State of Rhode Island
Department of Administration / Division of Purchases
One Capitol Hill, Providence, Rhode Island 02908-5855
Tel: (401) 574-8100 Fax: (401) 574-8387

Solicitation Information
February 17, 2014

ADDENDUM # 2

RFP# 7548421

TITLE: PRIMARY ELECTRICAL SERVICES UPGRADE – PHASE 1 - RIC

Submission Deadline: Monday February 24, 2014 at 11:30 am (Local Time)

Notice to Vendors:

- Attached is information related to this solicitation

Thomas Bovis
Interdepartmental Project Manager

Interested parties should monitor this website, on a regular basis, for any additional information that may be posted.

RDK ENGINEERS
70 Fargo Street, Suite 800 | Boston, MA 02210-1964
P: 617-345-9885 | F: 617-345-4226

Campus Primary Electrical Services Upgrade – Phase 1
Rhode Island College
Providence, RI

Issued February 13, 2014

Under the provisions of Article 7 of Section 00200, Instructions to Bidders, Bidders are informed that the Bidding Documents for the above mentioned Project are modified, corrected, and/or supplemented as follows. Addendum No. 1 becomes part of the Bidding Documents and Contract Documents.

Acknowledge receipt of this addendum by inserting its name and number in Article 1 of the Bid form. Failure to acknowledge receipt of the Addendum may subject the Bidder to disqualification.

Project Manual Changes

Note: Updated specification sections are attached herewith. Modifications are indicated with an outside border to the left of the effected text.

Item 1-1 Section 00010 – Table of Contents

Delete Section 00010 – Table of Contents in its entirety and replace with the attached Section 00010 – Table of Contents.

Item 1-2 Section 00100 – Invitation to Bid

Delete Section 00100 – Invitation to Bid in its entirety and replace with the attached Section 00100 – Invitation to Bid.

Item 1-3 Section 00410 – Bid Form

Delete Section 00410 – Bid Form in its entirety and replace with the attached Section 00410 – Bid Form.

Item 1-4 Section 01200 - Attachment A – Price and Payment Procedures

Delete Section 01200 - Attachment A – Price and Payment Procedures in its entirety and replace with the attached Section 01200 - Attachment A – Price and Payment Procedures.

Item 1-5 Section 01500 – Temporary Facilities and Controls

Delete Section 01500 – Temporary Facilities and Controls in its entirety and replace with the attached Section 01500 – Temporary Facilities and Controls.

RDK ENGINEERS
70 Fargo Street, Suite 800 | Boston, MA 02210-1964
P: 617-345-9885 | F: 617-345-4226

Item 1-6 Section 016000 – Electrical Specification

Delete Section 016000 – Electrical Specification in its entirety and replace with the attached Section 016000 – Electrical Specification.

Item 1-7 Section 016700 – Telecommunications Specification

Delete Section 016700 – Telecommunications Specification in its entirety and replace with the attached Section 016700 – Telecommunications Specification.

Item 1-8 Section 310000 – Earthwork

Delete Section 310000 – Earthwork in its entirety and replace with the attached Section 310000 – Earthwork.

Item 1-9 Section 334000 – Storm Drainage Utilities

Delete Section 334000 – Storm Drainage Utilities in its entirety and replace with the attached Section 334000 – Storm Drainage Utilities.

Item 1-10 Appendix 1 - Soil Management Plan

Insert Appendix 1 - Soil Management Plan as part of Construction Document Set.

Drawing Changes

Note: Updated drawings are attached herewith.

Item 1-11 Drawing C2.0 – Site Plan

Replace Drawing C2.0 dated 12/12/2013 with drawing C2.0 dated 02/13/2014. Changes include location of existing manholes and addition of communications handhole.

Item 1-12 Drawing E1.0 – Electrical Site Lighting Plan Phase 1

Replace Drawing E1.0 dated 12/12/2013 with drawing E1.0 dated 02/13/2014. Changes include re-feeding of existing lighting, modification to the site light specification, as well as additional annotations.

Item 1-13 Drawing E2.0 – Electrical Site Plan Phase 1

RDK ENGINEERS
70 Fargo Street, Suite 800 | Boston, MA 02210-1964
P: 617-345-9885 | F: 617-345-4226

Replace Drawing E2.0 dated 12/12/2013 with drawing E2.0 dated 02/13/2014. Changes include location of existing manholes, addition of communications handhole and location of existing site lighting pole to be re-fed.

Item 1-14 Drawing E7.0 – Electrical Campus One Line Diagram

Replace Drawing E7.0 dated 12/12/2013 with drawing E7.0 dated 02/13/2014. Changes include additional branch circuits at site lighting panel and annotations.

Item 1-15 Drawing E8.0 – Electrical Details

Replace Drawing E8.0 dated 12/12/2013 with drawing E8.0 dated 02/13/2014. Changes include addition of detail E705 and modification to duct bank details.

Item 1-16 Drawing ED2.0 – Electrical Site Demo Plan Phase 1

Replace Drawing ED2.0 dated 12/12/2013 with drawing ED2.0 dated 02/13/2014. Changes include demolition of additional wood poles.

Clarifications

Item 1-17 Do the documents include charges from outside utilities? Can an allowance be included so these charges are covered equally?

Contractors shall provide for an allowance of $5,000.00.

Item 1-18 Will the Phase 1 Contractor set the transformer and switchgear equipment or will the Pre-purchase Contractor do it?

Phase 1 Contractor to install per manufacturer's requirements. Transformer and Switchgear Contractor to provide factory representatives during installation as noted in the contract documents.

END OF ADDENDUM NO. 1

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APPENDICES
Appendix 1 Soil Management Plan for Rhode Island College

END OF DOCUMENT

DOCUMENT 00100 – INVITATION TO BID

NOTICE TO CONTRACTORS – BID NO. (*fill in*)

Date:	December 12, 2013
Project:	Primary Electrical Service Upgrades - Phase 1 Rhode Island College, Providence, RI
Project Description:	This project consists of the replacement/upgrade of the existing medium voltage electrical system and associated distribution. In addition, the project will include associated site upgrades with relocation of overhead telecommunication to an underground distribution.
Completion Time:	All contract work shall be completed no later than August 15, 2014.
Owner:	State of Rhode Island Board of Governors for Higher Education, Rhode Island College, and State of Rhode Island
Purchaser:	Rhode Island College (RIC), Purchasing Office
Design Agent:	RDK Engineers 70 Fargo Street, Suite 800 Boston, MA 02210

The **Owne**r is soliciting bids for the Primary Electrical Service Upgrades Project - Phase 1 on the Providence Campus of Rhode Island College, in accordance with the plans and specifications dated *(insert date of documents).*

Sealed proposals addressed to the **Purchaser** shall be received on or before the date and time specified below. At that time they will be opened and read aloud in public.

General Contractors are invited to submit an offer under seal to the Purchaser at the appropriate address, for construction of the above Project, on or before:

Time: _____ ( ), Date: _____ .

NOTE: Plans and specifications are available to download from the RI Division of Purchases website at www.purchasing.ri.gov (labeled with the issue date of this Solicitation Information document) at no cost.

A certified check or **Bid Bond** payable to the Rhode Island College in an amount equal to five percent (5%) of the proposal shall be submitted with the bid.

A **Performance** and **Payment Bond** equal to one hundred percent (100%) of the contract price with a surety company registered and licensed in the State of Rhode Island shall be required of the successful bidder.

This project is subject to terms, conditions and provisions of the Rhode Island General Laws Chapter 37-14.1 et. Seq, and regulations promulgated thereunder, which require that ten percent (10%) of the dollar value of work performed on the project be performed by minority business enterprises, and prevailing wage rates to be paid under the contract for this project must be in accordance with those prevailing wages on file in the Rhode Island Department of Labor, Office of the Director.

Bidders are also subject to the terms, conditions, and provisions of Chapters 2, 12, and 13 of Title 37, general laws of the State of Rhode Island, 1956 as amended, including apprentice requirements of 13-3.1.

Refer to Documents 00200 –Instructions to Bidders and 00210 – Supplemental Instructions to Bidders for specific Bidding requirements including additional State and Federal mandates.

The **Purchaser** reserves the right to waive any technicalities in the bids, award in the best interest of the College, and accept or reject any or all offers.

The **Owner** will hold a mandatory pre-bid conference at

Rhode Island College, Engineering Building at:

Time: _____ ( ) on Date: _____ .

END OF DOCUMENT

DOCUMENT 00410 - BID FORM

Date: February 13, 2014

To: Rhode Island College
Purchasing Office
600 Mount Pleasant Avenue
Providence, RI 02908-1991

Project: Primary Electrical Service Upgrades - Phase 1
Rhode Island College, Providence, Rhode Island

Submitted by: _____
(include address, tel. & FAX nos., and license no. if applicable)

_____

_____

1. BID

Having examined the Place of The Work and all matters referred to in the Bid Documents and in the Contract Documents prepared by RDK Engineers for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of:

_____($ _____.)
(written, and numerically)

- We have included the specified Allowances from Section 01200 in Division 1 of the Specifications in the above Bid sum as follows:

Insert Allowance name	$Amount	_____
Insert Allowance name	$Amount	_____
Total Allowances	$Amount	_____

- We have included the required Bid security in the above Bid Sum. We have included 100% Payment and Performance Bonds in the above Bid Sum.

- We have included the original Bid and required additional **"public copy"** if required by Document 00210 – Supplemental Instructions to Bidders.

2. ALTERNATES

We propose to modify the above Bid Sum by the following amount(s) as identified by (a) numbered Alternative(s) specified in Section 01200 of the Specifications, and as may be selected by the Owner:

Add Alternate No.___ - Name of Alternate

Add: _____ ($_____)

3. UNIT PRICES

Per Section 01200, provide unit prices/SF or each as noted for the following items:

Name of Unit Price - _____($_____/SF)

Cutting and Disposing Isolated Trees	EACH	_____($_____/SF)
Portland Cement Concrete Sidewalk	SY	_____($_____/SF)
Bituminous Sidewalk	SY	_____($_____/SF)
Bituminous Curbing	LF	_____($_____/SF)
Remove and Reset Precast Concrete Curb	LF	_____($_____/SF)
Remove and Reset Modular Block Wall	SF	_____($_____/SF)
Test Pit	EA	_____($_____/SF)
Loam and Seed	SY	_____($_____/SF)
Sawcut	SF	_____($_____/SF)
Permanent Pavement Restoration	SY	_____($_____/SF)
Bituminous Berm	LF	_____($_____/SF)
Bituminous Curb	LF	_____($_____/SF)
Rock Removal (Trench)	CY	_____($_____/SF)
Loading, transportation & disposal of soil as daily cover at RIRRC or other landfill/disposal facility		_____($_____/Ton)
Loading, transportation, & disposal of soil as solid waste soil at RIRRC or other landfill/disposal facility		_____($_____/Ton)
Loading, transportation, and disposal of soil as hazardous waste soil		_____($_____/Ton)

<u>Electrical:</u>

Furnish and install one (1) manhole.	_____($_____/SF)
Furnish and install one (1) handhole.	_____($_____/SF)
Furnish and install one (1) 10 LF of each ductbank section with accessories (including cable).	_____($_____/SF)
Furnish and install one (1) pole and associated site lighting.	_____($_____/SF)

4. ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for sixty days from the bid closing date. If this bid is accepted by the Owner within the time period stated above, we will:

- Proceed under the Agreement, subject to compliance with required State regulatory agency approvals as described in the Bid Documents.
- Furnish the required bonds in compliance with amended provisions of the Instructions to Bidders.
- Commence work within seven days after receipt of a Purchase Order from RIC Purchasing.

If this bid is accepted within the time stated, and we fail to commence the Work, or we fail to provide the required Bonds, the security deposit shall be forfeited to the Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

5. CONTRACT TIME

If this bid is accepted, Substantial Completion of the Work shall be achieved no later than August 31, 2014. We have included all premium time or additional staffing required to accommodate this schedule.

The transformer and switchgear will be delivered on or before August 11, 2014. If this date is not met, the substantial completion date will be adjusted by Owner accordingly.

Substation area must be ready to receive transformer and switchgear no later than July 14, 2014.

Transformer and switchgear equipment installation must be completed within 21 calendar days of receipt of the equipment.

Completion of all conduit and duct bank by July 20, 2014.

Completion of all cable pulls by July 22, 2014.

6. LIQUIDATED DAMAGES

Time is of the Essence: If we fail to achieve certification of Substantial Completion at the expiration of the agreed upon Contract Time indicated above, we acknowledge that we will be assessed Liquidated Damages for each calendar day the project continues to be in default of Substantial Completion, as follows:

$1,000.00 per calendar day.

7. REQUIREMENT FOR LICENSE NUMBER

In compliance with the requirements of Rhode Island General Law, Section 5-65-23, my Rhode Island license number for the work to be performed by this firm as prime contractor is:

LICENSE NUMBER: _____ .

8. BID FORM SIGNATURE(S)

_____
(Bidder's name)

By: _____

Title: _____

Corporate Seal:

END OF DOCUMENT

Attachment A – 01200

A. Allowances

1. (*List and describe allowances*.)

B. Unit Prices

Cutting and Disposing Isolated Trees	EACH	_____($_____/SF)
Portland Cement Concrete Sidewalk	SY	_____($_____/SF)
Bituminous Sidewalk	SY	_____($_____/SF)
Bituminous Curbing	LF	_____($_____/SF)
Remove and Reset Precast Concrete Curb	LF	_____($_____/SF)
Remove and Reset Modular Block Wall	SF	_____($_____/SF)
Test Pit	EA	_____($_____/SF)
Loam and Seed	SY	_____($_____/SF)
Sawcut	SF	_____($_____/SF)
Permanent Pavement Restoration	SY	_____($_____/SF)
Bituminous Berm	LF	_____($_____/SF)
Bituminous Curb	LF	_____($_____/SF)
Rock Removal (Trench)	CY	_____($_____/SF)
Loading, transportation & disposal of soil as daily cover at RIRRC or other landfill/disposal facility		_____($_____/Ton)
Loading, transportation, & disposal of soil as solid waste soil at RIRRC or other landfill/disposal facility		_____($_____/Ton)
Loading, transportation, and disposal of soil as hazardous waste soil		_____($_____/Ton)

Electrical:

Furnish and install one (1) manhole.	_____($_____/SF)
Furnish and install one (1) handhole.	_____($_____/SF)
Furnish and install one (1) 10 LF of each ductbank section with accessories (including cable).	_____($_____/SF)
Furnish and install one (1) pole and associated site lighting.	_____($_____/SF)

C. Alternates

1. Site Civil ADD Alternates

Note: Costs for these services are to be provided based upon the assumption that characterizing/sampling soils and preparation and submittal of landfill/disposal facility acceptance paperwork to be completed by the Environmental Professional.

a. Loading, transportation, and disposal of 100 Tons of soil as daily cover at the Rhode Island Resource and Recovery Corporation (or other licensed properly landfill/disposal facility); $_____
b. Loading, transportation, and disposal of 100 Tons of soil as solid waste soil at the Rhode Island Resource and Recovery Corporation (or other properly licensed landfill/disposal facility); $_____
c. Loading, transportation, and disposal of 100 Tons of soil as hazardous waste soil at a properly licensed disposal facility; $_____

D. 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 MBE/DBE subcontractors and hours worked in a format acceptable to RIC.

3. A Minority Utilization Report for minority subcontractors must be included. Use the form provided as Attachment B.

E. Warranty Inspection Retainage

1. One-half of one percent of the cost of the Work will be retained from Final Payment for this purpose.

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

SECTION INCLUDES

1.01 Temporary Utilities
1.02 Construction Facilities
1.03 Removal of utilities and facilities with reseeding and repair of grounds.

1.01 TEMPORARY UTILITIES

A. The Owner will pay the cost of energy used. Exercise measures to conserve energy. Utilize the Owner's existing power service. Provide distribution equipment, wiring, and outlets to provide single-phase branch circuits for power.

B. Provide, maintain, and pay for cell phone service to the field supervisor at the time of project mobilization and until final completion.

1.02 CONSTRUCTION FACILITIES

A. Contractor needs to 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.

B. Storage Areas and Sheds: Arrange for project storage with RIC. Containers will be permitted within the project limit line.

C. Workers must park in lots assigned by the College with daily permits. Use of designated existing on-site streets and driveways for construction traffic is permitted. Tracked vehicles are not allowed on paved areas. Do not allow heavy vehicles or construction equipment in parking areas. Do not allow vehicle parking on existing sidewalks. Remove mud from construction vehicle wheels before entering streets. Cleanup dirt, rocks, and debris left on street from construction vehicles.

D. Use designated existing on-site roads for construction traffic. Provide and maintain access to fire hydrants and control valves free of obstructions.

E. Maintain areas free of waste materials, debris, and rubbish. Maintain the site in a clean and orderly condition. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other remote spaces, prior to enclosing the space. 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.

F. Before beginning any construction operation that can potentially trigger the existing fire alarm system, notify the Owner. Failure to so notify the Owner will subject the Contractor to a monetary fine for each occurrence, should the fire alarm system be activated inadvertently by a construction activity. Comply with Rhode Island College insurance underwriting standards and insurer recommendations for sprinkler impairment, and site maintenance.

1.03 REMOVAL OF UTILITIES AND FACILITIES

A. Remove temporary utilities, equipment, facilities, and materials, prior to Substantial Completion. Remove the underground installations to a minimum depth of 2 feet. Grade the site as indicated.

B. Clean and repair the damage caused by installation or use of temporary work. Restore the existing and new facilities used during construction to their original condition. Restore any temporary exterior laydown or storage areas to the original condition. After each use, regrade and reseed as required to meet this requirement.

C. Project Coordination

1. All work will be done on the Rhode Island College Campus. The campus is a year round operating facility and therefore the contractor(s) will require close coordination and approvals from RIC prior to all work.

2. RIC throughout the year has many campus events which may prohibit work during the event. Depending on the work activities planned, the College may not allow construction on days with major college events. These may include, but are not limited to: Rhode Island College Commencement (May 15, 2014 and May 17, 2014), freshman convocation (September 3, 2014), Homecoming (October 7, 2014 through October 11, 2014), and the President's opening coffee hour (August 27, 2014). The contractor will need to account for this and the date after which liquidated damages will be invoked will not be extended due to shutdowns for major events."

3. Most work may be done during normal working hours; however, there may be some times where after hours work is necessary. Contractor shall plan accordingly.

4. Work that takes place at roadways will require the contractor to coordinate campus police details.

5. Contractor will be required to coordinate all shutdowns and work with Rhode Island College and National Grid. Contractor will be required to coordinate all shutdowns and work with Rhode Island College and National Grid. Contractor will be required to give ten (10) days notice prior to performing any work which requires the shutdown of power to any building(s). All shutdowns shall be limited to a maximum of 8-hours. Number of shutdowns shall be discussed and scheduled with Owner. All shutdowns must be completed on or before August 31, 2014. Shutdowns will need to be scheduled during off hours such as 3rd shift or on weekends, as directed by the Owner.

6. Contractor will be required to obtain all necessary permits from the Rhode Island State Building Code Office and pay all necessary fees.

7. Contractor shall conduct a pre-construction video and documentary photos of the entire project site. These documents shall be submitted to the college prior to the commencement of work.

8. Contractor shall provide services and all associated cost of an independent outside utility verification company before commencing any work in the vicinity of existing subsurface utilities. "DIG SAFE" will not perform this service.

9. Contractor shall mark out proposed underground utility routes in field for review and approval prior to commencement of work.

END OF SECTION

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SECTION 016000

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SECTION 016000

ELECTRICAL

PART 1 - GENERAL

1.00 GENERAL PROVISIONS

A. The GENERAL REQUIREMENTS, DIVISION 1, and BIDDING AND CONTRACT REQUIREMENTS, DIVISION 0, are hereby made a part of this Specification Section.

B. Examine all Drawings and all Sections of the Specifications and requirements and provisions affecting the work of this Section.

1.01 SCOPE OF WORK

A. This project includes the replacement and/or upgrades of the existing Rhode Island College overhead campus electrical distribution system from overhead to underground.

B. This project will replace the existing outdoor substation transformer and several pole mounted transformers with new pad mounted transformers.

C. A new 5kV medium voltage outdoor switchgear lineup will be provided to redistribute new power via underground ducts.

D. The work under this Section shall include the furnishing of all materials, labor, equipment and supplies and the performance of all operations to provide complete working systems, in general, to include the following items:

1. Identification
2. Raceways and Conduit
3. Wire and Cable (600V)
4. Fuses
5. Grounding Systems
6. Underground Ductbank / Precast Manholes /Precast Handholes
7. Pad-mounted Transformers
8. Fire Seal and Fireproof Sealant
9. Supervision and Approval
10. Short Circuit Protection and Coordination Study
11. Testing
12. Operating and maintenance instructions and manuals
13. Coordination drawings
14. Shop drawings
15. Record (as-built) drawings

E. Work of this Section is generally shown on the Electrical Drawings.

F. The existing overhead and underground fiber optic cable is owned by Cox Communications. The fiber optic cable shall be located by the Contractor prior to starting any work. All efforts must be made to protect this fiber optic cable during construction, including using methods such as vacuum removal of soil and/or hand digging adjacent to the existing fiber cable. Should the fiber cable be damaged in any way during construction, Cox Communications will be called to perform an emergency repair. All charges for an emergency repair shall be borne by the Contractor.

G. Between Whipple Hall and Alger Hall, the utility poles indicated for removal on the plans cannot be removed until after Cox Communications has installed new fiber cable, spliced to the existing underground fiber cable at both ends, and completed all testing of the new fiber cable.

1.02 RELATED WORK

A. Principal classes of Work related to the Work of this Section are listed in the Specification Table of Contents, and are specified to be performed under the indicated Sections of the Specifications. Refer to the indicated Sections for description of the extent and nature of the indicated Work, and for coordination with related trades. This listing may not include all related Work items. It is the responsibility of the Contractor to coordinate and schedule the Work of this Section with that of all other trades.

B. The following work is not included in this section and will be provided under other sections:

1. Temporary light, power, water, heat, gas and sanitary facilities for use during construction and testing. Refer to Division 1, General Conditions.
2. Telephone system, wire, cable, equipment and instruments.
3. Excavation and backfill.
4. Concrete work including concrete housekeeping pads and blocks for vibrating and rotating equipment, and ductbank envelopes.

1.03 PRODUCTS FURNISHED, BUT NOT INSTALLED UNDER THIS SECTION

A. Furnish the following items for installation under other sections and provide wiring and connections as required:

1. Pre-cast manholes and handholes for installation under Division 2.
2. Pipe sleeves for placement into formwork by the General Contractor.

1.04 DEFINITIONS

A. As used in this Section, the following items are understood to have the following meaning:

1. "**Contractor or Subcontractor"**, unless otherwise qualified, shall mean the installer of the work specified under this Section.
2. **"Furnish"** shall mean purchase and deliver to the project site, complete with every necessary appurtenance.

3. **“Install”** shall mean unload at the delivery point at the site and perform all work necessary to establish secure mounting and proper operation at the proper location in the project.

4. **“Provide”** shall mean "Furnish" and "Install".

5. **“Work”** shall mean all labor, materials, equipment, apparatus, controls, accessories and all other items required for a proper and complete installation.

6. **“Concealed”** shall mean hidden from sight in chases, furred-in spaces, shafts, hung ceilings, embedded in construction or in a crawl space. Areas to be concealed as part of tenant alterations to the building shall also be considered in this definition.

7. **“Exposed”** shall mean not installed underground or concealed as defined above.

8. **“Furnished by Others"** shall mean materials or equipment purchased under other sections of the general contract and installed by this section of the specifications by this trade Contractor.

9. **“Owners Representative”** shall be the party responsible to make decisions regarding all contractual obligations in reference to the Scope of Work for the Owner.

10. **“Date of Substantial Completion"** shall indicate the date where the work has been formally accepted as evidenced by completed final punch list or where the work has reached the stage that the Owner obtains beneficial use and commences utilization of the installed systems for business or occupancy purposes. The GENERAL REQUIREMENTS, DIVISION 1, shall supersede this definition where specifically defined.

1.05 CODES, REFERENCES AND PERMITS

A. Materials, installation of systems and equipment provided under this section shall be done in strict accordance with the Department of Public Safety, Department of Environmental Protection, State Building Code and any other Codes and Regulations having jurisdiction including but not limited to:

1. All Applicable NFPA Standards
2. National Electrical Code (NEC).
3. Occupational Safety and Health Administration (OSHA)
4. State and Local Building Codes
5. Underwriters' Laboratories, Inc (UL)

B. Unless otherwise specified or indicated, materials, workmanship and equipment performance shall conform with the latest governing edition of the following standards, codes, specifications, requirements, and regulations, except when more rigid requirements are specified or are required by applicable codes but not limited to:

1. American National Standards Institute (ANSI)
2. American Society of Testing and Materials (ASTM)
3. Institute of Electrical and Electronics Engineers (IEEE)
4. Insulated Cable Engineers Association (ICEA)
5. National Electrical Contractors Association (NECA)

6. National Electric Manufacturers Association (NEMA)

C. Codes, laws and standards provide a basis for the minimum installation criteria acceptable. The drawings and specifications illustrate the scope required for this project, which may exceed minimum codes, laws and standards.

D. Give all notices, file all plans, obtain all permits and licenses, and obtain all necessary approvals from authorities having jurisdiction. Deliver all certificates of inspection to the authorities having jurisdiction. No work shall be covered before examination and approval by the Owner's Representative, inspectors, and authorities having jurisdiction. Replace imperfect or condemned work to conform to requirements, satisfactory to Owner's Representative, and without extra cost to the Owner. If work is covered before inspection and approval, this Contractor shall pay costs of uncovering and reinstalling the covering, whether it meets contract requirements or not.

1.06 GENERAL REQUIREMENTS

A. Nameplates

1. Each major component of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment.

1.07 MATERIAL AND EQUIPMENT STANDARDS

A. Where equipment or materials are specified with the name of a manufacturer, such specification shall be deemed to be used for the purpose of establishing a standard for that particular item. No equipment or material shall be used unless previously approved by the Owner's Representative.

B. Substitutions may be offered for review provided the material, equipment or process offered for consideration is equal in every respect to that indicated or specified. The request for each substitution must be accompanied by complete specifications together with drawings or samples to properly appraise the materials, equipment or process. The Contractor shall highlight and list all applicable specification requirements, which the substituted material deviates from.

C. If a substitution of materials or equipment in whole or in part is made, this Contractor shall bear the cost of any changes necessitated by any other trade as a result of said substitution.

D. All materials, equipment and accessories provided under this section shall be new and unused products of recognized manufacturers as approved.

1.08 SUBMITTALS

A. Conform to the requirements of Division 1, General Conditions, for schedule and form of all submittals unless specifically noted otherwise in this section. Coordinate this submittal with submittals for all other finishes. Shop drawings and design layouts shall be prepared by licensed installing Contractor s and shall note the name(s), license number(s) and license expiration date(s) of the Contractor (s) installing electrical systems.

B. Definitions:

1. Shop Drawings are information prepared by the Contractor to illustrate portions of the work in more detail than indicated in the Contract Documents.

2. Acceptable Manufacturers: The mechanical design for each product is based on the single manufacturer listed in the schedule or shown on the drawings. In Part 2 of the specifications, certain Alternate Manufacturers are listed as being acceptable. In addition, the MATERIAL AND EQUIPMENT STANDARDS paragraph potentially allows for substitutions as being acceptable. These are acceptable only if, as a minimum, they:

a. Meet all performance criteria listed in the schedules and outlined in the specifications. For example, to be acceptable, an emergency generator must deliver equal kW / kVA at equal or greater efficiency using equal or less fuel as the emergency generator listed in the schedules.

b. Fit within the available space it was designed for, including space for maintenance and component removal, with no modification to either the space or the product. Clearances to

walls, ceilings, and other equipment will be at least equal to those shown on the design drawings. The fact that a manufacturer's name appears as acceptable shall not be taken to mean the Engineer has determined that the manufacturer's products will fit within the available space – this determination is solely the responsibility of the Contractor.

c. Products must adhere to all architectural considerations including, but not limited to; being of the same color as the product scheduled or specified and fitting within the architectural enclosures and details.

C. Submittal Procedures, Format and Requirements

1. Review submittal packages for compliance with Contract Documents and then submit to Owner's Representative for review. Submit enough sets of shop drawings such that, after review, two sets will be kept by the reviewer, with only the remaining sets returned with reviewer's marks and comments.

2. Each Shop Drawing shall indicate in title block, and each Product Data package shall indicate on cover sheet, the following information:

a. Title

b. Equipment number

c. Name and location of project

d. Names of Owner, Engineer and Seller

e. Names of manufacturers, suppliers, vendors, etc.

f. Date of submittal

g. Whether original submittal or resubmitted

3. Shop Drawings showing manufacturer's product data shall contain detailed dimensional drawings (minimum ¼" – 1' scale) including plans and sections (where physical clearance could be an issue). Provide larger scale details as necessary.

4. Submit accurate and complete description of materials of construction, manufacturer's published performance characteristics, sizes, weights, capacity ratings (performance data, alone, is not acceptable), electrical requirements, starting characteristics, wiring diagrams, and acoustical performance for complete assemblies. Drawings shall clearly indicate location (terminal block or wire number), voltage and function for all field terminations, and other information necessary to demonstrate compliance with all requirements of Contract Documents.

5. Provide Shop Drawings showing details of piping connections to all equipment. If connection details are not submitted and connections are found to be installed incorrectly, this Contractor shall reinstall them within the original contract price.

6. Provide complete data for all auxiliary services and utilities required by submitted equipment. This shall include fuel, cooling and exhaust requirements and points of connections.

7. Provide a complete description of all controls and instrumentation required including electrical power connection drawing for all components and interconnection wiring to starters, detailed information

on starters, control diagrams, termination diagrams, and all control interfaces with a central control system.

8. Provide installation and erection information including; lifting requirements, and any special rigging or installation requirements for all equipment.

9. The Owner's Representative shall approve all materials before commitment for materials is made.

D. Product Data: Submit complete manufacturer's product description and technical information including:

1. Identification

2. Raceways and Conduit

3. Wire and Cable (600V)

4. Wire and Cable (above 600V)

5. Fuses

6. System Grounding Components

7. Manholes and handholes

8. Pad-Mounted Transformers

9. Identification, labels and tags, including database for all equipment, and devices.

10. O&M table of contents

E. Submit shop drawings and product data grouped to include complete submittals of related systems, products and accessories in a single submittal.

1. Do not submit multiple product information in a single bound manual.

2. Three-ring binders shall not be accepted.

F. Deviations:

1. Concerning deviations other than substitutions, proposed deviations from Contract Documents shall be requested individually in writing whether deviations result from field conditions, standard shop practice, or other cause. Submit letter with transmittal of Shop Drawings which flags the deviation to the attention of the Owner's Representative.

2. Without letters flagging the deviation to the Owner's Representative, it is possible that the Engineer may not notice such deviation or may not realize its ramifications. Therefore, if such letters are not submitted to the Owner's Representative, the Seller shall hold the Engineers, his consultants and the Owner harmless for any and all adverse consequences resulting from the deviations being implemented. This shall apply regardless of whether the Engineer has reviewed or approved shop drawings containing the deviation, and will be strictly enforced.

3. Approval of proposed deviations, if any, will be made at discretion of Engineer.

G. Schedule: Incorporate shop drawing review period into construction schedule so that Work is not delayed. This Contractor shall assume full responsibility for delays caused by not incorporating the following shop drawing review time requirements into his project schedule. Allow at least 10 working days, exclusive of transmittal time, for review each time shop drawing is submitted or resubmitted

with the exception that 20 working days, exclusive of transmittal time are required for the following:

1. Short circuit and coordination report.
2. Coordination drawings.
3. If more than five (5) shop drawings of a single trade are received in one calendar week.

H. Responsibility

1. Intent of Submittal review is to check for capacity, rating, and certain construction features. The Contractor shall ensure that work meets requirements of Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction; and for coordination of work of this and other Sections. Work shall comply with approved submittals to extent that they agree with Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor the shop drawing errors or deviations from requirements of Contract Documents. The Engineer's noting of some errors while overlooking others will not excuse the Contractor from proceeding in error. Contract Documents requirements are not limited, waived nor superseded in any way by review.
2. Inform Contractor, manufacturers, suppliers, etc. of scope and limited nature of review process and enforce compliance with contract documents.

I. In the event that the Contractor fails to provide Shop Drawings for any of the products specified herein:

1. The Contractor shall furnish and install all materials and equipment herein specified in complete accordance with these Specifications.
2. If the Contractor furnishes and installs material and/or equipment that is not in complete accordance with these Specifications, he shall be responsible for the removal of this material and/or equipment. He shall also be responsible for the replacement of this material and/or equipment with material and/or equipment that is in complete accordance with these Specifications, at the direction of the Owner’s Representative.
3. Removal and replacement of materials and/or equipment that is not in complete compliance with these Specifications shall be done at no extra cost to the Owner.
4. Removal and replacement of materials and/or equipment that is not in complete compliance with these Specifications shall not be allowed as a basis for a claim of delay of completion of the Work.

J. Mark dimensions and values in units to match those specified.

K. Submit Material Safety Data Sheets (MSD) on each applicable product with submittal.

1.09 OPERATION AND MAINTENANCE DATA

A. Commence preparation of the Operating and Maintenance (O&M) manuals immediately upon receipt of “Approved” or “Approved as Noted” shop drawings and submit each section within one month. The final submission shall be no later than two months prior to the projected date of Substantial Completion of the Project.

B. Submit O&M table of contents in the submittal phase. O&M manuals shall be built as submittals are accepted and shall include the individual equipment manufacturer’s data retrieval sheet, as per Attachment A in Part IV for input into the Owner’s Maintenance Management System. Form shall be provided and completed electronically.

C. Each O&M document shall include the manufacturer’s web address for equipment specific O&M information for Internet access by the Owner.

D. The manual shall consist of three (3) sets of manuals and include three (3) sets of CDs, which shall contain the scanned content of the entire manual. The manual shall highlight the actual equipment used and <u>not</u> be a master catalog of all similar products of the manufacturer. The manual shall be submitted for review prior to creation of the CDs.

E. The Manual shall contain the following:

1. Operations Manual

   a. Systems description including all relevant information needed for day-to-day operations and management including start-up and shutdown instructions.

   b. Wiring diagrams, schematics, logic diagrams and sequence of operations that accurately depict the controls system.

   c. Depiction of each interface screen where programmable logic and visual displays are provided. Descriptors shall be provided to define displayed data, alarms, etc.

   d. A single sheet (for ease of removal) of all access codes and passwords necessary to access all levels of control and programming.

   e. Trouble shooting guide defining common alarms/problems with possible cause and effect.

2. Maintenance Manual

   a. Define all maintenance activities required to ensure system operation within manufacturer's specified parameters. Provide table of all required activities plotted vs. interval with adequate fill-in-space for “activity completion date” and “comments”. Where multiple instrument readings are required, provide data sheet formatted to accommodate activity.

   b. Define recommended spare parts inventory with part numbers and source defined for ordering by the Owner. Identify lead time on all parts, source location and cost.

   c. Provide copy of all warranty information with associated date of substantial completion (commencement of warranty) and end date of coverage. Define all components/subsystems specifically included and excluded.

F. Provide O&M manuals for each of the following:

1. Pad Mount Transformers

1.10 RECORD DRAWINGS

A. Refer to DIVISION 1, General Conditions, for record drawings and procedures to be provided under this section, unless specifically noted otherwise in this section.

B. Record Drawings (red-line drawings) will be updated by this Contractor daily for review with the monthly requisition. The record drawing shall be an accurate depiction of the systems as completed, including dimensions (vertical/horizontal) of concealed components off fixed building elements.

C. The Electrical Foreman shall maintain complete and separate set of prints of Contract Drawings at job site at all times and shall record work completed and all changes from original Contract Drawings clearly and accurately including work installed as a modification or addition to the original design.

D. At completion of work the Electrical Contractor shall prepare a complete set of record drawings on AutoCAD showing all systems as actually installed. The Architectural background AutoCAD files will be made available for the Contractor's copying, at his expense, to serve as backgrounds for the drawings. The Electrical Contractor shall transfer changes from field drawings onto AutoCAD drawings and submit copy of files and three sets of prints to Owner's Representative for comments as to compliance with this section. CADD layering as established by the A&E design team shall be maintained with any and all changes done by the Contractor.

E. The Architect and Engineer are not granting to the Contractor any ownership or property interest in the CADD Drawings by the delivery of the CADD Disks to the Contractor. The Contractor's rights to use the CADD disks and the CADD Drawings are limited to use for the sole purpose of assisting in the Contractor's performance of its contractual obligations under its contract with respect to the Project. The Architect and Engineer are granting no further rights. Any reuse or other use by the Contractor will be at the Contractor's sole risk and without liability to the Architect and Engineer. The Contractor hereby waives and releases any losses, claims, damages, liabilities of any nature whatsoever, and costs (including attorney fees) arising out of, resulting from, or otherwise related to the use of the CADD Disks and CADD Drawings by the Contractor. The Contractor, to the maximum extent permitted by law, hereby agrees to indemnify, defend and hold the Architect and Engineer harmless from all loses, claims, damages, liabilities, and costs (including attorney fees) arising out of, resulting from, or otherwise related to the use of the CADD Disks and CADD Drawings by the Contractor.

F. Record Drawings, shall show "as-built" condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual manufacturer and model numbers of final equipment installation.

1.11 WARRANTIES

A. Submit manufacturer's standard replacement warranties for material and equipment furnished under this Section. Such warranties shall be in addition to and not in lieu of all liabilities which the manufacturer and the Electrical Contractor may have by law or by provisions of the Contract Documents.

B. All materials, equipment and work furnished under this Section shall be guaranteed against all defects in materials and workmanship for a minimum period of one-year (1) commencing with the Date of Substantial Completion. Where individual equipment sections specify longer warranties, provide the

longer warranty. Any failure due to defective material, equipment or workmanship which may develop, shall be corrected at no expense to the Owner including all damage to areas, materials and other systems resulting from such failures.

C. Guarantee that all elements of each system meet the specified performance requirements as set forth herein or as indicated on the Drawings.

D. Upon receipt of notice from the Owner of the failure of any part of the systems during the warranty period, the affected parts shall be replaced. Any equipment requiring excessive service shall be considered defective and shall be replaced.

1.12 COORDINATION

A. Refer to Division 1, General Conditions, for coordination requirements applicable to this section, unless specifically noted otherwise in this section.

B. Materials and apparatus shall be installed as fast as conditions of the building will permit and must be installed promptly when and as required.

C. Confer with all other trades relative to location of all apparatus and equipment to be installed and select locations so as not to conflict with work of other Sections. Any conflicts shall be referred immediately to the Owner’s Representative for decision to prevent delay in installation of work. All work and materials placed in violation of this clause shall be readjusted to the Owner’s Representative's satisfaction at no expense to the Owner.

D. Where work of this section will be installed in close proximity to work of other sections or where there is evidence that the work of this section may interfere with work of other sections, assist in working out space conditions to make satisfactory adjustment. Prepare and submit for approval 3/8" scale or larger working drawings and sections, clearly showing how the work is to be installed in relation to the work of other sections. If the work of this section is installed before coordinating with other trades or so as to cause interference with work of other trades, make changes necessary to protect conditions without extra charge.

E. Keep fully informed as to the shape, size and position of all openings required for all apparatus, conduit, cable, sleeves, etc., and give information in advance to allow construction of required openings. Furnish all sleeves, pockets, supports and incidentals, and coordinate with the General Contractor for the proper setting of same.

F. All distribution systems which require pitch or slope such as condensate drains and water piping shall have the right of way over those which do not. Confer with other trades as to the location of pipes, ducts, lights and apparatus and install work to avoid interferences.

G. Make reasonable modifications in the work as required by structural interferences, or by interference with work of other trades, or for proper execution of the work without extra charge.

1.13 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

A. It is the intention of the Specifications and Drawings to call for complete, finished work, tested and ready for continuous operation. Any apparatus, appliance, material or work not shown on the Drawings, but mentioned in the Specifications or vice-versa, or any incidental accessories necessary to make the work complete in all respects and ready for operation, even if not particularly specified, shall be provided by this Contractor without additional expense to the Owner.

B. The Drawings are generally diagrammatic. The locations of all items that are not definitely fixed by dimensions are approximate only. The exact locations must be

determined at the project and shall have the approval of the Owner's Representative before being installed. This Contractor shall follow Drawings, including his shop drawings, in laying out work and shall check the Drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions. Where space conditions appear inadequate, notify the Owner's Representative before proceeding with the installation. This Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

C. Any requests for information (RFI) for resolving an apparent conflict or unclarity, or a request for additional detail, shall include a sketch or equivalent description of Contractor's proposed solution.

D. Size of conduits, cable trays, raceways and methods of running them are shown, but it is not intended to show every offset and fitting, nor every structural difficulty that may be encountered. To carry out the true intent and purpose of the Drawings, all necessary parts to make complete approved working systems ready for use, shall be furnished without extra charge. All work shall be installed in an approved workmanlike manner.

1.14 INSPECTION OF SITE CONDITIONS

A. Prior to submission of bid, visit the site and review the related construction documents to determine the conditions under which the Work has to be performed and send a report, in writing, to the Owner's Representative, noting any conditions which might adversely affect the Work of this Section of the Specifications.

1.15 SURVEY AND MEASUREMENTS

A. Base all required measurements, horizontal and vertical, from referenced points established WITH the Owner's Representative. The Electrical Contractor shall be responsible for correctly laying out the Work required under this Section of the Specifications.

B. In the event of discrepancy between actual measurements and those indicated, notify the Owner's Representative in writing and do not proceed with the related work until instructions have been issued.

1.16 DELIVERY, STORAGE AND HANDLING

A. No materials shall be delivered or stored on site until corresponding Shop Drawings have been approved.

B. All manufactured materials shall be delivered to the site in original packages or containers bearing the manufacturer's labels and product identification.

C. Protect materials against dampness. Store off floors, under cover and adequately protected from damage.

D. Inspect all equipment and materials, upon receipt at the job site, for damage and conformance to approved shop drawings.

1.17 PROTECTION OF WORK AND PROPERTY

A. This Contractor shall be responsible for the care and protection of all work included under this Section until the completion and final acceptance of this Contract.

B. Protect all equipment and materials from damage from all causes including, but not limited to, fire, vandalism and theft. All materials and equipment damaged or stolen shall be repaired or replaced with equal material or equipment at no additional cost to the Owner.

C. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by work or workmen under this Section and make good damage thus caused.

D. Damaged materials are to be removed from the site; no site storage of damaged materials will be allowed.

1.18 SUPERVISION

A. Supply the service of a competent Supervisor with a minimum of 5 years experience in Electrical construction supervision who shall be in charge of the Electrical work at the site.

1.19 SAFETY PRECAUTIONS

A. Life safety and accident prevention shall be a primary consideration. Comply with all of the safety requirements of the Owner and OSHA throughout the entire construction period of the project.

B. Furnish, place and maintain proper guards and any other necessary construction required to secure safety of life and/or property.

1.20 SCHEDULE

A. Construct work in sequence under provisions of Division 1 and as coordinated with the Owner's Representative.

1.21 HOISTING, SCAFFOLDING AND PLANKING

A. The work to be done under this Section of the Specifications shall include the furnishing, set-up and maintenance of all derricks, hoisting machinery, cranes, helicopters, scaffolds, staging and planking as required for the work.

1.22 SLEEVES, INSERTS AND ANCHOR BOLTS

A. Coordinate with other trades the location of and maintaining in proper positions, sleeves, inserts and anchor bolts to be supplied and/or set in place under this section of the specifications. In the event of incorrectly located preset sleeves, inserts and anchor bolts, etc., all required cutting and patching of finished work shall be done under this section of the specifications.

B. All pipes passing through floors, walls, ceilings or partitions shall be provided with fire stopping to maintain the fire rating of the structure. All penetrations and associated fire stopping shall be installed in accordance with the fire stopping manufacturer's listed installation details. Provide sleeves for all penetrations where required by the listed detail, for the penetration of all mechanical room floors and where specifically required on the drawings.

C. Field drilling (core drilling), when required, shall be performed under this section of the specifications, after receipt of approval by the Owner's Representative.

1. When coring cannot be avoided, provide ¼ inch pilot hole prior to coring. When coring through floor or slab, verify location of core on floor below and protect and piping, ductwork, wiring, furniture, personnel, etc., below the location of the core.

1.23 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORTS

A. Provide all supplementary steel, factory fabricated channels and supports required for the proper installation, mounting and support of all Electrical equipment, piping, etc., required by the Specifications.

B. Supplementary steel and factory fabricated channels shall be firmly connected to building construction in a manner approved by the Owner's Representative as shown on the drawings or herein specified.

C. The type and size of the supporting channels and supplementary steel shall be determined by the Contractor and shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.

D. All supplementary steel and factory fabricated channels shall be installed in a neat and workmanlike manner parallel to the walls, floors and ceiling construction. All turns shall be made with 90 degree and 45 degree fittings, as required to suit the construction and installation conditions.

E. All supplementary steel including factory fabricated channels, supports and fittings shall be galvanized steel, aluminum or stainless steel where exposed or subject to rust producing atmosphere. Factory fabricated channels shall be manufactured by Unistrut, H-strut, Powerstrut or approved equal.

1.24 HAZARDOUS MATERIALS

A. Removed batteries shall be recycled by a facility approved by the Owner's Representative. A uniform hazardous waste manifest shall be prepared for all disposals and returned with all applicable signoffs prior to application for final payment.

B. Removed fluorescent and HID lamps shall be recycled by a facility approved by the Owner's Representative. A uniform hazardous waste manifest shall be prepared for all disposals and returned with all applicable signoffs prior to application for final payment.

C. All ballasts in lighting fixtures to be disposed shall be verified to be PCB free. All ballasts manufactured prior to 1979 and not labeled as PCB free shall be considered to contain PCB's. Provide written verification to the Owner's Representative that confirms PCB free waste. Where PCB free waste cannot be verified, ballasts shall be recycled by a facility approved by the Owner's Representative, with PCB components eliminated by a high temperature incineration. A uniform hazardous waste manifest shall be prepared for all disposals and returned with all applicable signoffs prior to application for final payment. All handling shall conform to EPA requirements. Provide breakout cost for this scope.

D. Where it has been identified that asbestos-containing material exists within the scope limits, refer to the Asbestos Abatement specification section for requirements.

1.25 ACCESSIBILITY

A. All work provided under this Section of the Specification shall be installed so that parts requiring periodic inspection, maintenance and repair are accessible. Work of this trade shall not infringe upon clearances required by equipment of other

trades, especially code required clearances to electrical gear. Minor deviations from the drawings may be made to accomplish this, but changes of substantial magnitude shall not be made prior to written approval from the Owner's Representative.

1.26 PROJECT CLOSEOUT

A. Certificates Of Approval

1. Upon completion of all work, provide certificates of inspections from the following equipment manufacturers stating that the authorized factory representatives have inspected and tested the operation of their respective equipment and found the equipment to be in satisfactory operating condition and installed per the manufacturers installation instructions and requirements.

   a. Switchboard, Unit Substation and/or Power Switchgear

B. Substantial Completion

1. When the Contractor considers the Work under this Section is substantially complete, the Contractor shall submit written notice, through the General Contractor, with a detailed list of items remaining to be completed or corrected and a schedule of when each remaining work item will be completed. Should the engineer determine the list of remaining work does not constitute substantial completion the engineer will notify the Architect and/or Owner and he will not make a substantial completion site visit.

2. The following items shall be completed prior to the written request for substantial completion site visit:

   a. Certification of successful operation of all systems.

   b. Training of the Owner's personnel in the operation of the systems.

   c. Record Drawings in accordance with the contract specifications.

   d. Operation and Maintenance manuals.

   e. Testing reports.

   f. Manufacturer's certificates of approvals.

   g. Emergency contact list for reporting of malfunctioning equipment during the warrantee period.

   h. Contractors Project Completion certificate.

3. Should the Engineer, during the substantial completion visit, observe that the Work is substantially complete, s/he will provide a written listing of the observed deficiencies referred herein as the Punch List. The Punch List will provide for a place for the Contractor and general Contractor to sign off and date each item individually indicating that the observed deficiency item has been corrected.

4. Should the Engineer, during the substantial completion site visit, observe that the Work is not substantially complete, s/he will provide, a written list of the major deficiencies and a reason for the work not being considered substantially complete.

5. If the work is found not to be substantially complete then the engineer shall be reimbursed for his time to re-observe the work. A re-observation

fee shall be charged to the Contractor through the contractual agreement for any further observations by the engineer.

6. The Contractor shall remedy all deficiencies listed in the punch list within the time frame required by the contract.

C. Engineers Construction Completion Certification

1. Where required by the applicable code, the Engineers Construction Completion Certification will be issued by RDK Engineers when all required functional tests are complete and all reports are complete. The following is a minimum listing of the required systems to be tested with reports generated indicating they are complete and ready for use:

   a. Emergency and Egress Lighting System

   b. Fire Alarm System

   c. Emergency and Standby Generator

   d. Automatic Transfer Switch

2. There shall be NO outstanding items identified on the punch list for scope within any of these categories.

D. Final Completion

1. The following items shall be submitted prior to the written request for Final completion:

   a. Revised Substantial Completion items to be resubmitted in accordance with the review process comments.

   b. Warranties commencing the date of Substantial completion

   c. Individual Signed and dated Punch List acknowledging completion of all punch list items

2. When the Contractor considers all of the punch list work items complete, the Contractor shall submit written notice through the General Contractor that all Punch List items are complete and resolved and the work is ready for final observation site visit. The signature lines for completion of each punch list item shall be signed by the Contractor indicating the work is complete and signed by the General Contractor indicating s/he has inspected the work and found it to be complete. Should the Engineer find the work to be finally complete and all Punch List items are complete the Engineer will make a recommendation to the Architect or Owner. If the Engineer has found the punch list work to be incomplete during final inspection a written listing of the observed deficiencies will be prepared by the Engineer.

3. If the work is not fully complete then the engineer shall be reimbursed for his time to re-observe the work. A re-observation fee shall be charged to the Contractor through the contractual agreement for any re-observations by the engineer.

E. Re-observation Fees

1. The re-observation fee shall be $1200.00 per visit.

F. Contractor's Project Completion Certificate

1. Upon completion of work and prior to request for Certificate of Occupancy, each Trade Contractor and the General Contractor shall issue a certificate stating that work has been installed generally consistent with construction documents and all applicable codes. RDK

Engineers can furnish a blank Contractor's certificate form upon request. The certificate shall certify:

a. Execution of all work has been in accordance with the approved construction documents.

b. Execution and control of all methods of construction was in a safe and satisfactory manner in accordance with all applicable local, state and federal statutes and regulations.

2. The certificate shall include the following information:

a. Project.

b. Permit Number.

c. Location.

d. Construction Documents.

e. Date on Plans and Specifications submitted for approval and issuance of the Building Permit.

f. Addendum(a) and Revision Dates.

3. The certificate shall be signed by the Contractor and include the following:

a. Signature.

b. Date.

c. Company.

d. License Number.

e. License Expiration Date.

PART 2 - PRODUCTS

2.00 NOT USED

2.01 IDENTIFICATION

A. Nameplates

1. Nameplates shall be laminated white Bakelite with minimum 1/4" high black recessed letters.

2. Nameplates shall be securely attached to the equipment. Utilize mechanical fasteners such as galvanized steel or brass screws for exterior applications. High strength adhesives or cements may be used for interior applications.

3. Equipment panel and valve bar code labels shall be 4" by 2½" and designed to withstand temperatures of -22°F to +392°F. Labels are designed to be resistant to water, acid/solvent, dirt and oil repellant. Labels shall be high tensile Graphiplast® tearing strength as well as scratch resistant and affixed to equipment by cable ties or adhesive clear pouch. Location of label shall be at unit control panel, next to factory nameplate, lower right-hand corner of panel, and/or tie wrapped to localize disconnect at unit. Installation instructions shall be provided with the labels to assure durability (i.e., clean surface prior to adhering adhesive label, leave cable ties loose on outside of equipment to allow freedom of movement due to the elements, etc.) and with adhesive tags not secured when temperatures are below 45°F ambient temperature.

2.02 RACEWAYS AND CONDUIT

A. Rigid Galvanized Steel (RGS) Conduit

1. RGS shall be zinc-coated steel that conforms to ANSI C80.1, UL Specification No. 6 and Federal Specification WW-C-581e by Allied Tube and Conduit, Republic Steel, Wheatland Tube or approved equal.

2. RGS fittings shall be threaded. Split couplings or non-threaded fittings shall not be used.

3. Nipples and Close Nipples shall be RGS, length as noted or as required to conform to field conditions.

B. Intermediate Metal Conduit (IMC)

1. IMC shall be zinc-coated steel that conforms to ANSI C80.6, UL Standard No. 1242 and Federal Specification WW-C-581e by Allied Tube and Conduit, Wheatland Tube or approved equal.

2. IMC fittings shall be threaded.

C. Polyvinyl Chloride (PVC) Non-metallic Conduit

1. PVC conduit and fittings shall be Schedule 40 or Schedule 80, 90°C. UL Listed equal to Carlon Plus 40 or Plus 80. PVC shall meet NEMA Specification TC-2, TC-3 and UL-651.

2. PVC, fittings and solvent cement shall be by single approved manufacturer.

3. PVC shall be sunlight resistant and listed for exposed or outdoor usage.

D. Miscellaneous Conduit Fittings

1. Elbows shall be large, 48" Radius elbows unless noted otherwise.

2. Bushings shall be threaded pressed steel hot dipped galvanized with conduit end stop and integrally molded noncombustible phenolic insulated surface rated for 150°C.

3. Bonding bushings shall be threaded pressed steel hot dipped galvanized with conduit end stop and integrally molded noncombustible phenolic insulated surface rated for 150°C with a lay-in tin plated copper grounding lug.

4. Exposed conduit expansion fittings shall be hot-dipped galvanized malleable iron with external bonding jumper equal to O.Z./Gedney Type EX for RGS or Type TX for EMT (4” maximum expansion).

5. Provide water-tight gland sealing assemblies with pressure bushings equal to OZ/Gedney Type WSK for new cast-in-place installations or Type CSCM for retrofit (core drilling of existing walls) as required for below grade wall and floor penetrations.

2.03 WIRE AND CABLE (600V)

A. Provide single-conductor, annealed copper wire and cable with insulation rated for 600 V, of sizes specified and scheduled on Drawings, by General Electric, Southwire, Okonite or approved equal, for secondary service, feeders, branch and system wiring. Wire sizes shown and specified are American Wire Gauge for copper conductors.

B. The use of aluminum conductors is not allowed.

C. Wire #10 and larger shall be stranded; #12 and smaller shall be solid. Wire and cable shall have THWN-THHN or XHHW insulation for branch circuit and feeder conductors. Type RHW/USE shall be used for all conductors installed in below grade raceways.

D. Conductor Color-coding

1. Service entrance, branch circuit and feeder conductors shall be color-coded per national electric code requirements. Conductors #12 and #10 shall be colored with a factory applied solid or striped compound coating (black, red, blue, brown, orange or yellow). Neutrals and equipment grounds shall have solid compound or solid color coating (white, gray and green), except that neutrals with colored stripe shall be used where required by code. Phase conductors #8 and larger with stripes, bands or hash marks shall have background color other than white, green and gray.

2. Alternative field-applied color coding methods may be used for wire #8 or larger, with color code as specified in other sections of this specification. Coloring shall be applied by the use of flame-retardant vinyl tape, equal to 3M Scotch 35.

E. Splices and Terminations

1. Ampacity and temperature rating of splices and connectors shall be equal to or greater than those of associated wires and cables.

2. Make splices in branch circuit or feeder wiring from #12 to #10 with UL-listed, solderless screw on connectors rated 600 V.

3. Make splices in branch circuit or feeder wiring above #10 with UL-listed 90°C, 600V, compression butt splice barrel equal to Burndy YS-L HYLINK.

4. Conductor terminations shall be standard bolt-on lugs with hex screws listed for attachment of copper wire and cable to panelboards, switchboards, disconnect switches and other electrical equipment.

5. Make terminations for stranded conductors on screw terminals with UL Listed 105°C, 600V PVC insulated barrel compression locking fork tongue terminal equal to Burndy TP-LF VINYLUG.

6. Make bus terminations for conductors #6 and larger with UL-listed 90°C, 600V, compression standard barrel length lugs equal to Burndy YA-L for conductor sizes to #4/0. Connectors for cable 250 KCMil and larger shall be with UL-listed 90°C, 600V, compression long barrel length two hole lugs equal to Burndy YA-2N. Lugs shall be high conductivity seamless copper electro-tin plated for corrosion protection.

F. Wire management shall be provided by self-extinguishing self-locking nylon ties with -65 to 350°F. range for bundling conductors.

G. Arc-proofing

1. Provide flexible, flame-retardant, organic-composition-coated elastomer arc-proofing tape equal to 3M Scotch 77 on power cable in manholes and handholes, suitable to withstand 200 A arc for 30 seconds. Tape shall be self-extinguishing and shall not support combustion. Cover with glass cloth tape equal to 3M Scotch 69 as a binder.

2. Tape shall have been tested with 186-hour distilled water exposure and 3% salt water and shall be ultra-violet and weather resistant.

H. Cable pulling compounds shall be UL Listed and be suitable for use with the specified cable insulation system. The compound shall reduce the coefficient of friction, while not adding any long term issues to the installation such as premature aging of the insulation system, added flammability or drying in such a manner as to stick the cable in place in

2.04 UNDERGROUND DUCTS, PRE-CAST MANHOLES AND PRE-CAST COMMUNICATIONS HANDHOLES.

A. Underground Ducts

1. Raceways shall comply with Section 2.00 and 3.00 of this Specification unless specifically modified in this section of the Specification.

2. Spacers shall accommodate a minimum of two (2) inch conduit separation and three (3) inches from the top, bottom and side edges of the duct bank. Spacers shall accommodate the specified conduit sizes and interlock horizontally. Spacers shall be equal to Carlon or Underground Devices Incorporated.

3. PVC bell ends shall be utilized for all conduit transitions building foundations where sealing fittings are not otherwise specified.

4. Bends in excess of 30 degrees over a 10 foot length shall be factory fabricated galvanized rigid steel conduit. Where required to turn up at specified locations, factory fabricated long radius 90º galvanized rigid steel sweeps shall be used.

B. Pre-cast Manholes

1. Manhole shall be pre-cast concrete designed for the following loads:

a. The roof shall be designed for 4,000 pounds loading over any SF of roof area.

b. The walls shall be designed for the summation of the following:

1) Soil pressure of not less than an equivalent fluid pressure of 33 pcf.

2) Hydrostatic pressure of 5 feet measured from the base of the manhole.

3) A surcharge of 2.5 feet of soil weighing 120 pcf.

2. Concrete and concrete design shall be in accordance with ACI 318-1986.

3. Concrete shall have a minimum and maximum 28 day strength of 4,000 and 5,000 psi respectively.

4. Steel reinforcing bars shall conform to ASTM A615-1987A Grade 40 or 60. Welded wire mesh shall conform to ASTM A185-1985E1 or A497-1986.

5. Pulling eyebolts, with a minimum 8,000 pound pulling strength, shall be installed adjacent to window knockouts at eight (8) places.

6. Zinc alloy inserts 1/2 inch – 13 x 1-1/2 inch shall be installed at 48 places.

7. Openings and knockouts shall be clear of reinforcement.

8. Construction joint shall be sealed with asphalt cement or equivalent.

9. Manhole frame extension for 38 inch cover (SPC E-945, SC 0174868) shall be cast into top section where shown. Manufacturer's identification

and month/year when manufactured shall be legibly marked in/on concrete in the side of the 36 inch opening.

10. Top of MH shall have a smooth finish. Top of MH to be 4 inches above final grade.

11. Pre-cast units shall be the products of manufacturer regularly engaged in the supply of pre-cast concrete manholes and handholes, including products by American Precast, Rondo, Chase or approved equal.

12. Refer to drawings for additional requirements.

C. Handholes

1. Handholes and associated covers shall be constructed of polymer concrete consisting of aggregate matrix bound together with a polymer resin. Internal reinforcement may be provided by means of steel and/or fiberglass.

2. Material shall have the following properties:

a. Compressive strength: 9000 psi

b. Flexural strength: 6000 psi

c. Tensile strength: 800 psi

3. The installed enclosure shall be rated for a minimum test load of 8000 pounds distributed over a 10” x 10” area, and intended for non-deliberate heavy vehicular traffic only unless specifically noted otherwise on the drawings.

4. The boxes and covers shall be green. Covers shall be provided with stainless steel bolts at each corner. The logo shall specifically identify the service inside, “Communications”. The logo shall be permanently recessed in the cover. Non-metallic covers shall be provided with electronic markers encased in the polymer concrete for ease in locating buried handholes.

5. Precast handholes shall be Quazite type PD. Dimensions shall be as indicated on the drawings. Equal construction in precast or cast in place concrete will be accepted. Sides shall be flared to prevent frost heave.

2.05 MEDIUM VOLTAGE CABLE

A. General

1. This specification covers single conductor shielded medium voltage power cable insulated with an ozone and discharge resistant, flexible, rubber like thermosetting dielectric. Cable shall be 1/C stranded compact copper, extruded semi-conducting ethylene-propylene rubber (EPR) conductor screen, extruded semi-conducting ethylene-propylene rubber insulation, extruded semi-conducting ethylene-propylene rubber (EPR) insulation screen, copper shield tape and an overall PVC jacket.

2. The cable shall be suitable for use in wet and dry locations in conduit or underground duct system installations. The cable shall be rated 105°C for normal operation, 140°C for emergency overload operation and 250°C for short circuit conditions. Emergency overload operation may occur for periods up to 1500 hours cumulative during the life of the cable without adverse impact on life.

3. The cable shall meet or exceed the latest editions of ICEA S-68-516, ASTM B-496 & B-400, AEIC CS6-96 and UL-1072.

4. The medium voltage power cable shall have a performance record demonstrating a minimum of twenty (20) years successful operating experience in utility and industrial power cable applications.

5. Medium voltage power cable shall be Okonite or approved equal.

B. Conductor

1. Uncoated soft copper wire as defined on the plans, stranded concentric compact round copper per ASTM B-496 or aluminum per ASTM B-400 for sizes up to and including 1000 kcmil.

C. Conductor Screen

1. Extruded layer of semi-conducting EPR thermosetting compound applied over the conductor.

D. Insulation

1. The insulation shall be flexible thermosetting dielectric ethylene propylene elastomer. The insulation compound shall not contain any polyethylene.

2. The insulation shall be extruded with the conductor and insulation shield to prevent interfacial contamination. The extrusion operation shall be performed by multiple in line extruder heads thereby permitting the measurement and accurate individual control of the wall thickness of each layer of compound as the cable is being manufactured.

3. Insulation level shall be 133%.

E. Insulation Screen

1. The insulation screen shall be an extruded semi-conducting EPR compound applied over the insulation.

F. Shield

1. The insulation shield shall be covered with a bare copper 5 mil tape. It shall be applied helically with a 12½ -25 % nominal overlap.

G. Jacket

1. The overall jacket shall be PVC.

2. The jacket shall have an identifying legend repeated at no more than two (2) foot intervals, unmarked surfaces not exceeding six inches, including Manufacturer, Voltage, Conductor Size and Material Cu, Jacket Type, Insulation Level 133% and MV-105.

H. Production Tests

1. Conductors shall meet the electrical resistance requirements of ICEA-68-516 Section 2.5

2. Insulation Resistance test shall be performed in accordance with the requirements of ICEA S 68 516. Each cable shall have an insulation resistance not less than that corresponding to the insulation resistance constant of 50,000 megohms per 1000 ft. at 15.6°C.

3. A high voltage ac test performed in accordance with ICEA S-68-516.

4. Shield resistance measured and recorded from end to end on the completed cable.

5. Corona Test: Each reel of completed shielded power cable shall comply with the maximum partial discharge of 5 picocoulombs at 200 volts/mil (7.9 kV/mm). The partial discharge test shall be performed in

accordance with the procedures of Section F of AEIC CS6 and an X/Y graph will be recorded showing the corona test results.

6. Cables shall be tested according to NEMA WC 7 (ICEA S-66-524) and NEMA WC 8 (ICEAS-68-516) and inspected at the factory prior to shipping. Provide test reports along with manufacturer's data with the submittals.

I. Cable Terminations

1. Outdoor: Terminations that are exposed to the weather, such as riser poles.

   a. Terminations of the shielded power cables shall be manufactured molded rubber terminations, IEEE 48, Class 1. Elastimold type 35MTG, or approved equal with the grounding device for the metallic shield (Elastimold Type 20 MA for metallic type shield) and NEMA 2-hole, long-barrel terminal connector. The connector shall be listed for copper/aluminum applications.

2. Indoor: Terminations that are inside equipment or weatherproof compartments of outdoor equipment, such as transformers and switchgear.

   a. Terminations of shielded power cables rated 25kV or less shall be done with an IEEE Standard 48 Class 1 termination. It shall either be a one-piece design where high-dielectric constant stress control is integrated within a skirted insulator made of silicone rubber, gray in color, or provide for positive placement of the stress control with the installation of a stress patch. The termination shall not require heat or flame for installation. The terminations shall be 3M Brand 5630K Series Quick Term II cold shrink Termination Kits or Raychem TFT-E-SG. Only a NEMA 2-hole, long-barrel terminal connector shall be used. The connector shall be listed for copper/aluminum applications.

3. The standard withstand test voltage of the completed terminations shall conform to IEEE Standard No. 48.

J. Splices and Taps

1. Unless specified otherwise, all splices and taps shall be as per items A and B below. Only where hand-made splices are called out on the contract documents, shall Item C apply.

2. In manholes, splices for feeders shall only be 600 Amp non-loadbreak power distribution connectors. Approved manufacturers are Elastimold and Cooper. Order manufacturer's corresponding cable adapter and compression connector sized per phase conductor. Elastimold or Cooper insulating plug, basic insulating plug, and/or connecting plug shall be required for assembly. Manufacturer's approved tape shield adaptors are required.

3. In above ground cabinets and transformers, splices shall be 200 Amp Elastimold load-break connectors with test points mounted on Z-point load-break junction. The Z-point load-break junction is to be mounted on a universal mounting bracket with parking stands.

4. Handmade splices to cable are not allowed.

K. Submittals

1. Product data shall be highlighted indicating the cable type or splicing/terminating material to be used.

2. Material Certificates shall be submitted for each cable reel, certifying compliance with all required testing of the referenced documents.

3. Certified Test Reports documenting conformance of each cable length to the testing from each referenced standard shall be submitted and approved prior to cable shipment.

4. Qualifications of each cable installer responsible for splicing and terminating the cables specified, including the background experience of each such individual on similar previous projects.

2.06 PAD MOUNTED DISTRIBUTION SUBSTATION TRANSFORMER - LIQUID FILLED (PRE-PURCHASE)

A. This section is for information and coordination only. This equipment will be turned over by the Owner for installation by the Electrical Contractor under this contract.

B. General

1. This specification covers the electrical and mechanical characteristics of the 6,000 kVA 3-phase Step-Down Pad-Mounted Distribution Transformer.

C. Applicable Standards

1. All characteristics, definitions, and terminology, except as specifically covered in this specification, shall be in accordance with the latest revision of the following ANSI/IEEE, NEMA, and Department of Energy standards.

a. C57.12.00: IEEE Standard for Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.

b. C57.12.28: Pad-Mounted Equipment - Enclosure Integrity.

c. C57.12.34: IEEE Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers (2500 kVA and Smaller) - High Voltage: 34500GrdY/19920 Volts and Below; Low-Voltage: 480 Volt 2500 kVA and Smaller (issued in March 2005 - combines C57.12.22 and C57.12.26).

d. C57.12.90: IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers and IEEE Guide for Short-Circuit Testing of Distribution and Power Transformers.

e. C57.12.91: Guide for Loading Mineral-Oil-Immersed Transformers.

f. NEMA TR 1-1993 (R2000): Transformers, Regulators and Reactors, Table 0-2 Audible Sound Levels for Liquid-Immersed Power Transformers.

g. NEMA 260-1996 (2004): Safety Labels for Pad-Mounted Switchgear and Transformers Sited in Public Areas.

h. 10 CFR Part 431: Department of Energy – Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule.

D. Ratings

1. The transformer shall be designed in accordance with this specification and the kVA rating shall be 6,000 kVA.

2. The primary voltage shall be 22,900V, Delta configuration, and the basic lightning impulse insulation level (BIL) shall be 125 kV.

3. The secondary voltage shall be 4,160 GRDY/2,400V configuration, and the basic insulation level (BIL) of the secondary voltage shall be 60 kV.

4. The transformer shall be furnished with full capacity high-voltage taps. The tap changer shall be clearly labeled to reflect that the transformer must be de-energized before operating the tap changer as required in Section 4.3 of ANSI C57.12.34. The unit shall have the following tap configurations:

   a. Two – 2 ½% taps above and below rated voltage (split taps)

5. The average winding temperature rise above ambient temperature, when tested at the transformer rating, shall not exceed 55°C, and when tested at 112% of the base rating, shall not exceed 65°C.

6. The percent impedance voltage, as measured on the rated voltage connection, shall be 6.5%. The tolerance on the impedance shall be +/- 7.5%.

E. Construction

1. The core and coil shall be vacuum processed to ensure maximum penetration of insulating fluid into the coil insulation system. While under vacuum, the windings will be energized to heat the coils and drive out moisture, and the transformer will be filled with preheated filtered degassed insulating fluid. The core shall be manufactured from burr-free, grain-oriented silicon steel and shall be precisely stacked to eliminate gaps in the corner joints. The coil shall be insulated with B-stage, epoxy coated, diamond pattern, insulating paper, which shall be thermally cured under pressure to ensure proper bonding of conductor and paper. Coils shall be either aluminum or copper (eliminate a metal if one is required over the other).

2. The dielectric coolant shall be listed less-flammable fluid meeting the requirements of National Electrical Code Section 450-23 and the requirements of the National Electrical Safety Code (IEEE C2-2002), Section 15. The dielectric coolant shall be non-toxic*, non-bioaccumulating and be readily and completely biodegradable per EPA OPPTS 835.3100. The base fluid shall be 100% derived from edible seed oils and food grade performance enhancing additives. The fluid shall not require genetically altered seeds for its base oil. The fluid shall result in zero mortality when tested on trout fry *. The fluid shall be certified to comply with the US EPA Environmental Technology Verification (ETV) requirements, and tested for compatibility with transformer components. The fluid shall be Factory Mutual Approved, UL Classified Dielectric Medium (UL-EOUV) and UL Classified Transformer Fluid (UL-EOVK), Envirotemp® FR3 fluid.

   *(Per OECD G.L. 203)

3. Tank and Cabinet Enclosure

a. The high-voltage and low-voltage compartments, separated by a metal barrier, shall be located side-by-side on one side of the transformer tank. When viewed from the front, the low-voltage compartment shall be on the right. Each compartment shall have a door that is constructed so as to provide access to the high-voltage compartment only after the door to the low-voltage compartment has been opened. There shall be one or more additional fastening devices that must be removed before the high-voltage door can be opened. Where the low-voltage compartment door is of a flat panel design, the compartment door shall have three-point latching with a handle provided for a locking device. Hinge pins and associated barrels shall be constructed of corrosion-resistant material, passivated AISI Type 304 or the equivalent.

b. A recessed, captive, penta-head or hex-head bolt that meets the dimensions per ANSI C57.12.28 shall secure all access doors.

c. The compartment depth shall be in accordance with C57.12.34, unless additional depth is specified.

d. The tank base must be designed to allow skidding or rolling in any direction. Lifting provisions shall consist of four lifting lugs welded to the tank.

e. The tank shall be constructed to withstand 7 psi without permanent deformation, and 15 psi without rupture. The tank shall include a 15 psig pressure relief valve with a flow rate of minimum 35 SCFM.

f. The exterior of the unit shall be painted Munsell 7GY3.29/1.5 green. The cabinet interior and front plate shall be painted gray for ease of viewing the inside compartment.

g. The tank shall be complete with an anodized aluminum laser engraved nameplate. This nameplate shall meet Nameplate B per ANSI C57.12.00.

4. High Voltage Bushings and Terminals

a. High voltage bushings will be installed in the high voltage termination compartment located on the front left of the transformer and requiring access via the low voltage termination compartment on the front right.

b. Bushing Style

1) The high voltage bushings shall be 25 kV 200A bushing wells with bushing well inserts installed. The bushings shall be externally removable and be supplied with a removable stud (Re: Cooper Power Systems catalog sections 800-32, 500-12, and 500-26).

c. Bushing Configuration

1) The transformer shall be provided with six (6) high voltage bushings in accordance Figure 2 dimensions of ANSI C57.12.34 for loop feed configurations. The bushing heights shall be in accordance with Figure 3 minimum dimensions of ANSI C57.12.34.

5. Secondary Bushings and Terminals

a. Bushing Style

1) The transformer shall be provided with tin-plated spade-type bushings for vertical takeoff. Bushings shall be 1,200A, porcelain, 4-hole spade.

b. Bushing Configuration

1) The transformer shall be provided with bushings in a staggered arrangement.

6. Overcurrent Protection

a. INTEGRAL VACCUUM, FAULT INTERRUPTER (VFI): The high-voltage overcurrent protection scheme provided with the transformer shall be an integral Vacuum Fault Interrupter (VFI). The VFI shall have a maximum interrupting rating of 12,000A RMS symmetrical with resettable fault protection. The VFI shall also include a Tri-Phase electronic breaker control with over 100 minimum trip settings and 5 selectable time current curves.

1) VFI shall be in series with ELSP under-oil partial-range current-limiting back-up fuses with an interrupting rating of 50,000 A.

7. Overvoltage Protection

a. The overvoltage protection scheme provided with the transformer shall protect the high-voltage or winding.

1) DEAD-FRONT BUSHINGS: Externally mounted, Distribution Class M.O.V.E. Dead-front elbow arresters shall be supplied.

F. Labeling

1. A temporary bar code label shall be attached to the exterior of the transformer in accordance with ANSI C57.12.34**.**

G. Finish Performance Requirements

1. The tank coating shall meet all requirements in ANSI C57.12.28 including:

a. Salt Spray

b. Crosshatch adhesion

c. Humidity

d. Impact

e. Oil resistance

f. Ultraviolet accelerated weathering

g. Abrasion resistance – taber abraser

2. The enclosure integrity of the tank and cabinet shall meet the requirements for tamper resistance set forth in ANSI C57.12.28 including but not limited to the pry test, pull test, and wire probe test.

H. Production Testing

1. All units shall be tested for the following:

a. No-Load (85°C or 20°C) losses at rated current

b. Total (85°C) losses at rated current

c. Percent Impedance (85°C) at rated current

d. Excitation current (100% voltage) test

e. Winding resistance measurement tests

f. Ratio tests using all tap settings

g. Polarity and phase relation tests

h. Induced potential tests

i. Full wave and reduced wave impulse test

2. Minimally, transformers shall conform to efficiency levels for liquid immersed distribution transformers, as specified in Table I.1 of the Department of Energy ruling. "10 CFR Part 431 Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule; October 12, 2007." Manufacturer shall comply with the intent of all regulations set forth in noted ruling. This efficiency standard does not apply to step-up transformers.

3. In addition, the manufacturer shall provide certification upon request for all design and other tests listed in C57.12.00, including verification that the design has passed short circuit criteria per ANSI C57.12.00 and C57.12.90.

4. Manufacturer shall conform to guaranteed average losses as specified in ANSI C57.12.00. The no-load losses of a transformer shall not exceed the specified no-load losses by more than 10%, and the total losses of a transformer shall not exceed the specified total losses by more than 6%.

I. Approved Manufacturers

1. Cooper Power Systems, Eaton, Square D and GE.

J. Accessories

1. The following accessories and options shall be provided:

a. Welded main tank cover with bolted handhole

b. 1.0" upper fill plug

c. 1.0" drain valve w/ sampling device in LV compartment

d. Automatic pressure relief valve

e. Ground provisions per C57.12.34 section 9.11.

f. Meet NEMA TR-1 sound levels

g. Liquid level gauge

h. Dial-type thermometer gauge

i. Pressure vacuum gauge

j. Upper fill valve

k. Schrader valve

l. Nitrogen blanket

m. Ground connectors

n. Danger high voltage warning signs

o. Non-PCB decal

p. Touch-up paint

K. Transformer Evaluation

1. Unit loss evaluation, guaranteed average losses. Criteria to properly evaluate quoted losses:

a. Core loss evaluation (A-factor) ____ $/watt

b. Winding loss evaluation (B-factor) ____ $/watt

L. Shipping

1. Transformer shall be loaded and unloaded with overhead crane, so a pallet is not to be provided for transformer.

M. Data With Proposal

1. The following data shall be submitted with the proposal:

a. Core losses

b. Winding losses

c. Percent Impedance

d. Typical bid drawing

e. Approval drawing – drawings shall show final dimensions and features.

f. Record Drawing – drawings shall show final dimensions and features.

N. Service

1. The manufacturer of the transformer shall have regional service centers located within 2 hours flight time of all contiguous 48 states. Service personnel shall be factory trained in commissioning and routine service of quoted transformers.

2.07 PAD-MOUNTED TRANSFORMERS – LIQUID FILLED

A. General

1. This specification section covers the electrical and mechanical characteristics of the 4,160 Volt, pad mounted transformers throughout the site which are replacing the existing pole mounted transformers.

2. Furnish and install a dead front, liquid filled, three-phase URD distribution transformers in accordance with the ratings indicated on the drawings. The transformer shall consist of a welded transformer tank with air-filled high and low voltage terminating compartments assembled as an integral unit suitable for exterior mounting on a concrete pad.

3. Units shall, as a minimum, meet the latest requirements of :

a. Factory Mutual

4. Refer to the drawings for the kVA ratings, primary and secondary voltages and primary and secondary connections. The basic insulation level (BIL) ratings for the primary shall be 60 kV minimum. Secondary BIL shall be 30 kV.

5. The transformer shall be furnished with (2) - 2½% taps above and (2) below rated voltage full capacity high-voltage taps. The tap changer shall be clearly labeled that the transformer must be de-energized before operating. The tap changer switch shall be an externally operated, snap action switch with a hotstick handle and padlocking provisions.

   The dielectric coolant shall be listed less-flammable fluid meeting the requirements of National Code Section 450-23, including a minimum fire point of 300°C. The fluid shall be biodegradable, non-toxic, and non-bioaccumulating. It shall be Factory Mutual Approved and UL Classified, Envirotemp FR3 fluid or equal.

6. Impedance shall be 5.7% unless indicated otherwise.

7. The average winding temperature rise above ambient temperature, when tested at the transformer rating shall not exceed 65°C.

8. The transformers shall be manufactured by ABB, Cooper Power Systems or GE.

B. Enclosure

1. The pad-mounted equipment shall meet the requirements for tamper resistance set forth in ANSI C57.12.28 including but not limited to the pry test, pull test, and wire probe test. In addition to the regular locking provision, a recessed, captive, pentahead bolt that meets the dimensions set forth in ANSI C57.12.28 shall secure all access doors.

2. Each compartment shall have a separate door with provisions for a single padlock capable of locking both compartments. The high voltage compartment shall be mechanically interlocked to prevent opening unless the low voltage compartment is opened. Each compartment door shall have a minimum of three tamperproof hinges made of corrosion-resistant material.

3. The tank must be welded using cold-rolled steel and equipped with (4) extra-heavy duty, welded-in-place lifting lugs and jacking pads.

4. The transformer shall be of sealed tank construction of sufficient strength to withstand a pressure of 7 psig without permanent distortion, and 15 psig without rupturing or affecting cabinet security per ANSI C57.12.26 paragraph 7.5.2. The tank shall include a pressure relief as required to meet the listing of the specified fluid.

5. The tank shall be cleaned with an alkaline cleaning agent to remove grease and oil. A zinc phosphate coating shall then be chemically bonded to the metal to assure coating adhesion and retard corrosion. The tank shall be primed with an electrodeposited powder epoxy to provide a barrier against moisture, salt, and corrosives. The topcoats shall be liquid polyurethane paint to seal and provide ultraviolet protection. The tank coating shall meet all requirements in ANSI C57.12.28. Color shall be munsell green.

6. The tank shall be complete with an anodized aluminum engraved nameplate.

7. The following accessories shall be provided:

   a. Upper Fill Plug

   b. Drain/Sampling Valve in LV compartment

   c. Automatic Pressure Relief Valve

d. SS NEMA 2-Hole Ground Pad

e. SS Cabinet Hinges & Mounting Studs

f. Liquid Level Gauge

g. Dial Type Thermometer with maximum level indicator

h. Tap for vacuum/pressure Gauge

i. High Voltage 200A Bushing Inserts

j. Low Voltage 10-Hole Spade w/Supports

k. Four position, break before make, T-blade switch

l. HV Warning Signs

C. Core and Coil

1. The core shall be manufactured from burr-free, grain-oriented silicon steel and shall be precisely stacked to eliminate gaps in the corner joints. The coil shall be insulated with B-stage, epoxy coated, diamond pattern, insulating paper, which shall be thermally cured under pressure to ensure proper bonding of conductor and paper.

2. Core windings shall be aluminum.

3. The core and coil shall be vacuum processed to ensure maximum penetration of insulating fluid into the coil insulation system. The windings shall be heated to drive out moisture, and the transformer will be filled with preheated filtered degassed insulating fluid.

D. High Voltage

1. The transformer shall be provided with six (6) high voltage bushing wells, each phase bussed together, rated for full three-phase duty in accordance with ANSI C57.12.26 for radial feed configurations. One set shall receive dead front load break elbows for the incoming service and the other set shall be for elbow style surge arresters.

2. Provide a primary 3-position switch (open, closed and grounded) which shall be interlocked to prevent operation when the transformer is energized.

3. The high voltage bushings provided shall be 200A fixed stud bushing wells conforming to ANSI/IEEE 386. The bushings shall be externally removable, externally clamped and have a molded in semi-conductive shield.

4. Loadbreak Bushing Inserts shall conform to ANSI/IEEE386. Current carrying path shall be all copper and have a hex-broached base to accommodate torque tool for installation assistance. A latched elbow indicator ring shall be provided.

5. The transformer primary shall include a loadbreak Bay-O-Net assembly with a flapper valve to minimize oil spillage. Overcurrent protection shall be provided by a Bay-O-Net expulsion fuse mounted in series with a partial range under-oil ELSP current-limiting fuses with an interrupting rating of 30,000 A.

6. Externally mounted, Heavy-Duty Distribution Class M.O.V.E. Deadfront elbow arresters shall provide primary overvoltage protection.

E. Low Voltage

1. The low-voltage line and neutral bushings shall be one-piece epoxy or fiberglass polyester material with tinned copper or aluminum terminal spades. The low-voltage bushings shall be bolted on and externally clamped.

2. Low voltage bushings shall be replaceable utilizing the access provided or through the removal of the cover.

3. The bushings shall accommodate up to two (2) hole lugs.

F. Low Voltage Distribution Panelboard

1. Where shown on drawings, provide a low voltage distribution panel section within the secondary compartment.

2. Provide a fully bussed distribution panel sized for the FLA output of the transformer (see schedules).

3. Provide branch distribution circuit breakers as indicated on drawings.

G. Submittals

1. ANSI basic design tests for audible sound level and temperature rise are to be made on a sufficient number of transformers and ratings for the style submitted. Design tests are not required to be repeated for this submission, unless the design has changed so as to modify the reliability of previous results. Submit for Record.

2. Certified test reports for transformers by serial number shall include the following minimum tests in accordance with the latest revision of ANSI Standard Test Code C57.12.90:

a. No-load loss and excitation current at rated voltage on the rated voltage connection.

b. Polarity and phase-relation tests on the rated voltage connection

c. Ratio tests on the rated voltage connection and on all tap connections.

d. Impedance and load loss at rated current on the rated voltage connection

e. Mechanical leak and pressure test on tank and coolers.

3. Provide time current characteristic curves for protective devices.

2.08 MEDIUM VOLTAGE LOAD INTERRUPTER OUTDOOR SWITCHGEAR (PRE-PURCHASE)

A. This section is for information and coordination only. This equipment will be turned over by the Owner for installation by the Electrical Contractor under this contract.

B. General

1. The Contractor shall furnish and install the medium voltage load interrupter switchgear as specified herein and as shown on the contract drawings.

C. References

1. The medium voltage load interrupter switchgear and all components shall be designed, manufactured and tested in accordance with the latest applicable standards as follows:

a. ANSI/IEEE C37.20.3

b. ANSI/IEEE C37.20.4

c. ANSI C37.22

d. ANSI C37.57, C37.58

e. NEMA SG5

f. NEMA SG6

g. CSA 22.2 No.31-M89 (5/15 kV ratings only)

h. EEMAC G8-3.3

2. Listing by Underwriters Laboratories (UL) shall be provided for 5 kV class medium voltage load interrupter switchgear.

D. Submittals – for Review/Approval

1. The following information shall be submitted to the Engineer:

a. Master drawing index

b. Front view elevation

c. Top view

d. Single line diagram

e. Nameplate schedule

f. Component list

g. Conduit entry/exit locations

h. Assembly ratings including:

1) Short-circuit rating

2) Voltage

3) Continuous current

4) Basic Impulse Level

i. Major component ratings including:

1) Voltage

2) Continuous current

3) Interrupting ratings

j. Cable terminal sizes

2. Where applicable or required by the Engineer the following additional information shall be submitted to the Engineer:

a. Connection details between close-coupled assemblies

b. Electrical schematic diagram

c. Descriptive bulletins

d. Product data sheets

E. Submittals – for construction

1. The following information shall be submitted for record purposes:

a. Final as-built drawings and information for items listed 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

e. Seismic certification as specified

F. Qualifications

1. The manufacturer of the assembly shall be the manufacturer of the major components within the assembly.

2. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.

3. 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.

G. Provide Seismic tested equipment as follows:

1. The manufacturer shall certify the equipment based upon a dynamic and/or static structural computer analysis of the entire assembly structure and its components, provided it is based upon actual seismic testing from similar equipment. The analysis shall be based upon all applicable seismic requirements of the 2006 International Building Code.

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.

H. Delivery, storage and handling

1. Equipment shall be handled and stored in accordance with manufacturer's instructions. One (1) copy of these instructions shall be included with the equipment at time of shipment.

2. Each switchgear assembly shall be split into shipping groups for handling as indicated on the drawings or per the manufacturer's recommendations. Shipping groups shall be designed to be shipped by truck, rail or ship. Shipping groups shall be bolted to skids. Accessories shall be packaged and shipped separately. Each switchgear shipping group shall be equipped with lifting eyes for handling solely by crane.

I. Operation and Maintenance manuals

1. Equipment operation and maintenance manuals shall be provided with each assembly shipped, and shall include instruction leaflets and instruction bulletins for the complete assembly and each major component.

J. Manufacturers

1. Eaton/Cutler-Hammer, S&C Electric or approved equal.

2. The listing of specific manufacturers above does not imply acceptance of their products that do not meet the specified ratings, features and functions. Manufacturers listed above are not relieved from meeting these specifications in their entirety. Products in compliance with the specification and manufactured by others not named will be considered only if pre-approved by the Engineer ten (10) days prior to bid date.

K. Ratings

1. Switchgear assembly ratings shall be as follows:

a. Nominal System Voltage: 5.0 kV, 3-phase, 3- wire

b. System Grounding: Solid

c. Main Cross Bus Continuous Current: 1,200 A

d. Maximum Design Voltage: 4.76 kV

e. BIL: 60 kV

f. Main Cross Bus Momentary Current (10 Cycle) Asymmetrical RMS: 40 kA

g. Main Cross Bus 2-Second Short Circuit Current: 25 kA Symmetrical RMS

h. Fuse Rating: See Drawings.

i. Type of Fuse: CLE

j. Fuse Interrupting Rating: 19 kA Sym RMS

k. Fused Switch Fault close: 26.5 kA Asym RMS

L. Breaker/Switch ratings shall be as follows:

3-Phase MVA	206 MVA at 4.76 kV
Continuous Current Rating	1200 Amperes
Circuit Breaker Rated Short-Circuit Current at Rated Maximum kV	25 kA Symmetrical RMS
Voltage Range Factor K=	1
Short-Time (2-Second) Current	25 kA Sym RMS
Circuit Breaker Closing and Latching Capability (and assembly momentary)	40 kA Asym RMS/65 kA Peak
Switch continuous/load break	1200 Amperes
Switch Fault Close	40 kA Asymmetrical RMS/65 kA Peak

M. 5 KV Construction

1. The metal-enclosed load interrupter switchgear shall consist of deadfront, completely metal-enclosed vertical sections containing vacuum circuit breaker (main) load interrupter switches and fuses (where shown) of the number, rating and type noted on the drawings or specified herein.

2. Complete line up of switchgear shall be contained within an outdoor NEMA 3R enclosure.

3. The following features shall be supplied on every vertical feeder section containing a three-pole, two-position open-closed switch:

   a. A minimum 8-inch x 16-inch high-impact viewing window that permits full view of the position of all three switch blades through the closed door. The window shall not be more than 58-inches above the switch pad level to allow ease of inspection

   b. The door shall be interlocked with the switch so that:

      1) The switch must be opened before the door can be opened.

      2) The door must be closed before the switch can be closed.

   c. A hinged grounded metal barrier that is bolted closed in front of every switch to prevent inadvertent contact with any live part, yet allows for a full-view inspection of the switch blade position

   d. Provision for padlocking the switch in the open or closed position

   e. Green OPEN, Red CLOSED switch position indicators with the words “Open” and “Closed” in French, Spanish and English

   f. A hinged cover with rustproof quarter turn nylon latches over the switch operating mechanism to discourage casual tampering

   g. The switch shall be removable from the structure as a complete operational component.

4. Vertical section construction shall be of the universal frame type using die-formed and bolted parts. All enclosing covers and doors shall be fabricated from steel with thickness equal to or greater than that specified in ANSI/IEEE C37.20.3. No owner removable hardware for covers or doors shall be thread-forming type. To facilitate installation and maintenance of cables and bus in each vertical section, a split removable top cover and split removable rear covers with rustproof nylon handles] [padlockable hinged rear door held closed by bolts] shall be provided. A G90 grade galvanized base shall isolate equipment from contact with the concrete pad providing protection from rust. Heavy-duty hot dipped galvanized anchor clips shall be provided to anchor the switchgear to the concrete pad.

5. Each vertical section containing a switch shall have a single, full-length, flanged front door and shall be equipped with two (2) rotary latch-type padlockable handles. Provision shall be made for operating the switch and storing the removable handle without opening the full length door.

6. For main cubicle, furnish distribution class arresters with rating in accordance with manufacturers recommendations.

7. Main Circuit Breaker

a. Circuit breaker shall be operated by a motor-charged spring stored energy mechanism. The spring may be charged manually in an emergency or during maintenance procedures.

b. Circuit breaker shall have three (3) vacuum interrupter assemblies. Each vacuum interrupter shall have a contact wear indicator which does not require any tools to indicate the contact wear. The current transfer from the vacuum interrupter moving stem to the breaker main conductor shall be a non-sliding design. The breaker front panel shall be removable when the compartment door is open for ease of inspection and maintenance of the mechanism.

c. The breaker shall be electrically operated by:

1) 120- Vac close and AC capacitor trip.

d. Breaker shall be complete with control switch and red and green indicating lights to indicate breaker contact position.

e. The control voltage shall be derived from a control power transformer mounted in the switchgear.

f. Protective Relays:

1) The switchgear manufacturer shall furnish and install, in the metal-enclosed switchgear, the quantity, type and rating of protection relays as indicated on the drawings and described hereinafter in this specification.

2) EDR-5000

a) The protective relay for the Main Breaker circuit protection shall be a single multifunction, microprocessor-based relay that provides three-phase and ground directional instantaneous and time overcurrent protection, ANSI 50/51, 50/51G, or 50/51N, frequency, voltage, and power protection, metering and control functions as described below. The relay shall be Eaton device type EDR-5000 or approved equal

b) The relay shall be a solid-state microprocessor-based multifunctional type that operates from a 5 ampere or 1 ampere secondary output of current transformers. The relay shall provide ANSI 50/51 protective functions, and ANSI 50/51N or 50/51G ground fault protection functions for each windings as shown on the plans or as determined by the coordination study. The relay shall be configurable between true rms or fundamental sensing for each phase and ground. Ground element shall be capable of being utilized in residual, zero sequence, ground source connection schemes, or deactivated

c) The primary current transformer rating being used for phase and ground protection feeding the device shall be programmable for current

transformers with primary current ratings from 1 through 50,000 amperes

d) The relay shall provide the following protection and control functions:

i) Directional Phase overcurrent (67 or 50/51): Three inverse time overcurrent (51-1, 51-2, 51-3) functions and three instantaneous overcurrent (50-1, 50-2, 50-3) functions with adjustable time delay. It shall be possible to restrained the operation of the 51-2 and 51-3 elements based on voltage. These elements can be directionally controlled.

ii) Directional Ground overcurrent (67G or 50R/51R): Two inverse time overcurrent (51R-1, 51R-2) functions and two instantaneous overcurrent (50R-1, 50R-2) functions from calculated values with adjustable time delay. These elements can be directionally controlled.

iii) Directional Ground overcurrent (67G or 50X/51X): Two inverse time overcurrent (51X-1, 51X-2) functions and two instantaneous overcurrent (50X-1, 50X-2) functions from measured values with adjustable time delay. These elements can be directionally controlled

iv) Ground directional option for Zero Sequence Voltage Polarizing, Negative Sequence Polarizing or Ground Current Polarizing.

v) Negative sequence overcurrent protection with adjustable time delay (46-1, 46-2)

vi) Negative sequence overvoltage protection with adjustable time delay (47-1, 47-2)

vii) Three-phase main overvoltage protection with adjustable time delay (59M-1, 59M-2)

viii) Three-phase main undervoltage protection with adjustable time delay (27M-1, 27M-2)

ix) Auxiliary overvoltage protection with adjustable time delay (59A-1, 59A-2)

x) Auxiliary undervoltage protection with adjustable time delay (27A-1, 27A-2)

xi) Single-phase neutral overvoltage protection with adjustable time delay (59N-1, 59N-2)

xii) 6 Frequency elements that can be assigned to: over frequency, under frequency, rate of change, or vector surge (81-1, 81-2, 81-3, 81-4, 81-5, 81-6).

xiii) Apparent and Displacement Power Factor (55A-1, 55A-2, 55D-1, 55D-2)
xiv) Directional Power (32-1, 32-2, 32-3)
xv) Directional Vars (32V-1,32V-2, 32V-3)
xvi) Synch Check 25)
xvii) Auto reclosing (79)
xviii) Breaker failure protection with adjustable time delay (50-BF)
xix) VT fuse failure detection (LOP)
xx) Switch onto fault protection
xxi) Cold load pickup

The phase, and ground protection curves shall be independently field-selectable. Curves shall be selectable from the following:

IEEE: Moderately inverse, very inverse, extremely inverse

IEC: A, B, C or D

Thermal: Flat, It, I^2t, I^4t

Thermal curves shall be similar to those on low voltage trip units for close coordination with downstream devices.

e) The relay shall have 10 contact outputs that may be programmed for any protection function operation output

f) The relay shall have a front panel display of relay condition, and14 programmable LEDs that can be used for trip condition or breaker status

g) Provide a front communication port supporting ASCI communications to a personal computer or laptop computer.

h) Relay shall store four setting groups which can be called for via front panel operation, or contact input

i) Relay trip contacts shall not change state if power is lost or an undervoltage occurs. These contacts shall only cause a trip upon detection of an overcurrent or fault condition based upon programmed settings

j) A relay healthy alarm output shall be normally energized and shall drop out if a relay failure is detected in the self-test function or if control power is lost

k) The relay shall be suitable for operating on control power with a nominal input voltage of 48 to 125 Vdc or 120 to 240 Vac (50 or 60 Hz).

8. Load interrupter switches:

a. Three-pole gang-operated mechanism

b. Manual quick-make, quick-break over-toggle-type mechanism that does not require the use of a chain or a cable for operation, and utilizes a heavy-duty coil spring to provide opening and closing energy

c. The speed of opening and closing the switch shall be independent of the operator, and it shall be impossible to tease the switch into any intermediate position under normal operation

d. Separate main and break contacts to provide maximum endurance for fault close and load interrupting duty

e. Insulating barriers between each phase and between the outer phases and the enclosure

f. A maintenance provision for slow closing the switch to check switch blade engagement and slow opening the switch to check operation of the arc interrupting contacts

g. For fused switch cubicles, fault protection shall be furnished by fuses as specified with ratings as shown on drawings. Three (3) spare fuses shall be provided for each fuse size.

h. Provide blown fuse indication for each phase on each fused switch.

N. Bus

1. All phase bus conductors shall be silver-plated copper.

2. Ground bus shall be silver-plated copper and be directly fastened to a galvanized metal surface of each vertical section, and be of a size sufficient to carry the rated
(2-second) current of the switchgear assembly.

3. A neutral bus shall be provided only when indicated on the drawings. It shall be insulated for 1000 Vac to ground. The current rating of the neutral bus shall be 600 amperes.

O. Bus Supporting System

1. All bus shall be supported utilizing a high strength and high creep support providing 10.5-inch of creep distance between phases and ground. The molded fins shall be constructed of high track resistant cycloaliphatic epoxy.

2. All standoff insulators on switches and fuse mountings shall be glass polyester.

3. One (1) terminal pad per phase shall be provided for attaching contractor-supplied cable terminal lugs for a maximum of two (2) conductors per phase of the sizes indicated on the drawings. Sufficient space shall be allowed for contractor supplied electrical stress relief termination devices.

4. Small wiring, fuse blocks and terminal blocks within the vertical section shall be furnished as indicated on the drawings. Each control wire shall

be labeled with wire markers. Terminal blocks shall be provided for owner's connections to other apparatus.

P. Fuses

1. Fault protection shall be provided by fuses with continuous ratings as shown in the contract documents. Any fuse/switch integrated momentary and fault close ratings specified shall have been verified by test and UL and CSA certified.

Q. Owner Metering

1. Where indicated on the drawings, provide Owner metering in the switch structure on a hinged panel to provide safe isolated access to meters and all associated terminal and fuse blocks for maintenance, calibration or testing while the gear is energized.

2. Provide ring-type current transformers for each meter. Current transformers shall be wired to shorting-type terminal blocks.

3. Provide voltage transformers including primary fuses and secondary protective devices for metering as shown on the drawings.

4. Microprocessor-Based Metering System.

R. Accessories

1. Furnish distribution class surge arresters with ratings in accordance with manufacture's recommendations.

S. Enclosures

1. Enclosures shall be constructed per IEEE/ANSI C37.20.3 Outdoor specifications. (Exceeds NEMA 3R.)

2. Each vertical section shall have a sloped weatherproof roof with labyrinth shaped joints. Use of gasket or caulking to make roof joints weatherproof shall not be permitted. All exterior openings shall be screened to prevent the entrance of small animals and barriered to inhibit the entrance of snow, sand, etc. A minimum of one (1) 250-watt, 120-volt space heater shall be provided in each vertical section. Provide an Ameter to monitor space heater power supply in each section. Provide a 120Vac Recepticle and light in the front of each Switch section. Power for the space heater(s) shall be furnished by a control power transformer mounted in the switchgear. The design shall be non-walk-in type.

3. Each vertical section shall be ventilated at the top and bottom, both front and rear, to allow airflow to provide cooling and help prevent buildup of moisture within the structure. The ventilated covers shall be externally removable to allow safe maintenance of the filter media without providing access to live parts.

T. Nameplates

1. A nameplate shall be mounted on the front door of each switch vertical section in accordance with the drawings.

U. Finish

1. Prior to assembly, all enclosing steel shall be thoroughly cleaned and phosphatized. A powder coating shall be applied electrostatically, then fused-on by baking in an oven. The coating is to have a thickness of not less than 1.5 mils. The finish shall have the following properties:

a. Impact resistance (ASTM D-2794) 60 direct/60 indirect

b.	Pencil hardness (ASTM D-3363)	H
c.	Flexibility (ASTM D-522)	Pass 1/8-inch mandrel
d.	Salt spray (ASTM B117-85 [20])	600 hours
e.	Color	ANSI 61 gray

PART 3 - EXECUTION

3.00 NOT USED

3.01 IDENTIFICATION

A. Nameplates

1. Provide nameplates on all equipment listed in other sections of this specification including but not limited to switchboards, substations, panelboards, transformers, junction and pull boxes, disconnect switches, motor starters and motor control centers, contactors, time clocks, remote control stations, fire alarm panels, smoke detector remote test/alarm stations and fire alarm annunciators.

2. Nameplates shall designate equipment tag number as defined on the drawings, system voltage where applicable, circuit number, device controlled and system function. Refer to typical nameplate detail on the drawings for additional requirements.

3. Submit a complete list of proposed nameplates prior to order to ensure conformance to design criteria. Submittal shall include nomenclature, size and layout of each tag.

B. Equipment Identification

1. Equipment identification designations shall be taken from equipment schedules and coordinated with the Owner's facility group to assure designations match up with Owner's maintenance management system identification database.

3.02 RACEWAYS AND CONDUIT

A. General

1. Unless specified or shown on Drawings otherwise, install raceways and conduits concealed. Raceways and conduits may be run exposed on unfinished walls and basement ceilings with exposed structure, in mechanical rooms, electric rooms, attics and roof spaces.

2. Run concealed raceways and conduits in as direct lines as possible with minimum number of bends of longest possible radius. Install exposed raceways and conduits parallel to or at right angles to building lines.

3. Raceway and conduit runs shall be mechanically and electrically continuous from supply to outlet. Conduit shall enter and be secured to metallic enclosures with lock nut and bushing inside. Provide additional exterior lock nut for RGS connections. Bushings shall be the bonding type for conduit connections to metallic enclosures with concentric or eccentric knockouts. Lock nuts and bushings will not be required where conduits are screwed into threaded hubs.

4. Size raceways and conduits as required by NEC unless oversized raceways and conduits are shown on the Drawings. Raceways and conduits shall be ¾" minimum.

5. Install conduit systems complete before installation of conductors. Blow through and swab after plaster is finished and dry, and before conductors are installed.

6. Raceways and conduits supports shall be rigidly attached to the building structure utilizing corrosion resistant components suitable for use with the selected raceway or conduit. Refer to the seismic restraint sections of this specification for any additional requirements.

7. Field bending, cutting and threading shall be executed with the proper tools, resulting in bends and shortened conduits and raceways that are equivalent to factory fabricated and purchased components.

8. Provide standoff clips for conduits on exterior and wet location walls.

9. Protect all vertical conduit runs from the entrance of foreign material before installation of conductors and the final closure of the raceway system. All spare conduits (vertical and horizontal runs) shall be sealed with a bushing and appropriate insert to prohibit entrance of debris or vermin. Affix a label that indicates “Spare Conduit to _____” at each seal. Label shall be in accordance with the labeling section of this specification.

B. Rigid Galvanized Steel (RGS) Conduit

1. RGS may be used for all raceway applications outlined for EMT and PVC. RGS shall be used in locations where subject to accidental damage or abuse and for all above grade exterior applications unless other wiring methods are specified on the drawings. All circuit conductors in excess of 600 V shall be installed in RGS.

2. RGS shall not be used in corrosive environments.

3. All RGS fittings shall be threaded. Utilize Erickson couplings where joining two threaded conduits that cannot be rotated.

C. Intermediate Metal Conduit (IMC) may be used in any application, with same requirements, where RGS is allowed except for circuits operating at more than 600 V.

D. Polyvinyl Chloride (PVC) Non-metallic Conduit

1. PVC may be used for installation in concrete or direct burial applications where not subject to damage. PVC may be used in corrosive environments where specifically allowed on the drawings.

2. PVC shall not be used for penetrations from concrete slabs. Transition to RGS shall be made a minimum of 2” below the slab finished surface, prior to penetration.

3. All connections shall utilize solvent and glue in accordance with the recommendations of the conduit manufacturer.

E. Miscellaneous Conduit Fittings

1. Expansion/Deflection Fittings: Raceways and conduit buried or secured rigidly on opposite sides of building expansion joints and long runs of exposed conduit subject to expansion and contraction due to variations in temperature shall have expansion fittings. Raceways and conduit shall cross building expansion joints at right angles. Provide separate external copper bonding jumper secured with grounding straps on each end of fitting. Fittings shall safely deflect and/or expand/contract to twice the distance of potential movement.

2. Penetrations of all below grade exterior walls and flooring shall require approval by the Engineer and Architect. Submit proposed penetration points, size openings and penetration methods to Engineer and Architect. Penetrations shall utilize sealing fittings appropriately sized for the application. Duct bank penetrations are excluded from this requirement.

3. Sealing Fittings shall be installed wherever conduits pass from warm to cold locations to minimize condensation within the conduit. Sealing fittings shall be installed with RGS penetration of the wall and terminate in a suitably sized junction box.

4. Refer to other specification sections for requirements pertaining to sealing for hazardous atmospheres.

F. Raceway and Conduit Installation in Concrete Slabs

1. Raceways and conduit may be installed in slabs where specifically allowed on the drawings. Maximum outside diameters of raceways in slabs shall not exceed 1/3 slab thickness. No more than two 3/4" raceways shall cross in floor slab at a single point. Lateral spacing of parallel raceways shall be at least 6" on centers. Submit raceway layout plan for approval to Architect and Engineer and obtain signoff from the structural engineer of the actual installation before pouring slabs. All in slab installations shall be photographed, with prints and negatives appropriately marked and turned over to the Owner at job completion.

2. Raceways and conduit shall not be placed in slabs less than 3” thick.

3.03 WIRE AND CABLE (600V)

A. Homerun designations on the drawings are diagrammatic only. Install branch circuits and feeders from the power source to the attachment point as required for a complete system. Provide slack wire for connections to equipment installed by others. Refer to schedules and risers where specific conductor and associated raceway sizes are not indicated on the floor plans.

B. Connect branch circuit homerun with two or three circuits and common neutral only where specifically shown on the drawings. Circuits with common neutrals shall not be connected to the same phase to ensure cancellation of the return current in the neutral conductor.

C. Install wires and cable in raceways as specified. All conductor sizing is based upon no greater than three current carrying conductors in a conduit. Installation of up to six circuits (no greater than twelve current carrying conductors) in a single conduit will be allowed if the conductor sizing is increased to the required ampacity to accommodate de-rating factors required by the NEC and NFPA 70.

D. The minimum wire size shall be #12 unless #14 specifically allowed on the drawings for wiring of controls. Branch circuits longer than 75' for 120 V and 175' for 277 V from panel to last outlet shall be increased a minimum of one size above that shown on the drawings to minimize voltage drop to less than 2%.

E. Conductors shall be identified at all accessible locations in the following manner:

1. Color code secondary service, feeders and branch circuit conductors as follows:

208/120 Volts	Phase	480/277 Volts
Black	A	Brown
Red	B	Orange
Blue	C	Yellow
White	Neutral	Gray

Green	Ground	Green

2. Provide nonferrous wire markers, embossed or printed to correspond with the Drawings. Labels shall be permanently marked so that the source of the branch circuit or feeder may be readily identified. Hand written labels are not acceptable. Embossed tag equal to 3M Scotch Code STL-TAG or SCS-TM shall be applied with two miniature cable ties or slipped through both end holes. Heat bonded tag equal to 3M Scotch Code SCS-HB shall be permanently affixed with a heat gun.

F. Splices and Terminations

1. No more than twelve splices of current carrying conductors or six circuits, whichever is greater, shall be allowed in a single enclosure or junction box.

2. Splices and terminations shall be sized to the specified conductor. The insulation shall be cut back with the appropriate tools such that the conductors are not nicked or damaged.

3. The compression tool shall be appropriate for the installation of the provided lug or butt splice to ensure pressure necessary for a proper connection is applied.

4. Terminations shall not be stacked or bent unless specifically listed for the application.

G. Arc-proofing shall be applied to all feeders greater than 100 Amperes where multiple circuits are installed in common enclosures such as handholes, manholes and junction boxes. Apply tape in single, half-lapped layer as required by manufacturer's recommendations. Secure with strips of red plastic film tape on 208Y/120V conductors and yellow plastic film tape on 408Y/277V conductors.

H. Cable Pulling

1. Pull cables that share conduit at same time into completely installed raceway. Conductors shall not be pulled in raceways with existing wiring.

2. Submit cable pulling calculations for engineers approval prior to all mechanically assisted pulls. Attach pull ropes to conductors with basket-weave grips on pulling eyes. Provide means to measure tension during entire pull. Utilize pulling compounds to lessen friction in accordance with the manufacturer’s recommendations.

3. mechanically assisted pulls shall utilize equipment specifically designed for the purpose such as ropes, electric wench, pulleys, etc. The use of a motorized vehicle to assist in a cable pull is prohibited.

3.04 UNDERGROUND DUCT, PRECAST MANHOLES, AND PRECAST COMMUNICATIONS HANDHOLES

A. Underground Duct

1. Where nonmetallic underground conduit transitions from concrete encasement and continues exposed to pull box, cabinet, or other electric apparatus, portion through floor or wall and where exposed shall be rigid galvanized steel. Provide adapter below floor or outside wall to transition from PVC and metal conduit.

2. Where underground conduit enters building through membrane-waterproofed wall or floor, provide malleable iron seal with gland assembly and adjustable pressure bushings secured to masonry

construction with one or more integral flanges. Membrane waterproofing shall be secured to device in watertight manner.

3. Where underground conduit without concrete envelope enters building through non-waterproofed wall or floor, provide Schedule 40 galvanized pipe sleeve. Fill space between conduit and sleeve with suitable plastic expandable compound on each side of wall or floor.

4. Run conduits straight between manholes and upturned elbows. Unavoidable bends in nonmetallic conduits shall be made with assembling couplings at slight angle if resulting radius is at least 100 feet. For radii less than 100 feet, use 5º angle couplings or factory-made PVC coated galvanized rigid steel bend sections.

5. Space separators to prevent sagging of conduits and breaking of couplings and watertight seals, to maintain deformation of conduit at separators to 0.10" or less. Separators spacing shall not exceed 4' centers. Spacing between exterior surfaces of conduits shall be least 2" between telephone conduits, 2" between conduits containing cables operating at 600 V or less, 6" between telephone conduit and power conduit and 2” between conduits that contain cables operating at more than 600 V. Secure with cords where necessary. Do not use tie wires, reinforcing rods or metallic materials.

6. Stagger conduit couplings, so that couplings on adjacent conduits do not lie in same transverse plane.

7. Conduits shall terminate in end bells where lines enter manholes. Space end bells 9" center to center at manhole wall face for 4" conduits; space proportionately for other sizes. Flaring of duct bank to accommodate transition to end bell spacing shall start 10 feet from face of the manhole wall. Make new conduit entrances into existing manholes and building walls consistent with grading requirements and existing entrances; waterproof as required by Owner’s Representative. .

8. After concrete envelopes have set, nonmetallic conduits shall be cleared with mandrel of same size as conduit.

9. Seal active and spare conduit and duct that enters building with non-metallic blank seals until conductors pulled.

10. Excavation

    a. Excavation, shoring, bracing, backfiring and grading will be provided under Division 2. Trenches shall be evenly graded so that conduit slopes uniformly at least 3" per 100 feet, without horizontal or vertical waves. Unless specified otherwise, conduit shall slope uniformly from one manhole to next or from high point between manholes. Avoid low points between manholes, or upturned elbows.

    b. Trenches shall not be back filled until concrete envelopes have set sufficiently

11. Concrete

    a. Conduit envelopes shall be 2500 psi under Division 3, CONCRETE and shall extend at least three inches beyond exterior surface of each conduit in bank. Coordinate work of this section with that of Division 3.

b. Envelopes may be poured directly against sides of trenches, if trench wall is clean, even and free of loose material. Remove loose dirt and extraneous material. Concrete shall be spaded during pouring to eliminate voids under and between conduits and honeycombing of exterior surfaces. Power-driven tampers or agitators shall not be used.

c. Envelope between manholes shall be poured in single operation. Where more than one pour is necessary, provide 3/4" reinforcing rod dowels extending 18" into concrete on each side of joint.

d. Envelopes that cross conduits, pipelines, roads and driveways shall be reinforced. Provide reinforcement where envelopes connect to manhole and building walls. Reinforcement shall be ¾" rods in single layer (2) inches above bottom and below top of envelope. Outside rods shall be two (2) inches from outside edges of envelope and intermediate rod shall be placed in center of each space between conduits. Reinforcement rods shall be tied with pairs of “C” shaped ¾” rods on 18” centers.

B. Manholes

1. Do not construct or set manholes until final conduit grading has been determined, including field changes required by underground interferences. Set frames and covers to final grade.

2. Commercial precast assemblies shall be set on six (6) inches of level, 90 percent compacted granular fill, ¾ inch to one (1) inch size, extending twelve (12) inches beyond the manhole on each side. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator.

3. Provide a 2/0 AWG bare copper cable, surface mounted six (6) inches above finished floor around the perimeter of the manhole. The cables shall be exothermically welded to the two (2) 10’ by ¾” copper clad ground rods driven in opposing corners of the manhole. Connect all non-current carrying metal parts in manholes, including the cover collar, with 6 AWG bare copper to the 1/0 AWG ground. Seal hole where ground rod penetrates the manhole floor with mastic.

4. Cast-iron frames and covers not buried in masonry shall be cleaned of mortar, rust, grease, dirt and other contaminants, and given a coat of bituminous paint. Steel frames not buried in masonry and steel covers shall be cleaned of mortar, dirt and grease by an approved blasting process. Surfaces that cannot be cleaned satisfactorily by blasting shall be cleaned to bare metal by wire brushing or other mechanical means. Surfaces contaminated with rust, dirt, oil, grease, or other contaminants shall be washed with solvents until thoroughly cleaned. Immediately after cleaning, surfaces shall be coated with a pretreatment coating or be given a crystalline phosphate coating. As soon as practicable after the pretreatment coating has dried, treated surfaces shall be primed with a coat of primer and one coat of synthetic exterior gloss enamel.

C. Handholes

1. Do not construct or set manholes until final conduit grading has been determined, including field changes required by underground interferences. Set frames and covers to final grade.

2. Commercial precast assemblies shall be set on six (6) inches of level, 90 percent compacted granular fill, ¾ inch to one (1) inch size, extending

twelve (12) inches beyond the manhole on each side. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator.

3. Cast-iron frames and covers not buried in masonry shall be cleaned of mortar, rust, grease, dirt and other contaminants, and given a coat of bituminous paint. Steel frames not buried in masonry and steel covers shall be cleaned of mortar, dirt and grease by an approved blasting process. Surfaces that cannot be cleaned satisfactorily by blasting shall be cleaned to bare metal by wire brushing or other mechanical means. Surfaces contaminated with rust, dirt, oil, grease, or other contaminants shall be washed with solvents until thoroughly cleaned. Immediately after cleaning, surfaces shall be coated with a pretreatment coating or be given a crystalline phosphate coating. As soon as practicable after the pretreatment coating has dried, treated surfaces shall be primed with a coat of primer and one coat of synthetic exterior gloss enamel.

3.05 MEDIUM VOLTAGE CABLE

A. General

1. The installation of medium-voltage cables shall comply with IEEE C2, the NEC and all other applicable codes.

2. Deliver medium-voltage cable off factory reels complying with NEMA WC 26. Exposed ends of cable must be hermetically sealed.

3. Conductors shall be continuous, with minimum required splices. All splice locations shall be approved by the Owner's Representative prior to pulling any cable.

4. Exercise care, while installing conductors, so as not to damage the insulation. Follow the manufacturer's recommendations for minimum bending radius and other installation practices. If it is necessary to lubricate the conductors, in order to facilitate pulling, powdered soapstone or pulling-in compound shall be used. Oils or grease of any kind shall not be used for this purpose.

5. Ground shields of shielded cable at each termination, splice and separable insulated connector. Ground all metal bodies of terminators, splices, cable and separable fittings according to the manufacturer's written instructions.

B. Qualified cable installers only shall perform termination or splicing of medium voltage cables, with experience on the types of cables specified. Submit for approval, the name of each individual who will perform this work, including the background experience of each such individual on similar previous projects.

C. Pulling

1. Prior to pulling in any cable, check ducts by pulling a mandrel through each duct from manhole to manhole as the circuit runs requires. The mandrel shall have an outside diameter 3/8" less than the inside diameter of the duct and be at least 24" long. If any serious defects are found in the duct banks and manholes, notify the Owner. The work shall not proceed until the defects are corrected.

2. Pulling lines shall be attached to cables with ball-bearing swivels to prevent twisting of cable during pulling.

3. The pulling tension of the conductors shall be such that it will not damage the insulation. Pulling tension applied shall not exceed values recommended by the manufacturer.

4. Speed of pulling-in cable shall not exceed 100 feet per minute in straight ducts, 30-50' per minute shall be the average speed when bends are included and length of run in 300-400 feet. Pulling shall be at a constant rate and once pulling is started, the cable travel shall not be stopped until completion.

5. Personnel shall be stationed between the reel and the raceway entrance during pulling operations to inspect, control, lubricate and direct the passage of cable. The duct or raceway mouth shall be filled and equipped with a flair lead to prevent chafing of cable. When cables are to be pulled through intermediate manholes, or boxes, personnel shall be stationed at these locations to direct the cable.

D. Cables shall be bent no sharper than twelve times the cable OD during handling, pulling or final training of the cable.

E. When a cable is cut the ends shall be properly sealed. Cable ends, which have been exposed to the weather, shall be cut back a minimum of one foot and sealed. If seal is broken, it shall be repaired immediately. A combination of rubber and vinyl tape may also be used to provide a seal. The end shall first be sealed with Scotch Brand No. 23 (or approved equal from 3M or Plymouth Rubber Company) high voltage tape and then overwrapped with vinyl electrical tape.

F. Cables shall be arranged and permanently racked prior to terminating. Install duct shields at split nylon tube to protect the cables at duct mouths. Cable ends shall be temporarily supported. In manholes the cable ends shall be above water level. All bending and racking shall be done in such a manner that the cables will not bind at the duct mouth when the splicing is completed. After bending, cable sheath shall be smooth and free from cracks and wrinkles. Where cables are racked in manholes, they shall rest on porcelain saddles with freedom of horizontal movement to accommodate expansion and contraction of the cables in the ducts. Cables passing through manholes shall have at least one bend to accommodate such changes in length and shall be racked on walls around the longest path from raceway to raceway. Install medium-voltage cables inside of manholes so that the cable wraps around the interior of the manhole at least once.

G. Cables shall not pass under the manhole cover. Cable supports shall not project beneath the cover.

H. Compression type connectors and lugs shall be installed with appropriate dies and compression tools, keyed or coded to assure accurate matching.

I. Provide arc-proofing tape on all medium voltage cables in manholes, handholes and pull boxes where more than one circuit exists.

J. All medium-voltage cables shall be tested by a NETA certified testing company before electrical circuitry has been energized to demonstrate product capability and compliance with requirements. The test shall include the following:

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.2. Certify compliance with test parameters. A polarization index equal to or less than 1.25 on new installations shall be considered a failure.

2. Correct malfunctioning cables and accessories at project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3. Energize cable within 48 hours of acceptance test.

3.06 PAD MOUNTED DISTRIBUTION SUBSTATION TRANSFORMER

A. Installation

1. Anchor transformer securely to the concrete pad.
2. Ground the transformer case in accordance with NEC requirements and as detailed on the drawings.
3. Terminate high and low voltage cables. All hardware shall be silicon bronze. All connections shall be made with a calibrated torque wrench.
4. Energize transformer at no load for a minimum of 24 hours. Transformer shall be padlocked upon energization. The Owner shall be given a set of padlock keys as soon as locked.
5. Verify proper phase rotation.
6. Select tap changer settings for low voltage output at no load from 270V to 282V line to neutral.

B. Testing

1. Provide a standard insulating test on a sample of insulating oil withdrawn after all field installation testing complete. Furnish a copy of the test results in the O&M Manual.
2. Refer to the testing section of this specification for additional requirements.

3.07 PAD-MOUNTED TRANSFORMER – LIQUID FILLED

A. Installation

1. Anchor transformer securely to the concrete pad.
2. Ground the transformer case in accordance with NEC requirements and as detailed on the drawings.
3. Terminate high and low voltage cables. All hardware shall be silicon bronze. All connections shall be made with a calibrated torque wrench.
4. Energize transformer at no load for a minimum of 24 hours. Transformer shall be padlocked upon energization. The Owner shall be given a set of padlock keys as soon as locked.
5. Verify proper phase rotation.
6. Select tap changer settings for low voltage output at no load from 270V to 282V line to neutral.

B. Testing

1. Provide a standard insulating test on a sample of insulating oil withdrawn after all field installation testing complete. Furnish a copy of the test results in the O&M Manual.
2. Refer to the testing section of this specification for additional requirements.

3.08 MEDIUM VOLTAGE OUTDOOR SWITCHGEAR

A. Factory Testing

1. Standard factory tests shall be performed on the equipment under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.

2. Factory tests as outlined above shall be witnessed by the owner's representative.

   a. The manufacturer shall notify the owner two (2) weeks prior to the date the tests are to be performed

   b. The manufacturer shall include the cost of transportation and lodging for up to three (3) owner's representatives. The cost of meals and incidental expenses shall be the owner's responsibility

3. The manufacturer shall provide three (3) certified copies of factory test reports.

B. Field Quality Control

1. Provide the services of a qualified factory-trained manufacturer's representative to assist the Contractor in installation and startup of the equipment specified under this section for a period of xx working days. The manufacturer's representative shall provide technical direction and assistance to the Contractor in general assembly of the equipment, connections and adjustments, and testing of the assembly and components contained therein.

2. The Contractor shall provide three (3) copies of the manufacturer's field startup report.

C. Manufacturer's Certification

1. The Contractor shall provide a qualified factory-trained manufacturer's representative shall certify in writing that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.

2. The Contractor shall provide three (3) copies of the manufacturer's representative's certification.

D. Training

1. The Contractor shall provide a training session for up to five (5) owner's representatives for ·3 normal workdays at a job site location determined by the owner.

2. The training session shall be conducted by a manufacturer's qualified representative and consist of instruction on the assembly, switches and major components.

E. Installation

1. The Contractors shall install all equipment per the manufacturer's recommendations and the contract drawings.

2. All necessary hardware to secure the assembly in place shall be provided by the Contractor.

F. Field Adjustments

G. Field Testing

3.09 POWER SYSTEM STUDIES

A. Scope of Services

1. Provide a complete short-circuit study, equipment-interrupting or withstand evaluation, a protective-device coordination study and an arc-flash hazard analysis for the electrical distribution system.

The studies shall include all portions of the electrical distribution system from the normal and alternate sources of power throughout the low-voltage distribution system. Normal system operating methods, alternate operation, and operations which could result in maximum-fault conditions shall be thoroughly covered in the study.

2. A licensed professional engineer shall be in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.

B. Short-Circuit Study

1. The study shall be in accordance with applicable ANSI and IEEE standards.

2. The study input data shall include the utility company's short-circuit single and three phase contribution with the X/R ratio, the resistance and reactance components of each branch impedance, motor and generator contributions, base quantities selected, and all other applicable circuit parameters.

3. Short-momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at each switchgear bus, switchboard, motor control center, distribution panelboard, pertinent branch circuit panelboards, and other significant locations through the system.

4. An equipment evaluation study shall be performed to determine the adequacy of circuit breakers, controllers, surge arresters, busways, switches, and fuses by tabulating and comparing the short-circuit ratings of these devices with the maximum short-circuit momentary and interrupting duties. Evaluation study should be submitted prior to final approval of equipment submittals.

C. Protective-Device Coordination Study

1. A protective-device coordination study shall be performed to select or to verify the selection of power fuse ratings, protective-relay characteristics and settings, ratios, and characteristics of associated voltage and current transformers, and low-voltage breaker trip characteristics and settings.

2. The coordination study shall include all voltage classes of equipment from the utility's incoming line protective device down to and including each motor control center and/or panelboard. The phase and ground overcurrent protection shall be included as well as settings for all other adjustable protective devices.

3. Coordination shall be in accordance with requirements of the NEC and the recommendations of the IEEE Standard 399. TC curves shall be provided for each typical branch scenario from source to largest branch circuit device.

4. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios, manufacturer, type range of adjustment, and recommended settings. A tabulation of the recommended power fuse selection shall be provided for all fuses in the system. Discrepancies, problem areas, or inadequacies shall be promptly brought to the Owner's attention.

D. Arc Flash Study

1. Determine arc flash levels based upon minimum and maximum available utility fault and protective device settings as determined in the Protective Device Coordination Study.

2. Label all switchboards, panelboards, disconnects, starters, VFDs and any other electrical equipment likely to require maintenance or adjustment while energized.

3. Identify the current appropriate ratings of personal protective equipment (PPE).

4. Establish the Flash Protection Boundary (approach limit distance) as required by NFPA 70E.

5. Provide equipment specific environment and chemical arc-flash hazard warning labels per NEC® Section 110.16 requirements.

6. Label shall identify the level of arc flash hazard and the required PPE level.

7. Identify the risk of personal injury as a result of exposure to incident energy released during an arc flash event for each electrical distribution component (switchboard, switchgear, MCC, starter, panelboard, disconnect).

E. Study Report

1. The results of the power system studies shall be summarized in a final report.

2. The report shall include the following sections:

a. Description, purposes, basis, and scope of the study and a single-line diagram of the portion of the power system which is included within the scope of study.

b. Tabulations of circuit breaker, fuse, and other equipment ratings versus calculated short-circuit duties and commentary regarding same.

c. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection, and commentary regarding same.

d. Fault-current tabulations including a definition of terms and a guide for interpretation.

F. Implementation

1. Engage an independent testing firm for the purpose of inspecting, setting, testing, and calibrating the protective relays, circuit breakers and other applicable devices as recommended in the power-system study report.

2. Affix arc-flash hazard warning labels to each electrical distribution component.

3.10 BASIC ACCEPTANCE TESTS

A. General Scope

1. This section covers the required field tests and inspections to assess the suitability for initial energization of electrical power distribution equipment and systems. Failed components shall be replaced and retested for no additional cost to the project.

2. The purpose of this specification is to assure that all tested electrical equipment and systems are operational and within applicable standards and manufacturer's tolerances and that the equipment and systems are installed in accordance with design specifications.

3. All testing shall be performed by the Contractor responsible for the installation of the systems or by an independent testing organization under contract with the Contractor .

4. All equipment utilized for testing shall have a valid calibration sticker. All test reports shall indicate the equipment utilized and its associated calibration due date.

5. Coordinate all required shutdowns with the Owner. Any and all testing required after the Owner has taken occupancy (temporary or permanent) shall be assumed to be conducted during premium time.

6. A written record of all tests and a final report summarizing the findings shall be submitted for approval prior to energizing any electrical power distribution equipment and systems. All equipment shall be left in clean operational condition.

B. Inspection and Test Procedures

The following tests shall be conducted using the noted section of the latest edition of NETA ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment Systems as a reference:

1. Switchboard and Panelboard Assemblies – Visually inspect the equipment inside and out, check attachment to wall or floor, verify bus joint tightness, exercise all active components and perform continuity testing and megger phase to phase, neutral and ground. Minimum resistance shall be 100 megohms when 480V equipment tested at 1000VDC or 25 megohms when 208V equipment tested at 500VDC. Tabulate readings for each test. NETA ATS-7.1

2. Dry Type Transformers – Visually inspect the transformer inside and out, verify vibration isolation installation, verify installation of the grounding bonding jumper, verify termination joint tightness, measure no load and partially loaded voltage and adjust taps as necessary. NETA ATS-7.2

3. Low Voltage Cables - All feeders illustrated on the one line diagram shall be inspected and tested in accordance with the referenced standard. Visually inspect cables for physical damage, color code and proper termination. Check continuity for proper labeling and megger for insulation resistance. Megger test voltage shall be 1000VDC for 1 minute with no values less than 50 megohms. Tabulate readings for each feeder. NETA ATS-7.3

4. Low Voltage, Molded and Insulated Case Circuit Breakers with frame size greater than 225 amperes and/or with adjustable trip units shall be

tested and adjustable settings dialed to match the coordination study criteria. Perform an insulation resistance test at 1000VDC (thermal magnetic) or 500VDC (solid state) for 1 minute from pole to pole and pole to ground, resistance values shall not be less than 100 megohms. Perform resistance test across open and closed breaker contacts of each phase. Test trip settings tolerance with primary current injection. Tabulate readings for each breaker. NETA ATS-7.6

5. Disconnect the main bonding jumper at the service and at each separately derived system and verify single connection between the grounded and grounding conductor. Reconnect all disconnected bonding connections. Test the grounding electrode system for resistance to earth to verify a maximum of 25 ohms. NETA ATS-7.13

3.11 ACCEPTANCE TESTS BY AN INDEPENDENT TESTING FIRM

A. General Scope

1. This section covers the required field tests and inspections to assess the suitability for initial energization of electrical power distribution equipment and systems.

2. The purpose of this specification is to assure that all tested electrical equipment and systems are operational and within applicable standards and manufacturer's tolerances and that the equipment and systems are installed in accordance with design specifications.

3. All testing shall be performed by an independent testing organization. The testing firm shall be an independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm. The Contractor shall be responsible for all costs associated with the specified testing.

4. All inspections and field tests shall be in accordance with the latest edition of NETA ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment Systems.

B. Division of Responsibility

1. Coordinate all testing activity with the testing organization and the Owner.

2. Provide the testing organization with all information necessary for the completion of the identified testing including but not limited to electrical plans and specifications, short circuit and coordination study results and schedules.

3. Coordinate all required shutdowns with the Owner. Any and all testing required after the Owner has taken occupancy (temporary or permanent) shall be assumed to be conducted during premium time.

4. Provide all required field technical services, tooling, equipment, instrumentation, and supervision to perform specified tests and inspections.

5. Submit a test plan with requested dates and times that each test will be conducted for possible observation by the engineer or Owners representative.

6. A written record of all tests and a final report summarizing the findings shall be submitted for approval prior to energizing any electrical power distribution equipment and systems.

A. Inspection and Test Procedures

The following tests shall be conducted in accordance with the referenced NETA testing standards and as further outlined in this section on all applicable equipment/components installed, unless specifically noted otherwise:

1. NETA ATS-7.1 Switchgear and Switchboard Assemblies
2. NETA ATS-7.2 Transformers
   a. Dry Type
   b. Liquid Filled
3. NETA ATS-7.3 Cables
   a. Low Voltage, 600 V Max.

      All feeders illustrated on the one line diagram shall be tested in accordance with the referenced standard.
   b. Medium Voltage, 69 KV Max.
4. NETA ATS-7.5 Switches
   a. Air Low Voltage, 600 V Max

      All disconnect switches illustrated on the one line diagram shall be tested in accordance with the referenced standard.
   b. Air Medium Voltage, Metal Enclosed
   c. Oil Medium Voltage
   d. Vacuum Medium Voltage
5. NETA ATS-7.6 Circuit Breakers
   a. Low Voltage, Molded and Insulated Case

      All circuit breakers with frame size greater than 225 amperes and/or with adjustable trip units shall be tested in accordance with the referenced standard.
   b. Low Voltage, Power
6. NETA ATS-7.9 Protective Relays
7. NETA ATS-7.10 Instrument Transformers
8. NETA ATS-7.11 Metering
9. NETA ATS-7.13 Grounding Systems
10. NETA ATS-7.19 Surge Arresters
    a. Surge Arresters, Low Voltage
    b. TVSS
    c. Surge Arresters, Medium Voltage
11. NETA ATS-9 Thermographic Survey
    a. All equipment illustrated on the one line diagram shall be tested in accordance with the referenced standard.
    b. Utilize all available building loads for the survey.

END OF SECTION

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SECTION 016700

TELECOMMUNICATIONS SPECIFICATION

PART 1 - GENERAL

1.00 GENERAL PROVISIONS

A. The GENERAL REQUIREMENTS, DIVISION 1, and BIDDING AND CONTRACT REQUIREMENTS, DIVISION 0, are hereby made a part of this Specification Section.

B. Examine all Drawings and all Sections of the Specifications and requirements and provisions affecting the work of this Section.

1.01 SCOPE OF WORK

A. This project includes the relocation of existing underground communications utilities.

B. The work under this Section includes providing of all material, labor, equipment and supplies and the performance of all operations to provide a complete working Integrated Technology Network System as required by the Drawings and details and as specified herein. Where the Drawings, Specifications, Codes, Regulations, Laws, or the requirements of the local Authority conflict, provide the higher quality and higher quantity indicated or required and follow the most strict requirement. In general, the work includes, but is not limited to, the following:

1. Cabling for Modbus and POTS lines.
2. Protection of new and existing work.
3. Record Drawings and Documentation.
4. Staging.
5. Operation and Maintenance Instructions and Manuals for the Section's work.
6. Phasing of work and maintenance of service to existing and temporarily relocated items, owner equipment or workstations, etc. as required to meet the project schedule.
7. Coordination with manufacturers, other trades and Owner.
8. Supervision and Approval
9. Testing
10. Operating and maintenance instructions and manuals
11. Coordination
12. Shop drawings
13. Record (as-built) drawings

1.02 RELATED WORK

A. Principal classes of Work related to the Work of this Section are listed in the Specification Table of Contents, and are specified to be performed under the indicated Sections of the Specifications. Refer to the indicated Sections for description of the extent and nature of the indicated Work, and for coordination with related trades. This listing may not include all related Work items. It is the responsibility of the Contractor to coordinate and schedule the Work of this Section with that of all other trades.

B. The following work is not included in this section and will be provided under other sections:

1. Cutting coring and patching shall be by the Electrical contractor.

2. Structural supports necessary to distribute loading from equipment to roof or floor except as specified.

3. Temporary telephone facilities for use during construction and testing. Refer to Division 1, General Conditions.

4. Excavation and backfill.

5. Concrete work including concrete housekeeping pads and blocks for vibrating and rotating equipment, ductbank envelopes and cast-in-place manholes.

6. Flashing of roof and wall penetrations.

7. Painting, except as specified herein.

8. Conduit, conduit sleeves (except where noted), raceway (wiremold).

9. Raceway.

1.03 QUALIFICATIONS

A. The installer (Firm and Employees) shall be experienced in the operations they are engaged to perform. Demonstrate at least five years of continuous recent experience on similar projects. The installer shall hold and provide recent, up-to-date licenses, certifications and training certificates in the area the project is located and for the equipment to be installed.

B. The successful bidder shall be thoroughly familiar with the cabinet methods set forth in the latest release of the BICSI TDMMs (Building Industry Consulting Services International Telecommunications Distribution Methods Manuals) and unless otherwise specified, shall supervise the installation in accordance with the recommendations and practices outlined in the latest release of the BICSI Telecommunications Cabling Installation Manual.

C. Provide names of contacts from the last five similar projects including the general contractor, owner's representative, architect and engineer. Indicate project locations, scope and current phone numbers that the contacts can be reached at.

D. Qualified telecommunications installation firms shall have demonstrable design and installation training with certifications of competence. Certified training shall be industry recognized and at least equal to:

1. Building Industry Consulting Service International, Inc. (BICSI) Registered Communications Distribution Designer (RCDD).

2. Building Industry Consulting Service International, Inc. (BICSI) Registered Installer.

3. Approved Manufacturer's Certified Installer Program

   a. Each foreman and installer working on this project shall be trained and certified to the qualified level as specified by the manufacturer(s) for installation and maintenance of equipment being provided on this project. The training shall consist of at least a minimum of proper installation techniques of their specific equipment in order to have a complete operating system meeting or exceeding the requirements as specified herein. Each foreman and installer working on this project shall provide documentation from the manufacturer indicating that they have been adequately trained prior to the start of the project. Only foreman and installers who have been properly trained and documented by the manufacturer whose equipment is being provided on this project shall be allowed to install.

   b. Maintain at the site, an updated copy of the Manufacturer Trained Installers list including a copy of their training documentation from the manufacturer. This documentation shall be made available to the owner's representative upon request.

1.04 DEFINITIONS

A. As used in this Section, the following items are understood to have the following meaning:

1. ***"Contractor or Subcontractor or Sub-subcontractor"***, unless otherwise qualified, shall mean the installer of the work specified under this Section.

2. ***"Furnish"*** shall mean purchase and deliver to the project site, complete with every necessary appurtenance.

3. ***"Install"*** shall mean unload at the delivery point at the site and perform all work necessary to establish secure mounting and proper operation at the proper location in the project.

4. ***"Provide"*** shall mean "Furnish" and "Install".

5. ***"Work"*** shall mean all labor, materials, equipment, apparatus, controls, accessories and all other items required for a proper and complete installation.

6. ***"Concealed"*** shall mean hidden from sight in chases, furred-in spaces, shafts, hung ceilings, embedded in construction or in a crawl space. Areas to be concealed as part of tenant alterations to the building shall also be considered in this definition.

7. ***"Exposed"*** shall mean not installed underground or concealed as defined above.

8. ***"Furnished by others"*** shall mean materials or equipment purchased under other sections of the general contract and installed by this section of the specifications by this trade contractor.

9. ***"Owners Representative"*** shall be the party responsible to make decisions regarding all contractual obligations in reference to the Scope of Work for the Owner.

10. ***"Date of Substantial Completion"*** shall indicate the date where the work has been formally accepted as evidenced by completed final punch list or where the work has reached the stage that the owner obtains beneficial use and commences utilization of the installed systems for business or occupancy purposes. The GENERAL REQUIREMENTS, DIVISION 1, shall supercede this definition where specifically defined.

1.05 CODES, REFERENCES AND PERMITS

A. Materials, installation of systems and equipment provided under this section shall be done in strict accordance with the Rhode Island Department of Public Safety Codes, Rhode Island Department of Environmental Protection, Rhode Island State Building Code and any other Codes and Regulations having jurisdiction including but not limited to:

1. All Applicable NFPA Standards

2. National Electrical Code (NEC)

3. Occupational Safety and Health Administration (OSHA)

4. State and Local Building Codes

5. Underwriters' Laboratories, Inc (UL)

B. Unless otherwise specified or indicated, materials, workmanship and equipment performance shall conform with the latest governing edition of the following standards, codes, specifications, requirements, and regulations, except when more rigid requirements are specified or are required by applicable codes but not limited to:

1. American National Standards Institute (ANSI)

2. American Society of Testing and Materials (ASTM)

3. Institute of Electrical and Electronics Engineers (IEEE)

4. Insulated Cable Engineers Association (ICEA)

5. National Electric Manufacturers Association (NEMA)

6. ANSI – American National Standards Institute

7. TIA/EIA – Telecommunications Industry Alliance/Electronics Industry Alliance

8. FCC – Federal Communications Commission

9. NEC – National Electric Code

10. NFPA 70 – National Fire Protection Association

11. ANSI/TIA/EIA-568-B.1– Commercial Building Telecommunications Cabling

12. ANSI/TIA/EIA – 568-B.2- Commercial Building Telecommunications Cabling

13. ANSI/TIA/EIA-568-B.3 – Commercial Building Telecommunications Cabling

14. ANSI/TIA/EIA-569-A – Commercial Building Standard for Telecommunications Pathways and Spaces

15. ANSI/TIA/EIA-606 – The Administration Standards for the Telecommunications Infrastructure of Commercial Building

16. ANSI/TIA/EIA-607 – Commercial Building Grounding and Bonding Requirements for Telecommunications

17. FCC Part 15 (addresses electromagnetic radiation)

18. FCC Part 68 (connection of premise equipment and wiring to the network)

19. ANSI/ICEA – Insulated Cable Engineers Association

20. SP – Standards Proposal (EIA/TIA)

21. UL Compliance: The communication system supplied shall be listed by Underwriter's Laboratories under UL Standard 1459 (designation WYQQ on UL Listing Card) for Telephone Appliance and Equipment. A copy of the UL listing card for the proposed system shall be included with the contractor's submittal.

C. Give all notices, file all plans, obtain all permits and licenses, and obtain all necessary approvals from authorities having jurisdiction. Deliver all certificates of inspection to the authorities having jurisdiction. No work shall be covered before examination and approval by the Owner's Representative, inspectors, and authorities having jurisdiction. Replace imperfect or condemned work to conform to requirements, satisfactory to Owner's Representative, and without extra cost to the Owner. If work is covered before inspection and approval, this Contractor shall pay costs of uncovering and reinstalling the covering, whether it meets contract requirements or not.

1.06 GENERAL REQUIREMENTS

A. Nameplates

Each major component of equipment shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a plate secured to the equipment.

1.07 MATERIAL AND EQUIPMENT STANDARDS

A. Where equipment or materials are specified with the name of a manufacturer, such specification shall be deemed to be used for the purpose of establishing a standard for that particular item. No equipment or material shall be used unless previously approved by the Owner's Representative.

B. Substitutions may be offered for review provided the material, equipment or process offered for consideration is equal in every respect to that indicated or specified. The request for each substitution must be accompanied by complete specifications together with drawings or samples to properly appraise the materials, equipment or process. The contractor shall highlight and list all applicable specification requirements which the substituted material deviates from.

C. If a substitution of materials or equipment in whole or in part is made, this Contractor shall bear the cost of any changes necessitated by any other trade as a result of said substitution.

D. All materials, equipment and accessories provided under this section shall be new and unused products of recognized manufacturers as approved.

E. If three (3) or more manufacturers are indicated without the term “or equal” to “or approved equal”, then the material and equipment shall be supplied by one of those indicated and that material and equipment shall conform in all respects to the Drawings and Specifications.

F. Provide products of one manufacturer for each classification of equipment.

1.08 SUBMITTALS

A. Conform to the requirements of **Division 1**, **General Conditions**, for schedule and form of all submittals unless specifically noted otherwise in this section. Coordinate this submittal with submittals for all other finishes. Shop drawings and design layouts shall be prepared by licensed installing contractors and shall note the name(s), license number(s) and license expiration date(s) of the contractor(s) installing electrical systems.

B. Definitions:

1. Shop Drawings are information prepared by the Contractor to illustrate portions of the work in more detail than indicated in the Contract Documents.

2. Acceptable Manufacturers: The mechanical design for each product is based on the single manufacturer listed in the schedule or shown on the drawings. In Part 2 of the specifications, certain Alternate Manufacturers are listed as being acceptable. In addition, the MATERIAL AND EQUIPMENT STANDARDS paragraph potentially allows for substitutions as being acceptable. These are acceptable only if, as a minimum, they:

a. Meet all performance criteria listed in the schedules and outlined in the specifications. For example, to be acceptable, a category 5e cable must deliver equal MHz at equal or greater rates as the cable listed in the schedules.

b. Fit within the available space it was designed for, including space for maintenance and component removal, with no modification to either the space or the product. Clearances to walls, ceilings, and other equipment will be at least equal to those shown on the design drawings. The fact that a manufacturer’s name appears as acceptable shall not be taken to mean the Engineer has determined that the manufacturer’s products will fit within the available space – this determination is solely the responsibility of the contractor.

c. Products must adhere to all architectural considerations including, but not limited to; being of the same color as the product scheduled or specified, fitting within the architectural enclosures and details, and for diffusers – being the same size and of the same physical appearance as scheduled or specified products.

d. Any exception to the acceptable listed manufacturer or any feature or performance that deviates from the listed acceptable manufacturer components shall be clearly noted as an exception or it will be assumed by the review process that the substitution meets or exceeds the listed acceptable manufacturer component in every way.

C. Submittal Procedures, Format and Requirements

1. Review submittal packages for compliance with Contract Documents and then submit to Owner's Representative for review. Submit enough sets of shop drawings such that, after review, two sets will be kept by the reviewer, with only the remaining sets returned with reviewer's marks and comments.

2. Each Shop Drawing shall indicate in title block, and each Product Data package shall indicate on cover sheet, the following information:

a. Title

b. Equipment number

c. Name and location of project

d. Names of Owner, Engineer and Seller

e. Names of manufacturers, suppliers, vendors, etc.

f. Date of submittal

g. Whether original submittal or resubmitted

3. Shop Drawings showing manufacturer's product data shall contain detailed dimensional drawings (minimum ¼" – 1' scale) including plans and sections (where physical clearance could be an issue). Provide larger scale details as necessary.

4. Submit accurate and complete description of materials of construction, manufacturer's published performance characteristics, sizes, weights, capacity ratings (performance data, alone, is not acceptable), electrical requirements, starting characteristics, wiring diagrams, and acoustical performance for complete assemblies. Drawings shall clearly indicate location (terminal lock or wire number), voltage and function for all field terminations, and other information necessary to demonstrate compliance with all requirements of Contract Documents.

5. Provide Shop Drawings showing details of connections to all equipment. If connection details are not submitted and connections are found to be installed incorrectly, this contractor shall reinstall them within the original contract price.

6. Provide complete data for all auxiliary services and utilities required by submitted equipment. This shall include fuel, cooling and exhaust requirements and points of connections.

7. Provide a complete description of all controllers and instrumentation required including electrical power requirements for all components and detailed information on termination diagrams, and all control interfaces with a central control system.

8. Provide installation and erection information including; lifting requirements, and any special rigging or installation requirements for all equipment.

9. The Owner's Representative shall approve all materials before commitment for materials is made.

D. Product Data: Submit complete manufacturer's product description and technical information including:

1. Voice cable

2. MODBUS cable

E. Submit shop drawings and product data grouped to include complete submittals of related systems, products and accessories in a single submittal. Clearly mark or high-light each product part number within each submittal.

1. Access panel shop drawings shall be submitted to the Construction Supervisor for approval.

2. Do not submit multiple product information in a single bound manual.

3. Three-ring binders shall not be accepted.

F. Deviations:

1. Concerning deviations other than substitutions proposed deviations from Contract Documents shall be requested individually in writing whether deviations result from field conditions, standard shop practice, or other cause. Submit letter with transmittal of Shop Drawings which flags the deviation to the attention of the Owner's Representative.

2. Without letters flagging the deviation to the Owner's Representative, it is possible that the Engineer may not notice such deviation or may not realize its ramifications. Therefore, if such letters are not submitted to the Owner's Representative, the Seller shall hold the Engineers, his consultants and the Owner harmless for any and all adverse consequences resulting from the deviations being implemented. This shall apply regardless of whether the Engineer has reviewed or approved shop drawings containing the deviation, and will be strictly enforced.

3. Approval of proposed deviations, if any, will be made at discretion of Engineer.

G. Schedule: Incorporate shop drawing review period into construction schedule so that Work is not delayed. This contractor shall assume full responsibility for delays caused by not incorporating the following shop drawing review time requirements into his project schedule. Allow at least 10 working days, exclusive of transmittal time, for review each time shop drawing is submitted or resubmitted with the exception that 20 working days, exclusive of transmittal time are required for the following:

H. Responsibility

1. Intent of Submittal review is to check for capacity, rating, and certain construction features. The contractor shall ensure that work meets requirements of Contract Documents regarding information that pertains to fabrication processes or means, methods, techniques, sequences and procedures of construction; and for coordination of work of this and other Sections. Work shall comply with approved submittals to extent that they agree with Contract Documents. Submittal review shall not diminish responsibility under this Contract for dimensional coordination, quantities, installation, wiring, supports and access for service, nor the shop drawing errors or deviations from requirements of Contract Documents. The Engineer's noting of some errors while overlooking others will not excuse the contractor from proceeding in error. Contract Documents requirements are not limited, waived nor superseded in any way by review.

2. Inform contractors, manufacturers, suppliers, etc. of scope and limited nature of review process and enforce compliance with contract documents.

I. In the event that the contractor fails to provide Shop Drawings for any of the products specified herein:

1. The contractor shall furnish and install all materials and equipment herein specified in complete accordance with these Specifications.

2. If the contractor furnishes and installs material and/or equipment that is not in complete accordance with these Specifications, he shall be responsible for the removal of this material and/or equipment. He shall also be responsible for the replacement of this material and/or equipment with material and/or equipment that is in complete accordance with these Specifications, at the direction of the Owner’s Representative.

3. Removal and replacement of materials and/or equipment that is not in complete compliance with these Specifications shall be done at no extra cost to the Owner.

4. Removal and replacement of materials and/or equipment that is not in complete compliance with these Specifications shall not be allowed as a basis for a claim of delay of completion of the Work.

J. Mark dimensions and values in units to match those specified.

1.09 OPERATION AND MAINTENANCE DATA

A. Commence preparation of the Operating and Maintenance (O&M) manuals immediately upon receipt of “Approved” or “Approved as Noted” shop drawings and submit each section within one month. The final submission shall be no later than two months prior to the projected date of Substantial Completion of the Project.

B. Submit O&M table of contents in the submittal phase. O&M manuals shall be built as submittals are accepted and shall include the individual equipment manufacturer’s data retrieval sheet, as per Attachment A in Part IV for input into the Owner’s Maintenance Management System. Form shall be provided and completed electronically.

C. Each O&M document shall include the manufacturer’s web address for equipment specific O&M information for Internet access by the owner.

D. The manual shall consist of three (3) sets of manuals and include three (3) sets of CDs, which shall contain the scanned content of the entire manual. The manual shall highlight the actual equipment used and not be a master catalog of all similar products of the manufacturer. The manual shall be submitted for review prior to creation of the CDs.

E. The Manual shall contain the following:

1. Operations Manual

   a. Systems description including all relevant information needed for day-to-day operations and management.

   b. Wiring diagrams, schematics, logic diagrams and sequence of operations that accurately depict the system.

   c. Depiction of each interface screen where programmable logic and visual displays are provided. Descriptors shall be provided to define displayed data, alarms, etc.

   d. A single sheet (for ease of removal) of all access codes and passwords necessary to access all levels of control and programming.

   e. Trouble shooting guide defining common alarms/problems with possible cause and effect.

2. Maintenance Manual

   a. Define all maintenance activities required to ensure system operation within manufacturer's specified parameters. Provide table of all required activities plotted vs. interval with adequate fill-in-space for “activity completion date” and “comments”. Where multiple instrument readings are required, provide data sheet formatted to accommodate activity.

   b. Define recommended spare parts inventory with part numbers and source defined for ordering by the Owner. Identify lead time on all parts, source location and cost.

   c. Provide copy of all warranty information with associated date of substantial completion (commencement of warranty) and end date of coverage. Define all components/subsystems specifically included and excluded.

   d. Provide all information as listed on the facility support services data sheet as per attachment A in Part IV for input into the owner’s maintenance management system. Form shall be provided and completed electronically.

   e. Provide O&M manuals for each of the following:

      1) As-Built Records

      2) Pathway/Space Records

      3) Test Reports

1.10 RECORD DRAWINGS

A. Refer to DIVISION 1, General Conditions, for record drawings and procedures to be provided under this section, unless specifically noted otherwise in this section.

B. Record Drawings (red-line drawings) will be updated by this Contractor daily for review with the monthly requisition. The record drawing shall be an accurate depiction of the systems as completed, including dimensions (vertical/horizontal) of concealed components off fixed building elements.

C. The Foreman shall maintain complete and separate set of prints of Contract Drawings at job site at all times and shall record work completed and all changes from original Contract Drawings clearly and accurately including work installed as a modification or addition to the original design.

D. At completion of work the Contractor shall prepare a complete set of record drawings on AutoCAD showing all systems as actually installed. The Architectural background AutoCAD files will be made available for the contractor's copying, at his expense, to serve as backgrounds for the drawings. The Contractor shall transfer changes from field drawings onto AutoCAD drawings and submit copy of files and three sets of prints to Owner's Representative for comments as to compliance with this section. CADD layering as established by the A&E design team shall be maintained with any and all changes done by the contractor.

E. The Architect and Engineer are not granting to the Contractor any ownership or property interest in the CADD Drawings by the delivery of the CADD Disks to the Contractor. The Contractor's rights to use the CADD disks and the CADD drawings are limited to use for the sole purpose of assisting in the Contractor's performance of its contractual obligations under its contract with respect to the Project. The Architect and Engineer are granting no further rights. Any reuse or other use the Contractor will be at the Contractor's sole risk and without liability to the Architect and Engineer. The Contractor hereby waives and releases any losses, claims, damages, liabilities of any nature whatsoever, and costs (including attorney fees) arising out of, resulting from, or otherwise related to the use of the CADD Disks and CADD Drawings by the Contractor. The Contractor, to the maximum extent permitted by law, hereby agrees to indemnify, defend and hold the Architect and Engineer harmless from all loses, claims, damages, liabilities, and costs (including attorney fees) arising out of, resulting from, or otherwise related to the use of the CADD Disks and CADD Drawings by the Contractor.

F. Record Drawings, shall show "as-built" condition of details, sections, riser diagrams, control changes and corrections to schedules. Schedules shall show actual manufacturer and model numbers of final equipment installation.

G. The Contractor shall submit the record set for approval by the engineer a minimum of four weeks prior to seeking the permanent certificate of occupancy.

1.11 WARRANTIES

A. Submit manufacturer's standard replacement warranties for material and equipment furnished under this Section. Such warranties shall be in addition to and not in lieu of all liabilities which the manufacturer and the Telecommunication contractor may have by law or by provisions of the Contract Documents.

B. All materials, equipment and work furnished under this Section shall be guaranteed against all defects in materials and workmanship for a minimum period of one-year (1) commencing with the Date of Substantial Completion. Where individual equipment sections specify longer warranties, provide the longer warranty. Any failure due to defective material, equipment or workmanship which may develop, shall be corrected at no expense to the Owner including all damage to areas, materials and other systems resulting from such failures.

C. Provide a minimum 15+ year manufacturer's guarantee / warranty. This warranty / guarantee shall include all labor and material and shall be provided by a factory certified installer for the products being installed under this Section.

D. Guarantee that all elements of each system meet the specified performance requirements as set forth herein or as indicated on the Drawings.

E. Upon receipt of notice from the Owner of the failure of any part of the systems during the warranty period, the affected parts shall be replaced. Any equipment requiring excessive service shall be considered defective and shall be replaced.

1.12 COORDINATION

A. Refer to Division 1, General Conditions, for coordination requirements applicable to this section, unless specifically noted otherwise in this section.

B. Materials and apparatus shall be installed as fast as conditions of the building will permit and must be installed promptly when and as required.

C. Confer with all other trades relative to location of all apparatus and equipment to be installed and select locations so as not to conflict with work of other Sections. Any conflicts shall be referred immediately to the Owner's Representative for decision to prevent delay in installation of work. All work and materials placed in violation of this clause shall be readjusted to the Owner's Representative's satisfaction at no expense to the Owner.

D. Where work of this section will be installed in close proximity to work of other sections or where there is evidence that the work of this section may interfere with work of other sections, assist in working out space conditions to make satisfactory adjustment. Prepare and submit for approval 3/8" scale or larger working drawings and sections, clearly showing how the work is to be installed in relation to the work of other sections. If the work of this section is installed before coordinating with other trades or so as to cause interference with work of other trades, make changes necessary to protect conditions without extra charge.

E. Keep fully informed as to the shape, size and position of all openings required for all apparatus, conduit, cable, sleeves, etc., and give information in advance to allow construction of required openings. Furnish all sleeves, pockets, supports and incidentals, and coordinate with the General Contractor for the proper setting of same.

F. All distribution systems which require pitch or slope such as condensate drains and water piping shall have the right of way over those which do not. Confer with other trades as to the location of pipes, ducts, lights and apparatus and install work to avoid interferences.

G. Make reasonable modifications in the work as required by normal structural interferences, or by interference with work of other trades, or for proper execution of the work without extra charge.

1.13 COORDINATION DRAWINGS

A. Provide a set of Telecommunications coordination drawings for use in verifying required code clearances of all electrical equipment and for use in coordinating installation of equipment with other trades. Where practical, the CADD layering as established by the A&E team for the construction documents, shall be utilized in the preparation of all coordination drawings. Where CADD layering deviates from the A&E team's layering convention, submit the proposed layering system for approval. The CADD layering used shall provide, as a minimum, the flexibility of illustrating trade specific items similar to the established A&E team layering standard.

B. The intent of the coordination drawings is to identify and resolve installation conflicts prior to fabrication and installation of any MEP trade.

C. The HVAC contractor's floor plans shall be the basis for floor plan coordination. The Electrical contractor's reflected ceiling plans shall be the basis for reflected ceiling plan coordination. All other trades shall provide the HVAC / Electrical contractors with their Drawings / Layers for incorporation into one set of coordinated multi-trade drawings.

D. The CADD Drawings prepared by the Architect and Engineer contain representations of certain elements of the Project, and are not necessarily complete, nor are the CADD Drawings comparable or identical to final construction drawings. The Architect and Engineer make no representations or warranties with respect to the accuracy or completeness of the CADD Drawings. The Architect and Engineer do not recommend that the Contractor use the CADD Drawings in connection with the preparation of shop drawings. Should the Contractor choose to do so, however, the Contractor shall carefully review and compare the CADD Drawings with the corresponding final construction drawings to verify their accuracy and identify all discrepancies, differences, and inconsistencies in design, locations, dimensions, scope, and all other respects between the CADD Drawings and the corresponding final construction drawings. The Contractor, shall base the preparation and submission of shop drawings, and in general, shall base the performance of all its obligations with respect to the Project upon the information contained in the final construction drawings and not the CADD drawings. Nothing shall be construed as to relieve the Contractor of any of its obligations (such as, by way of illustration, the obligation to make field measurements or to coordinate drawings) under its contract with respect to the Project.

E. The Coordination Drawings shall be prepared as outlined below.

1. Prepare Telecommunication Coordination Drawings showing all Telecommunication work to be installed as part of Section 016700. The Coordination Drawings shall be created using AutoCAD and shall have a scale of ¼" or 3/8".

2. The Telecommunication Coordination Drawings shall show cable tray and speakers. Drawings shall include dimensions and elevation tags for all equipment, devices and material. This contractor shall coordinate exact locations of all racks, cabinets, UPS, information technology equipment and all MEP equipment with Owner's information technology representative. This contractor shall provide a coordinated dimensioned drawing of each server room, telecommunications room, equipment room and associated equipment within each room to engineer for record.

3. After incorporating all trades, resolve any areas of conflicts between trades under the direction of the General Contractor / Construction Manager and submit fully coordinated drawings to the Owner's Representative.

4. Do not install any of this work prior to the preparation and Engineer's review of the final Coordination Drawings. If Telecommunications work proceeds prior to the final Coordination Drawings, any change to the Telecommunications work to correct the interferences and conflicts which result will be made by this Contractor at no additional cost to the Owner.

5. Coordination Drawings are for this Contractor's and Owner's Representative's use during construction and shall not be construed as replacing any shop, "as-built", or Record Drawings required elsewhere in these Contract Documents.

6. Owner's Representative's review of Coordination Drawings shall not relieve this Contractor from his overall responsibility for coordination of all work performed pursuant to the Contract or from any other requirements of the Contract.

1.14 INTERPRETATION OF DRAWINGS AND SPECIFICATIONS

A. It is the intention of the Specifications and Drawings to call for complete, finished work, tested and ready for continuous operation. Any apparatus, appliance, material or work not shown on the Drawings, but mentioned in the Specifications or vice-versa, or any incidental accessories necessary to make the work complete in all respects and ready for operation, even if not particularly specified, shall be provided by this Contractor without additional expense to the Owner.

B. The Drawings are generally diagrammatic. The locations of all items that are not definitely fixed by dimensions are approximate only. The exact locations must be determined at the project and shall have the approval of the Owner's Representative before being installed. This Contractor shall follow Drawings, including his shop drawings, in laying out work and shall check the Drawings of other trades to verify spaces in which work will be installed. Maintain maximum headroom and space conditions. Where space conditions appear inadequate, notify the Owner's Representative before proceeding with the installation. This Contractor shall, without extra charge, make reasonable modifications in the layout as needed to prevent conflict with work of other trades or for proper execution of the work.

C. Any requests for information (RFI) for resolving an apparent conflict or unclarity, or a request for additional detail, shall include a sketch or equivalent description of contractors proposed solution.

D. Size of conduits, cable trays, raceways and methods of running them are shown, but it is not intended to show every offset and fitting, nor every structural difficulty that may be encountered. To carry out the true intent and purpose of the Drawings, all necessary parts to make complete approved working systems ready for use, shall be furnished without extra charge. All work shall be installed in an approved workmanlike manner.

1.15 INSPECTION OF SITE CONDITIONS

A. Prior to submission of bid, visit the site and review the related construction documents to determine the conditions under which the Work has to be performed and send a report, in writing, to the Owner's Representative, noting any conditions which might adversely affect the Work of this Section of the Specifications.

1.16 SURVEY AND MEASUREMENTS

A. Base all required measurements, horizontal and vertical, from referenced points established with the Owner's Representative. The Telecommunication Contractor shall

be responsible for correctly laying out the Work required under this Section of the Specifications.

B. In the event of discrepancy between actual measurements and those indicated, notify the Owner's Representative in writing and do not proceed with the related work until instructions have been issued.

1.17 DELIVERY, STORAGE AND HANDLING

A. No materials shall be delivered or stored on site until corresponding Shop Drawings have been approved.

B. All manufactured materials shall be delivered to the site in original packages or containers bearing the manufacturer's labels and product identification.

C. Protect materials against dampness. Store off floors, under cover and adequately protected from damage.

D. Inspect all equipment and materials, upon receipt at the job site, for damage and conformance to approved shop drawings.

1.18 PROTECTION OF WORK AND PROPERTY

A. This Contractor shall be responsible for the care and protection of all work included under this Section until the completion and final acceptance of this Contract.

B. Protect all equipment and materials from damage from all causes including, but not limited to, fire, vandalism and theft. All materials and equipment damaged or stolen shall be repaired or replaced with equal material or equipment at no additional cost to the Owner.

C. Protect all equipment, outlets and openings with temporary plugs, caps and covers. Protect work and materials of other trades from damage that might be caused by work or workmen under this Section and make good damage thus caused.

D. Damaged materials are to be removed from the site; no site storage of damaged materials will be allowed.

1.19 SUPERVISION

A. Supply the service of a competent Supervisor with a minimum of 5 years experience in Telecommunication construction supervision who shall be in charge of the Telecommunications work at the site.

1.20 SAFETY PRECAUTIONS

A. Life safety and accident prevention shall be a primary consideration. Comply with all of the safety requirements of the owner and OSHA throughout the entire construction period of the project.

B. Furnish, place and maintain proper guards and any other necessary construction required to secure safety of life and/or property.

1.21 SCHEDULE

A. Construct work in sequence under provisions of Division 1 and as coordinated with the Owner's Representative.

1.22 HOISTING, SCAFFOLDING AND PLANKING

A. The work to be done under this Section of the Specifications shall include the furnishing, set-up and maintenance of all derricks, hoisting machinery, cranes, helicopters, scaffolds, staging and planking as required for the work.

1.23 CUTTING AND PATCHING

A. Include all coring, cutting, patching, and fireproofing necessary for the execution of the work of this Section. Structural elements shall not be cut without written approval of the Architect. This Contractor shall be responsible for taking all precautions required to identify hidden piping, conduits, etc. before any core drilling and/or cutting of slabs commences, including X-raying the affected slabs. Provide fire stopping to maintain the fire rating of the fire resistance-rated assembly. All penetrations and associated fire stopping shall be installed in accordance with the fire stopping manufacturer's listed installation details and be listed by UL or FM.

B. All work shall be fully coordinated with all phases of construction, in order to minimize the requirements for cutting and patching.

C. Form all chases or openings for the installation of the work of this Section of the specifications, or cut the same in existing work and see that all sleeves or forms are in the work and properly set in ample time to prevent delays. Be responsible that all such chases, openings, and sleeves are located accurately and are of the proper size and shape and consult with the Owner's Representative band all other trades concerned in reference to this work. Confine the cutting to the smallest extent possible consistent with the work to be done. In no case shall piers or structural members be cut without the approval of the Owner's Representative.

D. Fit around, close up, repair, patch, and point around the work specified herein to match the existing adjacent surfaces and to the satisfaction of the Owner's Representative.

E. Fill and patch all openings or holes left in the existing structures by the removal of existing equipment which is part of this Section of the Specifications.

F. All of this work shall be carefully done by workmen qualified to do such work and with the proper and smallest tools applicable.

G. Any cost caused by defective or ill-timed work required by this Section of the specifications shall be borne by this Contractor.

H. When, in order to accommodate the work required under this Section of the specifications, finished materials of other trades must be cut or fitted, furnish the necessary drawings and information to the trades whose materials must be cut or fitted.

1.24 SUPPLEMENTARY STEEL, CHANNELS AND SUPPORT

A. Provide all supplementary steel, factory fabricated channels and supports required for the proper installation, mounting and support of all Telecommunications equipment, piping, etc., required by the Specifications.

B. Supplementary steel and factory fabricated channels shall be firmly connected to building construction in a manner approved by the Owner's Representative as shown on the drawings or herein specified.

C. The type and size of the supporting channels and supplementary steel shall be determined by the Contractor and shall be of sufficient strength and size to allow only a minimum deflection in conformance with the manufacturer's requirements for loading.

D. All supplementary steel and factory fabricated channels shall be installed in a neat and workmanlike manner parallel to the walls, floors and ceiling construction. All turns shall be made with 90 degree and 45 degree fittings, as required to suit the construction and installation conditions.

E. All supplementary steel including factory fabricated channels, supports and fittings shall be galvanized steel, aluminum or stainless steel where exposed or subject to rust producing atmosphere. Factory fabricated channels shall be manufactured by Unistrut, H-strut, Powerstrut or approved equal.

1.25 HAZARDOUS MATERIALS

A. Removed batteries shall be recycled by a facility approved by the owner's representative. A uniform hazardous waste manifest shall be prepared for all disposals and returned with all applicable signoffs prior to application for final payment.

B. A uniform hazardous waste manifest shall be prepared for all disposals and returned with all applicable signoffs prior to application for final payment. All handling shall conform to EPA requirements. Provide breakout cost for this scope.

C. Where it has been identified that asbestos-containing material exists within the scope limits, refer to the Asbestos Abatement specification section for requirements.

1.26 ACCESSIBILITY

A. All work provided under this Section of the Specification shall be installed so that parts requiring periodic inspection, maintenance and repair are accessible. Work of this trade shall not infringe upon clearances required by equipment of other trades, especially code required clearances to electrical gear. Minor deviations from the drawings may be made to accomplish this, but changes of substantial magnitude shall not be made prior to written approval from the Owner's Representative.

1.27 SEISMIC RESTRAINT REQUIREMENTS

A. Submit working plans and calculations reviewed, signed and stamped by a professional engineer who is registered in the State where the project is located and has specific experience in seismic calculations, certifying that the plans meet all seismic requirements established by authorities having jurisdiction over the project.

B. For each seismic restraint, provide certified calculations to verify adequacy to meet the following design requirements:

1. Ability to accommodate relative seismic displacements of supported item between points of support.

2. Ability to accommodate the required seismic forces.

C. For each respective set of anchor bolts provide calculations to verify adequacy to meet combined seismic-induced sheer and tension forces.

D. For each weldment between structure and item subject to seismic force, provide calculations to verify adequacy.

E. Restraints shall maintain the restrained item in a captive position without short circuiting the vibration isolation.

1.28 PROJECT CLOSEOUT

A. Certificates of Approval

1. Upon completion of all work, provide certificates of inspections from the following equipment manufacturers stating that the authorized factory representatives have inspected and tested the operation of their respective equipment and found the equipment to be in satisfactory operating condition and installed per the manufacturers installation instructions and requirements.

a. Horizontal and backbone link/channel test reports

b. Record drawings

c. Manufacturer Extended Warranty

B. Substantial Completion

1. When the Contractor considers the Work under this Section is substantially complete, the Contractor shall submit written notice, through the General Contractor, with a detailed list of items remaining to be completed or corrected and a schedule of when each remaining work item will be completed. Should the engineer determine the list of remaining work does not constitute substantial completion the engineer will notify the Architect and/or Owner and he will not make a substantial completion site visit.

2. The following items shall be completed prior to the written request for substantial completion site visit:

a. Certification of successful operation of all systems

b. Training of the owner's personnel in the operation of the systems

c. Record Drawings in accordance with the contract specifications

d. Operation and Maintenance manuals

e. Testing reports

f. Manufacturer's certificates of approvals, extended warranty

g. Emergency contact list for reporting of malfunctioning equipment during the warrantee period

h. Contractors Project Completion certificate

3. Should the Engineer, during the substantial completion visit, observe that the Work is substantially complete, s/he will provide a written listing of the observed deficiencies referred herein as the Punch List. The Punch List will provide for a place for the Contractor and general contractor to sign off and date each item individually indicating that the observed deficiency item has been corrected.

4. Should the Engineer, during the substantial completion site visit, observe that the Work is not substantially complete, s/he will provide, a written list of the major deficiencies and a reason for the work not being considered substantially complete.

5. If the work is found not to be substantially complete then the engineer shall be reimbursed for his time to re-observe the work. A re-observation fee shall be charged to the Contractor through the contractual agreement for any further observations by the engineer.

6. The Contractor shall remedy all deficiencies listed in the punch list within the time frame required by the contract.

C. Engineers Construction Completion Certification

1. Where required by the applicable code, the Engineers Construction Completion Certification will be issued by RDK Engineers when all life safety and health related issues are complete, all required functional tests are complete and all reports are complete. The following is a minimum listing of the required systems to be tested with reports generated indicating they are complete and ready for use:

a. Backbone cabling infrastructure test reports

2. There shall be NO outstanding items identified on the punch list for scope within any of these categories.

D. Final Completion

1. The following items shall be submitted prior to the written request for Final completion:

a. Revised Substantial Completion items to be resubmitted in accordance with the review process comments

b. Warranties commencing the date of Substantial completion

c. Individual Signed and dated Punch List acknowledging completion of all punch list items

2. When the Contractor considers all of the punch list work items complete, the Contractor shall submit written notice through the General Contractor that all Punch List items are complete and resolved and the work is ready for final observation site visit. The signature lines for completion of each punch list item shall be signed by the Contractor indicating the work is complete and signed by the General contractor indicating s/he has inspected the work and found it to be

complete. Should the Engineer find the work to be finally complete and all Punch List items are complete the Engineer will make a recommendation to the Architect or Owner. If the Engineer has found the punch list work to be incomplete during final inspection a written listing of the observed deficiencies will be prepared by the Engineer.

3. If the work is not fully complete then the engineer shall be reimbursed for his time to re-observe the work. A re-observation fee shall be charged to the Contractor through the contractual agreement for any re-observations by the engineer.

E. Re-observation Fees

1. The re-observation fee shall be $1200.00 per visit.

F. Contractor's Project Completion Certificate

1. Upon completion of work and prior to request for Certificate of Occupancy, each Trade Contractor and the General Contractor shall issue a certificate stating that work has been installed generally consistent with construction documents and all applicable codes. RDK Engineers can furnish a blank contractor's certificate form upon request. The certificate shall certify:

   a. Execution of all work has been in accordance with the approved construction documents.

   b. Execution and control of all methods of construction was in a safe and satisfactory manner in accordance with all applicable local, state and federal statutes and regulations.

2. The certificate shall include the following information:

   a. Project

   b. Permit Number

   c. Location

   d. Construction Documents

   e. Date on Plans and Specifications submitted for approval and issuance of the Building Permit

   f. Addendum(a) and Revision Dates

3. The certificate shall be signed by the Contractor and include the following:

   a. Signature

   b. Date

   c. Company

   d. License Number

   e. License Expiration Date

PART 2 - PRODUCTS

2.00 GENERAL

A. All devices shall comply with ANSI/TIA/EIA 568-B.1, B.2, B.3 standard including all Addendums.

B. Manufacturer and part numbers are indicated throughout the specification to establish quality and performance characteristics of individual products. Deviation from the listed manufacturer is not acceptable unless it is noted as “or approved equal”.

Acceptable Manufacturers of Equipment:

1. Splice Case: Corning or equal.

2. Splice Components: Corning or equal.

2.01 MODBUS CABLING

A. Modbus cable to be RS-485, 22AWG 2C, indoor/outdoor rated cable.

B. Coordinate Modbus termination types and locations with owner.

C. Outdoor rated cabling entering from the outside shall transition to indoor rated cable within 50 feet of entering building.

2.02 VOICE CABLING

A. Cable for voice shall be 4-pair, 24 AWG, Category 3 indoor/outdoor rated cable.

B. Outdoor rated cabling entering from the outside shall transition to indoor rated cable within 50 feet of entering building

2.03 VOICE TERMINATION BLOCKS

A. Voice Backbone Termination Block

1. 50 pair field terminated blocks, 110 type, 5-pair shall be manufactured by Panduit or approved equal.

2.04 BUILDING ENTRANCE PROTECTION (BEP)

A. Building Entrance Protection unit for outside voice cables, utilizing 110 IDC, shall be 50 pair, wall mounted.

2.05 BONDING AND GROUNDING

A. Refer to Section 2.01 – GENERAL for additional manufacturer’s requirements.

B. Provide products meeting the requirements of the drawings and specifications from one of the following manufacturers:

C. Belden (No. 8669) or equivalent.

D. Jumper cable shall be hollow braided, 60 amp capacity, copper.

E. Provide equal conductor as described in “B” above for aluminum equipment.

F. Jumpers shall have compression or exothermic type terminals on both ends of cables. Terminals shall be compatible with jumper cable material and equipment material in order to not have any degenerative reaction.

PART 3 - EXECUTION

3.00 GENERAL

A. All devices shall comply with ANSI/TIA/EIA 568 – B.1, B.2, B.3 Commercial Building Telecommunications Cabling Standard.

B. Coordinate all work with all contract documents including but not limited to:

1. Architectural floor plans and equipment layouts.

2. Electrical contract drawings.

3. Mechanical equipment.

4. Rhode Island College's telecommunications project manager.

C. Coordinate all work with all on-site contractors including but not limited to:

1. Electrical Contractor

2. Equipment Installer.

3. Rhode Island College's telecommunications project manager.

D. Refer to electrical drawings for pathways including sleeves, conduits, hand holes, and trenching to be utilized by this contractor.

E. Refer to telecommunications contract documents (drawings and specifications) fit-up, riser, elevations, and additional information.

F. Cooperate and coordinate with work of other sections in executing work of this section.

G. Perform work so that progress of entire project including work of other sections is not interfered with or delayed. Obtain detailed installation information from all manufacturers of equipment provided under other sections.

H. Provide information as requested on items furnished under this section which shall be installed under other sections.

I. Materials and Workmanship

1. Work shall be executed in workmanlike manner and shall be neat, plum, parallel to the building structure perpendicular to all electronics and associated cabling and neat in appearance when completed. All work shall adhere to the standards as set forth in this specification (See Section 1). Maintain maximum headroom at all times. Do not run work exposed unless shown exposed on drawings.

2. Material and equipment shall be new and installed according to manufacturer's recommended best practices so that completed installation shall operate safely and efficiently, and be neatly installed.

J. This contractor owns the greater quantity and better quality where conflicts exist.

K. Continuity of Services: Do not interrupt existing services. Existing services shall remain operational at all times. If the existing services need to be disrupted for any reason the contractor shall contact the Owner (representative to be announced at a later date) and schedule the aforementioned shutdown. The contractor shall schedule the shutdown with the Owner 48 hours in advance.

L. All cabling shall be terminated at both ends unless noted otherwise.

M. The requirements of Part One and Part Two of the Specifications also apply to the execution of the work.

N. Verify the exact location prior to bid of all items that may be indicated and determine exact location of all electrical items that are not indicated on the Drawings.

O. Include the cost of all work including sub-letting of any work that may be required to complete the work indicated in order to avoid work stoppages and jurisdictional disputes. The work to be sublet shall conform with precedent agreements and decisions of record. Jurisdictional assignment shall be a responsibility under this Section's contractual obligation.

P. Do not install equipment and materials which have not been reviewed by the Architect. Equipment and materials which are installed without the Architect's review or without complying to comments issued with the review shall be removed from the project when so instructed by the Architect. No payment will be made for unapproved or removal if it is ordered removed. The Installer shall be responsible for any ancillary costs incurred because of its removal and the installation of the correct equipment and materials.

Q. Obtain detailed information on installation requirements from the manufacturers of all equipment to be furnished, installed or provided. At the start of construction, check all Contract Documents including all Drawings and all Sections of the specifications for equipment requiring electrical connections and service and verify electrical characteristics of equipment prior to roughing.

R. Any and all material installed or work performed in violation of above requirements shall be re-adjusted and corrected by the Installer without charge.

S. Refer to all Drawings associated with the project, prior to the installation or roughing-in of the electrical outlets, conduit and equipment, to determine the exact location of all outlets.

T. After installation, equipment shall be protected to prevent damage during the construction period. Openings in conduits and boxes shall be closed to prevent the entrance of foreign materials.

U. Home runs indicated are not to be combined or reduced without written consent from the Architect.

V. All connections to equipment shall be made as required, and in accordance with the approved submittal and setting drawings.

W. Delivery, Storage and Handling:

1. Deliver, store, protect and handle products in accordance with recommended practices listed in Manufacturer's Installation and Maintenance Manuals.

2. Deliver equipment in individual shipping splits for ease of handling, mount on shipping skids and wrap for protection.

3. Inspect and report concealed damage to carrier within specified time.

4. Store in a clean, dry space. Maintain factory protection or cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation. Meet the requirements and recommendations of NFPA 70B and the Manufacturer. Location shall be protected to prevent moisture from entering enclosures and material.

5. Handle in accordance with NEMA and the Manufacturer's recommendations and instructions to avoid damaging equipment, installed devices and finish.

6. The equipment shall be kept upright at all times. When equipment has to be tilted for ease of passage through restricted areas during transportation, the Manufacturer shall be required to brace the equipment suitably to insure that the tilting does not impair the functional integrity of the equipment.

X. Site Observation:

1. Site observation visits will be performed randomly during the project by the Architect. Reports will be generated noting observations. Deficiencies noted on the site visit reports shall be corrected. All work shall comply with the Contract Documents, applicable Codes, regulations and local Authorities whether or not a particular deficiency has been noted in a site visit report.

2. Be responsible to notify the Architect ten working days prior to closing in work behind walls, raised access floors, ceilings, etc., so that installed work can be observed prior to being concealed.

3. Work concealed prior to observation and correction of deficiencies shall be made accessible for review at the discretion of the Architect. Bear all costs for allowing worked to be reviewed.

4. Areas shall stay accessible until deficiencies are corrected and accepted. Notify the Architect when all deficiencies are corrected. Return reports with items indicated as corrected prior to re-observation by the Architect.

Y. Project Open House:

1. If the Owner elects to have an open house at the end of the project, provide assistance to the Owner. Cooperate and provide manpower to operate and demonstrate systems during the open house as requested by the Owner.

Z. Change Orders, Modifications, Revisions and Directives:

1. When change orders, modifications, revisions or Architect's Directives are issued or authorized, provide the required additional material, equipment, personnel and workers to prevent delays in the work, and to complete the work within the time

limit of the Contract unless a specific time extension is requested with the change and accepted. Include costs for expediting deliveries where required.

2. Requests for additional compensation shall be submitted broken down and associated by item, tasks and Drawing or sketch number with material and labor costs, so quantities can be easily verified.

3. Requests shall be properly and adequately identified so the scope of work can be clearly determined. Indicate who originated change in work.

4. Submit on all credits broken down as requested for adds. Credits shall be separately identified and accounted for. Do not indicate as net changes with adds.

5. Unit costs for labor and material shall be equal for adds, deletes and credits.

AA. Loose materials shall not be stored on-site. A "gang box" is acceptable to be placed in a location agreeable to the Owner and the General Contractor. The Installer is responsible for all equipment and materials and for their delivery until the system is deemed complete and accepted by the Owner.

BB. Under no circumstances shall the Owner's or General Contractor’s waste containers, compactor or dumpster be used for any kind of waste material.

CC. A trailer may be used for the storage of materials to be located on the Owner's property at a location designated by the Owner and the General Contractor. Such on-site storage shall be kept locked by the Installer. Security for the trailer and its contents shall be strictly the responsibility of the Installer.

DD. Protect existing in spaces where work is being performed to protect it from damage and from the accumulation of dirt.

EE. Any ceilings, walls, floors, furniture, equipment, furnishings, etc., damaged by the work of this Section shall be replaced, or at the Owner's option, repaired with similar materials, workmanship and quality.

FF. Work includes field survey of existing conditions, systems, equipment and tracing of existing circuits in order to determine scope of work.

GG. Maintain the existing building in operation at all times during the entire construction period. If it is necessary to have a system shutdown, a written request for approval shall be submitted in advance stating the estimated shutdown time. Work shall be planned to minimize shutdown. Shutdowns shall be at the convenience of the Owner and, if necessary, on premium time.

HH. Clean and touch up all equipment, materials and work sites at the completion of work in each area.

II. Certain portions of the work area may be occupied during construction. Determine which areas and schedule work accordingly and include necessary premium time.

JJ. Make sure necessary provisions to provide continuous service of all existing systems throughout all occupied areas.

3.01 MODBUS CABLE

A. Install MODBUS, RS-485, 22 AWG 2C cable from the electrical area.

B. Coordinate termination type and location with owner.

C. Transition from outdoor rated cable to indoor rated cable within 50 feet of the entrance to the building.

3.02 VOICE HORIZONTAL CABLE

A. Provide Category 3 voice cables for a POTS line to the electrical area in scope.

B. All four pairs of each voice cable shall be terminated at both ends.

1. One end of each voice horizontal cable shall be terminated in an eight position, eight conductor, Category 3 modular insert(s) at the electrical area end outlet. The outlet shall be in an outdoor rated enclosure.

2. One end of each voice horizontal cable shall be terminated in a voice termination block (110 style) at the telecommunication room.

C. Install wire and cable in approved/provided raceways and cable tray as specified and as approved by the authorities that have jurisdiction.

D. Cable Pulling: Pulling Tension: Maximum pulling tensions for 4 pair horizontal UTP cable shall not exceed 11ON (25lbf).

E. Maintain cable twist to within ½" of the main point of mechanical termination (IDC).

F. When stripping cable for termination remove only a minimum amount (i.e., as little as possible) of cable jacket insulation.

G. Additional cable slack (service loop) shall be provided for maintenance or future cabling system changes:

1. Telecommunications Outlet = 10 feet

2. Equipment Racks = 10 feet

H. Splices are not permitted for any horizontal cabling.

I. Transition from outdoor rated cable to indoor rated cable within 50 feet of the entrance to the building.

3.03 VOICE TERMINATION BLOCKS

A. Provide a 50 pair 110 riser termination field in the IDF.

B. Terminate all voice cables on these 110 fields.

C. Provide C-4 clips for all horizontal cables and C-5 clips for all backbone cables.

3.04 BUILDING ENTRANCE PROTECTION

A. Provide building entrance protection for all outside plant copper cables at the entrance facility/demarcation point.

B. Provide all protector modules for each pair of outside plant copper cable.

3.05 BONDING AND GROUNDING

A. Provide a suitable telecommunications ground for equipment as required per ANSI/TIA/EIA-607 (telecommunications grounding), IEEE Emerald Green book and NEC requirements.

B. All cable tray, ladder rack, access floors and equipment racks and/or cabinets contained within the MDF and the IDF's shall be bonded together with #6 AWG, and then bonded/grounded with #6 AWG to the telecommunications grounding busbar (TGB).

C. All aforementioned telecommunications devices shall be grounded/bonded to the TGB using stranded #6 insulated copper (AWG wire). Coordinate exact grounding locations for each component.

3.06 LABELING AND IDENTIFICATION

A. All equipment and cabling shall be properly identified by means of clear and concise labels. All identification shall meet or exceed the minimum requirements of EIA/TIA 568, B.1, B.2, B.3, 606 and BICSI standards.

B. All labels must be permanent and shall be clearly printed on clear or opaque tape and meet the following requirements:

1. The font shall be approximately 1/8" in height, block characters and clearly legible.

2. The text and color shall contrast with the label background (e.g., black on white).

3. Hand written labels are not acceptable.

4. All labeling material shall meet the minimum flame rating requirements.

5. Embossed type labels are not acceptable.

6. Label patch panels and cross connect blocks numerically, top-to-bottom.

7. Label cable segments by designated incoming label.

C. Coordinate all labeling with the Rhode Island College telecommunications project manager.

3.07 DOCUMENTATION

A. Label all equipment as specified above

B. Provide the Owner with:

1. Hard copy documentation of "As-Built" Telecommunications Cabling Systems Administration Reports.

2. Hard copy documentation of test results for every cable segment and link in 3-ring binder. Documents shall include measured values as well as whether or not the test passed.

3. "As-Built" drawings indicating location of all equipment including but not limited to work area outlets, patch panels, cross connect blocks, on each segment and cable routing. Indicate labeling for each piece of equipment.

4. Refer to Part One for additional documentation.

3.08 TESTING

A. All cables shall be tested as noted below.

B. Provide a hard copy of all test results. Handwritten test results will not be accepted.

C. All testing shall be completed after all communication outlets have been secured in their final position and are properly labeled per this specification.

D. Building must be operational (i.e.; building lighting and power must be energized).

E. Provide Rhode Island College with individual binders documenting the MDF and IDF's. Each binder shall have the test technician's name printed and signed with date of test. Testing and documentation shall include but not limited to:

1. Cabling System

a. Provide testing and documentation for all pairs of the applicable backbone riser cables. Test shall include, but to be limited to; continuity, shorts and opens.

3.09 TERMINATIONS

A. All copper conductors of every cable shall be completely terminated/spliced.

B. Terminations shall be as indicated under the type of cabling specified in Part Two of the Specifications.

3.10 CABLE INSTALLATION STANDARDS AND CLEARANCES

A. Install cables in pathways required under the execution part of this section.

B. All pathways provided under this Section shall comply with fill capacities as per the Electrical Code, EIA/TIA and BICSI.

C. Cable bending radius shall not be less than minimum required by EIA/TIA and BICSI.

D. Cabling installed concealed shall be supported from the building structure (e.g. cable trays, "J" hooks, etc.).

E. At a minimum, exposed cabling installed in return air plenums shall be plenum rated cables.

F. Cables shall be installed no closer than 12 inches (305mm) to electrical fluorescent light fixtures, 4 feet from motors and transformers. When cables are required to cross power wiring, they shall only do so perpendicular to the power wiring. Telecommunications cabling and power wiring shall only cross each other the minimal number of times as required due to building design limitations.

G. Clearances: Clearances between cabling and other building systems as required by EIA/TIA 569-A and BICSI shall be maintained throughout the building.

H. All cables shall be installed in a neat and workman-like manner. Cables shall be installed parallel and perpendicular to building elements.

I. Cables installed in each Telecommunications Room and closets shall be installed in approved pathway systems (cable runway, etc.). Under no circumstance shall cables be allowed to "hang" across any spaces. Wrap cables frequently in order to dress them properly.

J. All cables shall have a minimum of 10 foot service loops in the telecommunications closets and rooms and shall have a minimum of 18 inch service loop at the work area outlet.

K. Provide expansion fittings and adequate cable slack at all building expansion joints.

3.11 CABLE PROTECTION

A. Cables to be installed in existing enclosed open bays or furred spaces where conduit stubs are not provided, shall be protected from chafing or any damage. The Installer shall verify that the warranty shall not be violated before installing any cabling in these locations.

B. Provide bushings in all metal studs and other openings where cables will pass through. Bushings shall be of two (2) piece construction with one piece inserted through the openings and the second piece locking it into place. Single piece bushings with locking tabs or friction fit are specifically prohibited.

C. Provide cutting, coring, sleeves and bushings and seal as required at all penetrations.

D. Cables damaged during installation shall not be repaired. They shall be completely replaced with new cable at no additional cost.

3.12 SYSTEM ACCEPTANCE

A. Obtain written acceptance from the Owner or their authorized representative for each cabling system installed on this project. Failure to obtain written acceptance shall result in delay of start of warranty period. No claim for additional costs will be allowed due to not receiving written acceptance. Warranty period will start upon receipt of written acceptance.

3.13 ACCEPTANCE DEMONSTRATIONS

A. Systems installed under this section shall be demonstrated to the Owner and Architect. Demonstrations are in addition to necessary testing and training sessions. Notify all parties at least 7 days prior to the scheduled demonstration. Schedule demonstrations in cooperation with and at times convenient to all parties and so as to not disturb ongoing activities.

B. Systems shall be tested prior to the demonstrations and each system shall be fully operational and tested prior to arranging the Acceptance Demonstration. Final payments will be withheld until a satisfactory demonstration is provided for all systems indicated or requested.

C. If the demonstration is not totally complete, performing all functions, features and connections or interfaces with other systems, or if there is a failure during the demonstration, additional demonstrations shall be arranged. Provide and pay for all

costs, labor and expenses incurred for all attendees for each additional demonstration required for acceptance and demonstration of complete system operation.

D. Demonstrations shall be scheduled in ample time to complete all activities prior to final acceptance and Owner occupancy. Demonstrations shall take place at least 30 days prior to the scheduled project completion date and 30 days prior to owner's use and occupancy.

E. As a minimum, provide demonstrations for systems indicated under "Work Included" under Part One of the Specifications. Provide demonstrations of additional systems as requested by the Owner or Architect.

3.14 PROJECT OWNER COORDINATION

A. Prior to Substantial Completion of the project and in ample time to address and resolve any coordination issues, request and arrange meetings between the Owner, Owner's Vendors and Consultants, Architect, and General Contractor to discuss the Scope of Work for each system being provided and the interface required for a fully functional and operational system upon project completion. Initial meetings shall be scheduled three months prior to the scheduled Substantial Completion date or as soon as Submittals are submitted and reviewed for projects with shorter schedules.

B. At these meetings the required interface with the Owner shall be reviewed, requests for information required to complete programming or for coordination shall be presented and system operation and philosophy shall be discussed.

C. Additional meetings shall be held as requested by any party so that all issues are resolved and with the goal and intent being that all systems are fully operational and functional upon project Substantial Completion and that the responsibility for all components required is clearly established.

3.15 CLEANING UP

A. Upon completion of all work and testing, thoroughly inspect all exposed portions of installation and completely remove all exposed labels, markings, and foreign material.

B. The interior of all equipment and cabinets shall be left clean; exposed surfaces shall be cleaned and plated surfaces polished.

C. Repair damage to finish surfaces resulting from work under this section.

D. Remove material and equipment from areas of work and storage areas.

E. All equipment shall be clean from dirt, dust, and fingerprints prior to final acceptance.

F. Touch up all damaged pre-finished equipment using materials and methods recommended by the Manufacturer.

END OF SECTION

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SECTION 310000

EARTHWORK (SITE)

PART 1 - GENERAL

1.00 DESCRIPTION

A. Provide facilities, labor, materials, tools, equipment, appliances, transportation, supervision, and related work necessary to complete the work specified in this section, and as shown on the Drawings.

B. Work performed under this Section of the Specifications shall be subject to the General Conditions, Supplementary Conditions and Division 01 General Requirements of the Contract Documents.

C. The work of this section includes but is not necessarily limited to:

1. Excavation, fill, and backfill, as indicated or required, including compaction.

2. Over excavation and compaction of existing fill materials below foundations and slabs.

3. Excavation and offsite disposal of unsuitable or excess materials unless on-site locations are designated. Excavation shall include removal and satisfactory disposal of all unclassified material encountered throughout the site.

4. Rough grading, including placement, moisture conditioning, and compaction of fills and backfill.

5. Placement of base and subbase course materials under structures, pavements, slabs, including compaction.

6. Trench excavation, bedding, and backfill for utility structures and utilities, including compaction.

7. The removal, hauling and stockpiling of suitable excavated materials for subsequent use in the work. Stockpiling shall include protection to maintain materials in a workable condition.

8. Rehandling, hauling, and placing of stockpiled materials for use in refilling, filling, backfilling, grading, and such other operations.

9. Protect and preserve all existing buildings, pavements, and utilities to remain.

10. Furnishing and installing all sheeting, shoring, and bracing of structural and trench excavations and its satisfactory removal, unless otherwise directed to have it remain in place.

11. Environmental controls.

12. Providing products in sufficient quantities to meet the project requirements.

13. Providing adequate pumping and drainage facilities to keep the work area sufficiently dry.

14. Obtain all required permits, licenses, and approvals of appropriate municipal and utility authorities, prior to commencing the work of this Section, and pay costs incurred therefrom.

D. Provide facilities, labor, materials, tools, equipment, appliances, and related work necessary to provide and maintain erosion control during construction operations. All erosion control measures shall be installed prior to earthwork operations and shall be maintained according to plans and other sections of the specifications.

1. Refer to Section 312500 – EROSION AND SEDIMENTATION CONTROLS.

E. Contractor shall be responsible for notifying all affected utility companies and DIG SAFE before starting work.

F. Refer to the Soil Management Plan for Rhode Island College, included herewith as Appendix 1, regarding proper handling and disposal of soil containing naturally-occurring arsenic. Contractor to store excavated materials onsite, in a location suitable to the Owner, for placement back into the utility trenches; however, any excess volume at the end will be tested by the Owner prior to disposal.

1.01 RELATED SECTIONS

A. Carefully examine all of the Contract Documents for requirements which affect the work in this Section. Other Specification Sections which directly relate to the work of this Section include, but are not limited to, the following:

1. Section 007355 - SWPPP

2. Section 018900 – SITE CONSTRUCTION PERFORMANCE REQUIREMENTS.

3. Section 312319 – DEWATERING.

4. Section 312500 – EROSION AND SEDIMENTATION CONTROLS.

5. Section 329220 – SEEDING AND SODDING.

1.02 LAWS, REGULATIONS, AND PLANS

A. Work shall be accomplished in accordance with regulations of local, county, state and federal agencies or utility company standards as they apply.

B. Work shall be accomplished in accordance with the Soil Management Plan for Rhode Island College, included herewith as Appendix 1.

1.03 QUALITY ASSURANCE

A. The Owner may retain and pay for the services of an independent testing and inspection firm and/or a Geotechnical Consultant to perform on-site observation and testing during the various phases of the construction operations. The scope of services will be determined by the Owner and the independent testing and inspection firm and/or the Geotechnical Consultant and will be provided to the Contractor. The Owner reserves the right to modify or waive the services of the independent testing and inspection firm and/or the Geotechnical Consultant. The services of an independent testing firm and/or Geotechnical Consultant may include, buy not necessarily be limited to, the following:

1. Observation during excavation and dewatering of building areas and controlled fill areas.

2. Laboratory testing and analysis of fill materials as specified herein and proposed by the Contractor for incorporation into the Work.

3. Observation of construction and performance of water content, gradation and compaction tests at a frequency and locations that the independent testing and inspection firm and/or the Geotechnical Consultant may require. The results of these tests will be submitted to the Owner, Engineer, and Contractor on a timely basis so that action can be taken to remedy indicated deficiencies. During the course of construction, the independent testing and inspection firm and/or the Geotechnical Consultant will advise the Owner in writing, if at any time in their opinion, the Work hereunder is of unacceptable quality. Failure of independent testing and inspection firm and/or the Geotechnical Consultant to give notice, shall not excuse the Contractor from latent defects discovered in his work.

B. The Contractor shall make provisions for allowing observations and testing of Contractor's work by the independent testing and inspection firm and/or the Geotechnical Consultant.

1. The presence of the independent testing and inspection firm and/or the Geotechnical Consultant does not include supervision or direction of the actual work of the Contractor, and his employees or agents. Neither the presence of the independent testing and inspection firm and /or the Geotechnical Consultant, nor any observations and testing performed by them, nor failure to give notice of defects shall excuse the Contractor from defects discovered in his work.

C. Costs related to retesting due to unacceptable qualities of work and failures discovered by testing shall be paid for by the Contractor at no additional expense to Owner, and the costs thereof will be deducted by the Owner from the Contract Sum.

D. Whenever floodplain compensation areas are designated on the plans, grading elevations are to be considered critical to the floodplain volumetric calculations and shall be constructed by the Contractor in strict conformance with the indicated grades.

1.04 SUBMITTALS

A. Submit, in an airtight container for the testing laboratory, a 50-pound sample of each type of off-site fill material that is to be used at the site. Submit samples a minimum of one week prior to use of proposed material at the site. Submit samples to the testing laboratory and/or the Geotechnical Consultant (copy of these transmittal forms shall be simultaneously sent to Engineer) or if no testing laboratory and/or Geotechnical Consultant is identified, then the Engineer shall be the recipient of the samples. Use of these proposed materials by the Contractor prior to testing and approval shall be at the Contractor's risk.

B. The Engineer will be responsible for the approval or rejection of the suitability of all materials.

C. Submit the name of each material supplier and specific type and source of each material. Any change in source throughout the project requires approval of the Owner or Engineer.

D. For use of geotextile fabrics or geogrids, submit manufacturer's product data including material's properties for approval by the Engineer.

1.05 COORDINATION

A. Prior to start of earthwork the Contractor shall arrange an on-site meeting with the Engineer, the Owner's Representative, the independent testing firm, and/or the

Geotechnical Consultant for the purpose of establishing the Contractor's schedule of operations and scheduling observation and testing procedures and requirements.

B. As construction proceeds, the Contractor shall be responsible for notifying the Owner and Engineer prior to the start of earthwork operations requiring observation and/or testing.

1.06 SUBSURFACE SOIL DATA

A. A geotechnical engineering report has been prepared by GZA GeoEnvironmental, Inc. dated November 13, 2013. This report is specifically not part of the Contract Documents, but is available to bidders for informational purposes

B. Review available logs of borings, test pit logs, jar soil samples, records of explorations and other pertinent data for the site. After obtaining Owner's permission, take whatever additional subsurface explorations deemed necessary at no expense to the Owner.

C. The above data are for general information and are accurate only at the particular locations and times the subsurface explorations were made. It is the Contractor's responsibility to make interpretations and to draw conclusions based on the character of materials to be encountered and the impact on his work based on his expert knowledge of the area and of earthwork techniques.

D. The Drawings in the geotechnical report showing existing ground elevations are only for whatever use the Contractor may make of them with no responsibility on the part of the engineers, surveyors, the Owner, the Engineer, and/or their representatives for the accuracy and/or the reliability of the information given.

E. If a potential conflict exists between the Geotechnical Report and these technical Specifications, the Contractor shall, immediately upon its discovery, request clarification from the Owner’s Representative or the Engineer.

PART 2 - PRODUCTS

2.00 MATERIALS

A. Subgrade is the material in excavation (cuts) and fills located below subbase, base course layer for slabs, sidewalks, pavement, and other improvements.

B. Granular Fill, Common Fill/Ordinary Borrow shall be friable soil containing no stone greater than two-thirds (2/3) the loose lift thickness with a maximum stone size of four (4) inches in diameter. The material shall be essentially free of trash, ice snow, tree stumps, roots, and organic materials. The soil shall contain no more than 10 percent passing the #200 sieve.

C. Sand-Gravel Fill, Gravel shall consist of inert material that is hard, durable stone and coarse sand, free from loam, clay, surface coatings and deleterious materials, and shall conform to the following gradation:

Sieve (ASTM D422)	Percent Passing by Weight
*	100
1/2-inch	50 - 85
No. 4	40 - 75
No. 10	30 - 60
No. 40	10 - 35
No. 100**	5 - 20
No. 200	0 - 8

* Four inches (4") where placed as subgrade within four (4) feet below pavements and slabs; one and one half inches (1-1/2") where placed as pipe bedding and backfill up to 24 inches above pipe; and elsewhere two thirds (2/3) the loose lift thickness.

** The amount passing the No. 100 sieve should be between forty percent (40%) and seventy percent (70%) of that amount passing the No. 40 sieve.

D. Sand shall consist of clean, inert, hard, durable grains of quartz or other hard, durable rock, free from loam or clay, surface coatings and deleterious materials.

1. The allowable amount of material passing a No. 200 sieve as determined by AASHTO-T11 or ASTM D422 shall not exceed 10 percent by weight. The maximum particle size shall be 1/4-inch (i.e., 100 percent passing the No. 4 sieve).

2. In addition to the above criteria when sand is used for bedding concrete pavers and for utility bedding it shall conform to the following gradation:

Sieve (ASTM D422)	Percent Passing by Weight
No. 4	100
No. 8	80 – 95
No. 16	55 – 85
No. 50	0 – 35
No. 200	0 – 5

E. Crushed Stone shall be composed of durable crushed rock consisting of angular fragments, free from a detrimental quantity of thin, flat, elongated pieces or shall be durable crushed gravel stone obtained by artificial crushing of gravel boulders or fieldstone.

1. The crushed stone shall be free from clay, loam, or deleterious material.

2. Crushed stone shall conform to the following gradation:

Sieve Size	Percent Passing by Weight		
	3/8-inch Stone	1/2-inch Stone	3/4-inch Stone
1 inch		-	100
3/4 inch		-	90 - 100
5/8 inch		100	-
1/2 inch	100	85 - 100	10 - 50
3/8 inch	85-100	15 - 45	0 - 20
No. 4	10-30	-	0 - 5
No. 8	10 (max)	0 - 5	-

Sieve Size	Percent Passing by Weight	
	1-1/2-inch Stone	2-inch Stone
2 inch	-	90 - 100
1-1/2 inch	100	-
1-1/4 inch	80-100	25 - 50
1 inch	-	-

3/4 inch	10 - 40	0 - 15
1/2 inch	0-8	-

Percent Passing by Weight

F. Structural Fill shall be free from ice and snow, roots, sod, rubbish and other deleterious or organic matter. Structural Fill shall conform to the following gradation requirements:

Sieve Size	Percent Passing by Weight
*	100
No. 4	30 - 95
No. 40	10 - 70
No. 200	0 – 15

* Two thirds (2/3) of the loose lift thickness.

G. Filter Fabric / Geotextiles:

1. Geotextile Fabric shall be used to prevent soil intrusion into drains and/or assist in stabilizing soil subgrades to be laid on approved soil subgrades prior to placement of fill materials.

   a. Contractor shall use Mirafi 140N or equivalent filter fabric in drainage recharge systems, underdrain systems between crushed stone and granular soils, leaching areas, or where indicated on the plans.

   b. Contractor shall use Mirafi FW700 or equivalent filter fabric to stabilize subgrade between natural glacial till and “Crushed Stone” in wet subgrades.

H. Controlled Low Strength Material or Controlled Density Fill:

1. Controlled low strength material or controlled density fill shall be a cement concrete backfill material that flows like a liquid, supports like a solid when cured, and levels without tamping or vibrating to reach 100 percent compaction. The material shall be used primarily as a backfill in lieu of compacted fill. The material shall be proportioned to yield a 28—day minimum compressive strength of 200 pounds per square inch. The material shall be produced and installed in accordance with ACI 229R, and ACI 116R, with a mix formulation to be approved by the Engineer or Geotechnical Consultant prior to placement of the material in the project.

I. Topsoil/Loam

1. Topsoil (stripped from site) or Loam (supplied from off-site) shall be a sandy loam or loam soil classification as defined by the USDA Soil Conservation Service, Soil Classification System consisting of a fertile, friable, natural topsoil/loam typical of locality, without admixture of subsoil, refuse or other foreign materials, shall be obtained from a well-drained arable site, and shall meet ASTM D5268. Material shall be such a mixture of sand, silt and clay particles as to exhibit sandy and clayey properties in about equal proportions. Material shall be free of stumps, roots, heavy or stiff clay, stones larger than 3/4-inch in diameter, lumps, coarse sand, noxious weeds, sticks, brush or other litter, and shall have the following mechanical analysis:

Textural Class	Percent of Total Weight	Average Percent
Sand 0.05 - 2.0 mm dia. range	45 to 75	60
Silt 0.002 - 0.05mm dia. range	15 to 35	25
Clay less than 0.002 mm dia. range	5 to 25	15

a. 95 percent of Topsoil shall pass a 2.0 mm sieve.

b. Topsoil/Loam shall have a pH value in the range of 6.0 to 7.0. If Topsoil/Loam material does not fall within the required pH range, limestone or aluminum sulfate shall be added to bring the pH within the specified limit.

2. Prior to stripping, the topsoil shall demonstrate, by the occurrence upon it of healthy crops, grass or other vegetative growth, that it is reasonably well drained and that it does not contain toxic amounts of either acid or alkaline elements.

3. Loam and topsoil shall contain not less than 4 percent nor more than 20 percent organic matter as determined by the loss on ignition of oven-dried samples. Test sample shall be oven-dried to a constant weight at a temperature of 230°F. ±9°.

4. In other portions of these specifications, the words ‘loam’ and ‘topsoil’ are used interchangeably.

2.01 USE OF MATERIALS

A. Use of materials shall be as described below and as shown on the plans. Further details can be found in the project plans. Combinations or layering of materials may be necessary in certain instances such as for detention embankments, subsurface disposal areas, and riprap walls as examples.

1. Granular Fill, Common/Ordinary Fill: Use common/ordinary fill for general grading as backfill, and as embankment fill in areas outside the building and pavement limits. Stones larger than twelve inches (12") shall be removed prior to compaction.

2. Sand-Gravel Fill, Gravel: Use for pipe bedding backfill and backfill below pavement and slab as base course layer. Use for material placed "in the wet". Use for pipe and utility bedding.

3. Sand: Use for conduit bedding and initial backfill, and gas line bedding and backfill. Use for bedding and backfill of direct burial cables and/or flexible piping. Use for bedding and filling joints for concrete unit pavers.

4. Crushed Stone: Use crushed stone as bedding for utility structures and piping under wet subgrade conditions.

5. Structural Fill: Use structural fill below subgrade elevation in soil bearing situations. Use structural fills below pavement gravel base course.

6. Filter Fabric/Geotextiles: To be used as filter barriers between natural earth material and backfill or other materials to assist in stabilizing soil subgrades.

7. Controlled Low Strength Material or Controlled Density Fill: Shall be used for trench backfill, anti-flotation bases, and/or lightweight backfill.

8. Topsoil/Loam: Use as fill in designated landscape and lawn areas; if off-site material is required, Loam shall be furnished and installed. Topsoil maybe used as fill in landscape and lawn areas if an excess of topsoil exists on-site.

PART 3 - EXECUTION

3.00 CLEARING AND GRUBBING

A. Cut and remove trees, remove stumps and brush. Legally dispose of off-site.

B. Wood wastes may be chipped and shredded on-site and reused on-site with prior approval of the Engineer.

C. Strip all topsoil, subsoil and other unsuitable materials to its full depth within the limits of the structural slab.

D. Under pavement areas, excavate to the required depth. Stockpile base and subbase material for future use as approved by the Engineer. Protect base and subbase material from contamination by other materials. Under landscape areas excavate topsoil and subsoil. Stockpile separately for future use.

3.01 DEWATERING

A. Provide, operate, and maintain site and subsurface drainage and dewatering in an acceptable manner as required to complete the work throughout the course of the project.

B. Remove, by pumping or other means, water accumulated in excavations and within two (2) feet below subgrade until earthwork, utilities, concrete, and other work operations are complete. Dewatering shall be considered incidental to the defined work items and costs for performing same shall be included in the bid price(s) and no separate payment shall be made to the Contractor for dewatering operations.

C. Provide, maintain, and operate wells, pumps, and related equipment including stand-by equipment of sufficient capacity to maintain excavations and trenches free of water to enable all work to be conducted in-the-dry and to protect bearing surfaces from disturbance.

D. Water from excavations shall be disposed of in such manner as will not cause injury to public health, public and private property, existing work, work to be completed or in progress, roads, walks, and streets, or cause any interference with use of same by public. Concrete or fill shall not be placed in excavations containing free water.

E. Construction may require excavation below water level in soil. The Contractor shall complete this work in-the-dry to maintain the undisturbed condition of the bearing soil.

F. Maintain groundwater at least two (2) feet below lowest exposed subgrade level. If the dewatering methods have not been adequate and the bearing soils are disturbed, remove disturbed soil and replace with compacted Structural Fill or lean concrete at no additional cost to the Owner.

G. Sumps shall be surrounded by suitable filter media to minimize the fines removed during pumping.

H. Pumped groundwater and surface water runoff shall be initially pumped to a settling basin to remove suspended solids prior to discharge. The Contractor shall furnish all treatment

systems that are necessary for pretreatment of groundwater prior to discharge in accordance with all applicable permits and regulations.

I. Discharge of pumped water, either surface water runoff or groundwater, shall be in compliance with discharge criteria contained in permits issued by governing agencies, and all legal requirements and regulations. All permits shall be obtained by the Contractor.

3.02 EXCAVATIONS

A. General Definitions

1. Unclassified Materials

a. Unclassified excavation includes the satisfactory removal and disposal of all materials (except contaminated materials defined below) encountered regardless of the nature of the materials and shall be understood to include, but not be limited to, blast rock, bedrock, earth, hardpan, fill, foundations, pavements, curbs, piping, railroad track and ties, cobblestones, footings, bricks, concrete, abandoned drainage and utility structures, and debris. Drilling, blasting, excavation, and disposal of rock shall be considered unclassified excavation and shall be included as a part of the Contract Price, with no separate payment items for its excavation and handling.

2. Contaminated Materials

a. The Contractor shall be familiar with the State of Rhode Island Department of Environmental Management (RIDEM) regulations governing the management of hazardous materials, hazardous waste, petroleum, used petroleum and solid waste when conducting earthwork operations.

b. In general, a hazardous waste (contaminated with oil or hazardous materials) is a waste or combination of wastes which, because of its quantity, concentration, physical, chemical or infectious characteristics, may cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating reversible illness or pose a substantial present or potential hazard to human health, safety, or welfare, or to the environment when improperly stored, treated, transported, or disposed of, or otherwise managed.

c. The Contractor shall immediately halt soil movement activities and notify the Owner if visual, olfactory, or other evidence suggests that soils may be contaminated with oil or hazardous materials. Contractor shall provide reasonable assistance to Owner and to Owner's Representative for access to potential contamination areas for proper assessment of hazardous conditions.

d. The Owner shall contact an environmental professional (such as a Licensed Site Professional) to test any earth materials suspected of containing hazardous waste. The results shall be evaluated by the environmental professional and compared with reporting thresholds found in the RIDEM Rules and Regulations for the Investigation and Remediation of the Hazardous Materials Releases. The Owner shall inform the Contractor of the laboratory test results as soon as possible and discuss the possible soil management, disposal, and recycling options available. Contaminated soils shall be managed and handled in compliance with the referenced state/federal regulations, guidelines, and

policies. Time and expenses associated with contaminated soils shall be negotiated between the Contractor and the Owner prior to the start of the soil management, soil disposal, and recycling work. Owner reserves the right to negotiate and contract with other entities for remedial work and, in that event, this Contractor shall make reasonable accommodations for other entities to perform this work.

e. Although there is no evidence of oil or hazardous material, there is a possibility of the presence of such wastes on this site. Appropriate testing, as recommended by an environmental professional shall be accomplished to assess the potential presence of oil or hazardous material. Earth material shall not be removed from the site unless on-site reuse is not possible.

f. Proper documentation of legal disposal of hazardous materials handled by this Contractor shall be provided by the Contractor to the Owner, Engineer, and review authorities. Additional guidance for possible disposal activities can be found in the RIDEM Rules and Regulations for Solid Waste Management facilities and/or the RIDEM Rules and Regulations for Hazardous Waste Management facilities.

g. Unless specifically identified as contaminated material under referenced statues and as defined above, as judged by the Engineer, excavated materials shall be considered unclassified as defined in item 1., above.

B. Site General Requirements

1. Control the grading so that ground is pitched to prevent water from running to excavated areas, damaging other structures, or adjacent properties.

2. Where soil has been softened or eroded by flooding, equipment, traffic, or placement during unfavorable weather, or such other conditions, it shall be removed and replaced by the Contractor with suitable material, and at no cost to the Owner.

3. Exercise care to preserve the material below and beyond the lines of excavation. Where excavation is carried out below indicated grade or beyond the lines of excavation, Contractor shall backfill and compact the over excavation with structural fill to the indicated grade, at no additional cost to the Owner and at the direction of the Engineer.

4. Provide sheeting, shoring and bracing to complete and protect all excavated areas, as required for safety and compliance with OSHA. Costs for sheeting, shoring, and bracing shall be included as a part of the Contract Price for completing the work and Owner shall make no separate payment for this work.

5. Excavated materials unsuitable for reuse, surplus excavated rock, and surplus excavated soil not used to fulfill requirements of the Contract, shall become the property of the Contractor and shall be removed from the site in accordance with the regulations and requirements of all municipalities or agencies having jurisdiction over the disposal sites and the route between the project and the disposal sites.

6. Under new footings and slabs. A minimum of two feet of the existing fill shall be over excavated beneath the proposed new footing and slab elevations. All unsuitable materials shall be removed from the footing/slabs to a limit defined by a 1 horizontal to 1 vertical slope extending downward and outward from two feet outside the edges of the footing/slabs.

7. Unsuitable materials which are classified as organics such as peat, trash, fill, stumps, debris, material determined to be hazardous, and topsoil and subsoil when determined by Engineer to be unacceptable for incorporation into the work

8. All suitable material, as determined by the Engineer, may be reused on the site provided it meets the gradation requirements for the given materials in the information of fill sections, embankments, subgrades, backfills, etc.

9. Do not over excavate below proposed design grades for the purpose of obtaining borrow for use off-site.

C. Proof Rolling

1. Prior to placing compacted fills, the exposed subgrade shall be heavily surface compacted with a minimum of six passes of a vibratory roller having a drum weight of at least 1,000 pounds and a dynamic force of at least 2,000 pounds. Areas not accessible to vibratory rollers shall be compacted with 10 passes of a walk behind plate compactor having a centrifugal force rated not less than 1,000 pounds. If weak areas of fill containing deleterious materials or organic content are encountered during over excavation or compaction of the exposed subgrade, these soils shall be removed to a limit defined by 1 horizontal to 1 vertical slope extending downward and outward from two feet outside the edge of the bearing area to suitable bearing soils and replaced with compacted structural fill The cost of all proof rolling shall be included in the Contract Price.

2. Should naturally occurring soils at or below footing bearing grades become disturbed during excavation activities, the disturbed soil should be recompacted in place or over excavated and replaced with a minimum of one foot of compacted “Sand-Gravel Fill” if the subgrade is dry, or 6 inches of ¾” crushed stone if the subgrade is wet. A layer of filter fabric similar to Mirafi FW700 may be required between the natural glacial till and “Crushed Stone”. The area shall then be backfilled as necessary with placed and compacted “Granular Fill”.

3.03 TRENCH EXCAVATION

A. Excavate as necessary for all utilities, and related structures and appurtenances, and for any other trenching necessary to complete the work.

B. Definitions:

1. Trench shall be defined as an excavation of any length where the width is less than twice the depth and where the shortest distance between payment lines does not exceed ten feet (10'). All other excavations shall be defined as open excavations.

2. The words "invert" or "invert elevation" as used herein shall be defined as the elevation at the inside bottom surface of the pipe or channel.

3. The words "bottom of the pipe" as used herein shall be defined as the base of the pipe at its outer surface.

C. In general, machine excavation of trenches will be permitted with the exception of preparation of pipe beds which will be hand work. Excavate by hand or machine methods to at least six inches (6") below the bottom of pipe or as shown on the Drawings. Excavation to final grade shall be made in such a manner as to maintain the undisturbed bearing character of the soils exposed at the excavation level.

D. Utilities or piping shall not be laid directly on boulders, cobbles, or other hard material. This material shall be removed to a minimum of six inches (6") below the bottom of pipe at all points and backfilled or compacted as specified.

E. Remove unsuitable material encountered at subgrade elevations, backfill with material specified herein and as otherwise indicated on the Drawings, specified, or directed. Compact as specified with approved compactors.

F. In general, the width of trenches shall be kept to a minimum and in the case of piping shall not exceed the sum of the pipes outside diameter plus 2'-0" to at least twelve inches (12") above the pipe.

3.04 ROCK EXCAVATION

A. Definitions

1. Rock is defined for payment purposes as stone or hard shale in original ledge, boulders over two cubic yards (2 yd3) in volume in open areas, and one cubic yard (1 yd3) in volume in trenches, and masonry or concrete that cannot be broken or removed by normal job equipment (power shovels, or track mounted excavator without the use of explosives or drills.

2. The definition does not include materials that can be removed by means other than drilling and blasting or drilling and wedging.

B. General

1. When rock is encountered, such material shall be removed to the clearance limits set forth in these Specifications.

2. Payment for rock excavation shall be made in accordance with Item 3.03A.1.

3. Rock excavation shall be performed to eliminate water pockets in the excavated rock subgrade. Contractor shall provide dewatering as required to keep the excavated rock subgrade dry until earthwork operations are complete.

C. Blasting

1. Contractor shall, before doing any blasting work, present to the Owner's Representative written certificate of insurance showing evidence that his insurance includes coverage for blasting operations.

2. No blasting shall be done without giving 24 hour prior notice to the Engineer. Written permission and approval of methods must be obtained from appropriate governing authorities.

3. The driller and geotechnical engineer shall log the bottom elevation of all drill holes made for blasting within the building area.

4. Experienced powdermen or persons who are licensed or otherwise authorized to use explosives shall conduct the blasting. Accurate records shall be maintained, noting location of each blast, time of detonation, total explosive weight in each blast, maximum explosive weight per delay in each blast hole, and designation of delay cap used in each hole.

5. Explosives shall be stored, handled, and employed in accordance with federal, state and local regulations, or, in the absence of such, in accordance with the provisions of AGC Manual of Accident Prevention in Construction of The

Associated General Contractors of America, Inc. and in accordance with applicable OSHA regulations.

6. The amount of vibration and airblast overpressure generated by blasting shall not exceed regulatory statutes or directives established by state, local or other governing authorities. In no case shall the maximum Peak Particle Velocity (PPV) exceed the limits indicated on Figure B-1, Appendix B, of the United State Bureau of Mines Report of Investigations, RI8507, 1980. These limits shall apply at all existing and under construction structures and utilities, as well as at property and construction limits.

7. Contractor shall take great care to prevent damage to existing buildings, foundations, glass and glazing, and trees to remain. Damage caused by Contractor's blasting operations shall be repaired by Contractor at no additional cost to the Owner.

D. Cross-Sectioning and Measurement

1. When rock is encountered, the rock shall be uncovered and exposed, and the Engineer shall be notified in writing by the Contractor before blasting work proceeds. Quantities shall be based on measurements of rock in their original position and to the limits of clearly defined vertical and horizontal construction lines required for the defined construction.

2. The rock shall then be measured, quantities established, and payment amounts shall be determined.

3. Excavation of material in question before agreement by the Engineer as to the character of the material, or failure to notify the Engineer, or failure to take measurements will forfeit the Contractor's right to payment for rock excavation.

4. The quantity of rock to be removed shall be based on the limits established under the Clearance Limits specified below.

5. Measurements shall be made by a registered surveyor, paid for by the Contractor and approved by the Engineer.

6. Cross-sectioning and measuring shall not be required when the payment for rock excavation is included as a part of the lump sum Contract Price as defined in Item 3.03A.1.

E. Clearance Limits

1. Slabs: Within the limits of the concrete lines as defined by the working plans or by duly authorized modifications thereto, plus twelve inches (12") outside the vertical concrete lines and twelve inches (12") below base.

2. Utility Trenches: All parts of pipe, valves, and fittings to a depth of six inches (6") below the bottom of the bell and for a width equal to the outside diameter of the pipe, plus fifteen inches (15") beyond the outside diameter on each side, provided that overlapping computed volumes of any ledge or boulder excavation shall be paid for only once.

3. Utility Structures: Twelve inches (12") outside of structure all around.

4. Any foreseen rock or boulder encountered, as defined above, which must be removed for construction of the work defined on the plans or in modification

thereto, shall be measured in its original position to the limits of clearly defined vertical construction lines and to the depth required for the defined construction.

F. Reuse of Excavated Rock

1. Fills

a. Reuse of excavated rock for fill materials shall require prior approval of the Owner's Representative and shall require compliance with gradation requirements for the specific type of fill for which it is being used.

3.05 PREPARATION OF EXCAVATION BOTTOMS

A. General Rock Subgrade Areas

1. Rock surfaces to receive backfill shall have a maximum slope of four (4) horizontal to one (1) vertical.

B. Pavement Areas

1. Loose rock is covered with 6 inches (6") of crushed stone or choke stone; and

2. Prior to placing crushed or choked stone, the area is rolled with a heavy vibratory roller or fully loaded ten wheel dump truck.

3. Proof-roll subgrade with a vibratory roller or a fully loaded ten-wheeled dump truck. Soft or hard areas and other objectionable material (stumps, wood, and organics) shall be excavated and backfilled with compacted structural fill.

4. Prior to the placement of blast rock fill over a bedrock subgrade, voids in the rock surface shall be choked off with appropriately graded choke stone or crushed stone to prevent migration of fines into fractures, and as approved by the Owner's Representative.

3.06 BACKFILLING AND PLACEMENT OF FILL MATERIALS

A. Site

1. Dewater subgrade areas prior to filling.

2. Compaction by puddling or jetting is prohibited.

3. Control groundwater and surface runoff to minimize disturbance of exposed natural ground surface, previously placed and compacted fill and material being placed.

4. Soil fill moisture shall be maintained at an acceptable working range to allow for proper compaction.

5. Do not place fill on frozen ground.

6. Do not place frozen fill.

7. Place fill in uniform horizontal layers and compact immediately after placement. Where the horizontal layer meets a rising slope, the layer shall be keyed into the slope by cutting a bench during spreading of preceding lift.

8. To the extent that is practical, each layer of fill shall be compacted to the specific density the same day it is placed.

9. Slope fill surfaces at the end of each day to provide for free surface drainage.

10. Protect structures and pipes from damage during backfilling operations. Repair damage at no cost to Owner.

11. Placement of fill shall not begin prior to observation and approval of subgrade conditions by Engineer.

12. Protect foundations, footings, and waterproofing during backfilling. Repair damage at no cost to Owner.

13. Prior to backfilling between foundation wall and sheeting, remove unsuitable material, including rubbish, organic materials, or other debris. Do not commence filling operations until conditions have been observed by Engineer.

14. Backfill shall not be placed against walls until they are braced or have cured sufficiently to develop strength necessary to withstand, without damage, pressure from backfilling and compacting operations.

15. Provide shoring, sheeting, and bracing of excavations as required to assure complete safety against collapse of the earth at the site of excavations. Alternatively, lay back excavations to suitable slope.

16. Upon completion of the work, the final ground surface shall be left in a firm, unyielding, true, uniform condition free from ruts. Repair disturbed areas caused equipment traffic at no cost to Owner.

B. Substation Area

1. Fill and backfill shall be placed in lifts not to exceed 6” and compacted to at least 95 percent of the maximum dry density as determined by ASTM D-1557 9modified proctor test).

C. Equipment

1. Compaction equipment used in open areas where space permits shall consist of vibratory rollers, fully loaded ten-wheel dump trucks, pneumatic compactors, or other similar equipment.

2. Compaction equipment for fill against foundation walls and in other confined areas shall be accomplished by means of drum-type, power-driven, hand-guided vibratory compactors operating at 2,000 cycles per minute, or by hand-guided vibratory plate tampers.

3.07 TRENCH BACKFILLING

A. General

1. Trenches shall be backfilled as soon as practicable with suitable approved materials. All trench backfilling shall be done with special care, in the following manner and as the Engineer may direct from time to time.

2. Backfill material shall be deposited in the trench, uniformly on both sides of the pipe, for the entire width of the trench. The backfill material shall be placed by

hand shovels in layers not more than 6 inches (6") thick in loose depth and each layer shall be thoroughly and evenly compacted by tamping on each side to provide uniform support.

3. Trench backfilling shall be placed so as not to disturb the previously installed pipes, utilities, concrete, and other work within and near the trench. The moisture content of the backfill material shall be such that proper compaction will be obtained. Backfill of trenches within areas of pavement construction shall be made in controlled compacted lifts extending to grades required to establish the proper pavement base courses.

4. In backfilling trenches, each layer of backfill material shall be adequately compacted in such a manner as to provide the required bearing value, so that paving can proceed immediately after backfilling is completed.

5. Any trenches or excavations improperly backfilled, or where settlement occurs, shall be reopened to the depth required for proper compaction, then refilled and compacted with the surface restored to the required grade and condition, at no additional cost to the Owner.

B. Embedment

1. The type of materials to be used in bedding and backfilling shall conform to the details shown on the Drawings and the following:

a. Embedment materials are those used for bedding, haunching and initial backfill. Perform in accordance with ASTM D2321. The following will describe the soils:

1) Class I - Angular crushed stone or rock, dense or open graded with little or no fines (3/4 inch stone size) (to be used in wet conditions or where shown on the Drawings).

2) Class II - Clean, coarse grained gravel, with a maximum stone size of 1-1/2 inches.

3) Embedment materials shall be free from lumps of frozen soil or ice when placed. Embedment materials shall be placed and compacted at optimum moisture content.

b. Foundation: A stable utility foundation of Class I or II material must be provided to insure proper line and grade is maintained. Unsuitable foundations such as organics, soft clay, and other soft materials must be removed and the material stabilized. Unsuitable or unstable foundation materials shall be undercut and replaced with a suitable bedding material of Class I or Class II (see 3.08B.5.), placed in 6 inch (6") lifts. The Engineer may approve other methods of stabilization, such as the use of geotextiles.

c. Bedding: Provide a stable and uniform bedding for the pipe and any protruding features of its joints and/or fittings. The bedding for the middle 1/3 of the pipe outside diameter should be loosely placed so that the pipe conforms to the trench. The remainder of the bedding at the base of the trench shall be compacted to a minimum of 95 percent modified proctor density as determined by ASTM D1557. Class I or Class II materials are suitable for use as bedding.

d. Initial Backfill: Initial backfill materials are required for a minimum of 3/4 of the pipe diameter. The initial backfill shall be from the pipe's

springline to 12 inches above the pipe to provide protection for the pipe from construction operations during placement of the final backfill and protect the pipe from stones or cobbles in the final backfill.

1) Class I materials must be used in wet trenches and Class I bedding and haunching materials shall be used.

2) Class II materials shall be used unless noted otherwise or wet conditions are encountered. The material shall be compacted in 6 inch (6") lifts to 95 percent modified proctor density (ASTM D1557).

3) Flooding or jetting as a procedure for compaction are not allowed.

e. Controlled Low Strength Materials (CLSM) or Controlled Density Fill (flowable fills) is acceptable backfill materials. Several considerations should be accounted for when using CLSM/CDF backfill. Provisions to prevent flotation of the pipe during placement of the CLSM/CDF must be used. This can include anchoring the pipe by placing flowable fill at the each joint and allowing the fill to partially cure prior to placing the flowable fill along the entire length of the pipe. Also, mechanical anchors such as bent rebar driven into competent soil or precast weights may be used at each joint to prevent flotation. When using CLSM/CDF, the fill should always be placed to completely encase the pipe.

f. Backfill. Backfill from one foot (two feet for HDPE pipe) above the top of the pipe to subgrade elevations shall be structural fill material. Generally, the excavated trench material may be used as this backfill. This backfill shall be placed in 12-inch (12") maximum lifts and compacted to a minimum of 92 percent modified proctor density to prevent excessive settlement at the surface.

g. Vehicular and Construction Loads: Pipe installation shall be suitable to carry H-25 live loads (40,000 lbs. axle - legal load) with 24 inches (24") of cover.

3.08 BACKFILLING AGAINST STRUCTURES

A. Backfilling against masonry or concrete shall only be done when approved. The Contractor shall not place backfill against or on structures until they have attained sufficient strength to support the loads (including construction loads) to which they will be subjected, without distortion, cracking or other damage. As soon as practicable after the structures are structurally adequate and other necessary work has been satisfactorily completed, any leakage tests or other testing of the structures shall be made by the Contractor, as required by the Engineer, at the Contractor's expense.

1. After the satisfactory completion of leakage tests and the satisfactory completion of any other required work in connection with the structures, the backfilling around the structures shall proceed using suitable and approved excavation material. The best of the backfill material shall be used for backfilling within 2 feet (2') of the structure. Just prior to placing backfill, the areas shall be cleaned of all excess construction material and debris and the bottom of excavations shall be in a thoroughly compacted condition.

B. Symmetrical backfill loading shall be maintained. Special care shall be taken to prevent any wedging action or eccentric loading upon or against the structures.

1. During backfilling operations, care shall be exercised that the equipment used will not overload the structures in passing over and compacting these fills.

Except as otherwise specified or directed, backfill shall be placed in layers not more than 12 inches (12") in loose depth and each layer of backfill shall be compacted thoroughly and evenly using approved types of mechanical equipment. Each pass of the equipment shall cover the entire area of each layer of backfill.

C. In compacting and other operations, the Contractor shall conduct his operations in a manner to prevent damage to structures due to passage of heavy equipment over and adjacent to structures. Repair damage made by the Contractor, at no additional cost to the Owner.

D. After backfilling the Contractor shall maintain the surfaces of backfill areas in good condition so as to present a smooth surface at all times level with adjacent surfaces. The Contractor shall repair any subsequent settling over backfilled areas immediately, in a manner satisfactory to the Engineer, and such maintenance shall be provided by the Contractor for the life of this Contract, at no additional cost to the Owner.

E. The finished subgrade of the filled excavations upon which pavements are to be constructed shall not be disturbed by traffic of other operations and shall be maintained in a satisfactory condition until the finished courses are placed. The storage or stockpiling of materials on finished subgrade will not be permitted.

F. Uniformly smooth grade all areas to be graded, as indicated including excavated sections and all areas disturbed as a result of the Contractor's operations. The finished surfaces shall be reasonably smooth, compacted and free from surface irregularities.

3.09 COMPACTION

A. Compaction Requirements

1. The degree of compaction is expressed as a percentage of the maximum dry density at optimum moisture content as determined by ASTM D1557, Method C. The compaction requirements are as follows:

Area	Minimum Degree of Compaction
Below slabs	95%
Pavement base course	95%
Pavement subbase	95%
General fill below pavement subbase	92%
Trench backfill	92%
Lawn areas	90%

2. Compaction percentages are based on the laboratory derived Maximum Density Values.

B. Moisture Control

1. Fill that is too wet for proper compaction shall be harrowed or otherwise dried to a proper moisture content to allow compaction to the required density. If fill cannot be dried within 24 hours of placement, it shall be removed and replaced with drier fill.

2. Fill that is too dry for proper compaction shall receive water uniformly applied over the surface of the loose layer. Sufficient water shall be added to allow compaction to the required density.

3. In no case shall fill be placed over material that is frozen. No fill material shall be placed, spread, or rolled during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until the moisture content and the density of the previously placed fill are as specified.

C. Lift Thickness of Material

1. Structural Fill and Sand Borrow. Place in layers not to exceed 12 inches (12") in thickness when utilizing heavy compaction equipment, and 6 inches (6") when utilizing light hand-operated compaction equipment.

2. Common Fill. Place in layers not to exceed 12 inches (12") in thickness when utilizing heavy compaction equipment, and 8 inches (8") when utilizing light hand-operated compaction equipment.

3. Crushed Stone, Gravel, Dense, Graded Crushed Stone for Subbase. Place in layers not to exceed 9 inches (9") in thickness when utilizing heavy compaction equipment, and 6 inches (6") when utilizing light hand-operated compacted equipment. Compact with a minimum of four (4) coverages of acceptable compaction equipment.

D. Grading Tolerances

1. Grading shall be completed to meet or exceed the following tolerances of uniformity*:

Location	Tolerance
Top of Subgrade Beneath Structures	1/2 inch
Top of Subgrade Beneath Paving	1/2 inch
Top of Subgrade Beneath Landscape Areas	1 inches
Top of Gravel and Gravel Bases	1/4 inch

* Uniformity is defined as no variations in the surface materials at the grades and slopes indicated on the Drawings that exceed the listed tolerance over a length of ten feet (10') horizontally in any direction.

2. The bottom of earth and rock excavations shall be formed to provide a smooth, uniform slope and grade. The bottom of the excavated grade shall be free of pockets, depressions or ridges that would collect or concentrate water, silts, or other such objectionable material prior to the placement of backfill or other finish materials.

E. Finish

1. Upon completion of the work, ground surface shall be left in a firm, unyielding, true, uniform condition, free of ruts.

3.10 SHEETING AND BRACING

A. General

1. Whenever sheeting and bracing will be required, it shall be furnished and installed by the Contractor in accordance with the recommendations of the structural engineer and/or geotechnical engineer engaged by the Contractor.

2. The Contractor shall engage licensed professional structural engineer and/or geotechnical engineer. These engineers shall be licensed in the state where the work is occurring and they shall prepare designs for the sheeting and bracing.

3. Submit the sheeting and bracing designs to the Owner and the Engineer for the project record. The sheeting and bracing plans and calculations shall bear the professional seals and signatures of the Contractor's engineers. These plans and calculations shall be submitted prior to the start of work.

4. The Contractor shall furnish and install the required sheeting and bracing in accord with the submitted designs. The Contractor shall include the costs for this work in his bid price for the project. No additional or separate compensation will be allowed.

END OF SECTION

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SECTION 334000

STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.00 DESCRIPTION

A. This Section specifies requirements for furnishing and installing the site storm drainage utilities system, as indicated on the Drawings and as specified herein.

B. The work shall include, but is not be limited to the following:

1. Site storm drainage system.

2. Connection of building drains from a point ten feet (10 ft.) outside of the building or structure foundation.

3. Site underdrains, headwalls, flared end sections and underground stormwater detention facilities.

4. Drainage to dedicated systems on the site shall conform to the State of Rhode Island Plumbing Code.

1.01 RELATED SECTIONS

A. Carefully examine all of the Contract Documents for requirements which affect the Work in this Section. Other specification sections, which directly relate to the Work of this section include, but are not limited to, the following:

1. Section 312319 – DEWATERING.

2. Section 312500 - EROSION AND SEDIMENTATION CONTROL.

3. Section 310000 - EARTHWORK.

4. Section 033055 – CAST-IN-PLACE CONCRETE (SITE).

1.02 SUBMITTALS

A. Shop Drawings

1. Materials list of items proposed for the work.

2. Shop drawings or descriptive literature, or both, showing dimensions, joint and other details of all materials proposed for the work. Shop drawings shall be submitted to the Engineer for approval prior to ordering material.

B. As-Built Drawings

1. Submit three (3) copies of As-Built Drawings upon completion and acceptance of work.

2. As-Built Drawings shall be complete and shall indicate the true measurement and location, horizontal and vertical, of all new drainage system construction. As-Built drawings shall include a minimum of three (3) ties showing the distance to

each catch basin and manhole from fixed permanent objects. As-Built Drawings shall also contain any additional information required by the municipality, and shall be stamped with the seal of a licensed land surveyor and licensed professional engineer.

1.03 QUALITY ASSURANCE

A. Work shall comply with the State of Rhode Island Plumbing Code.

1.04 COORDINATION AND VERIFICATION

A. Coordinate the work with the termination of storm drain connections at buildings, connections to municipal systems, and trenching operations.

B. The Contractor shall field verify and survey the size, location and elevations of all existing pipe and utility lines prior to ordering of materials for this utility system. A report of the findings of the verification survey shall be submitted to the Engineer for information and comment.

1.05 DELIVERY, STORAGE, AND HANDLING

A. All materials shall be adequately protected from damage during transit. Pipes shall not be dropped.

B. All pipe and other appurtenances shall be inspected before placement in the work and any found to be defective from any cause, including damage caused by handling, and determined by the Engineer to be unrepairable, shall be replaced at no cost to the Owner.

C. Storage and handling of pipes, manholes, catch basins, oil-grit separators, treatment units and other system appurtenances shall be in accordance with the manufacturer's recommendations.

1.06 INSPECTION

A. The manufacturer/supplier is responsible for the provision of all test requirements specified for each type of pipe. In addition, any pipe may be inspected at the plant for compliance with these specifications by an independent testing laboratory selected and paid by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections.

B. Inspection of the pipe may also be made after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the specification requirements, even though pipe samples may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the site at once.

PART 2 - PRODUCTS

2.00 GENERAL

A. All materials for storm drainage utilities system shall be new and unused.

2.01 PIPE

A. Reinforced Concrete Pipe: Pipe shall comply with the requirements of ASTM C76. All pipe 18 inches and smaller shall be Class V. All other pipe shall be Class III unless indicated otherwise on the Drawings.

1. Joints for the reinforced concrete pipe shall be the tongue and groove or bell and spigot type with rubber gasket conforming to ASTM C443.

2. Flared end pipe sections shall be constructed in conformance with ASTM C76, Class V requirements and shall be supplied by the same manufacturer as the pipe.

B. Filter Fabric for Underdrains: Equal to [Mirafi 140N], [Cevex25], or Typar 3351].

C. Filter Fabric for Flared End Sections and Headwalls with Stone Protection: Equal to Mirafi 600X, or approved equivalent.

D. Ductile Iron Pipe

1. Ductile iron pipe shall be designed in accordance with ANSI A21.50/AWWA C150 and manufactured in accordance with ANSI A21.51/AWWA C151.

2. Ductile iron pipe shall be thickness Class 52, furnished in 18-foot or 20-foot nominal lengths.

2.02 STORM DRAIN MANHOLES

A. Precast Concrete Construction:

1. Structure: 48-inch minimum inside diameter, precast concrete units (4,000 psi minimum compressive strength) with eccentric cone section tapering to 24-inch diameter and monolithic base section meeting the requirements of ASTM C478. All structures shall be designed for HS-20 loading, and shall be sized to accept pipe penetrations as shown on the Drawings.

2. Precast Unit Joint Seals: Preformed butyl rubber O-ring type seals meeting the requirements of ASTM C990.

3. Openings for pipe and materials to be embedded in the walls of the manholes sections for joint seals shall be cast in the sections at the required locations during manufacture. Sections with incorrectly cast and patched pipe openings will be rejected.

4. Openings shall be cast into the manhole sections to receive entering pipes during manufacture. The openings shall be sized to provide a uniform 2 inch maximum annular space between the outside of the pipe wall and the opening in the riser. After the pipe is in position, the annular space shall be solidly filled with

nonshrink mortar. Care shall be taken to assure that the openings are located to permit setting of the entering pipe at its correct elevation.

B. Unit Masonry Construction:

1. Brick shall be sewer brick conforming to ASTM C32, Grade MS or building brick conforming to ASTM C62, Grade SW.

2. Concrete block shall be solid block and shall conform to the ASTM C139.

3. Mortar shall be in conformance with ASTM C270, Type M. The mortar shall be composed of Portland cement hydrated lime, and sand, in the proportions of 1 part cement to 1/4 part hydrated limit to 3-1/2 parts sand by volume.

4. Cement shall be Type I or II Portland cement conforming to ASTM C150. Where masonry is exposed to salt water, Type II shall be used.

5. Hydrated lime shall be Type S conforming to ASTM C207.

6. Sand for masonry mortar shall conform to the gradation requirements of ASTM C144.

C. Steps:

1. Steps for manholes shall be steel reinforced copolymer polypropylene plastic step with at least a 14-inch wide stepping surface conforming to ASTM C478 and ASTM A615.

D. Manhole Frame and Cover: Grey iron casting conforming to ASTM A48, heavy duty, with word "DRAIN" embossed on cover. Letter size shall be three inches (3 in.). Frame and cover shall have a minimum clear opening of 24 inches and have a minimum weight of 475 pounds. Frame and cover shall be East Jordan Iron Works 2114Z/2110A , or approved equal.

2.03 OUTLET CONTROL MANHOLES OR STRUCTURES AND HEADWALLS

A. Outlet structures shall be made of concrete or precast concrete and shall be of the size, capacity, and dimensions indicated on the Drawings. Precast outlet structures shall be as manufactured by Rotondo & Sons, Inc., or approved equal.

B. Precast sections shall be cured by an approved ASTM method and shall not be shipped nor subject to loading until the concrete compressive strength has attained 4,000 psi minimum and 28 days after fabrication. Portland cement shall be Type II, ASTM C150.

C. The precast unit shall be designed for the following loads and possible combinations thereof:

1. H-20 loading, manhole riser with frame and cones, plus the weight of soil above and the soil loading due to the depth of the structure below finished grade.

2. Weight of precast concrete structure.

3. Initial handling and erection loading.

4. Cast in place concrete shall be constructed in accordance with Section 033055 – CAST-IN-PLACE CONCRETE (SITE).

D. Construction joints shall be sealed with a butyl rubber-based sealant.

E. Manhole riser sections, manhole steps, frames and covers shall be as specified for precast concrete storm drain manholes.

F. Grates and grills for outlet structures, which are not manufactured cast iron standards shall be hot dip galvanized iron units shop constructed to fit the dimensions indicated on the drawings. Safety bars shall be 60 ksi reinforcing steel.

2.04 SILT SACKS/SEDIMENT CONTROL DEVICES

A. Install at locations shown on the Drawings.

B. Manufacturer: ACF Environmental, Inc.; or approved equal.

C. Material shall be a polypropylene geotextile fabric with strength per ASTM D4884.

PART 3 - EXECUTION

3.00 GENERAL

A. Contractor shall verify the location, size invert and type of existing pipes at all points of connection prior to ordering new utility materials.

B. All pipe shall be laid accurately to the lines and grades shown on the Drawings and in conformance with the pipe manufacturer's recommendations.

C. As soon as the trench is excavated to the normal grade of the bottom of the trench, the Contractor shall immediately place the bedding material in the trench. The pipe shall be firmly bedded in the compacted bedding material accurately to the lines and grades shown on the Drawings.

D. Laying Pipe: Each length of pipe shall be laid with firm, full and even bearing throughout its entire length, in a prepared trench. Pipe shall be laid with bells upgrade unless otherwise approved by the Engineer.

1. Every length of pipe shall be inspected and cleaned of all dirt and debris before being laid. The interior of the pipe and the jointing seal shall be free from sand, dirt and trash. Extreme care shall be taken to keep the bells of the pipe free from dirt and rocks so that joints may be properly lubricated and assembled. No pipe shall be trimmed or chipped to fit.

2. No length of pipe shall be laid until the proceeding lengths of pipe have been thoroughly embedded in place, to prevent movement or disturbance of the pipe alignment.

E. Notch under pipe bells and joints where required to provide for uniform bearing under entire length of pipe.

F. Excavation, backfilling and compaction shall be as specified in Section 310000 - EARTHWORK (SITE).

G. Maintain optimum moisture content of bedding material to attain required compaction density.

H. Pipe Extension: Where an existing pipe is to be extended, the same type of pipe shall be used, unless otherwise approved by the Engineer.

I. Full Lengths of Pipe: Only full lengths of pipe shall be used in the installation except that partial lengths of pipe may be used at the entrance to structures, and to accommodate the required locations of service connection fittings.

J. Pipe Entrances to Drainage Structures: All pipe entering drainage structures shall be cut flush with the inside face of the structure, and the cut ends of the pipe surface within the structure shall be properly rounded and finished so that there will be no protrusion, ragged edges or imperfections that will impede or affect the hydraulic characteristics of the stormwater flow. The method of cutting and finishing shall be subject to the approval of the Engineer.

K. Protection During Construction: The Contractor shall protect the installation at all times during construction, and movement of construction equipment, vehicles and loads over and adjacent to any pipe shall be performed at the Contractor's risk.

1. At all times when pipe laying is not in progress, all open ends of pipes shall be closed by approved temporary watertight plugs. If water is in the trench when work is resumed, the plug shall not be removed until the trench has been dewatered and all danger of water entering the pipe eliminated.

L. Water Pipe – Drain Pipe Separation: When a drain pipe crosses above or below a water pipe, the following procedures shall be utilized:

1. Relation to Water Mains

a. Horizontal Separation: Whenever possible drains shall be laid at a minimum at least 5 feet, horizontally, from any existing or proposed water main. Should local conditions prevent a lateral separation of 5 feet, a drain may be laid closer than 5 feet to a water main if:

1) It is laid in a separate trench, or if

2) It is laid in the same trench with the water mains located at one side on a bench of undistributed earth, and if

3) In either case the elevation of the top (crown) of the drain is at least 12 inches below the bottom (invert) of the water main.

b. Vertical Separation: Whenever drains must cross under water mains, the drain shall be laid at such an elevation that the top of the pipe is at least 12 inches below the bottom of the water main. When the elevation of the drain cannot be varied to meet the above requirements, the water main shall be relocated to provide this separation or reconstructed with mechanical-joint pipe for a distance of 10 feet on each side of the drain. One full length of water main should be centered over the drain so that both joints will be as far from the sewer as possible.

2. When it is impossible to obtain horizontal and/or vertical separation as stipulated above, both the water main and drain shall be constructed of mechanical-joint cement lined ductile iron pipe or other equivalent based on water tightness and structural soundness. Both pipes shall be pressure tested by an approved method to assure water tightness.

3.01 EXCAVATION AND BACKFILLING FOR PIPES

A. The type of materials to be used in bedding and backfilling and the method of placement shall conform to the requirements of Section 310000 - EARTHWORK (SITE), the details shown on the Drawings and the following.

B. Embedment materials are those used for bedding, haunching and initial backfill around pipes as illustrated on the Drawings.

1. All embedment materials should be free from lumps of frozen soil or ice when placed. Embedment materials should be placed and compacted at optimum moisture content

C. Trench Bedding: Material must be provided to insure proper line and grade is maintained. Unsuitable or unstable materials shall be undercut and replaced with a suitable bedding material, placed in 6 inch lifts. Other methods of stabilization, such as geotextiles may be appropriate and their use must be approved by the Engineer or Owner's Representative.

1. Provide a stable and uniform bedding for the pipe and any protruding features of its joints and/or fittings. The middle of the bedding equal to 1/3 of the pipe outside diameter should be loosely placed, with the remainder compacted to a minimum of 95 percent Modified Proctor Density.

D. Haunching: Proper haunching provides a major portion of the pipe's strength and stability. Exercise care to insure placement and compaction of the embedment material in the haunches. For larger diameter pipes (pipes greater than 30 inch diameter), embedment materials should be worked under the haunches by hand. Haunching materials shall be placed and compacted in 6 inch maximum lifts, compacted to 95 percent Modified Proctor Density.

E. Initial Backfill: The initial backfill shall be from the springline to 24 inches above the pipe to provide protection for the pipe from construction operations during placement of the final backfill and protect the pipe from stones or cobbles in the final backfill. Compact initial backfill per Section 310000 - EARTHWORK (SITE).

1. Flooding or jetting as a procedure for compaction are not allowed.

F. Final Backfill: The final backfill should be the same material as the proposed embankment or surface finishes. Generally, the excavated material may be used as final backfill. Placement should be as specified for the embankment. In lieu of a specification, the final backfill should be placed in 12 inch maximum lifts and compacted to a minimum 95 percent modified proctor density to prevent excessive settlement at the surface. Compaction should be performed at optimum moisture content.

G. Vehicular and Construction Loads: During construction, avoid heavy equipment loads (greater than 40,000 lbs. per axle) over the pipe. Additional temporary cover should be placed over the pipe for heavy construction load crossings. Hydrohammers or hoe-pak compactors may not be used over the pipe until at least 48 inches of cover have been provided.

3.02 MANHOLES - PRECAST

A. Manholes: Shall be constructed at the locations and to the lines, grades, dimensions and design shown on Drawings or as required by the Engineer.

B. Precast Concrete Units: Shall be installed in a manner that ensures watertight construction and all leaks in precast concrete structures shall be sealed. If required, precast concrete structures shall be repaired or replaced to obtain watertight construction.

C. Stubs shall be short pieces of pipe cut from the bell ends of the pipe. Stubs shall be plugged with brick masonry unless otherwise directed by the Engineer.

D. Manhole Inverts shall conform accurately to the size of the adjoining pipes.

1. Manhole inverts shall be constructed of 3,500 psi concrete as shown on the Drawings.

2. Inverts shall be laid out in smooth diameter curves of the longest possible radius to provide uniform flow channels.

3. Invert shelves shall be graded with a 1 inch drop per one foot length sloped from the manhole walls.

E. Manhole steps shall be accurately positioned and embedded in the concrete when the section is cast. Precast reinforced concrete manhole sections shall be set vertical and with sections and steps in true alignment.

F. All holes in sections used for their handling shall be thoroughly plugged with rubber plugs made specifically for this purpose, or with mortar. The mortar shall be one part cement to 1-1/2 parts sand, mixed slightly damp to the touch, hammered into the holes until it is dense and an excess of paste appears on the surface, and finished smooth and flush with the adjoining surfaces.

G. Precast sections shall be level and plumb with approved joint seals. Water shall not be permitted to rise over newly made joints until after inspection and acceptance. All joints shall be watertight.

H. Openings which have to be cut in the sections in the field shall be carefully made to prevent damage to the riser. Damaged risers will be rejected and shall be replaced at no additional cost to the Owner.

3.03 BRICK MASONRY

A. Brick masonry structures shall be watertight. All leaks in brick masonry structures shall be sealed. All brick masonry shall be laid by skilled workmen.

B. All beds on which masonry is to be laid shall be cleaned and wetted properly. Brick shall be wetted as required to be damp, but free of any surface water when placed in the work. Bed joints shall be formed of a thick layer of mortar which shall be smoothed or furrowed slightly. Head joints shall be formed by applying a full coat of mortar on the entire brick end, or on the entire side, and then shoving the mortar covered end or side of the brick tightly against the bricks laid previously. The practice of buttering at the corners of the brick and then throwing the mortar or crappings in the empty joints will not be permitted. Dry or butt joints will not be permitted. Joints shall be uniform in thickness and approximately 1/4 inch thick.

C. Brickwork shall be constructed accurately to the required structure dimensions and tapered at the top to the dimensions of the flanges of the cast-iron frames, as shown on the Drawings.

D. Joints on the inside face of walls shall be tooled slightly concave with an approved jointer when the mortar is thumbprint hard. The mortar shall be compressed with complete contact along the edges to seal the surface of the joints.

E. All castings to be embedded in the brickwork shall be accurately set and built-in as the work progresses.

F. Water shall not be allowed to flow against brickwork or to rise on the masonry for 60 hours after it has been laid, and any brick masonry damaged in this manner shall be

replaced as directed at no additional cost to the Owner. Adequate precautions shall be taken in freezing weather to protect the masonry from damage by frost.

3.04 CONCRETE MASONRY UNITS

A. Concrete masonry units shall be soaked in water before laying. As circular concrete block walls are laid-up, the horizontal joints and keyways shall be flushed full with mortar. As rectangular blocks are laid-up, all horizontal and vertical joints shall be flushed full with mortar. Plastering of the outside of block structures will not be required. No structure shall be backfilled until all mortar has completely set.

3.05 MANHOLE STEPS

A. Steps shall be cast into the precast walls during manufacture.

B. Steps in brick masonry and concrete units shall be installed as the masonry courses are laid.

3.06 CASTINGS

A. Cast-iron frames for grates and covers shall be well bedded in cement mortar and accurately set to the proposed grades.

B. All voids between the bottom flange and the structure shall be completely filled to make a watertight fit. A ring of mortar, at least one-inch (1 in.) thick and pitched to shed water away from the frame shall be placed over and around the outside of the bottom flange. The mortar shall extend to the outer edge of the masonry all around its circumference and shall be finished smooth. No visible leakage will be permitted.

C. Structures within the limits of bituminous concrete pavement shall be temporarily set at the elevation of the bottom of the binder course. After the binder course has been compacted, the structures shall be set at their final grade. Backfill necessary around such structures after the binder course has been completed shall be made with 3,500 psi concrete.

3.07 CONNECTIONS TO EXISTING FACILITIES

A. General Requirements: The Contractor shall make all required connections of the proposed drainage system into existing drainage system, where and as shown on the Drawings.

B. Compliance with requirements of Owner of Facility: Connections into existing drainage system facilities shall be performed in accordance with the requirements of the Owner of the facility. The Contractor shall comply with all such requirements, including securing of all required permits, and paying the costs thereof.

3.08 MANHOLE CONNECTIONS

A. Manhole pipe connections for precast manhole bases may be accomplished by any method described below. The Contractor shall make sure that the outside diameter of the pipe is compatible with the particular pipe connection used.

1. A tapered hole filled with non-shrink waterproof grout after the pipe is inserted. This connection method will not be allowed when connecting PVC pipe to manholes.

2. The LOCK JOINT Flexible Manhole Sleeve cast in the wall of the manhole base. The stainless steel strap and exposed sleeve shall be protected from corrosion with a bitumastic coating.

3. PRESS WEDGE II gasket cast into the wall on the manhole base. The rubber wedge shall only be driven into the V slot from the outside of the manhole.

4. The RES-SEAL, a cast iron compression ring which compresses a rubber "O" ring gasket into a tapered hole in the wall of the manhole base. Exposed metal shall be protected from corrosion with a bitumastic coating.

5. KOR-N-SEAL neoprene boot cast into the manhole wall. The stainless steel clamp shall be protected from corrosion with a bitumastic coating.

3.09 CLEANING,TESTING, AND REPAIR

A. The Contractor shall clean the entire drainage system of all debris and obstructions. Cleaning shall include, removal of all formwork from structures, concrete and mortar droppings, construction debris and dirt. The system shall be thoroughly flushed clean and the Contractor shall furnish all necessary hose, pumps, pipe and other equipment that may be required for this purpose. No debris shall be flushed into existing drains, storm recharge chambers, storm drains and/or streams.

B. Testing and Correction of Defective Work: If a mandrel with a minimum length that is greater than the pipe diameter and a minimum diameter of 90 percent of the pipe diameter cannot be pulled through the pipe after seven (7) days of completed trench backfill, the pipe line shall be deemed unacceptable and the pipe lines shall be removed and replaced. The Contractor shall make the necessary repairs or replacements required to permanently provide an open and structurally sound drainage system capable of supporting the anticipated loading from all sources throughout the year.

3.10 FINAL INSPECTION

A. Upon completion of the work, and before final acceptance by the Engineer, the entire drainage system shall be subjected to a final inspection in the presence of the Engineer. The work shall not be considered as complete until all requirements for line, grade, cleanliness, mandrel tests, and other requirements have been met.

END OF SECTION

Rhode Island College

600 Mount Pleasant Avenue
Providence, Rhode Island

Prepared for **Rhode Island College**
600 Mount Pleasant Avenue
Providence, Rhode Island 02908

Prepared by **VHB /Vanasse Hangen Brustlin, Inc.**
10 Dorrance Street, Suite 400
Providence, Rhode Island 02903

February 12, 2014

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1.0 Introduction and Background

Vanasse Hangen Brustlin, Inc. (VHB), on behalf of the Rhode Island College (RIC), is submitting this Soil Management Plan (SMP) for a portion of the property (the Site) where proposed electrical service improvements will take place. VHB has prepared the following SMP for the excavation, stockpiling, management and off-Site disposal and/or re-use of soils at the Site.

As described in this SMP, the contractor shall assume that all soils managed during this project may contain elevated arsenic concentrations unless analytical testing has been completed and communicated to the contractor by RIC. In addition, excess soil shall not be transported off-Site unless in accordance with the SMP.

2.0 Soil Management Plan

2.1 Reasons for Soil Management

During previous soil investigations completed at the college, some elevated arsenic concentrations have been identified in soil at concentrations above the Rhode Island Department of Environmental Management (RIDEM) Residential Direct Exposure Criteria (RDEC) of 7 milligrams per kilogram (mg/kg). According to previous documentation as communicated to VHB by college representatives, no other contaminants were detected at levels above the applicable regulatory criteria, and the elevated arsenic was attributed to natural background conditions. VHB has not been provided with any documentation relative to sampling or arsenic concentrations within the proposed electrical service improvement area.

2.2 Soil Management Procedures

The procedures described in this SMP should be followed during the excavation, stockpiling, management and re-use of soils at the Site. Site activities should also conform to the bid documents associated with the electrical service improvement project.

2.2.1 Pre-Excavation Activities

The following activities should be adhered to prior to commencing excavation and other soil movement activities at the Site.

2.2.1.1 DIGSAFE

A minimum of 72 hours prior to conducting any Site grading or excavation, DIGSAFE should be contacted to obtain a valid DIGSAFE ticket to inform public utility owners to locate and mark all underground utilities in the proposed work zone. Additionally, there are some campus owned utilities that will need to be located utilizing an independent utility location company. The contractor is responsible for coordinating and hiring a sub-contractor to perform the services as Rhode Island College will not perform any utility location. The Site contractor shall coordinate with local authorities to obtain the location of utilities unmarked by

DIGSAFE (typically municipal water and sewer lines) at least 72 hours prior to excavation. When Site activities approach the location of any underground utility, the exact location shall be determined by safe and acceptable means. Any underground utility lines exposed in the excavation shall be protected, supported, or removed. If an unmarked underground utility is encountered, the contractor shall cease work immediately and notify the owner of the utility for further instruction.

2.2.1.2 Health and Safety

Prior to excavation, all staff working at the Site, including the contractor must prepare and familiarize themselves with their Site specific Health and Safety Plan (HASP). Each contractor performing tasks at the Site should have their own HASP applicable to their personnel. VHB has not prepared a HASP for Site contractors and assumes no responsibility for the health and safety of Site contractors or their personnel.

2.2.2 Excavation Activities

Site activities should be planned to be completed within a secured area of the Site and access to the Site should be restricted during the project. Additionally, off-hour access to the Site will be controlled with a locking temporary fence.

Soil excavation and grading shall be conducted in accordance with applicable Site permits.

During excavation activities, dust suppression methods must be utilized when visible windblown dusts are generated. The excessive generation of dust must be managed during soil excavation, stockpiling and loading. If excessive dust generation cannot be controlled or mitigated, the activity should be discontinued until conditions improve. (See **Section 2.3** for additional information.)

If the presence of oil or hazardous materials (OHM) or any other unforeseen condition is identified during excavation activities, Site activities will immediately stop. Contractors should contact the appropriate Environmental Professional and the Rhode Island College Project Manager prior to continuing Site activities. The appropriate Site contacts are provided in **Section 4.0**.

Excess excavated soils will be staged and temporarily stored for no more than 90 days in storage location(s) selected to prevent unauthorized access to the materials and approved by the Rhode Island College Project Manager. The Rhode Island College Project Manager will have the

authority to direct the placement of excess excavated soils into existing or new stockpile areas, and individual stockpiles generated during this project shall each be limited in size to 500 cubic yards.

Excess excavated soils will be stockpiled on polyethylene sheeting (6 mil minimum) and/or stored in roll-off containers. Stockpiled or stored soils will be covered with polyethylene sheeting (6 mil minimum) prior to leaving the Site and at the end of each workday. Soil shall be securely stockpiled in order to prevent migration and erosion from the stockpile locations.

Soil stockpiles shall be inspected daily; and damage to the covers shall be repaired immediately.

The contractor shall take measures to control stormwater run-off of impacted/stockpiled soils, which may include, siltation fences and staked hay bales in the areas of the Site used for stockpiling.

2.2.3 On-Site Reuse Procedures

Unless otherwise prohibited by RIDEM or other applicable regulations, soil generated from Site excavations may be placed back into its original excavation for use as backfill during the Site activities. The Contractor shall make all reasonable efforts to backfill soils at the corresponding depth and location from which the soils were originally removed.

2.2.4 Decontamination Procedures

Non-disposable equipment used during the soil excavation activities, including excavators, loaders and soil transport vehicles must be properly decontaminated in accordance with the Contractor's decontamination procedures as appropriate prior to removal from the Site.

2.3 Dust Prevention

The Contractor will prepare a Dust Prevention Plan prior to beginning work. During excavation activities, dust suppression methods must be utilized when visible windblown dusts are generated. The excessive generation of dust must be managed during soil excavation, stockpiling and loading. If excessive dust generation cannot be controlled or mitigated, the activity should be discontinued until conditions improve.

The Contractor shall maintain a water truck(s) at the Site to control airborne dust during soil excavation, grading and other Site development activities. Initiation of dust control measures will be at the direction of RIC, the Environmental Professional, and/or the Contractor. The Contractor shall use the water truck when the Site soils become dry and there is a potential for airborne dust. The Contractor shall have a sufficient number of operable water trucks to maintain a moist soil surface at all areas of the Site were exposed soils exist. Additionally, the Contractor shall install and maintain the facilities to fill and maintain the water truck(s).

2.4 Confirmatory Soil Sampling

The stockpile locations shall be accessible to the Environmental Professional upon completion of the stockpiling activities to allow for soil sample collection. Soil analytical testing must be performed by a Rhode Island Department of Health approved laboratory. The testing program for off-Site soil reuse-disposal must be completed in compliance with the permit requirements of the planned receiving facility. Approval from the Environmental Professional, RIC Project Manager and the proposed receiving facility representative must be acquired prior to soils leaving the Site.

At a minimum, analytical testing should include the following:

- Petroleum Hydrocarbons (EPA Method 8100M);
- Volatile Organic Compounds (EPA Method 8260);
- Semi-Volatile Organic Compounds (EPA Method 8270);
- Polychlorinated Biphenyls (EPA Method 8081);
- Total RCRA 8 Metals (EPA Method 6010 & 7471A);
- Flashpoint (EPA Method 1010M);
- Corrosivity (pH) (EPA Method 9045C); and
- Reactivity (Sulfide and Cyanide) (EPA Methods SW-846 7.3.3.2/9014 and SW-846 7.3.4.2/376.2).

2.4.1 Soils Classifications

Based on the analytical results, soils may be categorized as the following:

Non-Regulated: Results are below the RIDEM Method 1 Residential Direct Exposure Criteria (RDEC). Soils in this category do not require special handling.

Regulated: Results exceed the RDEC. These soils must be properly managed and taken to a permitted receiving facility.

Hazardous Waste: Results exceed United States Environmental Protection Agency (USEPA) Resource Conservation and Recovery Act (RCRA) hazardous waste criteria. These soils are subject to US EPA RCRA regulations and must be transported and disposed of at a RCRA-permitted treatment, storage, disposal (TSD) facility in accordance with applicable regulations.

2.5 Groundwater Assessment and Dewatering

At this time, the excavation activities are planned for a maximum of 10 feet below grade and it is anticipated that groundwater will be encountered in some locations during Site activities. Groundwater dewatering activities should be planned for the Site.

2.6 Off-Site Soil Disposal

This SMP proposes the reuse of the stockpiled soils on Site. Soils that cannot be reused on Site are subject to the following procedures:

1. Soil excavated from the Site may not be transported off-Site for re-use or disposal without prior approval from the Environmental Professional, RIC Project Manager and the proposed receiving facility representative.
2. Prior to off-Site shipment, a pre-classification soil sample(s) will need to be analyzed in accordance with the selected disposal facilities requirements. Laboratory testing must be completed by the Environmental Professional.
3. Soil analytical testing must be performed by a Rhode Island Department of Health approved laboratory.
4. Soil data may indicate that soil subject to removal from the Site meets the Residential Direct Exposure Criteria (RDEC) for all constituents and may have multiple options for re-use. Soil data will likely contain elevated arsenic concentrations that exceed the RDEC and will be subject to off-Site disposal.
5. No soil shall leave the Site for re-use or disposal without the approval of the Environmental Professional, the RIC Project Manager and the proposed receiving facility.
6. If soil does not meet the RDEC and cannot be reused on-Site, the soil subject to off-Site disposal must be properly managed and disposed of off-Site at an appropriately licensed facility.
7. If soils are to be removed from the Site, the soil will need to be transported under proper shipping documentation to an assigned disposal facility.

8. The Environmental Professional and RIC Project Manager should oversee the preparation of the necessary shipping documents and disposal procedures.
9. Copies of the material shipping records for any soils shipped from the Site must be provided to the Environmental Professional and the RIC Project Manager. This information will be included in closure reporting and likely submitted to the RIDEM.

3.0 Notification Requirements

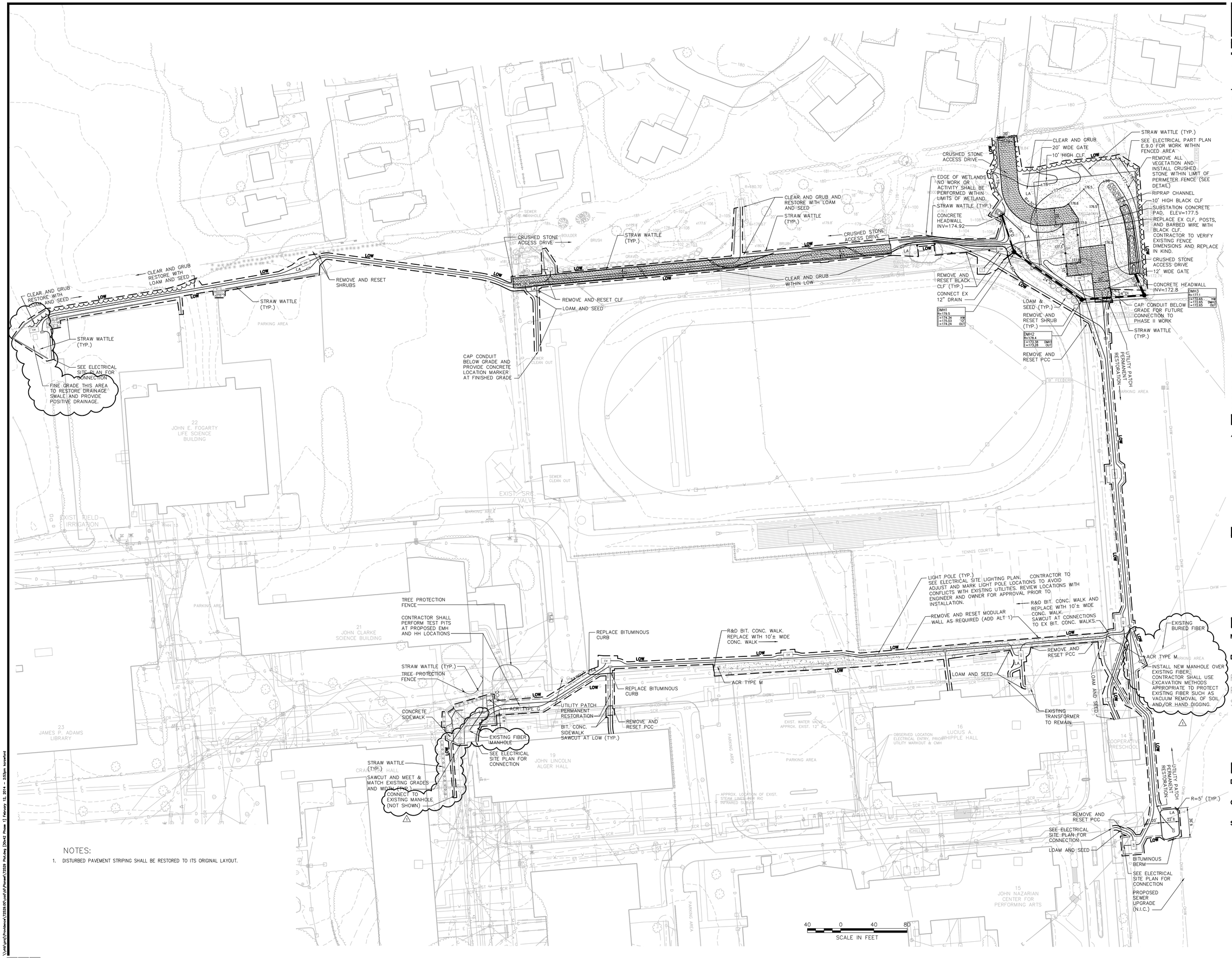
During previous soil investigations completed at the college, elevated arsenic concentrations have been identified in soil at concentrations above the RIDEM Residential Direct Exposure Criteria of 7 milligrams per kilogram (mg/kg). Based upon information provided to VHB by RIC, the elevated arsenic has been attributed to natural background conditions and RIDEM was notified of the previous arsenic concentrations identified at the college. If elevated arsenic concentrations are identified in soils at the Site, the concentrations shall be reported to RIDEM and managed in accordance with all applicable RIDEM regulations.

If extenuating Site or soil conditions are discovered beyond that which is outlined in this SMP, the Environmental Professional and the RIC Project Manager should be notified immediately.

4.0 Site Contacts

The following table provides the contact information for the various individuals that the Contractor may need to contact during the completion of this project.

Company/ Affiliation	Name	Address	Phone Number
VHB	Peter Grivers	10 Dorrance Street Providence, RI 02903	401-272-8100
Rhode Island College	Kevin Fitta	600 Mount Pleasant Ave Providence, RI 02908	401-456-9885
RIDEM Office of Waste Management	Jeffrey Crawford	235 Promenade Street Providence, RI 02903	401-222-2797
RIDEM Emergency Response	Jim Ball	235 Promenade Street Providence, RI 02903	401-222-2797 x7129 or 401-222-3070



NOTES:

1. DISTURBED PAVEMENT STRIPING SHALL BE RESTORED TO ITS ORIGINAL LAYOUT.

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REVISIONS

	DATE	CHK	DESCRIPTION
1	2/13/14		Addendum No. 1

SEAL

PROJECT

NUMBER
20130120

DATE
12/12/2013

RHODE ISLAND COLLEGE PRIMARY ELECTRICAL SERVICES UPGRADE

DRAWING

DRAWN BY

CHECKED BY

SCALE
1" = 40'

SITE PLAN

C2.0

OF

\\rdk\proj\Providence\72528.00\cad\dwg\Permit\72528 PhEdwg [36x42 Plot] by [Kirk] February 12, 2014 - 2:53pm kirkstard

LIGHTING NOTES:

1. REFER TO DRAWING E0.0 FOR LEGEND, SYMBOLS AND GENERAL NOTES.

2. REFER TO ARCHITECTURAL DRAWINGS, INCLUDING BUT NOT LIMITED TO, REFLECTED CEILING PLANS AND ELEVATIONS FOR ASSOCIATED NOTES, MOUNTING DETAILS AND EXACT LOCATIONS OF ALL LIGHTING FIXTURES.

3. PROVIDE COMMON FACE PLATE AND REQUIRED METAL INTERIOR BOX BARRIERS FOR ALL MULTIPLE GANG SWITCH LOCATIONS.

4. CIRCUIT NUMBERS ARE DIAGRAMMATIC. EXACT NUMBERS SHALL BE DETERMINED IN THE FIELD AND REFLECTED ON AS-BUILT DOCUMENTATION BY THE ELECTRICAL CONTRACTOR. THE ASSOCIATED CIRCUIT NUMBER AND SWITCH LEG NOMENCLATURE THAT ARE APPLIED TO EACH LIGHTING FIXTURE AND CONTROLLING DEVICE INFER INTERCONNECTING BRANCH CIRCUITRY.

5. VOLTAGE DROP HAS BEEN CONSIDERED IN THE DESIGN OF ALL BRANCH CIRCUIT AND FEEDER SIZES BASED UPON THE ILLUSTRATED EQUIPMENT LAYOUTS AND SHORTEST CONDUCTOR/RACEWAY ROUTING. THE CONTRACTOR SHALL BE RESPONSIBLE FOR DEVIATIONS TAKEN THAT WILL INCREASE CONDUCTOR/RACEWAY ROUTING LENGTHS. BRANCH CIRCUITS LONGER THAN 75' FOR 120V AND 175' FOR 277V FROM PANEL TO LAST OUTLET SHALL BE INCREASED A MINIMUM OF ONE SIZE ABOVE THAT SPECIFIED TO LIMIT VOLTAGE DROP TO LESS THAN 3%.

1

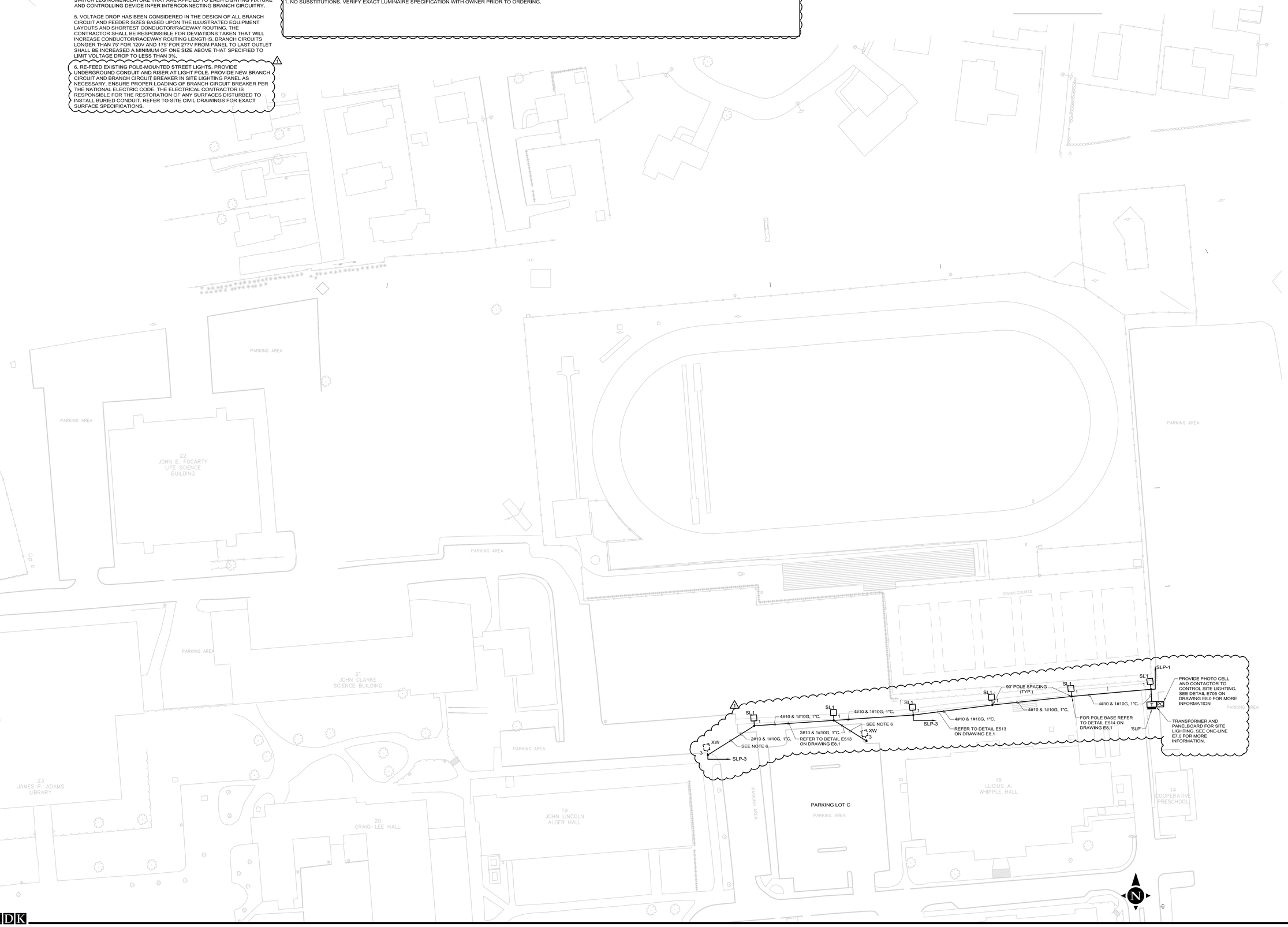
6. RE-FEED EXISTING POLE-MOUNTED STREET LIGHTS. PROVIDE UNDERGROUND CONDUIT AND RISER AT LIGHT POLE. PROVIDE NEW BRANCH CIRCUIT AND BRANCH CIRCUIT BREAKER IN SITE LIGHTING PANEL AS NECESSARY. ENSURE PROPER LOADING OF BRANCH CIRCUIT BREAKER PER THE NATIONAL ELECTRIC CODE. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR THE RESTORATION OF ANY SURFACES DISTURBED TO INSTALL BURIED CONDUIT. REFER TO SITE CIVIL DRAWINGS FOR EXACT SURFACE SPECIFICATIONS.

1

LIGHTING FIXTURE SCHEDULE

TYPE	MANUFACTURERS	CATALOG NUMBER	DESCRIPTION	LAMPS QTY	LAMPS TYPE	INPUT VOLTS	INPUT WATTS	REMARKS
SL1	LUMEC	DMS50-55W48LED4K-R-LE2F-240	LED LUMINAIRE AND 12' BLACK DECORATIVE METAL POLE	1	LED 4000K	240	55	NOTE 1
		RA856V (POLE); MJ (BRACKET);						

NOTES:
1. NO SUBSTITUTIONS. VERIFY EXACT LUMINAIRE SPECIFICATION WITH OWNER PRIOR TO ORDERING.



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RHODE ISLAND COLLEGE 1854

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1	02/13/2014		ADDENDUM #1

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PROJECT

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DATE
12/12/13

RHODE ISLAND COLLEGE
PRIMARY ELECTRICAL
SERVICES UPGRADE

DRAWING

DRAWN BY
RH

CHECKED BY
AT

SCALE
1" = 40'

ELECTRICAL
LIGHTING
SITE PLAN
PHASE 1

E1.0

G:\2013\20130120 - Rhode Island College Primary Electrical Services Upgrade\1000 Drawings\1004 Electrical\Dwg Files_Phase 2\20130120 E1.0 ELECTRICAL LIGHTING SITE PLAN PHASE 1.dwg [Sheet] February 13, 2014 - 4:07pm rhamilton

RDK

POWER NOTES:

1. REFER TO DRAWING E0.0 FOR LEGEND, SYMBOLS AND GENERAL NOTES.

2. VOLTAGE DROP HAS BEEN CONSIDERED IN THE DESIGN OF ALL BRANCH CIRCUITRY AND FEEDER SIZES BASED UPON THE ILLUSTRATED EQUIPMENT LAYOUTS AND SHORTEST CONDUCTOR/RACEWAY ROUTING. THE ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR DEVIATIONS TAKEN THAT WILL INCREASE CONDUCTOR/RACEWAY ROUTING LENGTHS.

3. MAINTAIN CONTINUITY OF BRANCH CIRCUITRY ASSOCIATED WITH ALL EXISTING POWER DEVICES TO REMAIN.

4. SWITCHBOARDS, PANELBOARDS, METER SOCKET ENCLOSURES AND MOTOR CONTROL CENTERS SHALL BE FIELD MARKED TO WARN QUALIFIED PERSONS OF POTENTIAL ELECTRIC ARC FLASH HAZARDS. THE MARKING SHALL BE LOCATED SO AS TO BE CLEARLY VISIBLE TO QUALIFIED PERSONS BEFORE EXAMINATION, ADJUSTMENT, SERVICING, OR MAINTENANCE OF THE EQUIPMENT.

5. ALL EQUIPMENT AND CONDUIT SHOWN LIGHT AND OUT OF FUNCTION ON THIS DRAWING IS EXISTING WORK COMPLETED UNDER SEPARATE CONTRACT. THE CONTRACTOR SHALL TIE IN TO EXISTING DUCT BANK SECTIONS AND MANHOLES AS SHOWN ON THIS DRAWING.

6. REFER TO ONE LINE DIAGRAM, DRAWING E7.0, FOR TRANSFORMER SPECIFICATION AND MORE INFORMATION.

7. REFER TO SITE CIVIL DRAWINGS FOR EXACT LOCATIONS AND ROUTING OF UNDERGROUND SERVICES.

8. CONDUIT AND EQUIPMENT SHOWN AS EXISTING ON THIS DRAWING IS PROVIDED UNDER SEPARATE CONTRACT. ELECTRICAL CONTRACTOR SHALL PROVIDE NEW CONDUCTORS IN EXISTING EMPTY UNDERGROUND DUCT AS INDICATED ON ONE LINE DIAGRAM: REFER TO DRAWING E7.0 FOR MORE INFORMATION.

9. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR RELOCATION AND/OR STORAGE OF EXISTING SITE FEATURES AND EQUIPMENT AS NECESSARY DURING CONSTRUCTION. THE ELECTRICAL CONTRACTOR SHALL RE-INSTALL ITEMS THAT HAVE BEEN MOVED ONCE WORK IS COMPLETE. COORDINATE WORK WITH RHODE ISLAND COLLEGE FACILITIES.

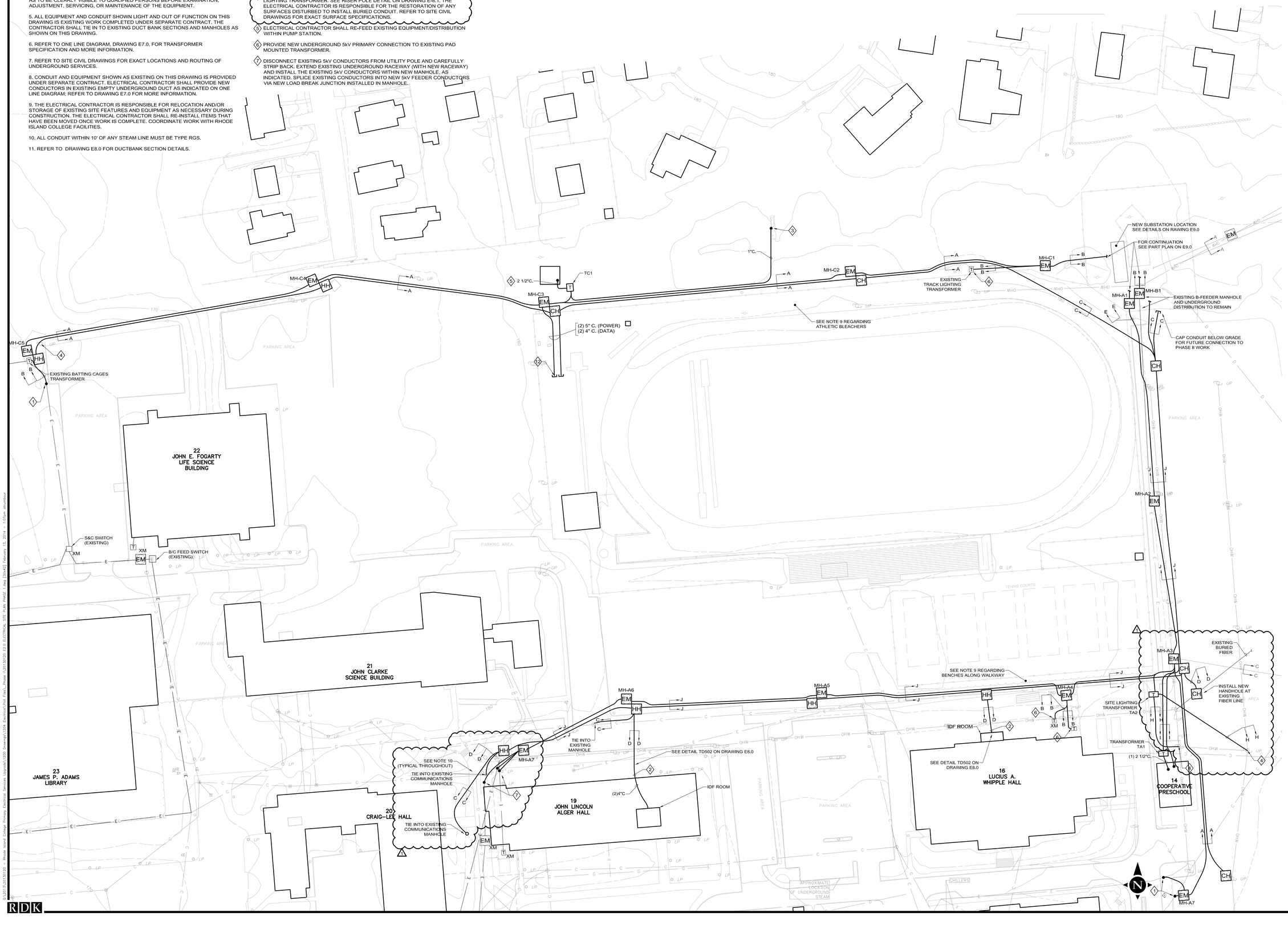
10. ALL CONDUIT WITHIN 10' OF ANY STEAM LINE MUST BE TYPE RGS.

11. REFER TO DRAWING E8.0 FOR DUCTBANK SECTION DETAILS.

KEY NOTES:

1. REMOVE EXISTING TRANSFORMER PRIMARY CONDUCTORS AND CONDUIT FROM RISER POLE. PROVIDE NEW CONDUIT AND PRIMARY CONDUCTORS FED UNDERGROUND FROM 5kV DISTRIBUTION AT NEW MANHOLE AS INDICATED.
2. PROVIDE DUCT BANK FROM COMMUNICATIONS HANDHOLE TO IDF ROOM IN BUILDING AS SHOWN. COORDINATE ROUTING INSIDE BUILDING WITH RIC PRIOR TO WORK. TERMINATE CONDUIT AND PULL STRING AT AN ACCESSIBLE POINT IN THE TELECOMMUNICATIONS ROOM CEILING. PROVIDE BUSHED CONDUIT ENDS AND MARK CONDUIT AS "TELECOMM. CONDUIT TO EXTERIOR MANHOLE".
3. PROVIDE NEW BRANCH CIRCUIT TO FEED EXISTING ELECTRIC HEAT IN WATER METER HOT BOX.
4. RE-FEED EXISTING POLE-MOUNTED PARKING LOT SITE LIGHTING FROM NEW SITE LIGHTING TRANSFORMER. SEE RISER POLE DETAIL ON DRAWING E-8.1. THE ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR THE RESTORATION OF ANY SURFACES DISTURBED TO INSTALL BURIED CONDUIT. REFER TO SITE CIVIL DRAWINGS FOR EXACT SURFACE SPECIFICATIONS.
5. ELECTRICAL CONTRACTOR SHALL RE-FEED EXISTING EQUIPMENT/DISTRIBUTION WITHIN PUMP STATION.
6. PROVIDE NEW UNDERGROUND 5kV PRIMARY CONNECTION TO EXISTING PAD MOUNTED TRANSFORMER.
7. DISCONNECT EXISTING 5kV CONDUCTORS FROM UTILITY POLE AND CAREFULLY STRIP BACK. EXTEND EXISTING UNDERGROUND RACEWAY (WITH NEW RACEWAY) AND INSTALL THE EXISTING 5kV CONDUCTORS WITHIN NEW MANHOLE, AS INDICATED. SPLICE EXISTING CONDUCTORS INTO NEW 5kV FEEDER CONDUCTORS VIA NEW LOAD BREAK JUNCTION INSTALLED IN MANHOLE.

NOTE:
ALL WORK SHOWN LIGHT AND OUT OF FUNCTION ON THIS DRAWING IS NOT IN CONTRACT.



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RHODE ISLAND COLLEGE
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DRAWING

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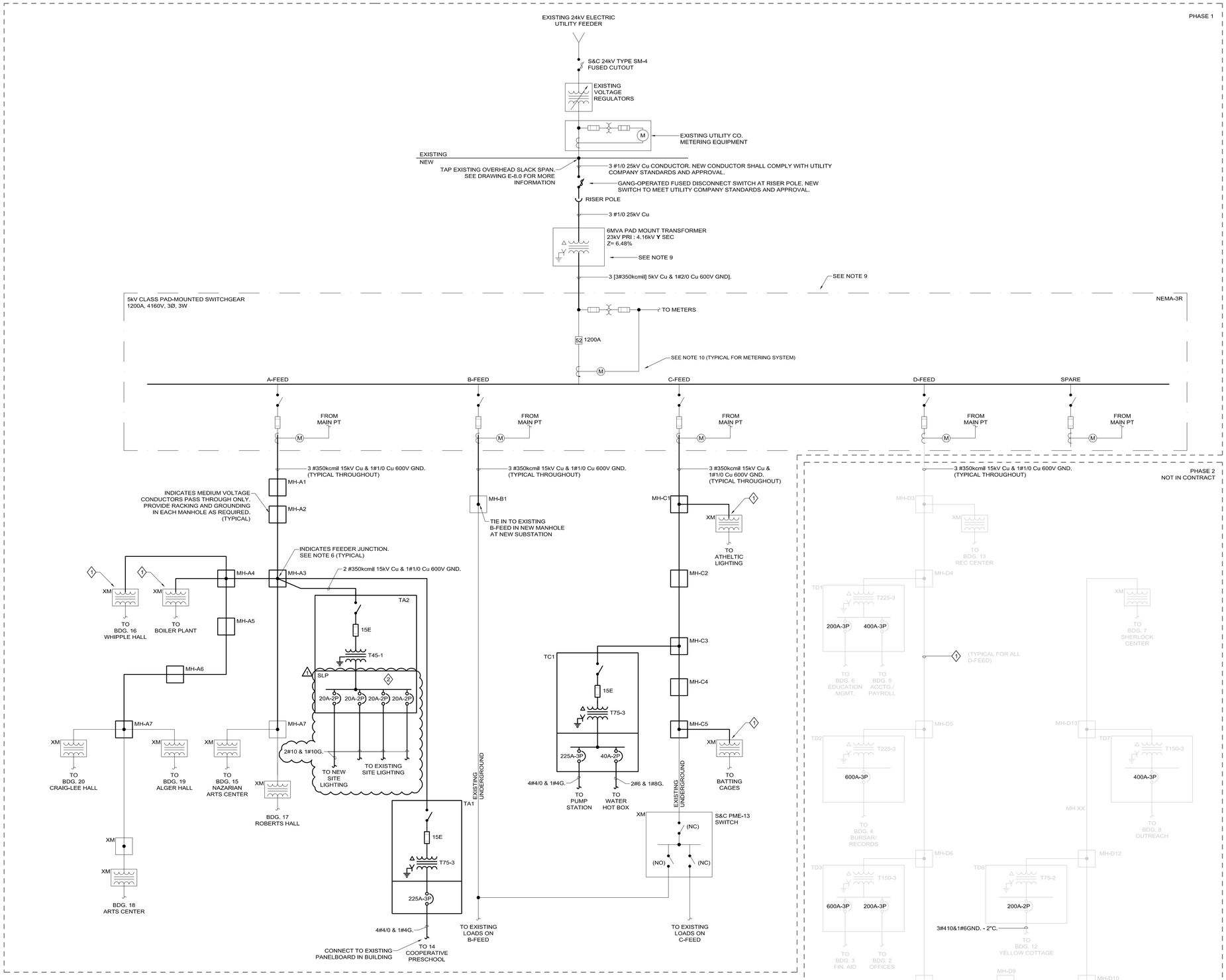
SCALE
1" = 40'

ELECTRICAL SITE PLAN
PHASE 1

E2.0



POWER RISER NOTES:

1. REFER TO DRAWING E0.0 FOR LEGEND, SYMBOLS AND GENERAL NOTES THAT MAY PERTAIN TO THIS DRAWING.

2. THIS DRAWING IS INTENDED TO ILLUSTRATE MAJOR EQUIPMENT AND REQUIRED INTERCONNECTIONS. REFER TO THE SITE PLANS FOR EXACT LOCATIONS AND THE SPECIFICATIONS FOR ADDITIONAL INSTALLATION REQUIREMENTS.

3. THE SERVICE AND ALL SEPARATELY DERIVED SYSTEMS SHALL BE GROUNDED IN ACCORDANCE WITH THE REQUIREMENTS OF ARTICLE 250 OF THE NEC. BOND ALL ELECTRICALLY CONDUCTIVE MATERIALS SUCH AS METAL PIPING SYSTEMS AND STRUCTURAL STEEL TO THE GROUNDING SYSTEM. REFER TO DETAILS FOR ADDITIONAL INFORMATION.

4. CONDUCTORS SHOWN AS NEW ON THIS ONE LINE INCLUDE CONDUCTORS TO BE INSTALLED IN BOTH NEW AND EXISTING CONDUIT PROVIDED UNDER SEPARATE CONTRACT. SEE SITE PLANS FOR MORE INFORMATION.

5. TIE EXISTING FEEDERS INTO NEW 5kV UNDERGROUND DISTRIBUTION AT MANHOLES SHOWN. SEE SITE PLANS FOR MORE INFORMATION.

6. ALL FEEDERS SHOWN AS A JUNCTION/SPLICE SHALL BE JUNCTIONED WITH A MULTI-POINT JUNCTION SYSTEM MOUNTED INSIDE MANHOLE. REFER TO TYPICAL DETAIL "600A SEPARABLE CONNECTOR DETAIL" ON DRAWING E8.1.

7. ALL NEW AND EXISTING MEDIUM VOLTAGE CONDUCTORS THAT REQUIRE A JUNCTION SHALL BE PROVIDED WITH 600A, NON LOAD-BREAK ELBOWS TO ALLOW FOR ADEQUATE CONNECTION. REFER TO TYPICAL DETAIL "600A SEPARABLE CONNECTOR DETAIL" ON DRAWING E8.1.

8. ALL NEW MEDIUM VOLTAGE CONDUCTOR CONNECTIONS TO NEW PAD-MOUNTED TRANSFORMERS SHALL BE PROVIDED WITH 600A, NON LOAD-BREAK ELBOWS TO ALLOW FOR ADEQUATE CONNECTION. REFER TO TYPICAL DETAIL "600A SEPARABLE CONNECTOR DETAIL" ON DRAWING E8.1.

9. PRIMARY ELECTRIC SERVICE TRANSFORMER AND MEDIUM VOLTAGE SWITCHGEAR ARE OWNER FURNISHED, ELECTRICAL CONTRACTOR INSTALLED.

10. PROVIDE METERING PER SPECIFICATIONS. ELECTRICAL CONTRACTOR SHALL PROVIDE MODBUS CONNECTION TO BMS SYSTEM IN WHIPPLE HALL. ELECTRICAL CONTRACTOR SHALL PROVIDE ALL PROGRAMMING NECESSARY TO INTEGRATE NEW MV METERING INTO EXISTING SIEMENS BMS. ALL WORK SHALL BE COORDINATED WITH RIC FACILITIES ENGINEERING.

KEY NOTES:

1. REFEED EXISTING PAD MOUNT TRANSFORMER WITH NEW MEDIUM VOLTAGE CABLES AS SHOWN.

2. RE-FEED EXISTING PARKING LOT LIGHTING CURRENTLY FED FROM POLE-MOUNTED TRANSFORMERS. PROVIDE NEW 20A-2P BRANCH CIRCUIT BREAKERS IN PANEL SLP, BRANCH CIRCUIT IN UNDERGROUND DUCT AND RISER AT EXISTING POLE. DEMOLISH EXISTING POLE MOUNTED TRANSFORMERS AND PRIMARY CONDUCTORS BACK TO SOURCE.

EXISTING EQUIPMENT LEGEND

XM	EXISTING EQUIPMENT TO REMAIN
X	EXISTING EQUIPMENT TO BE REMOVED
XR	EXISTING EQUIPMENT TO BE RELOCATED
XN	NEW LOCATION OF EXISTING RELOCATED EQUIPMENT
NR	EXISTING EQUIPMENT TO BE REMOVED AND NEW EQUIPMENT TO BE INSTALLED ON EXISTING BRANCH/FEEDER
	EXISTING EQUIPMENT FOR INFORMATION ONLY- INDICATED BY SYMBOL WITH LIGHT AND OUT OF FUNCTION LINE TYPE
	EXISTING EQUIPMENT TO BE REWORKED- INDICATED BY SYMBOL WITH DASHED AND IN FUNCTION LINE TYPE

PAD-MOUNTED TRANSFORMER SCHEDULE

TAG #	KVA RATING	PRIMARY VOLTAGE	SECONDARY VOLTAGE
T45-1	45	4160V	240/120V, 1Ø,3W
T75-1	75	4160V	240/120V,1Ø,3W
T75-3	75	4160V	208Y/120V,3Ø,4W
T150-3	150	4160V	208Y/120V,3Ø,4W
T225-3	225	4160V	208Y/120V,3Ø,4W

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RHODE ISLAND COLLEGE 1854

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REVISIONS

	DATE	CHK	DESCRIPTION
	12/12/2013		BID SET
1	02/13/2014		ADDENDUM #1

SEAL

PROJECT

NUMBER
20130120

DATE
12/12/13

RHODE ISLAND COLLEGE
PRIMARY ELECTRICAL
SERVICES UPGRADE

DRAWING

DRAWN BY
AT

CHECKED BY
RR

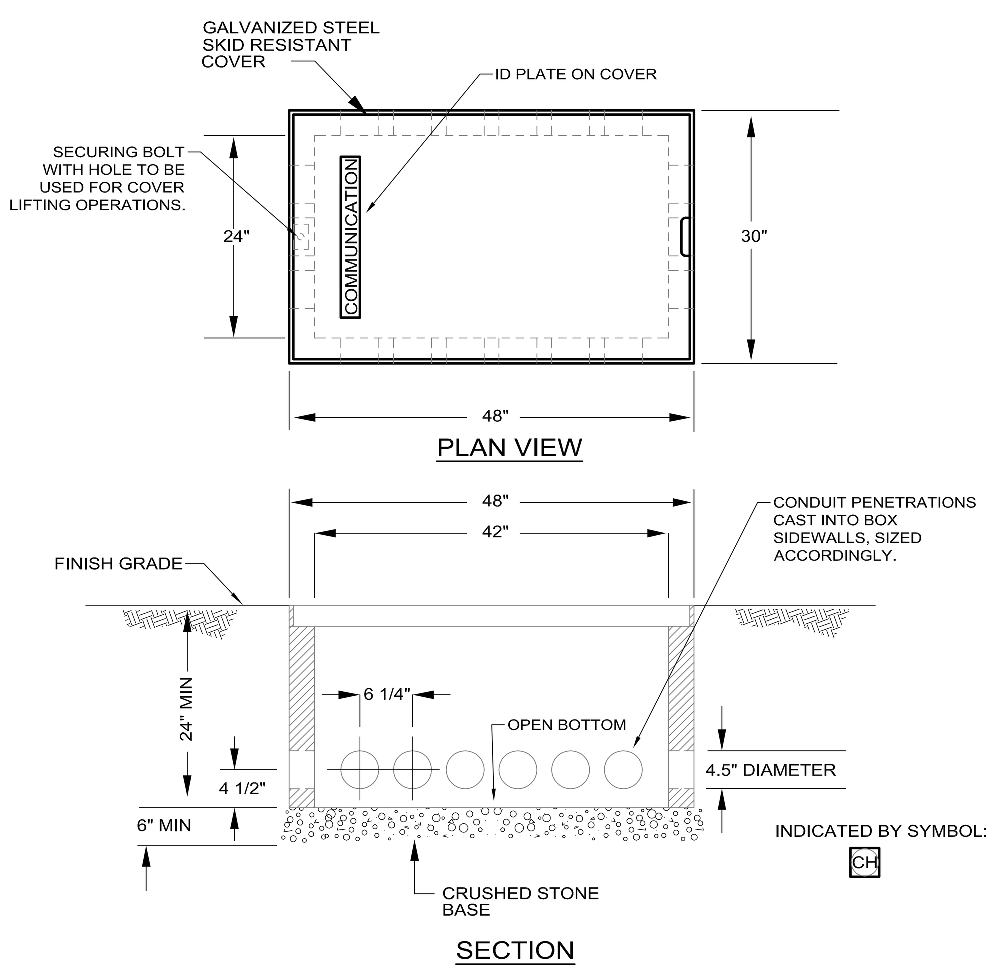
SCALE
NO SCALE

ELECTRICAL
CAMPUS ONE LINE
DIAGRAM

E7.0

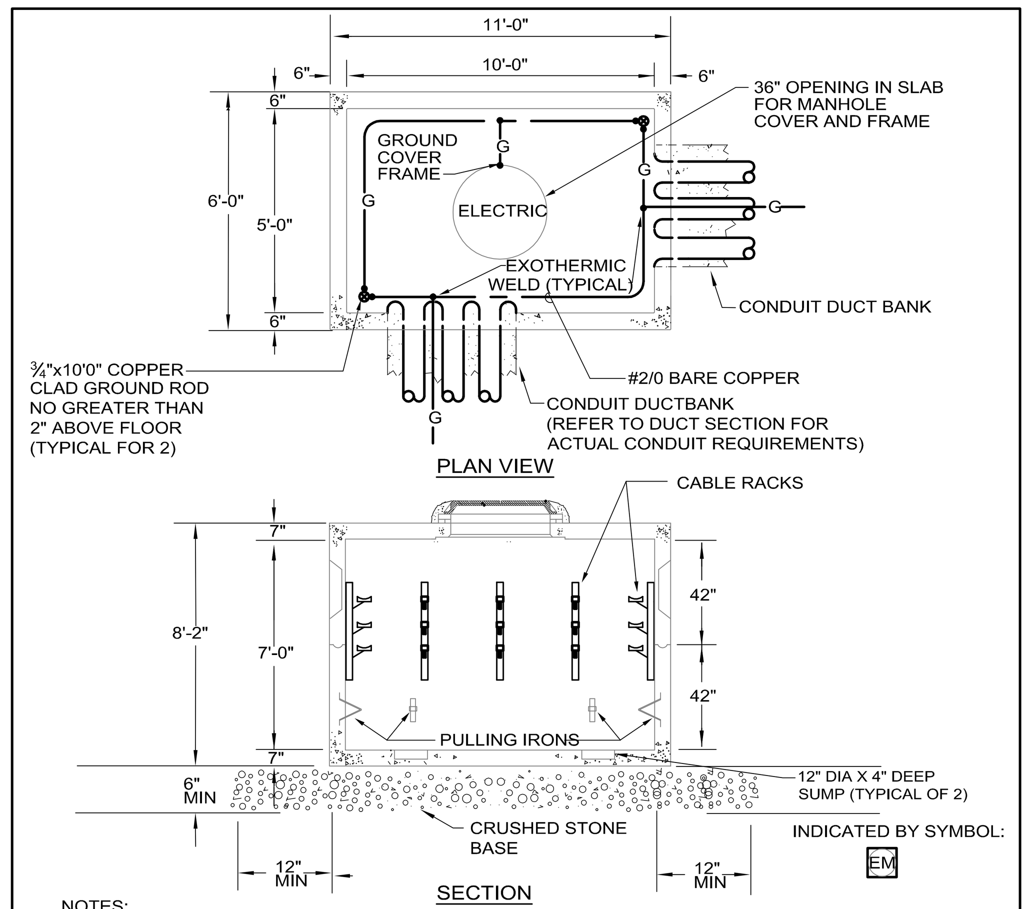
G:\2013\20130120 - Rhode Island College Primary Electrical Services Upgrade\1200 Drawings\1204 Electrical\Port Fire_Power 20130120 E7.0 ELECTRICAL ONE LINE DIAGRAM.dwg [10x42] Friday, 13, 2014 - 1:07pm - atarbox

RDK



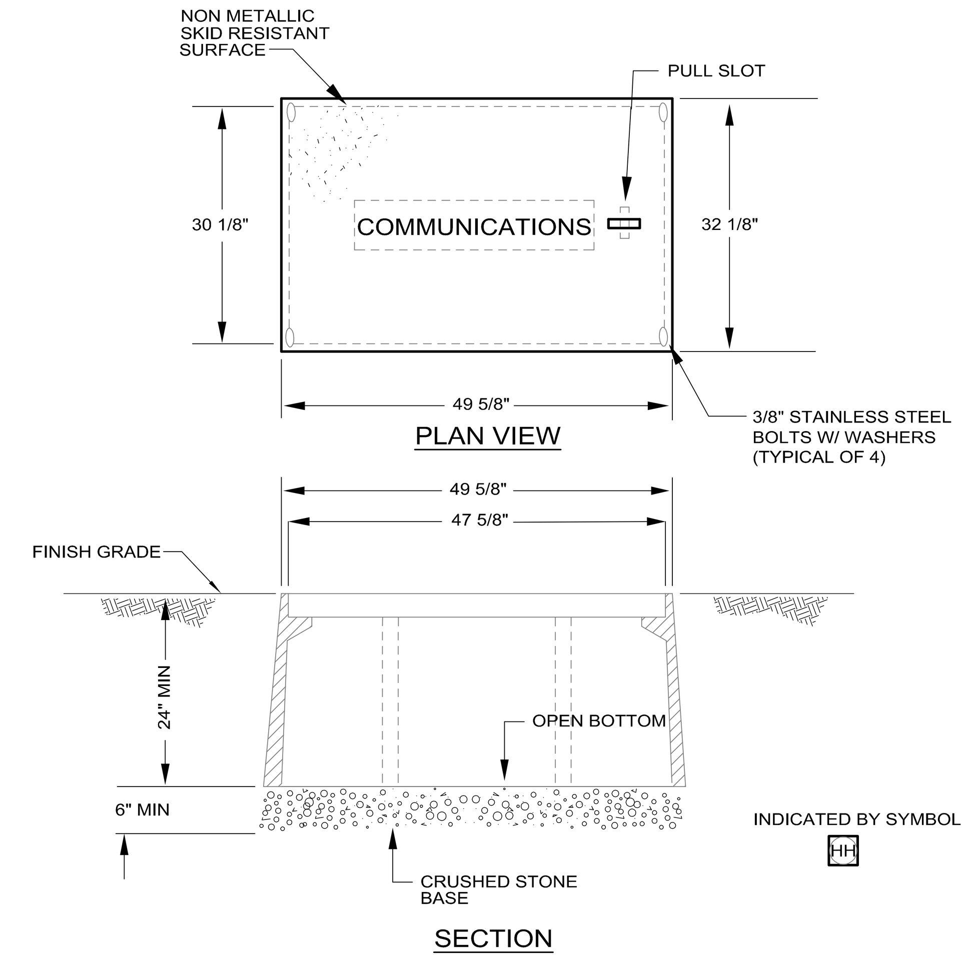
NOTES:
1. THIS IS A TYPICAL DETAIL. REFER TO DRAWING FOR ACTUAL DIMENSIONS OF HANDHOLE WHICH MAY DEVIATE FROM THESE DIMENSIONS. REFER TO THE SITE PLAN FOR QUANTITY OF CONDUITS AND THE "SERVICE" REQUIRED ON THE COVER.
2. THIS HANDHOLE IS AASHTO H20 RATED FOR 32,000LB PER AXLE LOAD.
3. HANDHOLE SHALL BE PRECAST CONCRETE, CONCAST TYPE FHR-30-48-24 OR SIMILAR

RDK | TYPICAL PRECAST HANDHOLE DETAIL | E509



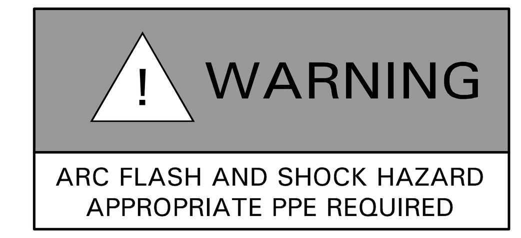
NOTES:
1. FRAME AND COVER SHALL BE CAST IRON BY BOSTON FOUNDRY OR EQUAL BY LEBARON OR NEENAH. COVER SHALL BE CAST WITH 1 1/2" HIGH LETTERS IDENTIFYING THE SERVICE (PRIMARY, SECONDARY ELECTRIC OR TELEPHONE).
2. DESIGN LOAD SHALL ACCOMMODATE UP TO AASHTO HS20-44.
3. CONCRETE ENCASED DUCT SHALL BE TIED INTO THE MANHOLE WALL WITH REBAR TO MINIMIZE DIFFERENTIAL SETTLEMENT. REFER TO SPECIFICATION FOR ADDITIONAL INFORMATION.
4. REFER TO SPECIFICATION FOR PULLING IRONS AND CABLE RACK REQUIREMENTS.
5. BOND ALL METAL COMPONENTS WITHIN MANHOLE INCLUDING COVER FRAME TO 2/0 GROUND LOOP WITH #6 BARE COPPER CONDUCTOR.
6. CONDUCTOR SHIELD SHALL BE GROUNDED TO BUS BAR AT EACH JUNCTION IN MANHOLE.

RDK | TYPICAL PRECAST ELECTRIC MANHOLE DETAIL | E507



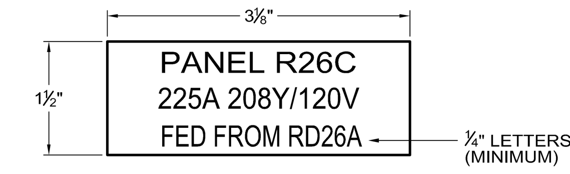
NOTES:
1. THIS IS A TYPICAL DETAIL. REFER TO DRAWING FOR ACTUAL DIMENSIONS OF HANDHOLE WHICH MAY DEVIATE FROM THESE DIMENSIONS. REFER TO THE SITE PLAN FOR QUANTITY OF CONDUITS AND THE "SERVICE" REQUIRED ON THE COVER.
2. THIS HANDHOLE IS INTENDED FOR NON-DELIBERATE VEHICULAR TRAFFIC ONLY, ANSI TIER 22 (22,500 POUND DESIGN LOAD)
3. HANDHOLE SHALL BE PREFABRICATED POLYMER CONCRETE AGGREGATE EQUAL TO QUAZITE OR EQUAL PRE CAST CONCRETE CONSTRUCTION.

RDK | TYPICAL PREFABRICATED HANDHOLE DETAIL | E505

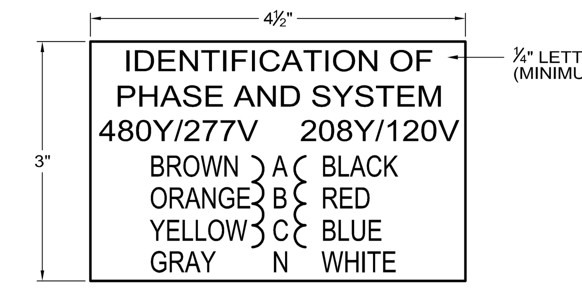


TYPICAL FLASH PROTECTION WARNING LABEL

PROVIDE ON ALL IN-LINE METER SOCKETS, SWITCHBOARDS, DISTRIBUTION PANELS, PANELBOARDS AND MOTOR CONTROL CENTERS IN ACCORDANCE WITH NEC 110.16.



TYPICAL NAMEPLATE DETAIL
UTILIZE MECHANICAL FASTENERS FOR ALL EXTERIOR LOCATIONS. TYPICAL FOR "SWITCHBOARDS", "PANELBOARDS", "STARTERS", "DISCONNECTS", AND "TRANSFORMERS".

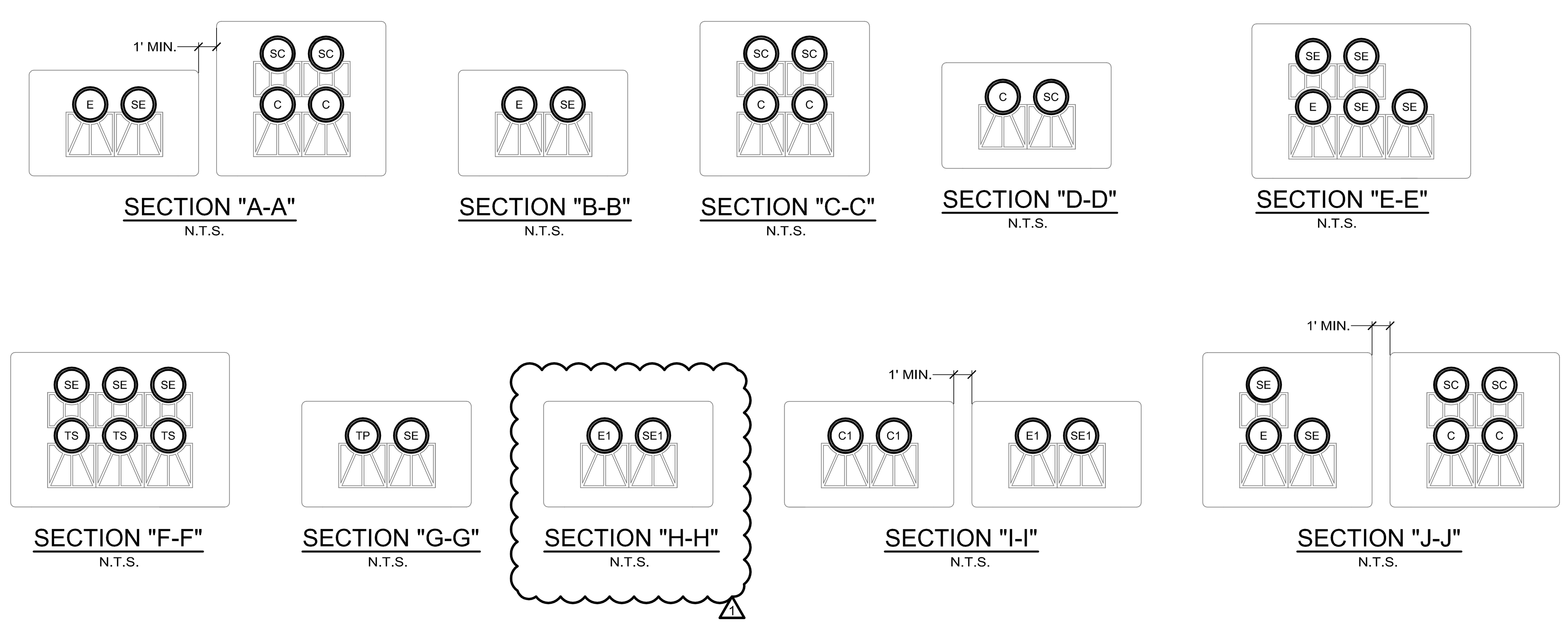


TYPICAL PANELBOARD CONDUCTOR NAMEPLATE DETAIL

TYPICAL FOR MOUNTING TO ALL DISTRIBUTION EQUIPMENT (SWITCHGEAR, SWITCHBOARDS, PANELBOARDS, ETC.)

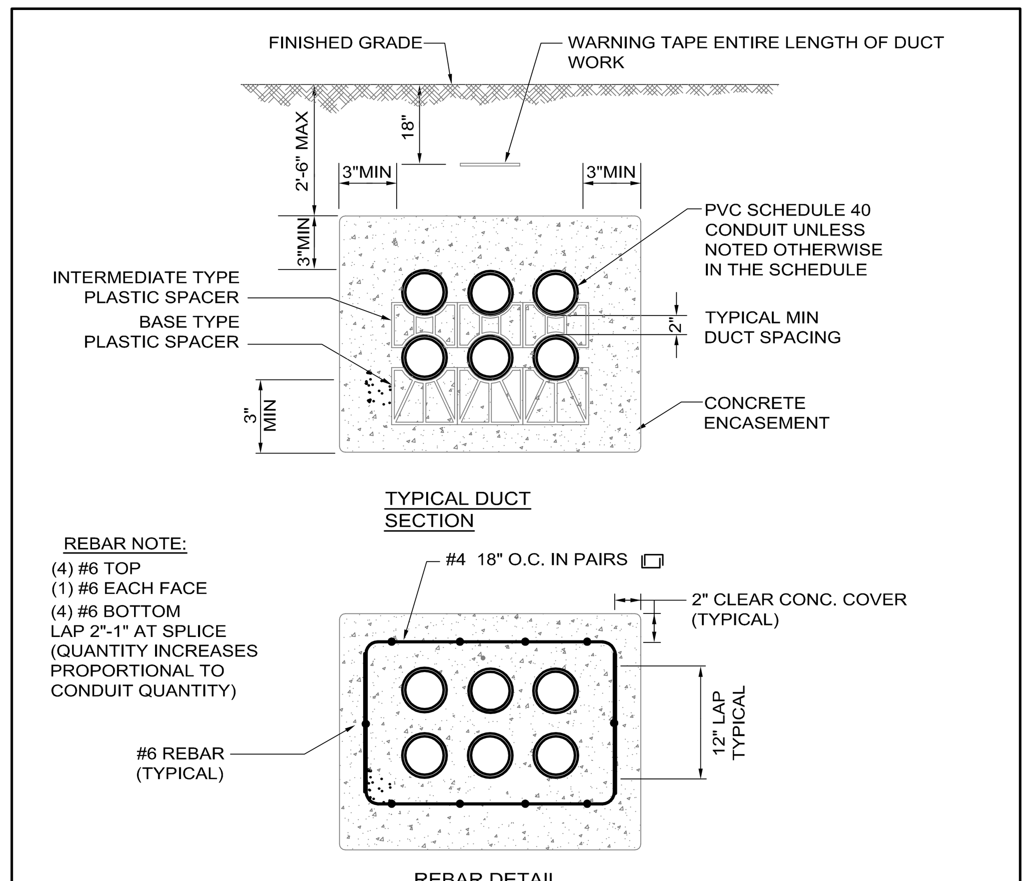
GENERAL NOTES:
1. REFER TO SPECIFICATIONS FOR ADDITIONAL NAMEPLATE REQUIREMENTS.
2. NAMEPLATE TO BE ⅛" THICK PLASTIC WITH WHITE CENTER LAMINATION. FACE SHALL BE BLACK, ENGRAVED LETTERS SHALL BE WHITE.
3. SECURE NAMEPLATE TO SURFACES WITH HIGH STRENGTH ADHESIVE CEMENT.

RDK | TYPICAL NAMEPLATES DETAIL | E303C



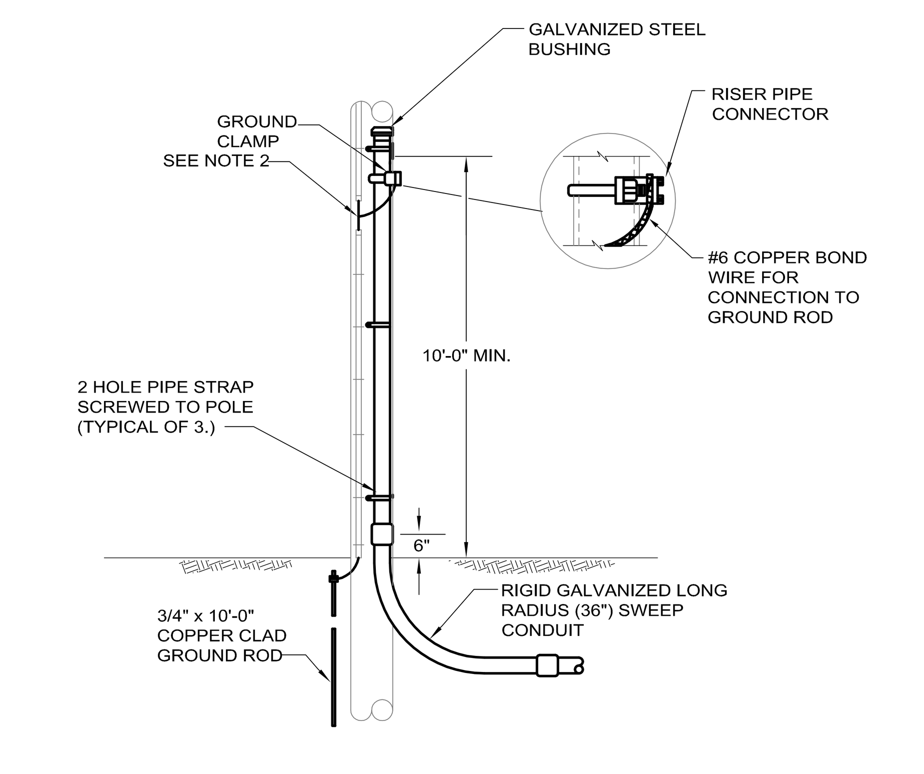
NOTES:
1. REFER TO TYPICAL ELECTRICAL DUCT DETAIL ON THIS SHEET FOR GENERAL CONSTRUCTION REQUIREMENTS.
2. REFER TO THE DUCT BANK CONDUIT SCHEDULE ON THIS SHEET FOR CONDUIT AND CONDUCTOR REQUIREMENTS ASSOCIATED WITH CONDUIT TAG.

RDK | ELECTRICAL DUCT SECTIONS | E-1



NOTES:
1. THIS DETAIL IS INTENDED TO ILLUSTRATE CONSTRUCTION OF TYPICAL DUCT BANK. REFER TO REFERENCED SECTION FOR QUANTITY AND SIZE OF CONDUIT REQUIRED. DUCT CONSTRUCTION SHALL BE MODIFIED TO ACCOMMODATE REQUIREMENTS ILLUSTRATED IN THE ACTUAL SECTION, UTILIZING THE CRITERIA ESTABLISHED IN THIS DETAIL AND AS WRITTEN IN THE SPECIFICATIONS.
2. REBAR SHALL BE USED FOR ALL DUCT BANKS INSTALLED UNDER TRAVELED WAYS, ROADWAYS, AND TRANSITIONS INTO MANHOLES/HANDHOLES AND FOUNDATIONS. REFER TO SPECIFICATIONS FOR ADDITIONAL DETAILS.
3. WARNING TAPE SHALL BE DETECTABLE TAPE FOIL BACKED 4 MIL POLYETHYLENE WITH FADE RESISTANT "BURIED ELECTRIC LINE BELOW" A MINIMUM OF 12 INCHES ABOVE THE BURIED SERVICE. TAPE SHALL BE EQUAL TO T & B NAF-0705
4. ALL ELBOWS SHALL BE TYPE RGS

RDK | TYPICAL ELECTRICAL DUCT DETAIL | E502

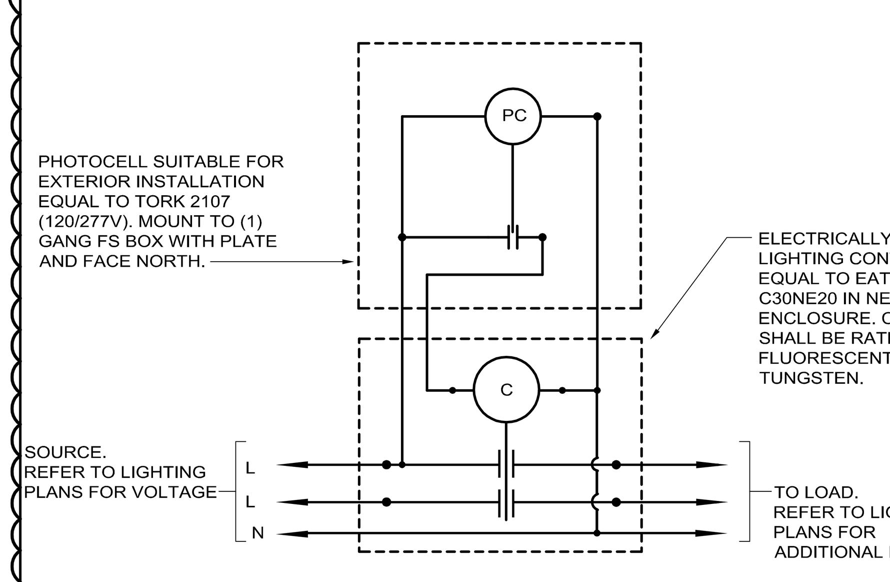


NOTES:
1. RISER PIPES SHALL BE LOCATED ON A STREET QUARTER OF POLE & WHEN POSSIBLE ON THE QUARTER AWAY FROM APPROACHING TRAFFIC.
2. GROUND METAL RISER PIPE TO ARRESTER GROUND LEAD WHERE AVAILABLE. PROVIDE AND INSTALL A #6 BARE COPPER GROUND WIRE AND MOLDING EXTENDING TO TOP OF STEEL PIPE.
3. GROUND CABLE CONNECTIONS SHALL BE EXOTHERMIC WELD.
4. CAP SPARE RACEWAYS 6" AFG FOR FUTURE USE.

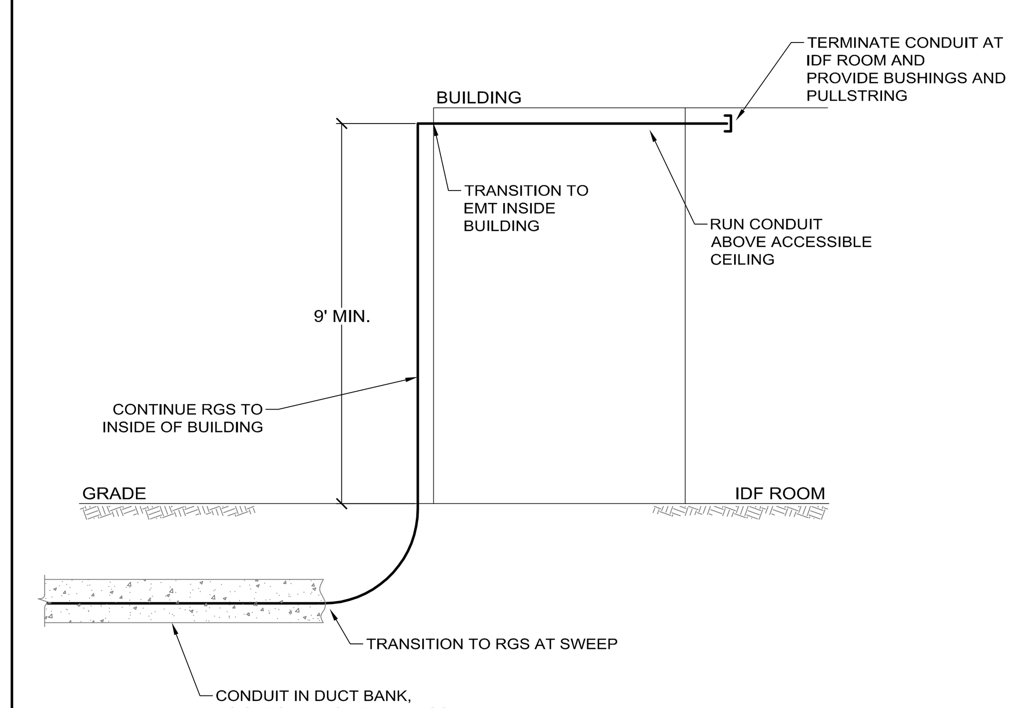
RDK | RISER POLE DETAIL | TD501

DUCT BANK CONDUIT SCHEDULE			
TAG	DESCRIPTION	CONDUIT	CONDUCTORS
E	4.16kV DISTRIBUTION	5" PVC	AS SPECIFIED ON ONE LINE DIAGRAM
SE	SPARE	5" PVC	EMPTY CONDUIT WITH PULL STRING
C	COMMUNICATION	4" PVC	AS SPECIFIED ON TELECOMMUNICATIONS DRAWINGS (CONDUCTORS BY TELECOMMUNICATIONS CONTRACTOR)
SC	SPARE	4" PVC	EMPTY CONDUIT WITH PULL STRING
TP	MAIN TRANSFORMER PRIMARY	5" PVC	3#1/0 25kV
TS	MAIN TRANSFORMER SECONDARY	5" PVC	3#350kcmil 15kV Cu & 1#1/0 Cu 600V GND.
C1	COMMUNICATION	1" PVC	EMPTY CONDUIT WITH PULL STRING
E1	ELECTRICAL CONDUIT	2½" PVC	AS SPECIFIED ON ONE LINE DIAGRAM
SE1	SPARE ELECTRICAL CONDUIT	2½" PVC	SPARE CONDUIT

NOTES:
1. REFER TO DUCT BANK SECTIONS FOR CORRESPONDING CONDUIT AND CONDUCTOR.
2. REFER TO THE TYPICAL DUCTBANK SECTION FOR DETAILS REQUIRED IN THE CONSTRUCTION OF THE DUCT BANK ENVELOPE.
3. REFER TO THE SPECIFICATIONS FOR ADDITIONAL INFORMATION INCLUDING BUT NOT LIMITED TO DUCT BANK REINFORCEMENT REQUIRED UNDER PAVED AREAS INTENDED FOR VEHICULAR TRAFFIC AND AT MANHOLE/BUILDING INTERFACES.
4. ALL CONDUCTORS INSTALLED IN DUCT SHALL BE SUITABLE FOR WET LOCATIONS.
5. ALL SERVICE ENTRANCE AND GENERATOR OUTPUT CONDUCTORS INSTALLED IN DUCT SHALL BE TYPE USE.
6. PROVIDE ALL EMPTY/SPARE CONDUIT WITH NYLON PULL STRING.



RDK | PHOTOCELL CONTROLLED CONTACTOR DETAIL | E705



RDK | CONDUIT TRANSITIONS AT BUILDINGS | TD502

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SEAL

PROJECT
NUMBER
20130120
DATE
12/12/13

RHODE ISLAND COLLEGE
PRIMARY ELECTRICAL
SERVICES UPGRADE

DRAWING
DRAWN BY
RH
CHECKED BY
AT
SCALE
N.T.S.

ELECTRICAL
DETAILS

E8.0

DEMOLITION NOTES:

1. REFER TO DRAWING E0.0 FOR LEGEND, SYMBOLS AND GENERAL NOTES.

2. THE ELECTRICAL DEMOLITION PLANS AND DETAILS INDICATE THE GENERAL INTENT AND ARE NOT INTENDED TO SHOW ALL ITEMS TO BE REMOVED OR RETAINED. THE ELECTRICAL CONTRACTOR SHALL VISIT THE SITE PRIOR TO THE SUBMISSION OF BIDS TO BECOME FAMILIAR WITH THE ACTUAL CONDITIONS AND EXTENT OF WORK. THE ELECTRICAL CONTRACTOR SHALL NOTIFY THE OWNER'S REPRESENTATIVE OF ANY UNANTICIPATED HIDDEN CONDITIONS ENCOUNTERED DURING DEMOLITION. THERE SHALL BE NO INTERRUPTION OF SERVICE TO ANY AREA OUTSIDE THE SCOPE LIMITS WITHOUT APPROVAL FROM THE OWNER'S REPRESENTATIVE. EXISTING EQUIPMENT TO REMAIN SHALL BE LEFT IN A CODE COMPLIANT MANNER.

4. THE ELECTRICAL CONTRACTOR SHALL DE-ENERGIZE AND REMOVE ALL CONDUCTORS AND RACEWAYS TO THEIR POINTS OF ORIGIN WITHIN THE AREA OF DEMOLITION SCOPE. ITEMS IDENTIFIED FOR DEMOLITION SHALL NOT BE ABANDONED IN PLACE. RACEWAYS THAT ENTER MASONRY WALLS AND FLOORS SHALL BE CUT FLUSH AT THE SURFACE FOR PATCHING BY OTHERS. ALL CIRCUIT BREAKERS ASSOCIATED WITH THE DEMOLITION SCOPE SHALL BE DE-ENERGIZED AND LABELED SPARE.

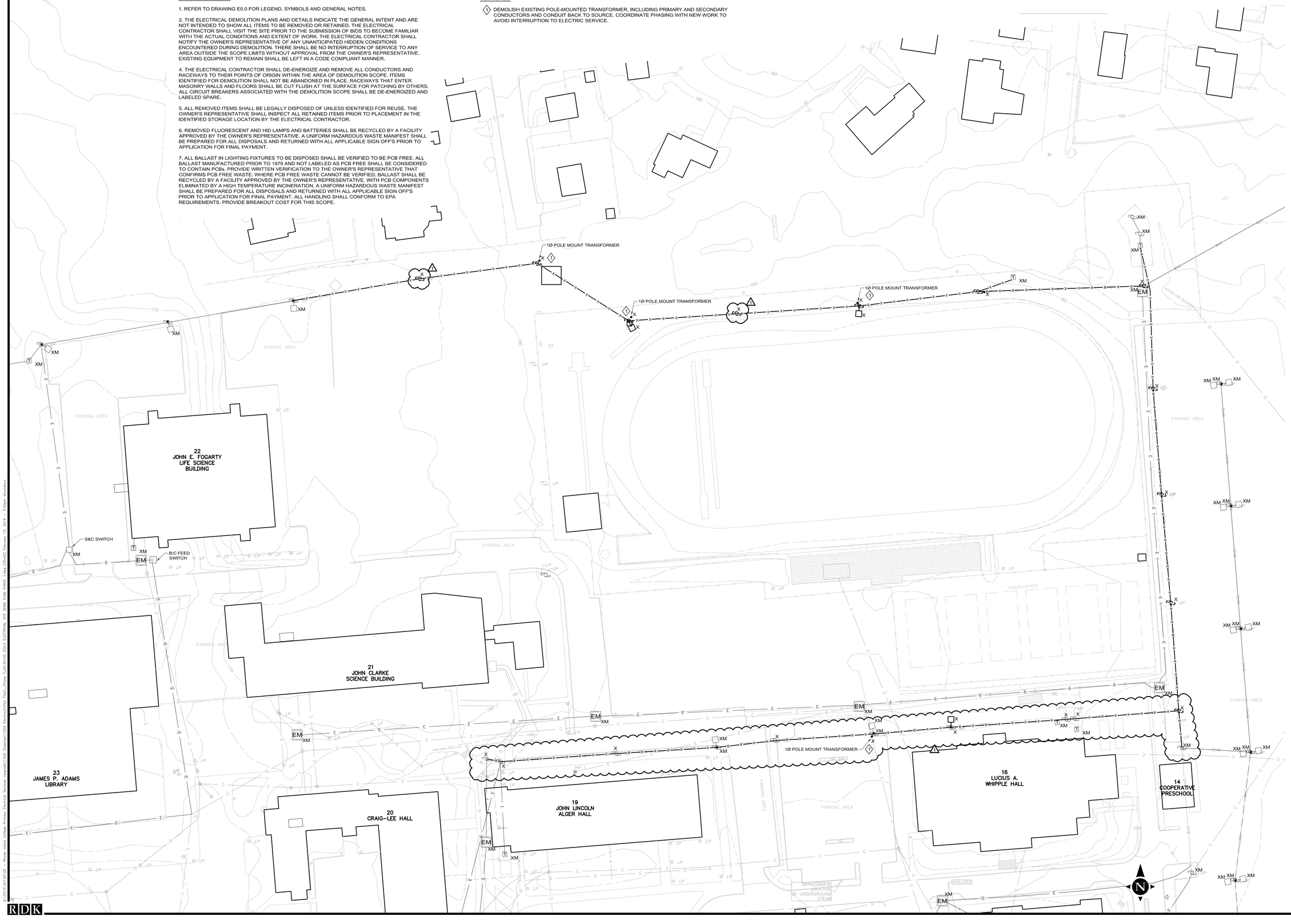
5. ALL REMOVED ITEMS SHALL BE LEGALLY DISPOSED OF UNLESS IDENTIFIED FOR REUSE. THE OWNER'S REPRESENTATIVE SHALL INSPECT ALL RETAINED ITEMS PRIOR TO PLACEMENT IN THE IDENTIFIED STORAGE LOCATION BY THE ELECTRICAL CONTRACTOR.

6. REMOVED FLUORESCENT AND HID LAMPS AND BATTERIES SHALL BE RECYCLED BY A FACILITY APPROVED BY THE OWNER'S REPRESENTATIVE. A UNIFORM HAZARDOUS WASTE MANIFEST SHALL BE PREPARED FOR ALL DISPOSALS AND RETURNED WITH ALL APPLICABLE SIGN OFF'S PRIOR TO APPLICATION FOR FINAL PAYMENT.

7. ALL BALLAST IN LIGHTING FIXTURES TO BE DISPOSED SHALL BE VERIFIED TO BE PCB FREE. ALL BALLAST MANUFACTURED PRIOR TO 1979 AND NOT LABELED AS PCB FREE SHALL BE CONSIDERED TO CONTAIN PCBs. PROVIDE WRITTEN VERIFICATION TO THE OWNER'S REPRESENTATIVE THAT CONFIRMS PCB FREE WASTE. WHERE PCB FREE WASTE CANNOT BE VERIFIED, BALLAST SHALL BE RECYCLED BY A FACILITY APPROVED BY THE OWNER'S REPRESENTATIVE, WITH PCB COMPONENTS ELIMINATED BY A HIGH TEMPERATURE INCINERATION. A UNIFORM HAZARDOUS WASTE MANIFEST SHALL BE PREPARED FOR ALL DISPOSALS AND RETURNED WITH ALL APPLICABLE SIGN OFF'S PRIOR TO APPLICATION FOR FINAL PAYMENT. ALL HANDLING SHALL CONFORM TO EPA REQUIREMENTS. PROVIDE BREAKOUT COST FOR THIS SCOPE.

KEY NOTES:

1. DEMOLISH EXISTING POLE-MOUNTED TRANSFORMER, INCLUDING PRIMARY AND SECONDARY CONDUCTORS AND CONDUIT BACK TO SOURCE. COORDINATE PHASING WITH NEW WORK TO AVOID INTERRUPTION TO ELECTRIC SERVICE.



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SCALE
1" = 40'

ELECTRICAL SITE
DEMO PLAN
PHASE 1

ED2.0