

# **AS-BUILT DRAWINGS**

## **Volume XIII**

**Operations & Maintenance Manual  
2016**

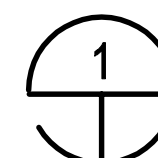
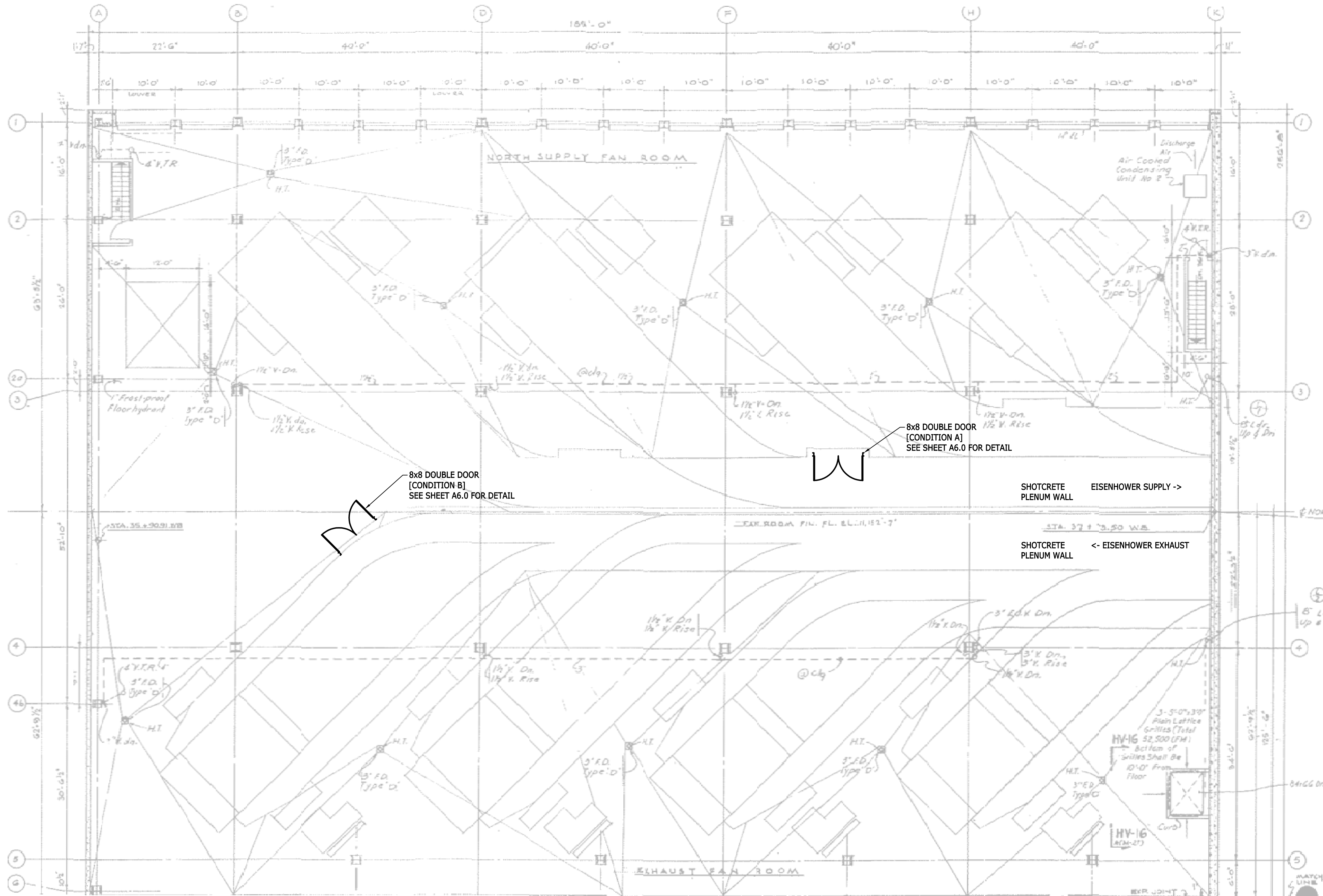




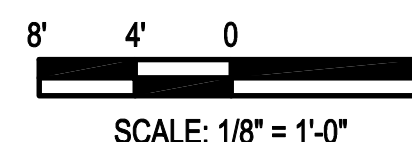




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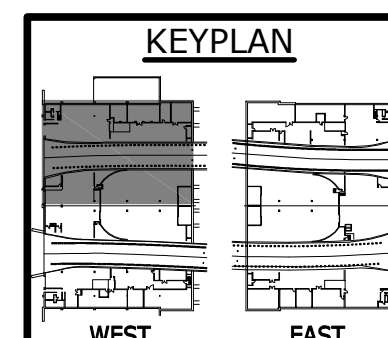


ARCHITECTURAL FAN LEVEL PLAN - WEST - NORTH (SHOTCRETE PLENUM CONDITION)  
SCALE: 1/8" = 1'-0"



GENERAL NOTE:

1. MAINTAIN EXISTING DOORS INTO PLENUM.
2. CONTRACTOR TO VERIFY ALL DOOR LOCATIONS WITH CDOT PRIOR TO DEMOLITION.



EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

**BARNARD EJMT TEAM**

BCER  
CONSULTING ENGINEERS

BARNARD

RONDINELLI  
A REEF GROUP LIFE SAFETY

Western States  
Fire Protection Co.

STURGEON  
ELECTRIC

Project No. C0703-360

Subcontract 17810

RECORD DRAWINGS - 2015-11-16

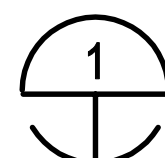
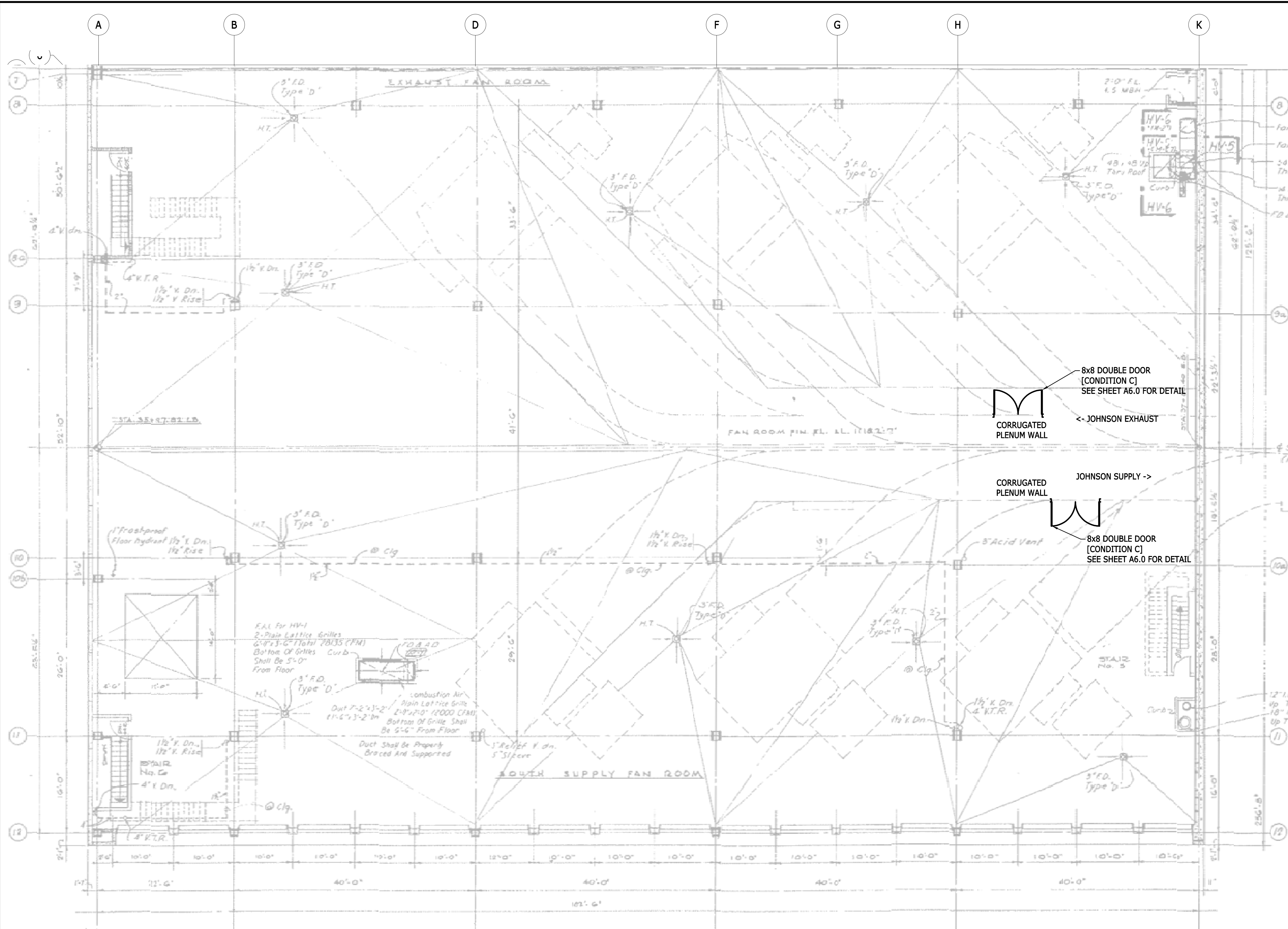
REVISIONS	Date
Num	Description

ARCHITECTURAL FAN  
LEVEL PLAN - WEST -  
NORTH  
Drawing Number  
**A2.0**

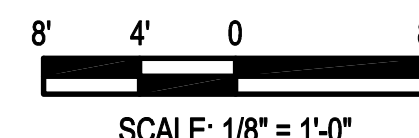
DRAWN BY: JEB  
CHECKED BY: SCR

XREFS=(x=to, y=system), West Ventilation Building - Grid, West Ventilation Building - Fan Level) Layouts=(A2.2 ARCHITECTURAL FAN LEVEL PLAN - WEST - SOUTH) DIMSCALE=1/8"=1'-0" 1-F:\3914002\dwg\jmt - fixed fire suppression system\Architectural\A2.2 ARCHITECTURAL FAN LEVEL PLAN - WEST - SOUTH.dwg JAN 25, 2015 8:41AM JBAKER

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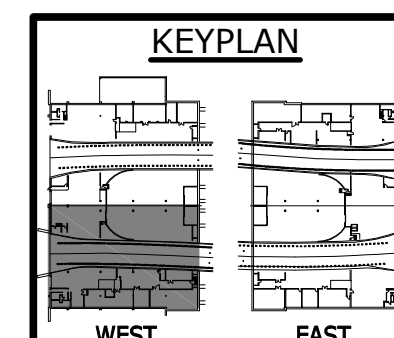


ARCHITECTURAL FAN LEVEL PLAN - WEST - SOUTH (CORRUGATED PLENUM CONDITION)  
SCALE: 1/8" = 1'-0"



GENERAL NOTE:

1. MAINTAIN EXISTING DOORS INTO PLENUM.
2. CONTRACTOR TO VERIFY ALL DOOR LOCATIONS WITH CDOT PRIOR TO DEMOLITION.



ARCHITECTURAL FAN LEVEL PLAN - WEST - SOUTH  
Drawing Number  
**A2.1**

**EISENHOWER/JOHNSON  
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FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Num	Description	Date

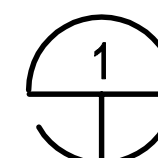
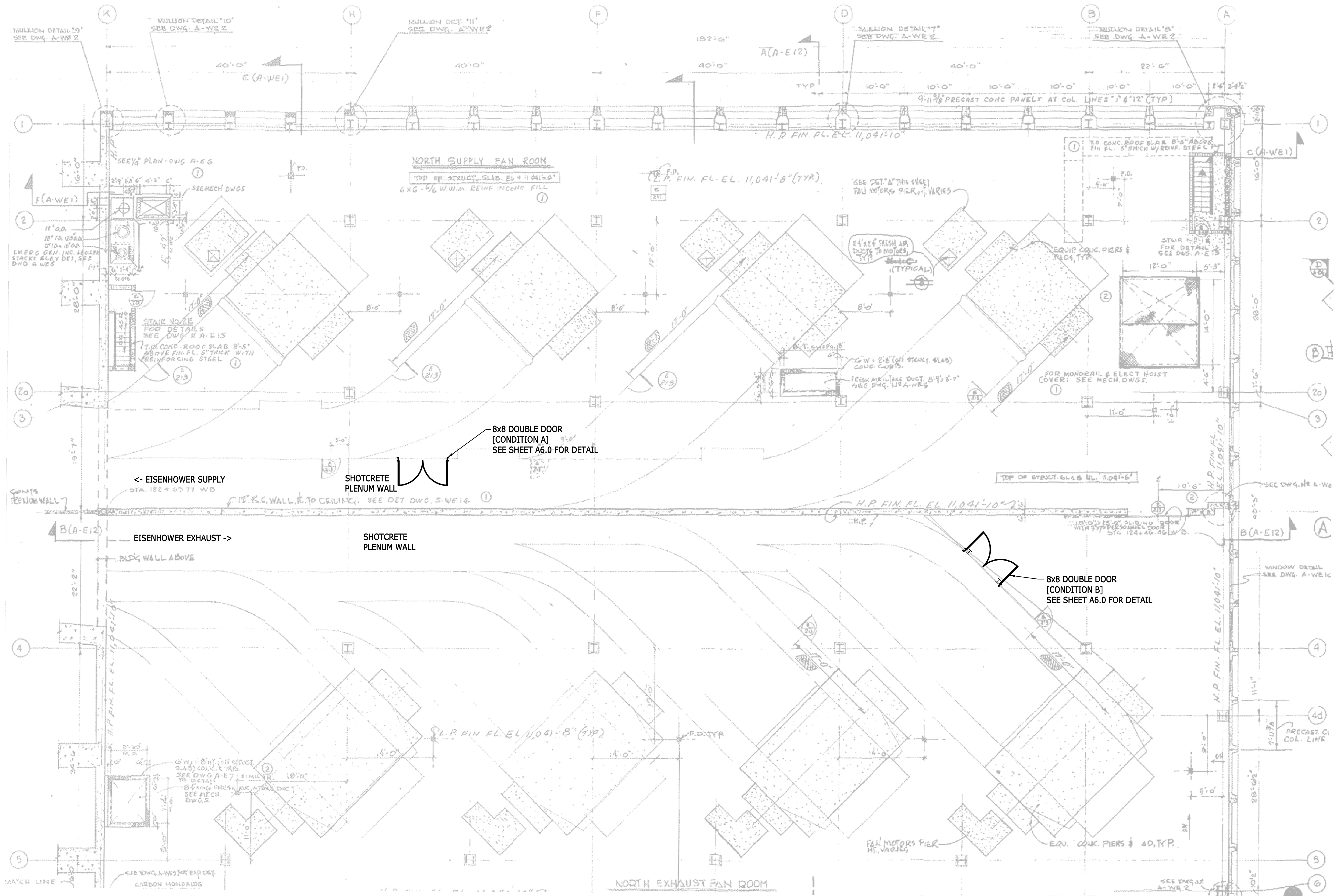
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**BARNARD** **RONDELLO**  
A REE GROUP life safety

**BCER** **Sturgeon ELECTRIC** **ALF**  
Western States Fire Protection Co. ENGINEERS

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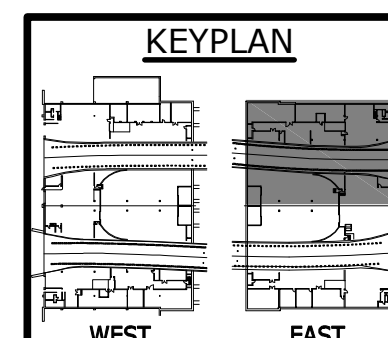


ARCHITECTURAL FAN LEVEL PLAN - EAST - NORTH (SHOTCRETE PLENUM CONDITION)  
SCALE: 1/8" = 1'-0"

8' 4' 0' 8'  
SCALE: 1/8" = 1'-0"

GENERAL NOTE:

1. MAINTAIN EXISTING DOORS INTO PLENUM.
2. CONTRACTOR TO VERIFY ALL DOOR LOCATIONS WITH CDOT PRIOR TO DEMOLITION.



EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Revisions	Date
Num	Description

ARCHITECTURAL FAN LEVEL PLAN - EAST - NORTH  
Drawing Number  
**A2.2**

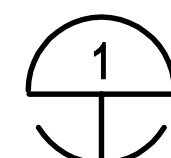
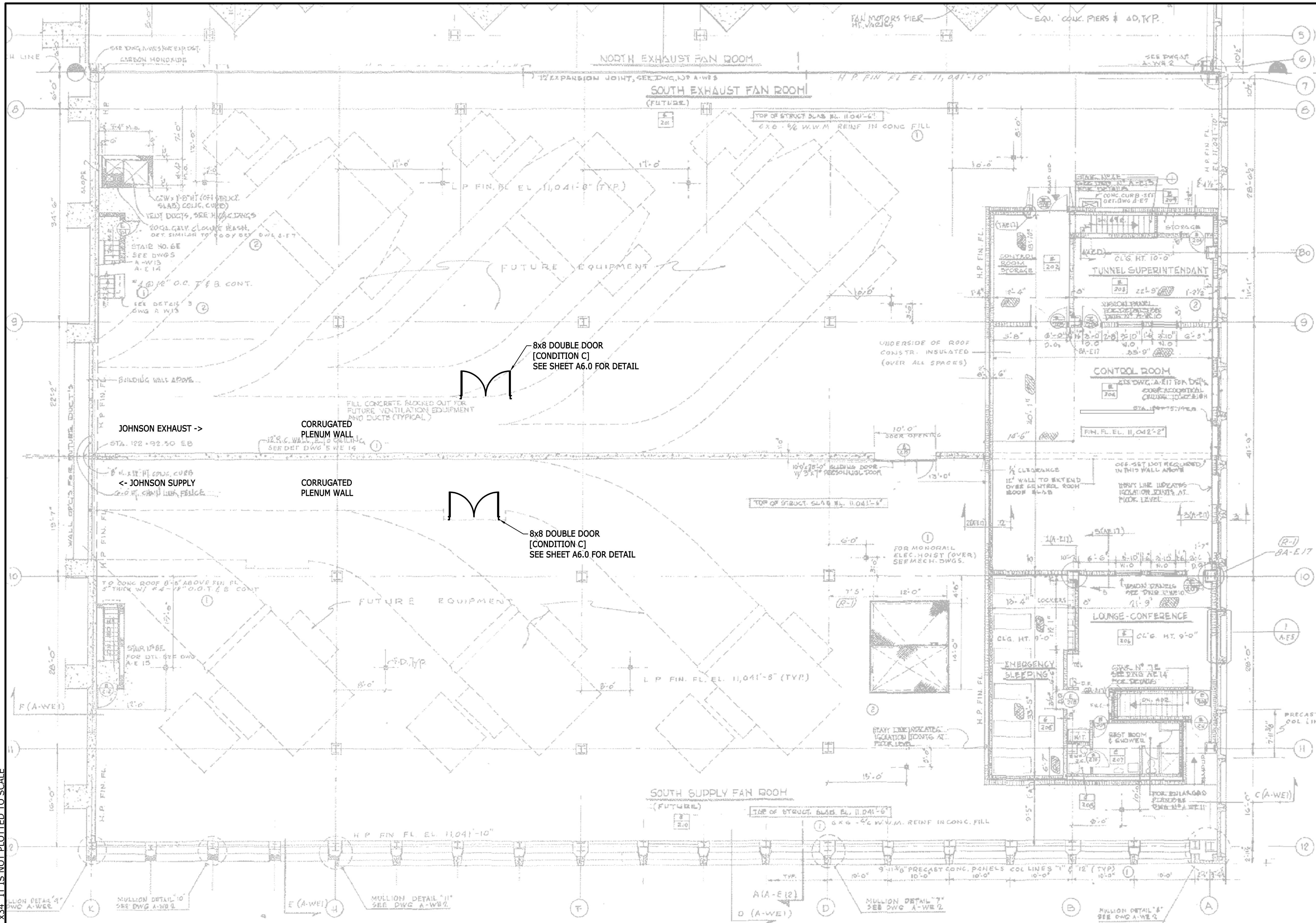
**BARNARD EJMT TEAM**

**BARNARD** **RONDINELLI**  
A REE GROUP COMPANY

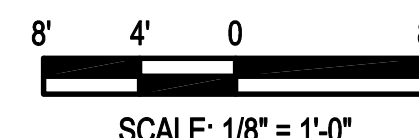
**BCER** **Sturgeon ELECTRIC**  
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ENGINEERS



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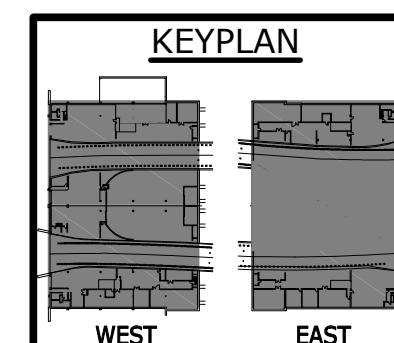
ARCHITECTURAL FAN LEVEL PLAN - EAST - SOUTH (CORRUGATED PLENUM CONDITION)  
SCALE: 1/8" = 1'-0"



SCALE: 1/8" = 1'-0"

GENERAL NOTE:

1. MAINTAIN EXISTING DOORS INTO PLENUM.
2. CONTRACTOR TO VERIFY ALL DOOR LOCATIONS WITH CDOT PRIOR TO DEMOLITION.



ARCHITECTURAL FAN LEVEL PLAN - EAST - SOUTH

Drawing Number

A2.3

EISENHOWER/JOHNSON MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

BARNARD EJMT TEAM

BCER  
CONSULTING ENGINEERS

BARNARD

RONDINELLI  
A PER GROUP LIFE SAFETY

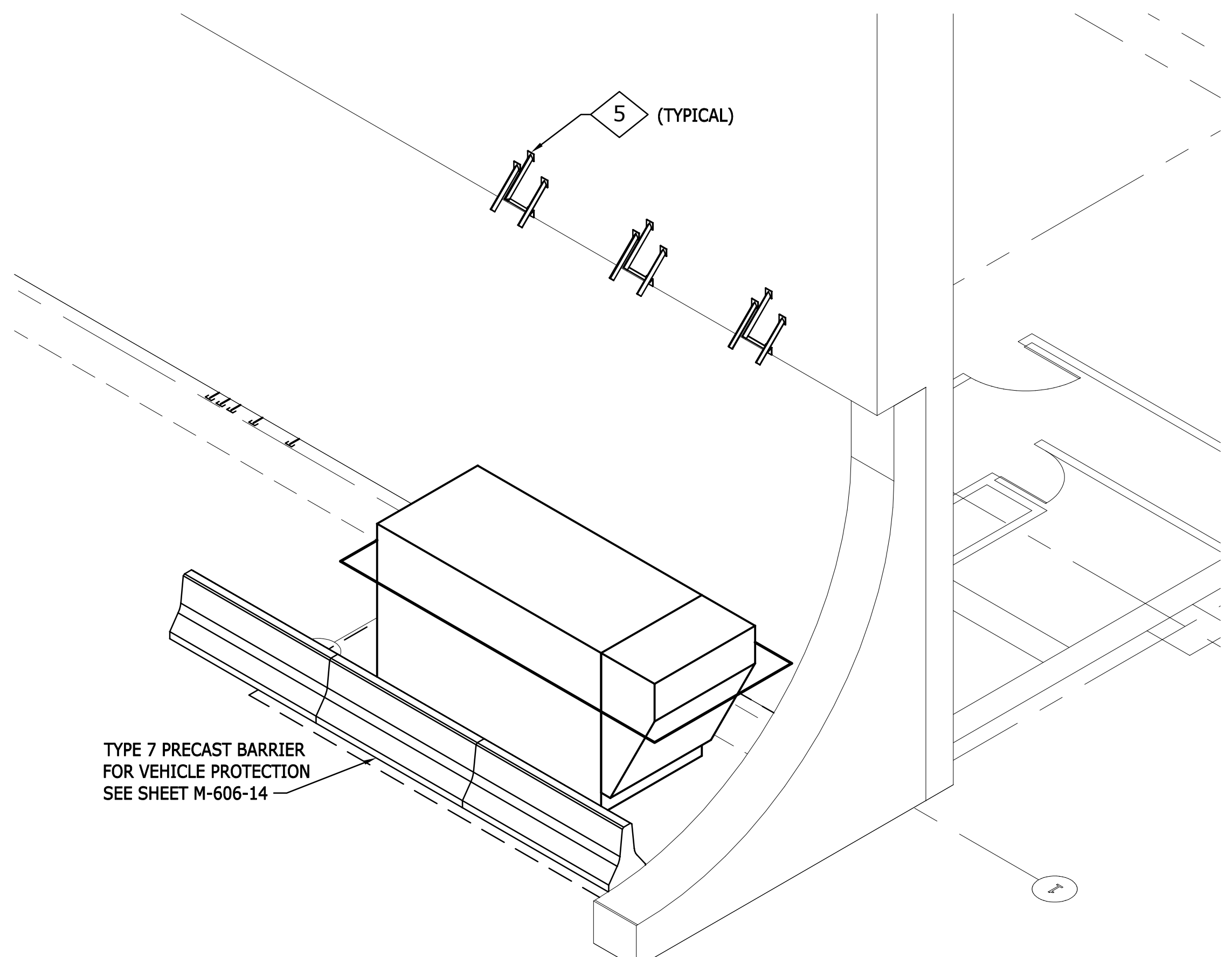
Sturgeon  
ELECTRIC

Western States  
Fire Protection Co.

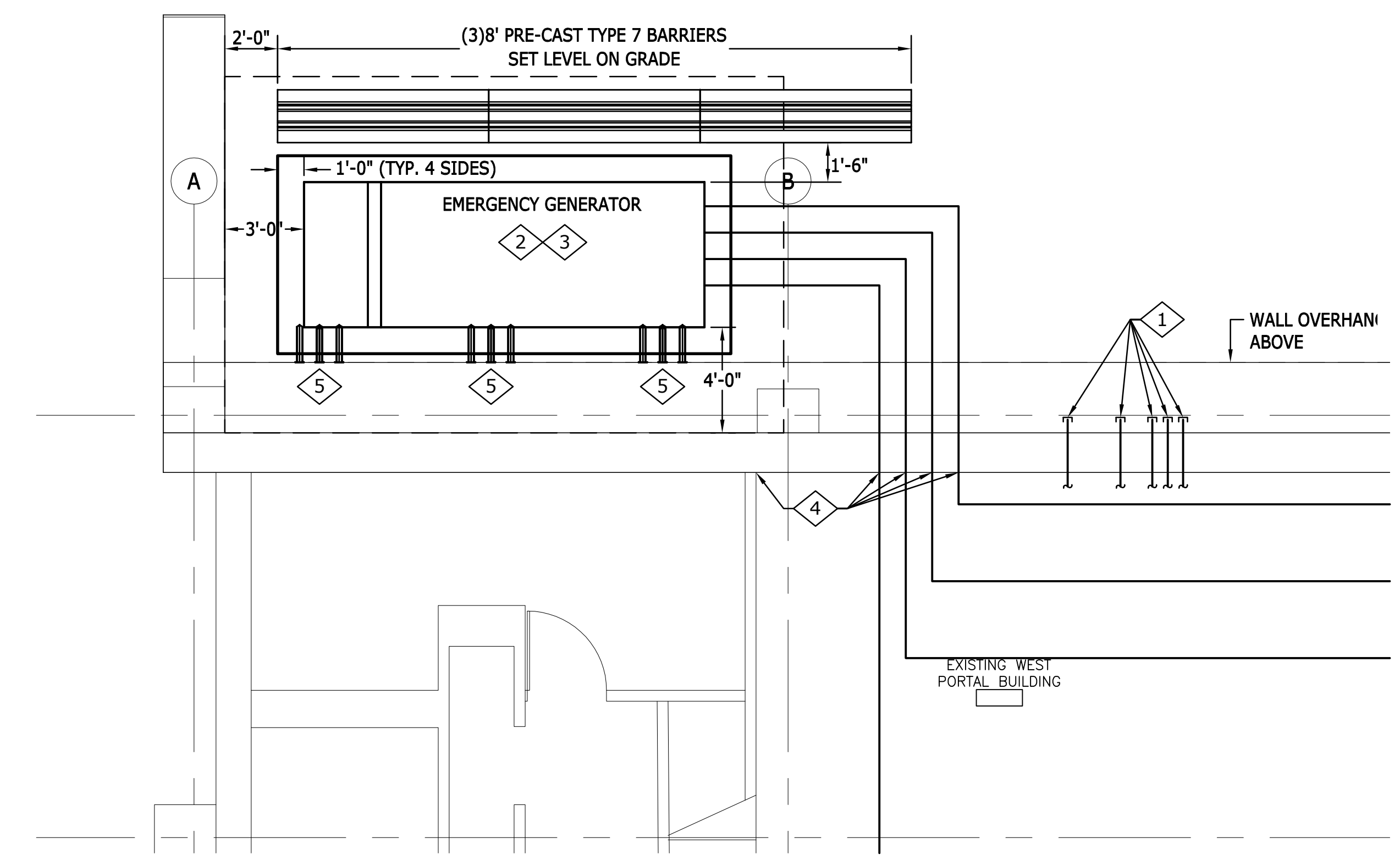
ALF  
CONSULTING ENGINEERS

Num	Revisions	Date
	Description	

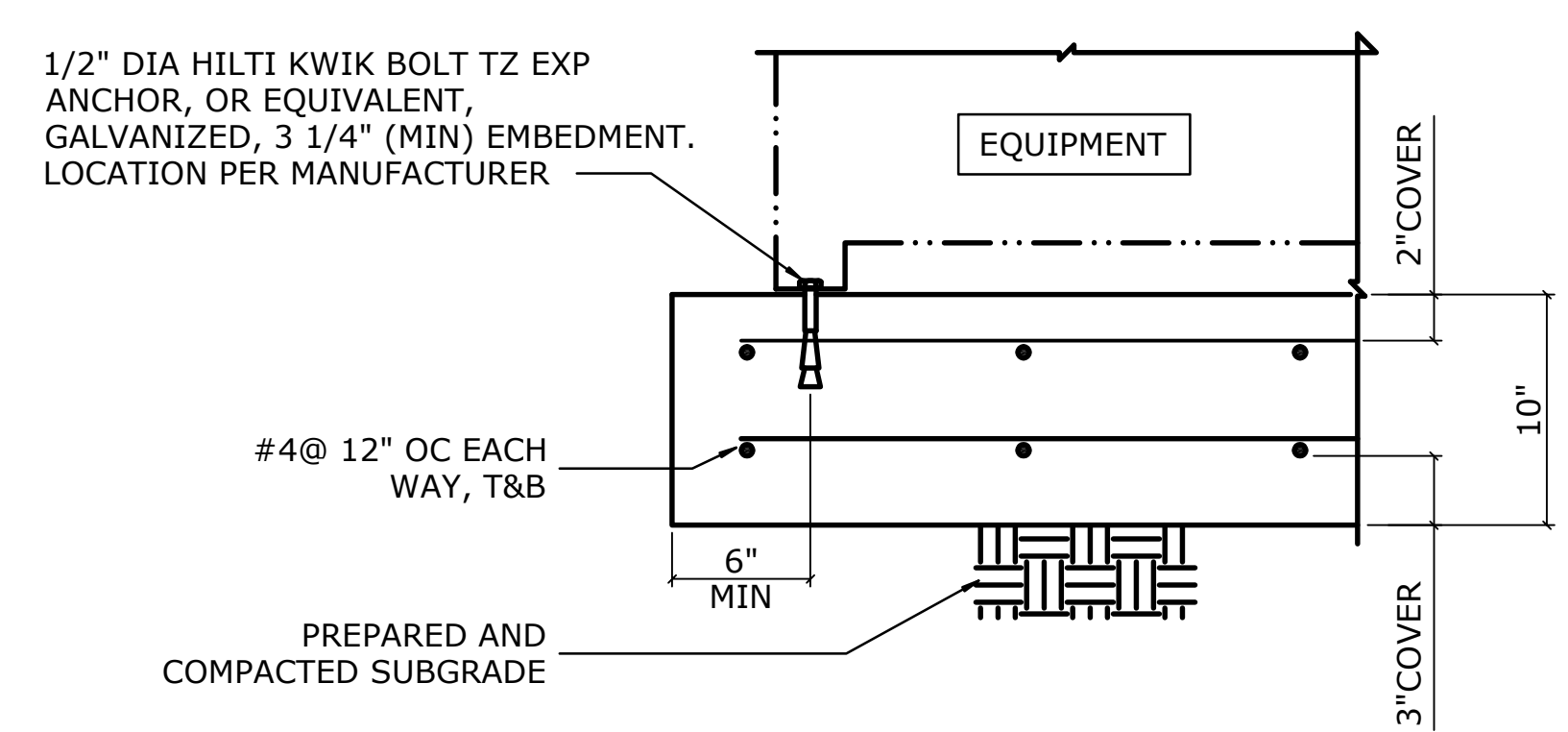
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**1 ARCHITECTURAL EMERGENCY GENERATOR ISOMETRIC**  
SCALE: 1/4" = 1'-0"



**2 ARCHITECTURAL EMERGENCY GENERATOR PLAN**  
SCALE: 1/4" = 1'-0"



**DETAIL NOTES:**

- CONTRACTOR TO PROVIDE MIX THAT MEETS THE REQUIREMENT OF CLASS D AS OUTLINED IN TABLE 601-1 OF CDOT STANDARD SPECIFICATIONS.
- TOP OF CONCRETE PAD SHALL BE STRAIGHT AND LEVEL IN ALL DIRECTIONS.
- CONTROL JOINTS:
  - 2" DEPTH
  - MAXIMUM ASPECT RATIO OF 1.5 TO 1 FOR LAYOUT
  - MAXIMUM SPACING OF 12 FEET
  - TOP LAYER OF REINFORCING DOES NOT CONTINUE THROUGH JOINT

**3 ARCHITECTURAL EMERGENCY GENERATOR PAD DETAIL**  
SCALE: 1-1/2" = 1'-0"

**GENERAL NOTES:**

- SAW CUT AND REMOVE EXISTING ASPHALT FOR NEW CONCRETE PAD.
- ATTACH GENERATOR SKID BRACKETS TO NEW CONCRETE PAD PER MANUFACTURER'S RECOMMENDATION.
- SEE ELECTRICAL DRAWINGS FOR EMERGENCY GENERATOR INSTALLATION DETAILS.
- PAINT EMERGENCY GENERATOR FOREST SERVICE BROWN (FEDERAL STANDARD COLOR 20059 OR THE EQUIVALENT SHERWIN WILLIAMS COLOR SW2838).
- SET THREE 8' TYPE 7 BARRIERS (SEE M&S SHEET M-606-14) TO PROVIDE VEHICLE PROTECTION FOR THE EMERGENCY GENERATOR, WALL HYDRANT AND FIRE DEPARTMENT CONNECTIONS. PAINT BARRIERS FOREST SERVICE BROWN, FEDERAL STANDARD COLOR 20059 OR THE EQUIVALENT SHERWIN WILLIAMS COLOR SW2838. COAT TYPE 7 BARRIERS WITH SHERWIN WILLIAMS PRO INDUSTRIAL ANTI-GRAFFITI COATING.

**WORK NOTES:**

- CORE DRILL FOR WALL HYDRANT AND FIRE DEPARTMENT CONNECTION. SEE FIRE PROTECTION DRAWINGS.
- MAINTAIN POSITIVE DRAINAGE AROUND NEW CONCRETE PAD.
- COORDINATE NEW CONCRETE PAD SIZE WITH ELECTRICAL DRAWINGS AND EMERGENCY GENERATOR SIZE.
- CORE DRILL FOR ELECTRICAL (SHEET E5.0) AND GAS CONNECTIONS (SHEET M6.1). SEE SHEET A6.3 FOR CORE DETAIL. FIELD LOCATE.
- METAL ICE AND SNOW GUARD, MOUNT ~23'-0" ABOVE FINISH GRADE SEE DETAIL SHEET A6.2.

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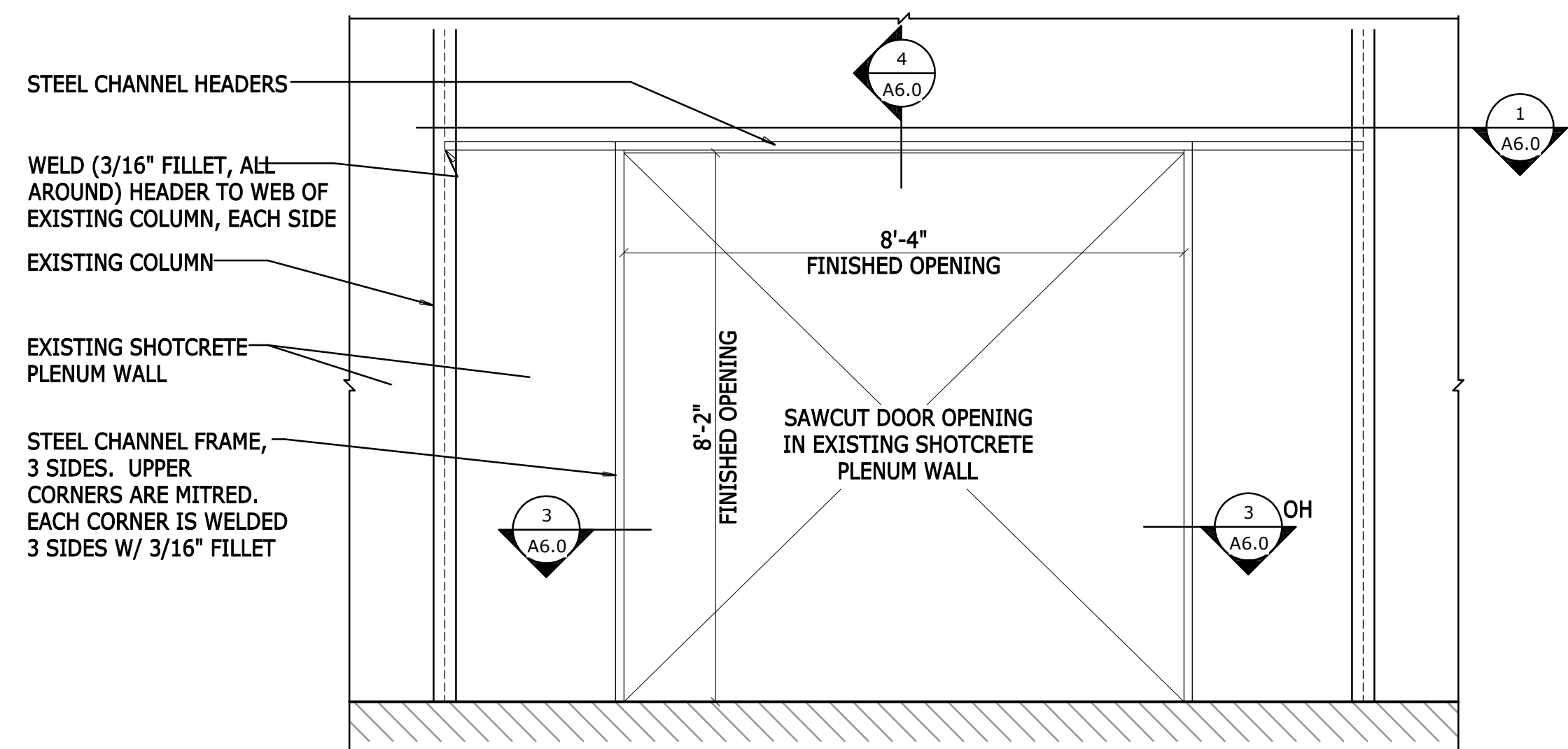
**BARNARD EJMT TEAM**  
**BARNARD**  
**STURGEON ELECTRIC**  
**RONDINELLI**  
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 BLP  
 BLP  
 BLP

Revisions	Num	Description	Date
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ARCHITECTURAL EMERGENCY GENERATOR PLAN			
Drawing Number			
<b>A2.4</b>			

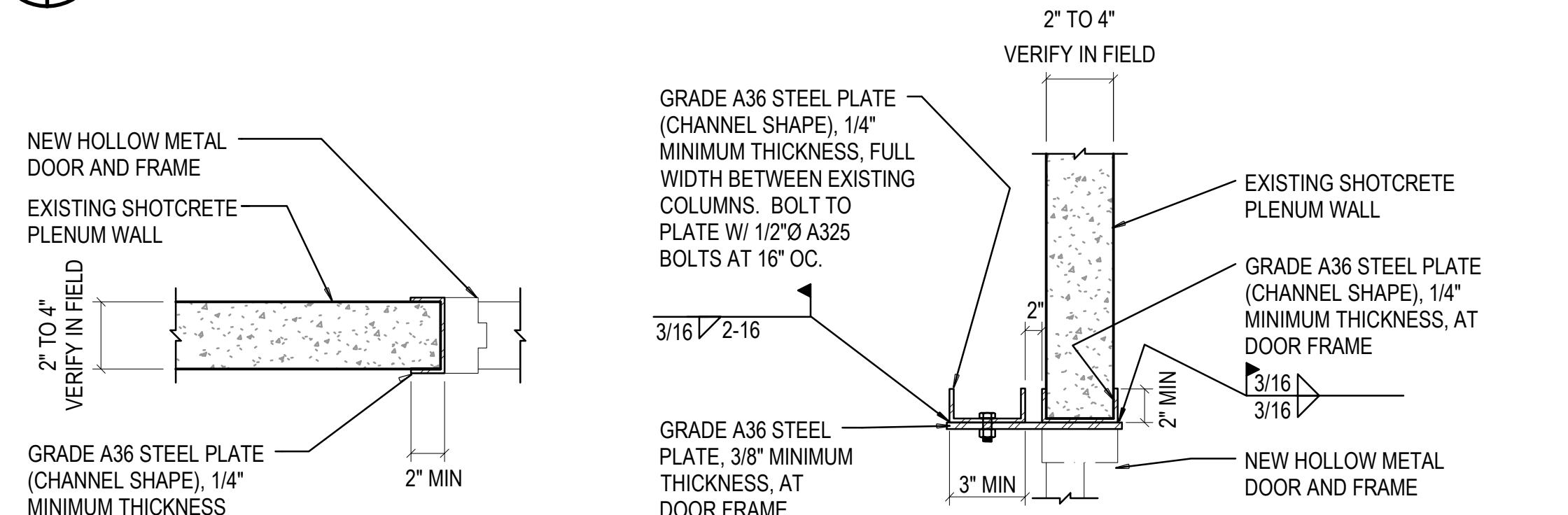
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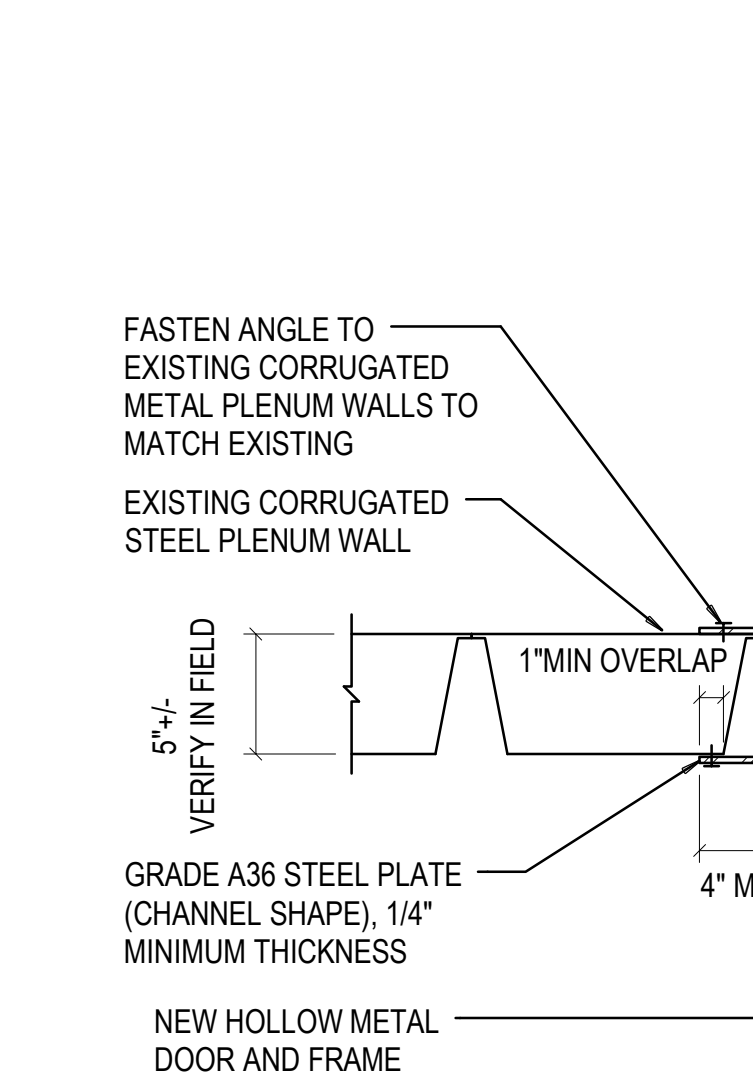
**1** **CONDITION A, HEADER PLAN**  
 SCALE: 1/2" = 1'-0"



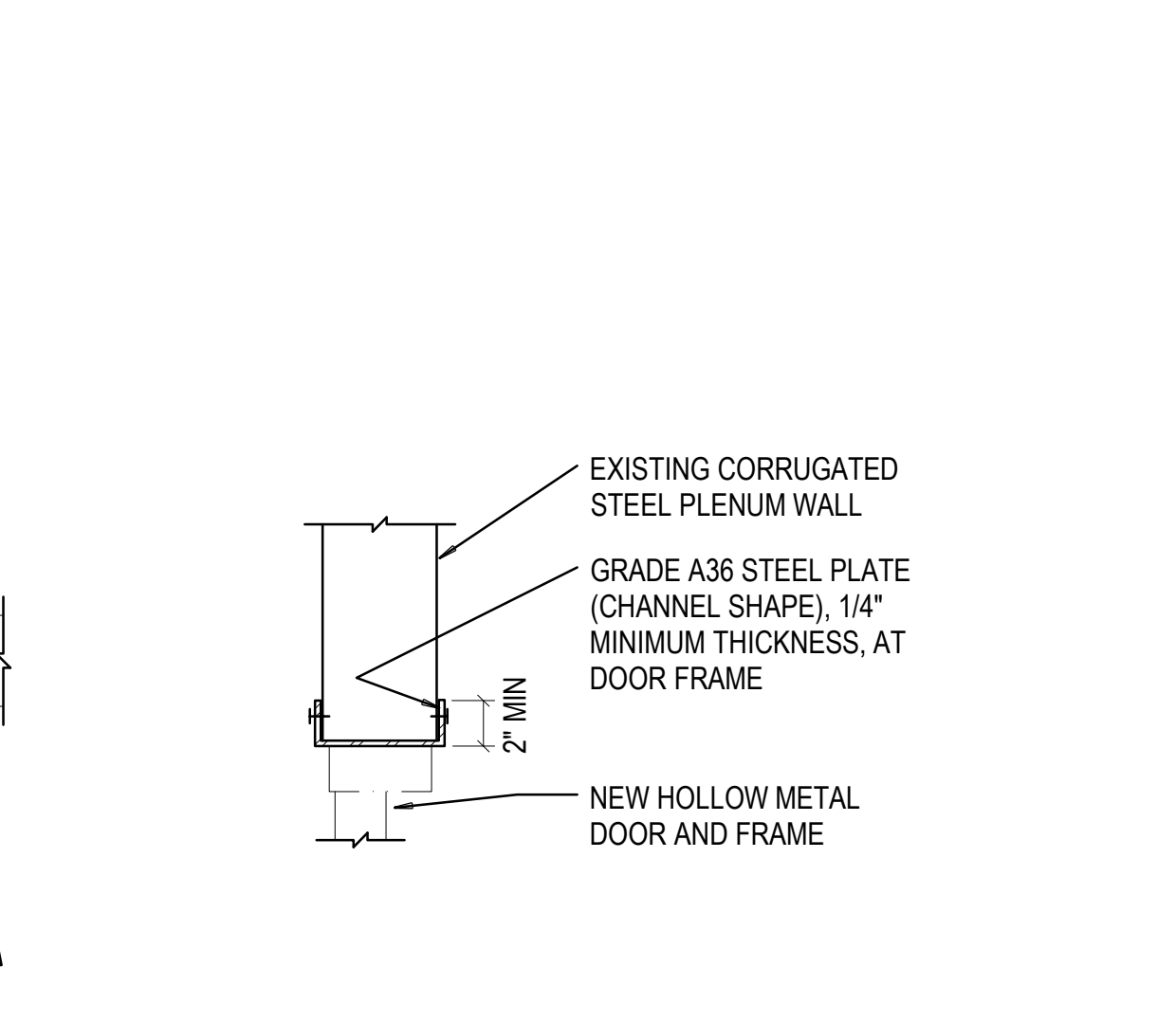
**2** **CONDITION A ELEVATION**  
 SCALE: 1/2" = 1'-0"



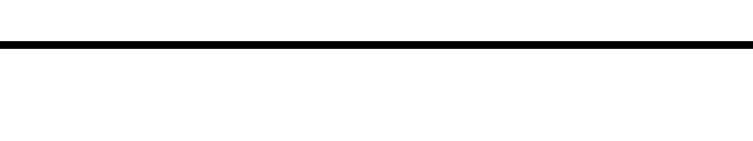
**3** **CONDITION A JAMB**  
 SCALE: 1-1/2" = 1'-0"  
 SCALE: 1/2" = 1'-0"



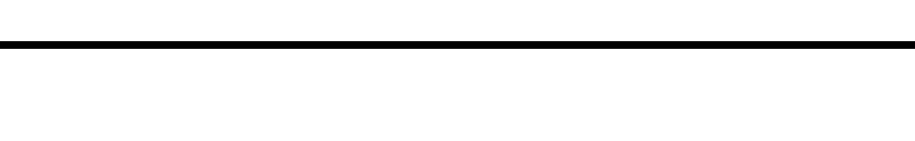
**4** **CONDITION A HEADER**  
 SCALE: 1-1/2" = 1'-0"  
 SCALE: 1/2" = 1'-0"



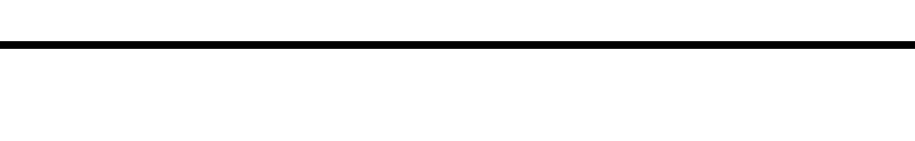
**10** **CONDITION C JAMB**  
 SCALE: 1-1/2" = 1'-0"  
 SCALE: 1/2" = 1'-0"



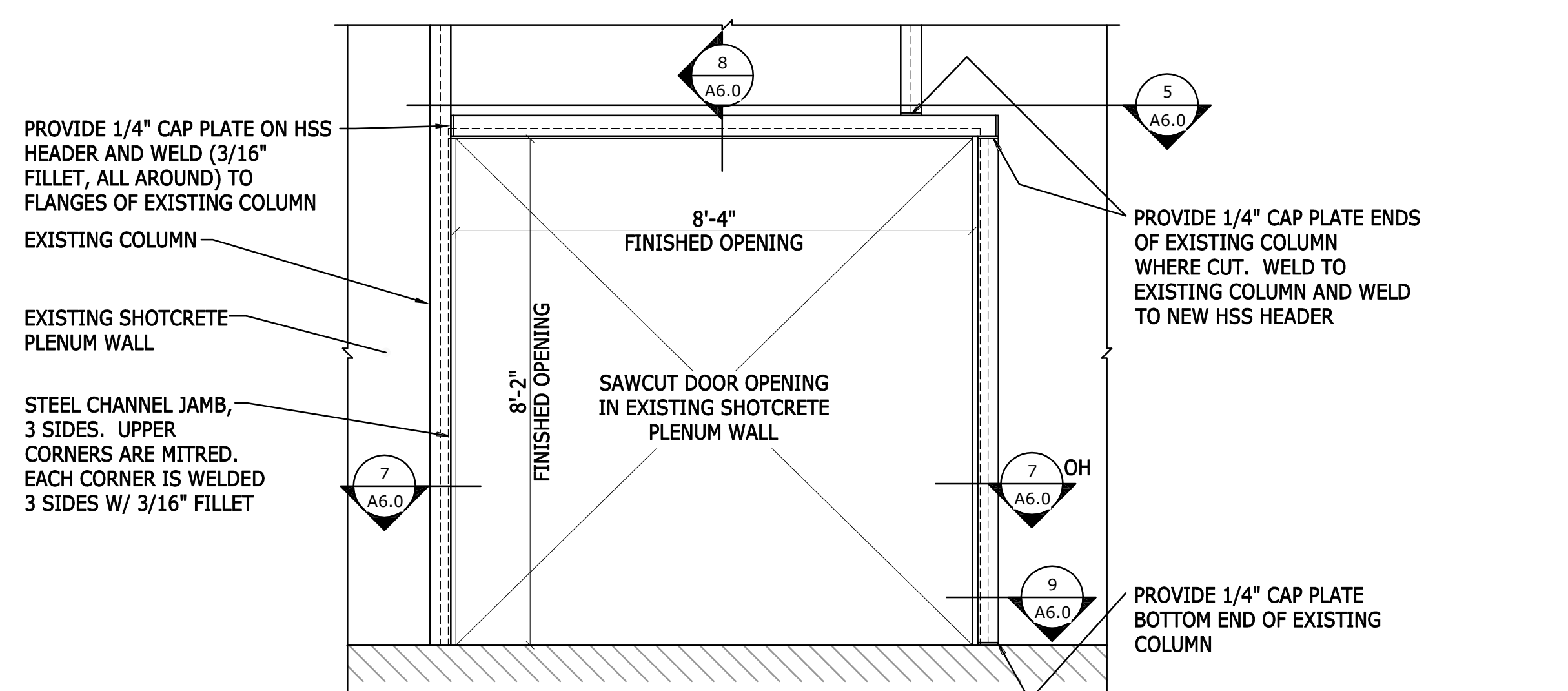
**11** **CONDITION C HEADER**  
 SCALE: 1-1/2" = 1'-0"  
 SCALE: 1/2" = 1'-0"



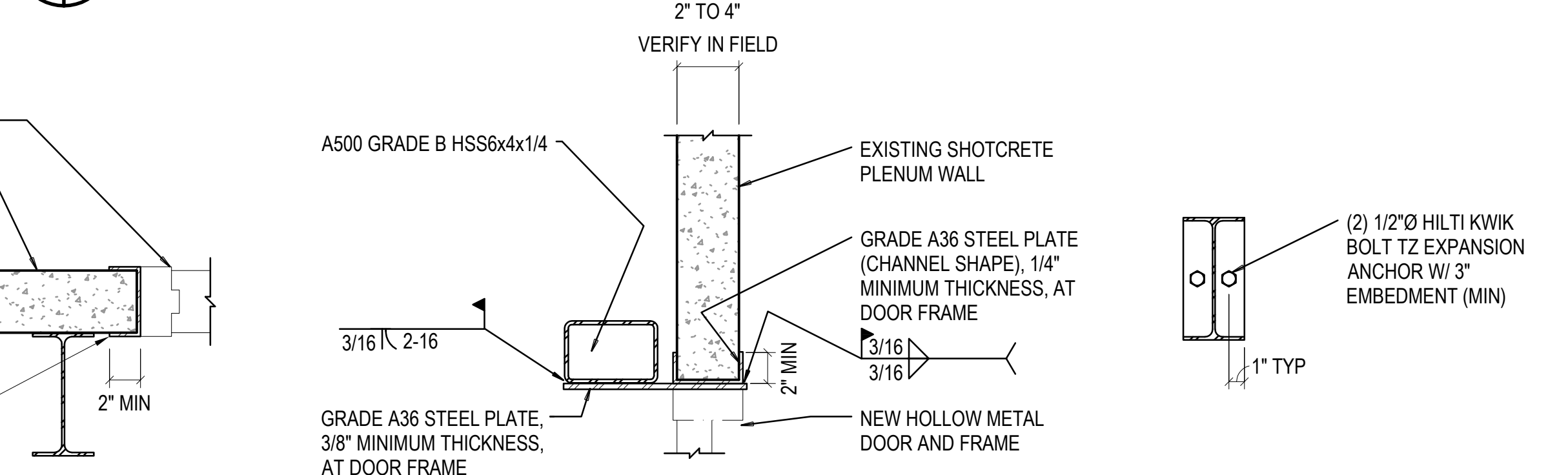
**12** **CONDITION C ELEVATION**  
 SCALE: 1/2" = 1'-0"



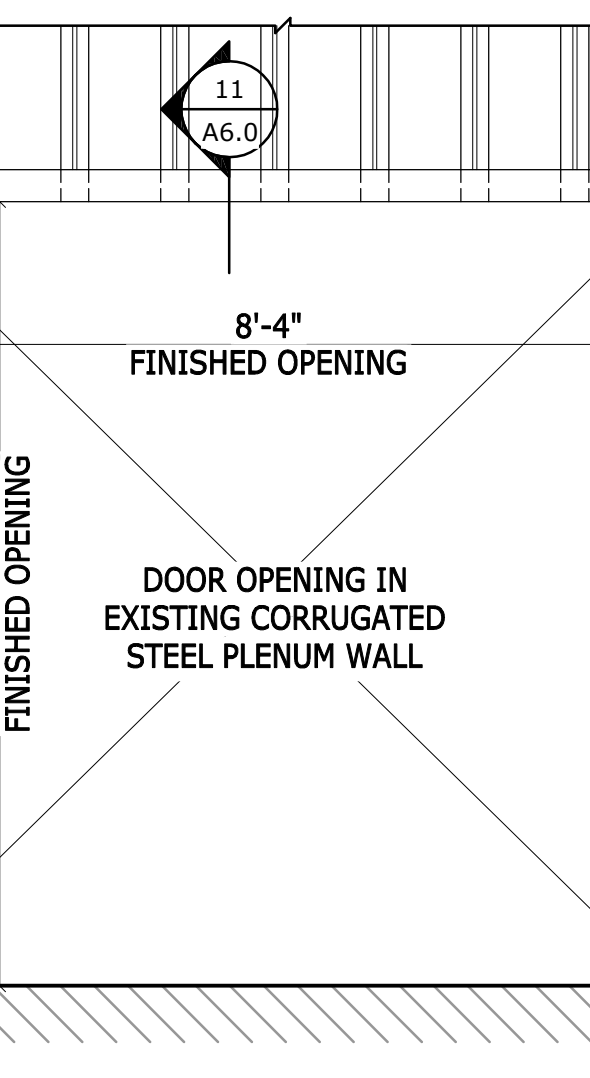
**5** **CONDITION B, HEADER PLAN**  
 SCALE: 1/2" = 1'-0"



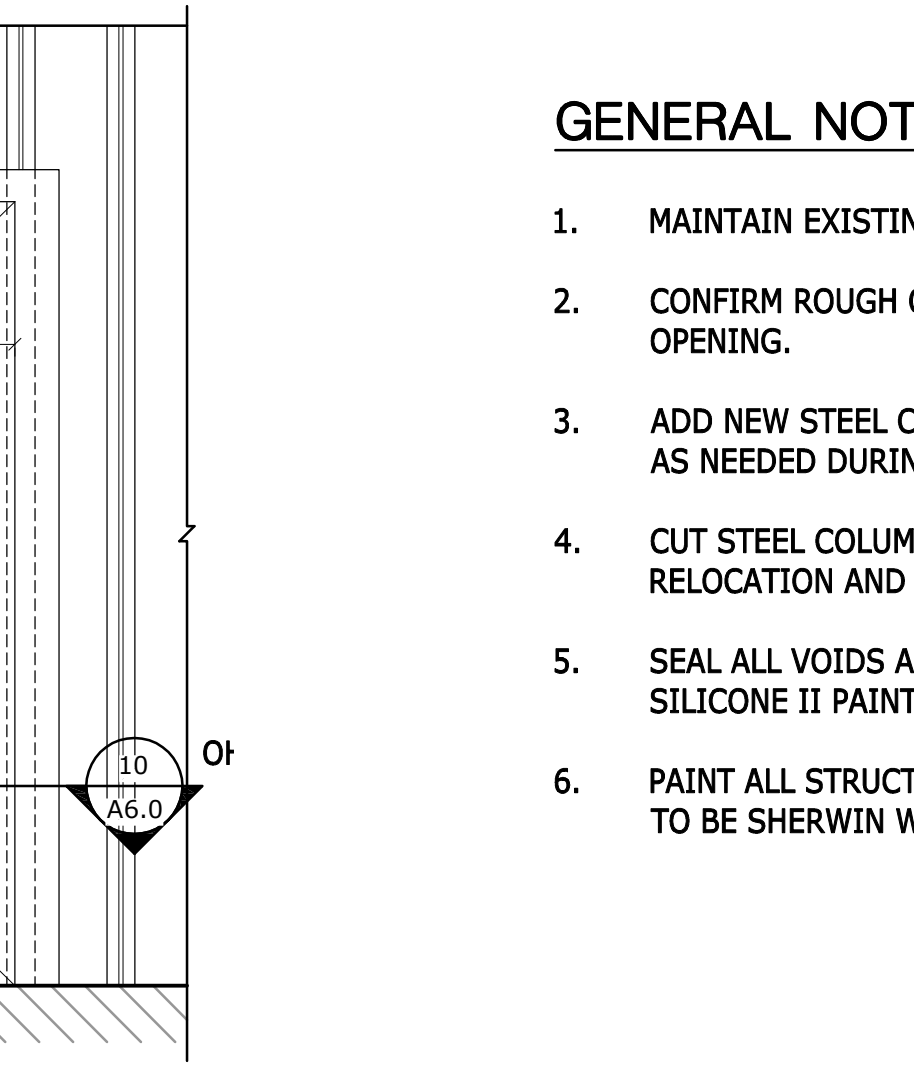
**6** **CONDITION B ELEVATION**  
 SCALE: 1/2" = 1'-0"



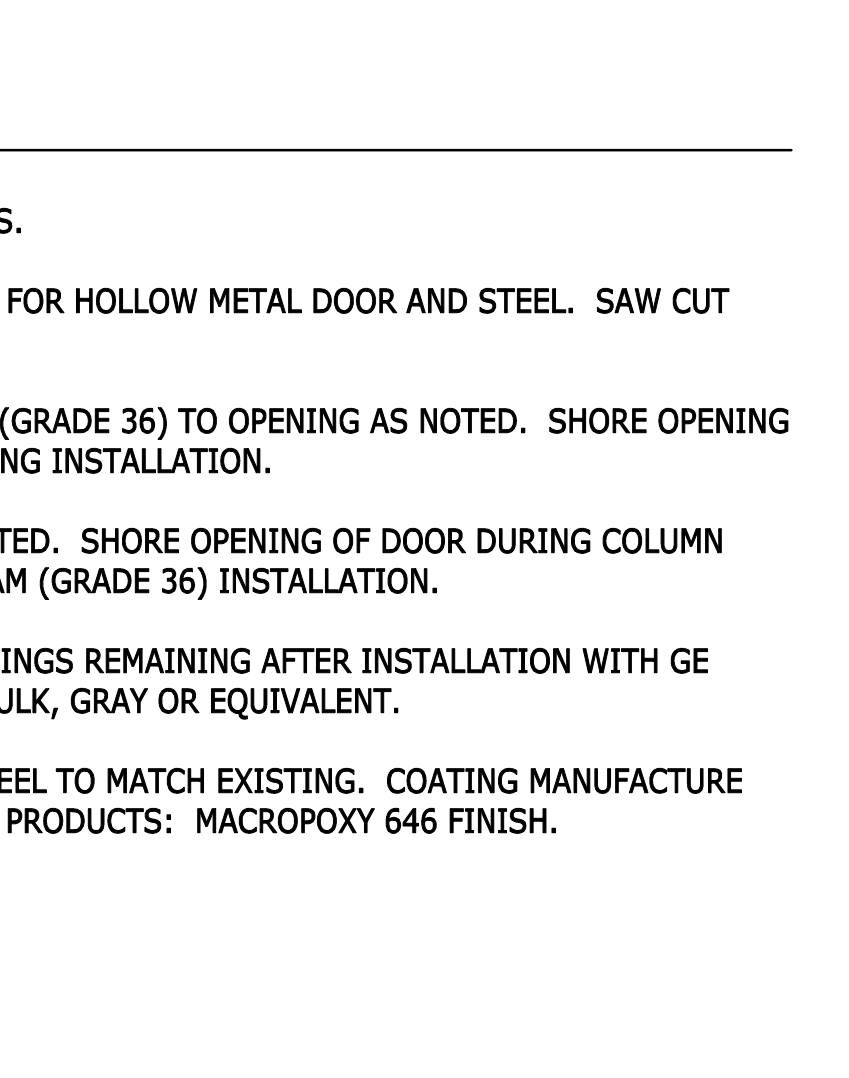
**7** **CONDITION B JAMB**  
 SCALE: 1-1/2" = 1'-0"  
 SCALE: 1/2" = 1'-0"



**8** **CONDITION B HEADER**  
 SCALE: 1-1/2" = 1'-0"  
 SCALE: 1/2" = 1'-0"



**9** **CONDITION B (E) COL BASE CONN**  
 SCALE: 1-1/2" = 1'-0"  
 SCALE: 1/2" = 1'-0"



**GENERAL NOTES:**

1. MAINTAIN EXISTING DOORS.
2. CONFIRM ROUGH OPENING FOR HOLLOW METAL DOOR AND STEEL. SAW CUT OPENING.
3. ADD NEW STEEL CHANNEL (GRADE 36) TO OPENING AS NOTED. SHORE OPENING AS NEEDED DURING FRAMING INSTALLATION.
4. CUT STEEL COLUMN AS NOTED. SHORE OPENING OF DOOR DURING COLUMN RELOCATION AND NEW BEAM (GRADE 36) INSTALLATION.
5. SEAL ALL VOIDS AND OPENINGS REMAINING AFTER INSTALLATION WITH GE SILICONE II PAINTABLE CAULK, GRAY OR EQUIVALENT.
6. PAINT ALL STRUCTURAL STEEL TO MATCH EXISTING. COATING MANUFACTURE TO BE SHERWIN WILLIAMS PRODUCTS: MACROPOXY 646 FINISH.

**BARNARD EJMT TEAM**

**BARNARD** **RONDINELLI**

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Western States Fire Protection Co.

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

Revisions	Date

ARCHITECTURAL DOOR DETAIL

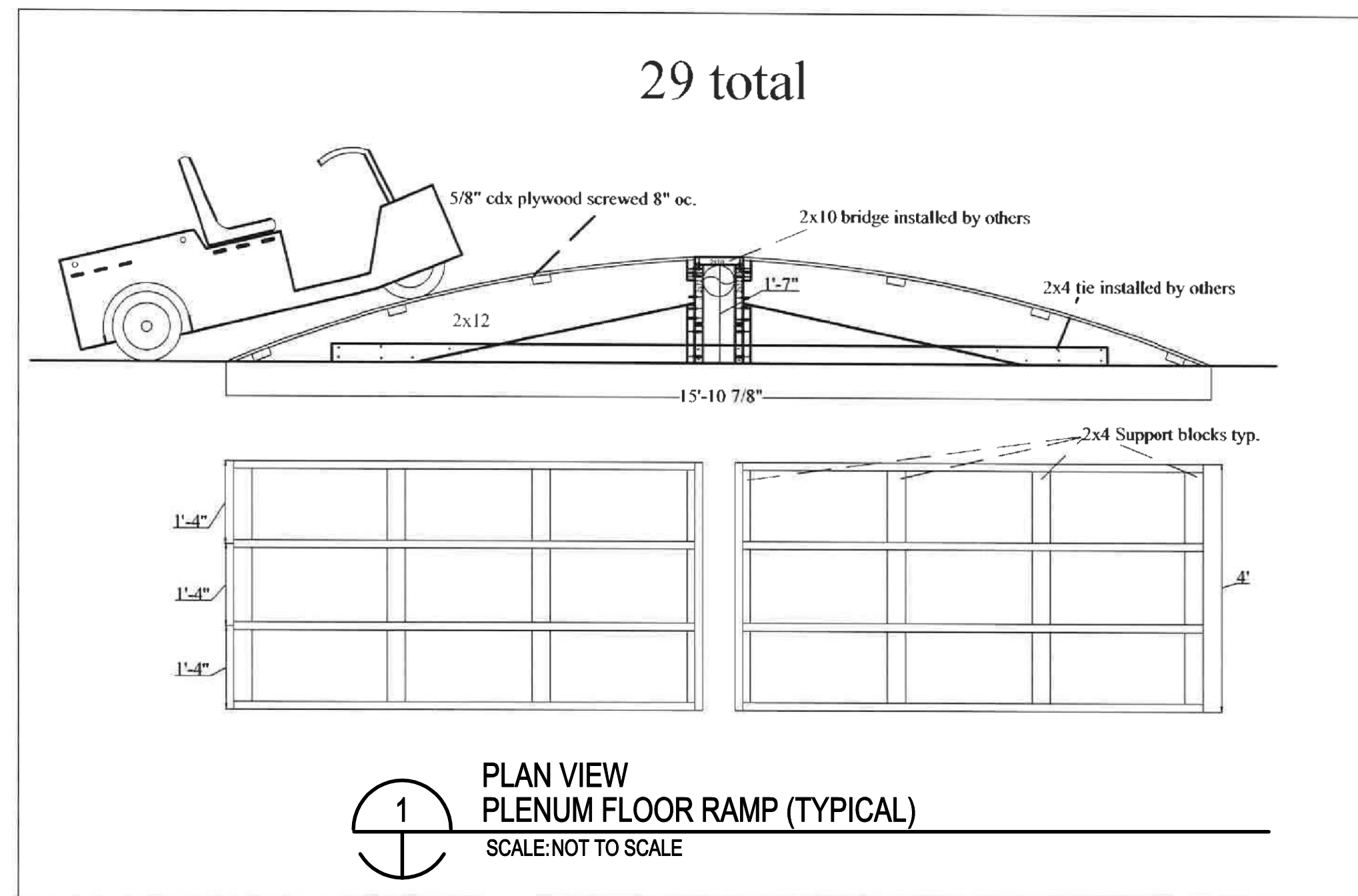
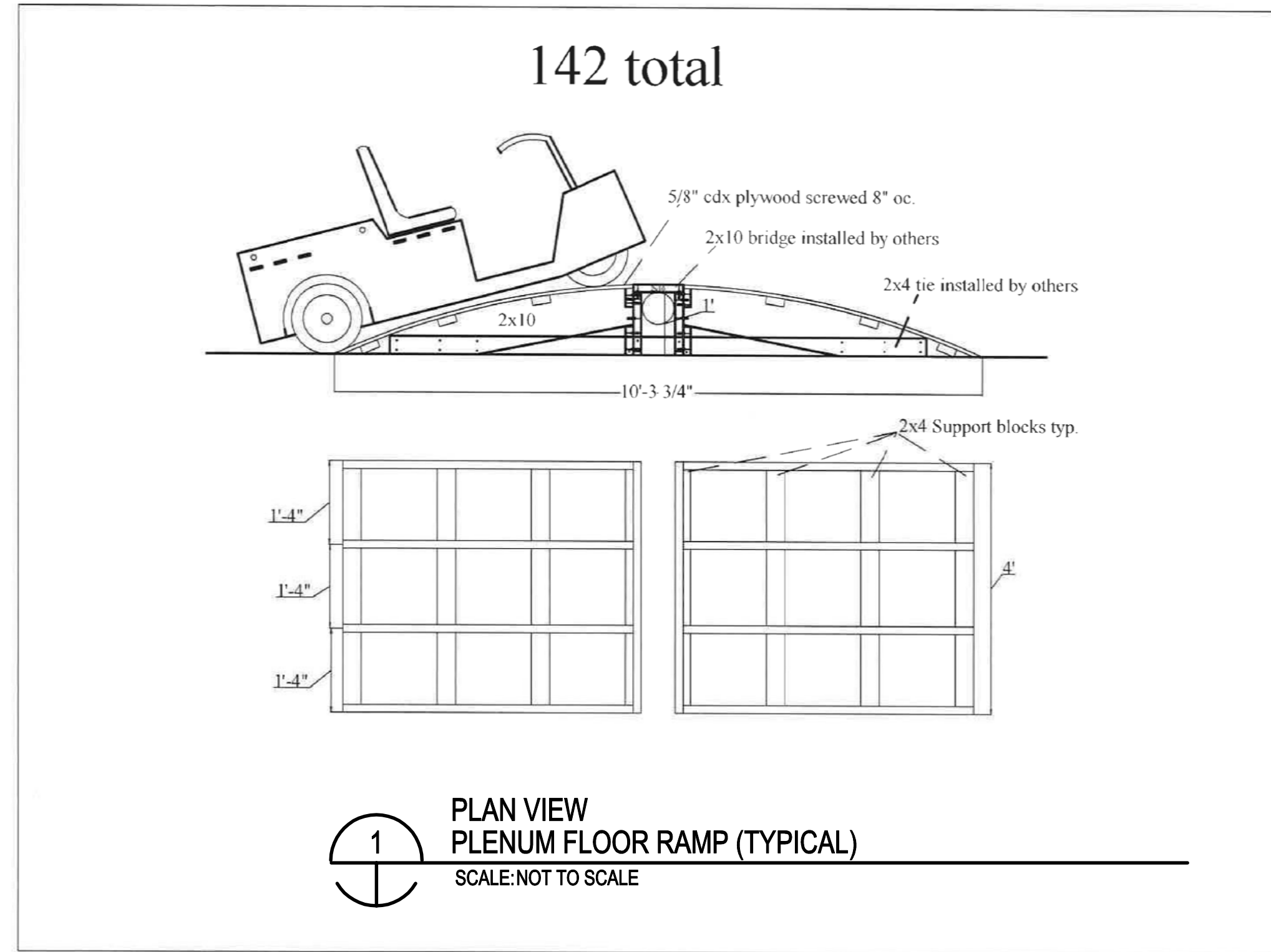
Drawing Number

**A6.0**

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**GENERAL NOTES:**

- CONTRACTOR TO PROVIDE SHOP DRAWINGS FOR ENGINEER APPROVAL PRIOR TO FABRICATION AND INSTALLATION.



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FIXED FIRE SUPPRESSION SYSTEM  
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ARCHITECTURAL RAMP  
DETAIL

Drawing Number

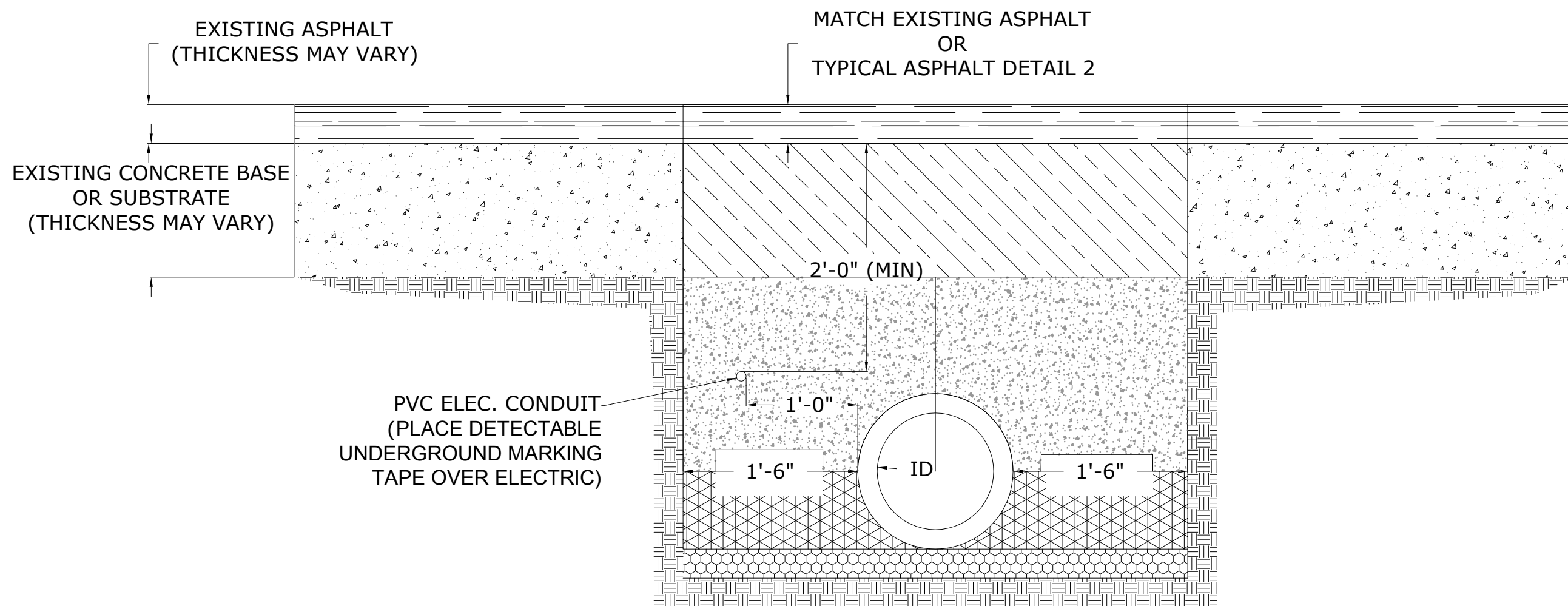
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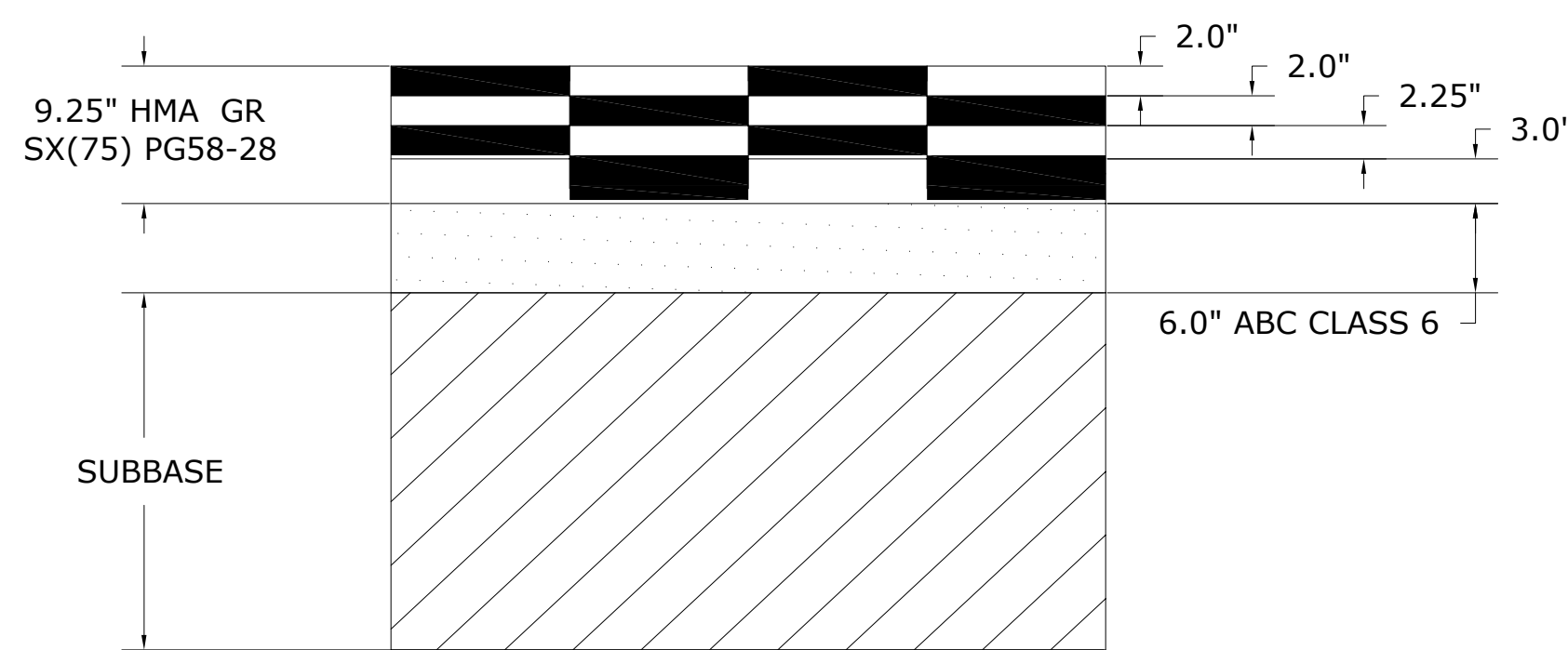
**1** PIPE IN ROADWAY TRENCH DETAIL  
SCALE: 1" = 1'-0"

LEGEND	
	EARTH
	EMBANKMENT MATERIAL
	STRUCTURE BACKFILL**, CLASS 1 OR 2
	BEDDING MATERIAL*
	EXISTING CONCRETE ROADWAY BASE
	BEDROCK
	ASPHALT
	STRUCTURE BACKFILL, CLASS 1
	FLOW-FILL**

\* BEDDING MATERIAL FOR RIGID PIPE IN SOIL SHALL BE 3 IN. OF LOOSE STRUCTURE BACKFILL (CLASS 1 OR 2). BEDDING IS NOT REQUIRED FOR FLEXIBLE PIPE IN SOIL. BEDDING MATERIAL FOR RIGID OR FLEXIBLE PIPE IN ROCK SHALL BE 12 IN. OF LOOSE STRUCTURE BACKFILL, CLASS 1.

\*\* PER SECTION 206.02(a) - STRUCTURAL BACKFILL (FLOW-FILL) MEETING THE FOLLOWING REQUIREMENTS CAN BE SUBSTITUTED FOR CLASS 1 BACKFILL TO BACKFILL CULVERTS AND SEWER PIPES:

CEMENT	50 LBS/YD <sup>3</sup>
COARSE AGGREGATE	1700 LBS/YD <sup>3</sup>
FINE AGGREGATE	1840 LBS/YD <sup>3</sup>
WATER	325 (OR AS NEEDED) LBS/YD <sup>3</sup>



**2** TYPICAL ASPHALT SECTION  
SCALE: 1/2" = 1'-0"

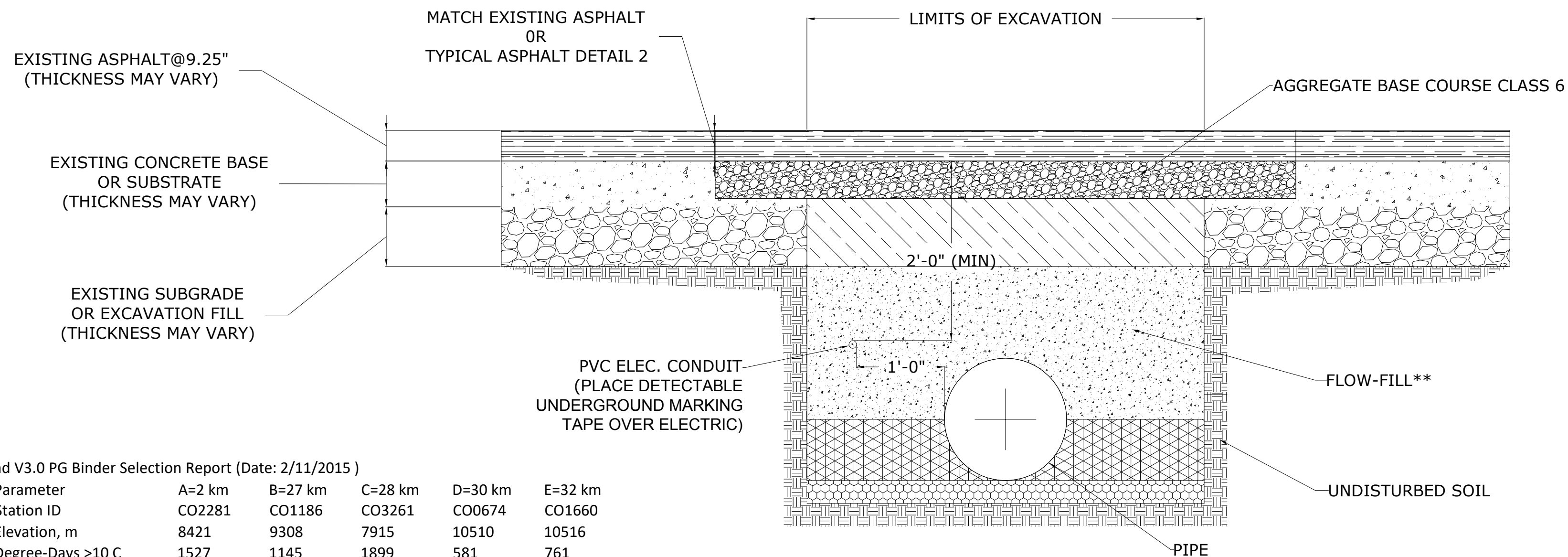
**ASPHALT GENERAL NOTES:**

- THE CONTRACTOR SHALL FOLLOW THE LTPP BIND AND LOCATION CLIMATE DATA REPORT (THIS PAGE) FOR SELECTION OF THE ASPHALT BINDER.
- ALL PATCHING SHALL BE UNDERLAIN BY SIX INCHES OF AGGREGATE BASE COURSE CLASS 6. THE AGGREGATE BASE COURSE SHALL HAVE AN R-VALUE OF AT LEAST 78 WHEN TESTED BY THE HVEEM STABILOMETER METHOD.
- ALL ASPHALT PATCHING AND PAVING SHALL BE HOT MIX ASPHALT (GRADING SX) (75) (PG58-28)
- LIFTS SHALL BE PERFORMED AT A MINIMUM 2-IN AND A MAXIMUM OF 3-IN, LIFTS SHALL BE COMPLETED WITH THE THICKEST LIFT ON THE BOTTOM FOLLOWED BY THINNER LIFTS.
- ASPHALT SMOOTHNESS SHALL CONFORM TO CDOT STANDARD SPECIFICATION SECTION 105.07.
- FLOWFILL SHALL BE USED AS STRUCTURAL BACKFILL FOR THE BACKFILL OF PIPE 3.4. ACROSS THE WEST BOUND I-70 LANE OF TRAVEL AT THE EAST PORTAL SIDE. ALL OTHER TRENCH LOCATIONS SHALL BE BACKFILLED WITH NATIVE OR CLASS 1 BACKFILL.
- MATERIAL SUPPLIER AND MANUFACTURED PRODUCTS SHALL BE ON CDOT'S APPROVED VENDOR MATERIAL LIST.

**LTPPBinder V3.0 PG Binder Selection Report (Date: 2/11/2015)**

Parameter	A=2 km	B=27 km	C=28 km	D=30 km	E=32 km
Station ID	CO2281	CO1186	CO3261	CO0674	CO1660
Elevation, m	8421	9308	7915	10510	10516
Degree-Days >10 C	1527	1145	1899	581	761
Low Air Temperature, C	-31.2	-27.2	-25.2	-30.3	-30.4
Low Air Temp. Std Dev	3.4	3.5	3.9	3.5	2.9
<b>Input Data</b>					
Latitude, Degree	39.62				
Yearly Degree-Days >10C	1183				
Lowest Yearly Air Temp., Deg. C	-28.9				
Low Temp. Std. Dev., Deg. C	3.4				
Base HT PG	52				
<b>Traffic Adjustments for HT</b>					
Desired Reliability, Percent	98				
Traffic Loading, Million ESAL	Up to 3 M. ESAL				
Traffic Speed	Slow				
High Temp. Adjustment	2.8				

PG Temperature	HIGH	LOW
PG Temp. at 50% Reliability	38.4	-19.9
PG Temp. at Desired Reliability	40.0	-26.5
Adjustments for Traffic	2.8	
Adjustments for Depth	0.0	0.0
Adjusted PG Temperature	42.8	-26.5
Selected PG Binder Grade	46	-28



**3** TYPICAL HIGHWAY TRENCH DETAIL  
SCALE: 1" = 1'-0"

**BARNARD EJMT TEAM**

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**Sturgeon ELECTRIC**

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**EISENHOWER/JOHNSON**

**MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM

DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Num	Revisions	Date
	Description	

CHECKED BY: JMC  
DRAWN BY: JBC

CIVIL MISCELLANEOUS DETAILS

Drawing Number  
**C0.2**



Hydraulic Analysis Report - EAST BOUND 2 DROP INLETS

Project Data  
 Project Title: EJMT FFSS EAST BOUND INLETS  
 Designer: JBC  
 Project Date: Thursday, May 28, 2015  
 Project Units: U.S. Customary Units  
 Notes:

Curb and Gutter Analysis: DI4 - Eastbound inlet 2 of 2 NEW  
 Notes: Assumes full flow with 25% Clogging factor taken after calculations

Gutter Input Parameters  
 Longitudinal Slope of Road 0.016 ft/ft  
 Cross-Slope of Pavement 0.04 ft/ft  
 Depressed Gutter Geometry  
 Cross-Slope of Gutter 0.05 ft/ft  
 Manning's n 0.015  
 Gutter Width 9 ft  
 Design Flow 4.076 cfs  
 Gutter Result Parameters  
 Width of Spread 6.154 ft  
 Gutter Depression 1.08 in  
 Area of Flow 1.162 ft^2  
 Eo (Gutter Flow to Total Flow) 1  
 Gutter Depth at Curb 4.034 in  
 Inlet Input Parameters  
 Inlet Location Inlet on Grade  
 Inlet Type Grate  
 Grate Type Curved Vane  
 Grate Width 4.5 ft  
 Grate Length 2.5 ft  
 Local Depression 0 in  
 Inlet Result Parameters  
 Intercepted Flow 3.997 cfs  
 Bypass Flow 0.079 cfs  
 Approach Velocity 4 ft/s  
 Splash-over Velocity 6.79 ft/s  
 Efficiency 0.98  
 Clogging at 25%  
 Percent Clogging 25 %  
 Intercepted flow after clogging 2.998  
 Bypass flow after clogging 1.078

Curb and Gutter Analysis: DI2 - Eastbound inlet 1 of 2 (NEW)  
 Notes:

Gutter Input Parameters  
 Longitudinal Slope of Road 0.016 ft/ft  
 Cross-Slope of Pavement 0.04 ft/ft  
 Depressed Gutter Geometry  
 Cross-Slope of Gutter 0.05 ft/ft  
 Manning's n 0.015  
 Gutter Width 9 ft  
 Design Flow 1.078 cfs  
 Gutter Result Parameters  
 Width of Spread 3.737 ft  
 Gutter Depression 1.08 in  
 Area of Flow 0.684 ft^2  
 Eo (Gutter Flow to Total Flow) 1  
 Gutter Depth at Curb 2.874 in  
 Inlet Input Parameters  
 Inlet Location Inlet on Grade  
 Inlet Type Grate  
 Grate Type Curved Vane  
 Grate Width 4.5 ft  
 Grate Length 2.5 ft  
 Local Depression 1 in  
 Inlet Result Parameters  
 Intercepted Flow 1.072 cfs  
 Bypass Flow 0.006 cfs  
 Approach Velocity 2.26 ft/s  
 Splash-over Velocity 6.79 ft/s  
 Efficiency 0.995

Hydraulic Analysis Report - WEST BOUND 2 DROP INLETS

Project Data  
 Project Title: EJMT FFSS EAST BOUND INLETS  
 Designer: JBC  
 Project Date: Thursday, May 28, 2015  
 Project Units: U.S. Customary Units  
 Notes:

Curb and Gutter Analysis: DI1 - Westbound inlet 1 of 2 (Existing)  
 Notes: Assumes full flow with 25% Clogging factor taken after calculations

Gutter Input Parameters  
 Longitudinal Slope of Road 0.009 ft/ft  
 Cross-Slope of Pavement 0.059 ft/ft  
 Depressed Gutter Geometry  
 Cross-Slope of Gutter 0.069 ft/ft  
 Manning's n 0.015  
 Gutter Width 9 ft  
 Design Flow 1.064 cfs  
 Gutter Result Parameters  
 Width of Spread 3.3874 ft  
 Gutter Depression 1.08 in  
 Area of Flow 0.7435 ft^2  
 Eo (Gutter Flow to Total Flow) 1  
 Gutter Depth at Curb 3.4783 in  
 Inlet Input Parameters  
 Inlet Location Inlet on Grade  
 Inlet Type Grate  
 Grate Type Reticuline  
 Grate Width 3.33 ft  
 Grate Length 1.25 ft  
 Local Depression 1 in  
 Inlet Result Parameters  
 Intercepted Flow 1.064 cfs  
 Bypass Flow 0.000 cfs  
 Approach Velocity 1.4311 ft/s  
 Splash-over Velocity 2.8684 ft/s  
 Efficiency 1.00

Curb and Gutter Analysis: DI3 - Westbound inlet 2 of 2 (NEW)  
 Notes:

Gutter Input Parameters  
 Longitudinal Slope of Road 0.009 ft/ft  
 Cross-Slope of Pavement 0.052 ft/ft  
 Depressed Gutter Geometry  
 Cross-Slope of Gutter 0.062 ft/ft  
 Manning's n 0.015  
 Gutter Width 9 ft  
 Design Flow 4.076 cfs  
 Gutter Result Parameters  
 Width of Spread 5.993 ft  
 Gutter Depression 1.08 in  
 Area of Flow 1.339 ft^2  
 Eo (Gutter Flow to Total Flow) 1  
 Gutter Depth at Curb 4.82 in  
 Inlet Input Parameters  
 Inlet Location Inlet on Grade  
 Inlet Type Grate  
 Grate Type Curved Vane  
 Grate Width 4.5 ft  
 Grate Length 2.5 ft  
 Local Depression 1 in  
 Inlet Result Parameters  
 Intercepted Flow 4.016 cfs  
 Bypass Flow 0.06 cfs  
 Approach Velocity 3.045 ft/s  
 Splash-over Velocity 6.79 ft/s  
 Efficiency 0.985  
 Clogging at 25%  
 Percent Clogging 25 %  
 Intercepted flow after clogging 3.012  
 Bypass flow after clogging 1.064

Hydraulic Analysis Report

Project Data  
 Project Title: EISENHOWER/JOHNSON MEMORIAL TUNNEL FFSS  
 Designer: JBC  
 Project Date: Thursday, May 28, 2015  
 Project Units: U.S. Customary Units  
 Notes:

Channel Analysis: 18" RCP @ 0.02 - CHANNEL ANALYSIS

Notes:  
 Input Parameters  
 Channel Type: Circular  
 Pipe Diameter: 1.5000 ft  
 Longitudinal Slope: 0.0200 ft/ft  
 Manning's n: 0.0120  
 Flow: 4.0760 cfs

Result Parameters  
 Depth: 0.5147 ft  
 Area of Flow: 0.5365 ft^2  
 Wetted Perimeter: 1.8775 ft  
 Hydraulic Radius: 0.2858 ft  
 Average Velocity: 7.5972 ft/s  
 Top Width: 1.4243 ft  
 Froude Number: 2.1814  
 Critical Depth: 0.7727 ft  
 Critical Velocity: 4.4419 ft/s  
 Critical Slope: 0.0046 ft/ft  
 Critical Top Width: 1.50 ft  
 Calculated Max Shear Stress: 0.6424 lb/ft^2  
 Calculated Avg Shear Stress: 0.3566 lb/ft^2

Channel Analysis: 12" RCP @ 0.01 - CHANNEL ANALYSIS

Notes:  
 Input Parameters  
 Channel Type: Circular  
 Pipe Diameter: 1.0000 ft  
 Longitudinal Slope: 0.0100 ft/ft  
 Manning's n: 0.0120  
 Flow: 4.0760 cfs

Result Parameters  
 Depth: 0.8828 ft  
 Area of Flow: 0.7338 ft^2  
 Wetted Perimeter: 2.4428 ft  
 Hydraulic Radius: 0.3004 ft  
 Average Velocity: 5.5545 ft/s  
 Top Width: 0.8433 ft  
 Froude Number: 0.9165  
 Critical Depth: 0.8540 ft  
 Critical Velocity: 5.7058 ft/s  
 Critical Slope: 0.0104 ft/ft  
 Critical Top Width: 0.71 ft  
 Calculated Max Shear Stress: 0.5509 lb/ft^2  
 Calculated Avg Shear Stress: 0.1875 lb/ft^2

Channel Analysis: 8" PVC @ 0.1483 - CHANNEL ANALYSIS

Notes:  
 Input Parameters  
 Channel Type: Circular  
 Pipe Diameter: 1.5000 ft  
 Longitudinal Slope: 0.1483 ft/ft  
 Manning's n: 0.0120  
 Flow: 2.0380 cfs

Result Parameters  
 Depth: 0.2202 ft  
 Area of Flow: 0.1611 ft^2  
 Wetted Perimeter: 1.1797 ft  
 Hydraulic Radius: 0.1366 ft  
 Average Velocity: 12.6485 ft/s  
 Top Width: 1.0618 ft  
 Froude Number: 5.7220  
 Critical Depth: 0.5383 ft  
 Critical Velocity: 3.5733 ft/s  
 Critical Slope: 0.0042 ft/ft  
 Critical Top Width: 1.44 ft  
 Calculated Max Shear Stress: 2.0379 lb/ft^2  
 Calculated Avg Shear Stress: 1.2640 lb/ft^2

Channel Analysis: 8" PVC @ 0.1043 - CHANNEL ANALYSIS

Notes:  
 Input Parameters  
 Channel Type: Circular  
 Pipe Diameter: 1.5000 ft  
 Longitudinal Slope: 0.1483 ft/ft  
 Manning's n: 0.0120  
 Flow: 2.0380 cfs

Result Parameters  
 Depth: 0.2202 ft  
 Area of Flow: 0.1611 ft^2  
 Wetted Perimeter: 1.1797 ft  
 Hydraulic Radius: 0.1366 ft  
 Average Velocity: 12.6485 ft/s  
 Top Width: 1.0618 ft  
 Froude Number: 5.7220  
 Critical Depth: 0.5383 ft  
 Critical Velocity: 3.5733 ft/s  
 Critical Slope: 0.0042 ft/ft  
 Critical Top Width: 1.44 ft  
 Calculated Max Shear Stress: 2.0379 lb/ft^2  
 Calculated Avg Shear Stress: 1.2640 lb/ft^2

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**BARNARD EJMT TEAM**



EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

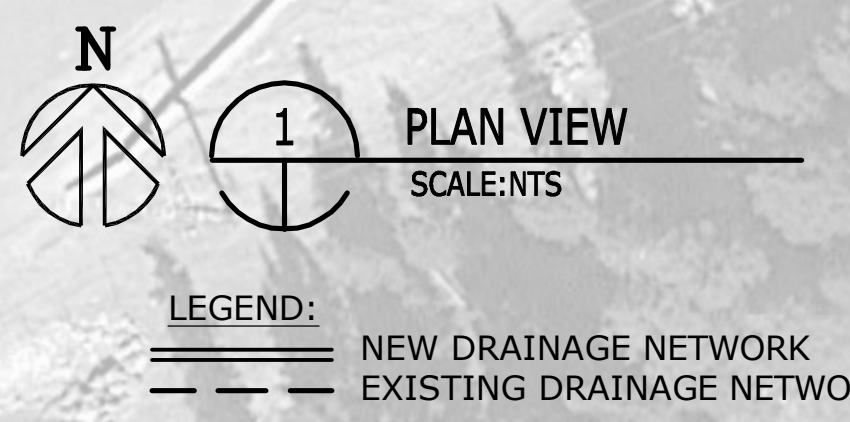
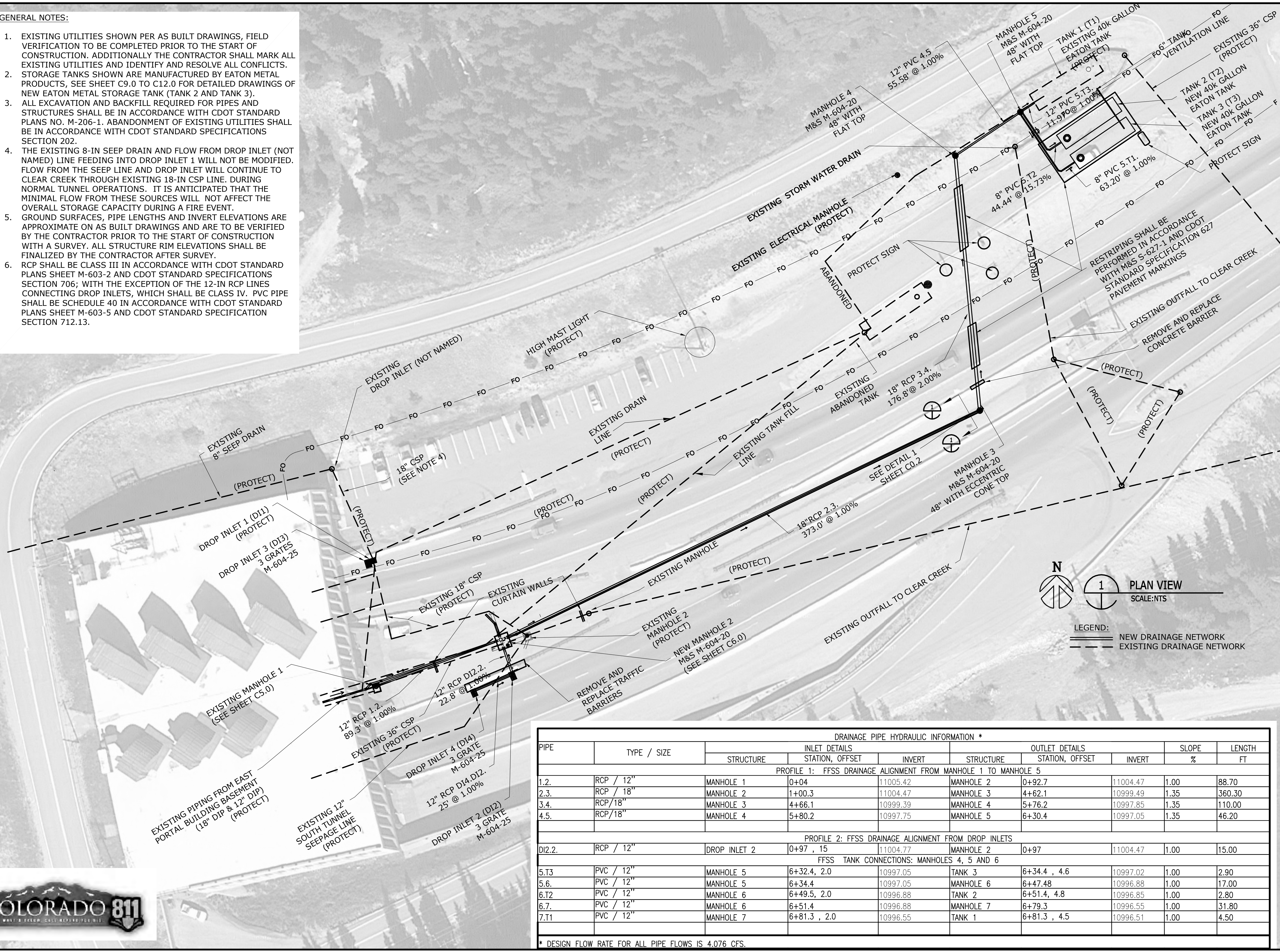
Revisions	Date
Num	Description

CO.3 HYDRAULIC ANALYSIS REPORTS

Drawing Number  
C0.3

GENERAL NOTES:

- EXISTING UTILITIES SHOWN PER AS BUILT DRAWINGS, FIELD VERIFICATION TO BE COMPLETED PRIOR TO THE START OF CONSTRUCTION. ADDITIONALLY THE CONTRACTOR SHALL MARK ALL EXISTING UTILITIES AND IDENTIFY AND RESOLVE ALL CONFLICTS.
- STORAGE TANKS SHOWN ARE MANUFACTURED BY EATON METAL PRODUCTS, SEE SHEET C9.0 TO C12.0 FOR DETAILED DRAWINGS OF NEW EATON METAL STORAGE TANK (TANK 2 AND TANK 3).
- ALL EXCAVATION AND BACKFILL REQUIRED FOR PIPES AND STRUCTURES SHALL BE IN ACCORDANCE WITH CDOT STANDARD PLANS NO. M-206-1. ABANDONMENT OF EXISTING UTILITIES SHALL BE IN ACCORDANCE WITH CDOT STANDARD SPECIFICATIONS SECTION 202.
- THE EXISTING 8-IN SEEP DRAIN AND FLOW FROM DROP INLET (NOT NAMED) LINE FEEDING INTO DROP INLET 1 WILL NOT BE MODIFIED. FLOW FROM THE SEEP LINE AND DROP INLET WILL CONTINUE TO CLEAR CREEK THROUGH EXISTING 18-IN CSP LINE. DURING NORMAL TUNNEL OPERATIONS. IT IS ANTICIPATED THAT THE MINIMAL FLOW FROM THESE SOURCES WILL NOT AFFECT THE OVERALL STORAGE CAPACITY DURING A FIRE EVENT.
- GROUND SURFACES, PIPE LENGTHS AND INVERT ELEVATIONS ARE APPROXIMATE ON AS BUILT DRAWINGS AND ARE TO BE VERIFIED BY THE CONTRACTOR PRIOR TO THE START OF CONSTRUCTION WITH A SURVEY. ALL STRUCTURE RIM ELEVATIONS SHALL BE FINALIZED BY THE CONTRACTOR AFTER SURVEY.
- RCP SHALL BE CLASS III IN ACCORDANCE WITH CDOT STANDARD PLANS SHEET M-603-2 AND CDOT STANDARD SPECIFICATIONS SECTION 706; WITH THE EXCEPTION OF THE 12-IN RCP LINES CONNECTING DROP INLETS, WHICH SHALL BE CLASS IV. PVC PIPE SHALL BE SCHEDULE 40 IN ACCORDANCE WITH CDOT STANDARD PLANS SHEET M-603-5 AND CDOT STANDARD SPECIFICATION SECTION 712.13.



DRAINAGE PIPE HYDRAULIC INFORMATION \*

PIPE	TYPE / SIZE	INLET DETAILS			OUTLET DETAILS			SLOPE %	LENGTH FT
		STRUCTURE	STATION, OFFSET	INVERT	STRUCTURE	STATION, OFFSET	INVERT		
PROFILE 1: FFSS DRAINAGE ALIGNMENT FROM MANHOLE 1 TO MANHOLE 5									
1.2.	RCP / 12"	MANHOLE 1	0+04	11005.42	MANHOLE 2	0+92.7	11004.47	1.00	88.70
2.3.	RCP / 18"	MANHOLE 2	1+00.3	11004.47	MANHOLE 3	4+62.1	10999.49	1.35	360.30
3.4.	RCP / 18"	MANHOLE 3	4+66.1	10999.39	MANHOLE 4	5+76.2	10997.85	1.35	110.00
4.5.	RCP / 18"	MANHOLE 4	5+80.2	10997.75	MANHOLE 5	6+30.4	10997.05	1.35	46.20
PROFILE 2: FFSS DRAINAGE ALIGNMENT FROM DROP INLETS									
DI2.2.	RCP / 12"	DROP INLET 2	0+97 , 15	11004.77	MANHOLE 2	0+97	11004.47	1.00	15.00
FFSS TANK CONNECTIONS: MANHOLES 4, 5 AND 6									
5.T3	PVC / 12"	MANHOLE 5	6+32.4 , 2.0	10997.05	TANK 3	6+34.4 , 4.6	10997.02	1.00	2.90
5.6.	PVC / 12"	MANHOLE 5	6+34.4	10997.05	MANHOLE 6	6+47.48	10996.88	1.00	17.00
6.T2	PVC / 12"	MANHOLE 6	6+49.5 , 2.0	10996.88	TANK 2	6+51.4 , 4.8	10996.85	1.00	2.80
6.7.	PVC / 12"	MANHOLE 6	6+51.4	10996.88	MANHOLE 7	6+79.3	10996.55	1.00	31.80
7.T1	PVC / 12"	MANHOLE 7	6+81.3 , 2.0	10996.55	TANK 1	6+81.3 , 4.5	10996.51	1.00	4.50

\* DESIGN FLOW RATE FOR ALL PIPE FLOWS IS 4.076 CFS.

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**BARNARD EJMT TEAM**

**BARNARD** **BARNARD** **RONDINELLI**

Western States Fire Protection Co.

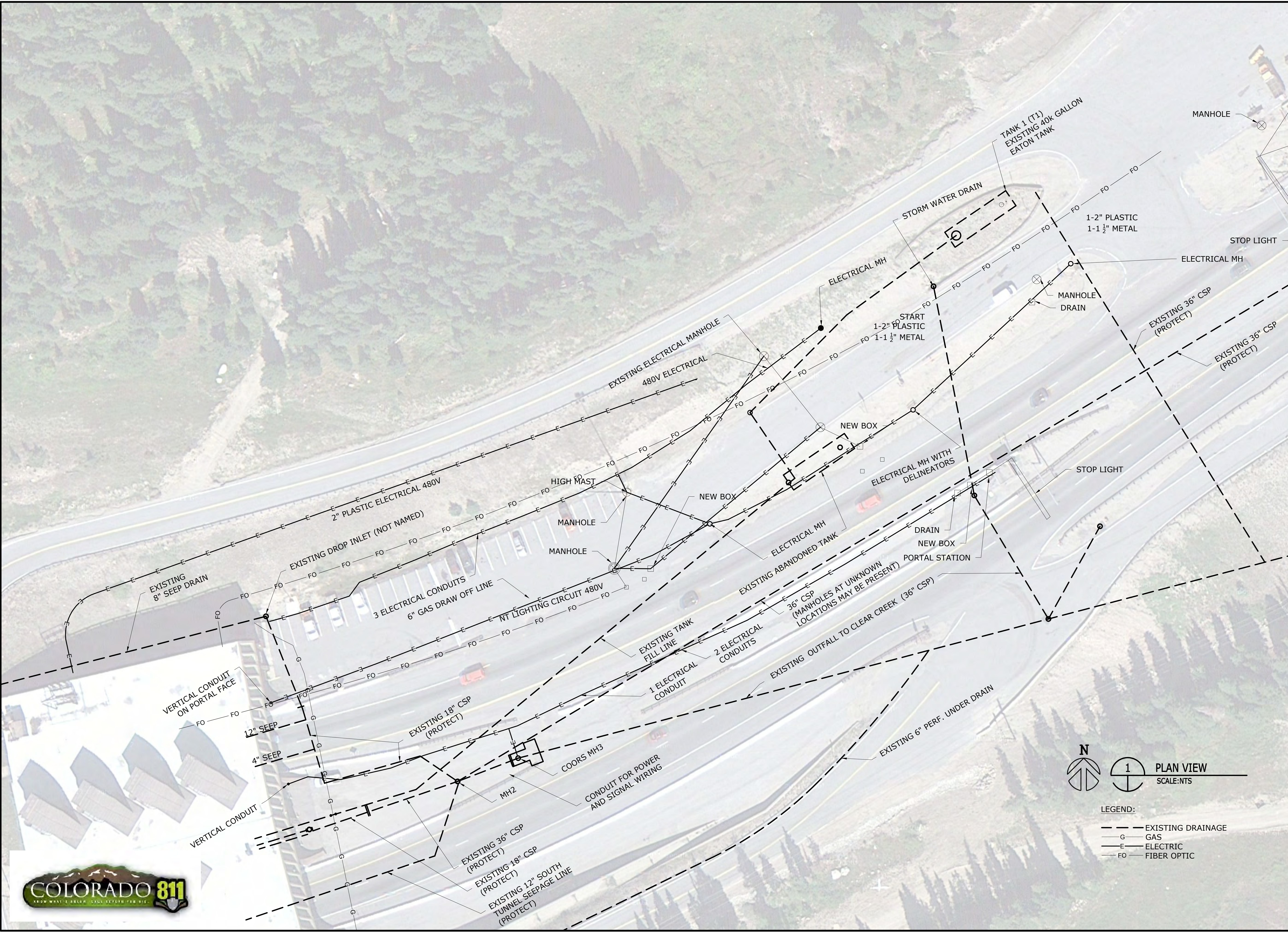
Sturgeon Electric

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Revisions	Date
Description	
Num	
DRAWN BY: JBC	
CHECKED BY: JIM	
EAST PORTAL BUILDING FFSS DRAINAGE PLAN	
Drawing Number	
<b>C1.0</b>	

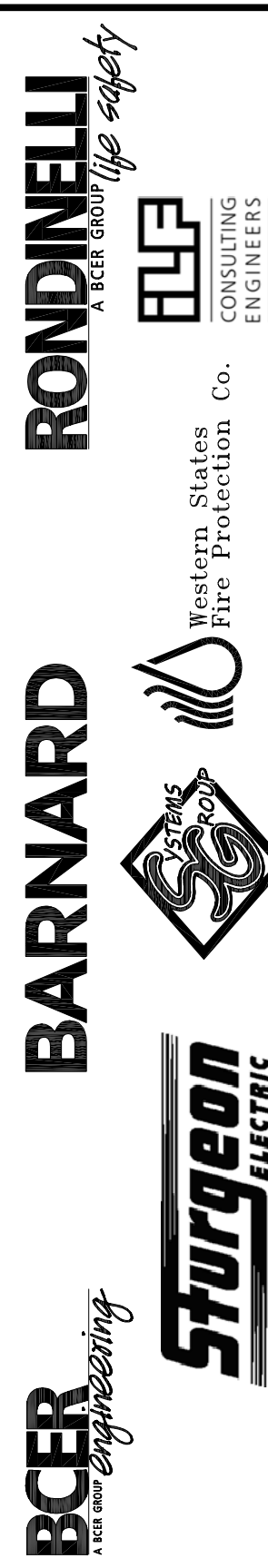
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N  
 1 PLAN VIEW  
 SCALE: NTS

**LEGEND:**  
 - - - - - EXISTING DRAINAGE  
 G GAS  
 E ELECTRIC  
 FO FIBER OPTIC

# BARNARD EJMT TEAM



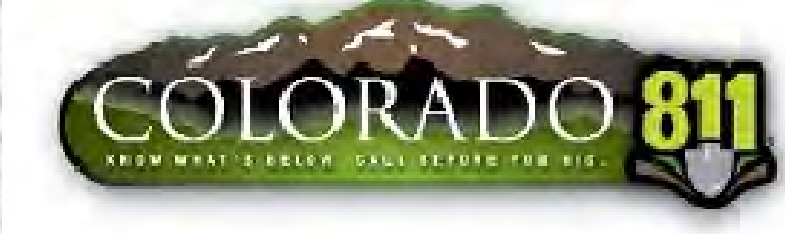
# EISENHOWER/JOHNSON MEMORIAL TUNNEL

FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

Revisions	Date	Description

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EAST PORTAL BUILDING EXISTING UTILITIES  
 Drawing Number  
**C1.1**



# BARNARD EJMT TEAM

**BCER** CONSULTING ENGINEERS  
**BARNARD**  
**RONDINELLI**  
**STURGEON ELECTRIC**  
 A TEAM GROWING SAFETY  
 Western States Fire Protection Co.

# EISENHOWER/JOHNSON MEMORIAL TUNNEL

FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

Revisions		Checked By: -
Num	Description	Date

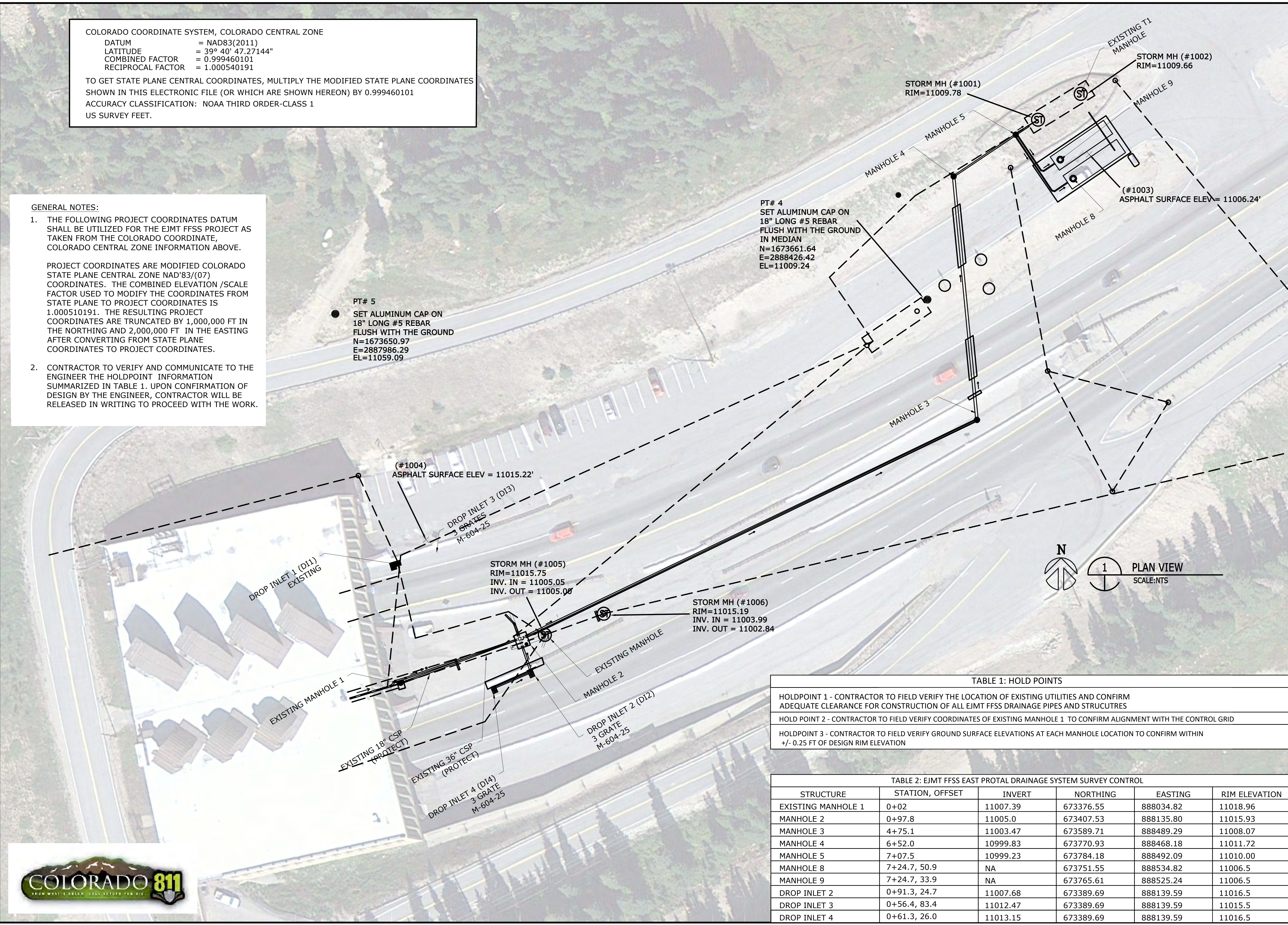
1.2 SURVEY POINTS  
 Drawing Number  
**C1.2**

COLORADO COORDINATE SYSTEM, COLORADO CENTRAL ZONE  
 DATUM = NAD83(2011)  
 LATITUDE = 39° 40' 47.27144"  
 COMBINED FACTOR = 0.999460101  
 RECIPROCAL FACTOR = 1.000540191  
 TO GET STATE PLANE CENTRAL COORDINATES, MULTIPLY THE MODIFIED STATE PLANE COORDINATES SHOWN IN THIS ELECTRONIC FILE (OR WHICH ARE SHOWN HEREON) BY 0.999460101  
 ACCURACY CLASSIFICATION: NOAA THIRD ORDER-CLASS 1 US SURVEY FEET.

### GENERAL NOTES:

- THE FOLLOWING PROJECT COORDINATES DATUM SHALL BE UTILIZED FOR THE EJMT FFSS PROJECT AS TAKEN FROM THE COLORADO COORDINATE, COLORADO CENTRAL ZONE INFORMATION ABOVE.  
 PROJECT COORDINATES ARE MODIFIED COLORADO STATE PLANE CENTRAL ZONE NAD'83/(07) COORDINATES. THE COMBINED ELEVATION /SCALE FACTOR USED TO MODIFY THE COORDINATES FROM STATE PLANE TO PROJECT COORDINATES IS 1.000510191. THE RESULTING PROJECT COORDINATES ARE TRUNCATED BY 1,000,000 FT IN THE NORTHING AND 2,000,000 FT IN THE EASTING AFTER CONVERTING FROM STATE PLANE COORDINATES TO PROJECT COORDINATES.
- CONTRACTOR TO VERIFY AND COMMUNICATE TO THE ENGINEER THE HOLDPOINT INFORMATION SUMMARIZED IN TABLE 1. UPON CONFIRMATION OF DESIGN BY THE ENGINEER, CONTRACTOR WILL BE RELEASED IN WRITING TO PROCEED WITH THE WORK.

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**TABLE 1: HOLD POINTS**

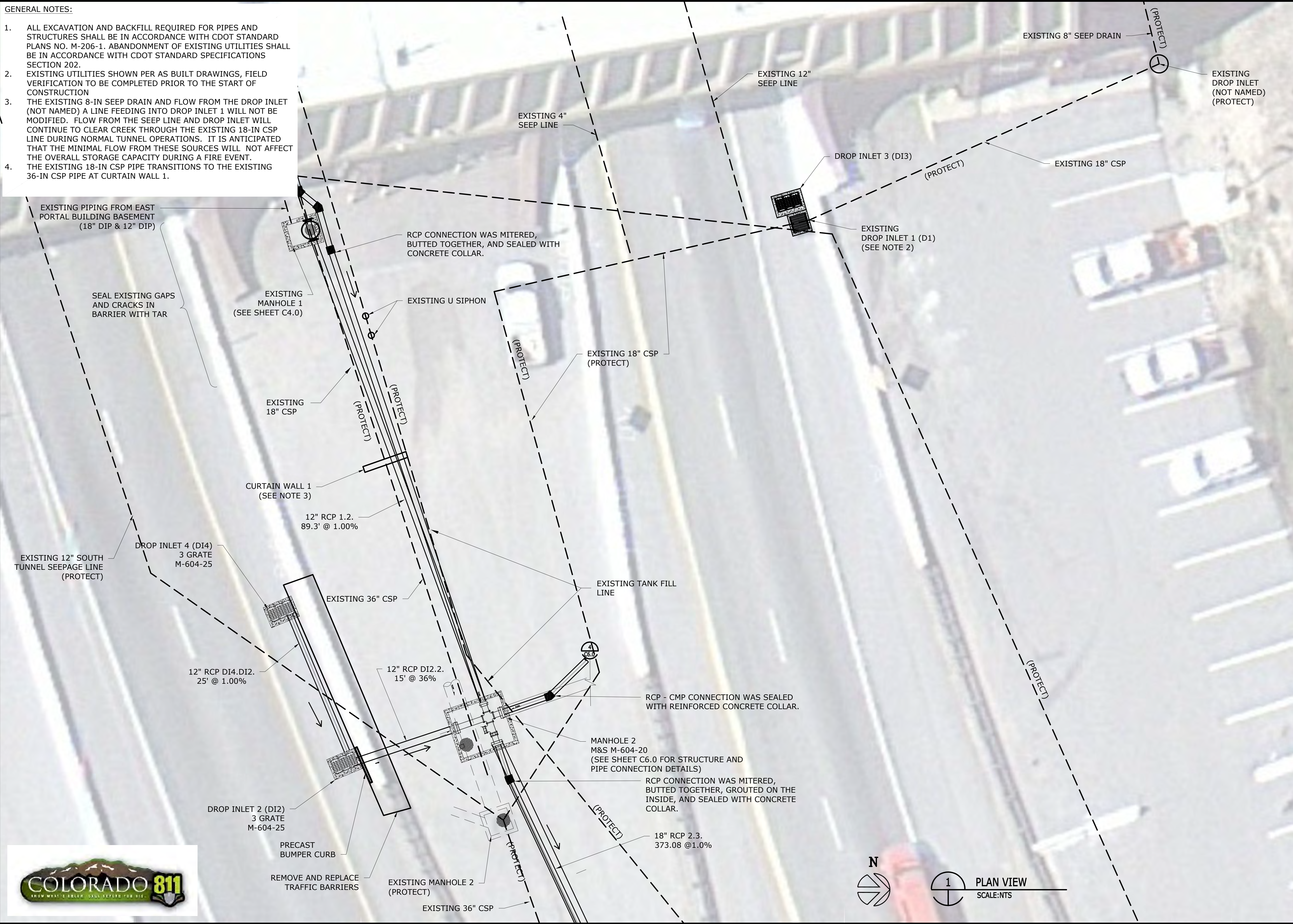
HOLDPOINT 1 - CONTRACTOR TO FIELD VERIFY THE LOCATION OF EXISTING UTILITIES AND CONFIRM ADEQUATE CLEARANCE FOR CONSTRUCTION OF ALL EJMT FFSS DRAINAGE PIPES AND STRUCTURES
HOLD POINT 2 - CONTRACTOR TO FIELD VERIFY COORDINATES OF EXISTING MANHOLE 1 TO CONFIRM ALIGNMENT WITH THE CONTROL GRID
HOLDPOINT 3 - CONTRACTOR TO FIELD VERIFY GROUND SURFACE ELEVATIONS AT EACH MANHOLE LOCATION TO CONFIRM WITHIN +/- 0.25 FT OF DESIGN RIM ELEVATION

**TABLE 2: EJMT FFSS EAST PROTAL DRAINAGE SYSTEM SURVEY CONTROL**

STRUCTURE	STATION, OFFSET	INVERT	NORTHING	EASTING	RIM ELEVATION
EXISTING MANHOLE 1	0+02	11007.39	673376.55	888034.82	11018.96
MANHOLE 2	0+97.8	11005.0	673407.53	888135.80	11015.93
MANHOLE 3	4+75.1	11003.47	673589.71	888489.29	11008.07
MANHOLE 4	6+52.0	10999.83	673770.93	888468.18	11011.72
MANHOLE 5	7+07.5	10999.23	673784.18	888492.09	11010.00
MANHOLE 8	7+24.7, 50.9	NA	673751.55	888534.82	11006.5
MANHOLE 9	7+24.7, 33.9	NA	673765.61	888525.24	11006.5
DROP INLET 2	0+91.3, 24.7	11007.68	673389.69	888139.59	11016.5
DROP INLET 3	0+56.4, 83.4	11012.47	673389.69	888139.59	11015.5
DROP INLET 4	0+61.3, 26.0	11013.15	673389.69	888139.59	11016.5

**GENERAL NOTES:**

1. ALL EXCAVATION AND BACKFILL REQUIRED FOR PIPES AND STRUCTURES SHALL BE IN ACCORDANCE WITH CDOT STANDARD PLANS NO. M-206-1. ABANDONMENT OF EXISTING UTILITIES SHALL BE IN ACCORDANCE WITH CDOT STANDARD SPECIFICATIONS SECTION 202.
2. EXISTING UTILITIES SHOWN PER AS BUILT DRAWINGS, FIELD VERIFICATION TO BE COMPLETED PRIOR TO THE START OF CONSTRUCTION
3. THE EXISTING 8-IN SEEP DRAIN AND FLOW FROM THE DROP INLET (NOT NAMED) A LINE FEEDING INTO DROP INLET 1 WILL NOT BE MODIFIED. FLOW FROM THE SEEP LINE AND DROP INLET WILL CONTINUE TO CLEAR CREEK THROUGH THE EXISTING 18-IN CSP LINE DURING NORMAL TUNNEL OPERATIONS. IT IS ANTICIPATED THAT THE MINIMAL FLOW FROM THESE SOURCES WILL NOT AFFECT THE OVERALL STORAGE CAPACITY DURING A FIRE EVENT.
4. THE EXISTING 18-IN CSP PIPE TRANSITIONS TO THE EXISTING 36-IN CSP PIPE AT CURTAIN WALL 1.



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**BARNARD EJM TEAM**

**BARNARD** **RONDINELLI**

**BCER** **Sturgeon Electric** **Western States Fire Protection Co.** **ALF CONSULTING ENGINEERS**

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

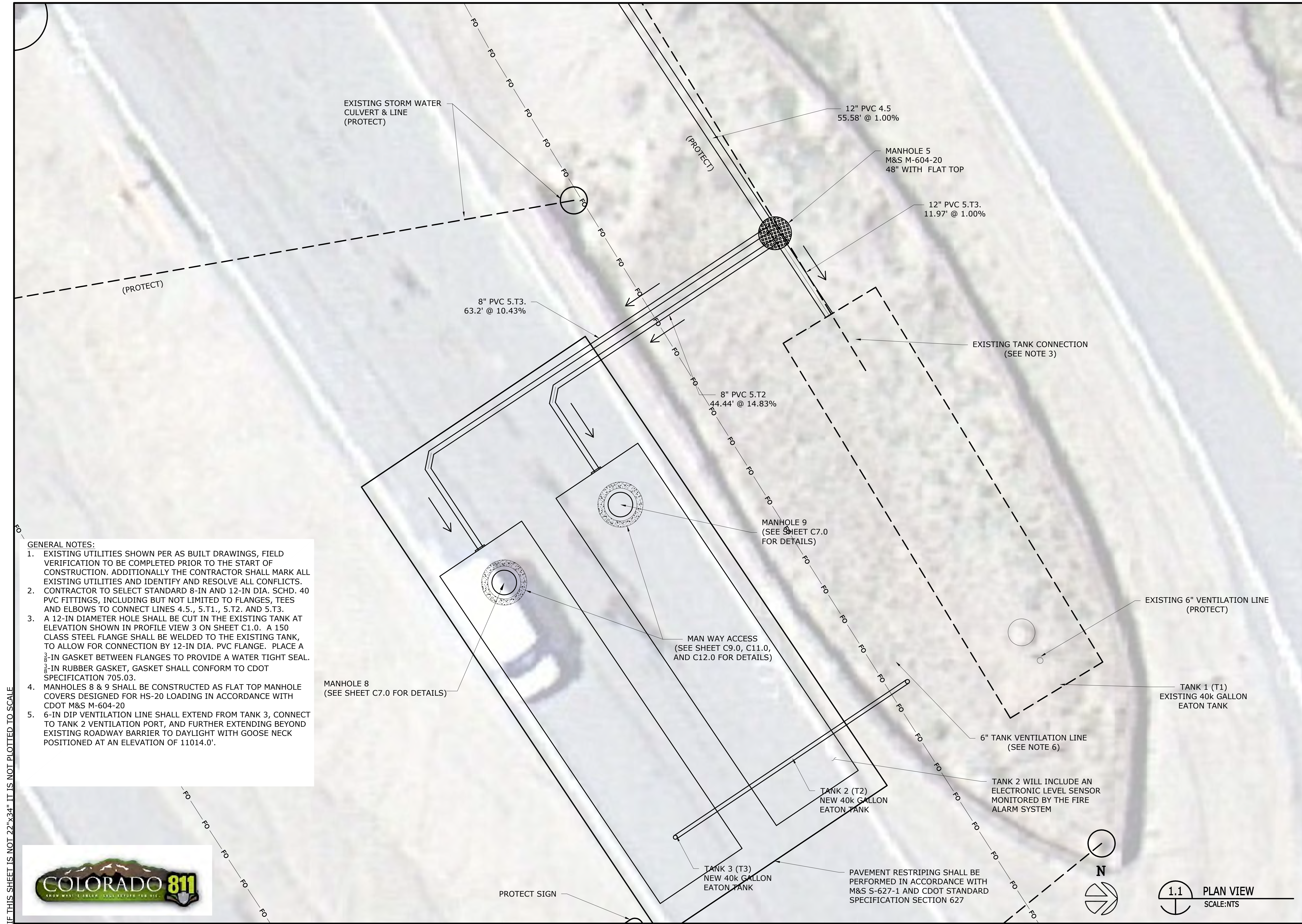
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Revisions	Date
Num	Description

DRAWN BY: JBC CHECKED BY: JM

EAST PORTAL BUILDING  
FFSS DRAINAGE PLAN

Drawing Number  
**C2.0**



- GENERAL NOTES:**
- EXISTING UTILITIES SHOWN PER AS BUILT DRAWINGS, FIELD VERIFICATION TO BE COMPLETED PRIOR TO THE START OF CONSTRUCTION. ADDITIONALLY THE CONTRACTOR SHALL MARK ALL EXISTING UTILITIES AND IDENTIFY AND RESOLVE ALL CONFLICTS.
  - CONTRACTOR TO SELECT STANDARD 8-IN AND 12-IN DIA. SCHD. 40 PVC FITTINGS, INCLUDING BUT NOT LIMITED TO FLANGES, TEES AND ELBOWS TO CONNECT LINES 4.5., 5.T1., 5.T2. AND 5.T3.
  - A 12-IN DIAMETER HOLE SHALL BE CUT IN THE EXISTING TANK AT ELEVATION SHOWN IN PROFILE VIEW 3 ON SHEET C1.0. A 150 CLASS STEEL FLANGE SHALL BE WELDED TO THE EXISTING TANK, TO ALLOW FOR CONNECTION BY 12-IN DIA. PVC FLANGE. PLACE A  $\frac{3}{8}$ -IN GASKET BETWEEN FLANGES TO PROVIDE A WATER TIGHT SEAL.  $\frac{3}{8}$ -IN RUBBER GASKET, GASKET SHALL CONFORM TO CDOT SPECIFICATION 705.03.
  - MANHOLES 8 & 9 SHALL BE CONSTRUCTED AS FLAT TOP MANHOLE COVERS DESIGNED FOR HS-20 LOADING IN ACCORDANCE WITH CDOT M&S M-604-20
  - 6-IN DIP VENTILATION LINE SHALL EXTEND FROM TANK 3, CONNECT TO TANK 2 VENTILATION PORT, AND FURTHER EXTENDING BEYOND EXISTING ROADWAY BARRIER TO DAYLIGHT WITH GOOSE NECK POSITIONED AT AN ELEVATION OF 11014.0'.

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**BARNARD EJMT TEAM**

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Western States Fire Protection Co.

**Sturgeon Electric**

BCER  
BARNARD EJMT TEAM

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360    Subaccount 17810

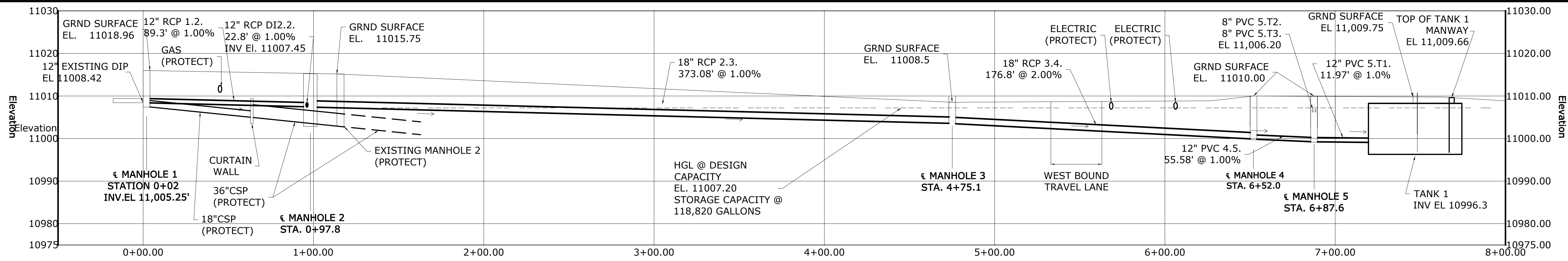
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Revisions	Date

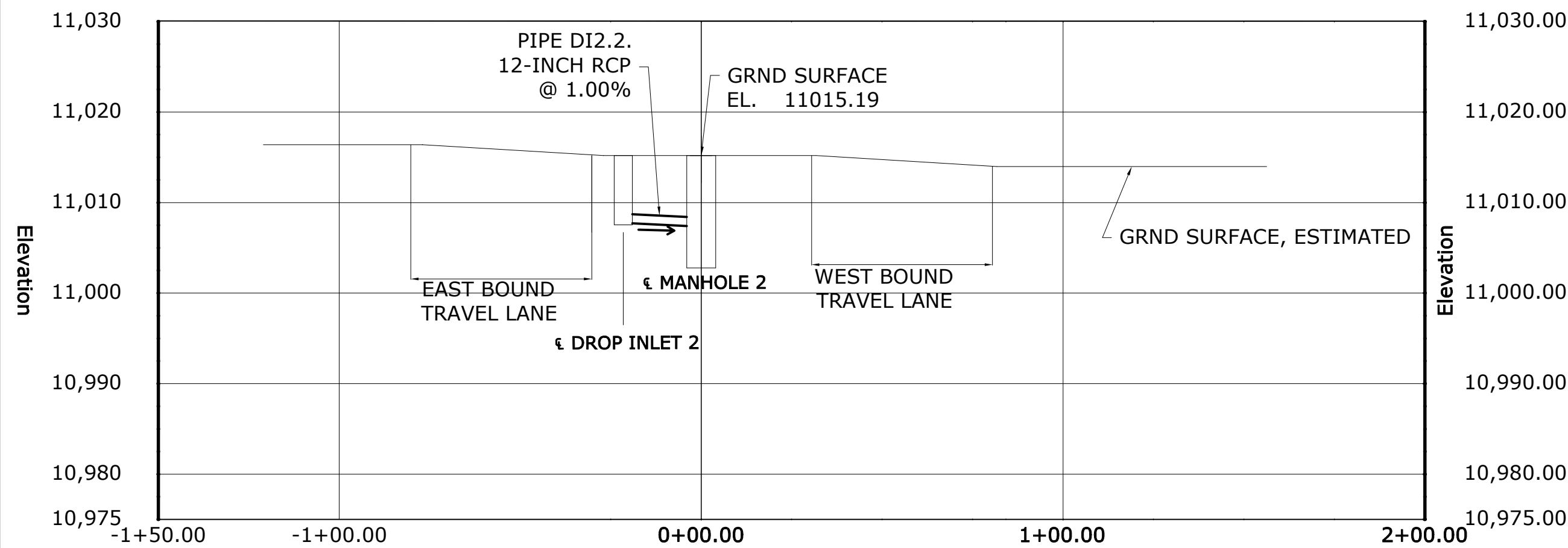
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EAST PORTAL BUILDING  
FFSS DRAINAGE PLAN

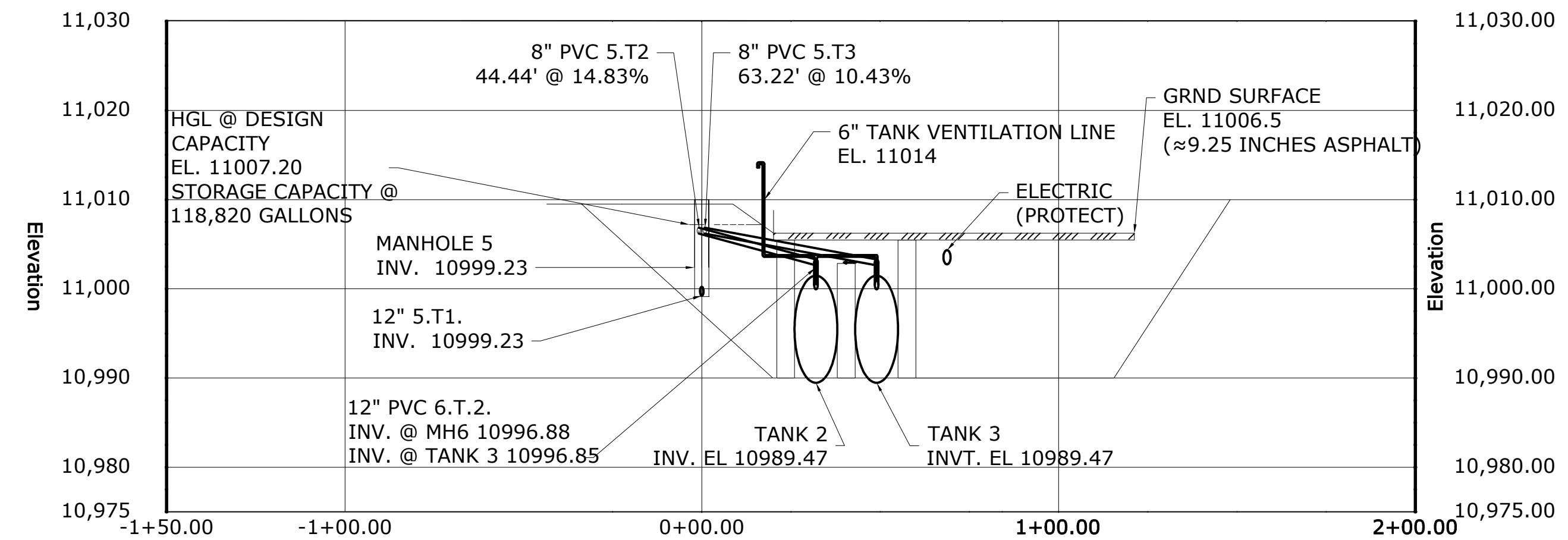
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**C3.0**



**1** PROFILE 1: FFSS DRAINAGE ALIGNMENT FROM MANHOLE 1 TO TANK 1  
SCALE:NTS



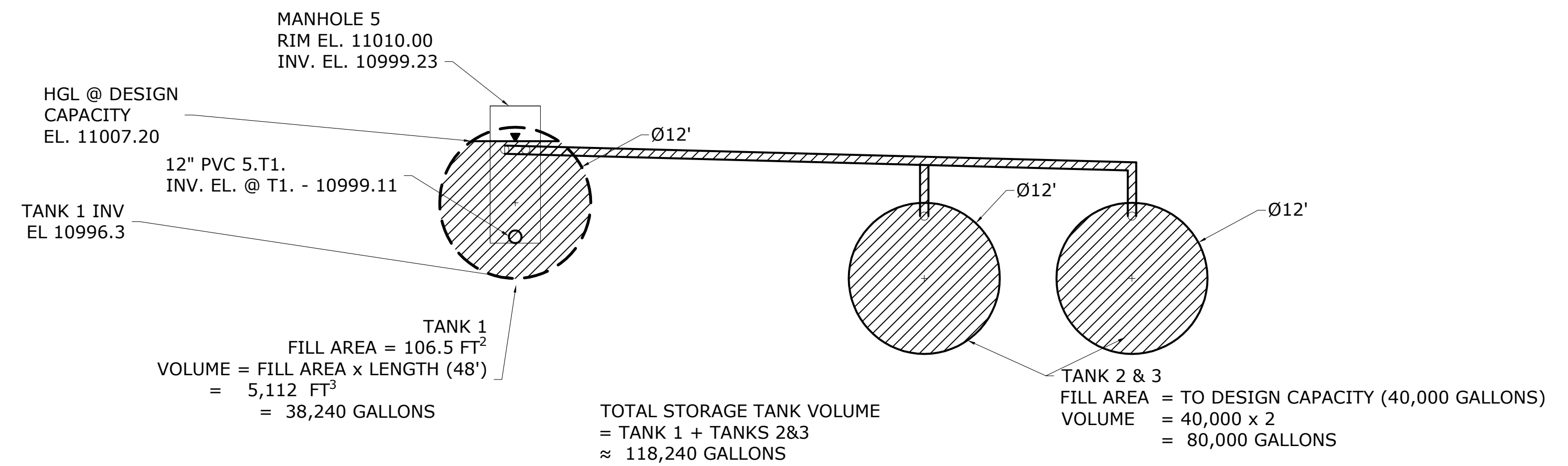
**2** PROFILE 2: FFSS PIPE D2.2 ALIGNMENT  
SCALE:NTS



**3** PROFILE 3: FFSS DRAINAGE MANHOLE 5 TO DISCHARGE STORAGE TANKS  
SCALE:NTS

**GENERAL NOTES:**

- GROUND SURFACE ELEVATIONS ARE ASSUMED BASED ON THE PROVIDED AS BUILT DRAWINGS AND SURVEY ELEVATION POINTS TAKEN. ALL ELEVATIONS INCLUDING; GROUND SURFACE, PIPE INVERTS, AND STRUCTURE RIM AND INVERTS, SHALL BE FIELD VERIFIED PRIOR TO START OF CONSTRUCTION.
- DISCHARGE STORAGE TANKS SHOWN ARE MANUFACTURED BY EATON METAL PRODUCTS, SEE SHEETS C9.0 - C12.0 FOR DETAILED DRAWINGS OF NEW EATON METAL STORAGE TANK.
- DETAILS REGARDING ELECTRONIC TANK LEVEL EQUIPMENT ARE PROVIDED ON FA SHEETS.
- ALL NEW MANHOLES TO BE CONSTRUCTED SHALL CONFORM TO CDOT STANDARD PLAN NO. M-604-20.
- THE DESIGN FLOW RATE FOR ALL PIPES IS 4.076 CFS WITH THE EXCEPTION OF 5.T2. AND 5.T3. WHICH ASSUMES EACH 8 INCH PIPE WILL CARRY HALF THE DESIGN FLOW AT 2.038 CFS. THE STATED FLOW RATES CORRELATE TO THE MOST DEMANDING FFSS TWO ZONES ACTIVATED AND THE EXISTING STANDPIPE SYSTEM.



**4** VOLUME CALCULATIONS  
SCALE:NTS

**BARNARD EJM T TEAM**  
**BARNARD RONDINELLI**  
**BCER**  
**Sturgeon Electric**  
**Western States Fire Protection Co.**  
**RFP**  
**ENGINEERS**

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
**FIXED FIRE SUPPRESSION SYSTEM**  
**DESIGN BUILD PROJECT**  
 Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

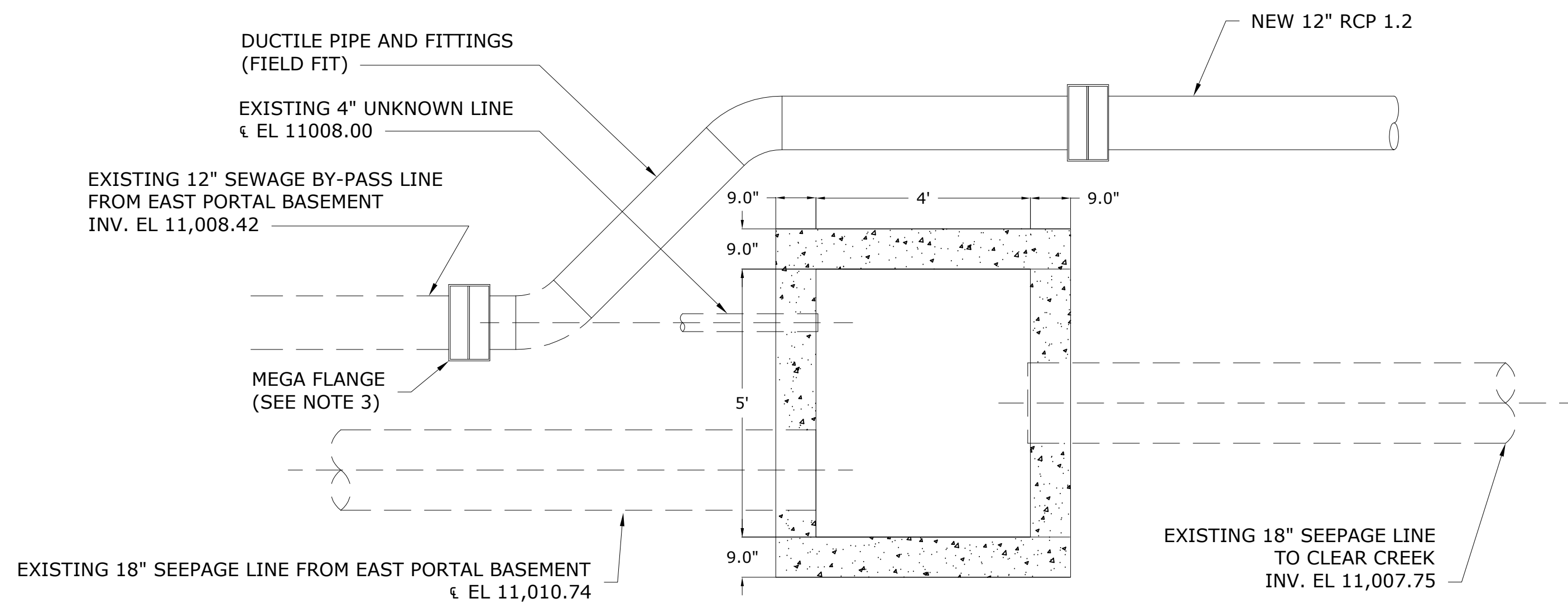
Revisions	Date

EAST PORTAL BUILDING  
 FFSS DRAINAGE PROFILE  
 Drawing Number  
**C4.0**



IF THIS SHEET IS NOT 22" X 34" IT IS NOT PLOTTED TO SCALE

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



**1** EXISTING MANHOLE 1 PLAN VIEW  
SCALE: 1/2" = 1'-0"

**GENERAL NOTES:**

1. ALL ELEVATIONS PROVIDED SHALL BE FIELD VERIFIED PRIOR TO START OF CONSTRUCTION.
2. CARE SHALL BE TAKEN TO LIMIT DAMAGE TO EXISTING PIPES AND STRUCTURES.
3. 150 CLASS FLANGE SHALL BE USED FOR CONNECTION OF 12-IN PIPE.
4. A PIPE JOINT SEALING COMPOUND SHALL BE USED IN ACCORDANCE WITH CDOT STANDARD SPECIFICATION 705.04 FOR ALL APPLICABLE PIPE JOINTS.
5. ALL EXCAVATIONS AND BACKFILL SHALL BE IN ACCORDANCE WITH CDOT STANDARD PLANS M-206-1.
6. THE CONTRACTOR SHALL VERIFY THE EXISTING ROADWAY MATERIAL PRIOR TO THE START OF CONSTRUCTION. MILL AND OVERLAY OF EXISTING ASPHALT WILL BE PROVIDED ADJACENT TO DRAINAGE PIPE IN ROADWAY.

**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

**BARNARD EJM T TEAM**  
BCER CONSULTING ENGINEERS  
**BARNARD**  
**RONDINELLI**  
A BEER GROUP LIFE SAFETY  
WESTERN STATES FIRE PROTECTION CO.  
WESTERN STATES FIRE PROTECTION CO.  
STURGEON ELECTRIC

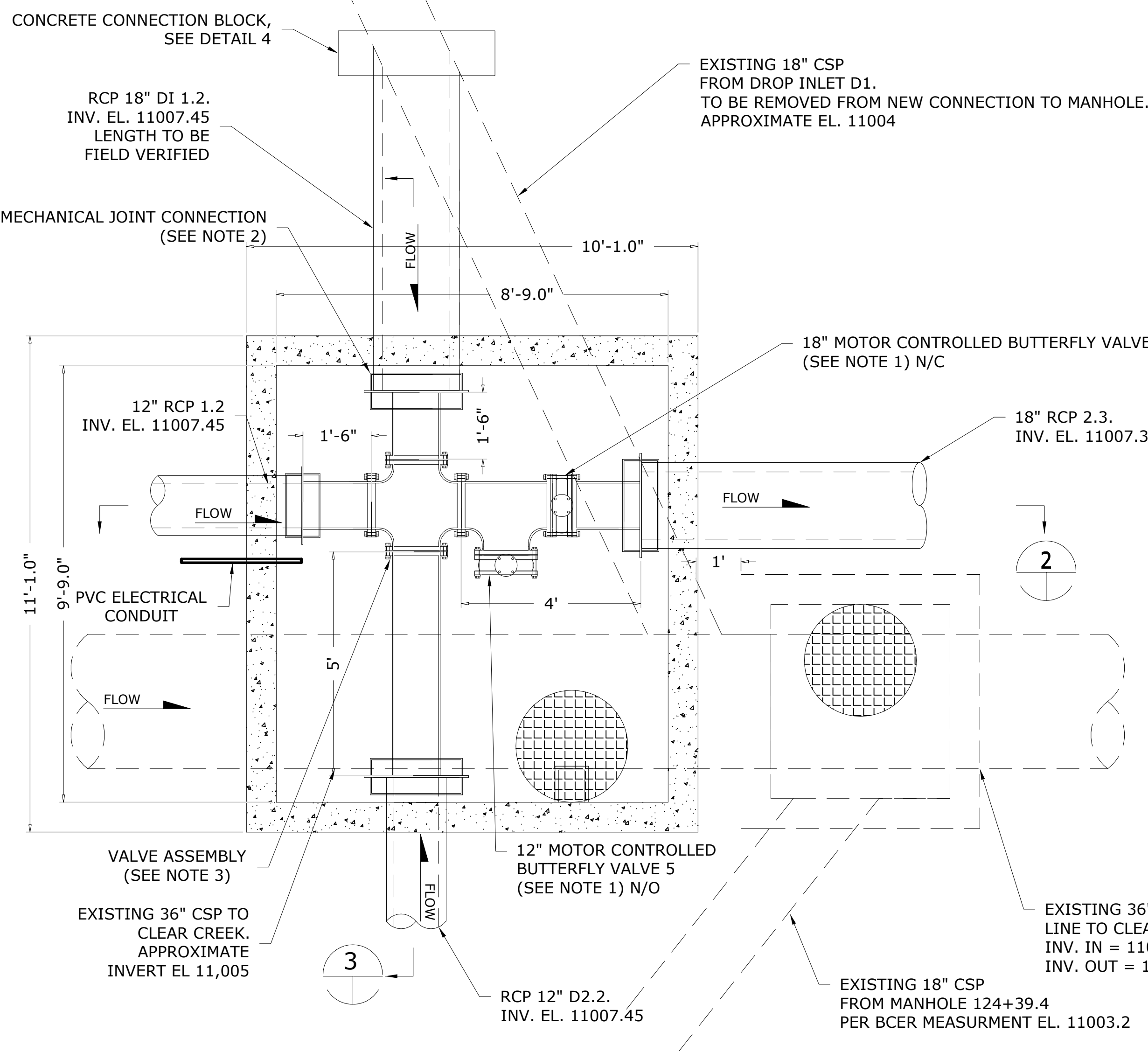
Revisions	Date
Num	Description

DRAWN BY: JBC CHECKED BY: JM

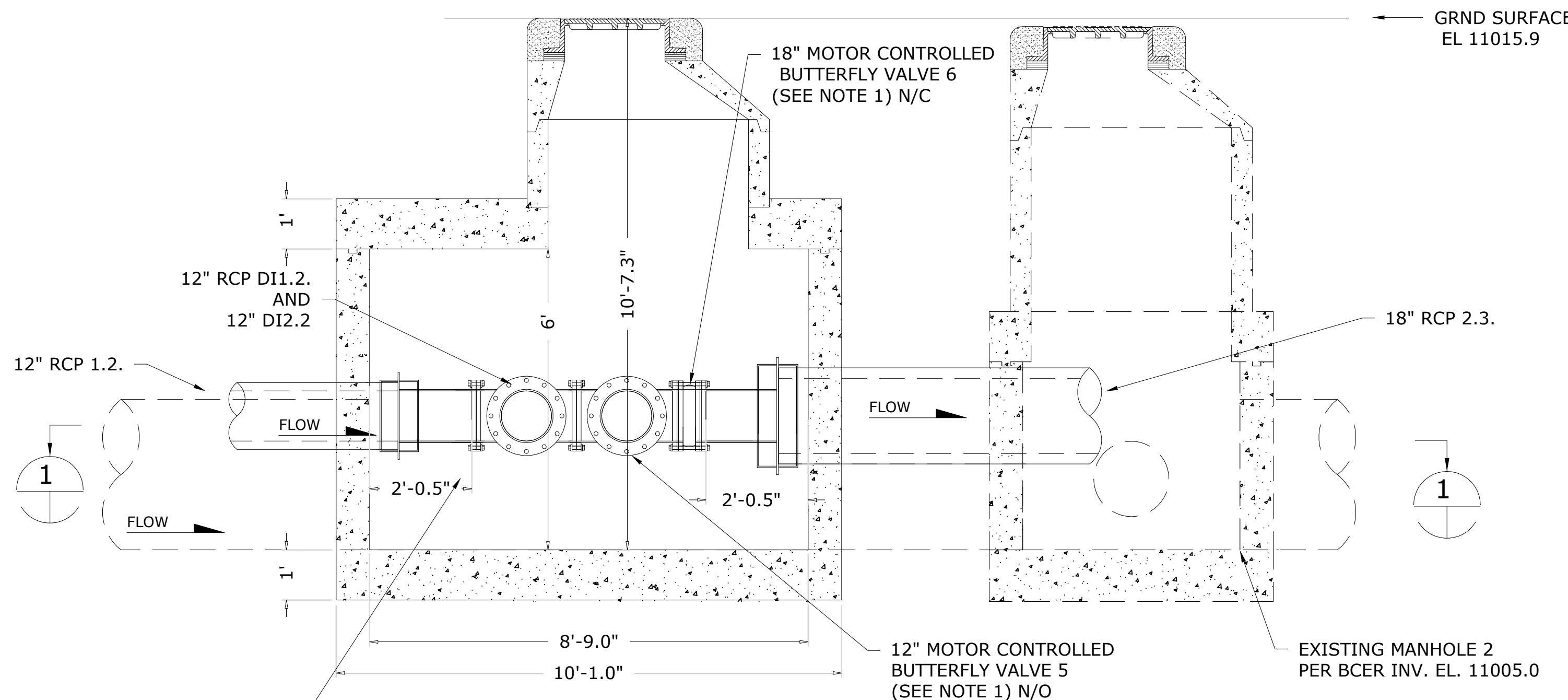
EXISTING MANHOLE 1  
Drawing Number  
**C5.0**



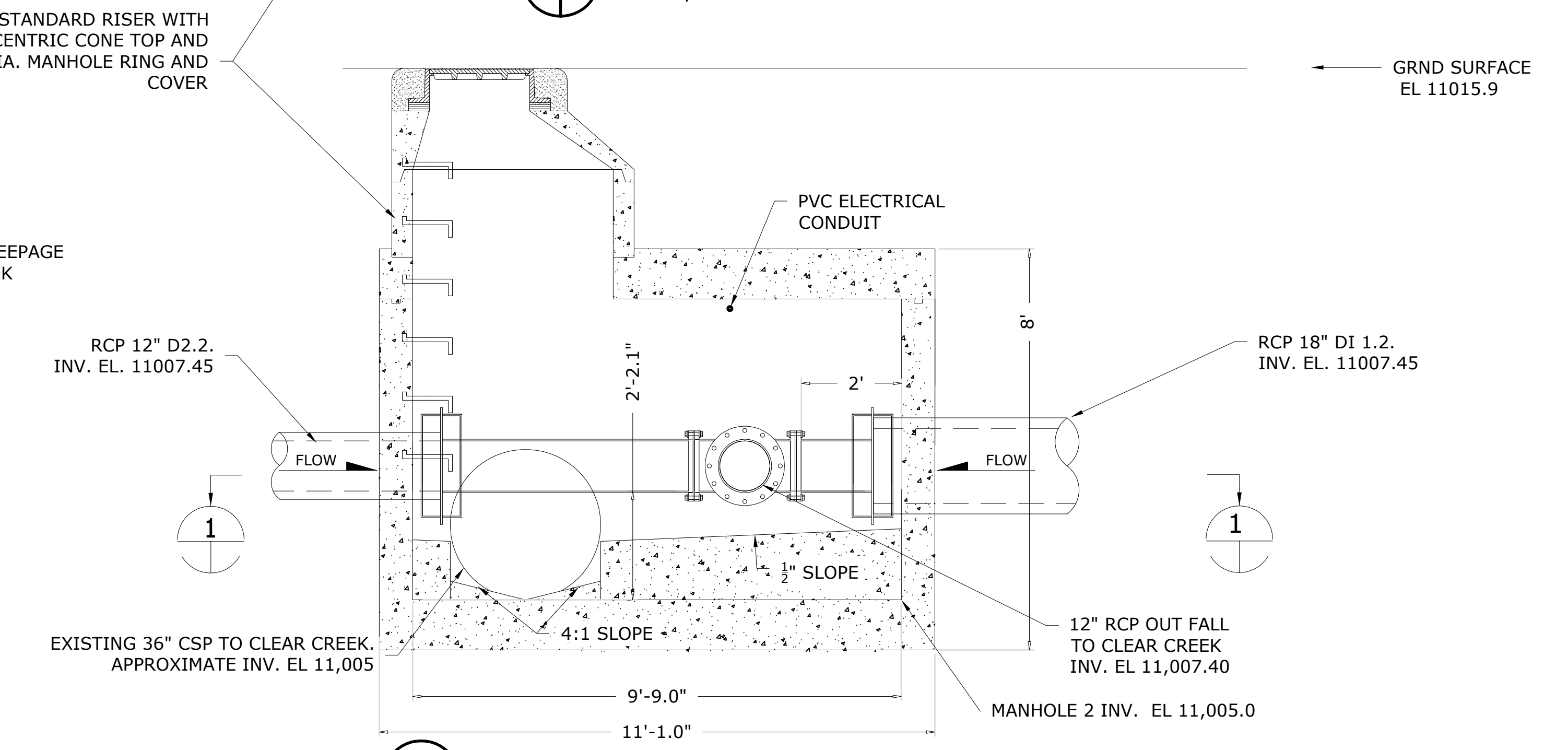
IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



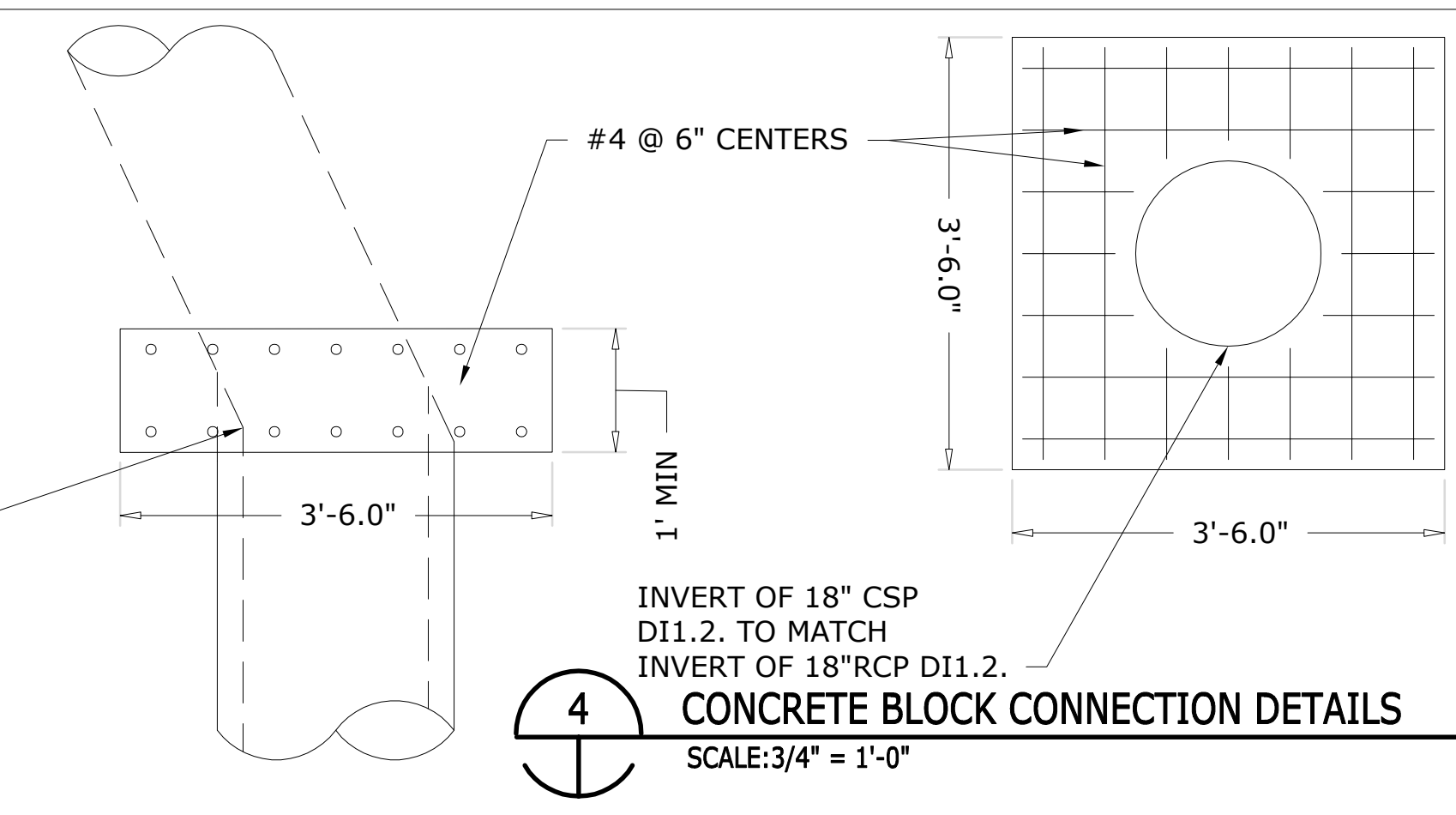
**1 PLAN VIEW MANHOLE 2**  
SCALE: 1/2" = 1'-0"



**2 MANHOLE 2 SECTION**  
SCALE: 1/2" = 1'-0"



**3 MANHOLE 2 SECTION**  
SCALE: 1/2" = 1'-0"



**4 CONCRETE BLOCK CONNECTION DETAILS**  
SCALE: 3/4" = 1'-0"

**GENERAL NOTES:**

- MOTOR CONTROLLED ELECTRONIC BUTTERFLY VALVES (SEE SHEET M6.4 FOR VALVE SPECIFICATIONS)
- A MECHANICAL JOINT CONNECTION SIMILAR TO ROMAC FC4000 FLANGED SHALL BE USED BETWEEN CONNECTION OF ALL RCP PIPES TO STEEL PIPES INSIDE OF THE MANHOLE BOX. THE MECHANICAL JOINT SHALL BE CONSTRUCTED SUCH THAT THE PIPE INVERTS ARE MATCHING. THE REINFORCED CONCRETE PIPES SHALL BE PASS THROUGH THE MANHOLE WALL AND BE HAND PACKED WITH GROUT AT THE MANHOLE WALL.
- THE VALVE ASSEMBLY SHALL BE FITTED TOGETHER UTILIZING 150 CLASS DIP CONNECTIONS AND VALVES. THE VALVE ASSEMBLY IS DISCUSSED AS ALL PIPE, FITTINGS AND VALVES CONNECTED WITHIN MANHOLE 2.
- ALL ELEVATIONS PROVIDED SHALL BE FIELD VERIFIED PRIOR TO START OF CONSTRUCTION.
- THE MANHOLE SHALL BE CONSTRUCTED IN ACCORDANCE WITH CDOT M&S M-604-20, INCLUDING BUT NOT LIMITED TO REINFORCEMENT, STEPS COVER AND FLOW CHANNEL. REINFORCEMENT SHALL CONSIST OF DEFORMED BARS ONLY PER ASTM A615.
- RCP SHALL BE CLASS II IN ACCORDANCE WITH CDOT STANDARD PLANS SHEET M-603-2 AND CDOT STANDARD SPECIFICATIONS SECTION 706.
- CARE SHALL BE TAKEN TO LIMIT DAMAGE TO EXISTING PIPES.
- A PIPE JOINT SEALING COMPOUND SHALL BE USED IN ACCORDANCE WITH CDOT STANDARD SPECIFICATION 705.04 FOR ALL APPLICABLE PIPE JOINTS. RCP PIPE PROTRUSIONS THROUGH STRUCTURE WALL SHALL BE HAND PACKED WITH GROUT TO PROVIDE WATER TIGHT SEAL THROUGH STRUCTURE WALL.
- THE PRECAST MANHOLE SUPPLIER SELECTED BY THE CONTRACTOR SHALL PROVIDE STAMPED STRUCTURAL REINFORCEMENT DRAWINGS AND CALCULATIONS FOR MANHOLE 2, PRIOR TO THE START OF MANHOLE 2 EXCAVATION AND PLACEMENT. CALCULATIONS SHALL SHOW THAT THE STRUCTURE IS DESIGNED FOR HS-20 LOADING.
- THE 36-IN CSP PIPE SHALL BE OPEN WITHIN THE NEW MANHOLE 2. A FLOW CHANNEL SHALL BE CONSTRUCTED IN ACCORDANCE WITH M&S M-604-20.

VALVE DURATION TABLE

INFLOW	OPERATION	V5 12" VALVE	V6 12" VALVE	OUTFLOW
RCP 1.2, RCP D1.2, RCP D2.2	NORMAL TUNNEL OPERATION	OPEN	CLOSED	36" CSP TO CLEAR CREEK
RCP 1.2, RCP D1.2, RCP D2.2	FFSS EVENT	CLOSED	OPEN	RCP 2.3. TO TANKS



**BARNARD EJMT TEAM**

**BARNARD** **RONDINELLI**

**BCER** **Sturgeon Electric**

Western States Fire Protection Co.

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

Num	Revisions	Date
	Description	

MANHOLE 2

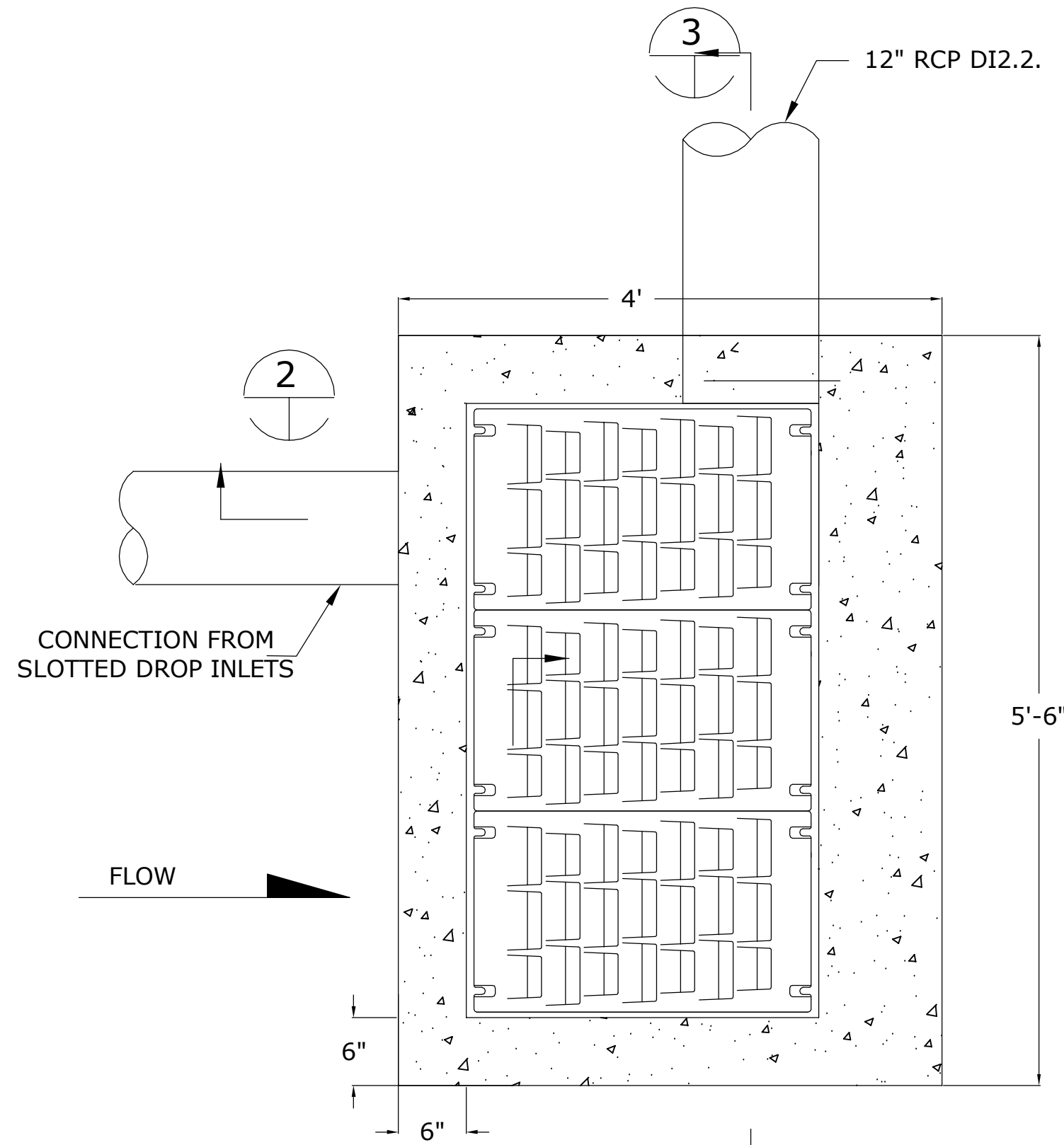
Drawing Number **C6.0**

DRAWN BY: JBC CHECKED BY: JM

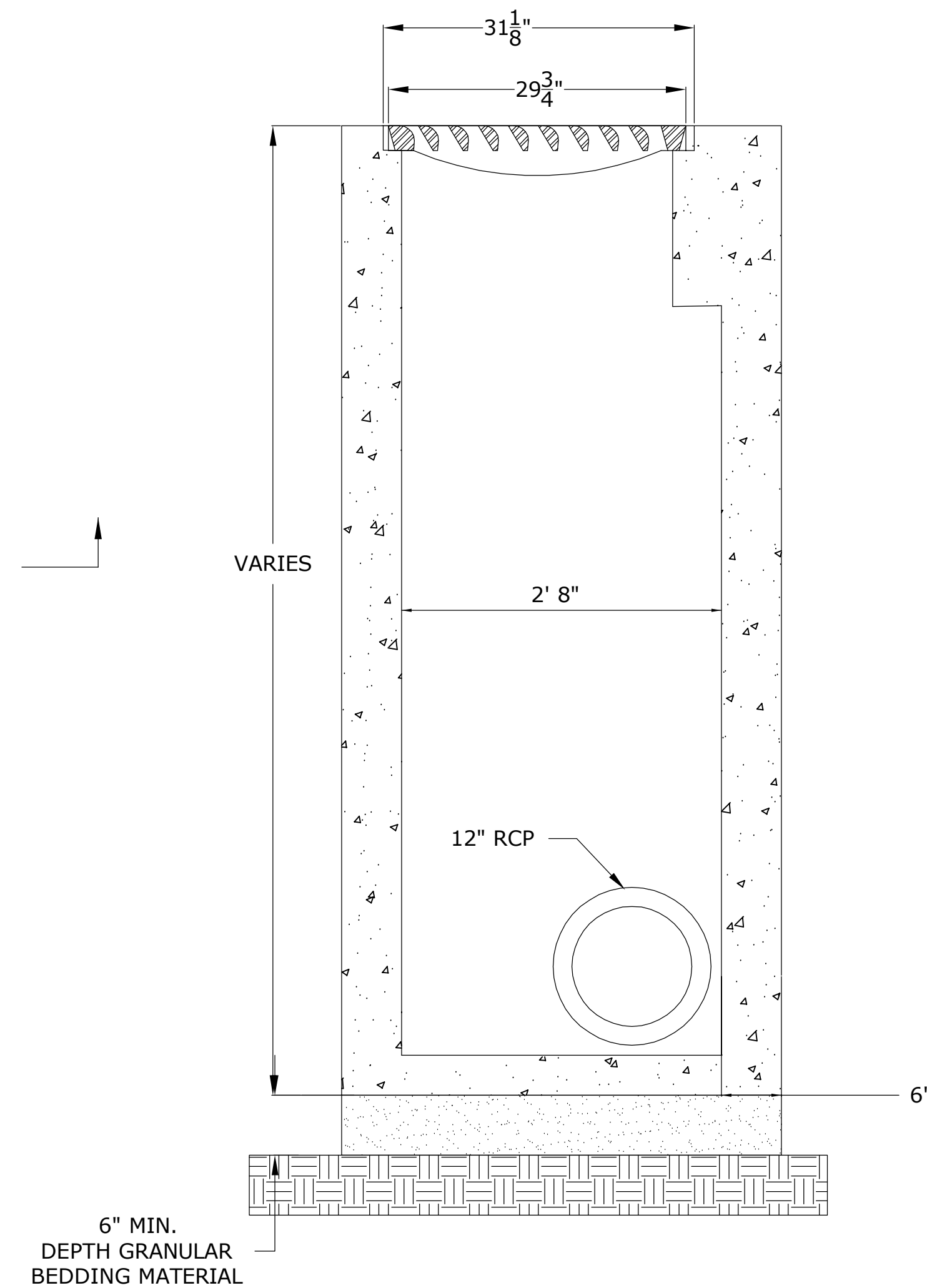


GENERAL NOTES:

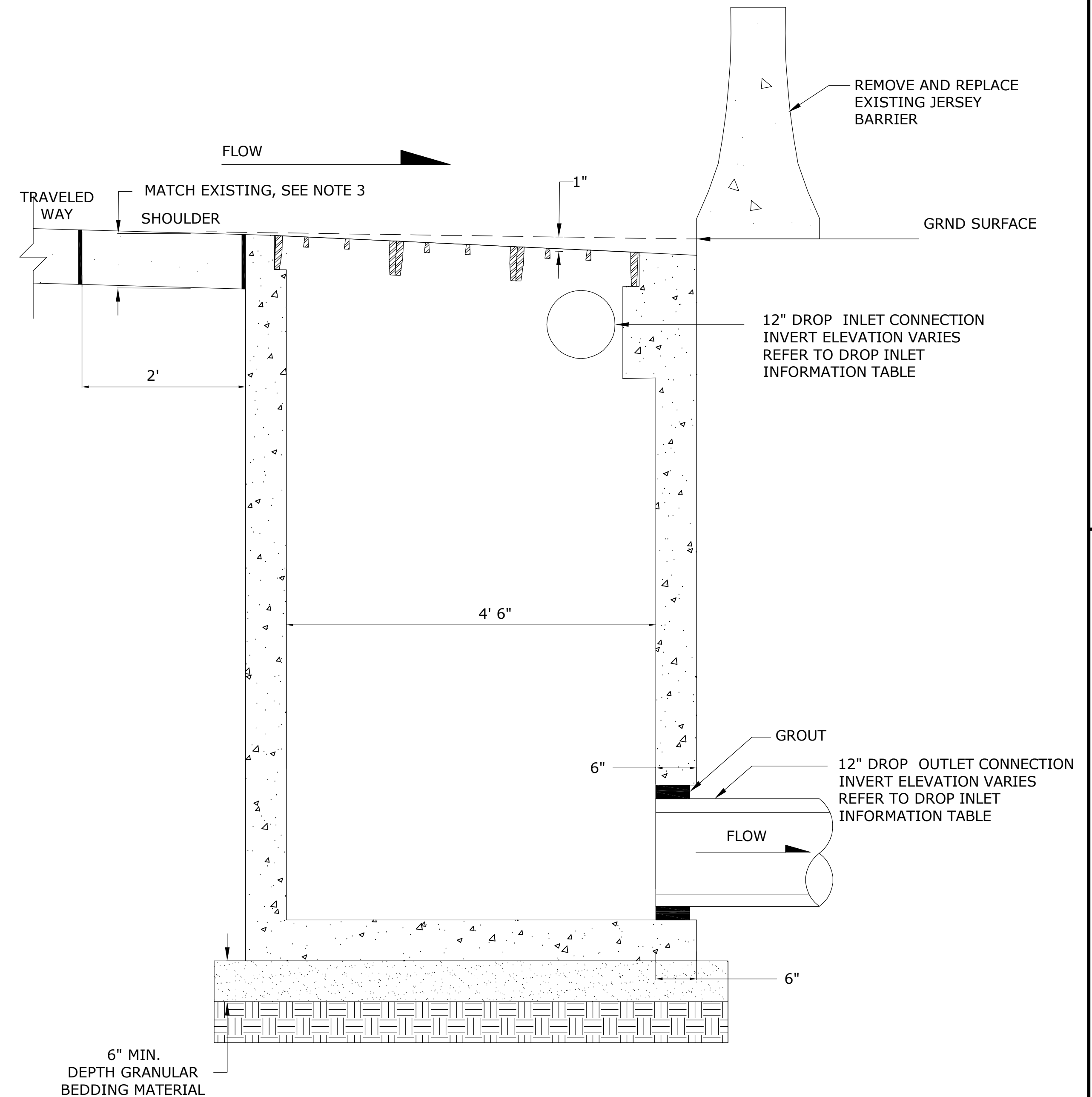
- DROP INLET STRUCTURES SHALL CONFORM TO CDOT STANDARD PLANS M-604-25, VANE GRATE INLET INCLUDING BUT NOT LIMITED TO REINFORCING.
- PRECAST DROP INLET SHALL BE BEDDED ON AN APPROVED GRANULAR BEDDING MATERIAL AS SPECIFIED IN CDOT STANDARD SPECIFICATION SECTION 603.05.
- IT IS ASSUMED THAT THE SHOULDER OF THE TRAVEL LANES IS 9 FT. CONTRACTOR WILL CONFIRM SHOULDER WIDTH WITH SURVEY PRIOR TO START OF CONSTRUCTION. CURRENT LANE IMPACT WITH 5.5 FT WIDE DROP INLET BOX AND 2 FT WIDE APPROACH CHANNEL WILL NOT IMPACT LANE CONFIGURATION.
- CONTRACTOR TO CONFIRM SURFACE ELEVATION AND PROVIDE DROP INLET BOX WITH APPROPRIATE DEPTH SUCH THAT INVERT ELEVATIONS SHOWN IN THE DROP INLET INFORMATION TABLE AND THE SURFACE CAN BE LEVELED AS SHOWN IN THE DRAWINGS AND DISCUSSED IN NOTE 5 BELOW.
- THE CONCRETE AND/OR ASPHALT TO BE PLACED AT THE SURFACE OF THE DROP INLET BOX SHALL BE PLACED TO MATCH THE EXISTING CROSS-SLOPE GUTTER AND A MINIMUM GUTTER WIDTH OF 9.0FT. THE LONGITUDINAL SLOPE OF THE ROAD IS ASSUMED TO BE 0.016 (FT/FT) FOR THE EAST BOUND LANE OF TRAVEL WITH A CROSS-SLOPE OF PAVEMENT ASSUMED AT 0.04 (FT/FT) AND 0.009 (FT/FT) FOR THE WEST BOUND LANE OF TRAVEL WITH A CROSS-SLOPE OF PAVEMENT ASSUMED AT 0.05 (FT/FT).
- A PIPE JOINT SEALING COMPOUND SHALL BE USED IN ACCORDANCE WITH CDOT STANDARD SPECIFICATION 705.04 FOR ALL APPLICABLE PIPE JOINTS. RCP PIPE PROTRUSIONS THROUGH STRUCTURE WALL SHALL BE HAND PACKED WITH GROUT TO PROVIDE WATER TIGHT SEAL THROUGH STRUCTURE WALL.



1 PLAN VIEW DROP INLET TYPICAL  
SCALE: 1/2" = 1'-0"



2 SECTION VIEW TYPICAL DROP INLET  
SCALE: 1/2" = 1'-0"



3 SECTION VIEW TYPICAL DROP INLET  
SCALE: 1/2" = 1'-0"

STRUCTURE	TYPE / SIZE	STATION	OFFSET	RIM ELEVATION	INLET DETAILS			Angle deg	OUTLET DETAILS		
					PIPE	STATION	INVERT		PIPE	STATION	INVERT
DROP INLET 1	EXISTING 40" X 40"	0+32.0	86.0	11015.5	D13.D11.	0+29.4	11012.22	0	EXISTING	NA	NA
DROP INLET 2	SEE SHEET 8.1 FOR DROP INLET 3 INFORMATION										
DROP INLET 3	VANE GRATE INLET (3 GRATE)	0+56.4	83.4	11015.5	NA	NA	NA	0	D13.D11.	0+54.3, 82.0	11012.47
DROP INLET 4	VANE GRATE INLET (3 GRATE)	0+61.3	26.0	11016.5	NA	NA	NA	0	D14.D12.	0+63.4, 27.4	11013.15

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**BARNARD EJMT TEAM**

**BARNARD**  
BCER CONSULTING ENGINEERS

**RONDINELLI**  
A REFERRAL LIFE SAFETY

**Sturgeon ELECTRIC**

Western States Fire Protection Co.

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

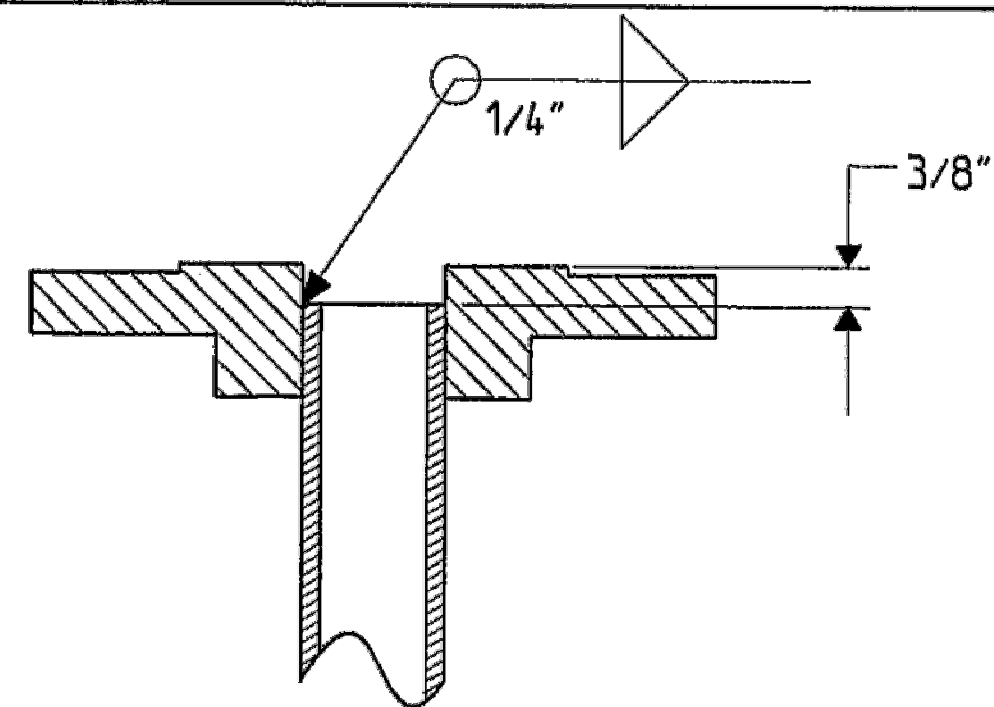
Revisions	Date
Num	Description

DRAWN BY: JBC  
CHECKED BY: JMC  
DROP INLET DETAILS  
Drawing Number  
**C8.0**

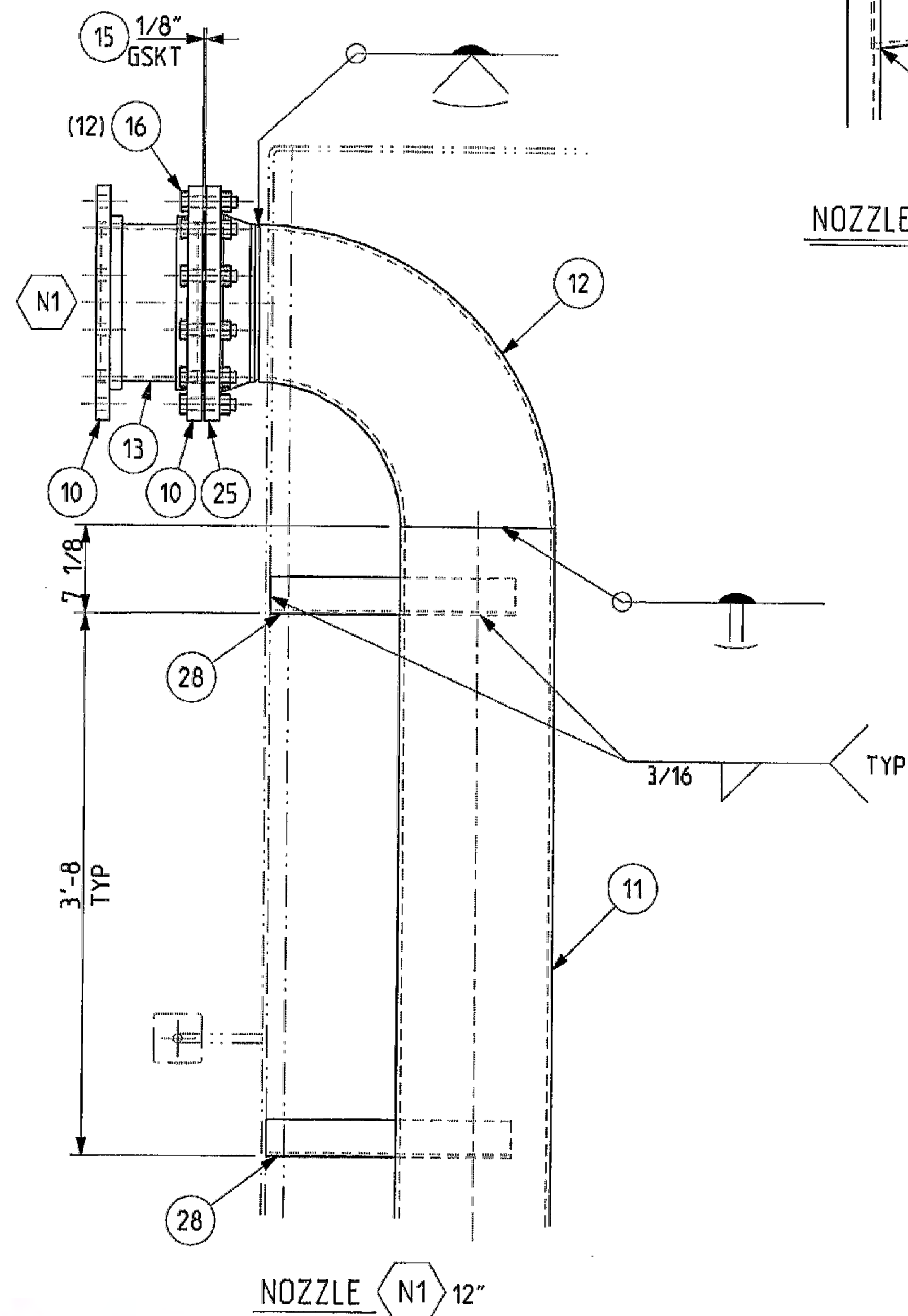




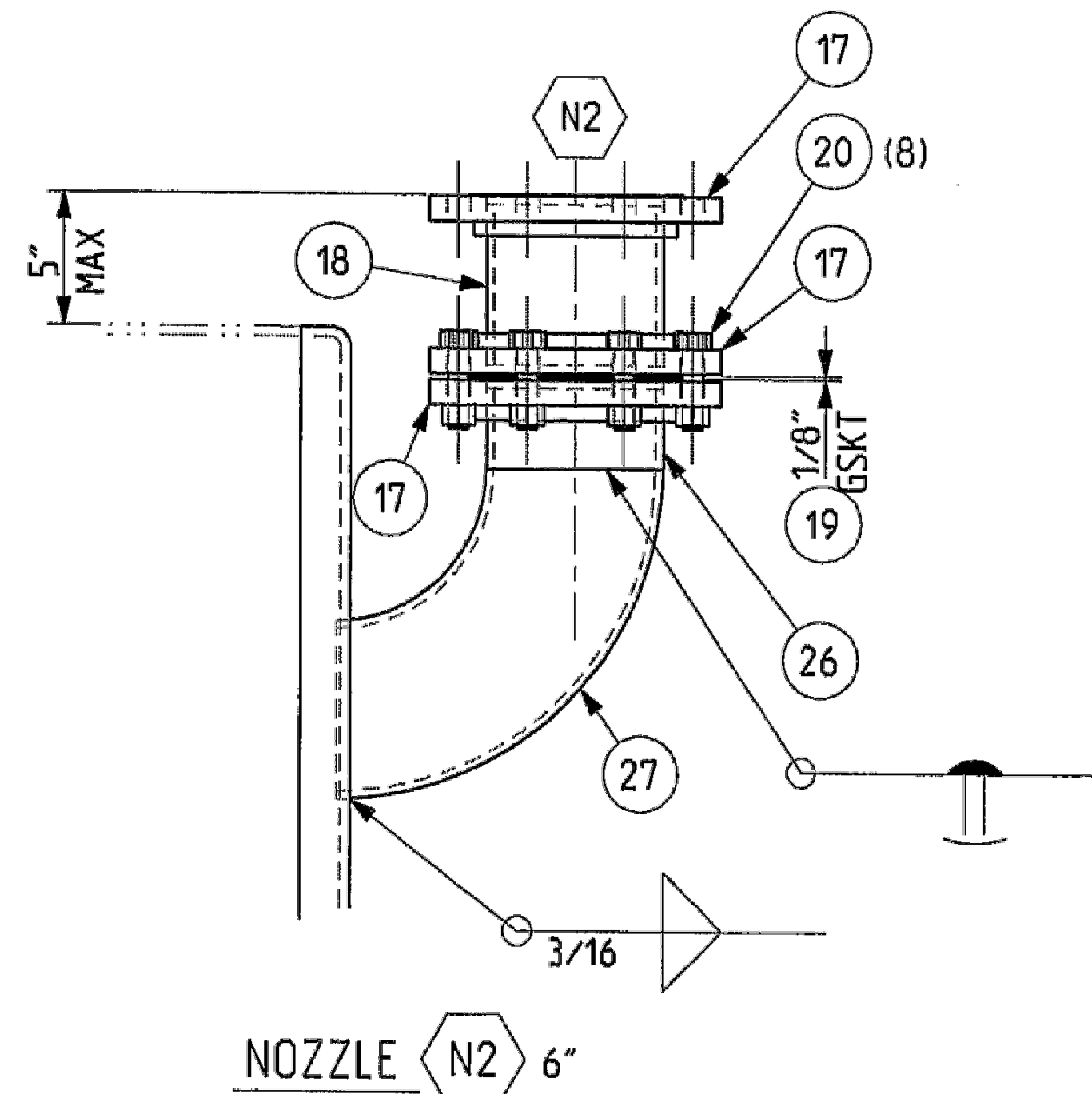
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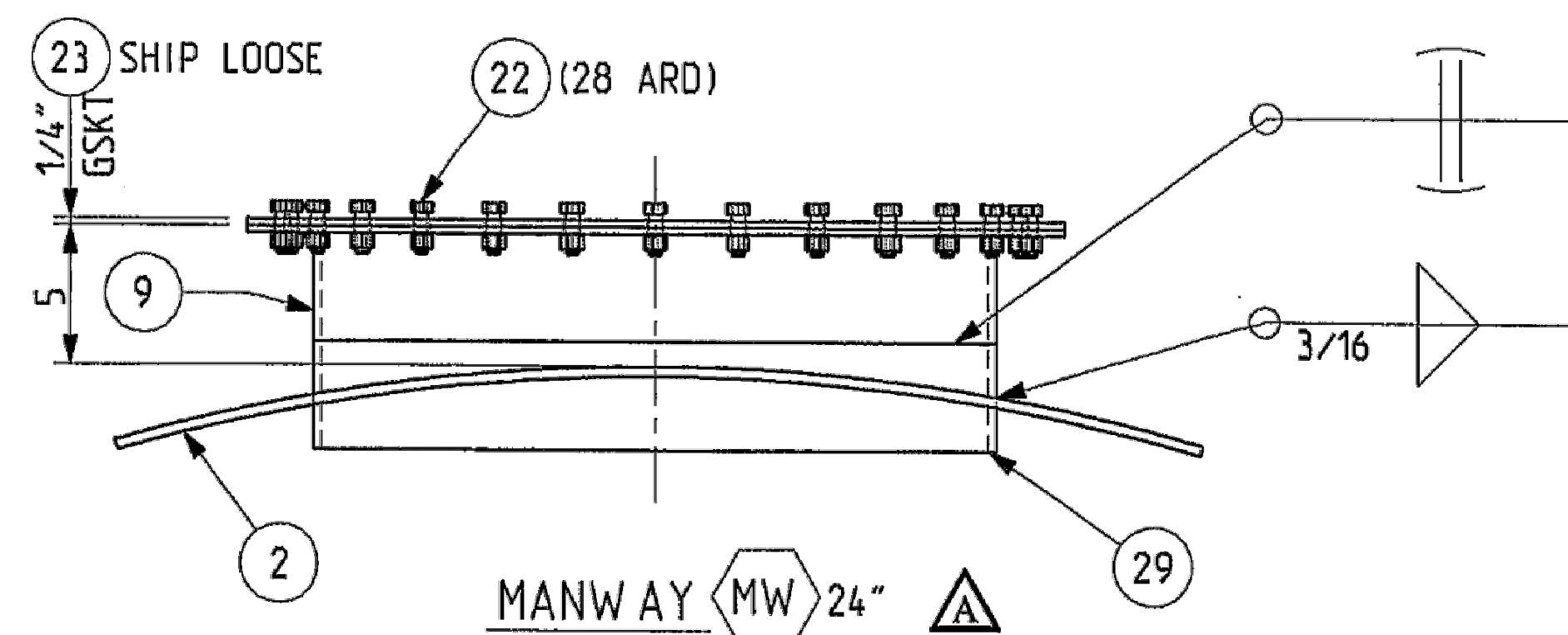
FLANGE DETAIL



NOZZLE N1 12"



NOZZLE N2 6"



SHIP MANWAY WITH COVER ATTACHED  
REMOVE COVER AND ATTACH MK-23 GASKET  
AND RISER (D-8839-1B) AFTER SHIPPING

NOTES:

1. TANK SHALL BE CONSTRUCTED IN ACCORDANCE WITH UNDERWRITERS LAB INC. STANDARDS FOR UNDERGROUND STORAGE TANKS SUBJECT TO UL-58 LATEST REVISION (SWRI LABEL APPLIED).
2. LEAK TEST AT MORE THAN 3 P.S.I AND LESS THAN 5 P.S.I.
3. TANK IS DESIGNED FOR ZERO PRESSURE FOR ATMOSPHERIC CONDITION ONLY.
4. ALL OPENINGS SHALL BE COVERED TO PREVENT ENTRANCE OF DIRT & MOISTURE DURING SHIPMENT.
5. OUTSIDE ONLY TO BE SANDBLASTED (COMMERCIAL) & COATED W/COAL TAR EPOXY - BARBOLINE BITUMASTIC 300.

**APPROVED**  
FOR CONSTRUCTION  
DATE.....BY.....

**FOR CUSTOMER APPROVAL**  
DATE 6/3/15 JG

WORK THIS DWG WITH D-8839-1

Revisions	No.	Date	By	Chk'd	Description
	B	2/13/15	CG	RT	REMOVED NOZZLE N3
	A	1/28/15	CG	RT	UPDATED NOZZLES PER CUSTOMER
Revision Description					
<b>EATON SALES &amp; SERVICE LLC</b> DENVER					
144" DIA x 48'-0" LONG - 40000 GALLON STI-P3					
HORIZONTAL UNDER GROUND STORAGE TANK UL-58					
P.O. # 0004718					
Loc: DENVER, COLORADO					
Cust: COLORADO DEPARTMENT OF TRANSPORTATION					
EMP No. 8839-D01 Dwg. No. D-8839-1A BY B					
Date: 1/14/15					

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Revisions	No.	Date	By	Chk'd	Description

EATON TANK (2 OF 4)

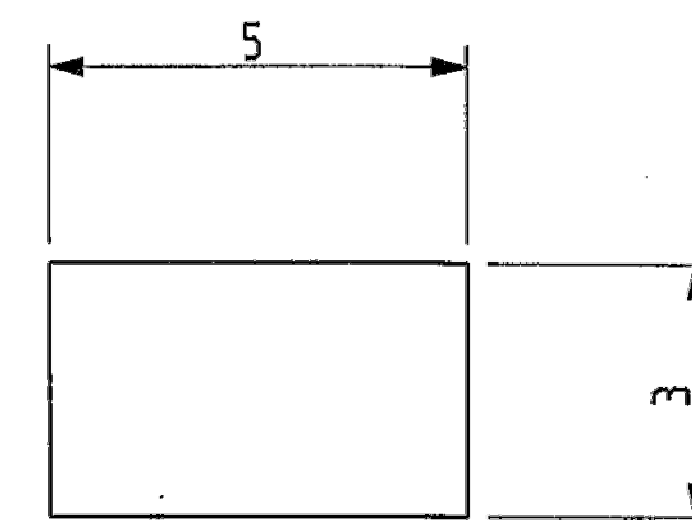
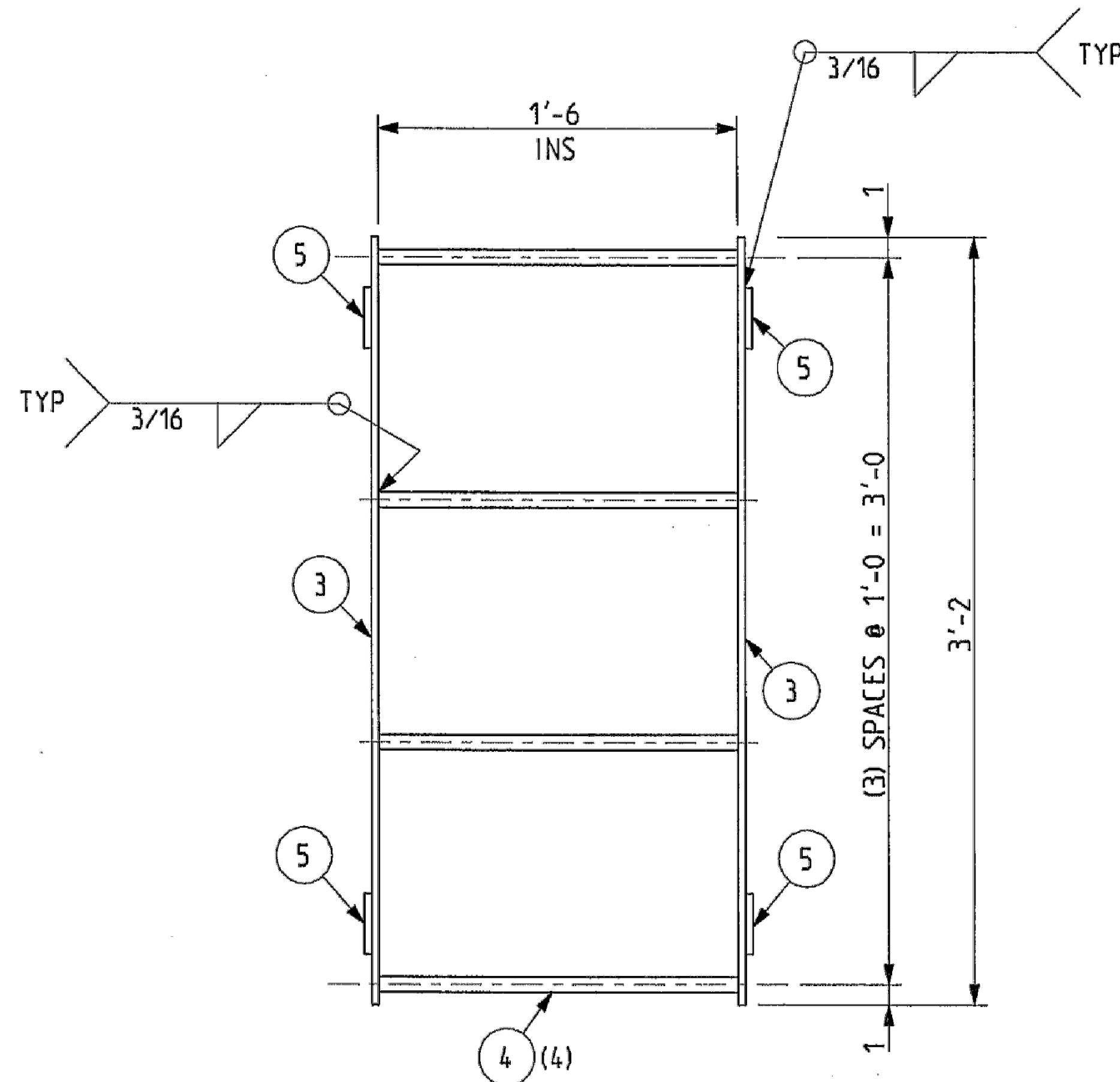
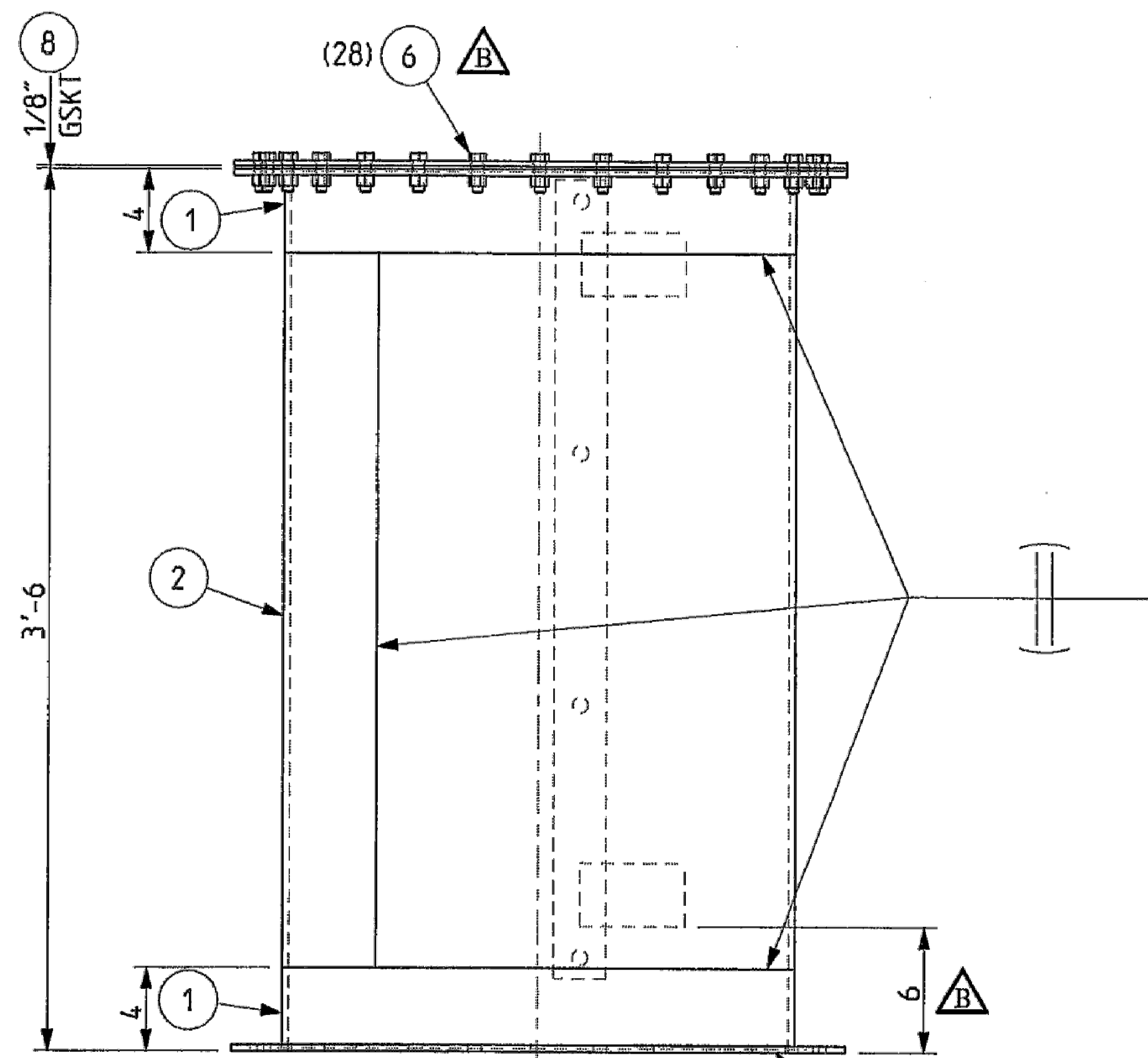
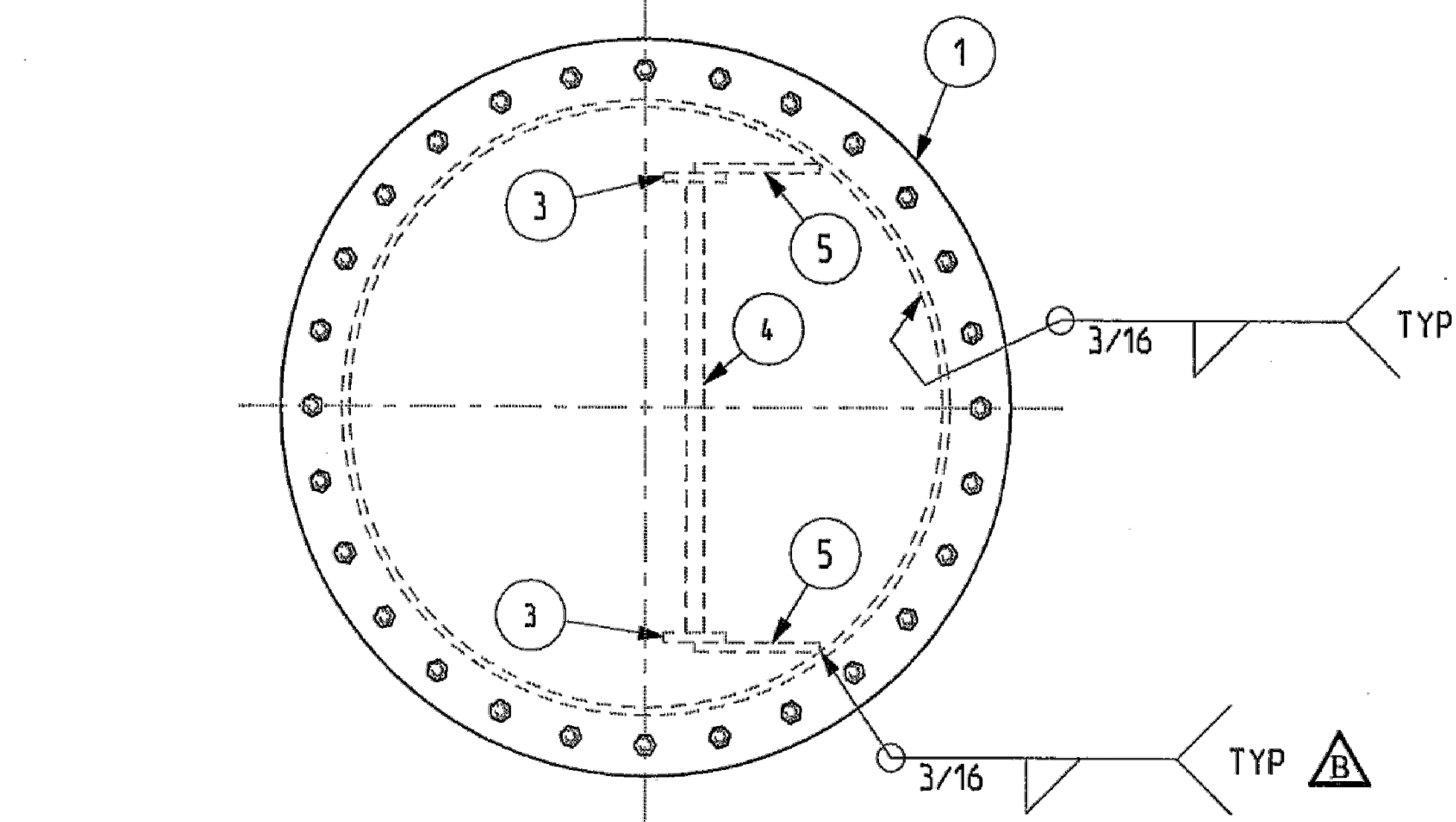
Drawing Number

C10.0

**BARNARD EJMT TEAM**  
**BARNARD**  
**RONDINELLI**  
 A BEER GROUP life safety  
 CONSULTING ENGINEERS  
**Sturgeon ELECTRIC**  
 Western States Fire Protection Co.  
 BCFE



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DETAIL 5  
3/8" PL.

**APPROVED**  
 FOR CONSTRUCTION  
 DATE.....BY.....

BILL OF MATERIAL							
Ship Pcs	Mark No.	Assy Pcs	Description	Length Inches	Material Spec	Weights	Component Part No.
△ B	8839-1B-1	2	MANWAY 24" B/L		A-36	265	
△ B	8839-1B-2	1	PLATE, 5/16" x 34" ROLLED	76 3/8	A-36	230	
	8839-1B-3	2	FB. 3/8" x 2 1/2" LADDER RAIL	38	A-36	20	
	8839-1B-4	4	LADDER RUNG 3/4" DIA.	18	A-36	9	
△ B	8839-1B-5	4	FB. 3/8" x 3"	5	A-36	6	
△ B	8839-1B-6	28	1/2" BOLT W/ NUT	1 1/2	STEEL	4	
△ B	8839-1B-8	1	1/8" GSKT FOR 24" MANWAY		FIBER	-	

QTY SHOWN FOR (1) TANK.  
(2) TANKS REQUIRED

**FOR CUSTOMER APPROVAL**  
 DATE 2/12/15

WORK THIS DWG WITH D-8839-1 & -1A

No.	Date	By	Chk'd	Revision Description
B	2/13/15	CG	RT	CHGD MANWAY SIZE & LADDER CLIP
A	1/28/15	CG	RT	UPDATED MANWAY AND LADDER HEIGHT

**EATON**  
 EATON METAL PRODUCTS CO LLC  
 DENVER - SALT LAKE CITY  
 MANWAY RISER W/LADDER DETAIL  
 14 1/2" DIA x 48'-0" LONG - 40000 GALLON STI-P3  
 P.O. # 0004718  
 Loc: DENVER, COLORADO  
 Cust: COLORADO DEPARTMENT OF TRANSPORTATION  
 EMP No. 8839-D01 Dwg. No. D-8839-1B

**BARNARD EJMT TEAM**  
**BARNARD**  
**RONDINELLI**  
**STURGEON ELECTRIC**  
 BCER  
 Western States Fire Protection Co.  
 CONSULTING ENGINEERS

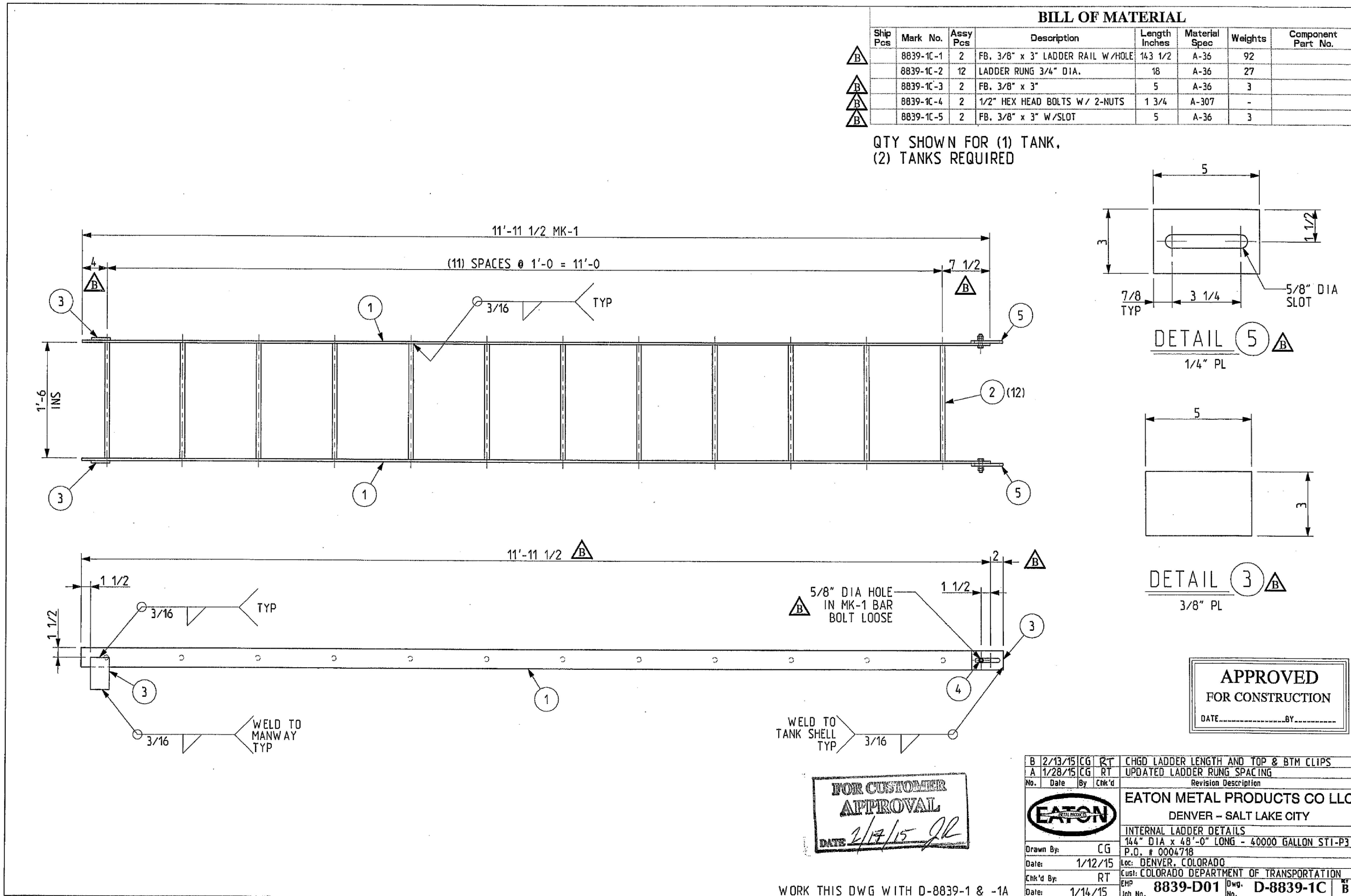
**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Num	Description	Date

DRAWN BY: JBC  
 CHECKED BY: JIM

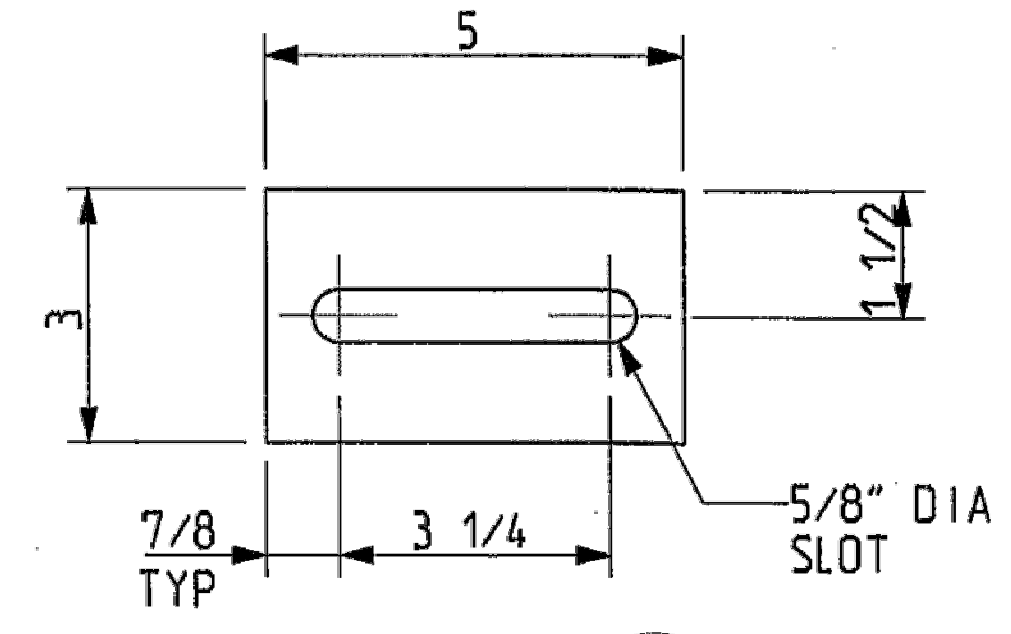
EATON TANK (3 OF 4)  
 Drawing Number  
**C11.0**

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

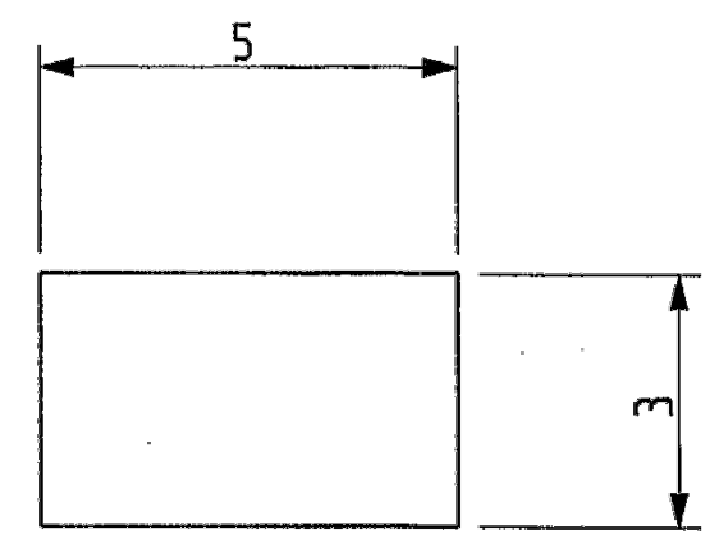


BILL OF MATERIAL							
Ship Pcs	Mark No.	Assy Pcs	Description	Length Inches	Material Spec	Weights	Component Part No.
△ B	8839-1C-1	2	FB, 3/8" x 3" LADDER RAIL W/HOLE	143 1/2	A-36	92	
△ B	8839-1C-2	12	LADDER RUNG 3/4" DIA.	18	A-36	27	
△ B	8839-1C-3	2	FB, 3/8" x 3"	5	A-36	3	
△ B	8839-1C-4	2	1/2" HEX HEAD BOLTS W/ 2-NUTS	1 3/4	A-307	-	
△ B	8839-1C-5	2	FB, 3/8" x 3" W/SLOT	5	A-36	3	

QTY SHOWN FOR (1) TANK.  
(2) TANKS REQUIRED



DETAIL 5  
1/4" PL



DETAIL 3  
3/8" PL

**APPROVED**  
 FOR CONSTRUCTION  
 DATE.....BY.....

**FOR CUSTOMER APPROVAL**  
 DATE 2/17/15 JR

B	2/13/15	CG	RT	CHGD LADDER LENGTH AND TOP & BTM CLIPS
A	1/28/15	CG	RT	UPDATED LADDER RUNG SPACING
No.	Date	By	Chk'd	Revision Description
<b>EATON</b> EATON METAL PRODUCTS CO LLC DENVER - SALT LAKE CITY INTERNAL LADDER DETAILS 144" DIA x 48'-0" LONG - 40000 GALLON STI-P3 P.O. # 0004718 Loc: DENVER, COLORADO Cust: COLORADO DEPARTMENT OF TRANSPORTATION EMP Job No. <b>8839-D01</b> Dwg. No. <b>D-8839-1C</b> B				
Drawn By:	CG	Date:	1/12/15	
Chk'd By:	RT	Date:	1/14/15	

WORK THIS DWG WITH D-8839-1 & -1A

**BARNARD EJMT TEAM**  
**BARNARD**  
**RONDINELLI**  
 CONSULTING ENGINEERS  
 Western States Fire Protection Co.  
**Sturgeon ELECTRIC**  
 BCER  
 Sturgeon Electric

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

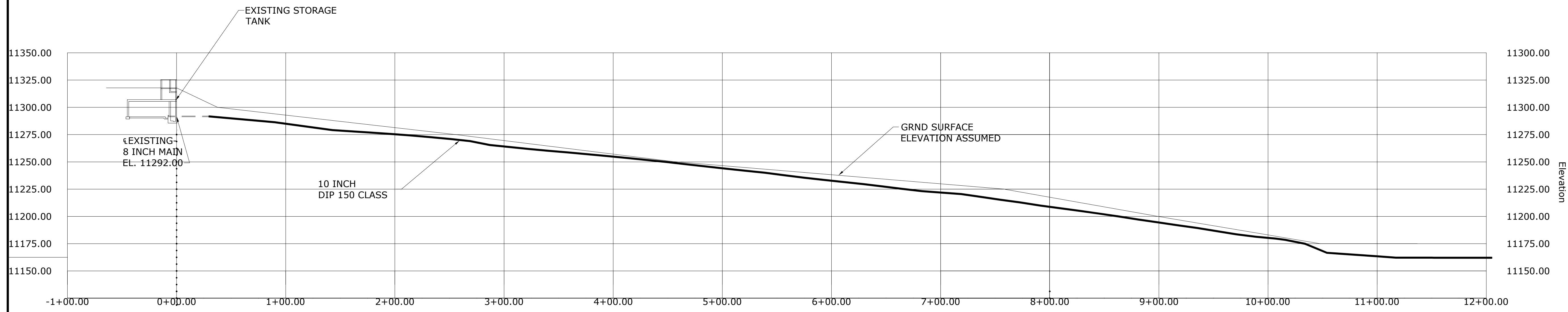
Revisions	Num	Description	Date

EATON TANK (4 OF 4)  
 Drawing Number  
**C12.0**



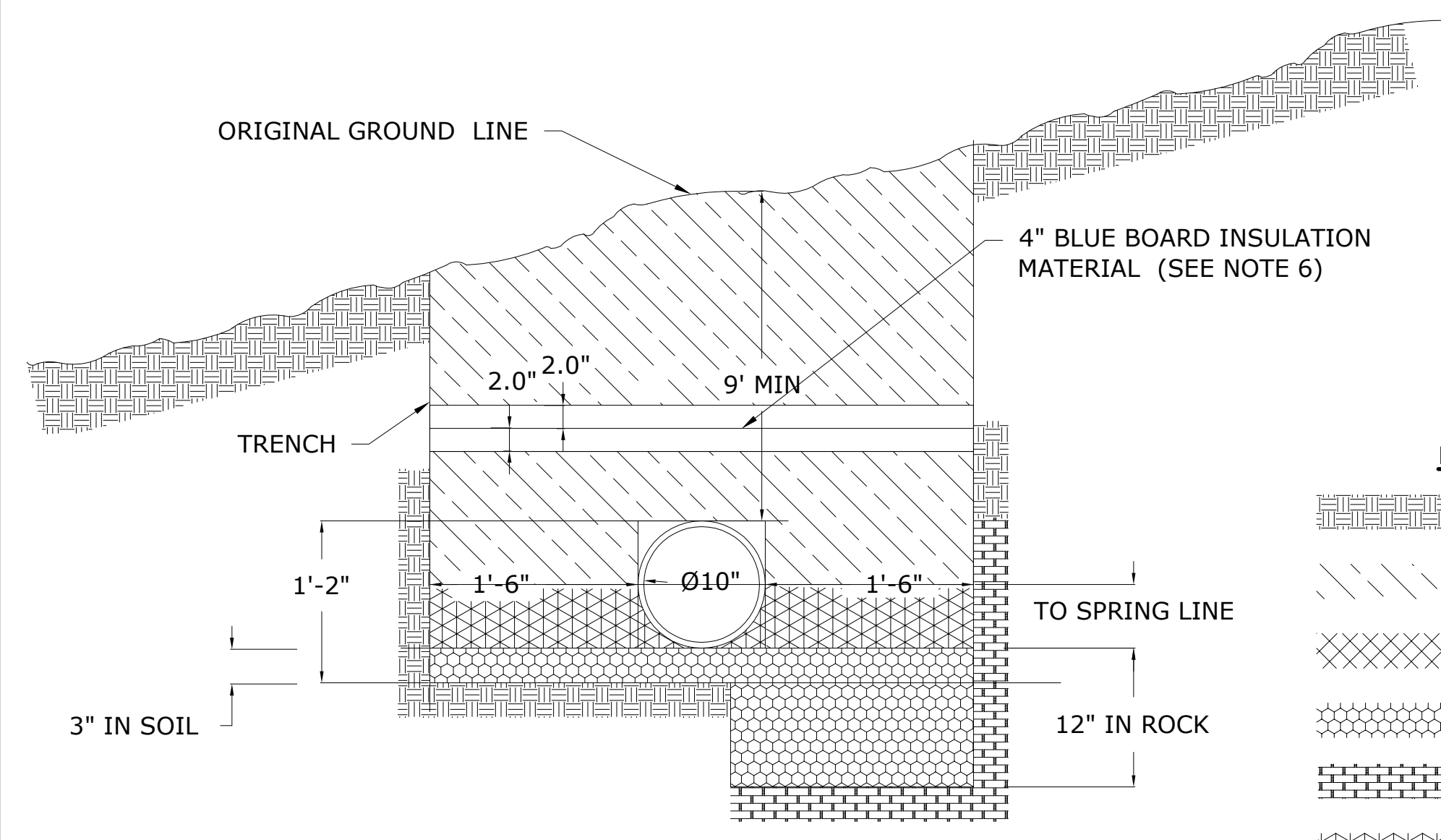


IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



**1 WEST SIDE FFSS SUPPLY PROFILE**  
SCALE: 1/2" = 1'-0"

- GENERAL NOTES:**
- GROUND SURFACE ELEVATIONS ARE ASSUMED BASED ON THE PROVIDED AS BUILT DRAWINGS AND MANUAL ELEVATION POINTS TAKEN. ALL ELEVATIONS INCLUDING; GROUND SURFACE, PIPE INVERTS, AND STRUCTURES, SHALL BE FIELD VERIFIED PRIOR TO START OF CONSTRUCTION.
  - DETAILS REGARDING ELECTRONIC TANK LEVEL EQUIPMENT WILL BE PROVIDED AT RFC DRAWING SUBMISSION.
  - PIPE LENGTHS AND ELEVATIONS ARE APPROXIMATE BASED ON AS BUILT DRAWINGS AND WILL BE VERIFIED PRIOR TO THE START OF CONSTRUCTION WITH A DETAILED SURVEY.
  - SEE M6.0 FOR THRUST BLOCK LOCATIONS AND DETAILS.
  - CONTRACTOR TO REMOVE EXISTING 8" SUPPLY PIPE AND CORE A 12" HOLE FOR PLACEMENT OF NEW 10" DIP. ANNULAR SPACE BETWEEN CORE AND NEW 10" PIPE SHALL BE HAND PACKED WITH GROUT AND MADE WATER TIGHT.
  - 4" OF BLUE BOARD INSULATION SHALL BE PLACED 6" TO 12" ABOVE BEDDED DIP PIPE. BLUE BOARD INSULATION SHALL BE PLACED ACROSS THE FULL WIDTH OF PIPE TRENCH.
  - FOR ROADWAY TRENCH DETAILS SEE DETAILS 2 SHEET C0.2



**2 SUPPLY PIPE TRENCH DETAIL**  
SCALE: NTS

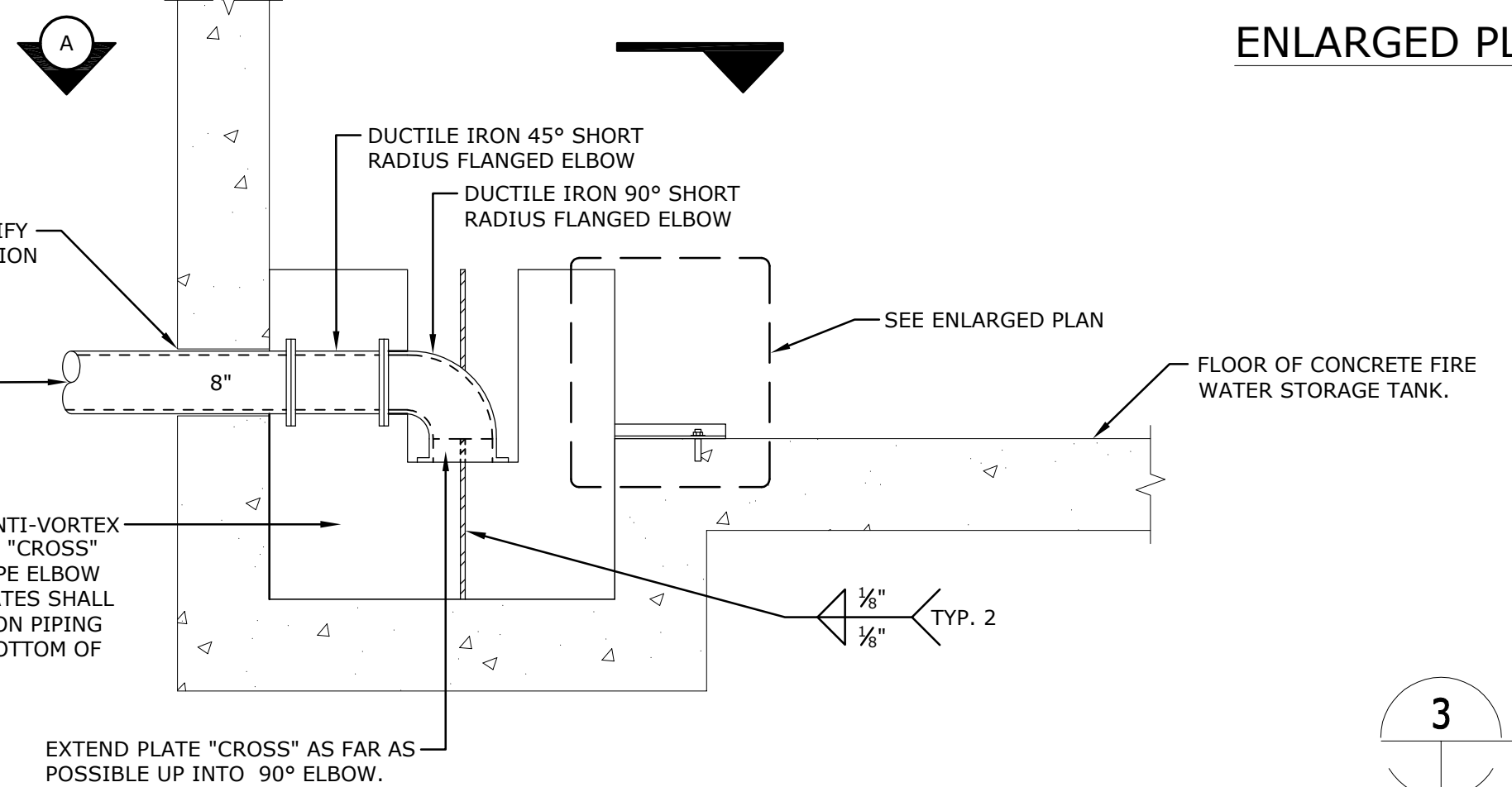
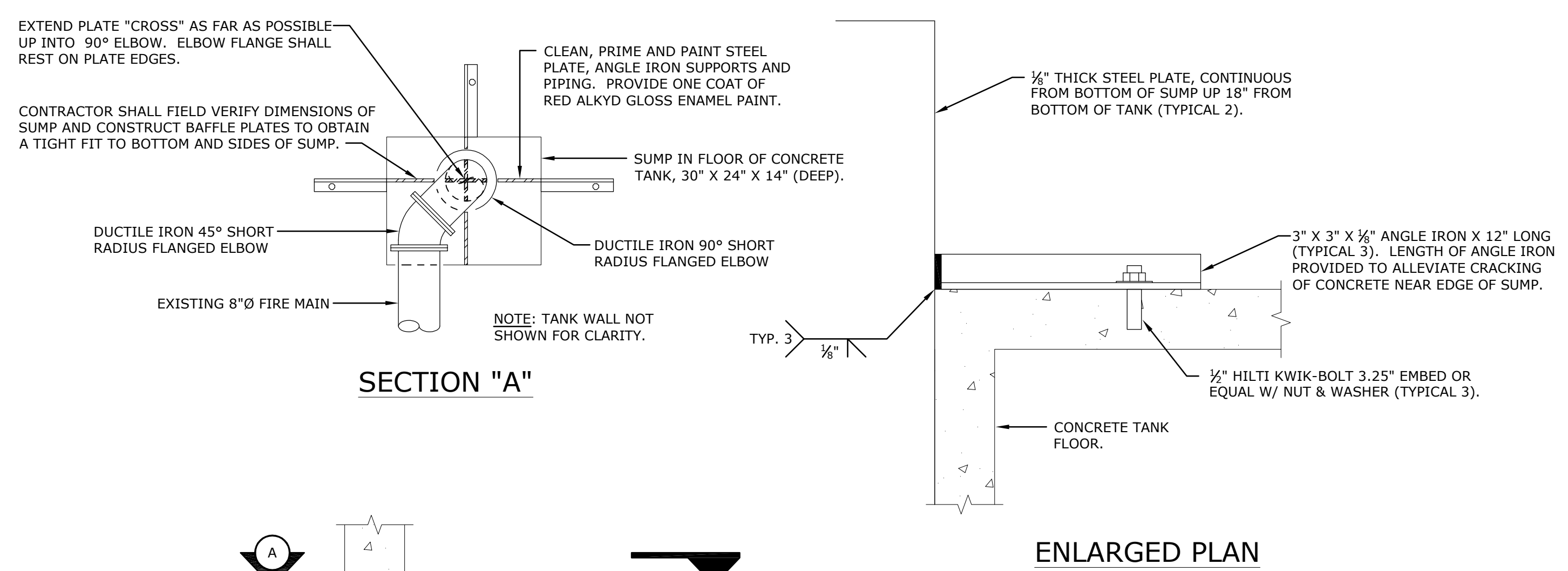
**LEGEND**

	EARTH
	EMBANKMENT MATERIAL
	STRUCTURE BACKFILL**, CLASS 1 OR 2
	BEDDING MATERIAL*
	BEDROCK
	STRUCTURE BACKFILL, CLASS 1

\* BEDDING MATERIAL FOR RIGID PIPE IN SOIL SHALL BE 3 IN. OF LOOSE STRUCTURE BACKFILL (CLASS 1 OR 2). BEDDING IS NOT REQUIRED FOR FLEXIBLE PIPE IN SOIL. BEDDING MATERIAL FOR RIGID OR FLEXIBLE PIPE IN ROCK SHALL BE 12 IN. OR LOOSE STRUCTURE BACKFILL, CLASS 1.

\*\* PER CDOT SECTION 206.02(a) - STRUCTURAL BACKFILL (FLOW-FILL) MEETING THE FOLLOWING REQUIREMENTS BE SUBSTITUTED FOR CLASS 1 OR CLASS 2 BACKFILL TO BACKFILL CULVERTS AND SEWER PIPES:

CEMENT	50 LBS/YD <sup>3</sup>
COARSE AGGREGATE	1700 LBS/YD <sup>3</sup>
FINE AGGREGATE	1840 LBS/YD <sup>3</sup>
WATER	325 (OR AS NEEDED) LBS/YD <sup>3</sup>



**3 ANTI-VORTEX BAFFLE DETAIL**  
SCALE: NOT TO SCALE

**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT**

Project No. C0703-360  
Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Revisions	Date
Num	Description

WEST SIDE FFSS SUPPLY PROFILE  
Drawing Number  
**C13.0**

DRAWN BY: JBC  
CHECKED BY: JIM

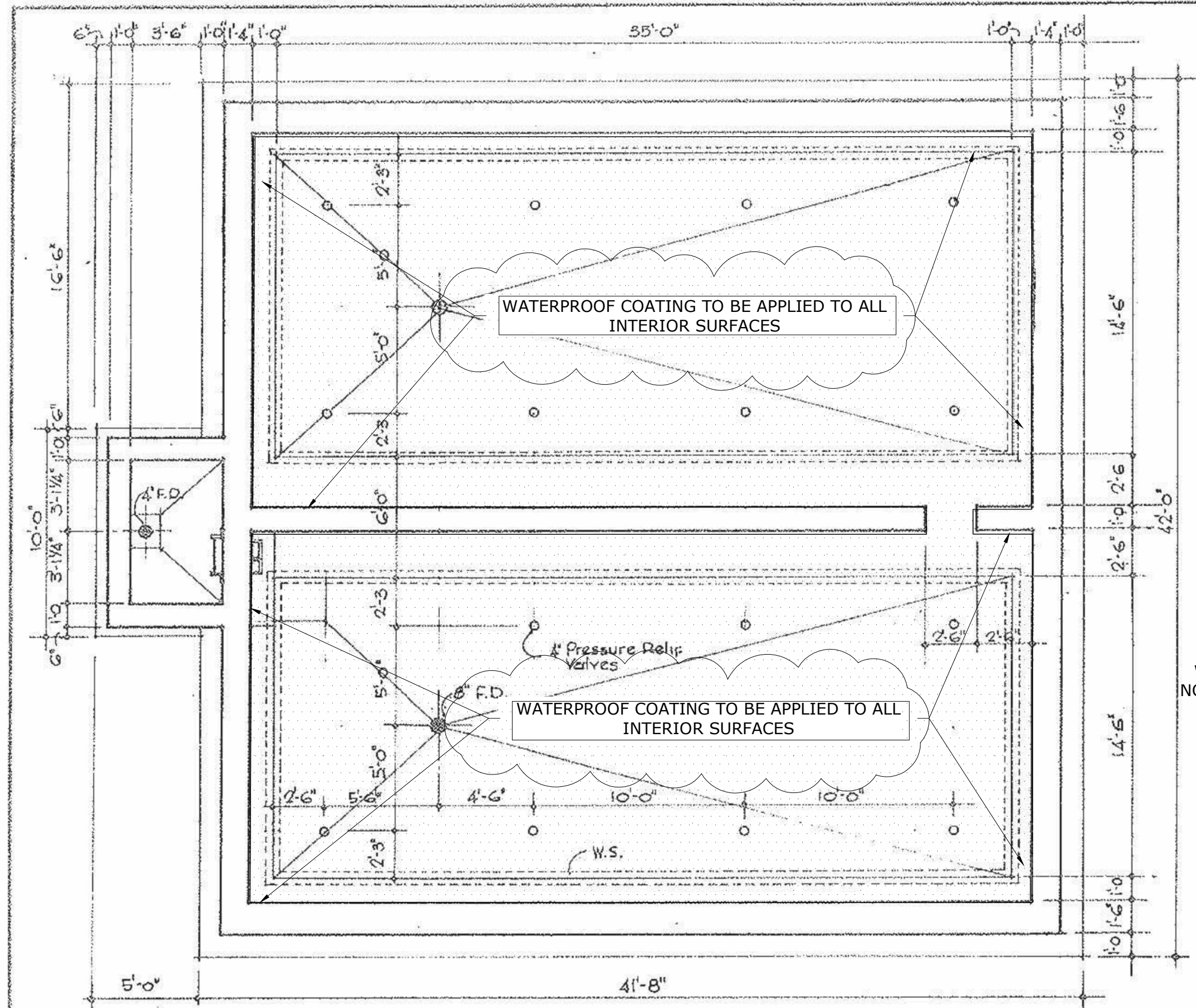
**BARNARD EJMT TEAM**

**BCER** **BARNARD** **RONDINELLI**

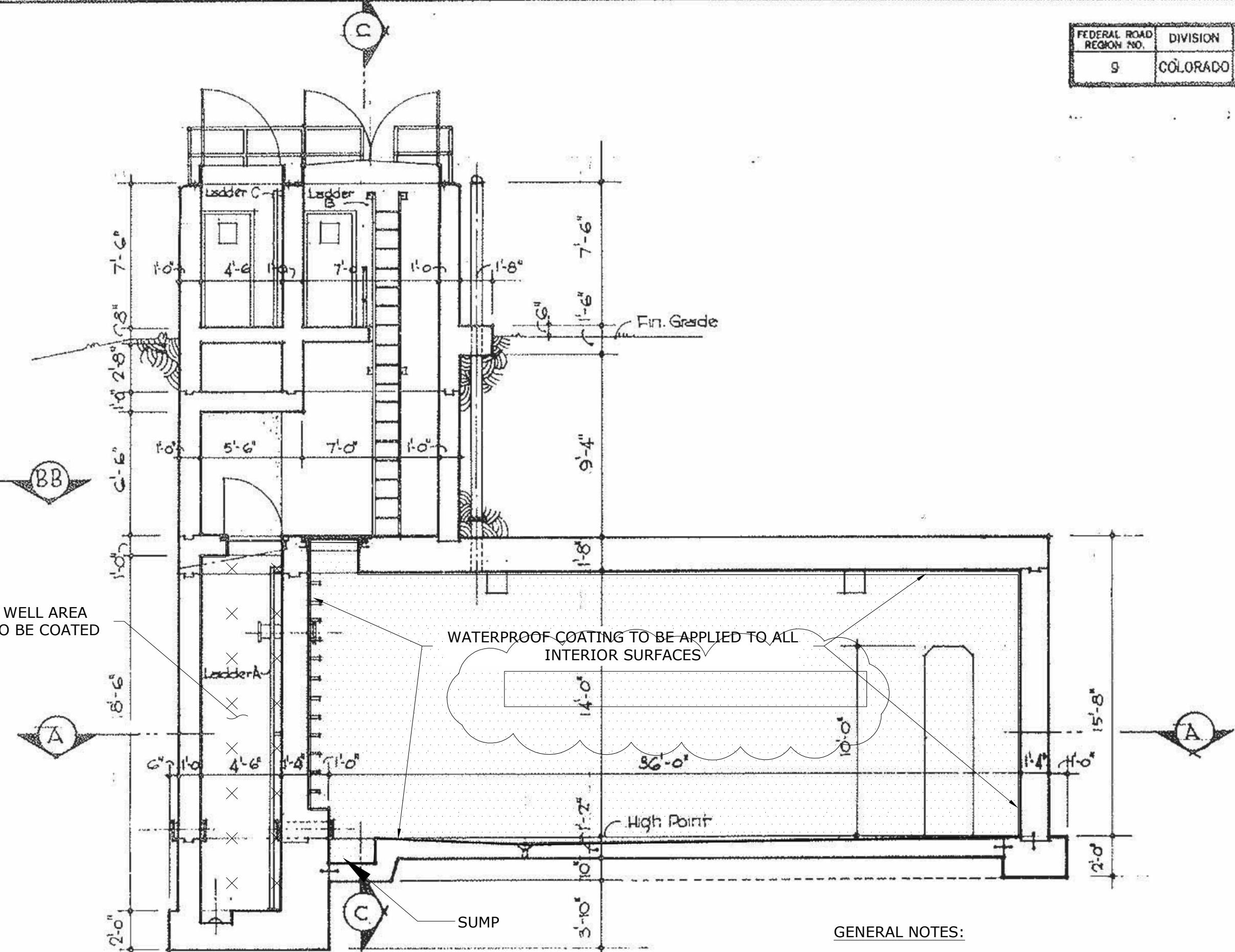
**Sturgeon ELECTRIC** **Western States Fire Protection Co.** **ALF CONSULTING ENGINEERS**



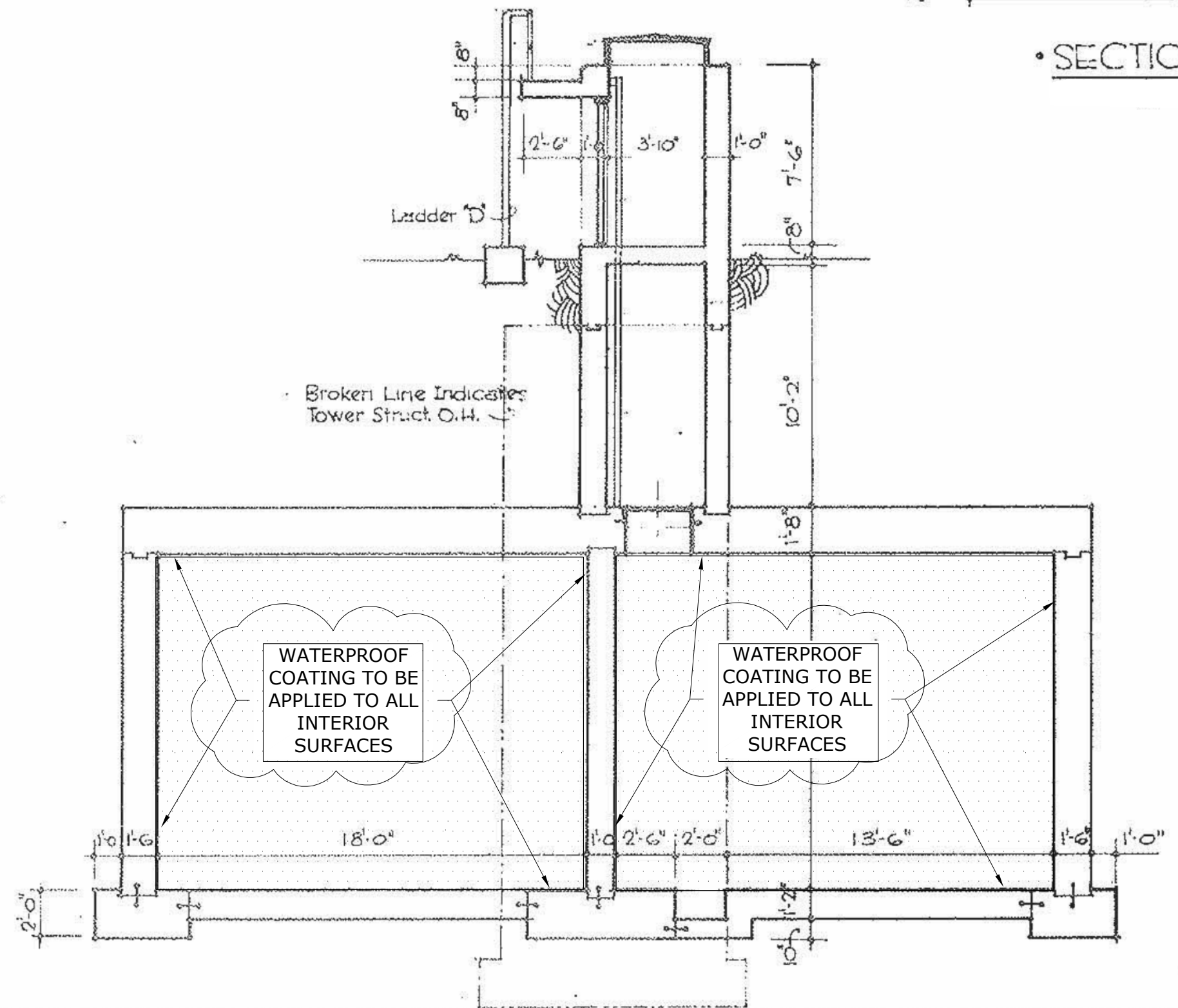
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SECTION A-A



SECTION B-B



SECTION C-C

FEDERAL ROAD REGION NO.	DIVISION	PROJECT NO.	SHEET NO.	TOTAL SHEETS
9	COLORADO	170-3(34)220	22 BX	326

AS CONSTRUCTED  
REVISED DATE  
OCT 26, 1973

GENERAL NOTES:

1. WATERPROOF COATING SHALL BE BE APPLIED TO ALL INTERIOR SURFACES OF THE EXISTING WATER STORAGE TANK.
2. APPLICATION THICKNESS OF THE WATERPROOF COATING SHALL BE IN ACCORDANCE WITH THE MANUFACTURER RECOMMENDATIONS.

WATERPROOF CONCRETE COATING APPLICATION SPECIFICATIONS

MATERIAL:

1. THE COATING MATERIAL SHALL BE A FLEXIBLE CONCRETE WATERPROOFING MATERIAL SUITABLE FOR DRINKING WATER APPLICATIONS.
2. FOLLOW MANUFACTURER'S APPLICATION INSTRUCTIONS FOR ALL MATERIALS USED INCLUDING BUT NOT LIMITED TO; CONCRETE REPAIR MATERIALS, FILLERS, ADMIXTURES, AND COATINGS.

APPLICATION:

1. SURFACE PREPARATION SHALL INCLUDE CLEANING OF ALL TANK SURFACES. FOLLOW ALL MANUFACTURER'S RECOMMENDATIONS FOR SURFACE PREPARATION. SURFACE PREPARATION MAY REQUIRE MECHANICAL ABRASION FOLLOWING MANUFACTURER'S RECOMMENDATIONS. THE SURFACE SHALL BE FREE OF DUST, DIRT, LAITANCE, MINERALS, PAINTS, OILS, GREASES, OR ANY OTHER CONTAMINANTS.
2. PATCH ALL HOLES AND NON-MOVING CRACKS BEFORE INSTALLATION. USE ONLY MATERIALS SUITABLE FOR USE WITH THE EXISTING SUBSTRATE AND WATERPROOF COATING.
3. STOP ALL ACTIVE WATER INGRESS INTO THE TANK PRIOR TO APPLICATION OF COATING MATERIAL.
4. FOLLOW MANUFACTURER'S RECOMMENDATION FOR APPLICATION SURFACE AND ENVIRONMENTAL REQUIREMENTS.
5. APPLY MATERIAL WITH APPROVED APPLICATION EQUIPMENT.
6. ALLOW AT LEAST 24 HOURS BEFORE APPLICATION OF SECOND COAT, IF REQUIRED.
7. CLEAN SURFACE PRIOR TO REFILLING TANK. TAKE CARE TO NOT CONTAMINATE NEW OR EXISTING PLUMBING SYSTEMS. DO NOT ALLOW CONTAMINATION OF EXISTING WATER SUPPLY SYSTEM.

STATE OF COLORADO DIVISION OF HIGHWAYS			
SCALE: NOTED	APPROVED BY:	DRAWN BY J.O.C	
DATE: 9-9-73	REVISED:		
WATER STORAGE TANK			
		DESIGNED DRAWING: 63-18	

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Num	Revisions	Description	Date

STORAGE TANK CONCRETE LINING - DETAILS (1-2)

Drawing Number

C14.0

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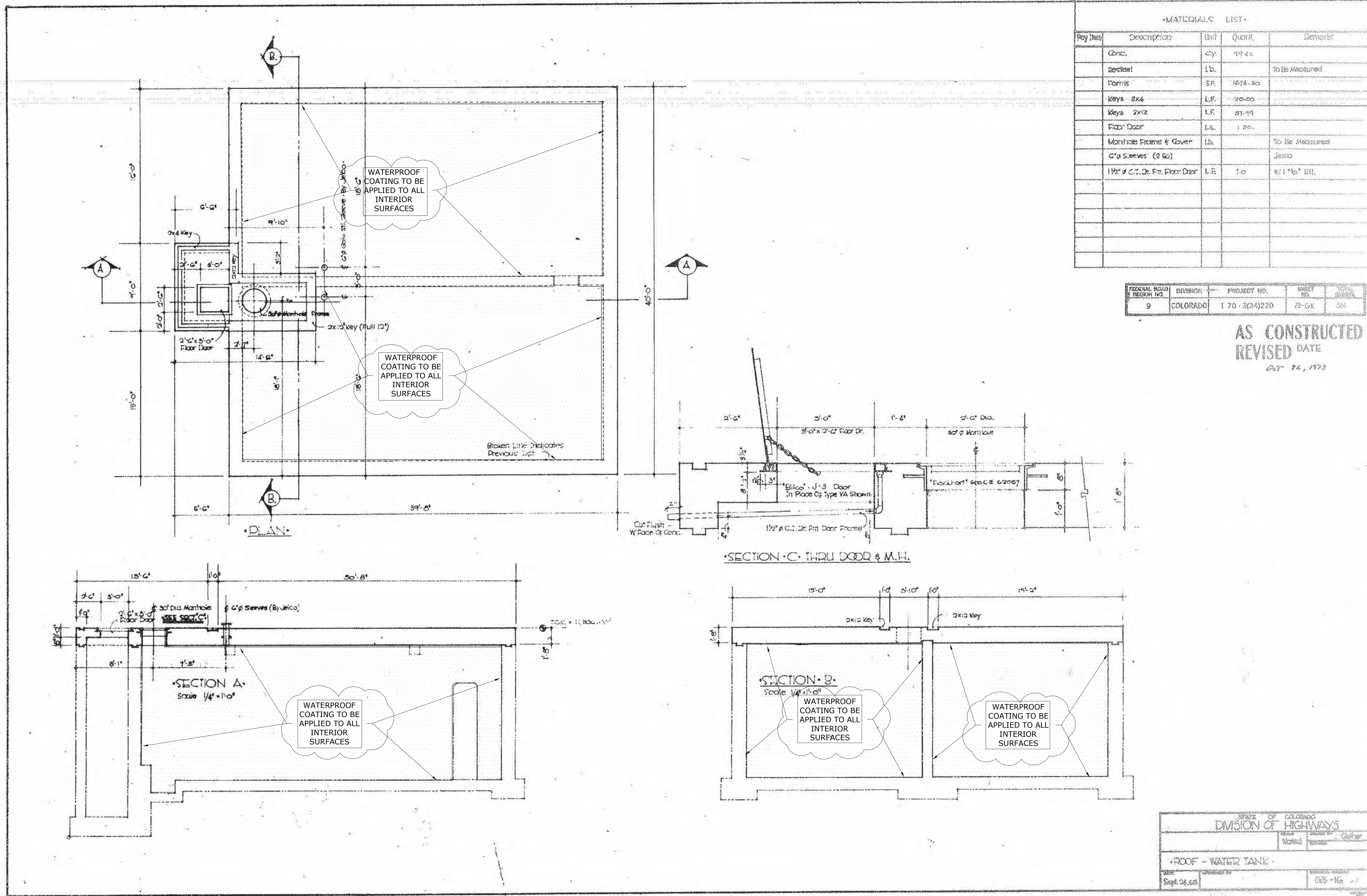
Western States Fire Protection Co.



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1 WEST SIDE STORAGE TANK COATING  
SCALE: NTS



EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

**BARNARD EJM TEAM**  
BCER  
BARNARD  
RONDINELLI  
Sturgeon Electric  
Western States Fire Protection Co.  
A BEER GROUP LIFE SAFETY

Num	Revisions	Date
	Description	

STORAGE TANK CONCRETE LINING - DETAILS (2-2)  
Drawing Number  
**C15.0**

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**ELECTRICAL PROJECT NARRATIVE:**

**OVERVIEW**

THE NEW EJMT FIRE SUPPRESSION SYSTEM WILL INCLUDE ADDITIONS AND MODIFICATIONS TO THE EXISTING ELECTRICAL SYSTEMS IN BOTH THE EAST AND WEST PORTAL BUILDINGS. THE MAJOR COMPONENTS OF THE FIRE SUPPRESSION SYSTEM INCLUDE: A FIRE PUMP, DELUGE VALVES, CIRCULATING PUMPS, AND BOILERS. A NEW GENERATOR AND ASSOCIATED ELECTRICAL DISTRIBUTION SYSTEM WILL BE INSTALLED AT THE WEST PORTAL BUILDING TO PROVIDE BACKUP ELECTRICAL POWER FOR THESE MAJOR COMPONENTS IN THE EVENT OF A POWER FAILURE. THE SYSTEM ALSO INCLUDES FIRE ALARM PANELS, FIRE PROTECTION CABINETS, FIBER OPTIC LINEAR HEAT DETECTION SYSTEMS, VIDEO CAMERAS, THREE (3) WORK STATIONS, AND ASSOCIATED FLAT SCREEN DISPLAYS. ALL ELECTRONIC EQUIPMENT ASSOCIATED WITH THESE SYSTEMS WILL BE BATTERY BACKED UP. THE EXISTING EAST PORTAL BUILDING GENERATOR WILL PROVIDE BACKUP ELECTRICAL POWER FOR SYSTEM ELECTRONIC EQUIPMENT POWERED FROM THE EAST ELECTRICAL DISTRIBUTION SYSTEM.

A NEW LEVEL SENSOR WILL BE INSTALLED IN THE NEW FIRE WATER ENTRY ROOM IN THE WEST PORTAL BUILDING. THIS SENSOR WILL BE MONITORED BY THE FIRE ALARM SYSTEM. NEW FIRE PROTECTION SYSTEM CONTROLLED VALVES WILL BE INSTALLED IN THE EXISTING SEWER TREATMENT ROOM IN THE EAST PORTAL BUILDING. THESE VALVES WILL DIVERT FIRE-EVENT WATER TO NEW AND EXISTING COLLECTION TANKS. A LEVEL SENSOR WILL BE INSTALLED IN THE COLLECTION TANK SYSTEM AND WILL BE MONITORED BY THE FIRE ALARM SYSTEM.

**WEST PORTAL BUILDING**

THE NEW FIRE PUMP, CIRCULATING PUMPS, AND BOILER WILL BE LOCATED IN THE WEST PORTAL BUILDING AND WILL BE POWERED FROM A NEW STANDBY POWER DISTRIBUTION SYSTEM UTILIZING A SPARE CIRCUIT BREAKER LOCATED IN THE EXISTING 480Y/277V SWITCHGEAR. IN THE EVENT OF A UTILITY POWER FAILURE, A NEW NATURAL GAS POWERED GENERATOR WILL PROVIDE STANDBY POWER VIA NEW AUTOMATIC TRANSFER SWITCHES.

THE EXISTING 480Y/277V SWITCHGEAR HAS TWO SPARE 1,600A POWER CIRCUIT BREAKERS. ONE OF THESE BREAKERS WILL BE USED TO POWER THE NEW FIRE SUPPRESSION SYSTEM STANDBY POWER DISTRIBUTION SYSTEM. A NEW FEEDER WILL BE ROUTED BETWEEN THE MAIN ELECTRICAL ROOM AND NEW FIRE PUMP/MECHANICAL ROOM. ALL OF THE FIRE SUPPRESSION SYSTEM'S LARGE ELECTRICAL LOADS ARE LOCATED IN THIS PORTION OF THE BUILDING.

WHEN POWER ON THE WEST SIDE OF THE TUNNEL IS BEING FED FROM THE EXISTING 500KW GENERATOR, CDOT PERSONNEL MUST OPEN THE 1200AMP BREAKER IN THE WEST SIDE MOTOR CONTROL CENTER LABELED "FIRE PROTECTION FIRE PUMP". THIS WILL PREVENT THE LOAD FROM THE NEWLY INSTALLED FIRE SUPPRESSION SYSTEM FROM BEING PLACED ONTO THE EXISTING 500KW TRANSFORMER. ONCE THIS BREAKER IS OPEN THE FIRE SUPPRESSION SYSTEM WILL RUN ON THE NEW 350KW GENERATOR.

A NEW 480V, 3-PHASE FIRE PUMP CONTROLLER/AUTOMATIC TRANSFER SWITCH WILL BE INSTALLED TO POWER THE FIRE PUMP FROM EITHER UTILITY POWER OR THE NEW GENERATOR. A NEW 480V, 3-PHASE AUTOMATIC TRANSFER SWITCH WILL BE INSTALLED TO POWER ALL OTHER EQUIPMENT ASSOCIATED WITH THE FIRE SUPPRESSION SYSTEM INCLUDING: FIRE PUMP, CIRCULATING PUMPS, BOILERS, BOILER ROOM LIGHTING, FIRE PROTECTION CABINETS, REMOTE CONTROL CABINETS, ZONE VALVES, AND A NEW 208Y/120V, 100A, 3-PHASE PANEL. THIS LOW VOLTAGE PANEL WILL POWER THE FIRE ALARM PANEL, FIBER OPTIC LINEAR HEAT DETECTION SYSTEM, VIDEO CAMERAS, WORK STATION, AND ASSOCIATED FLAT SCREEN DISPLAYS IN THE WEST PORTAL BUILDING. A NEW 350KW (DE-RATED TO 238KW) GENERATOR WILL BE INSTALLED TO PROVIDE STANDBY POWER TO ALL FIRE SUPPRESSION EQUIPMENT DESCRIBED ABOVE. IN ADDITION TO THE GENERATOR, ALL ELECTRONIC SYSTEM EQUIPMENT WILL ALSO BE BATTERY BACKED UP. THESE BATTERIES WILL KEEP ALL EQUIPMENT POWERED DURING AN AC POWER TRANSITION BETWEEN UTILITY AND GENERATOR SOURCES.

TWO (ONE PER TUNNEL) 480V, 30A, 3-PHASE CIRCUITS WILL BE INSTALLED FROM THE WEST PORTAL BUILDING TO POWER THE FIRE PROTECTION CABINETS, REMOTE CONTROL CABINETS, AND VALVE CABINETS LOCATED IN THE WEST HALF OF EACH PLENUM. A SMALL STEP-DOWN TRANSFORMER INSTALLED AT EACH PANEL WILL PROVIDE THE 120V POWER NEEDED TO CONTROL AND MONITOR ALL THE FIRE SUPPRESSION REMOTE MOUNTED EQUIPMENT.

A NEW LEVEL SENSOR WILL BE INSTALLED TO MONITOR THE EXISTING WATER STORAGE TANK AND WILL BE CONNECTED TO THE FIRE ALARM SYSTEM.

**EAST PORTAL BUILDING**

THE FIRE SUPPRESSION SYSTEM EQUIPMENT THAT WILL BE LOCATED IN THE EAST PORTAL BUILDING REQUIRES VERY LITTLE POWER. THE FIRE ALARM PANELS, FIBER OPTIC LINEAR HEAT DETECTION SYSTEM, VIDEO CAMERAS, TWO WORK STATIONS, AND FLAT SCREEN DISPLAYS WILL BE POWERED FROM THE EXISTING EMERGENCY POWER SYSTEM.

LOCATED IN THE MAIN ELECTRICAL ROOM IS A 480Y/277V, 1,200A GENERATOR BACKED UP PANEL WITH SPARE SPACE AND CAPACITY FOR ALL THE FIRE SUPPRESSION SYSTEM COMPONENTS THAT WILL BE POWERED FROM THE EAST PORTAL BUILDING. IN ADDITION TO THE GENERATOR, ALL ELECTRONIC SYSTEM EQUIPMENT WILL ALSO BE BATTERY BACKED UP. THESE BATTERIES WILL KEEP ALL EQUIPMENT POWERED DURING AN AC POWER TRANSITION BETWEEN UTILITY AND GENERATOR SOURCES.

THREE NEW CIRCUIT BREAKERS WILL BE INSTALLED IN PANEL EV TO POWER TWO (2) 480V, 3-PHASE CIRCUITS NEEDED FOR FIRE SUPPRESSION SYSTEM EQUIPMENT THAT WILL BE INSTALLED IN THE EAST HALF OF EACH PLENUM, AND A 30KVA 480V-208/120V TRANSFORMER AND 208Y/120V, 100A, 3-PHASE PANEL. THIS LOW VOLTAGE PANEL WILL POWER THE FIRE ALARM PANEL, FIBER OPTIC LINEAR HEAT DETECTION SYSTEM, VIDEO CAMERAS, WORK STATIONS, AND ASSOCIATED FLAT SCREEN DISPLAYS IN THE EAST PORTAL BUILDING. A SMALL STEP-DOWN TRANSFORMER INSTALLED AT EACH PANEL WILL PROVIDE THE 120V POWER NEEDED TO CONTROL AND MONITOR ALL THE FIRE SUPPRESSION SYSTEM REMOTE MOUNTED EQUIPMENT.

WATER RELEASED DURING A FIRE-EVENT WILL BE COLLECTED IN EXISTING AND NEW COLLECTION TANKS. NEW VALVES WILL BE INSTALLED IN THE EXISTING SEWER TREATMENT ROOM AND NEW MANHOLE 2 TO DIVERT WATER INTO THESE TANKS. THESE VALVES WILL BE CONTROLLED BY THE FIRE PROTECTION SYSTEM. FINALLY, AS PART OF THE FIRE SUPPRESSION PROJECT, A NEW LEVEL SENSORS WILL BE INSTALLED IN THE COLLECTION TANK SYSTEM AND MONITORED BY THE FIRE ALARM SYSTEM.

**GENERAL NOTES:**

1. ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR INSTALLING ALL CONDUIT, WIRE AND FINAL CONNECTIONS SHOWN ON THESE DRAWINGS, THE SYSTEMS GROUP DRAWINGS, AND WESTERN STATES FIRE PROTECTION DRAWINGS. SYSTEMS GROUP SHALL BE RESPONSIBLE FOR ALL PROGRAMMING, CONFIGURING AND SETUP OF FIRE ALARM SYSTEMS. ELECTRICAL CONTRACTOR SHALL BE RESPONSIBLE FOR STARTUP SUPPORT OF SYSTEMS.
2. CONDUIT INSTALLATION INCLUDES RUNNING MULTIPLE IMC CONDUITS IN BOTH SUPPLY PLENUMS (APPROXIMATELY 9,000' PER TUNNEL). DETAILS REGARDING THE BRACKET TO SUPPORT THE CONDUIT IN BOTH PLENUMS IS SHOWN ON THE SYSTEMS GROUP DRAWINGS.

OVERCURRENT DEVICE SETTINGS	FEEDER IDENTIFIER	COPPER CONDUCTORS INSULATION PER SPECIFICATIONS	FEEDER IDENTIFIER	COPPER CONDUCTORS INSULATION PER SPECIFICATIONS
20	3WG20	(3#12 + 1#12G)1/2"C	4WG20	(4#12 + 1#12G)3/4"C
30	3WG30	(3#10 + 1#10G)3/4"C	4WG30	(4#10 + 1#10G)3/4"C
40	3WG40	(3#8 + 1#10G)3/4"C	4WG40	(4#8 + 1#10G)3/4"C
50	3WG50	(3#6 + 1#10G)3/4"C	4WG50	(4#6 + 1#10G)1"C
60	3WG60	(3#4 + 1#10G)1"C	4WG60	(4#4 + 1#10G)1-1/4"C
70	3WG70	(3#4 + 1#8G)1"C	4WG70	(4#4 + 1#8G)1-1/4"C
100	3WG100	(3#1 + 1#8G)1-1/4"C	4WG100	(4#2 + 1#8G)1-1/4"C
125	3WG125	(3#1/0 + 1#6G)1-1/2"C	4WG125	(4#1/0 + 1#6G)2"C
150	3WG150	(3#1/0 + 1#6G)1-1/2"C	4WG150	(4#1/0 + 1#6G)2"C
175	3WG175	(3#2/0 + 1#6G)2"C	4WG175	(4#2/0 + 1#6G)2"C
200	3WG200	(3#3/0 + 1#6G)2"C	4WG200	(4#3/0 + 1#6G)2"C
225 *	3WG225	(3#4/0 + 1#3/0G)2"C		
250 *	3WG250	(3#250KCML + 1#3/0G)2-1/2"C		
300	3WG300	(3#350KCML + 1#4G)2-1/2"C	4WG300	(4#350KCML + 1#4G)3-1/2"C
350	3WG350	(3#500KCML + 1#3G)3"C	4WG350	(4#500KCML + 1#3G)3-1/2"C
400	3WG400	(3#500KCML + 1#3G)3"C	4WG400	(4#500KCML + 1#3G)3-1/2"C
500	3WG500	2[(3#250KCML + 1#2G)2-1/2"C]	4WG500	2[(4#250KCML + 1#2G)3"C]
600	3WG600	2[(3#350KCML + 1#1G)2-1/2"C]	4WG600	2[(4#350KCML + 1#1G)3"C]
800	3WG800	2[(3#500KCML + 1#1/0G)3"C]	4WG800	2[(4#500KCML + 1#1/0G)3-1/2"C]
20	2WG20	(2#12 + 1#12G)3/4"C		
30	2WG30	(2#10 + 1#10G)3/4"C		

\* GROUND WIRE SIZE ADJUSTED TO ACCOMMODATE 1200A OVER-CURRENT DEVICE.

**ELECTRICAL DRAWING LIST**

Sheet Number	Sheet Title
E1.0	ELECTRICAL GENERAL INFORMATION
E1.1	ELECTRICAL LEGEND
E1.2	ELECTRICAL SCHEDULES
E1.3	ELECTRICAL SCHEDULES
E2.1	WEST ELECTRICAL ONE-LINE DIAGRAM
E2.2	EAST ELECTRICAL ONE-LINE DIAGRAM
<del>E3.1</del>	<del>ELECTRICAL SITE PLAN - WEST</del>
E3.2	ELECTRICAL SITE PLAN - EAST
E5.0	ELECTRICAL ROADWAY LEVEL PLAN - WEST
E5.1	ELECTRICAL MEZZANINE LEVEL PLAN - WEST
E6.0	ELECTRICAL ROADWAY LEVEL PLAN - EAST
E6.1	ELECTRICAL FAN LEVEL PLAN - EAST
E7.0	ELECTRICAL SPECIFICATIONS
E7.1	ELECTRICAL SPECIFICATIONS
E7.2	ELECTRICAL SPECIFICATIONS

**BARNARD EJMT TEAM**

**BARNARD**

electrical engineering

**RONDINELLI**

A REF ABOVE life safety

**ELF**

Western States Fire Protection Co.

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

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**RECORD DRAWINGS - 2015-11-16**

RECORD DRAWINGS

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Revisions	Description	Date

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Drawing Number  
**E1.0**

ELECTRICAL GENERAL INFORMATION

# ELECTRICAL LEGEND

ALL SYMBOLS IN LEGEND MAY NOT NECESSARILY BE USED ON THIS PROJECT

## ABBREVIATIONS AND DESCRIPTIONS

+4'-6"	MOUNTING HEIGHT AFF	(D)	DEDICATED	GFCI	GROUND FAULT CIRCUIT INTERRUPTER	MG	MOTOR GENERATOR UNIT	RTU	ROOF TOP UNIT	VDC	VOLTS DIRECT CURRENT
A	AMPS	DP	DISTRIBUTION PANEL	GRC	GALVANIZED RIGID CONDUIT	MH	MANHOLE	SCA	SHORT CIRCUIT CURRENT AVAILABLE	VFD	VARIABLE FREQUENCY DRIVE
AC	ALTERNATING CURRENT	(E)	EXISTING	H	PREFIX DENOTING 277/480 PANEL	MTD	MOUNTED	SRG	SIGNAL REFERENCE GRID	WHM	WATTHOUR METER
ac	ABOVE COUNTER	EC	ELECTRICAL CONTRACTOR	HP	HORSE POWER	MTS	MANUAL TRANSFER SWITCH	ST	SHUNT TRIP	WP	WEATHERPROOF
AFCI	ARC FAULT CIRCUIT INTERRUPTER	EF	EXHAUST FAN	IG	ISOLATED GROUND	N	NEUTRAL	SW	SWITCH	WR	WEATHER RESISTANT
AFF	ABOVE FINISHED FLOOR	EOL	END OF LINE RESISTOR	KV	KILOVOLT	NC	NORMALLY CLOSED	TS	TEST SWITCH	9	4WG100 NUMBER REFERS TO FEEDER SCHEDULE
AFG	ABOVE FINISHED GRADE	EM	EMERGENCY	KVA	KILO VOLT-AMPERE	NIC	NOT IN CONTRACT	TTB	TELEPHONE TERMINAL BOARD	2	AHU-1 REFERS TO EQUIPMENT SCHEDULE
AHU	AIR HANDLING UNIT	EMT	ELEC. METALLIC TUBING	KVAR	KILOVAR	NO	NORMALLY OPEN	TTC	TELEPHONE TERMINAL CABINET	9	WORK NOTE SYMBOL
AIC	AMPERE INTERRUPTING CAPACITY	EPO	EMERGENCY POWER OFF	KW	KILOWATT	PA	PREACTION SYSTEM	TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSER	1	E-5 NUMBER DESIGNATES DETAIL SHEET ON WHICH DETAIL IS LOCATED
AF	AMP FRAME	EWC	ELECTRIC WATER COOLER	L	PREFIX DENOTING 120/208V PANEL	PDU	POWER DISTRIBUTION UNIT	UC	UNDERCABINET	2	REVISION SYMBOL
AT	AMP TRIP	EX	EXPLOSION-PROOF	LV	LOW VOLTAGE	PF	POWER FACTOR	UF	UNDERFLOOR	220	ROOM NUMBER
ATS	AUTO. TRANSFER SWITCH	F	FUSE OR FIRE	M	MONITOR	Ø OR PH	PHASE	UG	UNDERGROUND	(RR)	DARK AND DASHED SYMBOLS DENOTE REMOVAL WORK
B	BATTERY	FA	FIRE ALARM	MC	MECHANICAL CONTRACTOR	PT	POTENTIAL TRANSFORMER	UPS	UNINTERRUPTIBLE POWER SUPPLY	⊙	LIGHT LINE WEIGHT SYMBOLS DENOTE EXISTING (REMOVE & RELOCATE)
BKR	BREAKER	FCU	FAN COIL UNIT	MCC	MOTOR CONTROL CENTER	PVC	POLYVINYL CHLORIDE	V	VOLTS	○	(R) (RELOCATED)
C	CONDUIT	FDR	FEEDER	MDP	MAIN DISTRIBUTION PANEL	(R)	RELOCATED	VAC	VOLTS ALTERNATING CURRENT		
CKT	CIRCUIT	FI	FILM ILLUMINATOR	MDS	MAIN DIST. SWITCHBOARD	(RR)	REMOVE & RELOCATE				
CP	CONTROL PANEL	FS	FIRE SUPPRESSION			RM	ROOM				
CT	CURRENT TRANSFORMER	G	GROUND			RT	RAINTIGHT				

## POWER / LIGHTING / ONE-LINE DIAGRAMS

SINGLE RECEPTACLE DUPLEX RECEPTACLE GROUND FAULT CIRCUIT INTERRUPTER RECEPTACLE ISOLATED GROUND RECEPTACLE DOUBLE DUPLEX RECEPTACLE SPECIAL PURPOSE OUTLET CEILING SPECIAL PURPOSE OUTLET CEILING DUPLEX RECEPTACLE JUNCTION BOX FLOOR MOUNTED JUNCTION BOX BRANCH CIRCUIT PANELBOARD MAIN DISTRIBUTION PANEL OR SWITCHBOARD	TRANSFORMER CIRCUIT BREAKER DISCONNECT W/SIZE NON-FUSED DISCONNECT SWITCH W/SIZE FUSED DISCONNECT SWITCH W/SIZE MOTOR STARTER OR CONTACTOR COMBINATION MOTOR STARTER/DISCONNECT SWITCH MOTOR CAP RACEWAY TURNED UP RACEWAY TURNED DOWN PUSH BUTTON VARIABLE FREQUENCY DRIVE	FLUORESCENT STRIP FLUORESCENT FIXTURES RECESSED FLUORESCENT FIXTURES FIXTURE(S) ON EMERGENCY CIRCUIT	SINGLE-POLE SWITCH 2 = DOUBLE-POLE SWITCH 3 = THREE-WAY SWITCH 4 = FOUR-WAY SWITCH P = SWITCH AND PILOT LIGHT K = KEY OPERATED SWITCH D = DIMMER SWITCH LOWER CASE LETTER INDICATES SWITCHING LETTER REFERS TO FIXTURE SCHEDULE ALL FIXTURES IN ROOM ARE THIS TYPE UNLESS NOTED OTHERWISE	CIRCUIT BREAKER < 600V BREAKER WITH DRAWOUT FEATURE < 600V FUSE < 600V FUSE AND SWITCH < 600V CIRCUIT BREAKER WITH GROUND FAULT PROTECTION BATTERY PAD MOUNTED TRANSFORMER GROUND GROUND ROD	AUTOMATIC TRANSFER SWITCH MANUAL TRANSFER SWITCH TRANSFORMER ENGINE-GENERATOR UNIT PANEL BOARD DESIGNATION INSIDE
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**BARNARD** **RONDINELLI**

**BCER** **Sturgeon Electric**

Western States Fire Protection Co. CONSULTING ENGINEERS

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

Revisions	Num	Description	Date

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**RECORD DRAWINGS**  
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E1.1 ELECTRICAL LEGEND

Drawing Number

# E1.1

## GENERATOR DEMAND LOAD

DESCRIPTION	kW	COMMENT
GENERATOR SIZE	<b>350.0</b>	kW RATING UP TO 3,000'
DERATE	<b>-112.0</b>	4% DERATE PER 1,000'
<b>RATING AT 11,000'</b>	<b>238.0</b>	<b>Tunnel Elevation</b>
FIRE PUMP (150Hp)	148.0	RUNNING LOAD
WEST PORTAL FIRE PROTECTION SYSTEM EQUIPMENT	6.0	FIRE PROTECTION CABINETS AND REMOTE CONTROL PANELS
PANEL EMWL1	12.0	FIRE WORKS, FIBER OPTIC DETECTION, PUMP ROOM LIGHTING AND FANS
CIRCULATING PUMPS	0.0	DO NOT RUN DURING A FIRE EVENT
<b>CALCULATED GENERATOR LOAD</b>	<b>166.0</b>	<b>69.7%</b>

## ADDITIONAL DEMAND LOAD ON DP-EV

DESCRIPTION	kW	COMMENT
EAST PORTAL FIRE PROTECTION SYSTEM EQUIPMENT	6.0	FIRE PROTECTION CABINETS AND REMOTE CONTROL PANELS
PANEL EMEL1	12.8	FIRE WORKS, FIBER OPTIC DETECTION, ETC.
<b>DEMAND LOAD</b>	<b>18.8</b>	<b>23A AT 480V, 3-PHASE</b>

## EQUIPMENT SCHEDULE

MECH. DESIGNATION	EQUIPMENT DESCRIPTION	VOLTS	PH	HP	MCA	KW	KVA	PANEL DESIGNATION	CB SIZE	FEEDER SIZE		REMARKS
FP-1	FIRE PUMP	480	3	150			149.6	FIRE PUMP CONTROLLER	1200	(3#4/0 & 1#3/0G)2" IMC.		
BES-1	BOILER EQUIPMENT SKID	480	3				66.5	EMWH1	100	(3#1 & 1#6G)1-1/2" IMC.		
P-1	HEATING CIRC. PUMP	480	3	25			28.3	POWERED FROM SKID		PRE-WIRED (BY SKID MANUFACTURER)		PACKAGED WITH SKID
P-2	HEATING CIRC. PUMP	480	3	25			28.3	POWERED FROM SKID		PRE-WIRED (BY SKID MANUFACTURER)		PACKAGED WITH SKID
P-3	BOILER CIRC. PUMP	120	1	0.5			1.0	POWERED FROM SKID		PRE-WIRED (BY SKID MANUFACTURER)		PACKAGED WITH SKID
P-4	BOILER CIRC. PUMP	120	1	0.5			1.0	POWERED FROM SKID		PRE-WIRED (BY SKID MANUFACTURER)		PACKAGED WITH SKID
B-1	BOILER CONTROL PANEL	120	1			1.2	1.2	POWERED FROM SKID		PRE-WIRED (BY SKID MANUFACTURER)		PACKAGED WITH SKID
B-2	BOILER CONTROL PANEL	120	1			1.2	1.2	POWERED FROM SKID		PRE-WIRED (BY SKID MANUFACTURER)		PACKAGED WITH SKID
TCP	HOT WATER SYSTEM CONTROL PANEL	120	1			0.9	0.9	POWERED FROM SKID		PRE-WIRED (BY SKID MANUFACTURER)		PACKAGED WITH SKID
VF-1	BOILER VENT FAN 1	208	3	2			2.8	EMWL1	20	(3#12 & 1#12G)3/4" IMC.		VFD
VF-2	BOILER VENT FAN 2	208	3	1			1.7	EMWL1	15	(3#12 & 1#12G)3/4" IMC.		VFD

## TYPICAL TUNNEL VOLTAGE DROP CALCULATION

DESCRIPTION	NOTES	FEEDER						
		AMPACITY	LOAD AMPS	LENGTH FEET	VOLTAGE	PF	VOLTAGE DROP	% DROP
(3#6 & 1#10G)3/4" IMC.	FPC-1	65	3.60	500	480	1.0	1.77	0.37
(3#6 & 1#10G)3/4" IMC.	FPC-2	65	3.00	1000	480	1.0	2.94	0.61
(3#6 & 1#10G)3/4" IMC.	FPC-3, RCP	65	3.00	1000	480	1.0	2.94	0.61
(3#6 & 1#10G)3/4" IMC.	FPC-4	65	1.80	1000	480	1.0	1.77	0.37
(2#6 & 1#10G)3/4" IMC.	FPC-5	65	1.04	1000	480	1.0	1.02	0.21
			<b>TOTAL</b>	<b>4500</b>			<b>10.44</b>	<b>2.18</b>

## FIRE PUMP VOLTAGE DROP CALCULATIONS

DESCRIPTION	NOTES	FEEDER						
		AMPACITY	LOAD AMPS	LENGTH FEET	VOLTAGE	PF	VOLTAGE DROP	% DROP
FIRE PUMP OPERATING AT 115% FLA								
(3#250KCMIL & 1#4G)2-1/2" IMC.	115% FLA OF PUMP	250	207	140	480	0.8	3.59	0.75
(3#4/0 & 1#4G)2" IMC.	115% FLA OF PUMP	225	207	10	480	0.8	0.28	0.06
			<b>TOTAL</b>	<b>150</b>			<b>3.88</b>	<b>0.81</b>
FIRE PUMP STARTING								
(3#250KCMIL & 1#4G)2-1/2" IMC.	STARTING (ACROSS-THE-LINE)	250	1080.00	140	480	0.6	18.45	3.84
(4#4/0 & 1#4G)2-1/2" IMC.	STARTING (ACROSS-THE-LINE)	225	1080.00	10	480	0.6	1.40	0.29
			<b>TOTAL</b>	<b>150</b>			<b>19.85</b>	<b>4.14</b>

## EJMT WEST PORTAL FAULT CURRENT SCHEDULE

NODE DESCRIPTION	NODE TYPE	LINE VOLTAGE	FROM	TO	XFRMR SIZE	FEEDER INFORMATION			CONDUCTOR TYPE	CONDUIT TYPE	SYM.RMS FAULT CURRENT	PER UNIT R VALUE	PER UNIT JX VALUE	X/R RATIO
						RUNS	SIZE	LENGTH						
XCEL ENERGY	UTILITY		151	0										
PAD MOUNTED XFMR	XFMR	480	0	1	2,000						45,219	0.00860	0.05250	6.10
480V SWITCHGEAR	PANEL	480	1	2		1	3200A Busduct	110	Cu	Mag.	42,591	0.01251	0.05508	4.40
250A BUSSED GUTTER	PANEL	480	2	3		1	#250KCMIL	140	Cu	Mag.	16,970	0.07814	0.11827	1.51
150A ATS		480	3	4		1	#1/0	10	Cu	Mag.	15,868	0.08856	0.12305	1.39
EMWH1	PANEL	480	4	5		1	#1/0	10	Cu	Mag.	14,881	0.09897	0.12782	1.29
FIRE PUMP CONTROLLER		480	3	6		1	#4/0	10	Cu	Mag.	16,202	0.08361	0.12270	1.47
EMWL1	XFMR	208	5	7	30.0						1,427	3.21231	2.19449	0.68

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**BARNARD EJMT TEAM**

**BARNARD**  
**RONDINELLI**  
A LIFE-CYCLE SAFETY  
**ELF**  
Western States Fire Protection Co.  
  
**Sturgeon Electric**

**EISENHOWER/JOHNSON**

**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Revisions	Date	Description

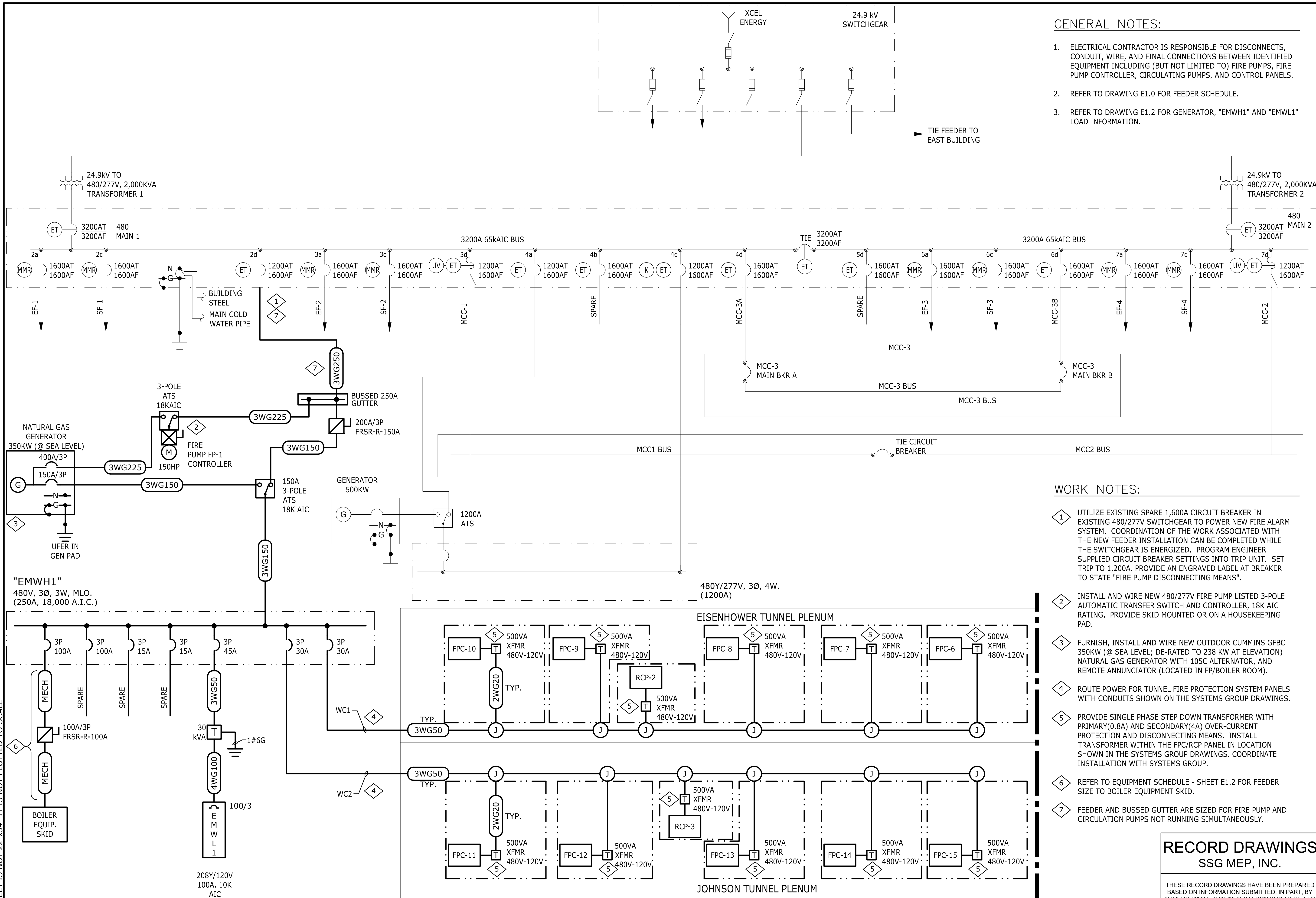
E1.2 ELECTRICAL SCHEDULES

Drawing Number

**E1.2**

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE





**GENERAL NOTES:**

1. ELECTRICAL CONTRACTOR IS RESPONSIBLE FOR DISCONNECTS, CONDUIT, WIRE, AND FINAL CONNECTIONS BETWEEN IDENTIFIED EQUIPMENT INCLUDING (BUT NOT LIMITED TO) FIRE PUMPS, FIRE PUMP CONTROLLER, CIRCULATING PUMPS, AND CONTROL PANELS.
2. REFER TO DRAWING E1.0 FOR FEEDER SCHEDULE.
3. REFER TO DRAWING E1.2 FOR GENERATOR, "EMWH1" AND "EMWL1" LOAD INFORMATION.

**WORK NOTES:**

1. UTILIZE EXISTING SPARE 1,600A CIRCUIT BREAKER IN EXISTING 480/277V SWITCHGEAR TO POWER NEW FIRE ALARM SYSTEM. COORDINATION OF THE WORK ASSOCIATED WITH THE NEW FEEDER INSTALLATION CAN BE COMPLETED WHILE THE SWITCHGEAR IS ENERGIZED. PROGRAM ENGINEER SUPPLIED CIRCUIT BREAKER SETTINGS INTO TRIP UNIT. SET TRIP TO 1,200A. PROVIDE AN ENGRAVED LABEL AT BREAKER TO STATE "FIRE PUMP DISCONNECTING MEANS".
2. INSTALL AND WIRE NEW 480/277V FIRE PUMP LISTED 3-POLE AUTOMATIC TRANSFER SWITCH AND CONTROLLER, 18K AIC RATING. PROVIDE SKID MOUNTED OR ON A HOUSEKEEPING PAD.
3. FURNISH, INSTALL AND WIRE NEW OUTDOOR CUMMINS GFBC 350KW (@ SEA LEVEL; DE-RATED TO 238 KW AT ELEVATION) NATURAL GAS GENERATOR WITH 105C ALTERNATOR, AND REMOTE ANNUNCIATOR (LOCATED IN FP/BOILER ROOM).
4. ROUTE POWER FOR TUNNEL FIRE PROTECTION SYSTEM PANELS WITH CONDUITS SHOWN ON THE SYSTEMS GROUP DRAWINGS.
5. PROVIDE SINGLE PHASE STEP DOWN TRANSFORMER WITH PRIMARY(0.8A) AND SECONDARY(4A) OVER-CURRENT PROTECTION AND DISCONNECTING MEANS. INSTALL TRANSFORMER WITHIN THE FPC/RCP PANEL IN LOCATION SHOWN IN THE SYSTEMS GROUP DRAWINGS. COORDINATE INSTALLATION WITH SYSTEMS GROUP.
6. REFER TO EQUIPMENT SCHEDULE - SHEET E1.2 FOR FEEDER SIZE TO BOILER EQUIPMENT SKID.
7. FEEDER AND BUSSED GUTTER ARE SIZED FOR FIRE PUMP AND CIRCULATION PUMPS NOT RUNNING SIMULTANEOUSLY.

**RECORD DRAWINGS**  
SSG MEP, INC.

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**1 WEST VENTILATION BLDG 480V SWITCHGEAR ONE-LINE DIAGRAM**  
SCALE:N.T.S.

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360  
 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

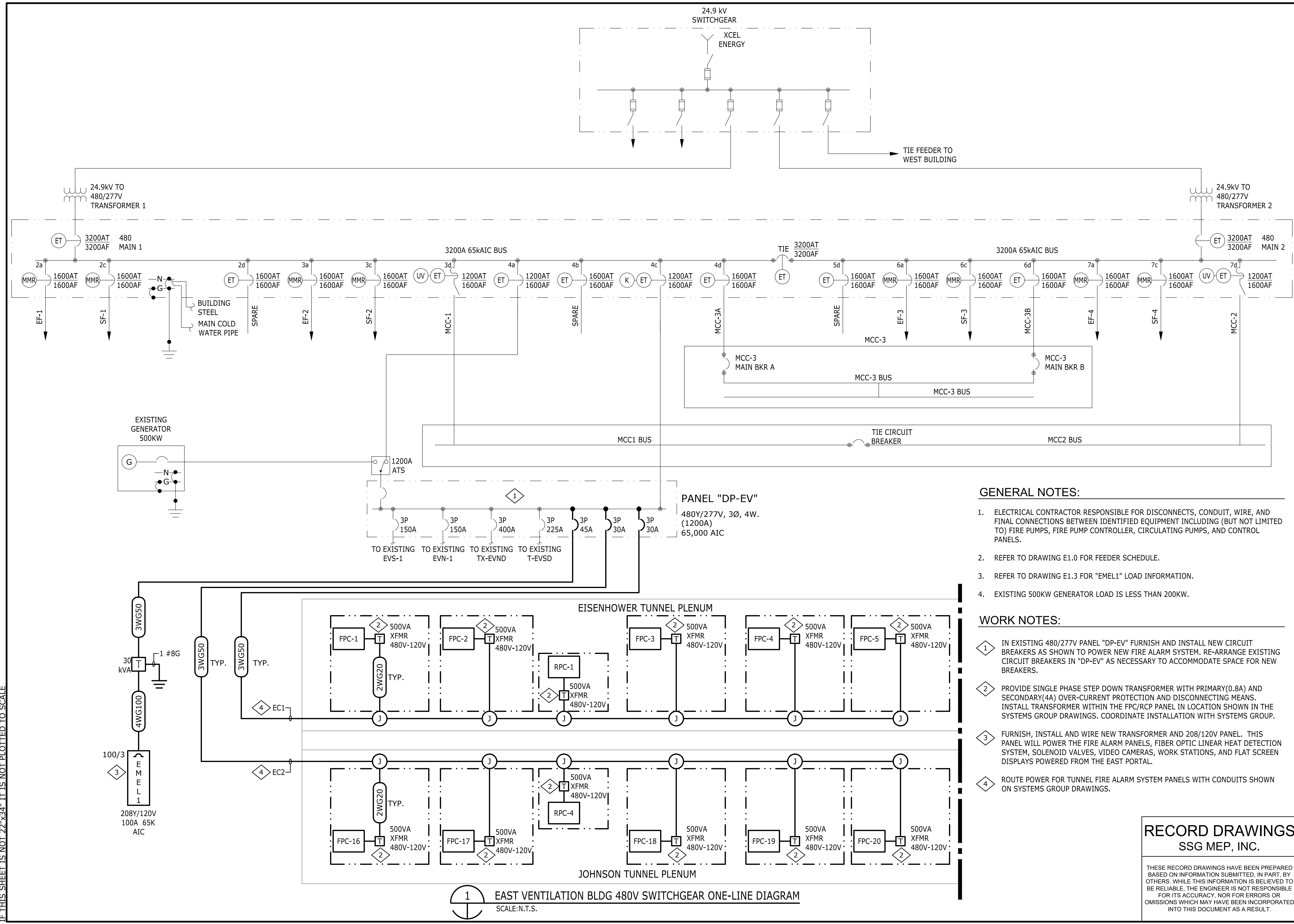
Revisions	Date

DRAWN BY: ART  
 CHECKED BY: GEP

Drawing Number  
**E2.1**

**BARNARD EJM TEAM**  
**BARNARD**  
**STURGEON ELECTRIC**  
**BCER**  
**RONDINELLI**  
 A LIFE SAFETY TEAM  
 WESTERN STATES FIRE PROTECTION CO.  
 ENGINEERS





**GENERAL NOTES:**

1. ELECTRICAL CONTRACTOR RESPONSIBLE FOR DISCONNECTS, CONDUIT, WIRE, AND FINAL CONNECTIONS BETWEEN IDENTIFIED EQUIPMENT INCLUDING (BUT NOT LIMITED TO) FIRE PUMPS, FIRE PUMP CONTROLLER, CIRCULATING PUMPS, AND CONTROL PANELS.
2. REFER TO DRAWING E1.0 FOR FEEDER SCHEDULE.
3. REFER TO DRAWING E1.3 FOR "EMEL1" LOAD INFORMATION.
4. EXISTING 500KW GENERATOR LOAD IS LESS THAN 200KW.

**WORK NOTES:**

- ① IN EXISTING 480/277V PANEL "DP-EV" FURNISH AND INSTALL NEW CIRCUIT BREAKERS AS SHOWN TO POWER NEW FIRE ALARM SYSTEM. RE-ARRANGE EXISTING CIRCUIT BREAKERS IN "DP-EV" AS NECESSARY TO ACCOMMODATE SPACE FOR NEW BREAKERS.
- ② PROVIDE SINGLE PHASE STEP DOWN TRANSFORMER WITH PRIMARY(0.8A) AND SECONDARY(4A) OVER-CURRENT PROTECTION AND DISCONNECTING MEANS. INSTALL TRANSFORMER WITHIN THE FPC/RCP PANEL IN LOCATION SHOWN IN THE SYSTEMS GROUP DRAWINGS. COORDINATE INSTALLATION WITH SYSTEMS GROUP.
- ③ FURNISH, INSTALL AND WIRE NEW TRANSFORMER AND 208/120V PANEL. THIS PANEL WILL POWER THE FIRE ALARM PANELS, FIBER OPTIC LINEAR HEAT DETECTION SYSTEM, SOLENOID VALVES, VIDEO CAMERAS, WORK STATIONS, AND FLAT SCREEN DISPLAYS POWERED FROM THE EAST PORTAL.
- ④ ROUTE POWER FOR TUNNEL FIRE ALARM SYSTEM PANELS WITH CONDUITS SHOWN ON SYSTEMS GROUP DRAWINGS.

1 EAST VENTILATION BLDG 480V SWITCHGEAR ONE-LINE DIAGRAM  
SCALE:N.T.S.

**RECORD DRAWINGS**  
 SSG MEP, INC.  
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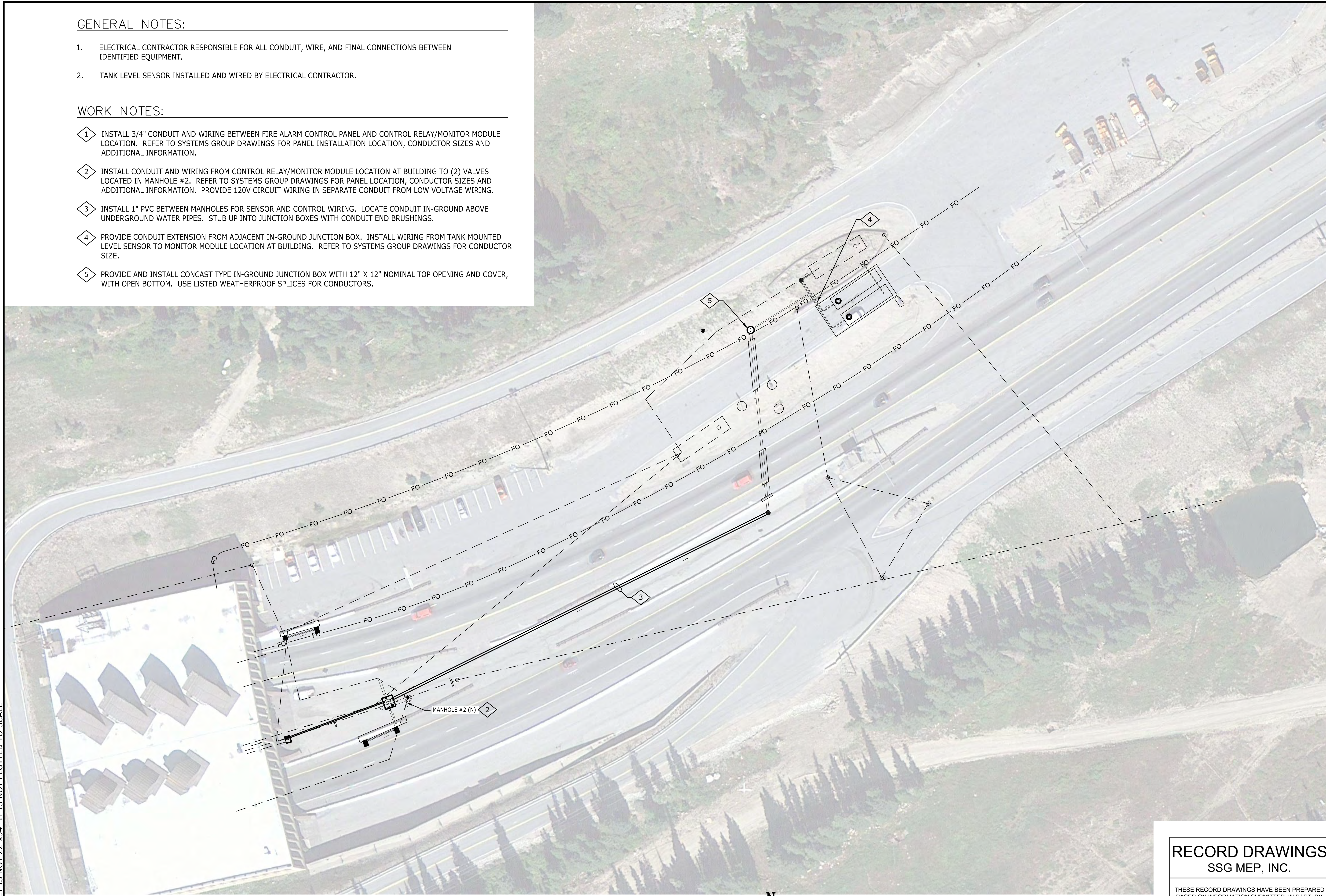
<b>BARNARD EJMT TEAM</b> <b>BARNARD</b> <b>RONDINELLI</b> <small>A LIFE SAFETY TEAM</small> <b>Sturgeon Electric</b> <small>Western States Fire Protection Co.</small> <small>ALP ENGINEERS</small>		
<b>EISENHOWER/JOHNSON</b> <b>MEMORIAL TUNNEL</b> FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT		Project No. C0703-360 Subaccount 17810 <b>RECORD DRAWINGS - 2015-11-16</b>
REVISIONS Num Description Date	DRAWN BY: ART CHECKED BY: GEP	
E2.2 EAST ELECTRICAL ONE-LINE DIAGRAM Drawing Number <h2 style="margin: 0;">E2.2</h2>		

**GENERAL NOTES:**

1. ELECTRICAL CONTRACTOR RESPONSIBLE FOR ALL CONDUIT, WIRE, AND FINAL CONNECTIONS BETWEEN IDENTIFIED EQUIPMENT.
2. TANK LEVEL SENSOR INSTALLED AND WIRED BY ELECTRICAL CONTRACTOR.

**WORK NOTES:**

1. INSTALL 3/4" CONDUIT AND WIRING BETWEEN FIRE ALARM CONTROL PANEL AND CONTROL RELAY/MONITOR MODULE LOCATION. REFER TO SYSTEMS GROUP DRAWINGS FOR PANEL INSTALLATION LOCATION, CONDUCTOR SIZES AND ADDITIONAL INFORMATION.
2. INSTALL CONDUIT AND WIRING FROM CONTROL RELAY/MONITOR MODULE LOCATION AT BUILDING TO (2) VALVES LOCATED IN MANHOLE #2. REFER TO SYSTEMS GROUP DRAWINGS FOR PANEL LOCATION, CONDUCTOR SIZES AND ADDITIONAL INFORMATION. PROVIDE 120V CIRCUIT WIRING IN SEPARATE CONDUIT FROM LOW VOLTAGE WIRING.
3. INSTALL 1" PVC BETWEEN MANHOLES FOR SENSOR AND CONTROL WIRING. LOCATE CONDUIT IN-GROUND ABOVE UNDERGROUND WATER PIPES. STUB UP INTO JUNCTION BOXES WITH CONDUIT END BRUSHINGS.
4. PROVIDE CONDUIT EXTENSION FROM ADJACENT IN-GROUND JUNCTION BOX. INSTALL WIRING FROM TANK MOUNTED LEVEL SENSOR TO MONITOR MODULE LOCATION AT BUILDING. REFER TO SYSTEMS GROUP DRAWINGS FOR CONDUCTOR SIZE.
5. PROVIDE AND INSTALL CONCAST TYPE IN-GROUND JUNCTION BOX WITH 12" X 12" NOMINAL TOP OPENING AND COVER, WITH OPEN BOTTOM. USE LISTED WEATHERPROOF SPLICES FOR CONDUCTORS.



IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**BARNARD EJMT TEAM**

**BCER**  
Engineering

**BARNARD**

**STURGEON**  
ELECTRIC

**RONDELLO**  
A LIFE CARE GROUP  
CONSULTING ENGINEERS

Western States  
Fire Protection Co.

**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT**

Project No. C0703-360  
Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

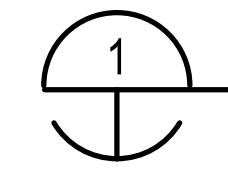
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SSG MEP, INC.**

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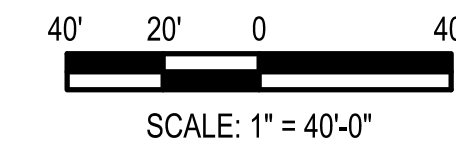
REVISIONS Num	Description	Date

ELECTRICAL SITE PLAN - EAST

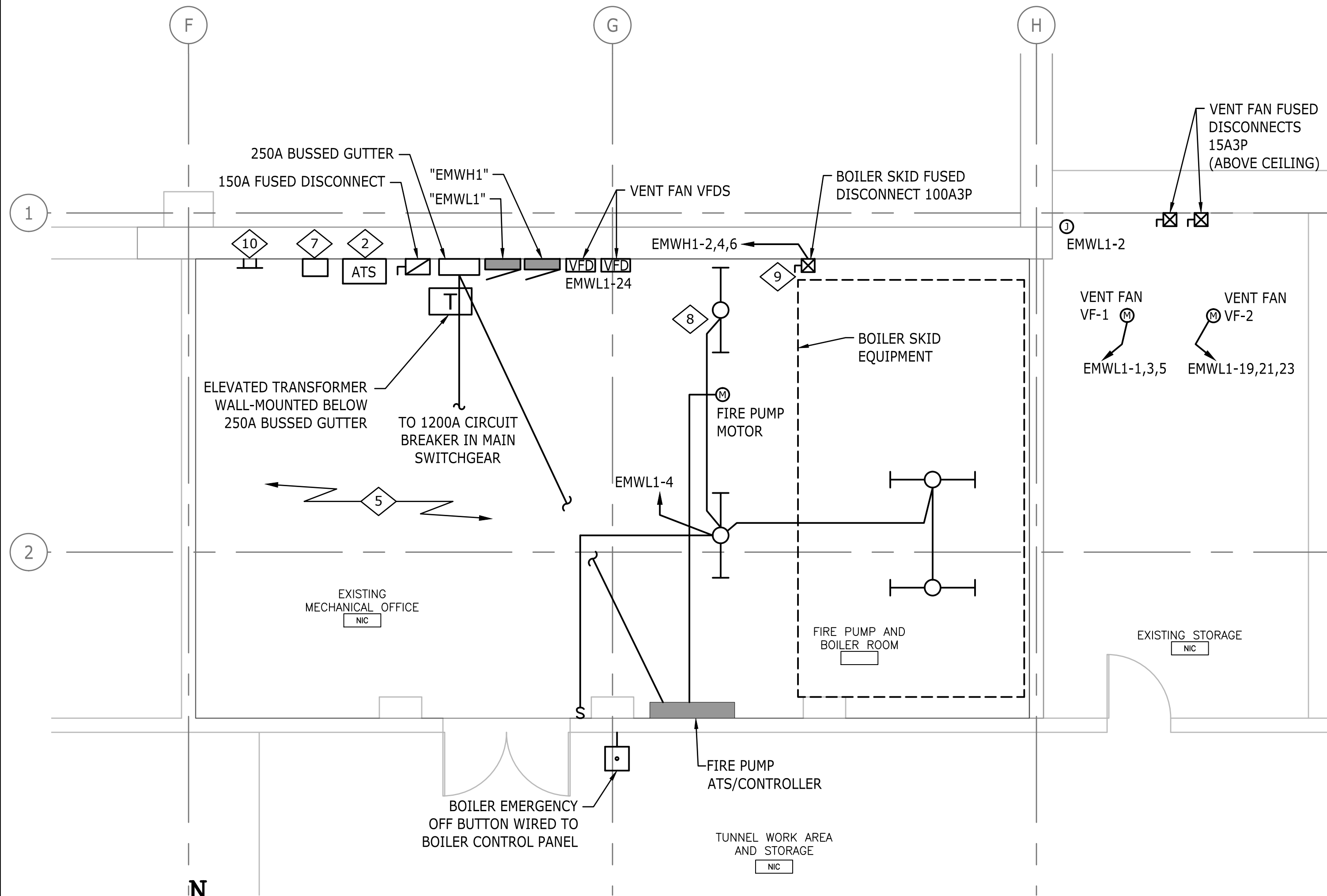
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**E3.2**



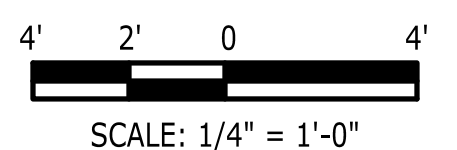
**ELECTRICAL SITE PLAN - EAST**  
SCALE: 1" = 40'-0"



IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



**1 ENLARGED ELECTRICAL PLAN**  
SCALE: 1/4" = 1'-0"

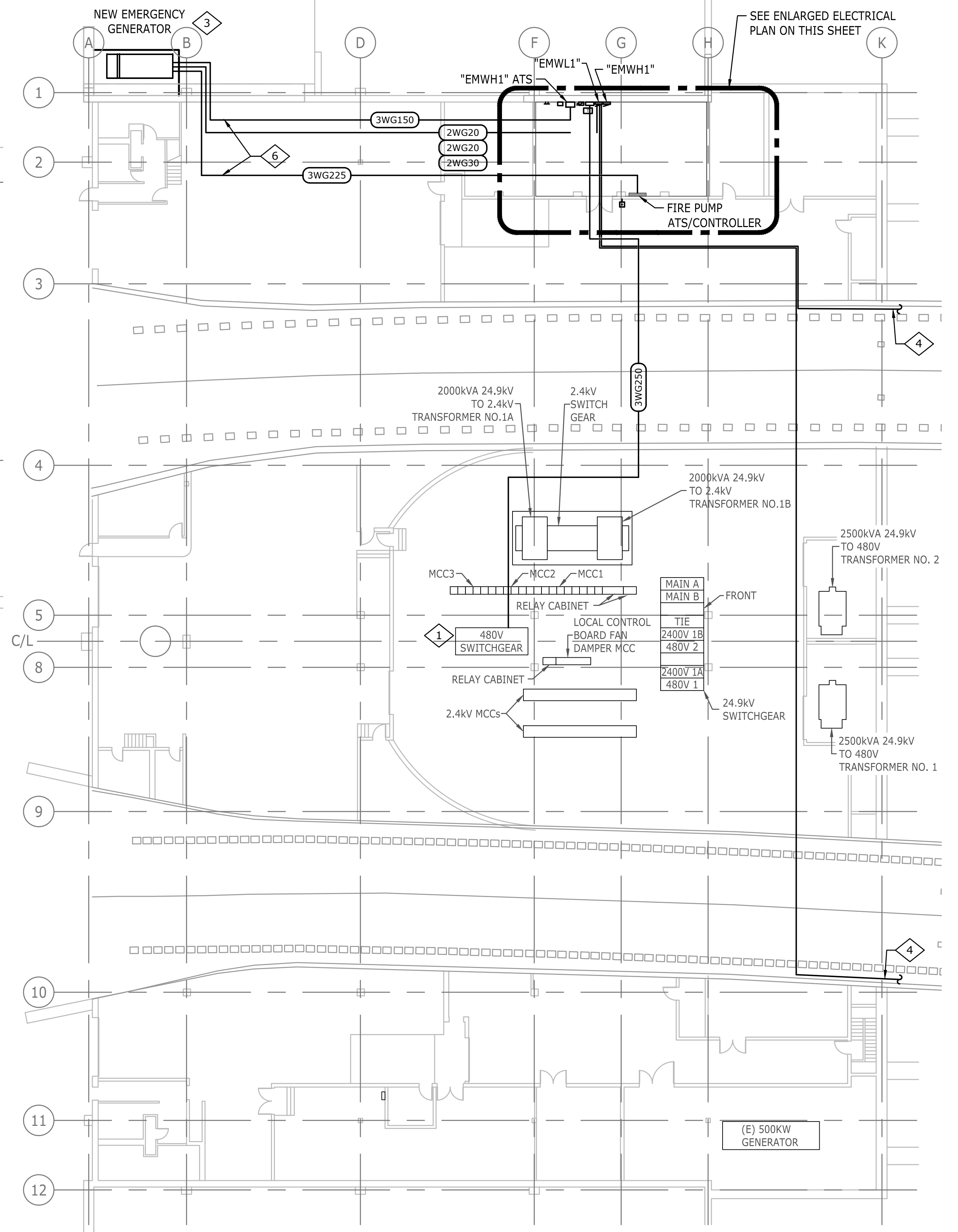


**GENERAL NOTES:**

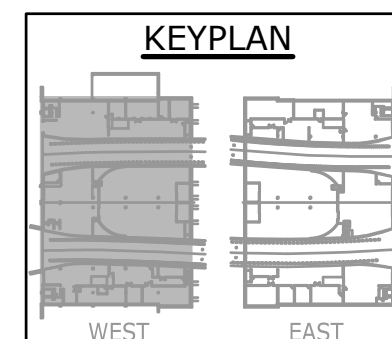
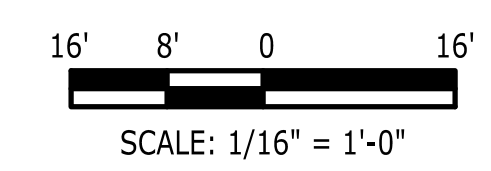
1. ELECTRICAL CONTRACTOR RESPONSIBLE FOR ALL CONDUIT, WIRE, AND FINAL CONNECTIONS BETWEEN IDENTIFIED EQUIPMENT.

**WORK NOTES:**

- 1 UTILIZE SPARE 1,600A CIRCUIT BREAKER IN EXISTING 480V MAIN SWITCHGEAR TO POWER NEW FIRE PROTECTION SYSTEM. SET TO 1,200A TRIP.
- 2 FURNISH, INSTALL, AND WIRE NEW 480/277V, 150A ONAN OTPC 3-POLE AUTOMATIC TRANSFER SWITCH. PROVIDE WALL MOUNT.
- 3 FURNISH, INSTALL AND WIRE NEW CUMMINS GFBC 350KW NATURAL GAS GENERATOR WITH ONAN OUTDOOR WEATHERPROOF ENCLOSURE. LOCATE AT NORTH OF THE BUILDING. HORIZONTAL EXHAUST SHALL EXTEND 12" (MINIMUM) BEYOND THE EXTERIOR OF WEATHERPROOF ENCLOSURE. FURNISH, INSTALL AND WIRE GENERATOR REMOTE ANNUNCIATOR PANEL.
- 4 CONDUITS TO FIRE PROTECTION CABINETS, REMOTE CONTROL PANELS, SPRINKLER VALVE CABINETS. SEE SYSTEMS GROUP DRAWINGS FOR ADDITIONAL INFORMATION.
- 5 THE EXISTING MECHANICAL OFFICE IS CURRENTLY EQUIPPED WITH (6) STRIP LIGHT CEILING FIXTURES. ELECTRICAL CONTRACTOR SHALL REMOVE ANY EXISTING FIXTURES THAT FALL WITHIN THE NEW PUMP CONTROL ROOM. INSTALL (4) OF THE EXISTING FIXTURES IN THE REMAINING MECHANICAL OFFICE SPACE. RETURN UNUSED EXISTING FIXTURES TO OWNER.
- 6 IN ADDITION TO POWER CONDUITS, ALSO PROVIDE 3/4" CONDUITS FROM GENERATOR TO FIRE PUMP AND EMWH1 ATS FOR STATUS AND CONTROL WIRING.
- 7 GENERATOR ANNUNCIATOR PANEL.
- 8 PROVIDE (4) NEW 4' PENDANT MOUNTED STRIP LIGHT FIXTURES WITH (2) LAMPS IN CROSS SECTION AND WIRE GUARD IN FIRE PUMP AND BOILER ROOM LITHONIA MODEL # Z2-32-MVOLT-GEB10IS-SQ48-WGZ48 OR APPROVED EQUAL. CONTRACTOR TO REARRANGE FIXTURES AS NEEDED, BASED ON EQUIPMENT AND PIPING LAYOUT, TO PROVIDE EVEN LIGHT DISTRIBUTION.
- 9 NEW BOILER EQUIPMENT SKID WITH SINGLE-POINT ELECTRICAL CONNECTION. REFER TO WEST ELECTRICAL ONE-LINE DIAGRAM, SHEET E2.1 FOR ADDITIONAL INFORMATION.
- 10 PROVIDE GROUND BAR FOR NEW FIRE SUPPRESSION ELECTRICAL SYSTEM GROUNDING. CONNECT #4/0 TO NEARBY COLD WATER PIPING, #4/0 TO BUILDING MAIN GROUND SYSTEM, AND #6 FOR NEW TRANSFORMER GROUND.



**2 ELECTRICAL ROADWAY LEVEL PLAN - WEST**  
SCALE: 1/16" = 1'-0"



**RECORD DRAWINGS**  
SSG MEP, INC.

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**BARNARD EJMT TEAM**

**BARNARD**  
**RONDELLO**  
 A LIFE SAFETY SYSTEMS COMPANY  
**Western States Fire Protection Co.**  
 ENGINEERS  
**Sturgeon Electric**

**EISENHOWER/JOHNSON**

**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

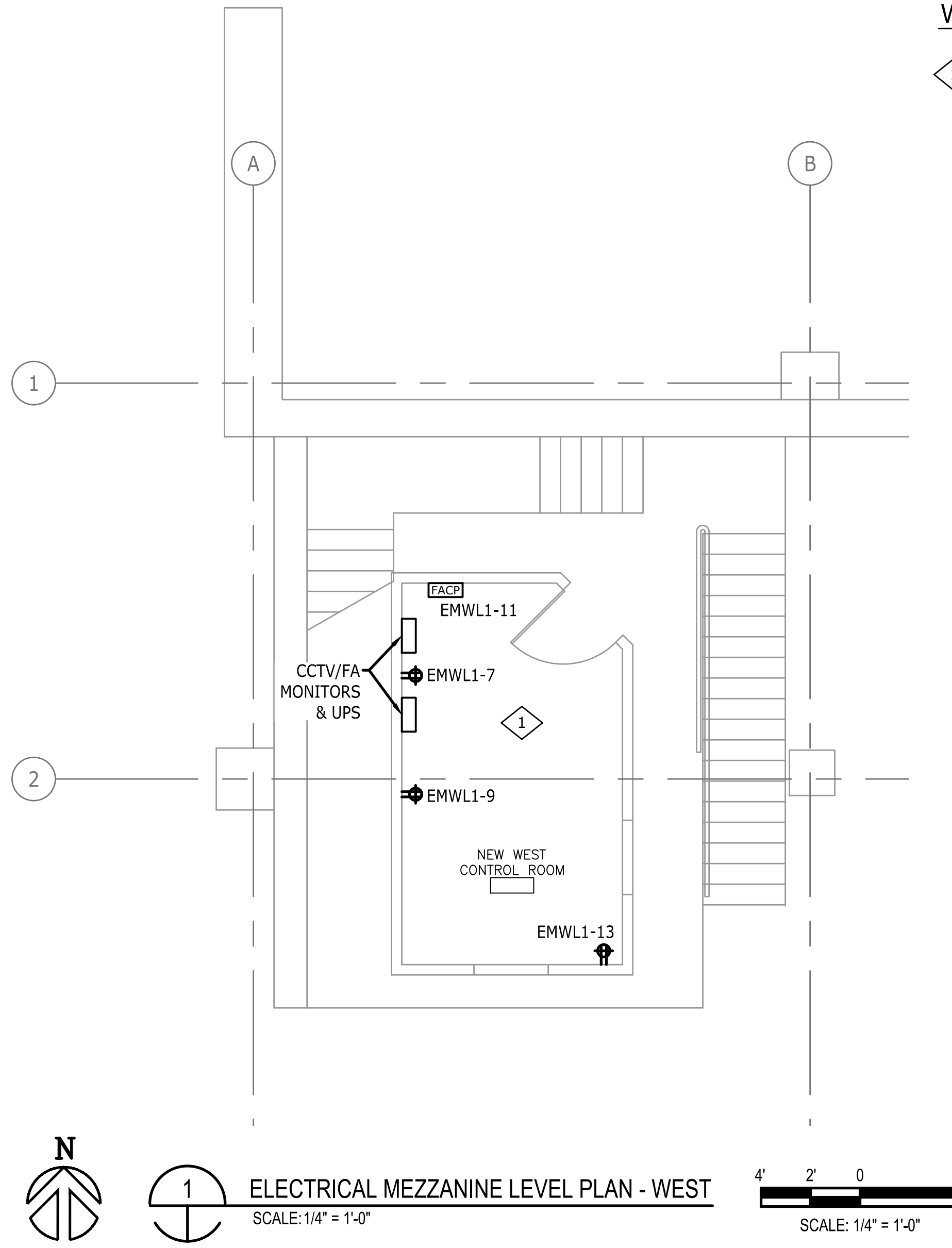
Num	Description	Date

DRAWN BY: ART      CHECKED BY: GEP

Drawing Number  
**E5.0**

XREFS=pc-1b, West Ventilation Building - Grid, West Ventilation Building - Mezzanine, x-cable-WestPanaMezzanine) Layout=ES\_1 ELECTRICAL MEZZANINE LEVEL PLAN - WEST]  
DIMSCALE=1 (linesrvjbs@91402uLWjgJmT - fixed fire suppression systemsheets ElectricalES\_1 ELECTRICAL MEZZANINE LEVEL PLAN - WEST).dwg JAN 23, 2015 12:44PM CHENDERSON

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



**GENERAL NOTES:**

- ELECTRICAL CONTRACTOR RESPONSIBLE FOR ALL CONDUIT, WIRE, AND FINAL CONNECTIONS BETWEEN IDENTIFIED EQUIPMENT.

**WORK NOTES:**

- PROVIDE (4) 120V/20A CIRCUITS FROM PANEL "EMWL1". COORDINATE EXACT REQUIREMENTS WITH FIRE ALARM CONTRACTOR PRIOR TO INSTALLATION. REFER TO PANEL "EMWL1" SHEET E1.3 AND FIRE ALARM DRAWINGS FOR ADDITIONAL INFORMATION.

**RECORD DRAWINGS  
SSG MEP, INC.**

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Num	Description	Date

ELECTRICAL MEZZANINE  
LEVEL PLAN - WEST

Drawing Number  
**E5.1**

**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

**BARNARD EJMT TEAM**

**BCER**  
Engineering

**BARNARD**

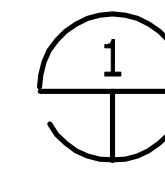
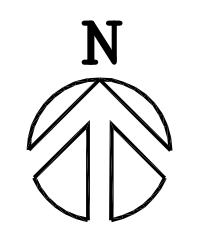
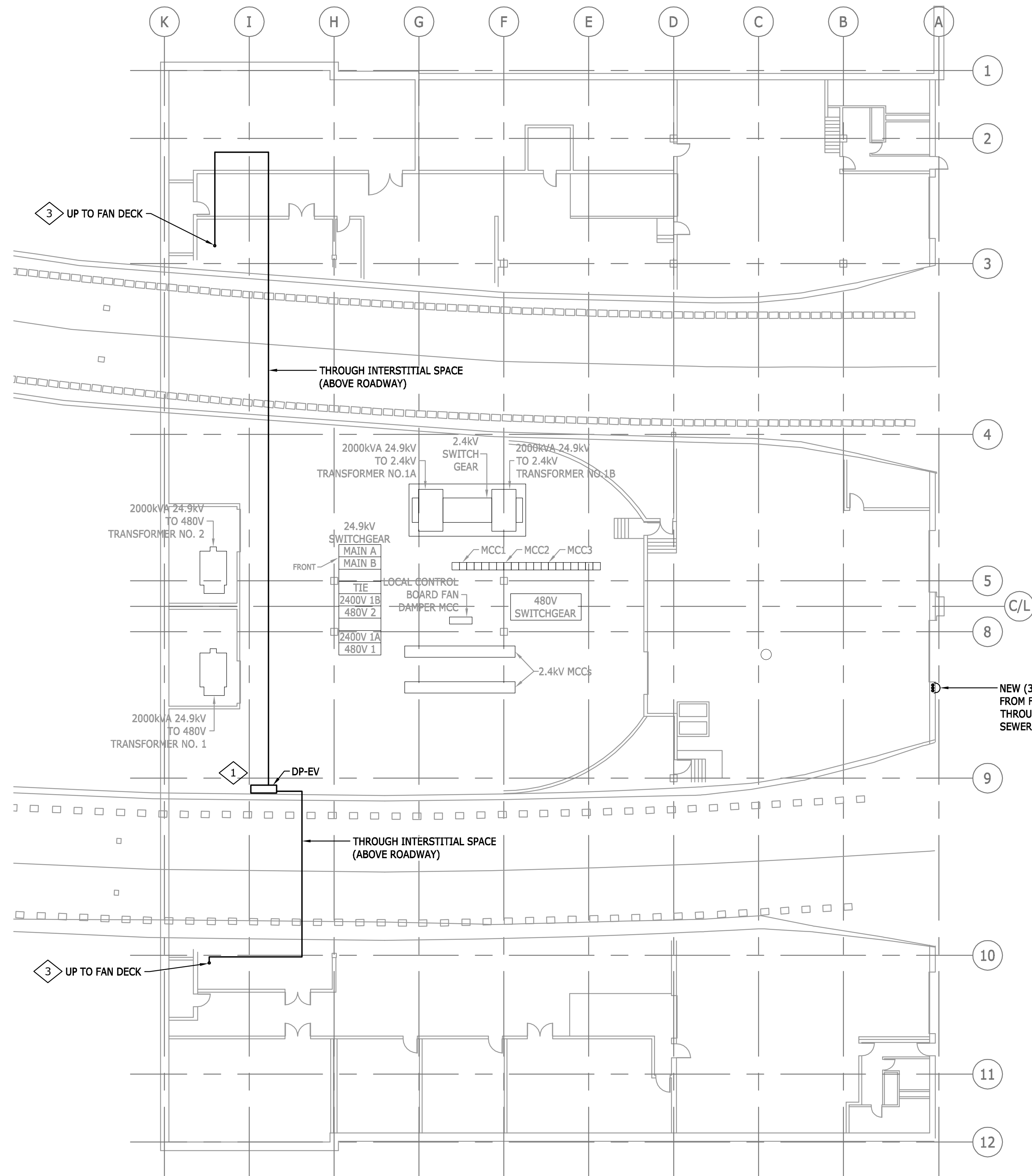
**RONDINELLI**  
A LIFE SAFETY GROUP

**ELF**  
ENGINEERS

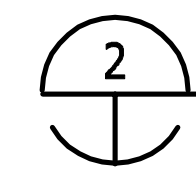
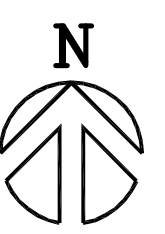
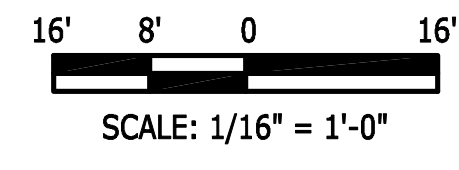
**Sturgeon ELECTRIC**

**SSG**  
Engineering

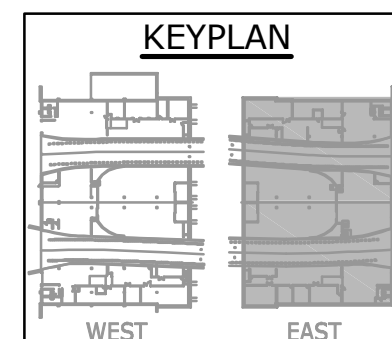
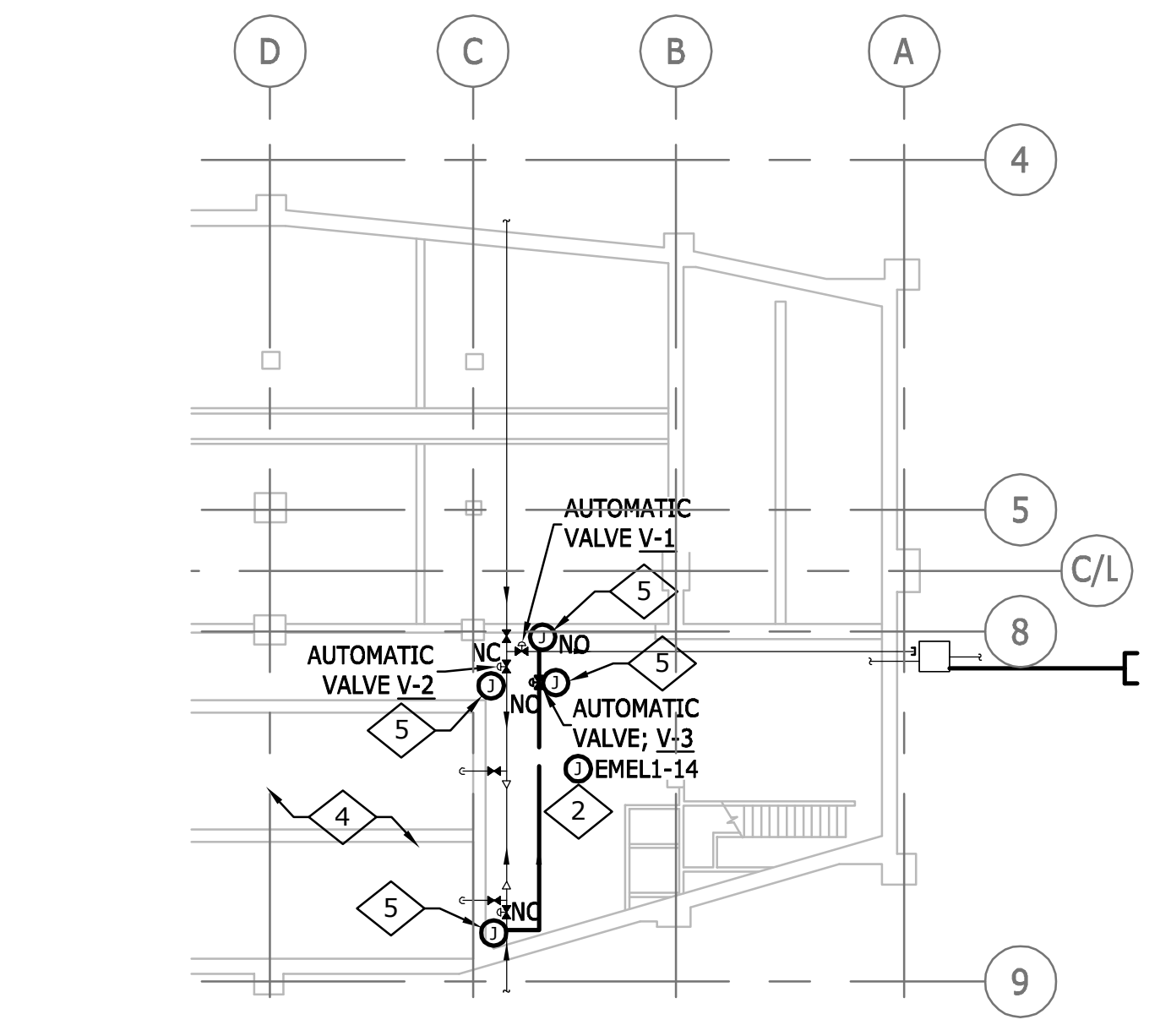
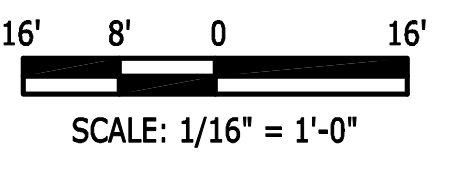
**Western States Fire Protection Co.**



**ELECTRICAL ROADWAY LEVEL PLAN - EAST**  
SCALE: 1/16" = 1'-0"



**ELECTRICAL SEWER TREATMENT PLAN - EAST**  
SCALE: 1/16" = 1'-0"



**RECORD DRAWINGS**  
**SSG MEP, INC.**

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**GENERAL NOTES:**

- 1. ELECTRICAL CONTRACTOR RESPONSIBLE FOR ALL CONDUIT, WIRE, AND FINAL CONNECTIONS BETWEEN IDENTIFIED EQUIPMENT.
- 2. AUTOMATIC VALVES FURNISHED BY BRACONIER, WIRED BY ELECTRICAL CONTRACTOR.

**WORK NOTES:**

- 1. IN EXISTING 480/277V "DP-EV" PANEL FURNISH AND INSTALL NEW CIRCUIT BREAKERS TO POWER NEW FIRE ALARM DISTRIBUTION SYSTEM. REFER TO EAST ONE-LINE DIAGRAM SHEET E2.2 AND PANEL SCHEDULES SHEET E1.3 FOR ADDITIONAL INFORMATION.
- 2. PROVIDE 120V CIRCUIT FOR CONNECTION TO DRAINAGE SYSTEM CONTROL VALVES FROM PANEL EMEL1.
- 3. CONDUITS TO FIRE PROTECTION CABINETS, REMOTE CONTROL PANELS, INSULATED VALVE ENCLOSURES. SEE SYSTEMS GROUP DRAWINGS FOR ADDITIONAL INFORMATION.
- 4. INSTALL 3/4" CONDUIT AND WIRING BETWEEN FIRE ALARM CONTROL PANEL AND CONTROL-RELAY/MONITOR MODULE PANEL. REFER TO SYSTEMS GROUP DRAWINGS FOR PANEL INSTALLATION LOCATION, CONDUCTOR SIZES AND ADDITIONAL INFORMATION.
- 5. INSTALL 3/4" CONDUIT AND WIRING FROM VALVE TO CONTROL-RELAY/MONITOR MODULE PANEL. REFER TO SYSTEMS GROUP DRAWINGS FOR CONDUCTOR SIZES AND ADDITIONAL INFORMATION.

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Subaccount 17810  
Project No. C0703-360

**BARNARD EJMT TEAM**

Logos for **BCER**, **BARNARD**, **STURGEON ELECTRIC**, **RONDELINI**, and **ELF**.

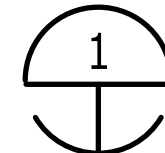
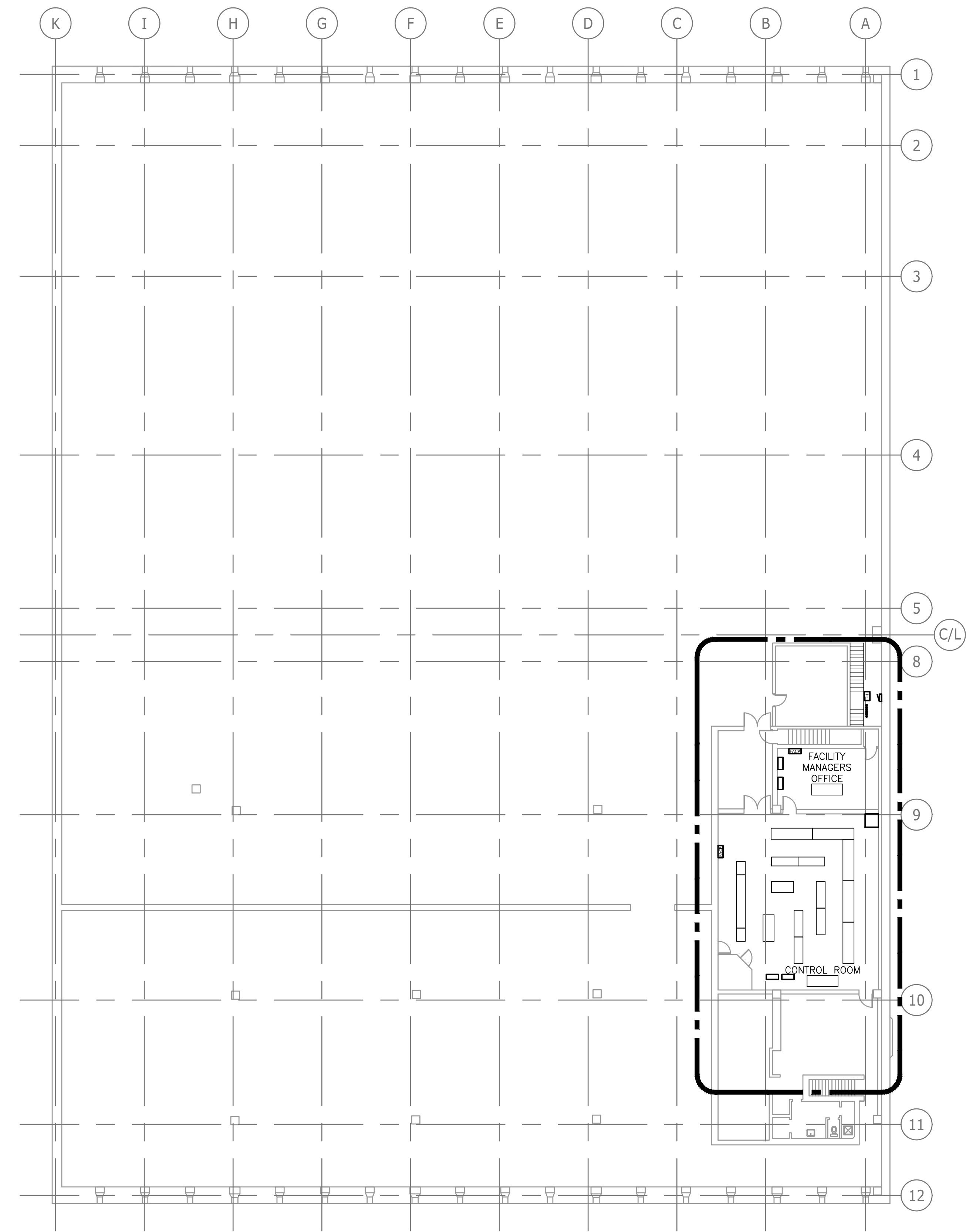
**RECORD DRAWINGS - 2015-11-16**

Revisions	Date
Num	Description

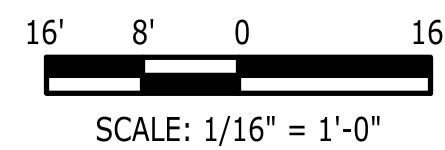
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ELECTRICAL ROADWAY LEVEL PLAN - EAST
Drawing Number
<b>E6.0</b>

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



**ELECTRICAL FAN LEVEL PLAN - EAST**  
SCALE: 1/16" = 1'-0"

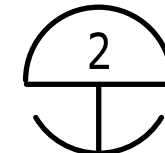
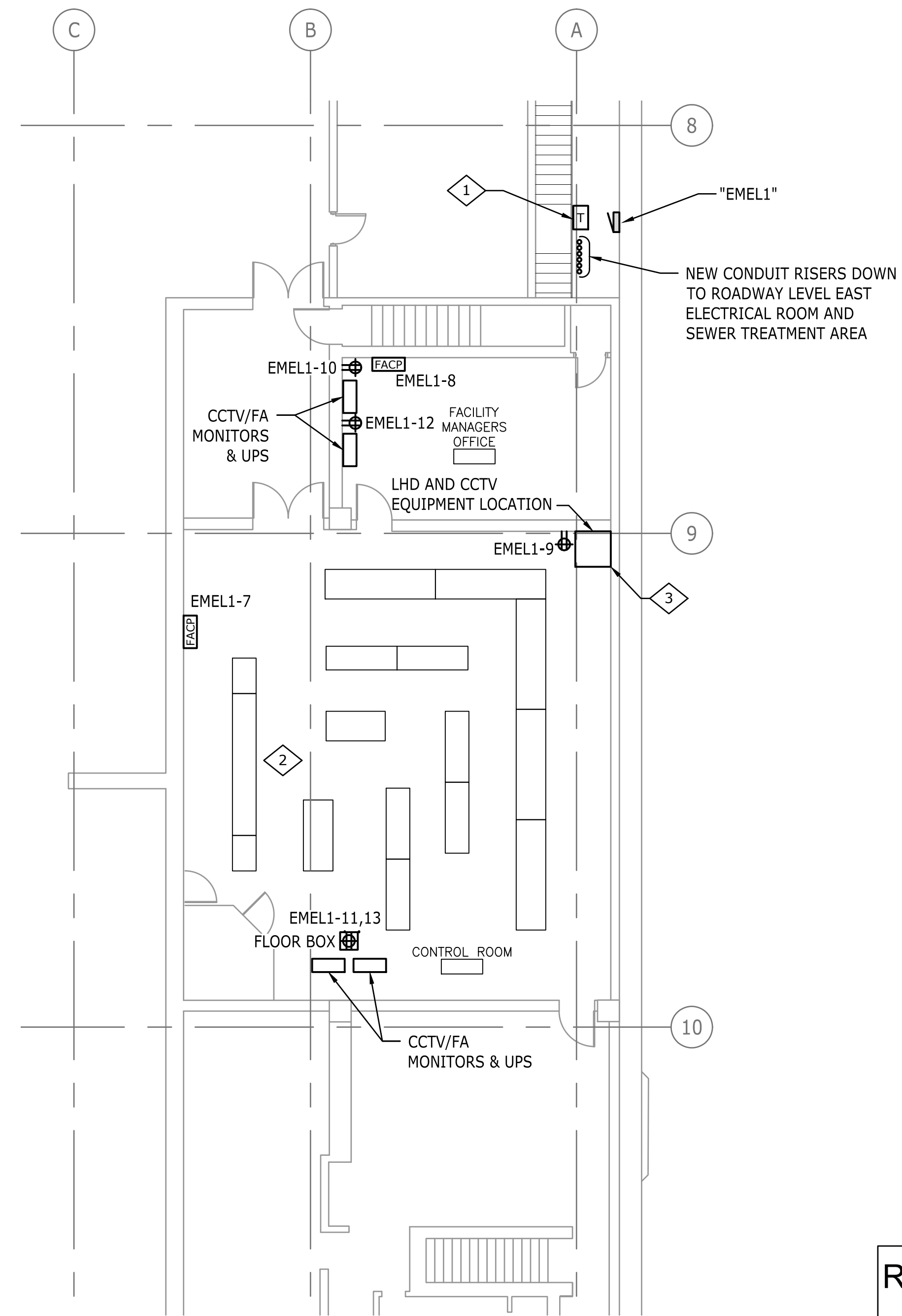


**GENERAL NOTES:**

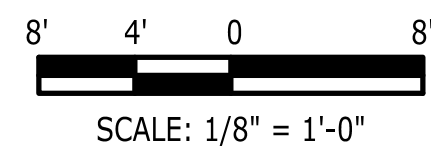
1. ELECTRICAL CONTRACTOR RESPONSIBLE FOR ALL CONDUIT, WIRE, AND FINAL CONNECTIONS BETWEEN IDENTIFIED EQUIPMENT.

**WORK NOTES:**

- 1 INSTALL NEW TRANSFORMER AND PANEL. LOCATION TO BE FIELD LOCATED.
- 2 PROVIDE BRANCH CIRCUIT WIRING BETWEEN PANEL AND FIRE ALARM PANEL, EQUIPMENT RACK, FIREWORKS COMPUTER, FLAT SCREEN, AND FIRE ALARM PANEL LOCATED IN THIS AREA. VERIFY REQUIREMENTS WITH SYSTEMS GROUP DRAWINGS PRIOR TO ROUGH IN.
- 3 LHD AND CCTV EQUIPMENT CABINET IS MOVABLE. MAKE ALL POWER AND LOW VOLTAGE CONNECTIONS TO ALLOW CABINET MOVEMENT OF 24". CONFIRM LOCATION WITH CDOT BEFORE MAKING FINAL CONNECTIONS.



**ENLARGED ELECTRICAL FAN LEVEL PLAN - EAST**  
SCALE: 1/8" = 1'-0"



**RECORD DRAWINGS**  
SSG MEP, INC.

THESE RECORD DRAWINGS HAVE BEEN PREPARED BASED ON INFORMATION SUBMITTED, IN PART, BY OTHERS. WHILE THIS INFORMATION IS BELIEVED TO BE RELIABLE, THE ENGINEER IS NOT RESPONSIBLE FOR ITS ACCURACY, NOR FOR ERRORS OR OMISSIONS WHICH MAY HAVE BEEN INCORPORATED INTO THIS DOCUMENT AS A RESULT.

Revisions	Date
Num	Description

ELECTRICAL FAN LEVEL PLAN - EAST

Drawing Number

**E6.1**

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

**BARNARD EJMT TEAM**

**BCER** **BARNARD** **BARNARD** **RONDINELLI**

**Sturgeon Electric** **Western States Fire Protection Co.** **ALF Consulting Engineers**







**3.12 CONDUIT**

**A. ALL WIRING FOR SYSTEMS OPERATING OVER 50 VOLTS SHALL BE INSTALLED IN CONDUIT. CONDUIT SHALL BE OF SIZE REQUIRED BY NEC OR LARGER AS INDICATED ON DRAWINGS, AND SHALL BE INSTALLED ACCORDING TO THE NEC. BENDS SHALL BE MADE WITH AN APPROVED HICKEY OR CONDUIT BENDING MACHINE. FACTORY BENDS OVER 1-1/4 INCHES ARE APPROVED.**

**B. EXPOSED CONDUIT SHALL NOT BE INSTALLED IN FINISHED AREAS UNLESS PRIOR APPROVED BY ARCHITECT. EXPOSED CONDUIT MAY BE INSTALLED IN EQUIPMENT ROOMS AND AT SURFACE MOUNTED EQUIPMENT. ALL EXPOSED CONDUIT SHALL BE RUN AT RIGHT ANGLES AND PARALLEL TO THE BUILDING LINES.**

**C. ALL UNDERGROUND CONDUIT SHALL BE INSTALLED AT A MINIMUM OF 30 INCHES BELOW FINISHED GRADE. CONDUITS INSTALLED BELOW CONCRETE SLABS SHALL BE A MINIMUM OF 12 INCHES BELOW SLAB. ALL UNDERGROUND CONDUITS SHALL BE INSTALLED IN SELECT BACKFILL.**

**D. USE APPROVED TYPE COUPLINGS AND CONNECTORS IN ALL CONDUIT RUNS, AND MAKE ALL JOINTS TIGHT. PROVIDE PREMIUM QUALITY COMPRESSION TYPE COUPLINGS. PROVIDE INSULATED BUSHINGS FOR ALL TERMINATIONS IN PIPE SIZES 1-1/4 INCHES AND LARGER. PROVIDE WEATHERPROOF FITTINGS FOR RUNS EXPOSED TO WEATHER AND HIGH HUMIDITY, AND CONCRETE TIGHT FITTINGS FOR CONDUITS INSTALLED IN CONCRETE SLABS. PROVIDE SEAL-OFF FITTINGS WHERE CONDUITS ENTER OR LEAVE HAZARDOUS AREAS OR AREAS OF WIDELY DIFFERENT TEMPERATURE AND/OR HUMIDITY.**

**E. PRIOR TO PULLING OF CONDUCTORS, CONDUITS SHALL BE CLEANED OF ALL FOREIGN MATTER. PROVIDE 200 POUND TEST NYLON PULL-LINES IN ALL CONDUITS INTENDED FOR FUTURE USE.**

**F. PROVIDE CONDUIT WITH APPROPRIATE FITTINGS INSTALLED AS REQUIRED PER THE FOLLOWING CRITERIA:**

- BELOW GRADE IN EARTH: USE PVC OR PVC COATED RIGID STEEL CONDUIT. GRC IS REQUIRED WHERE UNDERGROUND OR UNDERSLAB CONDUITS PENETRATE A CONCRETE SLAB OR FOUNDATION WALL.**
- ABOVE GRADE, EXTERIOR (EXCEPT ROOFS): USE IMC WITH WEATHERPROOF FITTINGS.**
- ABOVE GRADE, INTERIOR:**
  - IN ALL LOCATIONS SUBJECT TO DAMAGE: USE IMC.**

**G. USE PVC COATED OR BITUMINOUS COATED GALVANIZED RIGID METAL ELBOWS FOR STUB UPS AND 90° BENDS IN UNDERGROUND CONDUITS AND FOR ALL RISERS TO GRADE AND ENTRY FROM BUILDING EXTERIOR.**

**3.13 WIRING**

**A. NO WIRE SHALL BE INSTALLED PRIOR TO COMPLETION OF WORK WHICH MIGHT CAUSE DAMAGE TO CONDUCTORS. ALL SERVICE CONDUCTORS, FEEDERS, AND BRANCH CIRCUITS SHALL BE COLOR CODED IN ACCORDANCE WITH ARTICLE 210-5 OF THE NEC. COLOR CODING SHALL BE VIA COLORED INSULATION OR TAPE AT ALL TERMINATION LOCATIONS. WIRING FOR SPECIAL SYSTEMS SUCH AS MECHANICAL EQUIPMENT, ETC., SHALL BE IN ACCORDANCE WITH MANUFACTURERS WIRING DIAGRAMS FURNISHED.**

**B. WIRING SHALL BE CONTINUOUS FROM OUTLET TO OUTLET OR JUNCTION BOX. SPLICES SHALL BE HELD TO A MINIMUM, AND SHALL BE MADE ONLY AT READILY ACCESSIBLE PULL BOX, JUNCTION BOX, OR OUTLET BOX. THE INSULATION VALUE OF THE JOINT SHALL EQUAL THAT OF THE CONDUCTOR. SPLICES AND CONNECTION SHALL BE MADE BY TWISTING TIGHT AND INSTALLING INSULATED PRESSURE OR WIRE NUT CONNECTORS FOR #10 AWG AND SMALLER, AND WITH STEEL CRIMP-ON SLEEVES AND OVERALL NYLON INSULATOR FOR #8 AWG AND LARGER.**

**C. COLOR CODE ALL CONDUCTORS. WIRE SIZES #6 AWG AND LARGER THAT HAVE BLACK INSULATION COLOR-CODED ELECTRICAL TAPE, SHALL HAVE TAPE APPLIED AT ALL JUNCTION, SPLICE, PULL, OR TERMINATION POINTS. COLOR TAPE SHALL BE APPLIED TO AT LEAST 6 INCHES OF THE CONDUCTOR.**

**D. COLOR CODE WIRES AS FOLLOWS:**

208/120 VOLTS  
PHASES: A-BLACK, B-RED, C-BLUE  
NEUTRAL-WHITE, GROUND-GREEN

480/277 VOLTS  
PHASES: A-BROWN, B-ORANGE, C-YELLOW  
NEUTRAL-GRAY, GROUND-GREEN

**E. ALL BRANCH CIRCUITS FOR 120 VOLT POWER SYSTEMS SHALL HAVE DEDICATED NEUTRAL WIRES FOR EACH CIRCUIT. NO SHARED NEUTRAL WIRES ARE ALLOWED.**

**3.14 GROUNDING**

**A. PROVIDE GROUNDING ELECTRODE CONDUCTOR AT GENERATOR PAD SIZED IN ACCORDANCE WITH THE DRAWINGS :**

- A MINIMUM OF 20 INCHES OF #2 AWG BARE SOLID COPPER CONDUCTOR LOCATED NEAR THE BOTTOM OF THE CONCRETE FOUNDATION OR FOOTING THAT IS IN DIRECT CONTACT WITH EARTH. ELECTRODE SHALL BE CADWELDED, OR EQUAL, TO ALL VERTICAL REINFORCING BARS, AND SHALL BE ENCASED BY AT LEAST 2 INCHES OF CONCRETE. (UFFER GROUND)**

**B. ALL ELECTRICAL NEUTRALS, RACEWAYS, AND NON-CURRENT CARRYING PARTS OF ELECTRICAL EQUIPMENT AND ASSOCIATED ENCLOSURES SHALL BE GROUNDED IN ACCORDANCE WITH NEC ARTICLE 250. AN IDENTIFIED GROUNDING CONDUCTOR SHALL BE INSTALLED IN ALL METALLIC OR PVC CONDUITS. CONNECT GROUND WIRE TO THE GROUND TERMINAL OF ALL DEVICES.**

**3.15 OUTLET BOXES**

**A. BOXES SHALL BE SUITABLE FOR REQUIREMENTS OF EACH OUTLET AND OF SUCH DIMENSIONS AS WILL FIT STRUCTURAL CONDITIONS. BOXES SHALL BE INSTALLED IN RIGID MANNER.**

**B. PROVIDE SINGLE GANG (OR AS REQUIRED FOR OUTLET) PLASTER OR TILE RINGS FOR ALL FLUSH OUTLETS INSTALLED AT FINISHED WALL AND CEILING SURFACES (TILE, GYPSUM BOARD, PLASTER, ETC.).**

**3.16 WIRING DEVICES**

**A. WALL SWITCH OUTLETS SHOWN AT DOOR LOCATIONS SHALL BE INSTALLED ON LATCH SIDE OF DOOR WITHIN 12" OF THE DOOR FRAME WHERE PERMISSIBLE. WALL SWITCH OUTLETS SHOWN AT DOOR LOCATIONS ON THE SWING SIDE OF THE DOOR SHALL BE MOUNTED SUCH THAT THE SWING OF THE DOOR DOES NOT OBSTRUCT THE SWITCH AND WITHIN 12" OF THE OUTSIDE SWING RADIUS. ALL DEVICES SHALL BE MOUNTED VERTICALLY**

**B. INSTALL COVERPLATES FOR ALL OUTLETS.**

**3.17 LIGHTING**

**A. ALL LUMINAIRES AND EQUIPMENT AS INDICATED ON THE DRAWINGS AND AS DESCRIBED HEREIN SHALL BE FURNISHED AND INSTALLED. ALL LUMINAIRES SHALL BEAR THE UL SEAL OF APPROVAL.**

**B. ALL LUMINAIRES SHALL BE SECURELY SUPPORTED AND ALL OUTLETS SHALL BE SECURELY ANCHORED. FURNISH ALL SUPPORTS NECESSARY FOR INSTALLATION INCLUDING STRUCTURAL MEMBERS WHERE REQUIRED.**

**C. FOR ALL NEW AND EXISTING FLUORESCENT LUMINARIES USING DOUBLE-ENDED LAMPS (EXCLUDING EMERGENCY LUMINAIRES), PROVIDE AND/OR INSTALL A DISCONNECT KIT, WITHIN THE LUMINAIRE, THAT BREAKS BOTH THE HOT AND NEUTRAL SUPPLY CONDUCTORS PER NEC 410.103(G).**

**3.18 BRANCH CIRCUIT PANELS**

**A. UPDATE THE PANEL DIRECTORY AT THE COMPLETION OF THE PROJECT BY PROPERLY IDENTIFYING EACH CIRCUIT. INSTALL PANELS UP 6 FOOT, 7 INCHES TO TOP OF TRIM OR AS DIRECTED BY ENGINEER. MOUNT PANELS A MINIMUM OF 24" ABOVE FINISHED FLOOR**

**3.19 WIRING FOR MECHANICAL EQUIPMENT**

**A. FURNISH AND INSTALL CIRCUITS, FEEDERS, DISCONNECT SWITCHES, OUTLETS AND MAKE ALL CONNECTIONS TO MOTORS AND/OR CONTROLS FOR HEATING, VENTILATING, AIR CONDITIONING, AND PLUMBING EQUIPMENT AS CALLED FOR IN THE DRAWINGS AND SPECIFICATIONS.**

**B. FLEXIBLE CONDUIT SHALL BE USED FOR CONNECTIONS TO MOTORS AND/OR OTHER EQUIPMENT WHERE VIBRATION IS ENCOUNTERED AND/OR AS CALLED FOR ON THE DRAWINGS. EVERY EFFORT SHALL BE MADE TO MAINTAIN A MAXIMUM FLEXIBLE CONDUIT LENGTH OF 3 FEET.**

**C. INSTALL AND CONNECT ALL MAGNETIC STARTERS AND LINE VOLTAGE CONTROLLERS, PUSHBUTTON STATIONS, THERMOSTATS, ETC., FURNISHED BY OTHERS. LOCATE AS DIRECTED BY MECHANICAL CONTRACTOR. REFER TO MECHANICAL DRAWINGS AND SPECIFICATIONS FOR ALL POWER AND CONTROL OUTLETS AND REQUIRED WIRING.**

**D. LINE VOLTAGE CONTROL WIRING, INCLUDING INTERLOCKS WITH OTHER MECHANICAL EQUIPMENT, SHALL BE BY CONTRACTOR, AT THE DIRECTION OF AND UNDER THE SUPERVISION OF THE MECHANICAL CONTRACTOR.**

**3.20 REMODEL WORK**

**A. ALL WIRING RUNS IN EXISTING AREAS ARE TO BE KEPT CONCEALED AS MUCH AS POSSIBLE. WHERE IMPOSSIBLE, RUN SURFACE RACEWAY AS NECESSARY ON EXISTING SURFACES AS APPROVED BY THE ARCHITECT. ALL EXPOSED RACEWAYS IN FINISHED AREAS SHALL BE PAINTED AS DIRECTED BY THE ARCHITECT.**

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**RECORD DRAWINGS**  
**SSG MEP, INC.**

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Revisions																					
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ELECTRICAL SPECIFICATIONS																					
Drawing Number																					
<b>E7.2</b>																					

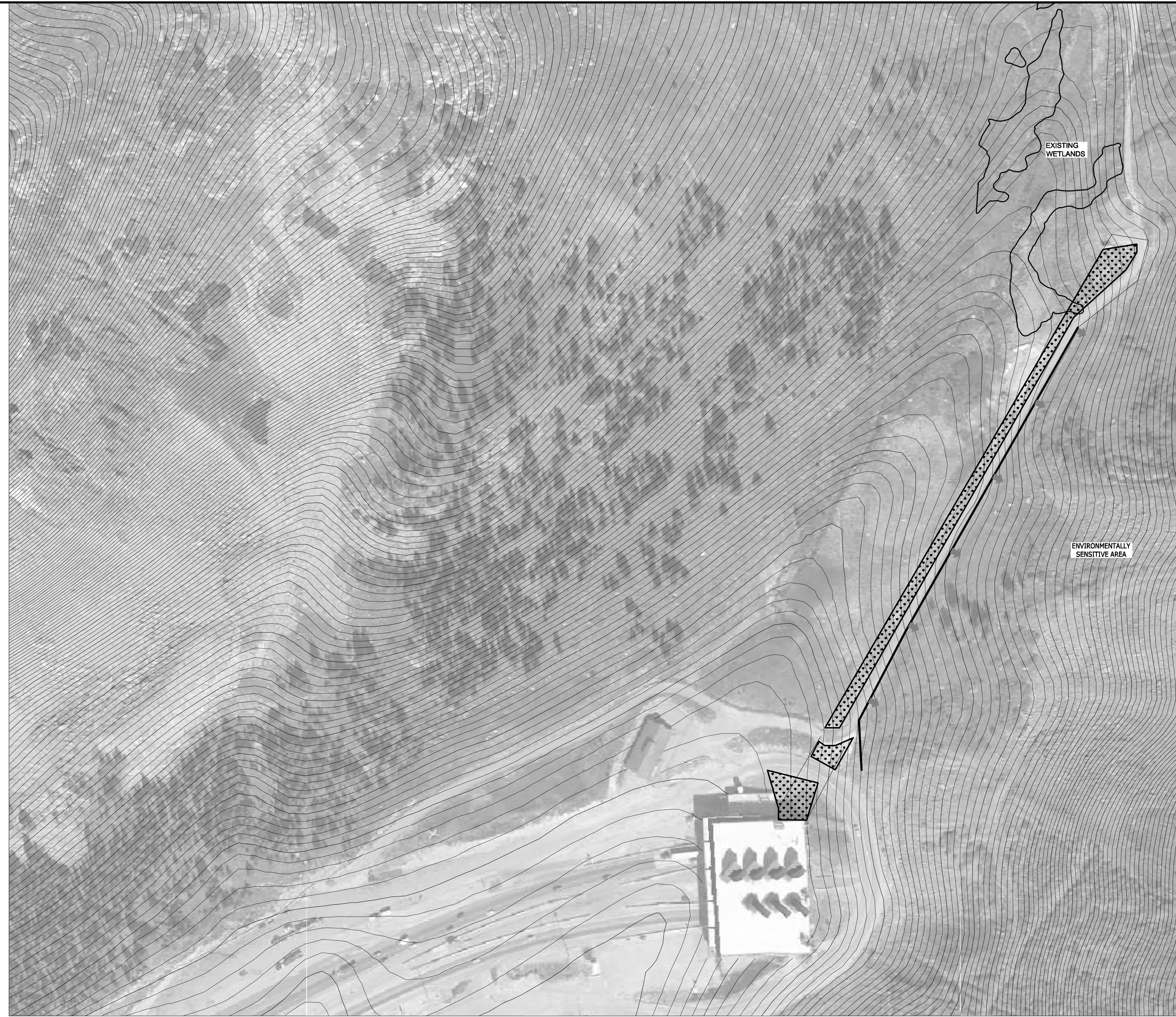
**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
**FIXED FIRE SUPPRESSION SYSTEM**  
**DESIGN BUILD PROJECT**

Project No. C0703-360  
Subaccount 17810

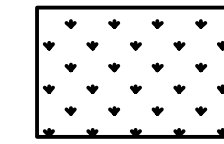
**RECORD DRAWINGS - 2015-11-16**

BARNARD EJMT TEAM

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### LEGEND



RESTORED VEGETATION

THE FOLLOWING APPROVED USFS SEED MIX SHALL BE USED FOR RESEEDING:

SPECIES	PLS lbs./acre
ROCKY MOUNTAIN FESCUE (FESTUCA SAXIMONTANA)	2.00
TUFTED HAIRGRASS (DESCHAMPSIA CESPITOSA)	1.50
ALPINE BLUEGRASS (POA ALPINE)	2.00
ALPINE TIMOTHY (PHLEUM ALPINUM)	1.50
WESTERN YARROW (ACHILLEA MILLEFOLIUM VAR. OCCIDENTALIS)	0.10
BLUE MOUNTAIN PENSTEMON (PENSTEMON RYDBERGII)	0.20
MOUNTAIN PHLOX (LINANTHUS GRANDIFLORAS)	0.20
ICELAND POPPY (PAPAVER NUDICAULE)	0.20
<b>TOTAL:</b>	<b>7.70</b>

INSTALL NETLESS BLANKETS ON SLOPES GREATER THAN 4H:1V.

NOTE: USFS TO PROVIDE SEED MIX WITH A MINIMUM OF ONE MONTH'S NOTICE FROM CONTRACTOR. SEED MIX INFORMATION WILL BE UPDATED ONCE THIS IS RECEIVED FROM THE USFS.

CONTACT: PAUL SEMMER, 970-262-3448, PSEMMER@FS.FED.US

RESEEDING TO TAKE PLACE AFTER SEPTEMBER 1, 2015 AND BEFORE NOVEMBER 1, 2015. CLEARING AND WORK LIMITS TO BE CONFINED TO WITHIN 20-FT OF THE TRENCHLINE.

# BARNARD EJMT TEAM

BCER  
BARNARD  
BARNARD  
EJMT TEAM

BARNARD  
EJMT TEAM

Sturgeon  
ELECTRIC

Western States  
Fire Protection Co.

RFLP  
CONSULTING  
ENGINEERS

RONDINELLI  
A TREE GROWERS LIFE SAFETY

## EISENHOWER/JOHNSON MEMORIAL TUNNEL FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT

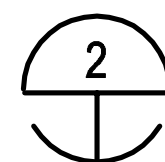
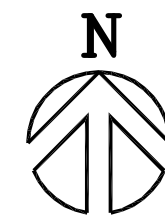
Project No. C0703-360      Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

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Num	Description

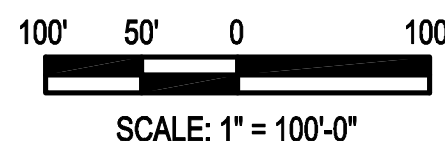
WEST PORTAL LANDSCAPE PLAN

Drawing Number

**L1.0**



WEST PORTAL LANDSCAPE PLAN  
 SCALE: 1" = 100'



IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



LEGEND	
	RESTORED VEGETATION

THE FOLLOWING APPROVED USFS SEED MIX SHALL BE USED FOR RESEEDING:

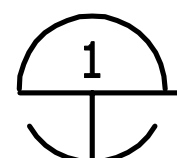
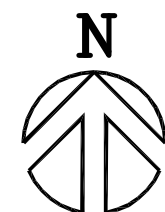
SPECIES	PLS lbs./acre
ROCKY MOUNTAIN FESCUE (FESTUCA SAXIMONTANA)	2.00
TUFTED HAIRGRASS (DESCHAMPSIA CESPITOSA)	1.50
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WESTERN YARROW (ACHILLEA MILLEFOLIUM VAR. OCCIDENTALIS)	0.10
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ICELAND POPPY (PAPAVER NUDICAULE)	0.20
<b>TOTAL:</b>	<b>7.70</b>

INSTALL NETLESS BLANKETS ON SLOPES GREATER THAN 4H:1V.

NOTE: USFS TO PROVIDE SEED MIX WITH A MINIMUM OF ONE MONTH'S NOTICE FROM CONTRACTOR. SEED MIX INFORMATION WILL BE UPDATED ONCE THIS IS RECEIVED FROM THE USFS.

CONTACT: PAUL SEMMER, 970-262-3448, PSEMMER@FS.FED.US

RESEEDING TO TAKE PLACE AFTER SEPTEMBER 1, 2015 AND BEFORE NOVEMBER 1, 2015.  
CLEARING AND WORK LIMITS TO BE CONFINED TO WITHIN 20-FT OF THE TRENCHLINE.



1 EAST PORTAL LANDSCAPE PLAN  
SCALE: 1" = 100'

100' 50' 0 100'  
SCALE: 1" = 100'-0"

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Revisions	Date
Num	Description

EAST PORTAL LANDSCAPE PLAN

Drawing Number

1.1

**BARNARD EJMT TEAM**

**BCER** **BARNARD** **BARNARD** **RONNINELLI**

Western States Fire Protection Co.

**Sturgeon Electric**

**ALF** **ALF**

Western States Fire Protection Co.

Western States Fire Protection Co.

DRAWING #	DESCRIPTION
FA0.00	FIRE ALARM: COVER PAGE
FA0.01	FIRE ALARM: LEGEND
FA0.02	FIRE ALARM: NARRATIVE
FA0.03	FIRE ALARM: SEQUENCE OF OPERATIONS PART #1
FA0.04	FIRE ALARM: SEQUENCE OF OPERATIONS PART #2
FA0.05	FIRE ALARM: SEQUENCE OF OPERATIONS DETAILS
FA0.06	FIRE ALARM: TUNNEL VENTILATION SECTOR PLAN
FA0.07	FIRE ALARM: SITE KEY PLAN
FA1.01	FIRE ALARM: SITE PLAN - EAST
FA1.02	FIRE ALARM: SITE PLAN - WEST
FA2.E01	FIRE ALARM: LOWER LEVEL EAST
FA2.E02	FIRE ALARM: ROADWAY LEVEL EAST
FA2.E03	FIRE ALARM: FAN LEVEL EAST
FA2.N01	FIRE ALARM: EISENHOWER TUNNEL FP ZONES NT-01 TO NT-05
FA2.N02	FIRE ALARM: EISENHOWER TUNNEL FP ZONES NT-06 TO NT-15
FA2.N03	FIRE ALARM: EISENHOWER TUNNEL FP ZONES NT-16 TO NT-25
FA2.N04	FIRE ALARM: EISENHOWER TUNNEL FP ZONES NT-26 TO NT-35
FA2.N05	FIRE ALARM: EISENHOWER TUNNEL FP ZONES NT-36 TO NT-45
FA2.N06	FIRE ALARM: EISENHOWER TUNNEL FP ZONES NT-46 TO NT-55
FA2.N07	FIRE ALARM: EISENHOWER TUNNEL FP ZONES NT-56 TO NT-65
FA2.N08	FIRE ALARM: EISENHOWER TUNNEL FP ZONES NT-66 TO NT-75
FA2.N09	FIRE ALARM: EISENHOWER TUNNEL FP ZONES NT-76 TO NT-85
FA2.N10	FIRE ALARM: EISENHOWER TUNNEL FP ZONES NT-86 TO NT-90
FA2.S01	FIRE ALARM: JOHNSON TUNNEL FP ZONES ST-01 TO ST-05
FA2.S02	FIRE ALARM: JOHNSON TUNNEL FP ZONES ST-06 TO ST-15
FA2.S03	FIRE ALARM: JOHNSON TUNNEL FP ZONES ST-16 TO ST-25
FA2.S04	FIRE ALARM: JOHNSON TUNNEL FP ZONES ST-26 TO ST-35
FA2.S05	FIRE ALARM: JOHNSON TUNNEL FP ZONES ST-36 TO ST-45
FA2.S06	FIRE ALARM: JOHNSON TUNNEL FP ZONES ST-46 TO ST-55
FA2.S07	FIRE ALARM: JOHNSON TUNNEL FP ZONES ST-56 TO ST-65
FA2.S08	FIRE ALARM: JOHNSON TUNNEL FP ZONES ST-66 TO ST-75
FA2.S09	FIRE ALARM: JOHNSON TUNNEL FP ZONES ST-76 TO ST-85
FA2.S10	FIRE ALARM: JOHNSON TUNNEL FP ZONES ST-86 TO ST-93
FA2.W01	FIRE ALARM: ROADWAY LEVEL WEST
FA2.W02	FIRE ALARM: ROADWAY LEVEL WEST
FA2.W03	FIRE ALARM: FAN LEVEL WEST

DRAWING #	DESCRIPTION
FA3.01	FIRE ALARM: ONE LINE DIAGRAM FIRE ALARM
FA3.02	FIRE ALARM: ONE LINE DIAGRAM CCTV
FA4.01	FIRE ALARM: E. CNTL. RM EST3 PANEL LAYOUT & CALCULATIONS
FA4.02	FIRE ALARM: W. CNTL. RM EST3 PANEL LAYOUT & CALCULATIONS
FA4.03	FIRE ALARM: MGR OFF. EST3 PANEL LAYOUT & CALCULATIONS
FA4.04	FIRE ALARM: RCP #1 EST3 PANEL LAYOUT & CALCULATIONS
FA4.05	FIRE ALARM: RCP #2 EST3 PANEL LAYOUT & CALCULATIONS
FA4.06	FIRE ALARM: RCP #3 EST3 PANEL LAYOUT & CALCULATIONS
FA4.07	FIRE ALARM: RCP #4 EST3 PANEL LAYOUT & CALCULATIONS
FA4.08	FIRE ALARM: DELUGE RELEASING & FPC HEAT LOAD CALCS
FA4.09	FIRE ALARM: FPC01 THRU FPC04 BATTERY CALCULATIONS
FA4.10	FIRE ALARM: FPC05 THRU FPC08 BATTERY CALCULATIONS
FA4.11	FIRE ALARM: FPC09 THRU FPC12 BATTERY CALCULATIONS
FA4.12	FIRE ALARM: FPC13 THRU FPC16 BATTERY CALCULATIONS
FA4.13	FIRE ALARM: FPC17 THRU FPC20 BATTERY CALCULATIONS
FA4.14	FIRE ALARM: CONDUIT FILL CALCULATIONS
FA4.15	FIRE ALARM: CONDUIT FILL CALCULATIONS
FA5.01	FIRE ALARM: FIRE PROTECTION PANEL FPC #01 WIRING DIAGRAM
FA5.02	FIRE ALARM: FIRE PROTECTION PANEL FPC #02 WIRING DIAGRAM
FA5.03	FIRE ALARM: FIRE PROTECTION PANEL FPC #03 WIRING DIAGRAM
FA5.04	FIRE ALARM: FIRE PROTECTION PANEL FPC #04 WIRING DIAGRAM
FA5.05	FIRE ALARM: FIRE PROTECTION PANEL FPC #05 WIRING DIAGRAM
FA5.06	FIRE ALARM: FIRE PROTECTION PANEL FPC #06 WIRING DIAGRAM
FA5.07	FIRE ALARM: FIRE PROTECTION PANEL FPC #07 WIRING DIAGRAM
FA5.08	FIRE ALARM: FIRE PROTECTION PANEL FPC #08 WIRING DIAGRAM
FA5.09	FIRE ALARM: FIRE PROTECTION PANEL FPC #09 WIRING DIAGRAM
FA5.10	FIRE ALARM: FIRE PROTECTION PANEL FPC #10 WIRING DIAGRAM
FA5.11	FIRE ALARM: FIRE PROTECTION PANEL FPC #11 WIRING DIAGRAM
FA5.12	FIRE ALARM: FIRE PROTECTION PANEL FPC #12 WIRING DIAGRAM
FA5.13	FIRE ALARM: FIRE PROTECTION PANEL FPC #13 WIRING DIAGRAM
FA5.14	FIRE ALARM: FIRE PROTECTION PANEL FPC #14 WIRING DIAGRAM
FA5.15	FIRE ALARM: FIRE PROTECTION PANEL FPC #15 WIRING DIAGRAM
FA5.16	FIRE ALARM: FIRE PROTECTION PANEL FPC #16 WIRING DIAGRAM
FA5.17	FIRE ALARM: FIRE PROTECTION PANEL FPC #17 WIRING DIAGRAM
FA5.18	FIRE ALARM: FIRE PROTECTION PANEL FPC #18 WIRING DIAGRAM
FA5.19	FIRE ALARM: FIRE PROTECTION PANEL FPC #19 WIRING DIAGRAM
FA5.20	FIRE ALARM: FIRE PROTECTION PANEL FPC #20 WIRING DIAGRAM
FA5.21	FIRE ALARM: IVE CABINET DETAILS
FA5.22	FIRE ALARM: FIRE PROTECTION PANEL MOUNTING DETAILS

DRAWING #	DESCRIPTION
FA6.01	FIRE ALARM: DETAILS - LINEAR HEAT HANGER
FA6.02	FIRE ALARM: DETAILS - SYSTEM SIGNAGE
FA6.03A	FIRE ALARM: DETAILS - EAST CONTROL RACK #1 - FRONT VIEW
FA6.03B	FIRE ALARM: DETAILS - EAST CONTROL RACK #1 - MID-FRONT VIEW
FA6.04A	FIRE ALARM: DETAILS - EAST CONTROL RACK #1 - REAR VIEW
FA6.04B	FIRE ALARM: DETAILS - EAST CONTROL RACK #1 - MID-REAR VIEW
FA6.05A	FIRE ALARM: DETAILS - EAST CONTROL RACK #2 - FRONT VIEW
FA6.05B	FIRE ALARM: DETAILS - EAST CONTROL RACK #2 - MID-FRONT VIEW
FA6.06A	FIRE ALARM: DETAILS - EAST CONTROL RACK #2 - REAR VIEW
FA6.06B	FIRE ALARM: DETAILS - EAST CONTROL RACK #2 - MID-REAR VIEW
FA6.07A	FIRE ALARM: DETAILS - WEST CONTROL RACK #1 - FRONT VIEW
FA6.07B	FIRE ALARM: DETAILS - WEST CONTROL RACK #1 - MID-FRONT VIEW
FA6.08A	FIRE ALARM: DETAILS - WEST CONTROL RACK #1 - REAR VIEW
FA6.08B	FIRE ALARM: DETAILS - WEST CONTROL RACK #1 - MID-REAR VIEW
FA6.09A	FIRE ALARM: DETAILS - WEST CONTROL RACK #2 - FRONT VIEW
FA6.09B	FIRE ALARM: DETAILS - WEST CONTROL RACK #2 - MID-FRONT VIEW
FA6.10A	FIRE ALARM: DETAILS - WEST CONTROL RACK #2 - REAR VIEW
FA6.10B	FIRE ALARM: DETAILS - WEST CONTROL RACK #2 - MID-REAR VIEW
FA6.11	FIRE ALARM: DEVICE WIRING DETAILS
FA6.12	FIRE ALARM: DEVICE WIRING DETAILS
FA6.13	FIRE ALARM: DEVICE WIRING DETAILS
FA6.14	FIRE ALARM: FIRE PROTECTION BRACKET HANGER DETAILS
FA6.15	FIRE ALARM: FIRE PROTECTION BRACKET HANGER DETAILS
FA6.16	FIRE ALARM: DETAILS-EAST CNTRL-RACK #1-WIRE-FRONT-TOP
FA6.17	FIRE ALARM: DETAILS-EAST CNTRL-RACK #1-WIRE-FRONT-BOTTOM
FA6.18	FIRE ALARM: DETAILS-EAST CNTRL-RACK #1-WIRE-REAR-TOP
FA6.19	FIRE ALARM: DETAILS-EAST CNTRL-RACK #1-WIRE-REAR-BOTTOM
FA6.20	FIRE ALARM: DETAILS-EAST CNTRL-RACK #2-WIRE-FRONT-TOP
FA6.21	FIRE ALARM: DETAILS-EAST CNTRL-RACK #2-WIRE-FRONT-BOTTOM
FA6.22	FIRE ALARM: DETAILS-EAST CNTRL-RACK #2-WIRE-REAR-TOP
FA6.23	FIRE ALARM: DETAILS-EAST CNTRL-RACK #2-WIRE-REAR-BOTTOM
FA6.24	FIRE ALARM: DETAILS-WEST CNTRL-RACK #1-WIRE-FRONT-TOP
FA6.25	FIRE ALARM: DETAILS-WEST CNTRL-RACK #1-WIRE-FRONT-BOTTOM
FA6.26	FIRE ALARM: DETAILS-WEST CNTRL-RACK #1-WIRE-REAR-TOP
FA6.27	FIRE ALARM: DETAILS-WEST CNTRL-RACK #1-WIRE-REAR-BOTTOM
FA6.28	FIRE ALARM: DETAILS-WEST CNTRL-RACK #2-WIRE-FRONT-TOP
FA6.29	FIRE ALARM: DETAILS-WEST CNTRL-RACK #2-WIRE-FRONT-BOTTOM
FA6.30	FIRE ALARM: DETAILS-WEST CNTRL-RACK #2-WIRE-REAR-TOP
FA6.31	FIRE ALARM: DETAILS-WEST CNTRL-RACK #2-WIRE-REAR-BOTTOM

**NICET CERTIFICATION**

JOHN BALLMAN  
SYSTEMS GROUP  
800 EAST 64TH AVENUE, UNIT #17  
DENVER, COLORADO 80229  
(303) 298-7900

NICET LEVEL: IV  
TECHNICAL AREA: FIRE ALARM SYSTEMS  
CERTIFICATE NUMBER: #101808

APPROVED BY: \_\_\_\_\_  
DATE: \_\_\_\_\_

REVIEW NUMBER: 1   
2   
3

John Ballman Nicet Fire Alarm systems Level IV Certification #101808
Date: _____

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**BARNARD EJMT TEAM**

**EISENHOWER/JOHNSON**

**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360
Subaccount 17810


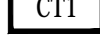
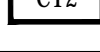
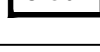
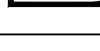

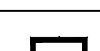
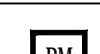





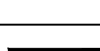


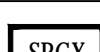

**RECORD DRAWINGS - 2015-11-16**

Num	Description	Date

FIRE ALARM:  
COVER PAGE

Drawing Number  
**FA0.00**

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FIRE ALARM LEGEND			
SYMBOL	DESCRIPTION	MODEL	BACK BOX
	FIRE ALARM CONTROL PANEL	EST3	3-CAB5, OR 3-CAB7B
	FIRE PROTECTION CABINET	31-40SF & 41-50SF	SUPPLIED
	REMOTE CONTROL PANEL	31-40SF	SUPPLIED
	MONITOR MODULE, SINGLE CIRCUIT	SIGA-CT1	4 SQUARE (2-1/8" (D) x W/ ONE GANG)
	MONITOR MODULE, DUAL CIRCUIT	SIGA-CT2	4 SQUARE (2-1/8" (D) x W/ ONE GANG)
	UNIVERSAL INPUT/OUTPUT MOTHERBOARD, 6 SLOT	SIGA-UI06R	N/A
	UNIVERSAL INPUT/OUTPUT MOTHERBOARD, 2 SLOT	SIGA-UI02R	N/A
	DELUGE ZONE DESIGNATION	N/A	N/A
 P	PHOTOELECTRIC SMOKE DETECTOR W/ BASE P = Photoelectric	SIGA2-PS & SIGA-SB	4" SQUARE, 2-1/8" DEEP, 3-0 RING
 HCO	HEAT AND CO DETECTOR, ADDRESSABLE, FIXED AT 135 DEGREE	SIGA2-HCOS & SIGA-SB	4" SQUARE, 2-1/8" DEEP, 3-0 RING
	CONTROL RELAY MODULE	SIGA-CR	4" SQUARE, 2-1/8" DEEP, 1-GANG PLASTER RING
	MULTI-VOLTAGE RELAY	RIC-1	4" SQUARE, 2-1/8" DEEP, BLANK COVER
	FIBER SPLICE BOX	28024033	SUPPLIED
	DELUGE ZONE VALVE	BERMAD FP400E-3DC-66	N/A
	DELUGE SERVICE DISCONNECT SWITCH	RELA-SRV-1	4 SQUARE (2-1/8" (D) x W/ ONE GANG)
	TANK LEVEL SENSOR	DON'T HAVE YET	N/A
	FIBER OPTIC LINEAR HEAT DETECTOR	LIOS LHD3-04	PART OF CONTROL ROOM EQUIPMENT RACK
	JUNCTION BOX	SIZE VARIES DEPENDING ON APPLICATION	N/A
	END OF LINE RESISTOR	RATING VARIES DEPENDING ON APPLICATION	N/A
	FLOW SWITCH	PART OF BERMAD DELUGE VALVE ABOVE	N/A
	TAMPER SWITCH	705W	N/A
	CCTV CAMERA	AVIGILON 2.0W-H3PTZ-DP20	1 GANG 2 1/2" DEEP BACK BOX
	SUPERVISED END OF LINE DEVICE	RELA-EOL	1 GANG 2 1/2" DEEP BACK BOX
	AIR TEMPERATURE SWITCH	STEGO KT-011 TYPE	N/A
	PRESSURE SWITCH	PS-40-2	N/A
	SURGE PROTECTION DEVICE	MODEL VARIES DEPENDING ON APPLICATION	N/A
	FIBER CALIBRATION BOX	N/A	N/A

**WIRE SPECIFICATIONS:**

FIBER OPTIC LINEAR HEAT DETECTION CABLE - 2/C, 62.5/125u MULTI-MODE ARMORED CABLE. LIOS TYPE 28030504 IN TUNNEL ROADWAY AREAS. LIOS TYPE 28030606 IN NON-TUNNEL ROADWAY AREAS. E2000 APC CONNECTORS. FIBER, CONNECTORS, AND BREAK-OUT PIGTAILS PROVIDED BY SYSTEMS GROUP.

FIRE ALARM FIBER OPTIC CABLE - 4/C, 62.5/125u MULTI-MODE FIBER, 820nm, OUTSIDE PLANT (OSP) DISTRIBUTION TYPE CABLE, KEVLAR STRENGTH MEMBER. BREAK-OUT FIBER KIT FOR "ST" TYPE CONNECTOR. "ST" CONNECTORS PROVIDED BY ELECTRICAL CONTRACTOR. FIBER TRANSCEIVER PROVIDED BY SYSTEMS GROUP.

CCTV FIBER OPTIC CABLE - 6/C, 62.5/125u SINGLE-MODE FIBER, 850nm, OUTSIDE PLANT (OSP) DISTRIBUTION TYPE CABLE, KEVLAR STRENGTH MEMBER, BREAK-OUT KIT FOR "LC" CONNECTOR. "LC" CONNECTORS PROVIDED BY ELECTRICAL CONTRACTOR. FIBER TRANSCEIVER PROVIDED BY SYSTEMS GROUP.

CAT 5e ETHERNET CABLE - 1000BASE-T, 4-PAIR UTP CAT 5e. RJ-45 CONNECTORS PROVIDED BY ELECTRICAL CONTRACTOR.

#18 TFN CONDUCTOR - STRANDED, TFN JACKET INSULATION. SEE COLOR CODES. PROVIDED BY ELECTRICAL CONTRACTOR.

#16 THHN CONDUCTOR - STRANDED, THHN JACKET INSULATION. SEE COLOR CODES. PROVIDED BY ELECTRICAL CONTRACTOR.

#14 THHN CONDUCTOR - STRANDED, THHN JACKET INSULATION. SEE COLOR CODES. PROVIDED BY ELECTRICAL CONTRACTOR.

#12 THHN CONDUCTOR - STRANDED, THHN JACKET INSULATION. SEE COLOR CODES. PROVIDED BY ELECTRICAL CONTRACTOR.

#16 TWISTED PAIR - 2/C, #16 CONDUCTORS, STRANDED, TFN JACKET INSULATION, MINIMUM 6 TWISTS PER FOOT. SEE COLOR CODES BELOW. PROVIDED BY ELECTRICAL CONTRACTOR.

#12 TWISTED PAIR - 2/C, #12 CONDUCTORS, STRANDED, THHN JACKET INSULATION, MINIMUM 6 TWISTS PER FOOT. SEE COLOR CODES. PROVIDED BY ELECTRICAL CONTRACTOR.

#10 THHN CONDUCTOR - SOLID, THHN JACKET, GREEN. PROVIDED BY ELECTRICAL CONTRACTOR.

#6 THHN CONDUCTOR - SOLID, THHN JACKET. PROVIDED BY ELECTRICAL CONTRACTOR.

COLOR CODES FOR TUNNEL PLENUMS:

WATERFLOW IDC CKT - YELLOW/BLUE

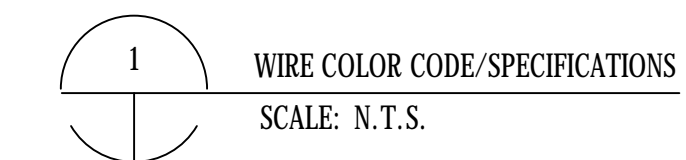
TAMPER IDC CKT - ORANGE/BROWN

DELUGE VALVE RELEASING CIRCUIT - PINK/PURPLE

SIGNALING DEVICE LOOP SLC CIRCUIT - RED/BLACK

CAMERA POWER CIRCUIT - RED/BLACK

\*LIGHTER COLOR (+), DARKER COLOR (-)



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Western States Fire Protection Co.

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A fire alarm life safety  
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**Sturgeon ELECTRIC**  
Serving the industry since 1952

**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT**

Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Revisions	Num	Description	Date

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

FIRE ALARM:  
LEGEND

Drawing Number  
**FA0.01**





FIRE ALARM SEQUENCE OF OPERATIONS MATRIX FOR THE EISENHOWER/JOHNSON MEMORIAL TUNNEL

INPUTS		OUTPUT																												
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	BB	
FACP/RCP/FPC PANELS																														
	AC POWER FAILURE (NOTE #5)			X						X																				
	LOW BATTERY (NOTE #5)			X						X																				
	GROUND FAULT			X						X																				
	OPEN CIRCUIT			X						X																				
	ALARM SILENCE BUTTON			X						X																				
	MANUALLY ACTIVATED PANEL SWITCH			X						X																			X	
	RCP HIGH TEMPERATURE		X					X		X																				
	RCP LOW TEMPERATURE		X					X		X																				
	FCP HIGH TEMPERATURE		X					X		X																				
	FCP LOW TEMPERATURE		X					X		X																				
MISCELLANEOUS CONTROLS	FIREWORKS MANUAL "ON" SWITCH									X			X	X	X		X		X			← SEE NOTE #9 →				X			X	
	FIREWORKS MANUAL "OFF" SWITCH									X																X			X	
	FACP/RCP PANEL SWITCH			X						X																X			X	
	CCTV MANUAL PAN/TILT CONTROL									X																X				
	CCTV MANUAL ZOOM CONTROL									X																	X			
DEGRADED FIBER "B" OPERATION	EVENT 1 PRE-ALARM		← NOT AVAILABLE IN FIBER MODE "B" →																											
	EVENT 1 ALARM (NOTE #2)	X			X			X	X	X			X	X	X		X	X		X	X									
DEGRADED FIBER "A" OPERATION	EVENT 1 PRE-ALARM	X			X			X	X	X			X	X	X		X	X		X	X									
	EVENT 1 ALARM (NOTE #3)	X			X			X	X	X			X	X	X		X	X		X	X									
	LIOS FOLHD TROUBLE			X						X					X					X										
	LIOS FOLHD LOSS OF PRIMARY "A" FIBER			X						X					X					X										
	LIOS FOLHD LOSS OF SECONDARY "B" FIBER			X						X					X					X										

- NOTE #1: IN REDUNDANT FIBER OPERATION, DELUGE ZONE RELEASE IS SINGLE ALARM SIGNAL FROM PRIMARY FIBER "A". ALARM SIGNALS, CCTV PRE-ALARM IS TRIGGERED BY PRE-ALARM SIGNAL ON SECONDARY FIBER "B". CCTV PRE-ALARM SIGNAL REPORTS TO SYSTEM AS AN ALARM SIGNAL, PER CDOT REQUEST.
- NOTE #2: IN DEGRADED MODE FOR FIBER OPERATION (LOSS OF SECONDARY FIBER "B"), DELUGE ZONE RELEASE IS SINGLE ALARM SIGNAL FROM PRIMARY FIBER "A" ONLY. CCTV IS TRIGGERED BY ALARM SIGNAL ON PRIMARY FIBER "A".
- NOTE #3: IN DEGRADED MODE FOR FIBER OPERATION (LOSS OF PRIMARY FIBER "A"), DELUGE ZONE RELEASE IS SINGLE ALARM SIGNAL FROM SECONDARY FIBER "B" ONLY. CCTV PRE-ALARM IS TRIGGERED BY PRE-ALARM SIGNAL ON SECONDARY FIBER "B". CCTV PRE-ALARM SIGNAL REPORTS TO SYSTEM AS AN ALARM SIGNAL, PER CDOT REQUEST.
- NOTE #4: CONTROL OUTPUT STATUS FEEDBACK IS REPORTED TO FIREWORKS DISPLAY UNITS AND LIGHTS THE ASSOCIATED DEVICE ICON ONLY. THIS FEEDBACK WILL NOT REPORT TO THE FACP PANELS, NOR PRINT-OUT ON THE SYSTEM PRINTER.
- NOTE #5: FPC CABINET "TROUBLE" IS A COMMON TROUBLE INDICATION FOR CIRCUITS ASSOCIATED WITH THE CABINET POWER SUPPLY ONLY, INCLUDING BATTERY AND AC POWER ISSUES.
- NOTE #6: EQUIPMENT RACK "TROUBLE" IS A COMMON TROUBLE INDICATION FOR CIRCUITS ASSOCIATED WITH THE CABINET POWER SUPPLY ONLY, INCLUDING BATTERY AND AC POWER ISSUES.
- NOTE #7: UPS "TROUBLE" WILL ONLY REPORT TO THE ASSOCIATED WORKSTATION AS INDICATED. THE UPS TROUBLE CONDITION WILL NOT REPORT THRU THE FIRE ALARM SYSTEM, NOR PRINT-OUT ON THE SYSTEM PRINTER.
- NOTE #8: NC = NO CHANGE
- NOTE #9: DRAINAGE SYSTEM WILL PRE-POSITION TO THE EISENHOWER (NORTH) TUNNEL DRAINAGE SOO IF AUTOMATIC DELUGE RELEASE ALARM OR MANUAL ACTIVATION SWITCH FOR AN EISENHOWER (NORTH) TUNNEL ZONE; OR WILL PRE-POSITION TO THE JOHNSON (SOUTH) TUNNEL DRAINAGE SOO IF AUTOMATIC DELUGE RELEASE OR MANUAL ACTIVATION SWITCH FOR JOHNSON (SOUTH) TUNNEL ZONE. DRAINAGE VALVE POSITION LATCHES TO INITIAL POSITION (NORTH OR SOUTH) BASED ON INITIAL AUTOMATIC DELUGE RELEASE ALARM OR MANUAL ACTIVATION SWITCH.
- NOTE #10: FIRE PUMP CAN BE MANUALLY TURNED ON AND OFF BY THE SYSTEM OPERATOR AS WARRANTED BY THE SYSTEM EVENT. ONCE WATER TANK "EMPTY" LEVEL IS RECEIVED, THE FIRE PUMP IS LOCKED OUT AND WILL NOT RESTART UNTIL WATER TANK "EMPTY" LEVEL ALARM IS RESTORED. ONCE WATER IS RESTORED TO THE SYSTEM AND THE WATER TANK LEVEL ALARM IS RESTORED, THE FIRE PUMP CAN BE MANUALLY RESTARTED VIA THE FIRE PUMP OVERRIDE SWITCH LOCATED AT THE ECR, WCR, OR FMO FACP PANELS.
- NOTE #11: "PRE-ALARM" AND "ALARM" STROBES ARE ONLY LOCATED IN THE EAST CONTROL ROOM.
- NOTE #12: THE SYSTEM DESIGN ALLOWS FOR A MAXIMUM OF TWO (2) DELUGE ZONES ACTIVATED AT ANY GIVEN TIME. IF THE SYSTEM OPERATOR ELECTS TO MANUALLY MOVE THE DELUGE RELEASE TO ANOTHER TUNNEL ZONE, THE OPERATOR MUST ACTIVATE THE NEXT DELUGE ZONE, PRIOR TO SHUTTING OFF ANY ACTIVATED ZONE TO AVOID WATER HAMMER ISSUES IN THE FIRE SUPPRESSION PIPING. THIS APPLIES IN THE EVENT OF THE MAXIMUM TWO (2) ACTIVATED SCENARIOS, AS WELL.
- NOTE #13: THE DRAINAGE VALVES ARE LATCHED INTO THE INITIAL ALARM CONDITION (NORTH OR SOUTH) POSITION UNTIL THE DRAINAGE VALVE RESET SWITCH IS OPERATED ON THE ECR, WCR, OR FMO FACP PANELS; EVEN AFTER SYSTEM IS FULLY RESET. THE DRAINAGE VALVES CAN BE OVERRIDEN VIA DRAINAGE VALVE OVERRIDE SWITCH ON THE ECR, WCR, OR FMO FACP.

**BARNARD EJMT TEAM**

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

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Project No. C0703-360  
 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

Revisions  
 Num Description Date  
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FIRE ALARM:  
 SEQUENCE OF OPERATIONS PART #2

Drawing Number  
**FA0.04**

DRAWN BY: B.T.L. | CHECKED BY: AEE-Jr

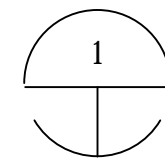
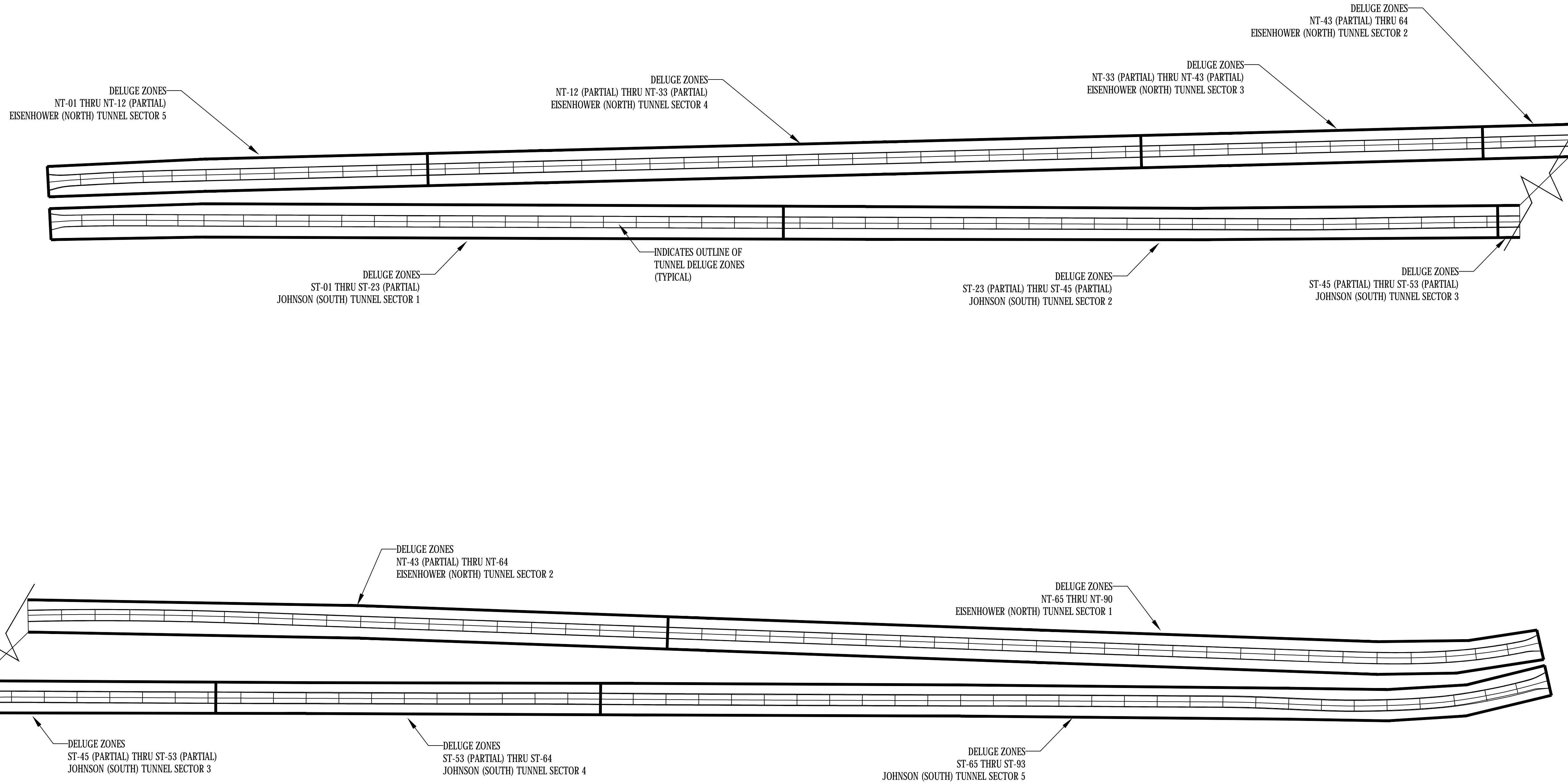




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CONTINUED ON THIS SHEET FROM ABOVE

CONTINUED ON THIS SHEET BELOW



FIRE ALARM TUNNEL VENTILATION SECTOR PLAN  
SCALE: N.T.S.

**BARNARD EJMT TEAM**

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A COMMITMENT TO SAFETY  
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 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Revisions	Date
Num	Description

FIRE ALARM:  
 TUNNEL VENTILATION  
 SECTOR PLAN

Drawing Number  
**FA0.06**

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

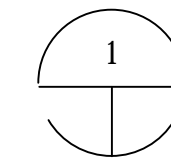
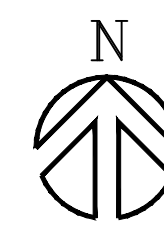
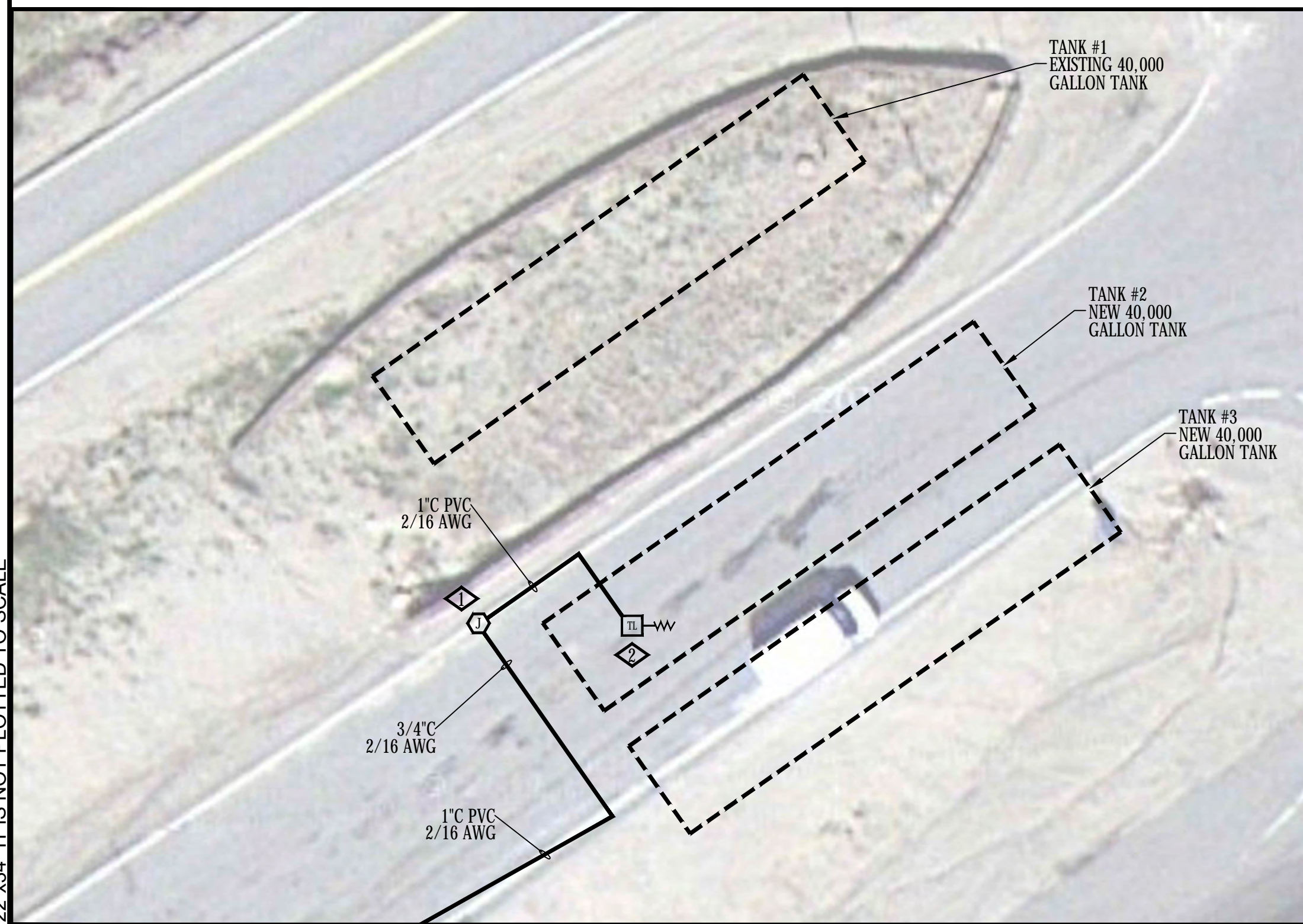
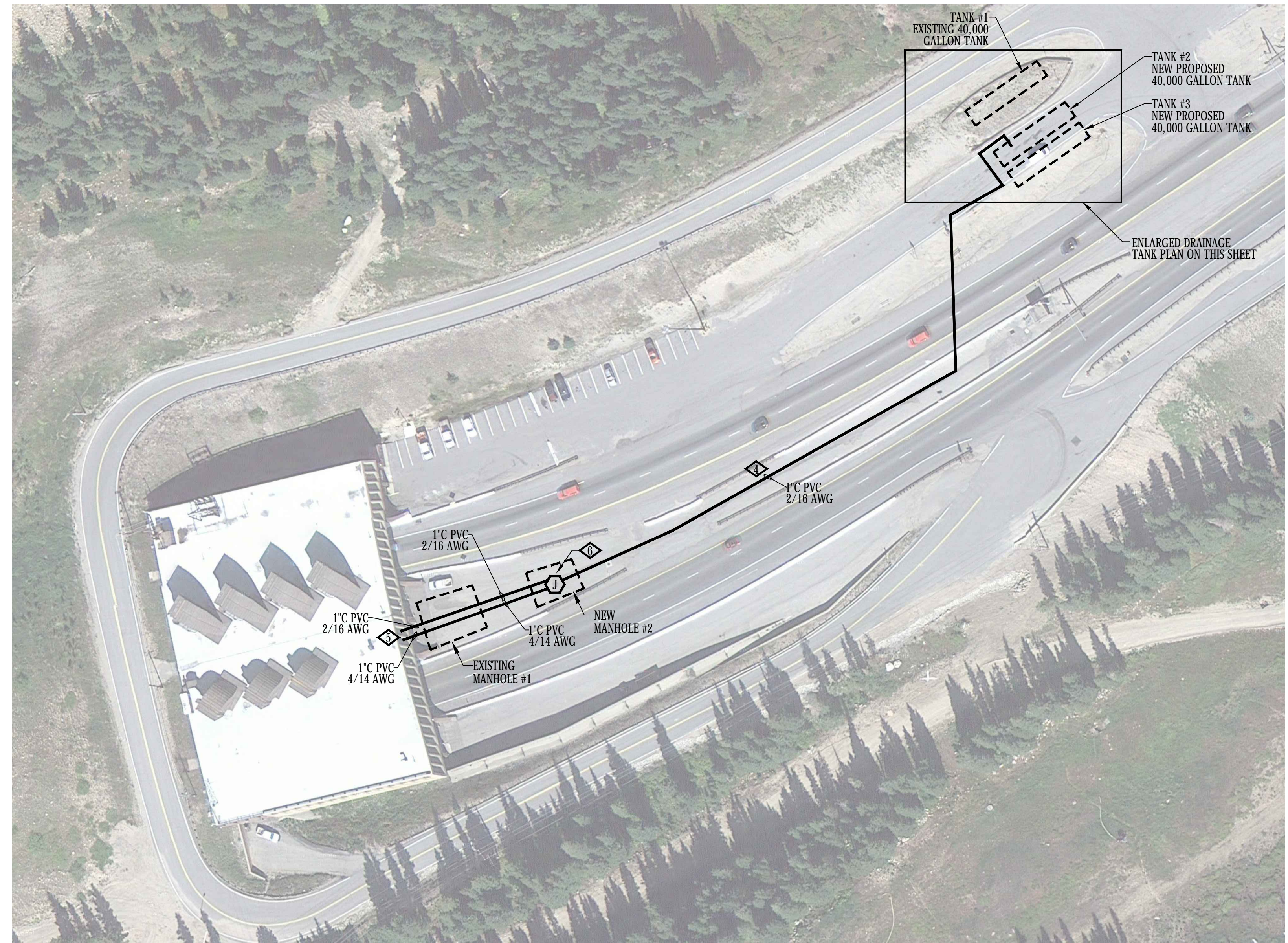


**GENERAL NOTES:**

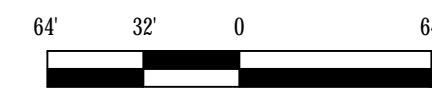
1. IF FIELD CONDITIONS RESULT IN A CHANGE TO THE SHOP DRAWING INSTALLATION IN ANY WAY, CONTACT FAS SYSTEMS GROUP TO VERIFY PROPOSED CHANGES ARE COMPLIANT WITH NFPA 72 AND PROJECT REQUIREMENTS.
2. EACH CONTROL CABINET AND ADDRESSABLE DEVICE SHALL BEAR A TYPED LABEL INDICATING ITS ADDRESS OR DESIGNATION, WHICH CAN BE SEEN WITHOUT A LADDER OR LIFT. SMOKE AND HEAT DETECTORS SHALL HAVE THEIR LABEL ON ITS BASE.

**DETAIL NOTES:**

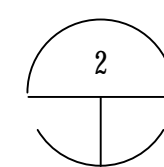
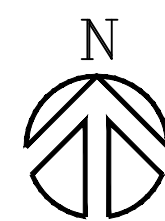
1. WEATHERPROOF BACK BOX PROVIDED BY ELECTRICAL CONTRACTOR.
2. ELECTRICAL CONTRACTOR TO CONNECT TANK HIGH LEVEL SWITCH TO THE TANK HIGH LEVEL IDC CIRCUIT. LEVEL SWITCH ACCESSED BY WEST MANHOLE.
3. NOTE NOT USED.
4. PVC RACEWAY TO UTILIZE THE SAME TRENCH AS THE NEW 12" DISCHARGE LINE.
5. FOR CONTINUATION, SEE JUNCTION BOXES ON SHEET FA2.E01.
6. ELECTRICAL CONTRACTOR TO CONNECT FIRE ALARM CONTROL CIRCUITRY TO DRAINAGE SYSTEM CONTROL VALVES (V-5 AND V-6) IN MANHOLE #2. SEE CIVIL SHEET C6.0.



FIRE ALARM - SITE PLAN - EAST  
SCALE: 1/64" = 1'-0"



SCALE: 1/64" = 1'-0"



ENLARGED DRAINAGE TANK PLAN  
SCALE: 1/16" = 1'-0"



SCALE: 1/16" = 1'-0"

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**BARNARD EJMT TEAM**

**BCER** **BARNARD** **BARNARD** **RONDINELLI** **Sturgeon Electric** **Western States Fire Protection Co.** **ALF** **ENGINEERS**

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Revisions	Date
Num	Description

FIRE ALARM:  
SITE PLAN - EAST

Drawing Number

**FA1.01**

DRAWN BY: B.T.L. | CHECKED BY: AEE-JR

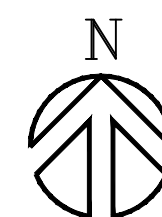
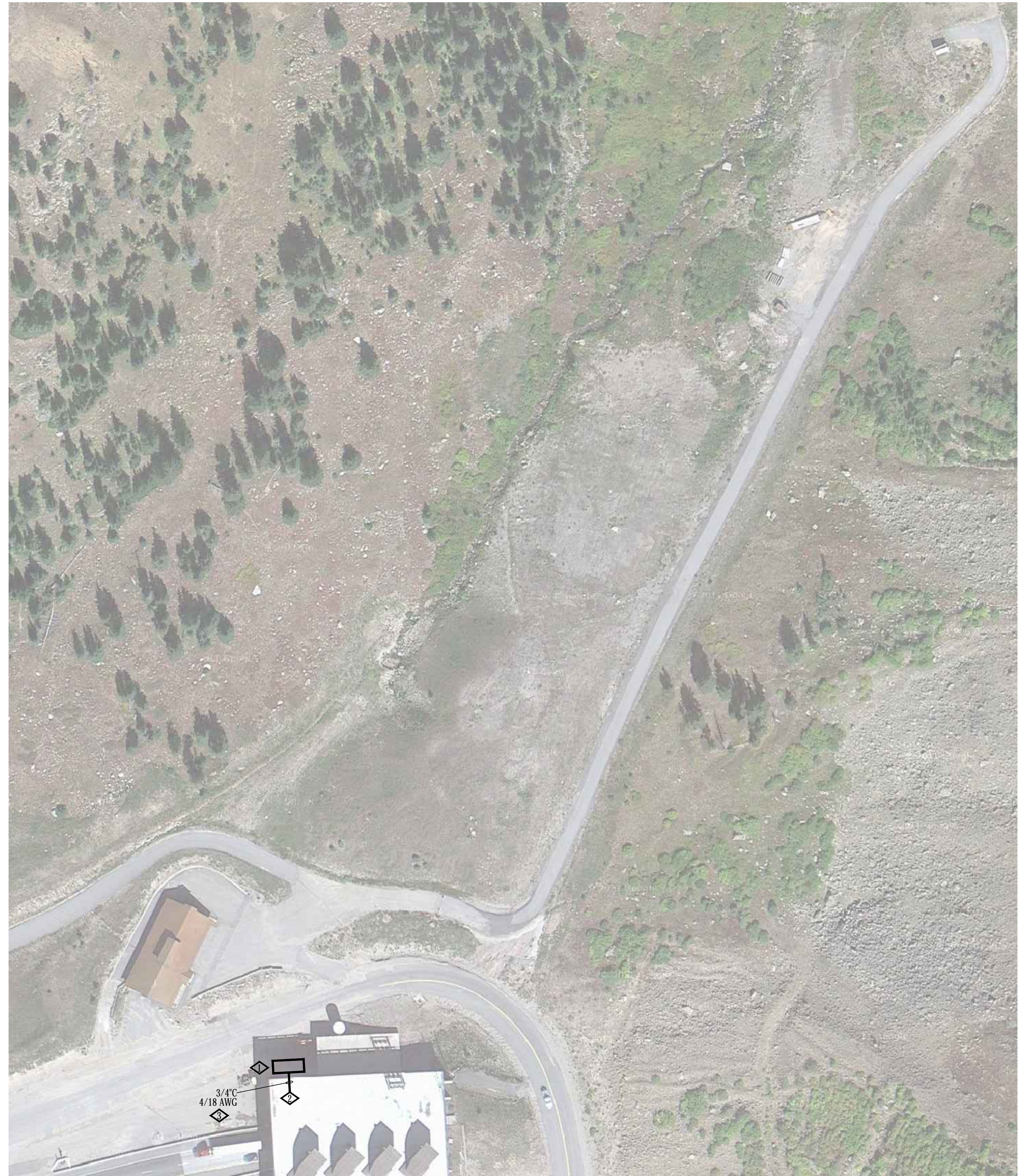
IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

GENERAL NOTES:

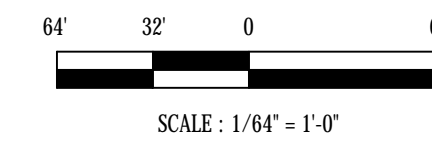
1. IF FIELD CONDITIONS RESULT IN A CHANGE TO THE SHOP DRAWING INSTALLATION IN ANY WAY, CONTACT FAS SYSTEMS GROUP TO VERIFY PROPOSED CHANGES ARE COMPLIANT WITH NFPA 72 AND PROJECT REQUIREMENTS.
2. EACH CONTROL CABINET AND ADDRESSABLE DEVICE SHALL BEAR A TYPED LABEL INDICATING ITS ADDRESS OR DESIGNATION, WHICH CAN BE SEEN WITHOUT A LADDER OR LIFT. SMOKE AND HEAT DETECTORS SHALL HAVE THEIR LABEL ON ITS BASE.

DETAIL NOTES:

- ◇ LOCATION OF EMERGENCY GENERATOR.
- ◇ FOR CONTINUATION, SEE JUNCTION BOX ON SHEET FA2.W01.
- ◇ BLU/YEL WIRE PAIR - GEN RUN STATUS  
ORC/BRN WIRE PAIR - GEN TROUBLE

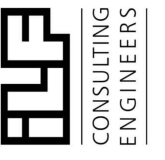


1  
FIRE ALARM - SITE PLAN - WEST  
SCALE: 1/64" = 1'-0"



**BARNARD EJMT TEAM**

**BCER** **BARNARD** **RONDINELLI**  
A FAS SYSTEMS GROUP COMPANY



Western States  
Fire Protection Co.



**Sturgeon**  
ELECTRIC

**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
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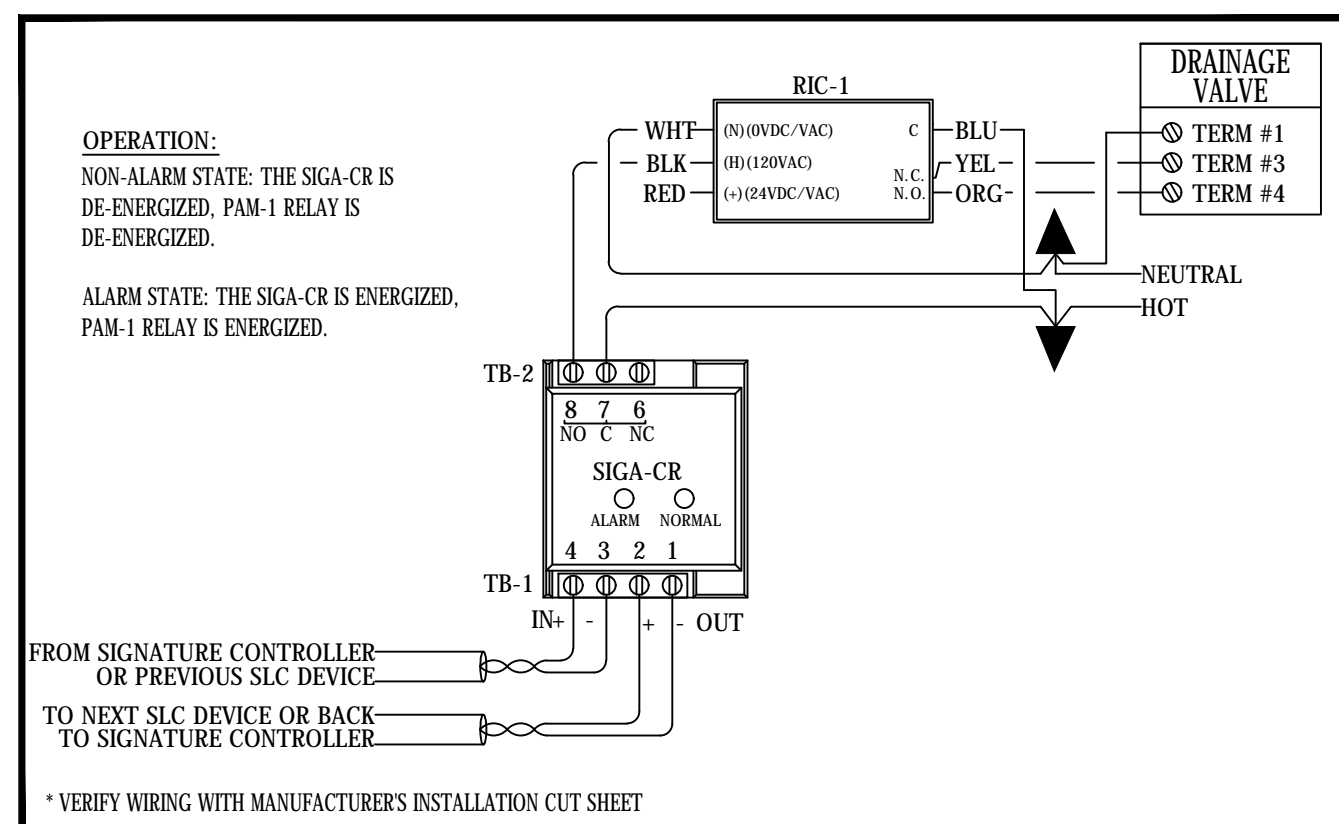
Num	Description	Date

FIRE ALARM:  
SITE PLAN - WEST

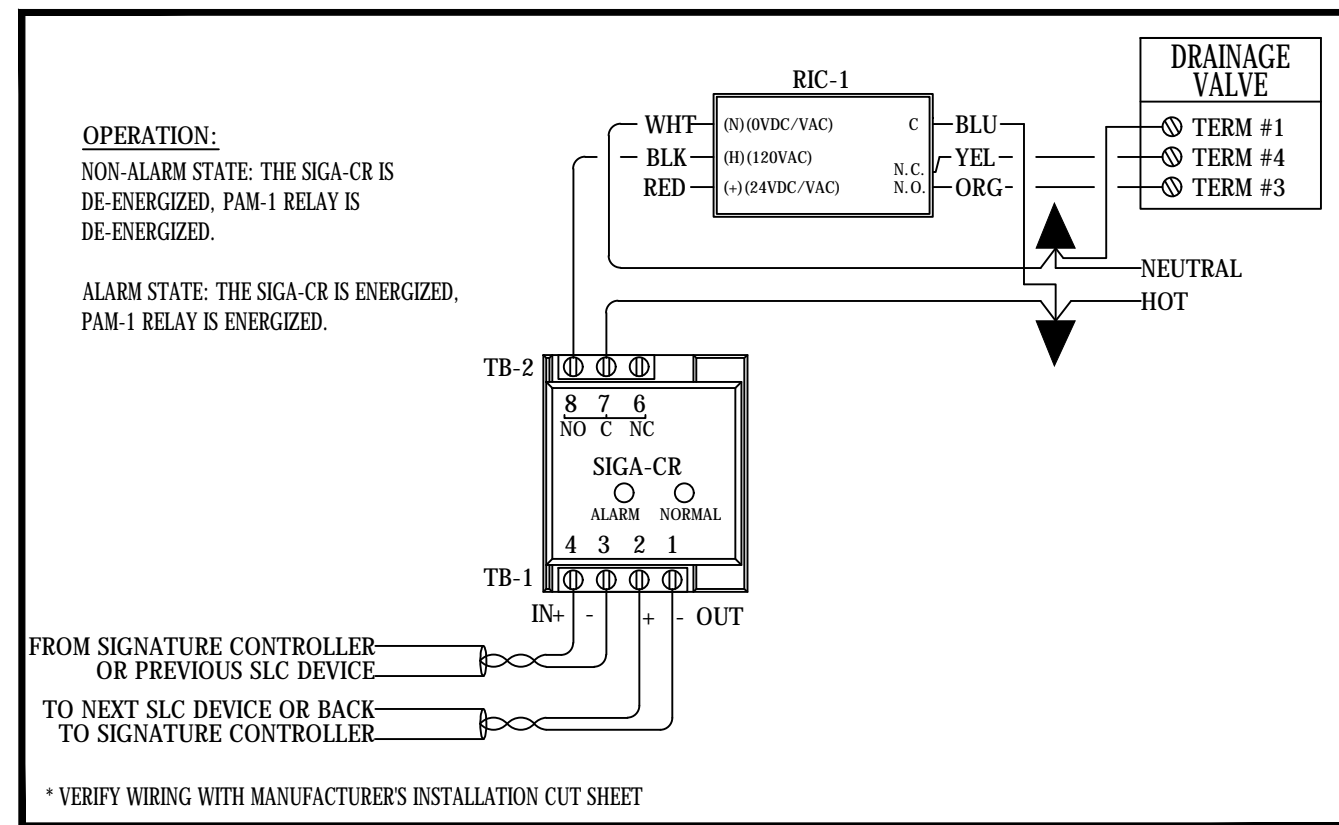
Drawing Number  
**FA1.02**

DRAWN BY: B.T.L. | CHECKED BY: AEE-Jr

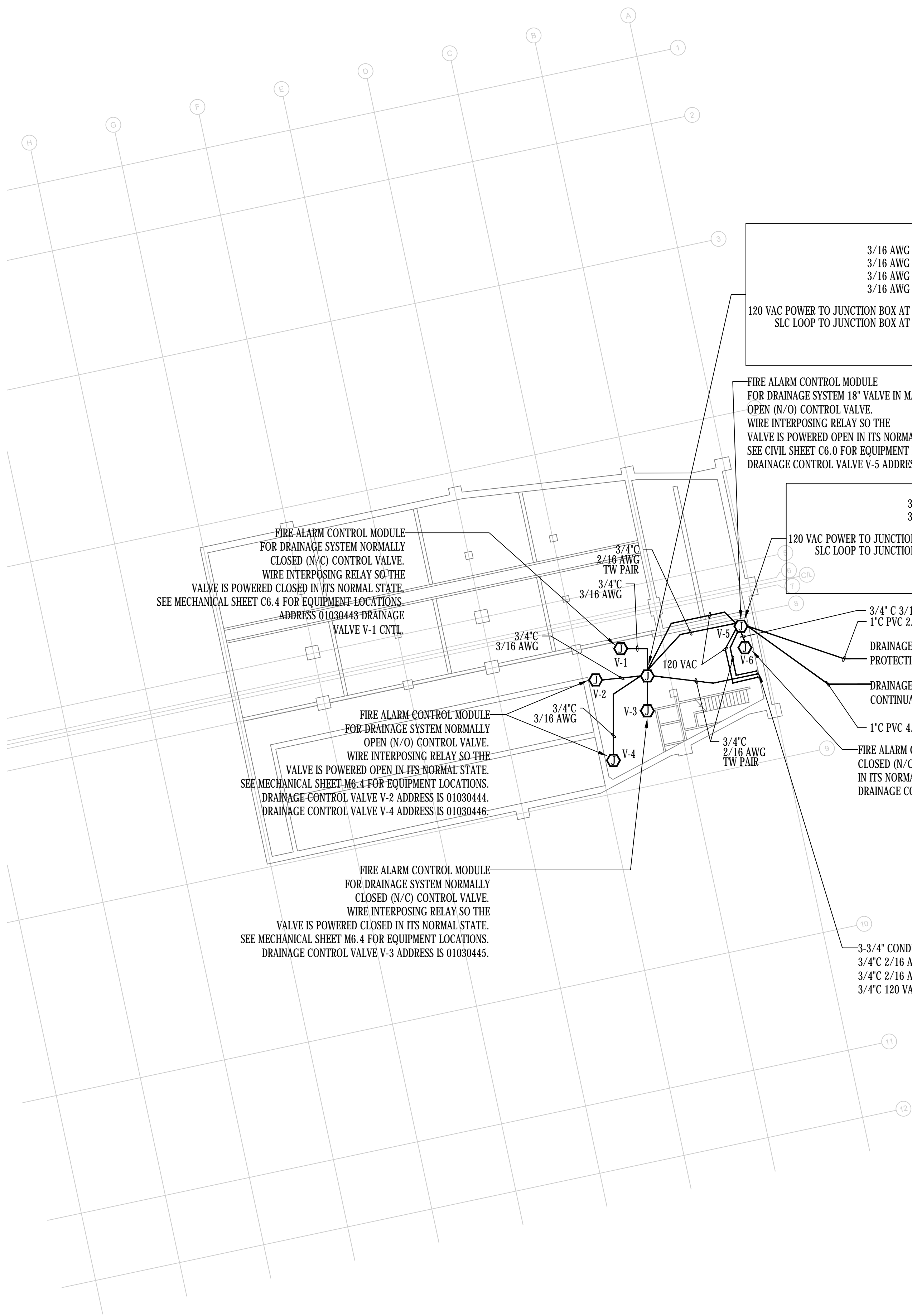
IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



1 TYPICAL NORMALLY OPEN DRAINAGE CONTROL VALVE WIRING  
SCALE: NOT TO SCALE



2 TYPICAL NORMALLY CLOSED DRAINAGE CONTROL VALVE WIRING  
SCALE: NOT TO SCALE



- GENERAL NOTES:**
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**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT**

**BARNARD EJMT TEAM**

**BARNARD**  
Western States Fire Protection Co.  
CONSULTING ENGINEERS

**RONDINELLI**  
A FAS SYSTEMS GROUP COMPANY  
CONSULTING ENGINEERS

**Sturgeon Electric**

**BCER**  
Barnard Consulting Engineering

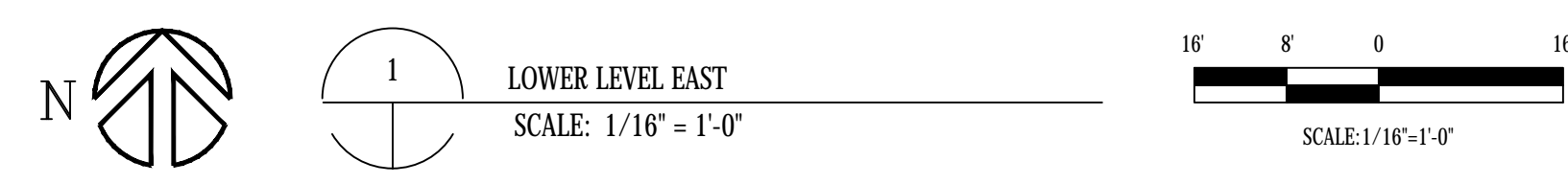
Revisions	Date

FIRE ALARM:  
LOWER LEVEL EAST

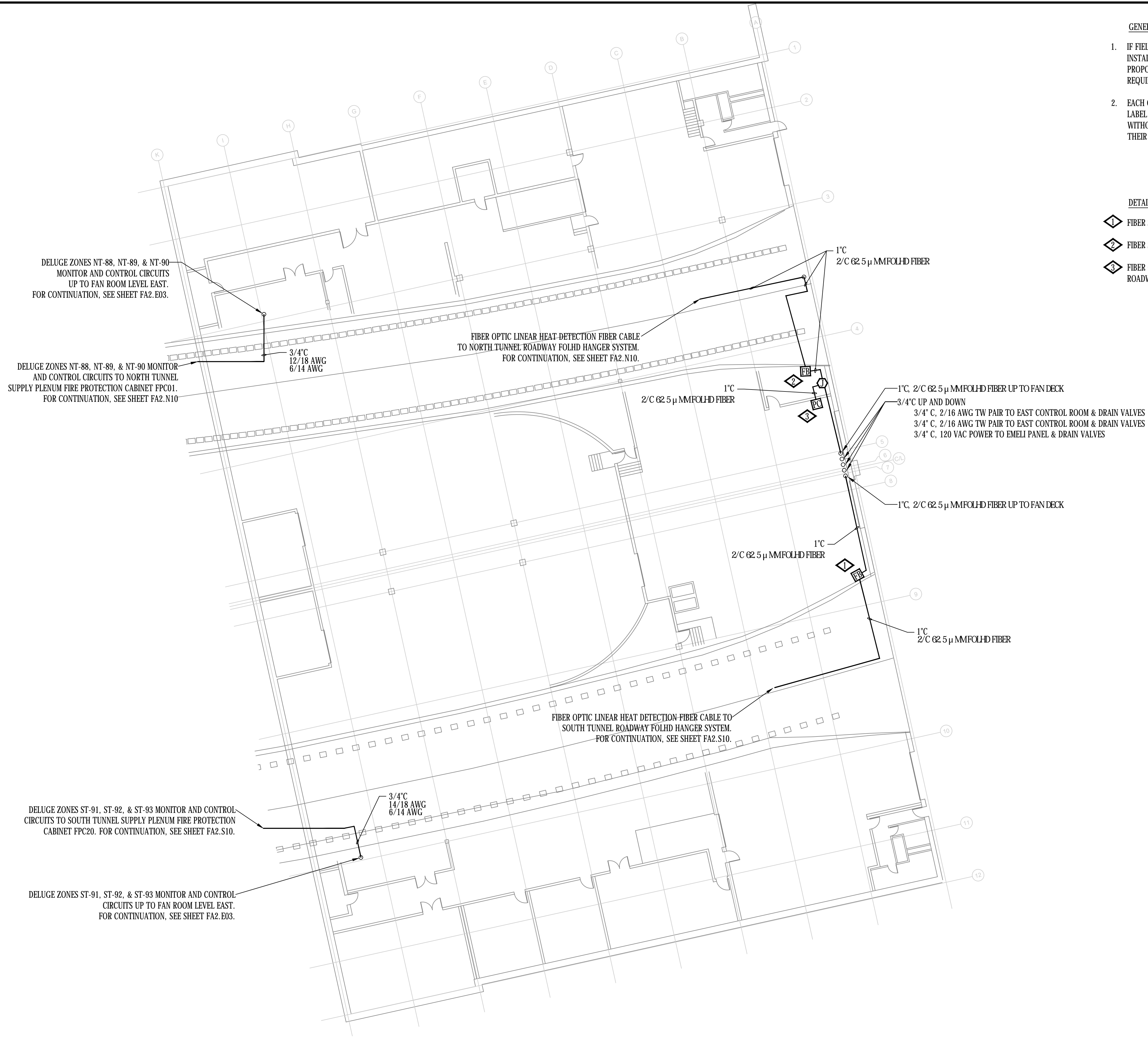
Drawing Number  
**FA2.E01**

Project No. C0703-360  
Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF



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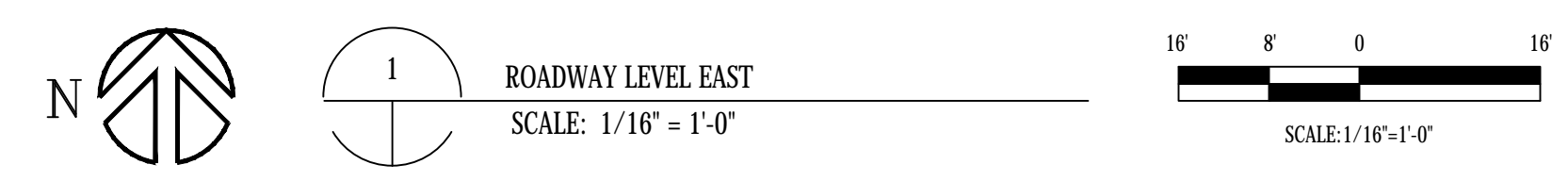


**GENERAL NOTES:**

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**DETAIL NOTES:**

- ① FIBER SPLICE BOX LOCATED AT MEZZANINE LEVEL OF CENTER STAIR.
- ② FIBER SPLICE BOX LOCATED ABOVE LOCKER ROOMS.
- ③ FIBER CALIBRATION BOX LOCATED BY LOCKER ROOM ENTRY DOOR AT ROADWAY LEVEL.



**BARNARD EJMT TEAM**

**BARNARD** **RONDINELLI**

**BCER** **Sturgeon Electric**

Western States Fire Protection Co.

ALF CONSULTING ENGINEERS

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

**FIXED FIRE SUPPRESSION SYSTEM**

**DESIGN BUILD PROJECT**

Project No. C0703-360 Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

Revisions	Date
Num	Description

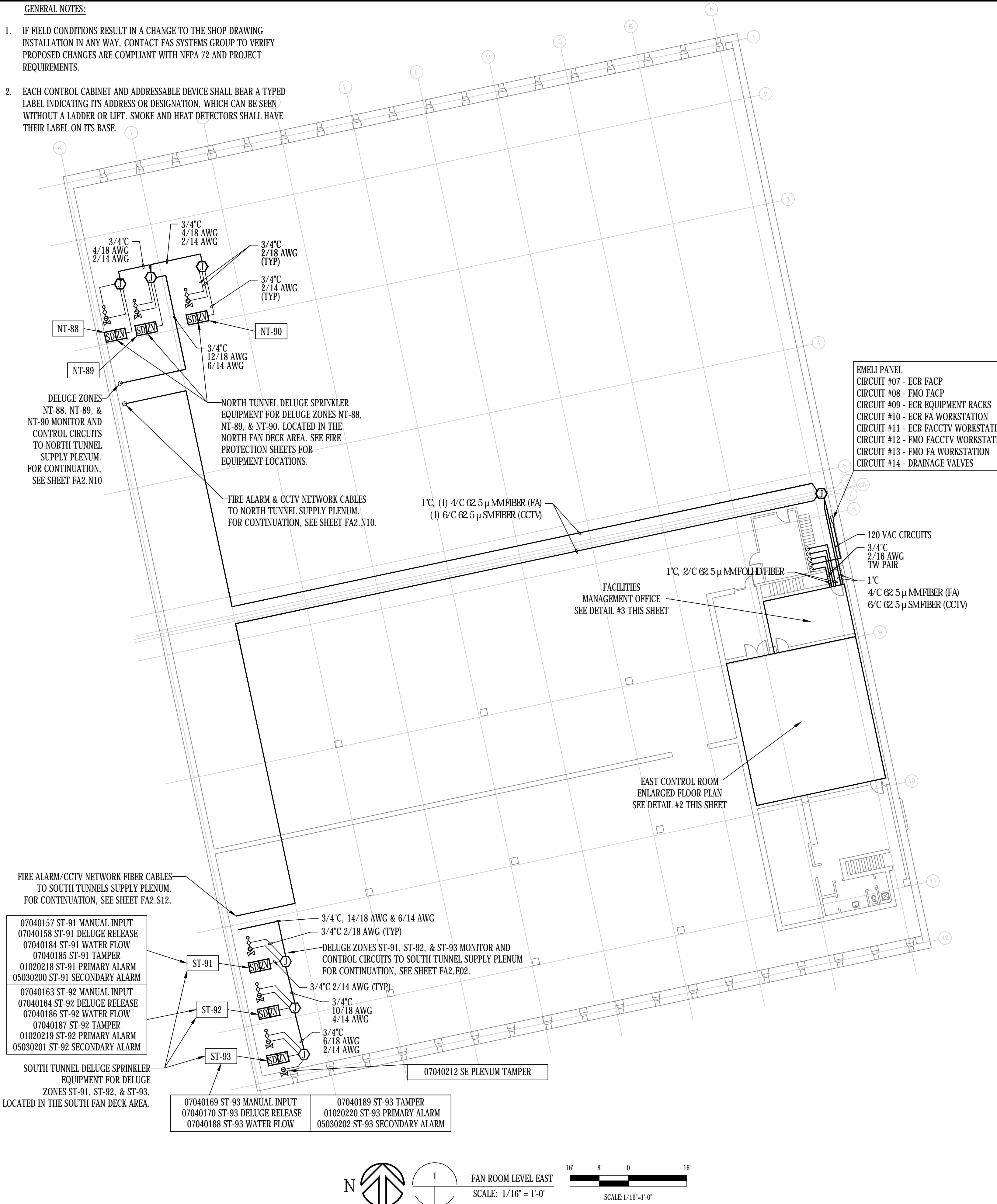
DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

FIRE ALARM:  
ROADWAY LEVEL EAST

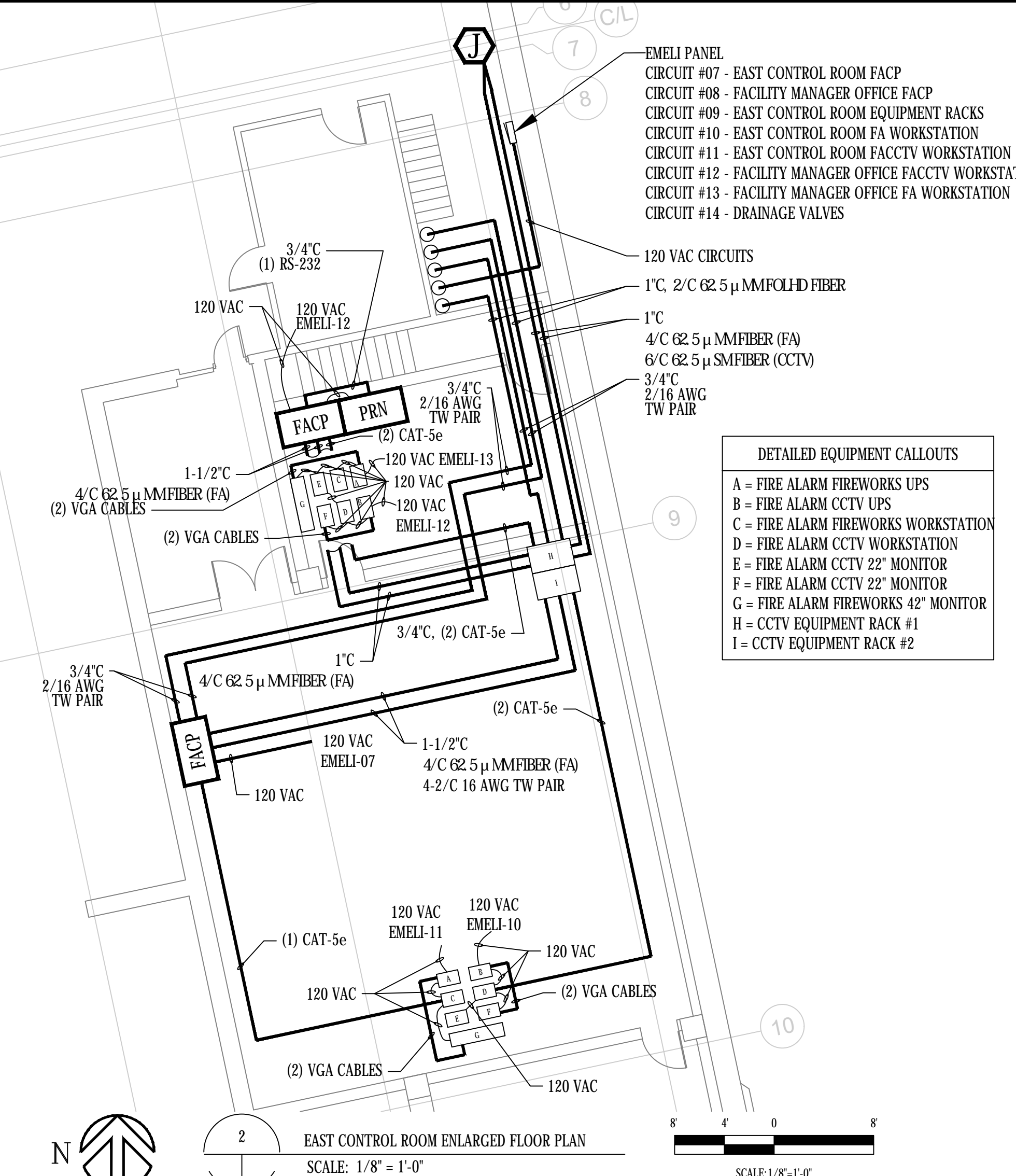
Drawing Number  
**FA2.E02**

**GENERAL NOTES:**

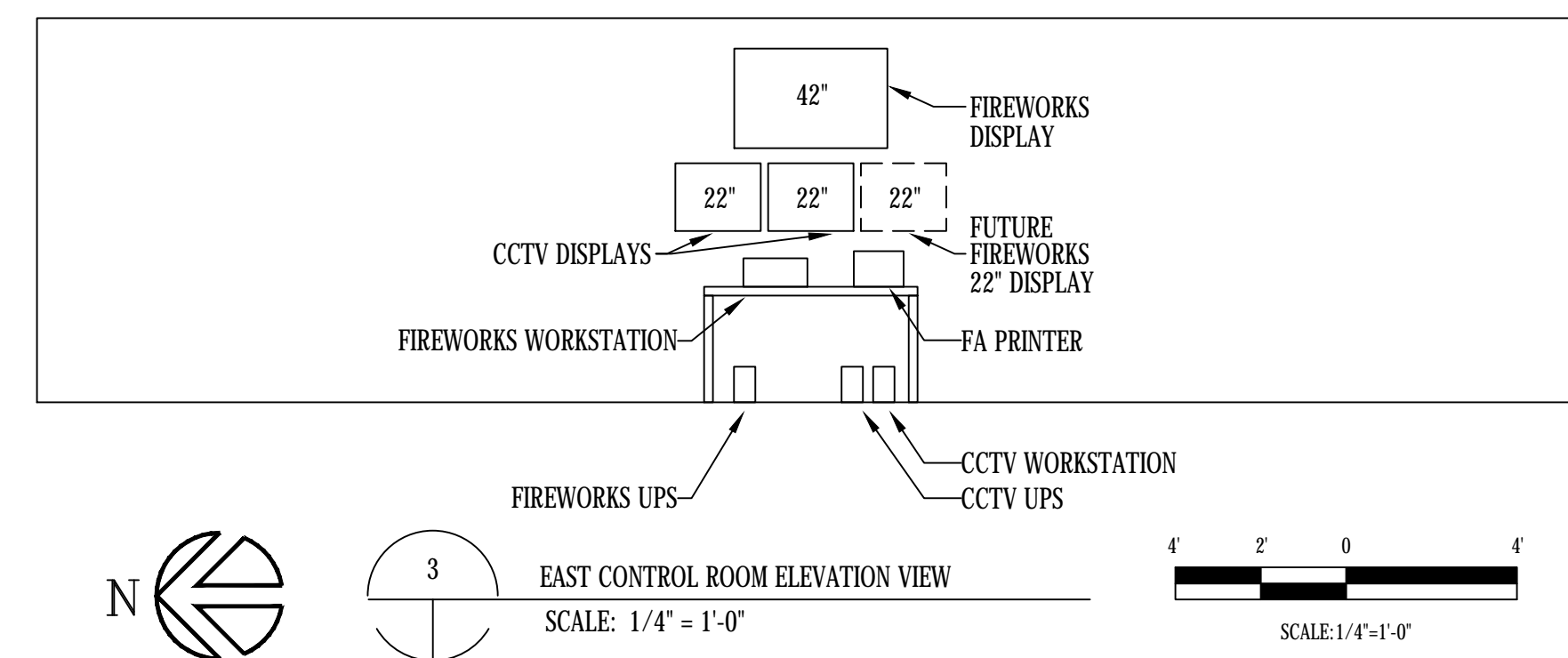
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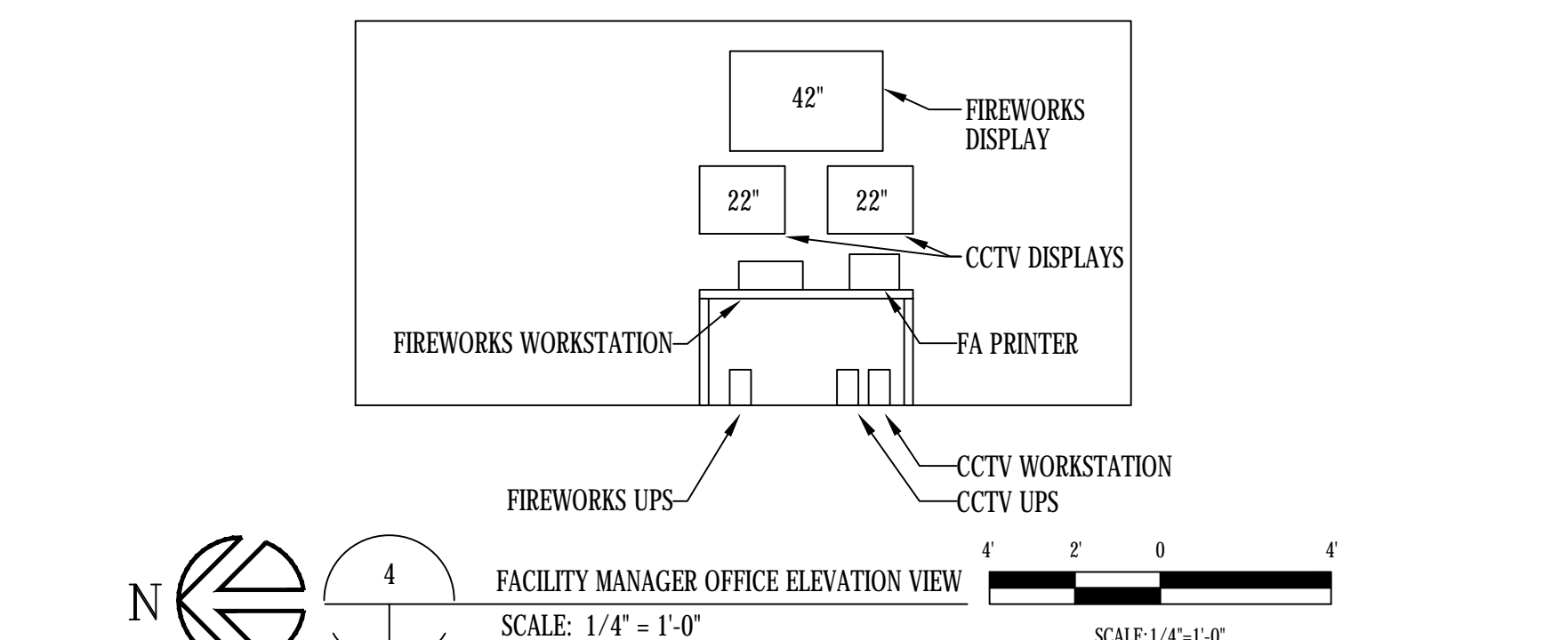
**1 FAN ROOM LEVEL EAST**  
SCALE: 1/16" = 1'-0"



**2 EAST CONTROL ROOM ENLARGED FLOOR PLAN**  
SCALE: 1/8" = 1'-0"



**3 EAST CONTROL ROOM ELEVATION VIEW**  
SCALE: 1/4" = 1'-0"



**4 FACILITY MANAGER OFFICE ELEVATION VIEW**  
SCALE: 1/4" = 1'-0"

**DETAILED EQUIPMENT CALLOUTS**

- A = FIRE ALARM FIREWORKS UPS
- B = FIRE ALARM CCTV UPS
- C = FIRE ALARM FIREWORKS WORKSTATION
- D = FIRE ALARM CCTV WORKSTATION
- E = FIRE ALARM CCTV 22" MONITOR
- F = FIRE ALARM CCTV 22" MONITOR
- G = FIRE ALARM FIREWORKS 42" MONITOR
- H = CCTV EQUIPMENT RACK #1
- I = CCTV EQUIPMENT RACK #2

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**BARNARD EJMT TEAM**

**BARNARD**

**BCER**

**RONDINELLI**

**Sturgeon Electric**

**EISENHOWER/JOHNSON MEMORIAL TUNNEL FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT**

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

Num	Revisions	Date
1	RELOCATED EQUIPMENT	2015-7-24

DATE CHECKED BY: AEE-JF  
DRAWN BY: B.T.L.

**FIRE ALARM: FAN LEVEL EAST**

Drawing Number  
**FA2.E03**

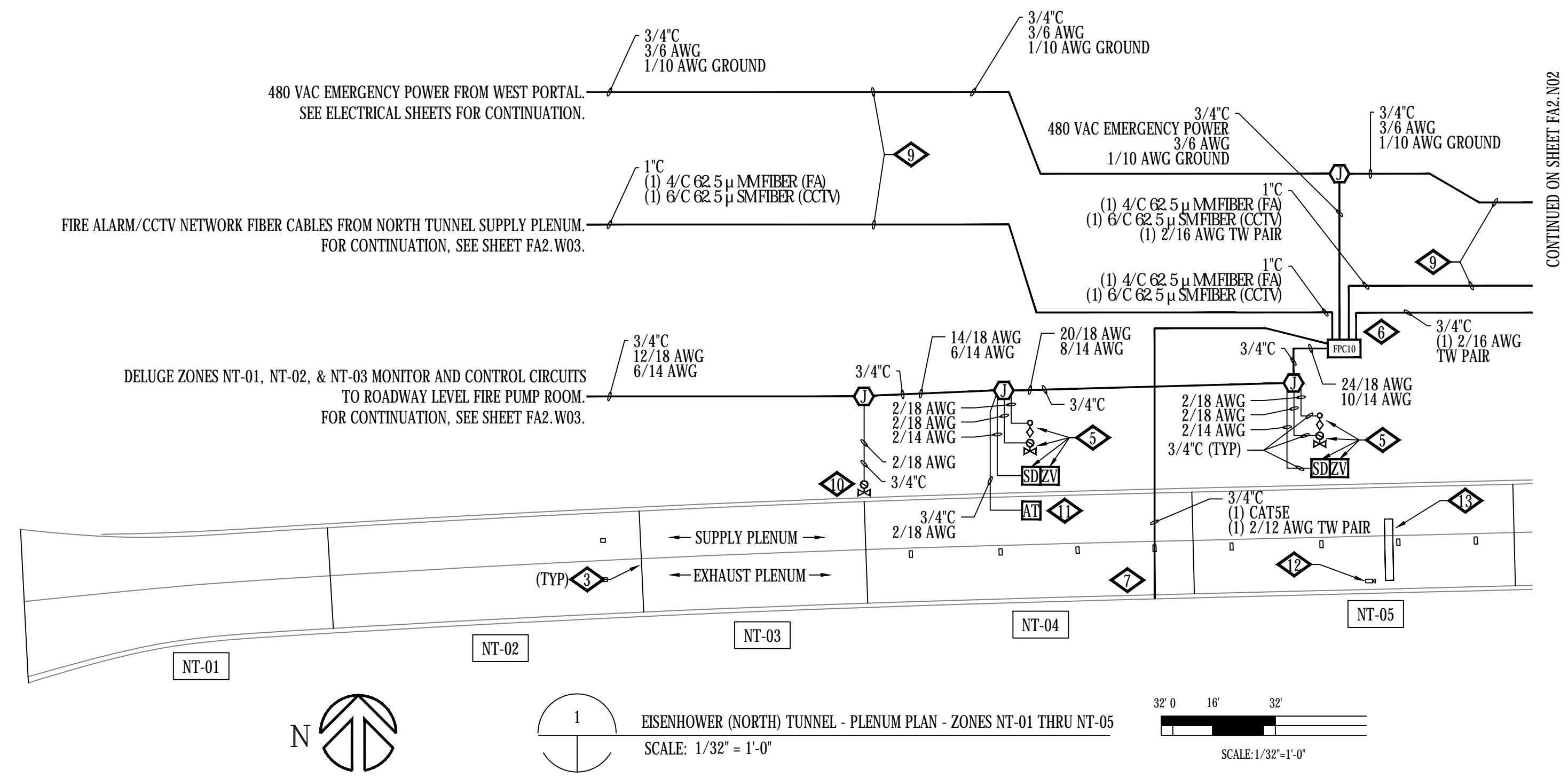


**GENERAL NOTES:**

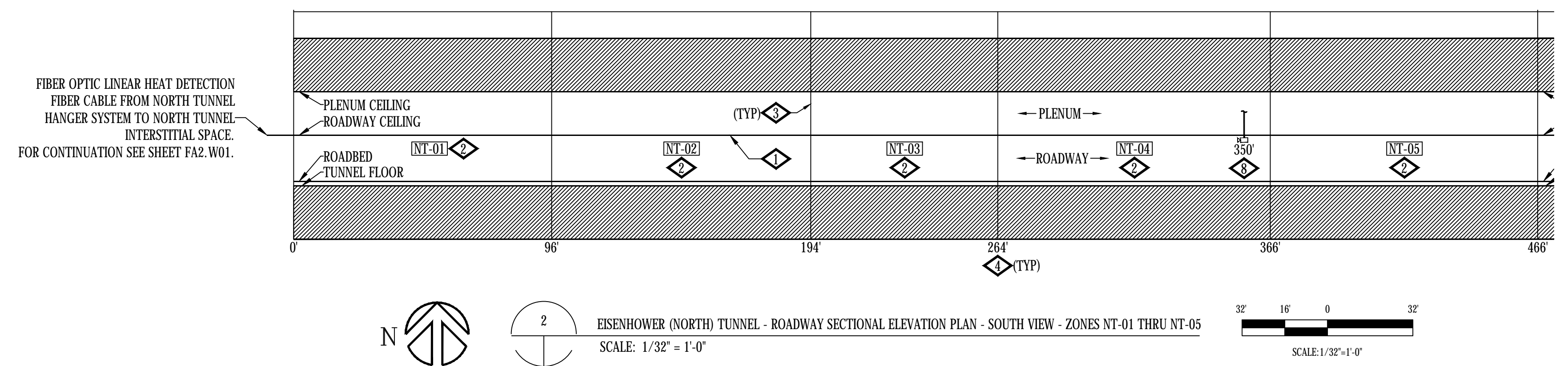
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**DETAIL NOTES:**

1. FIBER OPTIC LINEAR HEAT DETECTION (FOLHD) FIBER CABLE IN FOLHD HANGER. CABLE TO BE MOUNTED APPROXIMATELY 2 INCHES BELOW ROADWAY CEILING TILE. SEE SHEETS FA6.01, FA6.14 AND FA6.15.
2. DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
3. DELUGE ZONE BOUNDARY.
4. DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
5. DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
6. EQUIPMENT LOCATED IN SUPPLY PLENUM.
7. ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
8. MOUNT CCTV CAMERA TO ROADWAY WALL TILE ABOVE EXIT PATHWAY. SEE SHEET FA6.02. DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
9. MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
10. FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
11. MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
12. EXISTING CCTV TRAFFIC CAMERA, SHOWN FOR REFERENCE PURPOSES, TO REMAIN.
13. EXISTING TRAFFIC CONTROL MESSAGE BOARD, SHOWN FOR REFERENCE PURPOSES, TO REMAIN. ROUTE FOLHD FIBER AND HANGER ABOVE THE MESSAGE BOARD. IT IS ACCEPTABLE TO RUN THE FOLHD CABLE WITHOUT THE HANGER WHERE THERE IS INSUFFICIENT CLEARANCE BETWEEN THE EXISTING MESSAGE BOARD AND THE EXISTING CEILING TILE, WHERE APPLICABLE. LIMIT THE FOLHD CABLE RUNS WITHOUT THE HANGER TO THE MINIMUM DISTANCE POSSIBLE TO CLEAR THE OBSTRUCTION.



CONTINUED ON SHEET FA2.W02



CONTINUED ON SHEET FA2.W02

ADDRESSING		
04020166	FPC10	CCTV TROUBLE
04020167	FPC10	BPS TROUBLE
04020168	FPC10	HI TEMP
04020169	FPC10	LO TEMP

ADDRESSING		
04020127	NT-01	MANUAL INPUT
04020128	NT-01	DELUGE RELEASE
04020156	NT-01	WATER FLOW
04020157	NT-01	TAMPER
05020126	NT-01	PRIMARY ALARM
01020221	NT-01	SECONDARY ALARM

ADDRESSING		
04020133	NT-02	MANUAL INPUT
04020134	NT-02	DELUGE RELEASE
04020158	NT-02	WATER FLOW
04020159	NT-02	TAMPER
05020127	NT-02	PRIMARY ALARM
01020222	NT-02	SECONDARY ALARM

ADDRESSING		
04020139	NT-03	MANUAL INPUT
04020140	NT-03	DELUGE RELEASE
04020160	NT-03	WATER FLOW
04020161	NT-03	TAMPER
05020128	NT-03	PRIMARY ALARM
01020223	NT-03	SECONDARY ALARM

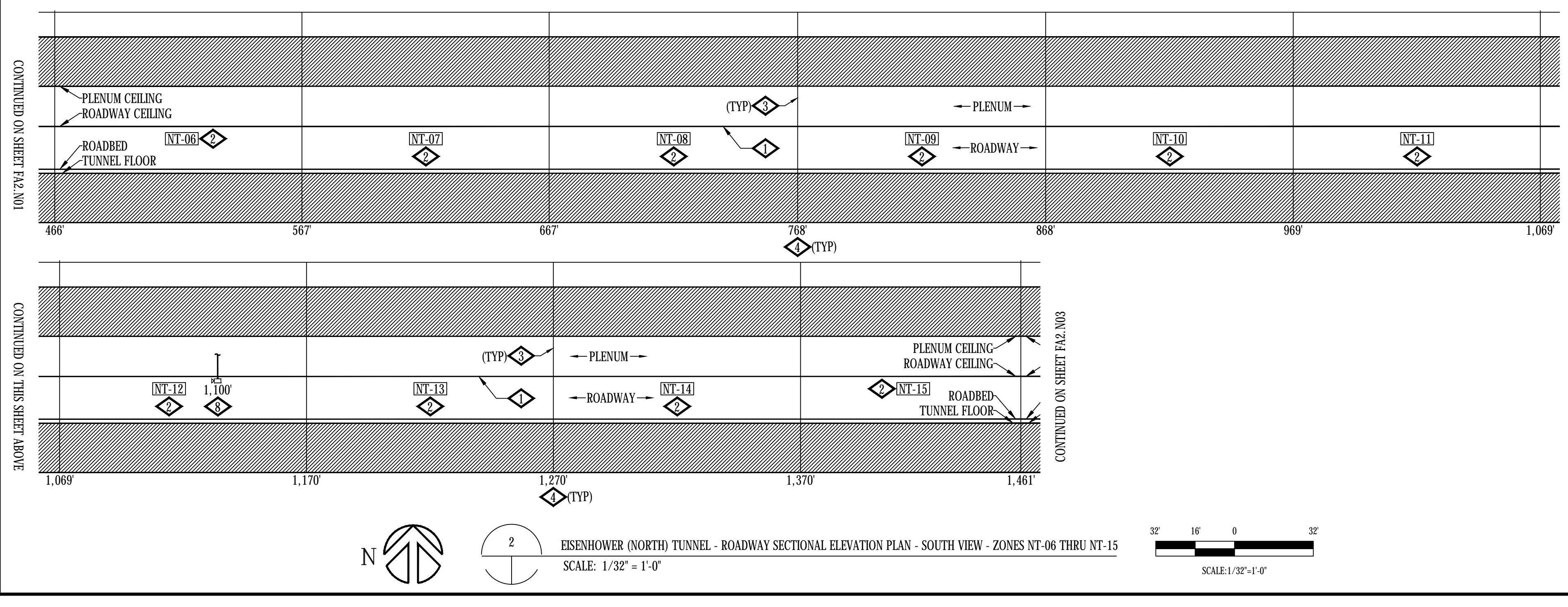
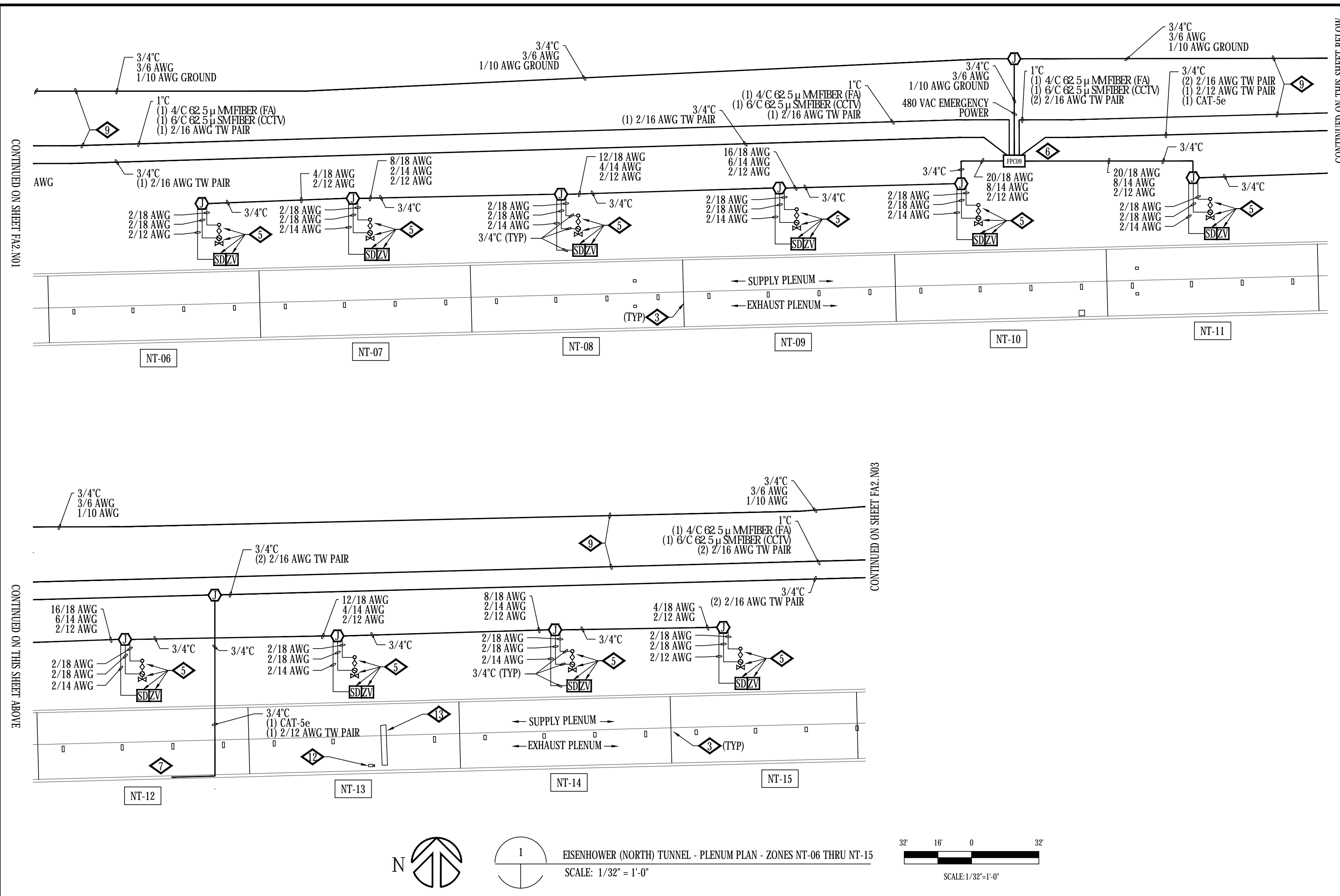
ADDRESSING		
04020145	NT-04	MANUAL INPUT
04020146	NT-04	DELUGE RELEASE
04020162	NT-04	WATER FLOW
04020163	NT-04	TAMPER
04020170	NT-04	ISO VALVE TAMPER
04020171	NT-04	IVE LO TEMP
05020129	NT-04	PRIMARY ALARM
01020224	NT-04	SECONDARY ALARM

ADDRESSING		
04020151	NT-05	MANUAL INPUT
04020152	NT-05	DELUGE RELEASE
04020164	NT-05	WATER FLOW
04020165	NT-05	TAMPER
05020130	NT-05	PRIMARY ALARM
01020225	NT-05	SECONDARY ALARM

Num	Description	Date

**FIRE ALARM:**  
 EISENHOWER TUNNEL  
 FP ZONES NT-01 TO NT-05  
 Drawing Number  
**FA2.N01**

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



- GENERAL NOTES:**
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  - DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - DELUGE ZONE BOUNDARY.
  - DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - EQUIPMENT LOCATED IN SUPPLY PLENUM.
  - ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
  - MOUNT CCTV CAMERA TO ROADWAY WALL TILE ABOVE EXIT PATHWAY. SEE SHEET FA6.02. DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
  - MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
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ADDRESSING		
04020456	FPC09	HI TEMP
04020457	FPC09	LO TEMP
04020458	FPC09	CCTV TROUBLE
04020459	FPC09	BPS TROUBLE

ADDRESSING		
04020377	NT-06	MANUAL INPUT
04020378	NT-06	DELUGE RELEASE
04020436	NT-06	WATER FLOW
04020437	NT-06	TAMPER
05020131	NT-06	PRIMARY ALARM
01020226	NT-06	SECONDARY ALARM

ADDRESSING		
04020383	NT-07	MANUAL INPUT
04020384	NT-07	DELUGE RELEASE
04020438	NT-07	WATER FLOW
04020439	NT-07	TAMPER
05020132	NT-07	PRIMARY ALARM
01020227	NT-07	SECONDARY ALARM

ADDRESSING		
04020389	NT-08	MANUAL INPUT
04020390	NT-08	DELUGE RELEASE
04020440	NT-08	WATER FLOW
04020441	NT-08	TAMPER
05020133	NT-08	PRIMARY ALARM
01020228	NT-08	SECONDARY ALARM

ADDRESSING		
04020401	NT-10	MANUAL INPUT
04020402	NT-10	DELUGE RELEASE
04020444	NT-10	WATER FLOW
04020445	NT-10	TAMPER
05020135	NT-10	PRIMARY ALARM
01020230	NT-10	SECONDARY ALARM

ADDRESSING		
04020407	NT-11	MANUAL INPUT
04020408	NT-11	DELUGE RELEASE
04020446	NT-11	WATER FLOW
04020447	NT-11	TAMPER
05020138	NT-11	PRIMARY ALARM
01020231	NT-11	SECONDARY ALARM

ADDRESSING		
04020413	NT-12	MANUAL INPUT
04020414	NT-12	DELUGE RELEASE
04020448	NT-12	WATER FLOW
04020449	NT-12	TAMPER
05020139	NT-12	PRIMARY ALARM
01020232	NT-12	SECONDARY ALARM

ADDRESSING		
04020419	NT-13	MANUAL INPUT
04020420	NT-13	DELUGE RELEASE
04020450	NT-13	WATER FLOW
04020451	NT-13	TAMPER
05020140	NT-13	PRIMARY ALARM
01020233	NT-13	SECONDARY ALARM

ADDRESSING		
04020425	NT-14	MANUAL INPUT
04020426	NT-14	DELUGE RELEASE
04020452	NT-14	WATER FLOW
04020453	NT-14	TAMPER
05020141	NT-14	PRIMARY ALARM
01030126	NT-14	SECONDARY ALARM

ADDRESSING		
04020431	NT-15	MANUAL INPUT
04020432	NT-15	DELUGE RELEASE
04020454	NT-15	WATER FLOW
04020455	NT-15	TAMPER
05020142	NT-15	PRIMARY ALARM
01030127	NT-15	SECONDARY ALARM

**BARNARD EJMT TEAM**

**BARNARD BARNARD**

**RONDINELLI** *A safe way to work safely*

**ELF** **ENGINEERS**

Western States Fire Protection Co.

**BCEC** *Business Consulting & Engineering*

**Sturgeon ELECTRIC**

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**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

Num	Date	Description

Drawn by: B.T.L. | Checked by: AEE-Jr

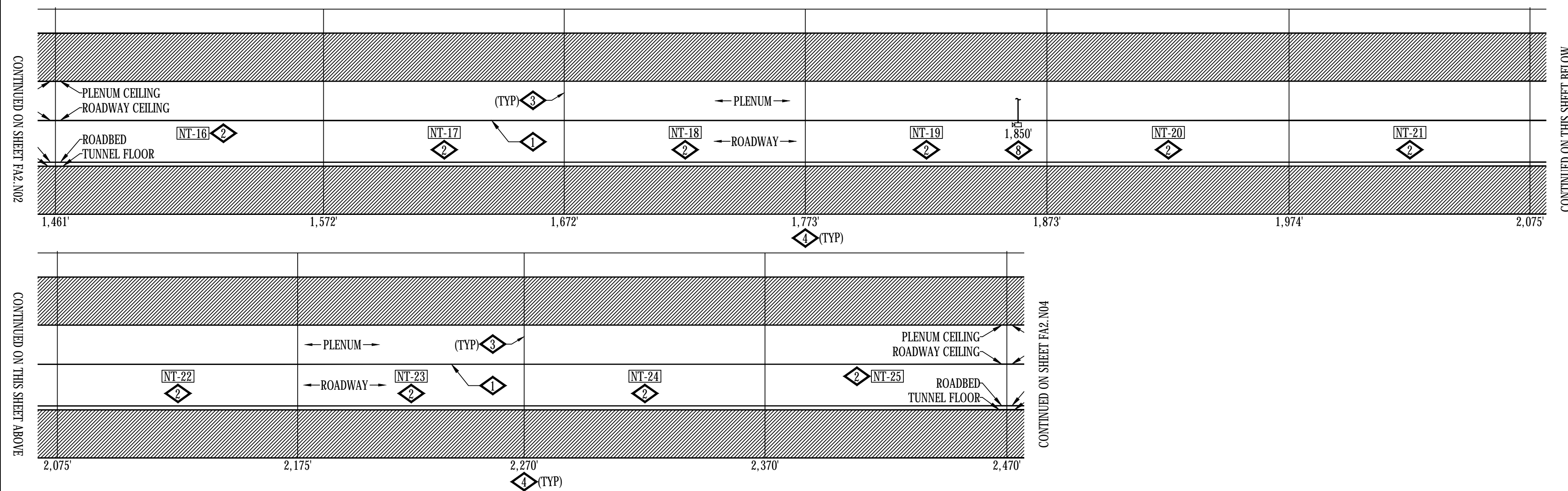
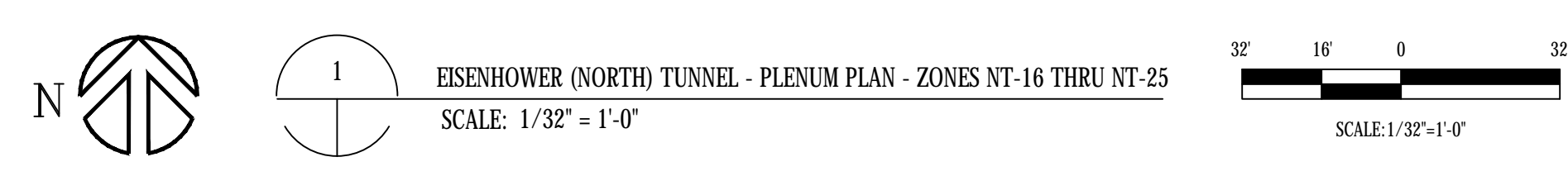
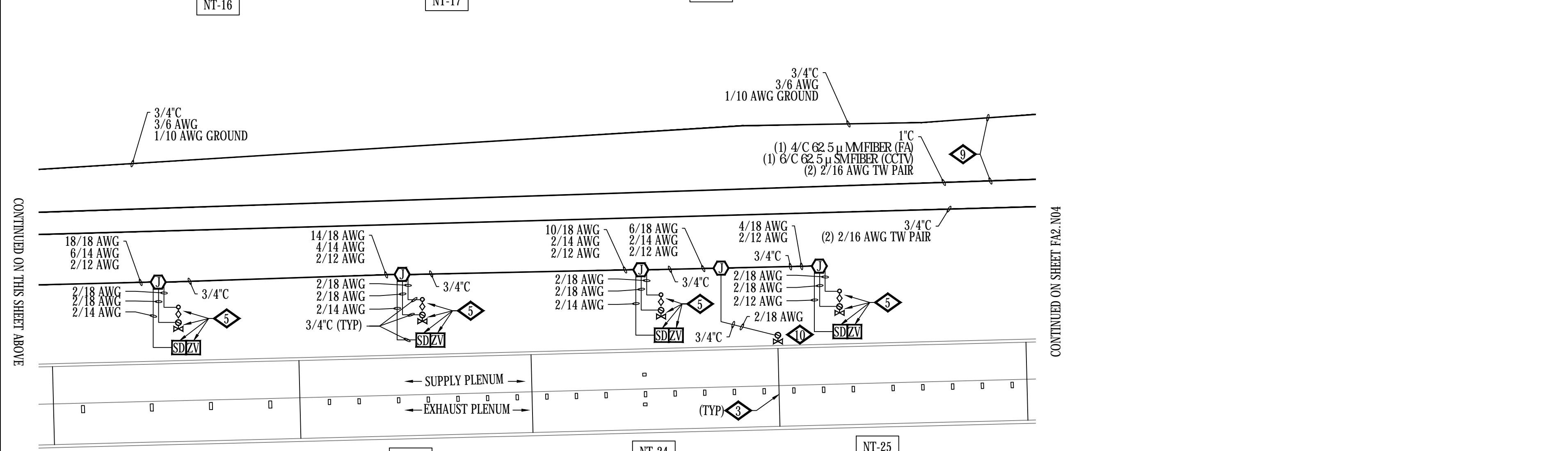
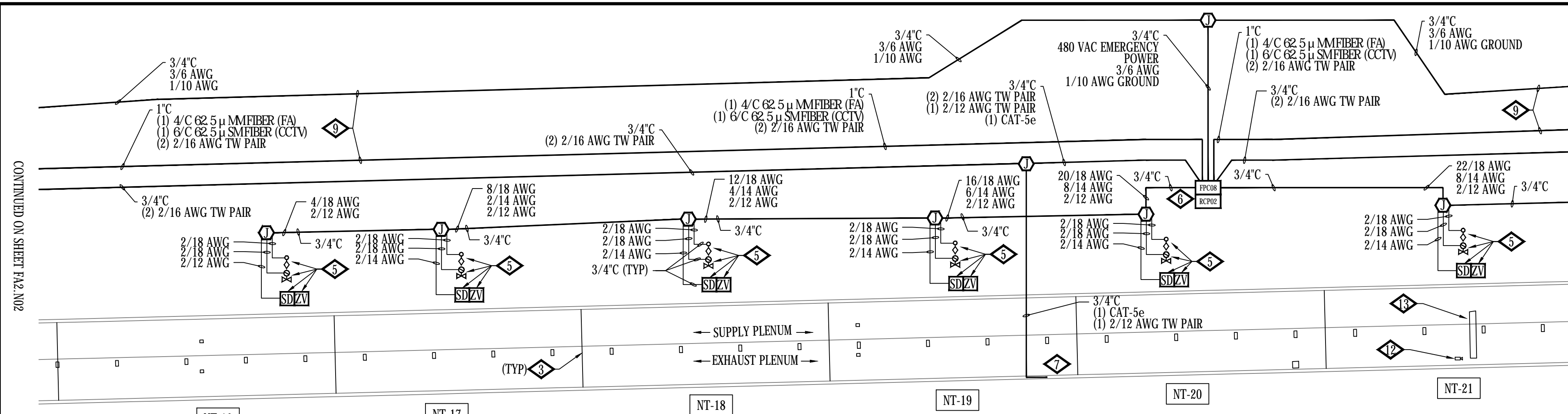
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**FIRE ALARM:**

EISENHOWER TUNNEL

FP ZONES NT-06 TO NT-15

Drawing Number **FA2.N02**



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- FIBER OPTIC LINEAR HEAT DETECTION (FOLHD) FIBER CABLE IN FOLHD HANGER. CABLE TO BE MOUNTED APPROXIMATELY 2 INCHES BELOW ROADWAY CEILING TILE. SEE SHEETS FA6.01, FA6.14 AND FA6.15.
  - DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - DELUGE ZONE BOUNDARY.
  - DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - EQUIPMENT LOCATED IN SUPPLY PLENUM.
  - ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
  - MOUNT CCTV CAMERA TO ROADWAY WALL TILE ABOVE EXIT PATHWAY. SEE SHEET FA6.02. DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
  - MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
  - EXISTING CCTV TRAFFIC CAMERA, SHOWN FOR REFERENCE PURPOSES, TO REMAIN.
  - EXISTING TRAFFIC CONTROL MESSAGE BOARD, SHOWN FOR REFERENCE PURPOSES, TO REMAIN. ROUTE FOLHD FIBER AND HANGER ABOVE THE MESSAGE BOARD. IT IS ACCEPTABLE TO RUN THE FOLHD CABLE WITHOUT THE HANGER WHERE THERE IS INSUFFICIENT CLEARANCE BETWEEN THE EXISTING MESSAGE BOARD AND THE EXISTING CEILING TILE, WHERE APPLICABLE. LIMIT THE FOLHD CABLE RUNS WITHOUT THE HANGER TO THE MINIMUM DISTANCE POSSIBLE TO CLEAR THE OBSTRUCTION.

ADDRESSING		
04030231	RCPO2	LO TEMP
04030232	RCPO2	HI TEMP
04030206	FPC08	HI TEMP
04030207	FPC08	LO TEMP
04030208	FPC08	CCTV TROUBLE
04030209	FPC08	BPS TROUBLE

ADDRESSING		
04030127	NT-16	MANUAL INPUT
04030128	NT-16	DELUGE RELEASE
04030186	NT-16	WATER FLOW
04030187	NT-16	TAMPER
05020143	NT-16	PRIMARY ALARM
01030128	NT-16	SECONDARY ALARM

ADDRESSING		
04030133	NT-17	MANUAL INPUT
04030134	NT-17	DELUGE RELEASE
04030188	NT-17	WATER FLOW
04030189	NT-17	TAMPER
05020144	NT-17	PRIMARY ALARM
01030129	NT-17	SECONDARY ALARM

ADDRESSING		
04030139	NT-18	MANUAL INPUT
04030140	NT-18	DELUGE RELEASE
04030190	NT-18	WATER FLOW
04030191	NT-18	TAMPER
05020145	NT-18	PRIMARY ALARM
01030130	NT-18	SECONDARY ALARM

ADDRESSING		
04030145	NT-19	MANUAL INPUT
04030146	NT-19	DELUGE RELEASE
04030192	NT-19	WATER FLOW
04030193	NT-19	TAMPER
05020146	NT-19	PRIMARY ALARM
01030131	NT-19	SECONDARY ALARM

ADDRESSING		
04030151	NT-20	MANUAL INPUT
04030152	NT-20	DELUGE RELEASE
04030194	NT-20	WATER FLOW
04030195	NT-20	TAMPER
05020147	NT-20	PRIMARY ALARM
01030132	NT-20	SECONDARY ALARM

ADDRESSING		
04030157	NT-21	MANUAL INPUT
04030158	NT-21	DELUGE RELEASE
04030196	NT-21	WATER FLOW
04030197	NT-21	TAMPER
05020148	NT-21	PRIMARY ALARM
01030133	NT-21	SECONDARY ALARM

ADDRESSING		
04030163	NT-22	MANUAL INPUT
04030164	NT-22	DELUGE RELEASE
04030198	NT-22	WATER FLOW
04030199	NT-22	TAMPER
05020149	NT-22	PRIMARY ALARM
01030134	NT-22	SECONDARY ALARM

ADDRESSING		
04030169	NT-23	MANUAL INPUT
04030170	NT-23	DELUGE RELEASE
04030200	NT-23	WATER FLOW
04030201	NT-23	TAMPER
05020150	NT-23	PRIMARY ALARM
01030135	NT-23	SECONDARY ALARM

ADDRESSING		
04030175	NT-24	MANUAL INPUT
04030176	NT-24	DELUGE RELEASE
04030202	NT-24	WATER FLOW
04030203	NT-24	TAMPER
05020151	NT-24	PRIMARY ALARM
01030136	NT-24	SECONDARY ALARM
04030210	NT-24	ISO VALVE TAMPER

ADDRESSING		
04030181	NT-25	MANUAL INPUT
04030182	NT-25	DELUGE RELEASE
04030204	NT-25	WATER FLOW
04030205	NT-25	TAMPER
05020152	NT-25	PRIMARY ALARM
01030137	NT-25	SECONDARY ALARM

**BARNARD EJM TEAM**

**BARNARD BARNARD**

**STURGEON ELECTRIC**

**RONDINELLI**

**BCER**

**Western States Fire Protection Co.**

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

**FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT**

Project No. C0703-360 Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

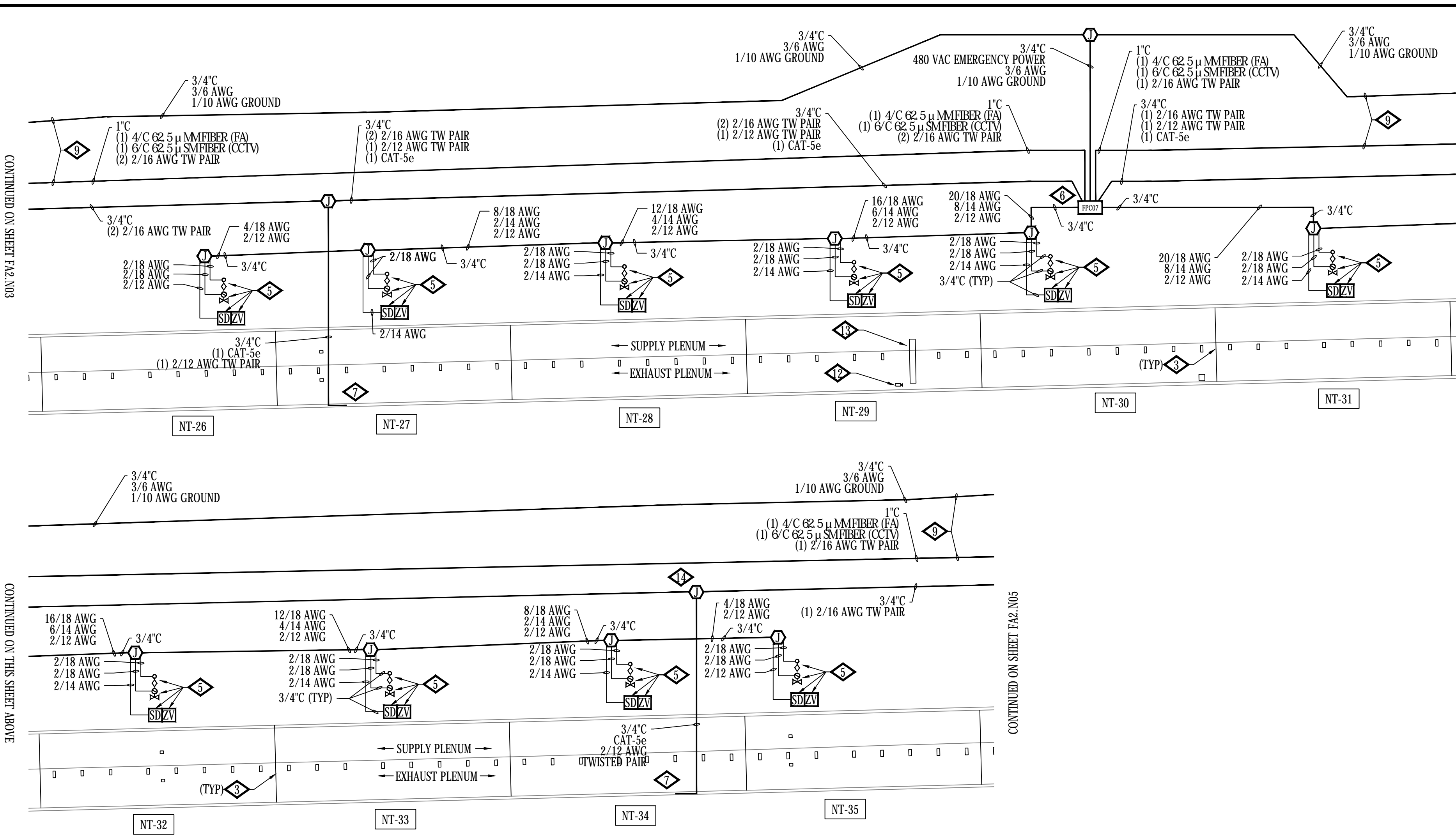
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Revisions

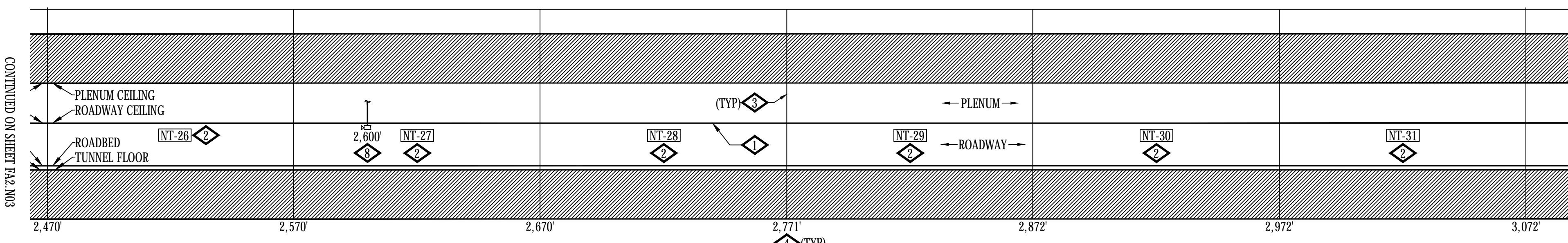
Drawn By: B.T.L. Checked By: AEE-JF

**FIRE ALARM: EISENHOWER TUNNEL FP ZONES NT-16 TO NT-25**

Drawing Number **FA2.N03**



N  
 1  
 EISENHOWER (NORTH) TUNNEL - PLENUM PLAN - ZONES NT-26 THRU NT-35  
 SCALE: 1/32" = 1'-0"



N  
 2  
 EISENHOWER (NORTH) TUNNEL - ROADWAY SECTIONAL ELEVATION PLAN - SOUTH VIEW - ZONES NT-26 THRU NT-35  
 SCALE: 1/32" = 1'-0"

- GENERAL NOTES:**
- IF FIELD CONDITIONS RESULT IN A CHANGE TO THE SHOP DRAWING INSTALLATION IN ANY WAY, CONTACT FAS SYSTEMS GROUP TO VERIFY PROPOSED CHANGES ARE COMPLIANT WITH NFPA 72 AND PROJECT REQUIREMENTS.
  - EACH CONTROL CABINET AND ADDRESSABLE DEVICE SHALL BEAR A TYPED LABEL INDICATING ITS ADDRESS OR DESIGNATION, WHICH CAN BE SEEN WITHOUT A LADDER OR LIFT. SMOKE AND HEAT DETECTORS SHALL HAVE THEIR LABEL ON ITS BASE.
- DETAIL NOTES:**
- FIBER OPTIC LINEAR HEAT DETECTION (FOLHD) FIBER CABLE IN FOLHD HANGER. CABLE TO BE MOUNTED APPROXIMATELY 2 INCHES BELOW ROADWAY CEILING TILE. SEE SHEETS FA6.01, FA6.14 AND FA6.15.
  - DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - DELUGE ZONE BOUNDARY.
  - DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - EQUIPMENT LOCATED IN SUPPLY PLENUM.
  - ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
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  - MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
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  - LONGSPAN VLS-IN-L CAT5e EXTENDER LOCATED IN JUNCTION BOX AS SHOWN.

ADDRESSING	
04030456	FPC07 HI TEMP
04030457	FPC07 LO TEMP
04030458	FPC07 CCTV TROUBLE
04030459	FPC07 BPS TROUBLE

ADDRESSING		ADDRESSING	
04030377	NT-26 MANUAL INPUT	04030383	NT-27 MANUAL INPUT
04030378	NT-26 DELUGE RELEASE	04030384	NT-27 DELUGE RELEASE
04030436	NT-26 WATER FLOW	04030438	NT-27 WATER FLOW
04030437	NT-26 TAMPER	04030439	NT-27 TAMPER
05020153	NT-26 PRIMARY ALARM	05020154	NT-27 PRIMARY ALARM
01030138	NT-26 SECONDARY ALARM	01030139	NT-27 SECONDARY ALARM

ADDRESSING		ADDRESSING	
04030389	NT-28 MANUAL INPUT	04030395	NT-29 MANUAL INPUT
04030390	NT-28 DELUGE RELEASE	04030396	NT-29 DELUGE RELEASE
04030440	NT-28 WATER FLOW	04030442	NT-29 WATER FLOW
04030441	NT-28 TAMPER	04030443	NT-29 TAMPER
05020155	NT-28 PRIMARY ALARM	05020156	NT-29 PRIMARY ALARM
01030140	NT-28 SECONDARY ALARM	01030141	NT-29 SECONDARY ALARM

ADDRESSING		ADDRESSING	
04030401	NT-30 MANUAL INPUT	04030407	NT-31 MANUAL INPUT
04030402	NT-30 DELUGE RELEASE	04030408	NT-31 DELUGE RELEASE
04030444	NT-30 WATER FLOW	04030446	NT-31 WATER FLOW
04030445	NT-30 TAMPER	04030447	NT-31 TAMPER
05020157	NT-30 PRIMARY ALARM	05020158	NT-31 PRIMARY ALARM
01030142	NT-30 SECONDARY ALARM	01030143	NT-31 SECONDARY ALARM

ADDRESSING		ADDRESSING	
04030413	NT-32 MANUAL INPUT	04030419	NT-33 MANUAL INPUT
04030414	NT-32 DELUGE RELEASE	04030420	NT-33 DELUGE RELEASE
04030448	NT-32 WATER FLOW	04030450	NT-33 WATER FLOW
04030449	NT-32 TAMPER	04030451	NT-33 TAMPER
05020159	NT-32 PRIMARY ALARM	05020160	NT-33 PRIMARY ALARM
01030144	NT-32 SECONDARY ALARM	01030145	NT-33 SECONDARY ALARM

ADDRESSING		ADDRESSING	
04030425	NT-34 MANUAL INPUT	04030431	NT-35 MANUAL INPUT
04030426	NT-34 DELUGE RELEASE	04030432	NT-35 DELUGE RELEASE
04030452	NT-34 WATER FLOW	04030454	NT-35 WATER FLOW
04030453	NT-34 TAMPER	04030455	NT-35 TAMPER
05020161	NT-34 PRIMARY ALARM	05020162	NT-35 PRIMARY ALARM
01030146	NT-34 SECONDARY ALARM	01030147	NT-35 SECONDARY ALARM

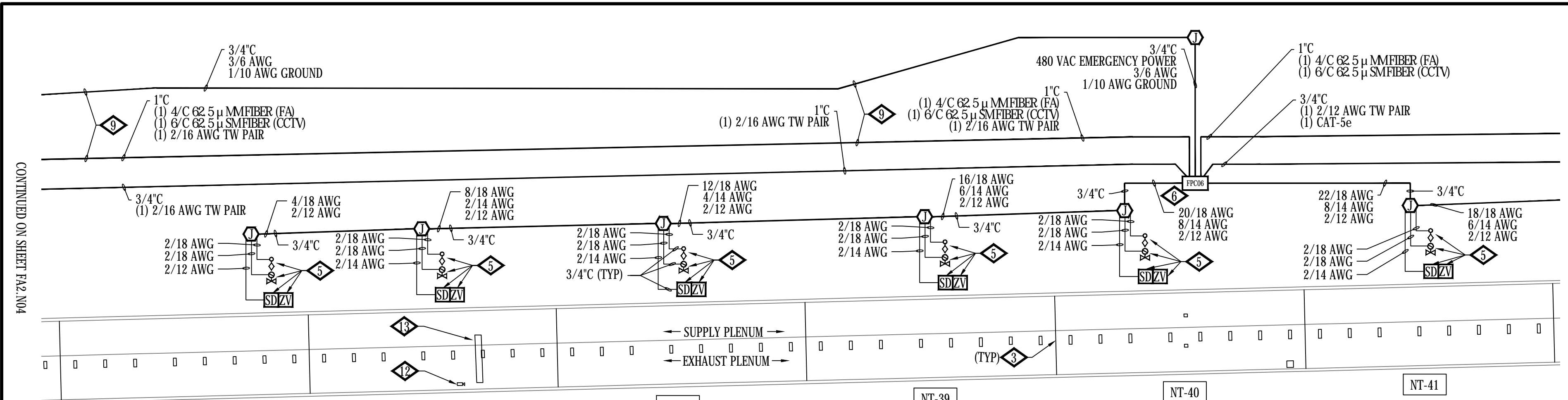
**BARNARD EJMT TEAM**  
**BARNARD** **BARNARD** **BARNARD**  
**RONDINELLI**  
**BCER**  
**Sturgeon Electric**  
**Western States Fire Protection Co.**  
**ALF**  
 CONSULTING ENGINEERS

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

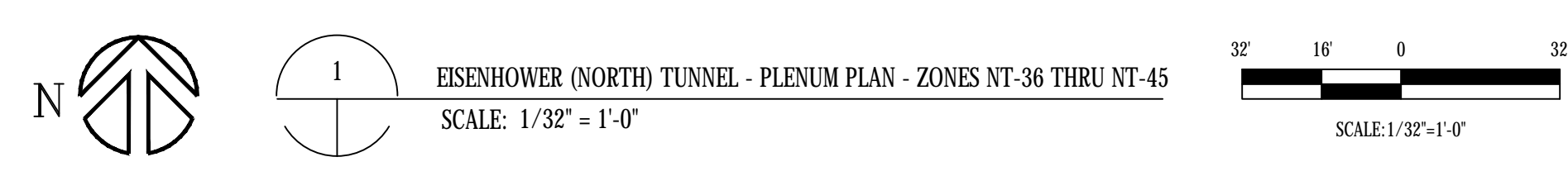
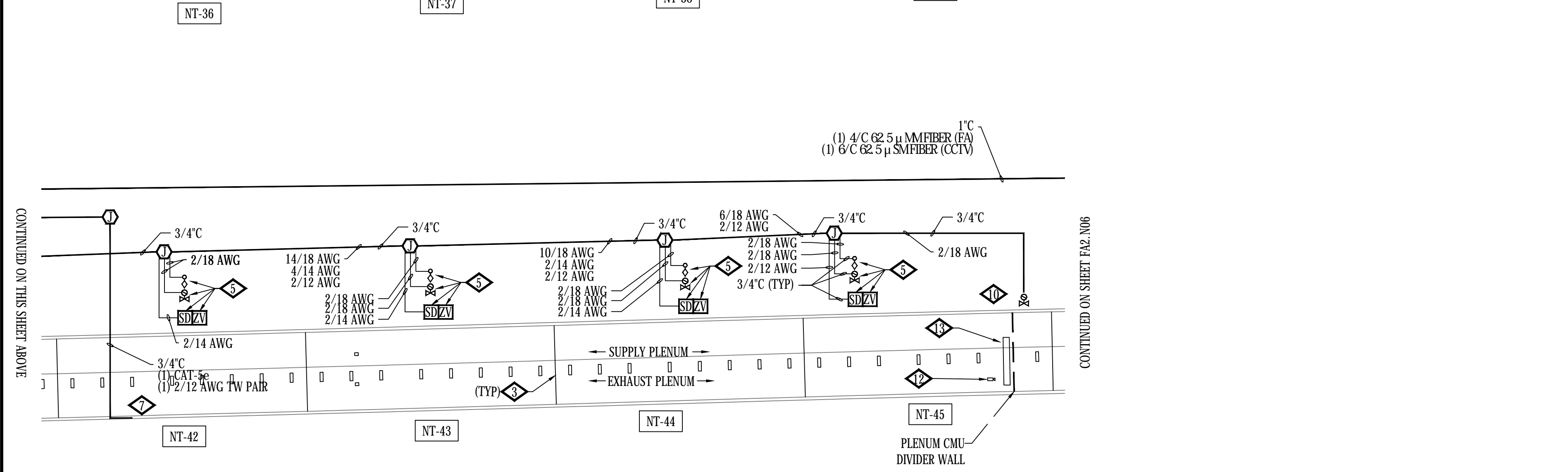
Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

DATE: \_\_\_\_\_  
 DRAWN BY: B.T.L. CHECKED BY: AEE-JT  
 REVISIONS: \_\_\_\_\_  
 FIRE ALARM: EISENHOWER TUNNEL FP ZONES NT-26 TO NT-35  
 Drawing Number **FA2.N04**

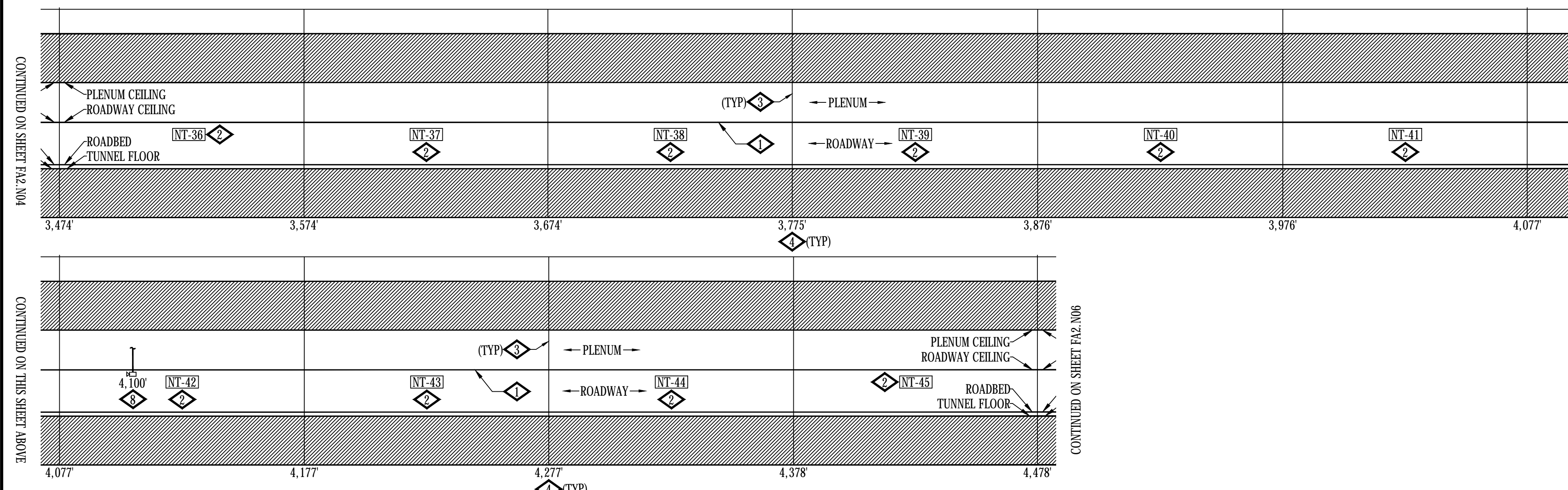
O & M Manual ASBUILT - 67



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  - 3 DELUGE ZONE BOUNDARY.
  - 4 DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - 5 DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
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  - 10 FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - 11 MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
  - 12 EXISTING CCTV TRAFFIC CAMERA, SHOWN FOR REFERENCE PURPOSES, TO REMAIN.
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1 EISENHOWER (NORTH) TUNNEL - PLENUM PLAN - ZONES NT-36 THRU NT-45  
SCALE: 1/32" = 1'-0"



2 EISENHOWER (NORTH) TUNNEL - ROADWAY SECTIONAL ELEVATION PLAN - SOUTH VIEW - ZONES NT-36 THRU NT-45  
SCALE: 1/32" = 1'-0"

ADDRESSING		
04040206	FPC06	HI TEMP
04040207	FPC06	LO TEMP
04040208	FPC06	CCTV TROUBLE
04040209	FPC06	BPS TROUBLE

ADDRESSING		
04040127	NT-36	MANUAL INPUT
04040128	NT-36	DELUGE RELEASE
04040186	NT-36	WATER FLOW
04040187	NT-36	TAMPER
05020163	NT-36	PRIMARY ALARM
01030148	NT-36	SECONDARY ALARM

ADDRESSING		
04040133	NT-37	MANUAL INPUT
04040134	NT-37	DELUGE RELEASE
04040188	NT-37	WATER FLOW
04040189	NT-37	TAMPER
05020164	NT-37	PRIMARY ALARM
01030149	NT-37	SECONDARY ALARM

ADDRESSING		
04040139	NT-38	MANUAL INPUT
04040140	NT-38	DELUGE RELEASE
04040190	NT-38	WATER FLOW
04040191	NT-38	TAMPER
05020165	NT-38	PRIMARY ALARM
01030150	NT-38	SECONDARY ALARM

ADDRESSING		
04040145	NT-39	MANUAL INPUT
04040146	NT-39	DELUGE RELEASE
04040192	NT-39	WATER FLOW
04040193	NT-39	TAMPER
05020166	NT-39	PRIMARY ALARM
01030151	NT-39	SECONDARY ALARM

ADDRESSING		
04040151	NT-40	MANUAL INPUT
04040152	NT-40	DELUGE RELEASE
04040194	NT-40	WATER FLOW
04040195	NT-40	TAMPER
05020167	NT-40	PRIMARY ALARM
01030152	NT-40	SECONDARY ALARM

ADDRESSING		
04040157	NT-41	MANUAL INPUT
04040158	NT-41	DELUGE RELEASE
04040196	NT-41	WATER FLOW
04040197	NT-41	TAMPER
05020168	NT-41	PRIMARY ALARM
01030153	NT-41	SECONDARY ALARM

ADDRESSING		
04040163	NT-42	MANUAL INPUT
04040164	NT-42	DELUGE RELEASE
04040198	NT-42	WATER FLOW
04040199	NT-42	TAMPER
05020169	NT-42	PRIMARY ALARM
01030154	NT-42	SECONDARY ALARM

ADDRESSING		
04040169	NT-43	MANUAL INPUT
04040170	NT-43	DELUGE RELEASE
04040200	NT-43	WATER FLOW
04040201	NT-43	TAMPER
05020170	NT-43	PRIMARY ALARM
01030155	NT-43	SECONDARY ALARM

ADDRESSING		
04040175	NT-44	MANUAL INPUT
04040176	NT-44	DELUGE RELEASE
04040202	NT-44	WATER FLOW
04040203	NT-44	TAMPER
05020171	NT-44	PRIMARY ALARM
01030156	NT-44	SECONDARY ALARM

ADDRESSING		
04040181	NT-45	MANUAL INPUT
04040182	NT-45	DELUGE RELEASE
04040204	NT-45	WATER FLOW
04040205	NT-45	TAMPER
05020172	NT-45	PRIMARY ALARM
01030157	NT-45	SECONDARY ALARM
04040230	NT-45	ISO VALVE TAMPER

CONTINUED ON SHEET FA2.N04

CONTINUED ON THIS SHEET BELOW

CONTINUED ON THIS SHEET ABOVE

CONTINUED ON SHEET FA2.N06

CONTINUED ON THIS SHEET BELOW

CONTINUED ON SHEET FA2.N04

CONTINUED ON SHEET FA2.N06

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

BARNARD EJMT TEAM

Western States Fire Protection Co.

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Subaccount 17810

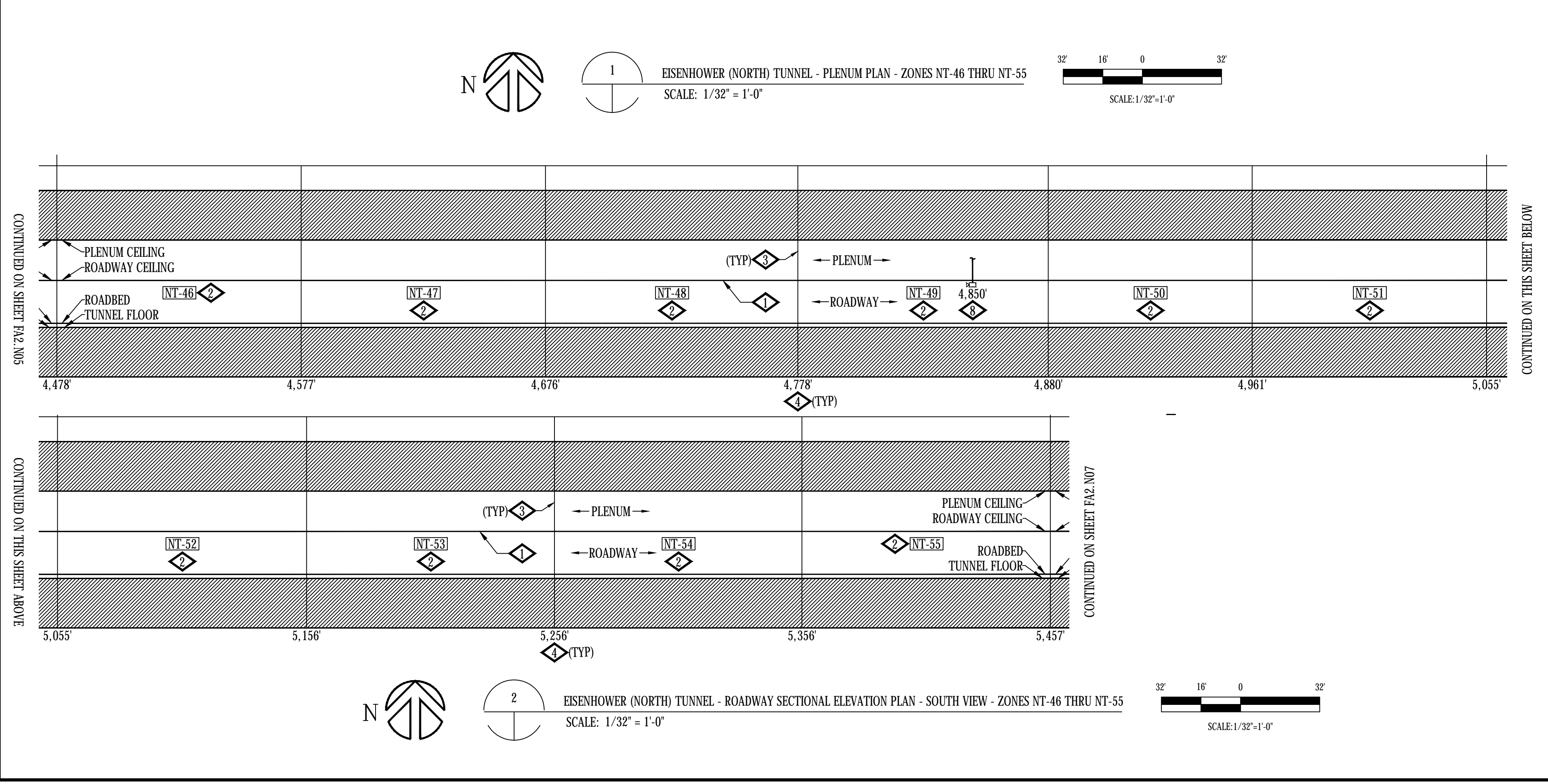
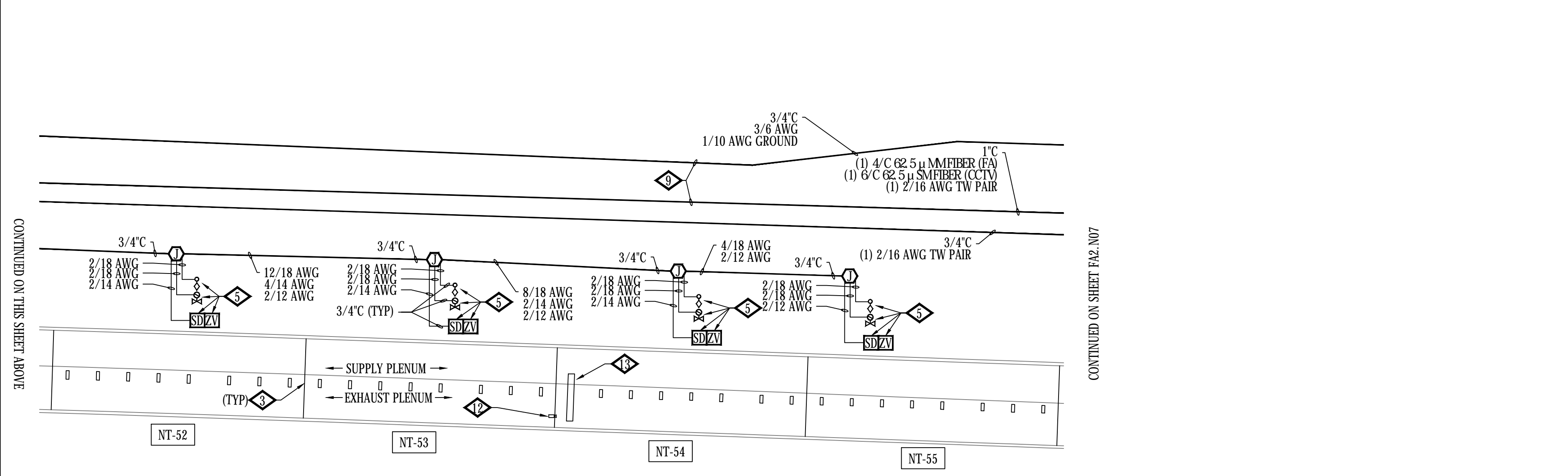
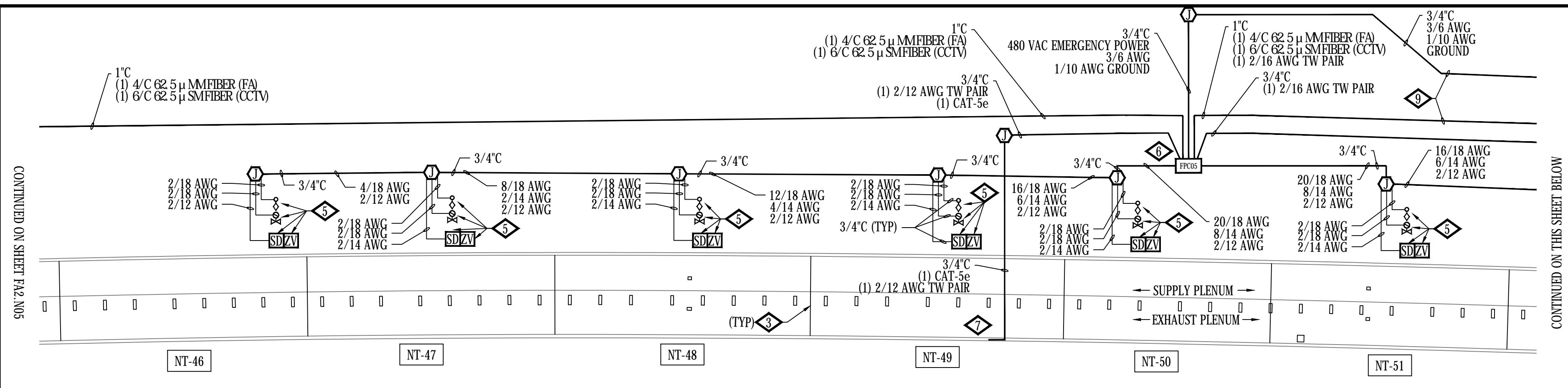
RECORD DRAWINGS - 2015-11-16

Num	Date	Description

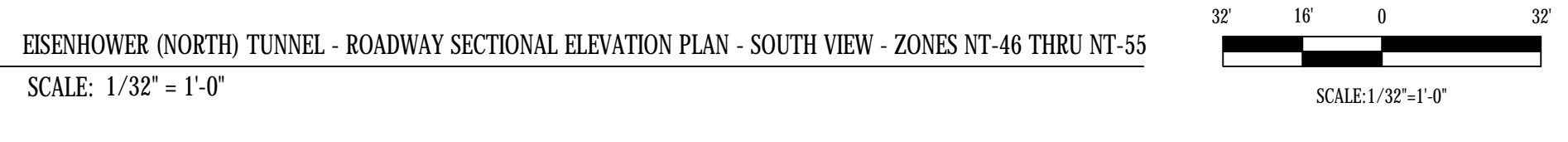
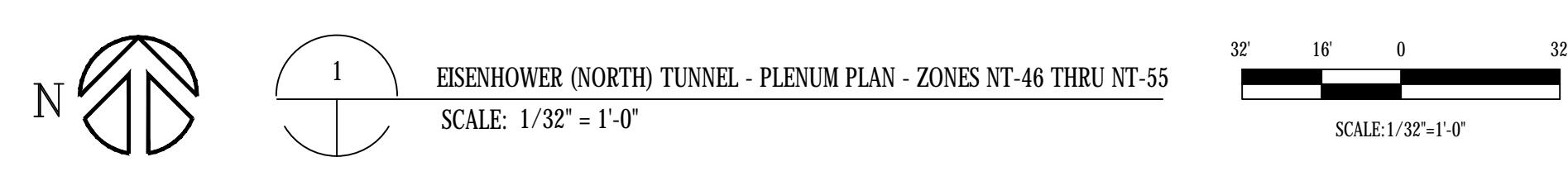
DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

FIRE ALARM:  
EISENHOWER TUNNEL  
FP ZONES NT-36 TO NT-45

Drawing Number  
**FA2.N05**



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  - DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - DELUGE ZONE BOUNDARY.
  - DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - EQUIPMENT LOCATED IN SUPPLY PLENUM.
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  - MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
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ADDRESSING	
03020206	FPC05 HI TEMP
03020207	FPC05 LO TEMP
03020208	FPC05 CCTV TROUBLE
03020209	FPC05 BPS TROUBLE

ADDRESSING		ADDRESSING	
03020127	NT-46 MANUAL INPUT	03020133	NT-47 MANUAL INPUT
03020128	NT-46 DELUGE RELEASE	03020134	NT-47 DELUGE RELEASE
03020186	NT-46 WATER FLOW	03020188	NT-47 WATER FLOW
03020187	NT-46 TAMPER	03020189	NT-47 TAMPER
05020173	NT-46 PRIMARY ALARM	05020174	NT-47 PRIMARY ALARM
01030158	NT-46 SECONDARY ALARM	01030159	NT-47 SECONDARY ALARM

ADDRESSING		ADDRESSING	
03020139	NT-48 MANUAL INPUT	03020145	NT-49 MANUAL INPUT
03020140	NT-48 DELUGE RELEASE	03020146	NT-49 DELUGE RELEASE
03020190	NT-48 WATER FLOW	03020192	NT-49 WATER FLOW
03020191	NT-48 TAMPER	03020193	NT-49 TAMPER
05020175	NT-48 PRIMARY ALARM	05020176	NT-49 PRIMARY ALARM
01030160	NT-48 SECONDARY ALARM	01030161	NT-49 SECONDARY ALARM

ADDRESSING		ADDRESSING	
03020151	NT-50 MANUAL INPUT	03020157	NT-51 MANUAL INPUT
03020152	NT-50 DELUGE RELEASE	03020158	NT-51 DELUGE RELEASE
03020194	NT-50 WATER FLOW	03020196	NT-51 WATER FLOW
03020195	NT-50 TAMPER	03020197	NT-51 TAMPER
05020177	NT-50 PRIMARY ALARM	05020178	NT-51 PRIMARY ALARM
01030162	NT-50 SECONDARY ALARM	01030163	NT-51 SECONDARY ALARM

ADDRESSING		ADDRESSING	
03020163	NT-52 MANUAL INPUT	03020169	NT-53 MANUAL INPUT
03020164	NT-52 DELUGE RELEASE	03020170	NT-53 DELUGE RELEASE
03020198	NT-52 WATER FLOW	03020200	NT-53 WATER FLOW
03020199	NT-52 TAMPER	03020201	NT-53 TAMPER
05020179	NT-52 PRIMARY ALARM	05020180	NT-53 PRIMARY ALARM
01030164	NT-52 SECONDARY ALARM	01030165	NT-53 SECONDARY ALARM

ADDRESSING		ADDRESSING	
03020175	NT-54 MANUAL INPUT	03020181	NT-55 MANUAL INPUT
03020176	NT-54 DELUGE RELEASE	03020182	NT-55 DELUGE RELEASE
03020202	NT-54 WATER FLOW	03020204	NT-55 WATER FLOW
03020203	NT-54 TAMPER	03020205	NT-55 TAMPER
05020181	NT-54 PRIMARY ALARM	05020182	NT-55 PRIMARY ALARM
01030166	NT-54 SECONDARY ALARM	01030167	NT-55 SECONDARY ALARM

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**BARNARD EJMT TEAM**

BCER **BARNARD** **STURGEON ELECTRIC** **RONDINELLI** **Western States Fire Protection Co.**

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

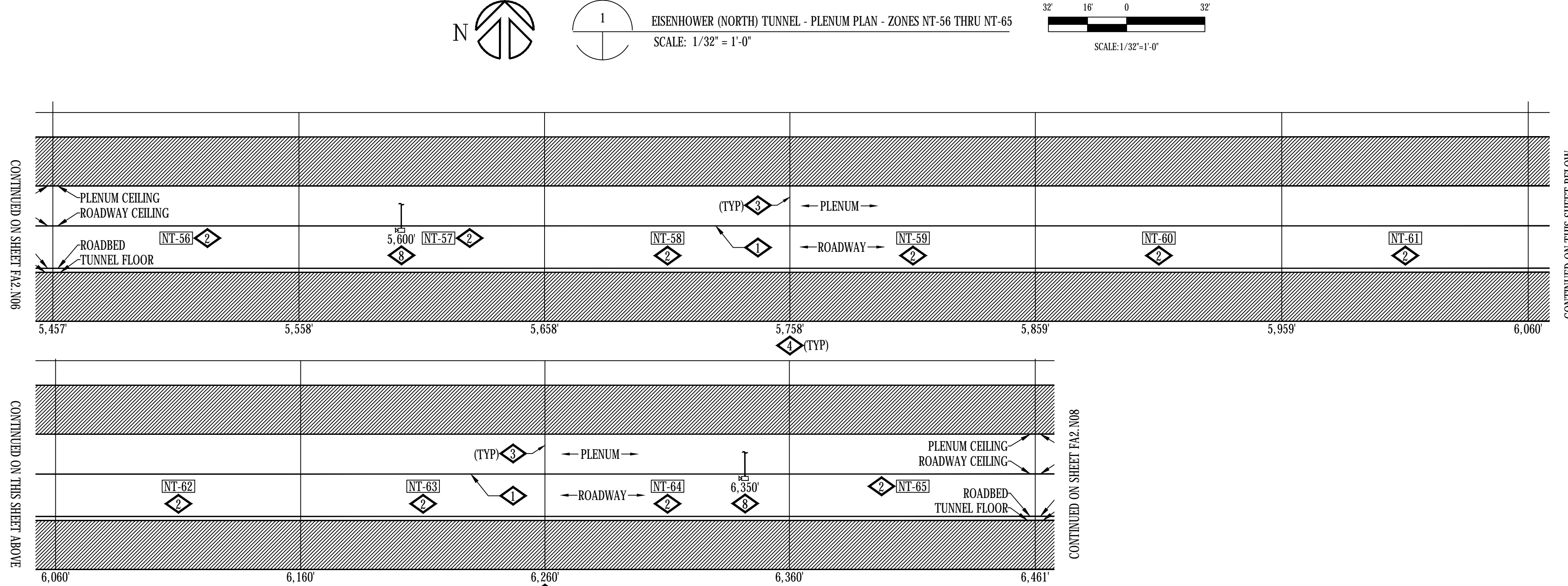
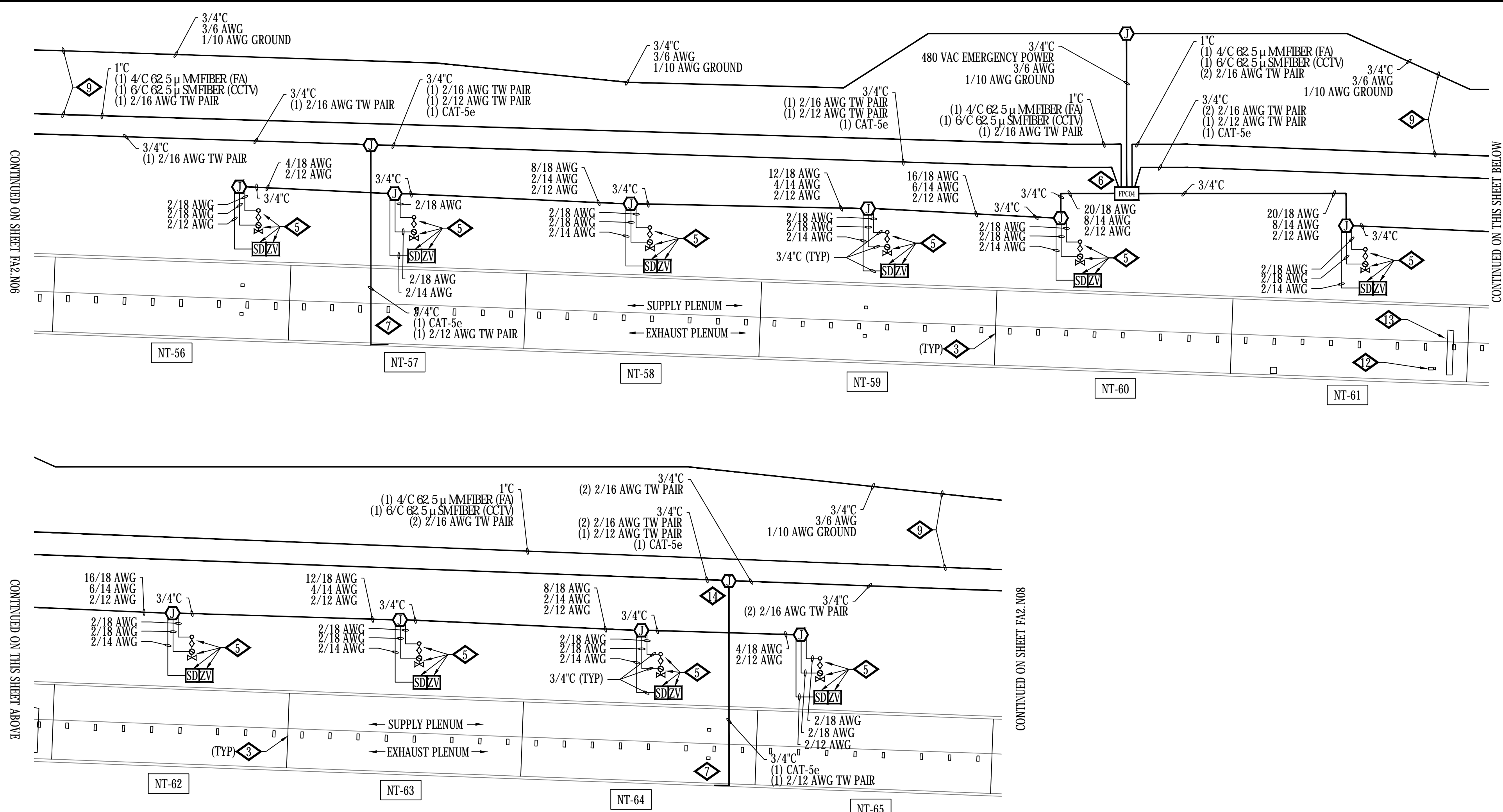
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Revisions	Date	Description

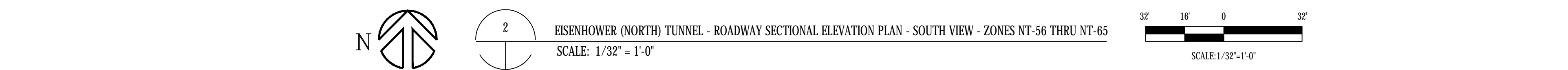
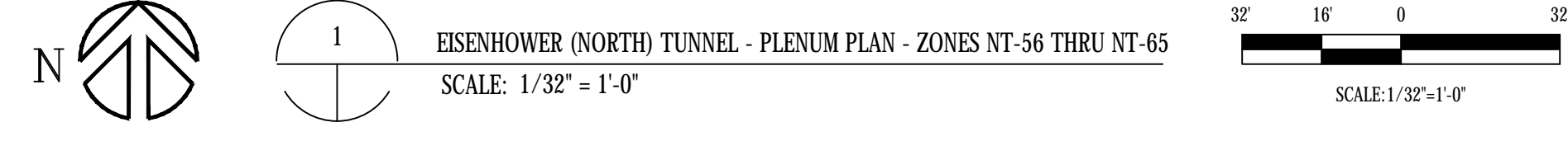
DRAWN BY: B.T.L. CHECKED BY: AEE-JF

FIRE ALARM:  
EISENHOWER TUNNEL  
FP ZONES NT-46 TO NT-55

Drawing Number  
**FA2.N06**



- GENERAL NOTES:**
- IF FIELD CONDITIONS RESULT IN A CHANGE TO THE SHOP DRAWING INSTALLATION IN ANY WAY, CONTACT FAS SYSTEMS GROUP TO VERIFY PROPOSED CHANGES ARE COMPLIANT WITH NFPA 72 AND PROJECT REQUIREMENTS.
  - EACH CONTROL CABINET AND ADDRESSABLE DEVICE SHALL BEAR A TYPED LABEL INDICATING ITS ADDRESS OR DESIGNATION, WHICH CAN BE SEEN WITHOUT A LADDER OR LIFT. SMOKE AND HEAT DETECTORS SHALL HAVE THEIR LABEL ON ITS BASE.
- DETAIL NOTES:**
- FIBER OPTIC LINEAR HEAT DETECTION (FOLHD) FIBER CABLE IN FOLHD HANGER. CABLE TO BE MOUNTED APPROXIMATELY 2 INCHES BELOW ROADWAY CEILING TILE. SEE SHEETS FA6.01, FA6.14 AND FA6.15.
  - DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - DELUGE ZONE BOUNDARY.
  - DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - EQUIPMENT LOCATED IN SUPPLY PLENUM.
  - ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
  - MOUNT CCTV CAMERA TO ROADWAY WALL TILE ABOVE EXIT PATHWAY. SEE SHEET FA6.02. DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
  - MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
  - EXISTING CCTV TRAFFIC CAMERA, SHOWN FOR REFERENCE PURPOSES, TO REMAIN.
  - EXISTING TRAFFIC CONTROL MESSAGE BOARD, SHOWN FOR REFERENCE PURPOSES, TO REMAIN. ROUTE FOLHD FIBER AND HANGER ABOVE THE MESSAGE BOARD. IT IS ACCEPTABLE TO RUN THE FOLHD CABLE WITHOUT THE HANGER WHERE THERE IS INSUFFICIENT CLEARANCE BETWEEN THE EXISTING MESSAGE BOARD AND THE EXISTING CEILING TILE, WHERE APPLICABLE. LIMIT THE FOLHD CABLE RUNS WITHOUT THE HANGER TO THE MINIMUM DISTANCE POSSIBLE TO CLEAR THE OBSTRUCTION.
  - LONGSPAN VLS-1N-L CAT5e EXTENDER LOCATED IN JUNCTION BOX AS SHOWN.



ADDRESSING	
03020456	FPC04 HI TEMP
03020457	FPC04 LO TEMP
03020458	FPC04 CCTV TROUBLE
03020459	FPC04 BPS TROUBLE

ADDRESSING	
03020377	NT-56 MANUAL INPUT
03020378	NT-56 DELUGE RELEASE
03020436	NT-56 WATER FLOW
03020437	NT-56 TAMPER
05020183	NT-56 PRIMARY ALARM
01030168	NT-56 SECONDARY ALARM

ADDRESSING	
03020389	NT-58 MANUAL INPUT
03020390	NT-58 DELUGE RELEASE
03020440	NT-58 WATER FLOW
03020441	NT-58 TAMPER
05020185	NT-58 PRIMARY ALARM
01030170	NT-58 SECONDARY ALARM

ADDRESSING	
03020401	NT-60 MANUAL INPUT
03020402	NT-60 DELUGE RELEASE
03020444	NT-60 WATER FLOW
03020445	NT-60 TAMPER
05020187	NT-60 PRIMARY ALARM
01030172	NT-60 SECONDARY ALARM

ADDRESSING	
03020413	NT-62 MANUAL INPUT
03020414	NT-62 DELUGE RELEASE
03020448	NT-62 WATER FLOW
03020449	NT-62 TAMPER
05020189	NT-62 PRIMARY ALARM
01030174	NT-62 SECONDARY ALARM

ADDRESSING	
03020425	NT-64 MANUAL INPUT
03020426	NT-64 DELUGE RELEASE
03020452	NT-64 WATER FLOW
03020453	NT-64 TAMPER
05020191	NT-64 PRIMARY ALARM
01030176	NT-64 SECONDARY ALARM

ADDRESSING	
03020383	NT-57 MANUAL INPUT
03020384	NT-57 DELUGE RELEASE
03020438	NT-57 WATER FLOW
03020439	NT-57 TAMPER
05020184	NT-57 PRIMARY ALARM
01030169	NT-57 SECONDARY ALARM

ADDRESSING	
03020395	NT-59 MANUAL INPUT
03020396	NT-59 DELUGE RELEASE
03020442	NT-59 WATER FLOW
03020443	NT-59 TAMPER
05020186	NT-59 PRIMARY ALARM
01030171	NT-59 SECONDARY ALARM

ADDRESSING	
03020407	NT-61 MANUAL INPUT
03020408	NT-61 DELUGE RELEASE
03020446	NT-61 WATER FLOW
03020447	NT-61 TAMPER
05020188	NT-61 PRIMARY ALARM
01030173	NT-61 SECONDARY ALARM

ADDRESSING	
03020419	NT-63 MANUAL INPUT
03020420	NT-63 DELUGE RELEASE
03020450	NT-63 WATER FLOW
03020451	NT-63 TAMPER
05020190	NT-63 PRIMARY ALARM
01030175	NT-63 SECONDARY ALARM

ADDRESSING	
03020431	NT-65 MANUAL INPUT
03020432	NT-65 DELUGE RELEASE
03020454	NT-65 WATER FLOW
03020455	NT-65 TAMPER
05020192	NT-65 PRIMARY ALARM
01030177	NT-65 SECONDARY ALARM

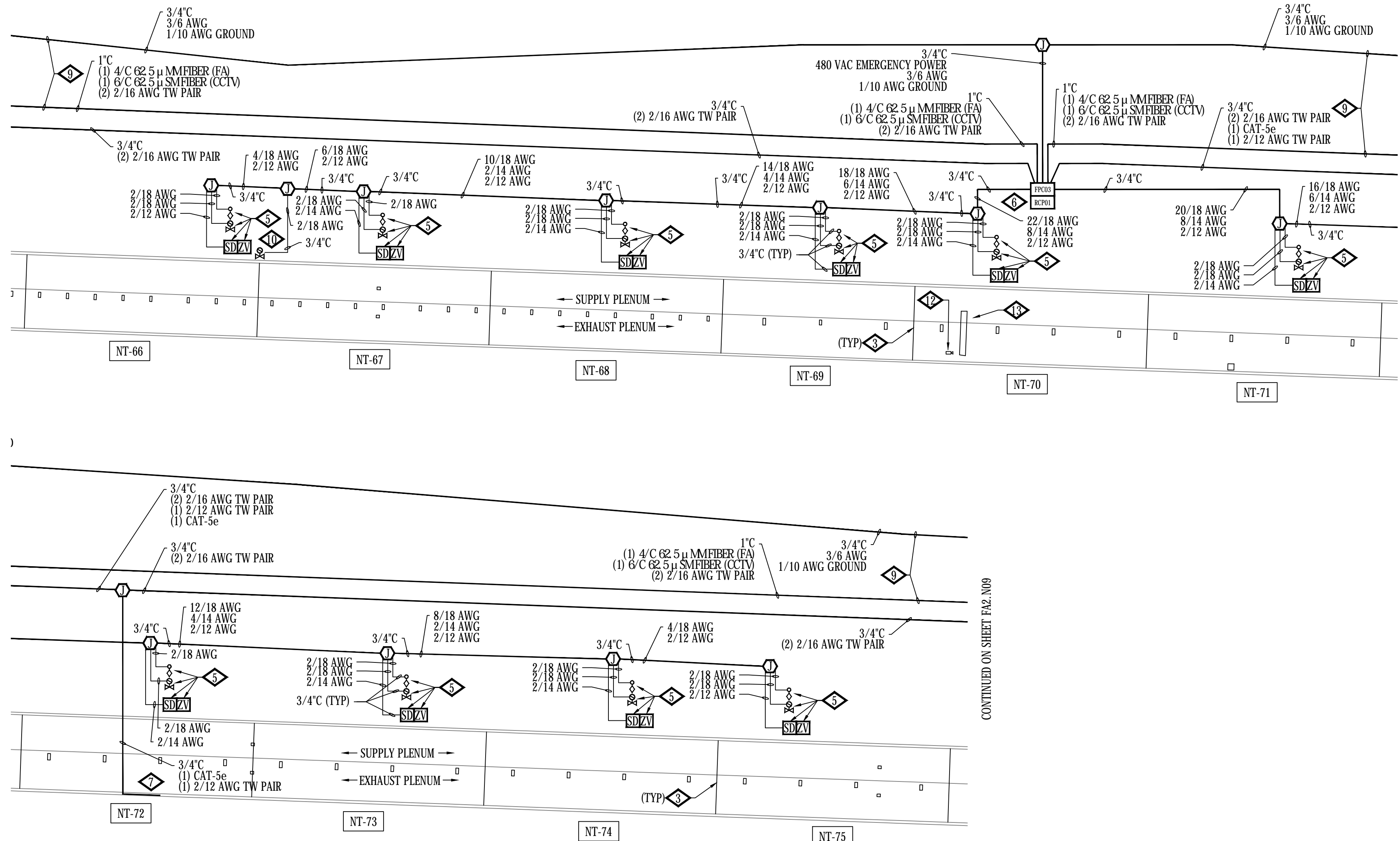
**BARNARD EJM TEAM**  
**BARNARD**  
**Sturgeon Electric**  
**RONDINELLI**  
**BCER**  
**Western States Fire Protection Co.**

**EISENHOWER/JOHNSON MEMORIAL TUNNEL FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT**  
 Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

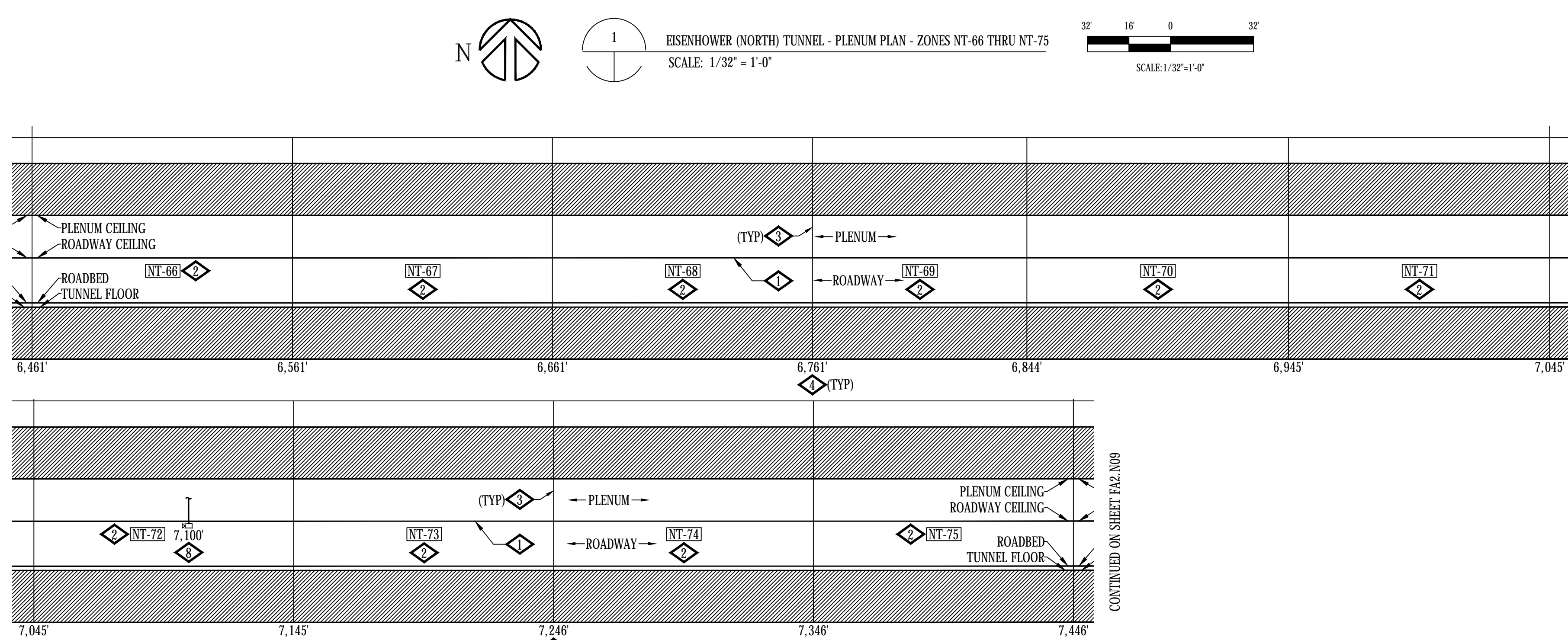
Num	Date	Description

**FIRE ALARM:**  
 EISENHOWER TUNNEL  
 FP ZONES NT-56 TO NT-65  
 Drawing Number  
**FA2.N07**

Drawn by: AEE-JR  
 Checked by: B.T.L.



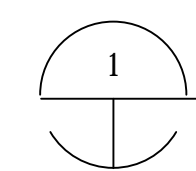
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EISENHOWER (NORTH) TUNNEL - PLENUM PLAN - ZONES NT-66 THRU NT-75  
SCALE: 1/32" = 1'-0"

EISENHOWER (NORTH) TUNNEL - ROADWAY SECTIONAL ELEVATION PLAN - SOUTH VIEW - ZONES NT-66 THRU NT-75  
SCALE: 1/32" = 1'-0"

- GENERAL NOTES:**
- IF FIELD CONDITIONS RESULT IN A CHANGE TO THE SHOP DRAWING INSTALLATION IN ANY WAY, CONTACT FAS SYSTEMS GROUP TO VERIFY PROPOSED CHANGES ARE COMPLIANT WITH NFPA 72 AND PROJECT REQUIREMENTS.
  - EACH CONTROL CABINET AND ADDRESSABLE DEVICE SHALL BEAR A TYPED LABEL INDICATING ITS ADDRESS OR DESIGNATION, WHICH CAN BE SEEN WITHOUT A LADDER OR LIFT. SMOKE AND HEAT DETECTORS SHALL HAVE THEIR LABEL ON ITS BASE.
- DETAIL NOTES:**
- FIBER OPTIC LINEAR HEAT DETECTION (FOLHD) FIBER CABLE IN FOLHD HANGER. CABLE TO BE MOUNTED APPROXIMATELY 2 INCHES BELOW ROADWAY CEILING TILE. SEE SHEETS FA6.01, FA6.14 AND FA6.15.
  - DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - DELUGE ZONE BOUNDARY.
  - DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - EQUIPMENT LOCATED IN SUPPLY PLENUM.
  - ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
  - MOUNT CCTV CAMERA TO ROADWAY WALL TILE ABOVE EXIT PATHWAY. SEE SHEET FA6.02. DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
  - MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
  - EXISTING CCTV TRAFFIC CAMERA, SHOWN FOR REFERENCE PURPOSES, TO REMAIN.
  - EXISTING TRAFFIC CONTROL MESSAGE BOARD, SHOWN FOR REFERENCE PURPOSES, TO REMAIN. ROUTE FOLHD FIBER AND HANGER ABOVE THE MESSAGE BOARD. IT IS ACCEPTABLE TO RUN THE FOLHD CABLE WITHOUT THE HANGER WHERE THERE IS INSUFFICIENT CLEARANCE BETWEEN THE EXISTING MESSAGE BOARD AND THE EXISTING CEILING TILE, WHERE APPLICABLE. LIMIT THE FOLHD CABLE RUNS WITHOUT THE HANGER TO THE MINIMUM DISTANCE POSSIBLE TO CLEAR THE OBSTRUCTION.

ADDRESSING		
03030231	RCP01	HI TEMP
03030232	RCP01	LO TEMP
03030206	FPC03	HI TEMP
03030207	FPC03	LO TEMP
03030208	FPC03	CCTV TROUBLE
03030209	FPC03	BPS TROUBLE

ADDRESSING		
03030127	NT-66	MANUAL INPUT
03030128	NT-66	DELUGE RELEASE
03030186	NT-66	WATER FLOW
03030187	NT-66	TAMPER
05020193	NT-66	PRIMARY ALARM
01030178	NT-66	SECONDARY ALARM
03030210	NT-66	ISO VALVE TAMPER

ADDRESSING		
03030133	NT-67	MANUAL INPUT
03030134	NT-67	DELUGE RELEASE
03030188	NT-67	WATER FLOW
03030189	NT-67	TAMPER
05020194	NT-67	PRIMARY ALARM
01030179	NT-67	SECONDARY ALARM

ADDRESSING		
03030139	NT-68	MANUAL INPUT
03030140	NT-68	DELUGE RELEASE
03030190	NT-68	WATER FLOW
03030191	NT-68	TAMPER
05020195	NT-68	PRIMARY ALARM
01030180	NT-68	SECONDARY ALARM

ADDRESSING		
03030145	NT-69	MANUAL INPUT
03030146	NT-69	DELUGE RELEASE
03030192	NT-69	WATER FLOW
03030193	NT-69	TAMPER
05020196	NT-69	PRIMARY ALARM
01030181	NT-69	SECONDARY ALARM

ADDRESSING		
03030151	NT-70	MANUAL INPUT
03030152	NT-70	DELUGE RELEASE
03030194	NT-70	WATER FLOW
03030195	NT-70	TAMPER
05020197	NT-70	PRIMARY ALARM
01030182	NT-70	SECONDARY ALARM

ADDRESSING		
03030157	NT-71	MANUAL INPUT
03030158	NT-71	DELUGE RELEASE
03030196	NT-71	WATER FLOW
03030197	NT-71	TAMPER
05020198	NT-71	PRIMARY ALARM
01030183	NT-71	SECONDARY ALARM

ADDRESSING		
03030163	NT-72	MANUAL INPUT
03030164	NT-72	DELUGE RELEASE
03030198	NT-72	WATER FLOW
03030199	NT-72	TAMPER
05020199	NT-72	PRIMARY ALARM
01030184	NT-72	SECONDARY ALARM

ADDRESSING		
03030169	NT-73	MANUAL INPUT
03030170	NT-73	DELUGE RELEASE
03030200	NT-73	WATER FLOW
03030201	NT-73	TAMPER
05020200	NT-73	PRIMARY ALARM
01030185	NT-73	SECONDARY ALARM

ADDRESSING		
03030175	NT-74	MANUAL INPUT
03030176	NT-74	DELUGE RELEASE
03030202	NT-74	WATER FLOW
03030203	NT-74	TAMPER
05020201	NT-74	PRIMARY ALARM
01030186	NT-74	SECONDARY ALARM

ADDRESSING		
03030181	NT-75	MANUAL INPUT
03030182	NT-75	DELUGE RELEASE
03030204	NT-75	WATER FLOW
03030205	NT-75	TAMPER
05020202	NT-75	PRIMARY ALARM
01030187	NT-75	SECONDARY ALARM

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**BARNARD EJMT TEAM**  
**BARNARD**  
**RONDINELLI**  
**BCER**  
**STURGEON ELECTRIC**

*Western States Fire Protection Co.*

*safe*

*engineering*

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
**FIXED FIRE SUPPRESSION SYSTEM**  
**DESIGN BUILD PROJECT**

Project No. C0703-360  
 Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

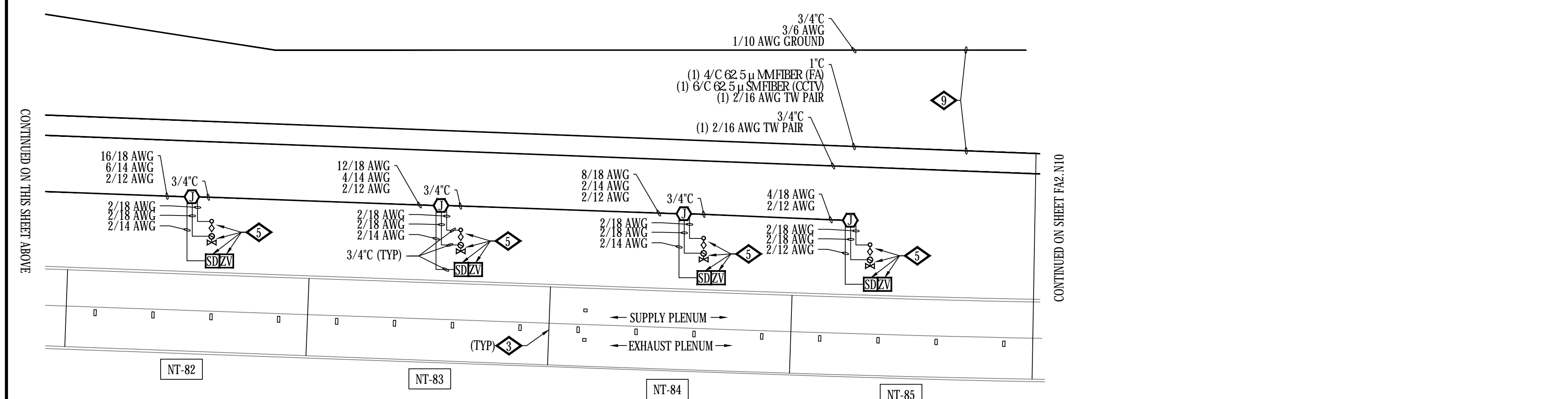
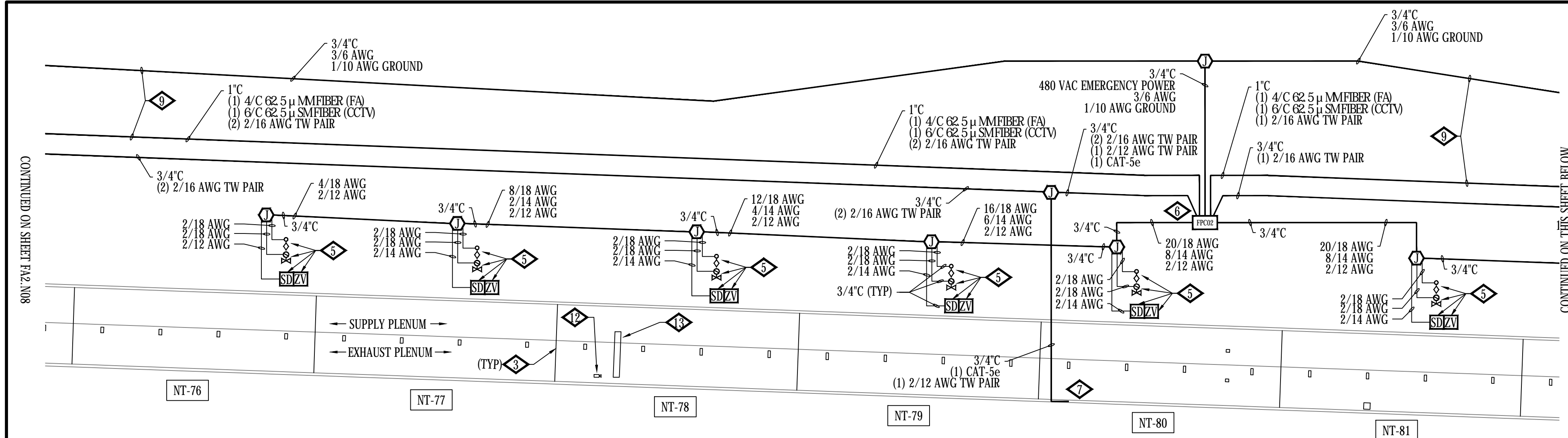
Num	Description	Date

DRAWN BY: B.T.L. | CHECKED BY: AEE-JR

**FIRE ALARM:**  
**EISENHOWER TUNNEL**  
**FP ZONES NT-66 TO NT-75**

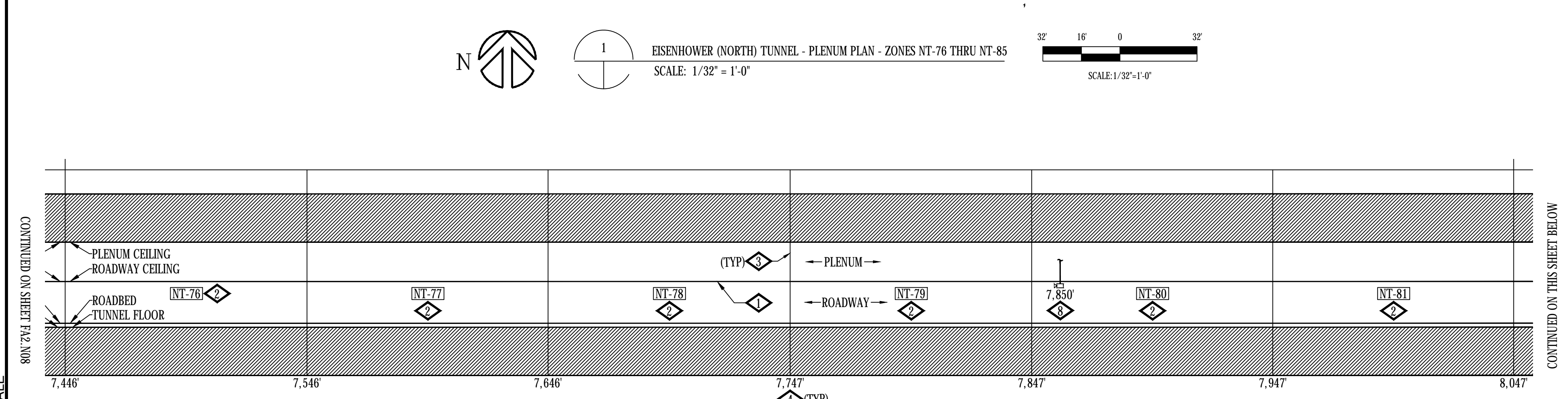
Drawing Number  
**FA2.N08**





- GENERAL NOTES:**
- IF FIELD CONDITIONS RESULT IN A CHANGE TO THE SHOP DRAWING INSTALLATION IN ANY WAY, CONTACT FAS SYSTEMS GROUP TO VERIFY PROPOSED CHANGES ARE COMPLIANT WITH NFPA 72 AND PROJECT REQUIREMENTS.
  - EACH CONTROL CABINET AND ADDRESSABLE DEVICE SHALL BEAR A TYPED LABEL INDICATING ITS ADDRESS OR DESIGNATION, WHICH CAN BE SEEN WITHOUT A LADDER OR LIFT. SMOKE AND HEAT DETECTORS SHALL HAVE THEIR LABEL ON ITS BASE.
- DETAIL NOTES:**
- FIBER OPTIC LINEAR HEAT DETECTION (FOLHD) FIBER CABLE IN FOLHD HANGER. CABLE TO BE MOUNTED APPROXIMATELY 2 INCHES BELOW ROADWAY CEILING TILE. SEE SHEETS FA6.01, FA6.14 AND FA6.15.
  - DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - DELUGE ZONE BOUNDARY.
  - DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - EQUIPMENT LOCATED IN SUPPLY PLENUM.
  - ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
  - MOUNT CCTV CAMERA TO ROADWAY WALL TILE ABOVE EXIT PATHWAY. SEE SHEET FA6.02. DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
  - MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
  - EXISTING CCTV TRAFFIC CAMERA, SHOWN FOR REFERENCE PURPOSES, TO REMAIN.
  - EXISTING TRAFFIC CONTROL MESSAGE BOARD, SHOWN FOR REFERENCE PURPOSES, TO REMAIN. ROUTE FOLHD FIBER AND HANGER ABOVE THE MESSAGE BOARD. IT IS ACCEPTABLE TO RUN THE FOLHD CABLE WITHOUT THE HANGER WHERE THERE IS INSUFFICIENT CLEARANCE BETWEEN THE EXISTING MESSAGE BOARD AND THE EXISTING CEILING TILE, WHERE APPLICABLE. LIMIT THE FOLHD CABLE RUNS WITHOUT THE HANGER TO THE MINIMUM DISTANCE POSSIBLE TO CLEAR THE OBSTRUCTION.

EISENHOWER (NORTH) TUNNEL - PLENUM PLAN - ZONES NT-76 THRU NT-85  
SCALE: 1/32" = 1'-0"



EISENHOWER (NORTH) TUNNEL - ROADWAY SECTIONAL ELEVATION PLAN - SOUTH VIEW - ZONES NT-76 THRU NT-85  
SCALE: 1/32" = 1'-0"

ADDRESSING		
03030456	FPC02	HI TEMP
03030457	FPC02	LO TEMP
03030458	FPC02	CCTV TROUBLE
03030459	FPC02	BPS TROUBLE

ADDRESSING			ADDRESSING		
03030377	NT-76	MANUAL INPUT	03030383	NT-77	MANUAL INPUT
03030378	NT-76	DELUGE RELEASE	03030384	NT-77	DELUGE RELEASE
03030436	NT-76	WATER FLOW	03030438	NT-77	WATER FLOW
03030437	NT-76	TAMPER	03030439	NT-77	TAMPER
05020203	NT-76	PRIMARY ALARM	05020204	NT-77	PRIMARY ALARM
01030188	NT-76	SECONDARY ALARM	01030189	NT-77	SECONDARY ALARM

ADDRESSING			ADDRESSING		
03030389	NT-78	MANUAL INPUT	03030395	NT-79	MANUAL INPUT
03030390	NT-78	DELUGE RELEASE	03030396	NT-79	DELUGE RELEASE
03030440	NT-78	WATER FLOW	03030442	NT-79	WATER FLOW
03030441	NT-78	TAMPER	03030443	NT-79	TAMPER
05020205	NT-78	PRIMARY ALARM	05020206	NT-79	PRIMARY ALARM
01030190	NT-78	SECONDARY ALARM	01030191	NT-79	SECONDARY ALARM

ADDRESSING			ADDRESSING		
03030401	NT-80	MANUAL INPUT	03030407	NT-81	MANUAL INPUT
03030402	NT-80	DELUGE RELEASE	03030408	NT-81	DELUGE RELEASE
03030444	NT-80	WATER FLOW	03030446	NT-81	WATER FLOW
03030445	NT-80	TAMPER	03030447	NT-81	TAMPER
05020207	NT-80	PRIMARY ALARM	05020208	NT-81	PRIMARY ALARM
01030192	NT-80	SECONDARY ALARM	01030193	NT-81	SECONDARY ALARM

ADDRESSING			ADDRESSING		
03030413	NT-82	MANUAL INPUT	03030419	NT-83	MANUAL INPUT
03030414	NT-82	DELUGE RELEASE	03030420	NT-83	DELUGE RELEASE
03030448	NT-82	WATER FLOW	03030450	NT-83	WATER FLOW
03030449	NT-82	TAMPER	03030451	NT-83	TAMPER
05020209	NT-82	PRIMARY ALARM	05020210	NT-83	PRIMARY ALARM
01030194	NT-82	SECONDARY ALARM	01030195	NT-83	SECONDARY ALARM

ADDRESSING			ADDRESSING		
03030425	NT-84	MANUAL INPUT	03030431	NT-85	MANUAL INPUT
03030426	NT-84	DELUGE RELEASE	03030432	NT-85	DELUGE RELEASE
03030452	NT-84	WATER FLOW	03030454	NT-85	WATER FLOW
03030453	NT-84	TAMPER	03030455	NT-85	TAMPER
05020211	NT-84	PRIMARY ALARM	05020212	NT-85	PRIMARY ALARM
01030196	NT-84	SECONDARY ALARM	01030197	NT-85	SECONDARY ALARM

**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT**

**BARNARD EJM TEAM**

**BARNARD**  
WESTERN STATES  
FIRE PROTECTION CO.

**RONDINELLI**  
A LIFE-SAVING TECHNOLOGY

**BCER**  
CONSULTING ENGINEERS

**Sturgeon ELECTRIC**

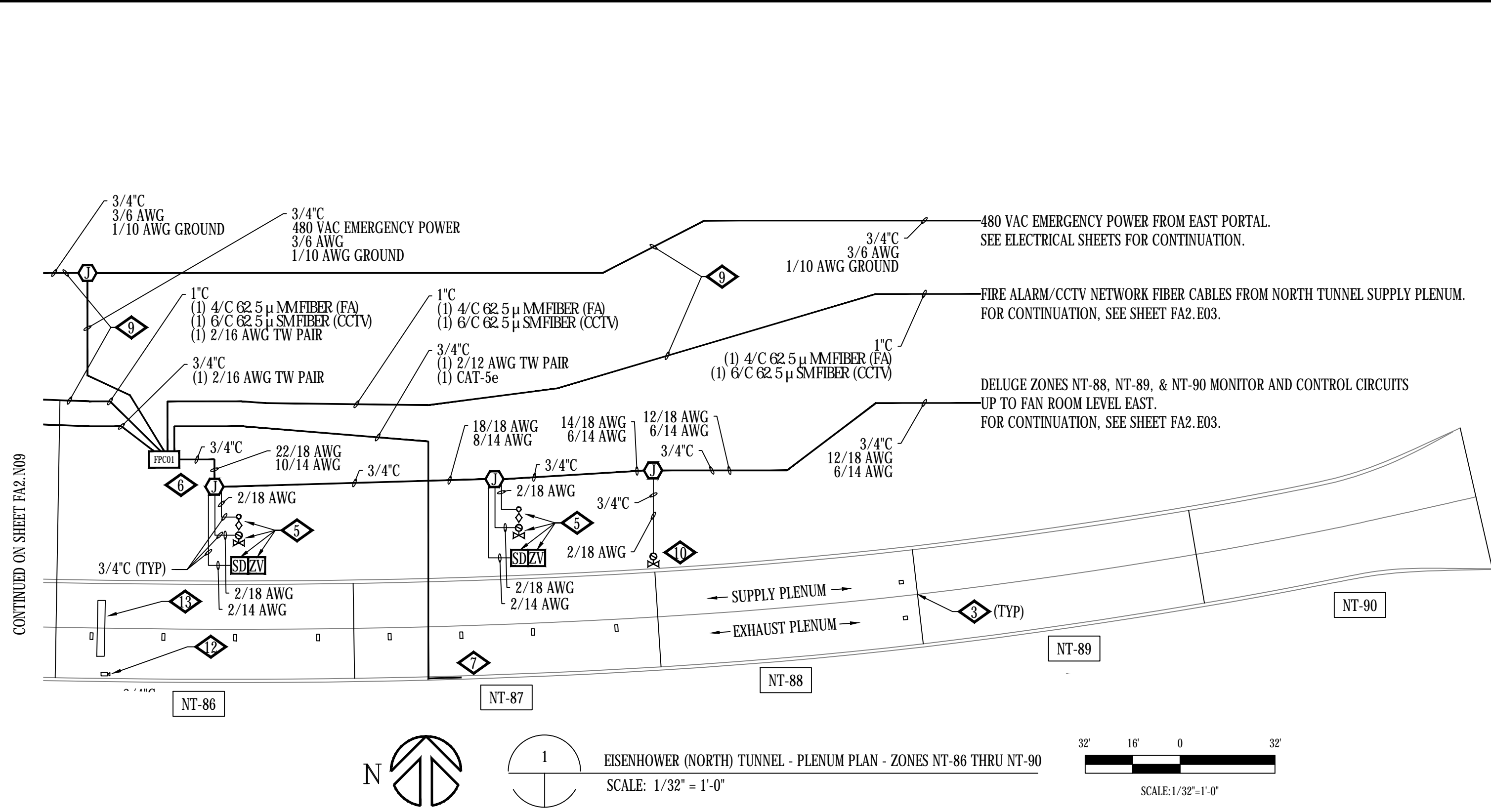
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Num	Date	Description

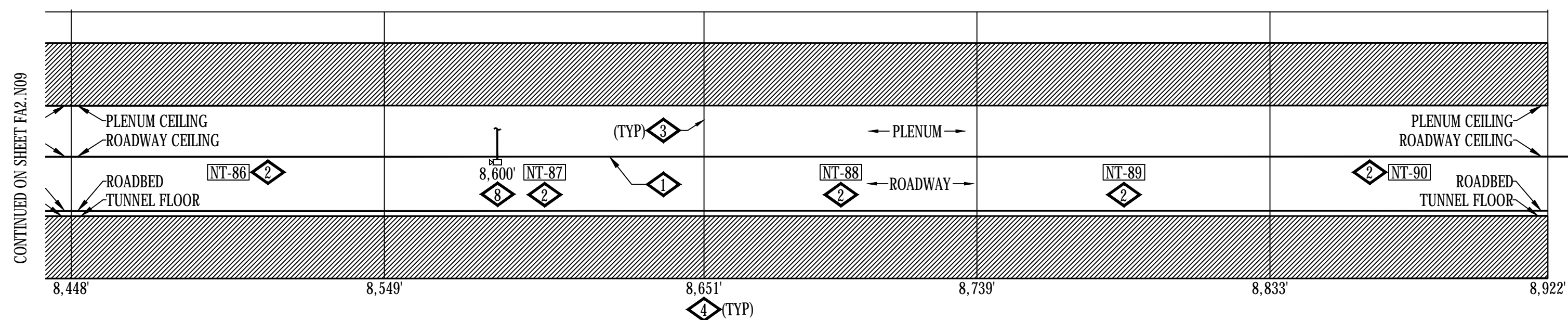
Drawn By: B.T.L. Checked By: AEE-JT

**FIRE ALARM:  
EISENHOWER TUNNEL  
FP ZONES NT-76 TO NT-85**

Drawing Number  
**FA2.N09**



1  
EISENHOWER (NORTH) TUNNEL - PLENUM PLAN - ZONES NT-86 THRU NT-90  
SCALE: 1/32" = 1'-0"



2  
EISENHOWER (NORTH) TUNNEL - ROADWAY SECTIONAL ELEVATION PLAN - SOUTH VIEW - ZONES NT-86 THRU NT-90  
SCALE: 1/32" = 1'-0"

- GENERAL NOTES:**
- IF FIELD CONDITIONS RESULT IN A CHANGE TO THE SHOP DRAWING INSTALLATION IN ANY WAY, CONTACT FAS SYSTEMS GROUP TO VERIFY PROPOSED CHANGES ARE COMPLIANT WITH NFPA 72 AND PROJECT REQUIREMENTS.
  - EACH CONTROL CABINET AND ADDRESSABLE DEVICE SHALL BEAR A TYPED LABEL INDICATING ITS ADDRESS OR DESIGNATION, WHICH CAN BE SEEN WITHOUT A LADDER OR LIFT. SMOKE AND HEAT DETECTORS SHALL HAVE THEIR LABEL ON ITS BASE.
- DETAIL NOTES:**
- FIBER OPTIC LINEAR HEAT DETECTION (FOLHD) FIBER CABLE IN FOLHD HANGER. CABLE TO BE MOUNTED APPROXIMATELY 2 INCHES BELOW ROADWAY CEILING TILE. SEE SHEETS FA6.01, FA6.14 AND FA6.15.
  - DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - DELUGE ZONE BOUNDARY.
  - DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - EQUIPMENT LOCATED IN SUPPLY PLENUM.
  - ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
  - MOUNT CCTV CAMERA TO ROADWAY WALL TILE ABOVE EXIT PATHWAY. SEE SHEET FA6.02. DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
  - MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
  - EXISTING CCTV TRAFFIC CAMERA, SHOWN FOR REFERENCE PURPOSES, TO REMAIN.
  - EXISTING TRAFFIC CONTROL MESSAGE BOARD, SHOWN FOR REFERENCE PURPOSES, TO REMAIN. ROUTE FOLHD FIBER AND HANGER ABOVE THE MESSAGE BOARD. IT IS ACCEPTABLE TO RUN THE FOLHD CABLE WITHOUT THE HANGER WHERE THERE IS INSUFFICIENT CLEARANCE BETWEEN THE EXISTING MESSAGE BOARD AND THE EXISTING CEILING TILE, WHERE APPLICABLE. LIMIT THE FOLHD CABLE RUNS WITHOUT THE HANGER TO THE MINIMUM DISTANCE POSSIBLE TO CLEAR THE OBSTRUCTION.

FIBER OPTIC LINEAR HEAT DETECTION FIBER CABLE FROM NORTH TUNNEL HANGER SYSTEM TO NORTH TUNNEL INTERSTITIAL SPACE. FOR CONTINUATION SEE SHEET FA2.E02.

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**BARNARD EJMT TEAM**

**BARNARD RONDINELLI**  
A COMMITMENT TO SAFETY

**BCER**  
BARNARD RONDINELLI CONSULTING ENGINEERS

**Sturgeon Electric**  
Western States Fire Protection Co.

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

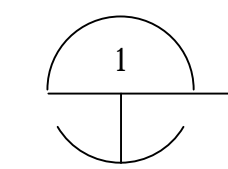
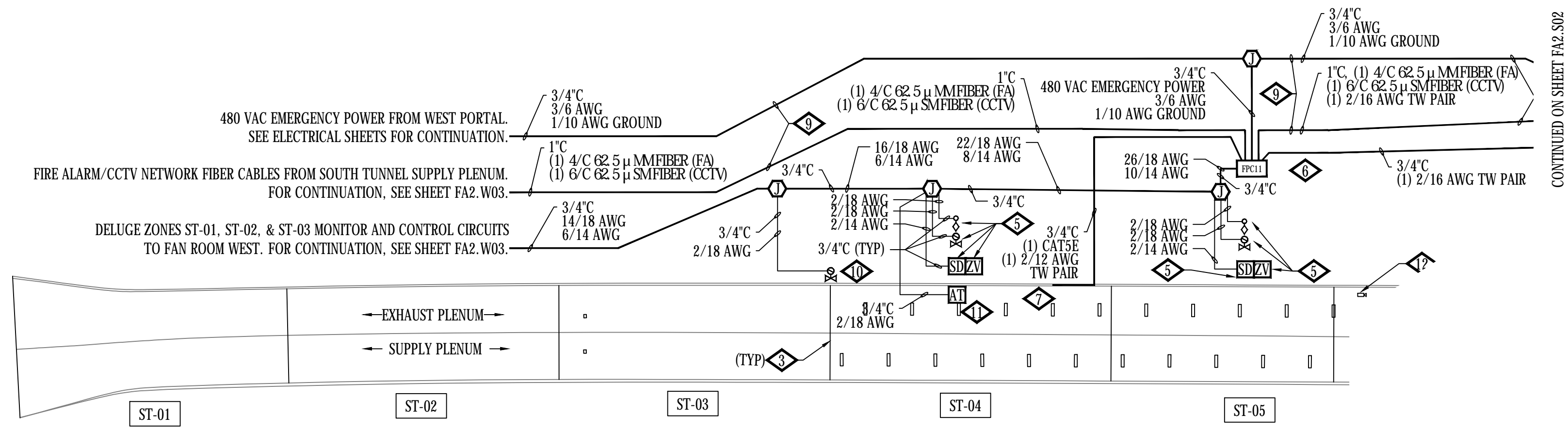
Revisions	Date	Description

Drawn by: B.T.L. | Checked by: AEE-JF

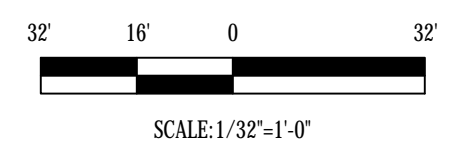
**FIRE ALARM:**  
EISENHOWER TUNNEL  
FP ZONES NT-86 TO NT-90

Drawing Number  
**FA2.N10**

ADDRESSING			ADDRESSING			ADDRESSING		
03040166	FPC01	HI TEMP	03040127	NT-86	MANUAL INPUT	03040133	NT-87	MANUAL INPUT
03040167	FPC01	LO TEMP	03040128	NT-86	DELUGE RELEASE	03040134	NT-87	DELUGE RELEASE
03040168	FPC01	CCTV TROUBLE	03040156	NT-86	WATER FLOW	03040158	NT-87	WATER FLOW
03040169	FPC01	BPS TROUBLE	03040157	NT-86	TAMPER	03040159	NT-87	TAMPER
			05020213	NT-86	PRIMARY ALARM	05020214	NT-87	PRIMARY ALARM
			01030198	NT-86	SECONDARY ALARM	01030199	NT-87	SECONDARY ALARM
						03040170	NT-87	ISO VALVE TAMPER

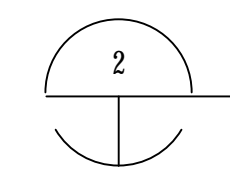
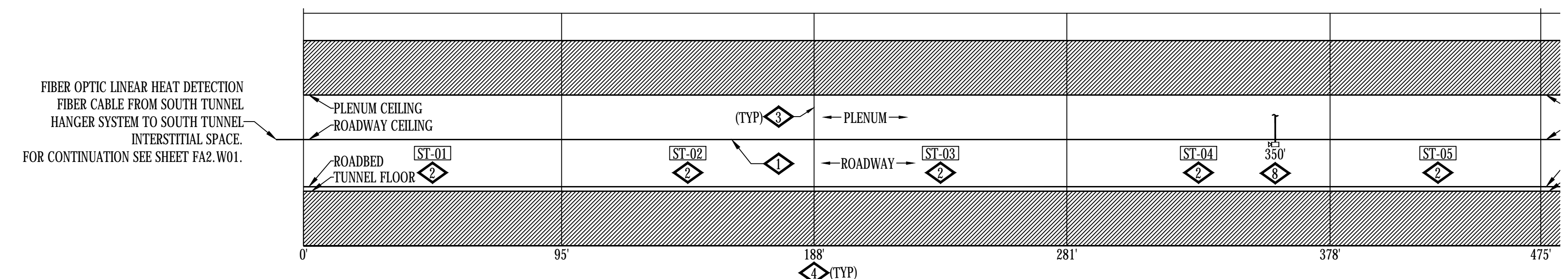


JOHNSON (SOUTH) TUNNEL - PLENUM PLAN - ZONES ST-01 THRU ST-05  
SCALE: 1/32" = 1'-0"

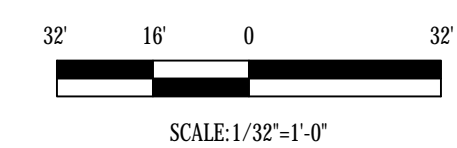


CONTINUED ON SHEET FA2.S02

- GENERAL NOTES:**
- IF FIELD CONDITIONS RESULT IN A CHANGE TO THE SHOP DRAWING INSTALLATION IN ANY WAY, CONTACT FAS SYSTEMS GROUP TO VERIFY PROPOSED CHANGES ARE COMPLIANT WITH NFPA 72 AND PROJECT REQUIREMENTS.
  - EACH CONTROL CABINET AND ADDRESSABLE DEVICE SHALL BEAR A TYPED LABEL INDICATING ITS ADDRESS OR DESIGNATION, WHICH CAN BE SEEN WITHOUT A LADDER OR LIFT. SMOKE AND HEAT DETECTORS SHALL HAVE THEIR LABEL ON ITS BASE.
- DETAIL NOTES:**
- 1 FIBER OPTIC LINEAR HEAT DETECTION (FOLHD) FIBER CABLE IN FOLHD HANGER. CABLE TO BE MOUNTED APPROXIMATELY 2 INCHES BELOW ROADWAY CEILING TILE. SEE SHEETS FA6.01, FA6.14 AND FA6.15.
  - 2 DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - 3 DELUGE ZONE BOUNDARY.
  - 4 DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - 5 DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - 6 EQUIPMENT LOCATED IN SUPPLY PLENUM.
  - 7 ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
  - 8 MOUNT CCTV CAMERA TO ROADWAY WALL TILE ABOVE EXIT PATHWAY. SEE SHEET FA6.02. DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
  - 9 MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - 10 FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - 11 MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
  - 12 EXISTING CCTV TRAFFIC CAMERA, SHOWN FOR REFERENCE PURPOSES, TO REMAIN.
  - 13 EXISTING TRAFFIC CONTROL MESSAGE BOARD, SHOWN FOR REFERENCE PURPOSES, TO REMAIN. ROUTE FOLHD FIBER AND HANGER ABOVE THE MESSAGE BOARD. IT IS ACCEPTABLE TO RUN THE FOLHD CABLE WITHOUT THE HANGER WHERE THERE IS INSUFFICIENT CLEARANCE BETWEEN THE EXISTING MESSAGE BOARD AND THE EXISTING CEILING TILE, WHERE APPLICABLE. LIMIT THE FOLHD CABLE RUNS WITHOUT THE HANGER TO THE MINIMUM DISTANCE POSSIBLE TO CLEAR THE OBSTRUCTION.



JOHNSON (SOUTH) TUNNEL - ROADWAY SECTIONAL ELEVATION PLAN - NORTH VIEW - ZONES ST-01 THRU ST-05  
SCALE: 1/32" = 1'-0"



CONTINUED ON SHEET FA2.S02

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

ADDRESSING		
06020166	FPC11	HI TEMP
06020167	FPC11	LO TEMP
06020168	FPC11	CCTV TROUBLE
06020169	FPC11	BPS TROUBLE

ADDRESSING		
06020145	ST-04	MANUAL INPUT
06020146	ST-04	DELUGE RELEASE
06020162	ST-04	WATER FLOW
06020163	ST-04	TAMPER
01020129	ST-04	PRIMARY ALARM
05020221	ST-04	SECONDARY ALARM
06020170	ST-04	IVE LOW TEMP
06020172	ST-04	ISO VALVE TAMPER

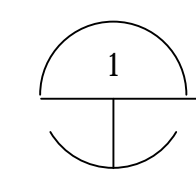
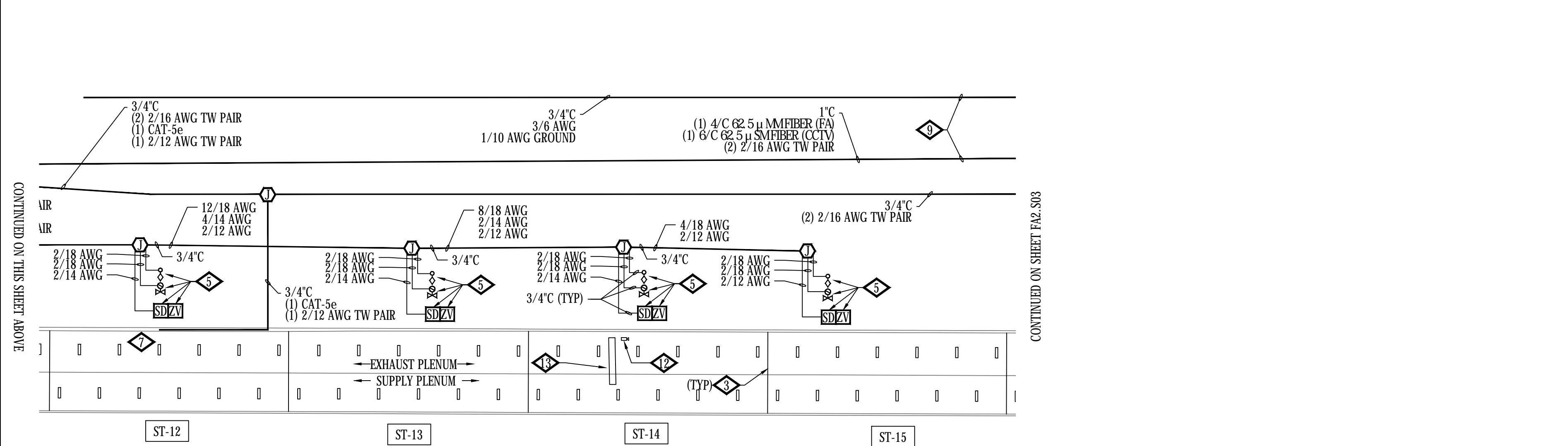
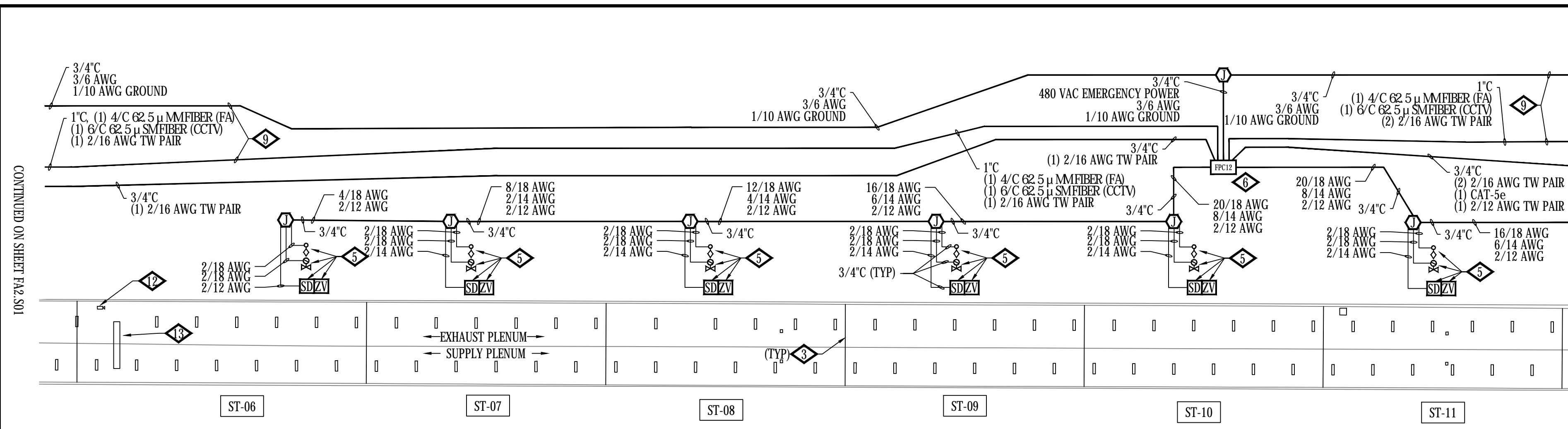
ADDRESSING		
06020151	ST-05	MANUAL INPUT
06020152	ST-05	DELUGE RELEASE
06020164	ST-05	WATER FLOW
06020165	ST-05	TAMPER
01020130	ST-05	PRIMARY ALARM
05020222	ST-05	SECONDARY ALARM

**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT**  
 Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

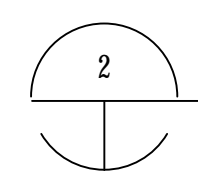
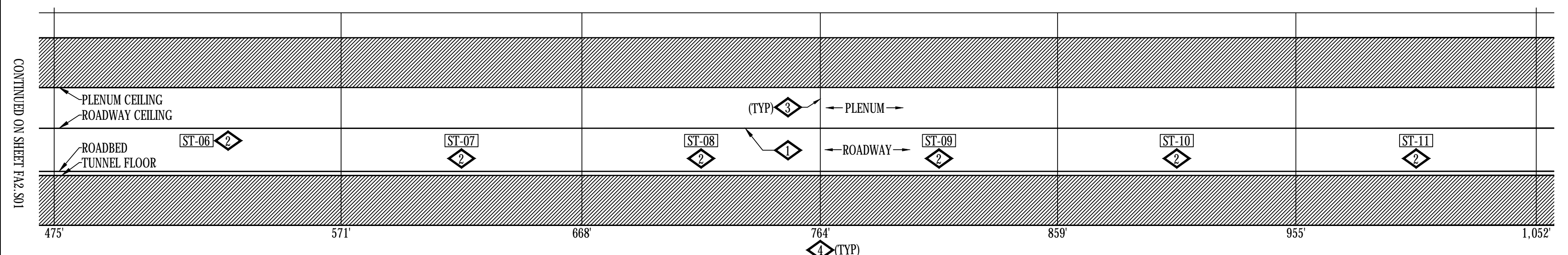
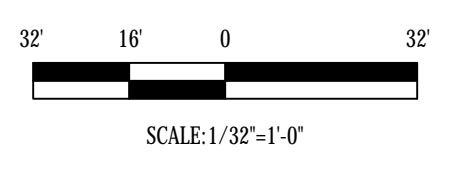
Revisions	Date	Description

FIRE ALARM:  
 JOHNSON TUNNEL  
 FP ZONES ST-01 TO ST-05  
 Drawing Number  
**FA2.S01**

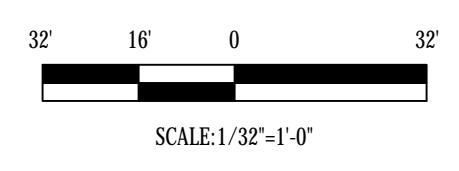
**BARNARD EJMT TEAM**  
**BARNARD**  
**RONDINELLI**  
**Sturgeon Electric**  
**BCER**  
**Western States Fire Protection Co.**  
**ALF**  
**ENGINEERS**



JOHNSON (SOUTH) TUNNEL - PLENUM PLAN - ZONES ST-06 THRU ST-15  
SCALE: 1/32" = 1'-0"



JOHNSON (SOUTH) TUNNEL - ROADWAY SECTIONAL ELEVATION PLAN - NORTH VIEW - ZONES ST-06 THRU ST-15  
SCALE: 1/32" = 1'-0"



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  - DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - DELUGE ZONE BOUNDARY.
  - DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - EQUIPMENT LOCATED IN SUPPLY PLENUM.
  - ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
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  - MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
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ADDRESSING		
06020456	FPC12	HI TEMP
06020457	FPC12	LO TEMP
06020458	FPC12	CCTV TROUBLE
06020459	FPC12	BPS TROUBLE

ADDRESSING		
06020377	ST-06	MANUAL INPUT
06020378	ST-06	DELUGE RELEASE
06020436	ST-06	WATER FLOW
06020437	ST-06	TAMPER
01020131	ST-06	PRIMARY ALARM
05020223	ST-06	SECONDARY ALARM

ADDRESSING		
06020383	ST-07	MANUAL INPUT
06020384	ST-07	DELUGE RELEASE
06020438	ST-07	WATER FLOW
06020439	ST-07	TAMPER
01020132	ST-07	PRIMARY ALARM
05020224	ST-07	SECONDARY ALARM

ADDRESSING		
06020389	ST-08	MANUAL INPUT
06020390	ST-08	DELUGE RELEASE
06020440	ST-08	WATER FLOW
06020441	ST-08	TAMPER
01030133	ST-08	PRIMARY ALARM
05020225	ST-08	SECONDARY ALARM

ADDRESSING		
06020395	ST-09	MANUAL INPUT
06020396	ST-09	DELUGE RELEASE
06020442	ST-09	WATER FLOW
06020443	ST-09	TAMPER
01030134	ST-09	PRIMARY ALARM
05020226	ST-09	SECONDARY ALARM

ADDRESSING		
06020401	ST-10	MANUAL INPUT
06020402	ST-10	DELUGE RELEASE
06020444	ST-10	WATER FLOW
06020445	ST-10	TAMPER
01030135	ST-10	PRIMARY ALARM
05020227	ST-10	SECONDARY ALARM

ADDRESSING		
06020407	ST-11	MANUAL INPUT
06020408	ST-11	DELUGE RELEASE
06020446	ST-11	WATER FLOW
06020447	ST-11	TAMPER
01030138	ST-11	PRIMARY ALARM
05020228	ST-11	SECONDARY ALARM

ADDRESSING		
06020413	ST-12	MANUAL INPUT
06020414	ST-12	DELUGE RELEASE
06020448	ST-12	WATER FLOW
06020449	ST-12	TAMPER
01030139	ST-12	PRIMARY ALARM
05020229	ST-12	SECONDARY ALARM

ADDRESSING		
06020419	ST-13	MANUAL INPUT
06020420	ST-13	DELUGE RELEASE
06020450	ST-13	WATER FLOW
06020451	ST-13	TAMPER
01030140	ST-13	PRIMARY ALARM
05020230	ST-13	SECONDARY ALARM

ADDRESSING		
06020425	ST-14	MANUAL INPUT
06020426	ST-14	DELUGE RELEASE
06020452	ST-14	WATER FLOW
06020453	ST-14	TAMPER
01030141	ST-14	PRIMARY ALARM
05020231	ST-14	SECONDARY ALARM

ADDRESSING		
06020431	ST-15	MANUAL INPUT
06020432	ST-15	DELUGE RELEASE
06020454	ST-15	WATER FLOW
06020455	ST-15	TAMPER
01030142	ST-15	PRIMARY ALARM
05020232	ST-15	SECONDARY ALARM

**BARNARD EJM TEAM**

**BARNARD** **RONDINELLI**

**BCER** **Sturgeon ELECTRIC**

Western States Fire Protection Co.

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

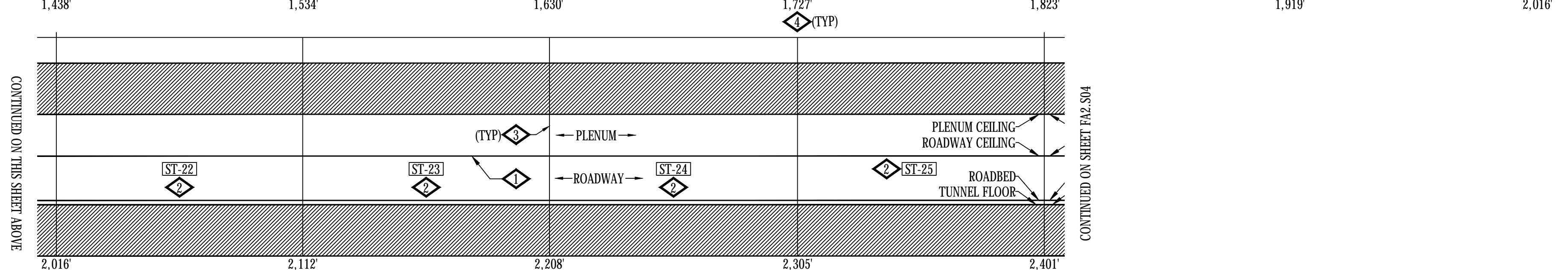
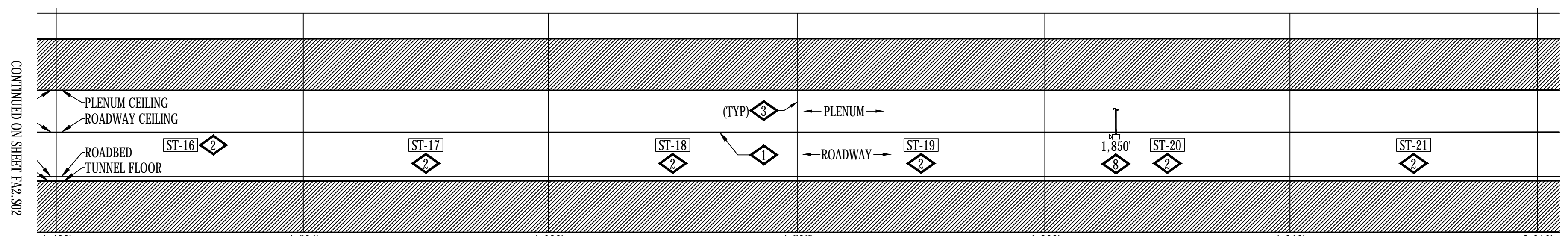
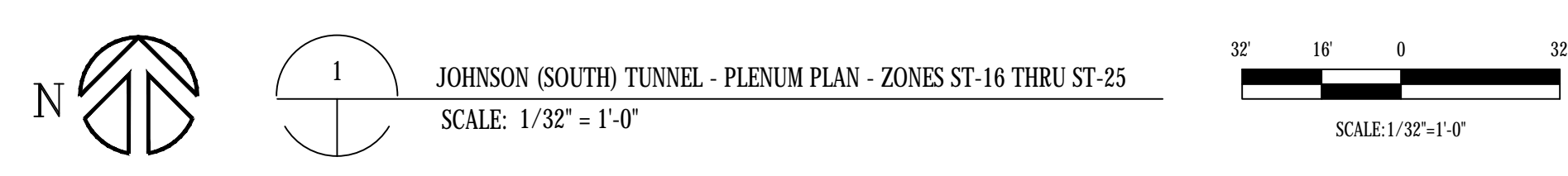
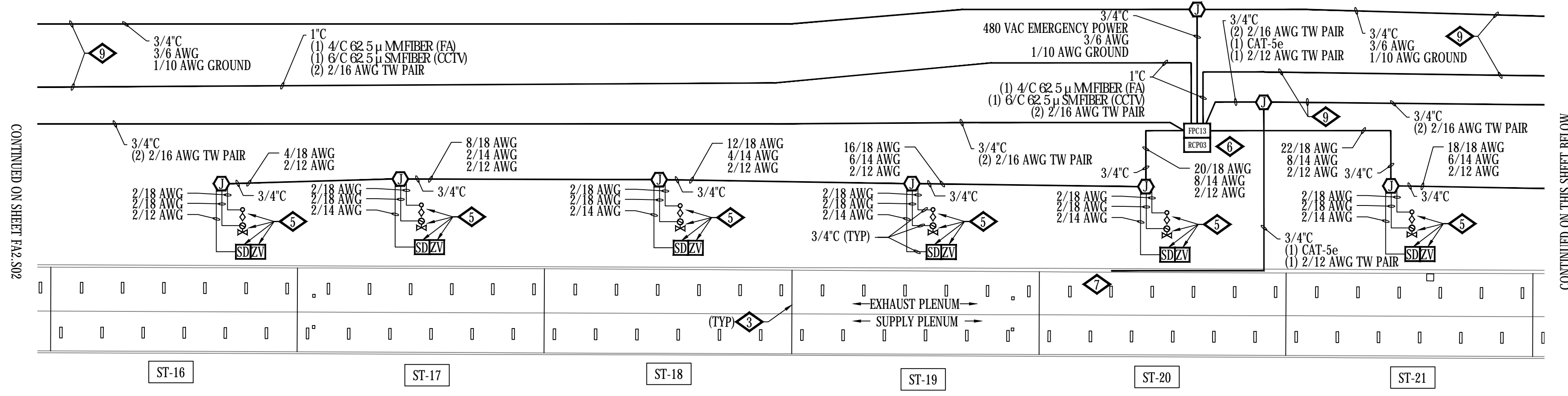
RECORD DRAWINGS - 2015-11-16

Num	Revisions	Date

Drawn by: B.T.L. Checked by: AEE-JT

FIRE ALARM: JOHNSON TUNNEL FP ZONES ST-06 TO ST-15

Drawing Number **FA2.S02**



- GENERAL NOTES:**
- IF FIELD CONDITIONS RESULT IN A CHANGE TO THE SHOP DRAWING INSTALLATION IN ANY WAY, CONTACT FAS SYSTEMS GROUP TO VERIFY PROPOSED CHANGES ARE COMPLIANT WITH NFPA 72 AND PROJECT REQUIREMENTS.
  - EACH CONTROL CABINET AND ADDRESSABLE DEVICE SHALL BEAR A TYPED LABEL INDICATING ITS ADDRESS OR DESIGNATION, WHICH CAN BE SEEN WITHOUT A LADDER OR LIFT. SMOKE AND HEAT DETECTORS SHALL HAVE THEIR LABEL ON ITS BASE.
- DETAIL NOTES:**
- FIBER OPTIC LINEAR HEAT DETECTION (FOLHD) FIBER CABLE IN FOLHD HANGER. CABLE TO BE MOUNTED APPROXIMATELY 2 INCHES BELOW ROADWAY CEILING TILE. SEE SHEETS FA6.01, FA6.14 AND FA6.15.
  - DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - DELUGE ZONE BOUNDARY.
  - DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - EQUIPMENT LOCATED IN SUPPLY PLENUM.
  - ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
  - MOUNT CCTV CAMERA TO ROADWAY WALL TILE ABOVE EXIT PATHWAY. SEE SHEET FA6.02. DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
  - MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
  - EXISTING CCTV TRAFFIC CAMERA, SHOWN FOR REFERENCE PURPOSES, TO REMAIN.
  - EXISTING TRAFFIC CONTROL MESSAGE BOARD, SHOWN FOR REFERENCE PURPOSES, TO REMAIN. ROUTE FOLHD FIBER AND HANGER ABOVE THE MESSAGE BOARD. IT IS ACCEPTABLE TO RUN THE FOLHD CABLE WITHOUT THE HANGER WHERE THERE IS INSUFFICIENT CLEARANCE BETWEEN THE EXISTING MESSAGE BOARD AND THE EXISTING CEILING TILE, WHERE APPLICABLE. LIMIT THE FOLHD CABLE RUNS WITHOUT THE HANGER TO THE MINIMUM DISTANCE POSSIBLE TO CLEAR THE OBSTRUCTION.

ADDRESSING	
06030230	RCPO3 HI TEMP
06030231	RCPO3 LO TEMP
06030206	FPC13 HI TEMP
06030207	FPC13 LO TEMP
06030208	FPC13 CCTV TROUBLE
06030209	FPC13 BPS TROUBLE

ADDRESSING		
06030127	ST-16	MANUAL INPUT
06030128	ST-16	DELUGE RELEASE
06030186	ST-16	WATER FLOW
06030187	ST-16	TAMPER
01020143	ST-16	PRIMARY ALARM
05020233	ST-16	SECONDARY ALARM

ADDRESSING		
06030133	ST-17	MANUAL INPUT
06030134	ST-17	DELUGE RELEASE
06030188	ST-17	WATER FLOW
06030189	ST-17	TAMPER
01020144	ST-17	PRIMARY ALARM
05030126	ST-17	SECONDARY ALARM

ADDRESSING		
06030139	ST-18	MANUAL INPUT
06030140	ST-18	DELUGE RELEASE
06030190	ST-18	WATER FLOW
06030191	ST-18	TAMPER
01020145	ST-18	PRIMARY ALARM
05030127	ST-18	SECONDARY ALARM

ADDRESSING		
06030145	ST-19	MANUAL INPUT
06030146	ST-19	DELUGE RELEASE
06030192	ST-19	WATER FLOW
06030193	ST-19	TAMPER
01020146	ST-19	PRIMARY ALARM
05030128	ST-19	SECONDARY ALARM

ADDRESSING		
06030151	ST-20	MANUAL INPUT
06030152	ST-20	DELUGE RELEASE
06030194	ST-20	WATER FLOW
06030195	ST-20	TAMPER
01020147	ST-20	PRIMARY ALARM
05030129	ST-20	SECONDARY ALARM

ADDRESSING		
06030157	ST-21	MANUAL INPUT
06030158	ST-21	DELUGE RELEASE
06030196	ST-21	WATER FLOW
06030197	ST-21	TAMPER
01020148	ST-21	PRIMARY ALARM
05030130	ST-21	SECONDARY ALARM

ADDRESSING		
06030163	ST-22	MANUAL INPUT
06030164	ST-22	DELUGE RELEASE
06030198	ST-22	WATER FLOW
06030199	ST-22	TAMPER
01020149	ST-22	PRIMARY ALARM
05020131	ST-22	SECONDARY ALARM

ADDRESSING		
06030169	ST-23	MANUAL INPUT
06030170	ST-23	DELUGE RELEASE
06030200	ST-23	WATER FLOW
06030201	ST-23	TAMPER
01020150	ST-23	PRIMARY ALARM
05030132	ST-23	SECONDARY ALARM

ADDRESSING		
06030175	ST-24	MANUAL INPUT
06030176	ST-24	DELUGE RELEASE
06030202	ST-24	WATER FLOW
06030203	ST-24	TAMPER
01020151	ST-24	PRIMARY ALARM
05030133	ST-24	SECONDARY ALARM

ADDRESSING		
06030181	ST-25	MANUAL INPUT
06030182	ST-25	DELUGE RELEASE
06030204	ST-25	WATER FLOW
06030205	ST-25	TAMPER
01020152	ST-25	PRIMARY ALARM
05030134	ST-25	SECONDARY ALARM
06030232	ST-25	ISO VALVE TAMPER

**BARNARD EJMT TEAM**

**BARNARD** Western States Fire Protection Co.

**BCEC** CONSULTING ENGINEERS

**STURGEON ELECTRIC**

**RONDINELLI** A COMMITMENT TO SAFETY

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

**FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT**

Project No. C0703-360 Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

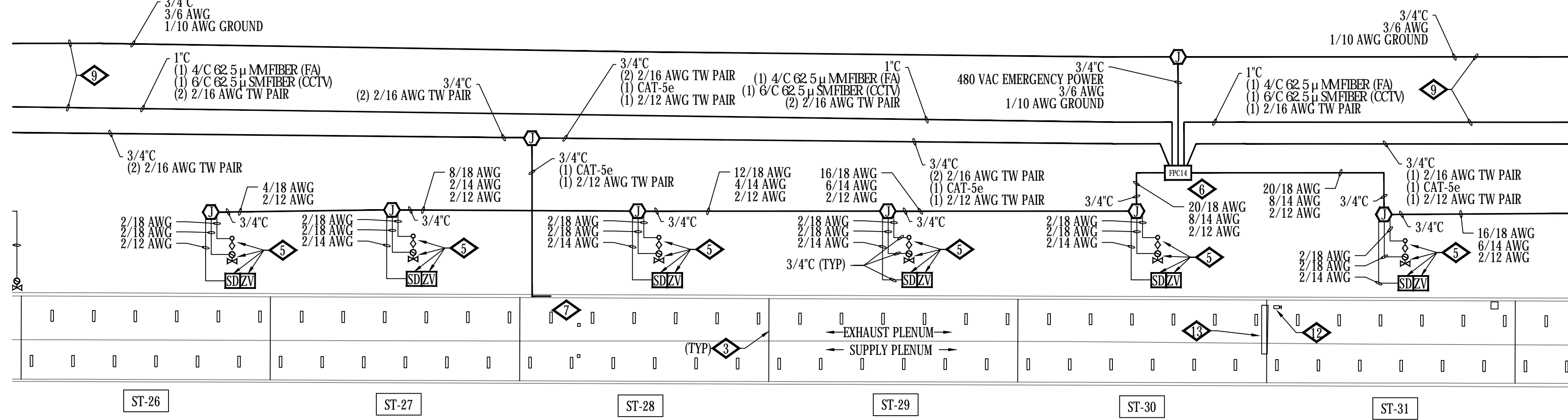
Num	Description	Date

DRAWN BY: B.T.L. CHECKED BY: AEE-JF

**FIRE ALARM: JOHNSON TUNNEL FP ZONES ST-16 TO ST-25**

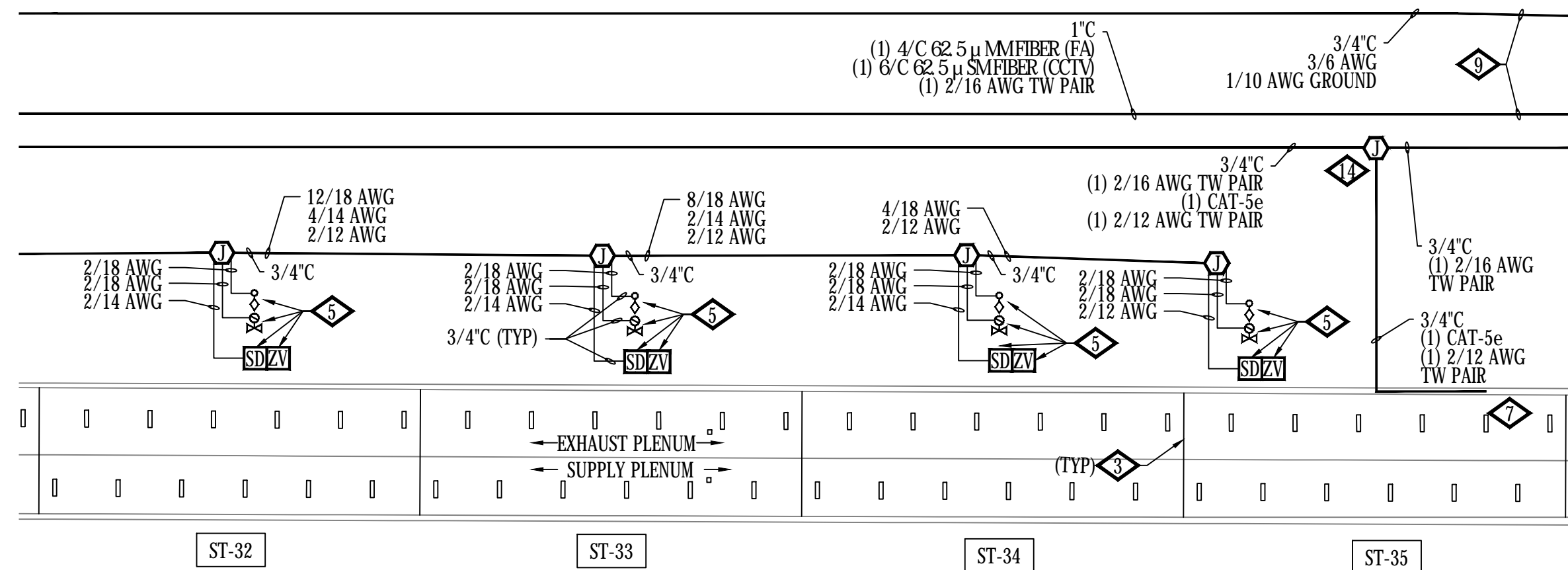
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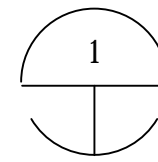


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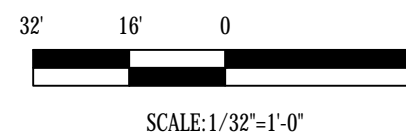
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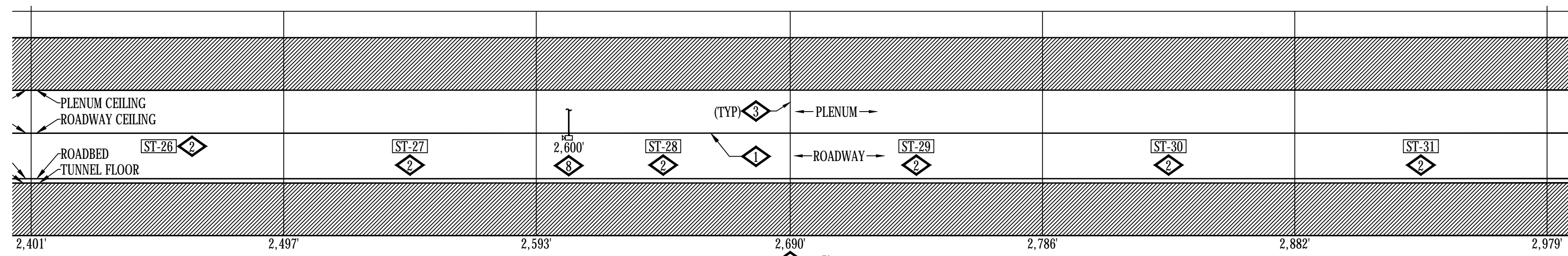
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JOHNSON (SOUTH) TUNNEL - PLENUM PLAN - ZONES ST-26 THRU ST-35  
SCALE: 1/32" = 1'-0"

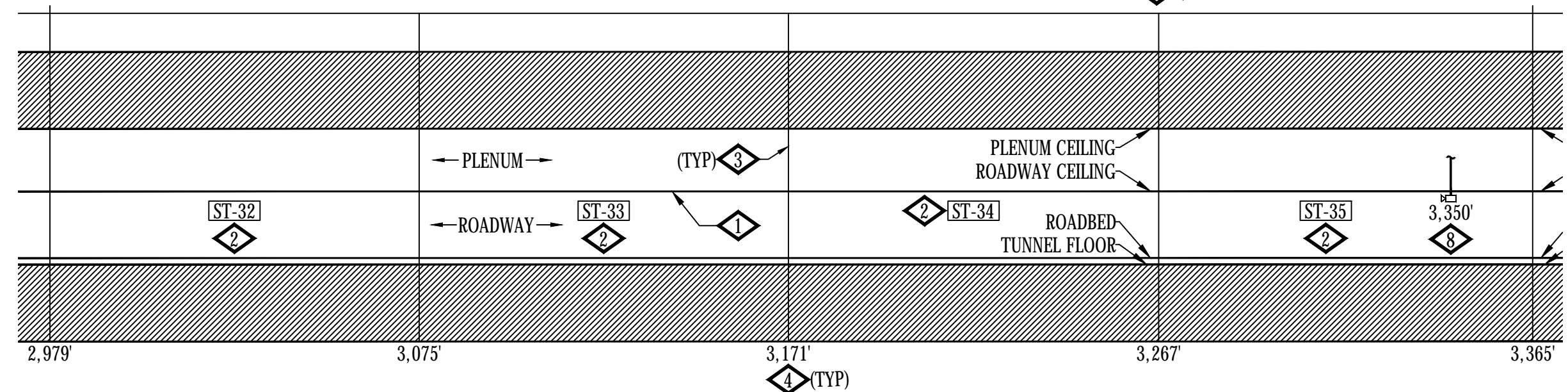


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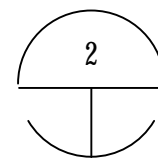


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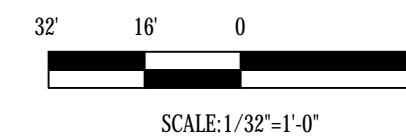
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JOHNSON (SOUTH) TUNNEL - ROADWAY SECTIONAL ELEVATION PLAN - NORTH VIEW - ZONES ST-26 THRU ST-35  
SCALE: 1/32" = 1'-0"



GENERAL NOTES:

- IF FIELD CONDITIONS RESULT IN A CHANGE TO THE SHOP DRAWING INSTALLATION IN ANY WAY, CONTACT FAS SYSTEMS GROUP TO VERIFY PROPOSED CHANGES ARE COMPLIANT WITH NFPA 72 AND PROJECT REQUIREMENTS.
  - EACH CONTROL CABINET AND ADDRESSABLE DEVICE SHALL BEAR A TYPED LABEL INDICATING ITS ADDRESS OR DESIGNATION, WHICH CAN BE SEEN WITHOUT A LADDER OR LIFT. SMOKE AND HEAT DETECTORS SHALL HAVE THEIR LABEL ON ITS BASE.
- DETAIL NOTES:
- ◇ FIBER OPTIC LINEAR HEAT DETECTION (FOLHD) FIBER CABLE IN FOLHD HANGER. CABLE TO BE MOUNTED APPROXIMATELY 2 INCHES BELOW ROADWAY CEILING TILE. SEE SHEETS FA6.01, FA6.14 AND FA6.15.
  - ◇ DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - ◇ DELUGE ZONE BOUNDARY.
  - ◇ DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - ◇ DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - ◇ EQUIPMENT LOCATED IN SUPPLY PLENUM.
  - ◇ ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
  - ◇ MOUNT CCTV CAMERA TO ROADWAY WALL TILE ABOVE EXIT PATHWAY. SEE SHEET FA6.02. DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
  - ◇ MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - ◇ FIRE LOOP ISOLATION VALVE TAMPERS. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - ◇ MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
  - ◇ EXISTING CCTV TRAFFIC CAMERA, SHOWN FOR REFERENCE PURPOSES, TO REMAIN.
  - ◇ EXISTING TRAFFIC CONTROL MESSAGE BOARD, SHOWN FOR REFERENCE PURPOSES, TO REMAIN. ROUTE FOLHD FIBER AND HANGER ABOVE THE MESSAGE BOARD. IT IS ACCEPTABLE TO RUN THE FOLHD CABLE WITHOUT THE HANGER WHERE THERE IS INSUFFICIENT CLEARANCE BETWEEN THE EXISTING MESSAGE BOARD AND THE EXISTING CEILING TILE, WHERE APPLICABLE. LIMIT THE FOLHD CABLE RUNS WITHOUT THE HANGER TO THE MINIMUM DISTANCE POSSIBLE TO CLEAR THE OBSTRUCTION.
  - ◇ LONGSPAN VLS-1N-L CAT5e EXTENDER LOCATED IN JUNCTION BOX AS SHOWN.

ADDRESSING	
06030456	FPC14 HI TEMP
06030457	FPC14 LO TEMP
06030458	FPC14 CCTV TROUBLE
06030459	FPC14 BPS TROUBLE

ADDRESSING		ADDRESSING	
06030377	ST-26 MANUAL INPUT	06030383	ST-27 MANUAL INPUT
06030378	ST-26 DELUGE RELEASE	06030384	ST-27 DELUGE RELEASE
06030436	ST-26 WATER FLOW	06030438	ST-27 WATER FLOW
06030437	ST-26 TAMPERS	06030439	ST-27 TAMPERS
01020153	ST-26 PRIMARY ALARM	01020154	ST-27 PRIMARY ALARM
05030135	ST-26 SECONDARY ALARM	05030136	ST-27 SECONDARY ALARM

ADDRESSING		ADDRESSING	
06030389	ST-28 MANUAL INPUT	06030395	ST-29 MANUAL INPUT
06030390	ST-28 DELUGE RELEASE	06030396	ST-29 DELUGE RELEASE
06030440	ST-28 WATER FLOW	06030442	ST-29 WATER FLOW
06030441	ST-28 TAMPERS	06030443	ST-29 TAMPERS
01020155	ST-28 PRIMARY ALARM	01020156	ST-29 PRIMARY ALARM
05030137	ST-28 SECONDARY ALARM	05030138	ST-29 SECONDARY ALARM

ADDRESSING		ADDRESSING	
06030401	ST-30 MANUAL INPUT	06030407	ST-31 MANUAL INPUT
06030402	ST-30 DELUGE RELEASE	06030408	ST-31 DELUGE RELEASE
06030444	ST-30 WATER FLOW	06030446	ST-31 WATER FLOW
06030445	ST-30 TAMPERS	06030447	ST-31 TAMPERS
01020157	ST-30 PRIMARY ALARM	01020158	ST-31 PRIMARY ALARM
05030139	ST-30 SECONDARY ALARM	05030140	ST-31 SECONDARY ALARM

ADDRESSING		ADDRESSING	
06030413	ST-32 MANUAL INPUT	06030419	ST-33 MANUAL INPUT
06030414	ST-32 DELUGE RELEASE	06030420	ST-33 DELUGE RELEASE
06030448	ST-32 WATER FLOW	06030450	ST-33 WATER FLOW
06030449	ST-32 TAMPERS	06030451	ST-33 TAMPERS
01020159	ST-32 PRIMARY ALARM	01020160	ST-33 PRIMARY ALARM
05030141	ST-32 SECONDARY ALARM	05030142	ST-33 SECONDARY ALARM

ADDRESSING		ADDRESSING	
06030425	ST-34 MANUAL INPUT	06030431	ST-35 MANUAL INPUT
06030426	ST-34 DELUGE RELEASE	06030432	ST-35 DELUGE RELEASE
06030452	ST-34 WATER FLOW	06030454	ST-35 WATER FLOW
06030453	ST-34 TAMPERS	06030455	ST-35 TAMPERS
01020161	ST-34 PRIMARY ALARM	01020162	ST-35 PRIMARY ALARM
05030143	ST-34 SECONDARY ALARM	05030144	ST-35 SECONDARY ALARM

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360  
Subaccount 17810

RECORD DRAWINGS - 2015-11-16

Num	Date	Description

FIRE ALARM:  
JOHNSON TUNNEL  
FP ZONES ST-26 TO ST-35

Drawing Number

FA2.S04

**BARNARD EJMT TEAM**

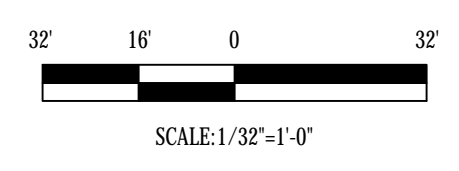
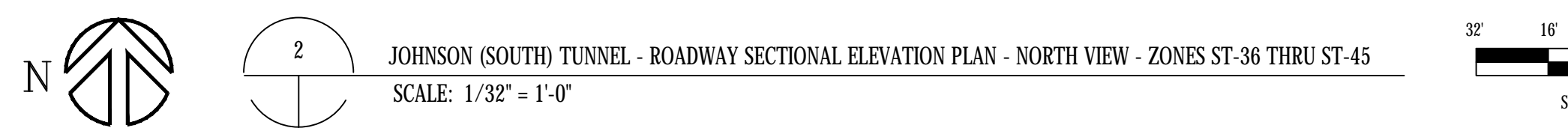
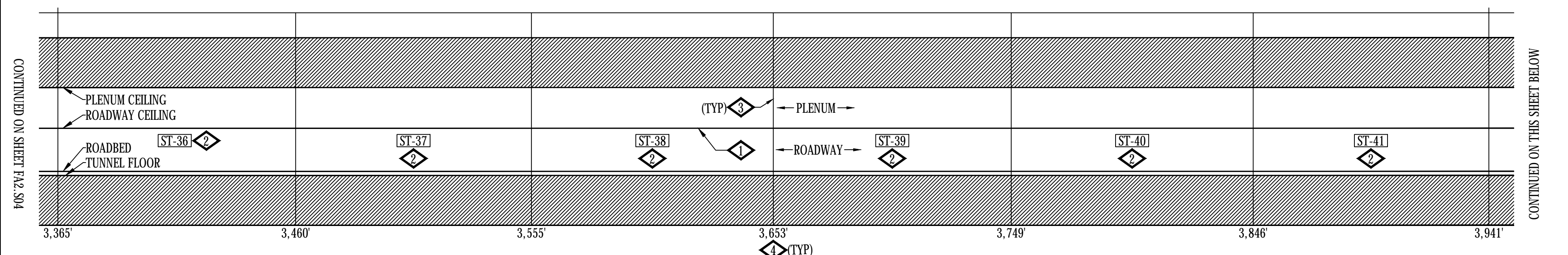
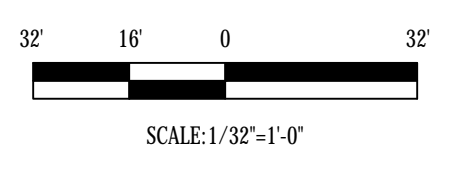
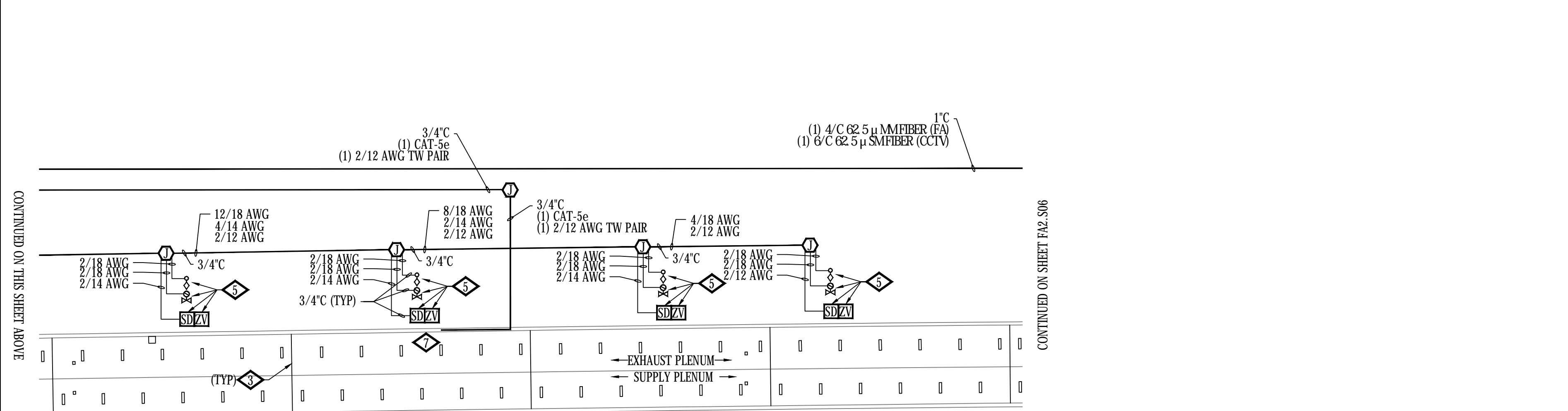
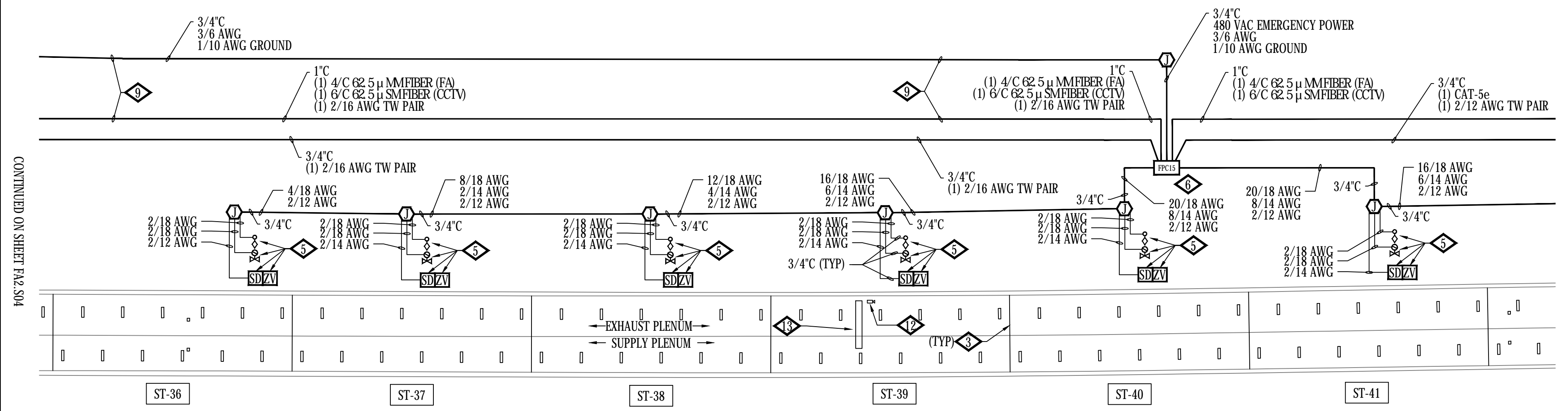
**BARNARD**  
Western States Fire Protection Co.

**Sturgeon**  
ELECTRIC

**BCER**  
Engineering

**RONDINELLI**  
A fire growth life safety

**ELF**  
ENGINEERS



- GENERAL NOTES:**
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  - DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - DELUGE ZONE BOUNDARY.
  - DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - EQUIPMENT LOCATED IN SUPPLY PLENUM.
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  - MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
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ADDRESSING		
06040206	FPC15	HI TEMP
06040207	FPC15	LO TEMP
06040208	FPC15	CCTV TROUBLE
06040209	FPC15	BPS TROUBLE

ADDRESSING			ADDRESSING		
06040127	ST-36	MANUAL INPUT	06040133	ST-37	MANUAL INPUT
06040128	ST-36	DELUGE RELEASE	06040134	ST-37	DELUGE RELEASE
06040186	ST-36	WATER FLOW	06040188	ST-37	WATER FLOW
06040187	ST-36	TAMPER	06040189	ST-37	TAMPER
01020163	ST-36	PRIMARY ALARM	01020164	ST-37	PRIMARY ALARM
05030145	ST-36	SECONDARY ALARM	05030146	ST-37	SECONDARY ALARM

ADDRESSING			ADDRESSING		
06040139	ST-38	MANUAL INPUT	06040145	ST-39	MANUAL INPUT
06040140	ST-38	DELUGE RELEASE	06040146	ST-39	DELUGE RELEASE
06040190	ST-38	WATER FLOW	06040192	ST-39	WATER FLOW
06040191	ST-38	TAMPER	06040193	ST-39	TAMPER
01020165	ST-38	PRIMARY ALARM	01020166	ST-39	PRIMARY ALARM
05030147	ST-38	SECONDARY ALARM	05030148	ST-39	SECONDARY ALARM

ADDRESSING			ADDRESSING		
06040151	ST-40	MANUAL INPUT	06040157	ST-41	MANUAL INPUT
06040152	ST-40	DELUGE RELEASE	06040158	ST-41	DELUGE RELEASE
06040194	ST-40	WATER FLOW	06040196	ST-41	WATER FLOW
06040195	ST-40	TAMPER	06040197	ST-41	TAMPER
01020167	ST-40	PRIMARY ALARM	01020168	ST-41	PRIMARY ALARM
05030149	ST-40	SECONDARY ALARM	05030150	ST-41	SECONDARY ALARM

ADDRESSING			ADDRESSING		
06040163	ST-42	MANUAL INPUT	06040169	ST-43	MANUAL INPUT
06040164	ST-42	DELUGE RELEASE	06040170	ST-43	DELUGE RELEASE
06040198	ST-42	WATER FLOW	06040200	ST-43	WATER FLOW
06040199	ST-42	TAMPER	06040201	ST-43	TAMPER
01020169	ST-42	PRIMARY ALARM	01020170	ST-43	PRIMARY ALARM
05030151	ST-42	SECONDARY ALARM	05030152	ST-43	SECONDARY ALARM

ADDRESSING			ADDRESSING		
06040175	ST-44	MANUAL INPUT	06040181	ST-45	MANUAL INPUT
06040176	ST-44	DELUGE RELEASE	06040182	ST-45	DELUGE RELEASE
06040202	ST-44	WATER FLOW	06040204	ST-45	WATER FLOW
06040203	ST-44	TAMPER	06040205	ST-45	TAMPER
01020171	ST-44	PRIMARY ALARM	01020172	ST-45	PRIMARY ALARM
05030153	ST-44	SECONDARY ALARM	05030154	ST-45	SECONDARY ALARM

**BARNARD EJMT TEAM**

**BARNARD** **RONDINELLI**

**BCER** **Sturgeon Electric**

Western States Fire Protection Co.

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

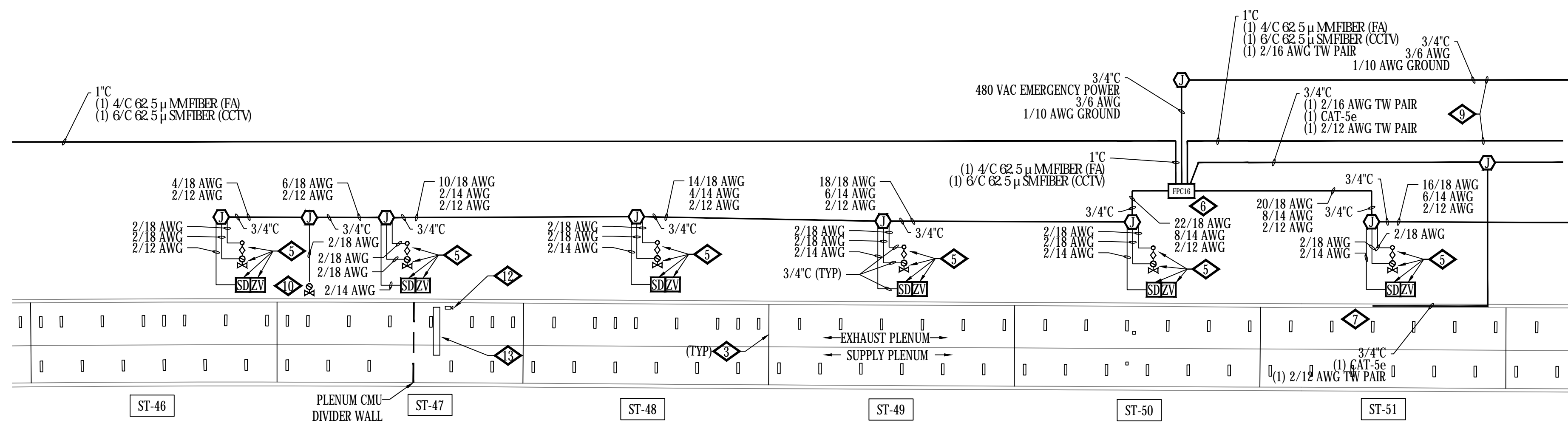
Num	Description	Date

Drawn by: B.T.L. Checked by: AEE-JT

FIRE ALARM: JOHNSON TUNNEL FP ZONES ST-36 TO ST-45

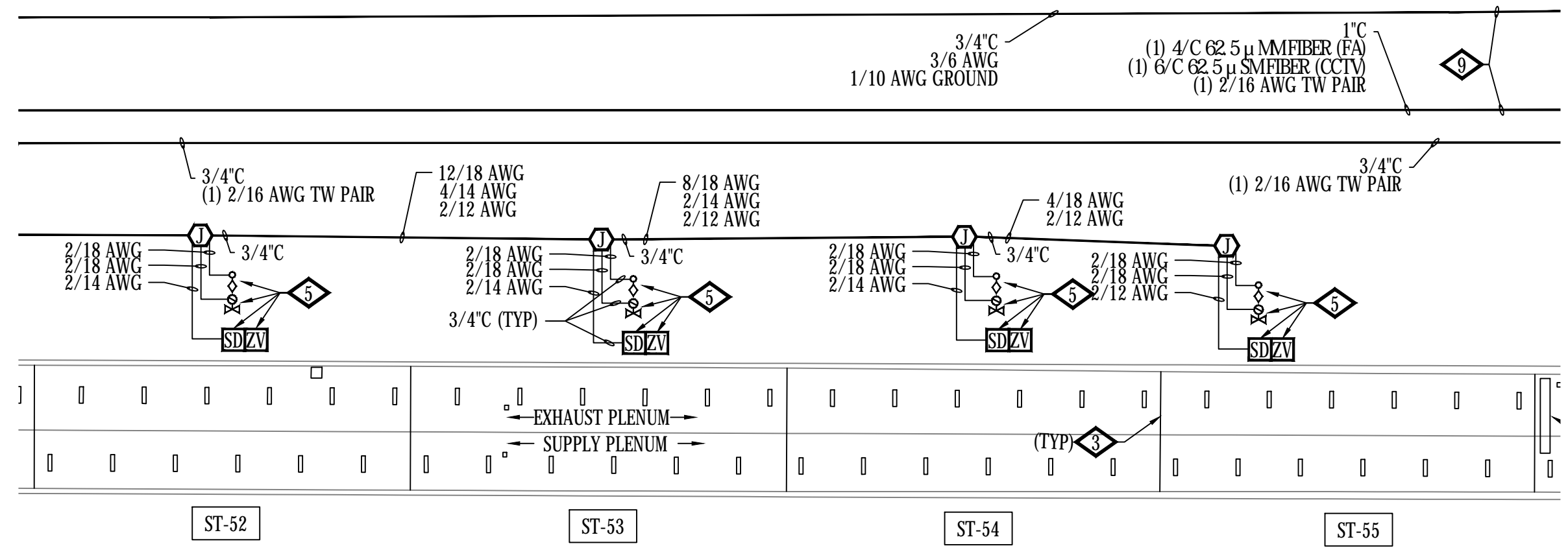
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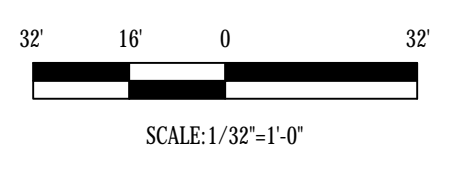
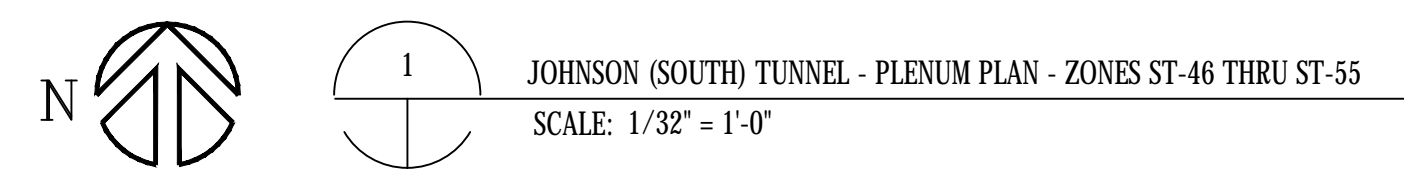


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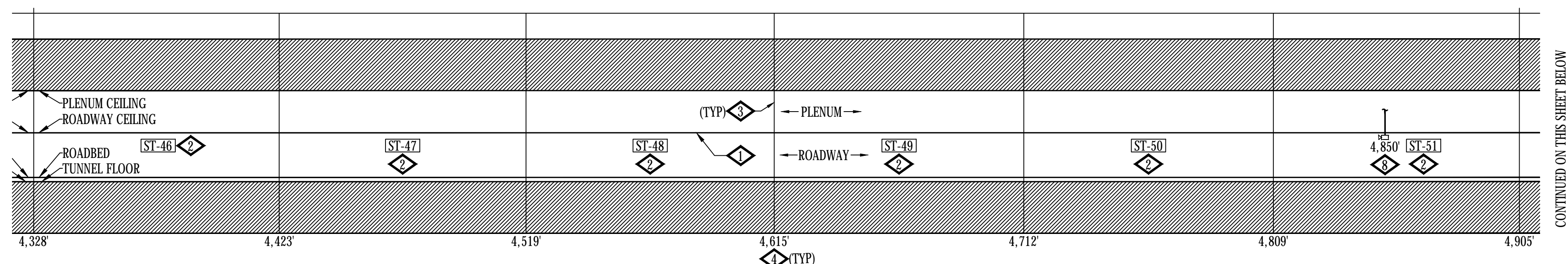
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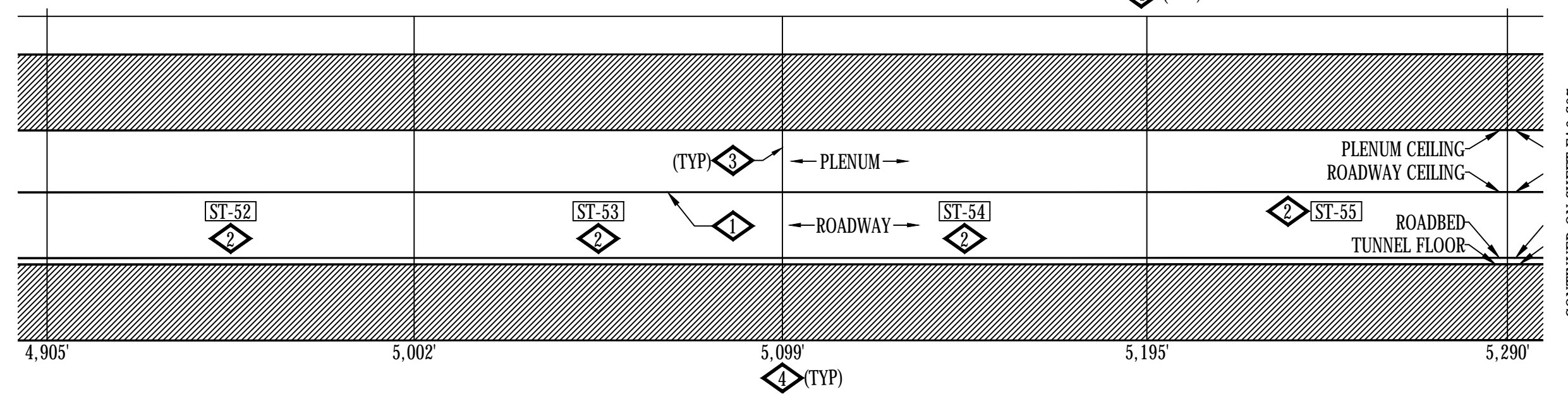


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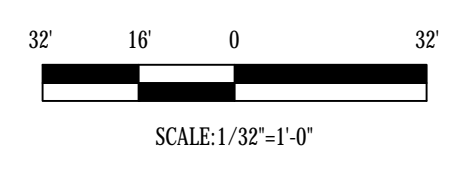


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GENERAL NOTES:

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DETAIL NOTES:

- 1. FIBER OPTIC LINEAR HEAT DETECTION (FOLHD) FIBER CABLE IN FOLHD HANGER. CABLE TO BE MOUNTED APPROXIMATELY 2 INCHES BELOW ROADWAY CEILING TILE. SEE SHEETS FA6.01, FA6.14 AND FA6.15.
- 2. DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
- 3. DELUGE ZONE BOUNDARY.
- 4. DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
- 5. DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
- 6. EQUIPMENT LOCATED IN SUPPLY PLENUM.
- 7. ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
- 8. MOUNT CCTV CAMERA TO ROADWAY WALL TILE ABOVE EXIT PATHWAY. SEE SHEET FA6.02. DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
- 9. MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
- 10. FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
- 11. MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
- 12. EXISTING CCTV TRAFFIC CAMERA, SHOWN FOR REFERENCE PURPOSES, TO REMAIN.
- 13. EXISTING TRAFFIC CONTROL MESSAGE BOARD, SHOWN FOR REFERENCE PURPOSES, TO REMAIN. ROUTE FOLHD FIBER AND HANGER ABOVE THE MESSAGE BOARD. IT IS ACCEPTABLE TO RUN THE FOLHD CABLE WITHOUT THE HANGER WHERE THERE IS INSUFFICIENT CLEARANCE BETWEEN THE EXISTING MESSAGE BOARD AND THE EXISTING CEILING TILE. WHERE APPLICABLE. LIMIT THE FOLHD CABLE RUNS WITHOUT THE HANGER TO THE MINIMUM DISTANCE POSSIBLE TO CLEAR THE OBSTRUCTION.

ADDRESSING			
07020206	FPC16	HI TEMP	
07020207	FPC16	LO TEMP	
07020208	FPC16	CCTV TROUBLE	
07020209	FPC16	BPS TROUBLE	

ADDRESSING			
07020127	ST-46	MANUAL INPUT	
07020128	ST-46	DELUGE RELEASE	
07020186	ST-46	WATER FLOW	
07020187	ST-46	TAMPER	
01020173	ST-46	PRIMARY ALARM	
05030155	ST-46	SECONDARY ALARM	

ADDRESSING			
07020133	ST-47	MANUAL INPUT	
07020134	ST-47	DELUGE RELEASE	
07020188	ST-47	WATER FLOW	
07020189	ST-47	TAMPER	
01020174	ST-47	PRIMARY ALARM	
05030156	ST-47	SECONDARY ALARM	
07020210	ST-47	ISO VALVE TAMPER	

ADDRESSING			
07020139	ST-48	MANUAL INPUT	
07020140	ST-48	DELUGE RELEASE	
07020190	ST-48	WATER FLOW	
07020191	ST-48	TAMPER	
01020175	ST-48	PRIMARY ALARM	
05030157	ST-48	SECONDARY ALARM	

ADDRESSING			
07020145	ST-49	MANUAL INPUT	
07020146	ST-49	DELUGE RELEASE	
07020192	ST-49	WATER FLOW	
07020193	ST-49	TAMPER	
01020176	ST-49	PRIMARY ALARM	
05030158	ST-49	SECONDARY ALARM	

ADDRESSING			
07020151	ST-50	MANUAL INPUT	
07020152	ST-50	DELUGE RELEASE	
07020194	ST-50	WATER FLOW	
07020195	ST-50	TAMPER	
01020177	ST-50	PRIMARY ALARM	
05030159	ST-50	SECONDARY ALARM	

ADDRESSING			
07020157	ST-51	MANUAL INPUT	
07020158	ST-51	DELUGE RELEASE	
07020196	ST-51	WATER FLOW	
07020197	ST-51	TAMPER	
01020178	ST-51	PRIMARY ALARM	
05030160	ST-51	SECONDARY ALARM	

ADDRESSING			
07020163	ST-52	MANUAL INPUT	
07020164	ST-52	DELUGE RELEASE	
07020198	ST-52	WATER FLOW	
07020199	ST-52	TAMPER	
01020179	ST-52	PRIMARY ALARM	
05030161	ST-52	SECONDARY ALARM	

ADDRESSING			
07020169	ST-53	MANUAL INPUT	
07020170	ST-53	DELUGE RELEASE	
07020200	ST-53	WATER FLOW	
07020201	ST-53	TAMPER	
01020180	ST-53	PRIMARY ALARM	
05030162	ST-53	SECONDARY ALARM	

ADDRESSING			
07020175	ST-54	MANUAL INPUT	
07020176	ST-54	DELUGE RELEASE	
07020202	ST-54	WATER FLOW	
07020203	ST-54	TAMPER	
01020181	ST-54	PRIMARY ALARM	
05030163	ST-54	SECONDARY ALARM	

ADDRESSING			
07020181	ST-55	MANUAL INPUT	
07020182	ST-55	DELUGE RELEASE	
07020204	ST-55	WATER FLOW	
07020205	ST-55	TAMPER	
01020182	ST-55	PRIMARY ALARM	
05030164	ST-55	SECONDARY ALARM	

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

**BARNARD EJM TEAM**

**BARNARD** **RONDINELLI**

**Sturgeon Electric**

**BCER** **Western States Fire Protection Co.**

Num	Description	Date

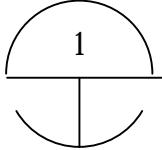
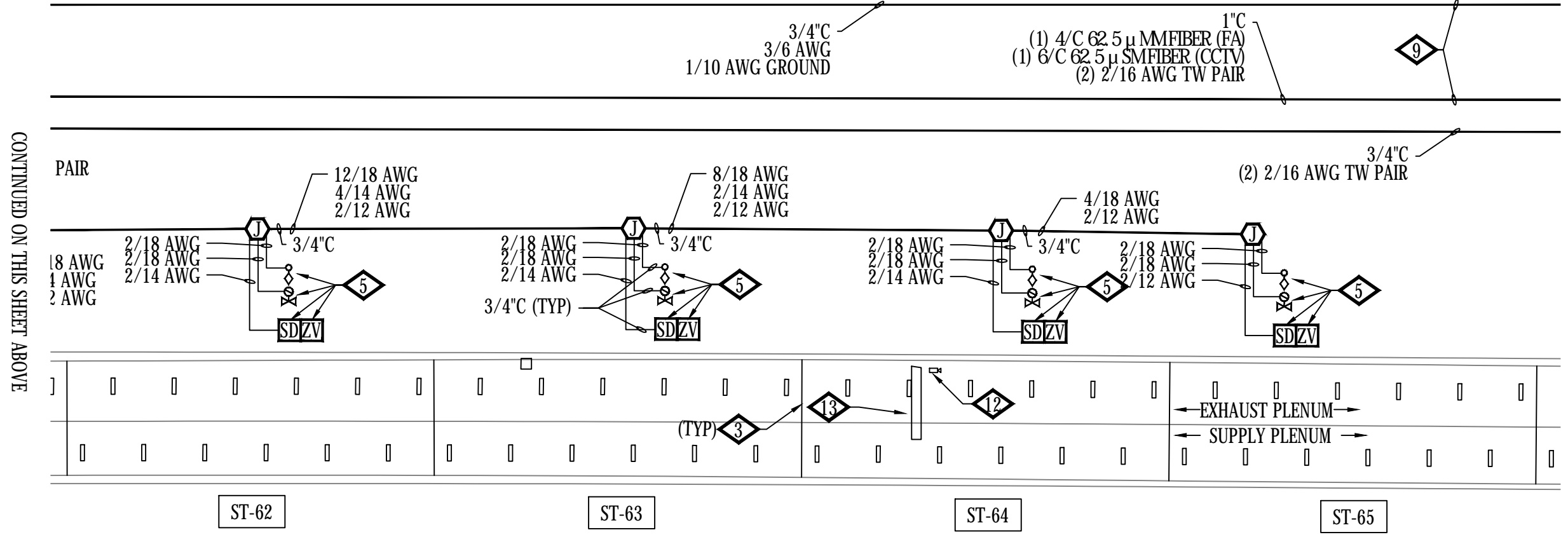
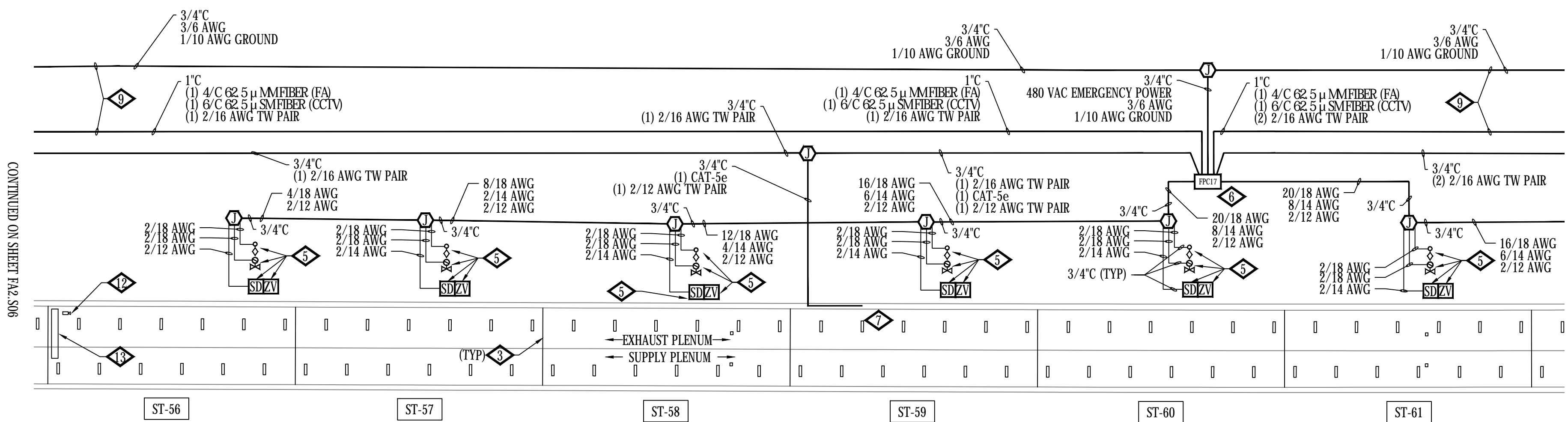
FIRE ALARM:  
JOHNSON TUNNEL  
FP ZONES ST-46 TO ST-55

Drawing Number  
**FA2.S06**

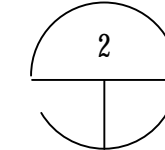
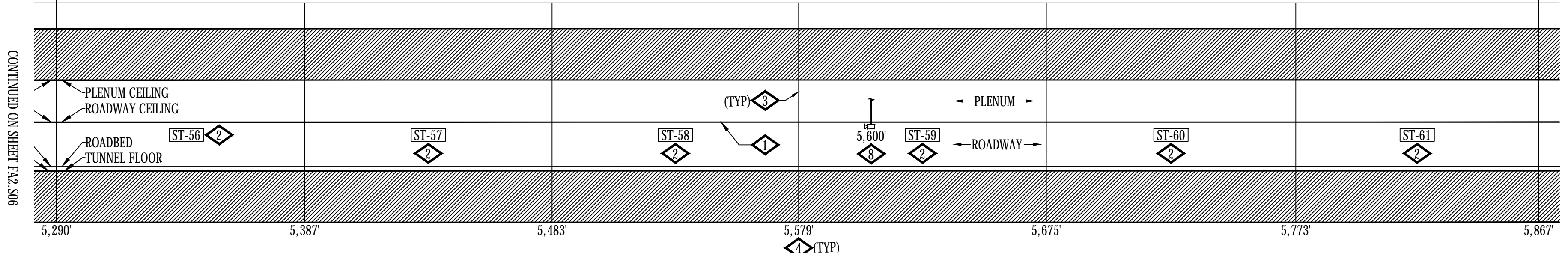
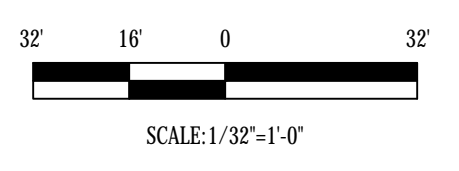
DRAWN BY: B.T.L. CHECKED BY: AEE-JT

RECORD DRAWINGS - 2015-11-16

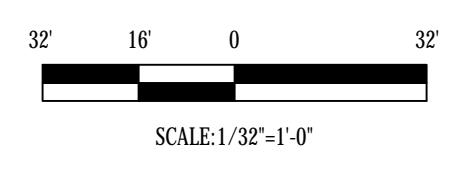




JOHNSON (SOUTH) TUNNEL - PLENUM PLAN - ZONES ST-56 THRU ST-65  
SCALE: 1/32" = 1'-0"



JOHNSON (SOUTH) TUNNEL - ROADWAY SECTIONAL ELEVATION PLAN - NORTH VIEW - ZONES ST-56 THRU ST-65  
SCALE: 1/32" = 1'-0"



- GENERAL NOTES:**
- IF FIELD CONDITIONS RESULT IN A CHANGE TO THE SHOP DRAWING INSTALLATION IN ANY WAY, CONTACT FAS SYSTEMS GROUP TO VERIFY PROPOSED CHANGES ARE COMPLIANT WITH NFPA 72 AND PROJECT REQUIREMENTS.
  - EACH CONTROL CABINET AND ADDRESSABLE DEVICE SHALL BEAR A TYPED LABEL INDICATING ITS ADDRESS OR DESIGNATION, WHICH CAN BE SEEN WITHOUT A LADDER OR LIFT. SMOKE AND HEAT DETECTORS SHALL HAVE THEIR LABEL ON ITS BASE.
- DETAIL NOTES:**
- FIBER OPTIC LINEAR HEAT DETECTION (FOLHD) FIBER CABLE IN FOLHD HANGER. CABLE TO BE MOUNTED APPROXIMATELY 2 INCHES BELOW ROADWAY CEILING TILE. SEE SHEETS FA6.01, FA6.14 AND FA6.15.
  - DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - DELUGE ZONE BOUNDARY.
  - DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - EQUIPMENT LOCATED IN SUPPLY PLENUM.
  - ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
  - MOUNT CCTV CAMERA TO ROADWAY WALL TILE ABOVE EXIT PATHWAY. SEE SHEET FA6.02. DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
  - MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
  - EXISTING CCTV TRAFFIC CAMERA, SHOWN FOR REFERENCE PURPOSES, TO REMAIN.
  - EXISTING TRAFFIC CONTROL MESSAGE BOARD, SHOWN FOR REFERENCE PURPOSES, TO REMAIN. ROUTE FOLHD FIBER AND HANGER ABOVE THE MESSAGE BOARD. IT IS ACCEPTABLE TO RUN THE FOLHD CABLE WITHOUT THE HANGER WHERE THERE IS INSUFFICIENT CLEARANCE BETWEEN THE EXISTING MESSAGE BOARD AND THE EXISTING CEILING TILE, WHERE APPLICABLE. LIMIT THE FOLHD CABLE RUNS WITHOUT THE HANGER TO THE MINIMUM DISTANCE POSSIBLE TO CLEAR THE OBSTRUCTION.

ADDRESSING		
07020456	FPC17	HI TEMP
07020457	FPC17	LO TEMP
07020458	FPC17	CCTV TROUBLE
07020459	FPC17	BPS TROUBLE

ADDRESSING		
07020377	ST-56	MANUAL INPUT
07020378	ST-56	DELUGE RELEASE
07020436	ST-56	WATER FLOW
07020437	ST-56	TAMPER
01020183	ST-56	PRIMARY ALARM
05030165	ST-56	SECONDARY ALARM

ADDRESSING		
07020383	ST-57	MANUAL INPUT
07020384	ST-57	DELUGE RELEASE
07020438	ST-57	WATER FLOW
07020439	ST-57	TAMPER
01020184	ST-57	PRIMARY ALARM
05030166	ST-57	SECONDARY ALARM

ADDRESSING		
07020389	ST-58	MANUAL INPUT
07020290	ST-58	DELUGE RELEASE
07020440	ST-58	WATER FLOW
07020441	ST-58	TAMPER
01020185	ST-58	PRIMARY ALARM
05030167	ST-58	SECONDARY ALARM

ADDRESSING		
07020395	ST-59	MANUAL INPUT
07020396	ST-59	DELUGE RELEASE
07020442	ST-59	WATER FLOW
07020443	ST-59	TAMPER
01020186	ST-59	PRIMARY ALARM
05030168	ST-59	SECONDARY ALARM

ADDRESSING		
07020401	ST-60	MANUAL INPUT
07020402	ST-60	DELUGE RELEASE
07020444	ST-60	WATER FLOW
07020445	ST-60	TAMPER
01020187	ST-60	PRIMARY ALARM
05030169	ST-60	SECONDARY ALARM

ADDRESSING		
07020407	ST-61	MANUAL INPUT
07020408	ST-61	DELUGE RELEASE
07020446	ST-61	WATER FLOW
07020447	ST-61	TAMPER
01020188	ST-61	PRIMARY ALARM
05030170	ST-61	SECONDARY ALARM

ADDRESSING		
07020413	ST-62	MANUAL INPUT
07020414	ST-62	DELUGE RELEASE
07020448	ST-62	WATER FLOW
07020449	ST-62	TAMPER
01020189	ST-62	PRIMARY ALARM
05030171	ST-62	SECONDARY ALARM

ADDRESSING		
07020419	ST-63	MANUAL INPUT
07020420	ST-63	DELUGE RELEASE
07020450	ST-63	WATER FLOW
07020451	ST-63	TAMPER
01020190	ST-63	PRIMARY ALARM
05030172	ST-63	SECONDARY ALARM

ADDRESSING		
07020425	ST-64	MANUAL INPUT
07020426	ST-64	DELUGE RELEASE
07020452	ST-64	WATER FLOW
07020453	ST-64	TAMPER
01020191	ST-64	PRIMARY ALARM
05030173	ST-64	SECONDARY ALARM

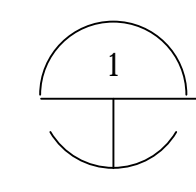
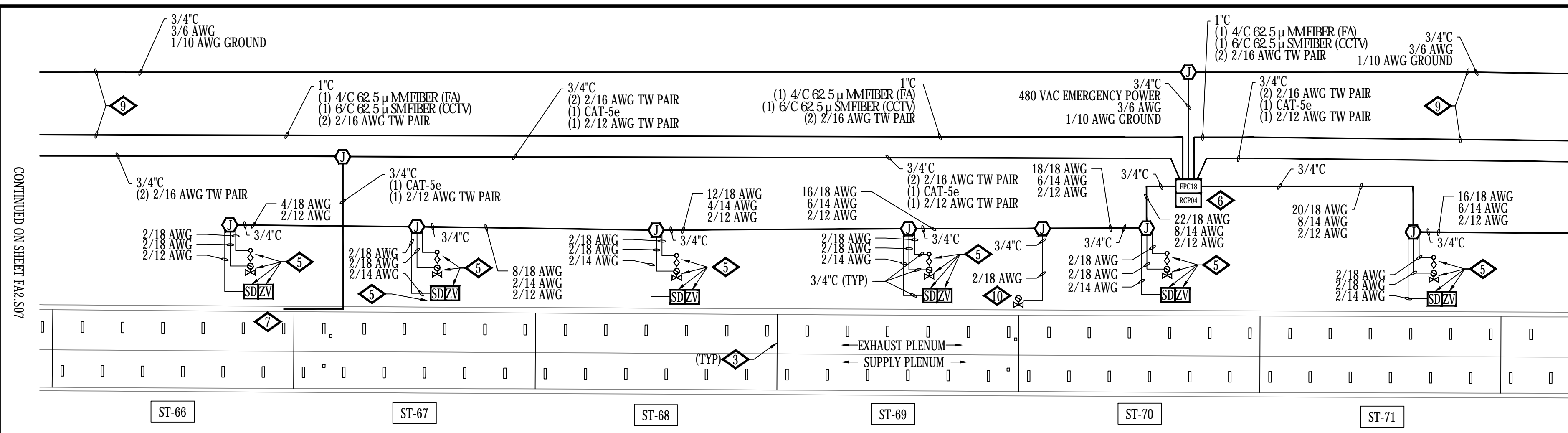
ADDRESSING		
07020431	ST-65	MANUAL INPUT
07020432	ST-65	DELUGE RELEASE
07020454	ST-65	WATER FLOW
07020455	ST-65	TAMPER
01020192	ST-65	PRIMARY ALARM
05030174	ST-65	SECONDARY ALARM

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

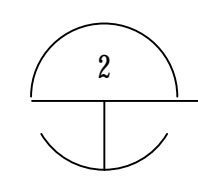
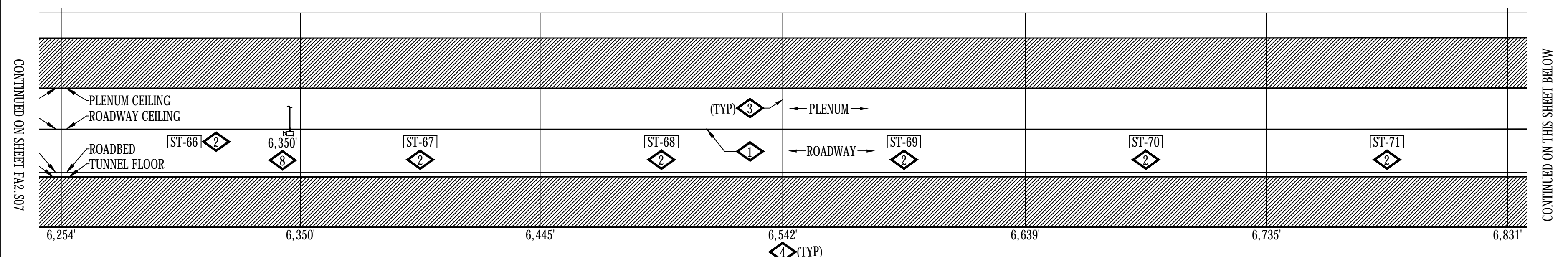
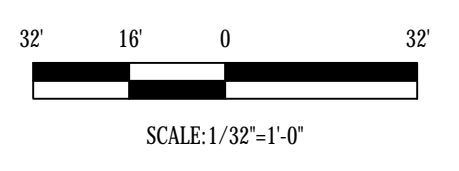
**BARNARD EJM TEAM**  
**BARNARD** **BARNARD** **RONDINELLI**  
Western States Fire Protection Co.  
**Sturgeon Electric**  
**BCER** **Sturgeon Electric** **RONDINELLI**  
A COMMITMENT TO SAFETY  
CONSULTING ENGINEERS

Revisions		
Num	Description	Date

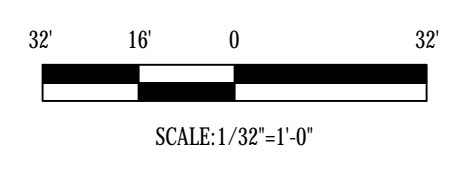
FIRE ALARM:  
JOHNSON TUNNEL  
FP ZONES ST-56 TO ST-65  
Drawing Number  
**FA2.S07**



JOHNSON (SOUTH) TUNNEL - PLENUM PLAN - ZONES ST-66 THRU ST-75  
SCALE: 1/32" = 1'-0"



JOHNSON (SOUTH) TUNNEL - ROADWAY SECTIONAL ELEVATION PLAN - NORTH VIEW - ZONES ST-66 THRU ST-75  
SCALE: 1/32" = 1'-0"



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  - DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - DELUGE ZONE BOUNDARY.
  - DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  - EQUIPMENT LOCATED IN SUPPLY PLENUM.
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  - LONGSPAN VLS-IN-L-CAT5e EXTENDER LOCATED IN JUNCTION BOX AS SHOWN.

ADDRESSING		
07030231	RCP04	HI TEMP
07030232	RCP04	LO TEMP
07030206	FPC18	HI TEMP
07030207	FPC18	LO TEMP
07030208	FPC18	CCTV TROUBLE
07030209	FPC18	BPS TROUBLE

ADDRESSING		
07030127	ST-66	MANUAL INPUT
07030128	ST-66	DELUGE RELEASE
07030186	ST-66	WATER FLOW
07030187	ST-66	TAMPER
01020193	ST-66	PRIMARY ALARM
05030175	ST-66	SECONDARY ALARM

ADDRESSING		
07030133	ST-67	MANUAL INPUT
07030134	ST-67	DELUGE RELEASE
07030188	ST-67	WATER FLOW
07030189	ST-67	TAMPER
01020194	ST-67	PRIMARY ALARM
05030176	ST-67	SECONDARY ALARM

ADDRESSING		
07030139	ST-68	MANUAL INPUT
07030140	ST-68	DELUGE RELEASE
07030190	ST-68	WATER FLOW
07030191	ST-68	TAMPER
01020195	ST-68	PRIMARY ALARM
05030177	ST-68	SECONDARY ALARM

ADDRESSING		
07030145	ST-69	MANUAL INPUT
07030146	ST-69	DELUGE RELEASE
07030192	ST-69	WATER FLOW
07030193	ST-69	TAMPER
01020196	ST-69	PRIMARY ALARM
05030178	ST-69	SECONDARY ALARM
07020210	ST-69	ISO VALVE TAMPER

ADDRESSING		
07030151	ST-70	MANUAL INPUT
07030152	ST-70	DELUGE RELEASE
07030194	ST-70	WATER FLOW
07030195	ST-70	TAMPER
01020197	ST-70	PRIMARY ALARM
05030179	ST-70	SECONDARY ALARM

ADDRESSING		
07030157	ST-71	MANUAL INPUT
07030158	ST-71	DELUGE RELEASE
07030196	ST-71	WATER FLOW
07030197	ST-71	TAMPER
01020198	ST-71	PRIMARY ALARM
05030180	ST-71	SECONDARY ALARM

ADDRESSING		
07030163	ST-72	MANUAL INPUT
07030164	ST-72	DELUGE RELEASE
07030198	ST-72	WATER FLOW
07030199	ST-72	TAMPER
01020199	ST-72	PRIMARY ALARM
05030181	ST-72	SECONDARY ALARM

ADDRESSING		
07030169	ST-73	MANUAL INPUT
07030170	ST-73	DELUGE RELEASE
07030200	ST-73	WATER FLOW
07030201	ST-73	TAMPER
01020200	ST-73	PRIMARY ALARM
05030182	ST-73	SECONDARY ALARM

ADDRESSING		
07030175	ST-74	MANUAL INPUT
07030176	ST-74	DELUGE RELEASE
07030202	ST-74	WATER FLOW
07030203	ST-74	TAMPER
01020201	ST-74	PRIMARY ALARM
05030183	ST-74	SECONDARY ALARM

ADDRESSING		
07030181	ST-75	MANUAL INPUT
07030182	ST-75	DELUGE RELEASE
07030204	ST-75	WATER FLOW
07030205	ST-75	TAMPER
01020202	ST-75	PRIMARY ALARM
05030184	ST-75	SECONDARY ALARM

**BARNARD EJMT TEAM**

**BARNARD** **RONDINELLI**

**BCER** **Sturgeon ELECTRIC**

Western States Fire Protection Co.

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

Num	Revisions	Date
	Description	

FIRE ALARM: JOHNSON TUNNEL FP ZONES ST-66 TO ST-75

Drawing Number **FA2.S08**

DRAWN BY: B.T.L. CHECKED BY: AEE-JT

CONTINUED ON SHEET FA2.S08

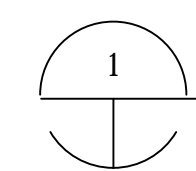
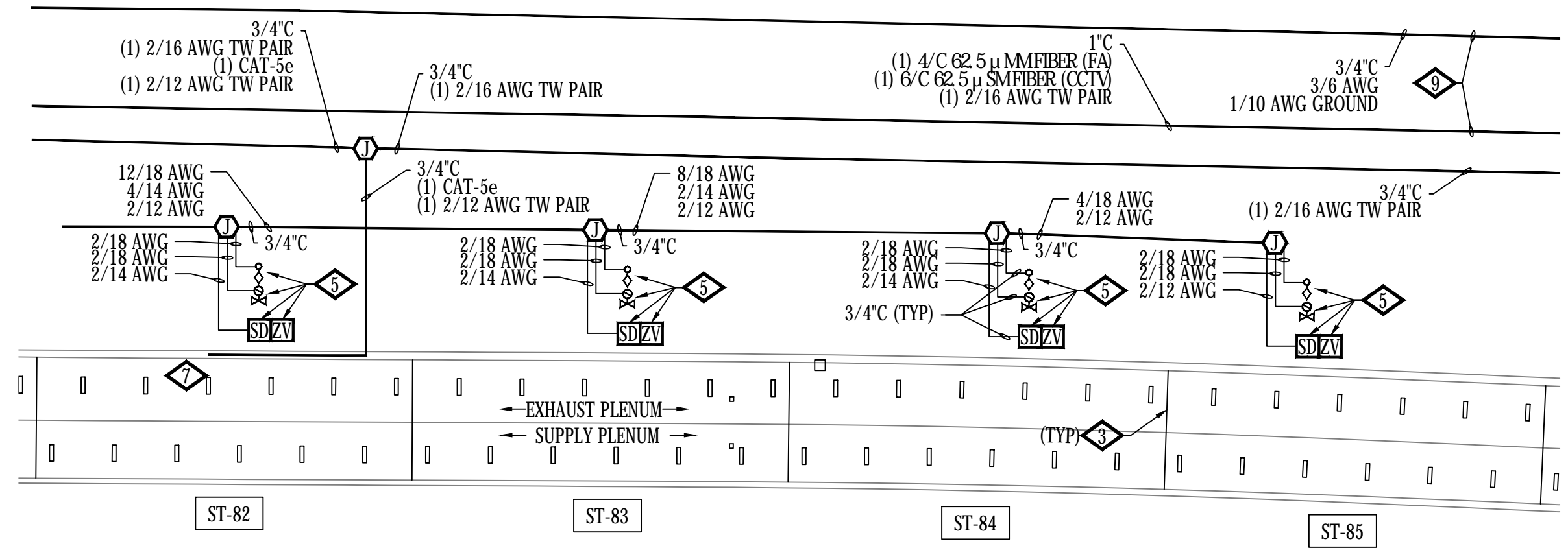
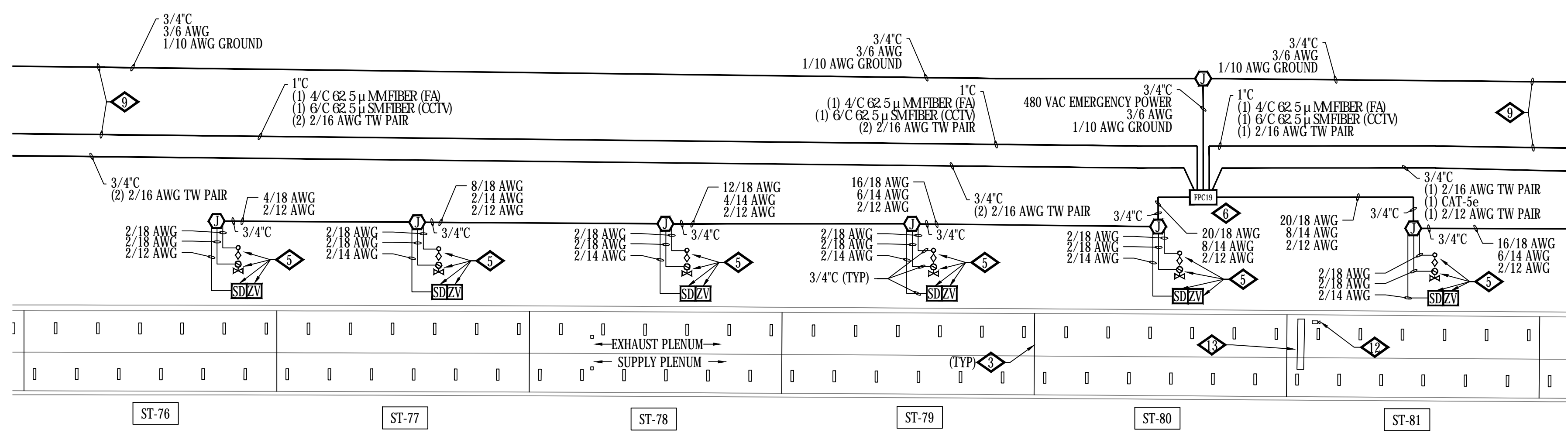
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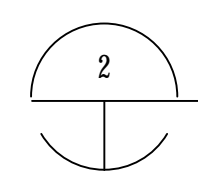
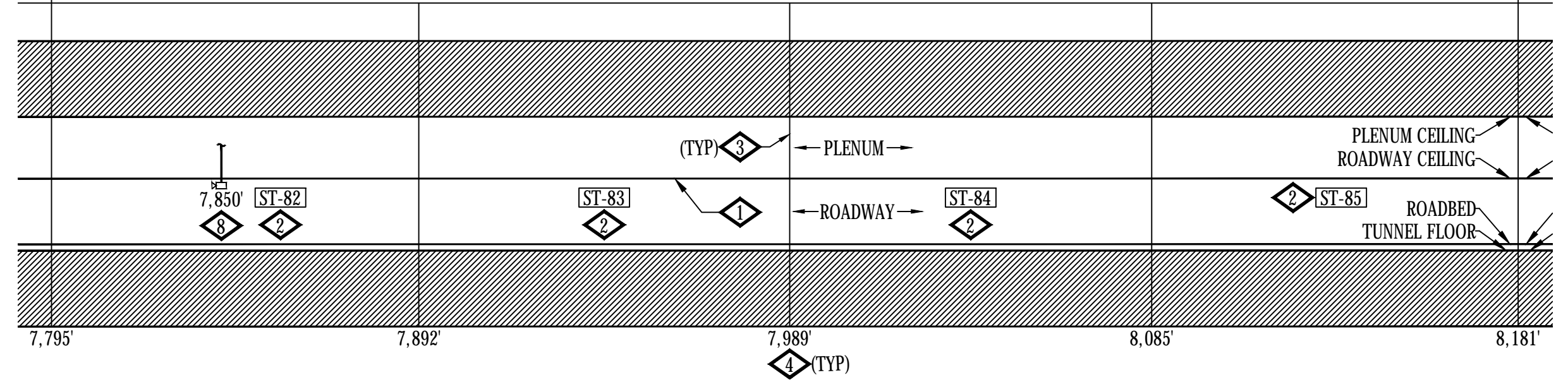
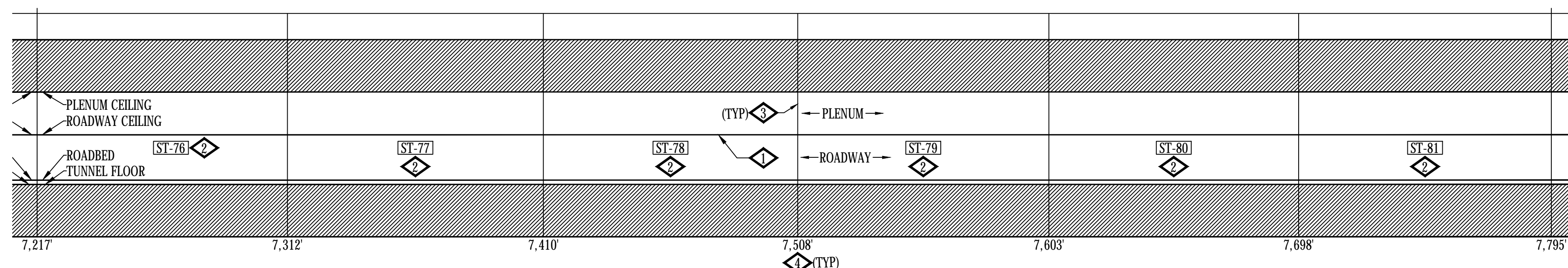
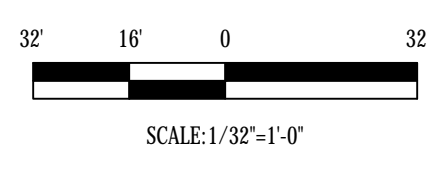
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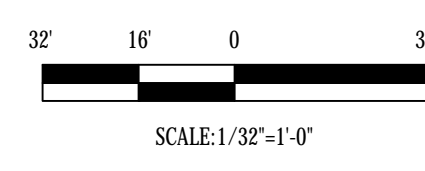
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JOHNSON (SOUTH) TUNNEL - PLENUM PLAN - ZONES ST-76 THRU ST-85  
SCALE: 1/32" = 1'-0"



JOHNSON (SOUTH) TUNNEL - ROADWAY SECTIONAL ELEVATION PLAN - NORTH VIEW - ZONES ST-76 THRU ST-85  
SCALE: 1/32" = 1'-0"



CONTINUED ON THIS SHEET BELOW

CONTINUED ON SHEET FA2.S10

GENERAL NOTES:

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  - DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  - DELUGE ZONE BOUNDARY.
  - DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  - DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
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  - MOUNT CCTV CAMERA TO ROADWAY WALL TILE ABOVE EXIT PATHWAY. SEE SHEET FA6.02. DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
  - MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  - FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
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ADDRESSING		
07030456	FPC19	HI TEMP
07030457	FPC19	LO TEMP
07030458	FPC19	CCTV TROUBLE
07030459	FPC19	BPS TROUBLE

ADDRESSING		
07030377	ST-76	MANUAL INPUT
07030378	ST-76	DELUGE RELEASE
07030436	ST-76	WATER FLOW
07030437	ST-76	TAMPER
01020203	ST-76	PRIMARY ALARM
05030185	ST-76	SECONDARY ALARM

ADDRESSING		
07030383	ST-77	MANUAL INPUT
07030384	ST-77	DELUGE RELEASE
07030438	ST-77	WATER FLOW
07030439	ST-77	TAMPER
01020204	ST-77	PRIMARY ALARM
05030186	ST-77	SECONDARY ALARM

ADDRESSING		
07030389	ST-78	MANUAL INPUT
07030390	ST-78	DELUGE RELEASE
07030440	ST-78	WATER FLOW
07030441	ST-78	TAMPER
01020205	ST-78	PRIMARY ALARM
05030187	ST-78	SECONDARY ALARM

ADDRESSING		
07030395	ST-79	MANUAL INPUT
07030396	ST-79	DELUGE RELEASE
07030442	ST-79	WATER FLOW
07030443	ST-79	TAMPER
01020206	ST-79	PRIMARY ALARM
05030188	ST-79	SECONDARY ALARM

ADDRESSING		
07030401	ST-80	MANUAL INPUT
07030402	ST-80	DELUGE RELEASE
07030444	ST-80	WATER FLOW
07030445	ST-80	TAMPER
01020207	ST-80	PRIMARY ALARM
05030189	ST-80	SECONDARY ALARM

ADDRESSING		
07030407	ST-81	MANUAL INPUT
07030408	ST-81	DELUGE RELEASE
07030446	ST-81	WATER FLOW
07030447	ST-81	TAMPER
01020208	ST-81	PRIMARY ALARM
05030180	ST-81	SECONDARY ALARM

ADDRESSING		
07030413	ST-82	MANUAL INPUT
07030414	ST-82	DELUGE RELEASE
07030448	ST-82	WATER FLOW
07030449	ST-82	TAMPER
01020209	ST-82	PRIMARY ALARM
05030191	ST-82	SECONDARY ALARM

ADDRESSING		
07030419	ST-83	MANUAL INPUT
07030420	ST-83	DELUGE RELEASE
07030450	ST-83	WATER FLOW
07030451	ST-83	TAMPER
01020210	ST-83	PRIMARY ALARM
05030192	ST-83	SECONDARY ALARM

ADDRESSING		
07030425	ST-84	MANUAL INPUT
07030426	ST-84	DELUGE RELEASE
07030452	ST-84	WATER FLOW
07030453	ST-84	TAMPER
01020211	ST-84	PRIMARY ALARM
05030193	ST-84	SECONDARY ALARM

ADDRESSING		
07030431	ST-85	MANUAL INPUT
07030432	ST-85	DELUGE RELEASE
07030454	ST-85	WATER FLOW
07030455	ST-85	TAMPER
01020212	ST-85	PRIMARY ALARM
05030194	ST-85	SECONDARY ALARM

**BARNARD EJMT TEAM**

**BARNARD** CONSULTING ENGINEERS

**RONDINELLI** FIRE & LIFE SAFETY

**ELF** CONSULTING ENGINEERS

Western States Fire Protection Co.

**Sturgeon** ELECTRIC

**BCER** CONSULTING ENGINEERS

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM

DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

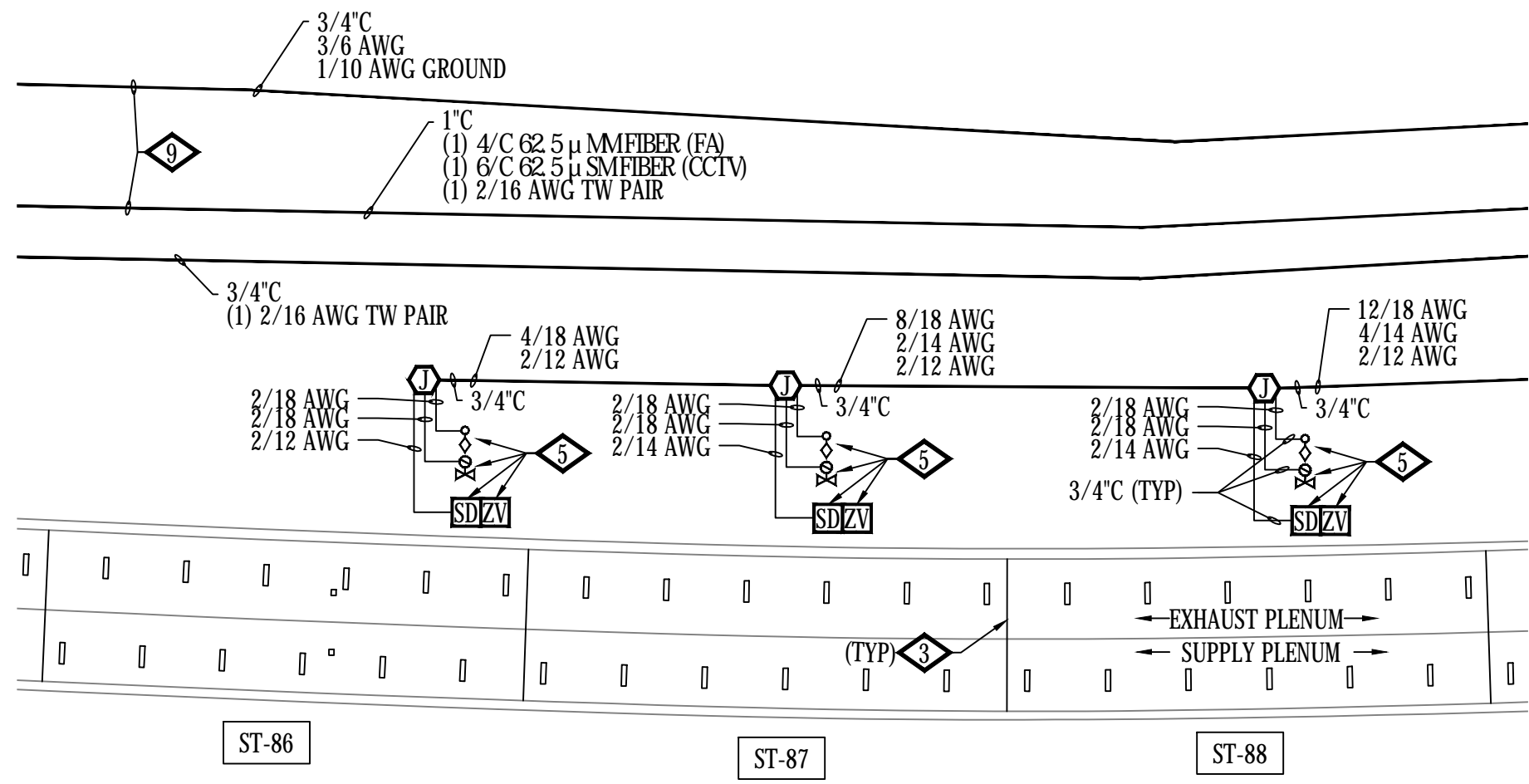
Revisions	Date	Description

FIRE ALARM:  
JOHNSON TUNNEL  
FP ZONES ST-76 TO ST-85

Drawing Number

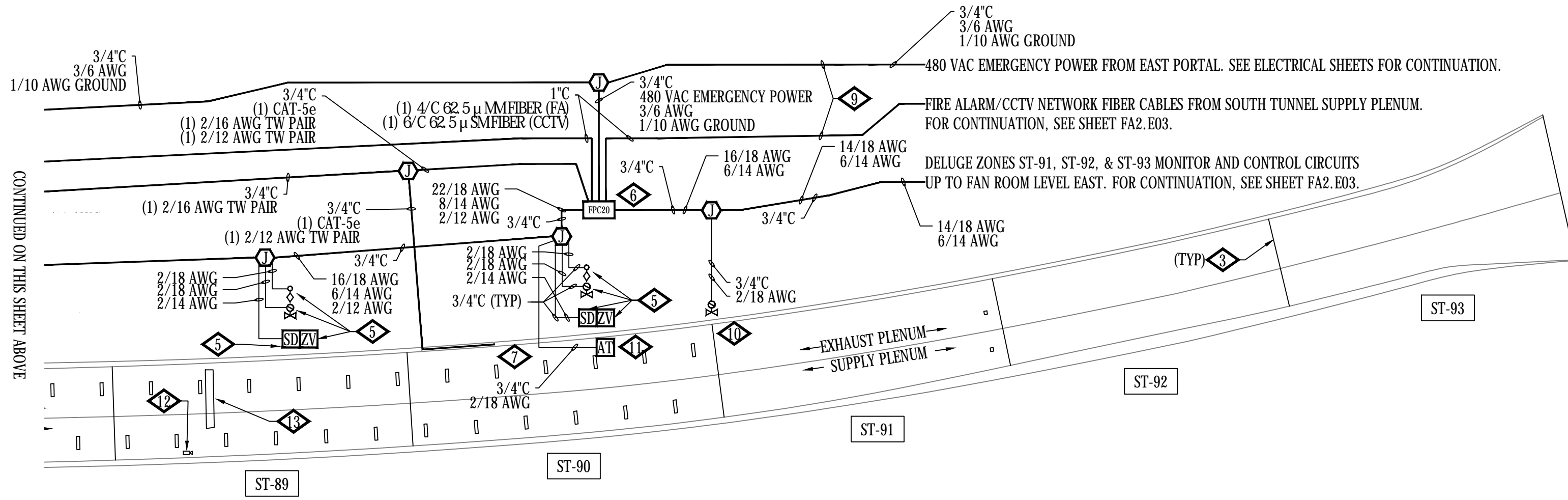
**FA2.S09**

DRAWN BY: B.T.L. CHECKED BY: AEE-JF

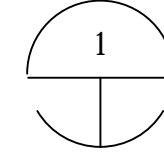


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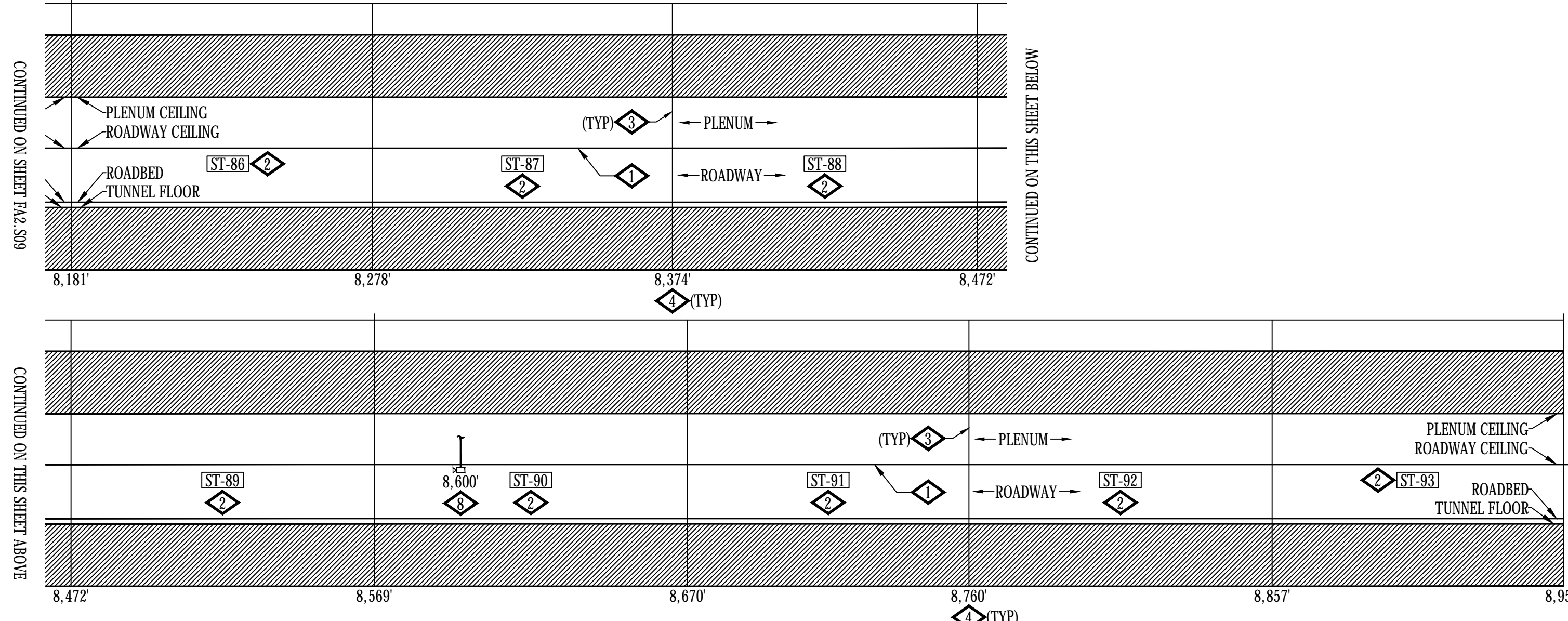
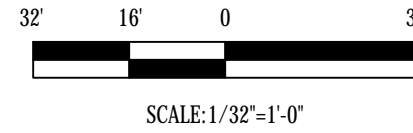
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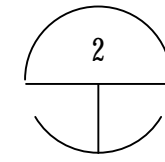


JOHNSON (SOUTH) TUNNEL - PLENUM PLAN - ZONES ST-86 THRU ST-93  
SCALE: 1/32" = 1'-0"

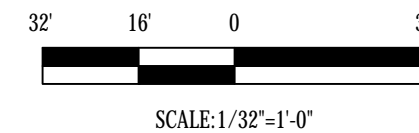


CONTINUED ON SHEET FA2.S09

CONTINUED ON THIS SHEET BELOW



JOHNSON (SOUTH) TUNNEL - ROADWAY SECTIONAL ELEVATION PLAN - NORTH VIEW - ZONES ST-86 THRU ST-93  
SCALE: 1/32" = 1'-0"



GENERAL NOTES:

1. IF FIELD CONDITIONS RESULT IN A CHANGE TO THE SHOP DRAWING INSTALLATION IN ANY WAY, CONTACT FAS SYSTEMS GROUP TO VERIFY PROPOSED CHANGES ARE COMPLIANT WITH NFPA 72 AND PROJECT REQUIREMENTS.
  2. EACH CONTROL CABINET AND ADDRESSABLE DEVICE SHALL BEAR A TYPED LABEL INDICATING ITS ADDRESS OR DESIGNATION, WHICH CAN BE SEEN WITHOUT A LADDER OR LIFT. SMOKE AND HEAT DETECTORS SHALL HAVE THEIR LABEL ON ITS BASE.
- DETAIL NOTES:
1. FIBER OPTIC LINEAR HEAT DETECTION (FOLHD) FIBER CABLE IN FOLHD HANGER. CABLE TO BE MOUNTED APPROXIMATELY 2 INCHES BELOW ROADWAY CEILING TILE. SEE SHEETS FA6.01, FA6.14 AND FA6.15.
  2. DELUGE ZONE SIGNS MOUNTED AT MOST CENTER-POINT OF DELUGE ZONE AND +84" FROM WALKWAY FLOOR. SEE SHEET FA6.02.
  3. DELUGE ZONE BOUNDARY.
  4. DIMENSION INDICATED APPROXIMATE DISTANCE OF DELUGE ZONE BOUNDARY TO WEST END PORTAL.
  5. DELUGE SPRINKLER SYSTEM EQUIPMENT LOCATED IN SUPPLY PLENUM. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  6. EQUIPMENT LOCATED IN SUPPLY PLENUM.
  7. ROUTE CAMERA ETHERNET AND POWER RACEWAY AND CIRCUITRY IN A CONCEALED FASHION THRU EXISTING EXHAUST PLENUM OPENING TO BACKSIDE OF ROADWAY WALL TO WALL MOUNTED LOCATION.
  8. MOUNT CCTV CAMERA TO ROADWAY WALL TILE ABOVE EXIT PATHWAY. SEE SHEET FA6.02. DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
  9. MAINTAIN MAXIMUM SEPARATION POSSIBLE BETWEEN 480 VAC POWER AND FIRE ALARM RACEWAYS. SEE SHEETS FA6.14 AND FA6.15.
  10. FIRE LOOP ISOLATION VALVE TAMPER. SEE FIRE PROTECTION SHEETS FOR EQUIPMENT LOCATIONS.
  11. MOUNT AIR TEMPERATURE SENSOR INSIDE INSULATED VALVE ENCLOSURE (IVE), OF ASSOCIATED TUNNEL DELUGE ZONE.
  12. EXISTING CCTV TRAFFIC CAMERA, SHOWN FOR REFERENCE PURPOSES, TO REMAIN.
  13. EXISTING TRAFFIC CONTROL MESSAGE BOARD, SHOWN FOR REFERENCE PURPOSES, TO REMAIN. ROUTE FOLHD FIBER AND HANGER ABOVE THE MESSAGE BOARD. IT IS ACCEPTABLE TO RUN THE FOLHD CABLE WITHOUT THE HANGER WHERE THERE IS INSUFFICIENT CLEARANCE BETWEEN THE EXISTING MESSAGE BOARD AND THE EXISTING CEILING TILE, WHERE APPLICABLE. LIMIT THE FOLHD CABLE RUNS WITHOUT THE HANGER TO THE MINIMUM DISTANCE POSSIBLE TO CLEAR THE OBSTRUCTION.

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

ADDRESSING		
07040190	FPC20	HI TEMP
07040191	FPC20	LO TEMP
07040192	FPC20	CCTV TROUBLE
07040193	FPC20	BPS TROUBLE

ADDRESSING		
07040127	ST-86	MANUAL INPUT
07040128	ST-86	DELUGE RELEASE
07040174	ST-86	WATER FLOW
07040175	ST-86	TAMPER
01020213	ST-86	PRIMARY ALARM
05030195	ST-86	SECONDARY ALARM

ADDRESSING		
07040133	ST-87	MANUAL INPUT
07040134	ST-87	DELUGE RELEASE
07040176	ST-87	WATER FLOW
07040177	ST-87	TAMPER
01020214	ST-87	PRIMARY ALARM
05030196	ST-87	SECONDARY ALARM

ADDRESSING		
07040139	ST-88	MANUAL INPUT
07040140	ST-88	DELUGE RELEASE
07040178	ST-88	WATER FLOW
07040179	ST-88	TAMPER
01020215	ST-88	PRIMARY ALARM
05030197	ST-88	SECONDARY ALARM

ADDRESSING		
07040145	ST-89	MANUAL INPUT
07040146	ST-89	DELUGE RELEASE
07040180	ST-89	WATER FLOW
07040181	ST-89	TAMPER
01020216	ST-89	PRIMARY ALARM
05030198	ST-89	SECONDARY ALARM

ADDRESSING		
07040151	ST-90	MANUAL INPUT
07040152	ST-90	DELUGE RELEASE
07040182	ST-90	WATER FLOW
07040183	ST-90	TAMPER
01020217	ST-90	PRIMARY ALARM
05030199	ST-90	SECONDARY ALARM
07040194	ST-90	ISO VALVE TAMPER
07040195	ST-90	IVE LOW TEMP

BARNARD EJMT TEAM

BARNARD RONDINELLI

BARNARD RONDINELLI  
A COMMITMENT TO EXCELLENCE  
WESTERN STATES FIRE PROTECTION CO.  
ENGINEERS

BCER  
BUSINESS CONSULTING ENGINEERING

Sturgeon  
ELECTRIC

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL

FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

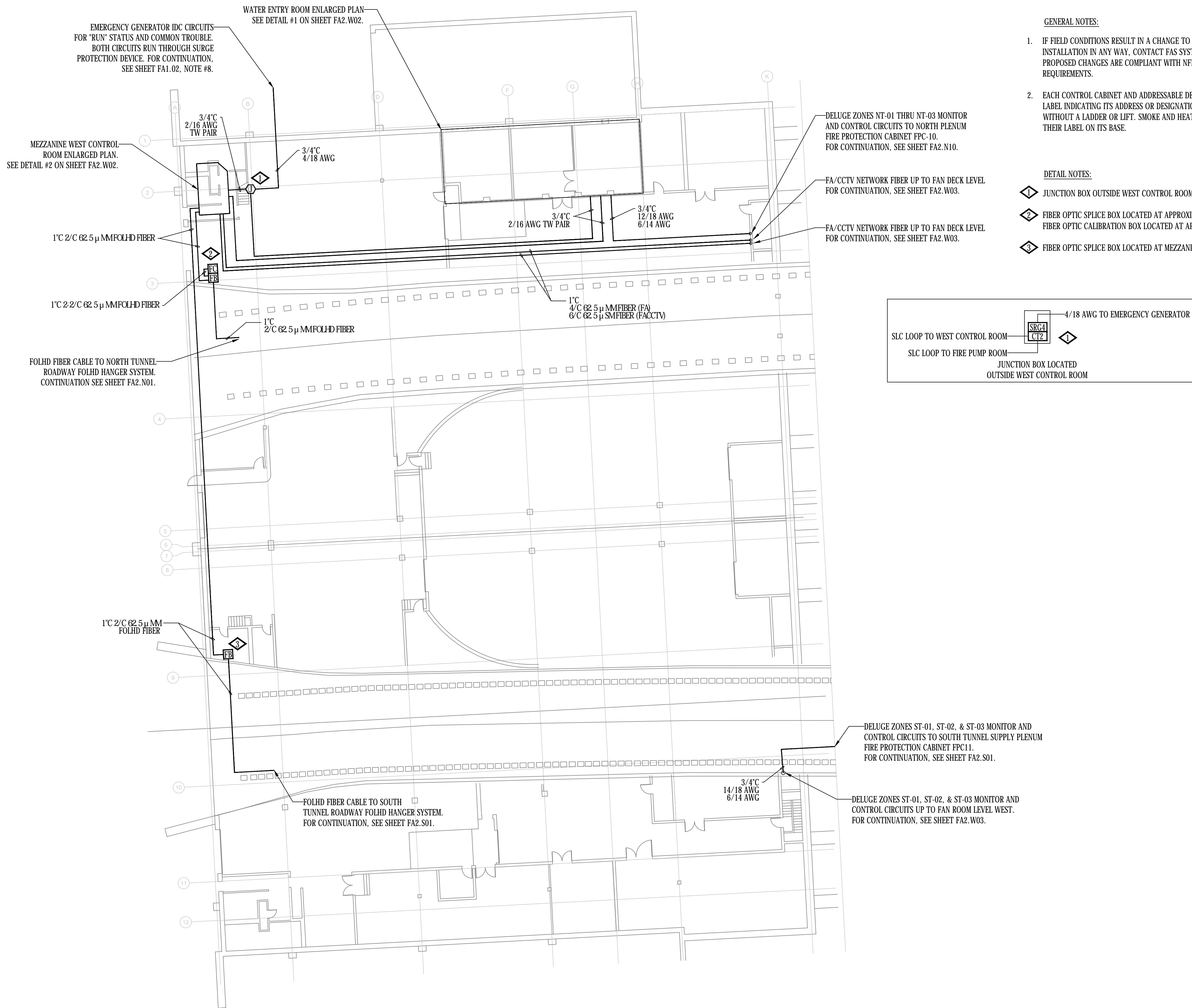
Project No. C0703-360  
Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Num	Date	Description

FIRE ALARM:  
 JOHNSON TUNNEL  
 FP ZONES ST-86 TO ST-93  
 Drawing Number  
**FA2.S10**

DRAWN BY: B.T.L. | CHECKED BY: AEE-JT

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

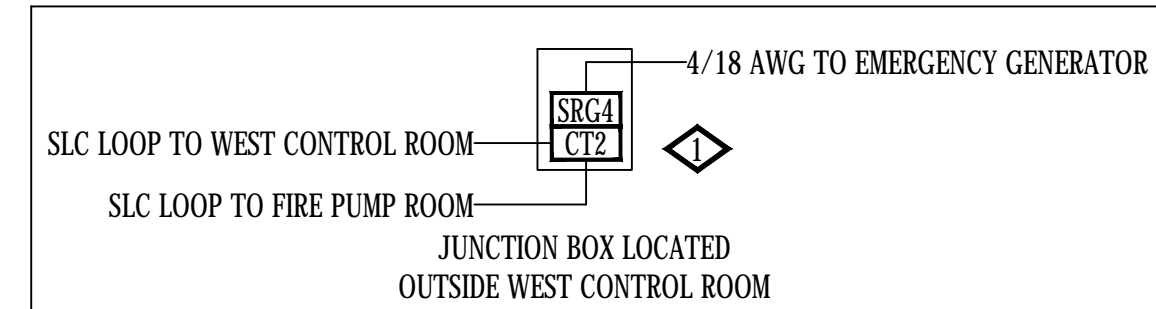


**GENERAL NOTES:**

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**DETAIL NOTES:**

- ① JUNCTION BOX OUTSIDE WEST CONTROL ROOM.
- ② FIBER OPTIC SPLICE BOX LOCATED AT APPROXIMATELY 12' A.F.F. FIBER OPTIC CALIBRATION BOX LOCATED AT APPROXIMATELY 5' A.F.F.
- ③ FIBER OPTIC SPLICE BOX LOCATED AT MEZZANINE LEVEL STAIR LANDING.



Revisions

Num	Description	Date

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

FIRE ALARM:  
ROADWAY LEVEL WEST

Drawing Number  
**FA2.W01**

**BARNARD EJMT TEAM**

**BARNARD** **RONDINELLI**

BCER **Sturgeon Electric**

Western States Fire Protection Co.

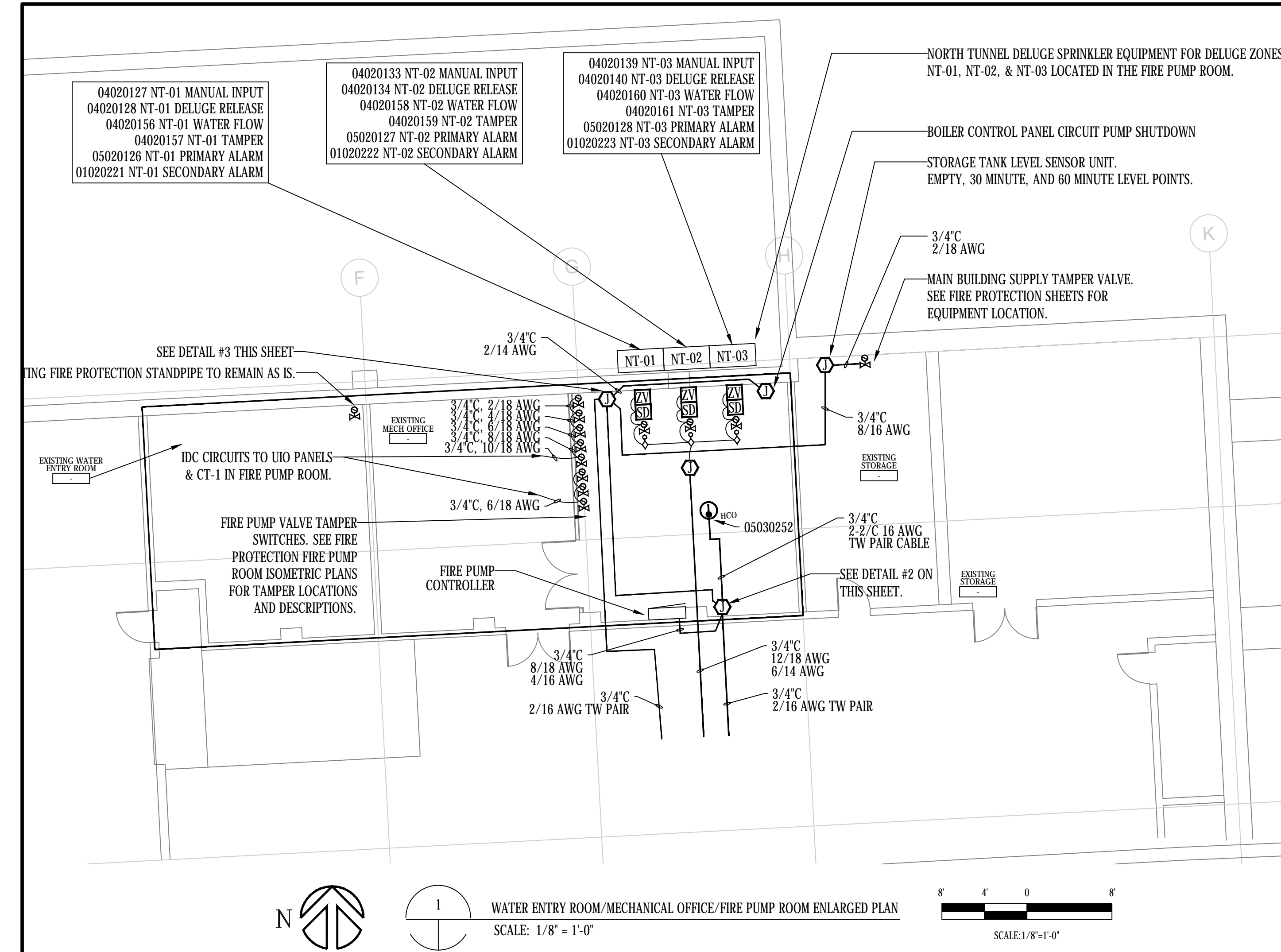
ALF CONSULTING ENGINEERS

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

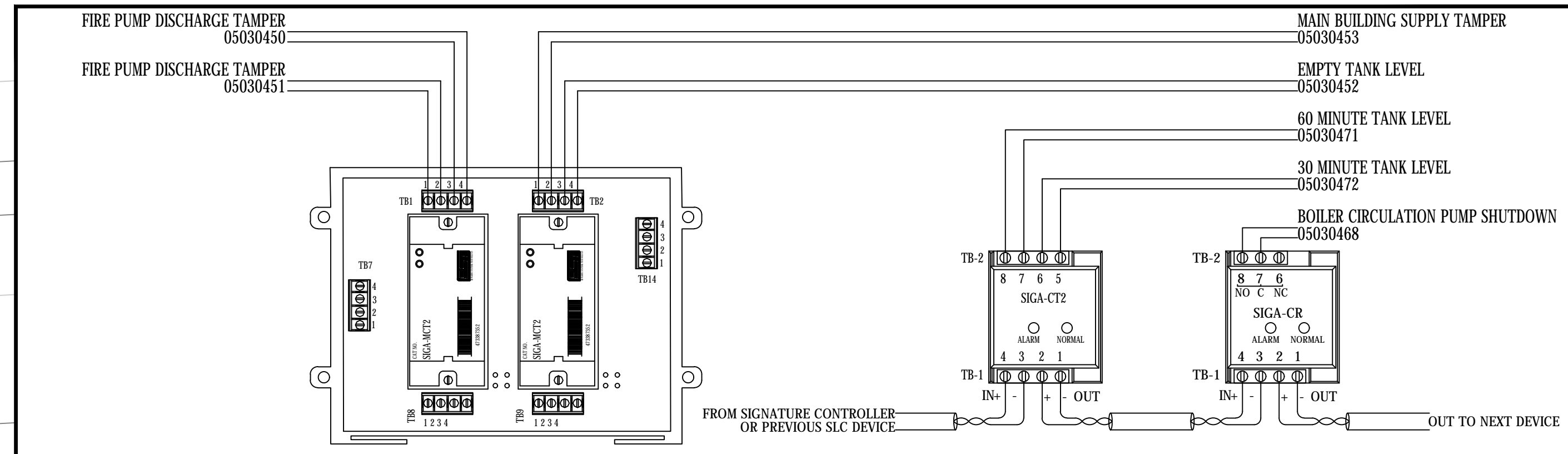
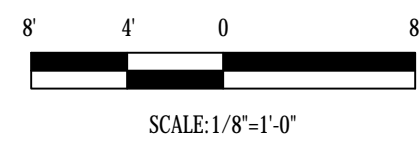
FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

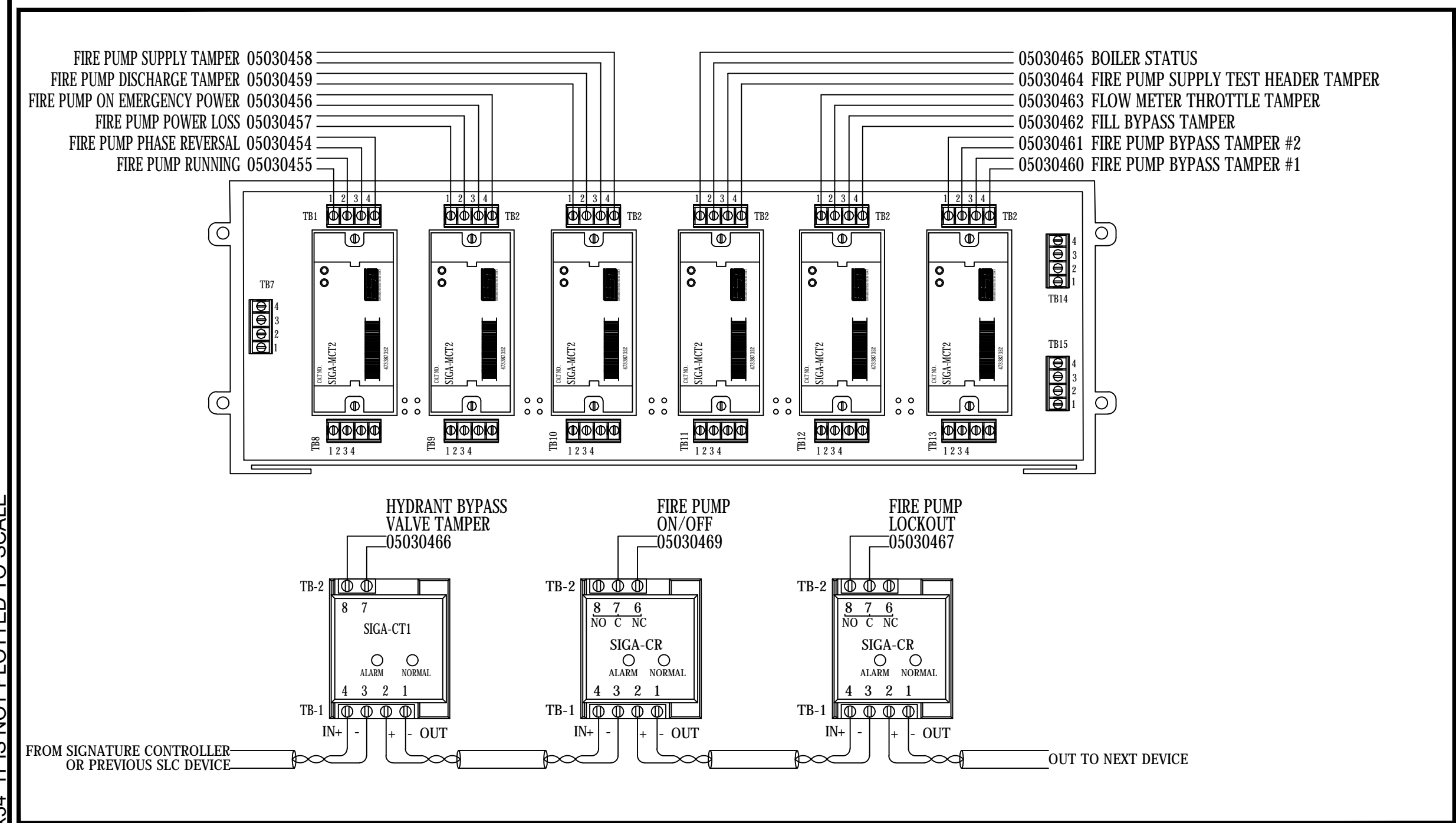
RECORD DRAWINGS - 2015-11-16



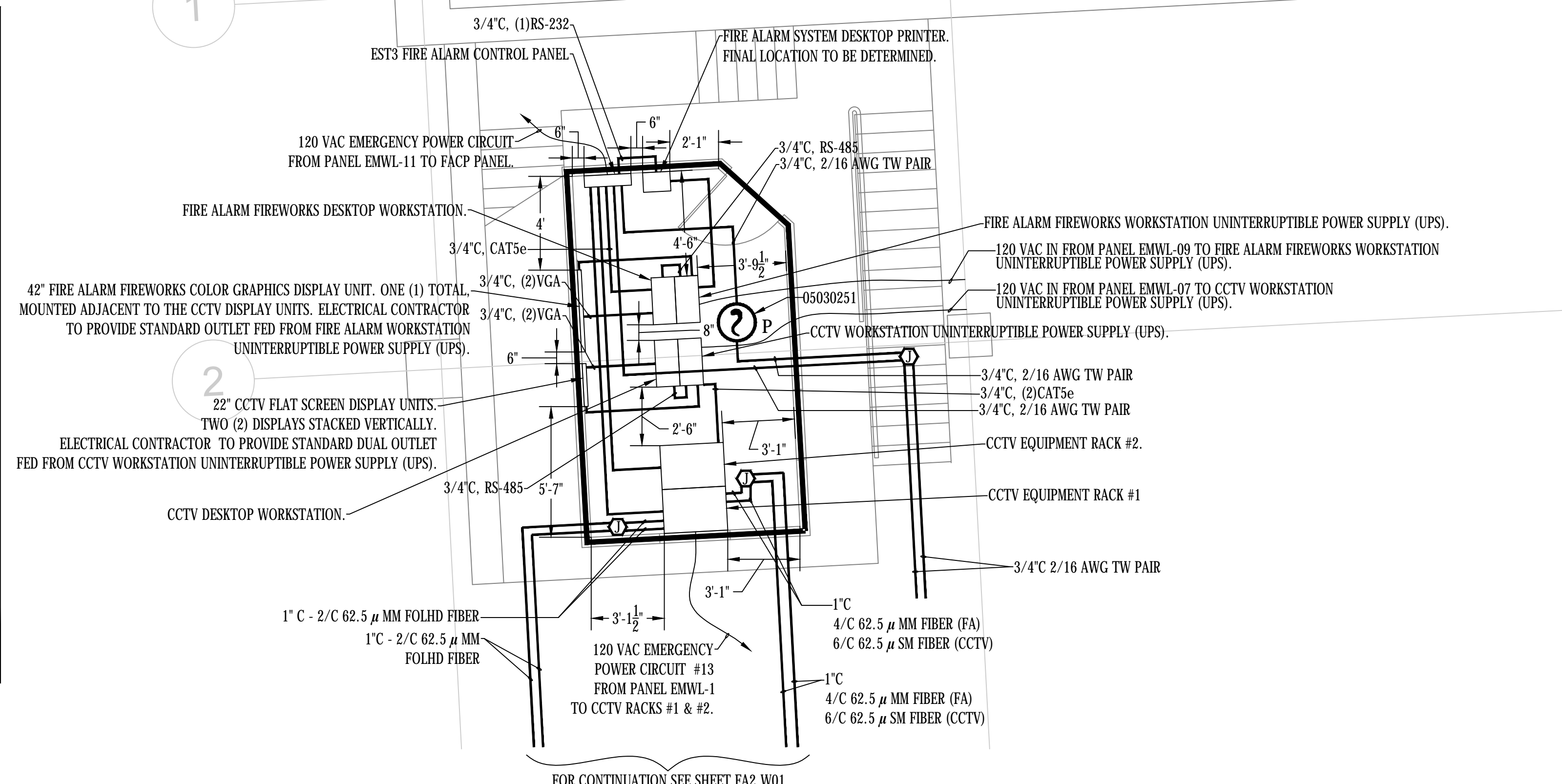
1 WATER ENTRY ROOM/MECHANICAL OFFICE/FIRE PUMP ROOM ENLARGED PLAN  
SCALE: 1/8" = 1'-0"



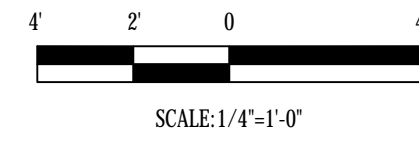
3 SIGA-UI02 DETAIL  
SCALE: N.T.S.



2 SIGA-UI06R DETAIL  
SCALE: N.T.S.



4 MEZZANINE WEST CONTROL ROOM ENLARGED PLAN  
SCALE: 1/4" = 1'-0"



**GENERAL NOTES:**

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- 3. SIGNATURE SERIES PHOTO-ELECTRIC DETECTORS SHOULD BE MOUNTED NO CLOSER THAN 26" TO AN ELECTRONIC BALLAST OR THE WIRING FROM BALLAST FIXTURE RECEPTACLES, WHERE POSSIBLE.

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**BARNARD EJMT TEAM**

**BARNARD** **RONDINELLI** **Sturgeon Electric**

Western States Fire Protection Co.

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360  
Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

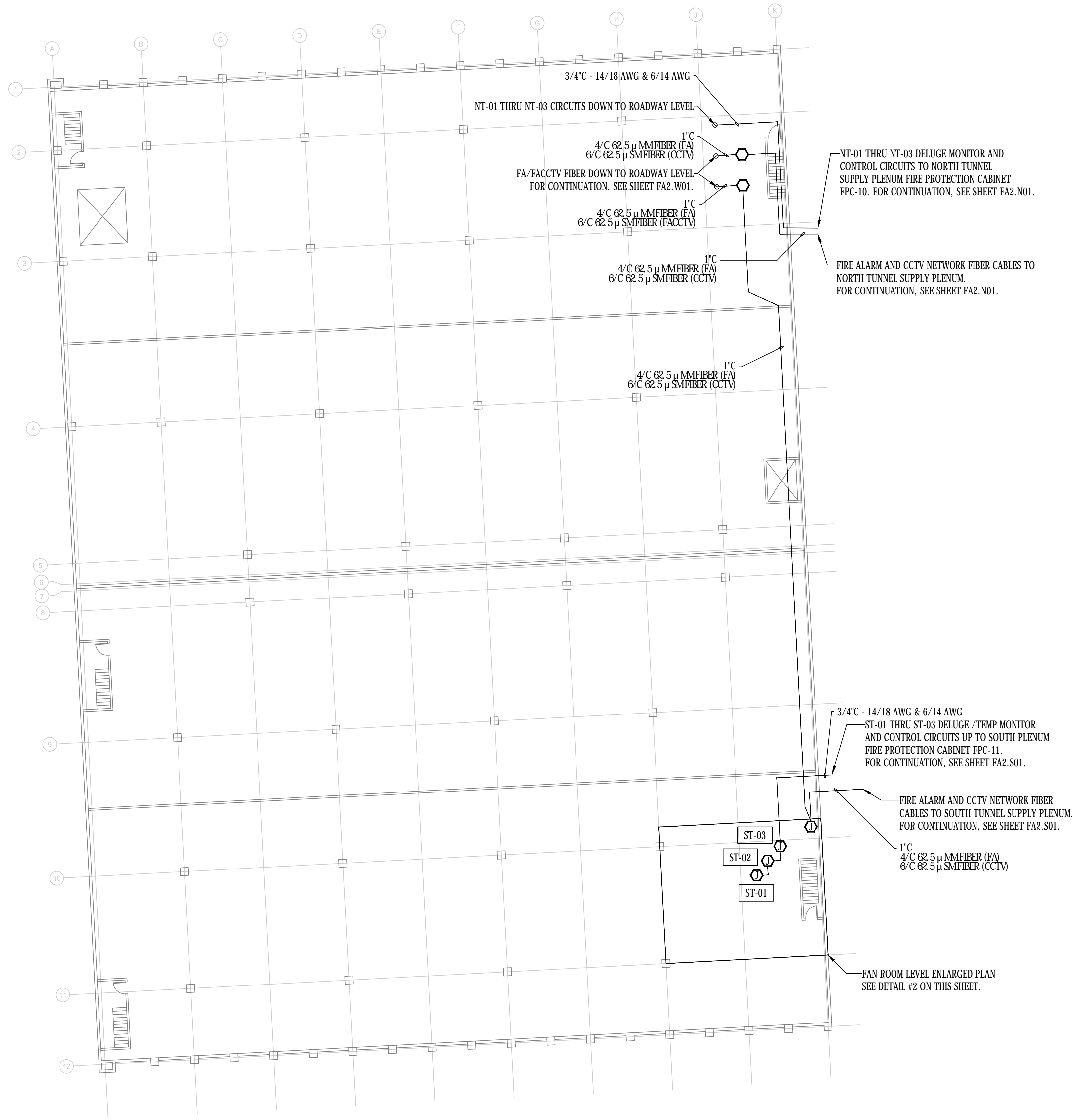
Revisions	Date

DATE: \_\_\_\_\_  
DRAWN BY: B.T.L. | CHECKED BY: AEE-JR

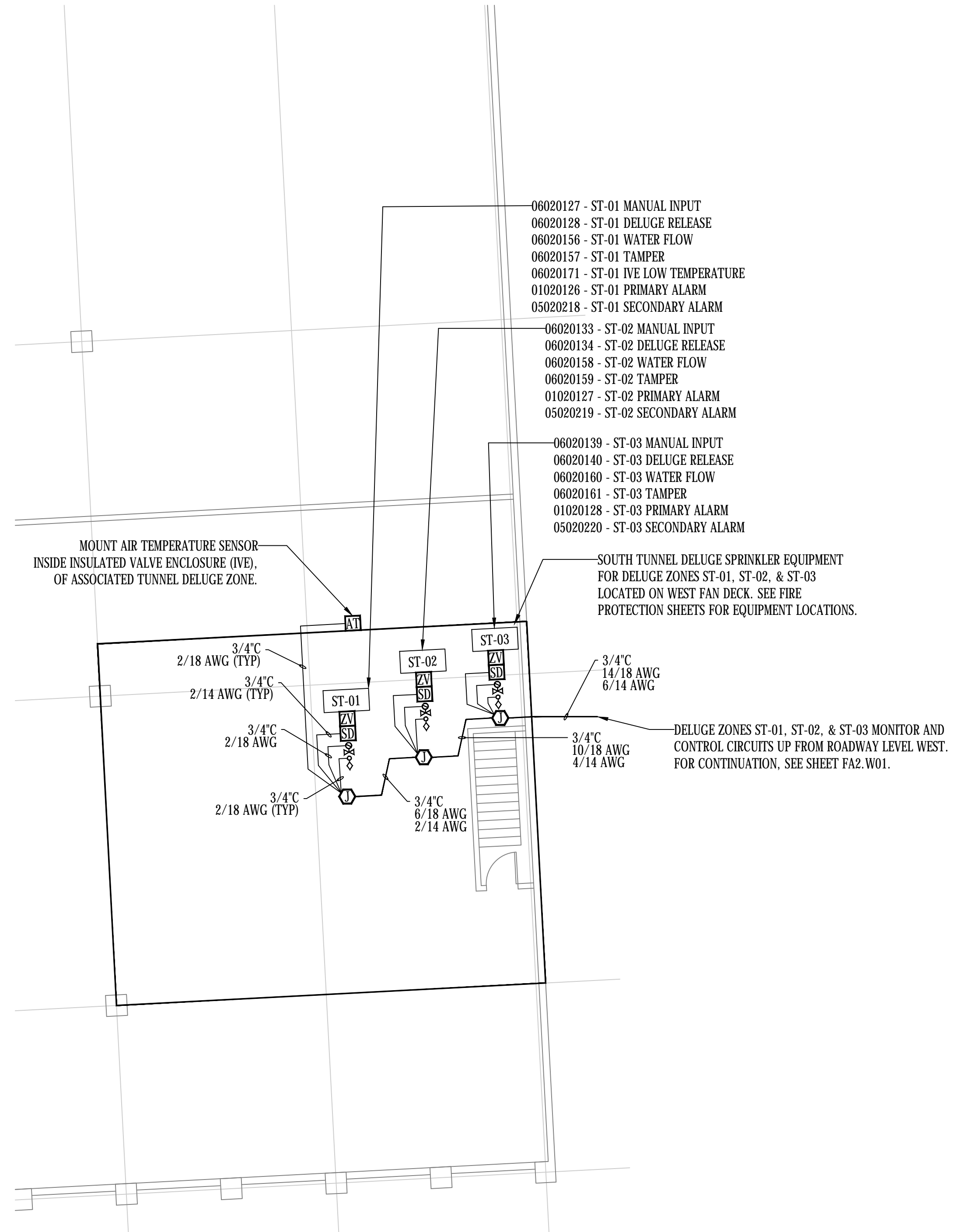
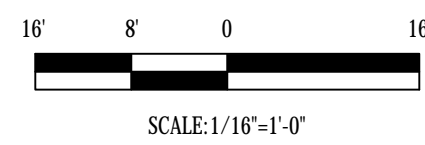
FIRE ALARM: ROADWAY LEVEL WEST

Drawing Number: **FA2.W02**

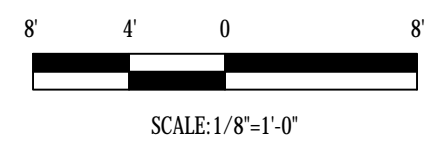
IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



1 FAN ROOM LEVEL WEST  
SCALE: 1/16" = 1'-0"



2 FAN ROOM LEVEL ENLARGED PLAN  
SCALE: 1/8" = 1'-0"

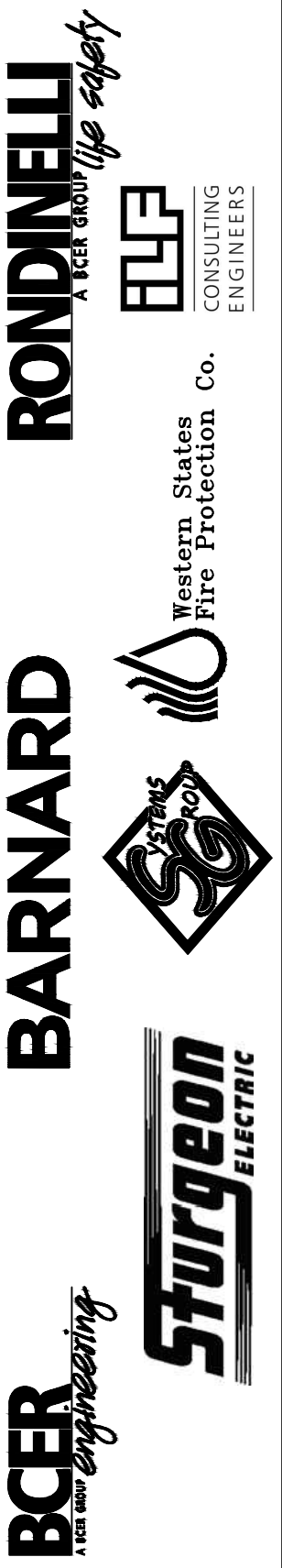


**GENERAL NOTES:**

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**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT**

**BARNARD EJMT TEAM**



Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Revisions	Date

**FIRE ALARM:  
FAN LEVEL WEST**

Drawing Number  
**FA2.W03**

DRAWN BY: B.T.L. CHECKED BY: AEE-JF

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**2** FIRE ALARM SYSTEM FIBER OPTIC BUDGET CALCULATION  
SCALE: NOT TO SCALE

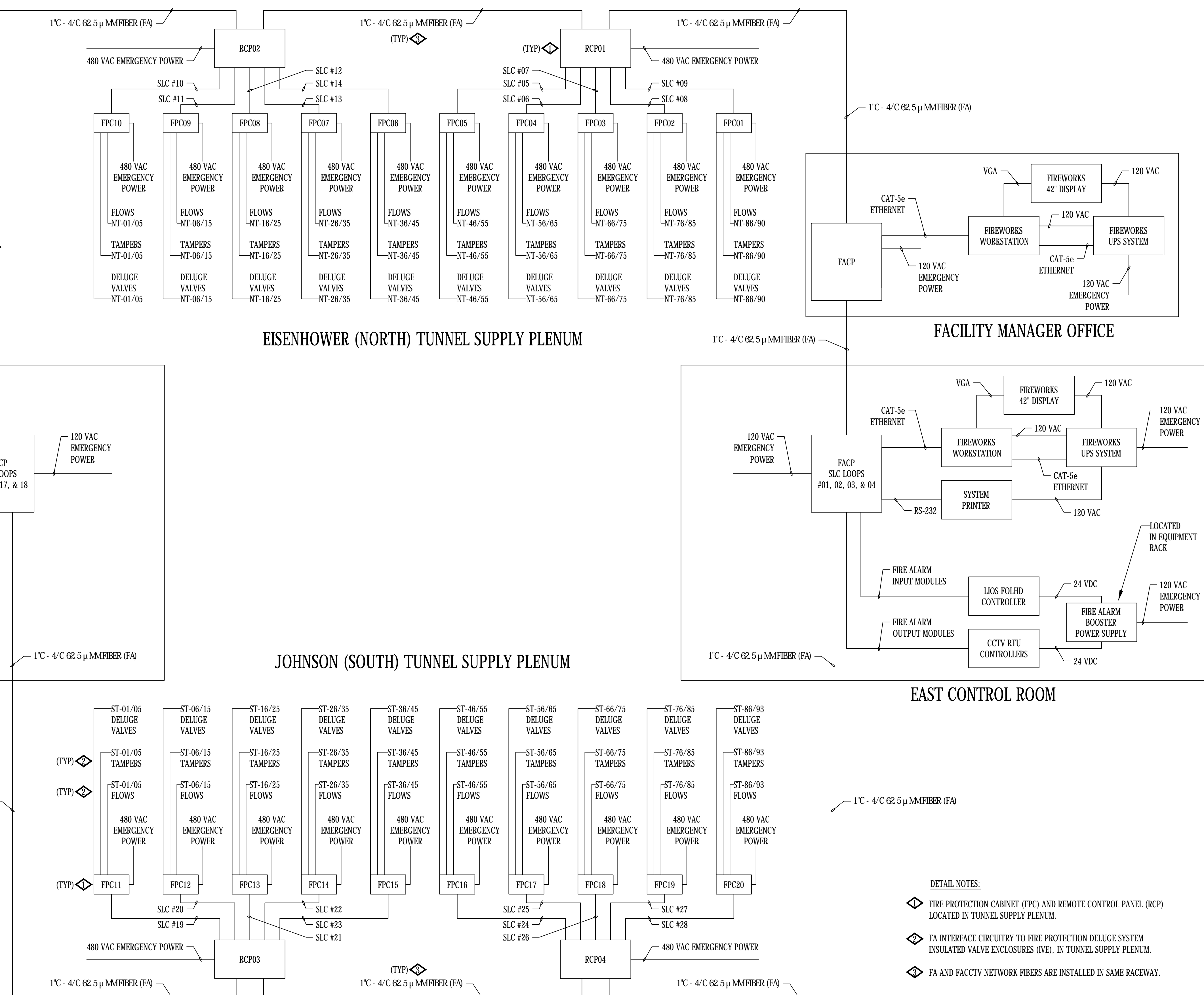
EISENHOWER - JOHNSON MEMORIAL TUNNEL  
FIBER OPTICS BUDGET CALCULATION

FIRE ALARM FIBER NETWORK

LONGEST FIBER RUN BETWEEN ANY 2 PANELS = 4,500 FEET  
MULTI-MODE FIBER CABLE LOSS = 3.5dB/KM = 3.5dB/3,280.8 FEET  
LC CONNECTOR dB LOSS (AVERAGE) = 0.2dB  
LC CONNECTOR dB LOSS (MAXIMUM) = 0.75dB  
ALLOWABLE dB LOSS (POWER BUDGET) BETWEEN FA PANELS = 10dB

MAXIMUM ALLOWABLE dB LOSS = 10.00 dB  
FIBER CABLE dB LOSS @ 4,500 FEET = 4.80 dB  
CONNECTOR DB LOSS X 2 CONNECTORS = 1.50 dB  
SPARE dB LOSS AVAILABLE = 3.70 dB

**1** FIRE ALARM SYSTEM ONE-LINE RISER DIAGRAM  
SCALE: NOT TO SCALE



- DETAIL NOTES:
- ◆ FIRE PROTECTION CABINET (FPC) AND REMOTE CONTROL PANEL (RCP) LOCATED IN TUNNEL SUPPLY PLENUM.
  - ◆ FA INTERFACE CIRCUITRY TO FIRE PROTECTION DELUGE SYSTEM INSULATED VALVE ENCLOSURES (IVE), IN TUNNEL SUPPLY PLENUM.
  - ◆ FA AND FAC TV NETWORK FIBERS ARE INSTALLED IN SAME RACEWAY.

**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT**

Project No. C0703-360  
Subaccount 17810

**BARNARD EJM TEAM**

**BARNARD**  
Western States  
Fire Protection Co.

**RONNINELLI**  
A safe and reliable  
life safety

**Sturgeon Electric**

**BCER**  
Electrical Consulting Engineers

**ELF**  
Engineering Life Safety

Revisions	Date	Description

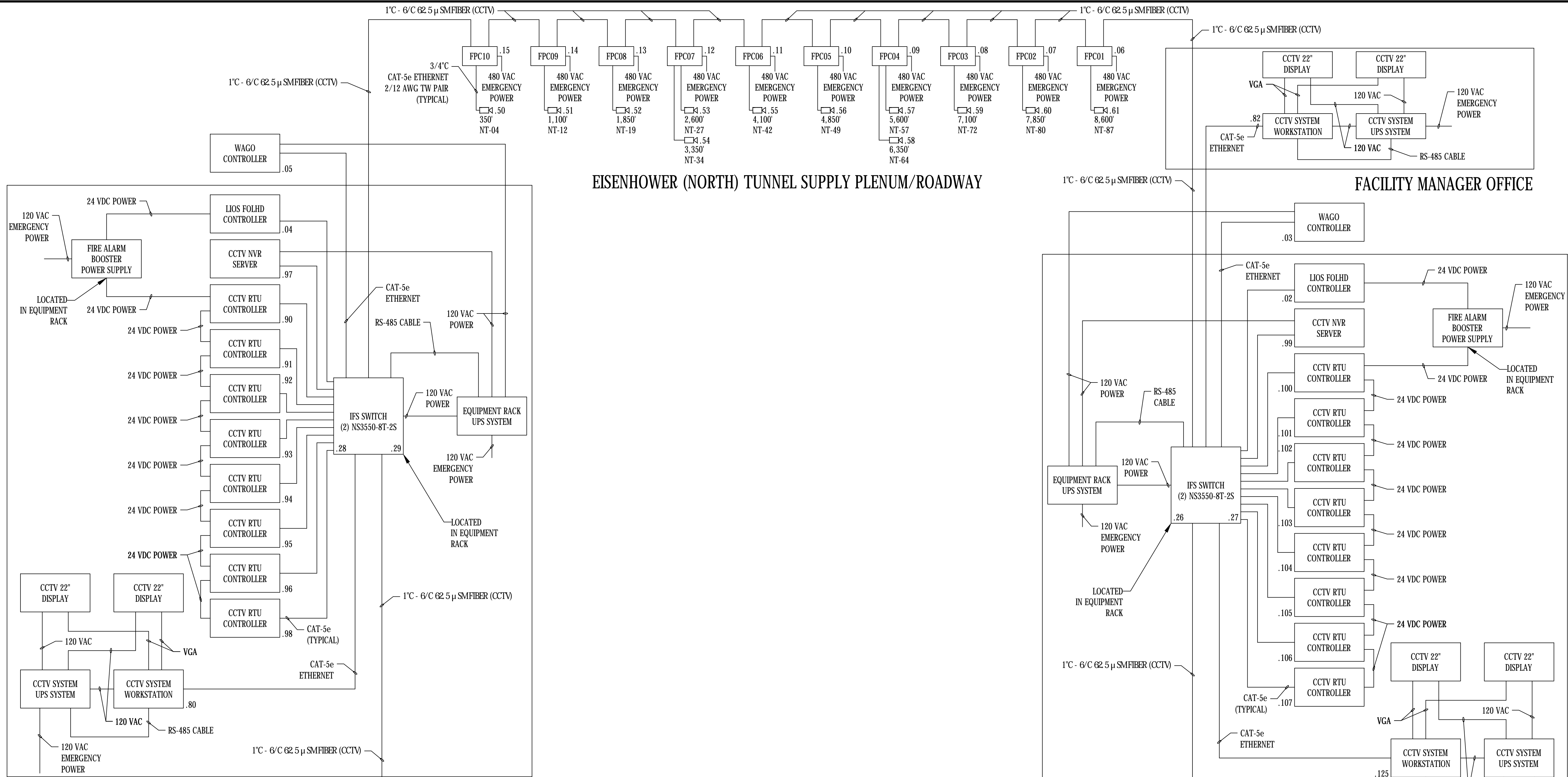
DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

FIRE ALARM:  
ONE LINE DIAGRAM  
FIRE ALARM

Drawing Number  
**FA3.01**



IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



EISENHOWER - JOHNSON MEMORIAL TUNNEL  
FIBER OPTICS BUDGET CALCULATION

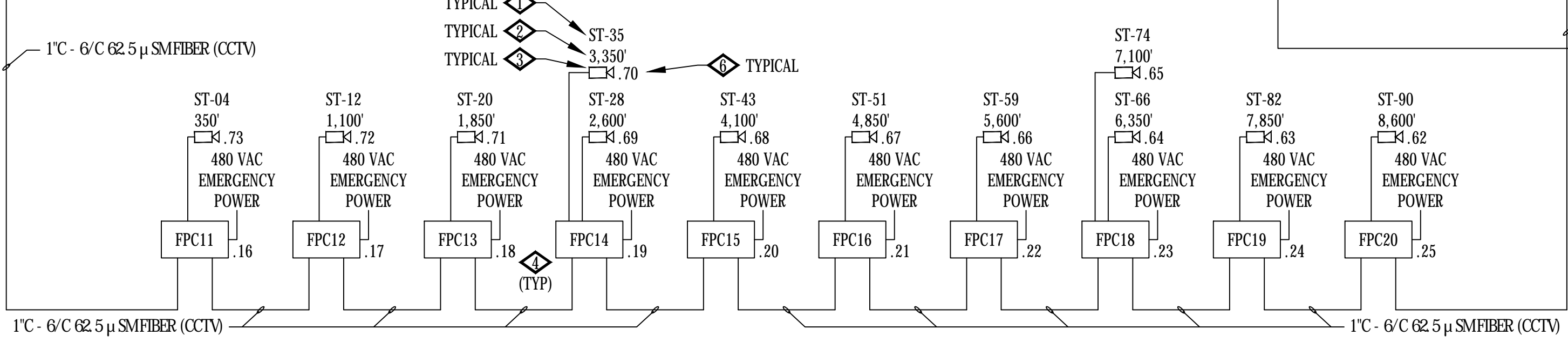
**FA CCTV FIBER NETWORK**

LONGEST FIBER RUN BETWEEN ANY 2 SWITCHES = 1,000 FEET  
MULTI-MODE FIBER CABLE LOSS = 3.5dB/KM = 3.5dB/3,280.8 FEET  
LC CONNECTOR dB LOSS (AVERAGE) = 0.2dB  
LC CONNECTOR dB LOSS (MAXIMUM) = 0.75dB  
ALLOWABLE dB LOSS (POWER BUDGET) BETWEEN CCTV SWITCHES = 7.5dB

MAXIMUM ALLOWABLE dB LOSS = 7.50 dB  
FIBER CABLE dB LOSS @ 4,500 FEET = 1.07 dB  
CONNECTOR DB LOSS X 2 CONNECTORS = 1.50 dB  
SPARE dB LOSS AVAILABLE = 4.93 dB

2 CCTV SYSTEM FIBER OPTIC BUDGET CALCULATION  
SCALE: NOT TO SCALE

**JOHNSON (SOUTH) TUNNEL SUPPLY PLENUM/ROADWAY**



1 CCTV SYSTEM ONE-LINE RISER DIAGRAM  
SCALE: NOT TO SCALE

- DETAIL NOTES:**
- ◇ INDICATES TUNNEL DELUGE ZONE.
  - ◇ DIMENSION INDICATES APPROXIMATE DISTANCE OF CAMERA TO WEST PORTAL END.
  - ◇ CCTV CAMERA LOCATED ON TUNNEL ROADWAY WALL TILE ABOVE ROADWAY EXIT.
  - ◇ FIRE PROTECTION CABINET (FPC) LOCATED IN TUNNEL SUPPLY PLENUM.
  - ◇ FIRE ALARM AND FACCTV NETWORK FIBERS ARE INSTALLED IN SAME RACEWAY.
  - ◇ ADDRESSING SCHEME 223.223.223.XX

**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT**

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

**BARNARD EJM TEAM**

**BARNARD** **RONDINELLI** **ELF**

Western States Fire Protection Co. ENGINEERS

**Sturgeon Electric**

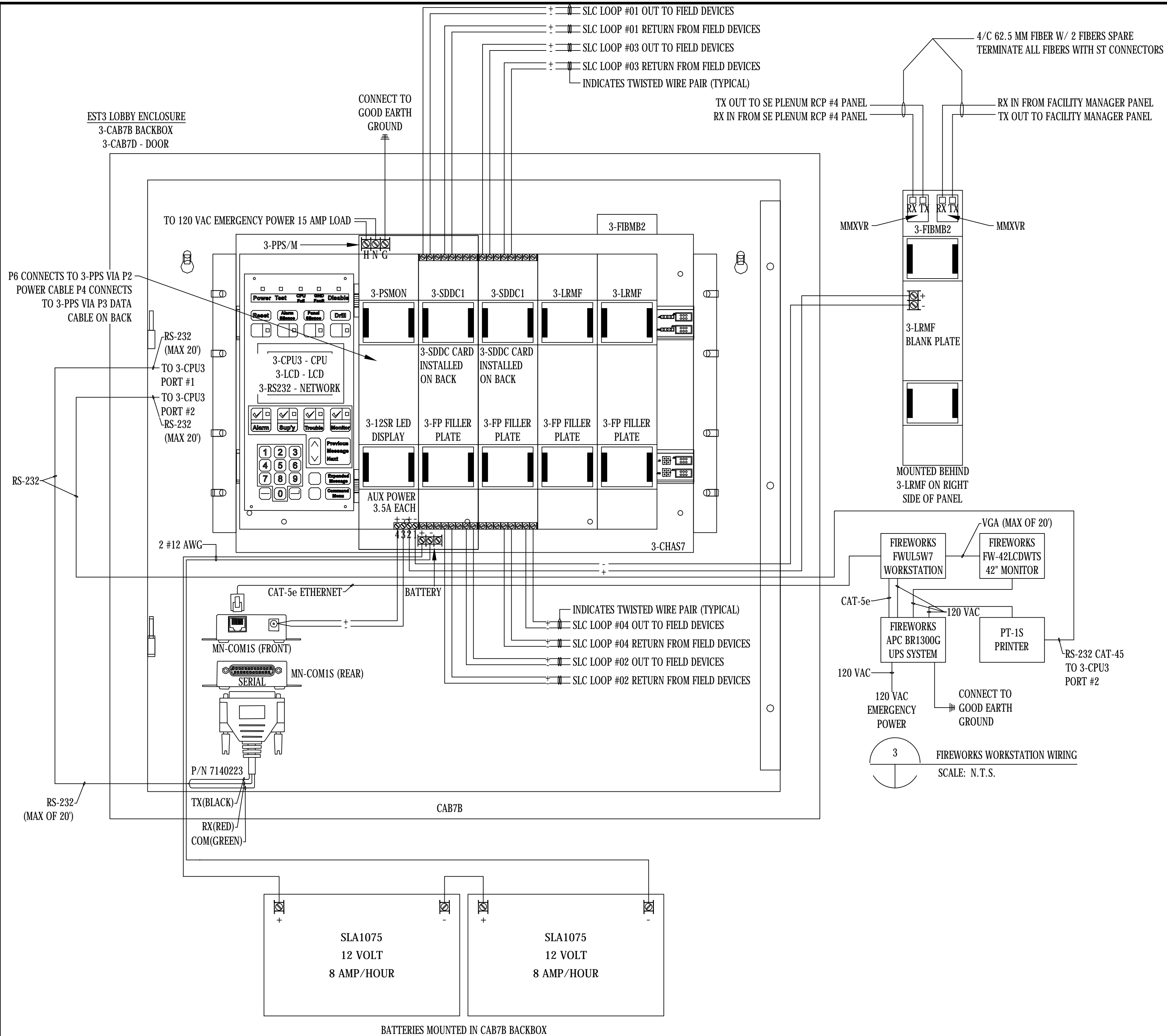
Revisions	Date

DRAWN BY: B.T.L. CHECKED BY: AEE-JF

FIRE ALARM:  
ONE LINE DIAGRAM  
CCTV

Drawing Number  
**FA3.02**

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

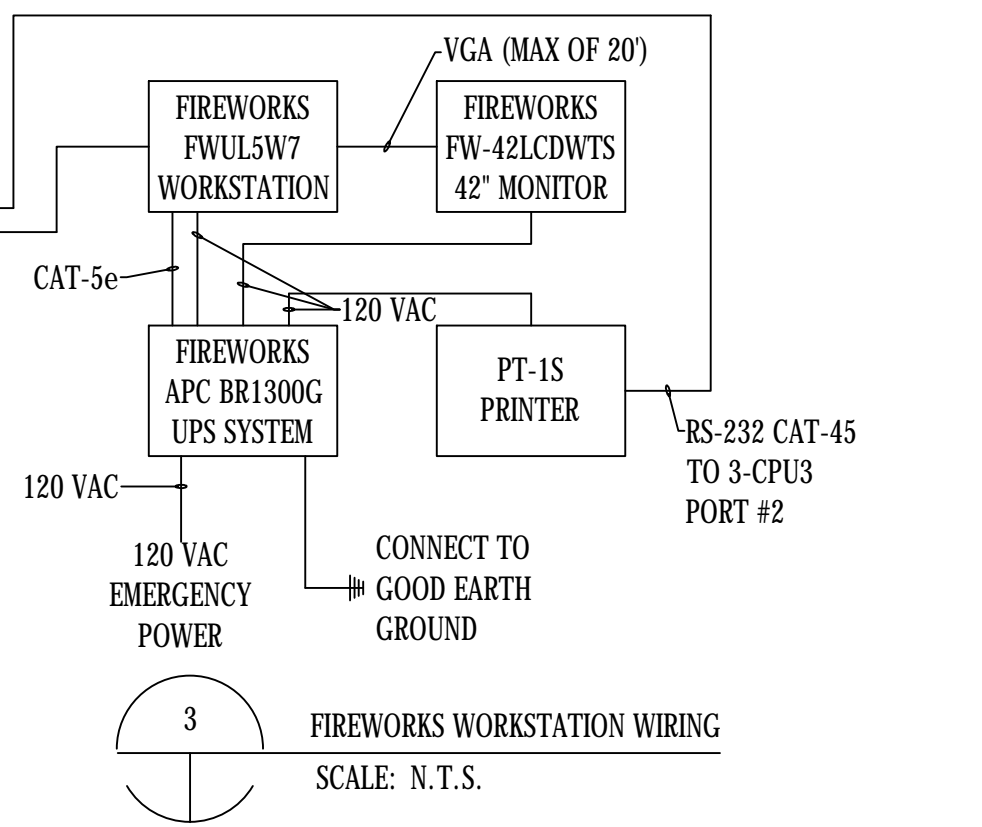


1 EAST CONTROL ROOM - FACP PANEL LAYOUT & WIRING  
SCALE: N.T.S.

Supply Voltage & Battery Periods  
120 VAC Supply Voltage  
EJMT - EAST CONTROL ROOM - EST3

QTY.	Model	Description	Stby mA	Alm mA
4		Standby Hours		
5		Alarm Minutes		
1	3-CPU3	Central Processor Module	155	165
1	3-RS232	RS232 Communication Card	58	58
2	3-SDDC1	Signature Dual Driver Controller (LRM)	528	672
1	3-LCD	Liquid Crystal Display Module	40	42
2	3-PPS/M	Primary Power Supply (Included in 3-CPU3 Current)	0	0
1	3-12SR	Control Display Module, 12 Switches, 12 Led's (Red)	20	20
1	MN-COM1S	MN/EC Serial Communications/LAN Interface	60	60
1	3-FIBMB2	Fiber Optic Communications Interface	105	105
2	MMXVR	Plug-In Standard Output Multi Mode Transceiver	40	40
TOTAL LOAD			1006	1162
Total Stand-By and Alarm Current			1006	1162
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current			4024	96.833
Total Standby/Alarm Current			4120.833	
Battery De-Rating Factor +20%			4945.000	
4.95 Calculated Battery Ampere Hours				
Quantity	Model	Description		
2	SLA1075	8.0 AH Battery		

4 EAST CONTROL ROOM - EST3 FACP PANEL CALCULATION  
SCALE: N.T.S.



3 FIREWORKS WORKSTATION WIRING  
SCALE: N.T.S.

Supply Voltage & Battery Periods  
120 VAC Supply Voltage  
EJMT - East Control Room Equipment Rack - BPS10A

QTY.	Model	Description	Stby mA	Alm mA	Total Stby mA	Total Alm mA
4		Standby Hours				
5		Alarm Minutes				
8	IoLogik E2210	CCTV Controller	203	350	1624	2800
1	LIOS LHD3-02	Controller	1875	1875	1875	1875
0	TOTAL load for the 200mA Auxiliary Power Source					
1		Aux STANDBY load delivered during a power fail	12		12	0
1		Aux ALARM current delivered during a power fail		12	0	12
Total NAC & AUX Load					3511	4687
1	BPS10A	Remote Booster Power Supply, 10A, 120Vac, Red			70	270
TOTAL LOAD					3581	4957
Total Stand-By and Alarm Current					3581	4957
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current					14324	413.083
Total Standby + Alarm Current					14737.083	
Battery De-Rating Factor +20%					17684.500	
17.68 Calculated Battery Ampere Hours						
Quantity	Model	Description				
2	SLA1116	18.0 AH Battery				

2 EAST CONTROL ROOM - CCTV RACK BPS10A CALCULATION  
SCALE: N.T.S.

UPS System Calculations  
EJMT - EAST CONTROL ROOM - FA WORK STATION

Description	Qty	Load (W)	Total Load (W)
Standby: 5 min.			
Fireworks Workstation	1	350	350
42" Monitor	1	180	180
PT-1S Printer	1	48	48
Total Load			578
20% Spare Capacity			115.6
UPS Capacity			693.6

UPS System Calculations  
EJMT - EAST CONTROL ROOM - CCTV WORK STATION

Description	Qty	Load (W)	Total Load (W)
Standby: 5 min.			
CCTV Workstation	1	635	635
22" Monitor	2	25	50
Total Load			685
20% Spare Capacity			137
UPS Capacity			822

UPS System Calculations  
EJMT - EAST CONTROL ROOM - CCTV RACK EQUIPMENT

Description	Qty	Load (W)	Total Load (W)
Standby: 5 min.			
SG300-20 Switch	1	16.05	16.05
System 750 WAGO	3	102	306
DVR Server	1	495	495
Total Load			817.05
20% Spare Capacity			163.41
UPS Capacity			980.46

5 EAST CONTROL ROOM - UPS CALCULATIONS  
SCALE: N.T.S.

**BARNARD EJMT TEAM**

**BARNARD** **RONDINELLI**

Western States Fire Protection Co.

**Sturgeon Electric**

BCER **Sturgeon Electric**

**EISENHOWER/JOHNSON**

**MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM

DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

Revisions

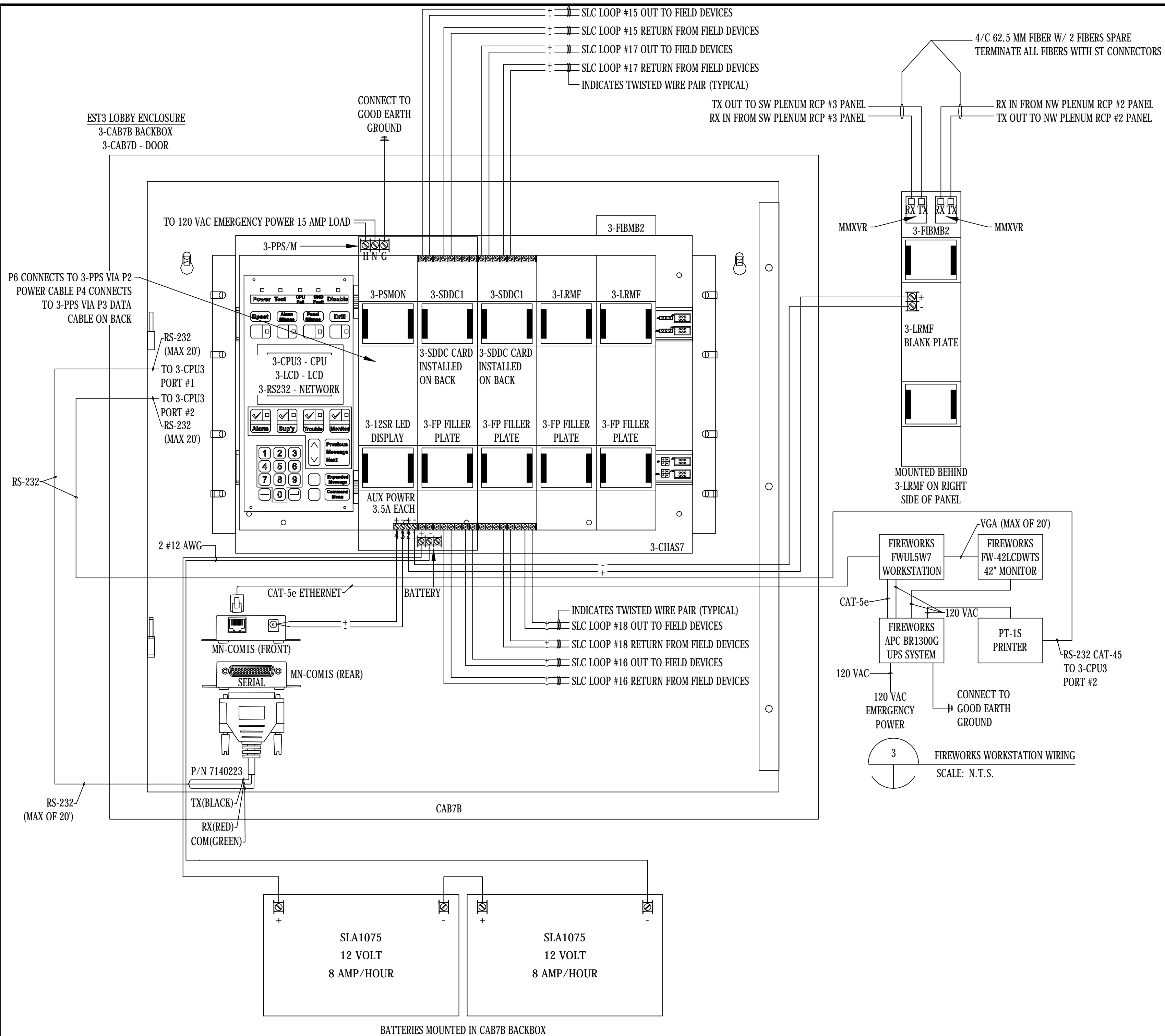
Num	Description	Date

DRAWN BY: B.T.L. CHECKED BY: AEE-JF

FIRE ALARM:  
E. CNTR. RM EST3 PANEL  
LAYOUT & CALCULATIONS

Drawing Number  
**FA4.01**

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



1 WEST CONTROL ROOM - FACP PANEL LAYOUT & WIRING  
SCALE: N.T.S.

Supply Voltage & Battery Periods  
120 VAC Supply Voltage  
EJMT - WEST CONTROL ROOM - EST3

QTY.	Model	Description	Stby mA	Alm mA
4		Standby Hours		
5		Alarm Minutes		
1	3-CPU3	Central Processor Module	155	165
1	3-RS232	RS232 Communication Card	58	58
2	3-SDDC1	Signature Dual Driver Controller (LRM)	528	672
1	3-LCD	Liquid Crystal Display Module	40	42
2	3-PPS/M	Primary Power Supply (Included in 3-CPU3 Current)	0	0
1	3-12SR	Control Display Module, 12 Switches, 12 Led's (Red)	20	20
1	MN-COM1S	MN/EC Serial Communications/LAN Interface	60	60
1	3-FIBMB2	Fiber Optic Communications Interface	105	105
2	MMXVR	Plug-In Standard Output Multi Mode Transceiver	40	40
TOTAL LOAD			1006	1162
Total Stand-By and Alarm Current			1006	1162
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current			4024	96.833
Total Standby/Alarm Current			4120.833	
Battery De-Rating Factor +20%			4945.000	
4.95	Calculated Battery Ampere Hours			
Quantity	Model	Description		
2	SLA1075	8.0 AH Battery		

4 WEST CONTROL ROOM - EST3 FACP PANEL CALCULATION  
SCALE: N.T.S.

Supply Voltage & Battery Periods  
120 VAC Supply Voltage  
EJMT - West Control Room Equipment Rack - BPS10A

QTY.	Model	Description	Stby mA	Alm mA	Total Stby mA	Total Alm mA
4		Standby Hours				
5		Alarm Minutes				
8	IoLogik E2210	CCTV Controller	203	350	1624	2800
1	LIOS LHD3-02	Controller	1875	1875	1875	1875
0	TOTAL load for the 200mA Auxiliary Power Source				0	0
1	Aux STANDBY load delivered during a power fail				12	12
1	Aux ALARM current delivered during a power fail				0	12
Total NAC & AUX Load					3511	4687
1	BPS10A	Remote Booster Power Supply, 10A, 120Vac, Red			70	270
TOTAL LOAD					3581	4957
Total Stand-By and Alarm Current					3581	4957
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current					14324	413.083
Total Standby + Alarm Current					14737.083	
Battery De-Rating Factor +20%					17684.500	
17.68	Calculated Battery Ampere Hours					
Quantity	Model	Description				
2	SLA1116	SLA1116 18.0 AH Battery				

2 WEST CONTROL ROOM - CCTV RACK BPS10A CALCULATION  
SCALE: N.T.S.

UPS System Calculations  
EJMT - WEST CONTROL ROOM - FA WORK STATION

Description	Qty	Load (W)	Total Load (W)
Standby: 5 min.			
Fireworks Workstation	1	350	350
42" Monitor	1	180	180
PT-1S Printer	1	48	48
Total Load			578
20% Spare Capacity			115.6
UPS Capacity			693.6

UPS System Calculations  
EJMT - WEST CONTROL ROOM - CCTV WORK STATION

Description	Qty	Load (W)	Total Load (W)
Standby: 5 min.			
CCTV Workstation	1	635	635
22" Monitor	2	25	50
Total Load			685
20% Spare Capacity			137
UPS Capacity			822

UPS System Calculations  
EJMT - WEST CONTROL ROOM - CCTV RACK EQUIPMENT

Description	Qty	Load (W)	Total Load (W)
Standby: 5 min.			
SG300-20 Switch	1	16.05	16.05
System 750 WAGO	3	102	306
DVR Server	1	495	495
Total Load			817.05
20% Spare Capacity			163.41
UPS Capacity			980.46

5 WEST CONTROL ROOM - UPS CALCULATIONS  
SCALE: N.T.S.

**BARNARD EJMT TEAM**

**BARNARD**

**Sturgeon ELECTRIC**

**RONDINELLI**

Western States Fire Protection Co.

**EISENHOWER/JOHNSON**

**MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM

DESIGN BUILD PROJECT

Project No. C0703-360

Subaccount 17810

REVISIONS

Num	Description	Date

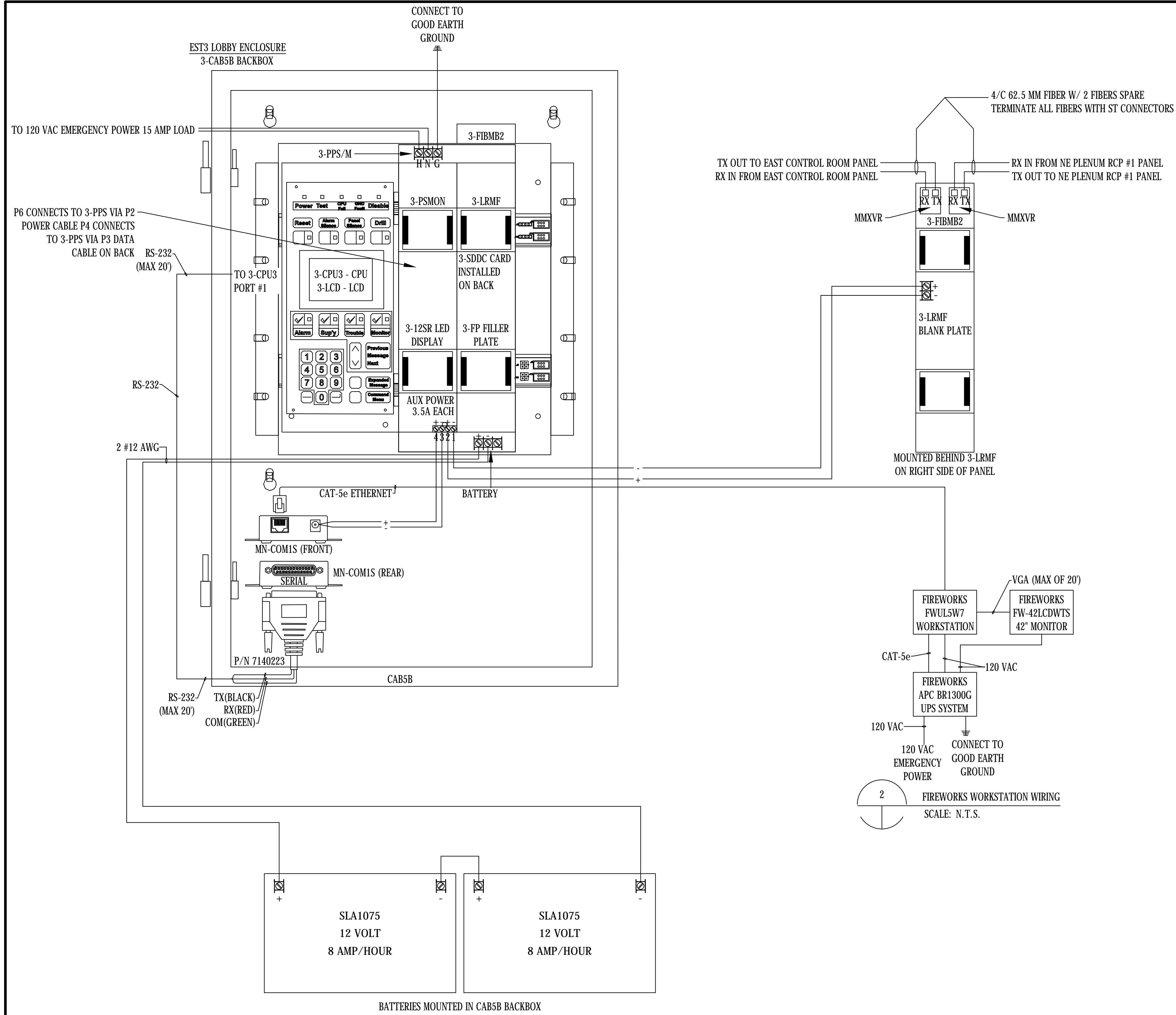
DRAWN BY: B.T.L. | CHECKED BY: AEE-JR

FIRE ALARM:  
W. CONT. RM EST3 PANEL  
LAYOUT & CALCULATIONS

Drawing Number

FA4.02

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



Supply Voltage & Battery Periods  
120 VAC Supply Voltage  
EJMT - FACILITY MANAGER OFFICE - EST3

QTY.	Model	Description	Stby mA	Alm mA
4		Standby Hours		
5		Alarm Minutes		
1	3-CPU3	Central Processor Module	155	165
1	3-RS232	RS232 Communication Card	58	58
1	3-LCD	Liquid Crystal Display Module	40	42
1	3-PPS/M	Primary Power Supply (Included in 3-CPU3 Current)	0	0
1	3-12SR	Control Display Module, 12 Switches, 12 Led's (Red)	20	20
1	MN-COM1S	MN/EC Serial Communications/LAN Interface	60	60
1	3-FIBM2	Fiber Optic Communications Interface	105	105
2	MMXVR	Plug-In Standard Output Multi Mode Transceiver	40	40
<b>TOTAL LOAD</b>			<b>478</b>	<b>490</b>
Total Stand-By and Alarm Current			478	490
Standby Hours * Total Standby Current			1912	
(Alarm Minutes/60) * Total Alarm Current				40.833
Total Standby/Alarm Current			1952.833	
Battery De-Rating Factor +20%			2343.400	

Quantity	Model	Description
2.34		Calculated Battery Ampere Hours
2	SLA1075	8.0 AH Battery

UPS System Calculations				
EJMT - FACILITY MANAGER OFFICE - FA WORK STATION				
Standby: 5 min.				
Description	Qty	Load (W)	Total Load (W)	
Fireworks Workstation	1	350	350	
42" Monitor	1	180	180	
<b>Total Load</b>			<b>530</b>	
20% Spare Capacity			106	
<b>UPS Capacity</b>			<b>636</b>	

UPS System Calculations				
EJMT - FACILITY MANAGER OFFICE - CCTV WORK STATION				
Standby: 5 min.				
Description	Qty	Load (W)	Total Load (W)	
CCTV Workstation	1	635	635	
22" Monitor	2	25	50	
<b>Total Load</b>			<b>685</b>	
20% Spare Capacity			137	
<b>UPS Capacity</b>			<b>822</b>	

**4** FACILITY MANAGER OFFICE - UPS CALCULATIONS  
SCALE: N.T.S.

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

**BARNARD EJMT TEAM**

**BARNARD**

**RONDINELLI**

**BCER**

**Sturgeon Electric**

**Western States Fire Protection Co.**

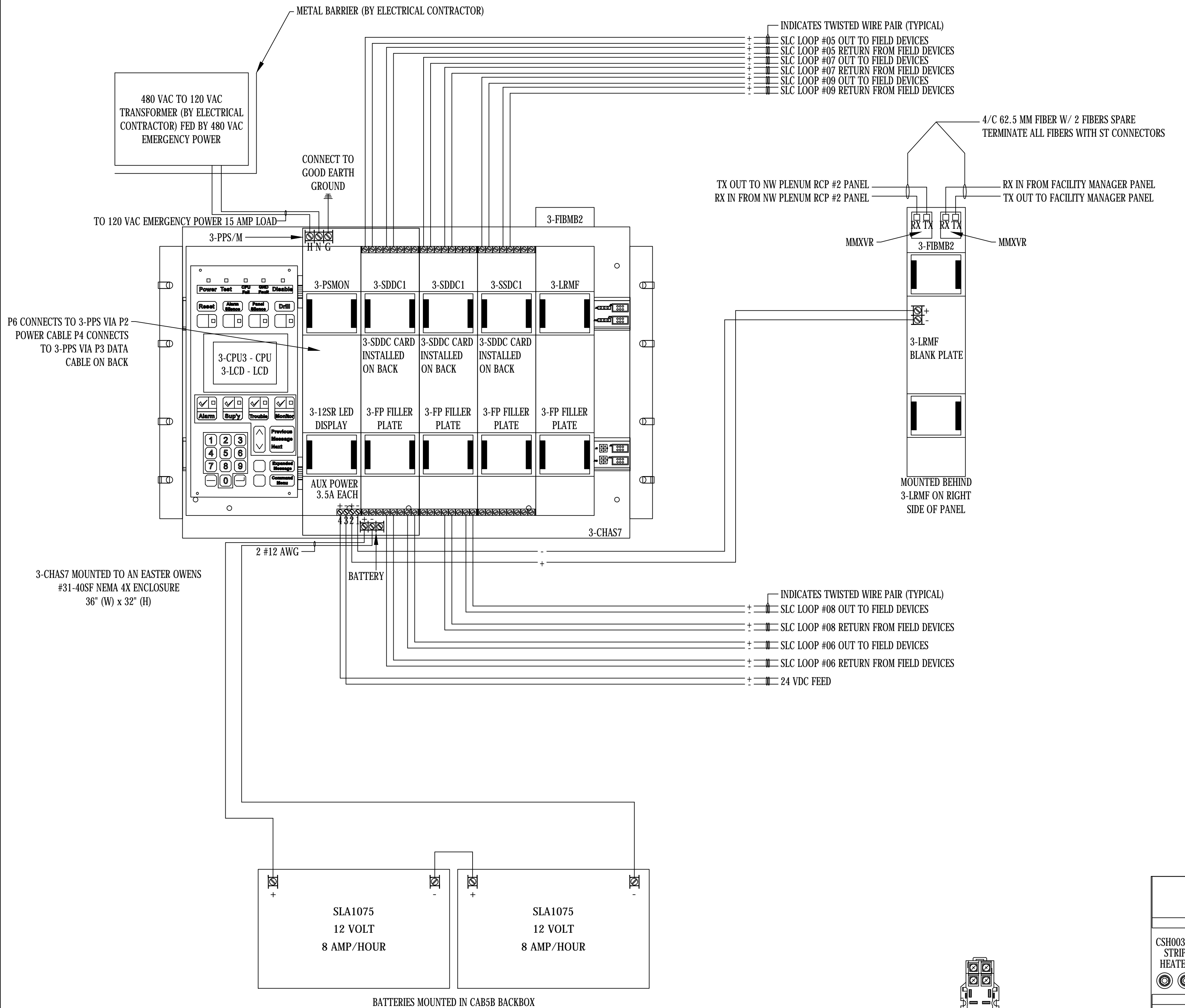
**ALF CONSULTING ENGINEERS**

Revisions	Date

FIRE ALARM:  
MGR OFF, EST3 PANEL  
LAYOUT & CALCULATIONS

Drawing Number  
**FA4.03**

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



Supply Voltage & Battery Periods  
120 VAC Supply Voltage  
EJMT - RCP #1 - NORTHEAST PLENUM - EST3

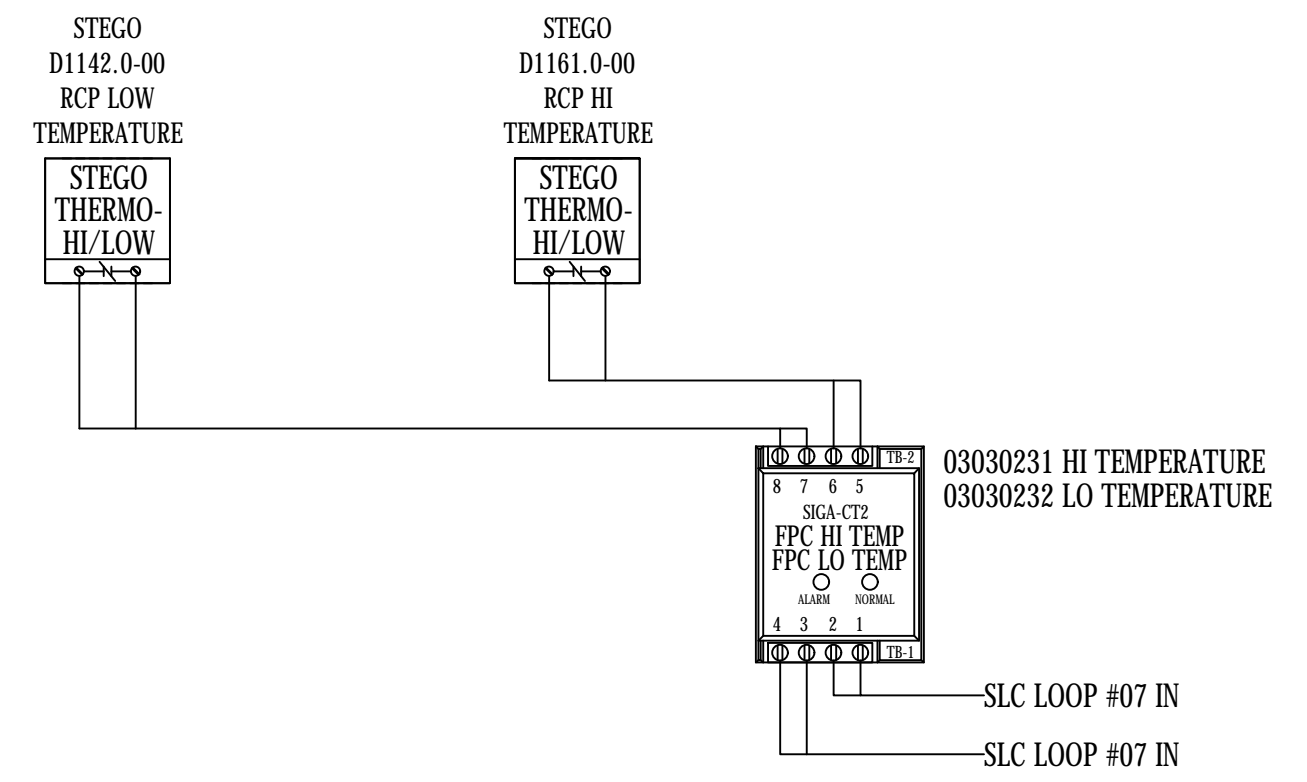
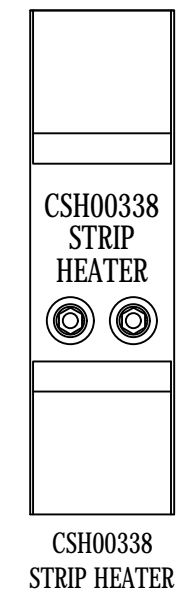
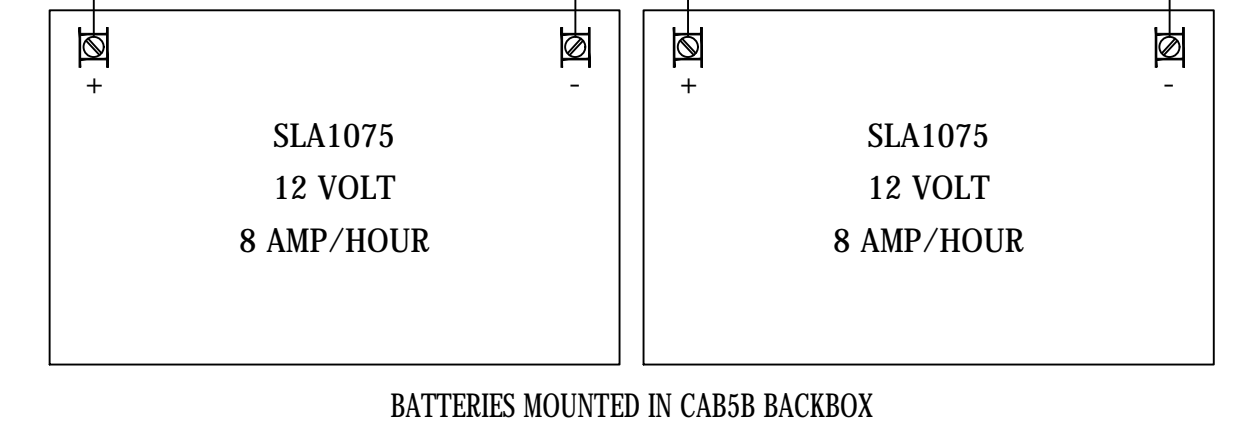
QTY.	Model	Description	Stby mA	Alm mA
1	3-CPU3	Central Processor Module	155	165
1	3-RS232	RS232 Communication Card	58	58
1	3-SDDC1	Signature Driver Controller (LRM)	144	204
2	3-SDDC1	Signature Dual Driver Controller (LRM)	528	672
1	3-LCD	Liquid Crystal Display Module	40	42
1	3-PPS/M	Primary Power Supply (Included in 3-CPU3 Current)	0	0
1	3-12SR	Control Display Module, 12 Switches, 12 Led's (Red)	20	20
1	MN-COM1S	MN/EC Serial Communications/LAN Interface	60	60
1	3-FIBM2	Fiber Optic Communications Interface	105	105
2	MMXVR	Plug-In Standard Output Multi Mode Transceiver	40	40
TOTAL LOAD			1150	1366
Total Stand-By and Alarm Current			1150	1366
Standby Hours * Total Standby Current			4600	
Alarm Minutes/60 * Total Alarm Current				113.833
Total Standby/Alarm Current			4713.833	
Battery De-Rating Factor +20%			5656.600	

Quantity	Model	Description
5.66		Calculated Battery Ampere Hours
2	SLA1075	8.0 AH Battery

2 NORTHEAST PLENUM - RCP #1 PANEL CALCULATION  
SCALE: N.T.S.

1 NORTHEAST PLENUM RCP #1 - FACP PANEL LAYOUT & WIRING  
SCALE: N.T.S.



**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

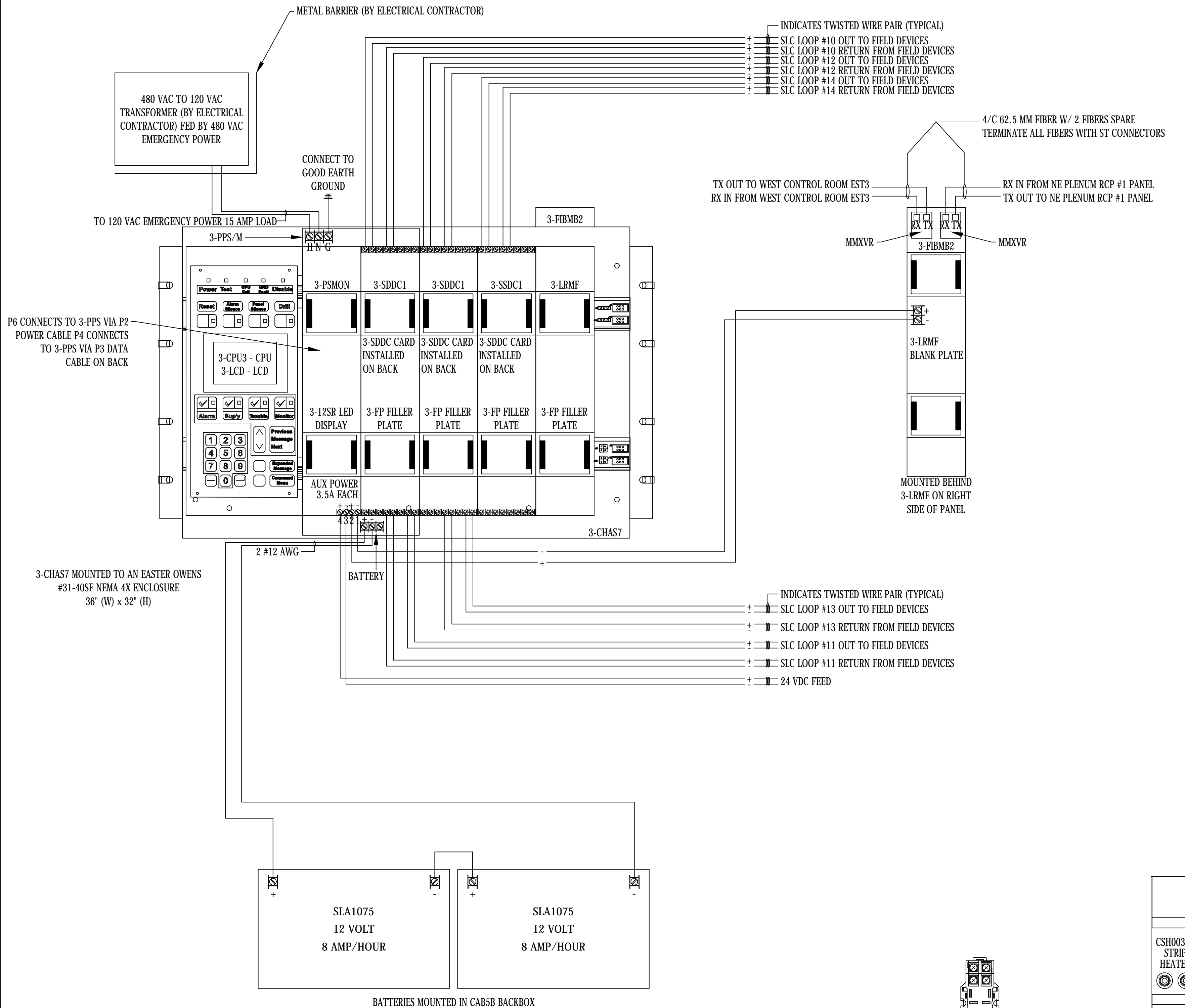
**BARNARD EJM TEAM**  
**BARNARD**  
**RONNINELLI**  
**Sturgeon Electric**  
**BCER**  
**Western States Fire Protection Co.**  
**ALF CONSULTING ENGINEERS**

Revisions	Date
Num	Description

FIRE ALARM:  
 RCP #1 EST3 PANEL  
 LAYOUT & CALCULATIONS  
 Drawing Number  
**FA4.04**

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



Supply Voltage & Battery Periods  
120 VAC Supply Voltage  
EJMT - RCP #2 - NORTHWEST PLENUM - EST3

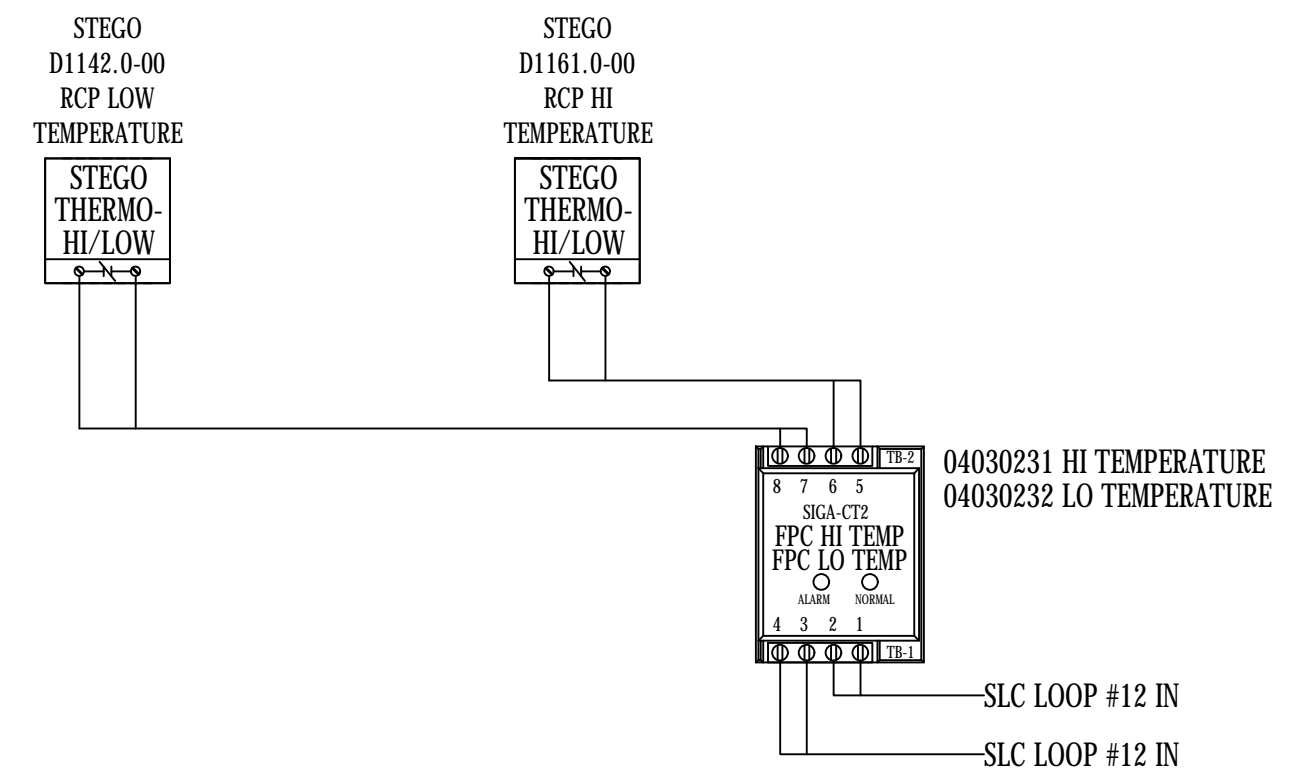
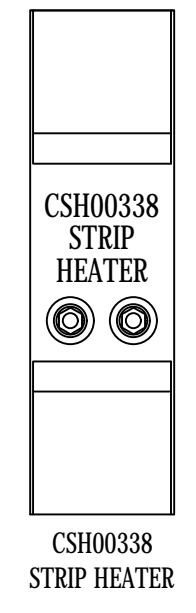
QTY.	Model	Description	Stby mA	Alm mA
4	Standby Hours			
5	Alarm Minutes			
1	3-CPU3	Central Processor Module	155	165
1	3-RS232	RS232 Communication Card	58	58
1	3-SDDC1	Signature Driver Controller (LRM)	144	204
2	3-SDDC1	Signature Dual Driver Controller (LRM)	528	672
1	3-LCD	Liquid Crystal Display Module	40	42
1	3-PPS/M	Primary Power Supply (Included in 3-CPU3 Current)	0	0
1	3-12SR	Control Display Module, 12 Switches, 12 Led's (Red)	20	20
1	MN-COM1S	MN/EC Serial Communications/LAN Interface	60	60
1	3-FIBM2	Fiber Optic Communications Interface	105	105
2	MMXVR	Plug-In Standard Output Multi Mode Transceiver	40	40
TOTAL LOAD			1150	1366
Total Stand-By and Alarm Current			1150	1366
Standby Hours * Total Standby Current			4600	
(Alarm Minutes/60) * Total Alarm Current				113.833
Total Standby/Alarm Current			4713.833	
Battery De-Rating Factor +20%			5656.600	

Quantity	Model	Description
5.66		Calculated Battery Ampere Hours
2	SLA1075	8.0 AH Battery

2 NORTHWEST PLENUM - RCP #2 PANEL CALCULATION  
SCALE: N.T.S.

1 NORTHWEST PLENUM RCP #2 - FACP PANEL LAYOUT & WIRING  
SCALE: N.T.S.



**BARNARD EJMT TEAM**

**BARNARD** **RONDINELLI**

**BCER** **Sturgeon Electric**

Western States Fire Protection Co. CONSULTING ENGINEERS

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

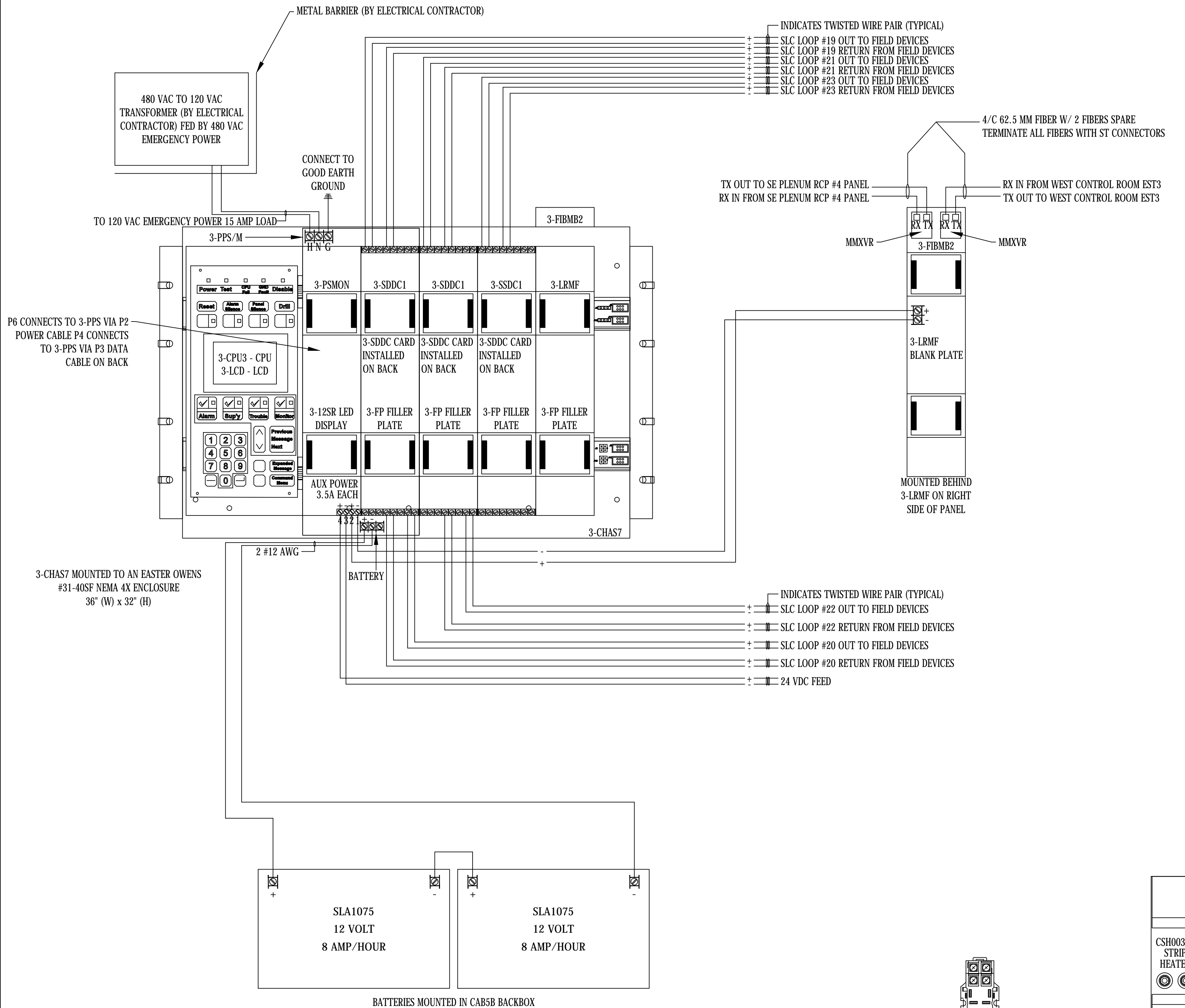
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Revisions	Date
Num	Description

FIRE ALARM:  
RCP #2 EST3 PANEL  
LAYOUT & CALCULATIONS

Drawing Number  
**FA4.05**

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



Supply Voltage & Battery Periods  
 120 VAC Supply Voltage  
 EJMT - RCP #3 - SOUTHWEST PLENUM - EST3

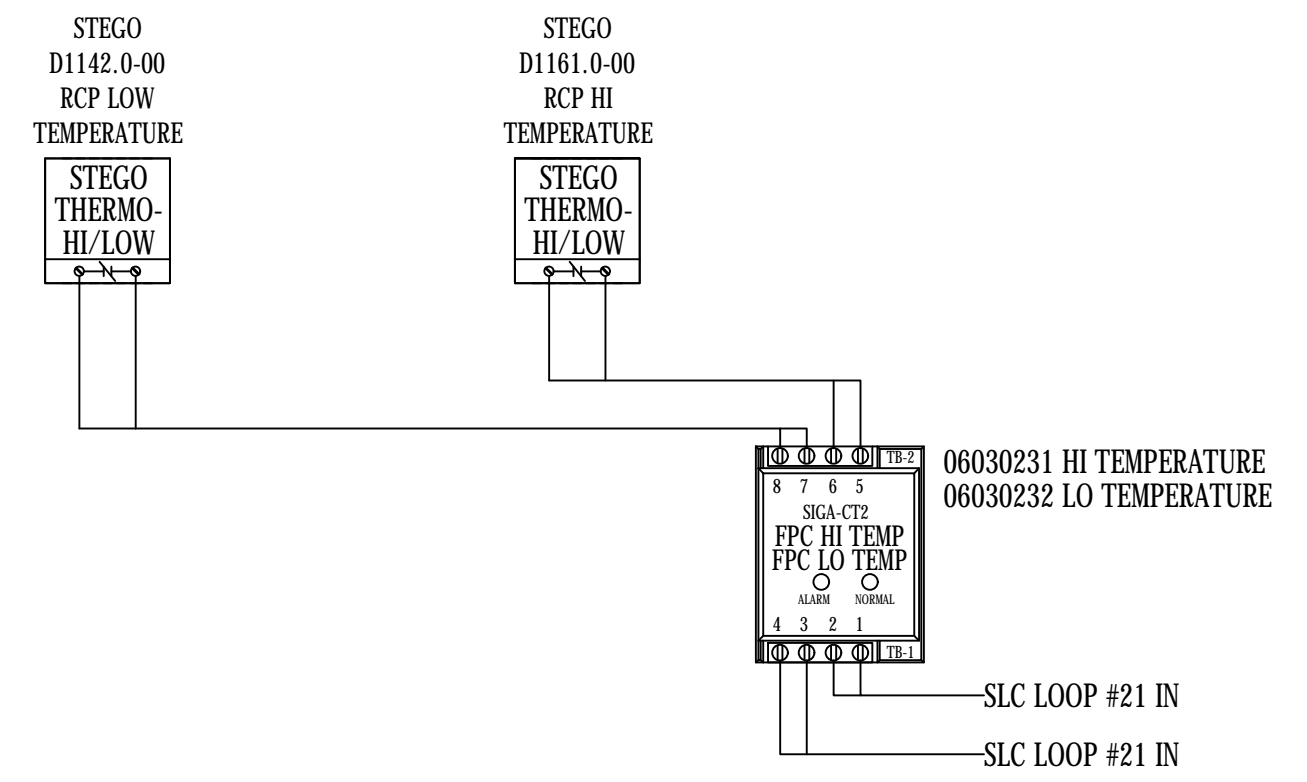
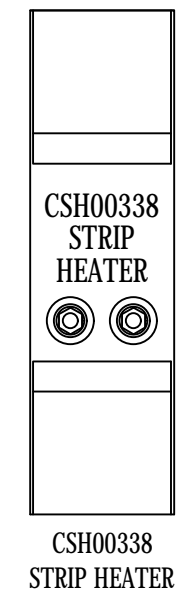
QTY.	Model	Description	Stby mA	Alm mA
4	Standby Hours			
5	Alarm Minutes			
1	3-CPU3	Central Processor Module	155	165
1	3-RS232	RS232 Communication Card	58	58
1	3-SDDC1	Signature Driver Controller (LRM)	144	204
2	3-SDDC1	Signature Dual Driver Controller (LRM)	528	672
1	3-LCD	Liquid Crystal Display Module	40	42
1	3-PPS/M	Primary Power Supply (Included in 3-CPU3 Current)	0	0
1	3-12SR	Control Display Module, 12 Switches, 12 Led's (Red)	20	20
1	MN-COM1S	MN/EC Serial Communications/LAN Interface	60	60
1	3-FIBM2	Fiber Optic Communications Interface	105	105
2	MMXVR	Plug-In Standard Output Multi Mode Transceiver	40	40
TOTAL LOAD			1150	1366
Total Stand-By and Alarm Current			1150	1366
Standby Hours * Total Standby Current			4600	
(Alarm Minutes/60) * Total Alarm Current				113.833
Total Standby/Alarm Current			4713.833	
Battery De-Rating Factor +20%			5656.600	

Quantity	Model	Description
5.66	Calculated Battery Ampere Hours	
2	SLA1075	8.0 AH Battery

2 SOUTHWEST PLENUM - RCP #3 PANEL CALCULATION  
 SCALE: N.T.S.

1 SOUTHWEST PLENUM RCP #3 - FACP PANEL LAYOUT & WIRING  
 SCALE: N.T.S.



**BARNARD EJMT TEAM**

**BARNARD** **RONDINELLI**

**BCER** **Sturgeon Electric**

Western States Fire Protection Co.

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

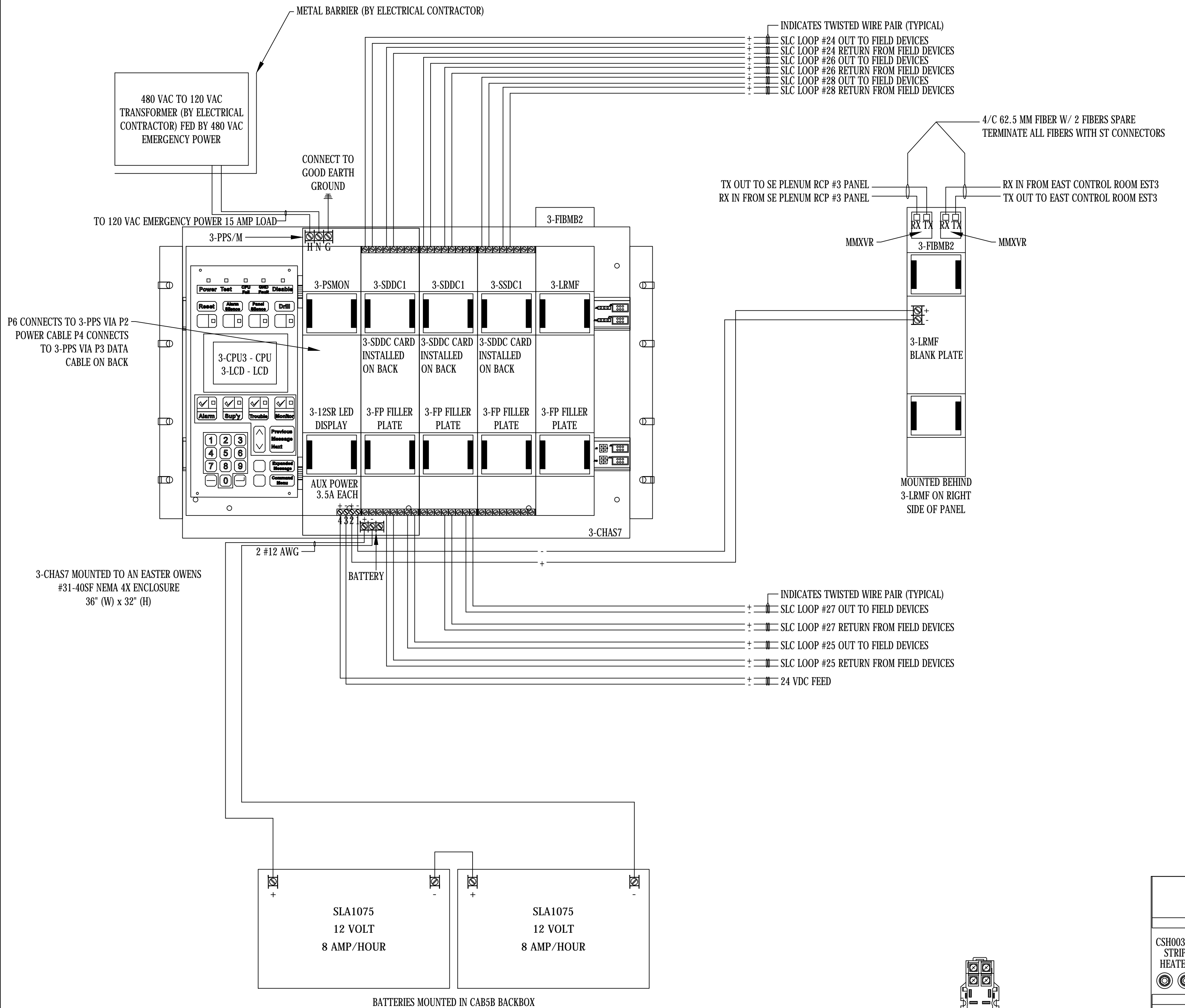
Revisions	Date
Num	Description

FIRE ALARM:  
 RCP #3 EST3 PANEL  
 LAYOUT & CALCULATIONS

Drawing Number  
**FA4.06**

DRAWN BY: B.T.L. | CHECKED BY: AEE-JT

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



1 SOUTHEAST PLENUM RCP #4 - FACP PANEL LAYOUT & WIRING  
SCALE: N.T.S.

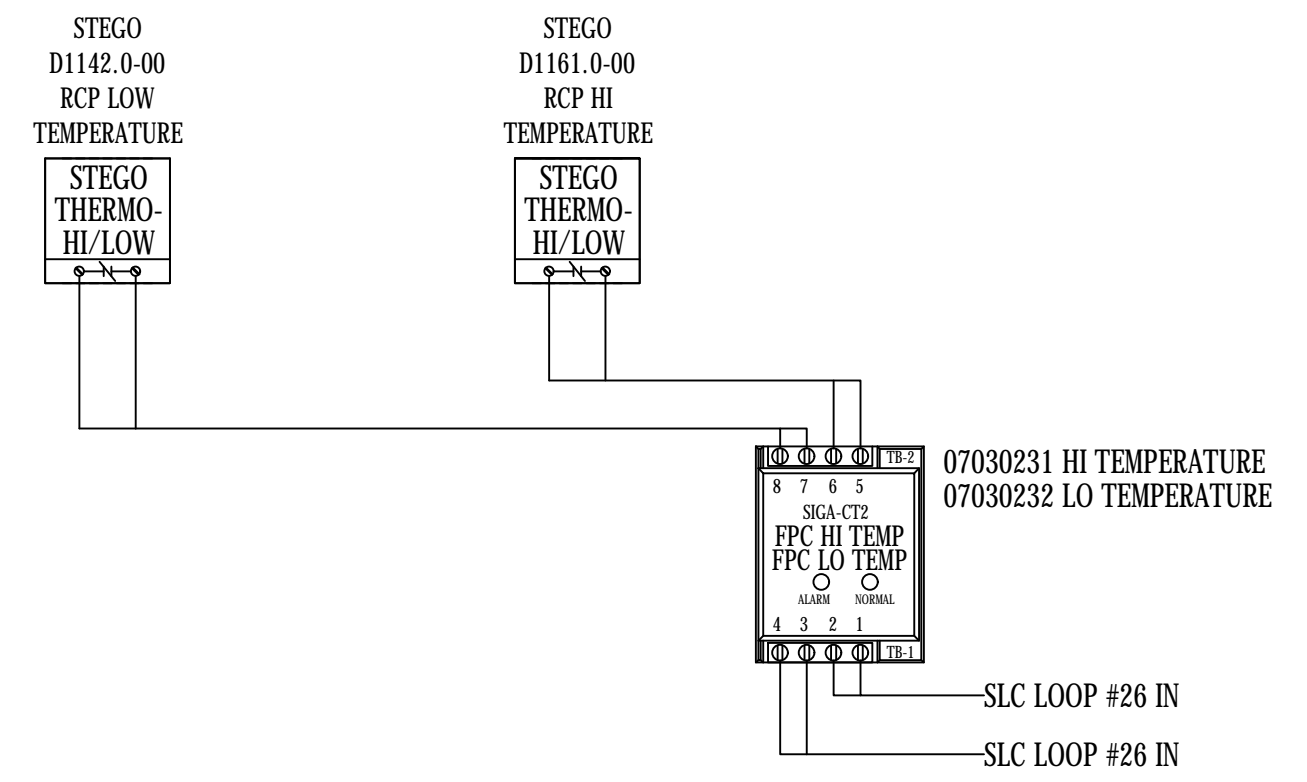
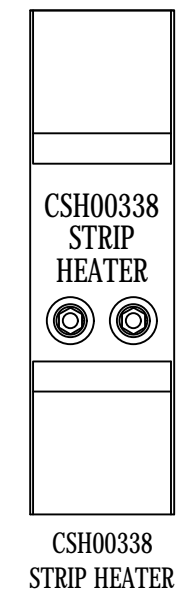
Supply Voltage & Battery Periods  
120 VAC Supply Voltage  
EJMT - RCP #4 - SOUTHEAST PLENUM - EST3

QTY.	Model	Description	Stby mA	Alm mA
1	3-CPU3	Central Processor Module	155	165
1	3-RS232	RS232 Communication Card	58	58
1	3-SDDC1	Signature Driver Controller (LRM)	144	204
2	3-SDDC1	Signature Dual Driver Controller (LRM)	528	672
1	3-LCD	Liquid Crystal Display Module	40	42
1	3-PPS/M	Primary Power Supply (Included in 3-CPU3 Current)	0	0
1	3-12SR	Control Display Module, 12 Switches, 12 Led's (Red)	20	20
1	MN-COM1S	MN/EC Serial Communications/LAN Interface	60	60
1	3-FIBM2	Fiber Optic Communications Interface	105	105
2	MMXVR	Plug-In Standard Output Multi Mode Transceiver	40	40
TOTAL LOAD			1150	1366
Total Stand-By and Alarm Current			1150	1366
Standby Hours * Total Standby Current			4600	
Alarm Minutes/60 * Total Alarm Current				113.833
Total Standby/Alarm Current			4713.833	
Battery De-Rating Factor +20%			5656.600	

Quantity	Model	Description
5.66		Calculated Battery Ampere Hours
2	SLA1075	8.0 AH Battery

2 SOUTHEAST PLENUM - RCP #4 PANEL CALCULATION  
SCALE: N.T.S.



**BARNARD EJMT TEAM**

**BARNARD** **RONDINELLI**

**BCER** **Sturgeon Electric**

Western States Fire Protection Co. CONSULTING ENGINEERS

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Revisions	Date
Num	Description

FIRE ALARM:  
RCP #4 EST3 PANEL  
LAYOUT & CALCULATIONS

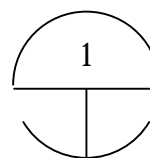
Drawing Number  
**FA4.07**



INCREMENTAL VOLTAGE DROP CALCULATIONS FOR DELUGE VALVE RELEASING CIRCUITS  
 MINIMUM UL RATED VOLTAGE: 16 VOLTS  
 Current shown in calculations is RMS current at 16 volts.

Resistance	12 Gauge	2.01
	14 Gauge	3.19
	16 Gauge	5.08

Circuit Number: Location: 500 ft Solenoid Release Ckt w/12 AWG INPUT VOLTAGE = 20.4 VOLTS							
Notification Circuit	Current (in amps)	Wire Distance (in feet)	Total Distance (in feet)	Wire Size (AWG)	Resistance (Ohms)	Voltage Drop	From Baseline Voltage
ASCO HT8210G027	0.442	525	525	12	2.1105	0.9328	19.4672
Totals:	0.442	525			2.1105	0.9328	19.4672
Total Devices:							
Circuit Number: Location: 400 ft Solenoid Release Ckt w/14 AWG INPUT VOLTAGE = 20.4 VOLTS							
Notification Circuit	Current (in amps)	Wire Distance (in feet)	Total Distance (in feet)	Wire Size (AWG)	Resistance (Ohms)	Voltage Drop	From Baseline Voltage
ASCO HT8210G027	0.422	425	425	14	2.7115	1.1443	19.2557
Totals:	0.422	425			2.7115	1.1443	19.2557
Total Devices:							
Circuit Number: Location: 300 ft Solenoid Release Ckt w/14 AWG INPUT VOLTAGE = 20.4 VOLTS							
Notification Circuit	Current (in amps)	Wire Distance (in feet)	Total Distance (in feet)	Wire Size (AWG)	Resistance (Ohms)	Voltage Drop	From Baseline Voltage
ASCO HT8210G027	0.422	325	325	14	2.0735	0.8750	19.5250
Totals:	0.422	325			2.0735	0.8750	19.5250
Total Devices:							
Circuit Number: Location: 200 ft Solenoid Release Ckt w/14 AWG INPUT VOLTAGE = 20.4 VOLTS							
Notification Circuit	Current (in amps)	Wire Distance (in feet)	Total Distance (in feet)	Wire Size (AWG)	Resistance (Ohms)	Voltage Drop	From Baseline Voltage
ASCO HT8210G027	0.422	225	225	14	1.4355	0.6058	19.7942
Totals:	0.422	225			1.4355	0.6058	19.7942
Total Devices:							
Circuit Number: Location: 100 ft Solenoid Release Ckt w/14 AWG INPUT VOLTAGE = 20.4 VOLTS							
Notification Circuit	Current (in amps)	Wire Distance (in feet)	Total Distance (in feet)	Wire Size (AWG)	Resistance (Ohms)	Voltage Drop	From Baseline Voltage
ASCO HT8210G027	0.442	125	125	14	0.7975	0.3525	20.0475
Totals:	0.442	125			0.7975	0.3525	20.0475
Total Devices:							



DELUGE SOLENOID RELEASING CIRCUIT VOLTAGE DROP CALCULATIONS 500' MAXIMUM  
 SCALE: N.T.S.

NOTE: CIRCUIT WIRE LENGTHS INCLUDE AN ADDITIONAL 25 FEET OF WIRE TO ACCOUNT FOR RACEWAY AND CIRCUIT ROUTING IN EQUIPMENT.

FPC/RCP HEAT LOSS CALCULATION  
 INSULATED ENCLOSURE AREA  

$$Asf = \frac{(2x8'x32') + (2x8'x36') + (2x36'x32')}{144 \text{ SQ IN/SQ FT}}$$
 Asf = 23.56 S.F.

CLIMATE CONDITIONS  
 -30° F AMBIENT  
 40° F INTERIOR

INSULATION  
 R=6.0

BOX ASSEMBLY U-VALUE

IA FILM COEFFICIENT:	0.68
INSULATION:	6.00
METAL CABINET:	0.0
OA FILM COEFFICIENT:	0.17
	6.85

$$U = 1/R = 0.146 \text{ BTU/SQ FT} \cdot ^\circ\text{F}$$

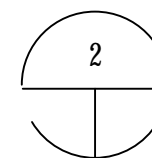
CABINET HEAT LOSS

$$Q_{cab} = A \cdot U \cdot T$$

$$= (23.56 \text{ SQ FT}) (0.146 \text{ BTU/SQ FT} \cdot ^\circ\text{F}) (40^\circ\text{F} - (-30^\circ\text{F}))$$

$$Q_{cab} = 240 \text{ BTU/HR}$$

$$= (70 \text{ WATTS})$$



TYPICAL FPC CABINET HEAT LOAD CALCULATIONS  
 SCALE: N.T.S.

**BARNARD EJMT TEAM**

**BCER** **BARNARD** **RONDINELLI** **Sturgeon Electric**  
 Western States Fire Protection Co.  
 CONSULTING ENGINEERS

EISENHOWER/JOHNSON

MEMORIAL TUNNEL

FIXED FIRE SUPPRESSION SYSTEM

DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

Num	Description	Date

DRAWN BY: B.T.L. | CHECKED BY: AEE-JR

FIRE ALARM:  
 DELUGE RELEASING & FPC  
 HEAT LOAD CALCS

Drawing Number  
**FA4.08**

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #1					
	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
4	Standby Hours				
5	Alarm Minutes				
5	SIGA-REL	25	170	125	850
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1497	2222
1	BPS10A Remote Booster Power Supply, 10A, 120Vac, Red			70	270
	TOTAL LOAD			1567	2492
Total Stand-By and Alarm Current				1567	2492
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6268	207.667
Total Standby + Alarm Current Battery De-Rating Factor +20%				6475.667	7770.800
7.77	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

1 FPC01 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #2					
	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
4	Standby Hours				
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1622	3072
1	BPS10A Remote Booster Power Supply, 10A, 120Vac, Red			70	270
	TOTAL LOAD			1692	3342
Total Stand-By and Alarm Current				1692	3342
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6768	278.500
Total Standby + Alarm Current Battery De-Rating Factor +20%				7046.500	8455.800
8.46	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

2 FPC02 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #3					
	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
4	Standby Hours				
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
2	PTZ Camera	44	44	88	88
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1666	3116
1	BPS10A Remote Booster Power Supply, 10A, 120Vac, Red			70	270
	TOTAL LOAD			1736	3386
Total Stand-By and Alarm Current				1736	3386
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6944	282.167
Total Standby + Alarm Current Battery De-Rating Factor +20%				7226.167	8671.400
8.67	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

3 FPC03 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #4					
	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
4	Standby Hours				
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1622	3072
1	BPS10A Remote Booster Power Supply, 10A, 120Vac, Red			70	270
	TOTAL LOAD			1692	3342
Total Stand-By and Alarm Current				1692	3342
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6768	278.500
Total Standby + Alarm Current Battery De-Rating Factor +20%				7046.500	8455.800
8.46	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

4 FPC04 BATTERY CALCULATIONS  
SCALE: N.T.S.

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

# BARNARD EJMT TEAM

**BCER** Fire Alarm Engineering  
**BARNARD**  
**RONDINELLI** A fire alarm life safety  
**ELF** ENGINEERS  
**Sturgeon Electric**  
Western States Fire Protection Co.

# EISENHOWER/JOHNSON

**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Revisions	Date
Num	Description

FIRE ALARM:  
FPC01 THRU FPC04  
BATTERY CALCULATIONS

Drawing Number  
**FA4.09**

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #5					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1622	3072
1 BPS10A Remote Booster Power Supply, 10A, 120Vac, Red				70	270
TOTAL LOAD				1692	3342
Total Stand-By and Alarm Current				1692	3342
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6768	278.500
Total Standby + Alarm Current Battery De-Rating Factor +20%				7046.500	8455.800
8.46	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

1 FPC05 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #6					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1622	3072
1 BPS10A Remote Booster Power Supply, 10A, 120Vac, Red				70	270
TOTAL LOAD				1692	3342
Total Stand-By and Alarm Current				1692	3342
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6768	278.500
Total Standby + Alarm Current Battery De-Rating Factor +20%				7046.500	8455.800
8.46	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

2 FPC06 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #7					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
2	PTZ Camera	44	44	88	88
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1666	3116
1 BPS10A Remote Booster Power Supply, 10A, 120Vac, Red				70	270
TOTAL LOAD				1736	3386
Total Stand-By and Alarm Current				1736	3386
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6944	282.167
Total Standby + Alarm Current Battery De-Rating Factor +20%				7226.167	8671.400
8.67	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

3 FPC07 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #8					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	350	350	350	350
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1555	3005
1 BPS10A Remote Booster Power Supply, 10A, 120Vac, Red				70	270
TOTAL LOAD				1625	3275
Total Stand-By and Alarm Current				1625	3275
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6500	272.917
Total Standby + Alarm Current Battery De-Rating Factor +20%				6772.917	8127.500
8.13	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

4 FPC08 BATTERY CALCULATIONS  
SCALE: N.T.S.

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**BARNARD EJMT TEAM**

**BCER** Western States Fire Protection Co. CONSULTING ENGINEERS  
**BARNARD**  
**STURGEON ELECTRIC**  
**RONNINELLI** A fire safety life safety  
**WESTERN STATES FIRE PROTECTION CO.**  
**ALF**  
**ENGINEERS**

EISENHOWER/JOHNSON

**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Revisions	Date	
Num	Description	
DRAWN BY: B.T.L.   CHECKED BY: AEE-JT		
FIRE ALARM: FPC05 THRU FPC08 BATTERY CALCULATIONS		
Drawing Number		
<b>FA4.10</b>		

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #9					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1622	3072
1	BPS10A Remote Booster Power Supply, 10A, 120Vac, Red			70	270
	TOTAL LOAD			1692	3342
	Total Stand-By and Alarm Current			1692	3342
	Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current			6768	278.500
	Total Standby + Alarm Current Battery De-Rating Factor +20%			7046.500	8455.800
8.46	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

1 FPC09 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #10					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	125	850
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1497	2222
1	BPS10A Remote Booster Power Supply, 10A, 120Vac, Red			70	270
	TOTAL LOAD			1567	2492
	Total Stand-By and Alarm Current			1567	2492
	Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current			6268	207.667
	Total Standby + Alarm Current Battery De-Rating Factor +20%			6475.667	7770.800
7.77	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

2 FPC10 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #11					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	125	850
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1497	2222
1	BPS10A Remote Booster Power Supply, 10A, 120Vac, Red			70	270
	TOTAL LOAD			1567	2492
	Total Stand-By and Alarm Current			1567	2492
	Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current			6268	207.667
	Total Standby + Alarm Current Battery De-Rating Factor +20%			6475.667	7770.800
7.77	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

3 FPC11 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #12					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1622	3072
1	BPS10A Remote Booster Power Supply, 10A, 120Vac, Red			70	270
	TOTAL LOAD			1692	3342
	Total Stand-By and Alarm Current			1692	3342
	Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current			6768	278.500
	Total Standby + Alarm Current Battery De-Rating Factor +20%			7046.500	8455.800
8.46	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

4 FPC12 BATTERY CALCULATIONS  
SCALE: N.T.S.

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**BARNARD EJMT TEAM**

**BARNARD** **RONNINELLI**  
Western States Fire Protection Co.  
CONSULTING ENGINEERS



EISENHOWER/JOHNSON

MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Num	Revisions	Date
	Description	

FIRE ALARM:  
FPC09 THRU FPC12  
BATTERY CALCULATIONS

Drawing Number

**FA4.11**

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #13					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1622	3072
1 BPS10A Remote Booster Power Supply, 10A, 120Vac, Red				70	270
TOTAL LOAD				1692	3342
Total Stand-By and Alarm Current				1692	3342
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6768	278.500
Total Standby + Alarm Current Battery De-Rating Factor +20%				7046.500	8455.800
8.46	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

1 FPC13 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #14					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1666	3116
1 BPS10A Remote Booster Power Supply, 10A, 120Vac, Red				70	270
TOTAL LOAD				1736	3386
Total Stand-By and Alarm Current				1736	3386
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6944	282.167
Total Standby + Alarm Current Battery De-Rating Factor +20%				7226.167	8671.400
8.67	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

2 FPC14 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #15					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1622	3072
1 BPS10A Remote Booster Power Supply, 10A, 120Vac, Red				70	270
TOTAL LOAD				1692	3342
Total Stand-By and Alarm Current				1692	3342
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6768	278.500
Total Standby + Alarm Current Battery De-Rating Factor +20%				7046.500	8455.800
8.46	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

3 FPC15 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #16					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1622	3072
1 BPS10A Remote Booster Power Supply, 10A, 120Vac, Red				70	270
TOTAL LOAD				1692	3342
Total Stand-By and Alarm Current				1692	3342
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6768	278.500
Total Standby + Alarm Current Battery De-Rating Factor +20%				7046.500	8455.800
8.46	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

4 FPC16 BATTERY CALCULATIONS  
SCALE: N.T.S.

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**BARNARD EJMT TEAM**

**BARNARD** **RONDINELLI**  
Western States Fire Protection Co.  
CONSULTING ENGINEERS  
**Sturgeon Electric**

EISENHOWER/JOHNSON

MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Num	Revisions	Date
	Description	

FIRE ALARM:  
FPC13 THRU FPC16  
BATTERY CALCULATIONS

Drawing Number  
**FA4.12**

DRAWN BY: B.T.L. CHECKED BY: AEE-JF

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #17					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1622	3072
1 BPS10A Remote Booster Power Supply, 10A, 120Vac, Red				70	270
TOTAL LOAD				1692	3342
Total Stand-By and Alarm Current				1692	3342
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6768	278.500
Total Standby + Alarm Current Battery De-Rating Factor +20%				7046.500	8455.800
8.46	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

1 FPC17 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #18					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1666	3116
1 BPS10A Remote Booster Power Supply, 10A, 120Vac, Red				70	270
TOTAL LOAD				1736	3386
Total Stand-By and Alarm Current				1736	3386
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6944	282.167
Total Standby + Alarm Current Battery De-Rating Factor +20%				7226.167	8671.400
8.67	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

2 FPC18 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #19					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
10	SIGA-REL	25	170	250	1700
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1622	3072
1 BPS10A Remote Booster Power Supply, 10A, 120Vac, Red				70	270
TOTAL LOAD				1692	3342
Total Stand-By and Alarm Current				1692	3342
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6768	278.500
Total Standby + Alarm Current Battery De-Rating Factor +20%				7046.500	8455.800
8.46	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

3 FPC19 BATTERY CALCULATIONS  
SCALE: N.T.S.

Supply Voltage & Battery Periods					
120 VAC Supply Voltage					
Fire Protection Cabinet #20					
4	Standby Hours	Stby mA	Alm mA	Total Stby mA	Total Alm mA
5	Alarm Minutes				
8	SIGA-REL	25	170	200	1360
1	NS3550-8T-2S Managed Switch	417	417	417	417
2	S35-2MLC SFP Transceiver	7.5	7.5	15	15
1	PTZ Camera	44	44	44	44
2	ASCO HT8210G027 Solenoids	442	442	884	884
0	TOTAL load for the 200mA Auxiliary Power Source			0	0
1	Aux STANDBY load delivered during a power fail	12		12	0
1	Aux ALARM current delivered during a power fail		12	0	12
	Total NAC & AUX Load			1572	2732
1 BPS10A Remote Booster Power Supply, 10A, 120Vac, Red				70	270
TOTAL LOAD				1642	3002
Total Stand-By and Alarm Current				1642	3002
Standby Hours * Total Standby Current (Alarm Minutes/60) * Total Alarm Current				6568	250.167
Total Standby + Alarm Current Battery De-Rating Factor +20%				6818.167	8181.800
8.18	Calculated Battery Ampere Hours				
Quantity	Model	Description			
2	SLA1097	SLA1097 10.0 AH Battery			

4 FPC20 BATTERY CALCULATIONS  
SCALE: N.T.S.

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**BARNARD EJMT TEAM**

**BCER** CONSULTING ENGINEERS  
**BARNARD**  
**BARNARD** CONSULTING ENGINEERS  
**RONDINELLI** CONSULTING ENGINEERS  
**Sturgeon ELECTRIC**  
 Western States Fire Protection Co.

**EISENHOWER/JOHNSON**

**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Revisions	Date	Description

FIRE ALARM:  
 FPC17 THRU FPC20  
 BATTERY CALCULATIONS  
 Drawing Number  
**FA4.13**  
 DRAWN BY: B.T.L. | CHECKED BY: AEE-JF  
 ASBUILT - 101

Cable Information	OD (in)	Area	Quantity	Total Area
18 awg TFN	0.0783	0.00482		0
16 awg TFN	0.0888	0.00619		0
14 awg THHN	0.102	0.00817		0
12 awg THHN	0.119	0.01112		0
16/2 Tw awg TFN	0.155	0.01887	1	0.01887
4/c MM Fiber (FA)	0.41	0.13203	1	0.13203
4/c MM Fiber (CC)	0.41	0.13203	1	0.13203
Cable Eight		0		0
Cable Nine		0		0
Cable Ten		0		0
<b>Total</b>			<b>3</b>	<b>0.28292</b>

Trade Size	ID (in)	Area	Permissible Area	Fill (%)
1/2	0.660	0.3421	0.1368	n/a
3/4	0.864	0.5863	0.2345	n/a
1	1.105	0.9590	0.3836	29.50
1 1/4	1.448	1.6467	0.6587	17.18
1 1/2	1.683	2.2246	0.8899	12.72
2	2.150	3.6305	1.4522	7.79
2 1/2	2.557	5.1351	2.0541	5.51
3	3.176	7.9223	3.1689	3.57
3 1/2	3.671	10.5842	4.2337	2.67
4	4.166	13.6310	5.4524	2.08

1 CONDUIT FILL CALCULATIONS - FA/CCTV FIBERS & (1) SLC LOOP  
SCALE: N.T.S.

Cable Information	OD (in)	Area	Quantity	Total Area
18 awg TFN	0.0783	0.00482		0
16 awg TFN	0.0888	0.00619		0
14 awg THHN	0.102	0.00817		0
12 awg THHN	0.119	0.01112		0
16/2 Tw awg TFN	0.155	0.01887	2	0.03774
4/c MM Fiber (FA)	0.41	0.13203	1	0.13203
4/c MM Fiber (CC)	0.41	0.13203	1	0.13203
Cable Eight		0		0
Cable Nine		0		0
Cable Ten		0		0
<b>Total</b>			<b>4</b>	<b>0.30179</b>

Trade Size	ID (in)	Area	Permissible Area	Fill (%)
1/2	0.660	0.3421	0.1368	n/a
3/4	0.864	0.5863	0.2345	n/a
1	1.105	0.9590	0.3836	31.47
1 1/4	1.448	1.6467	0.6587	18.33
1 1/2	1.683	2.2246	0.8899	13.57
2	2.150	3.6305	1.4522	8.31
2 1/2	2.557	5.1351	2.0541	5.88
3	3.176	7.9223	3.1689	3.81
3 1/2	3.671	10.5842	4.2337	2.85
4	4.166	13.6310	5.4524	2.21

2 CONDUIT FILL CALCULATIONS - FA/CCTV FIBERS & (2) SLC LOOPS  
SCALE: N.T.S.

Cable Information	OD (in)	Area	Quantity	Total Area
18 awg TFN	0.07830	0.00482		0.00000
16 awg TFN	0.08880	0.00619		0.00000
14 awg THHN	0.10200	0.00817		0.00000
12 awg THHN	0.11900	0.01112		0.00000
16/2 Tw awg TFN	0.15500	0.01887	2	0.03774
4/c MM Fiber (FA)	0.19000	0.02835		0.00000
4/c MM Fiber (CC)	0.19000	0.02835		0.00000
Cat 5e Ethernet	0.24500	0.04714	1	0.04714
12/2 Tw awg THHN	0.41000	0.13203	1	0.13203
Cable Ten		0.00000		0.00000
<b>Total</b>			<b>4</b>	<b>0.21691</b>

Trade Size	ID (in)	Area	Permissible Area	Fill (%)
1/2	0.660	0.3421	0.1368	n/a
3/4	0.864	0.5863	0.2345	37.00
1	1.105	0.9590	0.3836	22.62
1 1/4	1.448	1.6467	0.6587	13.17
1 1/2	1.683	2.2246	0.8899	9.75
2	2.150	3.6305	1.4522	5.97
2 1/2	2.557	5.1351	2.0541	4.22
3	3.176	7.9223	3.1689	2.74
3 1/2	3.671	10.5842	4.2337	2.05
4	4.166	13.6310	5.4524	1.59

3 CONDUIT FILL CALCULATIONS - (2) SLC LOOPS, (1) CAT-5e ETHERNET, & (1) 2/12 AWG CAMERA POWER  
SCALE: N.T.S.

Cable Information	OD (in)	Area	Quantity	Total Area
18 awg TFN	0.07830	0.00482	4	0.01926
16 awg TFN	0.08880	0.00619		0.00000
14 awg THHN	0.10200	0.00817		0.00000
12 awg THHN	0.11900	0.01112	2	0.02224
16/2 Tw awg TFN	0.15500	0.01887		0.00000
4/c MM Fiber (FA)	0.19000	0.02835		0.00000
4/c MM Fiber (CC)	0.19000	0.02835		0.00000
Cable Eight		0.00000		0.00000
Cable Nine		0.00000		0.00000
Cable Ten		0.00000		0.00000
<b>Total</b>			<b>6</b>	<b>0.04150</b>

Trade Size	ID (in)	Area	Permissible Area	Fill (%)
1/2	0.660	0.3421	0.1368	12.13
3/4	0.864	0.5863	0.2345	7.08
1	1.105	0.9590	0.3836	4.33
1 1/4	1.448	1.6467	0.6587	2.52
1 1/2	1.683	2.2246	0.8899	1.87
2	2.150	3.6305	1.4522	1.14
2 1/2	2.557	5.1351	2.0541	0.81
3	3.176	7.9223	3.1689	0.52
3 1/2	3.671	10.5842	4.2337	0.39
4	4.166	13.6310	5.4524	0.30

4 CONDUIT FILL CALCULATIONS - (1) DELUGE ZONE  
SCALE: N.T.S.

Cable Information	OD (in)	Area	Quantity	Total Area
18 awg TFN	0.07830	0.00482	8	0.03852
16 awg TFN	0.08880	0.00619		0.00000
14 awg THHN	0.10200	0.00817	2	0.01634
12 awg THHN	0.11900	0.01112	2	0.02224
16/2 Tw awg TFN	0.15500	0.01887		0.00000
4/c MM Fiber (FA)	0.19000	0.02835		0.00000
4/c MM Fiber (CC)	0.19000	0.02835		0.00000
Cable Eight		0.00000		0.00000
Cable Nine		0.00000		0.00000
Cable Ten		0.00000		0.00000
<b>Total</b>			<b>12</b>	<b>0.07711</b>

Trade Size	ID (in)	Area	Permissible Area	Fill (%)
1/2	0.660	0.3421	0.1368	22.54
3/4	0.864	0.5863	0.2345	13.15
1	1.105	0.9590	0.3836	8.04
1 1/4	1.448	1.6467	0.6587	4.68
1 1/2	1.683	2.2246	0.8899	3.47
2	2.150	3.6305	1.4522	2.12
2 1/2	2.557	5.1351	2.0541	1.50
3	3.176	7.9223	3.1689	0.97
3 1/2	3.671	10.5842	4.2337	0.73
4	4.166	13.6310	5.4524	0.57

5 CONDUIT FILL CALCULATIONS - (2) DELUGE ZONES  
SCALE: N.T.S.

Cable Information	OD (in)	Area	Quantity	Total Area
18 awg TFN	0.07830	0.00482	12	0.05778
16 awg TFN	0.08880	0.00619		0.00000
14 awg THHN	0.10200	0.00817	4	0.03269
12 awg THHN	0.11900	0.01112	2	0.02224
16/2 Tw awg TFN	0.15500	0.01887		0.00000
4/c MM Fiber (FA)	0.19000	0.02835		0.00000
4/c MM Fiber (CC)	0.19000	0.02835		0.00000
Cable Eight		0.00000		0.00000
Cable Nine		0.00000		0.00000
Cable Ten		0.00000		0.00000
<b>Total</b>			<b>18</b>	<b>0.11271</b>

Trade Size	ID (in)	Area	Permissible Area	Fill (%)
1/2	0.660	0.3421	0.1368	32.95
3/4	0.864	0.5863	0.2345	19.22
1	1.105	0.9590	0.3836	11.75
1 1/4	1.448	1.6467	0.6587	6.84
1 1/2	1.683	2.2246	0.8899	5.07
2	2.150	3.6305	1.4522	3.10
2 1/2	2.557	5.1351	2.0541	2.19
3	3.176	7.9223	3.1689	1.42
3 1/2	3.671	10.5842	4.2337	1.06
4	4.166	13.6310	5.4524	0.83

6 CONDUIT FILL CALCULATIONS - (3) DELUGE ZONES  
SCALE: N.T.S.

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**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT**

**BARNARD EJMT TEAM**  
BARNARD  
Western States Fire Protection Co.  
STURGEON ELECTRIC  
BCER  
RONDINELLI  
Western States Fire Protection Co.  
Western States Fire Protection Co.  
Western States Fire Protection Co.

Num	Date	Description

FIRE ALARM:  
CONDUIT FILL  
CALCULATIONS

Drawing Number  
**FA4.14**

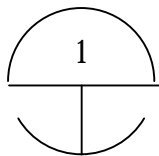
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

DRAWN BY: B.T.L. | CHECKED BY: AEE-JR

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

Cable Information	OD (in)	Area	Quantity	Total Area
18 awg TFN	0.07830	0.00482	16	0.07704
16 awg TFN	0.08880	0.00619		0.00000
14 awg THHN	0.10200	0.00817	6	0.04903
12 awg THHN	0.11900	0.01112	2	0.02224
16/2 Tw awg TFN	0.15500	0.01887		0.00000
4/c MM Fiber (FA)	0.19000	0.02835		0.00000
4/c MM Fiber (CC)	0.19000	0.02835		0.00000
Cable Eight		0.00000		0.00000
Cable Nine		0.00000		0.00000
Cable Ten		0.00000		0.00000
Total			24	0.14831

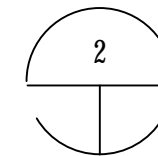
Intermediate Metal Conduit (IMC)				
Trade Size	ID (in)	Area	Permissible Area	Fill (%)
1/2	0.660	0.3421	0.1368	n/a
3/4	0.864	0.5863	0.2345	25.30
1	1.105	0.9590	0.3836	15.47
1 1/4	1.448	1.6467	0.6587	9.01
1 1/2	1.683	2.2246	0.8899	6.67
2	2.150	3.6305	1.4522	4.09
2 1/2	2.557	5.1351	2.0541	2.89
3	3.176	7.9223	3.1689	1.87
3 1/2	3.671	10.5842	4.2337	1.40
4	4.166	13.6310	5.4524	1.09



CONDUIT FILL CALCULATIONS - (4) DELUGE ZONES  
SCALE: N.T.S.

Cable Information	OD (in)	Area	Quantity	Total Area
18 awg TFN	0.07830	0.00482	20	0.09630
16 awg TFN	0.08880	0.00619		0.00000
14 awg THHN	0.10200	0.00817	8	0.06537
12 awg THHN	0.11900	0.01112	2	0.02224
16/2 Tw awg TFN	0.15500	0.01887		0.00000
4/c MM Fiber (FA)	0.19000	0.02835		0.00000
4/c MM Fiber (CC)	0.19000	0.02835		0.00000
Cable Eight		0.00000		0.00000
Cable Nine		0.00000		0.00000
Cable Ten		0.00000		0.00000
Total			30	0.18392

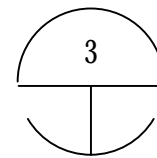
Intermediate Metal Conduit (IMC)				
Trade Size	ID (in)	Area	Permissible Area	Fill (%)
1/2	0.660	0.3421	0.1368	n/a
3/4	0.864	0.5863	0.2345	31.37
1	1.105	0.9590	0.3836	19.18
1 1/4	1.448	1.6467	0.6587	11.17
1 1/2	1.683	2.2246	0.8899	8.27
2	2.150	3.6305	1.4522	5.07
2 1/2	2.557	5.1351	2.0541	3.58
3	3.176	7.9223	3.1689	2.32
3 1/2	3.671	10.5842	4.2337	1.74
4	4.166	13.6310	5.4524	1.35



CONDUIT FILL CALCULATIONS - (5) DELUGE ZONES  
SCALE: N.T.S.

Cable Information	OD (in)	Area	Quantity	Total Area
18 awg TFN	0.0783	0.00482	24	0.11556
16 awg TFN	0.0888	0.00619		0
14 awg THHN	0.102	0.00817	10	0.08171
12 awg THHN	0.119	0.01112		0
16/2 Tw awg TFN	0.155	0.01887		0
4/c MM Fiber (FA)	0.19	0.02835		0
4/c MM Fiber (CC)	0.19	0.02835		0
Cable Eight		0		0
Cable Nine		0		0
Cable Ten		0		0
Total			34	0.19728

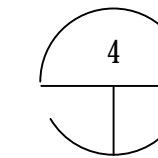
Intermediate Metal Conduit (IMC)				
Trade Size	ID (in)	Area	Permissible Area	Fill (%)
1/2	0.660	0.3421	0.1368	n/a
3/4	0.864	0.5863	0.2345	33.65
1	1.105	0.9590	0.3836	20.57
1 1/4	1.448	1.6467	0.6587	11.98
1 1/2	1.683	2.2246	0.8899	8.87
2	2.150	3.6305	1.4522	5.43
2 1/2	2.557	5.1351	2.0541	3.84
3	3.176	7.9223	3.1689	2.49
3 1/2	3.671	10.5842	4.2337	1.86
4	4.166	13.6310	5.4524	1.45



CONDUIT FILL CALCULATIONS - (5) DELUGE ZONES, ISOVALVE, AND AIR TEMP  
SCALE: N.T.S.

Cable Information	OD (in)	Area	Quantity	Total Area
6 awg THHN	0.162	0.02061	3	0.06184
8 awg THHN	0.15	0.01767	1	0.01767
Cable Three		0		0
Cable Four		0		0
Cable Five		0		0
Cable Six		0		0
Cable Seven		0		0
Cable Eight		0		0
Cable Nine		0		0
Cable Ten		0		0
Total			4	0.07951

Intermediate Metal Conduit (IMC)				
Trade Size	ID (in)	Area	Permissible Area	Fill (%)
1/2	0.660	0.3421	0.1368	23.24
3/4	0.864	0.5863	0.2345	13.56
1	1.105	0.9590	0.3836	8.29
1 1/4	1.448	1.6467	0.6587	4.83
1 1/2	1.683	2.2246	0.8899	3.57
2	2.150	3.6305	1.4522	2.19
2 1/2	2.557	5.1351	2.0541	1.55
3	3.176	7.9223	3.1689	1.00
3 1/2	3.671	10.5842	4.2337	0.75
4	4.166	13.6310	5.4524	0.58



CONDUIT FILL CALCULATIONS - 480 VAC POWER  
SCALE: N.T.S.

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

BARNARD EJMTEAM

BARNARD  
Sturgeon Electric  
RONDINELLI  
Western States Fire Protection Co.  
ALF  
ENGINEERS

Revisions	Date
Num	Description

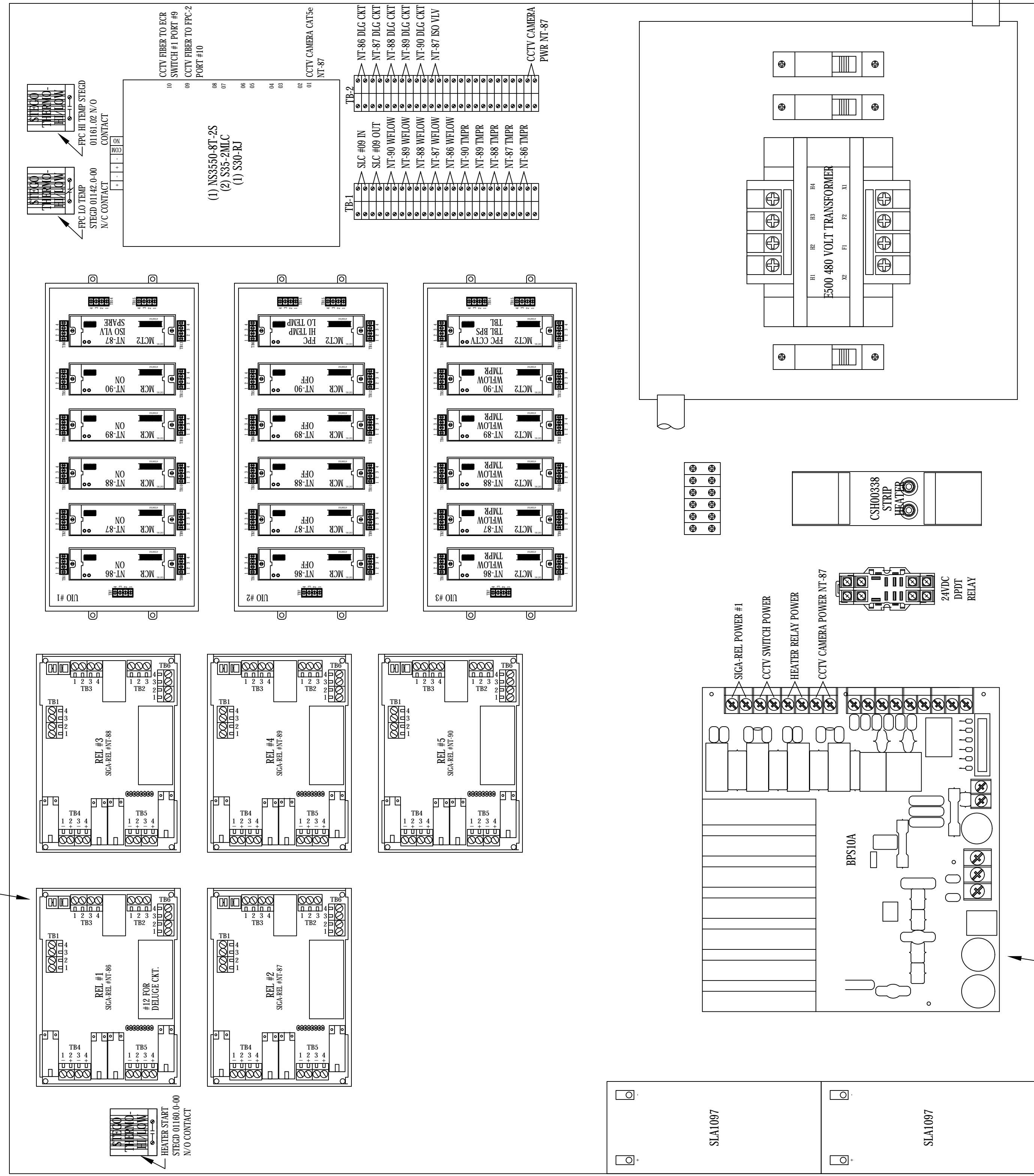
FIRE ALARM:  
CONDUIT FILL  
CALCULATIONS

Drawing Number  
**FA4.15**

DRAWN BY: B.T.L. CHECKED BY: AEE-JF  
ASBUILT - 103



IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



TYPICAL SIGA-REL SWITCH SETTINGS  
 SW1 = OFF SW5 = OFF  
 SW2 = OFF SW6 = OFF  
 SW3 = OFF SW7 = OFF  
 SW4 = OFF SW8 = OFF

BOOSTER POWER SUPPLY SETTINGS  
 JP1 = 2-3 SW1-1 = OFF SW2-1 = ON  
 JP2 = 2-3 SW1-2 = OFF SW2-2 = ON  
 JP3 = INSTALLED SW1-3 = OFF SW2-3 = ON  
 JP4 = INTACT SW1-4 = OFF SW2-4 = ON  
 SW1-5 = ON SW2-5 = OFF  
 SW1-6 = ON SW2-6 = OFF  
 SW1-7 = ON SW2-7 = OFF  
 SW1-8 = ON SW2-8 = OFF

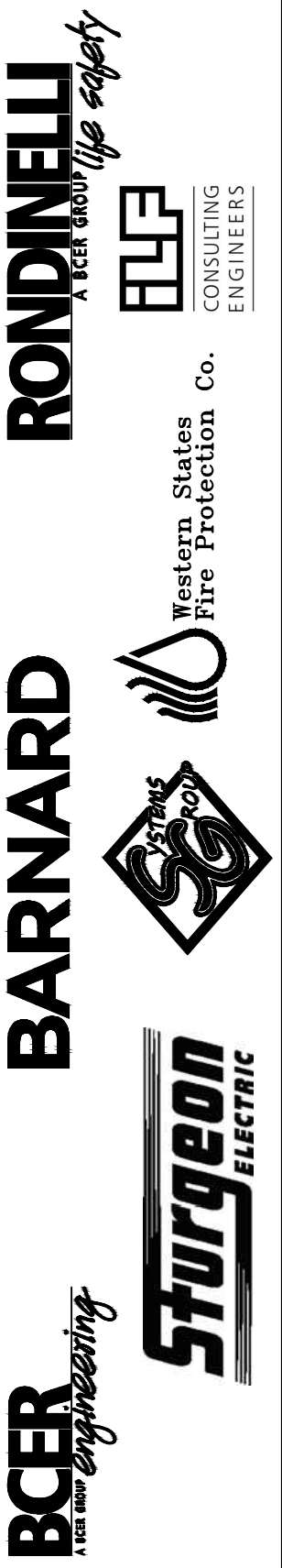
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1 FPC #01 PANEL LAYOUT  
 SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #01  
 EASTER OWENS NEMA 4X ENCLOSURE #31-40SF  
 SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 32" H)

EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

BARNARD EJMT TEAM



Revisions	Date

FIRE ALARM:  
 FIRE PROTECTION PANEL  
 FPC #01 WIRING DIAGRAM

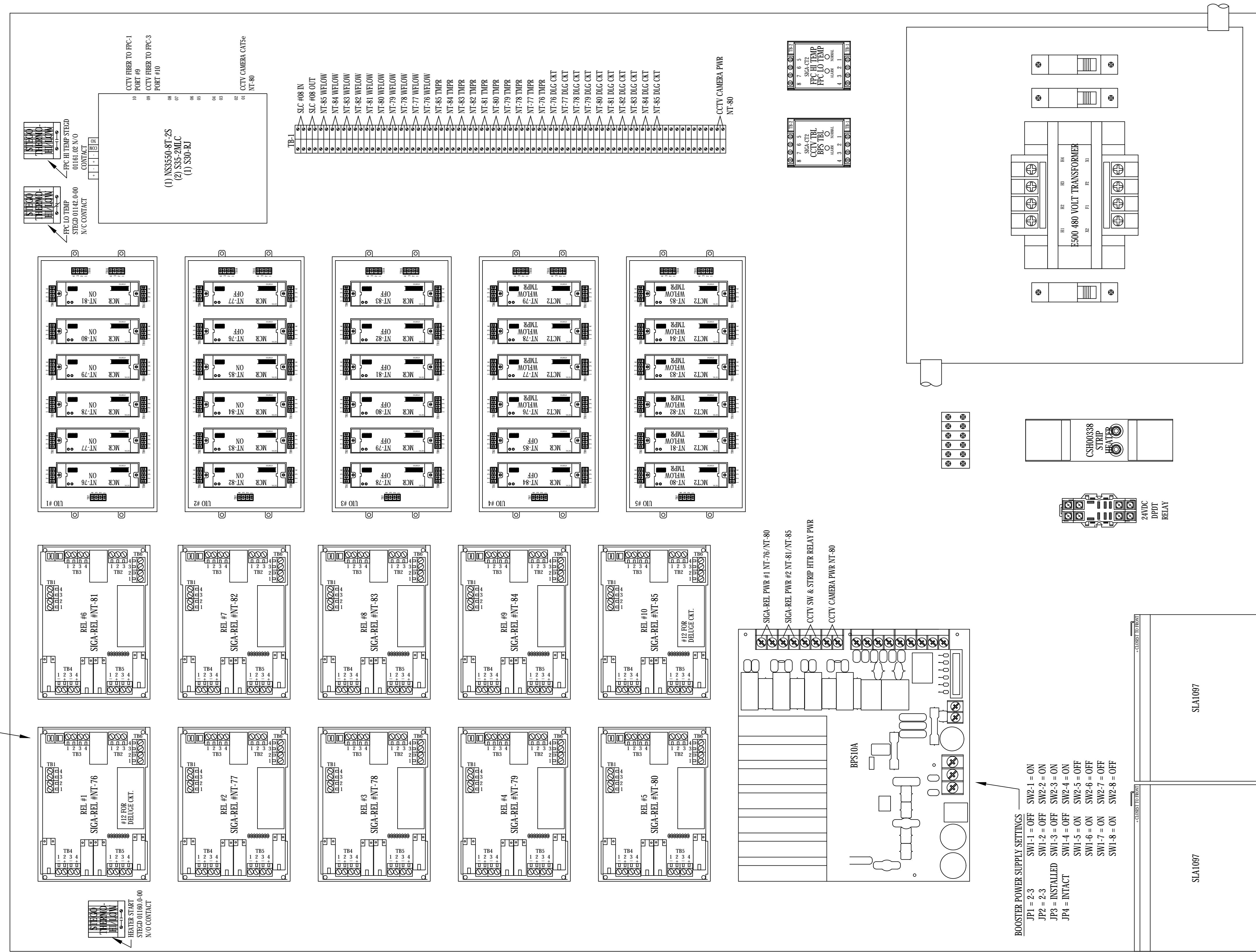
Drawing Number  
**FA5.01**

Project No. C0703-360 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

DRAWN BY: B.T.L. CHECKED BY: AEE-JF

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS  
 SW1 = OFF SW5 = OFF  
 SW2 = OFF SW6 = OFF  
 SW3 = OFF SW7 = OFF  
 SW4 = OFF SW8 = OFF



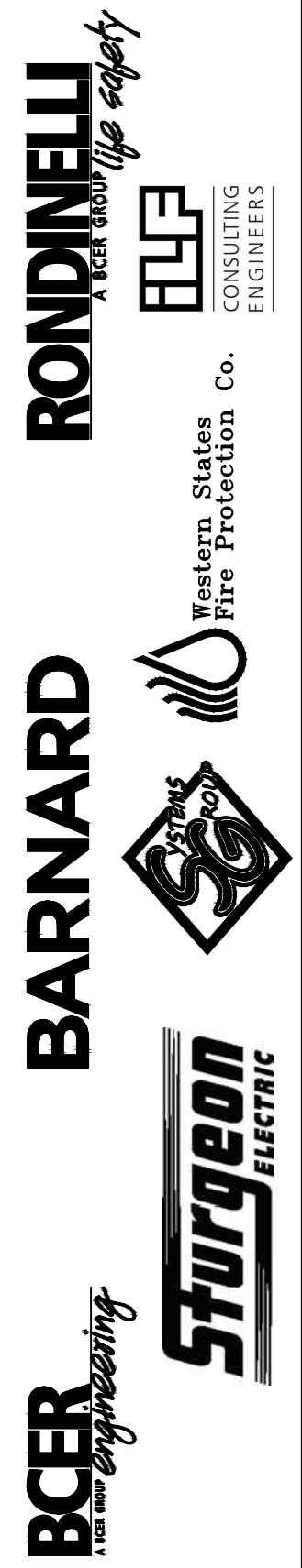
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1 FPC #02 PANEL LAYOUT  
 SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #02  
 EASTER OWENS NEMA 4X ENCLOSURE #41-50SF  
 SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 48" H)

EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

BARNARD EJMT TEAM



Revisions	Date

FIRE ALARM:  
 FIRE PROTECTION PANEL  
 FPC #02 WIRING DIAGRAM

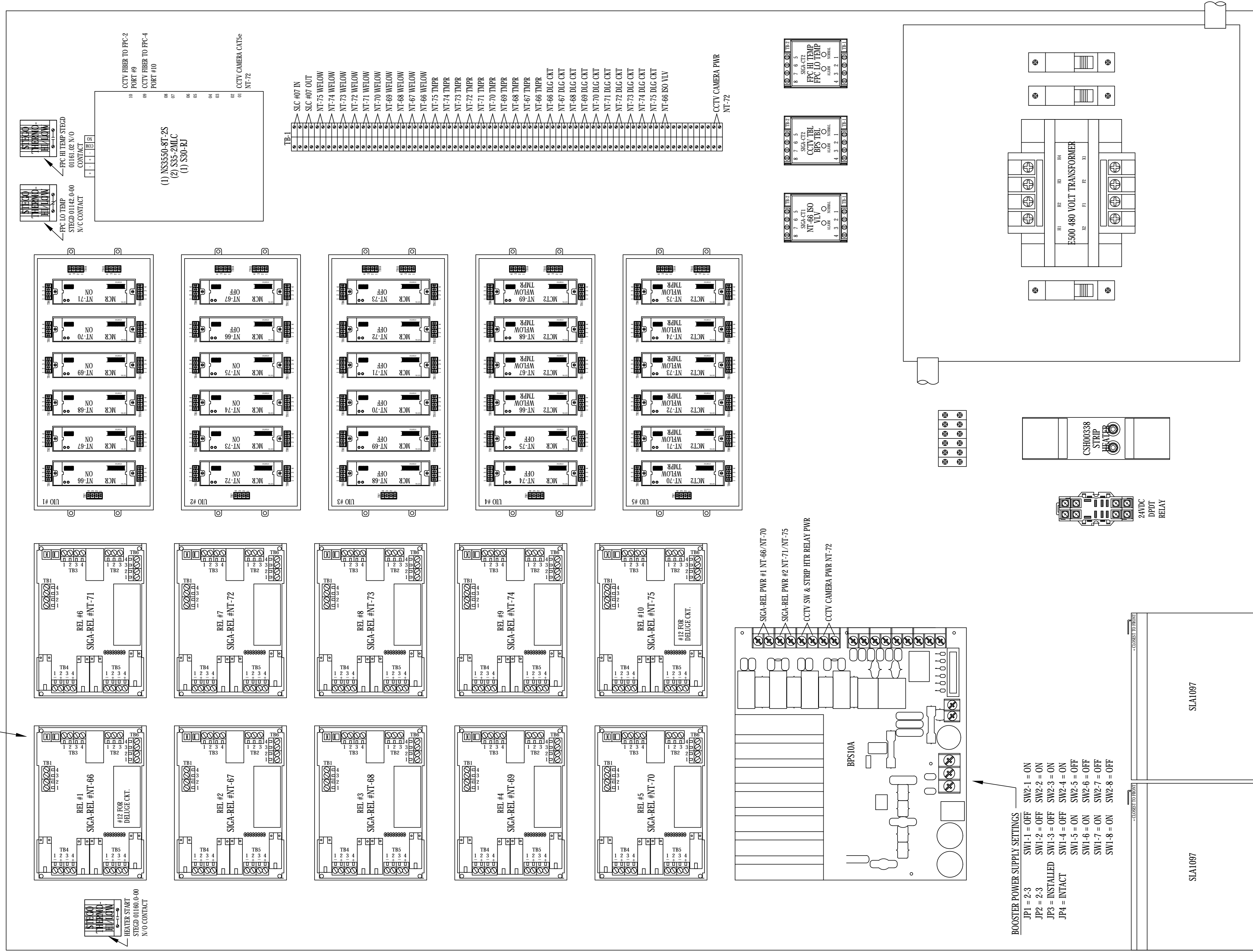
Drawing Number  
**FA5.02**

Project No. C0703-360  
 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS  
SW1 = OFF SW5 = OFF  
SW2 = OFF SW6 = OFF  
SW3 = OFF SW7 = OFF  
SW4 = OFF SW8 = OFF



ADDRESSES = 0303XXXX

1 FPC #03 PANEL LAYOUT  
SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #03  
EASTER OWENS NEMA 4X ENCLOSURE #41-50SF  
SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 48" H)

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

**BARNARD EJMT TEAM**  
BCER BARNARD BARNARD RONDINELLI  
Sturgeon Electric Western States Fire Protection Co. ALP  
A COMMITMENT TO EXCELLENCE  
A COMMITMENT TO YOUR SAFETY  
CONSULTING ENGINEERS

Revisions

Num	Description	Date

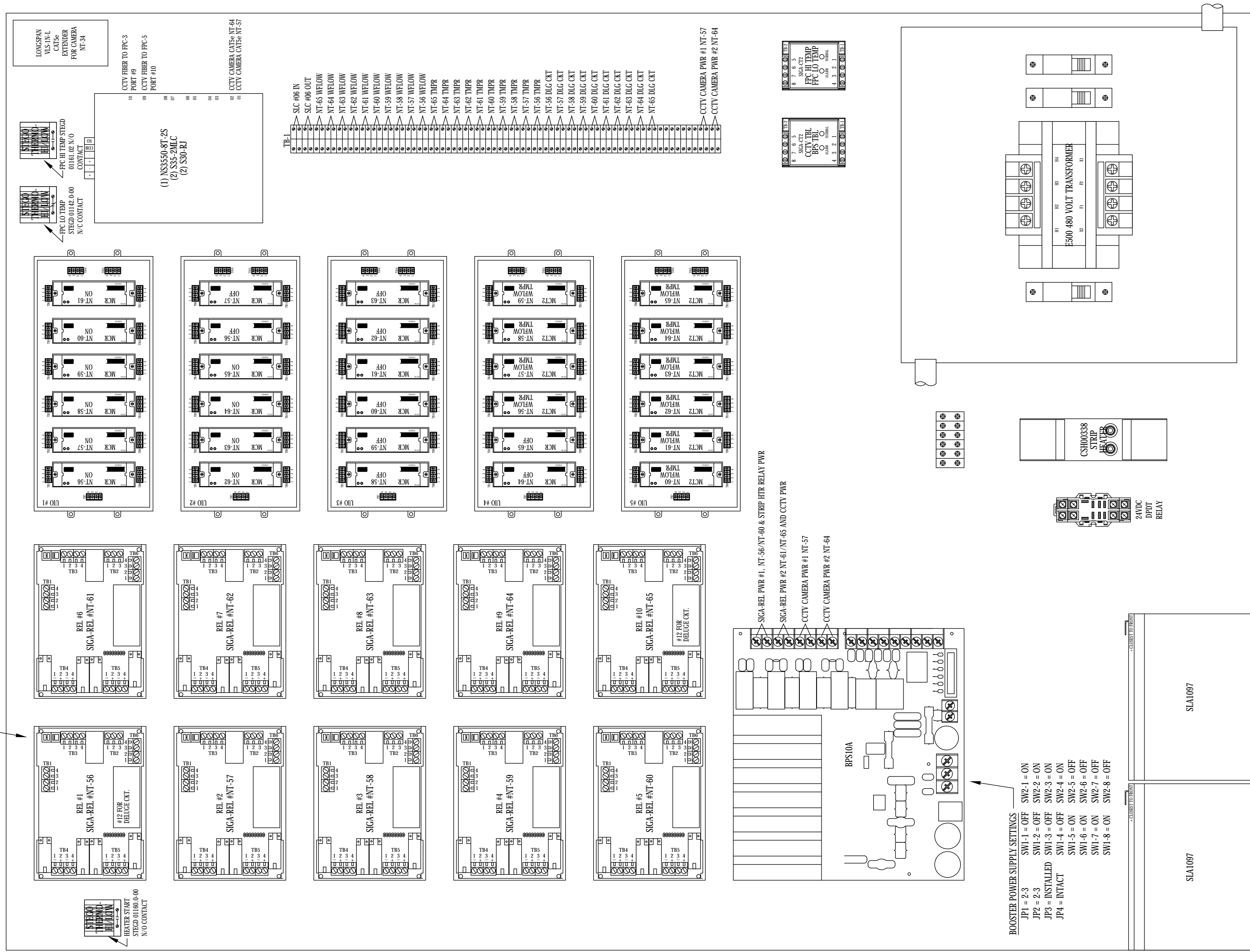
FIRE ALARM:  
FIRE PROTECTION PANEL  
FPC #03 WIRING DIAGRAM  
Drawing Number

FA5.03

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS  
 SW1 = OFF SW5 = OFF  
 SW2 = OFF SW6 = OFF  
 SW3 = OFF SW7 = OFF  
 SW4 = OFF SW8 = OFF



ADDRESSES = 0302XXXX

1 FPC #04 PANEL LAYOUT  
 SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #04  
 EASTER OWENS NEMA 4X ENCLOSURE #41-50SF  
 SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 48" H)

Revisions	Date

FIRE ALARM:  
 FIRE PROTECTION PANEL  
 FPC #04 WIRING DIAGRAM  
 Drawing Number  
**FA5.04**

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360  
 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

**BARNARD EJMT TEAM**

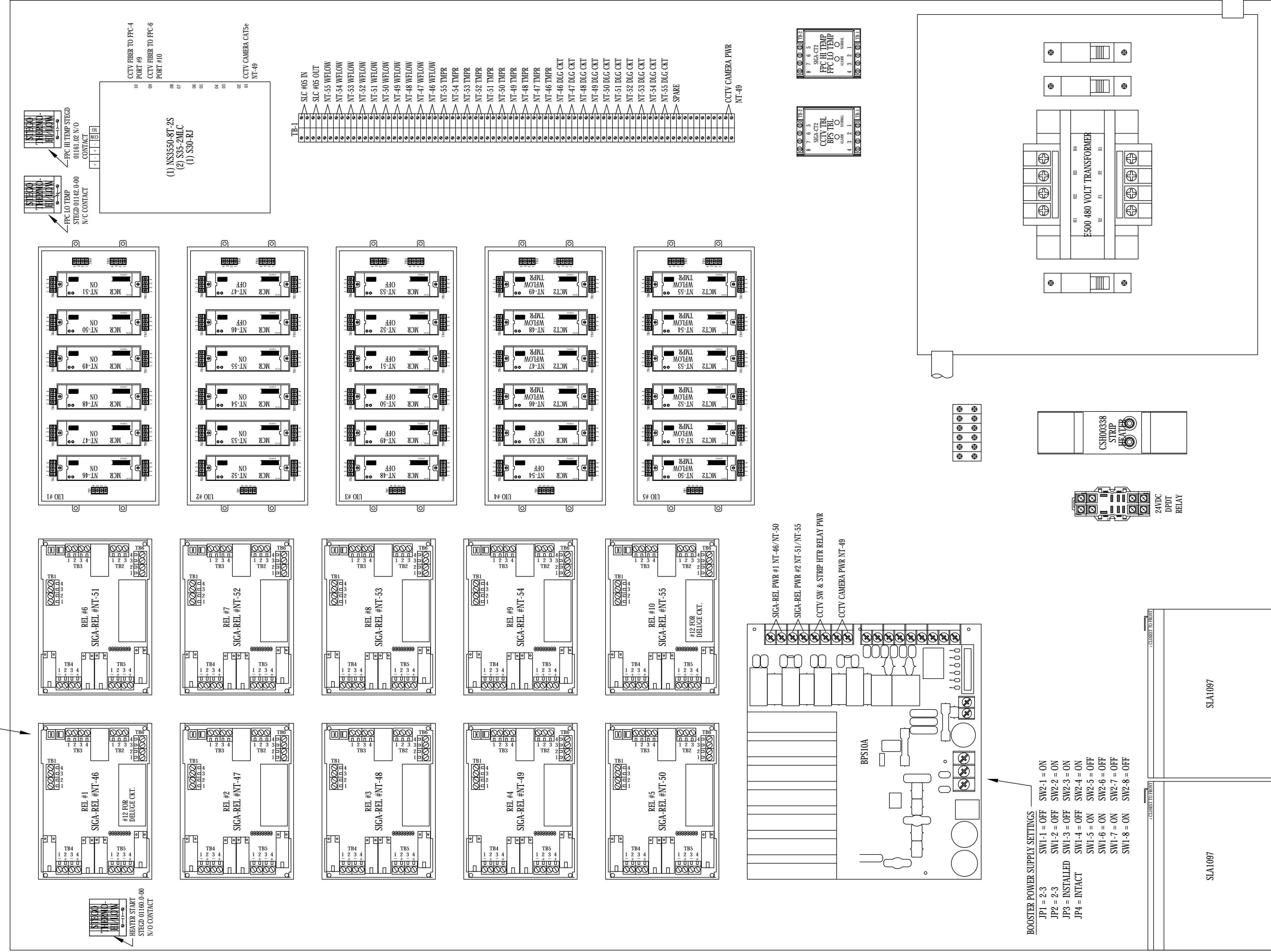
**BCER** **BARNARD** **STURGEON ELECTRIC**

**RONDINELLI** **Western States Fire Protection Co.**

**Western States Fire Protection Co.**  
 CONSULTING ENGINEERS

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS  
SW1 = OFF SW5 = OFF  
SW2 = OFF SW6 = OFF  
SW3 = OFF SW7 = OFF  
SW4 = OFF SW8 = OFF



ADDRESSES = 0302XXXX

1 FPC #05 PANEL LAYOUT  
SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #05  
EASTER OWENS NEMA 4X ENCLOSURE #41-50SF  
SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 48" H)

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Revisions	Date
Num	Description

FIRE ALARM:  
FIRE PROTECTION PANEL  
FPC #05 WIRING DIAGRAM  
Drawing Number  
**FA5.05**

**BARNARD EJMT TEAM**

**BARNARD** **STURGEON ELECTRIC**

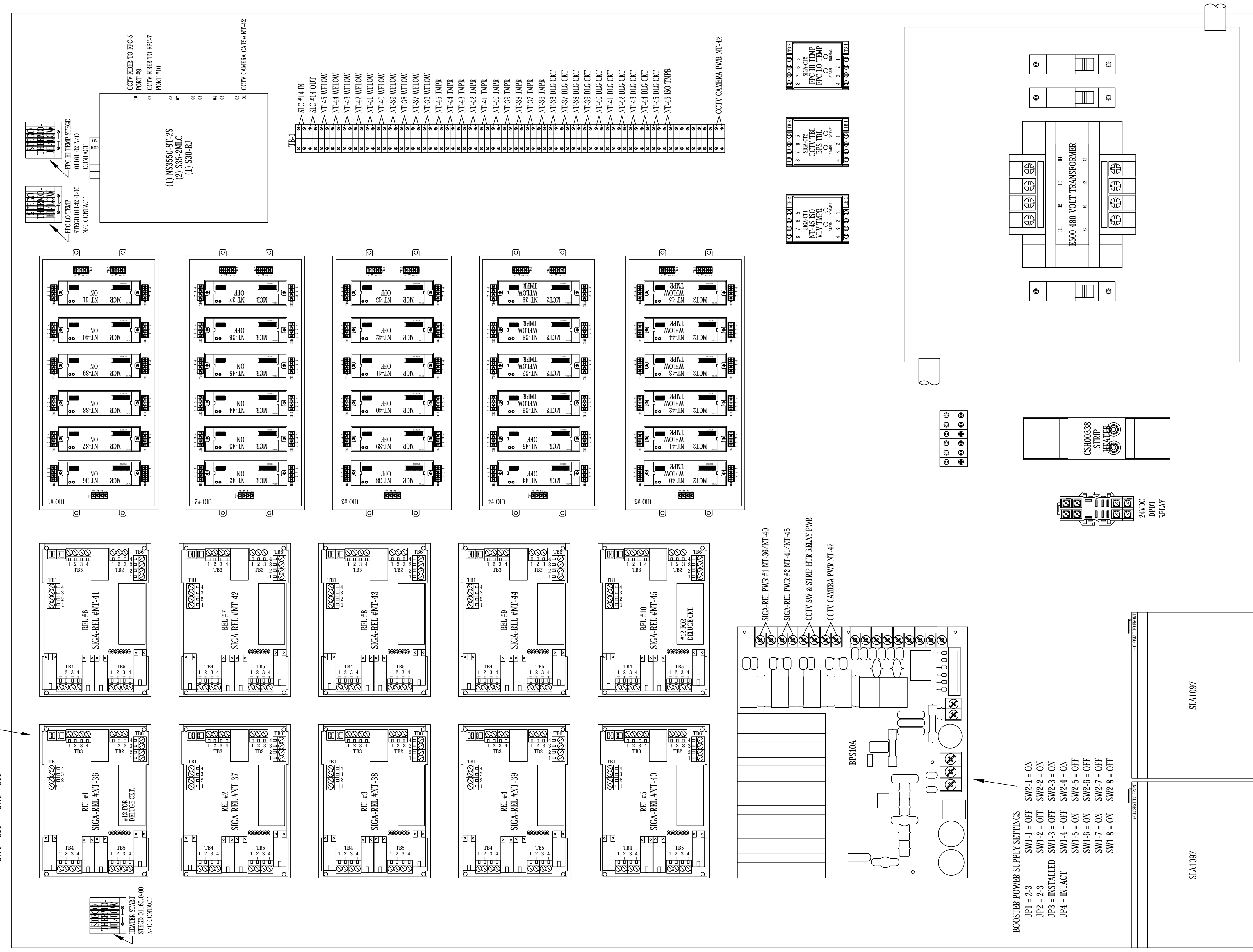
**BCER** **Western States Fire Protection Co.**

**RONDINELLI** **Western States Fire Protection Co.**

**Sturgeon Electric** **Western States Fire Protection Co.**

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS  
 SW1 = OFF SW5 = OFF  
 SW2 = OFF SW6 = OFF  
 SW3 = OFF SW7 = OFF  
 SW4 = OFF SW8 = OFF



ADDRESSES = 0404XXXX

1 FPC #06 PANEL LAYOUT  
 SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #06  
 EASTER OWENS NEMA 4X ENCLOSURE #41-50SF  
 SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 48" H)

EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

**BARNARD EJMT TEAM**

BCER **BARNARD** **STURGEON** **RONDINELLI**  
 Fire Alarm Consulting Engineers  
 Western States Fire Protection Co.

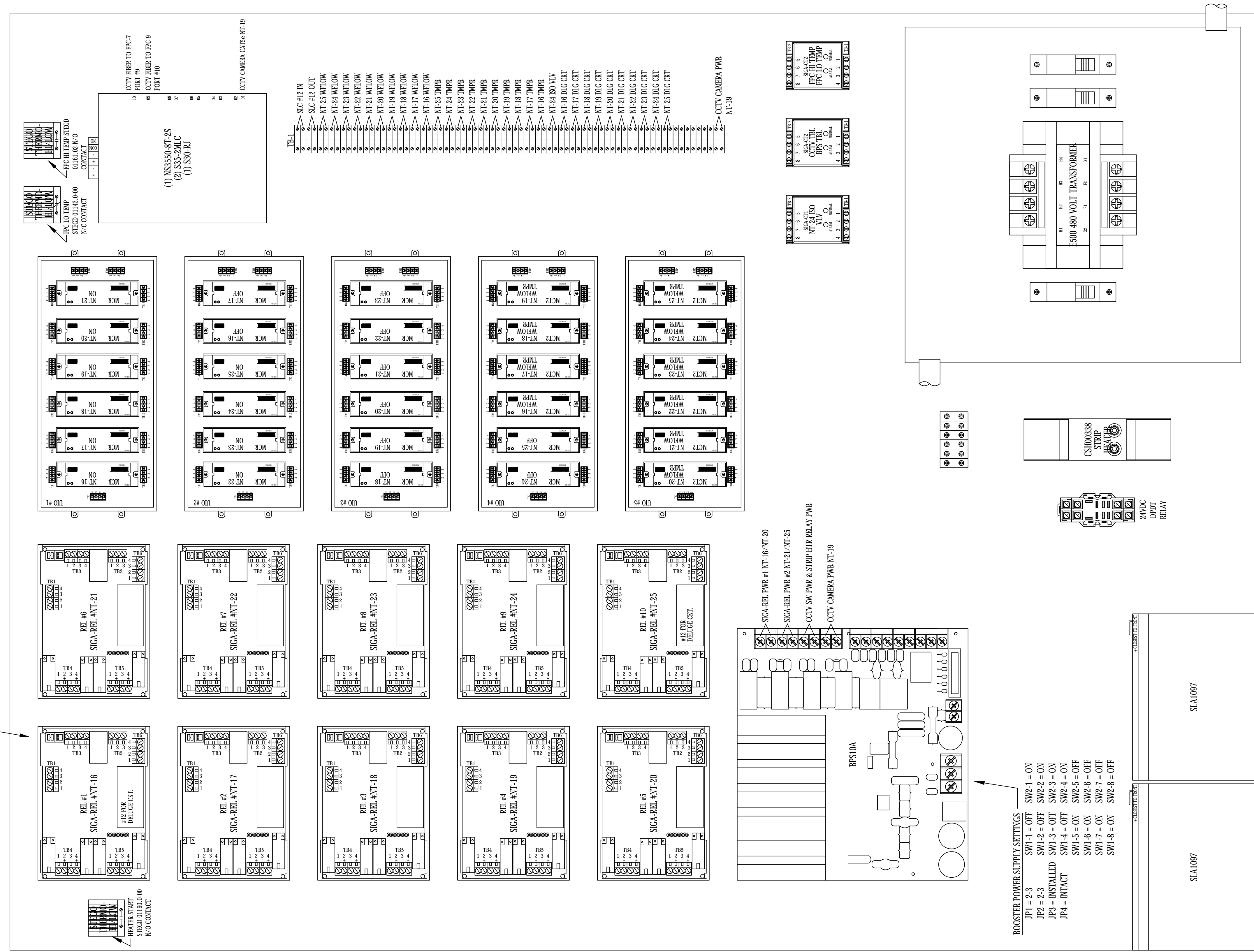
Revisions	Date
Num	Description

FIRE ALARM:  
 FIRE PROTECTION PANEL  
 FPC #06 WIRING DIAGRAM  
 Drawing Number  
**FA5.06**



IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS  
 SW1 = OFF SW5 = OFF  
 SW2 = OFF SW6 = OFF  
 SW3 = OFF SW7 = OFF  
 SW4 = OFF SW8 = OFF



ADDRESSES = 0403XXXX

1 FPC #08 PANEL LAYOUT  
 SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #08  
 EASTER OWENS NEMA 4X ENCLOSURE #41-50SF  
 SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 48" H)

EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360  
 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

**BARNARD EJMT TEAM**

BCER **BARNARD** **STURGEON** **RONDINELLI**  
 CONSULTING ENGINEERS  
 Western States Fire Protection Co.

Revisions	Date

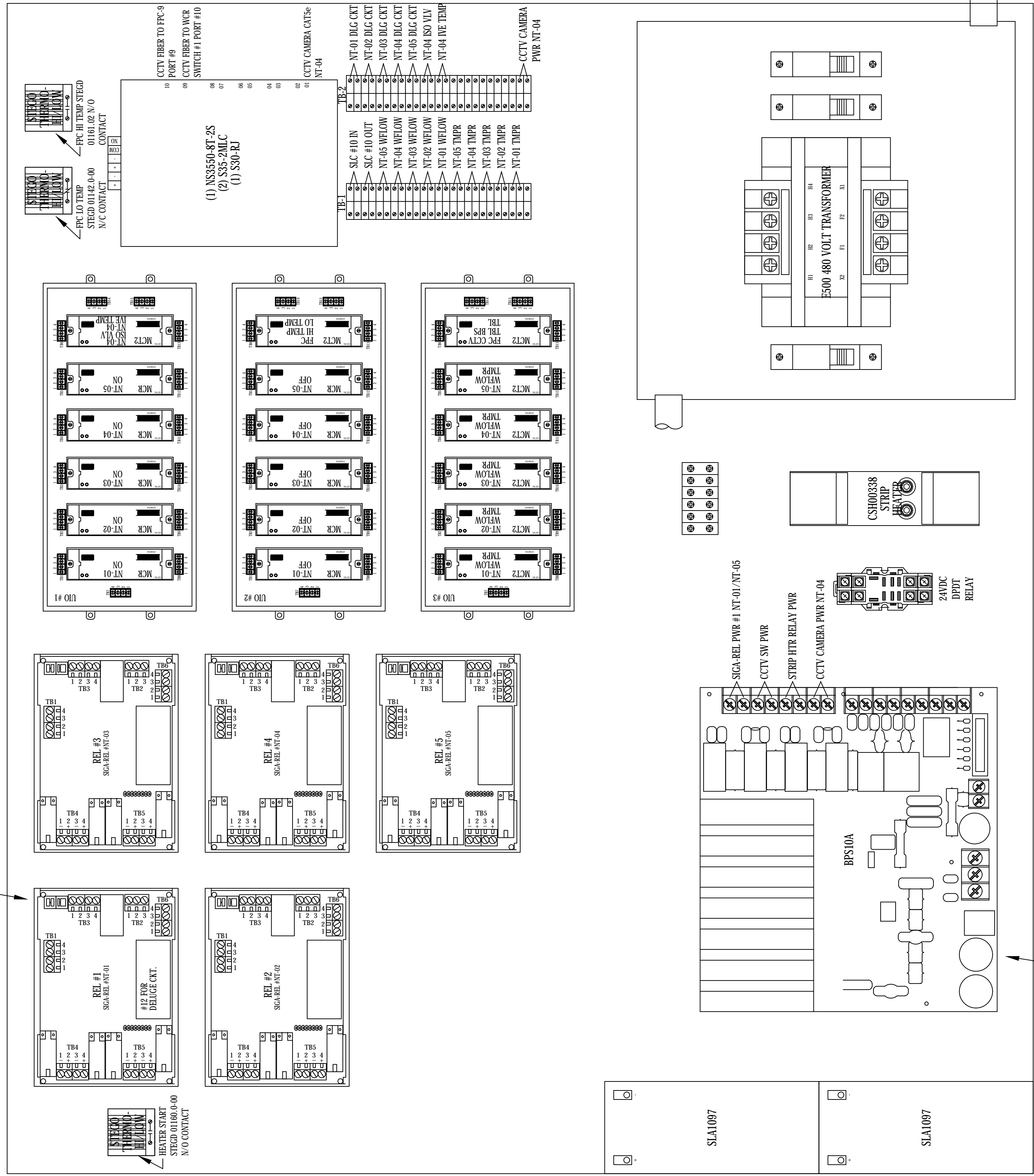
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 FIRE PROTECTION PANEL  
 FPC #08 WIRING DIAGRAM  
 Drawing Number  
**FA5.08**





IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS  
SW1 = OFF SW5 = OFF  
SW2 = OFF SW6 = OFF  
SW3 = OFF SW7 = OFF  
SW4 = OFF SW8 = OFF



ADDRESSES = 0402XXXX

1 FPC #10 PANEL LAYOUT  
SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #10  
EASTER OWENS NEMA 4X ENCLOSURE #31-40SF  
SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 32" H)

Revisions	Date

FIRE ALARM:  
FIRE PROTECTION PANEL  
FPC #10 WIRING DIAGRAM

Drawing Number  
**FA5.10**

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

**BARNARD EJMT TEAM**

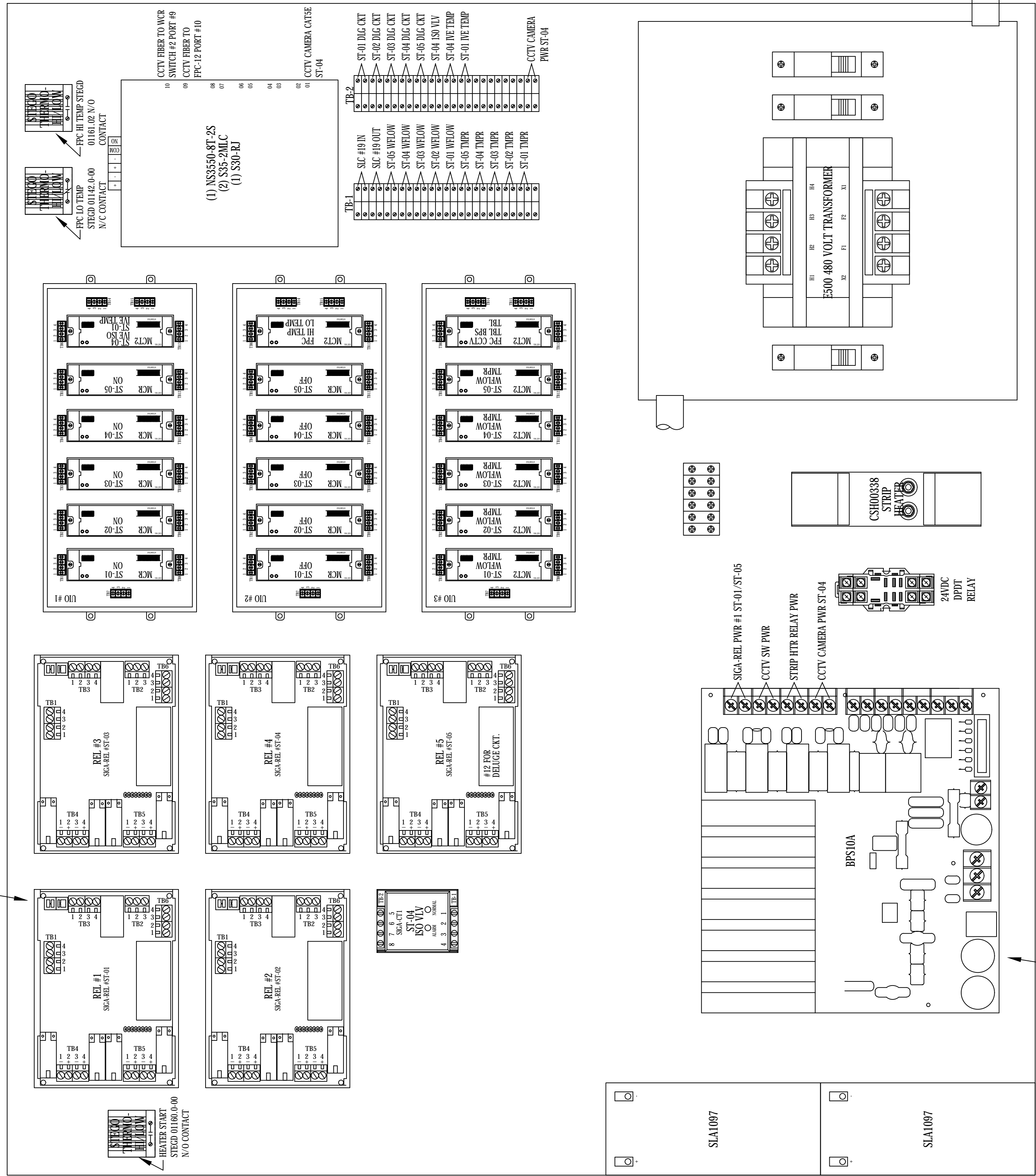
**BCER** **BARNARD** **RONDINELLI**  
Western States Fire Protection Co.

**Sturgeon Electric** **ALF** **ENGINEERS**

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS

- SW1 = OFF
- SW2 = OFF
- SW3 = OFF
- SW4 = OFF
- SW5 = OFF
- SW6 = OFF
- SW7 = OFF
- SW8 = OFF



ADDRESSES = 0602XXXX

BOOSTER POWER SUPPLY SETTINGS

- JP1 = 2-3
- JP2 = 2-3
- JP3 = INSTALLED
- JP4 = INTACT
- SW1-1 = OFF
- SW1-2 = OFF
- SW1-3 = OFF
- SW1-4 = OFF
- SW1-5 = ON
- SW1-6 = ON
- SW1-7 = ON
- SW1-8 = ON
- SW2-1 = ON
- SW2-2 = ON
- SW2-3 = ON
- SW2-4 = ON
- SW2-5 = OFF
- SW2-6 = OFF
- SW2-7 = OFF
- SW2-8 = OFF

1 FPC #11 PANEL LAYOUT  
SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #11  
EASTER OWENS NEMA 4X ENCLOSURE #31-40SF  
SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 32" H)

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Revisions	Date

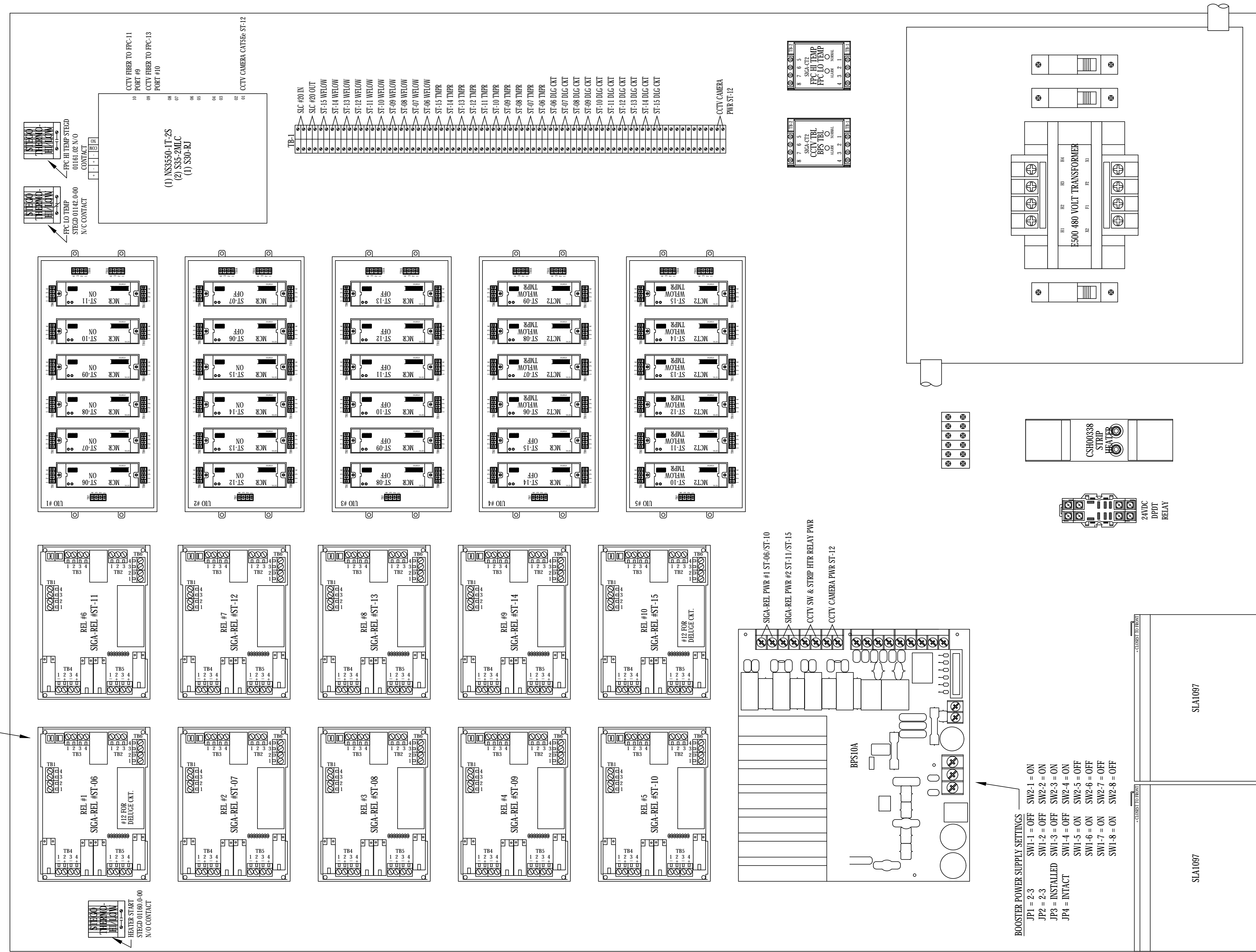
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FIRE PROTECTION PANEL  
FPC #11 WIRING DIAGRAM  
Drawing Number  
**FA5.11**

**BARNARD EJMT TEAM**

BCER **BARNARD** **RONDINELLI**  
Western States Fire Protection Co.  
Sturgeon Electric  
ELF  
Western States Fire Protection Co. ENGINEERS

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS  
 SW1 = OFF SW5 = OFF  
 SW2 = OFF SW6 = OFF  
 SW3 = OFF SW7 = OFF  
 SW4 = OFF SW8 = OFF



ADDRESSES = 0602XXXX

1 FPC #12 PANEL LAYOUT  
 SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #12  
 EASTER OWENS NEMA 4X ENCLOSURE #41-50SF  
 SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 48" H)

EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

Revisions	Date
Num	Description

FIRE ALARM:  
 FIRE PROTECTION PANEL  
 FPC #12 WIRING DIAGRAM

Drawing Number

FA5.12

DRAWN BY: B.T.L. CHECKED BY: AEE-JF

**BARNARD EJMT TEAM**

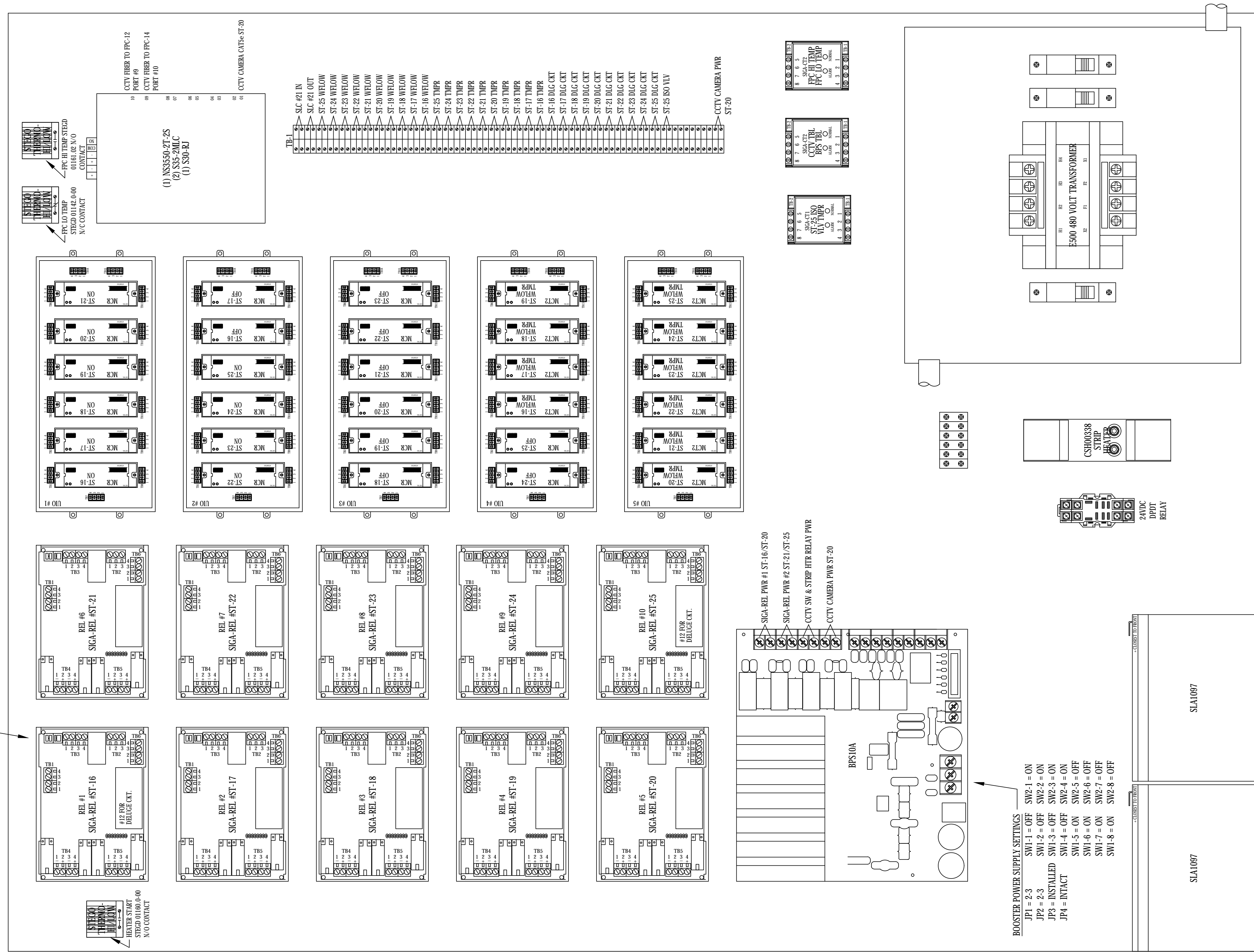
BCER **BARNARD** **STURGEON ELECTRIC**

RONDINELLI **Western States Fire Protection Co.**

Western States Fire Protection Co. ENGINEERS

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS  
 SW1 = OFF SW5 = OFF  
 SW2 = OFF SW6 = OFF  
 SW3 = OFF SW7 = OFF  
 SW4 = OFF SW8 = OFF



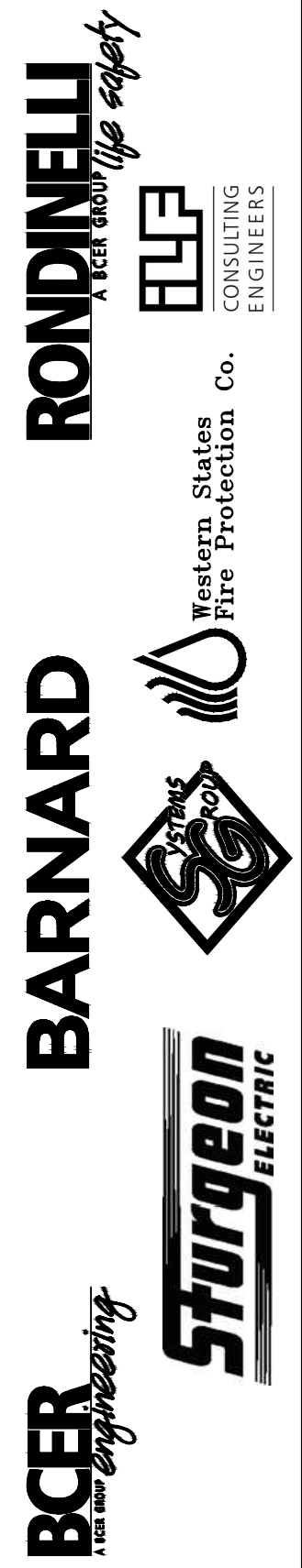
ADDRESSES = 0603XXXX

1 FPC #13 PANEL LAYOUT  
 SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #13  
 EASTER OWENS NEMA 4X ENCLOSURE #41-50SF  
 SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 48" H)

EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

BARNARD EJMT TEAM



Revisions	Date

FIRE ALARM:  
 FIRE PROTECTION PANEL  
 FPC #13 WIRING DIAGRAM

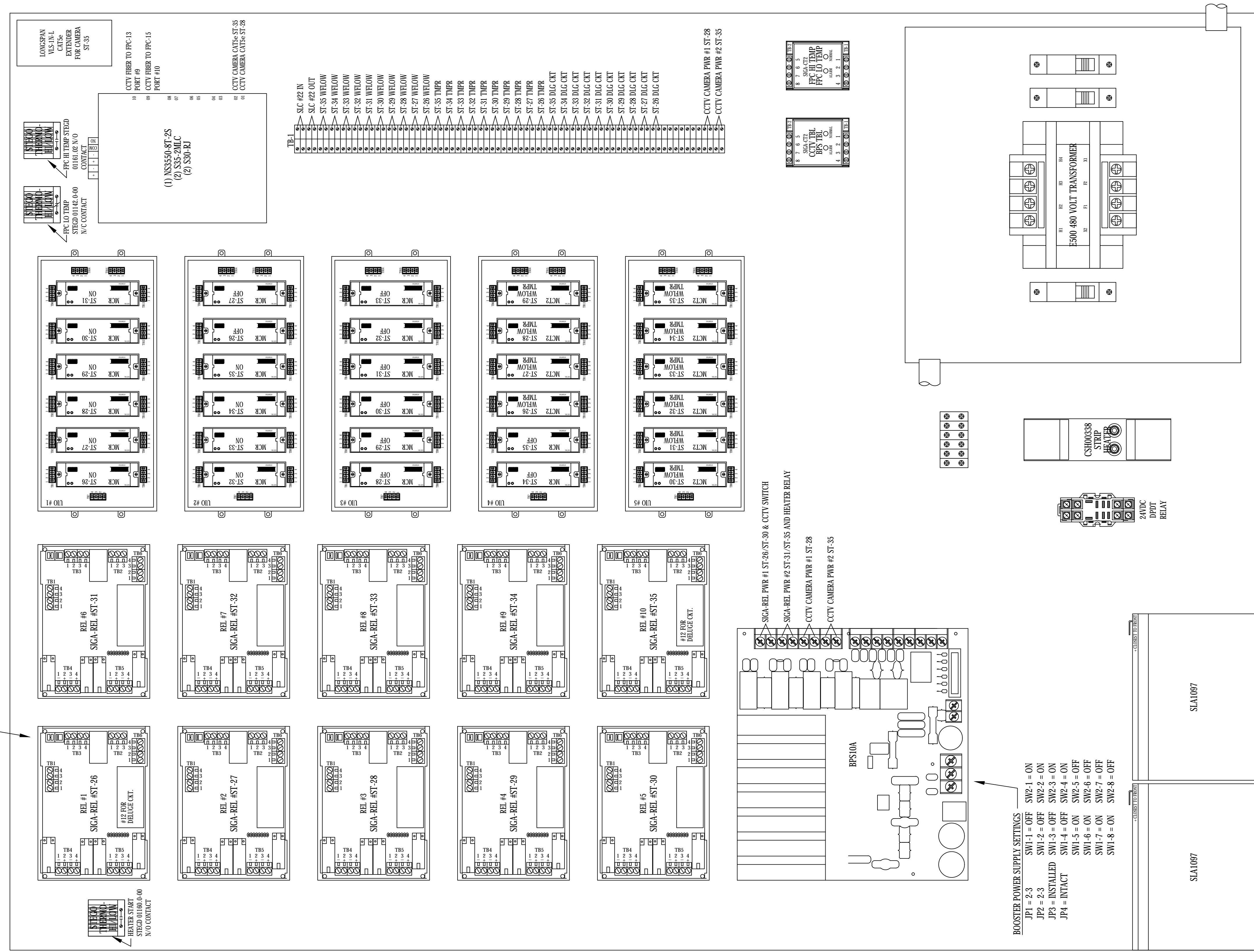
Drawing Number  
**FA5.13**

Project No. C0703-360  
 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

DRAWN BY: B.T.L. CHECKED BY: AEE-JF

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS  
 SW1 = OFF SW5 = OFF  
 SW2 = OFF SW6 = OFF  
 SW3 = OFF SW7 = OFF  
 SW4 = OFF SW8 = OFF



ADDRESSES = 0603XXXX

1 FPC #14 PANEL LAYOUT  
 SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #14  
 EASTER OWENS NEMA 4X ENCLOSURE #41-50SF  
 SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 48" H)

EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

Revisions	Date
Num	Description

FIRE ALARM:  
 FIRE PROTECTION PANEL  
 FPC #14 WIRING DIAGRAM

Drawing Number  
**FA5.14**

**BARNARD EJMT TEAM**

**BARNARD** **STURGEON ELECTRIC** **RONDINELLI**

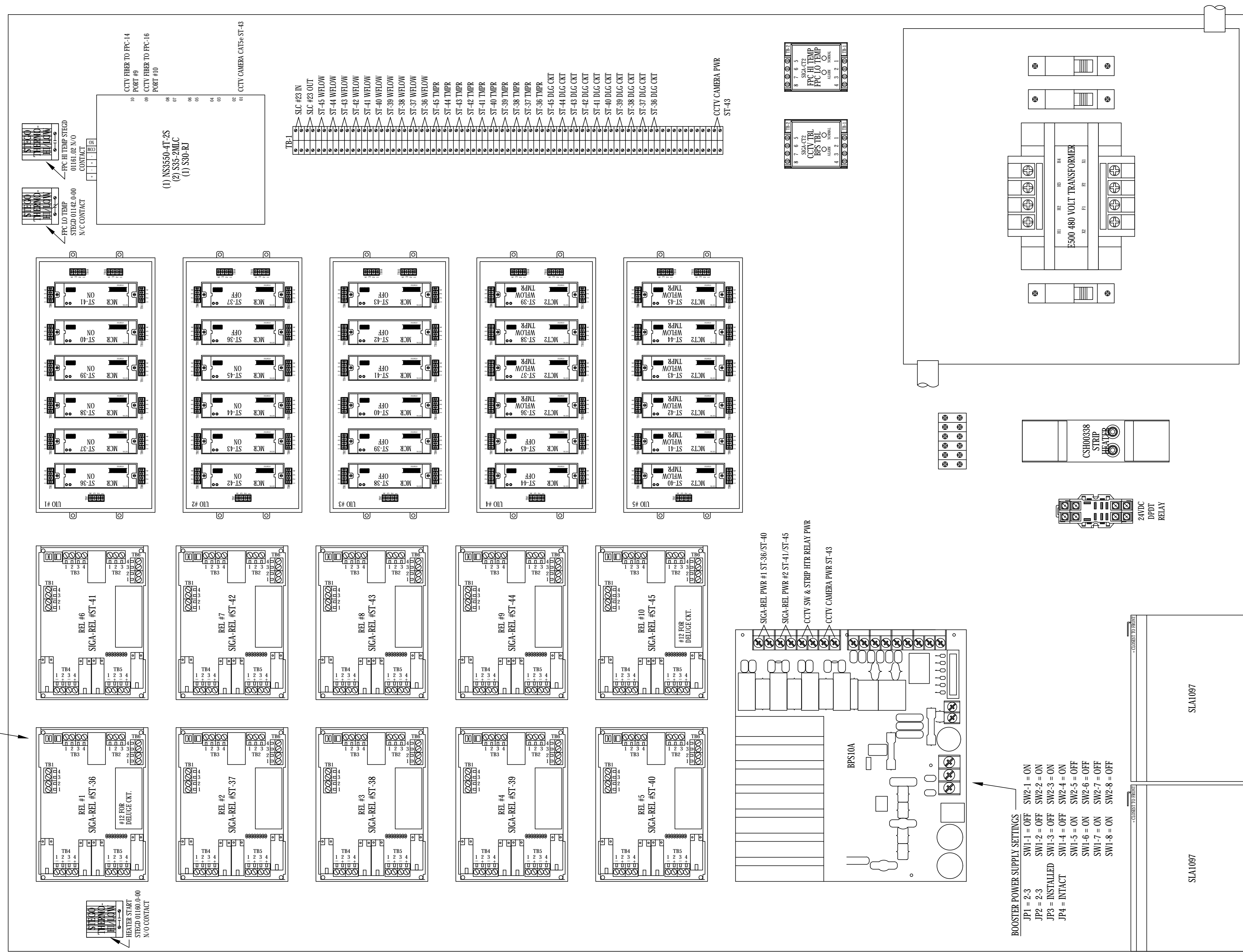
BCER **Sturgeon Electric** **Rondinelli** **Western States Fire Protection Co.**

Western States Fire Protection Co. ENGINEERS

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**TYPICAL SIGA-REL SWITCH SETTINGS**

- SW1 = OFF SW5 = OFF
- SW2 = OFF SW6 = OFF
- SW3 = OFF SW7 = OFF
- SW4 = OFF SW8 = OFF



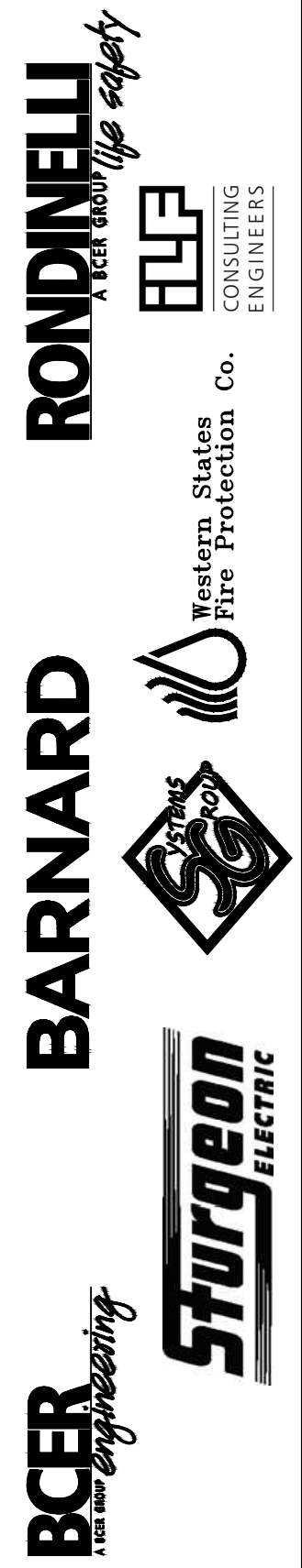
ADDRESSES = 0604XXXX

1 FPC #15 PANEL LAYOUT  
SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #15  
EASTER OWENS NEMA 4X ENCLOSURE #41-50SF  
SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 48" H)

**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT**

**BARNARD EJMT TEAM**



Revisions	Date

FIRE ALARM:  
FIRE PROTECTION PANEL  
FPC #15 WIRING DIAGRAM

Drawing Number  
**FA5.15**

Project No. C0703-360  
Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

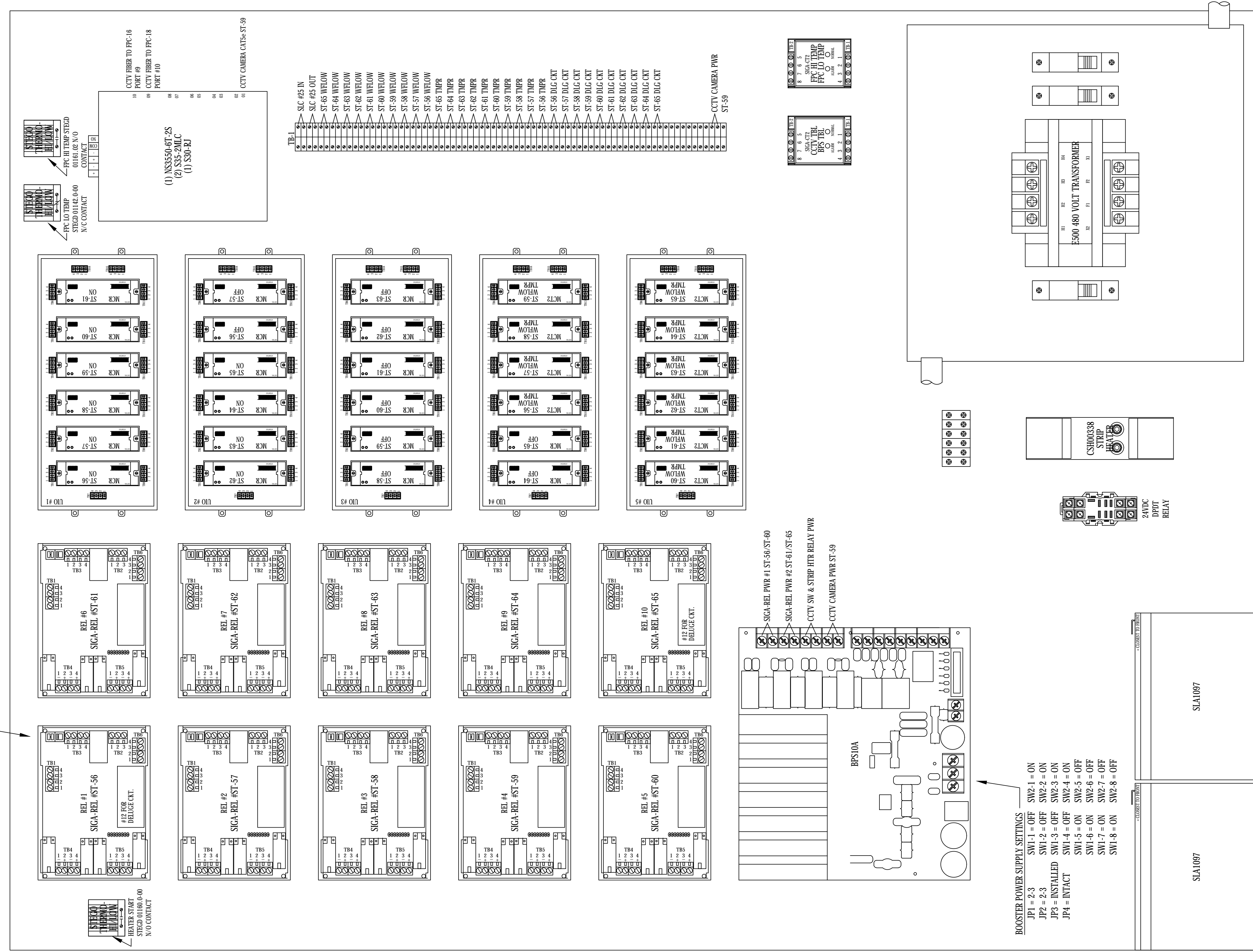
DRAWN BY: B.T.L. | CHECKED BY: AEE-JF





IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS  
SW1 = OFF SW5 = OFF  
SW2 = OFF SW6 = OFF  
SW3 = OFF SW7 = OFF  
SW4 = OFF SW8 = OFF



ADDRESSES = 0702XXXX

1 FPC #17 PANEL LAYOUT  
SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #17  
EASTER OWENS NEMA 4X ENCLOSURE #41-50SF  
SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 48" H)

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Revisions	Date
Num	Description

FIRE ALARM:  
FIRE PROTECTION PANEL  
FPC #17 WIRING DIAGRAM  
Drawing Number

FA5.17

**BARNARD EJMT TEAM**

**BARNARD** **STURGEON ELECTRIC** **RONDINELLI**

BCER **Western States Fire Protection Co.**

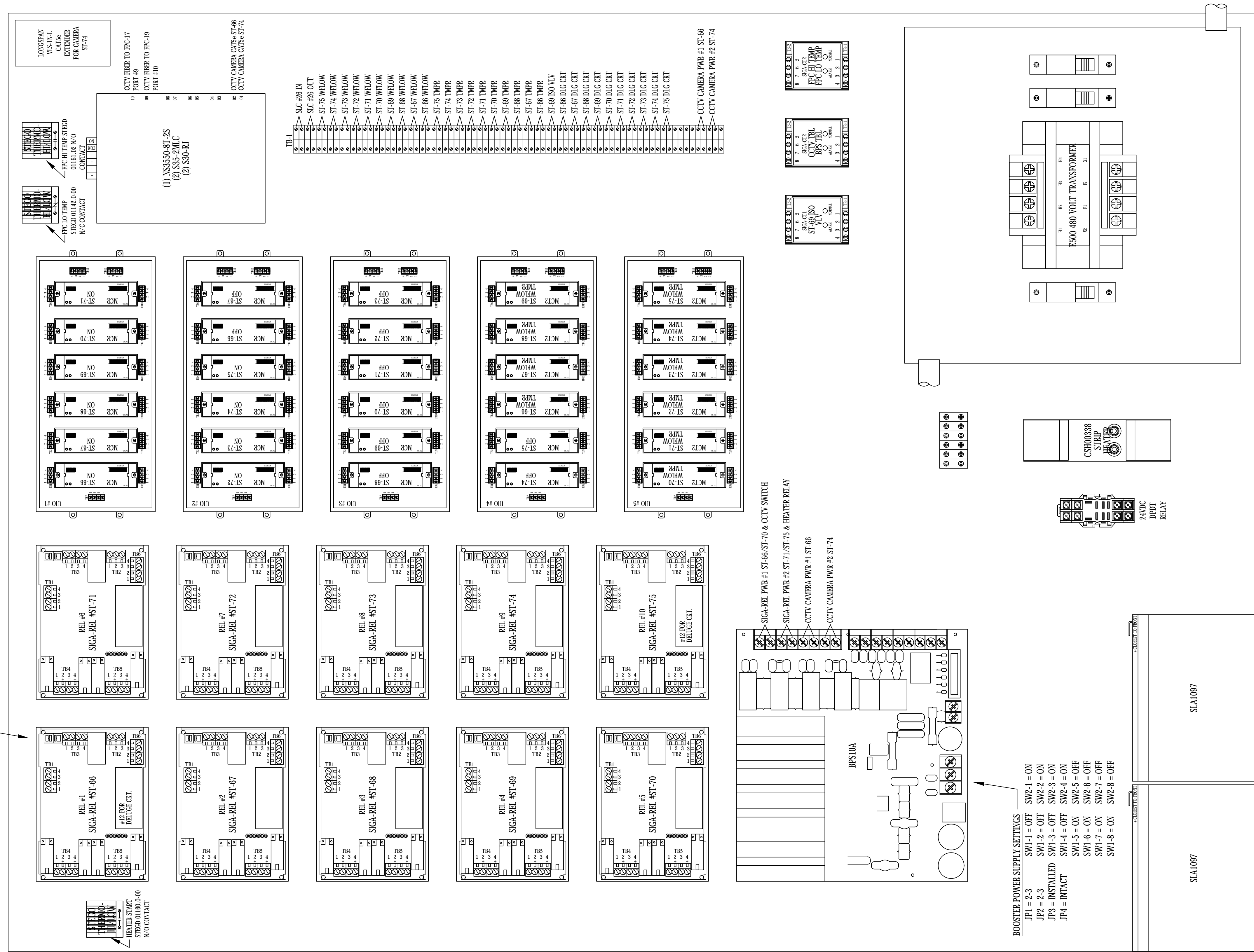
Sturgeon Electric logo: **Sturgeon ELECTRIC**

Rondinelli logo: **RONDINELLI** A COMMITMENT TO SAFETY

Western States Fire Protection Co. logo: **Western States Fire Protection Co.**

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS  
SW1 = OFF SW5 = OFF  
SW2 = OFF SW6 = OFF  
SW3 = OFF SW7 = OFF  
SW4 = OFF SW8 = OFF



ADDRESSES = 0703XXXX

1 FPC #18 PANEL LAYOUT  
SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #18  
EASTER OWENS NEMA 4X ENCLOSURE #41-50SF  
SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 48" H)

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360  
Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Table with 2 columns: Revisions (Num, Description, Date), FIRE ALARM: FIRE PROTECTION PANEL FPC #18 WIRING DIAGRAM, Drawing Number

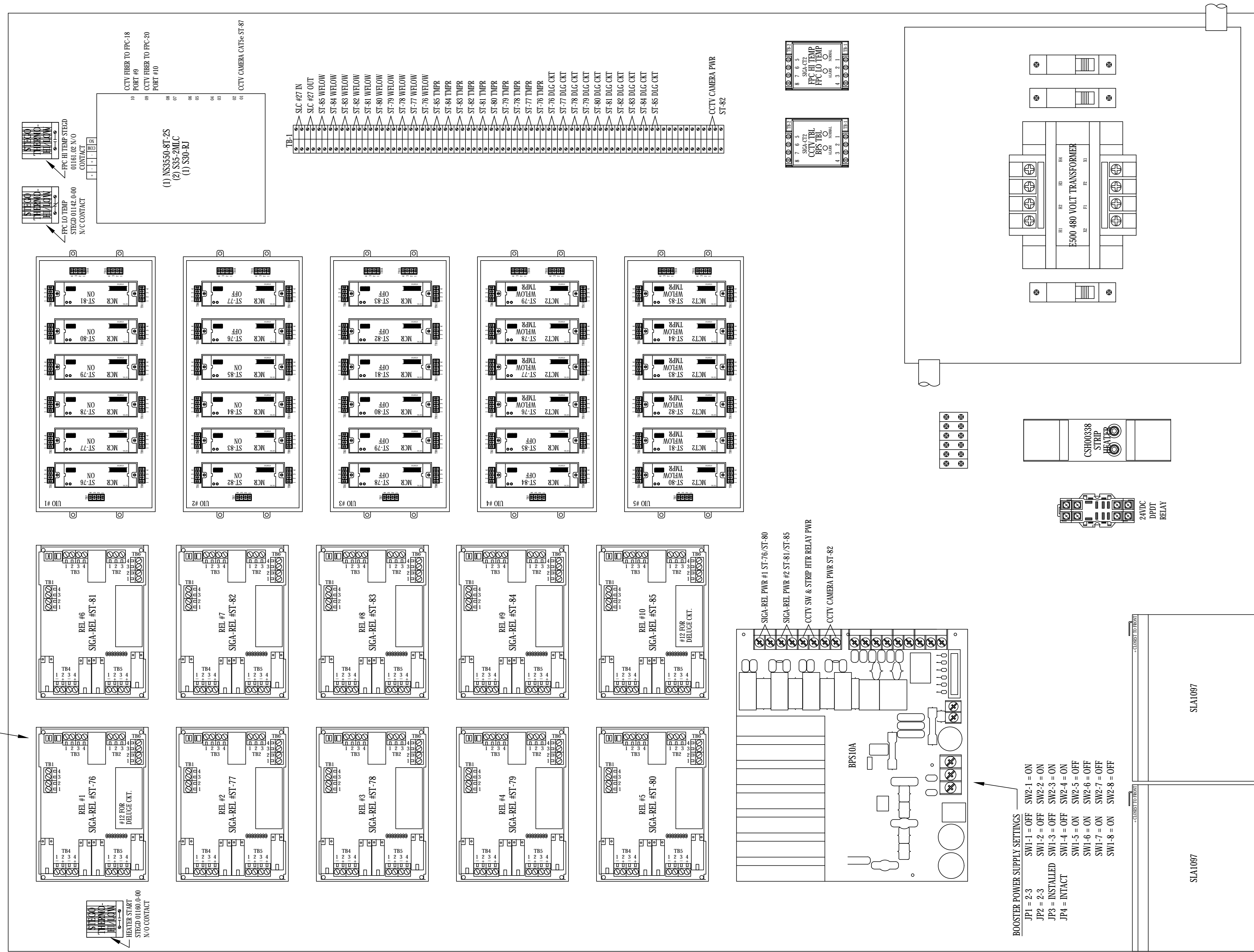
FA5.18

BARNARD EJMT TEAM

Logos for BCER, BARNARD, STURGEON ELECTRIC, RONNINELLI, and Western States Fire Protection Co.

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS  
 SW1 = OFF SW5 = OFF  
 SW2 = OFF SW6 = OFF  
 SW3 = OFF SW7 = OFF  
 SW4 = OFF SW8 = OFF



ADDRESSES = 0703XXXX

1 FPC #19 PANEL LAYOUT  
 SCALE: 1/2" SCALE

PANEL LAYOUT FOR FPC #19  
 EASTER OWENS NEMA 4X ENCLOSURE #41-50SF  
 SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 48" H)

EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-15

Revisions	Date
Num	Description

FIRE ALARM:  
 FIRE PROTECTION PANEL  
 FPC #19 WIRING DIAGRAM  
 Drawing Number

FA5.19

**BARNARD EJMT TEAM**

BCER **BARNARD** **STURGEON ELECTRIC** **RONDINELLI**

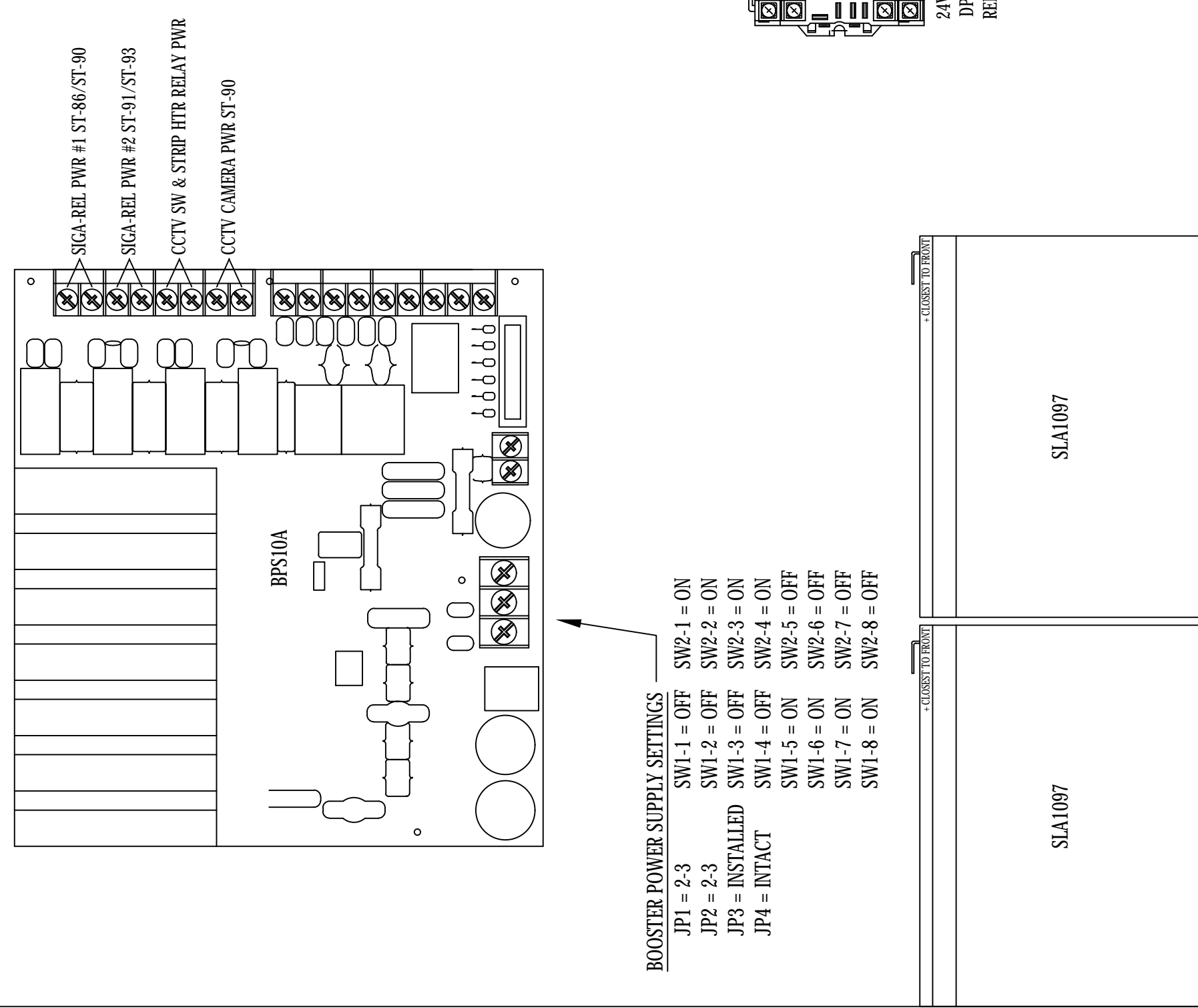
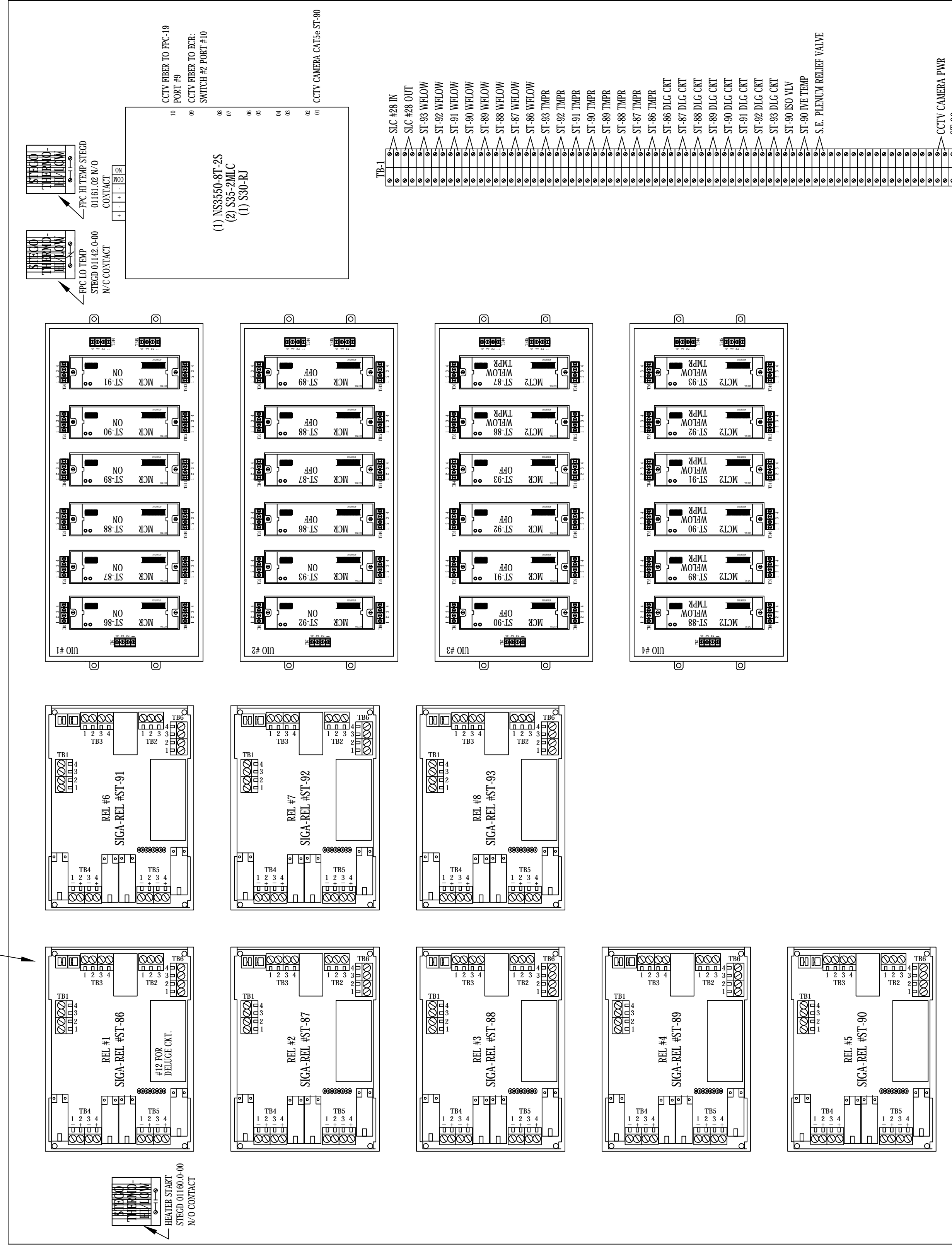
Western States Fire Protection Co. **ELF** CONSULTING ENGINEERS

A COMMITMENT TO SAFETY

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

TYPICAL SIGA-REL SWITCH SETTINGS

- SW1 = OFF SW5 = OFF
- SW2 = OFF SW6 = OFF
- SW3 = OFF SW7 = OFF
- SW4 = OFF SW8 = OFF



- BOOSTER POWER SUPPLY SETTINGS
- JP1 = 2-3 SW1-1 = OFF SW2-1 = ON
  - JP2 = 2-3 SW1-2 = OFF SW2-2 = ON
  - JP3 = INSTALLED SW1-3 = OFF SW2-3 = ON
  - JP4 = INTACT SW1-4 = OFF SW2-4 = ON
  - SW1-5 = ON SW2-5 = OFF
  - SW1-6 = ON SW2-6 = OFF
  - SW1-7 = ON SW2-7 = OFF
  - SW1-8 = ON SW2-8 = OFF

ADDRESSES = 0704XXXX

PANEL LAYOUT FOR FPC #20  
EASTER OWENS NEMA 4X ENCLOSURE #41-50SF  
SHOWN AT HALF SCALE (ACTUAL SIZE: 36" W x 48" H)

Revisions	
Num	Description Date

FIRE ALARM:  
FIRE PROTECTION PANEL  
FPC #20 WIRING DIAGRAM

Drawing Number  
**FA5.20**

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

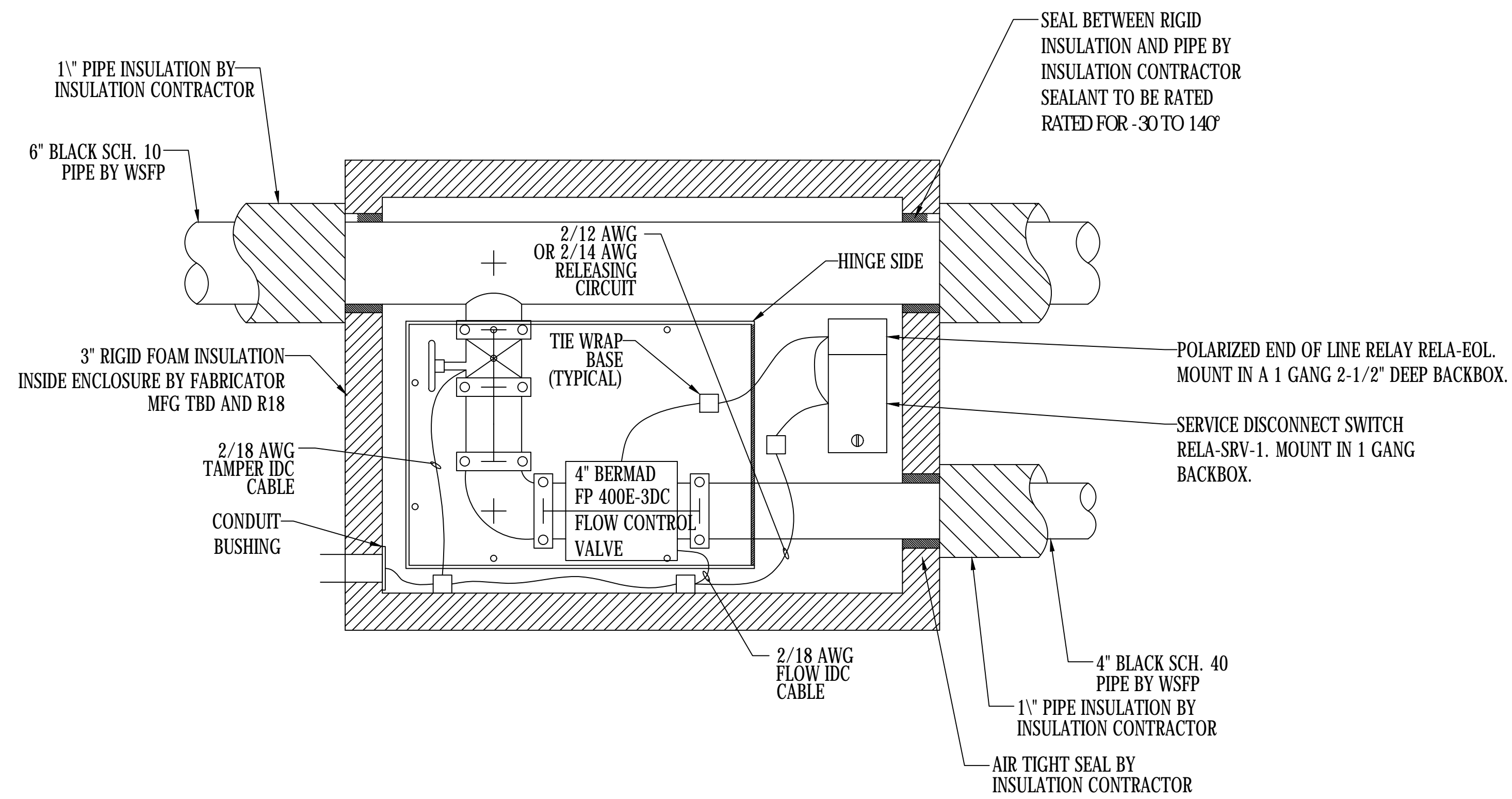
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

**BARNARD EJMT TEAM**

BCER **BARNARD** **STURGEON** **RONDINELLI**

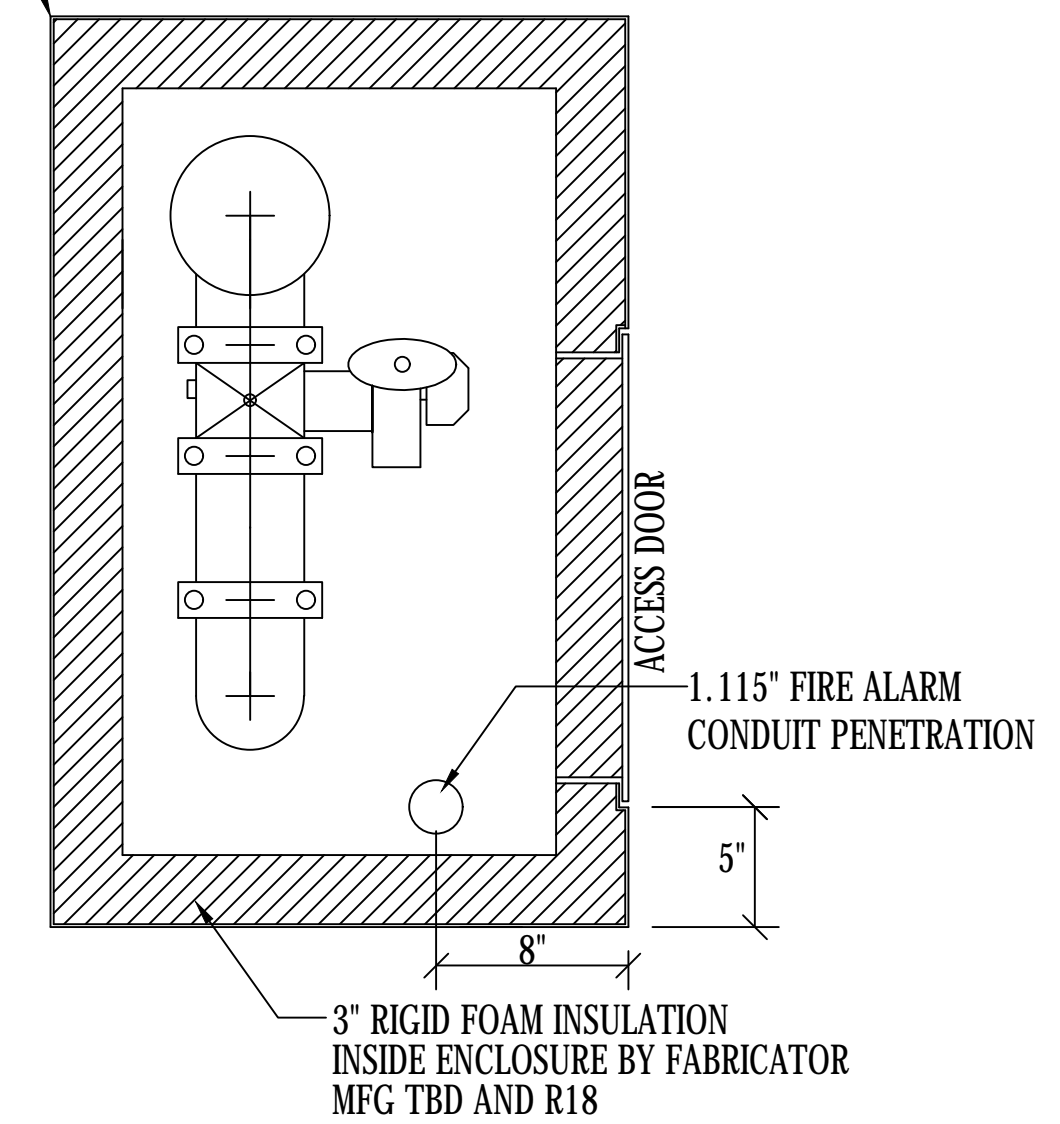
Western States Fire Protection Co.  
ELECTRIC ENGINEERS

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



1 IVE CABINET - FRONT VIEW  
SCALE: N.T.S.

PINCH POINT THIS EDGE OF ENCLOSURE IS CLOSE TO CURVED TUNNEL WALL AND CAN NOT BE INCREASED TO ALLOW FOR INSTALLATION



2 IVE CABINET - SIDE VIEW  
SCALE: N.T.S.

**BARNARD EJMT TEAM**

**BCER** *Engineering*

**BARNARD**

**STURGEON** ELECTRIC

**RONDINELLI** *A COMMITMENT TO SAFETY*

**ELF** CONSULTING ENGINEERS

Western States Fire Protection Co.

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

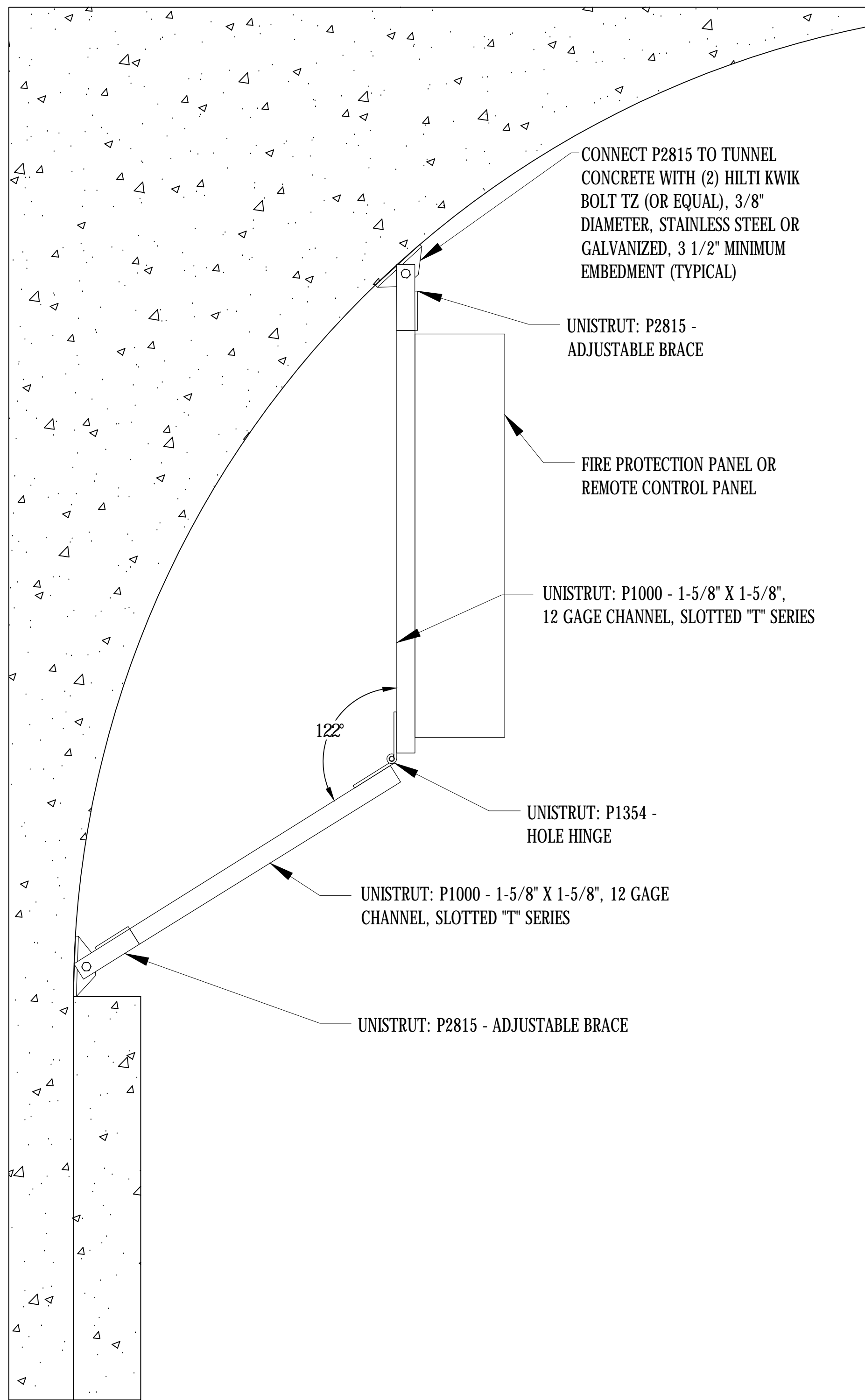
Num	Revisions	Description	Date

FIRE ALARM:  
IVE CABINET DETAILS

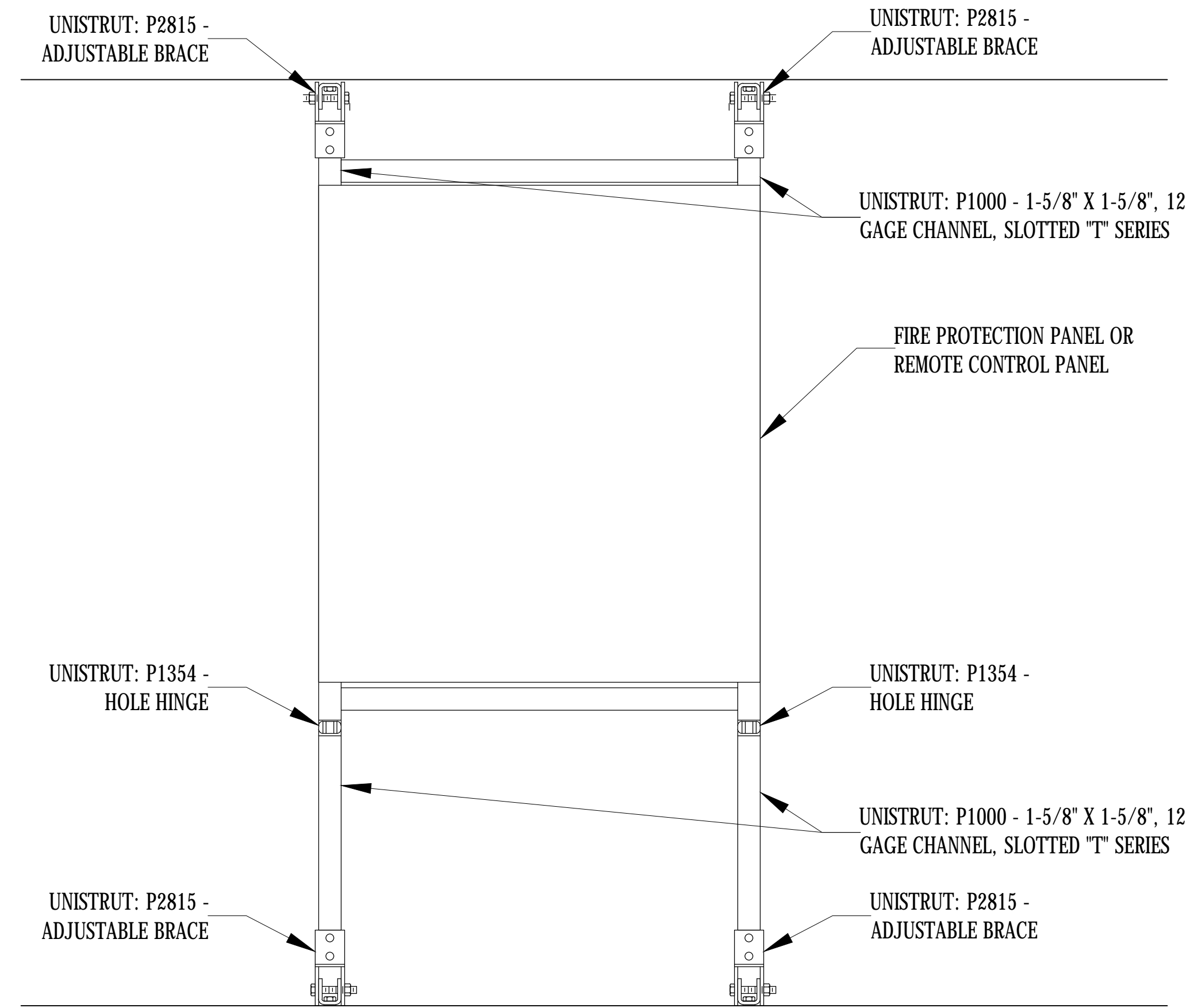
Drawing Number  
**FA5.21**

DRAWN BY: B.T.L. | CHECKED BY: AEE-JR

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1 TYPICAL FIRE PROTECTION CABINET/REMOTE CONTROL PANEL (FPC/RCP) MOUNTING DETAIL - SIDE VIEW  
SCALE: N.T.S.



2 TYPICAL FIRE PROTECTION CABINET/REMOTE CONTROL PANEL (FPC/RCP) MOUNTING DETAIL - FRONT VIEW  
SCALE: N.T.S.

Description	Qty	Weight	Total Weight
Fire Protection Cabinet			
41-50SF Back Box & Back Plane	1	265	265
VR1TMS 5V Pwr Module	1	0.15	0.15
24DC12 12V Pwr Module	1	0.45	0.45
MC350-1T/1S CCTV Switch	1	1.2	1.2
MCR300-1T/2S Media Converter	1	0.5	0.5
MCR300-1T/1S Media Converter	2	0.5	1
S35-2MLC SFP Transceivers	2	0.6	1.2
BPS10A Power Supply	1	13	13
SLA-1097 Battery	2	7.1	14.2
SIGA-REL Releasing Module	10	0.52	5.2
SIGA-MCR Relay Module	20	0.18	3.6
SIGA-MCT2 Input Module	10	0.1	1
SIGA-U06 Motherboard	5	0.56	2.8
SIGA-CT2 Input Module	1	0.4	0.4
SIGA-CT1 Input Module	1	0.4	0.4
480v-120v Transformer	1	10	10
Transformer Barrier	1	3	3
Wire	1	20	20
Total			343.1

3 FIRE PROTECTION CABINET MAX WEIGHT CALCULATIONS  
SCALE: NONE

Description	Qty	Weight	Total Weight
Remote Control Panel			
31-40SF Back Box & Back Plane	1	265	265
3-CHAST Chassis	1	8.4	8.4
3-LCD Display Module	1	0.8	0.8
3-CPU3 CPU Module	1	0.7	0.7
3-PPS/M Power Supply	1	5	5
3-SSDC1 SLC Module	1	0.5	0.5
3-SSDC1 SLC Module	2	0.5	1
3-12SR Control Module	1	0.1	0.1
3-LRMF Rail Module	1	0.35	0.35
3-FP Filler Plate	4	0.1	0.4
3-FIBM2 Fiber Comm Interface	1	1	1
MMXVR Transceiver	2	0.5	1
SLA-1075 Battery	2	5.6	11.2
480v-120v Transformer	1	10	10
Transformer Barrier	1	3	3
Wire	1	5	5
Total			313.45

4 REMOTE CONTROL PANEL MAX WEIGHT CALCULATIONS  
SCALE: NONE

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

**BARNARD EJMT TEAM**

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Western States  
Fire Protection Co.

Sturgeon  
ELECTRIC

SG  
Sturgeon  
Electric

Western States  
Fire Protection Co.

ALP  
Consulting  
Engineers

RONDINELLI  
A fire safety life safety

Revisions	Date
Num	Description

FIRE ALARM:  
FIRE PROTECTION PANEL  
MOUNTING DETAILS

Drawing Number

**FA5.22**

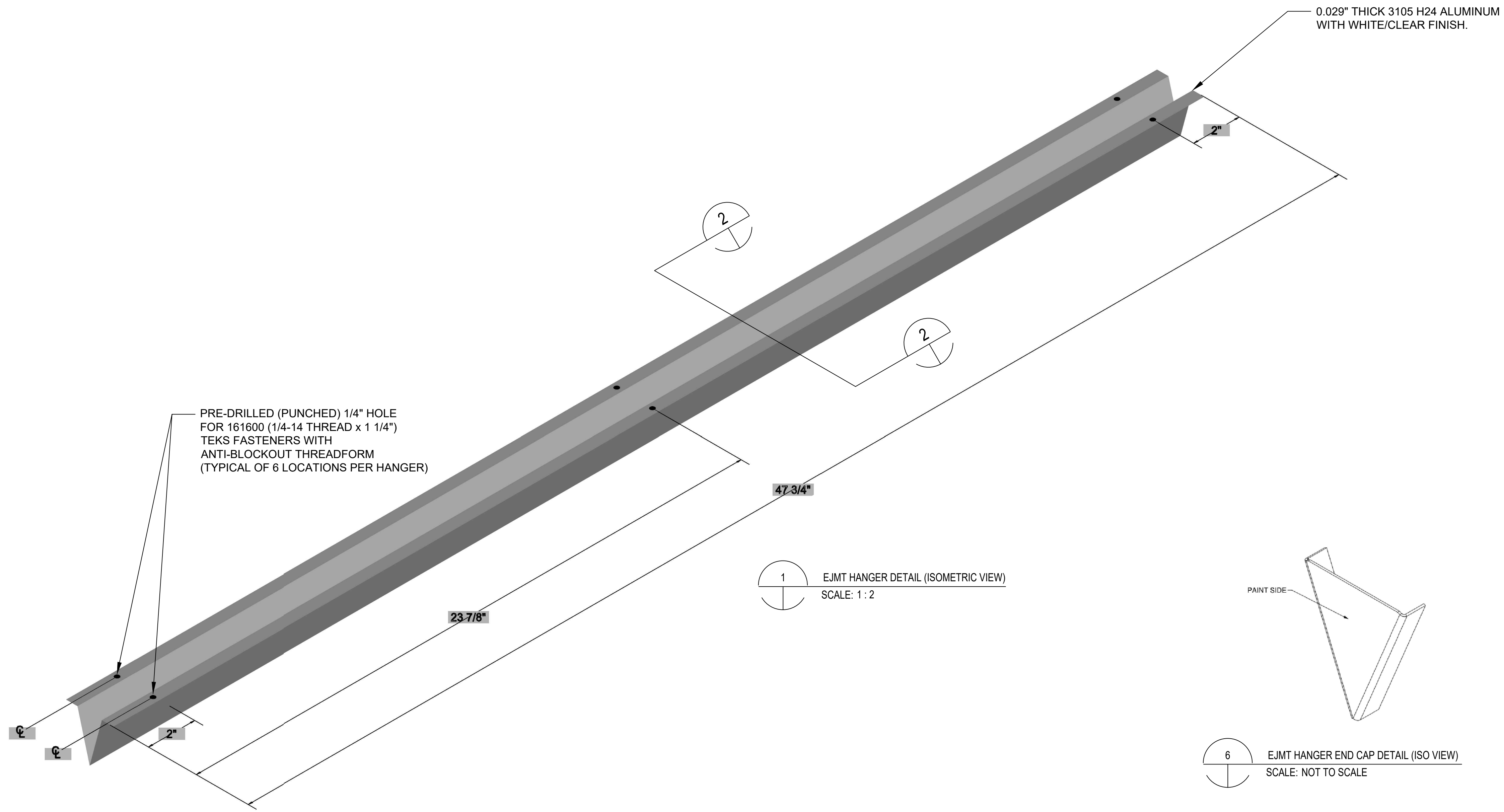
Subaccount 17810

Project No. C0703-360

RECORD DRAWINGS - 2015-11-16

DRAWN BY: B.T.L. | CHECKED BY: AEE-JT

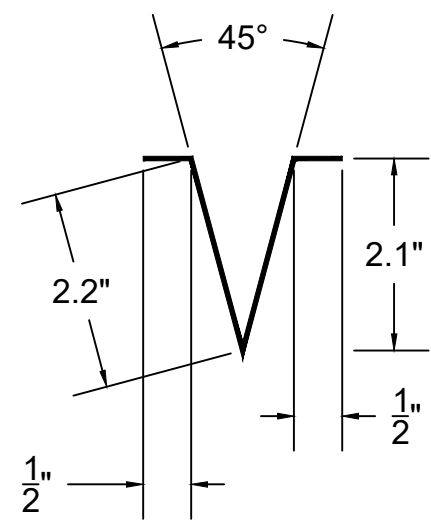
IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



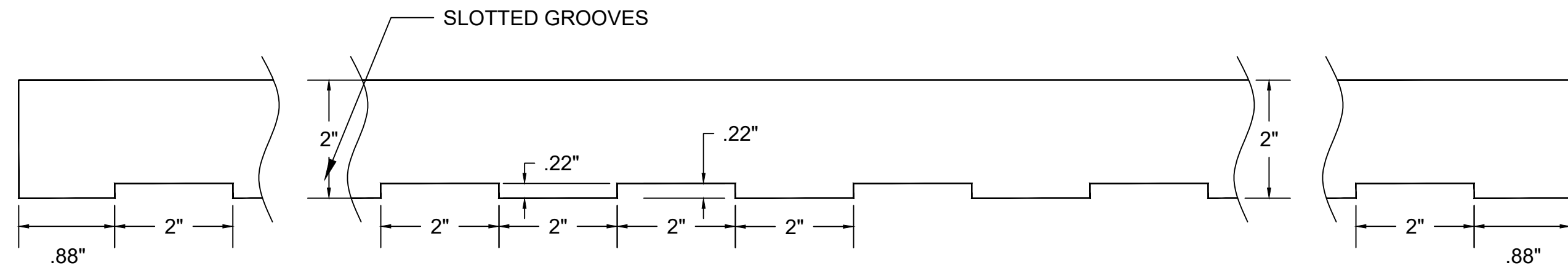
PRE-DRILLED (PUNCHED) 1/4" HOLE FOR 161600 (1/4-14 THREAD x 1 1/4") TEKS FASTENERS WITH ANTI-BLOCKOUT THREADFORM (TYPICAL OF 6 LOCATIONS PER HANGER)

0.029" THICK 3105 H24 ALUMINUM WITH WHITE/CLEAR FINISH.

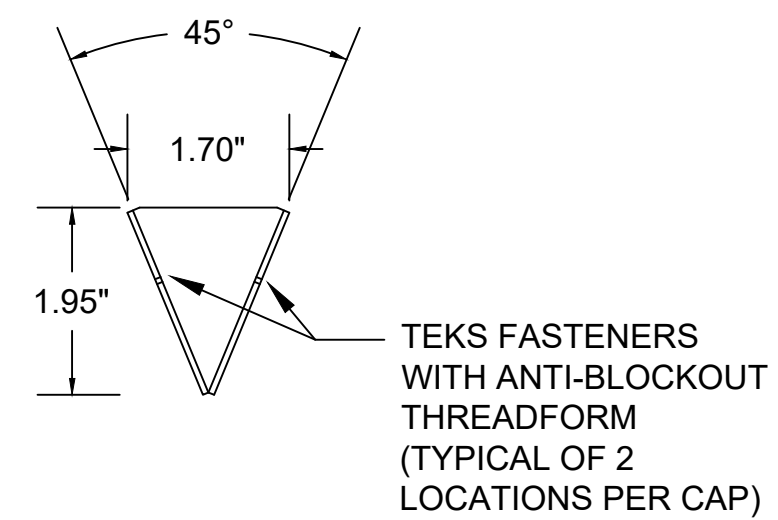
2 EJMT HANGER DETAIL (FRONT VIEW)  
SCALE: 1 : 2



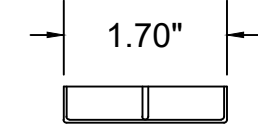
3 EJMT HANGER DETAIL (SIDE VIEW)  
SCALE: 1 : 2



4 EJMT HANGER END CAP DETAIL (FRONT VIEW)  
SCALE: 1 : 2

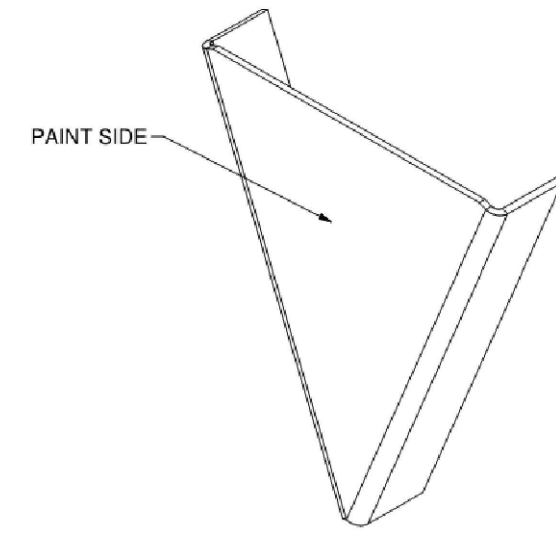


5 EJMT HANGER END CAP DETAIL (TOP VIEW)  
SCALE: 1 : 2



1 EJMT HANGER DETAIL (ISOMETRIC VIEW)  
SCALE: 1 : 2

6 EJMT HANGER END CAP DETAIL (ISO VIEW)  
SCALE: NOT TO SCALE



**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

**BARNARD EJMT TEAM**

**BARNARD**

**BCER**  
BARNARD CONSULTING ENGINEERS

**STURGEON ELECTRIC**

**Western States Fire Protection Co.**

**RONDINELLI**  
A SAFE APPROACH TO LIFE SAFETY

**ELF**  
CONSULTING ENGINEERS

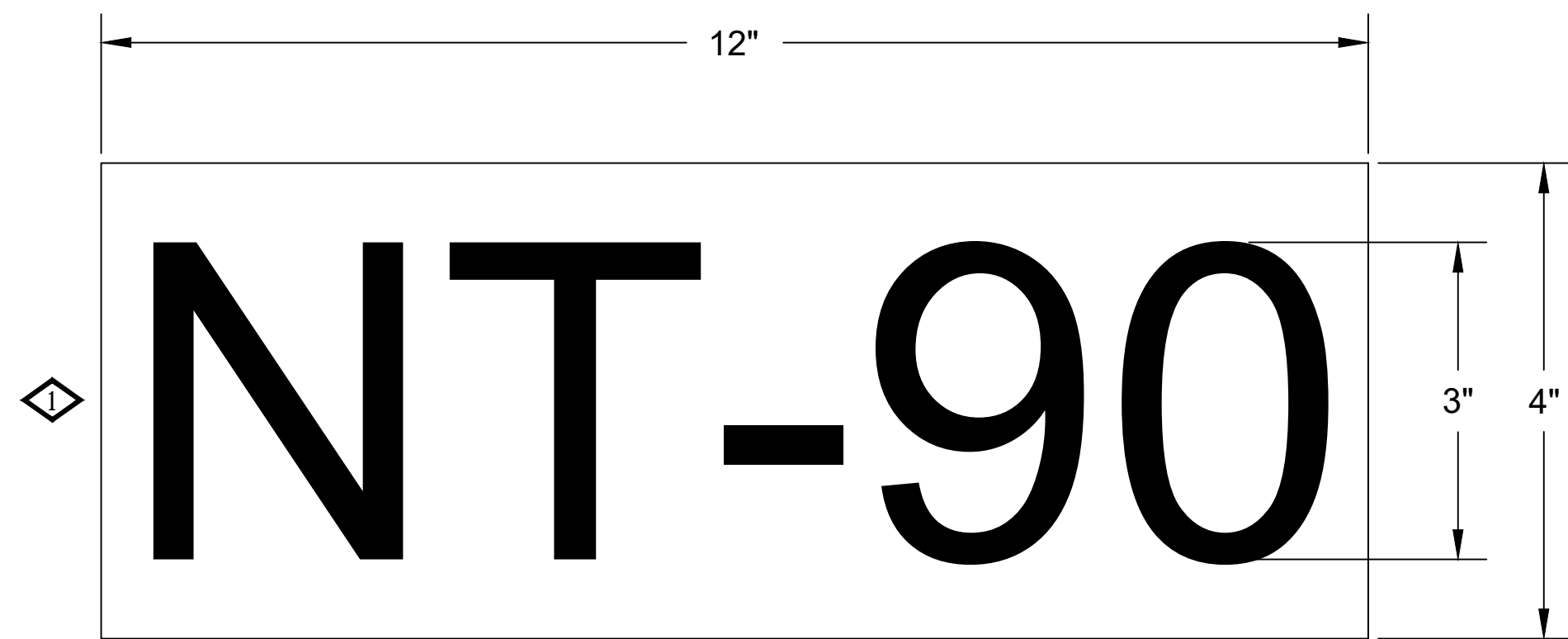
Revisions	Date
Num	Description

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

FIRE ALARM:  
DETAILS - LINEAR HEAT HANGER

Drawing Number

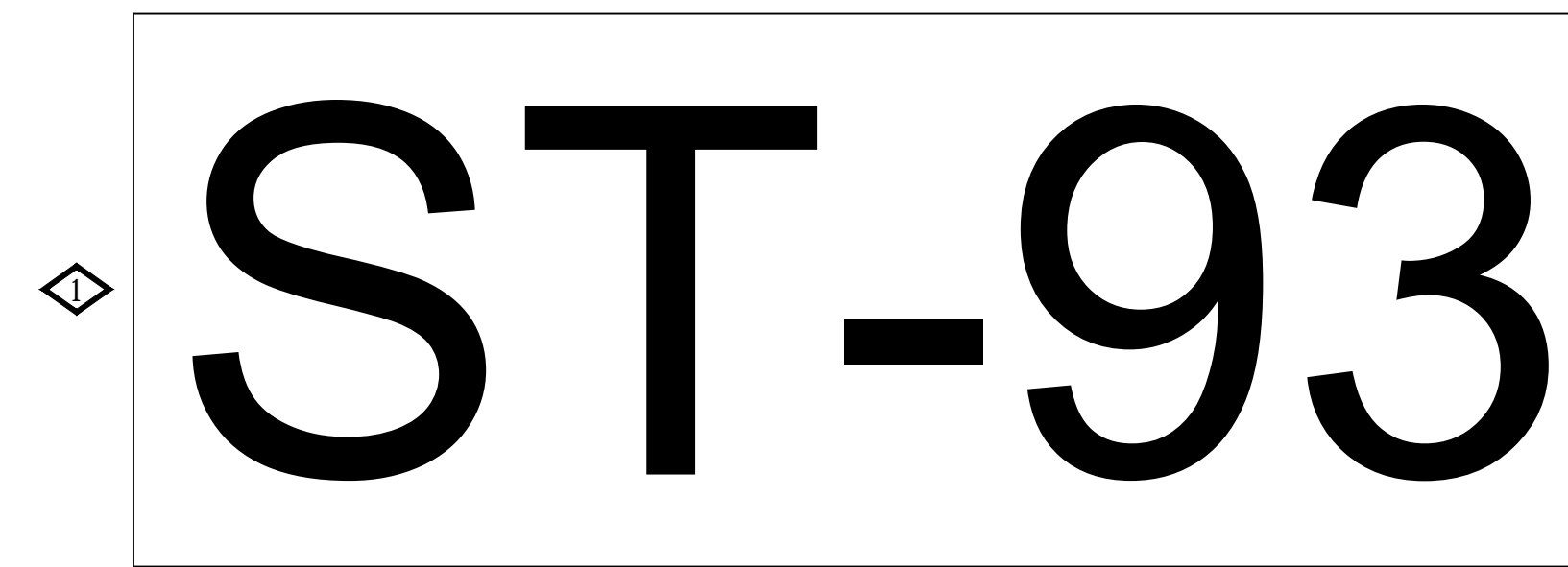
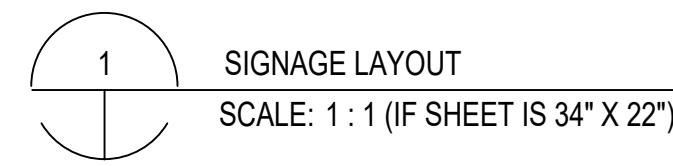
**FA6.01**



**EISENHOWER (NORTH) TUNNEL**

NORTH TUNNEL = NT-1 THRU NT-90  
 WEST PORTAL = NT-1, NT-2, & NT-3  
 INTERNAL NORTH TUNNEL = NT-4 THRU NT-87  
 EAST PORTAL = NT-88, NT-89, & NT-90

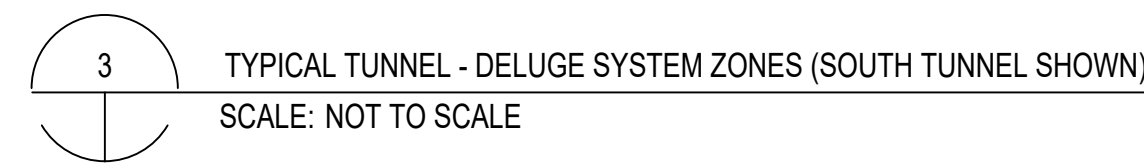
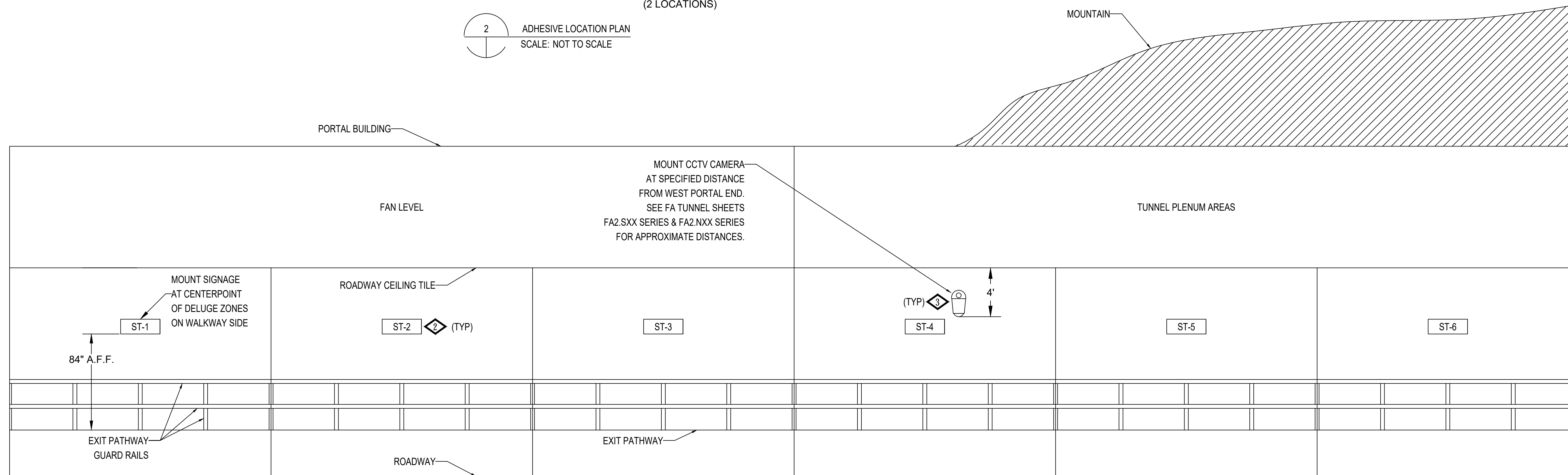
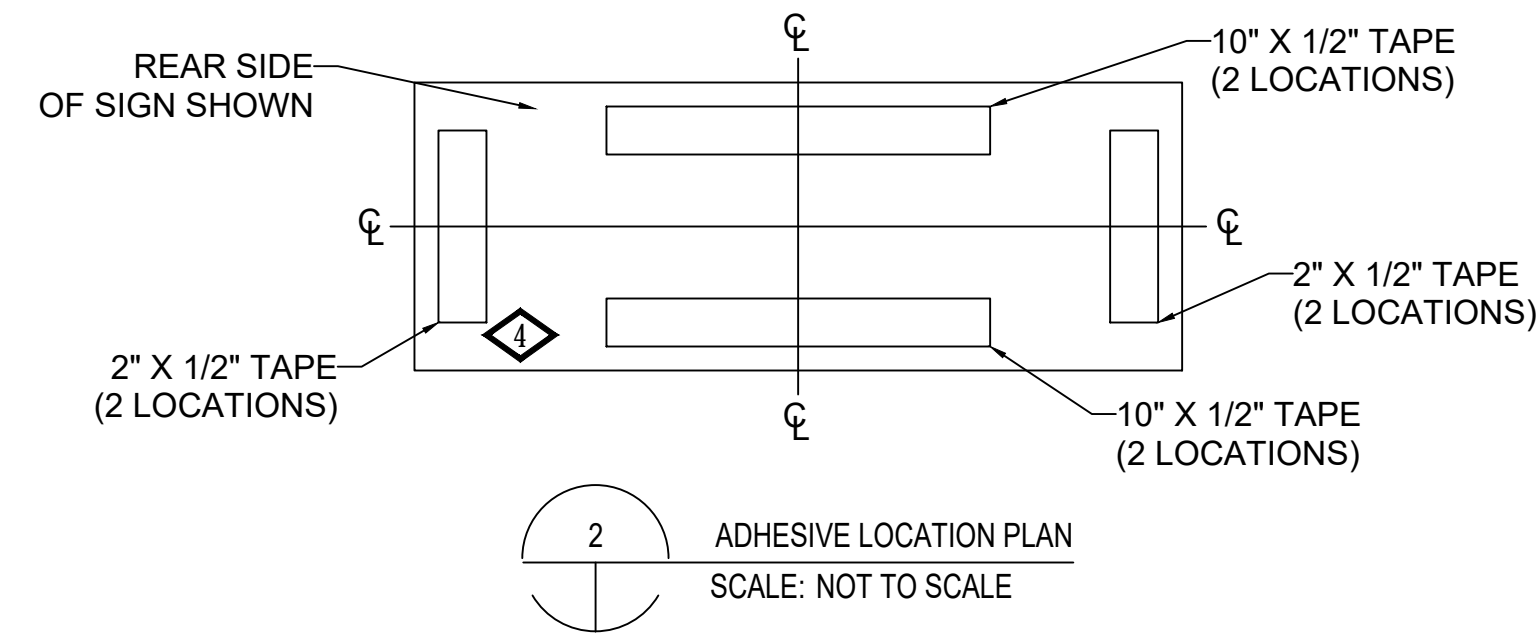
TUNNEL ZONING DELUGE SYSTEM IS FROM WEST TO EAST NUMERICALLY IN BOTH TUNNELS.  
 ARIAL FONT SHALL BE UTILIZED.



**JOHNSON (SOUTH) TUNNEL**

SOUTH TUNNEL = ST-1 THRU ST-93  
 WEST PORTAL = ST-1, ST-2, & ST-3  
 INTERNAL SOUTH TUNNEL = ST-4 THRU ST-90  
 EAST PORTAL = ST-91, ST-92, & ST-93

TUNNEL ZONING DELUGE SYSTEM IS FROM WEST TO EAST NUMERICALLY IN BOTH TUNNELS.  
 ARIAL FONT SHALL BE UTILIZED.



- DETAIL NOTES:**
- 1 SIGN MATERIAL IS 3M REFLECTIVE 280i VINYL, WHITE, WITH BLACK ADHESIVE LETTERING. SIGN BACKER MATERIAL IS 0.032" THICK ALUMINUM.
  - 2 THE BOTTOM OF THE DELUGE ZONE SIGN WILL BE LOCATED APPROXIMATELY 3" ABOVE THE EXISTING TUNNEL SEGMENT SIGN.
  - 3 FIRE ALARM CCTV CAMERAS WILL BE MOUNTED WITH BOTTOM OF LENS AT 4' BELOW THE CEILING TILE. EXISTING TRAFFIC CONTROL CAMERAS ARE MOUNTED WITH THE BOTTOM OF THE LENS AT APPROXIMATELY 7' 6" BELOW THE CEILING TILE.
  - 4 SIGN ADHESIVE IS 3M VHB TAPE. TYPE 4941F X 1/2" WIDE.

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**BARNARD EJMT TEAM**

**BARNARD**

**BARNARD**

**STURGEON ELECTRIC**

**BARNARD**

**RONDINELLI**

**Western States Fire Protection Co.**

**ALF**

**ENGINEERS**

**EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT**

Project No. C0703-360 Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

Revisions	Date
Num	Description

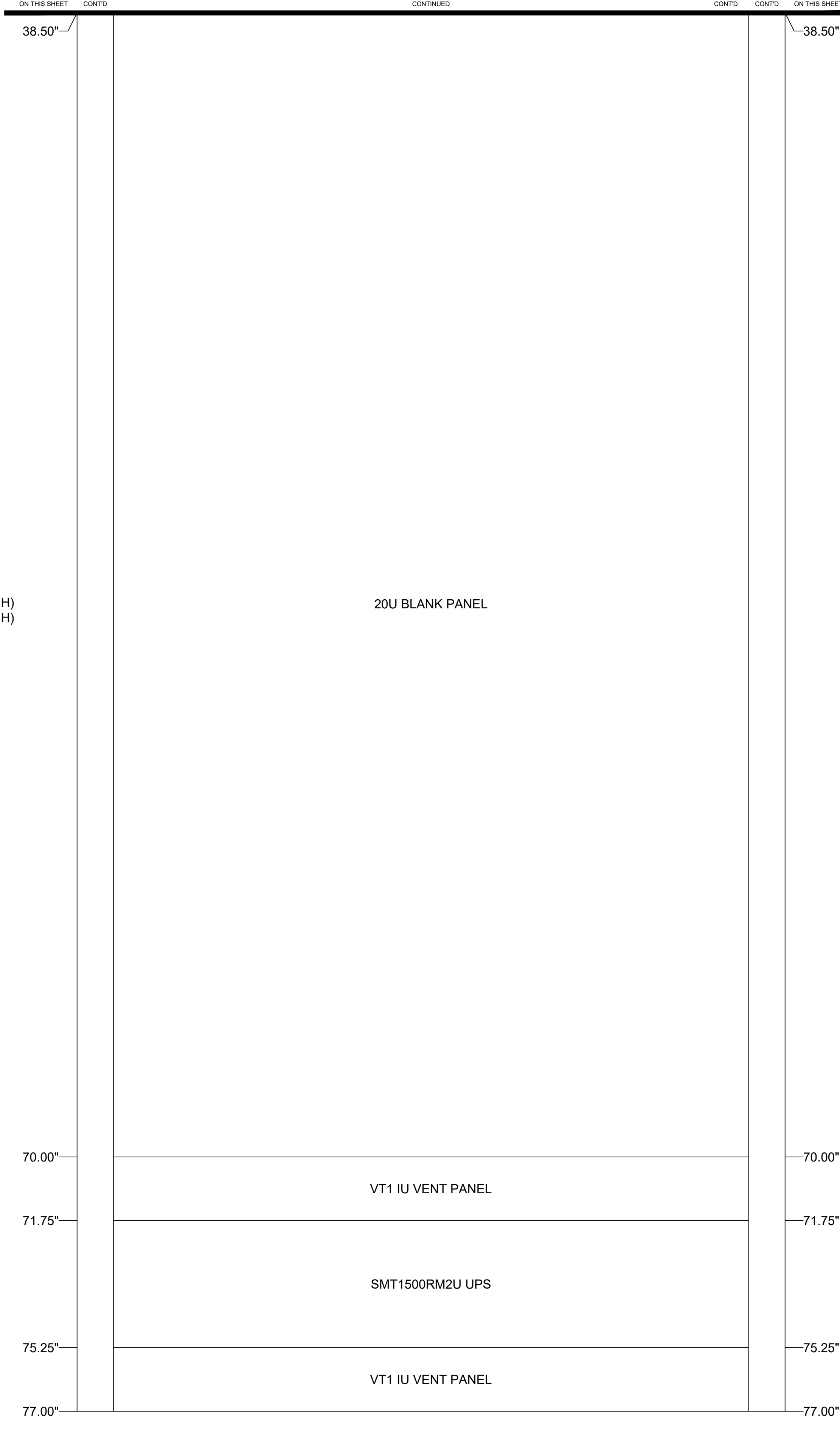
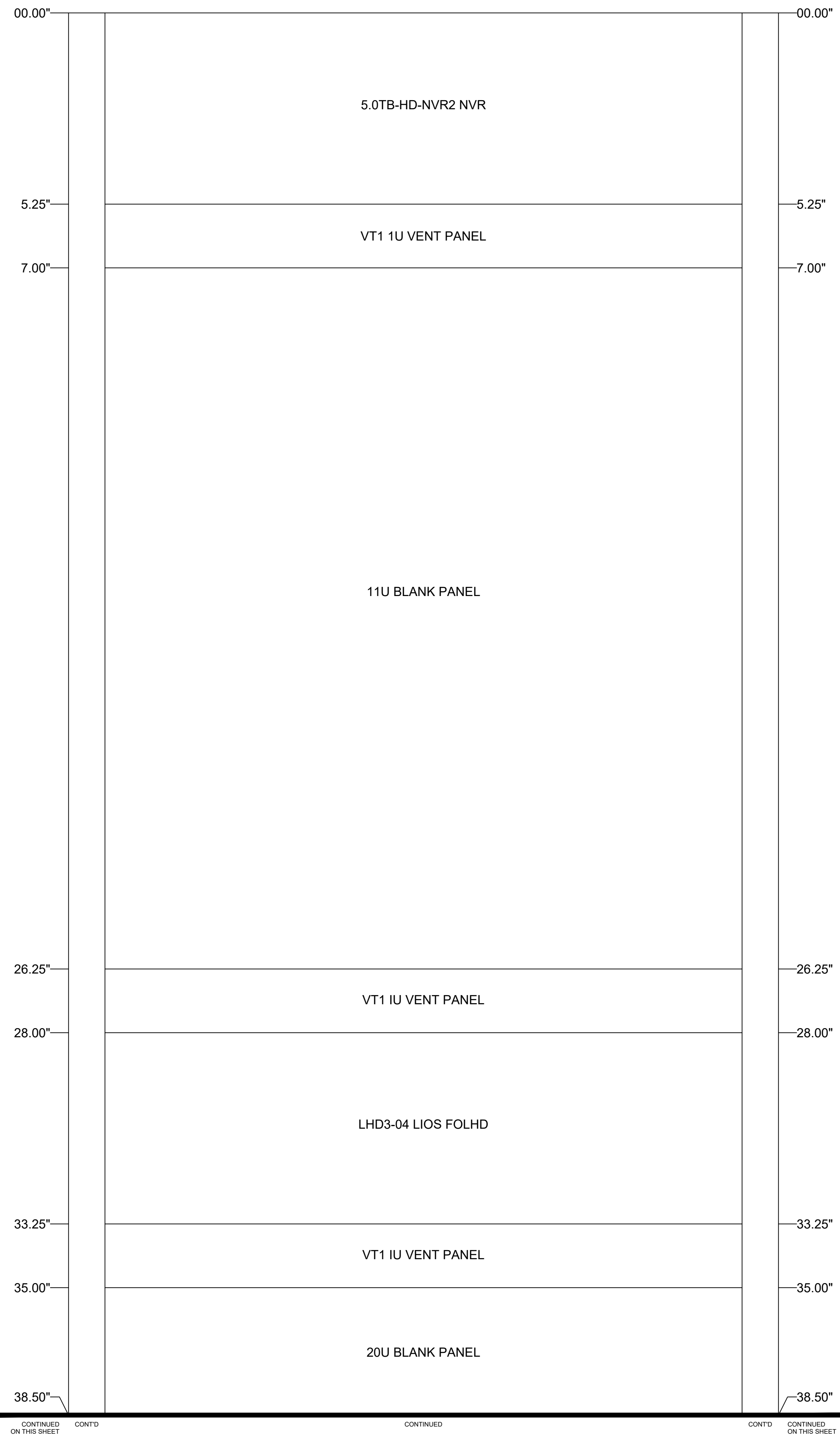
FIRE ALARM:  
 DETAILS - SYSTEM  
 SIGNAGE

Drawing Number  
**FA6.02**

DRAWN BY: B.T.L. | CHECKED BY: AEE-JR



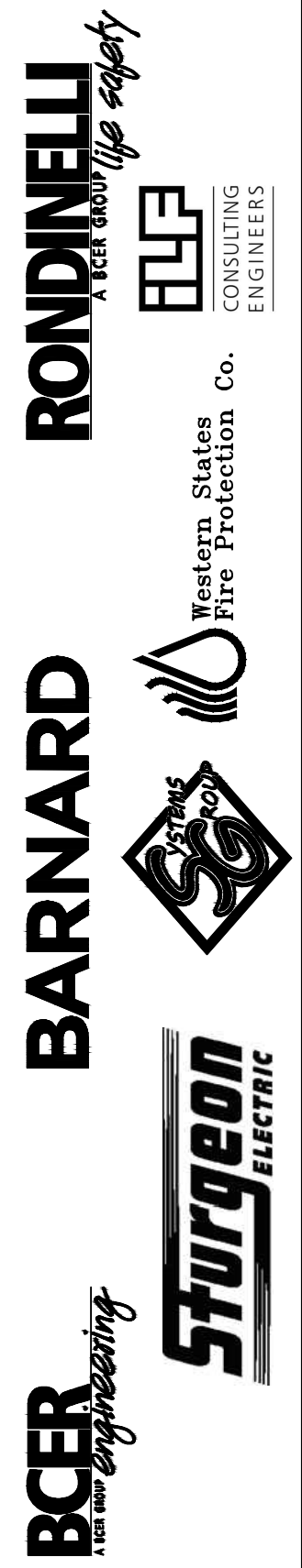
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MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32LRD  
 OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8"(H)  
 USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8"(H)  
 EAST CONTROL ROOM - RACK #1  
 FRONT VIEW

 EAST CONTROL ROOM - RACK #1 - FRONT VIEW  
 SCALE: 1/2

**BARNARD EJMT TEAM**



**EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT**

Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

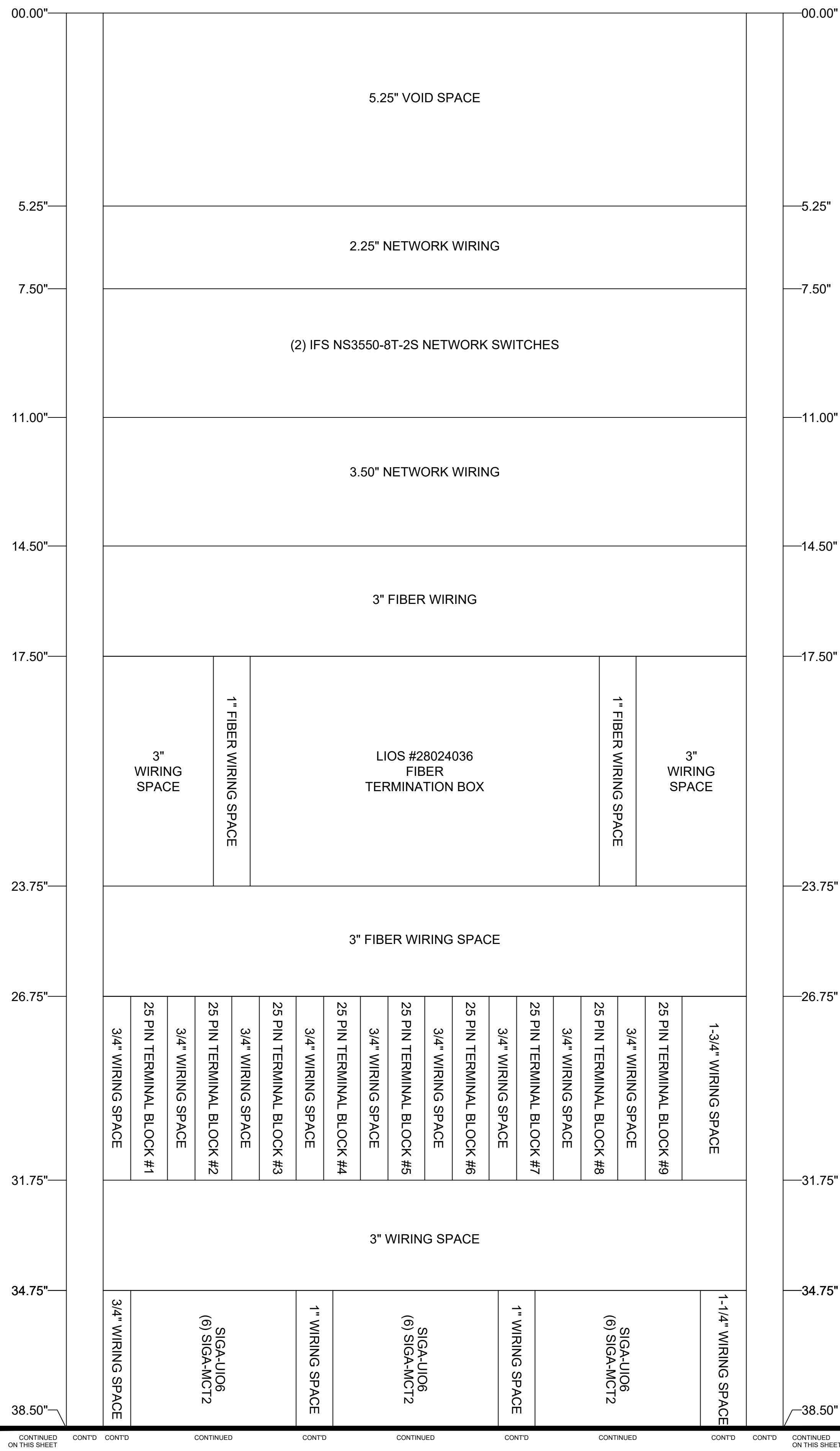
Revisions Num	Description	Date

FIRE ALARM:  
 DETAILS - EAST CONTROL  
 RACK #1 - FRONT VIEW

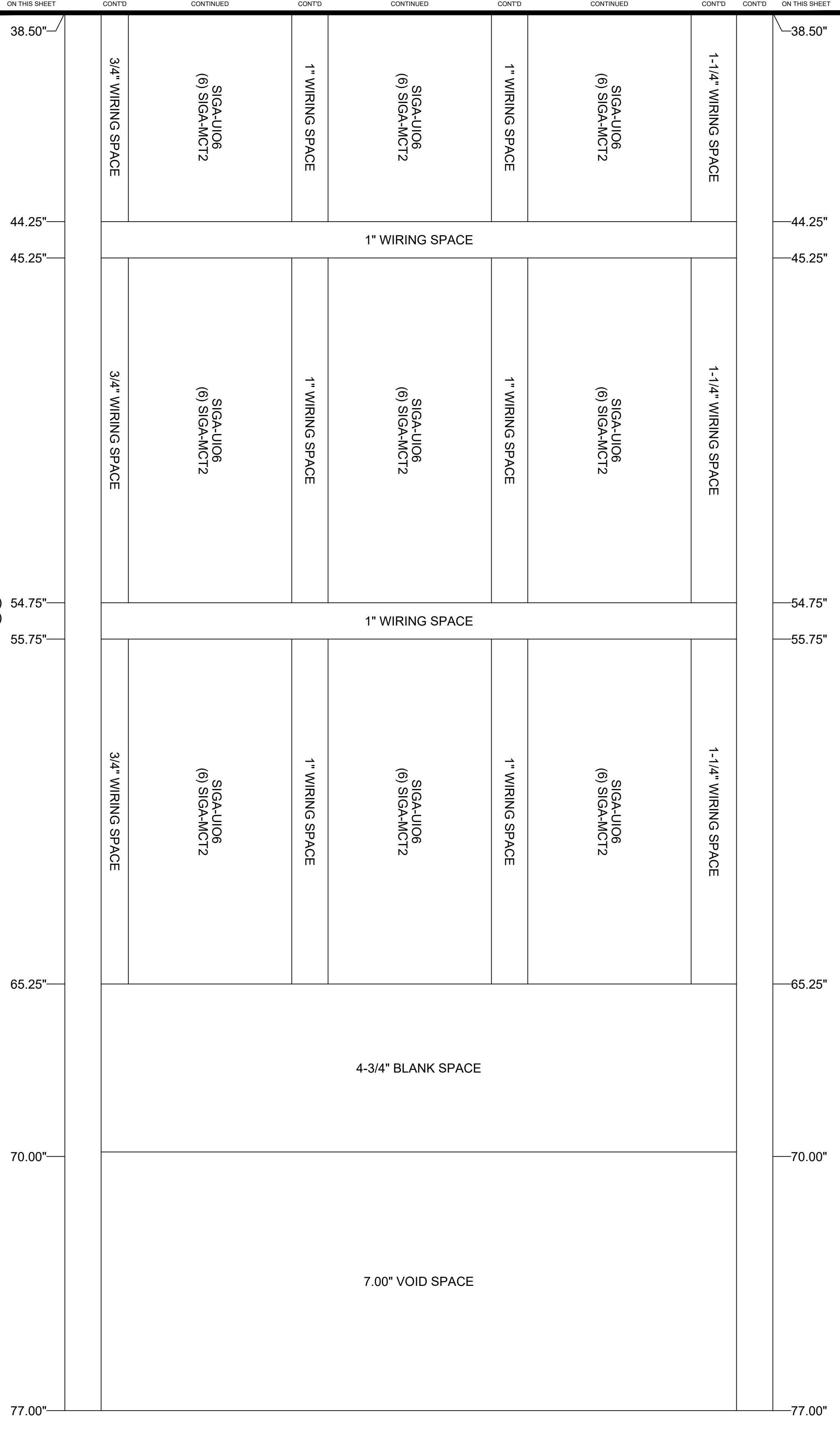
Drawing Number  
**FA6.03A**

DRAWN BY: B.T.L. | CHECKED BY: AEE-Jr

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MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32LRD  
 OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8"(H) 54.75"  
 USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8"(H) 55.75"  
 EAST CONTROL ROOM - RACK #1  
 MID-FRONT VIEW  
 (6" SET BACK FROM FRONT MODULE LEVEL)  
 1 EAST CONTROL ROOM - RACK #1 - MID-FRONT VIEW  
 SCALE: 1/2



EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

Revisions	Date	Description

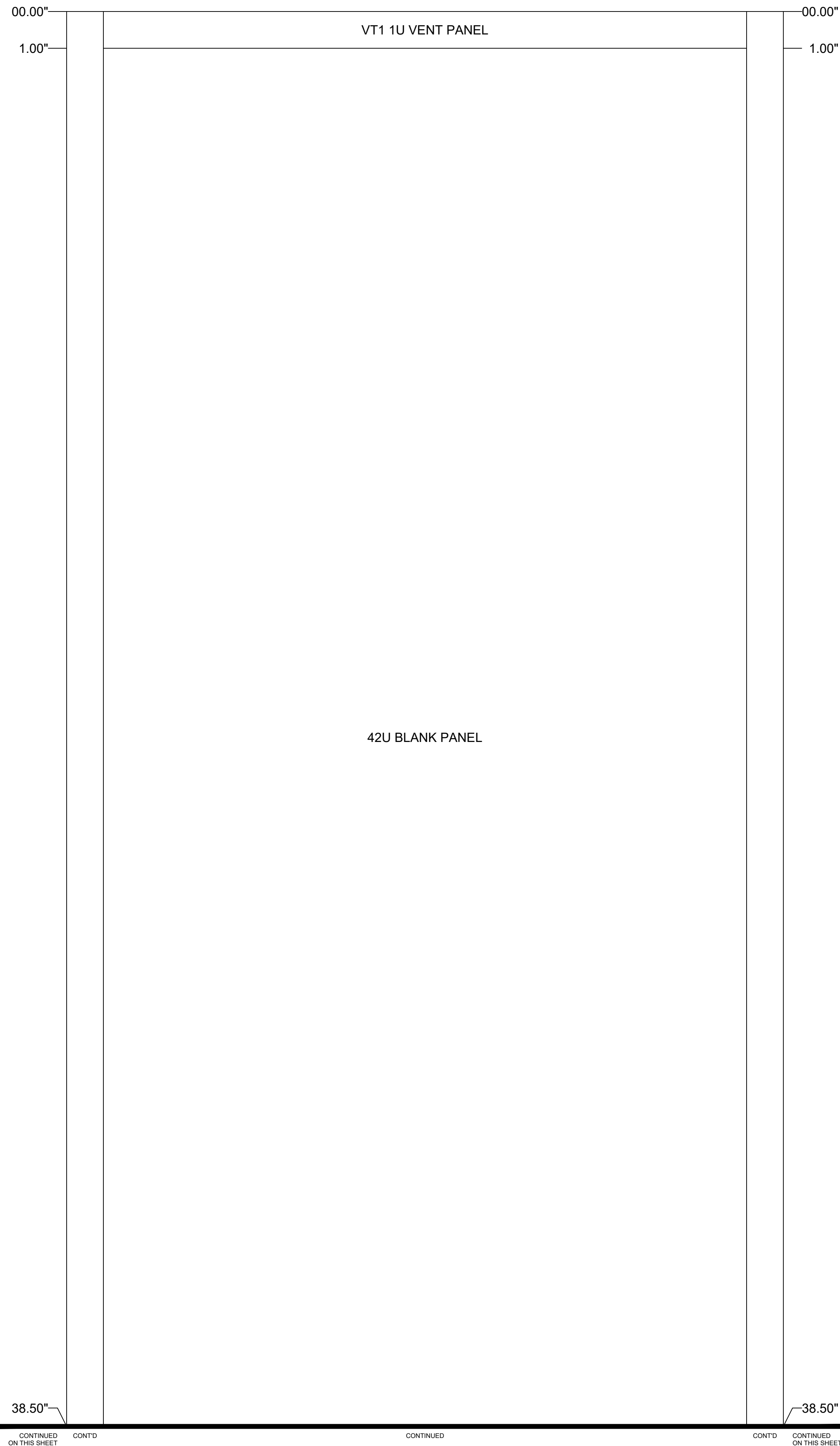
FIRE ALARM:  
 DETAILS - EAST CONTROL  
 RACK #1 - MID-FRONT VIEW  
 Drawing Number  
**FA6.03B**

**BARNARD EJMT TEAM**

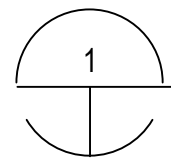
**BCER** INCORPORATED **BARNARD** **RONDINELLI**  
 A TEAM APPROVED FOR SAFETY  
 ENGINEERS

**Sturgeon ELECTRIC**  
 Western States Fire Protection Co.  
 ENGINEERS

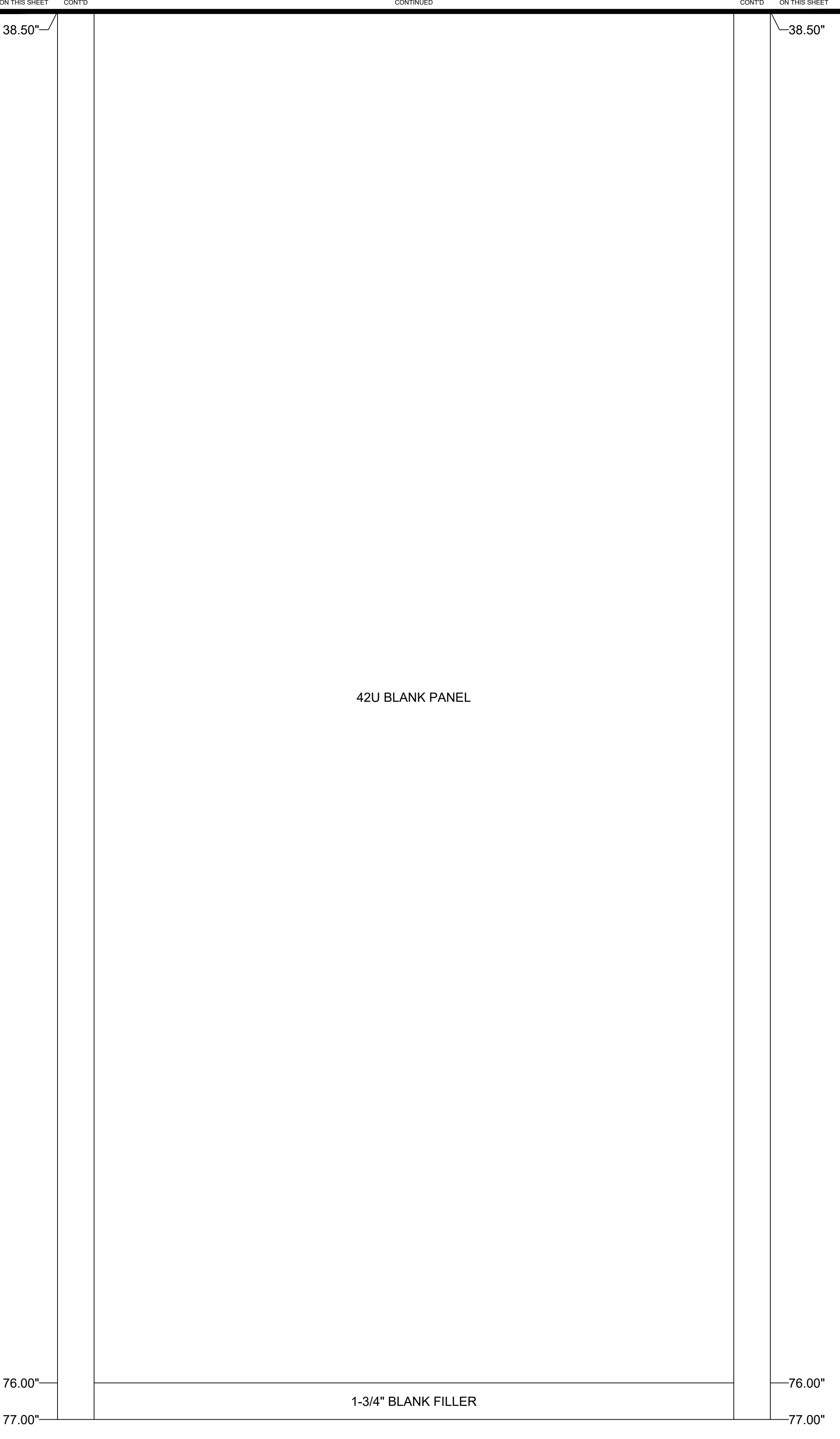
IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32  
 OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8"(H)  
 USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8"(H)  
 EAST CONTROL ROOM - RACK #1  
 REAR VIEW



EAST CONTROL ROOM - RACK #1 - REAR VIEW  
 SCALE: 1/2



EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

Revisions	Date
Num	Description

FIRE ALARM:  
 DETAILS - EAST CONTROL  
 RACK #1 - REAR VIEW

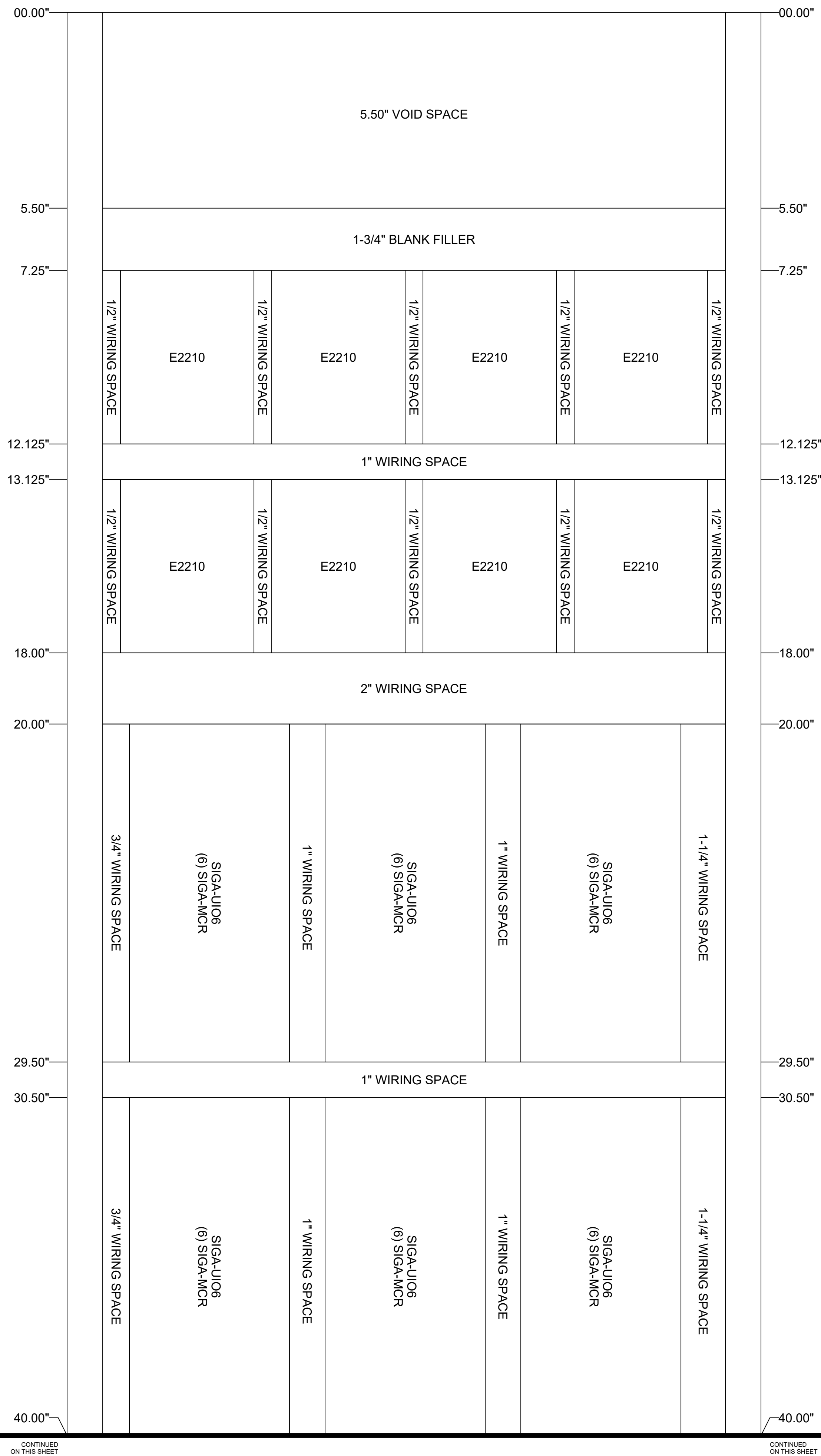
Drawing Number  
**FA6.04A**

**BARNARD EJMT TEAM**

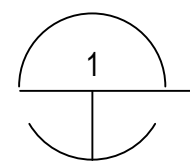
BCER **BARNARD** **RONDINELLI**  
WESTERN STATES FIRE PROTECTION CO.  
WESTERN STATES FIRE PROTECTION CO.  
**STURGEON ELECTRIC**  
WESTERN STATES FIRE PROTECTION CO.  
WESTERN STATES FIRE PROTECTION CO.

DRAWN BY: B.T.L. | CHECKED BY: AEE-Jr

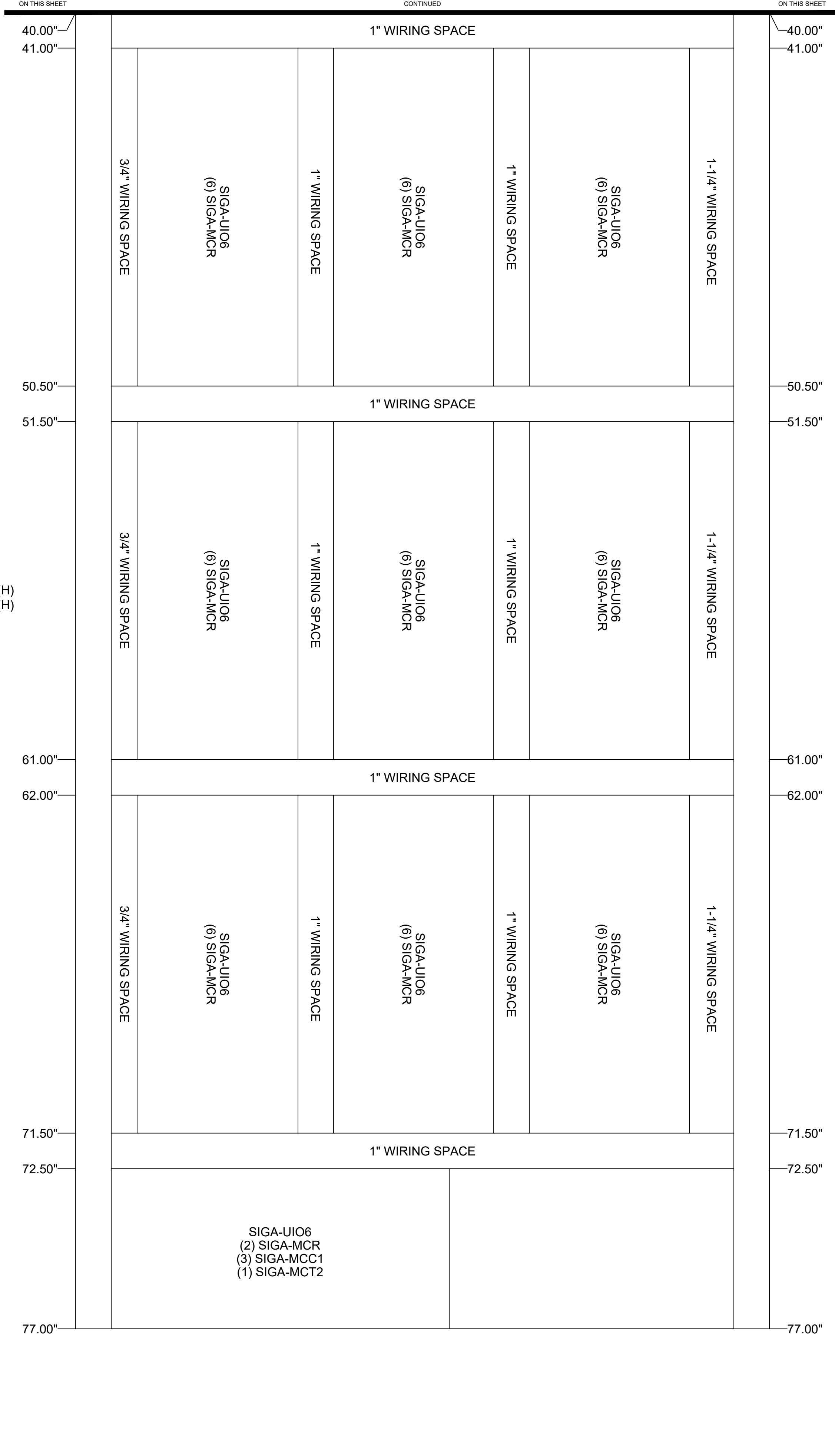
IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32LRD  
 OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8"(H)  
 USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8"(H)  
 EAST CONTROL ROOM - RACK #1  
 MID-REAR VIEW  
 (6" SET BACK FROM FRONT MODULE LEVEL)



EAST CONTROL ROOM - RACK #1 - MID-REAR VIEW  
 SCALE: 1/2



- SIGA-UI06  
 (2) SIGA-MCR  
 (3) SIGA-MCC1  
 (1) SIGA-MCT2

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

**BARNARD EJMT TEAM**  
**BARNARD**  
**BCER**  
**RONDINELLI**  
**STURGEON ELECTRIC**  
 Western States Fire Protection Co.  
 CONSULTING ENGINEERS

Project No. C0703-360  
 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Revisions	Date

FIRE ALARM:  
 DETAILS - EAST CONTROL  
 RACK #1 - MID-REAR VIEW  
 Drawing Number  
**FA6.04B**

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

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00.00"

00.00"

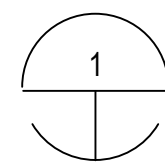
CONTINUED ON THIS SHEET  
38.50"

CONTINUED

CONTINUED ON THIS SHEET  
38.50"

44U BLANK PANEL

MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32LRD  
OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8"(H)  
USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8"(H)  
EAST CONTROL ROOM - RACK #2  
FRONT VIEW



EAST CONTROL ROOM - RACK #2 - FRONT VIEW  
SCALE: 1/2

44U BLANK PANEL

38.50"

38.50"

CONTINUED ON THIS SHEET

CONT'D





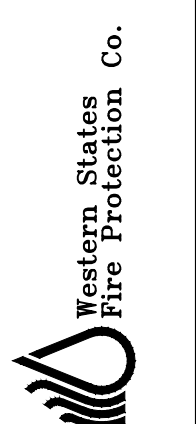

CONTINUED

CONT'D

CONTINUED ON THIS SHEET

77.00"

**BARNARD EJMT TEAM**

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

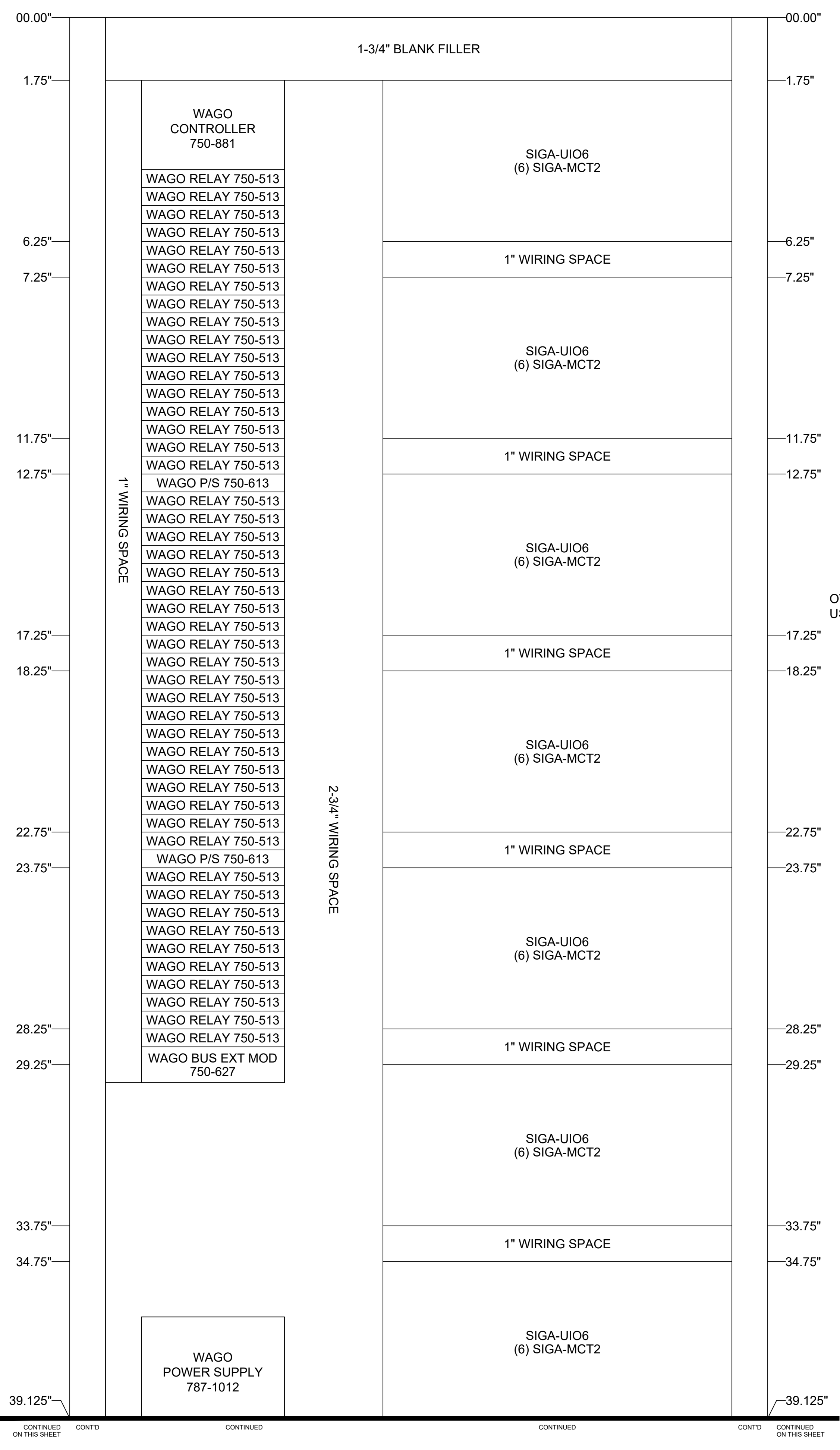
Revisions	Description	Date

FIRE ALARM:  
DETAILS - EAST CONTROL  
RACK #2 - FRONT VIEW

Drawing Number  
**FA6.05A**

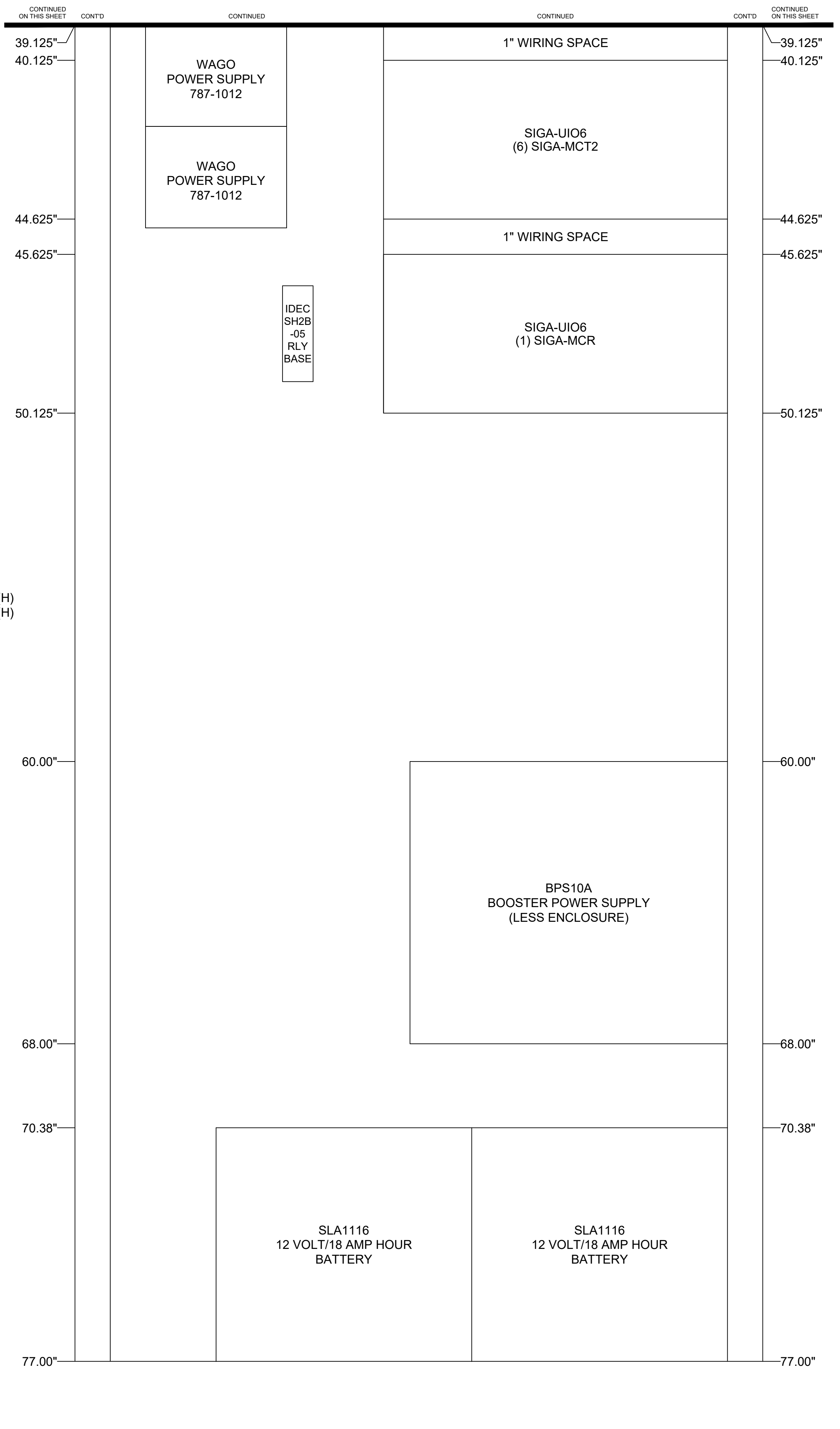
DRAWN BY: B.T.L. | CHECKED BY: AEE-Jr

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32LRD  
 OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8"(H)  
 USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8"(H)  
 EAST CONTROL ROOM - RACK #2  
 MID-FRONT VIEW  
 (6" SET BACK FROM FRONT MODULE LEVEL)

1 EAST CONTROL ROOM - RACK #2 - MID-FRONT VIEW  
 SCALE: 1/2



**BARNARD EJMT TEAM**

**BARNARD**  
Western States Fire Protection Co.

**RONDINELLI**  
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**ELF**  
ENGINEERS

**Sturgeon ELECTRIC**

**EISENHOWER/JOHNSON**  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

Revisions	Description	Date

FIRE ALARM:  
 DETAILS - EAST CONTROL RACK #2 - MID-FRONT VIEW

Drawing Number

## FA6.05B

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IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

00.00" 00.00"

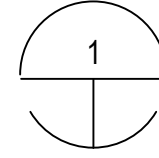
CONTINUED ON THIS SHEET CONTD 38.50"

CONTINUED ON THIS SHEET

CONTINUED ON THIS SHEET CONTD 38.50"

44U BLANK PANEL

MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32LRD  
OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8"(H)  
USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8"(H)  
EAST CONTROL ROOM - RACK #2  
REAR VIEW



1 EAST CONTROL ROOM - RACK #2 - REAR VIEW  
SCALE: 1/2

44U BLANK PANEL

38.50" 38.50"

CONTINUED ON THIS SHEET CONTD CONTD CONTD CONTINUED ON THIS SHEET

77.00"

77.00"

**BARNARD EJMT TEAM**



**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT**

Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

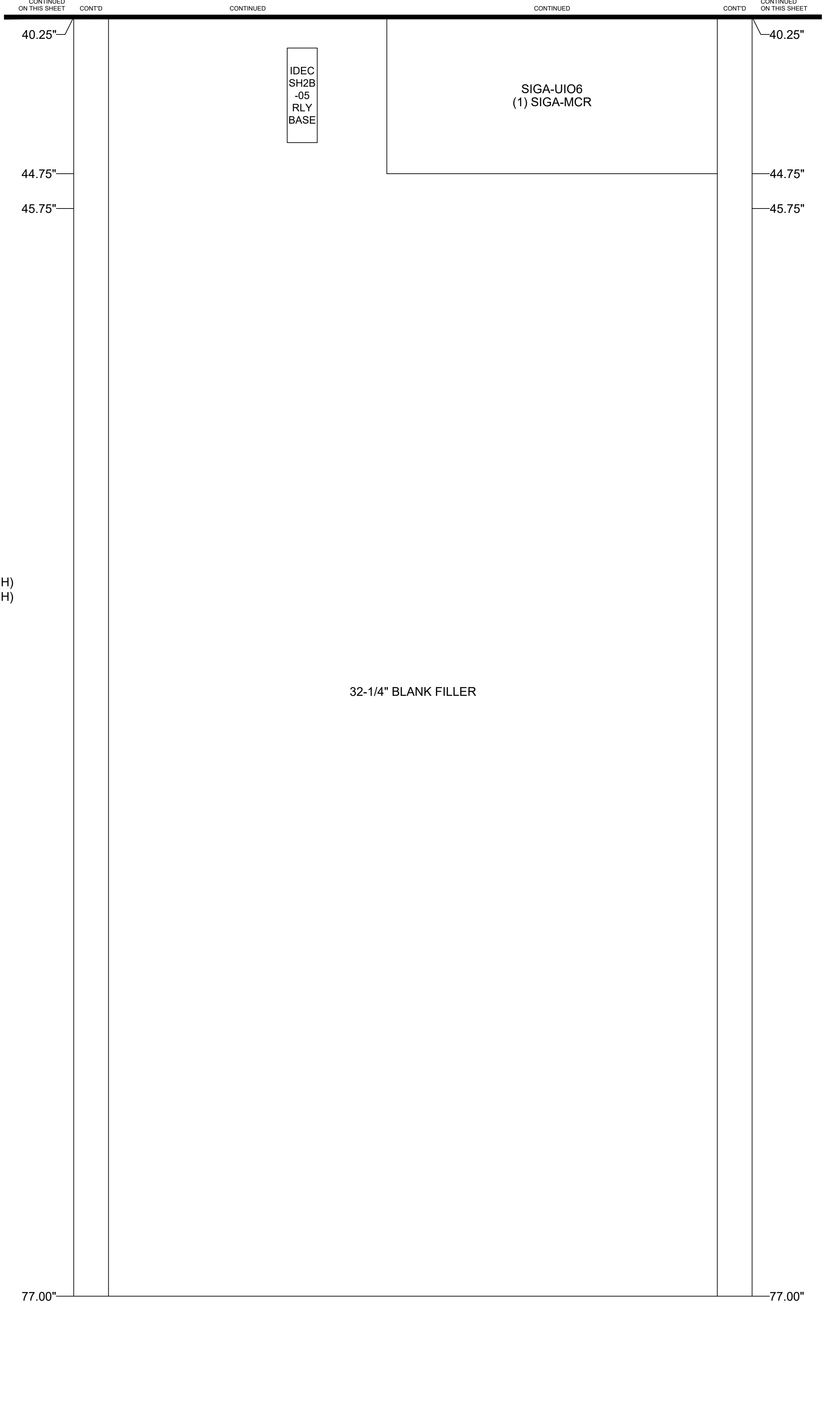
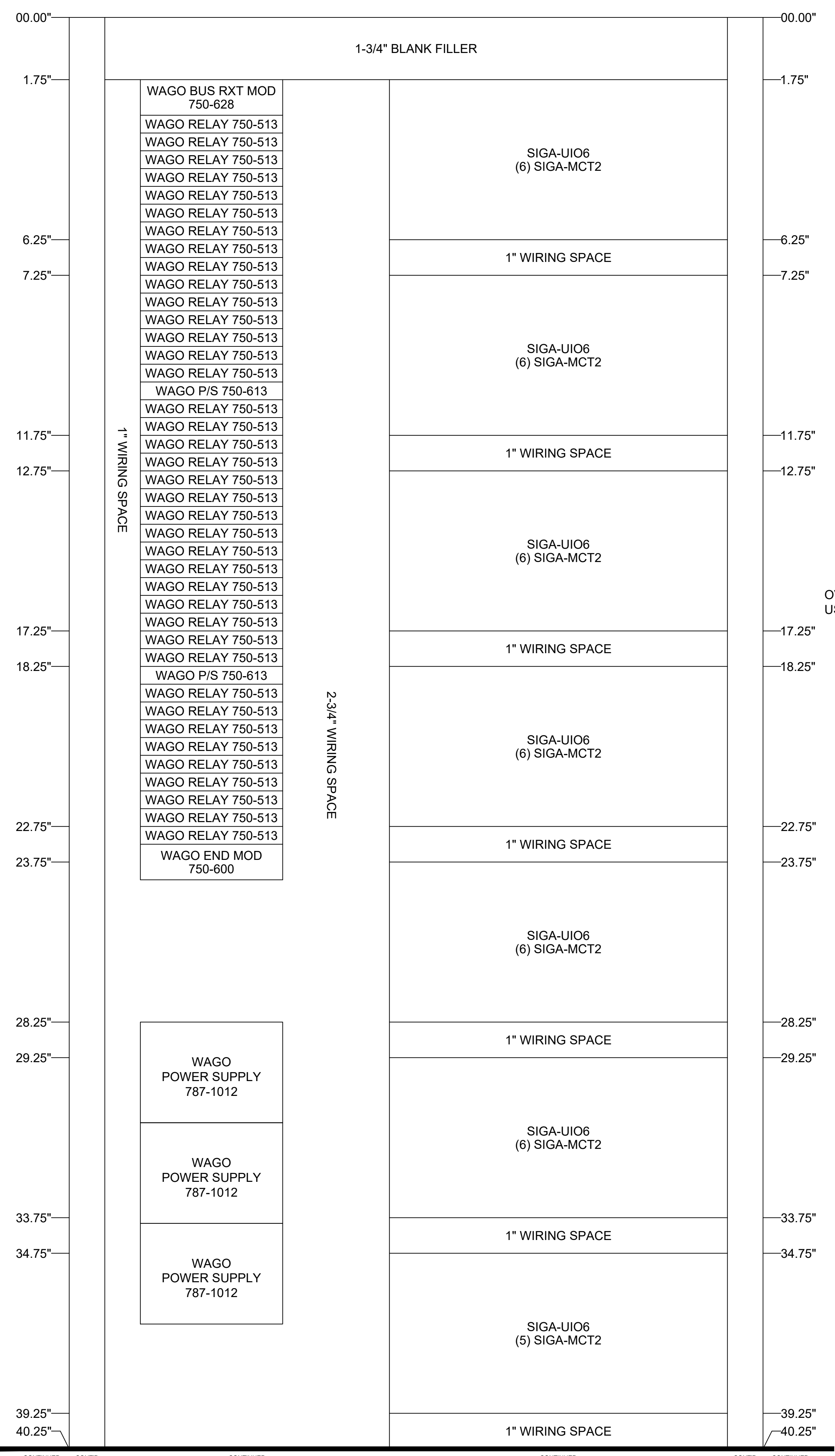
Num	Description	Date

FIRE ALARM:  
DETAILS - EAST CONTROL  
RACK #2 - REAR VIEW

Drawing Number  
**FA6.06A**

DRAWN BY: B.T.L. | CHECKED BY: AEE-Jr

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MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32LRD  
 OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8"(H)  
 USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8"(H)  
 EAST CONTROL ROOM - RACK #2  
 MID-REAR VIEW  
 (6" SET BACK FROM FRONT MODULE LEVEL)

1 EAST CONTROL ROOM - RACK #2 - MID-REAR VIEW  
 SCALE: 1/2

**BARNARD EJMT TEAM**

**BCER** CONSULTING ENGINEERS  
**BARNARD** CONSULTING ENGINEERS  
**RONNINELLI** A CERTIFIED LIFE SAFETY  
**Western States Fire Protection Co.**  
**STURGEON ELECTRIC**

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Revisions	Date
Num	Description

FIRE ALARM:  
 DETAILS - EAST CONTROL RACK #2 - MID-REAR VIEW

Drawing Number  
**FA6.06B**

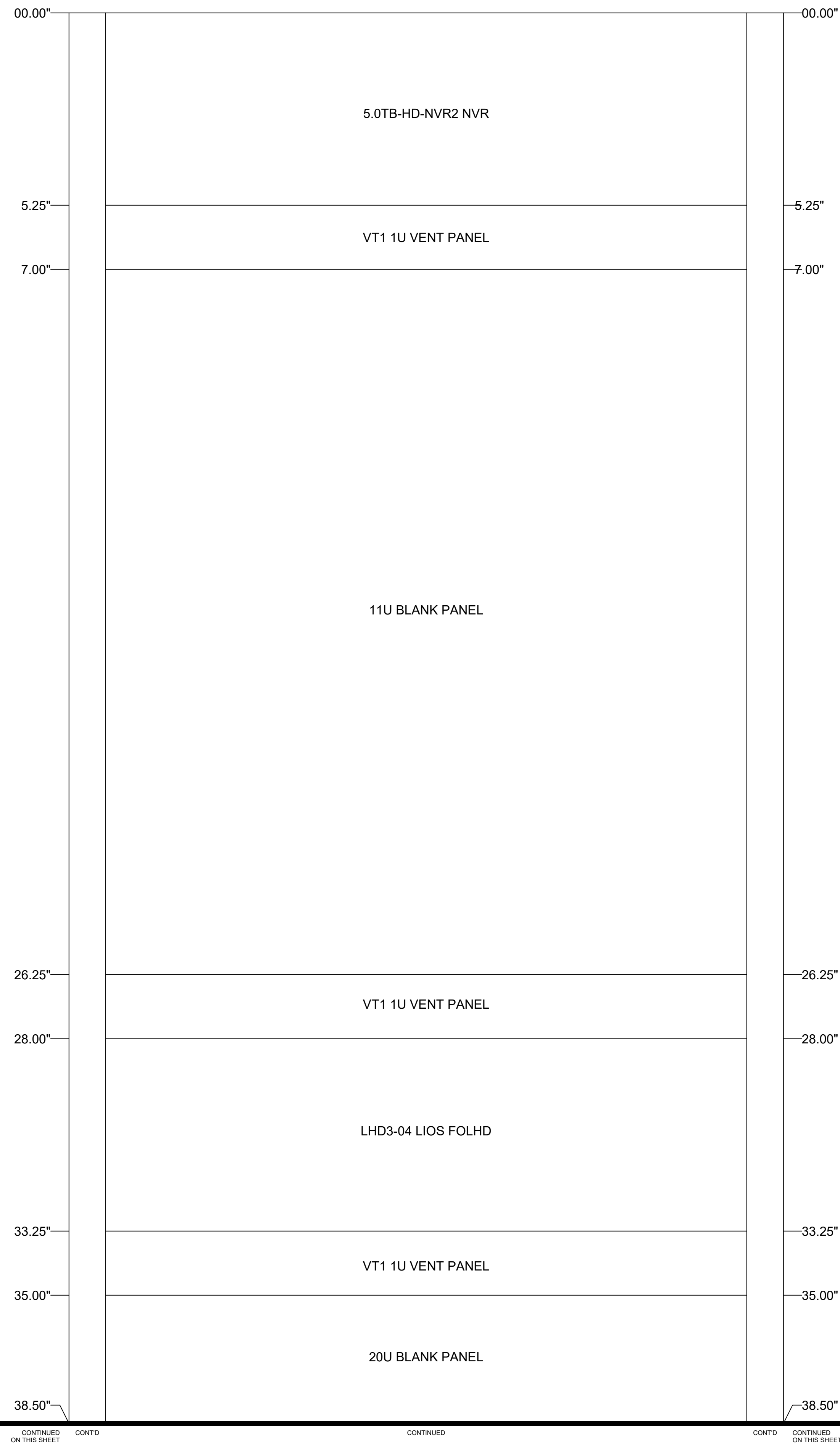
DRAWN BY: B.T.L. | CHECKED BY: AEE-JT

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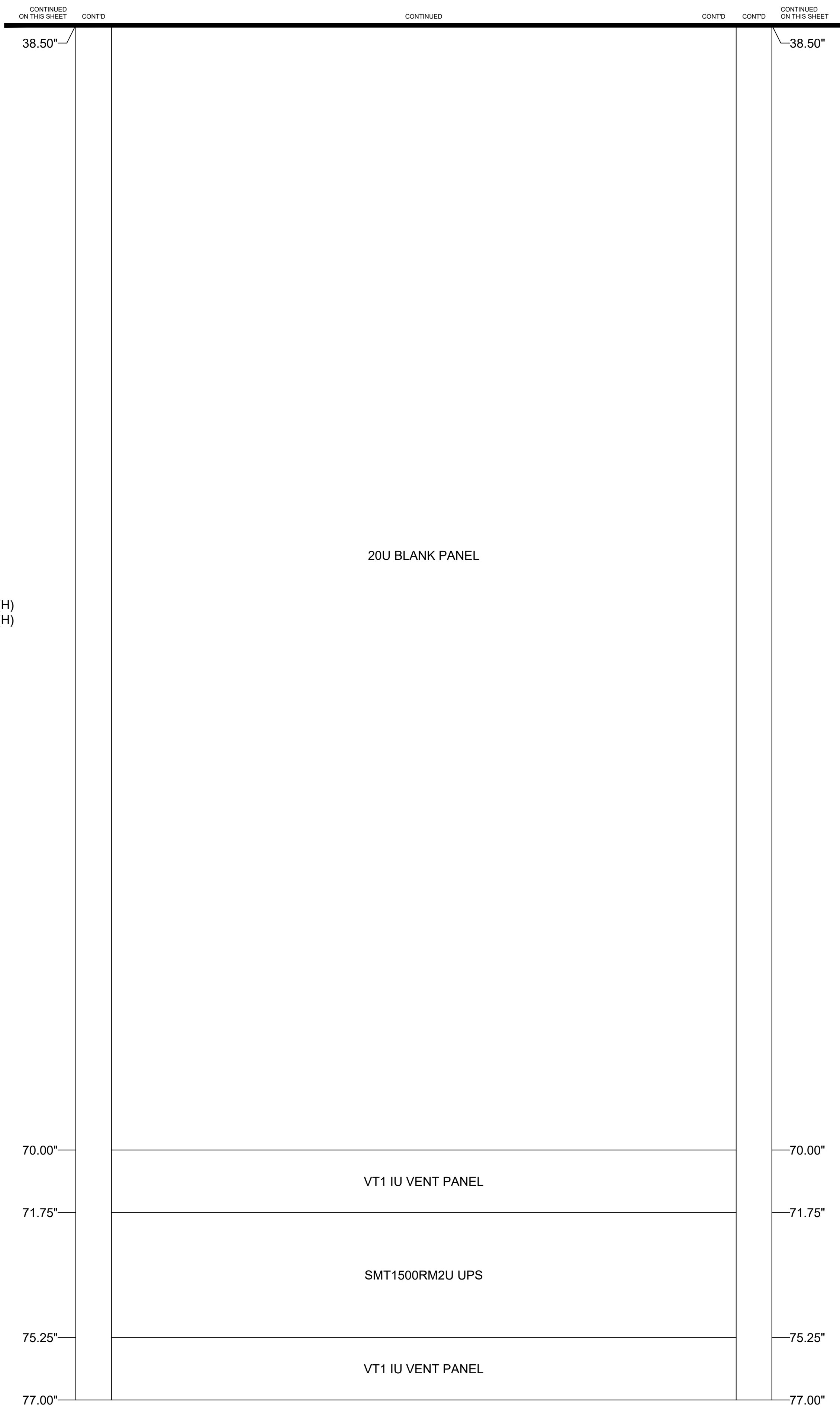
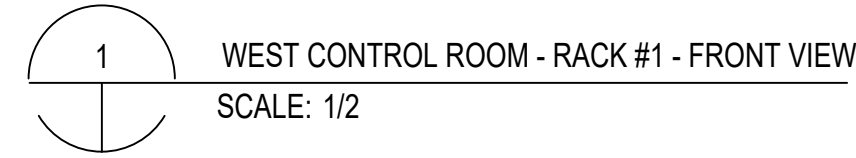
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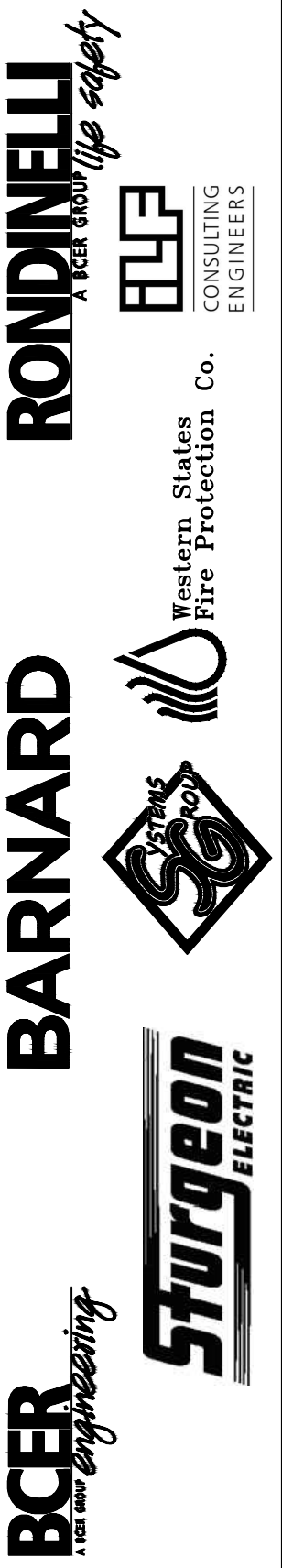
IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32LRD  
 OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8"(H)  
 USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8"(H)  
 WEST CONTROL ROOM - RACK #1  
 FRONT VIEW



**BARNARD EJMT TEAM**



EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

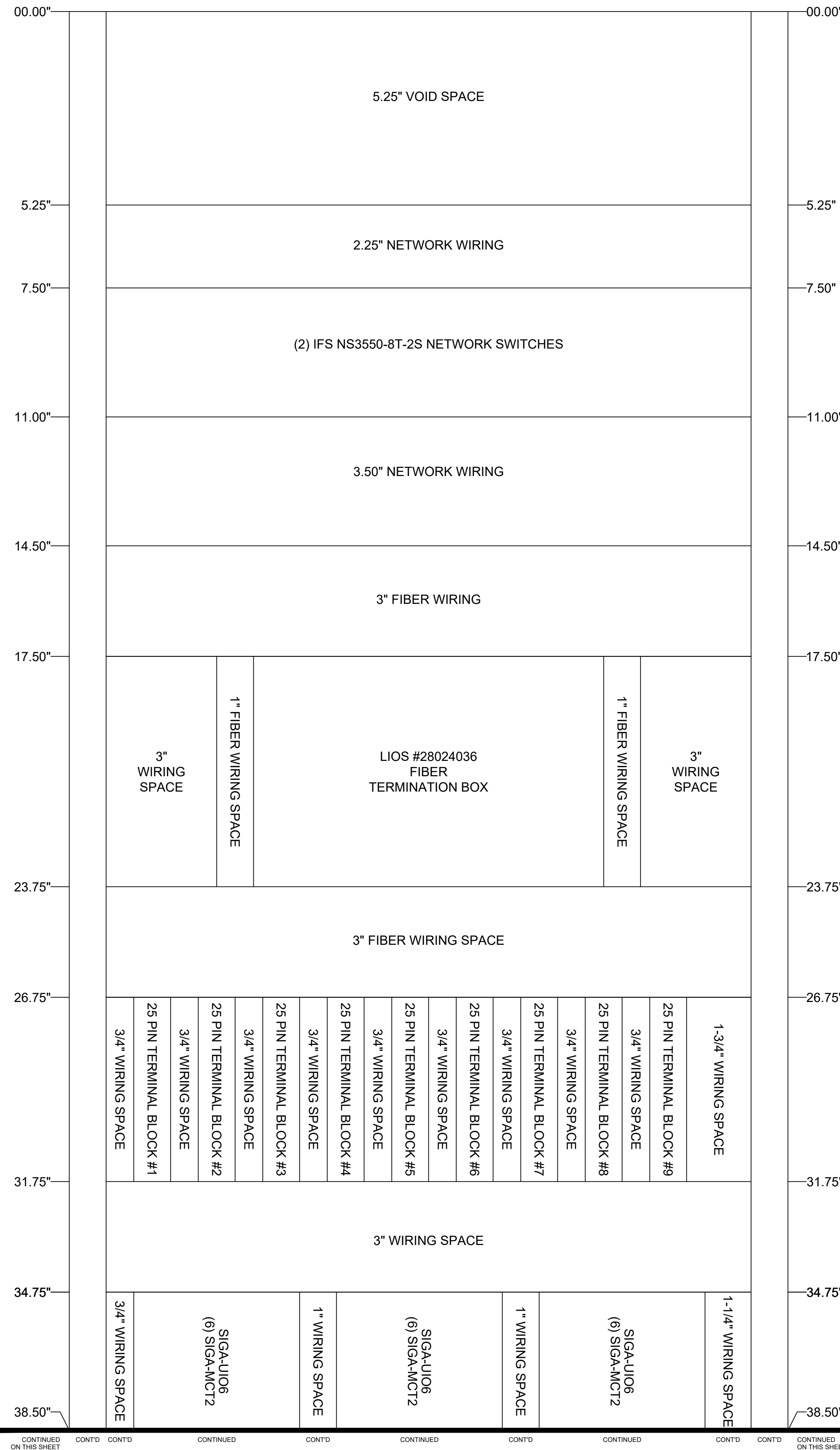
Revisions	Date
Num	Description

FIRE ALARM:  
 DETAILS - WEST CONTROL  
 RACK #1 - FRONT VIEW

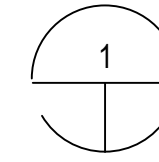
Drawing Number  
**FA6.07A**

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

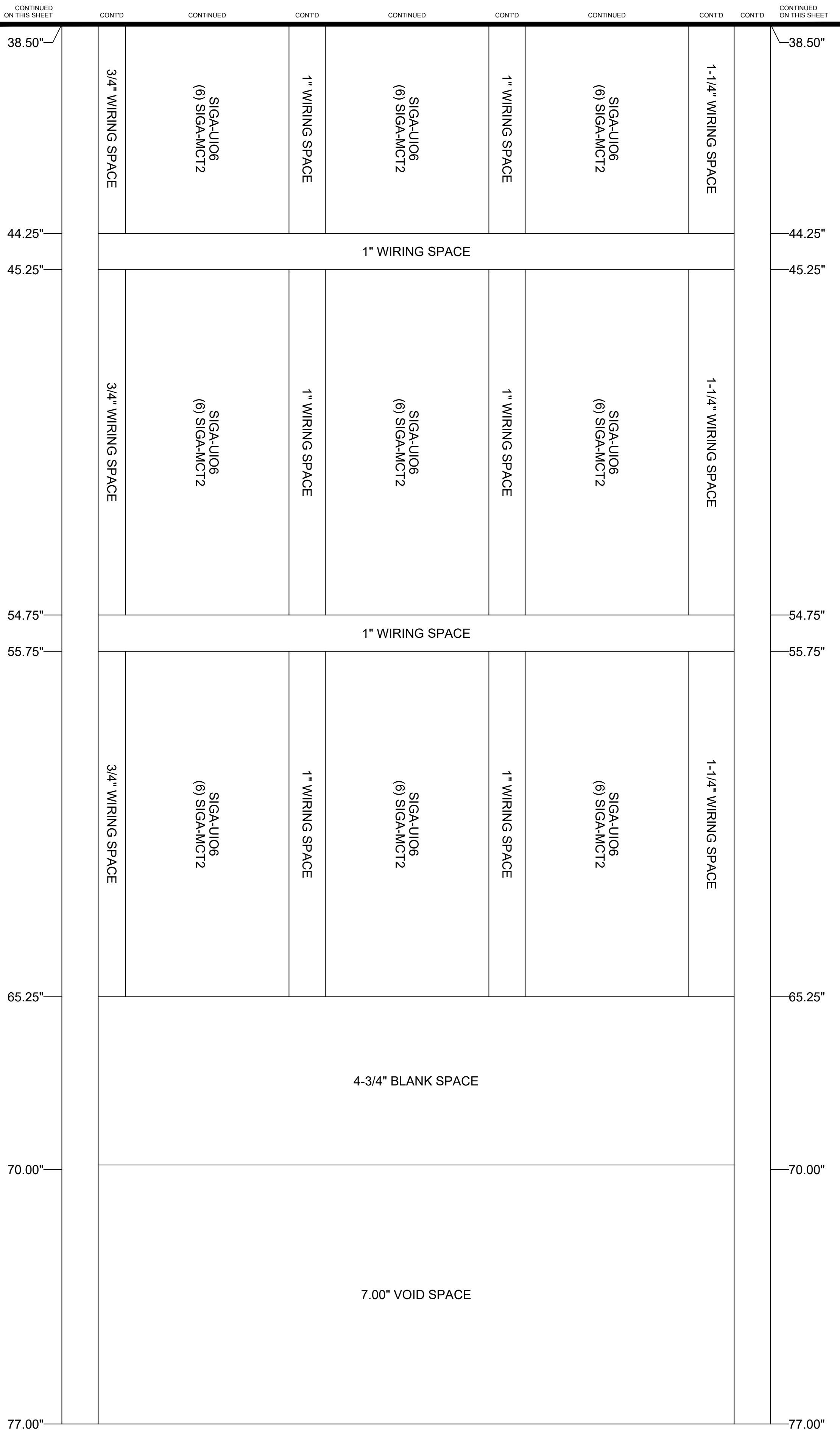
IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32LRD  
 OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8"(H) 54.75"  
 USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8"(H) 55.75"  
 WEST CONTROL ROOM - RACK #1  
 MID-FRONT VIEW  
 (6" SET BACK FROM FRONT MODULE LEVEL)



1 WEST CONTROL ROOM - RACK #1 - MID-FRONT VIEW  
 SCALE: 1/2



**BARNARD EJMT TEAM**

**BCER** *Engineering* **BARNARD** **RONDINELLI** *A TEAM WITH THE SAFETY*  
**ELF** *ENGINEERS* **Western States Fire Protection Co.**  
**Sturgeon ELECTRIC**

**EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT**

Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

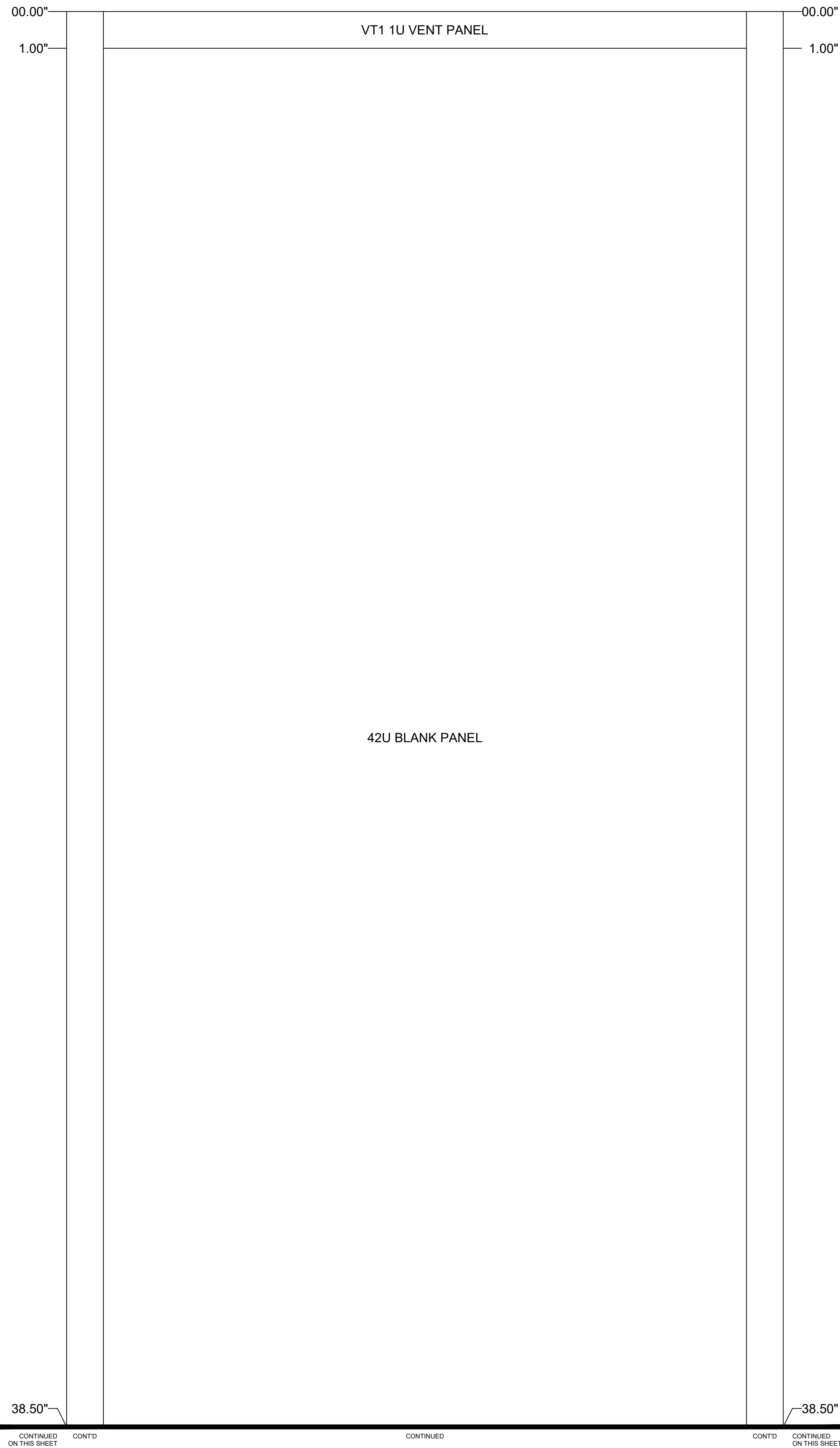
Revisions	Num	Description	Date

FIRE ALARM:  
 DETAILS - WEST CONTROL RACK #1 - MID-FRONT VIEW  
 Drawing Number

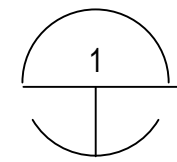
**FA6.07B**

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

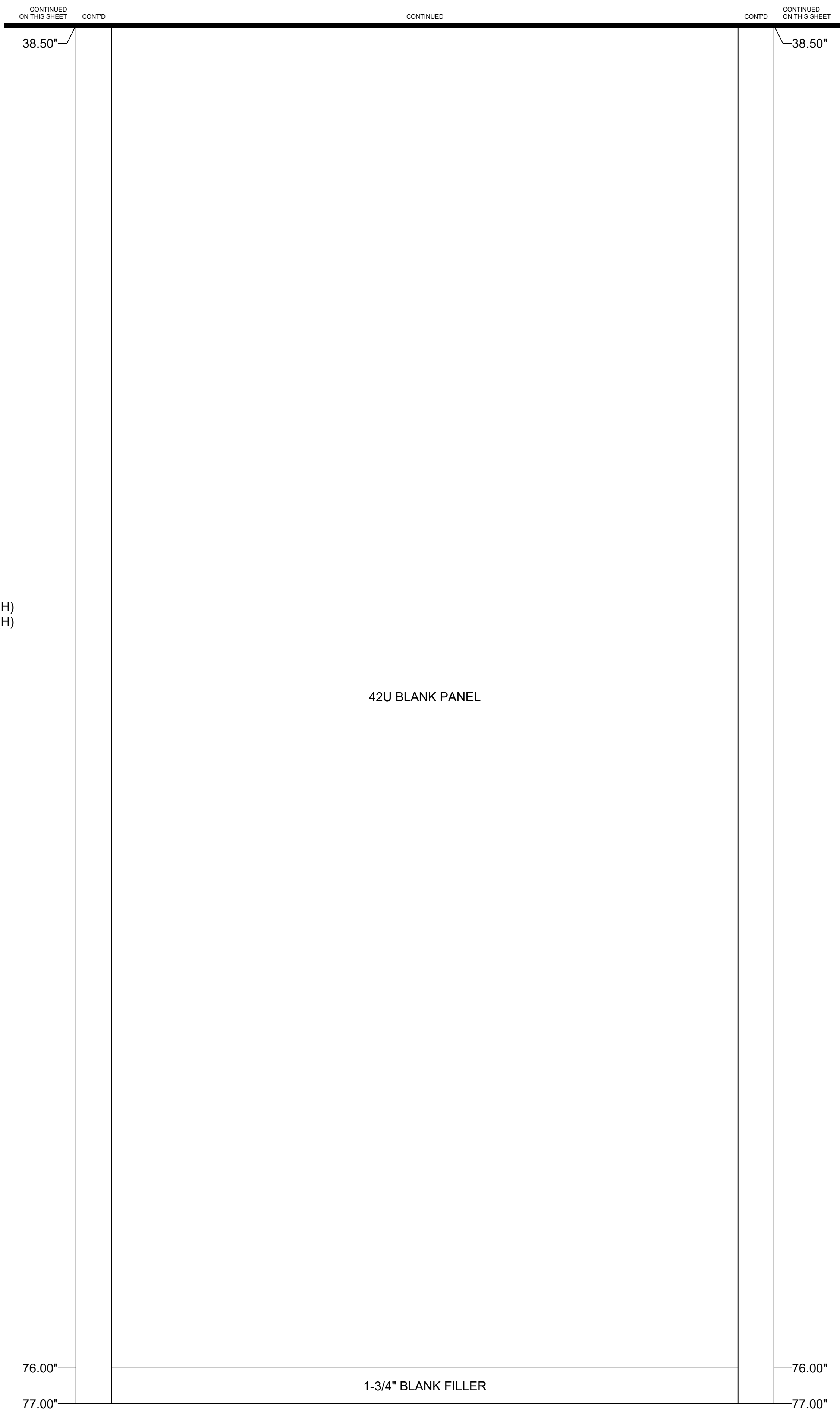
IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32  
 OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8"(H)  
 USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8"(H)  
 WEST CONTROL ROOM - RACK #1  
 REAR VIEW



WEST CONTROL ROOM - RACK #1 - REAR VIEW  
 SCALE: 1/2



EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

**BARNARD EJMT TEAM**

BCER **BARNARD** **RONDINELLI**  
WESTERN STATES FIRE PROTECTION CO.  
WESTERN STATES FIRE PROTECTION CO.  
**STURGEON ELECTRIC**  
WESTERN STATES FIRE PROTECTION CO.

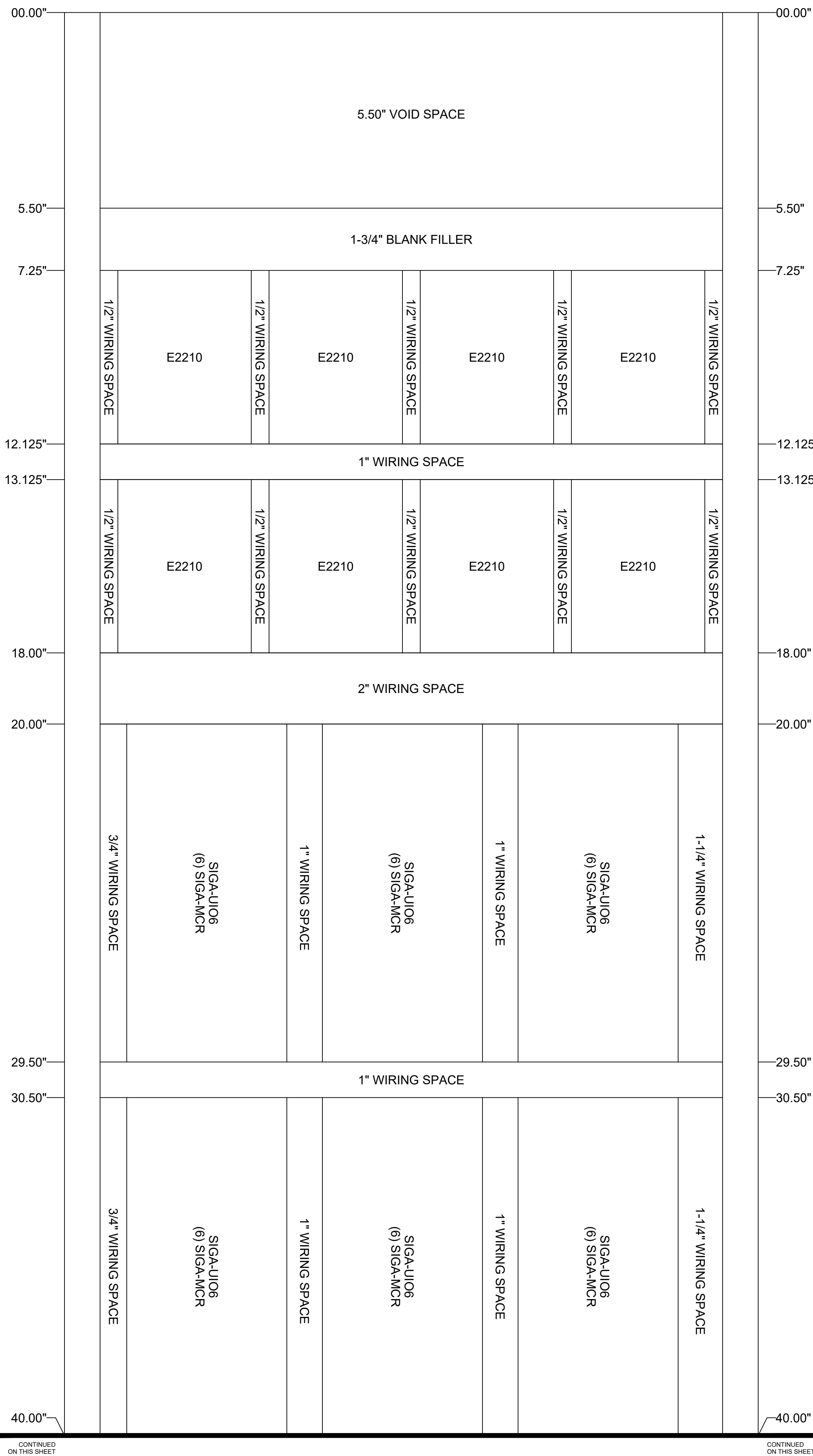
Revisions	Date
Num	Description

DRAWN BY: B.T.L. | CHECKED BY: AEE-Jr

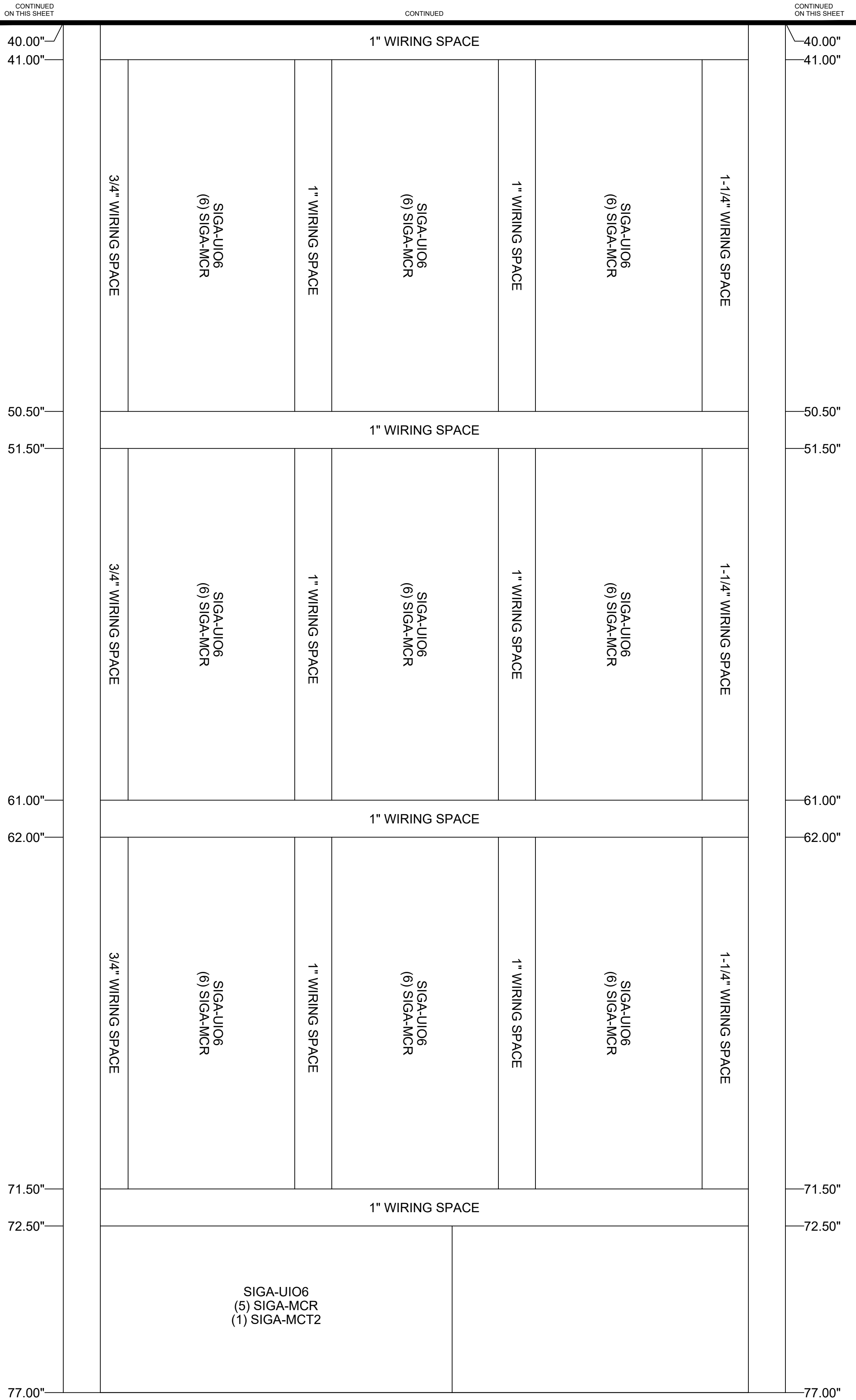
FIRE ALARM:  
 DETAILS - WEST CONTROL  
 RACK #1 - REAR VIEW

Drawing Number  
**FA6.08A**

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32LRD  
OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8"(H)  
USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8"(H)  
WEST CONTROL ROOM - RACK #1  
MID-REAR VIEW  
(6" SET BACK FROM FRONT MODULE LEVEL)



EISENHOWER/JOHNSON

MEMORIAL TUNNEL

FIXED FIRE SUPPRESSION SYSTEM

DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

**BARNARD EJMT TEAM**

**BCER**  
Engineering

**BARNARD**

**BARNARD**

**RONDINELLI**  
A Fire Growth Life Safety



**Western States Fire Protection Co.**

**ELF**  
CONSULTING ENGINEERS

Revisions Num	Description	Date

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

FIRE ALARM: DETAILS - WEST CONTROL RACK #1 - MID-REAR VIEW

Drawing Number

**FA6.08B**

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

00.00"

00.00"

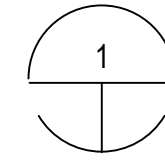
CONTINUED ON THIS SHEET  
38.50"

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CONTINUED ON THIS SHEET  
38.50"

44U BLANK PANEL

MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32LRD  
OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8"(H)  
USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8"(H)  
WEST CONTROL ROOM - RACK #2  
FRONT VIEW



WEST CONTROL ROOM - RACK #2 - FRONT VIEW  
SCALE: 1/2

44U BLANK PANEL

38.50"

38.50"

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CONTINUED ON THIS SHEET

77.00"

77.00"

**BARNARD EJMT TEAM**

**BCER**  
BARNARD EJMT TEAM  
CONSULTING ENGINEERS

**BARNARD**

**RONDINELLI**

WESTERN STATES  
FIRE PROTECTION CO.  
CONSULTING ENGINEERS



EISENHOWER/JOHNSON

MEMORIAL TUNNEL

FIXED FIRE SUPPRESSION SYSTEM

DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

Revisions	Description	Date

FIRE ALARM:  
DETAILS - WEST CONTROL  
RACK #2 - FRONT VIEW

Drawing Number

**FA6.09A**

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IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

00.00"

00.00"

38.50"

38.50"

38.50"

38.50"

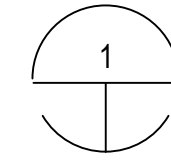
77.00"

77.00"

44U BLANK PANEL

44U BLANK PANEL

MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32LRD  
OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8"(H)  
USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8"(H)  
WEST CONTROL ROOM - RACK #2  
REAR VIEW



WEST CONTROL ROOM - RACK #2 - REAR VIEW  
SCALE: 1/2

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**BARNARD EJMT TEAM**

**BCER** INCORPORATED *engineering*

**BARNARD**

**STURGEON** ELECTRIC

**RONDINELLI** A LIFE SAVING SAFETY

**Western States Fire Protection Co.**

**ALF** CONSULTING ENGINEERS

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

Revisions	Date
Num	Description

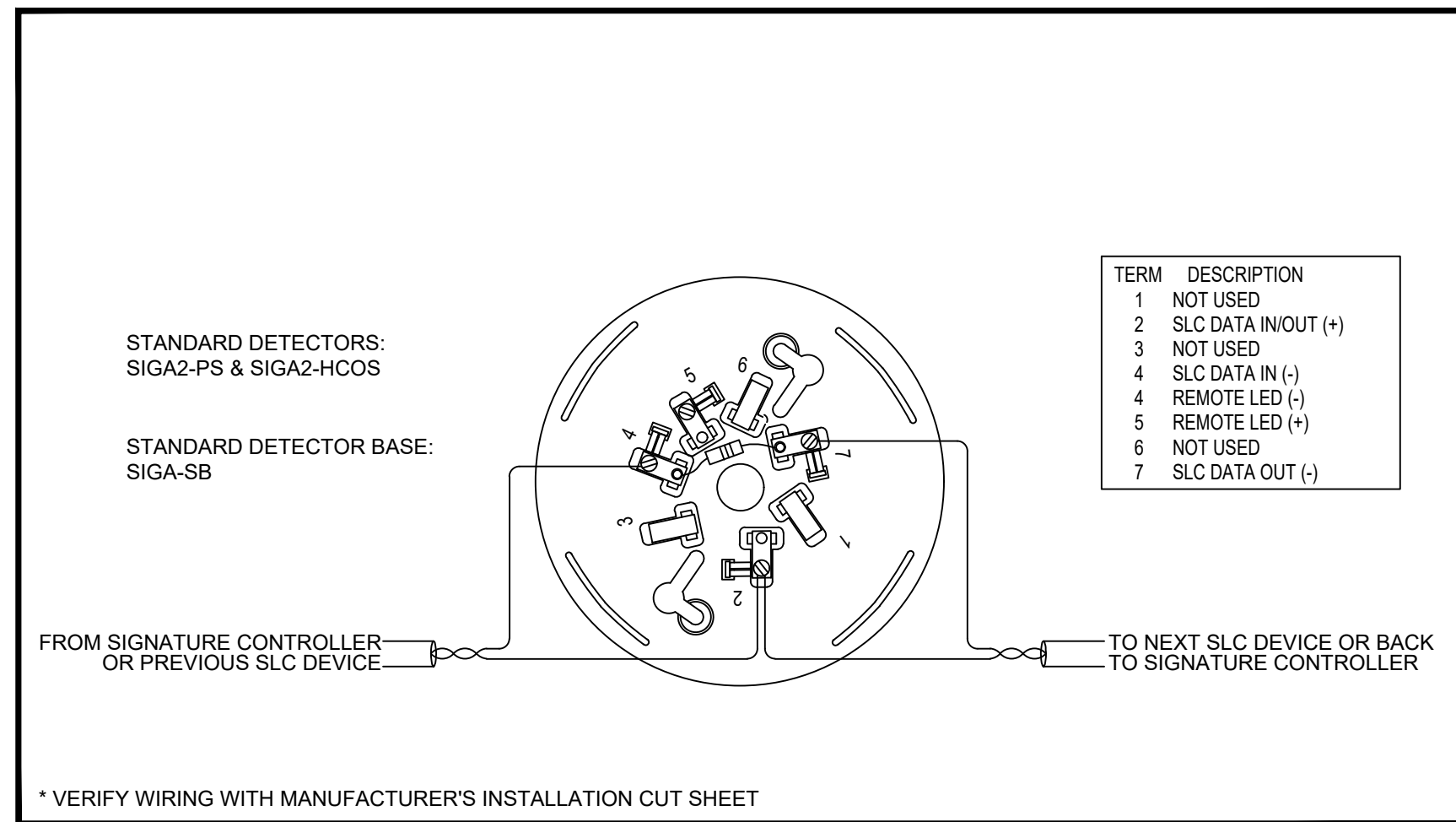
DRAWN BY: B.T.L. | CHECKED BY: AEE-JR

FIRE ALARM:  
DETAILS - WEST CONTROL RACK #2 - REAR VIEW

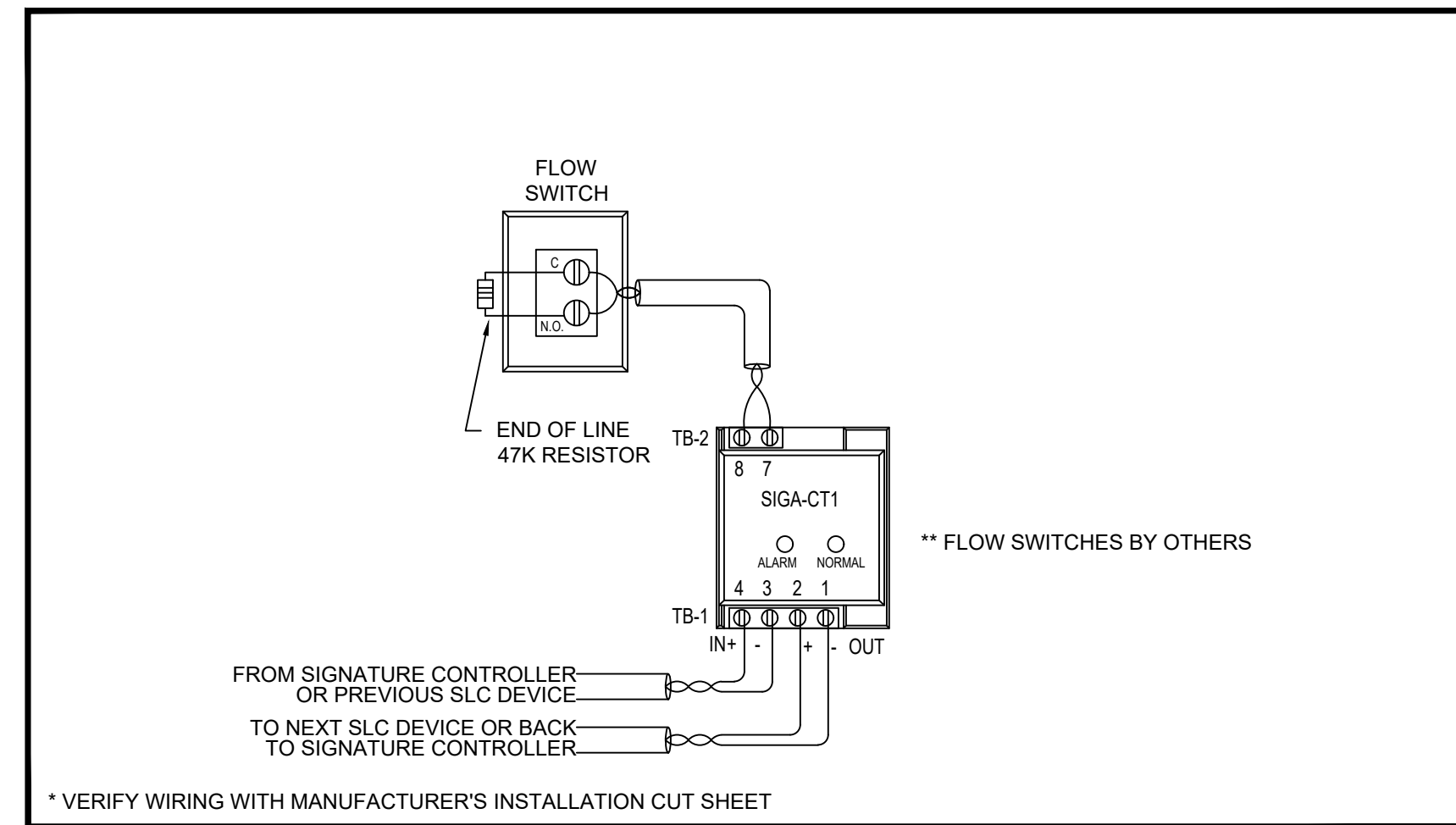
Drawing Number  
**FA6.10A**



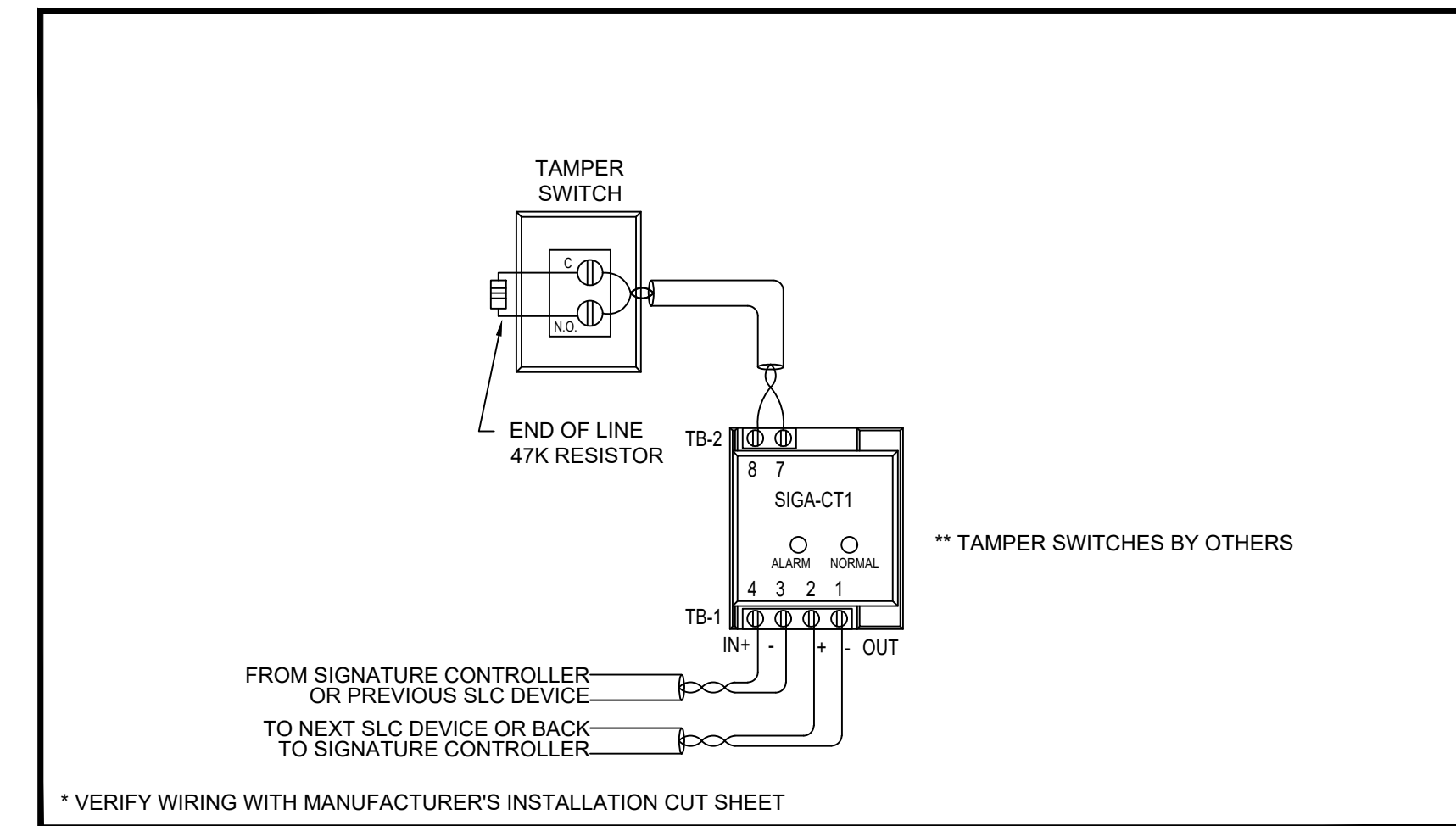




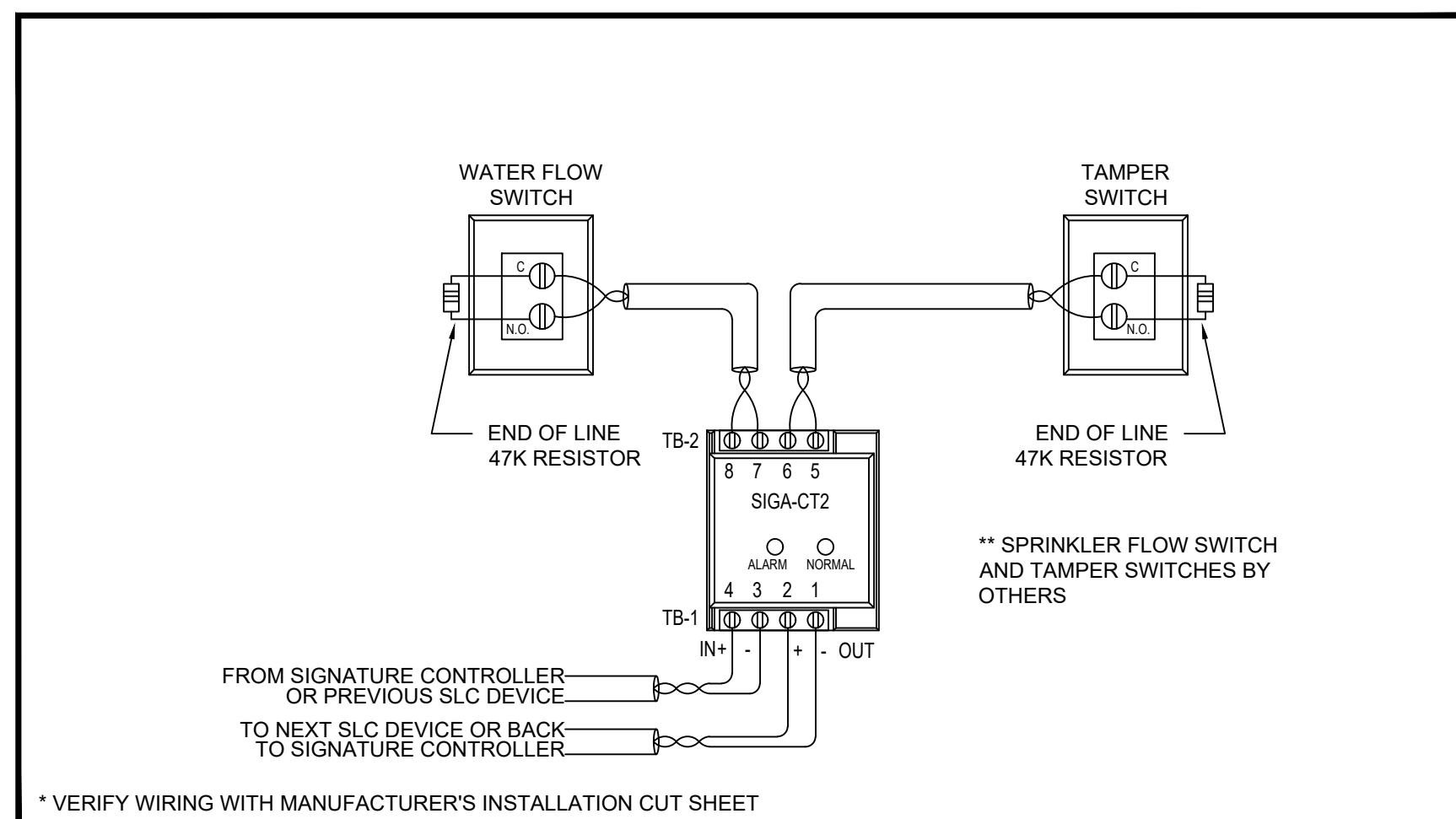
1 SMOKE OR HEAT/CO COMBO DETECTOR WIRING  
SCALE: NOT TO SCALE



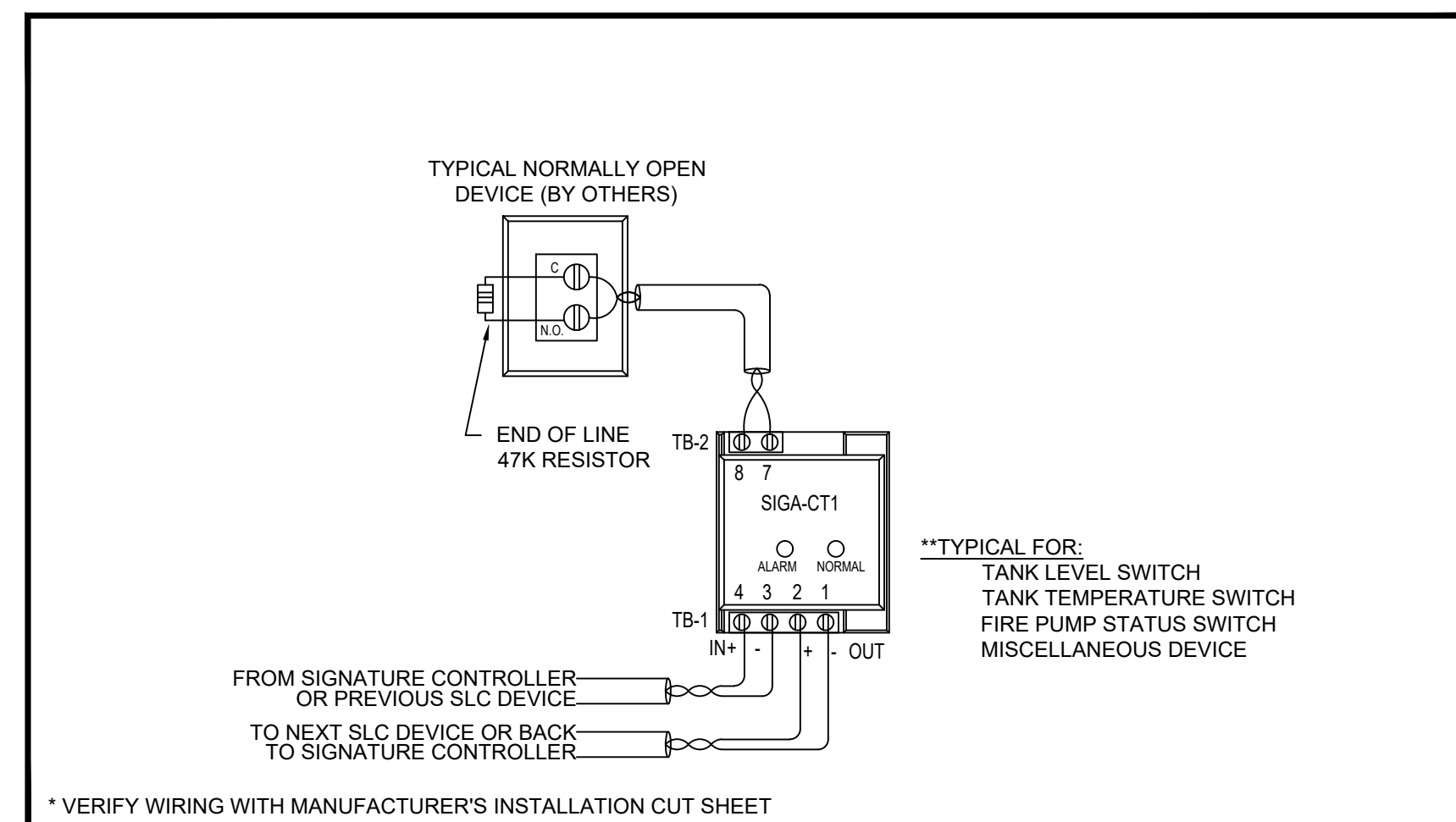
2 FLOW SWITCH MONITOR WIRING  
SCALE: NOT TO SCALE



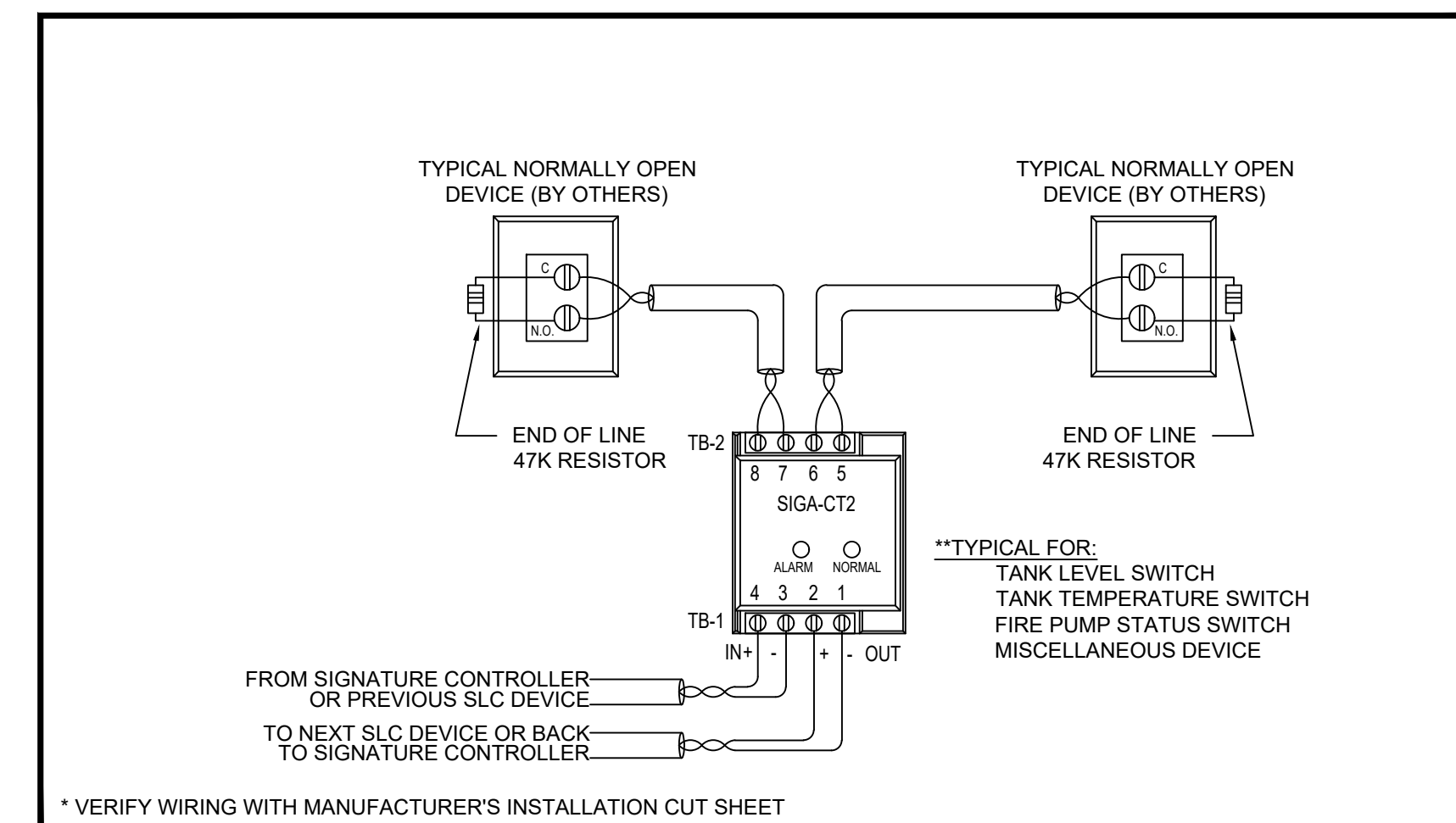
3 TAMPER SWITCH MONITOR WIRING  
SCALE: NOT TO SCALE



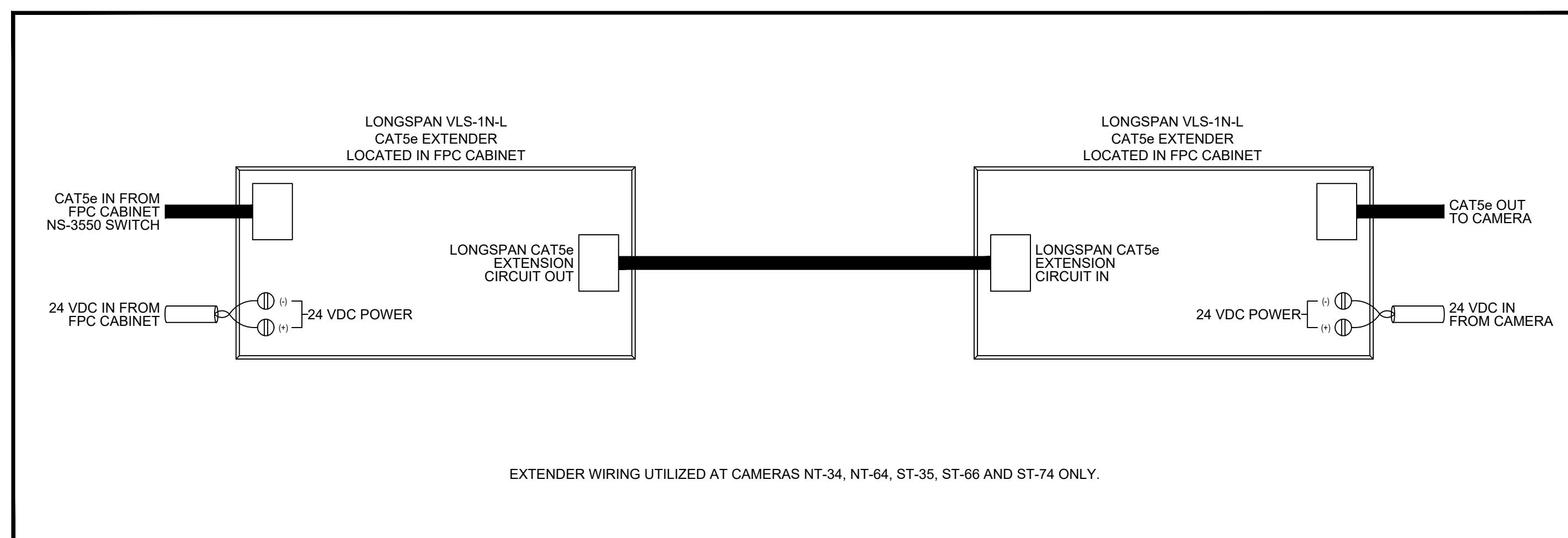
4 FLOW AND TAMPER SWITCH MONITOR WIRING  
SCALE: NOT TO SCALE



5 TYPICAL SINGLE NORMALLY OPEN DEVICE MONITOR WIRING  
SCALE: NOT TO SCALE



6 TYPICAL DUAL NORMALLY OPEN DEVICE MONITOR WIRING  
SCALE: NOT TO SCALE



7 TYPICAL CAT5e CAMERA EXTENSION WIRING  
SCALE: NOT TO SCALE

**BARNARD EJMT TEAM**

**BARNARD RONDINELLI**  
A COMMITMENT TO SAFETY  
Western States Fire Protection Co.  
CONSULTING ENGINEERS



**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT**

Project No. C0703-360  
Subaccount 17810

RECORD DRAWINGS - 2015-11-16

Revisions	Date

FIRE ALARM:  
DEVICE WIRING DETAILS

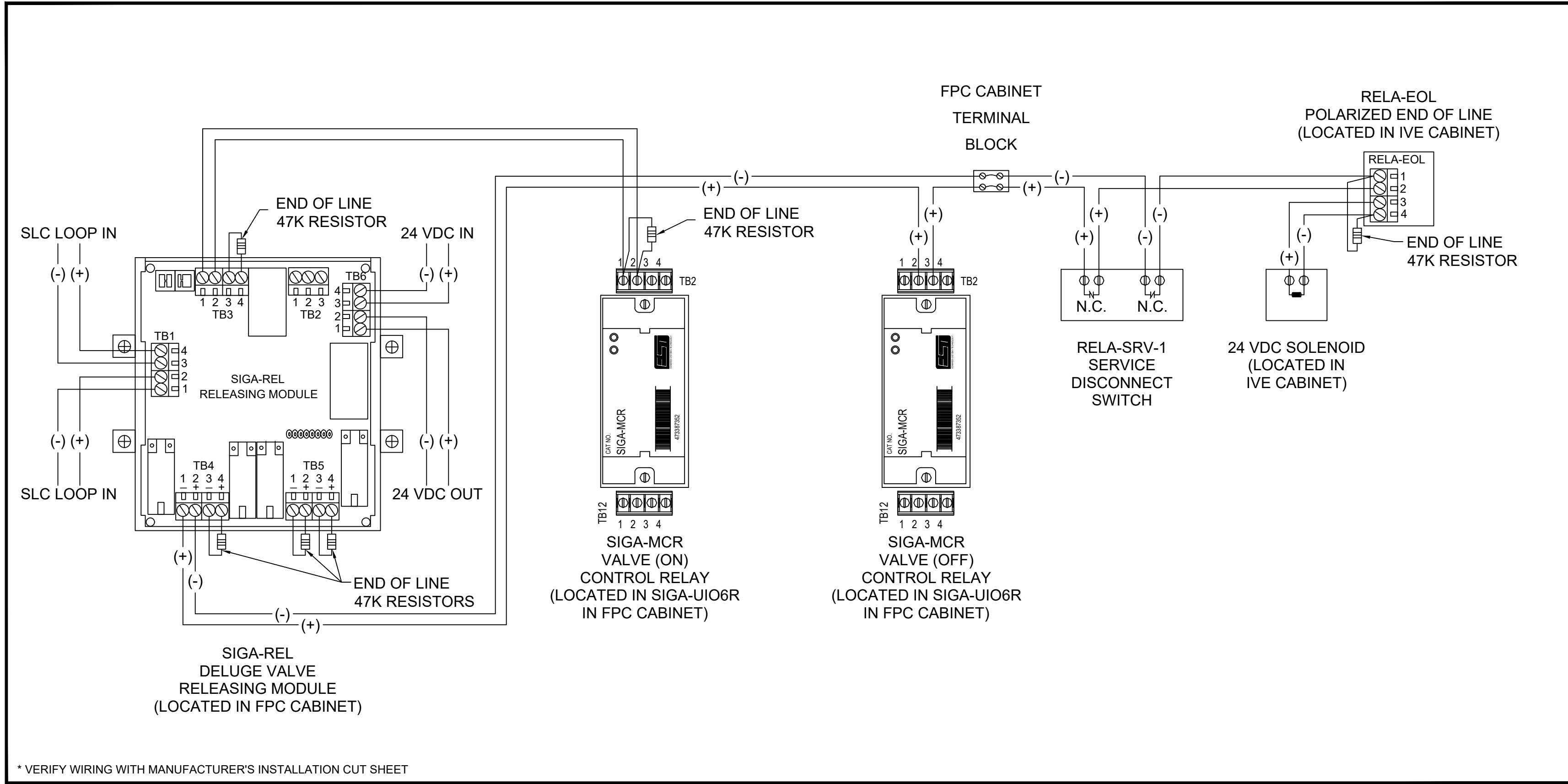
Drawing Number

FA6.11

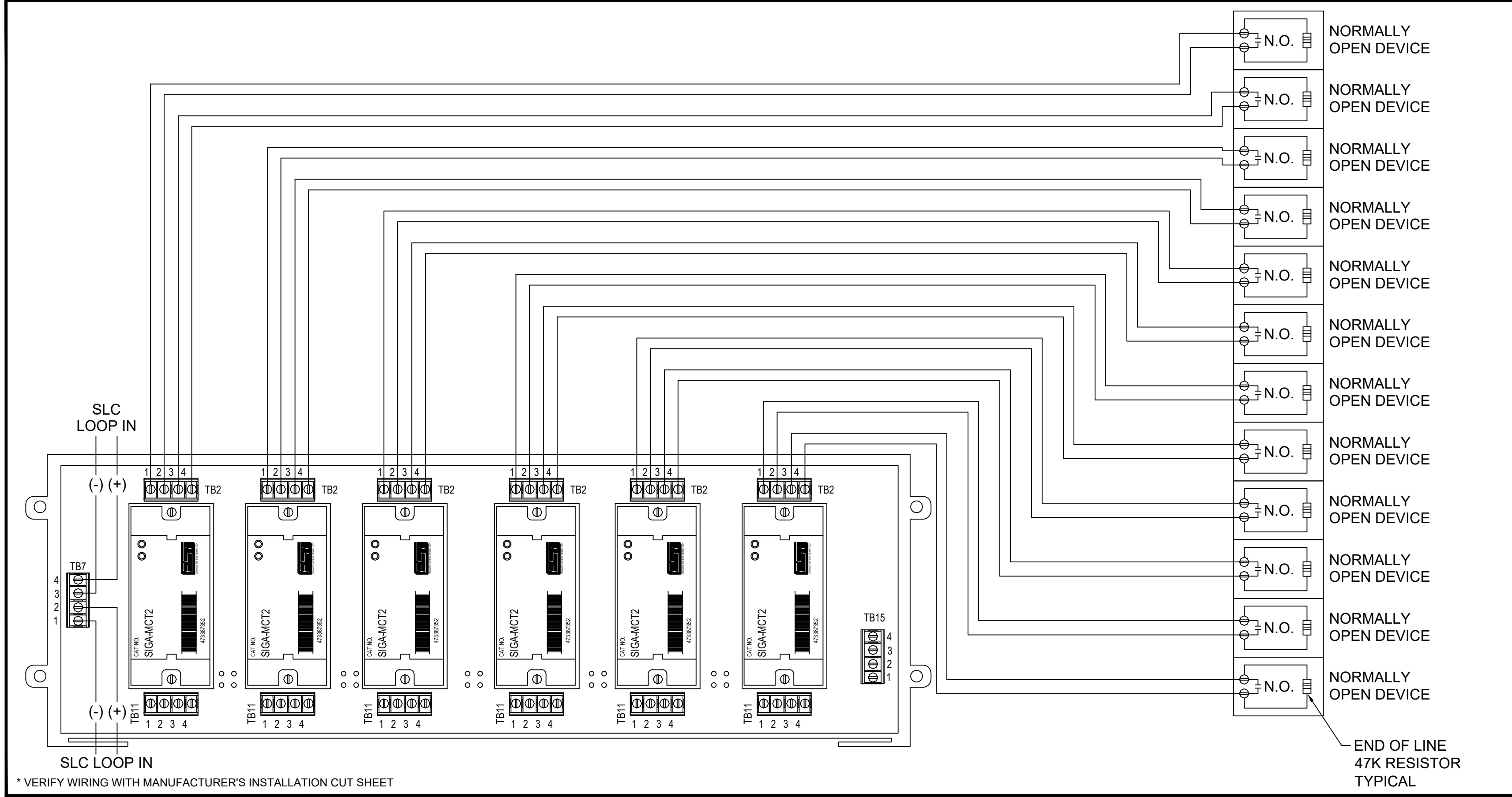
DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

ASBUILT - 144

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1 TYPICAL DELUGE VALVE RELEASING CIRCUIT WIRING  
SCALE: NOT TO SCALE



2 TYPICAL SIGA-UIO6 WITH (6) SIGA-MCT2 WIRING  
SCALE: NOT TO SCALE

**BARNARD EJMT TEAM**

BCER CONSULTING ENGINEERS  
BARNARD  
Western States Fire Protection Co.  
STURGEON ELECTRIC  
AEE  
RONDINELLI  
Western States Fire Protection Co.

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

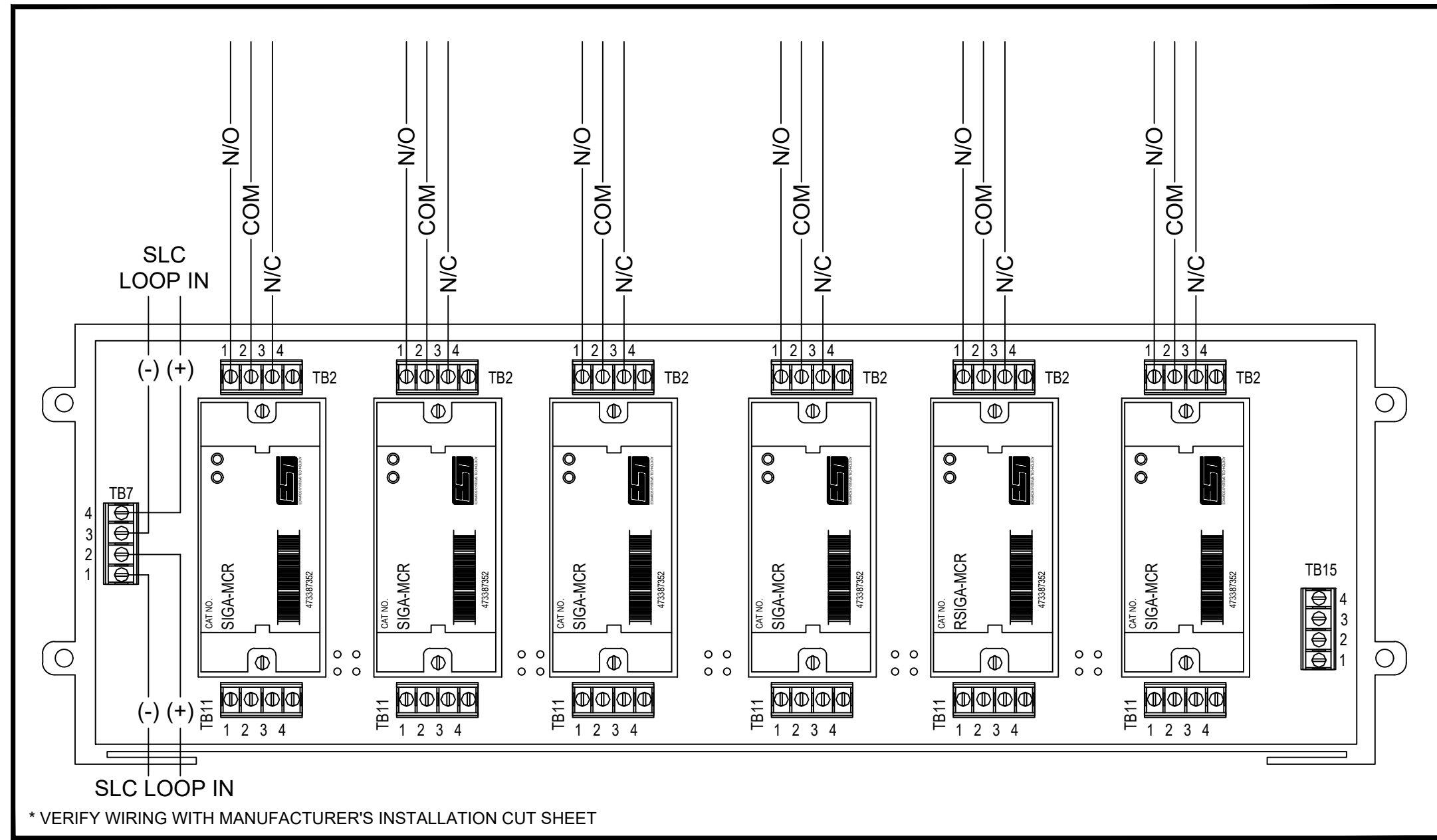
Num	Revisions Description	Date

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

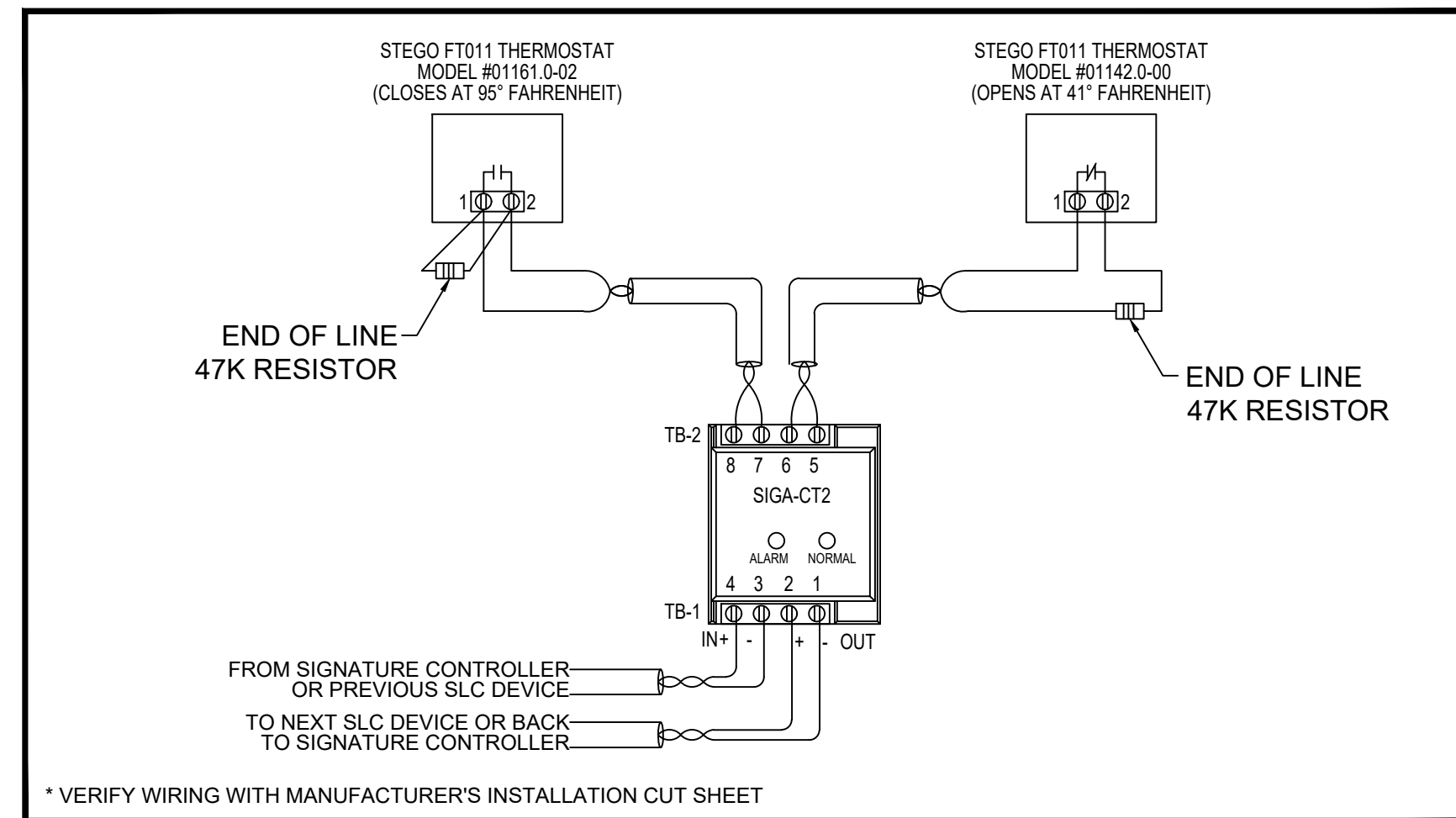
FIRE ALARM:  
DEVICE WIRING DETAILS

Drawing Number  
**FA6.12**

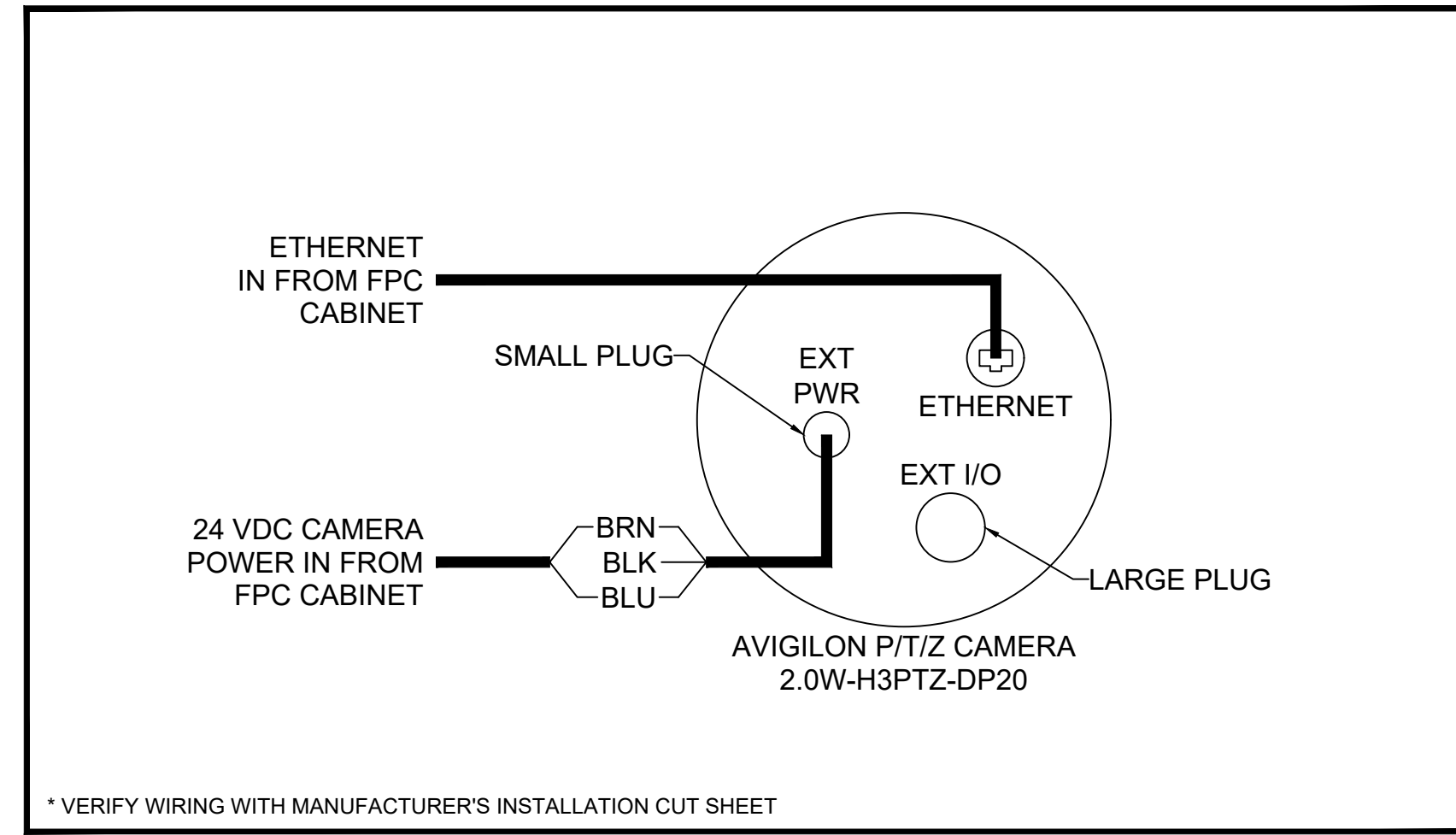
ASBUILT - 145



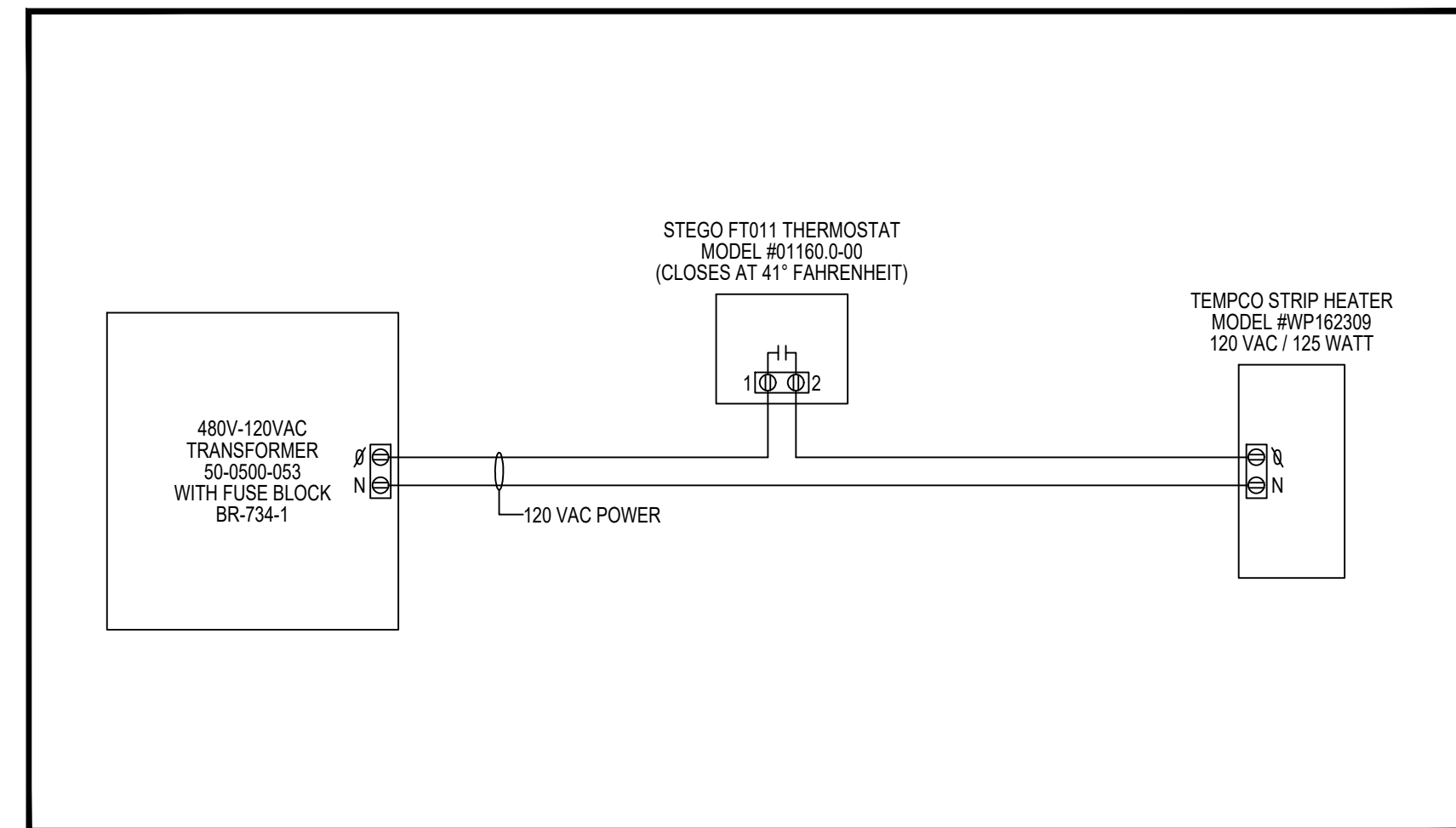
1 TYPICAL SIGA-UIO WITH (6) SIGA-MCR WIRING  
SCALE: NOT TO SCALE



3 CABINET TEMPERATURE THERMOSTAT MONITOR WIRING  
SCALE: NOT TO SCALE



2 TYPICAL PAN/TILT/ZOOM CAMERA WIRING  
SCALE: NOT TO SCALE



4 CABINET TEMPERATURE CONTROL WIRING  
SCALE: NOT TO SCALE

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

BARNARD EJMT TEAM

BCER  
Western States  
Fire Protection Co.  
ENGINEERS

BARNARD

Sturgeon Electric

RONNINELLI  
A CERTIFIED SAFETY  
ENGINEERING FIRM

Revisions	Date	Description

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

FA6.13

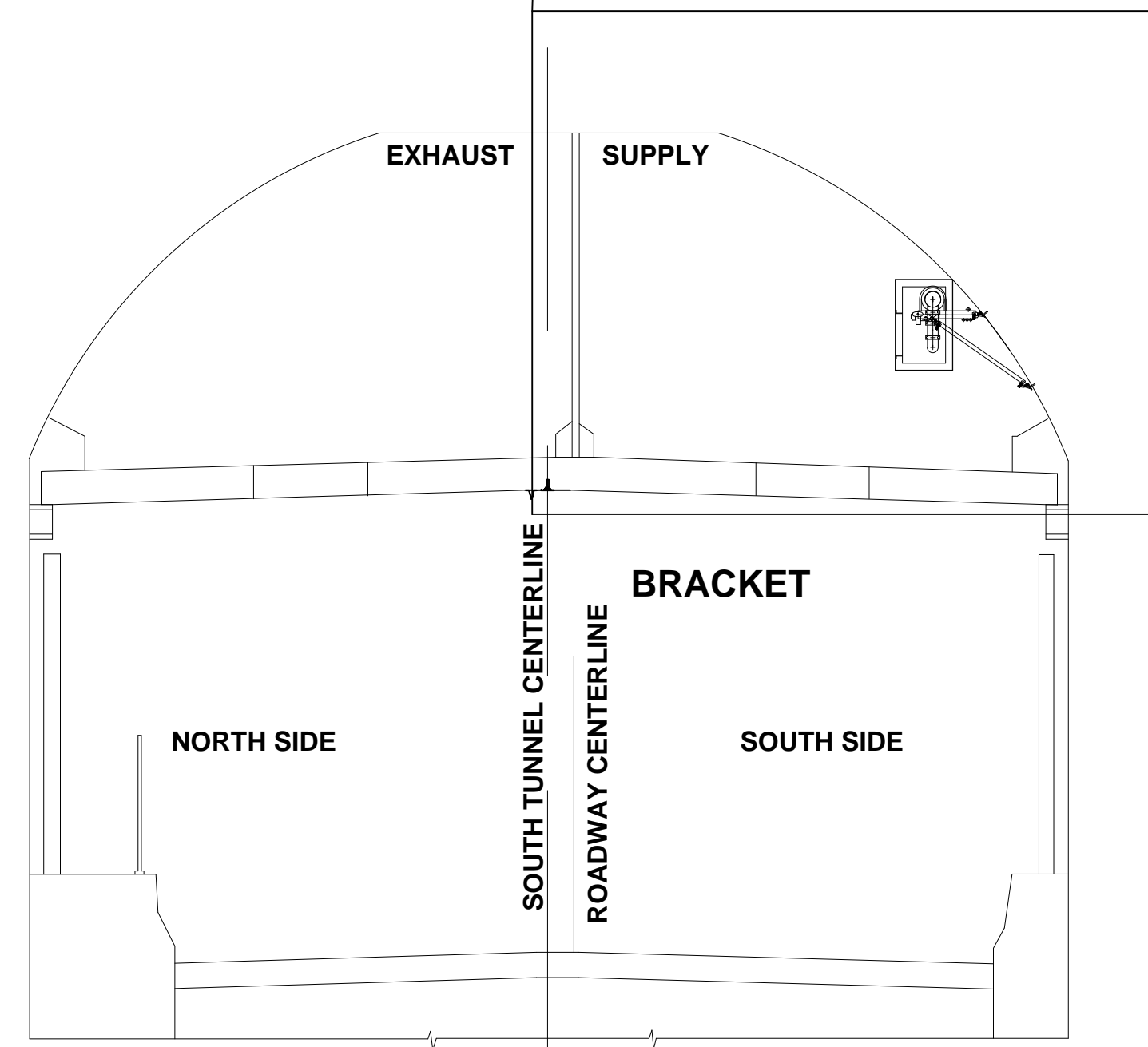
Fire Alarm: Device Wiring Details

Drawing Number

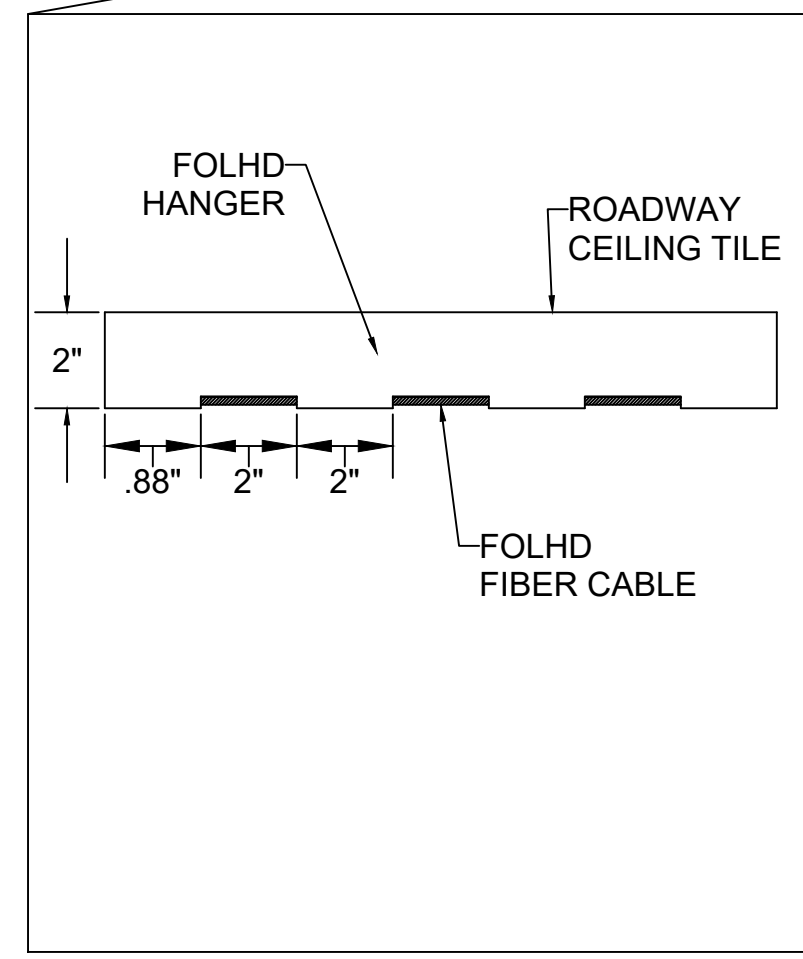
Drawn by: B.T.L. | Checked by: AEE-Jr



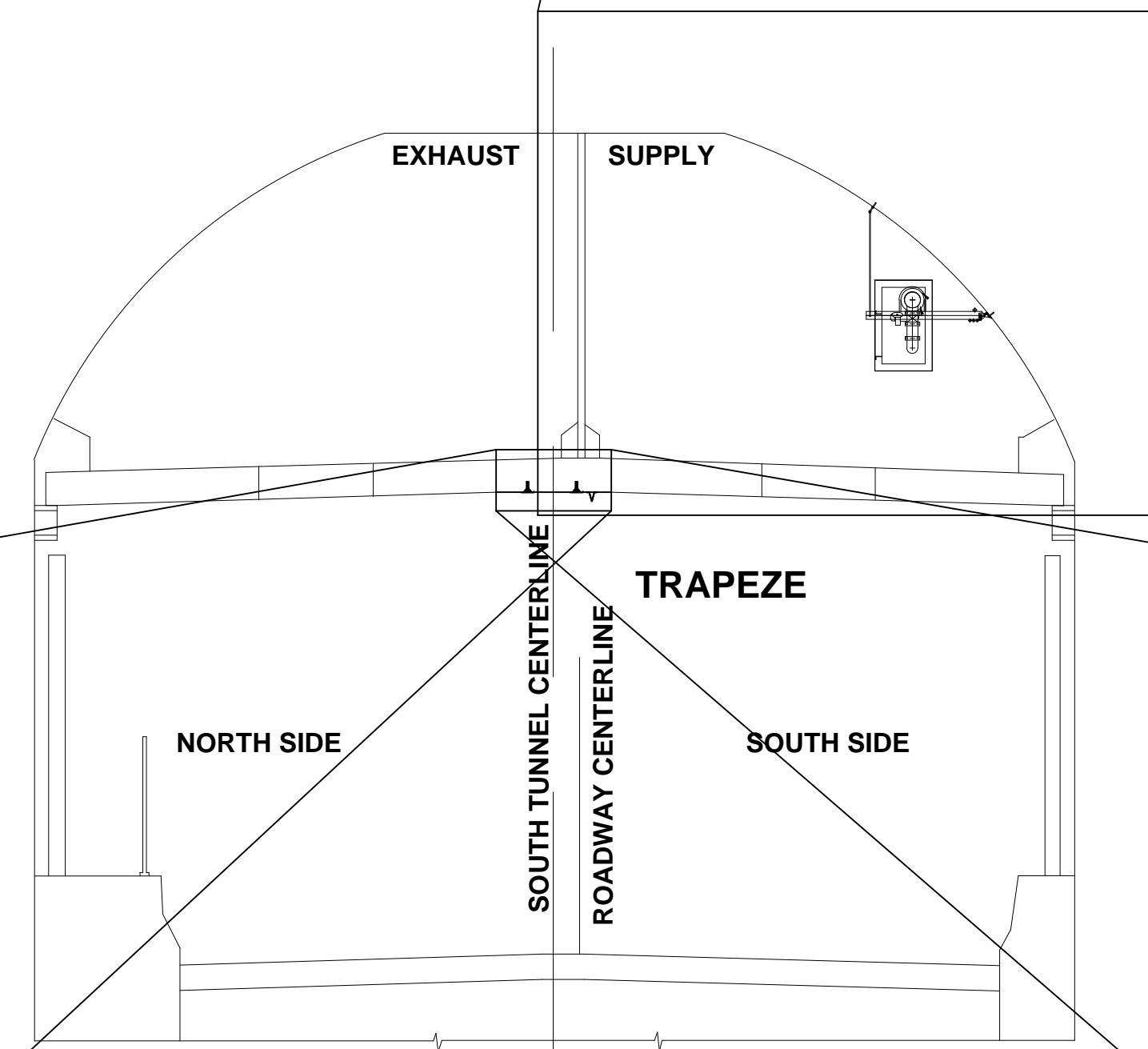
IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE



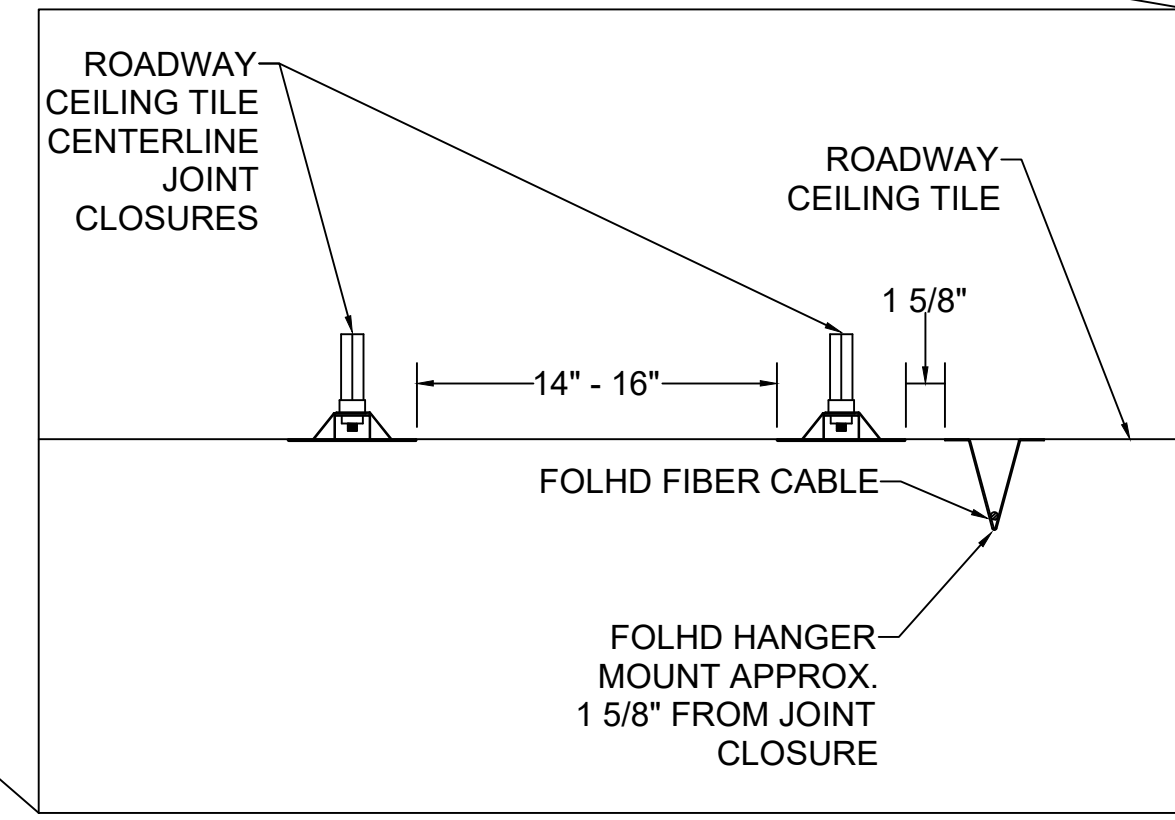
1 JOHNSON (SOUTH) TUNNEL IVE BRACKET - TYPICAL LOCATION  
SCALE: 1/64" = 1'-0"



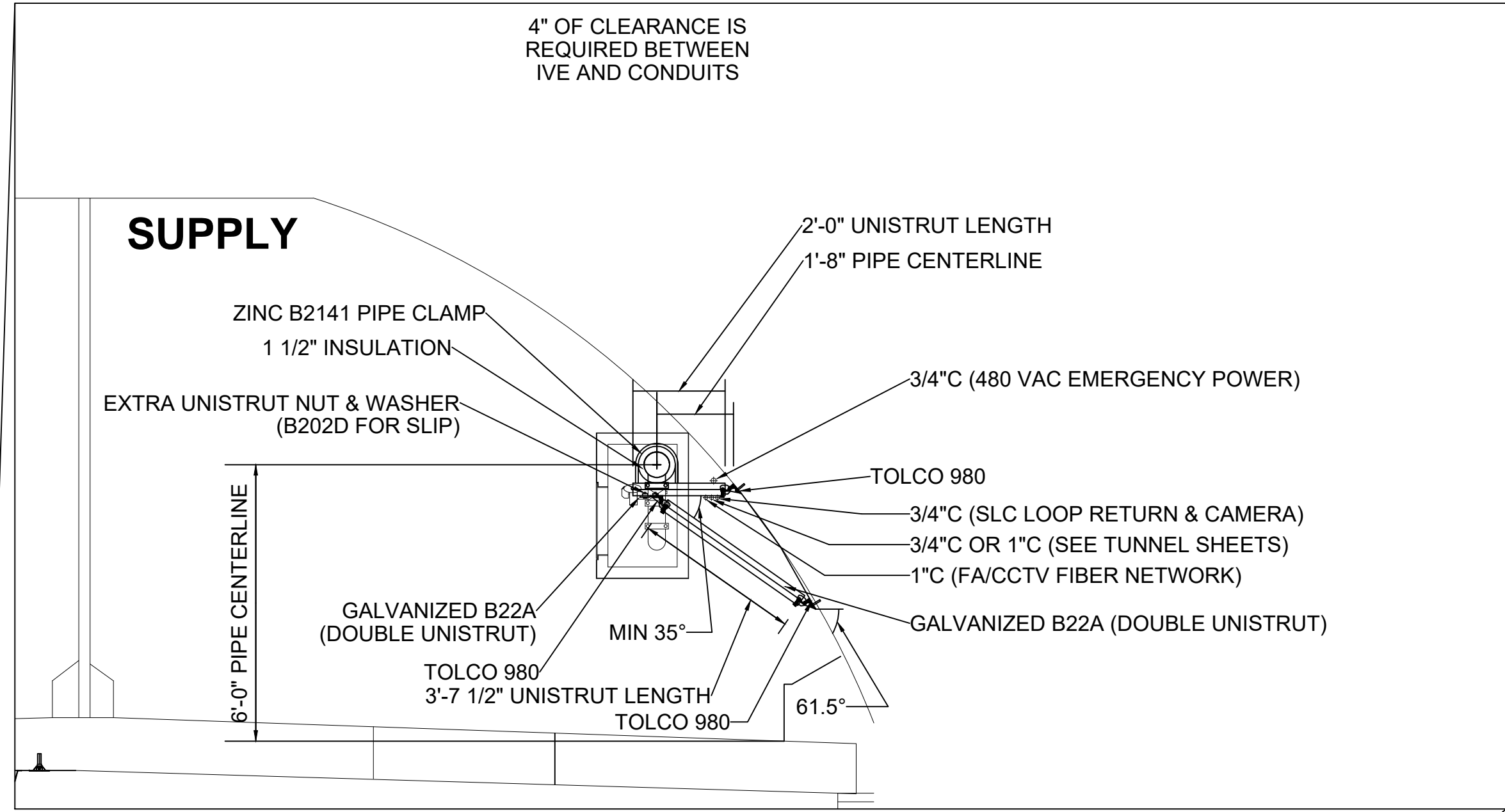
6 FOLHD HANGER - SIDE VIEW  
SCALE: 1/8" = 1'-0"



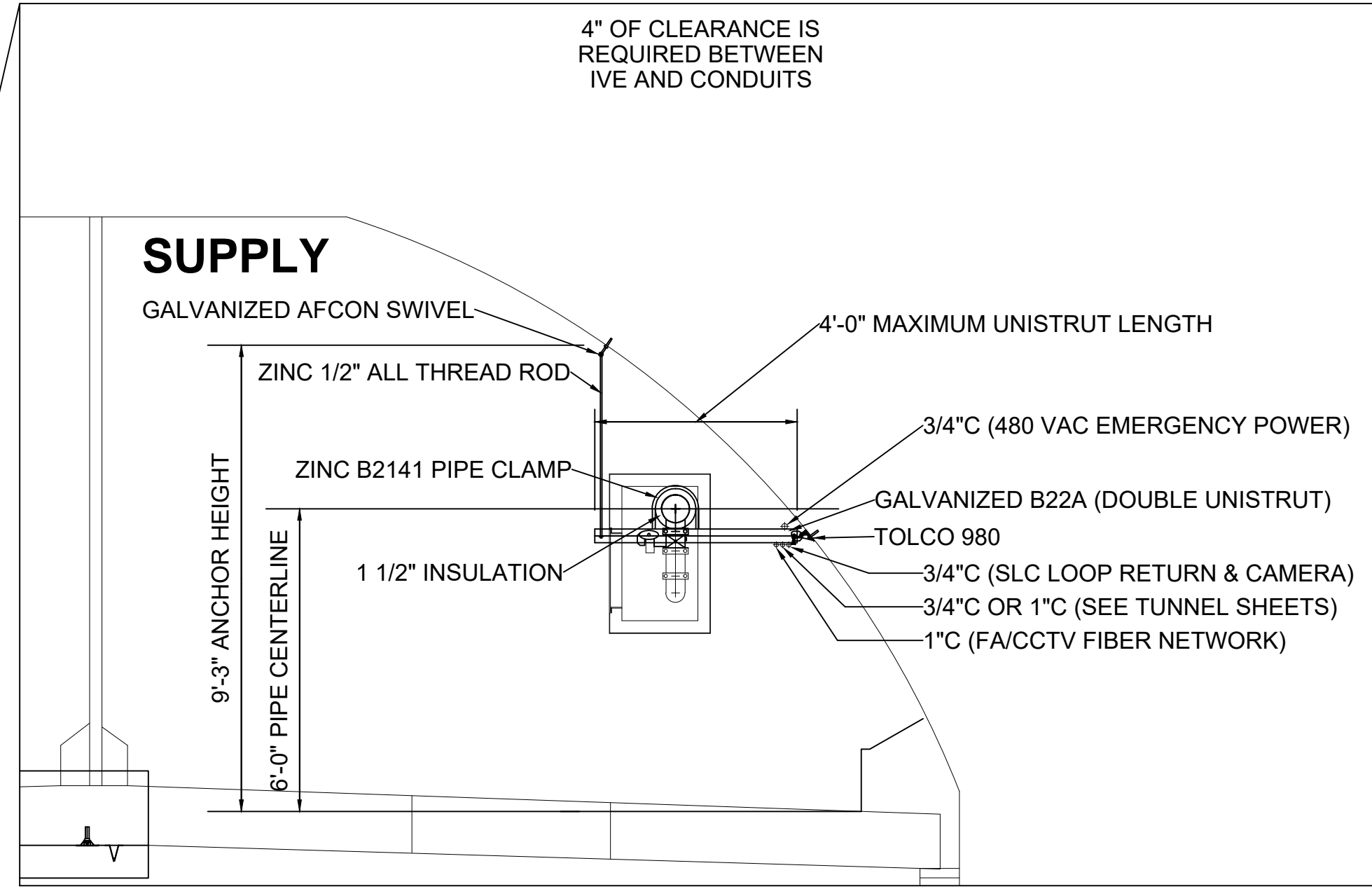
2 JOHNSON (SOUTH) TUNNEL IVE BRACKET - OBSTRUCTED LOCATION  
SCALE: 1/64" = 1'-0"



5 FOLHD HANGER - FRONT VIEW  
SCALE: 1/16" = 1'-0"



3 SECTION ENLARGEMENT #1 - TYPICAL LOCATION  
SCALE: 1/32" = 1'-0"



4 SECTION ENLARGEMENT #2 - OBSTRUCTED LOCATION  
SCALE: 1/32" = 1'-0"

EISENHOWER/JOHNSON  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360  
Subaccount 17810

**BARNARD EJMT TEAM**

BCER  
Engineering

BARNARD

RONDINELLI  
A fire alarm life safety

ALF  
Western States Fire Protection Co.  
CONSULTING ENGINEERS

Sturgeon  
ELECTRIC

Revisions	Date
Num	Description

FIRE ALARM:  
FIRE PROTECTION  
**BRACKET HANGER DETAILS**

FA6.15

DRAWN BY: B.T.L. | CHECKED BY: AEE-JT

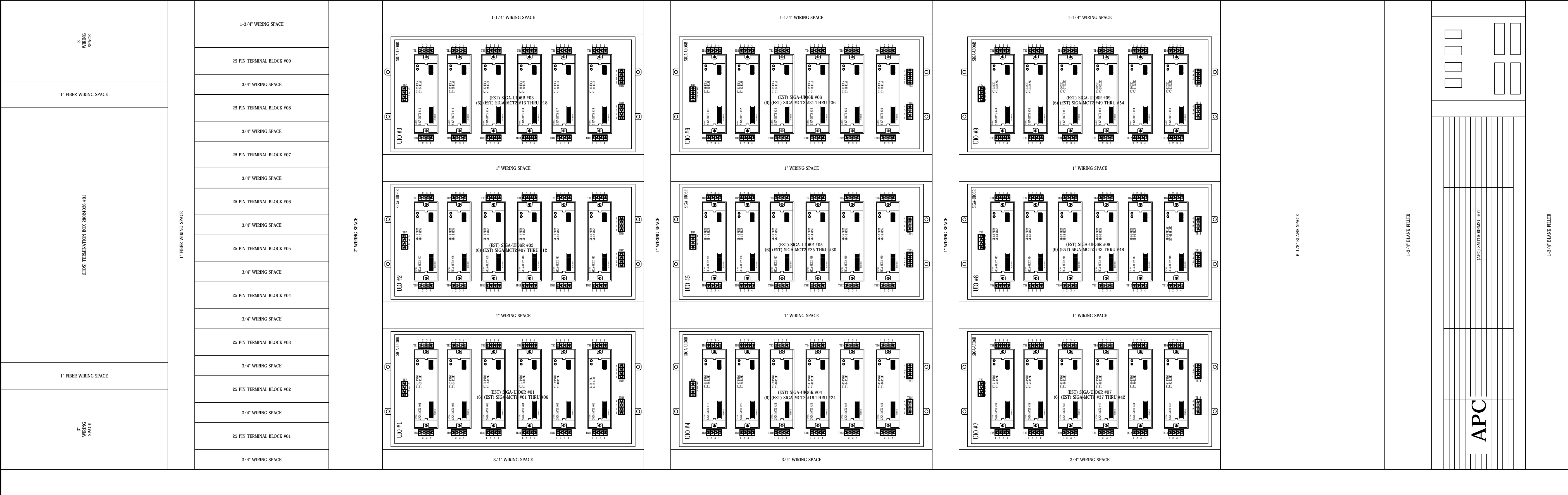
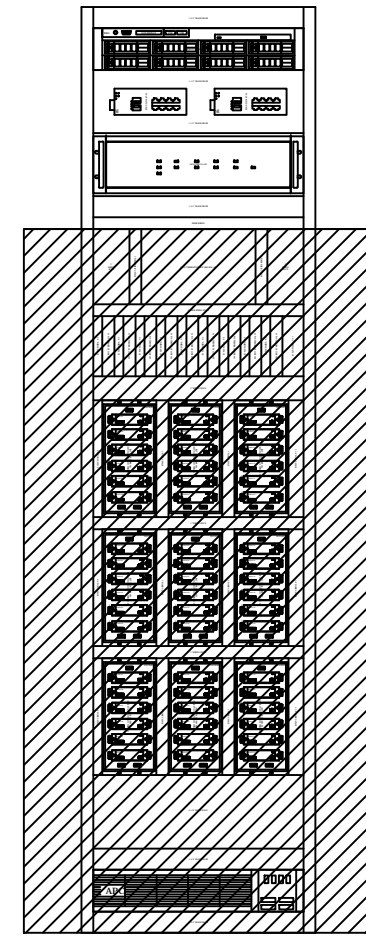


IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

SEE SHEET  
FA6.16

SEE SHEET  
FA6.16

1 EAST CONTROL ROOM - RACK #1 - FRONT VIEW - KEY PLAN  
SCALE: 1 : 16



MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32  
OVERALL DIMENSIONS ARE: 22-3/8" (W) x 32-5/8" (D) x 83-1/8" (H)  
USEABLE DIMENSIONS ARE: 19-1/2" (W) x 30-3/4" (D) x 77-1/8" (H)  
EAST CONTROL ROOM - RACK #1  
FRONT VIEW - BOTTOM SECTION

1 EAST CONTROL ROOM - RACK #1 - FRONT VIEW - BOTTOM SECTION  
SCALE: 1 : 2

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

BARNARD EJMT TEAM

BCER  
BARNARD  
RONDINELLI  
Sturgeon ELECTRIC  
Western States Fire Protection Co.  
ALF  
CONSULTING ENGINEERS

Revisions	Date

FIRE ALARM:  
DETAILS-EAST CNTRL-RACK  
#1-WIRE-FRONT-BOTTOM

Drawing Number  
**FA6.17**

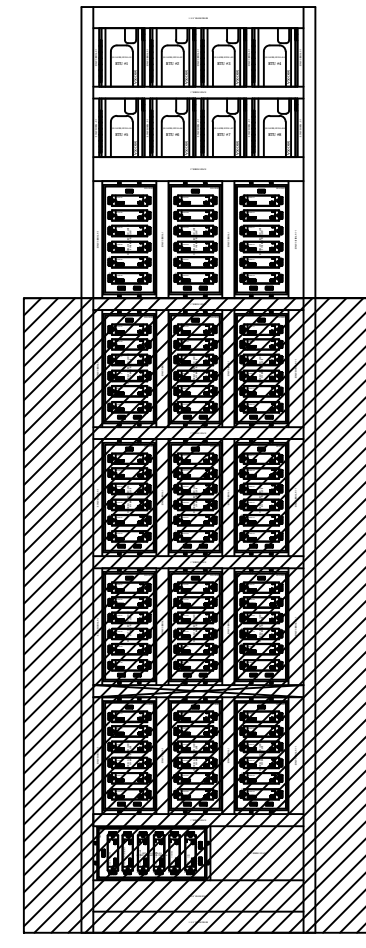
Project No. C0703-360  
Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF





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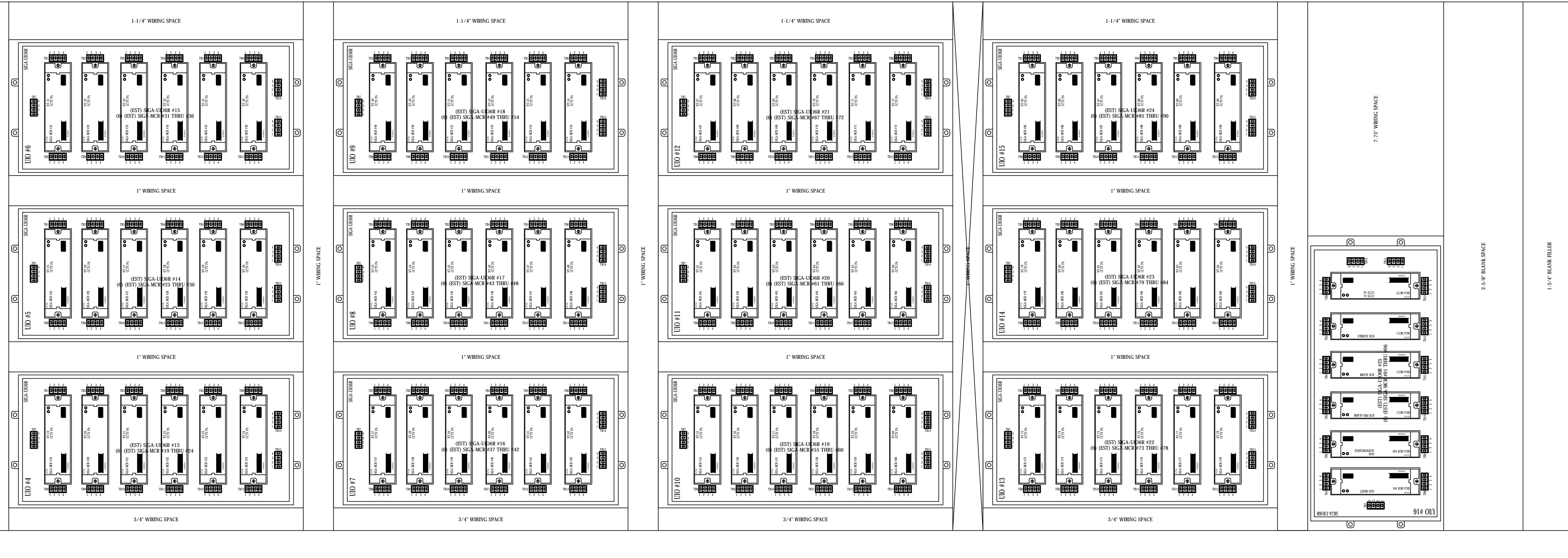
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EAST CONTROL ROOM - RACK #1 - REAR VIEW - KEY PLAN

SCALE: 1 : 16

SEE SHEET  
FA6.18

SEE SHEET  
FA6.18



MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32  
OVERALL DIMENSIONS ARE: 22-3/8" (W) x 32-5/8" (D) x 83-1/8" (H)  
USEABLE DIMENSIONS ARE: 19-1/2" (W) x 30-3/4" (D) x 77-1/8" (H)  
EAST CONTROL ROOM - RACK #1  
REAR VIEW - BOTTOM SECTION

1

EAST CONTROL ROOM - RACK #1 - REAR VIEW - BOTTOM SECTION

SCALE: 1 : 2

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

**BARNARD EJMT TEAM**

**BCER**  
CONSULTING ENGINEERS

**BARNARD**  
Western States  
Fire Protection Co.

**Sturgeon**  
ELECTRIC

**RONDINELLI**  
A LIFE SAVING TEAM

**ALP**  
ENGINEERS

**SG**

Revisions	Date
Num	Description

FIRE ALARM:  
DETAILS-EAST CNTRL-RACK  
#1-WIRE-REAR-BOTTOM

Drawing Number

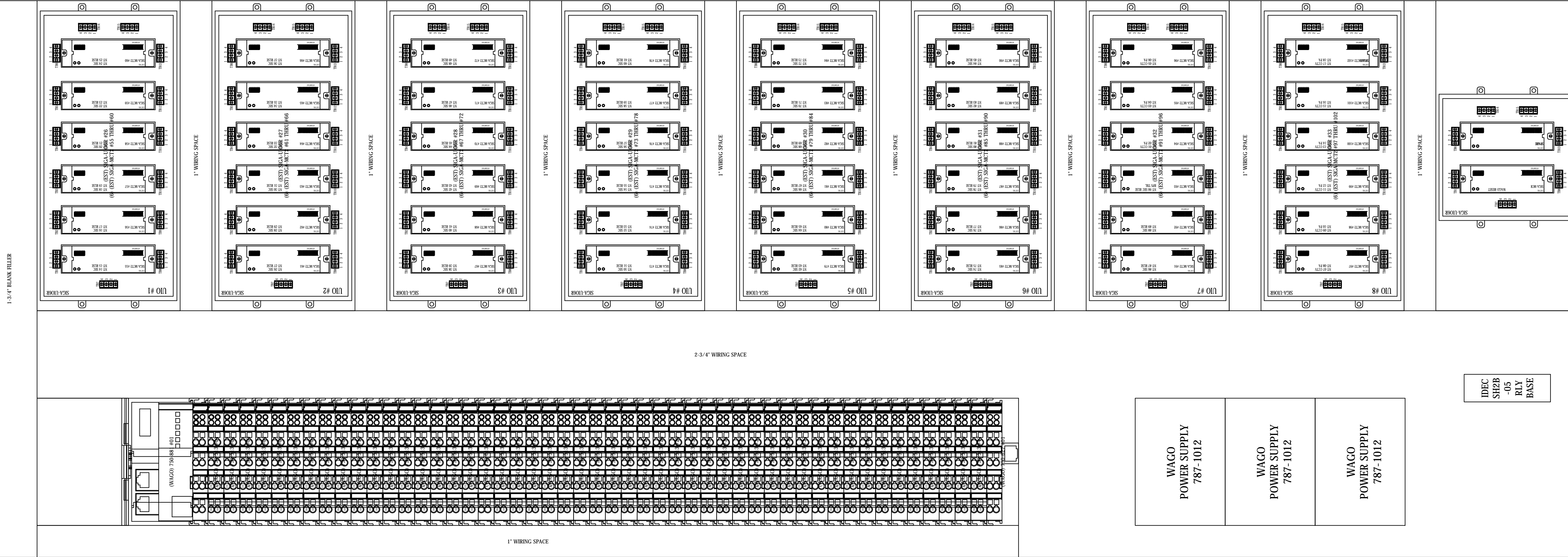
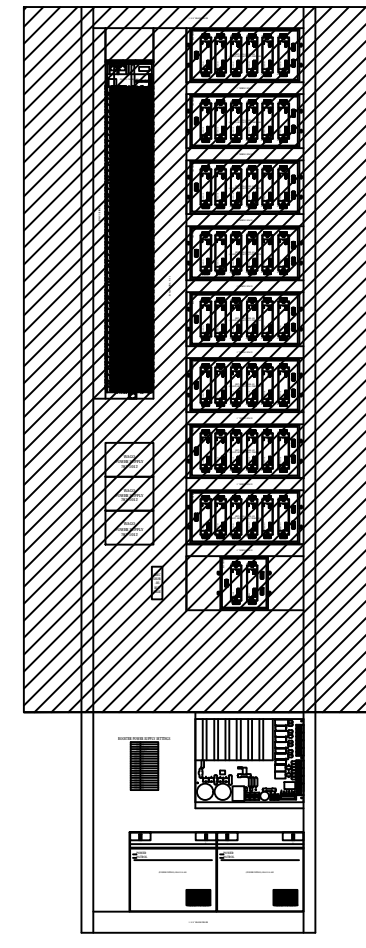
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ASBUILT - 152

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1 EAST CONTROL ROOM - RACK #2 - FRONT VIEW - KEY PLAN  
SCALE: 1 : 16



MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32  
OVERALL DIMENSIONS ARE: 22-3/8" (W) x 32-5/8" (D) x 83-1/8" (H)  
USEABLE DIMENSIONS ARE: 19-1/2" (W) x 30-3/4" (D) x 77-1/8" (H)  
EAST CONTROL ROOM - RACK #2  
FRONT VIEW - TOP SECTION

2 EAST CONTROL ROOM - RACK #2 - FRONT VIEW - TOP SECTION  
SCALE: 1 : 2

SEE SHEET  
FA6.21

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Revisions	Date
Num	Description

FIRE ALARM:  
DETAILS-EAST CNTRL-RACK  
#2-WIRE-FRONT-TOP

Drawing Number

FA6.20

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SEE SHEET  
FA6.21

**BARNARD EJMT TEAM**

**BCER**  
CONSULTING ENGINEERS

**BARNARD**

**RONDINELLI**  
A COMMITMENT TO SAFETY

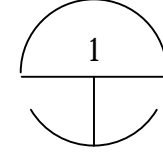
**Sturgeon**  
ELECTRIC

**SG**  
Western States  
Fire Protection Co.

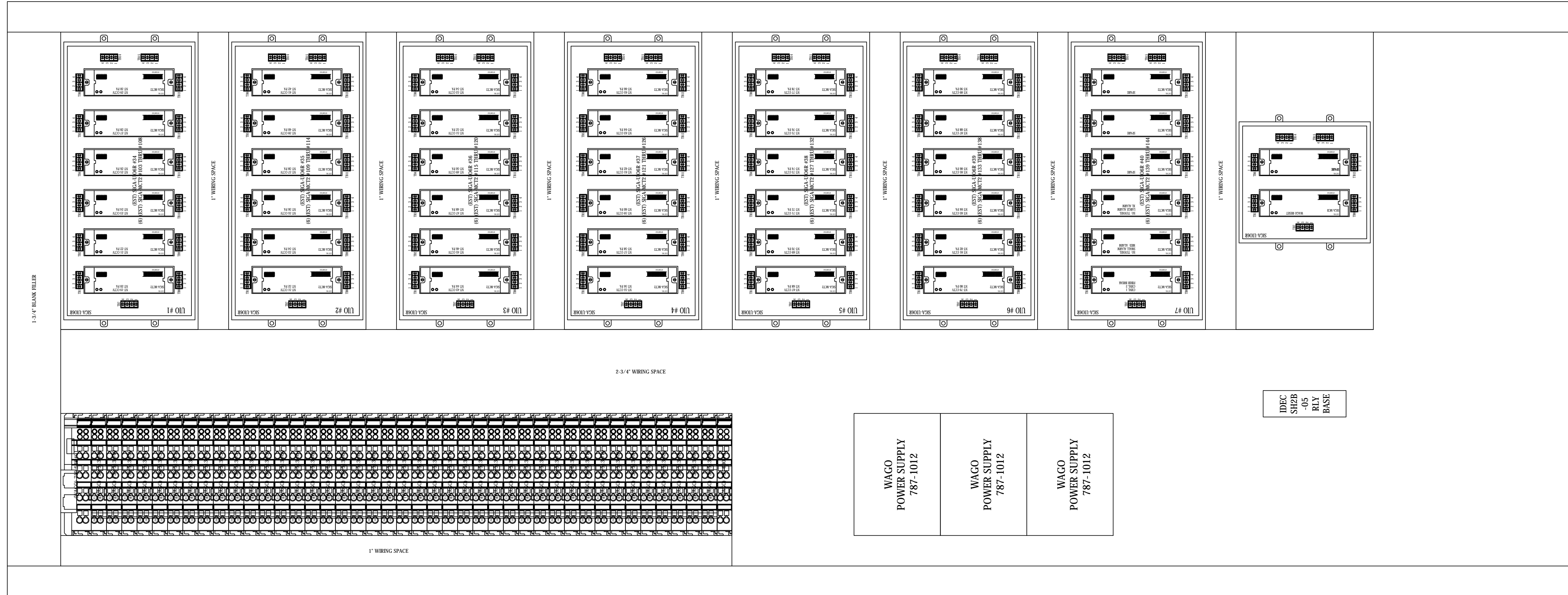
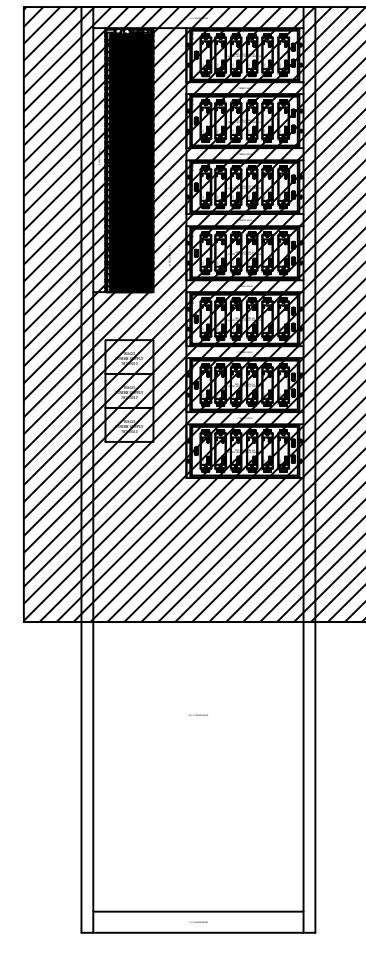
**ALF**  
CONSULTING  
ENGINEERS



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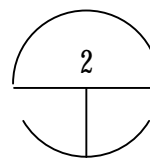


EAST CONTROL ROOM - RACK #2 - REAR VIEW - KEY PLAN  
SCALE: 1 : 16



SEE SHEET  
FA6.23

SEE SHEET  
FA6.23



EAST CONTROL ROOM - RACK #2 - REAR VIEW - TOP SECTION  
SCALE: 1 : 2

MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32  
OVERALL DIMENSIONS ARE: 22-3/8" (W) x 32-5/8" (D) x 83-1/8" (H)  
USEABLE DIMENSIONS ARE: 19-1/2" (W) x 30-3/4" (D) x 77-1/8" (H)  
EAST CONTROL ROOM - RACK #2  
REAR VIEW - TOP SECTION

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-15**

Revisions	Date
Num	Description

FIRE ALARM:  
DETAILS-EAST CNTRL-RACK  
#2-WIRE-REAR-TOP

Drawing Number  
**FA6.22**

**BARNARD EJMT TEAM**

**BCER** CONSULTING ENGINEERS  
**BARNARD** CONSULTING ENGINEERS  
**STURGEON ELECTRIC**  
**RONDINELLI** A LIFE SAVING LIFE SAFETY  
Western States Fire Protection Co.

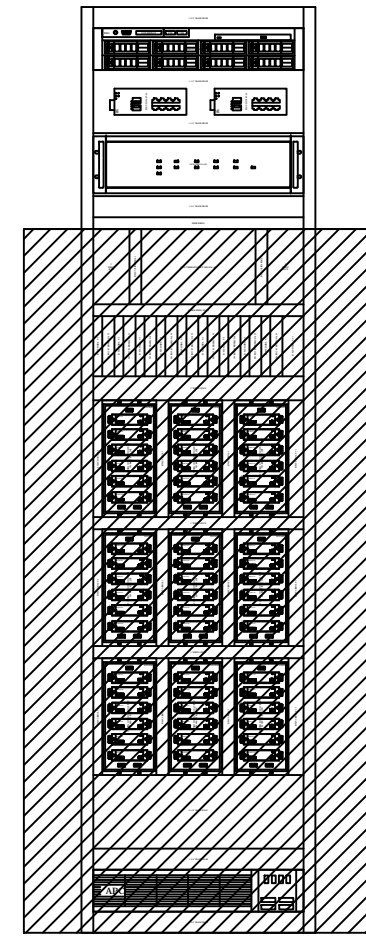




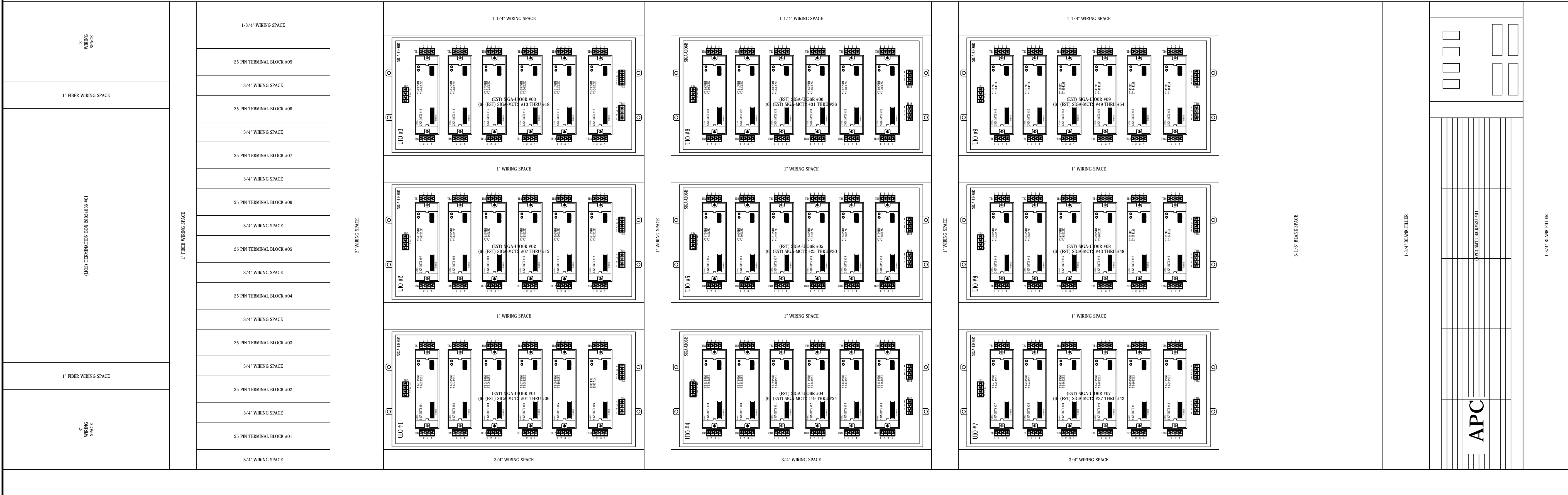
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SEE SHEET  
FA6.24

SEE SHEET  
FA6.24



1 WEST CONTROL ROOM - RACK #1 - FRONT VIEW - KEY PLAN  
SCALE: 1 : 16



MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32  
OVERALL DIMENSIONS ARE: 22-3/8" (W) x 32-5/8" (D) x 83-1/8" (H)  
USEABLE DIMENSIONS ARE: 19-1/2" (W) x 30-3/4" (D) x 77-1/8" (H)  
WEST CONTROL ROOM - RACK #1  
FRONT VIEW - BOTTOM SECTION

1 WEST CONTROL ROOM - RACK #1 - FRONT VIEW - BOTTOM SECTION  
SCALE: 1 : 2

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

BARNARD EJMT TEAM

BCER  
BARNARD  
RONDINELLI  
Sturgeon Electric  
Western States Fire Protection Co.  
ALF  
ENGINEERS

Revisions	Date
Num	Description

FIRE ALARM:  
DETAILS-WEST CNTRL-RACK  
#1-WIRE-FRONT-BOTTOM

Drawing Number  
**FA6.25**

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

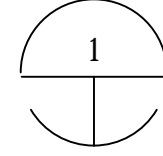
DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

APC

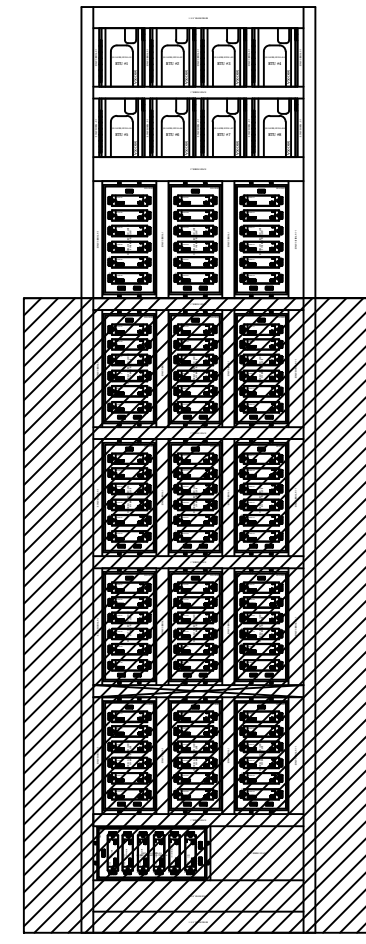




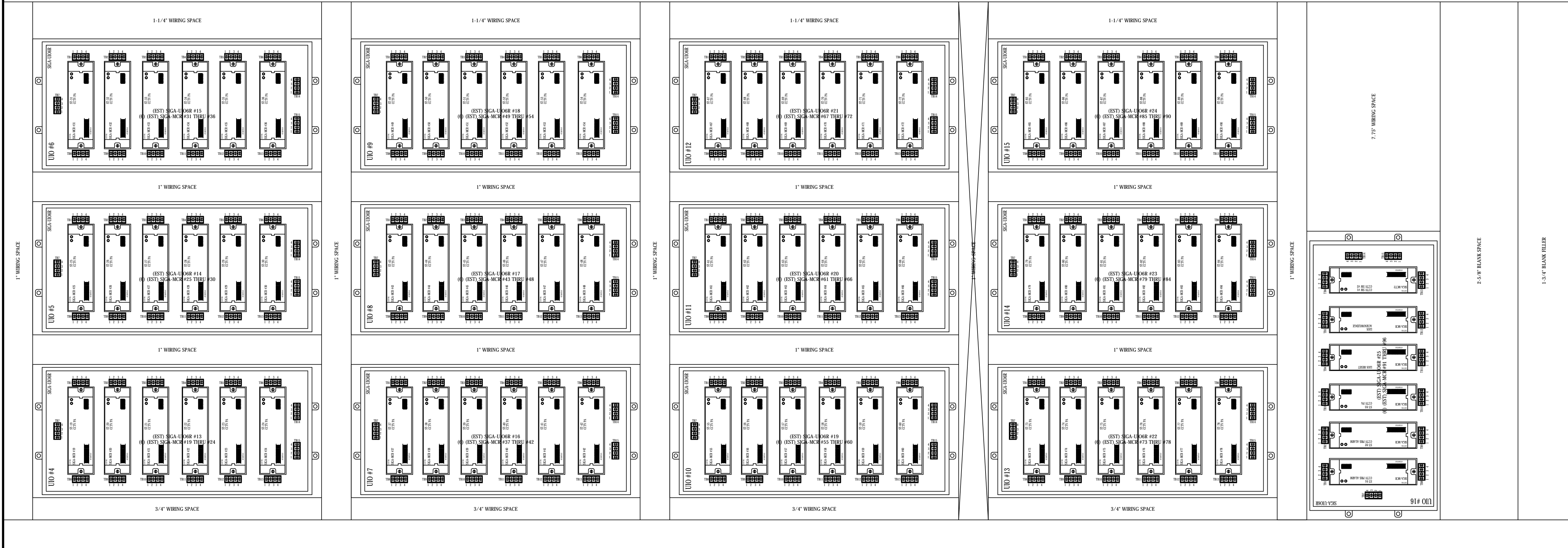
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WEST CONTROL ROOM - RACK #1 - REAR VIEW - KEY PLAN  
SCALE: 1 : 16

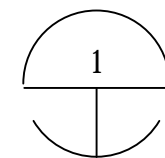


SEE SHEET  
FA6.26



SEE SHEET  
FA6.26

MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32  
OVERALL DIMENSIONS ARE: 22-3/8" (W) x 32-5/8" (D) x 83-1/8" (H)  
USEABLE DIMENSIONS ARE: 19-1/2" (W) x 30-3/4" (D) x 77-1/8" (H)  
WEST CONTROL ROOM - RACK #1  
REAR VIEW - BOTTOM SECTION



WEST CONTROL ROOM - RACK #1 - REAR VIEW - BOTTOM SECTION  
SCALE: 1 : 2

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

**BARNARD EJMT TEAM**

BCER  
BARNARD  
WESTERN STATES  
ENGINEERING

Sturgeon  
ELECTRIC

BARNARD

RONDINELLI  
A COMMITMENT TO LIFE SAFETY

WSP  
WESTERN STATES  
FIRE PROTECTION CO.  
ENGINEERS

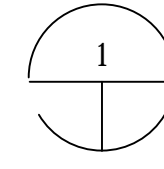
Revisions	Date

FIRE ALARM:  
DETAILS-WEST CNTRL-RACK  
#1-WIRE-REAR-BOTTOM

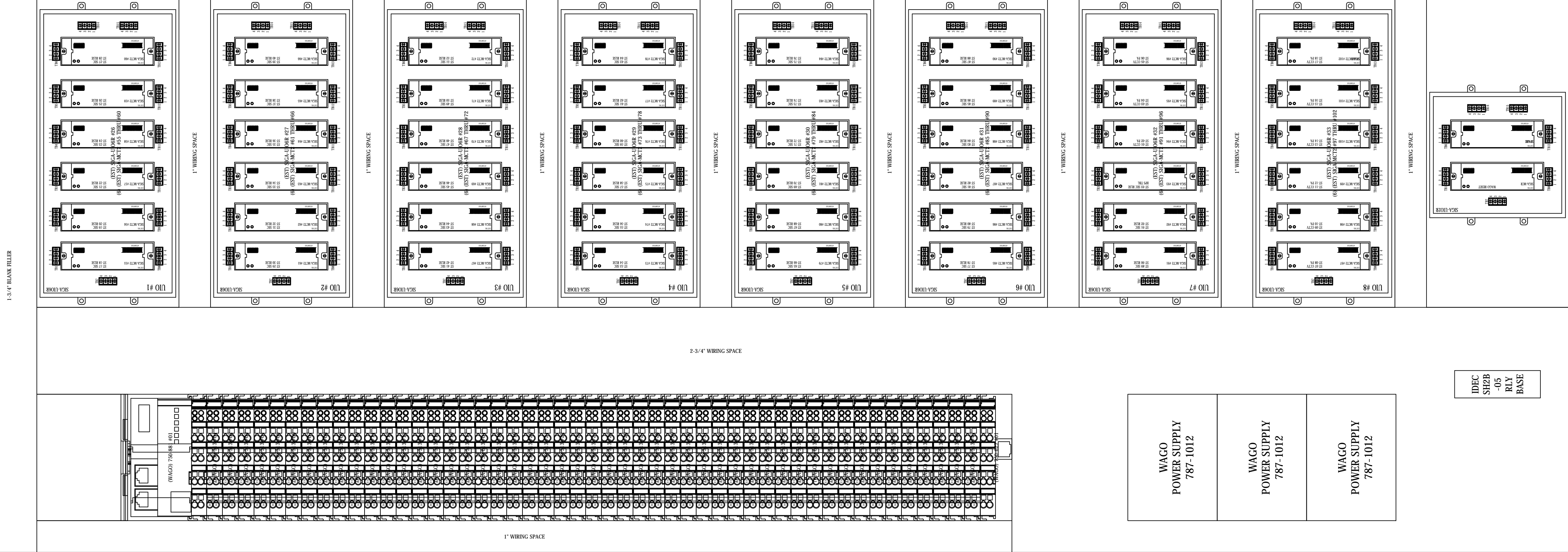
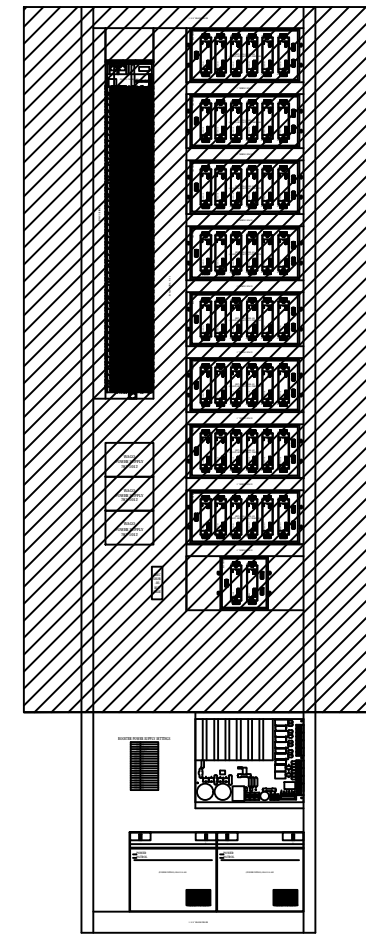
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**FA6.27**

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

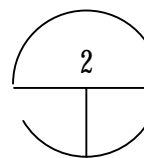
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1 WEST CONTROL ROOM - RACK #2 - FRONT VIEW - KEY PLAN  
SCALE: 1 : 16



MIDDLE ATLANTIC EQUIPMENT RACK WRK-44A-32  
OVERALL DIMENSIONS ARE: 22-3/8" (W) x 32-5/8" (D) x 83-1/8" (H)  
USEABLE DIMENSIONS ARE: 19-1/2" (W) x 30-3/4" (D) x 77-1/8" (H)  
WEST CONTROL ROOM - RACK #2  
FRONT VIEW - TOP SECTION



2 WEST CONTROL ROOM - RACK #2 - FRONT VIEW - TOP SECTION  
SCALE: 1 : 2

SEE SHEET  
FA6.29

Revisions	Date
Num	Description

FIRE ALARM:  
DETAILS-WEST CNTRL-RACK  
#2-WIRE-FRONT-TOP

Drawing Number

FA6.28

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

**BARNARD EJMT TEAM**

**BCER**  
CONSULTING ENGINEERS

**BARNARD**

**RONDINELLI**  
A COMMITMENT TO SAFETY

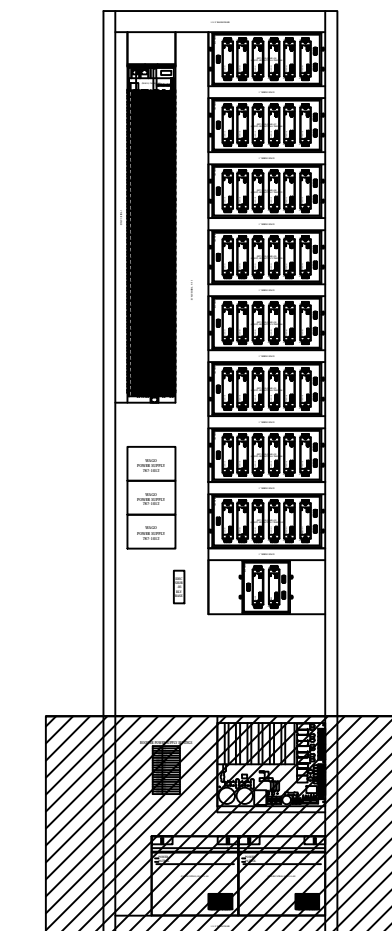
**Sturgeon**  
ELECTRIC

Western States  
Fire Protection Co.

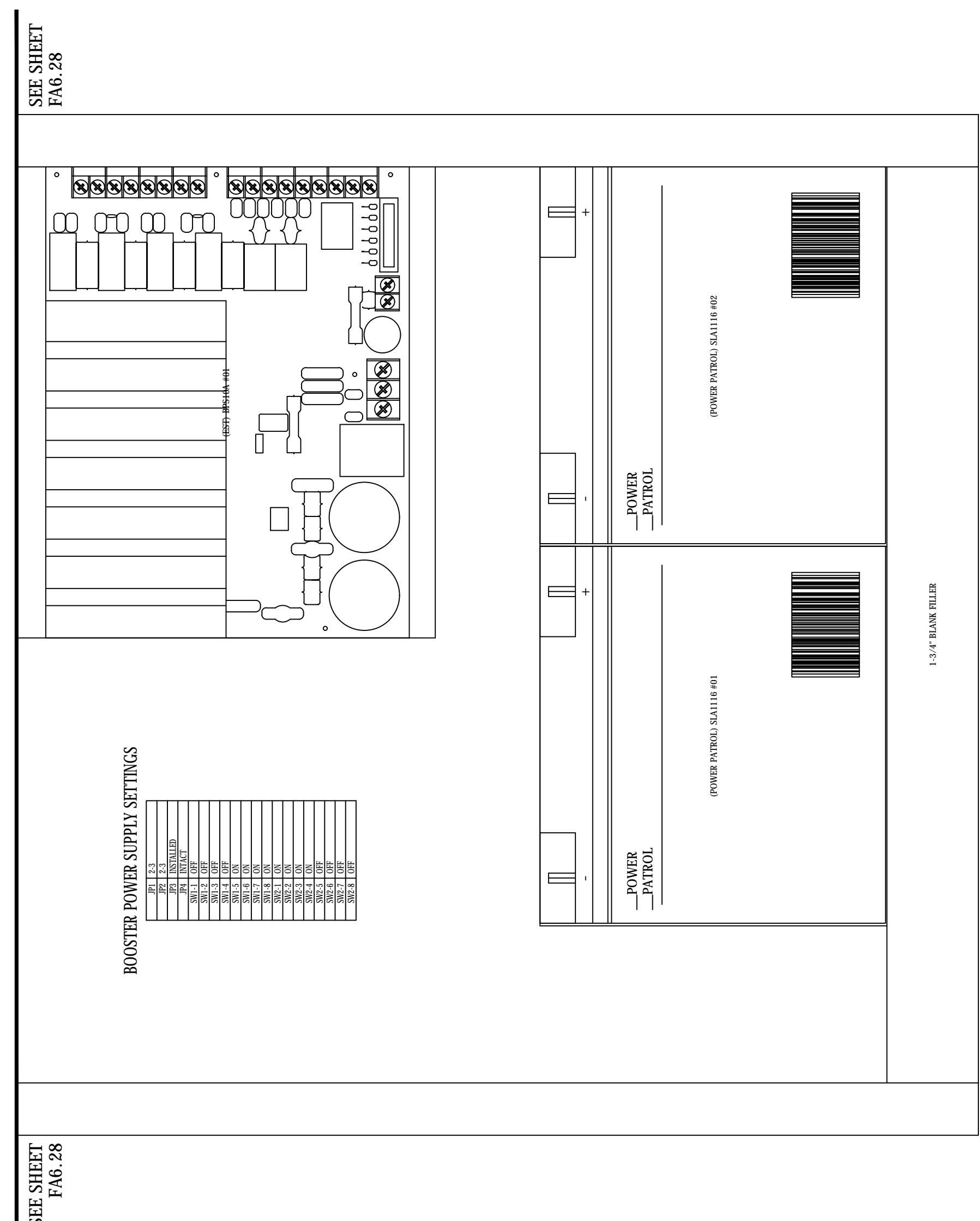
**ALF**  
CONSULTING ENGINEERS

EJMT Tunnel Project  
West Control Room  
RACK #2 Wiring Spreadsheet  
Mid-Front Level

ModBus Outputs	WAGO 513 Rly Mod #	WAGO 513 Rly #	UIO #	MCT2 #	Notes
Output 107	1	1	1	1	ST-17 Secondary Rise Alm
Output 108	1	2	1	1	ST-18 Secondary Rise Alm
Output 109	2	3	1	2	ST-19 Secondary Rise Alm
Output 110	2	4	1	2	ST-20 Secondary Rise Alm
Output 111	3	5	1	3	ST-21 Secondary Rise Alm
Output 112	3	6	1	3	ST-22 Secondary Rise Alm
Output 113	4	7	1	4	ST-23 Secondary Rise Alm
Output 114	4	8	1	4	ST-24 Secondary Rise Alm
Output 115	5	9	1	5	ST-25 Secondary Rise Alm
Output 116	5	10	1	5	ST-26 Secondary Rise Alm
Output 117	6	11	1	6	ST-27 Secondary Rise Alm
Output 118	6	12	1	6	ST-28 Secondary Rise Alm
Output 119	7	13	2	1	ST-29 Secondary Rise Alm
Output 120	7	14	2	1	ST-30 Secondary Rise Alm
Output 121	8	15	2	2	ST-31 Secondary Rise Alm
Output 122	8	16	2	2	ST-32 Secondary Rise Alm
Output 123	9	17	2	3	ST-33 Secondary Rise Alm
Output 124	9	18	2	3	ST-34 Secondary Rise Alm
Output 125	10	19	2	4	ST-35 Secondary Rise Alm
Output 126	10	20	2	4	ST-36 Secondary Rise Alm
Output 127	11	21	2	5	ST-37 Secondary Rise Alm
Output 128	11	22	2	5	ST-38 Secondary Rise Alm
Output 129	12	23	2	6	ST-39 Secondary Rise Alm
Output 130	12	24	2	6	ST-40 Secondary Rise Alm
Output 131	13	25	3	1	ST-41 Secondary Rise Alm
Output 132	13	26	3	1	ST-42 Secondary Rise Alm
Output 133	14	27	3	2	ST-43 Secondary Rise Alm
Output 134	14	28	3	2	ST-44 Secondary Rise Alm
Output 135	15	29	3	3	ST-45 Secondary Rise Alm
Output 136	15	30	3	3	ST-46 Secondary Rise Alm
Output 137	16	31	3	4	ST-47 Secondary Rise Alm
Output 138	16	32	3	4	ST-48 Secondary Rise Alm
Output 139	17	33	3	5	ST-49 Secondary Rise Alm
Output 140	17	34	3	5	ST-50 Secondary Rise Alm
Output 141	18	35	3	6	ST-51 Secondary Rise Alm
Output 142	18	36	3	6	ST-52 Secondary Rise Alm
Output 143	19	37	4	1	ST-53 Secondary Rise Alm
Output 144	19	38	4	1	ST-54 Secondary Rise Alm
Output 145	20	39	4	2	ST-55 Secondary Rise Alm
Output 146	20	40	4	2	ST-56 Secondary Rise Alm
Output 147	21	41	4	3	ST-57 Secondary Rise Alm
Output 148	21	42	4	3	ST-58 Secondary Rise Alm
Output 149	22	43	4	4	ST-59 Secondary Rise Alm
Output 150	22	44	4	4	ST-60 Secondary Rise Alm
Output 151	23	45	4	5	ST-61 Secondary Rise Alm
Output 152	23	46	4	5	ST-62 Secondary Rise Alm
Output 153	24	47	4	6	ST-63 Secondary Rise Alm
Output 154	24	48	4	6	ST-64 Secondary Rise Alm
Output 155	25	49	5	1	ST-65 Secondary Rise Alm
Output 156	25	50	5	1	ST-66 Secondary Rise Alm
Output 157	26	51	5	2	ST-67 Secondary Rise Alm
Output 158	26	52	5	2	ST-68 Secondary Rise Alm
Output 159	27	53	5	3	ST-69 Secondary Rise Alm
Output 160	27	54	5	3	ST-70 Secondary Rise Alm
Output 161	28	55	5	4	ST-71 Secondary Rise Alm
Output 162	28	56	5	4	ST-72 Secondary Rise Alm
Output 163	29	57	5	5	ST-73 Secondary Rise Alm
Output 164	29	58	5	5	ST-74 Secondary Rise Alm
Output 165	30	59	5	6	ST-75 Secondary Rise Alm
Output 166	30	60	5	6	ST-76 Secondary Rise Alm
Output 167	31	61	6	1	ST-77 Secondary Rise Alm
Output 168	31	62	6	1	ST-78 Secondary Rise Alm
Output 169	32	63	6	2	ST-79 Secondary Rise Alm
Output 170	32	64	6	2	ST-80 Secondary Rise Alm
Output 171	33	65	6	3	ST-81 Secondary Rise Alm
Output 172	33	66	6	3	ST-82 Secondary Rise Alm
Output 173	34	67	6	4	ST-83 Secondary Rise Alm
Output 174	34	68	6	4	ST-84 Secondary Rise Alm
Output 175	35	69	6	5	ST-85 Secondary Rise Alm
Output 176	35	70	6	5	ST-86 Secondary Rise Alm
Output 177	36	71	6	6	ST-87 Secondary Rise Alm
Output 178	36	72	6	6	ST-88 Secondary Rise Alm
Output 179	37	73	7	1	ST-89 Secondary Rise Alm
Output 180	37	74	7	1	ST-90 Secondary Rise Alm
Output 181	38	75	7	2	ST-91 Secondary Rise Alm
Output 182	38	76	7	2	ST-92 Secondary Rise Alm
Output 183	39	77	7	3	ST-93 Secondary Rise Alm
Output 184	39	78	7	3	BPS Trouble
Output 185	40	79	7	4	ST-01 CCTV Pre-Alm
Output 186	40	80	7	4	ST-02 CCTV Pre-Alm
Output 187	41	81	7	5	ST-03 CCTV Pre-Alm
Output 188	41	82	7	5	ST-04 CCTV Pre-Alm
Output 189	42	83	7	6	ST-05 CCTV Pre-Alm
Output 190	42	84	7	6	ST-06 CCTV Pre-Alm
Output 191	43	85	8	1	ST-07 CCTV Pre-Alm
Output 192	43	86	8	1	ST-08 CCTV Pre-Alm
Output 193	44	87	8	2	ST-09 CCTV Pre-Alm
Output 194	44	88	8	2	ST-10 CCTV Pre-Alm
Output 195	45	89	8	3	ST-11 CCTV Pre-Alm
Output 196	45	90	8	3	ST-12 CCTV Pre-Alm
Output 197	46	91	8	4	ST-13 CCTV Pre-Alm
Output 198	46	92	8	4	ST-14 CCTV Pre-Alm
Output 199	47	93	8	5	ST-15 CCTV Pre-Alm
Output 200	47	94	8	5	ST-16 CCTV Pre-Alm
Output 201	48	95	8	6	ST-17 CCTV Pre-Alm
Output 202	48	96	8	6	Spare Relay



1 WEST CONTROL ROOM - RACK #2 - FRONT VIEW - KEY PLAN  
SCALE: 1 : 16



SEE SHEET  
FA6.28

BOOSTER POWER SUPPLY SETTINGS

LINE NO.	TRIP POINT	TRIP POINT	TRIP POINT
301	1.33	1.33	1.33
302	1.33	1.33	1.33
303	1.33	1.33	1.33
304	1.33	1.33	1.33
305	1.33	1.33	1.33
306	1.33	1.33	1.33
307	1.33	1.33	1.33
308	1.33	1.33	1.33
309	1.33	1.33	1.33
310	1.33	1.33	1.33
311	1.33	1.33	1.33
312	1.33	1.33	1.33
313	1.33	1.33	1.33
314	1.33	1.33	1.33
315	1.33	1.33	1.33
316	1.33	1.33	1.33
317	1.33	1.33	1.33
318	1.33	1.33	1.33
319	1.33	1.33	1.33
320	1.33	1.33	1.33

MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32  
OVERALL DIMENSIONS ARE: 22-3/8"(W) x 32-5/8"(D) x 83-1/8" (H)  
USEABLE DIMENSIONS ARE: 19-1/2"(W) x 30-3/4"(D) x 77-1/8" (H)  
WEST CONTROL ROOM - RACK #2  
FRONT VIEW - BOTTOM SECTION

1 WEST CONTROL ROOM - RACK #2 - FRONT VIEW - BOTTOM SECTION  
SCALE: 1 : 2

**BARNARD EJMT TEAM**

**BARNARD**  
**RONNINELLI**  
Western States Fire Protection Co.  
**Sturgeon** ELECTRIC  
**BCER** CONSULTING ENGINEERS

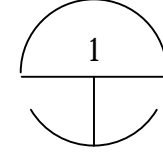
**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Revisions	Date
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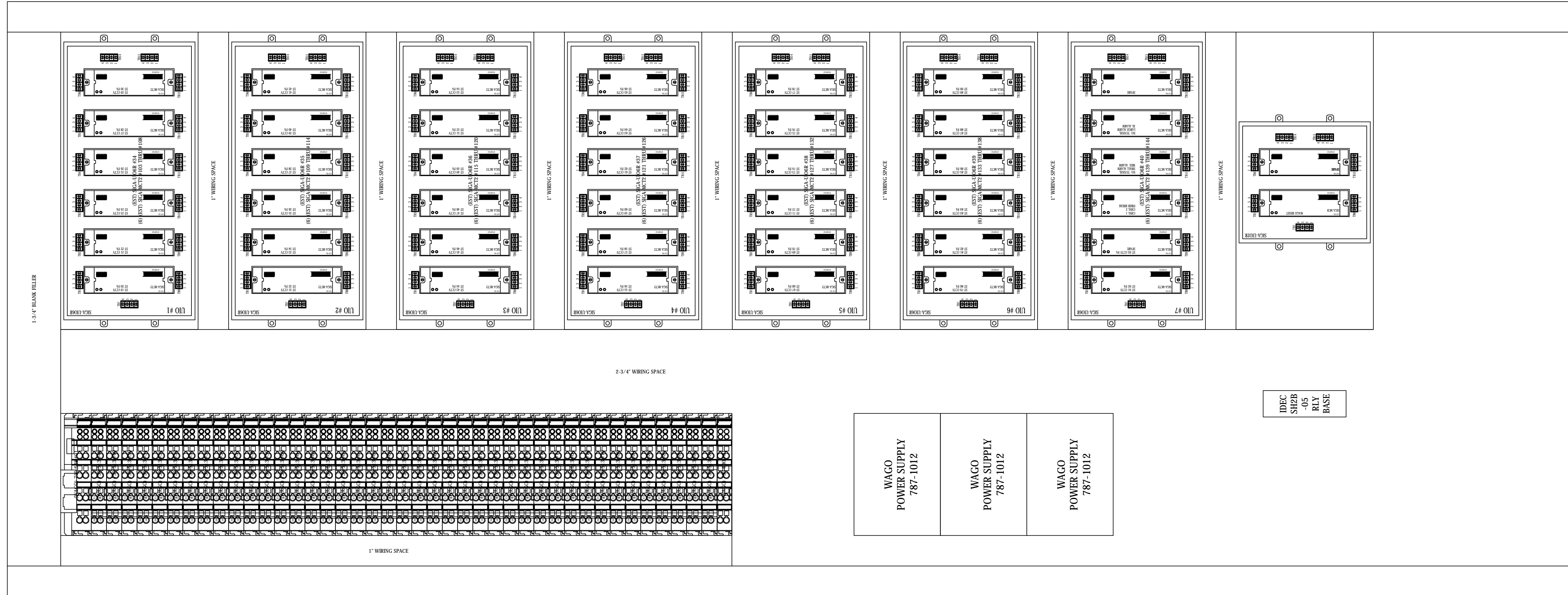
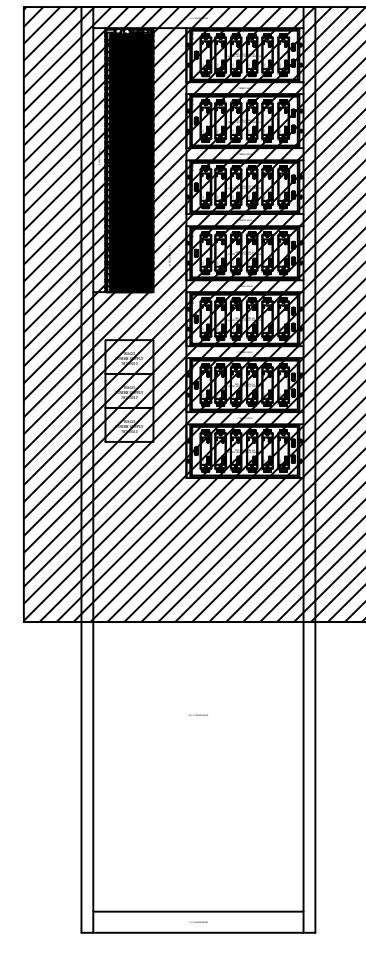
FIRE ALARM:  
DETAILS-WEST CNTRL-RACK #2-WIRE-FRONT-BOTTOM

Drawing Number  
**FA6.29**

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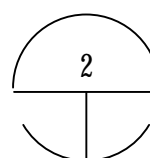
WEST CONTROL ROOM - RACK #2 - REAR VIEW - KEY PLAN  
SCALE: 1 : 16



SEE SHEET  
FA6.31

SEE SHEET  
FA6.31

MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32  
OVERALL DIMENSIONS ARE: 22-3/8" (W) x 32-5/8" (D) x 83-1/8" (H)  
USEABLE DIMENSIONS ARE: 19-1/2" (W) x 30-3/4" (D) x 77-1/8" (H)  
WEST CONTROL ROOM - RACK #2  
REAR VIEW - TOP SECTION



WEST CONTROL ROOM - RACK #2 - REAR VIEW - TOP SECTION  
SCALE: 1 : 2

EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

**BARNARD EJMT TEAM**

**BCER**  
CONSULTING ENGINEERS

**BARNARD**

**RONDINELLI**  
A COMMITMENT TO SAFETY

**STURGEON**  
ELECTRIC

Western States  
Fire Protection Co.

**ALF**  
CONSULTING ENGINEERS

Revisions	Date
Num	Description

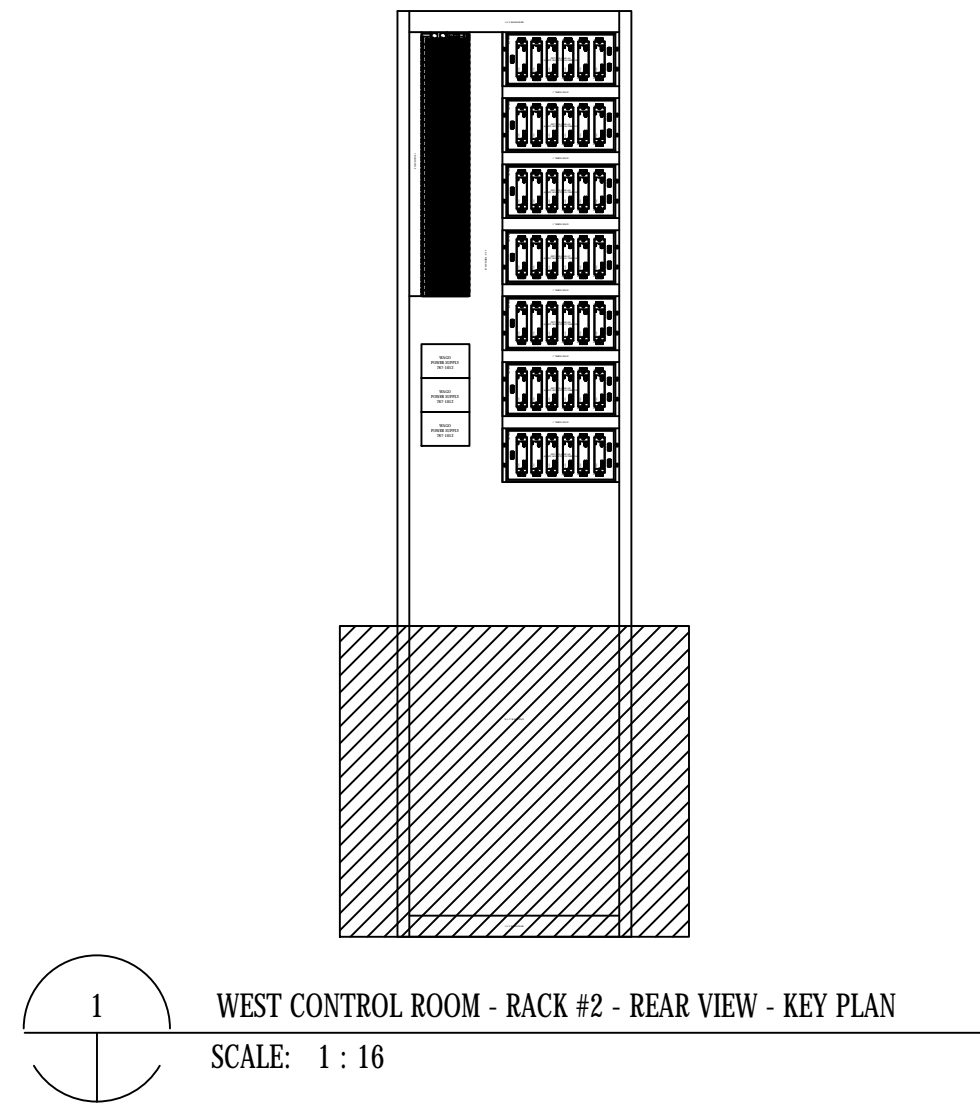
FIRE ALARM:  
DETAILS-WEST CNTRL-RACK  
#2-WIRE-REAR-TOP

Drawing Number

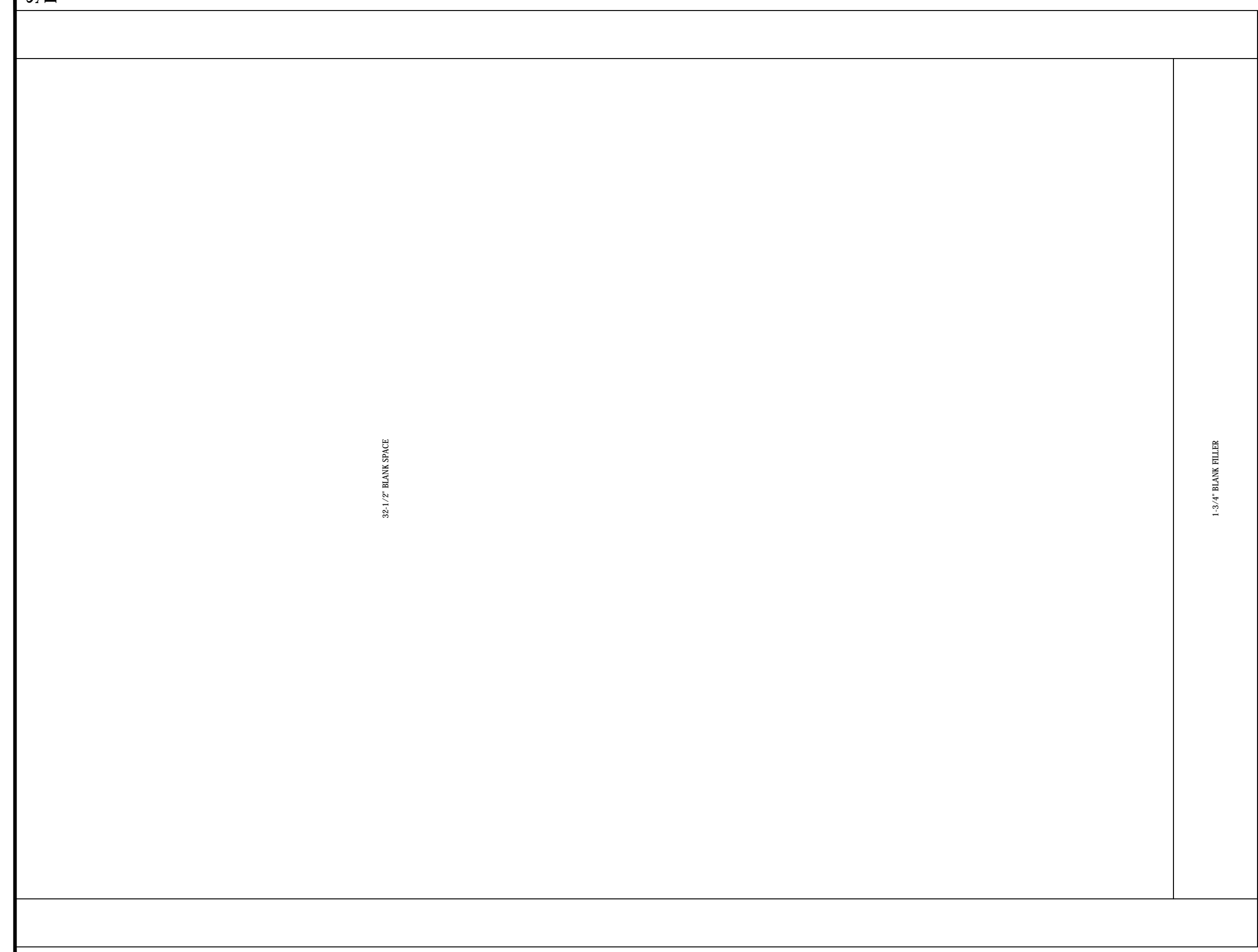
**FA6.30**

DRAWN BY: B.T.L. | CHECKED BY: AEE-JF

EJMT Tunnel Project West Control Room RACK #2 Wiring Spreadsheet Mid-Rear Level					
ModBus Outputs	WAGO 513 Rly Mod #	WAGO 513 Rly #	UIO #	MCT2 #	Notes
Output 203	49	97	1	1	ST-19 CCTV Pre-Alm
Output 204	49	98	1	1	ST-20 CCTV Pre-Alm
Output 205	50	99	1	2	ST-21 CCTV Pre-Alm
Output 206	50	100	1	2	ST-22 CCTV Pre-Alm
Output 207	51	101	1	3	ST-23 CCTV Pre-Alm
Output 208	51	102	1	3	ST-24 CCTV Pre-Alm
Output 209	52	103	1	4	ST-25 CCTV Pre-Alm
Output 210	52	104	1	4	ST-26 CCTV Pre-Alm
Output 211	53	105	1	5	ST-27 CCTV Pre-Alm
Output 212	53	106	1	5	ST-28 CCTV Pre-Alm
Output 213	54	107	1	6	ST-29 CCTV Pre-Alm
Output 214	54	108	1	6	ST-30 CCTV Pre-Alm
Output 215	55	109	2	1	ST-31 CCTV Pre-Alm
Output 216	55	110	2	1	ST-32 CCTV Pre-Alm
Output 217	56	111	2	2	ST-33 CCTV Pre-Alm
Output 218	56	112	2	2	ST-34 CCTV Pre-Alm
Output 219	57	113	2	3	ST-35 CCTV Pre-Alm
Output 220	57	114	2	3	ST-36 CCTV Pre-Alm
Output 221	58	115	2	4	ST-37 CCTV Pre-Alm
Output 222	58	116	2	4	ST-38 CCTV Pre-Alm
Output 223	59	117	2	5	ST-39 CCTV Pre-Alm
Output 224	59	118	2	5	ST-40 CCTV Pre-Alm
Output 225	60	119	2	6	ST-41 CCTV Pre-Alm
Output 226	60	120	2	6	ST-42 CCTV Pre-Alm
Output 227	61	121	3	1	ST-43 CCTV Pre-Alm
Output 228	61	122	3	1	ST-44 CCTV Pre-Alm
Output 229	62	123	3	2	ST-45 CCTV Pre-Alm
Output 230	62	124	3	2	ST-46 CCTV Pre-Alm
Output 231	63	125	3	3	ST-47 CCTV Pre-Alm
Output 232	63	126	3	3	ST-48 CCTV Pre-Alm
Output 233	64	127	3	4	ST-49 CCTV Pre-Alm
Output 234	64	128	3	4	ST-50 CCTV Pre-Alm
Output 235	65	129	3	5	ST-51 CCTV Pre-Alm
Output 236	65	130	3	5	ST-52 CCTV Pre-Alm
Output 237	66	131	3	6	ST-53 CCTV Pre-Alm
Output 238	66	132	3	6	ST-54 CCTV Pre-Alm
Output 239	67	133	4	1	ST-55 CCTV Pre-Alm
Output 240	67	134	4	1	ST-56 CCTV Pre-Alm
Output 241	68	135	4	2	ST-57 CCTV Pre-Alm
Output 242	68	136	4	2	ST-58 CCTV Pre-Alm
Output 243	69	137	4	3	ST-59 CCTV Pre-Alm
Output 244	69	138	4	3	ST-60 CCTV Pre-Alm
Output 245	70	139	4	4	ST-61 CCTV Pre-Alm
Output 246	70	140	4	4	ST-62 CCTV Pre-Alm
Output 247	71	141	4	5	ST-63 CCTV Pre-Alm
Output 248	71	142	4	5	ST-64 CCTV Pre-Alm
Output 249	72	143	4	6	ST-65 CCTV Pre-Alm
Output 250	72	144	4	6	ST-66 CCTV Pre-Alm
Output 251	73	145	5	1	ST-67 CCTV Pre-Alm
Output 252	73	146	5	1	ST-68 CCTV Pre-Alm
Output 253	74	147	5	2	ST-69 CCTV Pre-Alm
Output 254	74	148	5	2	ST-70 CCTV Pre-Alm
Output 255	75	149	5	3	ST-71 CCTV Pre-Alm
Output 256	75	150	5	3	ST-72 CCTV Pre-Alm
Output 257	76	151	5	4	ST-73 CCTV Pre-Alm
Output 258	76	152	5	4	ST-74 CCTV Pre-Alm
Output 259	77	153	5	5	ST-75 CCTV Pre-Alm
Output 260	77	154	5	5	ST-76 CCTV Pre-Alm
Output 261	78	155	5	6	ST-77 CCTV Pre-Alm
Output 262	78	156	5	6	ST-78 CCTV Pre-Alm
Output 263	79	157	6	1	ST-79 CCTV Pre-Alm
Output 264	79	158	6	1	ST-80 CCTV Pre-Alm
Output 265	80	159	6	2	ST-81 CCTV Pre-Alm
Output 266	80	160	6	2	ST-82 CCTV Pre-Alm
Output 267	81	161	6	3	ST-83 CCTV Pre-Alm
Output 268	81	162	6	3	ST-84 CCTV Pre-Alm
Output 269	82	163	6	4	ST-85 CCTV Pre-Alm
Output 270	82	164	6	4	ST-86 CCTV Pre-Alm
Output 271	83	165	6	5	ST-87 CCTV Pre-Alm
Output 272	83	166	6	5	ST-88 CCTV Pre-Alm
Output 273	84	167	6	6	ST-89 CCTV Pre-Alm
Output 274	84	168	6	6	ST-90 CCTV Pre-Alm
Output 275	85	169	7	1	ST-91 CCTV Pre-Alm
Output 276	85	170	7	1	ST-92 CCTV Pre-Alm
Output 277	86	171	7	2	ST-93 CCTV Pre-Alm
Output 278	86	172	7	2	Spare Relay (Wired to CT2)
Output 279	87	173	7	3	North Tunnel (Channel 1) Fiber Break
Output 280	87	174	7	3	South Tunnel (Channel 2) Fiber Break
Output 281	88	175	7	4	North Tunnel "Small" Fire
Output 282	88	176	7	4	North Tunnel "Medium" Fire
Output 283	89	177	7	5	North Tunnel "Large" Fire
Output 284	89	178	7	5	North Tunnel "Large" Fire

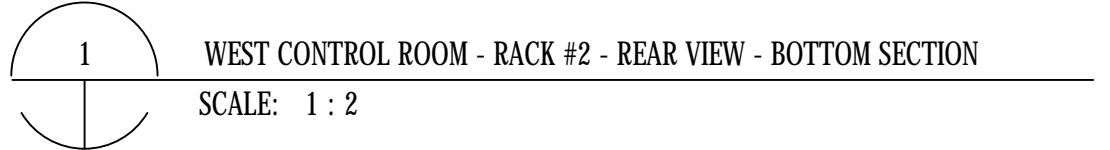


SEE SHEET  
FA6.30



SEE SHEET  
FA6.30

MIDDLE ATLANTIC EQUIPMENT RACK WRK-44SA-32  
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WEST CONTROL ROOM - RACK #2  
REAR VIEW - BOTTOM SECTION



THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

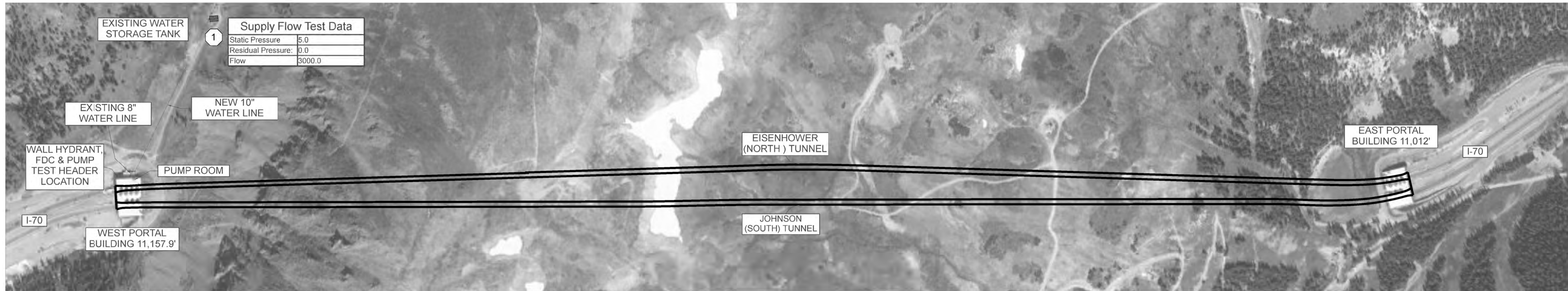
**BARNARD EJMT TEAM**  
BCER **BARNARD** **RONDINELLI**  
Sturgeon Electric  
Western States Fire Protection Co.  
ALF  
Consulting Engineers

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
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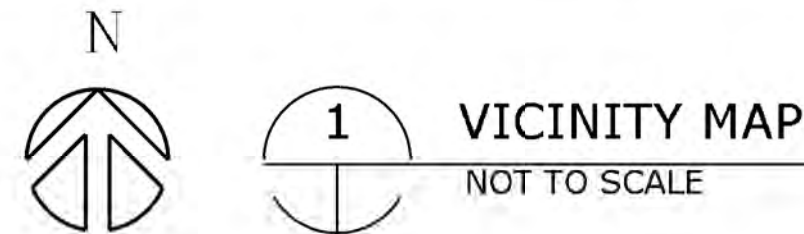
Revisions	Num	Description	Date

DRAWN BY: B.T.L. CHECKED BY: AEE-JF

FIRE ALARM:  
DETAILS-WEST CNTRL-RACK  
#2-WIRE-REAR-BOTTOM  
Drawing Number  
**FA6.31**



Supply Flow Test Data	
Static Pressure	5.0
Residual Pressure	0.0
Flow	3000.0

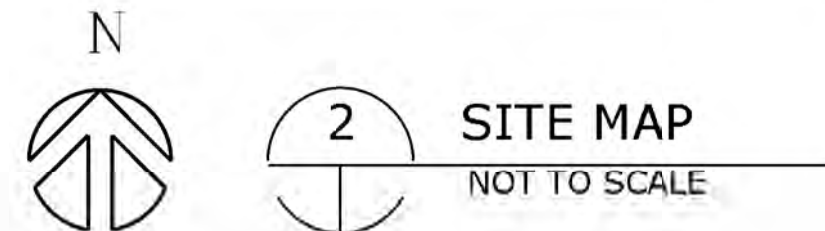
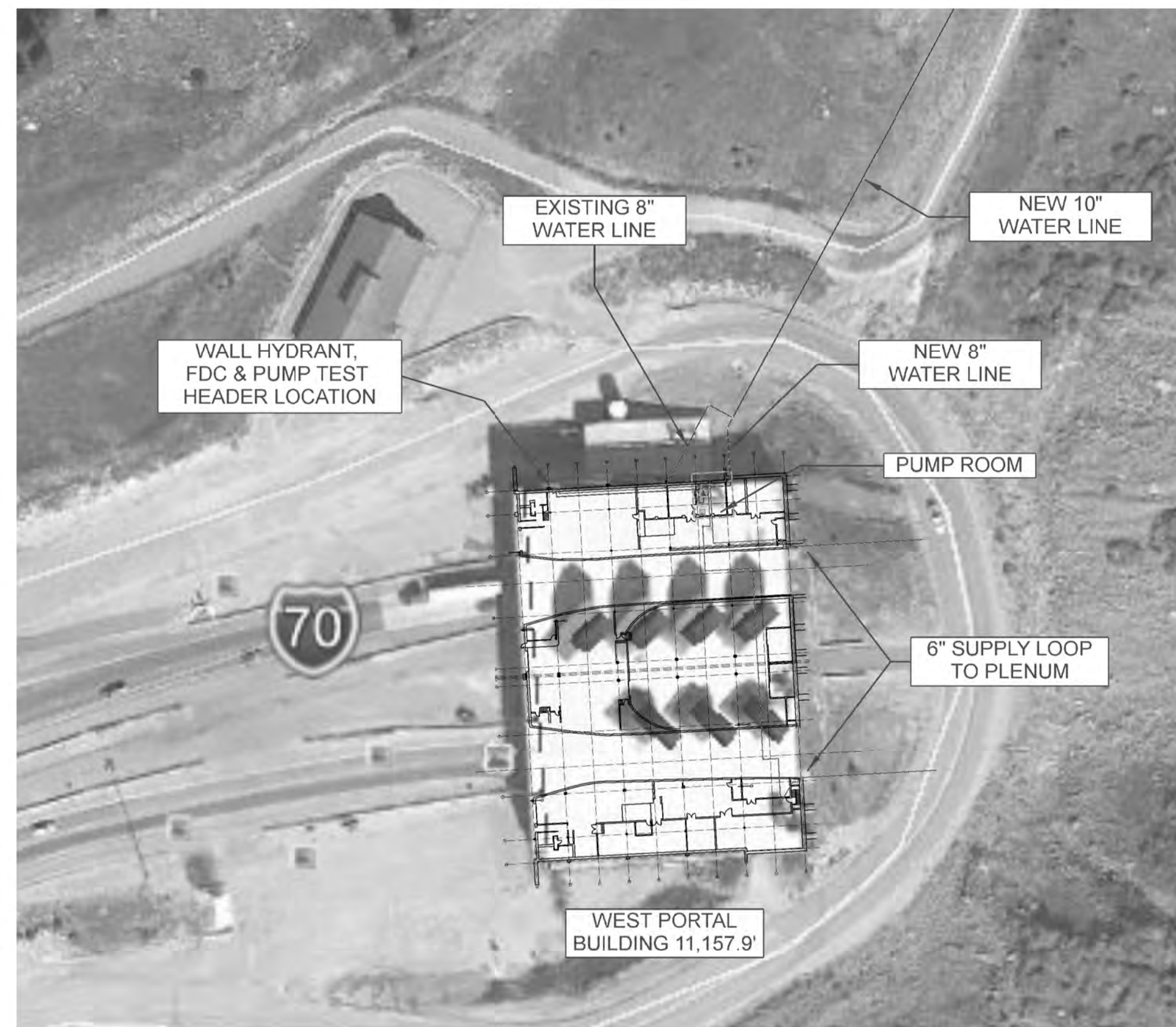


**GENERAL NOTE**

- ALL MATERIALS INSTALLED SHALL MEET THE BUY AMERICA REQUIREMENTS.
- ALL MATERIALS INSTALLED SHALL BE UL LISTED AND/OR FM APPROVED FOR FIRE SUPPRESSION USE WITH THE EXCEPTION OF:
  - BERMAD FP-400E-3DC-66 FLOW CONTROL VALVE WITH NO MANUAL RELEASE VALVE
  - BERMAD FP-430-UF PRESSURE RELIEF VALVE
  - BETE TF72FC NOZZLE
  - VIKING EC HSW FOR LIGHT HAZARD OCCUPANCY
- ALL DELUGE SYSTEM PIPING 1-IN TO 4-IN SHALL BE BLACK SCH. 40, ASTM A795 STEEL PIPE, U.S. MANUFACTURED WITH GROOVED OR THREADED ENDS FOR GROOVED FIRELOCK COUPLINGS OR THREADED CAST IRON #125 FITTINGS. ALL 6-IN AND 8-IN SUPPLY MAIN PIPE SHALL BE BLACK SCH. 10, ASTM A795 STEEL PIPE, U.S. MANUFACTURED WITH GROOVED ENDS FOR GROOVED FLEXIBLE COUPLINGS. ALL PORTAL SYSTEM PIPING THAT IS EXPOSED TO THE ROADWAYS SHALL BE GALVANIZED.
- BRACKET SUPPORTS IN TUNNEL PLENUMS SHALL BE DESIGNED TO SUPPORT 1,000 LBS (SEE FP1.2). ALL HANGERS AND SUPPORTS IN PORTAL BUILDINGS SHALL BE DESIGNED AND INSTALLED AS PER NFPA-13, CHAPTER-9 (SEE FP1.1).
- 6-IN SUPPLY LOOP AUXILIARY DRAINS AND LOW POINT DRAINS SHALL BE INSTALLED PER NFPA-13, CHAPTER 8.
- SEISMIC BRACING SHALL BE INSTALLED ON ALL 6-IN SUPPLY MAINS AND PUMP ROOM PIPING (SEE FP1.4). DELUGE SYSTEM PIPING 1-IN TO 4-IN SHALL BE MOUNTED DIRECTLY TO THE PLENUM FLOOR AND DOES NOT REQUIRE SEISMIC BRACING (SEE FP1.1).
- ALL PIPE PENETRATIONS THROUGH WALLS AND FLOORS SHALL BE CAULKED AND SEALED.
- HYDRAULIC PLACARDS SHALL BE POSTED IN FIRE PUMP MECHANICAL ROOM. VALVE LABELS AND PRESSURE SETTINGS SHALL BE PROVIDED AT EVERY FLOW CONTROL VALVE.
- SPARE NOZZLE CABINET SHALL BE LOCATED IN FIRE PUMP MECHANICAL ROOM AND STOCKED PER NFPA-13, 6.2.9.
- 6-IN SUPPLY LOOP SHALL BE INSULATED ON FAN DECK AND SUPPLY AIR PLENUMS. HEATED WATER SHALL BE CIRCULATED THROUGH 6-IN SUPPLY LOOP TO PREVENT PIPE FROM FREEZING.
- ALL 6-IN SUPPLY LOOP SYSTEM PIPING SHALL BE HYDROSTATICALLY TESTED AT 200 PSI OR AT 50 PSI ABOVE THE SYSTEM WORKING PRESSURE FOR TWO HOURS.

**SYSTEM TYPE**  
 3 NOZZLES SYSTEMS: QTY. 47 (EISENHOWER-NORTH)  
 4 NOZZLES SYSTEMS: QTY. 37 (EISENHOWER-NORTH)  
 12 NOZZLES SYSTEMS: QTY. 87 (JOHNSON-SOUTH)  
 SIDEWALL SYSTEMS: QTY. 12 (PORTAL BUILDINGS)

**SYSTEM COUNT**  
 EISENHOWER (NORTH) SYSTEMS: QTY. 90  
 JOHNSON (SOUTH) SYSTEMS: QTY. 93  
 TOTAL SYSTEMS: QTY. 183



**INDEX**

FP0.0	COVER PAGE
FP0.1	FFSS NARRATIVE
FP1.0	NOZZLES AND MISSING VENTS
FP1.0N	EISENHOWER (NORTH) VARIABLE MESSAGE SIGN OBSTRUCTION
FP1.0S	JOHNSON (SOUTH) VARIABLE MESSAGE SIGN OBSTRUCTION
FP1.1	HANGERS AND SUPPORTS
FP1.2	TUNNEL ARCH PLENUM BRACKET
FP1.3	INSULATED VALVE ENCLOSURES
FP1.4	SEISMIC BRACING
FP2.0	PIPE EXPANSION AND DEFLECTION
FP3.0	DELUGE SYSTEM LOCATIONS - KEY
FP3.1	DELUGE SYSTEM LOCATIONS - WEST
FP3.2	DELUGE SYSTEM LOCATIONS - WEST
FP3.3	DELUGE SYSTEM LOCATIONS - WEST
FP3.4	DELUGE SYSTEM LOCATIONS - EAST
FP3.5	DELUGE SYSTEM LOCATIONS - EAST
FP3.6	DELUGE SYSTEM LOCATIONS - EAST
FP3.7	DELUGE SYSTEM - EISENHOWER (NORTH) TUNNEL
FP3.8	DELUGE SYSTEM - JOHNSON (SOUTH) TUNNEL
FP3.9	DELUGE SYSTEM - SECTIONS
FP3.10	DELUGE SYSTEM - EISENHOWER (NORTH) TUNNEL - ICE FALL
FP4.0	WEST PORTAL - EISENHOWER (NORTH) ROADWAY LEVEL
FP4.1	WEST PORTAL - JOHNSON (SOUTH) ROADWAY LEVEL
FP4.2	WEST PORTAL - ISOMETRIC
FP5.0	FIRE PUMP ROOM PLAN & ISOMETRIC
FP5.1	FIRE PUMP ROOM SECTIONS, WALL HYDRANT, FDC & TEST HEADER
FP5.2	FIRE PUMP ROOM FLOW CONDITIONS
FP6.0	EAST PORTAL - EISENHOWER (NORTH) ROADWAY LEVEL
FP6.1	EAST PORTAL - JOHNSON (SOUTH) ROADWAY LEVEL
FP6.2	EAST PORTAL - ISOMETRIC

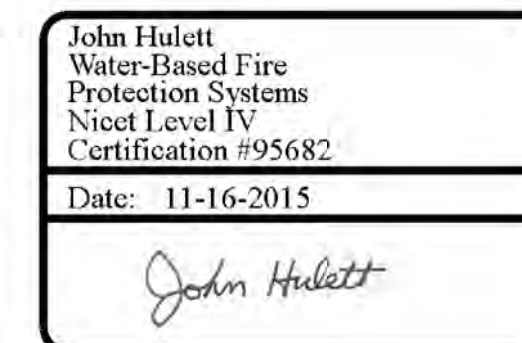
**NICET CERTIFICATION**

JOHN HULETT  
 WESTERN STATES FIRE PROTECTION CO.  
 7026 S. TUCSON WAY  
 CENTENNIAL, COLORADO 80112  
 (303) 792-0022

NICET LEVEL: IV  
 TECHNICAL AREA: WATER-BASED FIRE PROTECTION SYSTEMS  
 CERTIFICATE NUMBER: #95682  
 VALID THROUGH: 01-01-2016

APPROVED BY: *John Hulett*  
 DATE: 11-16-2015

REVIEW NUMBER:  1  
 2  
 3



**BARNARD EJMT TEAM**



**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

Num	Description	Date

COVER PAGE

Drawing Number  
**FP0.0**

**FIXED FIRE SUPPRESSION SYSTEM NARRATIVE**

THE FIXED FIRE SUPPRESSION SYSTEM (FFSS) IS SUPPLIED BY THE EXISTING WATER STORAGE TANK FED FROM STRAIGHT CREEK, NORTH OF THE WEST PORTAL. A NEW 10-IN UNDERGROUND PIPE WILL BE INSTALLED FROM THE EXISTING TANK TO WITHIN CLOSE PROXIMITY OF THE PORTAL WHERE THE EXISTING 8-IN DOMESTIC AND STANDPIPE IS SUPPLIED. THE LINE WILL TEE INTO THE EXISTING AT THIS POINT AND REDUCE DOWN TO 8-IN TO SUPPLY THE NEW 1,250 GPM ELECTRIC FIRE PUMP LOCATED IN THE WEST VENTILATION BUILDING.

THE WATER SUPPLY TO THE FIRE PUMP WAS HYDRAULICALLY CALCULATED. THIS CALCULATION ASSUMES THE WORST CASE SCENARIO WITH THE TANK EMPTY. THE ADDITIONAL 5 PSI STATIC PRESSURE AVAILABLE WHEN THE TANK IS FULL WAS NOT UTILIZED. THE ADJUSTED WATER SUPPLY TO THE FIRE PUMP SUCTION FLANGE IS 56.9 PSI STATIC PRESSURE WITH 49.6 PS AT 1,250 GPM. THIS ADJUSTMENT INCLUDES THE ADDITIONAL 500 GPM HOSE ALLOWANCE FOR THE EXISTING STANDPIPE SYSTEM. THE TOTAL FLOW FOR THIS CALCULATION IS 1,750 GPM.

THE 115 PSI @ 1,250 GPM FIRE PUMP IS SIZED TO PROVIDE THE REQUIRED PRESSURE AND FLOW FOR ANY TWO DELUGE SYSTEMS FLOWING AT THE SAME TIME. THE MOST DEMANDING SYSTEM IS THE EISENHOWER 3 NOZZLE SYSTEM WITH A FLOW OF 1,264.7 GPM. ALL DELUGE SYSTEM HYDRAULIC CALCULATIONS PROVIDE AT LEAST A 10% PRESSURE SAFETY FACTOR TO ALLOW FOR MINOR INSTALLATION CHANGES.

THE FIRE PUMP ASSEMBLY WILL BE PROVIDED WITH BOTH A FLOW METER AND A TEST HEADER. THE FLOW METER ALLOWS TESTING THE PERFORMANCE OF THE FIRE PUMP BY FLOWING WATER BACK TO THE PUMP SUCTION. THE TEST HEADER IS REQUIRED FOR THE ACCEPTANCE TEST AND TO VERIFY THE WATER SUPPLY FROM THE TANK EVERY 5 YEARS. THE FLOW METER CAN BE USED 4 OUT OF 5 YEARS WITH THE BENEFIT OF NOT FLOWING AND WASTING WATER OUTSIDE THE BUILDING FROM THE TEST HEADER.

A NEW WALL HYDRANT WILL BE PROVIDED CLOSE TO A NEW FIRE DEPARTMENT CONNECTION (FDC) AT THE NORTHWEST CORNER OF THE WEST VENTILATION BUILDING. THE WALL HYDRANT CAN SUPPLY A FIRE PUMPER TRUCK THAT CAN SUPPLEMENT THE WATER PRESSURE WITHIN THE FFSS THROUGH THE FDC. THE WALL HYDRANT WILL ALSO SERVE AS THE PUMP TEST HEADER WHEN REQUIRED. AN FDC WILL NOT BE PROVIDED AT THE EAST VENTILATION BUILDING BECAUSE THERE IS NO WATER SUPPLY FROM WHICH A PUMP TRUCK COULD DRAW TO SUPPLY ADDITIONAL WATER TO THE FFSS. JUST TO CLARIFY, A FIRE PUMPER TRUCK IS NOT REQUIRED FOR THE OPERATION OF THE SYSTEM BUT A RESPONDING FIRE DEPARTMENT COULD ASSIST IN THE EVENT OF A FIRE BY SUPPLEMENTING OR REPLACING THE FIRE PUMP.

DURING WINTER MONTHS A WATER TRUCK MAY NOT BE ABLE TO ACCESS THE WATER TANK FOR RE-SUPPLY. AN ARRANGEMENT OF VALVES WITH A BYPASS THAT IS NORMALLY CLOSED WILL BE PROVIDED TO ALLOW A WATER TRUCK LOCATED BELOW AT THE NORTHWEST VENTILATION BUILDING TO FILL THE WATER SUPPLY TANK UTILIZING THE FIRE PUMP.

IN THE EVENT OF A POWER OUTAGE, THE FIRE PUMP CONTROLLER IS EQUIPPED WITH AN AUTOMATIC TRANSFER SWITCH TO ALLOW OPERATION FROM THE EMERGENCY GENERATOR. ADDITIONALLY THE FIRE PUMP CONTROLLER IS OF THE SOFT START TYPE TO REDUCE THE INRUSH DEMAND ON THE EMERGENCY GENERATOR.

THERE ARE 183 DELUGE SYSTEMS PROVIDING COVERAGE OVER THE TUNNEL ROADWAY. THERE ARE 90 SYSTEMS IN THE EISENHOWER TUNNEL AND 93 SYSTEMS IN THE JOHNSON TUNNEL. THREE (3) OF THE DELUGE VALVES ARE LOCATED WITHIN THE FIRE PUMP ROOM. THE REMAINDERS OF THE DELUGE VALVES ARE LOCATED ON THE 6-IN. X 18,100 FT. LOOP LOCATED WITHIN THE SUPPLY PLENUMS AND THE FAN DECK OF THE VENTILATION BUILDINGS. THE CAPACITY OF THE 6-IN. LOOP IS APPROXIMATELY 30,000 GALLONS.

TEN (10) 6-IN. ISOLATION VALVES WILL BE PROVIDED ON THE 6-IN X 18,100 FT. LOOP. THESE VALVES WILL ALLOW SYSTEM REPAIRS IF REQUIRED TO OCCUR WITHOUT DRAINING THE ENTIRE SYSTEM. EACH OF THESE VALVES WILL HAVE A TAMPERS SWITCH. IN THE EVENT A VALVE IS CLOSED, A TROUBLE SIGNAL WILL BE DISPLAYED AT THE FIRE CONTROL PANEL (FCP).

BOILERS, EXPANSION TANKS, AND CIRCULATION PUMPS WILL BE PROVIDED WITHIN THE FIRE PUMP ROOM TO HEAT THE 6-IN. LOOP PIPING. THE SYSTEM HEAT WILL PROVIDE PROTECTION OF THE ZONE DELUGE VALVES LOCATED WITHIN INSULATED VALVE ENCLOSURE (IVE) CABINETS INSTALLED AROUND EACH ZONE VALVE IN THE PLENUM. THE VALVE ENCLOSURE WILL BE HEATED BY CONVECTIVE HEAT TRANSFER FROM THE CIRCULATING HOT WATER IN THE 6-IN. WET SUPPLY LOOP. THE HEATED WATER WILL BE DIRECTED EAST THRU THE SUPPLY PLENUM OF THE EISENHOWER TUNNEL WHERE IT WILL CROSS THROUGH THE EAST VENTILATION BUILDING ON THE FAN DECK AND RETURN WEST WITHIN THE SUPPLY PLENUM OF THE JOHNSON TUNNEL.

IN THE EVENT OF A FIRE, THE WATER SUPPLY TO THE DELUGE SYSTEMS CAN THEN TRAVEL EAST THRU BOTH SUPPLY PLENUMS TO THE ACTIVATED DELUGE SYSTEM ALLOWING WATER TO DISCHARGE FROM THE NOZZLES.

THERE ARE FOUR DIFFERENT TYPES OF DELUGE SYSTEMS WITHIN THE PROJECT. EACH SYSTEM IS DESIGNED TO PROVIDE AT LEAST 0.16 GALLONS PER SQUARE FOOT OVER THE ROADWAY WHILE TWO SYSTEMS ARE FLOWING. THE HYDRAULIC CALCULATIONS PROVIDED ARE FOR THE MOST DEMANDING AREA FOR EACH SYSTEM TYPE. THE LOCATION WAS DETERMINED BY CHANGING THE HYDRAULIC LOCATION UNTIL THE MOST DEMANDING CONDITION WAS FOUND.

THE DIFFERENCES BETWEEN EACH OF THE SYSTEM TYPES INCLUDE THE SIZE, NOZZLE TYPE, SPACING, PRESSURE, AND FLOW. EACH SYSTEM IS SIMILAR IN THAT IT PROVIDES THE DENSITY OF 0.16 GALLONS PER SQUARE FOOT. ALL OF THE DELUGE SYSTEMS WILL HAVE A MANUAL ISOLATION VALVE WITH A TAMPER SWITCH. IN THE EVENT A VALVE IS CLOSED, A TROUBLE SIGNAL WILL BE DISPLAYED AT THE FIRE CONTROL PANEL (FCP). IN THE EVENT A DELUGE SYSTEM IS ACTUATED, A PRESSURE SWITCH WILL INDICATE AN ALARM AT THE FCP.

THE DELUGE VALVE ASSEMBLIES ARE LOCATED APPROXIMATELY EVERY 100 FEET IN THE EISENHOWER SUPPLY PLENUM AND 96 FEET IN THE JOHNSON SUPPLY PLENUM. EACH DELUGE SYSTEM IS CONTROLLED BY A 4-IN. FLOW CONTROL VALVE. THIS VALVE IS HELD IN THE CLOSED POSITION BY A SMALL PRIME LINE. THE UPSTREAM SYSTEM WATER PRESSURE HOLDS THE VALVE CLOSED AND WHEN A SOLENOID VALVE IS OPENED BY A 24 VOLT CURRENT FROM THE FCP, THE FLOW CONTROL VALVE WILL OPEN. WHEN THE SOLENOID VALVE IS CLOSED, THE VALVE WILL CLOSE. ADDITIONALLY, THE FLOW CONTROL VALVE CAN OPERATE LIKE A PRESSURE REDUCING VALVE ALLOWING FOR ADJUSTMENT OF THE DOWNSTREAM PRESSURE. WITH THIS FEATURE, A HIGHER UPSTREAM PRESSURE WILL NOT OVER FLOW WHICH WOULD EFFECTIVELY REDUCE THE MINIMUM WATER SUPPLY DURATION OF ONE HOUR.

A 4-IN. CROSS MAIN WILL SUPPLY THE BRANCH LINES THAT SUPPLY THE ASSORTED NOZZLES. THE 4-IN. CROSS MAIN WILL NEED TO PENETRATE THE PLENUM WALL FOR EACH TUNNEL SYSTEM TO ALLOW ACCESS TO THE EXHAUST PLENUM VENTS. WITH EACH DELUGE SYSTEM LOCATED BELOW THE VALVE ASSEMBLY ALL CROSS MAINS AND BRANCH LINES WILL BE REQUIRED TO DRAIN AUTOMATICALLY TO AVOID TRAPPED WATER THAT COULD FREEZE WITHIN THE PIPE. THE BRANCH LINE PIPE WILL AUTOMATICALLY DRAIN FROM NOZZLES. THE CROSS MAIN WILL REQUIRE A 1/2-IN BALL DRIP THAT WILL AUTOMATICALLY DRAIN TO THE PLENUM FLOOR. THE BALL DRIP WILL AUTOMATICALLY OPEN AFTER THE SYSTEM IS SHUT DOWN AND THE PIPE IS NO LONGER PRESSURIZED.

THE EISENHOWER TUNNEL HAS TWO TYPES OF DELUGE SYSTEMS. BOTH SYSTEMS HAVE THE SAME LARGE BETE NOZZLES WITH THE DIFFERENCE BEING THREE (3) NOZZLES VERSES FOUR (4) NOZZLES. THE THREE NOZZLE SYSTEM REQUIRES MORE PRESSURE AT EACH NOZZLE TO PROVIDE THE 0.16 GALLONS PER SQUARE FOOT TO THE ROADWAY BELOW. THE LOCATION OF THE NOZZLES IS DETERMINED BY THE EXISTING PLENUM VENTS WITHIN THE EXHAUST PLENUM.

THE JOHNSON TUNNEL DELUGE SYSTEMS UTILIZE TWELVE (12) SMALLER BETE NOZZLES TO PROVIDE THE 0.16 GALLONS PER SQUARE FOOT TO THE ROADWAY BELOW. THE LOCATION OF THE NOZZLES IS DETERMINED BY THE EXISTING VENTS WITHIN THE SUPPLY AND EXHAUST PLENUM.

THE VENTILATION BUILDING DELUGE SYSTEMS UTILIZE TWELVE (12) HORIZONTAL SIDEWALL SPRINKLERS AS NOZZLES TO PROVIDE THE 0.16 GALLONS PER SQUARE FOOT TO THE ROADWAY BELOW. THE BRANCH LINES SUPPLYING THE NOZZLES AT THE PORTALS WILL BE EXPOSED ON THE WALL JUST BELOW THE LIGHTS. TO ADDRESS CONCERNS REGARDING CORROSION FROM ANTI-ICE SPRAY THAT CAN BECOME AIRBORNE FROM THE ROADWAY AT THE VENTILATION BUILDINGS, WE ARE PROVIDING GALVANIZED PIPE FOR THE BRANCH LINES AND NOZZLES WITH A CORROSION RESISTANT COATING.

CUSTOM BRACKETS AND TRAPEZE SUPPORTS WILL BE PROVIDED WITHIN THE SUPPLY PLENUM TO SUPPORT THE 6-IN. LOOP PIPING. THESE SUPPORTS WILL BE LOCATED AT A MAXIMUM OF 12.5 FT. ON CENTER. THE ENTIRE 6-IN. LOOP PIPING WILL BE PROVIDED WITH 1-1/2-IN FIBERGLASS INSULATION WITH A K-VALUE OF 0.23. ADDITIONALLY, RIGID 1-1/2-IN INSULATED PIPE SUPPORTS WILL BE PROVIDED FOR ALL HANGERS AND SUPPORTS.

THE VALVE ASSEMBLY FOR EACH DELUGE SYSTEM WILL BE INSIDE AN AIR TIGHT IVE. THE IVE'S ARE PROVIDED WITH 3-IN RIGID INSULATION WITH AN R-VALUE OF 18. THE IVE'S WILL HAVE AN ACCESS DOOR ALLOWING FOR EASE OF INSPECTION, TESTING, AND MAINTENANCE.

THE 6-IN. LOOP PIPING AND ITS SUPPLY WILL BE SEISMICALLY BRACED. CALCULATIONS ARE PROVIDED WITHIN THE DRAWINGS FOR THE MOST DEMANDING LONGITUDINAL AND LATERAL BRACE REQUIREMENTS. LONGITUDINAL BRACES WILL BE PROVIDED AT 100 FT. MAXIMUM DISTANCES WITHIN THE SUPPLY PLENUM AND WILL BE LOCATED AS CLOSE AS POSSIBLE TO THE VALVE ASSEMBLIES. EACH OF THE CUSTOM BRACKETS AND TRAPEZE SUPPORTS WITHIN THE PLENUM SERVE AS LATERAL BRACES AT 12.5 FT. MAXIMUM ON CENTER. THE LOOP AND SUPPLY PIPING WITHIN THE PORTALS WILL BE BRACED BY STANDARD METHODS WITH LONGITUDINAL BRACES AT 80 FT. MAXIMUM AND LATERAL BRACES AT 40 FT. MAXIMUM AND LOCATED WITHIN 1 FT. IN A CHANGE OF DIRECTION. ALL RISERS OR VERTICAL PIPING WILL BE PROVIDED WITH FOUR-WAY BRACING IN ACCORDANCE WITH NFPA-13.

A 4-IN. PRESSURE RELIEF VALVE WILL BE PROVIDED AT THE SOUTHEAST VENTILATION BUILDING TO PROVIDE PROTECTION OF SYSTEM COMPONENTS FROM THE POTENTIAL OF WATER HAMMERS THAT MAY OCCUR. WATER HAMMER IS USED TO DESCRIBE A PRESSURE SURGE THAT IS CAUSED WHEN A FLUID IS FORCED TO STOP OR CHANGE DIRECTION SUDDENLY. THE POTENTIAL FOR WATER HAMMER EXIST WHEN A DELUGE VALVE IS CLOSED.

EACH TUNNEL, AND THEIR RESPECTIVE AIR PLENUMS, CURVE NORTH AND SOUTH THROUGH THE MOUNTAIN AND CHANGE IN ELEVATION INCREASING FROM EAST TO WEST. THE CURVATURE OF THE TUNNELS OCCURS SLIGHTLY OVER A LARGE DISTANCE MAKING THE INSTALLATION OF ADDITIONAL FITTINGS AND SWING JOINTS UNNECESSARY. THE DEFLECTION IS MINIMAL BUT MUST BE ADDRESSED.

IN ADDITION, THE AIR PLENUMS ARE SUBJECT TO FREEZING TEMPERATURES IN THE WINTER MONTHS. TO PREVENT THE WATER IN THE PIPE FROM FREEZING, HOT WATER STARTING AT 100°F WITH A MAXIMUM DESIGN BOILER TEMPERATURE OF 130°F, WILL BE CIRCULATED THROUGH THE 6-IN. MAIN SUPPLY LOOP. MAIN PIPING WILL BE INSTALLED WHEN TEMPERATURES HAVE THE POTENTIAL TO BE -30°F. THE WORST CASE TEMPERATURE CHANGE WAS CALCULATED TO BE FROM -30°F TO 130°F. DUE TO DRASTIC CHANGES IN TEMPERATURE, THE 6-IN. PIPE WILL EXPAND AND CONTRACT. WHEN THE PIPE IS TO BE INSTALLED DURING THE COLD WEATHER SEASONS OR WHEN COLD WATER FROM THE STORAGE TANK IS INTRODUCED INTO THE PIPE DURING A FIRE OR TESTING SITUATION, THE STEEL PIPE WILL SHRINK. WHEN THE HOT WATER IS CIRCULATED THROUGH THE PIPE, THE STEEL PIPE WILL EXPAND. THE EXPANSION FROM THE CHANGE IN TEMPERATURE WILL CAUSE A PARALLEL DEFLECTION THAT IS ADDRESSED IN THIS DESIGN.

TO ACCOMMODATE CHANGES IN THE PIPE LENGTH AND DIRECTION, EXPANSION AND DEFLECTION WILL BE ADDRESSED CONTINUALLY FOR EVERY STICK OF PIPE ALONG THE ENTIRE LENGTH OF THE TUNNEL BY USING VICTAULIC STYLE 75 FLEXIBLE COUPLINGS AND VICTAULIC STYLE 155 EXPANSION JOINT 6-IN. NIPPLES. THROUGH PRODUCT DATA AS WELL AS EXPANSION AND DEFLECTION CALCULATIONS FOR A 25 FT. SECTION OF PIPE, A SOLUTION WAS DETERMINED TO PROVIDE EXPANSION JOINTS TO ACCOMMODATE THE EXPANSION AND DEFLECTION WITHIN EACH 25 FT. SECTION OF PIPE.

EXPANSION JOINTS SHALL BE INSTALLED AT EACH END OF PIPE APPROXIMATELY EVERY 25 FT. AN EXPANSION JOINT WILL CONSIST OF (2) STYLE 75 COUPLINGS WITH (1) STYLE 155 6-IN. SCHEDULE 40 NIPPLE, 4 INCHES IN LENGTH BETWEEN THE COUPLINGS. EACH EXPANSION JOINT WILL BE INSTALLED IN COLD WEATHER CONDITIONS, THUS EACH COUPLING SHALL BE INSTALLED TO SEPARATE THE TWO ENDS OF THE PIPE TO ALLOW FOR MAXIMUM POSSIBLE SEPARATION. WHEN THE PIPE EXPANDS DUE TO HOT WATER, THERE WILL BE ZERO DEFLECTION BETWEEN EACH PIECE OF PIPE. THE EXPANSION JOINT WILL PROVIDE 0.346-IN. OF EXPANSION WHICH EXCEEDS THE REQUIRED THERMAL EXPANSION LENGTH OF 0.3216-IN.

WHEN ANGULAR DEFLECTION IS REQUIRED, AN ADDITIONAL COUPLING AND NIPPLE SHALL BE ADDED TO ACCOMMODATE THE ANGULAR DEFLECTION BETWEEN THE COUPLINGS THAT ARE PROVIDED FOR THE EXPANSION JOINT. THIS COUPLING WILL NOT BE ABLE TO DEFLECT IN THE PARALLEL DIRECTION AND WILL NOT BE USED AS AN EXPANSION COUPLING.

IN ADDITION, TWO BRACKETS SHALL BE PROVIDED FOR EACH 25 FT. LENGTH OF PIPE. BOTH BRACKETS SHALL BE BRACED TO ALLOW MINIMAL DEFLECTION BETWEEN EACH 25 FT. STICK OF PIPE. A LONGITUDINAL BRACE SHALL BE INSTALLED EVERY 100 FT. WITH THE BRACED SUPPORT CLOSEST TO THE INSULATED VALVE ENCLOSURE TO LIMIT MOVEMENT AT THE DELUGE VALVE ASSEMBLIES AND TO PROVIDE THE REQUIRED SEISMIC BRACING.

**BARNARD EJMT TEAM**



**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

**FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT**

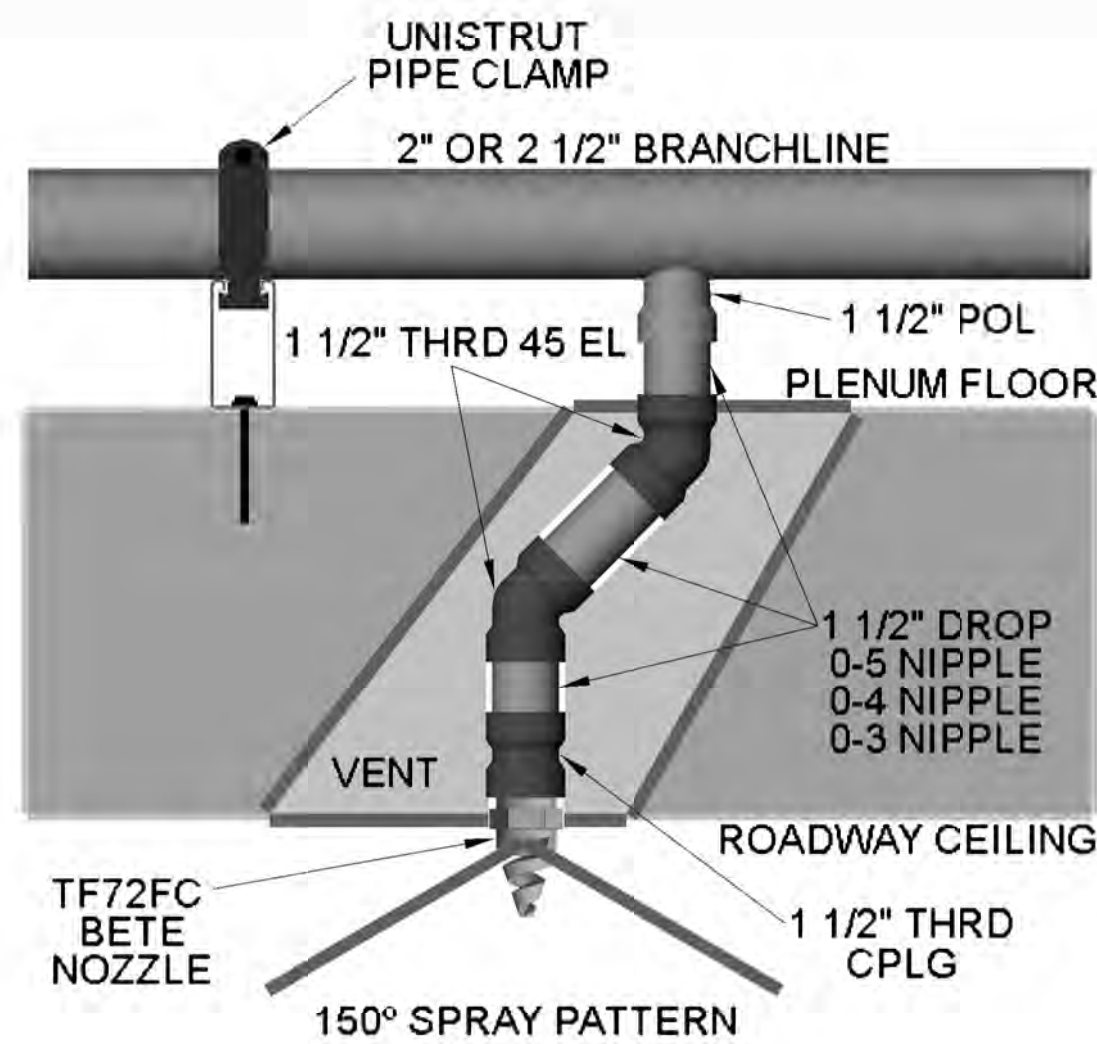
Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Revisions	Description	Date

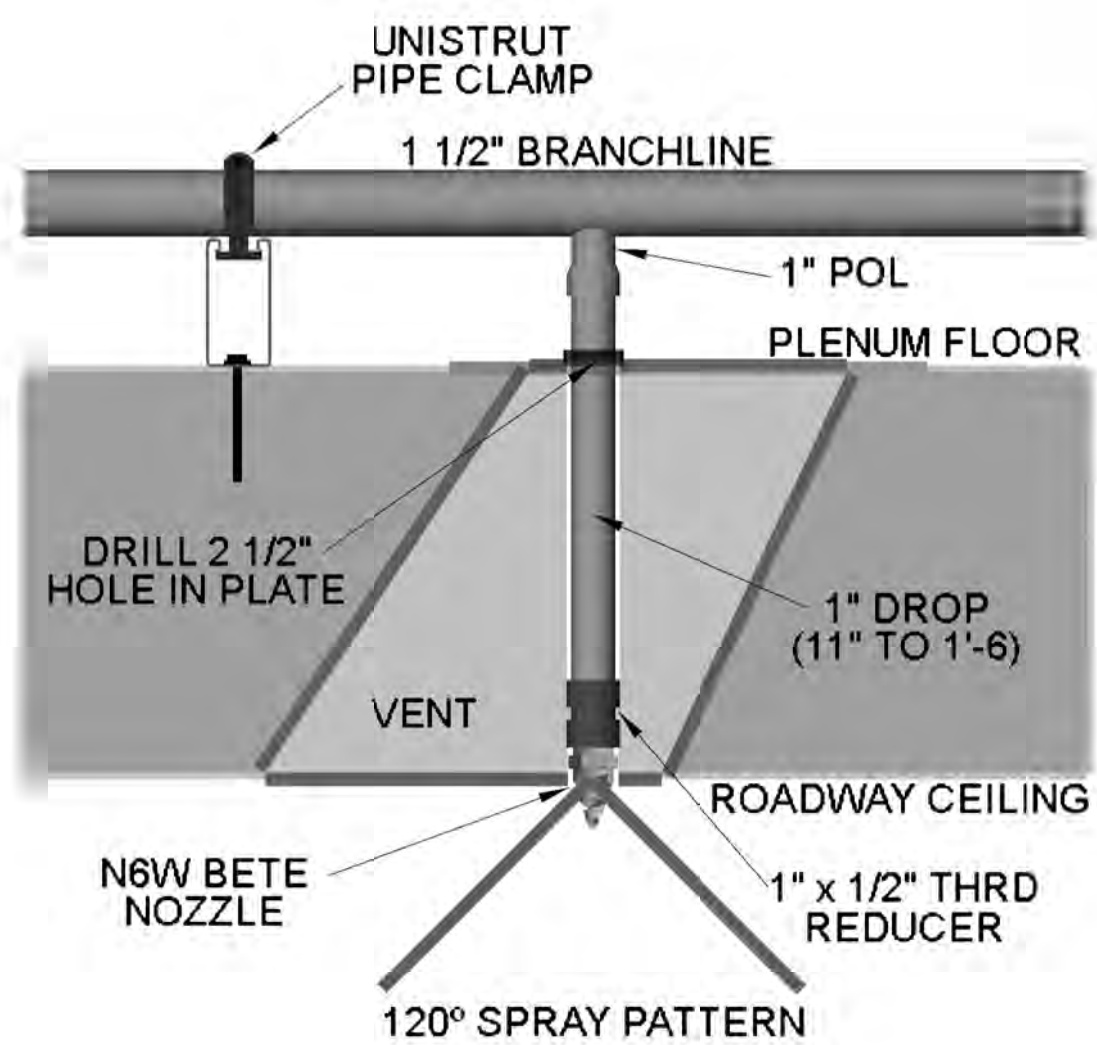
Num      Description      Date

FFSS NARRATIVE

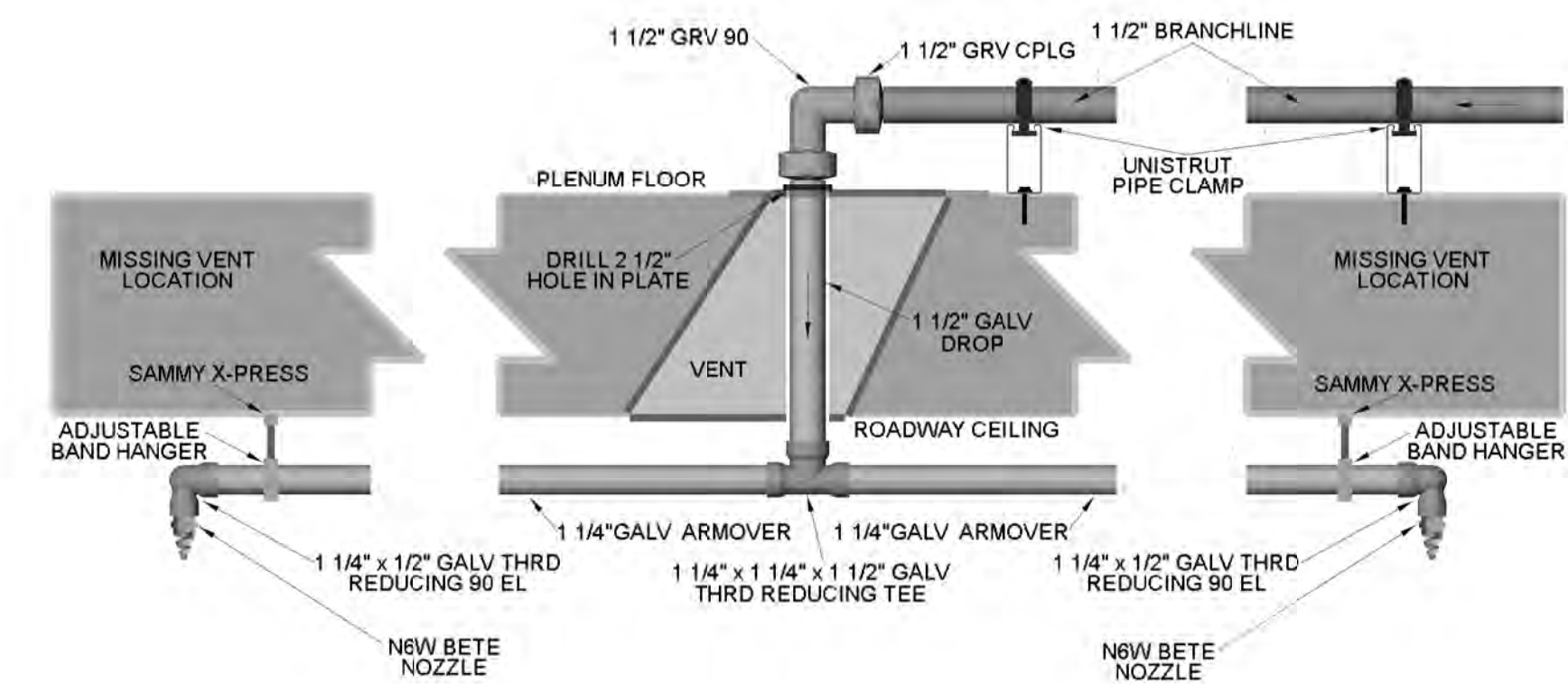
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**FPO.1**



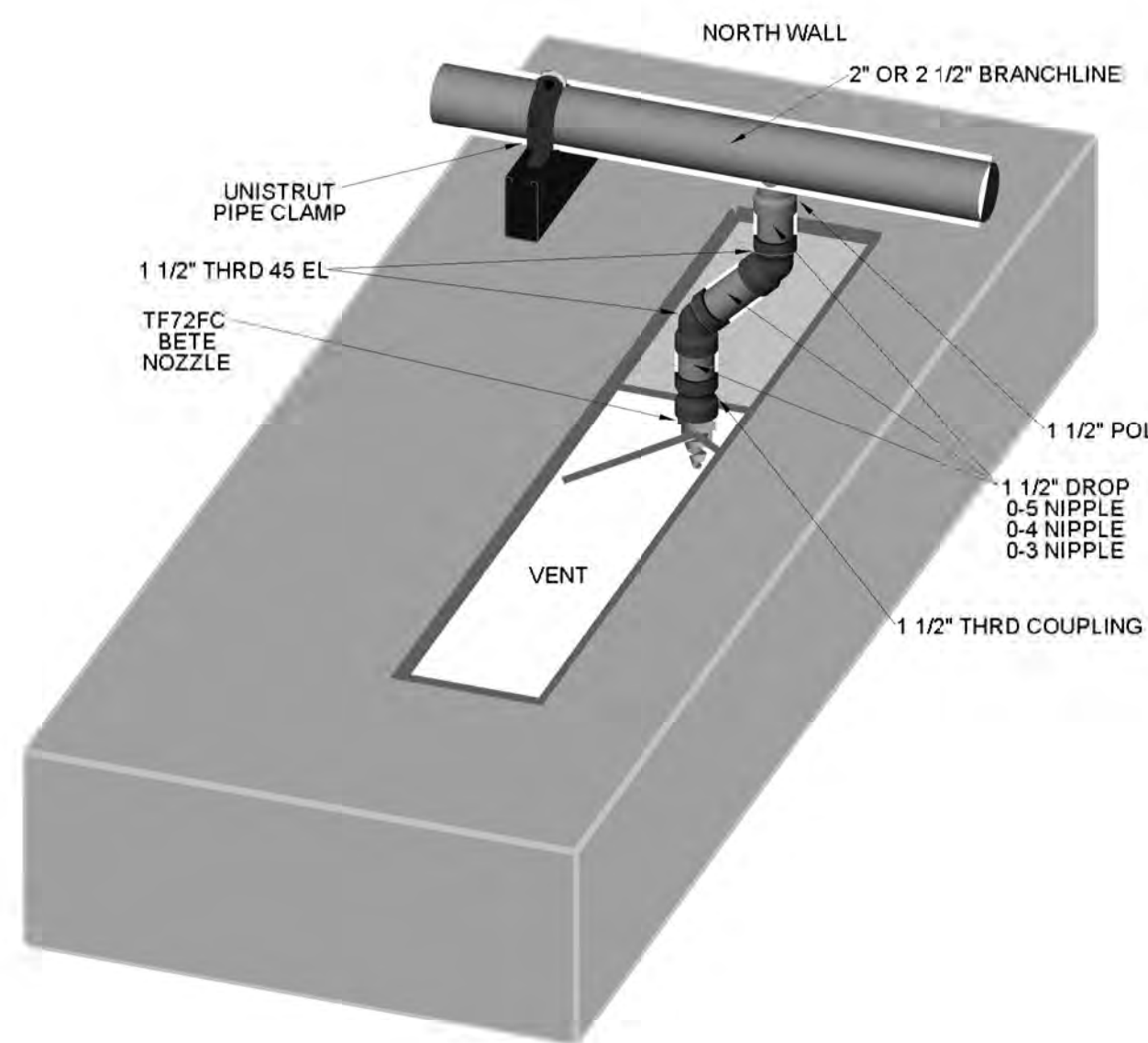
1 DROP TO NOZZLE - EISENHOWER (NORTH) TUNNEL  
NOT TO SCALE



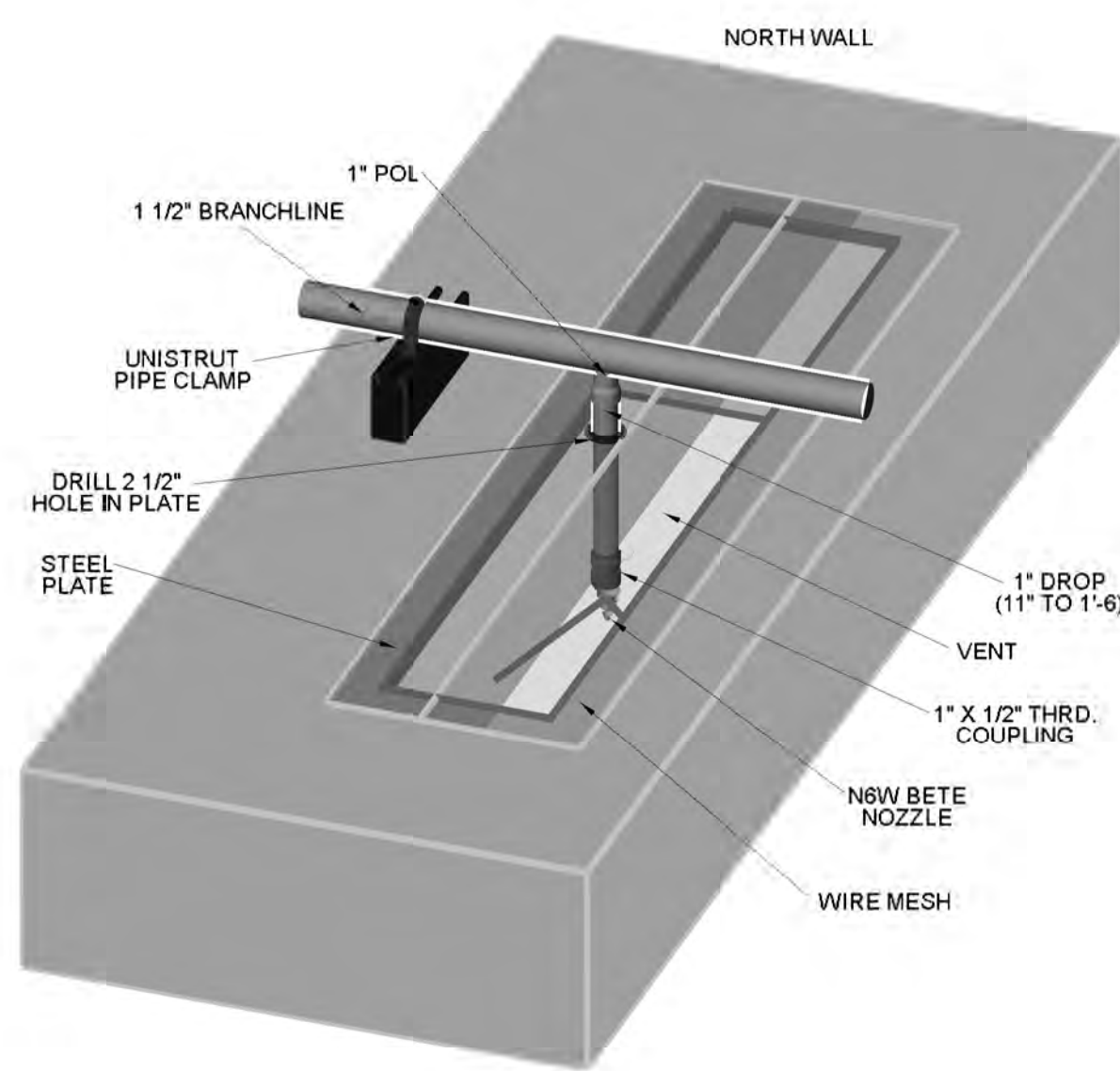
3 DROP TO NOZZLE - JOHNSON (SOUTH) TUNNEL  
NOT TO SCALE



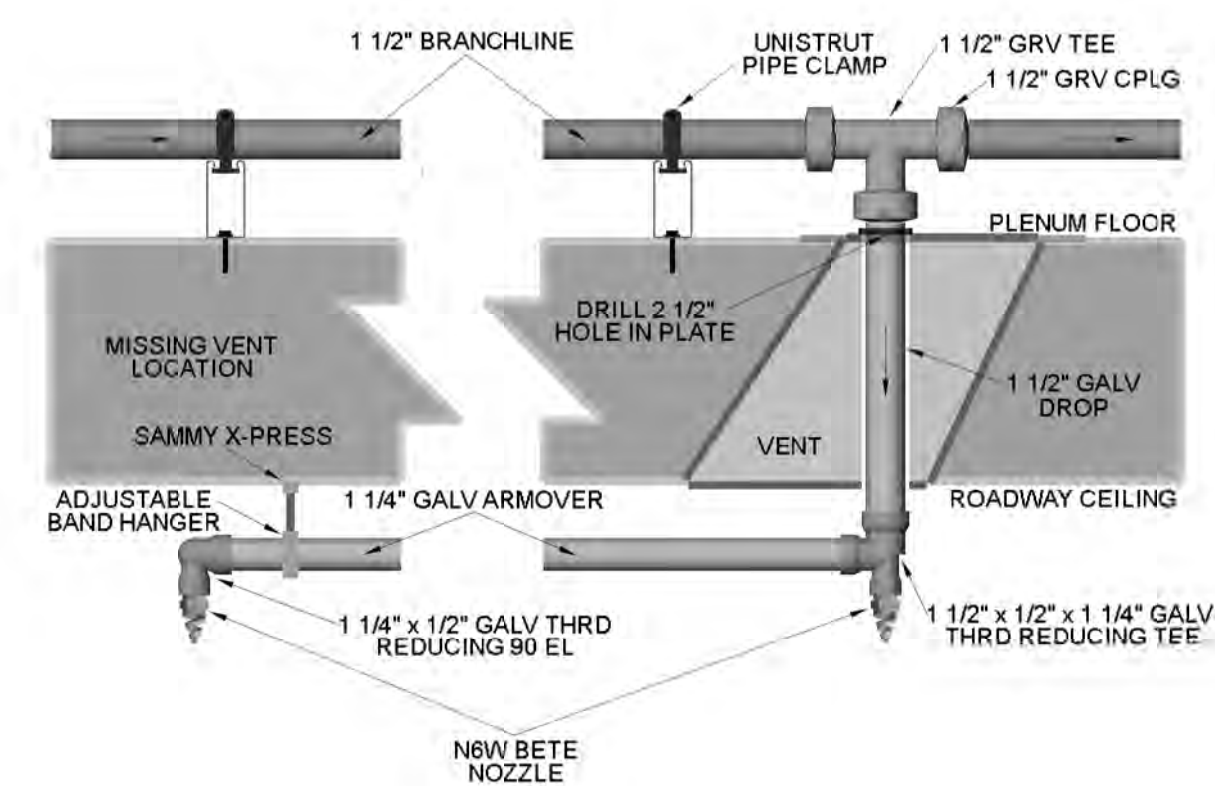
5 EXPOSED DROP TO NOZZLE - (SYSTEM ST-08 - ROADWAY)  
NOT TO SCALE



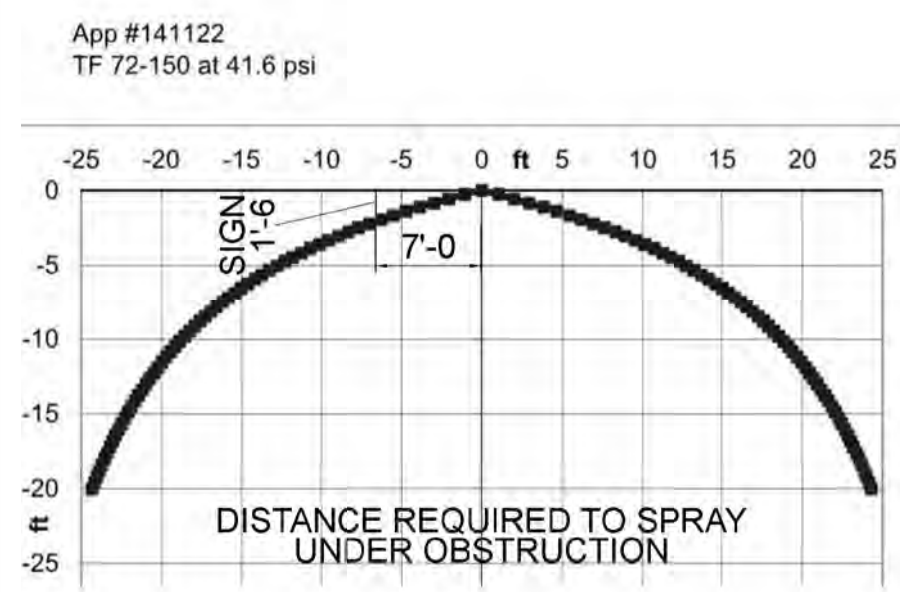
2 DROP TO NOZZLE - ISOMETRIC - EISENHOWER (NORTH) TUNNEL  
NOT TO SCALE



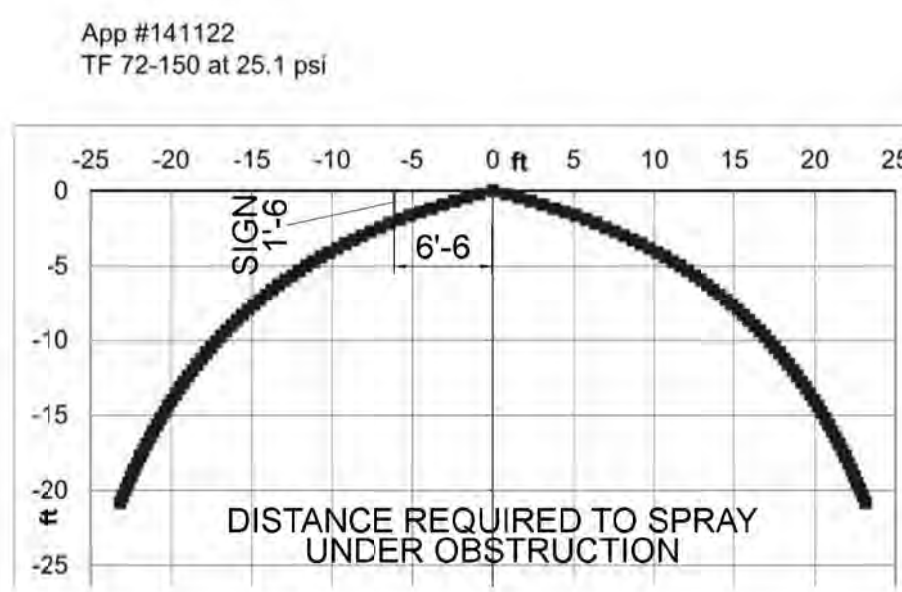
4 DROP TO NOZZLE - ISOMETRIC - JOHNSON (SOUTH) TUNNEL  
NOT TO SCALE



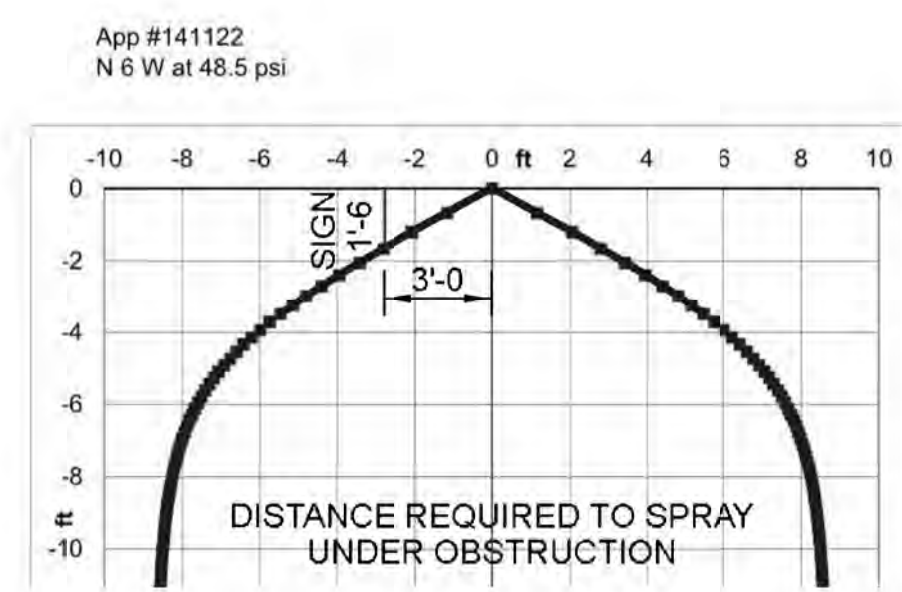
6 EXPOSED DROP TO NOZZLE - (SYSTEM ST-47 - ROADWAY)  
NOT TO SCALE



7 EISENHOWER (NORTH) TUNNEL  
3 NOZZLE - SPRAY OBSTRUCTION  
NOT TO SCALE



8 EISENHOWER (NORTH) TUNNEL  
4 NOZZLE - SPRAY OBSTRUCTION  
NOT TO SCALE



9 JOHNSON (SOUTH) TUNNEL  
NOZZLE - OBSTRUCTION GRAPH  
NOT TO SCALE

SPRINKLER HEAD LEGEND								
DESCRIPTION	SYMBOL	P/N	ORIFICE	NPT	"K"	SPRAY PATTERN	FINISH	QUANT.
BETE NOZZLE (EISENHOWER-NORTH)		TF72FC	1.13"	1 1/2"	30.4	150°	BRASS	289
BETE NOZZLE (JOHNSON-SOUTH)		N6W	1/2"	1/2"	6.64	120°	BRASS	1044
VIKING EXTENDED COVERAG EXTENDED COVERAGE HORIZONTAL SIDEWALL (PORTAL-BUILDINGS)		VK630	3/4"	3/4"	8.0	90°	WHITE	142
<b>PROJECT TOTAL</b>								<b>1477</b>

- ABBREVIATION LIST**
- THRD - THREADED
  - GRV - GROOVE
  - POL - PIPE OUTLET
  - EL - ELBOW
  - ATR - ALL THREAD ROD
  - CPLG - COUPLING
  - GALV - GALVANIZED

**BARNARD EJMT TEAM**

**BARNARD** **RONDELLI**

Western States Fire Protection Co.

Sturgeon Electric

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

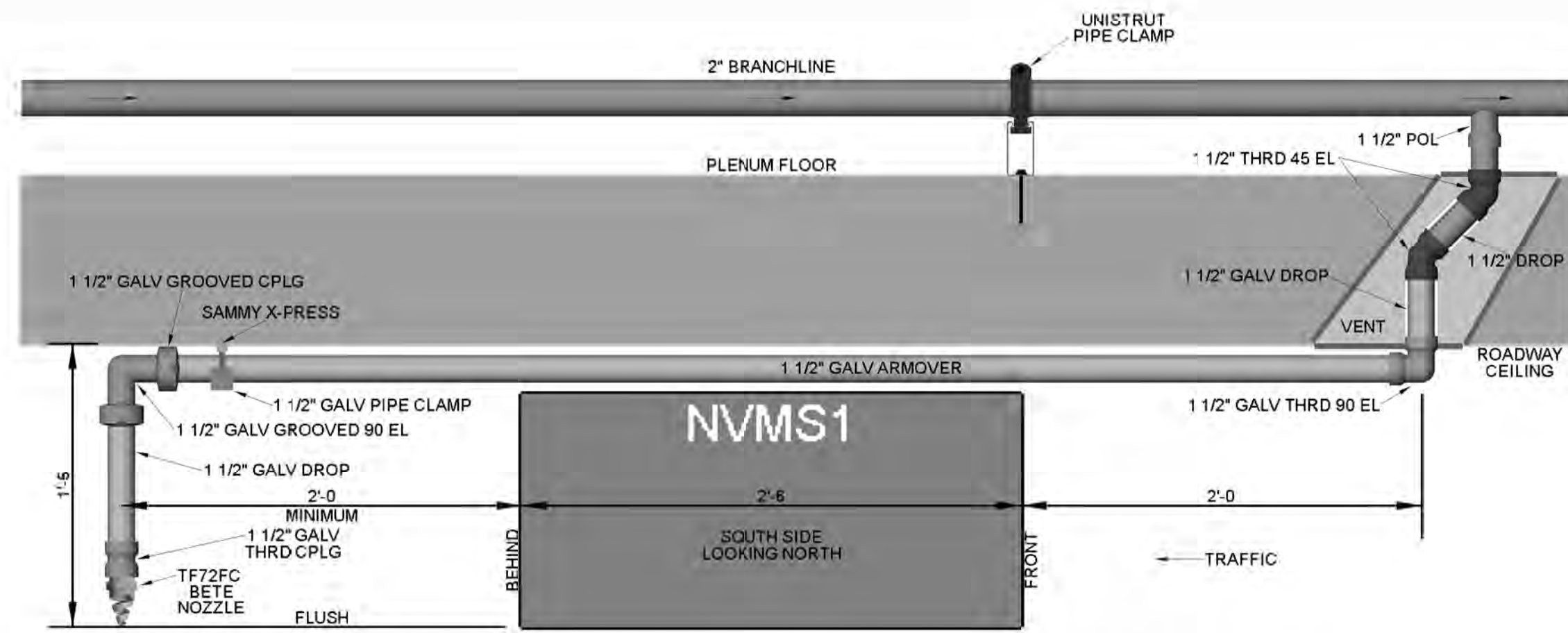
REVISIONS	Date

NOZZLES AND MISSING VENTS

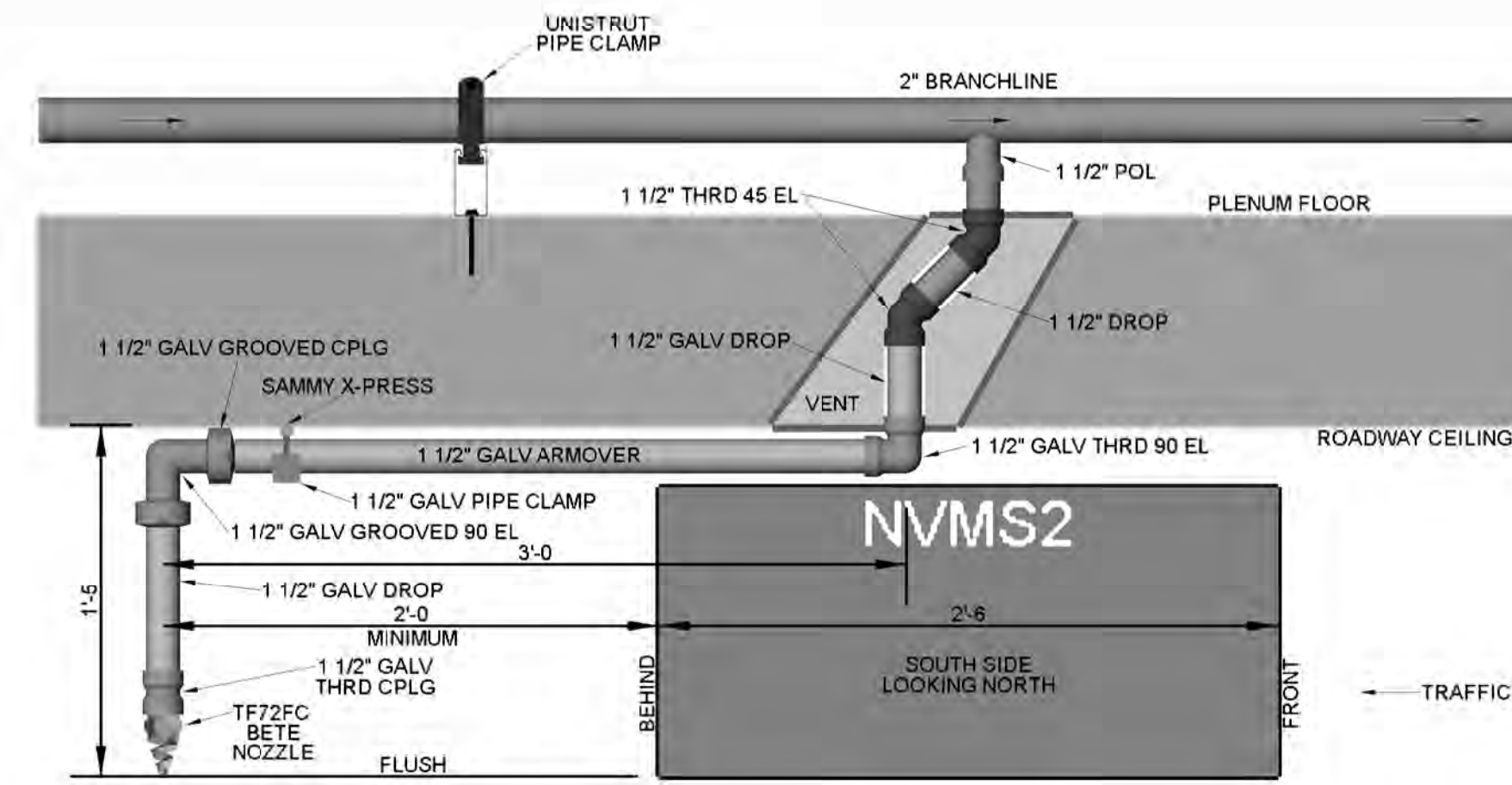
Drawing Number **FP1.0**

Checked by: JLB  
Drawn by: AMB

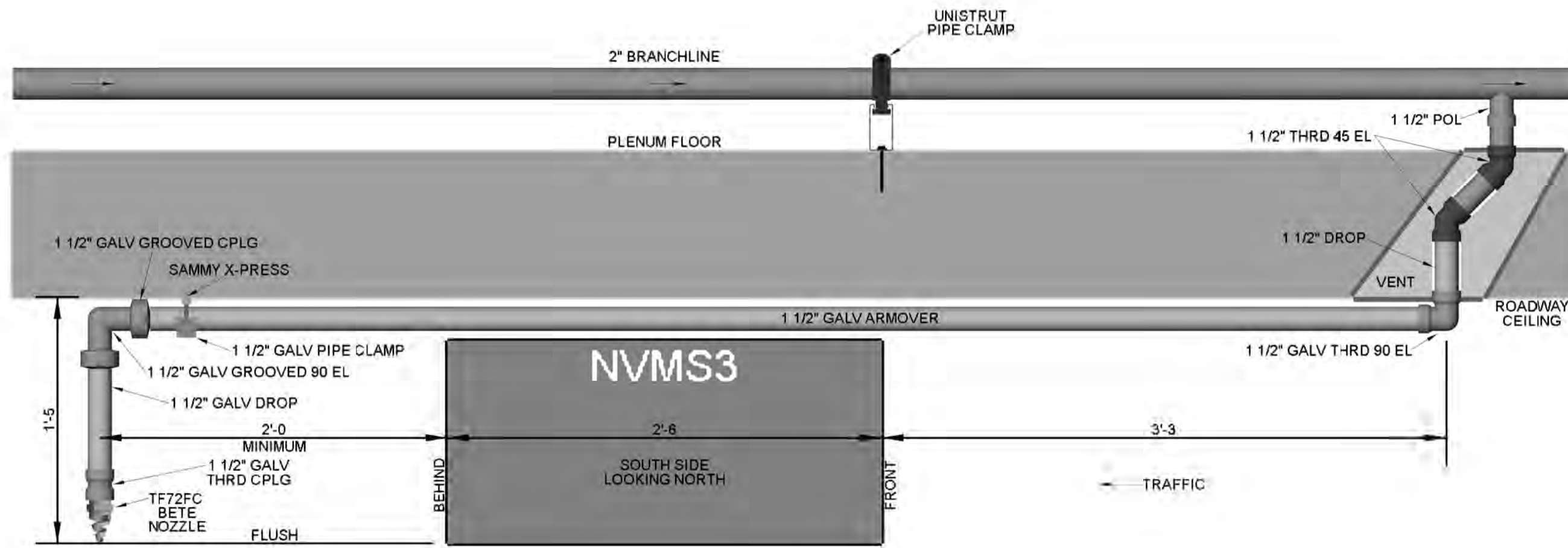




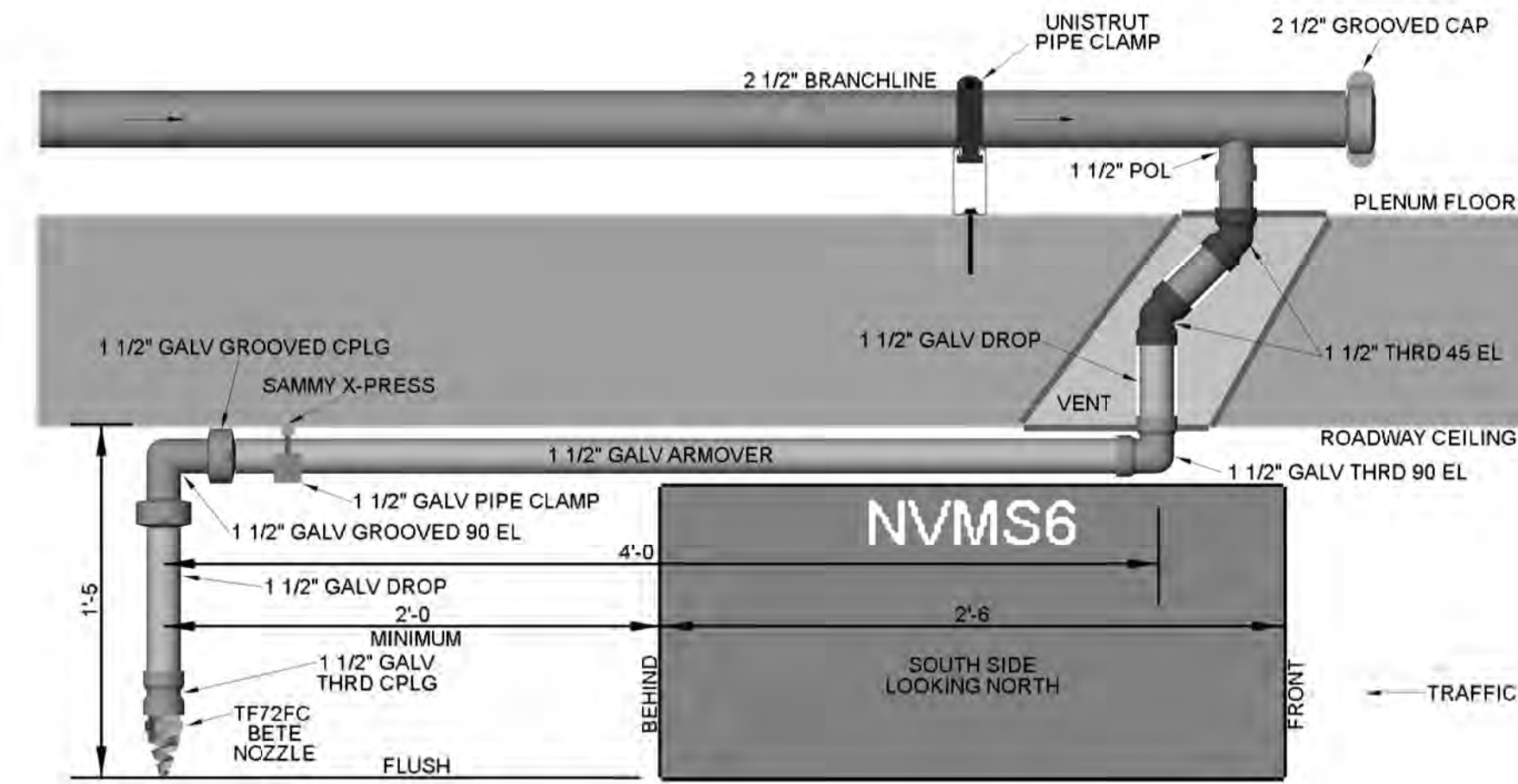
**1** EXPOSED DROP TO NOZZLE - (SYSTEM NT-05 - ROADWAY)  
NOT TO SCALE



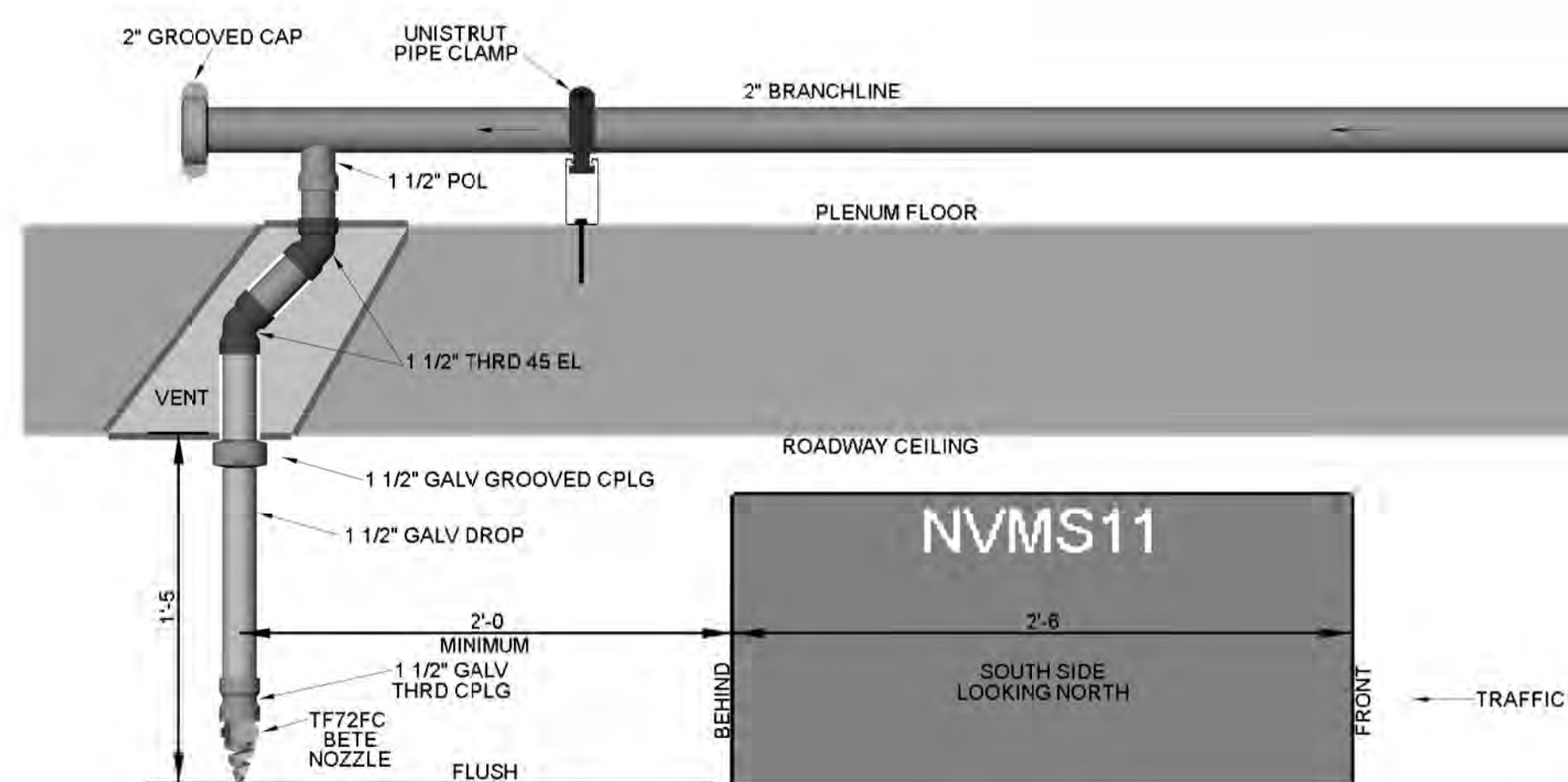
**2** EXPOSED DROP TO NOZZLE - (SYSTEM NT-13 - ROADWAY)  
NOT TO SCALE



**3** EXPOSED DROP TO NOZZLE - (SYSTEM NT-21 - ROADWAY)  
NOT TO SCALE



**4** EXPOSED DROP TO NOZZLE - (SYSTEM NT-45 - ROADWAY)  
NOT TO SCALE



**5** EXPOSED DROP TO NOZZLE - (SYSTEM NT-86 - ROADWAY)  
NOT TO SCALE

**BARNARD EJMT TEAM**

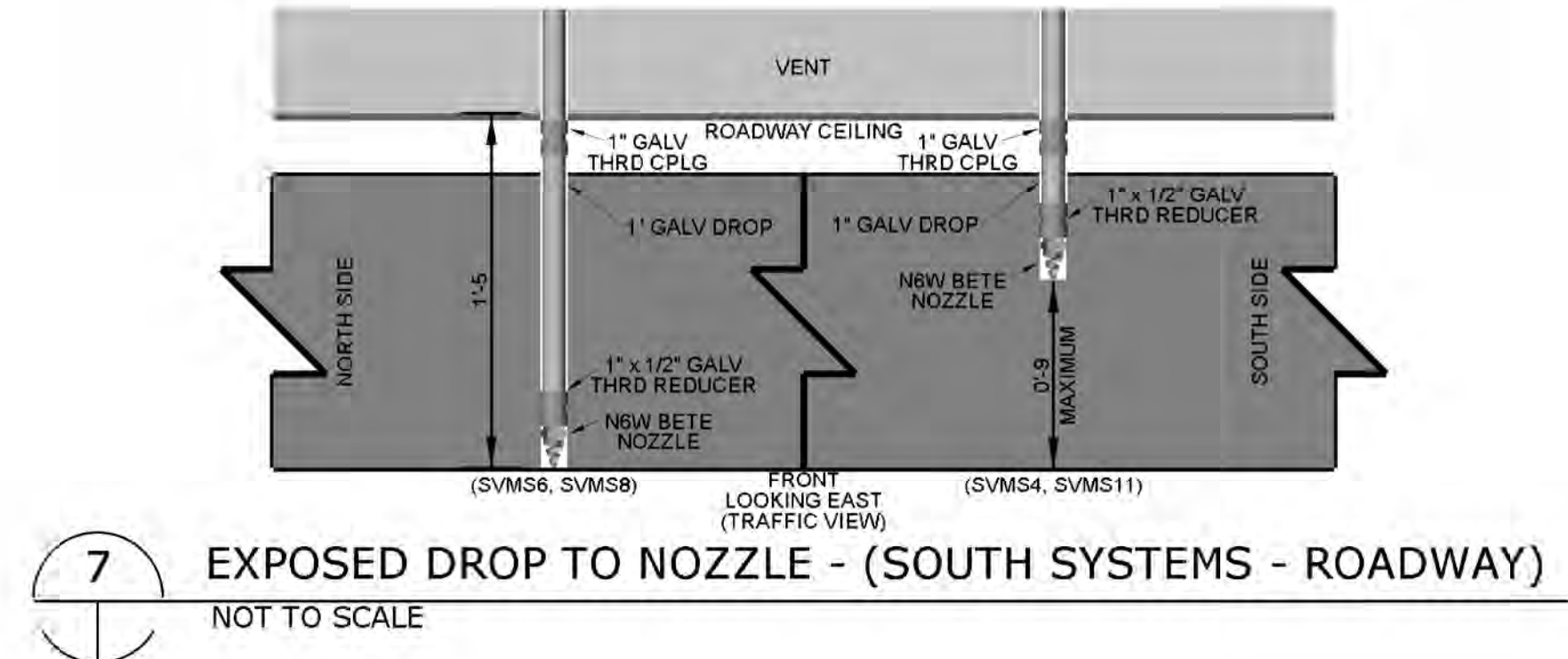
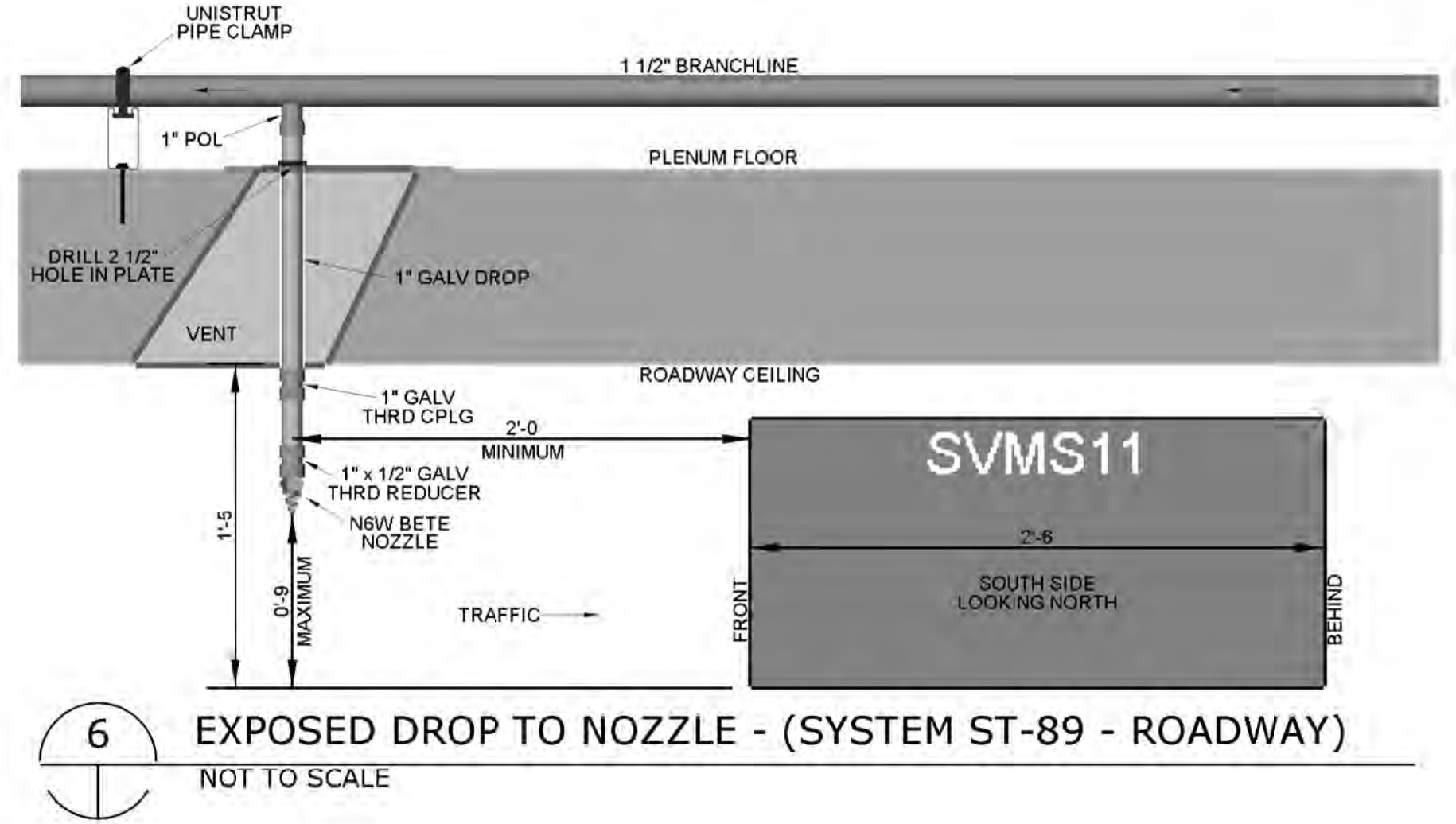
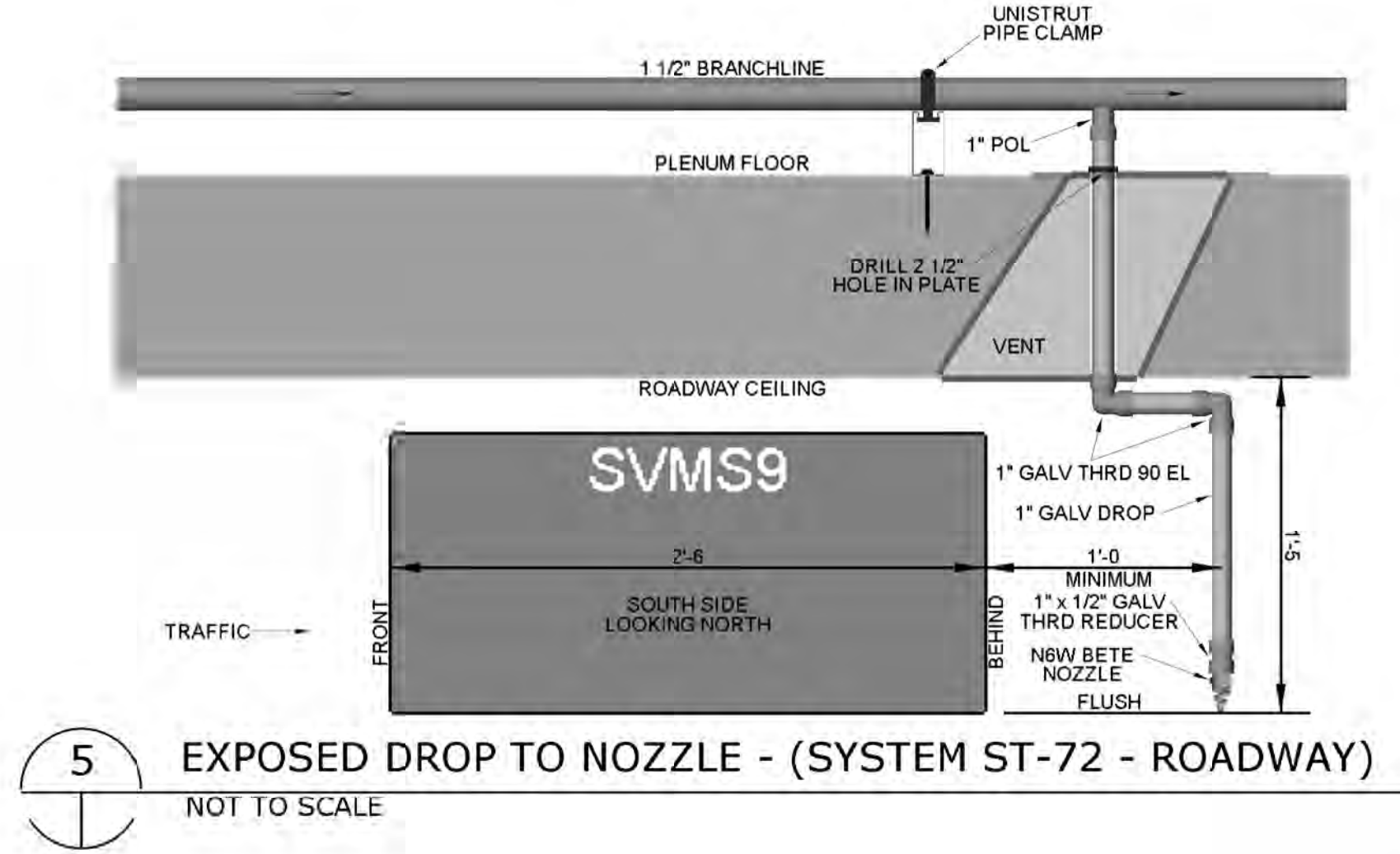
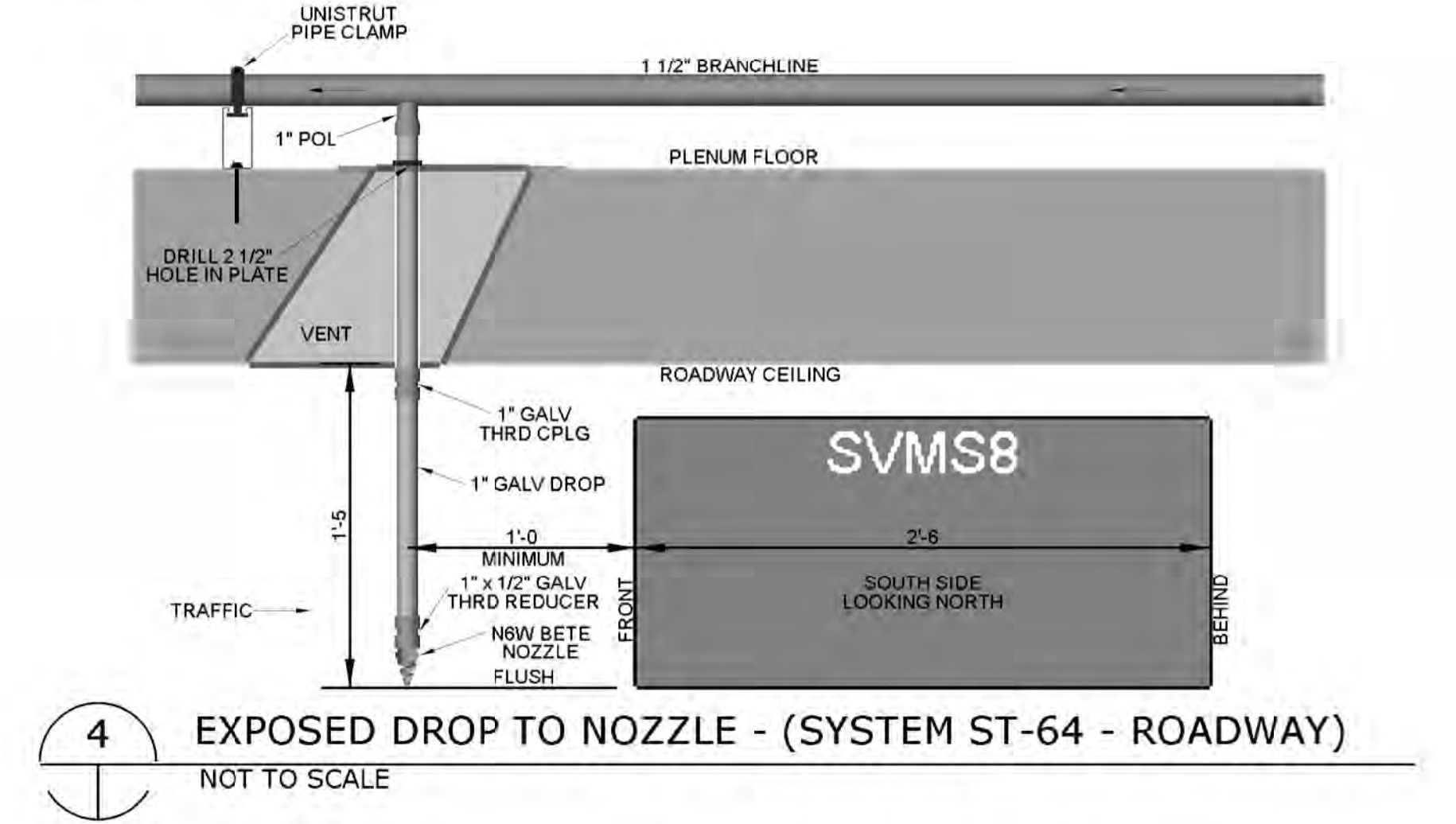
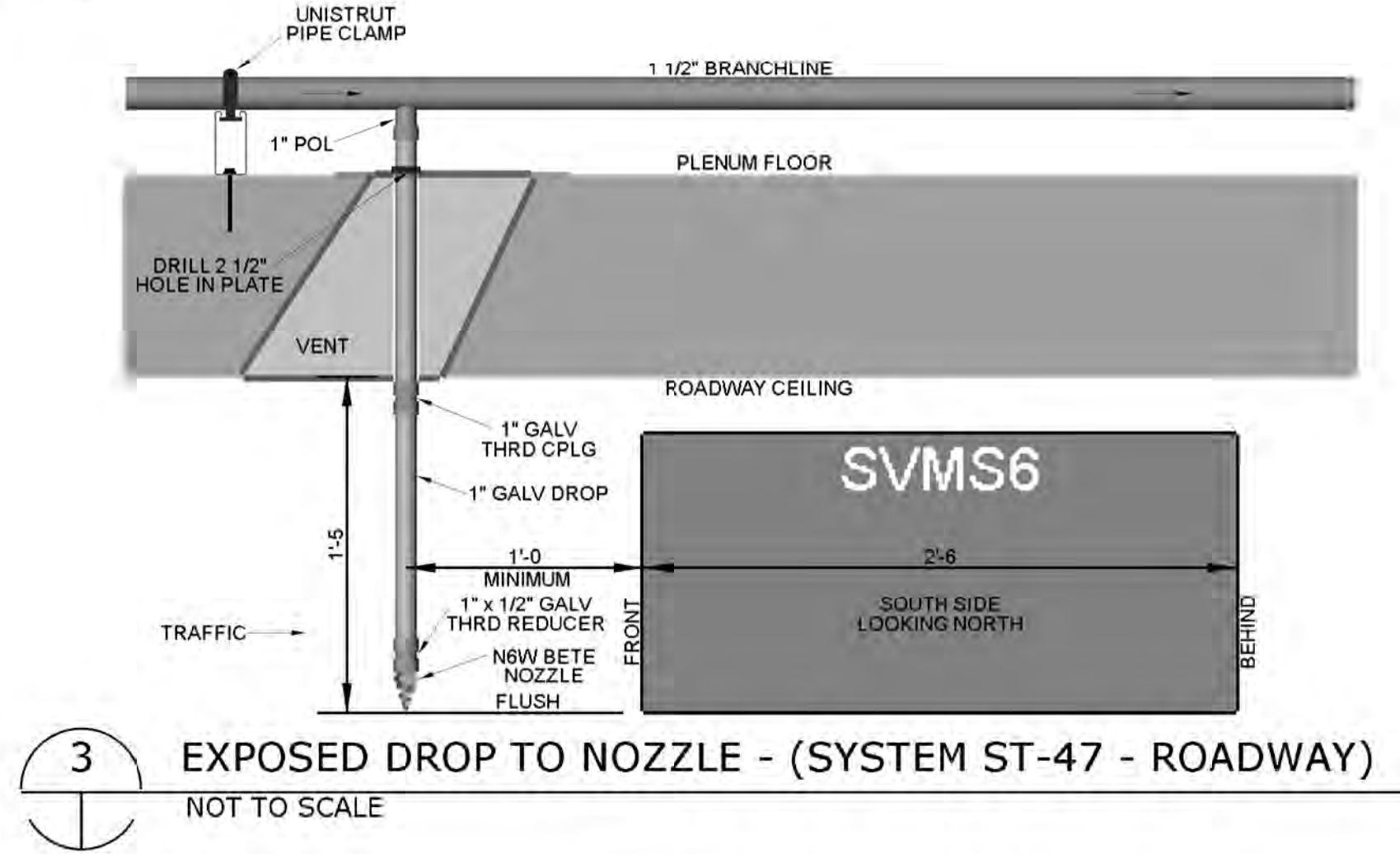
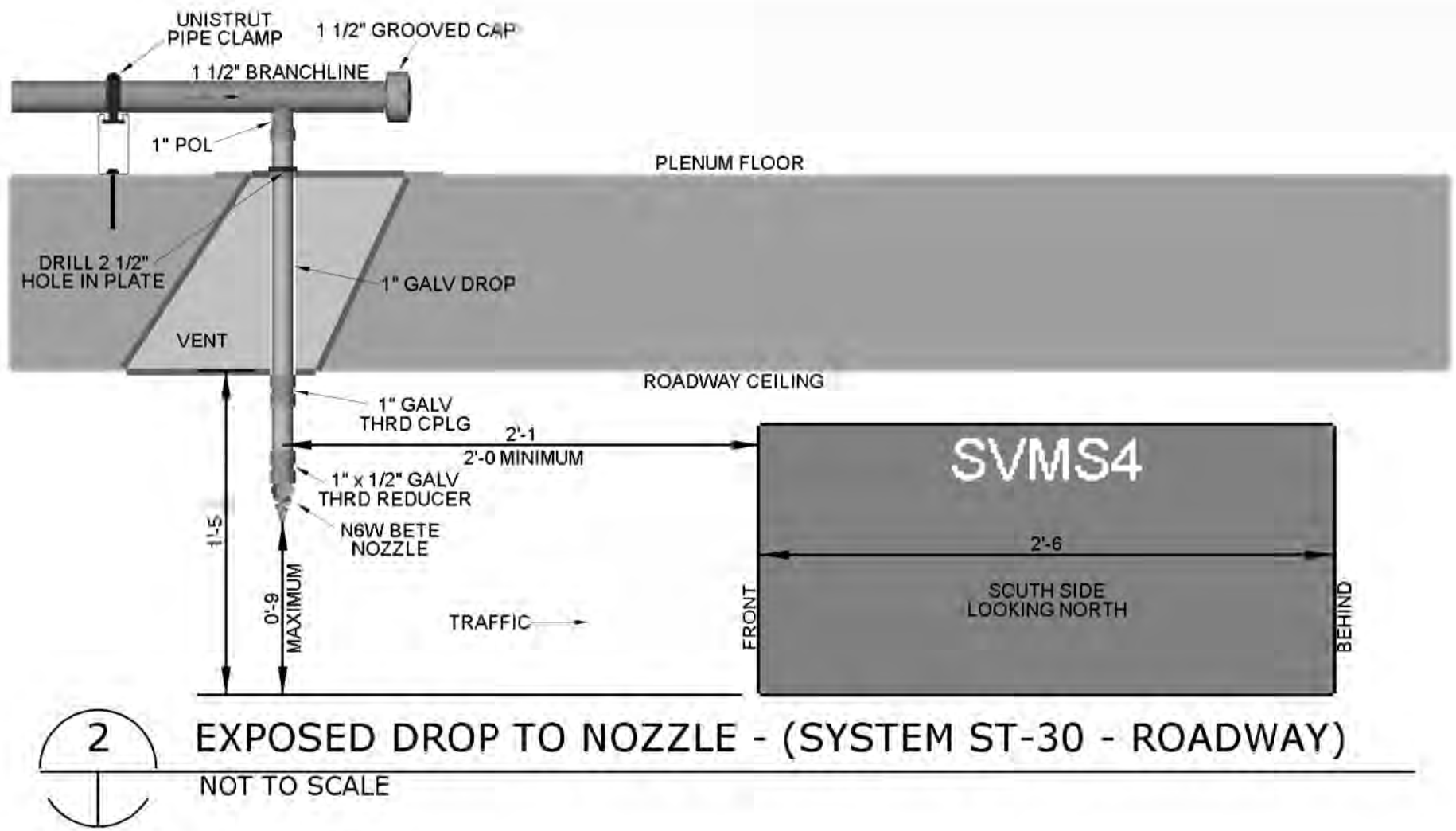
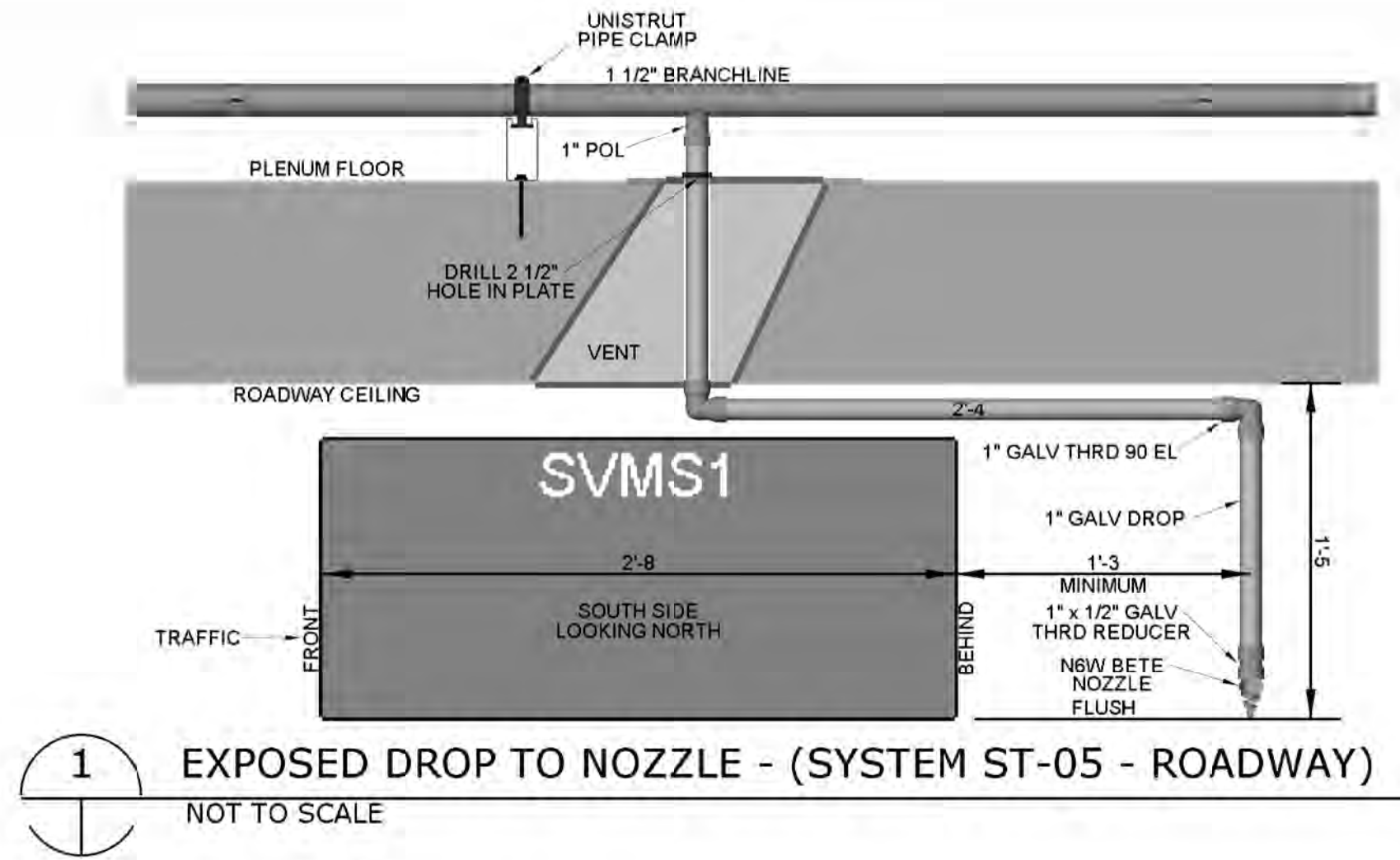
**BARNARD** **RONDNELLI** **Western States Fire Protection Co.**  
THE ENGINEERING WESTERN STATES FIRE PROTECTION CO.  
**Sturgeon ELECTRIC**

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

Project No. C0703-360  
 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Num	Revisions	Description	Date

DRAWN BY: AMB  
 CHECKED BY: JH  
 EISENHOWER (NORTH)  
 VARIABLE MESSAGE  
 SIGN OBSTRUCTION  
 Drawing Number  
**FP1.0N**



**BARNARD EJMT TEAM**

**BARNARD**  
Western States Fire Protection Co.

**RONINELLI**  
A life saving fire safety

**BCER**  
fire engineering

**Sturgeon Electric**

**RSE**  
Consulting Engineers

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

**FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT**

Project No. C0703-360 Subaccount 17810

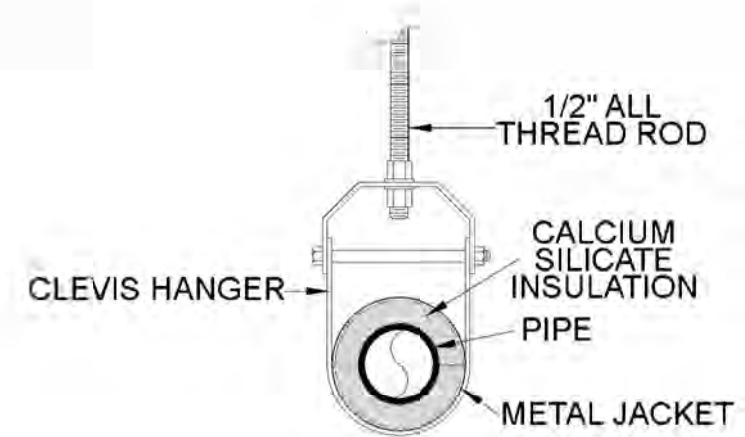
**RECORD DRAWINGS - 2015-11-16**

Num	Revisions Description	Date

JOHNSON (SOUTH) VARIABLE MESSAGE SIGN OBSTRUCTION

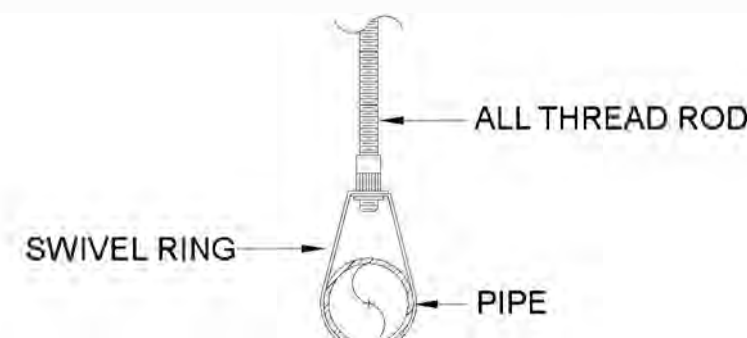
Drawing Number  
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Drawn by: AMB  
Checked by: JH



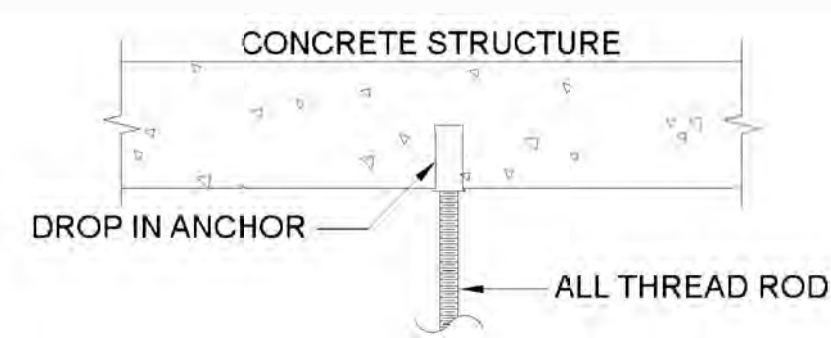
6" PIPE ONLY

**1** CLEVIS HANGER  
(PORTAL BUILDING - FREEZING AREAS)  
NOT TO SCALE



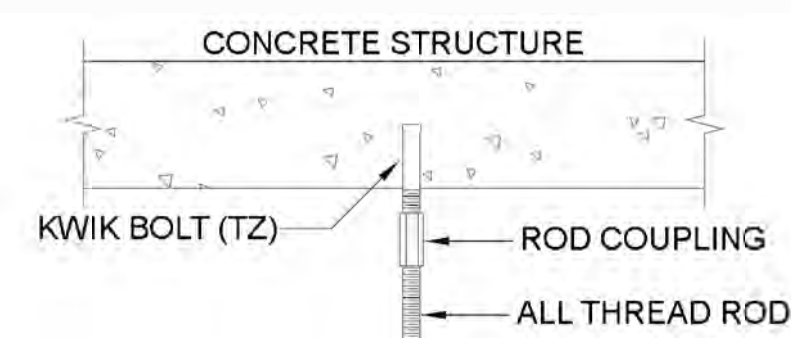
3/8" ALL THREAD ROD FOR PIPE 4" AND SMALLER  
1/2" ALL THREAD ROD FOR PIPE 6" AND LARGER

**2** ADJUSTABLE BAND HANGER  
(PORTAL DELUGE SYSTEM PIPING)  
NOT TO SCALE



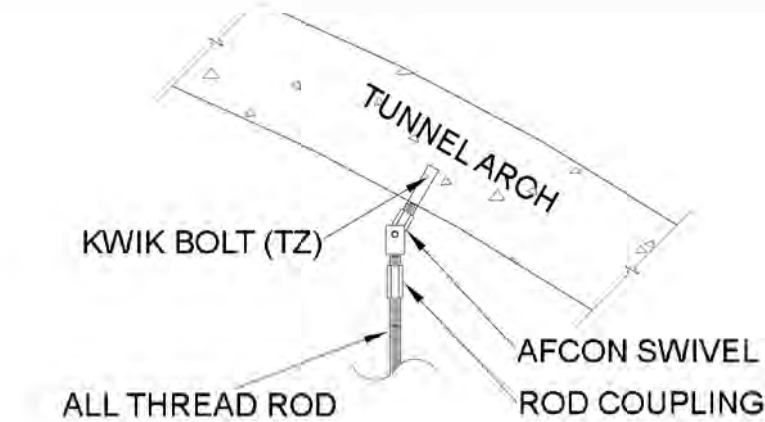
3/8" SIZES FOR PIPE 4" AND SMALLER  
1/2" SIZES FOR PIPE 6" AND LARGER

**3** HILTI DROP IN ANCHOR  
(VERTICAL & HORIZONTAL ANCHOR)  
NOT TO SCALE



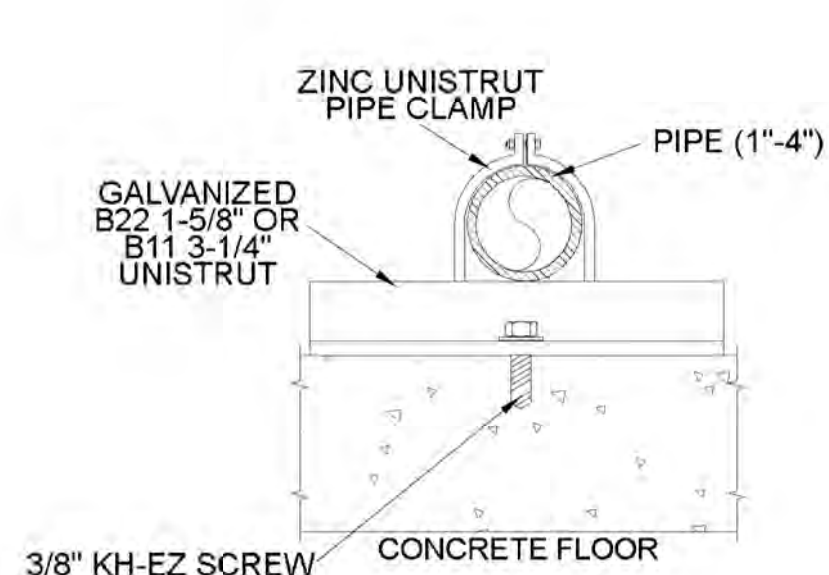
3/8" SIZES FOR PIPE 4" AND SMALLER  
1/2" SIZES FOR PIPE 6" AND LARGER

**4** HILTI KWIK BOLTS  
(VERTICAL & HORIZONTAL ANCHOR)  
NOT TO SCALE

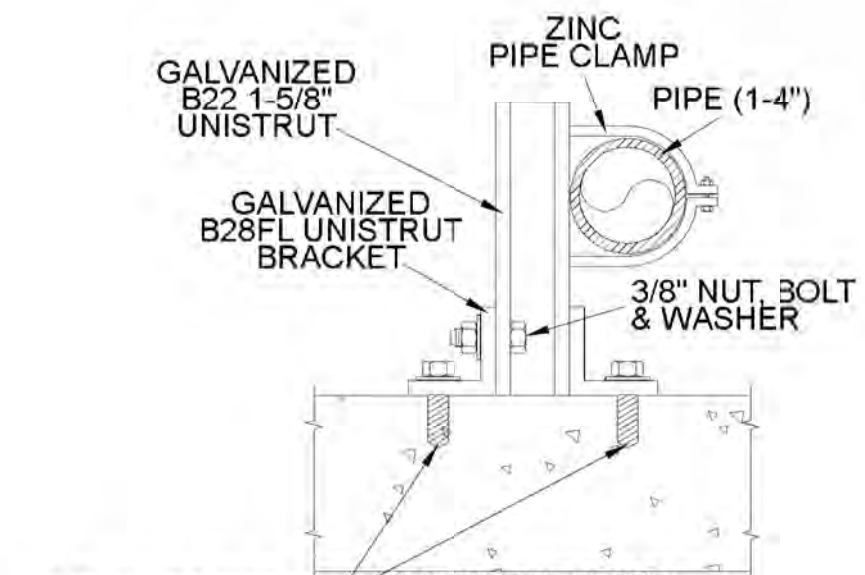


3/8" SIZES FOR PIPE 4" AND SMALLER  
1/2" SIZES FOR PIPE 6" AND LARGER

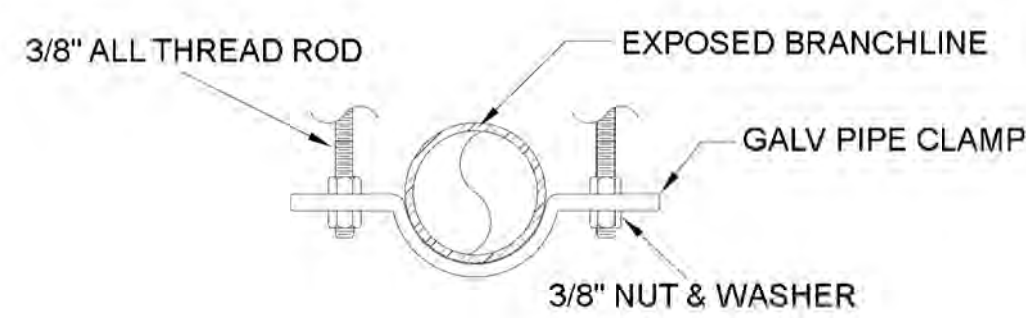
**5** AFCON 615 SWIVEL  
(PLENUM TUNNEL ARCH ANCHOR)  
NOT TO SCALE



**6** PIPE CLAMP DETAIL  
(PLENUMS - FLUSH MOUNTED)  
NOT TO SCALE

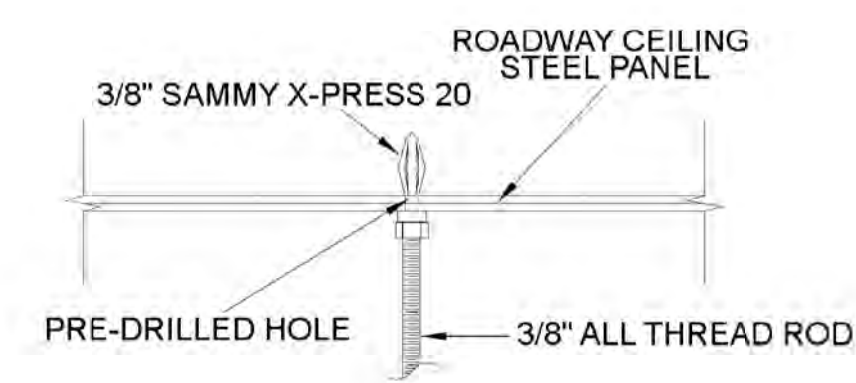


**7** UNISTRUT PIPE CLAMP  
(PLENUMS - OFFSET MOUNTED)  
NOT TO SCALE



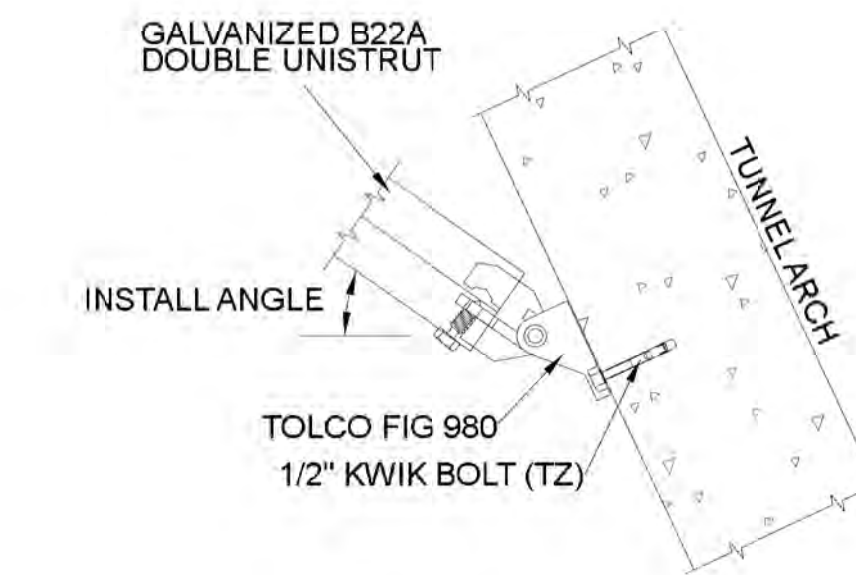
MAX PIPE SIZE = 2"

**8** PIPE CLAMP  
(EXPOSED PIPE - ROADWAY)  
NOT TO SCALE

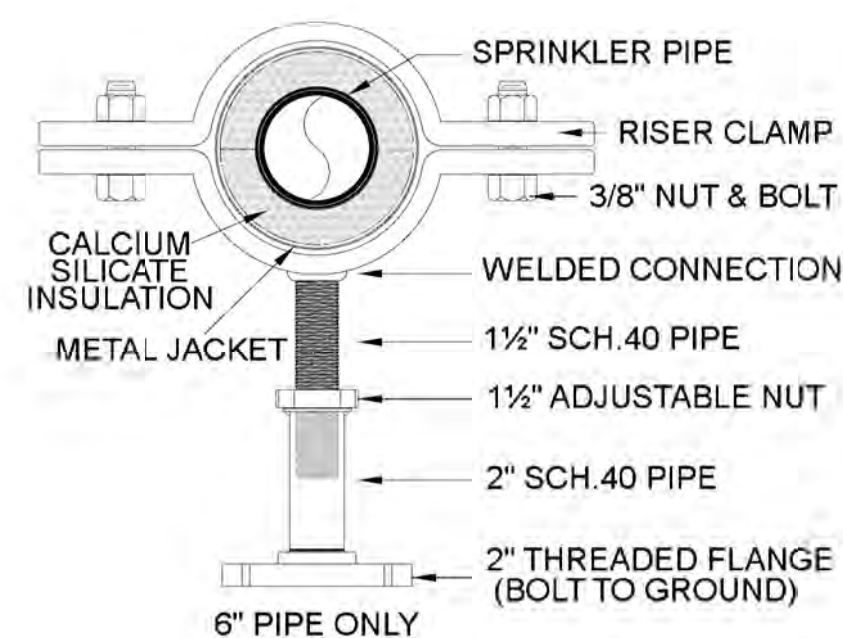


MAX PIPE SIZE = 2"

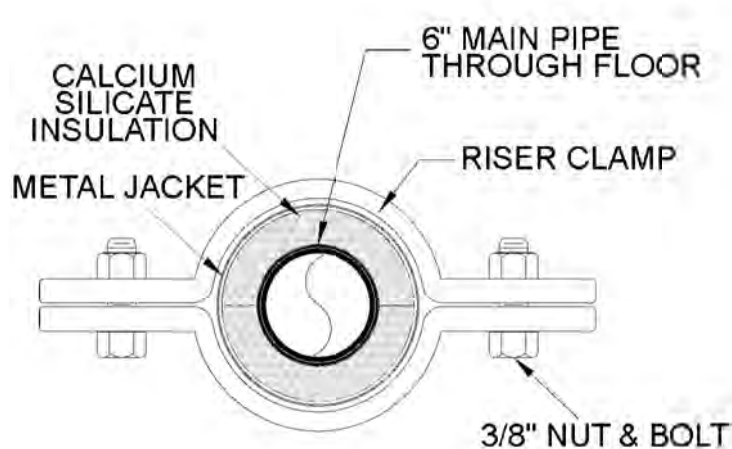
**9** SAMMY X-PRESS  
(EXPOSED PIPE - ROADWAY)  
NOT TO SCALE



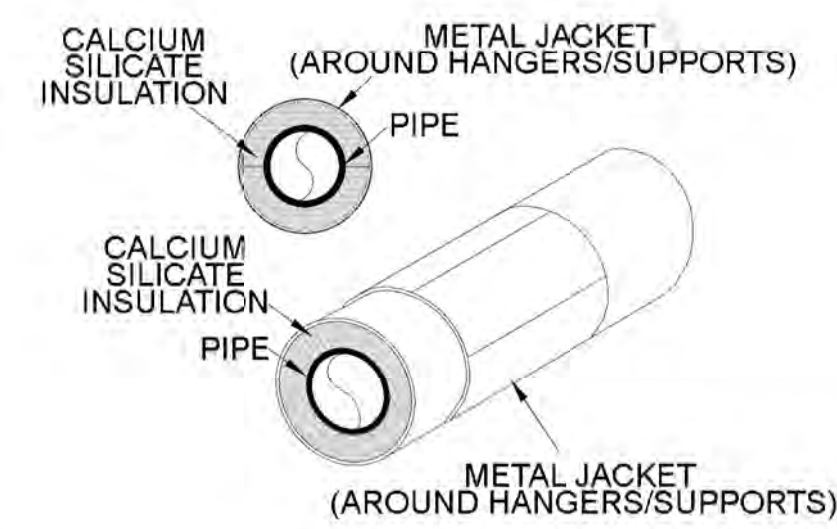
**10** TOLCO FIG. 980  
(PLENUM BRACKET TUNNEL ARCH ANCHOR)  
NOT TO SCALE



**11** ADJUSTABLE PIPE STAND  
(PORTAL BUILDING 6" MAIN PIPING)  
NOT TO SCALE

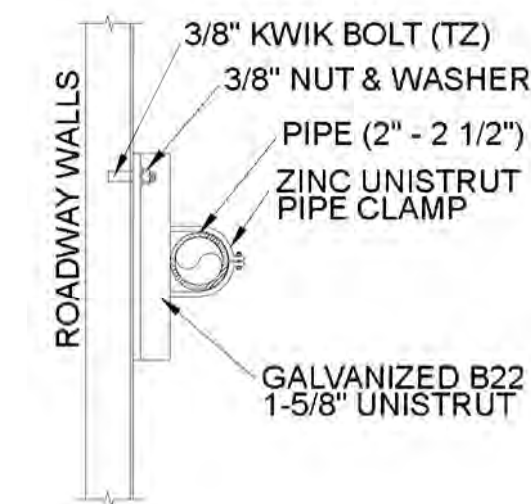


**12** FLOOR CLAMP  
(PORTAL BUILDING 6" MAIN PIPING)  
NOT TO SCALE

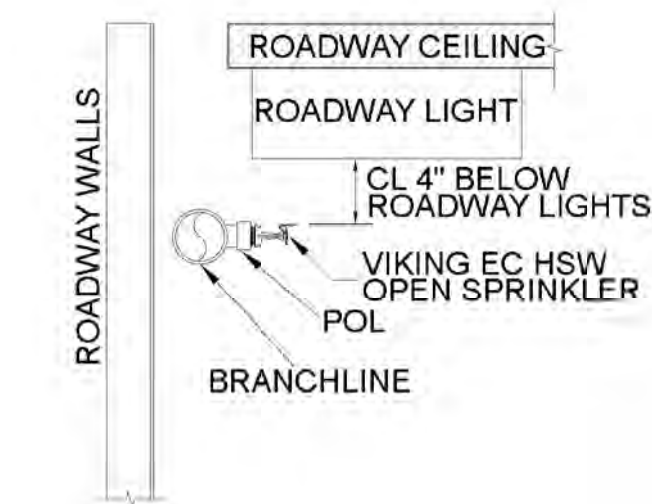


6" PIPING = 1 1/2" THICK FIBERGLASS INSULATION  
(K VALUE = 0.23 BTU-IN/HR - SF - °F)

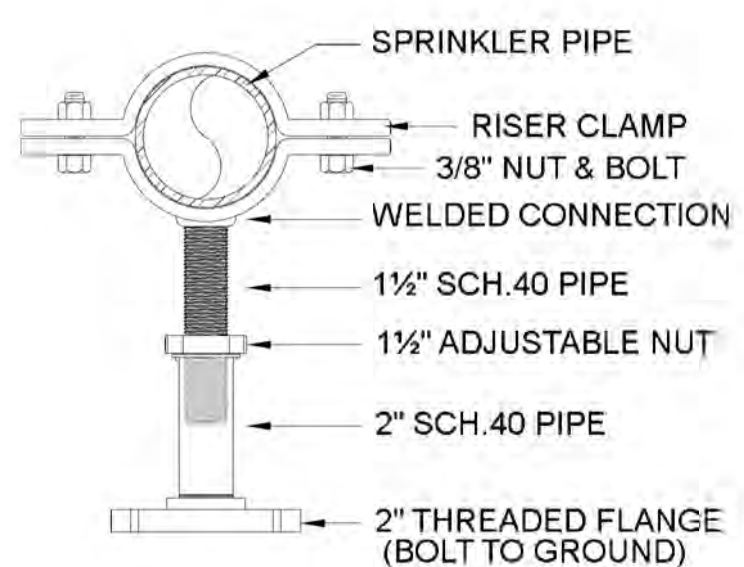
**13** 6" INSULATED PIPE  
(PLENUMS / PORTALS - FREEZING AREAS)  
NOT TO SCALE



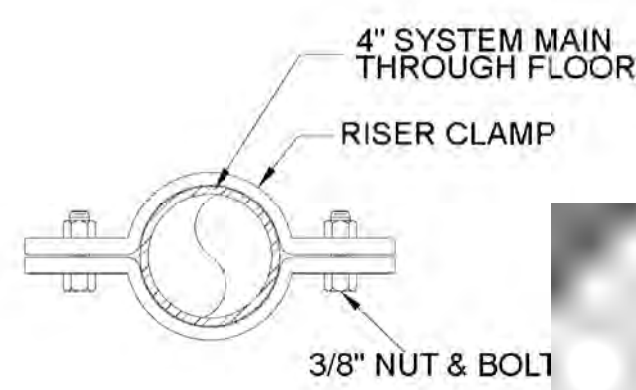
**14** WALL BRACE  
(PORTAL DELUGE SYSTEMS ROADWAYS)  
NOT TO SCALE



**15** HORIZONTAL SIDEWALL NOZZLES  
(PORTAL DELUGE SYSTEMS ROADWAYS)  
NOT TO SCALE



**16** ADJUSTABLE PIPE STAND  
(PUMP ROOM)  
NOT TO SCALE



**17** RISER CLAMP  
(4" PORTAL DELUGE SYSTEM PIPING)  
NOT TO SCALE

**MAXIMUM HANGER SPACING**

PIPE SIZE	*BETWEEN HANGERS	UNSUPPORTED PIPE LENGTH
1"	12'-0"	3'-0"
1 1/4"	12'-0"	4'-0"
1 1/2"	15'-0"	5'-0"
2"	15'-0"	5'-0"
2 1/2"	15'-0"	5'-0"
3"	15'-0"	5'-0"
4"	15'-0"	5'-0"
6"	15'-0"	5'-0"
8"	15'-0"	5'-0"

\*10'-0" MAX FOR HANGERS SUSPENDED FROM CONCRETE

**HANGER LEGEND**

DESCRIPTION	SYMBOL	P/N
PLENUM BRACKET	T	ASSEMBLY
CLEVIS	X	FIG. 1
ADJUSTABLE BAND HANGER	X	FIG. 200
UNISTRUT PIPE CLAMP	C	2004-2013

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

REVISIONS

Num	Description	Date

DRAWN BY: AMB CHECKED BY: JIH

**HANGERS AND SUPPORTS**

Drawing Number  
**FP1.1**

**BARNARD EJM TEAM**

**BARNARD** **RONDELLI**  
A Fire Suppression Life Safety Consulting Engineers

**BCER** **Sturgeon Electric**

Western States Fire Protection Co.

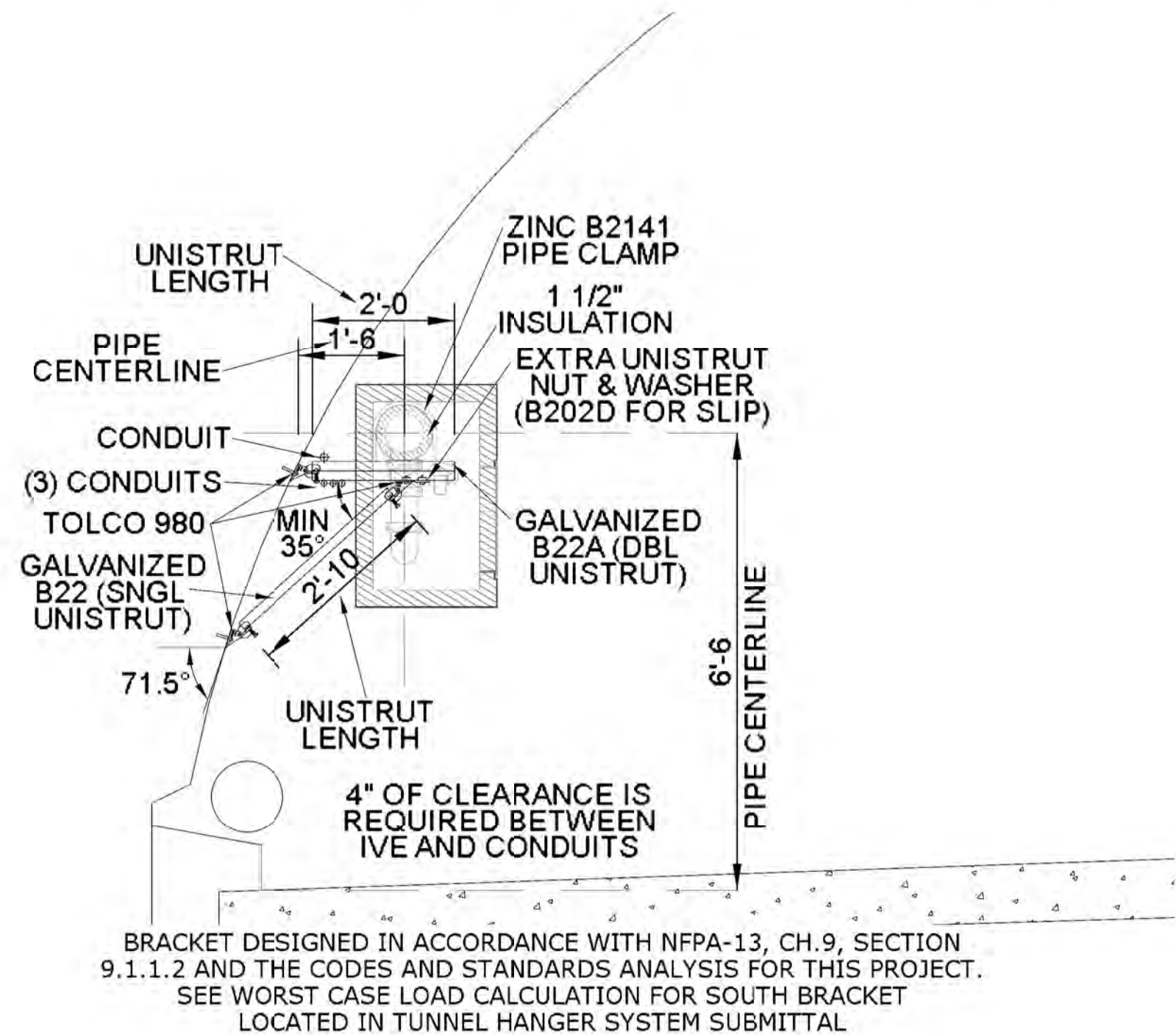
TUNNEL ARCH PLENUM BRACKET NARRATIVE

THE TUNNEL ARCH PLENUM BRACKETS ARE TO BE INSTALLED IN THE EISENHOWER (NORTH) SUPPLY AIR PLENUM ON THE NORTH TUNNEL ARCH WALL AND IN THE JOHNSON (SOUTH) SUPPLY AIR PLENUM ON THE SOUTH TUNNEL ARCH WALL. EACH BRACKET SHALL BE SPACED AT A MAXIMUM OF 12'-6" APART. THE BRACKETS ARE TO SUPPORT THE 6 INCH SUPPLY LOOP FOR THE FFSS. EVERY 25 FEET TWO BRACKETS SHALL SUPPORT ONE STICK OF 6 INCH BY 24 FEET OF SCHEDULE 10 PIPE WITH THE REQUIRED EXPANSION AND DEFLECTION JOINTS REQUIRED FOR EACH SECTION OF PIPE AND 25 FEET OF 4 SEPARATE CONDUITS. IN ADDITION, EVERY 100 FEET THE PIPE SHALL ALSO SUPPORT THE IVE ASSEMBLY FOR A SINGLE DELUGE SYSTEM. THE LOCATION FOR THE CONDUITS HAS BEEN DETERMINED TO ALLOW FOR INSTALLATION OF THE IVE AFTER THE IVE VALVES AND CONDUITS HAVE BEEN INSTALLED.

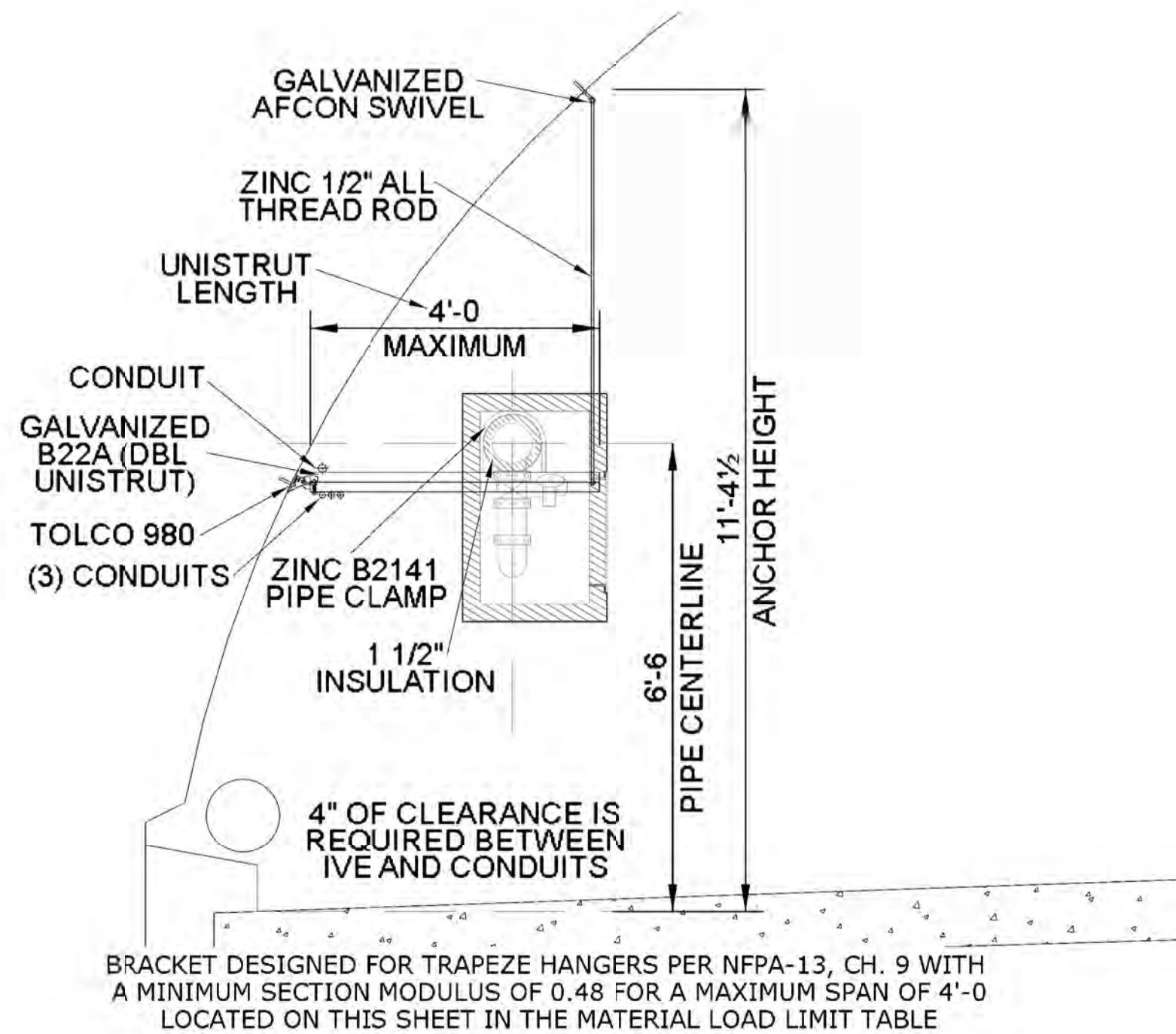
EACH BRACKET SHALL BE DESIGNED TO HOLD 12 FEET OF 6 INCH SCHEDULE 10 PIPE, 6 INCHES OF 6 INCH SCHEDULE 40 EXPANSION AND DEFLECTION JOINTS. THE WEIGHT OF THE IVE ASSEMBLY AND 4 SECTIONS OF CONDUIT 12'-6" IN LENGTH. ALL PIPE WEIGHTS, THE WEIGHTS FOR THE IVE ASSEMBLY, THE WEIGHTS FOR THE CONDUITS AND THE DESIGN LOADS FOR EACH BRACKET COMPONENT CAN BE FOUND IN TABLES LOCATED ON THIS SHEET. THE BRACKETS ARE DESIGNED TO HOLD 1000 LBS. IT HAS BEEN DETERMINED THAT THE JOHNSON (SOUTH) TUNNEL BRACKET - OPTION 1 IN DETAIL 3, HAS THE WORST CASE LOADING DUE TO THE LOCATION OF THE LOAD AND THE LARGER LENGTHS OF THE UNISTRUT THUS CALCULATIONS WERE PROVIDED FOR THIS ASSEMBLY. FOR DETAILS 2 AND 4 EACH BRACKET IS DESIGNED FOR A TRAPEZE HANGER PER NFPA-13, CH. 9, 2010 EDITION.

EJMT PIPE AND INSULATED VALVE ENCLOSURE WEIGHTS (LBS)  
(FOR MAXIMUM BRACKET SPAN OF 12'-6")

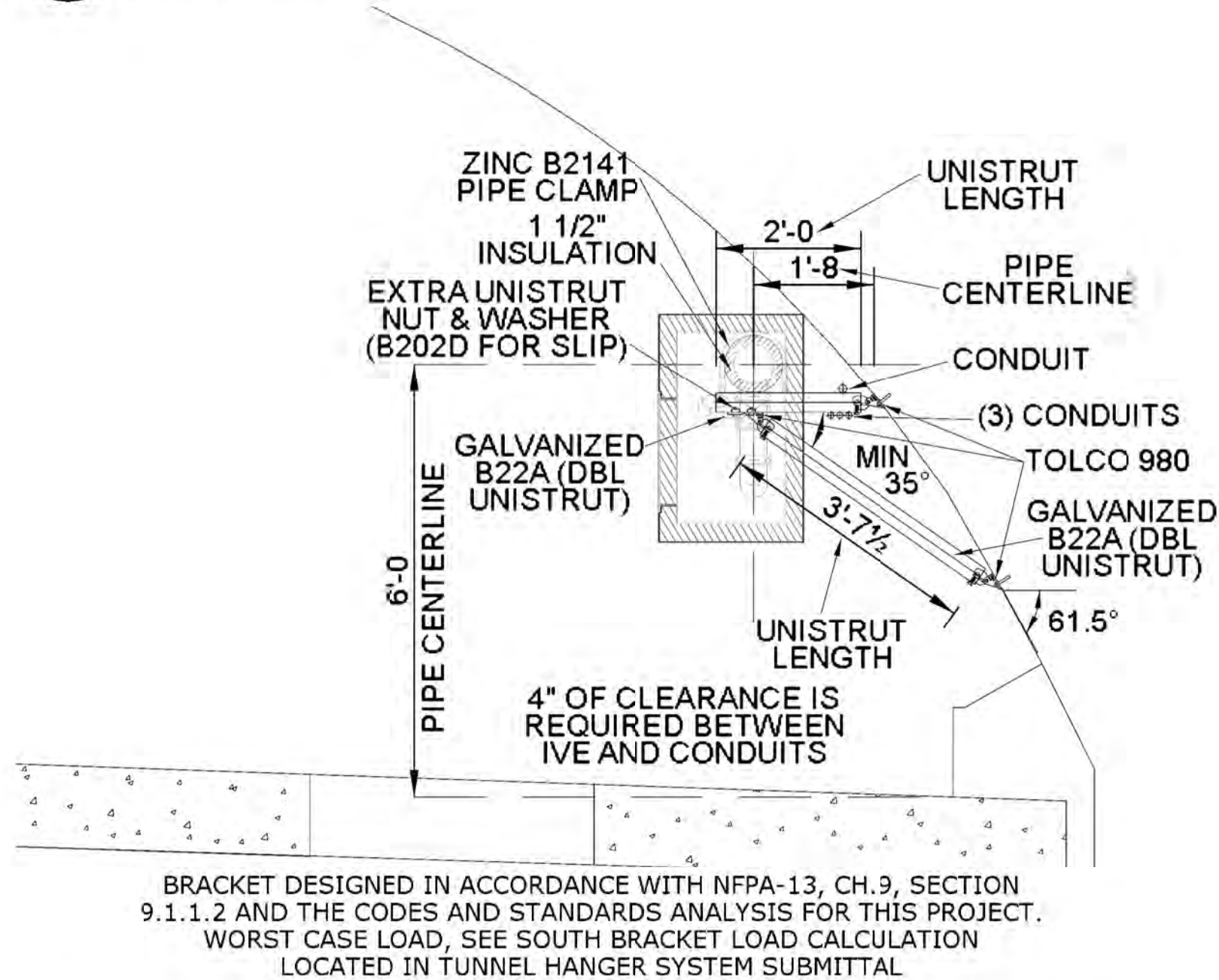
ITEM	QTY.	WEIGHT	TOTAL
6" SCHEDULE 10 PIPE WITH WATER (BY FOOT)	12.0	23.052	276.62
6" SCH. 40 PIPE WITH WATER (BY FOOT)	0.5	31.502	15.75
4" SCH. 40 PIPE WITH WATER (BY FOOT)	5.0	16.311	81.56
6" VIC 705W (BUTTERFLY VALVE)	1.0	28.7	28.70
4" VIC 705W (BUTTERFLY VALVE)	1.0	14.0	14.00
6" GROOVED COUPLING #75	2.0	7.0	14.00
4" GROOVED COUPLING #75	7.0	4.1	28.70
4" VIC FLK GROOVED 90 #001	2.0	6.7	13.40
4" GROOVED OUTLET	1.0	1.4	1.40
BERMAD VALVE	1.0	75.0	75.00
3/8" ATR FIG. 100	1.0	0.29	0.29
6" TOLCO FIG. 200 HANGER	1.0	1.0	1.00
4" TOLCO FIG. 200 HANGER	1.0	1.0	1.00
1.5" INSULATION	12.0	0.5	6.00
CABINET	1.0	104.0	104.00
4 CONDUITS @ 12'-6" LENGTHS	1.0	100.0	100.00
ACTUAL WEIGHT			761.42



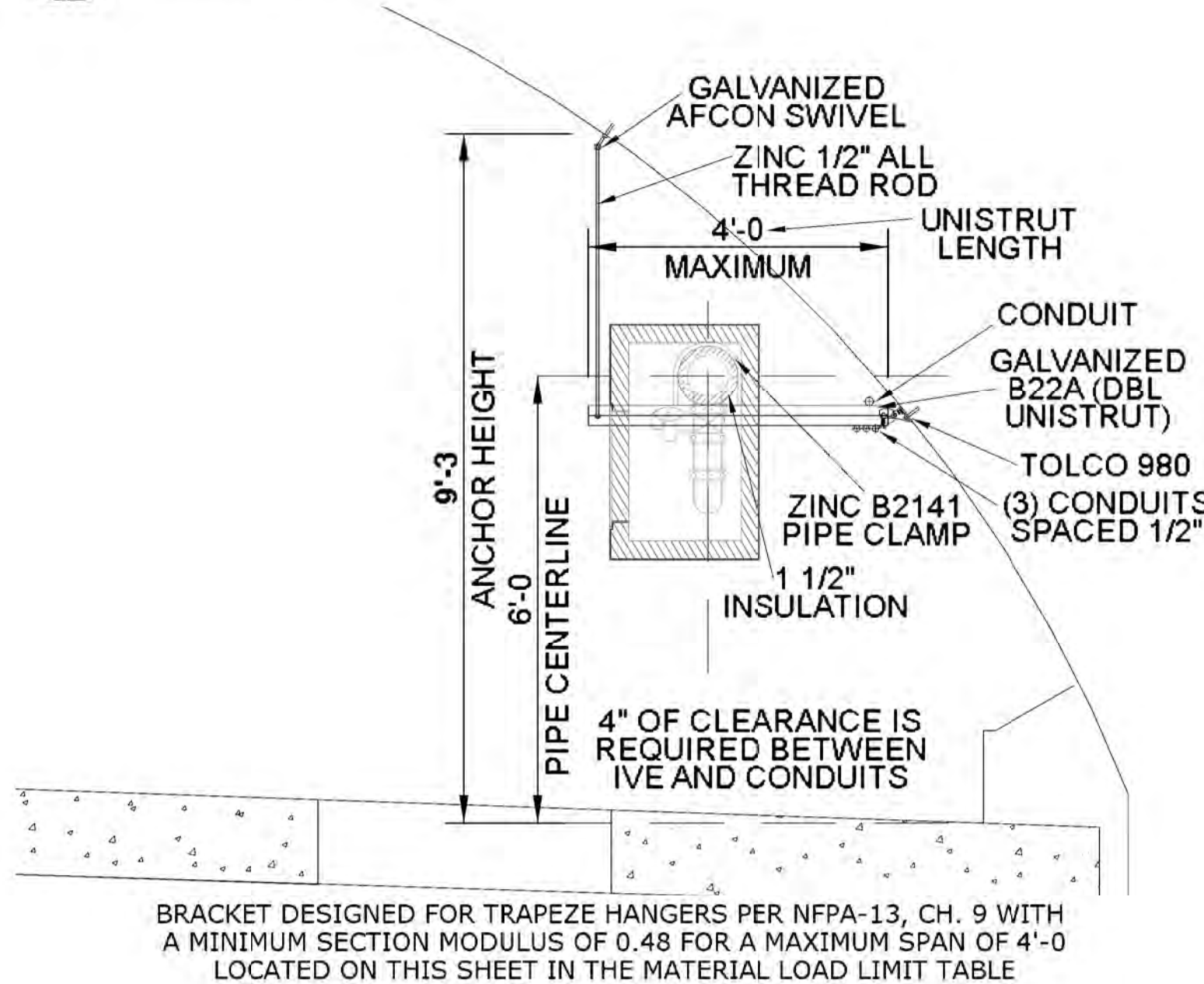
1 EISENHOWER (NORTH) TUNNEL BRACKET  
SCALE: 1/2" = 1'



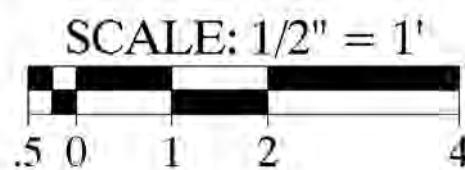
2 EISENHOWER (NORTH) TUNNEL BRACKET - WALL OBSTRUCTION  
SCALE: 1/2" = 1'



3 JOHNSON (SOUTH) TUNNEL BRACKET - OPTION 1  
SCALE: 1/2" = 1'



4 JOHNSON (SOUTH) TUNNEL BRACKET - OPTION 2  
SCALE: 1/2" = 1'



PRODUCT	MAXIMUM LOAD (cULus)	UNIT
FIG. 980	2,015	LBS

PRODUCT	FRACTURE LOAD	Fc (PSI)-CONCRETE TENSION	UNIT
1/2" KWIK BOLT TZ (3.25" EMBED)	11,240	3,500	LBS

PRODUCT	FRACTURE LOAD	Fc (PSI)-CONCRETE SHEAR	UNIT
1/2" KWIK BOLT TZ (3.25" EMBED)	7,419	7,640	LBS

PRODUCT	SHEAR MOMENT	UNIFORM LOAD				UNIT
		24"	30"	36"	42"	
B22 (SINGLE UNISTRUT)	0.5989	1,702	1,361	1,135	972	LBS
B22A (DOUBLE UNISTRUT)	1.7019	2,610	2,610	2,610	2,610	LBS

PRODUCT	COLUMN LOADING					UNIT
	24"	30"	36"	42"	48"	
B22 (SINGLE UNISTRUT)	3,993	3,802	3,589	3,360	3,118	LBS
B22A (DOUBLE UNISTRUT)	6,898	6,821	6,728	6,620	6,496	LBS

PRODUCT	RESISTANCE PULL				UNIT
	TO SLIP	OUT TENSION	SHEAR		
1/2" BOLT	-	-	18,000	14,000	LBS
1/2" N225 UNISTRUT NUT	1,500	2,000	-	-	LBS

PRODUCT	MAXIMUM PIPE SIZE	UNIT
1/2" AFCON 615 SWIVEL	8	IN

PRODUCT	MAXIMUM LOAD	UNIT
1/2" FIG. 70 ROD COUPLING	1,130	LBS

**BARNARD EJMT TEAM**

**BARNARD** **RONDELLO**

Western States Fire Protection Co.

**Sturgeon Electric**

**BCER** **Sturgeon Electric**

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM

DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

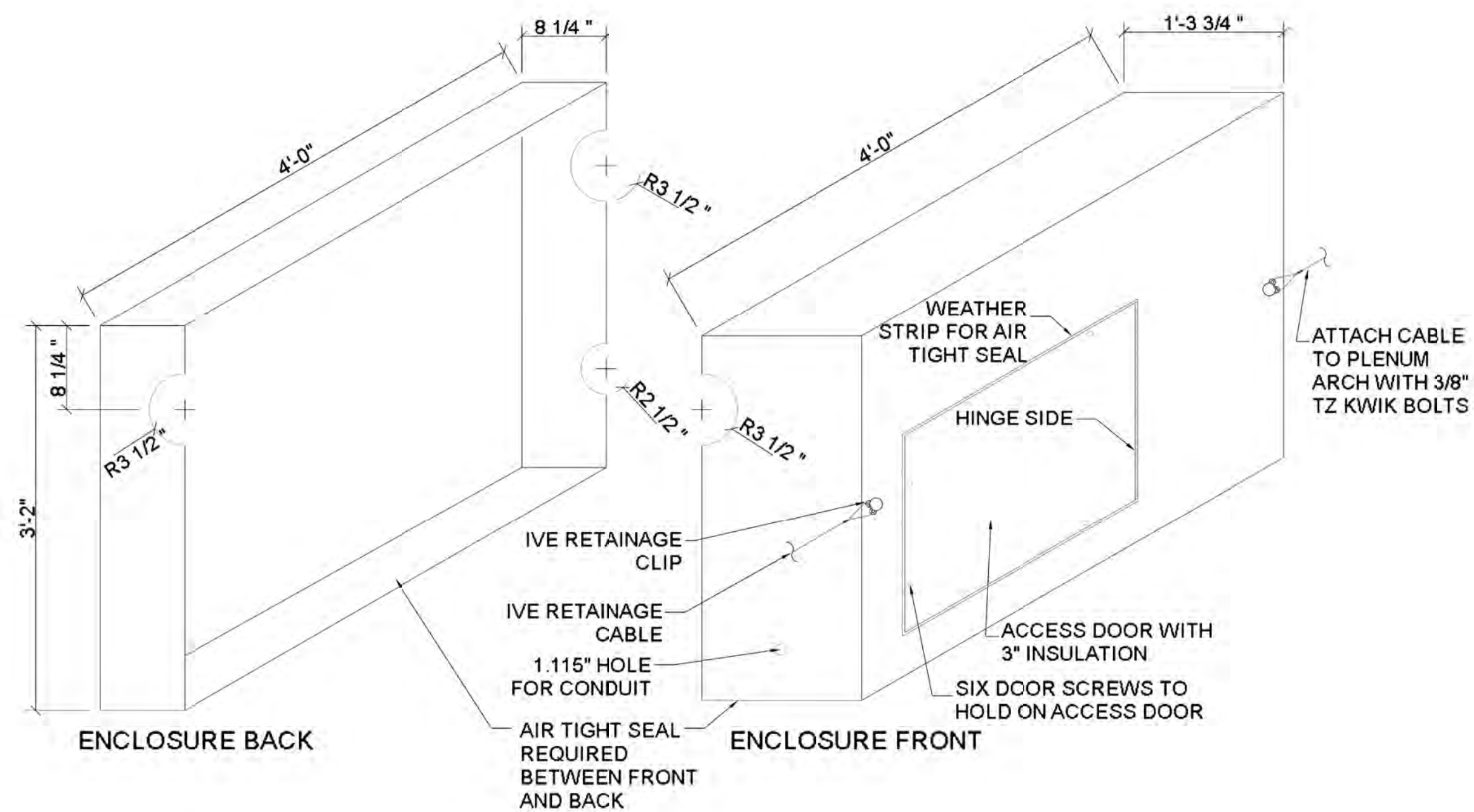
REVISIONS

Num	Description	Date

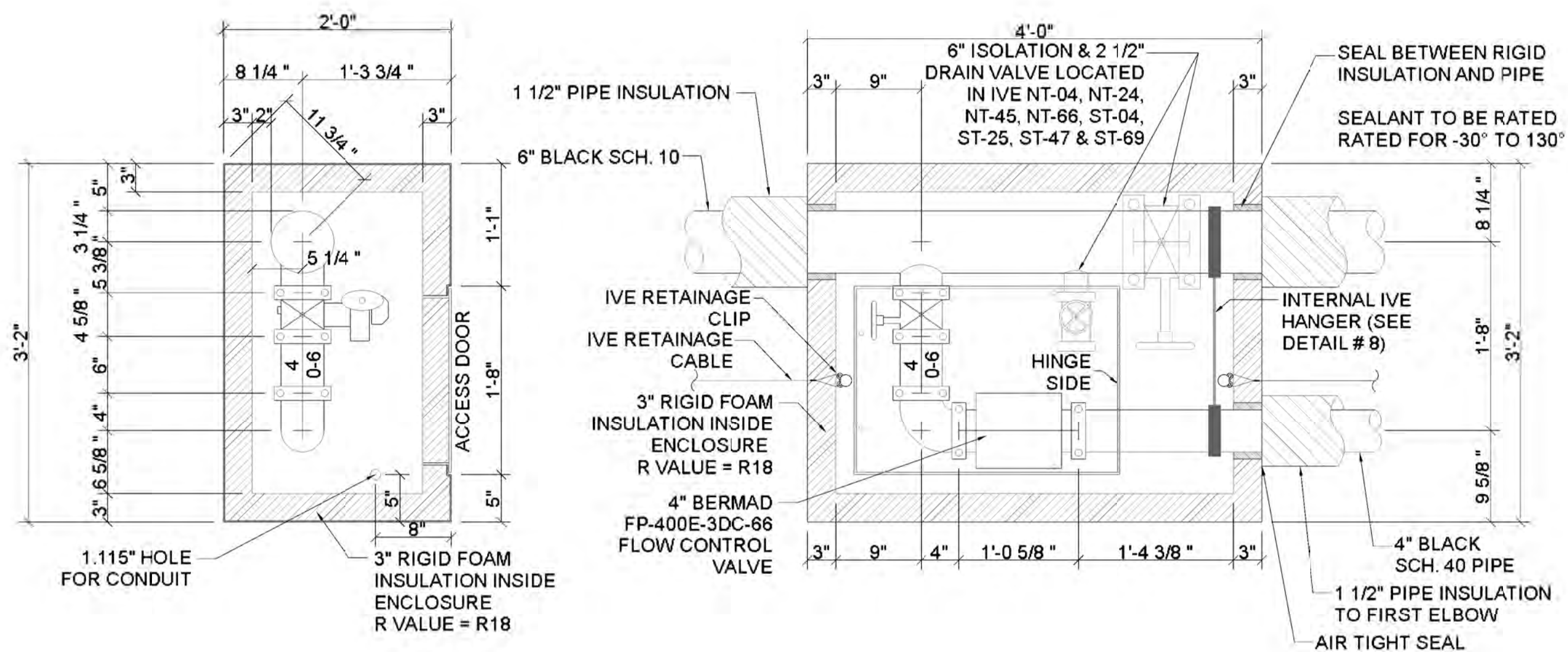
TUNNEL ARCH PLENUM BRACKET

Drawing Number **FP1.2**

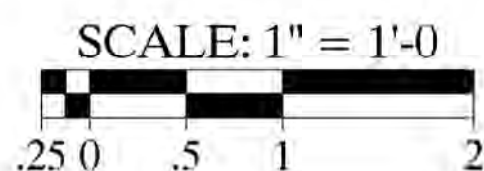
Checked by: JLH  
Drawn by: AMB



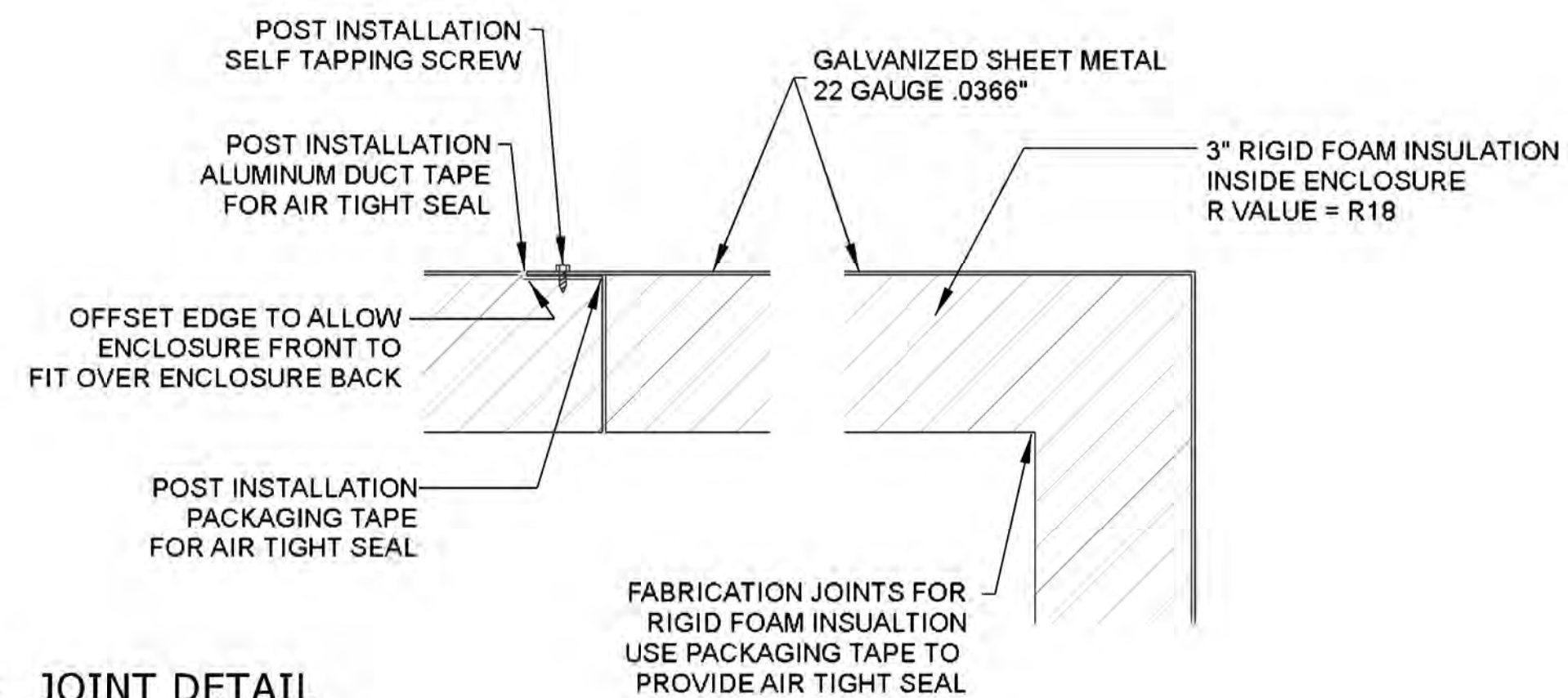
**1 ENCLOSURE ISOMETRIC**  
NOT TO SCALE



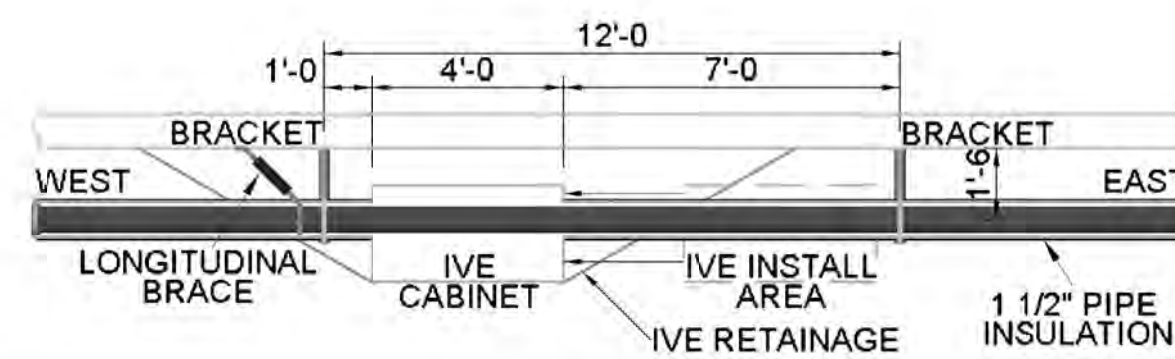
**2 ENCLOSURE FRONT AND END SECTIONS**  
SCALE: 1" = 1'-0"



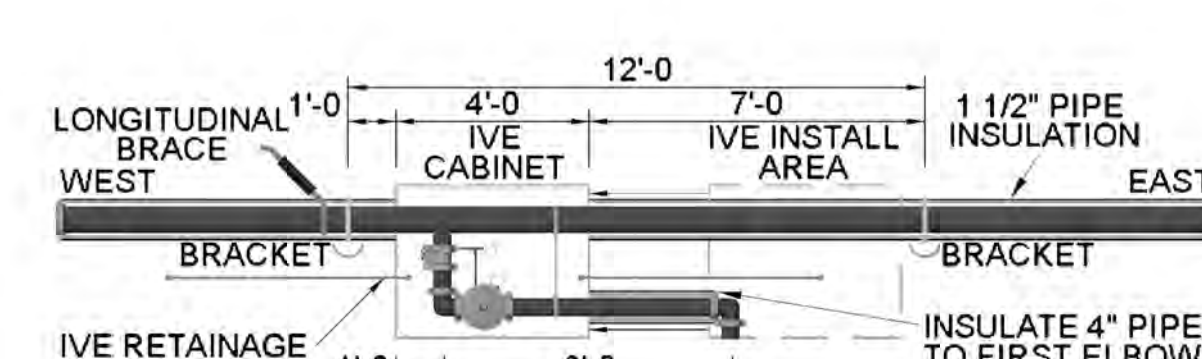
BACK CABINET FRONT CABINET



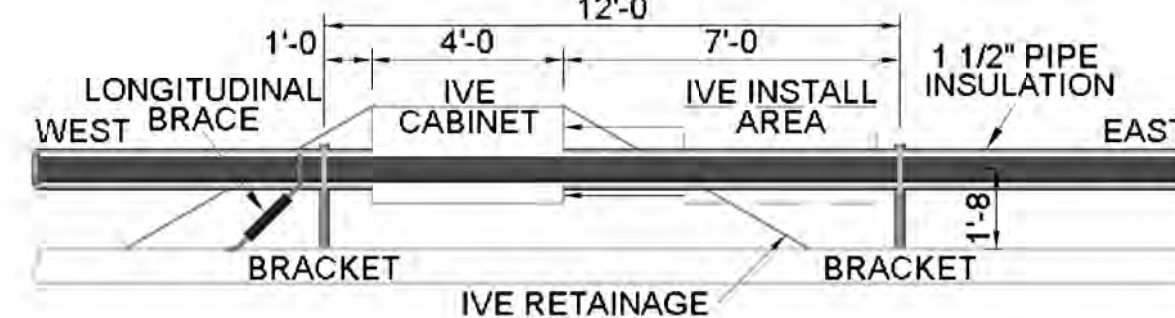
**3 JOINT DETAIL**  
NOT TO SCALE



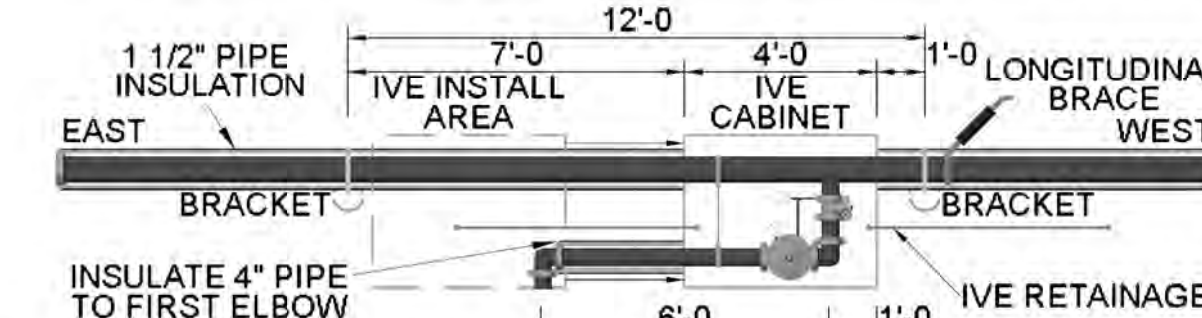
**4 EISENHOWER (NORTH) TUNNEL - PLAN VIEW**  
NOT TO SCALE



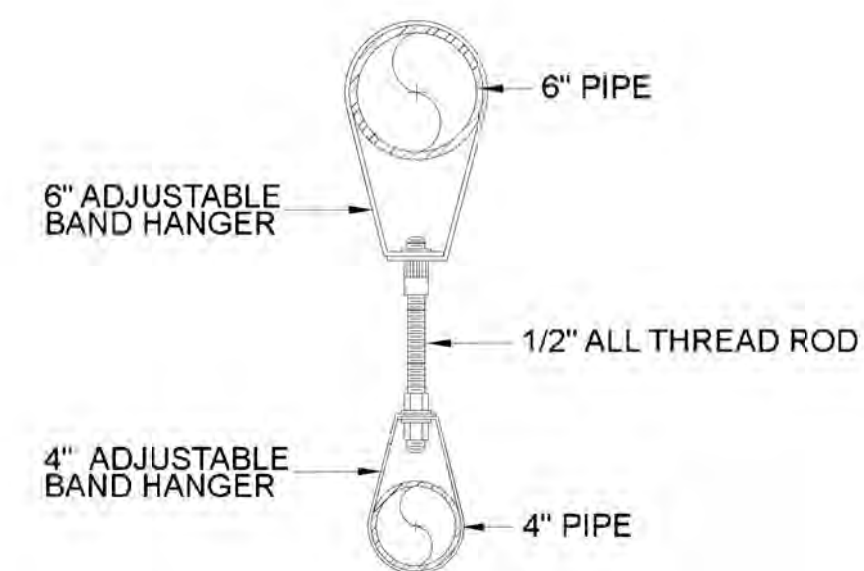
**5 EISENHOWER (NORTH) TUNNEL - FRONT VIEW**  
NOT TO SCALE



**6 JOHNSON (SOUTH) TUNNEL - PLAN VIEW**  
NOT TO SCALE



**7 JOHNSON (SOUTH) TUNNEL - FRONT VIEW**  
NOT TO SCALE



**8 INTERNAL IVE HANGER**  
NOT TO SCALE

**SITE CONDITIONS**

1. THE VALVE ENCLOSURES ARE TO BE INSTALLED IN THE SUPPLY PLENUMS.
2. TEMPERATURE RANGE FOR CABINETS LOCATION IS -30° TO 140° FAHRENHEIT.
3. WIND LOADS UP TO 137 MPH.

**GENERAL NOTE**

1. THIS DRAWING IS FOR THE EISENHOWER TUNNEL VALVE ENCLOSURES AND THE JOHNSON ENCLOSURES ARE MIRRORED.
2. ONE HUNDRED EIGHTY FOUR (184) INSULATED VALVE ENCLOSURES ARE REQUIRED WHICH INCLUDES TWO EXTRA ENCLOSURES FOR EACH TUNNEL.
3. THE 6" PIPE SUPPORTS THE VALVE ENCLOSURES AND NOT THE WALLS, FLOORS, OR CEILINGS.
4. THE SEAL BETWEEN THE FRONT AND BACK, AND AT THE DOOR MUST BE AIR TIGHT TO PREVENT HEAT LOSS. A WEATHER TIGHT GASKET SHALL BE PROVIDED. CAULKING OF GASKET IS NOT ALLOWED.
5. THE ACCESS DOOR IS MADE TO BE OPENED FOR INSPECTIONS, TESTING, AND MAINTENANCE.
6. 3" RIGID FOAM INSULATION SHALL BE PROVIDE INSIDE ENCLOSURE AND ON ACCESS DOOR WITH AN R VALUE = R18.
7. SYSTEM IDENTIFICATION NUMBERS AND LOOP ISOLATION VALVE LOCATIONS SHALL BE PROVIDED ON THE EXTERIOR FACE OF EACH INSULATED VALVE ENCLOSURE.
8. PROVIDE IVE RETAINAGE FOR PLENUM WIND LOADS.

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

**BARNARD EJMT TEAM**



Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Num	Description	Date

INSULATED VALVE ENCLOSURE  
Drawing Number  
**FP1.3**

### SEISMIC REQUIREMENTS

NFPA REQUIRES SEISMIC CALCULATIONS FOR THE WORST CASE SEISMIC LOAD. 6-IN LARGEST SPAN (WORST CASE LOAD) = 100 FT. 8-IN LARGEST SPAN = 20 FT. CALCULATIONS ARE PROVIDED FOR WORST CASE LOAD FOR 6-IN PIPE. THUS 8-IN PIPE SEISMIC BRACING SHALL FOLLOW WORST CASE LOAD SEISMIC BRACING.

SEISMIC COEFFICIENT,  $C_p = 0.35$   
(SEE SEISMIC REPORT FOR  $C_p$  VALUES)

WHERE REQUIRED:  
- SEISMIC BRACING ON ALL 6-IN SUPPLY LOOP MAINS AND 8-IN PUMP ROOM PIPING

WHERE NOT REQUIRED:  
- NO SEISMIC BRACING ON CROSS MAINS AND BRANGLINES OF DELUGE SYSTEMS

### SEISMIC CLEARANCE

PROVIDE CLEARANCE AT ALL PIPING EXTENDING THROUGH WALLS, FLOORS, FOUNDATIONS. NO CLEARANCE REQUIRED AT GYPSUM BOARD OR EQUALLY FRANGIBLE CONSTRUCTION THAT IS NOT REQUIRED TO HAVE A FIRE RESISTANCE RATING.

NOMINAL PIPE SIZE	CORE DRILL HOLE OR PIPE SLEEVE SIZE
INCH	INCH
6	10
8	14

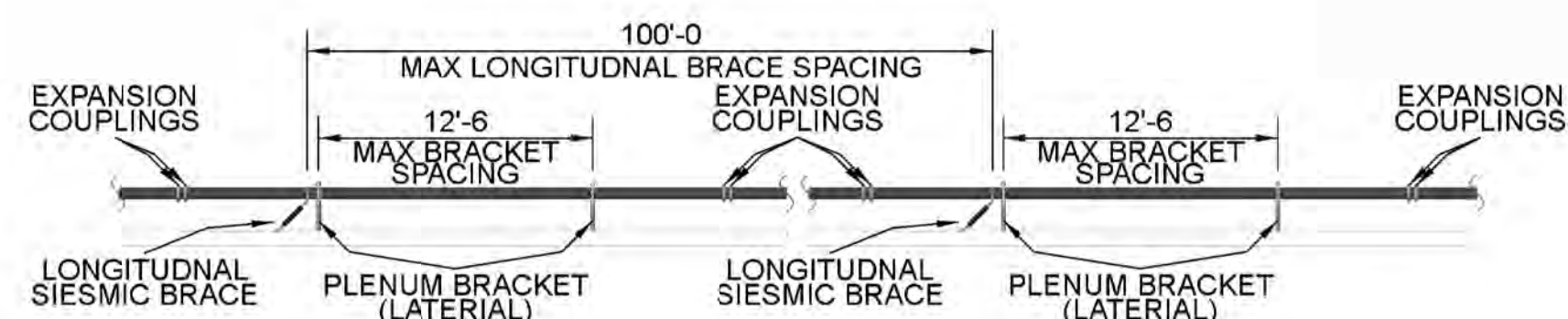
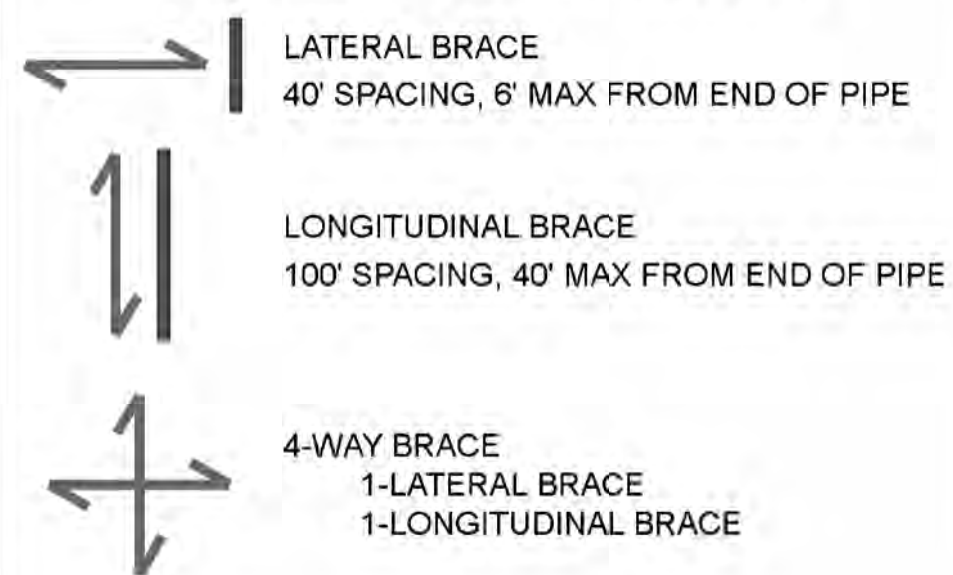
\*\*NOTE\*\*

ADDITIONAL LATERAL BRACING SHALL NOT BE REQUIRED FOR THE 6-IN SUPPLY LOOP MAIN THAT IS SUPPORTED BY A TUNNEL ARCH PLENUM BRACKET IN THE PLENUMS.

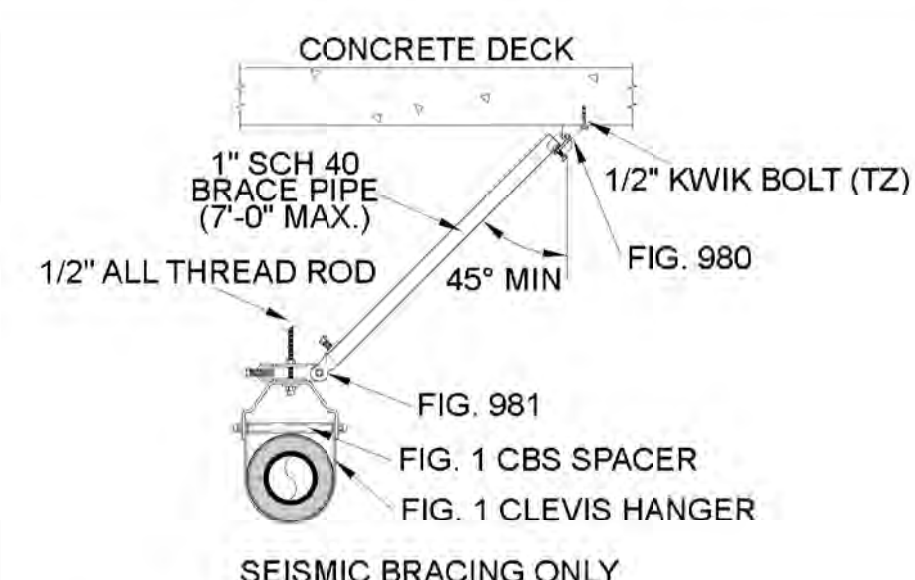
EARTHQUAKE PROTECTION NOTES:

- ALL EARTHQUAKE BRACING TO BE IN ACCORDANCE WITH NFPA-13, 2010 EDITION.
- FLEXIBLE COUPLINGS SHALL BE INSTALLED WHERE REQUIRED BY NFPA-13.
- FLEXIBLE COUPLINGS SHALL BE LOCATED IN ACCORDANCE WITH NFPA-13 AS FOLLOWS:
  - WITHIN 24-IN FROM THE TOP AND BOTTOM OF ALL RISERS.
  - WITHIN 12-IN ABOVE AND 24-IN BELOW FLOORS IN MULTISTORY BUILDINGS.
  - WITHIN 1 FT. OF ALL CONCRETE AND MASONRY WALL PENETRATIONS UNLESS CLEARANCE IS PROVIDED PER SECTION 9.3.4.
  - WITHIN 24-IN OF BUILDING EXPANSION JOINTS.
  - ABOVE AND BELOW ANY INTERMEDIATE POINTS OF SUPPORT FOR A RISER OR OTHER VERTICAL PIPE.
- CLEARANCE SHALL BE PROVIDED AROUND ALL PIPING EXTENDED THROUGH WALLS AND FLOORS PER SECTION 9.3.4 OR FLEXIBLE COUPLINGS SHALL BE PROVIDED.
- LONGITUDINAL SWAY BRACING SPACED AT A MAXIMUM OF 100 FT. SHALL BE PROVIDED FOR THE 6-IN SUPPLY MAIN.
- TOPS OF RISERS OVER 3 FT. SHALL BE SECURED AGAINST DRIFTING IN ANY DIRECTION USING A 4-WAY BRACE.
- LATERAL SWAY BRACING SPACED AT A MAXIMUM OF 40 FT. SHALL BE PROVIDED FOR THE 6-IN SUPPLY MAIN.
- LONGITUDINAL BRACING SHALL BE ATTACHED DIRECTLY TO FEED AND CROSS MAINS.
- LATERAL BRACING IN PORTALS SHALL BE ATTACHED DIRECTLY TO THE CLEVIS HANGER. LATERAL BRACING IN PLENUMS SHALL BE ATTACHED AROUND THE INSULATION.

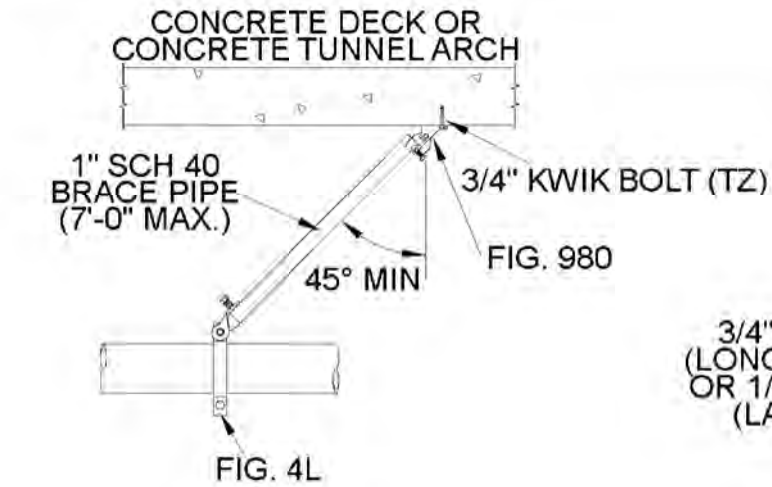
### SEISMIC BRACING LEGEND



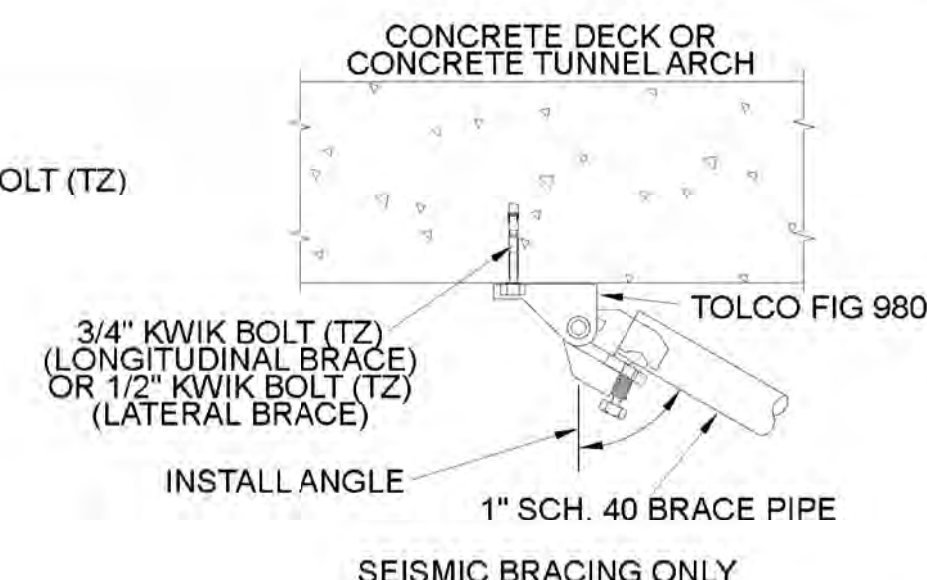
1 SEISMIC BRACING PER 100 FOOT SECTION  
NOT TO SCALE



2 LATERAL BRACE (PORTALS)  
NOT TO SCALE



3 LONGITUDINAL BRACE (PLENUMS & PORTALS)  
NOT TO SCALE



4 TOLCO FIG. 980 UNIVERSAL SWIVEL BRACE ATTACHMENT  
NOT TO SCALE

## SEISMIC CALCULATIONS

Project Address:

Eisenhower-Johnson Memorial Tunnel  
Interstate 70 at the Continental Divide  
Colorado, USA



Brace Information		Components Summary	
Maximum Spacing	40'-0"	Component Description	Adjusted Load
Maximum Brace Length	7'-0"	Tolco Fig. 1 Clevis Hanger With Fig. 1 CBS Swivel	1940 lbs / 1.414 = 1371 lbs.
Bracing Material	1" sch. 40 pipe	Tolco Fig. 980 Universal Swivel	2015 lbs / 1.141 = 1425 lbs.
Angle From Vertical	45 deg Minimum	Tolco Fig. 981 Universal Swivel	2015 lbs / 1.141 = 1425 lbs.
Least Rad. of Gyration	0.421"	*Adjusted load based on NPFA 13 Table 9.3.5.10.3 ** Calculation Based on CONCENTRIC Loading	
L/R Value	200	Assembly Detail	
Max Horizontal Load	1310 lbs.	Orientation of Brace Lateral	
Force Factor ( $C_p$ )	0.5	Fastener Information	
Fastener Information		Fastener Orientation NFPA Type E	
Type	Concrete Wedge Anchor (4000 psi Cracked Concrete)	Type	Concrete Wedge Anchor (4000 psi Cracked Concrete)
Diameter	1/2"	Diameter	3/4"
Length	3-1/4 in. Minimum	Length	4-3/4 in. Minimum
Maximum Load	797 lbs.	Maximum Load	1498 lbs.
Braced Pipe: 6" Sch. 10 Pipe		Load Information	
Size and Type of Pipe	Total Length	Size and Type of Pipe	Total Calculated Load
6" Sch. 10 Steel Pipe	40'-0"	6" Sch. 10 Steel Pipe	460.60
Percentage added for Fittings and Sprinkler Components		15%	
Total Adjusted Load of All pipe within Zone of Influence		529.70 lbs.	

## SEISMIC CALCULATIONS

Project Address:

Eisenhower-Johnson Memorial Tunnel  
Interstate 70 at the Continental Divide  
Colorado, USA



Brace Information		Components Summary	
Maximum Spacing	100'-0"	Component Description	Adjusted Load
Maximum Brace Length	7'-0"	Tolco Fig. 4L Pipe Clamp	2015 lbs / 1.414 = 1425 lbs.
Bracing Material	1" sch. 40 pipe	Tolco Fig. 980 Universal Swivel	2015 lbs / 1.414 = 1425 lbs.
Angle From Vertical	45 deg Minimum	*Adjusted load based on NPFA 13 Table 9.3.5.10.3 ** Calculation Based on CONCENTRIC Loading	
Least Rad. of Gyration	0.421"	Assembly Detail	
L/R Value	200	Orientation of Brace Longitudinal	
Max Horizontal Load	1310 lbs.	Fastener Information	
Force Factor ( $C_p$ )	0.5	Fastener Orientation NFPA Type B	
Type	Concrete Wedge Anchor (4000 psi Cracked Concrete)	Type	Concrete Wedge Anchor (4000 psi Cracked Concrete)
Diameter	3/4"	Diameter	3/4"
Length	4-3/4 in. Minimum	Length	4-3/4 in. Minimum
Maximum Load	1498 lbs.	Maximum Load	1498 lbs.
Braced Pipe: 6" Sch. 10 Pipe		Load Information	
Size and Type of Pipe	Total Length	Size and Type of Pipe	Total Calculated Load
6" Sch. 10 Steel Pipe	100'-0"	6" Sch. 10 Steel Pipe	1151.50
Percentage added for Fittings and Sprinkler Components		15%	
Total Adjusted Load of All pipe within Zone of Influence		1324.50 lbs.	

**BARNARD EJMT TEAM**

**BCER**  
mechanical engineering

**BARNARD**

**WESTERN STATES FIRE PROTECTION CO.**  
A fire brand life safety  
CONSULTING ENGINEERS  
Western States Fire Protection Co.  
RONDINELLI  
Western States Fire Protection Co.  
RONDINELLI  
Western States Fire Protection Co.  
RONDINELLI  
Western States Fire Protection Co.

**Sturgeon ELECTRIC**

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Num	Description	Date

SEISMIC BRACING

Drawing Number  
**FP1.4**

DRAWN BY: AMB  
CHECKED BY: JLH

THE 6-IN MAIN SUPPLY LOOP IS TO BE INSTALLED IN THE SUPPLY AIR PLENUMS LOCATED ABOVE THE ROADWAY TUNNELS AND ON THE FAN DECK IN EACH EAST AND WEST PORTAL. EACH TUNNEL AND ITS RESPECTIVE AIR PLENUMS CURVE NORTH AND SOUTH THROUGH THE MOUNTAIN AND CHANGE IN ELEVATION, INCREASING FROM EAST TO WEST. THE CURVATURE OF THE TUNNELS OCCURS SLIGHTLY OVER A LARGE DISTANCE MAKING THE INSTALLATION OF FITTINGS AND SWING JOINTS UNNECESSARY. THE DEFLECTION IS VERY MINIMAL BUT MUST BE ADDRESSED.

IN ADDITION THE AIR PLENUMS ARE SUBJECT TO FREEZING TEMPERATURES IN THE WINTER MONTHS. TO PREVENT THE WATER IN THE PIPE FROM FREEZING, HOT WATER STARTING AT 100°F WITH A MAXIMUM DESIGN BOILER TEMPERATURE OF 130°F, WILL BE CIRCULATED THROUGH THE 6-IN MAIN SUPPLY LOOP. MAIN PIPING WILL BE INSTALLED WHEN TEMPERATURES HAVE THE POTENTIAL TO BE -30°F. THE WORST CASE TEMPERATURE CHANGE WAS CALCULATED TO BE FROM -30 TO 130°F. DUE TO DRASTIC CHANGES IN TEMPERATURE, THE 6-IN PIPE WILL EXPAND AND CONTRACT. WHEN THE PIPE IS TO BE INSTALLED DURING THE COLD WEATHER SEASONS OR WHEN COLD WATER FROM THE STORAGE TANK IS INTRODUCED INTO THE PIPE DURING A FIRE OR TESTING SITUATION, THE STEEL PIPE WILL SHRINK. WHEN THE HOT WATER IS CIRCULATED THROUGH THE PIPE, THE STEEL PIPE WILL EXPAND. THE EXPANSION FROM THE CHANGE IN TEMPERATURE WILL CAUSE A PARALLEL DEFLECTION THAT MUST BE ADDRESSED.

TO ACCOMMODATE CHANGES IN THE PIPE LENGTH AND DIRECTION, EXPANSION AND DEFLECTION WILL BE ADDRESSED CONTINUALLY FOR EVERY STICK OF PIPE ALONG THE ENTIRE LENGTH OF THE TUNNEL BY USING VICTAULIC STYLE 75 FLEXIBLE COUPLINGS AND VICTAULIC STYLE 155 EXPANSION JOINT 6-IN NIPPLES. THROUGH PRODUCT DATA AND EXPANSION & DEFLECTION CALCULATIONS FOR A 25'-0 SECTION OF PIPE, A SOLUTION WAS DETERMINED TO PROVIDE EXPANSION JOINTS TO ACCOMMODATE THE EXPANSION AND DEFLECTION WITHIN EACH 25'-0 OF PIPE.

EXPANSION JOINTS SHALL BE INSTALLED AT EACH END OF PIPE APPROXIMATELY EVERY 25'-0. AN EXPANSION JOINT WILL CONSIST OF (2) STYLE 75 COUPLINGS WITH (1) STYLE 155 6-IN SCHEDULE 40 NIPPLE, 4 INCHES IN LENGTH BETWEEN THE COUPLINGS. EACH EXPANSION JOINT WILL BE INSTALLED IN COLD WEATHER CONDITIONS THUS EACH COUPLING SHALL BE INSTALLED TO SEPARATE THE TWO ENDS OF THE PIPE TO ALLOW FOR MAXIMUM POSSIBLE SEPARATION. WHEN THE PIPE EXPANDS DUE TO HOT WATER, THERE WILL BE ZERO DEFLECTION BETWEEN EACH PIECE OF PIPE. PER 25'-0, THE EXPANSION JOINT WILL PROVIDE 0.346-IN WHICH EXCEEDS THE REQUIRED THERMAL EXPANSION LENGTH OF 0.3216-IN.

WHEN ANGULAR DEFLECTION IS REQUIRED, AN ADDITIONAL COUPLING AND NIPPLE SHALL BE ADDED TO ACCOMMODATE THE ANGULAR DEFLECTION BETWEEN THE COUPLINGS THAT ARE PROVIDED FOR THE EXPANSION JOINT. THIS COUPLING WILL NOT BE ABLE TO DEFLECT IN THE PARALLEL DIRECTION AND WILL NOT BE USED AS AN EXPANSION COUPLING. MAXIMUM ALLOWABLE DEFLECTION AND EXPANSION OF EACH COUPLING CAN BE FOUND ON THIS SHEET.

IN ADDITION, TWO BRACKETS SHALL BE PROVIDED FOR EACH 25 FT. LENGTH OF PIPE. BOTH BRACKETS SHALL BE BRACED TO ALLOW MINIMAL DEFLECTION BETWEEN EACH 25 FT. STICK OF PIPE. A LONGITUDINAL BRACE SHALL BE INSTALLED EVERY 100 FT. WITH THE BRACED SUPPORT CLOSEST TO THE INSULATED VALVE ENCLOSURE TO LIMIT MOVEMENT AT THE DELUGE VALVE ASSEMBLIES AND TO PROVIDE THE REQUIRED SEISMIC BRACING. SEISMIC INFORMATION CAN BE FOUND ON DRAWING FP1.4.

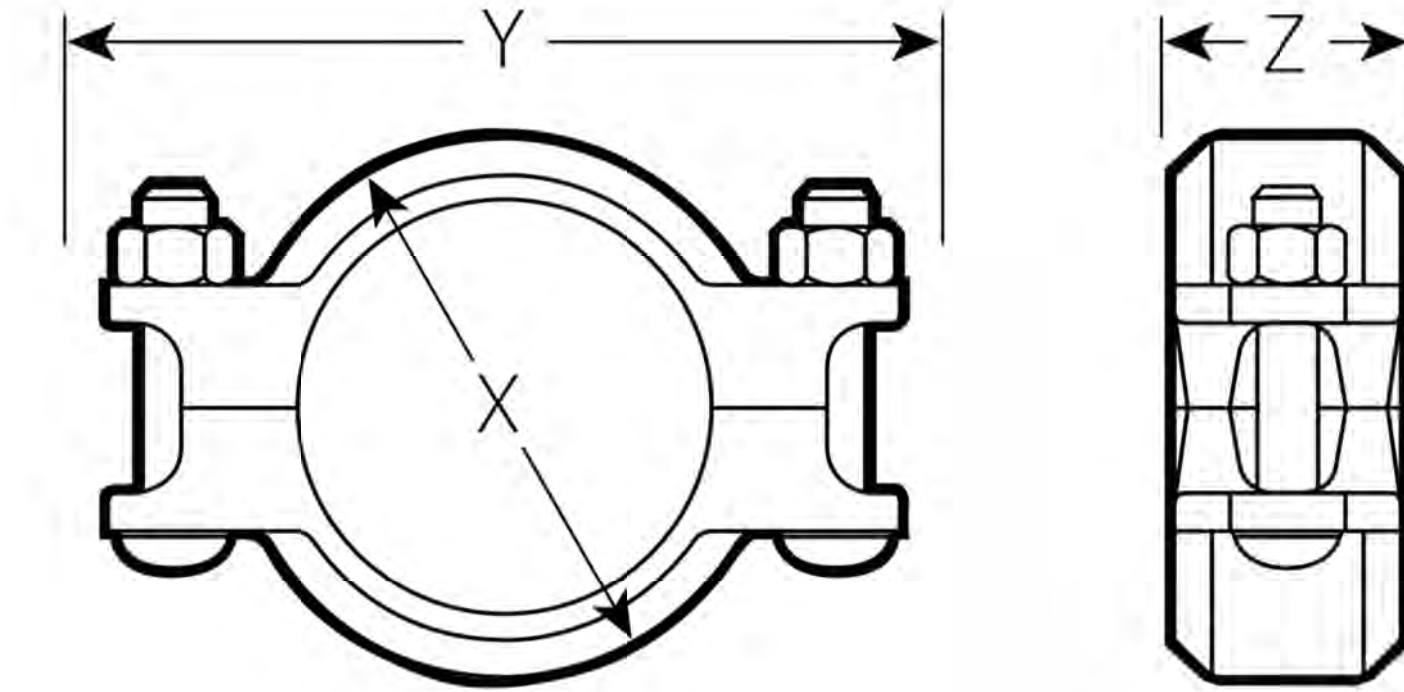
### VICTAULIC STYLE 75 COUPLING (DATA SHEET 6.05)

NOMINAL SIZE (INCHES)	ACTUAL OUTSIDE DIAMETER (INCHES)	MAX. WORK PRESSURE (PSI) *	MAX. END LOAD (LBS.) *	ALLOWED END SEP. (INCHES) †	DEFLECTION †		BOLT/NUT NO. - SIZE (INCHES) @	DIMENSIONS			APPROX. WEIGHT (KG)
					PER COUPLING (DEG.)	PIPE (IN./FT.)		X (INCHES)	Y (INCHES)	Z (INCHES)	
6	6.625	450	15,525	0 - 0.13	1' - 5'	0.23	2 - 5/8 X 3 1/4	8.00	11.07	2.13	7.0

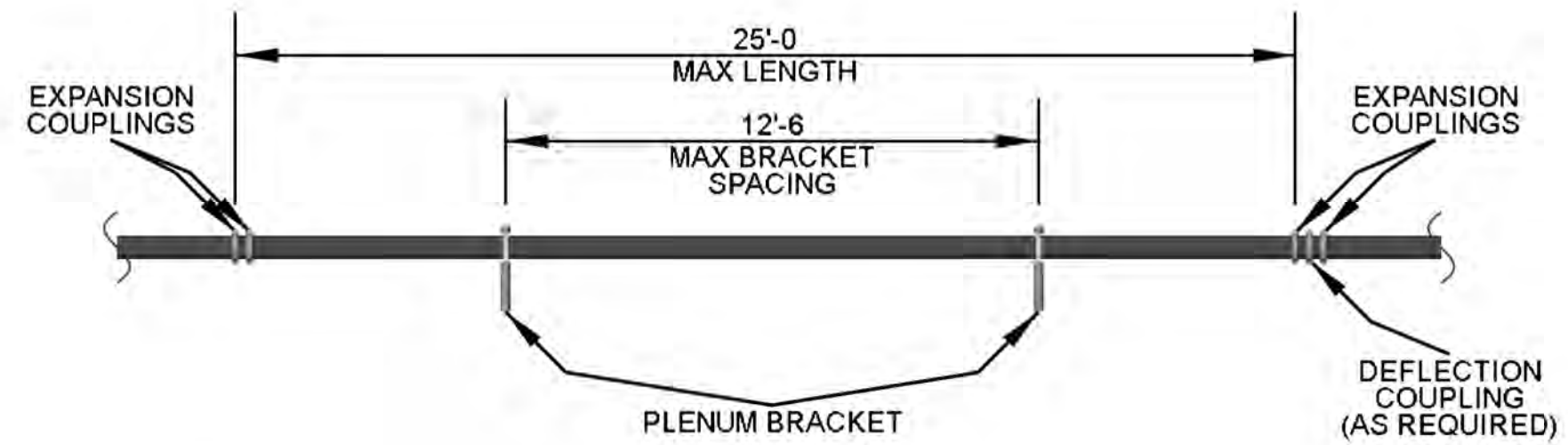
\* WORKING PRESSURE AND END LOAD ARE TOTAL, FROM ALL INTERNAL AND EXTERNAL LOADS, BASED ON STANDARD WEIGHT (ANSI) STEEL PIPE, STANDARD ROLL OR CUT GROOVED IN ACCORDANCE WITH VICTAULIC SPECIFICATIONS.

† ALLOWABLE PIPE END SEPARATION AND DEFLECTION FIGURES SHOW THE MAXIMUM NOMINAL RANGE OF MOVEMENT AVAILABLE AT EACH JOINT FOR STANDARD ROLL GROOVED PIPE. FIGURES FOR STANDARD CUT GROOVED PIPE MAY BE DOUBLED. THESE FIGURES ARE MAXIMUMS; FOR DESIGN AND INSTALLATION PURPOSES THESE FIGURES SHOULD BE REDUCED BY: 25% FOR 4" AND LARGER.

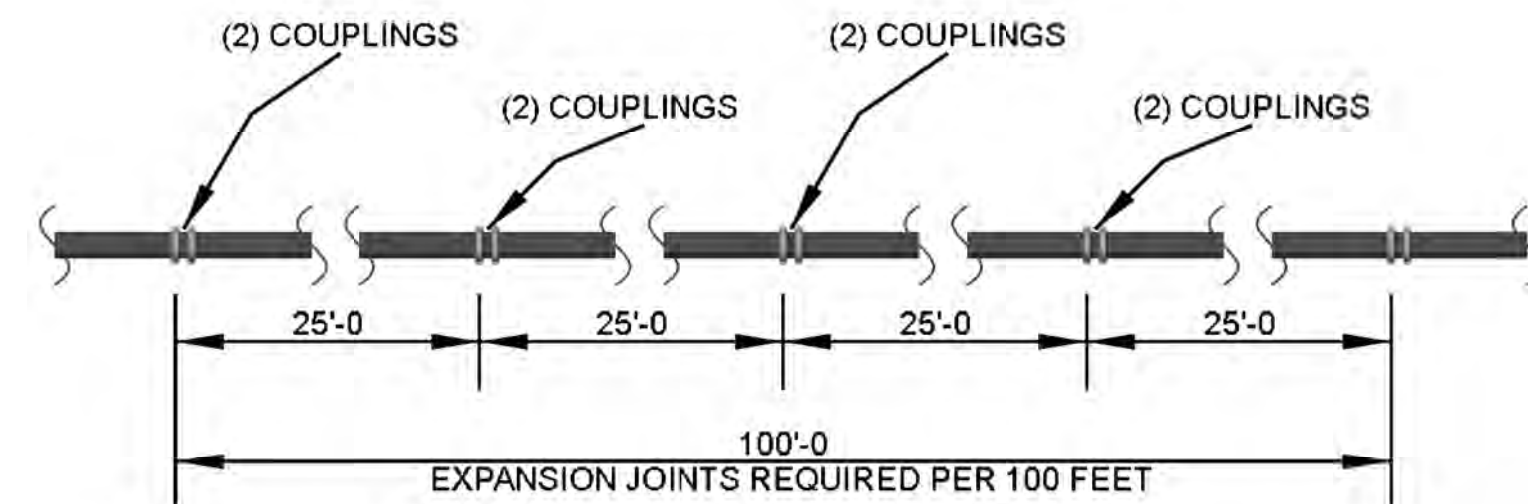
@ NUMBER OF BOLTS REQUIRED EQUALS NUMBER OF HOUSING SEGMENTS.



2 VICTAULIC STYLE 75 DIMENSIONS NOT TO SCALE



3 BRACING PER 25 FOOT SECTION NOT TO SCALE



4 EXPANSION JOINTS PER 100 FOOT SECTION NOT TO SCALE

### JOINT END SEPARATION / LONGITUDINAL EXPANSION

EXPANSION JOINT (GROOVE + GROOVE)	# OF COUPLINGS	ALLOWED DEFLECT. PER CPLG. (INCHES)	25.0% SAFETY FACTOR (INCHES)
ROLL GROOVE EXPANSION JOINT (ROLL + ROLL)	1	0.13*	0.0975
CUT GROOVE EXPANSION JOINT (CUT + CUT)	1	0.26	0.195
ROLL GROOVE TO CUT GROOVE EXPANSION JOINT (ROLL + CUT)	1	0.065 + 0.13	0.146
VICTAULIC STYLE 155 EXPANSION JOINT 6" CUT GROOVE SCH. 40 NIPPLE (ROLL + CUT + ROLL)	2	0.461	0.346

\* INFORMATION PROVIDED FROM VICTAULIC STYLE 75 (DATA SHEET 6.05)  
- COMBINATIONS OF EACH JOINT CAN BE USED TO OBTAIN THE REQUIRED EXPANSION

### JOINT END ANGULAR DEFLECTION (LATERAL DIRECTION CHANGE)

DEFLECTION JOINT (GROOVE + GROOVE)	ALLOWED DEFLECT. PER CPLG. (DEG)	25.0% SAFETY FACTOR (DEG)	ALLOWED CPLGS. PER 100FT. (QTY.)	ALLOWED DEFLECT. PER 100FT. (DEG)	ALLOWED DEFLECT. PER CPLG. (IN/FT)	25.0% SAFETY FACTOR (INCHES)	ALLOWED DEFLECT. PER 25FT (INCHES)	ALLOWED DEFLECT. PER 100FT (INCHES)
ROLL GROOVE DEFLECTION JOINT (ROLL + ROLL)	1' - 5'*	0° - 48.75'	4	3' - 15'	0.23*	0.173	4.313	17.25
CUT GROOVE DEFLECTION JOINT (CUT + CUT)	2' - 10'	1' - 37.5'	4	6' - 30'	0.46	0.345	8.625	34.50
ROLL GROOVE TO CUT GROOVE DEFLECTION JOINT (ROLL + CUT)	0' - 32.5' + 1' - 5'	1' - 13.13'	4	4' - 52'	0.115 + 0.230	0.259	6.469	25.875

\* INFORMATION PROVIDED FROM VICTAULIC STYLE 75 (DATA SHEET 6.05)  
- COMBINATIONS OF EACH JOINT CAN BE USED TO OBTAIN THE REQUIRED DEFLECTION

UN-EXPANDED PIPE (2) COUPLINGS AT MAX PARALLEL DEFLECTION  
EXPANDED PIPE (2) COUPLINGS AT ZERO PARALLEL DEFLECTION



(2) COUPLINGS AT MAX PARALLEL DEFLECTION (2) COUPLINGS AT ZERO PARALLEL DEFLECTION



(1) COUPLINGS AT MAX ANGULAR DEFLECTION (1) COUPLINGS AT MAX ANGULAR DEFLECTION

- INSTALLED AT MAX DEFLECTION DURING COLD TEMPERATURES  
- INTRODUCTION OF HOT WATER INTO COLD PIPES  
- INTRODUCTION OF COLD WATER INTO HOT PIPE

1 JOINT END SEPARATION AND DEFLECTION NOT TO SCALE

### THERMAL EXPANSION OF STEEL PIPE

$$dl = Lo \alpha (t1 - to)$$

Lo = INITIAL LENGTH (inches)  
Lo = 300 inches (PER 25 ft)

α = LINEAR EXPANSION COEFFICIENT (in/in°F)  
αSteel = 0.000067 (in/in°F)

to = INITIAL TEMPERATURE (°F)  
to = -30.00 °F

t1 = FINAL TEMPERATURE (°F)  
t1 = 130.00 °F

dl = CHANGE IN LENGTH (inches)  
dl = 0.3216 inches

**BARNARD EJMT TEAM**

**BARNARD**

**BCER**  
THE ENGINEERING

**Sturgeon ELECTRIC**

**RONDINELLI**  
A Fire Suppression Life Safety

**Western States Fire Protection Co.**

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

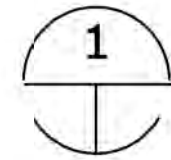
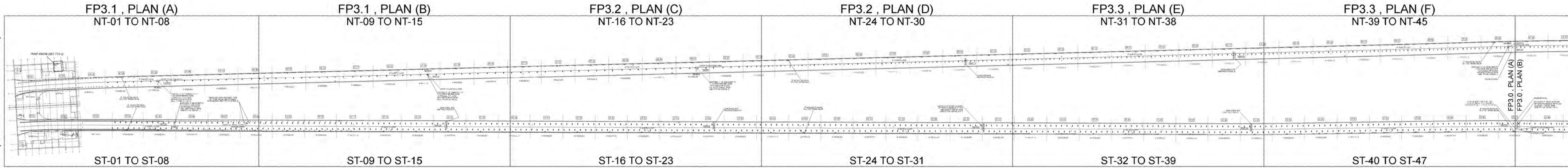
Num	Revisions	Date

PIPE EXPANSION AND DEFLECTION

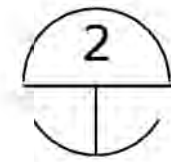
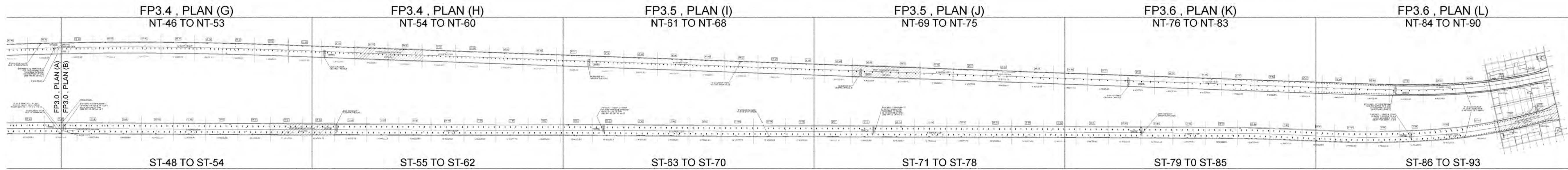
Drawing Number

**FP2.0**

WEST PORTAL BUILDING  
(SEE FP4.0 & FP4.1)



**1** PLAN (A) - DELUGE SYSTEMS , NT-01 TO NT-45 , ST-01 TO ST-47  
NOT TO SCALE



**2** PLAN (B) - DELUGE SYSTEMS , NT-46 TO NT-90 , ST-48 TO ST-93  
NOT TO SCALE

EAST PORTAL BUILDING  
(SEE FP6.0 & FP6.1)

LEGEND - SHEETS FP-3.0 TO FP-3.6

LINE TYPE	
	25'-0" SYSTEM LENGTH
	SYSTEM BOUNDARY LINES
	MOST DEMANDING SYSTEMS
	MATCHLINES

VALVE COUNTS	
	IVE CABINET: QTY. 180
	DELUGE VALVE: QTY. 183
	ISOLATION / DRAIN VALVE: QTY. 10

ABBREVIATION LIST	
NT-##	= NORTH TUNNEL - ID NUMBER
ST-##	= SOUTH TUNNEL - ID NUMBER
NVMS#	= NORTH VARIABLE MESSAGE SIGN ID NUMBER
SVMS#	= SOUTH VARIABLE MESSAGE SIGN ID NUMBER

EISENHOWER/JOHNSON

MEMORIAL TUNNEL

FIXED FIRE SUPPRESSION SYSTEM

DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

Num	Description	Date

DELUGE SYSTEM LOCATION KEY

Drawing Number  
**FP3.0**

**BARNARD EJMT TEAM**

**BARNARD**

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Engineering

**Sturgeon**  
ELECTRIC

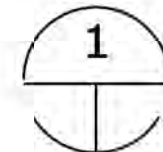
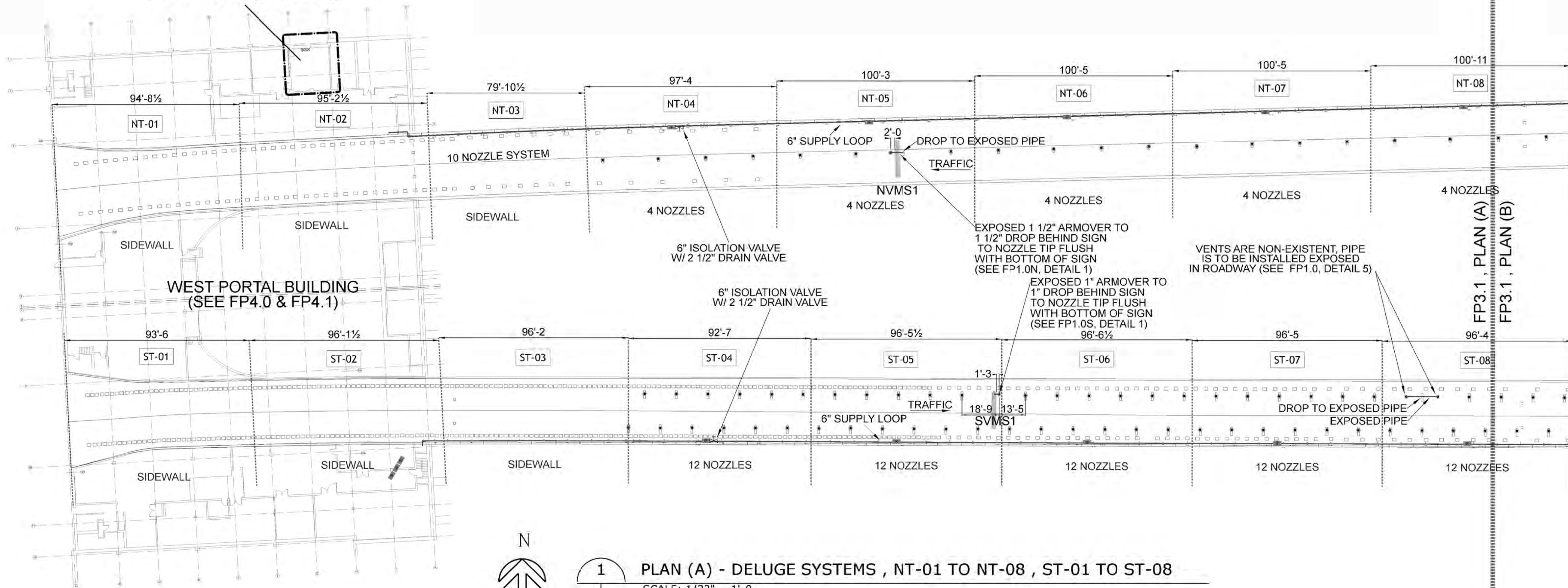
**SG**  
SPECIALTY GROUP

Western States  
Fire Protection Co.

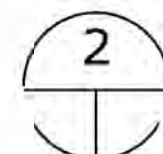
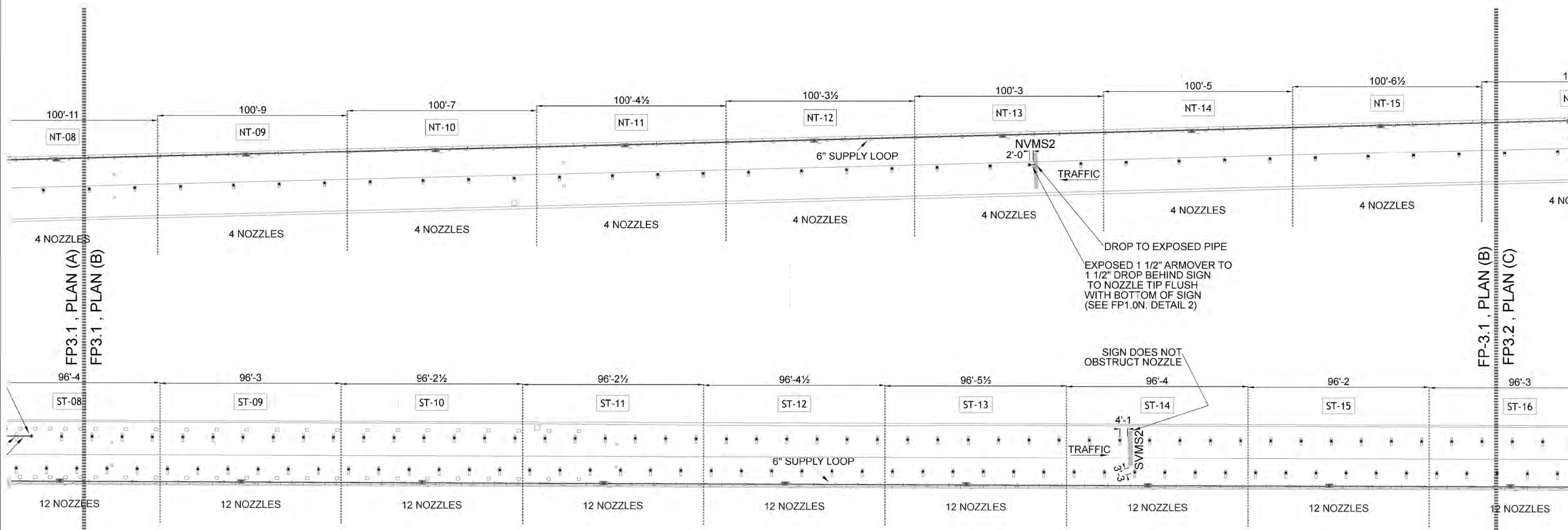
**RONDINELLI**  
A fire brand life safety  
CONSULTING  
ENGINEERS



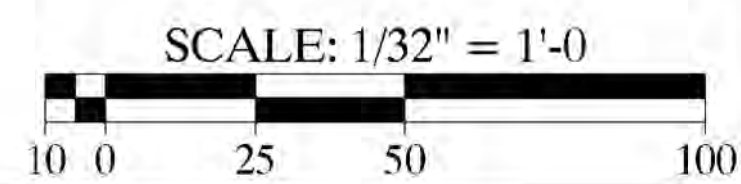
PUMP ROOM (SEE FP5.0)



PLAN (A) - DELUGE SYSTEMS , NT-01 TO NT-08 , ST-01 TO ST-08  
SCALE: 1/32" = 1'-0"



PLAN (B) - DELUGE SYSTEMS , NT-09 TO NT-15 , ST-09 TO ST-15  
SCALE: 1/32" = 1'-0"



EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Num	Description	Date

DELUGE SYSTEM LOCATION  
WEST, NT-01 TO NT-15  
WEST, ST-01 TO ST-15

Drawing Number

FP3.1

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### Deluge System Testing

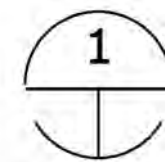
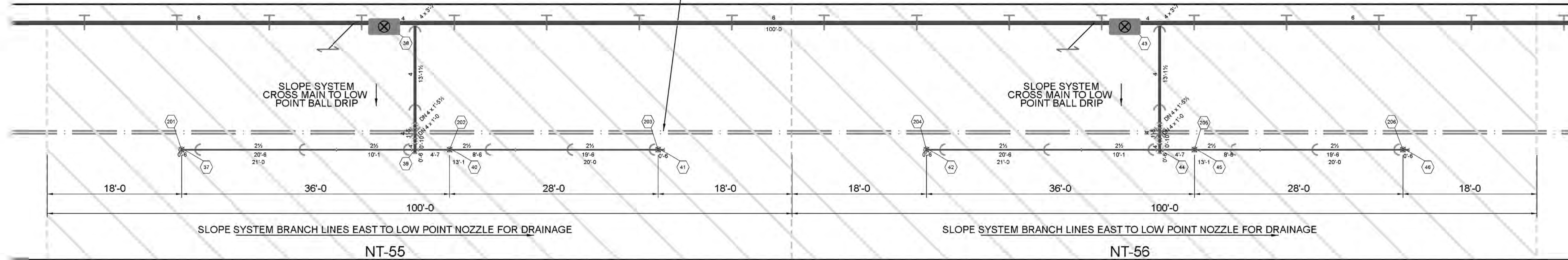
North Tunnel Test Date: 11/15/2015

Zone	Required Outlet (Factory Set) Pressure (psi)	Flow Control Valve Inlet Static (psi)	Flow Control Valve Inlet Residual (psi)	Flow Control Valve Outlet Residual (psi)	Fire Pump Supply Residual (psi)	Fire Pump Outlet Residual (psi)	Interpolated Flow from Fire Pump (gpm)	Flow Meter Reading (gpm)	Time for Flow Control Valve to Shut (sec)	Nozzle Spray Pattern	Notes:
NT-03	84	60	175	74	59	182.5	759	-	3 to 4	OK	Portal System - 10 Nozzle
NT-09	66	157	175	62	59	184	671	-	3 to 4	OK	4 Nozzle
NT-21	66	170	170	65	59	185	607	-	3 to 4	OK	4 Nozzle
NT-31	79	170	175	75	59	185	607	-	3 to 4	OK	3 Nozzle
NT-40	79	175	180	70	59	184	671	-	3 to 4	OK	3 Nozzle
NT-46	79	185	175	70	59	184	671	-	3 to 4	OK	3 Nozzle
NT-54	79	190	185	70	59	184	671	675	3 to 4	OK	3 Nozzle
NT-72	66	200	190	61	59	184	671	715	3 to 4	OK	4 Nozzle
NT-74	66	210	195	58	59	184	671	675	3 to 4	OK	4 Nozzle - ICE FALL AREA
NT-84	66	215	205	54	59	184	671	-	3 to 4	OK	4 Nozzle

Hydraulic Information	
Remote Area NORTH - 3 NOZZLES	
OCCUPANCY CLASSIFICATION	NORTH TUNNEL
DENSITY	0.16gpm/ft <sup>2</sup> for 6865.00ft <sup>2</sup> (Actual 6866.67ft <sup>2</sup> )
TOTAL HEADS FLOWING	6
K-FACTOR	30.4
TOTAL WATER REQUIRED	1218.1
TOTAL PRESSURE REQUIRED	146.1
BASE of RISER (gpm)	1218.1
BASE of RISER (psi)	146.1
SAFETY MARGIN (psi)	+19.3 (11.7%)

FACTORY SET  
EISENHOWER 3 NOZZLE  
FLOW CONTROL VALVE  
SYSTEM DEMAND  
75.2 PSI @ 609 GPM  
75.2X1.05 = 78.96 PSI  
SET AT 79 PSI

BETE NOZZLE TF72FC  
150 DEGREE SPRAY BRASS  
34" X 36" = 1224 SF  
1224 X 0.16 DENSITY = 196 GPM  
P = 41.6 PSI  
K = 30.4  
Q = 196 GPM



1 NT-55 & NT-56 - EISENHOWER (NORTH) TUNNEL - 3 NOZZLE SYSTEM

SCALE: 1/8" = 1'-0"

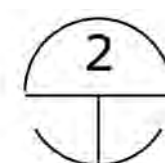
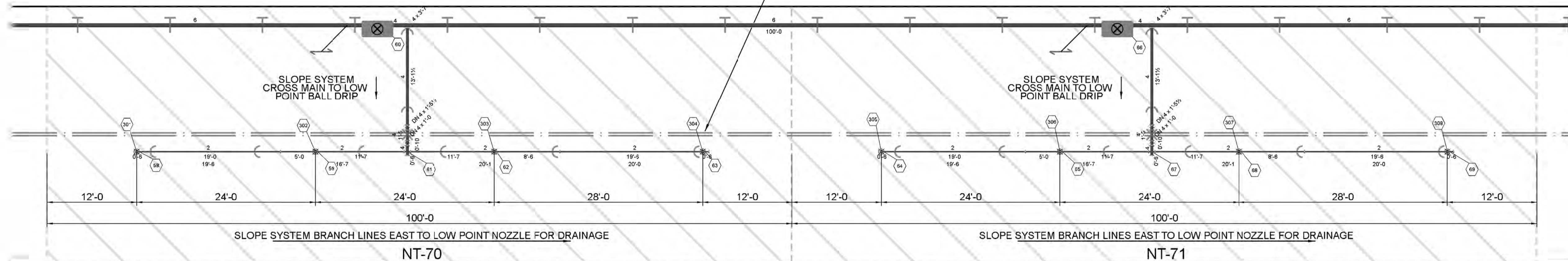
Hydraulic Information	
Remote Area NORTH - 4 NOZZLES	
OCCUPANCY CLASSIFICATION	NORTH TUNNEL
DENSITY	0.16gpm/ft <sup>2</sup> for 6865.00ft <sup>2</sup> (Actual 6866.21ft <sup>2</sup> )
TOTAL HEADS FLOWING	8
K-FACTOR	30.4
TOTAL WATER REQUIRED	1264.7
TOTAL PRESSURE REQUIRED	140.1
BASE of RISER (gpm)	1264.7
BASE of RISER (psi)	140.1
SAFETY MARGIN (psi)	+24.1 (14.7%)

FACTORY SET  
EISENHOWER 4 NOZZLE  
FLOW CONTROL VALVE  
SYSTEM DEMAND  
62.7 PSI @ 630.8 GPM  
62.7X1.05 = 65.83 PSI  
SET AT 66 PSI

60 MINUTE WATER SUPPLY

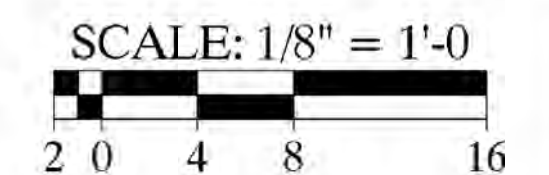
MOST DEMANDING: 1,264.7 GPM  
(4 NOZZLE SYSTEM - 2 ZONES)  
SAFETY FACTOR: 5%  
1,264.7 GPM X 1.05 = 1,327.9 GPM  
1,327.9 GPM X 60 MIN. = 79,676 GAL

BETE NOZZLE TF72FC  
150 DEGREE SPRAY BRASS  
34" X 28" = 925 SF  
925 X 0.16 DENSITY = 152.32 GPM  
P = 25.1 PSI  
K = 30.4  
Q = 152.32 GPM



2 NT-70 & NT-71 - EISENHOWER (NORTH) TUNNEL - 4 NOZZLE SYSTEM

SCALE: 1/8" = 1'-0"



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**STURGEON ELECTRIC**

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**RONNELL**  
A Fire Protection Life Safety

**ALF**  
CONSULTING ENGINEERS

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360  
Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Num	Description	Date

Checked by: JLH  
Drawn by: AMB

DELUGE SYSTEMS  
EISENHOWER (NORTH) TUNNEL  
Drawing Number  
**FP3.7**

**FACTORY SET**  
JOHNSON  
FLOW CONTROL VALVE  
SYSTEM DEMAND  
71.9 PSI @ 578.6 GPM  
71.9X1.05 = 75.50 PSI  
SET AT 76 PSI

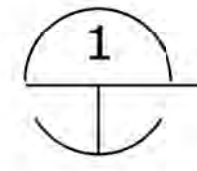
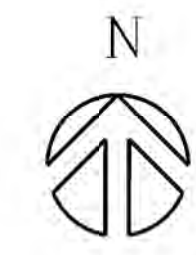
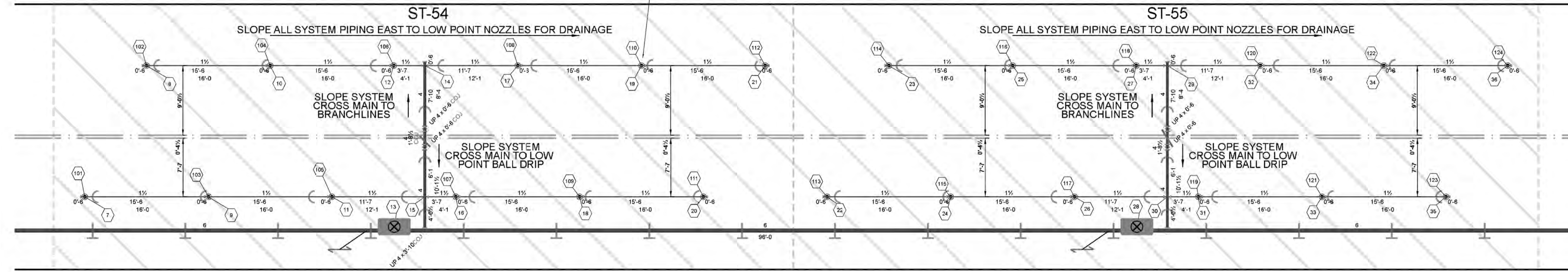
Hydraulic Information	
Remote Area SOUTH	
OCCUPANCY CLASSIFICATION	SOUTH TUNNEL
DENSITY	0.16gpm/ft <sup>2</sup> for 6590.00ft <sup>2</sup> (Actual 6590.70ft <sup>2</sup> )
TOTAL HEADS FLOWING	24
K-FACTOR	6.6
TOTAL WATER REQUIRED	1159.5
TOTAL PRESSURE REQUIRED	136.0
BASE of RISER (gpm)	1159.5
BASE of RISER (psi)	136.0
SAFETY MARGIN (psi)	+30.8 (18.5%)

BETE NOZZLE N6W  
120 DEGREE SPRAY BRASS  
17" X 17" = 289 SF  
289 X 0.16 DENSITY = 46.24 GPM  
P = 48.5 PSI  
K = 6.64  
Q = 46.24 GPM

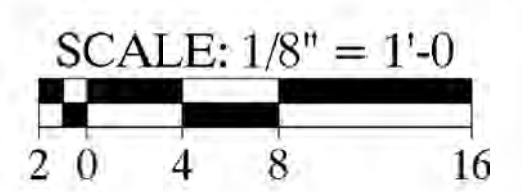
### Deluge System Testing

South Tunnel Test Date: 11/9/2015

Zone	Required Outlet (Factory Set) Pressure (psi)	Flow Control Valve Inlet Static (psi)	Flow Control Valve Inlet Residual (psi)	Flow Control Valve Outlet Residual (psi)	Fire Pump Supply Residual (psi)	Fire Pump Outlet Residual (psi)	Interpolated Flow from Fire Pump (gpm)	Flow Meter Reading (gpm)	Time for Flow Control Valve to Shut (sec)	Nozzle Spray Pattern	Notes:
ST-03	66	145	160	70	61	190	0	-	3 to 4	OK	Portal System - 12 Nozzle
ST-08	76	150	170	81	59	185	607	-	3 to 4	OK	12 Nozzle
ST-19	76	160	170	70	59	185	607	625	3 to 4	OK	12 Nozzle
ST-30	76	205	170	65	59	184	671	-	3 to 4	OK	12 Nozzle
ST-38	76	152	170	76	58	184	671	-	3 to 4	OK	12 Nozzle
ST-48	76	160	180	65	59	185	607	-	3 to 4	OK	12 Nozzle
ST-56	76	190	190	70	59	185	607	600	3 to 4	OK	12 Nozzle
ST-84	76	215	200	65	58	185	607	-	3 to 4	OK	12 Nozzle
ST-93	66	147	200	60	58	184	671	600	3 to 4	OK	Portal System - 12 Nozzle



**ST-54 & ST-55 - JOHNSON (SOUTH) TUNNEL - 12 NOZZLE SYSTEM**  
SCALE: 1/8" = 1'-0"



**BARNARD EJMT TEAM**

**BARNARD** **RONDELLI**

**BCER** **Sturgeon ELECTRIC**

Western States Fire Protection Co. ENGINEERS

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

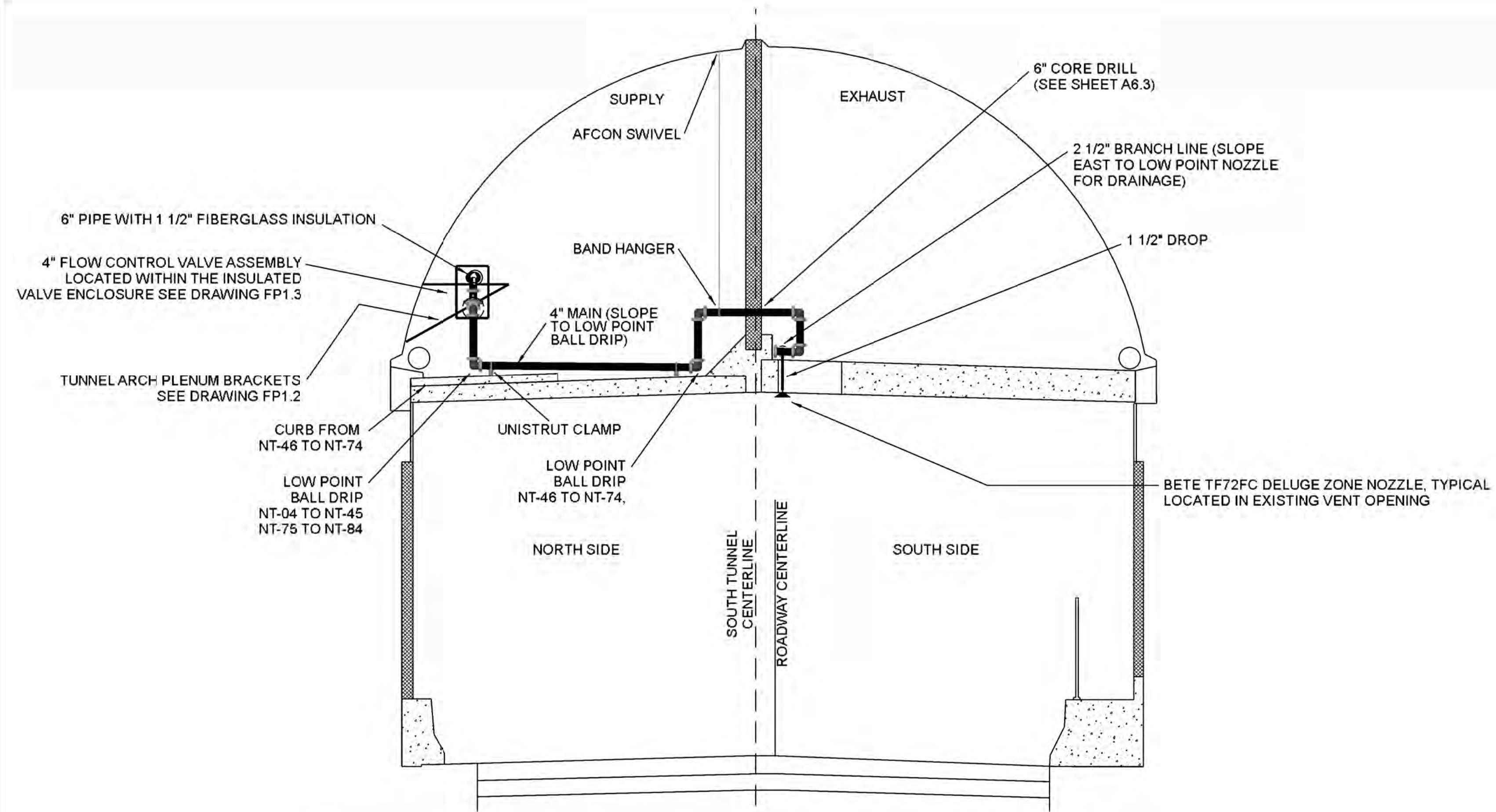
REVISIONS	Date

DELUGE SYSTEMS  
JOHNSON  
(SOUTH) TUNNEL

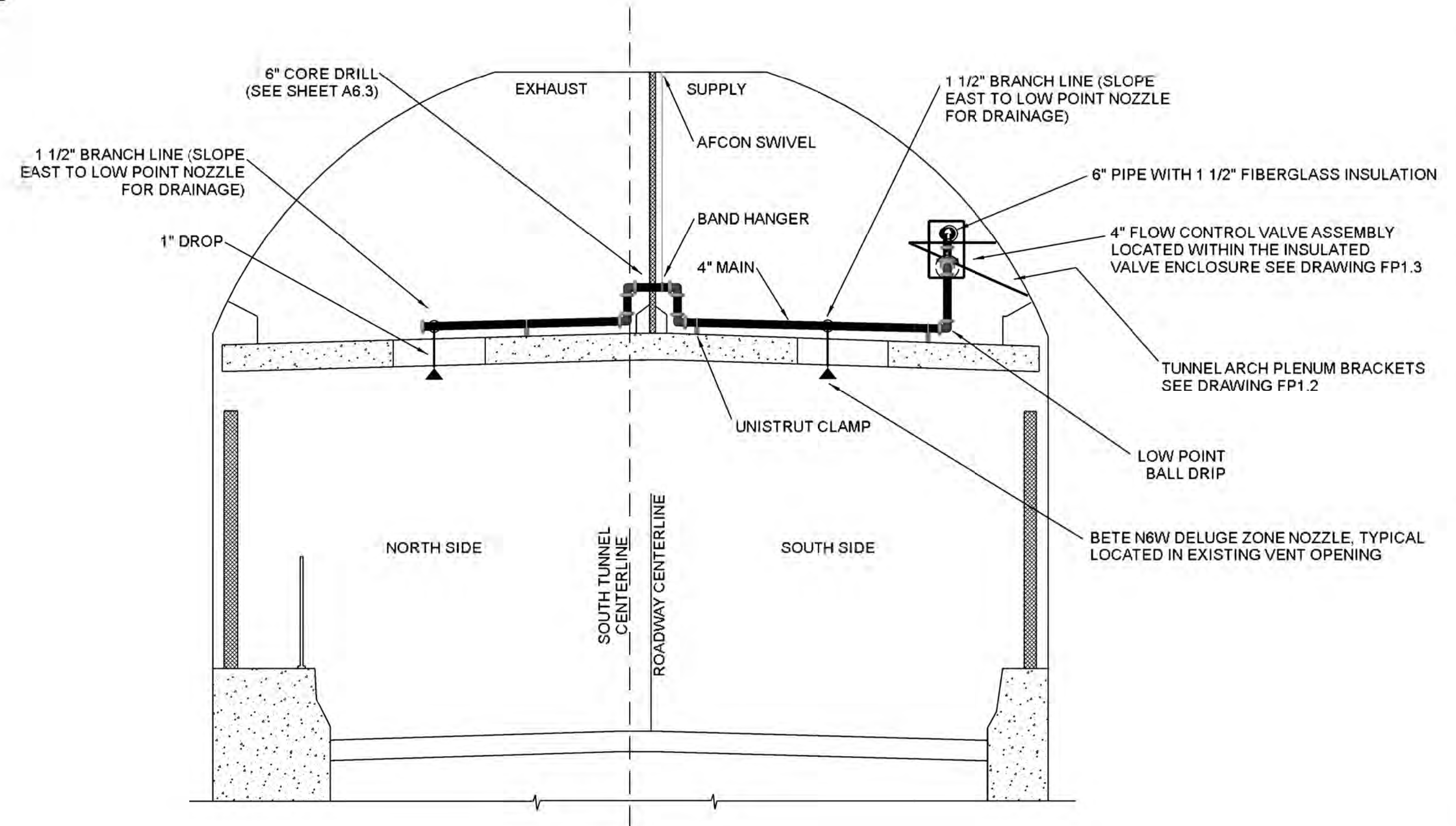
Drawing Number  
**FP3.8**

DRAWN BY: AMB  
CHECKED BY: JH





1 EISENHOWER (NORTH) TUNNEL - TYPICAL SECTION (LOOKING EAST)  
NOT TO SCALE



2 JOHNSON (SOUTH) TUNNEL - TYPICAL SECTION (LOOKING EAST)  
NOT TO SCALE

**BARNARD EJMT TEAM**

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*electrical engineering* *fire alarm life safety*  
 CONSULTING ENGINEERS  
 Western States Fire Protection Co.  
**Sturgeon ELECTRIC**

**EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT**

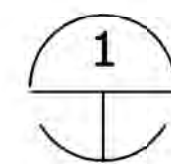
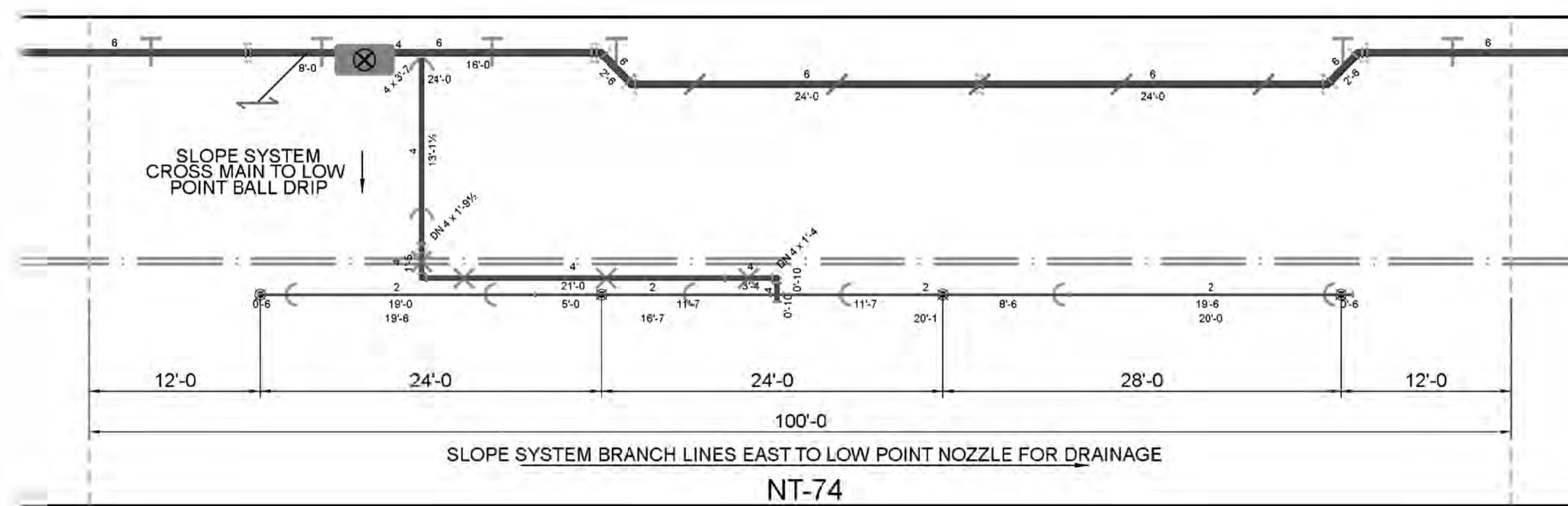
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**RECORD DRAWINGS - 2015-11-16**

Num	Revisions	Description	Date

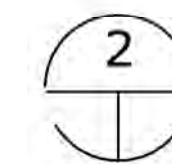
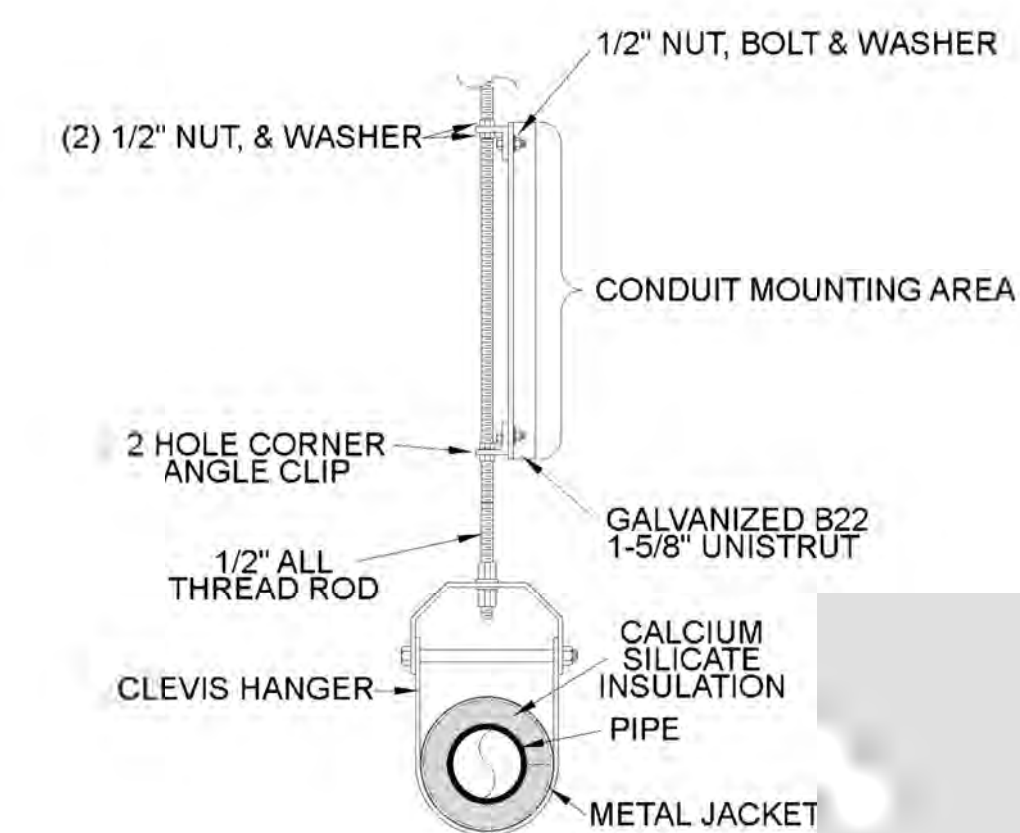
DELUGE SYSTEMS SECTIONS

Drawing Number  
**FP3.9**

DRAWN BY: AMB  
 CHECKED BY: JLN



NT-74 - EISENHOWER (NORTH) TUNNEL - ICE FALL SYSTEM  
SCALE: 1/8" = 1'-0"



CLEVIS HANGER - ICE FALL  
EISENHOWER (NORTH) TUNNEL - NT-74  
NOT TO SCALE



**BARNARD EJMT TEAM**

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**Western States Fire Protection Co.**

**Western States Fire Protection Co.**

**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

Num	Revisions Description	Date

DELUGE SYSTEMS  
EISENHOWER (NORTH)  
TUNNEL - ICE FALL

Drawing Number  
**FP3.10**

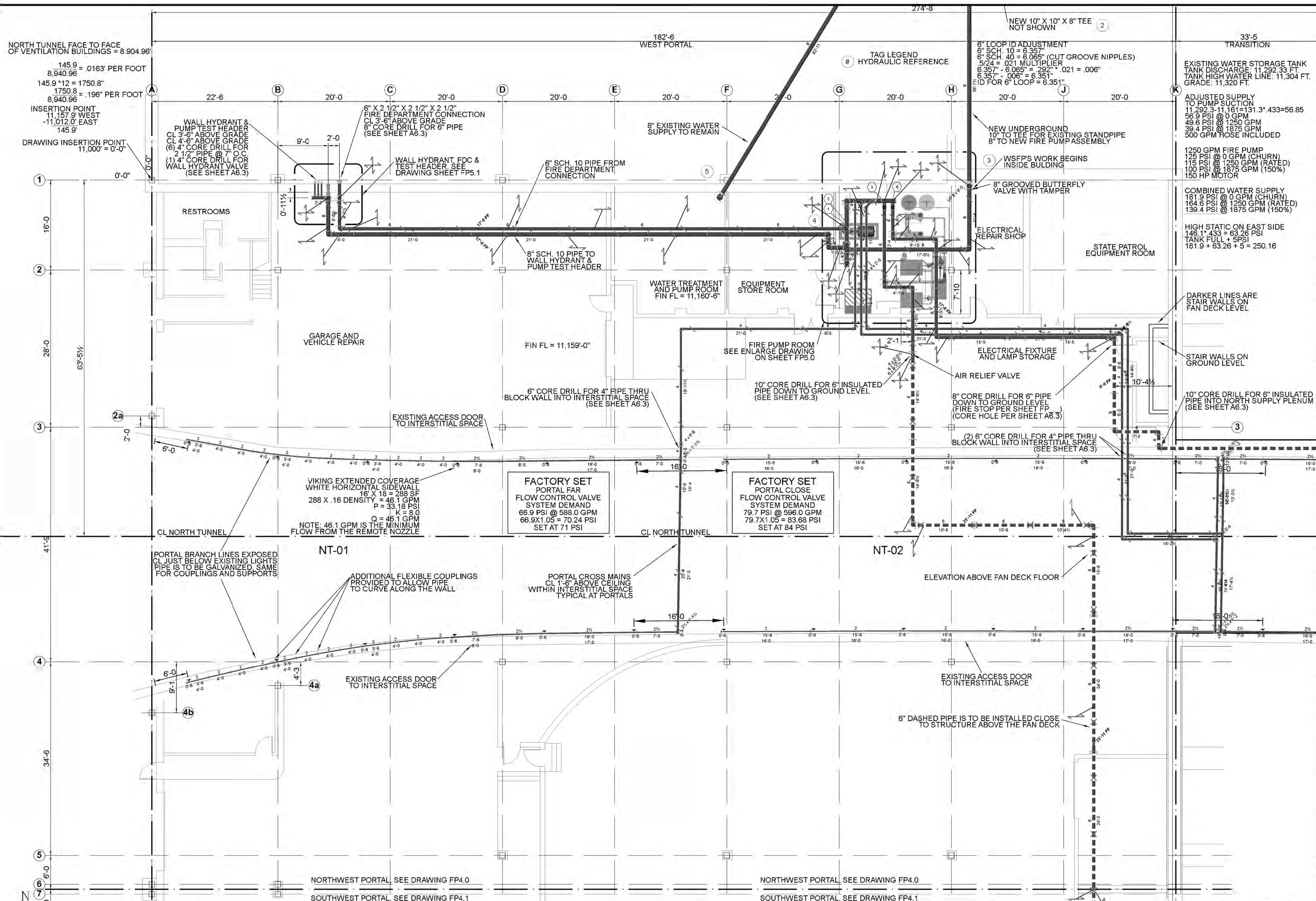
DRAWN BY: AMB  
CHECKED BY: JLH

NORTH TUNNEL FACE TO FACE OF VENTILATION BUILDINGS = 8,904.96'

145.9 = .0163' PER FOOT  
8,940.96  
145.9 \* 12 = 1750.8"  
1750.8 = .196" PER FOOT  
8,940.96

INSERTION POINT  
11,157.9' WEST  
-11,012.0' EAST  
145.9'

DRAWING INSERTION POINT  
11,000' = 0'-0"



EXISTING WATER STORAGE TANK  
TANK DISCHARGE: 11,292.33 FT  
TANK HIGH WATER LINE: 11,304 FT  
GRADE: 11,320 FT

ADJUSTED SUPPLY TO PUMP SUCTION  
11,292.3-11,161=131.3'  
433=56.85  
56.9 PSI @ 0 GPM  
49.6 PSI @ 1250 GPM  
39.4 PSI @ 1875 GPM  
500 GPM HOSE INCLUDED

1250 GPM FIRE PUMP  
125 PSI @ 0 GPM (CHURN)  
115 PSI @ 1250 GPM (RATED)  
100 PSI @ 1875 GPM (150%)  
150 HP MOTOR

COMBINED WATER SUPPLY  
181.9 PSI @ 0 GPM (CHURN)  
164.6 PSI @ 1250 GPM (RATED)  
139.4 PSI @ 1875 GPM (150%)

HIGH STATIC ON EAST SIDE  
146' \* 433 = 63.26 PSI  
TANK FULL + 5 PSI  
181.9 + 63.26 + 5 = 250.16

DARKER LINES ARE STAIR WALLS ON FAN DECK LEVEL

STAIR WALLS ON GROUND LEVEL

10" CORE DRILL FOR 6" INSULATED PIPE INTO NORTH SUPPLY PLENUM (SEE SHEET A6.3)

VIKING EXTENDED COVERAGE WHITE HORIZONTAL SIDEWALL  
16' X 18' = 288 SF  
288 X .16 DENSITY = 46.1 GPM  
P = 33.18 PSI  
K = 8.0  
Q = 46.1 GPM  
NOTE: 46.1 GPM IS THE MINIMUM FLOW FROM THE REMOTE NOZZLE

FACTORY SET PORTAL FAR FLOW CONTROL VALVE SYSTEM DEMAND  
66.9 PSI @ 588.0 GPM  
66.9X1.05 = 70.24 PSI  
SET AT 71 PSI

FACTORY SET PORTAL CLOSE FLOW CONTROL VALVE SYSTEM DEMAND  
79.7 PSI @ 596.0 GPM  
79.7X1.05 = 83.68 PSI  
SET AT 84 PSI

PORTAL BRANCH LINES EXPOSED CL JUST BELOW EXISTING LIGHTS PIPE IS TO BE GALVANIZED, SAME FOR COUPLINGS AND SUPPORTS

ADDITIONAL FLEXIBLE COUPLINGS PROVIDED TO ALLOW PIPE TO CURVE ALONG THE WALL

PORTAL CROSS MAINS CL 1'-6" ABOVE CEILING WITHIN INTERSTITIAL SPACE TYPICAL AT PORTALS

EXISTING ACCESS DOOR TO INTERSTITIAL SPACE

ELEVATION ABOVE FAN DECK FLOOR

EXISTING ACCESS DOOR TO INTERSTITIAL SPACE

6" DASHED PIPE IS TO BE INSTALLED CLOSE TO STRUCTURE ABOVE THE FAN DECK

**BARNARD EJMT TEAM**

**BARNARD** **RONDNELLI**

BCER **Sturgeon Electric**

Western States Fire Protection Co.

**EISENHOWER/JOHNSON MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

RECORD DRAWINGS - 2015-11-16

Num	Revisions	Date
	Description	

WEST PORTAL EISENHOWER (NORTH) ROADWAY LEVEL

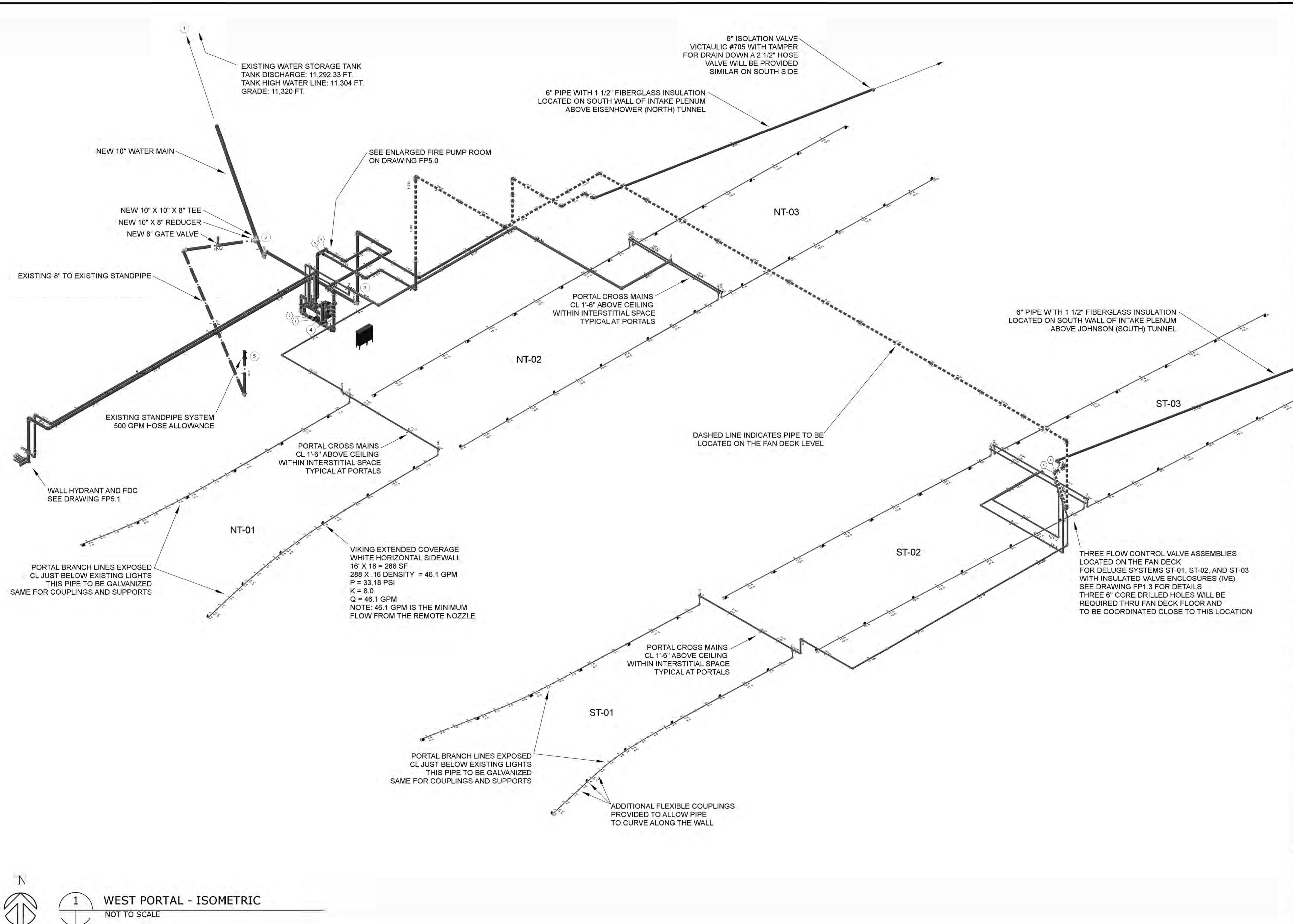
Drawing Number **FP4.0**

SCALE: 1/8" = 1'-0"

2 0 4 8 16

DRAWN BY: AMB CHECKED BY: JLH





EXISTING WATER STORAGE TANK  
TANK DISCHARGE: 11,292.33 FT.  
TANK HIGH WATER LINE: 11,304 FT.  
GRADE: 11,320 FT.

6" ISOLATION VALVE  
VICTAULIC #705 WITH TAMPER  
FOR DRAIN DOWN A 2 1/2" HOSE  
VALVE WILL BE PROVIDED  
SIMILAR ON SOUTH SIDE

6" PIPE WITH 1 1/2" FIBERGLASS INSULATION  
LOCATED ON SOUTH WALL OF INTAKE PLENUM  
ABOVE EISENHOWER (NORTH) TUNNEL

NEW 10" WATER MAIN

NEW 10" X 10" X 8" TEE  
NEW 10" X 8" REDUCER  
NEW 8" GATE VALVE

SEE ENLARGED FIRE PUMP ROOM  
ON DRAWING FP5.0

NT-03

PORTAL CROSS MAINS  
CL 1'-6" ABOVE CEILING  
WITHIN INTERSTITIAL SPACE  
TYPICAL AT PORTALS

6" PIPE WITH 1 1/2" FIBERGLASS INSULATION  
LOCATED ON SOUTH WALL OF INTAKE PLENUM  
ABOVE JOHNSON (SOUTH) TUNNEL

EXISTING 8" TO EXISTING STANDPIPE

EXISTING STANDPIPE SYSTEM  
500 GPM HOSE ALLOWANCE

NT-02

PORTAL CROSS MAINS  
CL 1'-6" ABOVE CEILING  
WITHIN INTERSTITIAL SPACE  
TYPICAL AT PORTALS

DASHED LINE INDICATES PIPE TO BE  
LOCATED ON THE FAN DECK LEVEL

ST-03

WALL HYDRANT AND FDC  
SEE DRAWING FP5.1

NT-01

VIKING EXTENDED COVERAGE  
WHITE HORIZONTAL SIDEWALL  
16" X 18" = 288 SF  
288 X .16 DENSITY = 46.1 GPM  
P = 33.18 PSI  
K = 8.0  
Q = 46.1 GPM  
NOTE: 46.1 GPM IS THE MINIMUM  
FLOW FROM THE REMOTE NOZZLE

PORTAL BRANCH LINES EXPOSED  
CL JUST BELOW EXISTING LIGHTS  
THIS PIPE TO BE GALVANIZED  
SAME FOR COUPLINGS AND SUPPORTS

ST-02

THREE FLOW CONTROL VALVE ASSEMBLIES  
LOCATED ON THE FAN DECK  
FOR DELUGE SYSTEMS ST-01, ST-02, AND ST-03  
WITH INSULATED VALVE ENCLOSURES (IVE)  
SEE DRAWING FP1.3 FOR DETAILS  
THREE 6" CORE DRILLED HOLES WILL BE  
REQUIRED THRU FAN DECK FLOOR AND  
TO BE COORDINATED CLOSE TO THIS LOCATION

PORTAL CROSS MAINS  
CL 1'-6" ABOVE CEILING  
WITHIN INTERSTITIAL SPACE  
TYPICAL AT PORTALS

ST-01

PORTAL BRANCH LINES EXPOSED  
CL JUST BELOW EXISTING LIGHTS  
THIS PIPE TO BE GALVANIZED  
SAME FOR COUPLINGS AND SUPPORTS

ADDITIONAL FLEXIBLE COUPLINGS  
PROVIDED TO ALLOW PIPE  
TO CURVE ALONG THE WALL

**BARNARD EJMT TEAM**

**BCER** CONSULTING ENGINEERS  
**BARNARD**  
**STURGEON ELECTRIC**  
**RONDINELLI** A fire about life safety  
Western States Fire Protection Co.

**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT**

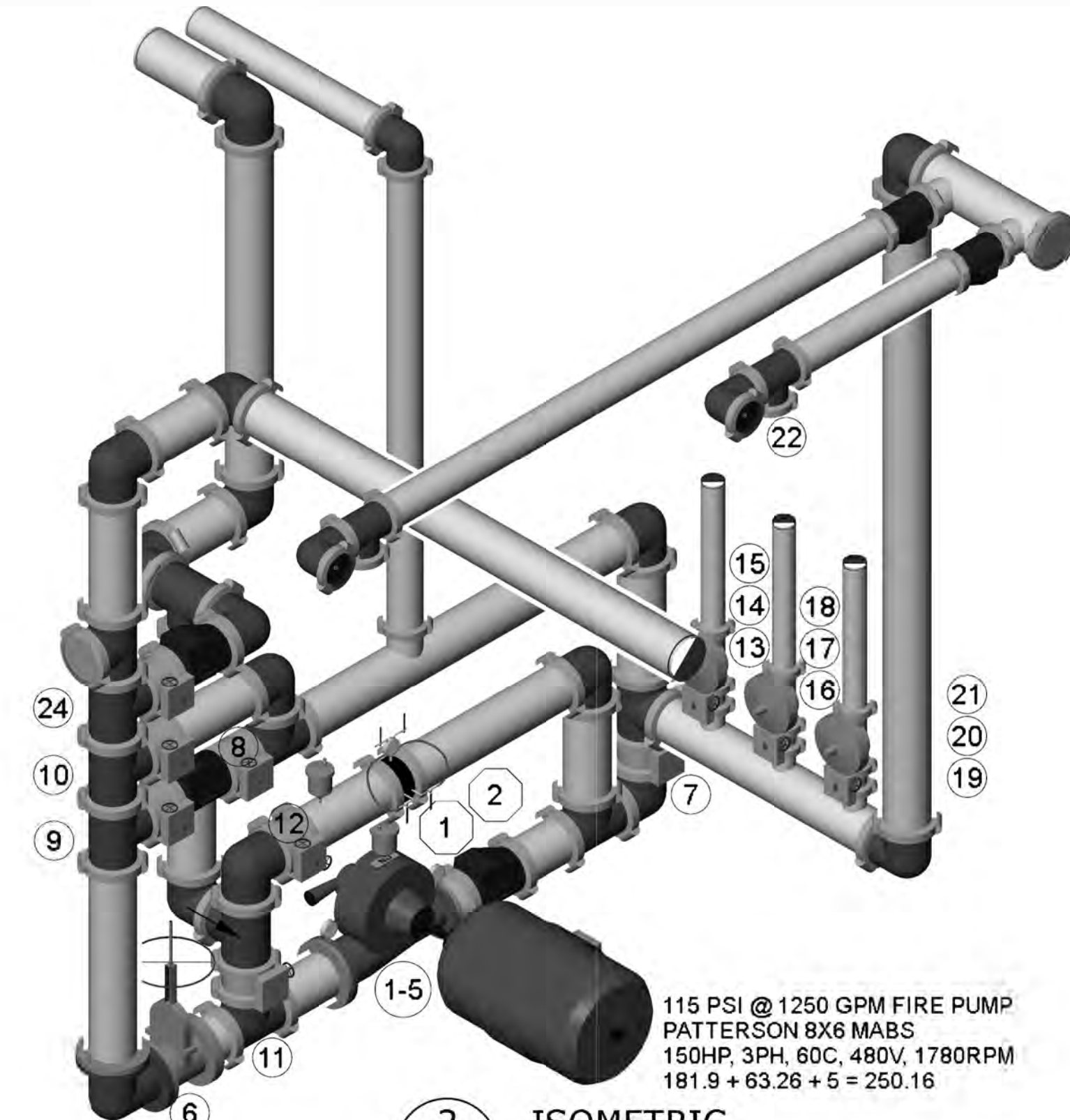
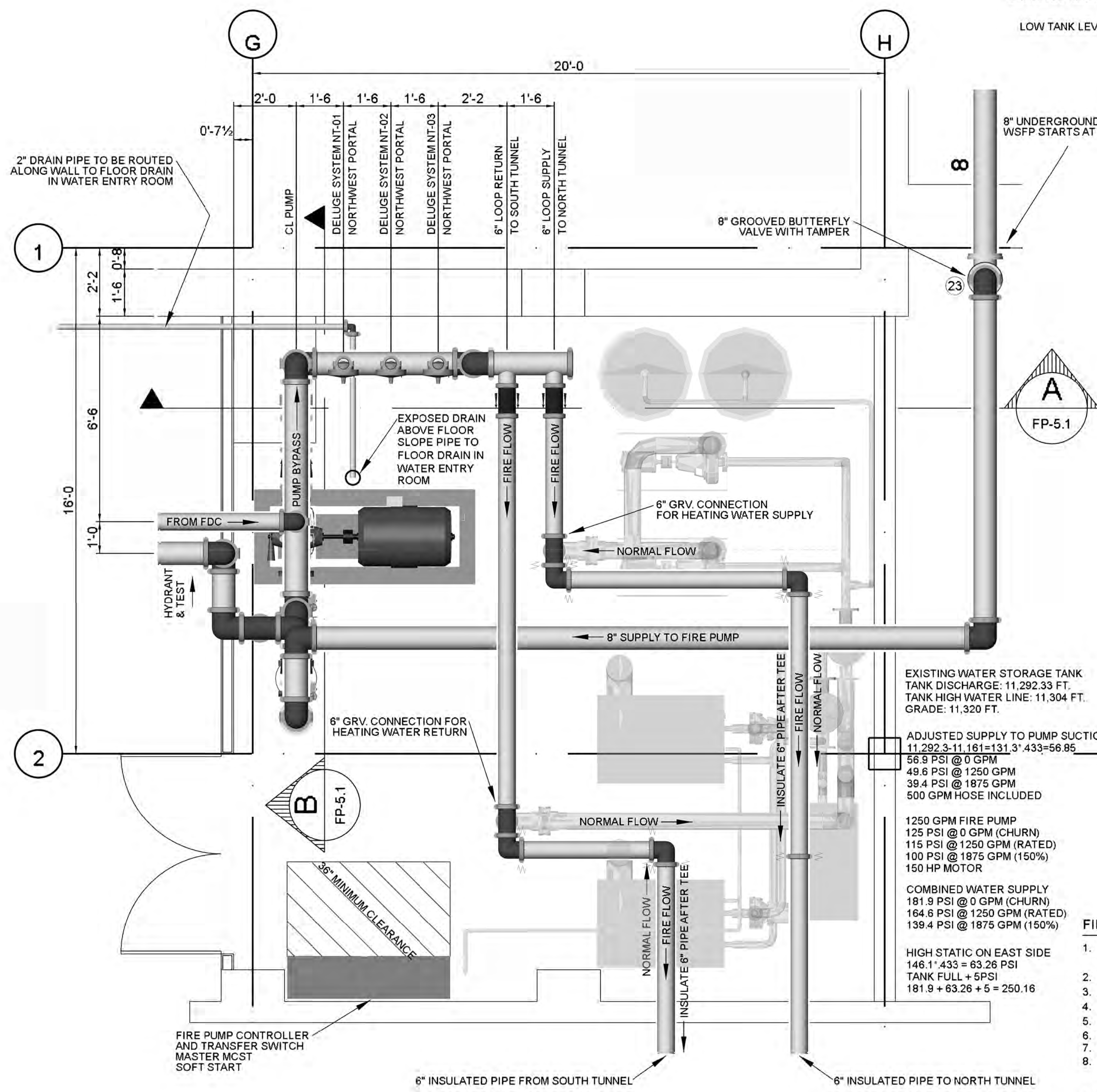
Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Num	Revisions	Date
	Description	

WEST PORTAL ISOMETRIC  
Drawing Number  
**FP4.2**

WEST PORTAL - ISOMETRIC  
NOT TO SCALE

TANK LEVEL READINGS  
 60 MINUTES REMAINING = 60.2 PSI  
 30 MINUTES REMAINING = 43.7 PSI  
 0 MINUTES REMAINING = 5.0 PSI  
 LOW TANK LEVEL = 30.4 PSI



2 ISOMETRIC  
 NOT TO SCALE

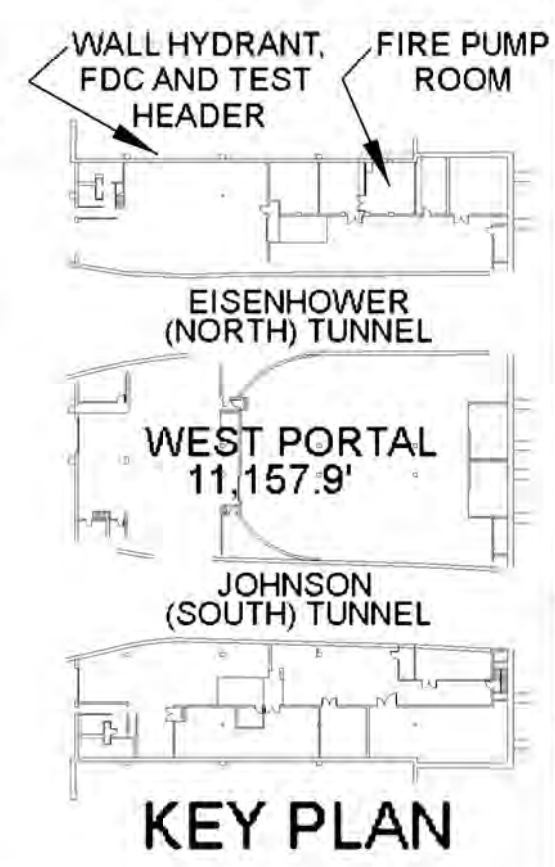
FIRE PUMP TAG LEGEND  
 # WIRED DEVICE # HYDRAULIC REFERENCE

DEVICES IN PUMP ROOM SUPERVISED AND ACTUATED BY FIRE ALARM PANEL

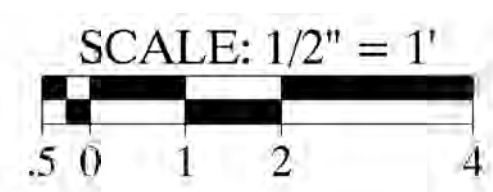
#	DEVICE	VALVE POSITION PER FLOW CONDITION		
		NORMAL FLOW	FIRE/FDC FLOW	STORAGE TANK RE-FILL
1	PUMP START	.	.	.
2	PUMP RUNNING	.	.	.
3	PUMP PHASE REVERSAL	.	.	.
4	PUMP LOSS OF PHASE	.	.	.
5	PUMP EMERGENCY POWER	.	.	.
6	PUMP SUPPLY - TAMPER SWITCH	N/O	OPEN	CLOSED
7	PUMP DISCHARGE - TAMPER SWITCH	N/O	OPEN	OPEN
8	PUMP BYPASS - TAMPER SWITCH	N/O	OPEN	CLOSED
9	PUMP BYPASS - TAMPER SWITCH	N/O	OPEN	CLOSED
10	RE-FILL BYPASS - TAMPER SWITCH	N/C	CLOSED	OPEN
11	RE-FILL - TAMPER SWITCH	N/C	CLOSED	OPEN
12	PUMP TEST - TAMPER SWITCH	N/C	CLOSED	CLOSED
13	NT-01 TAMPER SWITCH	N/O	OPEN	OPEN
14	NT-01 PRESSURE SWITCH	N/C	OPEN (FIRE IN ZONE)	CLOSED
15	NT-01 SOLENOID VALVE	N/O	OPEN	OPEN
16	NT-02 TAMPER SWITCH	N/O	OPEN	OPEN
17	NT-02 PRESSURE SWITCH	N/C	OPEN (FIRE IN ZONE)	CLOSED
18	NT-02 SOLENOID VALVE	N/O	OPEN	OPEN
19	NT-03 TAMPER SWITCH	N/O	OPEN	OPEN
20	NT-03 PRESSURE SWITCH	N/C	OPEN (FIRE IN ZONE)	CLOSED
21	NT-03 SOLENOID VALVE	N/O	OPEN	OPEN
22	6\"/>			

FIRE PUMP GENERAL NOTES

- ALL MATERIAL AND INSTALLATIONS OF THIS FIRE PUMP SHALL BE UL LISTED FOR FIRE PROTECTION USE AND CONFORM TO NFPA 20, 2010 EDITION.
- ELECTRICAL POWER WIRING AND ALARM WIRING IS BY ELECTRICAL CONTRACTOR.
- ALL FITTINGS TO BE GROOVED FIRELOCK OR GROOVED STANDARD BY VICTAULIC.
- ALL PIPING TO BE SCHEDULE 10 BLACK ASTM A-795 WITH GROOVED ENDS UNLESS NOTED OTHERWISE.
- ALL PAINTING TO BE IN ACCORDANCE WITH NFPA AND MANUFACTURERS DATA.
- FIRE PUMP FRAME TO BE ANCHORED TO CONCRETE PUMP ROOM FLOOR.
- LOW POINTS IN FIRE PUMP PIPING TO HAVE PROVISIONS FOR DRAINING.
- SUCTION AND DISCHARGE PIPING SHALL BE HYDROSTATICALLY TESTED AT NOT LESS THAN 200 PSI (13.8 BAR) PRESSURE, OR AT 50 PSI (3.4 BAR) IN EXCESS OF THE MAXIMUM PRESSURE TO BE MAINTAINED IN THE SYSTEM, WHICHEVER IS GREATER, FOR 2 HOURS.
- ALL CONTROL VALVES ARE TO HAVE TAMPER SWITCHES.
- CASING RELIEF VALVE TO BE PIPED TO FLOOR DRAIN SEPARATELY.
- FIRE PUMP PACKING GLAND TO BE PIPED TO THE FLOOR DRAIN SEPARATELY.
- HANGERS AND SUPPORTS TO BE PROVIDED IN ACCORDANCE WITH NFPA-13.
- SEISMIC BRACING TO BE PROVIDED IN ACCORDANCE WITH NFPA-13.
- ALL VALVES TO BE LABELED IN ACCORDANCE WITH NFPA-13.
- REFER TO PUMP SUBMITTAL FOR DETAILED INFORMATION ON PUMP AND CONTROLLER.
- PUMP SKID TO BE MOUNTED TO GROUT PAD.



1 PUMP ROOM PLAN  
 SCALE: 1/2" = 1'-0"



EISENHOWER/JOHNSON  
 MEMORIAL TUNNEL  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360  
 Subcontract 17810  
 RECORD DRAWINGS - 2015-11-16

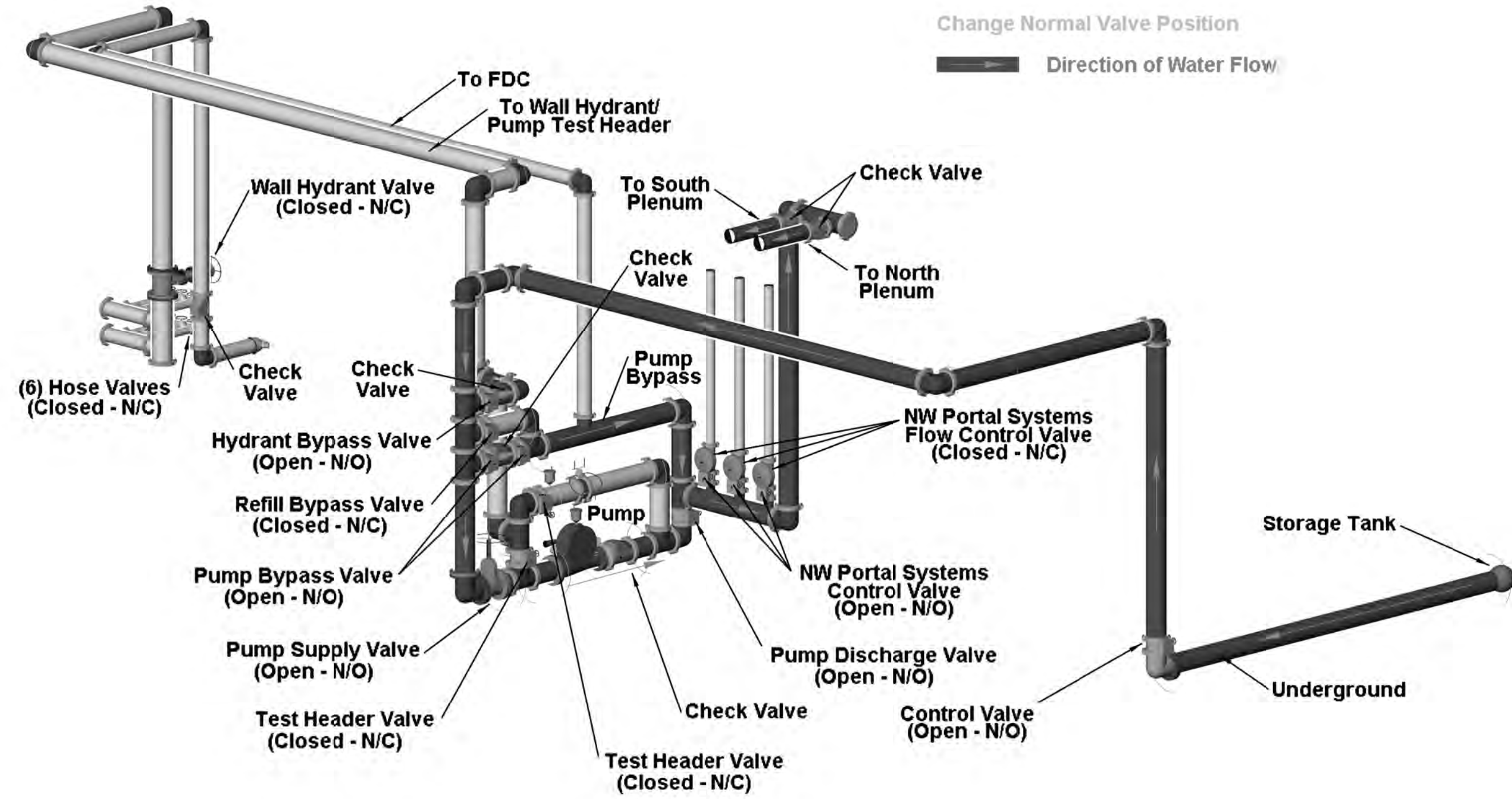
**BARNARD EJMT TEAM**  
**BARNARD**  
**STURGEON ELECTRIC**  
**RONDINELLI**  
**WESTERN STATES FIRE PROTECTION CO.**  
**BCER**  
**Western States Fire Protection Co.**  
**Sturgeon Electric**

REVISIONS  
 Date  
 Description  
 Num

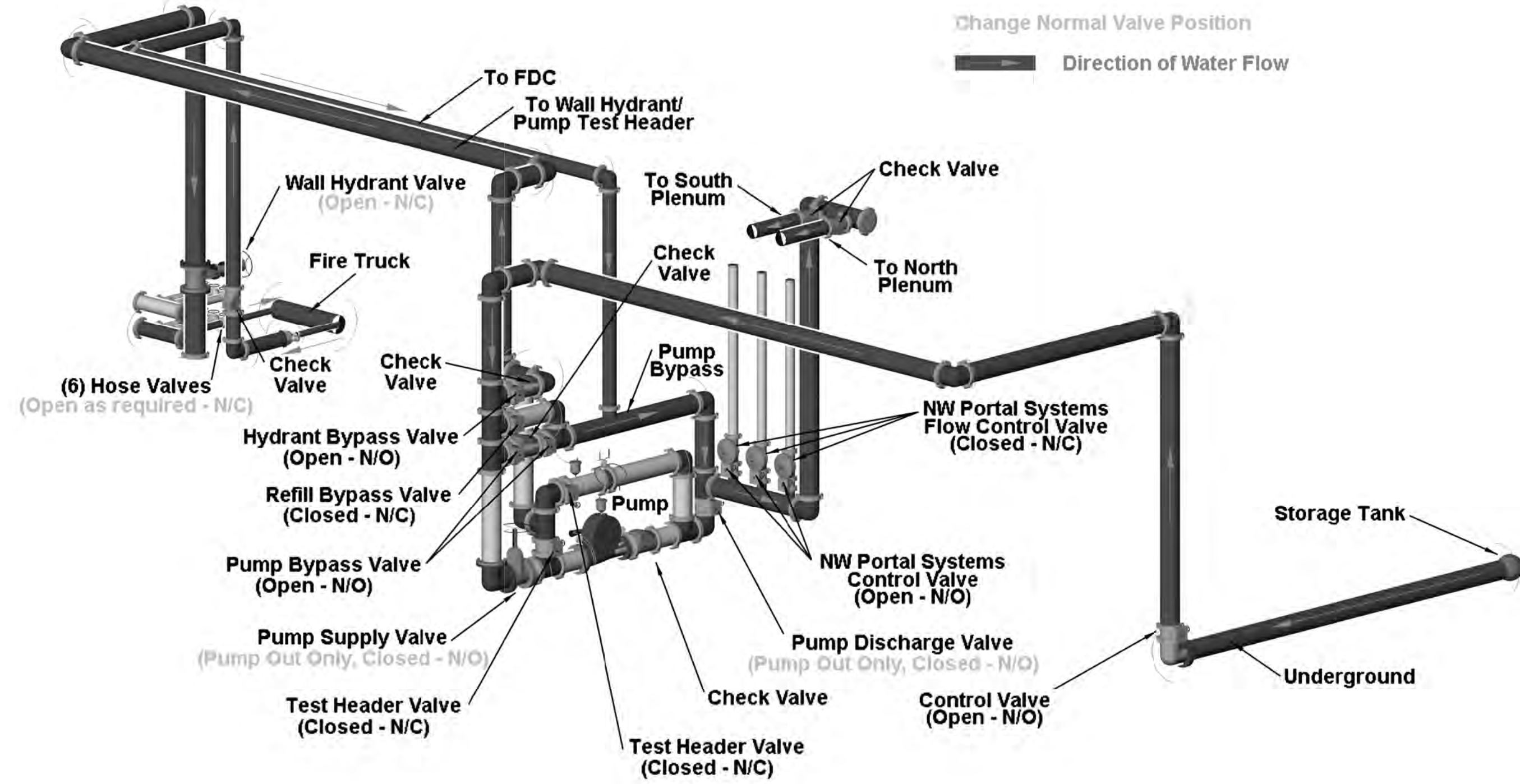
FIRE PUMP ROOM  
 PLAN AND  
 ISOMETRIC  
 Drawing Number  
**FP5.0**

CHECKED BY: JH  
 DRAWN BY: AMB

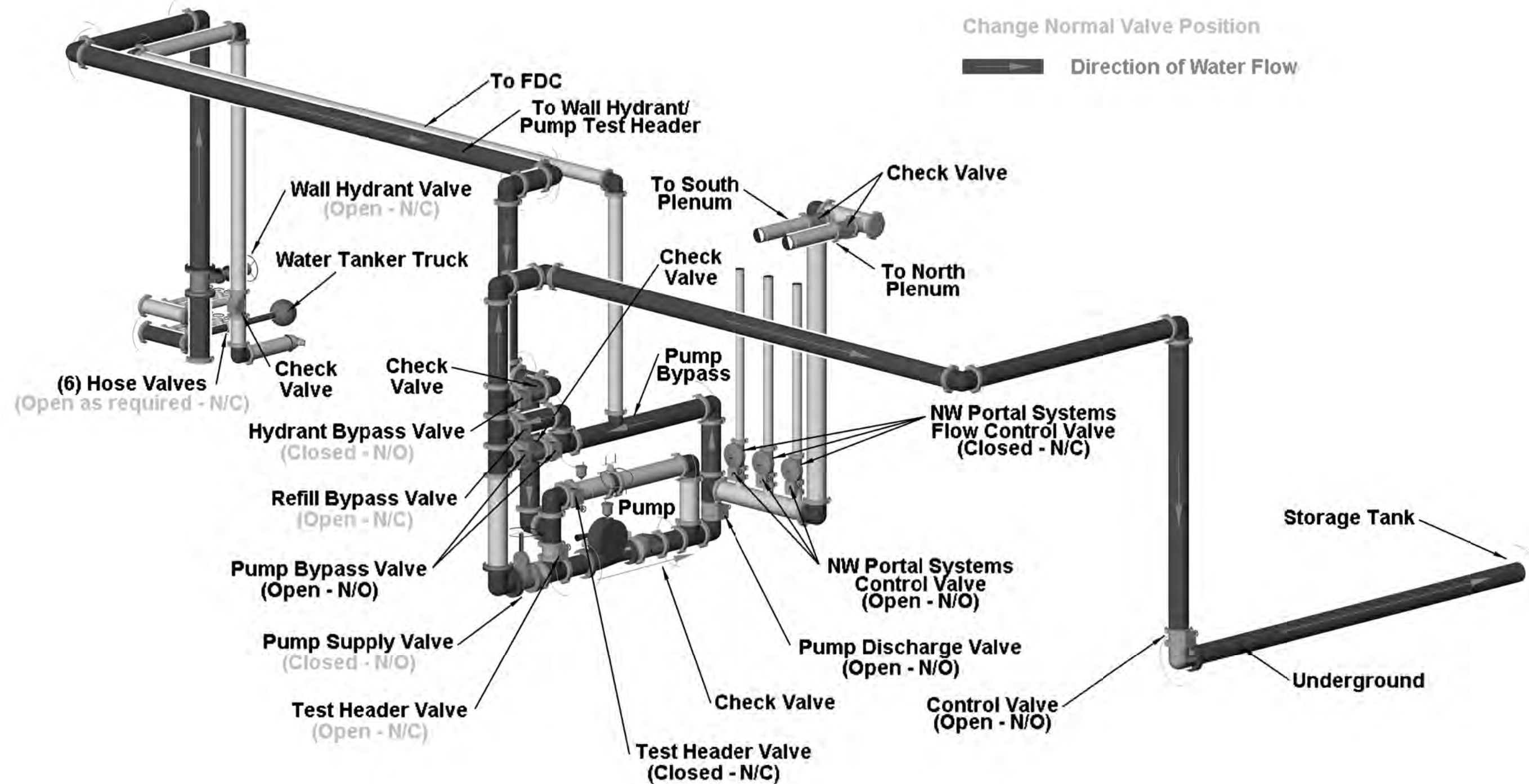




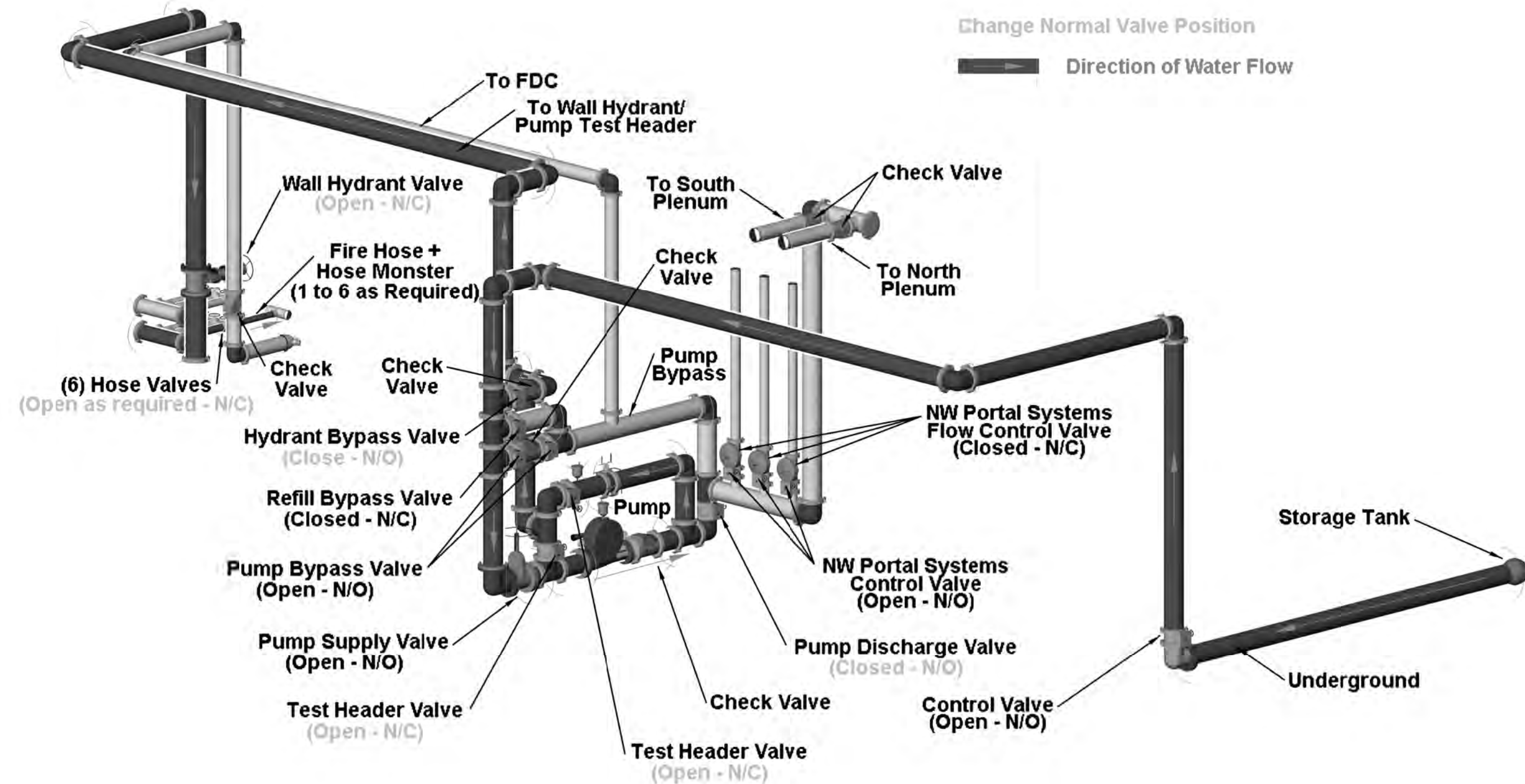
1 FIRE FLOW  
NOT TO SCALE



2 WALL HYDRANT AND FDC FLOW  
NOT TO SCALE



3 STORAGE TANK REFILL FLOW  
NOT TO SCALE



4 PUMP TEST FLOW  
NOT TO SCALE

**BARNARD EJMT TEAM**

**BARNARD RONDINELLI**  
A Fire Suppression Life Safety  
CONSULTING ENGINEERS

**Sturgeon ELECTRIC**

**BCER**  
Fire Suppression  
Engineering

Western States Fire Protection Co.

**EISENHOWER/JOHNSON  
MEMORIAL TUNNEL**  
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Project No. C0703-360 Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

Num	Description	Date

PUMP ROOM  
FLOW CONDITIONS

Drawing Number  
**FP5.2**

DRAWN BY: AMB  
CHECKED BY: JLH







THREE FLOW CONTROL VALVE ASSEMBLIES LOCATED ON THE FAN DECK FOR DELUGE SYSTEMS NT-88, NT-89, AND NT-90 WITH INSULATED VALVE ENCLOSURES (IVE) SEE DRAWING FP1.3 FOR DETAILS  
THREE 6" CORE DRILLED HOLES WILL BE REQUIRED THRU FAN DECK FLOOR AND TO BE COORDINATED CLOSE TO THIS LOCATION

6" ISOLATION VALVE VICTAULIC #705 WITH TAMPER FOR DRAIN DOWN A 2 1/2" HOSE VALVE WILL BE PROVIDED

6" PIPE WITH 1 1/2" FIBERGLASS INSULATION LOCATED ON NORTH WALL OF INTAKE PLENUM ABOVE EISENHOWER (NORTH) TUNNEL

PORTAL CROSS MAINS CL 1'-6" ABOVE CEILING WITHIN INTERSTITIAL SPACE TYPICAL AT PORTALS

NT-88

NT-89

NT-90

PORTAL BRANCH LINES EXPOSED CL JUST BELOW EXISTING LIGHTS THIS PIPE TO BE GALVANIZED SAME FOR COUPLINGS AND SUPPORTS

ADDITIONAL FLEXIBLE COUPLINGS PROVIDED TO ALLOW PIPE TO CURVE ALONG THE WALL

VIKING EXTENDED COVERAGE WHITE HORIZONTAL SIDEWALL 18' X 18' = 288 SF 288 X 0.16 DENSITY = 46.1 GPM P = 33.18 PSI K = 8.0 Q = 46.1 GPM  
NOTE: 46.1 GPM IS THE MINIMUM FLOW FROM THE REMOTE NOZZLE

ADDITIONAL FLEXIBLE COUPLINGS PROVIDED TO ALLOW PIPE TO CURVE ALONG THE WALL

ST-93

DASHED LINE INDICATES PIPE TO BE LOCATED ON THE FAN DECK LEVEL

PORTAL CROSS MAINS CL 1'-6" ABOVE CEILING WITHIN INTERSTITIAL SPACE TYPICAL AT PORTALS

ST-92

4" BERMAD FP-430-UF PRESSURE RELIEF VALVE SET AT 265 PSI LOCATED IN A VERTICALLY POSITIONED JOHNSON IVE PIPED TO OUTSIDE

6" CORE DRILL FOR 4" PRESSURE RELIEF DRAIN PIPE (SEE SHEET A6.3)

THREE FLOW CONTROL VALVE ASSEMBLIES LOCATED ON THE FAN DECK FOR DELUGE SYSTEMS ST-91, ST-92, AND ST-93 WITH INSULATED VALVE ENCLOSURES (IVE) SEE DRAWING FP1.3 FOR DETAILS  
THREE 6" CORE DRILLED HOLES WILL BE REQUIRED THRU FAN DECK FLOOR AND TO BE COORDINATED CLOSE TO THIS LOCATION

ST-91

6" PIPE WITH 1 1/2" FIBERGLASS INSULATION LOCATED ON SOUTH WALL OF INTAKE PLENUM ABOVE JOHNSON (SOUTH) TUNNEL

PORTAL BRANCH LINES EXPOSED CL JUST BELOW EXISTING LIGHTS THIS PIPE TO BE GALVANIZED SAME FOR COUPLINGS AND SUPPORTS

6" ISOLATION VALVE VICTAULIC #705 WITH TAMPER FOR DRAIN DOWN A 2 1/2" HOSE VALVE WILL BE PROVIDED



1

EAST PORTAL - ISOMETRIC  
NOT TO SCALE

**BARNARD EJMT TEAM**



**EISENHOWER/JOHNSON MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Num	Revisions Description	Date

DRAWN BY: AMB CHECKED BY: JLB

EAST PORTAL ISOMETRIC

Drawing Number  
**FP6.2**



**EISENHOWER JOHNSON TUNNEL, FIRE SPRINKLER PIPE FREEZE PROTECTION MECHANICAL SYSTEM NARRATIVE**

LOOP PIPING HEATING SYSTEM  
 THE NEW FIXED FIRE SUPPRESSION SYSTEM (FFSS) REQUIRES A MEANS TO KEEP THE 6" LOOP PIPING WATER FROM FREEZING IN THE PLENUMS. A NEW BOILER SYSTEM WILL PROVIDE A CIRCULATING HEATED WATER SYSTEM USING A PLATE AND FRAME HEAT EXCHANGER TO DECOUPLE THE HEATING WATER FROM THE "OPEN" FFSS PIPING. THE BOILERS WILL MAINTAIN A MINIMUM LOOP TEMPERATURE 80°F TEMPERATURE WHEN THE TUNNEL TEMPERATURE REACHES -30°F WHEN ONLY ONE BOILER OPERATES. THE PIPING WILL BE INSULATED COMPLETELY FROM THE BOILER/FIRE PUMP ROOM TO THE ENTIRE LOOP SERVING BOTH TUNNELS.

THE PIPING SYSTEM INCLUDES APPROXIMATELY 18,100 FEET OF 6 INCH PIPING. THE ENVIRONMENT THAT THE PIPE IS EXPOSED TO IS THE VENTILATION AIR PLENUMS ABOVE THE TRAFFIC TUNNELS. THIS AIR TEMPERATURE HAS BEEN MODELED USING -30°F AIR AND AN AVERAGE AIR VELOCITY DUE TO THE VENTILATING FANS OF 18. MPH. (NOTE: THE HEAT LOSS FROM THE INSULATED PIPE INCREASES 1.6% WHEN AIR VELOCITY REACHES 140 MPH).

THE ELEVATION OF THE TUNNEL IS 11,013 FT. (EAST) TO 11,158 FT. (WEST) ABOVE SEA LEVEL.

THE ENTIRE PIPING SYSTEM HEAT LOSS IS CALCULATED USING 1.5 INCHES OF FIBERGLASS INSULATION WITH AN "ALL-SERVICE" VAPOR BARRIER JACKETING.

THE PIPING INCLUDES A METAL JACKET TO PREVENT HIGH VELOCITY AIR DEGRADATION OF THE INSULATION.

THE PIPE HEAT LOSS MODEL USING 80°F MINIMUM WATER TEMPERATURE INDICATES 80°F WILL BE THE MINIMUM TEMPERATURE TO PROVIDE FOR VALVE CABINET HEAT LOSS.

THE SUMMARY OF HEAT LOSS (AT ALTITUDE) FROM THE SYSTEM IS AS FOLLOWS FOR 80° SWT:

18,100 FT OF 6 INCH PIPE	611,960 BTU/HR
180 VALVE CABINETS	36,360 BTU/HR
<b>TOTAL</b>	<b>648,320 BTU/HR</b>

THE NEW NON-CONDENSING TYPE BOILER SYSTEM INSTALLATION WILL BE LOCATED IN THE FIRE PUMP/MECH ROOM.

THE BOILER EFFICIENCY WILL BE 85%. THE ALTITUDE CORRECTION FOR THE BOILER INCLUDES A DERATION OF 44% (I.E. THE ALTITUDE OUTPUT WILL BE 56% OF TOTAL SEA LEVEL OUTPUT VALUE OF THE BOILER(S)).

USING THIS EFFICIENCY AND ALTITUDE DERATION INDICATES A TOTAL BOILER INPUT MINIMUM OF 1,363 MBH BASED ON THE TOTAL LOAD REQUIRED. WE HAVE ELECTED TO SET THE FFSS WATER TEMPERATURE TO 100°F FOR ADDED SAFETY OF THE VALVE CABINET HEATING.

THE SYSTEM HAS BEEN SIZED WITH TWO BOILERS (LEAD-LAG CONTROL) EACH WITH 1440 MBH INPUT. EACH BOILER HAS A CIRCULATION PUMP TO PROVIDE HEAT TO THE FFSS CIRCULATION PUMPING SYSTEM THROUGH A PLATE AND FRAME HEAT EXCHANGER. THE BOILER(S) WILL OPERATE TO PROVIDE 160°F SUPPLY WATER TO THE EXCHANGER THAT HEATS THE FFSS LOOP CIRCULATING WATER TO ~100°F SWT. REFER TO CALCULATIONS ON SHEET M1.2.

THE PRIMARY PUMPING SYSTEM FOR THE LOOP PIPING WILL BE PROVIDED BY TWO PUMPS. EACH WILL BE SIZED AT FULL FLOW CAPACITY OF 320 GPM FOR NORMAL OPERATION. THESE PUMPS WILL OPERATE IN LEAD-STANDBY FUNCTION AND WILL BE PROVIDED WITH TIME FUNCTION FOR EQUALIZING THE OPERATION TIME.

THE BOILERS ARE CLOSED COMBUSTION TYPE. THE INTAKE AND VENTING WILL BE ROUTED DIRECTLY TO THE OUTSIDE OF THE BUILDING USING INLINE FANS.

THE AUTOMATIC ZONE VALVE CABINETS WILL BE HEATED USING THE LOOP PIPING AS THE SOURCE. THE CABINETS WILL BE FULLY INSULATED.

THE BOILERS WILL BE PROVIDED WITH NATURAL GAS USING THE EXISTING BRANCH PIPING THAT WAS USED TO SERVE THE TUNNEL HEATERS. THE GAS IS DISTRIBUTED FROM THE WEST END, SOUTH BOILER ROOM GAS REGULATOR. EACH BOILER WILL BE PROVIDED WITH A GAS PRESSURE REGULATOR.

THE BOILER ROOM WILL BE PROVIDED WITH AN "EMERGENCY DISCONNECTING MEANS" IN ACCORDANCE WITH ASME CSD-2009, SECTION CE-110. THIS WILL ALLOW MANUAL REMOTE SHUT DOWN LOCATED JUST OUTSIDE THE BOILER ROOM.

**WASTE PIPING DRAINAGE CONTROL**

THE EXISTING WASTE PIPING FROM THE TUNNELS WILL BE MODIFIED BY THE ADDITION OF CONTROL VALVES IN THE EAST SEWER TREATMENT ROOM AND THE WASTE MANHOLE OUTSIDE OF THE EAST PORTAL BUILDING.

THE CONTROL VALVES SHALL BE CONTROLLED THROUGH THE FIRE ALARM SYSTEM.

THE VALVES WILL BE PROVIDED TO ALLOW WASTE TO FLOW TO THE EXISTING INDOOR SEDIMENTATION TANKS DURING NORMAL OPERATION. IF THE VALVES LOSE POWER DURING NORMAL OPERATION THEY WILL FAIL TO ALLOW FLOW TO THE SEDIMENTATION TANKS.

THE VALVES ARE ARRANGED SUCH THAT DURING A FIRE EVENT, THE AFFECTED TUNNEL (NORTH OR SOUTH) INFLUENT LINE WILL BE DIVERTED TO THE FFSS DRAINAGE SYSTEM. A NEW 12 INCH BYPASS LINE WILL BE INSTALLED TO DIVERT ANY FIRE WATER FROM THE SOUTH ROADWAY FROM ENTERING THE SEDIMENTATION TANKS. THE EXISTING 12 INCH OBSOLETE PIPE WILL BE USED TO FLOW ANY FIRE WATER TO THE NEW FFSS DRAINAGE SYSTEM OUTSIDE THE BUILDING.

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

**BARNARD EJMT TEAM**

**RONDINELLI**  
*A REEF GROUP life safety*



**BARNARD**



**Sturgeon**  
 ELECTRIC

**BCER**  
 CONSULTING ENGINEERS

**EISENHOWER/JOHNSON**

**MEMORIAL TUNNEL**

FIXED FIRE SUPPRESSION SYSTEM

DESIGN BUILD PROJECT

Project No. C0703-360 Subaccount 17810

**RECORD DRAWINGS - 2015-11-16**

Num	Revisions Description	Date

MECHANICAL NARRATIVE

Drawing Number  
**M1.1**

DRAWN BY: JEB | CHECKED BY: RDM





## PLATE AND FRAME HEAT EXCHANGER SCHEDULE

PLAN CODE	MFR.	MODEL	INSTALLED		GPM	% GLYCOL	HOT SIDE			INLET/OUTLET CONNECTION	COLD SIDE			INLET/OUTLET CONNECTION	MBH	HEAT TRANSFER AREA, SQ. FT.	OPERATIONAL WEIGHT	REMARKS		
			MFR.	MODEL			°F EWT	°F LWT	P.D. FT. W.C.		°F EWT	°F LWT	P.D. FT. W.C.							
PF-1	ALFA-LAVAL	AQ4M-FD			120	0	160	148.6	2.0	4"	320	0	75.7	80	11.6	4"	685	75.8	965	(1) (2) (3) (4) (5) (6)
SAME PF-1 WHEN OPERATED:					240	0	160	153.5			320		95	100			775			

- (1) PROVIDE FULLY WELDED, 304 STAINLESS STEEL, RATED AT 250 PSIG. OPERATING PRESSURE.  
 (2) PERFORMANCE BASED ON HIGHER HEATING SYSTEM SIDE GPM; 640 GPM; 2.9° ΔT; 936 MBH., 18.4 PSIG ΔP.  
 (3) P/F EXCHANGER SHALL BE RATED USING THE "AHRI RATING" REQUIREMENTS.  
 (4) PROVIDE W/ 34 PLATES, COUNTERCURRENT FLOW, 1 - PASS HOT & COLD SIDE; EPDMP GASKET MATERIAL.  
 (5) TEST PRESSURE: 325 PSIG.  
 (6) PROVIDE FRAME FOR MINIMUM OF 44 ADDITIONAL PLATES.

## EXPANSION TANK SCHEDULE

PLAN CODE	MFR.	MODEL	INSTALLED		SERVICE	CHARGE PRESSURE (PSIG)	% GLYCOL	OPERATING RANGE (°F)	CAPACITY		OPERATING WEIGHT (LBS.)	SYSTEM WATER VOLUME (GAL.) APPROX	REMARKS
			MFR.	MODEL					ACCEPT. VOLUME	TOTAL VOLUME			
ET-1	TACO	CA1400			FFSS HEATING	60	0.00	(40 - 130)	313	370	2,880	30,000	(2) (3)
ET-2	TACO	CA1400			FFSS HEATING	60	0.00	(40 - 130)	313	370	2,880	30,000	(2) (3)
ET-3	TACO	CAX42			BOILER HEATING	20	0.00	(40 - 180)	5	11	150	100	(1)

- (1) SUSPENDED TYPE MOUNTING.  
 (2) FLOOR MOUNTED TYPE.  
 (3) MAXIMUM SYSTEM PRESSURE; 200 PSIG.

## FAN SCHEDULE

PLAN CODE	MFR.	MODEL	INSTALLED		SYSTEM	FAN TYPE	CFM @ ALT.	S.P. IN W.C. @ S.L. (4)	WHEEL DIAMETER	FAN RPM (APPROX.)	DRIVE TYPE	H.P.	DAMPER		CURB TYPE	ELEC. VOLT/PH.	APPROX. WEIGHT (LBS.)	REMARKS
			MFR.	MODEL									TYPE	SIZE				
VF-1	ENERVEX	IPVB300			BOILER FLUE	INLINE-BI	1895	0.45	-	-	BELT	2.0	NA	NA	-	208/3		(1) (2) (3) (4) (5)
VF-2	ENERVEX	SFTA018			BOILER COMBUSTION	INLINE-BI	1008	0.49	-	-	BELT	1.0	NA	NA	-	208/3		(1) (2) (3) (4)

- (1) STEEL VENT WITH B.I. WHEEL. PROVIDE COATING IN AIRSTREAM ONLY.  
 (2) PROVIDE BELT AND MOTOR GUARD.  
 (3) PROVIDE UNIT MODULATING SPEED CONTROL, FLUE PRESSURE CONTROL, ABB ACH550 DRIVE, MOTOR DISCONNECT AND INTERLOCK WITH BOILER CONTROL PANEL.  
 (4) STATIC PRESSURE IS BASED ON PRELIMINARY MANUFACTURER SELECTION. PROVIDE FLUE CALCULATION OF FINAL SELECTION BY MANUFACTURER.  
 (5) PROVIDE 12"Ø MODULATING BALANCING BAFLE.

## AIR SEPARATOR SCHEDULE

PLAN CODE	MFR.	MODEL	INSTALLED		SERVICE	GPM	PRESSURE DROP (FT. OF HEAD)	PIPE SIZE	REMARKS
			MFR.	MODEL					
AS-1	B&G	RL-5			FFSS SYSTEM / HEATING	320		5"	(1)
AS-2	B&G	RL-4			HEATING	240		4"	(2)

- (1) RATED AT 250 PSIG  
 (2) RATED AT 125PSIG/350°F

## CHEMICAL BY-PASS FEEDER SCHEDULE

PLAN CODE	MFR.	MODEL	INSTALLED		SERVICE	VOLUME (GAL.)	PIPE SIZE (IN/OUT)	REMARKS
			MFR.	MODEL				
CBPF-1	NALCO	DBS-2			BOILER SYSTEM	2.0	3/4"	(1)

- (1) REFER TO SPECS ON M8.3.


## GAS EQUIPMENT AND GAS METER SCHEDULE

PLAN CODE	TYPE / SERVICE	MBH INPUT @S.L.	CFH @ SITE	MIN. GAS PRESSURE (IN. W.C.)	MAX. GAS PRESSURE (IN. W.C.)	FINAL CONNECTION SIZE	REMARKS
B2	BOILER	1440	2057	4.5	14	2.0	(1) (2) (3) (4) (5)
EG-1	EMERGENCY GENERATOR	4176	5966	15-20	-	2	(1) (2) (3) (4) (5)
(E) ENGR. BLDG.	ENGINEERING BUILDING	132	188	-	-	EXISTING	(1) (2) (3) (4) (5)
TOTAL GAS LOAD		7188	10268				

- (1) GAS SUPPLIED BY XCEL; 5 PSIG  
 (2) HEATING VALUE: 700 BTU/CF.  
 (3) HARD PIPE FINAL CONNECTION.  
 (4) PROVIDE UNION, 6" DIRT LEG AND GAS COCK.  
 (5) SEE PLANS / SCHEMATIC FOR REGULATORS.

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**BARNARD EJMT TEAM**

**BCER** **BARNARD** **BARNARD** **RONDINELLI**  
 CONSULTING ENGINEERS  
 Western States Fire Protection Co.  


**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT  
 Project No. C0703-360 Subaccount 17810  
**RECORD DRAWINGS - 2015-11-16**

Num	Revisions Description	Date

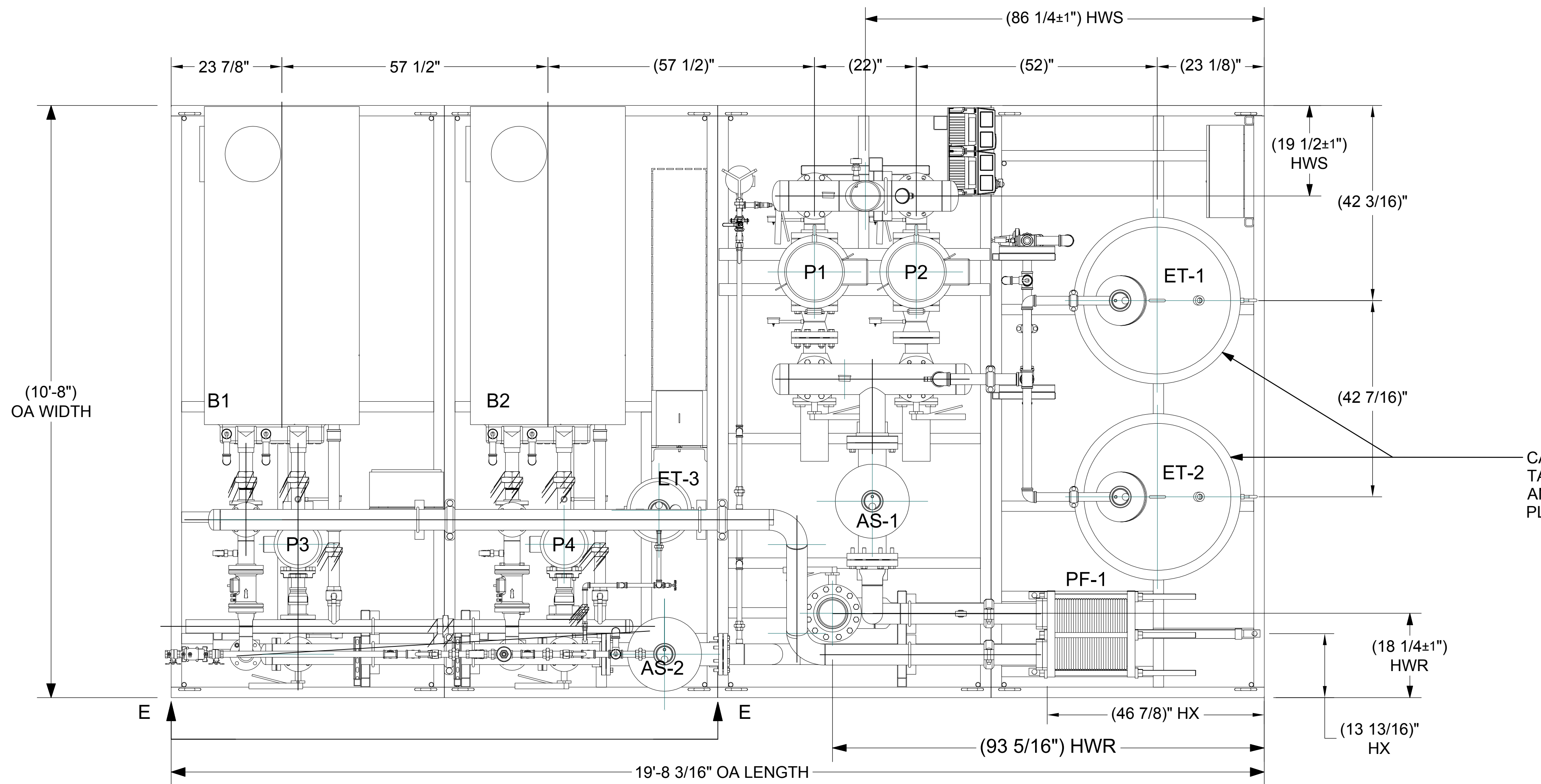
MECHANICAL SCHEDULES  
 Drawing Number  
**M2.1**







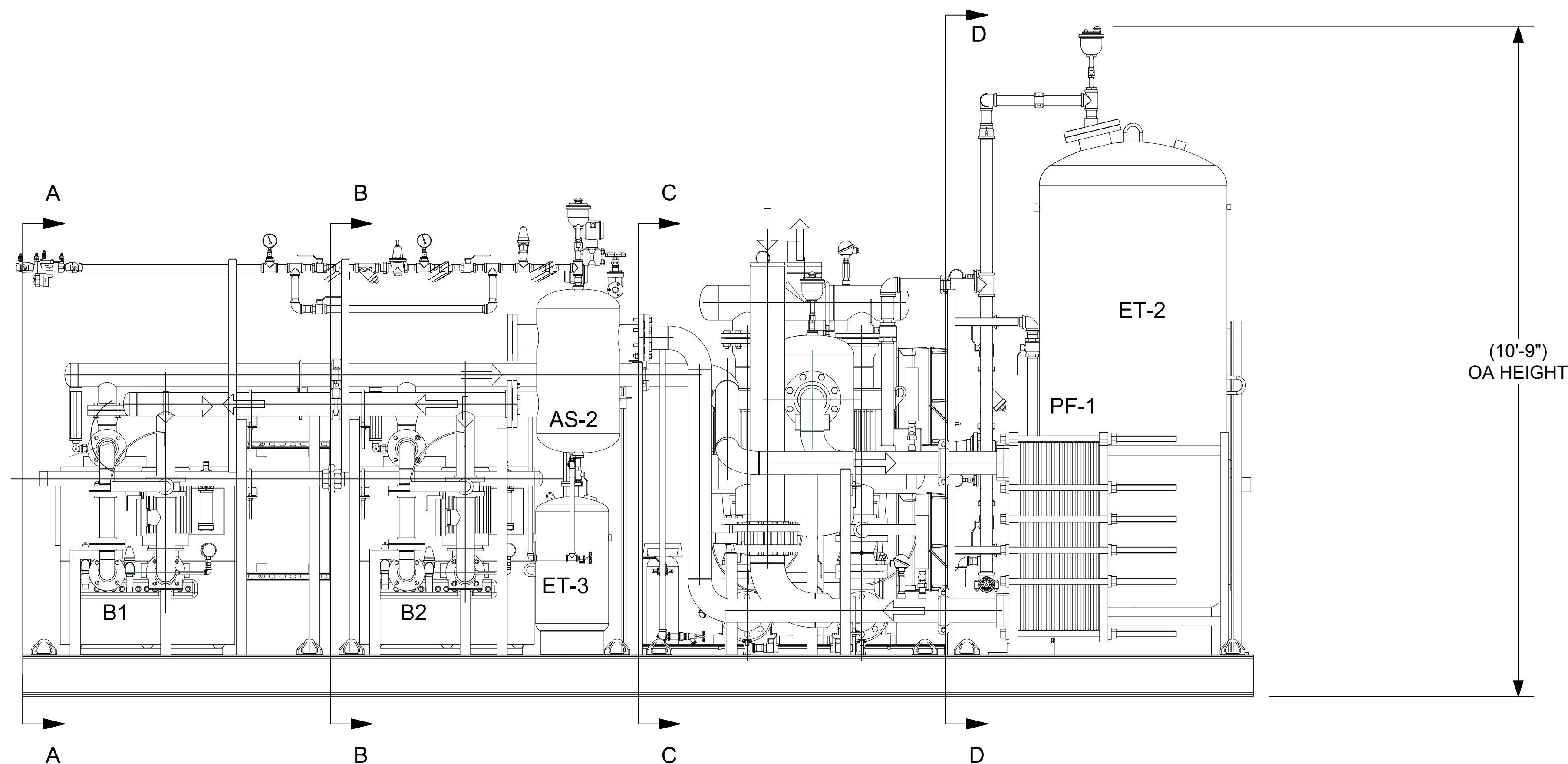
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**NOTES:**

1. FINISH: GRAY PAINT.
2. CONDITION POINT: 320 GPM @ 86.7 PSI  
SUCTION PRESSURE: 0 PSI MIN. / 0 PSI MAX
3. ALL DIMENSIONS SUBJECT TO CHANGE WITHOUT NOTICE:  
DO NOT USE FOR CONSTRUCTION PURPOSED UNLESS CERTIFIED.
4. (XX) INDICATE REFERENCE DIMENSIONS.
5. FILL BASE WITH NON-SHRINKING, NON-FERROUS GROUT:  
FAILURE TO DO SO VOIDS TIGERFLOW WARRANTY.
6. ALL STRUCTURAL WELDING SHALL BE PERFORMED BY AWS D1.1  
QUALIFIED WELDERS.
7. ALL PIPE WELDING SHALL BE PERFORMED BY ASME SECTION 9  
QUALIFIED WELDERS.
8. 48" CLEARANCE (CLEAR TO GROUND) REQUIRED IN FRONT OF  
CONTROL PANELS PER 2011 NEC TABLE 110-26 (A) (1).
9. 12" MINIMUM CLEARANCE AROUND SYSTEM FOR SYSTEM  
SERVICEABILITY.
10. VENT PIPING FOR BOILERS BY OTHERS.
11. GAS REGULATOR INTERNAL TO PACKAGED BOILER.
12. BACKFLOW PREVENTER ON BOILER MWL NOT PROVIDED.
13. **SEISMIC CALCULATIONS W/ COLORADO P.E. STAMP.**
14. EACH SKID MUST FIT THROUGH 5' X 7' DOOR.

CA-1400 EXPANSION  
TANK SHIPPED LOOSE  
AND ASSEMBLED ON  
PLACEMENT (BOLT-ON)



**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT

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**RECORD DRAWINGS - 2015-11-16**

Revisions	Date
Num	Description

MECHANICAL SKID PLAN  
AND ELEVATION

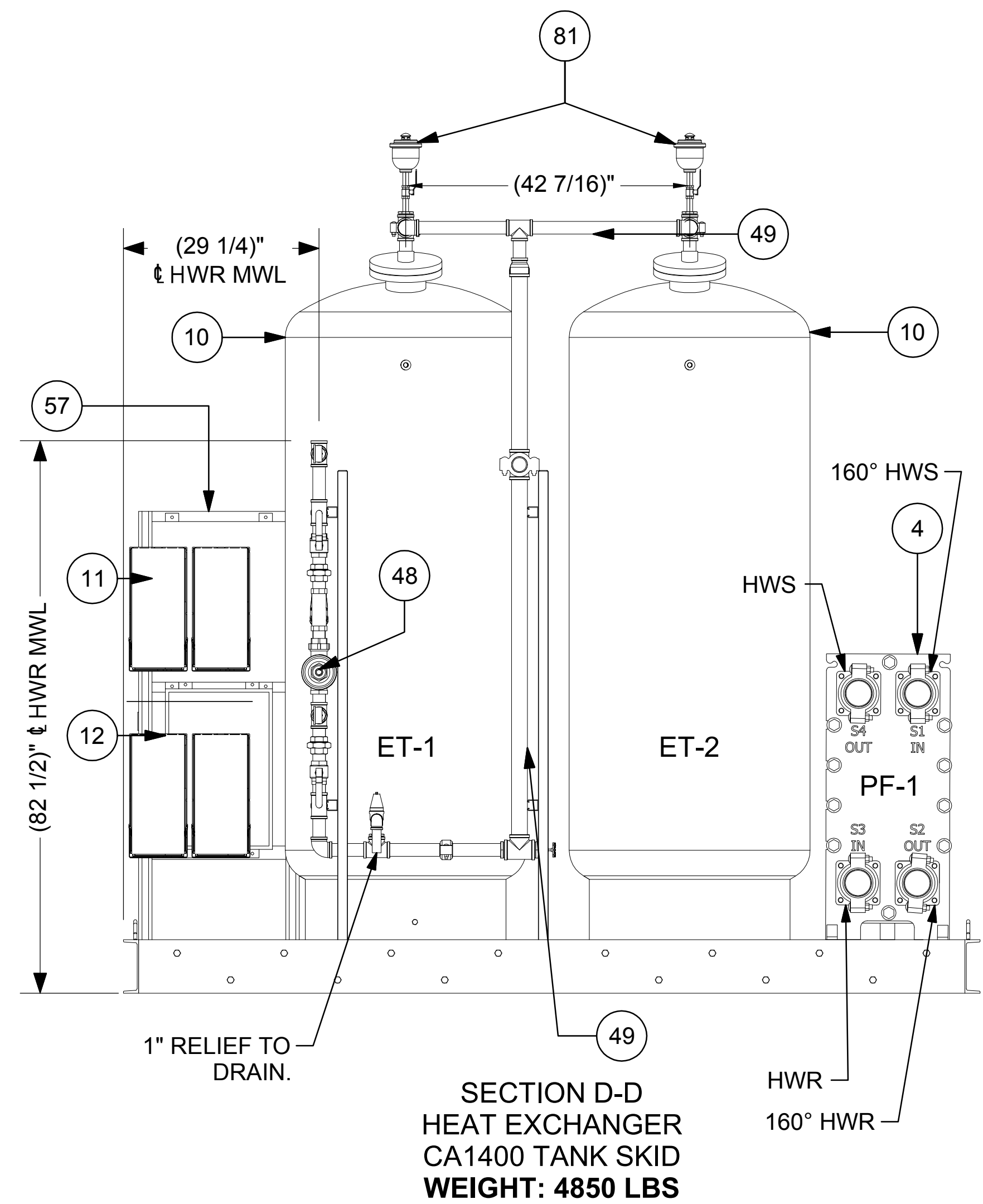
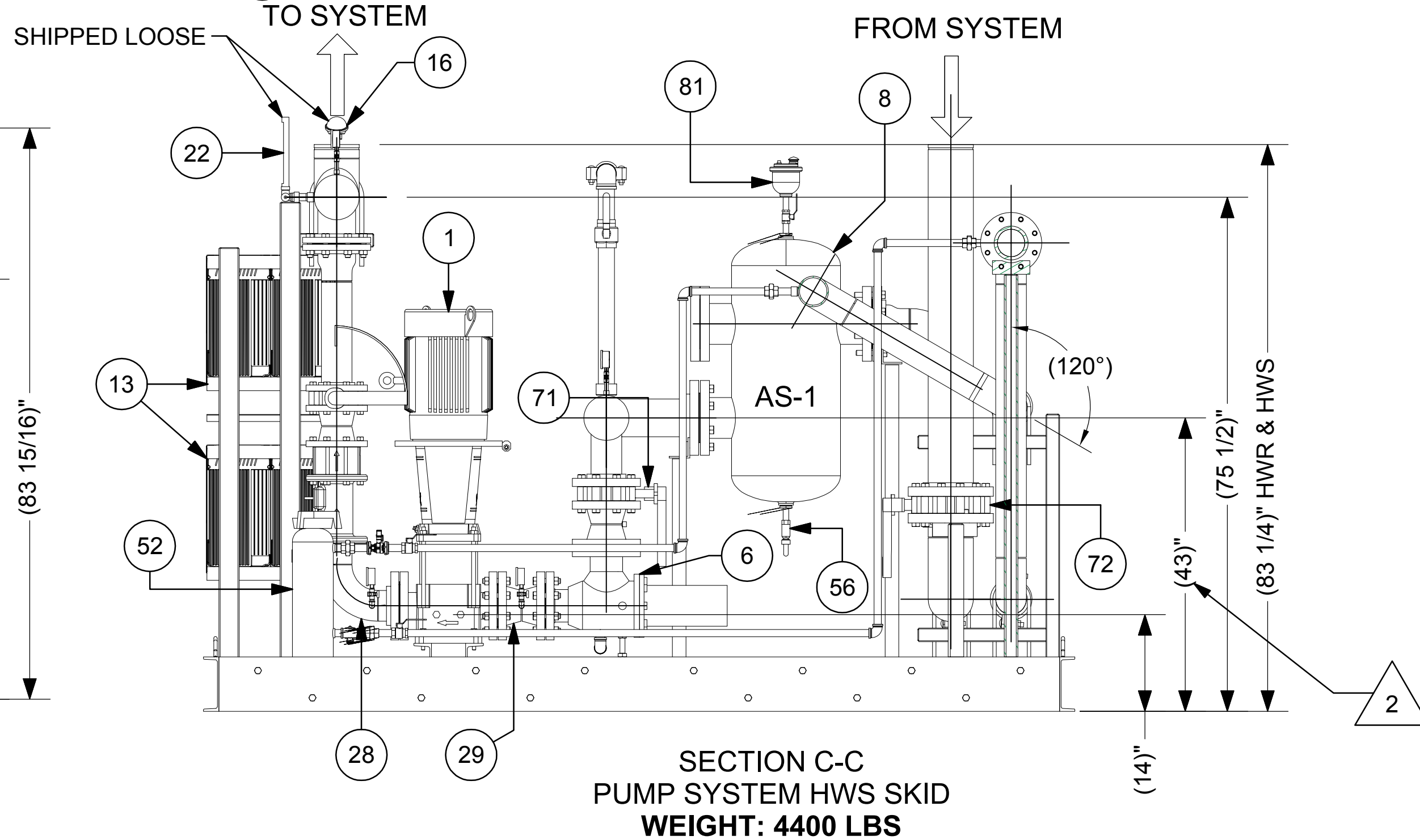
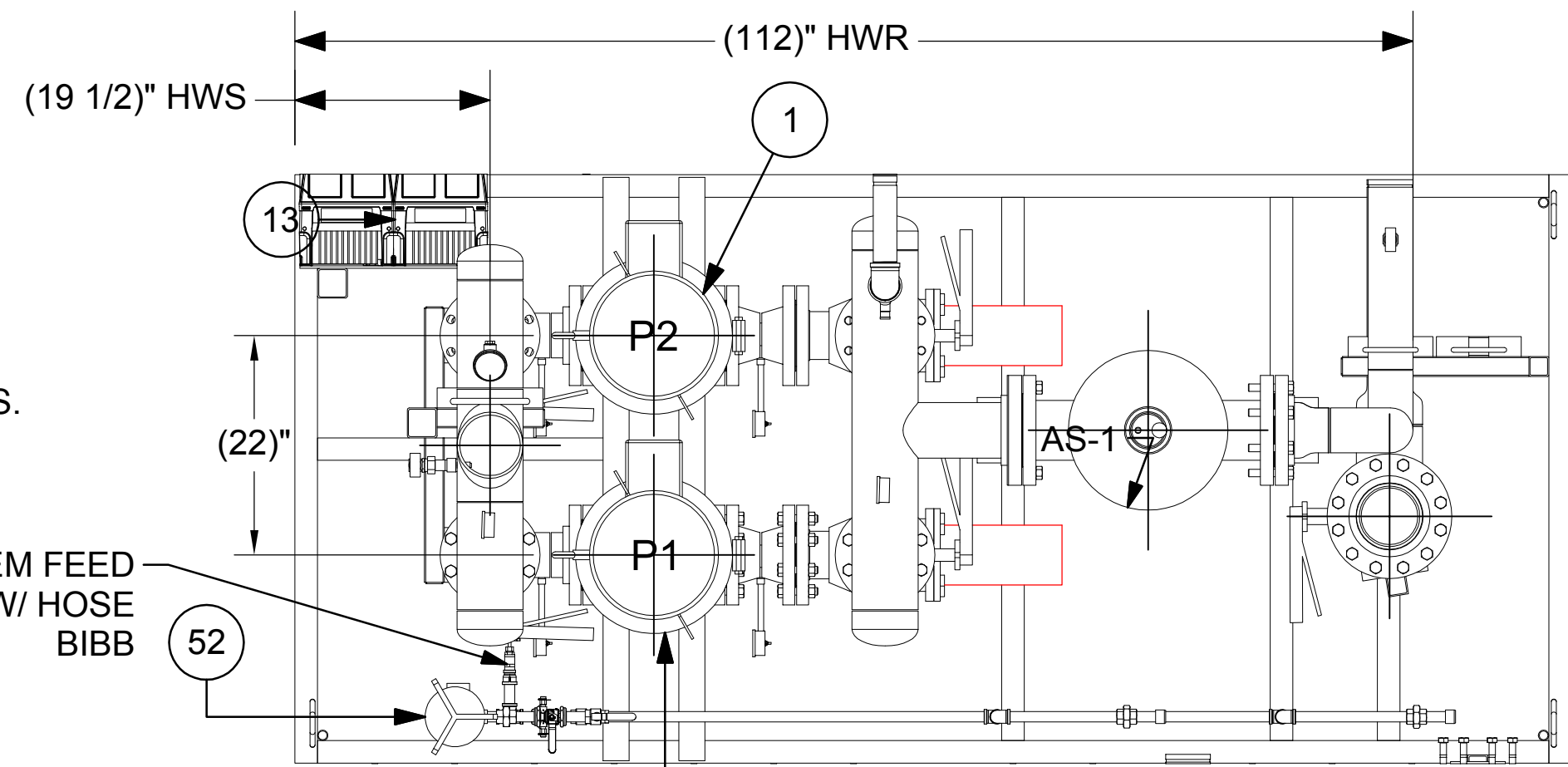
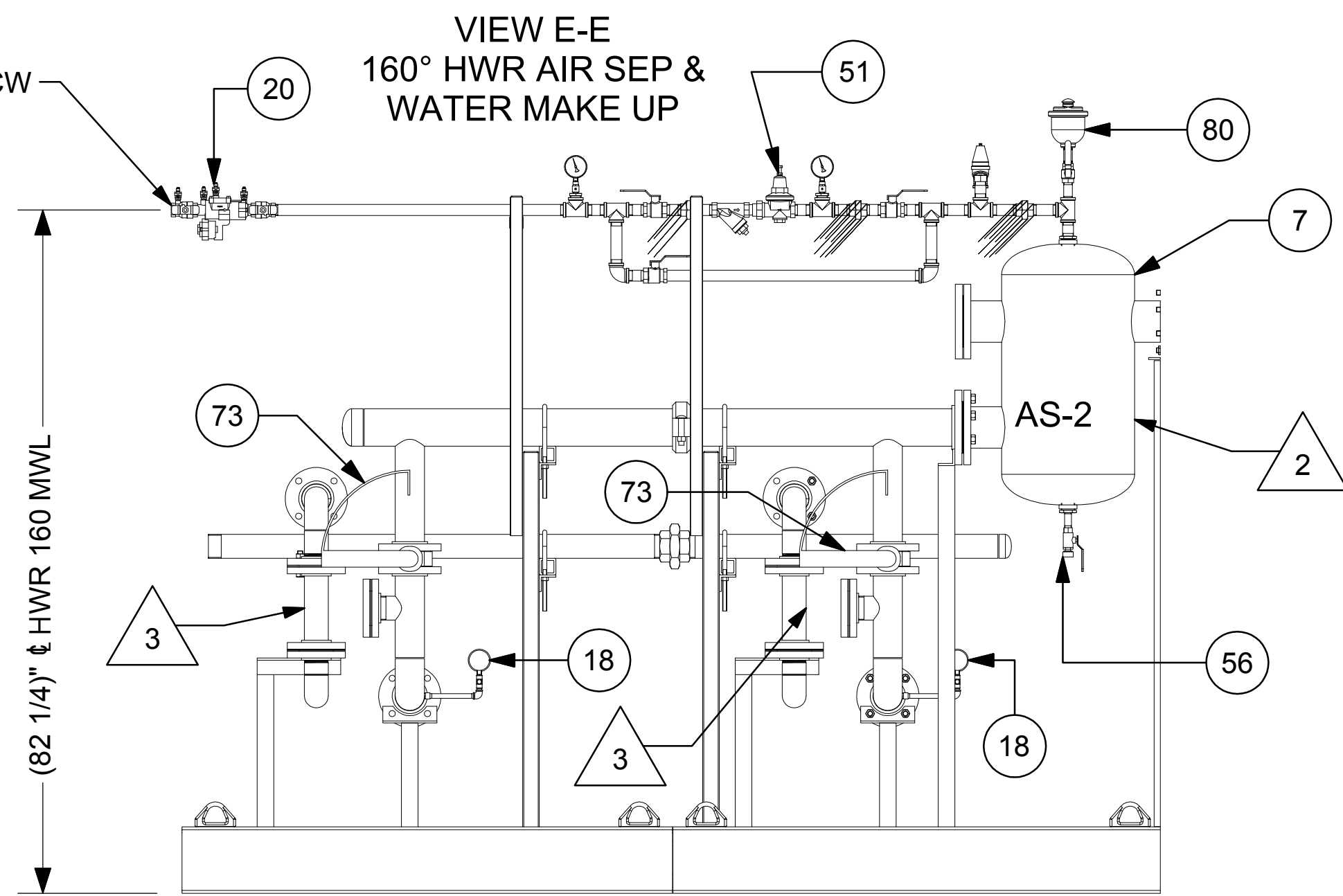
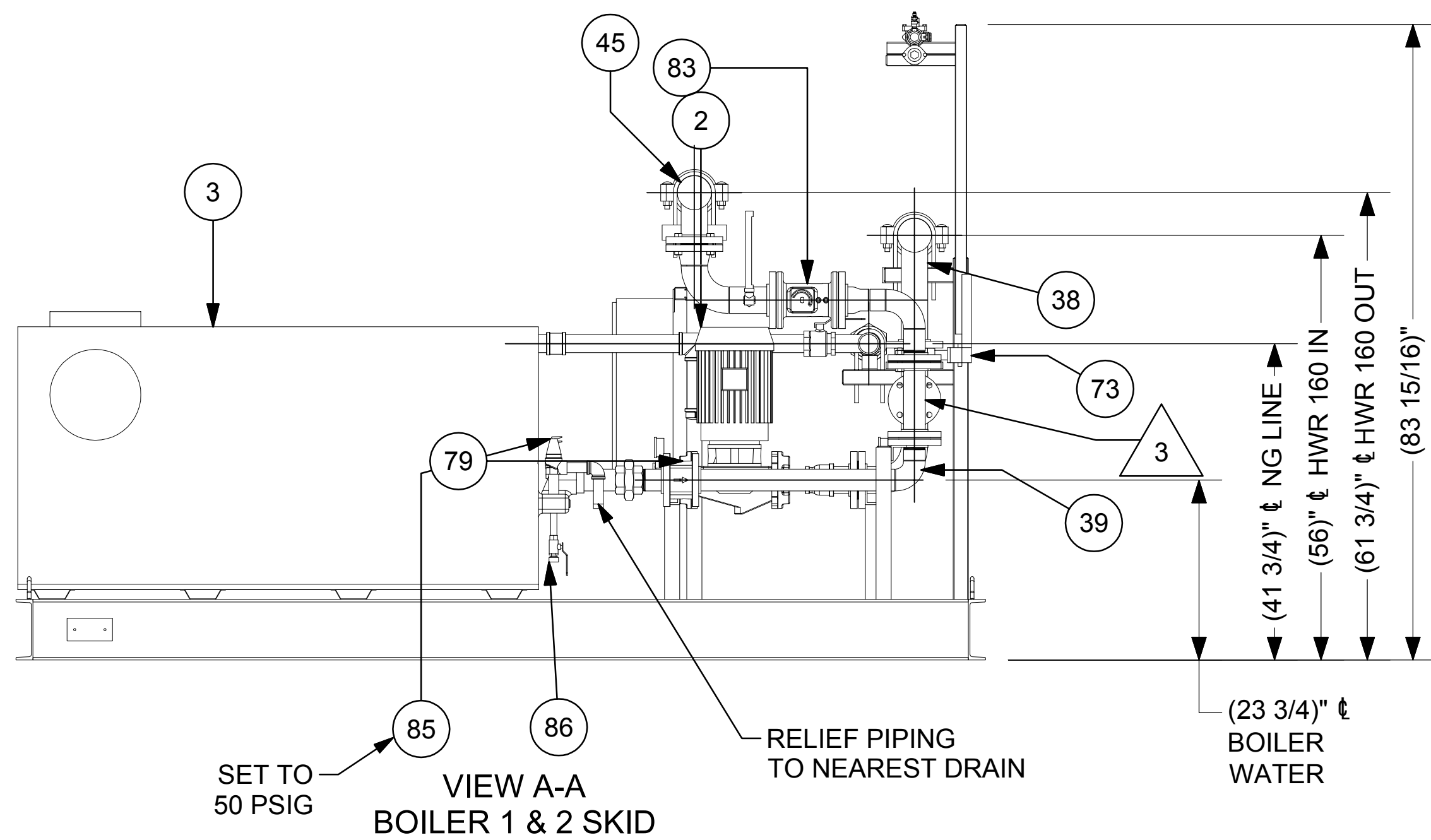
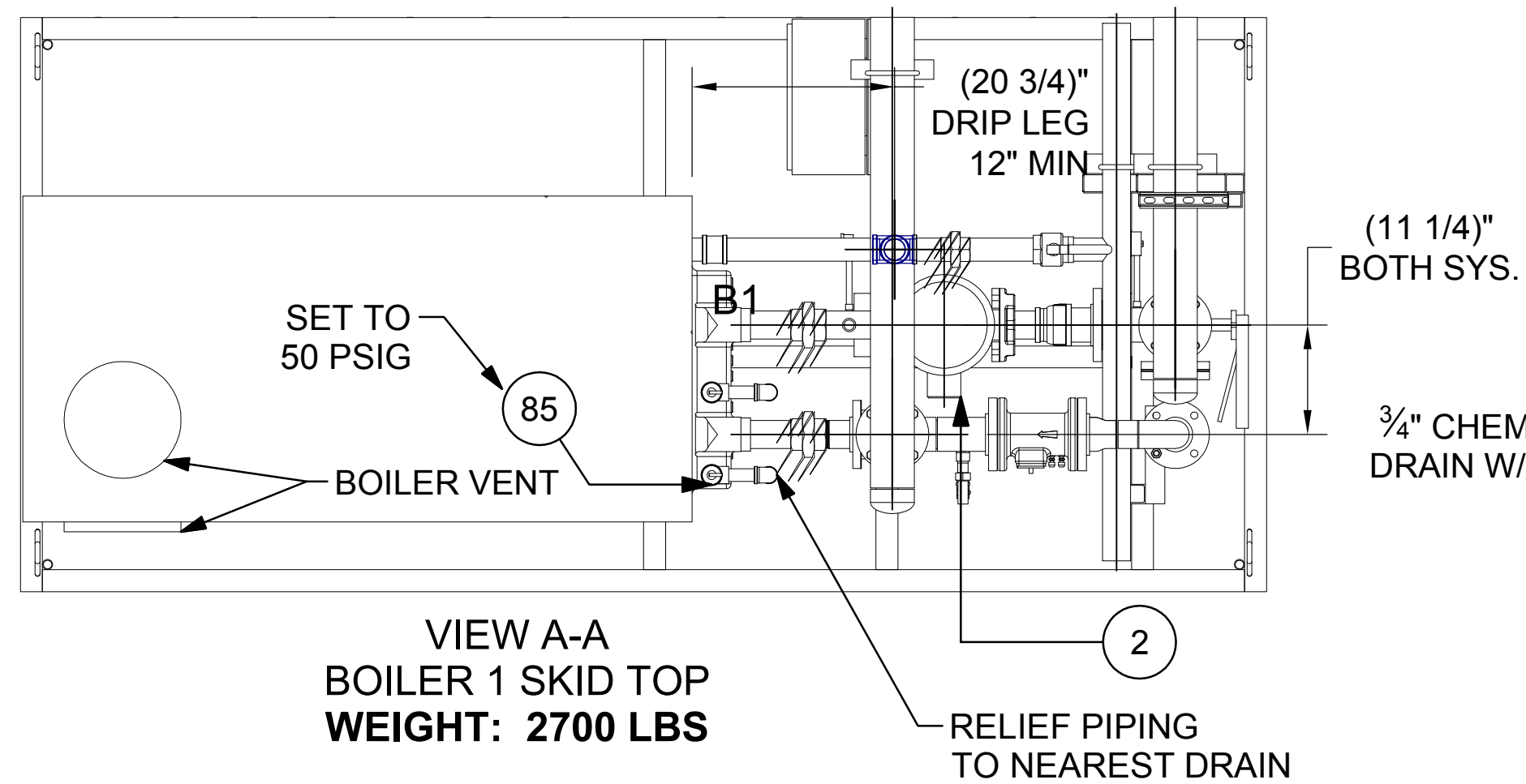
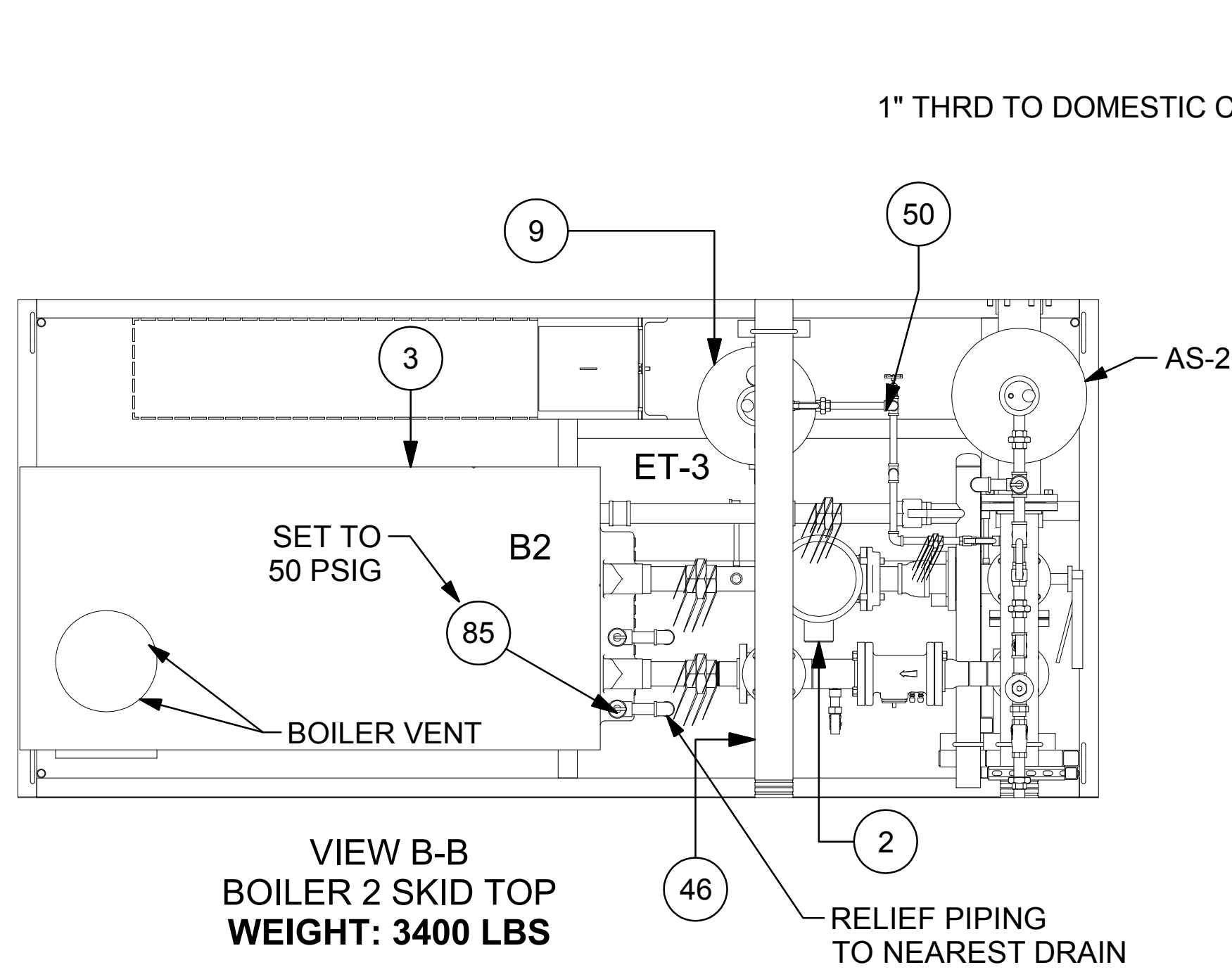
Drawing Number  
**M4.1**

**BARNARD EJMT TEAM**

**BARNARD** **RONDINELLI**  
A BEE GROUP life safety  
CONSULTING ENGINEERS

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**RECORD DRAWINGS - 2015-11-16**

Revisions	Date
Num	Description

MECHANICAL SKID VIEWS  
 Drawing Number  
**M4.2**

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 Western States Fire Protection Co.

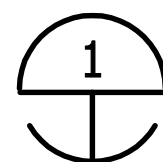
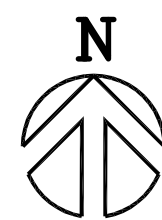
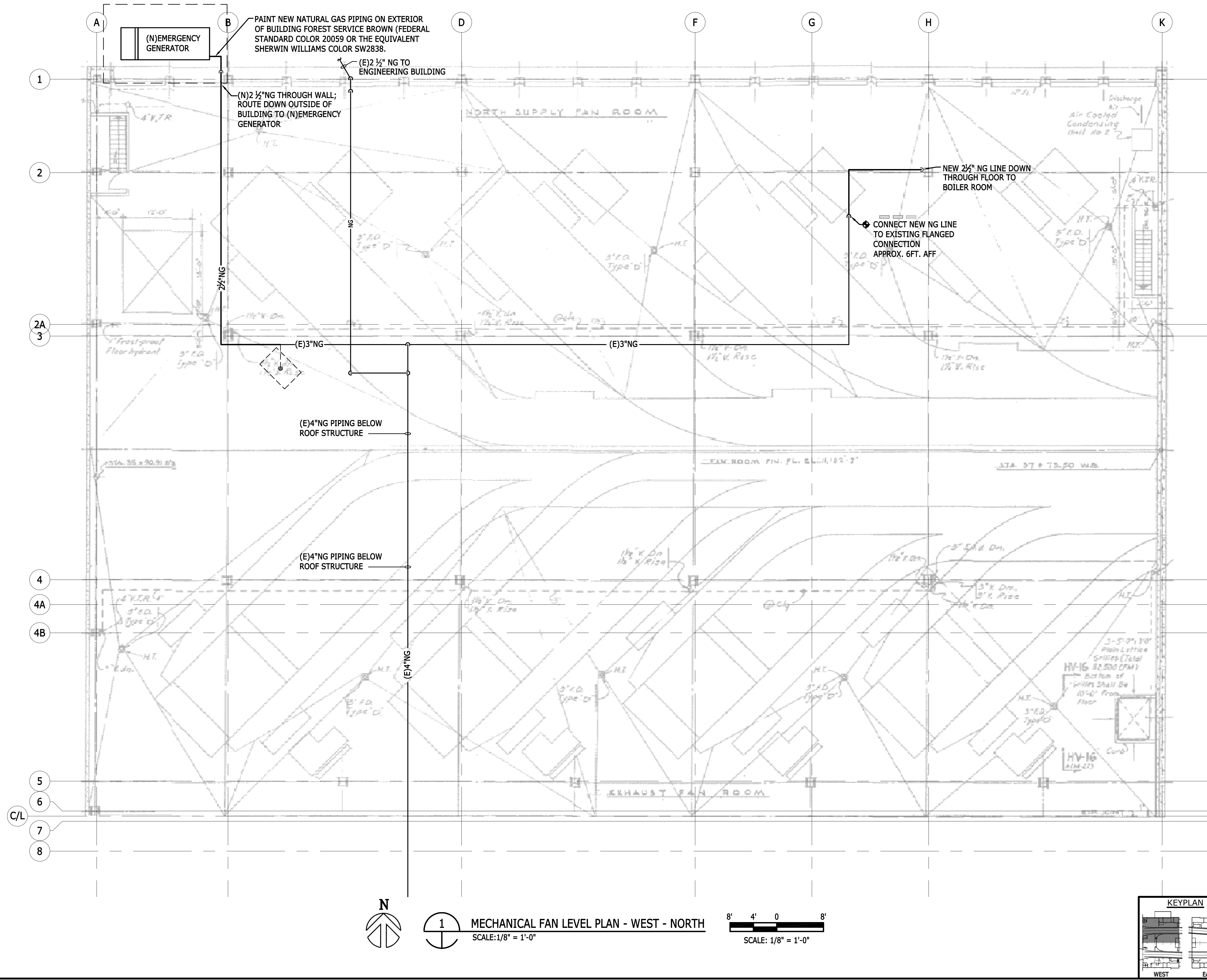
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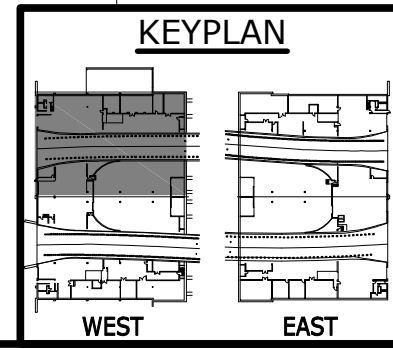
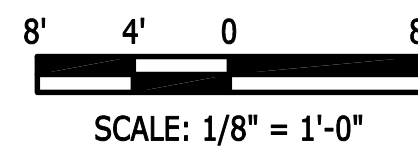




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MECHANICAL FAN LEVEL PLAN - WEST - NORTH  
SCALE: 1/8" = 1'-0"



**EISENHOWER/JOHNSON**  
**MEMORIAL TUNNEL**  
 FIXED FIRE SUPPRESSION SYSTEM  
 DESIGN BUILD PROJECT

**BARNARD EJMT TEAM**

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Revisions	Date
Num	Description

MECHANICAL FAN LEVEL PLAN - WEST - NORTH  
 Drawing Number  
**M6.1**

Project No. C0703-360  
 Subaccount 17810  
 RECORD DRAWINGS - 2015-11-16

DRAWN BY: JEB  
 CHECKED BY: RDM





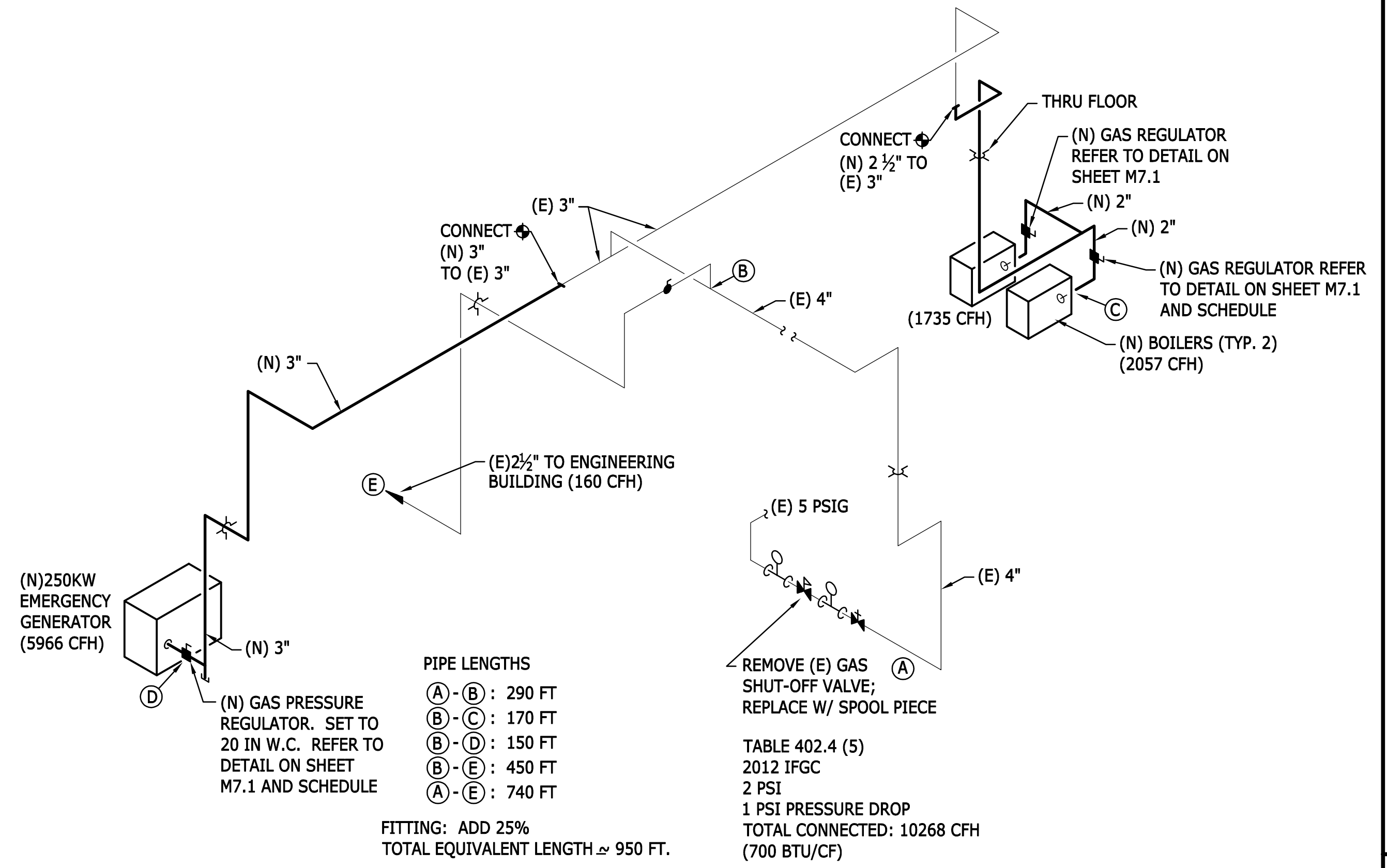








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1 EJMT GAS PIPE SIZING  
SCALE: NOT TO SCALE

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MEMORIAL TUNNEL  
FIXED FIRE SUPPRESSION SYSTEM  
DESIGN BUILD PROJECT  
Project No. C0703-360 Subaccount 17810  
RECORD DRAWINGS - 2015-11-16

Revisions	Date
Num	Description

DRAWN BY: JEB CHECKED BY: RDM

MECHANICAL GAS DETAILS  
Drawing Number  
**M7.2**

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Sturgeon  
ELECTRIC

MECHANICAL SPECIFICATIONS

230000 - BASIC MECHANICAL REQUIREMENTS

GENERAL REQUIREMENTS

- A. PROVIDE ALL ITEMS FOR COMPLETE AND SUCCESSFUL OPERATION OF ALL MECHANICAL SYSTEMS.
B. DRAWINGS ARE DIAGRAMMATIC ONLY. FOLLOW DRAWINGS AS CLOSELY AS ACTUAL BUILDING CONSTRUCTION AND THE WORK OF OTHER TRADES WILL PERMIT.
C. DEMONSTRATE THE OPERATION OF ALL SYSTEMS FOR THE OWNER AT A TIME AS DIRECTED BY THE OWNER.
D. LAY OUT ALL WORK IN ADVANCE. DO NOT DEFACE WORK OF OTHER TRADES. INSTALL ALL SLEEVES AND BLOCKOUTS; WATERPROOF AS REQUIRED.
E. RECORD DRAWINGS: THE CONTRACTOR SHALL MAINTAIN A MARK-UP SET OF DRAWINGS WHICH INDICATE VARIATIONS IN THE ACTUAL INSTALLATION FROM THE ORIGINAL DESIGN.
F. VERIFY THE ACTUAL ELECTRICAL SERVICE/VOLTAGE WITH THE ELECTRICAL DRAWINGS AND CONTRACTOR PRIOR TO ORDERING ANY MECHANICAL EQUIPMENT REQUIRING ELECTRICAL CONNECTIONS.

STANDARDS

- A. ALL MECHANICAL MATERIALS SHALL BE NEW, IN FIRST CLASS CONDITION, AND U.L. LISTED WHERE APPLICABLE.
B. COMPLY WITH CURRENT INTERNATIONAL BUILDING CODE, INTERNATIONAL MECHANICAL CODE, INTERNATIONAL PLUMBING CODE, INTERNATIONAL ENERGY COMPLIANCE CODE AND NATIONAL FIRE PROTECTION ASSOCIATION IN EFFECT FOR THIS JURISDICTION.
C. PROCURE AND PAY FOR ALL PERMITS, DEVELOPMENT FEES, LICENSES, AND LIABILITY INSURANCE, ETC. FURNISH CERTIFICATE OF FINAL INSPECTION AND APPROVAL FROM STATE BOILER INSPECTOR.
D. MATERIAL SHALL BE AS SPECIFIED, AND/OR NOTED ON THE CONTRACT DRAWING.

GUARANTEE

- A. REPLACE ANY WORK OR MATERIAL INSTALLED OR FURNISHED UNDER THIS CONTRACT WHICH DEVELOPS DEFECTS, EXCEPT FOR NORMAL WEAR, WITHIN FIVE (5) YEARS AFTER INTERIM ACCEPTANCE IS SECURED.
B. INCLUDE ROUTINE MAINTENANCE, INSPECTIONS AND PARTS FOR 5 YEARS FROM INTERIM ACCEPTANCE.

COORDINATION

- A. PRIOR TO FABRICATION OR INSTALLATION OF ANY MECHANICAL PIPING, AND PLUMBING WORK, PARTICIPATE IN PLANNING MEETINGS TO COORDINATE ROUTING OF ALL OTHER BUILDING UTILITIES SYSTEMS, SO AS TO COMPLETELY ESTABLISH ROUTINGS, ELEVATIONS, SPACE REQUIREMENTS, AND COORDINATION OF LAYOUT AND SUSPENSION REQUIREMENTS IN RELATIONSHIP TO THE BUILDING STRUCTURE.

OPERATION AND MAINTENANCE MANUALS

- A. PROVIDE O&M MANUALS FOR OWNER/ENGINEER APPROVAL AS REQUIRED BY THE CDOT CONTRACT BOOK 2 SECTION 19.16.
B. INCLUDE DESCRIPTION OF MECHANICAL EQUIPMENT, MANUFACTURER'S PRINTED OPERATING PROCEDURES, MAINTENANCE PROCEDURES, SERVICING INSTRUCTIONS AND SCHEDULES, MANUFACTURER'S SERVICE MANUALS, VALVE TAG LIST, NAME, ADDRESS AND TELEPHONE NUMBER FOR 24-HOUR SERVICE, STARTING, STOPPING, LUBRICATION, EQUIPMENT IDENTIFICATION NUMBERS, AND ADJUSTMENT CLEARLY INDICATED, PARTS LIST, MECHANICAL WARRANTIES, TEST AND BALANCE REPORT.

TRAINING

- A. PROVIDE PER THE REQUIREMENTS OF CDOT CONTRACT BOOK 2 SECTION 19.15.

230500 - BASIC MATERIALS AND METHODS

GENERAL WORK INCLUDED

- A. THE WORK INCLUDED UNDER THIS HEADING CONSISTS OF FURNISHING MATERIALS, SUPPLIES, EQUIPMENT, TOOLS, TRANSPORTATION AND FACILITIES, AND PERFORMING ALL LABOR AND SERVICES FOR, AS REQUIRED IN CONNECTION WITH, OR PROPERLY INCIDENTAL TO, THE HVAC & PLUMBING AND WORK, AS DESCRIBED IN THESE SECTIONS OF THE SPECIFICATIONS, SHOWN ON THE DRAWINGS, OR REASONABLY IMPLIED THEREFROM.
B. REMOVALS AND/OR RELOCATION OF EXISTING PIPING, INSULATION, FANS AND OTHER ASSOCIATED EQUIPMENT AS INDICATED ON THE PLANS OR AS REQUIRED TO COORDINATE AND ADAPT NEW AND EXISTING MECHANICAL SYSTEMS TO ALL OTHER WORK.
C. PROVIDE MECHANICAL IDENTIFICATION FOR ALL NEW PIPING. IDENTIFICATION SHALL BE BY SETON OR BRADY AND CONSIST OF

THE FOLLOWING:

- 1. BRASS VALVE TAGS WITH STAMPED LETTERS SHALL BE PROVIDED FOR ALL VALVES. SECURE TO THE VALVE WITH CHROME PLATED BALL CHAINS.
2. IDENTIFY ALL NEW PIPING, EQUIPMENT WITH PAINTED STENCILS, PLASTIC PIPE MARKERS OR PLASTIC TAPE MARKERS. MARKERS SHALL INDICATE TYPE INCLUDING SUPPLY OR RETURN AND DIRECTION OF FLOW.
3. ALL IDENTIFICATION SHALL CONFORM WITH ANSI A13.1.
D. SKID MOUNTED, FACTORY TESTED SYSTEMS.

230593 - TESTING, ADJUSTING, AND BALANCING

REQUIREMENTS

- A. SUBMIT TEST REPORTS FOR TESTING, ADJUSTING AND BALANCING.
B. AGENCY SHALL BE COMPANY SPECIALIZING IN THE ADJUSTING AND BALANCING OF SYSTEMS SPECIFIED IN THIS SECTION WITH MINIMUM THREE (3) YEARS DOCUMENTED EXPERIENCE AND NEBB CERTIFIED. PERFORM WORK UNDER SUPERVISION OF REGISTERED PROFESSIONAL ENGINEER.
C. TOTAL SYSTEM BALANCE SHALL BE PERFORMED IN ACCORDANCE WITH NEBB PROCEDURAL STANDARDS FOR TESTING, BALANCING AND ADJUSTING OF ENVIRONMENTAL SYSTEMS.
D. BEFORE COMMENCING WORK, VERIFY THAT SYSTEMS ARE COMPLETE AND OPERABLE. ENSURE THE FOLLOWING:
1. EQUIPMENT IS OPERABLE AND IN A SAFE AND NORMAL CONDITION.
2. TEMPERATURE CONTROL SYSTEMS ARE INSTALLED COMPLETE AND OPERABLE.
3. PROPER THERMAL OVERLOAD PROTECTION IS IN PLACE FOR ELECTRICAL EQUIPMENT.
4. PUMP& PIPING INSTALLATION IS COMPLETE AND OPERATIONAL.
E. PROMPTLY REPORT ABNORMAL CONDITIONS IN MECHANICAL SYSTEMS OR CONDITIONS WHICH PREVENT SYSTEM BALANCE.
F. ADJUSTING AND BALANCING:
1. ADJUST PUMPING SYSTEMS.
2. RECORDED DATA SHALL REPRESENT ACTUALLY MEASURED, OR OBSERVED, INITIAL CONDITION, AND FINAL CONDITION AFTER BALANCING.
3. PERMANENTLY MARK SETTINGS OF VALVES, AND OTHER ADJUSTMENT DEVICES ALLOWING SETTINGS TO BE RESTORED. SET AND LOCK MEMORY STOPS.
4. LEAVE SYSTEMS IN PROPER WORKING ORDER, CLOSING ACCESSORY DOORS, CLOSING DOORS TO ELECTRICAL SWITCH BOXES.
5. BALANCE SYSTEMS TO WITHIN 5% OF SCHEDULED VALUE.
G. COMPLY WITH THE REQUIREMENTS OF CDOT RFP BOOK 2 SECTION 19.14.

230700 - MECHANICAL INSULATION

- A. INSULATION THICKNESS BASED ON ASHRAE 90.1 RECOMMENDATIONS.
B. MANUFACTURERS: CERTAINTED; OWENS-CORNING; JOHNS-MANVILLE, CORP.; MANSON INSULATION CO.; ARMSTRONG; OR EQUAL.
C. GLASS FIBER: ASTM C 547, TYPE 1, RIGID MOLDED, NONCOMBUSTIBLE, 0.23 "K" VALUE AT 75 DEGREE F MEAN TEMPERATURE, MAXIMUM SERVICE TEMPERATURE 850 DEGREE F, MOISTURE SORPTION LESS THAN 0.2% BY VOLUME. COMPOSITE 25/50-FLAME SPREAD/SMOKE DEVELOPED RATING (ASTM E 84, UL 723, AND NFPA 255).
1. VAPOR RETARDER JACKET: ASTM C 1136, 45LBS/IN TENSILE STRENGTH (ASTM D 828), OR BEACH PUNCTURE 50 OZ IN/IN TEAR MINIMUM (ASTM D 781). WHITE KRAFT PAPER REINFORCED WITH GLASS FIBER YARN AND BONDED TO ALUMINUM FOIL, SECURED WITH SELF-SEALING LONGITUDINAL LAPS AND BUTT STRIPS.
2. CONNECTIONS: TACKS, PRESSURE SENSITIVE COLOR MATCHING VINYL TAPE, PERMA-WELD ADHESIVE.
D. EQUIPMENT INSULATION: RIGID FIBERGLASS BOARD (LOW TEMPERATURE): ASTM C 612, TYPE IA AND IB, 3 LB/CU FT DENSITY, 0.23 "K" VALUE AT 75 DEGREE F MEAN TEMPERATURE, MAXIMUM SERVICE TEMPERATURE 450 DEGREE F, MOISTURE SORPTION LESS THAN 5.0% BY WEIGHT, ALUMINUM FOIL FACING REINFORCED WITH FIBERGLASS SCRIM LAMINATED TO UL RATED KRAFT PAPER. COMPOSITE 25/50-FLAME SPREAD/SMOKE DEVELOPED RATING (ASTM E 84, UL 723, AND NFPA 90A).
1. SECURE WITH UL LISTED PRESSURE SENSITIVE TAPE AND/OR OUTWARD CLINCHED EXPANDED STAPLES AND VAPOR BARRIER COATING AS NEEDED.
E. EQUIPMENT INSULATION ACCESSORIES: PROVIDE STAPLES, BANDS, WIRE, WIRE NETTING, TAPE, CORNER ANGLES, ANCHORS AND STUD PINS AS RECOMMENDED BY INSULATION MANUFACTURER FOR APPLICATIONS INDICATED.
F. EQUIPMENT INSULATION COATINGS, MASTICS AND ADHESIVES.

- 1. VAPOR BARRIER COATING (STORE AND APPLY BETWEEN 40° F AND 100° F, PROTECT FROM FREEZING UNTIL DRY): USED ON BELOW AMBIENT PIPING/DUCT TO PREVENT MOISTURE INGRESS. PERMEANCE SHALL BE 0.013 PERMS OR LESS AT 43 MILS DRY PER ASTM E 96, PROCEDURE B.
a. FOSTER 30-80
b. CHILDERS CP-38
c. VIMASCO 749
G. HOT LOW PRESSURE PIPING (141° F TO 200° F):
1. APPLICATIONS:
a. HOT WATER SUPPLY AND RETURN.
b. DOMESTIC COLD WATER SUPPLY AND RETURN.
2. INSULATION:
a. FIBERGLASS: 1-1/2 INCH THICKNESS UP TO 1 1/2" INCH PIPE, 2-INCH THICKNESS FOR ALL OTHER PIPE SIZES.
H. HOT EQUIPMENT INSULATION (ABOVE AMBIENT TEMPERATURE):
1. APPLICATIONS:
a. HEAT EXCHANGERS.
b. HOT WATER EXPANSION TANKS.
c. AIR SEPARATORS.
2. INSULATION:
a. FIBERGLASS (HIGH TEMPERATURE): 2-INCH THICKNESS. DO NOT USE FOR EQUIPMENT ABOVE 450 DEGREE F.
I. INSTALLATION OF PIPING INSULATION
1. INSTALL INSULATION AFTER PIPING SYSTEM TESTS HAVE BEEN COMPLETED.
2. CLEAN PIPING TO REMOVE FOREIGN SUBSTANCES AND MOISTURE PRIOR TO APPLYING INSULATION.
3. INSTALL INSULATION PRODUCTS ACCORDING TO MANUFACTURER'S WRITTEN INSTRUCTIONS, BUILDING CODES, AND RECOGNIZED INDUSTRY STANDARDS.
4. OMIT INSULATION ON UNIONS, BALANCE COCKS, FLOW REGULATORS.
5. SECURE LONGITUDINAL JACKET LAPS AND BUTT STRIPS ACCORDING TO MANUFACTURER'S RECOMMENDATIONS.
6. FIRMLY RUB LAP AND BUTT STRIPS TO PRESSURIZE SEAM AND ENSURE POSITIVE CLOSURE.
7. INSULATE EACH CONTINUOUS RUN OF PIPING WITH FULL-LENGTH UNITS OF INSULATION, WITH SINGLE CUT PIECE TO COMPLETE RUN. DO NOT USE SCRAPS.
8. APPLY INSULATION TO PIPING WITH ALL JOINTS TIGHTLY FITTED TO ELIMINATE VOIDS.
9. EXTEND SURFACE FINISHES TO PROTECT ALL SURFACES, END, AND RAW EDGES OF INSULATION.
10. PROTECT VAPOR-BARRIER JACKETS ON PIPE INSULATION FROM PUNCTURE OR OTHER DAMAGE. AVOID THE USE OF STAPLES ON VAPOR BARRIER JACKETS. SEAL VAPOR BARRIER PENETRATIONS WITH VAPOR BARRIER COATING.
11. COVER VALVES, FITTINGS AND SIMILAR ITEMS WITH EQUIVALENT THICKNESS AND COMPOSITION OF INSULATION AS APPLIED TO ADJOINING PIPE RUN. INSTALL FACTORY MOLDED OR JOB FABRICATED COVERS (AT INSTALLER'S OPTION).
12. EXTEND PIPING INSULATION WITHOUT INTERRUPTION THROUGH WALLS, FLOORS AND SIMILAR PIPING PENETRATIONS.
13. PROVIDE THERMAL SHIELD INSERTS ON ALL PIPE.
a. MINIMUM INSULATION INSERT LENGTHS:
(1.) 1-1/2 - 2-1/2 INCH PIPE: 10-INCHES
(2.) 3 - 6-INCH PIPE: 12-INCHES
14. APPLY GALVANIZED METAL SHIELDS BETWEEN HANGERS OR SUPPORTS AND PIPE INSULATION. FORM SHIELDS TO FIT THE INSULATION AND EXTEND UP TO THE CENTERLINE OF THE PIPE. THE SHIELD LENGTH SHALL BE 4-INCHES LESS THAN THE ASSOCIATED INSULATION HANGER INSERT TO ALLOW FOR VAPOR RETARDING BUTT JOINTS ON EACH SIDE OF THE SHIELDS.
15. APPLY ADHESIVES, MASTICS AND COATINGS AT MANUFACTURER'S RECOMMENDED MINIMUM COVERAGE PER GALLON.
16. REPLACE ALL DAMAGED INSULATION IN WHOLE; REPAIR OF DAMAGED INSULATION WILL NOT BE ACCEPTED.
17. INSULATE FITTINGS AND VALVES WITH PVC INSULATED FITTING COVERS AND INSULATION INSERTS PER MANUFACTURER'S RECOMMENDATIONS.
J. INSTALLATION OF EQUIPMENT INSULATION
1. INSTALL INSULATION PRODUCTS ACCORDING TO MANUFACTURER'S INSTRUCTIONS, BUILDING CODES, AND RECOGNIZED INDUSTRY STANDARDS.
2. APPLY INSULATION AS CLOSE AS POSSIBLE TO EQUIPMENT BY GROOVING, SCORING, AND BEVELING INSULATION, IF NECESSARY. AS REQUIRED, SECURE INSULATION TO EQUIPMENT WITH STUDS, PINS, CLIPS, ADHESIVE, WIRES, OR BANDS
3. FILL JOINTS, CRACKS, SEAMS, AND DEPRESSIONS WITH BEDDING COMPOUND TO FORM SMOOTH SURFACE. ON COLD EQUIPMENT USE VAPOR RETARDANT CEMENT
4. MAINTAIN INTEGRITY OF VAPOR-BARRIER ON EQUIPMENT INSULATION AND PROTECT IT TO PREVENT PUNCTURE AND OTHER DAMAGE.
5. DO NOT APPLY INSULATION TO EQUIPMENT, MUFFLERS,

- BREECHINGS, OR STACKS WHILE HOT.
6. APPLY INSULATION USING STAGGERED JOINT METHOD AND DOUBLE LAYER CONSTRUCTION. APPLY EACH LAYER OF INSULATION SEPARATELY.
7. COVER INSULATED SURFACES WITH ALL-SERVICE JACKETING NEATLY FITTED AND FIRMLY SECURED. LAP SEAMS AT LEAST 2-INCH. APPLY OVER VAPOR BARRIER WHERE APPLICABLE.
8. DO NOT INSULATE MANHOLES, HANDHOLES, CLEANOUTS, ASME STAMP, OR MANUFACTURER'S NAMEPLATE. PROVIDE NEATLY BEVELED EDGE AT INTERRUPTIONS OF INSULATION.
9. PROVIDE REMOVABLE INSULATION SECTIONS WITH ALUMINUM JACKET AND STAINLESS STEEL BANDS TO COVER PARTS OF EQUIPMENT WHICH MUST BE OPENED FOR MAINTENANCE; INCLUDE METAL VESSEL COVERS, FASTENERS, FLANGES, FRAMES AND ACCESSORIES.

230900 - CONTROLS AND INSTRUMENTATION

WORK INCLUDED

- A. PROVIDE ALL LABOR, EQUIPMENT, AND MATERIAL NECESSARY FOR COMPLETE AND FULLY OPERATIONAL TEMPERATURE CONTROL VALVE OPERATION AND PROVIDE INTERFACE WITH BAS/LOCAL EQUIPMENT OPERATION THROUGH COORDINATION WITH OWNER.
B. THE AUTOMATIC TEMPERATURE CONTROL VALVE SYSTEM SHALL BE ELECTRIC.
C. THE CONTROL SYSTEM SHALL INCLUDE ALL CONTROL VALVES, OPERATORS, REQUIRED TO FULFILL THE INTENT OF THE DRAWINGS AND THE SEQUENCE OF OPERATION. COORDINATE ALL WORK WITH THE EQUIPMENT SUPPLIERS/OWNER AND ELECTRICAL CONTRACTOR.
D. PROVIDE ALL COMPLETION SERVICES SPECIFIED HEREINAFTER, INCLUDING FINAL SYSTEM PERFORMANCE VERIFICATION, TO ENSURE THE SYSTEM FUNCTIONS AS SPECIFIED IN THE SEQUENCE OF OPERATION.
E. CONTROLS AND ALARMS SHALL INTERFACE WITH FIRE ALARM SYSTEM.

AUTOMATIC CONTROL VALVES

- A. ALL AUTOMATIC CONTROL VALVES SHALL BE FURNISHED UNDER THIS SECTION AND INSTALLED UNDER THE MANUFACTURER'S INSTALLATION INSTRUCTIONS.
B. SIZE VALVES AND PROVIDE WITH ACTUATORS OF SUFFICIENT POWER FOR THE DUTY INTENDED. VALVE BODY AND ACTUATOR SELECTION SHALL BE SUFFICIENT TO HANDLE SYSTEM PRESSURE AND CLOSE AGAINST THE DIFFERENTIAL PRESSURES ENCOUNTERED. VALVE PRESSURE DROPS FOR WATER VALVES WILL BE 4-6 PSI FOR THE GPM SHOWN ON THE DRAWINGS.
C. VALVES AND ACTUATORS SHALL BE FOR NORMALLY-OPEN OR NORMALLY-CLOSED OPERATION AS SHOWN ON THE DRAWINGS.

CONTROL WIRING

- A. ELECTRICAL WIRING: PROVIDE IN ACCORDANCE WITH DIVISION 16 AS REQUIRED FOR THE TEMPERATURE CONTROL SYSTEM, INCLUDING ELECTRICAL INTERLOCK WIRING. COMPLY WITH THE NATIONAL ELECTRICAL CODE, LOCAL CODES, AND DIVISION 16 OF THESE SPECIFICATIONS.
B. INTERNAL CONTROL WIRING FOR EQUIPMENT SHALL BE PROVIDED BY THE MANUFACTURERS OF THAT EQUIPMENT.

232112 - SEISMIC

- A. PROVIDE SEISMIC BRACING ON PIPING IN MECHANICAL ROOM WHICH MATCHES THE ENTIRE FIRE SPRINKLER PIPING SYSTEM AND COMPLIES WITH THE BASE CONTRACT.

232113 - PIPING

- A. HEATING WATER PIPING: SCHEDULE 40, SEAMLESS OR RESISTANCE WELDED, STANDARD STEEL, CAST IRON SCREWED FITTINGS, RATED FOR 125 PSI. TEST PIPING FOR AT LEAST SIX (6) CONSECUTIVE HOURS, DURING WHICH TIME, PRESSURE SHALL REMAIN CONSTANT WITHOUT PUMPING. SUBJECT WELDED JOINTS TO THE HAMMER TEST AND COPPER JOINTS TO SOAP SUDS WHILE UNDER HYDROSTATIC PRESSURE.
B. THE HEATING WATER PIPING SHALL BE TYPE "L" HARD DRAWN COPPER, WITH CAST BRONZE OR WROUGHT COPPER FITTINGS, SOLDER JOINTS USING 95-5 SOLDER.
C. PROVIDE DIELECTRIC ISOLATION AND/OR COUPLINGS (I.E., WATERWAY FITTINGS) AT ALL CONNECTIONS BETWEEN DISSIMILAR PIPING.
D. PROVIDE CHEMICAL TREATMENT OF BOILER HEATING SYSTEM. PROVIDE USE 'BY-PASS FEEDER' FOR SOURCE AND PROVIDE CHEMICALS BRICKETTES.
E. NATURAL GAS PIPING
1. PIPE 2-INCHES AND SMALLER: ASTM A 53, GRADE B, TYPE E, SCHEDULE 40 BLACK STEEL PIPE, ELECTRIC RESISTANCE WELDED.
2. FITTINGS:
a. MALLEABLE IRON THREADED FITTINGS: ANSI B16.3; (CLASS

- 125 AND 300).
b. MALLEABLE IRON THREADED UNIONS: ANSI B16.30, CLASS 150, 250 OR 300; SELECTED BY INSTALLER FOR PROPER PIPING FABRICATION AND SERVICE REQUIREMENTS, INCLUDING STYLE, END CONNECTIONS, AND METAL-TO-METAL SEATS (IRON, BRONZE OR BRASS).
c. FORGED STEEL SOCKET-WELDED AND THREADED FITTINGS: ANSI B16.11, EXCEPT MSS SP-79 FOR THREADED REDUCER INSERTS; RATED TO MATCH SCHEDULE OF CONNECTED PIPE (UP TO 4-INCH PIPE SIZE).
3. PIPE 2-1/2 INCH AND LARGER: ASTM A 53, GRADE B, TYPE S, SCHEDULE 40 SEAMLESS BLACK STEEL PIPE.
4. FITTINGS:
a. STEEL FLANGES/FITTINGS: ANSI B 16.5, INCLUDING BOLTING AND GASKETING OF THE FOLLOWING MATERIAL GROUP, END CONNECTION AND FACING, EXCEPT AS OTHERWISE INDICATED.
1) MATERIAL GROUP: GROUP 1.1
2) END CONNECTIONS: BUTT WELD
3) FACINGS: RAISED-FACE
b. FORGED STEEL SOCKET-WELDED AND THREADED FITTINGS: ANSI B16.11, EXCEPT MSS SP-79 FOR THREADED REDUCER INSERTS; RATED TO MATCH SCHEDULE OF CONNECTED PIPE (UP TO 4-INCH PIPE SIZE).
c. WROUGHT STEEL BUTT-WELDED FITTINGS: ANSI B16.9, EXCEPT ANSI B16.28 FOR SHORT-RADIUS ELBOWS AND RETURNS; RATED TO MATCH CONNECTED PIPE.

F. NATURAL GAS VALVES

- 1. GAS COCKS 2-INCH AND SMALLER: 150 PSI WOG, BRONZE BODY, STRAIGHTAWAY PATTERN, SQUARE HEAD, THREADED ENDS. ACCEPTABLE MANUFACTURERS: LUNKENHEIMER, NIBCO, POWELL, STOCKHAM.
2. GAS COCKS 2-1/2 INCH AND LARGER: MSS SP-78; 175 PSI, LUBRICATED PLUG TYPE, SEMI-STEEL BODY, SINGLE GLAND, WRENCH OPERATED, FLANGED ENDS. ACCEPTABLE MANUFACTURERS: LUNKENHEIMER, NIBCO, POWELL, STOCKHAM.

232114 - PIPING SPECIALTIES

VALVES

- A. GENERAL: COMPLY WITH MSS-92 1980 "VALVE USERS MANUAL".
B. SIZES: PROVIDE VALVES OF SAME SIZE AS UPSTREAM PIPE SIZE. SIZE CONTROL VALVES FOR REQUIRED FLOW.
C. EXTENDED STEMS: WHERE INSULATION IS INDICATED OR SPECIFIED, PROVIDE EXTENDED STEMS TO ALLOW FULL OPERATION OF THE VALVE WITHOUT INTERFERENCE BY THE INSULATION.
D. BYPASS AND DRAIN CONNECTIONS: COMPLY WITH MSS SP-45.
E. END CONNECTIONS: AS SPECIFIED IN THE INDIVIDUAL VALVES SPECIFICATIONS.
1. THREADS: COMPLY WITH ANSI B2.1.
2. FLANGES: COMPLY WITH ANSI B16.1 FOR CAST IRON, ANSI B16.5 FOR STEEL, AND ANSI B16.24 FOR BRONZE.
3. SOLDER-JOINT: COMPLY WITH ANSI B16.18. WHERE SOLDERED END CONNECTIONS ARE USED, USE SOLDER HAVING A MELTING POINT BELOW 840 DEGREE F FOR CHECK VALVES AND BELOW 421 DEGREE F FOR BALL VALVES.
F. BALL VALVES: 3-INCH AND SMALLER: MSS-SP-110, 150 PSI SWP, 600 PSI WOG, TWO-PIECE ASTM B584 CAST BRONZE BODY, FULL PORT, CHROME PLATED BRASS/BRONZE BALL, TFE SEATS, ANTI-BLOWOUT STEM SEPARATE PACKNUT WITH ADJUSTABLE STEM PACKING, EXTENDED STEM, AND VINYL COVERED STEEL HANDLE. THREADED OR SOLDERED END CONNECTIONS. ACCEPTABLE MANUFACTURERS: NIBCO T/S 585-70; MILWAUKEE; APOLLO (CONBRACO); WATTS; GRINNELL
G. BUTTERFLY VALVES: 4-INCH AND LARGER: MSS-SP-68, ASTM A126, CLASS B FULLY LUGGED IRON BODY, ASTM B148 ALUMINUM BRONZE DISC, ASTM A582 416 STAINLESS STEEL STEM, RTFE SEAT LINER, REINFORCED NYLON BEARINGS, EPDM BUSHING AND NBR STEM SEALS. ASTM CLASS 250 WOG RATING. EPDM LINER, RATED FOR 200 PSI BI-DIRECTIONAL SHUTOFF AND 200 PSI DEAD-END SERVICE WITH DOWNSTREAM PIPING REMOVED. PROVIDE EXTENDED NECK FOR INSULATION. SIZES 4"-6" SHALL BE LEVER OPERATED WITH 10-POSITION THROTTLING PLATE. ACCEPTABLE MANUFACTURERS; KEYSTONE; NIBCO; MILWAUKEE; "ML" SERIES; STOCKHAM; CENTERLINE; WATTS; GRINNELL; VICTAULIC; APOLLO; DEZURIK
H. CHECK VALVES:
1. SWING CHECK VALVE: 2-1/2 INCH AND SMALLER: MSS SP-80; CLASS 150 SWP, ASTM B62 BRONZE BODY AND BONNET, HORIZONTAL SWING DESIGN, Y-PATTERN, WITH TFE SEAT DISC. THREADED OR SOLDERED END CONNECTIONS. ACCEPTABLE MANUFACTURERS: NIBCO T/S 433-Y; MILWAUKEE; GRINNELL; STOCKHAM.
2. 3-INCH AND LARGER: MSS SP-71; CLASS 250, ASTM A126 CLASS B DUCTILE IRON BODY WITH BRONZE TRIM, NON-ASBESTOS GASKET, HORIZONTAL SWING, AND FLANGED ENDS. VALVE SHALL BE CAPABLE OF BEING REFITTED WITHOUT REMOVING FROM PIPE. ACCEPTABLE MANUFACTURERS: NIBCO F918-B; MILWAUKEE; STOCKHAM; HAMMOND; GRINNELL.

IF THIS SHEET IS NOT 22"x34" IT IS NOT PLOTTED TO SCALE

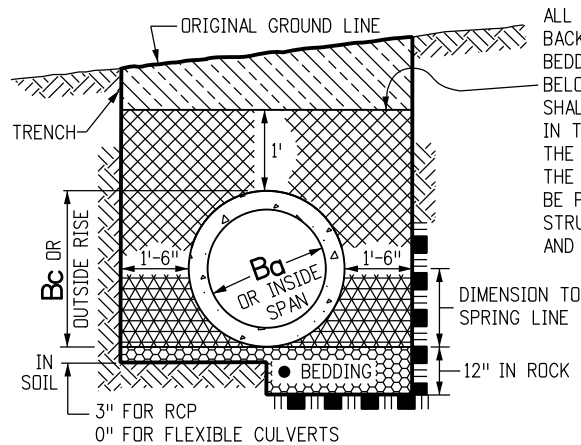
Vertical sidebar containing logos for BARNARD EJMT TEAM, RONDINELLI, BARNARD, BCR, Sturgeon Electric, and EISENHOWER/JOHNSON MEMORIAL TUNNEL. Includes project details: Project No. C0703-360, Subaccount 17810, RECORD DRAWINGS - 2015-11-16, and a Revisions table.







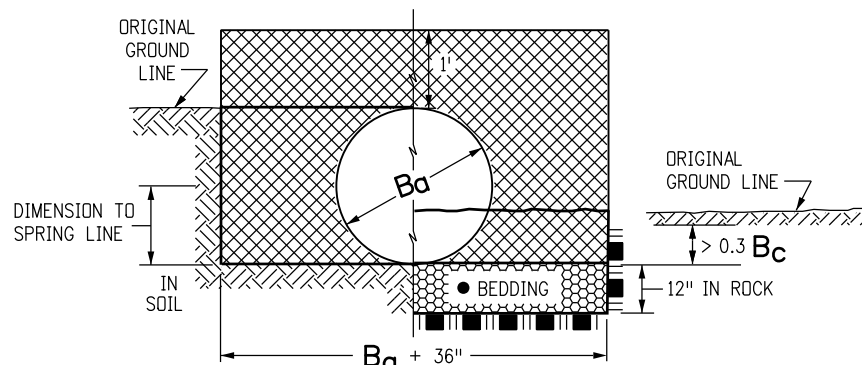




**PIPE IN TRENCH**

- THE BEDDING MATERIAL FOR RIGID PIPE IN SOIL SHALL BE 3 IN. OF LOOSE STRUCTURE BACKFILL (CLASS 1 OR 2). BEDDING IS NOT REQUIRED FOR FLEXIBLE PIPE IN SOIL. BEDDING MATERIAL FOR RIGID OR FLEXIBLE PIPE IN ROCK SHALL BE 12 IN. OF LOOSE STRUCTURE BACKFILL, CLASS 1.

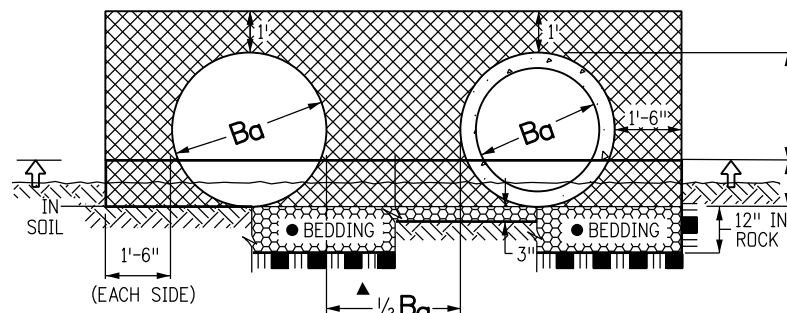
ALL EXCAVATION AND BACKFILL, INCLUDING BEDDING MATERIAL BELOW THIS LINE SHALL BE INCLUDED IN THE BID PRICE FOR THE PIPE. ABOVE THE LINE, THEY SHALL BE PAID FOR AS STRUCTURE EXCAVATION AND EMBANKMENT.



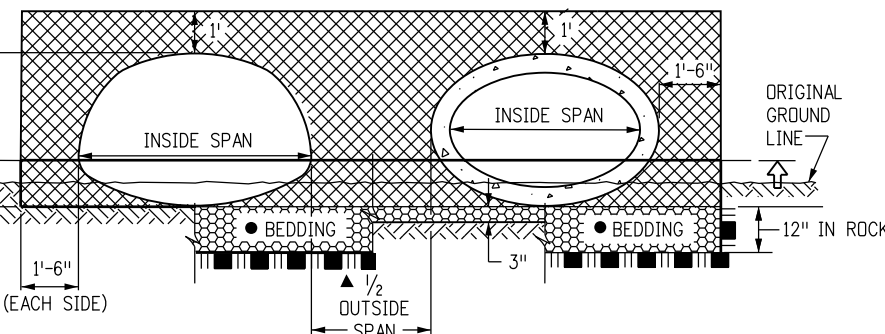
**CIRCULAR PIPE**

(WHERE ORIGINAL GROUND LINE IS BETWEEN  $0.3 B_c$  AND  $B_c + 1$  FT. ABOVE FLOWLINE)

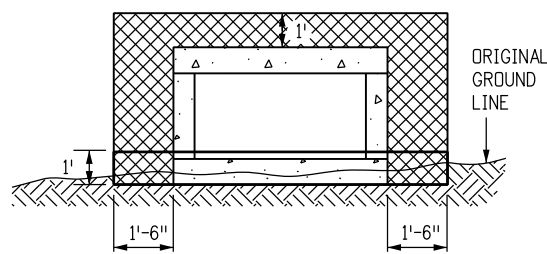
- ▲ WHEN TWO OR MORE CONDUITS ARE LAID SIDE-BY-SIDE, THEY SHALL BE PLACED SO THAT THEY ARE  $\frac{1}{2}$  OUTSIDE DIAMETER, OR  $\frac{1}{2}$  OUTSIDE SPAN, OR 3 FT. APART, WHICHEVER IS LESS. HOWEVER, IF END SECTIONS ARE USED, THE MINIMUM SPACING SHALL BE 1 FT. BETWEEN END SECTIONS.



**CIRCULAR PIPE IN FILL**

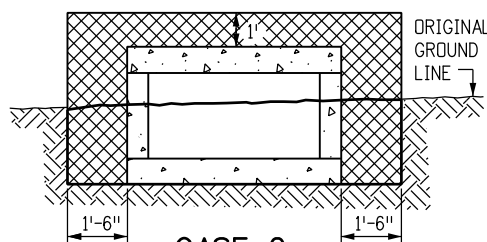


**ARCH OR ELLIPTICAL PIPE IN FILL**



**CASE 1**

APPLIES WHEN THE ORIGINAL GROUND LINE IS LESS THAN 1 FT. ABOVE THE BOTTOM OF THE BOX CULVERT. THE EMBANKMENT SHALL BE BUILT UP TO 1 FT. ABOVE THE BOTTOM OF THE BOX CULVERT AND THEN EXCAVATED TO THE BOTTOM OF THE BOX CULVERT. THIS EMBANKMENT AND EXCAVATION WILL NOT BE MEASURED AND PAID FOR SEPARATELY BUT SHALL BE INCLUDED IN THE COST OF THE WORK.

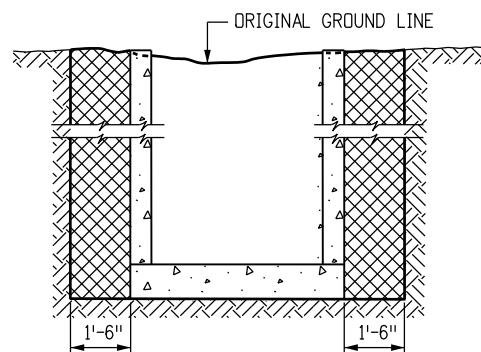


**CASE 2**

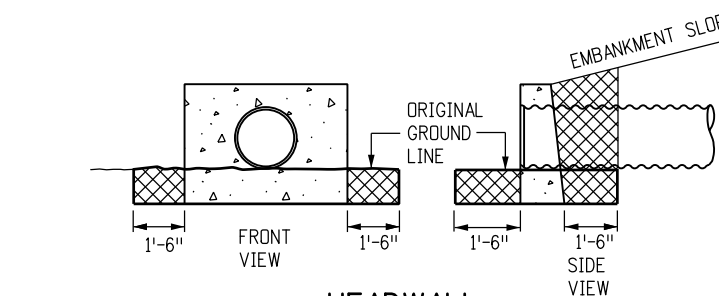
APPLIES WHEN THE ORIGINAL GROUND LINE IS MORE THAN 1 FT. ABOVE THE BOTTOM OF THE BOX CULVERT.

**CONCRETE BOX CULVERT**

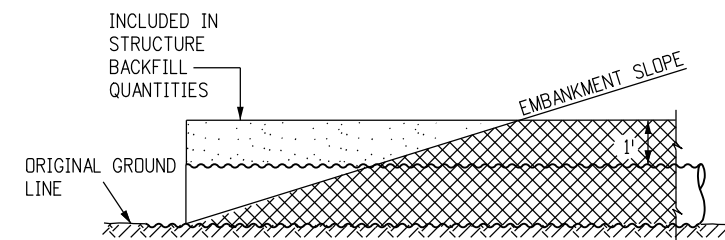
IN BOTH CASES, THE TRENCH (OUTLINED BY THE THICK SOLID LINE) SHALL THEN BE EXCAVATED TO ACCOMMODATE CONSTRUCTION OF THE BOX CULVERT.



**DROP INLETS AND DIVISION BOXES**



**HEADWALL**



**END OF PIPE**

**GENERAL NOTES**

1. EXCAVATION AND BACKFILL PATTERNS DIFFERENT FROM THOSE INDICATED ON THESE SHEETS WILL BE SHOWN ELSEWHERE ON THE PLANS.
2. EXCAVATION FOR CHANNEL CHANGE OR CHANNEL IMPROVEMENT WILL BE EITHER UNCLASSIFIED EXCAVATION OR MUCK EXCAVATION AND WILL BE NOTED ON THE PLANS. EXCAVATION FROM THE CHANNEL FLOWLINE TO THE DEPTH REQUIRED FOR THE NEW STRUCTURE AND INCIDENTAL CHANNEL EXCAVATION WILL BE PAID FOR AS STRUCTURE EXCAVATION.
3. STRUCTURE FOOTINGS WHICH ARE LOCATED IN ROCK SHALL BE POURED OUT TO UNDISTURBED ROCK WITHOUT FORMING IN CONFORMANCE WITH SUBSECTION 601.09(b).
4. STRUCTURAL PLATE CULVERTS SHALL BE CONSTRUCTED AS SHOWN ON THE PLANS.
5.  $B_o$  EQUALS THE INSIDE DIAMETER OF A PIPE AND  $B_c$  EQUALS THE OUTSIDE DIAMETER OF A PIPE. FOR THIN WALLED PIPES, IT IS ASSUMED THAT  $B_o = B_c$ .
6. APPROXIMATE STRUCTURE EXCAVATION AND BACKFILL QUANTITIES, UP TO 1 FT. OVER THE PIPE WILL BE SHOWN ON THE PLANS, FOR INFORMATION ONLY.

**LEGEND**

	STRUCTURE EXCAVATION LIMITS		ROCK
	STRUCTURE BACKFILL, CLASS 1 OR 2, AS SHOWN ON PLANS		BEDDING
	STRUCTURE BACKFILL, CLASS 1		CONCRETE
	EMBANKMENT MATERIAL		= WHEN FLOW LINE OF CULVERT IS LESS THAN $0.3 B_c$ BELOW THE ORIGINAL GROUND LINE, EMBANKMENT SHALL BE BUILT UP TO $0.3 B_c$ ABOVE THE FLOW LINE AND TRENCH EXCAVATED TO THE BOTTOM OF PIPE OR AS SHOWN.
	EARTH		WIDTH OF APRON

**CONDUIT WITH END SECTIONS**

**Computer File Information**

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Last Modification Date: 07/04/12	Initials: LTA
Full Path: www.coloradodot.info/business/designsupport	
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CAD Ver.: MicroStation V8	Scale: Not to Scale Units: English

**Sheet Revisions**

Date:	Comments
(R-X)	
(R-X)	
(R-X)	
(R-X)	

**Colorado Department of Transportation**

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**Project Development Branch DD/LTA**

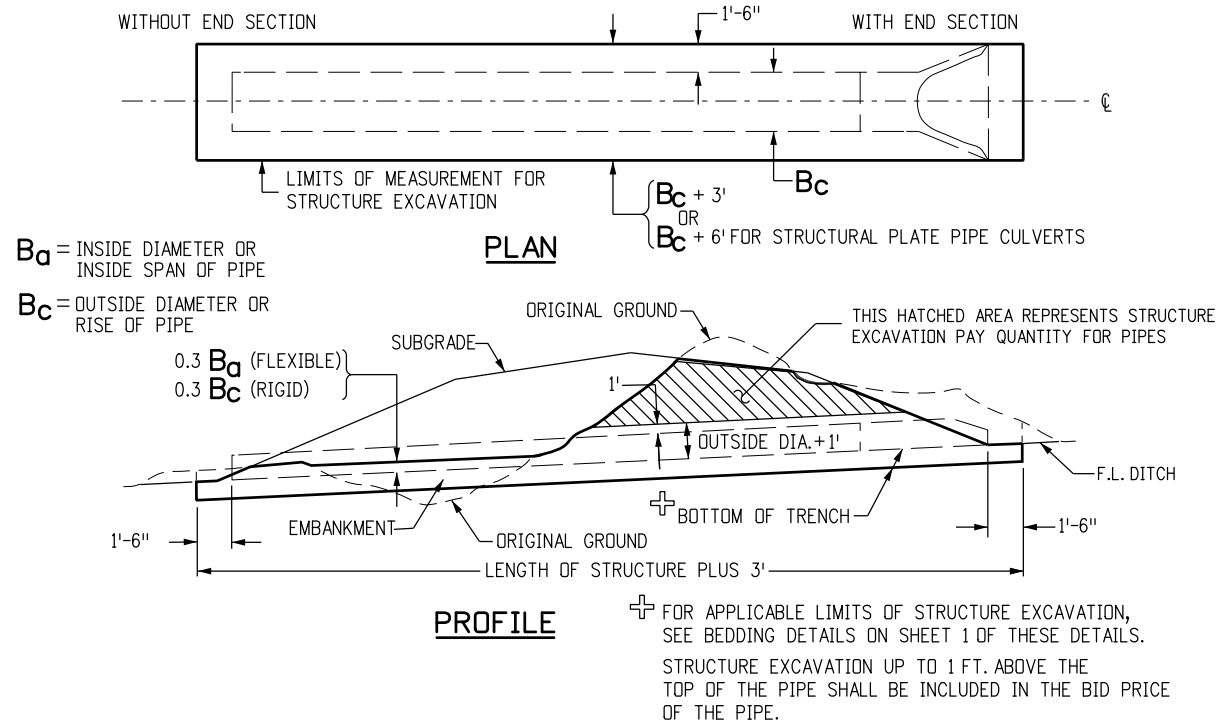
**EXCAVATION AND BACKFILL FOR STRUCTURES**

Issued By: Project Development Branch July 4, 2012

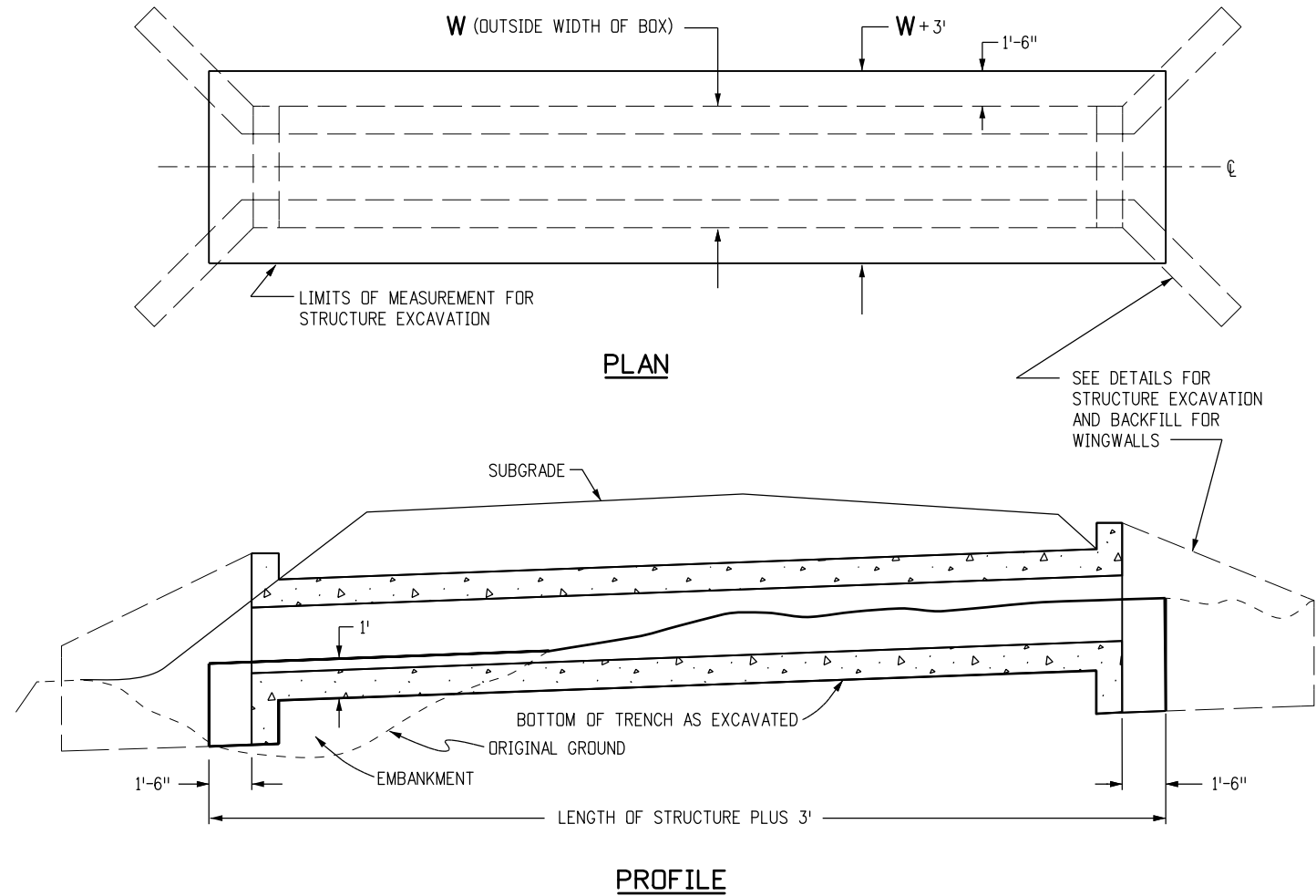
**STANDARD PLAN NO.**

M-206-1

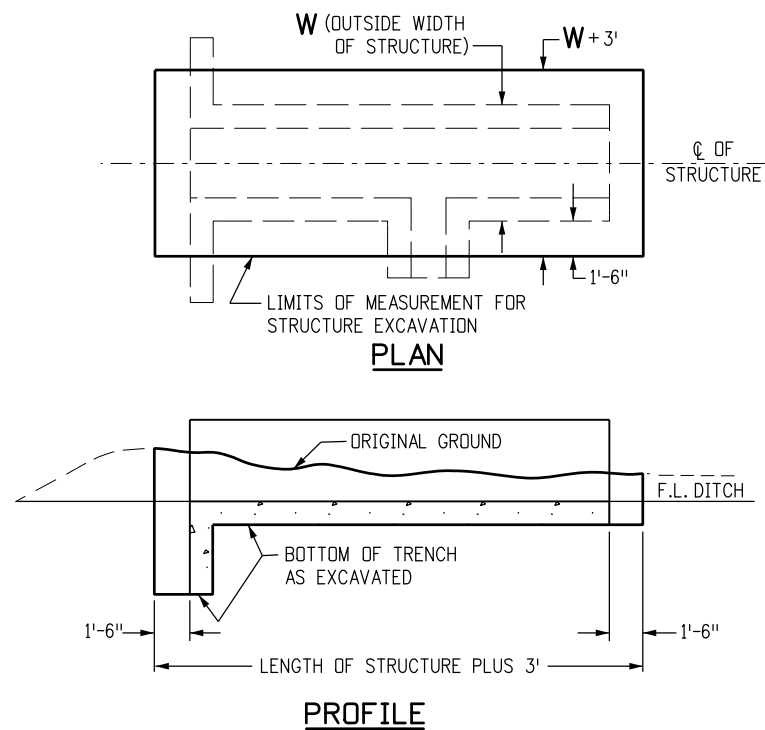
Sheet No. 1 of 2



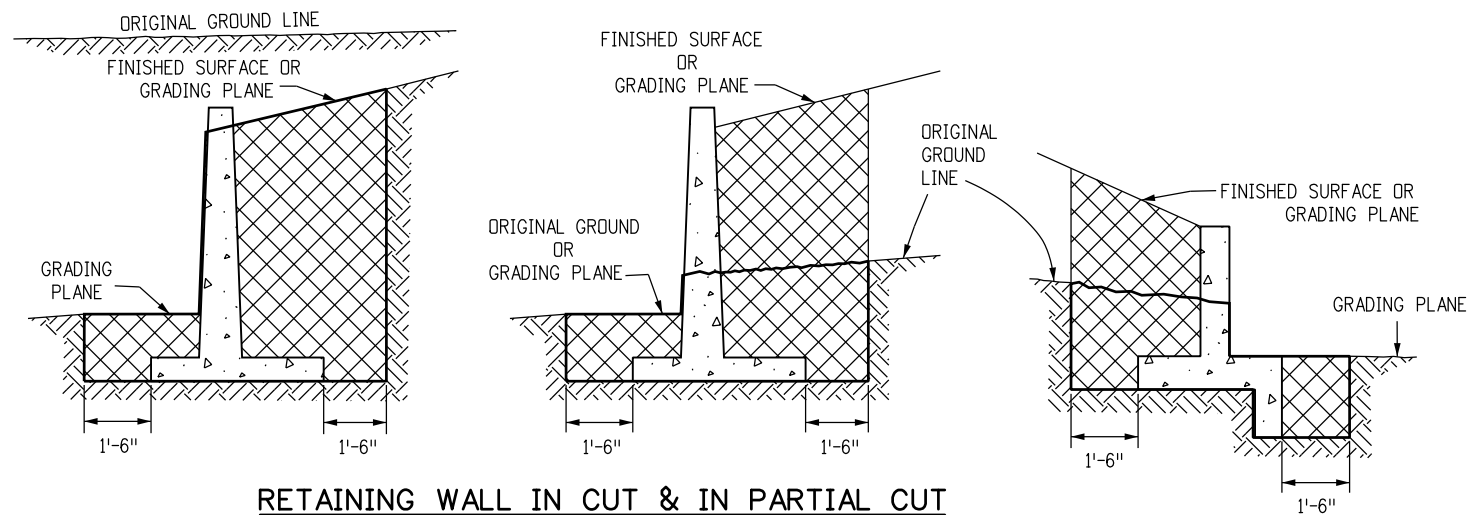
**STRUCTURE EXCAVATION MEASUREMENT FOR PIPE CULVERTS**



**STRUCTURE EXCAVATION MEASUREMENT FOR CONCRETE BOX CULVERTS**



**STRUCTURE EXCAVATION MEASUREMENT FOR DIVISION BOXES**



ANY ADDITIONAL EXCAVATION BEHIND THE LIMITS SHOWN SHALL BE FILLED WITH CLASS I BACKFILL MATERIAL. THE ADDITIONAL EXCAVATION AND BACKFILL WILL NOT BE MEASURED AND PAID FOR.

**LEGEND**

- STRUCTURE EXCAVATION LIMITS
- STRUCTURE BACKFILL, CLASS 1 OR 2, AS SHOWN ON PLANS
- CONCRETE

Computer File Information	
Creation Date: 07/04/12	Initials: DD
Last Modification Date: 07/04/12	Initials: LTA
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Sheet Revisions	
Date:	Comments
(R-X)	
(R-X)	
(R-X)	
(R-X)	

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**EXCAVATION AND BACKFILL FOR STRUCTURES**

Issued By: Project Development Branch July 4, 2012

**STANDARD PLAN NO.**

M-206-1

Sheet No. 2 of 2

**GENERAL NOTES**

**REINFORCED CONCRETE PIPE**

1. ADEQUATE COVER SHALL BE PROVIDED DURING CONSTRUCTION TO PROTECT THE PIPE FROM DAMAGE. THE MINIMUM COVER SHALL BE AS SHOWN ON THESE TABLES OR CONFORM TO AASHTO REQUIREMENTS, WHICHEVER IS GREATER. THE MINIMUM COVER FOR REINFORCED CONCRETE PIPE IS MEASURED FROM THE TOP OF THE PIPE TO THE BOTTOM OF THE PAVEMENT: HMA OR PCCP.
2. FILL HEIGHTS GREATER THAN MAXIMUM ALLOWED IN THE HEIGHTS OF FILL TABLE ON THIS SHEET REQUIRE SPECIAL DESIGN OF STRUCTURE.
3. PIPE DESIGN IS BASED ON SAFETY FACTOR OF 1.33 ON ULTIMATE STRENGTH.
4. THE HEIGHTS OF FILL OVER TOP OF PIPE ARE BASED ON UNIT WEIGHT OF SOIL AT 135 LBS. PER CUBIC FT.
5. PIPE CLASS IS DETERMINED FROM 0.01 IN. CRACK D-LOAD.
6. BEDDING IS CLASS B (MODIFIED) (FROM CONCRETE PIPE DESIGN MANUAL-AMERICAN CONCRETE PIPE ASSOCIATION) WITH SETTLEMENT RATIO  $R = 0.0 s_d$  (YIELDING BED). BEDDING MATERIAL FOR RIGID PIPE IN SOIL SHALL BE 3 IN. LOOSE THICKNESS STRUCTURE BACKFILL CLASS 2. BEDDING MATERIAL FOR RIGID PIPE IN ROCK SHALL BE 12 IN. LOOSE THICKNESS STRUCTURE BACKFILL CLASS 1.
7. CHANGES IN DESIGN FACTORS REQUIRE COMPENSATING CHANGES IN PIPE DESIGN.
8. MINIMUM WALL THICKNESS DIMENSIONS ARE BASED ON AASHTO M 170 (WALL B) FOR CIRCULAR PIPE, AND AASHTO M 207 FOR ELLIPTICAL PIPE.
9. SPACING FOR MULTIPLE PIPE INSTALLATIONS SHALL CONFORM TO THE DETAILS SHOWN ON STANDARD PLAN M-206-1.
10. WHEN A PIPE IS TO BE EXTENDED, THE SAME PIPE MATERIAL AND SIZE AS IN THE ORIGINAL PIPE INSTALLATION SHALL BE USED.

**NONREINFORCED CONCRETE PIPE**

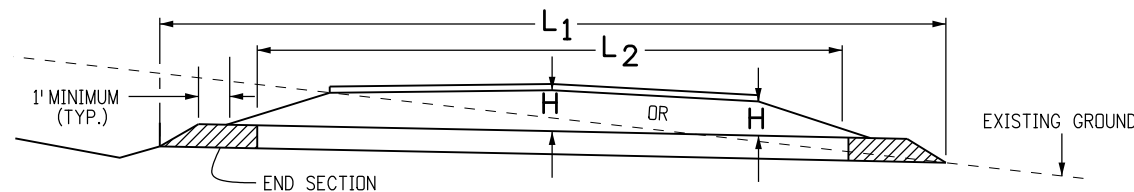
1. AT THE OPTION OF THE CONTRACTOR, NONREINFORCED CONCRETE PIPE CONFORMING TO AASHTO M 86 MAY BE USED IN LIEU OF REINFORCED CONCRETE PIPE FOR ALL SIZES 36 INCHES IN DIAMETER AND SMALLER. THE NONREINFORCED CONCRETE PIPE SHALL MEET THE SAME D-LOAD TO PRODUCE THE ULTIMATE LOAD UNDER THE THREE-EDGE BEARING METHOD AS SPECIFIED FOR REINFORCED CONCRETE PIPE IN CONFORMANCE WITH AASHTO M 170. THE CONTRACTOR SHALL PROVIDE WRITTEN CERTIFICATION OF CONFORMANCE. THE WALL THICKNESS OF THE NONREINFORCED PIPE MAY BE INCREASED AS REQUIRED TO MEET D-LOAD REQUIREMENT.
2. ALL REQUIREMENTS FOR REINFORCED CONCRETE PIPE, EXCEPT THOSE REFERRING TO REINFORCEMENT, SHALL APPLY TO NONREINFORCED CONCRETE PIPE.

CIRCULAR (CIR)			VERTICAL ELLIPTICAL (VE)				HORIZONTAL ELLIPTICAL (HE)			
PIPE SIZE = $B_a$ (INSIDE DIA)	WALL THICKNESS	0.3 $B_c$ (OUTSIDE DIA)	SPAN	RISE	WALL THICKNESS	0.3 OUTSIDE RISE	SPAN	RISE	WALL THICKNESS	0.3 OUTSIDE RISE
IN.		FT.	IN.				IN.			
			FT.				FT.			
12	2	0.40					23	14	2-3/4	0.49
15	2-1/4	0.49								
18	2-1/2	0.58								
21	2-3/4	0.66								
24	3	0.75					30	19	3-1/4	0.66
27	3-1/4	0.84					34	22	3-1/2	0.73
30	3-1/2	0.92					38	24	3-3/4	0.79
33	3-3/4	1.01								
36	4	1.10	29	45	4-1/2	1.35	45	29	4-1/2	0.95
42	4-1/2	1.28	34	53	5	1.58	53	34	5	1.10
48	5	1.45	38	60	5-1/2	1.78	60	38	5-1/2	1.23
54	5-1/2	1.62	43	68	6	2.00	68	43	6	1.38
60	6	1.80	48	76	6-1/2	2.23	76	48	6-1/2	1.53
66	6-1/2	1.97	53	83	7	2.43	83	53	7	1.68
72	7	2.15	58	91	7-1/2	2.65	91	58	7-1/2	1.83
78	7-1/2	2.32	63	98	8	2.85	98	63	8	1.98
84	8	2.50	68	106	8-1/2	3.08	106	68	8-1/2	2.13
90	8-1/2	2.68	72	113	9	3.28	113	72	9	2.25
96	9	2.85	77	121	9-1/2	3.50	121	77	9-1/2	2.40
102	9-1/2	3.02	82	128	9-3/4	3.69	128	82	9-3/4	2.54
108	10	3.20	87	136	10	3.90	136	87	10	2.68

△ ALSO EQUIVALENT ROUND DIMENSION FOR ELLIPTICAL PIPE.

**DIMENSIONS FOR REINFORCED CONCRETE PIPE**

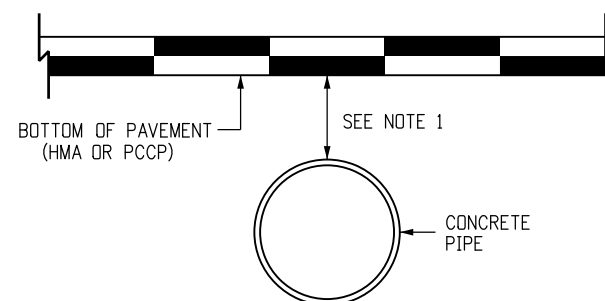
(FOR INFORMATION ONLY)



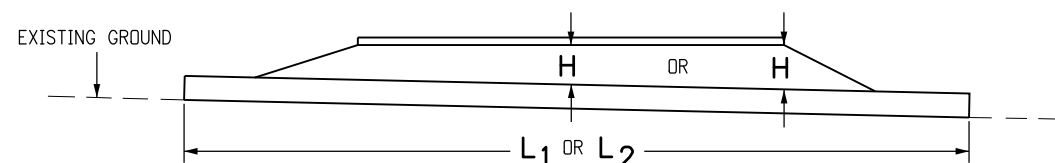
**CONCRETE PIPE WITH END SECTIONS**

NOTE: USE THE  $H$  THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

- $H$  = MAXIMUM HEIGHT OF FILL OVER TOP OF PIPE, EXCLUDING PAVEMENT THICKNESS.
- $L_1$  = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 617 OR 624.
- $L_2$  = LENGTH OF PIPE TO BE MEASURED WHEN PLACED IN ACCORDANCE WITH SECTION 603.



**MINIMUM COVER FOR RIGID PIPE**



**CONCRETE PIPE WITHOUT END SECTIONS**

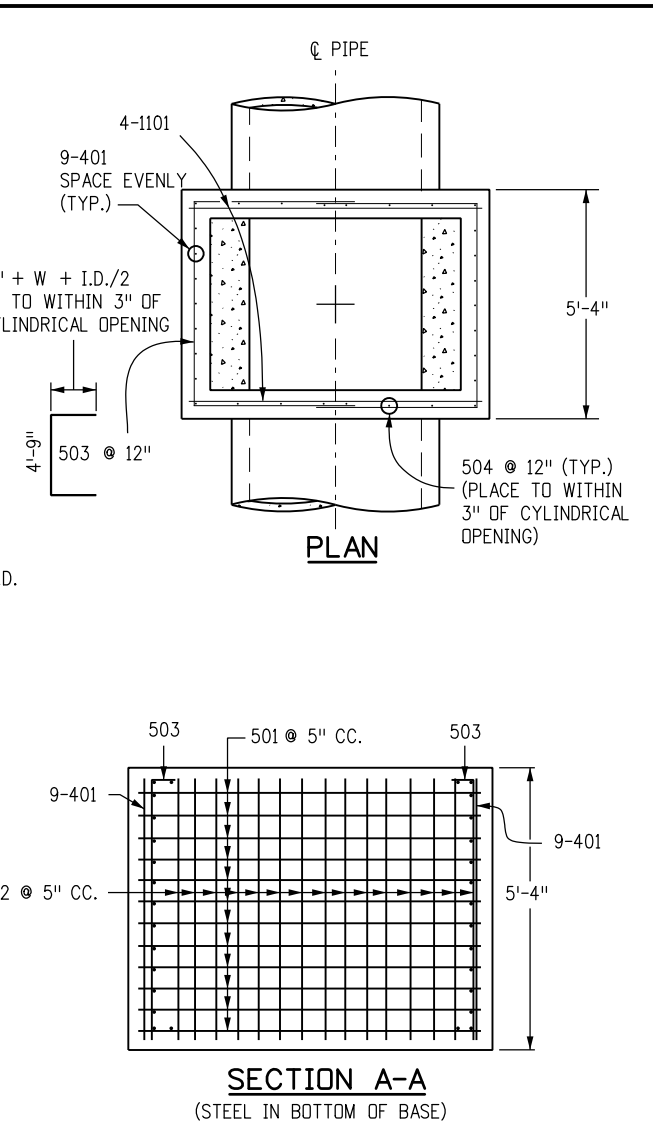
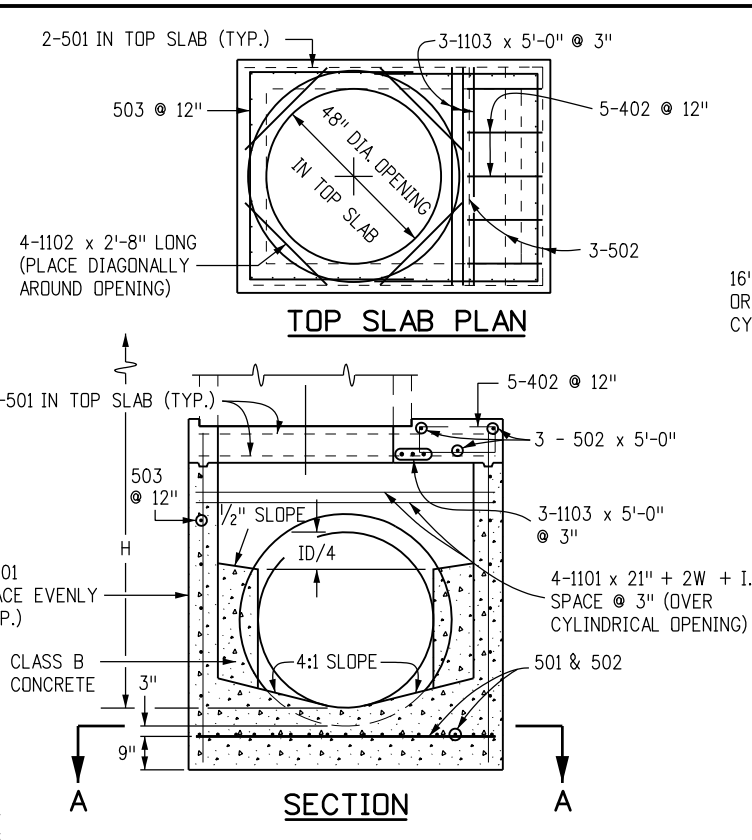
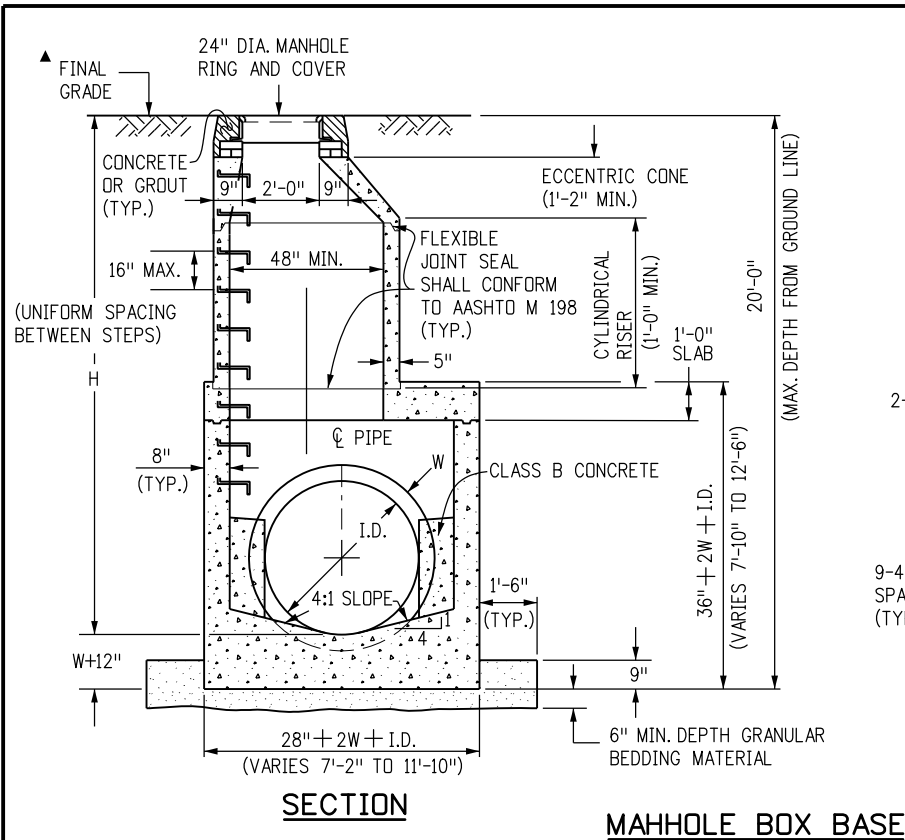
NOTE: USE THE  $H$  THAT IS GREATER FOR MAXIMUM ALLOWABLE FILL HEIGHT.

TYPE OF PIPE	HEIGHT OF FILL OVER TOP OF PIPE, $H$ (FEET)				
	CLASS OF PIPE (0.01 IN. CRACK D-LOAD)				
	CLASS CIR II CLASS VE II CLASS HE II 1000 D	CLASS CIR III CLASS VE III CLASS HE III 1350 D	CLASS CIR IV CLASS VE IV CLASS HE IV 2000 D	CLASS CIR V CLASS VE V 3000 D	CLASS VE VI 4000 D
CIRCULAR (CIR)	MIN. TO 18	MIN. TO 25	± 25 TO 37	± 37 TO 45	
VERTICAL ELLIPTICAL (VE)	MIN. TO 18	MIN. TO 25	± 25 TO 37	± 37 TO 45	± 45 TO 62
HORIZONTAL ELLIPTICAL (HE)	MIN. TO 18	MIN. TO 25	± 25 TO 37		

**ALLOWABLE RANGE OF HEIGHTS FOR FILL OVER REINFORCED CONCRETE PIPE**

(ALL SIZES)

<b>Computer File Information</b>		<b>Sheet Revisions</b>		<b>Colorado Department of Transportation</b>  4201 East Arkansas Avenue Denver, Colorado 80222 Phone: (303) 757-9083 Fax: (303) 757-9820 <b>Project Development Branch DD/LTA</b>	<b>REINFORCED CONCRETE PIPE</b> Issued By: Project Development Branch on July 4, 2012	<b>STANDARD PLAN NO.</b>
Creation Date: 07/04/12	Initials: DD	Date:	Comments:			<b>M-603-2</b>
Last Modification Date: 07/04/12	Initials: LTA					
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CAD Ver.: MicroStation V8	Scale: Not to Scale	Units: English				<b>Sheet No. 1 of 1</b>

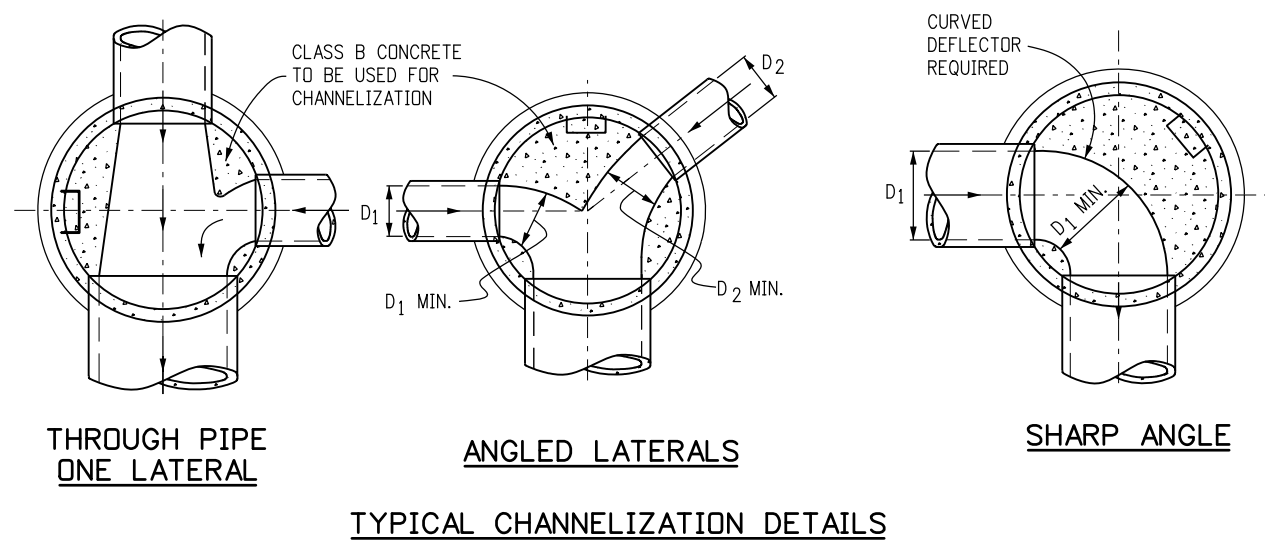


- ### GENERAL NOTES
1. SINCE ALL PIPE ENTRIES INTO THE BASE ARE VARIABLE, THE DIMENSIONS SHOWN ARE TYPICAL. ACTUAL DIMENSIONS AND QUANTITIES FOR CONCRETE AND REINFORCEMENT SHALL BE AS REQUIRED IN THE WORK.
  2. THE PRECAST FLAT TOP MAY BE USED ON ANY MANHOLE. THE ECCENTRIC CONE MAY BE USED WHEN THE MANHOLE "H" HEIGHT IS AT LEAST 8 FT.
  3. THE MANHOLE RING FRAME SHALL BE SET IN A BED OF GROUT. THE FRAME SHALL BE SURROUNDED WITH A CEMENT GROUT IN UNPAVED AREA, OR A CONCRETE COLLAR IN PAVED AREA. SEE DETAILS ON SHEETS 2 AND 3.
  4. DESIGN OF BOX BASE IS BASED ON STRAIGHT RUNS OF PIPE OR CHANGE IN DIRECTION OF LESS THAN 45°. SPECIAL DESIGN IS REQUIRED FOR 45° OR GREATER.
  5. PRECAST MANHOLES AND REINFORCEMENT SHALL CONFORM TO AASHTO M 199 (ASTM C 478).
  6. CAST-IN-PLACE MANHOLES SHALL BE CLASS B CONCRETE.
  7. STEPS SHALL BE REQUIRED WHEN THE MANHOLE DEPTH EXCEEDS 3 FT.-6 IN. AND SHALL CONFORM TO AASHTO M 199.
  8. ALL REINFORCING STEEL SHALL BE GRADE 60 AND EPOXY COATED. VERTICAL STEEL SHALL BE PLACED AT CENTERLINE OF WALL. ALL BARS SHALL HAVE A 2 IN. MINIMUM CLEARANCE.
  9. ALL PIPE ENTRIES INTO THE BASE OF MANHOLE SHALL BE CONNECTED BY OPEN CHANNELIZATION ADJUSTED FOR PIPE SIZE, SHAPE, SLOPE, AND DIRECTION OF FLOW. DETAILS SHOWN ARE TYPICAL FOR INSTALLATIONS WITH ALL INVERTS OF SAME RELATIVE ELEVATION. FOR EXCESSIVE ELEVATION DIFFERENCE BETWEEN INVERTS, SPECIAL BASE/CHANNEL DETAILS WILL BE SHOWN ON THE PLANS.
  10. FLOW CHANNELS AND INVERTS SHALL BE FORMED BY SHAPING WITH CLASS B CONCRETE OR APPROVED GROUT.
  11. STUB-OUTS SHALL EXTEND 2 FT. MINIMUM BEYOND OUTSIDE WALL SURFACE OF MANHOLE AND BE SATISFACTORILY PLUGGED.
  12. THE SLOPE OF THE MANHOLE COVER SHALL MATCH THE ROADWAY PROFILE AND CROSS SLOPE.
- ▲ WHEN FINAL GRADE IS PAVEMENT SURFACE, RECESS MANHOLE RING AND COVER 1/4" MIN. TO 1/2" MAX.

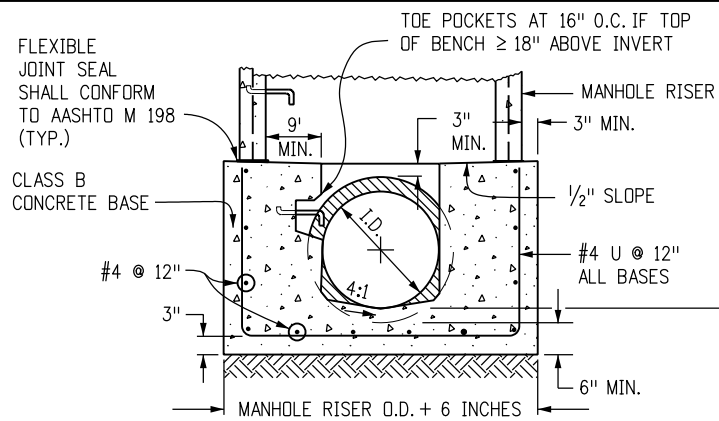
MARK	SIZE	TYPE	WT. #/FT.	BARS	I.D.						FORMULAS
					54"	60"	66"	72"	84"	96"	
401	4	I	0.668	{ NO. REQ'D. LENGTH WEIGHT * 18 8'-1" 97.2 18 8'-8" 104.2 18 9'-3" 111.2 18 9'-10" 118.2 18 11'-0" 132.3 18 12'-2" 146.3	401 BAR LENGTH = 32" + 2W + I.D.						
402	4	III	0.668	{ NO. REQ'D. LENGTH WEIGHT * 5 5'-5" 18.1 5 6'-0" 20.0 5 6'-7" 22.0 5 7'-2" 23.9 5 8'-4" 27.8 5 9'-6" 31.7	402 BAR LENGTH = I.D. + 2W						
501	5	I	1.043	{ NO. REQ'D. LENGTH WEIGHT * 17 7'-5" 131.5 17 8'-0" 141.8 17 8'-7" 152.2 17 9'-2" 162.5 17 10'-4" 183.2 17 11'-6" 203.9	501 BAR LENGTH = 24" + I.D. + 2W						
502	5	I	1.043	{ NO. REQ'D. LENGTH WEIGHT * 22 5'-0" 114.7 23 5'-0" 119.9 25 5'-0" 130.4 26 5'-0" 135.6 29 5'-0" 151.2 32 5'-0" 166.9	502 NUMBER BARS REQ'D. = $3 + \frac{(24+I.D.+2W)}{5} + 1$						
503	5	II	1.043	{ NO. REQ'D. LENGTH WEIGHT * 16 12'-10" 214.2 16 13'-5" 223.9 18 14'-0" 262.8 18 14'-7" 273.8 20 15'-9" 328.5 24 16'-11" 423.5	503 NUMBER BARS REQ'D. = $2 \left( \frac{13+I.D.+2W}{12} + 1 \right)$ BAR LENGTH = $4'-9" + 2(16+W+I.D./2)$						
504	5	I	1.043	{ NO. REQ'D. LENGTH WEIGHT * 12 8'-1" 101.2 14 8'-8" 126.6 14 9'-3" 135.1 16 9'-10" 164.1 18 11'-0" 206.5 20 12'-2" 253.8	504 NUMBER BARS REQ'D. = $2 \left( \frac{2W+I.D.-4}{12} + 1 \right)$ BAR LENGTH = $32" + 2W + I.D.$						
1101	11	I	5.313	{ NO. REQ'D. LENGTH WEIGHT * 4 7'-2" 152.3 4 7'-9" 164.7 4 8'-4" 177.1 4 8'-11" 189.5 4 10'-1" 214.3 4 11'-3" 239.1	1101 BAR LENGTH = 21" + I.D. + 2W						
1102	11	I	5.313	{ NO. REQ'D. LENGTH WEIGHT * 4 2'-8" 56.7 4 2'-8" 56.7 4 2'-8" 56.7 4 2'-8" 56.7 4 2'-8" 56.7 4 2'-8" 56.7	BENDING TYPE I STRAIGHT						
1103	11	I	5.313	{ NO. REQ'D. LENGTH WEIGHT * 3 5'-0" 79.7 3 5'-0" 79.7 3 5'-0" 79.7 3 5'-0" 79.7 3 5'-0" 79.7 3 5'-0" 79.7	TYPE II 16" + W + I.D./2						
* REINFORCING STEEL TOTAL					965.6	1,037.5	1,127.2	1,204.0	1,380.2	1,601.6	
CONCRETE - CUBIC YARDS - TOTAL					6.0	6.6	7.3	8.0	9.5	11.1	

NOTE: QUANTITIES ARE BASED ON SAME SIZE PIPE ENTRANCE TO AND EXIT FROM, BASE AND A 4 FT. MANHOLE ENTRANCE INTO TOP SLAB OF BASE.

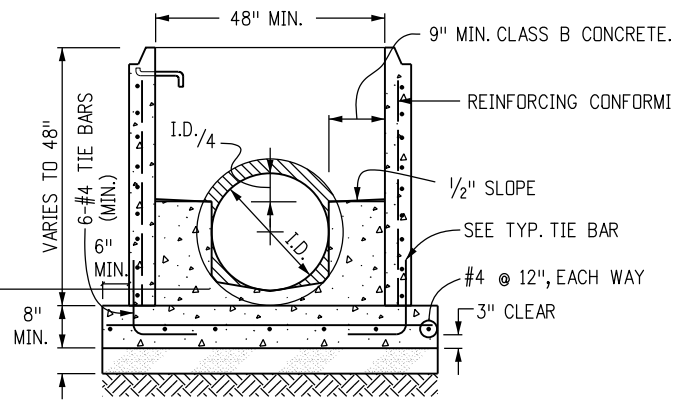
QUANTITIES FOR CONCRETE MANHOLE BOX BASE



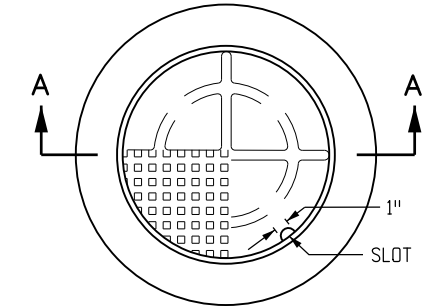
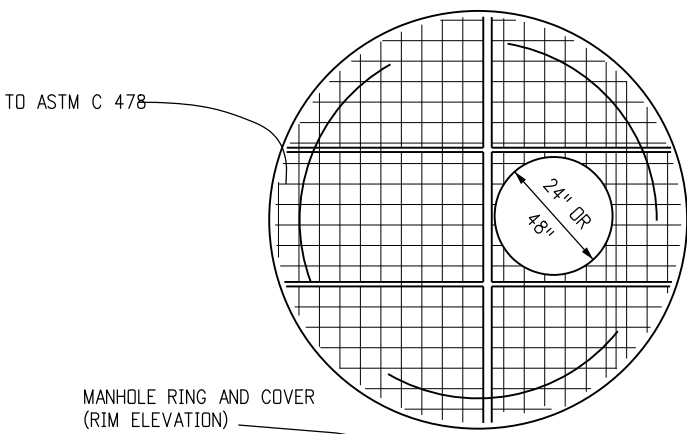
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**SECTION B-B**

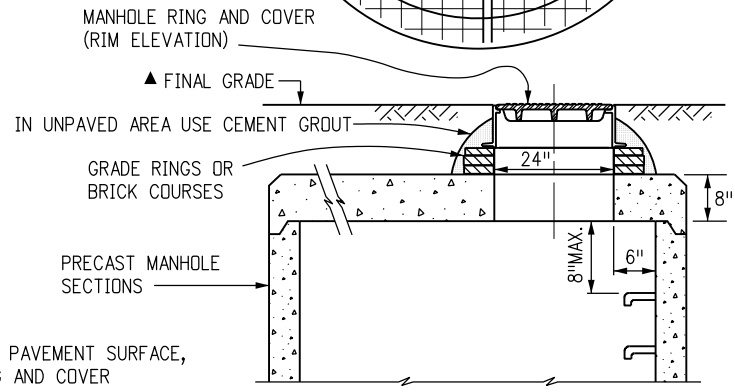


**SECTION D-D**



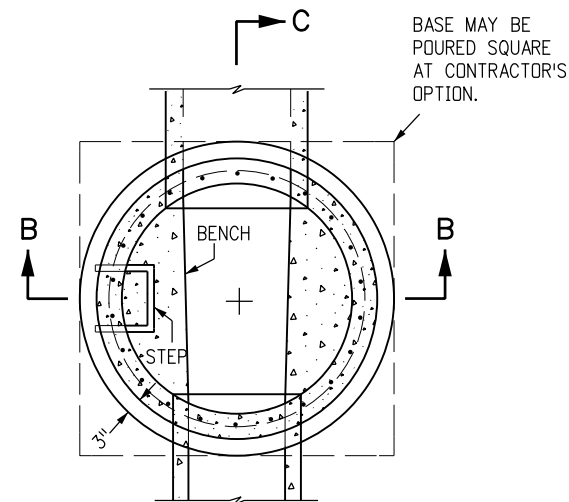
TOTAL WEIGHT: APPROXIMATELY 400 LBS. SHALL BE GRAY OR DUCTILE CAST IRON IN ACCORDANCE WITH SUBSECTION 712.06.

**SECTION A-A  
MANHOLE RING AND COVER**

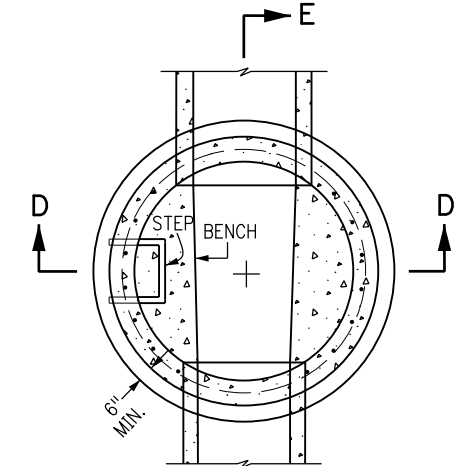
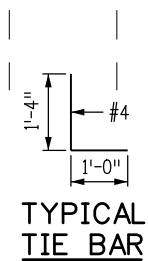


**FLAT TOP SECTION DETAIL**

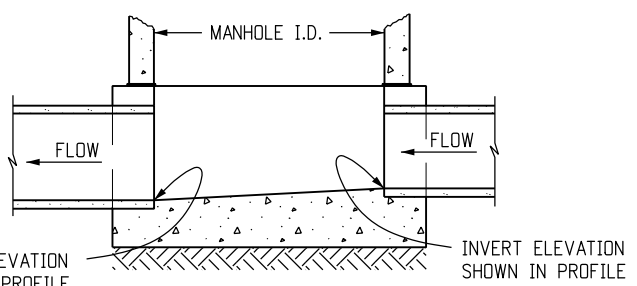
▲ WHEN FINAL GRADE IS PAVEMENT SURFACE, RECESS MANHOLE RING AND COVER 1/4" MIN. TO 1/2" MAX.



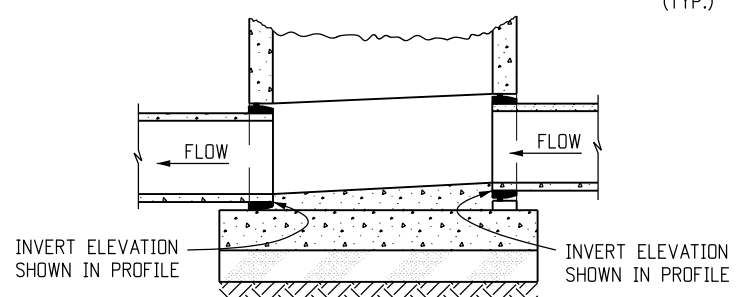
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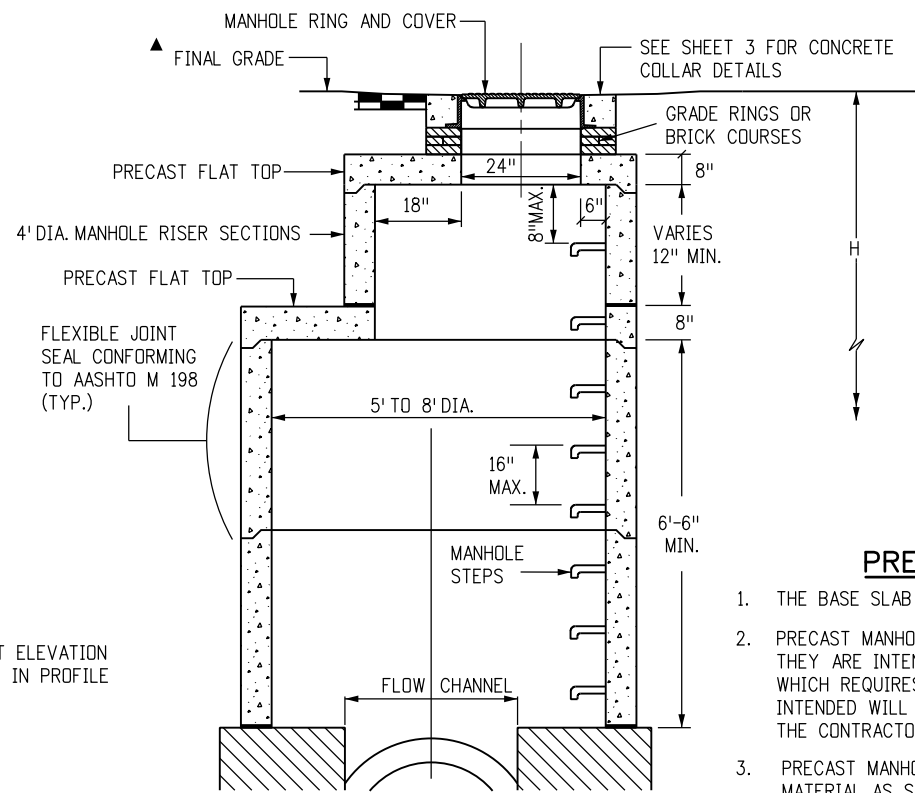
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**SECTION C-C  
CAST-IN-PLACE SLAB BASE**



**SECTION E-E  
PRECAST SLAB BASE**



**MANHOLE RISER DETAIL**

**LEGEND**

	SUITABLE SUBGRADE
	GRANULAR BEDDING MATERIAL
	CONCRETE

- PRECAST MANHOLE BASES NOTES:**
1. THE BASE SLAB SHALL BE POURED MONOLITHICALLY WITH BOTTOM RISER SECTION.
  2. PRECAST MANHOLE BASES SHALL FIT THE CONDITIONS AND LOCATIONS FOR WHICH THEY ARE INTENDED WITHOUT ANY FIELD MODIFICATIONS. ANY MANHOLE BASE WHICH REQUIRES FIELD CUTTING OR MODIFICATION IN ORDER TO FIT THE LOCATIONS INTENDED WILL BE REJECTED BY THE ENGINEER AND REMOVED AND REPLACED BY THE CONTRACTOR AT NO COST TO THE DEPARTMENT.
  3. PRECAST MANHOLE BASES SHALL BE BEDDED ON AN APPROVED GRANULAR BEDDING MATERIAL AS SHOWN ABOVE.

**Computer File Information**

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**MANHOLES**

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**STANDARD PLAN NO.**

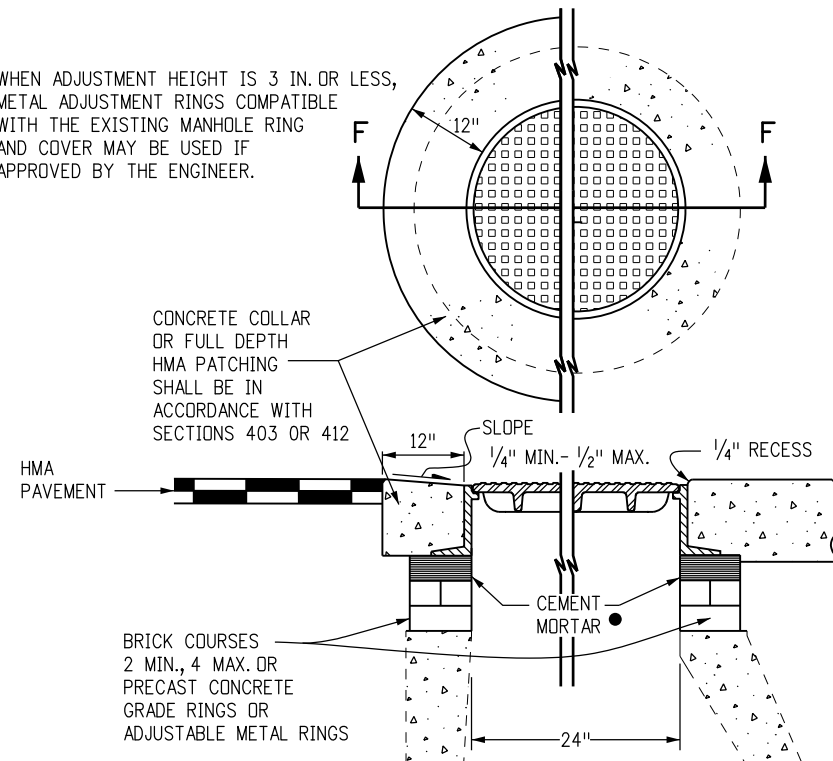
**M-604-20**

**Sheet No. 2 of 3**

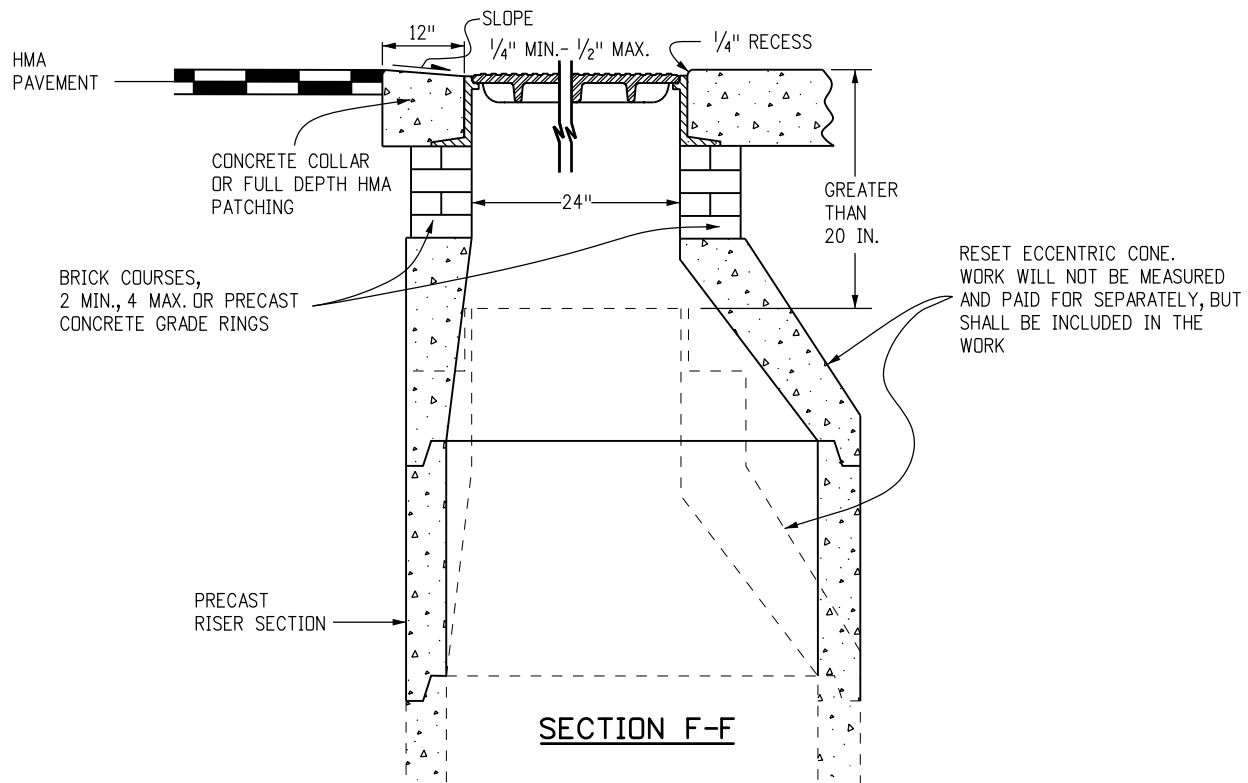
**T-BASE MANHOLES NOTES**

1. THE T-BASE SECTION SHALL BE SHOP-FABRICATED FOR DELIVERY TO THE CONSTRUCTION SITE AS A COMPLETE UNIT.
2. THESE DETAILS SHOW ONLY THE CONCEPTUAL AND STANDARD DIMENSIONAL REQUIREMENTS FOR TYPE T-BASE MANHOLES. THE CONTRACTOR SHALL FURNISH DETAILED SHOP DRAWINGS FOR APPROVAL PRIOR TO FABRICATION. THE DETAILS SHOWN HEREIN APPLY ONLY TO 48 IN. AND GREATER DIAMETER PIPES.
3. EXCEPT FOR CLASS OF PIPE, SPECIFICATIONS FOR THE MANHOLE SHALL BE THE SAME AS THOSE REQUIRED FOR THE ADJOINING PIPE.
4. THE T-BASE SECTION SHALL MAINTAIN ITS INTERNAL SHAPE AND FLOW AREA. GROUTING OR FILLING SHALL BE APPLIED SO AS TO NOT DISTURB THE NORMAL FLOW OR REDUCE THE AREA.

WHEN ADJUSTMENT HEIGHT IS 3 IN. OR LESS, METAL ADJUSTMENT RINGS COMPATIBLE WITH THE EXISTING MANHOLE RING AND COVER MAY BE USED IF APPROVED BY THE ENGINEER.

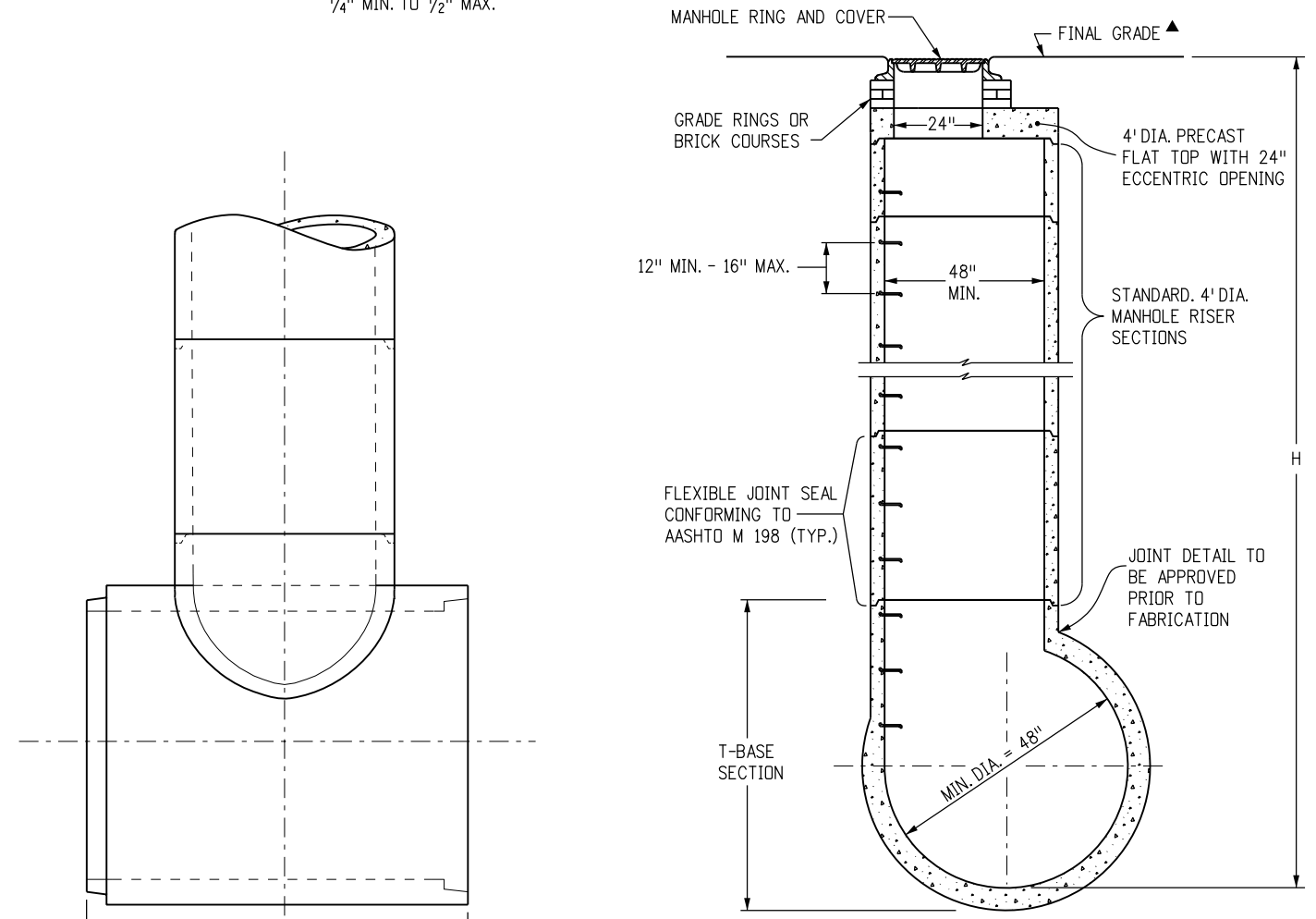


**SECTION F-F  
ADJUST MANHOLE 20 IN. OR LESS**



**SECTION F-F  
MODIFY MANHOLE GREATER THAN 20 IN.**

▲ WHEN FINAL GRADE IS PAVEMENT SURFACE, RECESS MANHOLE RING AND COVER 1/4" MIN. TO 1/2" MAX.



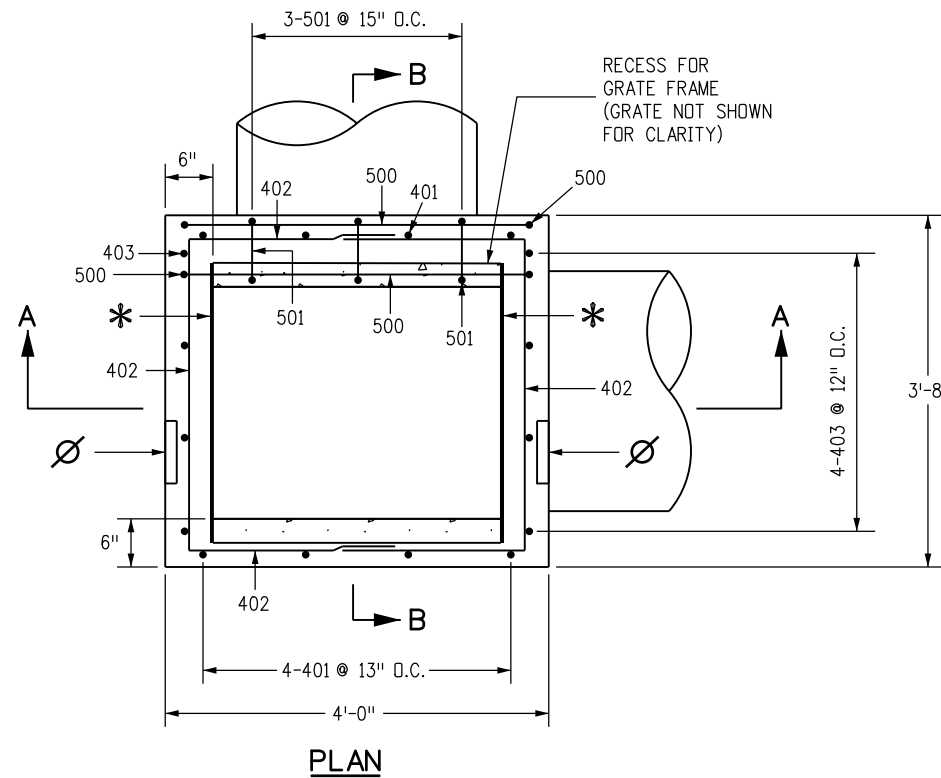
**CIRCULAR RIGID PIPE  
(LONGITUDINAL SECTION)**

**CIRCULAR RIGID PIPE  
(TRANSVERSE SECTION)**

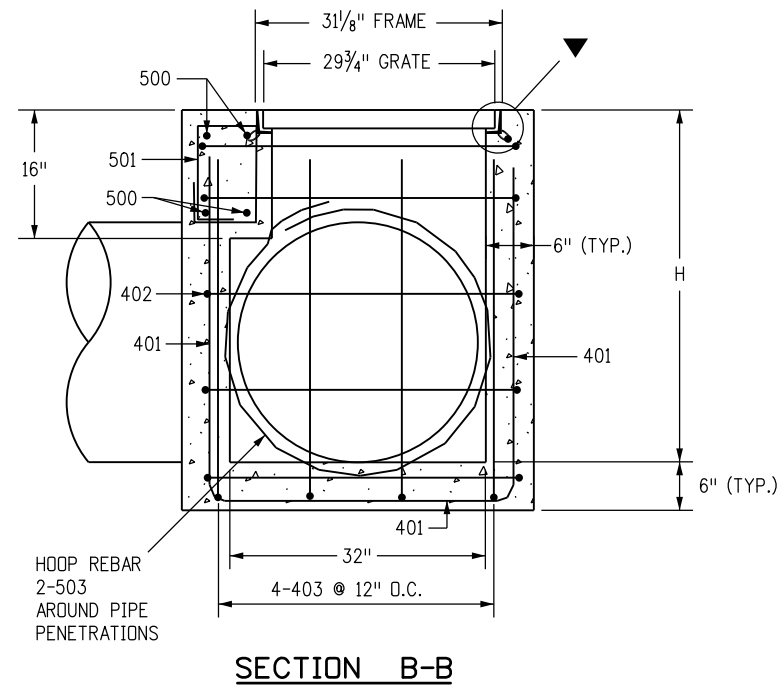
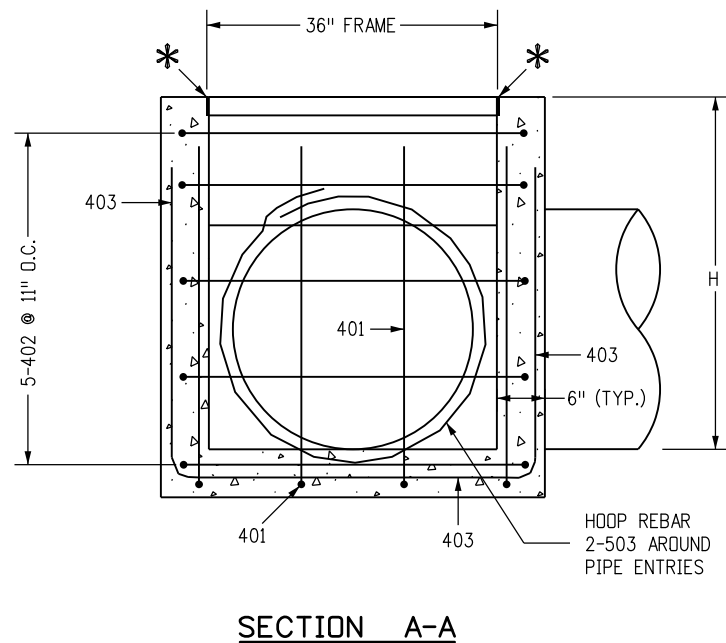
**MANHOLE T-BASE**

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						Sheet No. 3 of 3





- ### GENERAL NOTES
1. FOR THE 32 INCH AND 36 INCH INSIDE INLET DIMENSIONS, THE ALLOWABLE PIPE I.D. IS 30 INCHES OR LESS. FOR THE 72 INCH INSIDE INLET DIMENSION, THE ALLOWABLE PIPE I.D. IS "H" MINUS 18 INCHES, OR LESS, UP TO A MAXIMUM OF 66 INCHES FOR "H" OF 7 FEET OR MORE.
  2. ALL CONCRETE SHALL BE CLASS B.
  3. INLET MAY BE CAST-IN-PLACE OR PRECAST.
  4. REINFORCING BARS SHALL BE #4 UNLESS SHOWN OTHERWISE.
  5. ALL REINFORCING BARS SHALL BE GRADE 40 AND EPOXY COATED. REINFORCING BARS SHALL HAVE A MINIMUM CLEARANCE OF 2 IN.
  6. ALL EDGE DISTANCES NOT MARKED "CLEAR" ARE TO THE CENTERLINE OF THE BAR.
  7. CUT OR BEND REINFORCING BARS AROUND PIPES AS REQUIRED.
  8. STEPS SHALL BE REQUIRED WHEN THE INLET DEPTH "H" IS EQUAL TO OR GREATER THAN 4 FT. AND SHALL CONFORM TO AASHTO M 199.
  9. THE INVERT OF THE BOX SHALL BE SLOPED TO DRAIN.
  10. THE CONTRACTOR SHALL STAMP FLOW ARROWS INTO THE TOP SURFACE OF THE INLET BOX SIDEWALLS TO INDICATE THE DIRECTION OF RUNOFF. THE STAMPED ARROWS SHALL BE 6 IN. LONG, 1 IN. HIGH, AND 3/8 IN. DEEP. FOR INLETS IN SUMP CONDITIONS, THE STAMPED FLOW ARROWS SHALL INDICATE THE PREDOMINATE DIRECTION OF RUNOFF FLOW.
  11. A 4 IN. DIA. STAINLESS STEEL MEDALLION WITH "NO DUMPING DRAINS TO STREAM" OR SIMILAR MESSAGE SHALL BE FIRMLY ATTACHED TO TOP OF THE INLET SURFACE WITH A PERMANENT FASTENER. THE MEDALLION WILL HAVE A FISH SYMBOL AND BLUE COLOR BACKGROUND. ALTERNATIVELY, THIS MESSAGE MAY BE CAST WITH 1 IN. HEIGHT LETTERS INTO THE TOP OF THE INLET'S CONCRETE SURFACE OR SURROUNDING CONCRETE APRON. THE NO DUMPING MESSAGE SHALL BE ELIMINATED FOR INLETS LOCATED WITHIN THE SHOULDER OF CONTROLLED ACCESS FREEWAYS WHEN SPECIFIED IN THE PLANS.



- ### LEGEND
- ▼ GRATE TO BE INSTALLED DURING CONSTRUCTION OF THE BOX WITH THE VANE GRATE BOLTED IN PLACE TO THE FRAME.
  - \* TO FACILITATE REMOVAL OF THE GRATE, PLACE PLYWOOD 3 IN. x 1/4 IN. x 31-3/8 IN. ALONG EDGE OF THE GRATE AS SHOWN.
  - ∅ FLOW ARROW STAMP IN DIRECTION OF FLOW (TYP.). FLOW →

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Sheet Revisions	
Date:	Comments

**Colorado Department of Transportation**

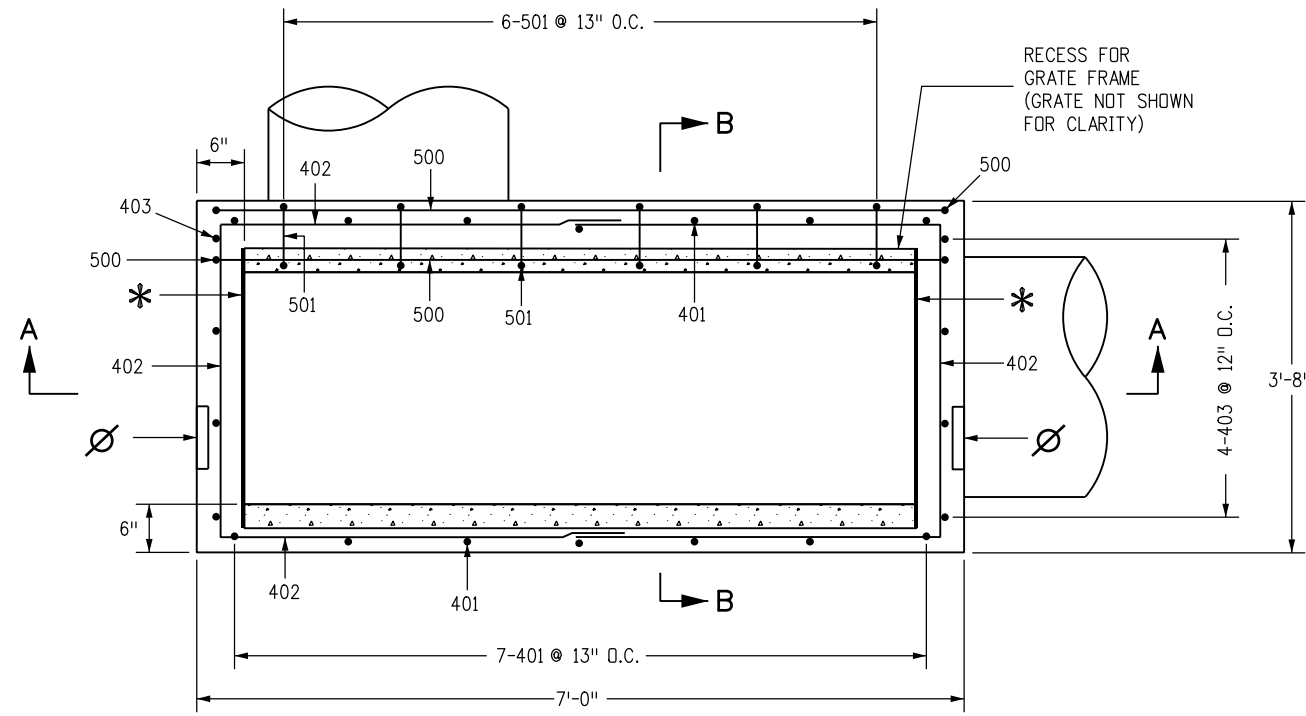
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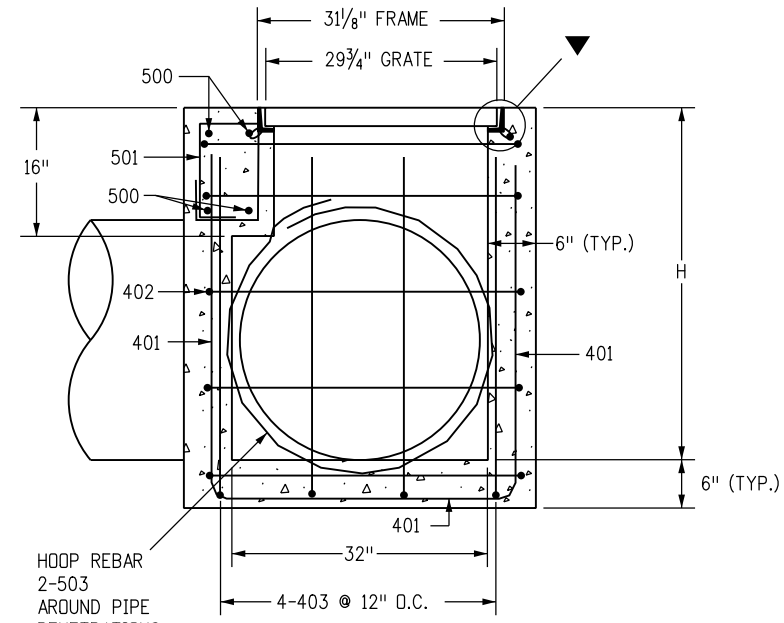
## VANE GRATE INLET

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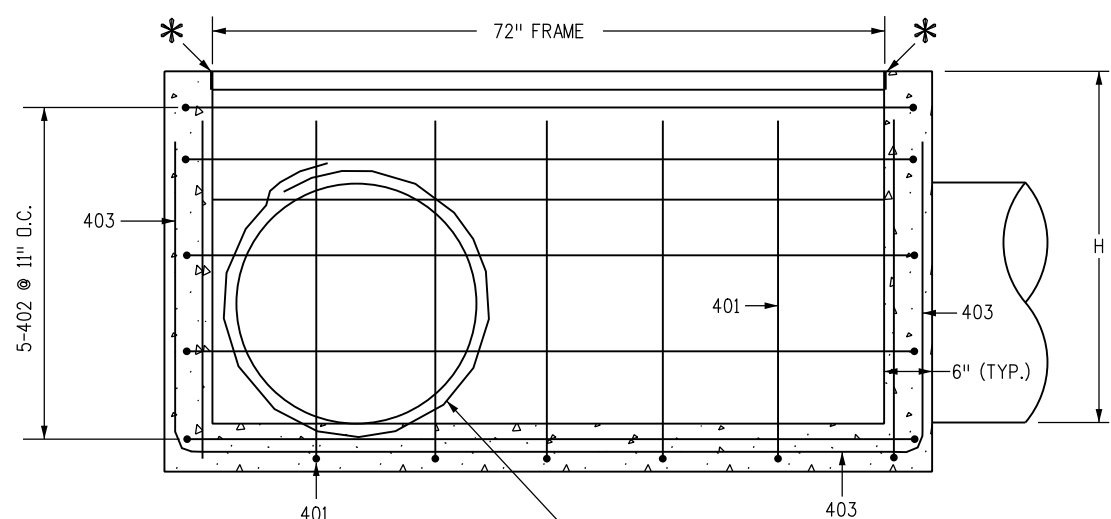
STANDARD PLAN NO.
M-604-25
Sheet No. 1 of 5



PLAN



SECTION B-B



SECTION A-A

LEGEND

- ▼ GRATE TO BE INSTALLED DURING CONSTRUCTION OF THE BOX WITH THE VANE GRATE BOLTED IN PLACE TO THE FRAME.
- \* TO FACILITATE REMOVAL OF THE GRATE, PLACE PLYWOOD 3 IN. x 1/4 IN. x 31-3/8 IN. ALONG EDGE OF THE GRATE AS SHOWN.
- ∅ FLOW ARROW STAMP IN DIRECTION OF FLOW (TYP.). FLOW →

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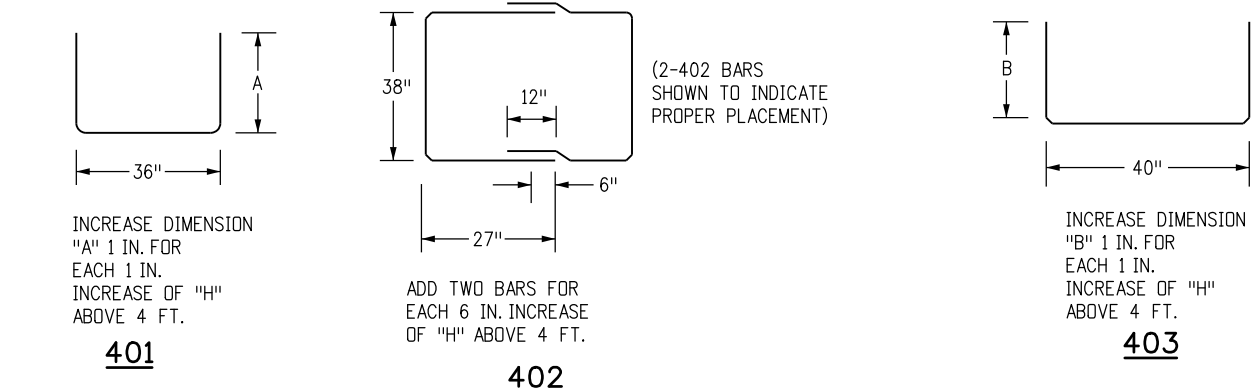
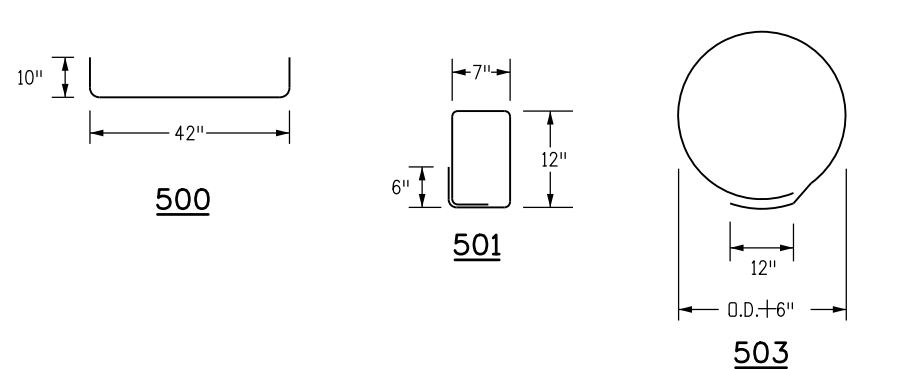
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# VANE GRATE INLET

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STANDARD PLAN NO.
M-604-25
Sheet No. 2 of 5



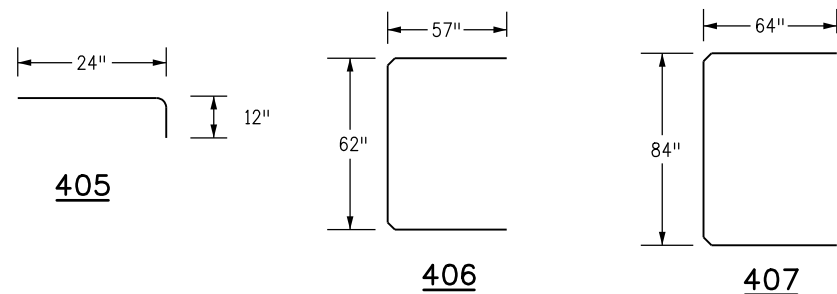
**36 IN. INLET BOX BENDING DIAGRAM**

INCREASE DIMENSION "A" 1 IN. FOR EACH 1 IN. INCREASE OF "H" ABOVE 4 FT.

ADD TWO BARS FOR EACH 6 IN. INCREASE OF "H" ABOVE 4 FT.

INCREASE DIMENSION "B" 1 IN. FOR EACH 1 IN. INCREASE OF "H" ABOVE 4 FT.

(2-402 BARS SHOWN TO INDICATE PROPER PLACEMENT)



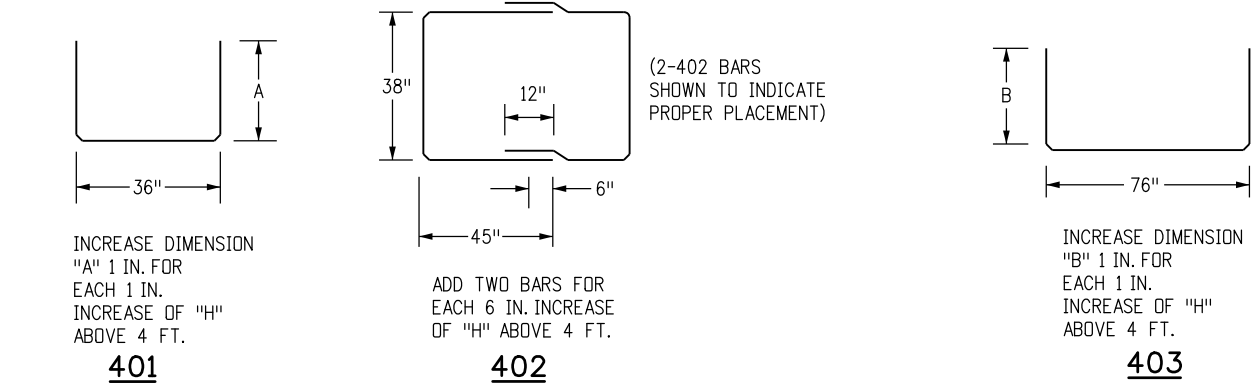
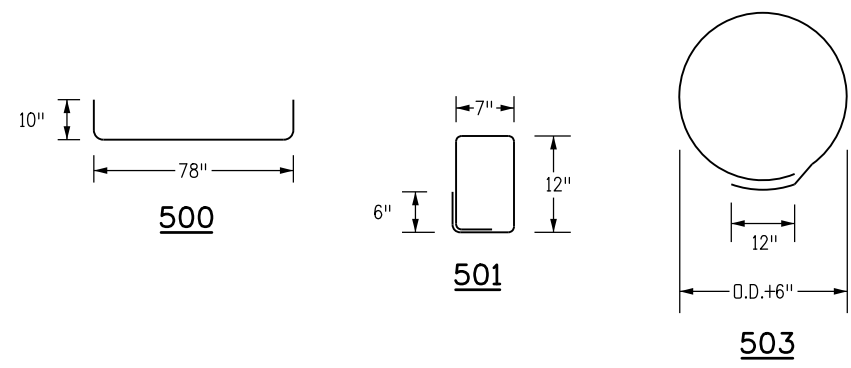
**INLET APRON BENDING DIAGRAM FOR 36 IN. INLET**

MARK	NO. REQ'D	LENGTH (EACH)
405	9	3'-0"
406	1	14'-8"
407	1	17'-8"

**BAR LIST FOR CONCRETE APRON**  
(FOR INFORMATION ONLY)

MARK	NO. REQ'D	HEIGHT "A"	HEIGHT "B"	LENGTH (EACH)
500	4			5'-2"
501	3			4'-2"
503	4			10'-5"
401	4	3'-10"		10'-8"
402	10			7'-8"
403	4		4'-0"	11'-4"

**BAR LIST FOR H = 4'-0" 36 IN. INLET**



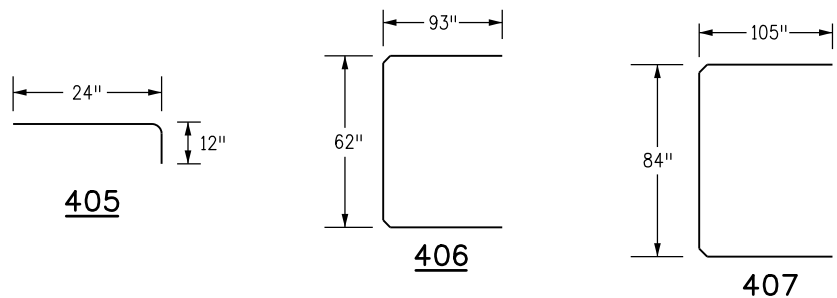
**72 IN. INLET BOX BENDING DIAGRAM**

INCREASE DIMENSION "A" 1 IN. FOR EACH 1 IN. INCREASE OF "H" ABOVE 4 FT.

ADD TWO BARS FOR EACH 6 IN. INCREASE OF "H" ABOVE 4 FT.

INCREASE DIMENSION "B" 1 IN. FOR EACH 1 IN. INCREASE OF "H" ABOVE 4 FT.

(2-402 BARS SHOWN TO INDICATE PROPER PLACEMENT)



**INLET APRON BENDING DIAGRAM FOR 72 IN. INLET**

MARK	NO. REQ'D	LENGTH (EACH)
405	13	3'-0"
406	1	20'-8"
407	1	24'-6"

**BAR LIST FOR CONCRETE APRON**  
(FOR INFORMATION ONLY)

MARK	NO. REQ'D	HEIGHT "A"	HEIGHT "B"	LENGTH (EACH)
500	4			8'-2"
501	6			4'-2"
503	4			10'-5"
401	7	3'-10"		10'-8"
402	10			10'-8"
403	4		4'-0"	14'-4"

**BAR LIST FOR H = 4'-0" 72 IN. INLET**

**QUANTITIES FOR ONE 36 IN. INLET**

H	NUMBER OF STEPS REQUIRED	CONC. CU. YD.	STEEL LBS.
4'-0"	1	1.3	180
4'-6"	2	1.5	186
5'-0"	2	1.6	201
5'-6"	2	1.7	207
6'-0"	3	1.8	222
6'-6"	3	1.9	227
7'-0"	3	2.1	243
7'-6"	4	2.2	248
8'-0"	4	2.3	263
8'-6"	4	2.4	269
9'-0"	5	2.5	285
9'-6"	5	2.7	289
10'-0"	5	2.8	306
10'-6"	6	2.9	310
11'-0"	6	3.0	326
11'-6"	6	3.1	331

**NOTES**

1. CONCRETE QUANTITY INCLUDES VOLUME OCCUPIED BY PIPES.
2. REINFORCING STEEL QUANTITY ASSUMES TWO 503 HOOPS FOR EACH 24 IN. PIPE.
3. BARS NUMBERED IN 400 SERIES INDICATES #4 SIZE BAR. BARS NUMBERED IN 500 SERIES INDICATES #5 SIZE BAR.
4. ALL REINFORCING BARS SHALL BE GRADE 40 AND EPOXY COATED.

**QUANTITIES FOR ONE 72 IN. INLET**

H	NUMBER OF STEPS REQUIRED	CONC. CU. YD.	STEEL LBS.
4'-0"	1	2.1	253
4'-6"	2	2.3	260
5'-0"	2	2.4	282
5'-6"	2	2.6	289
6'-0"	3	2.8	310
6'-6"	3	3.0	318
7'-0"	3	3.2	339
7'-6"	4	3.3	346
8'-0"	4	3.5	369
8'-6"	4	3.7	376
9'-0"	5	3.9	397
9'-6"	5	4.1	405
10'-0"	5	4.2	426
10'-6"	6	4.4	433
11'-0"	6	4.6	455
11'-6"	6	4.8	462

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Sheet Revisions	
Date:	Comments

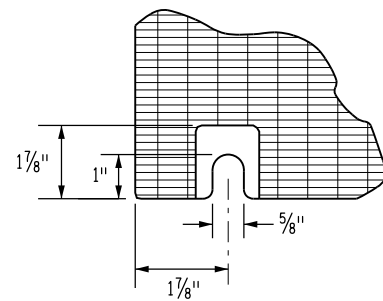
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**VANE GRATE INLET**

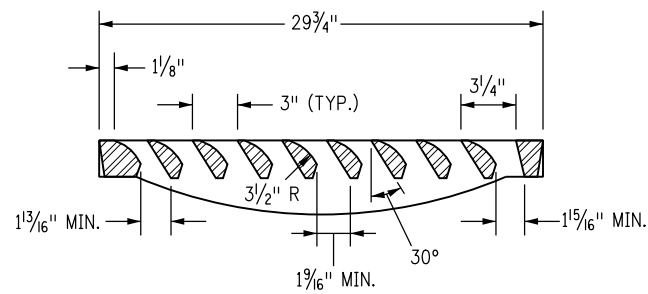
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STANDARD PLAN NO.  
**M-604-25**  
 Sheet No. 3 of 5

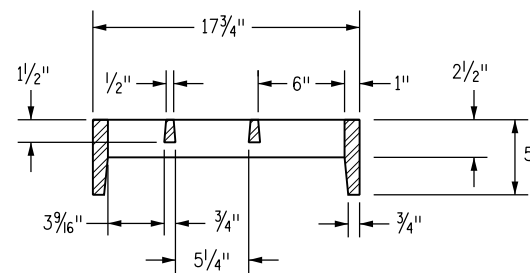


**DETAIL A**

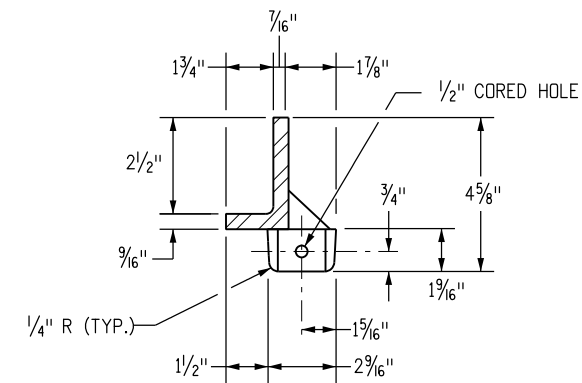
**BOLT SLOT AT CORNER (TYP.)**



**SECTION A-A**



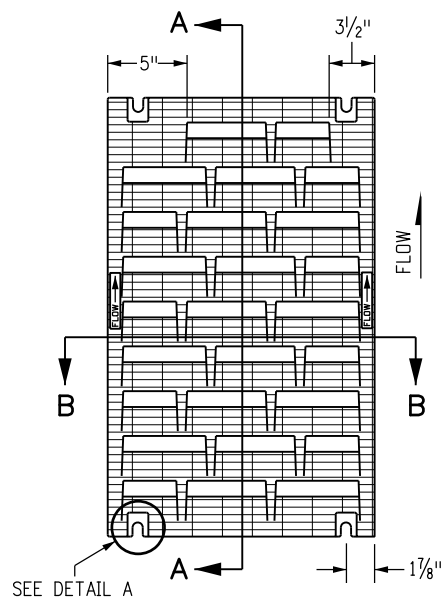
**SECTION B-B**



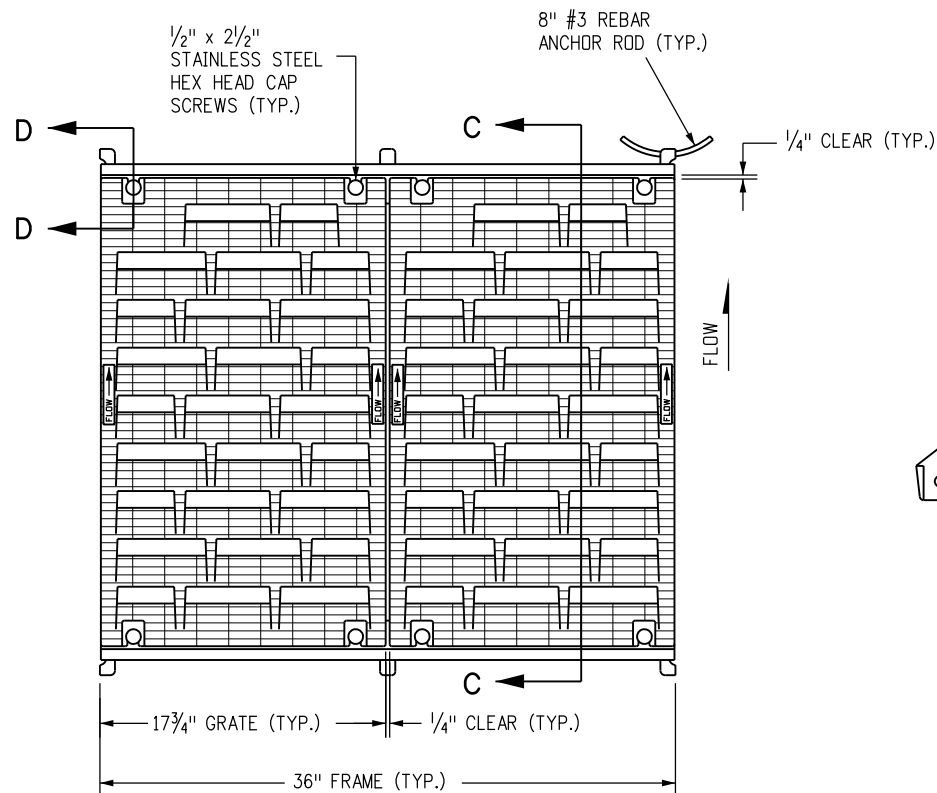
**DETAIL B**

**NOTES**

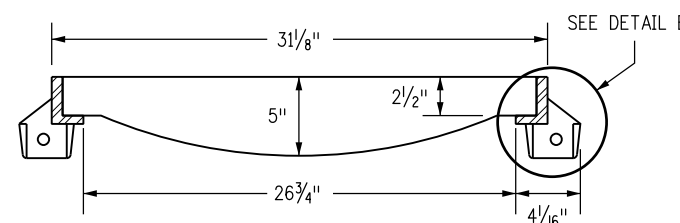
1. FREE OPEN AREA: 190 SQ. IN./GRATE.
2. MATERIAL: CAST GRAY IRON ASTM A-48 CLASS 35B.
3. FINISH: NO PAINT.
4. WEIGHT: GRATE 170 LBS. EACH; FRAME 29 LBS. EACH.
5. ALL REINFORCING BARS SHALL BE EPOXY COATED.



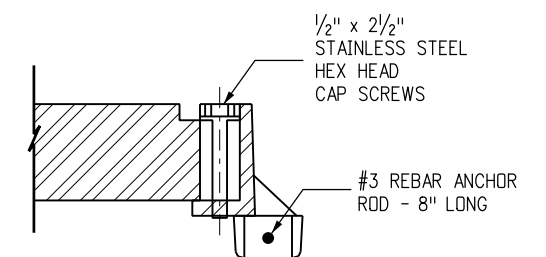
**GRATE PLAN**



**MULTIPLE GRATE WITH FRAME PLAN**



**SECTION C-C**



**SECTION D-D**

**Computer File Information**

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Last Modification Date: 07/04/12	Initials: LTA
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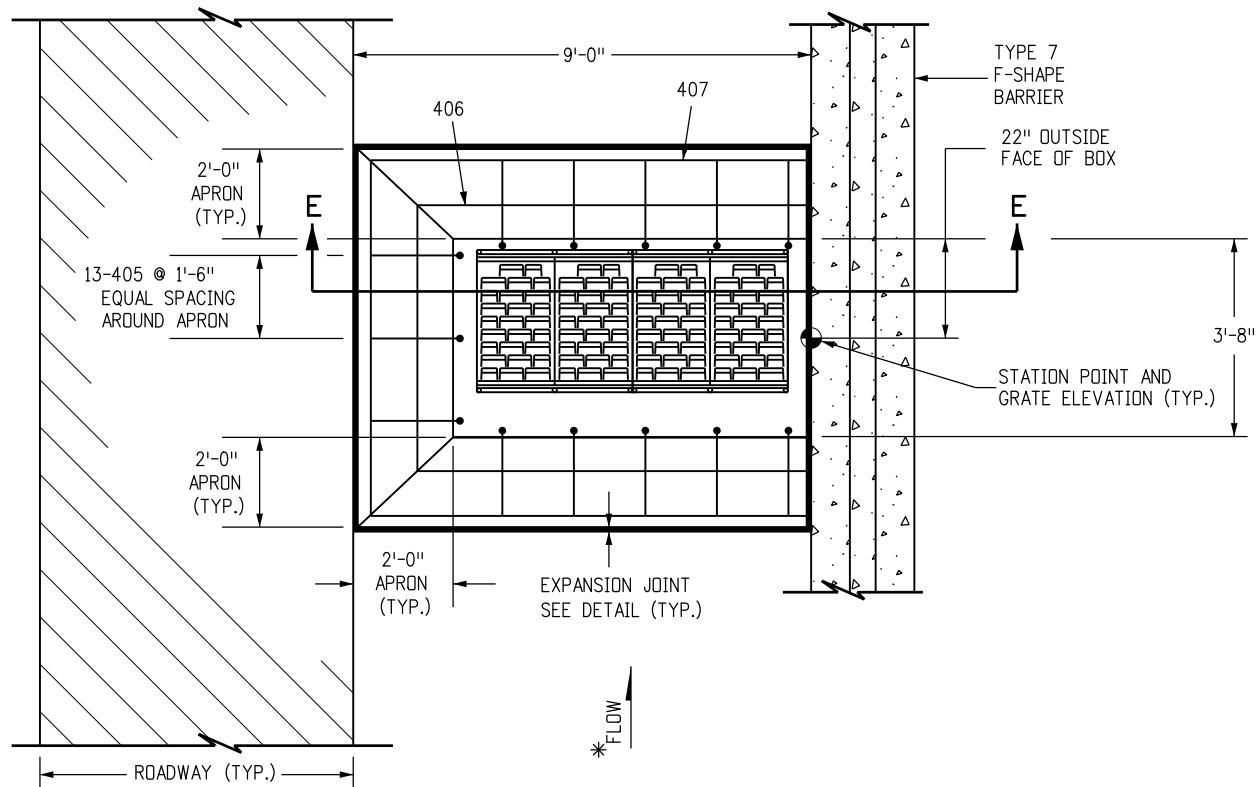
**VANE GRATE INLET**

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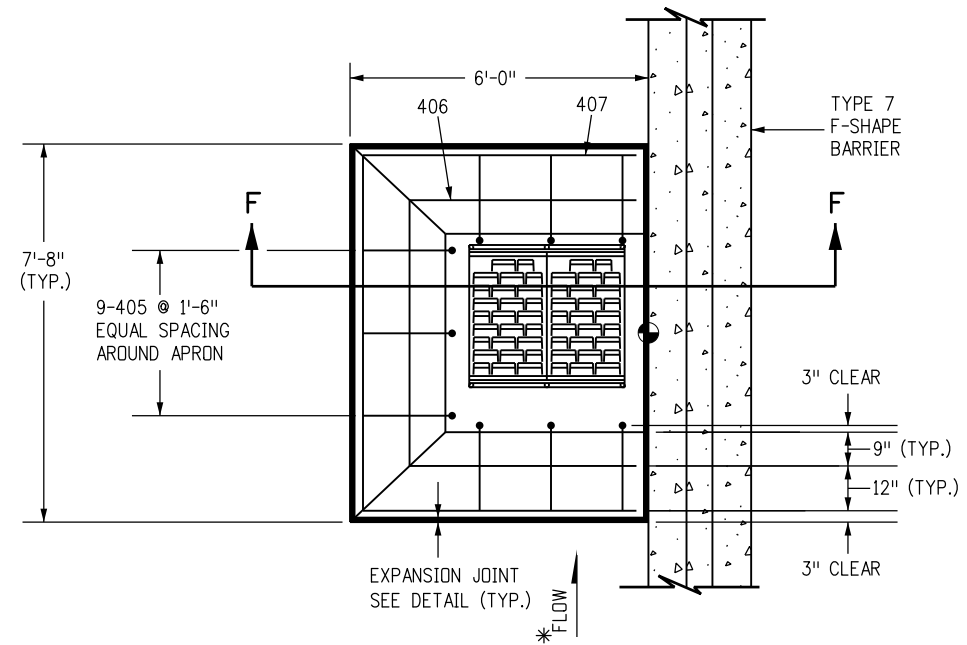
**STANDARD PLAN NO.**

M-604-25

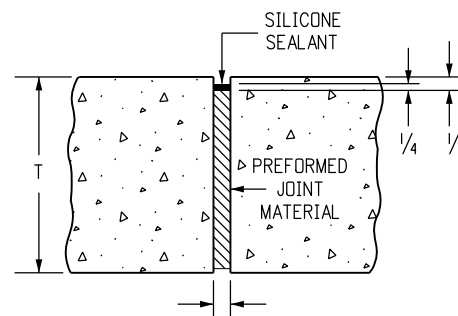
Sheet No. 4 of 5



**CONCRETE APRON FOR 72 IN. INLET**



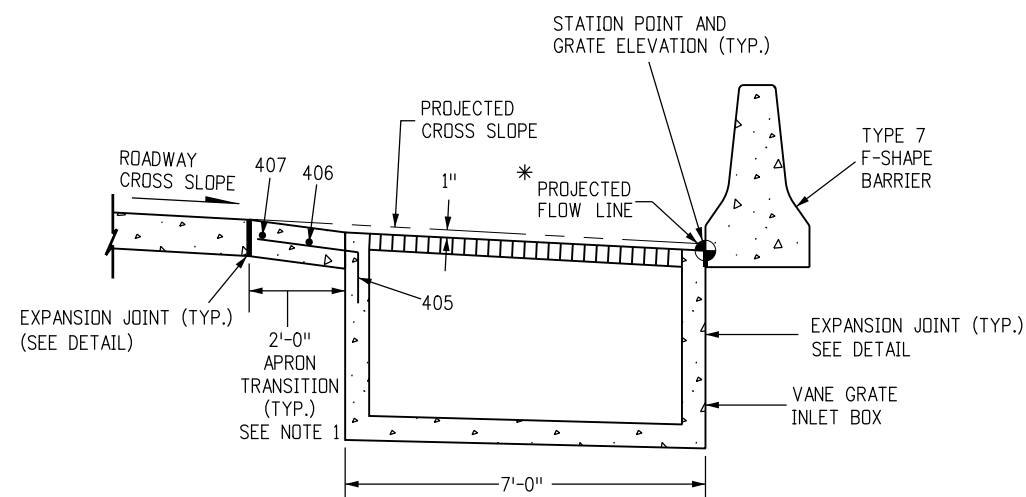
**CONCRETE APRON FOR 36 IN. INLET**



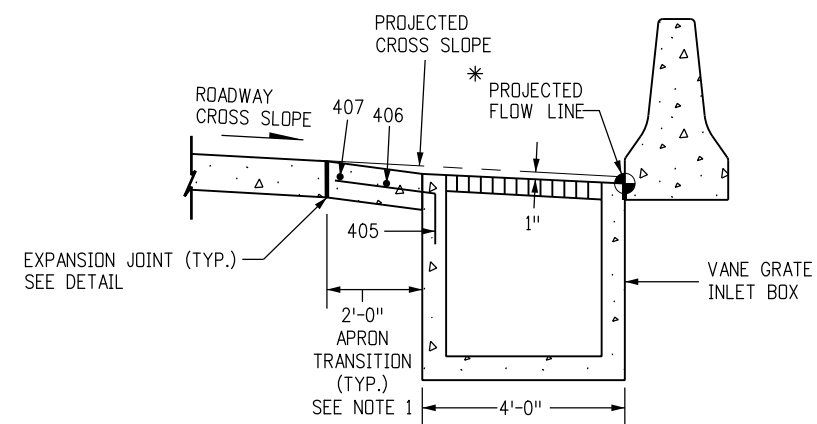
**EXPANSION JOINT (TYP.)**

**NOTES**

1. A 2 FT. CONCRETE TRANSITION APRON SHALL BE CONSTRUCTED AS SHOWN AND SHALL BE KEYED INTO THE INLET.
  2. CONCRETE APRON SHALL BE THE SAME THICKNESS AND TYPE AS THE SURROUNDING CONCRETE.
  3. THE COST OF THE CONCRETE APRON SHALL BE INCLUDED THE COST OF THE INLET.
- \* IF THE INLET IS OFFSET FROM THE BARRIER, SLOPE THE APRON ADJACENT TO THE BARRIER TO DIRECT FLOW TOWARD THE GRATE.



**SECTION E-E**



**SECTION F-F**

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**VANE GRATE INLET**

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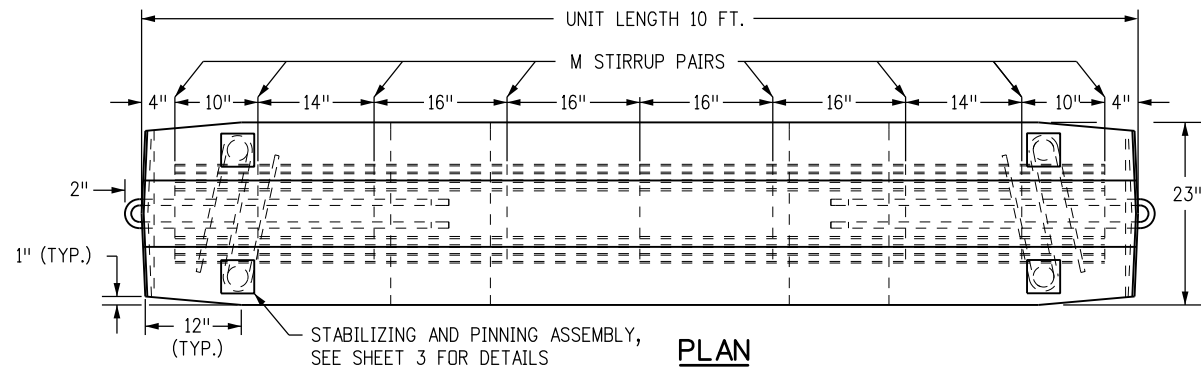
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**M-604-25**

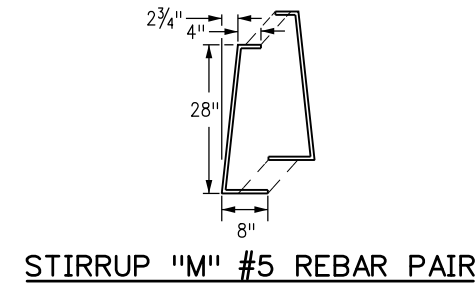
**Sheet No. 5 of 5**

**GENERAL NOTES**

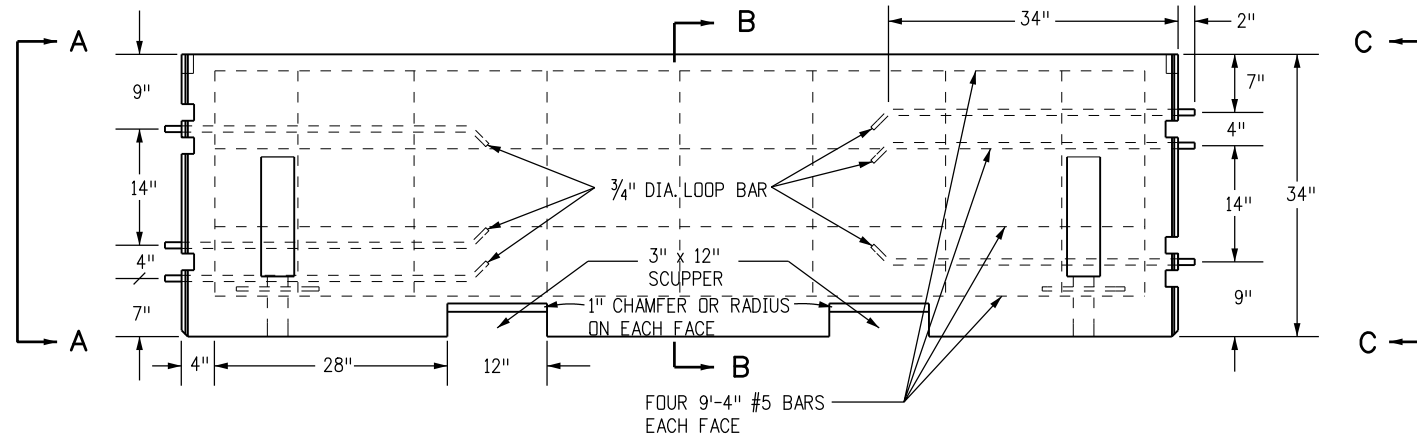
1. ALL STEEL REINFORCING SHALL BE 2 IN. CLEAR OF THE NEAREST SURFACE OF CONCRETE UNLESS OTHERWISE SHOWN. REINFORCING STEEL SHALL BE GRADE 40 MINIMUM.
2. CONCRETE SHALL BE CLASS D.
3. ALL PERMANENT PRECAST BARRIERS USED TO REPLACE OTHER CONCRETE BARRIERS, SHALL BE IN NEW CONDITION, UNDAMAGED, AND WITH NO REPAIRS.
4. FOR TEMPORARY INSTALLATIONS, INSTALL WITH A MINIMUM 4 FT. DISTANCE FROM THE CENTERLINE OF THE CONCRETE BARRIER TO ANY OBSTRUCTIONS BEHIND IT. FOR TEMPORARY INSTALLATIONS WITH LESS THAN A 4 FT. MINIMUM DISTANCE, STABILIZATION PINS SHALL BE USED ON EACH BARRIER UNIT ADJACENT TO, AND WITHIN 10 FT. OF BOTH SIDES OF THE OBSTRUCTION. SEE SHEET 3 FOR STABILIZATION PINNING DETAILS.
5. THE FLARE RATE FOR TEMPORARY INSTALLATIONS SHALL BE 10:1 OR FLATTER UNLESS OTHERWISE APPROVED BY THE ENGINEER FOR PERMANENT INSTALLATIONS. SEE THE FLARE RATES TABLE ON STANDARD M-606-13, SHEET 3.
6. STABILIZATION PINS SHALL BE USED TO ANCHOR EACH 10 FT. UNIT IN ALL PERMANENT INSTALLATIONS. SEE SHEET 3 FOR STABILIZATION PINNING DETAILS.
7. FOR ALL PERMANENT INSTALLATIONS THAT REQUIRE END ANCHORAGES. SEE STANDARD PLAN M-606-13, SHEET 1, FOR ANCHORAGE DETAILS.
8. THE MONTH AND YEAR THE PRECAST TYPE 7 CONCRETE BARRIER WAS MANUFACTURED SHALL BE MOLDED INTO ONE END OF EACH 10 FT. BARRIER UNIT.
9. APPROVED NON-SHRINK GROUT SHALL BE USED FOR GROUTING OVER ALL PINS AND GROUTING OF SCUPPERS.
10. WHEN HYDRAULIC ANALYSIS ALLOWS, SCUPPERS MAY NOT BE NEEDED ON:
  - A. MEDIAN INSTALLATION WITH INLET DRAINAGE.
  - B. SHOULDER BARRIER ON HIGH EDGE OF A SUPERELEVATED SHOULDER.
  - C. MEDIAN BARRIER ON A CREST VERTICAL CURVE.
  - D. PERMANENT BARRIER, IF SPECIFIED ON PLANS.
11. ALL INCIDENTAL WORK AND MATERIALS SUCH AS CONNECTING PINS, ANCHORS BOLTS, GROUT, AND EXCAVATION FOR END ANCHORAGE, WILL NOT BE PAID FOR SEPARATELY, BUT SHALL BE INCLUDED IN THE COST OF THE WORK.
12. ONE IN. DIAMETER THREADED INSERTS MAY BE CAST-IN-PLACE TO FACILITATE LIFTING FOR TEMPORARY BARRIER APPLICATIONS ONLY.
13. RETROREFLECTORIZATION IS REQUIRED ON BARRIERS. SEE BARRIER RETROREFLECTOR NOTES ON STANDARD PLAN S-612-1.



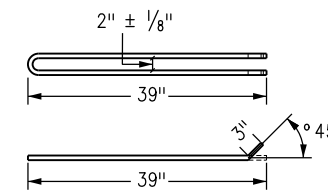
**PLAN**



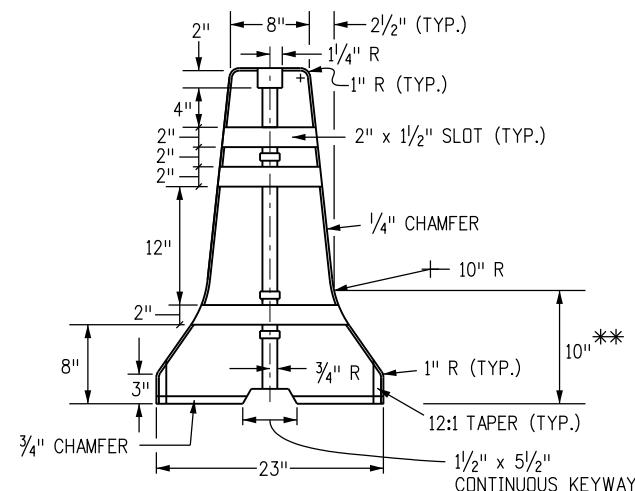
**STIRRUP "M" #5 REBAR PAIR**



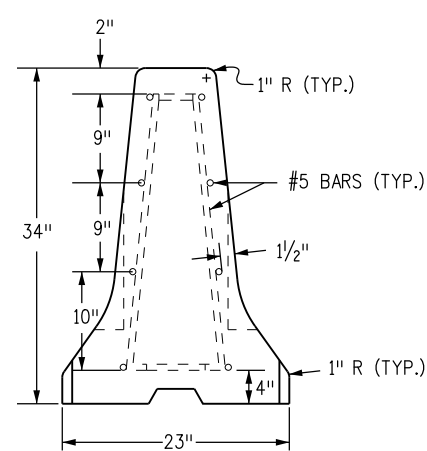
**ELEVATION BARRIER**



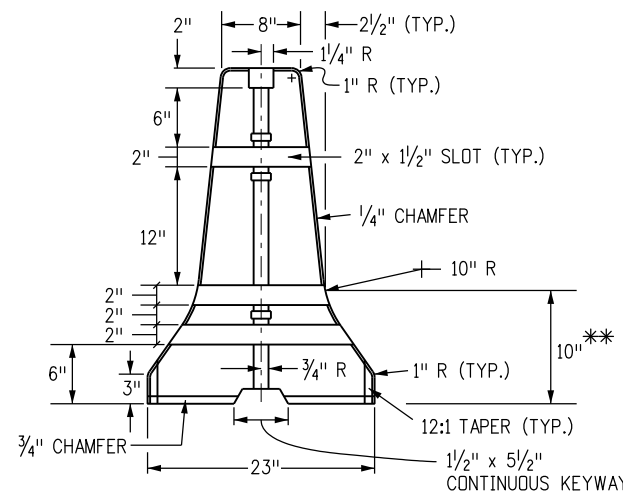
**LOOP BAR BENDING DETAIL (ASTM A36)**  
(HOT-DIP GALVANIZED AFTER FABRICATION)



**SECTION A-A**

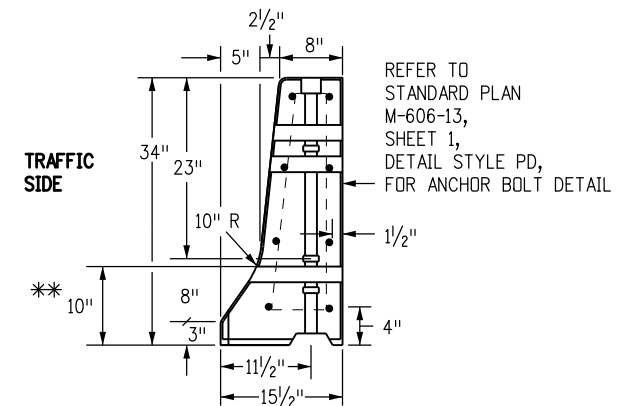


**SECTION B-B**

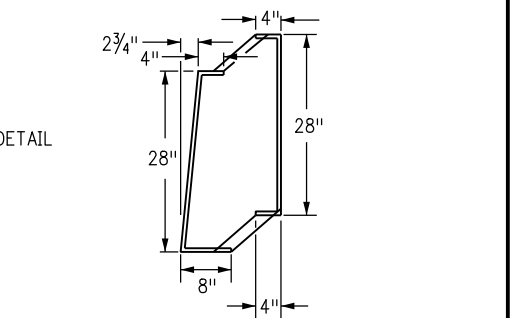


**SECTION C-C**

\*\* DIMENSIONS MARKED ARE TO THE INTERSECTION POINT OF THE BARRIER SLOPES. CONSTRUCT THE 10 IN. RADIUS TO PROVIDE A SMOOTH TRANSITION BETWEEN THE SLOPES.



**NARROW BASE SHOULDER BARRIER**



**NARROW BASE STIRRUP "M" #5 REBAR PAIR**

REFER TO STANDARD PLAN M-606-13, SHEET 1, DETAIL STYLE PD, FOR ANCHOR BOLT DETAIL

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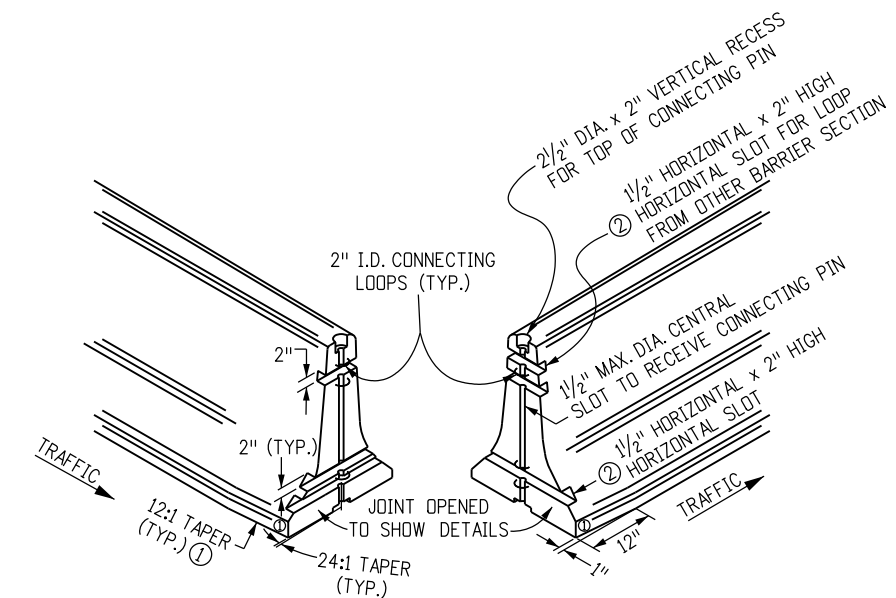
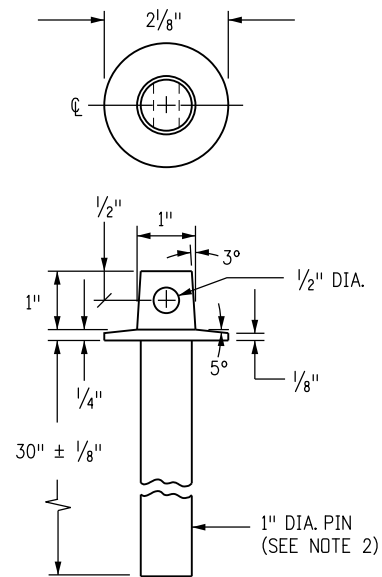
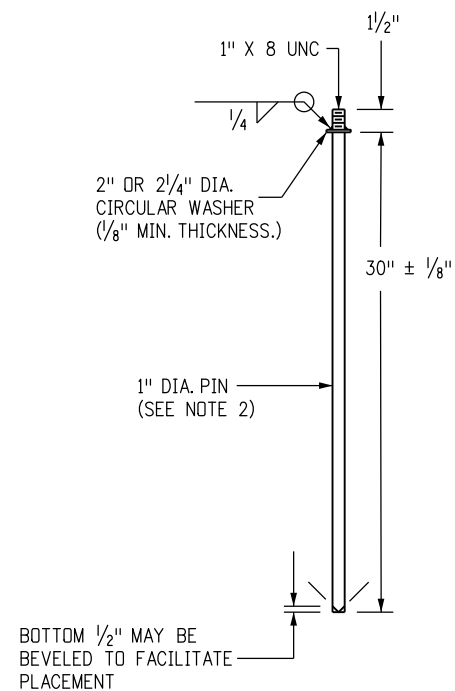
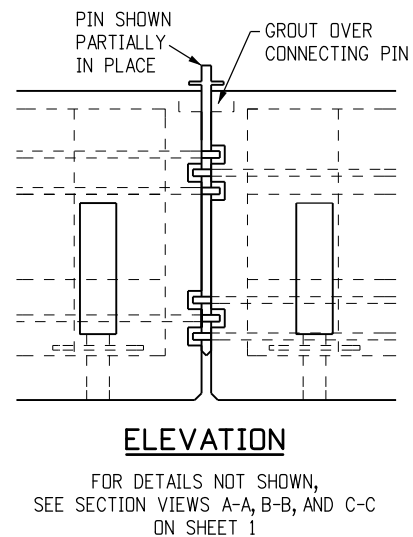
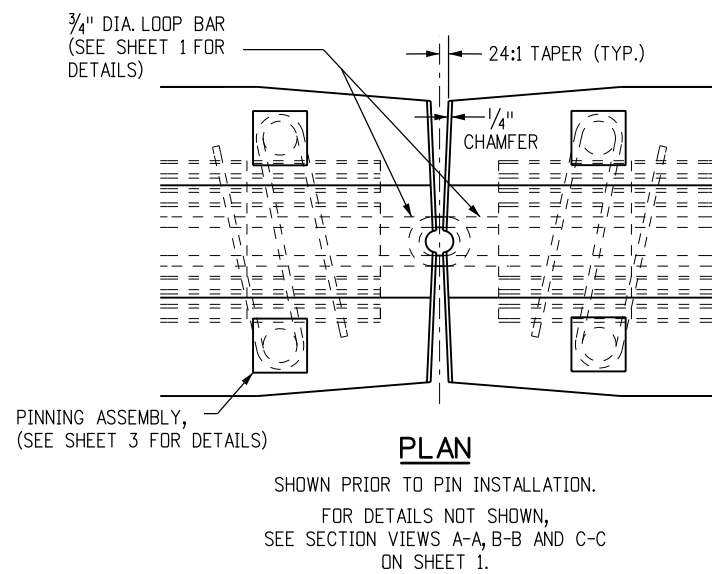
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**PRECAST TYPE 7 CONCRETE BARRIER**

Issued By: Project Development Branch July 4, 2012

STANDARD PLAN NO.
M-606-14
Sheet No. 1 of 3



- NOTES**
1. WASHERS SHALL BE FORGED AS AN INTEGRAL PART OF THE PIN, OR SHALL BE WELDED AS SHOWN.
  2. PINS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION.
  3. IF AN ALTERNATIVE TOP CONFIGURATION IS USED FOR LIFTING, THE LIFTING PIN SHALL BE PROVIDED. PINS SHALL CONFORM TO CRITICAL DIMENSIONS (PIN LENGTH DIAMETER).
  4. PINS SHALL CONFORM TO ASTM A449.
  5. APPROVED NON-SHRINK GROUT SHALL BE USED FOR GROUTING OVER ALL PINS, AND GROUTING OF SCUPPERS.
  6. BOTH ENDS OF THE BARRIER SHALL HAVE A 24:1 TAPER IN EACH DIRECTION FROM THE CENTER PIN RECESS TO ITS OUTER EDGE TO FACILITATE PLACEMENT ON CURVES.
  7. JOINTS BETWEEN CAST-IN-PLACE GUARDRAIL TYPE 7 AND PERMANENT INSTALLATION PRECAST TYPE 7 CONCRETE BARRIER SHALL INCLUDE ALL REGRESSES AND LOOPS IN THE CAST-IN-PLACE END, ALONG WITH THE PIN TO COMPLETE THE TYPICAL PRECAST TYPE 7 CONCRETE BARRIER JOINT.

- ① A 1 IN. BY 12 IN. TAPER IS REQUIRED AT THE BOTTOM OF ALL FOUR CORNERS OF THE BARRIER SECTIONS TO ELIMINATE SNAGGING OF SNOW PLOW BLADES. THE TAPER IS OPTIONAL ON PERMANENT INSTALLATIONS.
- ② THE HORIZONTAL SLOTS SHALL BE 1/2 IN. IN DEPTH AT THE CENTER OF THE BARRIER AND MAY DECREASE IN DEPTH AT THE EDGE OF THE BARRIER DUE TO THE (24:1) TAPER.

**DETAILS FOR PIN AND LOOP CONNECTION**

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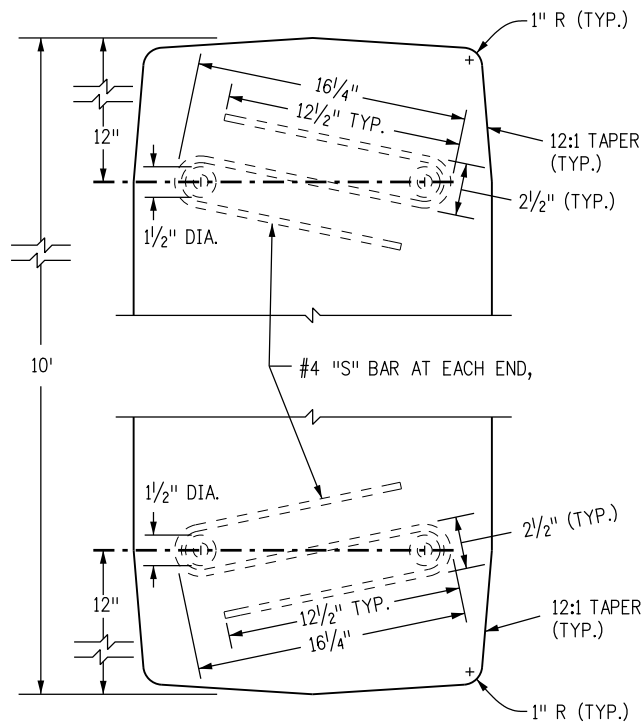
**PRECAST TYPE 7  
CONCRETE BARRIER**

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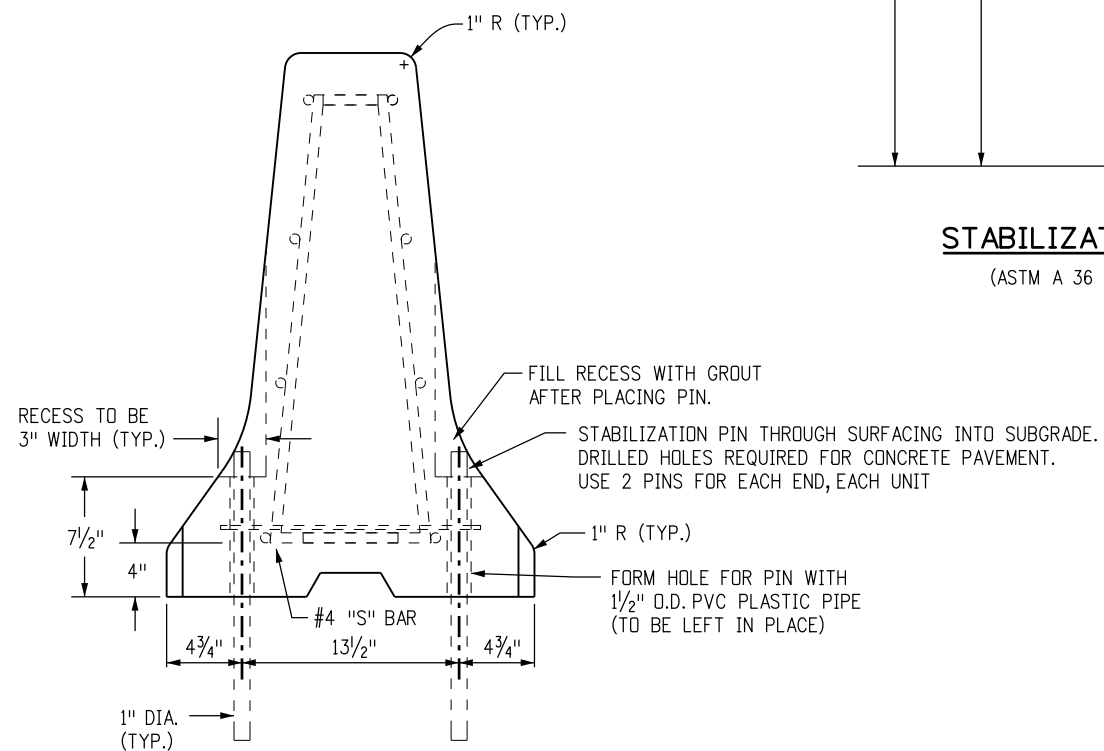
**STANDARD PLAN NO.**

M-606-14

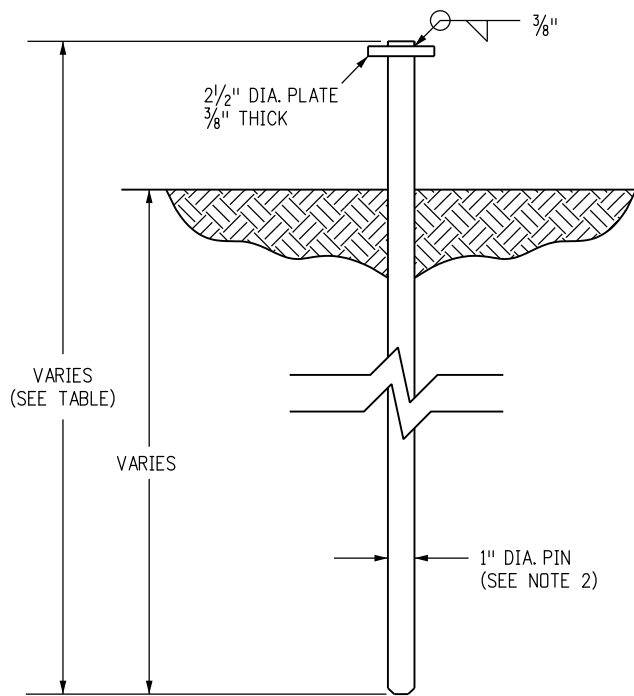
Sheet No. 2 of 3



**PLAN VIEW OF S BAR ENDS**

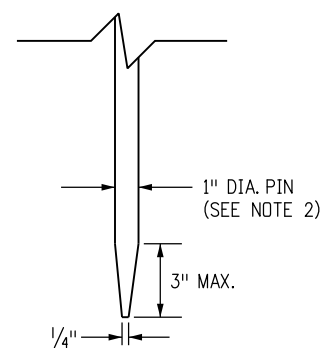


**ELEVATION VIEW WITH PINS**



**STABILIZATION PIN**

(ASTM A 36 STEEL)



**OPTIONAL TAPERED END PIN**

(SEE NOTE 4)

**NOTES**

1. SEE SHEET 1 FOR REINFORCEMENT AND OTHER DETAILS NOT SHOWN HERE.
2. PINS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION
3. FOR TERMINAL ANCHORING OF THE PERMANENT INSTALLATION OF PRECAST TYPE 7 CONCRETE BARRIER, SEE THE END ANCHORAGE DETAIL ON STANDARD PLAN M-606-13, SHEET 1.
4. AN OPTIONAL 3 IN. MAXIMUM TAPERED END POINT MAY BE PROVIDED ON THE STABILIZATION PIN TO FACILITATE DRIVING.

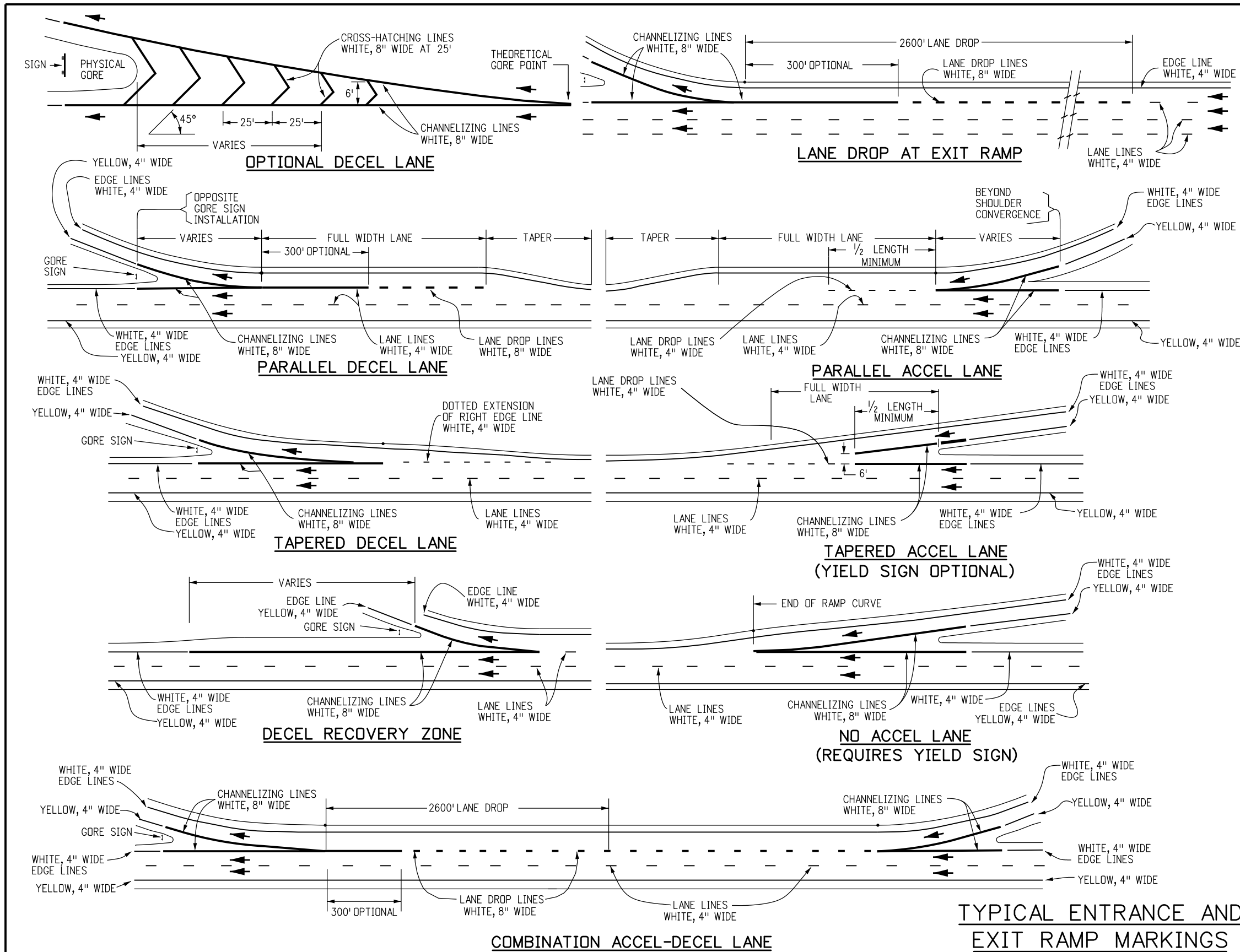
ROAD SURFACE	PIN LENGTH
CONCRETE	2 FT.-6 IN.
HMA	3 FT.
SOIL	3 FT.-6 IN.

**TABLE OF STABILIZATION PIN LENGTHS**

**DETAILS FOR STABILIZATION OF PERMANENT OR TEMPORARY PINNED PRECAST TYPE 7 CONCRETE BARRIER**

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Creation Date: 07/04/12	Initials: DD	Date:	Comments:			M-606-14
Last Modification Date: 07/04/12	Initials: LTA					Sheet No. 3 of 3
Full Path: www.coloradodot.info/business/designsupport	(R-X)					
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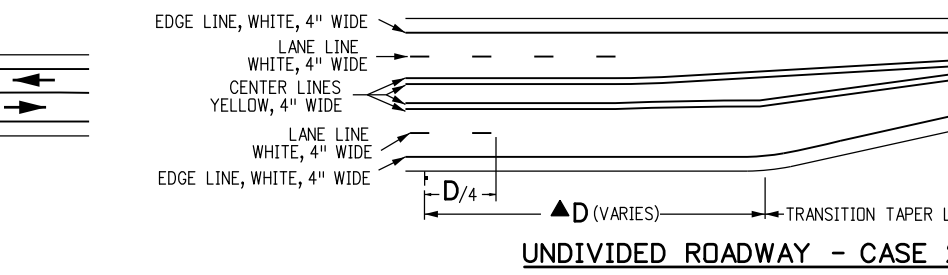
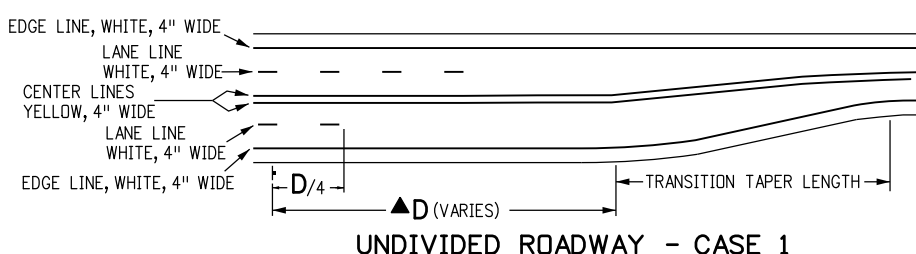
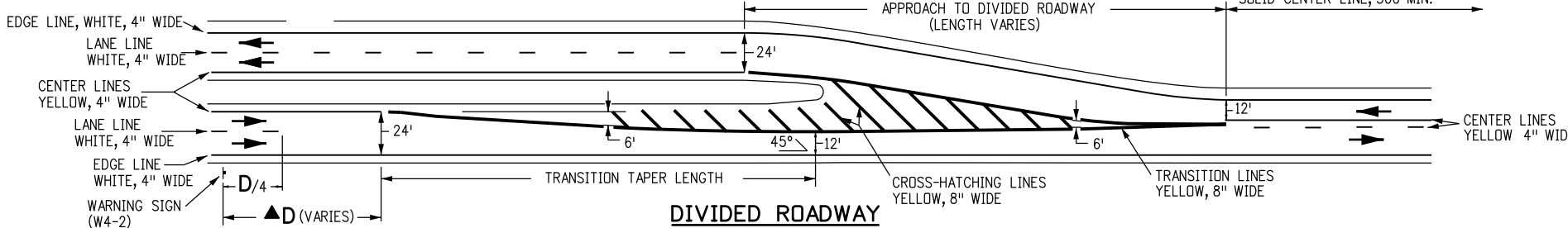
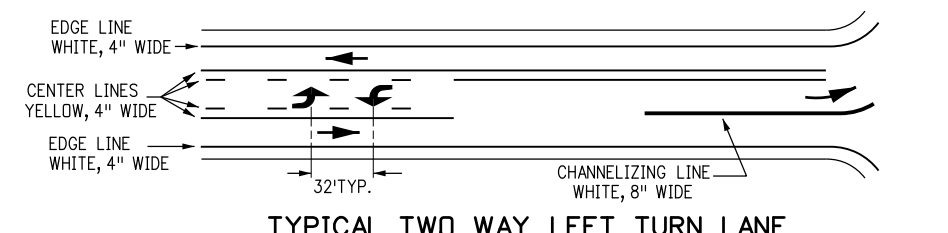
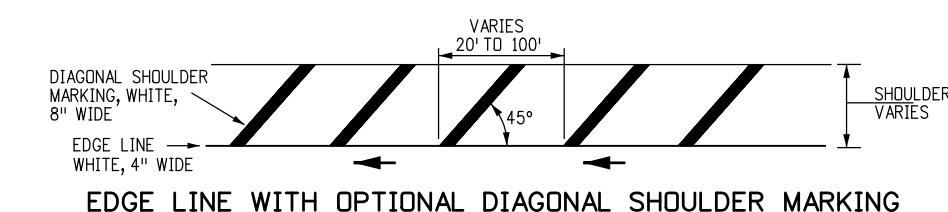
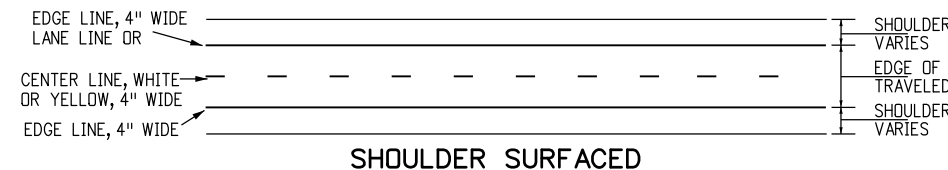
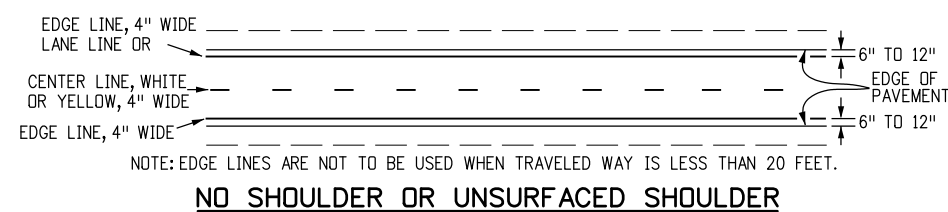
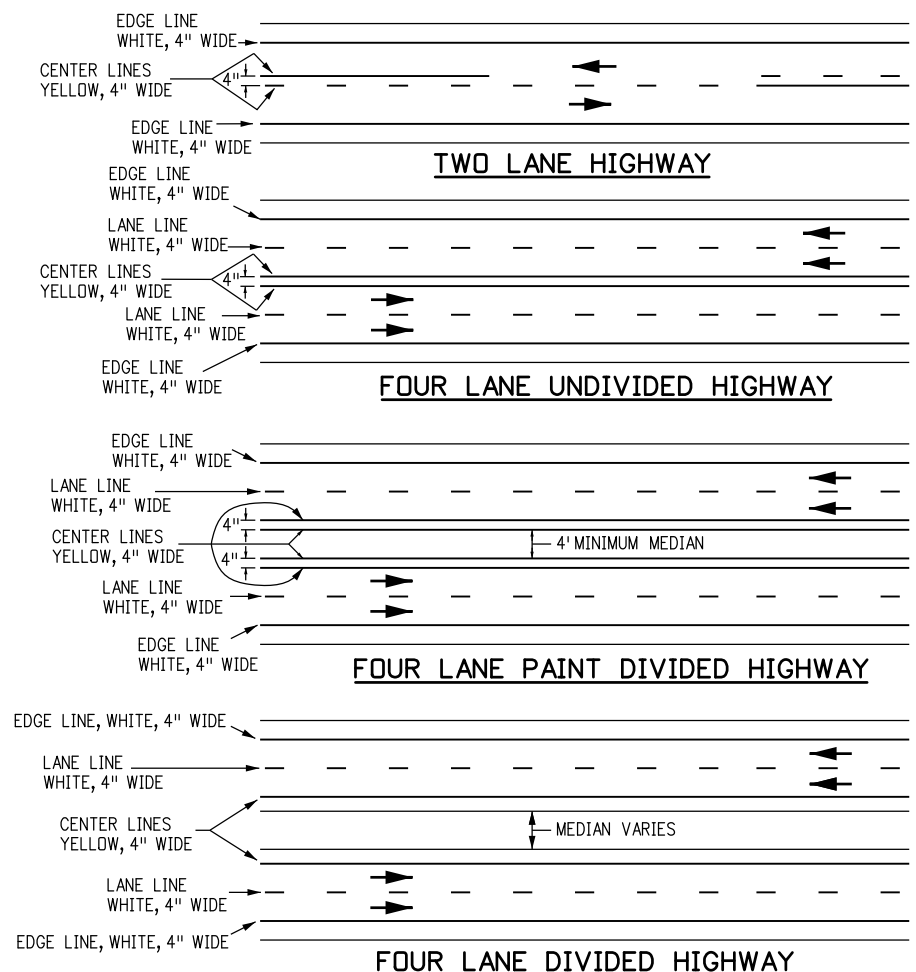
**GENERAL NOTES**

1. **CENTER LINES**  
 BROKEN YELLOW, 4 IN. WIDE - 10 FT. SEGMENTS WITH 30 FT. GAPS.  
 SOLID YELLOW, 4 IN. WIDE.  
 THESE LINES SEPARATE ADJACENT-OPPOSITE DIRECTION TRAFFIC LANES. DOUBLE LINES SHALL BE SPACED 4 IN. APART.
2. **LANE LINES**  
 BROKEN WHITE, 4 IN. WIDE - 10 FT. SEGMENTS WITH 30' GAPS.  
 SOLID WHITE, 4 IN. WIDE.  
 THESE LINES SEPARATE ADJACENT-SAME DIRECTION TRAFFIC LANES. A SOLID LINE MAY BE USED TO DISCOURAGE LANE CHANGING, WHILE TWO PARALLEL SOLID WHITE LINES ARE REQUIRED TO PROHIBIT LANE CHANGING.
3. **EDGE LINES**  
 SOLID WHITE OR YELLOW EDGE LINES SHALL BE 4 IN. WIDE. YELLOW EDGE LINES SHALL BE USED ONLY FOR LEFT EDGE, IN THE DIRECTION OF TRAVEL OF DIVIDED STREETS AND HIGHWAYS (SEPARATED BY OTHER THAN A PAINTED MEDIAN) AND ONE-WAY ROADWAYS (INCLUDING RAMP).  
 EDGE LINES ARE NOT CONTINUED THROUGH INTERSECTIONS AND ARE NOT BROKEN FOR DRIVEWAYS. CARE MUST BE TAKEN TO AVOID EDGE LINE APPEARING AS LANE LINE ALONG ROADWAYS WITH WIDE SHOULDERS AND/OR CLOSELY SPACED DRIVEWAYS.
4. **DOTTED LINES**  
 BROKEN WHITE, WIDTH MATCHING THE LINE BEING EXTENDED-2 FT. SEGMENTS WITH 4 FT. GAPS. THESE LINES ARE USED TO DELINEATE THE EXTENSION OF A LINE THROUGH AN INTERSECTION OR INTERCHANGE AREA.
5. **CHANNELIZING LINES**  
 SOLID WHITE, 8 IN. WIDE. THESE LINES ARE USED WITH ACCELERATION-DECELERATION LANES, PAVEMENT WIDTH TRANSITIONS, AND LEFT-RIGHT TURN SLOTS OR ISLANDS.
6. **CROSS-HATCHING LINES**  
 SOLID WHITE OR YELLOW, 8 IN. WIDE-45 DEGREE DIAGONAL, SPACED AT 25 FT. INTERVALS. THESE LINES ARE OPTIONAL AND MAY BE PLACED AT LOCATIONS INDICATED ON THE PLANS OR DETERMINED BY THE ENGINEER. YELLOW SHALL BE USED FOR PAINTED MEDIANS OR PAVEMENT WIDTH TRANSITIONS ONLY.  
 OPTIONAL DIAGONAL SHOULDER MARKINGS SHALL BE SOLID WHITE, 8 IN. WIDE, SPACED AT INTERVALS OF 20 FT. MINIMUM TO 100 FT. MAXIMUM.
7. **PARKING LINES**  
 SOLID WHITE, 3 IN. WIDE-DIAGONAL OR PARALLEL AS SHOWN ON THE PLANS OR DIRECTED BY THE ENGINEER.
8. **STOP LINES**  
 SOLID WHITE, 24 IN. WIDE-EXTEND PARALLEL TO INTERSECTED ROADWAY ACROSS ALL APPROACH LANES OR AS INDICATED AT LOCATIONS ON THE PLANS. LOCATE AT THE DESIRED STOPPING POINT, NOT MORE THAN 30 FT. NOR LESS THAN 4 FT. FROM THE NEAREST EDGE OF THE INTERSECTED TRAFFIC LANE.
9. **LANE DROP MARKINGS**  
 BROKEN WHITE, 8 IN. WIDE - 3 FT. SEGMENTS WITH 9 FT. GAPS. THESE LINES SHOULD BEGIN 2600 FT. IN ADVANCE OF THE THEORETICAL GORE POINT TO DISTINGUISH THE LANE DROP FROM A CONTINUOUS LANE. THE CHANNELIZING LINE MAY BE EXTENDED APPROXIMATELY 300 FT. UPSTREAM.

(CONTINUED ON SHEET NO. 2)

**TYPICAL ENTRANCE AND EXIT RAMP MARKINGS**

<b>Computer File Information</b>		<b>Sheet Revisions</b>		Colorado Department of Transportation  4201 East Arkansas Avenue Denver, Colorado 80222 Phone: (303) 757-9543 Fax: (303) 757-9219 <b>Safety &amp; Traffic Engineering Branch</b> <b>KCM/KEN</b>	<b>PAVEMENT MARKINGS</b>	<b>STANDARD PLAN NO.</b>
Creation Date: 07/04/12	Initials: SCL	Date: 10/18/12	Comments: SHEET 2 - ADDED "D" NOTE			S-627-1
Last Modification Date: 06/10/14	Initials: KEN	(R-2) 06/27/13	SHEET 5 - UPDATED BICYCLIST SYMBOL			Sheet No. 1 of 5
Full Path: www.coloradodot.info/library/traffic/traffic-s-standard-plans		(R-3) 09/16/13	UPDATED TYPICAL ISLAND MARKINGS DETAIL			
Drawing File Name: S-627-01_1of5.dgn		(R-4) 06/16/14	CORRECTED STRIPING ERROR IN PARALLEL ACCEL LANE DETAIL			
CAD Ver.: MicroStation V8	Scale: Not to Scale    Units: English			Issued By: Safety & Traffic Engineering Branch July 4, 2012		



**GENERAL NOTES**  
(CONTINUED FROM SHEET NO. 1)

- CROSSWALK LINES**  
SOLID WHITE, 12 IN. WIDE FOR TRANSVERSE LINE TYPE - EXTEND ACROSS ENTIRE WIDTH OF PAVEMENT. IF NO ADVANCE STOP LINE IS PROVIDED, INCREASE THE WIDTH OF THE CROSSWALK LINES TO 24 IN. THE DISTANCE BETWEEN THE LINES IS USUALLY DETERMINED BY THE WIDTH OF THE SIDEWALKS SO CONNECTED, HOWEVER, IN NO CASE SHALL THIS BE LESS THAN 6 FT.
- COMPLICATED AND/OR CHANNELIZED INTERSECTIONS AND MID-BLOCK CROSSWALKS** SHALL BE SOLID WHITE, 12 IN. TO 24 IN. WIDE AND 8 FT. TO 10 FT. LONG FOR LONGITUDINAL LINE TYPE AS DETAILED IN THE PLANS OR AS DIRECTED BY THE ENGINEER.
- WORD, ARROW AND SYMBOL MARKINGS**  
ALL LETTERS, ARROWS AND SYMBOLS SHALL BE IN CONFORMANCE WITH "THE STANDARD ALPHABETS FOR HIGHWAY SIGNS AND PAVEMENT MARKINGS" ADOPTED BY THE FEDERAL HIGHWAY ADMINISTRATION.
- TRANSITION TAPER LENGTH**  
L = MINIMUM LENGTH OF TAPER.  
S = DESIGN SPEED FOR NEW CONSTRUCTION OR NUMERICAL VALUE OF THE POSTED SPEED LIMIT OF THE 85TH PERCENTILE SPEED OF EXISTING TRAFFIC.  
W = WIDTH TRANSITIONED  
FORMULA: FOR SPEED 45 MPH OR MORE,  $L = S \times W$   
FOR SPEED 40 MPH OR LESS,  $L = \frac{WS^2}{60}$
- TRANSITION LINES**  
SOLID YELLOW, 8 IN. WIDE. THESE LINES ARE USED WHERE ADDITIONAL EMPHASIS OR VISIBILITY IS DESIRABLE AT PAVEMENT WIDTH TRANSITIONS. PLACE AT LOCATIONS INDICATED ON THE PLANS OR AS DIRECTED BY THE ENGINEER.
- SPEED MEASURING MARKING**  
SOLID WHITE, 24 IN. - EXTEND 4 FT. FROM OUTSIDE OF EDGE LINES ON SHOULDERS.

**NOTE:**  
D = THE DISTANCE FROM THE PAVEMENT WIDTH TRANSITION SIGN (W4-2) TO THE BEGINNING OF THE TRANSITION TAPER. FOR MORE INFORMATION ON THE "D" VALUE REGARDING SIGN AND PAVEMENT MARKING PLACEMENT, SEE THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES", TABLE 2C-4, CONDITION A: SPEED REDUCTION AND LANE CHANGING IN HEAVY TRAFFIC AND FOOTNOTE 2 REGARDING TYPICAL CONDITIONS.

**TYPICAL PAVEMENT WIDTH TRANSITION MARKINGS**

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Sheet Revisions	
Date:	Comments
10/18/12	ADDED MORE NOTES ON "D" VALUE

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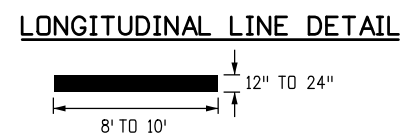
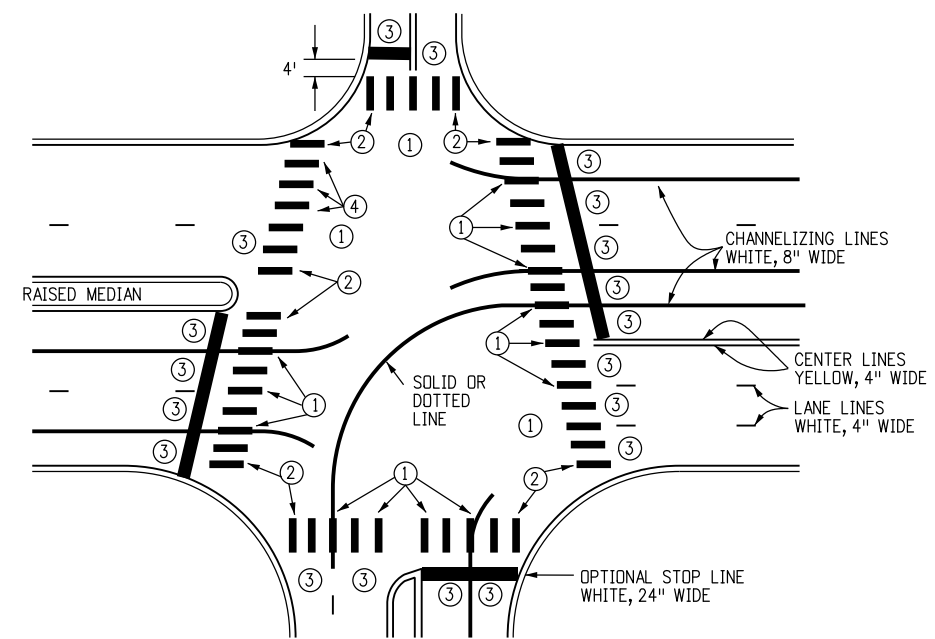
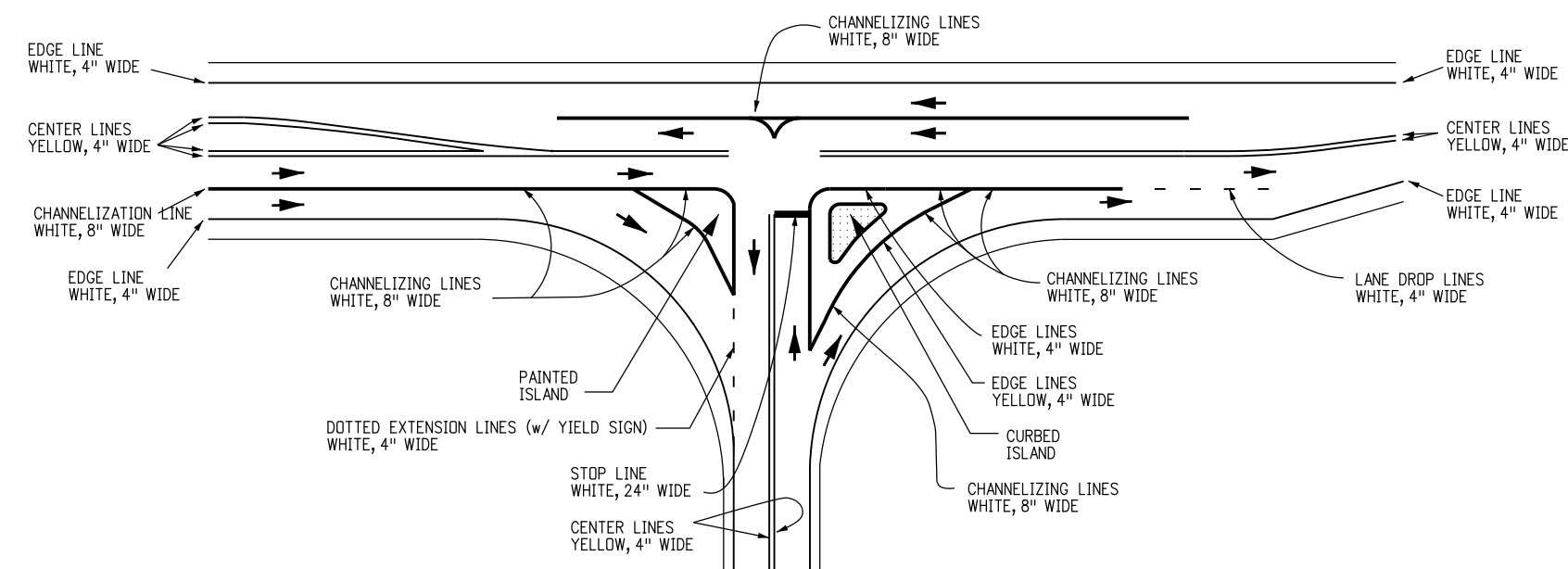
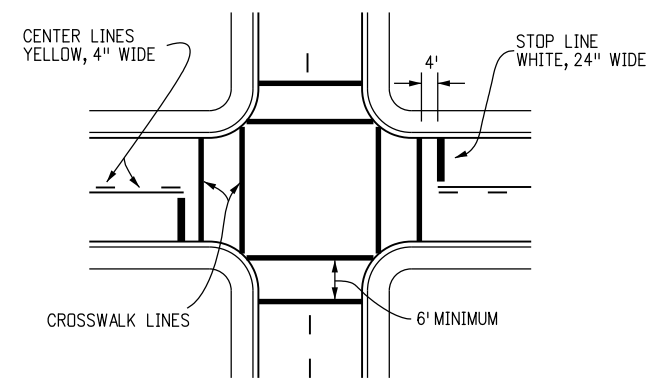
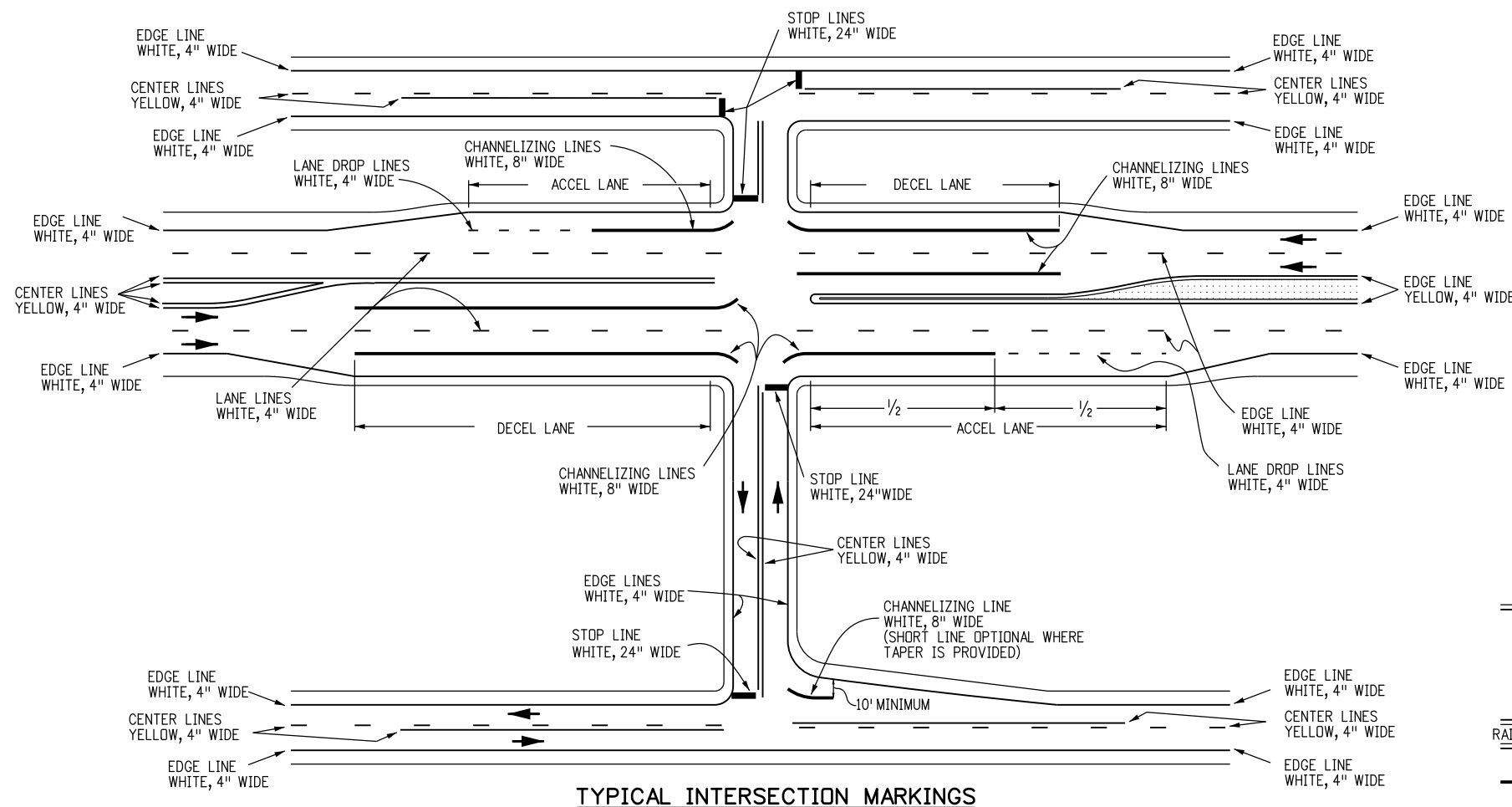
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- CROSSWALK NOTES**
- CENTER CROSSWALKS ON CURB RAMPS. IF SUCH RAMPS ARE NOT PROVIDED CENTER ON SIGNAL POLES WHEREVER PRACTICAL.
- ① CENTER ON LANE, CENTER OR CHANNELIZING LINE.
  - ② CENTER OR EXTENDED FLOW LINE.
  - ③ CENTER BETWEEN ADJACENT LINES.
  - ④ LINES AND SPACES TO APPROXIMATE ADJACENT PATTERN.

**INTERSECTIONS, ISLANDS AND CROSSWALKS**

**Computer File Information**

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**Sheet Revisions**

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09/16/13	ADDED ACCEL LANE IN TYP. ISLAND MARKING DETAIL

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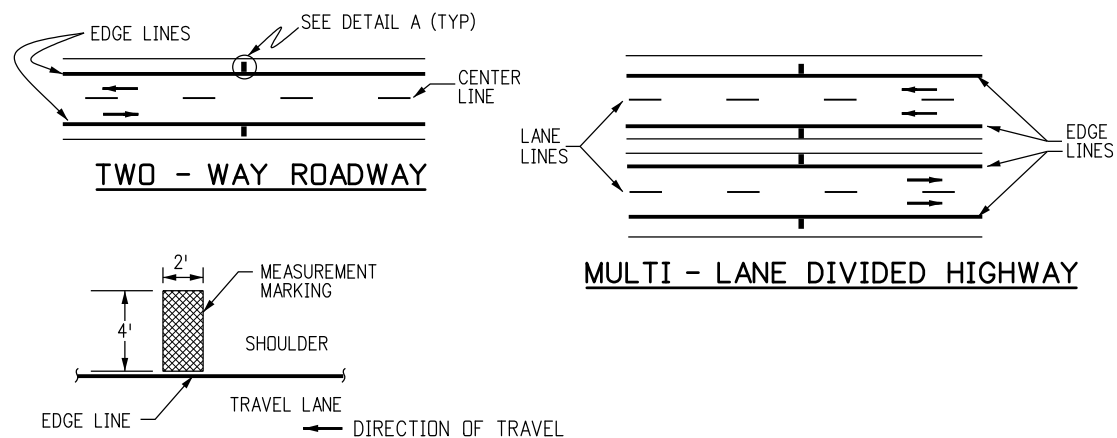
**PAVEMENT MARKINGS**

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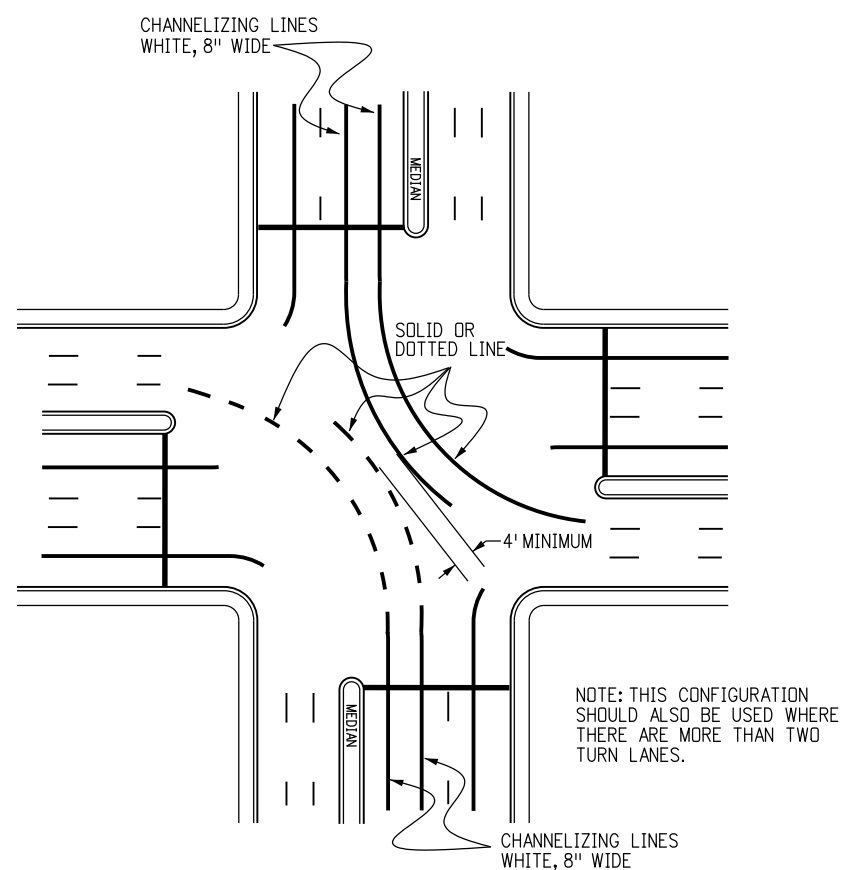
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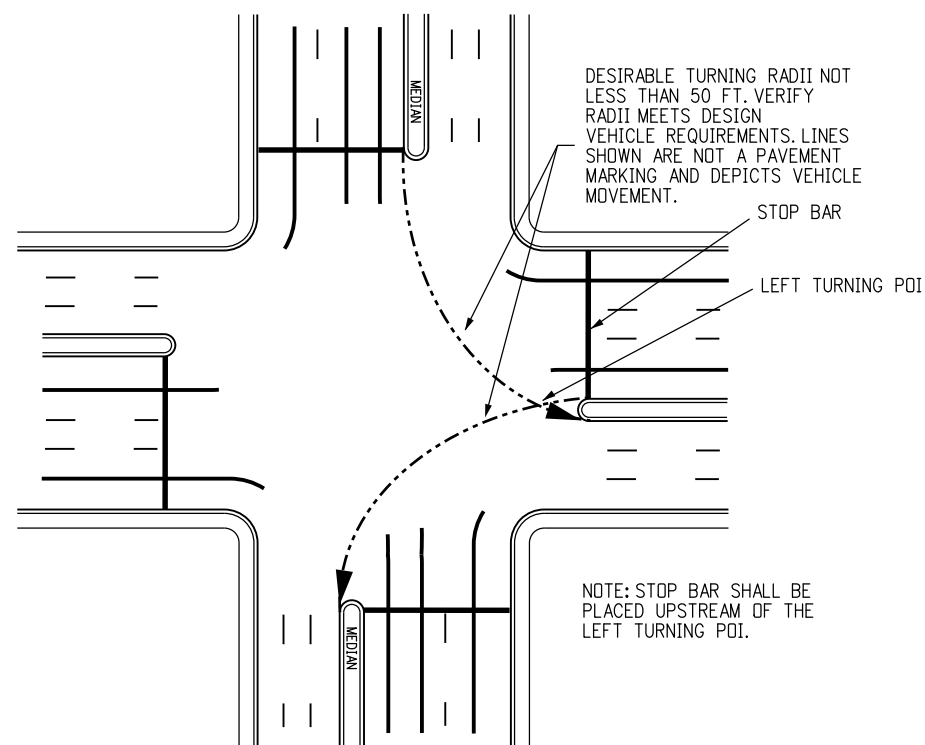
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**DETAIL A**  
**TYPICAL SPEED MEASUREMENT MARKING**



**TYPICAL DOUBLE LEFT TURN MARKINGS**



**TYPICAL STOP BAR PLACEMENT**

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Drawing File Name: S-627-01_4of5.dgn	(R-X)
CAD Ver.: MicroStation V8 Scale: Not to Scale Units: English	(R-X)

Sheet Revisions	
Date:	Comments

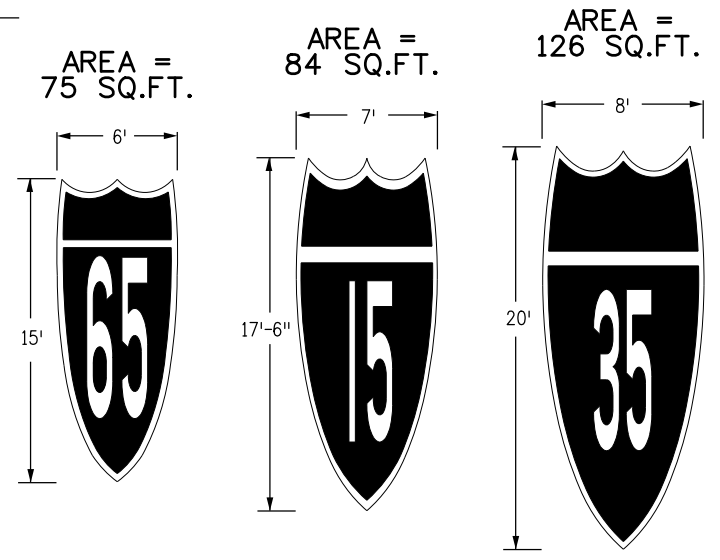
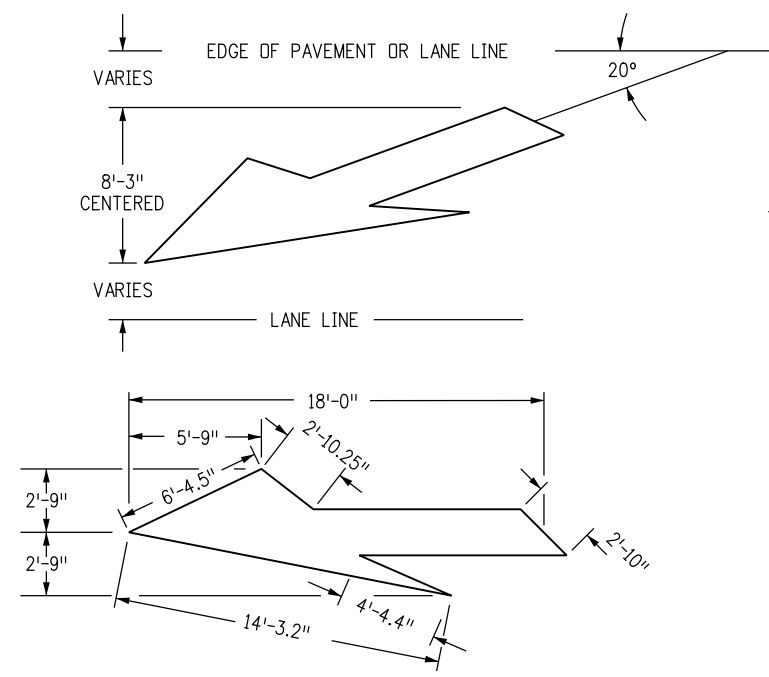
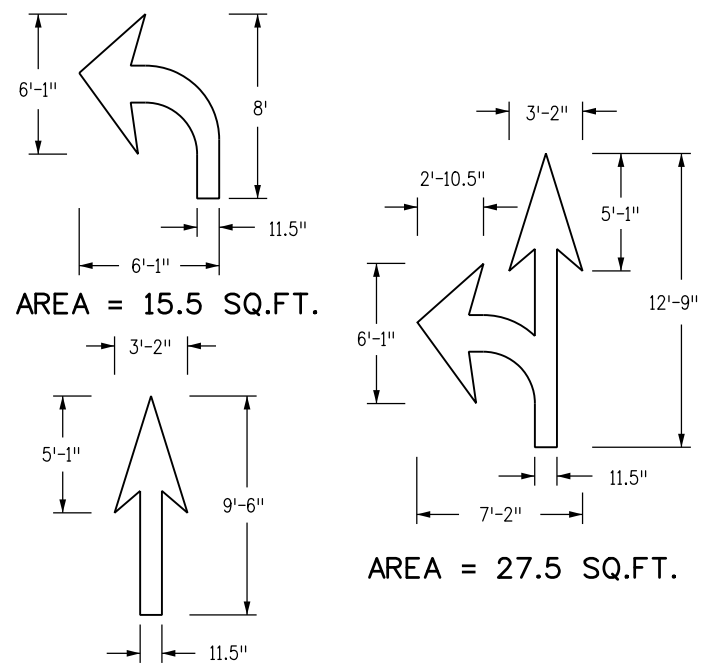
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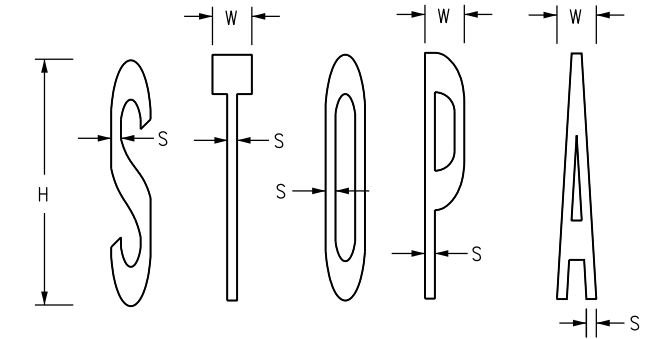
**ELONGATED ROUTE SHIELDS**

**ELONGATED ROUTE SHIELD NOTES**

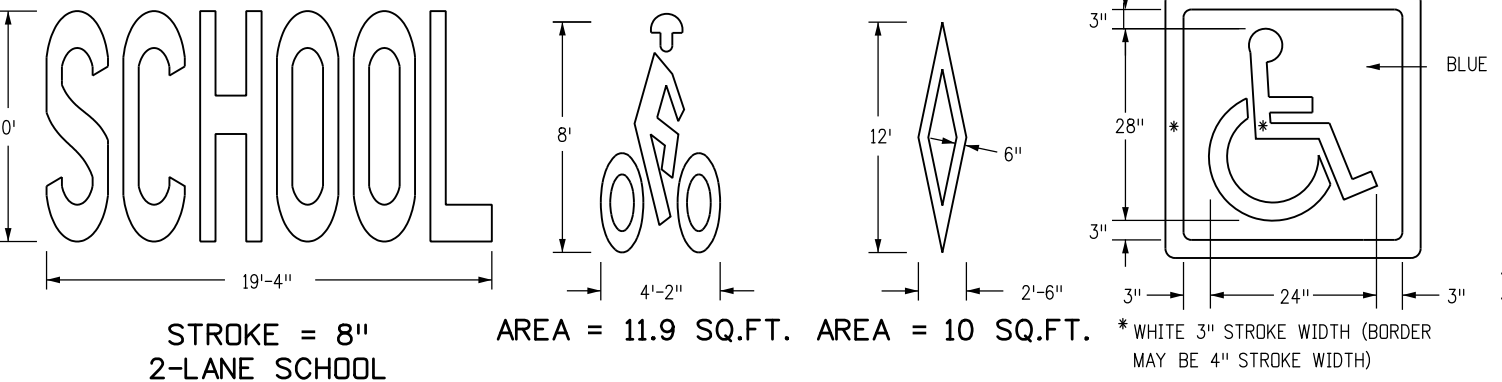
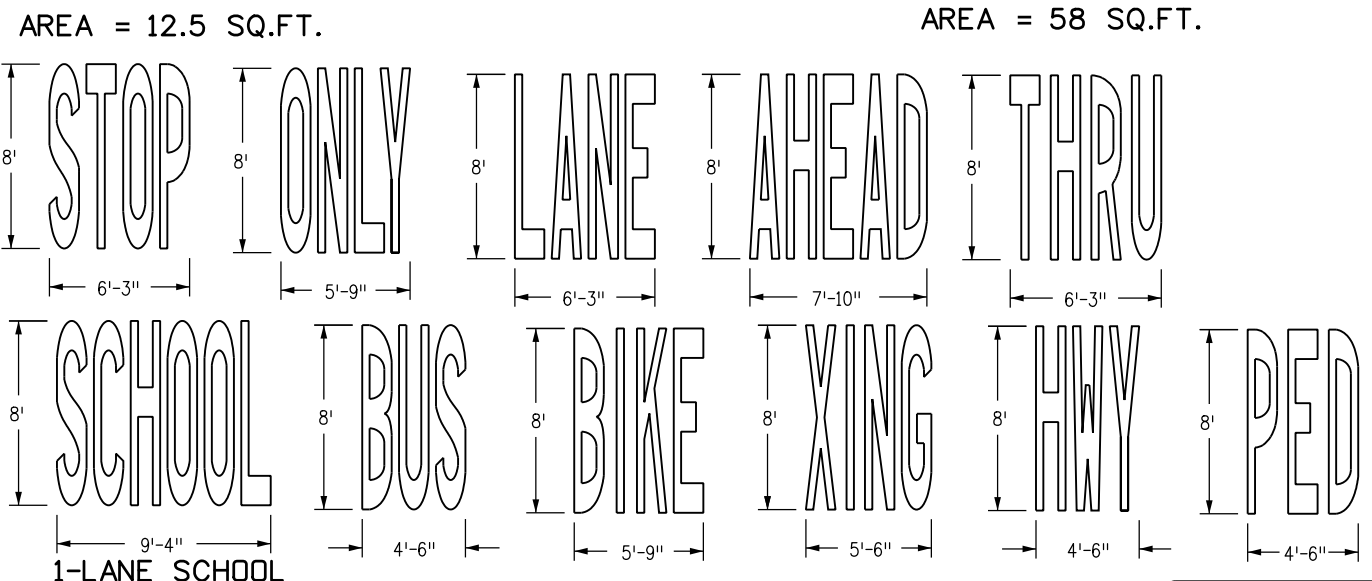
ELONGATED ROUTE SHIELDS SHALL BE AT LEAST 8'x20' WHEN USED ON HIGH SPEED ROADWAYS (45 MPH OR MORE).  
 PER FIGURE 3B-25 OF THE 2009 MUTCD ELONGATED ROUTE SHIELD COLORS SHALL CONFORM WITH THE STANDARD HIGHWAY SIGNS AND MARKINGS BOOK.

**DESIGNATED PAYMENT AREAS**

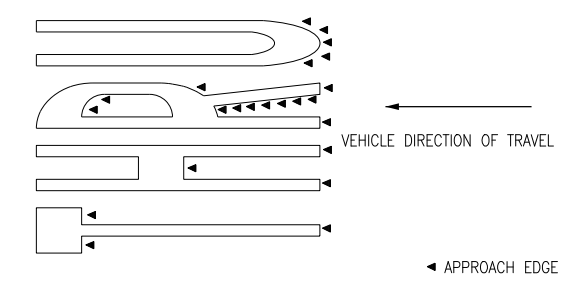
- FOR THE FOLLOWING H, W, AND S DIMENSIONS PAY:
- H = 4' WORDS**  
 BIKE - 5.5 SQ.FT. LANE - 6.0 SQ.FT.  
 ONLY - 6.0 SQ.FT. XING - 5.0 SQ.FT.
- H = 8' WORDS**  
 STOP - 23.0 SQ.FT. XING - 20.0 SQ.FT.  
 ONLY - 22.5 SQ.FT. LANE - 22.5 SQ.FT.  
 AHEAD - 29.0 SQ.FT. BIKE - 21.0 SQ.FT.  
 BUS - 18.5 SQ.FT. HWY - 16.5 SQ.FT.  
 THRU - 22.0 SQ.FT. SCHOOL(1L) - 33.0 SQ.FT.  
 PED - 17.5 SQ.FT. SCHOOL(2L) - 85.0 SQ.FT.



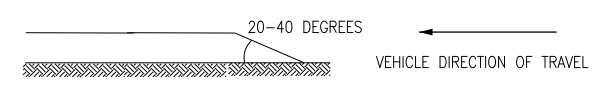
H = HEIGHT H = 8' H = 4'  
 W = WIDTH W = 1'-3.4" TO 1'-4" W = 7.7" TO 8"  
 S = STROKE S = 3.8" TO 4" S = 1.9" TO 2"  
**TYPICAL LETTER MEASUREMENTS**



**PAVEMENT MARKING WORDS AND SYMBOLS**



**TYPICAL APPROACH EDGE TAPERING PROFILE VIEW**



**WORD AND SYMBOL NOTES**

IF HEIGHT IS INCREASED OR DECREASED THEN ALL MEASUREMENTS CHANGE PROPORTIONATELY. EXAMPLE: "H" MEASUREMENT FOR STOP IS REDUCED TO 4' FROM 8' THEN SQUARE FEET = 5.75 (1/4 OF 23.0 SQ. FT.).

PAVEMENT WORD AND SYMBOL MARKINGS, TRANSVERSE AND LONGITUDINAL (CONTINENTAL) CROSSWALK LINES, AND STOP LINES WILL BE PAID FOR IN SQUARE FEET USING THEIR SPECIFIC BID ITEMS.

**TAPERING NOTES**

ALL PAVEMENT MARKING APPROACH EDGES FROM THE VEHICLE DIRECTION OF TRAVEL SHALL BE TAPERED USING A PUTTY KNIFE OR SIMILAR TOOL.

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Sheet Revisions	
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06/27/13	UPDATED BICYCLIST SYMBOL

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