

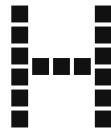
# **Test-Fit Study** Decarbonization Preliminary Feasibility Study

## *D-Lab Student Team*

Kevin Johnson  
Angelina Zhang  
Benedetta Zuccarelli

## *Team Mentors*

Susan Murcott, D-Lab Lecturer  
Rick Clemenzi, MIT Alumni for Climate Action (MACA)  
Judy Siglin, (MACA)

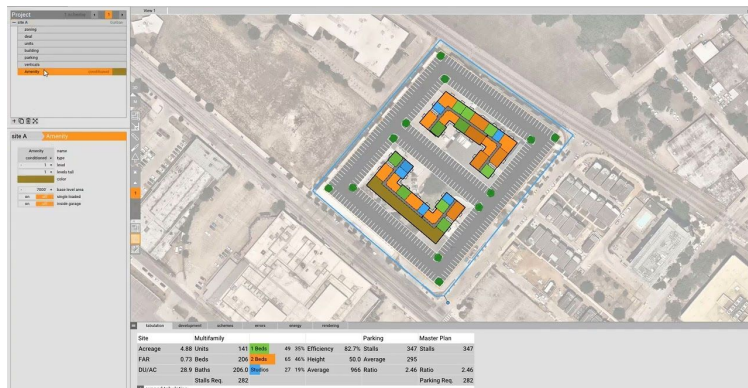


*EC.719 D-Lab Climate Change and Planetary Health*

*Final presentation - May 9th, 2024*

# Test-Fit Study What is a test fit?

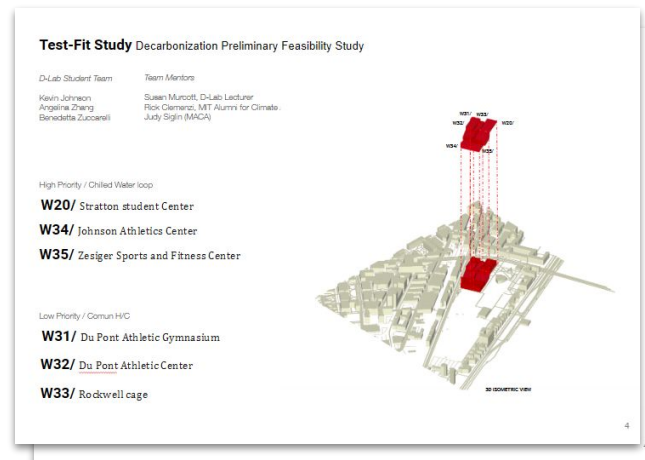
A **test fit** is a floor plan used by architects to assess the feasibility of a physical space and its ability to meet a client's programmatic needs. Though not necessarily very detailed, a test fit yields a rough determination of whether your program will fit physically in your desired site.



# Test-Fit Study What is our contribution?

As part of the MIT Building Decarbonization Pilot Project, we, as a student group, were pivotal in **compiling a comprehensive dossier** on existing campus building details, laying the **groundwork for future interventions** such as thermal storage installation. Our efforts involved **assessing and analyzing** the utility systems of these buildings, paving the way for strategic interventions aligned with MIT's Net Zero 2026 initiative.

Through this work, we gained invaluable insights into the complexities of decarbonizing buildings and transitioning to sustainable energy systems. **Collaborating closely with experts from diverse backgrounds**, we embraced a multidisciplinary approach to problem-solving, deepening our understanding of the ethical and moral dimensions of shaping our built environment for a more sustainable future.



# Test-Fit Study Decarbonization Preliminary Feasibility Study

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High Priority / Chilled Water loop

**W20/** Stratton student Center

**W34/** Johnson Athletics Center

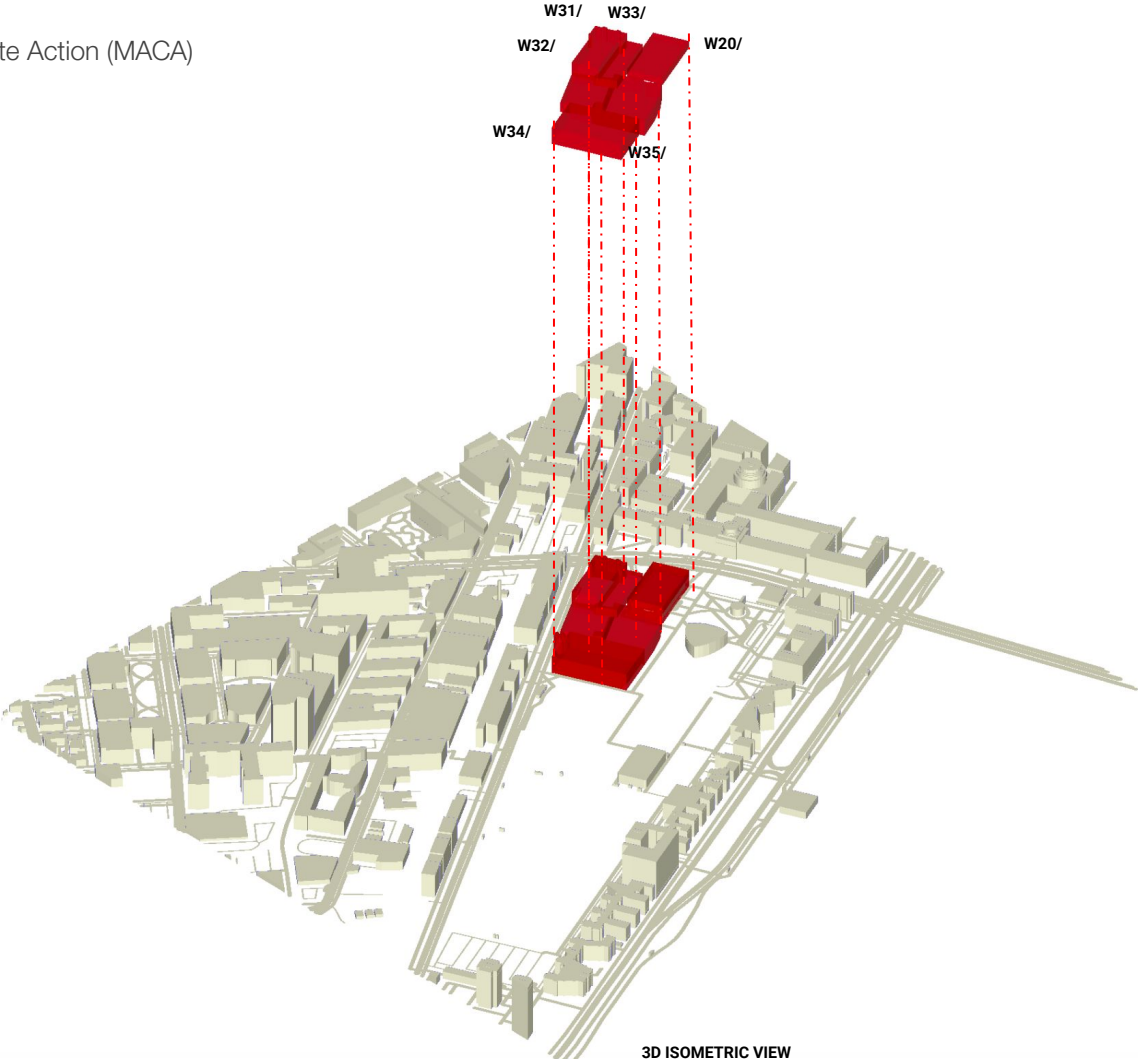
**W35/** Zesiger Sports and Fitness Center

Low Priority / Comun H/C

**W31/** Du Pont Athletic Gymnasium

**W32/** Du Pont Athletic Center

**W33/** Rockwell cage



3D ISOMETRIC VIEW



# Available Spaces for Geothermal Exchange and Thermal Storage Installation

PLAN VIEW

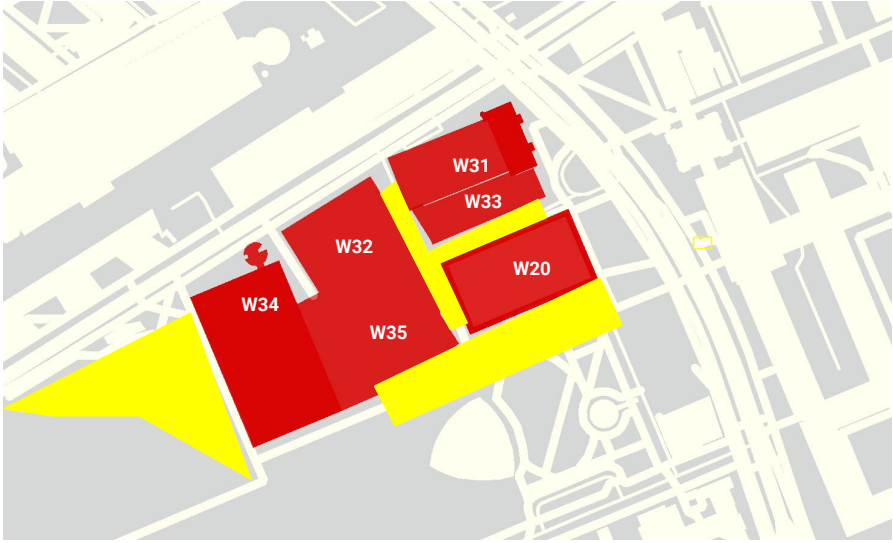
Satellite Image ArcGis Pro



- Buildings
- Available Space



Nolli MIT interpretation

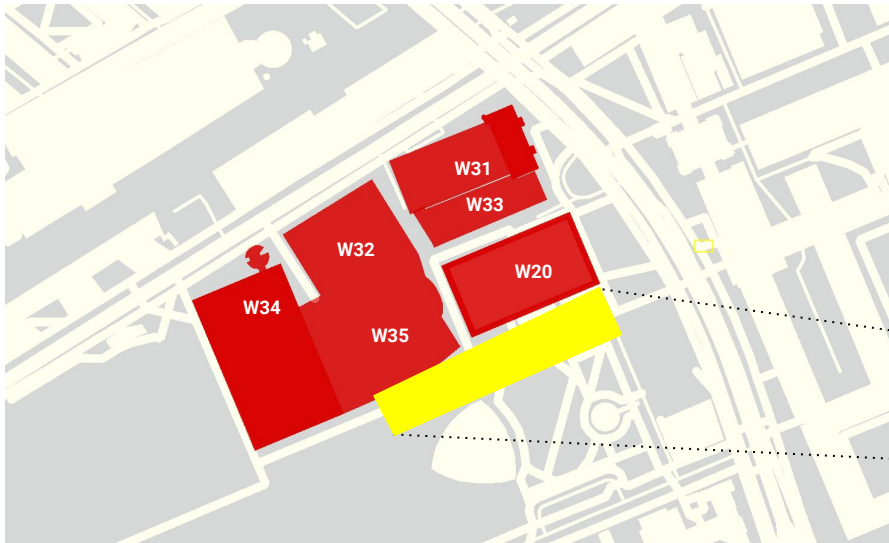





- Buildings
- Available Space
- MIT Campus

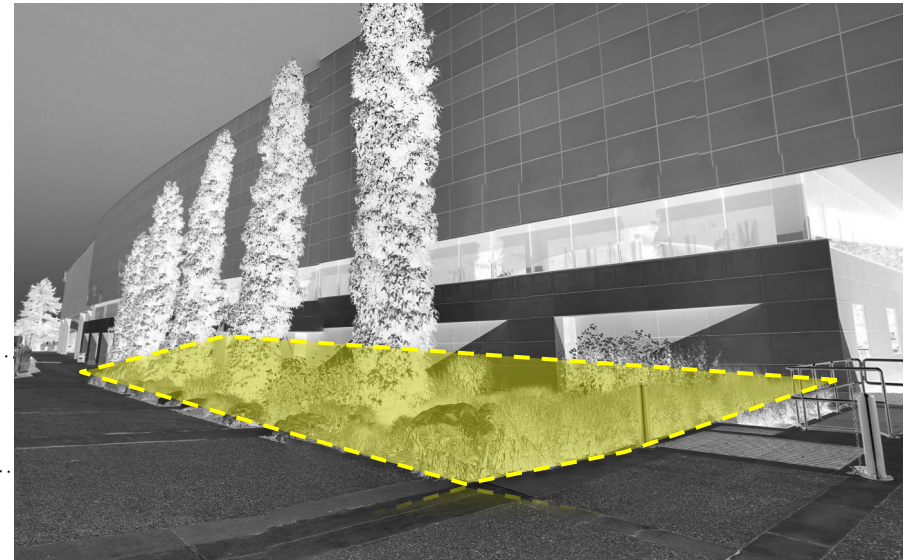
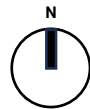
# Available Space 1 for Thermal Storage Installation

PLAN VIEW

Nolli MIT interpretation



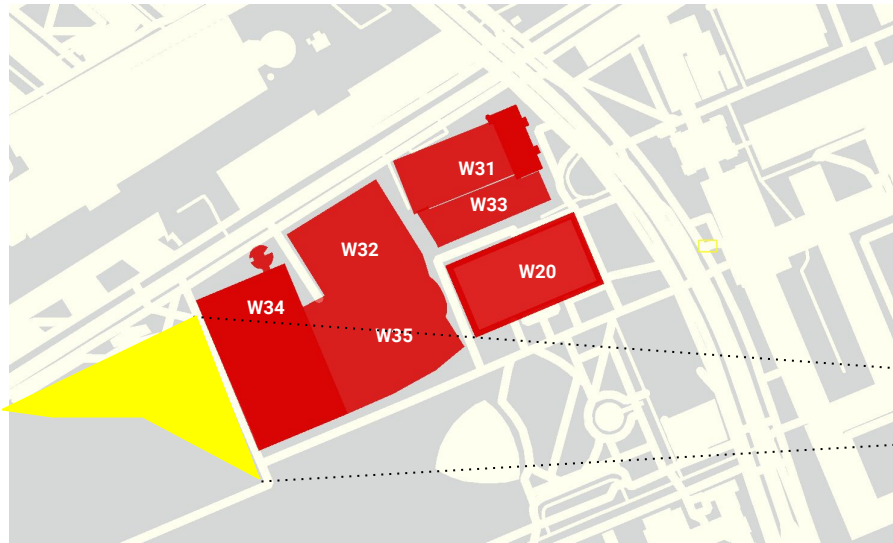
-  Buildings
-  Available Space
-  MIT campus



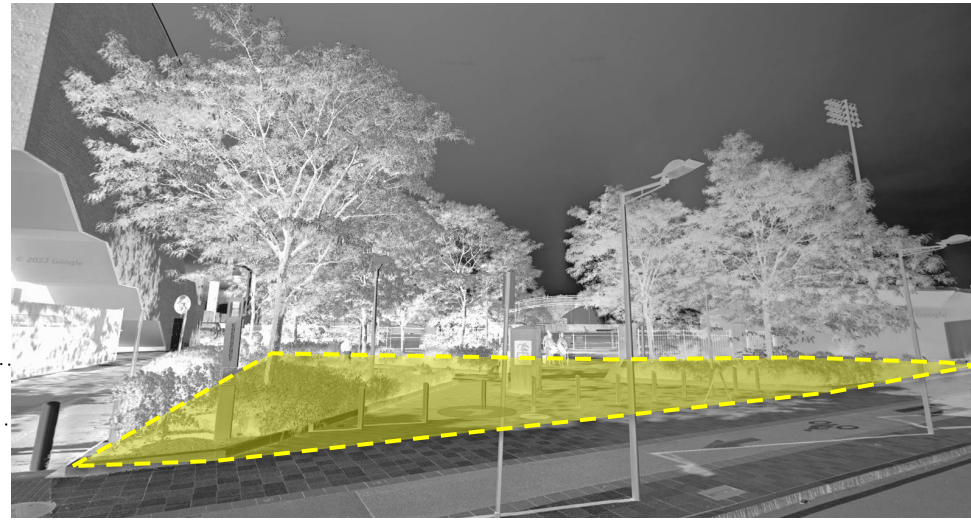
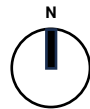
# Available Space 2 for Thermal Storage Installation

PLAN VIEW

Nolli MIT interpretation



- Buildings
- Available Space
- MIT campus

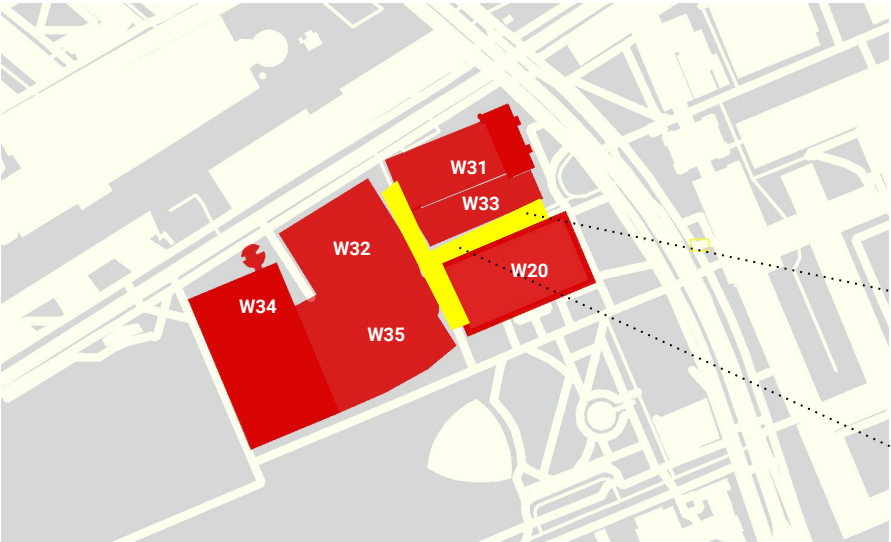




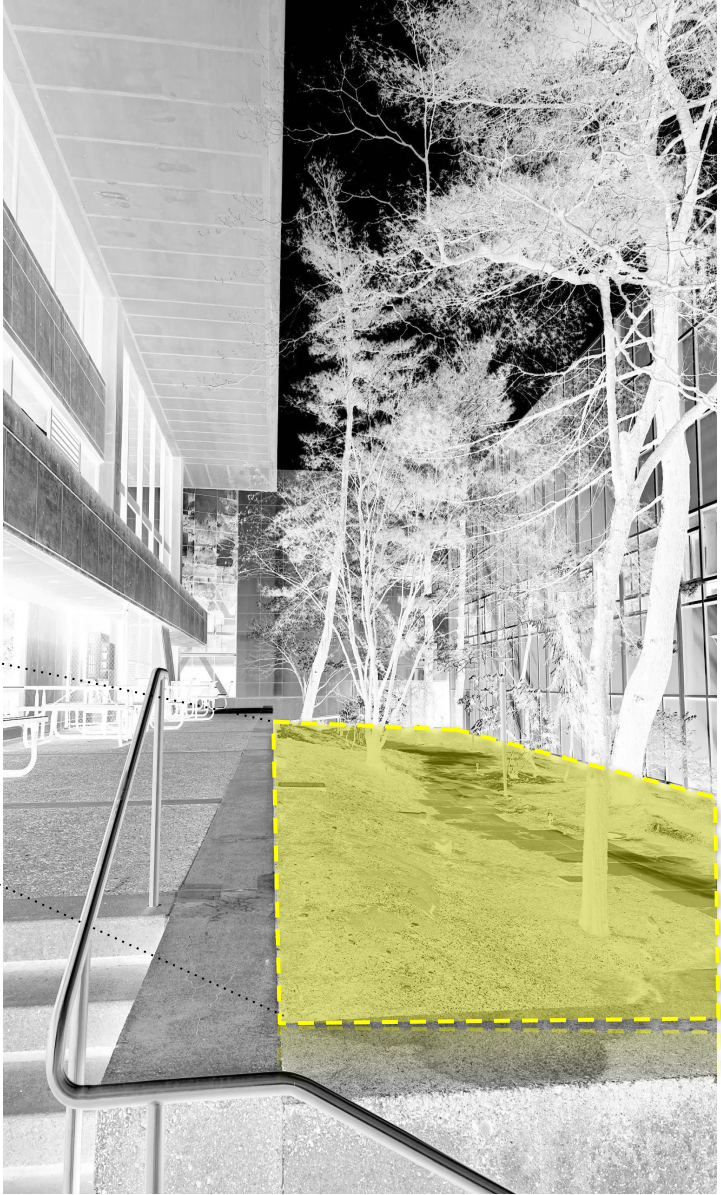
# Available Space 3 for Thermal Storage Installation

PLAN VIEW

Nolli MIT interpretation

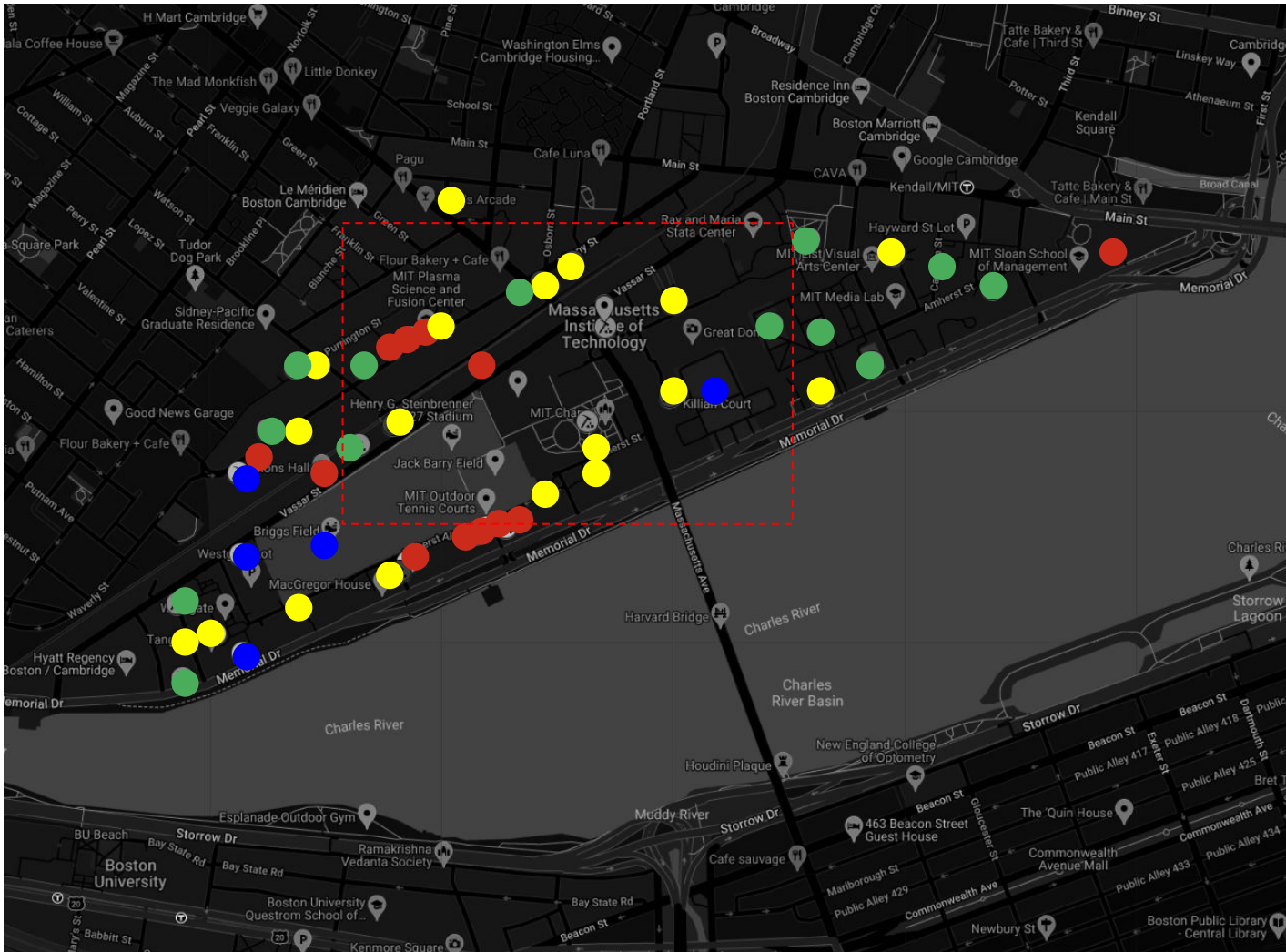


- Buildings
- Available Space
- MIT campus



# MIT POTENTIAL DRILL SITES

PLAN VIEW



Area ft<sup>2</sup>

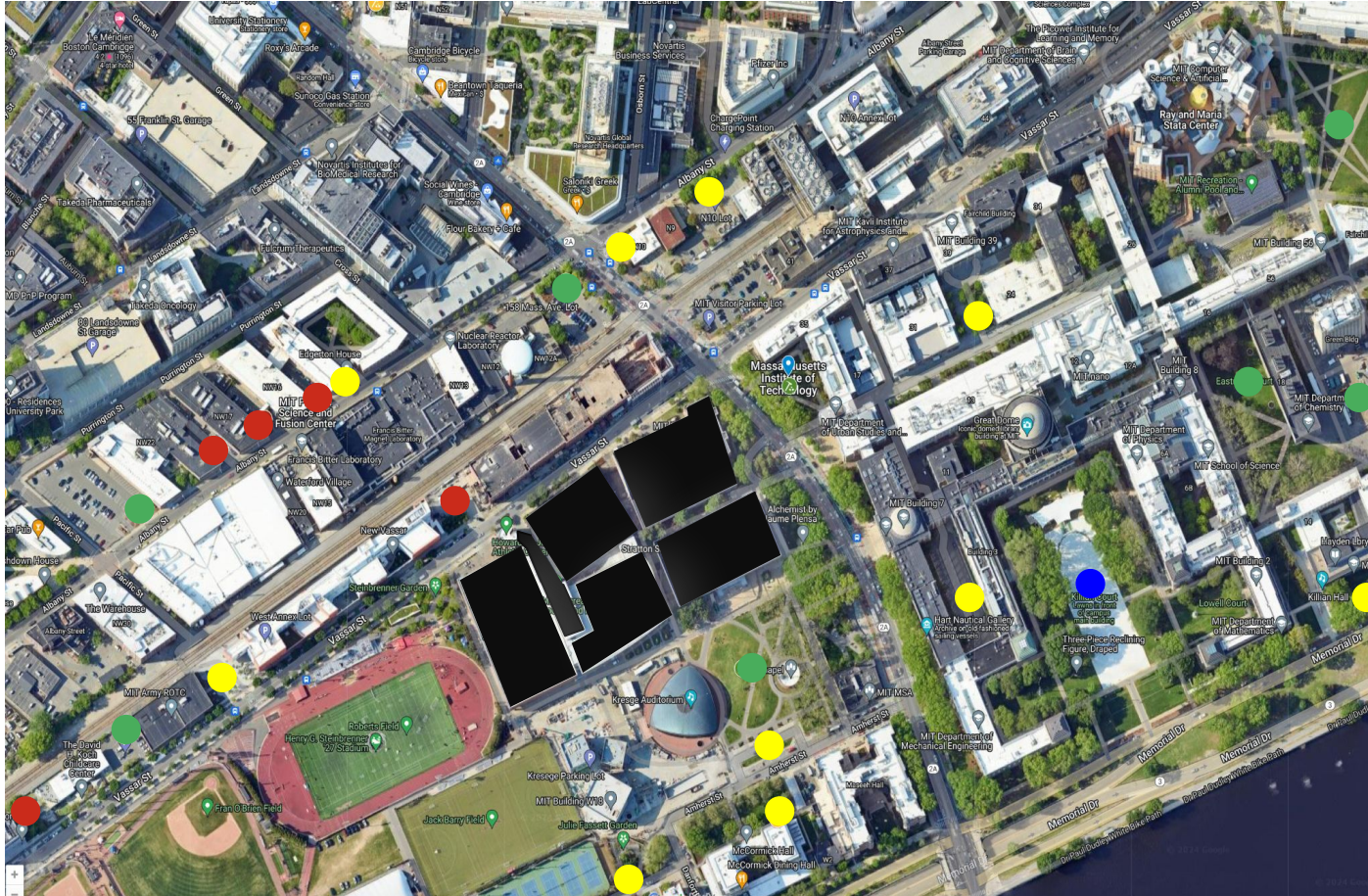
- >10,000
- <10,000 and >30,000
- <30,000 and >150,000
- <150,000

- Drill E01 - Ho
- Drill E02
- Drill E03
- Drill E04
- Drill E05
- Drill E06
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- Drill W35
- Drill W36
- Drill N01



# MIT POTENTIAL DRILL SITES

PLAN VIEW



Area ft<sup>2</sup>

● >10,000

● <10,000 and >30,000

● <30,000 and >150,000

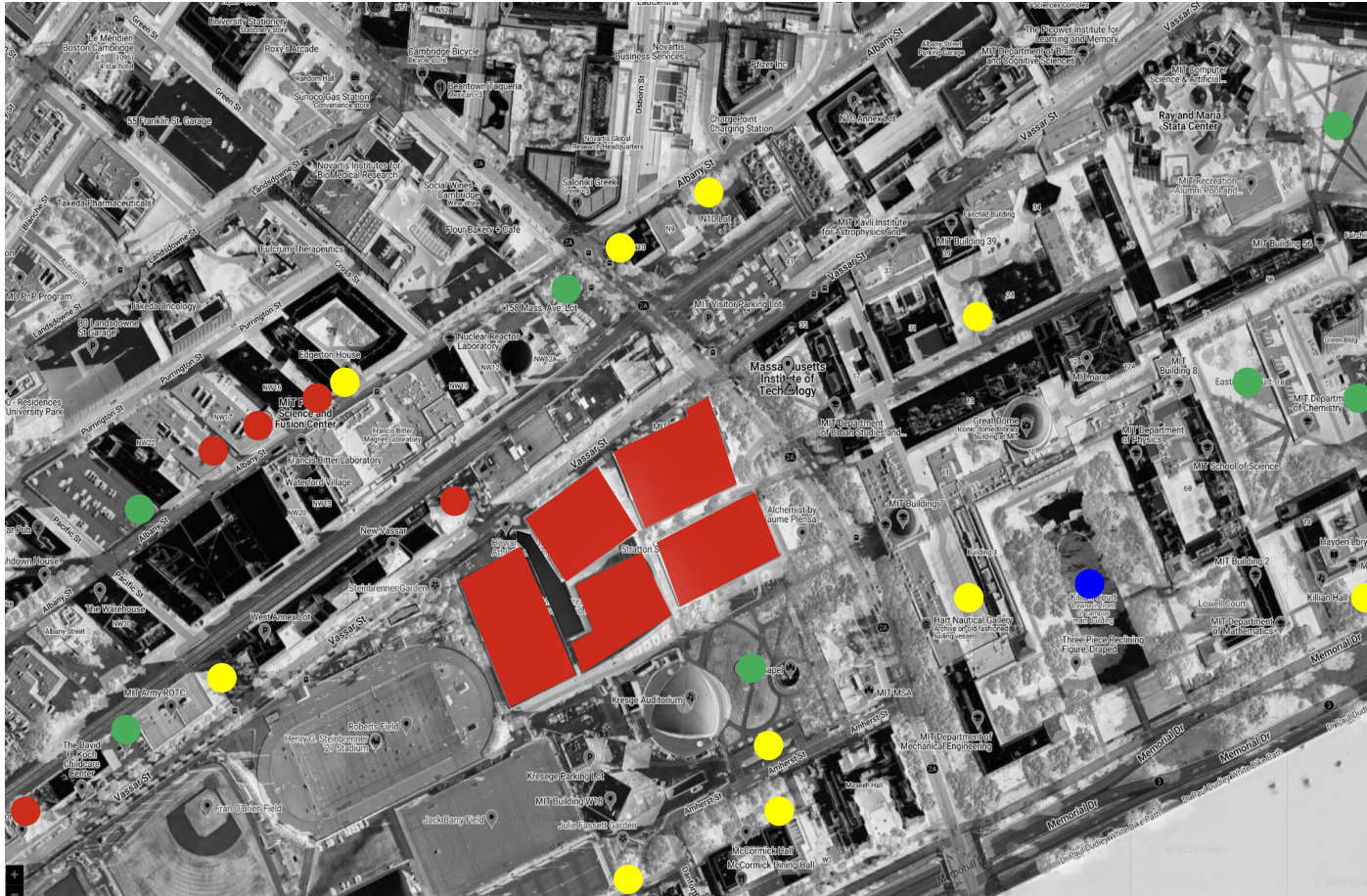
● <150,000

- Drill E01 - Ho
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- Drill W32
- Drill W33
- Drill W34
- Drill W35
- Drill W36
- Drill N01



# MIT POTENTIAL DRILL SITES

PLAN VIEW



Area ft<sup>2</sup>

- >10,000
- <10,000 and >30,000
- <30,000 and >150,000
- <150,000

- Drill E01 - Ho
- Drill E02
- Drill E03
- Drill E04
- Drill E05
- Drill E06
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- Drill W35
- Drill W36
- Drill N01



# MIT POTENTIAL DRILL SITES

## PLAN VIEW

Drill Site Survey name	Coordinates	AKA	Comment	Width ft	Height ft	Area ft^2
Drill E01	42.36158, -71.08928	Hockfield Court		143	220	31,460
Drill E02 Lower	42.3613, -71.0873		not great 50x50 rig access (need tree removal?)	80	110	8,800
Drill E02 Upper	42.3613, -71.0873		better 50x50 rig access	50	60	3,000
Drill E03	42.361073, -71.086124		parking lot	135	160	21,600
Drill E04	42.359410, -71.087791		Walker Adjacent (former, no longer, Saxon Tennis Court)	100	180	18,000
Drill E05	42.359955, -71.089094	McDermott Court		125	125	15,625
Drill E06		Eastman Court	Measuring estimated usable space avoiding trees	100	130	13,000
Drill E07	42.360034, -71.094149			100	200	20,000
Drill E08	42.360834, -71.095669	MIT Visitor Parking Lot		65	160	10,400
Drill E09	42.3588, -71.0926	Main Lot		70	240	16,800
Drill E10	42.36043, -71.09252		trees	80	130	10,400
Drill E11	42.35881, -71.08902		In front of Hayden Library, some trees	60	160	9,600
Drill E12	42.35887, -71.09153			300	575	172,500
Drill E13	42.36134, -71.08202			45	60	2,700
Drill E14	42°21'38.5"N 71°05'05.8"W	MIT Bldg E51 Lot		130	145	18,850
Drill W01	42.360643, -71.096109	158 Mass. Ave. Lot		100	150	15,000
Drill W02	143 Albany St, Cambridge, MA 02139	Edgerton House	trees in courtyard	70	110	7,700
Drill W03	42.359984, -71.098283		parking lot, measured full	40	110	4,400
Drill W04	42.359842, -71.098745		parking lot w/sky bridge, measured full	45	125	5,625
Drill W05	42.359668, -71.099186		parking lot, measured full	45	120	5,400
Drill W06	42.359315, -71.099889		parking lot, measured full	170	270	45,900
Drill W07	42.359324, -71.101507	70 Pacific Street Lot		120	235	28,200
Drill W08	42.359404, -71.101067	Waverly Path		50	530	26,500
Drill W09	42.358200, -71.101319			55	175	9,625
Drill W10	42.358221, -71.102153		trees, parking lot	125	210	26,250
Drill W11	42.357765, -71.102296		tree	45	100	4,500
Drill W12	42.357485, -71.102819	290 Albany St Lot	parking lot, measured full	250	265	66,250
Drill W13	42.355181, -71.104285		zip car lot	100	600	60,000
Drill W14	42.356048, -71.102784	Westgate Lot	parking lot, measured full	250	460	115,000
Drill W15	42.357502, -71.100846	Vicky Sirianni Garden	trees in courtyard	35	80	2,800
Drill W16	42.357980, -71.099982	Parking lot		100	110	11,000
Drill W17	42.358319, -71.099161		Crossover to Pacific Street	75	120	9,000
Drill W18	42.359356, -71.097069			30	70	2,100
Drill W19	42.361169, -71.094900	N10 Lot MIT CUP Central Utilities Plant		85	165	14,025
Drill W20	42.357937, -71.094337			55	175	9,625
Drill W21	42.357491, -71.094257			55	240	13,200
Drill W22	42°21'25.6"N 71°05'44.1"W			50	100	5,000
Drill W23	42°21'23.5"N 71°05'47.4"W			30	40	1,200
Drill W24	42°21'23.5"N 71°05'49.0"W			25	80	2,000
Drill W25	42°21'23.1"N 71°05'49.9"W			30	30	900
Drill W26	42°21'23.0"N 71°05'50.4"W			30	45	1,350
Drill W27	42°21'21.3"N 71°05'55.8"W			40	60	2,400
Drill W28	42.355753, -71.099011	Fowler Street		90	230	20,700
Drill W29	42.355119, -71.101373			70	120	8,400
Drill W30	42.354332, -71.102733			200	200	40,000

Area ft 2

● >10,000

● <10,000 and >30,000

● <30,000 and >150,000

● <150,000

- Drill E01 - Ho
- Drill E02
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- Drill W35
- Drill W36
- Drill N01

## First Priority / Chilled Water loop

W20, W34, W35

W20

W34

W35

## W20 Stratton Student Center - Overview

1. **Temporarily Abandoned Interfloor Air Exchange:** Three temporarily abandoned interfloor air exchange unit on both sides of the building. (Floor 4 & 5 near elevator)
2. **Daikin Multi Drop Variant Refrigerant Flow VRF:** High Wall Unit Heater, all four are on the same refrigerant loop; using Propylene Glycol as anti-freezes. (Floor 5)
3. **Air Conditioning units near window**
4. **Drill Sites** Utility Area made into a garden; Potential sites to be used for geo-exchange and thermal storage units



1



1



2



3



4





# W20 Stratton Student Center - "Basement"

## 1. Pumping Station

2. Thermometer: 136 degrees (Low; Typically 160 degrees)

## 3. Old Piping vs. New Piping

4. Standard Typical Hot/Chilled Water Loop: Glycol Hot water return

5. Standard Typical Hot/Chilled Water Loop



1



2



3



4

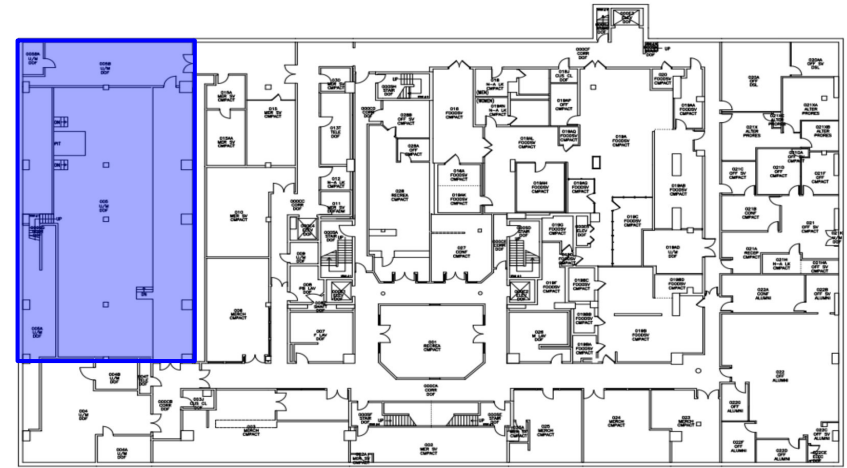
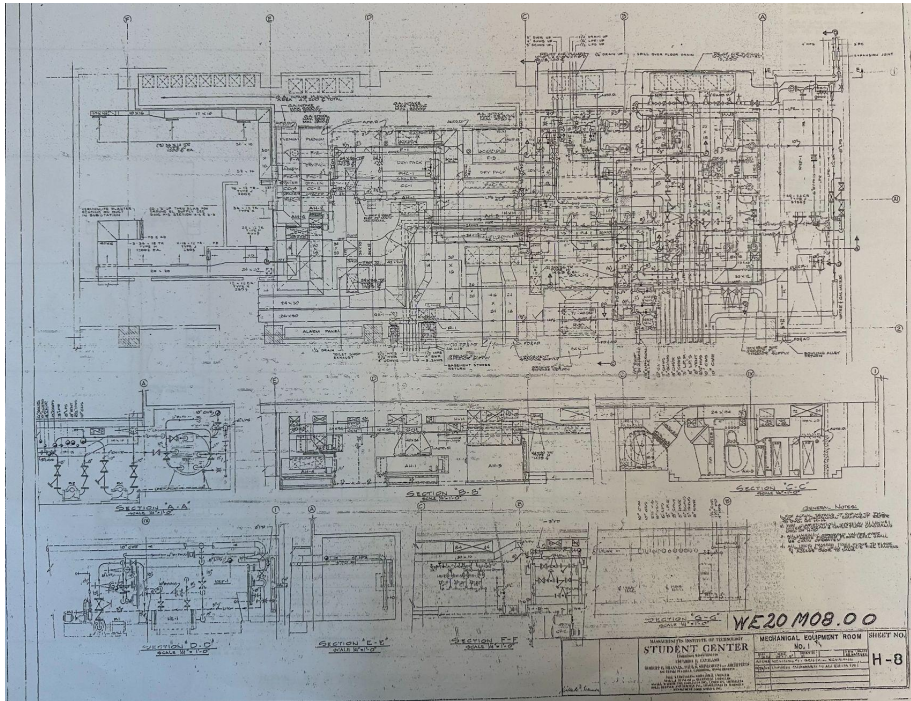


5





# W20 Stratton Student Center - "Basement"

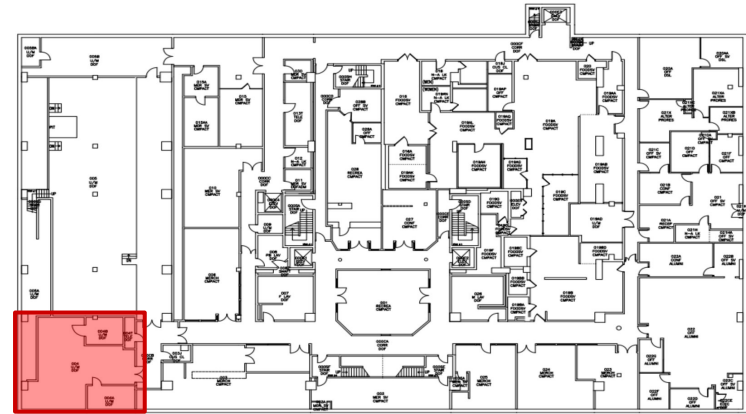
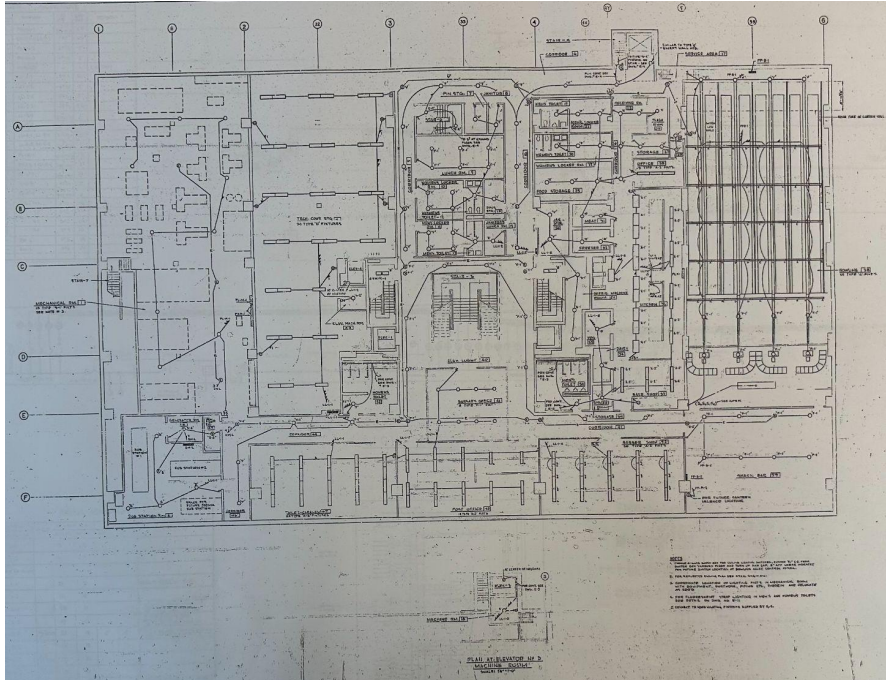


**Main Mechanical Room**



**Temperature: 146F**

# W20 Stratton Student Center - "Basement"

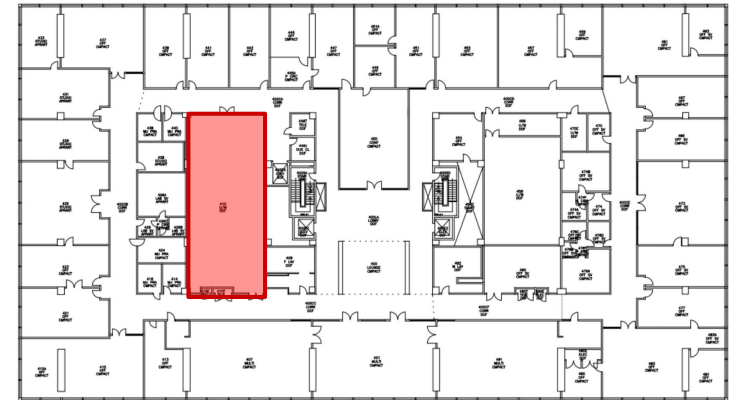
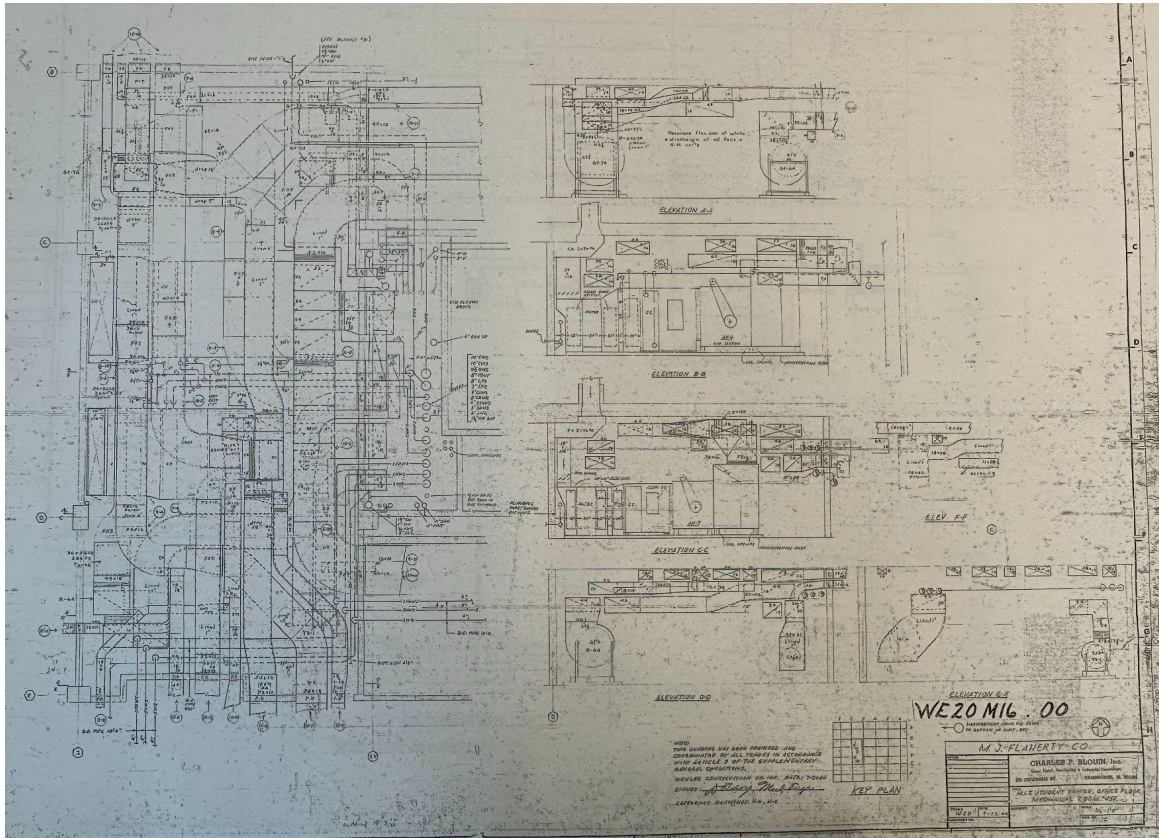


**W20-004A Electrical Closet**





# W20 Stratton Student Center - "4th Floor"



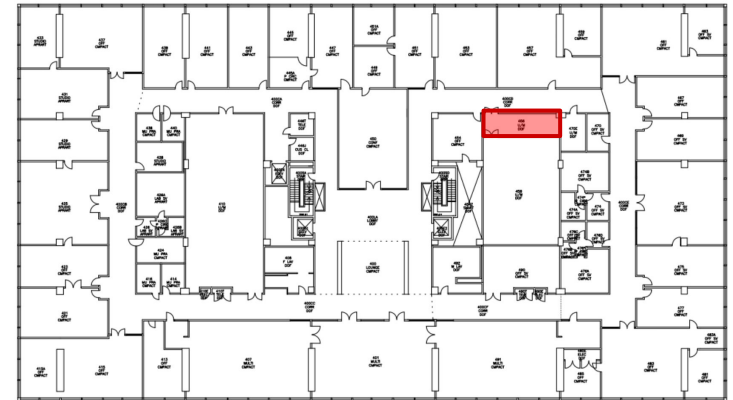
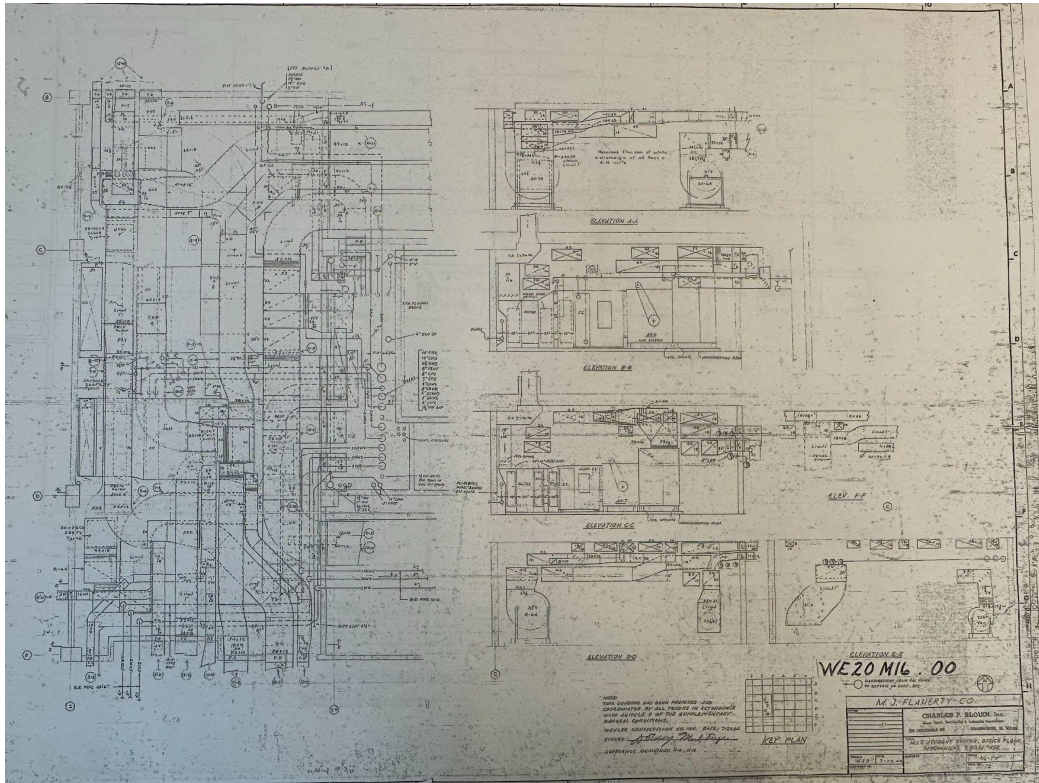
■ W20-410 Mechanical Room (4th Floor)

The image on the left should be verified.  
Does it refer to 4th or 5th floor?





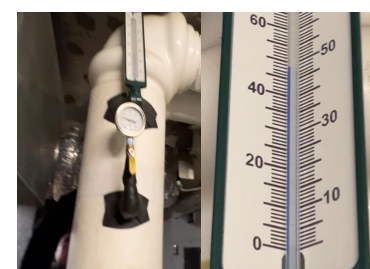
# W20 Stratton Student Center - "4th Floor"



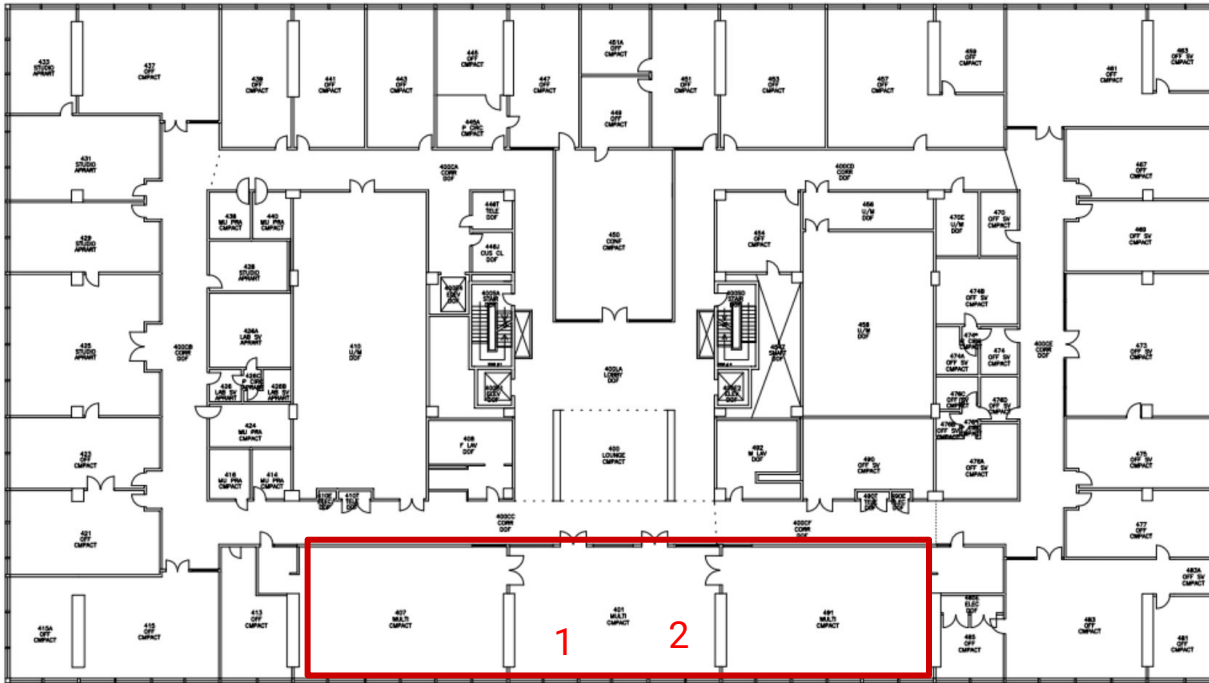
■ W20-456 Mechanical Room (4th Floor)



The image above should be verified.  
Does it refer to 4th or 5th floor?



# W20 Stratton Student Center - "4th Floor"



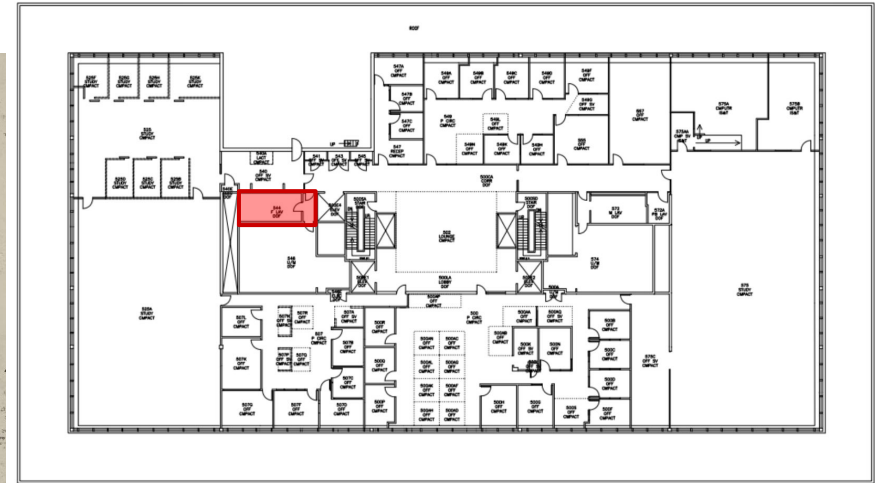
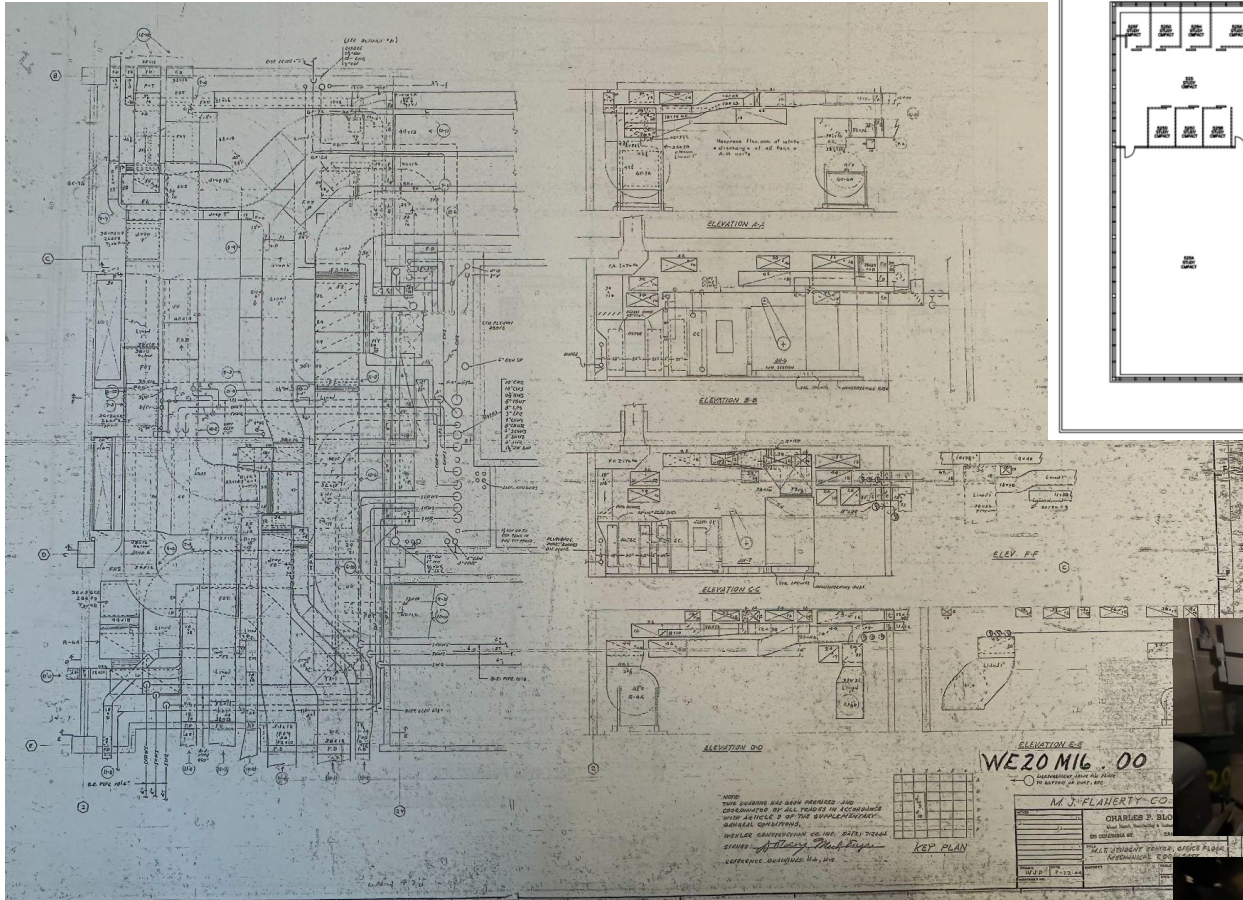
**1. Student Activities Rooms with radiator under the windows**

**2. Daikin Multi Drop Variant Refrigerant Flow (VRF) (Located in Dance Rooms)**

**3. Rooftop compressor for the VRF unit**

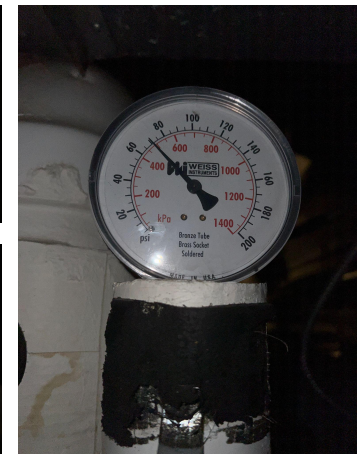
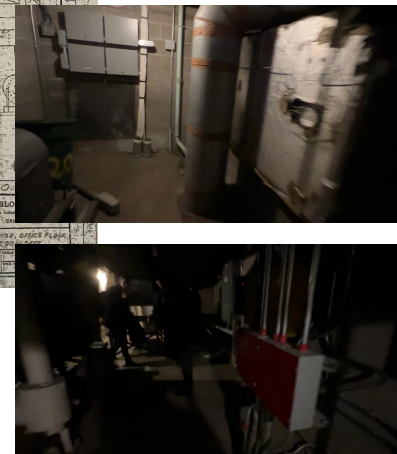


# W20 Stratton Student Center - "5th Floor"



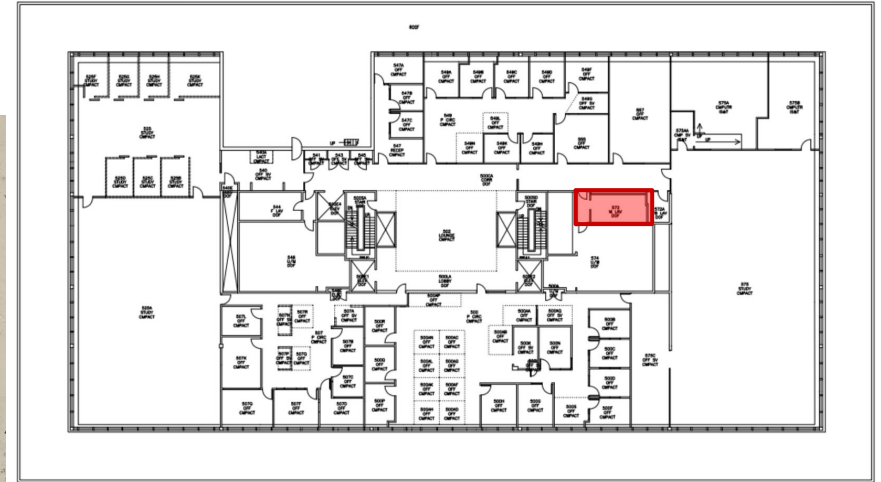
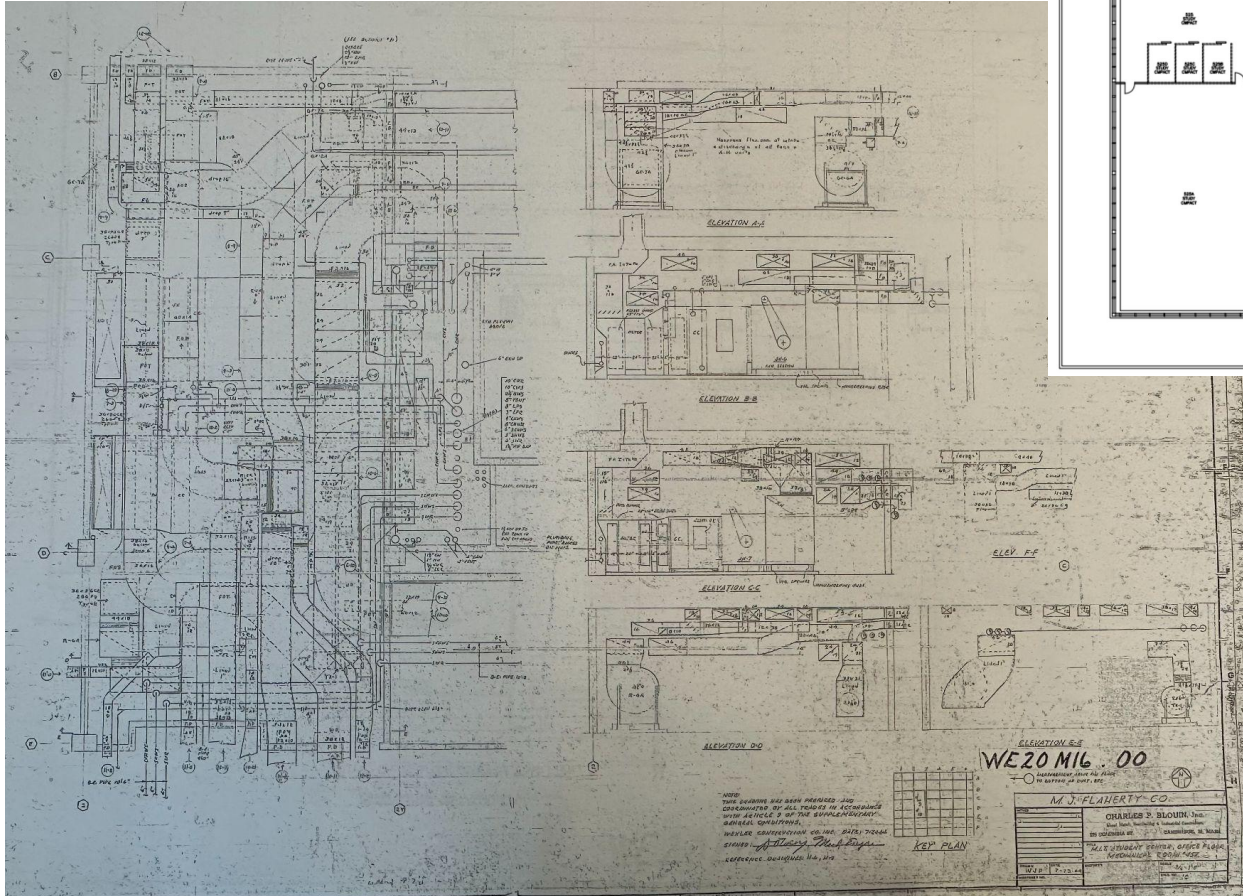
■ W20-544 Mechanical Room (5ht Floor, near women's bathroom)

The image above should be verified.  
Does it refer to 4th or 5th floor?





# W20 Stratton Student Center - "5th Floor"

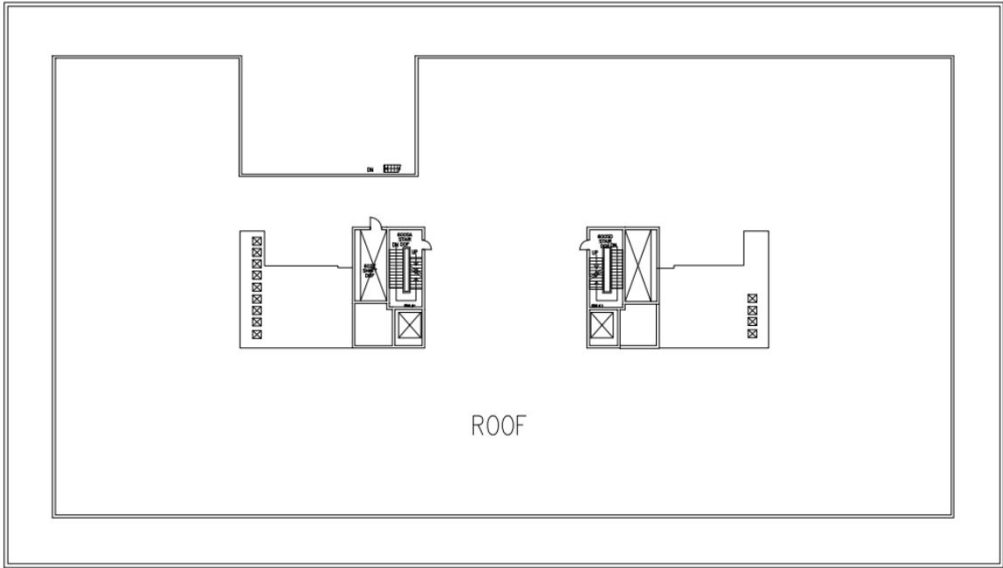


■ W20 - 572 Mechanical Room (5th Floor, near men's bathroom)



The image above should be verified. Does it refer to 4th or 5th floor?

# W20 Stratton Student Center - "5th Floor Rooftop"

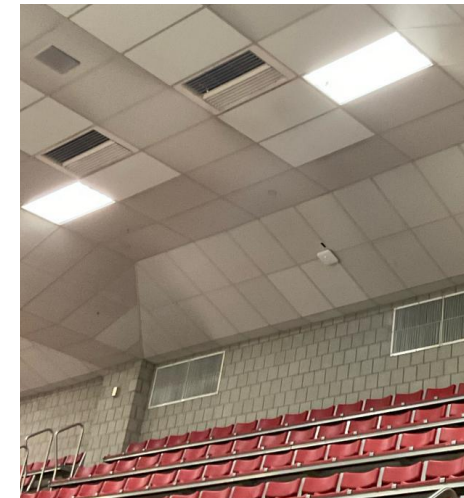
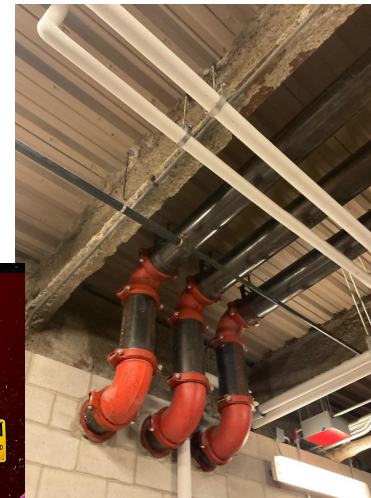
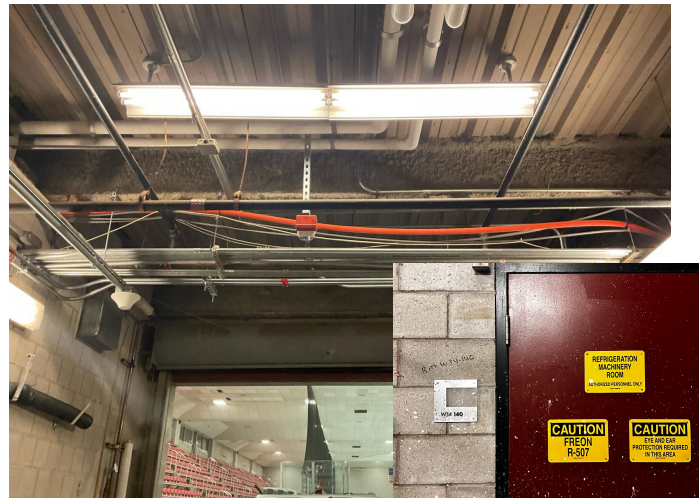


3. Rooftop compressor for the VRF unit



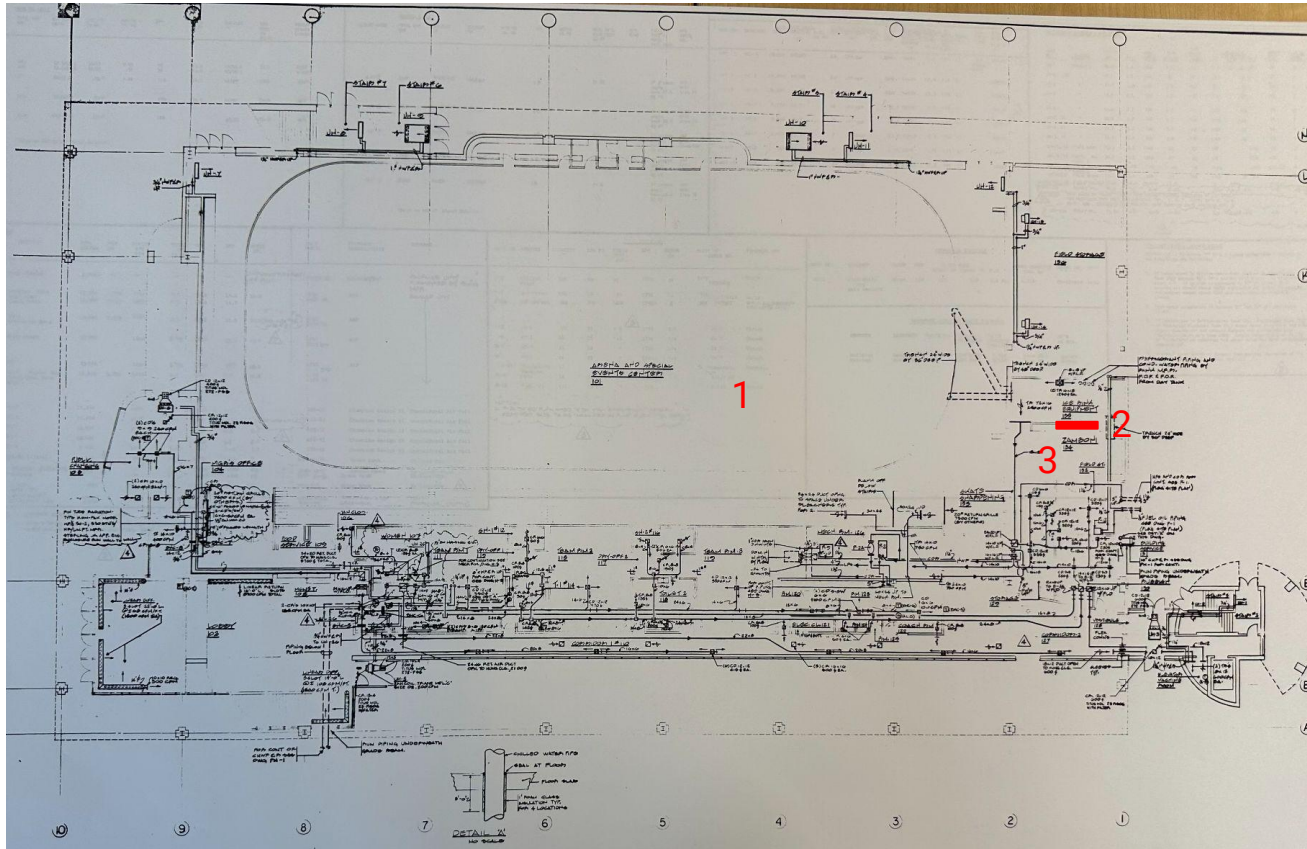
## W34 Johnson Athletics Center - Overview

1. Not insulated Water lines (suspect for ice making)
2. Acoustical Dropped Ceiling





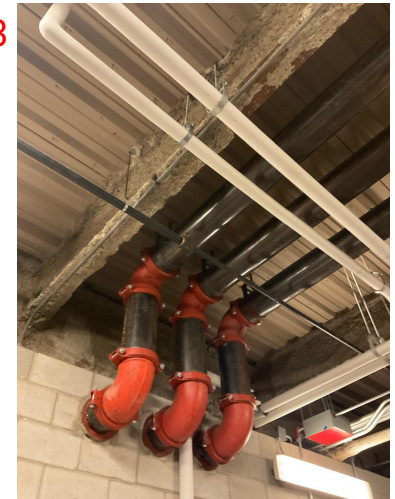
# W34 Johnson Athletics Center - "Ice Rink"



3



3



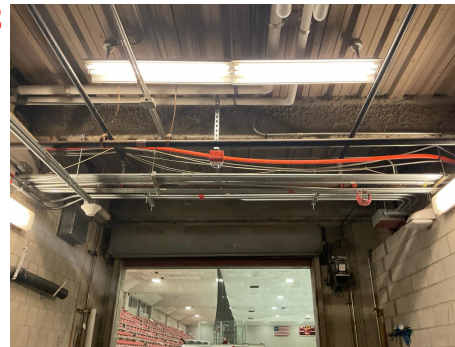
1



2

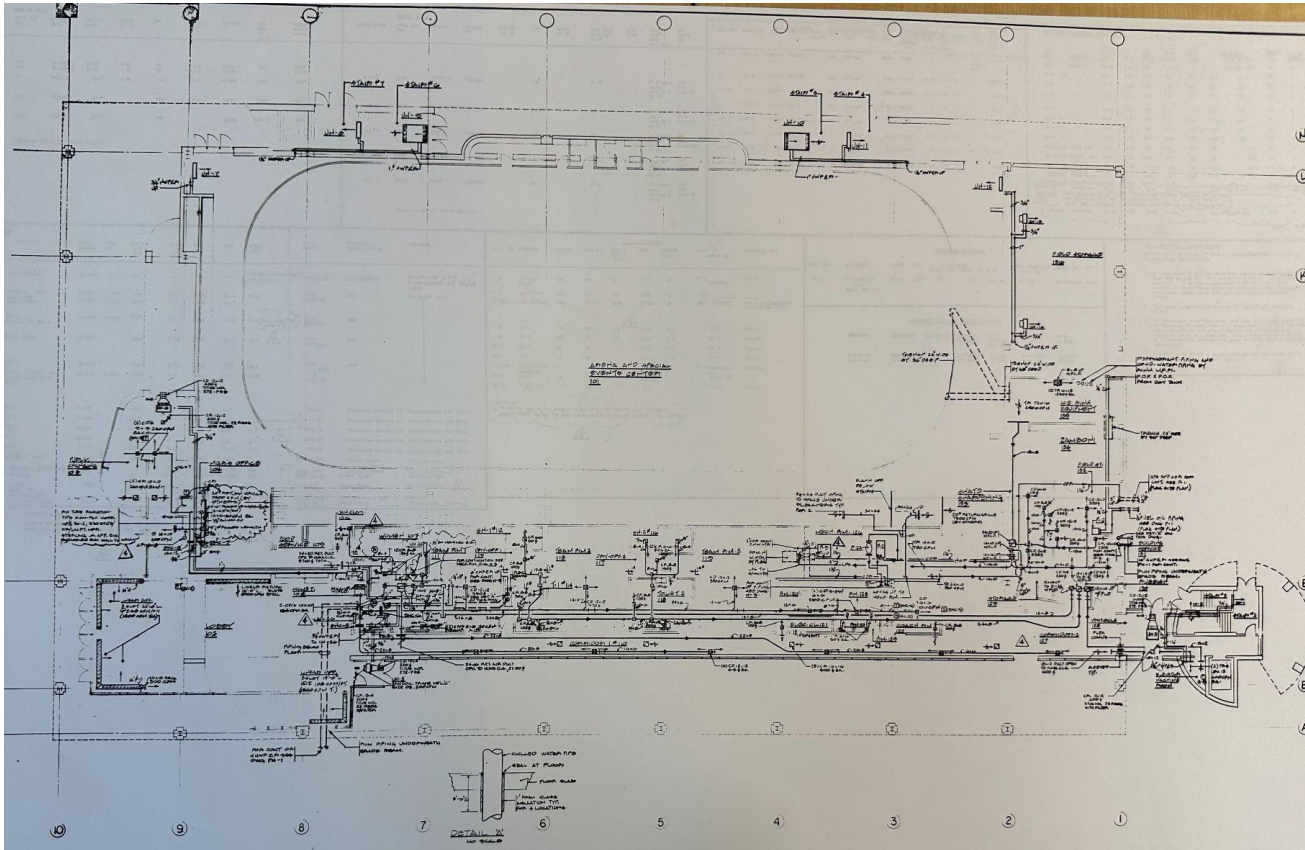


3





# W34 Johnson Athletics Center - "Ice Rink"



W34-130M



## W35 Zesiger Sports and Fitness Center - Overview

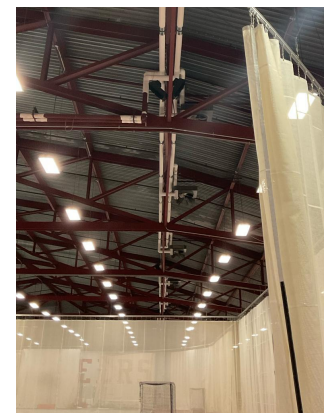
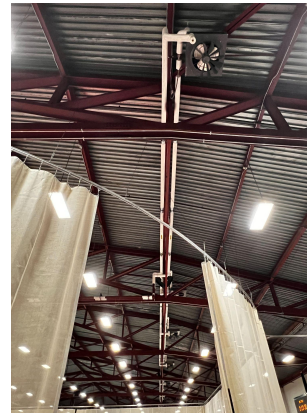
1. The athletic track is probably located in the upper floors of the ice rink.
2. Heating Supply & Returns system along the track



1



2

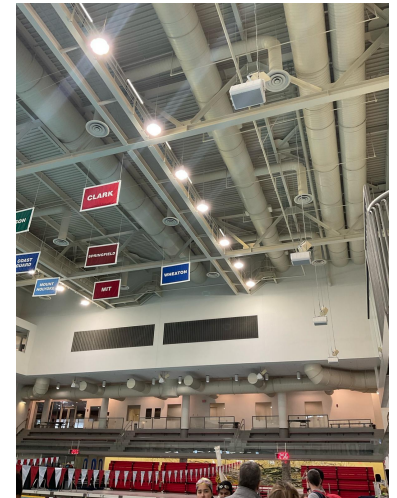
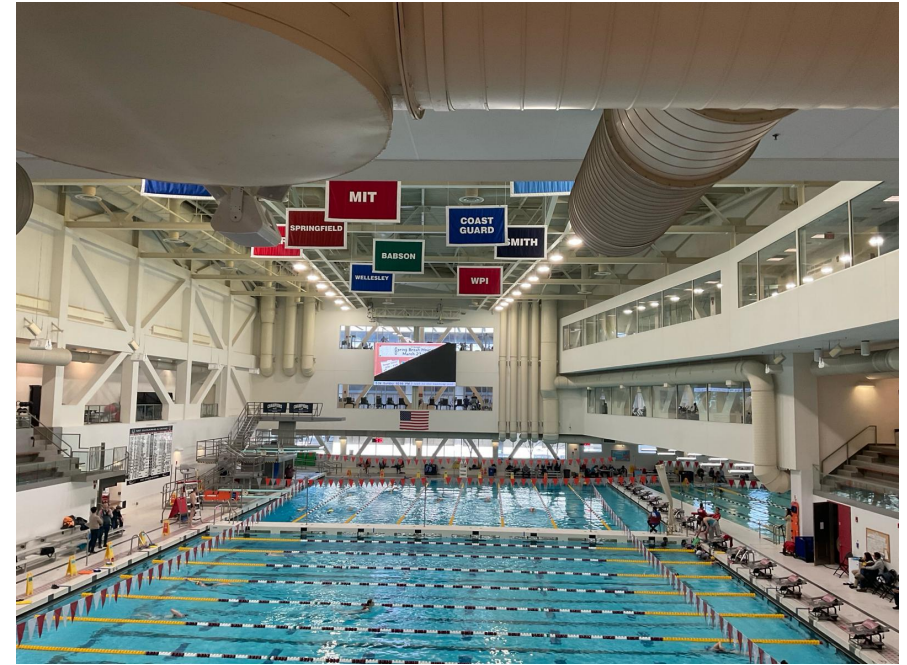




# W35 Zesiger Sports and Fitness Center - "Swimming Pool"

1. Radiators along the windows

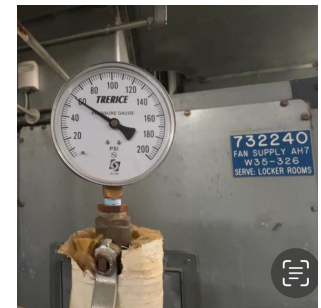
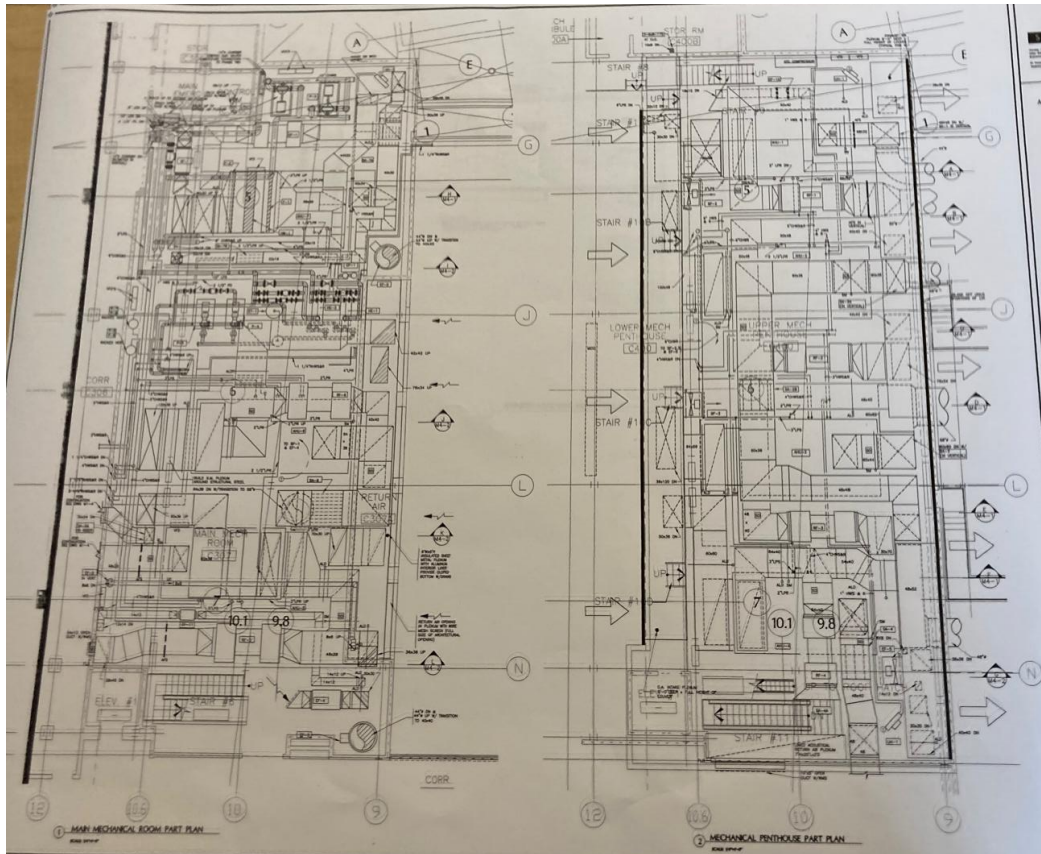
2. This building is on chiller loop





# W35 Zesiger Sports and Fitness Center - "Basement"

W35-326 (Swimming Pool Mechanics)



**Second Priority / Comun H/C  
(Not on Chiller Loop)**

**W31, W32, W33**





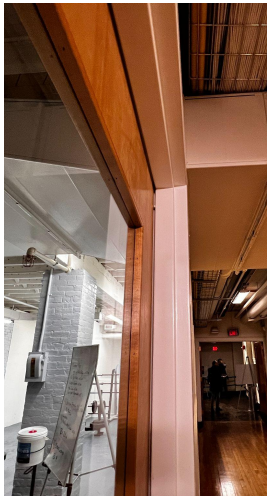
# W31 Du Pont Athletic Gymnasium - Overview

## 1. Connected Air Duct from hallway to Gym

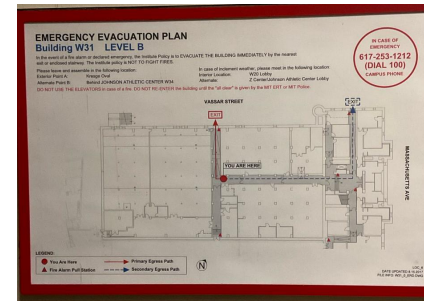
## 2. Wood Flooring: Potential to become radiant flooring for retrofit



1



2

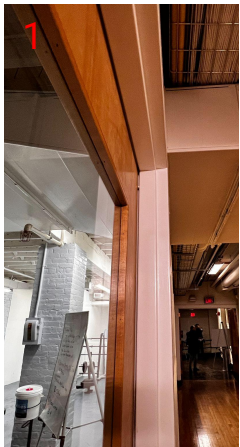
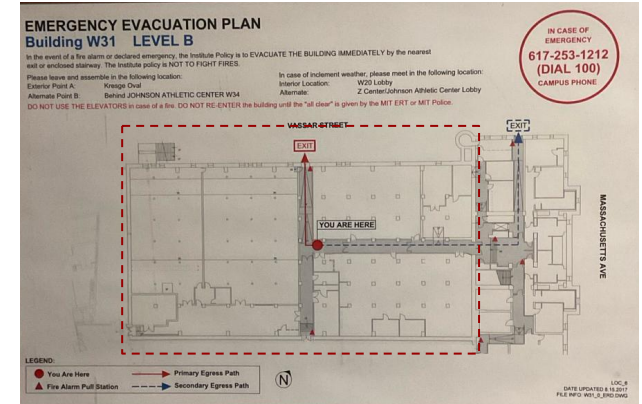
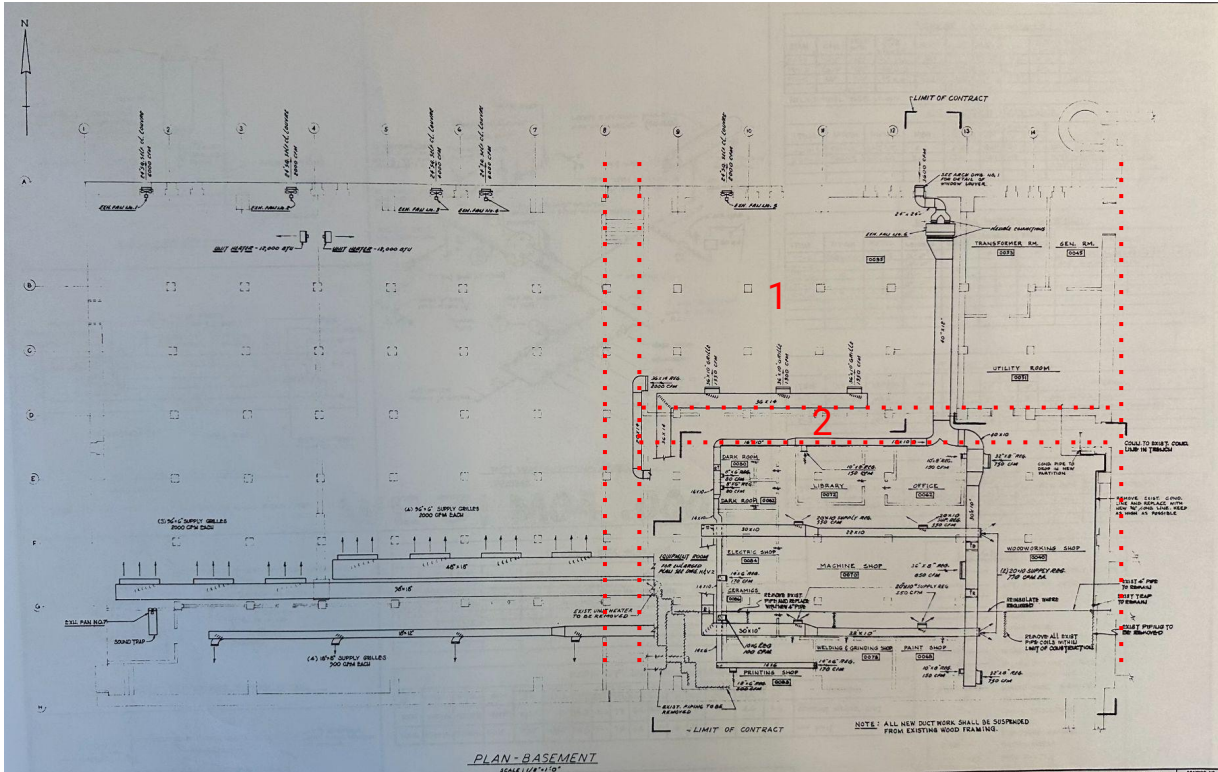


2





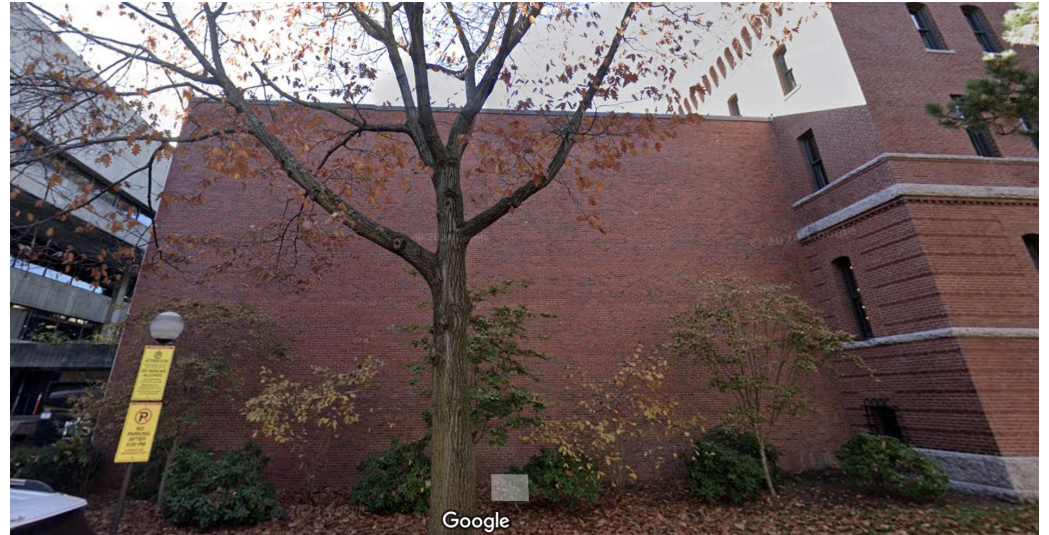
# W31 Du Pont Athletic Gymnasium - "Basement"





## W32 Du Pont Athletic Center - Overview

1. **Drop ceiling:** it hides systems and return air system
2. **Corridor interconnecting W31 and W32**
3. **Squash Court:** Back wall is the exterior brick wall



1



2

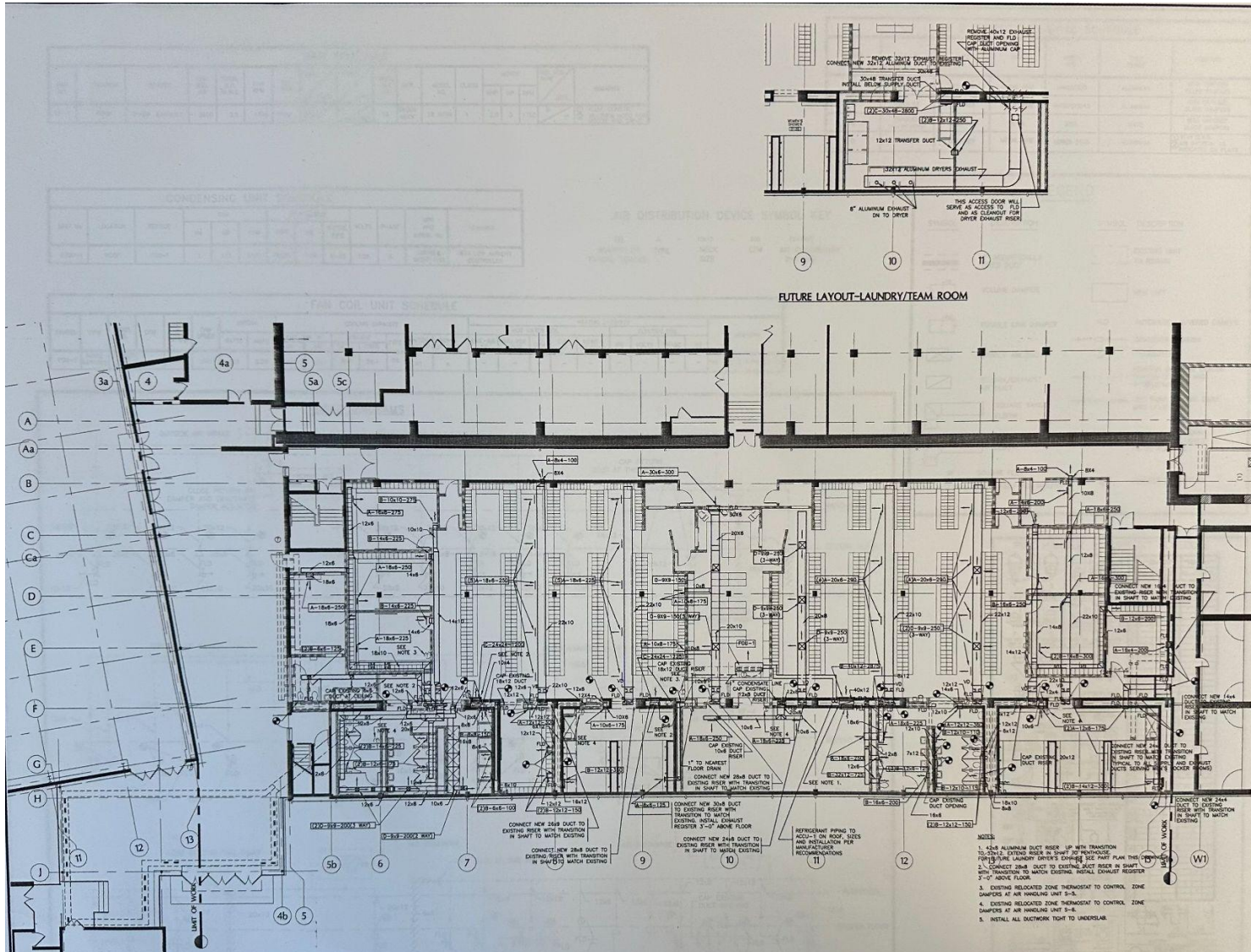


3



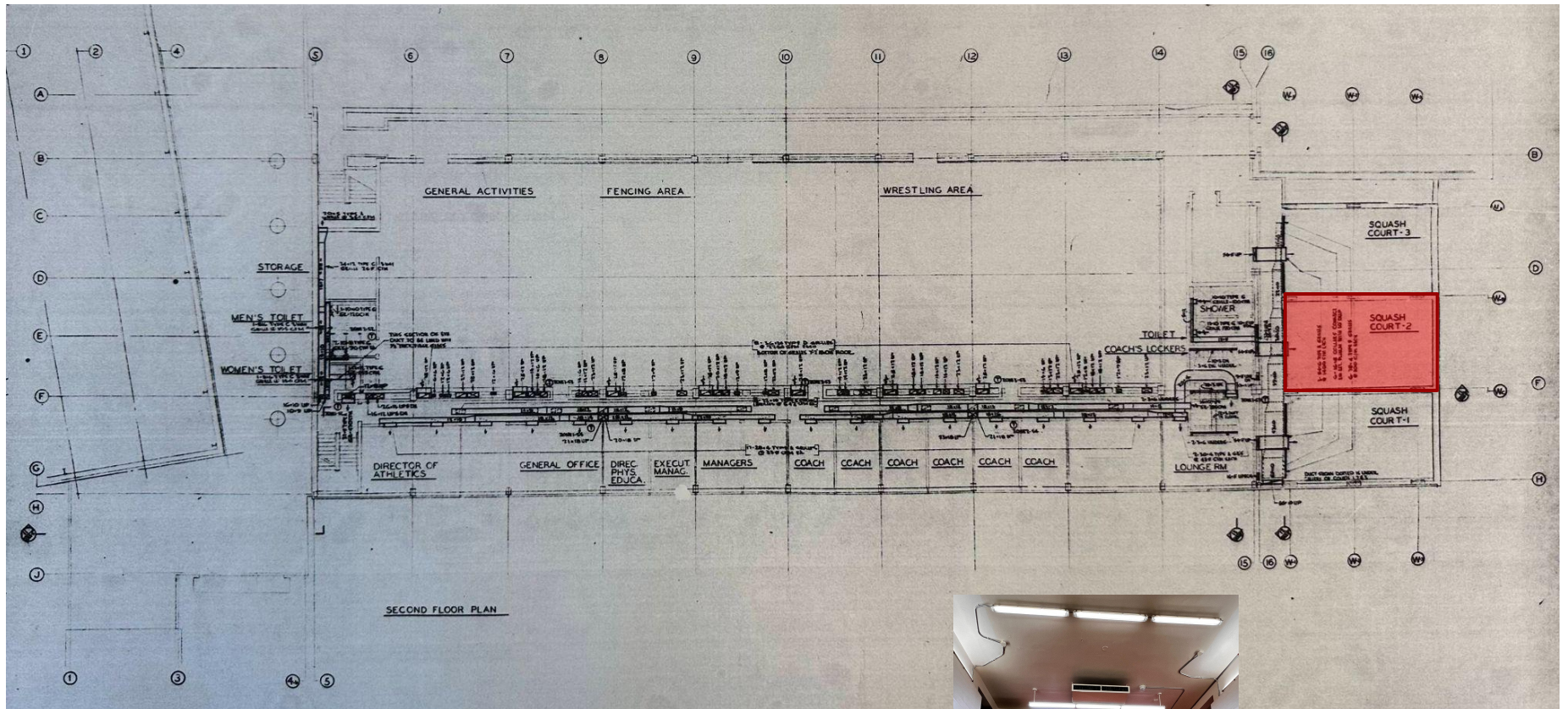


# W32 Du Pont Athletic Center - "Basement"





# W32 Du Pont Athletic Center - "Basement"

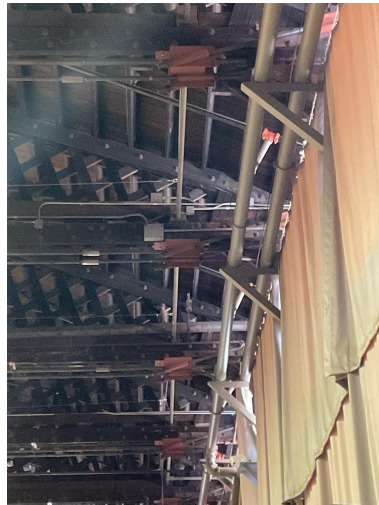


Massachusetts Ave



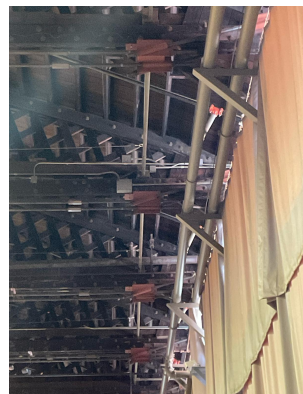
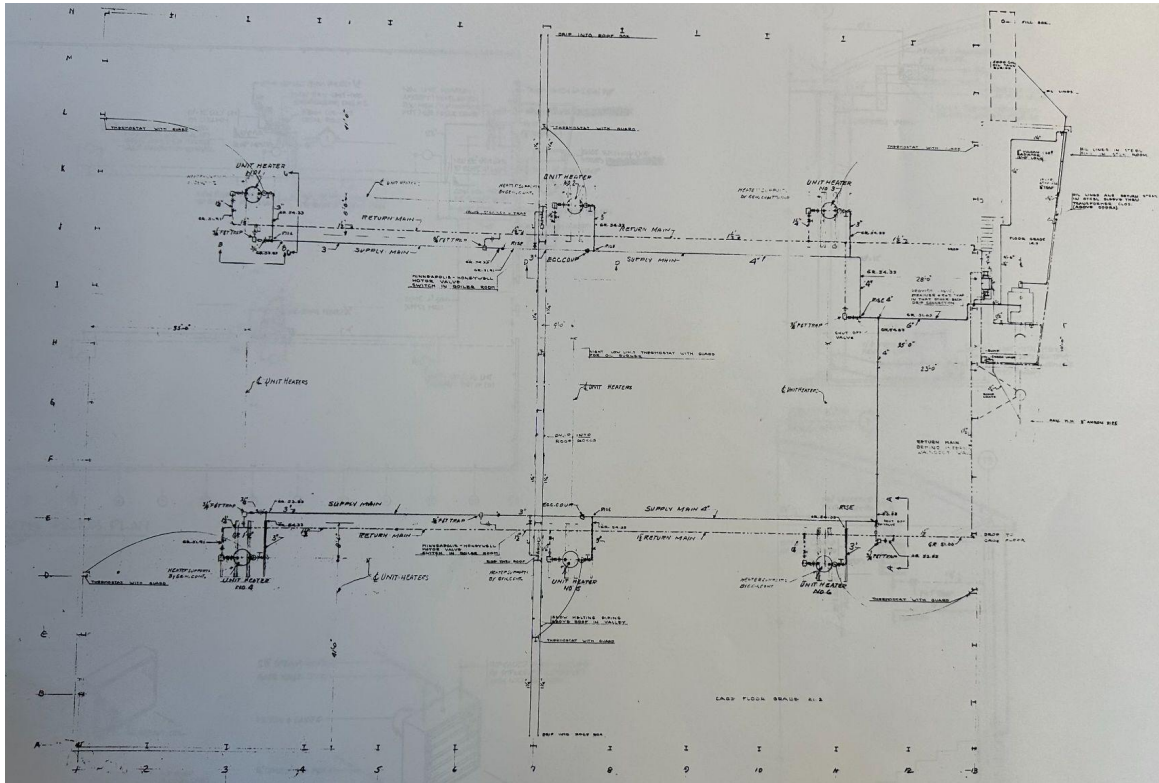
## W33 Rockwell cage - Overview

1. Not updated since 1970s
2. Possibility of retrofit the window systems



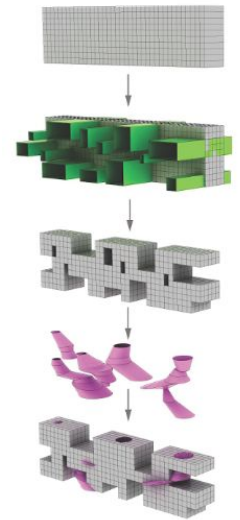


# W33 Rockwell cage - "The Cage"



# W79 Simmons Hall - Overview

- 1. **Hydronic Heating and Cooling System:** Uses circular piping to circulate hot glycol (yellow) and chilled water (green) for heating and cooling the building.
- 2. **Efficient Radiators:** Found in lobbies, room and common areas, connected to the heating system to provide additional warmth.
- 3. **High-Velocity Ventilation:** Efficiently distributes conditioned air throughout the building.
- 4. **Automated Window Technology:** Windows equipped with automatic controls to regulate temperature and sunlight.
- 5. **Other Components:** Include centralized temperature controls, sensors, and energy management systems to maintain a comfortable and efficient environment.



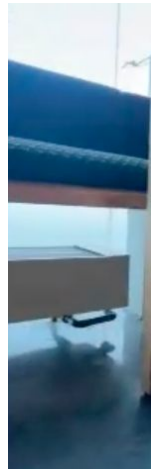
1



2



2



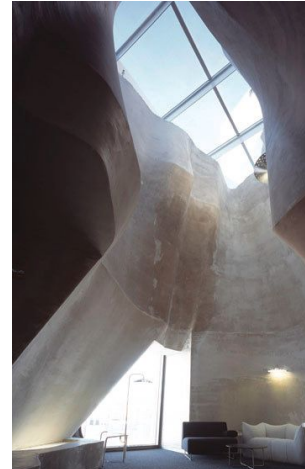
3



4



5





# Final Reflections and Comments



**Building W31**

**What is this machinery?  
Need for further investigation around  
the function of this device.**

The plans do not show how the rooftop units are integrated

**Is the tower part of the building ducted?**



**Building W35**

**This infrastructure on the left should be verified. What is its function?**

## NEXT STEPS

- Further investigation of the **mechanical devices** for each building
1. **Building W20:** Mechanical plans/elevation more detailed investigation
  2. **Building W31:** External machinery and investigate the rooftop units
  3. **Building W32:** Missing mechanical room layout detail
  4. **Building W33:** Missing plans
  5. **Building W34:** Missing detail of the mechanical room AHU
  6. **Building W35:** External machinery and Plans for pool heating equipment