Concord-Carlisle Regional High School

Integrated Design Team Charrette

April 26, 2011

omr architects

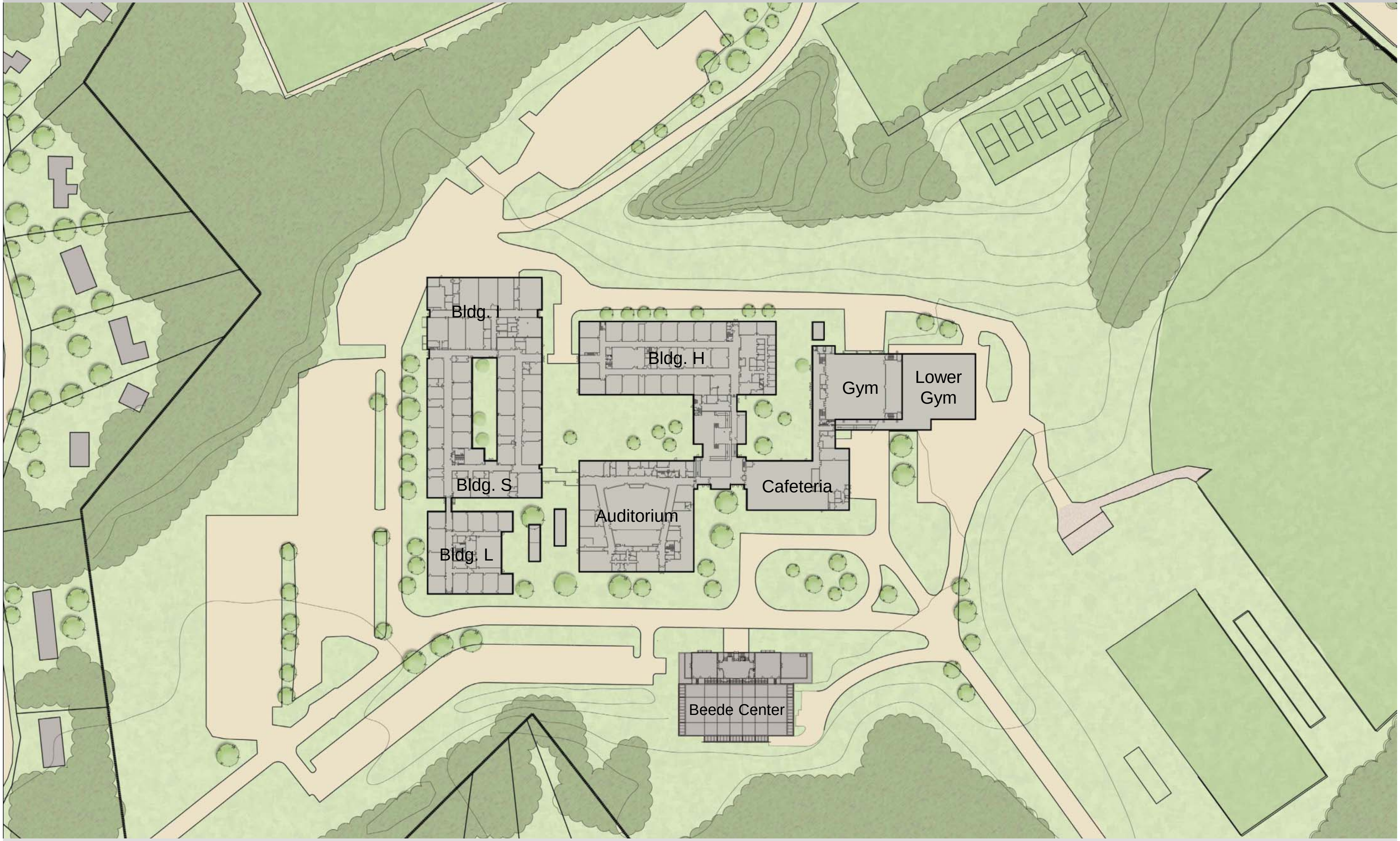
Agenda

- Welcome and Introductions
- Option 6R: Renovation and Addition Scheme

-- Lunch --

- Option 12R: New Build Scheme
- Wrap- up and Next Steps

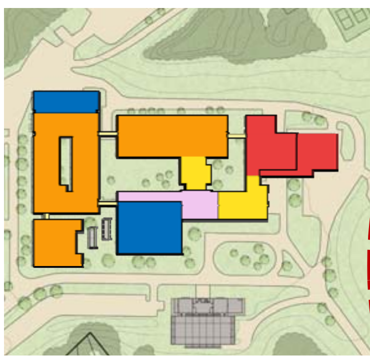
Existing Site Plan



Meeting #3 Summary

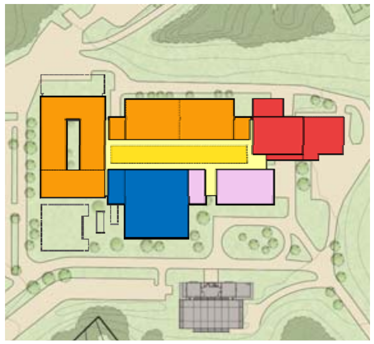
Existing Building

Option 1 – No Build
(repairs)

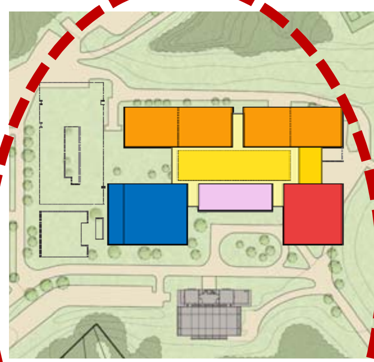


Option 2 – Full Renovation w/ Minor Additions
(Keep All Buildings)

Renovation/Minor Additions

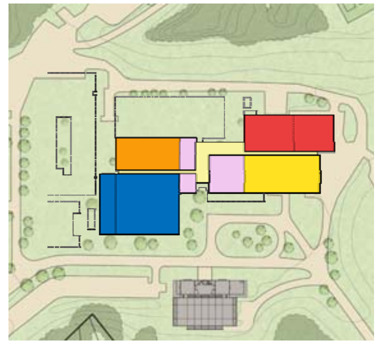


Option 3 – Full Renovation w/ Additions
(Infill Courtyards, Remove 'L' & 'I')

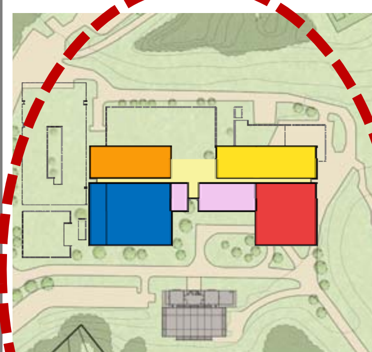


Option 4 – Major Renovation/Major Additions
(Keep 'A', 'H', & Cafe)

Minor Renovation/ Major Additions

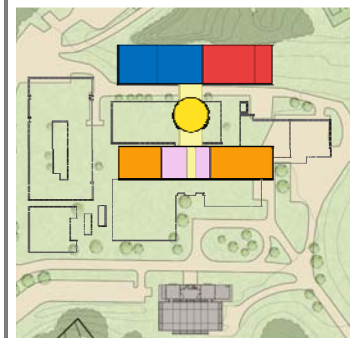


Option 5 – Minor Renovation /Major Additions
(Keeps 'A' and Gyms)

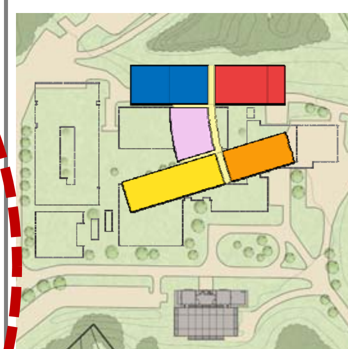


Option 6 – Minor Renovation /Major Additions
(Keeps 'A' and Cafe)

New Building 3 Phases

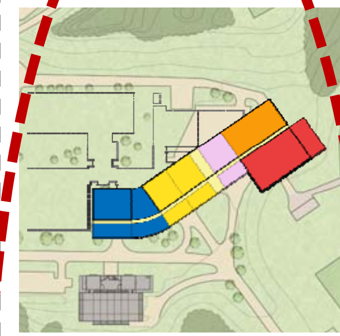


Option 7 – Phased New Building 3 Steps

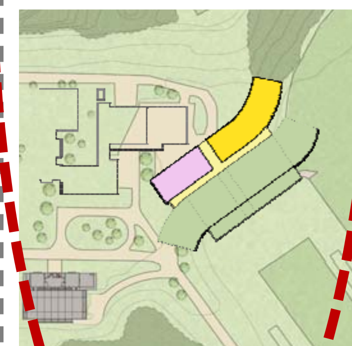


Option 8 – Phased New Building 3 Steps

New Building 1 or 2 Phases

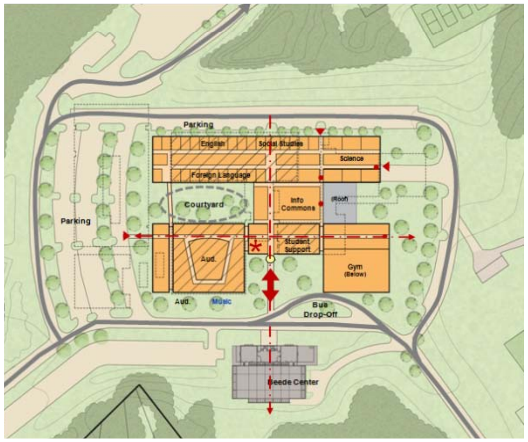


Option 9 – Phased New Building 2 Steps

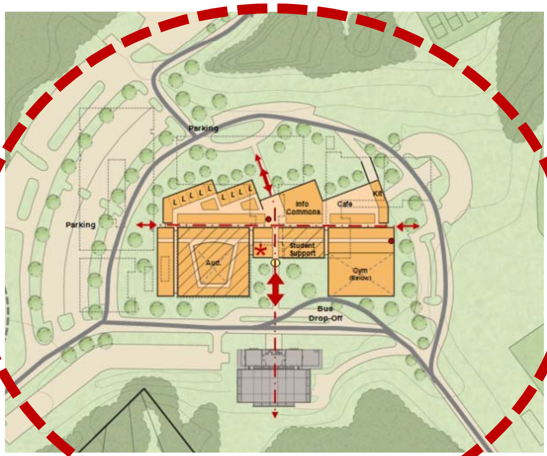


Option 10 – New Building 1 Step

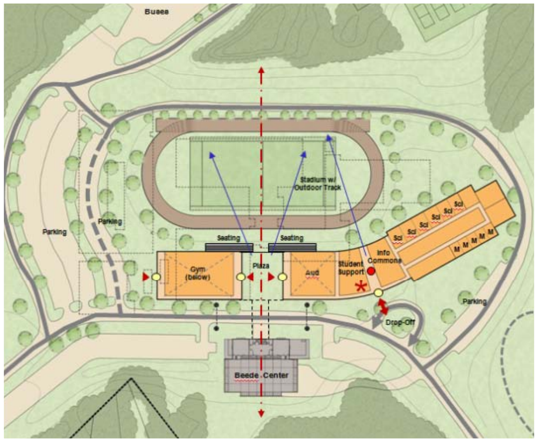
Meeting #4 Summary



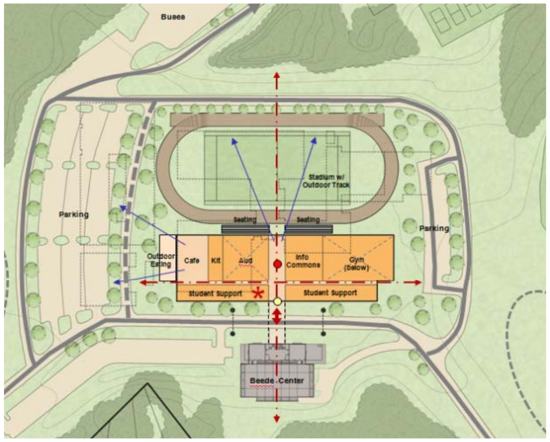
Option 4R
Major Addition / Major Renovation



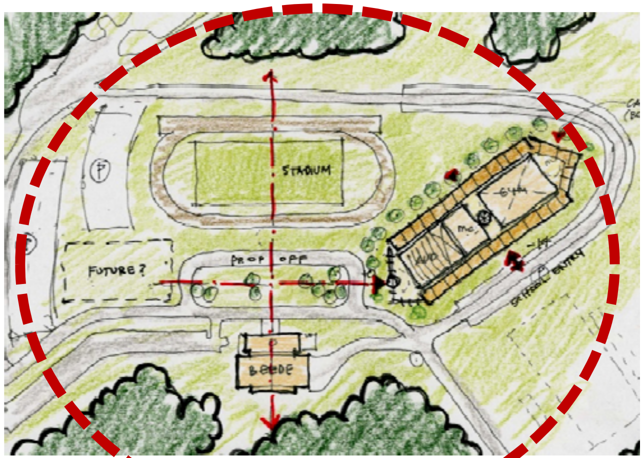
Option 6R
Major Addition / Minor Renovation



Option 9/10
New Building



Option 11
New Building



Option 12
New Building

Group Discussion Questions

1. **What is the Architecture 2030 Challenge?**

Group Discussion Questions

2. **According to the state's "Getting to Net Zero" report of 2009, what is the target year for adoption of zero net energy standards for commercial and residential new construction?**

Group Discussion Questions

3. **What do we have to meet with the Massachusetts Stretch Code which has been adopted by the Town of Concord?**

Group Discussion Questions

4. **What is biomimicry? Name one example of biomimicry that is used in a building design anywhere in North America.**

Group Discussion Questions

5. **How many K-12 schools are heated by biomass (woodchip) fired boilers in the state of Vermont? How many schools in the state of Massachusetts?**

Group Discussion Questions

6. Name one feature of the Willard Elementary School that the Owners really like.

Group Discussion Questions

7. Name one feature of the Willard Elementary School that you really like.

Group Discussion Questions

8. List one fact about the hydrology of the existing Concord-Carlisle High School site.

Group Discussion Questions

9. What are the predominant tree species on the Concord-Carlisle High School site?

10. **What is the Concord-Carlisle High School mascot?**

Sustainability Overview

Charrette guidelines for integrated design

you know you're doing ID when . . .

- . . . *you are an architect that is talking about BTUs and lighting power density*
- . . . *you are a mechanical engineer and you've been asked about window size and orientation*
- . . . *you are a owner and you've been asked about how the building will be occupied*
- . . . *you are a building operations specialist and you've been asked anything at all*

KEMA

Natural Ventilation Opportunities

INTRODUCTION — YOUR DETAILS — LOCATION — TYPE — PARAMETERS

School Designer

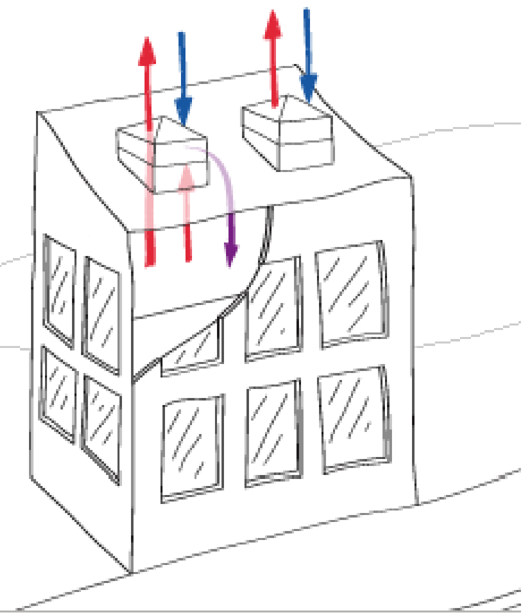
Introduction

Welcome to the breathing buildings school designer. This tool will calculate initial estimates of the openings and required e-stack equipment required to naturally ventilate your building successfully. It is intended to be used by architects and engineers at the early stages of design so that any requirements can be integrated into the building.

At the outset of a project, it is common to know very little about the spaces in the building - such as the type of lighting that will be employed - so the tool uses average values. However, if these details are available, the assumptions can be modified to reflect the specifics of your building. Once you have added your parameters, you will get a compiled email featuring all results and recommendations for your future reference. If you need further information as you go through the process, click the question mark at the top right for further help.

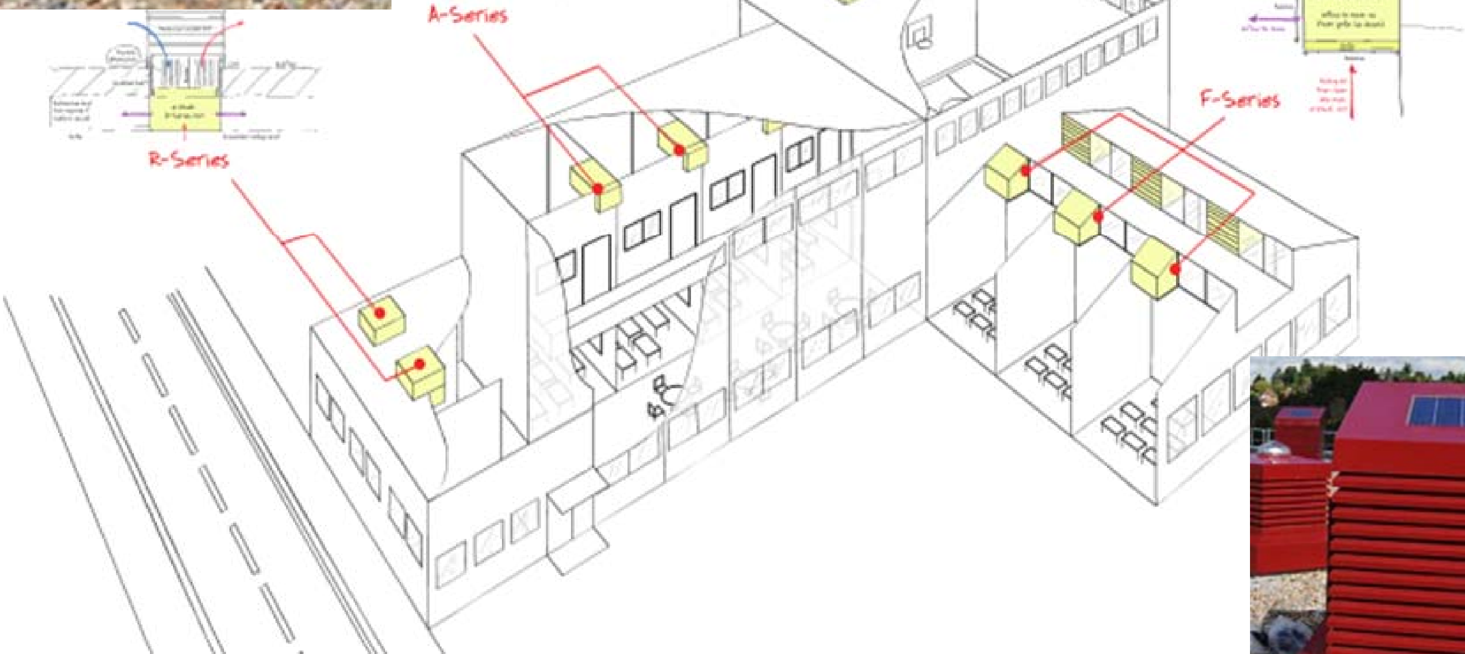
Next >

Breathing Buildings

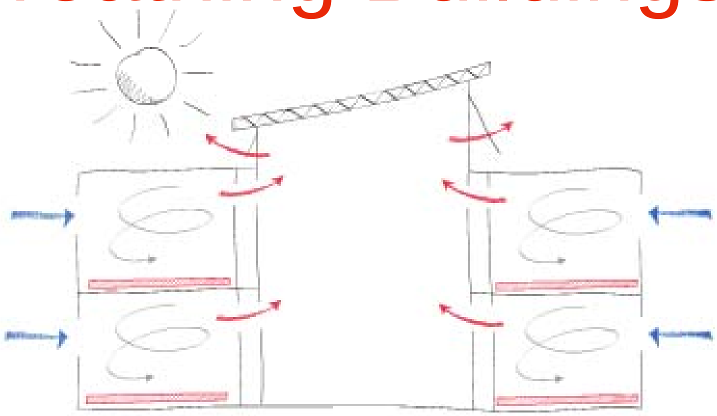


KEMA

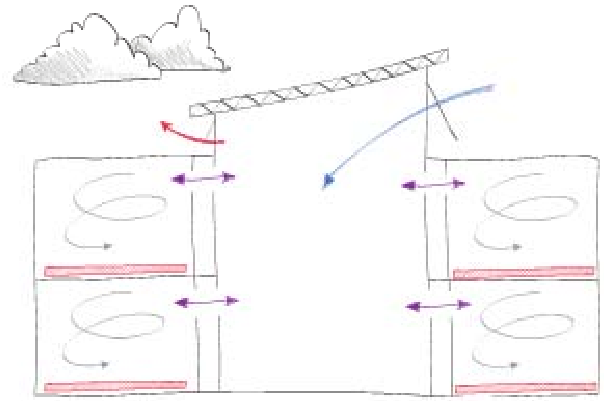
Natural Ventilation Opportunities



Breathing Buildings



Summer Strategy
Upwards Displacement Ventilation



Winter Strategy
Winter Mixing Ventilation

Breathing Buildings have developed an innovative low energy approach to the ventilation of buildings where rooms are connected to a central atrium. The system can be deployed in single as well as multi-storey buildings.

In summer the building is ventilated using upflow displacement ventilation. Air enters through exterior windows in each space before flowing into the atrium through e-stack A-Series units. The air rises within the atrium and exits through the openings at the top of the space. The difference in height between the low level entry of fresh air and the exit of warm air through the atrium creates a natural buoyancy effect which draws air through the building.

In winter, incoming air has to be warmed before it enters the occupied space. Instead of bringing air in at low level and pre-heating, a different strategy is used which can lead to significant energy savings. The low level openings in the side rooms are closed and the building is ventilated using the openings at the top of the atrium. Ventilation of the side rooms is then achieved by mechanically

Natural Ventilation Opportunities

Breathing Buildings

Natural Ventilation Opportunities

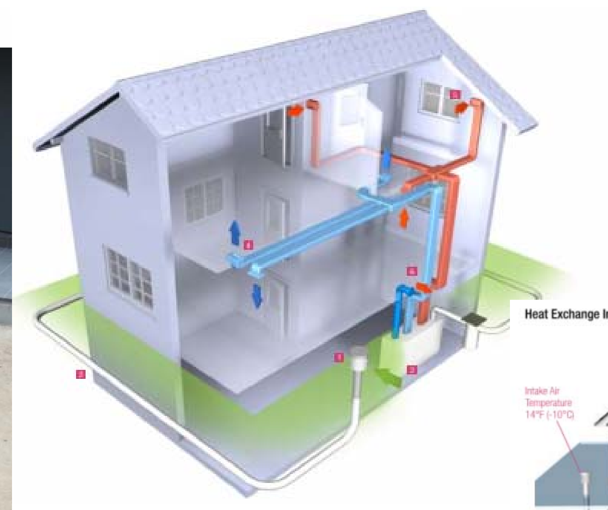
The Monodraught Windcatcher system has proved to be the most effective method of providing natural ventilation to any commercial building, by encapsulating the prevailing wind from any direction. Clean, fresh air, relatively free from contamination or traffic pollution, is entrained at roof level and is carried down to the rooms below through a controlled damper arrangement.

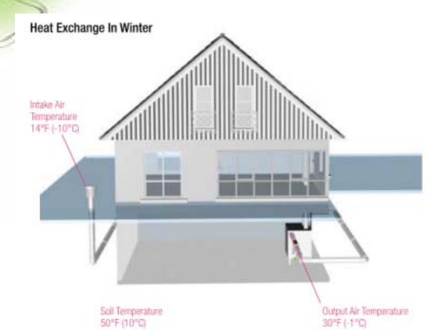
KEMA

Earth Air Tempering

Geothermal Energy Pre-conditions Fresh Air

1. Air inlet tower with integrated air filter draws in fresh air
2. REHAU ECOAIR pipes temper fresh air with geothermal energy
3. Fan propels air into ducts after passing through optional heat recovery ventilator
4. Registers distribute fresh air to rooms
5. Return vents remove stale air from rooms
6. Exhaust fans expel air from the building after passing through optional heat recovery ventilator

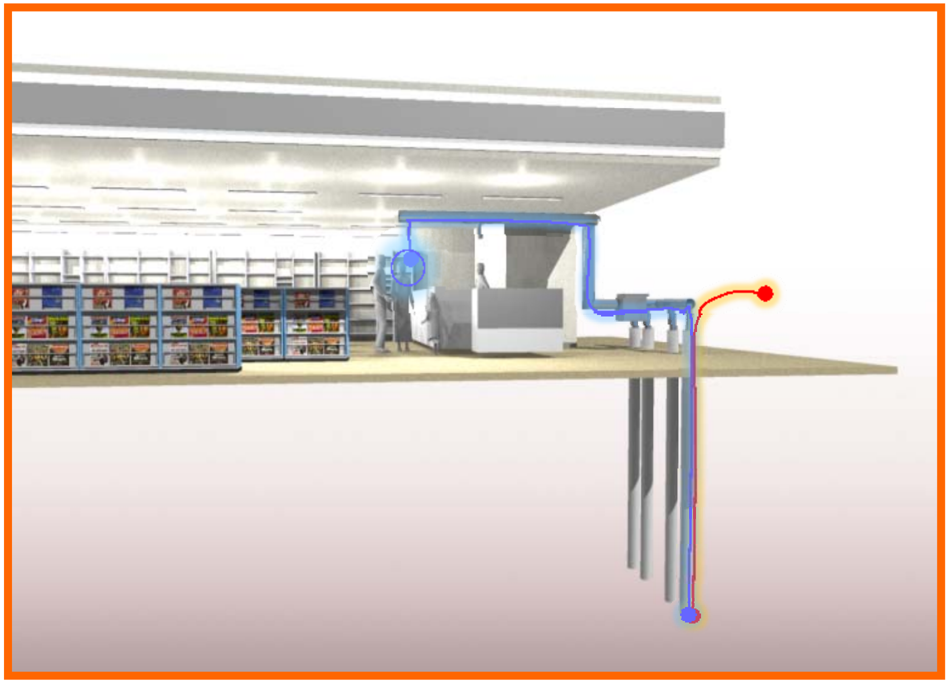




KEMA

Earth Air Tempering Geo-Power System

- air heat exchange and ventilation system. Unlike conventional heat-pumps, it utilizes geothermal heat from relatively shallow (16 ft.)
- temperature air inside will reduces the use of A/C(30-60% energy saving).
- Air contaminants are removed (95%).

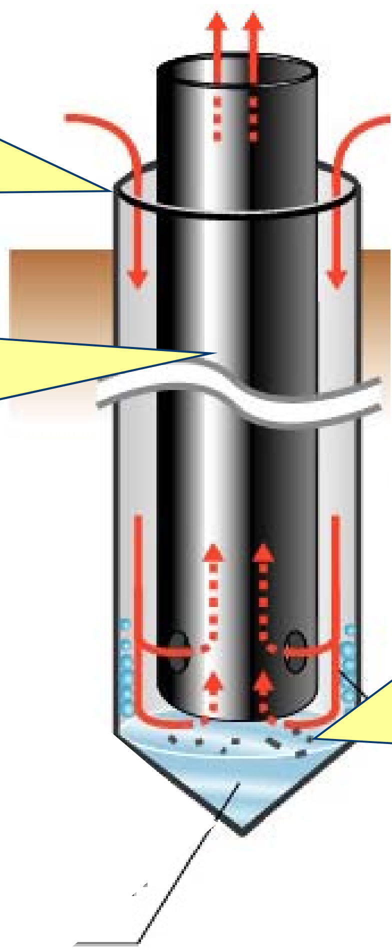


GEO Pipe Pre-treatment

The Geo Pipe

The outer pipe is made of aluminum which has effective heat transferability.

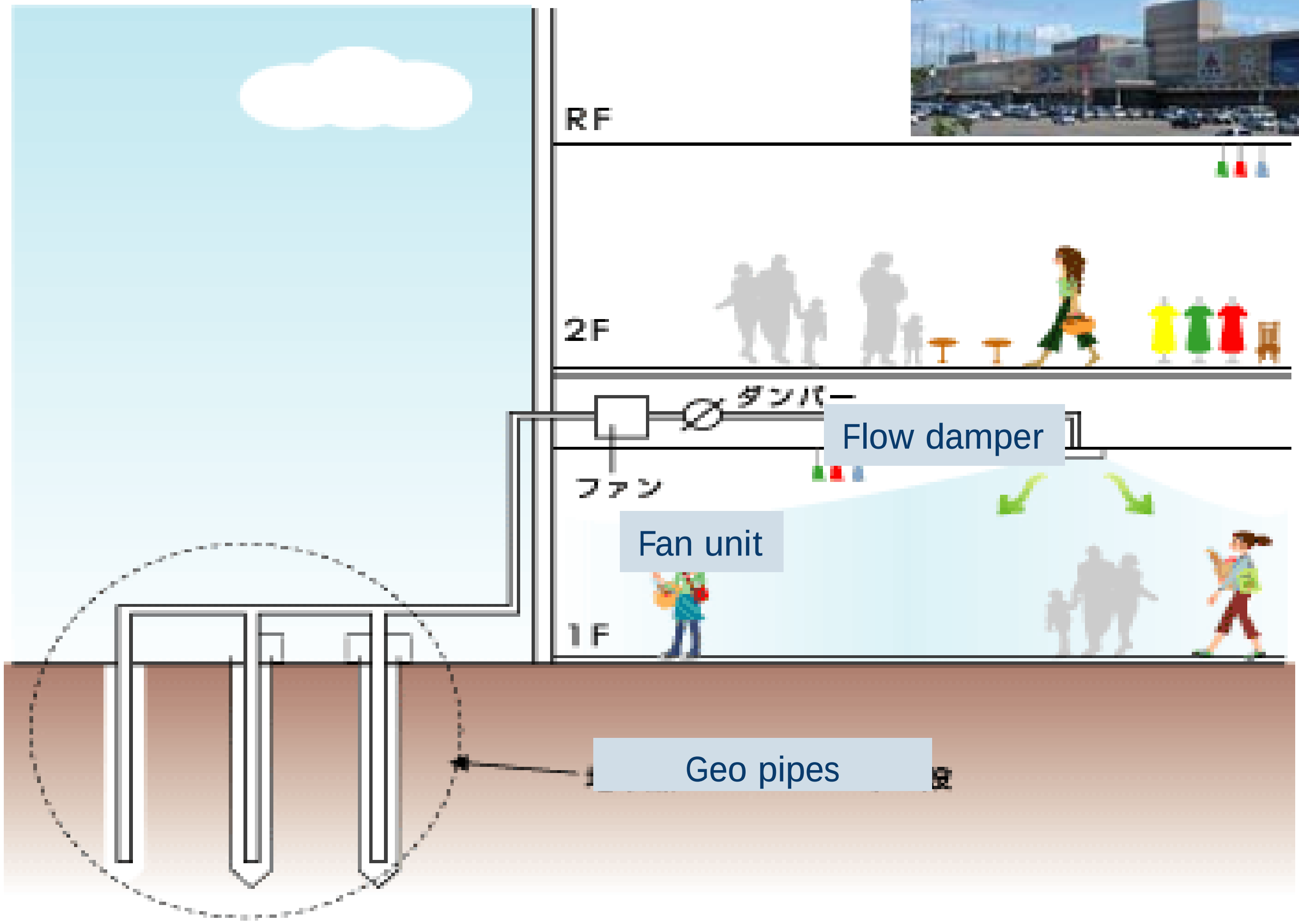
The inner pipe is made of plastic for better insulation.



Air Cleaning Effect

Data shows approx. 95% dust (99% pollen) are removed by dew condensation water in the bottom of pipe to keep outgoing air clean.

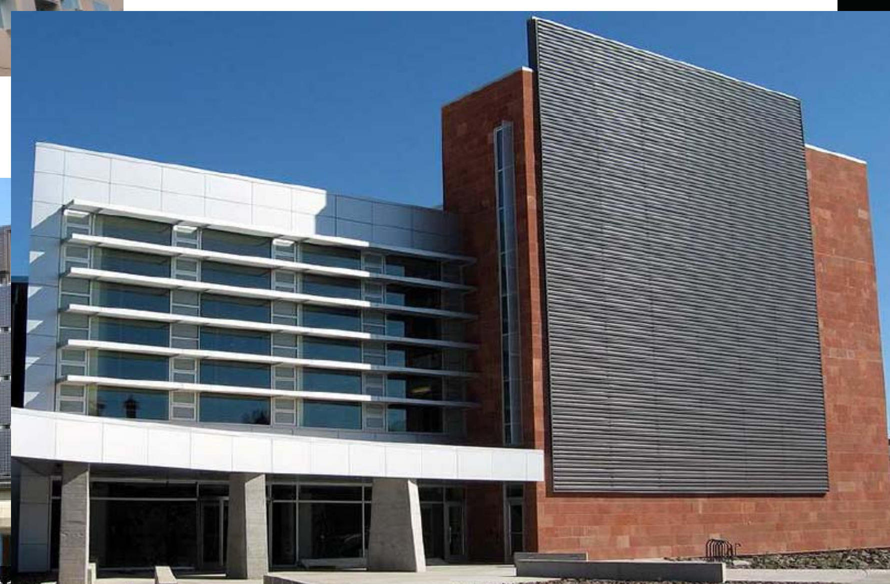
Geo-Power System



KEMA

Lets not forget the Solar options

Solar wall



Solar tubes

KEMA

ASHRAE & CBECS Energy Data

Energy Use Intensity Summary		
Site	Baseline EUI	14.14 kWh/ft2
	Proposed EUI	10.44 kWh/ft2
Site	Baseline EUI	0.39 Therms/ft2
	Proposed EUI	0.21 Therms/ft2
Site	Baseline EUI	87.07 Kbtu/ft2
	Proposed EUI	57.10 Kbtu/ft2

Average Heating Use (KBTU):	765,704
Average Cooling Use (KBTU):	2,426,914
Average Ventilation Use (KBTU):	1,803,727
Average Water Heating Use (KBTU):	186,587
Average Lighting Use (KBTU):	12,791,645
Average Cooking Use (KBTU):	0
Average Refrigeration Use (KBTU):	987,983
Average Office Equipment Use (KBTU):	483,130
Average Miscellaneous Use (KBTU):	3,643,318

Project Summary

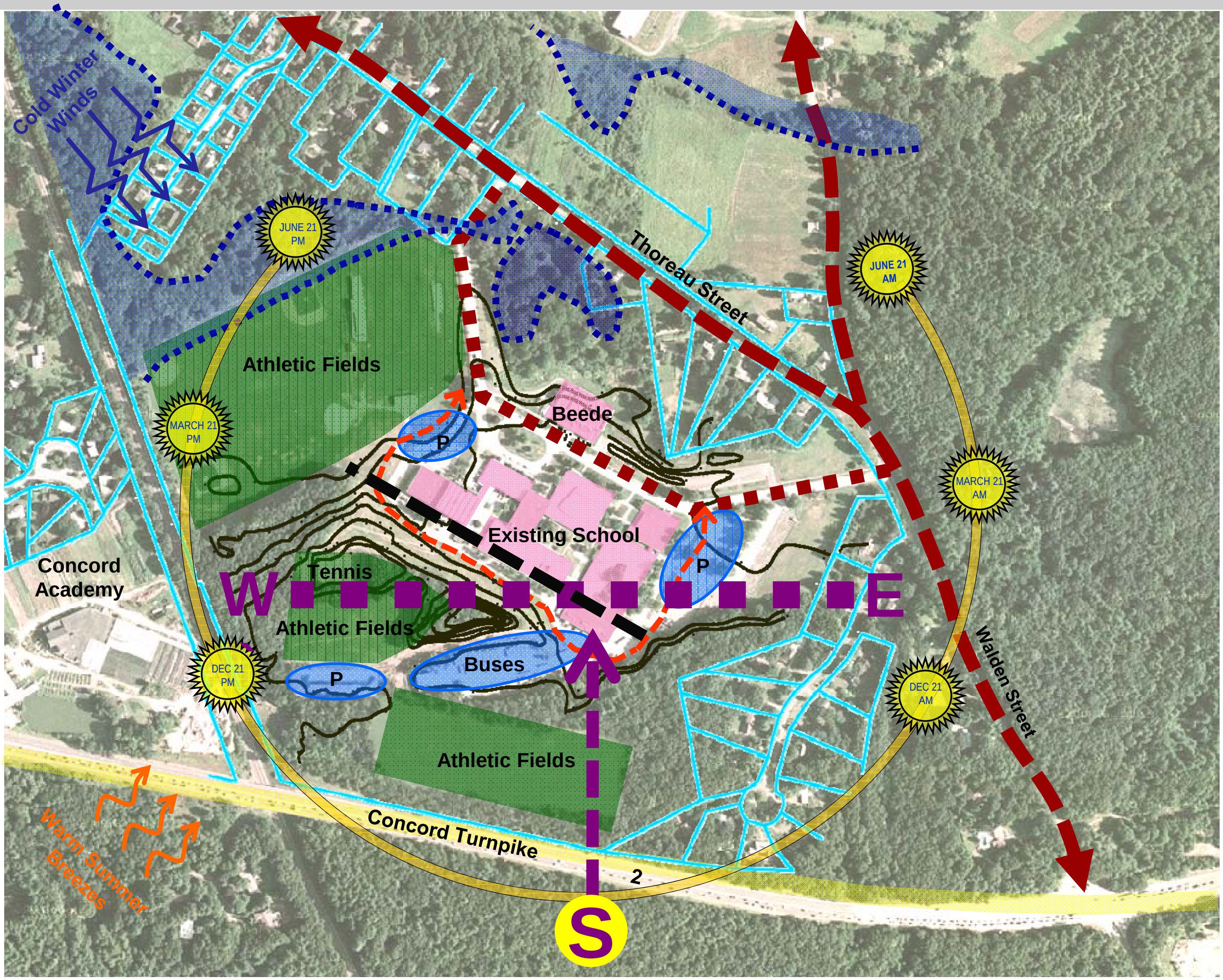
Energy Type	Baseline			EEM Reduction	Proposed			Percent Savings		
	Energy Use	Energy Cost	% of Total	Savings from Baseline	Energy Use	Energy Cost	% of Total	Energy Use	Energy Cost	% of Total Savings
Electricity	3,506,370 kWh	$561,019	82%	26%	2,590,288 kWh	$414,446	86%	26.1%	26.1%	21.5%
Natural Gas	96,289 Therms	$119,399	18%	45%	53,219 Therms	$65,991	14%	44.7%	44.7%	0.0%
Subtotal	**6,328,327 kWh**	**$680,418**	100%	34%	**4,149,973 kWh**	**$480,437**	100%	**34.4%**	**29.4%**	

End Use Analysis

End Use Type	Baseline			EEM Reduction	Proposed			Percent Savings		
	Energy Use	Energy Cost	% of Total	Savings from Baseline	Energy Use	Energy Cost	% of Total	Energy Use	Energy Cost	% of Total Savings
Heating	91,097 Therms	$112,960	17%	45%	50,103 Therms	$62,128	13%	45.0%	45.0%	7.5%
Cooling	1,155,706 kWh	$184,913	27%	40%	693,424 kWh	$110,948	23%	40.0%	40.0%	10.9%
Interior Lighting	1,104,822 kWh	$176,771	26%	35%	718,134 kWh	$114,901	24%	35.0%	35.0%	9.1%
Exterior Lighting	91,998 kWh	$14,720	2%	30%	64,399 kWh	$10,304	2%	30.0%	30.0%	0.6%
Interior Equipment	744,081 kWh	$119,053	17%	10%	669,672 kWh	$107,148	22%	10.0%	10.0%	1.7%
Fans	358,598 kWh	$57,376	8%	-10%	394,458 kWh	$63,113	13%	-10.0%	-10.0%	-0.8%
Pumps	6,429 kWh	$1,029	0%	15%	5,464 kWh	$874	0%	15.0%	15.0%	0.0%
Water Systems	5,192 Therms	$6,438	1%	40%	3,115 Therms	$3,863	1%	40.0%	40.0%	0.4%
TOTAL	*3,506,370 kWh*	*$561,019*	*82%*		*2,590,288 kWh*	*$414,446*	*86%*	*26.1%*	*26.1%*	*21.5%*
	96,289 Therms	*$119,399*	*18%*		*53,219 Therms*	*$65,991*	*14%*	*44.7%*	*44.7%*	*7.8%*
	6,328,327 kWh	**$680,418**	**100%**		**4,149,973 kWh**	**$480,437**	**100%**	**34.4%**	**29.4%**	
not accounted for	*0 kWh*	*$0*	*0%*		*0 kWh*	*$0*	*0%*	*0.0%*		

Satellite View

Building Orientation

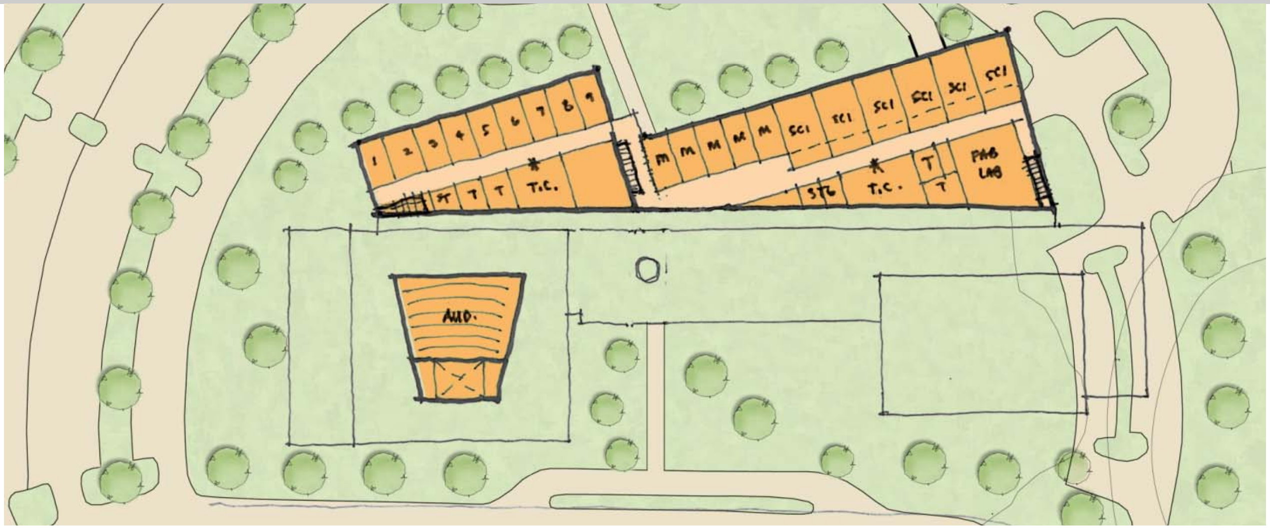


- Sun/Winds
- Topography
- Access
- Parking
- Neighbors
- Wetlands
- Fields

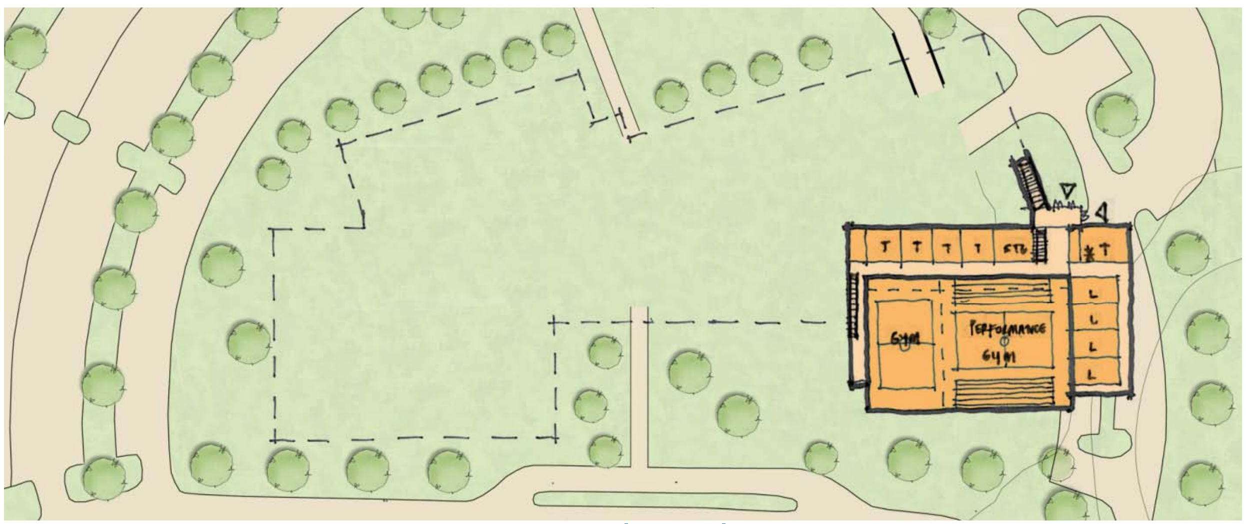
N

Option 6R: Ground Floor Plan

Option 6R: Floor Plans

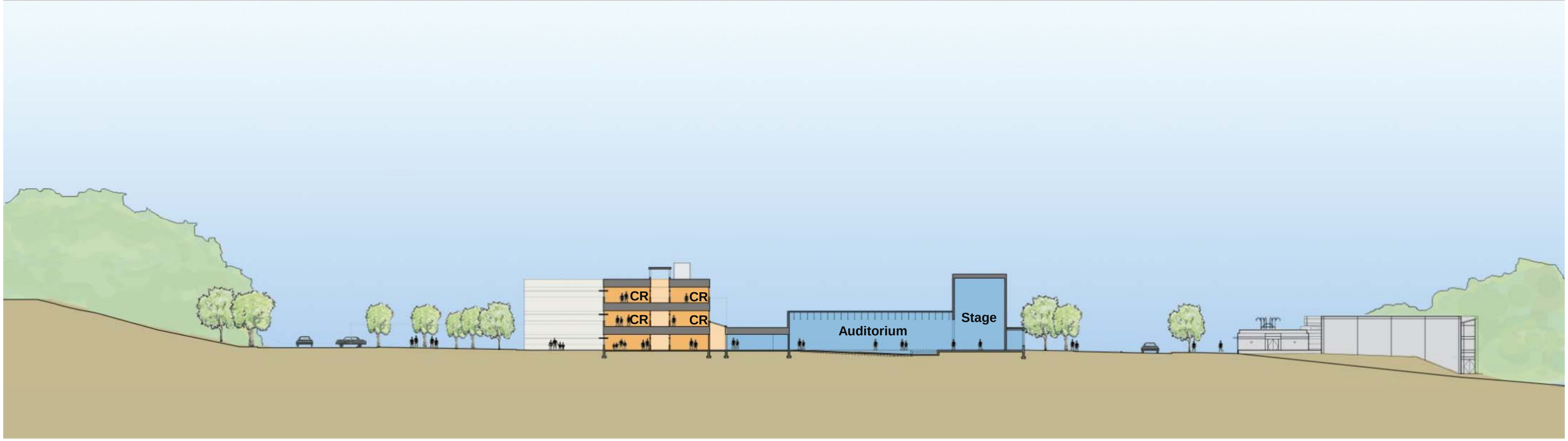


2nd and 3rd Floor Plan

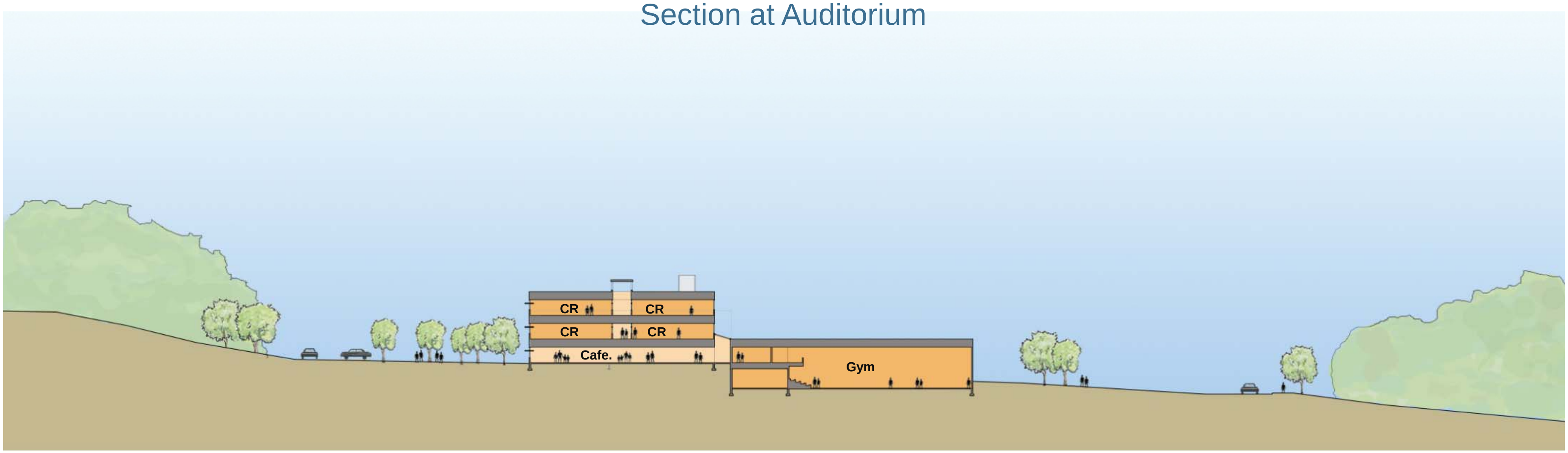


Lower Floor Plan

Option 6R: Sections

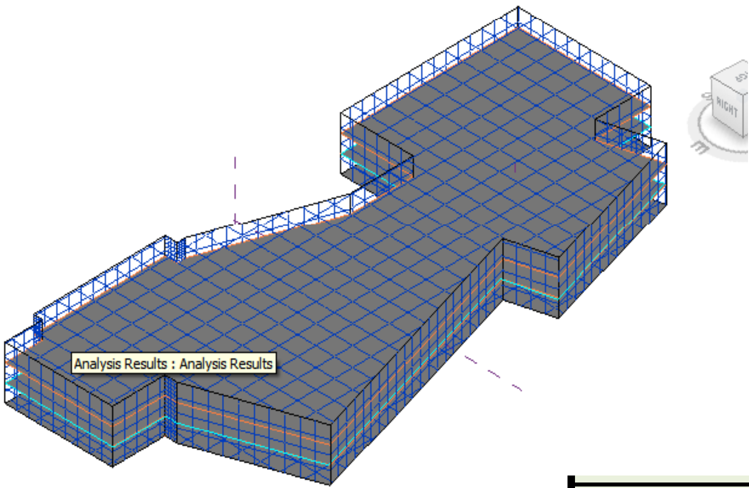


Section at Auditorium



Section at Cafeteria and Gymnasium

Building Mass - Energy Analysis



Energy Use Intensity

Electricity EUI:	12 kWh/sf/yr
Fuel EUI:	37 kBtu/sf/yr
Total EUI:	77 kBtu/sf/yr

ASHRAE baseline

Site	Baseline EUI	87.07 Kbtu/ft2
	Proposed EUI	57.10 Kbtu/ft2

Calibrated Model

Site	Baseline EUI	77.06 Kbtu/ft2
	Proposed EUI	50.29 Kbtu/ft2

Life Cycle Energy Use/Cost

Life Cycle Electricity Use:	87,363,608 kWh
Life Cycle Fuel Use:	2,803,125 Therms
Life Cycle Energy Cost:	$8,252,942

*30-year life and 6.1% discount rate for costs

Renewable Energy Potential

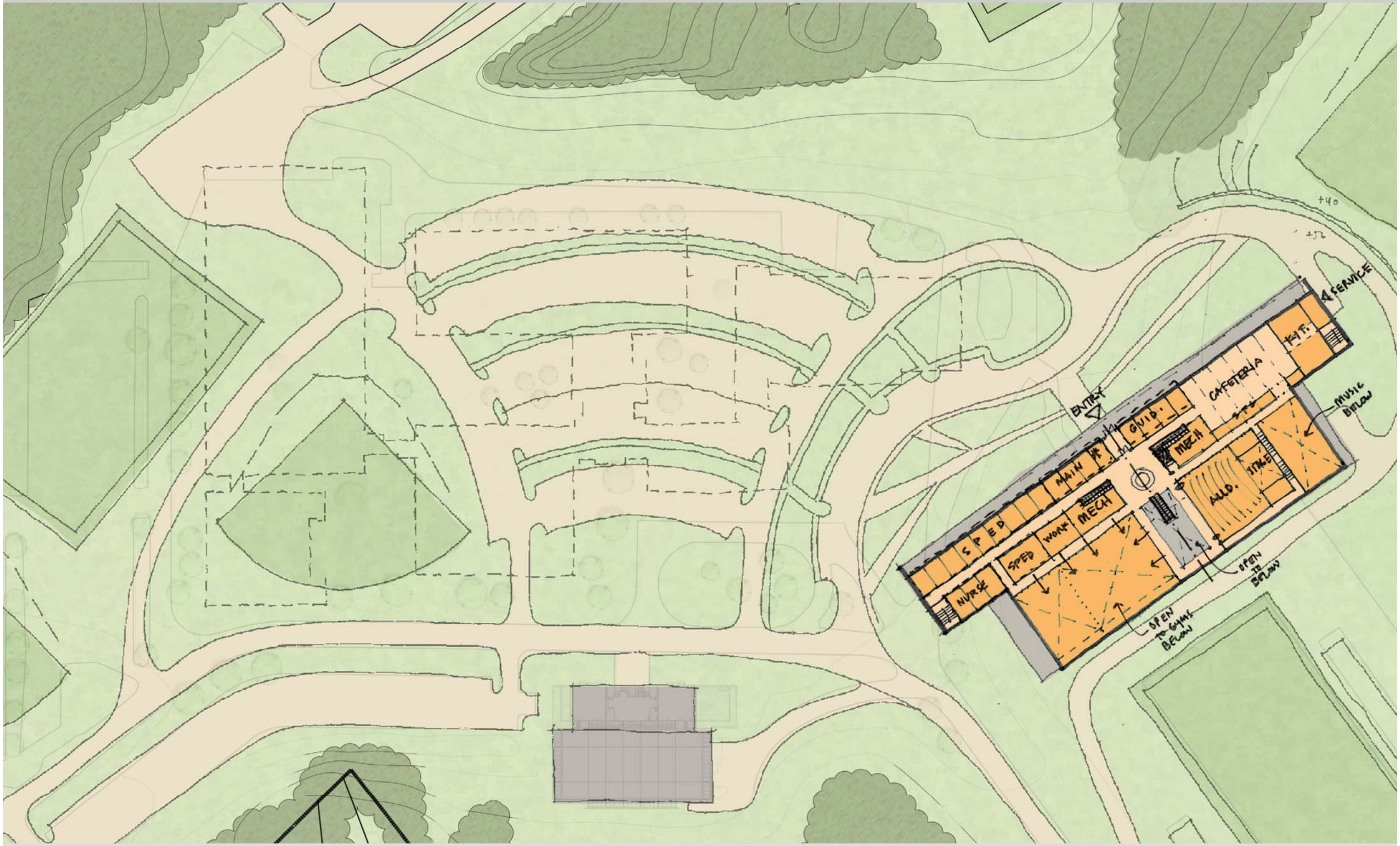
Roof Mounted PV System (Low efficiency):	333,627 kWh/yr
Roof Mounted PV System (Medium efficiency):	667,254 kWh/yr
Roof Mounted PV System (High efficiency):	1,000,881 kWh/yr
Single 15' Wind Turbine Potential:	2,969 kWh/yr

*PV efficiencies are assumed to be 5%, 10% and 15% for low, medium and high efficiency systems

roof area could generate 30-50% of electrical load

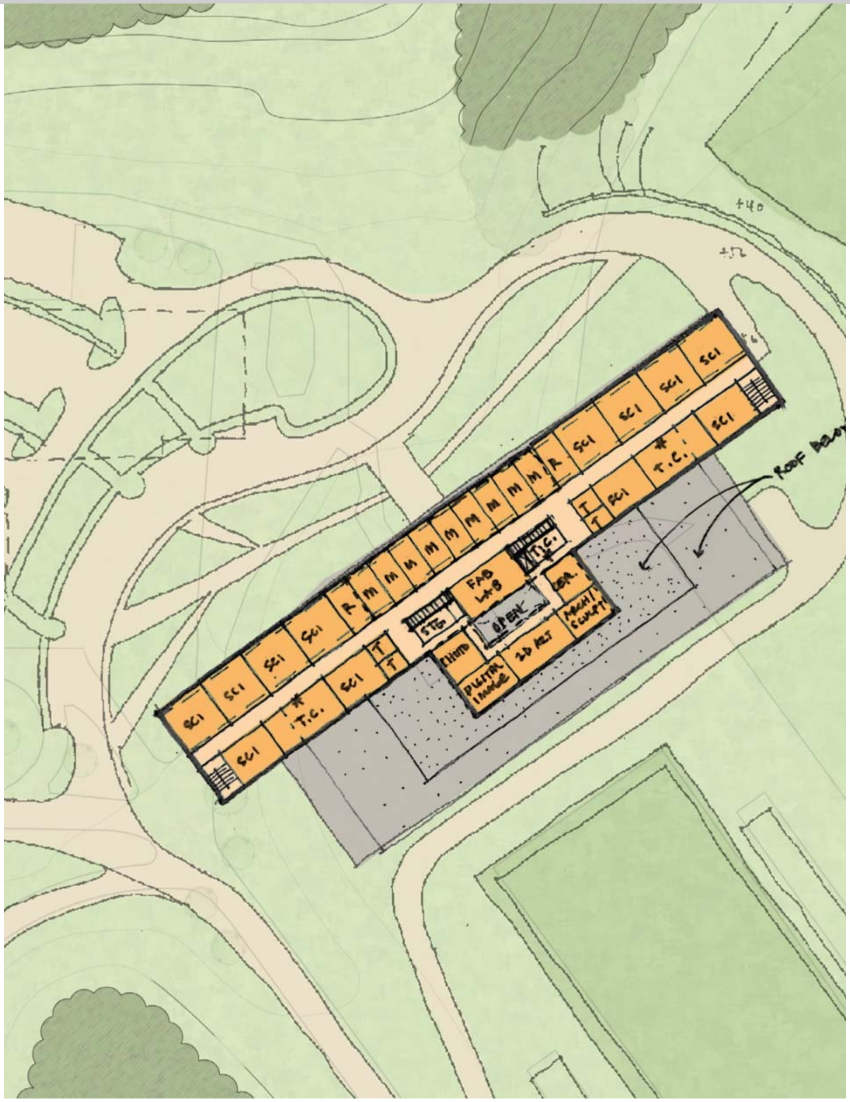

Lunch Break

Option 12R: Ground Floor Plan

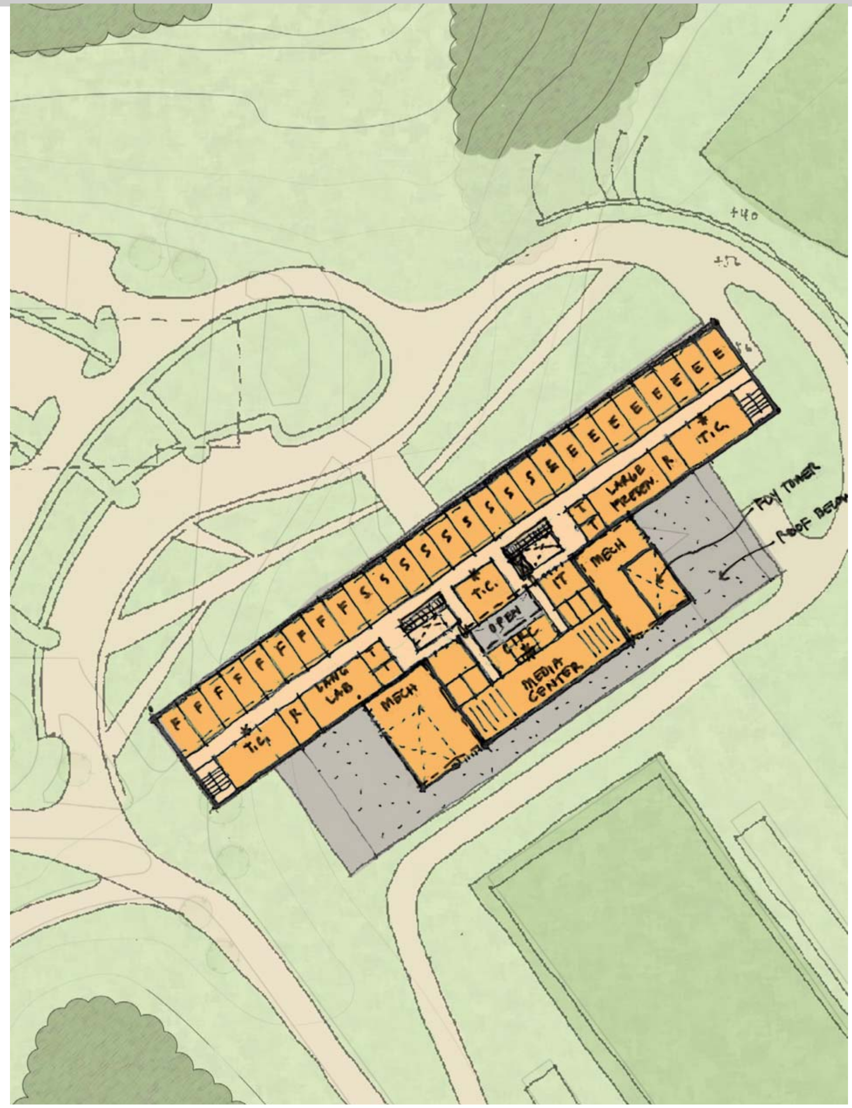


omr architects

Option 12R: Floor Plans

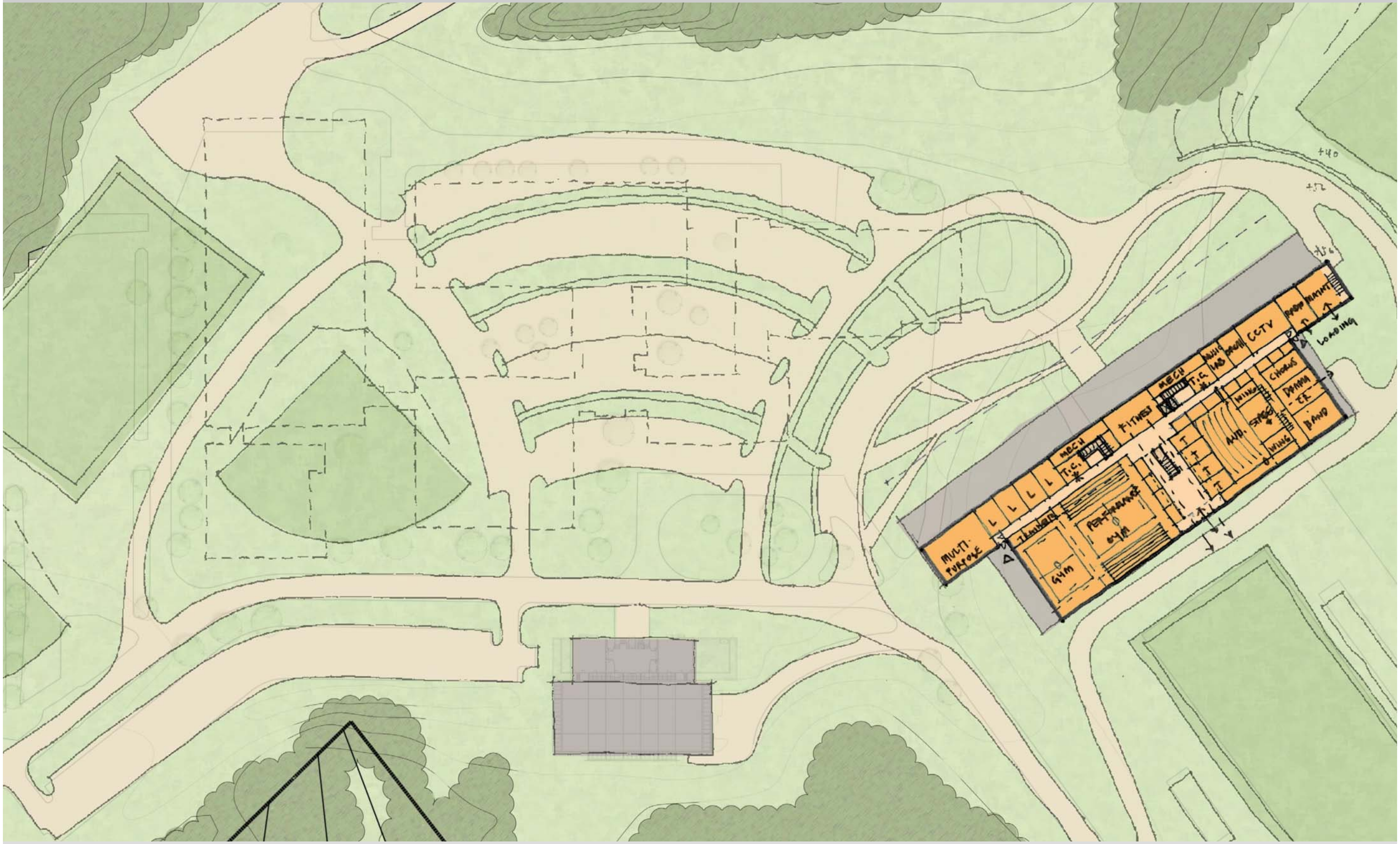


3rd Floor Plan

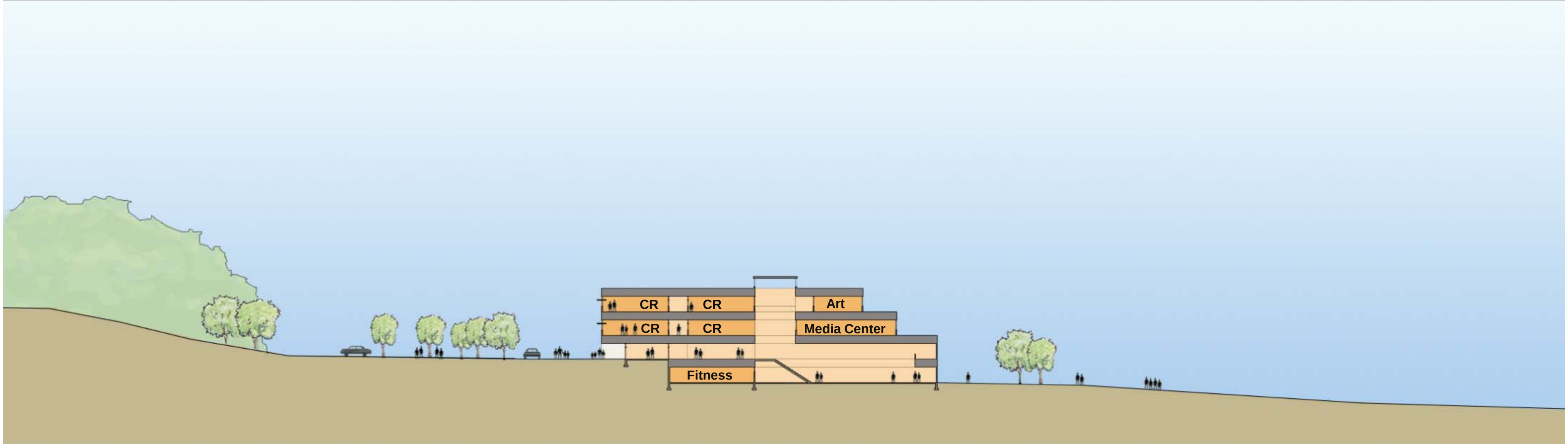


2nd Floor Plan

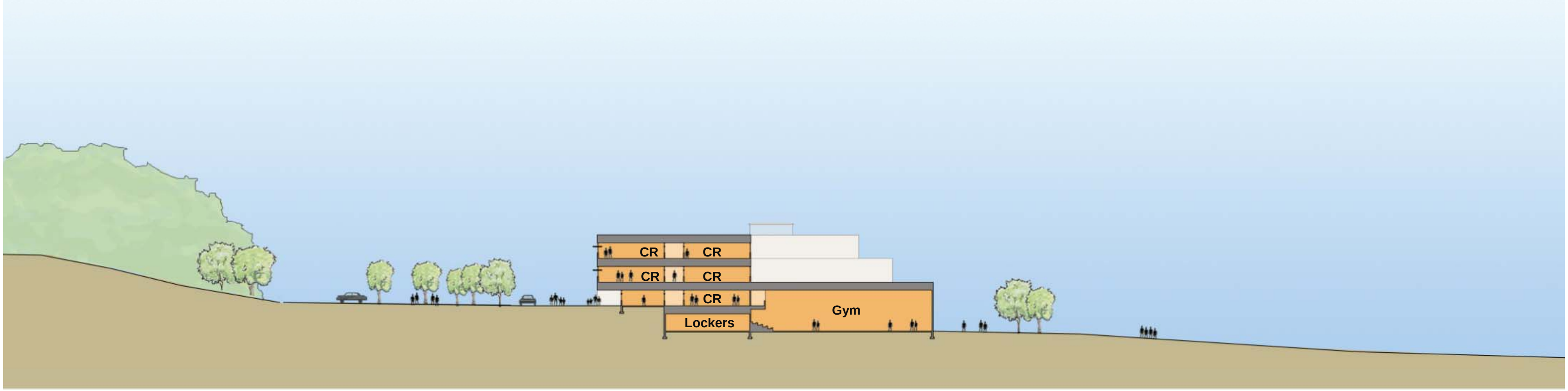
Option 12R: Lower Floor Plan



Option 12R: Sections



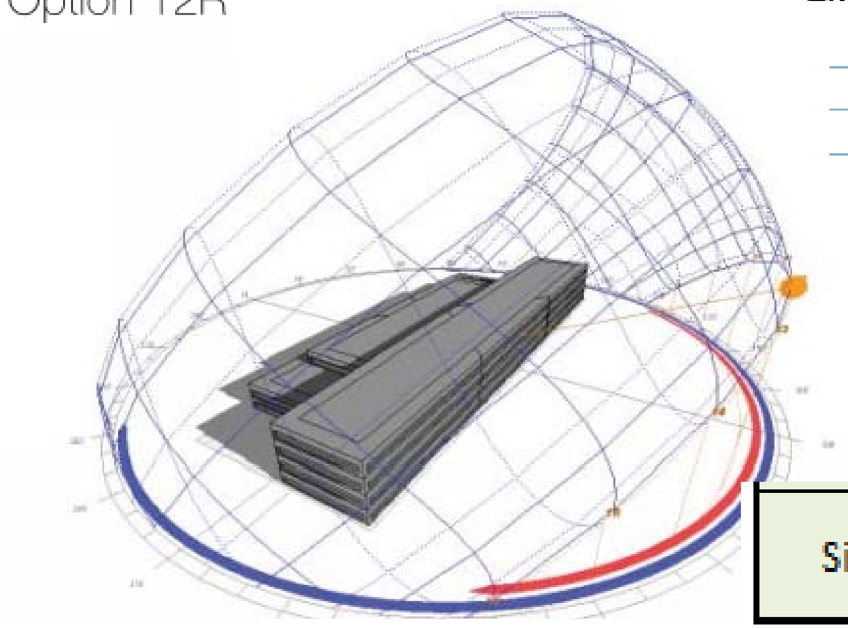
Section at Ground & Lower Entries



Section at Gymnasium

Building Mass - Energy Analysis

Option 12R



Energy Use Intensity

Electricity EUI:	12 kWh/sf/yr
Fuel EUI:	42 kBtu/sf/yr
Total EUI:	82 kBtu/sf/yr

ASHRAE baseline

Site	Baseline EUI	87.07 Kbtu/ft2
	Proposed EUI	57.10 Kbtu/ft2

Calibrated Model

Site	Baseline EUI	82.04 Kbtu/ft2
	Proposed EUI	53.01 Kbtu/ft2

Life Cycle Energy Use/Cost

Life Cycle Electricity Use:	90,342,240 kWh
Life Cycle Fuel Use:	3,159,512 Therms
Life Cycle Energy Cost:	$8,716,912

*30-year life and 6.1% discount rate for costs

Renewable Energy Potential

Roof Mounted PV System (Low efficiency):	365,132 kWh/yr
Roof Mounted PV System (Medium efficiency):	730,264 kWh/yr
Roof Mounted PV System (High efficiency):	1,095,395 kWh/yr
Single 15' Wind Turbine Potential:	2,969 kWh/yr

*PV efficiencies are assumed to be 5%, 10% and 15% for low, medium and high efficiency systems

roof area could generate 30-50% of electrical load

PACIFIC SCHOOL · 2007 ·

KEMA

Next Steps

SBC Meeting #5, May 4, 2011

- Approve Preliminary Alternative(s)