CORDJIA
Capital Projects Group, LLC

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Town of Camden, Maine

Camden Municipal Building

Retro-Commissioning Interim Report

March 28, 2011

Town of Camden

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CERTIFICATION

The Town of Camden retained Cordjia Capital Projects Group, LLC ("Cordjia") to perform a building retro-commissioning study in connection with the Camden Municipal Building located on the corner of Main and Washington Streets in Camden, Maine.

The conclusions and recommendations presented in this report are based on the review of plans and documents made available, interviews with the Town of Camden facilities staff, as well as Cordjia's experience with similar buildings.

Several site inspections that included exploratory probing, dismantling, the operation of equipment, and in-depth studies were performed as required. Although walk-through observations were performed, not all areas were observed. There may be defects in the building, which were in areas not observed or readily accessible or may not have been visible. This report has been prepared on behalf of and exclusively for the use of the Town of Camden for the purpose stated within the Project Understanding section of this report. The report, or any excerpt thereof, shall not be used by any party other than the Town of Camden or for any other purpose than specifically stated in our agreement or within the Project Understanding section of this report without the express written consent of Cordjia.

Any reuse or distribution of this report without such consent shall be at the Town of Camden and the recipient's sole risk, without liability to Cordjia.

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1. EXECUTIVE SUMMARY

The Town of Camden was interested in finding ways to improve building performance, reduce energy consumption, extend the life of the equipment, and improve the comfort of the Camden Municipal Building ("Municipal Building") located in Camden, Maine. As a result, Cordjia Capital Projects Group, LLC ("Cordjia") was retained to perform a retro-commissioning study for the Municipal Building.

The retro-commissioning study involved the collection of operational data and the performance of functional testing of building systems to identify flaws in operations and recommending opportunities to optimize energy efficiency and thermal comfort to meet the Town of Camden's requirements.

The recommendations within this report represent a 20% reduction in energy costs or approximately $7,175 annually. This equates to an 12% reduction in annual electrical costs ($2,245) and a 28% reduction in annual fuel costs ($4,930). If all the recommendations in this report are performed the aggregate return on investment ("ROI") is 2.9 years.

1.1. SUMMARY OF FINDINGS

The Municipal Building is a multi-use facility that houses the Camden Town Offices, Public Meeting Spaces, and the Opera House. The three-story, 41,800 square foot building was constructed in 1894 and has undergone multiple renovations over the last 117 years. Based upon information provided by the Town of Camden, the annual cost to operate this building (which includes electricity and fuel oil) was $33,414. Based on the new fuel oil cost of $2.35 per gallon, we estimate the current annual cost to be **$35,580.**

Specific components of the building reviewed include:

- Steam Boiler
- Steam Radiator Heating System
- Steam to Water Heat Exchanger
- Hot Water Circulation Pump
- Air to Air Heat Exchanger
- Main Building Air Handling Units
- Opera House Air Handling Units
- Main Building Condensing Units
- Opera House Condensing Units
- Cabinet Unit Heater
- Exhaust Fans
- Thermostats & Controls
- Pipe Insulation & Valves
- Lighting

The Municipal Building's mechanical systems have been replaced and upgraded several times over the years to include the installation of a new air conditioning system in 1999 that serves the Opera House and an air conditioning and ventilation system that was installed in 2003 that serves the Town Office areas.

The layout of the heating system in the building does not work well for its use today. There is limited ability to control the heating system from space to space and floor to floor. The heating loops in the building do not meet the design requirements of the heating system based on vertical piping of radiation units going between floors.

The following table shows a summary of our identified energy conservation measures that will improve building performance, reduce energy consumption, extend the life of the equipment, and improve the environment for the occupants of the Municipal Building.

ID	Energy Conservation Measure	Annual Fuel Cost Savings	Annual Electric Cost Savings	Implementation Cost	ROI
1	Install combustion air damper	$258	$0	$500	1.9
2	Change reset controls on steam to water heat exchanger	$557	$0	$0	0.0
3	Schedule occupied operation of air to air heat exchanger and communication to the air handlers	$0	$2,245	$850	0.4
4	Re-zone heating system	$2,543	$0	$17,870	7.0
5	Insulate steam piping	$1,572	$0	$1,240	0.8
6	Change controls on air handlers to simplify heating and cooling through the use of a modulating thermostat and eliminate simultaneous heating and cooling	Unable to calculate		$3,200*	-
Totals		**$4,930**	**$2,245**	**$20,460**	**2.9**
		$7,175			
		28% reduction	**12% reduction**		

* Energy Conservation Measure not included in totals

1.2. OTHER CONSIDERATIONS

We observed other considerations that were not part of our scope of work for the retro-commissioning study that we wish to bring to your attention:

- Windows have come off their tracks and are allowing outside air to infiltrate
- Openings through the exterior envelope are not sealed and are allowing outside air to infiltrate

Exterior Window

Outside Air Intake Louver

2. PROJECT UNDERSTANDING

The Town of Camden was interested in finding ways to improve building performance, reduce energy consumption, extend the life of the equipment, and improve the comfort of the Camden Municipal Building ("Municipal Building") located in Camden, Maine.

As a result, Cordjia performed a retro-commissioning study which involved the collection of operational data and the performance of functional testing of building systems to identify flaws in operations and recommend ways to optimize energy efficiency and thermal comfort to meet the Town of Camden's requirements.

The benefits of a retro-commissioning study include:

- Improving system operation – beyond preventative maintenance
- Improving equipment performance
- Improving energy savings
- Improving occupant comfort
- Increasing operation and maintenance ("O&M") staff capabilities and expertise
- Improving indoor environmental quality ("IEQ")
- Improving building documentation
- Increasing asset value

3. METHODOLOGY

Our approach to retro-commissioning involved a rigorous analysis of the Municipal Building's operations. Through observation, targeted functional testing, and analysis of trend and portable logger data, Cordjia identified deficiencies in the operation of the mechanical equipment, lighting, and related controls, and determined opportunities for corrective action and other operational improvements to optimize energy efficiency and thermal comfort.

In our retro-commissioning investigation, the following methods were used to identify and demonstrate opportunities for savings: engineering calculations, trending using data loggers, functional tests, and written site visit notes and photographs. In all cases, standard engineering calculations were used to estimate the potential energy impacts of correcting the identified deficiencies, including annual energy savings and peak demand savings.

4. EVALUATION TEAM

Several on-site inspections were performed in March 2011 by Blaine Buck, Mark Blair, Jill Edwards, Scott Holt, and Mitch Daigle of Cordjia. The on-site inspections also included Dave Morrison from the Camden Town Office. Mr. Morrison provided an overview of the building and access to all the building systems.

5. TOWN OF CAMDEN SUPPLIED INFORMATION

Prior to conducting the site inspections, Cordjia reviewed the latest information specific to the building including the following documents:

- Historical oil usage
- Historical electric usage
- Architectural plans, dated June 2006
- Mechanical plans, dated 2003, 2004, and 2006

6. OBSERVATIONS AND RECOMMENDATIONS

The following observations and considerations were developed as a result of our evaluation.

6.1. STEAM BOILER

Observation: The existing 1,519 MBH Burnham oil fired steam boiler was installed in approximately 1999 and might be the second or third boiler to operate in this building. The steam boiler has an older HB Smith Carlin burner. There are three 330 gallon fuel tanks in Basement No. 1 next to the boiler and a relatively new condensate tank and make-up feed pump. The combustion air supply is uncontrolled and allows cool air to pass through the burner, thereby reducing the efficiency of the boiler. The boiler appears to be maintained and operating at approximately 83% efficiency. There is no chemical water treatment on the boiler which would eliminate scaling on the water side of the boiler. With an effective steam trap maintenance program and a good condensate return system, the make-up water could be kept to a minimum thus reducing the need to treat make-up water.

Recommendations: It is recommended that a combustion air damper with an actuator be installed to only allow outside air into the boiler room when the boiler is firing. Studies have shown that air flow through idle boilers can reduce boiler efficiency by 1.5%.

Steam Boiler

Boiler Combustion Air Supply

6.2. STEAM RADIATOR HEATING SYSTEM

Observation: There are a total of ten steam zones throughout the building that have been modified over the years creating multi-floor zoning and multiple zones within the same area. We have identified and documented all of the zones. All the radiators and baseboard units have been accounted for within the ten zones. The zone control valves vary in age, some as far back as the 1960s. All the zone valves are controlled by Honeywell T-87 analog thermostats except for the thermostat in the assessor's office and meeting room. There are multiple style heating devices, radiators, baseboard, and wall units. Most of the original steam radiators have been modified with a manual control supply valve allowing for individual control of each unit within a particular zone. This is true for the fin tube style wall mounted units typical in the Town Manager's Office. The cast iron baseboard that is used in several zones allows steam to pass straight through without this type of device. There are a number of radiators that appear to be originally designed for a hydronic (water) heating system. They have been installed in several locations and are not as effective to operate as a steam radiator.

Recommendations: The zone control throughout the building should be modified to manage the individual spaces and individual floors. Multiple thermostats in the same space should be combined into one thermostat to control the heating and cooling specifically in the Finance area and the Main Town Office area. We recommend installing modulating programmable thermostats in occupied spaces.

Various Steam Radiator Heating Unit Styles

6.3. STEAM TO WATER HEAT EXCHANGER

Observation: In the basement there is a small TACO steam to water heat exchanger used for two of the four air handlers with reheat coils in the Main Town Office area and the Finance area. This unit has a dedicated circulation pump that is controlled by outside air and the water loop temperature control is set up to operate on outside air. The outside air set points were backward and have been corrected. Outside air reset works on this principle: the colder the ambient air, the hotter the water needs to be when supplied to the coils. The boiler temperature was set on 170°F when outside air was 70°F, and 70°F when the outside air was 20°F. As a result, this was forcing the control to operate the heat exchanger at 170°F all the time. A fourth air handler is located in the Tax Assessor area that has a steam coil for heat.

Recommendations: We corrected the heat exchanger set points to operate at 170°F when the outside air is 0°F and 112°F when the outside air is 60°F. The Honeywell T775R controller immediately responded and reset the loop temperature to 138°F on a 40°F day.

Steam to Water Heat Exchanger

6.4. HOT WATER CIRCULATION PUMP

Observation: The TACO hot water circulation pump is dedicated to the two air handlers that serve the Main Town Office area and the Finance area. This pump is also controlled by outside air and is currently set on 38°F. There is no control connection between the pump and the heat exchanger.

Recommendations: We recommend controlling the pump with the existing heat exchanger controller. These two components should be operating in sequence.

Hot Water Circulation Pump

6.5. AIR TO AIR HEAT EXCHANGER

Observation: HRV-1 is located in Basement No. 2 and is controlled by a Honeywell controller in Basement No. 1. The HRV unit was installed to perform two functions:

- Remove the humid air from Basement No. 2.
- Temper the outside air being delivered to Air Handler Nos. 1, 2 and 3. During the winter months the air would be heated through the exchanger and cooled during the summer months. This is all based on the air temperature of Basement No. 2.

The unit does not have any heating capabilities other than through the exchange of air. There is a defrost cycle available on the unit that is not being used based on the location of the unit and the supply air being exhausted.

The unit is controlled by a Honeywell T775E controller which is based on outside air humidity. The set point is set at 95% with a 1% humidity differential. This means when the humidity level rises above 95%, the unit will start and when the humidity level drops below 94%, the unit will shutdown. These numbers may be set higher for the winter months to ensure the unit does not run.

We are concerned about the controls for this unit because the unit is designed to recover exhaust heat from the basement and remove humidity in the summer which, in turn, cools the incoming air for the ventilation to the air handlers. The controller is not connected to the air handlers, therefore the unit will run on its own controls without knowing the status of the air handlers. During our on-site visits, the air handlers were off for the most part and the air to air heat exchanger was running and supplying air that was not being delivered anywhere.

Recommendations: We recommend connecting the operation of the air to air heat exchanger to the Main Town Office Air Handler No. 3. This will operate the unit only when the building is occupied during the day which is when humidity levels are highest. This will reduce the electrical consumption on this unit by 14 hours per day.

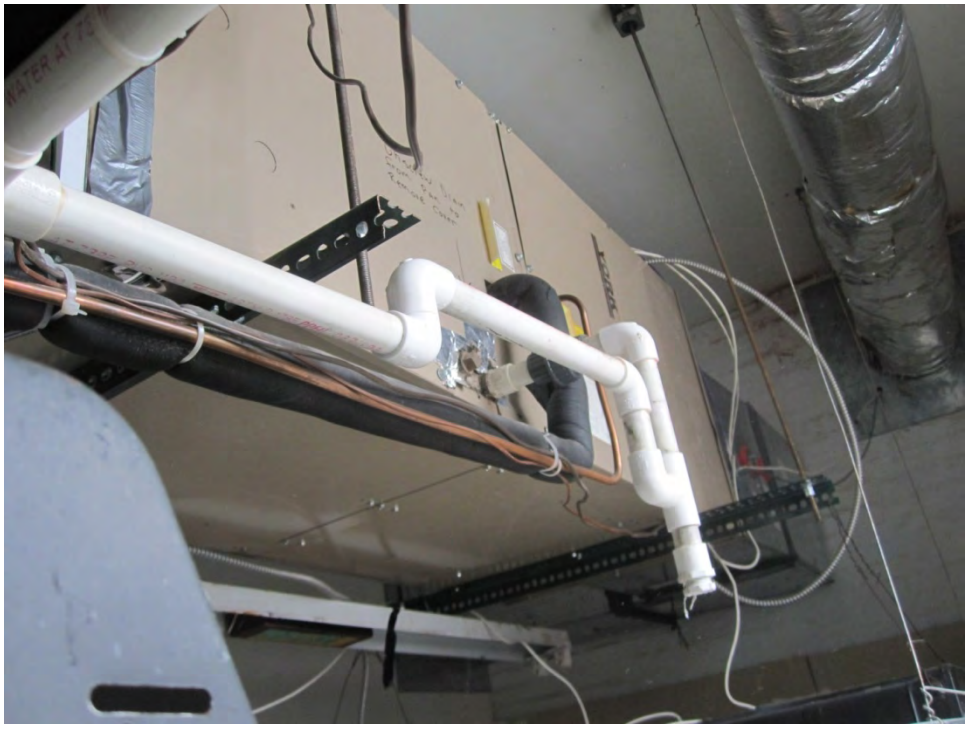
Air to Air Heat Exchanger

6.6. MAIN BUILDING AIR HANDLING UNITS

Air Handler No. 1 (Washington Street Meeting Room)

Observation: This unit is a 5 ton York air conditioning unit that is supplied with outside air through the air to air heat exchanger in the basement. This unit is controlled by a programmable thermostat and a Honeywell T775 R controller. The thermostat also controls the fin tube radiation in this area. The unit was not operating at the time of our on-site inspection and we noted the set points for heating and cooling at 66°F and 77°F respectively. The schedule was the same Sunday through Saturday 6:00 a.m. to 9:00 p.m. We are planning to return in order to measure the electrical demand once the air conditioning season starts.

Recommendations: We recommend that the timeframes be reviewed and adjusted to meet the needs of the space as well as changing unoccupied set points to minimize the run time of the equipment during off hours.



Air Handler No. 1

Air Handler No. 2 (Finance Area)

Observation: This unit is a York 3.5 ton air conditioning unit located above the bathroom ceiling on the back side of the Finance area. The unit is controlled by a programmable thermostat that controls the set points and schedule. The area of the building that this unit serves also has a heating thermostat that controls baseboard units and radiators. This heating thermostat also controls heating units in other parts of the building. The Honeywell controller in the basement was originally set up to control the heating of the space in two stages. This was changed at some point and the standalone thermostat in the Finance area was installed. The controller now only controls the discharge air set point when the programmable thermostat is calling for heat. The thermostat controls the unit when cooling is needed as well as the on and off schedule. We noted the set points for heating and cooling at 65°F and 76°F respectively. The schedule was Monday through Friday 6:30 a.m. to 6:00 p.m. with an unoccupied set point of 55°F heating and 80°F cooling. The unit is scheduled off Saturday and Sunday. We are planning to return in order to measure the electrical demand once the air conditioning season starts.

Recommendations: We recommend that the two systems be controlled by one modulating thermostat if the other heating considerations in this report are implemented.

Air Handler No. 2

Air Handler No. 3 (Town Office)

Observation: This unit is a 5 ton York air conditioning unit that is supplied with outside air through the air to air heat exchanger in the basement. The unit is controlled by a programmable thermostat and a Honeywell T775 R controller. The Honeywell controller in the basement was originally set up to control the heating of the space in two stages. The area of the building this unit serves also has a heating thermostat that controls baseboard units and radiators. The controller now only controls the discharge air set point when the programmable thermostat is calling for heat. The thermostat controls the unit when cooling is needed and the on/off schedule. The heating thermostat next to the air conditioning thermostat controls the baseboard in the Town Office area and some radiators on the second floor. The unit was not running at the time of our on-site inspection. We did turn the unit on to witness the unit through the sequence of operation. The thermostat was not controlling the unit and the reheat valve would not modulate. It is our understanding that the maintenance contractor is aware of this problem and going to make the necessary repairs. We noted the set points for heating and cooling at 65°F and 76°F respectively. The schedule was Monday through Friday 6:30 a.m. to 6:00 p.m. with an unoccupied set point of 55°F heating and 80°F cooling. The unit is scheduled off Saturday and Sunday. We are planning to return in order to measure the electrical demand once the air conditioning season starts.

Recommendations: We recommend that the two systems be controlled by one modulating thermostat if the other heating considerations in this report are implemented. The modulating heating valve also needs to be adjusted or replaced.

Air Handler No. 3

Air Handler No. 4 (Assessor's Office)

Observation: The 5 ton Bryant air conditioning unit has its own controller and a standalone thermostat. The thermostat was in the unoccupied mode, we assume for the winter months. This unit was originally installed to provide air conditioning and ventilation. This unit should be operating year round. The unit is equipped with an outside air damper that was not functioning during our on-site inspection and a steam coil to heat the discharge air. The steam control valve was functioning, but we did not measure any increase in temperature on the discharge air. The steam trap may need to be looked at because we did determine that the steam was available to the coil. We did not energize the condensing unit due to the time of year, however, we noted the set points for heating and cooling at 60°F and 75°F respectively. The schedule was Monday through Friday 8:00 a.m. to 4:30 p.m. with an unoccupied set point of 55°F heating and 80°F cooling. The unit is scheduled off Saturday and Sunday. We are planning on returning to measure the electrical demand once the air conditioning season starts. There are penetrations for the ductwork and wiring through the exterior wall that have not been sealed.

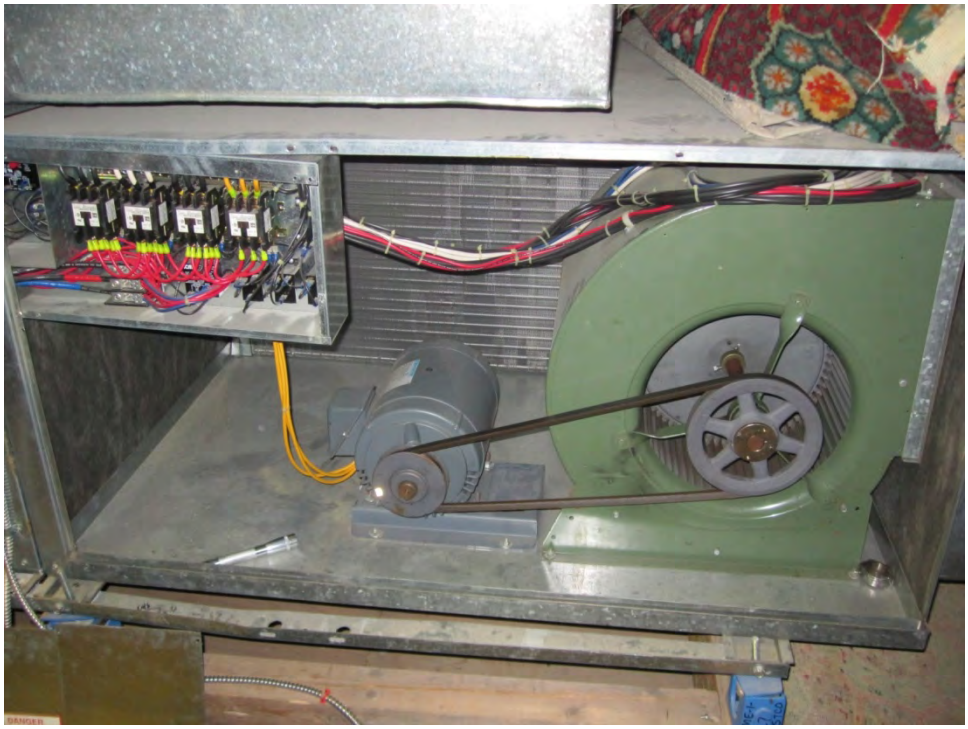
Consideration: We recommend replacing the outside actuator and consider running the air handler throughout the year for a few hours a day. Also investigate the steam coil to determine what is restricting the flow. The penetrations are address is Section 1.2, Other Considerations.

Air Handler No. 4

6.7. OPERA HOUSE AIR HANDLING UNITS

Observation: The Opera House and Tucker Room were upgraded with a complete air conditioning system in 1999. There are four air conditioning units located in the attic space of the building which run only during the summer months. These units are a little unusual based on the design of having the supply fan and condensing fan in the same enclosure. Typically, the condensing unit and compressors are located on the exterior of the building. These units adequately manage the space temperature during the summer months and are controlled by two thermostats, one located in the Opera House and one located in the Tucker Room. We were not able to run the units effectively during our on-site visit due to the time of year, but will return to operate the equipment through the full sequence of operation once the air conditioning season starts.

Recommendations: Cordjia will return in June 2011 to complete our inspection.



Opera House – Typical Air Handling Unit

6.8. CABINET UNIT HEATER

Observation: There is one cabinet unit heater in the lobby of the Finance area. The unit is supplied with steam for heat and is controlled locally by a manual speed control.

Recommendations: There is no recommendation at this time other to ensure the unit is secured during the summer months and that filters are changed on a regular schedule.

Cabinet Unit Heater

6.9. EXHAUST FANS

Observation: The exhaust fans are installed in the restrooms throughout the building and are controlled by wall switches. There is one exhaust fan in the basement next to the boiler that is controlled by a thermostat. This unit is not operating and is undersized to meet the needs of the space.

Recommendations: We recommend installing wall timers on the exhaust fans to ensure they are not left running while the space is not being used. The exhaust fan in the basement next to the boiler should be redesigned to adequately meet the needs of the space.

6.10. THERMOSTATS & CONTROLS

Observation: There are a number of thermostats in the building and, based on our on-site inspections, we understand from the staff that not everyone understands how they operate or what they operate. There are a number of Honeywell T-87 thermostats that do not have the capability of night setback.

Recommendations: We recommend replacing all the thermostats with one style that has the same features to eliminate developing an understanding of multiple programmable thermostats. We also recommend installing programmable thermostats in place of any Honeywell T-87 thermostats that are occupied Monday through Friday.

Heating Thermostat

Cooling Thermostat

6.11. PIPE INSULATION & VALVES

Observations: During our inspections, we observed several areas of the heating system that were not insulated. Heat loss through heat piping can create overheating in some spaces and reduced heating capacity in other spaces. In general, 90% of the insulation was in good shape, however, about 100 feet of insulation on varying pipe sizes was missing. All the valves throughout the basements were uninsulated.

Considerations: We recommend replacing the missing insulation and adding valve jackets throughout the facility.

6.12. LIGHTING

Observation: We observed the majority of the interior lighting to be either T-8 fluorescent fixtures or compact fluorescent bulbs. We did observe T-12 fluorescent fixtures in the basement and in unoccupied spaces. The chandeliers in the building all have incandescent candelabra bulbs. There are compact fluorescent bulbs available that fit this type of socket (if the Town of Camden is agreeable with this level of illumination and appearance of the chandelier). There are minimal exterior fixtures on the building. There are incandescent fixtures on the Washington Street side which are relatively low wattage and serve a specific purpose. There are three metal halide wall wash fixtures on the Elm Street side of the building. These fixtures are controlled by a time clock which is not in use. We assume that the lights are turned on when needed or during an event.

Recommendations: We recommend replacing the T-12 fixtures over the next 6 months with energy efficient T-8 fixtures. Any remaining incandescent bulbs throughout the building should continue to be replaced with compact fluorescent bulbs as they expire. If the time clock is not going to be used, it should be removed.

Exterior Lighting

Interior T-12 Lighting

Exterior Lighting Timeclock

Interior Incandescent Lighting

6.13. IMPROVING THE OPERATION OF THE HVAC SYSTEM

The primary goal of operating an HVAC system is to manage the system efficiently. HVAC system management can be enhanced by careful attention to the following operating rules:

- Operating Rule 1. Heat to the lowest temperature possible and cool to the highest temperature possible.
- Operating Rule 2. Avoid heating or cooling when heating or cooling is not needed.
- Operating Rule 3. Learn how your control system is supposed to work and then maintain it properly.
- Operating Rule 4. To insure that the minimum required amount of ventilation air is being used, adjust the ventilation system by altering the control system settings or by changing pulleys on fans or their drive motors, or by using variable speed drives.
- Operating Rule 5. If you do not need heating, cooling, or ventilation, turn off the HVAC system.

When a building owner understands how each of the HVAC system components work, he or she is then prepared to improve the operation on the physical system. By using these operating rules, and by adding additional rules customized to your own system, this understanding will result in improved operating procedure for both HVAC equipment and a reduction in energy consumption and operating costs.

6.14. MANAGING ENERGY COSTS

Office buildings in the United States use an average of 17 kilowatt-hours ("kWh") of electricity and 32 cubic feet of natural gas per square foot annually. In a typical office building, lighting, heating, and cooling represent about 65 percent of total use, making those systems the best targets for energy savings. Energy represents about 19 percent of total expenditures for the typical office building. This clearly makes energy a significant operational cost deserving management attention.

Conservation Measures

Most conservation measures will not only save money, but will also enhance both the aesthetics of your office and the productivity of your workers. Many office buildings can benefit from quick low-cost/no-cost energy-saving solutions, such as turning things off, turning things down, and keeping up with cleaning and maintenance.

Turning Things Off

Turning things off seems simple, but remember that for every 1,000 kWh that you save by turning things off, you save $100 on your utility bill, assuming average electricity costs of 10 cents per kWh.

Lights. Turn off lights when they are not in use. Occupancy sensors and timers can help, but a less expensive alternative would be to educate and motivate employees to turn off lights at the end of the day.

Computers and office equipment. The typical desktop computer, monitor, and shared printer draw about 200 watts per day. Most of the equipment sold today goes into a low-power sleep mode after a period of inactivity. Unfortunately, most users don't take advantage of this feature. Making sure that these energy saving modes are enabled can produce significant energy savings. A single monitor draws about 100 watts per day; if left on overnight and on weekends, it could add $30 or more to the annual energy bill.

Space heaters. Space heaters are energy hogs, drawing a kilowatt or more of power. As a first step, plug heaters into power strips controlled by occupancy sensors (other loads such as task lights and monitors can also be plugged into the power strips). Beyond that, recognizing that the perceived need for individual space heating usually signals a poor HVAC system control.

Turning Things Down

Some equipment cannot be turned off entirely, but turning it down to minimum levels where possible can save energy.

HVAC temperature setbacks. During closed hours, turn down temperature settings in warming seasons and up in cooling seasons.

Common-area lighting. If possible, dim hallway lighting by 30 percent during daytime hours to reduce demand charges and energy consumption.

Cleaning and Maintenance

Making sure that your HVAC system is regularly cleaned and serviced can help to prevent costly heating and cooling bills.

Check the economizer. Many air conditioning systems use a dampered vent called an economizer that draws in cool outside air when it is available to reduce the need for mechanically cooled air. If not regularly checked, the linkage on the damper can seize up or break. An economizer stuck in the fully open position can add as much as 50 percent to a building's annual energy bill by allowing hot air in during the air conditioning season and cold air in during the heating season. Have a licensed technician check, clean, and lubricate your economizer about once a year, and repair it if necessary. If the economizer is still operating, have the technician clean and lubricate the linkage and calibrate the controls.

Check air conditioning temperatures. With a thermometer, check the temperature of the return air going to your air conditioner and then check the temperature of the air coming out of the register that is

nearest the air conditioning unit. If the temperature difference is less than 14 degrees or more than 22 degrees, have a licensed technician inspect your air conditioning unit.

Change the filters. Filters should be changed on a monthly basis and more often if you are located next to a highway, construction site, or other site where the air is dirtier than usual.

Clean the condenser coils. Check the condenser coils quarterly for either man-made or natural debris that can collect in them. At the beginning and end of the cooling season, thoroughly wash the coils.

Check the airflow. Hold your hand up to the registers to ensure that there is adequate airflow. If there is little airflow, or dirt and dust are found in the register, have a technician inspect your unit and duct work.

Longer Term Solutions

Longer term solutions should also be considered. Although the actions covered in this section require more extensive implementation, they can dramatically increase the efficiency of your building without compromising the working environment.

Retro-Commissioning

Retro-commissioning is a process in which engineers check and tune up building systems to ensure that they are operating appropriately and efficiently. Studies have shown that continuously monitoring a building's energy systems can lead to reductions of 10 to 15 percent in annual energy bills. For the typical 50,000 square foot office building, that's equal to about $11,000 in savings per year. Savings typically come from resetting existing controls to reduce HVAC waste while maintaining or even increasing comfort levels for occupants. Retro-commissioning usually costs between 5 and 40 cents per square foot.

Lighting Measures

Smart lighting design in parking lots. In its Lighting Handbook, the Illuminating Engineering Society of North America recommends parking lots be lit at an average of one foot-candle or less of light, but most parking lots are designed with far more lighting than that. Using lower-wattage bulbs can actually increase the safety of your lot. An over lit lot can be dangerous to drivers if their eyes cannot adjust quickly enough in the transition from highly lit to dark areas. When designing lighting for a new parking lot, consider using low-wattage metal halide lamps instead of high-pressure sodium lamps in fixtures that direct the light downward. Even with a lower wattage, an office building could safely use fewer lamps if this choice is made. Metal halide is less efficient than high-pressure sodium in conventional terms, but it puts out more light in the blue part of the spectrum, which turns out to be easier for our eyes to see under low-light conditions.

7. ATTACHMENTS

Attachment A: Estimated Energy Savings Analysis

Attachment B: Historical Utility Usage

Attachment C: Existing & Proposed Heating Zone Drawings

Attachment D: Steam Radiator Output Analysis

ATTACHMENT A
ESTIMATED ENERGY SAVINGS ANALYSIS

CORDJIA
CAPITAL PROJECTS GROUP

Energy Utilization Metrics - HVAC Equipment
Town of Camden - Town Office and Opera House

Current Energy Baseline

Description/Location		Current Electrical Energy Baseline											Current Fuel Energy Baseline							Total Current Annual Energy Costs
Unit Number	Area Served	HP	Amperage	Voltage	Phases	Power Factor	KW	Usage Factor	Hours of Utilization	KWH / Day	KWH Cost / Day	Operating Days	Annual Electric Costs	CFM	Total MBH	Usage Factor	MBTU/Day	Fuel / Day (Gallons)	Fuel Cost / Day	Operating Days	Annual Fuel Costs	
AHU-1 Meeting Room	Supply Fan	0.33	2.7	230	1	1.00	1.074	100%	8	8.595	$0.86	365	$313.70				0	0.00	$0.00		$0.00	$313.70
AHU-1	Compressor		22.0	230	1	1.00	8.754	25%	8	17.508	$1.75	150	$262.61				0	0.00	$0.00		$0.00	$262.61
AHU-1	Condensing Fan	3.00	1.6	230	1	1.00	0.637	25%	8	1.273	$0.13	150	$19.10				0	0.00	$0.00		$0.00	$19.10
AHU-2 Financee	Supply Fan	0.75	4.5	240	1	1.00	1.868	100%	8	14.947	$1.49	365	$545.57				0	0.00	$0.00		$0.00	$545.57
AHU-2	Condensing Unit Compressor		28.0	230	1	1.00	11.141	25%	8	22.282	$2.23	150	$334.24				0	0.00	$0.00		$0.00	$334.24
AHU-2	Condensing Unit Fan	0.25	1.6	230	1	1.00	0.637	25%	8	1.273	$0.13	150	$19.10				0	0.00	$0.00		$0.00	$19.10
AHU-3 Town Offices	Supply Fan	0.75	5.4	240	1	1.00	2.242	100%	8	17.937	$1.79	365	$654.69				0	0.00	$0.00		$0.00	$654.69
AHU-3	Condensing Unit Compressor		1.6	230	1	1.00	0.637	25%	8	1.273	$0.13	150	$19.10				0	0.00	$0.00		$0.00	$19.10
AHU-3	Condensing Unit Fan		1.4	230	1	1.00	0.557	25%	8	1.114	$0.11	150	$16.71				0	0.00	$0.00		$0.00	$16.71
AHU-4 Assessor's Office	Supply Fan	0.75	4.3	230	1	1.00	1.711	100%	8	13.688	$1.37	365	$499.60				0	0.00	$0.00		$0.00	$499.60
AHU-4	Condensing Unit Compressor		22.5	230	1	1.00	8.953	25%	8	17.906	$1.79	150	$268.58				0	0.00	$0.00		$0.00	$268.58
AHU-4	Condensing Unit Fan	0.50	1.4	230	1	1.00	0.557	25%	8	1.114	$0.11	150	$16.71				0	0.00	$0.00		$0.00	$16.71
																	0	0.00	$0.00		$0.00	$0.00
HRV-1	Supply Fan	0.75	6.9	230	1	1.00	2.746	70%	24	46.125	$4.61	365	$1,683.55				0	0.00	$0.00		$0.00	$1,683.55
HRV-1	Exhaust Fan	0.75	6.9	230	1	1.00	2.746	70%	24	46.125	$4.61	365	$1,683.55				0	0.00	$0.00		$0.00	$1,683.55
TOTAL:							**44.26**			**211.16**	**$21.12**		**$6,336.81**		**0.00**		**0.00**	**0.00**	**$0.00**		**$0.00**	**$6,336.81**

Energy Conservation Measures

Description/Location		ECM Electrical Energy Usage Model											ECM Fuel Energy Model							Proposed Annual Energy Costs
Unit Number	Area Served	HP	Amperage	Voltage	Phases	Power Factor	KW	Usage Factor	Hours of Utilization	kWh / Day	kWh Cost / Day	Operating Days	Annual Electric Costs	CFM	Total MBH	Usage Factor	MBTU/Day	Fuel / Day (Gallons)	Fuel Cost / Day	Operating Days	Annual Fuel Costs	
AHU-1 Meeting Room	Supply Fan	0.33	2.7	230	1	1.00	1.074	100%	8	8.595	$0.86	365	$313.70				0	0.00	$0.00		$0.00	$313.70
AHU-1	Compressor		22.0	230	1	1.00	8.754	25%	8	17.508	$1.75	150	$262.61				0	0.00	$0.00		$0.00	$262.61
AHU-1	Condensing Fan	3.00	1.6	230	1	1.00	0.637	25%	8	1.273	$0.13	150	$19.10				0	0.00	$0.00		$0.00	$19.10
AHU-2 Financee	Supply Fan	0.75	4.5	240	1	1.00	1.868	100%	8	14.947	$1.49	365	$545.57				0	0.00	$0.00		$0.00	$545.57
AHU-2	Condensing Unit Compressor		28.0	230	1	1.00	11.141	25%	8	22.282	$2.23	150	$334.24				0	0.00	$0.00		$0.00	$334.24
AHU-2	Condensing Unit Fan	0.25	1.6	230	1	1.00	0.637	25%	8	1.273	$0.13	150	$19.10				0	0.00	$0.00		$0.00	$19.10
AHU-3 Town Offices	Supply Fan	0.75	5.4	240	1	1.00	2.242	100%	8	17.937	$1.79	365	$654.69				0	0.00	$0.00		$0.00	$654.69
AHU-3	Condensing Unit Compressor		1.6	230	1	1.00	0.637	25%	8	1.273	$0.13	150	$19.10				0	0.00	$0.00		$0.00	$19.10
AHU-3	Condensing Unit Fan		1.4	230	1	1.00	0.557	25%	8	1.114	$0.11	150	$16.71				0	0.00	$0.00		$0.00	$16.71
AHU-4 Assessor's Office	Supply Fan	0.75	4.3	230	1	1.00	1.711	100%	8	13.688	$1.37	365	$499.60				0	0.00	$0.00		$0.00	$499.60
AHU-4	Condensing Unit Compressor		22.5	230	1	1.00	8.953	25%	8	17.906	$1.79	150	$268.58				0	0.00	$0.00		$0.00	$268.58
AHU-4	Condensing Unit Fan	0.50	1.4	230	1	1.00	0.557	25%	8	1.114	$0.11	150	$16.71				0	0.00	$0.00		$0.00	$16.71
																	0	0.00	$0.00		$0.00	$0.00
HRV-1	Supply Fan	0.75	6.9	230	1	1.00	2.746	70%	8	15.375	$1.54	365	$561.18				0	0.00	$0.00		$0.00	$561.18
HRV-1	Exhaust Fan	0.75	6.9	230	1	1.00	2.746	70%	8	15.375	$1.54	365	$561.18				0	0.00	$0.00		$0.00	$561.18
TOTAL:							**44.26**			**149.66**	**$14.97**		**$4,092.09**		**0.00**		**0.00**	**0.00**	**$0.00**		**$0.00**	**$4,092.09**

Electrical Calculation ((((Amps x Volts) x Power Factor) x Hours of Utilization)/1000) x Cost per Kilowatt) x Operating Days
Mechanical calculation ((((Total MBH x Hours of Utlization) x Usage Factor)/138 MBH) x Cost of Fuel) x Operating Days

Electrical Calculations

HP	User Input Field (Manufacturer data)
Amperage:	User Input Field (Manufacturer data)
Voltage:	User Input Field (Manufacturer data)
Phases:	User Input Field
Power Factor:	True Power/Apparent Power (use .90 if unknown) Taken from Data Logger
KW (3 Phase):	(volts x amps x power factor (use .90 if unknown) x 1.732(sq. root of 3 for 3 phase only))/1000
KW (Single Phase)	(volts x amps x power factor (use .90 if unknown) (for single phase only))/1000
Usage Factor:	Field Observations and Data Logger Information (Verified against actual billing)
Hours of Utilization:	User Input Field (Based upon observations and verified against actual utility bill)

Mechanical Calculations

CFM:	User Input Field (Manufacturer data or design drawings)
Total MBH	User Input Field (Manufacturer data)
Usage Factor:	User Input Field (Based upon observations and verified against actual utility bill)
MBTU / Day	(Hours of Utilization x Total MBH) x Usage Factor
Usage Factor:	User Input Field (Based upon observations and verified against actual utility bill)
Fuel / Day (Gallons):	MBTU per Day / 138 MBH
Fuel Cost/Day:	Fuel per Day x Fuel Cost per Day)
Operating Days:	User Input Field (Estimated Heating days)
Annual Fuel Costs:	Fuel Cost per Day x Operating Days

ATTACHMENT B
HISTORICAL UTILITY USAGE

Town of Camden
Historical Utility Usage

Meter Number: All meters
CMP Account Number: All accounts

CMP Meter Data								CMP Delivery Charges							Standard Offer Charges	Total Electrical Costs	Supply & Transmission Costs	Demand Costs
Read Date	Prior Read Date	Days	Meter Reading	Prior Meter Reading	Actual KWH	Meter Multiplier	Total KWH	Service Charge	KWH Rate	Delivery Service	Demand KW	Demand Rate	Demand Charge	Total CMP Costs				
02/15/11	01/19/11	27	-	-	-	-	6,875	$93.78	0.045001	$309.38	15.92	$9.08	$144.55	$547.71	$548.48	$1,096.19	$951.64	$144.55
01/19/11	12/20/10	30	-	-	-	-	6,060	$93.78	0.044891	$272.04	6.40	$9.08	$58.11	$423.93	$482.13	$906.06	$847.95	$58.11
12/20/10	11/17/10	33	-	-	-	-	9,052	$93.78	0.041437	$375.09	20.00	$9.08	$181.60	$650.47	$658.37	$1,308.84	$1,127.24	$181.60
11/17/10	10/20/10	28	-	-	-	-	9,708	$93.78	0.039026	$378.86	66.40	$8.10	$537.84	$1,010.48	$659.81	$1,670.29	$1,132.45	$537.84
10/20/10	09/20/10	30	-	-	-	-	9,303	$93.78	0.042460	$395.01	64.80	$8.10	$524.88	$1,013.67	$695.47	$1,709.14	$1,184.26	$524.88
09/20/10	08/17/10	34	-	-	-	-	13,738	$93.78	0.037286	$512.23	76.80	$8.10	$622.08	$1,228.09	$886.43	$2,114.52	$1,492.44	$622.08
08/17/10	07/19/10	29	-	-	-	-	10,495	$93.78	0.041962	$440.39	70.64	$8.10	$572.18	$1,106.35	$774.21	$1,880.56	$1,308.38	$572.18
07/19/10	06/17/10	32	-	-	-	-	11,603	$94.89	0.039687	$460.49	82.56	$8.12	$670.08	$1,225.46	$802.01	$2,027.47	$1,357.39	$670.08
06/17/10	05/20/10	28	-	-	-	-	8,943	$96.54	0.041111	$367.66	53.36	$8.14	$434.35	$898.55	$641.31	$1,539.86	$1,105.51	$434.35
05/20/10	04/20/10	30	-	-	-	-	9,696	$96.54	0.042598	$413.03	51.92	$8.14	$422.63	$932.20	$723.73	$1,655.93	$1,233.30	$422.63
04/20/10	03/17/10	34	-	-	-	-	9,699	$96.54	0.042976	$416.82	18.24	$8.14	$148.47	$661.83	$731.23	$1,393.06	$1,244.59	$148.47
03/17/10	02/22/10	23	-	-	-	-	6,459	$96.54	0.045423	$293.39	12.24	$9.15	$112.00	$501.93	$516.60	$1,018.53	$906.53	$112.00
12 Month Total		**358**					**111,631**	**$1,137.51**	**0.041515**	**$4,634.39**	**539.28**	**$8.21**	**$4,428.77**	**$10,200.67**		**$18,320.45**	**$13,891.68**	**$4,428.77**
Monthly Average							**9,303**	**$94.79**	**0.041515**	**$386.20**	**44.94**	**$8.21**	**$369.06**	**$850.06**		**$1,526.70**	**$1,157.64**	**$369.06**
Daily Average							**312**	**$3.18**	**0.041515**	**$12.95**	**1.51**	**$8.21**	**$12.37**	**$28.49**		**$51.17**	**$38.80**	**$12.37**

Fuel Oil No. 2

Acct Number:

Billing Summary

Service Period

Month	Year	Days	Usage (Gal)	Unit Cost	Cost	Cost / Day
July	2009	31	147	$2.055	$302.09	$9.74
August	2009	31	5.2	$2.055	$10.69	$0.34
September	2009	30	0	$2.055	$0.00	$0.00
October	2009	31	544.9	$2.055	$1,119.77	$36.12
November	2009	30	761.9	$2.055	$1,565.70	$52.19
December	2009	31	1469.7	$2.055	$3,020.23	$97.43
January	2010	31	1456.3	$2.055	$2,992.70	$96.54
February	2010	28	1265.2	$2.055	$2,599.99	$92.86
March	2010	31	761.8	$2.055	$1,565.50	$50.50
April	2010	30	572.7	$2.055	$1,176.90	$39.23
May	2010	31	349.6	$2.055	$718.43	$23.18
June	2010	30	10.5	$2.055	$21.58	$0.72
12 Month Total			**7,345**		**$15,093.56**	

Estimated 12 Month Total for 2011 Fuel Costs based on current fuel prices of $2.35 a gallon and historical usage of 7,345 gallons: **$17,260.28**

Total Annual Electric and Fuel Costs: **$33,414.01**

Estimated 12 Month Total for 2011 Electric and Fuel Costs based on current fuel prices of $2.35 a gallon and historical usage of 7,345 gallons: **$35,580.73**

Town of Camden
Historical Utility Usage

Meter Number: GE82664407
CMP Account Number: 231-013-5775-011

CMP Meter Data								CMP Delivery Charges							Standard Offer Charges	Total Electrical Costs
Read Date	Prior Read Date	Days	Meter Reading	Prior Meter Reading	Actual KWH	Meter Multiplier	Total KWH	Service Charge	KWH Rate	Delivery Service	Demand KW	Demand Rate	Demand Charge	Total CMP Costs		
02/15/11	01/19/11	27	3856	3846	10	80	800	$32.76	0.004650	$3.72	15.92	$9.08	$144.55	$181.03	$0.00	$181.03
01/19/11	12/20/10	30	3846	3837	9	80	720	$32.76	0.004653	$3.35	6.40	$9.08	$58.11	$94.22	$0.00	$94.22
12/20/10	11/17/10	33	3837	3815	22	80	1,760	$32.76	0.004653	$8.19	20.00	$9.08	$181.60	$222.55	$0.00	$222.55
11/17/10	10/20/10	28	3815	3785	30	80	2,400	$32.76	0.004650	$11.16	66.40	$8.10	$537.84	$581.76	$0.00	$581.76
10/20/10	09/20/10	30	3785	3765	20	80	1,600	$32.76	0.004650	$7.44	64.80	$8.10	$524.88	$565.08	$0.00	$565.08
09/20/10	08/17/10	34	3765	3716	49	80	3,920	$32.76	0.004653	$18.24	76.80	$8.10	$622.08	$673.08	$0.00	$673.08
08/17/10	07/19/10	29	3716	3692	24	80	1,920	$32.76	0.004651	$8.93	70.64	$8.10	$572.18	$613.87	$0.00	$613.87
07/19/10	06/17/10	32	3692	3658	34	80	2,720	$33.15	0.004706	$12.80	82.56	$8.12	$670.08	$716.03	$0.00	$716.03
06/17/10	05/20/10	28	3658	3635	23	80	1,840	$33.72	0.004783	$8.80	53.36	$8.14	$434.35	$476.87	$0.00	$476.87
05/20/10	04/20/10	30	3635	3614	21	80	1,680	$33.72	0.004786	$8.04	51.92	$8.14	$422.63	$464.39	$0.00	$464.39
04/20/10	03/17/10	34	3614	3594	20	80	1,600	$33.72	0.004781	$7.65	18.24	$8.14	$148.47	$189.84	$0.00	$189.84
03/17/10	02/22/10	23	3594	3585	9	80	720	$33.72	0.004778	$3.44	12.24	$9.15	$112.00	$149.16	$0.00	$149.16
12 Month Total		**358**			**23**		**21,680**	**$397.35**	**0.004694**	**$101.76**	**539.28**	**$8.21**	**$4,428.77**	**$4,927.88**		**$4,927.88**
Monthly Average					**2**		**1,807**	**$33.11**	**0.004694**	**$8.48**	**44.94**	**$8.21**	**$369.06**	**$410.66**		**$410.66**
Daily Average							**61**	**$1.11**	**0.004694**	**$0.28**	**1.51**	**$8.21**	**$12.37**	**$13.77**		**$13.77**

Town of Camden
Historical Utility Usage

Meter Number: LG31168648
CMP Account Number: 231-013-5780-012

CMP Meter Data								CMP Delivery Charges							Standard Offer Charges	Total Electrical Costs
Read Date	Prior Read Date	Days	Meter Reading	Prior Meter Reading	Actual KWH	Meter Multiplier	Total KWH	Service Charge	KWH Rate	Delivery Service	Demand KW	Demand Rate	Demand Charge	Total CMP Costs		
02/15/11	01/19/11	27	86160	85178	982	1	982	$10.17	0.050316	$49.41	-	-	-	$59.58	$88.66	$148.24
01/19/11	12/20/10	30	85178	84231	947	1	947	$10.17	0.050317	$47.65	-	-	-	$57.82	$85.50	$143.32
12/20/10	11/17/10	33	84231	83189	1,042	1	1,042	$10.17	0.050317	$52.43	-	-	-	$62.60	$94.08	$156.68
11/17/10	10/20/10	28	83189	82460	729	1	729	$10.17	0.050316	$36.68	-	-	-	$46.85	$65.82	$112.67
10/20/10	09/20/10	30	82460	81748	712	1	712	$10.17	0.050309	$35.82	-	-	-	$45.99	$64.28	$110.27
09/20/10	08/17/10	34	81748	80921	827	1	827	$10.17	0.050314	$41.61	-	-	-	$51.78	$74.67	$126.45
08/17/10	07/19/10	29	80921	80269	652	1	652	$10.17	0.050322	$32.81	-	-	-	$42.98	$58.87	$101.85
07/19/10	06/17/10	32	80269	79598	671	1	671	$10.29	0.050402	$33.82	-	-	-	$44.11	$60.58	$104.69
06/17/10	05/20/10	28	79598	79017	581	1	581	$10.47	0.050516	$29.35	-	-	-	$39.82	$52.46	$92.28
05/20/10	04/20/10	30	79017	78385	632	1	632	$10.47	0.050522	$31.93	-	-	-	$42.40	$57.06	$99.46
04/20/10	03/17/10	34	78385	77613	772	1	772	$10.47	0.050518	$39.00	-	-	-	$49.47	$69.70	$119.17
03/17/10	02/22/10	23	77613	77009	604	1	604	$10.47	0.050530	$30.52	-	-	-	$40.99	$54.37	$95.36
12 Month Total		**358**			**763**		**9,151**	**$123.36**	**0.050380**	**$461.03**	**0.00**	**0.00**	**$0.00**	**$584.39**		**$1,410.44**
Monthly Average					**64**		**763**	**$10.28**	**0.050380**	**$38.42**	**0.00**	**0.00**	**$0.00**	**$48.70**		**$117.54**
Daily Average							**26**	**$0.34**	**0.050380**	**$1.29**	**0.00**	**0.00**	**$0.00**	**$1.63**		**$3.94**

Town of Camden
Historical Utility Usage

Meter Number: SA99035784
CMP Account Number: 231-013-5794-011

CMP Meter Data								CMP Delivery Charges							Standard Offer Charges	Total Electrical Costs
Read Date	Prior Read Date	Days	Meter Reading	Prior Meter Reading	Actual KWH	Meter Multiplier	Total KWH	Service Charge	KWH Rate	Delivery Service	Demand KW	Demand Rate	Demand Charge	Total CMP Costs		
02/15/11	01/19/11	27	15576	14989	587	1	587	$10.17	0.050307	$29.53	-	-	-	$39.70	$53.00	$92.70
01/19/11	12/20/10	30	14989	14371	618	1	618	$10.17	0.050307	$31.09	-	-	-	$41.26	$55.80	$97.06
12/20/10	11/17/10	33	14371	13664	707	1	707	$10.17	0.050311	$35.57	-	-	-	$45.74	$63.83	$109.57
11/17/10	10/20/10	28	13664	12988	676	1	676	$10.17	0.050311	$34.01	-	-	-	$44.18	$61.03	$105.21
10/20/10	09/20/10	30	12988	12105	883	1	883	$10.17	0.050317	$44.43	-	-	-	$54.60	$79.72	$134.32
09/20/10	08/17/10	34	12105	10685	1,420	1	1,420	$10.17	0.050317	$71.45	-	-	-	$81.62	$128.21	$209.83
08/17/10	07/19/10	29	10685	9184	1,501	1	1,501	$10.17	0.050313	$75.52	-	-	-	$85.69	$135.52	$221.21
07/19/10	06/17/10	32	9184	7831	1,353	1	1,353	$10.29	0.050399	$68.19	-	-	-	$78.48	$122.16	$200.64
06/17/10	05/20/10	28	7831	6774	1,057	1	1,057	$10.47	0.050520	$53.40	-	-	-	$63.87	$95.43	$159.30
05/20/10	04/20/10	30	6774	5854	920	1	920	$10.47	0.050522	$46.48	-	-	-	$56.95	$83.06	$140.01
04/20/10	03/17/10	34	5854	5065	789	1	789	$10.47	0.050520	$39.86	-	-	-	$50.33	$71.24	$121.57
03/17/10	02/22/10	23	5065	4522	543	1	543	$10.47	0.050516	$27.43	-	-	-	$37.90	$48.88	$86.78
12 Month Total		**358**			**921**		**11,054**	**$123.36**	**0.050385**	**$556.96**	**0.00**	**0.00**	**$0.00**	**$680.32**		**$1,678.20**
Monthly Average					**77**		**921**	**$10.28**	**0.050385**	**$46.41**	**0.00**	**0.00**	**$0.00**	**$56.69**		**$139.85**
Daily Average							**31**	**$0.34**	**0.050385**	**$1.56**	**0.00**	**0.00**	**$0.00**	**$1.90**		**$4.69**

Town of Camden
Historical Utility Usage

Meter Number: SA98921565
CMP Account Number: 231-013-5737-011

CMP Meter Data								CMP Delivery Charges							Standard Offer Charges	Total Electrical Costs
Read Date	Prior Read Date	Days	Meter Reading	Prior Meter Reading	Actual KWH	Meter Multiplier	Total KWH	Service Charge	KWH Rate	Delivery Service	Demand KW	Demand Rate	Demand Charge	Total CMP Costs		
02/15/11	01/19/11	27	28870	28119	751	1	751	$10.17	0.050320	$37.79	-	-	-	$47.96	$67.80	$115.76
01/19/11	12/20/10	30	28119	27397	722	1	722	$10.17	0.050319	$36.33	-	-	-	$46.50	$65.19	$111.69
12/20/10	11/17/10	33	27397	26141	1,256	1	1,256	$10.17	0.050318	$63.20	-	-	-	$73.37	$113.40	$186.77
11/17/10	10/20/10	28	26141	24800	1,341	1	1,341	$10.17	0.050313	$67.47	-	-	-	$77.64	$121.07	$198.71
10/20/10	09/20/10	30	24800	23344	1,456	1	1,456	$10.17	0.050316	$73.26	-	-	-	$83.43	$131.46	$214.89
09/20/10	08/17/10	34	23344	21630	1,714	1	1,714	$10.17	0.050315	$86.24	-	-	-	$96.41	$154.75	$251.16
08/17/10	07/19/10	29	21630	20143	1,487	1	1,487	$10.17	0.050316	$74.82	-	-	-	$84.99	$134.26	$219.25
07/19/10	06/17/10	32	20143	18629	1,514	1	1,514	$10.29	0.050396	$76.30	-	-	-	$86.59	$136.69	$223.28
06/17/10	05/20/10	28	18629	17297	1,332	1	1,332	$10.47	0.050526	$67.30	-	-	-	$77.77	$120.26	$198.03
05/20/10	04/20/10	30	17297	15281	2,016	1	2,016	$10.47	0.050521	$101.85	-	-	-	$112.32	$182.02	$294.34
04/20/10	03/17/10	34	15281	13444	1,837	1	1,837	$10.47	0.050523	$92.81	-	-	-	$103.28	$165.86	$269.14
03/17/10	02/22/10	23	13444	12106	1,338	1	1,338	$10.47	0.050523	$67.60	-	-	-	$78.07	$120.44	$198.51
12 Month Total		**358**			**1,397**		**16,764**	**$123.36**	**0.050404**	**$844.97**	**0.00**	**0.00**	**$0.00**	**$968.33**		**$2,481.53**
Monthly Average					**116**		**1,397**	**$10.28**	**0.050404**	**$70.41**	**0.00**	**0.00**	**$0.00**	**$80.69**		**$206.79**
Daily Average							**47**	**$0.34**	**0.050404**	**$2.36**	**0.00**	**0.00**	**$0.00**	**$2.70**		**$6.93**

Town of Camden
Historical Utility Usage

Meter Number: SA98921566
CMP Account Number: 231-013-5756-011

CMP Meter Data								CMP Delivery Charges							Standard Offer Charges	Total Electrical Costs
Read Date	Prior Read Date	Days	Meter Reading	Prior Meter Reading	Actual KWH	Meter Multiplier	Total KWH	Service Charge	KWH Rate	Delivery Service	Demand KW	Demand Rate	Demand Charge	Total CMP Costs		
02/15/11	01/19/11	27	41088	40455	633	1	633	$10.17	0.050316	$31.85	-	-	-	$42.02	$57.15	$99.17
01/19/11	12/20/10	30	40455	39917	538	1	538	$10.17	0.050316	$27.07	-	-	-	$37.24	$48.57	$85.81
12/20/10	11/17/10	33	39917	39043	874	1	874	$10.17	0.050320	$43.98	-	-	-	$54.15	$78.91	$133.06
11/17/10	10/20/10	28	39043	38206	837	1	837	$10.17	0.050311	$42.11	-	-	-	$52.28	$75.57	$127.85
10/20/10	09/20/10	30	38206	37398	808	1	808	$10.17	0.050309	$40.65	-	-	-	$50.82	$72.95	$123.77
09/20/10	08/17/10	34	37398	36596	802	1	802	$10.17	0.050312	$40.35	-	-	-	$50.52	$72.41	$122.93
08/17/10	07/19/10	29	36596	35875	721	1	721	$10.17	0.050319	$36.28	-	-	-	$46.45	$65.10	$111.55
07/19/10	06/17/10	32	35875	35135	740	1	740	$10.29	0.050405	$37.30	-	-	-	$47.59	$66.81	$114.40
06/17/10	05/20/10	28	35135	34447	688	1	688	$10.47	0.050523	$34.76	-	-	-	$45.23	$62.12	$107.35
05/20/10	04/20/10	30	34447	33665	782	1	782	$10.47	0.050524	$39.51	-	-	-	$49.98	$70.60	$120.58
04/20/10	03/17/10	34	33665	32782	883	1	883	$10.47	0.050521	$44.61	-	-	-	$55.08	$79.72	$134.80
03/17/10	02/22/10	23	32782	32228	554	1	554	$10.47	0.050523	$27.99	-	-	-	$38.46	$49.87	$88.33
12 Month Total		**358**			**738**		**8,860**	**$123.36**	**0.050391**	**$446.46**	**0.00**	**0.00**	**$0.00**	**$569.82**		**$1,369.60**
Monthly Average					**62**		**738**	**$10.28**	**0.050391**	**$37.21**	**0.00**	**0.00**	**$0.00**	**$47.49**		**$114.13**
Daily Average							**25**	**$0.34**	**0.050391**	**$1.25**	**0.00**	**0.00**	**$0.00**	**$1.59**		**$3.83**

Town of Camden
Historical Utility Usage

Meter Number: LG31168647
CMP Account Number: 231-013-5723-013

CMP Meter Data								CMP Delivery Charges							Standard Offer Charges	Total Electrical Costs
Read Date	Prior Read Date	Days	Meter Reading	Prior Meter Reading	Actual KWH	Meter Multiplier	Total KWH	Service Charge	KWH Rate	Delivery Service	Demand KW	Demand Rate	Demand Charge	Total CMP Costs		
02/15/11	01/19/11	27	21453	20967	486	1	486	$10.17	0.050309	$24.45	-	-	-	$34.62	$43.88	$78.50
01/19/11	12/20/10	30	20967	20818	149	1	149	$10.17	0.050336	$7.50	-	-	-	$17.67	$13.45	$31.12
12/20/10	11/17/10	33	20818	20434	384	1	384	$10.17	0.050313	$19.32	-	-	-	$29.49	$34.67	$64.16
11/17/10	10/20/10	28	20434	19493	941	1	941	$10.17	0.050319	$47.35	-	-	-	$57.52	$84.96	$142.48
10/20/10	09/20/10	30	19493	19019	474	1	474	$10.17	0.050316	$23.85	-	-	-	$34.02	$42.80	$76.82
09/20/10	08/17/10	34	19019	18627	392	1	392	$10.17	0.050306	$19.72	-	-	-	$29.89	$35.39	$65.28
08/17/10	07/19/10	29	18627	18367	260	1	260	$10.17	0.050308	$13.08	-	-	-	$23.25	$23.47	$46.72
07/19/10	06/17/10	32	18367	18082	285	1	285	$10.29	0.050386	$14.36	-	-	-	$24.65	$25.73	$50.38
06/17/10	05/20/10	28	18082	17775	307	1	307	$10.47	0.050521	$15.51	-	-	-	$25.98	$27.72	$53.70
05/20/10	04/20/10	30	17775	17458	317	1	317	$10.47	0.050536	$16.02	-	-	-	$26.49	$28.62	$55.11
04/20/10	03/17/10	34	17458	17115	343	1	343	$10.47	0.050525	$17.33	-	-	-	$27.80	$30.97	$58.77
03/17/10	02/22/10	23	17115	16833	282	1	282	$10.47	0.050532	$14.25	-	-	-	$24.72	$25.39	$50.11
12 Month Total		**358**			**385**		**4,620**	**$123.36**	**0.050377**	**$232.74**	**0.00**	**0.00**	**$0.00**	**$356.10**		**$773.15**
Monthly Average					**32**		**385**	**$10.28**	**0.050377**	**$19.40**	**0.00**	**0.00**	**$0.00**	**$29.68**		**$64.43**
Daily Average							**13**	**$0.34**	**0.050377**	**$0.65**	**0.00**	**0.00**	**$0.00**	**$0.99**		**$2.16**

Town of Camden
Historical Utility Usage

Meter Number: LG31168649
CMP Account Number: 231-013-5743-012

CMP Meter Data								CMP Delivery Charges							Standard Offer Charges	Total Electrical Costs
Read Date	Prior Read Date	Days	Meter Reading	Prior Meter Reading	Actual KWH	Meter Multiplier	Total KWH	Service Charge	KWH Rate	Delivery Service	Demand KW	Demand Rate	Demand Charge	Total CMP Costs		
02/15/11	01/19/11	27	63911	61275	2,636	1	2,636	$10.17	0.050315	$132.63	-	-	-	$142.80	$237.99	$380.79
01/19/11	12/20/10	30	61275	58909	2,366	1	2,366	$10.17	0.050317	$119.05	-	-	-	$129.22	$213.62	$342.84
12/20/10	11/17/10	33	58909	55880	3,029	1	3,029	$10.17	0.050314	$152.40	-	-	-	$162.57	$273.48	$436.05
11/17/10	10/20/10	28	55880	53096	2,784	1	2,784	$10.17	0.050316	$140.08	-	-	-	$150.25	$251.36	$401.61
10/20/10	09/20/10	30	53096	49726	3,370	1	3,370	$10.17	0.050315	$169.56	-	-	-	$179.73	$304.26	$483.99
09/20/10	08/17/10	34	49726	45063	4,663	1	4,663	$10.17	0.050315	$234.62	-	-	-	$244.79	$421.00	$665.79
08/17/10	07/19/10	29	45063	41109	3,954	1	3,954	$10.17	0.050316	$198.95	-	-	-	$209.12	$356.99	$566.11
07/19/10	06/17/10	32	41109	36789	4,320	1	4,320	$10.29	0.050398	$217.72	-	-	-	$228.01	$390.04	$618.05
06/17/10	05/20/10	28	36789	33651	3,138	1	3,138	$10.47	0.050523	$158.54	-	-	-	$169.01	$283.32	$452.33
05/20/10	04/20/10	30	33651	30302	3,349	1	3,349	$10.47	0.050523	$169.20	-	-	-	$179.67	$302.37	$482.04
04/20/10	03/17/10	34	30302	26827	3,475	1	3,475	$10.47	0.050521	$175.56	-	-	-	$186.03	$313.74	$499.77
03/17/10	02/22/10	23	26827	24409	2,418	1	2,418	$10.47	0.050521	$122.16	-	-	-	$132.63	$217.65	$350.28
12 Month Total		**358**			**3,292**		**39,502**	**$123.36**	**0.050389**	**$1,990.47**	**0.00**	**0.00**	**$0.00**	**$2,113.83**		**$5,679.65**
Monthly Average					**274**		**3,292**	**$10.28**	**0.050389**	**$165.87**	**0.00**	**0.00**	**$0.00**	**$176.15**		**$473.30**
Daily Average							**110**	**$0.34**	**0.050389**	**$5.56**	**0.00**	**0.00**	**$0.00**	**$5.90**		**$15.86**

ATTACHMENT C
EXISTING & PROPOSED HEATING ZONE DRAWINGS

WASHINGTON STREET

ELM STREET

FIRST & A HALF FLOOR OFFICE & PARTIAL STAGE

V C

V E

V I

FINANCE, ONE UNIT IN TUCKER ROOM AND ELM STREET SIDE OF THIRD FLOOR

OPERA HOUSE SECOND FLOOR THIS SIDE

12"ø

3 OIL TANKS

MEETING ROOM AND HALLWAY

A V B V HEX V J

BOILER ROOM

BOILER

ASSESSORS OFFICE

HEAT EXCHANGER

OPERA HOUSE SECOND FLOOR THIS SIDE

D V

1-1/2" HOT WATER SUPPLY & RETURN

ELECTRIC HOT WATER HEATER

APPROXIMATE LOCATION AIR TO AIR HEAT EXCHANGER

SUPPLY AIR TO SPLIT TO 3 HEATING COILS AND THEN TO FIRST FLOOR AHUS

AIR FROM BASEMENT

OUTDOOR AIR IN

EXHAUST AIR TO OUTDOORS

F V

TUCKER ROOM (ONE UNIT)

G V

SECOND FLOOR LANDING OUTSIDE TUCKER ROOM

H V

TOWN MANAGER, SECOND FLOOR KITCHEN AND WOMANS ROOM

BASEMENT FLOOR

EXISTING

LEGEND

V STEAM VALVE

A HEATING ZONE

WASHINGTON STREET

FIRST & A HALF FLOOR OFFICES & GREEN ROOM

V C

STAGE

V K

12"ø

3 OIL TANKS

MEETING ROOM AND HALLWAY

A V B

V

HEX

V J

BOILER ROOM

BOILER

HEAT EXCHANGER

ASSESSORS OFFICES

V E

V I

V L

ELM STREET SIDE OF THIRD FLOOR

FINANCE

OPERA HOUSE SECOND FLOOR THIS SIDE AND MENS ROOM

OPERA HOUSE SECOND FLOOR THIS SIDE AND WOMANS ROOM

V D

1-1/2" HOT WATER SUPPLY & RETURN

ELECTRIC HOT WATER HEATER

APPROXIMATE LOCATION AIR TO AIR HEAT EXCHANGER

SUPPLY AIR TO SPLIT TO 3 HEATING COILS AND THEN TO FIRST FLOOR AHUS

AIR FROM BASEMENT

OUTDOOR AIR IN

EXHAUST AIR TO OUTDOORS

V F

TUCKER ROOM AND SECOND FLOOR KITCHEN

V G

SECOND FLOOR LANDING OUTSIDE TUCKER ROOM

H V

TOWN MANAGER

ELM STREET

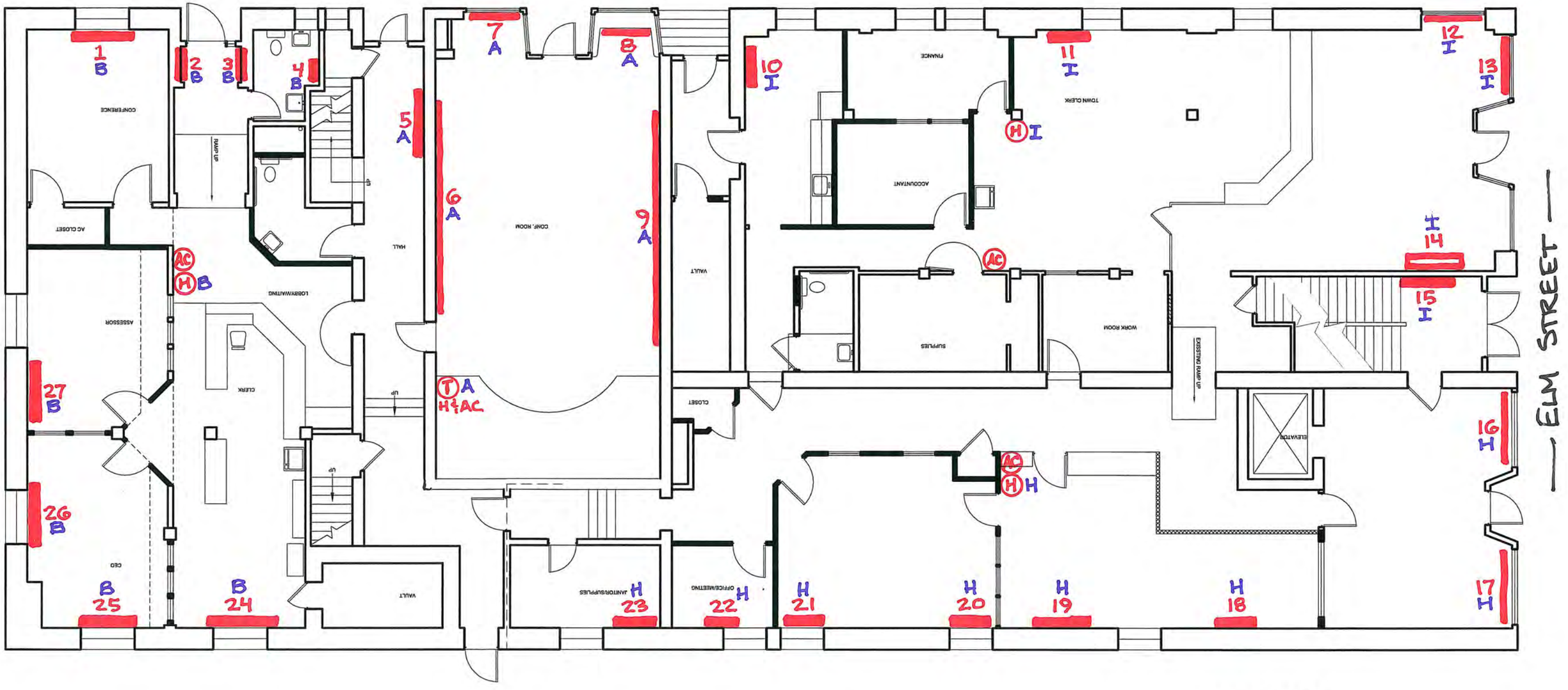
BASEMENT FLOOR

PROPOSED

LEGEND

- (V) STEAM VALVE
- A HEATING ZONE
- (V) NEW STEAM VALVE

WASHINGTON STREET



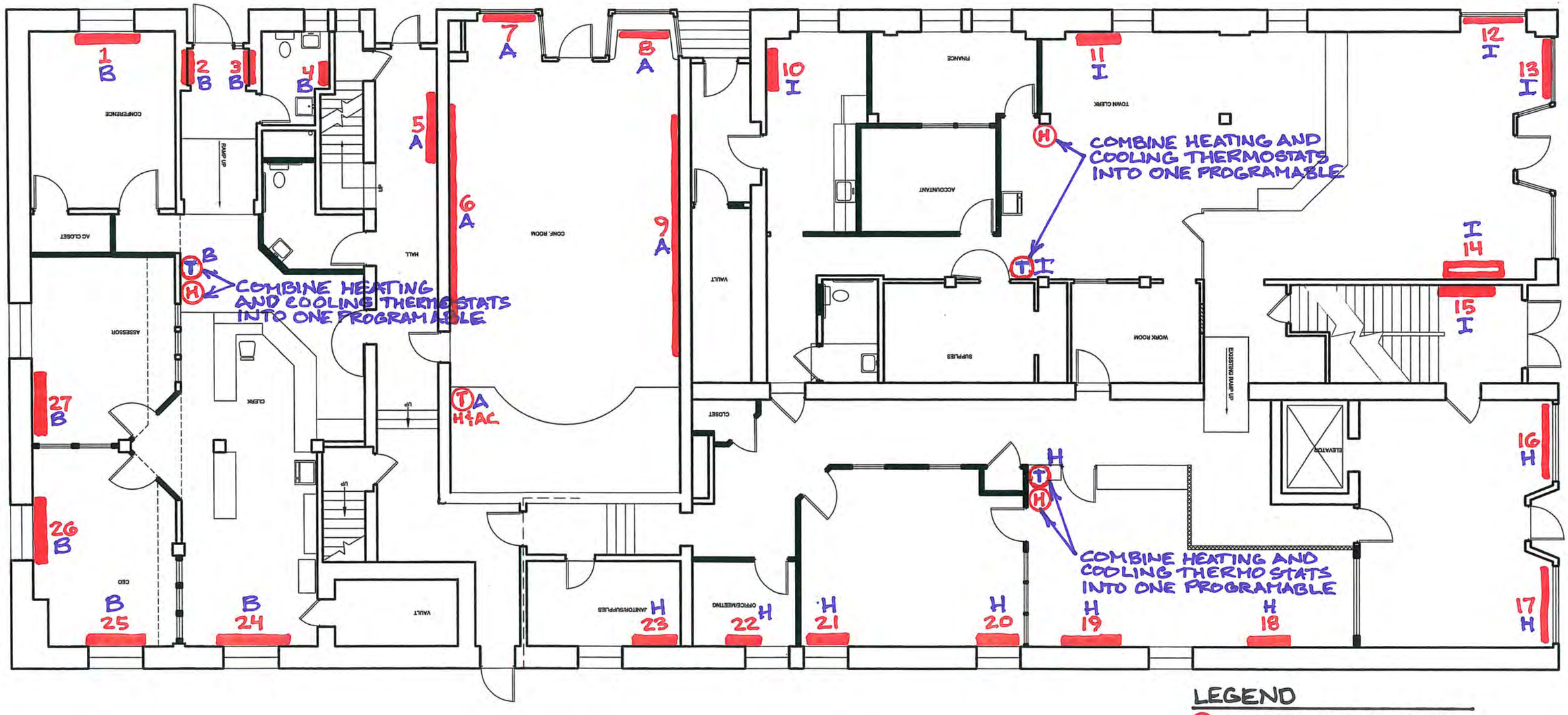
FIRST FLOOR

EXISTING

LEGEND

- (H) HEATING THERMOSTAT
- (AC) COOLING THERMOSTAT
- (T) HEATING & COOLING THERMOSTAT
- A HEATING ZONE

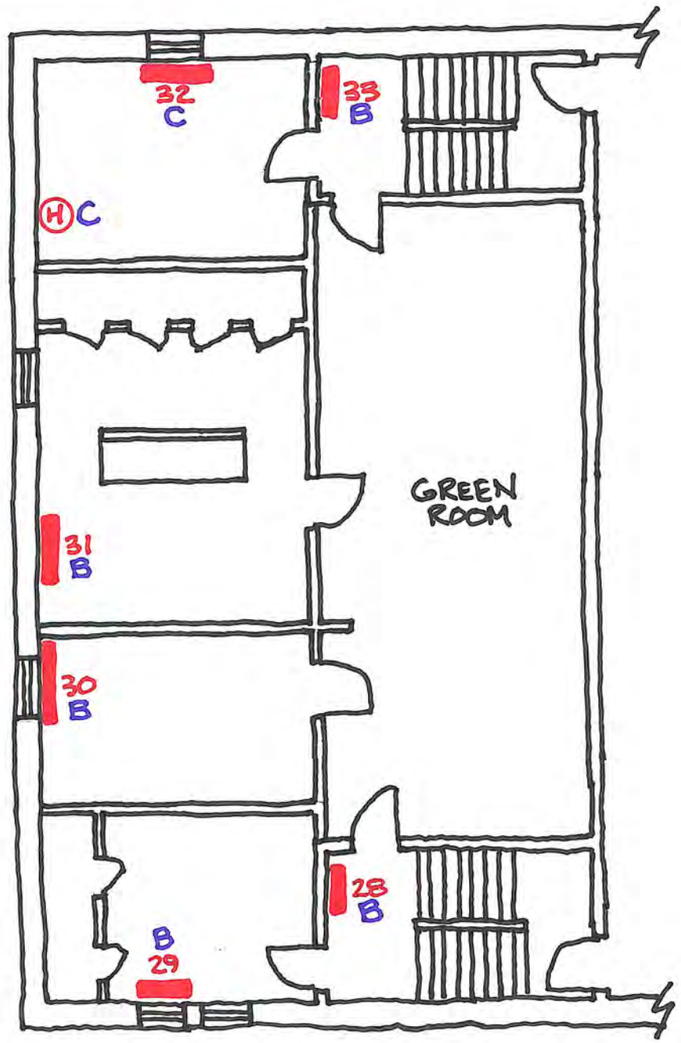
WASHINGTON STREET



FIRST FLOOR
PROPOSED

LEGEND
- (H) HEATING THERMOSTAT
- (AC) COOLING THERMOSTAT
- (T) HEATING & COOLING THERMOSTAT
- A HEATING ZONE
- 27 STEAM RADIATOR & UNIT NUMBER

— WASHINGTON STREET —



— ELM STREET —

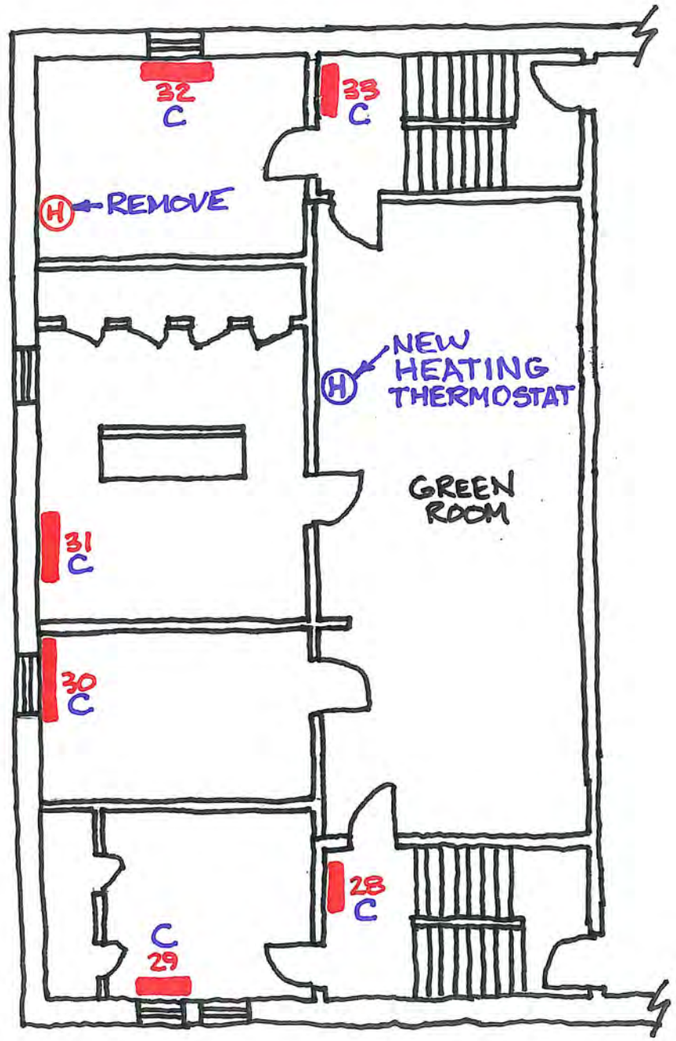
FIRST & A HALF FLOOR

EXISTING

LEGEND

- (H) HEATING THERMOSTAT
- A HEATING ZONE
- 30 STEAM RADIATOR & UNIT NUMBER

— WASHINGTON STREET —



— ELM STREET —

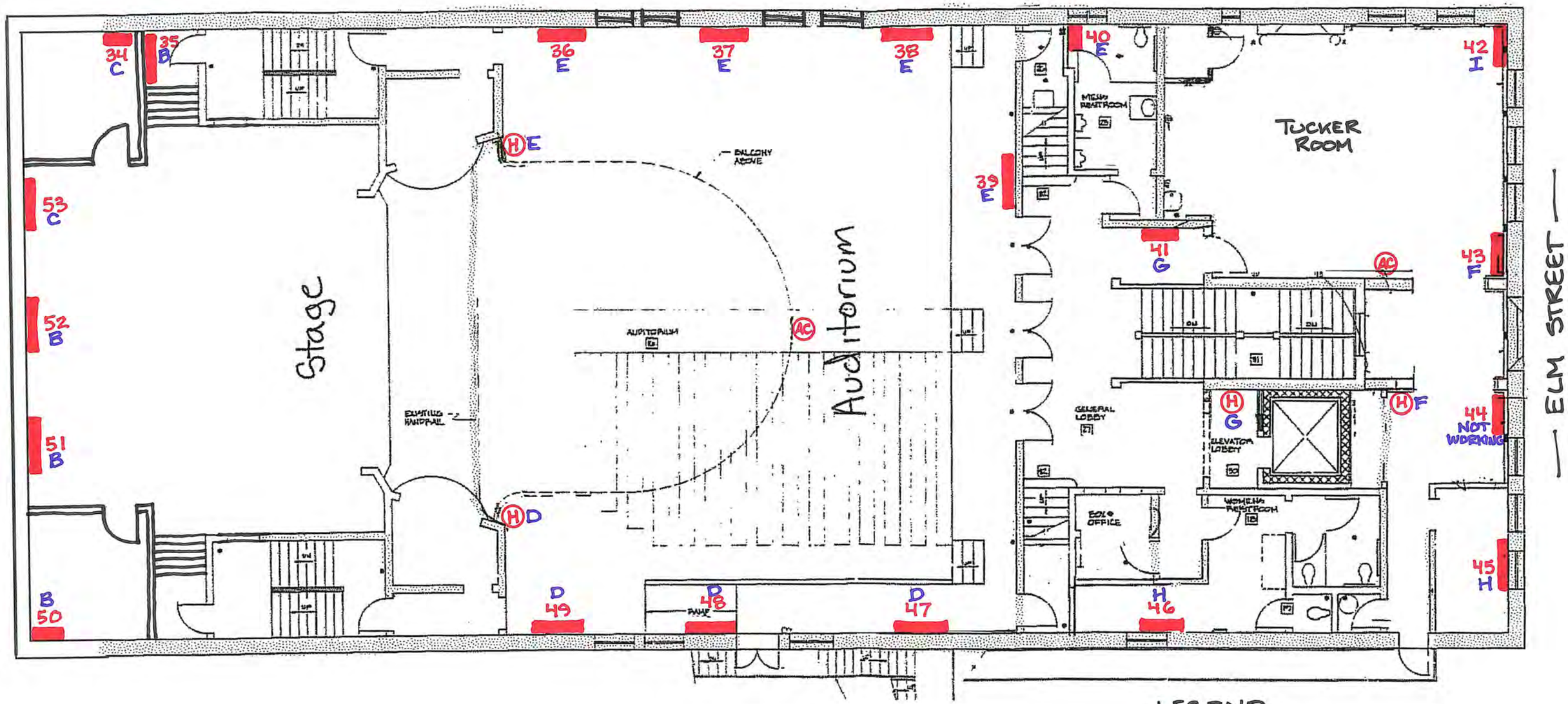
LEGEND

- (H) HEATING THERMOSTAT
- A HEATING ZONE
- 27 STEAM RADIATOR & UNIT NUMBER

FIRST & A HALF FLOOR

PROPOSED

WASHINGTON STREET



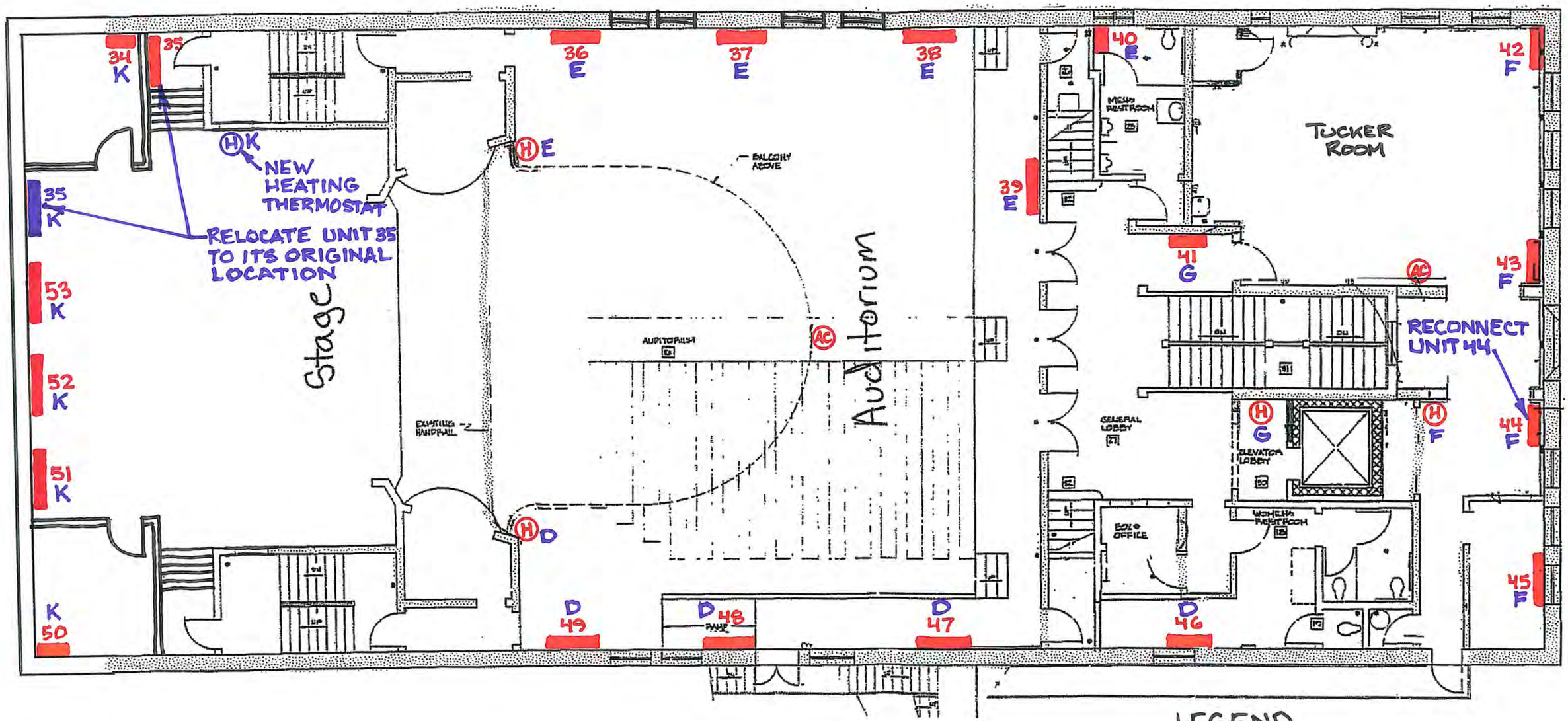
SECOND FLOOR

EXISTING

LEGEND

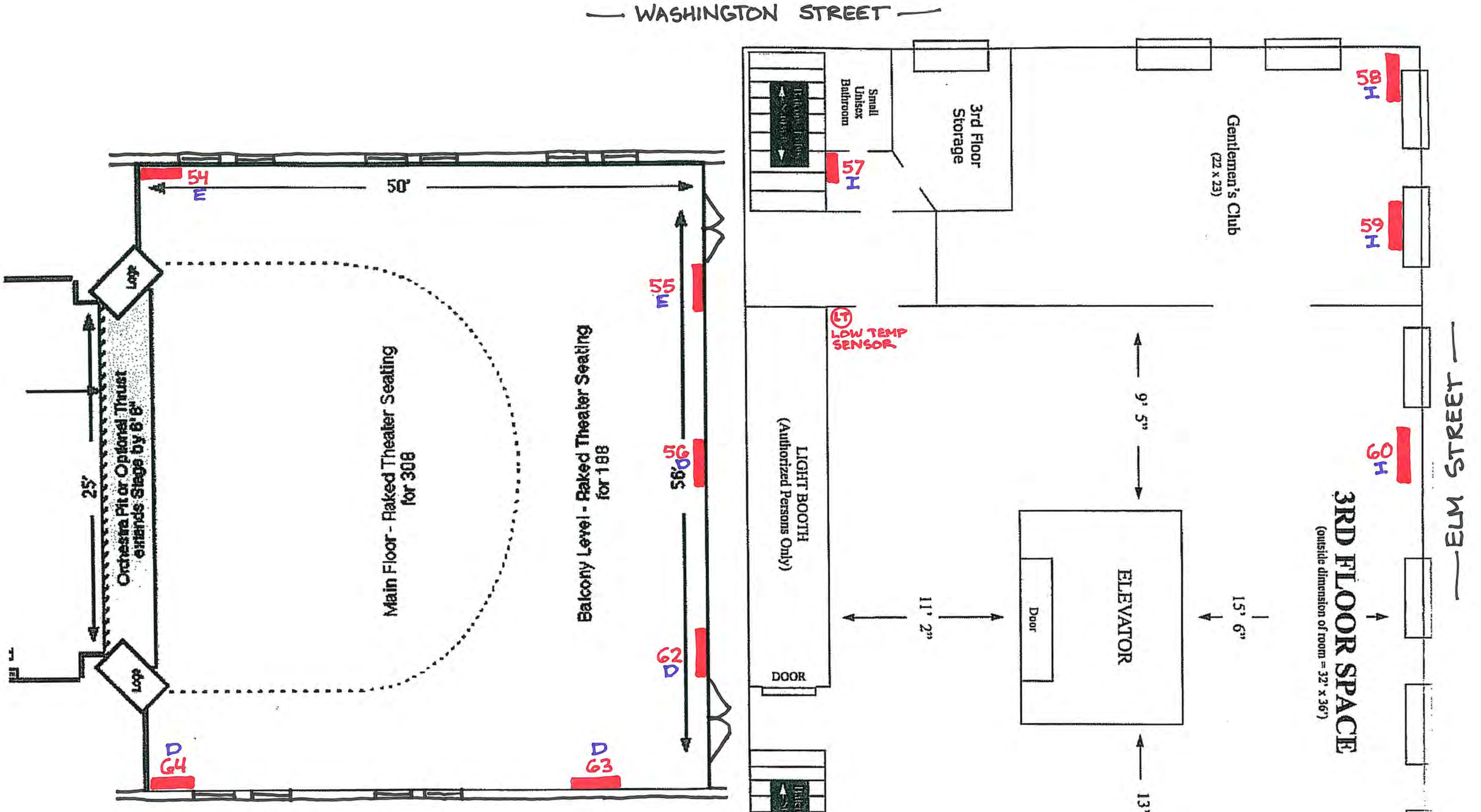
- (H) HEATING THERMOSTAT
- (AC) COOLING THERMOSTAT
- A HEATING ZONE
- 53 STEAM RADIATOR & UNIT NUMBER

WASHINGTON STREET



SECOND FLOOR
PROPOSED

LEGEND
- (H) HEATING THERMOSTAT
- (AC) COOLING THERMOSTAT
- A HEATING ZONE
- 27 STEAM RADIATOR & UNIT NUMBER



LEGEND

64 STEAM RADIATOR & UNIT NUMBER

A HEATING ZONE

THIRD FLOOR
EXISTING

— WASHINGTON STREET —

— ELM STREET —

3RD FLOOR SPACE
(outside dimension of room = 32' x 36')

Gentlemen's Club
(22 x 23)

3rd Floor Storage

Small Unisex Bathroom

LIGHT BOOTH
(Authorized Persons Only)

ELEVATOR

Door

DOOR

FIRE EXIT

NEW HEATING THERMOSTAT

LOW TEMP SENSOR

9' 5"

11' 2"

15' 6"

13' 2"

54 E

50'

55 E

56 D

58'

62 D

D G4

D G3

25'

Orchestra Pit or Optional Thrust extends Stage by 8'6"

Main Floor - Raked Theater Seating for 308

Balcony Level - Raked Theater Seating for 188

57 L

58 L

59 L

60 L

L G1

LEGEND

(H) HEATING THERMOSTAT

A HEATING ZONE

61 STEAM RADIATOR & UNIT NUMBER

THIRD FLOOR

PROPOSED

ATTACHMENT D
STEAM RADIATOR OUTPUT ANALYSIS

Town of Camden, Maine

March 28, 2011

Camden Opera House

Steam Radiator Output Analysis

First Floor

Unit No.	Zone	Proposed Zone	Columns	Sections	Sq Ft Section	Height Inches	Surface Area Sq Ft	BTU's psf/hr or pf/hr*		Total BTU's/hr
1	B	B	5	22	6.3	23	138.6	240		33,264
2	B	B	4	12	4	23	48	240		11,520
3	B	B	4	12	4	23	48	240		11,520
4	B	B	3	27	4.11	29	110.97	240		26,633
5	A	A	3	28	2.25	17	63	240		15,120
6	A	A	20' 4" Fin Tube Baseboard Heat					750	*	15,250
7	A	A	5'6" Fin Tube Baseboard Heat					750	*	4,125
8	A	A	5'6" Fin Tube Baseboard Heat					750	*	4,125
9	A	A	20' 4" Fin Tube Baseboard Heat					750	*	15,250
10	I	I	2	13	3.65	35	47.45	240		11,388
11	I	I	2	15	3.67	35	55.05	240		13,212
12	I	I	6'6" Fin Tube Baseboard Heat					750	*	4,875
13	I	I	5'6" Fin Tube Baseboard Heat					750	*	4,125
14	I	I	Dunham Bush CUH					-		29,000
15	I	I	5	18	9.25	35	166.5	240		39,960
16	H	H	5'6" Fin Tube Baseboard Heat					750	*	4,125
17	H	H	5'6" Fin Tube Baseboard Heat					750	*	4,125
18	H	H	4" x 20" Wide Multi Pass Register					1200		5,400
19	H	H	4" x 64" Wide Multi Pass Register					1200		19,200
20	H	H	4" x 20" Wide Multi Pass Register					1200		5,400
21	H	H	4" x 20" Wide Multi Pass Register					1200		5,400
22	H	H	4" x 20" Wide Multi Pass Register					1200		5,400
23	H	H	2	10	4	38	40	240		9,600
24	B	B	4	23	4.5	24	103.5	240		24,840
25	B	B	4	17	4.5	24	76.5	240		18,360
26	B	B	4	17	4.5	24	76.5	240		18,360
27	B	B	4	23	4.5	24	103.5	240		24,840
								Total First Floor:		**384,417**

Town of Camden, Maine

March 28, 2011

Camden Opera House

Steam Radiator Output Analysis

Second Floor

Unit No.	Zone	proposed zone	Columns	Sections	Sq Ft Section	Height Inches	Surface Area Sq Ft	BTU's psf/hr or pf/hr*		Total BTU's/hr
28	B	C	3	10	4.5	32	45	240		10,800
29	B	C	4	13	5	26	65	240		15,600
30	B	C	3' Fin Tube Baseboard Heat					750	*	2,250
31	B	C	4	16	8	38	128	240		30,720
32	C	C	4	10	5	26	50	240		12,000
33	B	C	3	10	4.5	32	45	240		10,800
34	C	K	4	5	8	38	40	240		9,600
35	B	K	5	20	10	38	200	240		48,000
36	E	E	4	24	8	38	192	240		46,080
37	E	E	4	24	8	38	192	240		46,080
38	E	E	4	24	8	38	192	240		46,080
39	E	E	4	24	8	38	192	240		46,080
40	E	E	2	8	4	37	32	240		7,680
41	G	G	2	10	4	37	40	240		9,600
42	I	F	2	12	4	37	48	240		11,520
43	F	F	2	15	4	37	60	240		14,400
44	-	F	2	12	4	37	48	240		11,520
45a	H	F	1	15	0.87	12	13.05	240		3,132
45b	H	F	1	15	0.87	12	13.05	240		3,132
46	H	D	1	16	1.25	16	20	240		4,800
47	D	D	4	24	8	38	192	240		46,080
48	D	D	4	24	8	38	192	240		46,080
49	D	D	4	24	8	38	192	240		46,080
50	B	K	4	8	5	26	40	240		9,600
51	B	K	5	20	10	38	200	240		48,000
52	B	K	5	20	10	38	200	240		48,000
53	C	K	5	20	10	38	200	240		48,000
								Total Second Floor:		**681,714**

Third Floor

Unit No.	Zone	Proposed zone	Columns	Sections	Sq Ft Section	Height Inches	Surface Area Sq Ft	BTU's psf/hr or pf/hr*	Total BTU's/hr
54	E	E	3	10	4.75	35	47.5	240	11,400
55	E	E	5	17	9.25	35	157.25	240	37,740
56	D	D	5	17	9.25	35	157.25	240	37,740
57	I	L	2	10	3.4	35	34	240	8,160
58	I	L	2	12	3.5	34	42	240	10,080
59	I	L	3	28	2.25	17	63	240	15,120
60	I	L	4	20	7.25	35	145	240	34,800
61	I	L	4	20	7.25	35	145	240	34,800
62	D	D	5	17	9.25	35	157.25	240	37,740
63	D	D	5	16	9.25	35	148	240	35,520
64	D	D	3	10	4.75	35	47.5	240	11,400
								Total Third Floor:	**274,500**
								Building Total:	**1,340,631**