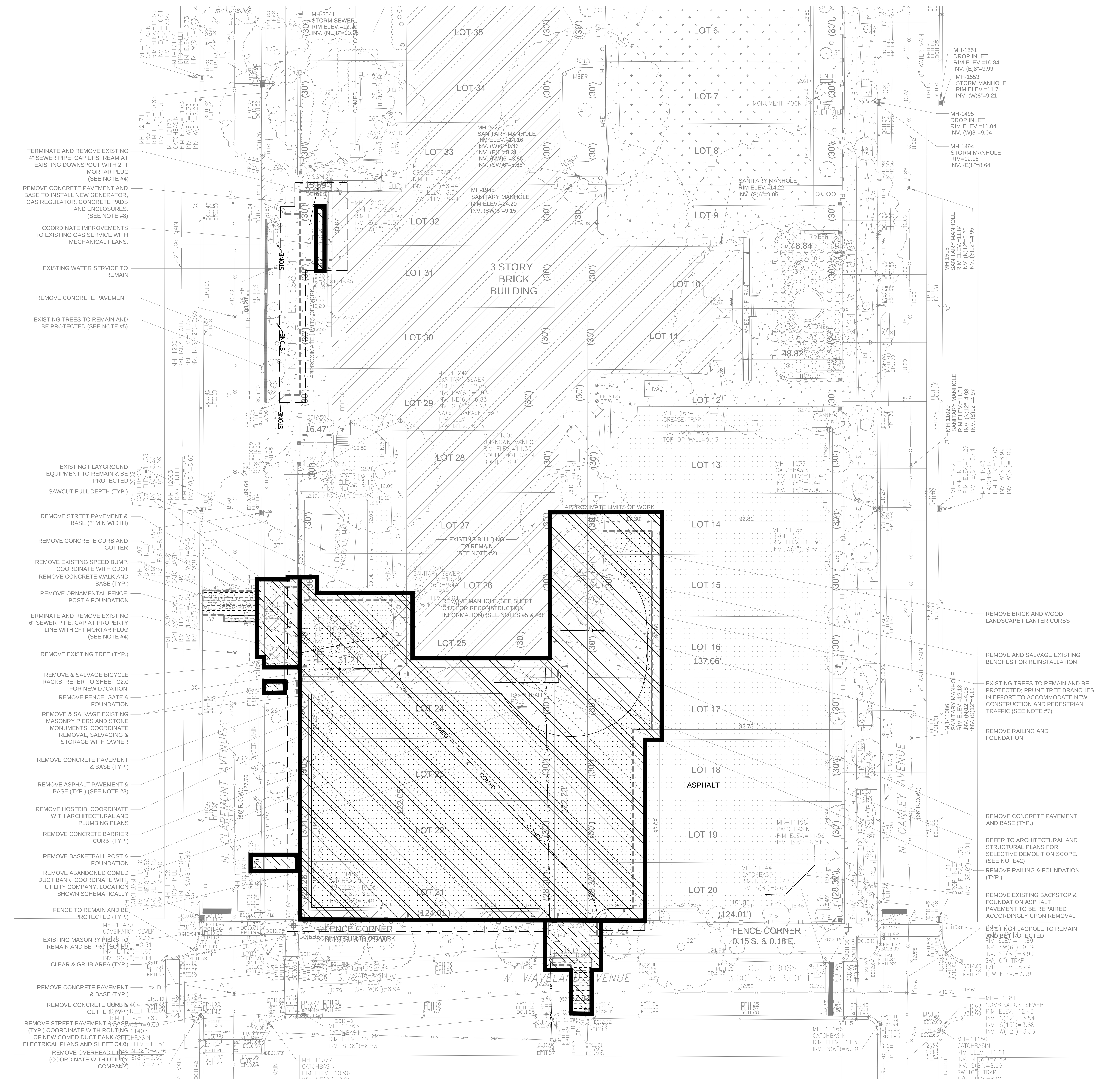


GRAPHIC SCALE

(IN FEET)
1 inch = 20ft.

LEGEND AND ABBREVIATIONS:

- PL — PROPERTY LINE
- APPROXIMATE LIMITS OF WORK
- REMOVE CONCRETE PAVEMENT AND BASE
- CLEAR & GRUB AREA COORDINATE WITH LANDSCAPE PLANS
- REMOVE ASPHALT PAVEMENT AND BASE
- REMOVE STREET PAVEMENT AND BASE
- EXISTING 3 STORY BUILDING TO REMAIN. COORDINATE WITH ARCHITECTURAL & STRUCTURAL PLANS
- REMOVE RAILING, ORNAMENTAL FENCE, POSTS GATES AND FOUNDATIONS
- REMOVE FENCE, POSTS GATES AND FOUNDATIONS
- STRUCTURE / TREE TO REMAIN AND BE PROTECTED
- REMOVE STRUCTURE / TREE
- REMOVE WATER LINE. CAP AS REQUIRED BY UTILITY COMPANY
- REMOVE SEWER LINE. CAP AS REQUIRED BY UTILITY COMPANY
- OHW — REMOVE OVERHEAD WIRE
- COMED — REMOVE COMED DUCT BANK COORDINATE WITH UTILITY COMPANY
- SAWCUT (FULL DEPTH)
- REMOVE CONCRETE CURB AND GUTTER
- REMOVE CONCRETE BARRIER CURB

SITE BASE DRAWING C1.0 SITE DEMOLITION PLAN

NOTES:

1. Excavation work within limits of work and within Property Line – Soils can be re–used if suitable for construction within the property line. Soils not suitable for re–use shall be removed and disposed in accordance with Section 31 23 18.14 CCDD & Uncontaminated Soil Disposal. See Legend for Uncontaminated Soil to be removed in accordance with 31 23 18.14.

2. Excavation work outside the Property Line – Soil cannot be re–used and shall be removed and disposed in accordance with Section 31 23 18.13 SOIL, FILL, BACKFILL, CU STRUCTURAL SOIL, & CONSTRUCTION & DEMOLITION DEBRIS REMOVAL. See Legend for Non–hazardous, non–special soils to be removed in accordance with 31 23 18.13. All areas of excavation outside the Property Line shall be handled in accordance with 31 23 18.13 regardless of drawing notation.

LEGEND FOR SMP1.0

- Uncontaminated Soil to be removed in accordance with 31 23 18.14.
- All areas of excavation outside the Property Line shall be handled in accordance with 31 23 18.13.

PUBLIC BUILDING COMMISSION OF CHICAGO
BUILDING SCHOOLS ACROSS CHICAGO
CHICAGO PUBLIC SCHOOLS CPS

ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION

3730 North Oakley Avenue Chicago, Illinois 60618

CHICAGO PUBLIC SCHOOLS

CITY OF CHICAGO, MAYOR RAHM EMANUEL

Issuance

Mark	Description	Date
	ISSUE FOR BID	11.15.2012
1	ADDENDUM	11.30.2012

WARNING:

ASBESTOS CONTAINING BUILDING MATERIALS ARE OR MAY BE PRESENT IN THIS BUILDING. AN ASBESTOS MANAGEMENT PLAN IS AVAILABLE IN THE SCHOOL FOR REVIEW UPON REQUEST. NO PERSON MAY DISTURB ASBESTOS CONTAINING MATERIALS UNLESS THAT PERSON IS A LICENSED ASBESTOS ABATEMENT WORKER OR CONDUCTS SUCH WORK IN ACCORDANCE WITH SECTIONS 028214 AND 028215 AND IN COMPLIANCE WITH ALL APPLICABLE FEDERAL, STATE AND LOCAL RULES AND REGULATIONS.

LEAD-BASED PAINT MAY BE PRESENT WITHIN THE BUILDING. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO TAKE APPROPRIATE SAFETY MEASURES IN ACCORDANCE WITH APPLICABLE FEDERAL, STATE, AND LOCAL RULES AND REGULATIONS INCLUDING OSHA (29 CFR 1926.62) COMPLIANCE, WASTE CHARACTERIZATIONS AND WASTE DISPOSAL. ALL WORK WITH SURFACES CONTAINING LEAD-BASED PAINT SHALL BE DONE IN ACCORDANCE WITH SECTION 028319.13 AND ALL APPLICABLE FEDERAL, STATE AND LOCAL RULES AND REGULATIONS.

PBC Project Name: Alexander Graham Bell Elementary School Addition

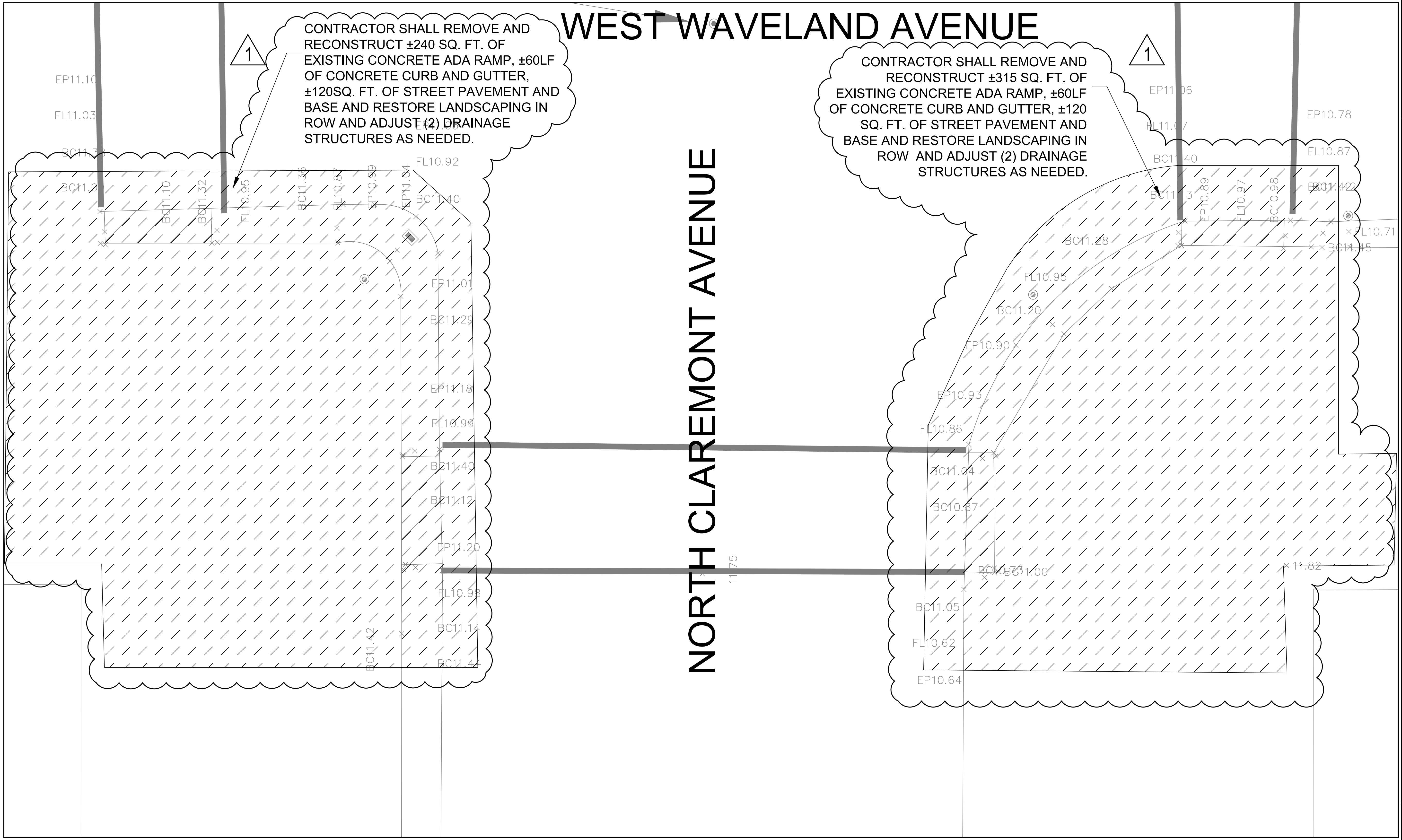
PBC Contract No.: 05530

Title

SOIL MANAGEMENT PLAN

Sheet

SMP1.0



2 / C3.1 INTERSECTION OF N. CLAREMONT AVE. & W. WAVELAND AVE.

SCALE: 1" = 5'

ISSUE DATE: 11.30.12

CSK-1.0

PAGE 1 OF 1

PROJECT: ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION
SMNG-A NO.: 1210
PBC NO.: 05530

ISSUE: ISSUE FOR ADDENDUM NO. 1
TITLE: SHEET C3.1; DETAIL 2: INTERSECTION OF N. CLAREMONT AVE. & W. WAVELAND AVE.
COMMENTS: ADDITIONAL ADA RAMP DEMOLITION AND CONSTRUCTION

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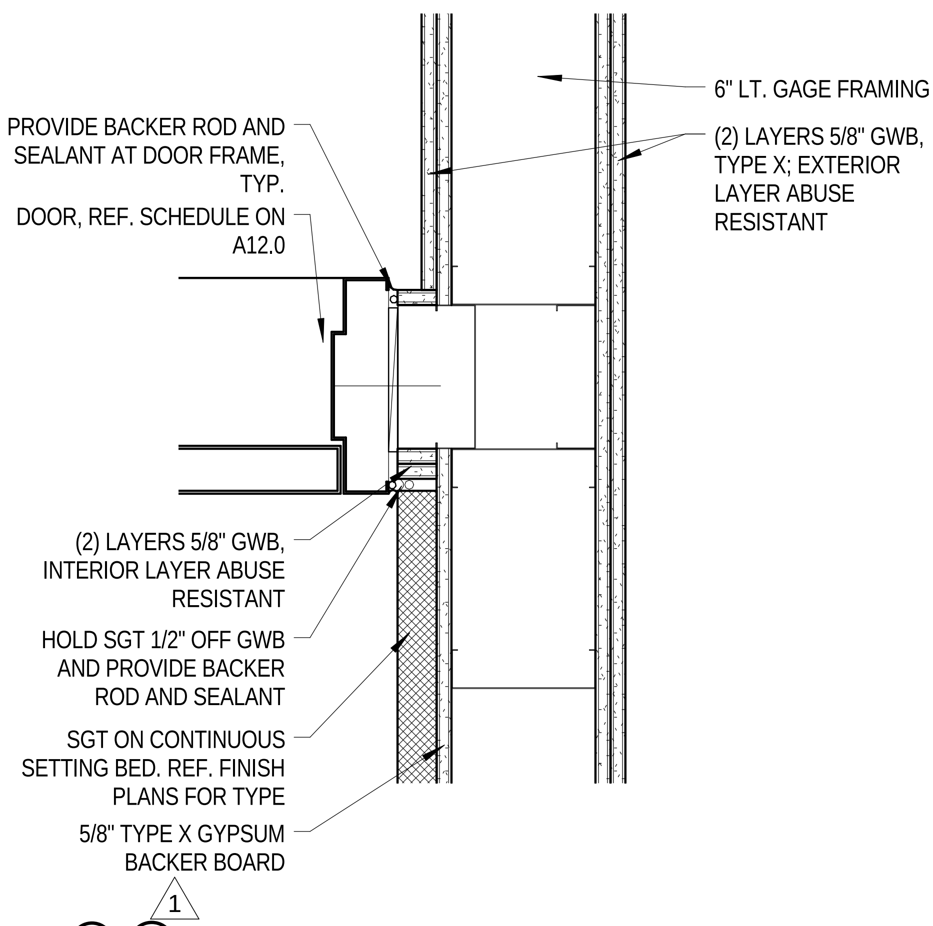
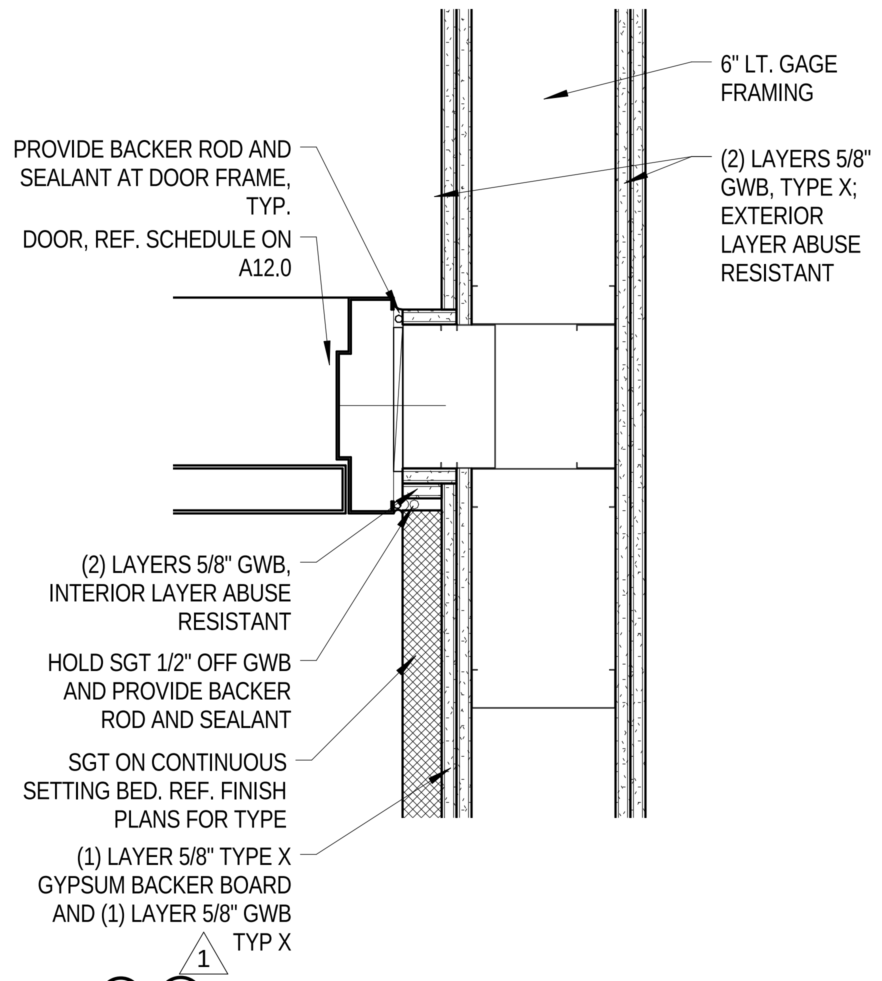
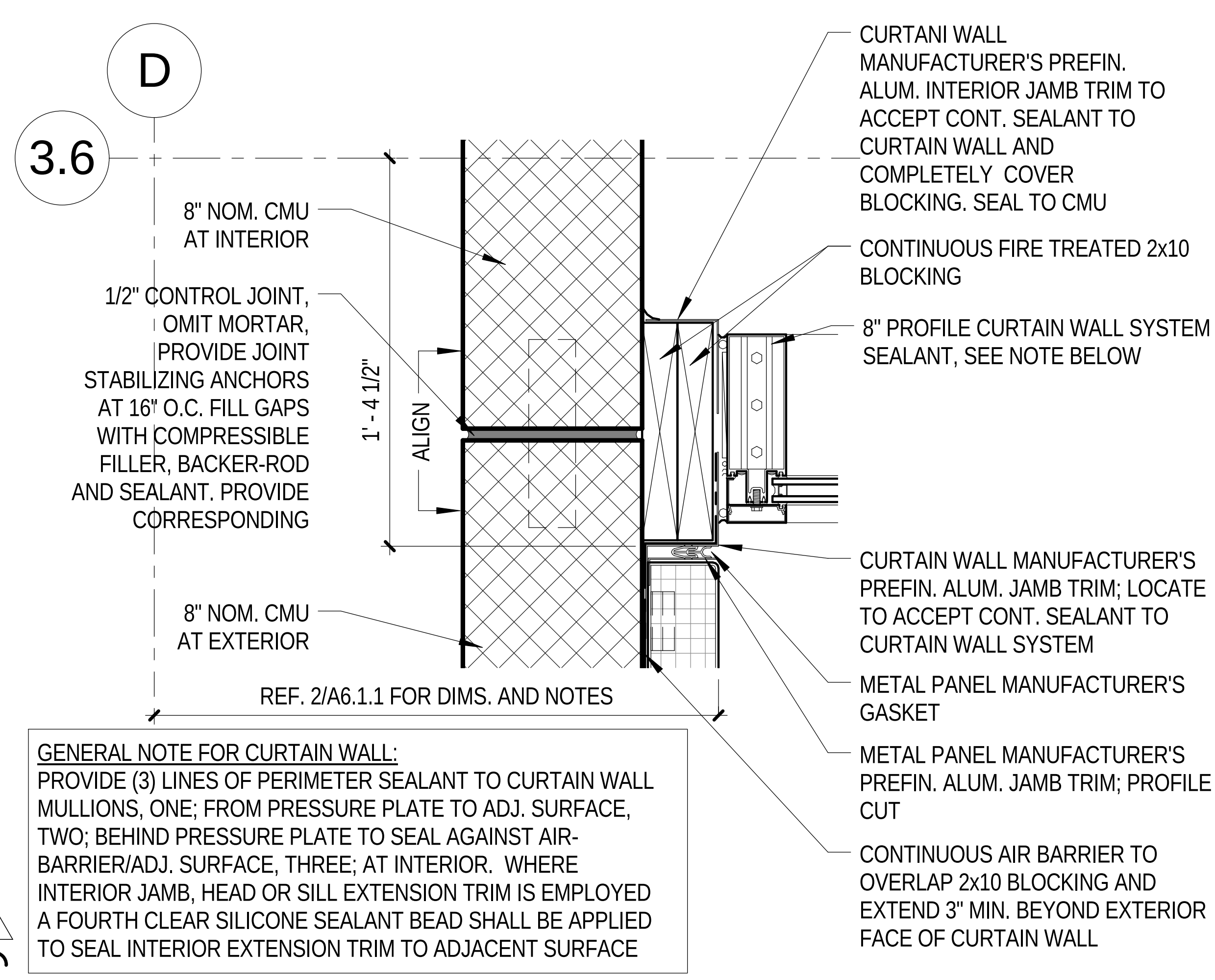


6 / A6.1.2 — 2 / ASK-01 PLAN DETAIL
1 1/2" = 1'-0"



7 / A6.1.2 — 3 / ASK-01 PLAN DETAIL
1 1/2" = 1'-0"



5 / A6.1.2 — 1 / ASK-01 PLAN DETAIL
1 1/2" = 1'-0"

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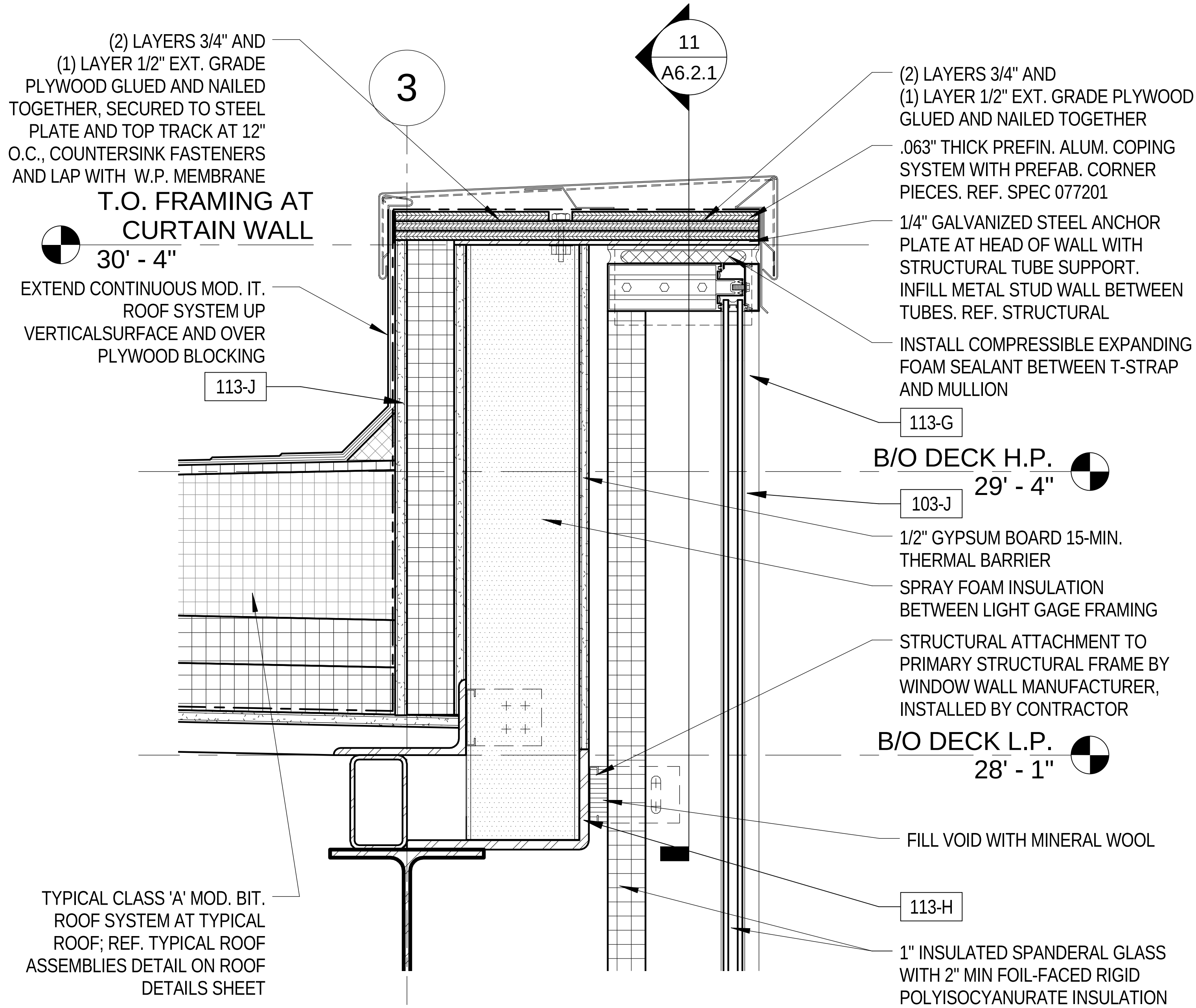
PROJECT:	ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION
SMNG-A NO.:	1210
PBC NO.:	05530
ISSUE:	ISSUE FOR ADDENDUM NO. 1
TITLE:	DETAILS ON SHEET A6.1.2
COMMENTS:	REF. SHEET A6.1.2

ISSUE DATE: 11.30.2012

ASK-01



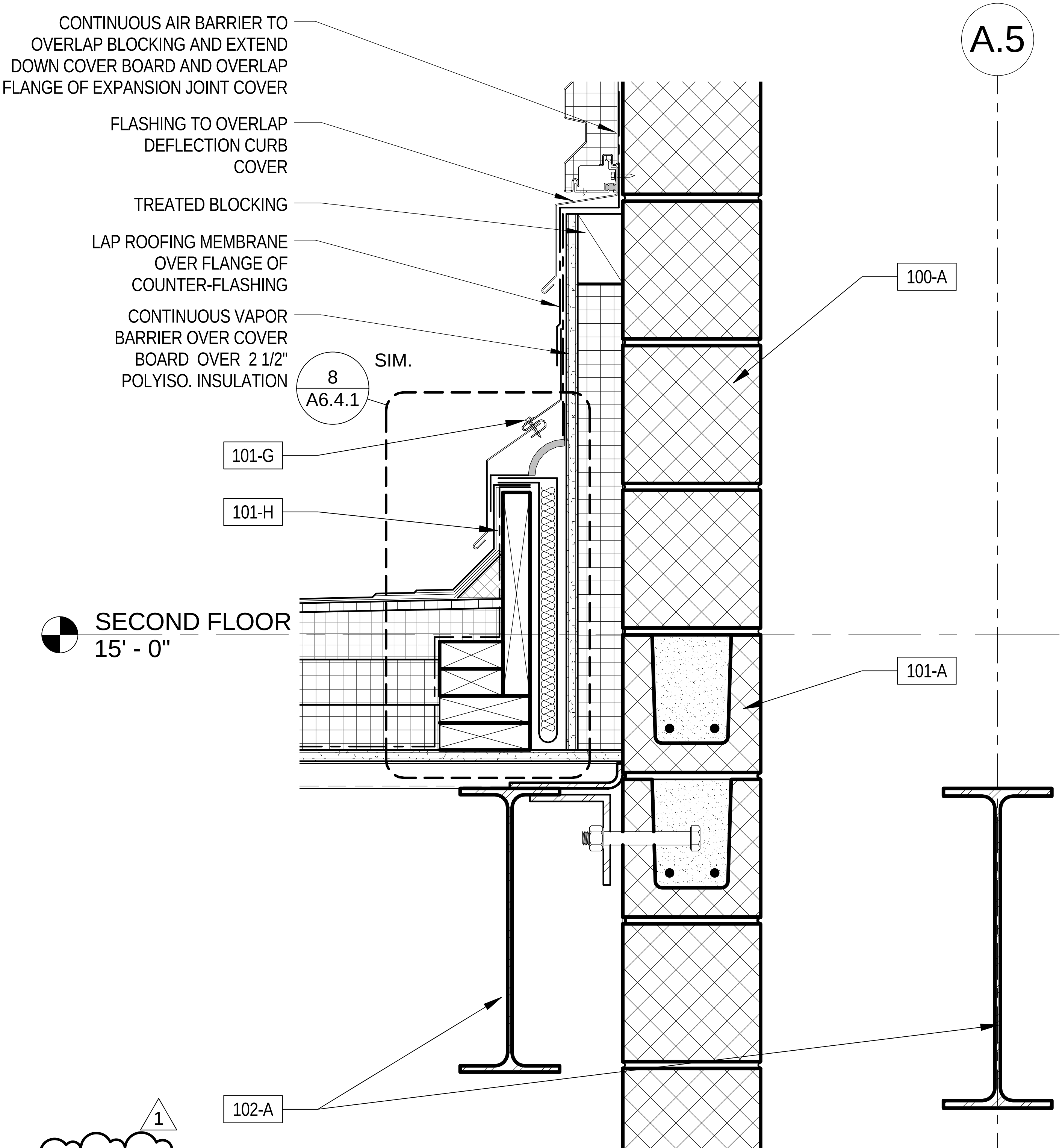
1

6 A6.2.1 | 1 ASK-02

SECTION DETAIL

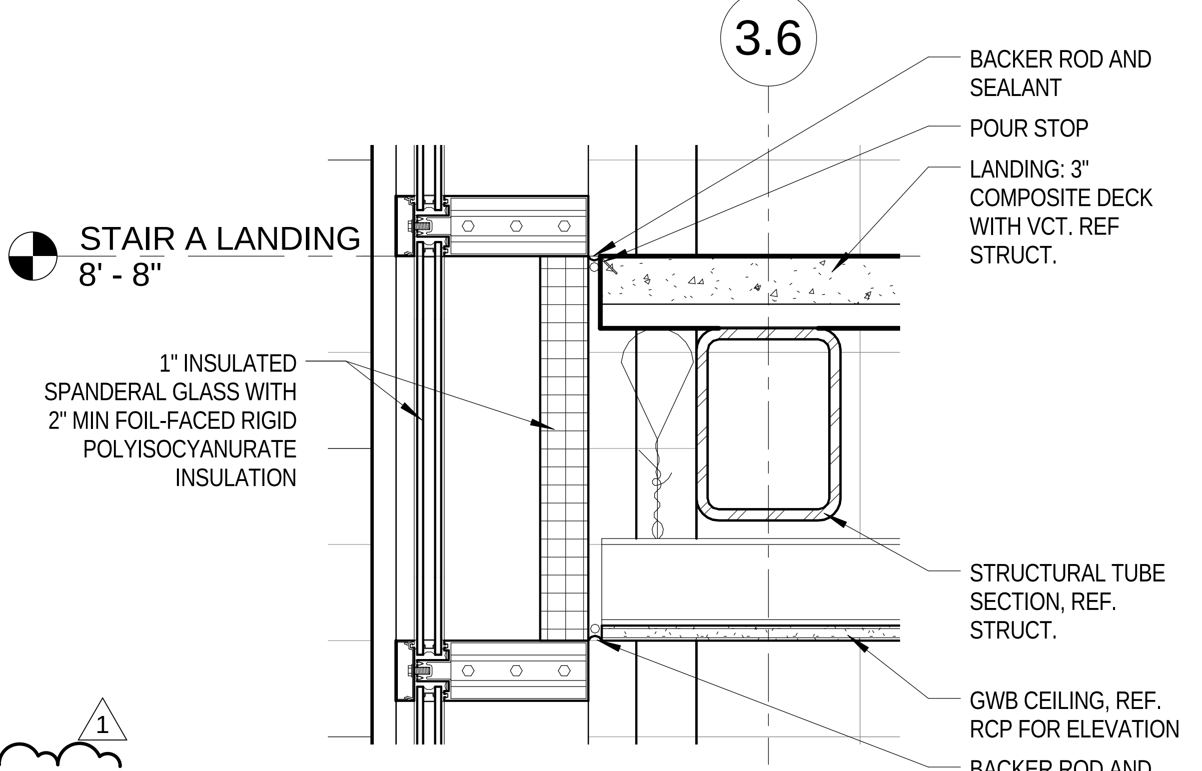
1 1/2" = 1'-0"

SMNG-A Architects, Ltd. Schroeder Murchie Niemiec Gazda-Auskalnis Architecture Planning Interior Architecture 936 W. Huron Street Chicago, IL 60642 312.829.3355 voice 312.829.8187 fax	PROJECT: SMNG-A NO.: PBC NO.: ISSUE: TITLE: COMMENTS:	ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION 1210 05530 ISSUE FOR ADDENDUM NO. 1 DETAIL 6/A6.2.1 REF. SHEET A6.2.1	ISSUE DATE: 11.30.2012 **ASK-02**



1 / A6.2.4 — 1 / ASK-03 SECTION DETAIL
1 1/2" = 1'-0"

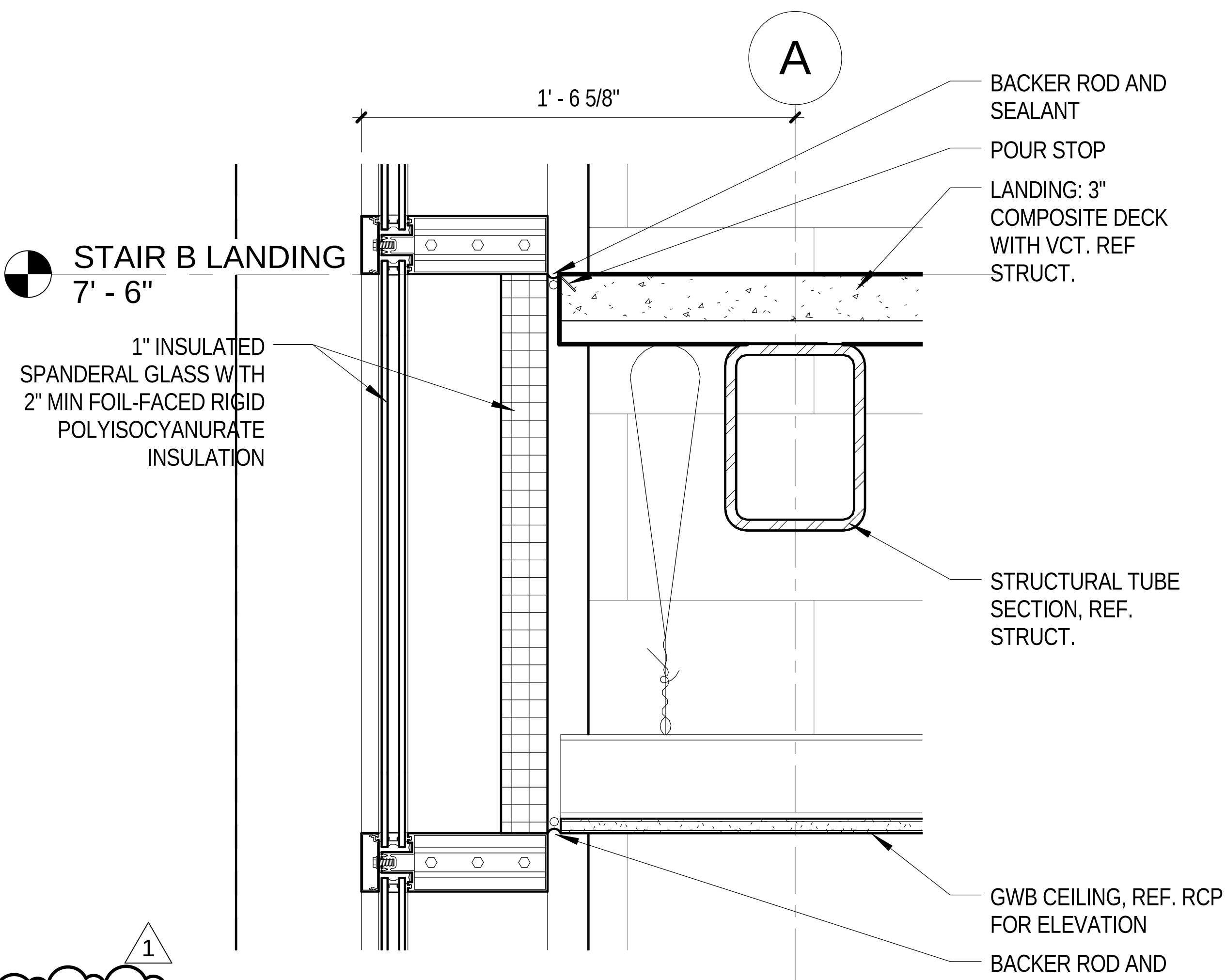
SMNG-A Architects, Ltd. Schroeder Murchie Niemiec Gazda-Auskalnis Architecture Planning Interior Architecture 936 W. Huron Street Chicago, IL 60642 312.829.3355 voice 312.829.8187 fax	PROJECT: SMNG-A NO.: PBC NO.: ISSUE: TITLE: COMMENTS:	ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION 1210 05530 ISSUE FOR ADDENDUM NO. 1 DETAIL 1/A6.2.4 REF. SHEET A6.2.4	ISSUE DATE: 11.30.2012 **ASK-03**



9 A6.2.4 | 2 ASK-04

SECTION DETAIL

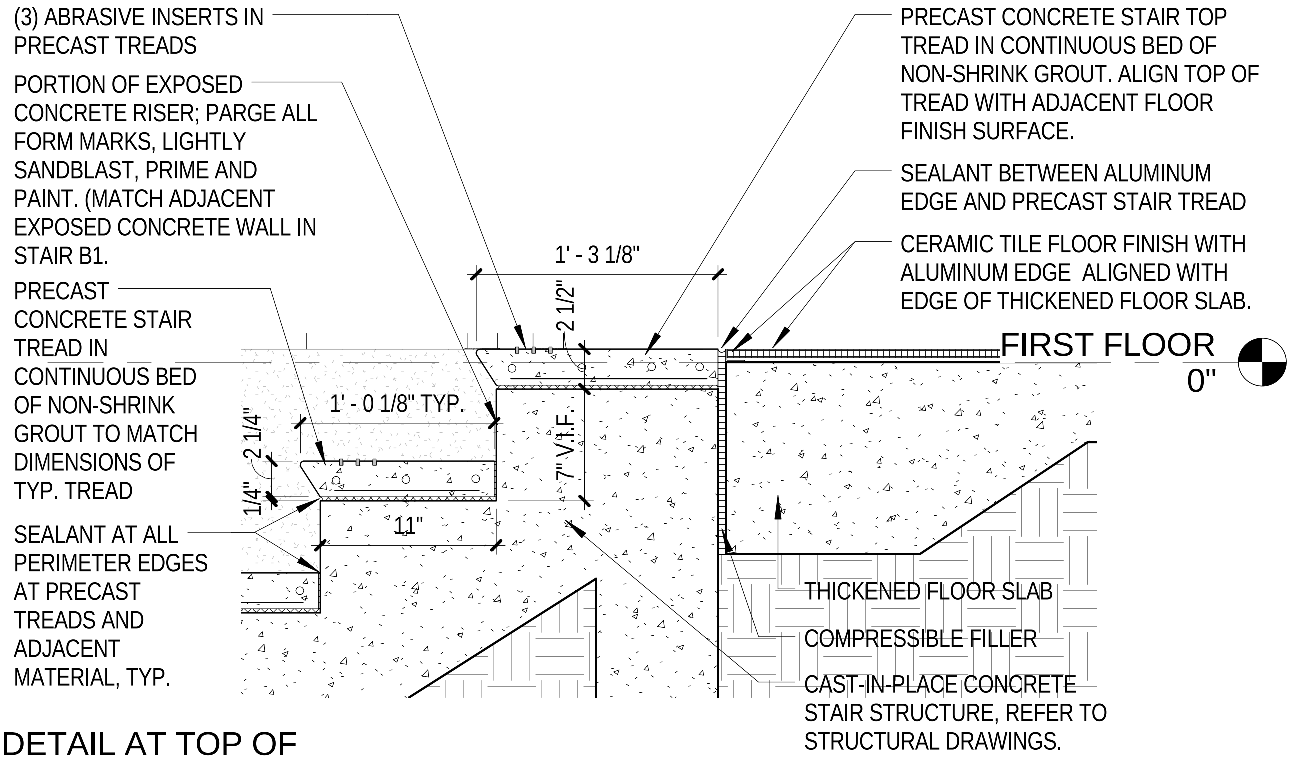
1 1/2" = 1'-0"



8 A6.2.4 | 1 ASK-04

SECTION DETAIL

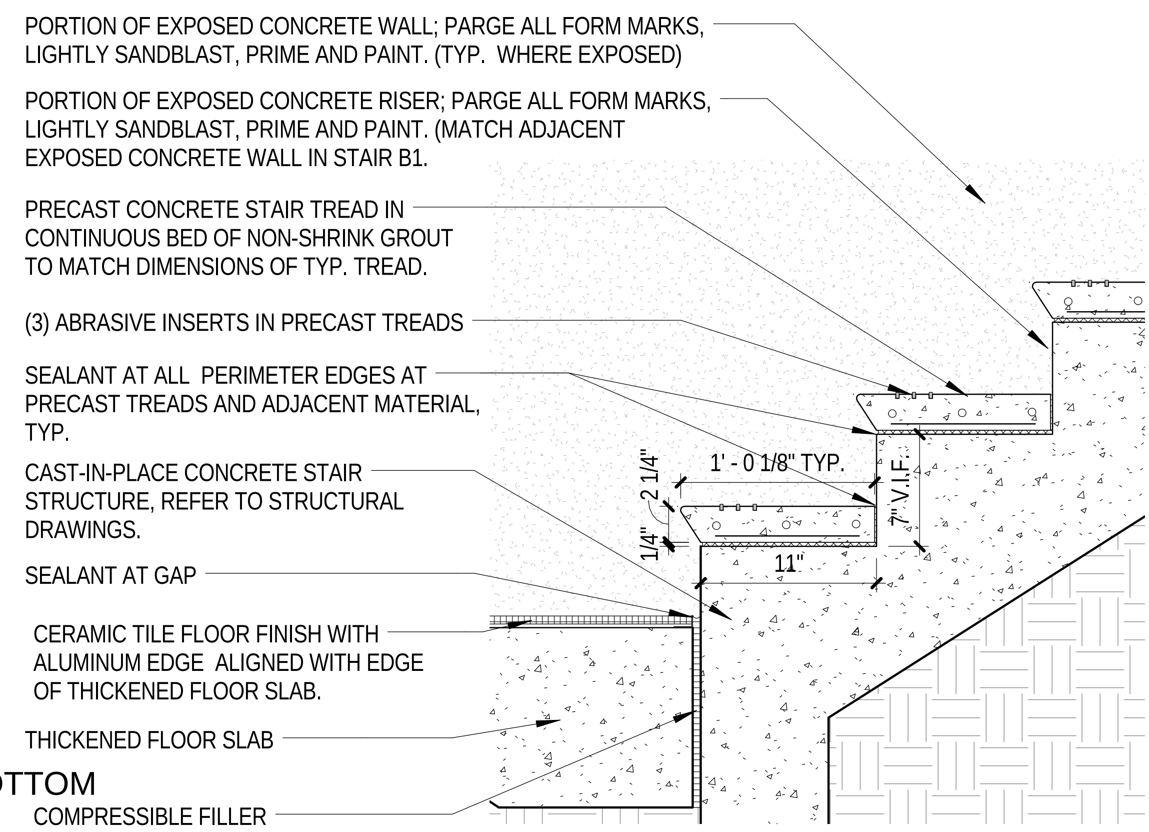
1 1/2" = 1'-0"



1

6 A6.2.4 3 ASK-05

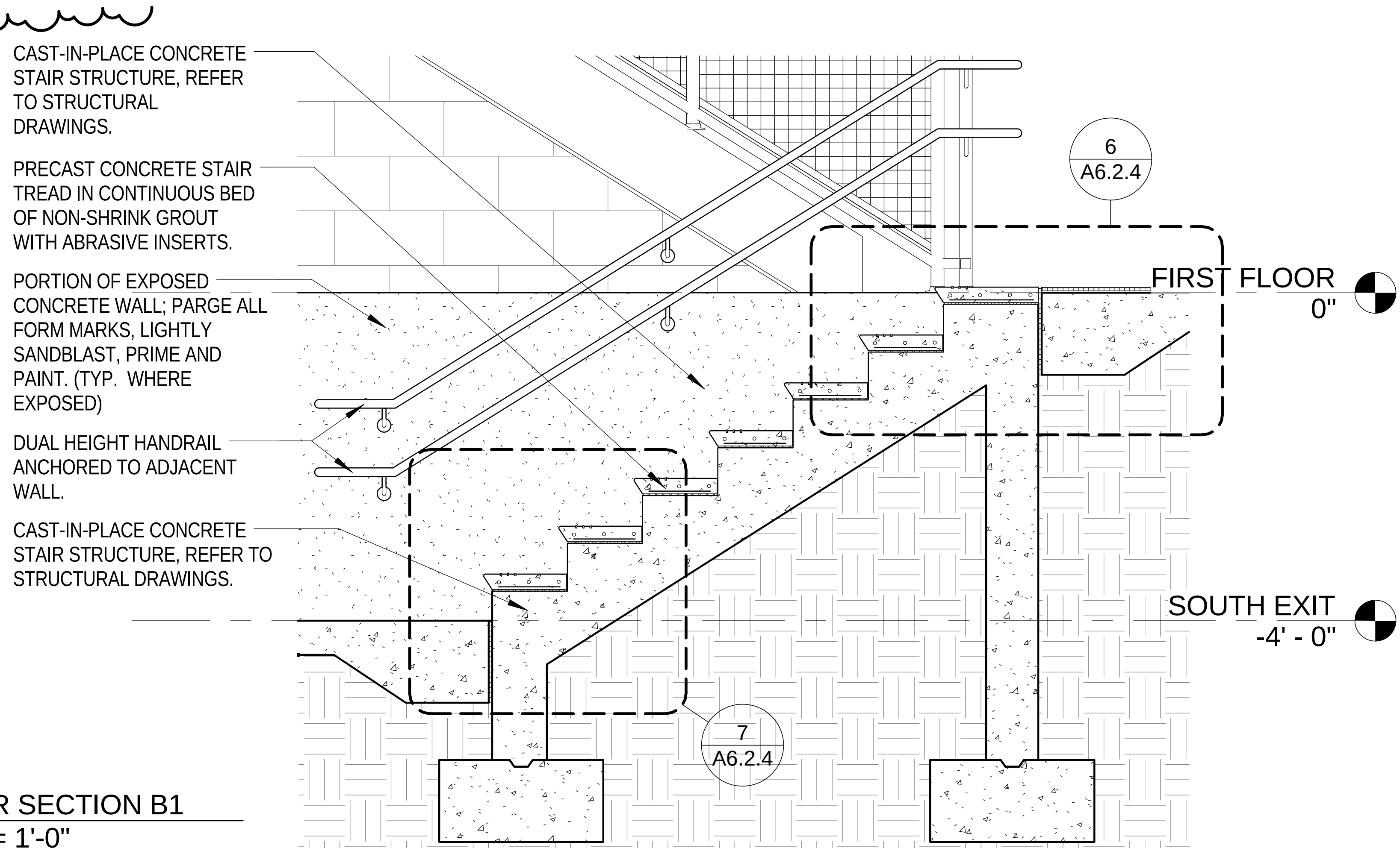
ENLARGED DETAIL AT TOP OF STAIR B1
1" = 1'-0"



1

7 A6.2.4 2 ASK-05

ENLARGED DETAIL AT BOTTOM OF STAIR B1
1" = 1'-0"



1

5 A6.2.4 1 ASK-05

STAIR SECTION B1
1/2" = 1'-0"

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PROJECT: ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION

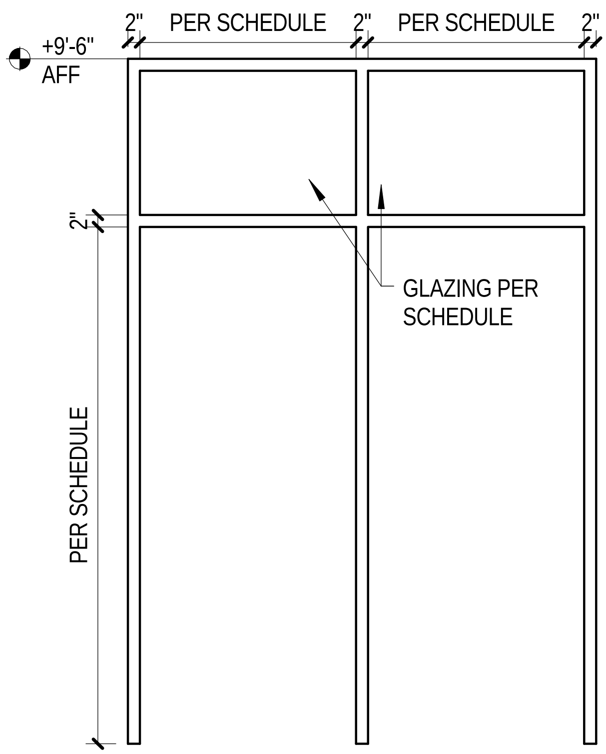
SMNG-A NO.: 1210
PBC NO.: 05530

ISSUE: ISSUE FOR ADDENDUM NO. 1
TITLE: PRECAST CONCRETE STAIR TREAD DETAILS AT STAIR B1
COMMENTS: REF. SHEET A6.2.4

ISSUE DATE: 11.30.2012

ASK-05

FRAME TYPES



FRAME TYPE 3

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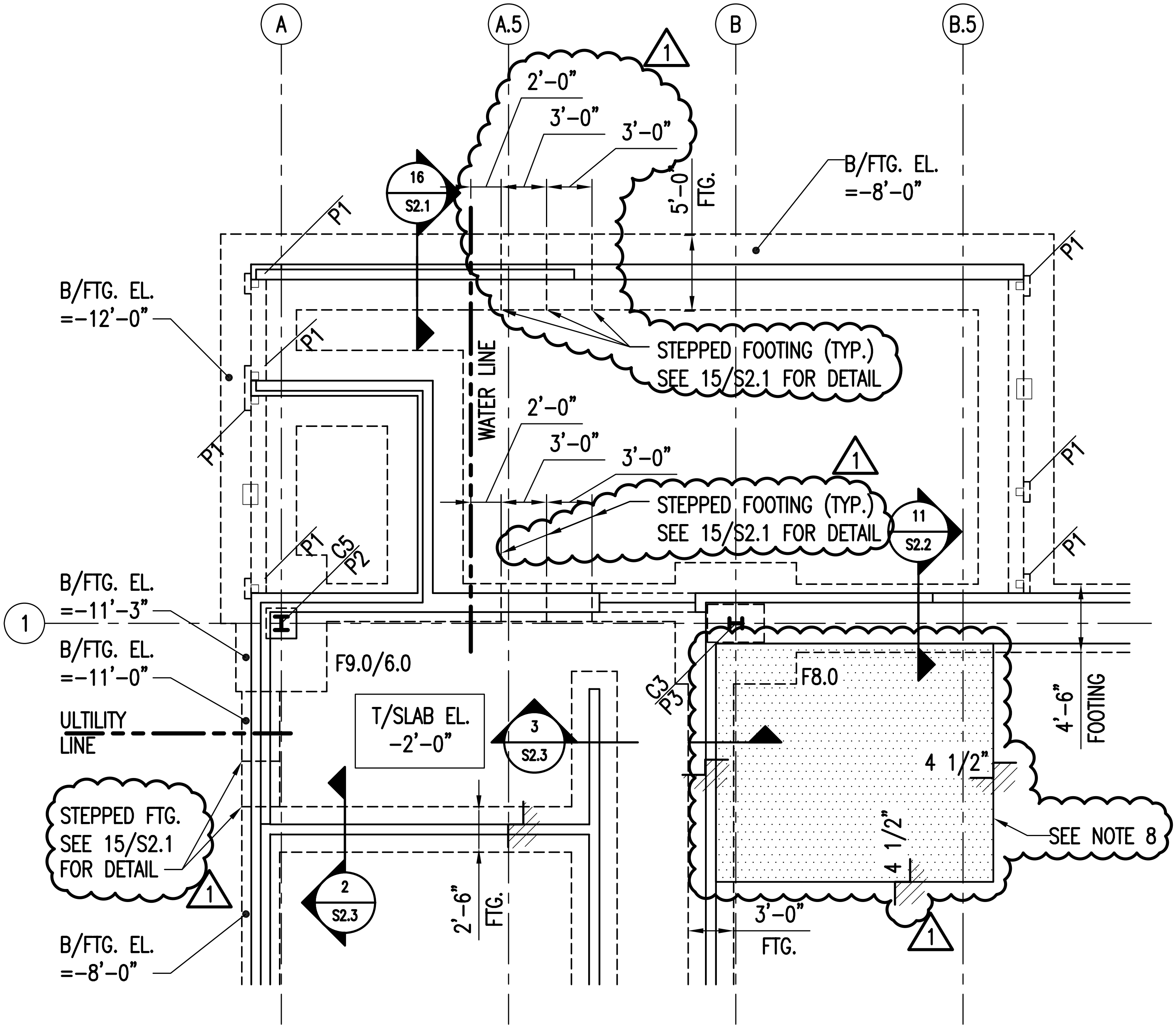
PROJECT:	ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION
SMNG-A NO.:	1210
PBC NO.:	05530
ISSUE:	ISSUE FOR ADDENDUM NO. 1
TITLE:	FRAME TYPE 3
COMMENTS:	REF. FRAME TYPES ON SHEET A12.0

ISSUE DATE: 11.30.2012

ASK-06



PARTIAL FOUNDATION/FIRST FLOOR PLAN

1/8"=1'-0"

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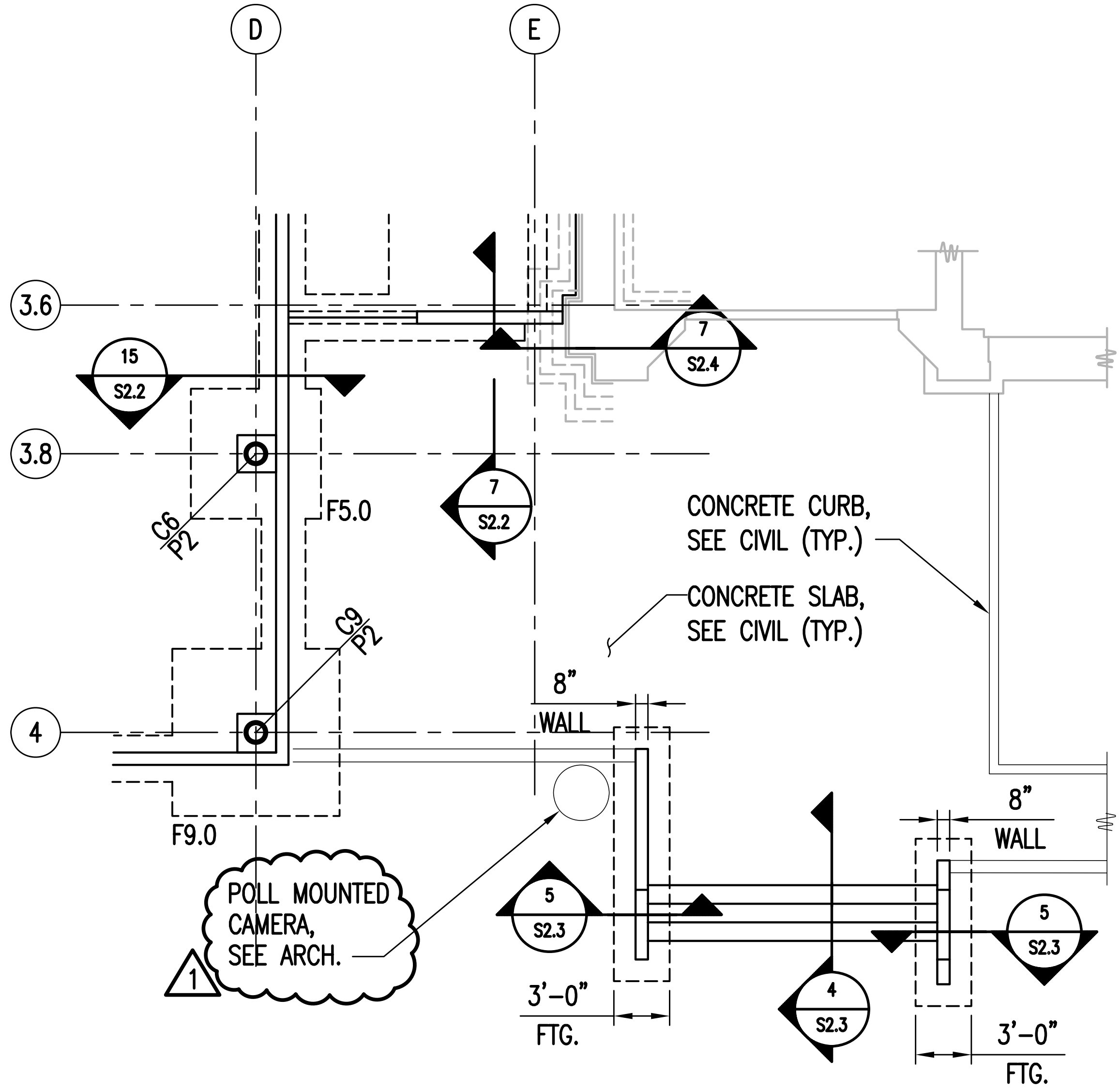
PROJECT: ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION

SMNG-A NO.: 1210
PBC NO.: 05530
CONTRACT NO.:
ISSUE: ISSUE FOR ADDENDUM NO. 1
TITLE: PARTIAL FOUNDATION/FIRST FLOOR PLAN
COMMENTS: -

ISSUE DATE: 11.30.12

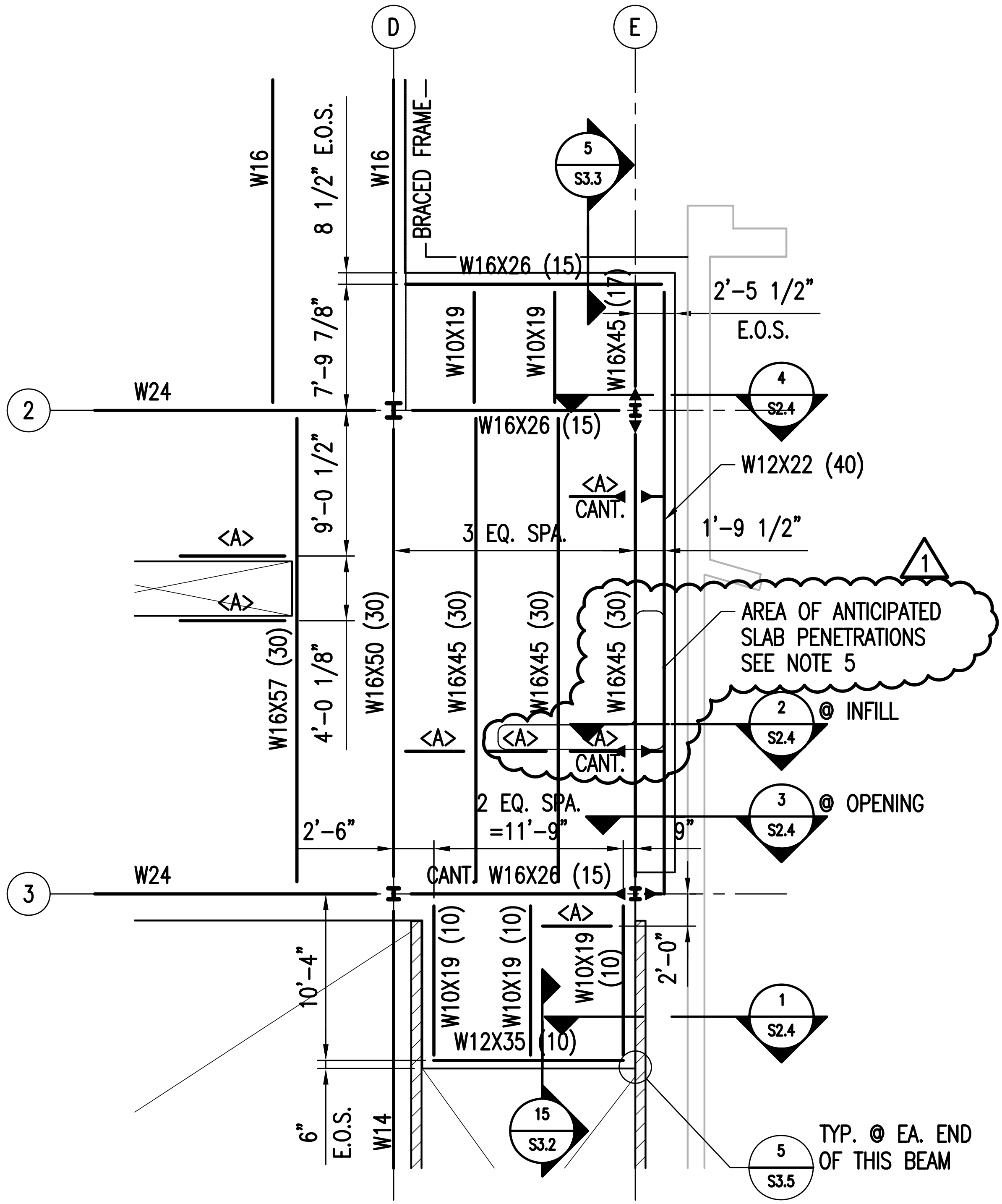
SSK-01



PARTIAL FOUNDATION/FIRST FLOOR PLAN

1/8"=1'-0"

SMNG-A Architects, Ltd. Schroeder Murchie Niemiec Gazda-Auskalnis Architecture Planning Interior Architecture 936 West Huron Street Chicago, Illinois 60642 312.829.3355 voice 312.829.8187 fax	PROJECT: ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION SMNG-A NO.: 1210 PBC NO.: 05530 CONTRACT NO.: ISSUE: ISSUE FOR ADDENDUM NO. 1 TITLE: PARTIAL FOUNDATION/FIRST FLOOR PLAN COMMENTS: -	ISSUE DATE: 11.30.12 **SSK-02** PAGE 1 OF 1



PARTIAL SECOND FLOOR FRAMING PLAN

1/8"=1'-0"

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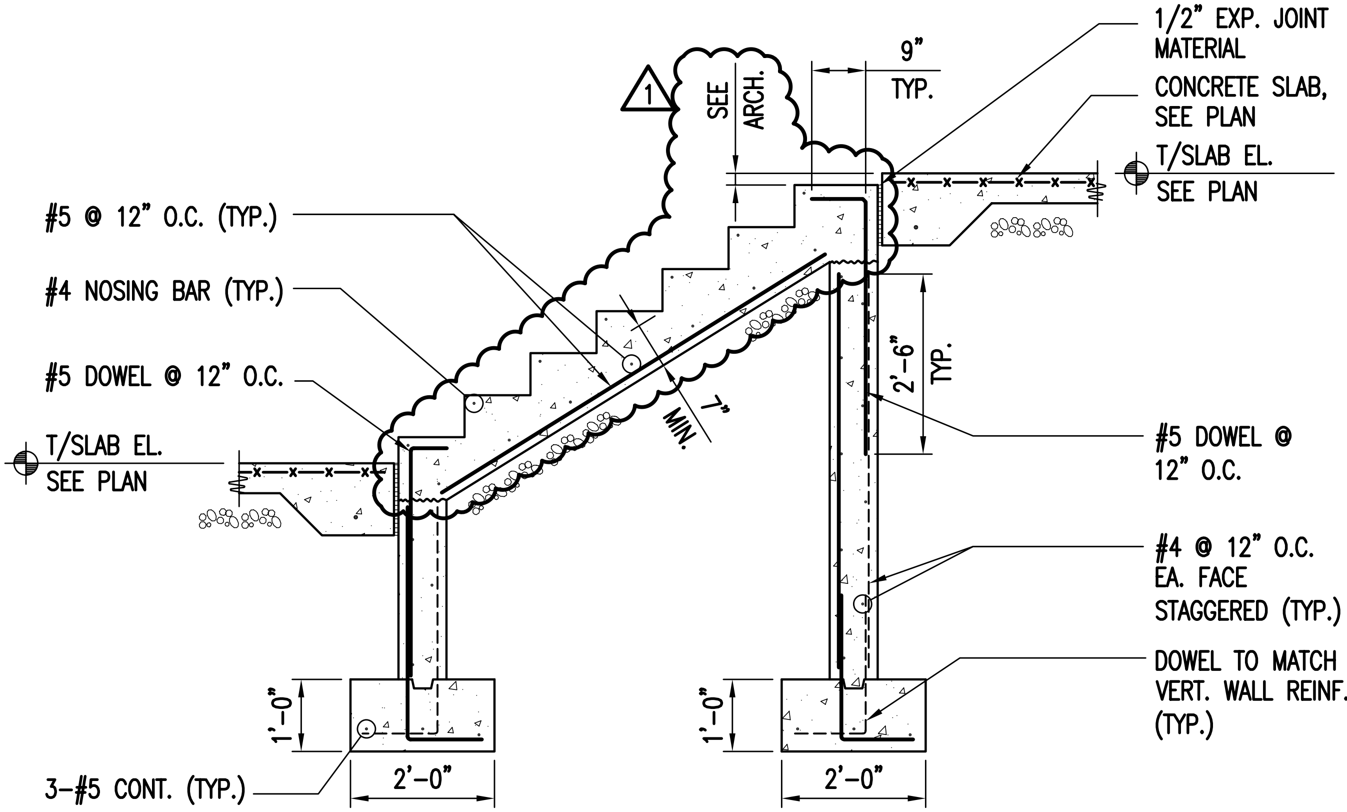
PROJECT:	ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION
SMNG-A NO.:	1210
PBC NO.:	05530
CONTRACT NO.:	
ISSUE:	ISSUE FOR ADDENDUM NO. 1
TITLE:	PARTIAL SECOND FLOOR FRAMING PLAN
COMMENTS:	-

ISSUE DATE: 11.30.12

SSK-03



1 / S2.3 **SECTION AT STAIR B** 1

1/2"=1'-0"

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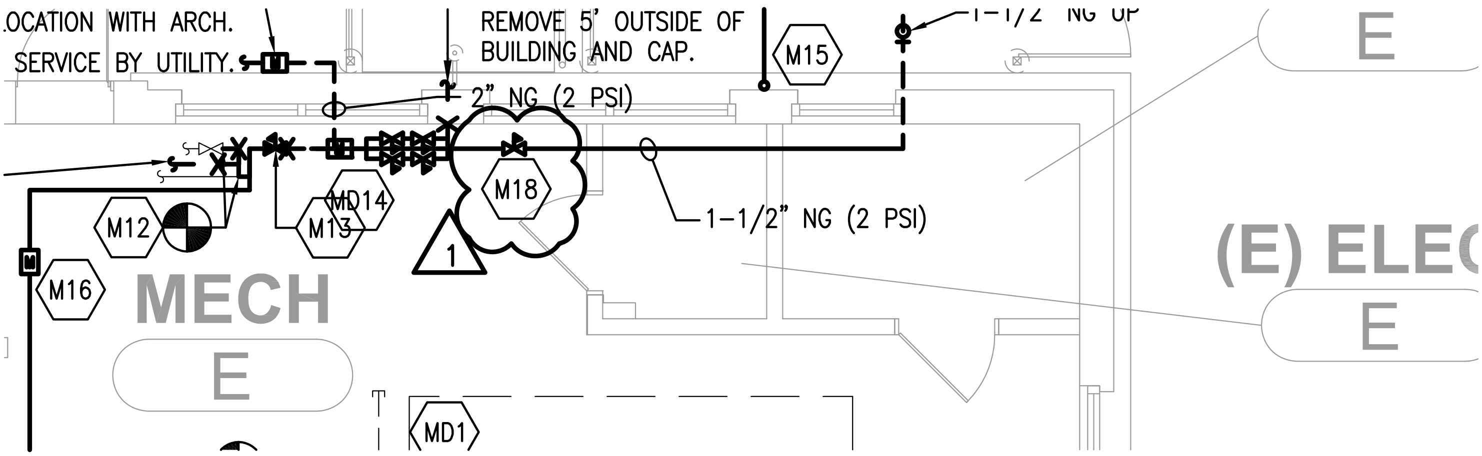

M15 PROVIDE NEW 4" GENERATOR EXHAUST FROM GENERATOR MUFFLER AND ROUTE UP ON EXTERIOR OF BUILDING. TERMINATE 3' ABOVE ROOF LINE WITH CAP. SEE DETAILS FOR WALL MOUNTING, AND FOR TERMINATION.

M16 PROVIDE NEW GAS SUB-METER TO MONITOR STATUS OF THE ANNEX GAS USAGE. GAS METER WILL BE PROVIDED WITH CONTACTS FOR CONNECTION TO BAS SYSTEM.

M17 PROVIDE NEW DIFFUSERS IN VERTICAL FACE OF NEW CEILING. COORDINATE EXACT LOCATION OF VERTICAL WITH ARCHITECTURAL DRAWINGS.

1

M18 PROVIDE A GAS PRESSURE REGULATOR IN CONJUNCTION WITH PURCHASED GENERATOR TO REDUCE GAS PRESSURE FROM 2 PSI TO REQUIRED PRESSURE OF GAS GENERATOR. DESIGN IS BASED ON 2 PSI TO 1 PSI.

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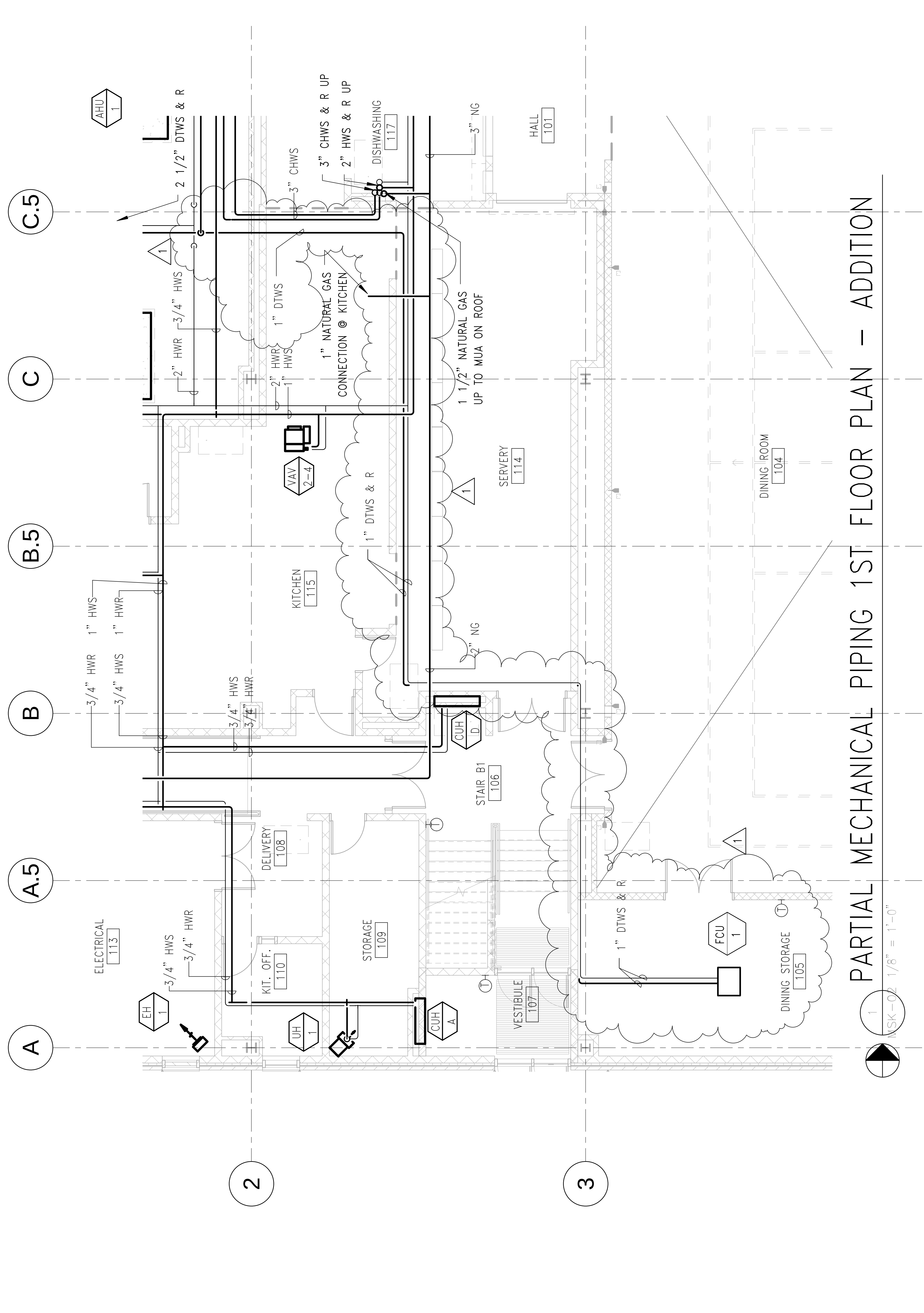
PROJECT: ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION
SMNG-A NO.: 1210
PBC NO.: 05530
CONTRACT NO.:
ISSUE: ISSUE FOR ADDENDUM NO. 1
TITLE: EXISTING BUILDING BOILER ROOM
COMMENTS: MODIFICATION TO EM GENERATOR GAS PIPING.
REFERENCE M0.1

ISSUE DATE: 11.30.12

MSK-01



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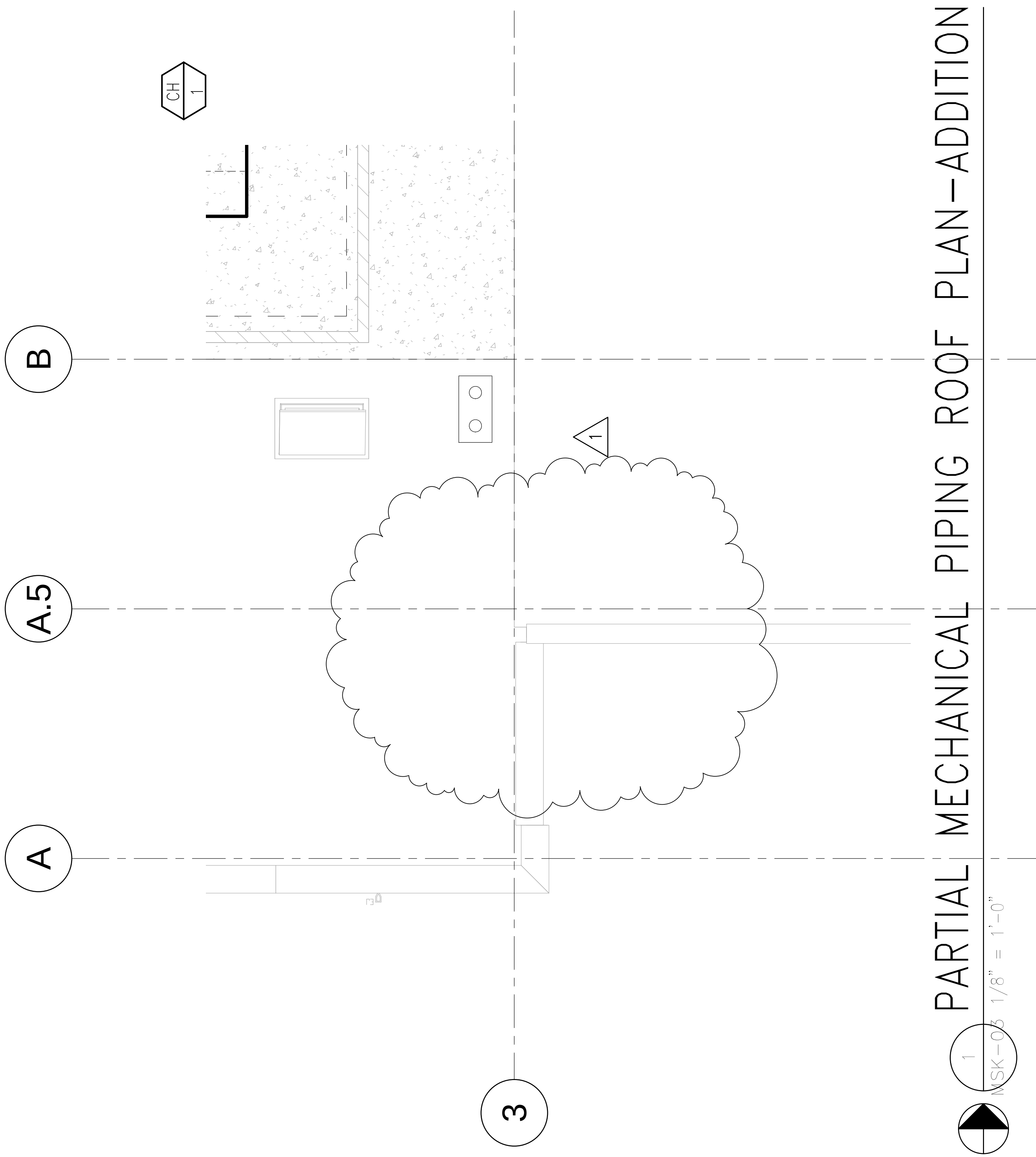
PROJECT: ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION

SMNG-A NO.: 1210
PBC NO.: 05530

ISSUE: ISSUE FOR ADDENDUM NO. 1
TITLE: PARTAIL MECHANICAL PIPING 1ST FL PLAN - ADDITION
COMMENTS: REMOVE AC-2 & EUH-3; PROVIDE FCU-1.
REFERENCE M2.1A

ISSUE DATE: 11.30.2012

MSK-02



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PROJECT:	ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION
SMNG-A NO.:	1210
PBC NO.:	05530
ISSUE:	ISSUE FOR ADDENDUM NO. 1
TITLE:	PARTIAL MECHANICAL ROOF PLAN - ADDITION
COMMENTS:	REMOVE CU-2 & ALL ASSOCIATED PIPING. REFERENCE M2.3A

ISSUE DATE: 11.30.2012

MSK-03

COMPUTER ROOM AIR CONDITIONING UNIT

TAG	SERVICE/ LOCATION	SUPPLY (CFM)	EXT STATIC	FAN HP	DRIVE	REFRIG. TYPE	TOTAL CAP. (MBH)	SENS. CAP (MBH)	# OF ROWS	FILTER TYPE	FILTER EFFICIENCY	ELECTRICAL DATA VOLTS	PHASE	WATTS	MCA	MOCP	MFG.	MODEL	REMARKS
AC-1	MDF	235	0.50	NA	DIRECT	R-410A	11.9	NA	NA	FLAT	30%	115	1	1,260	NA	20	SANYO	12XLS71	1,2

1

REMARKS:
1. PROVIDE FILTERS FOR SUPPLY AND RETURN GRILL
2. PROVIDE PACKAGED CONDENSATE PUMP WITH UNIT.

AIR COOLED CONDENSING/CONDENSER SCHEDULE

TAG	LOCATION	UNIT SERVED	AMB. TEMP. °F	REJECTION CAPACITY BTUH	COMPRESSOR DATA TYPE	QTY/HP	RPM	STEPS	CONDENSER FAN QTY	HP EA.	CFM TOTAL	ELECTRICAL DATA V	PH	HZ	FLA	UNIT WEIGHT (LBS)	MANUFACTURER AND MODEL	REMARKS
CU-1	ROOF	AC-1	91.7	NA	DC ROT. INV	50W	1750	2	1	30W	1059	115	1	60	0.6	100	SANYO C1271	

1

NOTES:
PROVIDE LOW AMBIENT KIT TO -20°

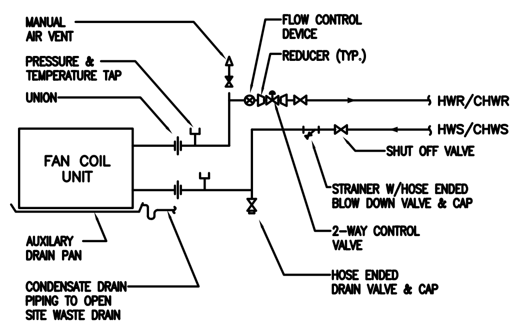
FAN COIL UNIT SCHEDULE

TAG	LOCATION	UNIT SIZE	HEATING COIL DATA (FLUID) MBH	GPM	WPD (FT)	ROW	EWT/LWT °F	EAT °F	LAT °F	COOLING COIL DATA TOTAL MBH	GPM	FLUID	WPD (FT)	ROW	EWT/LWT °F	EAT °F	LAT °F	FAN/MOTOR DATA CFM	SP	HP	V/PH/HZ	MANUFACTURER AND MODEL	REMARKS
FCU-1	STORAGE 105	020	8.6	0.4	0.2	1	150°/120°	70	85	8.0	1.8	30% P.G.	1.6	3	44°/58°	78	55	250	0.1	1/30	115/1/60	YORK FHF020	①②③

① THROW AWAY FILTER, FURNISH 2 FILTERS WITH EACH UNIT. ② CEILING RECESSED UNIT. PROVIDE MOUNTING PACKAGE FOR LAY-IN CEILING. ③ PROVIDE FRONT FACE SUPPLY AND RETURN GRILL ④ PROVIDE CONDENSATE PIPING AND CONNECT TO NEAREST OPEN SITE DRAIN.

1

1



NOTE:
FOR HORIZONTAL MOUNTED FAN COIL UNITS PROVIDE AN OVERFLOW SENSOR HARD WIRED TO FAN (SEE CODE)

FAN COIL UNIT COIL (HEATING AND COOLING) PIPING DIAGRAM

1 MSK04 N.T.S.

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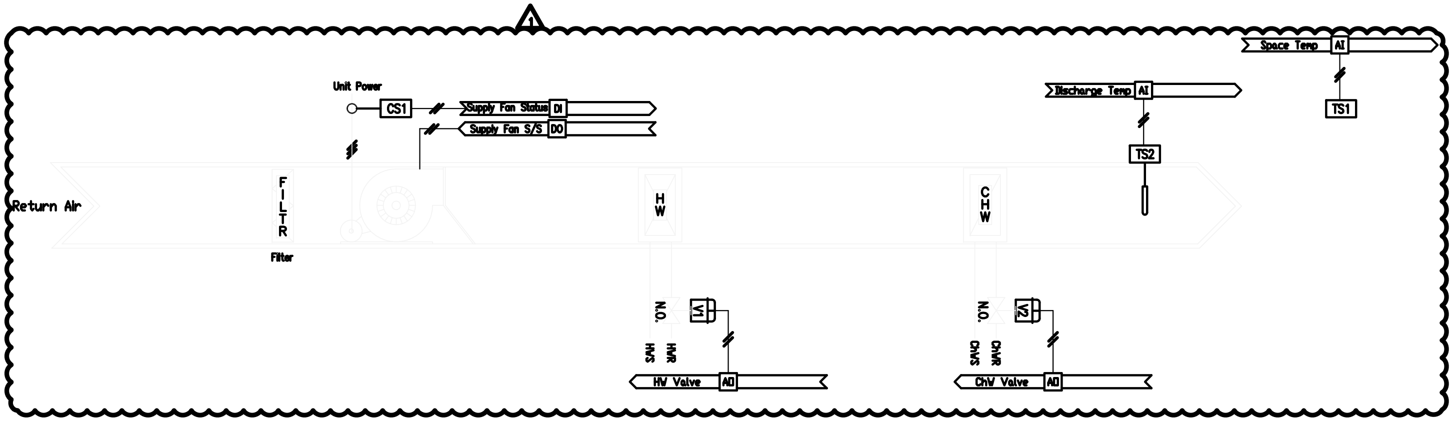
PROJECT: ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION
SMNG-A NO.: 1210
PBC NO.: 05530
CONTRACT NO.:
ISSUE: ISSUE FOR ADDENDUM NO. 1
TITLE: SCHEDULE MODIFICATIONS
COMMENTS: REMOVE AC-2, CU-2 & ADDED FCU-1. REFERENCE M4.1

ISSUE DATE: 11.30.12

MSK-04



Fan Coil Units (FCU-1)

POINTS LIST

ADDRESS	POINT DESCRIPTOR	DI	AI	DO	AO	VP	REMARKS
		POINT TYPE					
	Supply Fan S/S			•			
	Supply Fan Status	•					
	HW Valve				•		
	Discharge Temp		•				
	ChW Valve				•		
	Space Temp		•				

BILL OF MATERIAL

DESIG	QTY	MODEL NO.	DESCRIPTION	MFG / REMARKS
TS1			Space Temperature Sensor	
CS1			Current Switch	
V1-2			Control Valve	
TS2			Duct Temperature Sensor	

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PROJECT: ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION

SMNG-A NO.: 1210

PBC NO.: 05530

CONTRACT NO.:

ISSUE: ISSUE FOR ADDENDUM NO. 1

TITLE: FCU BAS DIAGRAM

COMMENTS: ADDED CONTROL DIAGRAM FOR FCU-1. REFERENCE M5.7

ISSUE DATE: 11.30.12

MSK-05

MECHANICAL/ELECTRICAL/PLUMBING COORDINATION SCHEDULE	M:	E:	P:

1. EQUIPMENT FURNISHED BY THE ELECTRICAL CONTRACTOR (MARK 'E'), MECHANICAL (MARK 'M'), PLUMBING (MARK 'P'), GENERAL (MARK 'G'), AND FIRE PROTECTION (MARK 'FP').
2. COORDINATE WITH ALL EQUIPMENT VENDORS ALL CIRCUITS REQUIRED. STARTERS PART OF PACKAGED EQUIPMENT, FURNISHED BY EQUIPMENT SUPPLIER. ALL STARTERS SHALL BE CONSIDERED "LOOSE" EXCEPT WHERE THE WORDS "PACKAGED" OR "CONTROL PANEL" APPEAR IN THE "REMARKS" COLUMN. FOLLOWING SCHEDULE IS A GUIDELINE OF DESIGN INFORMATION. IT IS ELECTRICAL CONTRACTORS RESPONSIBILITY TO COORDINATE PROTECTION AND STARTING DEVICES REQUIREMENT WITH OTHER TRADES.
3. ALL POWER WIRING BY ELECTRICAL CONTRACTOR.
4. ALL TEMPERATURE CONTROL AND INTERLOCK CONDUIT / WIRING, ETC. BY MECHANICAL CONTRACTOR. OTHER CONTROLS AND CONTROL CONDUIT / WIRING BY TRADE FURNISHING RESPECTIVE EQUIPMENT.
5. IT IS THE RESPONSIBILITY OF THE ELECTRICAL CONTRACTOR TO COORDINATE AND REVIEW THE ELECTRICAL CHARACTERISTICS, AMPACITY, AND OTHER REQUIREMENTS OF COMPONENTS BEFORE INSTALLATION OF WORK. MECHANICAL AND PLUMBING CONTRACTORS SHALL ADVISE ELECTRICAL CONTRACTOR OF ANY MOTOR / DEVICE CHANGES. THIS SCHEDULE IS FOR THE CONVENIENCE OF TRADE CONTRACTORS IN COORDINATING THEIR WORK. NOT ALL DEVICES, EQUIPMENT ARE NECESSARILY SHOW HERE. THIS SCHEDULE SHALL NOT BE THE BASIC OF ANY OMISSIONS OR JURISDICTION CLAIM BY ANY CONTRACTOR.
6. "ATC = COORDINATE WITH TEMPERATURE CONTROL CONTRACTOR FOR INTERFACE TO MEET REQUIRED SEQUENCE OF OPERATION"

						DISCONNECT SWITCH			STARTERS							CONTROL DEVICES						
												COMBINATION MAGNETIC										
TAG	DESCRIPTION / LOCATION	FULL LOAD AMPS	VOLTS	PHASE	HP / MCA / KW	NF	F	TOGGLE SWITCH	REDUCED VOLTAGE	VARIABLE OR TWO SPEED	MAGNETIC	NF	F	CB	THERMAL SWITCH	PB	HOA	PL	ON COVER	CONTACTOR	INTERLOCK WITH	REMARKS
AC-1	MDF AC UNIT/MDF ROOM		120	1	20 MOCP	E															WITH CU-1	
CU-1	MDF CONDENSING UNIT/ROOF		120	1	0.6 FLA	E															WITH AC-1	
FCU-1	STORAGE 105		120	1	57 W	E																1
EUH-A	ELECTRIC HEATER/TOILETS		208	1	1.5 KW	E																
EH-1	ELECTRIC HEATER/ELECTRIC RM		208	3	5 KW	E																
EH-2	ELECTRIC HEATER/PUMP ROOM		208	3	5 KW	E																
																						1
	UNIT HEATER/VESTIBULES		120	1	1/20 HP	M																
CUH-B	UNIT HEATER/VESTIBULES		120	1	1/20 HP	M																

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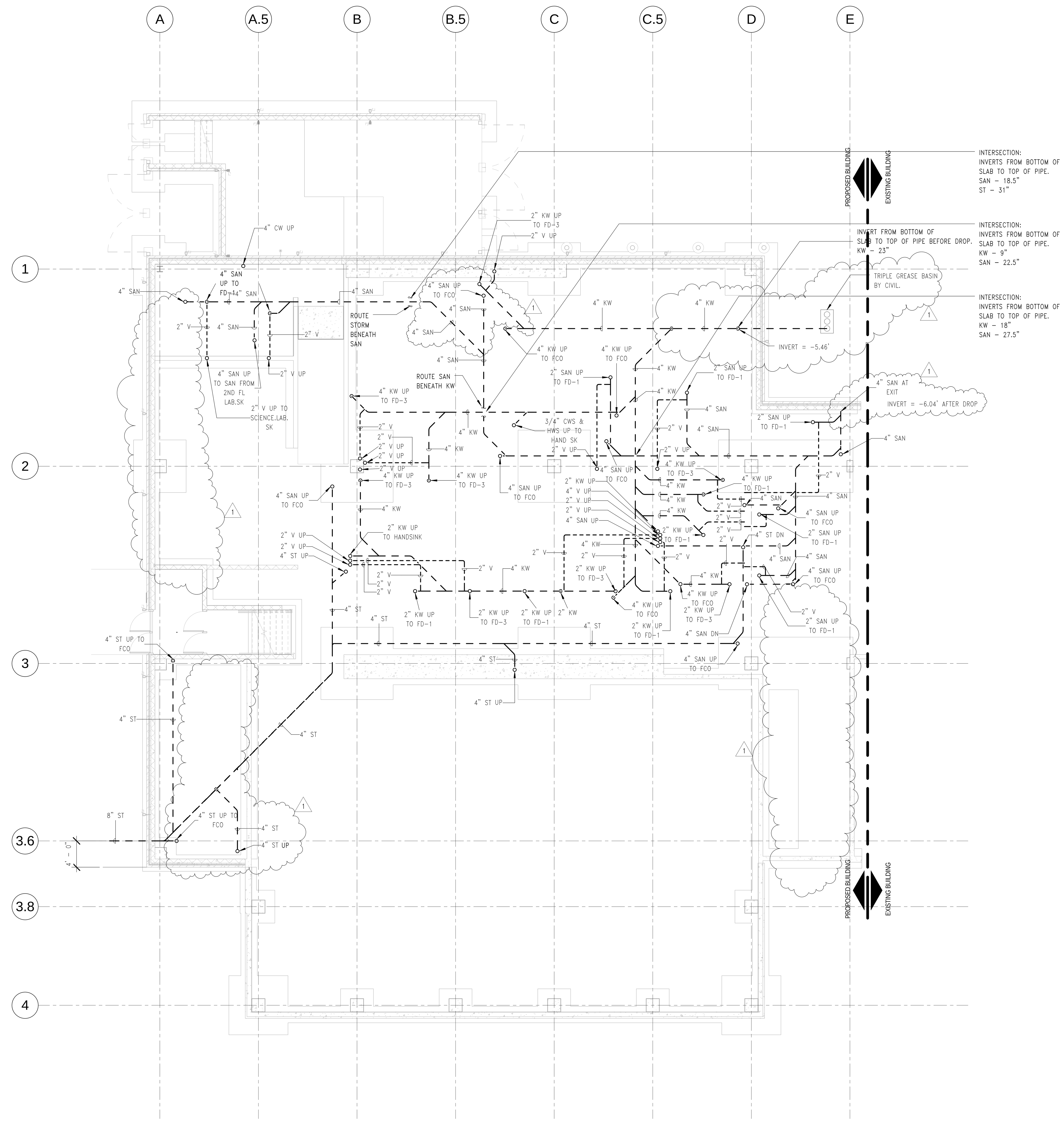
PROJECT: ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION
SMNG-A NO.: 1210
PBC NO.: 05530
CONTRACT NO.:
ISSUE: ISSUE FOR ADDENDUM NO. 1
TITLE: MEP COORDINATION SCHEDULE
COMMENTS: REMOVE AC-2, CU-2, EH-3; ADD FCU-1. REFERENCE M4.2

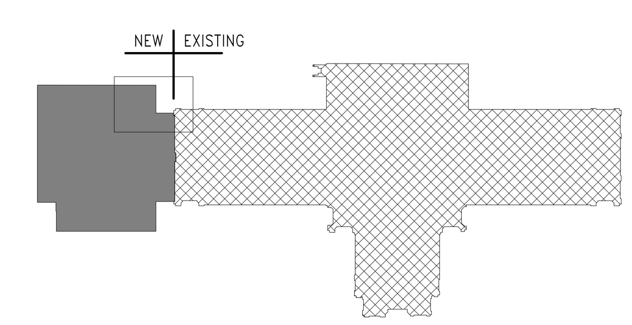
ISSUE DATE: 11.30.12

MSK-06



UNDERGROUND PLUMBING PLAN

1/4" = 1'-0"



KEYPLAN

1" = 100'-0"

PUBLIC BUILDING COMMISSION OF CHICAGO

BUILDING SCHOOLS ACROSS CHICAGO

CHICAGO PUBLIC SCHOOLS CPS

ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION

3730 North Oakley Avenue Chicago, Illinois 60618

Chicago Public Schools

CITY OF CHICAGO, MAYOR RAHM EMANUEL

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Acoustic Consultant

Edge Associates
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Food Service Consultant

George E. Krug
Buffalo Grove, Illinois
Hardware Consultant

Issuance

Mark	Description	Date
1	ISSUE FOR ADDENDUM NO.1	11.30.2012

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PBC Project Name: ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION

PBC Contract No.: 05530

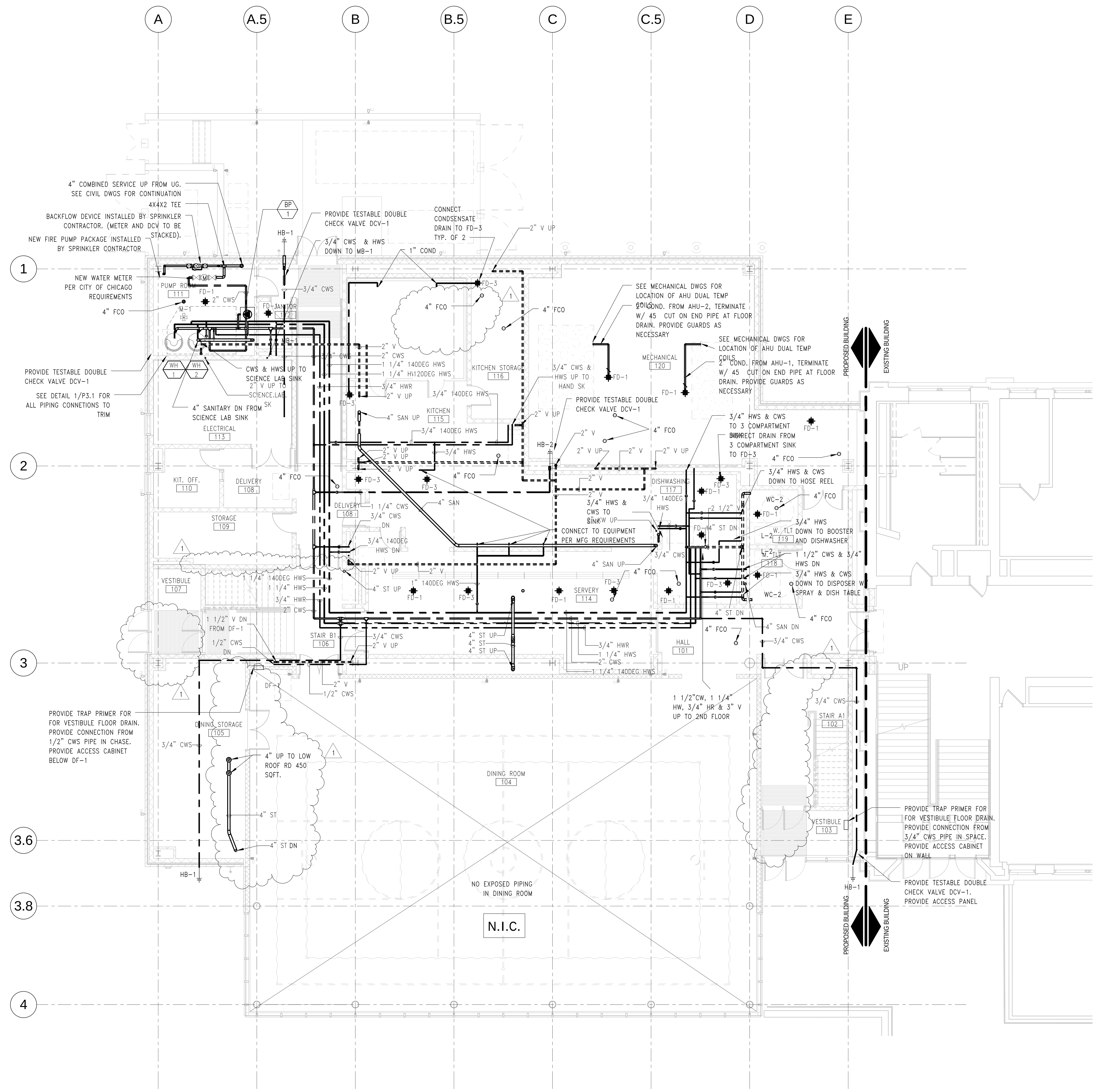
SMNG-A Project No.: 1210

Title

UNDERGROUND PLUMBING PLAN

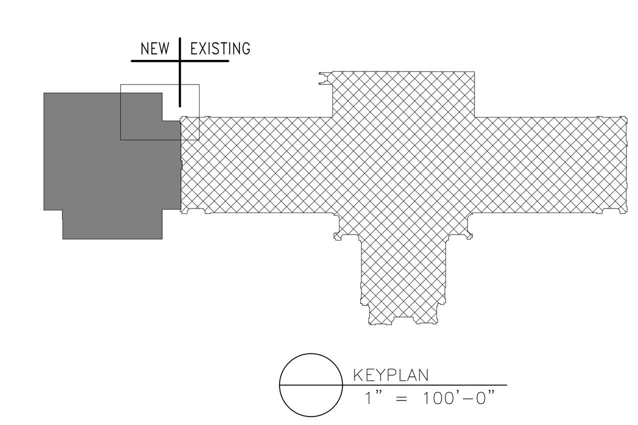
Sheet

P1.0A



PLUMBING 1ST FLOOR PLAN – ADDITION

1/8" = 1'-0"



KEYPLAN
1" = 100'-0"

PUBLIC BUILDING COMMISSION OF CHICAGO
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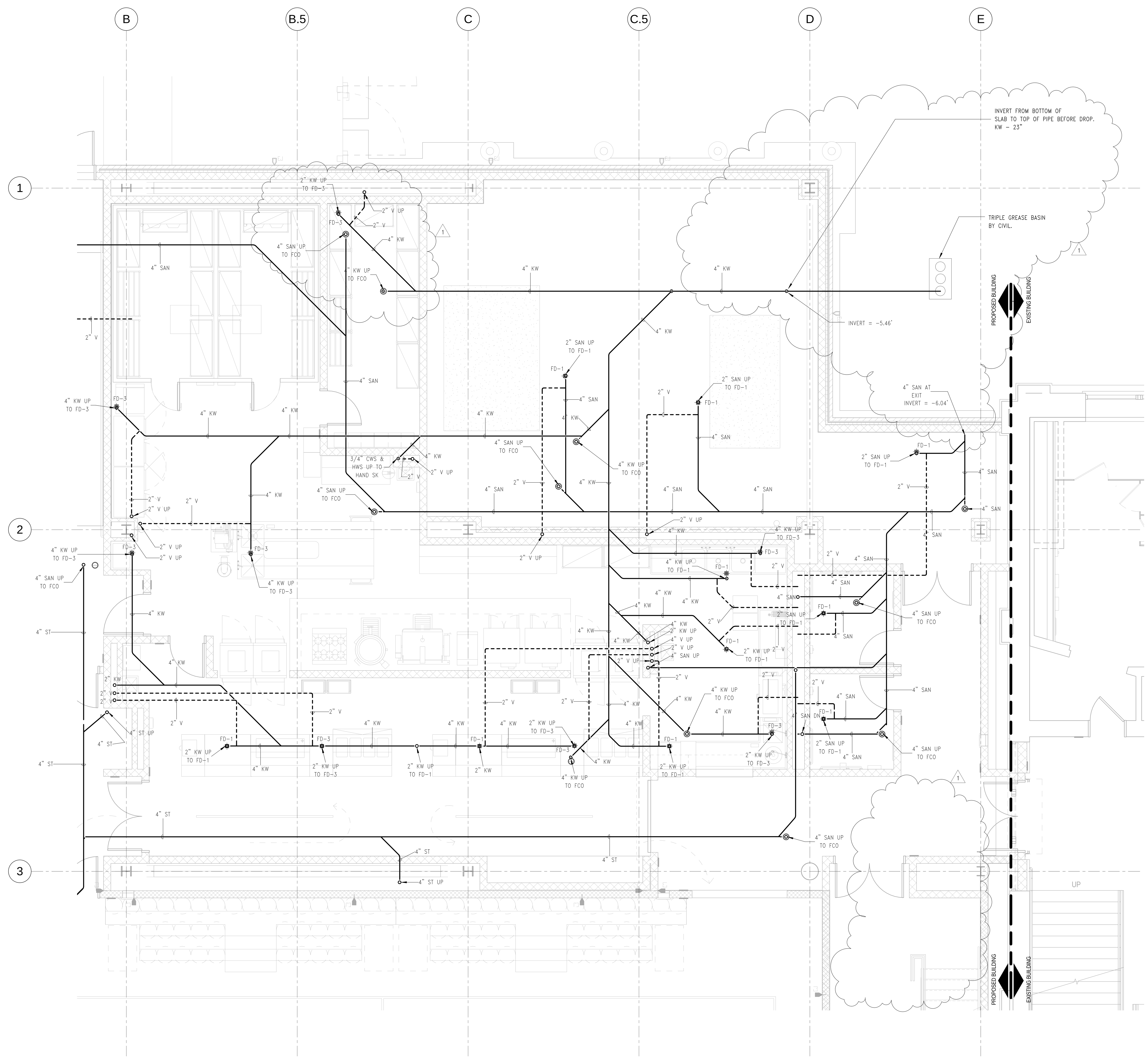
SMNG-A Project No.: 1210

Title

PLUMBING 1ST FLOOR PLAN - ADDITION

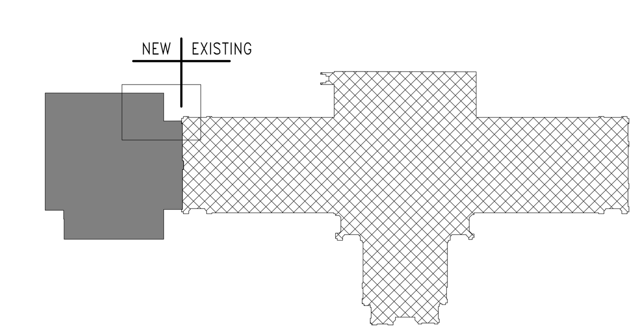
Sheet

P1.1A



ENLARGED UNDERGROUND PLUMBING PLAN – KITCHEN

P2.3 1/4" = 1'-0"



KEYPLAN 1" = 100'-0"

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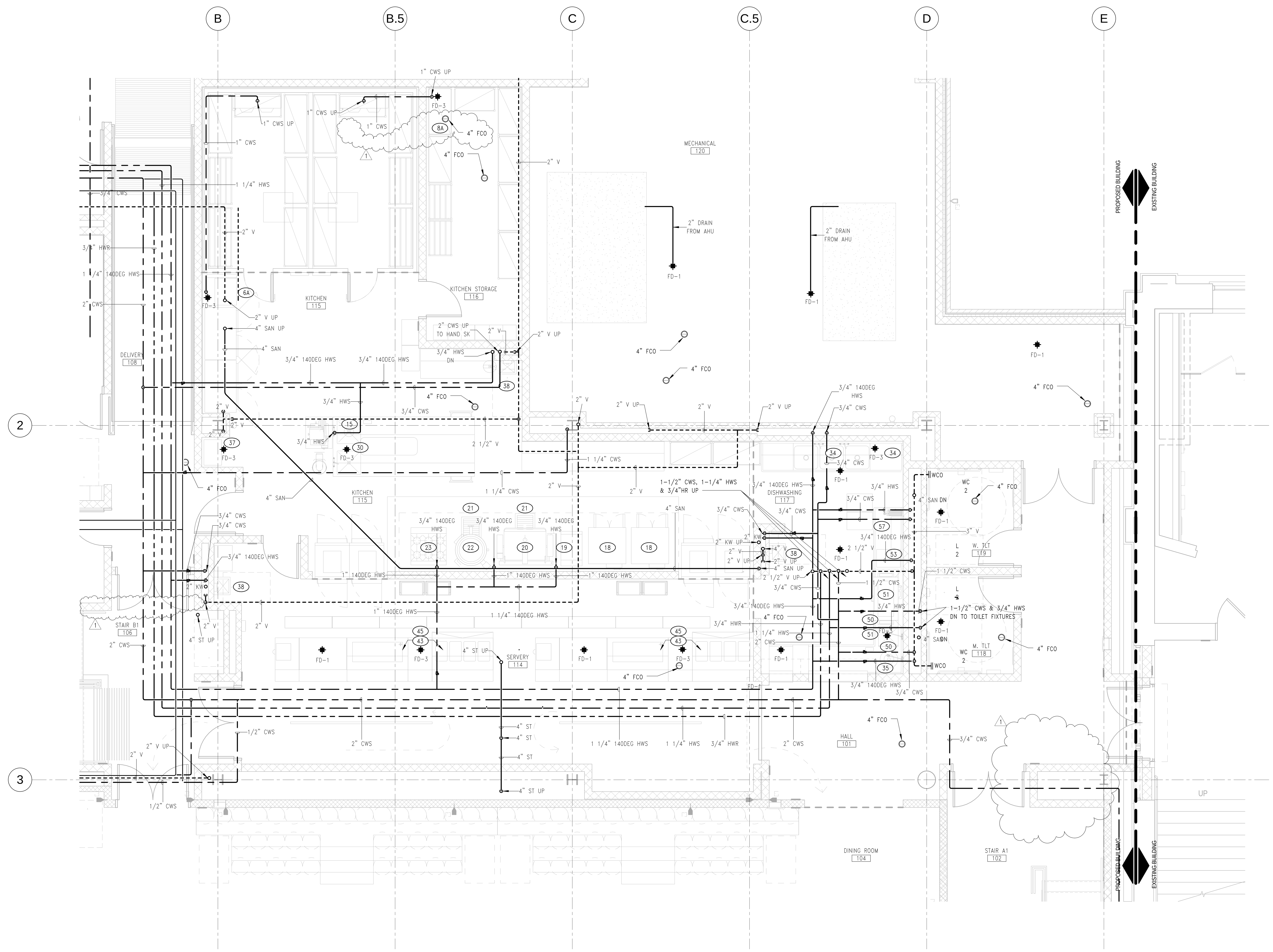
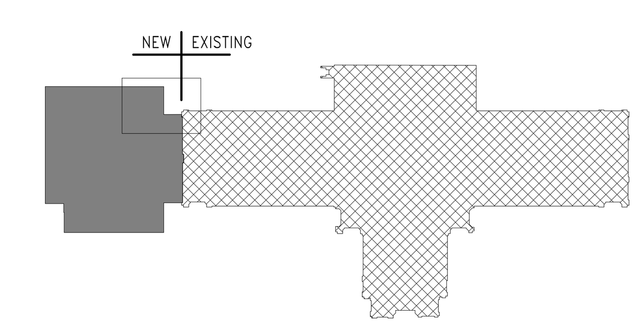
Title **ENLARGED UNDERGROUND PLUMBING PLAN - KITCHEN**

Sheet **P2.3**



ENLARGED 1ST FLOOR PLUMBING PLAN – KITCHEN

P2.4 1/4" = 1'-0"



KEYPLAN
1" = 100'-0"

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PBC Project Name: ALEXANDER GRAHAM BELL ELEMENTARY SCHOOL ADDITION

PBC Contract No.: 05530

SMNG-A Project No.: 1210

Title
ENLARGED 1ST FLOOR PLUMBING PLAN - KITCHEN

Sheet
P2.4

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes cold formed metal framing indicated and as specified, including engineering.

B. Coordination with Glazed Aluminum Curtain Wall Requirements. Section includes requirements for coordination with the supplier(s), designer(s) and installers of the Glazed Aluminum Curtain Wall system as specified in Section 08 44 13. Cold-Formed Metal Framing performance requirements shall be coordinated with Curtain Wall system components as shown on drawings, a specified, and as calculated for structural performance of the overall window system. All design, gravity and wind loads transferred from the Aluminum Curtain Wall systems, including concentrated loads at connections shall be closely coordinated and accommodated in the Cold Formed Metal Framing structural calculations and design. Contractor shall provide all necessary clips, plates, stiffeners, and associated work to accommodate perimeter fastening of Glazed Aluminum Curtain Wall system components.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's product information and installation instructions.

B. Shop Drawings: Submit Shop Drawings for special components and installations not fully dimensioned or detailed in manufacturer's product data.

1. Include placing drawings for framing members showing size and gauge designations, number, type, location and spacing. Indicate supplemental bracing, splines, accessories, and details as may be required for proper installation.
2. Submit shop drawings for the system framing and connections with the supporting construction stamped and signed by a State of Illinois Licensed Structural Engineer.

C. LEED Submittals:

1. LEED Credit MR 4.1: Submit product data for products having recycled content indicating percentages by weight of post-consumer and pre-consumer recycled content.

   a. Include a statement indicating the cost of each product having recycled content.

2. LEED Credit MR 5.1: Submit product data for products that have been extracted, harvested, or recovered, as well as manufactured within 500 miles of the Project site.

   a. Include a statement indicating the percentage by weight which is extracted, harvested, or recovered within 500 miles of the Project site.

1.3 PERFORMANCE REQUIREMENTS

A. Cold Formed Steel Framing, General: Design according to AiSI's "Stand for Cold-Formed Steel Framing – General Provisions."

1. Header: Design according to AISI's "Standard for Cold-Formed Steel Framing – Header Design."
2. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

B. Structural Performance: Provide cold-formed metal framing capable of withstanding loads within limits and under conditions indicates.

1. Design the systems for the loads indicates and required by Chicago Building Code, latest edition.
2. Design for Aluminum Window System and Aluminum Frames Entrances to ensure that engineered metal stud system account for the gravity loads and lateral forces are transferred from the storefront system to the wall system.
3. Design exterior non-load bearing wall framing to sustain load of 25 psf acting inward and outward (except 30 psf at corners) with a maximum horizontal deflection of L/240 of the wall height.

a. Maintain width of studs shown at exterior wall framing. Provide gauge and spacing required for design loads, but not greater than 16" o.c.

C. Design framing system to provide for movement of framing members without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 100 deg. F.

D. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

1. Upward and downward movement of 1 inch.

E. Design framing system to include additional members as may be required to accommodate attachment of masonry veneer anchors and insulated metal panel anchorages at spacings and dimensions shown on Construction Drawings and as specified.

1.4 QUALITY ASSURANCE

A. Component Design: Compute structural properties of members in accordance with AISI "Specification for the Design of Cold-Formed Steel Structural Members."

1. Design the systems for the loads indicated and required by code.

B. Welding: Use qualified welders and comply with American Welding Society (AWS) D1.3 "Structural Welding Code-Sheet Steel".

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in PBC Books 1+2. Install framing as part of the Project Mock-up to verify selections made under sample submittals, demonstrate product performance, and to set quality standards for installation.

D. Job Mock-up: Prior to installation of work, contribute to the project mock-up shown in the Construction Drawings and as specified in Section 01 14 10 "Preconstruction Project Mock-Up".

1.5 DELIVERY AND STORAGE

A. Protect metal framing units from rusting and damage. Deliver to the Project Site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade. Store off the ground in a dry ventilated space or protect with suitable waterproof coverings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide cold-formed metal framing by one of the following:

1. AllSteel Products, Inc.
2. California Expanded Metal Products Company.
3. Clark Steel Framing..
4. Dietrich Metal Framing
5. Formetal Co. Inc. (The).
6. MarinoWare; a division of Ware Industries.
7. SCAFCO Corporation.
8. Steeler, Inc.
9. The Steel Network.
10. United Metal Products, Inc.

2.2 METAL FRAMING

A. LEED Requirements: Provide at least 90% recycled steel content produced within 500 miles of the site.

B. System Components:

1. Provide manufacturer's standard minimum 18 gauge steel studs, steel runners (tracks), blocking, lintels, clip angles, shoes, reinforcements, fasteners, and accessories as recommended by manufacturer for the applications indicated, as needed to provide a complete metal framing system.

C. Materials and Finishes: ASTM A1003/A 1003M, structural grade required by design, Type H. G60 metallic coating.

D. Fasteners: Provide nuts, bolts, washers, screws, and other fasteners with corrosion-resistant plated finish.

E. Electrodes for Welding: Comply with AWS Code and as recommended by stud manufacturer.

F. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

2.3 FABRICATION

A. Basic Requirements: Framing components may be prefabricated into panels prior to erection. Fabricate panels plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated panels in a manner to prevent damage or distortion in any members in the assembly.

B. Cutting: Cut ends of member square to fit against abutting members.

C. Fastenings: Attach components by welding, bolting, or screw fasteners.

1. Wire tying of framing components is not permitted.

2.4 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer’s standard thickness and configuration, unless otherwise indicated , as follows:

1. Supplementary framing.
2. Lintels.
3. Bracing, bridging, and solid blocking.
4. Web stiffeners.
5. Anchor clips.
6. End clips.
7. Foundation clips.
8. Gusset plates.
9. Stud kickers, knee braces, and girts.
10. Hole reinforcing plates.
11. Backer plates.

2.5 ANCHORS CLIPS AND FASTENERS

A. Expansion Anchors: Fabricates from corrosion-resistant materials, with capability to sustain without failure, a load equal to 5 times design load, as determined by testing per ASTM E 488 conducts by a qualified independent testing agency.

B. Power Actuated Anchors: Fastener system of type suitable for application indicates, fabricates from corrosion-resistant materials, with capability to sustain, with failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.

C. Mechanical Anchors: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

D. Electrodes for Welding: Comply with AWS Code and as recommended by stud manufacturer.

E. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

2.6 FABRICATION

A. Fabricate cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do no torch cut.
3. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of weld, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by not less than three exposed screw threads.

4. Fasten other materials to cold-formed metal framing by welding, bolting, or screw fastening, according to Shop Drawings.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Pre-Installation Conference: Prior to the start of installation of metal framing systems, meet at the Project Site with the installers of other Work, including door and window frames, and Mechanical and Electrical Work. Review areas of potential interference and conflicts, and coordinate layout and support provisions for interfacing Work.

B. Before Sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicates to receive sprayed fire-resistive materials.

C. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire resistive materials below that are required to obtain fire-resistance rating indicates. Protect remaining fire-resistive materials from damage.

3.2 INSTALLATION

A. Basic Requirements:

1. Install metal framing systems in accordance with manufacturer's printed or written instructions and recommendations.

2. Install cold-formed metal framing according to AISI's "Standard for Cold-Formed Steel Framing – General Provisions" and to manufacturer's written instructions unless more stringent requirements are indicates.
3. Install framing members one-piece lengths unless slice connections are indicates for track or tension members.
4. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, unless entire integrated supporting structure has been completed and permanent connections to framing are secured.
5. Install continuous runner tracks sized to match studs. Align tracks accurately to the layout at base and tops of studs. Secure tracks as recommended by the stud manufacturer for the type of construction involved, except do not exceed 24" o.c. spacing. Provide fasteners at corners and ends of tracks.
6. Install cold-formed metal framing and accessories plumb, square, and true to line, and with connections securely fastened except as needed for diagonal bracing or required for non-plumbing walls or warped surfaced and similar requirement.

    a. Cut framing members by sawing or shearing do no torch cuts.
    b. Fasten cold-formed metal framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

        1) Comply with AWS D1.3 requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
        2) Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetrations.

7. Where stud system abuts structural columns or walls, including masonry walls, anchor ends of stiffeners to supporting structure.
8. Fasten hold reinforcing plate over web penetrations that exceed size of manufacturer's stand punched opening.
9. Install supplementary framing, blocking and bracing in the metal framing system wherever walls or partitions are indicated to support fixtures, equipment, services, casework, heavy trim and furnishings, and similar Work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight of loading resulting from the item supported.
10. Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges.
11. Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than 2 are either shown or indicated in manufacturer's instructions. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of the wall. Secure stud system all around to wall opening frame in the manner indicated.
12. Install horizontal stiffeners in stud system, spaced (vertical distance) at not more than 4'-6" o.c.
13. Frame both sides of expansion joints with separate studs. Do not bridge the joint with components of stud system.

B. Exterior Non-Loading Bearing wall installation.

1. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure as indicated.
2. Fasten both flanges of studs to top and bottom track, unless otherwise indicated. Space studs as follows:

   a. Stud Spacing: Install studs as indicated on Shop Drawings but not more than 16 inch apart.

3. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
4. Install horizontal bridging in wall studs, spaced in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
5. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, fasteners, and stud girts, to provide a complete and stable wall-framing system.

C. Field Painting: Touch up shop-applied protective coatings damaged during handling and installation. Use galvanizing repair paint.

3.3 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction:

1. The Owner's testing service may inspect welds
2. If, in the opinion of the Owner's testing service, based on reports of the testing service and inspection, additional testing will be required until satisfactory results are obtained at no additional cost to Owner. In such event, retesting will be paid by the Contractor.

B. Contractor’s Responsibilities

1. Notify Agency sufficiently in advance of operations to allow for his assignment of personnel and scheduling of tests.
2. Coordinate with Agencies’ personnel, provide access to Work.
3. Furnish casual labor and facilities to provide access to Work to be tested to facilitate inspections and tests.

END OF SECTION

SECTION 23 09 26

BUILDING AUTOMATION SYSTEM (BAS) - SEQUENCE OF OPERATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes the following:

1. Air Handling Units.
2. Terminal Units.
3. Central Chilled Water System.
4. Central Heating System.
5. Chillers.
6. Pumps.
7. Mechanical systems with automatic control.

1.2 SYSTEM DESCRIPTION

A. Refer to Division 23 Section "Building Automation System (BAS)" for a description of the systems to be controlled.

B. This Section defines the manner and method by which controls function.

1.3 SUBMITTALS

A. Refer to Division 23 Section "Building Automation System (BAS)" and Division 01 Sections for requirements for control shop drawings, product data, Users Manual, etc.

B. Programming Manual: Provide DDC system programming manual as well as documentation of site specific programming prior to the start of Acceptance Phase.

1.4 PROJECT RECORD DOCUMENTS

A. Within two weeks of the completion of commissioning, provide record documents to represent the final control configuration with actual setpoints and tuning parameters as existed at acceptance.

B. Record documents shall be modified control drawings with the actual installed information. Drawings shall be delivered in both reproducible hard copy and electronic format in AutoCAD v13 or later. Provide all supporting files, blocks, fonts, etc. required by the drawings.

C. Provide final points list

D. Provide final detailed wiring diagrams with all wire numbers and termination points indicated

E. Accurately record final sequences and control logic made after submission of shop drawings.

1.5 DEFINITIONS/ABBREVIATIONS

A. Absolute Minimum OA: Minimum flow rate setpoint to which the OA or primary air may throttle down. This value is acceptable as long as CO_2 levels are within acceptable limits.

B. AHU: Air Handling Unit

C. CHW: Chilled Water

D. CHWS: Chilled Water Supply

E. CHWR: Chilled Water Return

F. DDC: Direct Digital Control

G. Design Minimum OA: Minimum flow rate setpoint based on code requirements or designed system and coil capacities.

H. BAS: Building Automation System

I. MVR: Minimum required ventilation rate

J. OA: Outdoor Air

K. CHW: chilled water

L. HW: heating water

M. Physical Point: A point on the BAS that is physically connected to an I/O device such that a hardware point exists

N. Virtual Point: A point to store values (i.e.: a setpoint) that do not represent a physical device

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL

A. Sequences specified herein indicate the functional intent of the systems operation and may not fully detail every aspect of the programming that may be required to obtain the indicated operation. Contractor shall provide all programming necessary to obtain the sequences/system operation indicated.

B. When an air handling unit is not in operation, control devices shall remain in their “off” positions. “Off” positions may differ from the “normal” (meaning failed) position. Except as specified otherwise, “off” and “normal” positions of control devices shall be as follows:

Device	“Off” Position	“Normal” Position
Heating coil valves	closed/	open

	controlling	
Cooling coil valves	closed	closed
Outside air damper	closed	closed
Return air damper	open	open
Exhaust/relief air damper	closed	closed
Var. Freq. Drive	Off	Min. Speed

C. Except as specified otherwise, throttling ranges, proportional bands, and cycle differentials shall be centered on the associated setpoint. All modulating feedback control loops shall include the capability of having proportional, integral, and derivative action. Unless the loop is specified "proportional only" or "P+I", Contractor shall apply appropriate elements of integral and derivative gain to each control loop which shall result in stable operation, minimum settling time, and shall maintain the primary variable within the specified maximum allowable variance.

D. Scheduling Terminology: When air handlers are scheduled throughout the day, the following defines the terminology used:

1. Occupied Period: period of time when the building is in use and occupied. Generally systems will be fully operational throughout this period and ventilation air shall be continuously introduced. Space temperature setpoints will generally be in the "normal" range of 69°-76°F.
2. Unoccupied period: period of time when the building or zone is not in use and unoccupied. Ventilation air shall not be introduced.
3. Preoccupancy Period: Time prior to the Occupied period when the systems are returning the space temperatures from setback to "normal" or occupied setpoints (warm-up and cool-down). Ventilation air shall not be introduced unless outside air conditions permit free-cooling. Time period shall be determined by an optimum start strategy unless otherwise specified.
4. Setback Period: Setback start will typically coincide with the end of the occupied period and end with the start of the preoccupacy period, however it shall be provided with its own schedule. Generally systems will be off except to maintain a "setback" temperature.

E. Where any sequence or occupancy schedule calls for more than one motorized unit to start simultaneously, the BAS start commands shall be staggered by 5 second (adj.) intervals to minimize inrush current.

F. Alarm messages specified throughout the sequences are assigned to discrete priority levels. Priority levels dictate the handling and destination of alarm reports.

G. All setpoints shall be adjustable (adj.), they shall be modifiable, with the proper password level, from the operator interface or via a function block menu. For these points, it is unacceptable to have to modify programming statements to change the setpoint.

H. Where reset action is specified in a sequence of operation, but a reset schedule is not indicated on the drawings, one of the following methods shall be employed:

1. Contractor shall determine a fixed reset schedule which shall result in stable operation and shall maintain the primary variable within the specified maximum allowable variance.

2. A floating reset algorithm shall be used which increments the secondary variable setpoint (setpoint of control loop being reset) on a periodic basis to maintain primary variable setpoint. The recalculation time and reset increment shall be chosen to maintain the primary variable within the specified maximum allowable variance.
3. [Primary variable shall control the devices directly using a PID feedback control loop without resetting the secondary variable. However, the control devices shall still modulate as necessary to maintain upper and lower limits on the secondary variable. Proportional band, integral gain, and derivative term shall be selected to maintain the primary variable within the specified maximum allowable tolerance while minimizing overshoot and settling time. Contractor shall gain prior approval for implementing this method of reset.]

I. Where a supply air temperature or duct pressure setpoint is specified to be reset by the space temperature of the zones calling for the most cooling/heating, the following method shall be employed:

1. A floating reset algorithm shall be used which increments the secondary variable (e.g., supply air temperature or duct pressure) setpoint on a periodic basis to maintain primary variable (e.g. space temperature) setpoint. The reset increment shall be determined by the quantity of “need heat” or “need cool” requests from individual terminal units. A terminal unit’s “need heat” virtual point shall activate whenever the zone’s space temperature falls below the currently applicable (occupied or unoccupied) heating setpoint throttling range. A terminal unit’s “need cool” virtual point shall activate whenever the zone’s space temperature rises above the currently applicable (occupied, unoccupied, or economy) cooling setpoint throttling range. The recalculation time and reset increment shall be chosen to maintain the primary variable within the specified maximum allowable variance while minimizing overshoot and settling time. Reset range maximum and minimum values shall limit the setpoint range.

J. Where a supply air temperature, duct pressure, or differential water pressure setpoint is specified to be reset by valve or damper position of the zone or zones calling for the most cooling/heating, the following method shall be employed:

1. A floating reset algorithm shall be used which increments the secondary variable (e.g., supply air temperature, pipe or duct pressure) setpoint on a periodic basis to maintain primary variable (e.g. cooling valve, heating valve, damper position) setpoint of 85% open. The reset increment shall be calculated based on the average position of the quantity of the worst (most open valve/damper) zone(s) as specified. The recalculation time, reset increment and control device position influence shall be chosen to maintain the primary variable within the specified maximum allowable variance while minimizing overshoot and settling time. The BAS analog output value shall be acceptable as indicating the position of the control device.
2. Alternatively to continuously calculating the average of the quantity of worst valve/damper positions, a method similar to the one described above may be employed whereby the “need heat” or “need cool” virtual point shall increment by one unit each time a zone’s valve/damper position rises to greater than 95%. The quantity of “need heat” or “need cool” points shall then be the basis for reset.

K. Where “prove operation” of a device (generally controlled by a digital output) is indicated in the sequence, it shall require that the BAS, after an adjustable time delay & after the device is commanded to operate (feedback delay,) confirm that the device is operational via the status input. If the status point does not confirm operation after the time delay or anytime thereafter for an adjustable time delay (debounce delay) while the device is commanded to run, an alarm shall be enunciated audibly and via an alarm message at the operator interface and print at the alarm printers. A descriptive message shall be attached to the alarm message indicating the nature of the alarm and actions to be taken. Contractor shall provide messages to meet this intent.

L. The BAS shall provide for adjustable maximum rates of change for increasing and decreasing output from the following analog output points:

1. Speed control of variable speed drives
2. Chiller supply water temperature setpoint reset
3. Chiller demand limit
4. Travel rate of tower isolation and chiller isolation valves

M. Wherever a value is indicated to be dependent on another value (i.e.: setpoint plus 5°F) the BAS shall use that equation to determine the value. Simply providing a virtual point that the operator must set is unacceptable. In this case three virtual points shall be provided. One to store the parameter (5°F), one to store the setpoint, and one to store the value which is the result of the equation.

N. Some sequences rely on integration with third-party manufacturer control equipment. See the control equipment specifications, equipment schedules and equipment specifications for more information on this integration.

3.2 AIR HANDLING UNITS - GENERAL

A. Logic Strategies: The BAS shall fully control the air handlers. Generally, the BAS shall energize the AH (start the fans and activate control loops) as dictated for each air handler. The following indicates when and how the BAS shall energize the AHs and control various common aspects of them. The following "logic strategies" shall be included by reference with each air handler with any specific clarifications required:

1. Scheduled Occupancy: BAS shall determine the occupancy periods (occupied, unoccupied, preoccupancy, and setback) as defined above. The following details the common control aspects related to the scheduled occupancy.

    a. Occupied Period: BAS shall energize the AHU during all occupied periods.
    b. Setback Period: the BAS shall deenergize the unit except as required to maintain a setback temperature of 55°F with a 5°F cycle differential. Generally, where setback temperatures apply in multiple zones, the worst zone shall control the system. Setback setpoints generally apply except during preoccupancy and night purge. If, during the unoccupied period, there is a request for occupancy override, the occupancy mode shall become active for an adjustable period.
    c. Preoccupancy: BAS shall energize the AHU continuously during the preoccupancy period. Minimum OA flow shall be 0 CFM or the minimum OA damper position shall be 0%. "Normal" setpoints shall apply. Preoccupancy duration shall be one of the following as specified by reference:

        1) Fixed: The duration of the preoccupancy period shall be fixed as scheduled by the operator.

2) Optimum: The duration of the morning warm-up period shall vary according to outside air temperature and space temperature such that the space temperature rises to occupied period heating setpoint at the beginning of, but not before, the scheduled occupied period. The duration of the cool-down period shall vary according to outside air temperature and space temperature such that the space temperature falls to the occupied period cooling setpoint at the beginning of, but not before, the scheduled occupied period

2. Night Purge Cycle: The night purge cycle shall be allowed only when manually enabled via a graphic icon. Night purge cycle shall start and stop as listed below during the unoccupied mode to maintain the zone(s) at setpoint using OA only (economizer) for cooling. Mechanical cooling and heating shall be disabled during the night purge mode.

a. Night Purge Cycle Start: While the mode is enabled and during the unoccupied period, the BAS shall initiate the night purge cycle when:

1) The OA temperature falls to 10°F (adj.) below the space temperature(s) (highest space temperature served by the AHU if not a single zone unit)
2) And any (or an adjustable minimum number of) space temperature(s) is at least 5°F (adj.) above its normal occupied cooling setpoint
3) And all space temperatures (served by the AHU if not a single zone unit) are greater than their occupied heating setpoint
4) And outdoor air temperature is below 60°F (adj.).

b. Night Purge Cycle Stop: BAS shall disable the mode and deenergize AHU when:

1) The space temperature (highest space temperature for AHUs served by the AHU if not a single zone unit) falls to within 5°F (adj.) of OA temperature
2) Or any space temperature(s) fall(s) below its occupied heating setpoint.
3) Or all space temperatures fall below their occupied cooling setpoint.
4) Or the outdoor air temperature rises above the night cycle setpoint (60˚F [adj.]) by 5°F.

3. Sequenced Heating and Cooling: BAS shall control the heating and cooling coils and air side economizer detailed for the particular AH. Program logic shall directly prohibit the heating and cooling valves as well as the heating valve and economizer damper to be open (or above minimum) simultaneously. This does not apply to cooling and reheat valves that are used simultaneously for dehumidification.

B. Safeties

1. Freeze Safety: Upon operation of a freezestat, unit shall be deenergized with the exception of the heating loops. Typically supply and return fans where applicable shall be deenergized via a hardwired interlock[and an indication of the operation shall be sensed by the BAS. BAS shall enunciate appropriate alarm and remove and lock out the start command], [which shall initiate "fan failure" alarms]. OA dampers shall close and heating loops shall remain active.
2. Software Low-Limit Safety: Upon detection by the BAS of a unit supply temperature below a low limit setpoint (40°F unless specifically stated otherwise), unit shall be deenergized with the exception of the heating loops. BAS shall enunciate appropriate

alarm and remove and lock out the start command]]. OA dampers shall close and heating loops shall remain active. Once disabled, unit shall require a manual reset via the Operator Interface before it is allowed to restart.

3. Smoke Safety: Upon indication of smoke by a duct smoke detector the unit will shut down via hard-wired interlock and an indication of the operation shall be sensed by the BAS. BAS shall enunciate appropriate alarm and remove and lock out the start command], [which shall initiate "fan failure" alarms]. OA dampers shall close and heating loops shall remain active.
4. High or Low Pressure Safety: In VAV systems, upon activation of a high or low pressure safety switch, AHU shall be deenergized, fans shall be deenergized via a hard wired interlock[, and an indication of the operation shall be sensed by the BAS. BAS shall enunciate appropriate alarm and remove and lock out the start command], [which shall initiate "fan failure" alarms].
5. The detailed “Safety logic strategies” above shall be required by reference to them in each of the individual sequences specified below.

C. Diagnostics

1. Diagnostic Strategies: In addition to the standard alarm limits specified for all sensed variables the BAS monitor and diagnose anomalies in the operation of the air handlers. The following “diagnostic strategies” shall be included by reference with each air handler with any specific clarifications required:

   a. Run Time Limit: BAS shall accumulate the runtime of the status of associated rotating equipment and enunciate a level 5 alarm to indicate that the unit is in need of service.
   b. DP Switch Filter Monitoring: BAS shall monitor the differential pressure switch across the filter bank(s). An alarm shall be reported when pressure drop exceeds the switch’s setting.
   c. DP Transmitter Filter Monitoring: BAS shall monitor the differential pressure across the filter bank(s). An alarm shall be reported when pressure drop exceeds the alarm setting.

2. System Condition Alarming: BAS shall monitor the following parameters and enunciate an alarm under any of the following conditions in addition to other monitor and alarm functions specified above. These may not be specifically referenced in the individual sequences, but shall be provided wherever applicable.

   a. Enunciate a Level 2 alarm when any active (air flowing) discharge temperature goes above or below its setpoint plus ±8°F (adj.) for 15 min. continuously as follows:

      1) Sensor XXX is indicating that the discharge temperature is outside of acceptable limits.

   b. Enunciate a Level 2 alarm when any active (air flowing) heating duct or heating coil leaving temperature falls below its setpoint minus 8°F (adj.) for 15 min. continuously as follows:

      1) Sensor XXX is indicating that the heating air temperature is below acceptable limits.

c. Enunciate a Level 2 alarm when any active (air flowing) cooling duct or cooling coil leaving temperature exceeds setpoint plus 8°F (adj.) for 5 min. continuously as follows:

1) Sensor XXX is indicating that the cooling air temperature is above acceptable limits.

d. During the occupied period, enunciate a Level 2 alarm when any space temperature exceeds its active cooling setpoint plus 5°F (adj.) for 15 min. or falls below its active heating setpoint minus 5°F (adj.) for 15 min. continuously.

1) Zone XXX appears to be outside of acceptable limits.

e. Enunciate a Level 2 alarm when any active (air flowing) CO_2 reading rises above 1,200 PPM for 10 min. continuously as follows:

1) Sensor XXX is indicating that the CO_2 levels are above acceptable limits.

3.3 VAV AHU – HOT & CHILLED WATER (BAS-VAV-01)

A. General: The air handler shall be fully controlled by the BAS. For details on the referenced logic strategies refer to item 3.2 Air Handling Units General: Logic Strategies. Air handler control logic strategies shall include Air handler control logic strategies shall include:

1. scheduled occupancy with optimum preoccupancy
2. night purge
3. sequenced heating and cooling

B. Space Temperature Control: The space temperatures shall be controlled via individual VAV boxes. The setback setpoint for cycling the unit shall be 60°F (adj.) for heating and 85°F (adj.) for cooling. Ensure that these setpoints are outside the control range of all box control loops.

C. Supply/ Return Fan Enable: BAS shall control the supply fan as follows:

1. Start/Stop: BAS shall command the operation of the fan and it shall run continuously whenever the AHU is “energized” as specified for the applicable logic strategies specified in item Air Handlers General above.]
2. Proof: BAS shall prove fan operation and use the status indication to accumulate runtime. Upon failure of the fan, the BAS shall enunciate an alarm as specified above.

D. VAV Supply Fan Capacity Control: BAS shall control the output of the supply fan as follows:

1. VSD Control: Whenever the fan is energized, BAS shall control the speed of the VSD to maintain the supply duct static pressure setpoint. On start and stop, the VSD shall ramp to speed and slow down within adjustable acceleration and deceleration limits. BAS shall monitor a common alarm output from the drive and enunciate a level 2 alarm when an alarm is indicated.
2. Supply Duct Static Pressure Setpoint: Setpoint shall be determined using the following strategy:

a. Reset: from 0.5” w.c. (adj.) to 1.25” w.c. (adj.) to maintain the number of requests for static pressure sent from the VAV boxes at 4 (adj.). A request for static pressure shall be sent from a VAV box to the Parent AHU whenever the primary air damper is open greater than 90%.
b. Fixed: at 1.25” w.c. (adj.)

E. VAV Return Fan Capacity Control: BAS shall control the output of the return fan as follows:

1. VSD Control: Whenever the fan is energized, BAS shall control the speed of the VSD to maintain the return air flow at setpoint. On start and stop, the VSD shall ramp to speed and slow down within adjustable acceleration and deceleration limits. BAS shall monitor a common alarm output from the drive and enunciate a level 2 alarm when an alarm is indicated.
2. Return Air Flow Setpoint: Setpoint shall be determined using the following strategy:

a. Flow Tracking: The return air fan shall run to maintain a return flow setpoint of the supply flow minus an offset value (adj.). (This offset value shall be as scheduled on the contract drawings during the occupied period when the minimum OA flow control is enabled. During and unoccupied period, the offset value shall be 0 cfm.)
b. Offset reset by Building D.P.: The scheduled offset value above shall be reset by +/- 10% based upon the variance in building differential pressure from its setpoint of 0.05”w.c. (adj.) whenever the unit is in the occupied mode (OA damper is open.)

F. Discharge Temperature Control: The discharge temperature setpoint shall be determined as follows

1. During the occupied period, the discharge temperature shall be reset from 55°F to 65°F to maintain the number of active cooling requests from the served VAV boxes at 4 with all values being adjustable. A cooling request shall be sent from a VAV box to its parent AHU whenever the space temperature rises above the] ⊗
2. During the occupied period, the discharge temperature shall be overridden from a high of 65°F to a low of 55°F as the return air humidity rises from 50% to 60%. Reset shall be via a slow acting PID loop.
3. When the unit is energized for setback heating during the unoccupied period, the HW valve shall control for a discharge temperature setpoint of 75°F (adj.). The chilled water valve and economizer shall be disabled.
4. When the unit is energized for morning cool-down or setback cooling, the discharge setpoint shall be the warmest zone temperature, minus 15°F. The hot water valve shall be disabled.

G. OA Damper: BAS shall control the damper as follows:

1. Closed: When AH is deenergized, the damper shall remain in its “off” position. When the unit is energized during the unoccupied period, the minimum OA damper position/ flow rate shall be 0% / 0cfm.
2. Minimum OA Flow Control (constant): During the occupied period, the OA damper shall open to its minimum position (this shall be initially set at 100% but shall be user adjustable). The Return and Exhaust air dampers shall modulate as detailed below to maintain the scheduled minimum OA flow at setpoint. The OA flow shall be measured

by an OA flow station located in the OA intake duct. OA flow setpoint shall be as scheduled on the contract drawings.

3. Economizer Mode: Whenever the economizer is enabled in an unoccupied mode, the OA damper shall modulate in conjunction with the Return Air and Relief Air dampers.

H. Return Air & Relief Air Dampers: BAS shall control the dampers as follows:

1. Closed: When AH is deenergized, the dampers shall remain in their “off” position. When the unit is energized during the unoccupied period, the minimum OA flow rate shall be 0cfm.
2. Minimum OA Flow Control (constant): During the occupied period, the Return and Exhaust air dampers shall modulate via PID loop to maintain the scheduled minimum OA flow at setpoint as follows:

    a. On a decrease in OA flow below setpoint, the relief air damper shall modulate open as the return air damper modulates closed.
    b. On an increase in OA flow above setpoint, the relief air damper shall modulate closed as the return air damper modulates open.

3. Airside Economizer: BAS shall modulate the mixing dampers to provide “free cooling” when conditions merit. The free cooling shall generally be staged before any mechanical cooling. While conditions merit, dampers shall be modulated in a PID loop to maintain the mixed air temperature at its setpoint as follows:

    a. Economizer mode shall be active while the unit is energized AND outside air temperature falls below the switching setpoint of 70°F (adj.) (with 5°F cycle differential). Economizer mode shall be inactive when outside air temperature rises above switching setpoint, dampers shall return to their minimum positions as determined by the minimum OA flow control logic detailed above.
    b. The mixed air temperature setpoint shall be equal to the discharge air temperature setpoint - 2°F.
    c. Economizer logic shall remain enabled during night purge, cool-down and night set-up modes where applicable.
    d. Whenever the PID loop output for the airside economizer is greater than the PID loop output for the minim OA flow control, the airside economizer output shall override the minimum OA flow control output.

4. Dual-Temperature Coil Valve

    a. The action of the coil valve will be based upon the summer/winter flag.
    b. The valve will be closed in the night purge mode.
    c. The coil will have two modes:

        1) Heating

            a) The valve will modulate to maintain the coil deck setpoint as long as the central plant is in heating mode.
            b) Coordinate with the balancer to set the maximum position on the valve during heating mode. The default value for heating will be 50% of the full stroke of the valve.

2) Cooling

a) Activate when any of the zone dampers are more than 75% open to the coil with the economizer flag on or if the economizer flag is off, and discharge air temperature cannot be maintained

I. The valve will modulate to maintain the coil deck setpoint as long as the central plant is in cooling mode and the above condition is metSafeties: BAS shall execute the following safety logic strategies as detailed in item 3.2 Air Handling Units General: Safeties. Safety Logic strategies shall include:

1. Freeze Safety
2. Software Low Limit Safety
3. Smoke Safety
4. Supply Air High Pressure Safety
5. Return Air Low Pressure Safety

J. Diagnostics: BAS shall execute the following diagnostic strategies as detailed in item 3.2 Air Handling Units General: Diagnostics. Diagnostic Logic strategies shall include:

1. Run Time Limit
2. DP Transmitter Filter Monitoring

3.4 RTU SINGLE ZONE - GAS HEAT, NO RETURN FAN (BAS-RTU-05)

A. General: The air handler shall be fully controlled by the BAS. For details on the referenced logic strategies refer to item 3.2 Air Handling Units General: Logic Strategies. Air handler control logic strategies shall include Air handler control logic strategies shall include:

1. scheduled occupancy with optimum preoccupancy
2. night purge
3. sequenced heating and cooling

B. Space Temperature Setpoints: Two setpoints shall apply. Normal (72°F adj.)) and setback heating (65°F (adj.)). For use during the Night Purge Mode, separate heating and cooling setpoints shall be calculated.

1. Normal space cooling setpoint: shall be the normal space temperature plus 2°F (adj.)
2. Normal space heating setpoint: shall be the normal space temperature minus 2°F (adj.)
3. The space temperature setpoints above shall be the only values changed by the operator to adjust space temperatures. All other deadbands, differentials, etc. shall be calculated in the program logic (unless another means is provided to prohibit overlap of the heating and cooling loops and ensure a dead band such as function block templates that restrict the setpoint input).

C. Discharge Air Setpoint: The discharge air setpoint will be reset by space temperature on a ratchet loop that increases and decreases the setpoint based upon variance from space temperature.

1. Heating: The discharge air temperature will be reset from 70°F (adj.) to a fixed maximum of 95°F (adj.) based upon the variance of space temperature from setpoint.

2. Cooling: The discharge air temperature will be reset from 68°F (adj.) to a fixed minimum of 55°F (adj.) based upon the variance of space temperature from setpoint.
3. The BAS shall shut down the RTU through software and require a manual reset if the discharge air temperature falls below 40°F (adj.) for more than 1 minute.

D. Supply Fan Enable: BAS shall control the supply fan as follows:

1. Start/Stop: BAS shall command the operation of the fan and it shall run continuously in occupied and night purge modes.] Unit shall cycle on as needed during the night setback mode.
2. Proof: BAS shall prove fan operation and use the status indication to accumulate runtime. Upon failure of the fan, the BAS shall enunciate an alarm as specified above.

E. Economizer Dampers: BAS shall control the dampers as follows:

1. Closed: When AH is deenergized, dampers shall remain in their “off” positions. When the unit is energized during the unoccupied period, the minimum damper position/ flow rate shall be 0% / 0cfm.
2. Minimum Damper Position (constant): During the occupied period, applicable RA and OA dampers shall never be positioned less than the position set for the required minimum OA ventilation rate. This minimum position shall be determined by the Test & Balance Contractor. The BAS contractor shall coordinate with the T&B contractor and input the minimum position into the applicable controller logic.
3. Airside Economizer: BAS shall modulate the mixing dampers to provide “free cooling” when conditions merit. While conditions merit, dampers shall be modulated in a PID loop to maintain the mixed air temperature at its setpoint. The mixed air temperature setpoint shall be equal to the discharge air temperature setpoint. Economizer logic shall remain enabled during night purge where applicable. Economizer mode shall be active while the unit is energized AND outside air temperature falls below the switching setpoint of 70°F (adj.) (with 5°F cycle differential). Economizer mode shall be inactive when outside air temperature rises above switching setpoint, dampers shall return to their scheduled minimum positions as specified above.

F. Gas Heat:

1. The staging of the gas heater will be controlled locally by an integral control loop supplied with the RTU. The BAS will have the ability to reset the discharge air setpoint.
2. Or, the gas heater will be controlled via a PID loop to maintain the discharge temperature at setpoint.

G. Diagnostics: BAS shall execute the following diagnostic strategies as detailed in item 3.2 Air Handling Units General: Diagnostics. Diagnostic Logic strategies shall include:

1. Run Time Limit
2. DP Transmitter Filter Monitoring

3.5 (BAS-UH-01)

A. General: A unit mounted thermostat will cycle the fan to maintain an adjustable space temperature setpoint.

B. Valve: An aquastat on the hot water supply main will open the valve to the unit whenever there is hot water available.

3.6 UNIT HEATER ELECTRIC (BAS-UH-01)

A. General: A wall mounted thermostat will cycle the staged electric heating to maintain an adjustable setpoint.

3.7 VAV BOX WITH REHEAT CONTROL (BAS-VAV-06)

A. General: Control shall be pressure independent with minimum and maximum flow setpoints, scheduled occupancy with optimum preoccupancy. Schedule shall be the same as the parent AHU.

B. Space Temperature Control: Three setpoints shall apply. Normal (72°F adj.)), setback heating (65°F (adj.)), and setback cooling (85°F). These three values shall be the only values changed by the operator to adjust space temperatures. All other deadbands, differentials, etc. shall be calculated in the program logic (unless another means is provided to prohibit overlap of the heating and cooling loops and ensure a dead band such as function block templates that restrict the setpoint input). During the normal periods, separate heating and cooling setpoints shall be calculated.

1. Normal space cooling setpoint: shall be the normal space temperature plus 2°F (adj.)
2. Use the following paragraph when the system does have the capability of globally resetting SCU cooling setpoints down during night purge mode to take advantage of free cooling.
3. Normal space heating setpoint: shall be the normal space temperature minus 2°F (adj.)

C. Zone Damper: ⊗{use N.O. damper when smoke pressurization is requiredZone damper shall modulate to maintain zone volume setpoint. Zone volume setpoint shall be reset between maximum and minimum volume settings to maintain space temperature cooling setpoint with a 2°F (adj.) reset range. Zone volume setpoint shall go to the heating volume setpoint whenever the space temperature falls below the heating space temperature setpoint.

1. Cooling Minimum Volume setpoint shall be as scheduled on the drawings during the occupied period and shall be set to zero otherwise.
2. Heating Minimum Volume setpoint shall be as scheduled on the drawings. Whenever heating is requested from the box in any period, the minimum volume shall be set to an adjustable heating setpoint airflow.

D. Hydronic Reheat: N.O. Zone reheat coil valve shall modulate in a PI loop to maintain space temperature heating setpoint as defined above with a 2°F throttling range. Valve shall be closed whenever the parent AHU is off.

E. Radiant Heat: For spaces served by both finned tube radiation and VAV reheat coil, the finned tube radiation control valve shall modulate open to maximum position before the reheat coil valve is opened. Finned tube radiation shall not be operable if the outside air temperature is greater than 60°F (adj.). ⊗

F. Heating Request: This terminal shall issue a “heating request” as follows”

1. Whenever the reheat output is at 100%, or
2. Whenever the space temperature falls below the throttling range of the heating loop

G. Cooling Request: This terminal shall issue a “cooling request” as follows”

1. Whenever the zone damper output is at 100% (full cooling), or
2. Whenever the space temperature rises above the throttling range of the cooling loop

3.8 DUAL PASS VAV (FOR FUTURE RELEASE)

3.9 HEAT PUMP (FOR FUTURE RELEASE)

3.10 STEAM HEATING SYSTEMS CONTROL (BAS-BLR-01)

A. General: BAS shall control the Boiler system and equipment and provide monitoring and diagnostic information for management purposes.

B. Heating Enable: Heating shall be enabled when:

1. A “need for heat” exists from 2 (Adj.) AHU’s for 15 minutes , or any 3 zones (Adj.) continuously for 15 minutes (Adj.).
2. OR, outside air temperature is below 20F (adj 10F to 40F)
3. OR, any terminal device or AHU is scheduled to run for night warmup
4. OR, in the unoccupied mode when the temperature of any monitored space is below 50°F (adj.)
5. OR, whenever manually enabled by the operator at the operator interface. Once enabled, the Boiler shall run for a minimum of 30 minutes.

C. Heating Disable: Heating shall be disabled when:

1. A “need for heat” no longer exists at any AHU or zone. Provide ability to override call for heat from spaces with failed temperature sensors.
2. AND, Outside air temperature is 5F above the enable setpoint above
3. AND, no terminal device or AHU is scheduled to run for night warmup
4. AND, in the unoccupied mode, all monitored space temperatures are 5F above 50°F (adj.) described above.
5. AND, the system has been enabled for 30 minutes
6. OR, whenever manually disabled by the operator at the operator interface. Once enabled, the Heating Water System shall run for a minimum of 30 minutes

D. Steam Pressure Control: The BAS shall stage on the boilers (as stated below) and modulate each burner firing rate (%) separately to maintain the steam pressure at setpoint. This strategy is for a low pressure boiler The BAS shall control the burner modulation as follows:

1. Whenever at least one boiler is enabled and after a time delay (adj.), the BAS shall modulate the firing rate of all active boilers via a loop output to maintain the supply pressure at setpoint. When firing two boilers a separate signal will be sent to each boiler.
2. Whenever a boiler is enabled, its burner modulation output shall remain at 0% for 2 minutes (adj.) before modulating via the above. Except durning these first two minutes after startup, all operating boilers shall modulate at the same output %.
3. Supply pressure setpoint shall be 5 psi (adj. with a minimum of 5 psig and a maximum of 13 psig)
4. BAS shall broadcast an “allow” signal when the steam pressure is greater than 3 psig. This signal will prevent any AHU or fan powered terminal unit from operating in the occupied mode if the outside air temperature is less than 40 AND there is not sufficient steam pressure. Provide a single override button on the boiler screen to allow bypassing of this “allow” signal.
5. If there is a pre-occupancy start of an AHU to warm up the building, the boiler will be started up 30 minutes before the start of the preoccupancy period to allow the boiler to generate steam and warm up the steam pipes.

E. **Lead Boiler Enable:** The BAS shall enable the lead boiler whenever the following conditions are met. Once enabled, the lead boiler shall remain enabled until the Lead Boiler Disable conditions are met.

1. The heating system is enabled
2. AND, the supply steam pressure is less than the setpoint – 2 psi (adj.).
3. AND, it has been at least 2 min (adj.) since the Lead boiler was disabled.

F. Lead Boiler Disable: The BAS shall disable the lead boiler whenever the following conditions are met. Once disabled, the lead boiler shall remain disabled until the Lead Boiler Enable conditions are met again.

1. The system is no longer enabled
2. OR, the supply pressure is greater than setpoint + 4 psi (adj.) and the lag boiler has been disabled for at least 2 min (adj.).
3. AND, the lead boiler burner modulation output is less than 35% (adj. with minimum based on burner minimum turndown) for 1 minute (adj.) and the lag boiler has been disabled for at least 2 min (adj.).

G. Lag Boiler Enable: The BAS shall enable the lag boiler whenever the following conditions are met. Once enabled, the lag boiler shall remain enabled until the Lag Boiler Disable conditions are met.

1. The system has been enabled for at least 15 minutes (adj.)
2. AND, the lead boiler has been enabled for at least 10 minutes (adj.)
3. AND, the supply pressure is less than the setpoint – 3 psi
4. AND, the burner modulation output to the lead boiler is greater than 99% (adj.) for 3 minutes (adj.).
5. AND, the lag boiler has been off for at least 5 minutes (adj.)
6. OR the lead boiler is enabled and alarms on lack of status

H. Lag Boiler Disable: The BAS shall disable the lag boiler whenever the following conditions are met. Once disabled, the lag boiler shall remain disabled until the Lag Boiler Enable conditions are met again.

1. The lead boiler is no longer enabled
2. OR, the lag boiler burner modulation output is less than 35% (adj. with minimum based on burner minimum turndown) for 1 minute (adj.).

I. Combustion Damper:

1. The combustion damper and independent end switch shall be hard wired to the associated boiler. On a command from the boiler the damper shall open and the damper end switch will prove the damper position for the boiler. When the boiler shuts down the damper will close.
2. The BAS shall monitor the status of the combustion damper via a spare contact on the end switch for each damper. The BAS shall enunciate an alarm upon a failure of the damper to open or close.

J. Proof Of Boiler Operation: The BAS shall prove the operation of the boilers via boiler status, and boiler alarm points. A boiler shall be assessed as failed based on the following:

1. The BAS shall enunciate an alarm after a five minute delay on the start command if the boiler status is off. After the first five minutes the alarm shall have a 30 second delay. Note that the boiler status shall be based on the gas valve circuit being enabled to fire, not on boiler draft fan status.
2. To provide backup in the case of signal fail or power failure of the controller associated with the boilers, provide a relay that has normally closed contacts to enable each boiler. When the controller fails or loses program, the relay should be deenergized and the boiler will be enabled (remote operation selected at the remote/local switch). The controls contractor shall provide any and all devices necessary to accomplish this, and coordinate the installation and operation of those devices with the boiler manufacturer.
3. BAS shall monitor the boiler status and accumulate runtime. The BAS shall rotate lead boiler designation on a schedule of daily or weekly. The engineer will select the time of day that the boilers rotate lead. The BAS will also track boiler run time (indicate each boilers run time on graphic) and allow the engineer to select the lead boiler to help equalize run time.

K. Feed Water Control Panel Monitoring: The BAS shall monitor the following from the feed water panel.

1. Feed water system alarm.
2. Low - receiver tank level alarm. This is not the alarm that opens the makeup valve it is the level that shuts down the feed pumps.

L. Boiler Chemical Feed Panel: The BAS shall monitor the water makeup rate as a pulse output from the panel and provide the following functions at the BAS.

1. Makeup water totalization in gallons.
2. Makeup water totalization for each fill cycle and start time of fill cycle.

M. Remote/Local Switch

1. In the “Local” position, the boiler/burner unit will operate via local boiler firing rate control.

2. In the “Remote” position, the BAS contractor will provide provisions to enable/disable the boiler burner unit and control firing rate.
3. The following shall be provided by the boiler manufacturer:

   a. Each burner panel will include as standard, a control toggle switch allowing the operating engineer to choose boiler/burner firing rate mode via the local boiler control or the BAS.
   b. Switch shall be labeled “Remote/Local Switch” with an etched nameplate affixed to the burner panel.
   c. All boiler/burner safety limit controls and alarms will remain active and independent of the Remote/Local selector switch position chosen by the operating engineer.
   d. As built wiring diagrams from the burner manufacturer will clearly show the “Remote/Local Switch” and enable/disable point terminals.

N. Boiler Vacuum System (remove if not applicablen):

1. Provide a hardwire “ call for vacuum” for the boiler system. This call for vacuum will be present when either boiler status is “ON”. The circuit will have a time delay to deenergize relay (TDE), adjustable 0-60 minutes, so that the vacuum pump will run for up to an hour after both boilers shut down. The call for vacuum interlock will only control the vacuum pumps when the vacuum system is in auto.

O. Emergency Fuel Burner Switch

1. Provide an emergency fuel burner switch adjacent to the primary entrance door and if required by the drawings at a second entrance.
2. The switch will be located between 6 ft and 7 ft above the floor,
3. The switch will be labeled “Emergency Fuel Burner Switch” and the switch button will be hard wired to each boilers safety circuit (the circuit that requires manual reset).
4. The switch will be an Eaton HT800, or equal, with two sets of contacts and a red 30mm button, one contact is for the boilers and the other for the BAS. If there is more than one door to the boiler room, there shall be a switch located at each door. For multiple switches either switch will trip the boilers and signal the BAS. When the switch is pushed in it trips the boilers.

P. Miscellaneous Monitoring:

1. The BAS shall monitor and display the CO level in the boiler room and enunciate the following alarms at the BAS head end computer:

   a. “CO leakage from Boiler” alarm at 50ppm (adj.)
   b. “CO LEVELS DANGEROUSLY HIGH” at 75ppm (adj.)

2. The BAS contractor shall hardwire an alarm horn and the monitor will have a local progressive or digital display of CO level and a high level alarm. The alarm horn shall be wired directly to a relay output on the CO monitor. The local display and alarm horn output shall not depend upon the BAS to be activated.

3.11 CHILLED WATER SYSTEM – AIR COOLED CHILLER, PRIMARY ONLY CV PUMPS (BAS-CHW-01)

A. General: BAS shall fully control the chilled water systems and equipment and provide monitoring and diagnostic information for management purposes. Verify the applicable inputs from and outputs to the chiller. This sequence assumes a communication interface and all points shown in the control documents.

1. Cooling Enable: Cooling shall be enabled when:

   a. Any chilled water valve opens more than 50% open continuously for 10 min. (adj.)
   b. AND the outside air temperature is above 55°F.
   c. AND Heating is NOT enabled
   d. OR chilled water system is manually enabled by the operator

2. Once enabled, the chilled water system will operate for a minimum of 30 minutes. Cooling Disable: Cooling shall be disabled when:

   a. All chilled water valves are closed to cooling
   b. OR the outside air temperature is 5F below the enable setpoint.
   c. OR heating is enabled
   d. OR all the AHU's served by the cooling system are unoccupied in the BAS schedule
   e. OR the chilled water system is manually disabled by the operator

3. Proof of Chiller Operation: BAS shall prove the operation of the chillers via chiller status and alarm points.
4. Chilled Water Temperature Control: The chilled water temperature shall be controlled by the chiller manufacturer's unit mounted controls. The chilled water supply temperature setpoint shall be

B. CHW Pump Control

1. The lead Chilled water pump shall be started to serve the chiller whenever the system is enabled as stated in the system start sequence below. One (1) Pump shall run continuously whenever the system is enabled.
2. BAS shall prove operation of the pumps. Upon failure of the lead pump, the standby shall be started. An alarm shall be enunciated at the operator interface.
3. BAS shall monitor pump status and accumulate runtime of the pumps. The lead pump shall be rotated to equalize runtime between the pumps.

C. Chilled Water System Start Sequence: When the chilled water system is enabled as specified above, the following sequence shall occur:

1. The lead Chilled water pump shall start and operation proven
2. Wait one minute (adj.).
3. Command the chiller to start under its own control
4. Monitor chiller status and prove operation. If status is not indicated within 5 minutes (adj.) of a command to start, enunciate an alarm.

D. Chiller Stop Sequence: When the chilled water system is disabled as specified above, the following sequence shall occur:

1. Remove chiller run command.
2. Wait for status to clear and for the chiller to stop under control.
3. Wait 5 min. (adj.) then stop the chilled water pump.

3.12 DUAL TEMP SYSTEM PRIMARY/SECONDARY INTERFACE (BAS-DTW-01 & 02)

A. Operation

1. Pump Enable: BAS shall control the pumps as follows:

   a. Heating: The dual temp pump will run whenever the heating system is enabled
   b. Cooling: The dual temp pump will run when cooling is enabled and the AHU's or terminal units are in optimal start for cooling or the any one of the devices served in the cooling mode is in the occupied mode.
   c. Proof: BAS shall prove pump operation and use the status indication to accumulate runtime. Upon failure of the pump, the BAS shall enunciate an alarm as specified above and enable the lag pump.
   d. Lead/Lag: BAS shall monitor pump status and accumulate runtime of the pumps. The BAS shall rotate lead pump designation on a weekly schedule. The engineer will select the time of day that the pumps rotate lead. The BAS will also track pump run time (indicate each pumps run time on graphic) and allow the engineer to select the lead pump to help equalize run time

2. Pump VFD Control (BAS-DTW-02):

   a. Monitor the differential pressure of the dual temperature water system where shown on the drawings. Ratchet the speed of the VFD on the pump in the following way:

      1) Increase the pump speed as long as any of the differential pressures is below its setpoint. Establish the timing of this decision to maximize the stability of the control loop.
      2) Decrease the pump speed as long as all of the differential pressures are above setpoint. Establish the timing of this decision to maximize the stability of the control loop.

B. Changeover

1. Changeover can only occur automatically, twice in a given day with a minimum 6 hour delay between changeovers.
2. Provide the operator to initiate the changeover

C. Changover Heating to Cooling

1. Configuration is primary hot water system open to the dual temp system via dual temp three way valves

2. Shutdown the boilers and or heat exchangers using applicable sequences for the heating system and leave the primary hot water pump enabled
3. Open primary hot water mixing valve to provide full flow through the boilers and open all AHU and terminal unit heating valves.
4. When the dual temp return water is 10F lower than the maximum supply temperature allowed to the chiller shutdown the primary hotwater system pumps and the dual temp system pumps. If chiller maximum water temp is greater than 100F use 100F as the maximum.
5. Open the dual temp 3-way valves to the chiller water primary system and close any heating only control valves on the dual temp loop.
6. Once the limit switches on both dual temp three way valves indicate fully open to cooling, startup the primary chilled water system per its sequence and startup the dual temp pump.

D. Changover Cooling to Heating

1. Configuration is primary chilled water system open to the dual temp system via dual temp three way valves
2. Shutdown the chillers using applicable sequences for the heating system and leave the primary chilled water pump enabled
3. Open all AHU and terminal unit cooling valves.
4. When the dual temp return water is greater than 65F shutdown the primary chilled water system pumps and the dual temp system pumps.
5. Open the dual temp 3-way valves to the hot water primary system and open any heating only control valves on the dual temp loop.
6. Once the limit switches on both dual temp three way valves indicate fully open to heating, startup the primary hot water system per its sequence and startup the dual temp pump.

E. Heating-Only Isolation Valves (where applicable): Once the changeover from cooling to heating is complete, the heating-only isolation valves shall open. When changing from heating to cooling, the valves will remain open until the system changeover valves have confirmed the change from hot to chilled water primary systems.

3.13 STEAM TO HOT WATER HEAT EXCHANGER, VV PUMPS (BAS-BLR-05)

A. **General**: BAS shall control the hot water systems and equipment and provide monitoring and diagnostic information for management purposes.

1. Heating Enable: Heating shall be enabled when:

   a. Any hot water valve opens more than 50% continuously for 10 min. (adj.).
   b. OR, the OAT is less than 20°F (adj.)
   c. OR whenever manually enabled by the operator at the operator interface.
   d. Whenever the Heating Water System is started automatically (does not apply to a manual enable) by the BAS, it shall run for a minimum of 1 hour.

2. Heating Disable: Heating shall be disabled [[when:

   a. All hot water valves are opens to less than 5% continuously for 10 min. (adj.).
   b. AND, the OAT is greater than 25°F (adj.)

c. AND the system has been enabled for at least an 1 hour as stated above.
d. OR whenever manually disabled by the operator at the operator interface.

B. HW Pump Enable

1. One HW pump shall run continuously whenever heating system is enabled.
2. BAS shall prove operation of the pump. Upon failure of the pump, the standby shall be started.
3. BAS shall monitor pump status and accumulate runtime of the pumps. The lead pump shall be rotated to equalize runtime between the pumps.

C. Remote DP Control

1. BAS shall vary the speed of the enabled pump via PID loop to maintain the differential pressure setpoint across the remote differential pressure sensor.
2. The speed of the pump shall be modulated from 0-100% as the PID loop output varies from 0-100%. However, the speed of the pump shall never fall below the minimum speed of the drive (initially 20%.)
3. As the PID loop output drops to the minimum speed of the drive+10% (adj.), the Bypass Valve shall start to modulate open. The bypass valve shall modulate from 0 to 100% open on a PID loop output of 30 to 0%.
4. The differential pressure setpoint shall be 15 psi (adj. as determined by the balance contractor).

D. Heating Water Supply Temperature Setpoint: The BAS shall reset the hot water supply temperature setpoint from 180°F (adj.) to 120°F (adj.) as the OA temperature rises from 10°F (adj.) to 50°F (adj.) requests via a signal to the heat exchanger steam control valves.

E. Heating Water Supply Temperature Control:

1. The BAS shall modulate the 1/3 and 2/3 steam valves to the Heat Exchanger in series via PID loop to maintain the HW supply temperature setpoint.
2. The valves shall remain closed until pump status is proven.
3. Steam supply temperature and pressure to the Heat Exchanger shall be monitored by the BAS
4. A temperature switch will monitor the temperature of the domestic hot water. The switch will be hard wired to close the steam valves if the water temperature exceeds 160F. The switch will have a second set of contacts to provide an alarm input to the BAS.

3.14 EXHAUST FANS (BAS-EF-01)

A. Toilet and General Exhaust fans: BAS shall control the starting and stopping of these fans as follows.

1. Start/Stop: BAS shall command the operation of the Exhaust fan and it shall run continuously during the occupied period.
2. Proof: BAS shall prove fan operation and use the status indication to accumulate runtime. Upon failure of the exhaust fan, the BAS shall enunciate an alarm as specified above.

B. T-Stat controlled Exhaust fans and heater shall be controlled by a thermostat to maintain a maximum of 85°F. Whenever the fan runs, its associated isolation damper & OA damper shall open. Whenever the fan stops, the dampers shall close. Thermostat shall also operate unit heater to maintain a minimum temperature of 65°F.

C. Exhaust fans: shall be controlled by a thermostat to maintain a maximum of 85°F. Whenever the fan runs, its associated OA damper shall open and when the fan stops the OA damper will close.

3.15 GLYCOL FILL SYSTEM

A. Glycol Fill pump will be controlled by its own package system.

B. Provide a separate ball float to monitor the low level of the tank through the BAS. The low level monitored by the BAS will be above the low level permissive for the gycol pump.

3.16 RADIANT HEAT (BAS-UH-01) STEAM OR HOT WATER

A. General: Control shall be scheduled occupancy with optimum preoccupancy. Schedule shall be the same as the parent AHU, if applicable.

B. Space Temperature Control: Three setpoints shall apply. Normal (72°F adj.)), setback heating (65°F (adj.)), and setback cooling (85°F). These three values shall be the only values changed by the operator to adjust space temperatures. All other deadbands, differentials, etc. shall be calculated in the program logic (unless another means is provided to prohibit overlap of the heating and cooling loops and ensure a dead band such as function block templates that restrict the setpoint input).

1. Normal space heating setpoint: shall be the normal space temperature minus 2°F (adj.)

C. Radiant Heat: The the finned tube radiation control valve shall modulate maintain space setpoint. ⊗

D. Heating Request: This terminal shall issue a “heating request” as follows”

1. Whenever the radiant heat output is at 100%, or
2. Whenever the space temperature falls below the throttling range of the heating loop

3.17 DEDICATED OUTSIDE AIR - GAS HEAT & DX WITH REHEAT (BAS-DOAS-01)

A. General: The air handler shall be fully controlled by the BAS. For details on the referenced logic strategies refer to item 3.2 Air Handling Units General: Logic Strategies. Air handler control logic strategies shall include Air handler control logic strategies shall include:

1. scheduled occupancy
2. Night night purge
3. sequenced heating and cooling

B. Discharge Air Control : The discharge air will have two setpoints, the drybulb temperature will setpoint control the gas furnace or the DX cooling. There will also be a discharge air relative humidity setpoint. When dx cooling is enabled the humidity setpoint will control the hot gas reheat coil to maintain a discharge air relative humididty.

1. Heating: The discharge air temperature (DAT) will be 65°F (adj.) with a fixed maximum of 75°F and a fixed minimum of 60°F.
2. Dehumidification:

   a. The discharge air temperature will be reset from 67°F (adj.) with a fixed maximum of 75°F and an fixed minimum of 65°F.
   b. The discharge air relative humidity will be 60% at 65°F
   c. When the discharge air setpoint is increased the relative humidity will be reset such that when the DAT is 75F the discharge air relative humidity will be 40%..
   d. When the discharge air setpoint is decreased the relative humidity will be reset such that when the DAT is 65F the discharge air relative humidity will be 57%.

3. The BAS shall shut down the RTU through software and require a manual reset if the discharge air temperature falls below 40°F (adj.) for more than 5 minutes.

C. Supply Fan Enable: BAS shall control the supply fan as follows:

1. Start/Stop: BAS shall command the operation of the fan and it shall run continuously in occupied modes. Unit shall cycle on as needed during the night setback modes. Unit OA damper shall open via hard wire interlock whenever the unit fan is commanded on. Damper end switch shall prevent the unit fan from starting until the damper is proven open as detailed below..
2. Proof: BAS shall prove fan operation and use the status indication to accumulate runtime. Upon failure of the fan, the BAS shall disable and lockout the unit enable command. A manual software reset shall be required to restart the unit. The BAS shall also enunciate an alarm as specified above.

D. OA Damper: The outside air damper shall be controlled as follows:

1. Closed: When AH is deenergized, OA damper shall remain in the closed position.
2. Open: When the AH is enabled, the OA damper shall be hard wire interlocked to open. Damper end switch shall prevent the unit fan from starting, through a hardwire interlock, until the damper is proven open. BAS shall also monitor the status of the end switch and prove operation. Upon a failure of the damper to be proven open, the BAS shall disable and lockout the unit enable command. A manual software reset shall be required to restart the unit (a single software reset point that resets both the supply fan and the OA damper failures is acceptable). The BAS shall also enunciate an alarm as specified above. The end switch must be an independent device. An end switch internal to the actuator is not acceptable.

E. Gas Heat: Whenever the unit is enabled, the gas heat shall be controlled as follows:

1. The staging of the gas heater will be controlled locally by an integral control loop supplied with the RTU. The BAS will have the ability to reset the discharge air setpoint.
2. Or, the gas heater will be controlled via a PID loop to maintain the discharge temperature at the heating discharge temperature setpoint. The heating discharge temperature setpoint shall be equal to the discharge air temperature setpoint – 2°F (adj.)
3. To help prevent the unit from cycling between heating and cooling too often, the gas heat shall not be allowed until the cooling has been disabled for at least 2 minutes (adj.).
4. Heating will not be enabled when the RTU intake air temperature is above the heating setpoint – 2°F

5. Otherwise, the gas heat shall not be disabled as long as the unit supply fan status is proven on.

F. DX Cooling: Whenever the unit is enabled and status has been proven on, the DX cooling shall be controlled as follows:

1. The DX cooling stages shall be enabled based on a PID loop output to maintain the discharge temperature at setpoint.
2. The first stage of cooling shall be enabled when:

   a. The PID loop output exceeds 30% (adj.) with a 25% (adj.) differential to cut off.
   b. AND, the RTU intake air temperature is above 55°F (adj.)

3. As applicable, the second stage of cooling shall be enabled when:

   a. The PID loop output exceeds 60% (adj.) with a 25% (adj.) differential to cut off.
   b. AND, the RTU intake air temperature is above 75°F (adj.)

G. Hot Gas Reheat: Whenever the unit is enabled and DX Cooling is enabled, the Hot Gas reheat coil controlled as follows:

1. The Hot Gas reheat coil valve will modulate to maintain the supply air relative humidity setpoint.

H. Safeties: BAS shall execute the following safety logic strategies as detailed in item 3.2 Air Handling Units General: Safeties. Safety Logic strategies shall include:

1. Software Low Limit Safety
2. Smoke Safety

I. Diagnostics: BAS shall execute the following diagnostic strategies as detailed in item 3.2 Air Handling Units General: Diagnostics. Diagnostic Logic strategies shall include:

1. Run Time Limit
2. DP Transmitter Filter Monitoring

3.18 ***4 PIPE FAN COIL UNIT (BAS-FC-03)***

A. ***Space Temperature Control: The space temperature setpoint shall be per the scheduled occupancy with optimum preoccupancy logic strategy. Three setpoints shall apply. Normal (70°F winter/74°F summer (adj.)), setback heating (65°F (adj.)), and setback cooling (85°F). These values shall be the only values changed by the operator to adjust space temperatures. All other deadbands, differentials, etc. shall be calculated in the program logic (unless another means is provided to prohibit overlap of the heating and cooling loops and ensure a dead band such as function block templates that restrict the setpoint input). During the normal periods, separate heating and cooling setpoints shall be calculated.***

1. ***Normal space cooling setpoint: shall be the normal space temperature plus 2°F (adj.)***
2. ***Normal space heating setpoint: shall be the normal space temperature minus 2°F (adj.)***

B. ***Heating:* *The HW heating valve shall be modulated to maintain space temperature at the heating setpoint via PID loop.***

C. ***Cooling:* *The ChW valve shall be modulated maintain space temperature at the cooling setpoint via PID loop.***

D. ***Requests:* *The fan coil SCU's "heat request" shall activate whenever the space temperature falls 2°F below the heating differential range or the heating PID output is greater than 50%. The fan coil SCU's "cool request" shall activate whenever the space temperature rises 2°F above the cooling differential range or the cooling PID output is greater than 50%.***

E. ***Fan:* *Fan shall be enabled to run continuously during the occupied mode. During unoccupied mode, fan shall be deenergized except as required to maintain setback temperature setpoints for both heating and cooling with a cycle differential of 3°F (adj.). Fan status shall be proven. Upon a fan failure, an alarm shall be enunciated.***

END OF SECTION

SECTION 23 82 19

FAN-COIL UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes fan-coil units and accessories.

1.2 DEFINITIONS

A. EMS: Energy management system.

1.3 SUBMITTALS

A. Product Data: Include rated capacities, fan curves, operating characteristics, furnished specialties, and accessories.

B. LEED Submittals:

1. Credit EQ5: Certification that equipment has been provided with Minimum Efficiency Reporting Value (MERV) 13 filters.

C. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Wiring Diagrams: Power, signal, and control wiring.

D. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Ceiling suspension components.
2. Structural members to which fan-coil units will be attached.
3. Method of attaching hangers to building structure.
4. Size and location of initial access modules for acoustical tile.
5. Items penetrating finished ceiling, including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.

6. Perimeter moldings for exposed or partially exposed cabinets.

E. Factory Color Chart: Unit color to be selected from standard factory colors by architect.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For fan-coil units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Maintenance schedules and repair part lists for motors, coils, integral controls, and filters.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, and the City of Chicago Electrical Code, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 DELIVERY, STORAGE AND HANDLING

A. Units shall be stored and handled in accordance with manufacturer's instructions.

B. Protect units from damage and construction debris before installation. Cover open pipe ends during shipping and storage at the construction site.

1.6 COORDINATION

A. For fan coils that penetrate or are supported by the ceiling, coordinate layout and installation of fan-coil units and suspension system components with other construction that penetrates or is supported by ceilings, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fan-Coil-Unit Filters: Furnish one spare filter for each filter installed.
2. Fan Belts: For belt driven fans, furnish one spare fan belt for each unit installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, provide diffusers by one of the following:

1. Carrier Corporation.
2. International Environmental Corporation.
3. McQuay International.
4. YORK International Corporation.

2.2 FAN-COILS

A. Description: Factory-packaged and -tested units rated according to ARI 440, ASHRAE 33, and UL 1995.

B. Coil Section Insulation: ½ inch foil covered, closed cell foam complying with ASTM C 1071 and attached with adhesive complying with ASTM C 916.

1. Fire-Hazard Classification: Insulation and adhesive shall have a combined maximum flame-spread index of 25 and smoke-developed index of 50 when tested according to ASTM E 84.

C. Main and Auxiliary Drain Pans: Insulated stainless steel formed to slope from all directions to the drain connection as required by ASHRAE 62.

D. Chassis: Galvanized steel where exposed to moisture. Floor-mounting units shall have leveling screws.

E. Cabinet: Steel with baked-enamel finish in manufacturer's standard paint color as selected by Architect.

1. Vertical Unit Front Panels: Removable, steel, with steel discharge grille and channel-formed edges, cam fasteners, and insulation on back of panel.
2. Horizontal Unit Bottom Panels: Fastened to unit with cam fasteners and hinge and attached with safety chain; with steel discharge grilles.
3. Steel recessing flanges for recessing fan-coil units into ceiling or wall.

F. Outdoor-Air Wall Box (for fan coils with an outside air intake): Minimum 0.1265-inch- thick, aluminum, rain-resistant louver and box with integral eliminators and bird screen.

1. Louver Configuration: Vertical, rain-resistant louver.
2. Louver Material: Aluminum.
3. Bird Screen: 1/2-inch mesh screen on interior side of louver.
4. Decorative Grille: On outside of intake.
5. Finish: Anodized aluminum, color as selected by Architect from manufacturer's standard colors.

G. Outdoor-Air Damper (for fan coils with an outside air intake): Provide damper by one of the manufacturers listed in Division 23 Section “Building Automation System (BAS) - Basic Materials, Interface Devices, and Sensors”. Dampers shall be sized for the actual project specific design conditions and reviewed by the temperature controls contractor. Barn door damper sizing is unacceptable. If the manufacturer cannot provide one of the exact dampers specified, properly sized for the project, the unit shall be shipped without dampers and contractor shall provide and field install dampers and blank offs.

H. Filters: Minimum arrestance according to ASHRAE 52.1, and a minimum efficiency reporting value (MERV) according to ASHRAE 52.2.
1. Glass Fiber Treated with Adhesive: 80 percent arrestance and 8 MERV.

I. Hydronic Coils (where scheduled): Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.

J. Fan and Motor Board: Removable.

1. Fan: Direct drive, forward curved, double width, centrifugal; directly connected to motor. Painted-steel or aluminum wheels, and aluminum, painted-steel, or galvanized-steel fan scrolls.
2. Motor: Permanent Split-Couple (PSC) permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
3. Wiring Termination: Connect motor to chassis wiring with plug connection.

K. Drain Pan: Where cooling coils are scheduled, provide factory drain pan for to cover all coil locations. Condensate piping will be connected to nearest open site drain.

1. Provide condensate return pump where required to pipe to nearest open site drain.

L. Factory, Hydronic Piping Package: ASTM B 88, Type L (ASTM B 88M, Type B) copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.

1. Hose Kits: Minimum 400-psig working pressure, and operating temperatures from 33 to 211 deg F. Tag hose kits to equipment designations.

   a. Length: 24 inches (600 mm).
   b. Minimum Diameter: Equal to fan-coil-unit connection size.

2. Two-Piece Ball Valves: Bronze body with full-port, chrome-plated bronze ball; Polytetrafluoroethylene PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.
3. Automatic Flow-Control Valve: Brass or ferrous-metal body; 300-psig working pressure at 250 deg F, with removable, corrosion-resistant, tamperproof, self-cleaning piston spring; factory set to maintain constant indicated flow with plus or minus 10 percent over differential pressure range of 2 to 80 psig.
4. Y-Pattern Hydronic Strainers: Cast-iron body (ASTM A 126, Class B); 125-psig working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 hose-end, full-port, ball-type blowdown valve in drain connection.
5. Wrought-Copper Unions: ASME B16.22.
6. See temperature controls section for control valve specification.
7. Risers (for stack type units): ASTM B 88, Type L (ASTM B 88M, Type B) copper pipe with hose and ball valve for system flushing.

M. Provide toggle type or door-interlocked disconnect switch.

N. Provide fan motor contactor with provisions for local-remote “user” switch to start and stop fan motor. User switch shall not disconnect 24V control power to DDC controller.

O. Control devices and operational sequences are specified in Division 23.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive fan-coil units for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine roughing-in for piping and electrical connections to verify actual locations before fan-coil-unit installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fan-coil units level and plumb.

B. Install fan-coil units to comply with NFPA 90A.

C. Suspend fan-coil units from structure with elastomeric hangers. Vibration isolators are specified in Division 23 Section "Vibration Controls for HVAC."

D. Install new filters in each fan-coil unit within two weeks after preliminary acceptance.

3.3 CONNECTIONS

A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties. Specific connection requirements are as follows:

1. Install piping adjacent to machine to allow service and maintenance.
2. Provide factory piping package for hydronic units. Install piping package if shipped loose.
3. Connect piping to fan-coil-unit.
4. Where drawings/details do not indicate piping arrangement, provide:

    a. Hydronic units (per coil): Supply side – isolation valve, y-strainer with blow down valve and hose cap, manual air vent, union, control valve with actuator, union, p&t tap and union coil connection. Return side – isolation valve, p&t, auto flow valve, p&t and manual air vent.
    b. Steam units: Supply side – isolation valve, y-strainer (3 or 9 o'clock position), union, control valve with actuator, vacuum breaker and union coil connection. Return side – isolation valve, check valve, union, steam trap, union, strainer (3 or 9 o'clock position) and union coil connection.

5. Connect condensate drain to indirect waste.

    a. Install condensate trap of adequate depth to seal against the pressure of fan. Install cleanouts in piping at changes of direction.

B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."

C. Connect wiring according to Division 26 Section "Conductors and Cables for Electrical Systems."

3.4 CLEANING

A. Clean fan-coil units internally, on completion of installation, according to manufacturer's written instructions. Clean fan interiors to remove foreign material and construction dirt and dust. Vacuum clean fan wheels, cabinets, and coils entering air face.

B. After completing system installation and testing, adjusting, and balancing modular indoor air-handling and air-distribution systems, clean filter housings and install new filters.

C. Clean exterior prior to transfer to Owner.

3.5 CONTRACTOR STARTUP AND REPORTING

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.

B. Perform the following field tests and inspections and prepare test reports:

1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
2. Operate electric heating elements through each stage to verify proper operation and electrical connections.
3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

3.6 DEMONSTRATION AND COMMISSIONING

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fan coil units. Refer to Division 01 Section "Demonstration and Training."

1. Train Owner's maintenance personnel on procedures and schedules for starting up and shutting down, troubleshooting, servicing, and maintaining fan coils. The training will occur after the startup report has been provided to the owner and the trainer will provide two (2) Installation and Operations manuals for the use of the owner’s personnel during training.
2. Review data in maintenance manuals. Refer to Division 01 Section "Operation and Maintenance Data." All required and recommended maintenance will be reviewed as well as operational trouble shooting. Provide a written trouble shooting guide if the IOM does not include one.
3. Schedule training with Owner, through Architect, with at least seven days' advance notice.
4. Training will occur in two (2) separate two (2) hour sessions, neither on the same day the UV is started up

B. Demonstrate proper operation of equipment to commissioning agent or designated owners personnel. The scope of the demonstration will include functional performance requirements under building automation control as well as any commissioning requirements in Division 01 and 23 sections.

END OF SECTION