



UVM Central Utility Plant: A Half Century of Growth, Innovation, & Efficiency

IDEA Campus Energy 2018 Baltimore, MD

Presenters: Sal Chiarelli, UVM, Mike Pelletier, UVM, Bill Mahoney, RMF

Time: 10:30 AM – 11:00 AM March 8, 2018 (Thursday)



PRESENTERS



Sal Chiarelli
Director of Physical Plant
University of Vermont



Mike Pelletier, PE, CEM
Senior Project Engineer
University of Vermont



Bill Mahoney, PE
Mechanical Engineer
RMF Engineering



Chartered in 1791

Fifth oldest university in New England (after Harvard, Yale, Dartmouth and Brown)

Called UVM for *Universitas Viridis Montis*, Latin for “University of the Green Mountains”

Mascot: Catamount

460-acre campus, 6 million Sq. Ft.

100+ majors in 7 undergraduate schools and colleges

Undergraduate Students: 10,513

Graduate Students: 1,542

Medical Students: 461

1,600 full and part-time faculty





EXISTING CAMPUS UTILITIES

Electric Distribution from 125 Municipal Utility Services & Gas from Municipal service at 125 points

Central Steam Boiler Plant

Four 40,000 PPH + One 64,000 PPH Dual Fuel Boilers

200 PSI Steam Delivered Year-Round to 80 Buildings

Converted From No. 6 Fuel Oil Backup to No. 2 Low Sulfur

Central Chiller Plant

Two 1,365 Ton Steam Turbine Drive Centrifugal Chillers

Interconnected Satellite Chiller Plants (Absorbers and Electric Chillers)

42F CHW Delivered May Through October (minimal winter load) to 15 Buildings



CHW Generation & Distribution

- Central Chiller Plant
 - Inside Cage Boiler Plant
 - Cooling Towers to North
- Satellite Chillers
- Variable Primary & P/S Pumping
- Radial Feed Distribution
 - Migrating to Being Looped
 - Up to 20" Diameter
 - Direct Buried
 - Pre-insulated Ductile Iron
- Adding Service to Existing Buildings
- STEM
- Residence Hall



Satellite Chillers

Cooling Towers

Central Chillers

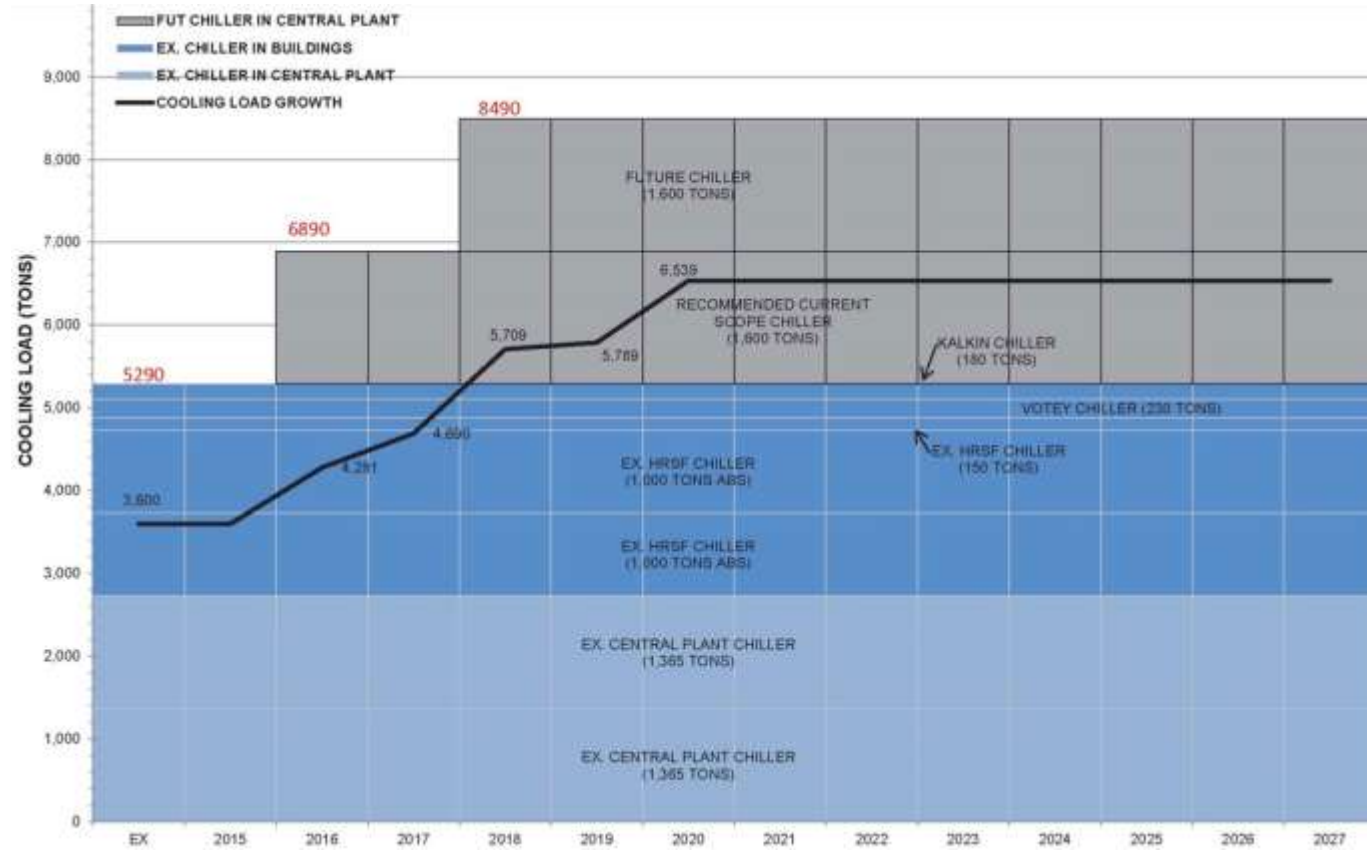
Satellite Chillers



CHILLED WATER CAPACITY NEEDS

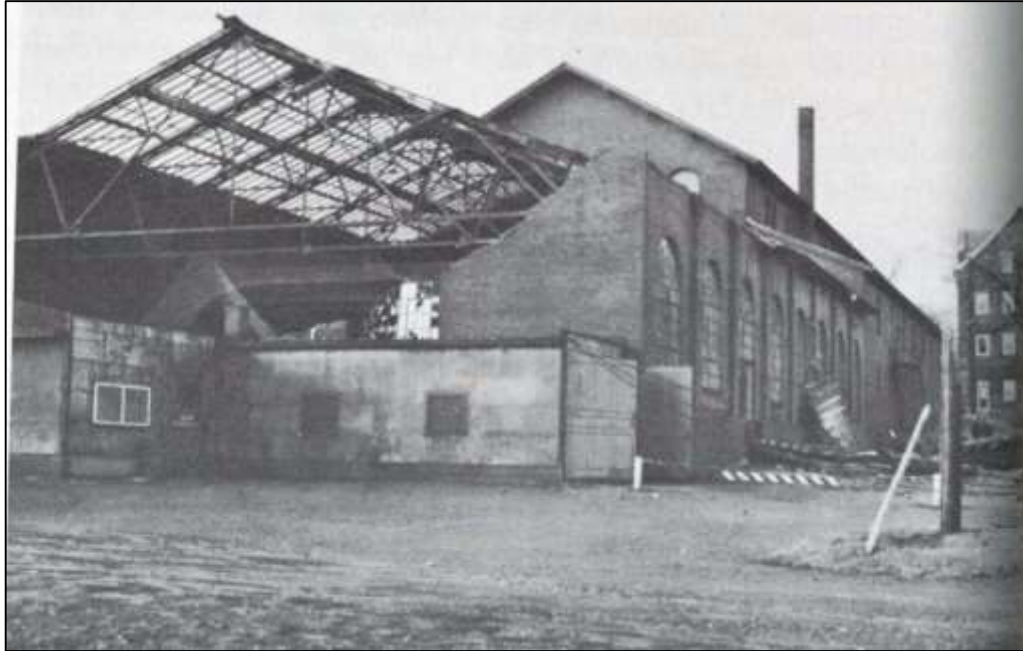
- N+1 Reliability Goal
- Unreliable Smaller Remote Units
- Two 1,600 Ton Chillers
- Potential for Future 3rd

New equipment to be located in a physical addition to the “Cage Plant”





A Building Full of UVM History





A Building Full of UVM History

- National Register of Historic Places
- 1901 Original Construction
- 1915 Addition
 - Glass Roof
 - Dirt Floor
 - Drill Hall
 - Indoor Track
 - Batting **Cage**

The structure was erected in stone on a brick and concrete foundation in 1901. Andrews, Jacques and Rantoul were the architects. Originally, the building measured 99 by 140 feet. In 1915 A.L. Lawrence designed the 100 by 120 foot extension at the east end of the building. This addition, with its glass roof and dirt floor, was used as a drill hall and indoor track.

(continued on Continuation Sheet #7)

GPO 525-724

Form 10-300a
(July 1969)

UNITED STATES DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE

NATIONAL REGISTER OF HISTORIC PLACES INVENTORY - NOMINATION FORM

Section 7

(Continuation Sheet) #7

(Number all entries)

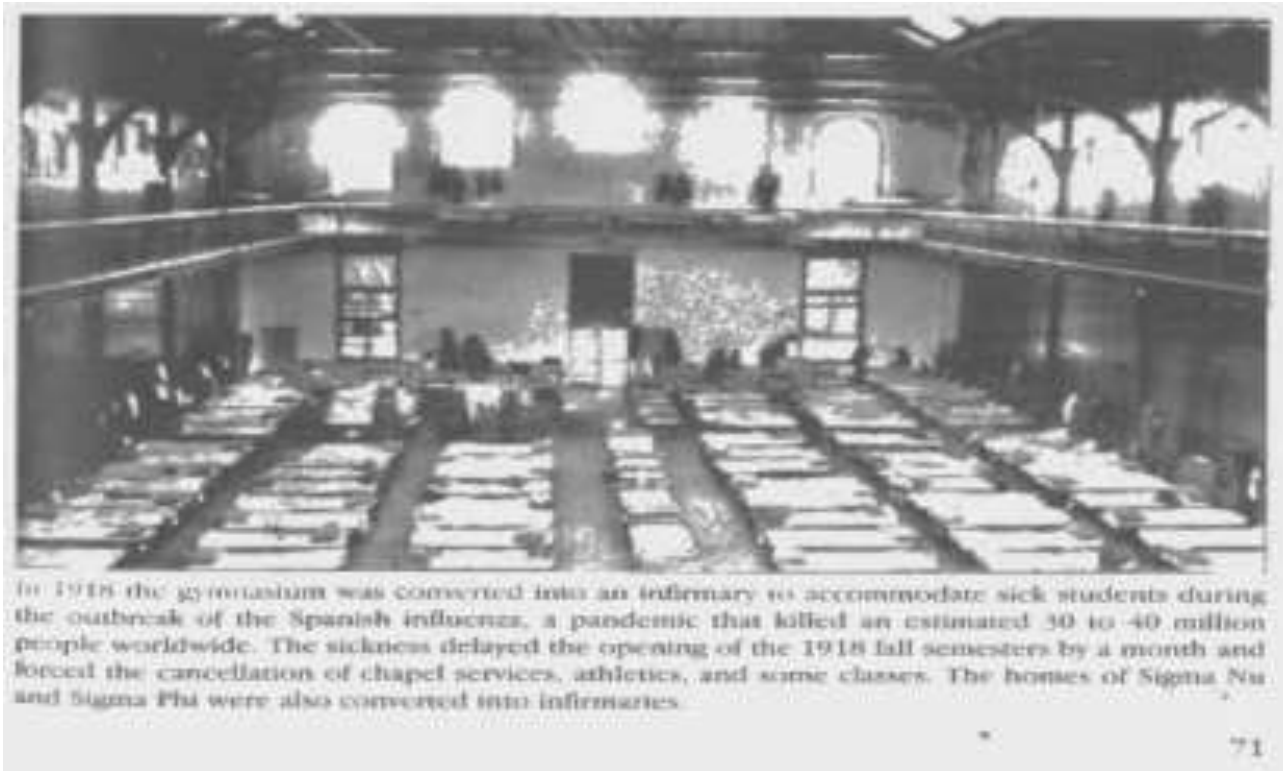
The building's strange location, out of line with the rest of the buildings along University Place, is explained by the fact that the University did not own the land to the south at that time. In fact, in order to have the building face west as its neighbors do, it was necessary to purchase a small strip of the adjacent corner lot.

From its construction in 1901 until 1927, when the city erected Memorial Auditorium, the building played a dual role as a University and civic cultural center. It was the scene of University convocations, public concerts, balls, plays and the home of the Burlington Symphony Orchestra. When the University built a new gym in 1963, the building was remodeled to accommodate the ROTC program and various offices. In 1973-74 the interior was again reworked on the plan of Burlington Associates to serve as theatre.

STATE	Vermont
COUNTY	Chittenden
FOR NPS USE ONLY	
ENTRY NUMBER	DATE



A Building Full of UVM History



In 1918 the gymnasium was converted into an infirmary to accommodate sick students during the outbreak of the Spanish influenza, a pandemic that killed an estimated 30 to 40 million people worldwide. The sickness delayed the opening of the 1918 fall semesters by a month and forced the cancellation of chapel services, athletics, and some classes. The homes of Sigma Nu and Sigma Phi were also converted into infirmaries.

In 1918, the gymnasium was used as an infirmary during Spanish influenza outbreak.



A Building Full of UVM History

Early events held inside the “Gymnasium Addition” included skits, banquets, and Commencement ceremonies. Notice the windows, the dirt floor, and the batting cage nets suspended from ceiling.





A Building Full of UVM History



After 1962, the vacated “Old Gym” served as ROTC headquarters, Military Studies department, a testing facility for civil engineering, and a research laboratory for forestry and zoology.

In 1974, the west portion of building became the Royall Tyler Theater.





2000's

To improve safety and efficiency issues, a major project was undertaken to convert the HTHW system entirely to steam for the south campus buildings. HTHW equipment was removed to free up space.

This multi-phase multi-year project involved **10 miles of new and replacement piping** to replace the original direct buried piping which showed severe signs of aging.



New steam piping laid in pre-cast metal insulating jacket and supported by concrete piers.

2010's

Two **1,360 ton steam-driven York chillers** were installed inside the Plant (in the space that once held the HTHW equipment). These were the **first ever steam-driven chillers in the State of Vermont**. The chillers are efficient because most of the energy used comes from excess steam from the boilers that would otherwise be wasted.

Chilled water was initially piped to Davis Center, Bailey-Howe, Royall Tyler and Old Mill/Lafayette.



The chilled water piping was extended to supply Jeffords Hall, HSRF and Given buildings.

Converted boilers from No.6 to No.2 fuel oil and the underground tanks were emptied, cleaned and replaced with No. 2 fuel.

The Plant was upgraded to convert the Plant from HTHW to **"Delta V" direct digital controls**.

A service upgrade to the Plant.



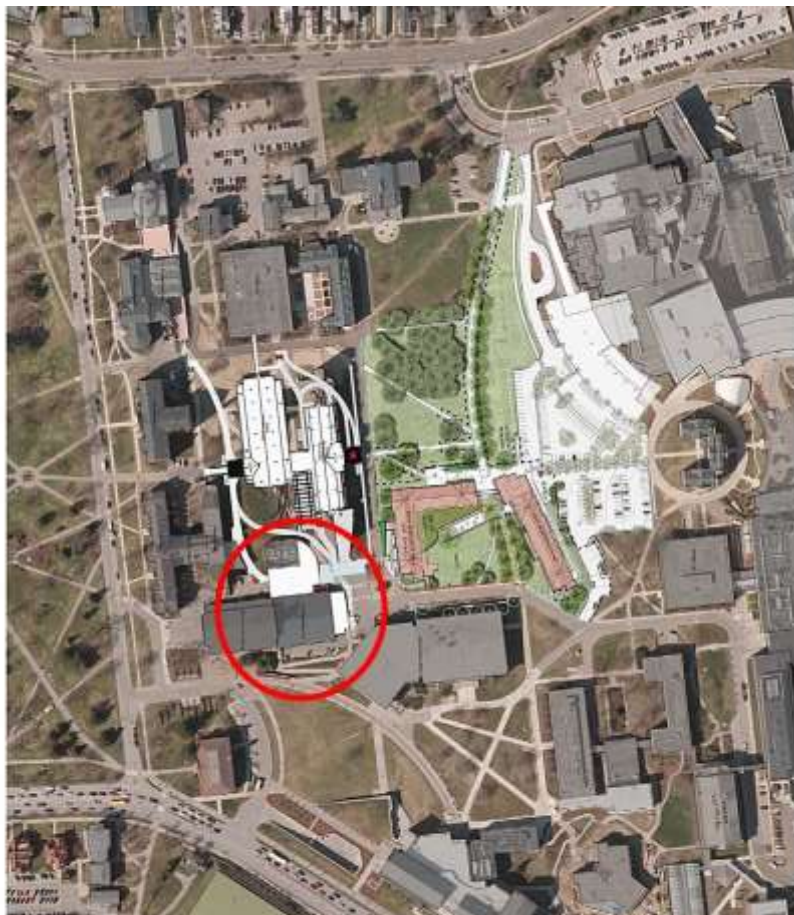
Process and components on virtual display in control room.

Work was underway for building a **new central air conditioning plant** as Trustees approved a plan to build a **new chilled water plant** to meet the demand and to replace existing inefficient equipment in other buildings.

What will the next 50 years bring?

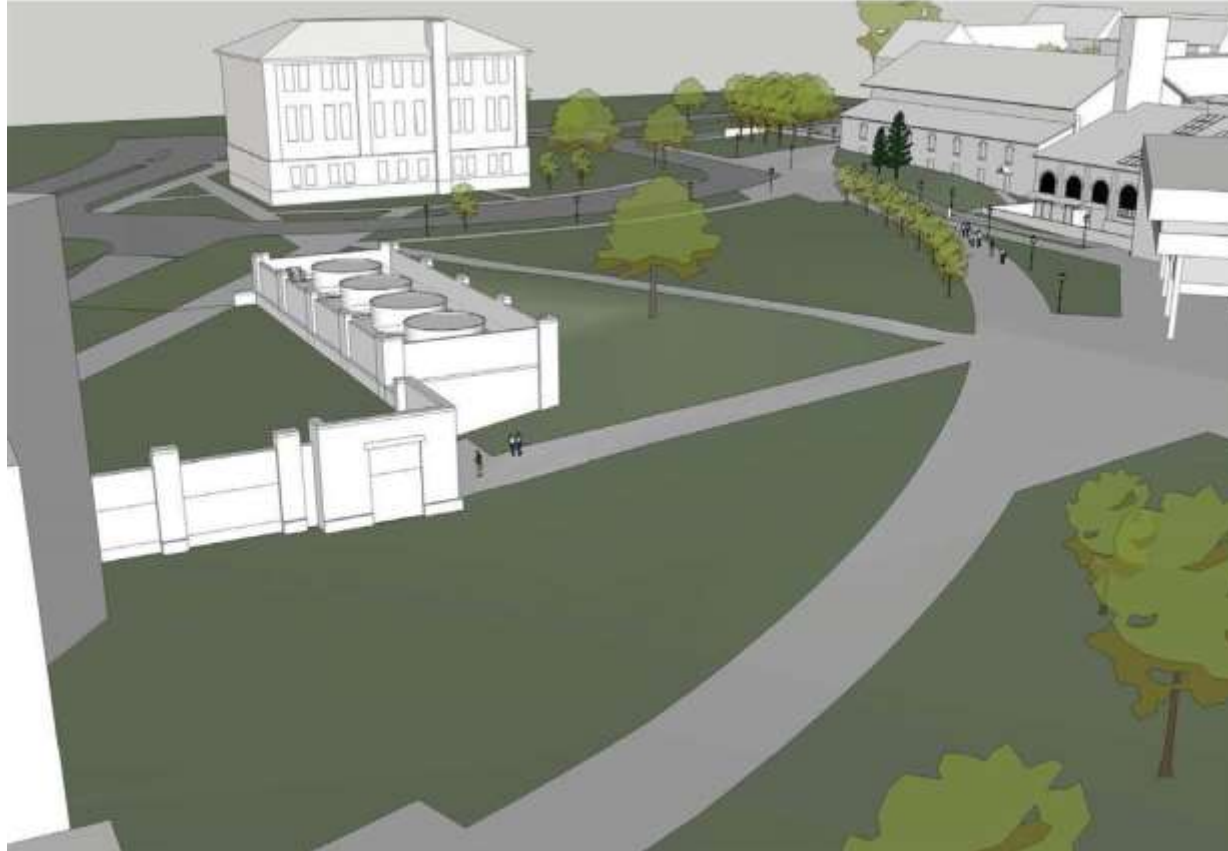


SITE CONTEXT





COOLING TOWER SITING





COOLING TOWER SITING





PLANT EXPANSION





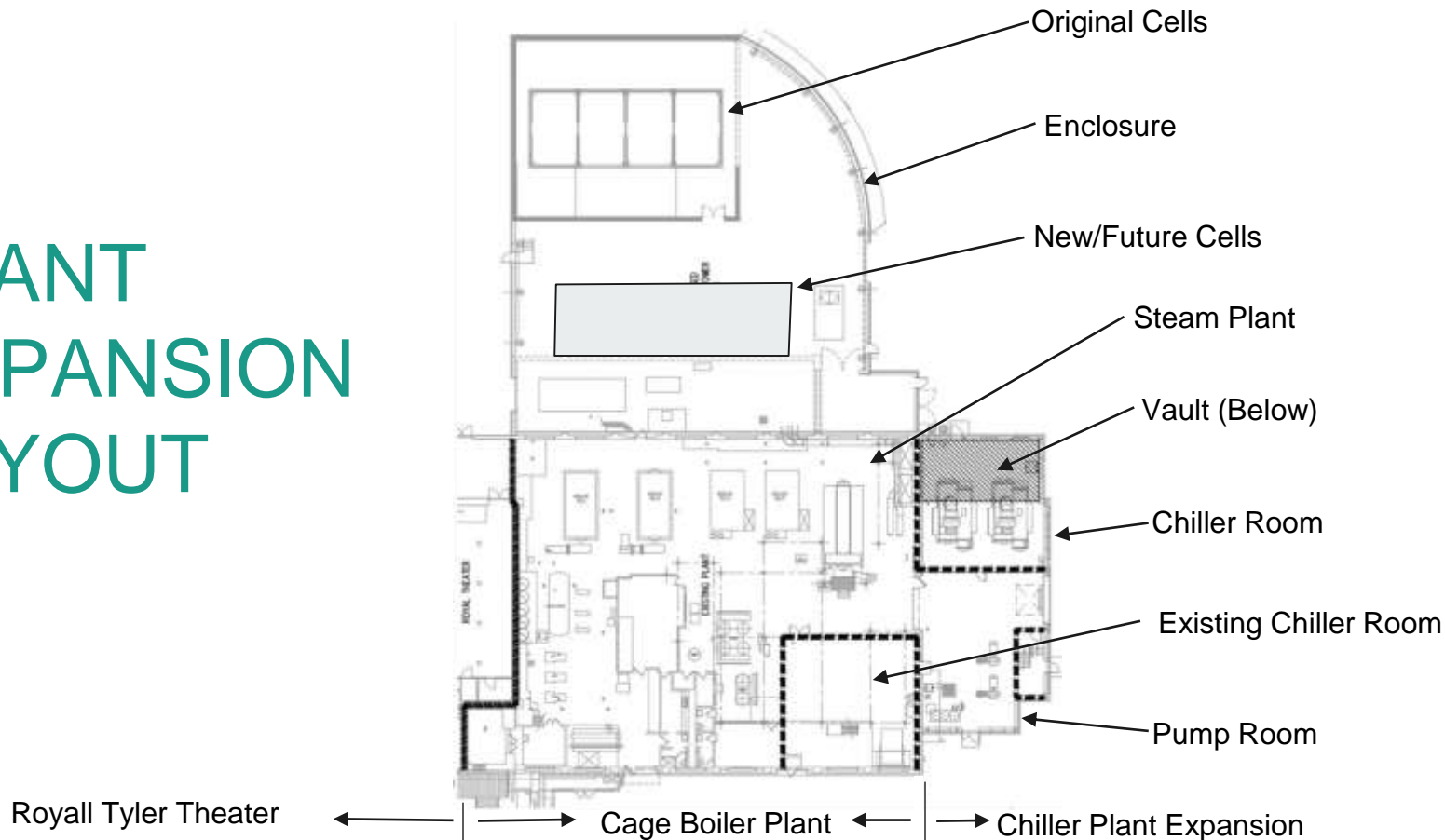
Before

After



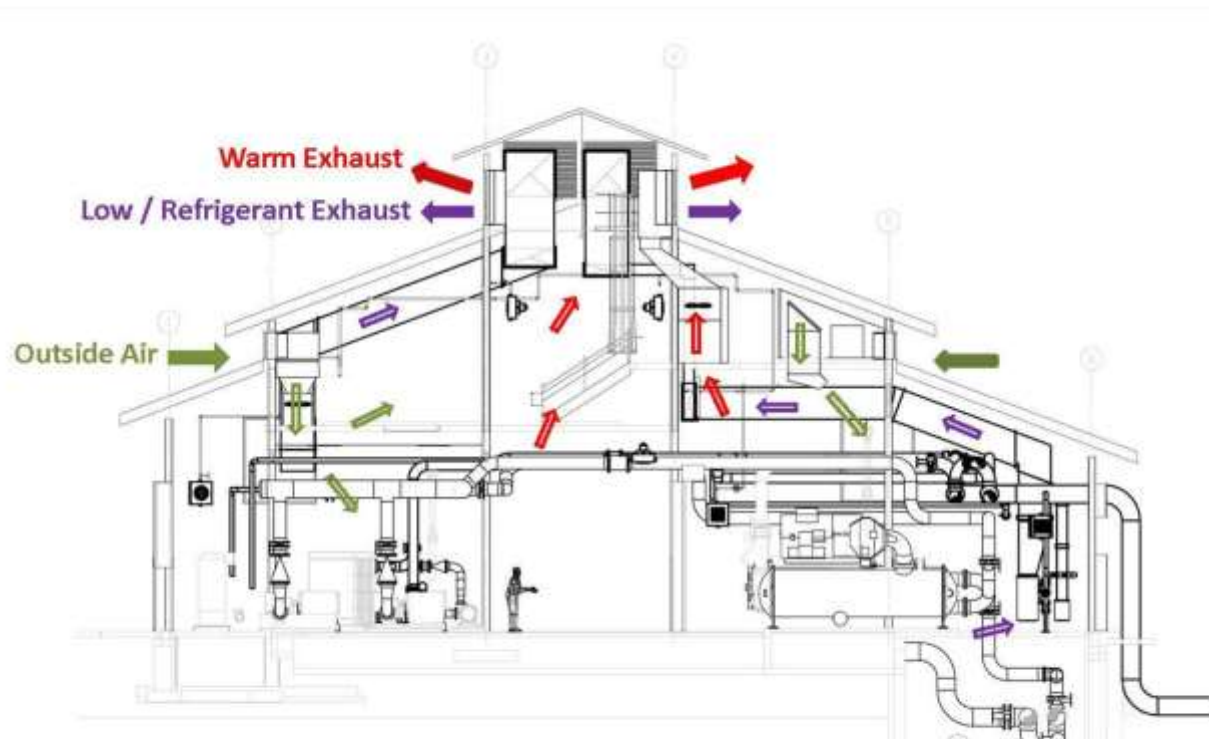
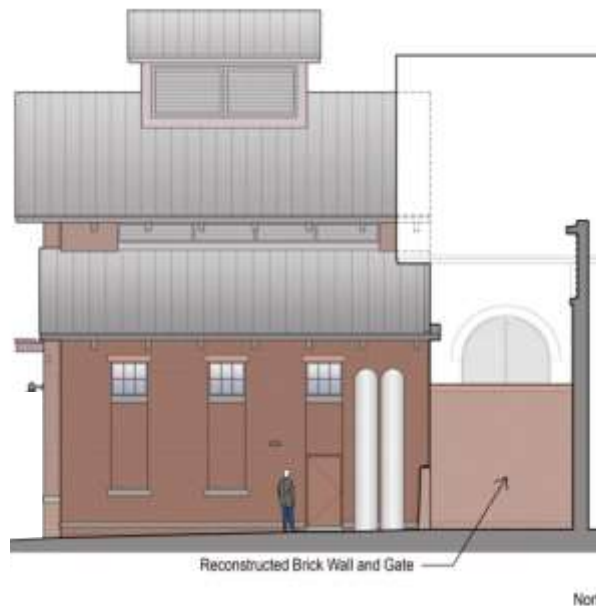


PLANT EXPANSION LAYOUT





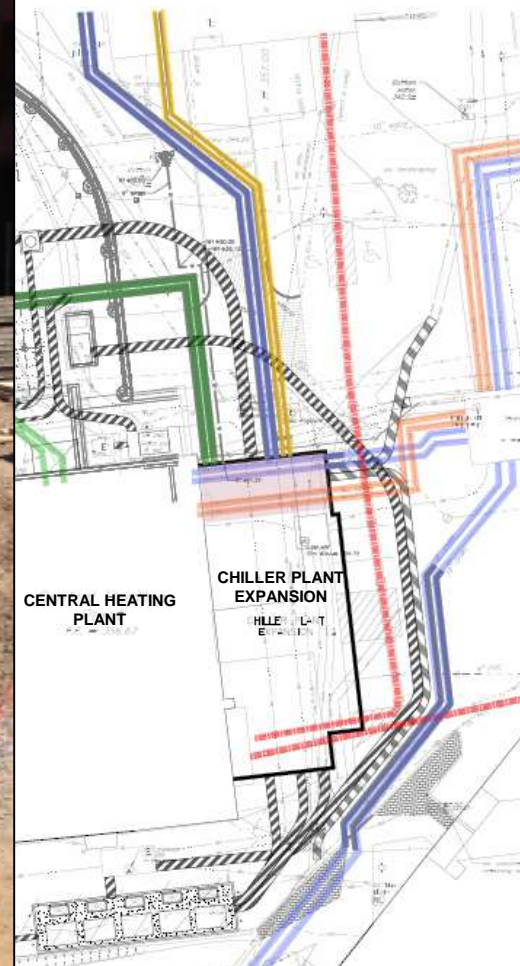
HVAC





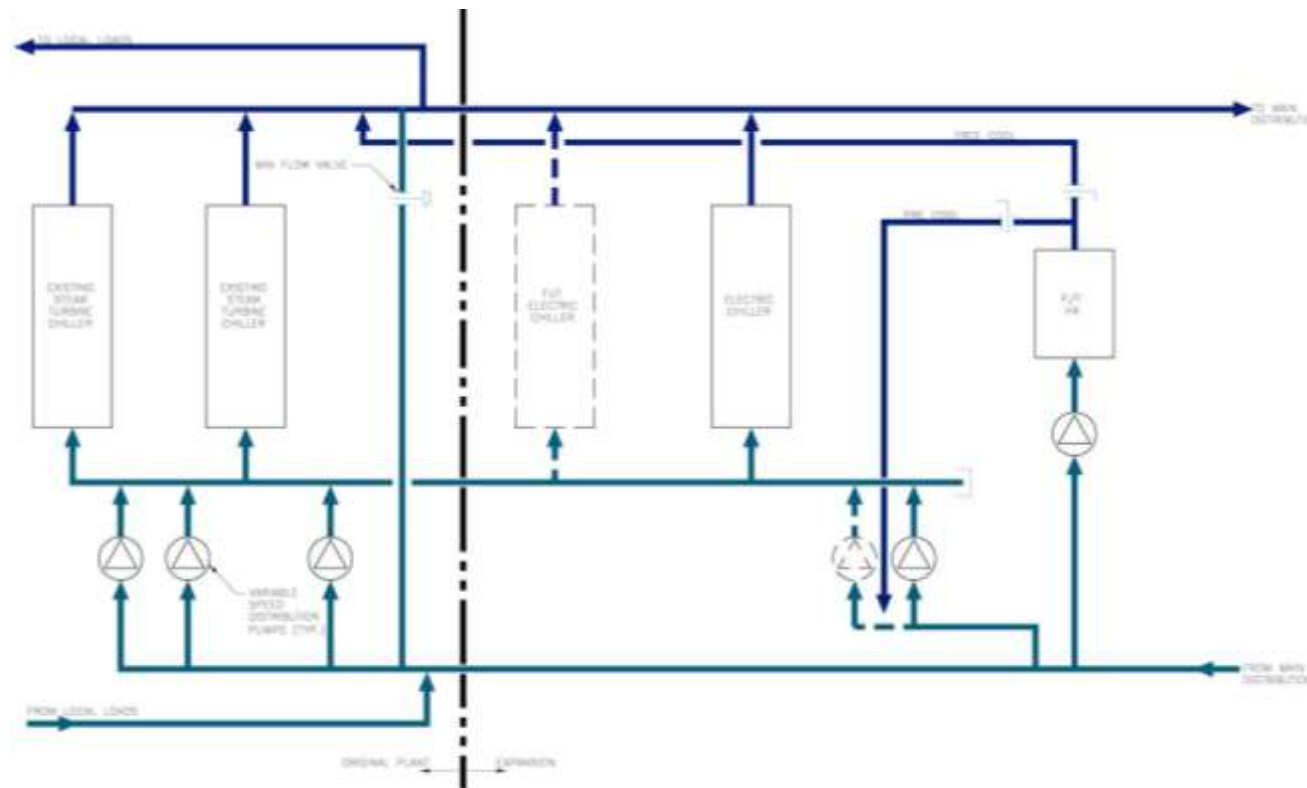
Congested Utilities

- Busy Area
- Telecomm Backbone
 - Zero Interruption
 - Vault in Expansion
- Multiple Relocations
 - Out of Expansion
 - Out of CT Backbone
- Vault below Expansion
- New Services
 - Municipal Electric
 - STEM Building



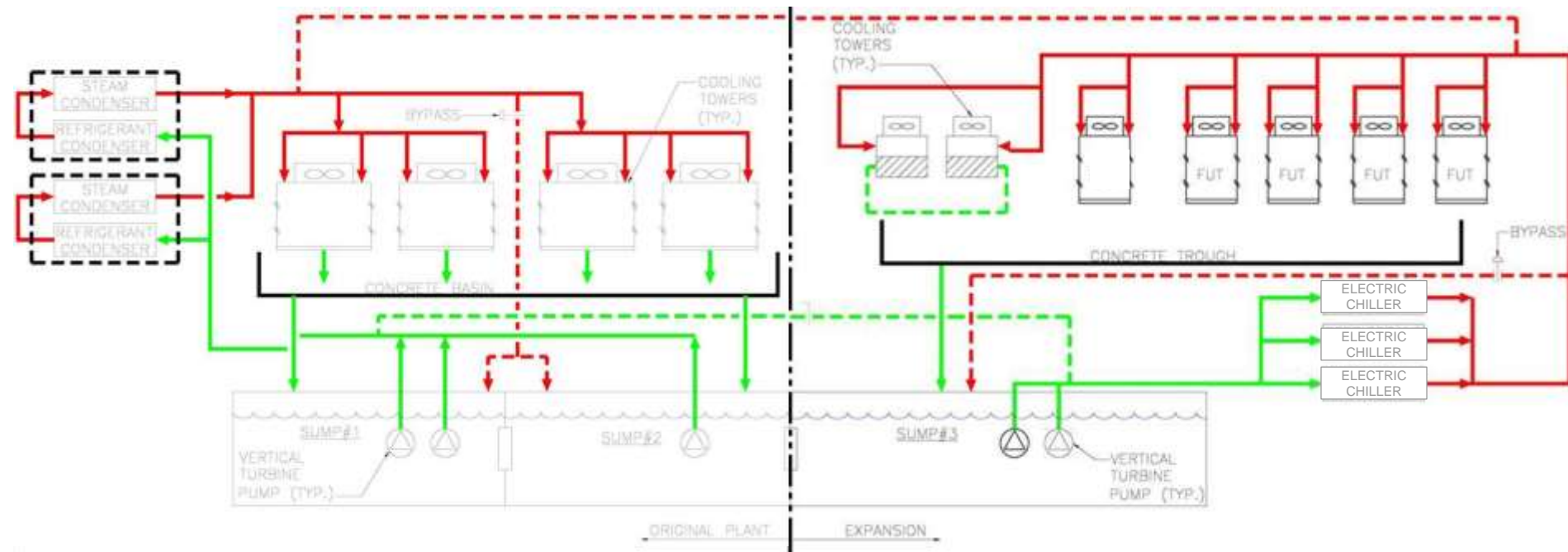


CHILLED WATER CIRCUIT





CONDENSER WATER CIRCUIT



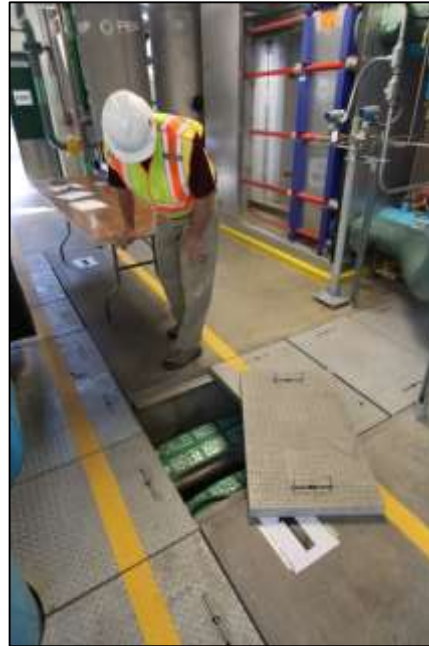
PROJECT RESULTS



- 1,500 ton (0.57 Kw/Ton) electric centrifugal chiller
- Auxiliaries
- A future 1,500 ton unit
- Ultimate installed cooling capacity to 5,730 tons
- Free cooling system



ACCESSIBLE FLOOR TRENCH





PLANT FEATURES





EXTERIOR





OPERATIONS

Steam Freeze Protection

- Concrete Basins and
- Concrete Collection Trough

Free Cooling

- Standalone OR
- Series / Upstream of Chiller

Electric or Steam Cooling - as Rates Dictate

Can Meet Loads as Low as 200 Tons





Control Migration

Discuss each

Rehearse /

Contingency F

Unknown Ut

Existing Sys

Improvement



e (Level A/B/C)

all excavation for

records (esp.

er protective slabs)

ng



Open House Celebration



Physical Plant Department

OPEN HOUSE

The University community is invited to join us to celebrate the completion of the UVM Central Plant expansion.



Get a behind-the-scenes look inside the Plant where steam and chilled water is produced for heating and cooling university buildings.

Wednesday, August 2, 2017

12:00 noon – 2:00 pm

Free Ice Cream, Refreshments and Facility Tours

RSVP and details at:

go.uvm.edu/cage

Please enter the site via the sidewalk between the Centennial Sculpture and the Bailey-Howe Library entrance. Stairs lead down towards the Plant.

Please wear closed toe shoes if you want to tour the inside of the plant.



Community Education

Hosted 20 small group tours
through the entire Plant

140 attendees

123 scoops of
Ben & Jerry's Ice Cream





NEXT STEPS

4th & 5th Chillers

Electric Service in place

Revisit Steam

Space to expand in cooling
tower yard

Identify space for 5th chiller

Complete CHW Loop & Upgrade Satellite Pumps





Thank you

Audience Q & A



