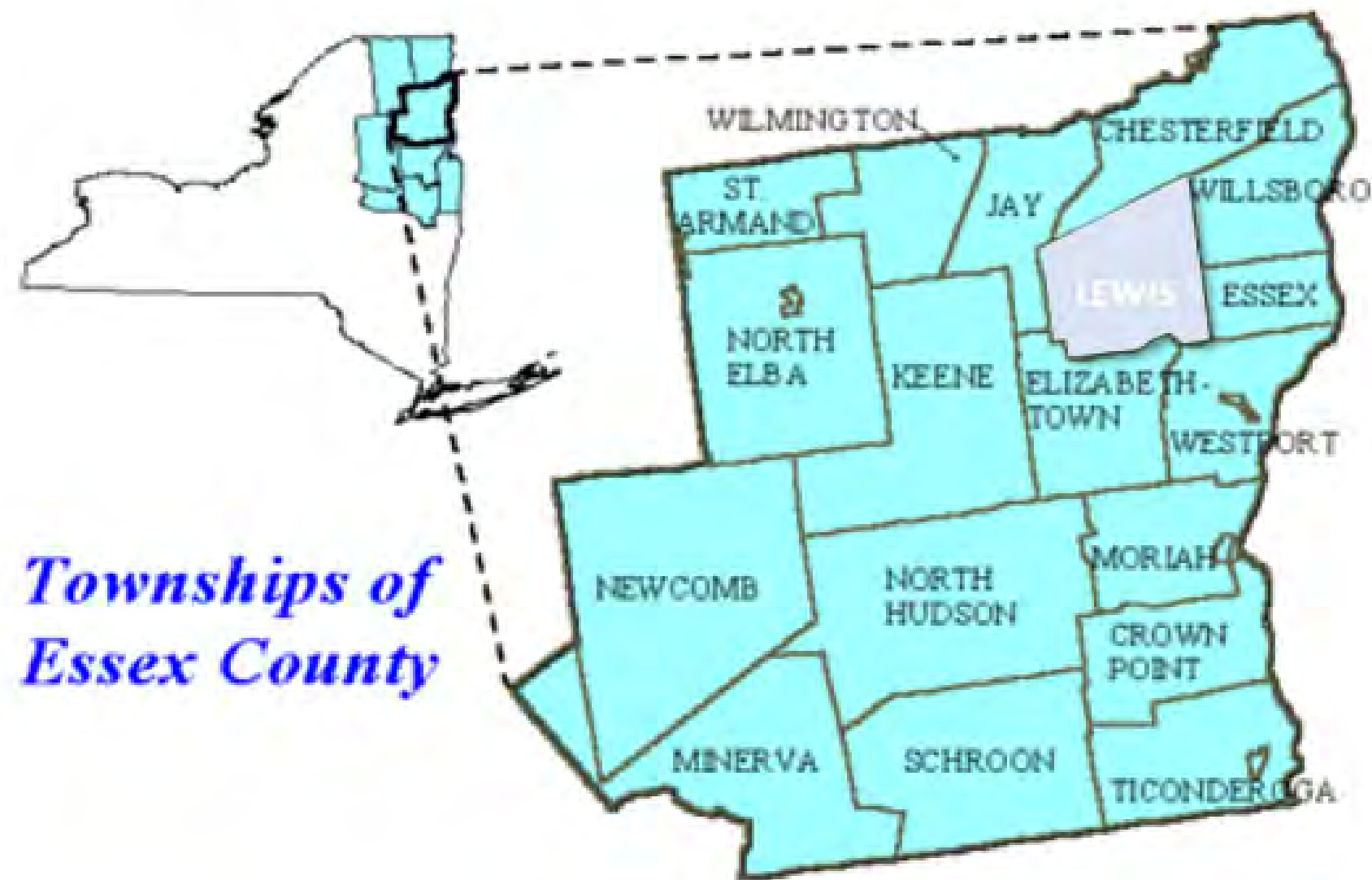
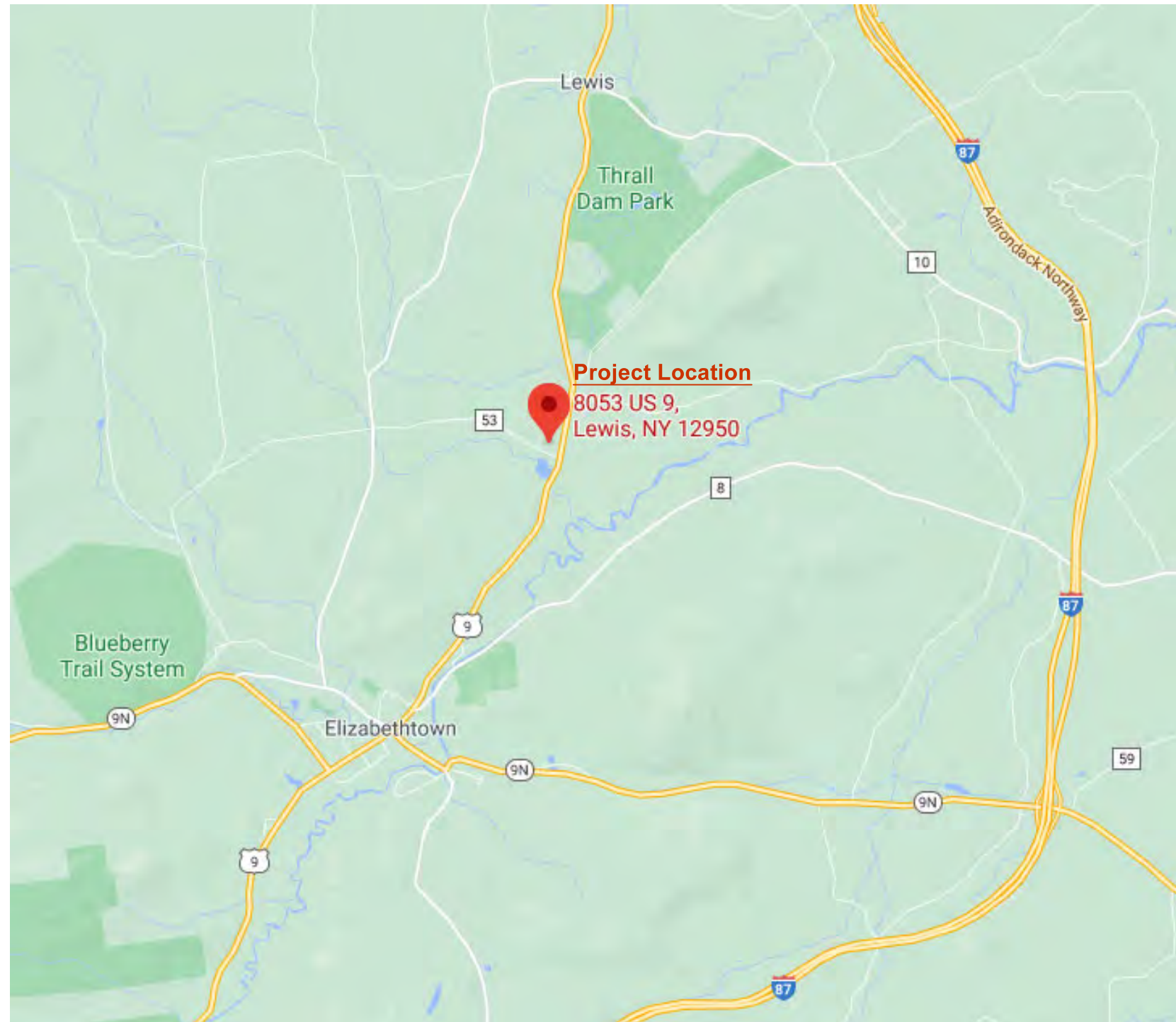


## **APPENDIX D**

### **CONSTRUCTION PLANS & SPECIFICATIONS**



1 PROJECT AREA  
SCALE: NTS



2 PROJECT LOCATION  
SCALE: NTS

# ESSEX COUNTY SALT STORAGE FACILITY LEWIS, NY

NYS DEC WQIP # C100551G  
ESSEX COUNTY PROJECT # P-0101-2017

**GENERAL NOTES:**

IT IS THE RESPONSIBILITY OF ALL CONTRACTS TO REVIEW ALL DRAWINGS FOR COORDINATION, REFERENCE LOAD CONDITIONS, PENETRATIONS, ANCHORS, ELEVATIONS PERTAINING TO THE SCOPE OF WORK SPECIFICALLY IDENTIFIED IN THE PLANS AND SPEFICIATIONS.

ALL CONTRACTS ARE RESPONSIBLE FOR MEANS, METHODS, SCHEDULING, SAFETY AND SECURITY AT THE PROJECT SITE.

THE OWNER IS RESPONSIBLE FOR THE BUILDING PERMIT, ELECTRICAL INSPECTION AND OTHER PERMITS BY REGULATORY AGENCIES.

CONTRACT DRAWINGS ARE SUPPLEMENTED BY SPECIFICAIONS, WHICH COMPLETES THE MINIMUM REQUIREMENTS FOR MATERIALS AND INSTALLATION AND THE TERM "PROVIDED BY". CONFLICTS BETWEEN DOCUMENTS ARE TO BE ASSUMED TO BE THE MOST STRINGENT REQUIREMENTS OF THE TWO, WITH FINAL RESOLUTION BY THE ENGINEER.

ALL CONTRACTORS ARE RESPONSIBLE FOR COORDINATION OF RESPECTIVE SUBCONTRACTORS, SUPPLIERS, DELIVERIES, UNLOADING AND LOADING OF ALL MATERIALS AND EQUIPMENT.

**TABLE OF CONTENTS:**

C001	COVER
C101	SITE PLAN
C201	STORMWATER PLAN
C301	SITE NOTES AND DETAILS
S101	FOUNDATION AND BUILDING PLAN
S201	FOUNDATON SECTIONS AND DETAILS
W101	FABRIC MEMBRANE STRUCTURE AND COVER
E001	ELECTRICAL NOTES AND DETAILS
E101	ELECTRICAL PLAN AND SECTION

**CONTRACT**

ALL CONTRACTS
SITE (BY OWNER)
SITE (BY OWNER)
SITE (BY OWNER)
STRUCTURAL (SC)
STRUCTURAL (SC)
SPECIAL CONST (WC)
ELECTRICAL (EC)
ELECTRICAL (EC)

ESSEX COUNTY DEPARTMENT OF PUBLIC WORKS

CONSTRUCTION WORK FOR

ESSEX COUNTY SALT STORAGE FACILITY

8053 US ROUTE 9, ELIZABETHTOWN, NY 12932

DRAWING DATE: XX/XX/XX

REVISIONS

NO. DATE DESCRIPTION

1. XX/XX/XX XX/XX/XX

DRAWING TITLE

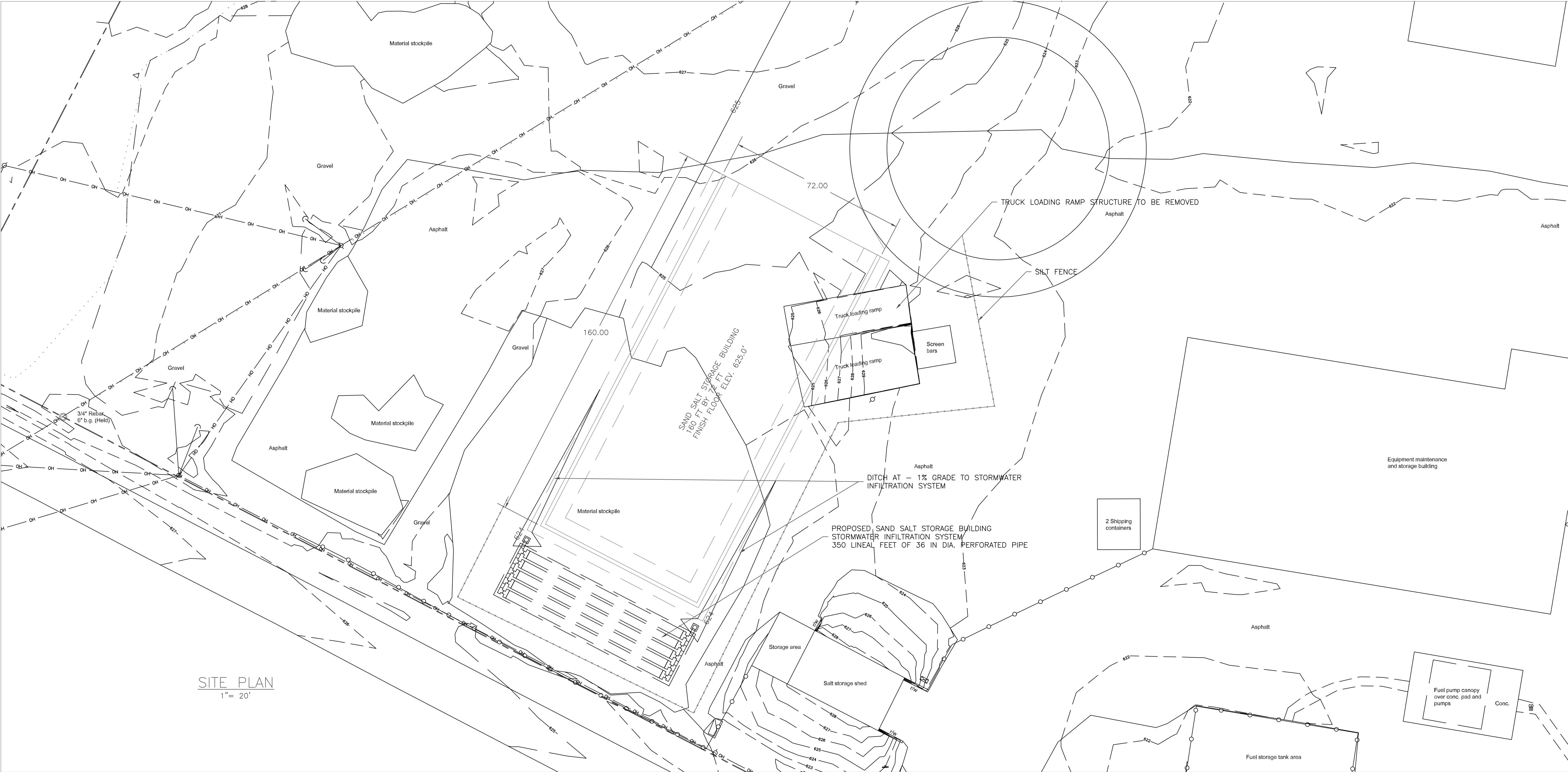
FOUNDATION AND  
BUILDING PLAN

DATE

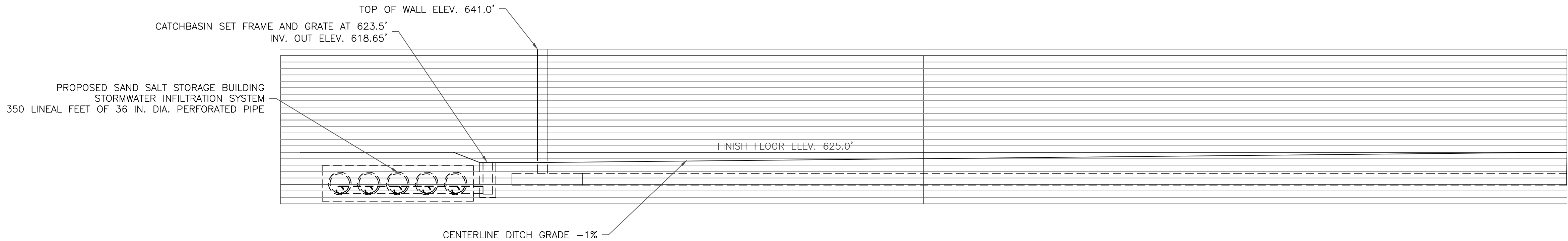
PROJECT NO.

DWG. NO.

C001



SITE PLAN  
1" = 20'



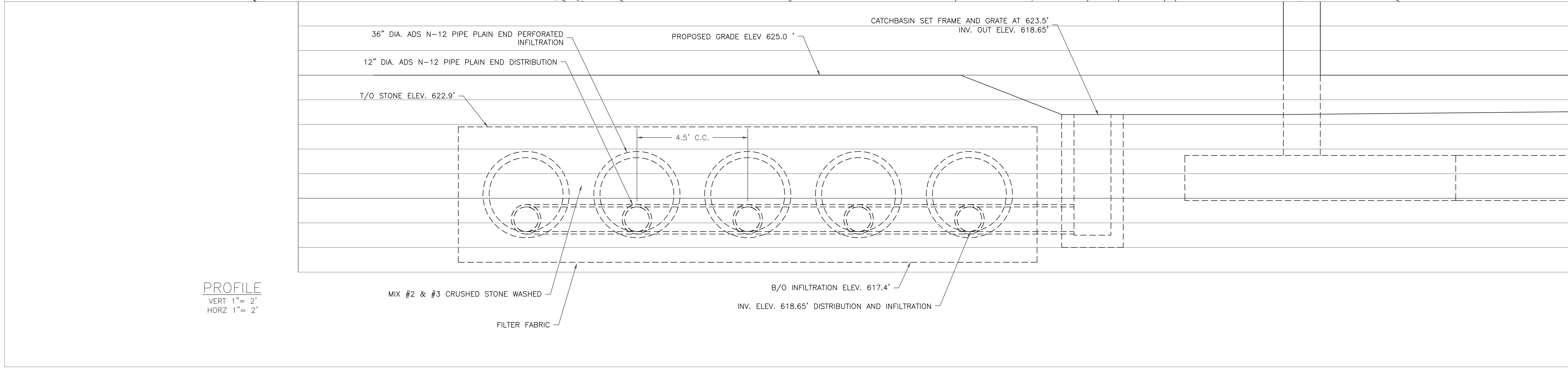
PROFILE  
VERT 1" = 10'  
HORZ 1" = 10'

ESSEX COUNTY DEPARTMENT OF PUBLIC WORKS  
CONSTRUCTION WORK FOR  
ESSEX COUNTY SALT STORAGE FACILITY  
80533 US ROUTE 9, ELIZABETHTOWN, NY 12932

DRAWING DATE: XX/XX/XX		
REVISIONS		
NO.	DATE	DESCRIPTION
1.	XX/XX/XX	XX/XX/XX

DRAWING TITLE  
SITE PLAN

DATE	DWG. NO.
PROJECT NO.	C101

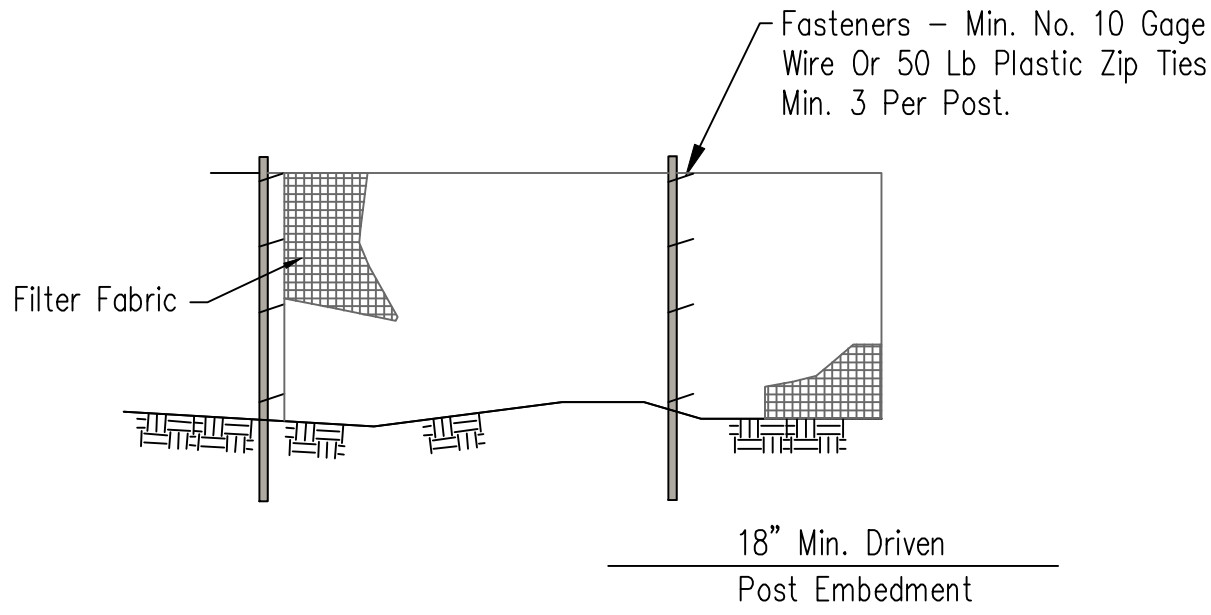


ESSEX COUNTY DEPARTMENT OF PUBLIC WORKS			CONSTRUCTION WORK FOR			ESSEX COUNTY SALT STORAGE FACILITY			8053 US ROUTE 9, ELIZABETHTOWN, NY 12932		
DRAWING DATE: XX/XX/XX											
REVISIONS											
NO.	DATE		DESCRIPTION								
1.	XX/XX/XX		XX/XX/XX								
DRAWING TITLE											
STORMWATER PLAN											
DATE						DWG. NO.					
PROJECT NO.						C201					

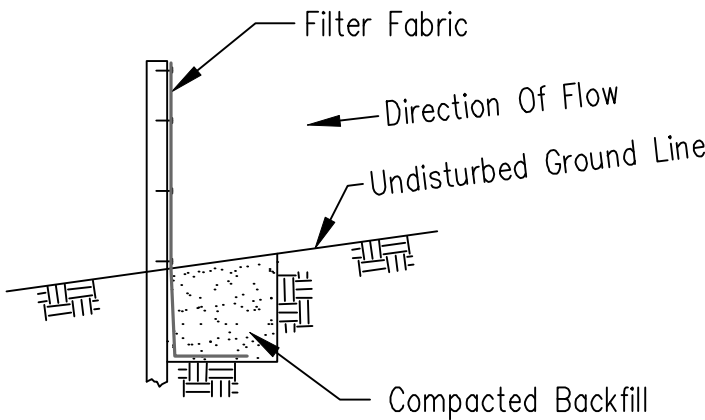
Test Pit #1 (44,242057 N; -73.569131 W)  
Date: September 18, 2019  
Mapped Soil Series: Champlain loamy sand  
Distance to nearest jurisdictional wetland > 100'  
Distance to nearest existing or proposed well > 100'  
Distance to nearest water body > 100'  
Depth to Seasonal High Groundwater Table > 48"  
Depth to bedrock > 82"  
Depth of test pit = 82"  
Slope = 0%  
Acceptable System: Conventional Standard Absorption

Horizon	Depth (inches)	USDA Texture	Munsell Color	Redoxymorphic Features
C <sup>a</sup>	0-13	Sand	10yr 5/3, brown	No
Ab	13-17	Sand	10yr 4/4, dark yellowish	No
Bsb	17-30	Sand	10yr 5/6, yellowish brown	No
C	30-48+	Sand	10yr 6/3, pale brown	No

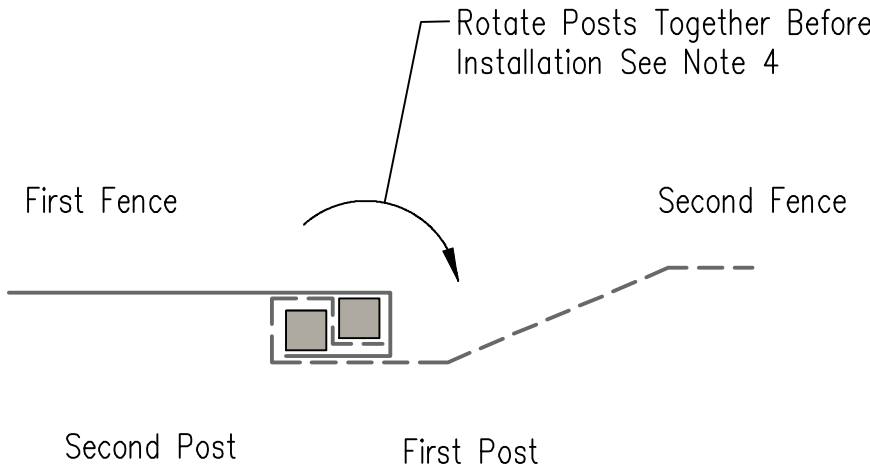
Basis of Design Stormwater  
Proposed Sand Salt Storage building 12800 sq. ft.  
Proposed impervious 12800 sq. ft.  
Basis of Design Stormwater– Guide for Minor Projects– Stormwater Management– Lake George Park Commission  
Proposed impervious 12800 sq. ft.  
12800 sq. ft. \*1.5 gal. sq. ft. = 19200 gal./lf. 3 ft. dia. perf. pipe = 362.3 lf of 3 ft. dia. perf. pipe required 350 lf of 3 ft. dia. perf. pipe provided.



ELEVATION



FABRIC ANCHOR DETAIL



SPLICE DETAIL–PLAN VIEW

SILT FENCE

- NOTES:
1. Temporary silt fence shall be installed prior to any grading work in the area to be protected. Fence shall be maintained throughout the construction period and removed in conjunction with the final grading and site stabilization.
  2. Filter fabric shall meet the requirements of material specification 592 Geotextile Table 1 or 2, Class I with equivalent opening size of at least 30 for nonwoven and 50 for woven.
  3. Fence posts shall be either wood post with a minimum cross-sectional area of 1.5" X 1.5" or a standard steel post.
  4. When splices are necessary make splice at post according to splice detail. Place the end post of the second fence inside the end post of the first fence. Rotate both posts together at least 180 degrees to create a tight seal with the fabric material. Cut the fabric near the bottom of the posts to accommodate the 6 inch flap. Then drive both posts and bury the flap. Compact backfill well.

ESSEX COUNTY DEPARTMENT OF PUBLIC WORKS

CONSTRUCTION WORK FOR

ESSEX COUNTY SALT STORAGE FACILITY

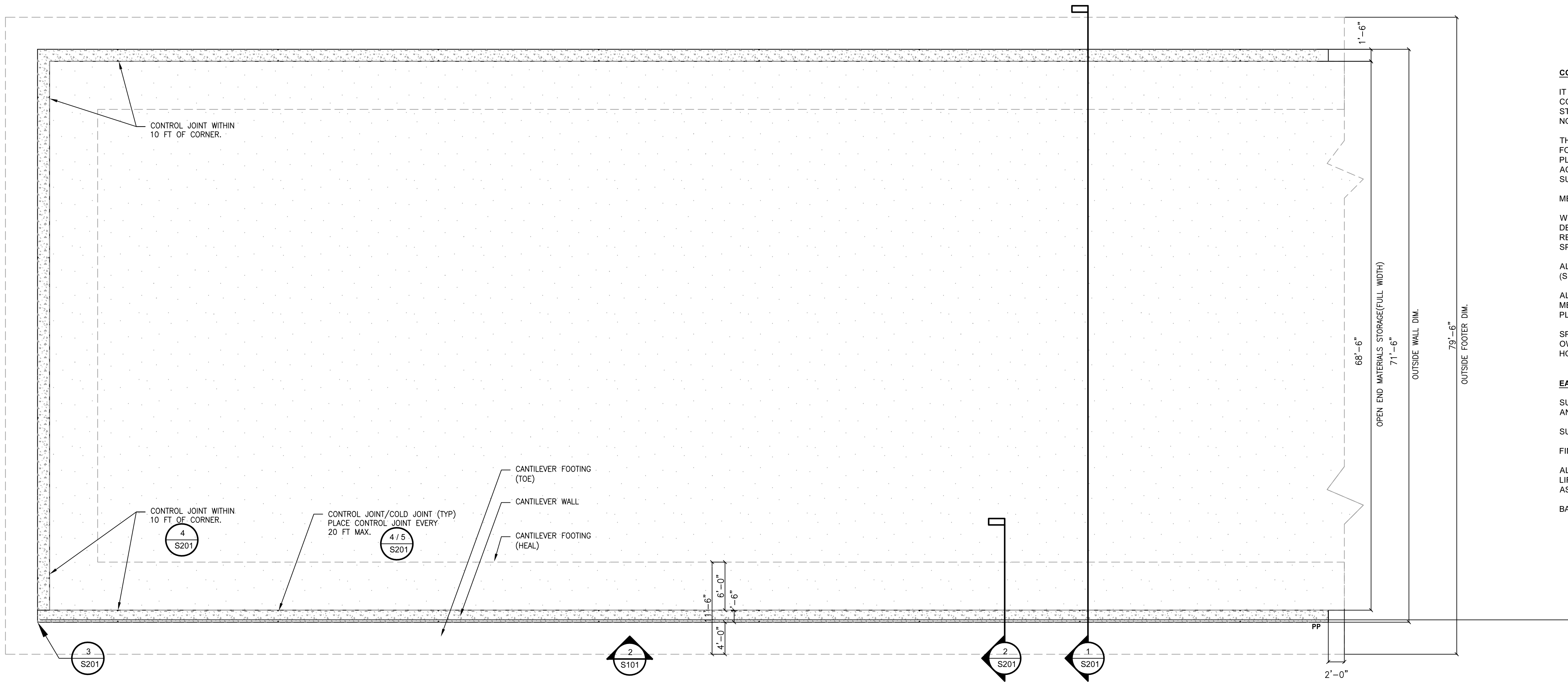
80533 US ROUTE 9, ELIZABETHTOWN, NY 12932

DRAWING DATE: XX/XX/XX		
REVISIONS		
NO.	DATE	DESCRIPTION
1.	XX/XX/XX	XX/XX/XX

DRAWING TITLE

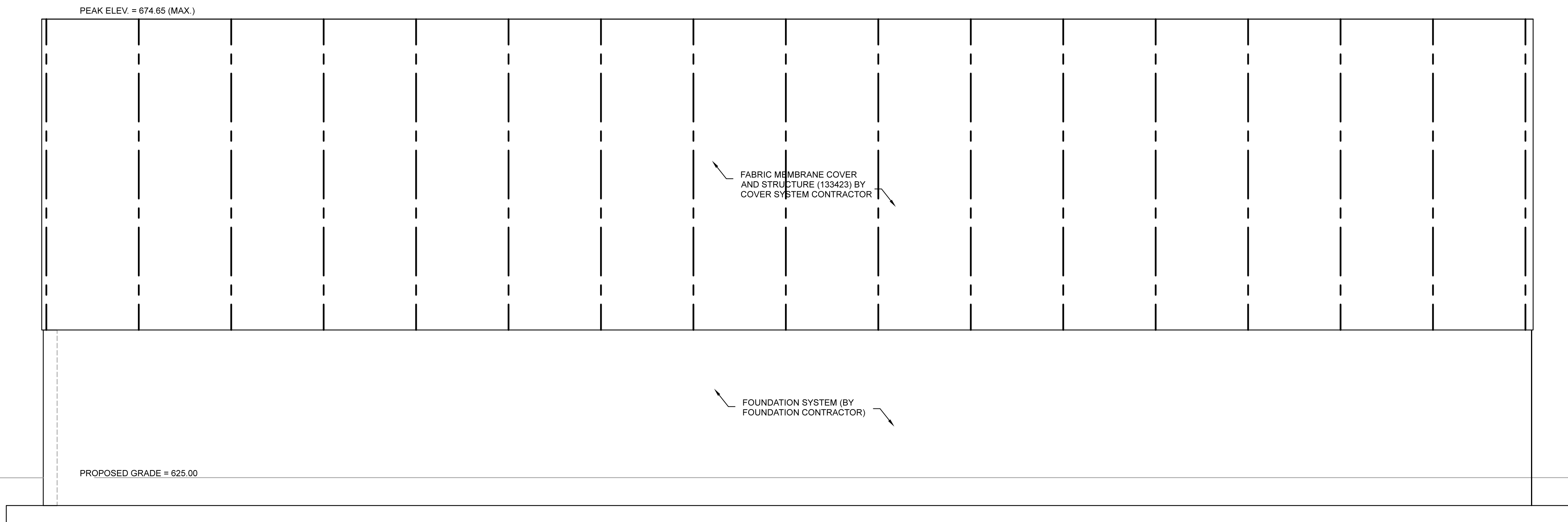
NOTES  
AND  
DETAILS

DATE	DWG. NO.
PROJECT NO.	C301



1  
S101

FOUNDATION PLAN  
SCALE: 1/8" = 1'



2  
S102

CANOPY STRUCTURE ELEVATION  
SCALE: 1/8" = 1'

**CANTILEVERED WALL DESIGN:**  
FACTOR OF SAFETY AGAINST SLIDING AND OVERTURNING: 1.5  
UNIT WEIGHT OF SAND/SALT MIX: 110 LBS/CF  
INTERNAL FRICTION, ANGLE OF REPOSE: 32 DEGREES (MAX)  
ACTIVE EARTH PRESSURE: ASSUMES SAND/SALT EXTENDS TO TOP OF WALL WITH PILED SAND/SALT AT SPECIFIED ANGLE OF REPOSE.  
IMPACT LOAD: 250 LBS/FT AT 7 FT

**CONCRETE NOTES:**

IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO FIELD VERIFY EXISTING CONDITIONS, DIMENSIONS, AND OTHER CONSTRUCTION CONTRACTS PRIOR TO THE START OF CONSTRUCTION. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY THE ENGINEER OF DISCREPANCIES UPON DISCOVERY.

THE CONTRACTOR SHALL SUBMIT COPIES OF SHOP DRAWINGS TO THE ENGINEER FOR REVIEW FOR CONCRETE MIX DESIGN AND STEEL REINFORCEMENT PLACEMENT DRAWINGS INCLUDING BAR LENGTHS, BENDS AND SPLICES IN ACCORDANCE WITH SPECIFICATIONS. SEE SPECIFICATIONS FOR ADDITIONAL SUBMITTAL REQUIREMENTS.

MEASURE, MIX, BATCH AND DELIVER CONCRETE IN ACCORDANCE WITH ASTM C94.

WHEN AIR temperature IS BELOW 40 DEGREES F, OR IS EXPECTED TO FALL BELOW 40 DEGREES F, CONCRETE SHALL BE PLACED AND CURED IN ACCORDANCE WITH THE REQUIREMENTS OF ACI 306 (COLD WEATHER CONCRETE), AND THE SPECIFICATIONS.

ALL CONCRETE WORK SHALL COMPLY WITH THE PROVISIONS OF ACI 301. (SPECIFICATIONS FOR STRUCTURAL CONCRETE).

ALL CONCRETE SHALL BE PLACED IN ACCORDANCE WITH ACI 304 (GUIDE FOR MEASURING, MIXING, TRANSPORTING AND PLACING CONCRETE). CONSOLIDATE PLACED CONCRETE BY MECHANICAL VIBRATION.

SPECIAL INSPECTION REQUIREMENTS: 1705.3 CONCRETE CONSTRUCTION, BY OWNERS TERM CONTRACT FOR TESTING SERVICES. NOTIFY THE ENGINEER 24 HOURS IN ADVANCE OF SCHEDULED CONCRETE DELIVERY FOR COORDINATION.

**EARTHWORK NOTES:**

SUBGRADE SHALL BE PREPARED BY THE OWNER, INCLUDING EXCAVATION TO GRADE AND COMPACTION.

SUBBASE SHALL BE PREPARED BY THE OWNER INCLUDING COMPACTION.

FINE GRADE OF SUBBASE AND COMPACTION TO BE PROVIDED BY THE CONTRACTOR.

ALL CONTROLLED FILL WITHIN THE FOUNDATION FOOTPRINT SHALL BE PLACED IN 8" LIFTS AND COMPACTED TO A MINIMUM OF 95% OF MODIFIED PROCTOR DENSITY PER ASTM D-1557.

BACKFILL MATERIALS SHALL BE PROVIDED BY THE OWNER.

ESSEX COUNTY DEPARTMENT OF PUBLIC WORKS

CONSTRUCTION WORK FOR

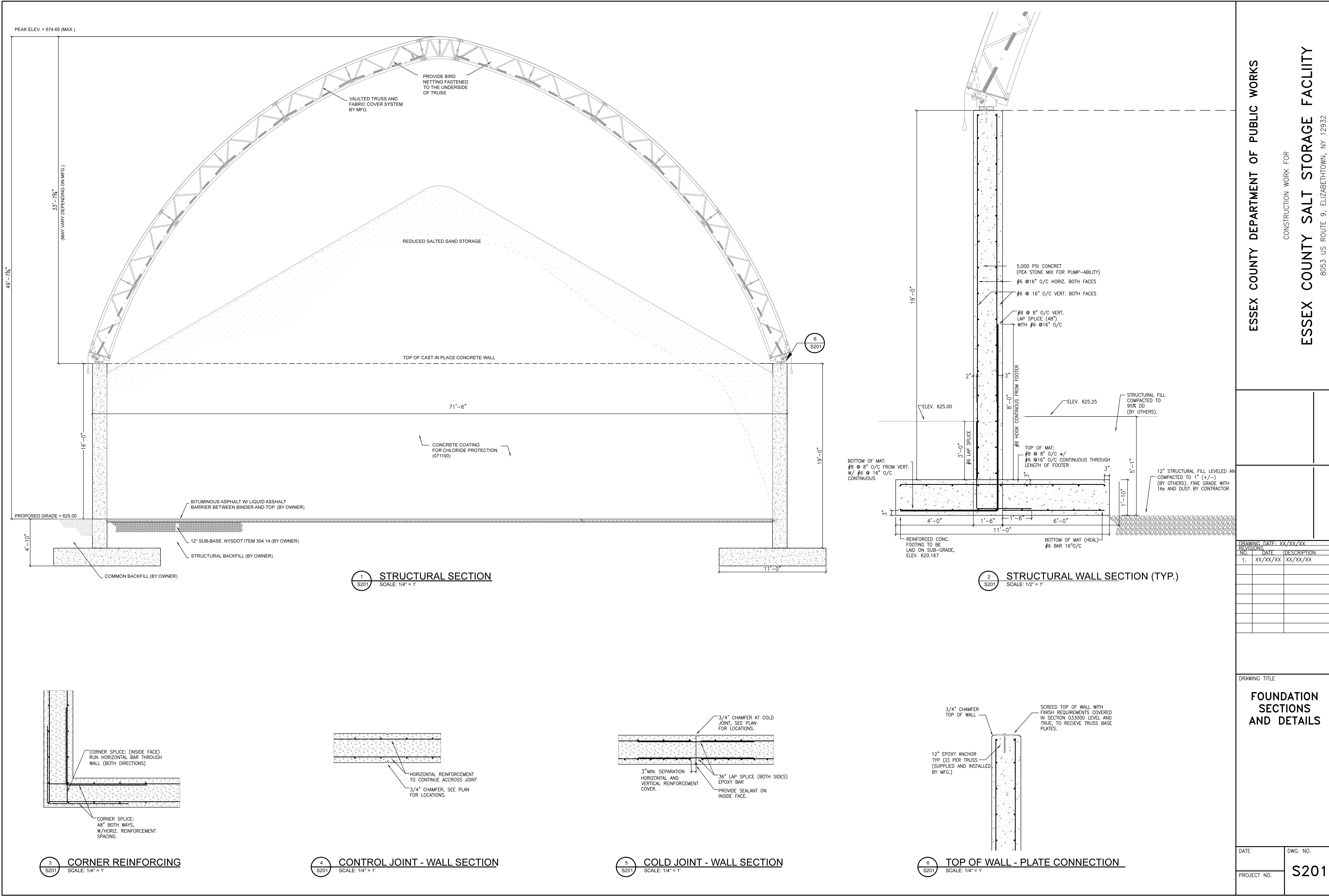
ESSEX COUNTY SALT STORAGE FACILITY

8053 US ROUTE 9, ELIZABETHTOWN, NY 12932

DRAWING DATE: XX/XX/XX		
REVISIONS		
NO.	DATE	DESCRIPTION
1.	XX/XX/XX	XX/XX/XX

DRAWING TITLE  
FOUNDATION AND BUILDING PLAN

DATE	DWG. NO.
PROJECT NO.	S101



ESSEX COUNTY DEPARTMENT OF PUBLIC WORKS

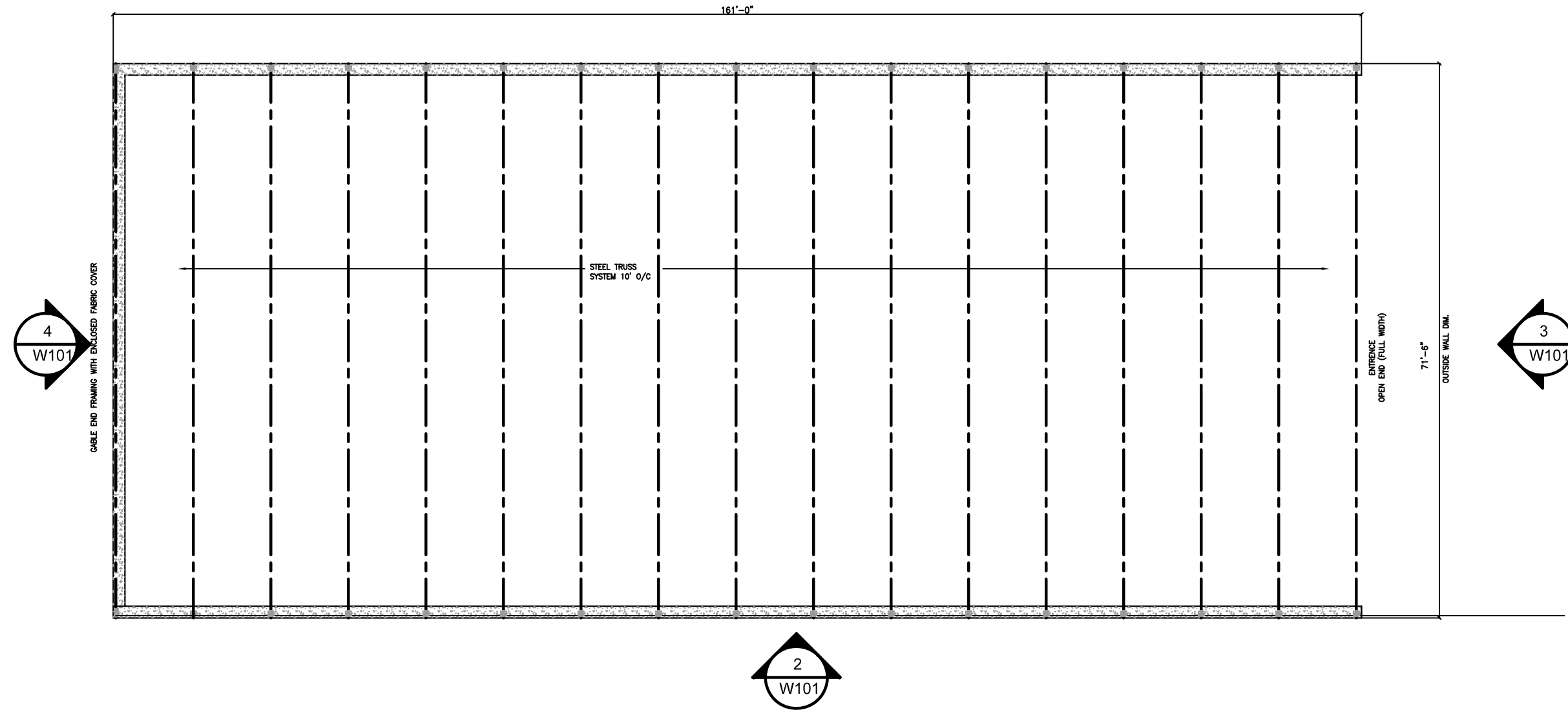
CONSTRUCTION WORK FOR

ESSEX COUNTY SALT STORAGE FACILITY

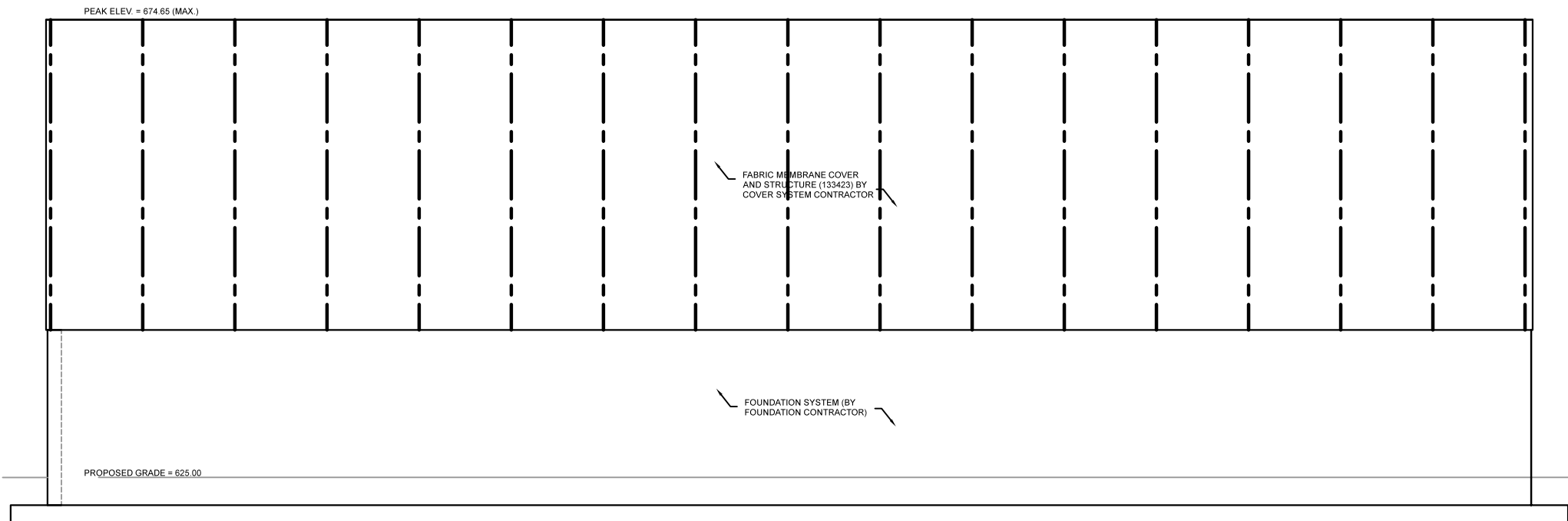
8053 US ROUTE 9, ELIZABETHTOWN, NY 12932

DRAWING DATE: XX/XX/XX		
NO.	DATE	DESCRIPTION
1.	XX/XX/XX	XX/XX/XX

DRAWING TITLE		
FOUNDATION SECTIONS AND DETAILS		
DATE	DWG. NO.	S201
PROJECT NO.		



1 COVER SYSTEM - PLAN  
SCALE: 1/16" = 1'



2 COVER SYSTEM - SECTION  
SCALE: 1/16" = 1'

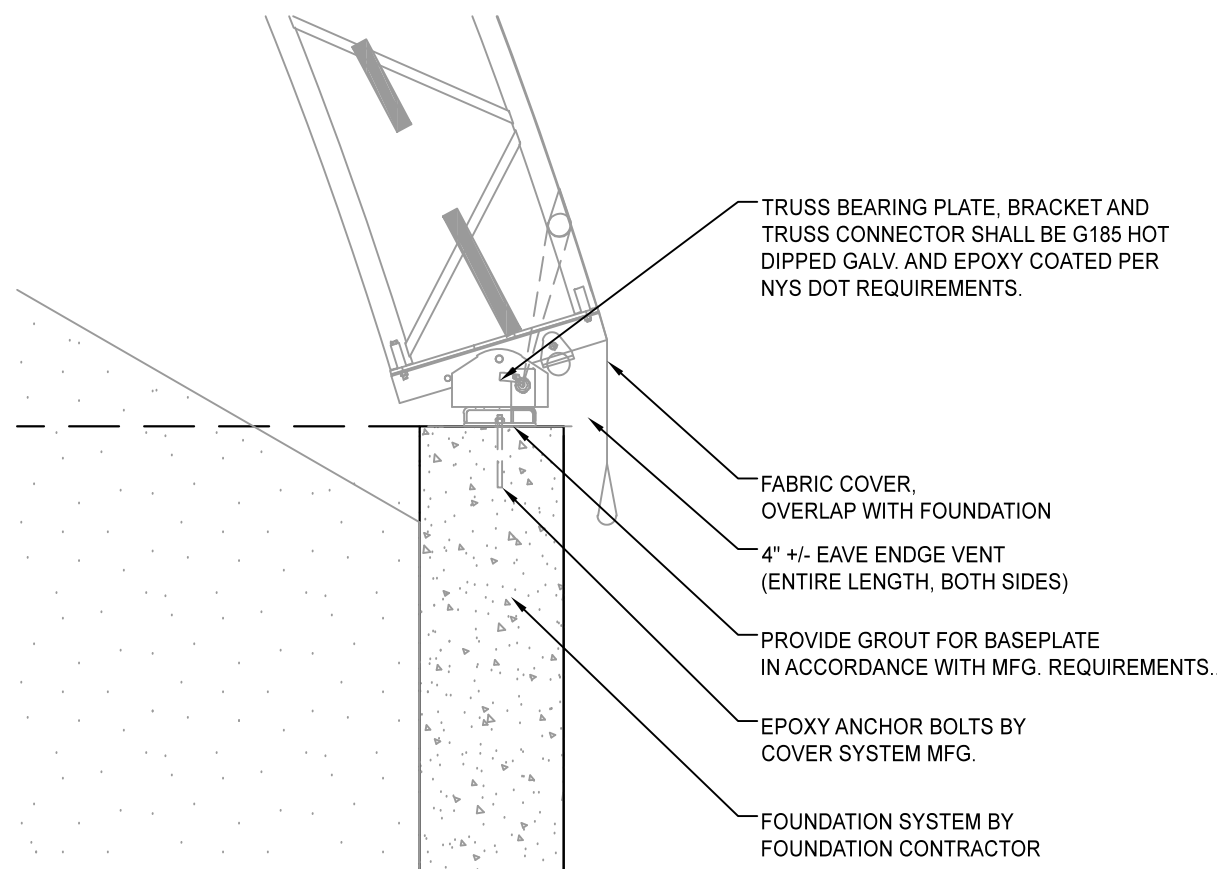
DESIGN CRITERIA: NYS BUILDING CODE (MOST RECIENT ADDITIONS OR ADOPTIONS)

TRUSS LOAD COMBINATIONS ACCORDING TO NYS BUILDING CODE:  
USE AND OCCUPANCY: COMMERCIAL - LOW HAZARD  
IMPORTANCE FACTOR: 0.8

CT = 1.2  
CE = 0.9  
GROUND SNOW LOAD = 70 PSF

WIND DESIGN  
WIND LOAD: 120 MPH, 3 SEC. GUST  
WIND EXPOSURE: C  
IMPORTANCE FACTOR: 1  
ROOF HT: 43' 3"  
DESIGN ENCLOSURE: PARTIALLY ENCLOSED

SEISMIC DESIGN:  
SS  
S1  
IMPORTANCE FACTOR = 1  
SITE CLASS  
USE GROUP  
R- LONGITUDINAL  
R- TRANSVERSE  
OCCUPANCY STANDARD



5 COVER SYSTEM SOFFIT - DETAIL  
SCALE: 1/2" = 1'

GENERAL NOTES:

IT IS THE INTENT OF THIS (W) CONTRACT FOR THE FABRIC MEMBRANE COVER AND STRUCTURE. PLANS AND SPECIFICATIONS TO PROVIDE A COMPLETE SYSTEM, PLACED ON THE PROPOSED FOUNDATION BY THE FOUNDATION (S) CONTRACT. (W) CONTRACT IS RESPONSIBLE TO REVIEW ALL CONTRACT DRAWINGS AND SPECIFICATIONS, INCLUDING BUT NOT LIMITED TO ALL DIMENSIONS, STRUCTURE CONNECTIONS AND DESIGN CONDITIONS TO ENSURE STRUCTURE PERFORMS AS AN INTEGRATED SYSTEM.

TRUSS WEIGHT IS TO BE ADDED TO THE DESIGN DEAD LOAD BY THE TRUSS MANUFACTURER. PROVIDE SUBMITTALS FOR TRUSSES INCORPORATING ALL LOADS AND CONNECTION DETAILS WITH NYS PE STAMP PER SPECIFICATION 133423. PROVIDE BRACING FOR TRUSSES IN ACCORDANCE WITH MANUFACTURERS INFORMATION.

VENTILATION OPENINGS SHALL BE LOCATED AT OR NEAR THE HIGHEST AND LOWEST POINT OF THE ROOF PROVIDING A RATIO OF ONE SQUARE INCH OF FREE AIR AREA FOR EACH 55 SQ FT OF STRUCTURE FLOOR AREA. EACH VENTILATION OPENING SHALL BE WEATHERPROOF.

FABRIC MEMBRANE COVER AND STRUCTURE SHALL BE DESIGNED AS A 3 SIDED STRUCTURE WITH THE LOADING AREA AS AN OPEN END.

ERRECTION OF THE COVER SYSTEM SHALL BE CONDUCTED BY AN EXPERIENCED LICENSED CONTRACTOR WITH A WORKING KNOWLEDGE OF APPLICABLE CODES AND INDUSTRY ACCEPTABLE STANDARD PRACTICES.

ALL WORK SHALL CONFORM, AT A MINIMUM, TO STATE AND LOCAL BUILDING CODES, SPECIFIED BASIS OF DESIGN, AND REGULARORY AGENCY REQUIREMENTS. WORK NOT EXPLICITLY SHOW ON THESE CONTRACT DRAWINGS SHALL CONFORM TO ALL APPLICABLE CODES AND ACCEPTABLE STANDARDS.

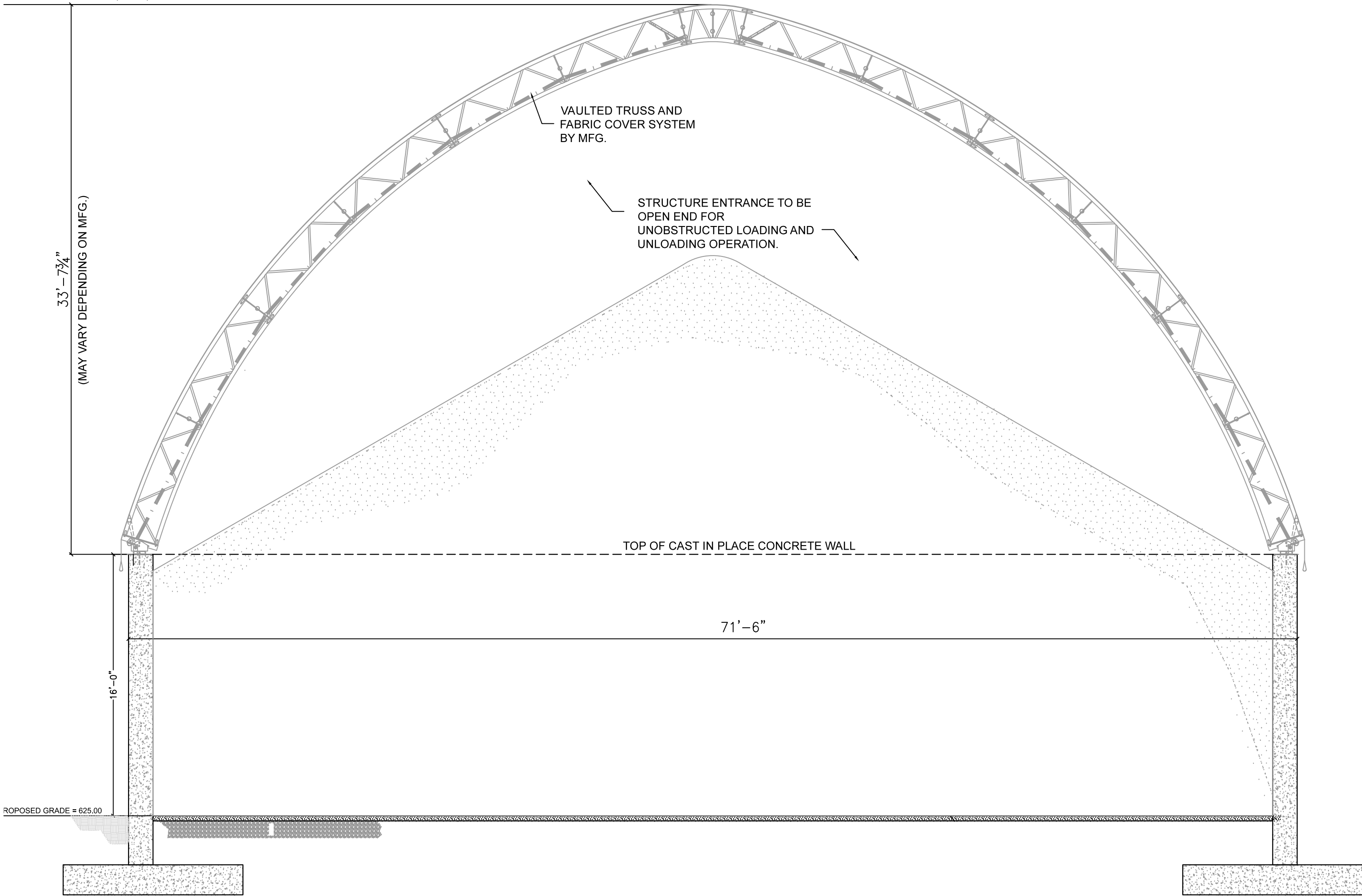
CONTRACTOR (W) SHALL VERIFY ALL DIMENSIONS, ELEVATIONS AND CONDITIONS ON THESE DRAWINGS WITH ALL OTHER RELEVANT CONSTRUCTION DRAWINGS PRIOR TO THE START OF CONSTRUCTION. THE CONTRACTOR SHALL NOTIFY THE OWNER/ENGINEER OF ANY DISCREPANCIES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. THE CONTRACTOR SHALL PROVIDE ADEQUATE SHORING, BRACING, FRAMEWORK AND SAFETY REQUIREMENTS FOR THE PROTECTION OF LIFE AND PROPERTY DURING CONSTRUCTION.

CONTRACTOR/COVER SYSTEM MANUFACTURER SHALL PROVIDE THE NECESSARY INSPECTION OF THE STRUCTURAL SYSTEM AND PROVIDE CERTIFICAION THAT THE COVER SYSTEM WAS INSTALLED ACCORDING TO THE CONSTRUCTION DRAWINGS AND MANUFACTURERS SUBMITTALS.

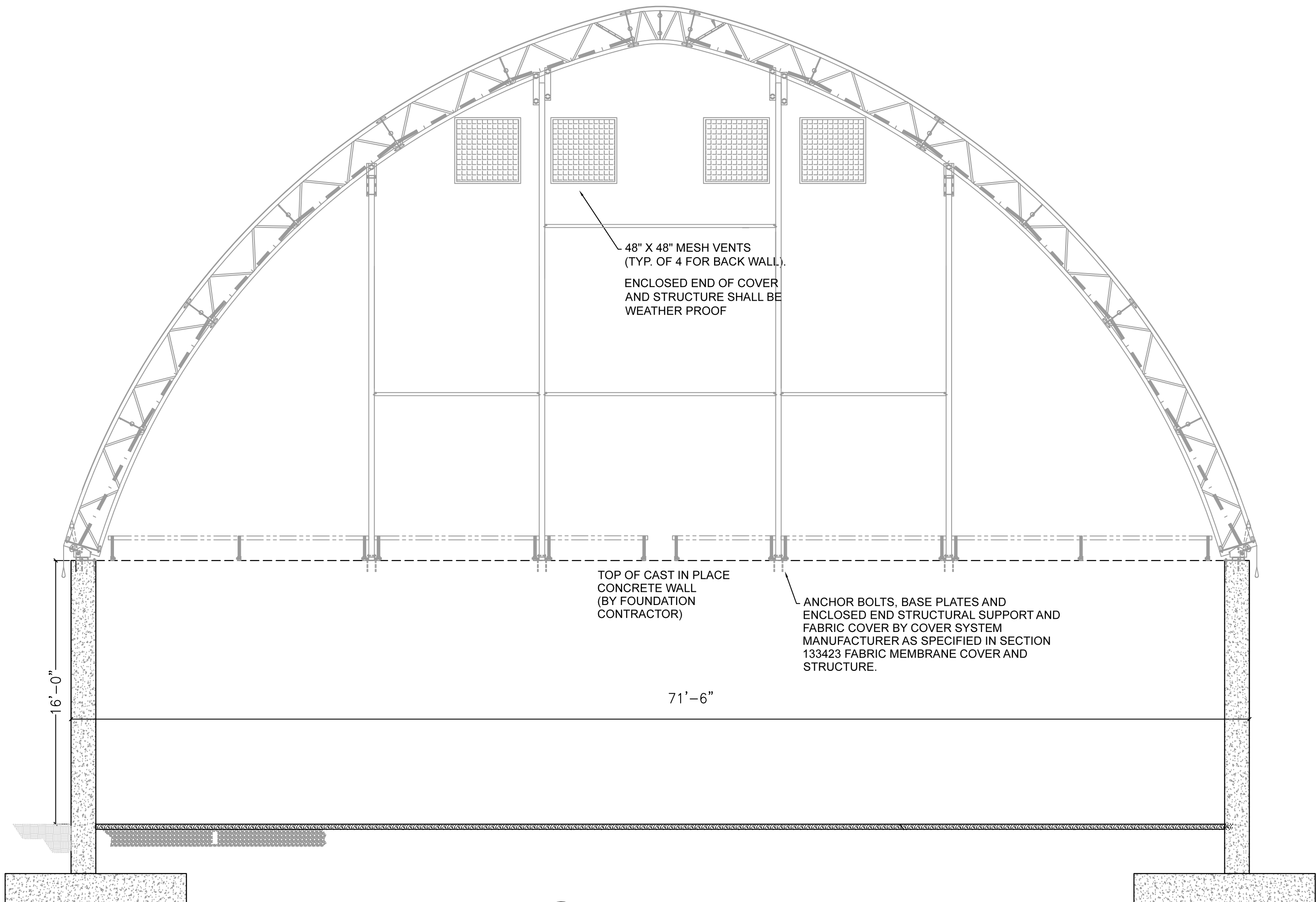
CONTRACTOR/MANUFACTURER SHALL PROVIDE INSPECTION OF ALL STEEL, BOTLTED CONNECTIONS, AND WELDED CONNECTIONS IN ACCORDANCE WITH NYS BUILDING CODE. ALL CONNECTIONS SHALL MAINTAIN THE SAME CORROSION RESISTANCE REQUIREMENTS OF THE TYPE 316 STAINLESS STEEL FASTNERS, OR THE G90 GALVANIZED STRUCTURAL STEEL REQUIREMENTS OF THE STRUCTURAL MEMBERS.

FRAMING IS SHOWN FOR REFERENCE PURPOSES. ALL FRAMING AND COVER DESIGN IS THE RESPONSIBILITY OF THE MANUFACTUER UNDER THE CONTRACTOR.

EAK ELEV. = 674.65 (MAX.)



3 COVER SYSTEM - FRONT ELEVATION  
SCALE: 3/16" = 1'



4 COVER SYSTEM - REAR ELEVATION  
SCALE: 3/16" = 1'

ESSEX COUNTY DEPARTMENT OF PUBLIC WORKS

CONSTRUCTION WORK FOR

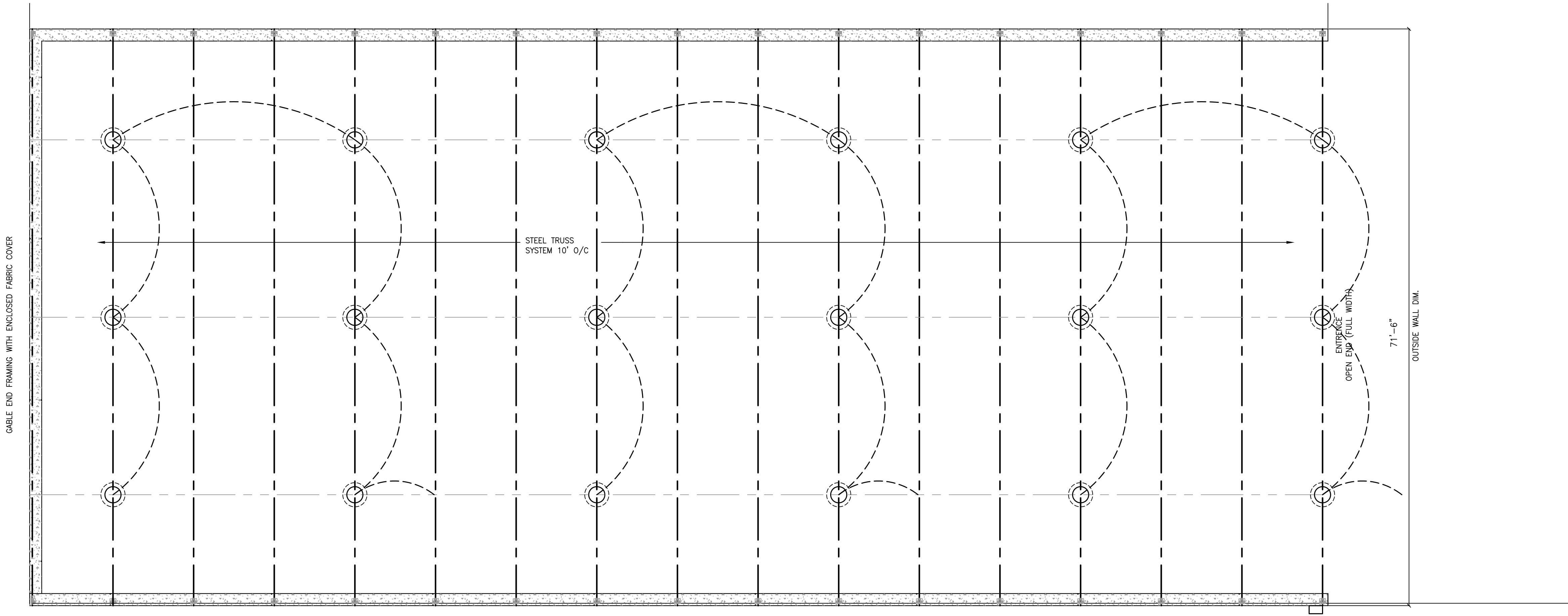
ESSEX COUNTY SALT STORAGE FACILITY

8053 US ROUTE 9, ELIZABETHTOWN, NY 12932

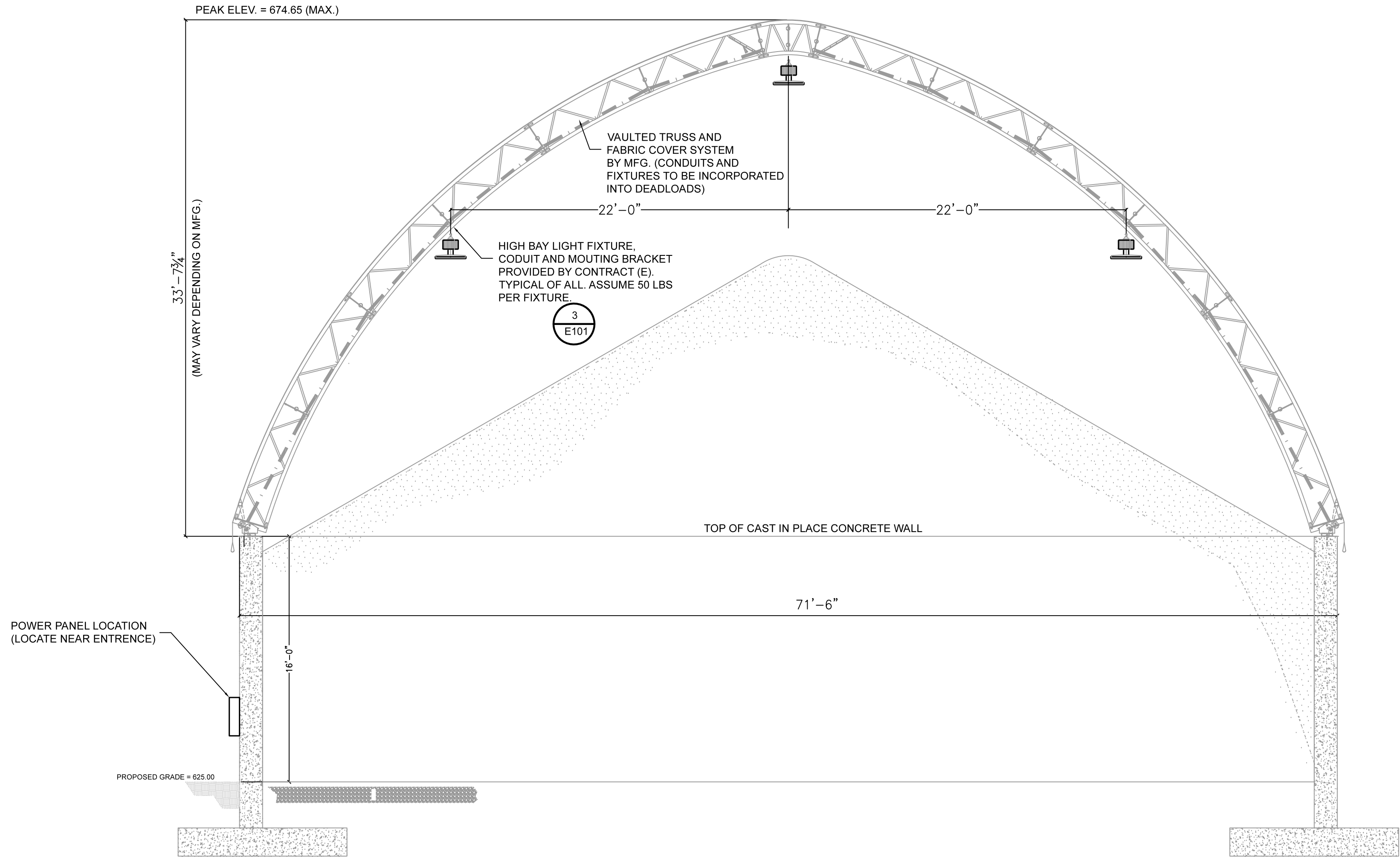
DRAWING DATE: XX/XX/XX		
REVISIONS		
NO.	DATE	DESCRIPTION
1.	XX/XX/XX	XX/XX/XX

DRAWING TITLE  
FABRIC MEMBRANE  
COVER  
AND STRUCTURE

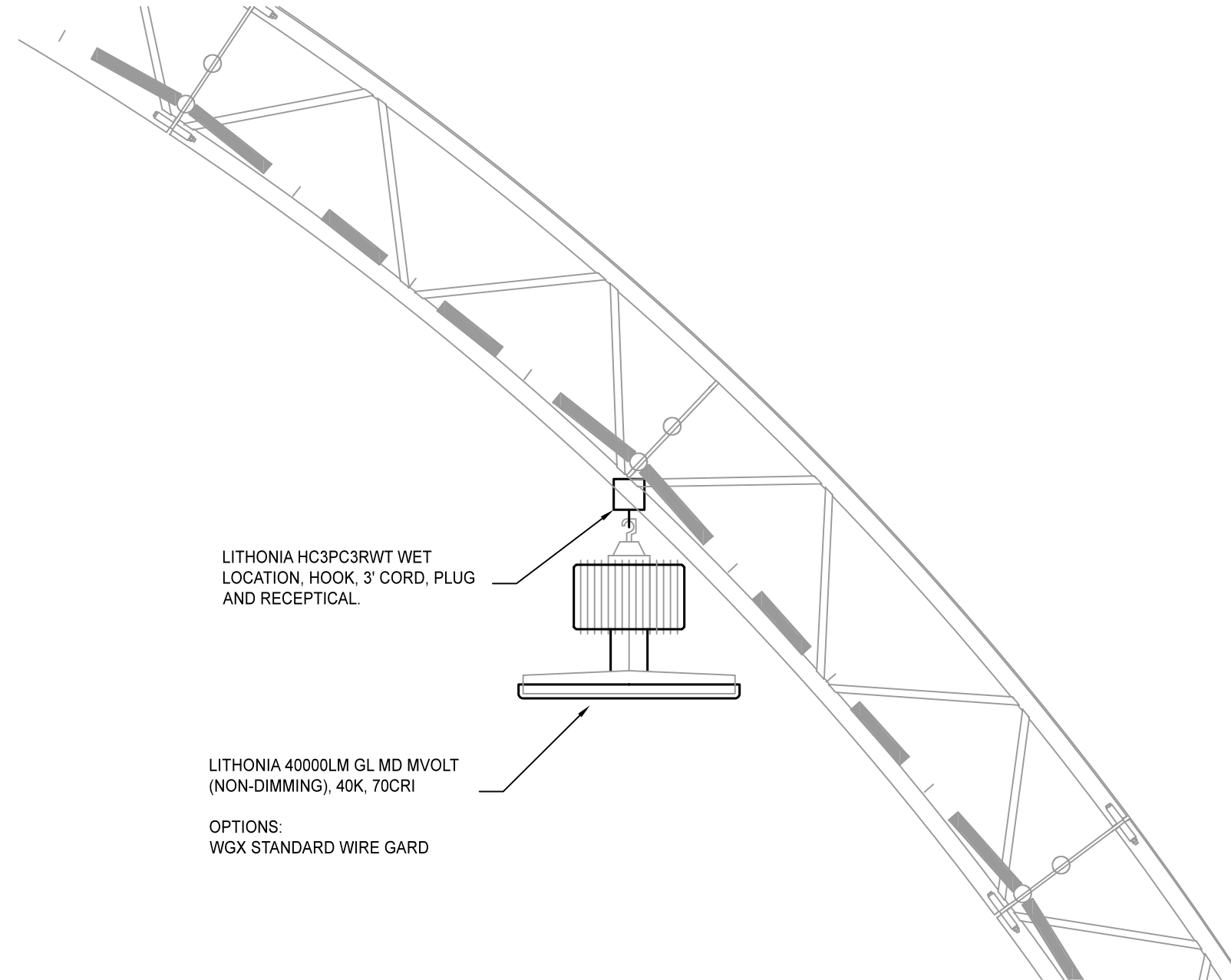
DATE  
PROJECT NO.  
DWG. NO.  
W101



1  
E101  
**ELECTRICAL - PLAN**  
SCALE: 1/8" = 1'



2  
E101  
**ELECTRICAL - SECTION**  
SCALE: 3/16" = 1'



3  
E101  
**HIGH BAY LIGHTING - SECTION**  
SCALE: 1/2" = 1'



HIGH BAY LED LIGHT FIXTURE: LITHONIA JHBL, MODEL JHBL-40000LM-PCL-WD-MVOLT-GZ10-35K-80CRI-WGX-HCX-DL, SHOWN IN PLAN AND SECTION VIEW.



POWER PANEL, (NEMA #)



JUNCTION BOX



GROUND FAULT INTERRUPT, QUADRAPLEX OUTLET.

ESSEX COUNTY DEPARTMENT OF PUBLIC WORKS

CONSTRUCTION WORK FOR

ESSEX COUNTY SALT STORAGE FACILITY

8053 US ROUTE 9, ELIZABETHTOWN, NY 12932

DRAWING DATE: XX/XX/XX		
REVISIONS		
NO.	DATE	DESCRIPTION
1.	XX/XX/XX	XX/XX/XX

DRAWING TITLE

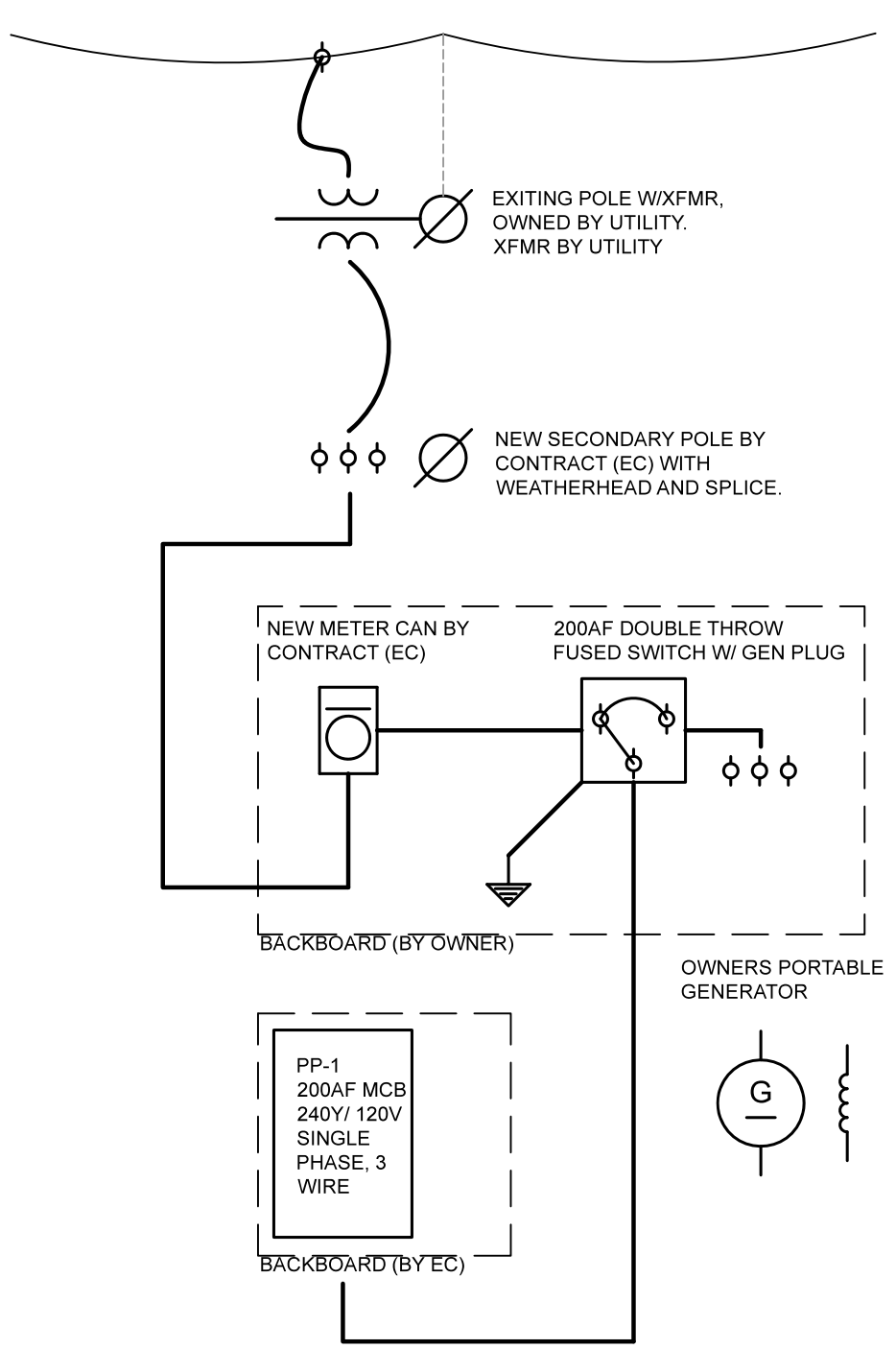
**ELECTRICAL  
PLAN AND  
ELEVATION**

DATE

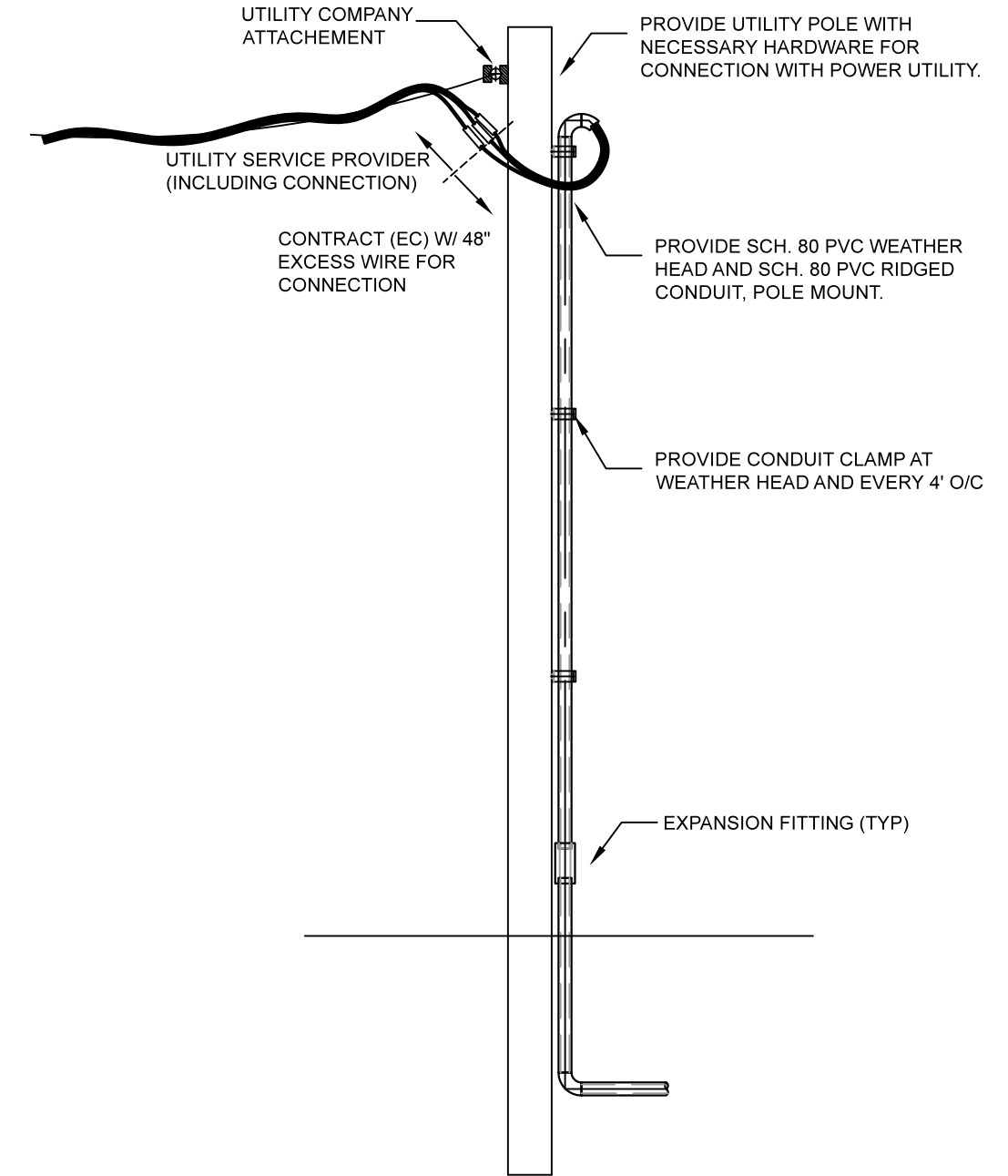
DWG. NO.

PROJECT NO.

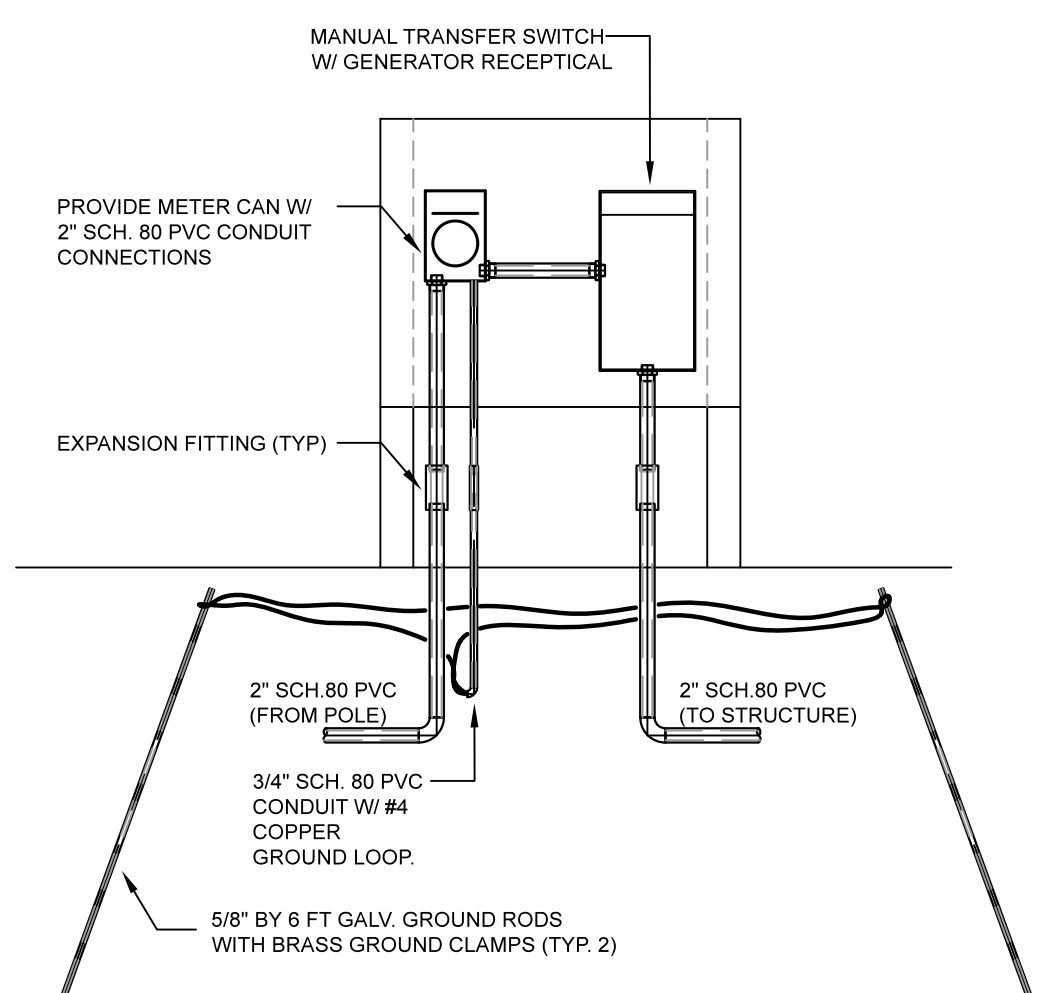
**E101**



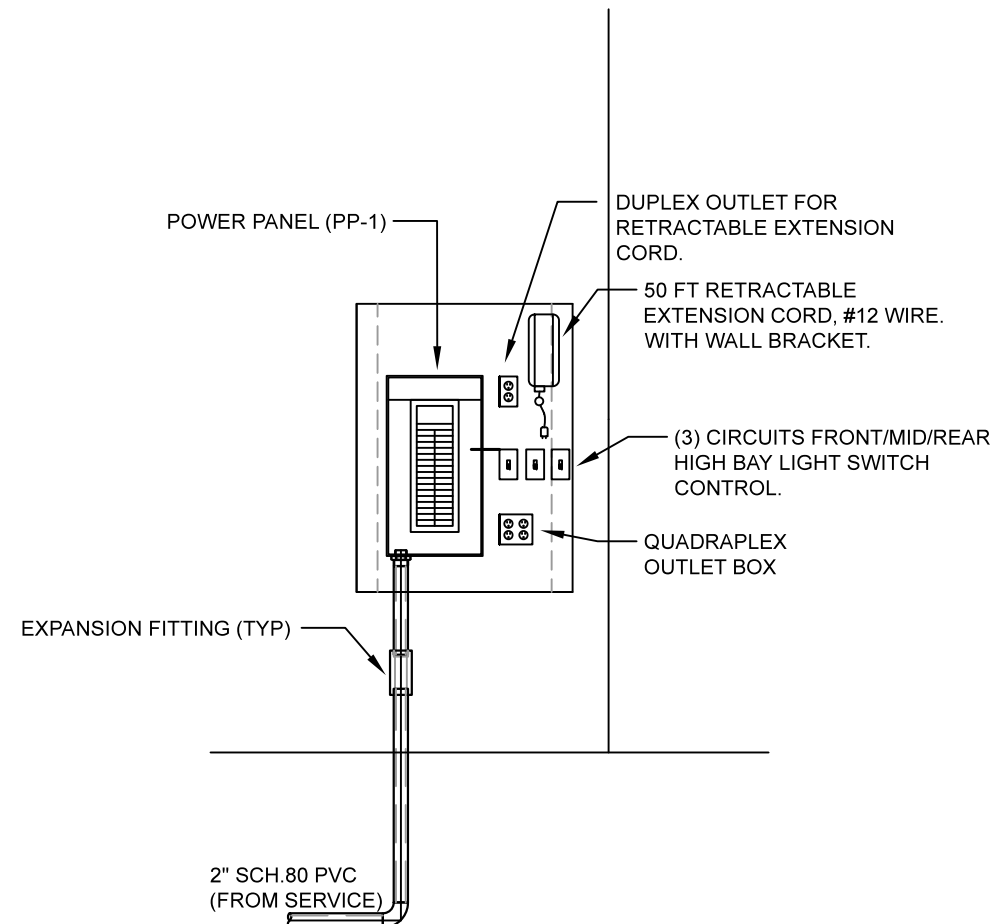
1  
E101  
ELECTRICAL - PLAN  
SCALE: 3/8" = 1'



1  
E101  
ELECTRICAL - PLAN  
SCALE: 3/8" = 1'



1  
E101  
ELECTRICAL - PLAN  
SCALE: 3/8" = 1'



1  
E101  
ELECTRICAL - PLAN  
SCALE: 3/8" = 1'

- HB** HIGH BAY LED LIGHT FIXTURE: LITHONIA JHBL, MODEL JHBL-4000LM-PCL-WD-MVOLT-GZ10-35K-80CRI-WGX-HCX-DL, SHOWN IN PLAN AND SECTION VIEW.
- PP** POWER PANEL, (NEMA #)
- JB** JUNCTION BOX
- GFI** GROUND FAULT INTERRUPT, QUADRAPLEX OUTLET.

**ELECTRICAL NOTES:**

ELECTRICAL PANEL GROUNDING SHALL BE IN ACCORDANCE WITH NEC, INCLUDING ALL FIXTURES, ENCLOSURES, RECEPTICALS AND ELECTRICAL EQUIPMENT.

ELECTRICAL EQUIPMENT INSTALLATION SHALL HAVE THE PROPER CLEARANCES FOR OPERATION AND SERVICE ACCORDING TO THE NEC.

SURFACE MOUNT ALL ELECTRICAL CONDUITS AND BOXES. ALL CONDUITS AND BOXES SHALL BE NEMA 3R, CORROSION RESISTANT.

ALL FASTNER HARDWARE FOR ELECTRICAL EQUIPMENT SHALL BE TYPE 316 STAINLESS STEEL.

**ELECTRICAL DESIGN:**

40000LM, GLASS, MED BEAM, 3500K SPECTRUM, 36158 LUMENS, 294 WATTS, 2.45 AMP/FIXTURE @120 VAC, (6) FIXTURES PER CIRCUIT, 14.7 AMPS. USE 20 AMP BREAKER WITH #10 (2) AND GROUND.

DRAWING DATE: XX/XX/XX		
REVISIONS		
NO.	DATE	DESCRIPTION
1.	XX/XX/XX	XX/XX/XX

DRAWING TITLE

ELECTRICAL NOTES AND DETAILS

Essex County Department of Public Works  
Essex County Salt Storage Facility, Lewis NY  
Project #: P-0101-2017  
(Contract: Foundation)

SECTION 031000 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Formwork for cast-in-place concrete.
2. Shoring, bracing, and anchorage.
3. Architectural form liners.
4. Form accessories.
5. Form stripping.

B. Related Requirements:

1. Section 032000 - Concrete Reinforcing: Reinforcing steel and required supports for cast-in-place concrete.
2. Section 033000 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frame, slabs-on-grade, and other concrete components associated with building.
3. Section 055000 - Metal Fabrications: Product requirements for metal fabrications for placement by this Section.

1.2 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Section 012000 - Price and Payment Procedures: Contract Sum/Price modification procedures.

1.3 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 347 - Guide to Formwork for Concrete.

B. American Forest & Paper Association:

1. AF&PA - National Design Specification (NDS) for Wood Construction.

C. APA - The Engineered Wood Association:

1. APA/EWA PS 1 - Voluntary Product Standard - Structural Plywood.

Essex County Department of Public Works  
Essex County Salt Storage Facility, Lewis NY  
Project #: P-0101-2017  
(Contract: Foundation)

D. ASTM International:

1. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
2. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
3. ASTM E96M - Standard Test Methods for Water Vapor Transmission of Materials.

1.4 COORDINATION

- A. Section 013000 - Administrative Requirements: Requirements for coordination.
- B. Coordinate Work of this Section with other Sections of Work in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other Work.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information on void form materials and installation requirements.
- C. Shop Drawings:
  1. Indicate:
    - a. Formwork, shoring, and reshoring.
    - b. Pertinent dimensions, openings, methods of construction, types of connections, materials, joint arrangement and details, ties and shores, location of framing, studding and bracing, and temporary supports.
    - c. Means of leakage prevention for concrete exposed to view in finished construction.
    - d. Sequence and timing of erection and stripping, assumed compressive strength at time of stripping, height of lift, and height of drop during placement.
    - e. Vertical, horizontal, and special loads according to ACI 347, and camber diagrams when applicable.
    - f. Notes to formwork erector showing size and location of conduits and piping embedded in concrete according to ACI 318.
    - g. Procedure and schedule for removal of shores and installation and removal of reshores.

- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.6 QUALITY ASSURANCE

- A. Perform Work according to ACI 347, 301, and 318.

Essex County Department of Public Works  
Essex County Salt Storage Facility, Lewis NY  
Project #: P-0101-2017  
(Contract: Foundation)

- B. For wood products furnished for Work of this Section, comply with AF&PA.

1.7 QUALIFICATIONS

- A. Contractor experienced in the construction of form work, shoring and bracing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept void forms on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 - PRODUCTS

2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Design and construct formwork, shoring, and bracing according to ACI 318 to conform to design and applicable code requirements to achieve concrete shape, line, and dimension as indicated on Drawings.
- B. Vapor Retarder Permeance: Maximum 1 perm when tested according to ASTM E96.

2.2 WOOD FORM MATERIALS

- A. Plywood Forms:
  - 1. Application: Exposed finish concrete.
  - 2. Description:
    - a. Comply with APA/EWA PS 1.
    - b. Panels: Full size, 4 by 8 feet.
    - c. Label each panel with grade trademark of APA/EWA.
  - 3. Plywood for Surfaces to Receive Membrane Waterproofing:
    - a. Minimum Thickness: 5/8 inch.
    - b. Grade: APA/EWA "B-B Plyform Structural I Exterior."
  - 4. Plywood with "Smooth Finish" Indicated on Drawings:

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- a. Minimum Thickness: 3/4 inch.
- b. Grade: APA/EWA "HD Overlay Plyform Structural I Exterior."

## 2.3 PREFABRICATED FORMS

### A. Preformed Steel Forms:

- 1. Description: Matched, tightly fitted, and stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.
- 2. Minimum Thickness: 16 gage

### B. FRP Forms: Matched, tightly fitted, and stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

### C. Pan:

- 1. Material: Steel
- 2. Configuration: Size and profile as required.

### D. Steel Forms:

- 1. Description: Sheet steel, suitably reinforced.
- 2. Design: For particular use as indicated on Drawings.

### E. Form Liners: Smooth, durable, grainless, and non-staining hardboard unless otherwise indicated on Drawings.

## 2.4 COATINGS

### A. Coatings for Aluminum:

- 1. Polyamide epoxy finish coat with paint manufacturer's recommended primer for aluminum substrate.
- 2. One coat primer and one coat finish.

## 2.5 FORMWORK ACCESSORIES

### A. Form Ties:

- 1. Type: cone.
- 2. Material: Galvanized
- 3. Length: Fixed to wall dimensions.
- 4. Furnish waterproofing washer, integral waterbarrier.
- 5. Designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
- 6. Free of defects capable of leaving holes 1 to 1.25 in concrete surface.

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7. All fasteners shall break to a depth of 1" or more to provide a minimum of 1" cover from the concrete surface to the closest corrodible metal.

B. Spreaders:

1. Description: Standard, non-corrosive metal-form clamp assembly, of type acting as spreaders and leaving no metal within 1 inch of concrete face.
2. Wire ties, wood spreaders, or through bolts are not permitted.

C. Form Release Agent:

1. Description: Colorless mineral oil that will not stain concrete or absorb moisture or impair natural bonding or color characteristics of coating intended for use on concrete.
2. Formulate form-release agent with rust inhibitor for steel form-facing materials.

D. Corners:

1. Type: Chamfer, wood, pvc or rubber.
2. Size: ¾" unless otherwise noted.
3. Lengths: Maximum possible.

E. Dovetail Anchor Slot:

1. Material: Galvanized steel.
2. Thickness: 22 gauge.
3. Filling: Foam
4. Fasten slot to concrete formwork according to manufacturer instructions, and insert foam filler to prevent concrete from entering slot during pour.

F. Flashing Reglets:

1. Material: Galvanized steel
2. Thickness: 22 gauge
3. Lengths: Maximum possible.
4. Furnish alignment splines for joints.
5. Filling: Foam
6. Fasten flashing reglet to concrete formwork according to manufacturer instructions, and insert foam to prevent concrete from entering reglet during pour.

G. Vapor Retarder:

1. ASTM E 1745, Class A
2. Description: Polyethylene sheet.
3. Thickness: 15 mils.
4. Stegowrap 15 mil Class A or Moistop Ultra by Fortifiber.

H. Bituminous Joint Filler: Comply with ASTM D1751.

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- I. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Size, strength, and character to maintain formwork in place while placing concrete.
- J. Waterstop:
  - 1. Material: Flexible PVC, extruded from an elastomeric plastic material of which the basic resin is prime virgin polyvinyl chloride. No recycled or reclaimed material is permitted.
  - 2. Working Temperature Range: Minus 50 to plus 175 degrees F
  - 3. Width: Minimum flange width of 6 inches.
  - 4. Lengths: Maximum possible.
  - 5. Profile: Ribbed with a center bulb.
  - 6. Corner Sections: Preformed.
  - 7. Jointing: Heat welded.
  - 8. Performance Requirements

Property	Test Method	Required Limits
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Water absorption	ASTM D 570	0.15% max
Tear Resistance	ASTM D 624	200 lb/in (35 kN/m) min.
Ultimate Elongation	ASTM D 638	350% min.
Tensile Strength	ASTM D 638	2000 psi (13.78 Mpa) min.
Low Temperature Brittleness	ASTM D 746	No Failure @ -35°F (-37°C)
Stiffness in Flexure	ASTM D 747	600 psi (4.13 Mpa) min.
Specific Gravity	ASTM D 792	1.45 max.
Hardness, Shore A	ASTM D 2240	79 +3
Tensile Strength after accelerated extraction	CRD-C 572	1850 psi (11.03 Mpa) min.
Elongation after accelerated extraction	CRD-C 572	300% min.
Effect of Alkalies after 7 days: Weight Change Hardness Change	CRD-C 572	between -0.10% / +0.25% +/- 5 points

K. Waterstop (retrofit):

1. Description: Flexible strip of bentonite waterproofing compound in coil form for joints in concrete construction.

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PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify lines, levels, and centers before proceeding with formwork.
- C. Verify that dimensions agree with Drawings.
- D. If formwork is placed after reinforcement resulting in insufficient concrete cover over reinforcement, request instructions from Architect/Engineer before proceeding.

3.2 INSTALLATION

- A. Formwork:
  - 1. Provide top form for sloped surfaces steeper than 1.5 horizontal to 1 vertical to hold shape of concrete during placement, unless it can be demonstrated that top forms can be omitted.
  - 2. Construct forms to correct shape and dimensions, mortar-tight, braced, and of sufficient strength to maintain shape and position under imposed loads from construction operations.
  - 3. Camber forms where necessary to produce level finished soffits unless indicated otherwise on Drawings.
  - 4. Positioning:
    - a. Carefully verify horizontal and vertical positions of forms.
    - b. Correct misaligned or misplaced forms before placing concrete.
  - 5. Complete wedging and bracing before placing concrete.
  - 6. Erect formwork, shoring, and bracing to achieve design requirements according to ACI 301 to support vertical, lateral, static and dynamic loads and construction loads that might be applied until concrete structure can support such loads.
  - 7. Stripping:
    - a. Arrange and assemble formwork to permit dismantling and stripping.
    - b. Do not damage concrete during stripping.
    - c. Permit removal of remaining principal shores.
  - 8. Obtain approval of Architect/Engineer before framing openings in structural members not indicated on Drawings.
  - 9. Install fillet and chamfer strips on external corners of beams, joists, columns, and walls.
  - 10. Install void forms according to manufacturer instructions.
  - 11. Do not reuse wood formwork more than two times for concrete surfaces to be exposed to view.

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12. Do not patch formwork.
13. Leave forms in place for minimum number of days according to ACI 347.

B. Form Removal:

1. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads, and removal has been approved by Architect/Engineer.
2. Loosen forms carefully; do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
3. Store removed forms in manner that surfaces to be in contact with fresh concrete will not be damaged.
4. Discard damaged forms.
5. Form Release Agent:
  - a. Apply according to manufacturer instructions.
  - b. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
  - c. Do not apply form release agent if concrete surfaces are indicated to receive special finishes or applied coverings that may be affected by agent.
  - d. Soak inside surfaces of untreated forms with clean water, and keep surfaces coated prior to placement of concrete.
6. Form Cleaning:
  - a. Clean forms as erection proceeds to remove foreign matter within forms.
  - b. Clean formed cavities of debris prior to placing concrete.
  - c. Flush with water or use compressed air to remove remaining foreign matter.
  - d. Ensure that water and debris drain to exterior through cleanout ports.
  - e. Cold Weather:
    - 1) During cold weather, remove ice and snow from within forms.
    - 2) Do not use de-icing salts.
    - 3) Do not use water to clean out forms, unless formwork and concrete construction proceed within heated enclosure; use compressed air or other dry method to remove foreign matter.
7. Reuse and Coating of Forms:
  - a. Thoroughly clean forms and reapply form coating before each reuse.
  - b. For exposed Work, do not reuse forms with damaged faces or edges.
  - c. Apply form coating to forms according to manufacturer instructions.
  - d. Do not coat forms for concrete indicated to receive "scored finish."
  - e. Apply form coatings before placing reinforcing steel.

C. Forms for Smooth Finish Concrete:

1. Use steel, plywood, or lined-board forms.
2. Use clean and smooth plywood and form liners, uniform in size, and free from surface and edge damage capable of affecting resulting concrete finish.

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3. Install form lining with close-fitting square joints between separate sheets without springing into place.
4. Use full-sized sheets of form liners and plywood wherever possible.
5. Tape joints to prevent protrusions in concrete.
6. Apply forming and strip wood forms in a manner to protect corners and edges.
7. Level and continue horizontal joints.
8. Keep wood forms wet until stripped.

D. Architectural Form Liners:

1. Erect architectural side of formwork first.
2. Attach form liner to forms before installing form ties.
3. Install form liners square, with joints and pattern aligned.
4. Seal form liner joints to prevent grout leaks.
5. Dress joints and edges to match form liner pattern and texture.

E. Forms for Surfaces to Receive Membrane Waterproofing:

1. Use plywood or steel forms.
2. After erection of forms, tape form joints to prevent protrusions in concrete.

F. Framing, Studding, and Bracing:

1. Maximum Spacing of Studs:
  - a. Boards: Maximum 16 inches
  - b. Plywood: 12 inches
2. Size framing, bracing, centering, and supporting members for sufficient strength to maintain shape and position under imposed loads from construction operations.
3. Construct beam soffits of material minimum 2 inches thick.
4. Distribute bracing loads over base area on which bracing is erected.
5. When placed on ground, protect against undermining, settlement, and accidental impact.

G. Form Anchors and Hangers:

1. Do not use anchors and hangers leaving exposed metal at concrete surface.
2. Symmetrically arrange hangers supporting forms from structural-steel members to minimize twisting or rotation of member.
3. Penetration of structural-steel members is not permitted.

H. Inserts, Embedded Parts, and Openings:

1. Install formed openings for items to be embedded in or passing through concrete Work.
2. Locate and set in place items required to be cast directly into concrete.
3. Position recessed reglets for brick veneer masonry anchors according to spacing and intervals as indicated on Drawings.
4. Install accessories straight, level, and plumb, and ensure that items are not disturbed during concrete placement.

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5. Joints:
    - a. Install waterstops continuous without displacing reinforcement.
    - b. Heat-seal joints watertight.
  6. Openings:
    - a. Provide temporary ports or openings in formwork as required to facilitate cleaning and inspection.
    - b. Locate openings at bottom of forms to allow flushing water to drain.
  7. Close temporary openings with tight-fitting panels, flush with inside face of forms, and neatly fitted such that joints will not be apparent in exposed concrete surfaces.
- I. Form Ties:
1. Provide sufficient strength and quantity to prevent spreading of forms.
  2. Place ties at least 1 inch (25 mm) away from finished surface of concrete.
  3. Leave inner rods in concrete when forms are stripped.
  4. Space form ties equidistant, symmetrical, and aligned vertically and horizontally unless indicated otherwise on Drawings.
- J. Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.
- K. Construction Joints:
1. Install surfaced pouring strip where construction joints intersect on exposed surfaces to provide straight line at joints.
  2. Just prior to subsequent concrete placement, remove strip and tighten forms to conceal shrinkage.
  3. Appearance:
    - a. Show no overlapping of construction joints.
    - b. Construct joints to present same appearance as butted plywood joints.
  4. Arrange joints in continuous line straight, true, and sharp.
- L. Embedded Items:
1. Make provisions for pipes, sleeves, anchors, inserts, reglets, anchor slots, nailers, waterstops, and other features.
  2. Do not embed wood or uncoated aluminum in concrete.
  3. Obtain installation and setting information for embedded items furnished under other Sections.
  4. Securely anchor embedded items in correct location and alignment prior to placing concrete.
  5. Ensure that conduits and pipes, including those made of coated aluminum, meet requirements of ACI 318 regarding size and location limitations.

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M. Openings for Items Passing through Concrete:

1. Frame openings in concrete where indicated on Drawings.
2. Establish exact locations, sizes, and other conditions required for openings and attachment of Work specified under other Sections.
3. Coordinate Work to avoid cutting and patching of concrete after placement.
4. Perform cutting and repairing of concrete required as result of failure to provide required openings.

N. Screeds:

1. Set screeds and establish levels for tops of and finish on concrete slabs.
2. Slope slabs to drain where required or as indicated on Drawings.
3. Before depositing concrete, remove debris from space to be occupied by concrete and thoroughly wet forms; remove freestanding water.

O. Screed Supports:

1. For concrete over waterproof membranes and vapor retarder membranes, use cradle-, pad-, or base-type screed supports that will not puncture membrane.
2. Staking through membrane is not permitted.

P. Cleanouts and Access Panels:

1. Provide removable cleanout sections or access panels at bottoms of forms to permit inspection and effective cleaning of loose dirt, debris, and waste material.
2. Clean forms and surfaces against which concrete is to be placed.
3. Remove chips, sawdust, and other debris.
4. Thoroughly blow out forms with compressed air just before concrete is placed.

### 3.3 TOLERANCES

A. Construct formwork to maintain tolerances according to ACI 301.

B. Tolerances: Construct formwork to produce completed concrete surfaces within construction tolerances according to ACI 117.

C. Camber:

1. According to ACI 301.

### 3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

B. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

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C. Inspection:

1. Inspect erected formwork, shoring, and bracing to ensure that Work complies with formwork design and that supports, fastenings, wedges, ties, and items are secure.
2. Notify Architect/Engineer after placement of reinforcing steel in forms but prior to placing concrete.
3. Schedule concrete placement to permit formwork inspection before placing concrete.

3.5 ATTACHMENTS

- A. Basement Walls Not Exposed to View: Site-fabricated plywood coated with form oil.
- B. Basement Walls Exposed to View: Site-fabricated rough-sawn lumber.
- C. Supported Floor Slabs: Prefabricated glass-fiber pan forms, treated for exposed-to-view finish.

END OF SECTION 031000

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SECTION 032000 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Reinforcing bars.
2. Welded wire fabric.
3. Reinforcement accessories.

B. Related Requirements:

1. Section 031000 - Concrete Forming and Accessories: Form materials, waterstops, and accessories required to form cast-in-place concrete.
2. Section 033000 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frame, slabs on grade, and other concrete components associated with building.
3. Section 033500 - Concrete Finishing: Reinforcement for concrete floor toppings.

1.2 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 318 - Building Code Requirements for Structural Concrete.
3. ACI 530/530.1 - Building Code Requirements and Specification for Masonry Structures.
4. ACI SP-66 - ACI Detailing Manual.

B. American Welding Society:

1. AWS D1.4 - Structural Welding Code - Reinforcing Steel.

C. ASTM International:

1. ASTM A184 - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.
2. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
3. ASTM A704 - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
4. ASTM A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
5. ASTM A767 - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.

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6. ASTM A775 - Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
7. ASTM A884 - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
8. ASTM A934 - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
9. ASTM A996 - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement.
10. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

D. Concrete Reinforcing Steel Institute:

1. CRSI 10-MSP - Manual of Standard Practice.
2. CRSI 10PLACE - Placing Reinforcing Bars.

1.3 COORDINATION

- A. Section 013000 - Administrative Requirements: Requirements for coordination.
- B. Coordinate Work of this Section with placement of formwork, formed openings, and other Work.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Shop Drawings:
  1. Indicate bar sizes, spacings, locations, splice locations, and quantities of reinforcing steel and welded wire fabric.
  2. Indicate bending and cutting schedules.
  3. Indicate supporting and spacing devices.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Submit certified copies of mill test report of reinforcement materials analysis.
- E. Welder Certificates: Certify welders and welding procedures employed on Work, verifying AWS qualification within previous 12 months.
- F. Source Quality-Control Submittals: Indicate results of shop or factory tests and inspections.
- G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- H. Qualifications Statement:

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1. Welders: Qualify procedures and personnel according to AWS D1.1.

#### 1.5 QUALITY ASSURANCE

- A. Perform Work according to CRSI 10-MSP, ACI 301, ACI 318.
- B. Prepare Shop Drawings according to ACI SP-66.

#### 1.6 QUALIFICATIONS

- A. Welders: AWS qualified within previous 12 months for employed weld types.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
  1. Protect materials from moisture by storing in clean, dry location remote from construction operations areas.
  2. Provide additional protection according to manufacturer instructions.

#### 1.8 EXISTING CONDITIONS

- A. Field Measurements:
  1. Verify field measurements prior to fabrication.
  2. Indicate field measurements on Shop Drawings.

### PART 2 - PRODUCT

#### 2.1 REINFORCEMENT

- A. Deformed and Plain Reinforcement:
  1. Material: Steel bars.

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2. Comply with ASTM A706.
3. Yield Strength: 60 ksi.
4. Finish: Uncoated.

B. Welded Deformed Wire Fabric:

1. Comply with ASTM A1064.
2. Configuration: Flat sheets or Coiled rolls.
3. Finish: Uncoated.

## 2.2 FABRICATION

- A. Fabricate concrete reinforcement according to CRSI 10-MSP and ACI 318.
- B. Form standard hooks for 180-degree bends, 90-degree bends, stirrups and tie hooks, and seismic hooks as indicated on Drawings.
- C. Form reinforcement bends with minimum diameters according to ACI 318.
- D. Fabricate column reinforcement with offset bends at reinforcement splices.
- E. Form spiral column reinforcement from minimum 3/8-inch diameter continuous deformed bar or wire.
- F. Form ties and stirrups from following:
  1. Bars No. 10 and Smaller: No. 3 deformed bars
  2. Bars No. 11 and Larger: No. 4 deformed bars.
- G. Weld reinforcement according to AWS D1.4.
- H. Splicing:
  1. If not indicated on Drawings, locate reinforcement splices at point of minimum stress.
  2. Obtain approval of splice locations from Architect/Engineer.

## 2.3 ACCESSORY MATERIALS

- A. Tie Wire:
  1. Minimum 16 gage, annealed type
- B. Chairs, Bolsters, Bar Supports, and Spacers:
  1. Size and Shape: To strengthen and support reinforcement during concrete placement conditions.
  2. Where vapor retarder is used, furnish load-bearing pad on bottom to prevent vapor retarder puncture.

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- C. Special Chairs, Bolsters, Bar Supports, and Spacers Adjacent to Weather-Exposed Concrete Surfaces:
  - 1. Material: Plastic-coated or Stainless steel.
  - 2. Size and Shape: To meet Project conditions.
- D. Reinforcing Splicing Devices:
  - 1. Type: Mechanical threaded; full tension and compression.
  - 2. Size: To fit joined reinforcing.
- E. Epoxy Coating Patching Material: Type as recommended by coating manufacturer.

## 2.4 SOURCE QUALITY CONTROL

- A. Provide shop inspection and testing of completed assembly.
- B. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.
- C. Certificate of Compliance:
  - 1. If fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
  - 2. Specified shop tests are not required for Work performed by approved fabricator.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Place, support, and secure reinforcement against displacement.
- B. Do not deviate from required position beyond specified tolerance.
- C. Do not weld crossing reinforcement bars for assembly except as permitted by Architect/Engineer.
- D. Do not displace or damage vapor retarder.
- E. Accommodate placement of formed openings.
- F. Spacing:
  - 1. Space reinforcement bars with minimum clear spacing according to ACI 318 equal to one bar diameter but not less than 1 inch.
  - 2. If bars are indicated in multiple layers, place upper bars directly above lower bars.

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- G. Maintain minimum concrete cover around reinforcement according to ACI 318 applicable as follows:
1. Footings and Concrete Formed against Earth: 3 inches.
  2. Concrete Exposed to Earth or Weather:
    - a. No. 6 Bars and Larger: 2 inches.
    - b. No. 5 Bars and Smaller: 1-1/2 inches.
  3. Supported Slabs, Walls, and Joists:
    - a. No. 14 Bars and Larger: 1-1/2 inches.
    - b. No. 11 Bars and Smaller: 3/4 inch.
  4. Beams and Columns: 1-1/2 inches.
  5. Shell and Folded Plate Members:
    - a. No. 6 Bars and Larger: 3/4 inch.
    - b. No. 5 Bars and Smaller: 1/2 inch.
- H. Bond and ground reinforcement as specified in Section 260526 - Grounding and Bonding for Electrical Systems.

3.2 TOLERANCES

- A. Section 014000 - Quality Requirements: Requirements for tolerances.
- B. Install reinforcement within following tolerances for flexural members, walls, and compression members:
1. Reinforcement Depth Greater Than 8 Inches:
    - a. Depth Tolerance: Plus or Minus 3/8 inch.
    - b. Concrete Cover Tolerance: Minus 3/8 inch.
  2. Reinforcement Depth Less Than or Equal to 8 Inches:
    - a. Depth Tolerance: Plus or Minus 1/2 inch.
    - b. Concrete Cover Tolerance: Minus 1/2 inch.
- C. Foundation Walls: Install reinforcement within tolerances according to ACI 530/530.1.

3.3 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
- B. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

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- C. Field inspection and testing will be performed by Owner's testing laboratory according to ACI 318 .
- D. Provide unrestricted access to Work and cooperate with appointed inspection and testing firm.
- E. Reinforcement Inspection:
  - 1. Placement Acceptance: Inspect specified and ACI 318 material requirements and specified placement tolerances.
  - 2. Welding: Inspect welds according to AWS D1.1.
  - 3. Periodic Placement Inspection: Inspect for correct materials, fabrication, sizes, locations, spacing, concrete cover, and splicing.
  - 4. Weldability Inspection: Inspect for reinforcement weldability if formed from steel other than ASTM A706.
  - 5. Continuous Weld Inspection: Inspect reinforcement according to ACI 318.
  - 6. Periodic Weld Inspection: Inspect other welded connections.

3.4 ATTACHMENTS

- A. Reinforcement for Superstructure Framing Members: Deformed bars, unfinished.
- B. Reinforcement for Foundation Wall Framing Members and Slabs on Grade: Deformed bars and wire fabric, galvanized finish.
- C. Reinforcement for Parking Structure Framing Members: Deformed bars, epoxy-coated finish.

END OF SECTION 032000

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SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Cast-in-Place Concrete for Following Items:

1. Building frame members.
2. Beams, lintels, and columns.
3. Shear walls.
4. Retaining walls.
5. Foundation walls.
6. Footings.
7. Supported slabs.
8. Slabs on grade.
9. Control, expansion, and contraction joint devices.
10. Equipment pads.
11. Light pole base.
12. Flagpole base.
13. Thrust blocks.
14. Manholes.

B. Related Requirements:

1. Section 031000 - Concrete Forming and Accessories: Formwork and accessories, Placement of joint devices in formwork, Placement of joint device anchors in formwork.
2. Section 032000 - Concrete Reinforcing: Requirements for reinforcing steel and supports.
3. Section 033500 - Concrete Finishing: Finishing of concrete floor surfaces.
4. Section 033900 - Concrete Curing: Curing of concrete floor surfaces.
5. Section 079000 - Joint Protection: Requirements for sealants and primers.
6. Section 079500 - Expansion Control: Requirements for expansion and control joint cover assemblies.
7. Section 312323 - Fill: Sand layer over vapor retarder.

1.2 REFERENCE STANDARDS

A. American Concrete Institute:

1. ACI 301 - Specifications for Structural Concrete.
2. ACI 305R - Guide to Hot Weather Concreting.
3. ACI 306.1 - Standard Specification for Cold Weather Concreting.
4. ACI 308.1 - Specification for Curing Concrete.
5. ACI 318 - Building Code Requirements for Structural Concrete.

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B. ASTM International:

1. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
2. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
3. ASTM C33 - Standard Specification for Concrete Aggregates.
4. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
5. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
6. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
7. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete.
8. ASTM C150 - Standard Specification for Portland Cement.
9. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
10. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
11. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
12. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
13. ASTM C330 - Standard Specification for Lightweight Aggregates for Structural Concrete.
14. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
15. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
16. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
17. ASTM C685 - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing.
18. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.
19. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars.
20. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
21. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
22. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
23. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete.
24. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
25. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
26. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
27. ASTM D994 - Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
28. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
29. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
30. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.

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31. ASTM E96 - Standard Test Methods for Water Vapor Transmission of Materials.
32. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
33. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
34. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.

### 1.3 COORDINATION

- A. Section 013000 - Administrative Requirements: Requirements for coordination.
- B. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.

### 1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data on joint devices, attachment accessories, and admixtures.
- C. Design Data:
  1. Submit concrete mix design for each concrete strength.
  2. Submit separate mix designs if admixtures are required for following:
    - a. Hot and cold weather concrete Work.
    - b. Air entrained concrete Work.
  3. Identify mix ingredients and proportions, including admixtures.
  4. Identify chloride content of admixtures and whether or not chlorides were added during manufacture.
- D. Samples: Submit two samples of expansion/contraction joints and control joints.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Manufacturer Instructions: Submit installation procedures and interfacing required with adjacent Work.
- G. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

### 1.5 CLOSEOUT SUBMITTALS

- A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.

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- B. Project Record Documents: Record actual locations of embedded utilities and components concealed from view in finished construction.

#### 1.6 QUALITY ASSURANCE

- A. Perform Work according to ACI 301 and ACI 318.
- B. Comply with ACI 305R when pouring concrete during hot weather.
- C. Comply with ACI 306.1 when pouring concrete during cold weather.
- D. Acquire cement and aggregate from one source for Work.

#### 1.7 AMBIENT CONDITIONS

- A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
- B. Maintain concrete temperature after installation at minimum 50 degrees F for minimum seven days.

### PART 2 - PRODUCTS

#### 2.1 PERFORMANCE AND DESIGN CRITERIA

- A. Vapor Retarder Permeance: Maximum 1 perm when tested according to ASTM E96, water method.

#### 2.2 MATERIALS

- A. Concrete:
  - 1. Cement:
    - a. Comply with ASTM C150, Type II - Moderate Sulfate Resistant
    - b. Type: Portland.
  - 2. Hydraulic Cement:
    - a. Comply with ASTM C1157
  - 3. Expansive Hydraulic Cement: Comply with ASTM C845.
  - 4. Normal Weight Aggregates:
    - a. Comply with ASTM C33

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- b. Coarse Aggregate Maximum Size: According to ACI 318 and the mix designs specified below.
- 5. Water:
  - a. Comply with ACI 318.
  - b. Potable, without deleterious amounts of chloride ions, in compliance with ASTM C 94.
- B. Admixtures:
  - 1. General: Admixtures certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cementitious material and to be compatible with other admixtures and cementitious materials. Do not use admixtures containing calcium chloride. All admixtures shall comply with ASTM C494.
  - 2. Air-Entraining Admixture: ASTM C 260.
    - a. Daravair 1000; W. R. Grace & Co.
    - b. MB-AE90-BASF Construction Chemicals, LLC.
    - c. Substitutions or approved equal.
  - 3. Mid-Range Water-Reducing Admixture: ASTM C 494, Type A. Mid-range waterreducers shall only be accepted for use in concrete with water/cement ratios of .45 and above.
    - a. Daracem 55; W. R. Grace & Co.
    - b. Poly Heed 1020-BASF Construction Chemicals, LLC.
    - c. Substitutions or approved equal.
  - 4. High-Range Water-Reducing Admixture: ASTM C 494, Type F. High-range waterreducers shall be required for use in all concrete with water/cement ratios below 0.45.
    - a. ADVA 140; W. R. Grace & Co.
    - b. Glenium 3030 NS-BASF Construction Chemicals, LLC.
    - c. Substitutions or approved equal.
  - 5. Corrosion-Inhibiting Admixture: Commercially formulated, non-set-accelerating, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
    - a. DCI S (Normal Weather Concreting); W. R. Grace & Co., Construction Products.
    - b. DCI (Cold Weather Concreting); W. R. Grace & Co., Construction Products.
    - c. Substitutions or approved equal.
  - 6. Shrinkage Reducing Admixture: Shall be used for air-entrained concrete where freezethaw durability is required in structural members where cracks due to shrinkage are prevalent and the repercussions are most severe.
    - a. Eclipse Plus; W. R. Grace & Co., Construction Products.
    - b. Substitutions or approved equal.
  - 7. Shrinkage Reducing Admixture: Shall be for indoor slabs-on-grade, and may be used for any concrete where there is no requirement for entrained air.
    - a. Eclipse Floor; W. R. Grace & Co., Construction Products.
    - b. Approved Equal – Section 00710 – Paragraph 6.05.A.1.
  - 8. Fly Ash: Comply with ASTM C618.
  - 9. Silica Fume: Comply with ASTM C1240.
  - 10. Slag:

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- a. Description: Ground-granulated blast-furnace slag.
- b. Comply with ASTM C989
- c. Grade 100.

11. Plasticizing:

- a. Comply with ASTM C1017
- b. Type I, plasticizing, or II, plasticizing and retarding.

C. Joint Devices and Filler:

1. Joint Filler, Type A

- a. Description: Asphalt-impregnated fiberboard or felt.
- b. Comply with ASTM D1751 and D994.
- c. Thickness: 1/4 inch
- d. Profile: Tongue-and-groove.

2. Joint Filler, Type C

- a. Description: Premolded sponge rubber.
- b. Comply with ASTM D1752.
- c. Thickness: 1/2 inch

3. Construction Joint Devices:

- a. Material: Integral galvanized steel or extruded plastic.
- b. Profile: Tongue-and-groove with removable top strip exposing sealant trough and knockout holes spaced at 6 inches o.c.
- c. Furnish ribbed steel spikes with tongue to fit top screed edge.

4. Expansion and Contraction Joint Devices:

- a. Comply with ASTM B221.
- b. Material: Extruded aluminum.
- c. Filler Strip: Resilient neoprene with Shore A hardness of 35 to permit plus or minus 25 percent joint movement with full recovery.
- d. Cover Plate: Vinyl, of longest manufactured length at each location, and flush mounted.

5. Sealant:

- a. Comply with ASTM D6690.
- b. Type: [I] [II] [III] [IV].

6. Sealant:

- a. Description: Cold-applied,

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2.3 CONCRETE MIX

- A. Select proportions for concrete according to ACI 318 without trial mixtures or field test data if approved by Architect/Engineer.
- B. Performance and Design Criteria:
  - 1. Compressive Strength: 5,000 psi at 28 days.
  - 2. Cement Type: ASTM C150
  - 3. Minimum Cementitious Content: 790 lb./cu. yd. of concrete
  - 4. Aggregate Type: Normal weight.
  - 5. Fiber Reinforcement: None
  - 6. Maximum Water-Cement Ratio: 0.38
  - 7. Aggregate Size:
    - a. Maximum:  $\frac{3}{4}$  inch.
  - 8. Air Content: 6.5 percent, plus or minus 1.5 percent.
  - 9. Maximum Water: 300 lbs/cy of concrete.
  - 10. Slump:
    - a. Max. initial slump: 3 inches
    - b. Max. slump with high range water reducer: 8 inches
  - 11. Air Content: 6.5%
  - 12. Corrosion Inhibiting Admixture: 2 gal/cy of concrete
- C. Admixtures:
  - 1. Include admixture types and quantities indicated in concrete mix designs only if approved by Architect/Engineer.
  - 2. Cold Weather:
    - a. Use accelerating admixtures in cold weather.
    - b. Use of admixtures will not relax cold-weather placement requirements.
  - 3. Hot Weather: Use set-retarding admixtures.
  - 4. Do not use calcium chloride or admixtures containing calcium chloride.
  - 5. Add air entrainment admixture to concrete mix for Work exposed to freezing and thawing or deicing chemicals.
  - 6. For concrete exposed to deicing chemicals, limit fly ash, pozzolans, silica fumes, and slag content.
- D. Ready-Mixed Concrete: Mix and deliver concrete according to ASTM C94 and C685
- E. Site-Mixed Concrete: Mix concrete according to ACI 318.

2.4 ACCESSORIES

- A. Bonding Agent:

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1. Description: Polymer resin emulsion, Polyvinyl acetate, Latex emulsion, Two-component modified epoxy resin, Non-solvent two-component polysulfide epoxy Mineral-filled polysulfide polymer epoxy, Mineral-filled polysulfide polymer epoxy resin, Polyamide-cured epoxy.
- B. Vapor Retarder:
1. Description: Clear polyethylene film. Use Fabric Reinforced in areas that film is subject to aggressive conditions.
  2. Comply with ASTM E1745.
  3. Thickness: 8 mils
  4. Type: As recommended for below-grade application.
  5. Joint Tape: As recommended by manufacturer.
- C. Non-shrink Grout:
1. Description: Premixed compound consisting of non-metallic aggregate, cement, and water-reducing and plasticizing agents.
  2. Comply with ASTM C1107.
  3. Minimum Compressive Strength: 2,400 psi in 48 hours and 7,000 psi in 28 days.
- D. Concrete Reinforcing Fibers:
1. Description: High-strength industrial-grade fibers specifically engineered for secondary reinforcement of concrete.
  2. Comply with ASTM C1116.
  3. Tensile Strength: 130 ksi.
  4. Toughness: 15 ksi.
  5. Fiber Length: ¾ inch.
  6. Fiber Count: 34 million/lb.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
- B. Verify requirements for concrete cover over reinforcement.
- C. Verify that anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not interfere with placing concrete.

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3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
- B. Previously Placed Concrete:
  - 1. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent.
  - 2. Remove laitance, coatings, and unsound materials.
- C. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels, and pack solid with non-shrink grout.
- D. Remove debris and ice from formwork, reinforcement, and concrete substrates.
- E. Remove water from areas receiving concrete before concrete is placed.

3.3 INSTALLATION

- A. Placing Concrete:
  - 1. Place concrete according to ACI 301 and 318.
  - 2. Notify testing laboratory and Architect/Engineer minimum 24 hours prior to commencement of operations.
  - 3. Ensure that reinforcement, inserts, embedded parts, formed expansion and contraction joints, and any penetration castings are not disturbed during concrete placement.
  - 4. Install vapor retarder under interior slabs on grade according to ASTM E1643.
  - 5. Lap joints minimum 6 inches and seal watertight by adhesive applied between overlapping edges and ends.
  - 6. Repairs:
    - a. Repair vapor retarder damaged during placement of concrete reinforcement.
    - b. Using vapor retarder material, lap over damaged areas minimum 6 and seal watertight.
  - 7. Joint Filler:
    - a. Separate slabs on grade from vertical surfaces with ½ -inch- thick joint filler.
    - b. Place joint filler in floor slab pattern placement sequence; set top to required elevations; secure to resist movement by wet concrete.
    - c. Extend joint filler from bottom of slab to within 1/2 of finished slab surface.
    - d. Finish Joint Sealer Requirements: As specified
  - 8. Joint Devices:

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- a. Coordination: Install construction joint devices in coordination with floor slab pattern placement sequence; set top to required elevations; secure to resist movement by wet concrete.
  - b. Install joint device anchors, maintaining correct position to allow joint cover to be flush with floor and wall finish.
  - c. Install joint covers in longest practical length when adjacent construction activity is complete.
9. Deposit concrete at final position, preventing segregation of mix.
10. Place concrete in continuous operation for each panel or section as determined by predetermined joints.
11. Consolidate concrete.
12. Maintain records of concrete placement, including date, location, quantity, air temperature, and test samples taken.
13. Place concrete continuously between predetermined expansion, control, and construction joints.
14. Do not interrupt successive placement and do not permit cold joints to occur.
15. Place floor slabs in indicated checkerboard or saw-cut pattern.
16. Saw-Cut Joints:
  - a. Saw-cut joints within 12 hours after placing.
  - b. Use 3/16 inch thick blade.
  - c. Cut into 1/4 depth of slab thickness.
17. Screeding:
  - a. Screed floors and slabs on grade level.
  - b. Surface Flatness: FF 20 maximum 1/4 inch in 10 feet, unless otherwise noted for specific drainage purposes.
- B. Separate Floor Toppings:
  1. Prior to placing floor topping, remove deleterious material, roughen substrate concrete surface, and broom and vacuum clean.
  2. Place required dividers, edge strips, reinforcement and other items to be cast in concrete.
  3. Apply bonding agent to substrate.
  4. [Apply sand and cement slurry coat on base course, immediately prior to placing toppings.]
  5. Place concrete floor toppings to required lines and levels.
  6. Place topping in checkerboard panels, with dimension not to exceed 20 feet.
  7. Screed toppings level, maintaining surface flatness of FF 30 maximum 1/8 inch in 10 feet.
- C. Concrete Finishing:
  1. Provide formed concrete surfaces to be left exposed, walls, columns, beams, joists with smooth-rubbed finish.
  2. Finish concrete floor surfaces according to ACI 301 and ACI 318.

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3. Wood float surfaces receiving quarry tile, ceramic tile, and terrazzo, with full-bed setting system.
4. Steel trowel surfaces receiving carpeting, resilient flooring, seamless flooring, thin-set quarry tile, thin-set ceramic tile.
5. Steel trowel surfaces indicated to be exposed.
6. In areas with floor drains, maintain floor elevation at walls and pitch surfaces uniformly to drains at 1/8 inch per foot minimum, with wet designated areas at 1/4 inch per foot minimum.

D. Curing and Protection:

1. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
2. Protect concrete footings from freezing for minimum of 7 days.
3. Maintain concrete with minimal moisture loss at relatively constant temperature for period as necessary for hydration of cement and hardening of concrete.
4. Cure concrete according to ACI 308.1 method.
5. Cure floor surfaces according to ACI 301 and ACI 318.
6. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 7 days.
7. Spray water over floor slab areas and maintain wetness for 7 days.

3.4 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
- B. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.
- C. Inspection and Testing: Performed by Owner's testing laboratory according to ACI 318.
- D. Provide unrestricted access to Work and cooperate with appointed testing and inspection firm.
- E. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of Work.
- F. Concrete Inspections:
  1. Continuous Placement Inspection: Inspect for proper installation procedures.
  2. Periodic Curing Inspection: Inspect for specified curing temperature and procedures.
- G. Strength Test Samples:
  1. Sampling Procedures: Comply with ASTM C172.
  2. Cylinder Molding and Curing Procedures:
    - a. Comply with ASTM C31.
    - b. Cylinder Specimens: Field cured.

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3. Sample concrete and make one set of three cylinders for every 50 cu. yd. or less of each class of concrete placed each day, and for every 1,000 sq. ft. of surface area for slabs and walls.
4. If volume of concrete for a class of concrete would provide less than five sets of cylinders, take samples from five randomly selected batches, or from every batch if less than five batches are used.
5. Make one additional cylinder during cold weather concreting and field cure.

H. Field Testing:

1. Slump Test Method: Comply with ASTM C143.
2. Air Content Test Method: Comply with ASTM C173 and C231.
3. Temperature Test Method: Comply with ASTM C1064.
4. Compressive Strength Concrete:
  - a. Measure slump and temperature for each sample.
  - b. Measure air content in air-entrained concrete for each sample.

I. Cylinder Compressive Strength Testing:

1. Test Method: Comply with ASTM C39.
2. Test Acceptance: According to ACI 318.
3. Test one cylinder at seven days.
4. Test one cylinder at 28 days.
5. Retain one cylinder for 365 days for testing when requested by Architect/Engineer.
6. Submit to Owner remaining cylinders if testing is not required.

J. Patching:

1. Allow Architect/Engineer to inspect concrete surfaces immediately upon removal of forms.
2. Honeycombing or Embedded Debris in Concrete:
  - a. Not acceptable.
  - b. Notify Architect/Engineer upon discovery.
3. Patch imperfections as directed by Architect/Engineer according to ACI 301 and according to ACI 318.

K. Defective Concrete:

1. Description: Concrete not conforming to required lines, details, dimensions, tolerances, or specified requirements.
2. Repair or replacement of defective concrete will be determined by Architect/Engineer.
3. Do not patch, fill, touch up, repair, or replace exposed concrete except upon express direction of Architect/Engineer for each individual area.

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3.5 ATTACHMENTS

A. Schedule - Concrete Types and Finishes:

1. Foundation Walls: 5,000 psi, 28-day concrete; form finish with honeycomb-filled surface.

B. Schedule - Joint Fillers:

1. Basement Floor Slab Perimeter Joint Filler: Type A; set 1/8 inch below floor slab elevation.
2. Exterior Retaining Wall at Loading Dock Joint Filler: Type F; recessed 3/8 inch; provide sealant cover.

END OF SECTION 033000

## SECTION 033900 - CONCRETE CURING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Section Includes: Initial and final curing of horizontal and vertical concrete surfaces.
- B. Related Requirements:
  - 1. Section 033000 - Cast-in-Place Concrete: Cast-in-place or in-situ concrete for structural building frames, slabs on fill or grade, and other concrete components associated with construction.
  - 2. Section 033500 - Concrete Finishing: Surface finishing of concrete floor slabs and toppings.

#### 1.2 REFERENCE STANDARDS

- A. American Concrete Institute:
  - 1. ACI 301 - Specifications for Structural Concrete.
  - 2. ACI 302.1 - Guide to Concrete Floor and Slab Construction.
  - 3. ACI 308.1 - Specification for Curing Concrete.
  - 4. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
- B. ASTM International:
  - 1. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
  - 2. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
  - 3. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
  - 4. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.

#### 1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer's information on curing compounds, mats, paper, and film, including compatibilities and limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.

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E. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.4 QUALITY ASSURANCE

- A. Perform Work according to ACI **301, 302.1, 308.1, and 318.**

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
  2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Membrane-Curing Compound **Type A:**
1. Comply with ASTM C309
- B. Membrane-Curing Compound:
1. Comply with ASTM C1315
- C. Non-membrane-Forming Curing Compound **Type B**
1. Liquid, penetrating, silicate-based type.
  2. Type: Combination curing, hardening, and dustproofing.
- D. Absorptive Mats **Type C:**
1. Description:
    - a. Material: Burlap-polyethylene (PE).

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- b. Minimum Weight: **9 oz./sq. yd.**
  - c. Bonded to prevent separation during handling and placing.
- 2. Description: Comply with ASTM C171.
- E. Waterproof Paper **Type D**:
  - 1. Description: Curing paper treated to prevent separation during handling and placing.
  - 2. **Comply with ASTM C171.**
- F. PE Film **Type E**:
  - 1. Comply with ASTM **C171 and D2103.**
  - 2. Thickness: **6 mils**
- G. Water: Potable; not detrimental to concrete.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for application examination.
- B. Verify that substrate surfaces are ready to be cured.

#### 3.2 APPLICATION

- A. Horizontal Surfaces:
  - 1. Comply with ACI 308.1.
  - 2. Ponding: Maintain 100 percent coverage of water over floor slab areas continuously for 7 days.
  - 3. Spraying: Spray water over floor slab areas and maintain wet for 7 days.
  - 4. Absorptive Mat:
    - a. Spread **cotton fabric** over floor slab areas.
    - b. Spray with water until mats are saturated and maintain in saturated condition for **7** days.
  - 5. Absorptive Mat:
    - a. Saturate burlap-PE and place burlap-side down over floor slab areas.
    - b. Lap ends and sides.
    - c. Maintain in place for 7 days.

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6. Membrane-Curing Compound: Apply curing compound in **two coats with second coat applied at right angles to first.**
7. Non-membrane-Forming Curing Compound:
  - a. Apply curing compound in one coat **and scrub compound into surface.**
  - b. Maintain surface wet with curing compound, without ponding, for time as recommended by manufacturer.
8. PE Film:
  - a. Spread over floor slab areas.
  - b. Lap edges and sides.
  - c. Seal with pressure-sensitive tape **and cover with plywood.**
  - d. Maintain in place for 7 days.

B. Vertical Surfaces:

1. Comply with ACI 308.1
2. Spraying: Spray water over surfaces and maintain wet for 7 days.
3. Membrane-Curing Compound: Apply compound in **two coats with second coat applied at right angles to first.**
4. Non-membrane-Forming Curing Compound:
  - a. Apply curing compound in one coat **and scrub compound into surface.**
  - b. Maintain surface wet with curing compound, without ponding, for time as recommended by manufacturer.

3.3 PROTECTION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Do not permit traffic over unprotected floor surfaces.

3.4 ATTACHMENTS

- A. Storage Area Slabs:
  1. Description: Absorptive mats.
  2. Type: Burlap-PE.
- B. Retaining Walls:
  1. Description: Membrane-curing compound.
  2. Type: Acrylic.
  3. Color: Clear.

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C. Concrete Pavement:

1. Description: Membrane-curing compound.
2. Color: Opaque.

D. Other Floor Areas:

1. Description: Membrane-curing compound.
2. Type: Acrylic.
3. Color: Translucent.

END OF SECTION 033900

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SECTION 071100 - DAMPPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cold-applied asphalt] bituminous dampproofing.
2. Drainage panels. (Not Included)
3. Protective covers. (Not Included)

B. Related Requirements:

1. Section 072113 - Board Insulation: (Not Included)
2. Section 312323 - Fill: Backfilling as required at building perimeter and Site structures. (Not Included)

1.2 REFERENCE STANDARDS

A. ASTM International:

1. ASTM D41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing.
2. ASTM D43 - Standard Specification for Coal Tar Primer Used in Roofing, Dampproofing, and Waterproofing.
3. ASTM D449 - Standard Specification for Asphalt Used in Dampproofing and Waterproofing.
4. ASTM D450 - Standard Specification for Coal-Tar Pitch Used in Roofing, Dampproofing, and Waterproofing.
5. ASTM D1187 - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal.
6. ASTM D1227 - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
7. ASTM D3747 - Standard Specification for Emulsified Asphalt Adhesive for Adhering Roof Insulation.
8. ASTM D4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free.
9. ASTM D5643 - Standard Specification for Coal Tar Roof Cement, Asbestos Free.

B. National Roofing Contractors Association:

1. The NRCA Roofing Manual.

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1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit properties of primer, bitumen, and mastics.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- D. Manufacturer Instructions: Submit special procedures and perimeter conditions requiring special attention.
- E. Qualifications Statements:
  - 1. Submit qualifications for manufacturer and applicator.
  - 2. Submit manufacturer's approval of applicator.

1.4 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.
- B. Applicator: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.5 AMBIENT CONDITIONS

- A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
- B. Maintain ambient temperatures above 40 degrees F for 48 hours before and during application until membrane has cured.
- C. See Manufacturers Information for any additional conditions for application.

PART 2 - PRODUCTS

2.1 BITUMINOUS DAMPPROOFING

- A. Manufacturers:
  - 1. APOC, Inc; a division of Gardner Industries.
  - 2. Brewer Company (The).
  - 3. ChemMasters, Inc.
  - 4. Euclid Chemical Company (The); an RPM company.
  - 5. Henry Company.
  - 6. Karnak Corporation.
  - 7. Mar-flex Waterproofing & Building Products.

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8. W.R. Meadows, Inc.

2.2 MATERIALS

A. Hot Asphaltic Materials:

1. Asphalt: Comply with ASTM D449
2. Asphalt Primer:
  - a. Comply with ASTM D41
  - b. Compatible with substrate.
3. Asphaltic Sealing Mastic: Comply with ASTM D4586

B. Coal-Tar Materials:

1. Coal Tar: Comply with ASTM D450
2. Coal-Tar Primer:
  - a. Comply with ASTM D43
3. Coal-Tar Sealing Mastic:
  - a. Description: Bitumen filled with mineral dust and fibers, to mastic consistency, without asbestos.
  - b. Comply with ASTM D5643

C. Cold Asphaltic Materials:

1. Asphalt Emulsion: Comply with ASTM D3747.

2.3 ACCESSORIES (Not Included)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for application examination.
- B. Verify that substrate surfaces are durable and free of matter detrimental to adhesion or application of dampproofing system.
- C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

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3.2 PREPARATION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for application preparation.
- B. Clean and prepare surfaces to receive dampproofing.
- C. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.3 APPLICATION

- A. Do not apply dampproofing to surfaces unacceptable to manufacturer or applicator.
- B. Prime surfaces according to NRCA Roofing Manual.
- C. Prime surfaces at rate of 1.5 gal./100 sq. ft. and let primer dry.
- D. Bitumen:
  - 1. Apply cold bitumen with mop, roller or by spray application.
  - 2. Apply bitumen at temperature limited by equiviscous temperature plus or minus 25 degrees F, not exceeding finish blowing temperature for four hours.
  - 3. Apply bitumen in two coats, continuous and uniform, at rate of 1.25 gal./100 sq. ft. per coat.
- E. Apply dampproofing from top of foundation wall down to the footer, overlapping top of footer.
- F. Provide watertight seal with mastic on items projecting through dampproofing surface.
- G. Place drainage panel directly against membrane and butt joints to encourage drainage downward. (NIC)
- H. Protection Board: (NIC)

3.4 PROTECTION

- A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.
- B. Protect adjacent surfaces not designated to receive dampproofing.

3.5 ATTACHMENTS

- A. Foundation Wall: Two coatings of asphalt dampproofing.
- B. Subgrade Tunnel: Patch existing coal-tar dampproofing with two coatings of new coal-tar dampproofing at disturbed areas.

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- C. Cavity Wall: Two coats of asphalt dampproofing on exterior face of inner wythe of concrete masonry units.

END OF SECTION 071100

## SECTION 133423 - FABRIC MEMBRANE COVER AND STRUCTURE

### PART 1 - General

#### 1.1 INTENT OF SPECIFICATION

- A. This specification covers the design, manufacture, shipping, handling and erection of a prefabricated membrane covered structure.
- B. The specification as heretofore set forth is general in nature and scope and shall not be construed as to limit the work.
- C. It is the intent of this specification that the bidder shall include all labor, materials, equipment services and transportation to locate the building on the site designated with all other work.
- D. Buildings shall be complete and operating and shall include all exterior and interior materials and systems as shown or indicated in contract documents.
- E. All workmen shall be skilled and qualified for the work that they perform. All materials used, unless otherwise specified, shall be new and of the types and grades specified. The contractor shall certify that no asbestos containing building materials that exceed Federal mandated safe asbestos levels have been used in the construction of the membrane-covered structure.
- F. Work shall be performed as necessary and required for the construction of the project as indicated. Such work includes the supply and installation of a membrane-covered structure complete with exterior and interior finishes. The building shall be as dimensioned with all features and quantities as per specification.

#### 1.2 RELATED WORK

- A. The following specifications are referenced and included in the scope of work.
  - 1. None
- B. The following specifications are referenced for coordination with the scope of work.
  - 1. Section 033000 Cast-In-Place Concrete
  - 2. Section 310000 Earthwork: By owner
  - 3. Section 321216 Asphalt Concrete Paving: By owner

#### 1.3 REFERENCES AND STANDARDS

- A. The following publications are for the standards listed below but referred to within the document by basic letter designation only. They form a part of this specification to the extent referenced thereto:
  - 1. American Institute of Steel Construction (AISC):
    - a. S326-78 Design, Fabrication and Erection of Structural Steel Buildings
    - b. S329-85 Structural Joints Using ASTM A325 or A490 Bolts.

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2. American Iron and Steel Institute (AISI)
  - a. SG 503-76 The Design of Fabrication of Cold-Formed Steel Structures
  - b. c. American Society for Testing and Materials (ASTM):
  - c. A 36-89 Structural Steel
  - d. A 123 A-89 Standard Specification for Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
  - e. A 307-89 Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
  - f. A 325-89 High-Strength Bolts for Structural Steel Joints
  - g. A 500 A-90 Standard Specification for Cold Formed Welded And Seamless Carbon Steel Structural Tubing in Rounds and Shapes
  - h. A 563 Rev A-89 Carbon and Alloy Steel Nuts
  - i. A 687-89 High-Strength Non-Headed Steel Bolts and Studs.
3. American Society of Civil Engineers (ASCE) Minimum Design Loads for Building and Other Structures. Latest edition as required by State Code.
  - a. ASCE 7-02 American Society of Civil Engineers
  - b. ASCE 7-05 American Society of Civil Engineers
  - c. ASCE 7-08 American Society of Civil Engineers
  - d. ASCE 7-10 Minium design loads for buildings and other structures.
4. American Welding Society (AWS)
  - a. D1.1-2004 Structural Welding Code-Steel
  - b. D1.3-98 Structural Welding Code-steel sheet steel
5. National Fire Protection Association
  - a. NFPA 701-89.1 Standard methods of Fire Tests for Flame Resistant Textiles and Films. Small and Large Scale Test.
  - b. NFPA 701-96 Standard methods of Fire Tests for Flame Resistant Textiles and Films. Test Method 1 and Test Method 2.
6. New York State Uniform Fire Prevention and Building Code; Latest addition.

#### 1.4 SUBMITTALS

- A. The Contractor shall furnish detailed drawings for all structural work stamped by an engineer certified by the State of New York to verify compliance to local building code. Site specific calculation packages shall be provided upon request of the customer (Additional Fees shall apply).
- B. All work to be performed under the conditions of this specification shall comply with the rules and regulations of all agencies having jurisdiction for this classification of construction and design and shall conform to the applicable live loads due to wind, rain and snow.
- C. Building supplier must provide written certification that they have been in the steel tension membrane building business for 10 years or more under the same name.
- D. Duration of the Building supplier warranty must not exceed their number of years of business under the same name.

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- E. Building supplier must provide written references with contact information for at least five salt sheds currently in operation local to this location and of the same square footage.
- F. Complete, current, and extensive set of site-specific calculations for the entire structure including but not limited to the following:
  - a. Certification that the proposed structure meets all requirements of the New York State Uniform Fire Prevention and Building Code including provisions for drifting and unbalanced snow load, according to ASCE 7-10 - Minimum Design Loads for Buildings and other Structures. This is a pre-award submittal; refer to Section 002217 Supplementary Instructions to Bidders - Condition of Award.
  - b. Certification that the proposed structure shall hold the salt capacity required by the contract documents. This is a pre-award submittal; refer to Section 002217; Supplementary Instructions to Bidders - Condition of Award.
  - c. Design loads and load combinations
  - d. Foundation design and loads including proposed structures allowable differential settlement
  - e. Finite element analysis of any proposed thin shelled structure, any structure that relies on stressed skinned panels to resist lateral loads or any non-conventionally framed structure
  - f. Lateral load resisting system calculations showing path of all loads from the roof to the foundation wall.

#### 1.5 WORKMANSHIP

- A. The workmanship of all materials and components of the structure shall be commensurate with the functional requirements of the item.
- B. Building prefabrication shall be performed under factory conditions in a plant specifically arranged for this type of work. Contractor shall provide adequate space, equipment, personnel, and technical ability to coordinate the assembly and factory prefabrication of all major components of the work and all necessary operations in the packing, shipping and installation procedures. No fabrication shall be done until the materials have been tested and approved.
- C. Welding: Welding shall be employed only when specified in the original design. As per Section 1704.2 of IBC, the truss fabricator must be an Approved Welding Fabricator to AWS B5.17 and QC17. Successful bidder MUST supply AWS certificate of approval.
- D. On Site Welding: If welding is required on site, no welding shall be started until the AWS welding inspector has inspected and approved the materials, joint preparation, equipment and the qualifications of the welders. Welders doing unsatisfactory work will be removed and required to pass qualification tests again before returning to work.

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- E. Manufacturer: The structure supplier shall be a reputable manufacturer, that shall have at least 10 years direct experience in the design, manufacture and installation of structures of the type specified herein; shall operate according to a comprehensive quality system and shall provide three references with structures in use for at least five years which are clear span and each must enclose an area in excess of the square footage as stated in section 1.2.4.

## 1.6 SCOPE OF WORK

- A. Rigid steel frame supporting membrane covered roof and wall structure of the type described herein:
- B. The structure must provide a minimum height above the foundation in accordance with the construction drawings.
- C. Flat gable ends with 4' x 4' passive vents in accordance with the construction drawings. Ventilation openings shall be located at or near the highest and lowest point of the roof providing a ratio of one square inch of free air area for each 55 square feet of structure floor area. Each ventilation opening shall be weatherproof.
- D. Soffit vent system at top of foundation wall in accordance with construction drawings.
- E. Termination of Fabric to Concrete Wall System shall permit air flow along the eave edge, overlap the foundation, secured for all loading conditions and provide a weatherproof connection.
- F. Foundation Anchors-Bolt Connections must be engineered using Hilti Stainless Steel products. Provide design calculations and submittal on all materials signed and sealed by a NYS PE.
- G. Site Work (by owner)
- H. Delivery to Site
- I. Complete Structure & Accessory Installation.

## PART 2 - PRODUCTS

### 2.1 PRODUCT MANUFACTURER

- A. The following manufacturer is preapproved and meets or exceeds this Specification:
- B. Calhoun Super Structures, 3702 Bruce Road #10, Tara, Ontario N0H 2N0 Ph: 1-800-264-3994

### 2.2 GENERAL DESIGN REQUIREMENTS

- A. Scope
  - 1. The membrane shall be tensioned over the framework. The structure shall be rectangular in shape with vertical gable end walls. The interior of the structure below the main trusses shall be clear span free of any structural support members

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and shall provide unobstructed floor space. No exterior purlins, guy ropes or cables shall be used for anchoring the structure.

2. The structure shall include accessories to the extent shown on the project drawings required for the scope and intended use for:
3. Overhead doorways (not applicable)
4. Ventilation systems. (passive, vented)
5. Other structure accessories

B. Design Requirements - Structural Frame

1. Roof and Wall Surfaces: To provide for maximum compatibility with standard door, window, ventilation and other accessory and cladding systems, the structure shall be designed such that gable surfaces form flat planes.
2. Purlin Spacing: To provide for structural stability and to provide for installation of accessory items, the main structural trusses shall be laterally braced by load bearing purlins at intervals required by the truss design. Purlins must be Hot Dipped Galvanized post fabrication.
3. Wind and Frame Bracing: The structure shall be appropriately stabilized with wind bracing cable as well as any required secondary node restraint assemblies so as to efficiently transfer wind, snow and seismic induced stresses to the foundation/anchoring system. Cable diameter for main wind bracing shall be a minimum of 3/16" diameter and larger if so required. The end bays of the structure shall be designed to be X - braced early during installation to allow for permanent stability of the frame during installation.
4. Connecting Joints: Connections between structural elements shall be designed so as to transfer the compressive and tensile forces present in a given joint. A minimum of Grade 5 bolts shall be used at each truss chord joint. Primary axial steel, secondary purlins, and end wall frame connections shall be made with a minimum of Grade 5 hex bolts, carriage bolts and self drilling screws.
5. Mechanical Equipment Interface: The main structural roof trusses shall allow for installation of electrical and mechanical equipment based on collateral loads as defined in section 2.2.2. Likewise, the structure shall accept penetrations through the membrane for access doors and mechanical services with minimal modification.
6. Ancillary Systems: The structure shall be designed such that it can be readily retrofitted with insulation systems and other ancillary systems such as lighting, sprinklers, HVAC, provided collateral load factors are taken into account.

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7. Alternative Cladding materials: The structure shall be designed such that alternative covering materials such as metal wall cladding can be added with minimal modification, if required (provided collateral load factors are taken into account).
8. Shipping: The main structural trusses shall be standard planar-style trusses which nest tightly together in order to minimize shipping and storage volume.

C. Design Requirements - Membrane Cladding System

1. Membrane: The roof membrane shall form a weather tight shell over the structural frame. In order to provide for a good finished appearance and to insure weather tightness, the membrane shall be assembled and tensioned, in a manner to minimize wrinkles in hot and cold temperatures.
2. The gable wall membrane cladding shall be manufactured and connected to form one piece to the adjacent end wall and roof cladding.
3. Roof membrane horizontal stretch shall be maintained with horizontal purlins requiring no ongoing maintenance. Vertical stretch shall be maintained with a winch lock system requiring minimal ongoing maintenance.
4. Each bay shall have an individual fabric panel attached to each truss via a keder system. The keder system must include a vinyl cap to seal all extrusion.
5. Base Tensioning System: The membrane cladding shall be provided with a mechanical tensioning system that allows the membrane to be fully tensioned around the structure perimeter. The system shall be designed such that the membrane can be tightly and neatly secured over the structural frame and such that the system has remaining range of adjustment.
6. Membrane Seal at Openings and Base: The Dealer supplying the structure shall provide all materials and methods necessary to fully tension and seal the membrane material around all door, ventilation and other openings as well as around the structure perimeter below the main tensioning system. This seal shall provide a neat and finished appearance and eliminate any loose membrane cladding that could otherwise be damaged by flapping or abrasion.
7. The membrane shall not be designed to function as a structural member such that, should any damage to or penetrations of the membrane occur, the integrity of the structural framework shall not be affected.

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8. The Contractor shall provide drawings and calculations acceptable to the Architect/Engineer of Record, meeting the provisions of the applicable State Building Code. The Contractor shall bear all costs for production of drawings and associated structural calculations. Contractor shall make all revisions and corrections to those documents required for approval and shall resubmit as required to obtain approvals.
9. Successful bidders shall make all required changes or corrections and shall deliver to the Owner's Architect all approved drawings and reactions.

## 2.3 ENGINEERED DESIGN CRITERIA

- A. 2.2.1 The structure shall be designed using methodology as per the ASCE 7 standard referenced from the applicable building code. Primary and secondary framing shall comply with current issues of AISC, AISI, NEMA and ASTM specifications, as applicable. Structural members shall be designed using Allowable Stress Design (ASD) or Load Resistance Factored Design (LRFD) for the design loads given below. Appropriate safety factors to yield and ultimate shall be maintained. Wind load factors and coefficients used in design of structural members must be in accordance with the applicable ASCE 7 guidelines. An appropriately justified analysis method which considers both the large displacement geometric and material nonlinearities of the fabric cladding shall be used in determination of the load effects on all supporting elements. Upon request use of the methodology must be proven by providing a detailed calculation package. The use of Metal Building Software (MBS) is not acceptable for the aforementioned analysis.
- B. Snow Loads: The structure shall be designed based upon a minimum ground snow load for Lewis NY in accordance with NYS Building Code (70 PSF), including unbalanced snow loading conditions.
- C. Wind Loads: The structure shall be capable of withstanding a basic wind speed (3-second gust ) 120 mph, from any direction in accordance with NYS Building code The design wind pressure shall be based on an exposure category of C and appropriate wind load factors and coefficients in accordance with the applicable referenced ASCE 7 guidelines. In no event shall the wind load used in the design of the main wind force resisting system be less than 10 pounds per square foot multiplied by the area of the building or structure projected on a vertical plane that is normal to the wind direction ( or as prescribed by the applicable building code). Wind Uplift Resistance: Per ASTM D7158 Class-G 120-MPH Basic Wind Speed
- D. Rainfall: The structure shall be capable of withstanding the effects of rainfall up to 4 inches per hour for at least 2 hours.
- E. Deflection: For safety of specified or future suspended accessories, the maximum allowable deflection of structural members shall be no more than 1/180 of the clear span of that member when subjected to the design loads described herein.

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- F. Design Loads: The design shall be based as a minimum on the following design loads. Each member shall be designed to withstand stresses resulting from combinations of design loads that produce maximum percentage of actual to allowable stress in that member as per referenced ASCE 7 standard from applicable building code.
1. D= Dead Load + Collateral Load
  2. S= Symmetrical Snow or Live Load (Balanced or Unbalanced)
  3. Ws = Wind with internal suction
  4. Wp = Wind with internal pressure
  5. E = Earthquake

#### 2.4 OPERATION AND USE

- A. The main structural frame and cover shall be warranted to provide a minimum 15-year operational use period with appropriate inspection and maintenance.
- B. The structure shall be capable of being assembled, operated, and dismantled in all ambient temperatures between -20°F and 120°F.

#### 2.5 MATERIALS

- A. All materials used in the structure shall be new, without defects and free of repairs. The quality of the materials used shall be such that the structure is in conformance with the performance requirements as specified herein.
- B. Cladding Membrane: The structure shall be clad with a coated polyolefin fabric manufactured by an approved and reputable supplier with demonstrated long-term performance. The polyolefin membrane fabric shall be waterproof and free from defects. All roofs, walls, end walls and connecting sections shall be weather tight. The material shall be selected from the manufacturer's standard colors for the sidewalls and roof panels. The material scrim and coating must be UV stabilized, and must carry a minimum fifteen-year manufacturer's warranty and have a minimum life expectancy of 15 years. The minimum fabric specification is as follows:

Unit Weight	oz/yd2	12.1		ASTM D3776
Warp Construction	Tapes/in	16	Warp	ASTM D3775
		16	Weft	
1" Tensile Strength	lbf/inch	260	Warp	ASTM D4851
		255	Weft	
				ASTM
Tear Strength	lbf	81	Warp	D4533/D4851
	lbf	78	Weft	
Coating Thickness	mil	3.5		ASTM D1777 Mod
Coating Adhesion	lbf	5		ASTM D4851

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Modulus of Elasticity	lbf/ft	25.4	ASTM D4851
	lbf/ft	20.6	
Mullen Burst Strength	psi	661	ASTM D751
Low Temperature	-40	PASS	ASTM D2136
Flammability		Class A	ASTM E84-94
Light Transmission	%	16	
Thickness	mil	24	Caliper

- C. Acceptable membrane suppliers include: Fabrene, Intertape and Hagihara. The membrane manufacturer must demonstrate a minimum of five years successful field experience with provision of polyolefin membrane cladding in use on similar or larger size structures of the type contemplated in this specification.
- D. Metal: The main structure shall consist of a welded truss arches with parallel tube chords separated apart by webbing. A minimum of 3" of weld shall join the webb to the cord at each location. The webb shall be an open section to allow access to all surface areas for hot dip galvanization. Continuous tubular webbing is not acceptable.
- E. Truss sections are manufactured and post dip galvanized to insure proper protection on the inside as well as the external surfaces of the truss sections. All sections must be post dipped galvanized post fabrication to a minimum of CSA G-164 / ASTM A123-15. Truss shall be manufactured of a cold-formed and induction welded modified grade carbon steel, providing a finished tubular product with exceptional mechanical and corrosion resistant properties. Purlins must be hot dipped galvanized.
- F. Tolerances: All dimensional tubing tolerances are in accordance with ASTM A500, Section 10.
- G. Tubing shall be manufactured using steel conforming to ASTM A568, ASTM A1011 and G40.21 350W. Finished steel tubing used in the structure must have minimum structural and mechanical properties based on standard ASTM A500.
- H. All steel flat bar, cross rods and other steel components shall be fabricated from hot dipped galvanized material, meet the stated standards and have minimum structural and mechanical properties based on standard CSA G40.20/40.21-44W or ASTM A572 Grade C
- I. Corrosion Protection: as per 2.4.3 all Metal sections shall be hot dipped galvanized to a minimum of CSA G-164 / ASTM A123-15. This allows for maximum protection on all welded surfaces including the interior sections.
- J. Hardware:

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1. Bolts: Bolts subject to extreme stress and wear shall be structural bolts of Grade 5 and plated / galvanized that has been upgraded with a corrosion resistant topcoat finish. All bolts shall be installed and securely torqued so as to prevent change in tightness. Those subject to removal or adjustment shall not be swaged, peened, staked or otherwise installed.
2. Membrane Tensioning Hardware: The fabric membrane shall be tensioned with load rated hardware which is plated/hot dip galvanized so as to prevent corrosion. Hardware shall allow full and free rotation at the foundation connection to avoid fatigue failure of threaded assemblies.
3. Membrane Tensioning Webbing: The membrane shall be tensioned with load-tested tie-downs.
4. Cable Assemblies: Main and wind bracing cable assemblies shall be manufactured to the required length and press swaged with metal sleeves. The cables are manufactured using preformed 7-19 stainless steel cables, sized with appropriate safety factors.
  - a. 3/16" dia. = 4,200 lbs.
  - b. 1/4" dia. = 7,000 lbs.
  - c. 5/16" dia. = 9,800 lbs.
  - d. 3/8" dia. = 14,400 lbs.
  - e. 1/2" dia. = 22,800 lbs
5. Other Fasteners: Non-structural fasteners such as wood screws, Tek screws, etc., shall be of standard commercial quality
6. Exterior Trim: The aluminum alloy used in the extrusion shall meet or exceed 6063-T6.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION AND HANDLING

- A. Piece marking and Identification: All individual parts or bundles and packages of identical parts are to be clearly marked for identification. Bolts, nuts, washers and fasteners shall be packaged according to type, size and length. Shipping documentation shall include a list showing the description, quantity and piece mark of the various parts, components and elements.
- B. Material Delivery: The building system materials shall be delivered to the project site during normal working hours on weekdays. Installation contractor shall provide adequate workmen and equipment to promptly unload, inspect and accept material delivery.
- C. Handling: The installation contractor shall be responsible for unloading, field storage, protection and transfer to the work area of all materials and equipment required to

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perform the work. At no time shall materials be dropped, thrown or dragged over the transport equipment or the ground. Damage to any piece under its own or superimposed weight shall be cause for repair or replacement.

- D. Short, Damaged or Excess Materials: Installation contractor shall inspect, count and verify quantities based on the shipping documents.

### 3.2 INSTALLATION AND ERECTION

- A. Inspect and verify foundation wall for mounting of substructure.

B.