



# MORE THAN ARCHITECTS

## ADDENDUM

NO. 1

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### TO THE DRAWINGS AND THE PROJECT MANUAL

**PROJECT NAME:** Jarrell Middle School Addition and Renovations

**CLIENT NAME:** Jarrell Independent School District

**LOCATION:** Jarrell, Texas

**PROJECT NUMBER:** 01756-02-01

**PROPOSAL DATE:** 06, September 2018, 2:00 PM

**ADDENDUM DATE:** 30, August 2018

For additional information regarding this project, contact Mike Boyle at 512-387-3413



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### THIS ADDENDUM INCLUDES:

Architectural Items	12 Pages
Structural Items	5 Pages
Mechanical	24 Pages
Technology Items	12 Pages

### AND ALL ATTACHED REVISED DRAWING REFERENCES IN THE ADDENDUM

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## ARCHITECTURAL ITEMS FOR ADDENDUM NO. 1

### NOTICE TO PROPOSERS:

- A. This Addendum shall be considered part of the contract documents for the above-mentioned project as though it had been issued at the same time and incorporated integrally therewith. Where provisions of the following supplementary data differ from those of the original contract documents, this Addendum shall govern and take precedence.
- B. Proposers are hereby notified that they shall make any necessary adjustments in their estimate on account of this Addendum. It will be construed that each Proposer's proposal is submitted with full knowledge of all modifications and supplemental data specified therein. Acknowledge receipt of this addendum in the space provided on the proposal form. Failure to do so may subject Proposer to disqualification.

REFERENCE IS MADE TO THE DRAWINGS AND THE PROJECT MANUAL AS NOTED:

### PROJECT MANUAL:

AD No 1, Arch. Item 1: **Add:**

- 1) 00 7343 - Wage Rate Requirements

AD No 1, Arch. Item 2:

1. 00 2116 Instruction to Proposers: Add the attached Baseline Schedule

### BIDDER QUESTIONS (NOT OTHERWISE ANSWERED IN THE BODY OF THIS ADDENDUM):

AD No 1, Arch. Item 3: **Louvers**

**Question:** The details look like a 5" wind driven rain louver. The model in the mechanical louver schedule is a 4" drainable model. Please let me know if I am overlooking an architectural spec and if not, what type of louver I should quote.

**Answer:** The architectural details show intent for attachment and flashing at opening. The mechanical schedule is correct for the actual louver type.

AD No 1, Arch. Item 4: **Specification Section 11 53 00 Science Lab Equipment**

**Question #1:** 115300 2.02B1 states to see 016210 for the material. Grade A2 plain sliced book matched w/ solid core. Please advise whether its Oak or Maple?

**Answer:** Oak

**Question #2:** Section 115300 2.03A1a states 3/4" plywood w/ 1/8" hardwood edge. Section 2.03A2 states the back of the drawer fronts to be routed out recessed into opening. These are two completely different construction methods. Please advise whether a Lipped Overlay or Full Overlay style is required?

**Answer:** Full Overlay

**Question #3:** 115300 2.07 states Fume Hoods. None are shown or called for on the drawings. Please advise number needed & locations?

**Answer:** Delete spec section 115300 2.07 – No fume hoods are required.

### OTHER:

For informational purposes, refer to attached partial drawings of the existing fire sprinkler system.

### END OF ARCHITECTURAL ADDENDUM

**Huckabee**

**SECTION 00 7343  
WAGE RATE REQUIREMENTS**

**WAGE RATES**

- A. Attention is called to the fact that the Contractor must comply with all Federal, State and Local labor laws, including Chapter 2258 Texas Government Code Title 10, which requires that the Contractor pay not less than the following prevailing wage rates and rates for legal holidays and overtime, which have been ascertained by the awarding body, as follows:

General Decision Number: TX180327 01/05/2018 TX327

Superseded General Decision Number: TX20170327

State: Texas

Construction Type: Building

County: Williamson County in Texas.



BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Under Executive Order (EO) 13658, an hourly minimum wage of \$10.35 for calendar year 2018 applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2015. If this contract is covered by the EO, the contractor must pay all workers in any classification listed on this wage determination at least \$10.35 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on the contract in calendar year 2018. The EO minimum wage rate will be adjusted annually. Please note that this EO applies to the above-mentioned types of contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but it does not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(2)-(60). Additional information on contractor requirements and worker protections under the EO is available at [www.dol.gov/whd/govcontracts](http://www.dol.gov/whd/govcontracts).

Modification Number	Publication Date
0	01/05/2018

ASBE0087-014 01/01/2017

	Rates	Fringes
ASBESTOS WORKER/HEAT & FROST INSULATOR (Duct, Pipe and Mechanical System Insulation)....	\$ 22.22	10.02

BOIL0074-003 01/01/2017

Rates	Fringes
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BOILERMAKER.....\$ 28.00 22.35  
-----  
CARP1266-002 04/01/2017

Rates Fringes

CARPENTER (Excludes  
Acoustical Ceiling  
Installation, Drywall  
Hanging, Form Work, and Metal  
Stud Installation).....\$ 21.96 7.90  
-----

ELEC0520-003 06/04/2017

Rates Fringes

ELECTRICIAN  
Excludes Low Voltage Wiring.\$ 27.51 11%+5.09  
Low Voltage Wiring Only.....\$ 27.51 11%+5.09  
-----

ELEV0133-002 01/01/2017

Rates Fringes

ELEVATOR MECHANIC.....\$ 38.51 31.585+a+b

Footnote:

A. 6% under 5 years based on regular hourly rate for all  
hours worked. 8% over 5 years based on regular hourly rate  
for all hours worked.

B. Holidays: New Year's Day, Memorial Day, Independence Day,  
Labor Day, Thanksgiving Day, the Friday after Thanksgiving  
Day, Christmas Day, and Veterans Day.

-----  
ENGI0450-002 04/01/2014

Rates Fringes

POWER EQUIPMENT OPERATOR  
Cranes.....\$ 34.85 9.85  
-----

\* IRON0084-011 06/01/2017

Rates Fringes

IRONWORKER, ORNAMENTAL.....\$ 23.27 7.12  
-----

\* IRON0482-012 06/01/2017

Rates Fringes

IRONWORKER, STRUCTURAL.....\$ 22.15 6.68  
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PLUM0286-010 06/05/2017

Jarrell ISD – Jarrell Middle School Additions (1756-02-01)  
Jarrell, Texas

	Rates	Fringes
PIPEFITTER (Including HVAC Pipe Installation).....	\$ 28.78	12.33

-----  
SFTX0669-002 04/01/2017

	Rates	Fringes
SPRINKLER FITTER (Fire Sprinklers).....	\$ 29.03	15.84

-----  
SHEE0067-007 07/03/2017

	Rates	Fringes
SHEET METAL WORKER Excludes HVAC Duct Installation.....	\$ 24.85	14.93
HVAC Duct Installation Only.	\$ 24.85	14.93

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SUTX2014-053 07/21/2014

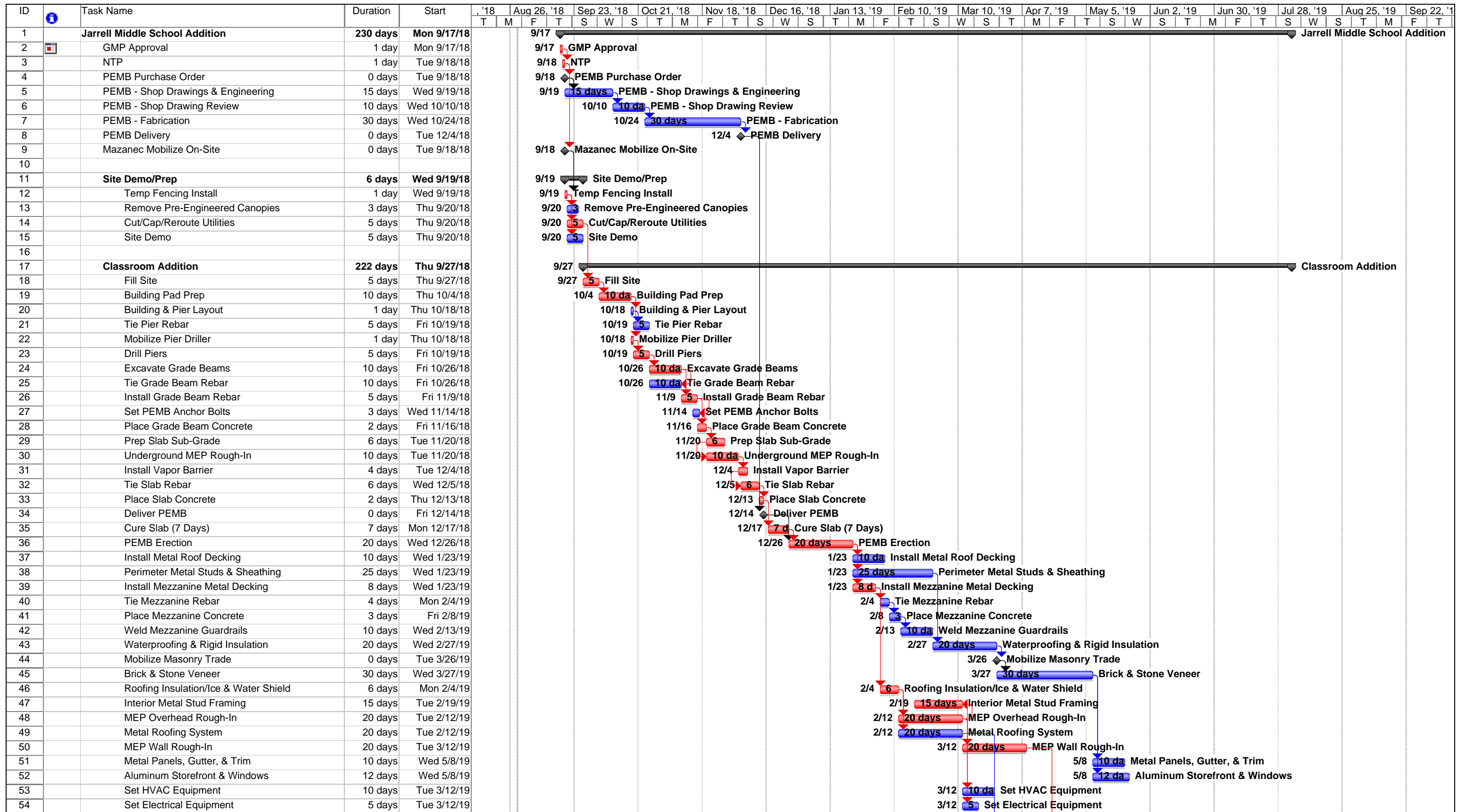
	Rates	Fringes
BRICKLAYER.....	\$ 20.16	0.00
CARPENTER (Acoustical Ceiling Installation Only).....	\$ 14.00	0.00
CARPENTER (Form Work Only).....	\$ 15.93	0.05
CEMENT MASON/CONCRETE FINISHER...	\$ 16.50	0.05
DRYWALL FINISHER/TAPER.....	\$ 16.96	4.34
DRYWALL HANGER AND METAL STUD INSTALLER.....	\$ 17.41	3.49
ELECTRICAL INSTALLER (Sound and Communication Systems) (Excludes Wiring).....	\$ 12.50	0.65
FLOOR LAYER: Carpet.....	\$ 21.88	0.00
GLAZIER.....	\$ 12.83	0.00
HVAC MECHANIC (HVAC Unit Installation Only).....	\$ 24.46	6.98
IRONWORKER, REINFORCING.....	\$ 12.27	0.00
LABORER: Common or General.....	\$ 13.22	0.04
LABORER: Mason Tender - Brick...	\$ 12.17	0.00
LABORER: Mason Tender -		

Jarrell ISD – Jarrell Middle School Additions (1756-02-01)  
Jarrell, Texas

Cement/Concrete.....	\$ 11.85	0.00
LABORER: Pipelayer.....	\$ 12.45	0.00
LABORER: Roof Tearoff.....	\$ 11.28	0.00
OPERATOR: Backhoe/Excavator/Trackhoe.....	\$ 19.43	3.49
OPERATOR: Bobcat/Skid Steer/Skid Loader.....	\$ 13.00	0.00
OPERATOR: Bulldozer.....	\$ 14.00	0.00
OPERATOR: Drill.....	\$ 14.50	0.00
OPERATOR: Forklift.....	\$ 16.40	0.00
OPERATOR: Grader/Blade.....	\$ 19.30	0.00
OPERATOR: Loader.....	\$ 14.00	0.00
OPERATOR: Mechanic.....	\$ 18.75	5.12
OPERATOR: Paver (Asphalt, Aggregate, and Concrete).....	\$ 16.03	0.00
OPERATOR: Roller.....	\$ 11.25	0.00
PAINTER (BRUSH AND ROLLER), Excludes Drywall Finishing/Taping.....	\$ 18.76	6.35
PLUMBER, Excludes HVAC Pipe Installation.....	\$ 24.24	4.16
ROOFER.....	\$ 12.00	0.00
TILE FINISHER.....	\$ 11.32	0.00
TILE SETTER.....	\$ 16.35	0.00
TRUCK DRIVER: Dump Truck.....	\$ 12.39	1.18
TRUCK DRIVER: Flatbed Truck.....	\$ 19.65	8.57
TRUCK DRIVER: Semi-Trailer Truck.....	\$ 12.50	0.00
TRUCK DRIVER: Water Truck.....	\$ 12.00	4.11
WATERPROOFER.....	\$ 16.30	0.06

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

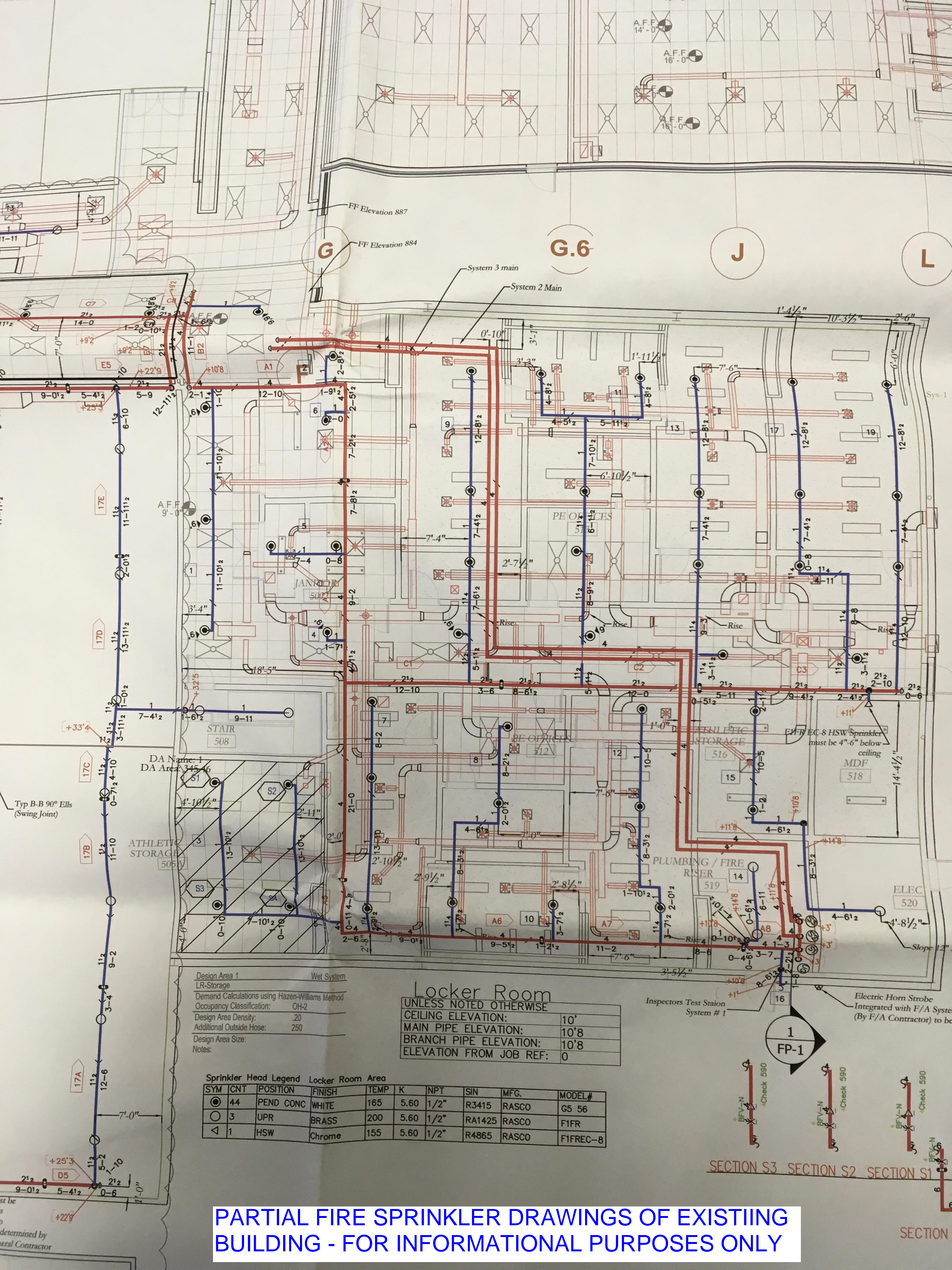
**END OF SECTION**



Project: Jarrell MS Baseline Schedule Date: Wed 8/29/18	Task		Critical Task Progress		Rolled Up Task		Rolled Up Progress		Project Summary	
	Task Progress		Milestone		Rolled Up Critical Task		Split		Group By Summary	
	Critical Task		Summary		Rolled Up Milestone		External Tasks		Deadline	







G

G.6

J

L

FF Elevation 887

FF Elevation 884

System 3 main

System 2 Main

Typ B-B 90° Ells (Swing Joint)

DA Name: 1  
DA Area: 345.46

ATHLETIC STORAGE  
505A

Design Area 1 Wet System  
LR-Storage  
Demand Calculations using Hazen-Williams Method  
Occupancy Classification: OH-2  
Design Area Density: .20  
Additional Outside Hose: 250  
Design Area Size:  
Notes:

**Locker Room**  
UNLESS NOTED OTHERWISE  
CEILING ELEVATION: 10'  
MAIN PIPE ELEVATION: 10'8"  
BRANCH PIPE ELEVATION: 10'8"  
ELEVATION FROM JOB REF: 0

Sprinkler Head Legend		Locker Room Area							
SYM	CNT	POSITION	FINISH	TEMP	K	NPT	SIN	MFG.	MODEL#
●	44	PEND CONC	WHITE	165	5.60	1/2"	R3415	RASCO	G5 56
○	3	UPR	BRASS	200	5.60	1/2"	RA1425	RASCO	F1FR
△	1	HSW	Chrome	155	5.60	1/2"	R4865	RASCO	F1FREC-8

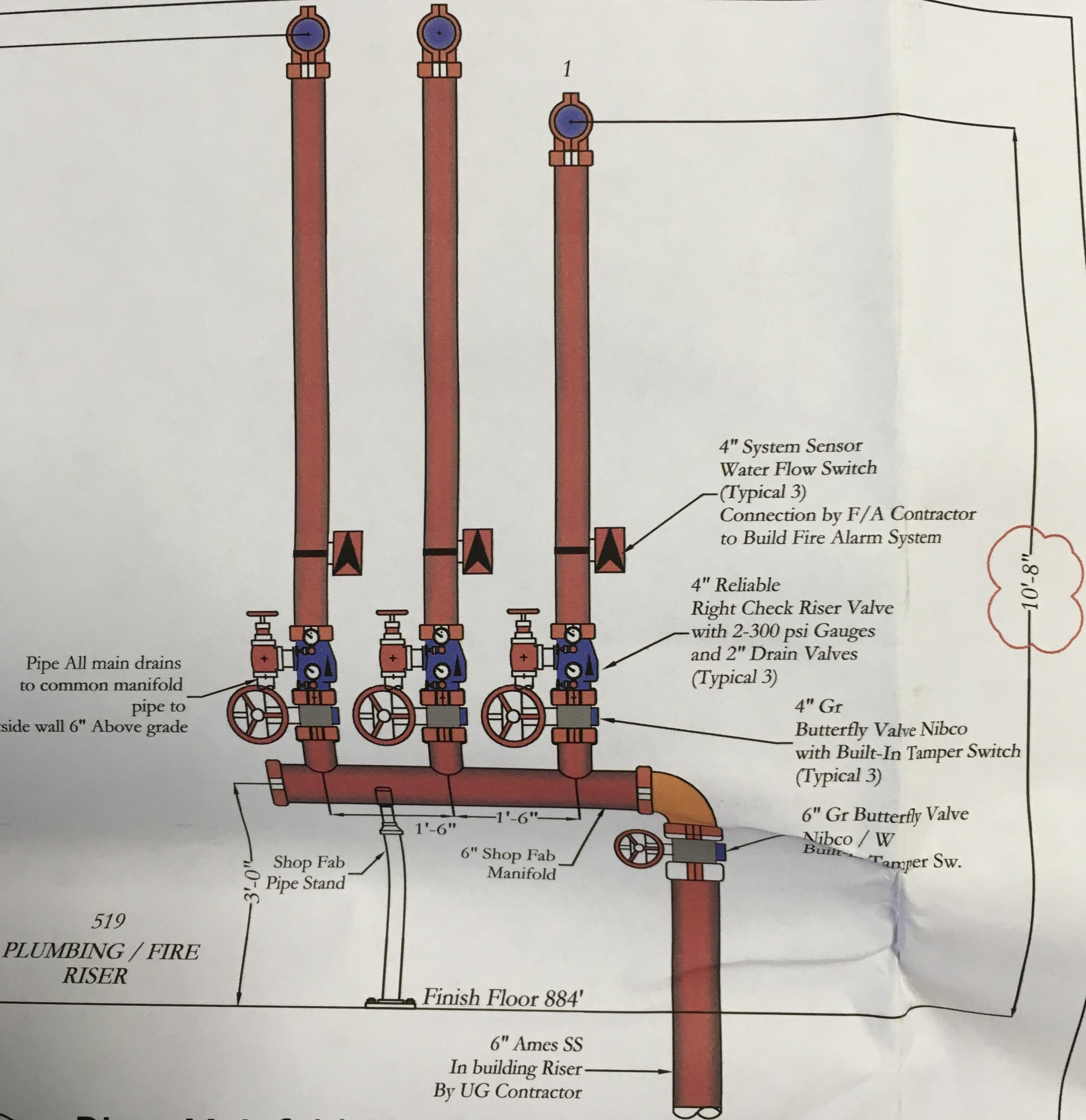
Inspectors Test Station System # 1

Electric Horn Strobe Integrated with F/A System (By F/A Contractor) to be

1  
FP-1

SECTION S3 SECTION S2 SECTION S1

**PARTIAL FIRE SPRINKLER DRAWINGS OF EXISTING BUILDING - FOR INFORMATIONAL PURPOSES ONLY**



Pipe All main drains to common manifold pipe to side wall 6" Above grade

4" System Sensor Water Flow Switch (Typical 3)  
Connection by F/A Contractor to Build Fire Alarm System

4" Reliable Right Check Riser Valve with 2-300 psi Gauges and 2" Drain Valves (Typical 3)

4" Gr Butterfly Valve Nibco with Built-In Tamper Switch (Typical 3)

6" Gr Butterfly Valve Nibco / W Built-In Tamper Sw.

3'-0" Shop Fab Pipe Stand

1'-6" 6" Shop Fab Manifold

Finish Floor 884'

6" Ames SS In building Riser By UG Contractor

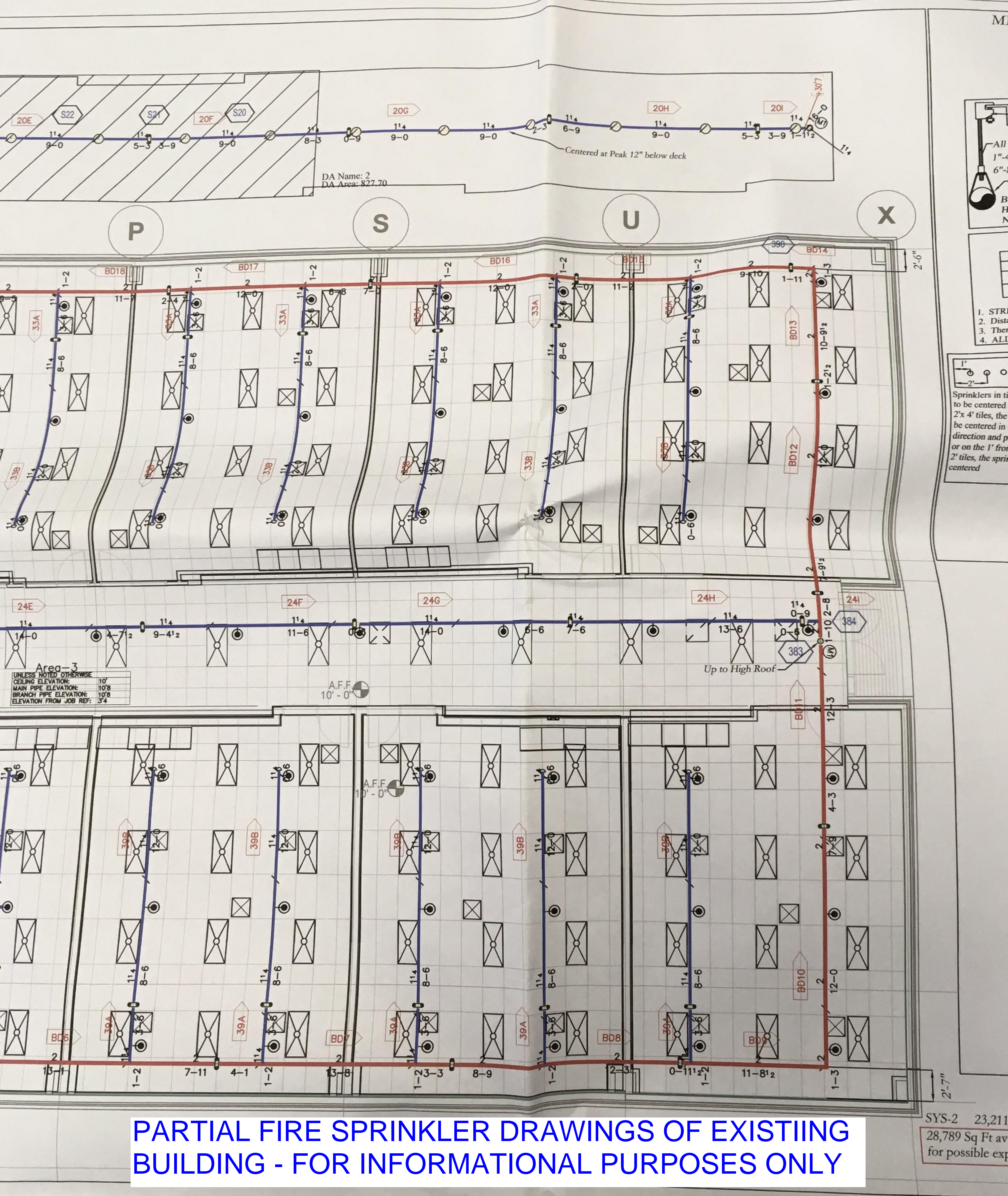
10'-8"

519 PLUMBING / FIRE RISER

# Riser Mainfold Elevation

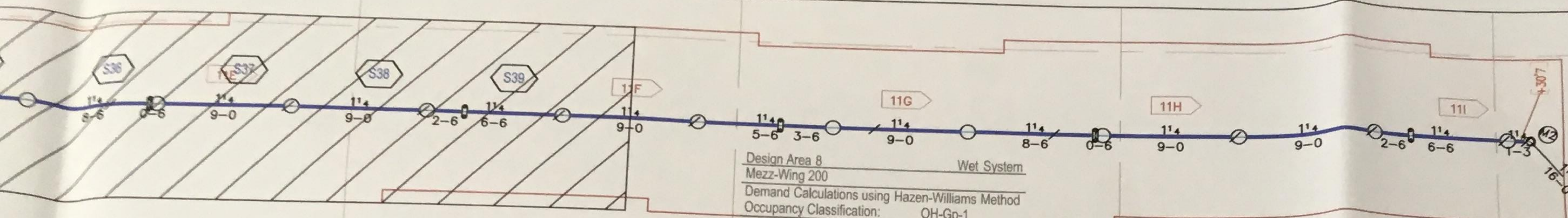
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PARTIAL FIRE SPRINKLER DRAWINGS OF EXISTIING BUILDING - FOR INFORMATIONAL PURPOSES ONLY

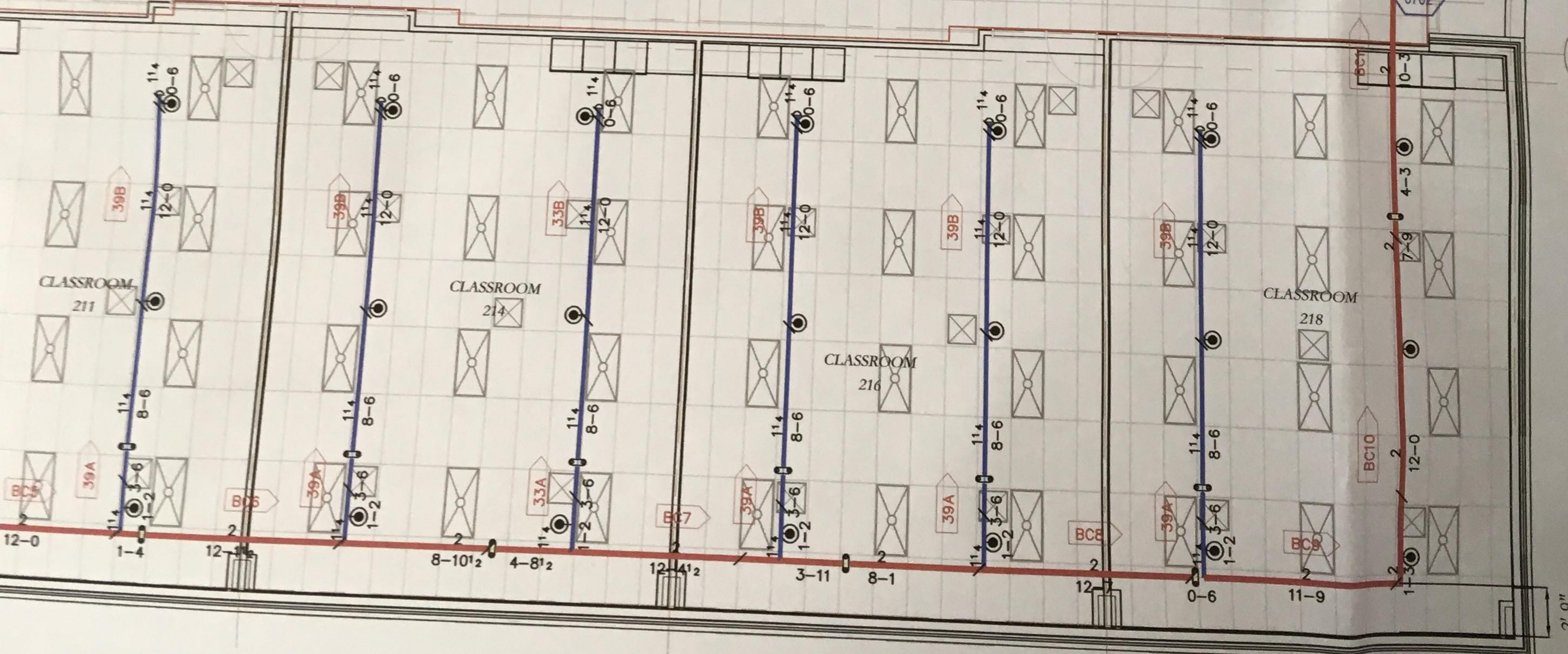
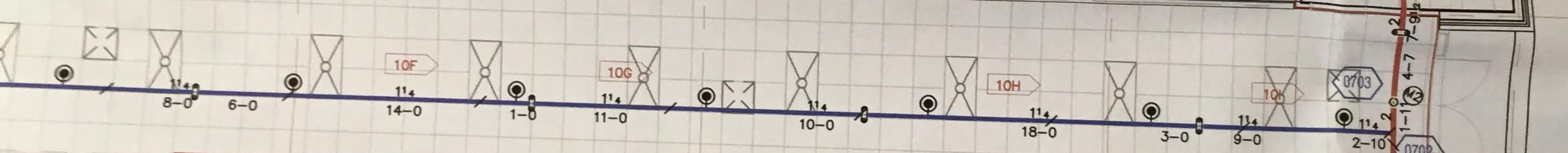
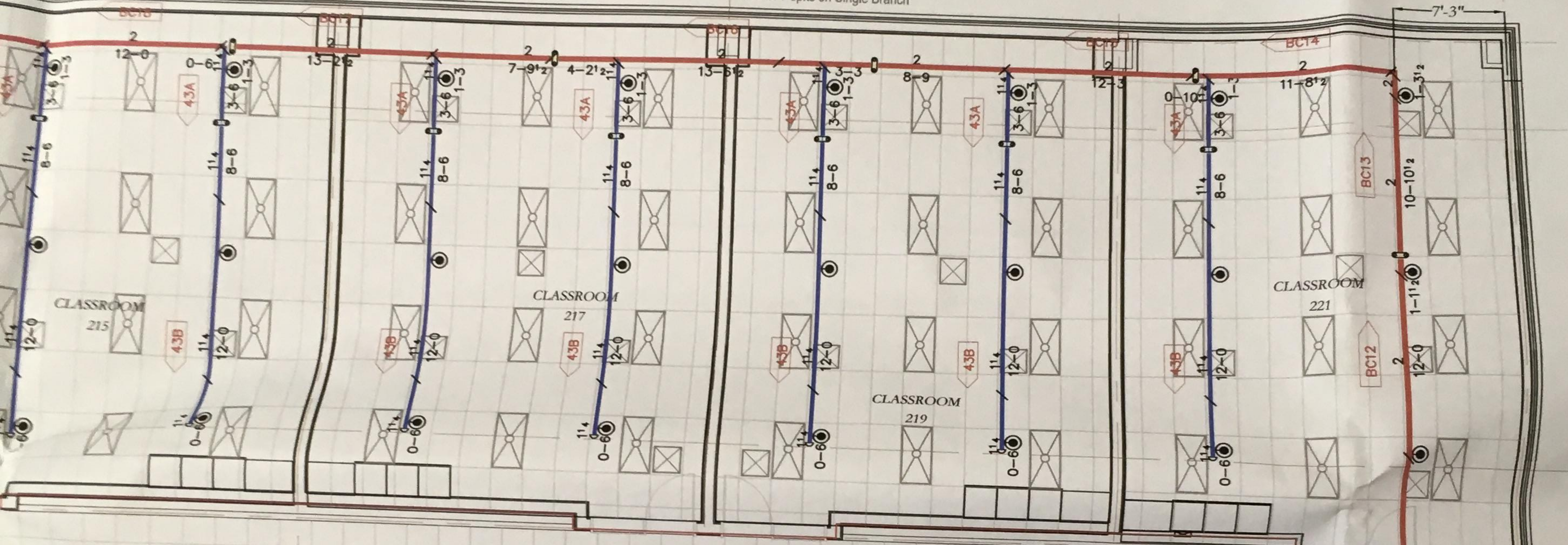


**PARTIAL FIRE SPRINKLER DRAWINGS OF EXISTING BUILDING - FOR INFORMATIONAL PURPOSES ONLY**

SYS-2 23,211  
28,789 Sq Ft av  
for possible exp

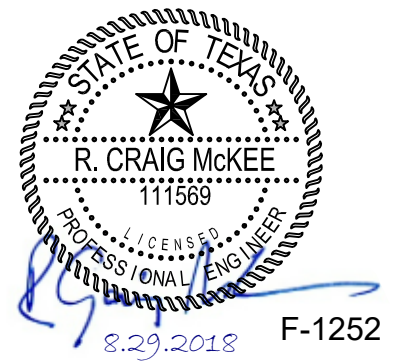


Design Area 8  
 Mezz-Wing 200  
 Wet System  
 Demand Calculations using Hazen-Williams Method  
 Occupancy Classification: OH-Gp-1  
 Design Area Density: .15  
 Additional Outside Hose: 250  
 Design Area Size: 845  
 Notes: 7 spks on Single Branch



Sys-3 43,572 SQ. FT.  
 8,428 Sq Ft Available  
 for possible expansion

PARTIAL FIRE SPRINKLER DRAWINGS OF EXISTING BUILDING - FOR INFORMATIONAL PURPOSES ONLY



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REFERENCE IS MADE TO THE DRAWINGS AND THE PROJECT MANUAL AS NOTED:

### DRAWINGS:

AD No 1, Struct Item 1: To the Drawings, Sheet S2.1, "DFE AND GRADE BEAM PLAN – SECTION 1"

- 1) Replace this sheet in its entirety with Sheet S2.1, included herein as part of this Addendum.

AD No 1, Struct Item 2: To the Drawings, Sheet S2.2, "FOUNDATION PLAN – SECTION 1"

- 1) Replace this sheet in its entirety with Sheet S2.2, included herein as part of this Addendum.

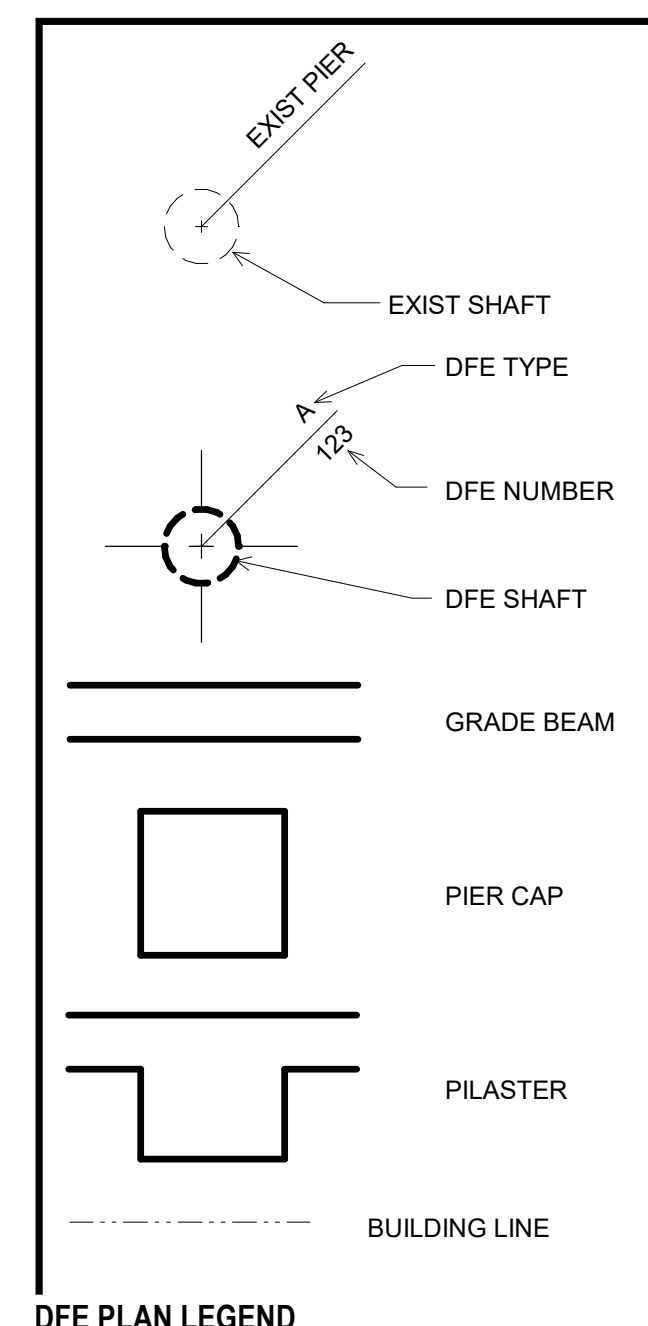
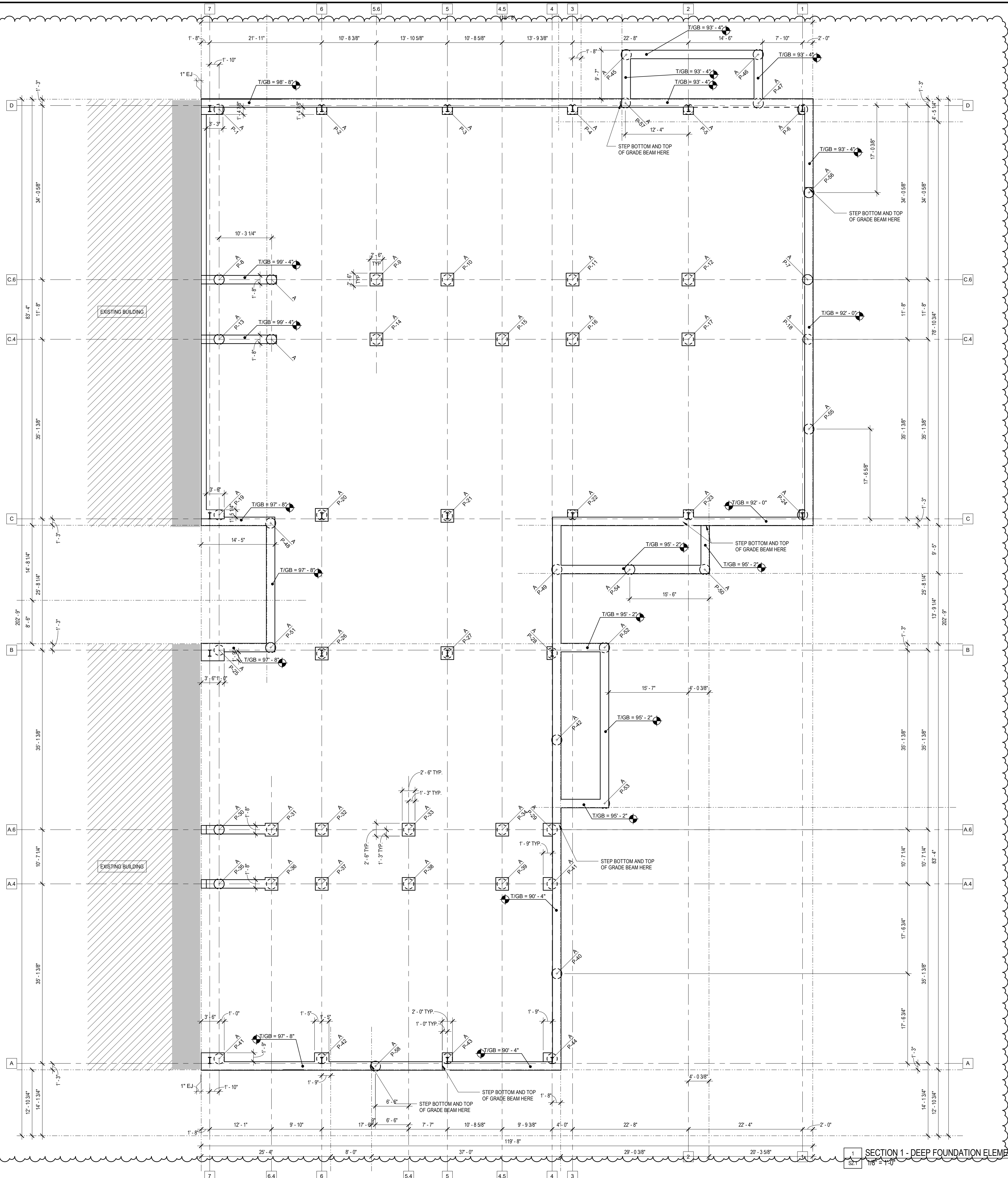
AD No 1, Struct Item 3: To the Drawings, Sheet S5.1, "CONCEPTUAL LOW ROOF AND MEZZANIE FRAMING – SECTION 1"

- 1) Replace this sheet in its entirety with Sheet S5.1, included herein as part of this Addendum.

AD No 1, Struct Item 4: To the Drawings, Sheet S5.2, "CONCEPTUAL ROOF FRAMING PLAN – SECTION 1"

- 1) Replace this sheet in its entirety with Sheet S5.2, included herein as part of this Addendum.

**END OF STRUCTURAL ADDENDUM**



- DFE PLAN NOTES**
1. REFERENCE 1/S3.1 FOR TYPICAL DEEP FOUNDATION ELEMENT DETAIL AND SCHEDULE.
  2. DEEP FOUNDATION ELEMENT SHALL BE CENTERED UNDER GRADE BEAMS OF COLUMNS UNLESS NOTED OTHERWISE.
  3. TOP OF DEEP FOUNDATION ELEVATION SHALL EQUAL BOTTOM OF GRADE BEAM OR PILASTER UNLESS NOTED OTHERWISE.
  4. BOTTOM OF PILASTER = BOTTOM OF DEEPEST GRADE BEAM (TYP.)

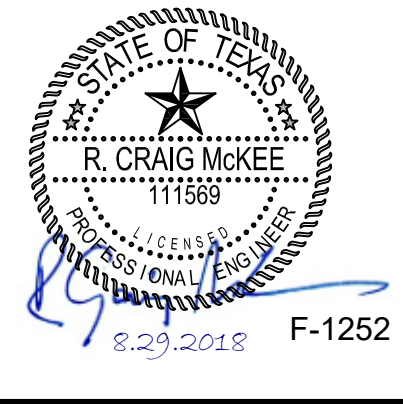
**IMPORTANT NOTE:**  
 FOUNDATION DESIGN IS PRELIMINARY  
 PENDING A FINAL GEOTECHNICAL REPORT  
 IN PROGRESS BY ALPHA TESTING. THESE  
 DRAWINGS SHALL NOT BE USED FOR  
 CONSTRUCTION PURPOSES.

Date 08/30/18

Revision / 1

JARRELL MIDDLE SCHOOL ADDITIONS  
 FOR  
 JARRELL I.S.D.  
 JARRELL, TEXAS

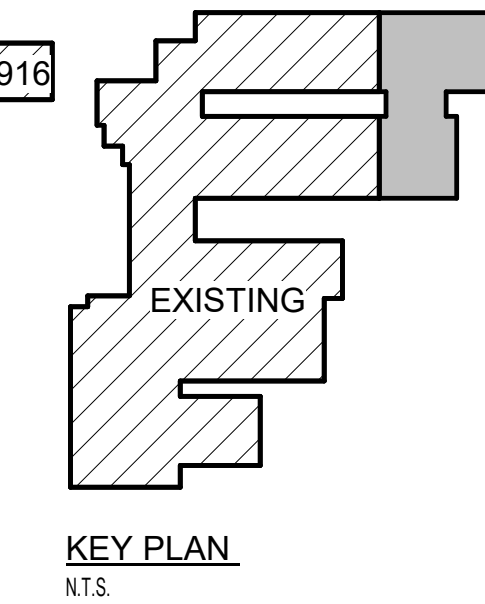
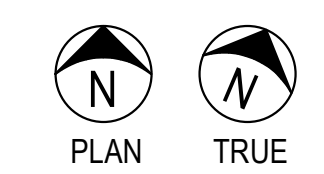
Project



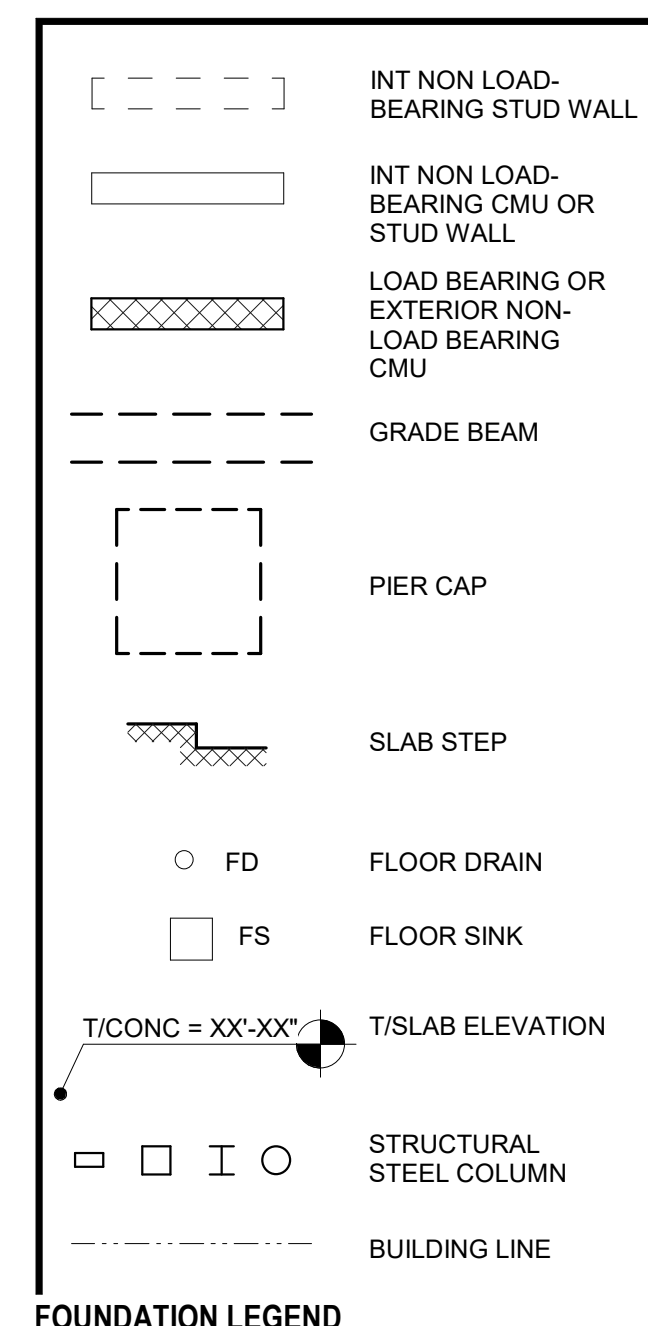
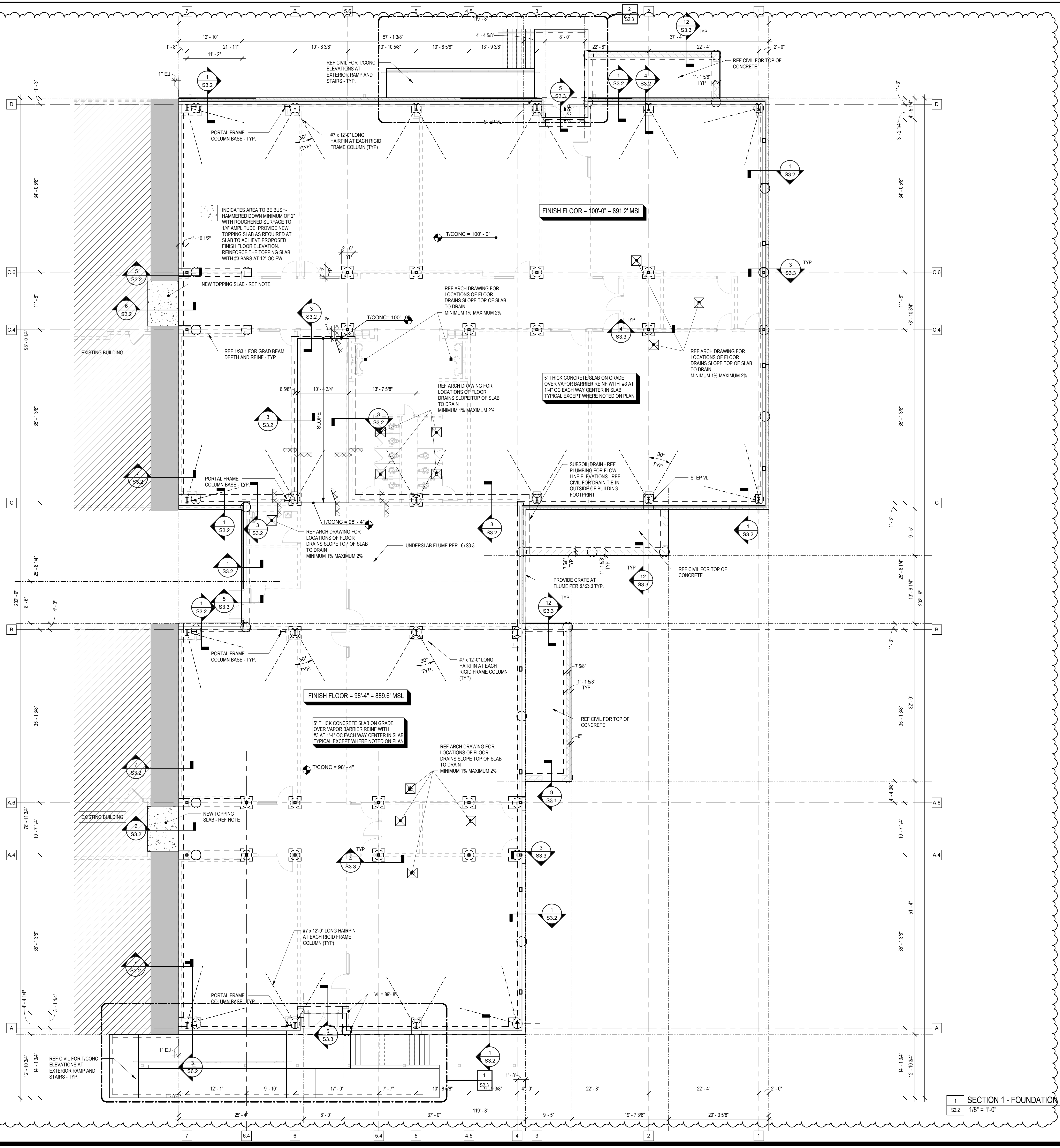
DFE AND GRADE BEAM PLAN - SECTION 1

Job No. 1756-02-01  
 Drawn By: MKAM  
 Date: 08/20/2018

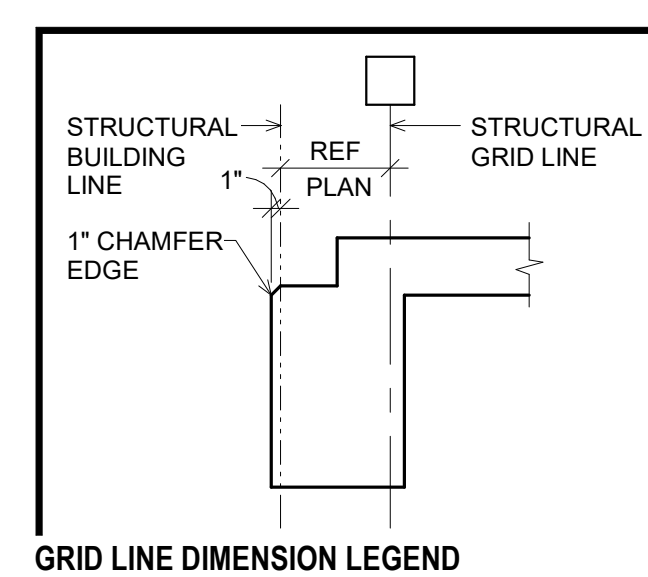
Sheet No. S2.1



SECTION 1 - DEEP FOUNDATION ELEMENTS PLAN



- FOUNDATION PLAN NOTES**
- FOR GENERAL NOTES, SEE DWG. S0.0.
  - FOR FOUNDATION SECTIONS & DETAILS, SEE S3 SERIES DRAWINGS.
  - SEE ARCH DRAWINGS FOR EXACT LOCATION OF SLAB DEPRESSIONS, OPENINGS AND ENTRY AREAS.
  - SLOPE TO AND BOTTOM OF STRUCTURAL SLAB AT ALL FLOOR DRAINS, MAINTAINING THE MINIMUM OVERALL CONCRETE SLAB THICKNESS AS SPECIFIED AND THE MINIMUM VOID DEPTH AS SPECIFIED.



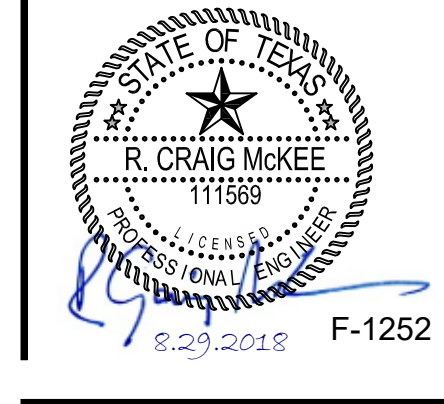
**IMPORTANT NOTE:**  
ALL PRE-ENGINEERED METAL BUILDING (PEMB) COMPONENTS SHOWN ON THIS SHEET ARE ONLY SHOWN HERE FOR CONCEPTUAL PURPOSES, AND ARE ONLY INTENDED TO INDICATE THE DESIGN INTENT OF MAJOR BUILDING COMPONENTS SUCH AS RIGID FRAME LOCATIONS, LOCATIONS OF PORTAL FRAMES, AND APPLICABLE DIMENSIONAL LIMITATIONS OF THESE COMPONENTS. ALL OF THESE COMPONENTS, INCLUDING BUT NOT LIMITED TO ALL MISCELLANEOUS FRAMING ASSOCIATED WITH THESE ITEMS, SHALL BE DESIGNED BY THE CONTRACTOR'S PEMB ENGINEER IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.

**IMPORTANT NOTE:**  
FOUNDATION DESIGN IS PRELIMINARY PENDING A FINAL GEOTECHNICAL REPORT IN PROGRESS BY ALPHA TESTING. THESE DRAWINGS SHALL NOT BE USED FOR CONSTRUCTION PURPOSES.

Date: 08/30/18  
Revision: 1

JARRELL MIDDLE SCHOOL ADDITIONS  
FOR  
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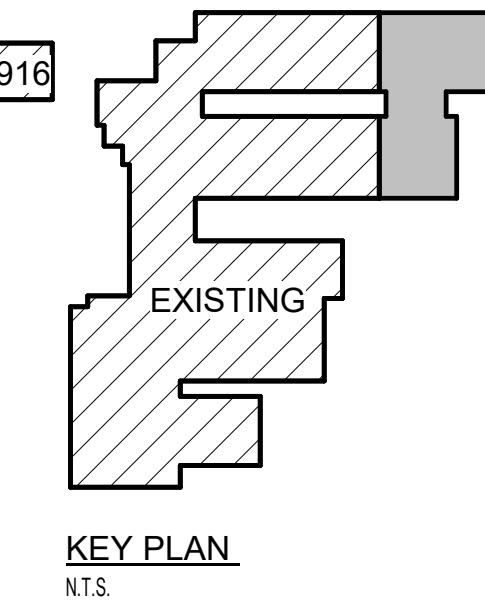
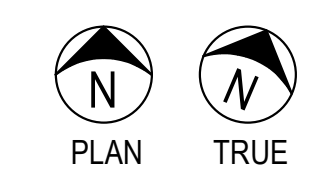
Project:



FOUNDATION PLAN - SECTION 1

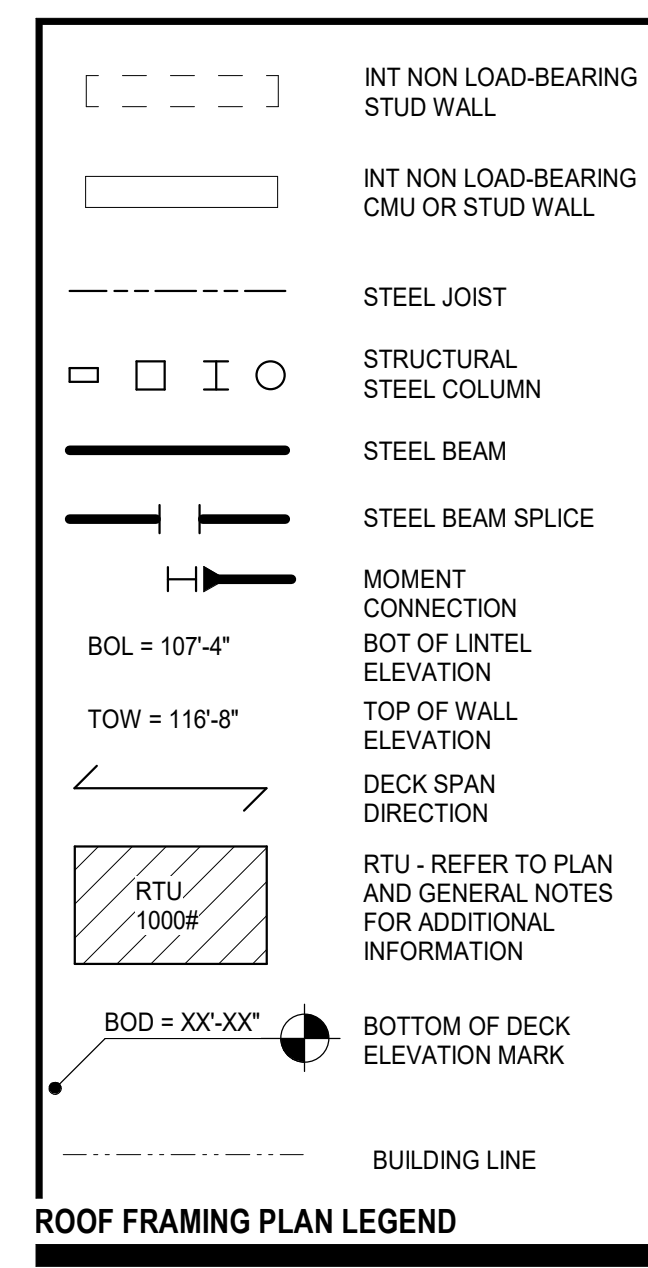
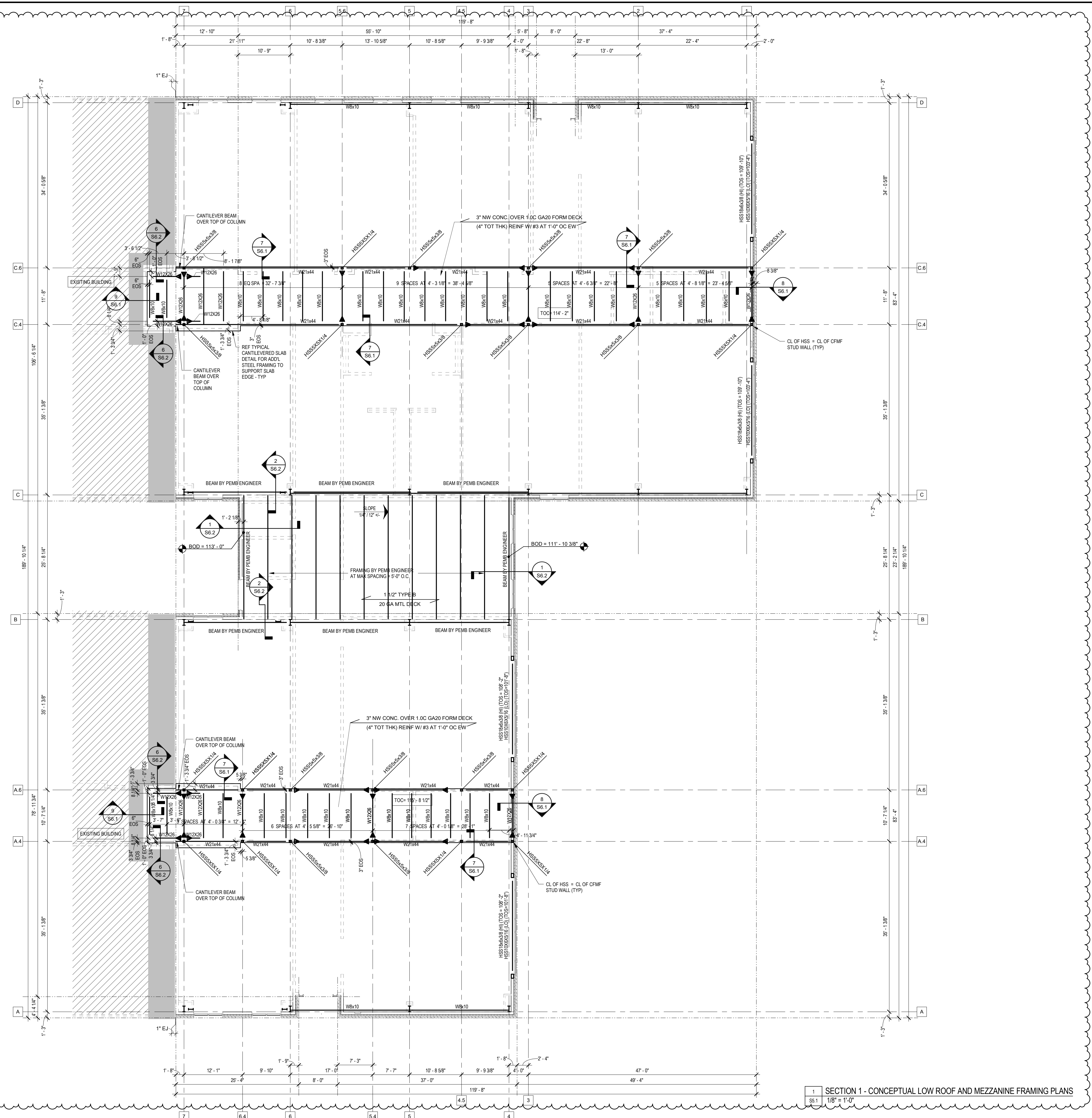
Job No. 1756-02-01  
Drawn By: MKAM  
Date: 08/22/2018

Sheet No. S2.2



SECTION 1 - FOUNDATION PLAN  
1/8" = 1'-0"





- ROOF PLAN NOTES**
- FOR GENERAL NOTES, SEE S0.0.
  - SEE ARCH DRAWINGS FOR EXACT LOCATIONS OF DOOR OPENINGS, FLOOR DROPS, FLOOR SLOPES, AND FLOOR DEPRESSIONS.

- FLOOR PLAN NOTES**
- FINISH FLOOR ELEVATIONS VARY FROM 100'-0". SEE FOUNDATION PLAN FOR FINISH FLOOR ELEVATIONS.
  - FOR GENERAL NOTES, SEE S0.0.
  - FOR FRAMING SECTIONS AND DETAILS, SEE S6 SERIES DRAWINGS.
  - MISCELLANEOUS FLOOR OPENINGS 12" SQUARE/ROUND OR LARGER SHALL BE FRAMED WITH L3x3x1/4, WHETHER OR NOT THEY ARE SHOWN ON THE DRAWINGS. SEE TYPICAL FRAME DETAIL AT A/C UNITS. PROVIDE ANGLE FRAMES AT ALL ROOF DRAINS.

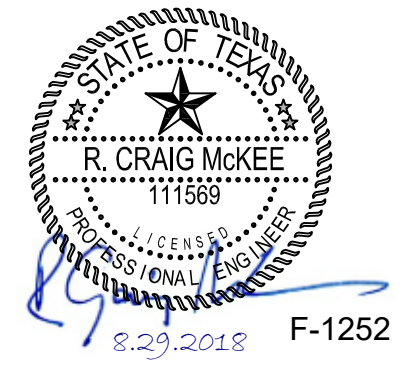
**IMPORTANT NOTE:**  
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Project

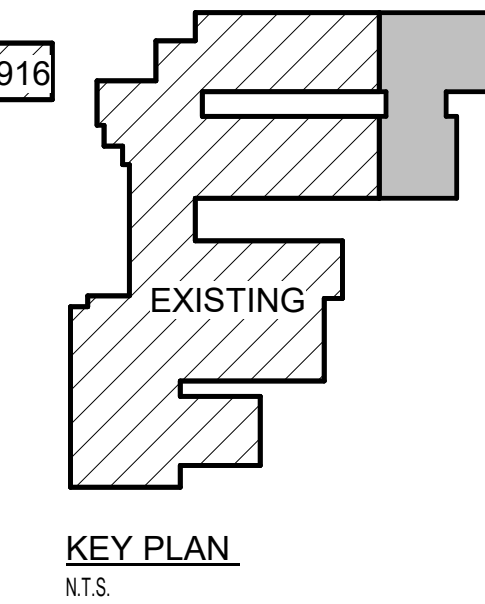
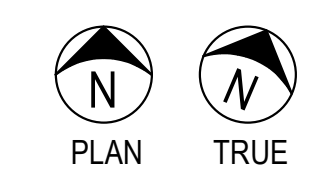


**Huckabee**  
 AUSTIN • DALLAS • FORT WORTH  
 HOUSTON • SAN ANGELO • WACO  
 www.huckabee-inc.com  
 800.687.9229

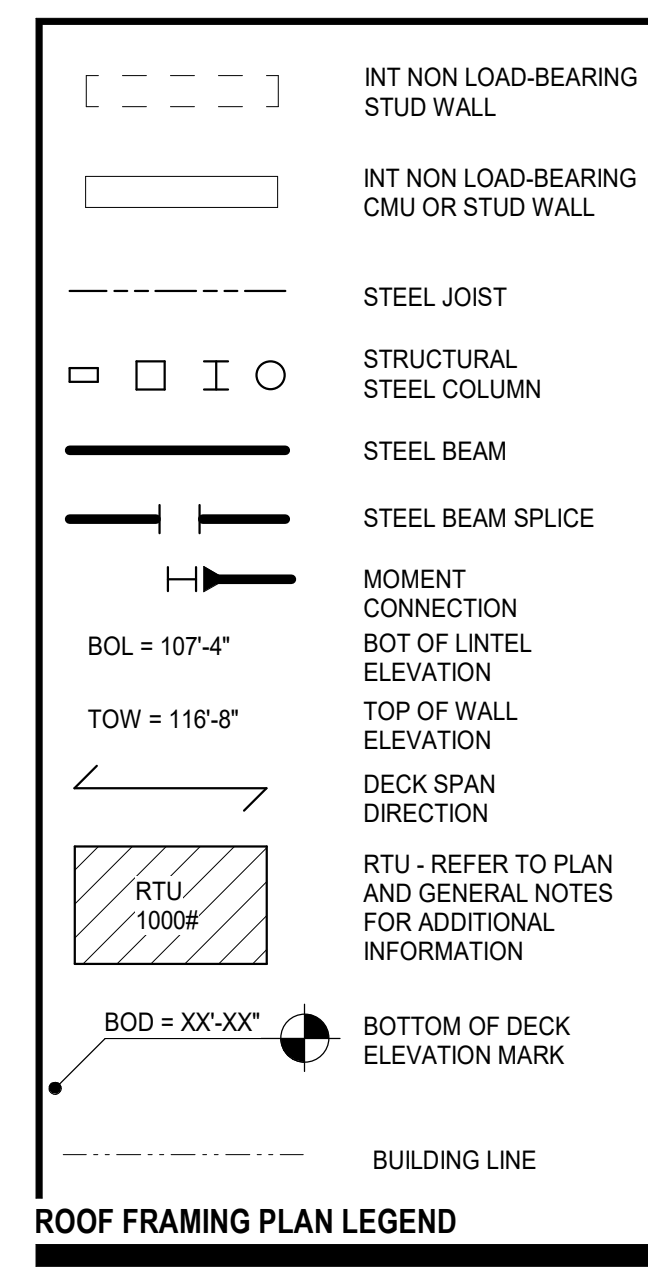
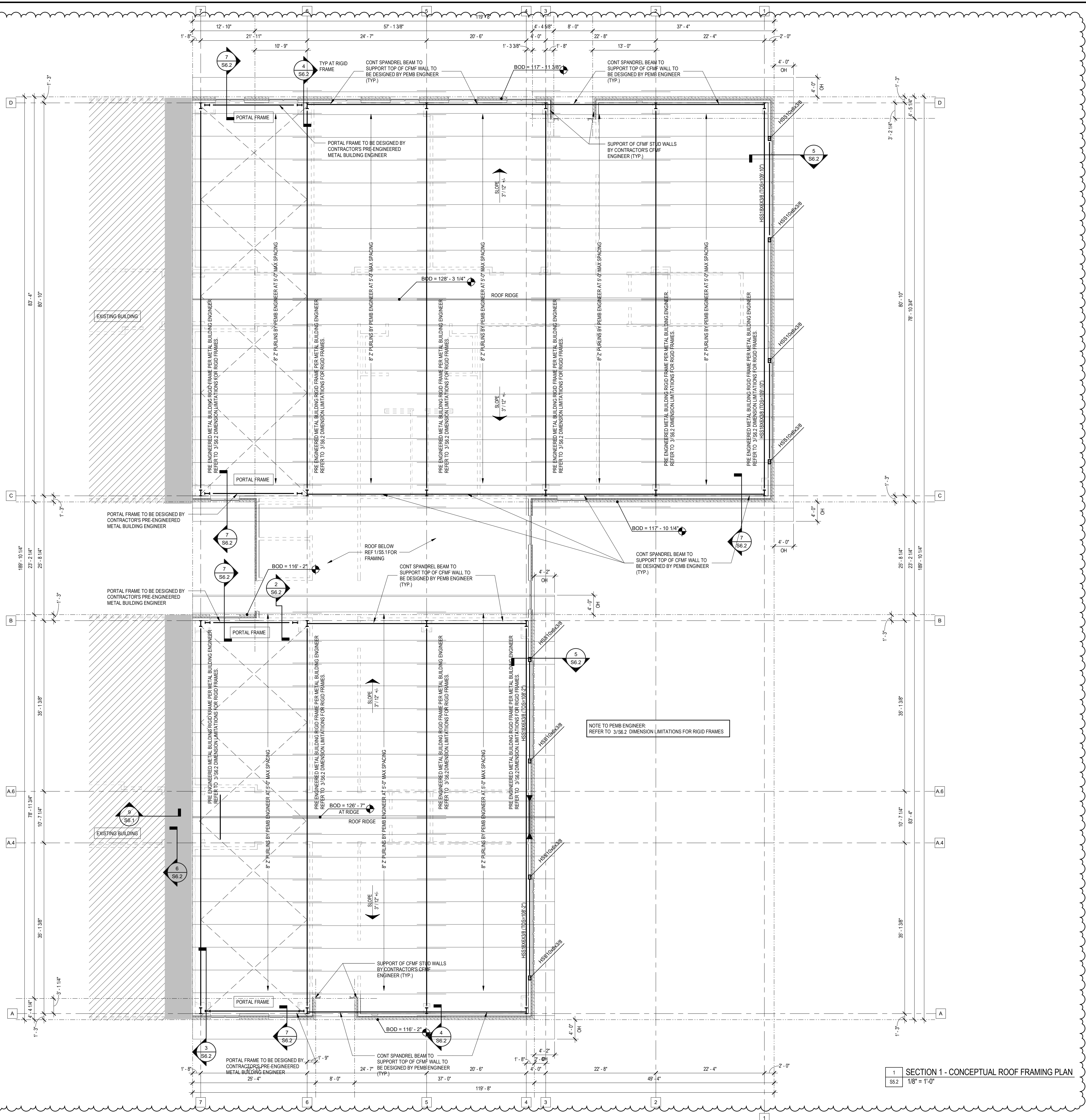
CONCEPTUAL LOW ROOF AND MEZZANINE FRAMING - SECTION 1

Job No. 1756-02-01  
 Drawn By: MKAM  
 Date: 08/22/2018

Sheet No. S5.1



SECTION 1 - CONCEPTUAL LOW ROOF AND MEZZANINE FRAMING PLANS  
 S5.1 1/8" = 1'-0"



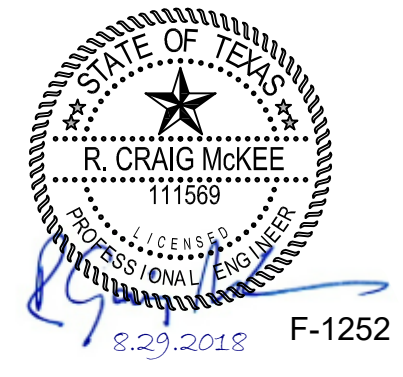
- ROOF PLAN NOTES**
- FOR GENERAL NOTES, SEE S0.0.
  - SEE ARCH DRAWINGS FOR EXACT LOCATIONS OF DOOR OPENINGS, FLOOR DROPS, FLOOR SLOPES, AND FLOOR DEPRESSIONS.

**IMPORTANT NOTE:**  
 ALL PRE-ENGINEERED METAL BUILDING (PEMB) COMPONENTS SHOWN ON THIS SHEET ARE ONLY SHOWN HERE FOR CONCEPTUAL PURPOSES, AND ARE ONLY INTENDED TO INDICATE THE DESIGN INTENT OF MAJOR BUILDING COMPONENTS SUCH AS RIGID FRAME LOCATIONS, LOCATIONS OF PORTAL FRAMES, AND APPLICABLE DIMENSIONAL LIMITATIONS OF THESE COMPONENTS. ALL OF THESE COMPONENTS, INCLUDING BUT NOT LIMITED TO ALL MISCELLANEOUS FRAMING ASSOCIATED WITH THESE ITEMS, SHALL BE DESIGNED BY THE CONTRACTOR'S PEMB ENGINEER IN ACCORDANCE WITH THE PROJECT SPECIFICATIONS.

Date: 08/30/18  
 Revision: 1

JARRELL MIDDLE SCHOOL ADDITIONS  
 FOR  
 JARRELL I.S.D.  
 JARRELL, TEXAS

Project:



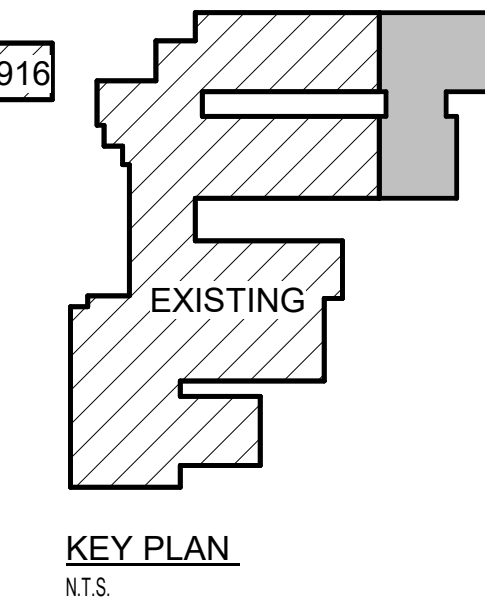
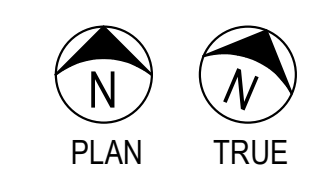
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CONCEPTUAL ROOF FRAMING PLAN - SECTION 1

Job No. 1756-02-01  
 Drawn By: MKAM  
 Date: 08/22/2018

Sheet No. S5.2

SECTION 1 - CONCEPTUAL ROOF FRAMING PLAN  
 1/8" = 1'-0"



Project Name: Jarrell Middle School Addition and Renovations  
Client: Jarrell ISD  
Jarrell, Texas  
Project Number: 01756-02-01



## MECHANICAL ITEMS FOR ADDENDUM NO. 1

### NOTICE TO PROPOSERS:

- A. This Addendum shall be considered part of the contract documents for the above-mentioned project as though it had been issued at the same time and incorporated integrally therewith. Where provisions of the following supplementary data differ from those of the original contract documents, this Addendum shall govern and take precedence.
- B. Proposers are hereby notified that they shall make any necessary adjustments in their estimate on account of this Addendum. It will be construed that each Proposer's proposal is submitted with full knowledge of all modifications and supplemental data specified therein. Acknowledge receipt of this addendum in the space provided on the proposal form. Failure to do so may subject Proposer to disqualification.

REFERENCE IS MADE TO THE DRAWINGS AND THE PROJECT MANUAL AS NOTED:

### PROJECT MANUAL:

AD No 1, Mech. Item 1: To the Project Manual, Section 23 09 23, "EMCS (BACNET)," Add Section in its entirety.

### END OF MECHANICAL ADDENDUM

Z:\HUCKABEE - AUSTIN\JARRELL\2 016 0662 002 MS RENOVATIONS\01 ADMIN 2 016 0662 002\ADDENDA 2 016 0662 002\ADDENDUM #1\ADDENDUM 1 - MECHANICAL 01756-02-01.DOCX  
ESTES, McCLURE & ASSOCIATES REGISTRATION NO. F-893

**Huckabee**

Mechanical Items For  
Addendum No. # 1  
Page 1 of 1

**SECTION 23 09 23**

**ENERGY MANAGEMENT CONTROL SYSTEM (BACNET)**



**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions, Division 1 Specifications and Section 23 00 00, apply to this Section.

**1.2 SUMMARY**

- A. It is the intent of this specification to describe the basic architecture and performance requirements of the Energy Management Control System (EMCS). The turn-key EMCS shall include Control Units, Distributed Controllers, Unitary Controllers, Local Area Networks (LANs), sensors, modems, wiring, connectors, control devices, actuators, installation and calibration, supervision, adjustments and fine tuning necessary for a complete and fully operational system.
- B. A distributed logic control system complete with all software and hardware functions shall be provided and installed. System shall be completely based on ANSI/ASHRAE Standard 135-2001, BACnet. This system is to control all mechanical equipment, including all unitary equipment such as VAV boxes, heat pumps, fan-coils, AC units, etc. and all air handlers, boilers, chillers, and any other listed equipment using Native BACnet-compliant components.
- C. All systems shall be complete true stand-alone systems.
- D. LonWorks or proprietary protocol software is not allowed.
- E. Everything shall be reprogrammed through software without change of any hardware. The owner shall have all the tools necessary to reprogram without any additional costs.
- F. A PC computer (Remote Workstation) is required at every school. A central work station (CPU) shall be installed in the Energy Manager's office and provided by the owner.
- G. EMCS shall have backward and forward compatibility.
- H. Systems shall be furnished and installed complete in all respects, including any and all equipment, controls, wiring, instrumentation, enclosures, labor, engineering, training, commissioning, programming, supervision, calibration, coordination with other trades, etc. No information given in (or omitted from) these specifications shall relieve the contractor of this absolute requirement. Include all associated electrical work except as noted. Work includes furnishing of all labor, superintendence, materials, tools, equipment and sources necessary for the complete installation or modification of the following systems as herein specified. It is the intent of these specifications that the Contractor shall furnish and install the systems complete in every respect and ready to operate. All equipment, miscellaneous items and accessories required for such installation and for the correct and convenient operation of the entire installation whether or not each such item or accessory is shown on the plans or mentioned in these specifications shall be furnished and installed.
- I. Bidders shall take into account that projects require verification of existing conditions that are not described in these specifications. Bids shall include, at Bidder's discretion, costs related to site verifications for renovation projects. No additional costs shall be allowed for such items.

- J. Should discrepancies or ambiguities arise within these specifications, the most stringent condition with regard to cost shall govern the bid. Obtain clarification from the Engineer prior to purchasing equipment and proceeding with the work.
- K. Where drawings are provided as part of or supplement to these specifications, such drawings are inherently schematic only and not intended to convey all controls, wiring, installation, details, etc. It shall be the responsibility of the EMCS contractor to verify that control approaches presented are appropriate for the HVAC systems involved, and that bids include all work described, specified, or otherwise necessary for a complete and functioning system.
- L. Schedule: Contractor acknowledges that submission of bid constitutes agreement with and conformance to the completion dates.
- M. Codes, Permits, and Fees: This contractor shall comply with all local, state and national codes, and shall secure and pay or all applicable costs, fees, permits, and licenses. No additional costs shall be allowed for these items.
- N. Other Conditions:
  - 1. Safety: Execute all work with the highest regard to safety. Comply with all laws governing safety, including the "Occupational Safety and Health Standards" and the "Safety and Health Regulations for Construction", State and federal. All applicable power tools used during construction shall have current approval under an approved Equipment Grounding Program, and shall bear the tag relating such. Contractor is solely responsible for all means and methods.
  - 2. Coordination and Supervision: Each bid shall include the necessary detail and interconnection work to coordinate his work with the work of other trades. Contractor shall keep competent supervisory personnel on the job whenever work is being performed which affects his trade.
  - 3. Storage of Materials: Each Contractor shall provide temporary storage facilities suitable for equipment stored at the job site. Storage facilities shall be weatherproof and lockable as required.
  - 4. Protection of Building and Materials: Each Contractor shall take necessary precautions to prevent damage to existing buildings and to work of other trades.
  - 5. Observations: Site observation by Owner or Engineer is for express purpose of verifying compliance by Contractor with Contract Documents, and shall not be construed as construction supervision nor indication of approval of manner or location in which work is being performed as being safe practice or place.
  - 6. Contractor is reminded that he shall also comply with all respects to the Invitation to Bid, General Conditions, Supplementary Conditions, Notice of Bidders, Instructions to Bidders, and all other governing parts of these specifications and the contract documents. These sections are included as part of the contract.
  - 7. Where the term "Contractor" is used within these specifications, it shall be understood to mean an approved controls manufacturer/contractor, and facility management systems contractor.
- O. The entire system shall be approved and listed by Underwriters Laboratories, Inc., under UL916 for energy management systems and FCC-Part 15 Subparagraph J Class A Emissions Requirements.
- P. Equipment and Software Updates/Upgrades:
  - 1. Equipment: All equipment, components, parts, materials, etc. provided throughout the period of Work (as governed in the Agreement) shall be fully compatible with all other equipment, etc. provided at any other time throughout the period of Work. Should updated versions of equipment be provided which are not fully compatible with earlier equipment provided, Contractor shall replace earlier equipment with the later version at no cost to Owner.

2. Software: All software upgrades applicable to system and offered by the manufacturer/contractor for this system shall be provided at no cost to the Owner throughout the period of work. This no cost upgrade shall include installation, programming, modifications to field equipment, data base revisions, training, etc. as appropriate.
- Q. The Engineer shall reserve all authority regarding approval, conditional approval, or rejection of systems not fully complying with these specifications.

### 1.3 WORK INCLUDED

- A. **Expand existing BACnet system All new equipment to be connected to the existing EMCS. All programming, software upgrades, controllers, etc. necessary to connect new equipment to existing control system shall be verified and provided by existing controls company.**
- B. The EMCS shall be a totally Native BACnet-based system, based on a distributed control system in accordance with this specification. All building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135–2001, BACnet. In other words, and controllers, including unitary controllers, shall be Native BACnet devices. No gateways shall be used for communication to controllers installed under this section. Gateways may be used for communication to existing systems or to systems installed under other sections.
- C. The Energy Management and Control System (EMCS) application program shall be written to communicate specifically utilizing BACnet protocols. Software shall include password protection, alarming, logging of historical data, full graphics including animation, full suite of field engineering tools including graphical programming and applications. Systems using operating systems other than that described above are strictly prohibited.
- D. Building controllers shall include complete energy management software, including scheduling building control strategies and logging routines. All energy management software and firmware shall be resident in field hardware and shall not be dependent on the operator's terminal. Operator's terminal software is to be used for access to field-based energy management functions only. Provide zone-by-zone direct digital logic control of space temperature, scheduling, runtime accumulation, equipment alarm reporting, and override timers for after-hours usage.
- E. All application controllers for every terminal unit (VAV, HP, UV, etc.) air handler, all central plant equipment, and any other piece of controlled equipment shall be fully programmable. Application controllers shall be mounted next to controlled equipment and communicate with building controller via BACnet LAN.
- F. Provide all necessary BACnet-compliant hardware and software to meet the system's functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers.
- G. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.
- H. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.
- I. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

- J. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.
- K. Provide and install all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.
- L. Provide complete manufacturer's specifications for all items that are supplied. Include vendor name of every item supplied.
- M. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.
- N. Provide a comprehensive operator and technician training program as described herein.
- O. Provide as-built documentation, operator's terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.
- P. Provide new sensors, dampers, valves, and install only new electronic actuators. No used components shall be used as any part or piece of installed system.
- Q. Unless otherwise specified, all products shall be of single manufacturer where possible with substitutions approved by Engineer/Owner.
- R. Provide all indicating devices, interface equipment, and other apparatus required to operate mechanical system and to perform functions specified and to operate other items specified.
- S. Provide protective devices to prevent damage to the EMCS as a result of lightning.
- T. The Energy Management Control system shall allow full user operation with minimum of training. It shall have an English language display, with both user prompts and a "help" user tutorial. It shall contain management reports for the monitoring of both current and historical energy usage, heating and cooling degree day, building status and after hours occupancy information.
- U. All applications programs shall be pre-engineered and pretested. Program entries shall utilize graphical templates.
- V. Workmanship:
  - 1. Contractor shall use only thoroughly trained and experienced workmen completely familiar with the items required and with the manufacturers recommended methods of installation. In all respects, the workmanship shall be of the highest grade, and all construction shall be done according to the best practice of the trade. Unless otherwise noted, conduit shall be concealed and installed square to the building lines. Any work not meeting these requirements shall be replaced or rebuilt without extra expense to the Owner

#### **1.4 RELATED SECTIONS**

- A. Section 23 00 00 - Basic Mechanical Requirements
- B. Section 23 05 93 – Testing, Adjusting, and Balancing for HVAC
- C. Section 23 81 26 – Split System HVAC Units

D. Section 26 00 00 – Basic Electrical Requirements

## 1.5 DEFINITIONS

A. Energy Management Control System, Facility Management System, Control System are to be considered the same.

## 1.6 REFERENCES

- A. The latest edition of the following standards and codes in effect and amended as of supplier's proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:
1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
  2. ANSI/ASHRAE Standard 135-2001, BACnet.
  3. Uniform Building Code (UBC), including local amendments.
  4. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
  5. National Electrical Code (NEC).
  6. FCC Part 15, Subpart J, Class A.
  7. EMC Directive 89/336/EEC (European CE Mark).
  8. City, county, state, and federal regulations and codes in effect as of contract date.
  9. Except as otherwise indicated the system supplier shall secure and pay for all permits, inspections, and certifications required for his work and arrange for necessary approvals by the governing authorities.

## 1.7 SPECIFICATION NOMENCLATURE

EMCS	Energy Management and Control System
WAN	Wide Area Network
RWS	Remote Work Station
HHI	Hand Held Interface
LAN	Local Area Network

## 1.8 QUALITY ASSURANCE

- A. Responsibility:
1. The supplier of the EMCS shall be responsible for inspection and Quality Assurance (QA) for all materials and workmanship furnished.
- B. Component Testing:
1. Maximum reliability shall be achieved through extensive use of high-quality, pre-tested components. Each and every controller, sensor, and all other DDC components shall be individually tested by the manufacturer prior to shipment.
- C. Tools, Testing and Calibration Equipment:
1. The EMCS supplier shall provide all tools, testing, and calibration equipment necessary to ensure reliability and accuracy of the system.

## 1.9 SUBMITTALS

- A. Drawings
1. The system supplier shall submit detailed complete, engineered drawings, control sequence, and bill of materials for approval.
  2. The contractor shall supply one electronic copy of the submittal.
  3. The electronic files will either be e-mailed to the architect, or posted to a project management and information exchange web site, depending on the architect's



- requirements. The architect and contractor can distribute copies of the files as desired.
4. The engineer will retain an electronic copy of the submittal and all responses.
- B. System Documentation
1. Include the following in submittal package:
    - a. Data sheets for all pieces of equipment.
    - b. System configuration diagrams in simplified block format.
    - c. All input/output object listings and an alarm point summary listing.
    - d. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
    - e. Complete bill of materials, valve schedule and damper schedule.
    - f. Manufacturer's instructions and drawings for installation, maintenance, and operation of all purchased items.
    - g. Overall system operation and maintenance instructions including preventive maintenance and troubleshooting instructions.
- C. For all system elements - operator's workstation(s), building controller(s), application controllers, routers, and repeaters, provide BACnet Protocol Implementation Conformance Statements (PICS) as per ANSI/ASHRAE Standard 135-2001.
- D. Provide complete description and documentation of any proprietary (non-BACnet) services and/or objects used in the system.
- E. A list of all functions available and a sample of function block programming that shall be part of delivered system.
1. Scheduling
    - a. The vendor shall provide a detailed project design and installation schedule with time markings and details for hardware items and software development phases. Schedule shall show all the target dates for transmission of project information and documents and shall indicate timing and dates for system installation, debugging, and commissioning.
  2. Drawings and Manuals:
    - a. Upon completion of the work, the Contractor shall provide the Owner with "record" layouts for the system. Layouts shall indicate all equipment and the function of each item shall be indicated.
  3. Operating instructions and as-built system flow diagrams and drawings shall be prepared, bound and delivered to the Owner. Each sensor, relay, switch, motor, controller, indicator (when inside panel), and item of equipment, etc., shall be identified with a number or mark identical to one which shall be tagged on each item. Large items of equipment may be identified by a suitable symbol listed in a legend on the control diagram.

#### **1.10 EMCS CONTRACTOR QUALIFICATION REQUIREMENTS**

- A. The Energy Management Control System Manufacturer/Contractor, to be acceptable to this project, must have had an established engineering and service office serving the Owner's area for a minimum of five years prior to bid date of this project and be the authorized installing contractor for the manufacturer of the BACnet components. This office shall have a staff of factory trained technicians fully capable of rendering training, instruction, calibration procedures and routine and emergency maintenance service on all system components furnished.
- B. Installers shall have not less than five years' experience with electronic and pneumatic controls.
- C. The entire system shall be provided by a qualified and approved Controls Manufacturer/Contractor. It shall be designed by engineers and installed by competent

technicians, all of which are regularly employed by the manufacturer of the control equipment. The Manufacturer/Contractor shall maintain permanent local facilities for engineering, installation, and 24 hour maintenance and service. Submit required Qualifications Form as specified. The manufacturer shall provide evidence of the ability to support and service the work in the Owner's facilities.

- D. The Bidder/Contractor shall be certified by the manufacturer of the equipment and have factory trained installers
- E. Equipment and performance are intended as a standard of quality, but not as a means of excluding other approved Manufacturers/Control Contractors.
- F. EMCS shall be as follows or equal.
  - 1. Alerton
- G. The Engineer and Owner shall reserve all authority regarding approval, conditional approval, or rejection of systems not fully complying with these specifications.

## **1.11 WARRANTY**

- A. The temperature control contractor shall guarantee all workmanship and material in the installed temperature regulation system for a period of one (1) year, such guarantee dating from the date of final acceptance of the entire air conditioning system by the Architect/Engineer.
- B. This warranty shall cover the repair or replacement without additional costs to the Owner of any defective materials, parts, etc. of facility workmanship.
- C. During the warranty period, the temperature controls contractor shall respond to calls for warranty service within eight (8) working hours. Emergency service shall be obtainable within four (4) hours of notification by the Owner. Emergency service shall be obtainable on a 24 hour basis, seven (7) days per week.
- D. The temperature control contractor's office shall be within a 150-mile radius of the job site
- E. Warranty Access:
  - 1. The Owner shall grant to the Contractor, reasonable access to the EMCS system during the warranty period. The owner shall provide, at no cost to the contractor, remote software access to an on-site computer or VPN access for the following functions:
    - a. Access to the entire facility control system by the contractor to provide service and diagnostic support.
- F. Service:
  - 1. All service of the system shall be furnished by the Contractor, at no cost to the Owner, for a period of one (1) year, concurrent with the warranty period specified above.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. General: All materials and equipment used shall be standard components, of regular manufacture for this application. All systems and components shall have been thoroughly tested and proven in actual use.
- B. Exceptions to the specification will qualify bid as unacceptable.

## 2.2 OPERATOR'S WORKSTATION

- A. This system is an addition to the existing control system and shall be connected to the existing local area network (LAN) and computer. No additional work station is required.
- B. The new graphics software shall be fully integrated to the owners existing front end software and existing workstation. Floor plan and interactive color graphics shall be provided for the school with each zone providing color indication of the zone comfort level. In addition to the floor plan graphic, each piece of controlled equipment shall be represented by a graphic that is accessible by clicking on the zone or indicated piece of equipment. All points shall be available on the graphic.

## 2.3 BUILDING CONTROLLER

- A. This system is an addition to the existing control system and shall be connected to the existing building controller if feasible. Field verify if existing building controller can be expanded or if additional building controller(s) is necessary.
- B. General:
  - 1. All communication with operator workstation and all application controllers shall be via BACnet. Building controller shall incorporate as a minimum, the functions of a 3-way BACnet router. Controller shall route BACnet messages between the high-speed LAN (Ethernet 10/100MHz), at least 4 master slave token passing (MS/TP) LANs, a point-to-point (PTP – RS-232) connection and an on-board modem.
    - a. Each MS/TP LAN must be software configurable from 9.6 to 76.8Kbps.
    - b. The RJ-45 Ethernet connection must accept either 10Base-T or 100Base-TX BACnet over twisted pair cable (UTP).
    - c. The direct access port must be a female DB-9 connector supporting BACnet temporary PTP connection of a portable BACnet operator terminal at 9.6 to 115.2 Kbps over RS-232 null modem cable.
  - 2. Building controller shall be capable of providing global control strategies for the system based on information from any objects in the system regardless if the object is directly monitored by the controller or by another controller. The program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site or downloaded via remote communications are not acceptable. Changing global strategies via firmware changes is also unacceptable.
  - 3. Programming shall be object-oriented using control function blocks, supporting DDC functions, 1000 Analog Values and 1000 Binary Values. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be resident on workstation and the same tool used for all controllers.
  - 4. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator's workstation or field computer.
  - 5. Building controller shall provide battery-backed real-time (hardware) clock functions.
  - 6. Controller shall have a memory needed to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1.5 years (cumulative).
  - 7. Global control algorithms and automated control functions should execute via 32-bit processor.
  - 8. Controller installation shall include memory-free gel-cell battery providing ongoing power conditioning and noise filtering for operation data integrity. It shall provide up to 5 minutes of powerless operation for orderly shutdown and data backup.
  - 9. BACnet Conformance:
    - a. Building Controller shall as a minimum support Point-to-Point (PTP), MS/TP and

Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a Native BACnet device and shall support simultaneous routing functions between all supported LAN types. Global controller shall be a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:

- b. Clock Functional Group
    - (1) Files Functional Group
    - (2) Reinitialize Functional Group
    - (3) Device Communications Functional Group
    - (4) Event Initiation Functional Group
  - 10. Refer to section 22.2, BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
  - 11. Standard BACnet object types supported shall include as a minimum: Analog Value, Binary Value, Calendar, Device, File, Group, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
  - 12. The Building Controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs) and function as a BACnet Broadcast Management Device (BBMD).
- C. Schedules:
- 1. Each building controller shall support a minimum of 250 BACnet Schedule Objects and 250 BACnet Calendar Objects.
- D. Logging Capabilities:
- 1. Each building controller shall log as minimum 1000 trendlogs. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
  - 2. Logs may be viewed both on-site or off-site via remote communication.
  - 3. Building controller shall periodically upload trended data to networked operator's workstation for long term archiving if desired.
  - 4. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.
  - 5. Alarm Generation:
    - a. Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
    - b. Each alarm may be dialed out as noted in paragraph 2 above.
    - c. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator's terminal or off-site via remote communications.
    - d. Controller must be able to handle up to 1500 alarm setups stored as BACnet event enrollment objects – system destination and actions individually configurable.

## **2.4 TERMINAL UNIT APPLICATION CONTROLLERS (ROOFTOPS, HEAT PUMPS, AC UNITS, FAN COILS)**

- A. General:
- 1. Provide one Native BACnet application controller for each piece of unitary mechanical equipment that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways

shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of unit.

**B. BACnet Conformance:**

1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a Native BACnet device. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
  - a. Files Functional Group
  - b. Reinitialize Functional Group
  - c. Device Communications Functional Group
2. Refer to section 22.2, BACnet Functional Groups in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
3. Standard BACnet object types supported shall include as a minimum—Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
4. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0–5 VDC, 4–20 mA, dry contact signals and a minimum of 3 pulse inputs. Any input on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor. Controller shall include binary outputs on board with analog outputs as needed.
5. All program sequences shall be stored on board controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using same programming tools as building controller and as described in operator workstation section. All programming tools shall be provided and installed as part of system.
6. Application controller shall include support for intelligent room sensor (see Section 2.9.B.). Display on room sensor shall be programmable at controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room sensor.

**C. Smoke Detectors:**

1. Smoke detectors (duct and area type) shall be provided, installed, and wired into the Fire Alarm System by the Electrical Contractor. The Controls Contractor shall be responsible for interlock wiring between duct smoke detectors and control relays, and starter safety circuits.

**2.5 DAMPERS AND VALVES**

**A. Control Dampers:**

1. The sheet metal contractor shall furnish and size all automatic control dampers unless provided with packaged equipment.
2. The sheet metal contractor shall install all dampers unless provided with packaged equipment.

3. Control air dampers shall be parallel blade for two-position control and opposed blade for modulating control applications. Dampers shall be galvanized with nylon bearings. Blade edge and tip seals shall be included for all dampers. Leakage through the damper shall not exceed **4 CFM per square foot at 1" w.c.** Blades shall be 16-gauge minimum and 10" wide maximum and frame shall be of welded channel iron. Dampers over 48" wide shall be equipped with a jackshaft to provide sufficient force throughout the intended operating range.
  4. All dampers used for modulating service shall be opposed blade type arrange for normally open or normally closed operation as required. The damper is to be sized so that when wide open the pressure drop is a sufficient amount of its close-off pressure drop for effective throttling.
  5. All dampers used for two-position or open-close control shall be parallel blade type arranged for normally open or closed operation as required.
  6. Damper linkage hardware shall be constructed of aluminum or corrosion resistant zinc & nickel-plated steel and furnished as follows:
    - a. Bearing support bracket and drive blade pin extension shall be provided for each damper section. Sheet metal contractor shall install bearing support bracket and drive blade pin extension. Sheet metal contractor shall provide permanent indication of blade position by scratching or marking the visible end of the drive blade pin extension.
    - b. Drive pin may be round only if V-bolt and toothed V-clamp is used to cause a cold weld effect for positive gripping. For single bolt or set-screw type actuator fasteners, round damper pin shafts must be milled with at least one side flat to avoid slippage.
- B. Multiple Section Dampers:
1. Size damper sections based on actuator manufacturers specific recommendations for face velocity, differential pressure and damper type. In general:
    - a. Damper section shall not exceed 24 ft-sq. with face velocity £ 1500 FPM.
    - b. Damper section shall not exceed 18 ft-sq. with face velocity £ 2500 FPM.
    - c. Damper section shall not exceed 13 ft-sq. with face velocity £ 3000 FPM.
  2. Damper manufacturer shall supply alignment plates for all multi-section dampers.
  3. Multiple section dampers of two or more shall be arranged to allow actuators to be direct shaft mounted on the outside of the duct.
  4. Multiple section dampers of three or more sections wide shall be arranged with a 3-sided vertical channel (8" wide by 6" deep) within the duct or fan housing and between adjacent damper sections. Vertical channel shall be anchored at the top and bottom to the fan housing or building structure for support. The sides of each damper frame shall be connected to the channels. Holes in the channel shall allow damper drive blade shafts to pass through channel for direct shaft mounting of actuators. Open side of channel shall be faced down stream of the airflow, except for exhaust air dampers.
  5. Multiple section dampers to be mounted flush within a wall or housing opening shall receive either vertical channel supports as described above or sheet metal stand out collars. Sheet metal collars (12" minimum) shall bring each damper section out of the wall to allow direct shaft mounting of the actuator on the side of the collar.

## 2.6 ENCLOSURES

- A. NEMA 2 rated enclosures for inside mounting, provide with weather shield for outside mounting.
- B. All controllers, power supplies and relays shall be mounted in enclosures.
- C. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean environment.
- D. Enclosures shall have hinged, locking doors.

- E. Provide laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate. Laminated plastic shall be 1/8" thick sized appropriately to make label easy to read.
- F. All direct digital controllers located indoors shall be installed in NEMA 1 enclosures. All direct digital controllers located outdoors shall be installed in NEMA 3R enclosures. Enclosures shall be of suitable size to accommodate all power supplies, relays and accessories required for the application. Each enclosure shall include a perforated subpanel for direct mounting of the enclosed devices. Include matched key locks for all enclosures provided.

## **2.7 SENSORS, SWITCHES, CONTROLLERS, TRANSDUCERS, AND MISCELLANEOUS DEVICES**

- A. Temperature Sensors:
  - 1. All temperature sensors to be solid state electronic, factory-calibrated to within 0.5°F, totally interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings. Mount 48 inches above finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells provided by control contractor, but installed by mechanical contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake and in a location that is in the shade most of the day.
- B. Intelligent Room Sensor with LCD Readout:
  - 1. Sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit, and shall allow occupant to raise and lower setpoint, and activate terminal unit for override use—all within limits as programmed by building operator. Sensor shall also allow service technician access to hidden functions as described in sequence of operation.
  - 2. The Intelligent Room Sensor shall simultaneously display room setpoint, room temperature, outside temperature, and fan status (if applicable) at each controller. This unit shall be programmable, allowing site developers the flexibility to configure the display to match their application. The site developer should be able to program the unit to display time-of-day, room humidity and outdoor humidity. Unit must have the capability to show temperatures in Fahrenheit or Centigrade.
  - 3. Override time may be set and viewed in half-hour increments. Override time count down shall be automatic, but may be reset to zero by occupant from the sensor. Time remaining shall be displayed. Display shall show the word "OFF" in unoccupied mode unless a function button is pressed.
  - 4. See sequence of operation for specific operation of LCD displays and function keys in field service mode and in normal occupant mode. Provide intelligent room sensors as specified in point list.
  - 5. Field service mode shall be customizable to fit different applications. If intelligent room sensor is connected to VAV controller, VAV box shall be balanced and all airflow parameters shall be viewed and set from the intelligent room sensor with no computer or
- C. LCD Operator Terminal:
  - 1. The LCD operator terminal is a small wall- or panel-mounted operator terminal that connects directly to the BACnet LAN. The communication design and messaging structure shall comply with ANSI/ASHRAE Standard 135-1995, BACnet. Each operator terminal shall be able to display any BACnet object from anywhere in the BACnet network.
  - 2. Each of these operator's terminals shall have a keypad and an adjustable backlit LCD, with a simple menu structure to give occupants and technicians intuitive access to system information. It shall have a minimum 4-line by 20-character display to allow an operator to query and adjust system values.

3. The system shall allow the connection of up to 16 LCD operator terminals to each Building Controller. The operator shall have the ability to connect to each of these operator terminals with a laptop computer via an RS-232 cable to gain system access, troubleshooting, and display programming.
- D. Field Service Tool:
1. Field service tool shall allow technician to view and modify all setpoints and tuning parameters stored in application controller. In addition, technician shall be able to view status of all inputs and outputs on digital readout. Each piece of data shall have a data code associated with it that is customizable.
  2. Field service tool shall plug into wall sensor and provide all the functionality specified. Operator workstation shall include the capability to disable operation of the field service tool.
  3. Provide Field Service Tool(s) for this project.
- E. Network Connection Tool:
1. Network connection tool shall allow technician to connect a laptop to any MS/TP network or at any MS/TP device and view and modify all information throughout the entire BACnet network. Laptop connection to tool shall be via Ethernet or PTP.
  2. Provide quick connect to MS/TP LAN at each controller. Tool shall be able to adjust to all MS/TP baud rates specified in the BACnet standard.
  3. Provide 1 Network Connection Tool for this project.
- F. Differential Pressure Switches (Air):
1. Provide differential pressure switches across fans and filters for status indication. Differential pressure switches shall have an adjustable setpoint from 0.05" w.c. to 2" w.c. with a switch differential that progressively increases from 0.02" w.c. at minimum to 0.8" w.c. at maximum. Switch shall be SPDT rated for 15A (non-inductive) at 277VAC.
- G. Differential Pressure Switches (Liquid):
1. Provide differential pressure switches across pumps and chillers to prove flow. Differential pressure switches shall have a 0-150 psig working differential pressure and have an adjustable setpoint from 4" w.c. to 43.5" w.c. on a fall and 5.5" w.c. to 45" w.c. on a rise. Liquid differential pressure switch enclosure shall carry a NEMA 4 rating. Switch shall be SPDT rated for 5A (inductive) at 125VAC.
- H. Float Switches:
1. Provide float switches in condensate drain pans as required by code. Float switches shall utilize a magnetically actuated dry reed switch. Float shall be constructed of seamless polypropylene. Switch shall be SPDT rated for 16A (non-inductive) at 120VAC.
- I. Mixed Air Low Limit Controllers (Freezestats):
1. Mixed air low limit controllers shall be manual reset, adjustable setpoint with 20-foot element serpentine across the entering air face of center cooling coil. Control shall be responsive only to the lowest temperature along the element.
- J. Static High Limit Controllers:
1. Discharge static high limit controllers shall be provided on all VAV AHU systems. When discharge static pressure exceeds setpoint, the supply fan shall be de-energized. Manual reset shall be required.
- K. Static Pressure Transducers (Air):
1. Provide static pressure transducers for monitoring supply duct static pressure. Static pressure transducers shall be 100% solid state and shall include glass on silicon, ultra stable capacitance sensors. Each static pressure transducer shall incorporate short circuit and reverse polarity protection. Transmitter output shall be either 0-10VDC or 4-



20mA. Static pressure transducers are to be provided in an enclosure that is suitable for duct mounting. The desired setpoint is to be in the top 50% of the transmitter's operating range.

- L. Differential Pressure Transducers (Air):
  - 1. Provide differential pressure transducers for monitoring air system and airflow measuring station differential pressures. Differential pressure transducers shall be 100% solid state and shall include glass on silicon, ultra stable capacitance sensors. Each differential pressure transducer shall incorporate short circuit and reverse polarity protection. Transducer output shall be either 0-10VDC or 4-20mA. Differential pressure transducers are to be provided in an enclosure that is suitable for duct mounting. The desired setpoint is to be in the top 50% of the transducer's operating range.
  
- M. Current Sensing Relays:
  - 1. Provide current switches for indication of equipment status. Amperage ratings shall be adjustable with the desired setpoint to be in the top 50% of the current relay's operating range. Current sensing relays shall incorporate trip indication LED's and shall be sized for proper operation with the equipment served.
  
- N. Relative Humidity Sensors:
  - 1. Relative humidity sensors shall have an accuracy of +/- 2% from 5 to 95% RH. Output signal shall be either be 0-10VDC or 4-20mA. Humidity transmitters shall be factory calibrated and require no field setting.
  
- O. CO2 Sensors:
  - 1. CO2 sensors shall be space or duct mounted carbon dioxide sensors as required by the application. Space CO2 sensors shall be mounted next to space temperature sensors. The sensor shall have a range of 0-2000 ppm with an accuracy of  $\pm 5\%$ . The response time for the sensor shall be less than one minute. The sensor shall be capable of providing an analog signal proportional to the CO2 level sensed. The signal shall be either 0-10VDC or 4-20mA.
  
- P. Duct/Well Sensors:
  - 1. Sensors for duct and water temperature sensing shall incorporate either RTD or Thermistor sensing devices. Sensing element accuracy shall be 0.1% over the sensor span or better. Where the element is being used for sensing mixed air or coil discharge temperatures and/or the duct cross sectional area is in excess of 14 square feet, the element shall be of the averaging type. Averaging duct sensors shall utilize a 6, 12 or 24 foot sensing element. Immersion sensors shall use matched 316 stainless steel bulb wells. All duct and immersion sensors shall be provided with conduit connection housings. Sensors shall be provided with adequate standoffs for insulation installation.
  
- Q. Selector Switches:
  - 1. Selector switches shall be 2 or 3-position, knob or key type as required by the sequence of operation. Selector switches shall feature oil tight construction and be fitted with snap-fit contact blocks rated for 10A, 600VAC/DC operation. Labels shall be provided indicating switch position.
  
- R. Pushbutton Switches:
  - 1. Pushbutton switches shall be either maintained or momentary as required by the sequence of operation. Pushbutton switches shall feature oil tight construction and be fitted with snap-fit contact blocks rated for 10A, 600VAC/DC operation. Labels shall be provided indicating switch function.

### **PART 3 EXECUTION**

### 3.1 EXAMINATION

- A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.
- B. Notify the owners' representative in writing of conditions detrimental to the proper and timely completion of the work.
- C. Do not begin work until all unsatisfactory conditions are resolved.
- D. Each bid must include all costs associated with providing wiring, conduit, concrete trenching, and earth trenching.

### 3.2 OPERATION

- A. BACnet Object List:
  - 1. The following points as defined for each piece of equipment are designated as follows:
    - a. Binary Out (BO) - Defined as any two-state output (start/stop) (enable/disable), etc.
    - b. Binary In (BI) - Defined as any two-state input (alarm, status), etc.
    - c. Analog In (AI) - Defined as any variable input (temperature) (position), etc.
    - d. Analog Out (AO) - Defined as any electrical variable output. 0–20mA, 4–20mA and 0–10VDC are the only acceptable analog outputs. The driver for analog outputs must come from both hardware and software resident in the controllers. Transducers will not be acceptable under any circumstance.
  - 2. Each and every point will be checked out by the Contractor and the Owner's Representative will inspect each point with the bidder prior to acceptance. Provide complete written documented inspections, test and checkout report. Calibrate all equipment.
- B. DDC Object Type Summary:
  - 1. Provide all database generation.
  - 2. Displays:
    - a. System displays shall show all analog and binary object types within the system. They shall be logically laid out for easy use by the owner. Provide outside air temperature indication on all system displays associated with economizer cycles.
  - 3. Run Time Totalization:
    - a. At a minimum, run time totalization shall be incorporated for each monitored supply fan, return fan, exhaust fan, hot water and chilled water pumps. Warning limits for each point shall be entered for alarm and or maintenance purposes.
  - 4. Trendlog:
    - a. All binary and analog object types (including zones) shall have the capability to be automatically trended.
  - 5. Alarm:
    - a. All analog inputs (High/Low Limits) and selected binary input alarm points shall be prioritized and routed (locally or remotely) with alarm message per owner's requirements.
  - 6. Database Save:
    - a. Provide back-up database for all stand-alone application controllers on disk.

### 3.3 INSTALLATION

- A. General:
  - 1. Install in accordance with manufacturer's instructions.
  - 2. Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

3. Provide a complete and operational temperature control and building automation system based on the following points and sequence of operation. The system shall be complete as to sequences and standard control practices. The determined point list is the minimum amount of points that are to be provided. If additional points are required to meet the sequence of operation, they will be provided.
- B. Location and Installation of Components:
1. Locate and install components for easy accessibility; in general, mount 48 inches above floor with minimum 3'-0" clear access space in front of units. Obtain approval on locations from owner's representative prior to installation.
  2. Enclosures and hardware or wiring shall not block or limit accessibility to service compartments of any other equipment.
  3. The work shall be coordinated fully, as it pertains to the fire protection system, fire alarm system, and electrical power system. All items shall be terminated in the DDC controllers in a predetermined order as indicated in the submittal drawings.
  4. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture and high or low temperatures.
  5. Identify all equipment and panels. Provide permanently mounted tags for all panels.
  6. Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections - sized to suit pipe diameter without restricting flow.
- C. Interlocking and Control Wiring:
1. Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 26 and all national, state and local electrical codes.
  2. Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for all communications trunks.
  3. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the owner's representative prior to rough-in.
  4. Provide auxiliary pilot duty relays on motor starters as required for control function.
  5. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings. Coordinate with electrical contractor.
  6. All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in conduit. All other wiring to be installed neatly and inconspicuously per local code requirements. If local code allows, control wiring above accessible ceiling spaces may be run with plenum rated cable (without conduit).
- D. Installation Requirements:
1. Any panels associated with the control system shall be furnished and installed under this section of the work. Panel wiring shall be terminated by connecting to numbered terminals strips. Wire nut connections shall not be allowed. All wiring shall be color coded and shall be tagged for future identification.
  2. Unless otherwise specified, all devices, panels, etc., furnished and/or installed by the Contractor shall be located where they can be calibrated and maintained from the floor without use of a ladder. These items shall be identified by means of plates made of plastic suitably engraved, embossed or punched, plastic tape will not be acceptable. At completion of job, the Contractor shall submit record drawings of any changes made during construction. This submittal shall be a condition of final payment.
  3. Any conduit on roof shall be absolute minimum and shall have prior written approval.
  4. All conduit used indoor and outdoor shall be metal and shall be of type and fittings to minimize corrosion and moisture entry.

E. Cable Installation and Attachments:

1. Control System wiring and equipment installation shall be in accordance with good engineering practices as established by the TIA/EIA and the NEC. Wiring shall meet all state and local electrical codes. All wiring shall test free from all grounds and shorts. All cable shall be supported from the building structure and bundled.
2. The support system shall provide a protective pathway to eliminate stress that could damage the cabling. The cable shall not be crushed, deformed, skinned, crimped, twisted, or formed into tight radius bends that could compromise the integrity of the cabling. Controls cables shall not be run loose on ceiling grid or ceiling tiles. Support shall be provided by mounting appropriate fasteners which may be loaded with multiple cables. Provided that the weight load is carried by the support rod or wire, the support assembly may attach to the ceiling grid for lateral stabilization. The required support wires for the ceiling grid or light fixtures shall not be utilized. Any fastener attached to the ceiling grid shall not interfere with inserting or removing ceiling tiles. All cabling and supports must be positioned at least 12 inches above the ceiling grid.
3. Controls cables shall be run in bundles above accessible ceilings and supported from building structure. Cabling shall be loosely bundled with wire wraps randomly spaced at 30 to 48 inches on center, wire wraps shall not be tight enough to deform cabling and shall not be used to support the cabling.
4. Attachments for cabling support shall be spaced at 48 to 60 inches on center. The cable bundle shall not be allowed to sag more than 12 inches mid-span between attachments. Attachments shall be sized as follows:

Bundles up to 1/2" dia. (Ten 1/4" cables)	2" bridle ring, Caddy #4BRT32 or equivalent
Bundles up to 3/4" dia. (Sixteen 1/4" cables)	3/4" J-Hook, Caddy #CAT12 or equivalent
Bundles up to 1-5/16" dia. (Fifty 1/4" cables)	1-5/16" J-Hook, Caddy #CAT21 or equivalent
Bundles up to 2" dia. (Eighty 1/4" cables)	2" J-Hook, Caddy #CAT21 or equivalent

Split bundles greater than 2" dia. or provide cable tray.
5. Do not mix different signal strength cables on the same J-Hook (i.e. fire alarm, 25 volt speaker cable). Multiple J-Hooks can be on the same attachment point up to the rated weight of the attachment device.
6. Controls cables shall be run in conduit stubs, where stubs are provided, from wall mounted devices to above accessible ceilings. Conduit shall be required only within walls and concealed spaces to provide access. Provide a plastic snap bushing or sleeve on the end of each conduit stub such as Thomas & Betts Catalog no. 443 - 3/4", 424 - 1", 425 - 1 1/4", 427 - 2" or equivalent.
7. Conduit, duct or track shall be used for controls cable in exposed areas.
8. All conduit, ducts, track and raceways shall be supported from the structure at industry standard intervals for the size specified, utilizing proper anchoring devices and techniques for each type of cable used.
9. All penetrations through fire rated walls or floors shall feature a short length of metal conduit. The hole shall be neatly cut, not oversize or irregular. Seal the interior of the conduit sleeve around the cables and around the outside of the sleeve on each side of the penetration with fire-stop caulk or putty, such as Minnesota Mining & Mfg. Co. (3M) - CP 25WB+ caulk, MPS-2+ putty, or equivalent. Install according to the manufacturers' instructions.
10. All cable shall have a label on both ends utilizing self-laminating, flexible vinyl film and non-smear nylon marking pens. Utilize Tyton Corporation Part No. RO175 Rite-On labels and Part No. FTP1 nylon marking pens or equivalent.
11. Each cable run shall include a three foot service loop with wire tie located in the ceiling above the control unit panel. This is to allow for future re-termination or repair.
12. No terminations or splices shall be installed in or above ceilings. Cable shall be continuous from one device termination to the next.
13. Mount all equipment firmly in place. Route cable in a professional, neat and orderly installation.
14. All cabling shall be placed with regard to the environment, EMI/RFI (interference) and its effect on communication signal transmission.

15. Do not route any controls cable within two feet of any light fixture, HVAC unit service access area, electric panel, or any device containing a motor or transformer.
  16. Low voltage controls cable will not be installed in the same conduit, duct or track with line voltage electrical cable.
  17. Maximum pulling tension should not exceed 25 lb/ft. or manufactures recommendation, whichever is less.
  18. Any pulling compounds utilized must be approved by the cable manufacturer and shall not degrade the strength or electrical characteristics of the cable.
  19. Cable bends shall not exceed the manufacturers' suggested bend radius.
  20. Provide for adequate ventilation in all equipment panels.
  21. Provide wiremold where wiring must run exposed. Obtain advance approval from Architect and Owner before running exposed. Coordinate with Owner and Architect.
  22. For all wiring, provide numbering on all terminations (both ends).
  23. Label all panels, cans, enclosures, controllers and correlate with air conditioning units served. Labeling shall relate to shop drawings and equipment served. Provide wiring diagram inside each enclosure.
  24. Provide a rain-tight enclosure for each rooftop unit controller.
  25. Locate outdoor air sensors shielded and on northern exposure.
- F. Termination practices:
1. Strip back only as much cable jacket as required to terminate.
  2. Preserve wire twists as closely as possible to point of termination (0.5" maximum) to keep signal impairment to a minimum.
  3. Avoid twisting cable during installation.
  4. Electrical Interlocks:
    - a. All electrical interlocks shall be provided as specified. All electrical interlocks shall be made by means of motor starters or shall be accomplished by separate relays. No motor power lead shall be utilized in an interlock circuit.

### 3.4 SERVICES

- A. Field Services:
1. Prepare and start logic control system under provisions of this section.
  2. Start-up and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.
  3. Provide the capability for off-site monitoring at control contractor's local or main office. At a minimum, off-site facility shall be capable of system diagnostics and software download. Owner shall provide phone line for this service for 1 year or as specified.
  4. Provide Owner's Representative with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.
- B. Demonstration:
1. Provide systems demonstration under provisions of Section 23 00 00.
  2. Demonstrate complete operating system to owner's representative.
  3. Provide certificate stating that control system has been tested and adjusted for proper operation.
- C. Programming:
1. Prior to completion of the control installation, schedule time with Owner's designated representatives to evaluate and select programming options and requirements. Contractor shall provide engineer for such meetings and consultations on an as-needed basis. Preparation time for the conference shall be in addition to the "in conference" time, and shall be provided on an as-needed basis without additional cost to the Owner.
  2. The Contractor shall also provide additional coordination as needed with the Owner's representative and Engineer to formulate and determine functions, reports, graphics, and alarms most desirable and suitable for the school district and writing the software

capability. Programming of these items shall be provided. The Contractor shall program the system using coordinated Owner provided schedules for time of day and holidays.

3. No hardware change shall be required for program changes.
- D. Documentation:
1. The Contractor shall provide a complete documentation package to the owner which shall include floor plans indicating location of EMCS equipment, wiring diagrams, bill of materials, data base information, and sequences of operation. The sequences of operation shall be submitted and approved by the owner in writing prior to installation and programming.
- E. Coordination:
1. For construction project installations where electrical and mechanical contractors are responsible for their respective trade, the electrical contractor is to provide line voltage to required equipment and the mechanical contractor is to install any devices that are to be included in systems. It is the controls contractor's responsibility to provide all devices with diagrams for location and coordinate with mechanical contractor prior to mechanical contractor starting installations. Controls contractor shall coordinate and provide all required work and wiring for duct mounted smoke detectors, control relays for unit shutdown, and interface with any fire alarm system. For installations where controls only work is provided, all necessary work shall be performed by the controls contractor.

## **PART 4 SEQUENCE OF OPERATION**

### **4.1 SEQUENCE OF OPERATION**

- A. The following are sequences of operations which will be accomplished by the EMCS. Coordinate with Owner in operating equipment to maximize comfort and economy. All points required to accomplish the sequences will be provided and connected to the EMCS.
- B. DDC Control - Rooftop Units, Split Systems and DX Units, and Heat Pumps: Each unit shall be started and stopped by the EMCS. Automatic override during low or high ambient temperatures shall be provided. Provide one outdoor air sensor per school. Provide an indoor air space sensor for every unit to monitor space temperature, and be capable of remote resetting space temperature by Owner.
- C. Provide one outside air relative humidity sensor and temperature sensor per campus. It is also acceptable to obtain outside air ambient conditions from a nearby weather station.
- D. ACRONYMS:
- |                 |   |
|-----------------|---|
| EMCS            | Energy Management Control System. The EMCS controls all of the HVAC functions as well as lighting schedules and lawn sprinkler schedules. |
| TCS             | Temperature Control Sensor. This is the device that controls the temperature in the space.  |
| VFD             | Variable Frequency Drive.   |
| DDC             | Direct Digital Control.   |
| OAU             | Outside Air Unit.   |
| CO <sub>2</sub> | Carbon Dioxide.   |
| CFM             | Cubic Feet per Minute   |
| GPM             | Gallons Per Minute  |
| A/H             | Air Handler   |
| F/C             | Fan Coil Unit   |
| CHW             | Chilled Water   |
| HW              | Hot Water   |
| VAV             | Variable Air Volume   |

UCP	Unit Control Panel
ppm	Parts Per Million – A measurement of the concentration of one substance within another. In this case, it is the number of CO2 particles in a sample of one million air particles.
Adj	Adjustable – All set points are assumed to be adjustable whether specified or not. The set points specified are values that should be programmed initially but can be changed if necessary.

E. DEFINITIONS:

1. Occupancy Period:
  - a. The period of the day that the owner wants the environmental conditions acceptable for occupancy. Outside air ventilation may not be enabled at all times during the occupancy period. This schedule will be defined for each component of the HVAC system and will not be the same for all components.
2. Outside Air Schedule:
  - a. The period of the day that outside air ventilation is enabled. This schedule will be defined for each component of the HVAC system.
3. Warm-up Mode:
  - a. The time between the end of the unoccupied and start of the occupied period during which the space temperature is increased (night setback) to the normal occupancy temperature.
4. Cool-down Mode:
  - a. The time between the end of the unoccupied and start of the occupied period during which the space temperature is lowered (night setup) to the normal occupied temperature.
5. Unoccupied Period:
  - a. The period of the day that the temperature control setting is lowered (heating) or raised (cooling) to conserve on the amount of energy required to condition the building. The fans are also turned “OFF” to conserve energy.

F. DOCUMENTATION

1. The Contractor shall provide a complete documentation package to the owner which shall include floor plans indicating location of EMCS equipment, wiring diagrams, bill of materials, data base information, and sequences of operation. The sequences of operation shall be submitted and approved by the owner in writing prior to installation and programming.

G. MONITORING

1. Domestic Water Supply Monitoring
  - a. The EMCS shall monitor low flow from the primary domestic water supply to each building during unoccupied schedules for leaks. When the amount of flow is greater than programmed (adj.) for more than 5 minutes (adj.), the EMCS shall send an alarm. The alarm shall be sent both as a text and email message stating the time & date. Provide all flow meters using floating ball technology (Omni Compound C2 water flow meter or equivalent) and controls points for a complete system. Meter shall be provided by controls contractor and installed by plumbing contractor.
2. Electric Meter Monitoring :
  - a. The EMCS shall monitor the electrical energy consumption at the buildings main electric feed. Pulse generator shall be furnished by the utility company and paid for by the owner. The temperature control contractor shall be responsible for coordinating requirements with utility company. The EMCS shall monitor pulse counts and broadcast signal to HMI operator workstation. The Division 26 contractor shall provide a dedicated 1” buried conduit from building to main electrical service for use by the temperature controls contractor. Pulse meters may be located on the MSB, coordinate with electrical contractor.

3. Cooler/Freezer Monitoring:
  - a. The walk-in cooler and the walk-in freezer shall each be monitored for space temperature. The EMCS shall generate an alarm should the space temperature exceed or drop below its assigned alarm limits (adj.).
4. Economizer Operation with FDD (Fault Detection and Diagnostics):
  - a. Each rooftop unit shall have its economizer status monitored by the EMCS. The unit's internal fault detection and diagnostics shall be capable of generating a visible alarm to be seen by the EMCS should the unit be in economizer when conditions are not met, or vice versa.

#### H. CONTROL

1. Domestic Hot Water:
  - a. The domestic hot water heater (s) and associated circulating pump(s) shall be disabled/enabled by the EMCS based on a time schedule. The domestic hot water supply for the hot water heater shall be monitored and shall generate an alarm upon exceeding above or dropping below its assigned alarm limits (adjustable). The points required to accomplish this sequence shall be connected to the nearest available EMCS controller. The price for this sequence shall not include a controller.
2. Freeze Protection:
  - a. Upon the outside air temperature dropping below an adjustable setpoint, all pumps in the building shall be started by the EMCS, all outside air dampers shall be closed, and all valves shall be opened to full flow through the water coil (s). Each building shall be provided with a temperature sensor located outside (northern exposure) to monitor outside air temperature.
3. Outside Lighting:
  - a. Provide auxiliary contactor(s) to control lighting. Include all hardware and software required and connect to nearest EMCS controller. Coordinate with electrical contractor.
4. Gang Toilet Exhaust Fans
  - a. Fans to be disabled/enabled by the EMCS based on a time schedule. The points required to accomplish this sequence shall be connected to the nearest available EMCS controller.
5. Crawlspace Exhaust Fans:

**4.2 Fans are to operate continuously down to 35°F outside air temperature. Measure R.H. and temperature in the crawlspace and outside. Above 35°F outside air, if the outside air has more grains of moisture than the crawlspace then have the capability to turn fSINGLE ZONE HEAT PUMP SPLIT SYSTEM WITH 2 STAGE COMPRESSOR AND CO2 CONTROL**

#### A. GENERAL:

1. Each unit shall be provided with a cooling section, heating section, supply fan section, and a microprocessor control board. The controls contractor shall provide an outside air/return air damper section, and a 0-100% motorized, modulating outside air damper with spring return. The mechanical contractor shall install the damper section. The space temperature sensor shall be provided with a local override button. The temperature control system contractor shall provide a dedicated stand-alone DDC controller for each unit. The occupied/unoccupied mode of operation shall be defined by the EMCS optimum start/stop schedule.

#### B. FAN CONTROL:

1. Fan speed shall be controlled by the air handler, based on its internal controls. The fan shall run in low speed during first stage cooling and high speed during second stage cooling.



C. OUTSIDE AIR CONTROL:

1. During unoccupied operation, the motorized, modulating outside air damper shall be fully closed.
2. During occupied operation, the motorized, modulating outside air damper shall be closed when the outside air temperature is below 20°F (adj.).
3. During occupied operation, the outside air damper shall be set to its minimum position (reference scheduled CFM). The EMCS shall monitor the CO2 level in the space and verify the level of CO2 is below setpoint of 1100 ppm. Upon a rise in CO2 above setpoint of 1100 ppm, the outside air damper shall modulate open from the minimum position to return the CO2 level below 1100 ppm. A linear progression shall be set so that at a CO2 level of 1190 ppm, the outside air damper shall modulate open to the maximum set position (e.g. maximum scheduled value of outside air CFM). An algorithm shall be set so that the outside air CFM follows a linear trend between maximum and minimum CFM for values between 1100 ppm and 1190 ppm. The outside air damper shall never open more than the schedule maximum outside air for the respective mode. Once the CO2 value falls below setpoint of 1100 ppm, the outside air damper shall modulate to its minimum position.

D. TEMPERATURE CONTROL:

1. Warm-up: The EMCS shall determine the required warm-up period based on the optimized start algorithm. In this mode, the outside air damper shall be fully closed and the EMCS will control the unit to reach occupied heating setpoint of 70°F (adjustable). Once the occupied heating setpoint temperature has been reached, the EMCS shall switch the unit to the occupied mode.
2. Cool-down: The EMCS shall determine the required cool-down period based on the optimized start algorithm. In this mode, the outside air damper shall be fully closed and the EMCS will control the unit to reach occupied cooling setpoint temperature of 74°F (adjustable). Once the occupied cooling setpoint temperature has been reached, the EMCS shall switch the unit to the occupied mode.
3. Unoccupied Mode: In the unoccupied mode of operation, the unit outside air damper shall be fully closed and the supply fan shall cycle with the unit's heating and cooling modes. The DDC controller shall enable the heating or cooling as required to maintain the unoccupied heating and cooling setpoints (initially 55°F heating and 82°F cooling) as sensed by the space temperature sensor. Upon a rise in space temperature above the unoccupied cooling setpoint, the DDC controller shall enable the mechanical cooling. On a drop in space temperature below the unoccupied heating setpoint, the DDC controller shall enable the heating. First stage of heating shall be to activate the reversing valve and operate in heat pump mode. Upon a further drop in space temperature, the electric heat shall be energized.
4. The space temperature sensor shall have an override pushbutton. Whenever the override pushbutton is depressed, the unit shall be indexed to the occupied mode for an adjustable period of time (initially 1 hour). After the override time period has expired, the unit shall revert back to the unoccupied mode.
5. Occupied Mode: In the occupied mode of operation, the unit supply fan shall cycle with a call for heating or cooling. The DDC controller shall energize the heating and cooling as required to maintain the occupied heating and cooling setpoints (initially 70°F heating, 74°F cooling) as sensed by a space temperature sensor with digital display and pushbutton override. Space set point shall be user adjustable within ±2°F (adj.). On a rise in space temperature above the occupied cooling setpoint, the DDC controller shall energize the first stage of mechanical cooling. Upon a further rise in space temperature of 2°F (adj.) above the occupied cooling setpoint, the DDC controller shall energize the second stage of mechanical cooling. On a drop in space temperature below the occupied cooling setpoint, the reverse shall occur. On a further drop in space temperature below the occupied heating setpoint, the DDC controller shall operate the reversing valve and operate in heat pump mode. Upon a further drop in space temperature below the occupied heating setpoint, the DDC controller shall energize the electric heat. On a rise

- in space temperature above the heating setpoint, the reverse shall occur.
6. Economizer Mode: In unoccupied or occupied mode, anytime there is a call for cooling in the space, and the outside air temperature is 55°F (adj.) or below, the motorized, modulating outside air damper is to open to the economizer outside air position (Reference scheduled CFM), and provide free cooling to the space. During economizer mode, the compressor is to remain off and the air handler fan is to operate in low speed.
    - a. Fans off. Provide alarms to measure airflow (via sail switch) to alert Owner.
  7. IDF/MDF/Electrical Room Split Systems:
    - a. Mini split DX units are to operate continuously regardless of occupancy schedule to maintain space temperature. EMCS shall monitor space temperature and shall alert owner anytime space temperature exceeds 90° F (adj.).

**END OF SECTION**



## TECHNOLOGY ITEMS FOR ADDENDUM NO. 1

### NOTICE TO PROPOSERS:

- A. This Addendum shall be considered part of the contract documents for the above-mentioned project as though it had been issued at the same time and incorporated integrally therewith. Where provisions of the following supplementary data differ from those of the original contract documents, this Addendum shall govern and take precedence.
- B. Proposers are hereby notified that they shall make any necessary adjustments in their estimate on account of this Addendum. It will be construed that each Proposer's proposal is submitted with full knowledge of all modifications and supplemental data specified therein. Acknowledge receipt of this addendum in the space provided on the proposal form. Failure to do so may subject Proposer to disqualification.

REFERENCE IS MADE TO THE DRAWINGS AND THE PROJECT MANUAL AS NOTED:

### PROJECT MANUAL:

#### AD No 1, Tech. Item 1: **To the Project Manual, Section 28 2000, "VIDEO SURVEILLANCE,"**

- 1) Replace paragraph 2.2 Standard Cameras in its entirety with the following:
  - a. "Acceptable manufacturer: American Dynamics Illustra mini-dome, 3-9mm varifocal lenses, indoor and outdoor cameras with vandal resistant housings, clear domes white housings. Supports H.265 video compression.
  - b. Outdoor Camera: Illustra ADCi610-D121
  - c. Indoor Camera: Illustra ADCi610-D111
  - d. Coordinate with Owner to confirm camera models prior to purchase of equipment."

#### AD No 1, Tech. Item 2: **To the Project Manual, Section 27 5313.13, "WIRELESS CLOCK SYSTEMS,"**

- 1) Remove this section in its entirety and replace with the following:
  - a. Section 27 5313 CLOCK SYSTEMS

### DRAWINGS:

#### AD No 1, Tech. Item 3: **To the Drawings, Sheet TD1.3, "Demolition Floor Plan – Section 1,"**

- 1) Updated Sheet Notes section to remove reference to sheet AVG1.1.

#### AD No 1, Tech. Item 4: **To the Drawings, Sheet T1.2 "Floor Plan – Section 1,"**

- 1) Updated Sheet Notes section to remove reference to sheet AVG1.1.

#### AD No 1, Tech. Item 5: **To the Drawings, Sheet T2.3, "Reflected Ceiling Plan – Section 1,"**

- 1) In response to contractor question regarding intrusion detection devices: added ceiling-mounted motion detectors near entry doors.
- 2) Updated Sheet Notes section to remove reference to sheet AVG1.1.

#### AD No 1, Tech. Item 6: **To the Drawings, Sheet T6.3, "Security Schedules,"**

- 1) Revised camera type schedule with updated camera model numbers.

#### AD No 1, Tech. Item 7:

- 1) In response to contractor question regarding access control system: provide new panel(s) as necessary to add new access control doors to the existing access control system.

Project Name: Jarrell Middle School Addition and Renovations  
Client: Jarrell ISD  
Jarrell, Texas  
Project Number: 01756-02-01

**END OF TECHNOLOGY ADDENDUM**

**Huckabee**

Structural Items For  
Addendum No. # 1  
Page 2 of 2

**SECTION 27 5313  
CLOCK SYSTEMS**

**PART 1 - Part 1 – GENERAL**

**1.1 GENERAL REQUIREMENTS & SCOPE**

- A. The system is specified as described.
  - 1. Extend the existing Telecor clock system.
  - 2. Furnish and install all system equipment, devices, accessories, and material in accordance with these specifications and drawing to provide a complete and operating system.
  - 3. All bids shall be based on the equipment as specified herein. The model designations are that of Telecor. The specifying authority must approve any alternate system
  - 4. System shall include the System Devices
    - a. Telecor (Sapling) analog clocks

**1.2 RELATED SECTIONS**

- A. Division 26 “Electrical”
- B. Division 26 Section “Common Work Results for Electrical”
- C. Division 27 Communications

**1.3 REFERENCES**

- A. System devices specified shall meet or exceed the requirements of the following.
  - 1. National Fire Protection Association (NFPA): 1. NFPA 70 - National Electrical Code (NEC).
  - 2. Manufacturer Installation and User Guides.

**1.4 DEFINITIONS**

- A. This section provides commonly used terms within this specification.
  - 1. GPS: Global Positioning System, a worldwide system that employs a constellation of satellites in an integrated network to determine geographic location anywhere in the world, and which employs and transmits Universal Coordinated Time, the world’s most accurate and reliable time.
  - 2. NTP: Network Time Protocol, used for synchronizing the clocks on computer networks and devices from either a public server or a separate server on a private local area network.
  - 3. UTC: Universal Coordinated Time

**1.5 SYSTEM DESCRIPTION**

- A. The system shall provide for automatic clock correction for Daylight Savings Time. The system shall automatically adjust one hour ahead in the spring and one hour back in the fall on the correct day and at the correct time. Daylight savings shall not require the use of any user input at the time of daylight savings.
- B. Include a Telecor, or Sapling, clock

- C. The system shall have the capabilities of synchronizing with an Atomic Clock. The system, as an option, would automatically set the time and date based on data received from an atomic clock decoder that receives GMT time from a WWVB transmitter located in Fort Collins, CO.
- D. The system shall support appropriate clock type (analog or digital) as per plans and specs.
- E. The system shall provide the ability to synchronize with an existing master clock system.
- F. The system shall provide a Real Time Clock as a back up to normal 60 Hz time keeping. The system shall measure and determine accuracy of the 60 Hz line frequency. If the system determines the frequency to be inaccurate, it shall automatically use the on board RTC for all future time keeping. Systems which do not provide this backup redundancy for time keeping accuracy will not be acceptable.
- G. U.S. only: System must operate in accordance with a “Radio Station Authorization”, Form FCC 601 – LM, granted by the Federal Communications Commission (FCC). This license will be issued to and held by the end user.

#### **1.6 REGULATORY REQUIREMENTS**

- A. Equipment and components furnished shall be of Manufacturer latest model.
- B. System shall be installed in compliance with local and state authorities having jurisdiction.
- C. U.S. only: The end user will hold a license, known as a “Radio Station Authorization” granted by the FCC. This license grants the end user protected use for wireless transmission at the designated frequency. This license will designate a unique “call sign” for each end user.
- D. U.S. only: Transmitter and receiver shall comply with Part 90 of FCC rules as follows: This device may not cause harmful interference. This device must accept interference received, including interference that may cause undesired operation. Transmitter frequency shall be governed by FCC Part 90.35. Transmitter output power shall be governed by FCC Part 90 257 (b).

#### **1.7 SUBMITTALS**

- A. Product Data: Submit complete catalog data for each component, describing physical characteristics and method of installation. Submit brochure showing available colors, styles, sizes, and finishes of clocks.
- B. Manufacturer Instructions: Submit complete installation, set-up and maintenance instructions.
- C. U.S. only: Operating License: Submit evidence of application for FCC Radio Station Authorization prior to installing equipment. Furnish the license or a copy of the application for the license, to the Owner/End User prior to operating the equipment. The original license must be delivered to the Owner/End User.

#### **1.8 QUALITY ASSURANCE**

- A. U.S. only: Permits: Operating license for the transmitter from the FCC.

- B. Qualifications: Manufacturer: Company specializing in manufacturing commercial time system products with a minimum of 30 continuous years of documented experience including 10 or more years of experience producing GPS wireless time systems.
- C. Installer: Company with documented experience in the installation of commercial time systems.
- D. Prior to installation a site survey must be performed to determine proper transmitter placement.

#### **1.9 DELIVERY STORAGE AND HANDLING**

- A. Deliver all components to the site in the Manufacturer original packaging.
- B. Packaging shall contain Manufacturer name and address, product identification number, and other related information.
- C. Store equipment in finished building and in unopened packaging until ready for installation.

#### **1.10 PROJECT SITE CONDITIONS**

- A. Clocks and/or Timers shall not be installed until painting and other finish work in each room is complete.
- B. Programmable Count Down Timers: a computer having the specified minimum system requirements for the scheduling software installation will be available for use in programming the timer.
- C. Transmitter - External Antenna: If required, coordinate installation of system antenna for access to the roof to comply with safety standards detailed in Manufacturer instructions and per local codes.

#### **1.11 SYSTEM STARTUP**

- A. At completion of installation and prior to final acceptance, turn on the equipment; ensure that all equipment is operating properly, and that all system devices and components are functioning.

#### **1.12 WARRANTY**

- A. Devices and components will have a 1 year warranty.
- B. Contractor to provide separate pricing for Manufacturer five-year extended clock warranty.
- C. Contractor to provide separate pricing for Manufacturer extended warranty on system devices.

### **PART 2 - PART 2 PRODUCTS**

#### **2.1 SECTION INCLUDES**

- A. The system and equipment is specified as described in this section.

- B. All bids shall be based on the equipment as specified herein. The model designations are that of Telecor. The specifying authority must approve an alternate system.

## **2.2 MANUFACTURER**

- A. System shall be manufactured by:
  - 1. Telecor Inc., Oswego, IL

## **2.3 ANALOG SECONDARY CLOCKS**

- A. Provide remote Analog Secondary clocks in locations as indicated on the drawings. The clock shall be a synchronous wired 12-hour, 12" semi-flush mounted, or single or double mounted, unit with a sweep second hand.
- B. The clocks shall be synchronous motor driven and operate on 117 volts or 24-volt AC power.
- C. The clocks shall have a high impact shatterproof acrylic lens.

## **2.4 SYSTEM OPERATION**

- A. The system shall perform in the sequence of operation as described.
  - 1. Configure and install system appliance detailed in Manufacturer installation instructions.
  - 2. Configure and install system devices per model specifications detailed in Manufacturer installation instructions.
  - 3. Transmitter Operation
  - 4. When power is first applied to the transmitter, it checks for and displays the software version. It then checks the position of the switches and stores their position in memory. The transmitter looks for the master time source.
  - 5. Master Time Source Operation
  - 6. NTP Time Source: With the transmitter in NTP mode, it connects over the Ethernet to the IP address of the NTP server. This IP address is programmed into the transmitter as part of its configuration. Once the connection to the NTP server is acknowledged, it downloads time data and synchronizes its internal master clock to NTP time. The transmitter then starts to transmit its internal time once every second. The transmitter updates its internal clock in this mode once per hour.
  - 7. Clock and/or Timer Operation
  - 8. After initial setup, the clock and/or timer will shut off the receiver. Six times each day an Analog Clock microprocessor will activate the receiver and starting with the stored channel it will again look for a valid time signal. Every 10 minutes a Digital Clock/Timer will activate the receiver and starting with the stored channel it will again look for a valid time signal. If necessary, the clocks will resynchronize to the correct time.
  - 9. If an Analog clock has not decoded a valid time signal for a pre-determined number of days, it will go to a step mode. Low battery voltage is a common cause of the clock to not properly decode a time signal. If a clock goes into step mode, replace the batteries first and then determine if the clock synchronizes to master time source before attempting other troubleshooting methods.
  - 10. If a Digital Clock/Timer has not decoded a valid time signal for a pre-determined number of days, the display colon indicator will flash continuously until a valid time signal is received.

## **2.5 EQUIPMENT**

- A. The system shall include all equipment as specified.



1. Telecor analog clocks
2. Dual Mounting Bracket

### **PART 3 - PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine conditions with the Installer present for compliance with requirements and other conditions affecting the performance of the system and the system devices.
- B. Do not proceed until unsatisfactory conditions have been corrected.
- C. Verify that construction is complete in spaces to receive equipment and that rooms are clean and dry.
- D. AC-powered devices: Verify that electrical power outlet is near location of clock or timer and the outlet is operational and properly grounded

#### **3.2 INSTALLATION**

- A. General: Install system devices in accordance with applicable codes.
- B. Install system devices in accordance with Manufacturer written instructions.
- C. Provide all system equipment necessary for a complete and operable system.
- D. Comply with requirements of Division 27 Sections "Common Work Results for Communications" and "Communications Horizontal Cabling."
- E. Cables: Install cables in raceways and cable trays except within consoles, cabinets, and desks [and except in accessible ceiling spaces and framed partitions where exposed wiring is allowed by Owner]. Install plenum cable where required. Conceal cable installation where possible.

#### **3.3 FIELD INSPECTION**

- A. Inspection: Make observations to verify that system devices and components are properly labeled.
- B. Prior to final acceptance, inspect each system device and component, adjust as required, and replace parts which are found defective.
- C. At completion of system device installation and prior to final acceptance, turn on the equipment; ensure that all equipment is operating properly, and that the system and all system devices and components are functioning.
- D. Wire Guards
  1. Secure to wall, using approved theft-resistant fasteners.

#### **3.4 MANUFACTURER SERVICES**

- A. System installation guides shall be provided.

- B. If needed, provide technical assistance as demonstrated in the manufacturer guides, on product start-up and system setup, to owners or installers representatives via phone, fax, or email.

### **3.5 CLEANING**

- A. Prior to final acceptance, clean exposed surfaces of devices, using cleaning methods recommended by Manufacturer.
- B. Remove temporary labels from clock faces. Do not remove labels from backs of clocks.

### **3.6 DEMONSTRATION**

- A. Provide training to Owner's representative on setting, adjusting and configuring device and routine maintenance.
- B. Provide training to Owner's representative on installing the software, adjusting and programming the transmitter, setting and adjusting system devices and routine maintenance

### **3.7 PROTECTION**

- A. Protect finished installation until final acceptance of the project.

### **3.8 TESTING**

- A. All devices must be tested at their operational location under normal operational conditions to assure reception of signal.

**END OF SECTION**

REFERENCE SHEET TG1.1 FOR ALL SYMBOLS AND PROJECT SPECIFIC NOTES.

**SHEET NOTES**

01. APPROXIMATE LOCATION OF EXISTING FLUSH MOUNTED INTERCOM SPEAKER(S), CONTRACTOR TO REMOVE PRIOR TO RENOVATIONS AND TRANSMIT TO OWNER FOR STORAGE. CABLING IS TO BE PULLED BACK TO ABOVE EXISTING CEILING. CABLE SHALL BE CAPPED SO AS TO NOT CAUSE A SHORT WITHIN THE EXISTING INTERCOM / PAGING SYSTEM. CABLE LOCATION TO BE NOTED WITHIN CONTRACTOR AS BUILT DRAWINGS. SPEAKERS ARE TO BE RE-INSTALLED AT NEW LOCATIONS SHOWN WITHIN THE T SERIES DRAWINGS.

02. APPROXIMATE LOCATION OF EXISTING OUTDOOR WIRELESS ACCESS POINT (WAP), CONTRACTOR SHALL REMOVE WAP AND TRANSMIT TO OWNER FOR STORAGE. EXISTING WAP CABLING SHALL BE COMPLETELY REMOVED AND NEW CABLING SHALL BE INSTALLED DURING RENOVATION. COORDINATE WITH OWNER FOR EXACT LOCATION AND INSTALLATION OF OUTDOOR WAP.

**KEYNOTE LEGEND**

(NOT ALL KEYNOTES MAY APPLY)

Date  
06/30/18  
Revision /  
1  
ADDENDUM #1

Project:  
JARRELL MS ADDITIONS  
FOR  
JARRELL I.S.D.  
JARRELL, TEXAS

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OR CONSTRUCTION

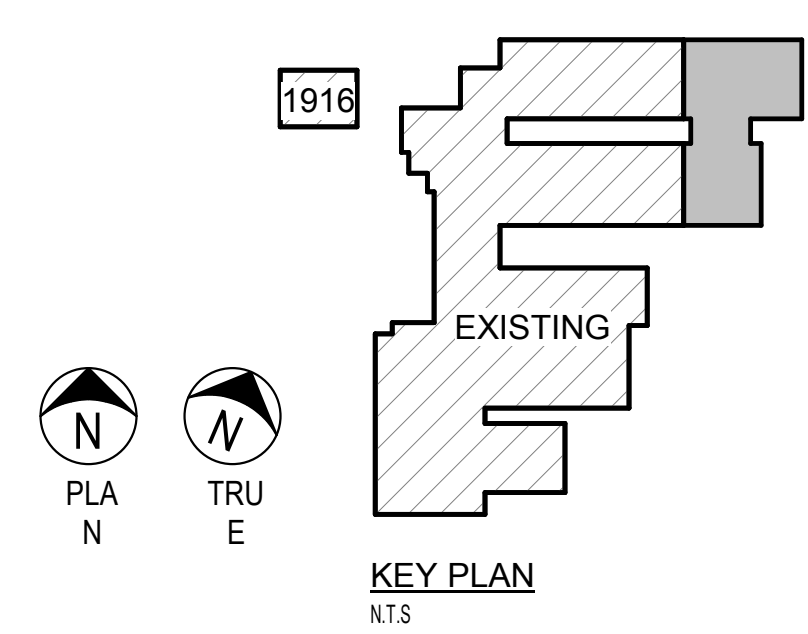
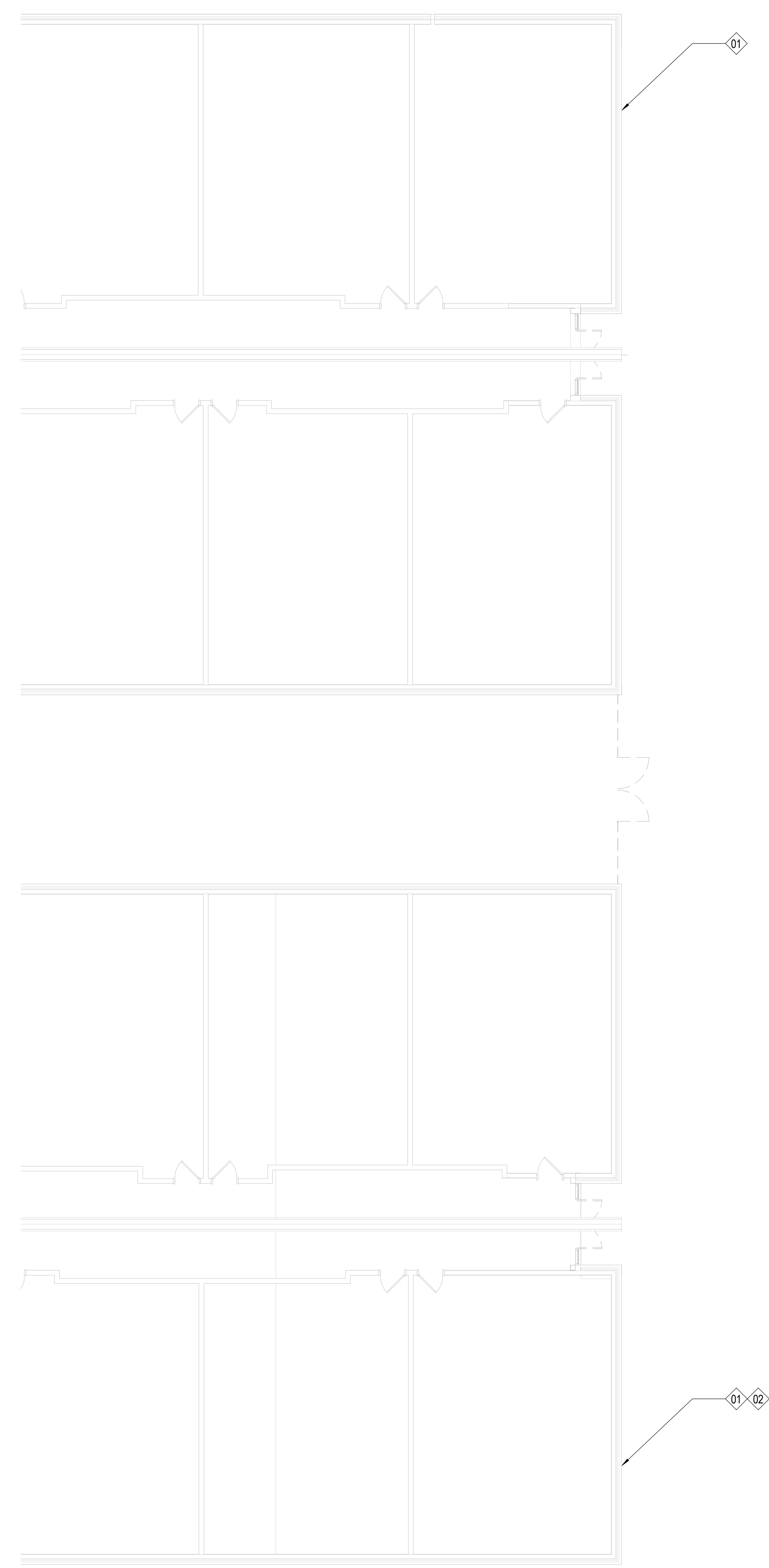
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Project No.	PDS	SEC	AV	DA
D-HUC-1034-02	RR	DP	MB	JF

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**DEMOLITION FLOOR PLAN - SECTION 1**

Job No. 1755-02-01	Sheet No. TD1.3
Drawn By: JK	
Date: 06/20/2018	

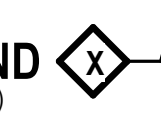


1 FLOOR PLAN - SECTION 1 - DEMOLITION  
TD1.3 1/8" = 1'-0"

REFERENCE SHEET TG1.1 FOR ALL SYMBOLS AND PROJECT SPECIFIC NOTES.

**SHEET NOTES**

- CONTRACTOR SHALL FURNISH (1) 2-GANG BACK BOX WITH (2) 1" CONDUITS STUBBED INTO THE ACCESSIBLE CEILING PLACED NEXT TO THE TEACHER WORK AREA LOCATION FOR AUDIO-VIDEO INTERFACE TO A WALL MOUNTED PROJECTOR.
- NEW LOCATION FOR EXTERIOR PAGING SPEAKERS REMOVED PRIOR TO RENOVATIONS. CONTRACTOR TO PROVIDE NEW CABLING AND CONNECT TO EXISTING INTERCOM / PAGING SYSTEM.
- FURNISH, TERMINATE, TEST AND LABEL COPPER AND FIBER OPTIC BACKBONE CABLES FROM EXISTING MDF TO NEW IDF.

**KEYNOTE LEGEND**   
(NOT ALL KEYNOTES MAY APPLY)

Date: 06/30/18  
 Revision / 1  
 ADDENDUM #1

JARRELL MS ADDITIONS  
 FOR  
 JARRELL I.S.D.  
 JARRELL, TEXAS

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Project No.	PDS	SEC	AV	DA
D-HUC-1034-02	RR	DP	MB	JF

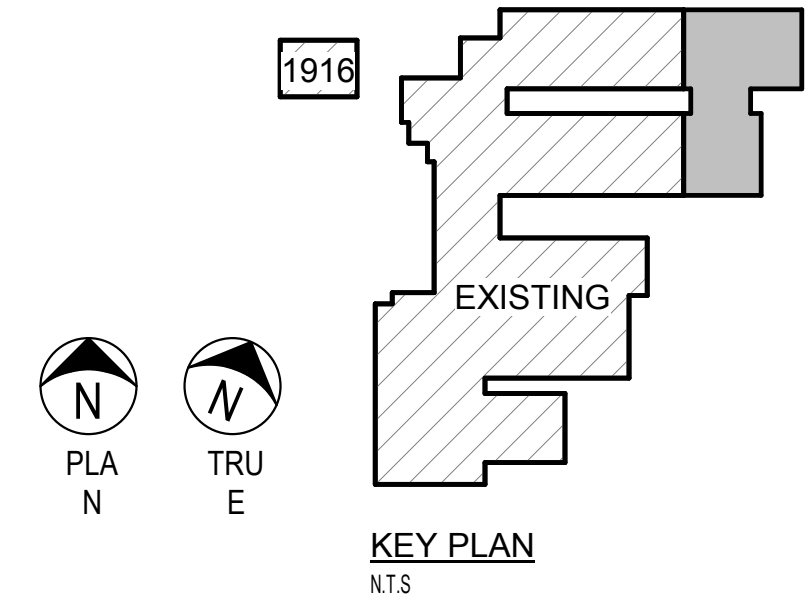
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**FLOOR PLAN - SECTION 1**

Job No. 1755-02-01	Sheet No. T1.2
Drawn By: JK	
Date: 05/22/2018	



**1 FLOOR PLAN - SECTION 1**  
 T1.2  
 1/8" = 1'-0"



REFERENCE SHEET TG1.1 FOR ALL SYMBOLS AND PROJECT SPECIFIC NOTES.

**SHEET NOTES**

CEILING TYPE	TYPE	HEIGHT
ESF - EXPOSED DECK AND STRUCTURE (FINISHED)		
ESP - EXPOSED DECK AND STRUCTURE (PRIMED)		
GYP - SUSPENDED 5/8" GYPSUM BOARD		
GYP1 - SUSPENDED 5/8" TYPE 'X' GYPSUM BOARD (1-HR. RATED)		
L1 - TYPE I 2'-0" X 2'-0" LAY-IN SUSPENDED CEILING TILE (STANDARD CEILING)		
L2 - TYPE II 2'-0" X 2'-0" LAY-IN SUSPENDED CEILING TILE (ABUSE RESISTANT)		
L3 - TYPE III 2'-0" X 2'-0" LAY-IN SUSPENDED CEILING TILE (HIGH HUMIDITY)		
L4 - TYPE IV 2'-0" X 2'-0" LAY-IN SUSPENDED CEILING TILE (VINYL COVERED)		
L5 - TYPE V 2'-0" X 2'-0" LAY-IN SUSPENDED CEILING TILE (ACOUSTIC 'REFLECTIVE')		
L6 - TYPE VI 2'-0" X 2'-0" LAY-IN SUSPENDED CEILING TILE (ACOUSTIC 'ABSORPTIVE')		
L7 - TYPE VII 2'-0" X 2'-0" LAY-IN SUSPENDED CEILING TILE (ACOUSTIC 'ABSORPTIVE' - GEN. USE)		
LWCS - LINEAR WOOD SUSPENDED CEILING		
LCS - LINEAR WOOD SUSPENDED CEILING		
MS - METAL SOFFIT PANELS		
PL - PLASTER		
SPS - SOLID POLYMER SURFACING		
WD - WOOD CEILING		

REFERENCE ARCHITECTURAL DRAWINGS TO VERIFY ALL CEILING TYPES AND HEIGHTS.

**CEILING TAG LEGEND**  
(NOT ALL CEILING TYPES MAY APPLY)

Date: 09/30/18  
Revision: 1  
ADDENDUM #1

JARRELL MS ADDITIONS  
FOR  
JARRELL I.S.D.  
JARRELL, TEXAS

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D-HUC-1034-02	RR	DP	MB	JF

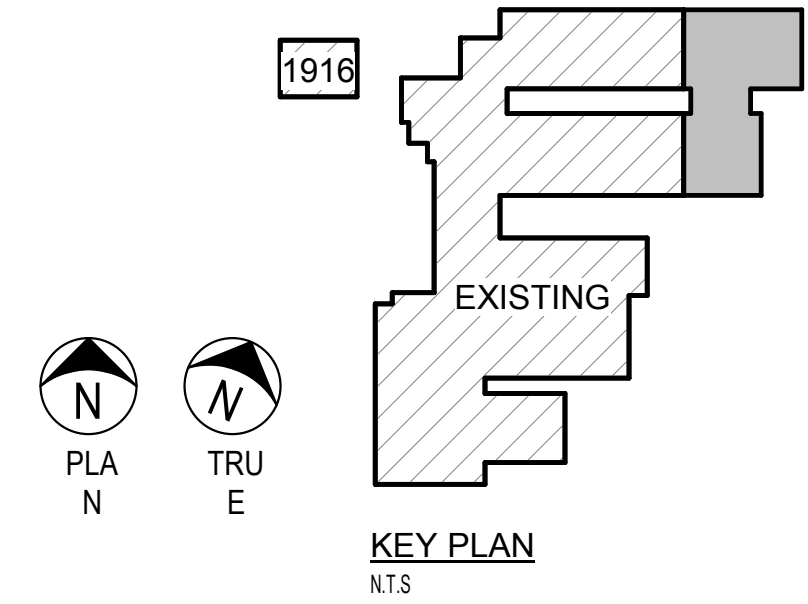
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REFLECTED CEILING PLAN  
- SECTION 1

Job No. 1755-02-01	Sheet No. <b>T2.3</b>
Drawn By: JK	
Date: 05/22/2018	



1 FLOOR PLAN - SECTION 1 - RCP  
1/8" = 1'-0"



CAMERA TYPE SCHEDULE			
CAMERA TYPE	MANUFACTURER	PART #	GENERAL DESCRIPTION
C1	AMERICAN DYNAMICS	ADC610-D111	1080P H.265 3-9 VARIFOCAL INDOOR FIXED DOME
C2	AMERICAN DYNAMICS	ADC610-D121	1080P H.265 3-9 VARIFOCAL OUTDOOR FIXED DOME

CAMERA SCHEDULE				
CAMERA NUMBER	CAMERA TYPE	MOUNTING STRUCTURE	LOCATION	
			ROOM NUMBER	ROOM NAME
1-1	C2	WALL MOUNT UNDER EXISTING CANOPY	EXTERIOR	SOUTHEAST OF 1.19 SCIENCE LAB
1-2	C2	WALL MOUNT	EXTERIOR	SOUTHEAST OF 1.19 SCIENCE LAB
1-3	C2	WALL MOUNT	EXTERIOR	SOUTHEAST OF 1.08 SCIENCE LAB
1-4	C2	WALL MOUNT	EXTERIOR	NORTHEAST OF 1.05 SCIENCE LAB
1-5	C2	WALL MOUNT	EXTERIOR	NORTHEAST OF 1.05 SCIENCE LAB
1-6	C1	CEILING	1.01	CORRIDOR
1-7	C1	CEILING	1.01	CORRIDOR
1-8	C1	CEILING	1.01	CORRIDOR
1-9	C1	CEILING	1.01	CORRIDOR
1-10	C1	CEILING	1.01	CORRIDOR

ACCESS CONTROL DOOR SCHEDULE									
DOOR NUMBER	DOOR TYPE	OPENING	ROOM DESCRIPTION		HARDWARE TYPE	LOCKING HARDWARE	CR	DPS	DETAIL
			ROOM NUMBER	ROOM NAME					
1.01A	B2A-1	DOUBLE	1.01	CORRIDOR	MECHANICAL LOCKSET - MONITORED	NONE	0	Y	1/TS.4
1.01C	B2A-1	DOUBLE	1.01	CORRIDOR	MECHANICAL LOCKSET - MONITORED	NONE	0	Y	1/TS.4

Revision / 1  
Date 06/30/18  
ADDENDUM #1

JARRELL MS ADDITIONS  
FOR  
JARRELL I.S.D.  
JARRELL, TEXAS

Project:

DRAFT  
COPY ONLY  
NOT FOR REGULATORY  
APPROVAL, PERMITTING,  
OR CONSTRUCTION



Project No.	PDS	SEC	AV	DA
D-HUC-1034-02	RR	DP	MB	JF



SECURITY SCHEDULES

Job No. 1755-02-01	Sheet No. T6.3
Drawn By: JK	
Date: 06/20/2018	