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June 18, 2009

Carol Duncan, P.E.
Public Works Engineer
Department of Public Works
645 Pine Street
Burlington, Vermont 05401

Re: Mechanical and Electrical Assessment of Existing City Buildings
City of Burlington, Vermont

Dear Carol,

L.N. Consulting has completed observations of the following buildings for the City of Burlington:

- Firestations #1, #2, #3, #4, #5
- City Hall
- Leddy Park Ice Rink
- Fletcher Free Library
- Firehouse Art Center

Below is our report of the existing mechanical and electrical systems, our recommendations for improvements, and probable construction cost spreadsheet for recommended improvements.

Fire Stations:

Station #1:

Fire Station #1 (FS1) is located on South Winooski avenue and was constructed in approximately 1940. The building includes three levels; basement, first floor and second floor. The basement includes a garage, equipment storage, and heating plant. The building is fitted with a slab on grade in the basement with a concrete block foundation wall that appears to be 18” thick. The first floor is constructed of a concrete slab that is supported by steel I-beams. The exterior walls above grade are brick inside and outside and appear to be 18” thick. The second floor exterior walls are concrete on the inside and brick on the outside and appear to be 18” thick.

The basement garage is fitted with two different garage doors. The first garage door is a double door, wooden framed unit with single pane glass. This door is 10’0” wide by 10’6” tall. The second garage door is a fiberglass overhead door fitted with insulated glass that has a 3/8” air gap between panes. This door is 10’0” wide by 10’6” tall. The first floor is fitted with (4) fiberglass overhead doors fitted with insulated glass that have

a 3/8” air gap between panes. These doors are 10’6” wide by 12’0” tall. The first floor is also fitted with (4) access doors. Three of the access doors connect to the garage. Two of them are glass doors, 3’0” x 7’0”, with aluminum frame and one does not close properly. The other access door connects to the training office and is also glass, 3’0” x 7’0”, with aluminum frame.

The second floor is fitted with wooden framed single pane glass windows that are fitted with storm screen/window systems. The storm windows do not appear operational.

Mechanical Systems:
The heating source for a majority of the building is a natural gas fired steam boiler located in the basement mechanical room. The boiler is a Bryant flexible tube boiler that was constructed in 1978 and has a heat input of 2.45 million btu/hr with an estimated seasonal efficiency of 70%. The boiler is supported by a single condensate receiver that is fitted with one feed pump. The steam is used to heat the basement spaces using multiple cast iron radiators mounted to the wall and one unit heater. The steam is used to heat the first floor garage area using (3) steam unit heaters. The steam is used to heat 60% of the second floor spaces using cast iron radiators.

On the day of the survey, the outdoor air temperature was 50 degrees F, three overhead doors on level one were open and two unit heaters were operational. We recommend correcting this condition due to the waste of heating energy.

The balance of the building is heated using electric resistance heat. This includes the following rooms; first floor administration office, first floor training office, second floor offices, and a portion of the second floor bunk rooms. The second floor exercise room and a portion of the second floor bunk rooms are heated with single pipe steam radiators. The basement and first floor bathrooms are currently not heated. There is no air conditioning in the facility.

There is minimal ventilation air throughout the building. The (2) second floor bathrooms, the attic, and the kitchen hood are currently the only spaces that are being ventilated. The kitchen hood does not meet code requirements as it does not cover the complete cooking surface.

General Mechanical Summary and Recommendations:
Our findings show that the existing building’s mechanical systems are inefficient and in poor condition. Furthermore, the building currently does not meet ventilation air code requirements.

We would recommend upgrading the heating plant to a variable volume system with new high efficiency gas-fired hot water condensing boilers. We would recommend demolishing all existing methods of heating and utilizing fin tube radiation in order to provide a common source of heat throughout the building. We would recommend

providing ventilation air to all spaces via energy recovery units with CO2 sensing capabilities. This will ensure that the energy recovery unit will only operate as needed to maintain minimum outdoor air requirements and minimize energy usage.

We would also recommend upgrading the kitchen exhaust hood to an efficient air system type hood that meets current building code requirements.

Station #2:

Fire Station #2 (FS2) is located on 132 North avenue and was constructed in approximately 1980. The building has a concrete foundation and a brick exterior.

Mechanical Systems:
The heating source for the majority of the building is via (3) Weil Mclain Ultra natural gas fired hot water boilers. The heating plant supports the garage and exercise room via hot water unit heaters and all other spaces using fin tube radiation. The heating plant also provides heating hot water to a Weil Mclain indirect water heater for domestic water heating. The upper level of the building are supported by (2) roof top units that are in poor condition. These units can provide heat and cooling, but are used for cooling only.

On the day of the survey, the outdoor air temperature was 50 degrees F, overhead doors in lower garage were open and (2) unit heaters were operational. We recommend correcting this condition due to the waste of heating energy.

There is minimal ventilation air throughout the building. There is no ventilation in any of the spaces with the exception of the bathrooms and locker rooms.

General Mechanical Summary and Recommendations:
Our findings show that the existing building's heating systems are in good condition being recently replaced. There are multiple spaces such as janitor's closets, living spaces, garages, and bunk spaced which require ventilation air per code. We would recommend providing ventilation air to all spaces via energy recovery units with CO2 sensing capabilities. This will ensure that the energy recovery unit will only run as needed to maintain minimum outdoor air requirements. We recommend replacing the existing roof top units with new equipment that is fitted with CO2 demand control to provide ventilation air while using heating water from the high efficiency heating system for heat. This will provide high efficiency mechanical building operation.

Station #3:

Fire Station #3 (FS3) is located on 20 Mansfield avenue and was constructed in approximately 1895. The building has a stone foundation and a brick exterior.

Mechanical Systems:

The heating source for the majority of the building is via (1) Peerless 360 MBH natural gas fired hot water boiler. The heating plant supports the bunk rooms, kitchen, living room, and weight room spaces through fin tube radiation. Gas fired unit heaters support the heating requirements for the garage and basement spaces. The equipment room located on the level two is heated via electric resistance units. There is no air conditioning in the facility.

There is minimal ventilation air throughout the building. There is no ventilation in any of the spaces with the exception of the kitchen. The kitchen hood does not meet code requirements as it does not cover the complete cooking area.

General Mechanical Summary and Recommendations:
Our findings show the existing building's mechanical systems are inefficient and in poor condition. Furthermore, the building currently does not meet ventilation air code requirements.

We would recommend upgrading the heating plant to a variable volume system with new high efficiency gas-fired hot water condensing boiler. We would recommend demolishing all gas fired unit heaters and electric resistance heating units and replacing them with fin tube radiation and hot water unit heaters in order to provide a high efficiency source of heat throughout the building. We would recommend providing ventilation air to all spaces via energy recovery units with CO2 sensing capabilities. This will ensure that the energy recovery unit will only run as needed to maintain minimum outdoor air requirements.

We would also recommend upgrading the kitchen exhaust hood to an efficient air system type hood that meets current building code requirements.

Station #4:

Fire Station #4 (FS4) is located on 1397 North Avenue and was constructed in approximately 1991. The building has a concrete foundation and a brick and stone exterior.

Mechanical Systems:
The heating source for the majority of the building is a Weil Mclain natural gas fired boiler. The boiler is vented via a 12"Ø Stack. The heating plant supports the level one offices, bathrooms, and exercise space using fin tube radiation. Hot water unit heaters support the heating requirements for the garage. There is no air conditioning in facility.

There is sufficient ventilation air throughout the building. All bathrooms and the exercise room are ventilated via exhaust fans. The janitor's closet currently does not have any exhaust air. The ventilation air damper in the garage is currently un-insulated and should be replaced with an insulated type damper. There is an existing dryer vent that is only 3"

above grade where it exits the building. We would recommend raising the vent in order to prevent obstructions from snow and leaves.

General Mechanical Summary and Recommendations:
Our findings show the existing building's mechanical systems are inefficient and in decent condition. The majority of the spaces are ventilated however there are is no recovery capabilities.

We would recommend upgrading the heating plant to a high efficiency gas-fired hot water condensing boilers. We would recommend providing ventilation air to all occupied spaces via energy recovery units with CO2 sensing capabilities. This will ensure that the energy recovery unit will only run as needed to maintain minimum outdoor air requirements.

Station #5:

Fire Station #5 (FS5) is located on 23 Ferguson Avenue and was constructed in approximately 1991. The building has a concrete foundation and a brick and stone exterior.

Mechanical Systems:
The heating source for the majority of the building is via a Weil Mclain natural gas fired boiler. The boiler is vented via a 12"Ø Stack. The heating plant supports the whole facility via heating hot water. The majority of level one is heated via fin tube radiation. Hot water unit heaters support the heating requirements for the garage and unit ventilators provide heating to the level one offices. The unit ventilators also have cooling capabilities through a DX system. Level two is conditioned via a Carrier split system unit with a DX coil and an external hot water heating coil. Fresh air is ducted to the return air plenum of the air handling unit, but there is no control damper or insulation on outdoor air duct.

There is sufficient ventilation air throughout the building. The two janitor's closets currently do not have any exhaust air. The ventilation air damper in the garage is currently un-insulated and should be replaced with an insulated type damper.

General Mechanical Summary and Recommendations:
Our findings show that the existing building's heating plant is in decent condition but is inefficient. The majority of the spaces are ventilated however there are is no energy recovery capabilities.

We would recommend upgrading the heating plant with a high efficiency gas-fired hot water condensing boiler. We would recommend providing ventilation air to all spaces via energy recovery units with CO2 sensing capabilities. This will ensure that the energy recovery unit will only run as needed to maintain minimum outdoor air requirements.

The level two air handling unit is in good condition however we would recommend providing insulation on the outdoor air duct as well as control damper in order to modulate the amount of outdoor air to the unit. We would recommend using this unit for cooling mode only as the ERV and finned tube would support heating mode functions.

Station #1:

Plumbing Systems:

The existing bathroom fixtures are not equipped with any water saving capabilities. The existing showers are not equipped with anti-scalding valves.

General Plumbing Summary and Recommendations:
Our findings show that the existing plumbing fixtures are in poor condition and are not equipped with any water saving technology. We would recommend replacing all bathroom fixtures with new low flow high efficiency fixtures. We would recommend replacing all water closets with new dual flush water closets. We would recommend that all lavatories be replaced and provided with automatic low flow faucets. We would recommend that all urinals be replaced with a new waterless type. We would also recommend that all shower valves be replaced to the anti-scalding type units. In the event the building undergoes a complete refit, we recommend installing heat recovery units on the shower waste water piping.

Station #2:

Plumbing Systems:

The building domestic hot water system is supported via a Weil Mclain indirect water heater. This water heater is in good condition. The existing bathroom fixtures are not equipped with any water saving capabilities. The existing showers are not equipped with anti-scalding valves.

General Plumbing Summary and Recommendations:
Our findings show that the existing plumbing fixtures are in good condition but are not equipped with any water saving technology. We would recommend replacing all bathroom fixtures controls with new low flow high efficiency units. We would recommend that all lavatory faucets be replaced and provided with automatic low flow faucets. We would recommend that all urinals be replaced with a new waterless type. We would also recommend that all shower valves be replaced to the anti-scalding type.

Station #3:

Plumbing Systems:

The building domestic hot water system is supported via a Bradford white gas fired water heater. This water heater is not efficient and should be replaced. The existing bathroom fixtures are not equipped with any water saving capabilities. The existing showers are not equipped with anti-scalding valves.

General Plumbing Summary and Recommendations:

Our findings show that the existing plumbing fixtures are in poor condition and are not equipped with any water saving technology. We would recommend replacing all bathroom fixtures with new low flow high efficiency fixtures. We would recommend replacing all water closets with new dual flush water closets. We would recommend that all lavatories be replaced and provided with automatic low flow faucets. We would recommend that all urinals be replaced with a new waterless type. We would also recommend that all shower valves be replaced to the anti-scalding type.

Finally, we would recommend replacing the existing gas fired water heater with an indirect water heater supported by the new high efficiency heating plant.

Station #4:

Plumbing Systems:

The building domestic hot water system is supported via a gas fired water heater. This water heater is not efficient and should be replaced. The existing bathroom fixtures are not equipped with any water saving capabilities.

General Plumbing Summary and Recommendations:

Our findings show that the existing plumbing fixtures are in decent condition but are not equipped with any water saving technology. We would recommend providing all water closets with new dual flush controls and would recommend that all lavatories be provided with automatic low flow faucets.

Finally, we would recommend replacing the existing gas fired water heater with an indirect water heater supported by the new high efficiency heating plant.

Station #5:

Plumbing Systems:

The building domestic hot water system is supported via a gas fired water heater. This water heater is not efficient and should be replaced. The existing bathroom fixtures are old and are not equipped with any water saving capabilities.

General Plumbing Summary and Recommendations:

Our findings show that the existing plumbing fixtures are in poor condition and are not equipped with any water saving technology. We would recommend replacing all bathroom fixtures with new low flow high efficiency fixtures. We would recommend replacing all water closets with new dual flush water closets. We would recommend that all lavatories be replaced and provided with automatic low flow faucets. We would recommend replacing the existing gas fired water heater with an indirect water heater supported by the new high efficiency heating plant.

Finally, there is water infiltration into the level one offices. We would recommend providing adequate building drainage in order to remedy this problem.

Electrical Systems:

Station #1:

Station #1, located on South Winooski Avenue, is fed via a relatively new three phase, four wire 120/208 volt service from the rear to a 600 amp main distribution panel (MDP). This panel has significant spare capacity and space for additional breakers. It could not be confirmed, however it should be verified that the main building grounding system at this panel is adequate.

Multiple panels are fed from MDP throughout the building. Some, particularly along south wall in basement, are very old and in bad condition. One panel actually has cardboard in place of plates on the cover. All the panels on this wall should be removed and replaced with one panel to serve all the loads.

The building has an emergency generator that serves a portion of the electrical load during a power outage and it is in relatively good condition. There is no nameplate information, however the generator looks to be about 10 kW. Although the generator as installed is adequate as far as any relevant codes are concerned, it may be desirable to provide new emergency generation, at Station #1 in particular, that would serve the entire building. Station #1 is understood to be the “main” fire station, so during any widespread, prolonged power outages, such as that during the 1998 Ice Storm, this station could more easily act as a central operating location. Also, similar to what was recommended at the MDP panel, verify grounding at the generator is correct.

The generator looks to be diesel-type. Presently, the generator sets on the floor with no containment. If there is a leak or spill, the fuel oil will not remain contained and could leak into a floor drain. A simple curb around the generator should be provided.

The fire alarm system is also relatively new. It is recommended the local smoke detectors, where provided, in sleeping areas be replaced with smoke detectors tied into the fire alarm system and that additional detectors be provided for any sleeping areas that presently do not have them.

Some other general items would be to investigate relocating the electrical circuiting out of the basement bathroom, replace broken or missing junction boxes and/or covers, providing covers to fluorescent fixtures in lounge/living room area and replacing bad receptacles. In the shower area, the light switch on the south end of the room is in very bad condition (we could actually turn on and off the lights by removing the cover plate). It is also approximately 12" from a shower stall, allowing someone within the shower to operate the switch.

There is a significant amount of T12 fluorescent-tube style lighting. Although better than incandescent lighting for energy consumption, the use of even more efficient T8 type lighting would save additional energy costs. Additionally, the existing exit lighting is fairly old and some energy costs may be reduced by using LED-style or similar fixtures. Maintenance for the LED fixtures would be minimal as well, and they have a much longer life than bulb-type exit lights.

Most of the wiring within the walls is very old. Continuing the work started by replacing the incoming electrical service into the building, the remaining electrical system, including most wiring and most panelboards, should be upgraded. Many circuits are cloth-covered conductors that are at least 60 years old. Although they may look fine within junction boxes where they connect to switches and receptacles, they may have become brittle within the walls, or even damaged by vermin. They also tend to not have been provided with ground wires. Similarly for the panelboards, they have most likely not been maintained over the years and could be safety or fire hazards unless they are replaced and properly grounded.

Station #2:

Station #2, located on 132 North Avenue near Ward Street, is fed via a single phase, 120/240 volt service to 400 amp main disconnect breaker. For the most part, the electric service to the building and much of the circuiting within the building is in good shape. As indicated for Station #1 above, the grounding at the main disconnect should be verified to be installed correctly for safety. All the main panelboards serving the building are located within the main electric room.

The building has an emergency generator that serves a portion of the electrical load during a power outage. Once again, there was no nameplate information however it looks to be a 10 kW Generac unit. Although in relatively good condition, consideration should be given to replace the automatic transfer switch (ATS). The switch is old and the circuiting confusing. The contactors within the ATS look to be nearing the expected life.

Similarly to Station #1, the role of Station #2 during an extreme emergency should be evaluated to determine whether the emergency generation within the building is adequate. And once again verify grounding at the generator is correct.

This generator also should have some form of oil containment provided as just like in Station #1 it presently does not.

Other than the above, there are not many other issues. Similarly to Station #1, replace local smoke detectors within sleeping areas with ones tied to fire alarm system. At the kitchen sink, GFI receptacles are required. There are lights in the first floor corridor that do not seem to operate.

Station #3:

Station #3, located on 20 Mansfield Avenue, is fed via an old single phase, 120/240 volt, 150 amp main panel. This panel serves two additional panels within the building on the second floor and truck bay. Due to its age, it is very likely the grounding system at this panel is inadequate. The 150 amp panel is located in a very awkward location, without adequate lighting.

The building has a very old 5 kW emergency generator that serves a portion of the electrical load during a power outage, and is in very poor condition. If it is determined this building requires emergency generation, this generator and all its associated components, including its ATS, should be replaced as soon as possible. Depending on what Station #1's needs will be, the generator at Station #1 could be moved to Station #3.

The fire alarm system is relatively new. It is recommended the local smoke detectors, where provided, in sleeping areas be replaced with smoke detectors tied into the fire alarm system and that additional detectors be provided for any sleeping areas that presently do not have them.

In the basement where the main panel and generator are located there are no receptacles, other than for dedicated equipment. Additionally, the lighting is both inadequate and outdated. The incandescent lamps should be replaced with fluorescent, or at least the bulbs should be replaced with compact fluorescents. There are lots of junction boxes without covers or in bad condition, and most wiring is not secured properly.

Basically, the entire electrical system within the building should be replaced. The second floor looks to be, for the most part, unoccupied, so prior to reoccupying this space the wiring should be reworked. The first floor panelboard located in the truck bay should be replaced or removed depending on how the electrical system would be configured for the master renovation. This would include replacing all lighting and lighting controls in this area as well.

Station #4:

Station #4, located at the far end of 1397 North Avenue near Staniford Road, is fed via a single phase, 120/240 volt service via a 200 amp combination main breaker/meter to a 200 amp main lug panel board. For the most part, the electric service to the building and much of the circuiting within the building is in good shape. The main panel within the building is located adjacent to the building's water service entrance and boiler equipment and should be relocated for safety reasons. As indicated for other stations, the grounding at the outdoor main disconnect should be verified to be installed correctly, also for safety. Taking a cursory look at the service entrance seems to indicate a relatively good grounding system, however the ground electrode wiring should be traced out and ground testing should be performed to verify this. All the main panelboards serving the building are located within the main electric room.

The building has a Generac emergency generator that serves a portion of the electrical load during a power outage. Once again, it looks to be 10 kW rated. The circuiting is in good condition and the ATS is also in good condition. As discussed for previous buildings, the use of the station should be reviewed to determine if the emergency power system loads are adequate, the grounding at the generator should be evaluated and fuel spill containment provided.

Other than the above, there are not many other issues. The fire alarm system looks to be fairly new, however there are local smoke detectors in the sleeping quarters, so new ones tied to the fire alarm system should be provided. There are several light fixtures that should have broken covers replaced, and more than a few incandescent bulbs that should be replaced, if the entire fixture cannot be replaced. It looks as if T8 instead of T12 fluorescent fixtures are being used, which is desirable from an energy savings standpoint. Replacing the existing exit lights with LED type may increase those savings.

Station #5:

Station #5, located in the south end on 23 Ferguson Avenue, is very similar to Station #4 and is fed via a single phase, 120/240 volt service via a 200 amp combination main breaker/meter to a 200 amp main lug panelboard. For the most part, the electric service to the building and much of the circuiting within the building is in good shape. Once again, the main panelboard is located in same room with other utilities. As indicated for other stations, the grounding at the main disconnect should be verified to be installed correctly for safety. Taking a cursory look at the service entrance seems to indicate a relatively good grounding system, however the ground electrode wiring should be traced out and ground testing should be performed to verify this. All the main panelboards serving the building are located within the main electric room.

The building has an Generac emergency generator that serves a portion of the electrical load during a power outage. Once again, it looks to be 10 kW rated. The circuiting is in

good condition and the ATS is also in good condition. As discussed for previous buildings, the use of the station should be reviewed to determine if the emergency power system loads are adequate, the grounding at the generator should be evaluated and fuel spill containment provided.

Other than the above, there are not many other issues. The fire alarm system looks to be fairly new, however there are local smoke detectors in the sleeping quarters, so new ones tied to the fire alarm system should be provided. There also seems to be no smoke detectors within the first floor corridor. There are several light fixtures that should have broken covers replaced.

It was particularly noted at this station that the garage lighting is on all the time. It may be desirable to provide occupancy sensors for the lighting in the garage, if not more locations, to automatically turn off light fixtures when the building is unoccupied. It is understood there are many instances where this building may not be occupied since it is typically manned by only two people at any one time.

General Electrical Summary and Recommendations:

Stations #2, #4 and #5 are in relatively good shape electrically. In general, most recommendations involve providing wired smoke detectors in sleeping quarters, verifying grounding at main service and generator, providing oil containment at generators, replacing incandescent fixtures with fluorescent, and outdated T12 fluorescent fixtures with T8 type or other more energy efficient fluorescent types. Also, general maintenance such as replacing broken box and fixture covers should be performed.

Station #3 basically needs an entire new electrical system. Because only one floor is essentially occupied it may make this easier to do, however no work should occur until it is determined what the ultimate plan is for this building. The fire alarm system is essentially adequate and only needs to be upgraded as needed to accommodate the final layout.

Station #1 also needs a new electrical system, although the service entrance and main panel are adequate. Station #1's "role" during emergencies should also be determined, as it may make sense to upgrade the emergency power system to serve the entire building, not just a few selected loads. If a new generator is desired, the existing one may be able to be used at Station #3 since it is in relatively good shape.

In addition to replacing light fixtures, including exit lights, with more efficient types, the general use of occupancy sensors, particularly in corridors, bathrooms, lounge areas, garages, and other areas particularly in some of the low-occupancy stations could save some energy costs.

City Hall:

City Hall is a two story structure with a basement and is located on 149 Church St. The building consists of approximately 11,900 sq. ft. per floor.

Mechanical Systems:
The existing hot water heating system includes (6) natural-gas fired, direct vent Weil-McLain GV-6 Series 2 hot water generators rated for 175 MBH input and 153 MBH output, and (2) natural-gas fired, direct vent A.O. Smith Legend 2000 hot water generators rated for 750 MBH input and 675 MBH output. The total system output is approximately 2,300 MBH. The Weil-McClain GV-6 hot water generators were installed in 1991 and the A.O. Smith Legend 2000 hot water generators were installed in 2001. The hot water generators are located in a sub-basement level on the north side of City Hall and are used to provide heating hot water to City Hall and the Firehouse Art Center.

The existing hot water heating distribution system is configured as a primary-secondary distribution system. Each Weil-McClain hot water generator is equipped with a dedicated primary circulating pump, which was supplied with the hot water generator installation, and each A.O. Smith hot water generator is equipped with a separate primary circulating pump. The primary pumps circulate water through the hot water generators and the primary loop piping, and heating hot water is distributed from the primary piping to individual zone loads via redundant horizontal, in-line circulating pumps. The secondary pumps are equipped with variable frequency drives to control motor speed/pump flow. The primary method of heating throughout the building is accomplished through air handling units with hot water heating coils, hot water convectors, and hot water cast iron radiators.

The cooling source for the building is primarily provided by the chiller plant located in the basement. The chiller plant consist of (1) Carrier 30HR050C500 water cooled chiller and (1) McQuay WGZ050AW27-Er10 water cooled chiller. The chiller plant utilizes (2) cooling towers located on the Fire House Art Center roof in order to reject heat from the water cooled chillers. The chilled water is distributed via pumps throughout the building to the cooling equipment. A condensing unit on the roof also provides cooling to an air handling unit through a DX coil. The primary method of cooling throughout the building is accomplished through air handling units with chilled water cooling coils.

Each level has varying methods for heating. Level 3 utilizes hot water cast iron radiators for space heating and a dedicated air handling unit with a chilled water cooling coil for space cooling. Level 2 utilizes hot water cast iron radiators for space heating and (2) mini split units are for space cooling in the Clerk and Treasurer offices and an air handling unit with a chilled water cooling coil for auditorium cooling. There is no HVAC in level 2 corridors. Level 1 utilizes hot water convectors for space heating and a dedicated air handling unit with a chilled water cooling coil for space cooling.

Ventilation air is accomplished through air handling units located throughout the building, and a heat recovery unit with a heating coil located in the basement. The air handling units do not currently provide year round ventilation. There are multiple spaces including bathrooms and copy areas which do not have exhaust or ventilation air.

General Mechanical Summary and Recommendations:
Overall, the building's mechanical system is in adequate condition; however, there are multiple locations that require or are not currently provided with year round ventilation. We would recommend modifying all air handling units and controls to utilize year round demand control ventilation. We would also recommend that ventilation air be provided to the fire pump room, level 1 bathroom, level 3 bathrooms, and for the copy room on level 3. We would also recommend providing heating, cooling, and ventilation air to the level 1 corridors. Finally, we would recommend insulating the air duct on the air handling unit serving level 3.

Plumbing Systems:

City Hall is equipped with Men's and Women's restrooms on level 1 and level 3. The level 1 bathrooms consist of (2) water closets, (2) Urinals, and (2) lavatories. The level 3 bathrooms consist of (5) water closets, (3) Urinals, and (4) lavatories. None of the existing bathroom fixtures are equipped with water saving controls. With the exception of the level 1 water closets, all of the bathroom fixtures are old and require replacement.

General Plumbing Summary and Recommendations:
We would recommend replacing all bathroom fixtures with new low flow high efficiency fixtures. We would recommend replacing all water closets with new dual flush water closets. We would recommend that all lavatories be replaced and provided with automatic low flow faucets. Finally we would recommend that all urinals be replaced with a new waterless type.

Electrical Systems:

City Hall is fed via a 1200 amp three phase, four wire 120/240 volt service to a 1200 amp main distribution panel (MDP) located in the basement, and is provided with a surge suppression system (TVSS) to protect the electrical system from spikes in power that may damage sensitive equipment. This system is non-typical, in that it is a special "delta"-wired system that separates all single phase and three phase into two separate systems within the building. As a result, to get power for devices like receptacles, lighting and other smaller loads, the single phase 120/240 volt system is used. For larger loads and motors that use three phase power, a separate three phase 240 volt system is used.

The above service entrance equipment is essentially new and in good condition. However, beyond this location most of the panelboards are older. There are only a few panelboards throughout the building.

The building has no emergency power generation, and therefore relies on battery-powered emergency lighting and fire alarm system.

The fire alarm system is very new and for the most part provides protection for the entire facility, however some areas, such as Payroll, may need some supplemental audio/visual devices, and storage-type areas, like that in the City Attorney's office where paper-documents are stored, should be provided with smoke detectors.

There is a significant amount of T8 fluorescent-tube style lighting on the upper 2nd and 3rd floors and compact fluorescent fixtures on 1st floor. The 1st floor, where the Planning and Zoning Department is located, has been recently renovated and as a result all electrical systems are in relatively good condition. Many offices on the 1st floor use dual-ballast fixtures that use two switches, allowing for less lighting to be used when desired. There are some locations that still use incandescent lamps, the most significant of which is Contois Auditorium where the wall mounted lighting uses incandescent bulbs. Some other isolated areas also used incandescent bulbs, however these are few.

Although energy efficient T8 style lamps are being used, it was noticed that almost all lighting was on, even in areas that rarely are occupied. Additionally, many fixtures have either broken covers or none at all. Because the lamps are fluorescent-tube style, when damaged they shatter into many small pieces, making covers even more important.

There is some exit and emergency lighting. On the upper floors, older incandescent type exit lights are used. In some stairwells, like the one to the bottom floor at northeast end of the building, there is no emergency egress lighting.

Most of the wiring within office areas is via surface mounted raceways (Wiremold), and in many of these locations the raceway is either full, disengaged from the wall or broken. As a result, where additional wiring or data cabling was required, it is run exposed; supported either to the surface raceway, baseboard molding, extended along the floor or hanging. This includes power wiring within flexible conduit as well as data and telephone cables.

Where surface raceway is not used on the 2nd and 3rd floors, the older, wall-run wiring and devices are used. In these situations, light switches are typically older, push-button style, and receptacles are older, non-grounded type. Although we were not able to confirm, this typically indicates that the wiring within the walls is older, cloth-covered cables that are not installed within conduit.

In offices on the upper floors, there seems to be a lack of receptacles as well, resulting in the extensive use of extension cords or power-strips, which could result in overloading of circuits. Similarly, no maintenance receptacles were located near the HVAC equipment in the bottom floor or in 4th floor attic space.

In the CEDO area, some receptacles are orange, indicating they are isolated ground-type, which may not be the case.

Most of the data/computer cabling is either hanging from above, taped to floors or exteneded along walls.

Other particular areas have specific issues. The "Recreation Office" has one receptacle, no data connector, and no light fixture switch. In the "CEDO" office, there is exposed wiring to some radiator valves, flexible conduit "hanging" from walls, non-grounded receptacles and exposed telephone cabling.

It also looks as if the "data system" within the building may need review. Some locations have modems, even though the building itself has a fiberoptic connection. It should be noted the fiberoptic connection from outdoors is located in the fire pump room.

General Electrical Summary and Recommendations:

The main electrical service entrance is adequate, however the electrical system beyond should be replaced. This includes most of the circuiting, including most if not all of the surface-mounted raceway. Although it is desired to have any new circuiting within walls, new surface mounted raceway could be implemented if needed; however it should be sized to accommodate the increased electrical needs of the building, both in size and number of receptacles and data outlets. All existing wiring within the walls should be replaced.

Provide maintenance receptacles near HVAC equipment, data centers or other locations where equipment that must be maintained is located.

Additional emergency lighting should be provided along each stair location, or any other egress path that presently would not have any lighting during a power outage.

Occupancy sensors should be employed throughout the building, particularly rarely used rooms, bathrooms, etc. It is recommended to provide sensors within office areas, particularly those being used by personnel who do not occupy them often. This could result in considerable energy savings, particularly due to the fact few rooms are ever occupied. Dual-ballast or dimmable lighting should be provided in all large open office areas.

Replacing or providing covers for fluorescent fixtures, or replacing incandescent bulbs with fluorescent-type, should be performed under general maintenance, if possible. This is also the case for missing covers on electrical junction boxes or devices. It may be desirable to replace outdoor wall mounted light fixtures with newer LED types, which can provide more light with fewer fixtures.

During any renovations, additional data/communications conduit and cabling should be provided to allow removal of existing system. A centralized design should be designed, with the possible inclusion of a dedicated communications room to allow for easier expansion in the future.

Leddy Park Ice Rink:

Leddy park ice rink is a two story structure located on 216 Leddy Park Rd.

Mechanical Systems:
The existing hot water heating plant consist of (2) Smith GB300 boilers with 1500 MBH input and 1233 MBH Output. The boilers are vented via a 16”Ø Stack and combustion air is accomplished through (2) 38”x24” control dampers which need replacement. The heating plant operates at 180°F and is a constant volume system with 3-way mixing valves. The hot water heating plant supports a portion of the domestic hot water heating and multiple hot water unit heaters and fan coil units located throughout the facility. The Green Mountain Glades locker room, the hockey store, the snack bar, the official’s locker room, level 2 viewing room, level 2 bathrooms, and level 2 storage area are all heated via hot water unit heaters. The Burlington high school boy’s locker room and team room’s A through D are heated via fan coil units with hot water heating coils. The other methods of heating in the facility include infrared heaters, sub-floor heating, and gas fired furnaces. (16) infrared heaters are utilized in order to provide heating for spectators in the stands. The sub-floor heating system supports the ice rink and is a product of the heat rejection of the refrigeration unit system which supports the cooling of the ice. American Standard Freedom 90 Gas fired air furnaces (residential quality) are utilized to provide heating for the warm-up room, Colchester boys locker room, Colchester girls locker room, and the level 2 offices. The unit supporting the level 2 offices is also equipped with a DX system which provides cooling to the space. There is currently no heat provided in the Burlington high school girls locker room.

The ice rink utilizes a Munters model A30 wheel type desiccant dehumidifier unit for space dehumidification and a water cooled refrigeration unit with (2) twin cylinder compressors in order to maintain the rink ice surface. The refrigeration unit is cooled via a remote cooling tower.

Exhaust fans provide ventilation throughout the facility. There is minimal ventilation air through out the facility. Many spaces including locker rooms and bathrooms are

currently not provided with ventilation air. The Kitchen ventilation does not currently meet code due to the construction of the cooking hood and filter rack

General Mechanical Summary and Recommendations:
Our findings show the existing building's mechanical systems are inefficient and in poor condition. Furthermore, there are multiple spaces such as bathrooms and locker rooms in which there is no ventilation air. This does not meet building code requirements and is a health concern.

We would recommend upgrading the heating plant to a variable volume system with new high efficiency gas-fired hot water condensing boilers. We would also recommend upgrading the refrigeration system to a high efficient chiller linked to the heating system in order to utilize the heat rejection from refrigeration process for heating. We would recommend providing ventilation air to all spaces via energy recovery units with hot water heating coils in order to provide heating and ventilation air to the spaces.

We would also recommend upgrading the kitchen exhaust hood to an efficient kitchen hood that meets current building code requirements.

Plumbing Systems:

Domestic hot water is provided to the facility via indirect and electric domestic water heaters. Two indirect water heaters, 200 gallon and 50 gallon, provide hot water to the zamboni storage tank, locker rooms, and bathrooms. A 7000 watt electric hot water heater provides domestic hot water to the kitchen fixtures. This water heater does not meet current energy efficiency requirements. The kitchen is also equipped with a grease interceptor which does not meet current building code requirements.

The existing locker room and bathroom fixtures are not equipped with any water saving capabilities. The existing showers are in poor condition, do not have scald proof shower valves, and should undergo replacement.

General Plumbing Summary and Recommendations:
Our findings show that the existing plumbing fixtures are in poor condition and are not equipped with any water saving technology. We would recommend replacing all bathroom fixtures with new low flow high efficiency fixtures. We would recommend replacing all water closets with new dual flush water closets. We would recommend that all lavatories be replaced and provided with automatic low flow faucets. We would recommend that all urinals be replaced with a new waterless type. We would also recommend that all showers be demolished and replaced with new shower units fitted with water saving controls.

We would recommend that the kitchen domestic water heater be replaced with a new 70 gallon indirect domestic hot water heater and the that the existing grease interceptor be

upgraded to meet code requirements. The indirect water heaters should be enhanced with a waste heat domestic water heater if the refrigeration plant is replaced.

Electrical Systems:

Leddy Ice Rink is fed via a 600 amp three phase, four wire 277/480 volt service from the from an outdoor pad mount transformer to a main 600 amp fused disconnect, which then feeds several panels via taps within a wireway. Although the switchgear looks to be in decent shape, it is at least 30 years old, making it older than its expected useful life, and in many instances no longer compliant with relevant electrical codes, such as the National Electrical Code (NEC). The panel was manufactured by Federal Pacific (FPE), which no longer exists, making it difficult to find replacement circuit breakers and parts. Other than the main distribution panel (Panel DP), the electrical panels have little to no spare breaker capacity, preventing any expansion. In fact, in many instances where new equipment requiring electric power was added to the building, taps from existing conductors or panelboards were made, which can result in reduced safety and reliability of existing electrical equipment since taps, etc., require cutting into these existing systems. It could not be confirmed, however it should be verified that the main building grounding system at this location is adequate. Typically an electric service of this age would require its main grounding to be revised to accommodate the latest standards.

Multiple small panels are fed from Panel DP throughout the building. Most are also manufactured by FPE and therefore have the same issues as the main electric panels, particularly the fact that there is no spare capacity. Similarly, some disconnect switches for older equipment are also FPE.

The building has no emergency generation, and therefore relies on battery-powered emergency lighting and fire alarm system.

The fire alarm system is very new and for the most part provides protection for the entire facility.

There is a significant amount of T8 fluorescent-tube style lighting. Above the small ice rink, “high bay” style HID lighting is being used. There are battery-powered emergency lights located under the bleachers and along the back walkway on east walkway at top of bleachers, however not along the west walkway adjacent to the rinks or at some stair locations. Additionally, the existing exit lighting is fairly old and some energy costs may be reduced by using LED-style or similar fixtures. Maintenance for the LED fixtures would be minimal as well, and they have a much longer life that bulb-type exit lights.

Although energy efficient T8 style lamps are being used, it was noticed that almost all lighting was on, even in areas that rarely are occupied. Apparently there are some occupancy sensors, however some of those are not working. Additionally, many fixtures

have either broken covers or none at all. Because the lamps are fluorescent-tube style, when damaged they shatter into many small pieces, making covers even more important.

Most of the wiring is conductors via conduit/raceway and seems to be in good condition. In several locations there were missing covers to junction boxes or devices that should be repaired as part of general maintenance.

Most of the data/computer cabling is either hanging from above, taped to floors or run along walls.

General Electrical Summary and Recommendations:

The main electrical service entrance should be replaced with new. Similarly, much of the downstream electrical panels throughout the building should be replaced as well. Where conductors or conduits can be reused, only those showing damage would need to be replaced.

Additional emergency lighting should be provided along west walkway and at each stair location.

Occupancy sensors should be employed throughout the building, particularly within rarely used rooms, bathrooms, etc. We recommend installing sensors within office areas, particularly those being used by personnel who do not occupy them often.

Replacing or providing covers for fluorescent fixtures should be performed under general maintenance, if possible. This is also the case for missing covers on electrical junction boxes or devices.

Replacement of the existing high-bay HID lighting should be considered not only for energy reasons but also to provide more light that comes on instantaneously when switched on.

During any renovations, additional data/communications conduit and cabling should be provided to allow removal of existing system.

In addition to replacing light fixtures, replace older exit lighting with newer LED style

Fletcher Free Library:

Mechanical Systems:
The existing library is composed of two main eras of construction. The original building is supported with a few small air handling units, radiators, and cabinet unit heaters. The newer building is supported by a large air handling unit (AHU-1) located in the basement behind the offices and a few cabinet unit heaters. The building heating source is (2)

Buderus Logano GE-515 atmospherically vented hot water boilers. These boilers are in great condition. The cooling source is (1) Carrier model 30HXC096RZ-540 water chiller which is cooled with a roof mounted BAC model VXT130CR induced draft cooling tower. The cooling system is in great condition.

Each air handling unit is fitted with a heating coil and cooling coil. The large air handling unit (AHU-1) serving the library addition is experiencing air balancing concerns which is effecting the basement offices with noise and air drafts. Each level of the new addition is fitted with terminal hot water reheat coils for zone control. Currently warm air is stratifying at the upper level of the library reducing comfort on this level.

The hot water unit heaters and cabinet unit heaters throughout the building appeared to be operational as does the perimeter radiation. Almost all systems are served by pneumatic controls, except for AHU#5 and the large air handling unit. The pneumatic controls system air compressor operated the entire period of time we completed the building observations.

The building roof is fitted with (3) centrifugal roof exhausters, which provide ventilation air exhaust. These units were not operating at the time of our visit.

General Mechanical Summary and Recommendations:
We recommend replacing all existing pneumatic controls system components with a new direct digital controls system. We recommend this control system provide demand control ventilation for all air handling units. We recommend completing and airflow engineering assessment of AHU-1 in order to correct the multiple air flow and stratification concerns with the unit. The conclusion of the assessment will determine an appropriate course of action. This should be completed in conjuction with the implementation of the demand controlled ventilation recommendation.

Plumbing Systems:
The existing water entrance is a dedicated 4” entrance reduced to a 2” water meter and 2” domestic water main for the building. There is also a dedicated 6” fire protection entrance which serves (1) 4” wet valve and (1) 4” dry valve. The domestic hot water is heated with an atmospherically vented gas fired tank type water heater. The bathroom plumbing fixtures are all in good condition, but do not implement water saving features. The plumbing system was recently renovated and is in great condition.

General Plumbing Summary and Recommendations:
We recommend replacing the inefficient tank type domestic water heater with a high efficiency water heater. The unit can be downsized as the building has a low domestic hot water load. We recommend replacing the lavatory faucets with automatic flow control units. We recommend replacing the water closets when they reach their peak life with dual flush toilets.

Electrical Systems:

Fletcher Library's main electric service is a 1600 amp three phase, four wire 120/208 volt switchboard fed from an outdoor pad mount transformer. The 1600 amp switchboard feeds which then feeds several panels via taps within a wireway. The switchgear looks to be in decent shape.

The building has no emergency generation, and therefore relies on battery-powered emergency lighting and fire alarm system.

The fire alarm system is very new and for the most part provides protection for the entire facility.

The lighting throughout is either T8 type fluorescent or compact fluorescent. There is little, if any, use of occupancy sensors. The newer library addition is fitted with 348 single tube fluorescent fixtures that are enabled during library operating hours. These fixtures mostly serve the bookshelves.

Most of the wiring is conductors via conduit/raceway and seems to be in good condition.

General Electrical Summary and Recommendations:

For the most part, the main electrical service entrance is in good shape and there is no need to replace. Similarly, much of the downstream electrical panels throughout the building are in good shape as well.

It may be advantageous to move the computer lab at the southeast corner of the first floor to the north side of the building, possibly the northeast corner. Using computers at the southeast corner requires the windows to be shaded so the users can see the computer screens and not have the sun in their eyes. However, this also prevents any radiant heat or natural light from the sun. Moving the lab to the north side would allow for the shades to be raised, particularly in the winter, to provide some additional natural heat and light. This revision linked with daylight control could be used to reduce operating expenses and provide more useful natural light for reading.

Occupancy sensors should be employed in several areas, particularly those with little traffic, such as in the conference, Pickering and West Wing rooms. It may even be appropriate to provide sensors within office areas, particularly those being used by personnel who do not occupy them often. This could result in energy savings; particularly due to the fact few rooms are ever occupied.

The light switching should be revised to separately switch the "corridor" perpendicular to the book shelves and the book shelf "aisles" between book shelves. The existing switching turns all the lighting on, even where it is not needed. Combining moving the

computer lab, many book shelf aisles could be provided with motion sensing, with possibly light-sensing override, to turn on lights only when someone is in the aisle and there is not enough natural light. This would significantly reduce the number of light fixtures on at one time.

In addition to replacing light fixtures, replace older exit lighting with newer LED style.

Firehouse Art Center:

The Firehouse Art Center (FG) is a four story structure with a basement and is located on 135 Church street. The basement, first, second, and third levels consist of approximately 2,500 sq. ft. per floor, and the fourth level consists of approximately 1,000 sq. ft..

Mechanical Systems:
The heating source for the building is provided via the hot water heating plant located in the City Hall basement. The hot water is distributed throughout the building and used to support the heating equipment. The primary method of heating throughout the building is accomplished through runtal radiation and radiant ceiling panels.

The cooling source for the building is primarily provided by the chiller plant located in the city hall basement. A condensing unit on the roof also provides cooling to an air handling unit through a DX coil. The chiller plant utilizes (2) cooling towers located on the fire house art center roof in order to reject heat from the water cooled chillers. The primary method of cooling throughout the building is accomplished through air handling units and fan coil units with chilled water cooling coils.

Each level has varying methods for heating and cooling. Level 3 and level 4 utilize runtal radiation for space heating and dedicated air handling units for space cooling. Level 2 utilizes runtal radiation for space heating and dedicated fan coil units for space cooling. Level 1 utilizes runtal radiation for office space heating, radiant ceiling panels for gallery space heating, and dedicated fan coil units for space cooling.

Ventilation air is accomplished through an exhaust fan and an energy recovery unit located on the roof. These units provide ventilation air to the bathrooms throughout the building.

General Mechanical Summary and Recommendations:
Overall, the building's mechanical system is in adequate condition; however we would recommend revising the control strategy for some of the systems. We would recommend relocating the thermostats located in the level three corridor to their associated room in order to provide better controllability. We would also recommend replacing all Erie control valves in the basement with new Belimo or Siemens control valves. Finally, the

fan coil unit serving the east studio is noisy. We would recommend providing a VFD for the unit in order to reduce the noise in the space and obtain desired distribution air flow.

Plumbing Systems:
The existing plumbing fixtures within the building are new and in good condition, however the lavatory faucets do not include automatic operation. The water closets are not dual flush however they should not be replaced. We recommend installing automatic faucets for all lavatories.

Electrical Systems:

The Firehouse Art Center is fed via a relatively new 600 amp three phase, four wire 120/208 volt service to a main distribution panel (MDP), which then feeds panels throughout the building. The MDP also has a surge suppression system (TVSS) to protect the electrical system from sudden spikes in power, which may damage equipment such as computers or other sensitive devices. The MDP and the panels it feeds all have adequate capacity for additional equipment.

Multiple small panels are fed from Panel DP throughout the building. Most are also manufactured by FPE and therefore have the same issues as the main electric panels, particularly the fact that there is no spare capacity.

The building has no emergency generation, and therefore relies on battery-powered emergency lighting and fire alarm system.

The fire alarm system is very new and for the most part provides protection for the entire facility.

There is a significant amount of incandescent lighting. This may be due to the need for certain lighting conditions, however this does result in significant energy usage. In some offices cord-style incandescent “lamps” are used instead of the ceiling fluorescent lighting, once again resulting in increased energy usage. Similarly, most of the lighting was on, even in unoccupied areas.

In the kitchen, the ceiling mounted fluorescent fixtures do not have covers. In any area where food is being prepared or served, it is recommended that light fixtures be provided with covers to prevent glass fragments from getting into either food, or food-prep equipment.

Most of the wiring is conductors via conduit/raceway and seems to be in good condition.

For the most part, there are adequate receptacles and data outlets throughout. One particular location that does not have a receptacle is on the roof adjacent to the HVAC equipment, for use during maintenance

General Electrical Summary and Recommendations:

For all practical purposes, the electric system with the building is in very good condition. Some items that should be considered are as follows:

- Occupancy sensors should be employed throughout the building, particularly rarely used rooms, bathrooms, etc. We recommend installing occupancy sensors within all office areas.

- An alternative to the incandescent lighting. Specific color-rendered fluorescent lighting may be able to produce similar, if not better, lighting to the incandescent lamps.

- Provide a maintenance receptacle for the outdoor HVAC equipment on the roof.

END

You will find attached a spreadsheet of the recommendations with a probable construction cost, notes, and recommended priority. We hope you find this report informative. Please contact us if you have any questions or concerns.

Sincerely,

L.N. Consulting, Inc.

John Askew, P.E.
Electrical Engineer

And

Wayne Nelson, P.E.
Mechanical Engineer

Encl.: Probable Construction Cost Spreadsheet