



**ENE Systems, Inc./Energy Efficient Investments, Inc.  
Preliminary Investment Grade Audit**

FOR:

Two Rivers Supervisory Union

Prepared by:

Michael Davey, CEM

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## 1.Executive Summary

Energy Efficient Investments, Inc. (EEI) and parent company, ENE Systems, Inc. have been collaborating with the Two Rivers Supervisory Union (TRSU) on a proposal to upgrade and renovate three of the schools within the union.

EEI is located in Merrimack, NH, and has a proven track record of designing and implementing energy improvements to mechanical systems, building controls systems, insulation and renewable systems. EEI is also an approved energy management contractor with Better Buildings, Pay for Performance, PSNH, Liberty Utilities, and Unitil in New Hampshire.

TRSU is located in East central Vermont and includes the towns of Andover, Baltimore, Cavendish, Chester, Ludlow, and Mount Holly. Schools include Cavendish Town Elementary, Chester-Andover Elementary, Green Mountain Union High, Ludlow Elementary, and Mount Holly School.



EEI in its role as Energy Service Company (ESCO) has agreed to develop an energy project targeting energy savings at the locations identified below:

| Building  | Location                       |
|---|--------------------------------|
| <b>Green Mountain Union High School (GMUHS)</b> | 716 Route 103 South, Chester   |
| <b>Chester-Andover Elementary School (CAES)</b> | 72 Main Street, Chester        |
| <b>Cavendish Town Elementary School (CTES)</b>  | 573 Main Street, Proctorsville |

Currently each of these schools is heated by #2 heating oil and there are no distributed natural gas options within the area.

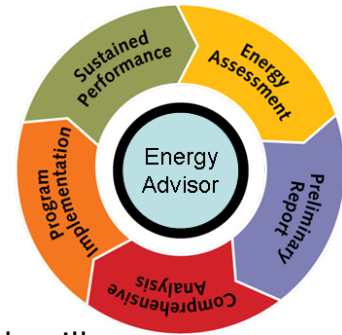
EEI proposes to convert all three buildings to propane gas for heating fuel. This plan which will reduce annual energy expenditures by more than \$70,000 and eliminate #2 fuel oil from all three locations. The GMUHS building alone will reduce its carbon emissions by more than 380 metric tonnes per year as well.

The development of every energy project starts with the initial energy assessment which includes a site visit and the collection of utility and operational costs for each location. The next step entails defining measures, budgetary costs, and estimated savings values by measure for each building. This information is documented in this **Preliminary Investment Grade**



**Audit (PIGA).** In December 2021, the PIGA will be submitted to TRSU for review and to determine which conservation measures have the funding and savings necessary to be included in the project.

On the following page, the revised Energy Conservation Measures Matrix shows the scope of upgrades the Two Rivers Supervisory Union has initially elected, including conversion of oil to propane gas, upgrade of ventilation to rooftop Heat Recovery units (HRV), Direct Digital Controls (DDC), and lighting upgrades in all three schools. Approval of this PIGA will lead to a final **IGA**, then to an **Energy Performance Contract (EPC)** which will clearly define the responsibilities of each party and will include a **Measurement and Verification (M&V)** procedure that will be used to measure the energy performance of the new systems and equipment installed throughout the TRSU.



| Two Rivers ECM Matrix                    |  |                     |                 |                 |
|--|--|---------------------|-----------------|-----------------|
| Measure Description                      |  | Cost                | Savings         | Rebate          |
| <b>Green Mountain Union High School</b>  |  |                     |                 |                 |
| GMU 1                                    | Boilers + Kitchen Conversion (Oil to Propane) + Tank       | \$1,118,950         | \$9,500         |                 |
| GMU 2                                    | Remove UV's, add ERV's w/ Perimeter Heat and LED Lighting  | \$5,073,500         | \$11,000        |                 |
| GMU 3                                    | Replace Windows  | \$2,527,000         |                 |                 |
| GMU 4                                    | Controls Upgrade   | \$695,000           | \$5,800         | \$10,000        |
| GMU 5                                    | Kitchen Renovation   | \$540,710           |                 |                 |
| GMU 6                                    | Electrical transformers                                    | \$132,050           | \$8,800         | \$3,000         |
| GMU 7                                    | Elevator   | \$174,000           |                 |                 |
| GMU 8                                    | Fire Doors, Bathroom upgrades, Concrete and Railings (Code | \$1,167,600         |                 |                 |
| GMU 9                                    | Sprinkler System   | \$695,000           |                 |                 |
| GMU 10                                   | Ceiling, Painting, Asbestos and Flooring                   | \$2,022,867         |                 |                 |
| GMU 11                                   | Millwork & Carpentry                                       | \$483,720           |                 |                 |
| GMU 12                                   | Brick Repointing & Masonry                                 | \$192,850           |                 |                 |
| GMU 13                                   | Electrical Service Upgrade                                 | \$973,000           |                 |                 |
| GMU 14                                   | Pavement   | \$598,500           |                 |                 |
| GMU 15                                   | Storage Addition   | \$178,220           |                 |                 |
| GMU 16                                   | Locker Room Renovation to Nurse & Guidance                 | \$390,000           |                 |                 |
| GMU 17                                   | Softball Field   | \$200,000           |                 |                 |
| <b>GMUHS Total</b>                       |  | <b>\$17,162,967</b> | <b>\$35,100</b> | <b>\$13,000</b> |
| <b>Chester Andover Elementary School</b> |  |                     |                 |                 |
| CAE 1                                    | Replace Federal Pacific Sub Panels                         | \$200,000           |                 |                 |
| CAE 2                                    | Fire Alarm Panel   | \$125,000           |                 |                 |
| CAE 3                                    | Gym ERU  | \$295,000           | \$2,500         |                 |
| CAE 4                                    | LED Lighting   | \$150,000           | \$5,000         | \$11,000        |



|   |  |                        |                 |                 |
|---|--|------------------------|-----------------|-----------------|
| CAE 5                                   | Convert from Oil to Propane              | \$100,000              | \$7,000         |                 |
| CAE 6                                   | Ventilation Upgrades                     | \$815,000              |                 |                 |
| CAE 7                                   | Controls upgrade                         | \$173,000              |                 |                 |
| CAE 8                                   | Pavement & Bus Drop Off Modifications    | \$472,500              |                 |                 |
| <b>CAES Total</b>                       |  | <b>\$2,330,500</b>     | <b>\$24,500</b> | <b>\$24,500</b> |
| <b>Cavendish Town Elementary School</b> |  |                        |                 |                 |
| CES 1                                   | LED lighting                             | \$78,000               | \$1,300         | \$5,500         |
| CES 2                                   | Condensing Boilers                       | \$390,000              | \$5,000         |                 |
| CES 3                                   | Remove Underground Oil Tank              | \$40,000               |                 |                 |
| CES 4                                   | Controls and drives                      | \$62,000               |                 | \$3,000         |
| CES 5                                   | Insulation and Weatherization            | \$66,500               | \$4,500         |                 |
| CES 6                                   | Fire Alarm                               | \$125,000              |                 |                 |
| <b>CTES Total</b>                       |  | <b>\$761,500</b>       | <b>\$10,800</b> | <b>\$8,500</b>  |
| <b>Sub total</b>                        |  | <b>\$20,254,967</b>    | <b>\$70,400</b> | <b>\$46,000</b> |
| <b>Bond</b>                             |  | \$202,550              |                 |                 |
| <b>Recommended Contingency</b>          |  | \$1,012,748            |                 |                 |
| <b>Grand total</b>                      |  | <b>\$21,470,265</b>    |                 |                 |
| <b>Deduct Alternates</b>                |  |                        |                 |                 |
| GMU                                     | Windows HS less patching for removed UVs | -\$2,327,000           |                 |                 |
| GMU                                     | Softball Field                           | -\$200,000             |                 |                 |
| GMU                                     | Pavement                                 | -\$598,500             |                 |                 |
| GMU                                     | Locker Room to Nurse &                   | -\$390,000             |                 |                 |
| GMU                                     | Storage Addition                         | -\$178,220             |                 |                 |
| GMU                                     | Kitchen Reno                             | -\$540,710             |                 |                 |
| CAE                                     | Gym Unit                                 | -\$295,000             |                 |                 |
| <b>Total after Deducts</b>              |  | <b>\$16,940,835.02</b> |                 |                 |

## 2.Facilities Background

### ***Green Mountain Union High School***

The Green Mountain Union High School is a 120,000sf, metal framed structure with un-insulated cement block infill and brick veneer exterior built in the 1970s. The roofs are flat with a metal superstructure, rubber membrane covering, and foam insulation. Heating was converted from electric hot water to #2 fuel oil around 1990. Ventilation is primarily through individual Unit Ventilators (UV) under windows. Some asbestos remains, primarily in the form of 9x9 inch floor tiles, pipe insulation and window caulking. Building controls are original pneumatics.





This building has the highest potential return on investment for fuel switching.

### ***Chester-Andover Elementary***

The Chester-Andover Elementary School is an approximately 50,000sf metal framed structure with cement block infill and red brick veneer exterior. It was built in 1954 and a classroom wing was added in 1966.



### ***Cavendish Elementary***

The Cavendish Elementary School is a 26,000sf wood framed building with a light truss roof structure. The roofs have inadequate insulation resulting in ice damming.



Major ice dams are occurring at the roof over the kitchen due to heat reaching the underside of the roof sheathing. We propose to air seal all penetrations with spray foam at the ceiling plane, then insulating with cellulose up to R-49 to comply with VT commercial building energy standards. Roof venting from soffits will need to be verified. Where needed exposed ductwork will be insulated up to code.

## **3. Utility Data Analysis**

Below is our energy consumption analysis of the school buildings. We used historical oil delivery data as well as water consumption and electrical bills to generate these results. To understand how the buildings behave during the heating and cooling seasons we analyzed consumption as it relates to the heating (HDD) and cooling (CDD) degree days. This gives us a baseline to understand how the building will react to changes that we make to the heating and cooling systems and building envelope.

During the 2018-2019 fiscal year, the three building areas had a total demand of nearly 70,000 gallons #2 heating oil and 840,000 kWhs of electricity. The average price per gallon of oil that year was \$2.58 per gallon.



Total cost of oil and electricity exceeded \$300,000 for the three schools.

As fuel conversion is a major potential option and due to the volatility of heating oil prices, EEI obtained quotes for alternative heating sources which included fuel oil, propane, and wood pellets. The Two Rivers Supervisory Union has elected to consider converting all three schools from oil to propane.

| Utility Analysis                |                                   |              |           |         |          |          |          |
|---------------------------------|-----------------------------------|--------------|-----------|---------|----------|----------|----------|
|                                 |                                   | Area (sq ft) |           |         |          |          |          |
| Building Areas                  | Green Mountain Union High School  |              |           |         |          | 120,000  |          |
|                                 | Chester-Andover Elementary School |              |           |         |          | 49,200   |          |
|                                 | Cavendish Town Elementary School  |              |           |         |          | 26,300   |          |
| Annual Utility Data (2018-2019) |                                   | GMUHS        |           | CAES    |          | CTES     |          |
|                                 | Oil (gal)                         | 46,420       | \$120,760 | 17,672  | \$44,952 | 5,663    | \$14,792 |
|                                 | Electricity (kWh)                 | 595,507      | \$80,664  | 126,560 | \$28,508 | 116,333  | \$18,514 |
|                                 | Water (gal)                       | 797,090      | \$3,157   | 324,699 | \$1,949  | No meter | \$7,365  |
| Utility rates (2018-2019)       |                                   |              |           |         |          |          |          |
|                                 | Oil (\$/Gallon)                   | \$2.584      |           | \$2.544 |          | \$2.612  |          |
|                                 | Electricity (\$/kWh)              | \$0.135      |           | \$0.225 |          | \$0.159  |          |
|                                 | Water (\$/gal)                    | \$0.004      |           | \$0.006 |          | NA       |          |
| Chester, VT                     |                                   |              |           |         |          |          |          |
|                                 | Outside design Temp (°F)          |              |           |         |          |          |          |
|                                 | Summer                            | 82/55        |           |         |          |          |          |
|                                 | Winter                            | 47/17        |           |         |          |          |          |
|                                 | Balance point 65°                 |              |           |         |          |          |          |
|                                 | HDD                               | 7853         |           |         |          |          |          |
|                                 | CDD                               | 486          |           |         |          |          |          |

## 4.Economic Analysis

Making good economic decisions requires analysis of available information, and understanding the time value of money. A Discounted Life Cycle Cost Analysis (DLCCA) is very useful for this type of situation where multiple alternatives are being evaluated. This is the Federal Energy Management Program (FEMP) approved method of analysis and is used to aid in decisions that are based on the most favorable economic outcome.



This project will be funded through a cost neutral loan or lease with the final finance vehicle to be selected by the school board.

EEI will apply for rebates from Efficiency Vermont and GMP for this project.

In the current market, most school districts want to limit their dependence on #2 oil due to high price, high carbon content, and dramatic price fluctuations. EEI is working with many other area school districts to reduce their dependence on #2 fuel oil by conversion or partial conversion of buildings to either natural gas, propane, or wood pellet. For Two Rivers the best current option is propane.

These are the key assumptions made for our Economic Analysis: The baseline fuel usage from the 2018-2019 fiscal year for all three schools; Building interior lighting fixtures were assumed to run 2,000 hours per year based on observation and interviews with staff; Exterior fixtures were assumed to run 1,825 hours per year.

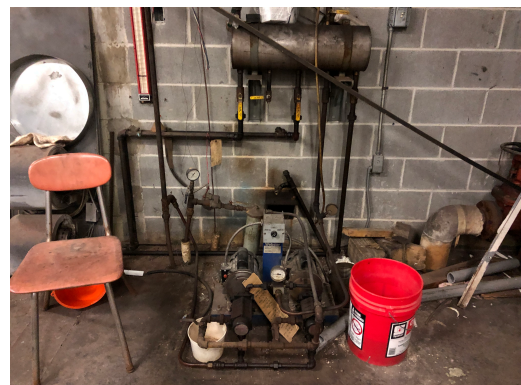
## **5. Energy Conservation Measures**

Here we define the Energy Conservation Measures (ECM) we have evaluated for this project with discussion of the specific measures on a building by building basis. Careful consideration was given to each measure and its interaction with overall building performance.

### **Boiler Replacement (GMU1, CAE5, CES2)**

EEI will convert all three schools to propane boilers (see appendix D for sample equipment cut sheet). GMUHS and CAES will get new condensing boilers. Existing CTES boilers will be converted to propane from oil.

Propane has the advantages that it is typically less costly in areas where it is easily accessible, it emits 37 percent less greenhouse gas than oil for the same heating production, and propane equipment is typically more efficient than oil as well.



Condensing boilers increase efficiency by recovering the latent heat of water vapor in the boiler exhaust gases. This increases efficiencies to as high as 98% from a typical 70-80% for non-



condensing units. Pictured above are existing fuel oil pumps at the GMUHS.



Conversion to Propane now would make a future conversion to natural gas much easier, should delivered or distributed natural gas become available locally. At left are existing boilers at CAES which will be converted to propane.

EEI has proposed an oil-to-propane conversion at all three locations. This will include the removal of the existing buried oil tanks at GMUHS and CTES. Removing these tanks now will be a major future cost

avoidance as State law would require that oil tanks and lines be replaced at some point.

At the GMUHS, the entire mechanical room will be updated with new pumps, Variable Frequency Drives (VFDs), and digital controls. The two existing boilers will be replaced with 3 new Viessmann condensing units which will provide all heating and provide redundancy.

### **Kitchen Renovation (GMU1, GMU5)**

EEI proposes to completely renovate the GMUHS kitchen including ceilings, finishes, conversion to propane gas, and the following equipment.

- PLANETARY MIXER
- Work Table 72 x 30
- Mobile pan rack
- Bun Pan rack (3)
- 26" Impulse sell rack (chips etc.)
- Coffee station pan rack 21 x 29 x 36H
- Coffee Brewer CWTF 2up/1dn
- 72 x 30 worktable with Pot rack / utensil bar
- 72 x 30 worktable adjoined to table above
- 72 x 30 work table with drawer
- 72 x 30 work table with single overshelf / spice rack Utility carts (7)
- 48 x 30 worktable on casters
- True Mfg milk cooler
- HEATED HOLDING PROOFING CABINET, MOBILE
- CONVECTION OVEN, GAS



- TILTING SKILLET BRAISING PAN, ELECTRIC
- RANGE, 60", 6 BURNERS, 24" GRIDDLE
- MEAT SLICER
- MILK COOLER
- Walk-in Cooler / Freezer Combination ~109"x241"x88"H
- DISHWASHER, CONVEYOR TYPE

## Envelope Upgrades (GMU3, CES5)

EEI completed a detailed building audit, verified air leakage locations, and found opportunities to improve building performance and save energy. Air leakage is caused by pressure differences and is subject to variations in wind velocity and HVAC system details. In order to control heating and cooling loads and allow the mechanical systems to operate effectively, pressure differences from the outdoor environment to the indoor building spaces must be controlled. The best way to do this is by tightening the building envelope by insulating and air sealing. This will extend the life cycle of the building by protecting it from the elements and will minimize moisture carried by the air penetrating the building. Also insulation and air sealing increases thermal performance of the building and the comfort, health, and safety of the building occupants.



Leaks were found in all three buildings, allowing heat to be lost during the winter and gained during the summer. These openings include gaps around doors, ceiling connections, pipe penetrations and windows. Also, ceiling beams and ceiling to wall connections contribute to leakage in some buildings. There are a number of building envelope defects and deficiencies that are contributing to higher than necessary air infiltration or exfiltration. The defects also



accelerate the deterioration of building components and increase maintenance costs. By replacing windows, insulating and air sealing, we will increase the energy performance of the building and improve the air quality, limiting contaminants and moisture from outside penetrating the buildings. At



left is pictured window flashing failure at GMUHS.

EEI proposes weatherization improvements including attic insulation, piping insulation, window replacement and caulking, exterior door weather-stripping, and sealing roof-wall joints, where necessary. This will prevent infiltration and improve the insulating properties of the buildings.

During the door weatherproofing process, door sweeps will be installed or replaced and hinges inspected to ensure proper mechanical functioning. Windows will be replaced or re-caulked around the rough-in perimeter, and locations along the soffit and fascia will be sealed. Roof penetrations, wall joints and any other envelope penetrations will be properly sealed. The implementation of effective air sealing treatments, such as weather-stripping all exits and entries and compartmentalizing fire stairwell doors, sealing off



air leakage from windows, rooftop mechanical curbs, sealing the intersection of structural assemblies, and sealing a variety of penetrations throughout each building will all be included in the detailed scope of work to be provided. Above you can see window seal failure at Green Mountain Union High School. At left are single pane windows at Chester-Andover Elementary.

### **Ventilation upgrades (GMU2, CAE6)**

EEI will install a carbon dioxide based demand control ventilation system that will improve the movement of fresh air into areas that have varying occupancy patterns and currently use large amounts of unconditioned outside air (such as gymnasiums, auditoriums, etc...) while minimizing the energy required to condition the air using heat recovery.

Controlling the amount of outside air introduced into the spaces will lead to energy savings through the decrease in thermal energy needed to condition the outside air when air flow is decreased during low/no occupancy periods.

EEI has proposed installation of demand control sensors at all three schools.

Additionally, at GMUHS we will remove the existing Unit Ventilators (UV's) beneath exterior windows and add 15 rooftop ventilation units, 7 of them Heat Recovery units (HRV's). We will reuse the water distribution system and



enhance comfort by installing perimeter radiant heating panels.

There will be a similar upgrade at the CTES with the removal of existing UVs, installation of 6 rooftop Energy Recovery Ventilators (ERVs), and installation of perimeter radiant panels.

There will be upgrades to the CAES ventilation system that will include an ERU for the gym as well as upgraded controls.

### **Controls Upgrade (GMU4, CAE7, CES4)**

Direct Digital Controls (DDC) are designed to provide overall building scheduling and setback capability, and can be accessed or modified using any computer web browser. It is very important to have the ability to trend the space temperatures and run times of equipment. A more advanced control strategy will limit the amount of time heating and air conditioning runs thereby saving energy and wear on equipment.

This project includes a comprehensive DDC system installation or upgrade at all three locations. The system will be web based, for remote monitoring and all existing pneumatic controls and valves will be replaced by electronic control systems.

### **Electrical Upgrades (GMU6, GMU13, CAE1)**

EEI evaluated the electrical systems of the school buildings and determined that the existing transformers at Green Mountain Union High School are standard efficiency models and are not designed to handle the loads of today's modern facilities. The most common efficiency for commercial and industrial transformers supplying linear loads in the 30-70 kVA range is 95%. Conventional transformer losses are non-linear, increasing by 2.7 times when feeding computer loads. If transformers are not properly vented to the exterior, their heat output adds to the building cooling load.

EEI proposes the replacement of existing transformers at GMUHS with new high efficiency units in order to improve the energy efficiency of the electrical distribution systems. The scope of work for this measure includes:

| Transformer | Size (kVa) |
|-------------|------------|
| T1          | 112.5      |
| T2          | 75         |
| T3          | 75         |
| T4          | 112.5      |
| T5          | 30         |
| T6          | 112.5      |
| T7          | 30         |
| T8          | 45         |
| T9          | 15         |



- Arrange for the delivery of purchased transformers to be stored at pre-arranged location
- Remove and replace each transformer
- Stage old transformers on site in a pre-designated area until disposal can be arranged
- Make all necessary provisions for removal and disposal of all old transformers and a 25 year product warranty

We will also upgrade the undersized service entrance at the GMUHS and replace the Federal Pacific brand sub-panels at the CAES. These panels are non-standard and difficult to maintain.

### **Elevator (GMU7)**

The project includes an elevator upgrade at the GMUHS that will bring it into full code compliance.

### **Code and ADA Issues (GMU7, GMU8, GMU9)**

EEI proposes the following Code and ADA upgrades:

- Elevator controls will be upgraded
- Full automatic NFPA compliant sprinkler system throughout
- All guardrails and handrails replaced. Handrails added where missing
- 55 doors and hardware replaced. All wireglass in sidelites replaced with tempered safety glazing
- Lift added to access the stage in the auditorium
- Bathrooms renovated to be handicapped accessible. The bathroom groupings at the main entrance and near the gym to be completely redone in a new layout. New single user toilet added at 2nd floor classroom wing. Miscellaneous renovations at other bathroom groupings to introduce ADA compliant plumbing fixture clearances

Low flow devices will be installed to reduce the amount of water used in the buildings. Locations for low flow device installation include restrooms, locker rooms, kitchens, and staff lounges. Reducing the amount of water with high quality low flow devices can save significant amounts of energy and water.

EEI has completed a detailed survey of the School District's buildings to determine water consumption for the schools. This ECM is designed to reduce water consumption, wastewater production and hot water energy usage through the installation of highly efficient plumbing products and controls. Low Flow Devices are important because they provide durable,



long-term use with minimal maintenance, improved hygiene, and energy efficiency.

The installation of this type of equipment will:

- Lower operating costs by reducing the amount of water being used per toilet/urinal flush or sink use
- Improve appearance of older fixtures by replacing with new, high efficiency ones
- Lower maintenance costs associated with plumbing leaks, clogs and breakage by replacing older fixtures with new, high efficiency ones

EEI proposes to change out older, high flow fixtures in order to meet or exceed the requirements of the Energy Act of 1992 which requires that toilet water use is limited to 1.6 gallons per flush, shower heads are limited to 2.5 gallons per minute, and faucets deliver less than 2.0 gallons per minute.

### **Fire Alarm and Sprinkler System (GMU9, CAE2, CES6)**

EEI will provide a full building sprinkler system at the GMUHS that will be compliant with all NFPA requirements. This will include all new black iron piping and sprinkler heads in the center of ceiling tiles or dropped below where clearances require. The system will include:

- Backflow preventer as required by the Chester Water Department
- Complete wet sprinkler system design to NFPA #13 for Floors 1-3 with Semi Recessed white pendent
- Two standpipes in stage area with exposed 2 1/2" brass fire department connections with 1 1/2" brass reducers
- Drawings to be stamped and approved by State Fire Marshal Office and Chester Fire Department

### **Ceiling, Painting, Asbestos and Flooring (GMU10)**

This project will include:

- Selective Finishes Replacement
- Hazardous material removal and corresponding finishes replacement
- Suspended ceiling replacement associated with ME renovations
- Removal and replacement of all remaining asbestos floor tiles
- Other asbestos removal where appropriate including pipe insulation and window caulking
- Repainting as needed

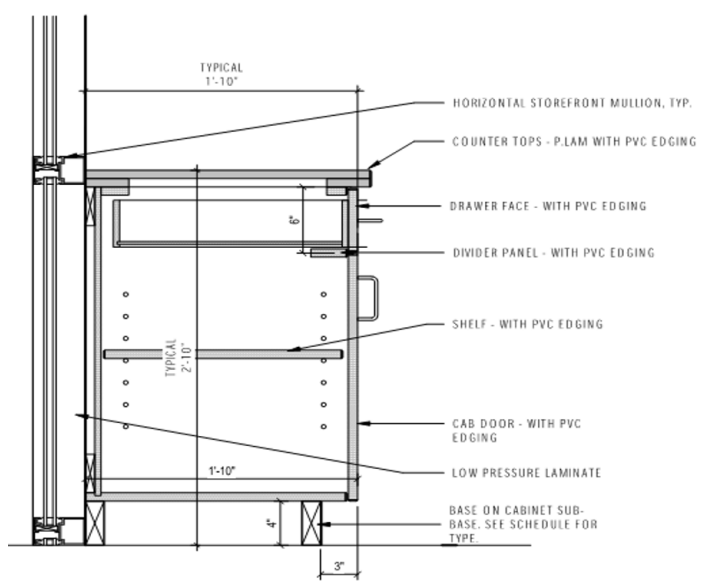


## Millwork & Carpentry (GMU11)

The removal of the old unit ventilators from under the windows at GMUHS will leave a gap in the cabinetry. We will infill these areas with new lower cabinets and counter tops that come up to the new window level. These will consist of 86 cabinets @ approx. 6'2" wide and another 19 @ approx. 14'0" wide.

At right is a side view of the proposed cabinet and an example of where they will be located.

The existing windows are original to the building and showing signs of their age. We plan to replace all windows on the exterior of the building as shown on elevation drawings. The lower area where there are now louvers will be replaced with an insulated panel, the operational windows will now work on a crank opening an awning style window to help bring in fresh air but keep the windows safer from falls. There are also areas throughout that we propose changing from standard glass to a "lami" glass, this is a low E-Argon window with a low U rating ranging between 0.24 – 0.33 and a SHGC rating ranging between 0.22 – 0.27. This is an opaque glass that will help cut down on the solar glare.



## Brick Repointing (GMU12)

We will inspect the full brick veneer perimeter for failing mortar. We will repoint as needed.

## Pavement Modifications (GMU14, CAE8)

EEI proposes repave the GMUHS and CAES lots and to add new paving at the CAES.

GMUHS – Approx. 160,000 sq/ft of driveway, parking lot & Some walkways



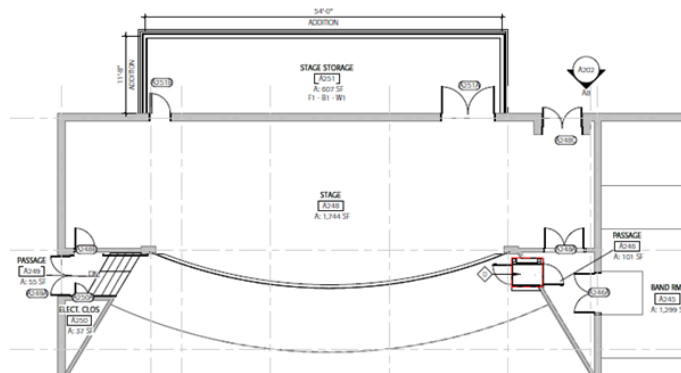
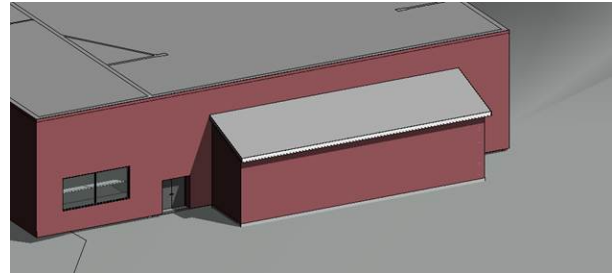
- Direct repave of existing asphalt. Grind up existing asphalt and repave over the entire complex's asphalt

CAES – Approx. 60,000 sq/ft of driveway & parking

- Direct repave of existing asphalt. Grind up existing asphalt and repave over the entire complex's asphalt
- 22,000 sq/ft of new parking lot in existing field. Assume all cut of existing, new sub-base, and new asphalt

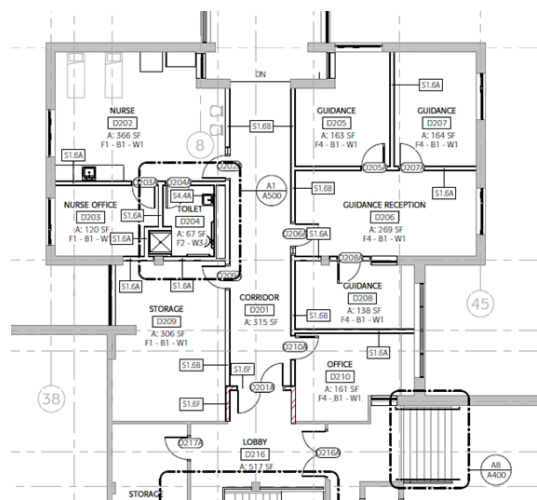
## Storage Addition (GMU15)

EEI proposes to build a storage addition as pictured to the right. This addition will match the style and appearance of the existing building. Floor plan below.



## Locker Room Renovation (GMU16)

Two sections of locker room at the GMUHS will be renovated into an examination room and office for the school nurse and a three office guidance space with a reception area. This concept is shown to the right.





## **Softball Field (GMU17)**

We will provide a high school grade softball field at the GMUHS with backstop, bleachers and dugout, as well as all required earthwork and grading.

## **Lighting Upgrades (GMU1, CAE4, CES1)**

EEI performed a detailed survey of the interior and exterior spaces in order to identify opportunities in which we can improve lighting quality, reduce maintenance costs, and save energy. The schools currently use a combination of T8 and T12 fluorescent lighting. We propose to replace existing fixtures with new high efficiency LED lighting.

The existing lighting demand per fixture, hours of operation, fixture quantities, and recommended retrofits are based on the physical inspection and site visits conducted by EEI. As a result of the survey and analysis, EEI has developed a high efficiency lighting upgrade project that will provide the district with new energy efficient lighting fixtures resulting in guaranteed annual energy savings and a reduction in electrical demand.

LED lighting provides excellent illumination, longer life expectancy, and reduced power consumption. Standardizing all fixtures and lamps will substantially reduce future maintenance requirements. New lighting will meet or exceed existing light levels while saving energy.

LED fixtures in a school environment have an estimated life of more than 20 years. There is significant maintenance savings through reduced replacement cost and installation labor when LED fixtures are used due to this longer lifespan.

EEI will replace exterior metal halide, high pressure sodium, and parking lot lighting with LED fixtures and lamps. LED lighting provides excellent illumination and has longer life expectancy producing savings in electric consumption and maintenance costs.





## **Appendix A – GMUHS Architectural Drawings (38 pages)**



**GREEN MOUNTAIN UNION HIGH SCHOOL**

716 VT-103, Chester, VT 05143  
Pre-Bond Pricing  
12-3-2021

## Team List

**OWNER:** TWO RIVERS SUPERVISORY UNION  
609 VT ROUTE 103  
LUDLOW, VT 05149

**CONSTRUCTION MANAGER:**  
ENERGY EFFICIENT INVESTMENTS  
19 STAR DRIVE  
MERRIMACK, NH 03054

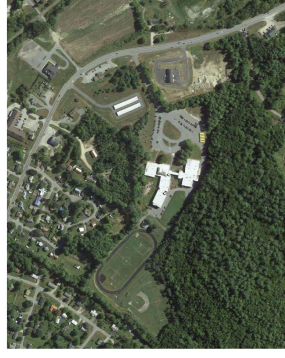
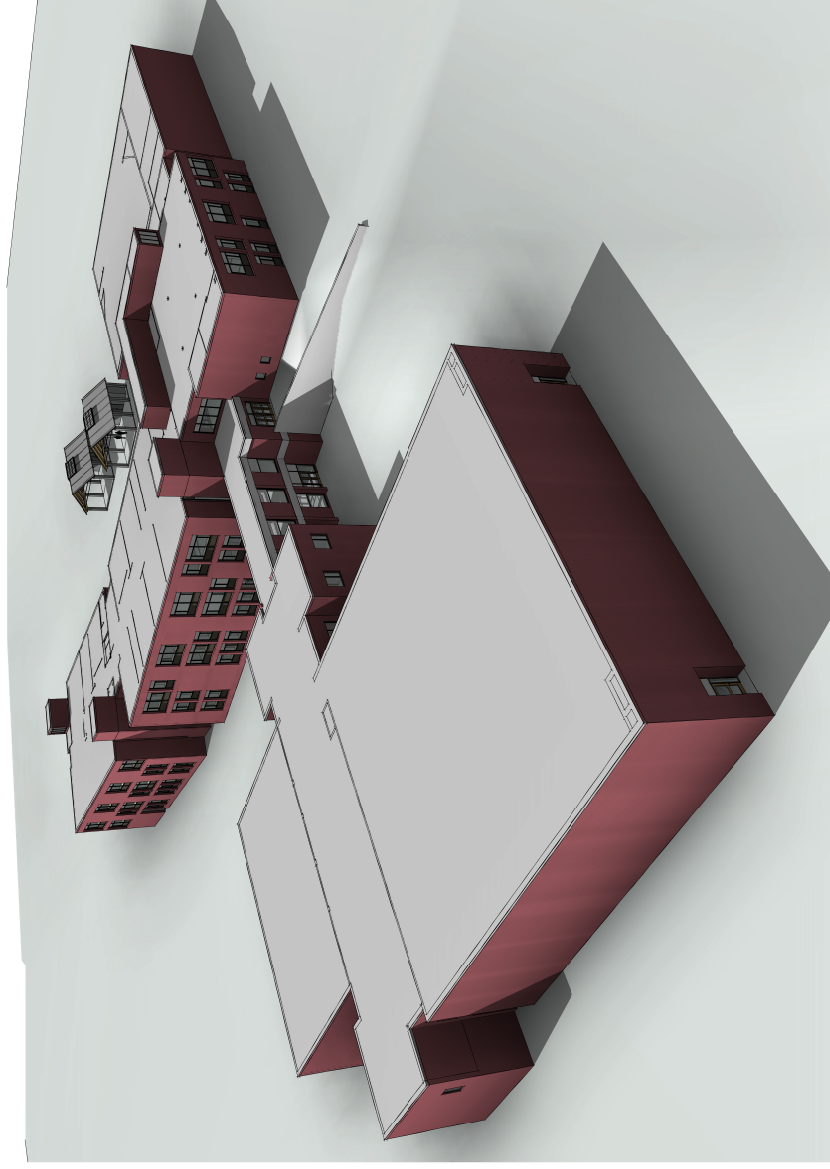
**CIVIL:**

**STRUCTURAL:**

**ARCHITECT:**  
BAMWELL ARCHITECTS, NH  
6 SOUTH PARK STREET  
LEBANON, NH 03766  
T: (603) 443-3778

**MEP/FP:**

| GENERAL |             | ARCHITECTURAL |               | STRUCTURAL |             | MECHANICAL |             | ELECTRICAL |             | PLUMBING |             | PAINTING |             | FINISHES |             | LANDSCAPE |             | OTHER |             |
|---------|-------------|---------------|---------------|------------|-------------|------------|-------------|------------|-------------|----------|-------------|----------|-------------|----------|-------------|-----------|-------------|-------|-------------|
| NO.     | DESCRIPTION | NO.           | DESCRIPTION   | NO.        | DESCRIPTION | NO.        | DESCRIPTION | NO.        | DESCRIPTION | NO.      | DESCRIPTION | NO.      | DESCRIPTION | NO.      | DESCRIPTION | NO.       | DESCRIPTION | NO.   | DESCRIPTION |
| G000    | GENERAL     | A000          | ARCHITECTURAL | S000       | STRUCTURAL  | M000       | MECHANICAL  | E000       | ELECTRICAL  | P000     | PLUMBING    | PA000    | PAINTING    | FI000    | FINISHES    | LA000     | LANDSCAPE   | OT000 | OTHER       |
| G001    | GENERAL     | A001          | ARCHITECTURAL | S001       | STRUCTURAL  | M001       | MECHANICAL  | E001       | ELECTRICAL  | P001     | PLUMBING    | PA001    | PAINTING    | FI001    | FINISHES    | LA001     | LANDSCAPE   | OT001 | OTHER       |
| G002    | GENERAL     | A002          | ARCHITECTURAL | S002       | STRUCTURAL  | M002       | MECHANICAL  | E002       | ELECTRICAL  | P002     | PLUMBING    | PA002    | PAINTING    | FI002    | FINISHES    | LA002     | LANDSCAPE   | OT002 | OTHER       |
| G003    | GENERAL     | A003          | ARCHITECTURAL | S003       | STRUCTURAL  | M003       | MECHANICAL  | E003       | ELECTRICAL  | P003     | PLUMBING    | PA003    | PAINTING    | FI003    | FINISHES    | LA003     | LANDSCAPE   | OT003 | OTHER       |
| G004    | GENERAL     | A004          | ARCHITECTURAL | S004       | STRUCTURAL  | M004       | MECHANICAL  | E004       | ELECTRICAL  | P004     | PLUMBING    | PA004    | PAINTING    | FI004    | FINISHES    | LA004     | LANDSCAPE   | OT004 | OTHER       |
| G005    | GENERAL     | A005          | ARCHITECTURAL | S005       | STRUCTURAL  | M005       | MECHANICAL  | E005       | ELECTRICAL  | P005     | PLUMBING    | PA005    | PAINTING    | FI005    | FINISHES    | LA005     | LANDSCAPE   | OT005 | OTHER       |
| G006    | GENERAL     | A006          | ARCHITECTURAL | S006       | STRUCTURAL  | M006       | MECHANICAL  | E006       | ELECTRICAL  | P006     | PLUMBING    | PA006    | PAINTING    | FI006    | FINISHES    | LA006     | LANDSCAPE   | OT006 | OTHER       |
| G007    | GENERAL     | A007          | ARCHITECTURAL | S007       | STRUCTURAL  | M007       | MECHANICAL  | E007       | ELECTRICAL  | P007     | PLUMBING    | PA007    | PAINTING    | FI007    | FINISHES    | LA007     | LANDSCAPE   | OT007 | OTHER       |
| G008    | GENERAL     | A008          | ARCHITECTURAL | S008       | STRUCTURAL  | M008       | MECHANICAL  | E008       | ELECTRICAL  | P008     | PLUMBING    | PA008    | PAINTING    | FI008    | FINISHES    | LA008     | LANDSCAPE   | OT008 | OTHER       |
| G009    | GENERAL     | A009          | ARCHITECTURAL | S009       | STRUCTURAL  | M009       | MECHANICAL  | E009       | ELECTRICAL  | P009     | PLUMBING    | PA009    | PAINTING    | FI009    | FINISHES    | LA009     | LANDSCAPE   | OT009 | OTHER       |
| G010    | GENERAL     | A010          | ARCHITECTURAL | S010       | STRUCTURAL  | M010       | MECHANICAL  | E010       | ELECTRICAL  | P010     | PLUMBING    | PA010    | PAINTING    | FI010    | FINISHES    | LA010     | LANDSCAPE   | OT010 | OTHER       |





### CODE NARRATIVE

This project is a limited renovation of an existing high school. The renovation does not change the use, occupancy or character of the existing building. An additional 100,000 sq. ft. of space is added to the existing building. An additional 100,000 sq. ft. of space is added to the existing building. The following scope of the renovation includes but is not limited to:

1. Installation of a whole school fire suppression system
2. Mechanical System Upgrade
3. Electrical System Upgrade
4. Heating and Cooling System Upgrade (see attached)
5. Structural and Foundation Repairs/Replacements of stairs and ramps
6. Addition of an accessible ramp to auditorium stage
7. Reconfiguration of selective kitchen floors and addit toilet rooms for accessibility
8. Extensive thinking/implementation
9. Detailed construction documents and specifications for all permanent and permanent
2. Detailed construction documents and specifications for all permanent and permanent

## CODE ANALYSIS

[illegible]

**GENERAL CODE PLAN NOTES:**

1. SEE DOOR SCHEDULE FOR OPENING PROTECTION REQUIREMENTS.
2. MECHANICAL, ELECTRICAL, & PLUMBING SUBCONTRACTORS TO COMPLY W/ FIRE BLOCKING & FRIS TO PRIMS REQUIREMENTS, SECTION 07.84.00.

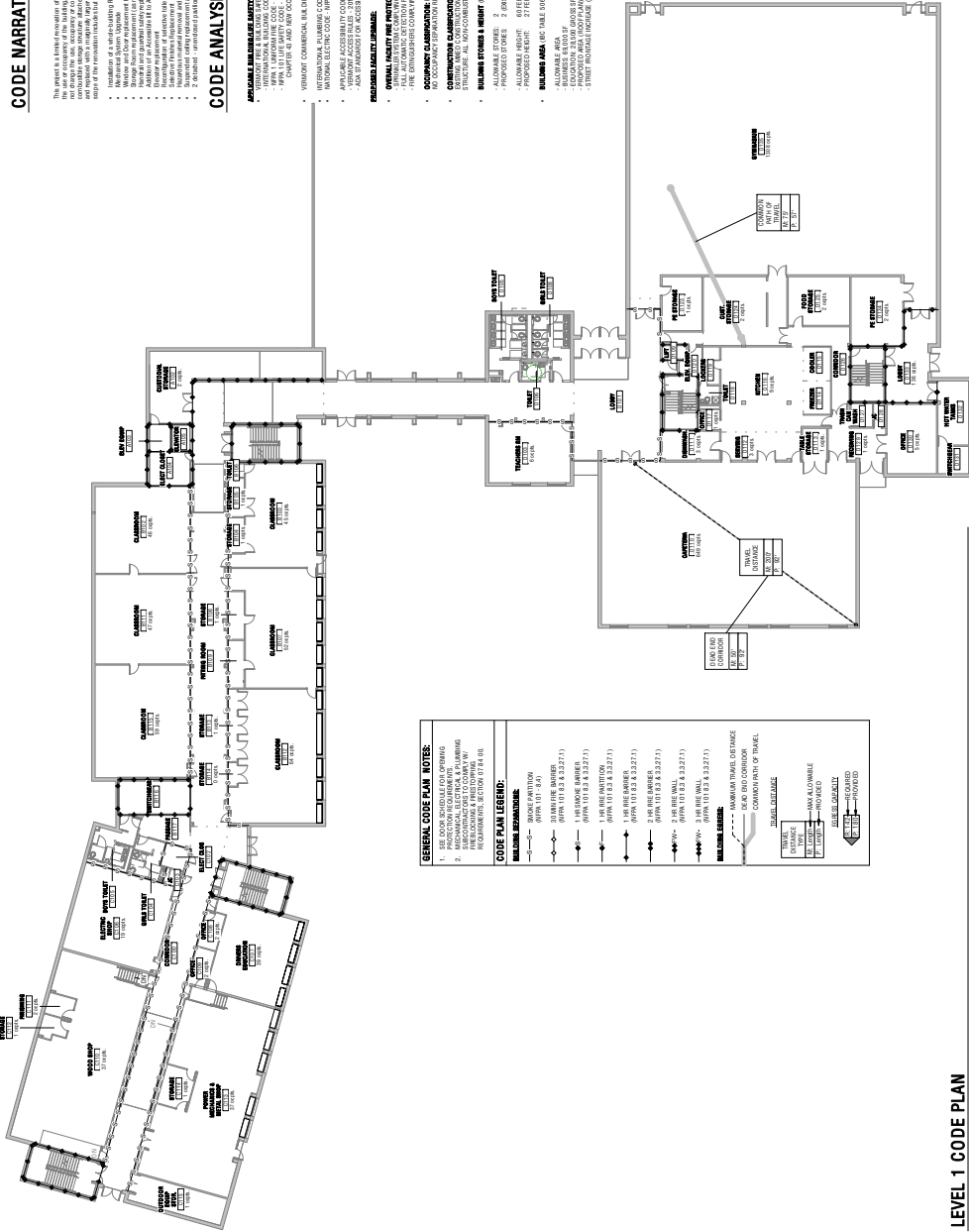
**CODE PLAN LEGEND:**

**NEW LINE REPAIRS:**

|     |   |
|-----|---|
| —S— | SMOKE PARTITION<br>(WPA 1.01 - B.4)               |
| —O— | 30 MM FIRE BARRIER<br>(WPA 1.01 B.3 & 3.3.2.7.1)  |
| —S— | 1 HR SMOKE BARRIER<br>(WPA 1.01 B.3 & 3.3.2.7.1)  |
| —O— | 1 HR FIRE PARTITION<br>(WPA 1.01 B.3 & 3.3.2.7.1) |
| —S— | 1 HR FIRE BARRIER<br>(WPA 1.01 B.3 & 3.3.2.7.1)   |
| —O— | 2 HR FIRE BARRIER<br>(WPA 1.01 B.3 & 3.3.2.7.1)   |
| —S— | 2 HR FIRE WALL<br>(WPA 1.01 B.3 & 3.3.2.7.1)      |
| —O— | 3 HR FIRE WALL<br>(WPA 1.01 B.3 & 3.3.2.7.1)      |

## **BUILDING FOR THE FUTURE**

Figure 1 is a schematic diagram of a travel distance calculation model. It includes a 'MAXIMUM TRAVEL DISTANCE' label, a 'DEAD END CORRIDOR' label, a 'COMMON PATH OF TRAVEL' label, a 'TRAVEL DISTANCE' box, a 'TRAVEL CAPACITY' box, and a 'MAX. ALLOWABLE' label. Arrows indicate the flow of information between these components.



## LEVEL 1 CODE PLAN

| OCCUPANCY LOAD - LARK 1 |         |      | Room | Area    | Apex Per Occupant | Use Guidelines Per ASHRAE 62.1 Table 7.1.2.2 |         | Occupants |
|-------------------------|---------|------|------|---------|-------------------|--|---------|-----------|
| Grade                   | Bedroom | Bath |      |         |                   | Bedroom                                      | General |           |
| LEVEL 1                 | VEHICLE | 11   |      | 150 SF  |                   |  |         | 20        |
|                         | VEHICLE | 13   |      | 171 SF  |                   |  |         |           |
|                         | VEHICLE | 14   |      | 192 SF  |                   |  |         |           |
|                         | VEHICLE | 15   |      | 213 SF  |                   |  |         |           |
|                         | VEHICLE | 25   |      | 339 SF  |                   |  |         |           |
|                         | VEHICLE | 26   |      | 360 SF  |                   |  |         | 1         |
|                         | VEHICLE | 27   |      | 381 SF  |                   |  |         |           |
|                         | VEHICLE | 28   |      | 402 SF  |                   |  |         |           |
|                         | VEHICLE | 31   |      | 454 SF  |                   |  |         |           |
|                         | VEHICLE | 33   |      | 495 SF  |                   |  |         |           |
| LEVEL 2                 | VEHICLE | 41   |      | 576 SF  |                   |  |         | 2         |
|                         | VEHICLE | 42   |      | 597 SF  |                   |  |         |           |
|                         | VEHICLE | 43   |      | 618 SF  |                   |  |         |           |
|                         | VEHICLE | 44   |      | 639 SF  |                   |  |         |           |
|                         | VEHICLE | 45   |      | 660 SF  |                   |  |         |           |
|                         | VEHICLE | 46   |      | 681 SF  |                   |  |         |           |
|                         | VEHICLE | 47   |      | 702 SF  |                   |  |         |           |
|                         | VEHICLE | 48   |      | 723 SF  |                   |  |         |           |
|                         | VEHICLE | 49   |      | 744 SF  |                   |  |         |           |
|                         | VEHICLE | 50   |      | 765 SF  |                   |  |         |           |
| LEVEL 3                 | VEHICLE | 51   |      | 816 SF  |                   |  |         | 1         |
|                         | VEHICLE | 52   |      | 837 SF  |                   |  |         |           |
|                         | VEHICLE | 53   |      | 858 SF  |                   |  |         |           |
|                         | VEHICLE | 54   |      | 879 SF  |                   |  |         |           |
|                         | VEHICLE | 55   |      | 900 SF  |                   |  |         |           |
|                         | VEHICLE | 56   |      | 921 SF  |                   |  |         |           |
|                         | VEHICLE | 57   |      | 942 SF  |                   |  |         |           |
|                         | VEHICLE | 58   |      | 963 SF  |                   |  |         |           |
|                         | VEHICLE | 59   |      | 984 SF  |                   |  |         |           |
|                         | VEHICLE | 60   |      | 1005 SF |                   |  |         |           |
| LEVEL 4                 | VEHICLE | 61   |      | 1056 SF |                   |  |         | 1         |
|                         | VEHICLE | 62   |      | 1077 SF |                   |  |         |           |
|                         | VEHICLE | 63   |      | 1098 SF |                   |  |         |           |
|                         | VEHICLE | 64   |      | 1119 SF |                   |  |         |           |
|                         | VEHICLE | 65   |      | 1140 SF |                   |  |         |           |
|                         | VEHICLE | 66   |      | 1161 SF |                   |  |         |           |
|                         | VEHICLE | 67   |      | 1182 SF |                   |  |         |           |
|                         | VEHICLE | 68   |      | 1203 SF |                   |  |         |           |
|                         | VEHICLE | 69   |      | 1224 SF |                   |  |         |           |
|                         | VEHICLE | 70   |      | 1245 SF |                   |  |         |           |
| LEVEL 5                 | VEHICLE | 71   |      | 1296 SF |                   |  |         | 1         |
|                         | VEHICLE | 72   |      | 1317 SF |                   |  |         |           |
|                         | VEHICLE | 73   |      | 1338 SF |                   |  |         |           |
|                         | VEHICLE | 74   |      | 1359 SF |                   |  |         |           |
|                         | VEHICLE | 75   |      | 1380 SF |                   |  |         |           |
|                         | VEHICLE | 76   |      | 1401 SF |                   |  |         |           |
|                         | VEHICLE | 77   |      | 1422 SF |                   |  |         |           |
|                         | VEHICLE | 78   |      | 1443 SF |                   |  |         |           |
|                         | VEHICLE | 79   |      | 1464 SF |                   |  |         |           |
|                         | VEHICLE | 80   |      | 1485 SF |                   |  |         |           |
| LEVEL 6                 | VEHICLE | 81   |      | 1536 SF |                   |  |         | 1         |
|                         | VEHICLE | 82   |      | 1557 SF |                   |  |         |           |
|                         | VEHICLE | 83   |      | 1578 SF |                   |  |         |           |
|                         | VEHICLE | 84   |      | 1599 SF |                   |  |         |           |
|                         | VEHICLE | 85   |      | 1620 SF |                   |  |         |           |
|                         | VEHICLE | 86   |      | 1641 SF |                   |  |         |           |
|                         | VEHICLE | 87   |      | 1662 SF |                   |  |         |           |
|                         | VEHICLE | 88   |      | 1683 SF |                   |  |         |           |
|                         | VEHICLE | 89   |      | 1704 SF |                   |  |         |           |
|                         | VEHICLE | 90   |      | 1725 SF |                   |  |         |           |

| DOCUMENT (LOAD - LINE 1) |             |          |                  |              |              |              | Use Classification (Per AIAA 191)      | Occupancy |
|--------------------------|-------------|----------|------------------|--------------|--------------|--------------|--|-----------|
|                          |             |          |                  |              |              |              | TABLE 7.1.2.2                          |           |
| Room                     | Room Number | Area     | Per Sq. Footment | Per Sq. Foot | Per Sq. Foot | Per Sq. Foot | Use Classification (Per AIAA 191)      | Occupancy |
| STORAGE                  | ST-14       | 20 SF    |                  | 600 SF       |              |              | Storage Use - No occupancy or assembly | 0         |
| CLIMATIZATION            | CL-15       | 1,180 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-16       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-17       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-18       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-19       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-20       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-21       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-22       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-23       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-24       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-25       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-26       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-27       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-28       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-29       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-30       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-31       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-32       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-33       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-34       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-35       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-36       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-37       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-38       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-39       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-40       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-41       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-42       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-43       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-44       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-45       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-46       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-47       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-48       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-49       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-50       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-51       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-52       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-53       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-54       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-55       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-56       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-57       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-58       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-59       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-60       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-61       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-62       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-63       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-64       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-65       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-66       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-67       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-68       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-69       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-70       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-71       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-72       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-73       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-74       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-75       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-76       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-77       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-78       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-79       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-80       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-81       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-82       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-83       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-84       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-85       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-86       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-87       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-88       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-89       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-90       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-91       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-92       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-93       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-94       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-95       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-96       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-97       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-98       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-99       | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |
| CLIMATIZATION            | CL-100      | 1,170 SF | 0 SF             |              |              |              | Conditioning - Mechanical              | 10        |

[illegible]

|  |  |                                  |   |   |                        |
|--|--|----------------------------------|---|---|------------------------|
|  | <b>SCHOOL</b><br>GREEN MOUNTAIN UNION HIGH SCHOOL<br>716 W F-103, Denver, CO 80149 | <b>STATUS</b><br>Pre-Load Rating | <b>FORM NO.</b> F103<br>CODE ANALYSIS - LEVEL 1 | <b>INDICATOR</b> 2-4000<br>SHEET NUMBER | <b>DATE</b> 12-12-2021 |
|  | <b>NOTES</b><br>NEW TANK AND PUMP AREAS  |                                  |   |   |                        |







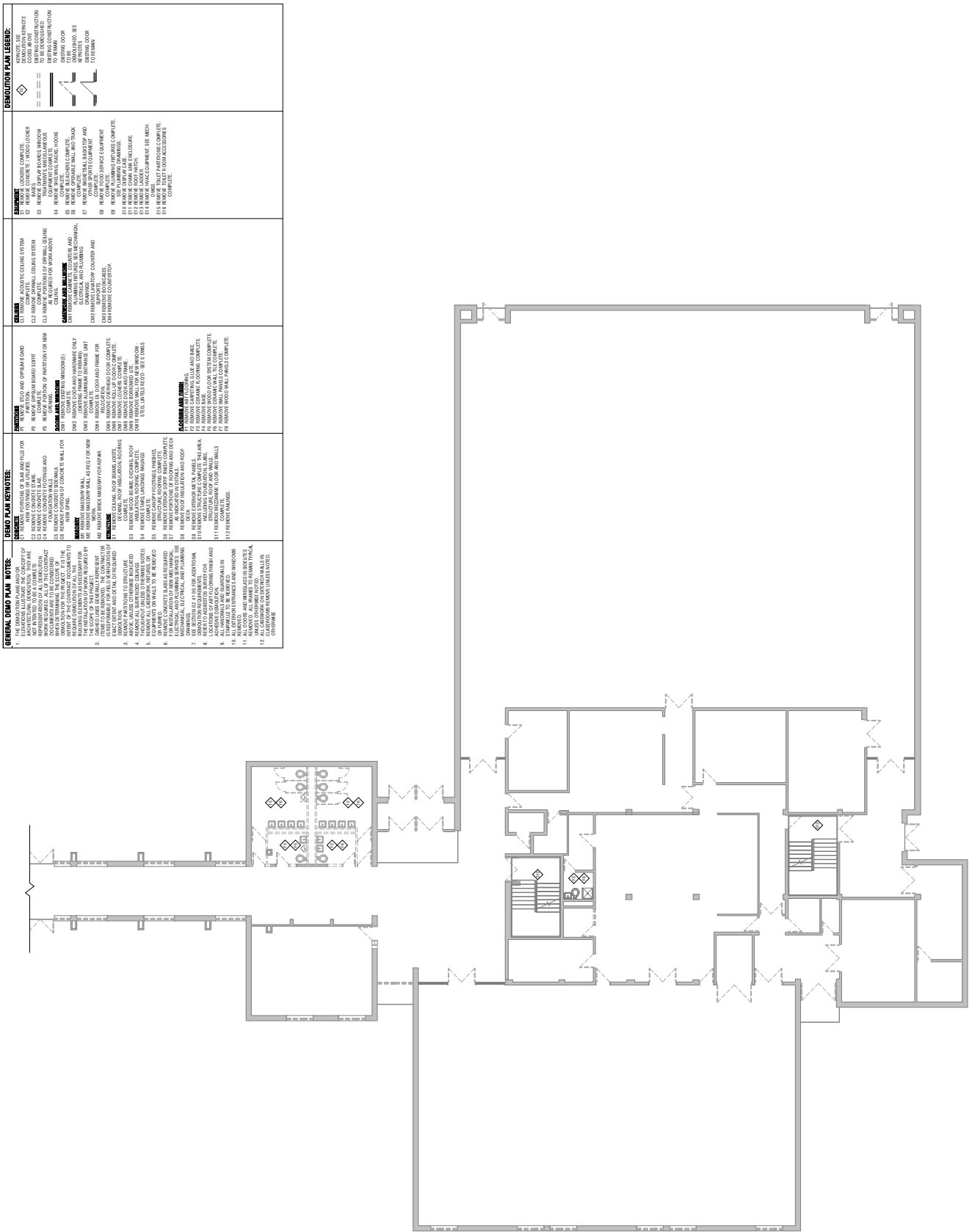








A8 LEVEL 1 DEMOLITION PLAN - AREA D  
SCALE: 1/8" = 1'-0"



| GENERAL DEMO PLAN NOTES:  | DEMO PLAN KEYNOTES:   | REMARKS   | CLIMB   | DEMOLITION PLAN LEGEND:   |
|---|---|---|---|---|
| 1. EXISTING LAYOUTS, THE SCOPE OF THE WORK, AND THE LOCATION OF THE WORK ARE SHOWN ON THIS PLAN. THE WORK REQUIRED, ALL OF THE CONTRACT WORK REQUIRED, AND THE LOCATION OF THE WORK REQUIRED, ARE SHOWN ON THIS PLAN. THE SCOPE OF THE WORK REQUIRED, ALL OF THE CONTRACT WORK REQUIRED, AND THE LOCATION OF THE WORK REQUIRED, ARE SHOWN ON THIS PLAN. | 1. EXISTING LAYOUTS, THE SCOPE OF THE WORK, AND THE LOCATION OF THE WORK ARE SHOWN ON THIS PLAN. THE WORK REQUIRED, ALL OF THE CONTRACT WORK REQUIRED, AND THE LOCATION OF THE WORK REQUIRED, ARE SHOWN ON THIS PLAN. THE SCOPE OF THE WORK REQUIRED, ALL OF THE CONTRACT WORK REQUIRED, AND THE LOCATION OF THE WORK REQUIRED, ARE SHOWN ON THIS PLAN. | 1. EXISTING LAYOUTS, THE SCOPE OF THE WORK, AND THE LOCATION OF THE WORK ARE SHOWN ON THIS PLAN. THE WORK REQUIRED, ALL OF THE CONTRACT WORK REQUIRED, AND THE LOCATION OF THE WORK REQUIRED, ARE SHOWN ON THIS PLAN. THE SCOPE OF THE WORK REQUIRED, ALL OF THE CONTRACT WORK REQUIRED, AND THE LOCATION OF THE WORK REQUIRED, ARE SHOWN ON THIS PLAN. | 1. EXISTING LAYOUTS, THE SCOPE OF THE WORK, AND THE LOCATION OF THE WORK ARE SHOWN ON THIS PLAN. THE WORK REQUIRED, ALL OF THE CONTRACT WORK REQUIRED, AND THE LOCATION OF THE WORK REQUIRED, ARE SHOWN ON THIS PLAN. THE SCOPE OF THE WORK REQUIRED, ALL OF THE CONTRACT WORK REQUIRED, AND THE LOCATION OF THE WORK REQUIRED, ARE SHOWN ON THIS PLAN. | 1. EXISTING LAYOUTS, THE SCOPE OF THE WORK, AND THE LOCATION OF THE WORK ARE SHOWN ON THIS PLAN. THE WORK REQUIRED, ALL OF THE CONTRACT WORK REQUIRED, AND THE LOCATION OF THE WORK REQUIRED, ARE SHOWN ON THIS PLAN. THE SCOPE OF THE WORK REQUIRED, ALL OF THE CONTRACT WORK REQUIRED, AND THE LOCATION OF THE WORK REQUIRED, ARE SHOWN ON THIS PLAN. |

banwell  
architects  
100 NORTH MAIN STREET  
SUITE 200  
DURHAM, NH 03824  
T: 603.843.3729

CONTRACTOR: GREEN MOUNTAIN UNION - AREA D  
100 NORTH MAIN STREET  
SUITE 200  
DURHAM, NH 03824  
T: 603.843.3729

CONSTRUCTION MANAGER:  
100 NORTH MAIN STREET  
SUITE 200  
DURHAM, NH 03824  
T: 603.843.3729

OWNER:  
100 NORTH MAIN STREET  
SUITE 200  
DURHAM, NH 03824  
T: 603.843.3729

DATE:  
10/13/2021

PROJECT:  
GREEN MOUNTAIN UNION - AREA D  
100 NORTH MAIN STREET  
SUITE 200  
DURHAM, NH 03824  
T: 603.843.3729

PROGRESS SET  
NOT FOR CONSTRUCTION

| NO. | DATE       | DESCRIPTION       |
|-----|------------|-------------------|
| 1   | 10/13/2021 | ISSUED FOR PERMIT |
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AD101D























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| INDEX OF DRAWINGS   |   |
|---|---|
| <b>NUMBERING SYSTEM:</b><br><br><div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">           01/A101<br/> <small>Sheet No.</small><br/> <small>Drawing No.</small> </div> <div style="width: 50%;">           01000000<br/> <small>Division</small><br/> <small>Project No.</small><br/> <small>Project Name</small> </div> </div>  | <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;">           01000000<br/> <small>Division</small><br/> <small>Project No.</small><br/> <small>Project Name</small> </div> <div style="width: 50%;">           01000000<br/> <small>Division</small><br/> <small>Project No.</small><br/> <small>Project Name</small> </div> </div>   |
| <h2 style="margin: 0;">LEGEND</h2>  |   |
| <h3 style="margin: 0;">ANNOTATION CALLOUTS/DRAWING SYMBOLS</h3>   |   |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <br/> <b>Room Name</b><br/>           R101<br/> <small>Room No.</small><br/> <small>Room Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Column</b><br/>           C1<br/> <small>Column No.</small><br/> <small>Column Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Beam</b><br/>           B1<br/> <small>Beam No.</small><br/> <small>Beam Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Slab</b><br/>           S1<br/> <small>Slab No.</small><br/> <small>Slab Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Wall</b><br/>           W1<br/> <small>Wall No.</small><br/> <small>Wall Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Foundation</b><br/>           F1<br/> <small>Foundation No.</small><br/> <small>Foundation Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Column</b><br/>           C1<br/> <small>Column No.</small><br/> <small>Column Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Beam</b><br/>           B1<br/> <small>Beam No.</small><br/> <small>Beam Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Slab</b><br/>           S1<br/> <small>Slab No.</small><br/> <small>Slab Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Wall</b><br/>           W1<br/> <small>Wall No.</small><br/> <small>Wall Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Foundation</b><br/>           F1<br/> <small>Foundation No.</small><br/> <small>Foundation Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Column</b><br/>           C1<br/> <small>Column No.</small><br/> <small>Column Name</small> </div> </div> | <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <br/> <b>Structural Column</b><br/>           C1<br/> <small>Column No.</small><br/> <small>Column Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Beam</b><br/>           B1<br/> <small>Beam No.</small><br/> <small>Beam Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Slab</b><br/>           S1<br/> <small>Slab No.</small><br/> <small>Slab Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Wall</b><br/>           W1<br/> <small>Wall No.</small><br/> <small>Wall Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Foundation</b><br/>           F1<br/> <small>Foundation No.</small><br/> <small>Foundation Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Column</b><br/>           C1<br/> <small>Column No.</small><br/> <small>Column Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Beam</b><br/>           B1<br/> <small>Beam No.</small><br/> <small>Beam Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Slab</b><br/>           S1<br/> <small>Slab No.</small><br/> <small>Slab Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Wall</b><br/>           W1<br/> <small>Wall No.</small><br/> <small>Wall Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Foundation</b><br/>           F1<br/> <small>Foundation No.</small><br/> <small>Foundation Name</small> </div> </div> |
| <h3 style="margin: 0;">SPECIFICATION</h3>   |   |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <br/> <b>Structural Column</b><br/>           C1<br/> <small>Column No.</small><br/> <small>Column Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Beam</b><br/>           B1<br/> <small>Beam No.</small><br/> <small>Beam Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Slab</b><br/>           S1<br/> <small>Slab No.</small><br/> <small>Slab Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Wall</b><br/>           W1<br/> <small>Wall No.</small><br/> <small>Wall Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Foundation</b><br/>           F1<br/> <small>Foundation No.</small><br/> <small>Foundation Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Column</b><br/>           C1<br/> <small>Column No.</small><br/> <small>Column Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Beam</b><br/>           B1<br/> <small>Beam No.</small><br/> <small>Beam Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Slab</b><br/>           S1<br/> <small>Slab No.</small><br/> <small>Slab Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Wall</b><br/>           W1<br/> <small>Wall No.</small><br/> <small>Wall Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Foundation</b><br/>           F1<br/> <small>Foundation No.</small><br/> <small>Foundation Name</small> </div> </div>   |   |
| <h3 style="margin: 0;">PARTITION KEY</h3>   |   |
| <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <br/> <b>Structural Column</b><br/>           C1<br/> <small>Column No.</small><br/> <small>Column Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Beam</b><br/>           B1<br/> <small>Beam No.</small><br/> <small>Beam Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Slab</b><br/>           S1<br/> <small>Slab No.</small><br/> <small>Slab Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Wall</b><br/>           W1<br/> <small>Wall No.</small><br/> <small>Wall Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Foundation</b><br/>           F1<br/> <small>Foundation No.</small><br/> <small>Foundation Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Column</b><br/>           C1<br/> <small>Column No.</small><br/> <small>Column Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Beam</b><br/>           B1<br/> <small>Beam No.</small><br/> <small>Beam Name</small> </div> <div style="width: 50%;"> <br/> <b>Structural Slab</b><br/>           S1<br/> <small>Slab No.</small><br/> <small>Slab Name</small> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 10px;"> <div style="width: 45%;"> <br/> <b>Structural Wall</b><br/> </div></div>   |   |

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| UNIL SCHEDULE S1 |  |             |             |      |          |      |     |                       |     |
|------------------|--|-------------|-------------|------|----------|------|-----|-----------------------|-----|
| Type             | Service Dom  | Main Site 1 | Main Site 2 | Site | Comments | Type | Max | Amount /<br>Frequency | SFC |
| 1.1A             | 1.1A 2.1A 2.2A 2.3A 2.4A 2.5A 2.6A 2.7A 2.8A 2.9A 2.10A 2.11A 2.12A 2.13A 2.14A 2.15A 2.16A 2.17A 2.18A 2.19A 2.20A 2.21A 2.22A 2.23A 2.24A 2.25A 2.26A 2.27A 2.28A 2.29A 2.30A 2.31A 2.32A 2.33A 2.34A 2.35A 2.36A 2.37A 2.38A 2.39A 2.40A 2.41A 2.42A 2.43A 2.44A 2.45A 2.46A 2.47A 2.48A 2.49A 2.50A 2.51A 2.52A 2.53A 2.54A 2.55A 2.56A 2.57A 2.58A 2.59A 2.60A 2.61A 2.62A 2.63A 2.64A 2.65A 2.66A 2.67A 2.68A 2.69A 2.70A 2.71A 2.72A 2.73A 2.74A 2.75A 2.76A 2.77A 2.78A 2.79A 2.80A 2.81A 2.82A 2.83A 2.84A 2.85A 2.86A 2.87A 2.88A 2.89A 2.90A 2.91A 2.92A 2.93A 2.94A 2.95A 2.96A 2.97A 2.98A 2.99A 3.00A 3.01A 3.02A 3.03A 3.04A 3.05A 3.06A 3.07A 3.08A 3.09A 3.10A 3.11A 3.12A 3.13A 3.14A 3.15A 3.16A 3.17A 3.18A 3.19A 3.20A 3.21A 3.22A 3.23A 3.24A 3.25A 3.26A 3.27A 3.28A 3.29A 3.30A 3.31A 3.32A 3.33A 3.34A 3.35A 3.36A 3.37A 3.38A 3.39A 3.40A 3.41A 3.42A 3.43A 3.44A 3.45A 3.46A 3.47A 3.48A 3.49A 3.50A 3.51A 3.52A 3.53A 3.54A 3.55A 3.56A 3.57A 3.58A 3.59A 3.60A 3.61A 3.62A 3.63A 3.64A 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1. OFFICIALS OF DISCREET CHARACTER AND FINE TASTE.
2. ALL GUESTS TO BE SEATED AT CIRCULAR TABLES.
3. TO BE SERVED IN THE ORDER OF THE FOLLOWING: FIRST COURSE, SOUP, FISH, MEAT, VEGETABLES, RICE, SALAD, FRUIT, DESSERT, AND COFFEE.
4. TO BE SERVED IN THE ORDER OF THE FOLLOWING: FIRST COURSE, SOUP, FISH, MEAT, VEGETABLES, RICE, SALAD, FRUIT, DESSERT, AND COFFEE.
5. TO BE SERVED IN THE ORDER OF THE FOLLOWING: FIRST COURSE, SOUP, FISH, MEAT, VEGETABLES, RICE, SALAD, FRUIT, DESSERT, AND COFFEE.
6. TO BE SERVED IN THE ORDER OF THE FOLLOWING: FIRST COURSE, SOUP, FISH, MEAT, VEGETABLES, RICE, SALAD, FRUIT, DESSERT, AND COFFEE.
7. TO BE SERVED IN THE ORDER OF THE FOLLOWING: FIRST COURSE, SOUP, FISH, MEAT, VEGETABLES, RICE, SALAD, FRUIT, DESSERT, AND COFFEE.
8. TO BE SERVED IN THE ORDER OF THE FOLLOWING: FIRST COURSE, SOUP, FISH, MEAT, VEGETABLES, RICE, SALAD, FRUIT, DESSERT, AND COFFEE.
9. TO BE SERVED IN THE ORDER OF THE FOLLOWING: FIRST COURSE, SOUP, FISH, MEAT, VEGETABLES, RICE, SALAD, FRUIT, DESSERT, AND COFFEE.
10. TO BE SERVED IN THE ORDER OF THE FOLLOWING: FIRST COURSE, SOUP, FISH, MEAT, VEGETABLES, RICE, SALAD, FRUIT, DESSERT, AND COFFEE.
11. TO BE SERVED IN THE ORDER OF THE FOLLOWING: FIRST COURSE, SOUP, FISH, MEAT, VEGETABLES, RICE, SALAD, FRUIT, DESSERT, AND COFFEE.
12. TO BE SERVED IN THE ORDER OF THE FOLLOWING: FIRST COURSE, SOUP, FISH, MEAT, VEGETABLES, RICE, SALAD, FRUIT, DESSERT, AND COFFEE.
13. TO BE SERVED IN THE ORDER OF THE FOLLOWING: FIRST COURSE, SOUP, FISH, MEAT, VEGETABLES, RICE, SALAD, FRUIT, DESSERT, AND COFFEE.
14. TO BE SERVED IN THE ORDER OF THE FOLLOWING: FIRST COURSE, SOUP, FISH, MEAT, VEGETABLES, RICE, SALAD, FRUIT, DESSERT, AND COFFEE.
15. TO BE SERVED IN THE ORDER OF THE FOLLOWING: FIRST COURSE, SOUP, FISH, MEAT, VEGETABLES, RICE, SALAD, FRUIT, DESSERT, AND COFFEE.

**TYPE S4**  
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| 54.4A<br>11.2" x<br>17.0" x<br>to Deck |              | 54.3" GP    |             | Yes  |                           | 54.4A       | 0732.00                  |     |
| 54.4A<br>11.2" x<br>17.0" x<br>to Deck |              | 54.3" GP    |             | Yes  |                           | 54.4A       | 0732.00                  |     |

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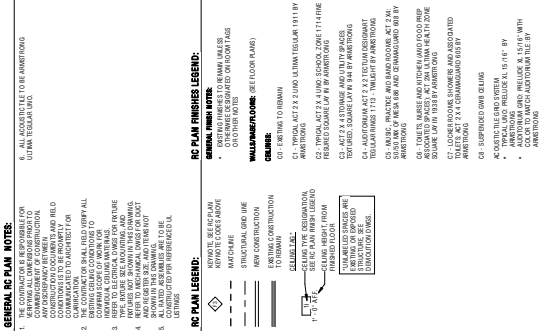


















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**WALL ADJUSTABLE LIGHT FIXTURES**

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|  | LINE ADJ WALL FIXTURE          |
|  | WALL ADJUST FIXTURE            |
|  | END ADJUSTABLE LIGHT FIXTURE   |
|  | MECHANICAL ELECTRICAL AND DATA |
| <input checked="" type="checkbox"/>   | SUPPLY AIR OUTLET              |
| <input checked="" type="checkbox"/>   | RETURN AIR OUTLET              |
|  | PERIODIC MAINTENANCE           |
|  | CULINARY FIX                   |
|  | END POIN                       |



**banwell**  
 A.C. & SONS  
 1000 W. 10th Street  
 Suite 1000  
 Minneapolis, MN 55403  
 T. 612.442.2278

COMPANY 2015 ACHETES ALL LEADS FROM  
 THE FOLLOWING COMPANIES:  
 CONSULTANTS: CH2M HILL  
 CH2M HILL

**OWNERS:**  
 CH2M HILL  
 1000 W. 10th Street  
 Suite 1000  
 Minneapolis, MN 55403  
 T. 612.442.2278

**CONSTRUCTION MANAGER:**  
 CH2M HILL  
 1000 W. 10th Street  
 Suite 1000  
 Minneapolis, MN 55403

**CMAL:**

**STRUCTURAL:**

**ARCHITECT:**  
 CH2M HILL  
 1000 W. 10th Street  
 Suite 1000  
 Minneapolis, MN 55403  
 T. 612.442.2278

**MPP/VE:**

ALL INFORMATION REQUIRED FOR THE SUCCESSFUL COMPLETION OF THE WORK IS CONTAINED IN THE PROJECT MANUAL PREPARED FOR THIS PROJECT.

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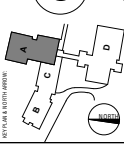
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## PROGRESS

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GREEN MOUNTAIN UNION HIGH  
SCHOOL  
716 VT-103, Chester, VT 05143

ISSUE ID: **Pre-Bond Pricing**

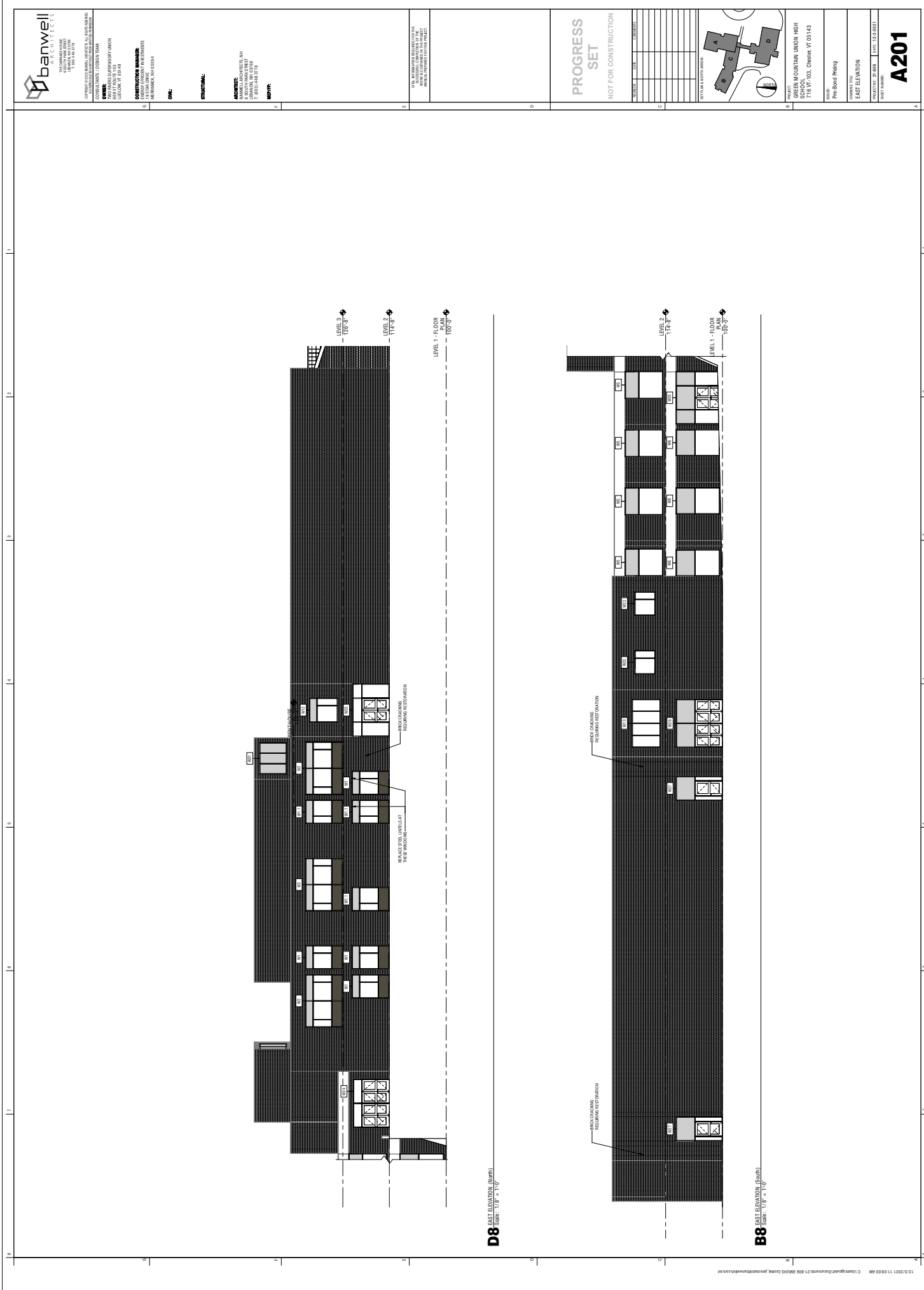
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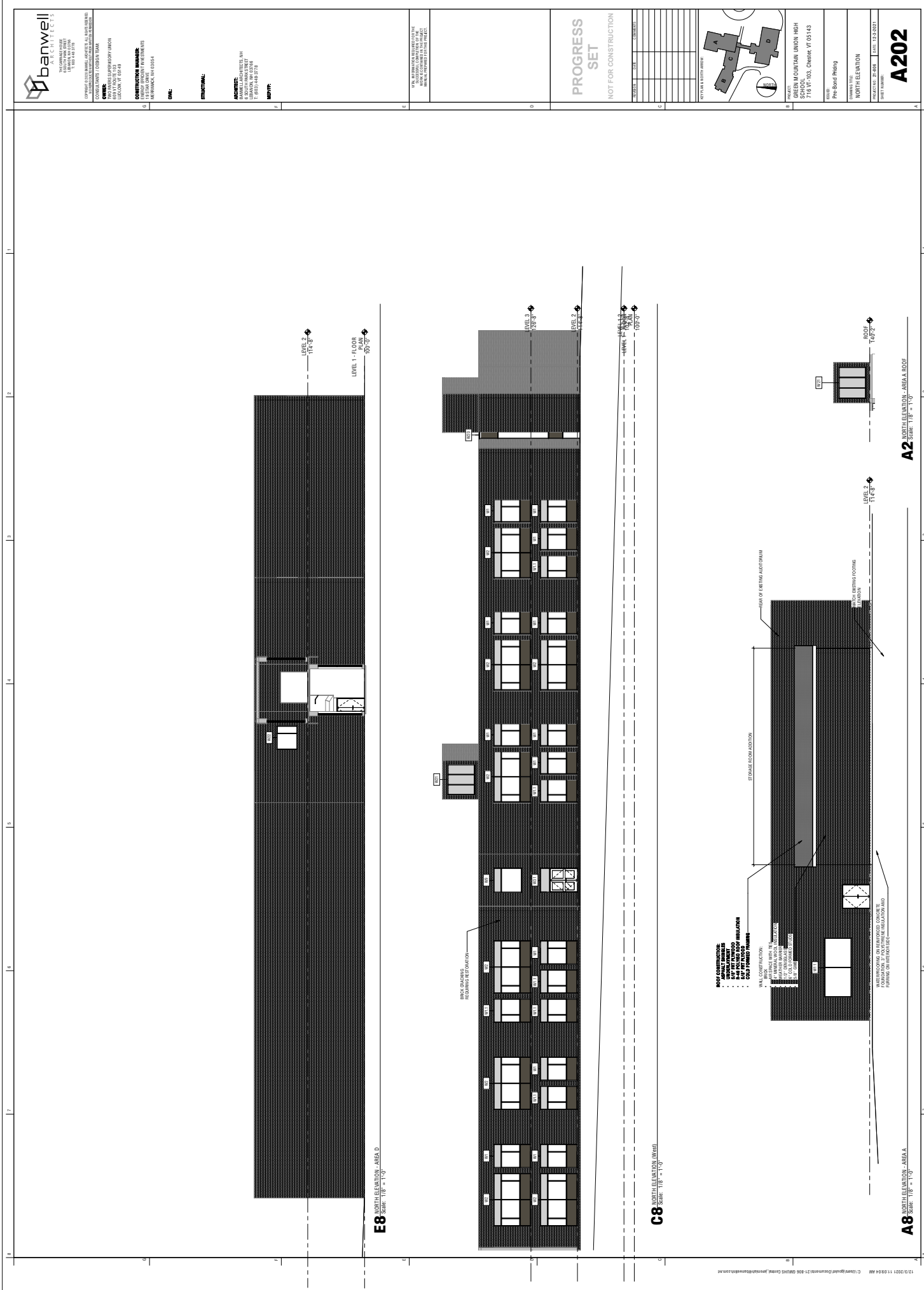












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GREEN MOUNTAIN UNION, VT 05143  
T: 802.248.2778

**OWNER:**  
GREEN MOUNTAIN UNION  
718 VT-103, Cheshire, VT 05143

**CONSULTANT / DESIGN TEAM:**  
ARCHITECT: BANWELL ARCHITECTS  
STRUCTURAL: BROWN ENGINEERING

**CONSTRUCTION MANAGER:**  
GREEN MOUNTAIN UNION  
718 VT-103, Cheshire, VT 05143

**DATE:**  
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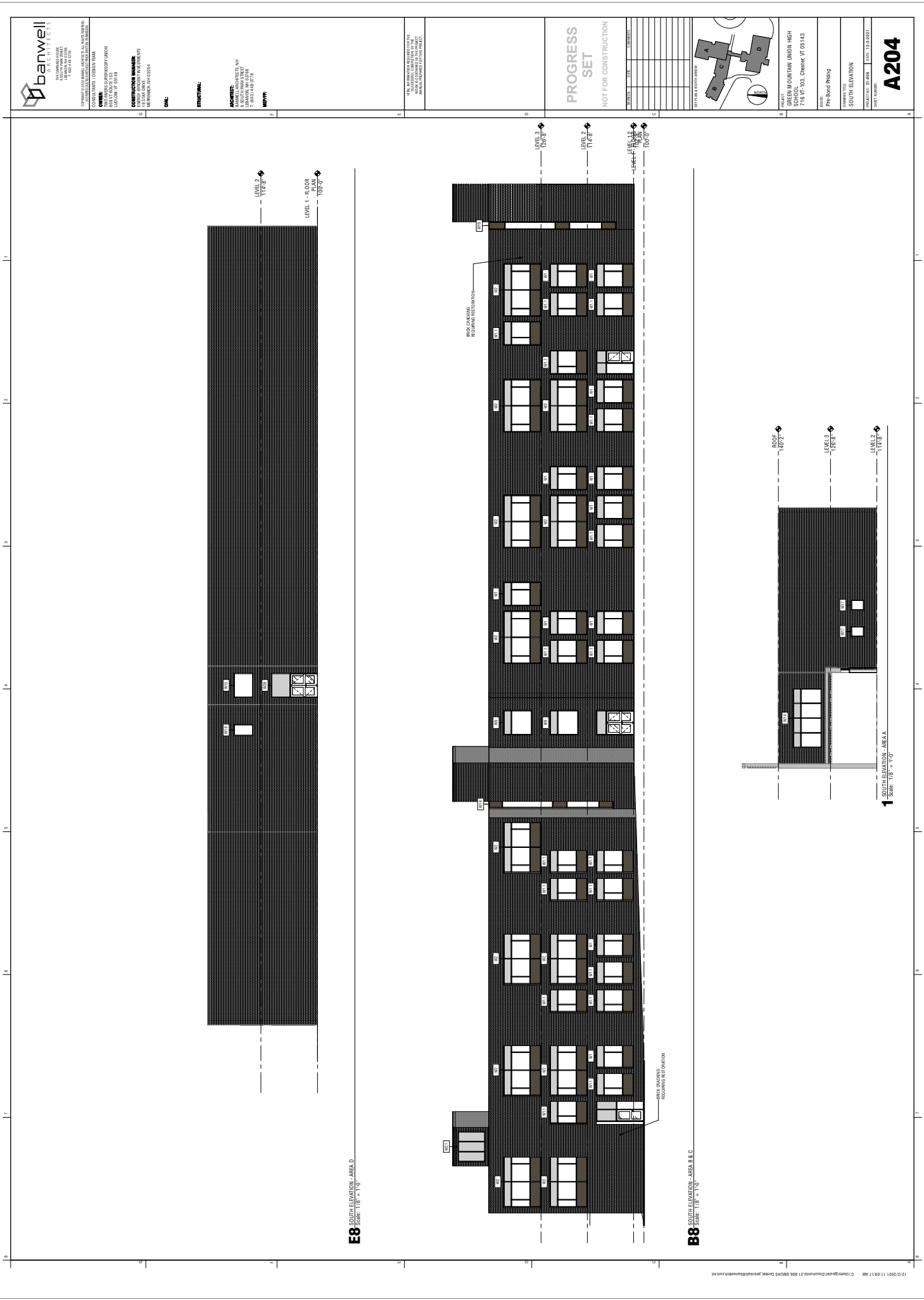
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**DATE:**  
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**OWNER:**  
GREEN MOUNTAIN UNION HIGH SCHOOL DISTRICT  
718 VT-103, Cheshire, VT 05143

**CONSULTANT / DESIGN TEAM:**  
BANWELL ARCHITECTS  
100 SOUTH MAIN STREET  
CHESHIRE, VT 05143

**CONSTRUCTION MANAGER:**  
GREEN MOUNTAIN UNION HIGH SCHOOL DISTRICT  
718 VT-103, Cheshire, VT 05143

**DATE:**  
10/10/2021

**PROJECT:**  
GREEN MOUNTAIN UNION HIGH SCHOOL DISTRICT  
718 VT-103, Cheshire, VT 05143

**PROJECT NUMBER:**  
A204

**PROJECT NAME:**  
GREEN MOUNTAIN UNION HIGH SCHOOL DISTRICT  
718 VT-103, Cheshire, VT 05143

**PROJECT ADDRESS:**  
718 VT-103, Cheshire, VT 05143

**PROJECT PHONE:**  
(802) 898-2778

**PROJECT FAX:**  
(802) 898-2778

**PROJECT EMAIL:**  
info@banwellarchitects.com

**PROJECT WEBSITE:**  
www.banwellarchitects.com

**PROJECT SOCIAL MEDIA:**  
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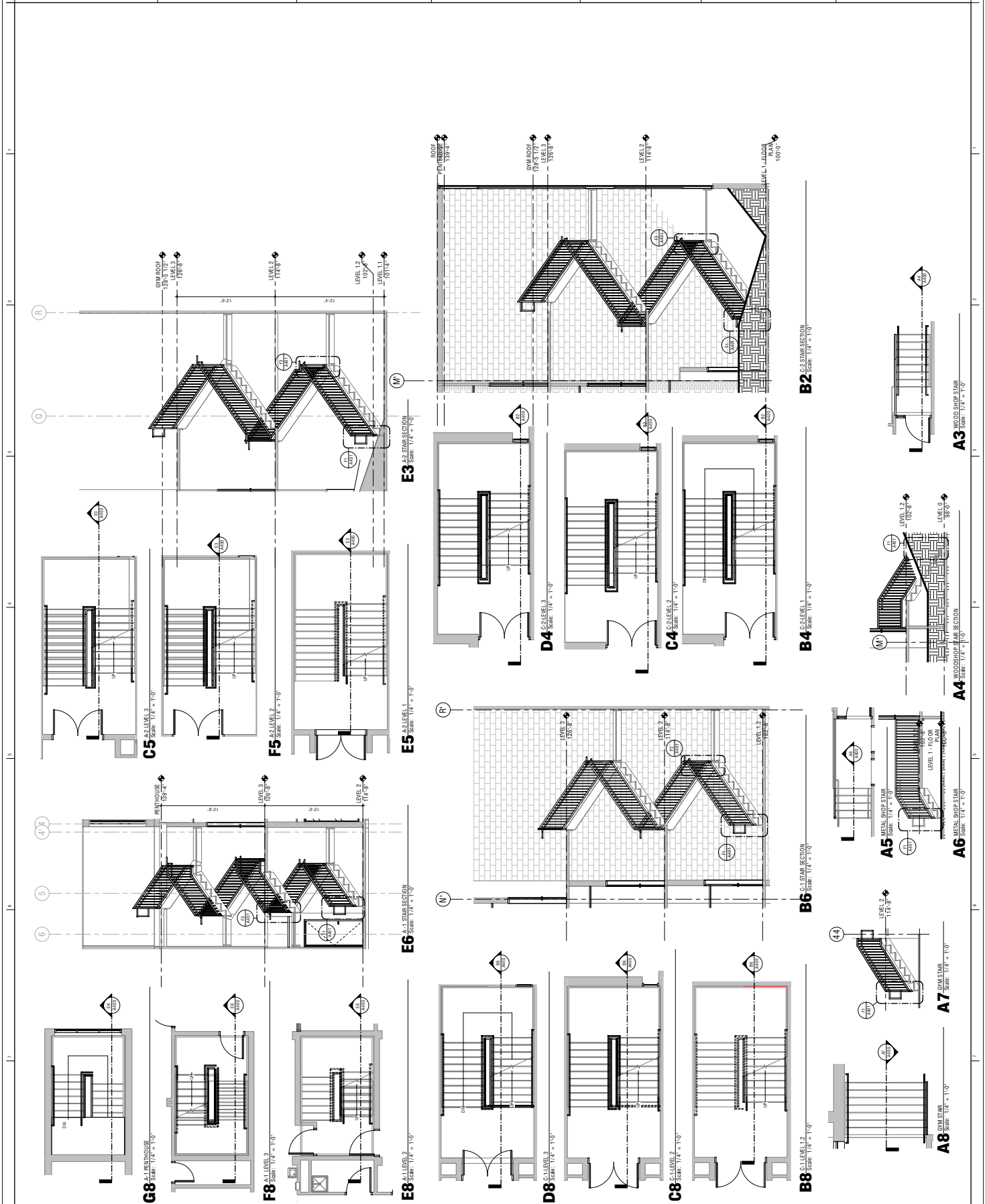
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**PROJECT SoundCloud:**  
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| ROOM | NUMBER | ROOM NAME | RECONFIGURED | 201 | 202 | 203 | 204 | 205 | 206 | 207 | 208 | 209 | 210 | 211 | 212 | 213 | 214 | 215 | 216 | 217 | 218 | 219 | 220 | 221 | 222 | 223 | 224 | 225 | 226 | 227 | 228 | 229 | 230 | 231 | 232 | 233 | 234 | 235 | 236 | 237 | 238 | 239 | 240 | 241 | 242 | 243 | 244 | 245 | 246 | 247 | 248 | 249 | 250 | 251 | 252 | 253 | 254 | 255 | 256 | 257 | 258 | 259 | 260 | 261 | 262 | 263 | 264 | 265 | 266 | 267 | 268 | 269 | 270 | 271 | 272 | 273 | 274 | 275 | 276 | 277 | 278 | 279 | 280 | 281 | 282 | 283 | 284 | 285 | 286 | 287 | 288 | 289 | 290 | 291 | 292 | 293 | 294 | 295 | 296 | 297 | 298 | 299 | 300 | 301 | 302 | 303 | 304 | 305 | 306 | 307 | 308 | 309 | 310 | 311 | 312 | 313 | 314 | 315 | 316 | 317 | 318 | 319 | 320 | 321 | 322 | 323 | 324 | 325 | 326 | 327 | 328 | 329 | 330 | 331 | 332 | 333 | 334 | 335 | 336 | 337 | 338 | 339 | 340 | 341 | 342 | 343 | 344 | 345 | 346 | 347 | 348 | 349 | 350 | 351 | 352 | 353 | 354 | 355 | 356 | 357 | 358 | 359 | 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| 860 | 861 | 862 | 863 | 864 | 865 | 866 | 867 | 868 | 869 | 870 | 871 | 872 | 873 | 874 | 875 | 876 | 877 | 878 | 879 | 880 | 881 | 882 | 883 | 884 | 885 | 886 | 887 | 888 | 889 | 890 | 891 | 892 | 893 | 894 | 895 | 896 | 897 | 898 | 899 | 900 | 901 | 902 | 903 | 904 | 905 | 906 | 907 | 908 | 909 | 910 | 911 | 912 | 913 | 914 | 915 | 916 | 917 | 918 | 919 | 920 | 921 | 922 | 923 | 924 | 925 | 926 | 927 | 928 | 929 | 930 | 931 | 932 | 933 | 934 | 935 | 936 | 937 | 938 | 939 | 940 | 941 | 942 | 943 | 944 | 945 | 946 | 947 | 948 | 949 | 950 | 951 | 952 | 953 | 954 | 955 | 956 | 957 | 958 | 959 | 960 | 961 | 962 | 963 | 964 | 965 | 966 | 967 | 968 | 969 | 970 | 971 | 972 | 973 | 974 | 975 | 976 | 977 | 978 | 979 | 980 | 981 | 982 | 983 | 984 | 985 | 986 | 987 | 988 | 989 | 990 | 991 | 992 | 993 | 994 | 995 | 996 | 997 | 998 | 999 | 1000 | 1001 | 1002 | 1003 | 1004 | 1005 | 1006 | 1007 | 1008 | 1009 | 1010 | 1011 | 1012 | 1013 | 1014 | 1015 | 1016 | 1017 | 1018 | 1019 | 1020 | 1021 | 1022 | 1023 | 1024 | 1025 | 1026 | 1027 | 1028 | 1029 | 1030 | 1031 | 1032 | 1033 | 1034 | 1035 | 1036 | 1037 | 1038 | 1039 | 1040 | 1041 | 1042 | 1043 | 1044 | 1045 | 1046 | 1047 | 1048 | 1049 | 1050 | 1051 | 1052 | 1053 | 1054 | 1055 | 1056 | 1057 | 1058 | 1059 | 1060 | 1061 | 1062 | 1063 | 1064 | 1065 | 1066 | 1067 | 1068 | 1069 | 1070 | 1071 | 1072 | 1073 | 1074 | 1075 | 1076 | 1077 | 1078 | 1079 | 1080 | 1081 | 1082 | 1083 | 1084 | 1085 | 1086 | 1087 | 1088 | 1089 | 1090 | 1091 | 1092 | 1093 | 1094 | 1095 | 1096 | 1097 | 1098 | 1099 | 1100 | 1101 | 1102 | 1103 | 1104 | 1105 | 1106 | 1107 | 1108 | 1109 | 1110 | 1111 | 1112 | 1113 | 1114 | 1115 | 1116 | 1117 | 1118 | 1119 | 1120 | 1121 | 1122 | 1123 | 1124 | 1125 | 1126 | 1127 | 1128 | 1129 | 1130 | 1131 | 1132 | 1133 | 1134 | 1135 | 1136 | 1137 | 1138 | 1139 | 1140 | 1141 | 1142 | 1143 | 1144 | 1145 | 1146 | 1147 | 1148 | 1149 | 1150 | 1151 | 1152 | 1153 | 1154 | 1155 | 1156 | 1157 | 1158 | 1159 | 1160 | 1161 | 1162 | 1163 | 1164 | 1165 | 1166 | 1167 | 1168 | 1169 | 1170 | 1171 | 1172 | 1173 | 1174 | 1175 | 1176 | 1177 | 1178 | 1179 | 1180 | 1181 | 1182 | 1183 | 1184 | 1185 | 1186 | 1187 | 1188 | 1189 | 1190 | 1191 | 1192 | 1193 | 1194 | 1195 | 1196 | 1197 | 1198 | 1199 | 1200 | 1201 | 1202 | 1203 | 1204 | 1205 | 1206 | 1207 | 1208 | 1209 | 1210 | 1211 | 1212 | 1213 | 1214 | 1215 | 1216 | 1217 | 1218 | 1219 | 1220 | 1221 | 1222 | 1223 | 1224 | 1225 | 1226 | 1227 | 1228 | 1229 | 1230 | 1231 | 1232 | 1233 | 1234 | 1235 | 1236 | 1237 | 1238 | 1239 | 1240 | 1241 | 1242 | 1243 | 1244 | 1245 | 1246 | 1247 | 1248 | 1249 | 1250 | 1251 | 1252 | 1253 | 1254 | 1255 | 1256 | 1257 | 1258 | 1259 | 1260 | 1261 | 1262 | 1263 | 1264 | 1265 | 1266 | 1267 | 1268 | 1269 | 1270 | 1271 | 1272 | 1273 | 1274 | 1275 | 1276 | 1277 | 1278 | 1279 | 1280 | 1281 | 1282 | 1283 | 1284 | 1285 | 1286 | 1287 | 1288 | 1289 | 1290 | 1291 | 1292 | 1293 | 1294 | 1295 | 1296 | 1297 | 1298 | 1299 | 1300 | 1301 | 1302 | 1303 | 1304 | 1305 | 1306 | 1307 | 1308 | 1309 | 1310 | 1311 | 1312 | 1313 | 1314 | 1315 | 1316 | 1317 | 1318 | 1319 | 1320 | 1321 | 1322 | 1323 | 1324 | 1325 | 1326 | 1327 | 1328 | 1329 | 1330 | 1331 | 1332 | 1333 | 1334 | 1335 | 1336 | 1337 | 1338 | 1339 | 1340 | 1341 | 1342 | 1343 | 1344 | 1345 | 1346 | 1347 | 1348 | 1349 | 1350 | 1351 | 1352 | 1353 | 1354 | 1355 | 1356 | 1357 | 1358 | 1359 | 1360 | 1361 | 1362 | 1363 | 1364 | 1365 | 1366 | 1367 | 1368 | 1369 | 1370 | 1371 | 1372 | 1373 | 1374 | 1375 | 1376 | 1377 | 1378 | 1379 | 1380 | 1381 | 1382 | 1383 | 1384 | 1385 | 1386 | 1387 | 1388 | 1389 | 1390 | 1391 | 1392 | 1393 | 1394 | 1395 | 1396 | 1397 | 1398 | 1399 | 1400 | 1401 | 1402 | 1403 | 1404 | 1405 | 1406 | 1407 | 1408 | 1409 | 1410 | 1411 | 1412 | 1413 | 1414 | 1415 | 1416 | 1417 | 1418 | 1419 | 1420 | 1421 | 1422 | 1423 | 1424 | 1425 | 1426 | 1427 | 1428 | 1429 | 1430 | 1431 | 1432 | 1433 | 1434 | 1435 | 1436 | 1437 | 1438 | 1439 | 1440 | 1441 | 1442 | 1443 | 1444 | 1445 | 1446 | 1447 | 1448 | 1449 | 1450 | 1451 | 1452 | 1453 | 1454 | 1455 | 1456 | 1457 | 1458 | 1459 | 1460 | 1461 | 1462 | 1463 | 1464 | 1465 | 1466 | 1467 | 1468 | 1469 | 1470 | 1471 | 1472 | 1473 | 1474 | 1475 | 1476 | 1477 | 1478 | 1479 | 1480 | 1481 | 1482 | 1483 | 1484 | 1485 | 1486 | 1487 | 1488 | 1489 | 1490 | 1491 | 1492 | 1493 | 1494 | 1495 | 1496 | 1497 | 1498 | 1499 | 1500 | 1501 | 1502 | 1503 | 1504 | 1505 | 1506 | 1507 | 1508 | 1509 | 1510 | 1511 | 1512 | 1513 | 1514 | 1515 | 1516 | 1517 | 1518 | 1519 | 1520 | 1521 | 1522 | 1523 | 1524 | 1525 | 1526 | 1527 | 1528 | 1529 | 1530 | 1531 | 1532 | 1533 | 1534 | 1535 | 1536 | 1537 | 1538 | 1539 | 1540 | 1541 | 1542 | 1543 | 1544 | 1545 | 1546 | 1547 | 1548 | 1549 | 1550 | 1551 | 1552 | 1553 | 1554 | 1555 | 1556 | 1557 | 1558 | 1559 | 1560 | 1561 | 1562 | 1563 | 1564 | 1565 | 1566 | 1567 | 1568 | 1569 | 1570 | 1571 | 1572 | 1573 | 1574 | 1575 | 1576 | 1577 | 1578 | 1579 | 1580 | 1581 | 1582 | 1583 | 1584 | 1585 | 1586 | 1587 | 1588 | 1589 | 1590 | 1591 | 1592 | 1593 | 1594 | 1595 | 1596 | 1597 | 1598 | 1599 | 1600 | 1601 | 1602 | 1603 | 1604 | 1605 | 1606 | 1607 | 1608 | 1609 | 1610 | 1611 | 1612 | 1613 | 1614 | 1615 | 1616 | 1617 | 1618 | 1619 | 1620 | 1621 | 1622 | 1623 | 1624 | 1625 | 1626 | 1627 | 1628 | 1629 | 1630 | 1631 | 1632 | 1633 | 1634 | 1635 | 1636 | 1637 | 1638 | 1639 | 1640 | 1641 | 1642 | 1643 | 1644 | 1645 | 1646 | 1647 | 1648 | 1649 | 1650 | 1651 | 1652 | 1653 | 1654 | 1655 | 1656 | 1657 | 1658 |  |
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**GENERAL DOOR/ WINDOW NOTES**

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## **Appendix B – GMUHS Assessment (8 Pages)**





April 6, 2021

Mike Davey  
Energy Efficient Investments  
19D Star Drive  
Merrimack, NH 03054

### Facility Observations for the Green Mountain Union High School

Banwell Architects has prepared this analysis of the facility based on site observations and discussions with facility staff. See existing notated plans that accompany this report.

Life safety observations: Please note that a full code review has not been performed.

1. The building is not currently protected by a sprinkler system. The largest floor is approximately 54,000 sf which exceeds the building size limitations of the IBC. The size restriction for the Assembly occupancies (most restrictive use) is 9,500 based on a type 2B building (Table 506.2, IBC 2015). The size restriction for Educational is 14,500 sf based on a type 2B building. This is only pointing out that the building is oversized for its use and does not indicate that the installation of a sprinkler system will be required. However, the state fire marshal may require a sprinkler system based on the extent of the renovation.  
Our recommendation would be to sprinkler the building to bring it into compliance. Installing a sprinkler system will address other concerns listed throughout this report including lessened door fire ratings at circulation areas and compliant egress from internal stairwells for example.
2. Fire rating requirements vary based on whether a sprinkler system is present in the building. In the current arrangement without a sprinkler system, the following requirements will need to be verified:
  - a. Hazardous spaces require a 1-hour fire rating including Boiler and furnace rooms, storage of combustible materials, janitors' closets, laundries, maintenance shops.
  - b. Exit enclosures and vertical openings require a 1-hour fire rating.
  - c. Corridors require a ½ hour rating.
3. The elevator controls are in need of upgrading which may trigger further improvements.



4. Stair guardrails and handrails appeared to not meet requirements for height, hand rail graspability and baluster spacing.



5. Both egress stairs in the gym wing are not in fire rated enclosures. Due to the layout this may be infeasible to do but suggest a conversation with Fire chief/ inspector on how to address.

Also, since these stairs exit through the street floor on the level below and the building is not sprinkled the rating should continue from the stairs to the exit doors which is not the currently the case. The same issue occurs at lower level egress from the stairwell located within the library.



6. Since the building does not have a sprinkler system, emergency windows from the classrooms may be required if the exceptions of section 15.2.11.1.1 (NFPA 2015) are not met. The classrooms on the north side of the lower level classroom wing appear to be non-compliant since there are no windows in those class rooms.



Accessibility observations: Please note that a full code review has not been performed.

- a. There is a lack of accessible bathrooms. Recommend converting some of the bathrooms to be accessible. A minimum plumbing fixture count related to occupancy has not been confirmed. See plan notes.
- b. There is a lack of accessible 34" high counter heights/sinks where others are provided throughout the facility.
- c. There did not appear to be any accessible drinking fountains. Code requires no fewer and two (one standard & one accessible) or one "hi-lo" drinking fountain (an accessible/standard combination unit).



- d. Ramps lack handrails. See notes on plans.



- e. Stage is not accessible.

Suggested work by architectural related divisions:

Div. 3: Add exterior concrete slab that is flush with threshold. Regrade as required.





**Div. 4:**

Facility director noted masonry repair/repointing needed in several areas. The following are areas observed:

**Brick failure 1:**



**Brick failure 2:**

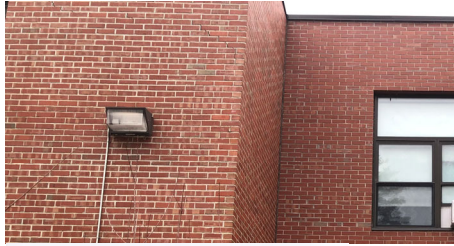


**Brick failure 3:**





Brick failure 4:



Brick failure 5:



Brick failure 6:



Div. 5:

- a. Misc. metals: Replace/add handrails (609 lf) and guardrails (449 lf) at stairs and where also noted on plans (see A23 for extent).
- b. Lintel observed needing repair



Div. 6:

- a. Casework: replace metal casework on exterior walls. There is a lack of accessible 34" high counter heights/sinks where other are provided throughout the facility. Suggest another meeting to define scope.





Div. 7:

- a. It's our understanding that the roofs were recently replaced and there are no insulation upgrades planned as part of this project. It was brought to our attention there are plans to install PV panels on the existing roofs. Recommend having a structural engineer evaluate the structure to accommodate the weight of the panels.
- b. Upon inspection it appears rated walls are CMU that extend to the deck above. Recommend an allowance to firestop openings in rated wall locations when existing ceilings are removed.
- c. Replace all damaged sills as part of window replacement. This one observed at cafeteria:



Div. 8:

- a. Replace all exterior windows and entrances with aluminum windows and storefronts.  
Exterior Aluminum doors: (12) Double doors, (7) Single doors.  
Window/storefront openings: 9,680 sf of glazing spread out over 135 openings. See plans for sizes
- b. Replace select windows with Kalwall where shown on elevations.  
Kalwall openings: 589 sf spread out over 12 openings. See plans for sizes.
- c. Interior flush wood doors appeared to be in poor shape. Suggest replacing all doors and replacing wire glass with tempered glazing throughout the school.  
Approximate count of doors to be replaced. 1 hour doors: 66. 30 min. doors: 91. Non-rated doors: 138.  
Please note that the rating requirements are lessened if a sprinkler system is installed. Corridor doors can be non-rated as opposed to 30 minutes. There is a difference in cost when comparing rated glazing in the door and sidelights as opposed to standard tempered safety glazing.



- d. Replace all door hardware and keying system throughout.
- e. Replace wire glass with 20 minute fire rated safety glazing throughout school. If sprinkler system is put in place the glazing can be replaced with non-rated tempered safety glazing. Approximate sf of wire glass: 700 sf

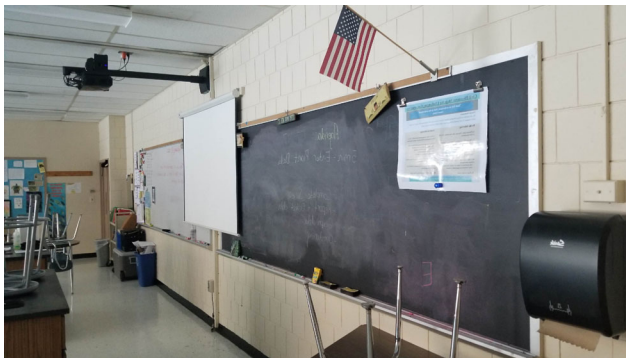
Div.9:

- a. Replace acoustic ceiling tiles throughout (see plans for approximate areas).
- b. Replace asbestos tile with VCT unless otherwise noted (see plans for approximate areas). Patch VCT where all unit ventilators removed. Suggesting rubber flooring at the cafeteria.

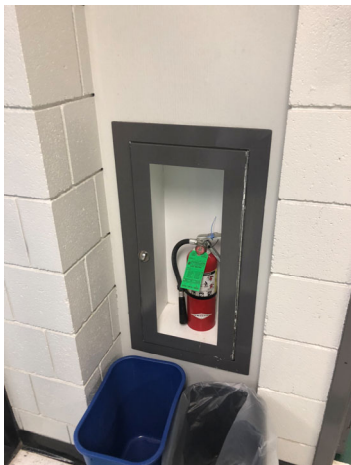


Div. 10:

- a. Replace existing chalk boards with marker boards (quantity not verified).



- b. Replace fire extinguisher cabinets throughout.





- c. Replace gym wall mats.

Div. 11:

- a. Replace equipment in kitchen such as the freezer, grease traps, range & mixer.  
Recommend having a kitchen supplier review on site.

Div. 14:

- a. Add lift to access stage

Sincerely,

A handwritten signature in blue ink, appearing to read "Jeremiah Goulet". The signature is fluid and cursive, with a long horizontal stroke at the end.

Jeremiah Goulet  
Registered Architect



## **Appendix C – CAES Assessment (5 pages)**





April 6, 2021

Mike Davey  
Energy Efficient Investments  
19D Star Drive  
Merrimack, NH 03054

#### Facility Observations for the Chester-Andover Elementary School.

Banwell Architects has prepared this analysis of the facility based on site observations and discussions with facility staff. See existing notated plans that accompany this report. Please note there are several discrepancies with these plans and field conditions. Several partitions are inaccurately represented or missing. Plumbing fixtures and casework is not represented. We did not gain access or review the modular building behind the school.

Life safety observations: Please note that a full code review has not been performed.

1. The building is not currently protected by a sprinkler system. The largest floor is approximately 49,200 sf which exceeds the building size limitations of the IBC. The size restriction for the Assembly occupancies (most restrictive use) is 9,500 sf based on a type 2B building (Table 506.2, IBC 2015). The size restriction for Educational is 14,500 sf based on a type 2B building. This is only pointing out that the building is oversized for it's use and does not indicate that the installation of a sprinkler system will be required. However, the state fire marshal may require a sprinkler system based on the extent of the renovation.  
Our recommendation would be to sprinkler the building. Installing a sprinkler system will address other concerns listed throughout this report including lessened door fire ratings at circulation areas.
2. There are a couple areas that are not consistent with a non-combustible building type (type 2B). Specifically, wood framed (type 5B) areas such as the maintenance shed in the north-west corner of the building. We also noticed wood framed walls/floors located on the stage and walls in the nurse's office. The presence of combustible construction in this school without sprinkler coverage is a concern. Recommend a discussion with the fire chief/ building inspector.





3. Fire rating requirements vary based on whether a sprinkler system is present in the building. In the current arrangement without a sprinkler system, the following requirements will need to be verified:
  - a. Hazardous spaces require a 1-hour fire rating including Boiler and furnace rooms, storage of combustible materials, janitors' closets, laundries, maintenance shops. We observed the wood framed storage walls on the stage are not only unrated but are also not enclosed. There are also wood framed floors above the stage accessed by a pull-down ladder for additional storage which we believe to be a hazard.



- b. Corridors require a ½ hour rating.
4. Since the building does not have a sprinkler system, emergency windows from the classrooms may be required if the exceptions of section 15.2.11.1.1 (NFPA 2015) are not met.



Accessibility observations: Please note that a full code review has not been performed.

- a. The nurse's office does not have an accessible bathroom and shower. A minimum plumbing fixture count related to occupancy has not been confirmed. See plan notes.
- b. There did not appear to be any accessible drinking fountains. Code requires no fewer and two (one standard & one accessible) or one "hi-lo" drinking fountain (an accessible/standard combination unit).
- c. Stage is not accessible
- d. There are no concrete landings flush with door thresholds at classroom exit doors.

Suggested work by architectural related divisions:

Div. 3:

- a) Add frost protected concrete landings flush with door thresholds at classroom exit doors. (6) locations, 5'x5' pad with 2 steps/handrails.

Div. 4:

- a. Existing brick has not been inspected for repointing needs.

Div. 5:

- a. Misc. metals: Replace handrails at stairs leading to stage

Div. 6:

- a. Casework appeared to be in fair condition. Suggest a meeting to define scope.

Div. 7:

- a. Roof condition unknown.
- b. Upon inspection it appears rated walls are CMU that extend to the deck above. Recommend an allowance to firestop openings in rated wall locations when existing ceilings are removed.

Div. 8:

- a. Windows appear to be single pane and original to the building. Recommend replacing all exterior windows with aluminum windows. Please note that the plans we received have not been thoroughly verified to confirm existing conditions (typical windows are 7'-4" high unless otherwise noted, see widths on plans). One design option could be a storefront system with vents down low and insulated Mapes panels up high. Approximately 3,759 sf of windows spread out over 309 openings. Approximately 700 sf of Mapes insulated panels spread out over 90 openings.





- b. Replace high gym windows with Kalwall. Approximately 1,600 sf spread out over 10 openings.



- c. Interior flush wood doors appeared to be in poor shape. Suggest replacing all doors and replacing wire glass with tempered glazing throughout the school.



- d. Exterior doors appeared to be in fair condition.
- e. Replace all door hardware and keying system throughout.

#### Div.9:

- a. Typical carpet throughout in classrooms/hallways appeared to be in fair condition. The principal inquired about hard flooring vs. carpet.
- b. Replace acoustic ceiling tiles throughout (approx. 40,000 sf).



- c. Replace VCT with a vinyl sports floor in the gym (approx. 4,660 sf)



Div. 11:

- a. Recommend having a kitchen supplier review kitchen equipment on site.

Div. 14:

- a. Add lift to access stage

Sincerely,



Jeremiah Goulet  
Registered Architect



## **Appendix D - Equipment sheet Propane Boiler (16 pages)**



# Technical Data Manual

Model Nos. and pricing : See Price List

# VIESSMANN®



## VITOCROSSAL 200

Gas-fired Condensing Boiler

663 to 1112 MBH (194 to 326 kW)



*Product may not be exactly as illustrated.*

### Vitocrossal 200

#### CM2 Series 186, 246, 311

#### High efficiency, gas-fired condensing boiler with pre-mix modulating cylinder burner

for natural gas or liquid propane gas with Inox-Crossal heat exchanger made of high-grade SA 240-316 Ti stainless steel.

For operation without low limit on boiler return water temperature.

For closed loop hot water heating systems with maximum supply water temperatures of 210°F (99°C) for a maximum operating pressure of 75 psig.

Heating input: 663 to 1112 MBH  
(194 to 326 kW)

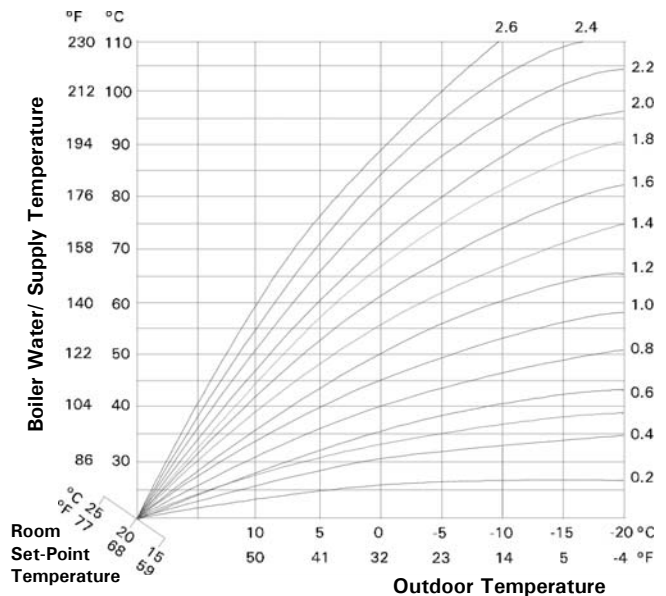
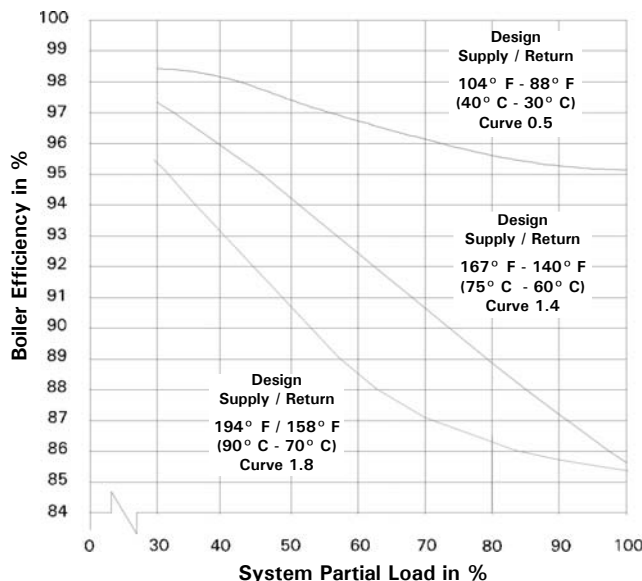




## Vitocrossal 200

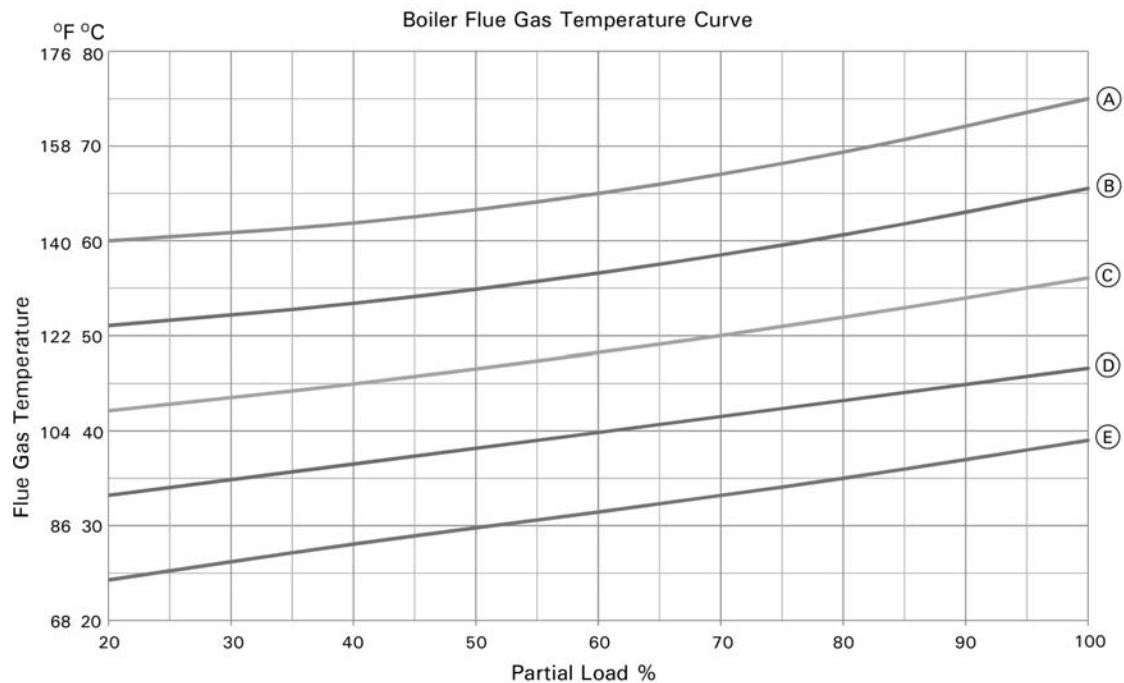
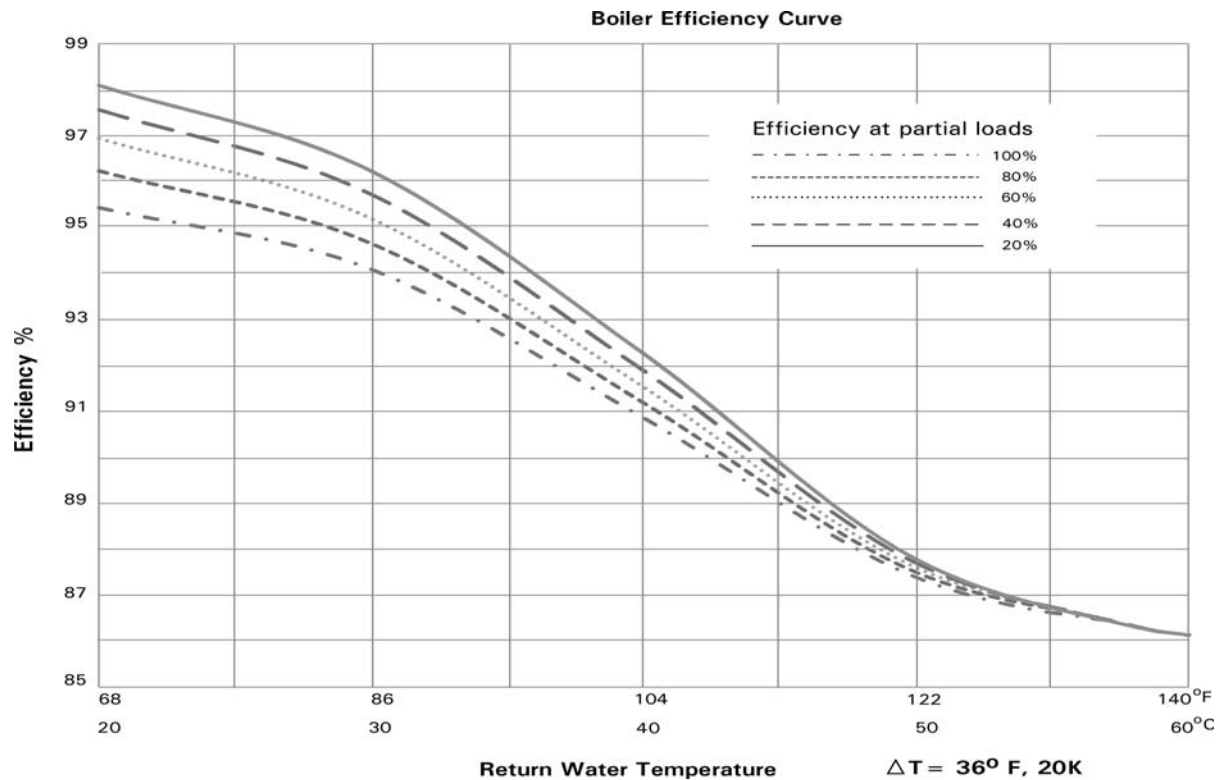
### Benefits at a glance:

- Inox-Crossal heat exchanger surface made of high-grade SA 240-316 Ti stainless steel for high operational reliability and long service life.
  - Easy dispersal of condensate through vertical gas flues; therefore no concentration of condensate.
  - Increased self-cleaning effect through smooth stainless steel surfaces.
- Highly efficient heat transfer and high condensation rate through
  - heat exchanger surfaces which intensely turbulate the flue gas flow
  - boiler water and hot gases flowing in counterflow.
- Efficiency up to 98% through intensive condensation. The flue gas temperature is only approximately 9 - 27°F (5 - 15°C) above boiler return temperature (see chart below).
- Clean combustion - through perfect match of burner and boiler, low combustion chamber loading and straight-through combustion chamber.
- Easy handling in boiler rooms through particularly low build height and weight.
- Easy installation and elimination of wiring mistakes with Viessmann prewired plug-in system.
- Heating boiler, heating system control, domestic hot water storage tank and all other Viessmann system technology components are coordinated to one another. All components are design-matched for quick installation.
- Pre-mix cylinder burner for environmentally-friendly operation with a modulation range from 20 to 100%.
- All hydronic connections can be fitted from above.
- Economical and safe heating system operation through Vitotronic digital control system with communication capability. Tailored to every need, covering all known control strategies and applications. Standard LON BUS for complete integration into building management systems.
- Particularly quiet operation.
- High altitude operation up to 10,000 ft. (3000 m) with a simple electronic adjustment.



Vitocrossal 200 boiler efficiency dependent on system heating water return temperatures and load conditions



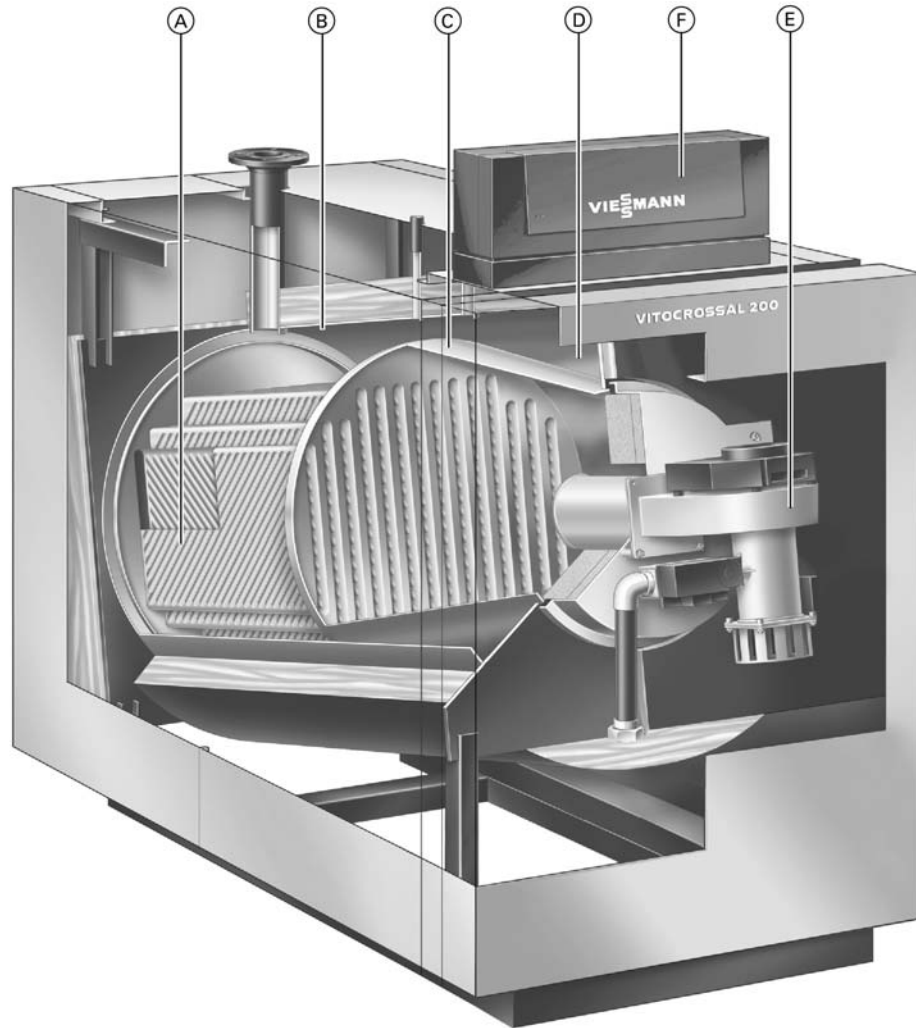
**Vitocrossal 200**

Flue gas temperature as a function of average partial load firings.

**Legend**

- (A) Supply/return temperature of 176/140°F (80/60°C)
- (B) Supply/return temperature of 158/122°F (70/50°C)
- (C) Supply/return temperature of 140/104°F (60/40°C)
- (D) Supply/return temperature of 122/86°F (50/30°C)
- (E) Supply/return temperature of 104/68°F (40/20°C)



**Cutaway Section****Legend**

- Ⓐ Inox-Crossal heat exchanger surface made from high-grade SA 240-316 Ti stainless steel
- Ⓑ Highly effective thermal insulation
- Ⓒ Water cooled stainless steel combustion chamber
- Ⓓ Wide water passageways with low pressure drop - good natural circulation
- Ⓔ Fully modulating pre-mix cylinder burner
- Ⓕ Vitotronic control unit



## Technical Data

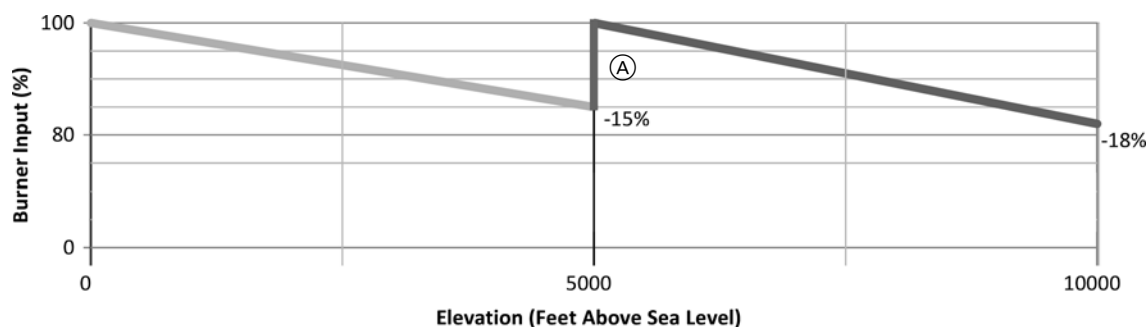
| Boiler Model  | CM2         | 186           | 246          | 311           |
|---|-------------|---------------|--------------|---------------|
| Input   | MBH<br>(kW) | 663<br>(194)  | 878<br>(257) | 1112<br>(326) |
| Minimum Input   | MBH<br>(kW) | 131<br>(38.5) | 175<br>(51)  | 222<br>(65)   |
| Output *1   | MBH<br>(kW) | 643<br>(188)  | 851<br>(249) | 1078<br>(316) |
| Net AHRI rating   | MBH<br>(kW) | 559<br>(164)  | 740<br>(217) | 937<br>(275)  |
| Combustion efficiency *1                                    | %           | 95            | 95           | 95            |
| Thermal efficiency *1                                       | %           | 97            | 97           | 97            |
| Overall length(e)   | in.<br>(mm) | 73<br>(1852)  | 73<br>(1852) | 73<br>(1852)  |
| Overall width (c)<br>(including insulation)                 | in.<br>(mm) | 36½<br>(930)  | 36½<br>(930) | 36½<br>(930)  |
| Overall height (a) *2<br>(including control unit)           | in.<br>(mm) | 66<br>(1676)  | 66<br>(1676) | 66<br>(1676)  |
| <b>Concrete boiler base</b>                                 |             |               |              |               |
| Length  | in.<br>(mm) | 40<br>(1005)  | 40<br>(1005) | 40<br>(1005)  |
| Width   | in.<br>(mm) | 31<br>(800)   | 31<br>(800)  | 31<br>(800)   |
| Thickness   | in.<br>(mm) | 4<br>(100)    | 4<br>(100)   | 4<br>(100)    |
| <b>Weight</b>   |             |               |              |               |
| Boiler body   | lb<br>(Kg)  | 503<br>(228)  | 536<br>(243) | 564<br>(256)  |
| Complete with the burner, control<br>and thermal insulation | lb<br>(Kg)  | 726<br>(329)  | 759<br>(344) | 792<br>(359)  |
| NOx @ 3% O <sub>2</sub>                                     | < 20 PPM *3 |               |              |               |

\*1 Tested to AHRI, BTS-2000 Testing Standard Method to Determine Efficiency of Commercial Heating Boilers.

\*2 Add 1½ in. (40 mm) when using seismic mounts (optional accessory).

\*3 Optional low NOx certified by SCAQMD Natural Gas models available.

**Note:** For altitude operation up to 4,999 feet, derate the input capacity by 3%/1000 ft.  
For operation from 5,000 to 10,000 feet, with the electronic altitude adjustment made,  
derate the input capacity by an additional 0.6%/1000 ft. for a total derate of 18%.



### Legend

(A) Input capacity after electronic altitude adjustment is made.

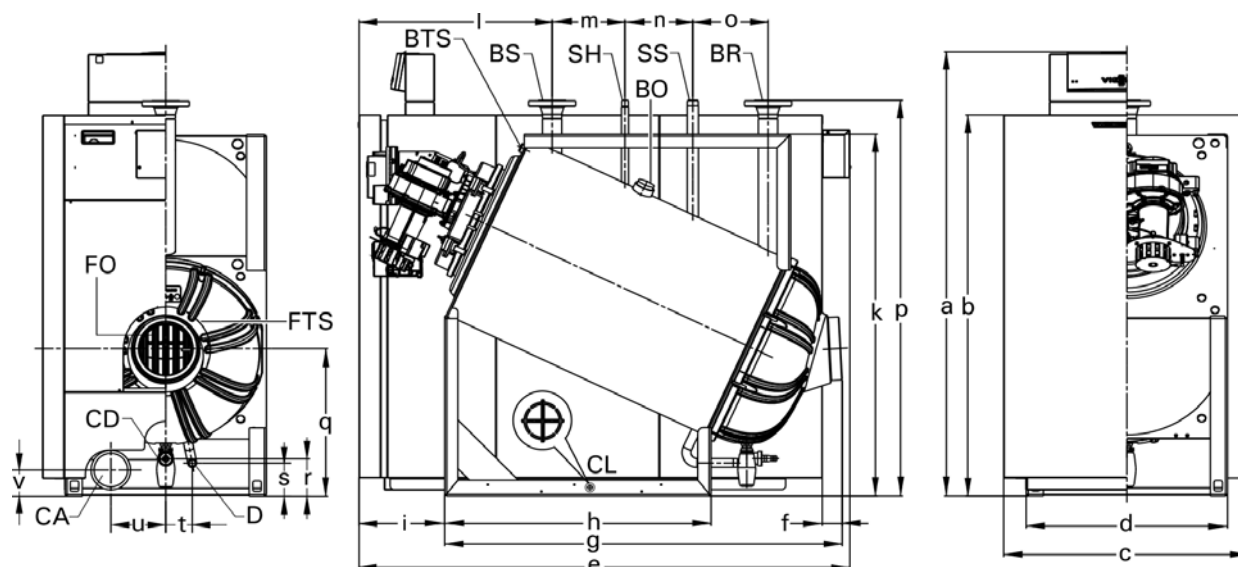


**Technical Data** *(continued)*

| <b>Boiler Model</b>   | <b>CM2</b>        | <b>186</b>        | <b>246</b>         | <b>311</b>         |
|---|-------------------|-------------------|--------------------|--------------------|
| <b>Boiler Water Content</b>   | USG               | 81                | 77                 | 74                 |
|   | (L)               | (306)             | (292)              | (279)              |
| <b>Heat exchanger surface</b>   | ft. <sup>2</sup>  | 72.9              | 98.8               | 121.5              |
| water cooled  | (m <sup>2</sup> ) | (6.8)             | (9.2)              | (11.3)             |
| <b>Maximum Operating Temperature</b>  | °F (°C)           | 210 (99)          | 210 (99)           | 210 (99)           |
| <b>Maximum Adjustable High Limit</b>  | °F (°C)           | 203 (95)          | 203 (95)           | 203 (95)           |
| <b>Maximum Operating Pressure</b>   | psig              | 75                | 75                 | 75                 |
|   | (kpa)             | (517)             | (517)              | (517)              |
| <b>Boiler Connections</b>   |                   |                   |                    |                    |
| Boiler supply and return (BS), (BR)<br>(ANSI flanges)   | in.<br>(mm)       | 2½<br>(65)        | 2½<br>(65)         | 2½<br>(65)         |
| Safety Supply   | in.<br>(mm)       | 1¼<br>(32)        | 1¼<br>(32)         | 1¼<br>(32)         |
| Boiler Drain  | in.               | 1½                | 1½                 | 1½                 |
| Condensate Drain  | in.               | ¾                 | ¾                  | ¾                  |
| <b>Vent pipe</b>  |                   |                   |                    |                    |
| Internal Diameter   | in.<br>(mm)       | 8<br>(201)        | 8<br>(201)         | 8<br>(201)         |
| <b>Combustion air</b>   |                   |                   |                    |                    |
| Internal Diameter   | in.<br>(mm)       | 6<br>(150)        | 6<br>(150)         | 6<br>(150)         |
| <b>Flue Gas Values</b>  |                   |                   |                    |                    |
| temperature (at a return<br>temperature of 86°F (30°C)<br>at rated input  | °F<br>(°C)        | 136<br>(58)       | 132<br>(55)        | 130<br>(54)        |
| at partial load   | °F<br>(°C)        | 95<br>(35)        | 95<br>(35)         | 95<br>(35)         |
| Temperature (at a return<br>temperature of 140°F (60°C)<br>at rated input                                       | °F<br>(°C)        | 167<br>(75)       | 167<br>(75)        | 167<br>(75)        |
| Mass flow rate (of flue gas)<br>at rated input  | lbs/h<br>(kg/h)   | 593<br>(269)      | 785<br>(356)       | 994<br>(451)       |
| at partial load   | lbs/h<br>(kg/h)   | 198<br>(90)       | 262<br>(119)       | 331<br>(150)       |
| <b>Max. condensate flow rate</b><br>for NG and LPG  | USG/h<br>(L/h)    | 6.6<br>(25)       | 8.5<br>(32)        | 10.8<br>(41)       |
| <b>Pressure</b>   |                   |                   |                    |                    |
| at boiler flue outlet   | pa                | 70                | 70                 | 70                 |
| at rated input  | "w.c.             | 0.28              | 0.28               | 0.28               |
| <b>Standby loss</b>   |                   |                   |                    |                    |
| at maximum input and steady<br>state condition 180°F/80°F<br>(82°C/27°C) supply and<br>return water temperature | BTU/h (W)<br>%    | 862 (252)<br>0.13 | 1053 (308)<br>0.12 | 1334 (391)<br>0.12 |
| At boiler water temperature<br>158°F (70°C) [room temperature<br>68°F (20°C)]                                   | BTU/h (W)<br>%    | 3315 (971)<br>0.5 | 3512 (1029)<br>0.4 | 4448 (1303)<br>0.4 |



## Dimensions



### Legend

|     |                                 |     |  |
|-----|---------------------------------|-----|--|
| FO  | Flue outlet                     | CL  | Centerline of weight distribution (along the length of the pressure vessel only) |
| D   | Drain                           | SH  | Female connection NPT 1/2 in. for pressure gage                                  |
| CD  | Condensate drain                | CA  | Combustion air pipe connection   |
| BR  | Boiler return                   | SS  | Safety supply; pressure relief valve, air vent, low water cut-off                |
| BTS | Boiler water temperature sensor | BO  | Boiler Inspection Opening  |
| BS  | Boiler supply                   | FTS | Flue gas temperature sensor  |

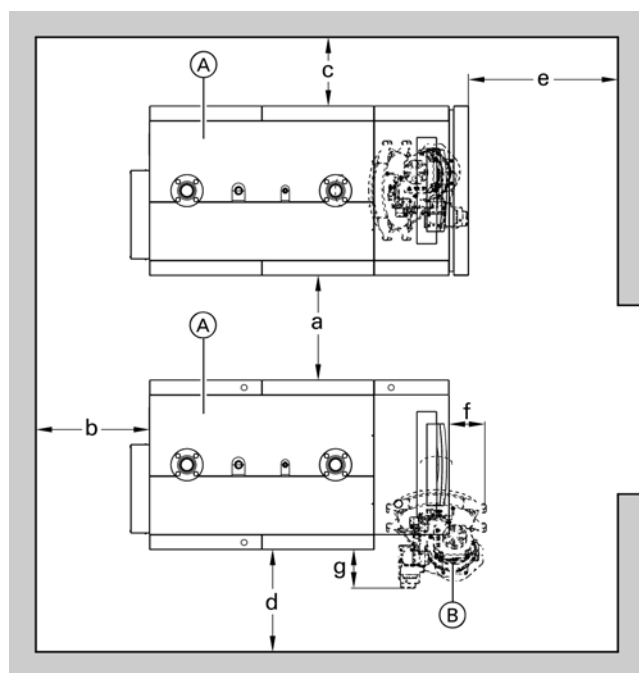
### Dimensions

| Model CM2 |   | 186        | 246        | 311        |
|-----------|---|------------|------------|------------|
| a*        | in. (mm)  | 66 (1676)  | 66 (1676)  | 66 (1676)  |
| b*        | in. (mm)  | 56½ (1438) | 56½ (1438) | 56½ (1438) |
| c         | in. (mm)  | 36½ (930)  | 36½ (930)  | 36½ (930)  |
| d         | in. (mm)  | 30 (760)   | 30 (760)   | 30 (760)   |
| e         | in. (mm)  | 73 (1852)  | 73 (1852)  | 73 (1852)  |
| f         | (flue pipe projection at the back)  | in. (mm)   | 3 (75)     | 3 (75)     |
| g         | in. (mm)  | 59 (1500)  | 59 (1500)  | 59 (1500)  |
| h         | (foot length)   | in. (mm)   | 39½ (1005) | 39½ (1005) |
| i         | (distance from front face of the cover to the front supporting foot)                      | in. (mm)   | 12¾ (323)  | 12¾ (323)  |
| k*        | in. (mm)  | 53¾ (1365) | 53¾ (1365) | 53¾ (1365) |
| l         | (distance from the front face of the cover to the centre of the boiler supply connection) | in. (mm)   | 28¾ (729)  | 28¾ (729)  |
| m         | in. (mm)  | 10¾ (275)  | 10¾ (275)  | 10¾ (275)  |
| n         | in. (mm)  | 10 (255)   | 10 (255)   | 10 (255)   |
| o         | in. (mm)  | 11¼ (284)  | 11¼ (284)  | 11¼ (284)  |
| p*        | in. (mm)  | 58¾ (1493) | 58¾ (1493) | 58¾ (1493) |
| q*        | in. (mm)  | 22 (558)   | 22 (558)   | 22 (558)   |
| r*        | in. (mm)  | 5½ (142)   | 5½ (142)   | 5½ (142)   |
| s*        | in. (mm)  | 5 (126)    | 5 (126)    | 5 (126)    |
| t         | in. (mm)  | 4 (100)    | 4 (100)    | 4 (100)    |
| u         | in. (mm)  | 8 (207)    | 8 (207)    | 8 (207)    |
| v         | in. (mm)  | 4 (100)    | 4 (100)    | 4 (100)    |

\* Add 1½ in. (40 mm) when using seismic mounts (optional accessory).



## Recommended Minimum Service Clearances



### Legend

- (A) Boiler  
(B) Burner

\*1 Clearance may be reduced to zero in multi-boiler installations, provided the side panel removal is not required.

**Note:** The burner, boiler control, condensate trap, venting and heat exchanger are still fully accessible from the front and rear of the boiler.

\*2 Clearance for vent pipe installation.

To enable convenient installation and maintenance, observe the stated clearance dimensions. Maintain the minimum clearances where space is tight.

In the delivered condition, the boiler door hinge bracket is factory installed on the left side of the door. If required, the boiler door hinge bracket can be reinstalled on the right side of the door.

| CM2           | 186       | 246       | 311       |
|---------------|-----------|-----------|-----------|
| a *1 in. (mm) | 20 (500)  | 20 (500)  | 20 (500)  |
| b *2 in. (mm) | 30 (760)  | 30 (760)  | 30 (760)  |
| c in. (mm)    | 20 (500)  | 20 (500)  | 20 (500)  |
| d in. (mm)    | 20 (500)  | 20 (500)  | 20 (500)  |
| e in. (mm)    | 24 (600)  | 24 (600)  | 24 (600)  |
| f in. (mm)    | 11 (280)  | 11 (280)  | 11 (280)  |
| g in. (mm)    | 15½ (395) | 15½ (395) | 15½ (395) |

### Mechanical room

- Avoid air contamination by halogenated hydrocarbons (e.g. as in sprays, paints, solvents and cleaning agents)
- Avoid very dusty conditions
- Avoid high levels of humidity
- Protect against frost and ensure good ventilation, otherwise the system may suffer faults and damage. In rooms where air contamination from halogenated hydrocarbons is to be expected, operate the boiler only in balanced flue mode.

### Minimum clearances to combustibles

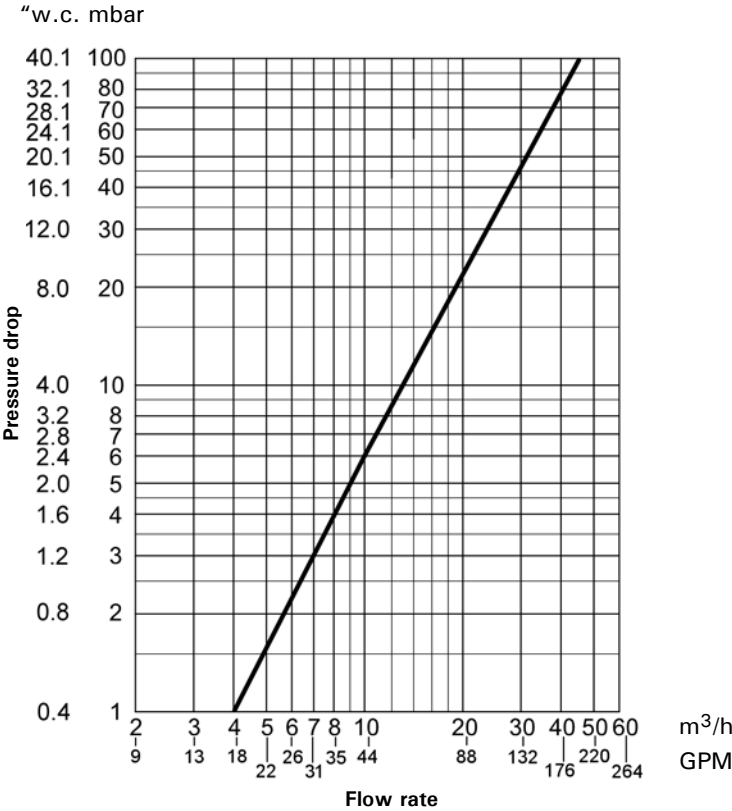
| Boiler model CM2 | 186                                       | 246 | 311 |
|------------------|---|-----|-----|
| Top              | 0   |     |     |
| Sides            | 0   |     |     |
| Flue             | As per vent manufacturer's specifications |     |     |
| Front            | 0   |     |     |
| Floor            | combustible                               |     |     |



# Flow Rate

## Pressure drop (primary circuit)

The Vitocrossal 200 is only suitable for fully pumped hot water heating systems.



## Recommended Flow Rates CM2

| Boiler model     |      | 186  | 246   | 311   |
|------------------|------|------|-------|-------|
| 20° F $\Delta t$ | GPM  | 63   | 84    | 106   |
| 40° F $\Delta t$ | GPM  | 31   | 42    | 53    |
| 11° C $\Delta t$ | m³/h | 14.3 | 19.07 | 24.07 |
| 22° C $\Delta t$ | m³/h | 7.04 | 9.53  | 12.04 |

$\Delta t$  = temperature difference

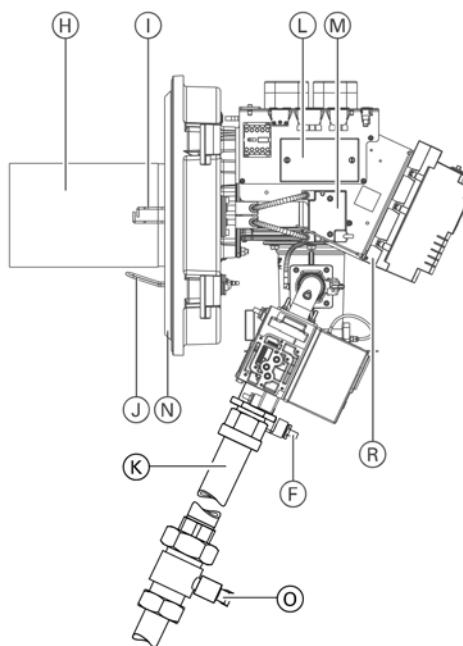
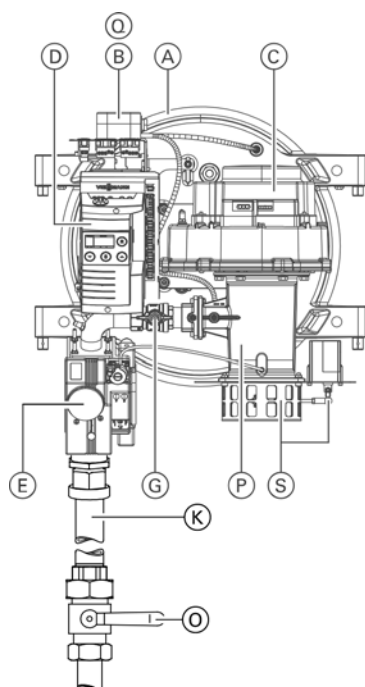
This boiler does not require a flow switch.



## Cylinder Burner

| Specifications  |          |             |              |              |
|---|----------|-------------|--------------|--------------|
| Boiler Model CM2  |          | 186         | 246          | 311          |
| Product ID  |          | see boiler  |              |              |
| Voltage   | V        | 120         | 120          | 120          |
| Frequency   | Hz       | 60          | 60           | 60           |
| <b>Power consumption</b>                                  |          |             |              |              |
| at max. input   | W        | 225         | 278          | 368          |
| at min. input   | W        | 51          | 52           | 67           |
| <b>Version</b>  |          | modulating  |              |              |
| <b>Dimensions</b>   |          |             |              |              |
| Length  | in. (mm) | 30.3 (770)  | 30.3 (770)   | 30.3 (770)   |
| Width   | in. (mm) | 21.5 (546)  | 21.5 (546)   | 21.5 (546)   |
| Height  | in. (mm) | 18.9 (482)  | 18.9 (482)   | 18.9 (482)   |
| <b>Weight</b>   |          |             |              |              |
| Burner only   | lb. (kg) | 61.0 (27.6) | 64.5 (29.3)  | 64.5 (29.3)  |
| Burner package (with kits, flanges and mounting hardware) | lb. (kg) | 93 (42.2)   | 100.5 (45.5) | 100.5 (45.5) |
| <b>Min. gas supply pressure</b>                           |          |             |              |              |
| Natural gas   | "w.c.    | 4           | 4            | 4            |
| Liquid propane gas  | "w.c.    | 10          | 10           | 10           |
| <b>Max. gas supply pressure</b>                           |          |             |              |              |
| Natural gas   | "w.c.    | 14          | 14           | 14           |
| Liquid propane gas  | "w.c.    | 14          | 14           | 14           |
| Gas connection  | NPT      | 1           | 1¼           | 1¼           |



**Cylinder Radiant Burner** *(continued)***CM2 pre-mix cylinder burner 186/246/311****Legend**

- |                                       |   |
|---------------------------------------|---|
| Ⓐ Boiler door                         | Ⓜ Ignition unit   |
| Ⓑ Air pressure switch 1               | Ⓝ Thermal insulation block                                  |
| Ⓒ Fan                                 | Ⓞ Manual shut-off valve                                     |
| Ⓓ Burner display and programming unit | Ⓟ Venturi mixing pipe                                       |
| Ⓔ Gas valve with gas pressure switch  | Ⓠ Air pressure switch 2                                     |
| Ⓕ Gas supply pipe                     | Ⓡ Burner control sub-base                                   |
| Ⓖ Burner test firing valve            | Ⓢ Servomotor and burner inlet damper (for models 246 / 311) |
| Ⓗ Cylinder burner assembly            |   |
| Ⓘ Ignition electrodes                 |   |
|                                       | Ⓤ Ionization electrode                                      |
|                                       | Ⓚ Gas pipe  |
|                                       | Ⓛ AC-EMI suppression filter device                          |

**Note:** Solenoid valve (choke valve) for CM2 model 186 (not shown).



## Standard Equipment

Boiler body with fitted mating ANSI flanges and gaskets to all connectors and fitted protective crate, plus flue gas collector collar.

|   |   |
|---|---|
| 1 | thermal insulation  |
| 1 | cylinder burner   |
| 1 | boiler control unit (see boiler control alternatives below) |
| 1 | boiler coding card  |
| 1 | technical documentation                                     |

Installation fittings for standard equipment includes:

- low water cut-off
- safety header (c/w 75 psig pressure relief valve, air vent and pressure gage)
- drain valve
- product documentation
- combustion air intake kit
- NG to LPG conversion kit

## Boiler Accessories

- Motorized flue gas damper (for cascade venting system)



Refer to the common venting flue vent damper Installation Instructions.

## Boiler Control Alternatives

### For single boiler systems

Vitotronic 300 (type GW6B) Single Boiler Operating Mode

Outdoor reset control for stand alone operation, for modulating water temperature and mixing valve control for a maximum of 2 heating circuits with mixing valve and additional Vitotronic 200-H, type HK1B for 1 or 3 additional heating circuits with mixing valve.

### For single-boiler or multiple-boiler installations

Custom control panels for residential or commercial applications are designed and manufactured by Viessmann to suit any customer's specific requirements. Custom control panels can integrate features such as pool heating, hot tub heating, snow melting, telephone tie-in, integration with Building Management Systems, as well as several other functions. Please inquire.

### For multi boiler systems (up to 8 boilers CM2 boilers)

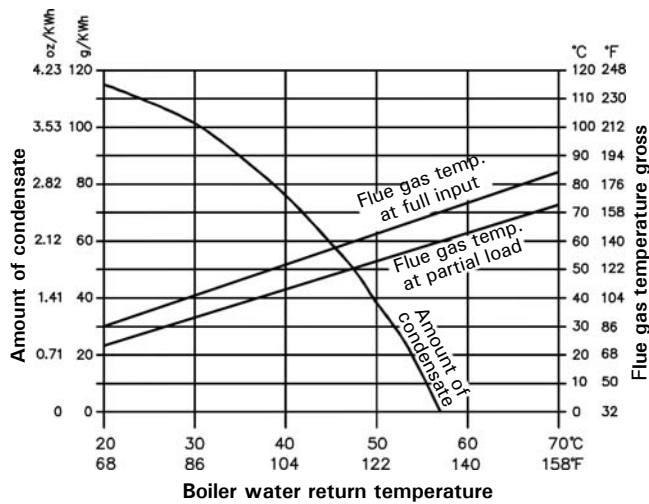
Vitotronic 300 (type GW6B) Lead boiler + Cascade Operating mode

Outdoor reset control for cascade operation in conjunction with a Vitotronic 300 GW6B operating in lag boiler mode, with mixing valve control for a maximum of 2 heating circuits with mixing valve and additional Vitotronic 200-H, type HK1B for 1 or 3 additional heating circuits with mixing valve.

Vitotronic 300 (type GW6B) Lag boiler Operating mode for modulating boiler water temperature in conjunction with a Vitotronic 300 GW6B operating in lead boiler + cascade mode.



## System Design Considerations



**Note:** The 'amount of condensate' and the 'flue gas temperature gross' graphs are independent of each other.

### Condensate and its disposal

During the operation of the boiler, the amount of condensate to be expected can be read from the above diagram.

The values given are approximate amounts occurring under practical conditions. Not included in the diagram is the amount of condensate occurring in the vent pipe and chimney system. The condensate from the chimney system can be collected together with the condensate from the heating boiler and be disposed of into a floor drain. The condensate will be between 3 and 4 on the pH scale. If local building requirements demand neutralizing the condensate before disposal, contact Viessmann Manufacturing Company Inc. for a correctly sized neutralization tank. The treated condensate will show pH values of between 6.5 and 9 and can then be disposed of into the waste water system.

### Design notes regarding draining condensate

The condensate drain to the sewer connection must be able to be inspected.

Route it with a gradient and equip the pipe with a P-trap; also provide suitable facilities for taking samples.

The bottom drain should be located below the anti-flooding level of the flue gas collector box.

Condensate drains must only be made from corrosion resistant materials (e.g. fibre reinforced hoses). Never use any galvanized materials or those containing copper or black iron for pipes, connectors, etc.

Install a P-trap in the condensate drain to prevent flue gases from escaping.

Ensure that the domestic drainage systems are made from materials which are resistant to acidic condensate such as:

- Stoneware pipes
- Hard PVC pipes
- PVC pipes
- PE-HD pipes
- PP(s) pipes
- ABS/ASA pipes
- Stainless steel pipes
- Borosilicate pipes

### Venting options

PP(s) (Polypropylene) flue gas/fresh air system for room air independent operation (sealed combustion), and PP(s) flue gas for room air dependent operation are tested to ANSI Z21.13 - CSA 4.9 (latest edition) standards and are certified together with the Vitocrossal 200 boiler as a constructional unit.

The Vitocrossal 200 boiler may also be vented using an special stainless steel, single-wall, (UL listed for category IV).

The boiler may be vented horizontally through the side wall or vertically through the roof.

For a more detailed description of the direct vent and single-wall vent system, please refer to the Vitocrossal 200 Installation Instructions venting section.



## System Design Considerations *(continued)*

Use ULC S-636 / UL 1738 certified for category IV boilers. The following vent system suppliers may be contacted for assistance in designing the appropriate stainless steel venting system for Vitocrossal 200 CM2 boilers.

For sealed combustion systems that are vertically vented, a Viessmann vacuum relief damper may be needed to protect the vent system against vacuum conditions. This very rare occurrence can happen when a boiler is firing at maximum capacity and the burner cycle is suddenly interrupted. (ie. power failure) For more information on this device, or questions specific to your application, please consult with the vacuum relief damper installation instructions or contact your local Viessmann representative.

|   |   |
|---|---|
| <b>M&amp;G / Duravent</b><br>www.duravent.com                           | <b>ICC - Industrial Chimney Co.</b><br>www.icc-rsf.com        |
| <b>Selkirk Canada Corporation</b><br>www.selkirkchimney.com             | <b>Z-Flex U.S. Inc</b><br>www.z-flex.com                      |
| <b>Jeremias Inc.</b><br>www.jeremiasinc.com                             | <b>Van-Packer Co. Inc.</b><br>www.vpstack.com                 |
| <b>Security Chimneys International Ltd.</b><br>www.securitychimneys.com | <b>Energex Inc.</b><br>(formerly Exhausto)<br>www.energex.com |
| <b>Metal-Fab Inc.</b><br>www.mtlfab.com                                 |   |

### System layout

The boiler max. water temperature limit is factory set to 203°F (95°C).

To minimize piping losses of the system, however, Viessmann recommends that the radiation and domestic hot water production in the system be designed for a 158°F (70°C) boiler supply water temperature.

### Combustion air supply

The boiler must not be located in areas or rooms where chemicals containing chlorine, bromine, fluorine, or other corrosive chemicals are stored. Examples include bleach, refrigerants, paint, paint thinner, hair spray, cleaning solvents, water softener salt, etc. The combustion air must not be contaminated with any amount of the above mentioned chemicals.

Boiler should never be installed in areas where excessive dust, high humidity, or risk of frost exist. Ensure adequate ventilation and supply of fresh combustion air.

### Boiler operation in marine environments (damp, salty coastal areas):

The service life of the boiler's exposed metallic surfaces, such as the casing and fan housing, is directly influenced by proximity to damp and salty marine environments. In such areas, higher concentration levels of chlorides from sea spray, coupled with relative humidity, can lead to degradation of the exposed metallic surfaces mentioned above. Therefore, it is imperative that boilers installed in such environments not be installed using direct vent systems which draw outdoor air for combustion. Such boilers must be installed using room air dependent vent systems; i.e. using room air for combustion. The indoor air will have a much lower relative humidity and, hence, the corrosion will be minimized.

Consult your local Viessmann sales representative with uncertainties in regard to a suitable boiler installation location.

This boiler/burner unit needs clean fresh air for safe operation. Provisions for combustion and ventilation air must be made at time of installation. For gas or propane installations, use the "Natural Gas Installation Code CAN/CSA-B149.1 or B149.2" (Canada), or "National Fuel Gas Code ANSI Z223.1" (USA), and/or provisions of local codes.

The sizing methods outlined in the aforementioned codes should be used when installing a round duct to supply combustion air from the outside.

### Warranty

Our warranty does not cover damages resulting from the following:

- Operation with contaminated fill and supplementary feed water
- Operation with contaminated combustion air
- Exposing the boiler to pressures and temperatures higher than its certified rating

See warranty sheet for details.



# System Design Considerations *(continued)*

## Water quality

Treatment for boiler feed water should be considered in areas with known problems, such as where a high mineral content and hardness exist. In areas where freezing might occur, it is recommended that an antifreeze be added to the system water for protection against freezing. Please adhere to the specifications given by the antifreeze manufacturer. Do not use automotive silicate-based antifreeze. Please observe that an antifreeze/water mixture may require a back flow preventer within the automatic water feed and influence components such as diaphragm expansion tanks, radiation, etc. A 40% antifreeze content will provide freeze-up protection to -10°F (-23°C). Do not exceed 50% antifreeze mix ratio and do not use antifreeze other than specifically made for hot water heating systems.

| Total output (MBH) | Total Hardness (ppm as CaCO <sub>3</sub> ) |
|--------------------|--|
| > 1 Total ≤ 680    | ≤ 200                                      |
| > 680 to ≤ 255     | ≤ 150                                      |

The pH value of the heating water should be between 8.2 and 9.5

## Oxygen diffusion barrier under floor tubing

The boiler warranty does not cover pressure vessel failure resulting from corrosion caused by the use of underfloor plastic tubing without an oxygen diffusion barrier. Such systems without oxygen diffusion barrier must have the tubing separated from the boiler with a heat exchanger. Viessmann always recommends the use of underfloor plastic tubing with an oxygen diffusion barrier.

## Boiler/burner start-up

Vitocrossal 200, CM2 boilers with Viessmann cylinder burners does not require start-up by Viessmann.

## Sound attenuation

Please consult a professional engineer who is specialized in noise attenuation for advice.

The burner/boiler systems, circulation pumps and other auxiliary equipment used in heating systems generate noise.

This noise is transferred from the boiler room via floorboards, ceiling and walls to neighboring rooms and via the flue gas system as well as the ventilation air and exhaust air apertures into other rooms and into the open, where they may cause a nuisance.

To avoid this from happening, additional protective measures may be required which should be considered at the design stage.

Subsequent measures to reduce noise nuisance frequently require extensive effort and expenditure.

## Airborne noise attenuation

Frequently, modern boilers are equipped with silencer hoods or sound insulated ventilation air inlet housings.

For larger systems, it may be necessary to route the ventilation air through a sound-insulated channel, in order to avoid a noise nuisance outside the building.

Flue gas silencers are generally only required where higher noise protection measures are called for. Whether or not a flue gas silencer is required can be predicted only with some difficulties, because of the complexity of the creation and propagation of flame noise, the interaction between the burner, boiler and the flue gas system as well as the operating mode (flue gas system operating with positive or negative pressure).

It is advisable, therefore, to assess the noise emission into the neighborhood and to consider the sound pressure level measured at the flue gas system outlet. It should be considered at the planning stage whether silencers might become necessary later.

In planning for its possible use, it is important that sufficient space for the flue gas silencer is available behind the boiler. Good engineering practice mandates that the exhaust pressure drop of the silencer be included in the vent size calculation.

## Anti-vibration measures

Anti-vibration supports can be field supplied as an economical and effective solution to combat noise generated.

When sizing such supports, take the entire operating weight of the boiler system and, when using longitudinal anti-vibration brackets, the condition of the supporting surface into consideration.

Effective anti-vibration measures are particularly important when installing boilers into an attic. Flexible couplings may be used to physically separate the combustion equipment from the building.

These should be installed into the boiler flow, return and safety pipe and as near as possible to the boiler.

Also insulate any braces or hanging arrangements, if installed, against sound/vibration transmission to the building.



