BALA

EXISTING CONDITIONS AND FEASIBILTY REPORT

I. HEATING, VENTILATING, AND AIR CONDITIONING

A. Executive Summary:

1. The building was originally constructed in 1969. All of the major HVAC systems are original to the building are well beyond the service life expectancy of these systems. Explanations and details of these systems are identified further in this report. The existing equipment has been well maintained but due to the age of the HVAC equipment and systems we recommend the replacement of all.

2. In general we recommend the following: The existing hot water boilers be replaced with high efficiency gas-fired condensing boilers making low temperature hot water (140°F supply temperature) to be circulated to the various heating coils in the building, install an air cooled chiller to provide cooling to the interior rooms and classrooms, replace the unit ventilators serving the classrooms with fan coil units that can cool or heat, serve the outdoor air ventilation requirements of the classrooms with ducted dedicated rooftop outdoor air systems (DOAS) with heat recovery system. Heating for the DOAS units is recommended to be hot water with self-contained direct expansion type cooling coil and condensing unit for cooling and dehumidification. All air handling units should be replaced with new units that include filtration upgrades. The pumps are recommended to be replaced with new pump sets allowing for variable speed pumping options. In general, the existing specialized exhaust systems serving shop equipment may be reused, with the exception of the fans serving the shops which should be replaced. A new direct digital control (DDC) building management system (BMS) should be provided for control and monitoring of the automatic temperature controls of the HVAC equipment. This BMS would also be connected to other building automation equipment including electrical and gas consumption meters. The BMS should be web-based accessible from the internet allowing for monitoring and alarm reporting remote from the site.

B. Hot Water Boiler System:

1. There are two (2) Cleaver Brooks CB 655-350 (350 boiler horsepower) fire-tube hot water boilers, each with an estimated capacity of 14,645 MBH input with the capability of burning 97.6 gallons per hour of No. 4 fuel oil. These boilers are original to the building. The boilers supply 180 deg. F hot water to the building. Each boiler is provided with dual low water cut-offs and operating and safety controls.

2. According to the Pre-Feasibility Study the boilers were re-tubed about 10-12 years ago and tubes are replaced as needed. Each boiler has an electric preheater to heat the oil before being burned in the boiler. Each boiler is served by an in-line destratification pump.

3. The breeching system is black steel welded type and is insulated with what appears to be calcium silicate with a canvas jacket. However, before an exact determination can be made, samples of the insulation should be tested for the presence of asbestos. The steel breeching terminates into a masonry chimney.

4. According to the Pre-Feasibility Study the underground fuel oil tank is original to the building. The tank has a Veeder Root TLS350 leak detection and monitoring system. The viscous number 4 fuel oil is heated in the tank via a hot water coil to allow the oil to be more easily pumped. The fuel oil suction line that runs between the building and the tank was recently replaced. A portion of the tank was uncovered during this repair and the tank appeared to be sound. Some sludge was observed in the bottom of the tank during this repair, which is to be expected. The fuel oil transfer pumps were recently replaced.

5. Unheated outdoor air for combustion is delivered into the boiler room via an in-line supply fan. Heat generated in the boiler room is exhausted via a wall mounted propeller fan. The hot water generated at each boiler is distributed to schedule 40 black steel insulated piping run throughout the school. There is a large pneumatically controlled 3- way valve located in the boiler room that provides outdoor temperature compensated hot water supply temperature to the building. The primary hot water pumps are base mounted rated for 900 GPM at 70 ft. head at 25 HP. These pumps are not original to the building. The pumps have been rebuilt and the motors replaced. Due to corrosion the expansion tanks were repaired recently.

6. Major isolation valves have been replaced in the boiler room to allow the boilers to be isolated. The school has been adding strategically placed isolation valves, as there were few isolation valves in the original hot water heating system.

C. Chilled Water System:

1. A 255 ton electric chiller was installed around 1995, replacing the original chiller. The chiller is connected to an open cooling tower located on the roof. This cooling tower is original and has 2-speed fan control. It was noted that the cooling tower was scheduled for replacement in the coming months. The chiller is a Trane RTHA 255 screw chiller utilizing R-22 refrigerant. There is one chilled water pump, one condenser water pump and a standby pump located between the 2 pumps that can serve as a back-up for either pump by positioning manual isolation valves. The chilled water pump is a base mounted Taco model 862- 162RP rated for 700 GPM at 70 ft. head at 20 HP. (Image 1) It was noted that the chilled water pump was rebuilt within the last couple of years. The condenser water pump is original and is rated for 870 GPM at 40 ft. head at 15 HP. The standby pump is rated for 870 GPM at 40 ft. head at 15 HP. All pumps are constant speed and are not served by variable speed drives.

2. Generally, the building is air conditioned except for the gym and shop areas. The classrooms, interior rooms in Part A, administrative areas, cafeteria, drafting shop, cosmetology and childcare are served by the chiller. The library, office technology, IT room, graphics shop and the health care area are served by stand-alone direct expansion air conditioning.

D. Piping Systems:

1. Eight-inch primary chilled water supply and return piping is distributed from the boiler room to the building cooling systems. Localized zone secondary pumps then distribute chilled water to the air handling units and unit ventilators. There are approximately eleven secondary zone pumps. The chilled water secondary pumps work in conjunction with zone secondary hot water pumps through a three-way changeover valve to provide seasonal cooling or heating.

2. The piping systems appear to be mostly original equipment. The majority of the piping in excess of 50 years old. ASHRAE does not list piping in the equipment life expectancy chart enclosed due to the vast differences in life expectations due to the maintenance of the systems. Proper chemical treatment must be maintained to reach 30 to 50 years of service life from a given piping system. These piping systems will get more problematic as they age further with the frequency of repairs escalating. Generally, piping systems over 40 years old are recommended to be replaced when significant renovations are planned.

E. Ductwork Systems:

1. The ductwork observed in the building is in fair condition and can be expected to last an indeterminate amount of time. Very few modifications to the ductwork have been observed with the exception of some shop areas. The interior of the ductwork was not surveyed and without diligent filter maintenance the ductwork can build up with dirt. Some grille faces were observed with dirt/debris between the blades. The exhaust and return ductwork will probably be in the worst condition due to the fact that the air is not filtered until after it passes through these systems.

2. Specialized exhaust systems in the shops are in use. The woodshop and auto shop are still being used in the school with the dust collector as the only active shop duct system still in operation.

3. ASHRAE Equipment Life Expectancy chart lists ductwork as having a 30 year average service life. The ductwork installed at the school is galvanized sheet metal. Ductwork has no moving parts and therefore does not wear out like many other HVAC systems. Insulation failure and dirt/debris build-up are usually the largest problems found in ductwork with an occasional fire damper failure. Duct leakage can also be a significant issue which causes systems to run inefficiently. Sealing of duct systems was not a common practice when these systems were originally built.

4. Program changes in the school (the vocational educational program for instance) are usually the reason ductwork is modified or replaced. Ventilation and Filtration standards have also impacted duct design as they have changed significantly over the last 50 years. Ductwork is the longest lasting component in HVAC systems and will usually only be changed if required by renovation plans.

F. Classrooms:

1. The classroom areas are provided with individual wall mounted classroom unit ventilators of the vertical discharge design located on the exterior wall of each space with adjacent fin tube radiation. All the unit ventilators, as well as fin tube, are served by dual temperature hot water/chilled water piping from local zone secondary pumps. The unit ventilators are provided with an outside air intake as well as filters, hydronic heating/cooling coil, supply fans and return air. Each unit ventilator is original to the building and is generally antiquated. The exhaust for the classrooms is handled by a wall grille tied into a central ducted exhaust system with a rooftop exhaust fan. Considering the age and general condition of the unit ventilator equipment, consideration should be given to completely replace these systems.

2. The partially below grade ground floor level has experienced poor air quality. The graphics area design and visual lab has no direct ducted ventilation. There are some wall openings that communicate with adjacent areas that have ventilation.

G. Administration Area:

1. Ductless cooling units have been added to the administration area to provide additional cooling and individual space temperature control. In some exterior rooms with unit ventilators, window air conditioners have been added.

2. The IT computer room has two 1-1/2-ton ductless cooling units to supplement the central cooling system and to provide redundancy.

3. In the school psychologist area there have been offices added to a former wide corridor. These offices have no direct ventilation.

H. Cafeteria/Kitchen:

1. The cafeteria is served by a 14,600 CFM air handler with heating and cooling coils. The adjacent kitchen is served by a 12,650 CFM 100% outside air unit.

2. The canopy hood over the warming/oven area is 10,600 CFM of exhaust with no visible fire suppression system.

3. The two hoods in the cooking area are 6900 CFM and 6000 CFM of exhaust respectfully and have a hood fire suppression system.

I. Shops:

1. The STEM area is served by a 2500 CFM 100% outside air unit with roof mounted fresh air hood.

2. The electrical shop is served by a 5000 CFM heating and ventilating unit with roof mounted fresh air hood.

3. The maintenance shop is served by a 4000 CFM heating and ventilating unit with roof mounted fresh air hood.

4. The HVAC shop is served by a 6000 CFM heating and ventilating unit with roof mounted fresh air hood.

5. The metal fabrication shop is served by a 6000 CFM heating and ventilating unit with roof mounted fresh air hood. The welding booths and benches have Fume Gator snorkels tied into utility set exhaust fans hung from the ceiling. The instructor's office has some ventilation off the central shop system and is cooled by a wall mounted air conditioner rejecting heat into the shop.

6. The plumbing shop is served by a 6000 CFM heating and ventilating unit with roof mounted fresh air hood. The plumbing classroom is heated by electric baseboard and cooled by a window air conditioner.

7. The carpentry shop 151 is served by a 6000 CFM heating and ventilating unit with roof mounted fresh air hood. Each piece of woodworking equipment is connected to a dedicated dust collector/filtration unit that discharges air back into the shop.

8. The office tech area is served by a 4650 CFM heating and ventilating unit with roof mounted fresh air hood.

9. The auto body shop is served by a 12,000 CFM heating and ventilating unit with roof mounted fresh air hood. A make-up air unit was added that has no coil to

temper the air. The space is heated with ceiling mounted horizontal unit heaters. There are ceiling paddle fans and smoke eater filtration units. The spray wash area hoods area exhausted to a Eurovac system. The instructor's elevated office has no ventilation and is cooled by a wall mounted air conditioner rejecting heat into the shop. The auto body computer lab has no air conditioning.

10. The auto technology shop is served by a 12,000 CFM heating and ventilating unit with roof mounted fresh air hood. There is an underfloor vehicle exhaust system ducted to a 5200 CFM fan. There are ceiling paddle fans. General ventilation for the shop is handled by a mix of high ceiling exhaust and exhaust pulled from lower areas of the shop. The instructor's elevated office has no ventilation and is cooled by a wall mounted air conditioner rejecting heat into the shop.

J. Automatic Temperature Control

1. The Automatic Temperature Controls (ATC) Systems for the building original equipment using compressed air to operate the pneumatic controls system. This equipment is very antiquated. A large central air compressor resides in the boiler room and a hard copper piping system is plumbed throughout the building to operate the controllers as well as the damper and valve actuators. This type of control system (pneumatic) has generally not been installed in buildings for over 25 years. Typically, when some of this equipment fails, it is either rebuilt or replaced with anything available at the time.

2. The automatic temperature control system is a Barber Coleman pneumatic system and is provided with an air storage tank and two (2) 5 HP tank mounted compressors, an auxiliary air storage tank and a stand-alone main compressor. It appears that the compressors are operating and maintaining adequate compressed air to the control system. The system is provided with a refrigerated air dryer, as well as, an oil/water separator. The control system is in poor condition. The controls system is outdated and well beyond its useable life.

3. ASHRAE Equipment Life Expectancy chart indicates pneumatic controls systems having an average of 20 years of serviceable life. The controls present in the building are over twice this age. Buildings of this vintage have usually had the controls systems replaced with DDC (direct digital control) systems which can be accessed from remote locations using the internet. The DDC controls can be interfaced with the older HVAC equipment to provide upgrade controls instrumentation and remote access. Improvements with calibration and repeatability along with serviceability have allowed updated schools to save energy with better control of the buildings HVAC systems. The only systems being installed in buildings are DDC and Web-based along with open protocol platforms allowing different manufacturers factory controls to integrate into building ATC systems. Pneumatic ATC systems are no longer available for all intents and are usually very hard to source spare parts maintaining the original manufacturer name brands.

K. Miscellaneous:

1. The desktop publishing area has an overhead direct expansion ducted cooling unit with no provisions for outside air.

2. There are extensive drain pans under the heating piping indicating a problem with leaks. The copier room has minimal exhaust given the nature of the copying activities.

3. Generally, there is no ventilation in the corridors.

L. Pool:

1. The pool area has been abandoned in place. The pool heating system has been mothballed and anti-freeze added to the piping system. The pool was heated by a 2001 1342 MBH cast iron boiler firing propane. The pool was then heated by a water to water shell and tube heat exchanger. The pool space is served by two 3,750 CFM heating and ventilating units with roof mounted fresh air hoods.

M. Code:

1. The building HVAC systems, where they meet code back when being originally installed, will not meet today's codes for energy, life-safety and Indoor Air Quality. Where it may be possible to renovate the existing HVAC systems to meet today's code, the impact usually includes replacing over 75% of the existing HVAC system. Quick impacts in operating cost savings can be accomplished by changing the boilers to condensing type and installing variable speed drives onto the large fan motors. These are modern standards of practice in today's HVAC designs. Renovating older HVAC equipment/systems in this manner will usually have more than a 5-year payback on investment. The present minimum code filtration standards cannot usually be accomplished without fan modifications to the older HVAC equipment

N. Recommendations for Renovation of the Existing Facility:

1. Hot Water System:

a. The existing steel fire-tube boilers are recommended to be removed and replaced with four new gas-fired condensing hot water boilers equal to Veissmann Vitocrosal Model 300 at 6,000 MBH each. The use of smaller boilers may be possible with improvements to the building envelope and new systems within the building. The availability of gas service is to be determined as the facility is in a remote location off the main road.

b. Remove the existing boiler breeching and stack system and replace with a new pre-engineered Category 4 AL29-4C stainless steel vent system. Provide direct combustion air to each boiler from an exterior louver.

c. Each boiler shall be provided with a constant volume primary boiler water circulation pump.

d. New boiler system shall include manufacturer’s boiler hot water reset controls and sequencing system.

2. Chilled Water System:

a. Remove the existing chiller and provide a new 225 ton centrifugal chiller with R-123 or R-134a refrigerant. A reduction in size may be possible based on building efficiency improvements and depending on the extent of additional loads.

b. Provide a new stainless steel induced draft crossflow cooling tower equal to Marley MD. Provide variable frequency drive for fan control.

3. Piping:

   a. All hot water, chilled water and condenser water piping is recommended to be replaced in order to provide a reliable water distribution for the next 30 to 40 years. Replace all piping from the main mechanical room to air handling units and terminal units.

   b. Remove all eleven zone secondary distribution pumps. Replace with dual temperature automatic changeover valves connected to the chilled water and hot water mains.

   c. Provide new variable flow chilled water secondary distribution pumps with variable frequency drives. Two pumps at 50% capacity each; 225 GPM, 15 HP.

   d. Provide new variable flow condenser water pumps. Two pumps at 50% capacity each; 280 GPM, 7.5 HP.

   e. Provide new variable flow hot water secondary distribution pumps with variable frequency drives. Three pumps at 35% capacity each; 500 GPM, 25 HP.

   f. All main distribution piping shall be Schedule 40 carbon steel with welded joints or mechanical couplings equal to Victaulic.

   g. Provide fiberglass pipe insulation with all service jacket to meet the MA energy code.

4. Ductwork:

   a. The extent of new ductwork systems depends on the extent of the renovations in each area. It may be possible to retain some of the existing ductwork. Where ductwork systems are retained, they shall be cleaned, patched and sealed. Reinsulate all cold or warm ductwork for supply air systems.

   b. Provide new ductwork systems where systems need to be replaced due to major reconfiguration or where new distribution systems are required. Insulate ductwork for all cold and warm supply air systems.

   c. Provide new or reconfigure existing industrial exhaust systems to meet program requirements.

   d. Provide new general exhaust systems for toilet rooms and other areas as required.

5. Classrooms:

   a. Remove all unit ventilators and replace with dual temperature chilled water/ hot water fan coil units. Units shall be ceiling concealed (where space permits) with ducted supply and return air.

   b. Supply air distribution shall be to four linear diffusers located near the perimeter wall.

   c. Return air shall be to one ceiling mounted filter return grille.

d. Provide new rooftop ventilation supply air systems to serve the classrooms. Units shall be 100% outside air with total energy recovery wheels. Heating shall be with hot water coils and cooling shall be provided with a DX cooling coil and a remote VRF (variable refrigerant flow) heat pump condensing unit. Supply and exhaust fans shall be variable sped with variable frequency drives.

e. Outside ventilation air shall be delivered to each classroom by connection to the fan coil unit return air duct. Exhaust air shall be froma ceiling exhaust grille.

f. Supply and exhaust ventilation air to each classroom shall be controlled by a variable volume terminal box based on space carbon dioxide concentration.

6. Administration Area:

a. Remove all ductwork, piping, air handling units, unit ventilators, fan coil units, and ductless heat pumps units including outdoor condensing units.

b. Provide a new variable refrigerant flow (VRF) heating and cooling system with ceiling mounted cassette fan coil units in each space. Total system capacity shall be approximately 25 tons. Locate heat recovery condensing unit on the roof and provide refrigerant piping distribution including branch selector boxes to serve each fan coil unit.

c. Provide a 1,500 CFM roof mounted energy recovery ventilator to provide ventilation air to all administration spaces. Provide supply and exhaust ductwork distribution to ceiling diffusers in each space.

d. Library shall be provided with a separate VRF system at 6 ton capacity.

e. Provide a 500 CFM ceiling concealed energy recovery ventilator for the library.

7. Cafeteria/Kitchen:

a. Replace air handling units serving cafeteria, kitchen, and food trades kitchen. The existing layout for these spaces is assumed to remain the same. All air handling unit ductwork shall be reused.

b. Cafeteria unit shall have a chilled water cooling coil and hot water heating coil, economizer damper section, filters and supply fan with variable frequency drive. Provide new in-line return fan with variable frequency drive.

c. Main kitchen and food trades kitchen air handling units shall be 100% makeup air units with recirculation capability interlocked with kitchen hood exhaust operation. Units shall have chilled water cooling coil and hot water heating coil with face and bypass dampers, mixing dampers, filters, and supply fan with variable frequency drive.

d. Replace kitchen hood exhaust fans for main kitchen and food trades kitchen. Existing hood exhaust ducts shall be replaced with new 10 gauge welded black iron ductwork.

8. Shops:

   a. Replace all air handling units serving shop areas. All units shall have hot water heating coil, economizer mixing damper section, MERV 8 and MERV 13 filters, and supply fan.

   b. STEM Area: 3,000 CFM with chilled water cooling coil. Provide laser cutter, CNC machine, 3D printer exhaust systems to roof as required.

   c. Electrical Shop: 5,000 CFM.

   d. Maintenance Shop: 4,000 CFM.

   e. HVAC Shop: 6,000 CFM.

   f. Metal Fabrication Shop: 6,000 CFM: Replace existing exhaust fans serving welding booths and benches with new utility sets. Provide a ductless split air conditioning unit for the instructor's office.

   g. Plumbing Shop: 6,000 CFM: Provide a ductless split heat pump unit to serve the plumbing classroom.

   h. Carpentry Shop: 9,000 CFM: Replace dust collector with new outdoor dust collector 6,000 CFM capacity.

   i. Office Tech Area: 4,650 CFM.

   j. Auto Body Shop: 12,000 CFM: Provide a new 4,000 CFM makeup air unit with hot water heating coil and face and bypass dampers interlocked with spray wash operation. Replace all unit heaters with vertical throw type. Provide a new ductless split heat pump unit for the instructor's office and auto body computer lab. Provide ventilation for both spaces.

   k. Auto Technology Shop: 12,000 CFM: Replace exhaust fan for the underfloor vehicle exhaust system, 5,200 CFM. Replace general exhaust fans. Provide a ductless split air conditioning unit for the instructor's office.

9. Automatic Temperature Controls:

   a. Replace all automatic temperature controls for building with a direct digital DDC control building automation system (BAS) with web access interface. System shall be open protocol BACnet.

   b. Manufacturer's controls for chiller and boilers shall be integrated with the BAS via BACnet interface.

   c. All VRF and ductless split system manufacturer's controls shall be integrated with the BAS through a BACnet interface.

   d. All air handling units shall be provided with a DDC controller by the automatic temperature controls (ATC) sub-contractor. All field devices for unit operation shall be provided by the ATC sub-contractor.

   e. Unitary controllers shall be provided for all terminal cooling and heating equipment including; fan coil units, unit heaters, fin-tube radiation, fans, etc.

f. Classroom ventilation shall be interfaced with space vacancy sensors to reduce ventilation to minimum limits when the space is unoccupied. Room carbon dioxide sensors shall modulate the ventilation supply air and exhaust air based on carbon dioxide concentration when the space is occupied.

g. Variable volume air handling units shall have supply air static pressure control reset.

h. Variable frequency drives for chilled water and hot water secondary pumps shall modulate flow based on a remote differential pressure sensor.

II. FIRE PROTECTION

A. Executive Summary:

1. The existing, limited area Fire Protection system is in excellent condition and protects a very small portion of the building (Carpentry Shop). In the interest of life safety and compliance to current codes and standards, we recommend an upgrade to a fully sprinkled building.

2. If a complete Fire Protection system upgrade is planned, new scope would include a new eight inch fire service, backflow preventer, new service valves, six zones with risers, supply mains, branch lines, sprinkler heads, fire department valves, fire department connection(s) and monitored alarm devices.

B. General:

1. The current Fire Protection system supply is fed from the existing eight inch water loop that runs around the building. The 4 inch service includes a three inch double check valve assembly, wet alarm valve and a fire department inlet connection on the riser. The estimated age of the installation is three years and components are in excellent condition.

2. Sprinkler coverage in the building is limited to a single zone located in the Carpentry Shop. Protection is provided within the structure at the high ceiling, above the mezzanine and in the storage areas below.

3. To bring the water-based fire suppression system up to current codes and standards, the following steps are necessary:

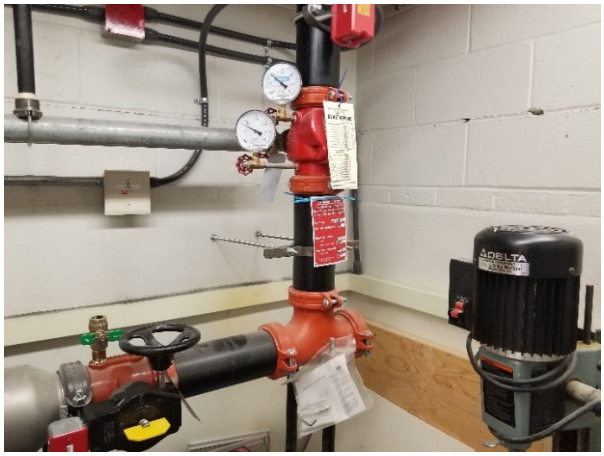
a. Provide a new eight inch fire service and entry components and four 6 inch wet alarm check valves to supply all occupied areas of the building. Include Sprinkler main piping to one Ground Floor zone, four First Floor Zones and one Second Floor zone.

b. Provide new fire department inlet connection(s) no more than 100 feet from municipal fire hydrant(s).

c. Provide distribution piping from the alarm valves to each zone. Include mains, branch lines and sprinkler heads to suit the occupancy hazard of each area served. Flush and perform pressure testing of all system piping.

d. Furnish all Fire Protection system monitoring devices for connection to the building fire alarm system (by Electrical).

e. It is recommended that the existing Carpentry Shop wet sprinkler system be back fed by the new Fire Protection service entry. The current 4 inch buried service shall be decommissioned and removed.



Existing 4 inch Fire Service entry to Carpentry Shop with 4 inch system riser

III. PLUMBING

A. Executive Summary:

1. The Plumbing piping systems serving the school are showing signs of age and are generally in fair condition. Plumbing fixtures and fittings, for the most part, are in fair to good condition. Details and recommendations for the individual systems and equipment are included herein.

2. If an overall renovation of the building and Plumbing systems is planned, suggested priorities include pipe insulation abatement (if required), lead and pressure testing of the potable water, sanitary, waste, vent and storm piping systems, replacement of inoperable valves, replacement of high consumption toilet room fixtures and a complete upgrade of the domestic water heating plant to include high-efficiency equipment.

B. Domestic Water:

1. The site is fed by an eight inch municipal main that loops around the building and includes a six inch domestic water service entry located in the main Boiler Room. The line reduces to four inch to serve the building. The existing remote-read meter, pressure reducing station and uninsulated copper piping are in fair to good condition. Exposed copper piping is in good condition and the main service pressure reducing valve is in fair condition; pressure gauges provide inaccurate readings and are in poor condition.

2. Copper domestic water piping, where visible, is showing signs of age; insulation, where present, is in generally poor condition. At the time of our visit, access to valves above the ceiling was not available.

3. The existing water-to-water, 500 gallon domestic water storage heater is in the Boiler Room. Domestic hot and boiler water circulators appear to have been replaced recently; pipe and insulation are in fair condition. There are no mixing or tempering valves on the on the main hot water supply system.

C. Sanitary, Waste and Storm:

1. Very little piping for these systems is visible. Exposed hub and spigot piping appear to have lead and oakum joints; materials testing is recommended. Roof drains are in fair condition and piping is expected to be undersized based on the current MA Plumbing Code. There is an underground gas and sand interceptor for the Auto Shop.

2. Boiler Room floor drains require cleaning and flushing; trap primers are not evident. The existing sump pump at the Boiler room lower level appears to be out of commission; the basin cover is not sealed and the floats are inoperable. Kitchen equipment does not appear to drain to a dedicated system, grease interceptors are provided at scullery sinks in both the Culinary Arts and Main Kitchens.

D. Gas:

1. The building is fed underground by two above-ground, exterior 1,000 gallon propane tanks. Equipment served includes the Emergency Generator, the Auto Body paint spray booth, pilots for the oil-fired heating boilers and the Culinary Arts Kitchen cooking line. Pipe, fittings and regulators are in good condition.

E. Fixtures:

1. Most toilet room fixtures viewed are in good condition; few accessible fixtures were noted. Flush valves and lavatory fittings do not comply with current code requirements for water conservation or ADA accessibility. Some of the original drinking fountains have been replaced with accessible water coolers with bottle fillers.

2. Locker Room shower fittings are in fair to poor condition. It is unknown whether shower heads comply with current code requirements for water conservation. Custodial closet mop receptors and fittings are in fair to good condition.

3. Several Shops include a floor-mounted wash fountain, a wall-hung drinking fountain and a single-occupant, tagged “All Gender” toilet room.

F. Classrooms:

1. Plumbing fixtures and fittings in Classrooms and Shops are in generally good condition. Specialty sinks in the Cosmetology and Dental Assistant Shops are in very good condition.

G. Shop Equipment Plumbing:

1. Plumbing air compressors and dryers are in good condition. Compressed air Hose Reels and outlets are in Industrial Automation, Carpentry and the Auto Shops.

H. Recommendations:

1. To bring the Plumbing systems up to current codes and efficiency standards, the following steps are necessary:

a. Test copper domestic water, cast iron storm and sanitary piping and joints for lead, replace the existing pressure reducing valve with a new assembly, perform asbestos abatement as required and replace pipe insulation.

b. Replace the domestic hot water plant with high-efficiency equipment, include a master mixing valve and add circulation pump and piping.

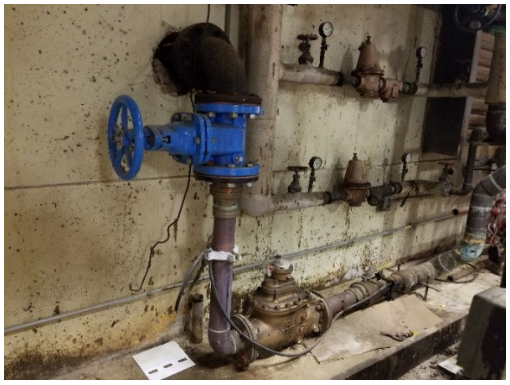
c. Review the roof drainage piping for proper sizing and replace non-compliant drains and piping.

d. Add trap primers and inserts to floor drains.

e. Replace toilet room fixtures and fittings to comply with accessibility and water conservation requirements.

f. Replace locker room shower fittings to comply with pressure-balancing and water conservation requirements.

g. Replace custodial mop receptor basins and fittings.



Domestic Water Service, Meter and PRV station

Water-to-Water Domestic Water Heater

Existing deficient Sump Pump and Basin

Non-ADA compliant, single-occupancy Toilet Room

IV. ELECTRICAL

A. Executive Summary:

1. The electrical systems serving the school are all dated from the 1960's and are operating well beyond the service life expectancy of these systems. Explanations and details of these systems are identified further in this report. The existing equipment has been well maintained, but due to the age of the majority of the electrical power distribution equipment and systems, we recommend the

replacement of all. Only the existing fire alarm panel, which was recently upgraded, would be suitable for use going forward.

2. In general we recommend the following: The existing main switchboard be replaced with a single consolidated, front accessible, wall mounted switchboard. This would include a new pad mount transformer from Wakefield Municipal Gas and Light. Presently, the existing utility owned and operated pad mount transformer serving the school, is located in a room directly behind the main switchboard. We recommend a new pad mount be located on the exterior of the building. Additionally, existing branch panels, which are located throughout the building be replaced and supplemented with additional panels, in dedicated electric closets, for more efficient power distribution. Most of the school's existing panels are located in the various shops. However, there are selected panels in non-code compliant electric closets. A new standby/emergency life safety generator would be provided to serve the IT and data systems, boiler, critical pumps, fans, kitchen refrigeration and life safety systems to include emergency lighting, to increase the safety of the school and to ensure critical systems remain operational during utility power outages. A new voice paging, fully addressable, fire alarm system using speaker strobe annunciation devices would be provided for greater emergency evacuation capability of the school, during fire alarm events and for efficient detection and notification of fire events in the facility. Updated AV systems, paging and sound systems would be provided to ensure operational efficiency. LED lighting with distributed lighting controls would be provided for energy efficient lighting, better lighting within each space and greater flexibility to provide healthy and functional lighting levels throughout the school. This would include wireless exterior parking lot LED lighting, emergency lighting at each egress door, emergency lighting along all egress pathways and enhanced lighting along vehicle roadways and parking areas for greater night time safety.

B. Utility Services:

1. The electric utility service extends underground from Hemlock Road, onto the school property via a right of way, to an interior pad mount transformer, served from an existing underground service. The pad mount transformer is rated at 3000KVA, 277/480V, 3 phase, 4 wire, owned by Wakefield Municipal Gas & Light Co.(WMG&L) The transformer feeds a single freestanding 4000A rated service to the building main switchboard.

2. The telecommunications services include a modernized wireless system for cellphone service along with fiber optic and copper phone lines. The latter extends overhead from Hemlock Road, onto the school property via a right of way, to an existing riser pole located in the vicinity of the electric utility pad mount transformer. The telecommunications service conductors are routed overhead to connection at the school. The existing wireless system includes a transceiver antenna located at the front of the school and another on an existing utility pole at the front of the school.

C. Main Electrical Services:

1. The main electric service is rated 277/480V, 4000A, 3 phase, 4 wire that includes 480V distribution sections and an integral 1000KVA dry type transformer serving 120/208V, 3000A rated distribution sections. There is a single WMG&L utility meter for the service, mounted to the end of the main switchboard. The main service switchboard is manufactured by Federal Pacific and appears to be the original service installed in the building. The electric utility services are underground from the riser pole on Hemlock Road.

2. The main electric service equipment appears to be in fair condition, however, routine maintenance and testing was performed in July of 2011. Power panel-boards throughout the school appear to be original and have never been up-graded or replaced. The main switchboard equipment appears to be covered in dust. Lack of routine testing, adequate ventilation, and general cleanliness are not conducive to prolonged safe and reliable operation.

D. Emergency/Standby Power System:

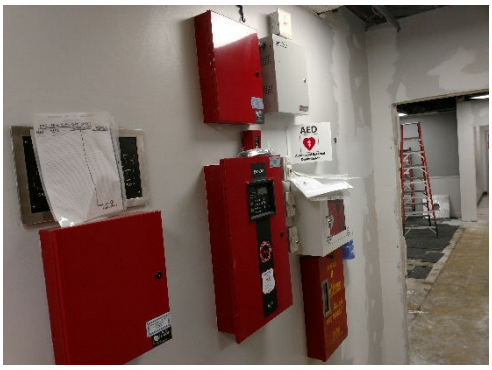
1. Emergency Electric Services

a. There is a 150KW, 120/208V, 3-phase, 4 wire, propane fired emergency generator located in a dedicated interior room. There is a single auto-matic transfer switch that serves selected emergency power panels throughout the school. Emergency egress lighting is supported from this generator. The generator due to age, appears well beyond its expected life.

2. Fire Alarm

a. The main fire alarm panel is manufactured by Silent Knight and appears to be a recently upgraded addressable system. The panel is located in the school's front office area. There was no remote annunciator ob-served at the main entrance to the school. The building is not sprin-klered, so there are smoke detectors installed throughout the building Smoke detection coverage is fairly consistent throughout the school, however, is inadequate due non-code complaint spacing of devices. However, there were areas throughout the building that lacked adequate smoke detector or carbon monoxide coverage such as the kitchen,

carpentry and auto shop. Without fire protection sprinkler systems, the building requires full smoke detection coverage throughout the school, in all spaces. Manual initiation devices (pull stations) appear to be located at all egresses from the school. Notification devices (audio/visual) appear to be retrofitted speaker/strobe type and are located throughout the school. Kitchen hood did not appear to include a dedicated fire suppression system or appear to be connected to the fire alarm system. A red fire alarm beacon is located at the main entrance to the school. A fire alarm DACT communicator panel is located in the main office area of the school for fire alarm communication with the fire department.



b. The existing installations appear safe and operational, but the building is not supported by full smoke detection throughout the building. Full smoke detection coverage is required when no fire protection systems such as fire sprinklers are present.

3. Lighting and Lighting Controls

a. Luminaires appear to be primarily a mixture of fluorescent type and LED retrofit lamps supplied by the utility. Most of the luminaires are very old or original to the select building area construction. Lighting controls appear to be all manual type operation with no apparent energy efficiency operations, such as occupancy/vacancy sensing or daylight sensing.

b. Lighting and lighting controls are extremely inefficient throughout the building and luminaires and controls are well beyond their useful life.

4. Clock System

a. There appears to be a functioning clock system that requires manual adjustments and setting. A limited quantity of existing clocks is controlled by a Simplex central clock control panel located in the front administrative office area. The school essentially does not include a fully functional central clock system.

5. Audio-Visual (AV)

   a. There does appear to be a dedicated audio systems. Site personnel stated that the existing public address system was operational, most of the speakers throughout the school are original, and well past their expected life.

   b. The existing audio/visual systems are extremely minimal and are limited in capabilities where they exist. Current audio/visual technologies provided in most public schools far exceed what exists in the building. However, most all classrooms appear to have basic projection systems.

6. Telephones

   a. Internal phone distributions appear to be voice over internet protocol (VoIP) and communication wiring appears to be aged beyond its expected life. The phones appear to be operational, but do not appear to support many of today's phone system technologies.

7. Security

   a. There is a basic security system within the school that includes a selected quantity of interior security cameras. Most door hardware is manual and lacks control keypads. Door contacts at entrances and camera

systems were not observed. Security monitors are located within the assistant principal's office.

b. The security system provides the minimal needs to monitor access doors and motion sensing. There was little evidence of camera systems for surveillance of the exterior grounds. Cameras were located in main lobby and corridors only, with selected camera locations at supplemental egress doors.

8. IT Network

a. There are IT network rooms located throughout the school that do not include dedicated cooling systems. Network cabling throughout the school is primarily concealed, but loosely installed where exposed. Wireless Access Points were observed in the building.

9. Photovoltaic System

a. There is no photovoltaic system at this building.

E. General Comments:

1. The fire alarm system appears to be relatively new compared to the age of the various other school electrical systems.

2. Several exterior building luminaires appear to be replaced with new LED type wall mounted lights. This appears to be the only betterment to the lighting systems and relatively older lighting compared to current lighting technologies.

3. Several of the power distribution panels are recessed, painted over, and lack NEC warning labels.

4. Convenience receptacles throughout common, classroom and office spaces are very limited in quantity.

F. Recommendations for Renovation of the Existing Facility:

1. Replacement of the existing utility transformer and main switchboard is required. The existing 4000A, 480/277V, 3-phase, 4 wire switchboard would be replaced with a new UL891 front accessible, wall mounted switchboard, equipped with an electrically operated main 4000A power breaker. Feeder breakers for the new switchboard would be Eaton series G or approved equal. All breakers would be low arc flash rated. The distribution would include new feeders to serve each shop, the classroom areas and gymnasium. The existing switchboard would be demolished and removed. Centralized 208V services would be limited and the system would transition to localized 208V distribution via area dry type transformers.

2. New satellite electric closets for normal utility power would be required to be strategically located for optimal distribution to serve classrooms, administrative spaces, the gymnasium and corridors. The satellite closets would house new dry type transformers, 120/208V panels for classrooms and administrative loads, and 277/480V panels to serve lighting and upgraded HVAC loads to include air conditioning in all classrooms.

3. New 2-hour fir rated satellite electric closets for life safety power would be required to be strategically located for optimal distribution for emergency lighting in all egress corridors, and to energize fire alarm equipment.

4. New 120/208V panels, dry type transformers and 277/480V panels in each of the shops. Panels would be “In-Kind” replacements, that included spare capacity for additional loads.

5. A new exterior 450KW 277/480V, natural gas fired standby/emergency generator, housed in a weatherproof, sound attenuated enclosure is required.

6. A new 2-hour fire rated main emergency electric room, that housed a new 300A Emergency ATS and a new 400A Standby power ATS. The automatic transfer switches shall be ASCO 7000 series or approved equal. The ATS switches would feed new distribution power panels, that would then serve panels throughout the building, located in satellite closets.

7. The building would require a distributed, fully networked lighting control system. The system would include a wireless exterior lighting system. The system would include local controls such as digital wall switches, daylighting controls, occupancy sensors, vacancy sensors and override switches that are tied into local room controllers, and then networked into the system via digital “network bridges” distributed thought the facility. The system would be integrated to the BMS system for desktop interface, control and programming. All existing line voltage light switching would be demolished and removed.

8. The building would require all new LED lighting fixtures. The new lights would provide indirect illuminance in all classrooms and administrative spaces. The luminaires would all be equipped with 0-10V dimming, so that lighting levels could be adjusted to suit user needs, daylighting an activities.

9. New site lighting would be required to meet IES lighting levels for parking lot and pedestrian pathway safety. The lights would include 25 foot high pole lights in all parking lot and roadway areas, 12 foot high pedestrian area lights and selected wall mounted luminaires at egress door entrances. All existing site lighting would be demolished and removed.

10. The existing fire alarm system that has been recently upgrade will require modification to enable voice paging and increased, code compliant strobe and speaker sound levels in all areas.

11. All existing wiring devices in classrooms, shops and administrative areas would require replacement with new energy code compliant 50% switching. The devices would be wired to new room occupancy sensors to automatically switch off half of each receptacle.

12. A submetering system would be required for energy management. The system would include energy submeters at all 480V and 208V panel, along with a central main submeter at the new main switchboard. The metering system would be integrated into the BMS for data collection, trending and benchmarking, or utility power optimization.

ASHRAE Equipment Life Expectancy chart

ASHRAE is the industry organization that sets the standards and guidelines for most all HVAC-R equipment. For additional info about ASHRAE the website is www.ashrae.org .

Equipment Item	Median Years
Air conditioners	
Window unit	10
Residential single or Split Package	15
Commercial through-the wall	15
Water-cooled package	15
Heat Pumps	
Residential air-to-air	15
Commercial air-to-air	15
Commercial water-to-air	19
Roof-top air conditioners	
Single-zone	15
Multi-zone	15
Boilers, hot water (steam)	
Steel water-tube	24 (30)
Steel fire-tube	25 (25)
Cast iron	35 (30)
Electric	15
Burners	21
Furnaces	
Gas- or oil-fired	18
Unit heaters	
Gas or electric	13
Hot water or steam	20
Radiant Heaters	
Electric	10
Hot water or steam	25

Equipment Item	Median Years
Air terminals	
Diffusers, grilles, and registers	27
Induction and fan coil units	20
VAV and double-duct boxes	20
Air washers	17
Ductwork	30
Dampers	20
Fans	
Centrifugal	25
Axial	20
Propeller	15
Ventilating roof-mounted	20
Coils	
DX, water, or steam	20
Electric	15
Heat Exchangers	
Shell-and-tube	24
Reciprocating compressors	20
Packaged chillers	
Reciprocating	20
Centrifugal	23
Absorption	23
Cooling towers	
Galvanized metal	20
Wood	20
Ceramic	34

Equipment Item	Median Years
Air-cooled condensers	20
Evaporative condensers	20
Insulation	
Molded	20
Blanket	24
Pumps	
Base-mounted	20
Pipe-mounted	10
Sump and well	10
Condensate 15	
Reciprocating engines	20
Steam turbines	30
Electric motors	18
Motor starters	17
Electric transformers	30
Controls	
Pneumatic	20
Electric	16
Electronic	15
Valve actuators	
Hydraulic	15
Pneumatic	20
Self-contained	10