

ADDENDUM NO. 2**NEW PRIMARY UNDERGROUND SERVICE
AND SWITCHGEAR REPLACEMENT
FOR THE MEADOWS COTTAGE COMPLEX
AT THE GOVERNOR BACON HEALTH CENTER
DHSS/OMB/DFM CONTRACT NO.: MC3505000016****FE&ES COMM. NO.: 09-1011**

- 1.0 This Addendum No. 2, dated July 6, 2011, shall be made part of the Project Manual and Drawings dated June 6, 2011, for the New Underground Electrical Service at the Meadows Cottage Complex, Governor Bacon Health Center, Delaware City, DE.
- 2.0 Any provision in any of the Contract Documents which may be in conflict or be inconsistent with the contents of this Addendum shall be void to the extent of such conflicts or inconsistency.
- 3.0 Sealed bids for **OMB/DFM Contract No. MC3505000016 – Governor Bacon Health Center – Meadows Cottage Complex – New Electrical Service**, will be received by the State of Delaware, Office of Management and Budget, Division of Facilities Management, in Room 002 of the Main Building Annex of the Herman Holloway Campus, 1901 N. DuPont Highway, New Castle, DE 19720 until 1:00 p.m., local time, on July 13, 2011. Bidder bears the risk of late delivery. Any bids received after the stated time will be returned unopened.

4.0 CLARIFICATIONS

- 4.1 The List of Bidders identified in Addendum No. 1 omitted one (1) contractor that was present at the Mandatory Pre-Bid Meeting. Bruce Cava, Guardian Construction Co., was present and they are eligible to competitively bid this project as a prime contractor.
- 4.2 After further review of the subcontractor list, a new subcontractor classification will be added to the Bid Form: it will be High Voltage Terminations. This subcontractor may be the same as the Electrical subcontractor, but is not required to be. Bid Form must identify the contractor who will be performing this work. Do not insert “self-performed” or other language of this type. This subcontract MUST be able to present their high voltage certificate of competency and other training credentials during construction.
- 4.3 Feeder schedule says primary cable has a concentric neutral, while the specifications call for a tape shield conductor. Which is correct?
Response: The feeder schedule is correct. Refer to Specification Section 260513 reissued in this Addendum for changes to several articles.

- 4.4 Manholes are not specified. Please provide.
Response: See new section 260513
- 4.5 The thickness of the Polyethylene pipe is not identified. What should the SDR be for this pipe?
Response: Pipe shall be HDPE, Type SDR-11 with dimensions SDR-4, black color
- 4.6 Please identify if any substitution requests were made.
Response: Refer to section 260513 for alternate manufacturers of primary cable.
- 4.7 At the pre-bid, we discussed replacing the storefront entrance to the electrical vault, but the drawings call for it to be reused.
Response: ALL contractors shall include an allowance equal to \$15,000 for the replacement of this storefront and the installation of a new steel door and door hardware. Cost for removal and disposal of existing storefront and door shall remain in the base bid.
- 4.8 Are there any Utility costs that will need to be paid for out of this contract?
Response: Yes, refer to Addendum No. 1.

5.0 CHANGES TO SPECIFICATIONS

- 5.1 Section BF: Bid Form: Replace existing Bid Form with new one, identifying three (3) additional Alternates, Allowance Acknowledgment and an additional subcontractor classification.
- 5.2 Section 260513: Delete section in its entirety. Replace with new Section 260513 attached.
- 5.3 Section 261350 Loadbreak Tapping Cabinet
- A. Article 1.02F **Change:** “Model EPME-15-3305-E2” to “Model EPME-15-340S-E2.”
- B. **Add** “Article 2.10E”: Provide 1’- 0” non-compartmentalized base spacer.”

6.0 CHANGES TO DRAWINGS

- A. Drawing E-5: Single line diagram: Identify that the main (Gateway) building is supported by a Kohler 350KW emergency generator.
- B. Drawing E-6: Add sketch SK-E6 for ductbank detail under Alternate No.’s 2 and 2A.

END OF ADDENDUM NO. 2

cc: All Registered Plan Holders

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BID FORM

Note: Submit four (4) copies of Bid Form.

For Bids Due: Wednesday, July 13, 2011, 1:00 p.m.

To: Mr. Daniel Episcopo
Office of Management and Budget
Division of Facilities Management
DHSS Herman Holloway Campus
Main Administration Bldg., Rm. 002
1901 N. DuPont Highway
New Castle, DE 19720

Name of Bidder: _____

Delaware Business License No.: _____

Taxpayer ID No.: _____

(Other License Nos.): _____

Phone No.: () _____

Fax No.: () _____

The undersigned, representing that they have read and understands the Bidding Documents and that this bid is made in accordance therewith, that they have visited the site and have familiarized themselves with the local conditions under which the Work is to be performed, and that their bid is based upon the materials, systems and equipment described in the Bidding Documents without exception, hereby proposes and agrees to provide all labor, materials, plant, equipment, supplies, transport and other facilities required to execute the work described by the aforesaid documents for the lump sum itemized below:

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BASE BID: All work shown on Contract Documents.

Amount: \$ _____ (\$ _____)

ALTERNATES

Alternate prices conform to applicable project specification section. Refer to specifications for a complete description of the following Alternates. An “ADD” or “DEDUCT” amount is indicated by the crossed out part that does not apply.

Alternate No. 1: Costs for Tilton Building Extension. (from TC-1 to TC-4)

Deduct: _____ (\$ _____)

Alternate No. 2: Installation of underground conduits by open cut excavation in lieu of directional boring methods for the area identified in Alternate No. 1.

Add/Deduct: _____ (\$ _____)

Alternate No. 2A: Installation of underground conduits by open cut excavation in lieu of directional boring methods for all areas except those in Alternate No. 1.

Add/Deduct: _____ (\$ _____)

Alternate No. 3: Deduct cost for four (4) temporary generators identified in phasing plan.

Deduct: _____ (\$ _____)

Alternate No.4: Deduct cost for new 3P-300A circuit breaker serving panel K1 in new switchboard.

Deduct: _____ (\$ _____)

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ALLOWANCE ACKNOWLEDGMENT:

We acknowledge that we have included an allowance equal to \$10,000 for utility company costs and \$15,000 for storefront, door and door hardware replacement at existing transformer vault at Gateway Building.

Acknowledged By

UNIT PRICES

There are no Unit Prices.

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We acknowledge the following Addenda, and the price(s) submitted include any cost/schedule impact they may have.

Addendum No.	Date
<u>1</u>	<u>6/24/11</u>
<u>2</u>	<u>7/6/11</u>
<u> </u>	<u> </u>

This bid shall remain valid and cannot be withdrawn for thirty (30) days from the date of opening of bids, and the undersigned shall abide by the Bid Security forfeiture provisions. Bid Security is attached to this Bid (if required).

The Owner shall have the right to reject any or all bids, and to waive any informality or irregularity in any bid received.

This bid is based upon work being accomplished by the Sub-Contractors named on the list attached to this bid.

Should We be awarded this contract, We pledge to achieve substantial completion of all the work within the indicated calendar days of the Notice to Proceed, as follows:

Base Bid	<u>120</u> calendar days
Alternate No. 1	<u> </u> calendar days
Alternate No. 2	<u> </u> calendar days
Alternate No. 2A	<u> </u> calendar days

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The undersigned represents and warrants that they have complied and shall comply with all requirements of local, state, and national laws; that no legal requirement has been or shall be violated in making or accepting this bid, in awarding the contract to them or in the prosecution of the work required; that the bid is legal and firm; that they have not, directly or indirectly, entered into any agreement, participated in any collusion, or otherwise taken action in restraint of free competitive bidding.

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Upon receipt of written notice of the acceptance of this Bid, the Bidder shall, within twenty (20) calendar days, execute the agreement in the required form and deliver the Contract Bonds, and Insurance Certificates, required by the Contract Documents.

I am / We are an Individual / a Partnership / a Corporation

By: _____ Trading as: _____
(Individual's/General Partner's/Corporate Name)

(State of Corporation)

Business Address: _____

Witness: _____ By: _____
(Authorized Signature)

(Title)

Date: _____

(SEAL)

ATTACHMENTS:

- Sub-Contractor List
- Non-Collusion Statement
- Bid Security
- (Others as Required by Project Manuals)

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SUBCONTRACTOR LIST

In accordance with Title 29, Chapter 6962 (d)(10)G Delaware Code, the following sub-contractor listing must accompany the bid submittal. The name and address of the sub-contractor must be listed for each category where the bidder intends to use a sub-contractor to perform that category of work. In order to provide full disclosure and acceptance of the bid by the Office of Management and Budget, Division of Facilities Management, it is required that bidders list themselves as being the sub-contractor for all categories where they are qualified and intend to perform such work.

<u>Subcontractor Category</u>	<u>Subcontractor</u>	<u>Address (City & State)</u>
1. Electrical	_____	_____ _____
2. Directional Boring	_____	_____ _____
3. Excavation	_____	_____ _____
4. High Voltage Terminations	_____	_____ _____
5.	_____	_____ _____

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NON-COLLUSION STATEMENT

This is to certify that the undersigned bidder has neither directly nor indirectly, entered into any agreement, participated in any collusion or otherwise taken any action in restraint of free competitive bidding in connection with this proposal submitted this date to the Office of Management and Budget, Division of Facilities Management.

All the terms and conditions of DHSS/OMB/DFM Contract No.: MC3505000016 have been thoroughly examined and are understood.

NAME OF BIDDER: _____

**AUTHORIZED REPRESENTATIVE
(TYPED):** _____

**AUTHORIZED REPRESENTATIVE
(SIGNATURE):** _____

TITLE: _____

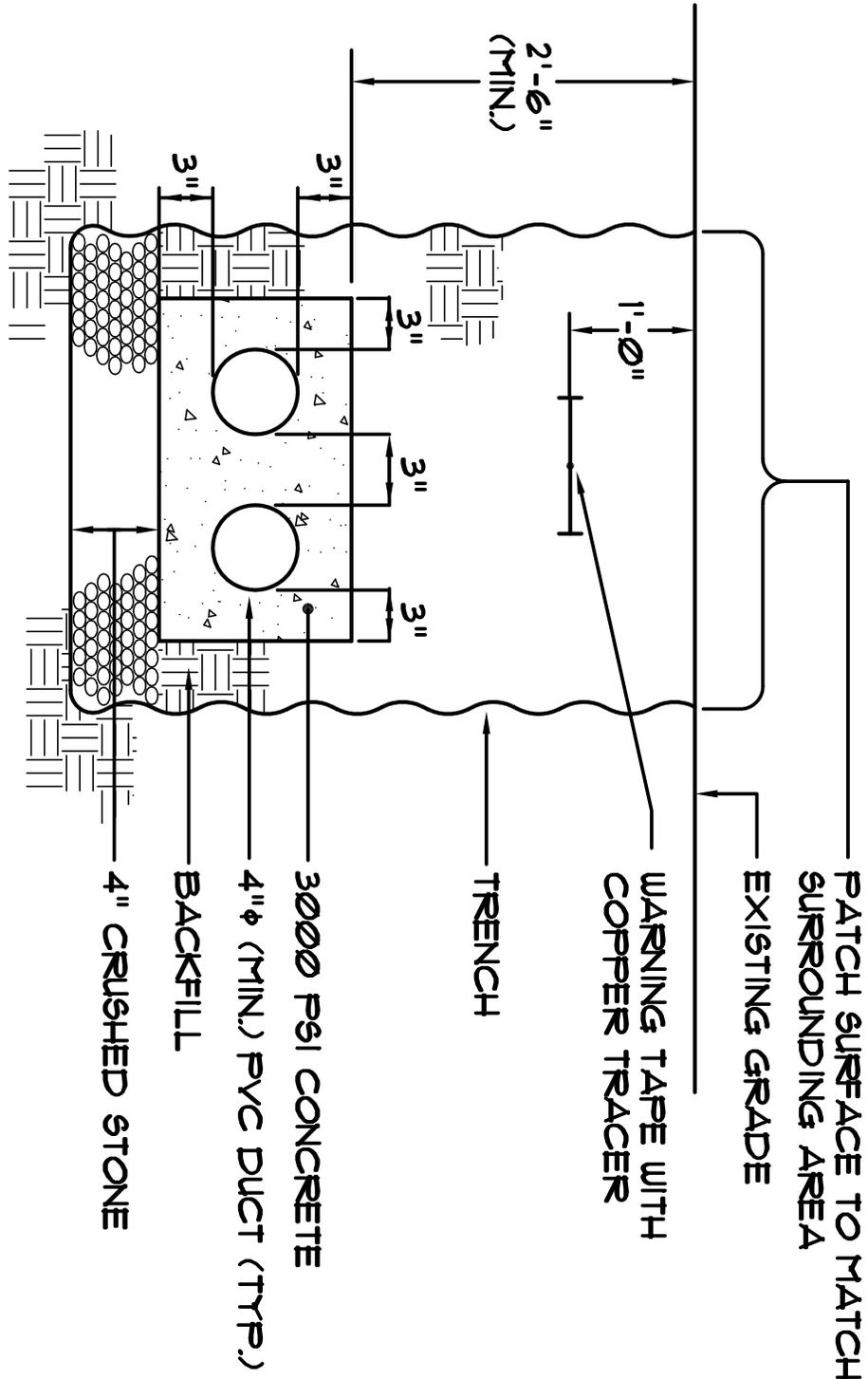
ADDRESS OF BIDDER: _____

PHONE NUMBER: _____

Sworn to and Subscribed before me this day of _____ 2011.

My Commission expires _____ NOTARY PUBLIC _____

THIS PAGE MUST BE SIGNED AND NOTARIZED FOR YOUR BID TO BE CONSIDERED.



TWO-WAY HIGH VOLTAGE DUCTBANK DETAIL

NO SCALE

PROJECT: NEW ELECTRICAL SERVICE - MEADOWS COTTAGE	DATE: 07/06/2011
GOVERNOR BACON HEALTH CENTER	SCALE: AS NOTED
SUBJECT: DUCTBANK DETAIL	SHEET AFFECTED: E-6
REVISION/ISSUE: ADDENDUM No. 2	SKETCH NO:
PROJECT NO: 09-1011	

SK-E6

SECTION 260513

HIGH VOLTAGE UNDERGROUND DISTRIBUTION

PART 1 - GENERAL

1.01 GENERAL PROVISIONS

- A. Applicable provisions of the entire specification, including Addenda, shall govern this section as fully as if repeated herein.
- B. Refer specifically to the technical provisions of Section 260499, "GENERAL REQUIREMENTS, ELECTRICAL."

1.02 SCOPE OF WORK

- A. The work under this section of the specification shall include all labor, materials, appliances and services necessary for and incidental to the primary completion of the High Voltage Distribution System for this structure and related work shown, implied or required by the drawings and/or described hereinafter.
- B. Electrical Service
 - 1. New Electric Service shall be 12,470/7200 VAC, 3 phase, 4 wire, taken from the campus aerial distribution system.
 - 2. Service shall run underground with necessary conduit and conductors for connection to a new terminal pole provided by this contractor. Contractor shall provide underground duct and terminations.
 - 3. Provide pad mounted transformers, load break tapping cabinets, precast concrete pads, grounding, etc.
 - 4. Provide all Primary and Secondary cables of size as indicated and make all connections to the transformer in accordance with and as specified. Primary Cables shall be as herein specified.

1.03 SUBMITTALS

- A. Submittals shall be in accordance with Section 260499, "GENERAL REQUIREMENTS, ELECTRICAL.
- B. Submit manufacturer's specifications and data showing dimensions, weights, capacities ratings, performance with operating points clearly indicated, finishes of materials and installation instructions for the following:
 - 1. Conduit
 - 2. Insulating Tape
 - 3. High Voltage Cables
 - 4. High Voltage Cables Terminating Kits
 - 5. Terminator
 - 6. Precast Concrete Transformer Pad
 - 7. Padmount Transformer
 - 8. Mule Tape
 - 9. Manholes, frames and collars
 - 10. Precast concrete pads
 - 11. Concrete
- C. Provide manufacturer's statement certifying that the product supplied meets or exceeds contract requirements for the following:
 - 1. High Voltage Cable
 - 2. High Voltage Terminator
- D. Submit cable terminator's Certificate of Competency.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Provide materials and equipment listed by UL or approved by Factory Mutual (FM) system, when such equipment is listed or approved.

2.02 CONDUIT

- A. Conduit shall be plastic, conforming to the following:
 - 1. Plastic duct for concrete encased burial shall be PVC or polyethylene and shall conform to NEMA TC6, TC8 and ASTM F-512 polyethelene, fusion welded.
 - 2. In conduit encased installation, duct shall be PVC, type EB.
 - 3. Tape: Plastic insulating tape shall conform to the requirements of UL 510.
- B. Rigid Steel 90° shall conform to Section 260500, Part B.

2.03 POWER WIRE AND CABLE

- A. Wire and cable conductor sizes are designated by American Wire Gauge (AWG). Conductors shall be copper. Insulated conductors shall bear the date of manufacturer imprinted on the wire insulation with other identification. Wire and cable manufactured more than 12 months before delivery to the job site shall not be used. Cable Standard of Design is Okonite. Prysmian approved equivalents acceptable.
- B. Primary wire and cables shall be as follows: 25 KV primary underground cable with concentric neutral Delmarva Power standard cable. Conductor to be #1/0 AWG solid aluminum with XLP (cross linked polyethylene) insulation and PVC outer jacket.
- C. Except as otherwise indicated, high voltage cable terminators for solid insulation nonmetallic jacketed cables shall be provided up to a maximum of 25 KV. Terminators shall be applied to single conductor cables which are exposed to the weather. The terminator and all components shall be the product of one manufacturer and finished in a package or kit form compatible with the insulation and conductor material. The kit shall include complete assembly and installation instructions. Contractor shall supply one complete copy of all manufacturer's instructions and information. The terminator shall comply with all requirements of IEEE 48, Class 1 except that the requirements of design tightness test need not be met. However, the terminator shall not exude any filler compound under either test or service. The terminator shall have a wet process porcelain insulator for outside weather service.

2.04 HIGH VOLTAGE CABLE TERMINATIONS

- A. Interior high voltage terminations shall comply with the requirements of IEEE Standard 48, Class 3, hand-wrapped stress cones, tapes or pennant type, or slip-on stress cones rated for use with cable provided.
- B. The termination material shall be the product of one manufacturer who shall furnish all components in the form of a kit which includes complete instructions which shall be followed for fabrication and installation except that two half lapped layers of self-adhesive silicone tape shall be applied overall.
- C. Termination shall include stress-relief cones and shield grounding.
- D. On conduit riser at aerial service connection:
 - 1. 25kV class, single piece terminator (class 1), with skirts, Elastimold Cat. No. PCT2-240-3/4/5.
- E. In pad mount transformer and tapping cabinet:
 - 1. 200 amp load break elbows with test point, standard of design is Elastimold Cat. No. 274LR-WX.
- F. Provide bushings, feed thru inserts, insulated parking bushings, ground caps and bushing inserts in all new primary equipment.

2.05 GROUNDING

- A. Ground rods shall be copper clad steel with a diameter adequate to permit driving to full length of the rod, but not less than 3/4 inch in diameter and 10 feet long unless otherwise indicated.

2.06 GROUND RING

- A. At each pad mounted primary switchgear (transformers, switch, etc.), provide a ground ring.

- B. Ground ring shall consist of a #4/0 bare copper conductor installed 18" from outer edge of concrete pad frost wall. Set 8'-0" ground rods on all corners and on 8'-0" intervals.
- C. Bond ground ring to ground rods with exothermic weld mounts (cap weld) connectors. Bond ground ring to main electric ground rod or ground bus in switchgear.
- D. Provide Fall-of-Potential test of each ground ring. Do not energize equipment until test reveals a low impedance (less than 5 ohms) path to earth ground.

2.07 PAD MOUNT TRANSFORMER

- A. Transformer shall be compartmental type, self-cooled, radial feed, dead front, Envirotron™ fluid filled, weather and tamper proof for pad mounting. All transformers shall meet 2010 DOE minimum efficiency requirements.
- B. Transformer #1 shall be rated 55°/65°C Rise, loop feed 12470 Delta primary, 480y/277 VAC GND Y Secondary, 3 Phase, with (2)-2 1/2% taps above and below rated voltage. Provide tap changer for de-energized operation only. Impedance shall be ANSI standard, 5% Nominal.
- C. Transformer #2 shall be residential style, rated 45KVA, 65°C Rise, 7,200VAC primary, 120/240VAC Secondary, 1 Phase, with (2)-2 1/2% taps above and below rated voltage. Provide tap changer for de-energized operation only. Impedance shall be ANSI standard, 5.75% nominal.
- D. Transformer primary shall be rated 95KV BIL, Secondary: 30KV BIL. High voltage compartment shall be on left and shall be interlocked with low voltage compartment on right so low voltage door must be opened before high voltage compartment is accessible. Terminations shall be dead front with well mounted load break fuse holders, current limiting fuse sized for 1.5 times full load current, mechanically interlocked with a three phase 200 ampere on-off oil immersed switch and 9 KV class lightning arrestors and feed through inserts.
- E. All fuses shall meet Coordination Study fuse requirements to properly coordinate upstream and downstream overcurrent protective devices.

- F. Low voltage compartment shall contain nameplate, and blade type spade terminals. Low voltage neutral shall be an insulated bushing grounded to the transformer tank by a removable ground strap. High and low voltage neutrals shall be internally connected.
- G. Provide filterpress and filling plug, drain plugs, liquid level indicator and dial type thermometer.
- H. Provide three (3) spare fuses.
- I. Transformer shall be pad-mount, Munsell Green #7GY3.29/1/5 as manufactured by RTE, ABB or Square D.
- J. Transformer Schedule:

	<u>Unit</u>	<u>Load Served</u>	<u>KVA</u>	<u>Temp. Rise</u>	<u>Sec. Volt</u>	<u>Feed Thru Inserts</u>
1.	TR-1	Main Building	750	55°/65°	480y/277V	No

2.08 POLE TOP TRANSFORMER

- A. Transformer shall be rated 480vac single phase primary, 120/240 VAC secondary, 37 ½ KVA, oil filled, weatherproof for pole mounting.
- B. Transformer shall be as manufactured by Cooper, ABB, Siemens or equal.

2.09 CAULKING COMPOUND

- A. Compound for the sealing of conduit risers shall be of putty like consistency workable with the hands at temperature as low as 35 degrees F, shall pump at a temperature of 300 degrees F, and shall not harden materially when exposed to air. The compound shall readily caulk or adhere to clean surfaces of the materials with which it is designed to be used. The compound shall have no injurious effects upon the hands of workmen or upon the materials. Material shall be UL listed for its intended purpose.

2.10 CONDUIT SPACERS

- A. Conduit spacers shall be manufactured of high impact polyethylene with sizes required by the conduits within the duct. Standard of design is Carlon Snap-Loc Type 5288/5289 as required. Provide reducer Type 5287 and Re-Bar Holder 5258 as required.

2.11 METAL FRAMES, COVERS AND GRATINGS

- A. Provide cast iron frames, covers and gratings conforming to Fed. Spec. RR-F-621.

2.12 PRECAST MANHOLES & EQUIPMENT PADS

- A. Provide precast manholes and equipment pads complete with all accessories, sumps, drains, facilities, collars, etc. required. Each casting shall be identified by having the manufacturers name and address cast into an interior face or permanently attached thereto.
- B. The complete assembly, including neck, collar, frame, and cover shall be rated for AASHTO H20 wheel loading. Submit manufacturer's certificate of compliance with requirements. Manholes shall be A.C. Miller, Penncast or equal. Manhole covers shall be 36 inches in diameter and shall have "ELECTRIC" cast in the cover.
- C. For manholes serving underground telecommunications services, cover shall have "ELECTRIC" cast in the cover.
- D. Pulling-in irons shall be steel bars cast in the walls and floors. In the floor they shall be centered under the manhole, and in the wall they shall be not less than 6 inches above or below, and opposite the conduits entering the manhole. Pulling-in irons shall be projected into the manhole approximately 4 inches. Irons shall be zinc-coated after fabrication.
- E. Cable racks, including hoods and insulators, shall be sufficient to accommodate the cables and shall be spaced not more than 18 inches horizontally.
- F. Equipment pads shall be two (2) piece construction, comprised of sides and top with formed opening for conduits entering pad.

2.13 CABLE RACKS IN MANHOLES

- A. Provide UL listed, 50% glass reinforced polymer cable racks in all manholes to support primary cables.
- B. Racks shall be 10" in length, Model MM10, and have optional HDL arm lock on each arm.
- C. The cable racks consist of a stanchion that shall be attached to the manhole wall in accordance with the manufacturer's recommendations and adjustable arms that lock into the stanchion. At least two (2) stanchions shall be installed on each manhole wall. Two (2) spare arms shall be installed at each stanchion for future use.
- D. Stanchions shall be 36" in length, shall incorporate multiple arm mounting holes that are 4" apart, and recessed bolt mounting holes. Holes or slots in the arms shall be provided to secure cables to racks with cable wire ties. The cable racks shall have a rated working load capacity of 400# and shall be marked with the manufacturer's name, plant location, and date manufactured.
- E. Provide cast-in-place or drop-in anchors to secure all stanchions to the manhole walls.
- F. Complete rack and stanchion assembly shall be manufactured by Underground Devices, Inc., 3304 Commercial Ave., Northbrook, IL 60062.

PART 3 - EXECUTION

3.01 PHASING NOTES

- A. The Meadows Cottage complex is a 24 hr/day, 7 day/week, 365day/year operation that services clients that live in the various cottages and provides essential services to these clients from the main support building.
- B. Under no conditions will any shutdowns be permitted without the express written approval by the Engineer and Owner. A minimum of seven (7) working days notice shall be given to coordinate shutdowns with the program/operations of the building.

- C. Any shutdowns to either the main building or any of the ten (10) remote cottages must be augmented with an emergency generator sized to handle the load of each building. Each cottage requires a 100kw generator. Four (4) generators will be provided by this contractor during a shutdown that affects the cottages. Clients will be relocated to accommodate the four (4) generator requirement. The main building maintains an existing 350KW diesel fired emergency generator and a separate generator to serve the main building will not be required.

- D. During Phase 3B, as described below, temporary services within the building will be required to maintain power to select loads. Provide up to two (2) 200amp circuits to feed select panels. Extended shutdowns of any duration must be kept to an absolute minimum. Once a shutdown is commenced, work shall continue uninterrupted until such time that permanent power is restored to all loads.

- E. The following is a suggested phasing sequence to minimize disruption to the facility during the replacement of the main switchgear. Contractor shall provide their own phasing sequence for approval prior to any planned shutdowns.
 - 1. Phase 1
 - a. Install new primary underground service from existing Service #1 through Tapping Cabinet #TC-1. Extend primary services to new pad mount transformer.

 - b. Provide a new pad mount transformer.

 - c. Extend secondary conduits from the new transformer to existing primary manhole #1, currently serving the primary switchgear. 2 to 4 hour shutdown to penetrate existing manhole with new conduits DAY #1.

 - d. Install temporary secondary feeders from new transformer to existing secondary switchboard. De-energize both existing primary services serving existing primary switchboard and transformer. 4 – 8 hour shutdown to make connections DAY #2. Temporary generators are required. Building generator is required.

2. Phase 2

- a. Disconnect and remove the existing primary services in their entirety, including underground primary feeders, three (3) air interrupter switches and transformer. Dispose of transformer properly.
 - b. Install new secondary 480vac switchboard including main circuit breaker, feeder circuit breakers, digital meter and Transient Voltage Surge Suppression.
 - c. Install new permanent secondary service from pad mount transformer new switchboard. Do not connect.
 - d. Pre-cut new conduits and secondary feeder conductors from new switchboard to existing switchboard.
3. Phase 3A
- a. Connect permanent secondary service from pad mounted transformer to new switchboard & remove temporary service to existing switchboard. 8 hour shutdown to make all connections and terminate DAY #3. Temporary generators are required. Building generator is required.
4. Phase 3B
- a. Remove existing distribution section in its entirety and extend new secondary conductors from new switchboard to new Termination Enclosure. 8 – 16 hour shutdown to make all final connections DAY #4. Temporary generators are required. Building generator is required.
5. Phase 4
- a. Prior to the de-energization of the existing primary aerial service #2, the single phase pad mounted transformer to serve the street light circuit and the single phase pole top transformer to serve the boat ramp must be completed.

3.02 GENERAL

- A. Underground cable installation shall conform to ANSI C2 and NFPA 70 except as otherwise specified or indicated.
- B. The Contractor shall promptly repair any utility lines or systems damaged by their operation.
- C. Refer specifically to Section 260543 - Utility Conduits by Directional Boring. This shall be the primary means of underground conduit installations.
- D. Under the appropriate alternate, open cut- excavation methods shall be used.

3.03 UNDERGROUND DUCT WITH CONCRETE ENCASEMENT

- A. Underground duct lines shall be constructed of individual conduits encased in concrete. Except where rigid galvanized steel conduit is indicated or specified, the conduit shall be PVC Type EB. The kind of conduit used shall not be mixed in any one duct bank. Ducts shall not be smaller than 4 inches in diameter unless otherwise indicated.
- B. The concrete encasement surrounding the bank shall be rectangular in cross-section and shall provide at least 3 inches of concrete cover for ducts. Conduit shall be separated by a minimum concrete thickness of 3 inches.
- C. Separation of conduits shall be accomplished by the use of pre-manufactured spacers. Spacers shall be installed to maintain the required concrete cover around all areas of conduits and be spaced at intervals not exceeding 8 feet on center.
- D. Provide reinforcing in duct banks under roadways and paved areas using # 4 rods on 12 inch center each way or in lieu thereof use concrete encased rigid steel conduit.
- E. The top of the concrete envelope shall not be less than 30 inches below grade or as required by the utility.
- F. Duct lines shall have a continuous slope downward toward manholes and away from buildings with a pitch of not less than 3 inches in 100 feet. Except at conduit risers, changes in direction runs exceeding a total of 10 degrees, either vertical or horizontal, shall be accomplished by long sweep bends having a minimum radius of curvature

of 25 feet, sweep bends may be made of one or more curved or straight sections or combinations thereof.

- G. Manufactured riser bends shall have a minimum radius of 18 inches for use with conduits of less than 3 inches in diameter and a minimum radius of 24 inches for ducts of 3 inches in diameter or larger unless noted otherwise.
- H. All other bends which change or off-set the direction of the ductbank shall be made with rigid steel conduit, having not less than a 60" minimum radius.
- I. Conduits shall terminate in end-bells where duct lines enter manholes. Separators shall be of precast concrete, high impact polystyrene, steel, or any combination of these. The joints of the conduits shall be staggered by rows and layers so as to provide a duct line having the maximum strength. During construction, partially completed duct lines shall be protected from the entrance of debris such as mud, sand and dirt by means of suitable conduit plugs.
- J. As each section of a duct line is completed from manhole to manhole, a testing mandrel not less than 12 inches long with a diameter of 1/4 inch less than the size of the conduit, shall be drawn through each conduit, after which a brush having the diameter of the duct, and having stiff bristles shall be drawn through until the conduit is clear of all particles of earth, sand, and/or gravel; conduit plugs shall then be immediately installed. Provide a plastic pull rope, having 3 feet of spare at each end.

3.04 CONCRETE

- A. Concrete for electrical requirements shall be at least 3500 psi concrete with one 1 inch maximum aggregate conforming to the requirements of Division 3 of these specifications.
- B. Concrete shall be composed of fine aggregate, coarse aggregate, Portland cement, and water so proportioned and mixed as to produce a plastic, workable mixture. Fine aggregate shall be of hard, dense, durable, clean, and uncoated sand. The coarse aggregate shall be reasonably well graded from 3/16 inch to 1 inch. The fine and coarse aggregates shall be free from injurious amounts of dirt, vegetable matter, and soft fragments of other deleterious substances. Water shall be fresh, clean, and free from salts, alkali, organic matter, and other impurities. Concrete shall have a compressive strength of 3500 psi at the age of 28 days. Slump shall not exceed 3 inches. Retempering of concrete will not be permitted.

- C. Exposed, unformed concrete surface shall be given a smooth, wood float finish. Concrete shall be cured for a period of not less than 7 days, and concrete made **with** high early strength Portland cement shall be repaired by patching honeycombed or otherwise defective areas with cement mortar as directed by the Engineer.
- D. Provide freeze protection for concrete when the ambient temperature falls below 40°F.

3.05 EXCAVATION & BACKFILLING

- A. Provide a plastic warning tape with continuous copper tracer approximately 12 inches below the top of the trench in the backfill. DETECTOTAPE is standard of design. Backfill shall be placed in layers not more than 6 inches thick and each layer shall be compacted.
- B. All excavation required under this section shall be performed by the Electrical Contractor. Coordinate all excavation with General Contractor prior to commencement.
- C. Backfilling shall progress as rapidly as the construction, testing and acceptance of the work permits. Backfill shall be free from roots, wood scrap material, and other vegetable matter and refuse. Compaction of backfill shall be to 90 percent of maximum density and in compliance with Division 2 requirements.

3.06 RECONDITIONING OF SURFACES

- A. Unpaved surfaces disturbed during the installation of duct shall be restored to their original elevation and condition. Sod or topsoil shall be preserved carefully and replaced after the backfilling is completed.
- B. Sod that is damaged shall be replaced with sod of quality equal to that removed. Where the surface is disturbed in a newly seeded area, the restored surface shall be reseeded with the same quantity and formula of seed as that used in the original seeding.
- C. The Contractor shall patch pavement, sidewalks, curbs and gutters where existing surfaces are removed for construction. Cut pavement edges shall be sawn. Graded aggregate base course shall have a maximum aggregate size of 1-1/2 inches.

Thickness of base course shall match existing but shall be at least 6 inches. Asphalt concrete shall be hot plant mixed and hot laid. Maximum aggregate size shall be ½ inch and match existing, but shall be at least 2 inches. Portland cement concrete pavement, sidewalks, curbs, and gutters, shall be repaired using 3500 psi concrete as specified in Division 3. Pavement thickness shall match existing thickness but shall be at least 6 inches. Sidewalk thickness and curb and gutter cross-sections shall match the existing.

3.07 CABLE PULLING

- A. Cables shall be pulled down grade with the feed-in point at the manhole or buildings of the highest elevation. Flexible cable feeds shall be used to convey cables through the manhole opening and into the duct runs.
- B. Cable lubricants shall be soapstone, graphite or talc for rubber or plastic jacketed cables. Lubricants for assisting in the pulling of 25 KV jacketed cables shall be those specifically recommended by the cable manufacturer.
- C. Cable pulling tensions shall not exceed the maximum pulling tension recommended by the cable manufacturer.
- D. Cables shall not be installed utilizing the shortest route, but shall be routed along those walls providing the longest route and the maximum spare cable lengths. All cables shall be formed to closely parallel walls, not to interfere with duct entrances, and shall be supported on brackets and cable insulators at a maximum of four (4) feet.
- E. Fireproofing (Arc Proofing) of Cables in Manholes, Handholes and Vaults: All wire and cables which will carry current at 2200 volts or more in manholes, handholes, and vaults shall be fireproofed.
 - 1. Strips of fireproofing tape approximately 1/16 inch thick by 3 inches wide shall be wrapped tightly around each cable spirally in half-lapped wrapping, or in two butt-joined wrappings with the second wrapping covering the joints in the first. The tape shall be applied with the coated side toward the cable and shall extend one inch into the ducts.
 - 2. To prevent unraveling, the fireproofing tape shall be random wrapped the entire length of the fireproofing with pressure sensitive glass cloth tape. The

fireproofing tape shall consist of a flexible, conformable fabric having one side coated with flame retardant, flexible polymeric coating and/or a chlorinated elastomer not less than 0.050 inch thick and shall weight not less than 2.5 pounds per square yard.

3. The tape shall be non-corrosive to cable sheath, shall be self-extinguishing, and shall not support combustion. The tape shall not deteriorate when subjected to oil, water, gases, saltwater, sewage and fungus.

3.08 CABLE PULLING PLAN

- A. At the same time primary cable shop drawings are submitted for review and approval, a Cable Pulling Plan shall be submitted by the cable manufacturer.
- B. The Cable Pulling Plan shall clearly indicate the following:
 1. Length of run of each pull from beginning to end.
 2. Quantity and location of all bends, offsets, manholes and termination points.
 3. Size of conduit in which cable is to be pulled.
 4. Size of cable to be installed in conduit (including ground conductor).
 5. Maximum permitted pulling tension on each cable and cable assembly.
 6. Actual pulling tension calculated on cable based on direction and length of run.
 7. Maximum sidewall pressure on cable.
 8. Actual sidewall pressure calculated on cable based on direction and length of run.
 9. Maximum jam ratio on cable.
 10. Actual jam ratio calculated based on direction and length of run.

- C. This plan shall clearly state the direction that this cable is to be pulled, the pulling device and number of pulls required to install the cable from end to end.
- D. No deviations to this pulling plan will be permitted during construction without the cable manufacturers' written approval.
- E. In the event the cable is not installed in accordance with this pulling plan, the cable shall be withdrawn and an entire new run of cable installed at no cost to the Owner.

3.09 CABLE TERMINATING

- A. Terminations of insulated power and lighting cables shall be protected from accidental contact, deterioration of coverings and moisture by the use of terminating devices and materials. Terminations shall be made using materials and methods as indicated or specified herein or as designated by the written instruction of the cable manufacturer and termination kit manufacturer.
- B. Termination for high voltage cables shall be rated, and be capable of withstanding test voltages in accordance with IEEE 48.
- C. Splices shall be made only in accessible locations in manholes or handholes and shall be suitable for continuous submersion in water.
- D. High voltage cable splicer/terminator certification of competency and experience shall be submitted 30 days before splices or terminations are made in high voltage cables. Splicer terminator experience during the immediate past three years shall include performance in splicing and terminating cables of the type and classification being provided under this contract.
- E. High voltage splices shall be made using a "kit" which shall be the product of one manufacturer and shall have the approval in writing of the manufacturer of the cable which is to be spliced. The Contractor shall provide the inspector with a copy of the manufacturer's instructions before splicing is started. Splices shall be made in manholes or handholes.
- F. Splices in shielded cables shall include covering the spliced area with metallic tape, or like material, to the original cable shield and by connecting it to the cable on each side of the splice. Provide a No. 6 AWG bare copper ground connection brought out in a watertight manner and grounded to a 3/4 inch by 10 foot ground rod as part of

the splice installation. Wire shall be trained to the sides of the enclosures in a manner to avoid interference with the working area.

3.10 PRECAST MANHOLES & EQUIPMENT PADS

- A. A commercial precast assembly shall be set on six (6) inches of level, 90 percent compacted crushed rock fill, 3/4 inch to 1 inch size, extending 12 inches beyond the manhole on each side. Granular fill shall be compacted by a minimum of four passes with a plate type vibrator. Installation shall conform to the manufacturer's instructions.
- B. Cast-iron frames, covers and gratings not buried in masonry shall be cleaned of mortar, rust, grease, dirt and other deleterious materials, 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 zinc chromate primer and one coat of synthetic exterior glass enamel.
- C. Concrete encased duct lines connecting to manholes shall be constructed to have a tapered section adjacent to the manhole to provide shear strength. Manholes shall be constructed to provide for keying the concrete envelope of the duct line into the wall of the manhole. Vibrators shall be used when this portion of the envelope is poured to assure a seal between the envelope and the wall of the manhole.
- D. For duct line connections to existing manholes, break the manhole wall out to the dimensions required and preserve the steel in the manhole wall. The steel shall be cut appropriately and bent out for tying into the reinforcing of the duct line envelope. Chip out the manhole walls to form a key for the duct line envelope. Provide necessary pumping as required for de-watering of existing manholes during construction.
- E. Shields shall be provided where cables enter and leave manholes, handholes, vaults, and other duct entrances and shall be of a suitable type manufactured for the purpose intended.

- F. Excavation for manholes shall be to depths required.
1. Excavated materials not required or suitable for backfill shall be removed from the project site. Provide sheeting and shoring as necessary for protection of work and safety of personnel. Remove water from excavation by pumping or other approved methods. Excavation shall be considered classified and ALL procedures required by OSHA shall be strictly adhered to.
 2. Backfilling around structures shall consist of earth, loam, sand-clay, or sand and gravel, free from large clods of earth or stones over one (1) inch in size. Backfill materials shall be placed symmetrically on all sides in loose layers not more than nine inches deep. Each layer shall be moistened, if necessary, and compacted with mechanical or hand tampers to 90 percent compaction. Surfaces disturbed during the installation of manholes and handholes shall be replaced as described under "Reconditioning of Surfaces."
 3. Top of manhole shall be set a minimum of 12" below finished grade with concrete collars provided to bring the manhole cover to proper elevation. In grass areas, manhole shall be set 18" below finished grade.

3.11 GROUNDING

- A. Noncurrent carrying metallic parts associated with electrical equipment shall have a maximum resistance to solid "earth" ground not exceeding the following values:
1. Ground manholes, handholes and vaults - 10 ohms.
 2. Grounding other metal enclosures of primary voltage electrical and electrically operated equipment - 10 ohms.
- B. Grounding electrodes shall be cone pointed driven ground rods driven full depth minus 6 inches, installed where indicated to provide an earth ground of the value before stated for the particular equipment being grounded.
- C. Grounding connections which are buried or otherwise normally inaccessible, and excepting specifically those connections for which access for periodic testing is required, shall be made by exothermic weld or by using a compatible mechanical connection and brazing over. Exothermic welds shall be made strictly in accordance

with the weld manufacturer's written recommendations. Welds which have "puffed up" or which show convex surfaces, indicating improper cleaning, are not acceptable. No mechanical connector is required at exothermic weldments.

- D. Grounding conductors shall be bare soft-drawn copper wire No. 4 AWG minimum unless otherwise indicated or specified. Provide ground conductor in each conduit in addition to the circuit conductors.

3.12 FIELD TESTS

- A. Test the high voltage cables after installation in accordance with the requirements of the appropriate IPECA-NEMA "Voltage Tests After Installation" paragraph in the particular specification for the cable involved. The contractor shall furnish the Architect with three copies of the results of the tests.
- B. Test ground rods for ground resistance value before any wire is connected. A portable ground testing megger shall be used to test each ground or group of grounds. The instrument shall be equipped with a meter reading directly in ohms or fractions thereof to indicate the ground value of the ground electrode under test.
- C. Refer to Section 260500 for further testing.
- D. Existing underground lines, transformers and secondary services shall be maintained during construction of the new service to the facility. The contractor shall provide temporary lines and connections to maintain the present services. All power outages shall be scheduled and obtain approval from Owner five (5) days in advance prior to any shutdown.
- E. Underground: Existing underground lines and their attachments shall be disconnected and removed after the new service has been energized.
- F. Transformer and Secondary Lines: The existing non-PCB transformers and primary equipment and secondary lines shall be disconnected and removed after the new service has been energized.
- G. The contractor shall provide all permits required for removal and transporting transformers and liquid.

3.13 REMOVAL AND DISPOSAL OF EXISTING OIL FILLED TRANSFORMERS

- A. Oil filled transformers are classified into three (3) categories for disposal purposes. They are:
1. PCB Free: This classification is reserved for transformers that measure less than 5PPM (parts per million) of Polychlorinated Biphenyl's.
 2. Non PCB: This classification is reserved for transformers that measure between 5PPM and 50PPM of PCB's.
 3. PCB Contaminated: This classification is reserved for transformers that measure greater than 50PPM of PCB's.
- B. The existing pad mounted transformer at the Meadow's Cottage facility was tested and found to contain 7PPM of PCB's. Transformer shall be removed and disposed of in accordance with TSCA requirements and a Uniform Waste Manifest provided to the Owner after disposal of unit at an approved PCB reclamation and Transformer recycling center.
- C. Contractor shall bear the expense to retest both the pad mounted transformer and the existing pole top transformer and provide evidence of the PCB level in each transformer prior to removal. The existing pole top transformer was not tested for the presence of PCB's.
- D. If the pole top transformer is found to have greater than 50PPM of PCB's, an extra will be granted for the disposal cost only of this unit. Removal costs and disposal costs for transformer testing less than 50PPM shall be included in the base bid.

END OF SECTION 260513

END OF ADDENDUM NO. 2 SPECIFICATIONS