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MEP/FP Pre-Bond Narrative	
Project Name:	**Amherst Wilkins School**
Project Location:	**Amherst, New Hampshire**
Document Date:	**November 1, 2023**
Project #:	**729342L**

Yeaton, A division of D&K has been engaged by Banwell Architects to evaluate the two proposed architectural options for the renovation and additions to the existing Wilkins School in Amherst, New Hampshire.

Overview Of Applicable Codes

All new construction elements and systems will conform to the following:

- The New Hampshire State Building Code
- IBC 2018 (International Building Code)
- IECC 2018 (International Energy Conservation Code)
- IMC 2018 (International Mechanical Code)
- IPC 2018 (International Plumbing Code)
- NEC 2020 (National Electrical Code)
- ASHRAE Standards
- Local Authorities Having Jurisdiction (AHJ)
- All Other Applicable Codes, Standards and State Amendments

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Existing Conditions

HVAC Systems:

Heating System – Boiler Room & Pumps: There are (2) Boilers:

- (1) oil fired Buderus GE515-12 cast iron boiler, rated for 1773 MBH when firing at 14.6 GPH. The boiler is in excellent condition and inspection tags indicate it is up to date on servicing. This boiler is in the original mechanical room.
- (1) oil fired Buderus GE515-10 cast iron boiler, rated for 1391 MBH when firing at 11.6 GPH. The boiler is in excellent condition and inspection tags indicate it is up to date on servicing. This boiler is in the mechanical room expansion, behind the original boiler room.
- All pumps are inline, manufactured by Taco. Pump motors are replaced on an as needed basis and serve dedicated zones or boiler injection. Overall, due to good maintenance, the pumps appear to be completely functional and in good condition.

Hydronic Piping & Heating Terminals: Heating hot water is distributed by inline pumps to heating terminals. Piping arrangement appears to be direct return. Hot water piping is steel or copper. Joining method is a mix of grooved piping/mechanical (Victaulic) fittings and threaded steel piping. Copper piping is soldered. The pipe insulation is in fair condition overall. Most piping is located in the attic space above the ceiling insulation.

Exhaust Systems: Bathrooms are exhausted by ceiling exhaust fans. Fans push air out of exterior wall louvers. Systems are aging but all appear to function, no odors were detected.

Ductwork & Duct Accessories: Ductwork observed in the attic space is in fair condition. Ducted hot coils, dampers and control valves are in fair condition.

HVAC-1 is a Trane Blower Coil model BCHC072 with hot water heating coil and Dx Cooling Coil. The unit is suspended in the attic space and provides heating, ventilation and air conditioning to office and administration areas. The unit has an approximate capacity is 2,400 CFM and condenser size is (6) tons cooling. The unit is in fair condition. The associated DX Condensing Unit is installed on grade, outside.

Unit provides constant volume supply/return air to spaces, with 2-way control dampers to allow air in during occupied hours. All duct branches to damper zones are furnished with 3-way hot water heating coils. Coils provide zone level control heat to each space with a thermostat.

All ductwork, insulation, dampers, and accessories appear to be in fair condition.

HV-2 & Exhaust: HV-2 is a Trane Blower Coil, size 8 with hot water heating coil. There is no DX cooling coil. The unit is suspended in the attic space and provides heating and ventilation and air to classrooms in the front section of the building. Approximate capacity is 3,200 CFM based off model number. The unit is in excellent condition. Associated exhaust fan provides return air to unit, or exhaust classroom air outside depending on outdoor air conditions. Fan is Greenheck model BSQ-200 and is in fair condition.

Unit provides constant volume supply/return air to classrooms. This system appears to be in good condition, and, like HVAC-1, some report the controls to be deficient.

All duct branches to damper zones are furnished with 3-way hot water heating coils. Coils provide zone level control heat to each space with a thermostat.

All ductwork, insulation, dampers, and accessories appear to be in fair condition. Aside from any control issues, this system appears to be well maintained.

Air delivery to spaces is through insulated ductwork run to ceiling supply grilles. Return/exhaust from classrooms is by low return grilles in the corners of each classroom. This layout promotes mixing of ventilation air to the breathing zone, although teachers noted that the openings in grilles were large enough for students to "hide" school supplies, food, or other items in them, producing odors over the long term.

HV-3 & Exhaust: HV-3 is a Trane Blower Coil, model BCH090 with hot water heating coil. There is no Dx Cooling Coil. The unit is suspended in the attic space and provides heating and ventilation and air to classrooms in the front section of the building. Approximate capacity is 3,200 CFM based off model number. The unit is in excellent condition. Associated exhaust fan provides return air to unit, or exhaust classroom air outside depending on outdoor air conditions. Fan is Greenheck model BSQ-200 and is in fair condition. Additionally, the unit has been furnished with a Plasma-Air air purification device in the supply duct.

Unit provides constant volume supply/return air to classrooms. This system appears to be in good condition, and, like HVAC-1 and HV-2, some report the control to be faulty. All duct branches to damper zones are furnished with 3-way hot water heating coils. Coils provide zone level control heat to each space with a thermostat.

All ductwork, insulation, dampers, and accessories appear to be in fair condition. Aside from any control issues, this system appears to be well maintained.

Air delivery to spaces is through insulated ductwork run to ceiling supply grilles. Return/exhaust from classrooms is by open transfer from classroom to hallway, and a large ceiling return in the hallway. Current code (IMC 2018) does not allow for the use of a hallway as a return air plenum and this return configuration would not be compliant with code requiring replacement.

Multi-Purpose Room HVAC: The room is served by a Carrier air handling unit model 2BCU112 hung above the stage. The unit appears to be roughly 15-20 years old but is well maintained with clean filters and has good service access. The air handler has a hot water heating coil and no cooling coil. Air is distributed to the multi-purpose area through a "Duct Sock", which has recently been cleaned. This unit is approaching the end of its typical service life of 20 years and the facilities personnel have reported issues with the "Duct Sock".

Kitchen/Cafeteria: Kitchen and cafeteria are heated by a small hot water blower coil with ducted supply and return. Kitchen Hood exhaust/makeup air provided by dedicated rooftop units. The system appears to be 15-20 years old but in clean, fair condition. The hood is not protected by an Ansul system.

Fuel Source: Fuel source for building heat is #2 oil. Oil is stored in a below grade tank located to the north of the building. The tank is monitored by a Veeder-Root System which appears to be in excellent condition.

Building Automation System: A Johnson Controls Metasys Building Automation is installed and controls the boiler rooms and attic air handling systems. The controllers are newly installed and in good condition.

Room temperature sensors branded Johnson Controls are installed in each classroom and operate hot water control valves in the fin-tube radiation and ducted hot water coils in the attic space. Building heat controls received mixed reviews from occupants – with most saying the controls are faulty or in some way deficient.

Plumbing Systems:

The building is served by a municipal water system. A 1 ½" water line enters the facility through a concrete pit, located in the back of the media center. Water riser consists of a 1 ½" Neptune water meter and (1) 1" Watts backflow preventers with isolation valves. The entrance appears to have been rebuilt at least once and connects into a 2" copper main serving the building. Entrance appears to be aging but remains functional. Insulation is deteriorating in all viewable areas and lacks any PVC protective covering.

There are two electric domestic water heaters serving this facility:

- One (1) 4,500-Watt electric hot water heater with 40-gallon storage capacity serves the original building and is in the original boiler room, manufactured by Vaughn. The heater appears to be in fair, but aging, condition. Piping is partially insulated and there is no tempering valve on the hot water distribution.
- One (1) 4,500-Watt electric hot water heater with 40-gallon storage capacity serves the building addition and is located an alcove off the main hallway, exposed to general traffic., manufactured by State. The heater is in new condition and ties into an existing piping network complete with recirculation pump, recirc. line and tempering valve. The system is exposed to view in an occupied corridor.

The system in the original building appears to lack hot water recirculation and is currently out of compliance with 2018 International Energy Code, the NH adopted energy criteria. Storage temperature is set to 110F, which distributes water to fixtures at a code compliant temperature but does not store water at a temperature high enough to eliminate the risk of legionella as outlined by the ASHRAE 188 – Risk Management for Building water Systems guidelines.

Some domestic hot water piping around the heater is not insulated. Note that when running, piping is likely hot and loses heat to the general surroundings. The current energy code requires insulation on hot water system piping, and it is suggested this piping be insulated, with PVC jacketing to cover exposed piping in heavily trafficked areas. The heater located in an IT alcove is accessible to general traffic, and piping is likely hot to the touch.

Water is distributed through the building primarily through hard copper tubing. Older piping is joined using soldered fittings. Press style fittings were observed in a few select areas. Overall, copper piping is in fair condition, valves do not appear to be corroding heavily and joints appear to be in good condition.

Newer runouts to new or replaced fixtures use a combination of PEX tubing and copper piping with press style and "shark-bite" fittings. All tubing and fittings appear to be in good condition.

Note that this piping, located in the attic space, is un-insulated and not compliant with the current State Energy Code.

Piping insulation was observed to be in poor condition, with exposed areas appearing to be torn, dirty or incomplete. Additionally, hot water piping replaced over the years has not been re-insulated. These areas are not currently compliant with the State Energy Code and contribute to heat loss in the system.

Sanitary & Vent Piping: Building sanitary and vent piping were observed to be schedule 40 cast iron. In the attic space, venting was observed to be hub and spigot joints and appeared to be in good condition, with no signs of corrosion.

Roof Drainage: The building has a rear addition section with a flat roof and primary roof drain system. There is no emergency drain system, and the roof does not require one. Arial maps indicate there are (3) primary roof drains.

Plumbing Fixtures:

- The water closets in group restrooms are floor mount with elongated bowl, open seat and top mounted manual flush valves. Fixtures appear to be consistent in manufacturer and style in gang bathrooms and are in good condition. Fixtures appear to meet ADA requirements in these locations. Toilet fixtures located in small class bathrooms are floor mounted and do not appear to meet ADA requirements. Fixtures appear functional and clean.
- The urinals are wall mounted with manual flush valves. Urinals are in good condition and appear to be well maintained.
- The lavatories are wall mounted with manual faucets. There does not appear to be a consistent brand or style throughout the building, but all faucets appeared to be in fair condition with no signs of leaking around the mounting.

Kitchen & Cooking Appliances:

- Wilkins School has a full kitchen connected to the multi-purpose room. Appliances are electric fired, no gas fired equipment was noticed.
- Stainless steel sinks and prep areas are clean and in good condition. Exposed to view vent piping was primarily schedule 40 PVC, and in fair condition. Grease traps were seen but not inspected on the inside. Overall, the kitchen and food storage area appeared to be well maintained and clean.

Fire Suppression Systems:

The building is fully protected by an automatic sprinkler system. A single zone wet-pipe system serves the entire facility. There are no dry valves and there is no fire pump serving the facility. There is a section of the building protected by an anti-freeze mixture of which there is only a few NFPA rated chemicals available, and it appears this system uses glycol which is not approved for freeze protection anymore due to it being flammable in higher concentrations when a treated system has been sitting for long periods. As such a minimum a new rated anti-freeze should be provided.

The building is served by a 6" riser thru the floor reducing to one (1) 4" double check assembly. Riser located in the multi-purpose of the original building. One (1) 4" control valve and wet riser

serve all occupied spaces in the building – classrooms, office areas, hallways, etc. Inspection tags indicate the system was installed in 2008. The current flow test data indicates 84 PSI static and 50 PSI residual pressures were recorded at the riser. Overall, the system is maintained well, passes inspections, and appears to have no issues besides the noted issue with glycol.

Sprinkler Coverage, Piping and Sprinkler Heads: Wet system piping material is black iron with grooved mechanical fittings. Branch piping observed uses threaded fittings. Fittings and piping are in good condition where they were visible.

Sprinkler heads were primarily exposed, vertical pendant style with a mix of semi-recessed pendants were installed in ceiling tiles and hard ceilings. Exposed piping with vertical heads are installed in high window, vaulted areas in the classrooms on the south portion of the building. There do not appear to be any flex-heads installed in this building. There are no sprinklers currently installed in the attic space of this building except for the addition which is glycol'd.

Electrical Systems:

The existing condition below is based on the current field condition and all electrical systems shall be replaced with any proposed future renovations or additions to the school. The system is currently adequate but will have to be upgraded/replaced as required.

Main Electrical Service/Distribution:
The building's electrical service is 800A, 277/480V, 3PH, 4W fed underground from exterior pole mounted transformers. The transformers are located just outside the main electric room via utility pole. The main switchgear is manufactured by Westinghouse. The majority of the panelboards are older recessed panels (Westinghouse, FPE) in the corridors and some newer panels (GE) throughout.

The existing main switchboard (Westinghouse, 1967) is in poor condition and well beyond its useful service life of 30+ years and should be replaced. There are some old panels (Westinghouse) for the kitchen, stage and recessed in the corridor that are beyond their useful life of 30+ years. Similarly, there are a couple of old FPE panels recessed in the corridor. These panesl are no longer manufactured, and replacement parts/breakers are not readily available and costly. These panels should be replaced.

Emergency Power System/Generator:
No existing generator.

Emergency Egress Lighting:
The emergency lighting consists of self-contained battery units, battery units with remote heads, and illuminated exit signs. Classrooms have EBUs. There are a few exit signs that are not illuminated. The exterior egress doors have remote emergency heads except for one location.

The emergency lighting and exit sign coverage is adequate in the corridors, common areas and classrooms but should be replaced in kind with any future renovations/additions. Exterior emergency lights should be added, egress doors lacking coverage.

Lighting and Controls:
The interior lighting consists of recessed fluorescent 2x4s in the corridors, surface mounted strip fixtures in the kitchen/utility areas, pendant mounted 2x4 fluorescent high-bay fixtures in the Café, and pendant fluorescent fixtures in some classrooms. The gym/cafeteria have fluorescent high bay fixtures and the kitchen has surface fluorescent wraparound fixtures. The exterior lighting consists of building mounted LED wall packs. There are a couple of storage spaces that have occupancy sensors. Controls consist mostly of local key switches for the corridors and manual bi-level switches for the classrooms.

The lights should be upgraded to more energy efficient LED fixtures. Automatic lighting controls should be added in common areas, classrooms, storage rooms, offices, conference rooms and public restrooms.

Telecommunications:
Telecom MDF is located on the 1st floor adjacent to the library. Telephone/data cabling terminates at patch panels on a network rack. There are ceiling/wall mounted projectors with smart boards in the classrooms. There are wireless access points throughout the classrooms and common areas. There is a Simplex timeclock system and a Dukane intercom/PA system.

Telecom equipment and cabling is in good condition and public address systems are functioning. No reported issues.

Fire Alarm System:
The fire alarm control panel FACP is an addressable Notifier system with voice evacuation. There are a mix of smoke and heat detectors in the corridors and classrooms (building fully sprinklered), pull stations at the egress doors, and notification throughout. Classrooms have ceiling mounted audible/visual devices. There is no carbon monoxide detector in the mechanical room. Public restrooms have visual notification.

In good condition and coverage is adequate for the existing building. The system shall be replaced with new with a new building or a renovation.

Devices & Wiring:
Power receptacles and tele/data devices are mostly surface, and associated wiring/cabling is routed in surface raceway/wiremold.

Portables:
The portable units are equipment with electrical equipment (lighting, power, fire alarm and low voltage, and shall remain as-is until the portables are removed as required.

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PROPOSED MECHANICAL SYSTEMS

❖ OPTION 1

HVAC Systems:

Ventilation air for the building shall be provided via two (2) dedicated outdoor air systems (DOAS) with an LP Gas burner and packaged DX cooling. They shall be located on the roof of the new additions and ducted to the spaces they serve. DOAS-1 shall serve the front half of the building including the existing wings as indicated in red on Figure 1. DOAS-1 shall be installed on the roof of the new addition. DOAS-2 shall serve the rearmost existing wing and the new 2-story addition as indicated in blue in Figure 1. DOAS-2 shall be installed on the roof of the new addition. DOAS-1&2 shall be sized for approximately 20,000 CFM. The units shall be provided with VFD fans and a total energy recovery wheel (Similar to a Trane Horizon). The fresh air shall be ducted directly into the space with a supply diffuser and the return/exhaust air shall be taken from a return air grille located in the space. The flow rate for spaces without Demand Control Ventilation (DCV) shall be provided with Aldes Car constant airflow regulators. The fresh and exhaust air ducts for high occupancy spaces shall be provided with DCV controlled via automatic control dampers and Ebtron air flow sensors to adjust air flow as required via a space mounted CO_2 sensor (Classrooms, conference, meeting etc.). This will control the ventilation air provided to the space based on the CO_2 levels in the space. The spaces with DCV shall also be provided with humidistats to allow for the ACD to be opened and the DOAS to be put into dehumidification mode if the space exceeds 60% relative humidity. The existing parts of the building will require higher maximum airflows than required strictly for ventilation rates in order to properly dehumidify due to the older loose envelope in the existing building.

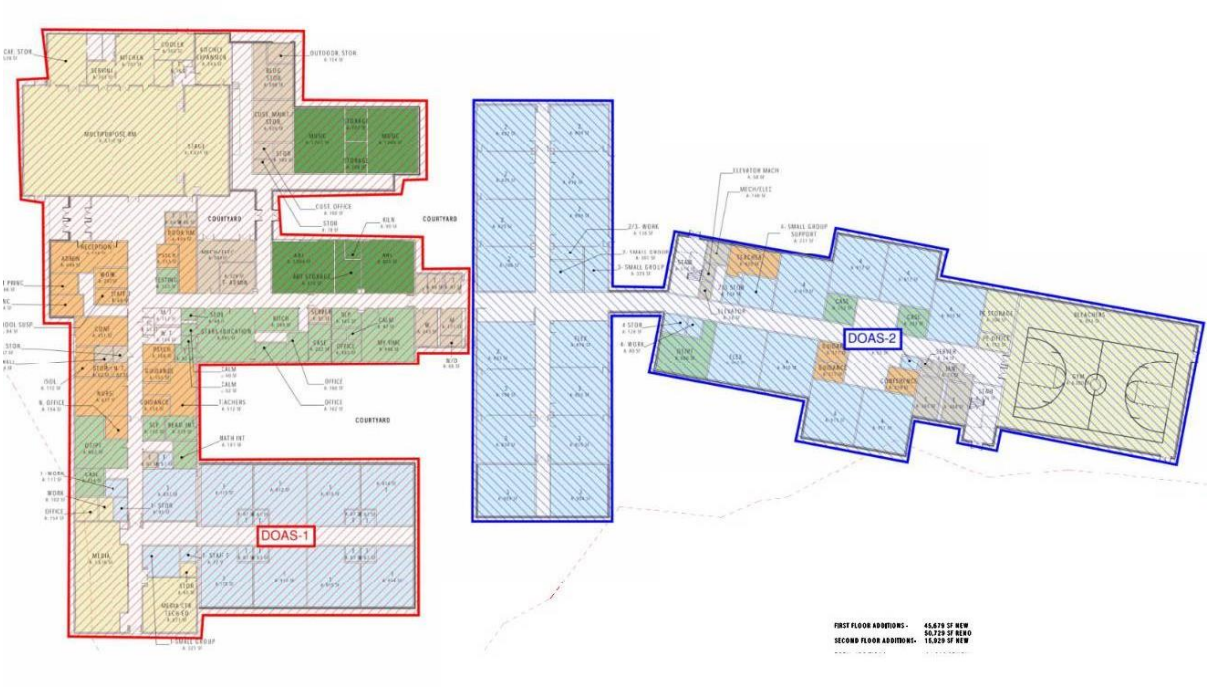

Figure 1: Dedicated Outdoor Air System Zones

Heating for the building shall be provided via a hydronic heating system served from a condensing gas fired boiler plant. The plant shall consist of three (3) 2,000 MBH boilers to provide n+1 redundancy. The boilers shall be sealed combustion type with vents and combustion air vents to the exterior. The boilers shall be piped in a primary/secondary configuration with one boiler pump per boiler and two (2) building circulation pumps sized for and estimated 175 GPM and 40' of head for circulation around the building. All finished spaces shall be provided with radiant ceiling panels for space heating. Unfinished spaces shall be provided with unit heaters and all vestibules shall be provided with cabinet unit heaters. The system shall operate at 160°F leaving water temperature with a ΔT of 40°F to allow for efficient condensing operation of the boilers.

A Variable Refrigerant Flow (VRF) Heat Pump, inclusive of heat reclamation capability, shall be provided to heat and cool the administration office, special services, and nurses office. The heat pumps shall have a rated performance down to -13°F. Ducted fan coils shall be provided for each space (excluding vestibules, utility, and storage rooms) and controlled via wall mounted thermostats. The VRF heat pumps shall be located on the flat roof. The heat pumps shall be provided with snow shrouds and mounted on 18" tall stands. The spaces shall be provided with secondary heating via hydronic radiant ceiling panels.

The existing gym and stage space shall be served by a split DX AHU with hydronic heating coil. The fresh air shall be supplied by DOAS-1. The unit shall be assumed to be a 20-ton unit at this point. The air shall be distributed via spiral ductwork exposed within the space. The existing duct sock shall be removed and replaced. The AHU shall be located in the storage space adjacent to the existing gym.

The proposed gym shall be served by a split DX AHU with hydronic heating coil. The fresh air shall be supplied by DOAS-2. The unit shall be assumed to be a 20-ton unit at this point. The air shall be distributed via spiral ductwork exposed within the space. The AHU is suggested to be hung from the ceiling in the PE Storage adjacent to the gym.

All mechanical, boiler, utility, and storage rooms shall be provided with hydronic unit heaters served off the boiler system. The vestibules shall be provided with a hydronic cabinet unit heater mounted in the ceiling for heating.

The electrical/IT rooms shall be provided with cooling only split DX systems with wall mounted fan coil. The associated condensing unit shall be installed on the roof. The refrigerant line sets shall be piped back to the interior evaporator located on the wall. If the electrical room does not have transformers or any heat generating equipment the split DX can be replaced with 75 CFM of exhaust ducted back to the associated DOAS. Final size and capacity of split DX systems shall be determined based on the heat rejection load of the equipment to be determined.

The kitchen shall be provided with a type 1 commercial exhaust hood for the range including a kitchen exhaust fan to be located on the roof. The hood shall be provided with cold air dampers, Ansul system and hood/fan controls. The kitchen makeup air unit shall be LPG fired and located in above the kitchen ceiling. It shall be sized to match the hood exhaust and shall be integrated with the hood control system.

The existing Tridium Niagara Version 4 system shall be upgraded and extended to all the new equipment in the building. The system shall be provided with a network gateway, remote

monitoring, and trending capabilities. The system shall control the occupancy schedule and all zone set points. The electrical contractor shall provide an allowance for up to 10-line voltage power drops for powering control transformers as required. All equipment, sensors, thermostats and humidistats shall be monitored and controlled via the DDC BMS system including all split DX systems, unit heaters and cabinet unit heaters.

Mechanical ductwork shall be:

- Grease laden kitchen exhaust ductwork shall be Metal-Fab IPIC Series 4G grease duct rated for a minimum zero clearance to combustibles. Access doors for cleaning shall be provided every 15' of run and at all elbows.
- Ductwork shall be galvanized rectangular or round spiral, constructed, and sealed in accordance with SMACNA standards for the applicable pressure classification for both positive and negative pressure, unless specifically noted otherwise.
- Exposed above ground ductwork shall be round spiral ductwork constructed in accordance with the recommendations of the ASHRAE Guide and SMACNA Guide (Current Edition).
- Concealed above ground ductwork shall be made of galvanized steel and constructed in accordance with the recommendations of the ASHRAE Guide and SMACNA Guide (Current Edition).
- Flexible ductwork, where applicable, shall be in lengths no greater than 6'-0" and shall not pass through any fire rated assemblies.

Mechanical piping shall be:

- 2" NPS and smaller shall be Type L Copper with soldered joints or Pro-Press mechanical joint.
- 2-1/2"NPS and larger shall be Schedule 40 Steel with mechanical joints.
- Pipe insulation will be fiberglass with ASJ and/or closed cell of thermal characteristics outlined in IECC 2018 – Chapter 5.

Plumbing Systems:

A new 3" domestic water service shall be provided with an RPZ backflow assembly to be located in the mechanical room. The cold-water piping shall be extended to the new proposed plumbing fixtures in the building as well as back fed to the existing cold-water distribution.

An LP gas service at 12" WC minimum shall be provided to serve the building. The gas piping should be routed to serve all gas fired equipment including boilers and any other gas fired equipment specified.

Domestic Hot Water for the building shall be provided by an LPG fired hot water heater (similar to a HTP Phoenix). They shall be in the mechanical room and piped to all the hot water fixtures in the building. The system discharge temperature shall be controlled via an electronic thermostatic mixing valve and a hot water recirculation system shall be provided to maintain temperature in the hot water piping. The kitchen shall be provided with 140°F hot water supply with its own hot water recirculation line and pump back to the central plant. Any existing water heaters shall be removed.

The public water closets shall be low flow type (1.0 GPF) with manually operated flush valves.

Stainless Steel sinks shall be installed in each classroom and provided with manually operated wing type levers.

The public lavatories shall be low flow type (0.5 GPF) with manual wing type levers.

A new sanitary service shall be provided to serve the plumbing fixtures in the new building. Floor drains shall be provided with trap guards and shall be provided for utility, mechanical, storage rooms. The existing sanitary service shall remain to serve the existing fixtures to remain.

Isolation valves shall be installed at every fixture and at all fixture batteries to facilitate service, as well as clean-outs in sanitary waste and roof drainage systems to allow inspection and/or rodding.

A new storm service shall be provided to serve the proposed additions roof drains. Internal leaders shall be utilized with the first 10'-0" of horizontal piping being insulated for elimination of condensation on cold cast-iron leaders.

Condensate drainage piping shall be provided for all cooling coils and piped back to mop sinks or air gap fittings located where needed in the building.

Non-freeze hose bibs shall be provided on the exterior of the building at minimum of 1 hose bibb per exposure to provide access to all areas of the perimeter of the building. Non-Freeze roof hydrants shall be provided on each flat roof.

Piping Materials:

- Above grade soil: waste and vent piping shall be cast iron with no-hub fittings.
- Below grade soil: waste and vent piping shall be cast iron with hub and spigot joints with rubber gaskets.
- Above grade domestic water piping shall be Type L Copper tubing with soldered or Pro-Press mechanical joints.
- Pipe insulation will be of type and thermal characteristics stipulated in IECC 2018 and MA state energy amendments.
- LP gas piping shall be schedule 40 steel with threaded or welded fittings.
- Above grade condensate pipes shall be schedule 40 PVC DWV piping.
- Above grade storm piping shall be cast iron with no-hub fittings.
- Below grade storm piping shall be cast iron with hub and spigot joints with rubber gaskets.

Fire Protection Systems:

The existing 6" fire service shall remain and shall be modified as required to serve the renovated and proposed spaces. The anti-freeze treated section of fire protection shall be removed and replaced with a dry pipe system to be compliant with the current code. The existing fire department connection and alarm bell can remain as is.

A standpipe system is not required in the current configuration and a fire pump is not expected to be required based on the current system pressure known from the sprinkler test tags.

Sprinklers shall be provided throughout the building as per NFPA 13. The attic shall be modified to be a warm attic to allow for installation of a wet system throughout the existing portion of the building.

Fire Protection Piping:

- 2" NPS and below shall be black steel schedule 40 pipe with threaded joints
- 2 ½" NPS and above shall be schedule 10 steel pipe with mechanical roll grove fittings and mechanical joints.
- All exposed piping in finished spaces shall be primed and painted.

❖ OPTION #2

HVAC Systems:

Ventilation air for the building shall be provided via two (2) dedicated outdoor air systems (DOAS) with an LP Gas burner and packaged DX cooling. They shall be located on the roof of the new additions and ducted to the spaces they serve. DOAS-1 shall serve the front half of the building including the existing to remain spaces. DOAS-2 shall serve the rear half of the proposed building including the second floor. DOAS-1&2 shall be sized for approximately 22,000 CFM. The units shall be provided with VFD fans and a total energy recovery wheel (Similar to a Trane Horizon). The fresh air shall be ducted directly into the space with a supply diffuser and the return/exhaust air shall be taken from a return air grille located in the space. The flow rate for spaces without Demand Control Ventilation (DCV) shall be provided with Aldes Car constant airflow regulators. The fresh and exhaust air ducts for high occupancy spaces shall be provided with DCV controlled via automatic control dampers and Ebtron air flow sensors to adjust air flow as required via a space mounted CO_2 sensor (Classrooms, conference, meeting etc.). This will control the ventilation air provided to the space based on the CO_2 levels in the space. The spaces with DCV shall also be provided with humidistats to allow for the ACD to be opened and the DOAS to be put into dehumidification mode if the space exceeds 60% relative humidity. The existing parts of the building will require higher maximum airflows than required strictly for ventilation rates in order to properly dehumidify due to the older looser envelope in the existing building.

Heating for the building shall be provided via a hydronic heating system served from a condensing gas fired boiler plant. The plant shall consist of three (3) 2,500 MBH boilers to provide n+1 redundancy. The boilers shall be sealed combustion type with vents and combustion air vents to the exterior. The boilers shall be piped in a primary/secondary configuration with one boiler pump per boiler and two (2) building circulation pumps sized for and estimated 175 GPM and 40' of head for circulation around the building. All finished spaces shall be provided with radiant ceiling panels for space heating. Unfinished spaces shall be provided with unit heaters and all vestibules shall be provided with cabinet unit heaters. The system shall operate at 160°F leaving water temperature with a ΔT of 40°F to allow for efficient condensing operation of the boilers.

A Variable Refrigerant Flow (VRF) Heat Pump, inclusive of heat reclamation capability, shall be provided to heat and cool the administration office, special services, and nurses' office. The heat pumps shall have a rated performance down to -13°F. Ducted fan coils shall be provided for each

space (excluding vestibules, utility, and storage rooms) and controlled via wall mounted thermostats. The VRF heat pumps shall be located on the flat roof. The heat pumps shall be provided with snow shrouds and mounted on 18" tall stands. The spaces shall be provided with secondary heating via hydronic radiant ceiling panels.

The cafeteria and stage space shall be served by a split DX AHU with hydronic heating coil. The fresh air shall be supplied by DOAS-1. The unit shall be assumed to be a 20-ton unit at this point. The air shall be distributed via spiral ductwork exposed within the space. The existing duct sock shall be removed and replaced.

The proposed gym shall be served by a split DX AHU with hydronic heating coil. The fresh air shall be supplied by DOAS-1. The unit shall be assumed to be a 20-ton unit at this point. The air shall be distributed via spiral ductwork exposed within the space.

All mechanical, boiler, utility, and storage rooms shall be provided with hydronic unit heaters served off the boiler system. The vestibules shall be provided with a hydronic cabinet unit heater mounted in the ceiling for heating.

The electrical/IT rooms shall be provided with cooling only split DX systems with wall mounted fan coil. The associated condensing unit shall be installed on the roof. The refrigerant line sets shall be piped back to the interior evaporator located on the wall. If the electrical room does not have transformers or any heat generating equipment the split DX can be replaced with 75 CFM of exhaust ducted back to the associated DOAS. Final size and capacity of split DX systems shall be determined based on the heat rejection load of the equipment to be determined.

The kitchen shall be provided with a type 1 commercial exhaust hood for the range including a kitchen exhaust fan to be located on the roof. The hood shall be provided with cold air dampers, Ansul system and hood/fan controls. The kitchen makeup air unit shall be LPG fired and located above the kitchen ceiling. It shall be sized to match the hood exhaust and shall be integrated with the hood control system.

The existing Tridium Niagara Version 4 system shall be upgraded and extended to all the new equipment in the building. The system shall be provided with a network gateway, remote monitoring, and trending capabilities. The system shall control the occupancy schedule and all zone set points. The electrical contractor shall provide an allowance for up to 10-line voltage power drops for powering control transformers as required. All equipment, sensors, thermostats and humidistats shall be monitored and controlled via the DDC BMS system including all split DX systems, unit heaters and cabinet unit heaters.

Mechanical ductwork shall be:

- Grease laden kitchen exhaust ductwork shall be Metal-Fab IPIC Series 4G grease duct rated for a minimum zero clearance to combustibles. Access doors for cleaning shall be provided every 15' of run and at all elbows.
- Ductwork shall be galvanized rectangular or round spiral, constructed, and sealed in accordance with SMACNA standards for the applicable pressure classification for both positive and negative pressure, unless specifically noted otherwise.
- Exposed above ground ductwork shall be round spiral ductwork constructed in accordance with the recommendations of the ASHRAE Guide and SMACNA Guide (Current Edition).

- Concealed above ground ductwork shall be made of galvanized steel and constructed in accordance with the recommendations of the ASHRAE Guide and SMACNA Guide (Current Edition).
- Flexible ductwork, where applicable, shall be in lengths no greater than 6'-0" and shall not pass through any fire rated assemblies.

Mechanical piping shall be:

- 2" NPS and smaller shall be Type L Copper with soldered joints or Pro-Press mechanical joint.
- 2-1/2" NPS and larger shall be Schedule 40 Steel with mechanical joints.
- Pipe insulation will be fiberglass with ASJ and/or closed cell of thermal characteristics outlined in IECC 2018 – Chapter 5.

Plumbing Systems:

A new 3" domestic water service shall be provided with an RPZ backflow assembly to be located in the mechanical room. The cold-water piping shall be extended to the new proposed plumbing fixtures in the building as well as back fed to the existing cold-water distribution.

An LP gas service at 12" WC minimum shall be provided to serve the building. The gas piping should be routed to serve all gas fired equipment including boilers and any other gas fired equipment specified.

Domestic Hot Water for the building shall be provided by an LPG fired hot water heater (similar to a HTP Phoenix). They shall be in the mechanical room and piped to all the hot water fixtures in the building. The system discharge temperature shall be controlled via an electronic thermostatic mixing valve and a hot water recirculation system shall be provided to maintain temperature in the hot water piping. The kitchen shall be provided with 140°F hot water supply with its own hot water recirculation line and pump back to the central plant. Any existing water heaters shall be removed.

The public water closets shall be low flow type (1.0 GPF) with manually operated flush valves.

Stainless Steel sinks shall be installed in each classroom and provided with manually operated wing type levers.

The public lavatories shall be low flow type (0.5 GPF) with manual wing type levers.

A new 6" sanitary service shall be provided to serve the plumbing fixtures in the new building. Floor drains shall be provided with trap guards and shall be provided for utility, mechanical, storage rooms. The existing sanitary service shall remain to serve the existing fixtures to remain.

Isolation valves shall be installed at every fixture and at all fixture batteries to facilitate service, as well as clean-outs in sanitary waste and roof drainage systems to allow inspection and/or rodding.

A new storm service shall be provided to serve the proposed additions roof drains. Internal leaders shall be utilized with the first 10'-0" of horizontal piping being insulated for elimination of condensation on cold cast-iron leaders.

Condensate drainage piping shall be provided for all cooling coils and piped back to mop sinks or air gap fittings located where needed in the building.

Non-freeze hose bibs shall be provided on the exterior of the building at minimum of 1 hose bibb per exposure to provide access to all areas of the perimeter of the building. Non-Freeze roof hydrants shall be provided on each flat roof.

Piping Materials:

- Above grade soil: waste and vent piping shall be cast iron with no-hub fittings.
- Below grade soil: waste and vent piping shall be cast iron with hub and spigot joints with rubber gaskets.
- Above grade domestic water piping shall be Type L Copper tubing with soldered or Pro-Press mechanical joints.
- Pipe insulation will be of type and thermal characteristics stipulated in IECC 2018 and MA state energy amendments.
- LP gas piping shall be schedule 40 steel with threaded or welded fittings.
- Above grade condensate pipes shall be schedule 40 PVC DWV piping.
- Above grade storm piping shall be cast iron with no-hub fittings.
- Below grade storm piping shall be cast iron with hub and spigot joints with rubber gaskets.

Fire Protection Systems:

The existing 6" fire service shall remain and shall be modified as required to serve the renovated and proposed spaces. A wet sprinkler system shall be extended throughout the building. A sprinkler zone control valve shall be provided to monitor the sprinklers on each floor.

A standpipe system is not required in the current configuration and a fire pump is not expected to be required based on the current system pressure known from the sprinkler test tags.

Sprinklers shall be provided throughout the building as per NFPA 13. The warm attic shall be protected by a wet sprinkler system. A 5" storz style fire department connection shall be provided for fire department use as per the Fire Marshal having jurisdiction.

Fire Protection Piping:

- 2" NPS and below shall be black steel schedule 40 pipe with threaded joints
- 2 ½" NPS and above shall be schedule 10 steel pipe with mechanical roll grove fittings and mechanical joints.
- All exposed piping in finished spaces shall be primed and painted.

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PROPOSED ELECTRICAL

❖ OPTIONS 1 & 2

Electrical Service/Power Distribution:

A utility pad mounted transformer with primary service from an existing riser pole shall be provided on site. The service shall be a new 1600 Amp, 480/277 volts, three phase four wire. The service entrance wiring shall be installed in accordance with Eversource Standards and Regulations. Primary cabling, transformer and terminations shall be provided by the utility.

A fully rated 480/277 volt main distribution panel within main electric room with feeder circuit breakers shall serve the large heating/ventilation/cooling equipment, 480/277 volt lighting panels, and dry type transformers serving general plug load power panels. There shall be fully rated (65K AIC) 480/277V and 208/120V panelboards to serve large HVAC and motor/equipment loads, lighting, and computer/plug loads. All electrical panelboards, dry-type transformers, and distribution equipment shall be located within dedicated locked electric rooms. There should be a panelboard within 150-ft of each classroom to minimize circuit lengths and voltage drop. The gym/stage, boiler rm., and kitchen shall have dedicated panels sized accordingly to serve each space. Large HVAC, elevator and/or equipment loads shall be fed from the main switchboard distribution section. Arc-flash mitigation shall be provided for all circuit breakers rated 1200A or higher.

One dedicated 480 volt, three phase feeders shall be provided to support the elevator.

Dry type Transformers shall provide power to 120/208 volt plug load panelboards, minimum of one per floor.

Primary cables and terminations are by the utility. Equipment pad, underground conduits, cabling, and grounding/bonding shall comply with (Eversource) utility construction standards. All charges by the utility, associated with providing permanent electrical power to the facility, shall be the responsibility of the electrical contractor**.**

Emergency Power System/Generator:

An Emergency Power System (NEC 700) shall be provided for backup during electric utility outages of selective loads including emergency lighting, HVAC for freeze protection, kitchen walk-in cooler/freezer, and IT/Security servers and headend. A liquid propane fueled emergency generator in Level 2 sound-attenuated enclosure with critical grade silencer and fuel tank storage (72-hour storage) will be provided, sized as a 300kW, 480/277V, 3PH, 4W power plant, with a unit mounted output circuit breakers including life safety (200A) and standby (400A). Provide physical separation/barrier between the emergency and standby output circuit breakers. The generator shall be located nearest the normal electric service entrance/main electric room.

Emergency power feeder shall be connected to an indoor 200 ampere rated automatic transfer switch with the normal side 200A branch feeder from the MDP, 200A emergency feeder from the

generator, and load side 200A feeder to a dedicated generator life safety distribution panel 'LSDP'. Include manual triple switch for portable/alternate source of power in accordance with NEC 700.3. Transfer switches shall be rated for 65,000 AIC, at 480/277 volts three phase, four wire**.** Provide surge protection on all emergency system distribution panels. Emergency feeders shall be installed with proper fire protection methods which consist of either fully protected by fire protection system, listed cable with minimum 2hr fire rating, or cable encased in min. 2in of concrete.

Standby power feeder shall be connected to an indoor 400 ampere rated automatic transfer switch with the normal side 400A branch feeder from the MDP, 400A standby feeder from the generator, and load side 400A feeder to a dedicated generator standby distribution panel 'SBDP'. Transfer switch shall be rated for 65,000 AIC, at 480/277 volts three phase, four wire**.**

Emergency Egress Lighting:

Provide emergency lighting as selective lighting fixtures connected to the generator life safety system. Provide a UL 924 lighting relay control device for all emergency fixtures controlled by separate local switch/sensors and emergency bypass modules for the lighting control system to override controls during loss of normal power. Provide stand-alone, self-contained emergency battery units in electrical, mechanical, and IT/data rooms. Provide LED/thermoplastic style exit signs with battery backup and connected to the generator life safety system along egress paths and doors. All common areas including vestibules/corridors, public restrooms, conference/meeting rooms, utility rooms, gymnasium, cafeteria, and classrooms shall have emergency lighting. Wall pack fixtures located near exterior emergency egress doors shall have integral battery backup and be connected to the emergency generator to provide emergency egress lighting.

Lighting and Controls:

All interior lighting shall be LED type. Provide occupancy sensor controls in offices, classrooms, storage rooms, restrooms, multi-purpose/meeting rooms and daylight responsive controls in areas within daylight zones. All occupancy and daylight sensors shall be connected as part of a digital, networked lighting control system. There shall be local override multi-level digital wall stations in each individual space such as offices, classrooms, and labs. The common areas including corridors shall be controlled by the lighting control system as time-of-day/programmed schedule with local occupancy sensor control for off-hours. Strategically placed override wall stations will be provided at suitable common area locations such as entry vestibule/lobby areas. A small relay-based lighting control panel will control site lighting as time-of-day/programmed schedule and integral fixture photocells. The basis of design for this product will be Acuity nLight Product. The exterior building mounted lighting shall be LED type full cutoff fixtures with integral photocells. Fixtures located near emergency egress doors shall have integral battery backup to provide emergency egress lighting. Provide light bollards along walkways in front of the building.

Ambient light levels shall be maintained in keeping with IESNA guidelines.

Interior lighting shall be LED products maintaining the following minimum lighting levels:

- 30-50 foot-candle for classrooms, offices and meeting rooms.
- 10-20 foot-candle for corridors and storage rooms.
- 10-30 foot-candle for restrooms and vestibule areas.
- 50-75 foot-candle for gymnasium and cafeteria.

Exterior lighting shall be LED products maintaining the following minimum lighting levels:

- 0.5-2 foot-candle for building exterior.
- 10-15 foot-candle for building entries.

Based on the Lighting Power Density listed for 2018 IECC, a school shall meet the requirement of a maximum of .81watts/sf.

Typical Classroom:

Lights in classroom shall be either recessed 2x4 or 2x2 LED volumetric fixtures for drop ACT ceilings, or parallel rows of continuous pendant direct/indirect linear fixtures. Vacancy sensors shall be provided as well as daylight sensors along the window wall. One set of two zone on/off raise/lower switches located at the main entrance door with another set located at secondary entrances.

Typical Office/Meeting Room:

Lights in the offices/meeting rooms to be 2x2 or 2x4 recessed volumetric LED to be located 6' on center with ceiling or wall occupancy/daylight sensors depending on size of room.

Typical Corridor:

Lights in the corridors to be 2x2 recessed volumetric LED to be located 12' on center, occupancy sensors to be located 40' on center allowing on/off control during off/closed hours.

Typical Entry/Vestibule:

Lights in the entry/vestibule area to be decorative pendant fixtures, and/or track spot/accent lights for wall displays, with local occupancy/daylight sensors allowing high/low dimming based on daylight zones during operational hours and on/off during off/closed hours.

Telecommunications:

A full and complete Telecommunications and Data system shall be provided for the proposed program layouts. Provide minimum two 4-inch underground conduits from new utility riser pole to demarcation inside building. Wiring shall consist of but not limited to: Jacks, faceplates, patch panels, termination blocks, CAT 6 copper horizontal cables, exterior/interior multimode 50-micron fiber links, and associated equipment required to support the installation, including racks, cable/ladder tray, conduits, and pathways. All active equipment including network switches and UPS units are by others.

Offices/meeting rooms shall have a minimum (4) tele/data outlets, each on a different wall or as directed by the owner. Each classroom shall have (1) wireless access point with (2) CAT6 drops and (1) wall phone with (1) CAT6 drop. The computer lab spaces shall have a data outlet (2-CAT6 drops) for each computer/workstation or as directed by the owner. Each tele/data outlet location shall be provided with two dedicated CAT6 cable drops for data/VoIP.
Wireless access points shall be provided as required throughout, at a minimum (1) for each space including classrooms but excluding private offices, restrooms, and storage areas with (2) CAT6 drops per wireless access point. Data drops will be provided for BMS/BAS Systems. Data drops shall originate from respective floor IDF rooms. Provide minimum two 4-inch conduits between IDF rooms on the same floor and minimum three 4-inch conduits between IDF rooms on different

floors. MDF and IDF rooms shall be provided with fire-rated mounting backboards, emergency power receptacles and ground bus bar.

There shall be a combination MDF/Data closet for the main server network switches and head-end equipment by others. The electrical contractor shall provide all passive equipment (data/fiber patch panels), floor mounted network racks, devices/jacks, cable & cable terminations, certified testing for a complete and operational system. Provide mounting backboards, dedicated quad receptacles, ladder tray and ground bus bar/bonding per TIA-607-B standards. The Data closets shall be located so that data cable lengths are limited to 290-ft maximum. Provide minimum 2-gang back box, 1" pathways with pull string to above accessible ceiling/space for all device locations. Provide cable hangers/trays to data closets only above accessible ceilings, otherwise, provide entirely conduit. Cabling shall be riser rated Category 6.

Provide a fully installed wired networked/IP-based clock system for the proposed with headend unit at the MDF room. The system will utilize PoE technology to synchronized clocks in all classrooms, offices/meeting rooms, gymnasium, and cafeteria.

Provide a fully installed school IP intercom/PA system by Valcom or equal and ceiling tile 2-way speakers within all classrooms, offices/meeting rooms and throughout common areas/corridors. The phone system will be used for paging. Multiple paging zones shall be provided throughout the school. Classrooms shall be provided with handsets and desk stations. Provide emergency indoor and outdoor horns/strobes for emergency notification alerting.

Fire Alarm System:

A fully addressable fire alarm system with voice evacuation shall be provided for the building. Provide fire alarm wiring, devices and equipment associated with the installation of a Voice Evacuation Fire Alarm System. Wiring will include audible & visual notification devices, initiation devices and sensors as required. Local transmission of alarm will be digital communication over leased telephone lines, cellular/IP transmitter or as directed by the Local Fire Department.

Provide smoke detector coverage 30' on center in corridors, entry vestibule, and electric/IT rooms. Provide heat detector coverage in mechanical rooms and accessible attic spaces. Provide manual pull stations within 5 feet of each exit door. Duct smoke detectors will be provided along with associated remote alarm indicators and test switches for air-handling units rated over 2000 CFM on both supply and return ducts/plenums. Provide door holdback devices at smoke doors and associated power for door release. Provide wiring and connections for all fire protection alarm switch monitoring and alarm bell. Provide 120VAC wiring for alarm bell. Provide interconnect wiring and monitor modules for sprinkler fire alarm flow, tamper, and low-pressure switches, elevator recall, and kitchen hood/fire suppression system. Provide interface with building management and security systems for unlock/release as required. Provide interface with public address/sound/lighting control systems for override on activation of alarm.

Carbon monoxide detection shall be provided in areas with fossil-fuel burning equipment including the mechanical room. Provide audio/visual notification speaker/strobe devices throughout including strobe-only devices in restrooms and small spaces. Fire alarm wiring shall be type MC fire alarm rated cable where completely concealed or conduit and wire if exposed.

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Devices & Wiring:

Power receptacles shall be provided to comply with National Electrical Code NEC 210.8 (Ground-Fault Protection) including restrooms, kitchens, classroom area countertops with sinks. Receptacles shall be provided to comply with NEC 210.63 within 25-ft of all HVAC equipment and shall be weatherproof ground-fault receptacles when located on exterior. Provide dedicated receptacles in Elec/Data closets for general power and telecommunication equipment. Provide dedicated circuits for classroom specialty equipment, countertops, etc. as required. Provide general-purpose receptacles in corridors every 50-ft maximum for general maintenance use. Provide general purpose/convenience receptacles in classrooms and offices based on residential guidelines (12' on center). Classroom countertops shall have metallic surface raceway (dual channel) for power and data with power receptacles spaced 3' on center. There shall be a quad receptacle for each computer/workstation with up to (4) workstation quad receptacles per circuit. Provide all power connections, disconnects and starters as required for HVAC equipment. Provide infrastructure (back boxes, pathways, 120VAC) for door access control and power assist automatic door operators. Provide power and connections for the kitchen equipment including stoves/ovens, dishwashers, display cases, food processors, refrigerators/freezers, kitchen hood/ventilation systems, and other appliances. The wiring shall be conduit and wire where subject to physical damage and above inaccessible ceiling and type MC cable where concealed. Refer to the new construction architectural plans for program space layouts.

Building wiring will be provided as conductors in conduit for exposed wiring and homerun wiring from panelboard to first outlet box. Wiring concealed in non-CMU walls shall be installed as MC Cable, with full sized green insulated, equipment grounding conductor. Wiring shall be #12 minimum and conduit shall be minimum 3/4". All feeder and branch circuit wiring shall be installed as copper.

Underground conduit and power wiring shall be provided for electric vehicle charging stations, illuminated signs, and remote irrigation or ejector pump stations as required.

Security-Intrusion-Surveillance:

Provide electrical infrastructure only for door access control/intercom, intrusion alarm, and video surveillance systems. The electrical contractor (E.C.) shall provide power/support wiring, empty back boxes, and pathways for card access control/intercom, intrusion alarm and IP cameras/NVR. Devices, cabling, and headend equipment shall be provided by security/AV vendor. All exterior doors, IT room, and boiler room shall have door access control/keyless entry. Coordinate locations with Owner and security/AV vendor. Include all data drops/Category 6 cabling for system equipment as required.

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Grounding and Bonding:

Provide grounding electrode system associated with the new electrical service to the building. In addition, provide grounding and bonding of the structural steel frame of the building with up to twenty grounding counterpoise locations at designated corners of the building structure. Provide a continuous ground ring around the building, terminating at the counterpoise locations. Provide a central ground bar located in the main electrical room to terminate grounding electrode conductors from two of the counterpoise systems, building steel and any rebar/UFER ground system associated with structural concrete installation. Provide a dedicated ground bar for each elec./IDF room and tie back to the central ground bar. Provide test wells at each of the counterpoise for owner testing and maintenance. The minimum size conductor shall be 3/0 copper. Installation shall provide a maximum tested resistance of 5 Ohms.

Lightning Protection:

Provide a UL Listed Lightning Protection system for the building in accordance with UL 96A and NFPA 780. System shall be provided as roof and roof top equipment mounted air terminals, cabling, supports and grounding counterpoise. Installation shall provide for a maximum of 5 ohms of tested resistance.