrical power system:
 - 1. PC-based workstation and software.
 - 2. Communication network and interface modules for RS-485 and Modbus TCP/IP data transmission protocols.

1.3 DEFINITIONS

- A. Ethernet: Local area network based on IEEE 802.3 standards.
- B. Firmware: Software (programs or data) that has been written onto read-only memory (ROM). Firmware is a combination of software and hardware. Storage media with ROMs that have data or programs recorded on them are firmware.
- C. HTML: Hypertext markup language.
- D. I/O: Input/output.
- E. KY Pulse: A term used by the metering industry to describe a method of measuring consumption of electricity that is based on a relay changing status in response to the rotation of the disk in the meter.
- F. LAN: Local area network; sometimes plural as "LANs."
- G. LCD: Liquid crystal display.
- H. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than; 15 volts (RMS) for sinusoidal AC, 21.2 volts peak for non-sinusoidal AC, 30 volts for continuous DC that is interrupted at a rate of 10 to 200Hz (680).
- I. Modbus TCP/IP: An open protocol for exchange of process data.

- J. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
- K. PC: Personal computer; sometimes plural as "PCs." (In this case, rack mounted type)
- L. rms: Root-mean-square value of alternating voltage, which is the square root of the mean value of the square of the voltage values during a complete cycle.
- M. RS-232: A TIA standard for asynchronous serial data communications between terminal devices.
- N. RS-485: A TIA standard for multipoint communications using two twisted-pairs.
- O. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.
- P. THD: Total harmonic distortion.
- Q. UPS: Uninterruptible power supply; used both in singular and plural context.
- R. WAN: Wide area network.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Attach copies of approved Product Data submittals for products (such as switchboards and switchgear) that describe power monitoring and control features to illustrate coordination among related equipment and power monitoring and control.
- B. Shop Drawings: For power monitoring and control equipment. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Outline Drawings: Indicate arrangement of components and clearance and access requirements.
 - 2. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
 - 3. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 4. Wiring Diagrams: For power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
 - 5. UPS sizing calculations for workstation.
 - 6. Surge Suppressors: Data for each device used and where applied.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer and manufacturer.
- B. Field quality-control reports.
- C. Other Informational Submittals:
 - 1. Manufacturer's system installation and setup guides, with data forms to plan and record options and setup decisions.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For power monitoring and control units, to include in emergency, operation, and maintenance manuals. Include the following:
 - 1. Operating and applications software documentation.
 - 2. Software licenses.
 - 3. Software service agreement.
 - 4. PC installation and operating documentation, manuals, and software for the PC and all installed peripherals. Software shall include system restore, emergency boot diskettes, and drivers for all installed hardware. Provide separately for each PC.
 - 5. Hard copies of manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM of the hard-copy submittal.
- B. Software and Firmware Operational Documentation:
 - 1. Self-study guide describing the process for setting equipment's network address; setting Owner's options; procedures to ensure data access from any PC on the network, using a standard Web browser; and recommended firewall setup.
 - 2. Software operating and upgrade manuals.
 - 3. Software Backup: On a magnetic media or compact disc, complete with Owner-selected options.
 - 4. Device address list and the set point of each device and operator option, as set in applications software.
 - 5. Graphic file and printout of graphic screens and related icons, with legend.
- C. Software Upgrade Kit: For Owner to use in modifying software to suit future power system revisions or power monitoring and control revisions.
- D. Software licenses and upgrades required by and installed for operating and programming digital and analog devices.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Manufacturer Qualifications: A firm experienced in manufacturing power monitoring and control equipment similar to that indicated for this Project and with a record of successful in-service performance.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.8 COORDINATION

- A. Coordinate features of distribution equipment and power monitoring and control components to form an integrated interconnection of compatible components.
 - 1. Match components and interconnections for optimum performance of specified functions.
- B. Coordinate Work of this Section with those in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

1.9 SOFTWARE SERVICE AGREEMENT

- A. Qualifications
 - 1. The URI Office of Information Technology Services must review and approve all Contracts that involve the purchase of hardware or software, which grant a third party the right to integrate with University IT infrastructure or access campus information containing University data, or that involve third-party service providers and cloud-based vendors that provide services that process or hold institutional data, in accordance with the protocols, processes, and procedures of the Office of Information Technology Services.
 - 2. Complete a Higher Education Community Vendor Assessment Toolkit (HECVAT) full assessment: The Full HECVAT, published <https://library.educause.edu/resources/2020/4/higher-education-community-vendor-assessment-toolkit>, needs to be completed by each vendor. The "HECVAT" is intended to simplify and speed up the process of gathering the information to assess the controls used by your organization to protect the University's data, comply with the terms of the Agreement and to provide an operationally stable, protected and recoverable service. The completed copy of the HECVAT, provided with your RFP response, will be reviewed and approved for compliance by the Chief Information Security Officer (CISO) prior to the Technical Review. HECVATs not approved by the URI CISO will not proceed to the Technical Review.
 - 3. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

4.

- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of project Completion. Upgrading software shall include the operating systems. Upgrade shall include new or revised licenses for use of software.

1.10 MANUFACTURERS

- A. The new Power Management System shall be fully compatible with the existing Eaton system currently installed at Substations 1 & 2.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide comparable product by one of the following:
 - 1. Eaton Corporation.
 - 2. Cooper Power Systems.
 - 3. GE by ABB.
 - 4. Schneider Electric - Power Management Operation.
 - 5. Siemens.

1.11 FUNCTIONAL DESCRIPTION

- A. Instrumentation and Recording Devices: Monitor and record data points, load profiles and chart energy consumption patterns.
 - 1. Calculate and Record the Following:
 - a. Generator plant running load.
 - b. Peak demand periods (kW and kVA).
 - 2. Measure and Record Data for the Following:
 - a. Medium Voltage Switchgear.
 - 1) Main Bus Amps Neutral
 - 2) Main Bus Average Voltage
 - 3) Main Bus L1 Current
 - 4) Main Bus L2 Current
 - 5) Main Bus L3 Current
 - 6) Main Bus L1 kW
 - 7) Main Bus L2 kW
 - 8) Main Bus L3 kW
 - 9) Main Bus Voltage A-B
 - 10) Main Bus Voltage B-C

- 11) Main Bus Voltage A-C
- 12) Main Bus Voltage A-N
- 13) Main Bus Voltage B-N
- 14) Main Bus Voltage C-N
- 15) Main Bus Total kVA
- 16) Main Bus Total kVAR
- 17) Main Bus Total kW
- 18) Main Bus Total kWh
- 19) Main Bus Power Factor
- 20) Generator No. 1 Main Opened/Closed/Tripped
- 21) Generator No. 2 Main Opened/Closed/Tripped
- 22) Load Breaker No. 1 Opened/Closed/Tripped
- 23) Load Breaker No. 2 Opened/Closed/Tripped
- 24) Load Breaker No. 3 Opened/Closed/Tripped
- 25) Load Breaker No. 4 Opened/Closed/Tripped
- 26) Arms Mode Activated
- 27) Loss Of Utility Voltage
- b. Engine Generators (Typical for two).
 - 1) Amps Neutral
 - 2) Average Voltage
 - 3) L1 Current
 - 4) L2 Current
 - 5) L3 Current
 - 6) L1 kW
 - 7) L2 kW
 - 8) L3 kW
 - 9) Voltage A-B
 - 10) Voltage B-C
 - 11) Voltage A-C
 - 12) Voltage A-N
 - 13) Voltage B-N
 - 14) Voltage C-N
 - 15) Total kVA
 - 16) Total kVAR
 - 17) Total kW
 - 18) Total kWh
 - 19) Genset Supplying Load
 - 20) Genset Running
 - 21) Not In Auto
 - 22) High Battery Voltage
 - 23) Low Battery Voltage
 - 24) Charger Ac Failure
 - 25) Fail To Start
 - 26) Low Coolant Temperature
 - 27) Pre-High Engine Temperature
 - 28) High Engine Temperature
 - 29) Pre-Low Oil Pressure
 - 30) Low Oil Pressure

- 31) Overspeed
- 32) Low Coolant Level
- 33) Fuel Tank Tank Analog (Gallons)
- 34) Fuel Tank High Fuel Level
- 35) Fuel Tank Critical High Fuel Level
- 36) Fuel Tank Low Fuel Level
- 37) Fuel Tank Critical Low Fuel Level
- 38) Check Genset
- 39) Ground Fault
- 40) High Ac Voltage
- 41) Low Ac Voltage
- 42) Under Frequency
- 43) Overload
- 44) Overcurrent
- 45) Short Circuit
- 46) Reverse kW
- 47) Reverse kVAR
- 48) Fail To Sync
- 49) Fail To Close
- 50) Load Demand
- 51) Genset Circuit Breaker Trip
- 52) Emergency Stop
- c. Medium Voltage Pad-Mounted Switchgear
 - 1) Main Bus Amps Neutral
 - 2) Main Bus Average Voltage
 - 3) Main Bus L1 Current
 - 4) Main Bus L2 Current
 - 5) Main Bus L3 Current
 - 6) Main Bus L1 kW
 - 7) Main Bus L2 kW
 - 8) Main Bus L3 kW
 - 9) Main Bus Voltage A-B
 - 10) Main Bus Voltage B-C
 - 11) Main Bus Voltage A-C
 - 12) Main Bus Voltage A-N
 - 13) Main Bus Voltage B-N
 - 14) Main Bus Voltage C-N
 - 15) Main Bus Total kVA
 - 16) Main Bus Total kVAR
 - 17) Main Bus Total kW
 - 18) Main Bus Total kWh
 - 19) Main Bus Power Factor
 - 20) Fdr 2-2 Main Opened/Closed/Tripped
 - 21) Generator Main Opened/Closed/Tripped
 - 22) Load Breaker No. 1 Opened/Closed/Tripped
 - 23) Load Breaker No. 2 Opened/Closed/Tripped
 - 24) Load Breaker No. 3 Opened/Closed/Tripped
 - 25) Load Breaker No. 4 Opened/Closed/Tripped

- B. Power Quality Monitoring: Identify power system anomalies and measure, display, and record trends and alarms of the following power quality parameters:
 - 1. Voltage regulation and unbalance.
 - 2. Continuous three-phase rms voltage.
 - 3. Periodic max./min./avg. voltage samples.
 - 4. Voltage excursions.

1.12 SYSTEM REQUIREMENTS

- A. Monitoring and Control System: Include rack mounted PC-based workstation with graphics capability and Web access, with its operating system and application software, connected to data transmission network.
- B. Addressable Devices: All transmitters and receivers shall communicate unique device identification and status reports to monitoring and control clients.
- C. Provide connection to thermostat and define set points below and above which University staff is notified.

1.13 OPERATING SYSTEM

- A. Software: Configured for a server and multiple client PCs, each with capability for accessing multiple devices simultaneously. Software shall include interactive graphics client and shall be Web enabled. Workstations and portable computers shall not require any software except for an Internet browser to provide connectivity and full functionality. Include a firewall recommended by manufacturer. 100 Base-T Ethernet, Modbus TCP/IP RS-232, and RS-485 digital communications.
- B. Operating System Software: Based on 32-bit, Microsoft Windows – (latest edition) workstation operating system. Software shall have the following features:
 - 1. Multiuser and multitasking to allow independent activities and monitoring to occur simultaneously at different workstations.
 - 2. Graphical user interface to show pull-down menus and a menu tree format.
 - 3. Capability for future additions within the indicated system size limits.
- C. Peer Computer Control Software: Shall detect a failure of workstation and associated server, and shall cause the other workstation and associated server to assume control of all system functions without interruption of operation. Drivers shall be provided in both central computers to support this mode of operation.

1.14 APPLICATIONS SOFTWARE

A. Basic Requirements:

1. Fully compatible with and based on the approved operating system.
2. Password-protected operator login and access; three levels, minimum.
3. Password-protected setup functions.
4. Context-sensitive online help.
5. Capability of creating, deleting, and copying files; and automatically maintaining a directory of all files, including size and location of each sequential and random-ordered record.
6. Capability for importing custom icons into graphic views to represent alarms and I/O devices.
7. Automatic and encrypted backups for database and history; automatically stored at a selected workstation and encrypted with a nine-character alphanumeric password, which must be used to restore or read data contained in backup.
8. Operator audit trail for recording and reporting all changes made to user-defined system options.

B. Workstation Server Functions:

1. Support other client PCs on the LAN and WAN.
2. Maintain recorded data in databases accessible from other PCs on the LAN and WAN.

C. Data Formats:

1. User-programmable export and import of data to and from commonly used Microsoft Windows Excel spreadsheet, database, billing, and other applications; using dynamic data exchange technology.
2. Option to convert reports and graphics to HTML format.
3. Interactive graphics.
4. Option to send preprogrammed or operator designed e-mail reports.

D. Metered Data: Display metered values in real time.

E. Equipment Documentation: Database for recording of equipment ratings and characteristics; with capability for graphic display on monitors.

F. Graphics: Interactive color-graphics platform with pull-down menus and mouse-driven generation of power system graphics, in formats widely used for such drafting; to include the following:

1. Site plan.
2. Floor plans.
3. Equipment elevations for all equipment monitored by this system.
4. Single-line diagrams quantity and content as per the Contract Documents.

G. User-Defined Monitoring and Control Events: Display and record with date and time stamps accurate to 0.1 second, and including the following:

1. Operator log on/off.
 2. Attempted operator log on/off.
 3. All alarms.
 4. Equipment operation counters.
 5. Out-of-limit, pickup, trip, and no-response events.
- H. Trending Reports: Display data acquired in real-time from different meters or devices, in historical format over user-defined time; unlimited as to interval, duration, or quantity of trends.
1. Spreadsheet functions of sum, delta, percent, average, mean, standard deviation, and related functions applied to recorded data.
 2. Charting, statistical, and display functions of standard Windows-based spreadsheet.
- I. Alarms: Display and record alarm messages from discrete input and controls outputs, according to user programmable protocol.
1. Functions requiring user acknowledgment shall run in background during computer use for other applications and override other presentations when they occur.
- J. Waveform Data: Display and record waveforms on demand or automatically on an alarm or programmed event. Include the graphic displays of the following, based on user-specified criteria:
1. Phase voltages, phase currents, and residual current.
 2. Overlay of three-phase currents, and overlay each phase voltage and current.
 3. Waveforms ranging in length from [2] **<Insert number>** cycles to [5] **<Insert number>** minutes.
 4. Disturbance and steady-state waveforms up to 512 points per cycle.
 5. Transient waveforms up to 83,333 points per cycle on 60-Hz base.
 6. Calculated waveform, based on recorded data, on a minimum of four cycles of data of the following:
 - a. THD.
 - b. rms magnitudes.
 - c. Peak values.
 - d. Crest factors.
 - e. Magnitude of individual harmonics.
- K. Data Sharing: Allow export of recorded displays and tabular data to third-party applications software.
1. Tabular data shall be in the comma-separated values.
- L. Reporting: User commands initiate the reporting of a list of current alarm, supervisory, and trouble conditions in system or a log of past events.
1. Print a record of user-defined alarm, supervisory, and trouble events on workstation printer.
 2. Sort and report by device name and by function.

3. Report type of signal (alarm, supervisory, or trouble), description, date, and time of occurrence.
4. Differentiate alarm signals from other indications.
5. When system is reset, report reset event with same information concerning device, location, date, and time.

M. Display Monitor:

1. Backlighted LCD to display metered data with touch-screen selecting device.
2. Touch-screen display shall be a minimum 16-inch diagonal, resolution of 800 by 600 RGB pixels, 256 colors; NEMA 250, Type 1 display enclosure.

1.15 COMMUNICATION COMPONENTS AND NETWORKS

- A. Network Configuration: High-speed, multi-access, open nonproprietary, industry standard communication protocol; LANs complying with EIA 485, 100 Base-T Ethernet, and Modbus TCP/IP.

1.16 POWER MONITORS

- A. Power management system shall communicate with and collect all available information from all electronic components specified in these contract documents, including but not limited to all:
1. VFI trip units in the exterior pad-mounted switch
 2. Protective devices in the paralleling switchgear (generator input and feeder output relays)
 3. Station batteries battery charger which shall be provided with all monitoring features available and with compatible communications capability.
 4. Thermostat (which shall be provided as the electronic type with communications capability compatible with the power management system).
 5. Power supply trouble signal.
 6. Points listed in 2.2(A)(2) of this section.

Note that all such devices shall from here forth be referenced to, for the sake of this specification, as a power monitor.

1.17 STANDALONE, WEB-ENABLED MONITORING AND CONTROL INSTRUMENT

- A. Separately mounted, permanently installed instrument for power monitoring and control.
1. Enclosure: NEMA 250, Type 1.
- B. Environmental Conditions: System components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability.

1. Indoor installation in heated and exhausted spaces that have environmental controls to maintain ambient conditions.
- C. Power-Distribution Equipment Monitor: Web enabled, with integral network port and embedded Web server with factory-configured firmware and HTML-formatted Web pages for viewing of power monitoring and equipment status information from connected devices equipped with digital communication ports.
- D. LAN Connectivity: Multipoint, RS-485 Modbus serial communication network, interconnecting all breaker trip units, protective relays, drives, and metering devices equipped with communications. Serial communication network connected to Ethernet server that functions as a gateway and server, providing data access via 100 Base-T LAN.
- E. Communication Devices within the Equipment: Addressed at factory and tested to verify reliable communication with network server.
- F. Server Configuration:
 1. Initial network parameters set using a standard Web browser. Connect via a local operator interface, or an RJ-45 port accessible from front of equipment.
 2. Network server shall be factory programmed with embedded HTML-formatted Web pages that are user configurable and that provide detailed communication diagnostic information for serial and Ethernet ports as status of RS-485 network; with internal memory management information pages for viewing using a standard Web browser.
 3. Login: Password protected; password administration accessible from the LAN using a standard Web browser.
 4. Operating Software: Suitable for local access; firewall protected.
- G. Data Access:
 1. Network server shall include embedded HTML pages providing real-time information from devices connected to RS-485 network ports via a standard Web browser.
- H. Equipment Monitoring Options: Login shall be followed by a main menu for selecting summary Web pages that follow.
- I. Summary Web pages shall be factory configured to display the following information for each communicating device within the power equipment lineup:
 1. User-Configured Custom Home Page: Provide for the lineup, showing status-at-a-glance of key operating values.
 2. Circuit Summary Page: Circuit name, three-phase average rms current, power (kW), power factor, and breaker status.
 3. Load Current Summary Page: Circuit name, Phase A, B, and C rms current values.
 4. Demand Current Summary Page: Circuit name, Phase A, B, and C average demand current values.
 5. Power Summary Page: Circuit name, present demand power (kW), peak demand power (kW), and recorded time and date.

6. Energy Summary Page: Circuit name, energy (kWh), reactive energy (kVARh), and time/date of last reset.
7. Specific Device Pages: Each individual communicating device shall display detailed, real-time information, as appropriate for device type.
 - a. Display historical energy data that shall be logged automatically for each device, as appropriate for device type.
 - b. Display historical data logged from each device in graphical time-trend plots. Value to be displayed on time-trend plot shall be user selectable. Time interval to be displayed on scale shall be for previous day or week.
8. Export historical energy data to a PC or workstation through network using FTP (File Transfer Protocol). Format exported data in a CSV (Comma Separated Variable) file format for importing into spreadsheet applications.

J. Communications:

1. Permanently connected to communicate via Modbus TCP via a 100 Base-T Ethernet.
2. Local Plug-in Connections: RS-232 and 100 Base-T Ethernet.
3. Monitor Display: Backlighted LCD to display metered data with touch-screen selecting device.

1.18 WORKSTATION HARDWARE

- A. Environmental Conditions: System components shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:
1. Indoor installation in spaces that have environmental controls to maintain ambient conditions of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing.
- B. Computer: Standard unmodified PC of modular design, designed for the latest version of Windows operating system.
1. Memory: 8 GB of usable installed memory.
 2. Real-Time Clock. Automatic time correction once every 24 hours by synchronizing clock with the Time Service Department of the U.S. Naval Observatory.
 3. Ports: Two RS-232-F serial ports for general use; one parallel port; four USB ports
 4. Replaceable graphics board.
 5. LAN Adapter Card.
 6. Sound Card: For playback and recording of digital WAV sound files associated with audible warning and alarm functions.
 7. Color Monitor: WXGA TFT, not less than 18 inches, LCD type.
 8. Keyboard: US English.
 9. Mouse: Standard.
 10. Minimum Disk Storage: 1TB, 7200 rpm hard drive.
 11. CD-RW/DVD-ROM Drive.

12. Rack Mountable Report Printer: Minimum resolution 600 dpi laser printer.

- a. Connected to central station and designated workstations.
- b. RAM: 2 MB, minimum.
- c. Printing Speed: Minimum 12 pages per minute.
- d. Paper Handling: Automatic sheet feeder with 250-sheet paper cassette and with automatic feed.

C. UPS: Self-contained.

1. Size: Provide a minimum of 10 hours of operation of workstation station equipment, including 2 hours of alarm printer operation.
2. Batteries: Sealed, valve regulated, recombinant, lead calcium.
3. Accessories:
 - a. Input-harmonics reduction.
 - b. Rectifier/charger.
 - c. Battery disconnect device.
 - d. Static bypass transfer switch.
 - e. Internal maintenance bypass/isolation switch.
 - f. Remote UPS monitoring.
 - g. Battery monitoring.
 - h. Remote battery monitoring.

1.19 RS-232 ASCII INTERFACE

- A. Provide ASCII interface if required to interconnect any of the power monitoring devices listed herein.

1.20 LAN CABLES

- A. Provide all cabling as required to interconnect all components indicated, as required for a complete and fully functioning system and as required for a complete job.
- B. Unshielded Twisted Pair Cables: Category 6 for horizontal cable for data service.

1.21 LOW-VOLTAGE WIRING

- A. Low-Voltage Control Cable: Multiple conductor, color-coded, No. 20 AWG copper, minimum.
 1. Sheath: PVC; except in plenum-type spaces, use sheath listed for plenums.
 2. Ordinary Switching Circuits: Three conductors unless otherwise indicated.
 3. Switching Circuits with Pilot Lights or Locator Feature: Five conductors unless otherwise indicated.

PART 2 - EXECUTION

2.1 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.
 - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

2.2 CABLING

- A. Comply with NECA 1.
- B. Wiring Method: Install wiring in raceway and cable tray except within consoles, cabinets, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
- C. Install LAN cables using techniques, practices, and methods that are consistent with specified category rating of components and that ensure specified category performance of completed and linked signal paths, end to end.
- D. Install cables without damaging conductors, shield, or jacket.

2.3 IDENTIFICATION

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
- B. Label each power monitoring and control module with a unique designation.

2.4 GROUNDING

- A. Comply with IEEE 1100, "Recommended Practice for Powering and Grounding Electronic Equipment."

2.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

C. Tests and Inspections:

1. Electrical Tests: Use caution when testing devices containing solid-state components.
2. Continuity tests of circuits.
3. Operational Tests: Set and operate controls at workstation and at monitored and controlled devices to demonstrate their functions and capabilities. Use a methodical sequence that cues and reproduces actual operating functions as recommended by manufacturer. Submit sequences for approval. Note response to each test command and operation. Note time intervals between initiation of alarm conditions and registration of alarms at central-processing workstation.
 - a. Coordinate testing required by this Section with that required by Sections specifying equipment being monitored and controlled.
 - b. Test LANs according to requirements in Section 271500 "Communications Horizontal Cabling."
 - c. System components with battery backup shall be operated on battery power for a period of not less than 10 percent of calculated battery operating time.
 - d. Verify accuracy of graphic screens and icons.
 - e. Metering Test: Load feeders, measure loads on feeder conductor with an rms reading clamp-on ammeter, and simultaneously read indicated current on the same phase at central-processing workstation. Record and compare values measured at the two locations. Resolve discrepancies greater than 5 percent and record resolution method and results.
 - f. Record metered values, control settings, operations, cues, time intervals, and functional observations and submit test reports printed by workstation printer.

- D. Power monitoring and control equipment will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- F. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.
- G. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible agency and representative.
- H. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.
- I. Remove and replace malfunctioning devices and circuits and retest as specified above.

2.6 ON-SITE ASSISTANCE

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to

three (of 8 hours on site time each) visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION

SECTION 261200 - MEDIUM-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following types of transformers with medium-voltage primaries:
 - 1. Pad-mounted, liquid-filled transformers.

1.3 DEFINITIONS

- A. NETA ATS: Acceptance Testing Specification.

1.4 ACTION SUBMITTALS

- A. Product Data: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, location of each field connection, and performance for each type and size of transformer indicated.
- B. Shop Drawings: Diagram power wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
 - 1. Underground primary and secondary conduit stub-up location.
 - 2. Dimensioned concrete base, outline of transformer, and required clearances.
 - 3. Ground rod and grounding cable locations.
- B. Qualification Data: For testing agency.
- C. Source quality-control test reports.
- D. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For transformer and accessories to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with IEEE C2.
- D. Comply with ANSI C57.12.10, ANSI C57.12.28, IEEE C57.12.70, and IEEE C57.12.80.
- E. Comply with NFPA 70.

1.8 DELIVERY, STORAGE, AND HANDLING

1.9 PROJECT CONDITIONS

1.10 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

PART 2 - PRODUCTS

2.1 GENERAL TRANSFORMER REQUIREMENTS

- A. Coil Material: Copper

2.2 PAD-MOUNTED, LIQUID-FILLED TRANSFORMERS

- A. Description: ANSI C57.12.13, ANSI C57.12.26, IEEE C57.12.00 pad-mounted, 2-winding transformers. Stainless-steel tank base and cabinet.
- B. Insulating Liquid: Mineral oil, complying with ASTM D 3487, Type II, and tested according to ASTM D 117.

- C. Basic Impulse Level: 30 kV.
- D. Full-Capacity Voltage Taps: Four 2.5 percent taps, 2 above and 2 below rated high voltage; with externally operable tap changer for de-energized use and with position indicator and padlock hasp.
- E. High-Voltage Switch: 100 A, make-and-latch rating of 10-kA RMS, symmetrical, arranged for radial feed with 3-phase, 2-position, gang-operated, load-break switch that is oil immersed in transformer tank with hook-stick operating handle in primary compartment.
- F. Primary Fuses: 150-kV fuse assembly with fuses complying with IEEE C37.47.
 - 1. Current-limiting type in dry-fuse holder wells, mechanically interlocked with liquid-immersed switch in transformer tank to prevent disconnect under load.
- G. High-Voltage Terminations and Equipment: Dead front with universal-type bushing wells for dead-front bushing-well inserts, complying with IEEE 386 and including the following:
 - 1. Bushing-Well Inserts: One for each high-voltage bushing well.
- H. Low Voltage Terminations: Provide 12 hole spade terminals on secondary to accommodate secondary feed.
- I. Accessories:
 - 1. Drain Valve: 1 inch, with sampling device.
 - 2. Dial-type thermometer.
 - 3. Liquid-level gage.
 - 4. Pressure Relief Device: Self-sealing with an indicator.

2.3 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.4 SOURCE QUALITY CONTROL

- A. Factory Tests: Perform design and routine tests according to standards specified for components. Conduct transformer tests according to IEEE C57.12.90.
- B. Factory Tests: Perform the following factory-certified tests on each transformer:
 - 1. Resistance measurements of all windings on rated-voltage connection and on tap extreme connections.
 - 2. Ratios on rated-voltage connection and on tap extreme connections.
 - 3. Polarity and phase relation on rated-voltage connection.
 - 4. No-load loss at rated voltage on rated-voltage connection.
 - 5. Excitation current at rated voltage on rated-voltage connection.

6. Impedance and load loss at rated current on rated-voltage connection and on tap extreme connections.
7. Applied potential.
8. Induced potential.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for medium-voltage transformers.
- B. Examine roughing-in of conduits and grounding systems to verify the following:
 1. Wiring entries comply with layout requirements.
 2. Entries are within conduit-entry tolerances specified by manufacturer and no feeders will have to cross section barriers to reach load or line lugs.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and that requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install transformers on concrete bases.
 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit and 4 inches high.
 2. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section 033000 "Cast-in-Place Concrete."
 3. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
- B. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

3.3 IDENTIFICATION

- A. Identify field-installed wiring and components and provide warning signs as specified in Section 260553 "Identification for Electrical Systems."

3.4 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Remove and replace malfunctioning units and retest.
- C. Test Reports: Prepare written reports to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective actions taken to achieve compliance with requirements.

END OF SECTION

SECTION 261300 - MEDIUM-VOLTAGE SWITCHGEAR

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 SUMMARY

- A. This specification section describes all labor, materials, equipment and services necessary for and incidental to furnishing the newly manufactured switchgear and control system required for the system specified herein.
- B. The Switchgear Manufacturer shall manufacture and furnish all equipment as described in this section of the specification. All equipment shall have a practical layout, consistent with good engineering design practices and all for future expansion capability.
- C. The Switchgear Manufacturer's scope of work shall also include factory testing and comprehensive system site start up and testing.
- D. This Section includes metal-clad, circuit-breaker switchgear with the following optional components, features, and accessories:
 - 1. Copper, silver-plated main bus at connection points.
 - 2. Communication modules.
 - 3. Analog instruments current and voltage.
 - 4. Relays as indicated on the drawings.
 - 5. Surge arresters.
 - 6. Provisions for future devices.
 - 7. Mimic bus.

1.3 REFERENCE STANDARDS

- A. The design, equipment, installation, and testing shall be in strict accordance with the applicable requirements set forth in ANSI, UL, IEEE and NEMA.

- B. The generator switchgear construction, including all internal components mounted, shall be UL listed and labeled under "Circuit Breakers and Metal-Clad Switchgear over 600 Volts (DLAH)", with a bus withstand rating of 50 KA amperes symmetrical at the time of the bid opening. Manufacturers submitting equipment line-ups without being listed and labeled under UL (DLAH) prior to bid opening shall not be accepted.
- C. The entire Critical Power Switchgear System, including all controls, breakers, buswork and components shall be completely manufactured and assembled by a single manufacturer and shall be UL listed and labeled under this manufacturer's name.
- D. All equipment and material supplied shall be in accordance with the latest edition and amendments of all applicable standards, codes, laws and regulations listed below:
 - 1. IEEE 1547 - Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces
 - 2. ANSI/IEEE C12 – Code for Electric Metering
 - 3. ANSI C37.04 – Standard Rating Structure for AC High Voltage Circuit Breaker Rated on a Symmetrical Current Basis.
 - 4. ANSI C37.06 – Preferred Ratings and Related Required Capabilities for AC High Voltage Circuit Breaker Rated on a Symmetrical Current Basis.
 - 5. ANSI C37.11 – Requirements for Electrical Control for AC High Voltage Circuit Breaker Rated on a Symmetrical Current Basis or a Total Current Basis.
 - 6. ANSI C37.12 – Guide to Specifications for AC High Voltage Circuit Breaker Rated on a Symmetrical Current Basis or a Total Current Basis.
 - 7. ANSI C37.20.2-2015 – IEEE Standard for Metal-Clad Switchgear.
 - 8. ANSI/IEEE C39.1 - Requirements for Electrical Analog Indicating.
 - 9. ANSI C57.13 - Requirements for Instrument Transformers.
 - 10. ANSI 255.1 - Gray Finishes for Industrial Apparatus and Equipment.
 - 11. ANSI 48 – Test Procedures and Requirements for High-Voltage AC Cable Terminations
 - 12. NFPA 70 - National Electric Code.
 - 13. NFPA 110 - Emergency and Standby Systems.
 - 14. National Electrical Code (NEC)
 - 15. Underwriters' Laboratories, Inc. (UL)
 - 16. National Electrical Manufacturers' Association (NEMA)
 - 17. Federal, State and local codes.

1.4 SUBMITTALS

- A. Product Data: For each type of switchgear and related equipment, include the following:
 - 1. Rated capacities, operating characteristics, furnished specialties, and accessories for individual circuit breakers.
 - 2. Time-current characteristic curves for overcurrent protective devices, including circuit-breaker relay trip devices.
- B. Shop Drawings: For each type of switchgear and related equipment, include the following:

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show method of field assembly and location and size of each field connection. Include the following:
 - a. Tabulation of installed devices with features and ratings.
 - b. Outline and general arrangement drawing showing dimensions, shipping sections, and weights of each assembled section.
 - c. Drawing of cable termination compartments showing preferred locations for conduits and indicating space available for cable terminations.
 - d. Floor plan drawing showing locations for anchor bolts and leveling channels.
 - e. Current ratings of buses.
 - f. Short-time and short-circuit ratings of switchgear assembly.
 - g. Nameplate legends.
 - h. Mimic-bus diagram.
2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting seismic restraints.
3. Wiring Diagrams: For each type of switchgear and related equipment, include the following:
 - a. Power, signal, and control wiring.
 - b. Three-line diagrams of current and future secondary circuits showing device terminal numbers and internal diagrams.
 - c. Schematic control diagrams.
 - d. Diagrams showing connections of component devices and equipment.
 - e. Schematic diagrams showing connections to remote devices including SCADA remote terminal unit.
- C. Samples: Representative portion of mimic bus with specified finish. Manufacturer's color charts showing colors available for mimic bus.
- D. Manufacturer Seismic Qualification Certification: Submit certification that switchgear, accessories, and components will withstand seismic forces defined in Section 26 05 48 "Vibration and Seismic Controls for Electrical Systems." Include the following:
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Field quality-control test reports.

- F. Operation and Maintenance Data: For switchgear and switchgear components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.5 QUALITY ASSURANCE

- A. It is the intent of the owner to receive bids only from domestic manufacturers who provide complete engineering, manufacturing production, testing and field services to manufacture and provide a highly reliable, fully integrated, state-of-the-art Critical Power Switchgear System that can be successfully supported by the Switchgear and Controls Manufacturer over the lifetime of the system. Qualified bidders shall meet the following requirements and provide the necessary support documentation indicated. Failure to provide this support documentation will be considered a non-responsive bid and will result in bid disqualification.
- B. The manufacturer shall have at least twenty years of experience in the design, manufacturing and support of generator control power systems and automatic transfer switches.
- C. Switchgear and Control Manufacturer shall be of adequate size and have necessary capital resources to demonstrate that it can fully support a project of this magnitude for the expected life of the equipment. The manufacturer must have a capital net worth of at least 20 times the value of the proposed equipment. Bidder upon request shall provide a complete copy of its most recent annual financial statement, prepared by an independent accounting firm, showing the net worth of the bidder as of that date.
- D. The switchgear manufacturer must have trained, factory employed, field service personnel on staff for installation support and start-up and to provide field support for the life of the system. Factory field service engineers shall be readily available twenty-four hours a day, 365 days a year. The manufacturer may not subcontract field service work or personnel. A 24 hour, toll free "Hot-Line", with a guaranteed call back response within 1 hour, from a qualified factory technician must be in place at the time of bid offering with a proven history of response.

As protection to the owner, any manufacturer wishing to limit themselves to a maximum number and type of field service visits for the startup of this equipment, must state so in their bid. Provide published field service rates, including overtime and holiday rates for additional visits. This information shall be provided for bid evaluation.

1.6 WARRANTY

- A. The Manufacturer shall provide a comprehensive two-year warranty that includes all parts and labor to repair or replace any defects that may appear within the two-year period, from date of shipment. All parts, labor, and transportation costs to remedy any defect or failure to comply with the contract documents shall be provided by the manufacturer and corrected at no cost to the owner.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store switchgear indoors in clean dry space with uniform temperature to prevent condensation. Protect switchgear from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.8 PROJECT CONDITIONS

- A. Product Selection for Restricted Space: Drawings indicate maximum switchgear dimensions.
- B. Interruption of Existing Electrical Service: Refer to 26 01 00 ELECTRICAL GENERAL CONDITIONS

1.9 COORDINATION

- A. Coordinate layout and installation of switchgear and components with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required clearances for workspace and equipment access doors and panels.
- B. Coordinate size and location of concrete bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.10 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Six of each type and rating used. Include spares for future transformers, control power circuits, and fusible devices.
 - 2. Indicating Lights: Six of each type installed.
- B. Maintenance Tools: Furnish tools and miscellaneous items required for interrupter switchgear test, inspection, maintenance, and operation. Include the following:
 - 1. Fuse-handling tool.
 - 2. Extension rails, lifting device, transport or dockable dolly or mobile lift, and all other items necessary to remove circuit breaker from housing and transport to remote location.
 - 3. Racking handle to move circuit breaker manually between connected and disconnected positions, and a secondary test coupler to permit testing of circuit breaker without removal from switchgear.

PART 2 - PRODUCTS

2.1 SYSTEM OVERVIEW

- A. Furnish the generator control and distribution switchgear, arranged to control the operation and distribution of power for the generating units indicated on the drawings.
- B. See specification 26 13 10 Integrated Power Assembly for requirements for the outdoor enclosure.
- C. The emergency generator paralleling switchgear shall be 3 phase, 3 wire.
- D. The switchgear shall be arranged for fully automatic or manual operation at the discretion of the operator. The system shall be designed to provide safe, manual operation that is completely independent of the of the automatic PLC system and the OIP and/or computer-based control system. Manual operation is to include hard wired interlocks, instruments and control switches as specified herein. Systems that provide redundant PLCs, computers, operator interface panels or HMIs, to provide back-up manual operation are unacceptable. Each Section shall be complete and include the necessary AC instrumentation, relaying, pilot lights, selector switches, etc., and accessories required to manually operate the paralleling switchgear to start/stop engine generators, synchronize the generators and control all circuit breaker operations. Include provisions to mount and wire engine/generator voltage regulator and/or governor control equipment, supplied by the engine generator vendor, for mounting in the switchgear.
- E. All control voltage for auxiliary relays, circuit breakers, synchronizing and other automatic equipment shall be obtained from the emergency generators, the engine starting batteries and the station battery system.

2.2 SEQUENCE OF OPERATIONS

- A. All system operation and control functions shall be coordinated and integrated such that during automatic and/or manual operation, no unsafe condition shall occur, no malfunction of intended operation shall occur, and the highest possible reliability of operation shall be maintained.
- B. Coordinate and integrate the functions and circuitry of all selector switches to ensure that the various settings available do not cause a malfunction of the intended system operation.
- C. Automatic Start Sequence: Provide interconnecting control circuits to produce the following normal operating function when a system start command is given to the engine generator standby system.
 - 1. Upon receipt of a start signal, start all the diesel generators.
 - 2. Close the generator output circuit breaker for the first generator to reach 90% operating voltage and a frequency of 58HZ. Any generator may be the first to close to the bus, independent of other generators. Systems that sequentially select which engine generator may close to the bus or systems that rely on timers to select which generator shall close to the bus shall not be acceptable.

3. Once the next diesel (random selection) has reached operating voltage and frequency, it shall synchronize to the unit on-line and close into the bus.
 4. In like manner, each generator shall synchronize to the on-line units and close into the bus, independent of the other units, until all available units are on the bus.
 5. Provide positive lockout such that no two engine generators can be connected to a dead bus simultaneously.
 6. Upon receipt of a stop signal, all individual generator circuit breakers shall open, and the engine generators shall continue to run at no load for an adjustable cool down period of time (0-56 minutes) before complete shutdown.
- D. Loss of Utility Sequence (Open Transition): Provide interconnecting control circuits to produce the following normal operating function when the utility power is lost (as determined by the adjustable, utility undervoltage setpoint) or if the utility has exceeded the adjustable hit counter limit for minor interruptions and the "Transfer Mode Selector Switch" is in the "Open Transition" mode:
1. Initiate an adjustable time delay of .5 - 10 seconds.
 2. Upon expiration of the time delay, initiate an automatic start sequence.
 3. After the first engine generator is connected to the bus, open the main utility breaker.
 4. Initiate an adjustable time delay of .5 to 10 seconds, then close the main generator breaker.
 5. Upon restoration of utility supply voltage, and after an adjustable period of time (0-60 minutes), the main generator breaker shall open and, after an adjustable time delay of (0 to 10 seconds), the utility main breaker shall close, providing a break-before-make (open transition), transfer to the utility source.
 6. After the load has been transferred to the utility source, the individual engine generator breakers shall open and the engine generators shall continue to run at no load for an adjustable period of time, from 0-56 minutes, before complete shutdown.
- E. Load Test Sequence (Load Bank) - Open Transition Load Assumption and Return: Provide interconnecting control circuits to produce the following normal operating function when the "Test Normal" switch is selected to the "Load Test" position, and when the "Transfer Mode Selector Switch" is in the "Open Transition" mode.
1. Initiate an automatic start sequence.
 2. After a pre-determined number of engine generators are closed to the bus (as selected by the register access panel on the master control cubicle door), the standby system shall be capable of assuming bus load.
 3. If both engines are selected for load bank testing, only one engine will be tested at a time.
 4. The operator may adjust the duration of testing for each engine on the OIP (0-8 hours, 15 minute increments).
 5. Upon completion of the first engine, the second engine will start, parallel, and ramp load off of the first engine.
 6. The first engine will unload, trip its breaker, and go into cooldown mode. The second engine will do likewise upon the end of its test period.
 7. If a utility failure occurs, load bank testing will be automatically stopped and the engines will respond to the outage. A "load dump" contact, connected to the load bank controls, will activate to shut down the load.

2.3 METAL-CLAD, CIRCUIT-BREAKER SWITCHGEAR

- A. All circuit breakers shall be the horizontal drawout type, with self-aligning line-side and load-side disconnecting devices. Primary disconnecting contacts shall be silver-plated copper.
- B. All circuit breakers shall be of equal rating and shall be interchangeable. The circuit breakers shall be rated as follows:
 - 1. Nominal voltage rating of 4,160 volts with a BIL of 60 KV.
 - 2. Continuous current rating of 1,200 amperes elements shall be supplied, as indicated on the drawings and detailed elsewhere in this specification, with a close and latch capability of 65 KA.
 - 3. Nominal 3 phase symmetrical interrupting capability of 40 KA with interrupting time not more than 3 cycles.
- C. Each circuit breaker shall contain three vacuum interrupters, separately mounted in a self-contained, self-aligning housing that can be removed as a complete unit. The interrupters shall be designed to facilitate the following work:
 - 1. Replacement of the interrupter assembly through a simple alignment of the primary contacts and adjustment of contact wipe.
 - 2. Measurement of available contact life by referring to a contact wear gap indicator for each vacuum interrupter, which requires no tools to operate and is easily visible when the breaker is withdrawn on extension rails.
- D. The circuit breaker shall be equipped with tinned-plated secondary contacts that automatically engage in the breaker operating position and can be manually engaged in the breaker test position.
- E. The breaker shall be operated via a spring-charged, stored energy system with an automatic electric recharging motor. The mechanism shall always store sufficient energy to insure a trip open operation. Trip, close and spring charge control power shall be 125 VDC derived from the Critical Power Switchgear Station Battery System.
- F. All circuit breakers shall be equipped with minimum of four sets of breaker auxiliary (a/b) contacts with the final number required to be determined by the Switchgear Manufacturer. Trip and close/spring charge control power fuse blocks shall be provided.
- G. All circuit breakers shall have circuit breaker status annunciator lights as detailed elsewhere in this specification. The circuit breaker annunciator shall be a group of three, individual 1.0" x 1.0" (minimum) back lit LED annunciators with engraved marking plates as follows:
 - 1. Circuit breaker open.
 - 2. Circuit breaker closed.
 - 3. Circuit breaker withdrawn.
- H. In addition to monitoring the breaker position and availability, the system PLCs shall also monitor the following:
 - 1. Circuit breaker disconnected
 - 2. Protective relay trip

3. Control voltage failure
 4. Springs not charged
 5. Failure of breaker trip or close circuitry
- I. Interlocks: Provide mechanical interlock to prevent removal or insertion of breaker while in the closed position. Provide interlock on breaker that automatically discharges closing springs upon removal from or insertion into compartment.

2.4 CONTROL AND SAFETY DEVICES

- A. Alarm Horn: A station alarm horn and silencing circuit with indicating lamp shall be provided to sound an audible should a malfunction occur. Should the alarm be silenced after a malfunction, receipt of another signal shall cause the horn to sound again (Annunciator Ring Back). When the failed circuit has been corrected, the alarm horn shall be automatically reset. Horn shall be rated for 88 to 90 decibels at 10 feet.
- B. Annunciator Alarm Ring-Back: All alarms shall be of the "Ring-Back" type. Any time the alarm horn is silenced, the next alarm shall re-energize the station alarm horn.
- C. Automatic DC Control Voltage System: Each generator control cubicle shall have a dedicated DC to DC converter to ensure stable DC control power for that section. The master cubicle shall have individual dedicated DC to DC converters for each PLC, a dedicated DC to DC converter for the OIP and dedicated DC to DC converters for the communications network devices. Each DC converter shall regulate the DC output voltage and provide stable 24VDC output voltage over an input range of 18-32 VDC, with 6ms hold up time and 20% reserve power capacity. Overvoltage protection shall protect against excessive output overvoltage (up to 110 %) conditions. Each DC to DC converter shall have an efficiency of 90% or better. This protection shall extend to all DC circuits.
- D. Automatic Synchronizer: Separate microprocessor-based synchronizers shall be provided for each generator and one shall also be provided that is dedicated to control the generator bus synchronization. The synchronizers shall be designed for use on three phase AC generators and provide for frequency, phase and voltage matching control, using either analog or discrete output signals compatible to the engine governor. Each synchronizer shall have a two line liquid crystal text display for operation, alarm indication and generator/bus voltage and frequency measured values. The synchronizer shall contain all control adjustments and input-output terminals legibly marked. The synchronizers shall include an LED synchroscope indication on the front of the synchronizer. Separate LEDs shall be provided that indicate when the synchronizer is signaling the governor to raise or lower frequency and raise or lower generator excitation. Control designs that utilize "On-Board" engine paralleling control systems or control systems that utilize a single synchronizer switched between multiple generator sources, is not acceptable.

The synchronizers shall operate over an ambient temperature range of -20 degrees Celsius to +70 degrees Celsius, 95% non-condensing ambient humidity. The synchronizers shall be capable of meeting the dielectric and surge withstand capabilities, as set forth in IEEE Standard 472-1974/ANSI C37.

- E. Back-lit LED Annunciation Panel: All annunciators shall have individual 1.575" x 1.575" square translucent windows with black engraved 3/8" lettering to indicate the nature of the alarm

condition, failure or status condition. LED indicators shall be plug in type with dual circuit design incorporation four redundant strings of LEDs such that a failed LED string does not render the lamp inoperative. A push-to-test button shall be furnished on each section with annunciation.

- F. Current Transformers: 0-5 ampere output, wound type, molded construction, with single secondary winding and primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices. Rated 50-400 Hertz, 600 volts at 10 kV BIL full wave and built to ANSI/IEEE C57.1.3 and UL in accordance with IEC 44-1.
- G. Engine Generator Control: Engine starting will be controlled by the hot standby, dual redundant system PLCs, located in the master control section, utilizing distributed I/O, which shall reside in each respective generator control cubicle, with individual power supply, chassis, and input/output cards for each engine generator. In the event of an I/O rack failure in the generator control section, the system shall be arranged such that an operator will still be able to manually start and parallel the associated engine generator. Programming shall be the responsibility of the generator control switchgear manufacturer. A fail to synchronize time delay operation shall be provided for each generator to terminate the operation of the synchronizer and sound a warning horn, in the event the generator is unable to be synchronized within an adjustable period of time, adjustable from 30 to 180 seconds. After failing to synchronize automatically, the operator, at his discretion, shall be able to connect either one or all the machines to the emergency bus by turning the master control switch, located on the master control cubicle door, to the manual position, and by operating the manual Synchroscope system and the circuit breaker control switches. Each engine generator control section shall be provided with separate alarm relays and alarm lights, to shut down the engine generator, disconnect it from the main bus, and illuminate a light to indicate a failure. The failure status shall be displayed on the Operator Interface Panel. If the generating plant is running automatically with the master selector switch in the "AUTO" position, a failure at the engine shall cause the respective fail light to light and the engine will be shut down and locked out of the automatic mode of operation. To reset an engine generator after a failure while in automatic operation, the engine selector switch shall be rotated to the "stop" position. After the failure has been corrected, the engine generator shall then be returnable to a standby condition by returning the selector switch to the "AUTO" position.
- H. Engine Generator Selector Switch: Rotary multistage snap-action type with 600 volt AC-DC silver plated contacts, engraved escutcheon plate, round, knurled, handle. An Electroswitch series 24 selector switch rated 30A at 600 vac, four-position engine selector switch labeled, "Stop-Off-Auto-Run", shall be provided on each engine generator control panel cubicle door." When the selector switch is in the "stop" position, the controls shall be locked out. Whenever the selector switch is placed in the "stop" position while the engine generator is operating, it will immediately shut down and its circuit breaker will trip. An "off" position shall be provided to allow a normal shutdown, with a time delay to allow the engine to cool after operating under load. Whenever the engine selector switch is placed in the "off" position while the engine is operating, the generator circuit breaker will trip, but the engine will continue to operate until the expiration of the cooldown time delay setting. When the engine selector switch is placed in the "auto" position, the engine generator shall be on standby and shall start whenever an engine start signal is received from the automatic transfer system. When the utility power returns, and the transfer system signals the engine generator to shut down, the circuit breaker will be tripped, and the engine will continue to operate for the idle time delay period before shutting down in readiness for the next power failure. When the engine selector switch is in the "run" position, the engine will start and come up to speed. It will continue to run until the selector switch is returned to "off" or "stop" position. This position is to be used for testing or for manual operation.

- I. Sync Selector and Frequency Meter Switches: Each synchronizing breaker shall be provided with a keyed sync switch and a separate keyed frequency meter switch to operate the synchroscope and frequency meter on the master cubicle swing panel. Using the frequency meter selector switch, an operator can view the comparison between the line and the load side frequency on the same meter. The sync selector switch turns on the synchroscope and provides phase angle comparison across the synchronizing breaker. The sync selector switch shall turn on the sync check relay to supervise the associated breaker. These switches shall have separate keyed handles that are removable in the Off position only, assuring that only one respective switch is on at any time. Only one keyed handle is provided for each of these functions ensuring that only one breaker may be synchronized at a given time.
- J. Manual Sync Enable Pushbutton: Each generator control cubicle shall be provided with a push button, that when depressed will bring the generator into synchronism with the generator bus during manual paralleling of an engine generator.
- K. Sync Check Relay: A separate sync check relay shall be located in the master control cubicle. The sync check relay shall be utilized for manual sync operation. Systems that utilize the automatic synchronizer in a sync check mode or automatic mode for manual operation are unacceptable. The sync check relay output contacts shall be rated 5A.
- L. Master "Manual-Auto" Control Switch: A spring return to center, three position, key selector switch labeled "Manual-Auto", shall be provided on the master control cubicle door." Whenever the master "manual-auto" control switch is placed in the "manual" position, the system shall annunciate this condition and the engine generator power circuit breakers and synchronizing shall be operated manually. A swing panel in the master control section shall be provided with Synchroscope, synchronizing lights, frequency meter and bus voltmeter for manual synchronizing through the engine generator power circuit breaker control switches, the Synchroscope and frequency meter switches on the engine generator control section door.
- M. Master Operator Interface Panel (OIP): The OIP shall be an industrial computer, with 23 inch, diagonal "TFT" color touch screen VGA display with HD 1080p (1920x1080, 16:9) resolution with 5ms response rate. The Operator Interface panel shall communicate with the two system PLCs and update the PLC time, every second for event time coordination. The OIP shall be supplied with a number of screens, described below, that shall allow the operator, with required clearance, to perform control functions and access adjustable system set-points in real time. Each set-point shall have preprogrammed high and low limits to ensure that a chosen value is within and acceptable range. The touchscreen shall have a maintenance mode that allows an operator to clean the screen without turning off the OIP or affecting system operation.
 - 1. Menu Screen: The menu screen will index all the screens used on the operator interface panel.
 - 2. Security Screen: A password is required to change any settings. This screen shall allow the operator to enter a user ID and password to change control set points. The system shall allow up to eight levels of password protection. A password is not required to view existing settings or status screens. The password is installed or changed via the Touch Screen using a virtual standard keyboard pop-up. Once an operator enters the system using his password, a password timer will run. The password lock will be reactivated after an adjustable time delay if there is no operator interaction with the OIP screen.
 - 3. Date and Time Screen: The Date and Time screen shall allow an operator to change the system's date and time.

4. Legend Screen: The legend screen describes the meaning for each symbol/color on the one-line screen.
 - a. Red – Closed or Energized
 - b. Green – Open or De-energized
 - c. Flashing – trouble
 - d. Grey – Future
5. System Single Line screen: This screen shall be the main access screen to other screens. There shall be a tab soft-key button off to the right side of the screen labeled “Menu” to allow the operator access to additional screens

This screen shall display the paralleling switchgear represented by an interactive single line screen. A block at the top of the screen shall display the overview system status with indications that the system is in auto or manual mode, engine load demand system status on or off, load control function in auto or manual mode and test status of the system whether it is in a load test or No-load test mode of operation. The Single line will display generator status and actual generator power in kW, rated kW and circuit breaker open/closed status for each generator in the system. Feeder breaker open/closed status shall be displayed. The device symbols and bussing depicted on the single line shall change color and will be red in color when energized and green if de-energized.

6. PLC Communication Status Screen: This screen shall indicate that the OIP is communicating properly with the two system PLCs and whether each PLC is in a run or disabled state with the PLC scan time displayed for each PLC.
7. Engine Data Screens: Each engine generator shall be represented by a pop-up metering screen with twelve, individual, dial type analog meters which shall display engine oil pressure, oil temperature, coolant temperature, left and right exhaust temperature, engine RPM and engine battery voltage, generator voltage, frequency, power factor, current and KW. Soft keys shall be provided under the voltmeter to allow reading each phase to phase voltage, A-B, B-C and C-A. The Ammeter shall have soft key to allow reading individual phase current. And the KW meter shall have soft keys under the meter to switch between KW, KVAR and KVA. These metered values shall also be displayed again on another screen in digital readout form together with all engine and generator data available through the communications link to the engine generator.

Engine operating hours and the total number of engine starts shall be displayed. In addition, a separate bar graph indication of generator loading percentage shall be displayed on this screen.

The engine data screen shall have a visual replication of the engine control switch showing the status of the actual switch position. Timer setpoints and actual real time status of the timers for cool down and fail to synchronize shall be displayed.

8. Demand Mode Screens: The generator Demand Mode screens allow an operator to select one of two different and distinct operating modes for generator loading control.
 - a. KW Based Spinning Reserve – This mode allows an operator to select the amount of excess KW loading capacity that the system will operate at. The control system will automatically add and remove engines as needed to maintain this selected KW spinning reserve capacity.

- b. **Percent KW Based Generator Demand** – The percent KW mode allows the operator to select the increase and decrease load set-points for the system to add and remove engine generating units. In this mode, the operator selects the increase load set-point (e.g.90%) at which time the next engine in sequence would be started when the loading on the bus reaches 90% of the on line generating capacity. Similarly, the decrease load set-point is selected to establish the bus load value at which to take a unit off line and maintain generation capacity, at the decrease load set-point, after the unit is taken off.

All two modes of load demand operation will operate such that no matter what settings are used, the system will never remove an engine generator where it would overload the system.

Each mode of load demand operation shall include a set-point and status screen that allows the operator to input the required set-points and view that actual real time values for increasing and decreasing engine generators on the bus. These various screens shall also display the selected engine sequence for adding and removing engines to the bus and the status of units online or offline and display totalized engine running hours.

9. **Master Control Screen:** Two virtual switches shall be displayed. The first switch allows the operator to select automatic or manual mode of operation from this screen. The second switch is provided to allow a generator no-load or load testing with the selected load control devices. A pushbutton is provided for resetting bus alarms. This screen shall also display a running time counter that displays the time in days, hours, minutes and seconds for the latest system operation.
10. **Utility Transfer Control Screen:** Provide setpoint screen to set the loss of utility time delay, to initiate engine starting and transfer. Provide adjustable time delay to retransfer upon return of utility. Hit counter settings shall allow the operator to set the number and duration of utility interruptions that would not be otherwise sensed by the loss of utility time delay and initiate the start and transfer sequence.
11. **Load Bank Engine Test Screen:** A test screen shall be provided to allow the operator to test the operation the engine generators. On this screen an operator can select which engines shall be tested and whether they will be started all at once or sequentially (consecutive or concurrent). A virtual selector switch shall be provided for each engine to select the unit for test mode of operation. A digital display for each unit shall display the test duration for that unit.
12. **Manual Breaker Controls Screen:** This screen displays the breaker positions and allows control of the feeder breakers from the OIP using Open and Close pushbuttons (breaker control is disabled in Automatic mode).
13. **Active Alarm Screen:** Upon receipt of an alarm, the active alarm screen shall display up to 2048 active alarms and the time the alarm was activated. A red operator interface alarm indicator will illuminate on the master cubicle door and the operator has the ability to acknowledge an individual alarm or all alarms. The operator can also filter alarms to see specific priorities or groups of alarms.
14. **Alarm and Event History Log Screen:** The alarm and event history screen shall display up to 2048 alarms and events. The operator can also filter alarms and events to see specific Priorities or Groups of alarms and events. The operator also has the ability to launch an external program to view historical files. These external files are created daily and are stored on the local hard drive. Within this program, the external files can be searched by keyword or filtered by priority or group.

Any switch operation either from the OIP or and actual hard wired switch shall be monitored and logged as to time of operation and who was logged in at the time.

15. Help Screens: Multiple help screens shall be provided that can be accessed from a button on each set point or control screen that provides a brief explanation of the associated set points and/or controls located on that screen.
16. Generator System Run Reports: A push button on the operator interface panel (OIP) is provided to initiate logging of all information required to generate a report of generator and transfer sequence parameters and operational sequences required for system test.

Three types of reports will be generated:

- a. Engine Generator Testing Data for each unit
- b. Transfer Test and Timing Data
- c. Alarm and Event Log

Engine Generator Testing Data will include:

- a. Engine date and time stamp of each gen-set run period
- b. Engine date and time stamp of each gen-set kilowatt setpoint requirement
- c. Graphical trend of generator kW, kVA, and kVAR
- d. Maximum and average values of generator kW, kVA, and kVAR
- e. Graphical trend of generator A, B and C phase amperes
- f. Maximum and average values of generator A, B and C phase amperes
- g. Graphical trend of generator AB, BC and AC phase voltage
- h. Maximum and average values of generator AB, BC and AC phase voltage
- i. Graphical trend of generator volts, amps, RPM and frequency
- j. Maximum and average values of generator volts, amps, RPM and frequency
- k. Graphical trend of engine coolant temperature, oil pressure and battery voltage
- l. Maximum and average values engine coolant temperature, oil pressure and battery voltage
- m. Graphical trend of engine left and right exhaust temperature
- n. Maximum and average values of engine left and right exhaust temperature

Transfer Test Data Will Include:

- a. Time and date stamp for each Engine Start signal (on, off), normal position and emergency position (open, closed)

Alarm and Event Log will include:

- a. All alarms and events captured during recording period.
- b. Encompass all Generator set, ATS, circuit breaker and emergency switchgear operational activity monitored by the switchgear PLC system.

- N. Meters: Switchboard instruments with 4.5 inch (115 mm) square recessed case and 250 degree scale, white dial with black figures, 60 Hertz, one percent accuracy shall be furnished for the following meters:

1. Ammeters - 5 ampere, scale for primary current
2. Frequency Meter - 55 to 65 Hertz scale
3. Wattmeters – Calibrated made movement, scale for available kilowatts
4. Voltmeters - 150v (3w) movement, scale for primary voltage

- O. Meter Selector Switches: Rotary multistage snap-action type with 600 volt AC-DC silver plated contacts with engraved escutcheon plate. An Electroschneider series 24 selector switch rated 30A at 600 VAC shall be furnished for the following switches:
1. Ammeter switch with positions OFF, 1, 2, 3.
 2. Sync Switch with "Off/On" positions
 3. Frequency meter switch with positions LINE, OFF, LOAD
 4. Voltmeter switch with positions OFF, 1-2, 2-3 and 3-1
- P. Potential Transformers: 120 volt single secondary, with primary fusing and secondary circuit breaker protection, primary/secondary ratio as required, burden and accuracy consistent with connected metering and relay devices, 60 Hertz.
- Q. Protective Relaying: All protective relaying shall be utility grade with drawout case or provided with CT and PT test switches to isolate the relays from the PTs and CTs for testing. The protective relays shall be separate and independent from all other controllers including the PLC control system and the engine mounted controls.
- R. Synchroscope: Switchboard instrument with 4.5 inch (115 mm) square recessed case and 360 degree scale, white dial with black figures, 60 Hertz, one percent accuracy, 150v movement, Scale: Slow-Fast.
- S. Programmable Controllers: The system shall be controlled by two redundant, hot standby programmable logic controllers with dual redundant reflective memory modules for each PLC to provide high speed, redundant fiber communications for synchronizing the scans between the two PLCs. Each PLC shall be provided with a separate power supply and chassis with distributed input/output cards via Profinet ring topology. All PLCs shall be backed up by non-volatile "Flash" memory. In the unlikely event that both of the PLC's are inoperable, the switchgear system shall default to manual control and provide audible and visual alarms to alert personnel so corrective action can be taken. During this time, if the system is in standby mode, should an engine start signal be received, the switchgear system will start all available engine generators. If the system is operating, all on-line generators will remain operational. For both scenarios, the switchgear will allow full manual control with all required hardwired interlocks installed, to prevent improper operation.
- T. Over and Under Voltage\Frequency Relay: An overvoltage (100 to 125%), undervoltage (75% to 100%), overfrequency (50 to 70 HZ) and underfrequency (50 to 70 HZ) relay shall be supplied to monitor the bus voltage and provide alarms and initiate load shedding external to all PLC controls for abnormal conditions. Red failure lights, auxiliary contacts, and an alarm in the engine generator master control section will be energized to indicate an abnormal voltage or frequency condition. Each setpoint has an independent time delay setting (adj. 1 to 30 seconds). Upon detecting a bus under frequency condition all available engines will be started. Under frequency load shedding will immediately trip all non-priority #1 loads. Automatic restoration of load occurs after the bus returns to normal frequency and the under frequency alarm has been reset using the failure reset push button.
- U. All control cubicles shall have interior convenience LED lighting with motion detector that turns the interior light on when the door is opened and a convenience receptacle. Both devices shall be powered by an external, remote 120 VAC, 20A control power source provided by the Electrical Contractor.

2.5 INSTRUMENT AND CONTROL WIRING

- A. Instrument and control wiring within the switchgear sections shall be of flame-retardant, type SIS, extra-flexible, tinned copper, rated 600 volts and approved for switchgear use.
- B. Control wiring shall be protected with individual circuit breakers with trip indication, monitored by the system PLC and alarmed on the OIP and logged in the event log.
- C. All wire terminations made at meters, relays CTs and PTs and other similar devices shall be made with ring-tongue or locking-spade crimp lugs or as required by the device termination point.
- D. All terminations shall be clearly identified by means of heat embossed vinyl sleeve markers at each end. Labeling tape, or paper, wire markers are not acceptable. Wire numbers shall match the Manufacturer's interconnection, schematic and wiring drawings.
- E. Terminal blocks shall utilize "Cage-Clamp" technology and shall be clearly marked for wiring to be installed or reconnected by the Contractor. All connections between shipping sections shall utilize plug connections to reduce installation time.
- F. Cage Clamp terminal blocks that provide high clamping force, maintenance free terminations shall be provided for secondary wire terminations.
- G. All current transformers shall be connected to shorting type mechanical, lever arm switches with test points. Current transformer secondary wiring shall be #12 AWG.
- H. Control wiring shall be labeled at each terminal point, with designations keyed to wiring diagrams.

2.6 SWITCHGEAR CONSTRUCTION

- A. The medium voltage switchgear shall be designed for operation at 4,160 volt, three phase, three wire and 60 Hz.
- B. The assembled switchgear structures shall be designed for the following insulation levels:
 - 1. Maximum design voltage of 4.76 kV.
 - 2. Insulation test (60 Hz) of 19 kV.
 - 3. Full-wave impulse test of 60 kV BIL.
- C. Compartments: Switchgear compartments shall be constructed as follows:
 - 1. All compartments and major components of the primary circuits, such as circuit breakers, transformers and bus, shall be completely enclosed within grounded metal barriers, isolating secondary control devices and their wiring from all high voltage primary devices.
 - 2. Power circuit breakers shall be installed in individual front compartments with separate doors. The breaker compartments shall have grounded metal safety shutters that automatically cover the primary breaker connections when the breaker is removed. The breaker compartment shall have a racking mechanism to move the breaker from operating

- to drawout positions. The mechanism shall automatically align the breaker and hold it rigid in the operating position. The safety shutters shall be driven by the racking mechanism.
3. Potential transformer compartments shall have drawout tray type construction. Power connections shall be automatically disconnected when the tray is drawn out.
 4. The main bus shall be fully compartmented. Access plates to the bus compartment shall be located in the rear of the switchgear.

D. Enclosures: The metal-clad switchgear enclosures shall be fabricated as follows:

1. Freestanding, floor mounted, indoor type.
2. Dead front, dead rear.
3. Fabricated on a die-formed steel base or base assembly, welded or bolted together to rigidly support the entire shipping unit for moving on rollers and floor mounting.
4. Die-pierced holes for connecting adjacent sections to assure alignment and facilitate future additions.
5. Bolts, nuts and Belleville spring washers of zinc-plated metal.
6. Designed to withstand the electrical and mechanical stresses occurring during operation of the assemblies.
7. Framework formed of code gauge steel (12 gauge minimum), suitable for anchorage to the floor.
8. Metal-clad construction, with rugged steel assemblies featuring bracing, reinforcing gussets and jig-welding, to assure rectangular-rigidity.
9. Open bottom sections, as required for ready installation and termination of conduits.
10. Removable side, top, front and back panels, attached by bolts and small enough for easy handling by one person.
11. Front and rear hinged, cubicle doors
12. Individual front doors for each power circuit breaker compartment.
13. Suitable means near the top and bottom of each switchboard to insure adequate ventilation for all equipment within the switchboard assembly.

E. Busses:

1. All busses shall be 4,160 volt, three-phase, three-wire, 60 Hertz.
2. All busses and stub connections shall be copper.
3. All busses shall be insulated by means of flame-retardant, track resistant epoxy insulation.
4. The continuous ampere rating of all power bus shall be 1200 amperes. Busses shall be sized such that the current density is not greater than the current carrying capacity of the rectangular copper bars, as required by UL and NEMA standards. Heat rise tests shall be conducted in accordance with ANSI C37.55. Buses and stub connections shall limit temperature rise to 30 degrees C at load current capacity and an ambient temperature of 40 degrees C.
5. A ground bus rated 25% of the current-carrying capacity of the switchgear main bus shall extend across the entire width of each switchgear assembly.
6. Nominal bus bracing capacity shall be equal to or greater than the interrupting rating of the highest rated breaker serving the bus. Minimum bus bracing shall be 40 KA symmetrical. Each bus connection to the breakers shall match the frame size of the circuit breaker to which the bus is connected.
7. Bus bar and interconnection joints shall be tin-plated, constant-high-pressure type, with Grade 5 steel, zinc plated bolts, nuts and Belleville spring washers.

8. Bus phase designations from front to back, top to bottom, left to right shall be A, B, C, respectively, when viewed from the front.
- F. The highest operating handles shall not appear higher than 6' 6" above the floor.
- G. Adequate clearance shall be allowed to permit good accessibility of feeder conductors and bus terminations for maintenance purposes.
- H. Finish: All steel parts shall be prepared for painting by a five (5)-step cleaning, phosphatizing and sealing process. The parts shall then be painted ANSI 61 gray, utilizing polyester powder coat applied by the electrostatic method and cured in a baking oven. This finish shall be suitable for outdoor, as well as indoor applications and have a corrosion resistance per ASTM B117 for 1000 hours, minimum.
- I. Nameplates:
 1. Externally visible, permanent nameplates shall be provided on the switchgear and control cubicle doors to identify each instrument, instrument switch, meter, protective relay, control switch, indicating light, circuit breaker compartment, etc. Relays shall be designated as to use, and as to the phase to which they are connected.
 2. Nameplates shall be laminated plastic, attached with bolts. Characters shall be white engraved on a black background.
 3. Equipment (i.e. relays, timer, PLC equipment, etc.) and terminal blocks within the switchgear compartments shall be suitably identified by labeling tape with thermally embossed text.
- J. Surge Arresters:
 1. Provide distribution class surge arresters, metal-oxide disk type with polymer insulators complying with ANSI/IEEE C62.11 based upon an arrester rating of 6 kV rms and mounted where indicated in the switchgear one line diagram and connected between each phase and ground.
- K. Miscellaneous:
 1. The system controls shall utilize heavy-duty industrial grade, controls and relays. All synchronizing and failure circuit relays shall embody the fail safe principle of dual contacts in parallel.
 2. The switchgear manufacturer shall be responsible for providing the coordinating wiring diagrams showing the electrical connections between the control switchgear and the engine generators, for use by the Electrical Contractor and engine generator service personnel during installation and checkout of the equipment.
 3. Provide a floor portable, manually operated, circuit breaker hoist for removal/transporting of a circuit breaker element and/or trunnion rollout assembly.

2.7 EQUIPMENT DESCRIPTION

A. Master Control Cubicle

The master control cubicle shall be furnished to control both automatic and manual synchronization of the engine generators, load management control and engine sequencing. The following basic components and any additional equipment necessary shall be furnished to provide for a complete and dependable system.

1. A Synchronizing swing panel shall be built into the master cubicle door with the following metering:
 - a. One Bus AC voltmeter, scaled as required
 - b. One Synchroscope
 - c. Two Synchronizing lamps
 - d. One Frequency meter, for station bus and generator units, dial type, 55 to 65 hertz scale
2. One voltmeter selector switch, wired to the bus voltmeter for reading phase to phase voltage
3. Two, independent and redundant programmable logic controllers, each PLC complete with Profinet communication and dual reflective memory modules, power supplies, etc., as required.
4. Operator Interface Panel (OIP), 23 inch, HD1080P touch screen, with 1920 x 1080 resolution, for access of PLC timers and set-points, engine sequencing with graphic screens to display system status and alarms, and to enable certain master control functions. The operator interface panel shall contain the screens and operate as detailed elsewhere in this section.

The operator interface panel shall contain the following basic screens:

- a. Main Menu
- b. System Single Line (with breaker positions)
- c. Alarm Screen
- d. Generator Screen
- e. Load Control Screen
- f. Load Demand Screen

The following functions can be initiated from the touch screen:

- a. Load Demand (On/Off Switch Function)
- b. System No-Load Test (On/Off Switch Function)
- c. Load Add (Pushbutton Function)
- d. Load Shed (Pushbutton Function)
- e. Increase Load Capacity (Pushbutton Function)

Upon receipt of an alarm, the operator interface panel automatically displays an alarm screen. An amber Operator Interface Alarm Present indicator on the master cubicle door will also illuminate, and the alarm horn will sound. All alarms can be reset using the failure-reset pushbutton on the master door.

The following system alarms are displayed on the operator interface alarm screen:

- a. Control Voltage Problem
- b. PLC Low Battery
- c. Bus Over Voltage
- d. Bus Under Voltage

- e. Bus Over Frequency
 - f. Bus Under Frequency
 - g. Over Load
 - h. Main Tank Low Fuel Level
 - i. All Engine Pre-Alarm and Alarm
 - j. PLC I/O Failure (identifies location and type of failure)
5. A main bus over and under voltage/frequency alarm relay (Crompton type 27/59), with alarm indication
 6. Underfrequency alarm reset pushbutton
 7. Sync-check relay for manual sync control
 8. Master "auto-man" switch, with red light
 9. Lamp test switch
 10. A backlit annunciation panel with the following conditions:

FUNCTION	COLOR	MODE
Alarm horn silenced	Red	Status
Control not in automatic	Red	Status
Critical control voltage failure	Red	Alarm
Load shed on	Red	Alarm
PLC No.1 in control	Green	Status
PLC No.2 in control	Green	Status
Operator Interface Alarm	Red	Alarm
PLC failure (Flashes on low Battery)	Red	Alarm
Station Battery Alarm	Amber	Alarm
Start signal present	Red	Status
(4) Spares		

11. USB port on the master cubicle door connected to the OIP to allow an operator to download files such as event and alarm logs
12. Ethernet ports, one wired on the master cubicle door and one internal spare port, both wired to an Ethernet hub in the switchgear that connects to the system PLCs (and other Ethernet capable devices) for troubleshooting and providing access to the internal Ethernet LAN for customer use, utilizing MODBUS TCP/IP protocol
13. 120AC convenience, duplex receptacle, wired out for control power supplied from an external source
14. (125/48) VDC to 24 VDC convertor
15. Control wiring, DC circuit breakers, WAGO terminals, nameplates, etc., as required. All wiring shall be labeled at both ends

B. Generator Control Cubicles

Separate generator control cubicle shall be furnished for each individual generator, arranged to control the start/stop sequence, synchronizing, monitoring and metering of its' associated engine generator. The following basic components shall be furnished along with any additional equipment necessary to provide for a complete and dependable system:

1. One AC voltmeter, scale as required, for reading phase to phase voltage
2. One AC ammeter, scale as required, for reading phase current
3. One wattmeter, scale as required
4. One Synchroscope switch with one removable keyed handle, used for manual synchronizing (key interlocked) to allow manual synchronizing of one breaker at a time
5. One manual sync enable pushbutton
6. One frequency meter switch, with bus-off-generator nameplate (key interlocked)
7. One voltmeter selector switch
8. One ammeter selector switch
9. One Voltage adjust switch, spring return to center off
10. One circuit breaker control switch, with a separate back-lit L.E.D. annunciator for circuit breaker status indications (circuit breaker opened, circuit breaker closed, circuit breaker with drawn). The annunciator shall match the other annunciators and be as specified herein
11. One PLC Distributed I/O Module, complete with input/output modules, communication modules, power supplies, etc., as required, for starting and stopping controls for each engine generator
12. One automatic synchronizer, Woodward type SPM-D2-10, for individual phase lock control of the engine generator
13. One manual speed adjust, with integral locking
14. An engine selector switch, with "Stop/Reset-Off-Auto-Run" nameplate shall be provided to operate as described herein
15. The switchgear and controls manufacturer shall mount and wire the governor load sharing module, furnished by the engine generator manufacturer
16. One Modbus/Ethernet gateway interface to engine generator, for reading engine alarm and status
17. Lamp test switch
18. A back-lit annunciation panel with the following conditions:

FUNCTION	MODE	COLOR
Engine alarm; summary alarm indication of the type of fault condition shall be displayed on the Operator Interface Panel.	Pre-alarm	Amber
Protective relay tripped	Shutdown	Red
Breaker failure	Shutdown	Red
Engine not available	Status	Red (Flashing)
Engine running	Status	Green
Critical control voltage failure	Shutdown	Red
PLC I/O Drop Failure	Shutdown	Red

19. Control wiring, DC circuit breakers, WAGO terminals, nameplates, etc. as required. All Wiring labels shall match manufacturers drawings

C. Generator Circuit Breaker Cubicles

Each generator breaker cubicle shall be metal-clad and furnished with the following basic components, and any additional equipment necessary to provide for a complete and dependable system.

1. One 4.160 KV, vacuum circuit breaker, 3 phase, 1200 amperes, stored energy, draw out type, arranged for operation on 125 VDC control power, with 40 KA, 3 phase, interrupting rating.
2. One set of (2) potential transformers, roll-out type, with required primary and 120 volt secondary
3. Two sets of (3) current transformers, ratio as required, for metering, relaying, etc. One set shall be dedicated for differential relaying
4. One set current transformers, supplied loose for mounting in generator terminal box, as required for differential relaying
5. One multi-function generator protection relay, Schweitzer model 700G (ANSI devices #87, #81O/U, #50/51V, #51G, #46, #40, #32 and #27/59)
6. One lockout relay, Electros witch Type LOR (ANSI device #86)
7. One circuit breaker control switch, with a separate back-lit L.E.D. annunciator for circuit breaker status indications (circuit breaker opened, circuit breaker closed, circuit breaker withdrawn). Annunciator shall match the other annunciators and be as specified herein
8. One lamp test pushbutton
9. A set of compression lugs for customer's generator connections
10. One set of three insulated boots for lug connections, each boot capable of handling up to 3 lugs, for use by the electrical contractor to eliminate the need for taped connections
11. A set of 3 phase, 1200 amperes, insulated copper bus and ground bus shall be furnished as required for main bus and breaker connections
12. Control wiring, DC circuit breakers, fuses, fuse blocks, WAGO terminals, nameplates, etc., as required. All wiring to be labeled at both ends with tubular sleeve, permanent wire markers.

D. Distribution Breaker Cubicles

Each distribution feeder breaker cubicle shall be metal-clad and furnished with the following basic components, and any additional equipment necessary to provide for a complete and dependable system.

1. Two 4.160 KV, vacuum circuit breakers, 3 phase, 1200 amperes, stored energy, draw out type, arranged for operation on 125 VDC control power, with 40 KA, 3 phase, interrupting rating.
2. Two sets of (3) current transformers, ratio as required, for metering, relaying, etc.
3. Two, three phase overcurrent and ground overcurrent relays, Schweitzer model 751 (ANSI device 50/51 and 51N),
4. Two lockout relays, Electros witch Type LOR (ANSI device #86)
5. Two circuit breaker control switches, with a separate back-lit L.E.D. annunciator for circuit breaker status indications (circuit breaker opened, circuit breaker closed, circuit breaker drawn out). Annunciators shall match the other annunciators and be as specified herein
6. One lamp test pushbutton
7. Two sets of compression lugs shall be provided for each breaker, for power cable connections
8. Two sets of three insulated boots for lug connections, each boot capable of handling up to 3 lugs, for use by the electrical contractor to eliminate the need for taped connections
9. A set of 3 phase, 1200 amperes, insulated copper bus and ground bus shall be furnished as required for main bus and breaker connections

10. Control wiring, DC circuit breakers, fuses, fuse blocks, WAGO terminals, nameplates, etc., as required. All wiring to be labeled at both ends with tubular sleeve, permanent wire markers.
- E. Station Battery and Battery Charger – refer to specification section 26 13 02 Substation Batteries, Rack, and Charger.

2.8 IDENTIFICATION

- A. Materials: Refer to Section 26 05 53 Identification for Electrical Systems. Identify units, devices, controls, and wiring.
- B. Mimic Bus: Continuous mimic bus applied to front of switchgear, arranged in single-line diagram format, using symbols and lettered designations consistent with approved final mimic-bus diagram.
 1. Mimic-bus segments coordinated with devices in switchgear sections to which applied, to produce a concise visual presentation of principal switchgear components and connections.
 2. Medium: Painted graphics, as approved.
 3. Color: Contrasting with factory-finish background.

2.9 STEEL FLOOR PLATES

- A. Provide bottom plates to cover rectangular openings in concrete pad/foundation to seal switchgear.

PART 3 - EXECUTION

3.1 COORDINATION

- A. The Switchgear Manufacturer shall be responsible for providing the coordinating interconnect diagrams showing the electrical connections between all related equipment specified this section of the specifications. The interconnect diagrams are for use by the Electrical Contractor and switchgear service personnel during installation and checkout of the equipment.
- B. The Engine Generator Vendor will supply the Switchgear Manufacturer with any required engine interface hardware, electronic governor, and voltage regulator system components. Along with this equipment, the Engine Generator Vendor will furnish detailed drawings outlining proper interconnection and physical mounting data. The equipment shall be mounted and wired by the Switchgear Manufacturer.
- C. The Switchgear Manufacturer shall verify the completion of all start-up commissioning and site testing of the Critical Power Switchgear System. The Switchgear Manufacturer shall also assist

the Engine-Generator Vendor as necessary in the performance of site start-up and testing of the engine-generators.

- D. The Electrical Contractor shall be responsible for obtaining and providing any required power coordination /arc flash study and furnishing a copy of the approved study to the switchgear manufacturer's start-up field engineer prior to the commencement of the switchgear startup procedures.

3.2 FACTORY TESTING

- A. At the factory, the Switchgear Manufacturer shall perform tests on the switchgear and generator controls as required verifying the proper operation of each component and demonstrating full compliance with the requirements of this specification. The factory test reports will be available upon request.
- B. The equipment shall be completely assembled, wired, adjusted, and tested at the factory. Rigid inspections before and after assembly shall assure correctness of design and workmanship. After assembly, each switchgear assembly shall be tested for operation under simulated conditions.
- C. After a visual inspection, the following operational tests shall be performed:
 - 1. Operate all circuit breakers in connected as well as in test positions. Check the operation of all interlocks by attempting to close breaker into interlocked configurations.
 - 2. Check racking mechanisms by removing and reinstalling each circuit breaker.
 - 3. Check stored energy mechanism of each breaker by tripping, closing and tripping each breaker after removal of control power.
 - 4. Dielectric tests.
 - 5. Test all protective relay devices by simulation tests.
- D. The Manufacturer shall supply all equipment, devices and circuitry required to simulate all synchronizing and paralleling functions, digital and analog signal inputs, outputs and confirmation signals, diesel generator control and operation. Automatic and manual operation of the paralleling circuit breakers and protective and indicating devices shall be included.

3.3 PACKING AND SHIPPING

- A. The Switchgear Manufacturer shall prepare all equipment covered by this specification in such a manner as to protect it against damage in transit.
- B. The Switchgear Manufacturer shall perform the following steps to prepare the equipment for shipping and final assembly at the site:
 - 1. All equipment shall be adequately packed to prevent damage from handling, weather, shock, vibration and corrosion during shipment by common carrier.

2. All metering and equipment shall be protected to ensure cleanliness during shipment, storage and erection.
 3. Each item of equipment shall be clearly marked. All boxes, crates and shipments shall be numbered and identified with the following information:
 - a. Owner's purchase order number.
 - b. Owner's name and delivery location.
 - c. Manufacturer's name and address.
 - d. Contents.
 4. All equipment shall have provisions for lifting and skidding. All lifting points shall be clearly marked.
 5. Each shipping unit shall be braced adequately and rigidly both internally and externally to prevent damage during transit or in the process of erection.
 6. When assemblies are supplied that require disassembly for installation or are shipped disassembled, each piece of the subassembly so affected shall be uniquely identified as to its assembly position. All loose peripheral equipment shall be boxed, crated or otherwise completely enclosed and protected during storage, handling and shipment.
- C. All equipment and material shall be shipped to the job site unless otherwise instructed.
- D. All equipment shall be adequately protected, braced and secured to prevent physical and environmental damage during transit and handling. All material not mounted or installed on the major equipment during shipping shall be properly crated and shipped with the associated equipment.
- E. Drawout circuit breakers shall be crated and shipped separately if recommended by the breaker vendor otherwise breakers will be shipped within the system.
- F. The Vendor shall coordinate shipping of all equipment and material with the successful Contractor.
- G. Shipping sections shall be arranged to permit transport through limited access as required.
- H. The equipment shall be equipped for handling by crane, pallet jack and rollers.

3.4 EXAMINATION

- A. Examine elements and surfaces to receive switchgear for compliance with requirements for installation tolerances, required clearances, and other conditions affecting performance.
1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Section 26 05 53 "Identification for Electrical Systems."
- B. Diagram and Instructions:

1. Frame under clear acrylic plastic on front of switchgear.
 - a. Operating Instructions: Printed basic instructions for switchgear, including control and key-interlock sequences and emergency procedures.
 - b. System Power Riser Diagrams: Depict power sources, feeders, distribution components, and major loads.
2. Storage for Maintenance: Include a rack or holder, near the operating instructions, for a copy of maintenance manual.

3.6 CONNECTIONS

- A. Cable terminations at switchgear are specified in Section 26 05 13 "Medium-Voltage Cables."
- B. Tighten bus joints, electrical connectors, and terminals according to manufacturer's published torque-tightening values.
- C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 05 13 "Medium-Voltage Cables."

3.7 FIELD QUALITY CONTROL

- A. Prepare for acceptance tests as follows:
 1. Test insulation resistance for each switchgear bus, component, connecting supply, feeder, and control circuit.
 2. Test continuity of each circuit.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:
 1. Inspect switchgear, wiring, components, connections, and equipment installation. Test and adjust components and equipment.
 2. Assist in field testing of equipment.
 3. Report results in writing.
- C. Perform the following field tests and inspections and prepare test reports:
 1. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Standards. Certify compliance with test parameters. Perform NETA tests and inspections for each of the following NETA categories:
 - a. Switchgear.
 - b. Circuit breakers.
 - c. Protective relays.

- d. Instrument transformers.
- e. Metering and instrumentation.
- f. Ground-fault systems.
- g. Battery systems.
- h. Surge arresters.

D. Remove and replace malfunctioning units and retest as specified above.

3.8 FIELD SERVICE START-UP AND TRAINING REQUIRMENTS

- A. The Switchgear Manufacturer shall provide the services of a field service engineer for a pre-installation coordination meeting with the Engine Generator Vendor and Electrical Contractor to coordinate the installation and interconnection of the Critical Power Switchgear System and generators.
- B. The Switchgear Manufacturer shall provide a field engineer for an initial visit to checkout the installation of the switchgear to allow the energization of the utility main service breaker if required.
- C. The Switchgear Manufacturer shall provide a field engineer for post installation start-up and testing assistance, prior to system turnover and initial instruction and training for the facility's operating personnel. This trip shall include all service required to checkout the Critical Power Switchgear System and demonstrate the complete operation for final acceptance by the owner.
- D. At the time of start-up of the system equipment, the Switchgear Manufacturer shall furnish (2) preliminary sets of installation, operating and maintenance manuals. At the conclusion of the site testing, the field engineer shall leave (1) manual at the site. This manual shall include any and all changes that have occurred during the equipment start-up. The amended manual shall serve as a reference tool until the final sets of O&M manuals are supplied.
- E. The instructions shall include recommended field test procedures as defined in the Standards. A schedule listing the frequency prescribed for performing the field tests shall be provided.
- F. Approximately six months after the complete system turnover, a visit shall be made to provide instruction for operating personnel on the complete operation and maintenance program for the Critical Power Switchgear System.
- G. The bid shall include the cost for the services of a factory authorized service representative to train the Owner's On-Site Work Force (OSWF) on procedures and schedules for programming, setting of relay, startup, shutdown, troubleshooting, servicing and preventive maintenance of all equipment. Included below:
 - 1. The instruction shall be dedicated and intensive and shall be provided by competent instructors fully familiar with the equipment.
 - 2. The instructions shall be presented in an eight hour session. The Field Service engineer will provide Instructions on the operation and maintenance of the switchgear, circuit breaker, protective relays and PLC equipment.
 - 3. The Owner will provide a suitable classroom environment on site for the instruction session.

4. The training session may be recorded by the owner.
5. Training to be scheduled with at least seven working days advance notice.
6. Provide both classroom training and hands-on equipment operation covering the following:
 - a. Safety precautions.
 - b. Features and construction of switchgear and accessories.
 - c. Routine inspection, test and maintenance procedures.
 - d. Routine cleaning.
 - e. Features, operation and maintenance of protective devices.
 - f. Interpretation of readings of indicating and alarm devices.
 - g. Review operating and maintenance manuals.
 - h. Review troubleshooting operations.

3.9 ADJUSTING

- A. Set field-adjustable, protective-relay trip characteristics according to results in Section 26 05 73 "Overcurrent Protective Device Coordination Study."

3.10 CLEANING

- A. On completion of installation, inspect interior and exterior of switchgear. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair damaged finishes.

3.11 PROTECTION

- A. Temporary Heating: Apply temporary heat to switchgear, according to manufacturer's written instructions, throughout periods when switchgear environment is not controlled for temperature and humidity within manufacturer's stipulated service conditions.

END OF SECTION

SECTION 261302 – SUBSTATION CONTROL BATTERIES RACK AND CHARGER

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.
- C. SUMMARY
 - 1. This Section Includes
 - a. Valve Regulated Lead Acid (VRLA) Type batteries
 - b. Battery system rack
 - c. Microprocessor-controlled float battery charger

1.2 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Electrical ratings, including the following:
 - a. Capacity to provide power during failure of normal ac.
 - b. Rectifier data.
 - c. Transfer time of transfer switch.
 - d. Data for specified optional features.
 - e. Battery charger.
 - f. Batteries.
 - g. Warranties.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, components, and location and identification of each field connection. Show access, workspace, and clearance requirements; details of control panels; and battery arrangement.
 - 1. Wiring Diagrams: Detail internal and interconnecting wiring; and power, signal, and control wiring.
 - 2. Elevation and details of control and indication displays.

3. Output distribution section.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Source quality-control test reports.
- C. Field quality-control test reports.
- D. Warranty: Special warranty specified in this Section.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For central battery inverter equipment to include in emergency, operation, and maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.
 - 1. Fuses: One for every 10 of each type and rating, but no fewer than **<Insert quantity>** of each.
 - 2. Cabinet Ventilation Filters: One complete set.
 - 3. One spare circuit board for each critical circuit.

1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Material confirm all applicable UL listings indicated herein.
- C. Conformance with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment in fully enclosed vehicles.
- B. Store equipment in spaces having environments controlled within manufacturers' written instructions for ambient temperature and humidity conditions for non-operating equipment.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace batteries that fail in materials or workmanship within specified warranty period. Special warranty, applying to batteries only, applies to materials only, on a prorated basis, for period specified.
1. Warranty Period: Include the following warranty periods, from date of Substantial Completion:
- a. Premium, Valve-Regulated, Recombinant, Lead-Calcium Batteries:
- 1) Full Warranty: One year.
 - 2) Pro Rata: 4 years.

PART 2 - PRODUCTS

2.1 BATTERY:

- A. Battery Type:
1. The battery shall be an AGM Absorbent Glass Mat Thin Plate Pure Lead (TPPL), VRLA type (example: EnerSys SBS-series). The Battery shall have a design and expected float service life of ten plus years at 77F (25C) operation.
- B. Rating:
1. Batteries shall have an end of life run time of 8 hours where:
- a. End of life is considered to be 5 years
 - b. The continuous load is: 8 Amps
 - c. The momentary load is: 70 Amps
 - d. The design factor is 1.1
 - e. The battery degradation factor is 1.25
 - f. The Ambient temperature of no lower than 50 deg Fahrenheit.
- C. Battery Construction:
1. Alloys: Positive grids must be manufactured of pure lead to assure long battery life and consistently low float current over the entire service life.
 2. Paste: Oxides must be produced from pure lead.
 3. Plates: Positive plates must be of the Thin Plate Pure Lead design to assure highly reliable electrical performance and low corrosion throughout the life of the battery system.
 4. Formation: Plate formation must be completed inside the container. There should be no free electrolyte after formation.
 5. Terminals: Terminals must be of sufficient strength to support normal inter-tier or inter-step cabling without additional bracing. Both the positive and the negative terminals must

be color coded to mark their polarity. Red for positive and Black for negative terminals must be used.

6. Container: The cell container and cover must be of a flame retardant material with an oxygen index (L.O.I.) of at least 28, meeting UL 94-V0. The cell cover shall include a low-pressure release vent. Each block shall have an integral flash arrestor system.

D. Performance:

1. The batteries must be able to operate between -40C to +50C.
2. The batteries must have the shelf life of 18 months at 25C without requiring freshening charge.
3. The batteries must have low self-discharge rate of <2% per month.
4. The batteries must be able to operate minimum 250 days float @ +65°C to 80% nominal capacity
5. The batteries must be compliant to Telcordia SR-4228, Level 3.
6. The batteries must be UL recognized and file number must be supplied.
7. The batteries must be able to maintain 70% of published rate at 0C.
8. Supplier must submit cycle life plot as a function of depth of discharge.

E. Transportation:

1. Finished batteries must comply with IATA/ICAO Special Provision A67 and not be classified as a hazardous material per DOT-CFR Title 49 parts 171-189.

F. Manufacturing Controls:

1. Products must be designed and manufactured under an ISO9001 Quality Assurance program (copy of certificate required) that is controlled and documented by written policies, procedures or instructions, and the work must be carried out in a manner consistent with those procedures.
2. Each battery unit must be clearly identified as to cell type, voltage and capacity as well as manufacturing control group for future Quality Assurance traceability. All cells in the battery shall be freshly formed. All units must be tested to verify electrical integrity.
3. Products must be manufactured under an ISO 14001, latest rev (copy of certificate required).

2.2 BATTERY SYSTEMS RACK

A. The battery Rack system shall be:

1. NEBS compliant
2. Pre-wired
3. With front terminals for easy maintenance
4. Capable of accommodating the required quantity of batteries in order to meet the amp hour requirements sited in these specifications in a single section not exceeding the dimensions shown on the contract documents
5. Shall accommodate all required batteries and the battery charger in the same footprint as indicated above.

2.3 BATTERY CHARGER

A. General

1. The battery charger shall be sized to continuously carry the load demand as required in the plans, and have sufficient reserve capacity as deemed appropriate for the application.
2. The battery charger shall provide a continuous regulated DC output derived from an AC source. The output shall be suitable to maintain the battery in a fully charged state, while supporting any additional DC loads as defined in the plans. The battery charger shall also have the ability to automatically or manually provide an equalizing charge as required for recharging the battery after discharge.
3. The battery charger shall be of a design that employs microprocessor technology to control and define all critical operational, calibration, regulation and alarm functions.

B. Operation

1. Battery charger shall automatically determine the appropriate DC output, in terms of either voltage or current required for maintaining the battery and load either by pre-programming or in-field re-programming, via the touch panel controls.
2. The battery charger shall automatically know and respond to any alarm options or remote sensing options installed according to the manufacturer's instructions without further operator action.
3. The battery charger shall display, via a 1% digital display and associated LED indicators, all functions important to operation.
4. During float operation, the digital display shall alternate between DC voltage and DC current indications as designated by the appropriate LED being lit for the respective indication.
5. During equalize operation, the digital display shall alternate between DC voltage and DC current indications as designated by the appropriate LED being lit for the respective indication. If the unit is employing a timer, either automatic or manual the LED indicators shall indicate timer function while the Digital display indicates the hours remaining for equalize charge.
6. Error and message codes, indicating certain self-diagnostic anomalies and operating conditions shall be indicated by the digital display, as required.

C. Protective Devices

1. The charger shall employ a circuit breaker as standard for each AC input and DC output protection.
2. AC input transient over voltage protection shall be accomplished via a MOV (metal-oxide varistor) on the AC input terminals.
3. DC external transient over voltage protection shall be via a MOV (metal-oxide varistor) on the DC bus. This shall be located on the output terminals of the battery charger.
4. The charger shall be protected against damage in the event that the battery is connected in reverse.
5. Protection from oscillatory surges (SWC) as defined by ANSI C37.90-1978. Battery charger shall operate correctly during and after application of oscillatory surges.
6. Output current limit shall be adjustable from 50% to 110% of rated output.
7. The battery charger shall protect itself from a short circuit in the output side electronically so as to limit the current output. When the short is corrected the battery charger will

automatically return to normal charger operation. During a short circuit of the output an error code shall be provided as indication. The error code shall be removed when the output voltage rises above 2.0VDC.

D. Controls

1. The following controls shall be located on the front panel, using touch sensitive switches to initiate all adjustments.
 - a. Charge mode key (selects float or equalize mode)
 - b. Equalization method key (selects timer method, manual, automatic, or manual timer)
 - c. Edit/Enter key (initiates changes in AT10.1 parameters)
 - d. Meter mode key (selects Volts, Amperes, hours, or alternating display)
 - e. Up key (increases parameter value in Edit mode)
 - f. Down key (decreases parameter value in Edit mode)
 - g. AC circuit breaker
 - h. DC circuit breaker
 - i. Lamp test key

E. Indicators

1. Standard front panel indicators shall include the following:
 - a. Digital meter, 1% accuracy, 4-digit, 7-segment
 - 1) The digital meter shall indicate the following;
 - a) DC Volts
 - b) DC Amperes
 - c) Equalize hours remaining
 - d) Error and message codes
 - b. DC Volts meter indicator (red LED)
 - c. DC Amperes meter indicator (red LED)
 - d. Equalize Hours Remaining indicator (red LED)
 - e. AC on indicator (green LED)
 - f. Float mode indicator (green LED)
 - g. Equalize mode indicator (yellow LED)
 - h. Manual equalize timer indicator (yellow LED)
 - i. Manual equalize indicator (yellow LED)
 - j. Automatic equalize indicator (yellow LED)
2. Standard Front Panel Primary Alarm indicators shall include the following:
 - a. High voltage DC alarm indicator (red LED)
 - b. Low voltage DC alarm indicator (red LED)
 - c. DC output failure alarm indicator (red LED)
 - d. Positive ground fault indicator (red LED)
 - e. Negative ground fault indicator (red LED)
 - f. AC failure alarm indicator (red LED)

- F. Current limit shall be factory set at 110% of rating. This shall also be the limit available from the battery charger. Field adjustments may be made over a range from 50% to 110% of rating. The current limit shall be displayed directly in amperes and is adjustable in 0.01A increments (0.1A increments for charger ratings of 30A and higher).
- G. Parallel operation of 2 or more chargers with the same DC voltage rating shall be a standard feature of the filtered charger with random load sharing.
- H. Operating environment shall be 0-50 deg C, storage at -40 to 70 deg C, RH 5 - 95% non-condensing, elevation to 1,000 meters.
- I. Construction
 - 1. Input (ac) and output (dc) terminals shall employ ZPS studs with solderless CU-AL compression lugs, accepting:
 - a. #12-6 AWG (6A to 25 Adc ratings) on 10-32 stud
 - b. #14-1/0 AWG (30-100 Adc ratings) on 1/4-20 stud
 - 2. Alarm function terminals - compression terminal block for #22-14 AWG.
 - 3. Enclosure shall be steel 18 GA for the outer skin, 16 GA for the door, and 14-16 GA for the chassis. Shall employ adequate knock-outs for top, bottom, and right side conduit entry.
 - 4. External finish will be ANSI-61 gray, baked epoxy powder coat. Mounting bases may be galvanized steel.
- J. Serviceability: The battery charger shall be serviceable by a technician using standard hand tools. Addition of any and all options including but not limited to filtering, alarm capabilities, battery eliminator, remote temperature compensation, and medium and high interrupting breakers, shall be able to be added in the field by the customer without any special training, using standard hand tools.
- K. Alarms, Self-Diagnostics and Error Codes
 - 1. The charger shall be capable of automatic self diagnostics, and indicate any anomaly by means of an error code on the digital display. Error and message code definitions shall be posted within the battery charger.
 - 2. Primary Alarms (***standard with all AT10.1 models***) shall provide an alarm sensing capability for all the following:
 - a. High voltage DC alarm indicator (red LED)
 - b. Low voltage DC alarm indicator (red LED)
 - c. DC output failure alarm indicator (red LED)
 - d. Positive ground fault indicator (red LED)
 - e. Negative ground fault indicator (red LED)
 - f. AC failure alarm indicator (red LED)
 - g. Summary alarm contact (one Form-C)
- L. Control Panel shall be a touch sensitive type, permanently laminated for protection, thereby eliminating the need for engraved functional nameplates.

M. Documentation

1. A user's manual, completely describing the installation, operation, and maintenance of the charger along with all accessories and options shall be included with charger. The charger shall have provision for storing the manual in a convenient permanent pocket.
2. Standard drawings, consisting of external outlines, internal layouts, electrical schematics, and point-to-point connection diagram will be featured in the manual. No-cost downloadable prints of these "standard" drawings will be made available online.

N. Accessories

1. DC output filter, consisting of one inductor and a one or two section capacitor capable of limiting the output ripple in accordance with NEMA PE5-1996. This filter reduces the output ripple voltage to 100 mV rms for 130 Vdc. The ripple voltage is measured at the *battery* terminals.
2. Battery Eliminator filter, consisting of one or more capacitors installed within the battery charger enclosure. This filter reduces the output ripple voltage to 100 mV rms for 130 Vdc. The ripple voltage is measured at the *charger* terminals.
3. Auxiliary Relay PC Board provides two (2) sets of form-C contacts for each alarm function listed in Section 11.2, plus two (2) additional summary alarm form-C contacts.
 - a. Barrier type terminals, for alarm contacts, accepting ring or spade lugs for #16-14 AWG
4. Copper ground bus bar, with one (1) solderless CU-AL compression terminal
5. AC input lightning arrestor
6. Fungus proofing
7. Anti-static coating
8. Remote temperature compensation probe (with automatic probe failure detection and fail-safe control override)
9. Forced load sharing interconnection cable
10. DNP/Modbus communications
11. Ground fault detection dc voltmeter
12. AC input voltmeter
13. AC input ammeter
14. End of discharge alarm
15. Battery discharge alarm
16. Vent/Fan control contactor
17. Rack/floor/wall-mount installation kit
18. Certified test data
19. Customized record drawings

O. AC input voltage will be single phase, 120 VAC, 60 Hz as standard.

P. Charger Output availability table:

1. DC voltage outputs (130V)
2. DC current outputs

- Q. Error codes as indicated on the front panel shall determine certain malfunctions as part of an integral microprocessor controlled self-diagnostic system. The error codes shall appear in the digital display as an alphanumeric indication beginning with the letter "E" followed by a number code, which reveals the problem being identified. Error code definitions shall be posted inside the access door to the charger and shall be listed in the manual. Certain "status" codes, preceded by the letter "A" are provided to indicate special operating conditions.
- R. Fail Safe Operation featuring a separate circuit from the micro controller to detect a low dc voltage condition and enable the common alarm on the main board to change state. This uniquely protects the battery due a failure of the microprocessor.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance.
 - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment will be installed, before installation begins.
- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install system components on floor and attach by bolting.
 - 1. Design each fastener and support to carry load indicated by seismic requirements and according to seismic-restraint details. See Section 260548 "Vibration and Seismic Controls for Electrical Systems" for seismic-restraint requirements.
 - 2. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
- B. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.

3.3 CONNECTIONS

- A. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams, unless otherwise indicated.

- B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."
 - 1. Separately Derived Systems: Make grounding connections to grounding electrodes and bonding connections to metallic piping systems as indicated; comply with NFPA 70.
- C. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

- A. Identify equipment and components according to Section 26 05 53 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Tests and Inspections:
 - 1. Inspect interiors of enclosures for integrity of mechanical and electrical connections, component type and labeling verification, and ratings of installed components.
 - 2. Test manual and automatic operational features and system protective and alarm functions.
 - 3. Test communication of status and alarms to remote monitoring equipment.
 - 4. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specifications. Certify compliance with test parameters.
 - 5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Remove and replace malfunctioning units and retest as specified above.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Verify that central battery inverter is installed and connected according to the Contract Documents.

- C. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements.
- D. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING AND CLEANING

- A. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- B. Install new filters in each equipment cabinet within 14 days from date of Substantial Completion.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain central battery inverters. Refer to Section 017900 "Demonstration and Training."

END OF SECTION

SECTION 261310 - INTEGRATED POWER ASSEMBLY (IPA)

PART 1 GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 SCOPE

- A. The specification covers requirements applicable to the provision of integrated power assembly-IPA. The IPA shall be environmentally controlled, and shall consist of a coordinated grouping of electrical power and control equipment as indicated on any accompanying data sheets and/or drawings. Any data sheets, drawings, or any other related documents accompanying this specification shall be considered a part of this specification.
- B. The supplier shall furnish, install, interconnect and test the equipment and materials shown on the contract drawings as being located in the Paralleling Switchgear IPA, and specified herein.

1.3 REFERENCES

- A. All materials, equipment and labor supplied by the supplier shall be in strict compliance with the statutes, codes and standards listed herein. Where conflicts exist between statutes, codes and standards, the more stringent requirement shall prevail. Applicable statutes, codes and standards are as listed below:
 - 1. American Institute of Steel Construction (AISC)
 - 2. American National Standard Institute (ANSI)
 - 3. American Society of Testing and Materials (ASTM)
 - 4. American Welding Society (AWS)
 - 5. AWS D1.1 Structural Welding Code – Steel
 - 6. National Fire Protection Association (NFPA)
 - 7. National Electric Code (NEC)
 - 8. National Electrical Manufacturers Association (NEMA)
 - 9. Underwriters' Laboratories (UL)
 - 10. International Building Code (IBC)

1.4 SUBMITTALS – FOR REVIEW/APPROVAL

A. The supplier shall provide the following submittals:

1. Any quality plans, forms, or procedures deemed necessary by the customer.
2. Structural drawings including:
 3. General notes.
 4. Building plan view.
 5. Building base skid detail.
 6. Building elevations.
 7. Certified structural calculations (if applicable).

B. Electrical drawings including:

1. Electrical notes.
2. Building electrical plan, showing conduit, cable tray, subfloor wireway, and any other means of wiring transit. Drawings shall also include conduit fill.
3. Building services wiring diagrams.
4. Grounding system plan.
5. Interconnection wiring diagrams.

1.5 SUBMITTALS – FOR CONSTRUCTION

A. The following information shall be submitted for record purposes:

1. Final as-built drawings and information for items listed in Paragraph 1.04, and shall incorporate all changes made during the manufacturing process
2. Wiring diagrams
3. Certified structural calculations (if applicable)
4. Installation information including equipment anchorage provisions
5. Seismic certification as specified

1.6 QUALITY REQUIREMENTS

A. The IPA shall be manufactured under an established autonomous quality assurance program. The supplier shall have a designated quality assurance (QA) manager.

1. The successful bidder shall be prepared to submit for customer approval, any and/or all quality plans, forms, and procedures applicable to the manufacturer of the IPA

1.7 QUALIFICATIONS

A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

- B. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- C. Provide Seismic tested equipment as follows:
1. The equipment and major components shall be suitable for and certified by actual seismic testing to meet all applicable seismic requirements of the 2015 International Building Code (IBC) Site Classification as indicated by the US Geological Survey for Kingston, RI see <http://earthquake.usgs.gov/research/hazmaps/design>. The site coefficients F_a and spectral response accelerations of and all other applicable parameters shall be as indicated by the aforementioned site for the area in which this project is being constructed. The test response spectrum shall be based upon a 5% damping factor, and a peak (SDS) of at least [Enter value from above website]g's (3 -12 Hz) applied at the base of the equipment in the horizontal direction. The forces in the vertical direction shall be at least 66% of those in the horizontal direction. The tests shall cover a frequency range from 1 to 100Hz. Guidelines for the installation consistent with these requirements shall be provided by the equipment manufacturer and based upon testing of representative equipment. Equipment certification acceptance criteria shall be based upon the ability for the equipment to be returned to service immediately after a seismic event within the above requirements without the need for repairs.
 2. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.
 - a. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed civil engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon the above criteria to verify the seismic design of the equipment.
 - b. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified in above codes.
 - c. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra

PART 2 PRODUCTS

- 2.1 The enclosure will consist of a roof, two sidewalls, two end walls, and a floor/underframe incorporating pre-painted aluminum stressed-skin semi-monocoque construction. The enclosure shall be as follows:

- A. One enclosure (referenced as the Switchgear Enclosure) shall house the following:
1. (1) 1200A, 4160V, 3-phase 3-wire generator paralleling switchgear
 2. (1) Paralleling Switchgear Master Control Cubicle
 3. (1) Dual Generator Control Cubicle
 4. (1) DC Station Battery System
 5. (1) 400A, 208Y/120V, 3PH, 4W Distribution Panel
 6. Fire Alarm Control Panel
 7. Power Management System
- B. The enclosure manufacturer shall have a representative, familiar with the project, on site during assembly of the switchgear enclosure to provide any required support to the site contractors.
- C. The entire structure, in its entirety, shall be weatherproof. No water leaking through the roof/walls shall be permitted.

2.2 APPROVED MANUFACTURERS

- A. The basis of design for the enclosure is as manufactured by Pritchard-Brown (Div. of Enviro Industries). An acceptable alternate manufacturer shall be acceptable if all specifications are met.
- B. The naming of a specific manufacture does not waive any requirements or performance of individual components described in this specification.
- C. Substitutions to this specification shall include complete submittal data clearly identifying all deviations or exceptions and shall be submitted with the bid.

2.3 ENCLOSURE REQUIREMENTS

- A. The enclosure shall be constructed to meet the following design criteria:
1. Weatherproof walk-in style enclosure.
 2. Rated to a wind load of 120 mph.
 3. Roof load equal to 50 lbs./ft².
 4. Distributed floor load to 200 lbs./ ft²
 5. Rain test equal to 4 inches/hr.
 6. Basic structure meets all seismic requirements of Zone 4 or equivalent.
 7. Dimensions to meet the requirements as indicated in the drawings.
 8. Enclosure drawings to be stamped by a PE registered in the state of Rhode Island.

- B. The roof shall incorporate a positive camber and be comprised of a mill-finish 6063-T6 extruded aluminum perimeter channel or “roof rail” with 16 gauge (minimum) roll-formed galvanized crossmembers or “roof bows” mechanically fastened to the roof rails. In a drop-over (no floor/underframe/tank) enclosure, two (2) roof lift rings per side (4 total) of 12,500 pound capacity each shall be located within the roof rail perimeter for the purpose of handling the enclosure. Integral structural “spreader bars” shall be incorporated between adjacent pairs of lift rings. The roof skin shall be a nominal 0.040-inch thick 3003-H16 or 3105-H14 mill-finish aluminum sheet and fastened to the roof bows and roof rails. The top skin shall be rolled over the perimeter of the roof rails to provide additional weather protection. A weatherproof mastic/sealant shall be used at the perimeter, as well as any joints required in the roof skin. The top skin shall be comprised of separate sheets of roof skin joined with lock-seam construction. This joint(s) shall include a high performance mastic tape or sealant for both joint structural integrity and weather protection. The roof color shall match the color of the exterior walls.
- C. The walls shall be manufactured utilizing mill-prepainted 0.040 inch thick (minimum) 3004-H36 aluminum panels hard-riveted to fabricated aluminized steel “Z” section wall posts located on 24 inch (maximum) centers. The enclosure walls shall incorporate an extruded structural “panel-cap” of mill finish extruded 6063-T6 aluminum. The panel-cap will interlock into the adjoining roof rail for a weatherproof structural connection between the roof and sidewalls. The bottom exterior of the sidewalls will incorporate a mill finish extruded 6063-T6 aluminum “rub rail” for a structural connection of the sidewalls to the base perimeter. Walls and ceiling will be provided with nominally 3 inches of rigid fiberglass insulation and covered with a painted white stucco finished aluminum panel.
- D. Corner posts shall be pairs of mating/interlocking mill finish 6063-T6 aluminum extrusions with one-half of each pair attached to the end of the wall. The halves will interlock upon assembly forming a structural, weatherproof corner.
- E. The floor structure shall be rated for a minimum distributed load of 200 lbs./ft² and reinforced as required to support prevailing point-loading (manufacturer to confirm required floor loading based on actual equipment selection). The floor and underframe assembly shall consist of fabricated or structural channel welded to form the outer perimeter. This perimeter shall be combined with formed or structural steel crossmembers (minimum 16-inch centers) to create a welded steel support structure for the installed switchgear equipment. Steel channel shall be incorporated into the floor structure for adequate structural support and attachment of the switchgear.
- F. The crossmembers shall be overlaid with a composite of 0.72-inch thick (nominal) oriented strand board (OSB) covered by 14 gauge (minimum) diamond plate steel for the purpose of load distribution, vibration isolation and sound attenuation. The diamond plate sheet shall be coated with a wear-resistant, high quality anti-corrosive material. Truss head screws shall be inserted in optimal locations through the diamond plate sheets to establish a ground connection to the underframe crossmembers.

- G. Exterior passage doors shall consist of one (1) single door (48" w x 80" h) and one (1) double door (96" w x 102" h). Equipment access doors shall consist of six (6) single doors (36" w x 96" h) aligned behind the switchgear assembly with sufficient access to remove the switchgear rear panels. All doors shall be of 18-gauge galvanized steel construction with an overlaid aluminum panel to match the enclosure exterior and incorporated into 16-gauge painted galvanized steel frames that are structurally integrated into the enclosure wall. The door(s) shall include heavy-duty continuous aluminum gear hinges and a passage latch, which includes commercial keysets. The passage latch shall incorporate a handicapped-access style lever-type operator for ease of egress in the event of emergency. The latch hardware shall allow escape from within when locked externally. Doors shall include a positive restraint to prevent the door from opening more than 100 degrees in normal operation. Door holdback hardware shall be provided to secure the door to the enclosure wall when the door is opened approximately 180 degrees during installation and maintenance evaluations. Wall adjacent to door shall include aluminum protector plate for impact protection from the protruding door handle. All door openings shall include an overhead rain gutter for channeling rainwater away from the enclosure. Interior framed openings matching the door locations in the switchgear enclosure will be provided.
- H. Lift rings shall be provided at the base perimeter for the purpose of lifting the complete enclosure with installed switchgear. The lift rings shall be 1.25-inch (nominal) steel plate and welded into the base or rupture basin (if applicable) perimeter at 4 locations.
- I. The switchgear enclosure shall be equipped with distribution equipment as indicated on the drawings and listed elsewhere in these specifications.
- J. Branch wiring shall be provided for vapor tight LED interior lighting, duplex GFCI receptacles, and heat pump. The entire enclosure shall be provided with (6) exterior LED lighting fixtures as indicated on the drawings. Exterior lighting shall be pre-wired to a junction box for switching control via remote mounted switching by electrical contractor. Lighting shall be shipped loose for field installation by the Electrical Contractor.
- K. All devices in the enclosure shall be pre-wired in E.M.T. conduit to the sections dedicated 120/208V panelboard by the enclosure manufacturer. An electrical stub-up shall be provided under the paralleling switchgear. Each distribution panelboard shall also be provided with a stub-up for field wiring of exterior electrical circuits and for field wiring of the switchgear load center.
- L. Refer to the following for additional electrical specifications of the electrical equipment installed in the Switchgear Weatherproof Enclosure
1. 262416 – PANELBOARDS
 2. 261300 – MEDIUM-VOLTAGE SWITCHGEAR
 3. 261302 – SUBSTATION CONTROL BATTERIES, RACK AND CHARGER
- M. Provide an adequately sized, wall mounted HVAC unit to service the switchgear enclosure as shown in the drawings.

2.4 INTEGRATED POWER ASSEMBLY (IPA)

- A. The IPA shall be designed and constructed for outdoor use under wind and seismic load conditions per the IBC guidelines for the job site.
- B. For equipment requiring rear access, the supplier shall provide 14-gauge minimum galvanized steel, gasketed and hinged equipment rear access doors, with 3-point latching system with galvanized padlockable handles, **“DANGER HIGH VOLTAGE”** sign, and drip shields/water flashing.
- C. The building shall be provided with an HVAC system, sized and provided by the supplier, considering the ambient site conditions, the dimensions of the building, the solar heating of the building, and the heat generated by the equipment within the building. The system shall be designed such that the sensible cooling capacity, NOT the total cooling capacity, will maintain an ambient temperature within the building of between 55°F winter and 80°F summer at design conditions. The system shall be provided with an electronic, automatic changeover thermostat. With communications, compatible with the Power Management System such that temperature may be monitored, trended and such that alarm points maybe defined and actuated.
- D. All wiring shall be type THWN, #12 AWG minimum for power circuits, minimum #14 AWG for control circuits. For all control interconnection wiring, both ends of the wire shall be provided with polyolefin sleeve type wire markers.
- E. EMT conduit shall be utilized for interior applications. RGS conduit shall be utilized for outdoor applications.
- F. 1/4-inch x 2-inch x 24-inch copper ground bar shall be provided, mounted approximately 12-inches above floor, connected to each end of the equipment ground bar and connected via exothermic walk in two locations to the grounding electrode system. A #4/0 green insulated copper ground cable shall be provided from the ground bar to the exterior ground pads. A green insulated copper ground wire/cable will be provided from the ground bar to all auxiliary electrical equipment per NEC Table 250-95.

PART 3 EXECUTION

3.1 TESTING AND INSPECTION

- A. The following testing and inspection shall be performed on the building:
 - 1. Continuity checks of all wiring installed by the supplier.
 - 2. Operational check of all supplier furnished and installed electrical apparatus.
 - 3. Switchgear shipping sections' bus shall be re-spliced, torqued and meggered.
 - 4. A certified test report shall be provided by the supplier's Quality Assurance Manager.

END OF SECTION

SECTION 261313 – MEDIUM VOLTAGE PAD-MOUNTED SWITCHGEAR

PART 1 - GENERAL

1.1 SCOPE

- A. This specification applies to three-phase, six (6) way, dual source with automatic source selection, 60 Hz, fully dead front, sectionalizing Pad-Mounted distribution switchgear.

1.2 APPLICABLE STANDARDS

A. Switchgear Assembly

- 1. IEEE C37.20.3 (*IEEE Standard for Metal-Enclosed Interrupter Switchgear*).
- 2. IEEE C37.74 (*IEEE Standard Requirements for Subsurface, Vault, and Pad-Mounted Load-Interrupter Switchgear and Fused Load- Interrupter Switchgear for Ac Systems Up to 38 kV*).
- 3. IEEE C57.12.28 (*IEEE Standard for Pad-Mounted Equipment Enclosure Integrity*).
- 4. IEEE C57.12.29 (*IEEE Standard for Pad-Mounted Equipment Enclosure Integrity for Coastal Environments*).
- 5. IEC 60529 (*Degrees of Protection Provided by Enclosure*).

B. Load-Interrupter Switches

- 1. IEEE 1247 (*IEEE Standard for Interrupter Switches for Alternating Current Rated Above 1000 Volts*).
- 2. IEC 62271-103 (*High-Voltage Switches—Part 1—Switches for Rated Voltages Above 1 kV and Less Than 52 kV*).

C. Fault Interrupters

- 1. IEEE C37.60 (*IEEE Standard Requirements for Overhead, Pad- Mounted, Dry-Vault, and Subsurface Automatic Circuit Reclosers and Fault Interrupters for Ac Systems Up to 38 kV*).
- 2. IEC 62271-111 (*High-Voltage Switchgear and Control Gear—Part 111—Overhead, Pad-Mounted, Dry-Vault, and Subsurface Automatic Circuit Reclosers and Fault Interrupters for Ac Systems Up to 38 kV*).

D. Isolating Disconnect

- 1. IEC 62271-102 (*High-Voltage Switchgear and Control Gear—Part 102—Alternating Current Disconnectors and Earthing Switches*).

E. Separable Insulated Connector System

1. IEEE 386 (*IEEE Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600 V*).
2. IEEE 592 (*IEEE Standard for Exposed Semiconducting Shields on High-Voltage Cable Joints and Insulated Connectors*).

F. Voltage Indicating System

1. IEC 62271-206 (*Voltage Presence Indicating Systems for Rated Voltages Above 1 kV and Up to and Including 52 kV*).

1.3 DEFINITIONS

- A. Dead-front switchgear design: Switchgear in which the energized components are insulated and completely enclosed within a grounded switch tank with dead-front terminations installed.
- B. Trip-free operation: Vacuum fault interrupter mechanism with trip circuitry that when combined with an over-current relay provides a trip-free operation to allow for fault current independent of the operating handle position.
- C. Way: A three-phase circuit consisting of three 600-amp bushings or 200-amp bushing wells, and one vacuum fault interrupter switch (VFI-Switch) or vacuum fault interrupter (VFI) connected to a common bus.

1.4 SUBMITTALS

A. For review/approval

1. The following information shall be submitted to the Engineer:

- a. Master drawing index
- b. Front view elevation
- c. Floor plan
- d. Top view
- e. Single line
- f. Nameplate schedule
- g. Component list
- h. Conduit entry/exit locations
- i. Assembly ratings including:
 - 1) Short-circuit rating
 - 2) Voltage
 - 3) Continuous current
 - 4) Basic Impulse Level
- j. Major component ratings including:
 - 1) Voltage
 - 2) Continuous current

3) Interrupting ratings

- k. Cable terminal sizes
- l. Product data sheets

B. For construction

- 1. The following information shall be submitted for record purposes:
 - a. Final as-built drawings and record information, and shall incorporate all changes made during the manufacturing process
 - b. Wiring diagrams
 - c. Certified production test reports
 - d. Installation information including equipment anchorage provisions

1.5 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.
- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.

1.6 WARRANTY

- A. The Pad-Mounted distribution switchgear shall be provided with a one-year warranty in-service/18 months maximum from date of shipment.

PART 2 - PRODUCTS

2.1 RATINGS

- A. Switchgear ratings shall be 15.5 kV.

Design voltage	15.5 kV
Basic insulation level	95 kV
Continuous current	600 amps
Load interrupting current	600 amps

- B. Mechanical operations for each mechanism: 15.5 kV/20 kA symmetrical: 2,000 load break operations.
- C. Required momentary & make and latch for both switch and VFI mechanisms:
 - 1. 20 kA symmetrical
 - 2. 32 kA asymmetrical
 - 3. 52 kA peak current
- D. Required fault closing ratings for both switch and VFI mechanisms:
 - 1. 20 kA symmetrical
 - 2. 32 kA asymmetrical
 - 3. 52 kA peak current
- E. The VFI-switch ways must be rated for a minimum of 1,000 fault close operations at full symmetrical fault current.
- F. Required fault interrupting current for both switch and VFI mechanisms:
 - 1. 20 kA symmetrical
 - 2. 32 kA asymmetrical
 - 3. 52 kA peak current
- G. The VFI-switch ways must be rated for fault interruption at full symmetrical fault current.
- H. 200-amp terminations including bushing wells, inserts and elbows have the following ratings per the IEEE Standard 386: 10 kA symmetrical; 13kA asymmetrical. No peak current rating for 200-amp terminations are provided by the manufacturers of these products. The switchgear shall be de-rated to 12.5 kA symmetrical when 200-amp bushing wells are requested.

2.2 CONSTRUCTION

A. General

- 1. The Pad-Mounted distribution switchgear shall consist of a 2-sided, sealed insulation tank, and separate front and rear cable compartments. Overall height, width, depth and layout shall conform to the manufacturer's standard construction practices for the configuration, ratings, and voltage class specified. Standard construction shall be of mild steel with stainless steel hardware.
- 2. The liquid or SF6 gas filled unit shall have a tamperproof bolted tank cover design, utilizing Buna-N rubber gaskets, if required. The sealed tank (with deadfront terminators installed) shall be capable of withstanding flood immersion while energized, and shall be impervious to contaminants and animals, so as not to compromise the main insulation structure. The cable compartments shall be located at the front and back of the tank respectively. The main cable compartments may house a combination of source way(s) and load or tap way(s). All switch and VFI operating handles shall be located on the same front plate as the ways that they operate, in order to reduce the likelihood of operating an incorrect

switch. Recessed lifting provisions for suitable balanced lift shall be provided on the tank ends.

3. Units shall be shipped complete with Envirotemp 200 less-flammable fluid for operation to minus 30 degrees C or pre-filled with SF6 gas.
4. The unit shall be equipped with a 1-inch oil-fill plug and a 1-inch drain plug with 3/8" sampler. A single automatic pressure relief valve shall be supplied that is hotstick-operable and located on the source-side front plate above the oil level indicator within the switchgear. The unit shall have sight gages to monitor the dielectric level located on each unit side equipped with an operating handle.
5. Provide 18-inch steel base spacer to allow for additional cable pulling space.

B. Electrical Components

1. The VFI-switch is a three-phase, gang-operated mechanism implementing a quick-make-quick-break design operating independently of the speed in which the external operating handle is opened or closed.
 - a. The VFI-switch mechanism shall have a two-position latch for Open and Closed positions. When the operating handle is pulled to the Open position, the vacuum contacts shall de-energize the circuit and then the VOIP switch shall rotate 90 degrees to create a safe-to-work isolation point. The contacts of the VOIP shall be visibly seen through the viewing windows on the switch tank surface when in the Open position thus providing a required Visible Open.
2. The VFI-trip vacuum fault Interrupter is a three-phase, gang-operated mechanism implementing a quick make, quick break design operating independently of the speed in which the external operating handle is opened or closed.
 - a. The Vacuum Fault Interrupter mechanism shall have a three-position latch for Open, Closed and Tripped positions. When the operating handle is pulled to the Open position, the vacuum contacts shall de-energize the circuit and then the VOIP switch shall rotate 90 degrees to create a safe-to-work isolation point. The contacts of the VOIP shall be visibly seen through the viewing windows on the switch tank surface when in the Open position thus providing a required Visible Open.
3. The internal bus shall be designed and constructed of copper bus bar and ribbon copper that are both silver plated. No tin-plated bus work shall be allowed. The bus work shall be insulated with solid-dielectric material to maintain the BIL rating of the design.
4. For above grade applications the internal wiring for the current transformers, trip circuitry and status of the mechanism shall be terminated to 304 stainless-steel connectors installed in welded-on half couplings on the surface of the switch tank.

C. Switch tank and enclosures

1. The switch tank, high-voltage enclosure as well as the low-voltage automation enclosures shall be constructed of 304 type stainless-steel and shall be welded using 308 type filler material to maintain the corrosion resistant properties of the stainless-steel.

2. All 600-amp bushings and 200-amp bushing wells shall be welded in place.
3. For double-sided padmount applications, the bushings shall be mounted horizontally and phased ABC-CBA, which matches the phasing of double-side padmount applications. The 304-type stainless-steel switch tank shall be sealed and submersible.
4. Tank connections shall be rated as waterproof for normally dry applications.
5. Provisions for lifting the switchgear shall be provided on each design.
6. Provisions for grounding the switch tank shall be either ground nuts or a ground pad welded to the switch tank. One ground nut with a ½" x 13 x 7/16" deep shall be provided for each way.
7. Load-break parking stands shall be provided as a standard feature.
8. Motor operator mounting brackets shall be welded to each handle housing for future installation of motor operators.
9. Two auxiliary contacts, 1A and 1B, shall be included and wired to the front plate of each VFI switch way and VFI way for position indication.

D. High-voltage terminations

1. 15 kV equipment shall be equipped based on required configuration for either 600-amp dead-break terminations or 200-amp bushing wells that will accept 200-amp load-break inserts.
2. If the equipment is supplied with 200-amp bushing wells, the switchgear shall be de-rated to 12.5 kA symmetrical.
3. Bushings and bushing wells shall be installed into the switch tanks for the best possible replacement arrangement for the equipment being replaced.
4. For double-sided padmount applications, the bushing pattern shall be horizontal and phased A, B, C – C, B, A.

E. Parking stands

1. Load-break parking stands shall be provided on the switch tank surface adjacent to the termination.

F. Lifting provisions

1. Lifting provisions shall be provided and positioned, so that the switchgear shall remain level when being lifted into position.

G. Grounding

1. ½" x 13 stainless-steel ground nuts or ground pads shall be welded to the switch tank and include a ½" diameter copper ground rod across the bottom of the switch tank.

H. Anchoring

1. Provisions for securing the switchgear the padmount foundation shall be for a ½" anchor.

I. Padmount enclosure

1. The padmount enclosure shall be constructed from a minimum of 11-gauge 304 stainless-steel and shall meet all the applicable requirements for IEEE standard C57.12.28.

2. The enclosure shall be tamperproof and weatherproof and suitable for mounting on a padmount foundation.
3. The enclosure shall be designed to shed water.
4. The base of the enclosure shall be provided with a minimum of a 2" internal flange to permit anchoring the unit to the foundation from within the cable compartments. 4" flanges are provided under the high voltage door sills to provide a means to cover any overhanging of the foundation.

J. Doors

1. Entrances to cable compartments shall be equipped with dual cabinet-style doors arranged so that the right-side door must be opened prior to the left.
2. The minimum and maximum depth of each cable compartment measured between the faceplate of the tank and the sill and/or doors shall be a minimum of 20 inches for 15 kV applications.

K. Hinges

1. All hinges, hinge pins and hinge mounting hardware shall be 304 stainless-steel or better.
2. The hinge pins shall be a minimum of 0.375" in diameter and 3" in length.
3. The gauges of the hinges shall be the same or greater than the gauge of the metal to which they are attached.

L. Remote fault indicators

1. Provisions for mounting remote fault indicators in the enclosure for each way shall be provided.

M. Paint

1. Interior and exterior surfaces that may be exposed to the atmosphere shall be powder coated per IEEE standard C57.12.28.
2. The total thickness of the dried coatings shall not be less than 3 mils.
3. The powder coat shall be green in color conforming to Munsell 7GY 3.29/1.5 Green or equivalent and shall provide superior weather and ultraviolet resistance properties.
4. All hardware shall be non-corrosive metals.

N. Security

1. Each enclosure door shall be secured with a locking mechanism consisting of a padlock and penta-head bolt in accordance with the latest revision of IEEE standard C57.12.28. When installed, the padlock shall hang in a normal position.
2. In addition to a means for padlocking, a captive, recessed penta-head security bolt and self-centering receptacle, both made of type 304 stainless-steel, or better, for corrosion resistance, shall be required for each access door as per IEEE standard C57.12.28. Penta-head bolt and receptacle shall be designed to minimize the possibility of misalignment, cross threading and galling.

2.3 OPERATING HANDLES AND POSITION INDICATION

- A. The switchgear shall operate on a single external operating handle to open the vacuum fault interrupter contacts and rotate the visible open isolation point switch. A vacuum contact position indicator shall be provided per way and located on the switch handle housing to indicate the position of the vacuum contacts.
1. Closed position: A semaphore indicating Closed in reflective silver letters on a reflective red background informs the operator that the vacuum contacts are in the Closed position. When the operating handle is positioned down and against the switch tank, the vacuum contacts and the visible open isolation point contacts are in the Closed position.
 2. Open position: A semaphore indicating Open in reflective silver letters on a reflective green background informs the operator that the vacuum contacts are in the Open position. When the operating handle is positioned up and away from the switch tank, the vacuum contacts and the visible open isolation point contacts are in the "Open" position.
 3. Tripped position: When the over-current relay, attached to a VFI-trip mechanism's CTs and trip circuitry, identifies an over-load or fault event, a signal shall be sent to the solenoid on the VFI-trip mechanism to activate the solenoid and trip the latch to open the vacuum contacts. The external operating handle shall remain in the closed position until the handle is pulled to open it. When the external operating handle is pulled to the Open position, the VFI-trip mechanism is re-set and the visible open isolation point is rotated to its open position. Operators can verify the position of the visible open by looking through the viewing windows on the tank surface.

2.4 NAMEPLATES

- A. 304 stainless-steel nameplates, with photo-engraved or etched letters, schematics, and numbers shall be welded to the switch tank.
- B. Main nameplate: The main nameplate includes the following information:
1. Name of manufacturer
 2. Manufacturer catalog number
 3. Month and year of manufacture
 4. Serial number
 5. Catalog number
- C. Ratings nameplate: The ratings nameplate shall include the IEEE required nameplate information regarding the ratings of the equipment.
- D. Schematic nameplate: The schematic diagram nameplate includes the following information:
1. Three-line diagram of internal bus
 2. Weight
- E. Way and bushing designation

1. A way nameplate, numbered 1 through 6, shall be welded to each switch handle housing. The bushings associated with that way shall be labeled with the way number and by A, B and C phase. For example: 1A, 1B, 1C.

2.5 OVER-CURRENT PROTECTION RELAYS

- A. A microprocessor-based overcurrent control shall be provided to initiate fault interruption.
- B. The control shall be mounted in a watertight enclosure and shall be removable in the field without taking the gear out of service.
- C. Control settings shall be field-programmable using a personal computer connected via a data port to the control. The data port shall be accessible from the exterior of the enclosure. Neither external power nor energization of the gear shall be required to set or alter control settings.
- D. Power and sensing for the control shall be supplied by integral current transformers.
- E. The minimum total clearing time (from initiation of the fault to total clearing) for fault interruption shall be 40 milliseconds (2.4 cycles) at 60 hertz.
- F. Event records shall be easily extractable from the control using a personal computer connected to the data port.

2.6 MOTOR OPERATORS

- A. Motor operators for local or remote operation of load-interrupter switches shall be available.
- B. Motor operators shall be factory-installed and wired for permanent installations.
- C. Switchgear assemblies furnished with one or more factory-installed and wired motor operators shall have auxiliary contacts wired to the motor operators to track the position of the isolating disconnect.
- D. Operating times to open or close a load-interrupter switch or fault interrupter shall be no longer than 3 seconds.
- E. The motor operators shall be 24 VDC gear motors with limit switches and reversing circuit to directly connect to the relay automation control without an interface board to open both the vacuum contacts and visible open mechanism in one operation.
- F. Motor operators and linkages shall be constructed from 304 stainless steel.
- G. Hardware to mount the motor operator directly to the switch tank shall be from non-corrosive materials.

2.7 AUTOMATION CONTROL/SOURCE TRANSFER CONTROL

- A. Operating description: Transfer on loss and return of source voltage in common-bus primary-selective system.
1. The normal condition shall be with one source load-interrupter switch (for the preferred source, as field-programmed) closed to energize the high-voltage bus, and with the other source load-interrupter switch (for the alternate source) open with its associated circuit available as a standby.
 2. The control shall monitor the conditions of both power sources and shall initiate automatic switching when the preferred-source voltage has been lost (or reduced to a predetermined level) for a period of time sufficient to confirm that the loss is not transient. Automatic switching shall open the preferred-source load-interrupter switch and then close the alternate-source load-interrupter switch to restore power to the high-voltage bus. The total transfer time from the preferred to the alternate source shall be approximately 6 seconds.
 3. When normal voltage returns to the preferred source for a preset time, the control shall initiate retransfer to the preferred source if in the automatic return mode or await manual retransfer if in the hold return mode. In the hold return mode, if the alternate source fails and the preferred source has been restored, the control shall initiate automatic retransfer to the preferred source.
 4. In the automatic return mode, the control shall provide open transition (non-paralleling) on retransfer.
- B. Transfer on Unbalance Condition
1. A field-programmable unbalance detection feature shall initiate automatic switching on detection of source-side open-phase conditions at the same system voltage level as the switchgear, whether caused by utility-line burndown, broken conductors, single-phase switching, equipment malfunctions, or single-phasing resulting from blown source-side fuses. The control shall continuously develop and monitor the negative-sequence voltage to detect any unbalance present as a result of an open- phase condition. Automatic switching shall occur when the system unbalance exceeds a predetermined unbalance-detect voltage for a period of time sufficient to confirm that the condition is not transient.
 2. When normal phase voltages return to the preferred source, the control shall initiate retransfer for common-bus primary-selective systems.
- C. Control features
1. The operating characteristics of the source-transfer control and its voltage-, current-, and time-related operating parameters shall be field-programmable and entered into the control by means of a keypad. To simplify entry of this information, a menu arrangement shall be utilized including keys dedicated to the operating characteristics and to each of the operating parameters. Entry of an access code shall be necessary before any operating characteristic or operating parameter can be changed.
 2. All operating characteristics and operating parameters shall be available for review on a liquid-crystal display with backlighting.

3. A selector switch shall be furnished for choosing manual or automatic operating mode. In the manual mode, local electrical open and closed operation by means of push buttons shall be enabled while automatic switching shall be inhibited.
4. The control shall automatically record system status and source-transfer control status every time a control operation occurs, for use in analyzing system events. All such operations shall be indicated by the illumination of a light-emitting diode lamp and shall be available for display by means of a dedicated event key.

D. Construction features

1. The source-transfer control shall use an advanced microprocessor and other solid-state electronic components to provide the superior reliability and serviceability required for use in power equipment. All components shall be soldered on printed-circuit boards to minimize the number of interconnections for increased reliability.
2. The control shall be located in the grounded, steel-enclosed low-voltage compartment/enclosure, with the operators. The compartment shall provide isolation from high voltage.

E. Voltage sensing and control power

1. Voltage sensing shall be provided by three elbow connected VT's on the line side of each source load-interrupter switch.
2. The output of the voltage transformers shall be directly proportional to line-to-ground voltage.
3. Control power shall be provided by the voltage transformers on each source.
4. An overcurrent-lockout feature shall be provided to prevent an automatic transfer operation that would close a source load-interrupter switch into a fault. The feature shall include a light-emitting diode lamp for indicating when a lockout condition has occurred, a reset key for manually resetting the lockout condition, and three current sensors for each source. Provisions shall be furnished for manually resetting the overcurrent-lockout feature from a remote location. Test keys shall be provided for simulating an overcurrent condition on each source.

PART 3 - EXECUTION

3.1 FACTORY TESTING

- A. The following standard factory tests shall be performed on switchgear provided under this section. All tests shall be in accordance with the latest version of IEEE and applicable NEMA standards.
 1. Mechanism Build
 - a. Hi-Pot test for one minute @ 40kVAC
 - b. Mechanical Testing
 2. Pre-Tank Assembly
 - a. Hi-Pot test for one minute @ 40kVAC

- b. Resistance test $<500 \mu\Omega$
 - c. CT Phase Test (if applicable)
 - d. Mechanical Testing 10 cycles
 - e. Internal Voltage Sensor Testing (if applicable)
3. Post Final Weld
- a. Hi-Pot test for one minute @ 40kVAC
 - b. Resistance test $<500 \mu\Omega$
 - c. CT Phase Test (if applicable)
 - d. Mechanical Testing 10 cycles
 - e. Internal Voltage Sensor Testing (if applicable)
 - f. Pressure Test $<.040$ PSI Differential
 - g. Final System Testing

- B. The manufacturer shall provide three (3) certified copies of factory test reports.

3.2 FIELD QUALITY CONTROL

- A. The Contractor shall provide the services of a qualified factory-trained manufacturer's representative to provide startup of the equipment specified under this section for a period of three (3) working days.
- B. The Contractor shall provide three (3) copies of the manufacturer's field startup report.

3.3 INSTALLATION

- A. The Contractor shall install all equipment per the manufacturer's recommendations and the contract drawings.
- B. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

3.4 FIELD ADJUSTMENTS

- A. The relays shall be set in the field by a qualified relay technician by:
- 1. The Contractor in accordance with settings designated in a coordination study of the system as required elsewhere in the contract documents .

END OF SECTION

SECTION 262416 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Lighting and appliance branch-circuit panelboards.
- B. Panelboards shall be fully rated for available fault currents. Series ratings shall not be accepted.

1.3 ACTION SUBMITTALS

- A. Panelboards shall be submitted subsequent to the fault current and coordination studies required in 260573. Equipment submittals prior to the required study shall not be reviewed by the Design Engineer and will be returned "rejected."
- B. Panelboards shall be submitted in a logical fashion and follow the order scheduled on the drawings. Disorganized submittals shall not be reviewed by the Design Engineer and will be returned "rejected."
- C. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- D. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 6. Include wiring diagrams for power, signal, and control wiring.
 - 7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain all panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA PB 1.
- D. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Handle and prepare panelboards for installation according to NEMA PB 1.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Owner and Construction Manager no fewer than ten days in advance of proposed interruption of electric service.
 - 2. Do not proceed with interruption of electric service until Owner and Construction Manager's written permission is received.
 - 3. Comply with NFPA 70E.

1.7 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- B. Enclosures: Surface-mounted cabinets.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Opening inner door shall expose circuit breaker operator handles and panelboard directory. Opening outer door shall expose terminals and circuit breakers in a single operation.
 - 3. Where two section panels are required, bolt boxes together to form one unit. Trim shall be two-piece construction with doors of equal size over each section.
 - 4. Power and lighting panels shall have heavy duty, continuous, section vertical-hinging to box section for access to wiring gutters in addition to trim door
 - 5. Finishes:
 - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Same finish as panels and trim.
 - 6. Directory Card: Inside panelboard door, mounted in transparent card holder.
 - 7. Panelboard designations shall be labeled on the front of the panel with a screw-on nameplate.
- C. Incoming Mains Location: Top and bottom.
- D. Phase, Neutral, and Ground Buses:
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- E. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus-Configured Terminators: Mechanical type.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

- G. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Series ratings shall not be acceptable.
- H. Panelboards shall have short circuit current rating equal to or greater than circuit breaker AIC ratings schedule on drawings. Panelboards rated 240 volts shall have the following minimum ratings:
 - 1. 10k AIC where shown fed via a 150 kVA transformer and less.
 - 2. 22k AIC where shown fed via a 225 kVA and 300 kVA transformer.
 - 3. 35k AIC where shown fed via a 500 kVA transformer.
- I. Panelboards served from transformers shall have a main breaker, unless an enclosed circuit breaker or fused switch is shown.

2.2 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: Circuit breaker.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.3 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replaceable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.
 - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - 5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).

6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
7. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Section 260548 "Vibration and Seismic Controls for Electrical Systems."
- C. Mount top of panelboards no more than 6'-6" above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box.
- E. Branch circuit wiring shall be peeled out of the wiring gutters at 90 degrees to circuit breakers and terminal lugs for a neat installation.
- F. Install overcurrent protective devices and controllers not already factory installed.
 1. Set field-adjustable, circuit-breaker trip ranges.
- G. Install filler plates in unused spaces.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- I. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573.16 "Overcurrent Protective Device Coordination Study."

3.6 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION

SECTION 262726 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Weather-resistant receptacles.
 - 3. Wall-switches.

1.3 DEFINITIONS

- A. GFCI: Ground-fault circuit interrupter.
- B. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

2.3 STRAIGHT-BLADE RECEPTACLES

- A. Convenience Receptacles, Premium Industrial Grade, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
 - 1. Description: One-piece solid brass mounting strap with integral brass grounding contacts. Minimum of triple-wipe contacts on both line and neutral.

2.4 GFCI RECEPTACLES

- A. General Description:
 - 1. Straight blade, non-feed-through type.
 - 2. Comply with NEMA WD 1, NEMA WD 6, Configuration 5-20R, UL 498, UL 943 Class A, and FS WC-596.
 - 3. Include indicator light that shows when the GFCI has malfunctioned and no longer provides proper GFCI protection. When malfunction occurs the indicator light shall remain ON and not turn off.

2.5 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS WS-896.

2.6 WALL PLATES

- A. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: 0.035-inch- thick, satin-finished, Type 302 stainless steel.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, **die-cast aluminum** with lockable cover.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Conductors:

1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

C. Device Installation:

1. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
2. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
3. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
4. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
5. Use a torque screwdriver when a torque is recommended or required by manufacturer.
6. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
7. Tighten unused terminal screws on the device.
8. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.

D. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

E. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

5. Using the test plug, verify that the device and its outlet box are securely mounted.
 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- B. Wiring device will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 262813 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirement of this Section shall prevail.

1.2 SUMMARY

- A. Section Includes:
 - 1. Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, and enclosed controllers.

1.3 REFERENCES

- A. Publications listed below (including amendments, addenda, revisions, supplements, and errata) form part of this specification to the extent referenced. Publications are referenced in the text by the basic designations only.
 - 1. National Electrical Code (NEC)
 - 2. Underwriter's Laboratories (UL)
 - a. UL 50 Enclosures for Electrical Equipment
 - b. UL 508 Standard for Safety Industrial Control Equipment
 - c. UL 977 Fused Power Circuit Devices
 - 3. American National Standard Institute (ANSI)

1.4 SUBMITTALS

- A. Product Data: For each type and rating of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
 - 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 - 2. Current-limitation curves for fuses with current-limiting characteristics.

3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse.
4. Coordination charts and tables and related data.

1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.

1.6 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F or more than 100 deg F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.7 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 2 - PRODUCTS

2.1 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
 - 1. Feeders: Class L, time delay.
 - 2. Motor Branch Circuits: Class RK5, time delay.
 - 3. Other Branch Circuits: Class RK1, time delay.
 - 4. Control Circuits: Class CC, fast acting.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION

SECTION 262816 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Nonfusible switches.
 - 3. Molded-case circuit breakers (MCCBs).
 - 4. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 5. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.
- B. Shop Drawings: For enclosed switches and circuit breakers. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Wiring Diagrams: For power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Field quality-control reports.
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. Include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.7 QUALITY ASSURANCE

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Engineer, Construction Manager, and Owner no fewer than seven days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.

3. Do not proceed with interruption of electric service without Engineer's, Construction Manager's, and Owner's written permission.
4. Comply with NFPA 70E.

1.9 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 FUSIBLE SWITCHES

- A. Type HD, Heavy Duty, Six Pole, Single Throw, 240-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- B. Accessories:
 1. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.2 NONFUSIBLE SWITCHES

- A. Type HD, Heavy Duty, Single Throw, 240-V ac, 200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- B. Accessories:
 1. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- B. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- C. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- D. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 1. Instantaneous trip.

2. Long- and short-time pickup levels.
 3. Long- and short-time time adjustments.
 4. Ground-fault pickup level, time delay, and I^2t response.
- E. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- F. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- G. Features and Accessories:
1. Standard frame sizes, trip ratings, and number of poles.
 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 3. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.

2.4 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 2. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Install fuses in fusible devices.

- D. Comply with NECA 1.

3.3 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573 "Overcurrent Protective Device Coordination Study."

END OF SECTION

SECTION 263213 ENGINE GENERATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section. Where Paragraphs of this Section conflict with similar paragraphs of the General and Supplementary Conditions and Division 1, requirements of this Section shall prevail.
- B. The requirements of this specification section shall be in addition to the supplemental contract document requirements. Where the requirements of this section conflict with other parts of these contract documents, the more stringent requirements shall apply. In the event that there is a conflict, the Electrical Contractor shall promptly notify the Engineer in writing.

1.2 SUMMARY

- A. This Section includes packaged engine-generator sets that will supply power per National Electrical Code Article 702 Optional Standby Systems with the following features:
 - 1. Diesel engine.
 - 2. Unit-mounted cooling system.
 - 3. Unit-mounted control and monitoring.
 - 4. Performance requirements for sensitive loads.
 - 5. Outdoor enclosure.
 - 6. Exhaust silencers.
 - 7. Fuel-oil system.
 - 8. Load bank.
- B. Related Sections include the following:
 - 1. Section 26 13 10 Integrated Power Assembly
 - 2. Section 26 13 00 Medium Voltage Switchgear for transfer switches including sensors and relays to initiate automatic-starting and -stopping signals for engine-generator sets.

1.3 DEFINITIONS

- A. Operational Bandwidth: The total variation from the lowest to highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.
- B. EPS: Emergency power supply.
- C. EPSS: Emergency power supply system.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of packaged engine generator indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. In addition, include the following:
1. Thermal damage curve for generator.
 2. Time-current characteristic curves for generator protective device.
 3. Generator fuel consumption at 100%, 75%, and 50% loading.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
1. Dimensioned outline plan and elevation drawings of engine-generator set and other components specified.
 2. Design Calculations: Signed and sealed by a qualified professional engineer. Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 3. Wiring Diagrams: Power, signal, and control wiring.
 4. Over-current protection, relays and control devices shall be identified, and their ratings marked.
 5. Electrical schematic drawings shall be provided to detail the operation of the load bank and the provided safety circuits. A system interconnection drawing shall be included for control wiring related to the load bank.
 6. Noise Emissions: Provide a submittal with suitably supported and documented noise emission calculations or measurement data to demonstrate compliance with noise levels outlined in the specification. The submittal shall ensure all aspects of noise emission from the unit have been included.
 7. Copy of blank NFPA 110 Acceptance Test form for review.

1.5 INFORMATIONAL SUBMITTALS

- A. Manufacturer Seismic Qualification Certification: Submit certification that day tank, engine-generator set, batteries, battery racks, accessories, and components will withstand seismic forces.
1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 - a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- B. Qualification Data: For testing agency.

C. Source quality-control test reports.

1. Certified summary of prototype-unit test report.
2. Certified Test Reports: For components and accessories that are equivalent, but not identical, to those tested on prototype unit.
3. Certified Summary of Performance Tests: Certify compliance with specified requirement to meet performance criteria for sensitive loads.
4. Report of factory test on units to be shipped for this Project, showing evidence of compliance with specified requirements.
5. Report of sound generation.
6. Report of exhaust emissions showing compliance with applicable regulations.
7. Certified Torsional Vibration Compatibility: Comply with NFPA 110.

D. Field quality-control test reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For packaged engine generators to include in emergency, operation, and maintenance manuals. Include the following:

1. List of tools and replacement items recommended to be stored at Project for ready access. Include part and drawing numbers, current unit prices, and source of supply.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: One for every 10 of each type and rating, but no fewer than one of each.
2. Indicator Lamps: Two for every six of each type used, but no fewer than two of each.
3. Filters: One set each of lubricating oil, fuel, and combustion-air filters.
4. Tools: Each tool listed by part number in operation and maintenance manual.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.

1. Maintenance Proximity: Not more than four hours' normal travel time from Installer's place of business to Project site.
2. Engineering Responsibility: Preparation of data for vibration isolators and seismic restraints of engine skid mounts, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

- B. Manufacturer Qualifications: A qualified manufacturer. Maintain, within 200 miles of Project site, a service center capable of providing training, parts, and emergency maintenance repairs.
- C. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL), and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- D. Source Limitations: Obtain packaged generator sets and auxiliary components through one source from a single manufacturer.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- F. Comply with ASME B15.1.
- G. Comply with NFPA 37.
- H. Comply with NFPA 70.
- I. Comply with NFPA 70 Article 702 Optional Standby Systems requirements.
- J. Comply with all Rhode Island state codes and requirements applicable to the installation of the diesel generators and fuel oil day tanks.
- K. Engine Exhaust Emissions: Comply with applicable state and local government requirements.
- L. Noise Emission: Comply with applicable state and local government requirements for maximum noise level due to sound emitted by generator set including engine, engine exhaust, engine cooling-air intake and discharge, and other components of installation.

1.9 PROJECT CONDITIONS

- A. Environmental Conditions: Engine-generator system shall withstand the following environmental conditions without mechanical or electrical damage or degradation of performance capability:
 - 1. Ambient Temperature: Minus 15 to plus 40 deg C.
 - 2. Altitude: Sea level to approximately 700 feet (215 m).

1.10 COORDINATION

- A. Coordinate size and location of concrete bases for package engine generators. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged engine generators and associated auxiliary components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 5 years from date of customer turnover.
 - a. No deductibles or warranty registration fees shall be allowed
 - b. Cost for the provision and installation of a temporary generator set shall be covered should a warranty repair take more than 48 hours.
 - c. The local selling distributor shall own equivalent sized portable generators and shall not rely on third party rental distributors.

1.12 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at customer turnover, provide 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.

1.13 FACTORY TESTING

- A. Equipment shall be factory assembled and tested to meet all the requirements of this specification in accordance with the approved factory test procedures.
 - 1. Perform functional testing of equipment including but not limited to the following:
 - a. Generator paralleling sequence of operation.
 - b. Graphical User interface

PART 2 - PRODUCTS

2.1 ENGINE-GENERATOR SET

- A. Factory-assembled and -tested, engine-generator set.

- B. Mounting Frame: Maintain alignment of mounted components without depending on concrete foundation; and have lifting attachments.
1. Rigging Diagram: Inscribed on metal plate permanently attached to mounting frame to indicate location and lifting capacity of each lifting attachment and generator-set center of gravity.
- C. Capacities and Characteristics:
1. Power Output Ratings: Nominal ratings as indicated on drawings.
 2. Output Connections: Three-phase, four wire.
 3. Nameplates: For each major system component to identify manufacturer's name and address, and model and serial number of component.
- D. Generator-Set Performance for Sensitive Loads:
1. Oversizing generator compared with the rated power output of the engine is permissible to meet specified performance.
 - a. Nameplate Data for Oversized Generator: Show ratings required by the Contract Documents rather than ratings that would normally be applied to generator size installed.
 2. Steady-State Voltage Operational Bandwidth: 3 percent of rated output voltage from no load to full load.
 3. Transient Voltage Performance: Not more than 20 percent variation for 50 percent step-load increase or decrease. Voltage shall recover and remain within the steady-state operating band within 3 second.
 4. Steady-State Frequency Operational Bandwidth: Plus or minus 0.25 percent of rated frequency from no load to full load.
 5. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there shall be no random speed variations outside the steady-state operational band and no hunting or surging of speed.
 6. Transient Frequency Performance: Less than 2-Hz variation for 50 percent step-load increase or decrease. Frequency shall recover and remain within the steady-state operating band within three seconds.
 7. Output Waveform: At no load, harmonic content measured line to neutral shall not exceed 2 percent total with no slot ripple. Telephone influence factor, determined according to NEMA MG 1, shall not exceed 50 percent.
 8. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at system output terminals, system shall supply a minimum of 300 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to winding insulation or other generator system components.
 9. Excitation System: Performance shall be unaffected by voltage distortion caused by nonlinear load.
 - a. Provide permanent magnet excitation for power source to voltage regulator.
 10. Start Time: Comply with NFPA 110, Type 10, system requirements.

2.2 ENGINE

- A. Fuel: Ultra Low Sulfur Diesel Fuel oil, Grade DF-2.
- B. Rated Engine Speed: 1800 rpm.
- C. Lubrication System: The following items are mounted on engine or skid:
 - 1. Filter and Strainer: Rated to remove 90 percent of particles 5 micrometers and smaller while passing full flow.
 - 2. Thermostatic Control Valve: Control flow in system to maintain optimum oil temperature. Unit shall be capable of full flow and is designed to be fail-safe.
 - 3. Crankcase Drain: Arranged for complete gravity drainage to an easily removable container with no disassembly and without use of pumps, siphons, special tools, or appliances.
- D. Engine Fuel System:
 - 1. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow under starting and load conditions.
 - 2. Relief-Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.
- E. Coolant Jacket Heater: Electric-immersion type with circulating pump, factory installed in coolant jacket system. Comply with NFPA 110 requirements for Level 1 equipment for heater capacity. A minimum 9KW heater rated for 208VAC operation shall be provided.
- F. Governor: Electronic adjustable isochronous, with speed sensing.
- G. Cooling System: Closed loop, liquid cooled, with radiator factory mounted on engine-generator-set mounting frame and integral engine-driven coolant pump.
 - 1. Coolant: Solution of 50 percent ethylene-glycol-based antifreeze and 50 percent water, with anticorrosion additives as recommended by engine manufacturer.
 - 2. Size of Radiator: Adequate to contain expansion of total system coolant from cold start to 110 percent load condition.
 - 3. Expansion Tank: Constructed of welded steel plate and rated to withstand maximum closed-loop coolant system pressure for engine used. Equip with gage glass and petcock.
 - 4. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer.
 - a. Minimum ambient capability of 122 degree F up to 900ft above sea level.
 - 5. Coolant Hose: Flexible assembly with inside surface of nonporous rubber and outer covering of aging-, ultraviolet-, and abrasion-resistant fabric.
 - a. Rating: 50-psig (345-kPa) maximum working pressure with coolant at 180 deg F (82 deg C), and noncollapsible under vacuum.
 - b. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

- H. Muffler/Silencer: Minimum critical type, sized as recommended by engine/enclosure manufacturer and selected with exhaust piping system to not exceed engine manufacturer's engine backpressure requirements.
1. Minimum sound attenuation of 25 dB at 500 Hz.
 2. Sound level measured at a distance of 10 feet from exhaust discharge after installation is complete shall be 85 dBA or less.
- I. Air-Intake Filter: Heavy-duty, engine-mounted air cleaner with replaceable dry-filter element and "blocked filter" indicator.
- J. Starting System: 24-VDC electric, with negative ground.
1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in Part 1 "Project Conditions" Article.
 2. Cranking Motor: Dual heavy-duty unit that automatically engage and release from engine flywheel without binding.
 3. Cranking Cycle: Comply with requirements of NFPA 110 for Level 1 systems.
 4. Battery: Two (2) Group 8D, connected for 24VDC and a system cold cranking ampacity of 1400. Each battery in the system shall 12VDC and have 190AH rating for 20 hours.
 5. Battery Cable: Size as recommended by engine manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.
 6. Battery Compartment: Factory fabricated of metal with acid-resistant finish and thermal insulation. Thermostatically controlled heater shall be arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in Part 1 "Project Conditions" Article. Include accessories required to support and fasten batteries in place.
 7. Battery-Charging Alternator: Factory mounted on engine with solid-state voltage regulation and 35-A minimum continuous rating.
 8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit shall comply with UL 1236 and include the following features:
 - a. Operation: Equalizing-charging rate of 35 A shall be initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit shall then be automatically switched to a lower float-charging mode and shall continue to operate in that mode until battery is discharged again.
 - b. Automatic Temperature Compensation: Adjust float and equalize voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
 - c. Automatic Voltage Regulation: Maintain constant output voltage regardless of input voltage variations up to plus or minus 10 percent.
 - d. Ammeter and Voltmeter: Flush mounted in door. Meters shall indicate charging rates.
 - e. Safety Functions: Sense abnormally low battery voltage and close contacts providing low battery voltage indication on control and monitoring panel. Sense high battery voltage and loss of ac input or dc output of battery charger. Either condition shall close contacts that provide a battery-charger malfunction indication at system control and monitoring panel.
 - f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.

- g. Supply Voltage: 120V single phase

2.3 FUEL OIL STORAGE

- A. Comply with NFPA 30.
- B. Comply with all State of Rhode Island codes and requirements applicable to the installation of fuel oil systems.
- C. Subbase-Mounted double-wall Fuel Oil Tank: Factory installed and piped, complying with UL 142 and Rhode Island DES requirements for fuel oil tanks. Features include the following:
 - 1. Digital tank level indicator.
 - 2. Capacity: 48 hours of useable fuel at 100% load factor.
 - 3. Manual vandal-resistant fill cap with 5-gallon spill bucket accessible from outside the enclosure. A RI approved overfill prevention valve shall be installed on this manual fill and a digital fuel gage with high fuel light and audible alarm shall be included at the exterior fill location.
 - 4. Containment Provisions: Comply with requirements of authorities having jurisdiction.
 - 5. Level Control: A digital based, fully adjustable, fuel oil level controller shall be provided and pre-wired to floats/sensors inside the day tank to control operation of remote supply pump(s) at the main fuel oil storage tank (by others).
 - 6. Low-Level Alarm Sensor: Liquid-level device operates alarm contacts at 25 percent of tank capacity.
 - 7. High-Level Alarm Sensor: Liquid-level device operates alarm at 90% tank fill capacity as required by NFPA-30.
 - 8. Piping Connections: Factory-installed fuel supply and return lines from tank to engine; local fuel fill, vent line, overflow line; and tank drain line with shutoff valve. Fuel supply and return connections for fuel piping from main diesel tank supply, piping shall be routed internal to generator enclosure.
 - 9. Tank Signage: All four sides of the exterior of the tank shall be affixed with an NFPA 704 label, and the manual fill port location shall be labeled with signage indicating the facility tank designation number, petroleum product contained and safe maximum fill height that coincides with the high fuel alarm float.

2.4 CONTROL AND MONITORING

- A. Controls – Generator Set Mounted
 - 1. Provide a fully solid-state, microprocessor based, generator set control. The control panel shall be designed and built by the engine manufacturer. The control shall provide all operating, monitoring, and control functions for the generator set. The control panel shall provide real time digital communications to all engine and regulator controls via SAE J1939.
- B. Environmental

1. The generator set control shall be tested and certified to the following environmental conditions:
 - a. -40°C to +70°C Operating Range
 - b. 100% condensing humidity, 30°C to 60°C
 - c. IP22 protection for rear of controller; IP55 when installed in control panel
 - d. 5% salt spray, 48 hours, +38°C, 36.8V system voltage
 - e. Sinusoidal vibration 6G's RMS, 24-1000Hz
 - f. Electromagnetic Capability (89/336/EEC, 91/368/EEC, 93/44/EEC, 93/68/EEC, BS EN 50081-2, 50082-2)
 - g. Shock: withstand 15G

C. Functional Requirements

1. The following functionality shall be integral to the control panel.
 - a. The control shall include a minimum 5.5 inch, 480 x 320 pixel, white backlit graphical display with text based alarm/event descriptions.
 - b. The control shall include a minimum of 6-line data display
 - c. Generator set overview screen displaying critical generator set mechanical and electrical data on a single screen.
 - d. Audible horn for alarm and shutdown with horn silence switch
 - e. Standard ISO labeling
 - f. Multiple language capability
 - g. Remote start/stop control
 - h. Local run/off/auto control integral to system microprocessor
 - i. Cooldown timer
 - j. Speed adjust
 - k. Lamp test
 - l. Emergency stop push button
 - m. Voltage adjust
 - n. Voltage regulator V/Hz slope – adjustable
 - o. Password protected system programming

D. Digital Monitoring Capability

1. The controls shall provide the following digital readouts for the engine and generator. All readings shall be indicated in English units with capability to be displayed in metric.
2. Engine
 - a. Engine oil pressure
 - b. Engine oil temperature
 - c. Engine coolant temperature
 - d. Engine RPM
 - e. Battery volts
 - f. Engine hours
 - g. Engine crank attempt counter
 - h. Engine successful start counter
 - i. Service maintenance interval
 - j. Real time clock

- k. Engine exhaust stack temperature
 - l. Engine main bearing temperature
- 3. Generator
 - a. Generator AC volts (Line to Line, Line to Neutral and Average)
 - b. Generator AC current (Avg and Per Phase)
 - c. Generator AC Frequency
 - d. Generator kW (Total and Per Phase)
 - e. Generator kVA (Total and Per Phase)
 - f. Generator kVAR (Total and Per Phase)
 - g. Power Factor (Avg and Per Phase)
 - h. Total kW-hr
 - i. Total kVAR-hr
 - j. % kW
 - k. % kVA
 - l. % kVAR
 - m. Generator bearing temperature
 - n. Generator stator winding temperature
- 4. Voltage Regulation
 - a. Excitation voltage
 - b. Excitation current
- E. Alarms and Shutdowns
 - 1. The control shall monitor and provide alarm indication and subsequent shutdown for the following conditions per NFPA110/99. All alarms and shutdowns are accompanied by a time, date, and engine hour stamp that are stored by the control panel for first and last occurrence:
 - 2. Engine Alarm/Shutdown
 - a. Low oil pressure alarm/shutdown
 - b. High coolant temperature alarm/shutdown
 - c. Loss of coolant shutdown
 - d. Overspeed shutdown
 - e. Overcrank shutdown
 - f. Emergency stop shutdown
 - g. Low coolant temperature alarm
 - h. Low battery voltage alarm
 - i. High battery voltage alarm
 - j. Control switch not in auto position alarm
 - k. Battery charger failure alarm
 - 3. Generator Alarm/Shutdown
 - a. Generator over voltage
 - b. Generator under voltage

- c. Generator over frequency
 - d. Generator under frequency
 - e. Generator reverse power (real and reactive)
 - f. Generator overcurrent
 - g. Generator current balance
 - 4. Voltage Regulator Alarm/Shutdown
 - a. Loss of excitation alarm/shutdown
 - b. Instantaneous over excitation alarm/shutdown
 - c. Time over excitation alarm/shutdown
 - d. Rotating diode failure
 - e. Loss of sensing
 - f. Loss of PMG
- F. Inputs and Outputs
- 1. Programmable Digital Inputs
 - a. The controller shall include the ability to accept programmable digital input signals. The signals may be programmed for either high or low activation using programmable Normally Open or Normally Closed contacts.
 - 2. Programmable Discrete Outputs
 - a. The control shall include the ability to operate sixteen (16) discrete outputs, integral to the controller, which are capable of sourcing up to 300mA.
- G. Maintenance
- 1. All engine, voltage regulator, control panel and accessory units shall be accessible through a single electronic service tool. The following maintenance functionality shall be integral to the generator set control
 - a. Engine running hours display
 - a. Service maintenance interval running hours or calendar days
 - b. Engine crank attempt counter
 - c. Engine successful starts counter
 - d. 40 events are stored in control panel memory
 - e. Chronological status event log capable of displaying a sequence of event leading up to a generator set shutdown
 - f. Programmable cycle timer that starts and runs the generator for a predetermined time. The timer shall use 7 user-programmable sequences that are repeated in a 7-day cycle. Each sequence shall have the following programmable set points:
 - 1) Day of week
 - 2) Time of day to start
 - 3) Duration of cycle
- H. Remote Communications

1. The control shall include Modbus TCP communications via Ethernet 10BASE-T and Modbus RTU communications via RS-485 half duplex with configurable baud rates from 2.4k to 57.6k.

- I. Remote Emergency-Stop Switch: Flush; surface mounted in NEMA 3R enclosure, unless otherwise indicated; and labeled "Emergency Generator Shut-Down". Push button shall be protected from accidental operation by hinged cover. Provide a minimum of one remote stops per generator and locate as indicated on the contract documents.

2.5 GENERATOR OVERCURRENT AND FAULT PROTECTION

- A. The generator output terminal box shall be provided with fully rated copper bus with NEMA hole pattern punching.
- B. Donut style differential CT's (provided by the switchgear manufacturer) shall be securely mounted on the winding neutral cables with secondaries wired to shorting type terminal block for extension to the paralleling switchgear provided multifunction protective relay. Retain one or more paragraphs in this Article to specify disconnect switch(es) and protective devices for the generator (alternator) component of generator set. Revise as required to accommodate multiple output devices. See Editing Instruction No. 10 in the Evaluations.

2.6 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

- A. Comply with NEMA MG 1.
- B. Drive: Generator shaft shall be directly connected to engine shaft. Exciter shall be rotated integrally with generator rotor.
- C. Electrical Insulation: Class H or Class F. Minimum of 125°C over 40°C ambient temperature rise.
- D. Stator-Winding Leads: Brought out to terminal box to permit future reconnection for other voltages if required.
- E. Construction shall prevent mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.
- F. Enclosure: Drip proof.
- G. Instrument Transformers: Mounted within generator enclosure.
- H. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
 1. Adjusting rheostat on control and monitoring panel shall provide plus or minus 5 percent adjustment of output-voltage operating band.
- I. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

- J. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.
- K. Subtransient Reactance: 14 percent, maximum.

2.7 OUTDOOR GENERATOR-SET ENCLOSURE (COMMON ENCLOSURE FOR TWO GENERATORS)

- A. The generator set shall be enclosed in a walk-in weatherproof enclosure as detailed on the drawings and constructed of aluminum throughout. The housing shall be designed to accommodate heavy snow loads and shall be equipped with motorized intake and exhaust louvers, pre-wired and pre-piped prior to shipment. Housing shall be Pritchard Brown #2130, and shall be constructed per IBC and BOCA requirements. Minimum performance requirements are as follows:
 - 1. Built to UL2200 standards
 - 2. IBC Seismically certified package
 - 3. Rigidity wind test equal to 115MPH
 - 4. Roof load equal to 50-pounds. per square foot
 - 5. Floor load equal to 200-pounds. Per square foot
 - 6. Rain test equal to 4 inches per hour
- B. Housing shall have hinged, lockable, keyed alike doors with stainless steel hardware. The doors shall be so arranged as to provide access to vital parts of the generator set for service. Oil pan well and oil drain extension shall be included. Coolant drain and oil drain shall be extended outside housing with lockable rustproof valves.
- C. Housing shall be prepainted with manufacturers standard baked-on aluminum exterior finish or spray painted with custom color. Baked-on or spray paint color shall be as selected by the Architect at the time of submission. Submit paint chart of baked-on finishes with submittal. Interior shall be anodized aluminum.
- D. Housing shall include sound attenuation with thickness and type of sound insulation and intake and exhaust baffles necessary to achieve a minimum reduction of 30 dB at 1 meter in a free field environment to achieve a maximum resultant sound level of 65dBA @ 23'. There shall be no puretone. Walls and ceiling shall be lined with perforated aluminum liner.
- E. Housing shall include motorized intake and exhaust air louvers for the generator set. Louvers shall be normally open, and electrically held closed, so that they immediately open on loss of power, or on a start command to the generator set.
- F. The maximum designed airflow velocity through the enclosure shall not exceed 700 feet per minute.
- G. Emergency Generator Break-Glass Station
 - 1. Furnish and install an emergency generator break-glass station for each generator, mounted and labeled on the exterior of the enclosure at each personnel access door so that it is within sight of the nearest building. Enclosure manufacturer shall consult with the Electrical

- Subcontractor as to the final location and arrangement of the generator to determine the proper location of the station.
2. Emergency generator break-glass station shall be as manufactured by Pilla
 3. Station shall be factory wired to the emergency generator stop contacts. Manual intervention shall be required to restart the generator following actuation of the emergency stop pushbutton.
- H. A lockable manual fuel fill with exterior 5 gallon spill bucket shall be furnished with an overfill prevention valve.
- I. Stand alone, factory plumbed inside the enclosure, automated programmable, fuel filtration and maintenance system shall be provided for the diesel fuel storage tank. The system shall be capable of removing water, sediment, particulate, and microbial contamination below levels stated in ASTM D975 (Standard Specification for Diesel Fuel Oils). The systems shall fully plumbed and wired within the enclosure.
- J. Housing shall be equipped with enclosed and gasketed LED fixtures, and on/off switch, and two (2) duplex GFCI receptacles. The enclosure shall also have two (2) DC lighting fixtures with self-contained battery with 120 volt input from enclosure panel.
- K. Housing shall be equipped with a minimum of two (2) 5kw electric unit heaters, prewired to the enclosure panelboard to maintain a minimum of 50°F with an exterior design temperature of 0°F.
- L. Housing shall be equipped with a thermostatically control exhaust fan.
- M. Housing shall be completely wired prior to shipment including main circuit breakers and enclosure panelboard as indicated on the drawings. Lugs shall be provided for incoming feeders.
- N. Enclosure power panelboard shall be 225A, 3 phase, 4 wire, 208/120 volt with 200 ampere, 3 pole main circuit breaker and branch breakers, sized as required, (minimum 20 ampere, single phase) for the following equipment including, but not limited to:
1. Jacket water heater
 2. Battery pad heater
 3. Enclosure heaters (2)
 4. Fuel polishing system
 5. Exhaust fan
 6. Battery charger
 7. Motorized dampers
 8. AC Lights and GFCI receptacles
 9. Circuit for ATC (2)
 10. Six (6) 20 ampere, single pole spares
- O. Non-rusting stairs and platforms constructed of grating to prevent snow/ice build up and aid in adverse weather traction shall be provided for one of the two personnel access doors. The stairs/platforms shall ship separate for installation on site by the installing electrical contractor. See bid documents for stair layout/coordination.
- P. The generator housing manufacturer shall commission the services of a registered Professional Engineer from the State of Rhode Island to certify that the construction of the generator housing

is in accordance with Seismic Zone Group IIB with effective peak ground acceleration of 0.10. The registered professional engineer shall stamp the enclosure shop drawings prior to submission, indicating compliance.

2.8 VIBRATION ISOLATION DEVICES

- A. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.
1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 2. Outside Spring Diameter: Not less than 80 percent of compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.9 LOAD BANK

- A. Description: Permanent, outdoor, weatherproof, remote-controlled, forced-air-cooled, resistive unit capable of providing a balanced 3-phase, delta-connected load to generator set at 100 percent rated-individual generator capacity, at unity power factor. Unit shall be capable of selective control of load in 25 percent steps and with minimum step changes of approximately 5 and 10 percent available.
- B. Resistive Load Elements: Corrosion-resistant chromium alloy with ceramic and steel supports. Elements shall be double insulated and designed for repetitive on-off cycling. Elements shall be mounted in removable aluminized-steel heater cases.
- C. Load-Bank Heat Dissipation: Integral fan with totally enclosed motor shall provide uniform cooling airflow through load elements. Airflow and coil operating current shall be such that, at maximum load, with ambient temperature at the upper end of specified range, load-bank elements operate at not more than 50 percent of maximum continuous temperature rating of resistance elements.
- D. Load Element Switching: Remote-controlled contactors switch groups of load elements. Contactor coils are rated 120 V. Contactors shall be located in a separate NEMA 250, Type 3R enclosure within load-bank enclosure, accessible from exterior through hinged doors with tumbler locks.
- E. Contactor Enclosures: Heated by thermostatically controlled strip heaters to prevent condensation.
- F. Load-Bank Enclosures: NEMA 250, Type 3R, complying with NEMA ICS 6. Louvers at cooling-air intake and discharge openings shall prevent entry of rain and snow. Openings for airflow shall be screened with 1/2-inch square, galvanized-steel mesh.

- G. Protective Devices: Power input circuits to load banks shall be fused, and fuses shall be selected to coordinate with emergency distribution switchgear circuit breaker and shall both be by the same manufacturer. Fuse blocks shall be located in contactor enclosure. Cooling airflow and overtemperature sensors shall automatically shut down and lock out load bank until manually reset. Safety interlocks on access panels and doors shall disconnect load power, control, and heater circuits. Fan motor shall be separately protected by overload and short-circuit devices. Short-circuit devices shall be noninterchangeable fuses with 200,000-A interrupting capacity.
- H. Control Panel: Provide one (1) integral to the load bank with a control power switch and pilot light, and switches controlling groups of load elements. The controller shall not require a separate source of control power or UPS power.
- I. Remote-Control Panel: Provide 1 separate from load bank in NEMA 250, Type 1 enclosure with a control power switch and pilot light, and switches controlling groups of load elements. The remote controller shall not require a separate source of control power or UPS power and shall be mounted integral to the generator control HMI structure in the paralleling switchgear.
- J. Control Sequence: Control panel may be preset for adjustable single-step loading of generator during automatic exercising.

2.10 NEUTRAL GROUNDING RESISTOR

A. General

1. Provide one (1) new NEMA 3R neutral grounding resistor for each generator set to be installed outdoor adjacent to the generator and switchgear enclosures as shown on the plan. The neutral ground resistors and enclosures shall be designed, constructed and tested in accordance with the latest applicable sections of NEMA, ANSI and IEEE 32-1972.
2. The grounding resistor(s) shall be manufacturer built complying with IEEE Standard 32 and rated for the system line-to-ground voltage with a current rating as shown on the Drawings. Resistors shall be capable of carrying rated ampacity for a time duration of 10 seconds without exceeding a temperature rise of 750°F.
3. Resistor units shall be edgewound type constructed of stainless steel with welded connections between units. The edgewound helix strap shall be wound around a refractory core reinforced by longitudinal steel supports. Each resistor element shall be individually supported at each end by ceramic insulators and shall be designed to permit thermal expansion.
4. The frame assembly for edgewound resistor units shall be constructed of corrosion resistant hot-dipped galvanized angle. All members shall be assembled using outdoor hardware and be of sufficient strength to withstand severe mechanical stress.
5. The grounding resistor shall be provided with a screened safety enclosure with provisions for lifting. It shall be suitable for suspending from structure above, indoor. The unit shall be adequately supported and mounted above each generator utilizing heavy duty structurally suitable unistrut frame and suitable cross braced to avoid sway from the air turbulence associated with the large volumes of air intake from the generator radiator fans.

6. The resistor shall incorporate a manufacturer installed ground fault sensing current transformer, C10 Relay Class, with entrance bushings and cable termination points for wiring interface with the ground fault sensing relays and alarm circuitry in the generator paralleling switchgear by the Installing Contractor. Bolt on ventilated covers shall be attached to the resistor frame. Neutral ground conductor connections to the resistor shall be terminated inside of the resistor enclosure, not externally.
7. Additional Requirements
 - a. Ground sensing current transformer
 - b. Entrance bushings and termination bars
 - c. Transformer standoff insulators
 - d. Mounting Stand
8. The grounding resistor shall be manufactured by Post Glover, IPC or equal.

A.

2.11 SOURCE QUALITY CONTROL

- A. Prototype Testing: Factory test engine-generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.
 1. Tests: Comply with NFPA 110, Level 1 Energy Converters and with IEEE 115.
- B. Project-Specific Equipment Tests: Before shipment, factory test engine-generator set and other system components and accessories manufactured specifically for this Project. Perform tests at rated load and power factor. Include the following tests:
 1. Test components and accessories furnished with installed unit that are not identical to those on tested prototype to demonstrate compatibility and reliability.
 2. Full load run.
 3. Maximum power.
 4. Voltage regulation.
 5. Transient and steady-state governing.
 6. Single-step load pickup.
 7. Safety shutdown.
 8. Provide 14 days' advance notice of tests and opportunity for observation of tests by Owner's representative.
 9. Report factory test results within 10 days of completion of test.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, equipment bases, and conditions, with Installer present, for compliance with requirements for installation and other conditions affecting packaged engine-generator performance.

- B. Examine roughing-in of piping systems and electrical connections. Verify actual locations of connections before packaged engine-generator installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with packaged engine-generator manufacturers' written installation and alignment instructions.
- B. Install packaged engine generator to provide access, without removing connections or accessories, for periodic maintenance.
- C. Install Schedule 40, black steel piping with welded joints for cooling water piping between engine-generator set and heat exchanger.
- D. Install Schedule 40, black steel piping with welded joints and connect to engine muffler. Install thimble at wall. Piping shall be same diameter as muffler outlet.
 - 1. Install condensate drain piping to muffler drain outlet full size of drain connection with a shutoff valve, stainless-steel flexible connector, and Schedule 40, black steel pipe with welded joints.
- E. Electrical Wiring: Install electrical devices furnished by equipment manufacturers but not specified to be factory mounted.
- F. Store equipment in a clean, dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping and specialties.
- B. Connect fuel, cooling-system, and exhaust-system piping adjacent to packaged engine generator to allow service and maintenance.
- C. Connect cooling-system water piping to engine-generator set and heat exchanger with flexible connectors.
- D. Connect engine exhaust pipe to engine with flexible connector.
- E. Connect fuel piping to engines with a gate valve and union and flexible connector.
- F. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 IDENTIFICATION

- A. Identify system components according to Section 230553 "Identification for Piping and Equipment" and Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections. Report results in writing.
- B. Perform tests and inspections and prepare test reports.
- C. Tests and Inspections:
 - 1. Perform test recommended by manufacturer and testing described below:
 - 2. Generator Pre-Testing
 - a. Pre-testing is required to prepare for the Installation Acceptance Test. Prior to scheduling the Installation Acceptance Test, a Pre-Acceptance Test of the system is performed by the contractor to verify that the system is operating properly and is ready for the Installation Acceptance Test.
 - b. Pre-Acceptance Test Procedure:
 - 1) The Pre-Acceptance Test is typically performed two weeks prior to scheduling the Installation Acceptance Test.
 - 2) Verify that the generator starts and runs when normal power is shut off.
 - 3) Operate the Generator long enough to assure it is operating properly, to verify it starts and transfers load to emergency loads in less than 10 seconds, and that all connected equipment is operating properly.
 - 4) Verify that dampers open and ancillaries operate properly.
 - 5) Verify that fuel delivery system is operational and functioning as designed.
 - 6) Check and adjust equipment
 - 7) Set and verify time and delays on transfer switches.
 - 8) Correct deficiencies and verify that the system is ready for the Installation Acceptance Test.
 - 9) The Owner's representative should witness this test.
 - 3. NFPA 110 Acceptance Tests: Perform tests required by NFPA 110 that are additional to those specified here including, but not limited to, single-step full-load pickup test.
 - 4. Battery Tests: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.
 - a. Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions.
 - b. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery.
 - c. Verify acceptance of charge for each element of the battery after discharge.

- d. Verify that measurements are within manufacturer's specifications.
- 5. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.
- 6. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine-generator system before and during system operation. Check for air, exhaust, and fluid leaks.
- 7. Exhaust-System Back-Pressure Test: Use a manometer with a scale exceeding 40-inch wg. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.
- 8. Exhaust Emissions Test: Comply with applicable government test criteria.
- D. Coordinate tests with tests for transfer switches and run them concurrently.
- E. Test instruments shall have been calibrated within the last 12 months, traceable to standards of NIST, and adequate for making positive observation of test results. Make calibration records available for examination on request.
- F. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
- G. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
- H. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- I. Remove and replace malfunctioning units, reinspect at a minimum and retest as required by owner.
- J. Report results of tests and inspections in writing. Record adjustable relay settings and measured insulation resistances, time delays, and other values and observations. Attach a label or tag to each tested component indicating satisfactory completion of tests.
- K. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each power wiring termination and each bus connection. Remove all access panels so terminations and connections are accessible to portable scanner.
 - 1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan 11 months after date of Substantial Completion.
 - 2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - 3. Record of Infrared Scanning: Prepare a certified report that identifies terminations and connections checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- L. Temporary Heating: Apply temporary heat to generator, according to manufacturer's written instructions, throughout periods when switchgear environment is not controlled for temperature and humidity within manufacturer's stipulated service conditions.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchgear.
 - 1. Training session shall be video recorded by manufacturer or manufacturer's representative/agent. Video recording shall be provided to owner in electronic format and on DVD for their use.
 - 2. Manufacturer shall provide two (2) individual eight (8) hour training sessions to be held at the owner's convenience.
 - a. Provide all written documentation detailing training sessions scope and agenda including any and all presentation materials to ownership for review and approval at 30 day prior to first scheduled training day. Do not proceed with training until owner approval is provided.

END OF SECTION

SECTION 265100 - LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Lighting fixtures.
 - 2. Emergency lighting units.
 - 3. Exit signs.
 - 4. Lighting fixture supports.

- B. Related Sections:

- 1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
 - 2. Section 262726 "Wiring Devices" for manual wall-box dimmers for incandescent lamps.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color-rendering index.
- C. LER: Luminaire efficacy rating.
- D. Lumen: Measured output of lamp and luminaire, or both.
- E. Luminaire: Complete lighting fixture, including ballast housing if provided.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of lighting fixture, arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:
 - 1. Physical description of lighting fixture including dimensions.
 - 2. Emergency lighting units including battery and charger.
 - 3. Energy-efficiency data.

- B. Installation instructions.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Equipment shall be certified for use in the State of the project and shall meet the State Energy Code and local energy ordinances. Comply with governing codes and regulations. Provide products of acceptable manufacturers, which have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. LED luminaire testing data shall be provided in accordance with the Requirements IES-LM-80-08
- D. Comply with NFPA 70.

1.8 COORDINATION

- A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

1.9 WARRANTY

- A. Special Warranty for Emergency Lighting Batteries: Manufacturer's standard form in which manufacturer of battery-powered emergency lighting unit agrees to repair or replace components of rechargeable batteries that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period for Emergency Lighting Unit Batteries: 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining nine years.

2. Warranty Period for Self-Powered Exit Sign Batteries: Seven years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for the remaining six years.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR LIGHTING FIXTURES AND COMPONENTS

- A. LED Fixtures: Comply with UL 8750.
- B. Metal Parts: Free of burrs and sharp corners and edges.
- C. Sheet Metal Components: Steel unless otherwise indicated. Form and support to prevent warping and sagging.
- D. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- E. Diffusers and Globes:
 1. Acrylic Lighting Diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
 - a. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.
 - b. UV stabilized.
 2. Glass: Annealed crystal glass unless otherwise indicated.

2.2 LED FIXTURES

- A. General Requirements for LED lighting fixtures:
 1. All fixtures shall meet all the applicable standards of:
 - a. ANSI
 - b. IESNA
 - c. UL
 - d. NEMA
 - e. JEDEC
 - f. IEEE-SA
 - g. DOE (CBEA)
 - h. Energy Star® - EPA
 2. All LED fixtures provided shall be manufactured and tested in accordance with the latest edition of the following Standards:

- a. ANSI/ANSI C78.377-2011
 - b. ANSI/IES RP-16-10
 - c. ANSI/UL 8750-2009
 - d. IES LM-79-08
 - e. IES LM-80-08
 - f. IES LM
 - g. IES TM-21-11
3. Certificates of compliance to these standards shall be furnished with all LED fixtures. Any fixture not bearing these listings / statements of compliance will be rejected.
 4. All types of LED fixtures provided shall be tested for at least 6,000 hours with data collection at a minimum of every 1,000 hours in accordance with the requirements of IES LM-80-08. In addition, the fixture shall be tested in two case temperatures (Ts); recommend nominal 55°C and 85°C. Certificates of compliance to these standards shall be furnished with all LED fixtures. Each fixture type shall be provided with a LM-80 test report. Any fixture not provided with this report will be rejected.
 5. All types of LED fixtures provided shall be provided with documented successful testing in accordance with the US DOW CALiPER program. Any fixture not provided with this report will be rejected.
 6. Color Temperature: 3500K, unless indicated otherwise
 7. Color Rendering Index: greater than 90 in accordance with the requirements of CIE TCI-69.
- B. All LEDs shall be batch sorted for color and brightness consistency and shall be manufactured by the same LED manufacturer.
- C. Substitution of LEDs by other manufacturers shall be equal in all respects of initial and maintained lumen output, lamp life, color consistency and compatibility with specified equipment. LED's shall be warm white color temperature consistent to 3500 Kelvin, unless noted otherwise in the luminaire schedule. Substitutions shall be submitted in the form of both manufacturer's printed data and corresponding samples for review.
- D. LED lumen output shall be tested in accordance with applicable IESNA LM-79 and LM-80 methods with no more than 30% depreciation in initial lumen output after 50,000 plus hours of operation for white LEDs and no more than 50% depreciation in initial lumen output after 30,000 plus hours for colored LEDs.
- E. LED Drivers: Reverse polarity protection, open circuit protection. Minimum 80% efficiency. Class A noise rating.
- F. Dimming: LED system capable of full and continuous dimming.
- G. Luminaire manufacturers wishing to supply LEDs in their products other than those listed above must verify that the LED manufacturer has been fabricating LEDs for a minimum of five years.

2.3 EXIT SIGNS

- A. General Requirements for Exit Signs: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC Operation: LEDs, 50,000 hours minimum rated lamp life.
2. Self-Powered Exit Signs (Battery Type): Integral automatic charger in a self-contained power pack.
 - a. Battery: Sealed, maintenance-free, nickel-cadmium type.
 - b. Charger: Fully automatic, solid-state type with sealed transfer relay.
 - c. Operation: Relay automatically energizes lamp from battery when circuit voltage drops to 80 percent of nominal voltage or below. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
 - d. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
 - e. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
 - f. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.4 EMERGENCY LIGHTING UNITS

A. General Requirements for Emergency Lighting Units: Self-contained units complying with UL 924.

1. Battery: Sealed, maintenance-free, lead-acid type.
2. Charger: Fully automatic, solid-state type with sealed transfer relay.
3. Operation: Relay automatically turns lamp on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
4. Test Push Button: Push-to-test type, in unit housing, simulates loss of normal power and demonstrates unit operability.
5. LED Indicator Light: Indicates normal power on. Normal glow indicates trickle charge; bright glow indicates charging at end of discharge cycle.
6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

2.5 LIGHTING FIXTURE SUPPORT COMPONENTS

- A. Comply with Section 260529 "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

- C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.
- D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- E. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.
- F. Hook Hangers: Integrated assembly matched to fixture and line voltage and equipped with threaded attachment, cord, and locking-type plug.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Lighting fixtures:
 - 1. Set level, plumb, and square with ceilings and walls unless otherwise indicated.
- B. Suspended Lighting Fixture Support:
 - 1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 2. Stem-Mounted, Single-Unit Fixtures: Suspend with twin-stem hangers.
 - 3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.
 - 4. Connect support wires or rods to building structure.
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery and retransfer to normal.
- B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION

SECTION 283111 - DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fire-alarm control unit.
 - 2. Manual fire-alarm boxes.
 - 3. System smoke detectors.
 - 4. Heat detectors.
 - 5. Notification appliances.
 - 6. Addressable interface device.
 - 7. Radio alarm transmitter.

1.3 DEFINITIONS

- A. LED: Light-emitting diode.
- B. NICET: National Institute for Certification in Engineering Technologies.

1.4 SYSTEM DESCRIPTION

- A. Noncoded addressable system, with automatic sensitivity control of smoke detectors and multiplexed signal transmission, dedicated to fire-alarm service only.

1.5 ACTION SUBMITTALS

- A. General Submittal Requirements:
 - 1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Engineer.
 - 2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.

- c. Licensed or certified by authorities having jurisdiction.
- B. Product Data: For each type of product indicated.
- C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 - 2. Primary Power Supply:
 - a. Primary power supply calculations which include all system requirements including any requirements for electrical door unlocking systems, visual signaling appliances, or any other auxiliary function powered by the system. The quantity, location, model or part number, rated capacity and loaded capacity shall be included for each power supply. Sizing shall be determined in accordance with the results of these calculations.
 - 3. Include voltage drop calculations for circuits.
 - a. Voltage drop calculations shall list the percentage of drop voltage. Provide power supply calculations that include all system requirements including any requirements for notification appliance circuits, or any other auxiliary function powered by the system. All notification appliance circuit(s) shall be sized with 10% voltage drop at 24 volts, with the last device operating no less than 20.4 volts
 - 4. Include battery-size calculations.
 - a. Standby battery capacity calculations. Battery calculations shall list the type of devices (detection, monitoring, and control), and modules; quantities, unit and extended amperage draw for quiescent and alarm conditions, total amperage draw and battery amp/hour rating. For design criteria, the calculated load shall be the design load, including spare capacity. In addition, the battery capacity used to meet the calculated load shall be a maximum of 80 percent of the amp/hour rating listed by the manufacturer
 - b. Fire alarm battery capacity shall be calculated in the following manner using the following definitions:
 - 1) Definitions:
 - a) $A(s)$ = Ampere in standby
 - b) $A(a)$ = Ampere in Alarm

$$\begin{array}{ll}
 \text{Standby current at the panel} & = A(s) \\
 \text{Additional panel capacity of 25\%} & = A(s) \times 25\%. \\
 \text{Total Standby current} & = A(s) + (A(s) \times 25\%)
 \end{array}$$

$$\begin{array}{ll}
 \text{Standby Time} & = 24 \text{ Hrs (24 hours minimum per NFPA 72)} \\
 \text{Standby amp-hours} & = 24 \text{ Hrs} \times (A(s) + (A(s) \times 25\%))
 \end{array}$$

$$\begin{array}{ll}
 \text{Alarm current at panel} & = A(a) \\
 \text{Additional panel capacity of 25\%} & = A(a) \times 25\%.
 \end{array}$$

$$\text{Total Alarm current} = A(a) + (A(a) \times 25\%)$$

$$\text{Alarm time (15 minutes)} = 0.25 \text{ Hrs (15 minutes minimum per NFPA 72)}$$

$$\text{Alarm amp-hours} = 0.25 \text{ Hrs} \times (A(a) + (A(a) \times 25\%))$$

- 2) Minimum total amp-hours required:
 - a) $(\text{Standby amp-hours} + \text{Alarm amp-hours}) = 60 \text{ AH or } (24 \text{ Hrs} \times (A(s) + (A(s) \times 25\%))) + (0.25 \text{ Hrs} \times (A(a) + (A(a) \times 25\%)))$
5. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
6. Include voice/alarm signaling-service equipment rack or console layout, grounding schematic, amplifier power calculation, and single-line connection diagram.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. Deliver copies to authorities having jurisdiction and include the following:
 1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 3. Record copy of site-specific software.
 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 5. Manufacturer's required maintenance related to system warranty requirements.
 6. Abbreviated operating instructions for mounting at fire-alarm control unit.
- B. Software and Firmware Operational Documentation:
 1. Software operating and upgrade manuals.
 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 3. Device address list.

4. Printout of software application and graphic screens.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
 1. Manual stations.
 2. Heat detectors.
 3. Smoke detectors.
- B. Fire-alarm signal shall initiate the following actions:
 1. Continuously operate alarm notification appliances.
 2. Identify alarm at fire-alarm control unit.
 3. Transmit an alarm signal to the remote alarm receiving station.
 4. Activate alarm communication system.
 5. Record events in the system memory.
- C. System trouble signal initiation shall be by one or more of the following devices and actions:
 1. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.

2. Loss of primary power at fire-alarm control unit.
3. Ground or a single break in fire-alarm control unit internal circuits.
4. Abnormal ac voltage at fire-alarm control unit.
5. Break in standby battery circuitry.
6. Failure of battery charging.
7. Abnormal position of any switch at fire-alarm control unit.

- D. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit.

2.2 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder.
2. Addressable initiation devices that communicate device identity and status.
 - a. Smoke sensors shall additionally communicate sensitivity setting.
 - b. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 3 line(s) of 80 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
 - a. Initiating Device Circuits: Style D.
 - b. Notification Appliance Circuits: Style Z.
 - c. Signaling Line Circuits: Style 2.

D. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.

- E. Alarm Signaling Service: Central emergency communication system with redundant preamplifiers, amplifiers, and tone generators as a special module that is part of fire-alarm control unit.
- F. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, and digital alarm radio transmitters shall be powered by 24-V dc source.
 - 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- G. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.3 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Single-action mechanism, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 2. Station Reset: Key- or wrench-operated switch.
 - 3. Indoor Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm. Lifting the cover actuates an integral battery-powered audible horn intended to discourage false-alarm operation.
 - a. Indoor protective shield shall be provided within the generator enclosures.

2.4 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Detectors shall be four-wire type.
 - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 - 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - 6. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
- B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

2.5 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated.
 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.6 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- B. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn, using the coded signal prescribed in UL 464 test protocol.
- D. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
 1. Rated Light Output:
 - a. 15/30/75 cd, selectable in the field.
 2. Mounting: Wall mounted unless otherwise indicated.

3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, red.

E. Tone Notification Appliances:

1. Appliances shall comply with UL 1480 and shall be listed and labeled by an NRTL.
2. High-Range Units: Rated 2 to 15 W.
3. Low-Range Units: Rated 1 to 2 W.
4. Mounting: semirecessed or surface mounted and bidirectional.
5. Matching Transformers: Tap range matched to acoustical environment of speaker location.

2.7 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.

2.8 RADIO ALARM TRANSMITTER

- A. Transmitter shall comply with NFPA 1221 and shall be listed and labeled by an NRTL.
- B. Comply with 47 CFR 90.
- C. Description: Manufacturer's standard commercial product; factory assembled, wired, tested, and ready for installation and operation.
1. Packaging: A single, modular, NEMA 250, Type 1 metal enclosure with a tamper-resistant flush tumbler lock.
 2. Signal Transmission Mode and Frequency: VHF or UHF 2-W power output, coordinated with operating characteristics of the established remote alarm receiving station designated by Owner.
 3. Normal Power Input: 120-V ac.
 4. Secondary Power: Integral-sealed, rechargeable, 12-V battery and charger. Comply with NFPA 72 requirements for battery capacity; submit calculations.
 5. Antenna: Omnidirectional, coaxial half-wave, dipole type with driving point impedance matched to transmitter and antenna cable output impedance. Wind-load strength of antenna and mounting hardware and supports shall withstand 100 mph with a gust factor of 1.3 without failure.
 6. Antenna Cable: Coaxial cable with impedance matched to the transmitter output impedance.
 7. Antenna-Cable Connectors: Weatherproof.
 8. Alarm Interface Devices: Circuit boards, modules, and other auxiliary devices, integral to the transmitter, matching fire-alarm and other system outputs to message-generating inputs of the transmitter that produce required message transmissions.

- D. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit or from its own internal sensors or controls and shall automatically transmit signal along with a unique code that identifies the transmitting station to the remote alarm receiving station. Transmitted messages shall correspond to standard designations for fire-reporting system to which the signal is being transmitted and shall include separately designated messages in response to the following events or conditions:
1. Transmitter Low-Battery Condition: Sent when battery voltage is below 85 percent of rated value.
 2. System Test Message: Initiated manually by a test switch within the transmitter cabinet, or automatically at an optionally preselected time, once every 24 hours, with transmission time controlled by a programmed timing device integral to transmitter controls.
 3. Transmitter Trouble Message: Actuated by failure, in excess of one-minute duration, of the transmitter normal power source, derangement of the wiring of the transmitter, or any alarm input interface circuit or device connected to it.
 4. Local Fire-Alarm-System Trouble Message: Initiated by events or conditions that cause a trouble signal to be indicated on the building system.
 5. Local Fire-Alarm-System Alarm Message: Actuated when the building system goes into an alarm state. Identifies device that initiated the alarm.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72 for installation of fire-alarm equipment.
- B. Install wall-mounted equipment, with tops of cabinets not more than 72 inches above the finished floor.
- C. Audible Alarm-Indicating Devices: Install not less than 6 inches below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- D. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches below the ceiling.
- E. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches above the finished floor.

3.2 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.3 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.4 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Tests and Inspections:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 - 3. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- D. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION

SECTION 31 0513 - SOILS FOR EARTHWORK

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Subsoil materials.
 - 2. Topsoil materials.
- B. Related Sections:
 - 1. Section 31 2213 - Rough Grading.
 - 2. Section 31 2317 - Trenching.
 - 3. Section 31 2323 – Fill.
 - 4. Section 32 9113 – Soil Preparation: Soil Supplements.
 - 5. Section 32 9200 – Turf and Grasses.
- C. Rhode Island Department of Transportation (RIDOT) Standard Specifications for Road and Bridge Construction
- D. Section 01 3300 - Submittal Procedures: Requirements for submittals.
- E. Materials Source: Submit name of imported materials source.

1.2 QUALITY ASSURANCE

- A. Furnish each soil material from single source throughout the Work.
- B. Perform Work in accordance with the RIDOT Standard Specifications for Road and Bridge Construction.

PART 2 PRODUCTS

- 2.1 Subsoil Type: If suitable, excavate and reuse existing materials
 - 1. Graded. Must be free of lumps and rocks greater than 3 inches.

2.2 TOPSOIL MATERIALS

- A. Topsoil Type: Conforming to the RIDOT Standard Specifications for Road and Bridge Construction.
 - 1. Reuse excavated soil material if in conformance with the RIDOT Standard Specifications for Road and Bridge Construction.
 - 2. Graded.
 - 3. Free of roots, rocks larger than 3 inches, debris, large weeds and foreign matter.
- B. Section 01 4000 - Quality Requirements: Testing and Inspection Services: Testing and analysis of soil material.

- C. Testing and Analysis of Subsoil Material: Perform in accordance with the RIDOT Standard Specifications for Road and Bridge Construction.
- D. Testing and Analysis of Topsoil Material: Perform in accordance with the RIDOT Standard Specifications for Road and Bridge Construction
- E. When tests indicate materials do not meet specified requirements, change material and retest.
- F. Furnish materials of each type from the same source throughout the Work.

PART 3 EXECUTION

3.1 EXCAVATION

- A. Excavate soils from designated areas. Strip topsoil to full depth of topsoil in designated areas.
- B. Stockpile excavated material meeting requirements for subsoil and topsoil. Remove excess excavated materials not intended for reuse from the site.
- C. Remove excavated materials not meeting requirements for subsoil or topsoil from the site.

3.2 STOCKPILING

- A. Stockpile materials on site designated by Engineer.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Prevent intermixing of soil types or contamination.
- E. Direct surface water away from the stockpile site to prevent erosion or deterioration of materials.
- F. Stockpile unsuitable materials, until disposed of, on impervious material and cover to prevent erosion and/or leaching.

3.3 STOCKPILE CLEANUP

- A. Remove the stockpile and leave the area in clean and neat condition. Grade the site surface to prevent free standing surface water.
- B. When a borrow area is indicated, leave the area in clean and neat condition. Grade the site surface to prevent free standing surface water.

END OF SECTION

SECTION 31 1000 - SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Removing surface debris.
 - 2. Removing designated paving, curbs, and demolition materials
 - 3. Removing designated trees, shrubs, and other plant life.
- B. Related Sections:
 - 1. Section 31 2213 - Rough Grading.
 - 2. Section 31 2316 - Excavation.
 - 3. Section 31 2317 - Trenching.

1.2 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Requirements for submittals.

1.3 QUALITY ASSURANCE

- A. Perform Work in accordance with the Rhode Island Department of Transportation (RIDOT) Standard Specifications for Road and Bridge Construction.

PART 2 EXECUTION

2.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Verification of existing conditions before starting work.

2.2 PREPARATION

- A. Call Local Utility Line Information service, Dig Safe (888) DIG-SAFE not less than 72 hours before performing Work.

2.3 PROTECTION

- A. Locate, identify, and protect utilities indicated to remain from damage.

2.4 CLEARING

- A. Clear areas required for access to the site and execution of the work to a maximum depth of six inches prior to trench and pad excavation.

2.5 REMOVAL

- A. Remove debris, rock, and extracted plant life from the site.
- B. Remove paving, curbs, and selected site demolition materials.
- C. Partially remove paving, curbs, and selected demolition materials as indicated on the Drawings. Neatly saw cut edges at right angle to surface.
- D. Continuously clean-up and remove waste materials from the site. Do not allow materials to accumulate on site.
- E. Do not burn or bury materials on site. Leave site in clean condition.

2.6 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile in the area designated on site to a depth not exceeding 2 feet and protect from erosion. Stockpile material on an impervious surface and cover over until disposed.
- D. Remove excess topsoil not intended for reuse from the site.
- E. Do not remove topsoil intended for reuse from the site.

2.7 SCHEDULES

- A. Provide the Owner and Engineer a schedule as to when anticipated earthwork and surface disruption occurs.

END OF SECTION

SECTION 31 2213 - ROUGH GRADING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes grading of topsoil and subbase soils.
 - 1. Cutting, grading, filling, rough contouring and compacting of the site for excavation for the exterior equipment pad/mounting and the duct bank.
- B. Related Sections:
 - 1. Section 31 0513 - Soils for Earthwork
 - 2. Section 31 1000 - Site Clearing
 - 3. Section 31 2316 - Excavation
 - 4. Section 31 2317 - Trenching
 - 5. Section 31 2323 - Fill

1.2 REFERENCES

- A. All work shall conform to the Rhode Island Department of Transportation (RIDOT) Standard Specifications for Road and Bridge Construction
- B. SUBMITTALS
 - 1. Section 01 3300 - Submittal Procedures: Requirements for submittals.

1.3 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the RIDOT Standard Specifications for Road and Bridge Construction.

PART 2 EXECUTION

2.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify survey bench mark(s) and intended elevations for the work are as indicated on the Drawings.

2.2 PREPARATION

- A. Call the local utility line information service, Dig Safe at (888) DIG-SAFE not less than 72 hours before performing Work.
 - 1. Request underground utilities to be located and marked within the construction area.
- B. Identify required lines, levels, contours, and datum.
- C. Protect utilities indicated to remain from damage.
- D. Protect bench marks, survey control points, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

END OF SECTION

SECTION 31 2316 - EXCAVATION

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavating for walking paths and access roads.
 - 2. Excavating for the concrete exterior equipment pad/mounting.
 - 3. Excavating for the concrete encased duct bank.
 - 4. Excavating for the loam and seed area.
- B. Related Sections:
 - 1. Section 31 2317 Trenching.

1.2 REFERENCES

- A. Local utility standards when working within 24 inches of utility lines.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Requirements for submittals.
- B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the Rhode Island Department of Transportation (RIDOT) Standard Specifications for Road and Bridge Construction.
- B. Maintain one copy of the excavation protection plan document on site.

1.5 QUALIFICATIONS

- A. Prepare an excavation protection plan under the direct supervision of a professional engineer experienced in the design of this work and licensed in the State of Rhode Island

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 PREPARATION

- A. Call the local utility line information service, DIG SAFE at 888 DIG-SAFE not less than 72 hours before performing Work.
 - 1. Request underground utilities to be located and marked within the construction area.
- B. Identify required lines, levels, contours, and datum.
- C. Notify utility companies of pending construction.
- D. Protect utilities indicated to remain from damage.
- E. Protect bench marks, survey control points existing structures, fences, sidewalks, paving and curbs from excavating equipment and vehicular traffic.

3.2 EXCAVATION

- A. Underpin adjacent structures which may be damaged by the excavation work.
- B. Excavate subsoil to accommodate the pad/mounting and duct bank construction.
- C. Compact disturbed load bearing soil in direct contact with the pad/mounting and duct bank to original bearing capacity; perform compaction in accordance with the RIDOT Standard Specifications for Road and Bridge Construction.
- D. Grade the top perimeter of excavation to prevent surface water from draining into the excavation.
- E. Trim excavation. Remove loose matter.
- F. Remove lumped subsoil, boulders, and rock up to 3 inches.
- G. Notify the Engineer of unexpected subsurface conditions.
- H. Correct areas over excavated with structural fill as directed by the Engineer.
- I. Remove excess and unsuitable material from site.
- J. Repair or replace items indicated to remain that are damaged by excavation.

3.3 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform inspection of excavation and controlled fill operations in accordance with the RIDOT Standard Specifications for Road and Bridge Construction.
- C. Request visual inspection of bearing surfaces by the Engineer before installing subsequent work.

3.4 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect the bottom of excavations and soil adjacent to and beneath the work from freezing.
- C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

END OF SECTION

SECTION 31 2317 - TRENCHING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavating the trench for the concrete exterior equipment pad/mounting and duct bank.
 - 2. Compacted fill from top of utility bedding to subgrade elevations.
 - 3. Backfilling and compaction.
- B. Related Sections:
 - 1. Section 03 3000 - Cast-In-Place Concrete: Concrete materials.
 - 2. Section 31 0513 - Soils for Earthwork: Soils for fill.
 - 3. Section 31 2213 - Rough Grading: Topsoil and subsoil removal from site surface.
 - 4. Section 31 2316 - Excavation: General building excavation.
 - 5. Section 31 2323 - Fill: General backfilling.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials.
- B. Rhode Island Department of Transportation (RIDOT) Standard Specifications for Road and Bridge Construction.

1.3 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Requirements for submittals.
- B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations.

PART 2 PRODUCTS –NOT USED

PART 3 EXECUTION

3.1 LINES AND GRADES

- A. Construct the proposed work to lines and grades indicated on the Drawings.
 - 1. Engineer and Owner reserve the right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

3.2 PREPARATION

- A. Call the local utility line information service DIG SAFE at 888 DIG-SAFE not less than 72 hours before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum locations.
- C. Protect plant life, lawns and other features remaining as part of final landscaping.
- D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities to remain.

3.3 TRENCHING

- A. Remove lumped subsoil, boulders, and rock.
- B. Perform excavation within 24 inches of an existing utility in accordance with the utility's requirements.
- C. Cut trenches to the width indicated on the Drawings. Remove water or materials that interfere with the Work.
- A. Correct areas over excavated with compacted backfill as specified in the RIDOT Standard Specifications for Road and Bridge Construction.
- B. Remove excess subsoil not intended for reuse from the site.

3.4 SHEETING AND SHORING

- A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- B. Support the trench to prevent damage to existing infrastructure.
- C. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.
- D. Repair damage to existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen fill materials.

- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Place fill material in continuous layers and compact in accordance with the RIDOT Standard Specifications for Road and Bridge Construction

3.6 FIELD QUALITY CONTROL

- A. Section 01 7000 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform in place compaction tests in accordance with the RIDOT Standard Specifications for Road and Bridge Construction.

3.7 PROTECTION OF FINISHED WORK

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting finished work.
- B. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

SECTION 31 2323 - FILL

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Fill under slabs-on-grade and all concrete exterior equipment pad/mounting.
 - 2. Fill under paving.
 - 3. Fill for over-excavation.
- B. Related Sections:
 - 1. Section 03 3000 - Cast-In-Place Concrete: Concrete materials.
 - 2. Section 31 0513 - Soils for Earthwork: Soils for fill.
 - 3. Section 31 2213 - Rough Grading: Site filling.
 - 4. Section 31 2316 - Excavation.
 - 5. Section 31 2317 - Trenching: Backfilling of utility trenches.
 - 6. Section 32 9119 - Landscape Grading: Filling of topsoil.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials.
- B. Rhode Island Department of Transportation (RIDOT) Standard Specifications for Road and Bridge Construction

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Requirements for submittals.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the RIDOT Standard Specifications for Road and Bridge Construction.

PART 2 PRODUCTS

2.1 FILL MATERIALS

- A. Granular Fill: per RIDOT Standard Specifications for Road and Bridge Construction for granular backfill material.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Coordination and project conditions.

3.2 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with granular backfill material.

3.3 BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Place fill material in continuous layers and compact in accordance with the RIDOT Standard Specifications for Road and Bridge Construction granular backfill material.
- D. Remove surplus backfill materials from site.
- E. Leave fill material stockpile areas free of excess fill materials.

3.4 FIELD QUALITY CONTROL

- A. Section 01 7000 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform in place compaction tests in accordance with the RIDOT Standard Specifications for Road and Bridge Construction granular backfill material.
- C. When tests indicate the Work does not meet specified requirements, remove the Work, replace and retest.

3.5 PROTECTION OF FINISHED WORK

- A. Section 01 7000 - Execution and Closeout Requirements: Protecting finished work.
- B. Reshape and re-compact fills subjected to vehicular traffic.

END OF SECTION

SECTION 31 2500 - EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Temporary perimeter sediment barrier.
 - 2. Temporary inlet protection device.
- B. Related Sections:
 - 1. Section 03 3000 - Cast-In-Place Concrete.
 - 2. Section 31 0513 - Soils for Earthwork.
 - 3. Section 31 1000 - Site Clearing.
 - 4. Section 31 2316 - Excavation.
 - 5. Section 31 2323 - Fill.
 - 6. Section 32 9119 - Landscape Grading.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials.
- B. Rhode Island Department of Transportation (RIDOT) Standard Specifications for Road and Bridge Construction.
- C. Rhode Island Department of Environmental Management.
- D. Rhode Island Soil Erosion and Sediment Control Handbook.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Requirements for submittals.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for submittals.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with the RIDOT Standard Specifications for Road and Bridge Construction and Rhode Island Soil Erosion and Sediment Control Handbook.

1.6 PRE-INSTALLATION MEETINGS

- A. Section 01 3000 - Administrative Requirements: Pre-installation meeting.
- B. Convene a minimum of one week prior to commencing the work of this section.

PART 2 PRODUCTS

2.1 BALED HAY

- A. Baled hay shall be in conformance with the RIDOT Standard Specifications for Road and Bridge Construction.
- B. Baled hay shall be placed as shown on the plans and shall be protected and maintained while surfaces are not stabilized with pavement or grass.

2.2 INLET PROTECTION

- A. Inlet protection shall be in conformance with the Rhode Island Soil Erosion and Sediment Control Handbook.
- B. External or internal inlet protection devices shall be placed as shown on the plans and shall be protected and maintained while surfaces are not stabilized with pavement or grass to prevent unwanted sediment from entering storm drains and waterways.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Verification of existing conditions before starting work.

3.2 CLEANING

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for cleaning.
- B. When sediment accumulation in sedimentation structures has reached a point one-quarter the depth of the sediment structure or device, remove and dispose of sediment.
- C. Do not damage structure or device during cleaning operations.
- D. Do not permit sediment to erode into construction or site areas or natural waterways.
- E. Clean channels when depth of sediment reaches approximately one half channel depth.

3.3 PROTECTION

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

END OF SECTION

SECTION 32 1123 - AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Aggregate subbase.
- B. Related Sections:
 - 1. Section 31 2213 - Rough Grading: Preparation of site for base course.
 - 2. Section 31 2317 - Trenching: Compacted fill under base course.
 - 3. Section 31 2323 - Fill: Compacted fill under base course.
 - 4. Section 32 1216 - Asphalt Paving: Base and finish asphalt courses.
 - 5. Section 32 9119 - Landscape Grading: Topsoil fill at areas adjacent to aggregate base course.

1.2 REFERENCES

- A. American Association of State Highway and Transportation Officials.
- B. Rhode Island Department of Transportation (RIDOT) Standard Specifications for Road and Bridge Construction.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Requirements for submittals.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with the RIDOT Standard Specifications for Road and Bridge Construction for granular backfill material.

PART 2 PRODUCTS

- A. AGGREGATE MATERIALS
- B. Aggregate materials, granular backfill material and gravel borrow subbase courses will be per the RIDOT Standard Specifications for Road and Bridge Construction.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify compacted substrate is dry and ready to support paving and imposed loads.

- C. Verify that the substrate has been inspected, and gradients and elevations are correct.

3.2 PREPARATION

- A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.
- B. Do not place fill on soft, muddy, or frozen surfaces.

END OF SECTION

SECTION 32 1216 - ASPHALT PAVING

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Asphalt paving base course and wearing course.
 - 2. Access roads and sidewalks (restore in kind).
- B. Related Requirement:
 - 1. Section 31 2213 - Rough Grading: Preparation of site for base and paving.
 - 2. Section 31 2323 - Fill: Compacted subbase for paving.
 - 3. Section 32 1123 - Aggregate Base Courses: Compacted subbase for paving.
 - 4. Section 32 1723 - Pavement Markings: Painted pavement markings, lines, and legends.

1.2 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials.
- B. Asphalt Institute.
- C. Rhode Island Department of Transportation (RIDOT) Standard Specifications for Road and Bridge Construction.
 - 1. Bituminous Concrete Base Course
 - 2. Bituminous Concrete Wearing Course

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Requirements for submittals.
- B. Product Data:
 - 1. Submit product information for asphalt and aggregate materials.
 - 2. Submit mix design with laboratory test results supporting design.

1.4 QUALITY ASSURANCE

- A. Mixing Plant: Conform to the RIDOT Standard Specifications for Road and Bridge Construction.
- B. Obtain materials from the same source throughout.
- C. Perform the Work in accordance with the RIDOT Standard Specifications for Road and Bridge Construction.
- D. Installer: Company specializing in performing the work of this section with documented experience.

PART 2 PRODUCTS

2.1 ASPHALT PAVING

- A. Performance / Design Criteria:
 - 1. Paving: Design commercial vehicles.
- B. Asphalt Materials: Asphalt base course and wearing course will be per the RIDOT Standard Specifications for Road and Bridge Construction
- C. Section 01 4000 - Quality Requirements: Testing, inspection and analysis requirements.
- D. Submit the proposed mix design of each class of mix for review prior to the beginning of Work.

EXECUTION

2.2 EXAMINATION

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify that the utilities indicated under paving are installed with excavations and trenches backfilled and compacted.
- C. Verify that the subbase has been compacted and is dry and ready to support paving and imposed loads.
- D. Verify that the gradients and elevations of the subbase are correct.

2.3 PREPARATION

- A. Prepare the subbase in accordance with the RIDOT Standard Specifications for Road and Bridge Construction.

2.4 DEMOLITION

- A. Saw cut and match existing paving as indicated on the Drawings.
- B. Clean existing paving to remove foreign material, excess joint sealant and crack filler from the paving surface.
- C. Repair surface defects in existing paving to provide uniform surface to receive new paving.

2.5 INSTALLATION

- A. Prepare subbase in accordance with the RIDOT Standard Specifications for Road and Bridge Construction.

- B. Tack Coat: Apply a tack coat in accordance with the RIDOT Standard Specifications for Road and Bridge Construction

2.6 TOLERANCES

- A. Section 01 4000 - Quality Requirements: Tolerances per the RIDOT Standard Specifications for Road and Bridge Construction.

2.7 FIELD QUALITY CONTROL

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

2.8 PROTECTION

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Immediately after placement, protect paving from mechanical injury per the RIDOT Standard Specifications for Road and Bridge Construction.

END OF SECTION

SECTION 32 1313 – CONCRETE PAVING

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes cast-in-place concrete for the following:
 - 1. Cement concrete sidewalks.
 - 2. ADA accessible curb ramps.
 - 3. Walkways.
 - 4. Miscellaneous cement concrete work.
- B. Related Sections:
 - 1. Section 31 2213 - Rough Grading: Preparation of site for base and paving.
 - 2. Section 31 2323 - Fill: Compacted subbase for paving.
 - 3. Section 32 1123 - Aggregate Base Courses: Compacted subbase for paving.

1.2 REFERENCES

- A. Rhode Island Department of Transportation (RIDOT) Standard Specifications for Road and Bridge Construction.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Requirements for Submittals.
- B. Product Data: Submittals for specified materials shall include reinforcement and forming accessories, admixtures, joint systems, sealant, curing compounds, dry-shake finish materials, and as directed by the Owner's construction representative.
- C. Design Data:
 - 1. Submit concrete mix design for specified concrete strength /class of concrete including revising mix proportions when characteristics of materials, project conditions, weather, test results, or other circumstances warrant.
 - a. Certify source for regional materials and distance from Project site.
- D. Certificates: Submit material certificates in lieu of material laboratory test reports when permitted by the Owner's construction representative. Material certificates shall be signed by the manufacturer and Contractor certifying that each material item complies with or exceeds requirements. Provide certification from admixture manufacturers that chloride content complies with requirements.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.

1.5 QUALITY ASSURANCE

- A. Comply with provisions of the following standards, except where more stringent requirements are indicated.
 - 1. RIDOT Standard Specifications for Road and Bridge Construction.
 - 2. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
 - 3. ACI 318, "Building Code Requirements for Reinforced Concrete."
 - 4. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
- B. Obtain cementitious materials from same source throughout.

PART 2 PRODUCTS

2.1 GENERAL

- A. Requirements shall be in accordance with RIDOT Standard Specifications for Road and Bridge Construction.

2.2 FORMS

- A. Form Materials: Plywood, metal, metal-framed plywood, or other acceptable panel-type materials to provide full-depth, continuous, straight, smooth exposed surfaces.
 - 1. Use flexible or curved forms for curves of a 100-foot or less radius.
 - 2. Provide commercial formulation form-release agent with a maximum of 350 g/L volatile organic compounds (VOC's) that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.3 REINFORCING MATERIALS

- A. Reinforcing Bars and Tie Bars: ASTM A 615, Grade 60, deformed.
 - 1. Welded Steel Wire Fabric: ASTM A 185.
 - a. Furnish in flat sheets, not rolls.
- B. Supports for reinforcement consisting of chairs, spacers, dowel bar supports and other devices for spacing and supporting shall be used for fastening reinforcing bars, welded wire fabric, and dowels in place. Use wire bar-type supports complying with CRSI specifications. Using pieces of wood, stone, brick, or other similar materials to support steel reinforcing shall not be allowed.

2.4 CONCRETE MATERIALS

- A. Portland cement concrete shall be Class XX, 4000 psi, air entrained, conforming to the RIDOT Standard Specifications for Road and Bridge Construction.
 - 1. Maximum aggregate size: 3/4 inches.
 - 2. Do not use fine or coarse aggregates that contain substances that cause spalling.

- B. Only potable water shall be used.

2.5 CURING MATERIALS

- A. Burlap cloth covering material shall be made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
- B. Moisture-retaining covers shall conform to one of the following, complying with ASTM C 171:
 - 1. Waterproof paper.
 - 2. Polyethylene film.
 - 3. White burlap-polyethylene sheet.

2.6 CONCRETE MIX

- A. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with the following properties and RIDOT Standard Specifications for Road and Bridge Construction.
 - 1. Compressive Strength (28-Day): 4,000 psi.
 - 2. Maximum Water-Cement Ratio at Point of Placement: 0.40.
 - 3. Maximum slump limit at point of placement shall be 3 inches. Adjustments to slump shall not be made with water.

2.7 CONCRETE MIXING

- A. Ready-mixed concrete shall comply with the requirements of ASTM C 94.
 - 1. When air temperature is between 85°F (30°C) and 90°F (32°C), reduce mixing and delivery time from 1½ hours to 75 minutes; when air temperature is above 90°F (32°C), reduce mixing and delivery time to 60 minutes.

2.8 JOINTING MATERIALS

- A. Pre-molded joint filler shall be asphalt-impregnated fiberboard conforming to ASTM D1751. Thickness shall be 3/4 inch unless otherwise shown on the drawings.
- B. Joint sealant shall be polyurethane conforming to ASTM C920, Type S, Grade P, Class 25 or approved equal.
- C. Where new concrete is installed adjacent to existing concrete, jointing materials shall match existing.

PART 3 EXECUTION

3.1 CONSTRUCTION METHODS

- A. In general, all work shall meet the requirements of the RIDOT Standard Specifications for Road and Bridge Construction.

3.2 SURFACE PREPARATION

- A. Adjust moisture content and proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving.
- B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.3 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines, grades, and elevations. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.
- B. Check completed formwork and screeds for grade and alignment to following tolerances:
 - 1. Top of Forms: Not more than 1/8 inch in 10 feet.
 - 2. Vertical Face on Longitudinal Axis: Not more than 1/4 inch in 10 feet.
- C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.4 PLACING REINFORCEMENT

- A. Comply with the Concrete Reinforcing Steel Institute's recommended practice for placing reinforcing bars and for placing and supporting reinforcement.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.
- C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.
- D. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction. Adjust wire into place during placement of concrete.

3.5 JOINTS

- A. General: Construct contraction, construction, and isolation joints true to line with faces perpendicular to surface plane of concrete. Construct transverse joints at right angles to the centerline, unless indicated otherwise.
 - 1. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.
- B. Provide weakened-plane contraction joints by sectioning concrete into areas as shown on drawings or as directed. Construct contraction joints for a depth equal to at least 1/4 of the concrete thickness, as follows:
 - 1. Form contraction joints in fresh concrete by grooving and finishing each edge of joint with a radius jointer tool.

- C. Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than ½ hour, unless paving terminates at isolation joints.
- D. Form isolation joints with preformed joint filler strips abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated.
 - 1. Locate expansion joints at intervals of 24 feet, unless indicated otherwise.
 - 2. Extend joint fillers full width and depth of joint, not less than ½ inch or more than 1 inch below finished surface where joint sealant is indicated. Place top of joint filler flush with finished concrete surface when no joint sealant is required.
 - 3. Furnish joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.
 - 4. Protect top edge of joint filler during concrete placement with a metal, plastic, or other temporary preformed cap. Remove protective cap after concrete has been placed on both sides of joint.
 - 5. All expansion and contraction joints shall be sealed with an approved sealant.

3.6 CONCRETE PLACEMENT

- A. Before placing concrete, inspect and complete formwork installation, reinforcing 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 reinforcing before placing concrete. Do not place concrete on surfaces that are frozen.
- 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 requirements of ACI 304R for measuring, mixing, transporting, and placing concrete.
- E. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- F. When concrete placement is interrupted for more than ½ hour, place a construction joint.
- G. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- H. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures to consolidate concrete complying with ACI 309R.
 - 1. Consolidate concrete along face of forms and adjacent to transverse joints with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading and consolidation. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.

- I. Screed paved surfaces with a straightedge and strike off. Use bull floats or darbies to form a smooth surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces prior to beginning finishing operations.
- J. Place concrete complying with ACI 305R and as specified when hot weather conditions exist.
 - 1. Cool ingredients before mixing to maintain concrete temperature at time of placement to below 90 °F (32 °C). Mixing water may be chilled 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 reinforcing steel with water-soaked burlap if it becomes too hot so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
 - 3. Fog spray forms, reinforcing steel, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.7 CONCRETE FINISHING

- A. Begin floating 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 within a tolerance of 1/4 inch in 10 feet as determined by a 10-foot-long straightedge placed anywhere on the surface in any direction. Cut down high spots and fill low spots. Refloat surface immediately to a uniform granular texture.
 - 1. Medium-to-Fine-Textured Broom Finish: Draw a soft bristle broom across concrete surface perpendicular to line of traffic to provide a uniform fine line nonslip texture finish.
- B. Tool edges of paving, and joints formed in fresh concrete with a jointing tool having a 1/4-inch radius. Repeat tooling of edges and joints after applying surface finishes. Eliminate tool marks on concrete surfaces.

3.8 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with the recommendations of ACI 306R for cold weather protection and ACI 305R for hot weather protection during curing.
- B. In hot, dry, and windy weather, protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before floating.
- C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- D. Cure concrete by moisture curing, moisture-retaining-cover curing, or a combination of these as follows:

1. Keep surfaces continuously moist for not less than 7 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 a 12-inch lap over adjacent absorptive covers.
2. 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.

3.9 FIELD QUALITY CONTROL TESTING

- A. Employ a qualified independent testing and inspection agency to sample materials, perform tests, and submit test reports during concrete placement as follows:
 1. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
 2. Slump: ASTM C 143; one test at point of placement for each compressive-strength test, but no less than one test for each day's pour of each type of concrete. Additional tests will be required when concrete consistency changes.
 3. Air Content: ASTM C 231, pressure method; one test for each compressive-strength test, but no less than one test for each day's pour of each type of air-entrained concrete.
 4. Concrete Temperature: ASTM C 1064; one test hourly when air temperature is 40 deg F (4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each set of compressive-strength specimens.
 5. Compression Test Specimens: ASTM C 31; one set of four standard cylinders for each compressive-strength test, unless directed otherwise. Mold and store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.
 6. Compressive-Strength Tests: ASTM C 39; one set for each day's pour of each concrete class exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. Test one specimen at 7 days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.
- B. When frequency of testing will provide fewer than five strength tests for a given class of concrete, conduct testing from at least five randomly selected batches or from each batch if fewer than five are used.
- C. Test results will be reported in writing to the Owner, concrete manufacturer, and Contractor within 24 hours of testing. Reports of compressive strength tests shall contain the project identification name and number, date of concrete placement, name of concrete testing agency, concrete type and class, location of concrete batch in paving, design compressive strength at 28 days, concrete mix proportions and materials, compressive breaking strength, and type of break for both 7-day and 28-day tests.
- D. Impact hammer, sonoscope, or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.

- E. The testing agency will make additional tests of the concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.10 REPAIRS AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet the requirements of this specification.
- B. Drill test cores where directed by the Owner when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep concrete paving not more than 2 days prior to date scheduled for Substantial Completion inspections.

END OF SECTION

SECTION 32 1600 – CURB

PART 1 GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Cement concrete curb: straight, circular, and transition.
 - 2. Asphalt curb.
- B. Related Sections:
 - 1. Section 31 2213 - Rough Grading.
 - 2. Section 31 2323 - Fill
 - 3. Section 32 1123 - Aggregate Base Courses.

1.2 REFERENCES

- A. Rhode Island Department of Transportation (RIDOT) Standard Specifications for Road and Bridge Construction.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Requirements for Submittals.

1.4 CLOSEOUT SUBMITTALS

- A. Section 01 7000 - Execution and Closeout Requirements: Closeout procedures.

1.5 QUALITY ASSURANCE

- A. Comply with provisions of the RIDOT Standard Specifications for Road and Bridge Construction.

PART 2 PRODUCTS

2.1 CURB MATERIAL AND DIMENSION

- A. Material requirements for both cement concrete and asphalt curb shall be in accordance with RIDOT Standard Specifications for Road and Bridge Construction.
- B. Dimensional requirements for both cement concrete and asphalt curb shall be in accordance with RIDOT Standard Details.

PART 3 EXECUTION

3.1 INSTALLATION

- A. In general, all work shall meet the requirements of the RIDOT Standard Specifications for Road and Bridge Construction and RIDOT Standard Details.
- B. The type of curb shall be installed in-kind to match existing conditions to restore the area that is disturbed by Work activities.

3.2 REPAIRS AND PROTECTION

- A. Remove and replace curbing that is broken, damaged, or defective, or does not meet the requirements of this specification.

END OF SECTION

SECTION 32 1723 - PAVEMENT MARKINGS

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Traffic lines and markings.
 - 2. Paint.
- B. Related Requirements:
 - 1. Section 32 1216 - Asphalt Paving.

1.2 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials.
- B. Rhode Island Department of Transportation (RIDOT) Standard Specifications for Road and Bridge Construction.

1.3 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit paint formulation for each type of paint.
- C. Samples:
 - 1. Submit sample plates of each color of material.

1.4 QUALITY ASSURANCE

- A. Perform the Work in accordance with the RIDOT Standard Specifications for Road and Bridge Construction.
- B. When paint has been stored for more than 2 months, invert containers several days prior to use. Minimize exposure to air when transferring paint. Seal drums and tanks when not in use.

1.5 AMBIENT CONDITIONS

- A. Section 01 5000 - Temporary Facilities and Controls: Ambient conditions control facilities for product storage and installation.
- B. Do not apply materials when surface and ambient temperatures are outside temperature ranges required by the paint product manufacturer.
- C. Do not apply exterior coatings during rain or snow when relative humidity is outside humidity range, or when the moisture content of surfaces exceed those required by the paint product manufacturer.

1.6 PAINTED PAVEMENT MARKINGS:

- A. Furnish materials in accordance with the RIDOT Standard Specifications for Road and Bridge Construction.

PART 2 EXECUTION

2.1 EXAMINATION

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Do not apply paint to concrete surfaces until concrete has cured for 28 days.

2.2 PREPARATION

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Maintenance and Protection of Traffic:
 - 1. Provide short term traffic control in accordance with Section 01 5000 - Temporary Facilities and Controls.
 - 2. Prevent interference with marking operations and to prevent traffic on newly applied markings before markings dry.
 - 3. Maintain access to classes during the school year.
- C. Surface Preparation.
 - 1. Clean and dry paved surface prior to painting.
 - 2. Blow or sweep surface free of dirt, debris, oil, grease or gasoline.
 - 3. Spot location of final pavement markings as specified and as indicated on the Drawings by applying pavement spots.
 - 4. Notify the Engineer after placing pavement spots and three days minimum prior to applying traffic lines.

2.3 DEMOLITION

- A. Remove existing markings in an acceptable manner. Do not remove existing pavement markings by painting over with blank paint. Remove by methods that will cause the least damage to pavement structure or pavement surface. Satisfactorily repair any pavement or surface damage caused by removal methods.

2.4 APPLICATION

- A. Agitate paint for 1-15 minutes prior to application to ensure even distribution of paint pigment.
- B. Dispense paint as directed by the manufacturer.
- C. Apply markings to indicated dimensions at existing locations.

- D. Prevent splattering and over spray when applying markings.
- E. Unless material is track free at the end of paint application, use traffic cones to protect markings from traffic until track free. When a vehicle crosses a marking and tracks it or when splattering or over spray occurs, eradicate affected marking and resultant tracking and apply new markings.
- F. Collect and legally dispose of residues from painting operations.

2.5 FIELD QUALITY CONTROL

- A. Section 01 4000 - Quality Requirements: Requirements for inspecting, testing.
- B. Inspect for incorrect location, insufficient thickness, line width, coverage, retention, uncured or discolored material, and insufficient bonding.
- C. Repair lines and markings, which after application and curing do not meet following criteria:
 - 1. Incorrect Location: Remove and replace incorrectly placed patterns.
 - 2. Insufficient Thickness, Line Width, Paint Coverage: Prepare defective material by acceptably grinding or blast cleaning to remove substantial amount of beads and to roughen the marking surface. Remove loose particles and debris. Apply new markings on the cleaned surface in accordance with this Section.
 - 3. Uncured or Discolored Material, Insufficient Bonding: Remove defective markings in accordance with the manufacturer's instructions.

2.6 PROTECTION

- A. Section 01 7000 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect painted pavement markings from vehicular and pedestrian traffic until paint is dry and track free. Follow manufacturer's recommendations. Consider barrier cones as satisfactory protection for materials requiring more than 2 minutes dry time.

END OF SECTION

SECTION 32 3100 – FENCES AND GATES

PART 1 GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Installing new fence and gates.
- B. Related Sections:
 - 1. Section 03 3000 - Cast-in-Place Concrete
 - 2. Section 31 0513 - Soils for Earthwork.
 - 3. Section 31 2316 - Excavation.

1.2 SUBMITTALS

- A. Section 01 3300 - Submittal Procedures: Requirements for submittals.
- B. Product data: Submit product data for all components in the form of manufacturers technical data, specifications, and installation instructions for materials, fence and gate posts, gates, fencing slats and accessories.

1.3 REFERENCES

- A. Rhode Island Department of Transportation (RIDOT) Standard Specifications for Road and Bridge Construction.

PART 2 PRODUCTS

2.1 NEW FENCE and GATES

- A. All components for the fencing and gates shall be new and per the Drawings and the manufacturer's requirements.

2.2 CONNECTION AND FOUNDATION

- A. The materials for connections and foundations will be per the Drawings and the manufacturer's requirements.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Section 01 3000 - Administrative Requirements: Verification of existing conditions before starting work.

3.2 PREPARATION

- A. Call Local Utility Line Information service, Dig Safe (888) DIG-SAFE not less than 72 hours before performing Work.

3.3 PROTECTION

- A. Locate, identify, and protect utilities indicated to remain from damage.

3.4 INSTALLATION

- A. Install fence to comply with ASTM F 567 and the RIDOT Standard Specifications for Road and Bridge Construction. Do not begin installation and erection before final grading is completed, unless otherwise permitted.

END OF SECTION

SECTION 01 56 39

TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
- B. Related Requirements:
 - 1. Section 015000 "Temporary Facilities and Controls" for temporary site fencing.
 - 2. Section 311000 "Site Clearing" for removing existing trees and shrubs.

1.3 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape at a height 6 inches (150 mm) above the ground for trees up to and including 4-inch (100-mm) size at this height and as measured at a height of 12 inches (300 mm) above the ground for trees larger than 4-inch (100-mm) size.
- B. Caliper (DBH): Diameter breast height; diameter of a trunk as measured by a diameter tape at a height 54 inches (1372 mm) above the ground line for trees with caliper of 8 inches (200 mm) or greater as measured at a height of 12 inches (300 mm) above the ground.
- C. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction and indicated on Drawings.
- D. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction and indicated on Drawings.
- E. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at **Project site**

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
 - a. Tree-service firm's personnel, and equipment needed to make progress and avoid delays.
 - b. Arborist's responsibilities.
 - c. Quality-control program.
 - d. Coordination of Work and equipment movement with the locations of protection zones.
 - e. Trenching by hand or with air spade within protection zones.
 - f. Field quality control.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings:
 1. Include plans, elevations, sections, and locations of protection-zone fencing and signage, showing relation of equipment-movement routes and material storage locations with protection zones.
 2. Detail fabrication and assembly of protection-zone fencing and signage.
 3. Indicate extent of trenching by hand or with air spade within protection zones.
- C. Samples: For each type of the following:
 1. Organic Mulch: 1-pint (0.5-L) volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
 2. Protection-Zone Fencing: Assembled Samples of manufacturer's standard size made from full-size components
 3. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.
- D. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
 1. Species and size of tree.
 2. Location on site plan. Include unique identifier for each.
 3. Reason for pruning.
 4. Description of pruning to be performed.
 5. Description of maintenance following pruning.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For arborist and tree service firm.

- B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
- D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
 - 1. Use sufficiently detailed photographs or video recordings.
 - 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.
- E. Quality-control program.

1.7 QUALITY ASSURANCE

- A. Arborist Qualifications: Licensed arborist in jurisdiction where Project is located.
- B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
- C. Quality-Control Program: Prepare a written program to systematically demonstrate the ability of personnel to properly follow procedures and handle materials and equipment during the Work without damaging trees and plantings. Include dimensioned diagrams for placement of protection zone fencing and signage, the arborist's and tree-service firm's responsibilities, instructions given to workers on the use and care of protection zones, and enforcement of requirements for protection zones.

1.8 FIELD CONDITIONS

- A. The following practices are prohibited within protection zones:
 - 1. Storage of construction materials, debris, or excavated material.
 - 2. Moving or parking vehicles or equipment.
 - 3. Foot traffic.
 - 4. Erection of sheds or structures.
 - 5. Impoundment of water.
 - 6. Excavation or other digging unless otherwise indicated.
 - 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.

- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Backfill Soil: Stockpiled soil from the site that is of suitable moisture content and granular texture for placing around tree; free of stones, roots, plants, sod, clods, clay lumps, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris, and other extraneous materials harmful to plant growth.
- B. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:
 - 1. Type: Shredded hardwood
 - 2. Size Range: 3 inches (76 mm) maximum to 1/2-inch (13 mm) minimum
 - 3. Color: Natural.
- C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements
 - 1. Plastic Protection-Zone Fencing: Plastic construction fencing constructed of high-density extruded and stretched polyethylene fabric with 2-inch (50-mm) maximum opening in pattern and weighing a minimum of 0.4 lb/ft. (0.6 kg/m); remaining flexible from minus 60 to plus 200 deg F (minus 16 to plus 93 deg C); inert to most chemicals and acids; minimum tensile yield strength of 2000 psi (13.8 MPa) and ultimate tensile strength of 2680 psi (18.5 MPa); secured with plastic bands or galvanized-steel or stainless-steel wire ties; and supported by tubular or T-shape galvanized-steel posts spaced not more than 96 inches (2400 mm) apart.
 - a. Height: 48 inches
 - b. Color: High-visibility orange, nonfading.
 - 2. Gates: Single-swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; gate-leaf width 36 inches.
- D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:
 - 1. Size 24" x24" size
 - 2. Lettering: 3-inch-**high** minimum, black characters on white background.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. Prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Tie a 1-inch (25-mm) blue vinyl tape around each tree trunk at 54 inches (1372 mm) above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated. Do not exceed indicated thickness of mulch.
 - 1. Apply 3-inch uniform thickness of organic mulch unless otherwise indicated. Do not place mulch within 6 inches of tree trunks.

3.3 PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people and animals from easily entering protected areas except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 - 1. Fencing: Install to comply with manufacturer's written instructions.
 - 2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
 - 3. Access Gates: Install where indicated adjust to operate smoothly, easily, and quietly; free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 50 feet dimension on protection-zone fencing, but no fewer than four signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.
- D. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete, and equipment has been removed from the site.
 - 1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
 - 2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving" unless otherwise indicated.
- B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.
- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches (75 mm) back from new construction and as required for root pruning.
- D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

- A. Prune tree roots that are affected by temporary and permanent construction. Prune roots as follows:
 - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.

2. Cut Ends: Do not paint cut root ends.
 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 4. Cover exposed roots with burlap and water regularly.
 5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."
- B. Root Pruning at Edge of Protection Zone: Prune tree roots flush with the edge of the protection zone by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand or with air spade to the depth of the required excavation to minimize damage to tree root systems. If excavating by hand, use narrow-tine spading forks to comb soil to expose roots. Cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune as directed by arborist.
1. Prune to remove only injured, broken, dying, or dead branches unless otherwise indicated. Do not prune for shape unless otherwise indicated.
 2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
 3. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
 - a. Type of Pruning: Cleaning, raising, reducing, and thinning where indicated by arborist and Architect.
 - b. Specialty Pruning: Structural, and utility as required but only after consultation with Architect and Owner.
- B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.
- C. Cut branches with sharp pruning instruments; do not break or chop.
- D. Do not paint or apply sealants to wounds.
- E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.
- F. Chip removed branches and dispose of off-site in accordance with state and municipal codes.

3.7 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.
 - 1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with backfill soil. Place backfill soil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or to be relocated that are damaged by construction operations, in a manner approved by the Landscape Architect.
 - 1. Submit details of proposed pruning and repairs.
 - 2. Perform repairs of damaged trunks, branches, and roots within 24 hours according to arborist's written instructions.
 - 3. Replace trees and other plants that cannot be repaired and restored to full-growth status, as determined by Architect.
- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
 - 1. Small Trees: Provide new trees of same size and species as those being replaced for each tree that measures 6 inches or smaller in caliper size.
 - 2. Large Trees: Provide two new tree(s) of 6-inch caliper size for each tree being replaced that measures more than 6 inches in caliper size.
 - a. Species: **As selected by Landscape Architect**
 - 3. Plant and maintain new trees as specified in Section 329300 "Plants."
- C. Excess Mulch: Rake mulched area within protection zones, being careful not to injure roots. Rake to loosen and remove mulch that exceeds a 3-inch uniform thickness to remain.

- D. Soil Aeration: Where directed by Architect, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch-diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash, and debris and legally dispose of them off Owner's property in compliance with all state and municipal codes.

PART 4 - MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Site demolition and clearing shall be paid for under the lump sum for the contract.

4.02 BASIS OF PAYMENT

- A. Site demolition and clearing will be paid for under the lump sum for the contract.

END OF SECTION 01 56 39

SECTION 32 91 00
TOPSOIL AND PLANTING SOIL

PART I - GENERAL

1.1 DESCRIPTION

A. This work consists of providing topsoil at the locations indicated on the Plans and/or as directed by the Project Manager/Landscape Architect. The following activities are covered by this section:

1. Testing, amending, placing and finish grading all stockpiled and borrow (new) topsoil.
2. Provide all borrow (new) topsoil necessary to properly complete all lawn and seeding operations.

B. Related Sections.

1. Section 024113 "Selective Site Demolition and Clearing" for topsoil stripping.
2. Section 313000 "Earthwork" for site earthwork.
3. Section 329200 "Turf and Grasses" for all lawn and turf development.

1.2 QUALITY ASSURANCE

A. Topsoil:

1. Source: The sources and use of the topsoil prior to stripping shall be known and documented. Pesticide use on the site shall be documented and provided to the Owner. Soils with a known use of residual (preemergence) herbicide within two years of stripping are not acceptable.
2. Testing: Representative samples of borrow topsoil and stockpiled topsoil shall be completely analyzed/tested to determine:
 - a. Nutrient analysis – to be performed by either a state extension laboratory or a soils laboratory with experience in agricultural nutrient analyses and resultant fertilizer and liming recommendations. Minimum analytic list to include nutrient analysis using the Modified Morgan extractant for soil for available phosphorus (P), potassium (K), calcium (Ca), manganese (Mg), iron, zinc, copper and boron and for total nitrogen and soluble nitrate.
 - b. Soil pH.
 - c. Organic content – determined by loss of weight on ignition.
 - d. Particle size analysis – sand, silt, and clay – analysis shall be determined using the hydrometer method of particle size analysis with size fractions based upon size limits established by USDA.
3. Before delivery of any borrow topsoil, furnish the Landscape Architect with a 5-gallon sample of material.
4. Topsoil testing costs shall be borne by the Contractor. At least 3 tests shall be taken from each source.
5. Testing laboratory shall be approved by the Owner and Landscape Architect.

1.3 SUBMITTALS

- A. Submit topsoil test results to the Landscape Architect for review. The Landscape Architect will be the sole judge of acceptability.

1.4 PRODUCT HANDLING

- A. Coordinate delivery of borrow topsoil such that it is placed and stockpiled where designated by the Owner.

PART 2 – PRODUCTS

2.1 TOPSOIL (GENERAL)

- A. Topsoil, separated from excavation material and stored as specified in Section 02200 shall be approved by the Project Manager/Landscape Architect before reuse. If not acceptable and/or if sufficient quantities are not available on-site, then topsoil from outside sources shall be furnished.
- B. Topsoil, to be furnished from on-site excavation and/or sources outside of the project limits, shall consist of loose, friable, sandy loam, or loam topsoil, free of admixture of subsoil, refuse, stumps, rocks, brush, weeds, roots and other materials which will prevent the formation of a suitable seed bed. No stones in excess of one and one-quarter inch (1-1/4") in diameter will be tolerated. The Contractor shall notify the Project Manager/Landscape Architect of the location of the source of supply for the topsoil at least ten (10) days prior to delivery of the topsoil to the project site.

In addition, topsoil furnished from off-site sources shall meet the following requirements:

- 1. The ph of the material shall be between 5.5 and 7.6.
- 2. The organic content shall be not less than three percent (3%) nor more than twenty percent (20%).
- 3. It shall be well graded with twenty percent (20%) to eight-five percent (85%) by weight passing a No. 200 sieve.
- 4. Any imported materials which do not meet the above requirements shall be rejected and removed from the site.

2.2 BORROW TOPSOIL FOR GENERAL PLANTING AND LOAM AND SEED AREAS

4 Texture

- 1. Shall be a sandy loam as per USDA Soil Classification as determined by laboratory particle size analysis, with the following additional particle size limits:

Sand (0.05 to 2 mm diam.) – minimum 60 % by weight
Silt (0.002 to 0.05 mm diam.) – between 10 and 30 % by weight

Clay (less than 0.002 mm diam. – between 5 and 15 % by weight

2. Topsoil shall not contain materials harmful to plant life, to be clean, fertile, friable, and well draining. All topsoil to be free of any subsoil earth clods, sods, and stones over ¾” in any dimension, sticks, roots, weeds, litter and other deleterious material.
3. Coarse Fragments: Topsoil must pass through a 3/8-inch mesh and be free of stones and other foreign materials that are retained by the screen. Gravel between 2 mm and 9.5 mm (3/8”) shall not exceed 5 percent by weight.
4. Topsoil Source: Obtain topsoil displaced from naturally well-drained sites where topsoil occurs at least 4 inches deep; do not obtain from bogs or marshes.
5. Nutrient levels shall be achieved by the Contractor’s addition of amendments to the topsoil to meet the optimum nutrient levels specified in the testing laboratory report.

5 Permeability:

1. The finished topsoil product must possess a permeability of between 0.5 and 3 inches per hour when compacted to 80% of maximum as determined by a standard Proctor test.

6 Organic Matter

1. Topsoil shall be uniform in quality and texture and contain organic matter and mineral elements necessary for sustaining healthy plant growth.
2. Topsoil shall have the following optimum ranges unless otherwise approved by the Landscape Architect.
Organic Matter Content 6-8%

7 Soil Reaction: pH 6 -7

8 Organic Amendments

1. Acceptable organic materials to achieve the organic matter range include sphagnum moss or commercially prepared compost with the following characteristics.
 - a. Sphagnum moss
 - b. Minimum organic matter content: 85%
 - c. Minimum fiber as retained by a 150 mm sieve: 60%
 - d. Maximum mineral content: 15%
 - e. Commercial Compost
 - f. Minimum organic matter content: 50%
 - g. Carbon-nitrogen ration: 20 to 30
 - h. Particle size: <3/8”

- i. Metals: Not to exceed state standards for biosolids

9 Metals: Metals shall not exceed state standards for agricultural soils.

10 Sand Amendments:

Sand required to achieve the specified permeability for topsoil should meet ASTM Standard C33, Concrete Sand, and possess a Coefficient of Uniformity less than 4 and a Fineness Modulus between 2.7 and 3.2

PART 3 – EXECUTION

3.1 SHAPING AND GRADING OF SUBSOIL AT ALL LAWN AREAS

- A. After rough grading has been completed, shape and grade lawn subgrade areas to lines and levels as noted on the drawings and as required based on total amounts of approved topsoil to allow placement of uniform depth of topsoil. Adjustments may be necessary due to field conditions. Provide all shaping adjustments at no additional cost to the Owner.
- B. Harrow or otherwise loosen the subgrade soil to 12" depth if required to correct for over compaction.
- C. After shaping of lawn subgrades remove all sticks, stones, or foreign material two (2) inches or greater in dimension. Remove debris and stone off-site.

3.2 TOPSOIL SPREADING

- A. Do not apply topsoil to the scarified subgrade without approval by the Landscape Architect. Once approved, no vehicular traffic will be allowed on finish subgrade. Topsoil will not be permitted to be spread until topsoil test reports have been submitted and approved. Topsoil shall not be delivered or worked in a frozen or muddy condition.
- B. Uniformly distribute and spread topsoil over all graded lawn areas to conform smoothly to the lines, grades, and elevations shown or otherwise required. All lawn areas to have a minimum of six (6) inches of topsoil after compaction. All approved stockpiled topsoil is to be spread unless otherwise directed by the Landscape Architect. Maintain consistent depths of material throughout the project area.

Manually supply topsoil around all trees to remain. Avoid damage to root systems.

- C. Topsoil shall be spread in (2) equal lifts. Bottom lift shall be thoroughly mixed with the loosened subgrade by disking, harrowing, or other approved means to create a transition layer.
- D. Place topsoil only when it can be immediately followed within 6 hours by lawn development operations.
- E. Re-supply and place topsoil to eroded, settled or damaged areas until all lawn areas are stabilized. Care shall be taken not to damage grass or pavement areas in the replacement to topsoil.

3.3 PROTECTION

- A. Remove weeds prior to lawn development operations. No weeds shall be allowed to go to seed.
- B. Keep heavy equipment, trucks, etc. off topsoil areas at all times.
- C. If compaction occurs, scarify to the full depth of the topsoil and regrade topsoil.

3.4 EXCESS TOPSOIL

- A. Material approved for reuse but not required to be installed remains the property of the Owner and shall be deposited at a location designated by the Owner.
- B. Material not approved for reuse remains the property of the Contractor and is to be removed from the site.

PART 4 - MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

- A. All soils and loam shall be measured as lump sum for the contract

10.02 BASIS OF PAYMENT

- A. All soils and loam shall be paid for as lump sum under the base bid for the contract.

END OF TOPSOIL AND PLANTING SOIL SECTION 32 91 00

SECTION 32 92 00 TURF AND GRASSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Seeding.
 - 2. Hydroseeding.
 - 3. Erosion-control material(s) for seeding.
- B. Related Sections:
 - 1. Section 024113 " Selective Site Demolition and Clearing" for topsoil stripping and stockpiling.
 - 2. Section 310000 "Earthwork" for excavation, filling and backfilling, and rough grading.
 - 3. Section 329100 "Topsoil and Planting Soil."

1.3 DEFINITIONS

- A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
- B. Finish Grade: Elevation of finished surface of planting soil.
- C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
- E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.

- F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
- G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
- H. Subsoil: All soil beneath the topsoil layer of the soil profile, and typified by the lack of organic matter and soil organisms.
- I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Pesticides and Herbicides: Include product label and manufacturer's application instructions specific to this Project.

1.5 INFORMATIONAL SUBMITTALS

- A. Certification of Grass Seed: From seed vendor for each grass-seed monostand or mixture stating the botanical and common name, 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.
 - 1. Certification of each seed mixture for turfgrass. Include identification of source and name and telephone number of supplier.
- B. Qualification Data: For qualified landscape Installer.
- C. Product Certificates: For soil amendments and fertilizers, from manufacturer.
- D. Material Test Reports: For standardized ASTM D 5268 topsoil, existing native surface topsoil and existing in-place surface soil
- E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of turf and meadows during a calendar year. Submit before expiration of required initial maintenance periods.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful turf and meadow establishment.

1. Professional Membership: Installer shall be a member in good standing of either the Rhode Island Nurserymen's and Landscape Association (RINLA) or the American Nursery and Landscape Association.
 2. Experience: Five years' experience in turf installation in addition to requirements in Division 01 Section "Quality Requirements."
 3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
 4. Pesticide Applicator: State licensed, commercial.
- B. Soil-Testing Laboratory Qualifications: An independent laboratory or university 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.
- C. Soil Analysis: For each unamended soil type, furnish soil analysis and a written report 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 the soil.
1. Testing methods and written recommendations shall comply with USDA's Handbook No. 60.
 2. The soil-testing laboratory shall oversee soil sampling, with depth, location, and number of samples to be taken per instructions from Landscape Architect. A minimum of two representative samples shall be taken from varied locations for each soil to be used or amended for planting purposes.
 3. Report suitability of tested soil for turf growth.
 - a. Based on the test results, state recommendations for soil treatments and soil amendments to be incorporated. State recommendations in weight per 1000 sq. ft. or volume per cu. yd. for nitrogen, phosphorus, and potash nutrients and soil amendments to be added to produce satisfactory planting soil suitable for healthy, viable plants.
 - b. Report presence of problem salts, minerals, or heavy metals, including aluminum, arsenic, barium, cadmium, chromium, cobalt, lead, lithium, and vanadium. If such problem materials are present, provide additional recommendations for corrective action.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.
- B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways, and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers, lime, and soil amendments with appropriate certificates.

1.8 PROJECT CONDITIONS

- A. Seeding Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.
1. For Turf areas to be seeded with Park Seed Mix
 - a. Spring Seeding: April 1 to May 31
 - b. Fall Seeding: August 5 to October 15

NOTE: Fall seeding is preferred for Turf areas

- B. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Apply products during favorable weather conditions according to manufacturer's written instructions.

1.9 MAINTENANCE SERVICE

- A. **Initial Turf Maintenance Service:** Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
1. **Seeded Turf: 12 months from date of acceptance at substantial completion.**
 - a. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.

PART 2 - PRODUCTS

2.1 SEED

- A. 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. Turf Grass Seed Mix: Proprietary seed mix as follows:
1. Products: Subject to compliance with requirements, provide the following:
 - a. URI #2 Improved Mix

<u>Variety</u>	<u>Percent by Weight</u>
Creeping Red Fescue (Improved varieties)	40
Improved Perennial Rye	20
Kentucky Blue Grass (Improved varieties)	20
Kentucky Blue 98/85	20

Seeding Rate:

New Seeding: 5-7 lbs. per 1000 SF

2. Seed Carrier: Inert material, sharp clean sand, or perlite, mixed with seed at a ratio of not less than two parts seed carrier to one part seed.

2.2 TURFGRASS SOD (This section provided for an Alternate option)

A. Turfgrass Sod: Certified Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in "Guideline Specifications to Turfgrass Sodding," as published by Turfgrass Producers International. Furnish viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted.

B. Turfgrass Species: Sod of grass species as follows:

1. Full Sun (Type I):

- A. Kentucky Bluegrass – Improved Varieties – 90%
- b. Fescue – Improved Varieties – 10%

2. Sun and Partial Shade (Type II):

- a. Turf type tall fescue – 50%
- b. Kentucky Bluegrass – 50%

2.3 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:

1. Class: Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.
2. Provide lime in form of ground limestone.

B. Perlite: Horticultural perlite, soil amendment grade.

C. Agricultural Gypsum: Finely ground, containing a minimum of 90 percent calcium sulfate.

D. 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 7.4; moisture content 35 to 55 percent by weight; 100 percent passing through 3/4-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; and as follows:
 - 1. Organic Matter Content: 50 to 60 percent of dry weight.
- B. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.
- C. 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 HERBICIDES AND FUNGICIDES

- A. Selective Herbicides and Fungicides: EPA registered and approved, of type recommended by manufacturer for application.
 - 1. Fungicides:
 - a. CIVITAS plant defense activator (866 335-3369).
 - 2. **Pre-emergent broadleaf weed control for Spring seeding:** Allowed Herbicides include:
 - a. SureGuard Herbicide (EPA approved) as manufactured by Valent. Contact Jim Santoro (508) 207-2094.
 - b. Approved equal.

2.6 FERTILIZER

- A. Organic Fertilize:
 - 1. Nature's Turf 8-1-9 as supplied by North Country Organics, Bradford, VT (802-222-4277)
 - 2. Apply as per manufacturer's written instructions and in amounts of N-P-K as recommended in soil reports from a qualified soil-testing agency.

2.7 MULCHES

- A. "Flexterra" FGM (Flexible Growth Medium as manufactured by Profile Erosion Control Solutions (PECS), registered trademark of Profile Products LLC.
Website: <http://www.profileproducts.com/corporate/index.htm>

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to be planted for compliance with requirements and other conditions affecting performance.
 - 1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
 - 2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
 - 3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
 - 4. Uniformly moisten excessively dry soil that is not workable, and which is too dusty.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
- C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Landscape Architect and replace with new planting soil.

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 and hydromulching overspray.
 - 2. Protect grade stakes set by others until directed to remove them.
- B. Install 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 TURF AREA PREPARATION

- A. Limit lawn subgrade preparation to areas to be seeded and/or sodded.
- B. Pitch lawn and meadow areas as noted on drawings to shed excess water away from building and walk/drive surfaces.
- C. During construction, prevent excessive compaction. Never handle soil when wet. Use only tracked equipment with a low weight bearing to spread the soil. Use lightweight equipment with flotation tires for finish grading.

- D. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than $\frac{3}{4}$ -inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
1. Mix soil amendments and fertilizers with topsoil at rates recommended from soil testing results.
 2. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
 - a. Delay mixing fertilizer with topsoil if seeding will not proceed within a few days.
 - b. Mix lime with dry soil before mixing fertilizer.
 3. Spread topsoil mix to a depth required to meet thickness, elevations and finish grades shown after light rolling and natural settlement. Do not spread if topsoil or subgrade is frozen, muddy, or excessively wet.
- E. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:
1. Remove existing grass, vegetation, and turf. Do not mix into surface soil.
 2. Loosen surface soil to a depth of at least of 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Trim high areas and fill depressions. Till soil to a homogeneous mixture of fine texture.
 3. Remove stones larger than $\frac{3}{4}$ inch in any dimension and sticks, roots, trash, and other extraneous matter.
 4. Legally dispose of waste material, including grass, vegetation, and turf, off Owner's property.
- F. Finish Grading: Grade lawn and meadow areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus $\frac{1}{2}$ inch of finish elevation. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit finish grading to areas that can be planted in the immediate future.
- G. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- H. Before planting, obtain Landscape Architect's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 PREPARATION FOR EROSION-CONTROL MATERIALS

- A. Prepare area as specified in "Turf Area Preparation" Article.
- B. Moisten prepared area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

3.5 HYDROSEEDING

- A. Hydroseeding: Mix specified seed, fertilizer, 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 fiber-mulch manufacturer's recommended tackifier.
 2. Apply slurry uniformly to all areas to be seeded in a one-step process.
 3. Anchor sod on slopes exceeding 1:6 with wood pegs/steel staples spaced as recommended by sod manufacturer but not less than 2 anchors per sod strip to prevent slippage.
- B. Saturate sod with fine water spray within two hours of planting. During first week after planting, water daily or more frequently as necessary to maintain moist soil to a minimum depth of 1-1/2 inches below sod.

3.6 TURF (LAWN) MAINTENANCE

- A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and remulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
 2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
 3. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
- B. Watering: Install and maintain temporary piping, hoses, and turf-watering equipment to convey water from sources and to keep turf uniformly moist to a depth of 4 inches.
1. Schedule watering to prevent wilting, puddling, erosion, and displacement of seed or mulch. Lay out temporary watering system to avoid walking over muddy or newly planted areas.
 2. Water turf with fine spray at a minimum rate of 1 inch per week unless rainfall precipitation is adequate.
- C. Mow turf for proposed lawn areas as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 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 Turf grass in lawn areas to a height of 2 inches- 2-1/2 inches.
- D. Turf Post fertilization: Apply fertilizer after initial mowing and when grass is dry.

1. Use organic fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.7 SATISFACTORY TURF

A. Turf installations shall meet the following criteria as determined by Landscape Architect:

1. Satisfactory Seeded Turf: **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 5 by 5 inches.
- B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.8 PESTICIDE APPLICATION

- A. Apply organic pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Notify Owner before each application is performed.
- B. Post-Emergent Organic Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

3.9 CLEANUP AND PROTECTION

- A. Promptly remove soil and debris created by turf work from paved areas. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.
- B. Erect temporary fencing or barricades and warning signs as required to protect newly planted areas from traffic. Maintain fencing and barricades throughout initial maintenance period and remove after plantings are established.

PART 4 - MEASUREMENT AND PAYMENT

4.01 METHOD OF MEASUREMENT

- A. Seeding shall be measured as a under the lump sum for the contract.

4.02 BASIS OF PAYMENT

- A. Seeding will be paid for as a lump sum for the contract.

END OF TURFS AND GRASSES
SECTION 32 92 00

SECTION 32 94 13
MOWING EDGE

PART 1 – GENERAL

1.1 DESCRIPTION

- A. This item of work shall consist of providing and installing the following:
Drip Skirt around building foundations.
- B. Other Related Work
 - 1. Section 32 12 16 – Bituminous Concrete (Asphalt) Paving
 - 2. Section 32 92 00 – Turf and Grasses
 - 3. Sound wall

1.2 WARRANTY

- A. 15-year limited material warranty for restraint edging from manufacturing defects in workmanship or material.

PART 2 – PRODUCTS

2.1 MOWING EDGE

- A. Steel Edging
 - 1. Manufacturers: As provided by Sure-loc Corporation, Holland Michigan or approved equal.
 - 2. Material
 - a. Manufactured from steel with interlocking system and stake punch out fabricated in each strip.
 - b. Edging to be in 16-foot sections
 - c. Sections lock together without offset or double thickness at points secured with two (2) 12-inch stakes at every joint.
 - d. Size: ¼” thickness
 - e. Finish: Powder coated, baked on enamel supplied in black color.
 - f. Stakes: Minimum of 12 inches long for 14-gauge edging.
- B. Crushed Stone
 - 1. Crushed stone for mowing edge shall conform to Section M.01.07 Filter Stone of the RIDOT Standard Specifications for Road and Bridge Construction, latest edition.
- C. Filter Fabric
 - 1. Filter Fabric to be 6 oz. needle punch non-woven fabric meeting the following:

PART 3 – EXECUTION

3.1 CONSTRUCTION METHODS

A. Drip Skirt

1. Install Filter Fabric.

<u>Properties</u>	<u>Test Method</u>	
D.		
Grab Tensile (lbs.)	ASTM D-4632	160
Elongation (%)	ASTM D-4632	50
Trapezoid Tear (lbs.)	ASTM D-4533	65
Puncture Resistance (lbs.)	ASTM D-4833	90
Permittivity (sec ⁻¹)	ASTM D-4491	1.6
Flow (gpm/ft ²)	ASTM D-4491	110
A.O.S. (U.S. sieve no.)	ASTM D-4751	70
Ultra-Violet Stability	ASTM D-4355	70
(strength retained %) 500 hrs.		
Weight (oz/yd ²)	ASTM D-5261	6
2. Install aluminum edging with stake pockets on inside of bed. Top of edging not to exceed ½” above finish grade.		
a. Stake edging using a minimum of 5 stakes per section.		
b. When backfilling, leave no more than two sections unsupported at one time.		
c. Compact backfill along edging ensuring that top edge is no more than ½” above finish grade.		

3. Backfill Mowing Edge area with crushed stone.

3.2 DELIVERY, STORAGE, AND HANDLING

All materials for the work of this section shall be delivered, stored, and handled to preclude damage of any nature. Manufactured materials shall be delivered and stored in their original containers, plainly marked with product and manufacturer's name.

**END OF MOWING EDGE
SECTION 329413**