



# SOWING SEEDS ACADEMY

Miami University • Elementary School • Team Red Hot Chili Bs

## Introduction

Energy Performance

Engineering

Financial Feasibility

Resilience

Architecture

Operations

Market Potential

Environmental Quality

Innovation

Closing Remarks

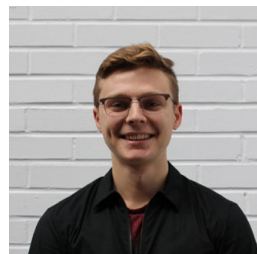
## TEAM PROFILE



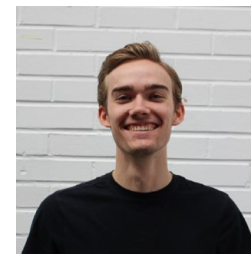
**KATIE MITCHELL**  
4th year  
BA Architecture  
Certified Passive House



**AUSTIN J CARF**  
4th year  
BA Architecture  
& Environmental Science



**JAMES MUSTILLO**  
3rd year  
BA Architecture



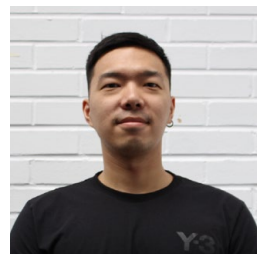
**ALEC FISETTE**  
3rd year, BA Architecture



**GRAZIELLA PILKINGTON**  
3rd year  
BA Architecture



**NATE CONLEY**  
4th year  
BS Engineering



**DI LI**  
4th year, BA  
Architecture



**EMMA PEVOAR**  
1st year  
M.Architecture  
LEED AP BD+C.

Introduction

# DESIGN GOALS

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LEARNING  
SUSTAINABILITY



SAFETY &  
INCLUSION



ADAPTATION



SYNERGY WITH  
COMMUNITY



PASSIVE HOUSE

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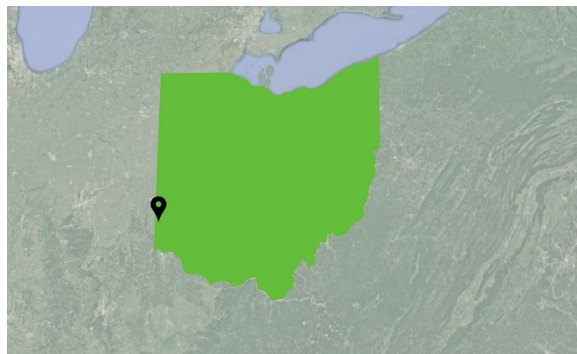
Environmental Quality

Innovation

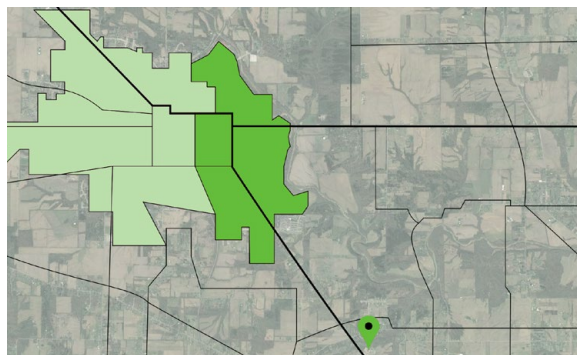
Closing Remarks

# SITE INFORMATION

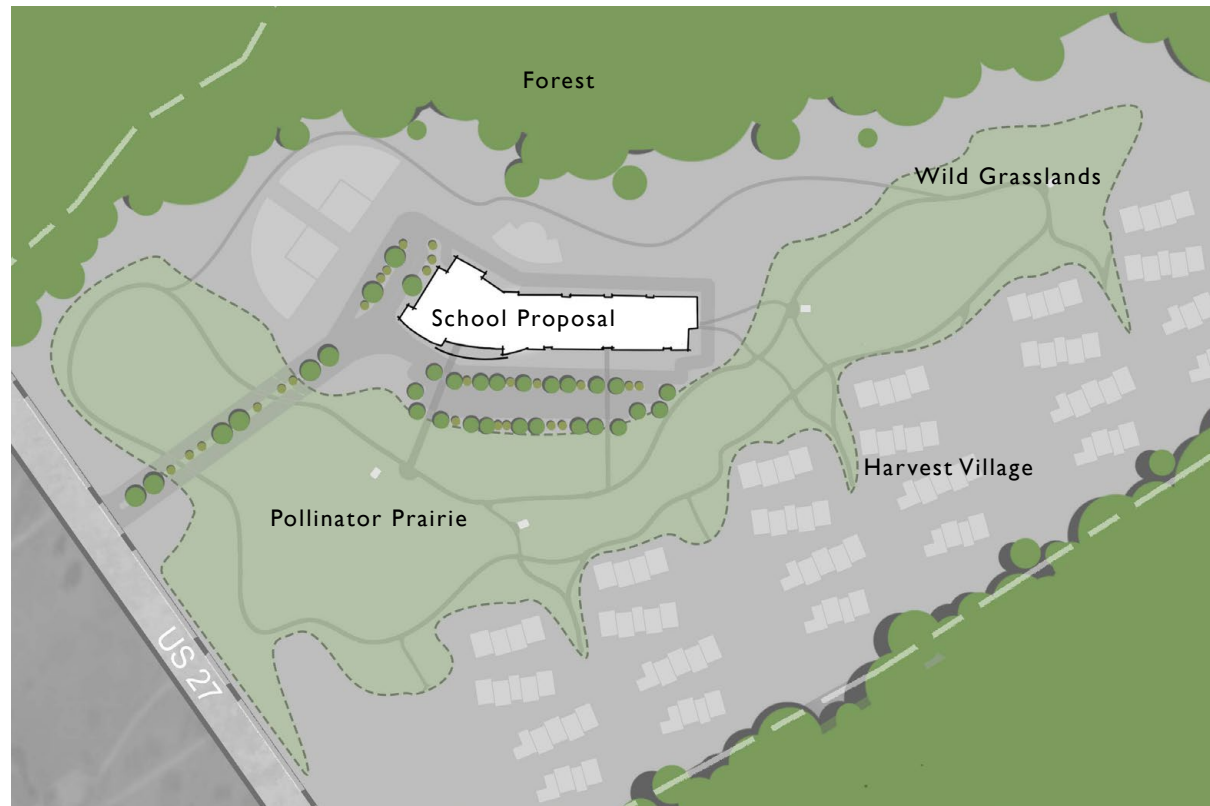
Ohio



Oxford, OH



Site Plan



Introduction

# CLIMATE ZONE 5A

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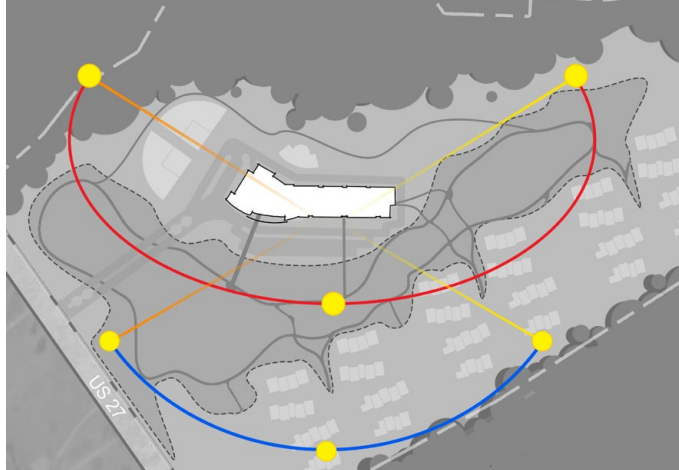
Market Potential

Environmental Quality

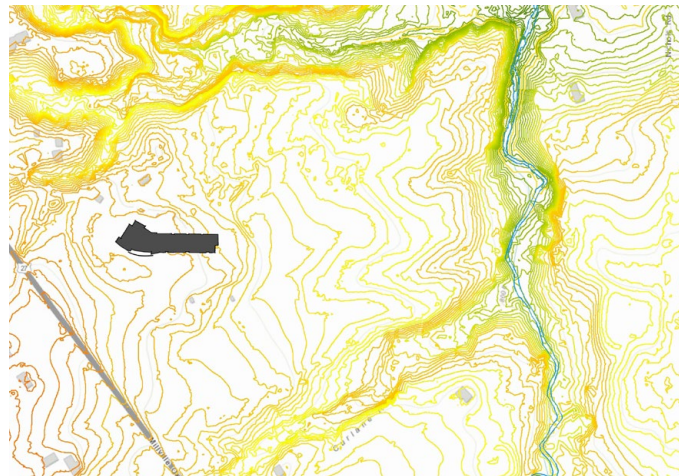
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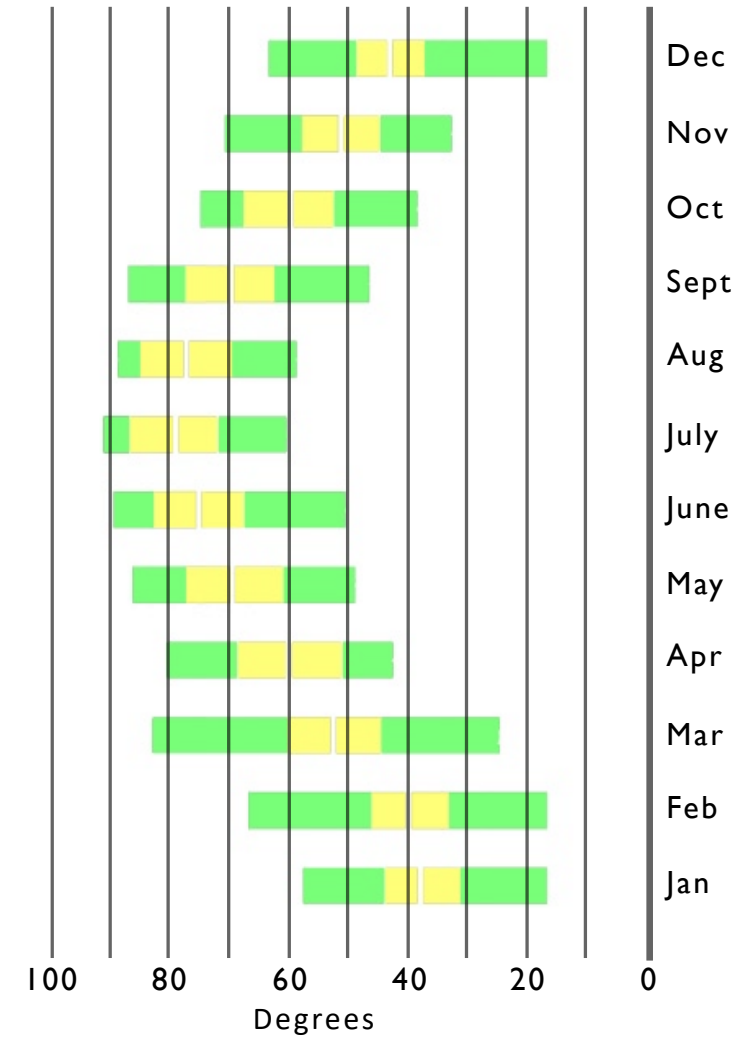
Sun Path



Water Runoff



Temperature By Month



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# THE COMMUNITY

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STUDENT

### Goals For School Users

- Interaction with natural ecosystems
- Respect for the environment
- Learning to read building systems and adjusting settings



TEACHER

- Incorporating system use and environmental lessons into the curriculum
- Utilizing outdoor learning spaces
- Showing students how to understand feedback technology



CUSTODIAN

- Understanding maintenance schedules and what needs to be outsourced
- Reading feedback dashboards and adjusting systems accordingly
- Becoming properly trained or qualified

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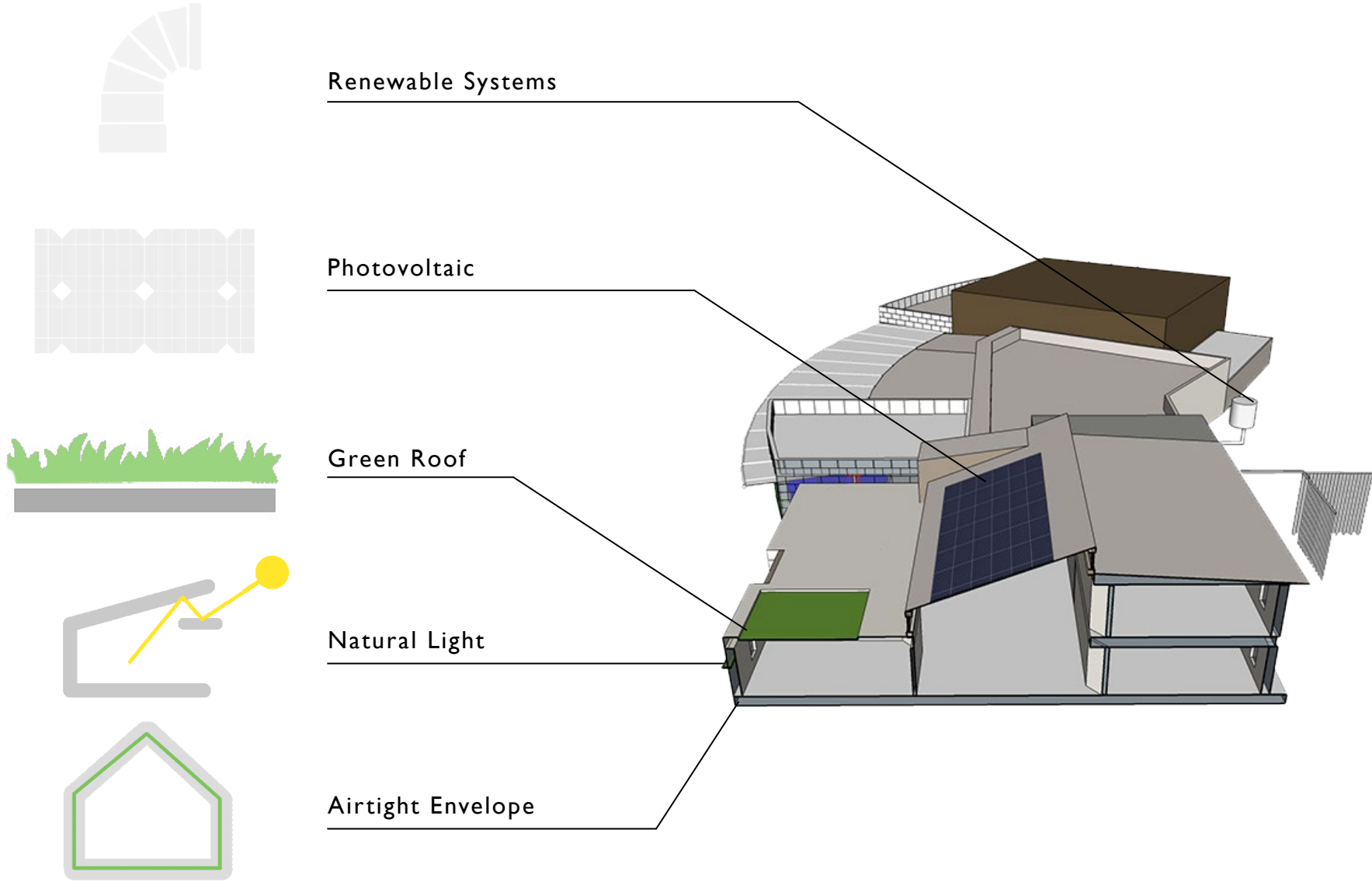
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# ENERGY OVERVIEW



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# PHOTO VOLTAIC SYSTEM

## Energy Performance

134,216 kWh/yr



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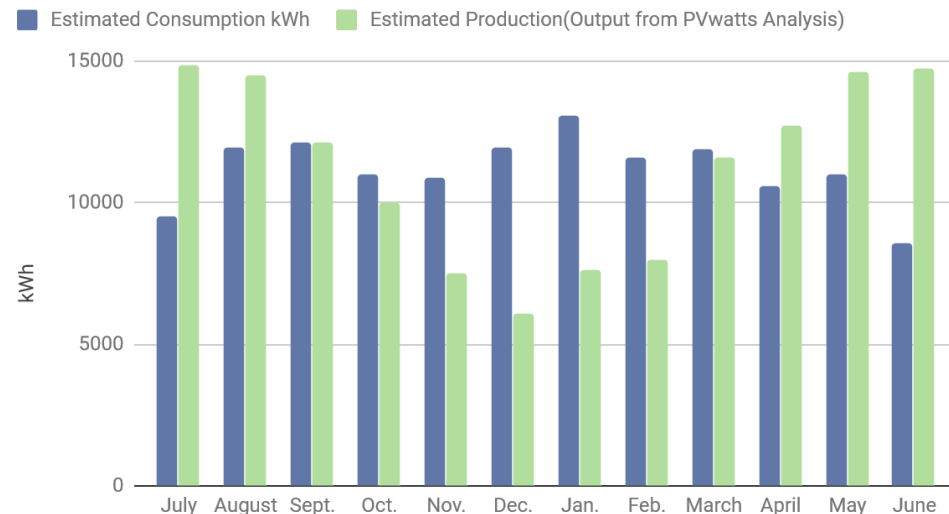
Innovation

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### Derating Factors

Derate Factor	Loss
Soiling	2.00%
Shading	2.00%
Snow	2.00%
Mismatch	2.00%
Wiring	2.00%
Connections	0.50%
Light Induced Degradation	0.00%
Nameplate	1.00%
Availability	2.00%
<b>Total Derate Factor</b>	<b>12.74%</b>

### Energy Consumption vs. Production



### Average Production

Month	Solar Radiation *Average	AC Energy (kWh)	Cost Savings
January	2.75	7,631	1,030.19
February	3.30	7,942	1,072.17
March	4.49	11,591	1,564.79
April	5.24	12,677	1,711.40
May	6.09	14,631	1,975.19
June	6.49	14,740	1,989.90
July	6.35	14,826	2,001.51
August	6.25	14,506	1,958.31
September	5.28	12,116	1,635.66
October	4.11	10,007	1,350.95
November	2.97	7,489	1,011.02
December	2.26	6,060	818.10
Annual	4.63	134,216	18,119.16



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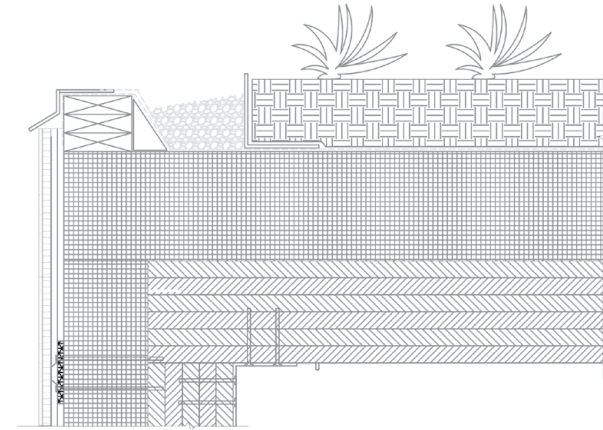
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# GREEN ROOF

Green Roof Tray System



Green Roof Section



Green Roof Terrace



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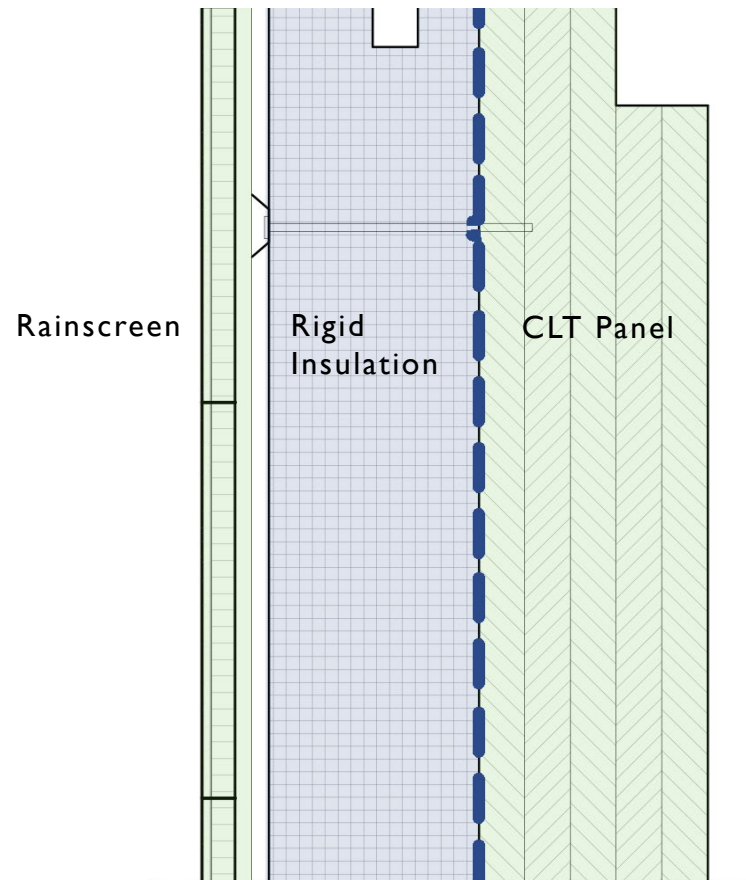
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# ENVELOPE

Envelope Section



## Control Layers

- Thermal**  
 Gutex Multitherm Wood Fiberboard Insulation
- Water, Air, Vapor**  
 Pro Clima DA Wrap  
 Tescon Vana Tape

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# NATURAL LIGHTING

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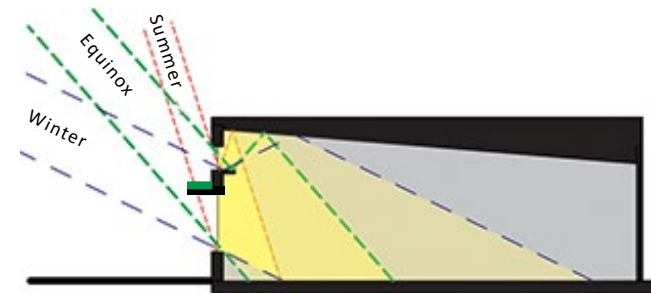
Closing Remarks

## Zola Thermoclad

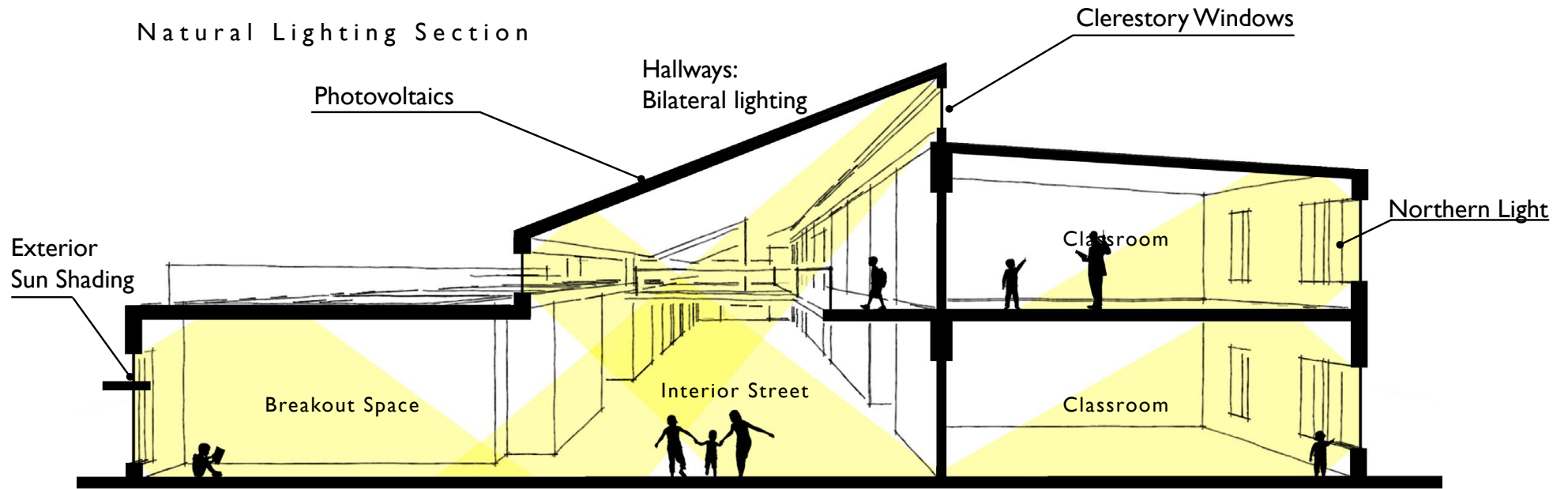


Selected window:  
 Zola Thermo Clad  
 Overall U-Value: 0.14  
 Center-of-glass U-Value: 0.09  
 SHGC: 0.5  
 VT: 71%  
 2 Low-e Coatings  
 Triple Pane, Argon  
 60 years expected service life

## Annual Sun Angle



## Natural Lighting Section



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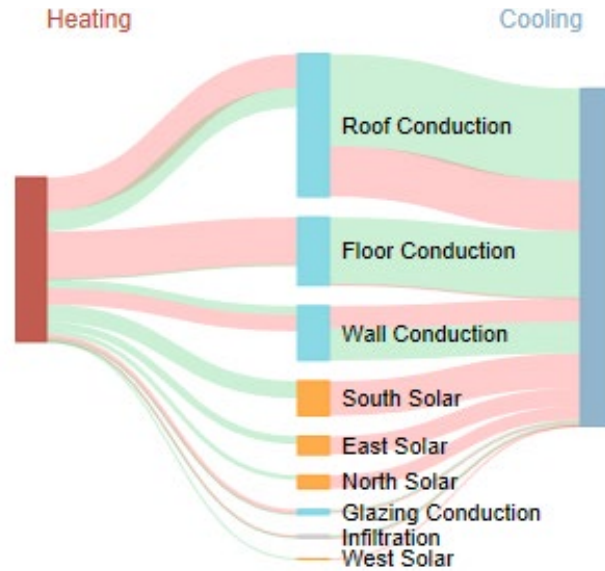
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## PRELIMINARY SEFAIRA MODELING

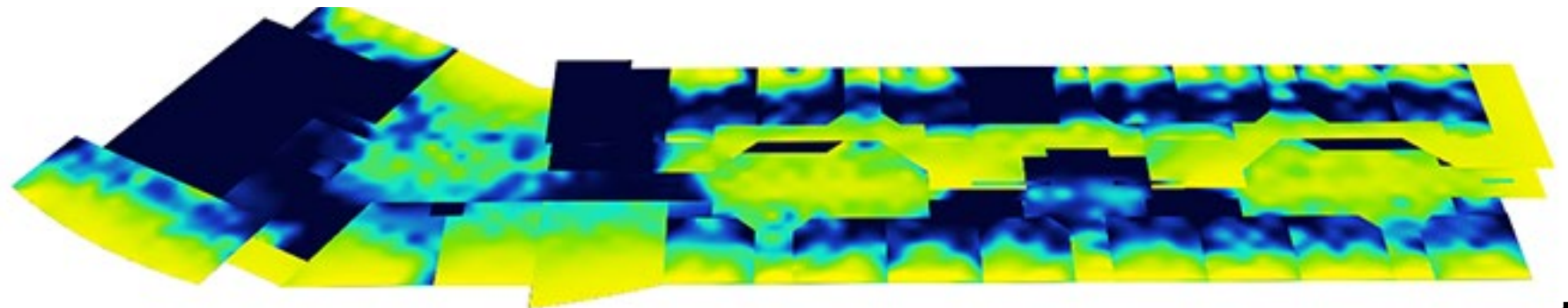
Sefaira Heating and Cooling Loads



Sefaira Energy Profile



Sefaira Natural Light Analysis



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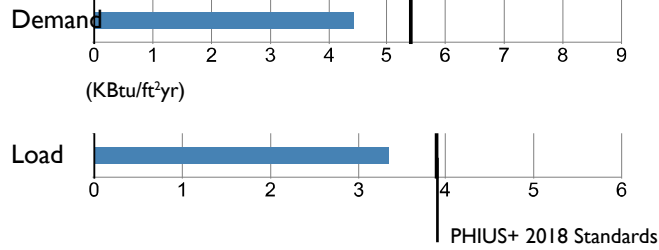
Environmental Quality

Innovation

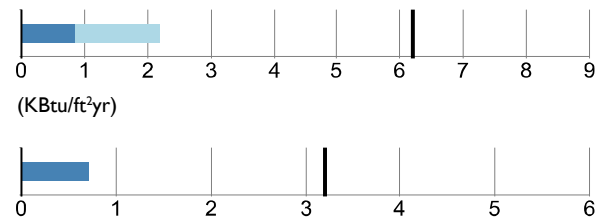
Closing Remarks

# PASSIVE HOUSE CRITERIA

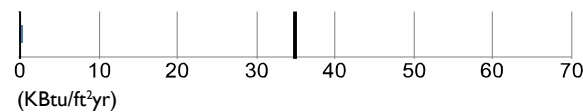
## Heating



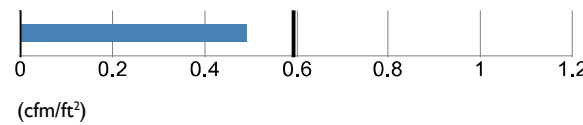
## Cooling



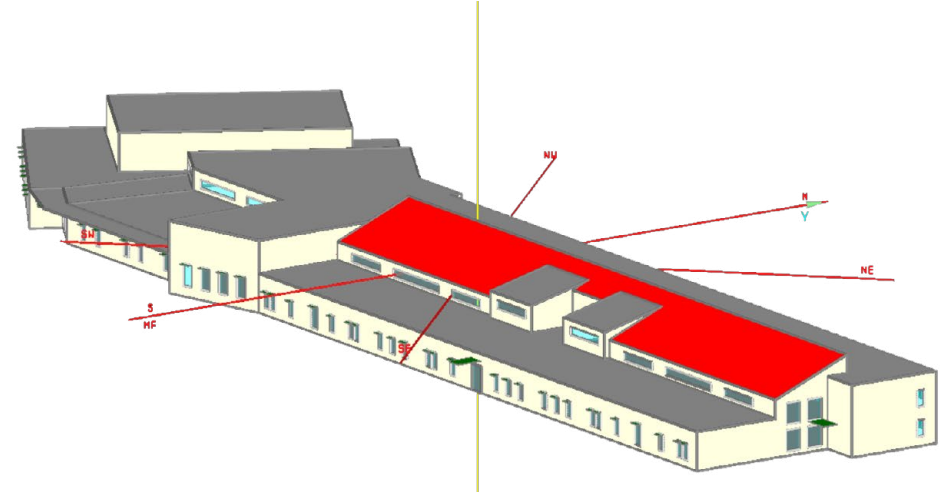
## Source Energy



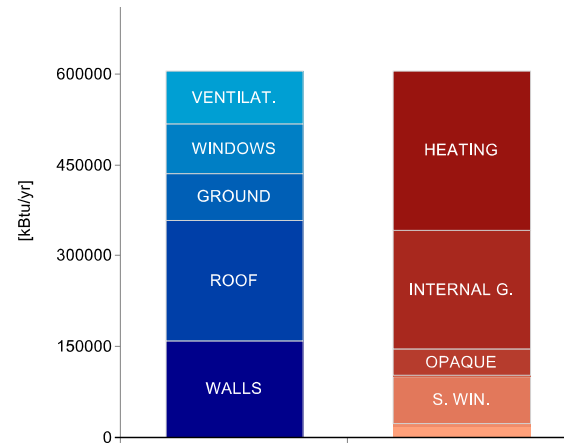
## Air Tightness



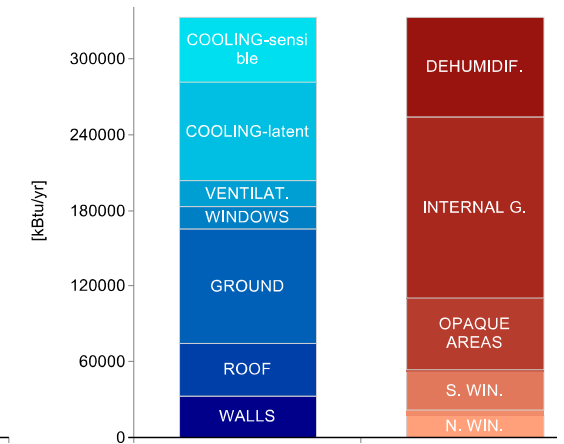
## WUFI Passive Model



### Winter Energy Balance



### Summer Energy Balance



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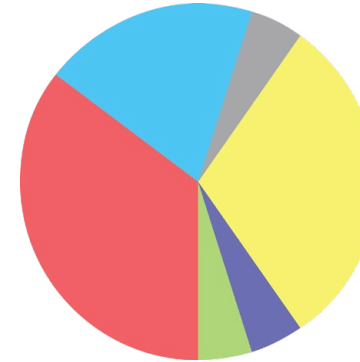
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## ENERGY USAGE COMPARISON

### Traditional School Energy Usage

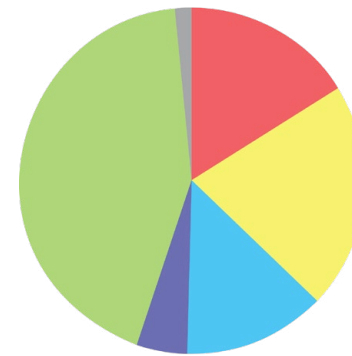
Space Heating	35%
Lighting	30%
Cooling	20%
Water Heating	5%
Plug Loads	5%
Ventilation	5%



Total Energy Usage : **5,085,115 kBTU/yr**

### Sowing Seeds Energy Usage

Space Heating	16%
Lighting	21%
Cooling	14%
Water Heating	4%
Plug Loads	43%
Ventilation	2%



Total Energy Usage : **452,977 kBTU/yr**

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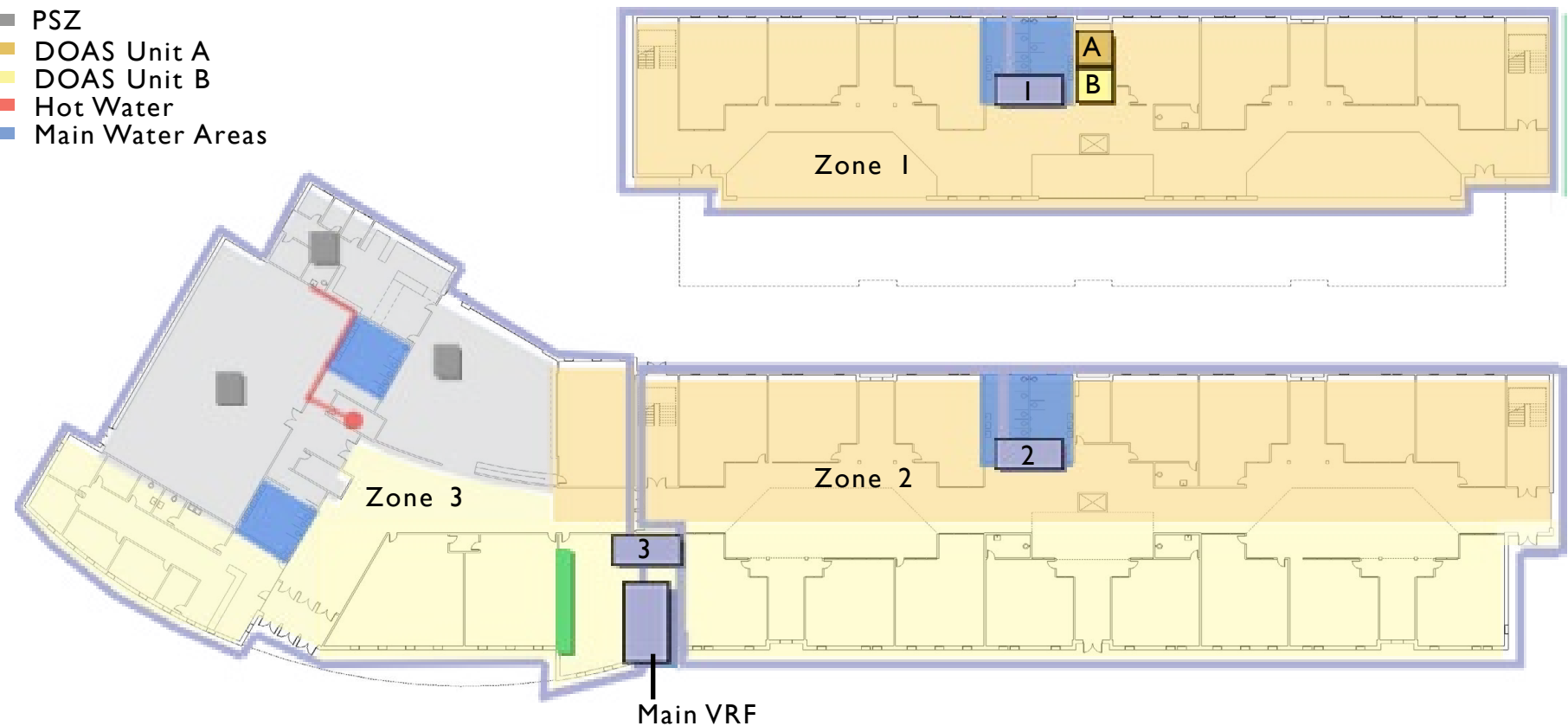
Innovation

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# MECHANICAL SYSTEM INTEGRATION

## Integration Plan

- Electric Switchbox
- VRF Branch Boxes
- PSZ
- DOAS Unit A
- DOAS Unit B
- Hot Water
- Main Water Areas



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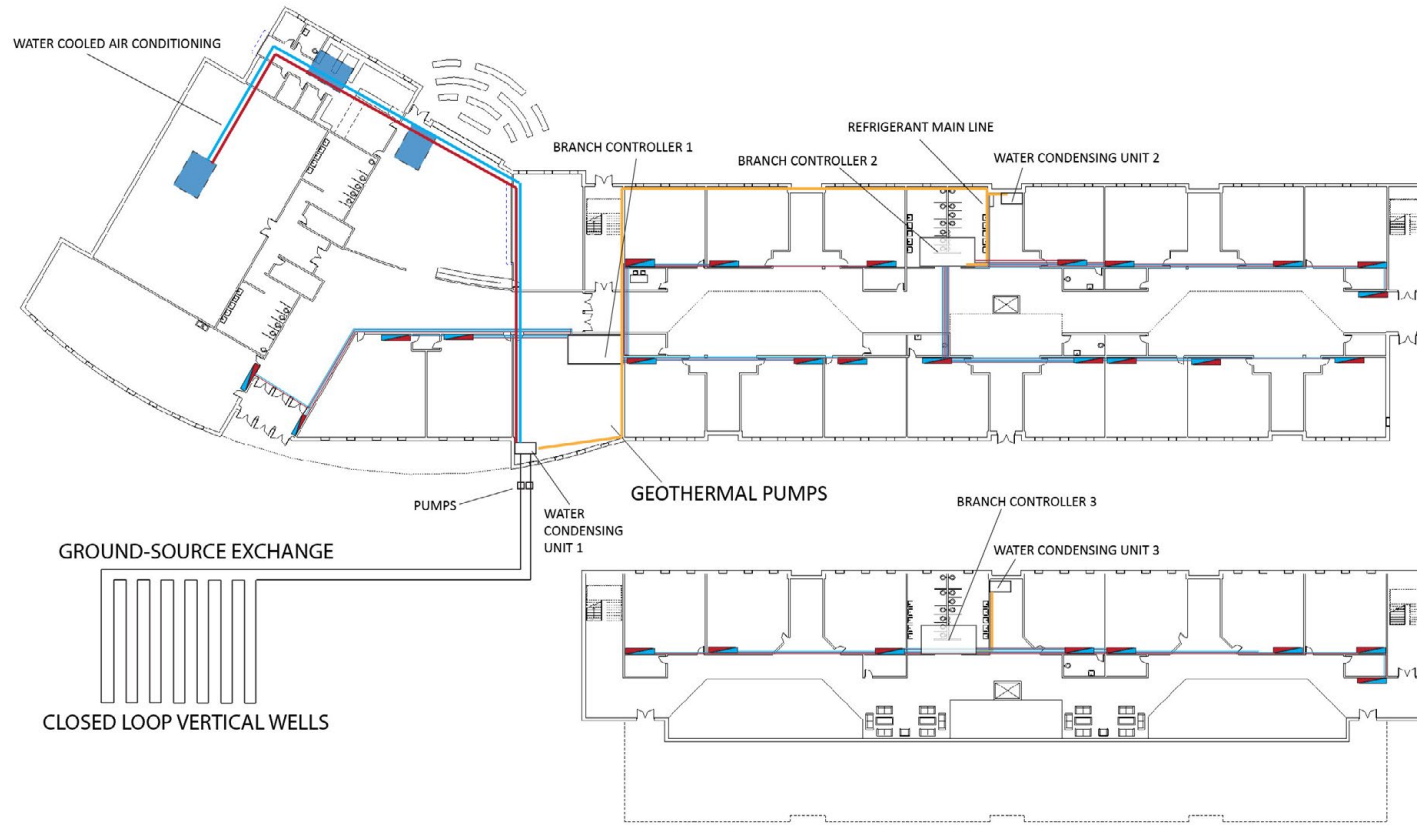
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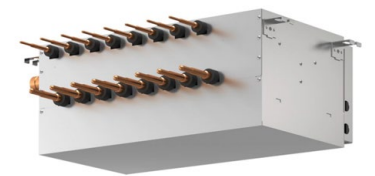
# VARIABLE REFRIGERANT FLOW SYSTEM



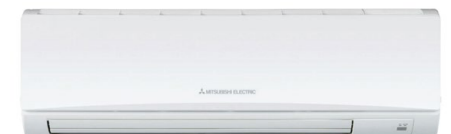
Mitsubishi VRF



Branch Controller



High Wall Unit



**Mitsubishi City Multi VRF Water Source Units**

Nominal Cooling Capacity (BTU/h):.....(2) 192,000 BTU/h; (1) 288,000 BTU/hr  
 Nominal Heating Capacity (BTU/h):.....(2) 215,000 BTU/hr; (1) 320,000 BTU/hr  
 Flow Rate Nominal / Actual (gpm):..... (2) 31.7; (1) 63.4



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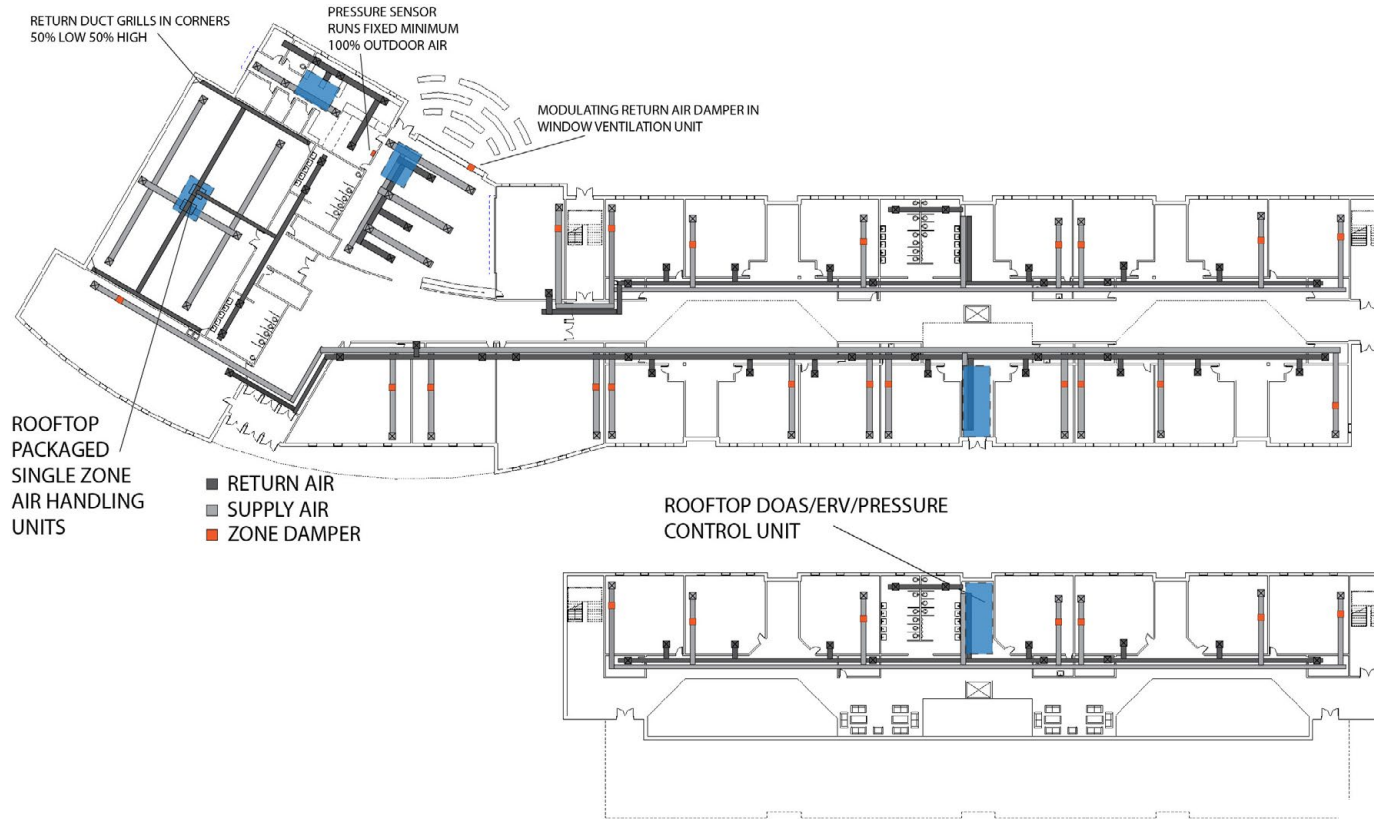
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# DEDICATED OUTDOOR AIR SYSTEM



## Mitsubishi PremiSys Dedicated Outdoor Air System

Outdoor Air Volume.....6,000 CFM

Exhaust Air Volume.....5,000 CFM



Gym Packaged Single Zone Unit



Kitchen PSZ



Mitsubishi DOAS Unit



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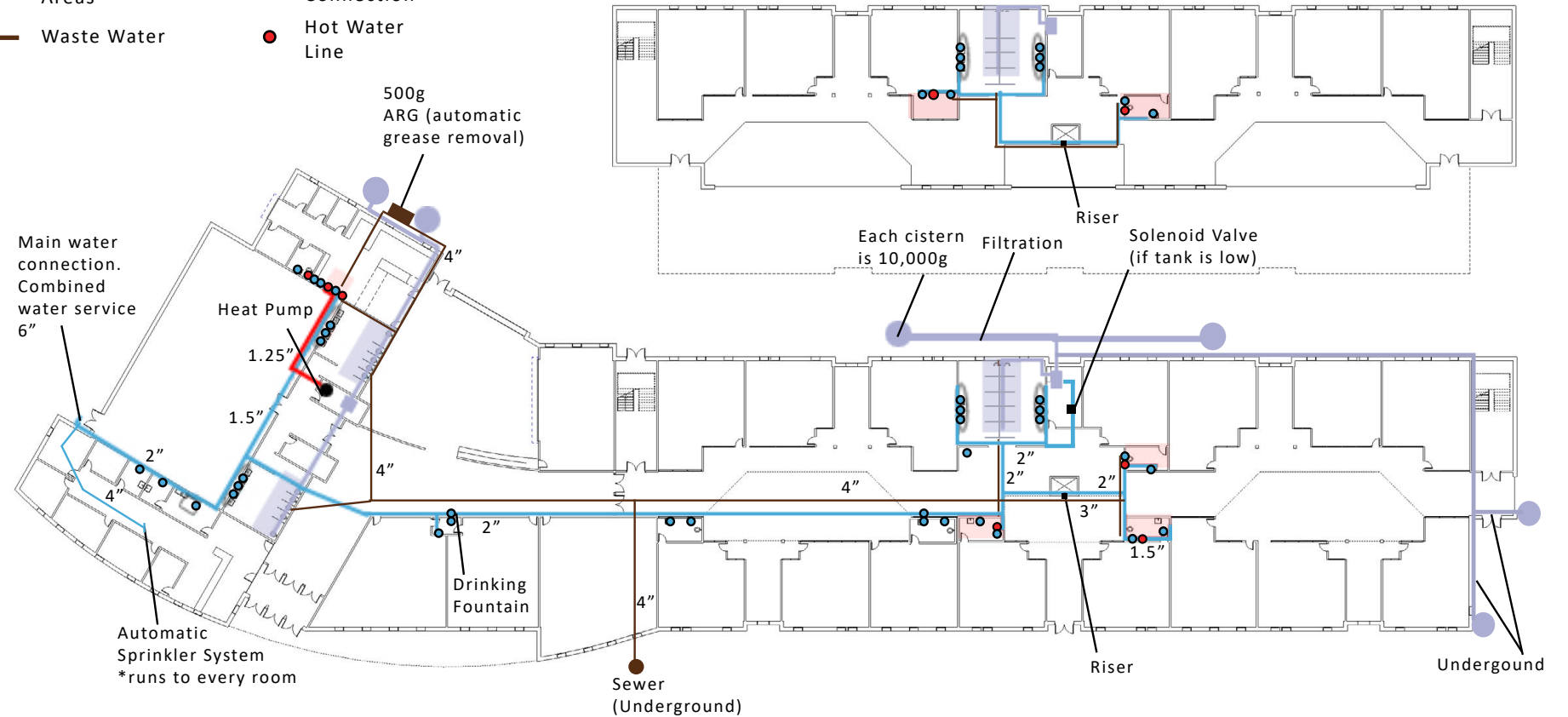
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# WATER SYSTEM

- Rainwater Collection Cistern
- Rainwater Group Toilets
- Hot Water Areas
- Waste Water
- Hot Water Line
- Cold Water Connection
- Hot Water Connection
- Hot Water Line



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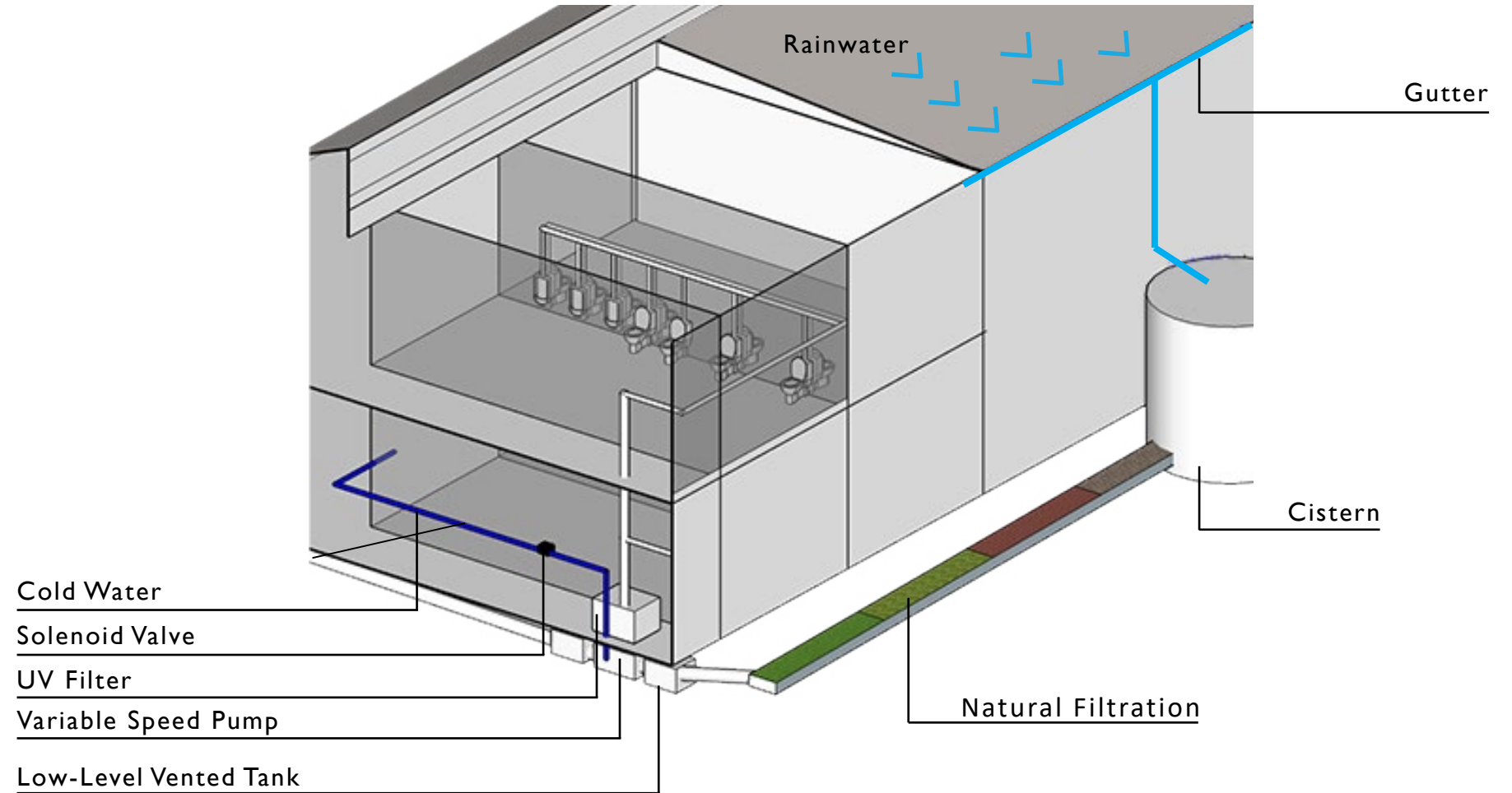
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## RAIN WATER REUSE



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# LIGHTING PLAN

Ⓢ	DAYLIGHT SENSOR
Ⓢ	OCCUPANCY SENSOR
\$	CONTROL SWITCH
☒	LED ARCHITECTURAL BASKET TROFFER
▭	LED LINEAR LOW-BAY LUMINAIRE



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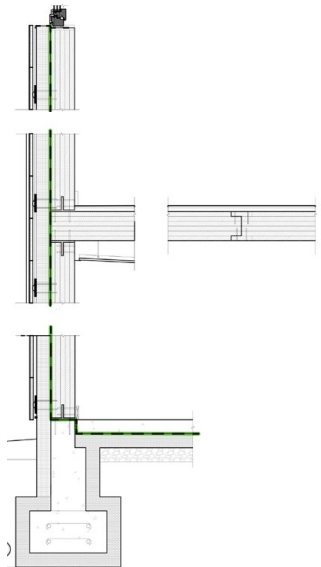
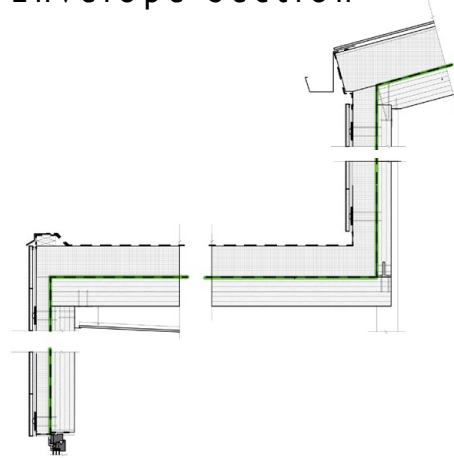
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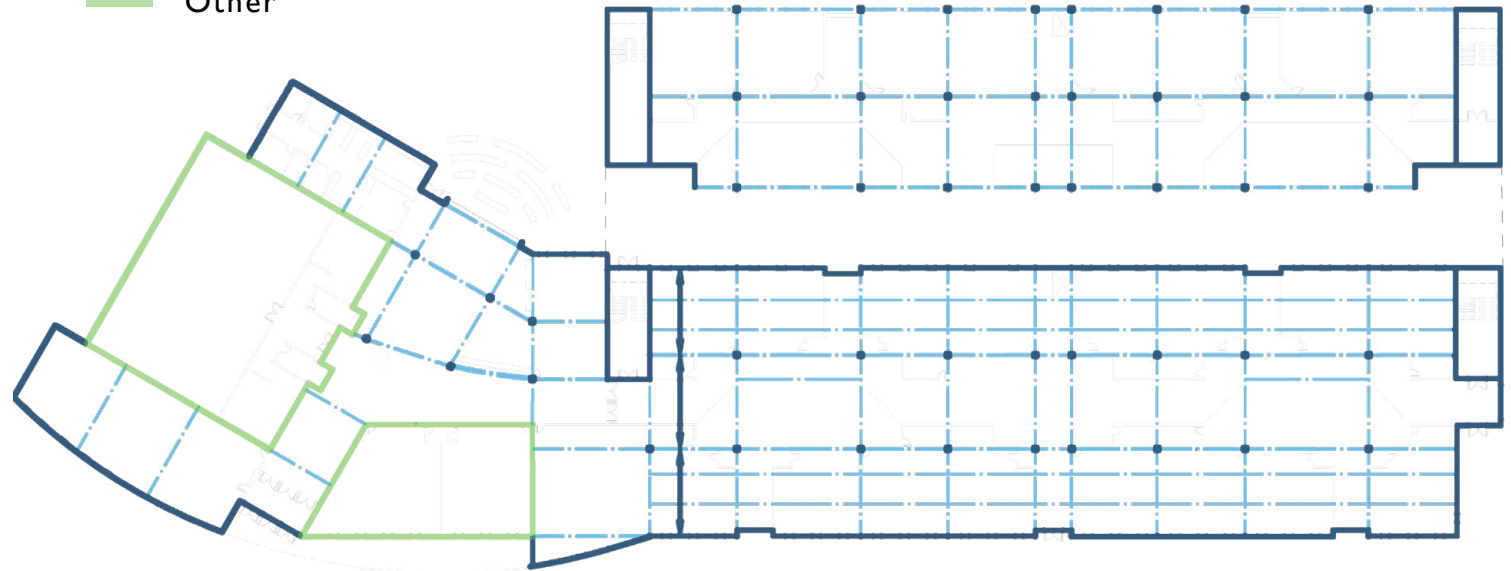
# STRUCTURE

## Envelope Section



## Structural Plan

- Glulam Beam
- CLT Panel
- Other



## CLT & Glulam Construction



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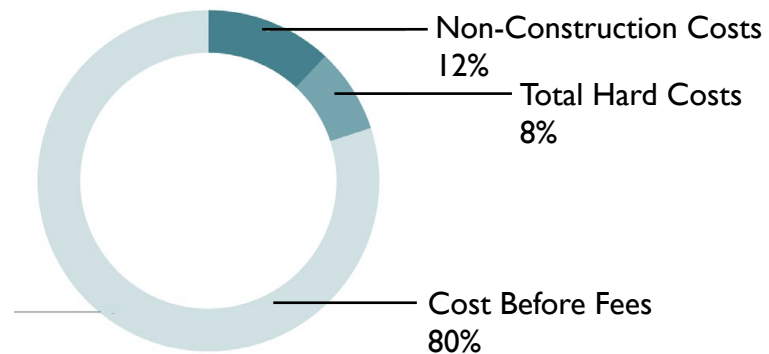
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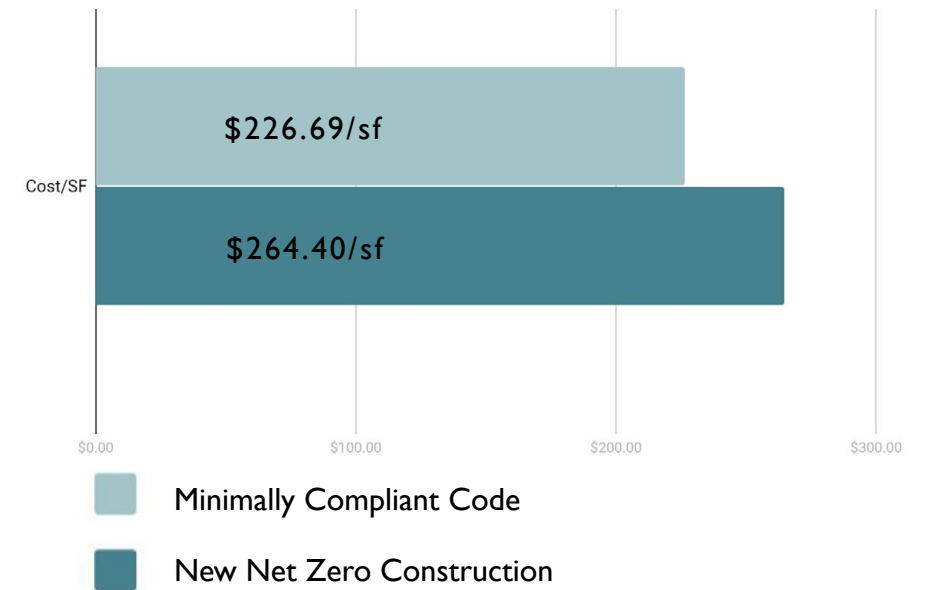
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# FINANCIAL ANALYSIS

## Price Breakdown



## Construction Costs



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# FINANCIAL ANALYSIS

## Marshall Elementary vs. Sowing Seeds

SCHEMATIC DESIGN ESTIMATE	MAUD MARSHALL ELEMENTARY SCHOOL BASE LINE COSTS			ADD/ SUBTRACT ADJUSTMENTS TO BASE LINE COSTS			SOWING SEEDS ACADEMY TEAM PROJECT COST		
	%	COST GSF	COST TOTAL	%	COST GSF	COST TOTAL	%	COST GSF	COST TOTAL
Division 01.0 General Conditions	2.22%	\$5.55	\$327,170.00	-1.06%	-\$2.65	\$156,100.00	1.00%	\$2.90	171,070
Division 02.0- Demolition	3.43%	\$8.55	\$504,406.00	-0.42%	-\$1.05	\$61,862	2.58%	\$7.50	\$442,544
Division 03.0- Foundation	2.17%	\$5.42	\$319,550	-1.39%	-\$3.46	\$204,050	0.67%	\$1.96	\$115,500
Division 04.0 - Substructure	1.80%	\$4.48	\$264,525	2.48%	\$6.19	\$365,475	3.67%	\$10.68	\$630,000
Division 05.0 - Superstructure	5.24%	\$13.06	\$770,680	13.45%	\$33.55	\$1,979,320	16.03%	\$46.61	\$2,750,000
Division 06.0 - Exterior Closure	12.18%	\$30.37	\$1,791,618	-6.31%	-\$15.73	\$927,794	5.03%	\$14.64	\$863,824
Division 07.0 - Roof	2.39%	\$5.96	\$351,514	-0.24%	-\$0.59	\$34,974	1.84%	\$5.37	\$316,540
Division 08.0 - Interior Construction Partitions	4.41%	\$11.01	\$649,495	0.01%	\$0.02	\$925	3.79%	\$11.02	\$650,420
Division 09.0 -Interior Construction Finishes	3.16%	\$7.88	\$464,749	-0.59%	-\$1.48	\$87,097	2.20%	\$6.40	\$377,652
Division 10.0 - Interior Construction Specialties	3.99%	\$9.95	\$586,802	-0.84%	-\$2.09	\$123,367	2.70%	\$7.85	\$463,435
Division 11.0 - Equipment	3.51%	\$8.74	\$515,849	0.38%	\$0.94	\$55,751	3.33%	\$9.69	\$571,600
Division 14.0 - Conveying Systems	0.58%	\$1.44	\$85,000	-0.03%	-\$0.08	\$5,000	0.47%	\$1.36	\$80,000
Division 21.0 - Fire Suppression	0.88%	\$2.19	\$129,105	0.27%	\$0.66	\$39,045	0.98%	\$2.85	\$168,150
Division 22.0 - Plumbing	3.14%	\$7.83	\$462,181	0.05%	\$0.12	\$7,064	2.73%	\$7.95	\$469,245
Division 23.0 - HVAC	10.73%	\$26.75	\$1,578,056	8.23%	\$20.51	\$1,210,291	16.25%	\$47.26	\$2,788,347
Division 26.0 - Electrical	7.13%	\$17.78	\$1,048,770	3.29%	\$8.21	\$484,400	8.93%	\$25.99	\$1,533,170
Division 27.0 - Technology	3.88%	\$9.68	\$571,049	1.17%	\$2.92	\$172,351	4.33%	\$12.60	\$743,400
Division 31.0 - Earthwork	8.38%	\$20.89	\$1,232,614	-0.92%	-\$2.30	\$135,862	6.39%	\$18.59	\$1,096,752
Division 32.0 - Site Utilities	2.81%	\$7.00	\$412,733	0.35%	\$0.88	\$51,912	2.71%	\$7.88	\$464,645
Division 33.0 - Site Improvements	6.83%	\$17.03	\$1,004,668	-2.76%	-\$6.88	\$405,649	3.49%	\$10.15	\$599,019
Gymnasium Renovation Allowance--HVAC	2.07%	\$5.16	\$304,328			\$0	1.77%	\$5.16	\$304,328
<b>SUBTOTAL</b>	<b>90.91%</b>	<b>\$226.69</b>	<b>\$13,374,861</b>			<b>\$2,224,779</b>	<b>90.91%</b>	<b>\$264.40</b>	<b>\$15,599,640</b>
Design Contingency (7%)	7.00%	\$15.87	936,240				7.00%	\$18.51	1,091,975
Escalation Contingency (2%)	2.00%	\$4.53	267,497				2.00%	\$5.29	311,993
Payment and Performance Bonds (1%)	1.00%	\$2.27	133,749				1.00%	\$2.64	155,996
<b>TOTAL HARD COST</b>	<b>100.00%</b>	<b>\$249.36</b>	<b>14,712,347</b>			<b>2,447,256.6</b>	<b>100.00%</b>	<b>\$290.84</b>	<b>17,159,604</b>
Construction Management and Contract Administration	15%	\$34.00	\$2,006,229				15.00%	\$39.66	\$2,339,946
<b>TOTAL CONSTRUCTION COST</b>		<b>\$283.37</b>	<b>\$16,718,577</b>			<b>2,780,973.5</b>		<b>\$330.50</b>	<b>\$19,499,550</b>

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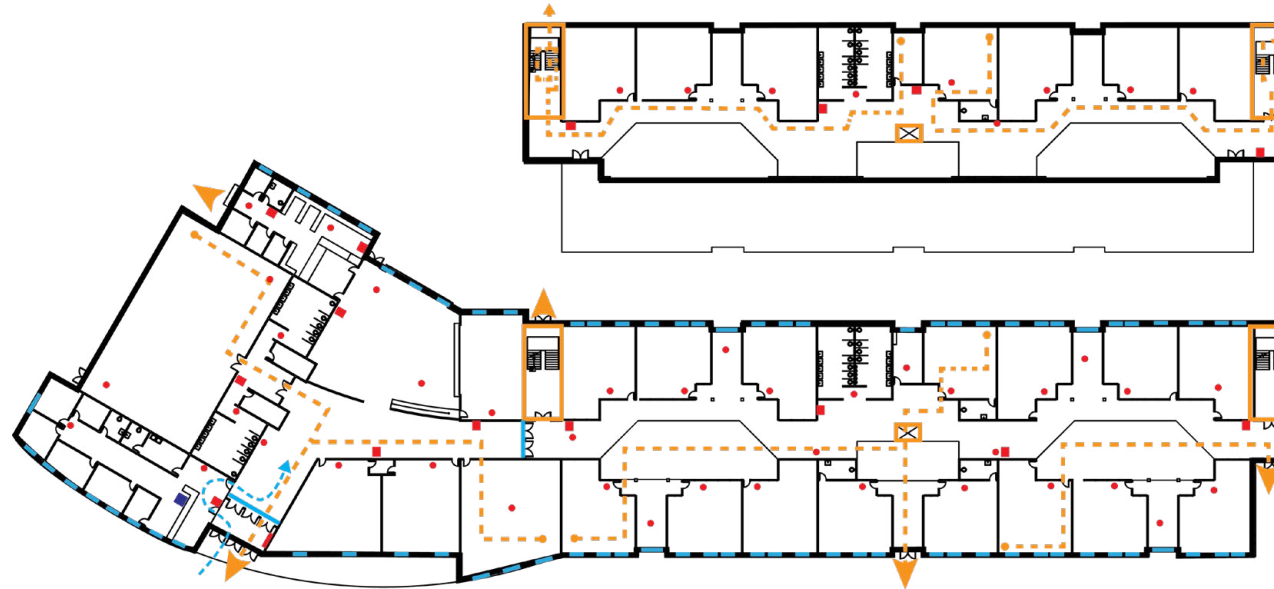
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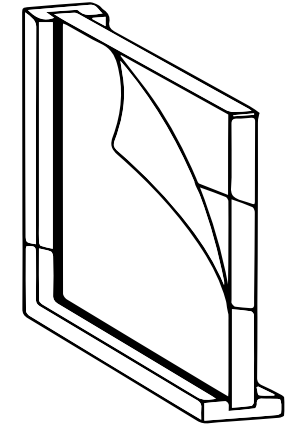
# SAFETY

Safety Plan



- KEY**
-  Means of Egress
  -  Egress Paths
  -  Fire-rated walls
  -  Fire extinguisher & pull
  -  Fire Alarm Control Panel
  -  Fire Alarm
  -  Armoured One Glass
  -  Gun Violence Barrier
  -  Panic Button
  -  Visitor circulation path

Armoured One Glazing





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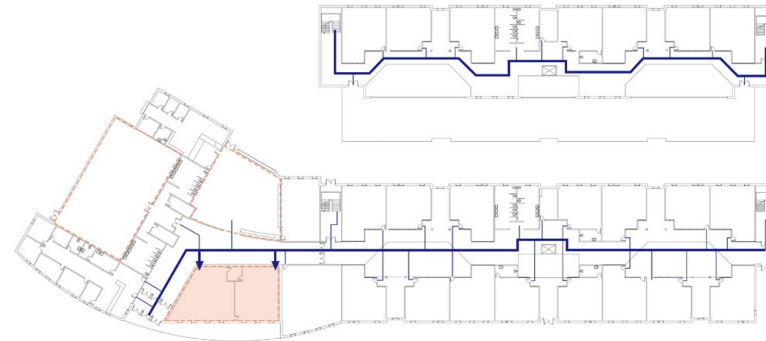
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## STORM SAFETY

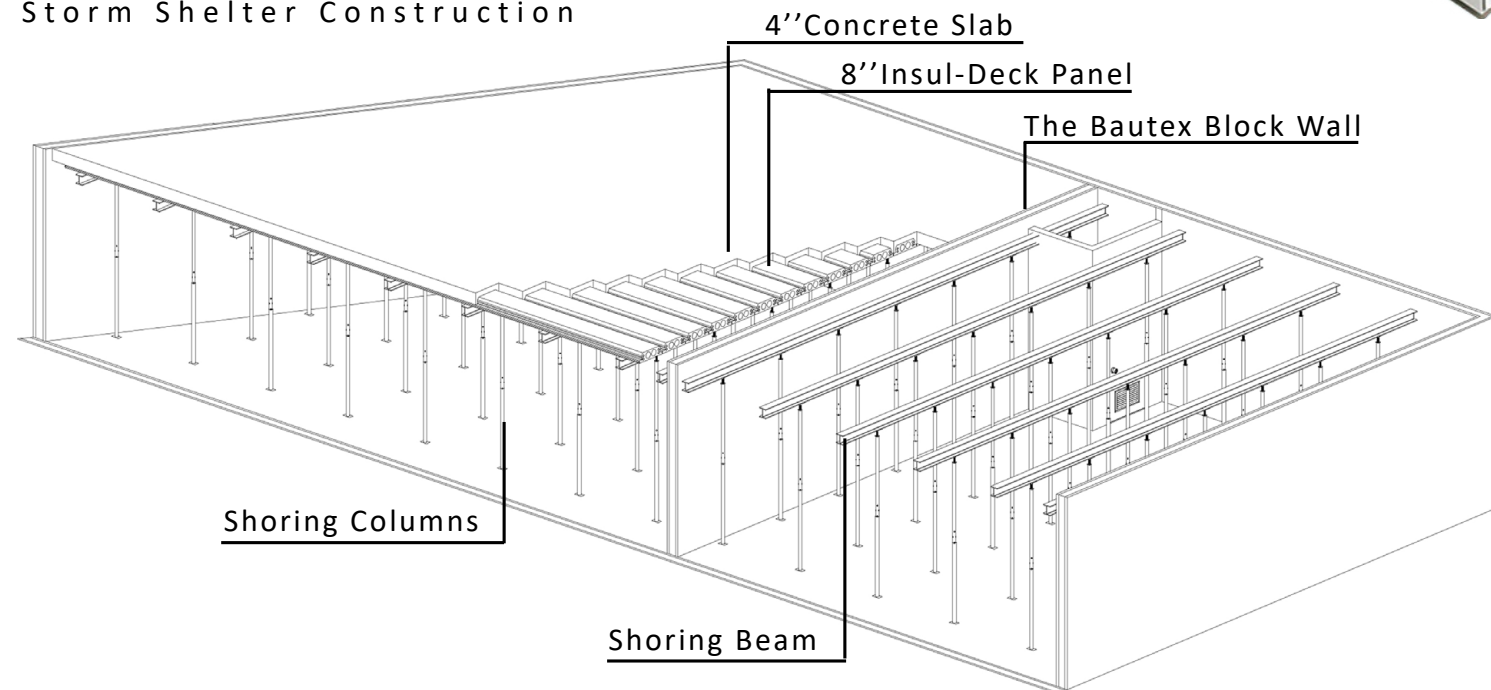
Storm Shelter Location



Storm Window



Storm Shelter Construction



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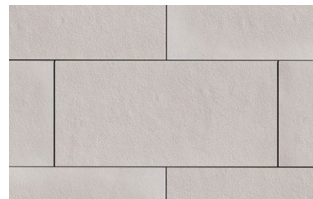
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# MATERIALS

Exterior Rendering of Academic Wing



Green Wall



Latham Limestone



Standing Seam  
Metal Roof



Recycled Aluminium  
Panels

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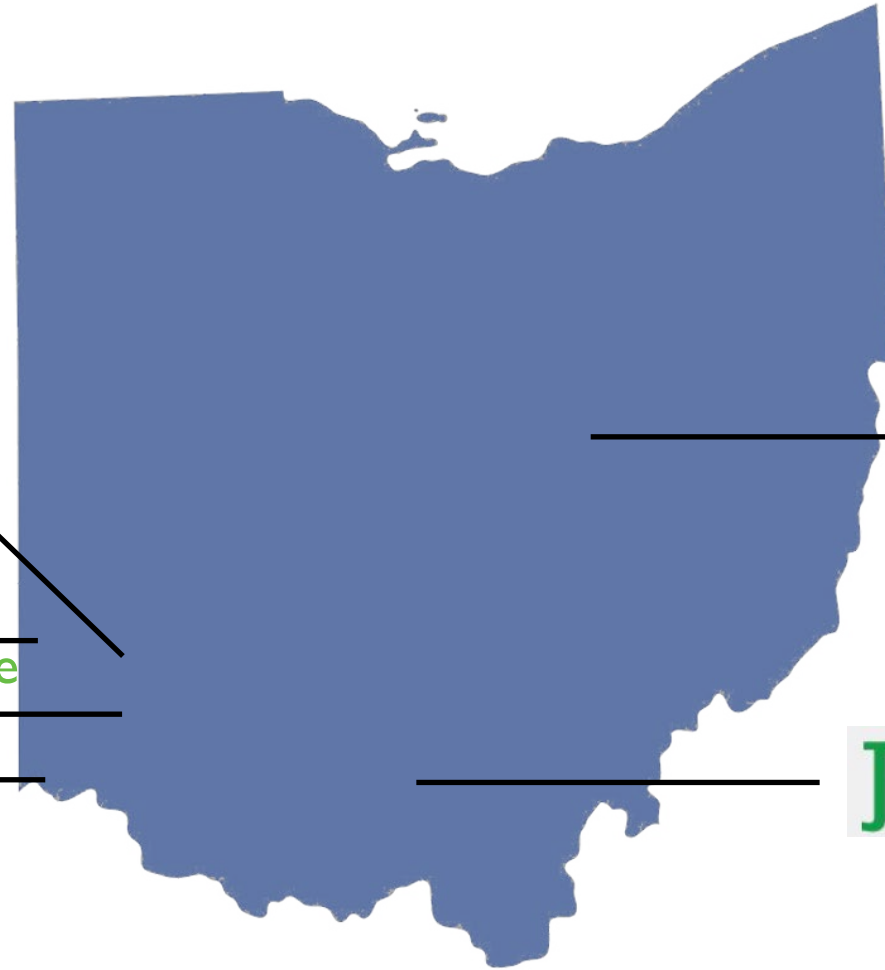
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# MATERIALS SOURCING



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# Floor Plans



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## Entrance Rendering



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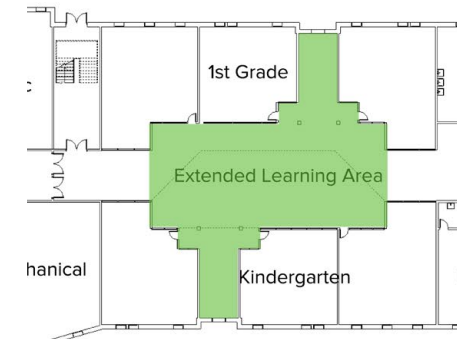
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## Interior Design

### Interior Street & Extended Learning Area



### ELA Plan



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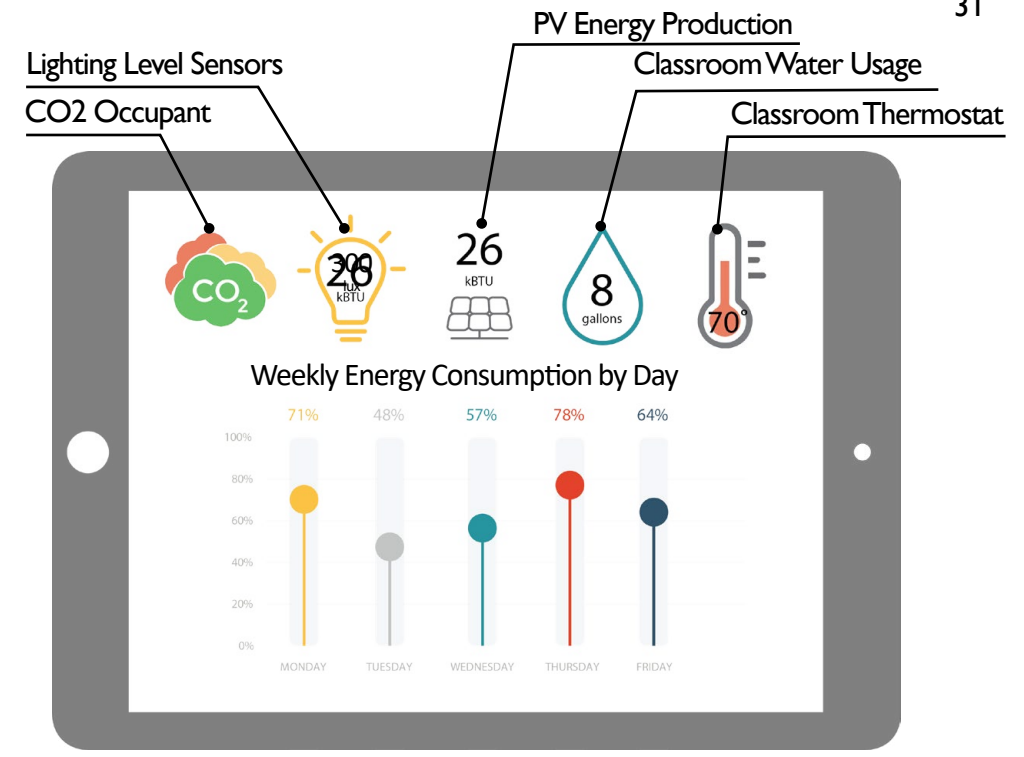
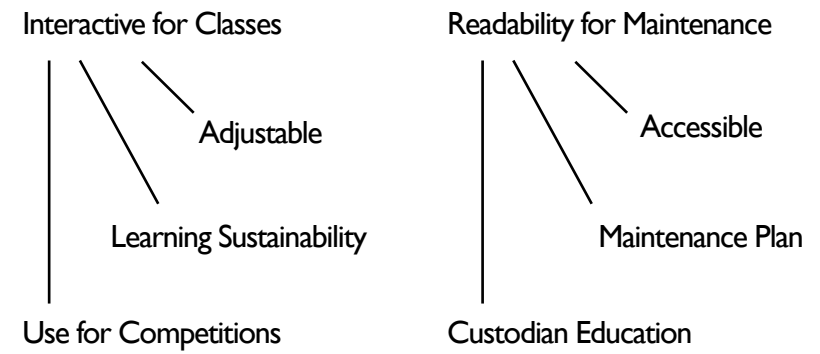
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# USER INTERFACE

## GOALS OF OPERATIONAL SYSTEMS



Mechanical Center Exterior

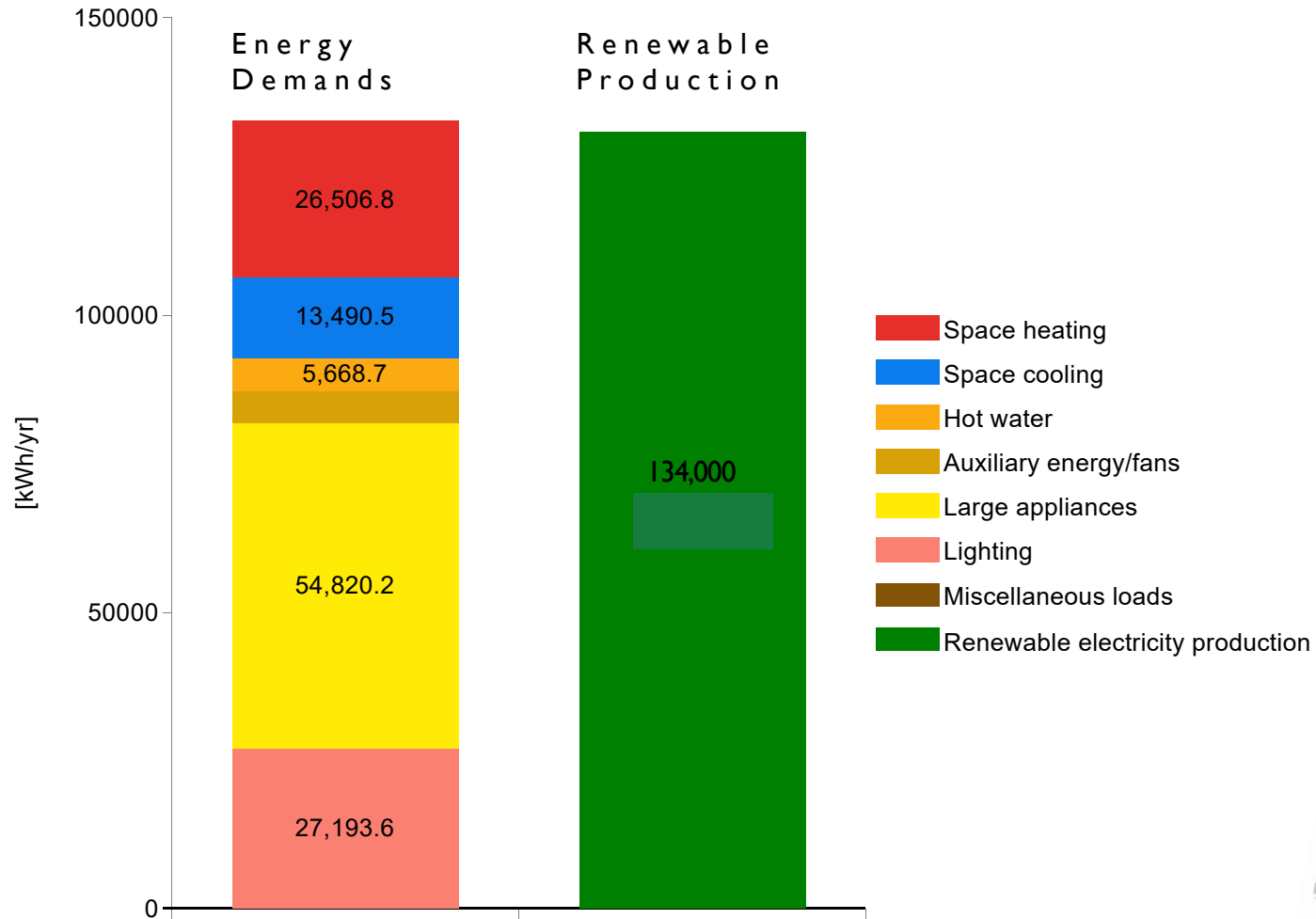


Mechanical Center Interior



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# ENERGY REDUCTION STRATEGIES



Colmac Heat Pump Hot Water Heater



Appliance Selections



Tunable White LED Troffer





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## EXISTING GYM RENOVATION

### Benefits

- Reduce carbon
- Reuse existing material and program space
- Upgrade to PHIUS+ standards
- Avoid costs associated with destruction and reconstruction

### Existing Gym



### Sowing Seeds Gym Incorporation



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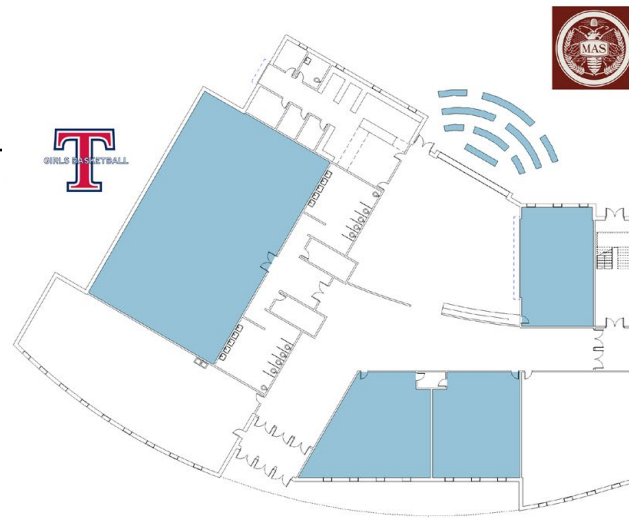
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# COMMUNITY USE



Talawanda HS Girls Basketball games and practices in the gymnasium



Oxford Community Arts Center - Introduction to Watercolors class



Math and English tutoring open to all students in the library



Miami Apiculture Society - Bee Keeping Demonstration in the outdoor classroom



Oxford Community Band regular practice in the music room

*Oxford Community Band*

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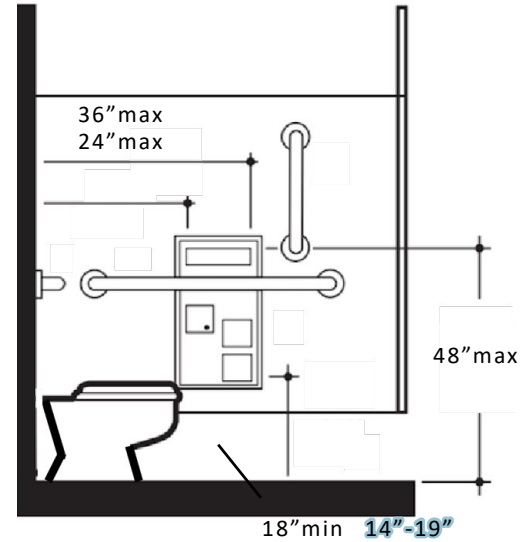
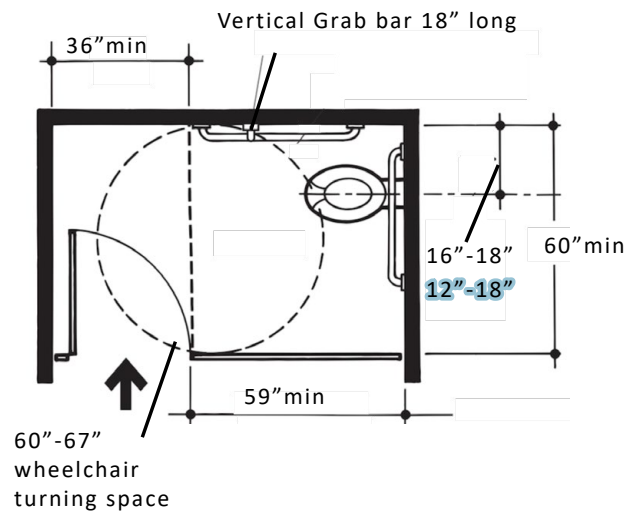
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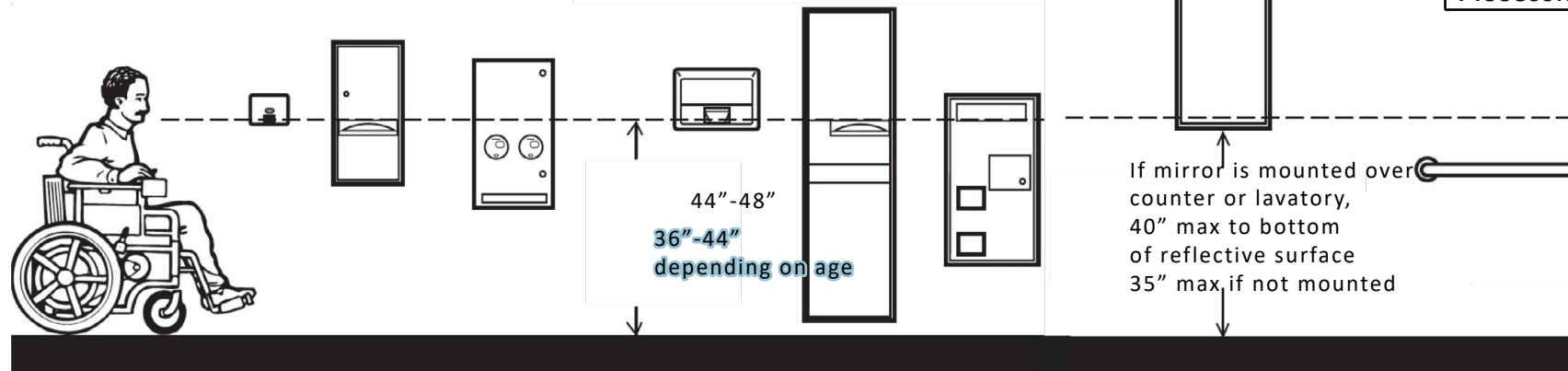
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# UNIVERSAL DESIGN



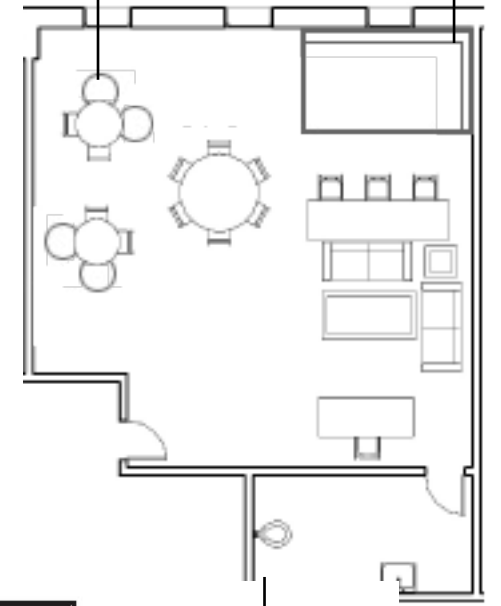
## Handicap Accessible Restroom Design



## Special Education Room

Bouncy Balls

Cushioned Mats



Accessible Bathroom

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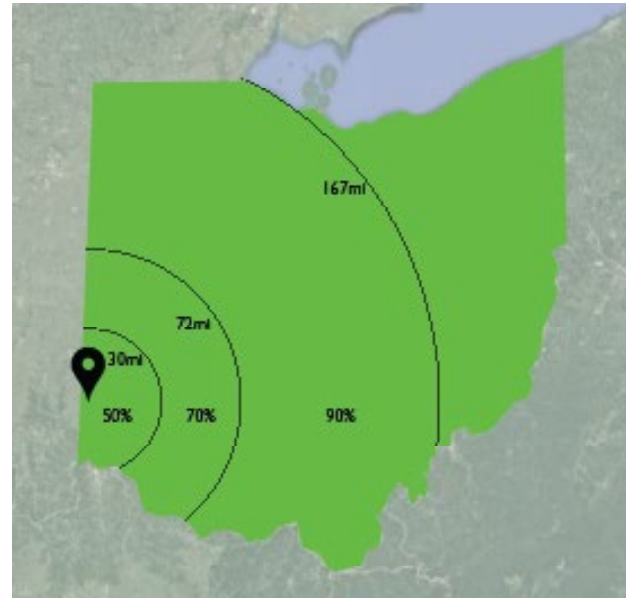
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# FEASIBILITY

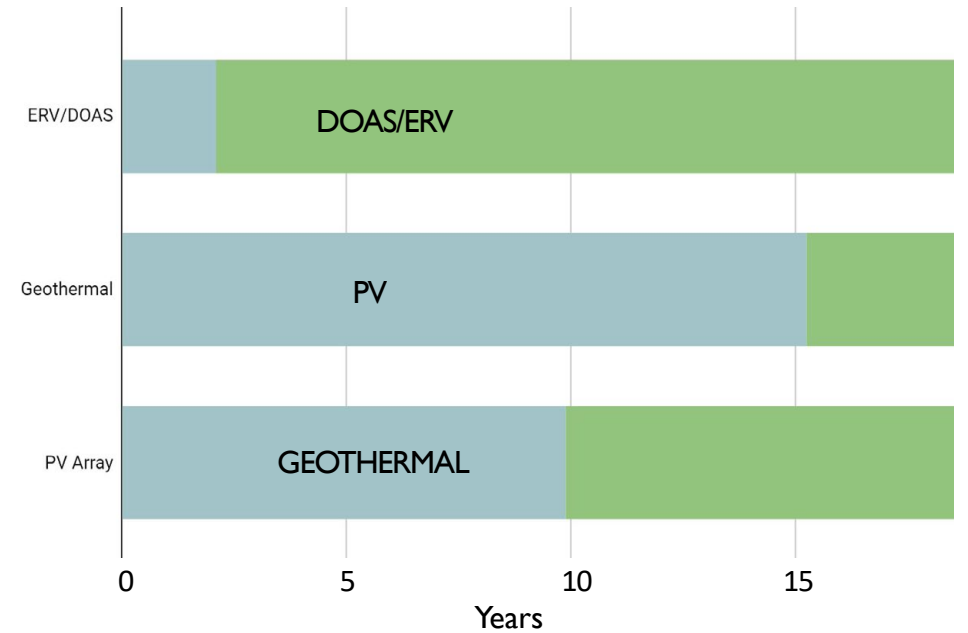
### Sourcing Radius



### Building Information Modeling

-   
 Collaborative Design
-   
 Coordinated Approach
-   
 Budget Reliability
-   
 Cohesive Data

### Return on Investment



- Years to Pay Back
- Savings

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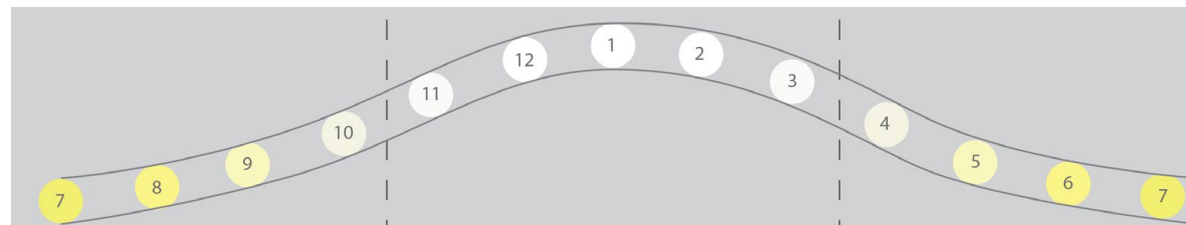
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# INDOOR ENVIRONMENT

## Interior Street



## Circadian Cycle



## Morning Light



## Afternoon Light



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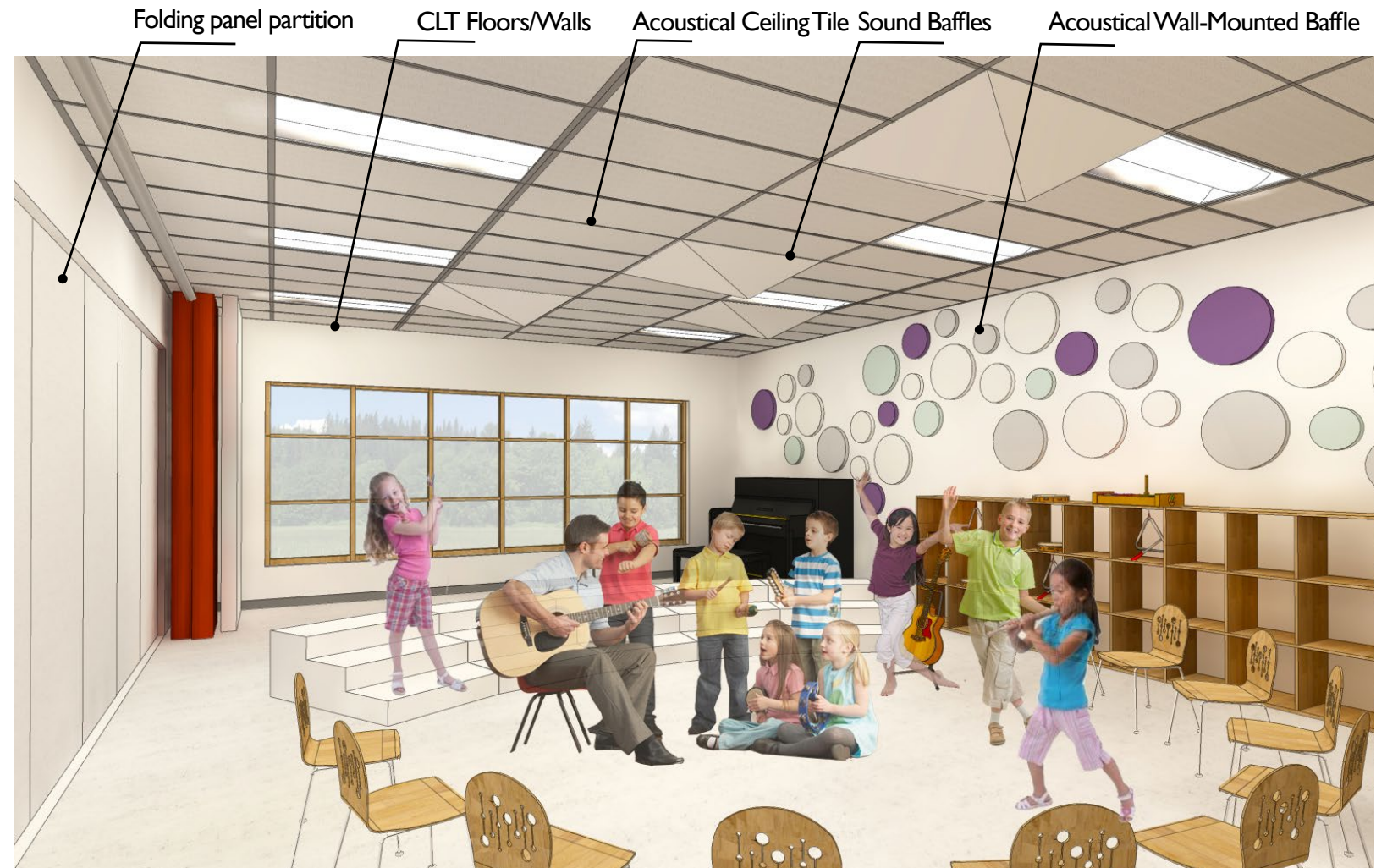
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# NOISE REDUCTION

## Music Room Acoustics



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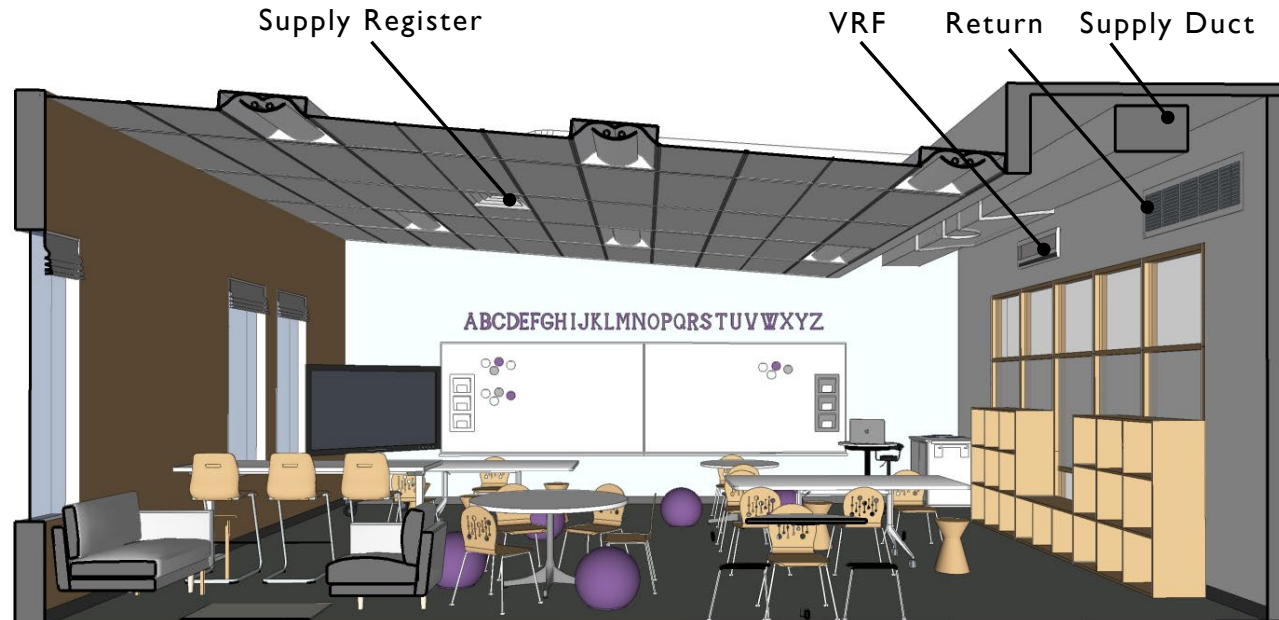
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# AIR QUALITY

Classroom HVAC Diagram



Air Circulation

	cfm/person	peak per-son/room	cfm/zone	supply duct size (.08)
<b>classroom</b>	<b>14.23</b>	<b>26</b>	<b>2,959.84</b>	<b>18" x 25"</b>
gym	20	400	8,000	30" x 35"
admin	20	25	500	10" x 11"
kitchen	15	20	300	9" x 9"
cafeteria	20	450	9,000	35" x 30"

Interior Green



Interior Comfort  
Factor Considerations:

- Variable Air Volume Box Dampers
- Demand Controlled Ventilation
- Bioclimatic Ionization

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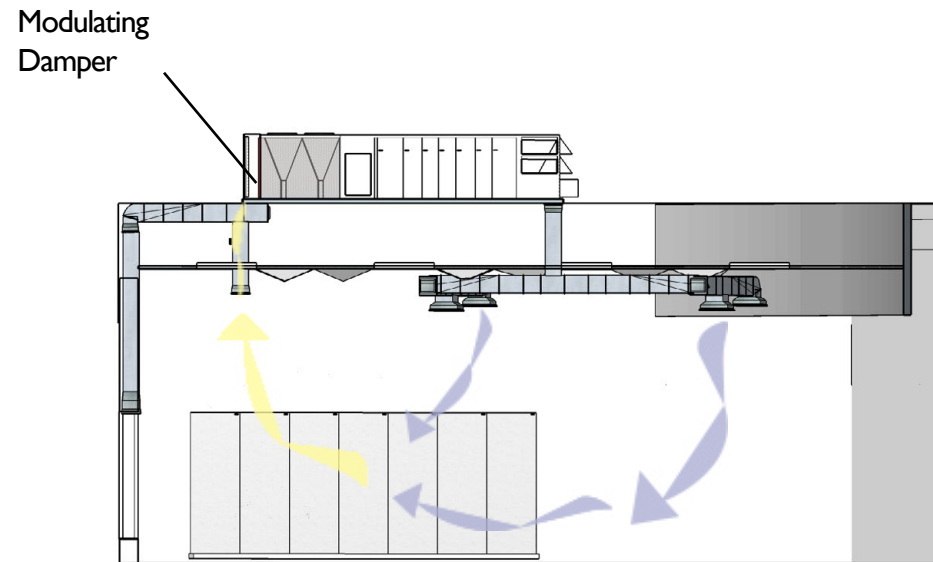
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## CAFETERIA

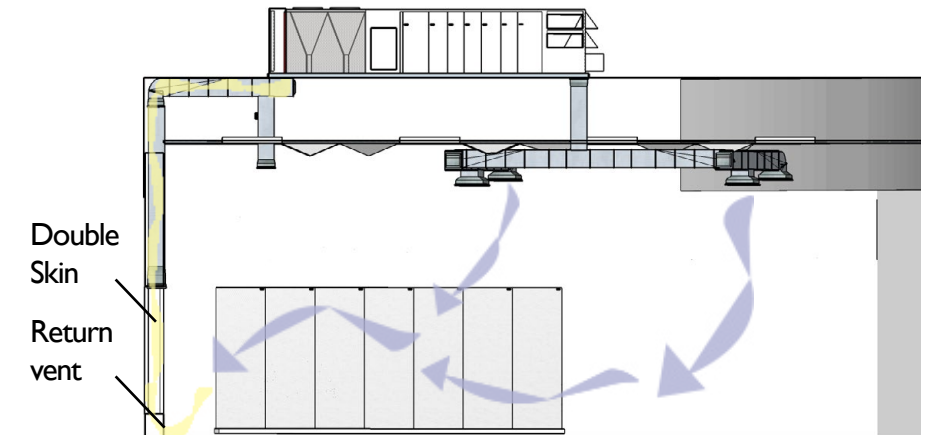


### ECONOMIZER DAYS

For days with an outside air temperature between 25-75°, the modulating damper senses the temperature and opens the ceiling return duct. When temperatures are close to being outside this range, the sensor can also operate at half its capacity, while the lower return vent also is open.

### FOOD CONSIDERATIONS

- Fresh fruit and vegetables available
- Proper portions and optional menu items
- Left-overs given to Take-Home-Dinner program
- Allergy accommodations



### DOUBLE SKIN VENTILATION

During days when the outside air temperature is below 25 or above 75°, the lower return vent is open and air flows up through the double skin wall and is ducted back to the PSZ to be reused. This means the PSZ can lessen its supply intake to 50%, saving energy. The air inside the double skin also serves as to strengthen the R-value of the glazing system and acts as a barrier to abnormally high or low temperatures, aiding in envelope control.



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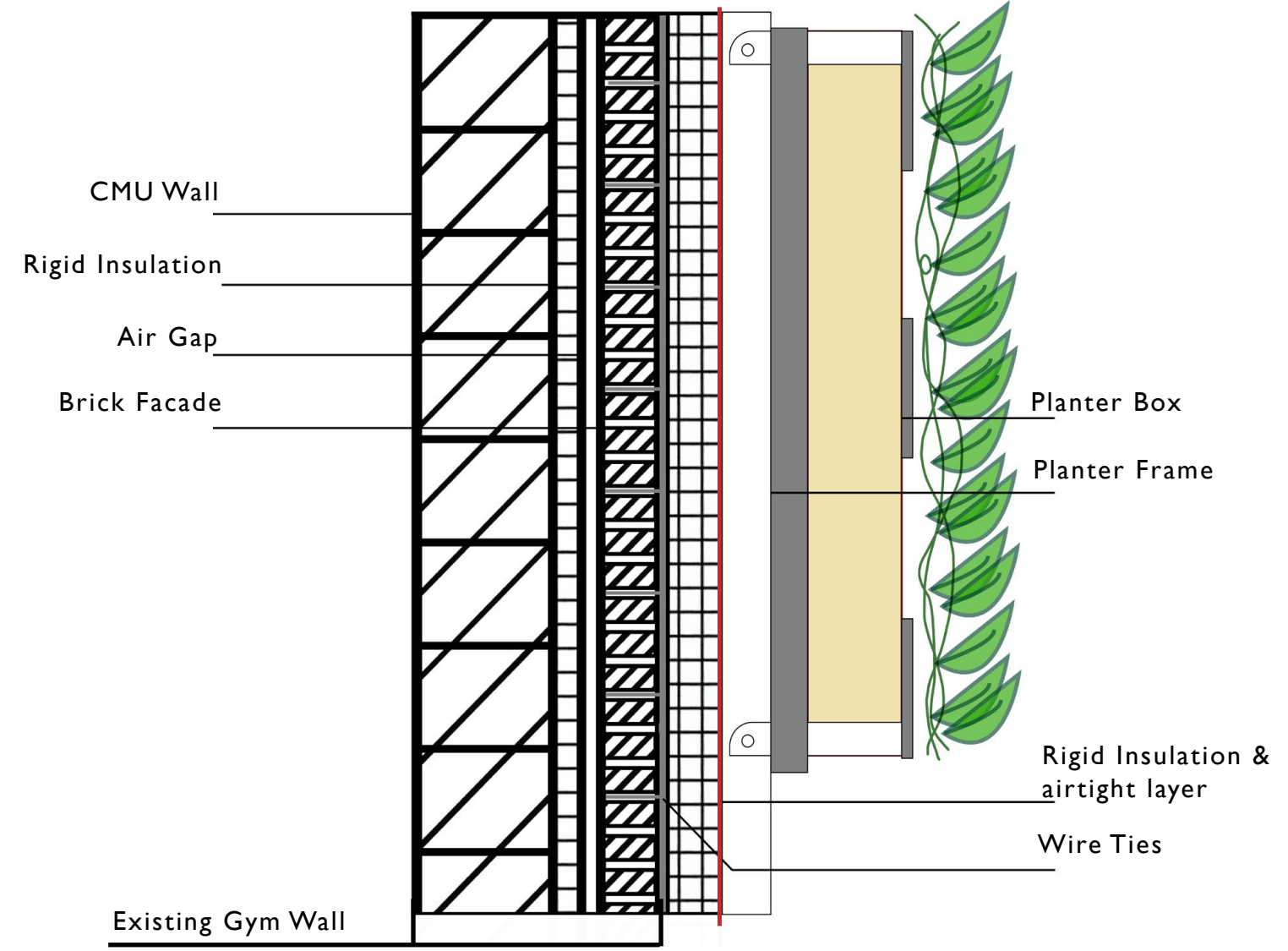
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# GYM RETROFIT

## GREEN WALL DETAIL



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# OUTDOOR ENVIRONMENT



Prairie



Nature Hut



Walking Path



# WELL BUILDING STANDARD



Air



Sound



Nourishment



Materials



Water



Thermal Comfort



Movement



Light



Mind



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# THANK YOU

