PSEG LONG ISLAND LLC

On Behalf of and as Agent for the

LONG ISLAND LIGHTING COMPANY d/b/a LIPA

Southampton to Deerfield Transmission Project

EXHIBIT E-3 — UNDERGROUND CONSTRUCTION

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EXHIBIT E-3: UNDERGROUND CONSTRUCTION

E-3.1. Cable Design

The high voltage cable required for the Project[1] will be designed for underground construction and operation. The Project's transmission lines will consist of a new 138 kV underground solid dielectric transmission line connecting the Southampton Substation to the Deerfield Substation. There are approximately 4.5 circuit miles between the Southampton Substation and Deerfield Substation.

The Facility will consist of three 2,000 square millimeter compact-segmental copper conductors measuring approximately 5.56 inches in diameter. The conductor will be a Milliken conductor comprised of annealed bare copper strands. The insulation will be XLPE with a thickness of approximately 850 mils, rated to an operating voltage of 138 kV. Metallic shielding will be a corrugated aluminum or equivalent, moisture impervious sheath that is designed for the fault current requirements and will prevent water migration into the cable. The jacket will be black HDPE including a semi-conducting polyethylene layer. Refer to Figure E-3-1 for a typical cable cross-section. The cable system will be designed for operation at 138 kV, and its initial operating voltage will be 69 kV. All specifications described below are typical designs and will be further defined and finalized within the EM&CP.

The Project design will be in accordance with all applicable PSEG Long Island transmission design criteria and applicable industry standards. The industry standards are produced by the following organizations:

- AEIC
- ANSI
- ASTM
- ICEA
- IEC
- IEEE
- NEMA

[1] For clarity and consistency, the Application includes a Master Glossary of Terms that defines terms and acronyms used throughout the Application.

Additionally, design standards shall be in compliance with the Applicant's storm hardening requirements for a National Oceanic and Atmospheric Administration Category III Hurricane.

The components of the cable system include:

1. Compacted, segmented copper conductor with water blocking compounds
2. Super smooth semi-conductive conductor shield
3. Super clean XLPE insulation
4. Super smooth semi-conductive insulation shield
5. Semi-conductive longitudinal water blocking tapes
6. Corrugated seamless aluminum metallic sheath or equivalent
7. Black HDPE jacket
8. Semi-conductive polyethylene over jacket

E-3.2 Cable System Installation

The proposed circuit will be constructed underground primarily within public ROW. A combination of different construction methods will be used to install the conduits. The route will use open-cut trench excavation methods. While trenchless crossings are not anticipated, this method may ease construction spanning certain features or may minimize impacts should future conditions require it.

The industry standards are produced by the following organizations:

- ACI
- AISC
- ANSI
- ASTM
- ASCE
- IBC
- NEMA

E-3.2.1 Open-Cut Trench Construction

Along much of the proposed transmission line route, the general sequence of construction activities will include:

- Pavement saw-cutting,
- trench excavation,
- duct placement,
- backfilling, and
- pavement restoration.

In areas not under pavement or sidewalk, either within the public ROW or at limited locations where temporary and permanent easements are proposed, construction activities will also include vegetation clearing and grubbing and restoration. Refer to Figure E-3-2 for a typical duct bank cross-section.

E-3.2.2 Pavement Saw-cutting

Most of the Facility will be installed within public ROW and under either road pavement or sidewalk concrete. To begin trench excavation, the existing pavement will need to be saw-cut and removed. The standard duct bank configuration requires that existing pavement be saw-cut on both sides of the planned excavation to a width of approximately 3 feet. All pavement will be properly restored consistent with applicable municipal, county, or state requirements once construction is complete.

E-3.2.3 Trench Excavation

In general, the trench will be excavated to a depth sufficient to provide a minimum of 3 feet and 6 inches of cover over the cable conduit. The construction contractor shall shore the trenches as necessary to meet OSHA standards. The standard duct bank configuration will require an excavation at least 3 feet in width to a minimum depth of 6 feet. Greater trench depth and/or alternative duct bank configurations may be required to avoid existing subsurface obstructions.

To minimize construction risks and delays due to unforeseen conditions, subsurface utility engineering will be performed during detailed design to locate and identify potential conflicts with existing utilities. In certain situations, it may be necessary to relocate existing utilities to allow for placement of the duct bank or splice vaults. Specific measures for the relocation of any existing utilities will be governed by the requirements of each specific utility owner.

E-3.2.4 Cable Installation and Splicing

Each cable will be installed in a 10-inch SDR 11 HDPE conduit. In addition to these conduits, two 4-inch SDR11 HDPE conduits will be installed for fiber optic communication and ground continuity conductor. The three power conduits will be arranged in a trefoil (triangular) configuration.

Cable splices will be 138 kV, 650 kV BIL, pre-molded style and proven to be compatible with the cable construction via a prequalification test performed in accordance with ICEA S-108-720 and IEC 60840. Splices will have sheath insulators and connections for sheath bonding and be suitable for long-term underwater operation to a depth of 10 feet. Splices will be performed at vault locations only and will be tested in accordance with IEEE Standard 404.

Cable terminations installed at the substations will be 138 kV, 650 kV BIL, outdoor style and proven to be compatible with the cable construction via a Prequalification Test performed in accordance with ICEA Standard S-108-720 and IEC Standard 60840. Terminations will be ANSI 70 gray, composite polymer type filled with insulating fluid protected by composite polymer isolation insulators to allow testing of the cable jacket. Terminations will be furnished with a connecting stud and a NEMA four-hole pad aerial lug. The aerial lug will be designed to carry the full emergency current without overheating. Terminations will be tested in accordance with IEEE Standard 48.

Sheath bonding will be multiple single-point with a maximum standing sheath voltage of 200 volts at rated steady-state loading. The 6 kV SVL will be the zinc oxide type. SVLs will be suitable for continuous operation with an applied voltage under either normal or emergency load and able to withstand over-voltages resulting from both single-phase to ground or three-phase system faults.

The bundle of conduits, as depicted in Figure E-3-2, will be strapped together to prevent movement during backfilling operations. To accommodate cable pulling, the minimum horizontal bend radius shall be maintained, except in special circumstances where limits are imposed by constraints such as above- or below-grade obstructions. Additionally, minimum vertical bend radius shall be maintained, except at the cable termination sweeps, which will use a lesser bend radius to accommodate cable clamping and cable termination at the substations. In no case shall the cable be bent to a radius less than that recommended by the manufacturer.

E-3.2.5 Temporary Pavement Restoration

The pavement may be temporarily restored upon completion of the trenching, duct placement, and backfilling to re-establish normal traffic operation. Temporary pavement restoration of hot-patch asphalt will be used until final pavement restoration occurs. The temporary hot-patch asphalt will be installed to the width of the saw-cut and match the existing roadway grade. Final restoration activities are further described below.

E-3.3 Splice Vault Installation

Splice vaults serve to install (pull) and connect (splice) successive lengths of cable. Each vault houses three cable splices, one splice for each phase of the circuits. Pre-cast concrete splicing vaults, measuring approximately 16'-0" length x 8'-0" width x 9'-0" height (inside dimensions) with approximate wall thicknesses of 12 inches, will be installed at approximate intervals of 2,000 – 2,500 feet along the underground route. Specific distances between splice vaults will be based on the number and severity of bends in the route verified by cable pulling tension and sidewall bearing pressure calculations, physical obstructions, topographic features, access requirements, cable pulling tension limitations, and maximum reel length quantities.

Vault excavations will be to an average depth of 12 feet with over excavations of 2 feet on each side for workspace. Each vault has two 36-inch diameter entry manholes. A cross section of a typical one-piece splice vault is shown in Figure E-3-3 and a cross section of a typical two-piece splice vault is shown in Figure E-3-4. Additionally, handholes shall be pre-cast measuring approximately 4'-6" length x 3'-6" width x 4'-0" height (inside dimensions) with approximate wall thickness of 6 inches and will be used to splice fiber optic communication cables. Cross sections of a typical handhole are shown in Figure E-3-5. Splice vaults and handholes shall be designed for H-20 loading and designed to limit water ingress.

Locations of splice vaults have been placed in areas to minimize construction impacts to traffic, businesses, and residences while also allowing adequate access for construction activities. Handholes will be placed at every splice vault.

E-3.4 Final Restoration

For construction within the public ROW and in areas of pavement disruption, final pavement restoration will be performed to standards outlined by the authority having jurisdiction over the ROW and will be performed prior to cable pulling and splicing operations.

In areas not under pavement or sidewalk, either within the public ROW or at limited locations where temporary and permanent easements are proposed, final restoration activities will be defined in the EM&CP.

E-3.5 Trenchless Crossings

No trenchless crossings are anticipated for this project. If a trenchless crossing is necessary, determination of which type of trenchless technology to utilize (e.g., Horizontal Directional Drill , Auger Bore), is generally defined by the limitations of technology, suitability of the soil conditions, location of existing structure foundations, and the availability of workspace.

E-3.5.1 Auger Bore Installation Method

Installation of an Auger Bore is typically ideal for shorter installations such as rail crossings and short road crossings. An Auger Bore installation consists of excavating and shoring two shafts, a sending shaft and receiving shaft, one on either side of the crossing. A sending shaft is typically larger, approximately 15'-0" length x 30'-0" width, to accommodate additional installation equipment and working space needed in the shaft. A receiving shaft is typically approximately 10"-0" length x 15'-0" width. Both shafts are excavated to approximately the same depth. Project requirements such as railroad or roadway restrictions and soil conditions usually dictate the depth required. Once the shafts are completed, equipment and material are lowered into the sending shaft.

Once the casing is in place, the conduit bundle can be installed and grouted into place. The conduit bundle transitions from the casing to an open-cut trench section on both ends and returns to the typical depth and configuration described in the open-cut installation.

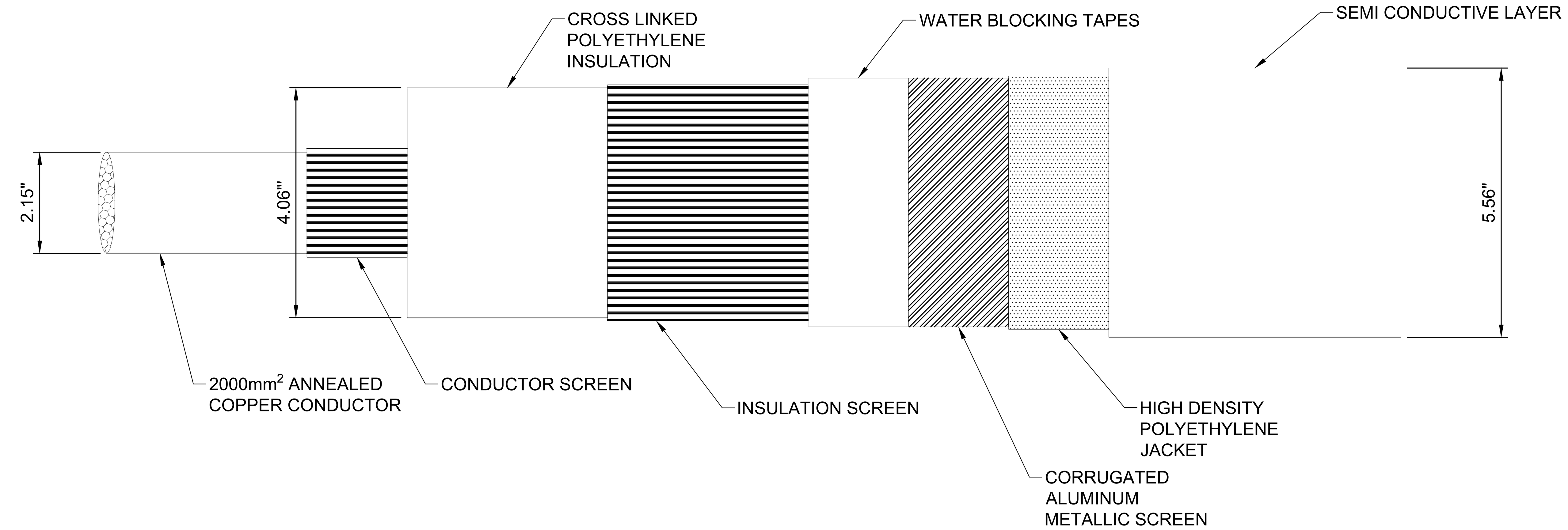
Lastly, all equipment is removed from each shaft, then the shaft is backfilled and restored to its original condition.

E-3.5.2 Horizontal Directional Drill Installation Method

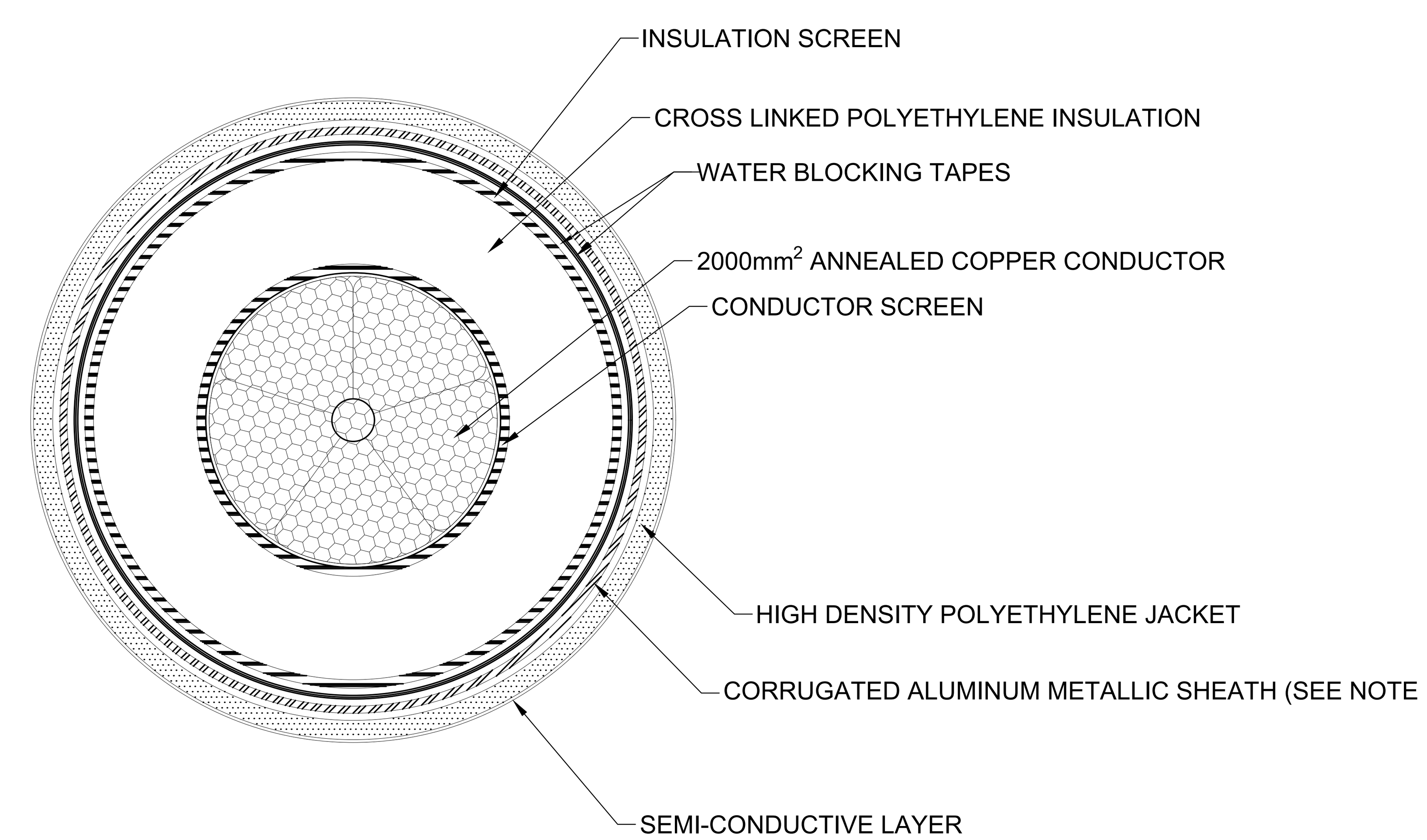
Installation of an HDD is typically ideal for longer installations such as water crossings. An HDD uses a surface mounted rig to drill a pilot hole along the path of the alignment. When the pilot hole exits the ground at the end point, a reamer is attached and pulled back through the pilot hole to increase the diameter of the bore path. Larger reamers will be added until the desired size of bore is reached. Once the bore hole is the correct size, a casing can be pulled through the bore hole. The conduits can then be installed in the bore hole and grouted into place. The conduit bundle transitions from the casing to an open-cut trench section on both ends and returns to the typical depth and configuration described in the open-cut installation.

FIGURE E-3-1

Typical Cable Cross-Section



138-kV 2000mm^2
ANNEALED COPPER
XLPE CABLE DETAIL



138-kV 2000mm^2
ANNEALED COPPER XLPE
CABLE CROSS SECTION

NOTE:
1. SHEATH MATERIAL AND CONFIGURATION TO BE DETERMINED AS PART OF THE ENVIRONMENTAL MANAGEMENT AND CONSTRUCTION PLAN. THIS MAY INCLUDE EITHER A CORRUGATED ALUMINUM METALLIC SHEATH AS SHOWN, OR A SHEATH UTILIZING COPPER CONCENTRIC NEUTRALS

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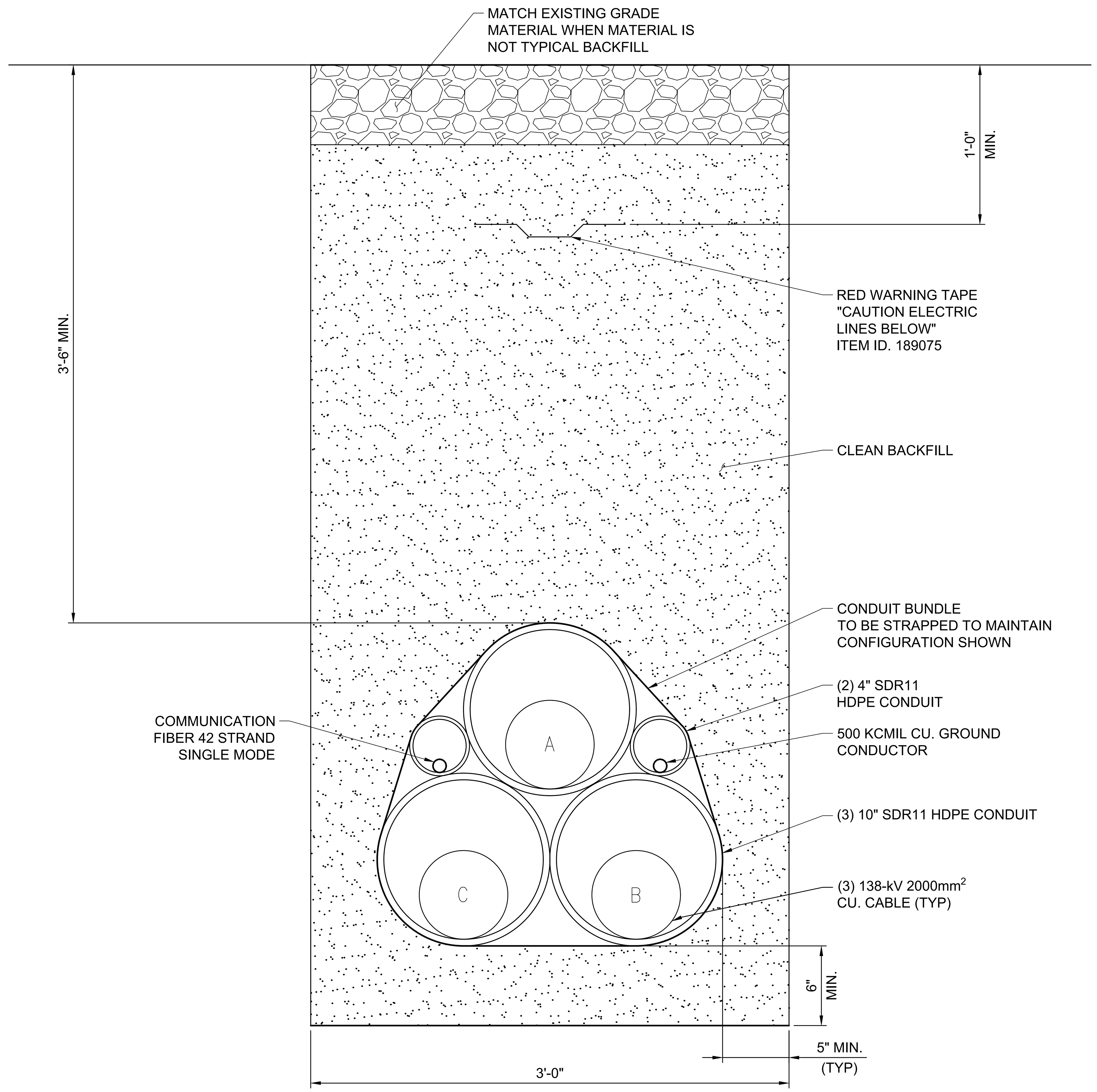
SOUTHAMPTON – DEERFIELD
138-kV TRANSMISSION LINE

SOUTHAMPTON TO DEERFIELD
FIGURE E-3-1
TYPICAL CABLE CROSS SECTION

PSEG LONG ISLAND
175 East Old Country Road
Hicksville, New York

FIGURE E-3-2

Typical Duct Bank Cross-Section



TYPICAL DIRECT BURIED CONDUITS IN
TREFOIL CONFIGURATION

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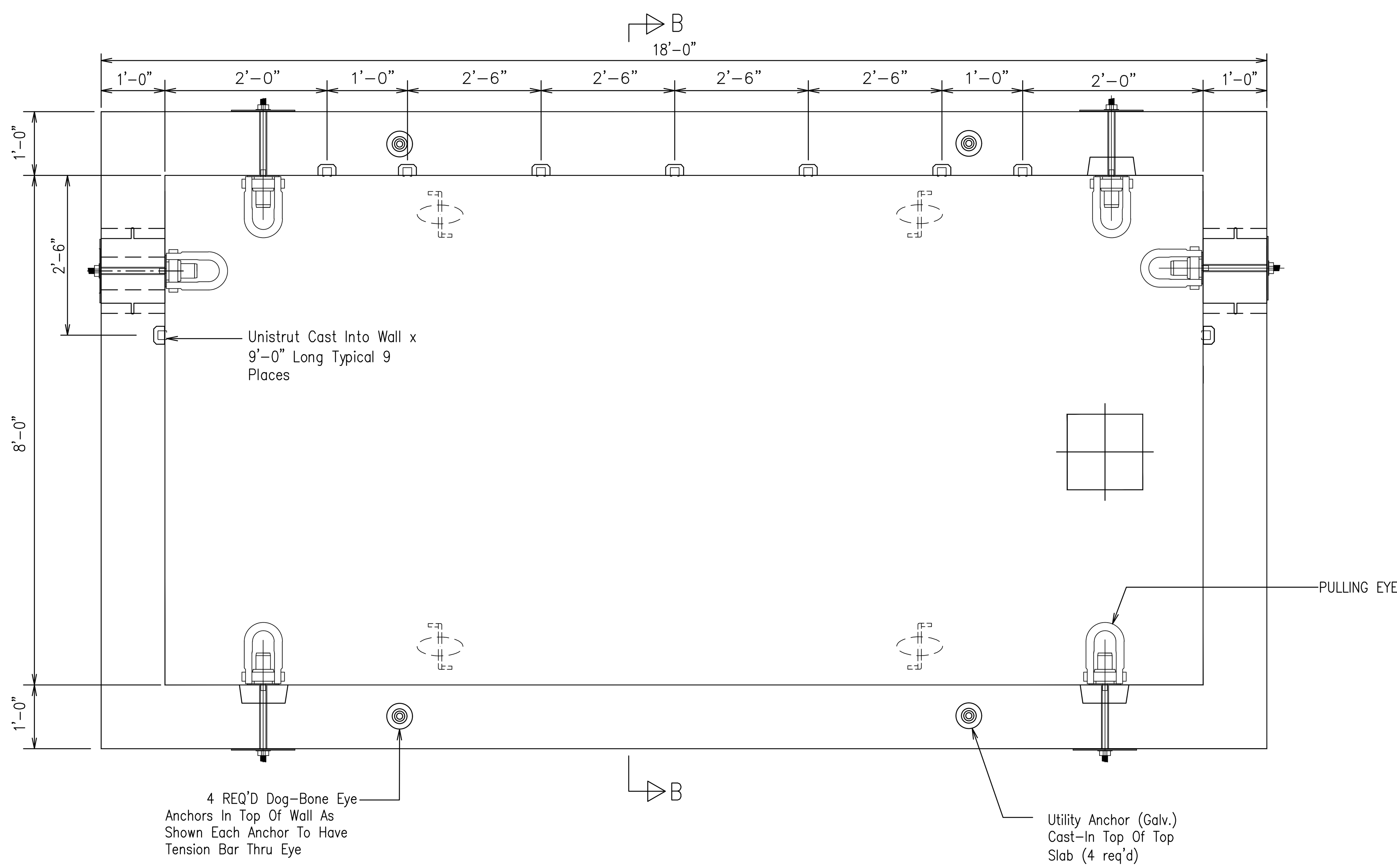
SOUTHAMPTON – DEERFIELD
138-kV TRANSMISSION LINE

SOUTHAMPTON TO DEERFIELD
FIGURE E-3-2
TYPICAL DUCT BANK CROSS SECTION

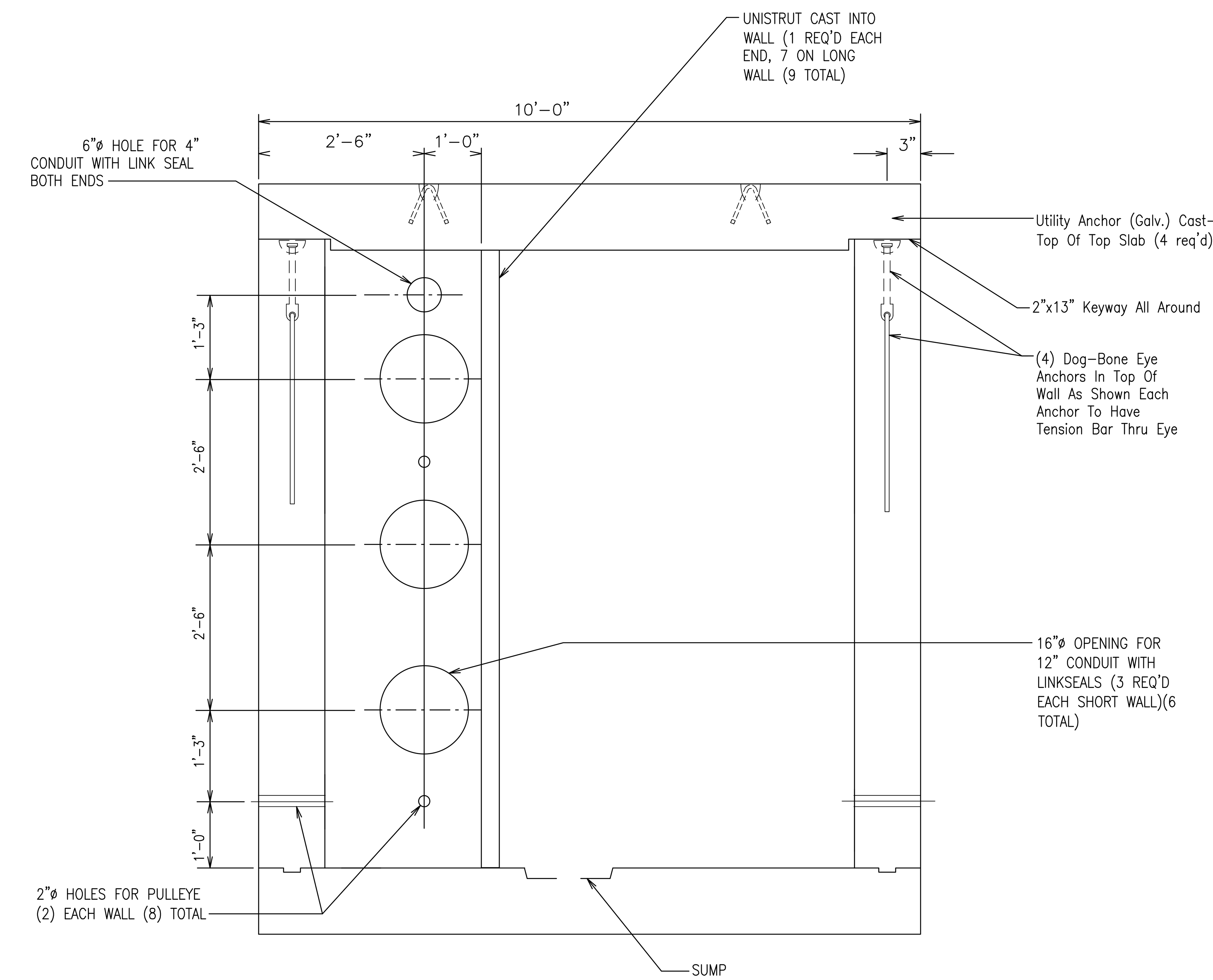
PSEG LONG ISLAND
175 East Old Country Road
Hicksville, New York

FIGURE E-3-3

Typical 138 kV One-Piece Splice Vault



SPICE VAULT PLAN VIEW



SPLICE VAULT FRONT VIEW

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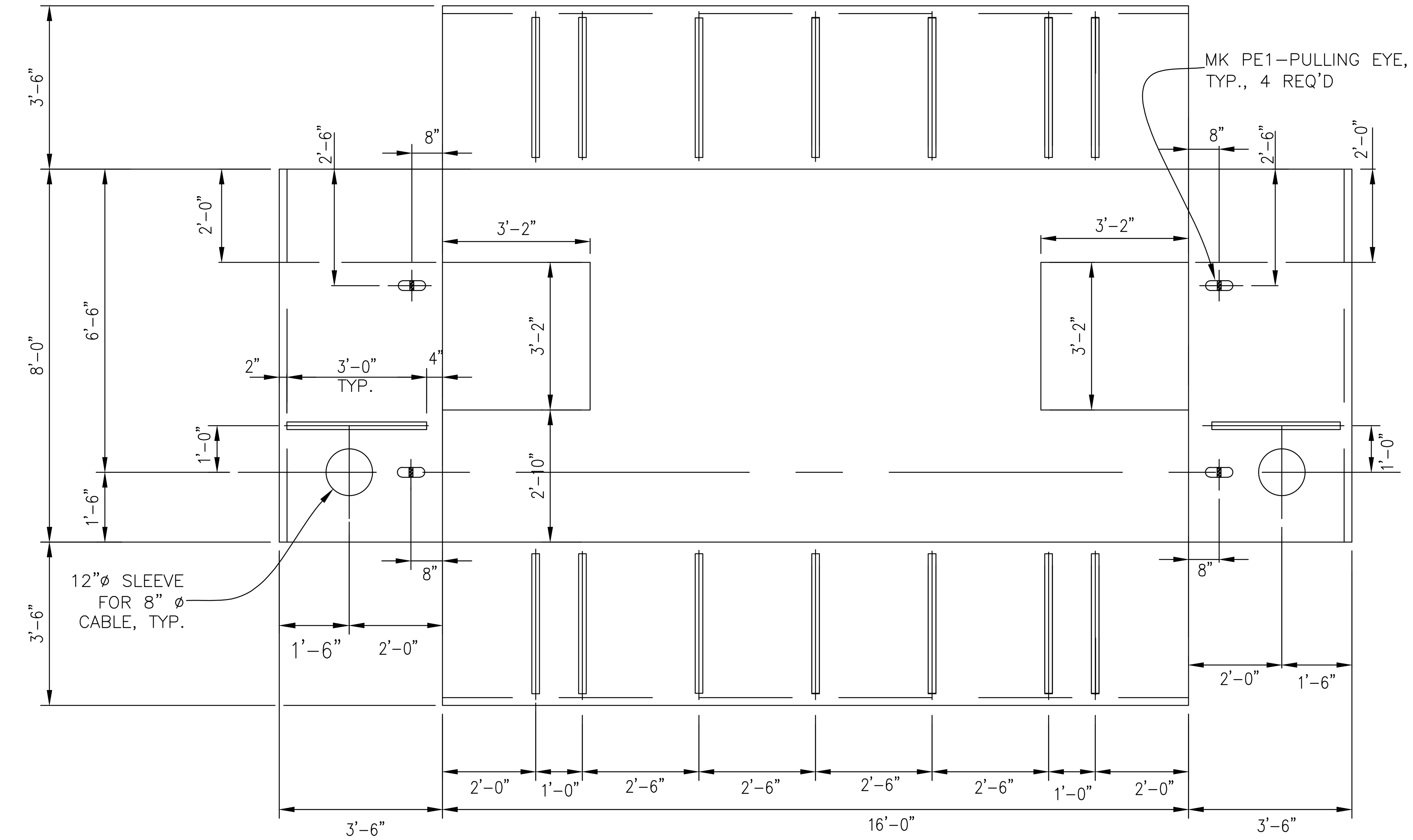
SOUTHAMPTON – DEERFIELD
138-kV TRANSMISSION LINE

SOUTHAMPTON TO DEERFIELD
FIGURE E-3-3
TYPICAL 138-KV ONE-PIECE SPLICE VAULT

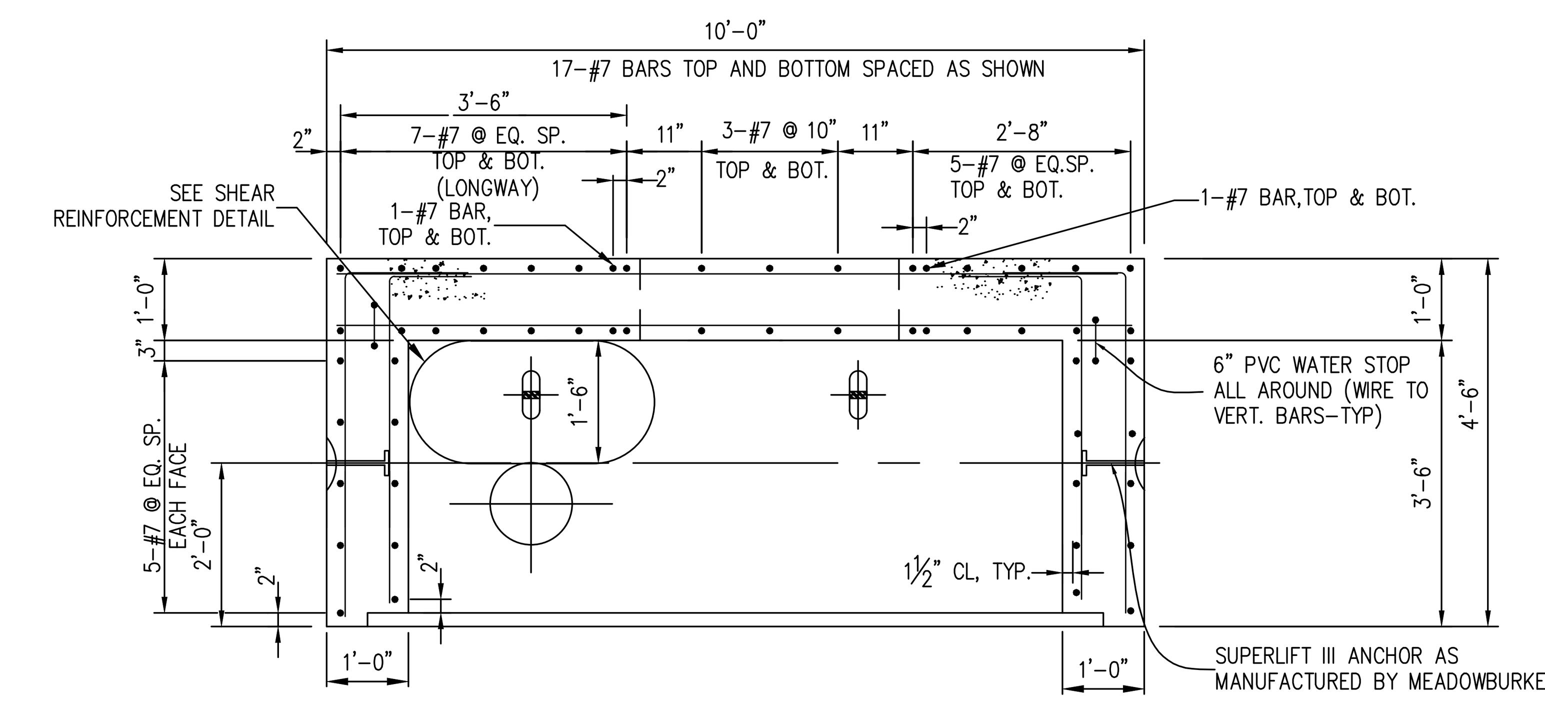
PSEG LONG ISLAND
175 East Old Country Road
Hicksville, New York

FIGURE E-3-4

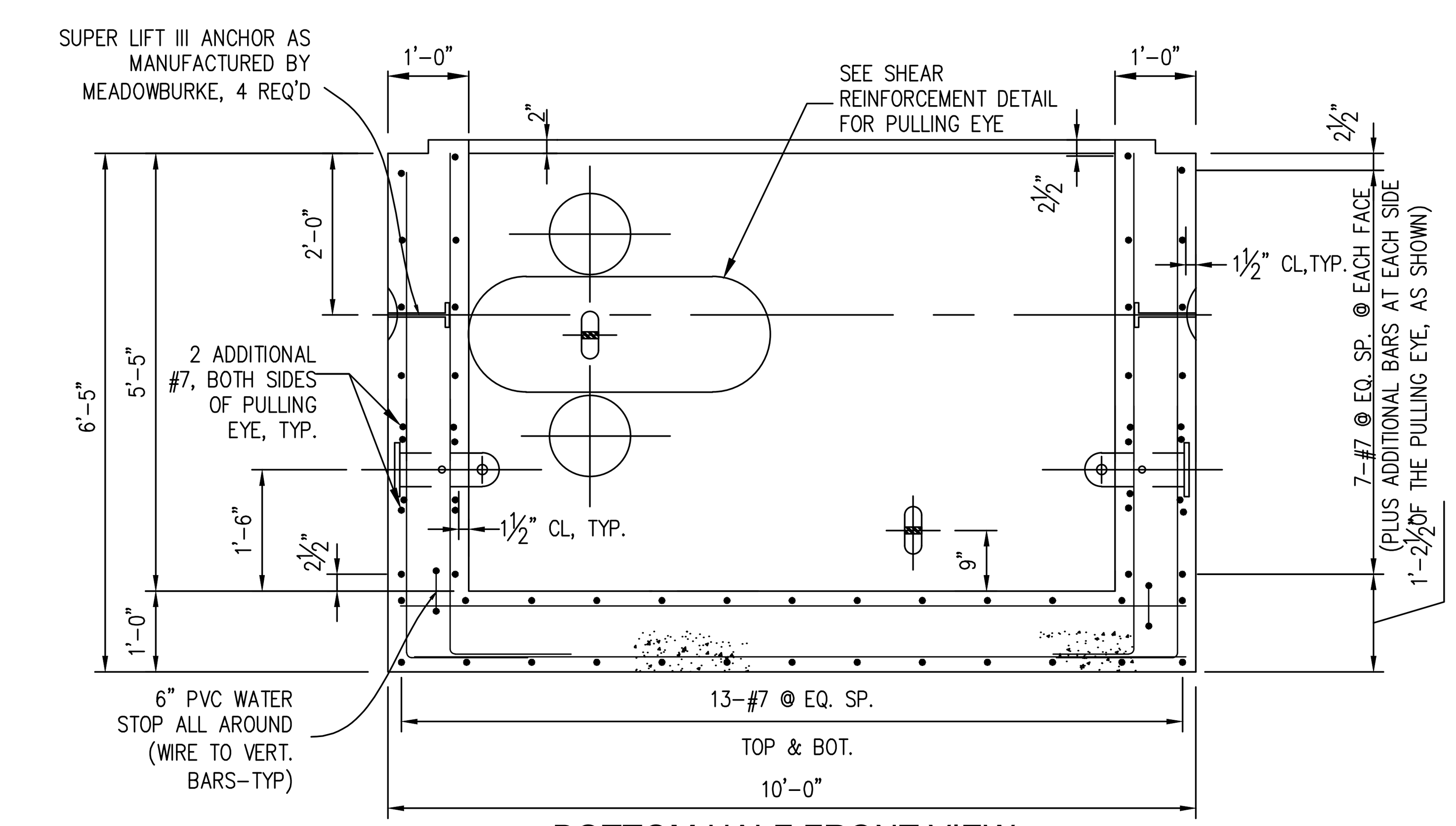
Typical 138 kV Two-Piece Splice Vault



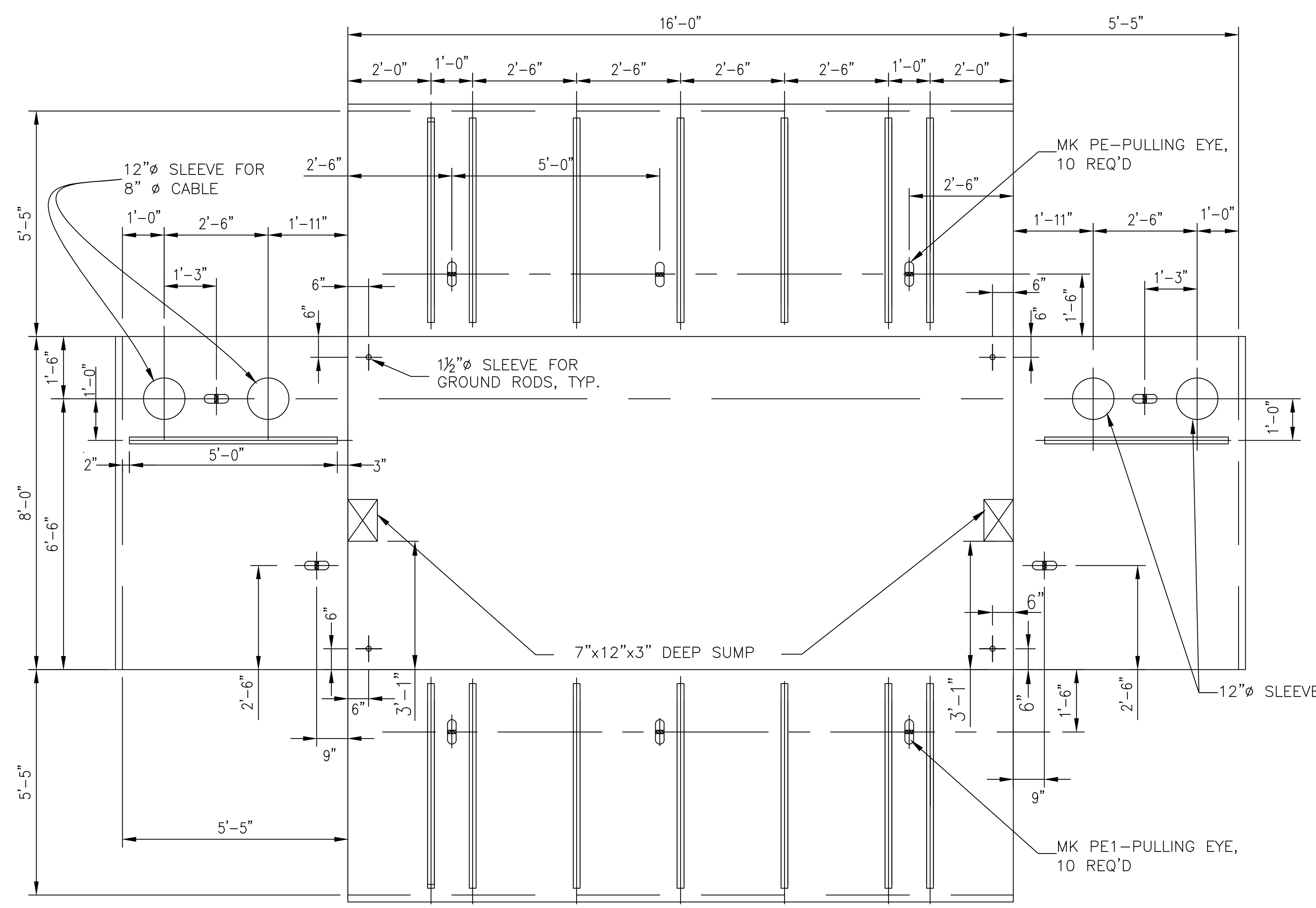
SPLICE VAULT TOP HALF



TOP HALF FRONT VIEW



BOTTOM HALF FRONT VIEW



SPLICE VAULT BOTTOM HALF

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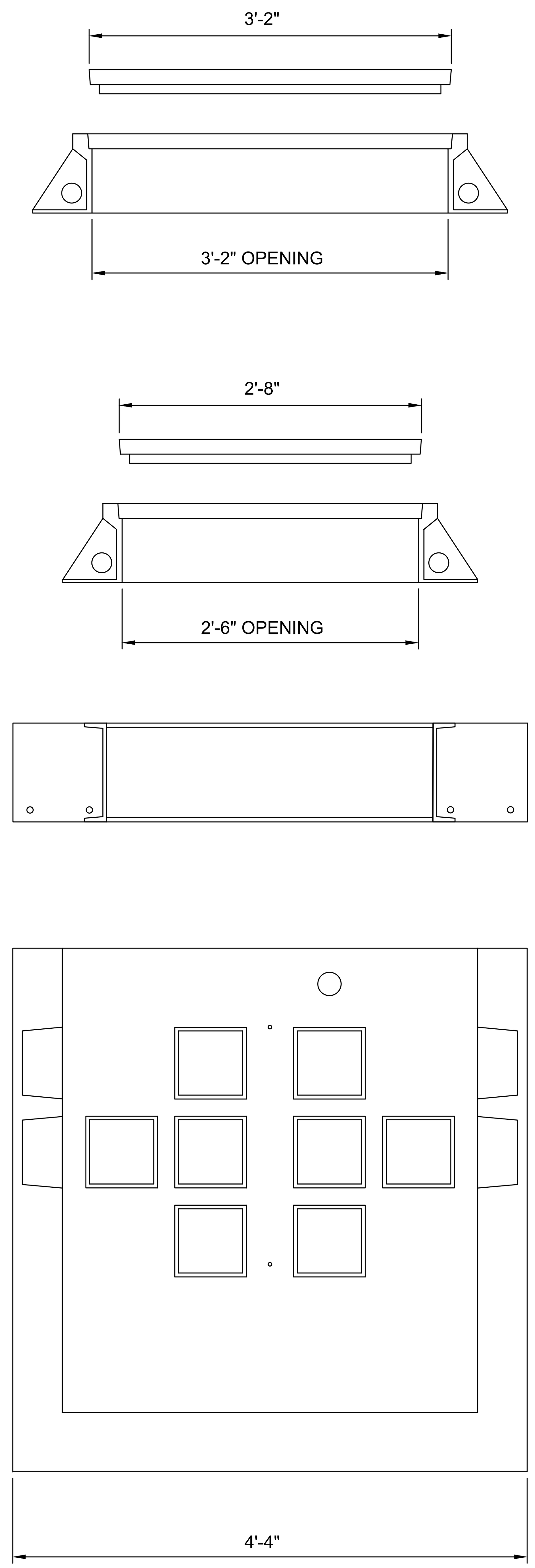
SOUTHAMPTON – DEERFIELD
138–kV TRANSMISSION LINE

SOUTHAMPTON TO DEERFIELD
FIGURE E–3–4
TYPICAL 138–KV TWO–PIECE SPLICE VAULT

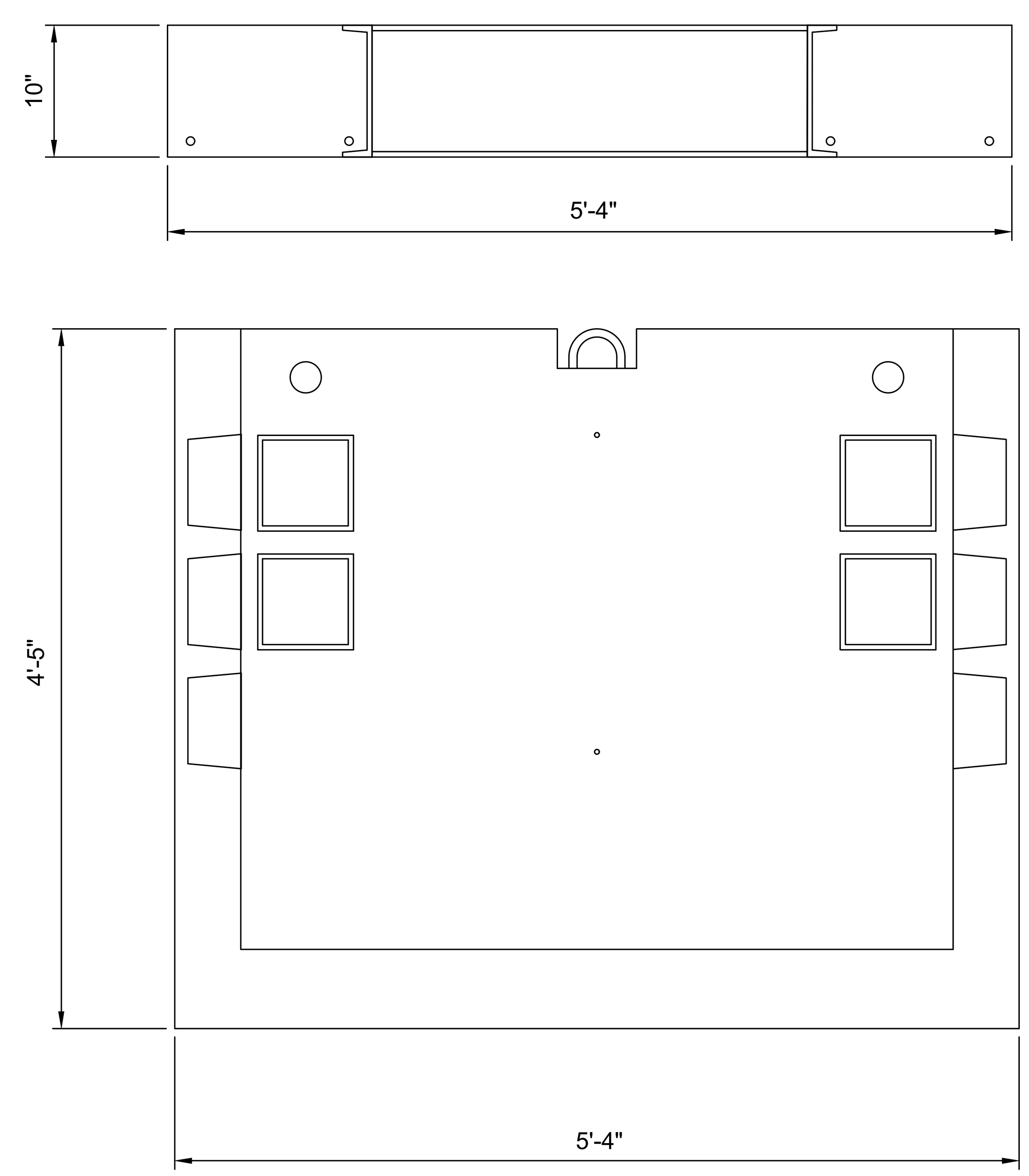
PSEG LONG ISLAND
175 East Old Country Road
Hicksville, New York

FIGURE E-3-5

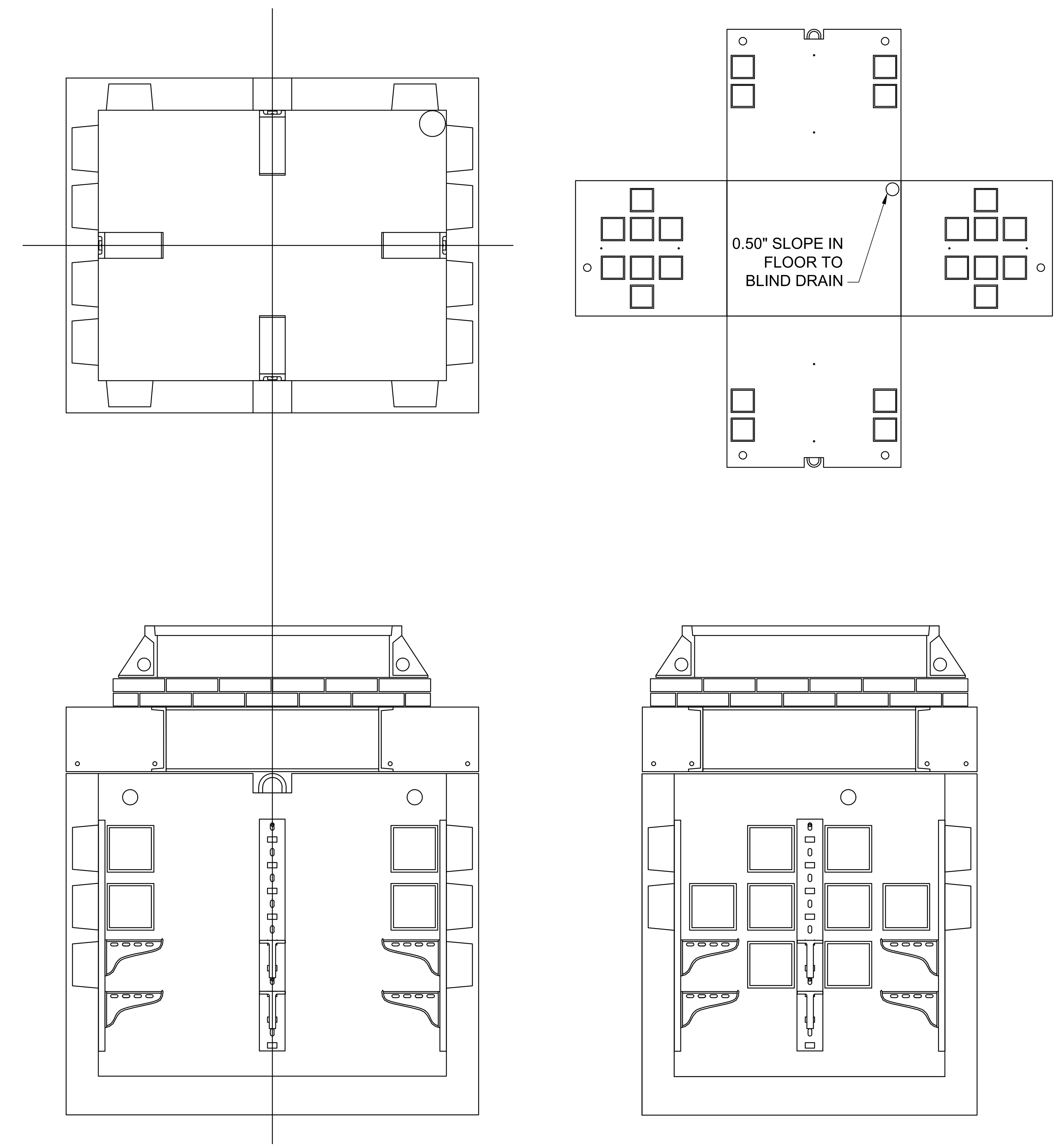
Typical Fiber Handhole



HANDHOLE SECTION END VIEW



HANDHOLE SECTION SIDE VIEW



HANDHOLE HALF EXPLODED PLAN VIEW

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SOUTHAMPTON – DEERFIELD
138-kV TRANSMISSION LINE

SOUTHAMPTON TO DEERFIELD
FIGURE E-3-5
TYPICAL FIBER HANDHOLE

PSEG LONG ISLAND
175 East Old Country Road
Hicksville, New York