ARROWSTREET

LINCOLN-ELIOT ELEMENTARY SCHOOL

DESIGN REVIEW COMMITTEE MEETING

NEWTON, MA

14 SEPTEMBER 2022

PREPARED FOR

NEWTON PUBLIC SCHOOLS

David Fleishman,
Superintendent

Ruthanne Fuller,
Mayor

AGENDA /

1 **DESIGN UPDATES**
- » SITE PLAN
- » FLOOR PLANS

2 **AUDITORIUM VISIONING UPDATE**

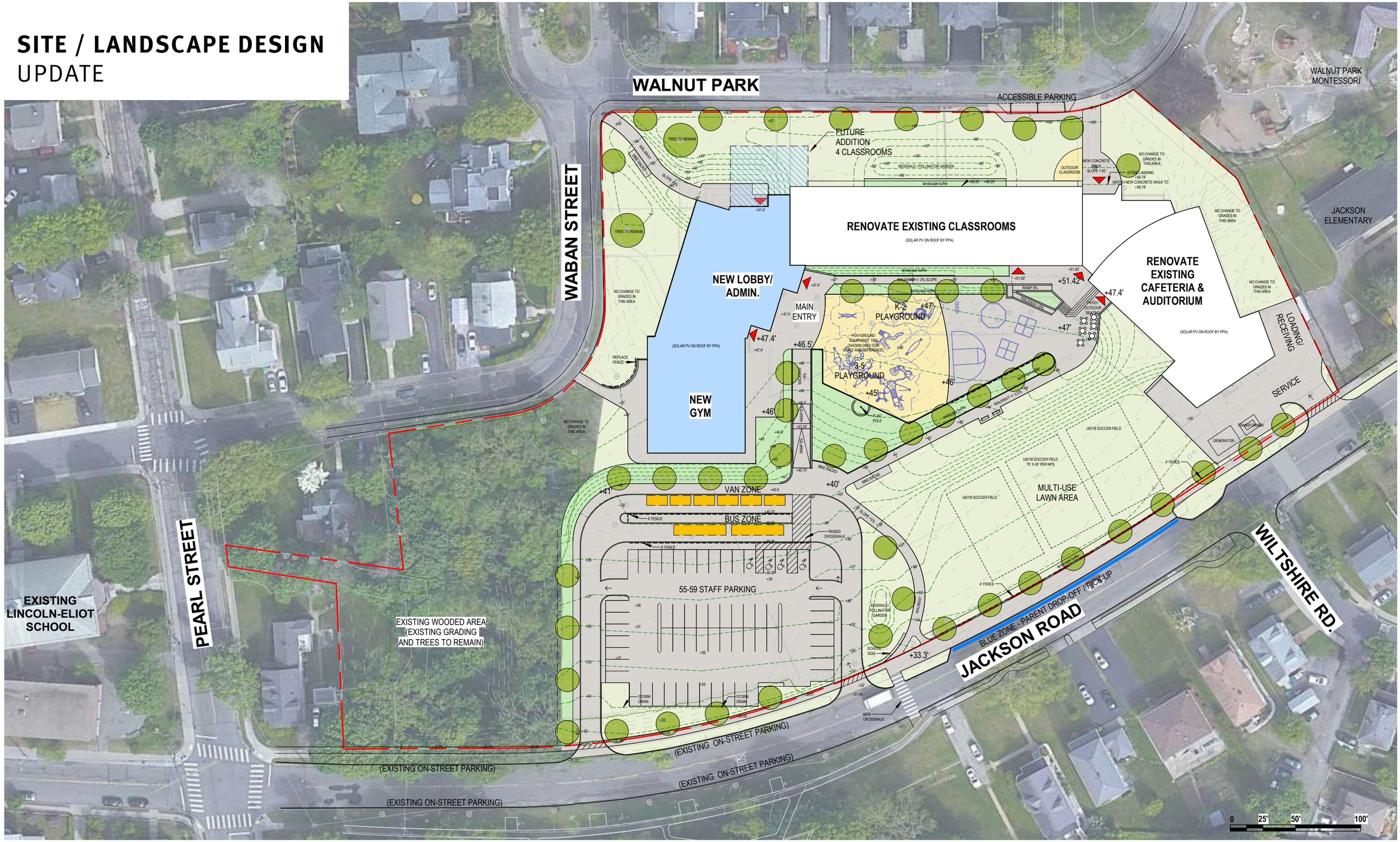
3 **BUILDING PERFORMANCE**
- » BUILDING ENVELOPE
- » ENERGY & LCCA
- » WATER REUSE LCCA
- » EMBODIED CARBON LCA

DESIGN UPDATES

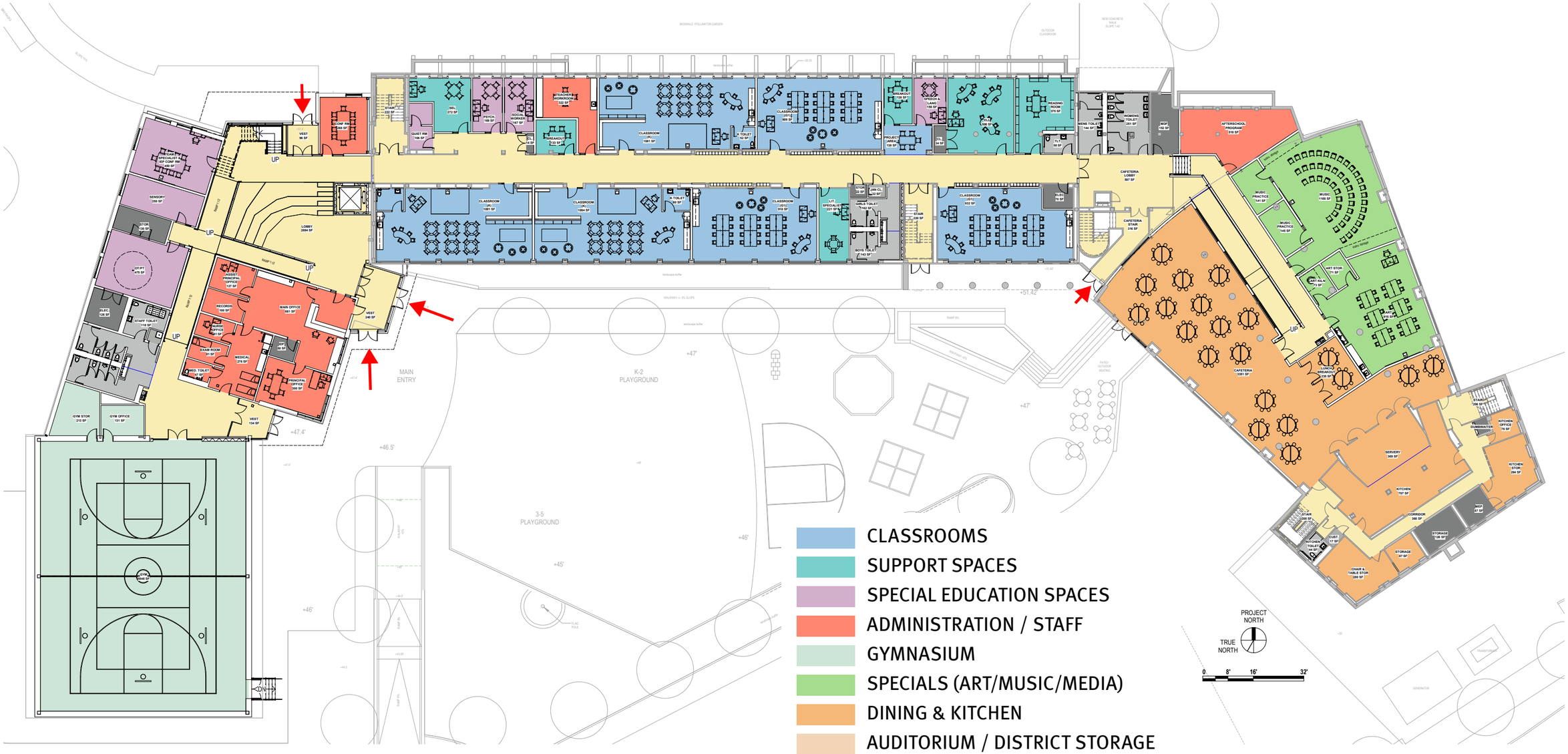
SITE PLAN

FLOOR PLANS

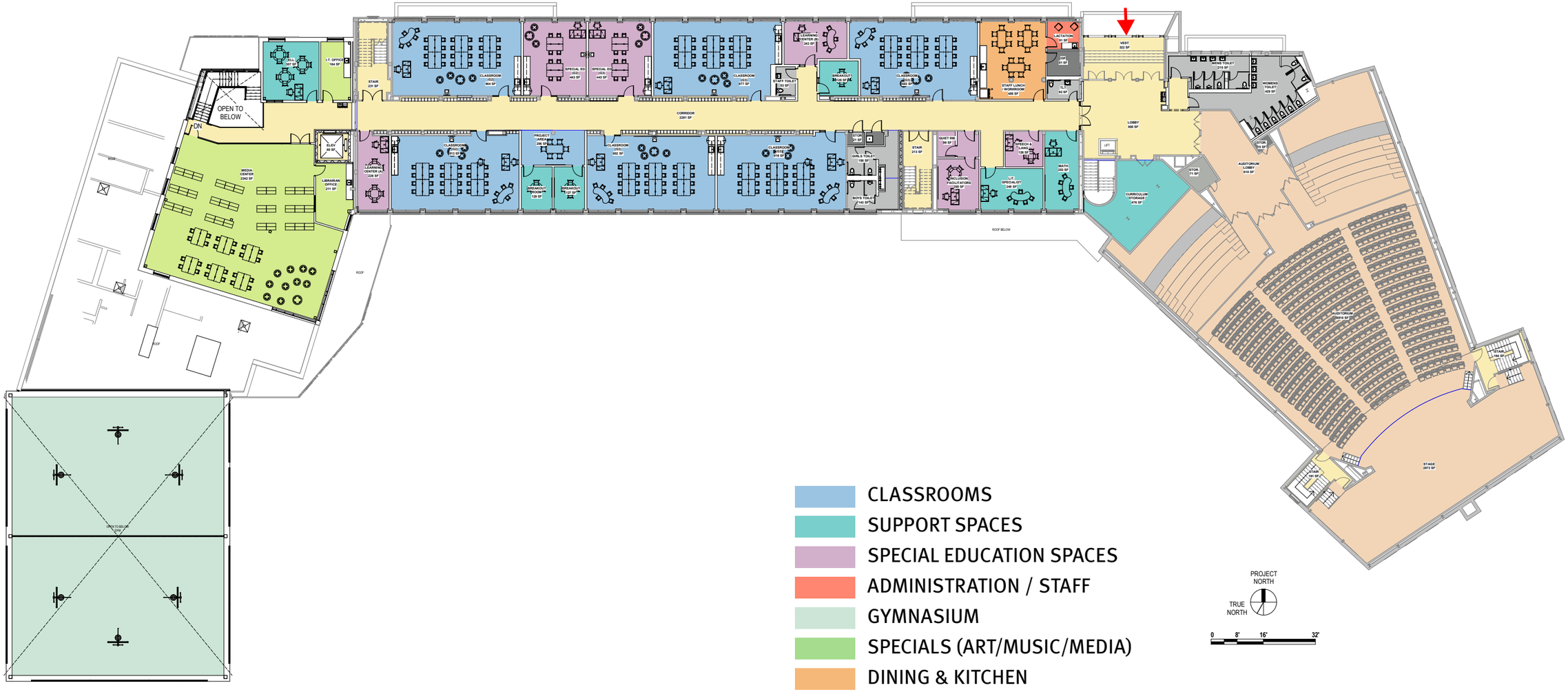
SITE / LANDSCAPE DESIGN
UPDATE



DESIGN UPDATES / DRAFT FIRST FLOOR PLAN



DESIGN UPDATES / DRAFT SECOND FLOOR PLAN

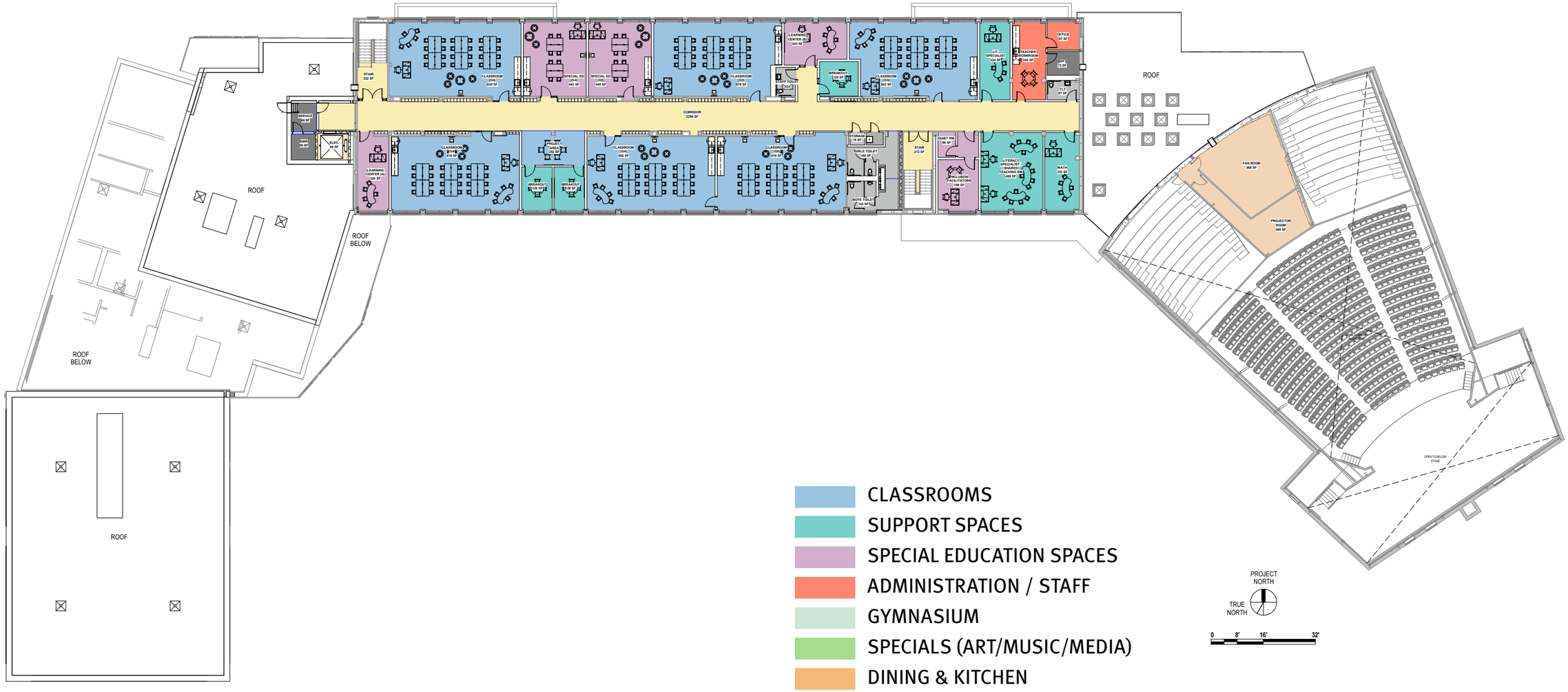


- CLASSROOMS
- SUPPORT SPACES
- SPECIAL EDUCATION SPACES
- ADMINISTRATION / STAFF
- GYMNASIUM
- SPECIALS (ART/MUSIC/MEDIA)
- DINING & KITCHEN
- AUDITORIUM / DISTRICT STORAGE
- CIRCULATION
- TOILETS/MEP/STORAGE

PROJECT NORTH
TRUE NORTH

0 8' 16' 32'

DESIGN UPDATES / DRAFT THIRD FLOOR PLAN



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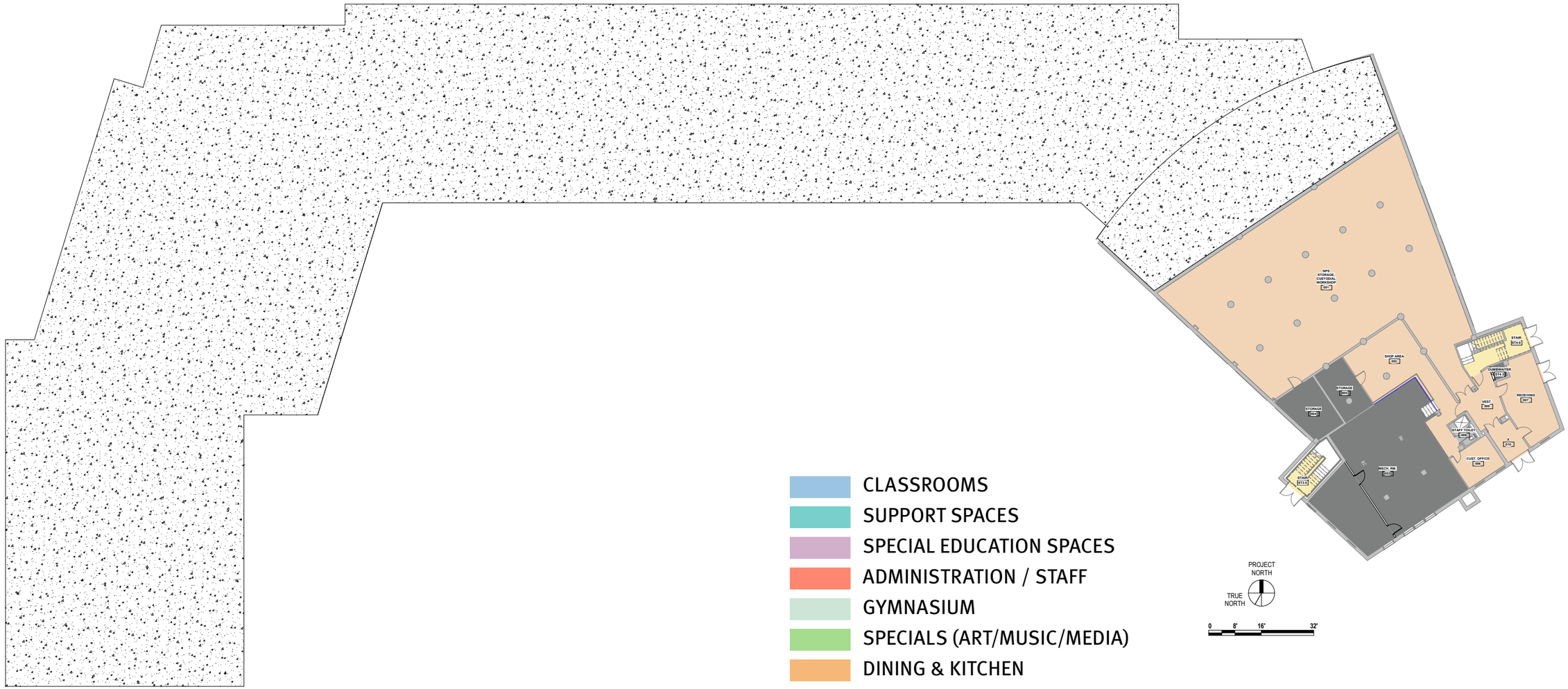
DESIGN UPDATES / DRAFT BASEMENT FLOOR PLAN



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AUDITORIUM VISIONING

AUDITORIUM UPDATE

FOUR THEMES EMERGED FROM THE WORKSHOPS AND SURVEY RESULTS

- **PRIORITY TO SCHOOL - STUDENTS, FACULTY, AND PROGRAMS**
  - Because the venue is located within the Lincoln-Eliot Elementary School, priority should be given to the educational experience and access of the school itself.
- **ACCESS TO COMMUNITY**
  - Stemming from a lack of access to Newton North High School auditorium, the community is concern that access to the Lincoln-Eliot auditorium will be similar.
- **FACILITY IMPROVEMENT**
  - Due to the current disrepair of the venue, the priority is to renovate and improve the facility to accommodate professional presentations and productions.
  - The goal to create a multi-use community venue with quality equipment and experience, but there is not much need for top-of-line equipment.
- **QUALITY EXPERIENCE**
  - A balance of access for students and the community indicates the venue is a combination of an elementary school and a professional setting is important to the group.

AUDITORIUM UPDATE

IN CONSIDERATION OF THE USES, THE GROUPS FELT THAT VENUE SHOULD INCLUDE:

- Basic house sound, lighting and communications package with infrastructure for rental equipment
- Projector and screen
- Broadcast capabilities, including interface with Newton Public TV and high-speed internet
- Recording options
- Stage-level accessible dressing room
- Stage-level storage
- Choir risers (removable or built into front of stage)
- Back-of-house dressing rooms and green rooms to support up to 30 people with options for overflow.
- Easy loading access for instruments, sets, costumes, etc.
- Security
- Front-of-house amenity spaces including public adult restrooms, concession area and common gathering space
- Easy-to-use and easy-to-operate systems
- Seating capacity: approximately 400 seats

BUILDING PERFORMANCE

BUILDING ENVELOPE

BUILDING PERFORMANCE
BUILDING ENVELOPE

NEW, HIGH PERFORMANCE EXTERIOR WALL

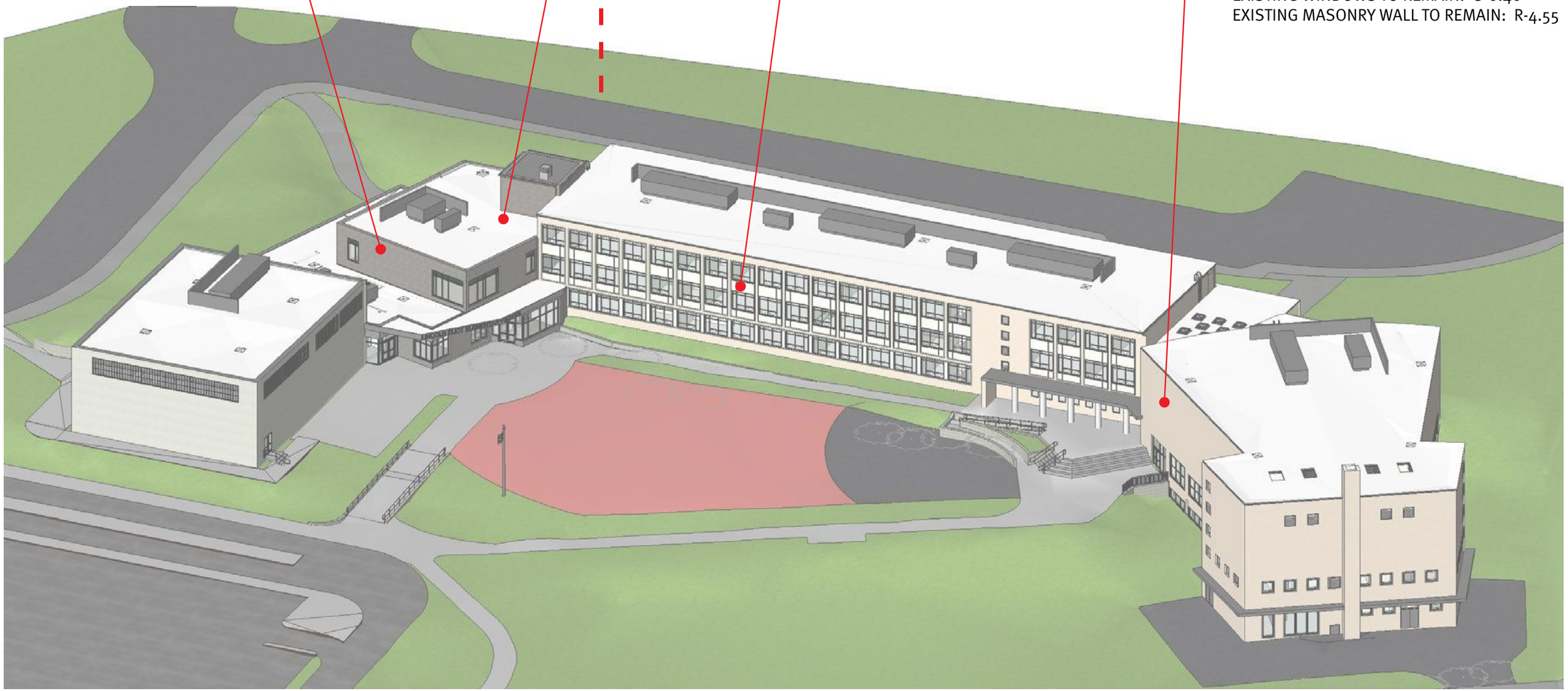
EXISTING EXTERIOR WALLS TO REMAIN

NEW ADDITION
WINDOWS: U-0.30
EXTERIOR WALL: R-27.04
SLAB EDGE: R-10 FOR 36”

ROOF (ENTIRE BUILDING)
PROPOSED EPDM ROOF
R-35.81

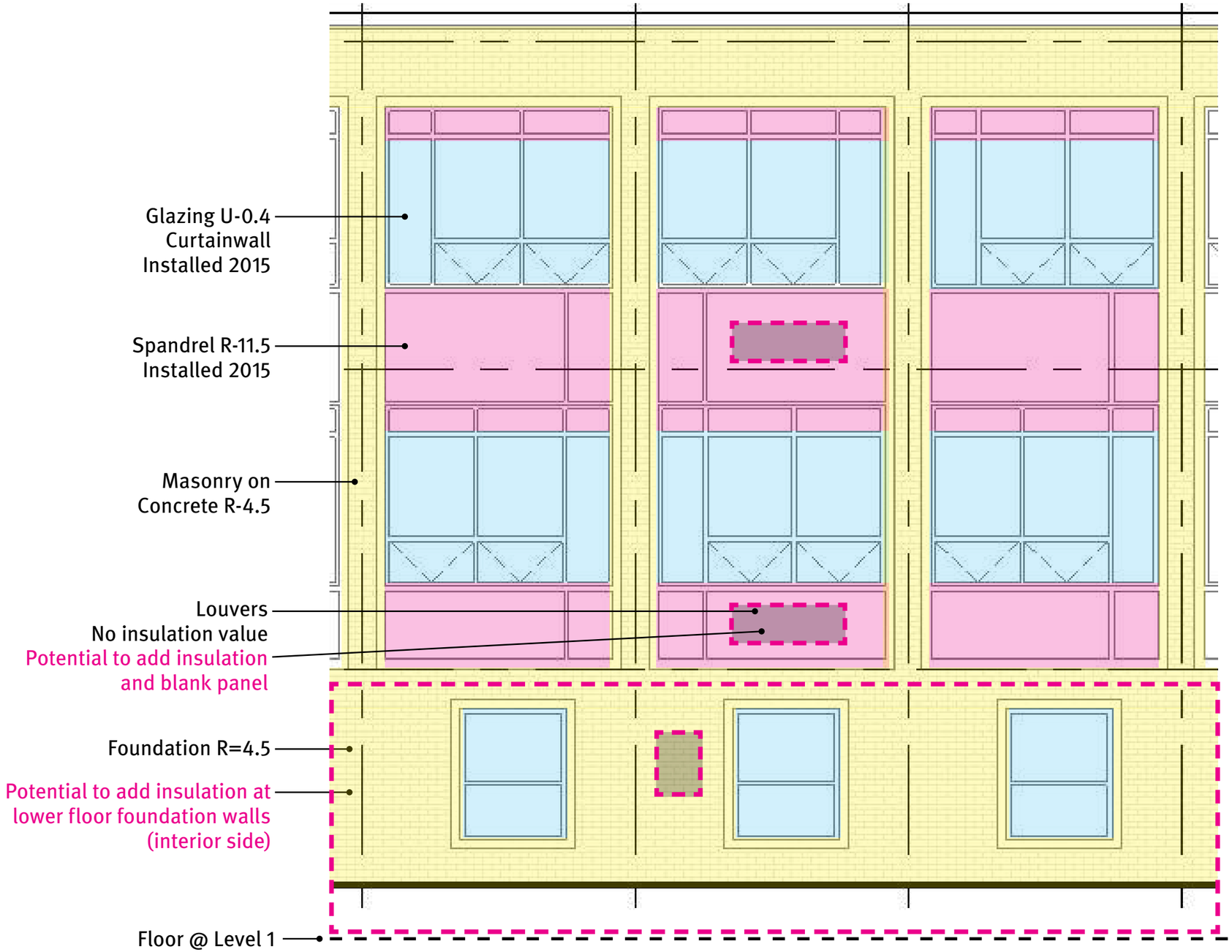
CLASSROOM WING
EXISTING WINDOWS TO REMAIN: U-0.40
EXISTING SPANDRELS TO REMAIN: R-11.6
EXISTING MASONRY TO REMAIN: R-4.55

AUDITORIUM & CAFETRIA
EXISTING WINDOWS TO REMAIN: U-0.40
EXISTING MASONRY WALL TO REMAIN: R-4.55



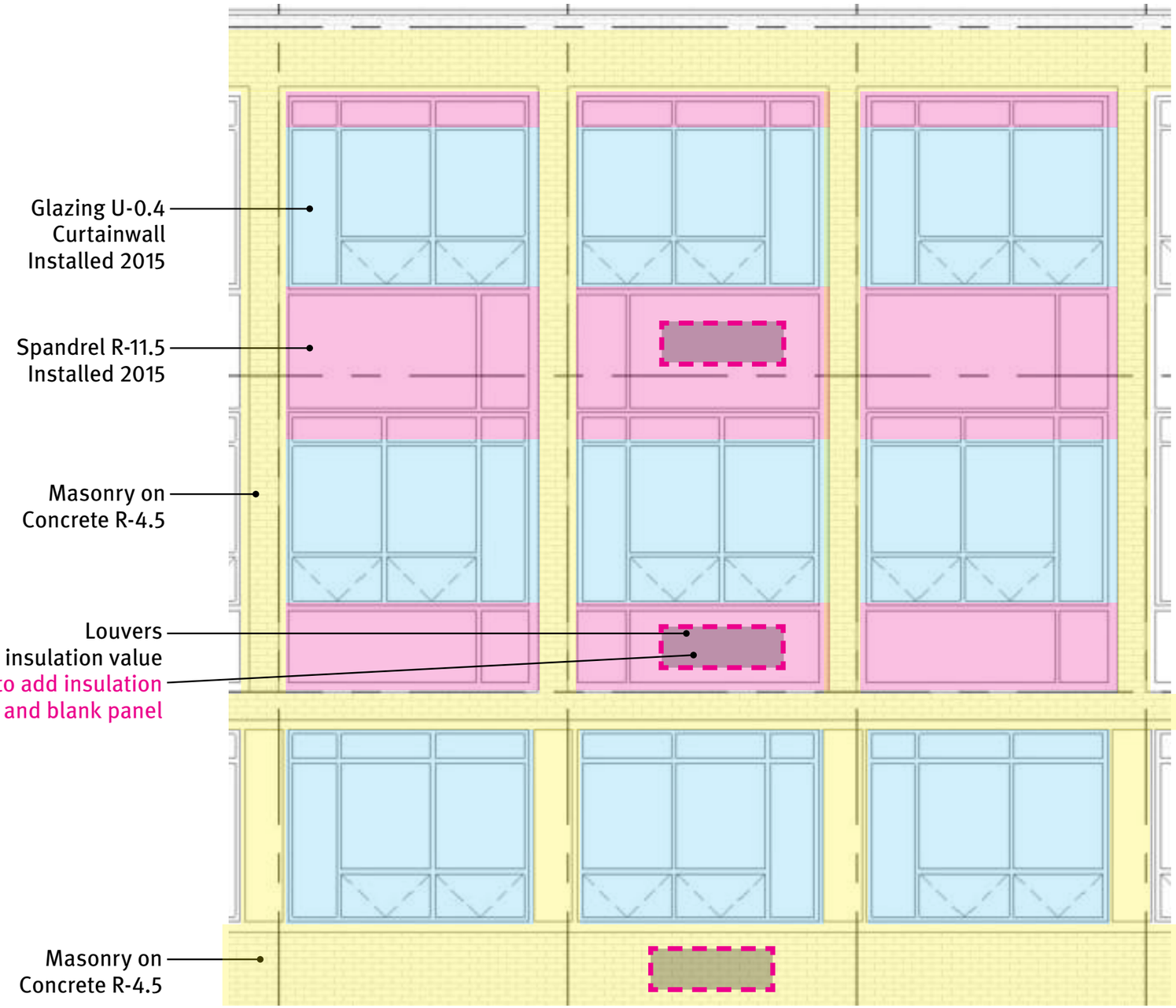
BUILDING ENVELOPE /EXTERIOR WALL

EXISTING CONDITIONS - EAST WALL



BUILDING ENVELOPE /EXTERIOR WALL

EXISTING CONDITIONS - WEST WALL



ENERGY & LCCA

FRAMING THE DISCUSSION

HVAC SYSTEM OPTIONS

ALL-ELECTRIC

#1

VRF

Overhead Ventilation

ALL-ELECTRIC

#2

Air Cooled Heat Pump Chiller & Electric Boiler

Displacement Ventilation

NET ZERO* ALL-ELECTRIC

#3

Ground Source Heat Pump

Displacement Ventilation

*CAN ACHIEVE AND EUI OF 25 MAX.

HVAC SYSTEM OPTIONS

ALL-ELECTRIC

#1

VRF

Overhead Ventilation

MULTIPLE SMALL ROOFTOP UNITS

VENTILATION SUPPLIED OVERHEAD

ALL-ELECTRIC

#2

Air Cooled Heat Pump Chiller & Electric Boiler

Displacement Ventilation

NET ZERO ALL-ELECTRIC

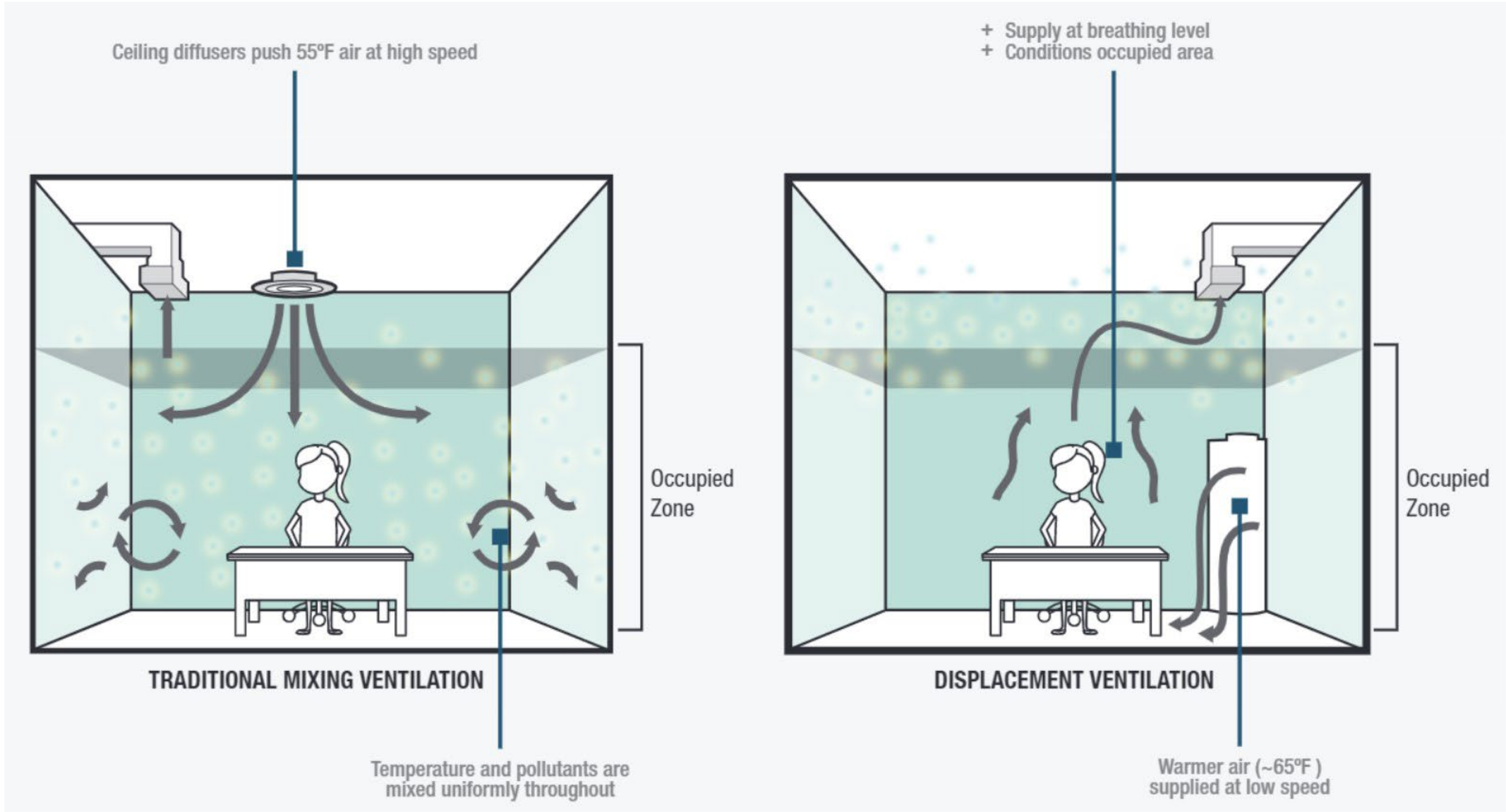
#3

Ground Source Heat Pump

Displacement Ventilation

SIMILAR TO #2 BUT GROUND USED INSTEAD OF AIR FOR HEAT TRANSFER (MORE EFFICIENT)

DISPLACEMENT VENTILATION VS. MIXING VENTILATION



- Improved indoor air quality (IAQ)
- Improved acoustics
- Improved thermal comfort
- Reduced energy

ENERGY & LCCA

FINDINGS

HVAC SYSTEM OPTIONS
QUALITATIVE COMPARISON

		EUI	Net Zero	Carbon Emissions	Indoor Air Quality	Acoustics	Annual Energy Cost	Annual Maintenance Cost	Annual Savings	Capital Investment Cost	Lifetime Savings	Discounted Payback	Eversource Incentive
#1	VRF (BOD)	◌		◌	○	○	◌	○	◌	●	NA	NA	◌
#2	Air Cooled Heat Pump Chiller & Electric Boiler	○		○	●	●	○	●	○	●	○	●	◌
#3	Ground Source Heat Pump	●	✓	●	●	●	●	●	●	◌	●	◌	●

Scale

● ○ ◌

Better ⟷ Worse

HVAC SYSTEM OPTIONS
QUANTITATIVE COMPARISON

		EUI	Net Zero	Carbon Emissions (mTons)	Annual Energy Use (MWh)	% Provided by PV	Annual Energy Cost	Annual Energy Cost/sf	Annual Maintenance Cost	Annual Savings	Capital Investment Cost	Lifetime Savings	Discounted Payback	Eversource Incentive *
#1	VRF (BOD)	33.9	No	598.7	972.4	48%	$242,435	$2.47	$78,246	NA	$6,386,755	NA	NA	$52,929
#2	Air Cooled Heat Pump Chiller & Electric Boiler	30.7	No	542.6	881.1	53%	$212,510	$2.17	$70,240	$37,931	$6,559,370	$1,174,236	5 yr	$74,394
#3	Ground Source Heat Pump	23	Yes	406.9	660.8	70%	$156,047	$1.59	$70,740	$93,894	$8,853,045	$2,104,579	36 yr	$213,181

All values are approximate and subject to change with further analysis.
*Eversource incentives for reference only. Not included in LCCA savings.

HVAC SYSTEM OPTIONS
COST COMPARISON

		EUI	HVAC Capital Investment Cost	Eversource Incentive *	Net After Incentive	HVAC Cost Delta	HVAC Cost Delta w/ Incentive	Total Construction Cost Delta	Total Construction Cost Delta w/ Incentive
#1	VRF	33.9	$6,386,755	$52,929	$6,333,826				
#2	Air Cooled Heat Pump Chiller & Electric Boiler	30.7	$6,559,370	$74,394	$6,484,976	3%	2%	0.42%	0.37%
#3	Ground Source Heat Pump	23	$8,853,045	$213,181	$8,639,864	39%	36%	6.01%	5.62%

All values are approximate and subject to change with further analysis.
*HVAC system #1 and 2 are only eligible for Eversource Path 2. System #3 is eligible for Path 1 ZNE Ready.

ACTIVITIES & DECISION POINTS

Activities performed

- Collect existing usage data and proposed occupancy schedule
- Energy modeling
- Determine site locations for PV and prelim design from Solect
- Develop enclosure assemblies
- Economic Engineering Assessment (LCCA) of HVAC system options
- Cost estimates for MEP system options

Schedule

- **Late April** - complete LCCA
- **September - Present Life Cycle Cost Assessment**
  - Decide on HVAC option for project

WATER REUSE LCCA
FINDINGS

WATER REUSE FOR IRRIGATION LCCA

Water Demand

	gallons	Pecent Reduced by Reuse
Flushing Demand	748250	0%
Cooling Tower Demand	0	0%
Irrigation Demand	278671	95%

Water Reuse Capital Cost

Reuse Design	Estimated Cost	No Reuse Design	Estimated Cost
Rainwater reuse system (25,000gal tank)	$330,197	Min required stormwater retention system	$0
Reuse piping to WC/urinals	$0	Potable only piping	$0
Reuse piping to cooling tower	$0		
Reuse piping to irrigation			
TOTAL	**$330,197**	TOTAL	**$0**

DELTA **$330,197**

Water Reuse Payback

Payback Period Calulation - Septic		Payback Period Calulation - Sewer	
Estimated demand savings in gallon/year	264,737	Estimated demand savings in gallon/year	264,737
Current water cost per gallon	-	Current water cost per gallon	$0.0136
Estimated annual water cost	n/a	Estimated annual water cost	$3,600.43
		Current sewer cost per gallon*	$0.00
		Estimated annual sewer cost	$0.00
Annual O&M Cost		Annual O&M Cost	
Payback period in years	**n/a**	**Payback period in years**	**92**

Notes: Assumes a separate water meter for irrigation, which will not incur sewer rates and will be billed as water only

EMBODIED CARBON LCA

FINDINGS

WHAT IS EMBODIED CARBON

Image: EC3

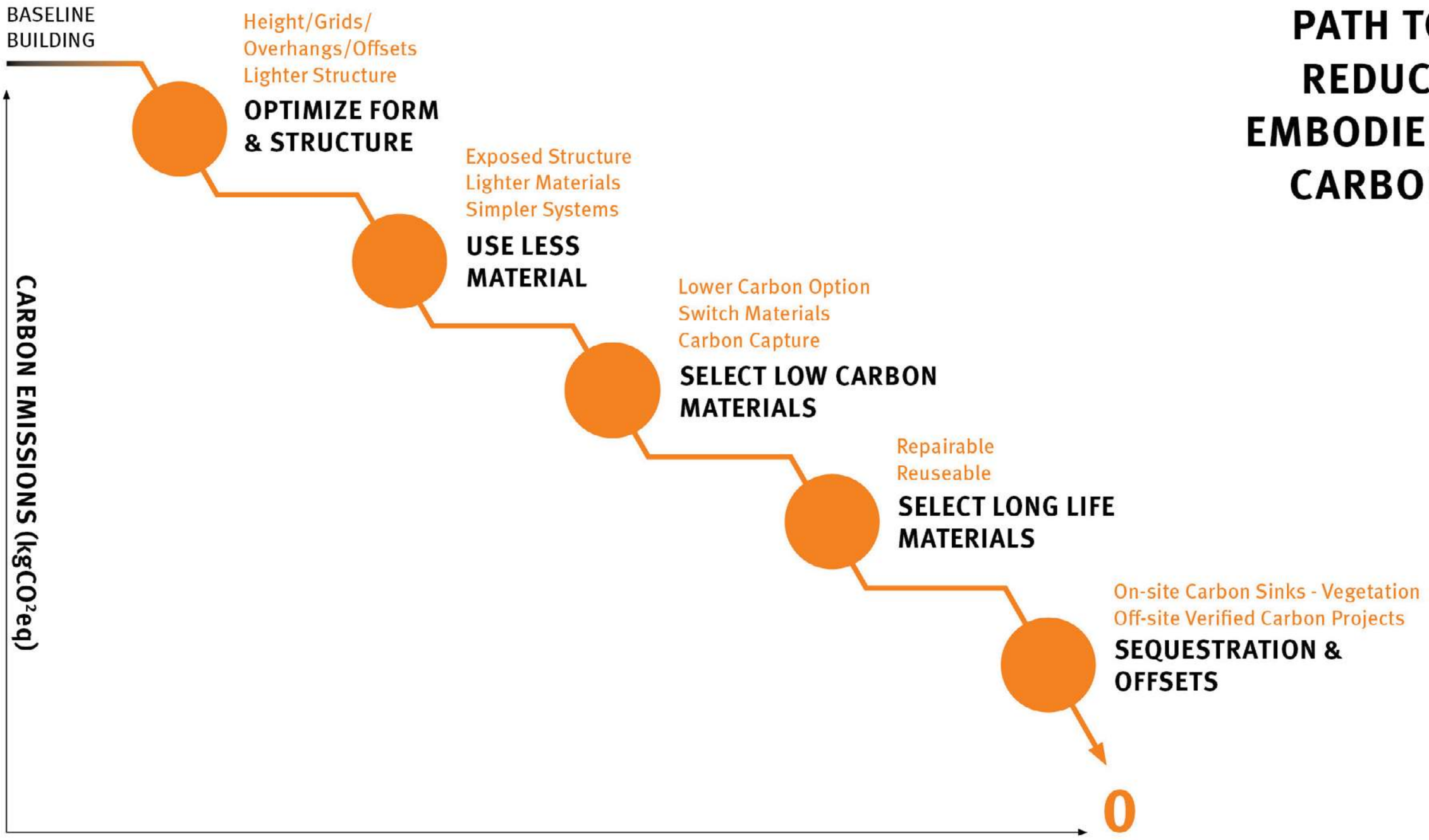
METRIC: GLOBAL WARMING POTENTIAL (GWP)

UNITS: $kgCO_2e$

TOOL: LIFE CYCLE ASSESSMENT

e = equivalence which means all greenhouse gases (CO2, CH4, N2O, HFCs, PFCs, SF6, NF3)

PATH TO REDUCE EMBODIED CARBON



HIGH CARBON MATERIALS
STRUCTURE & ENCLOSURE

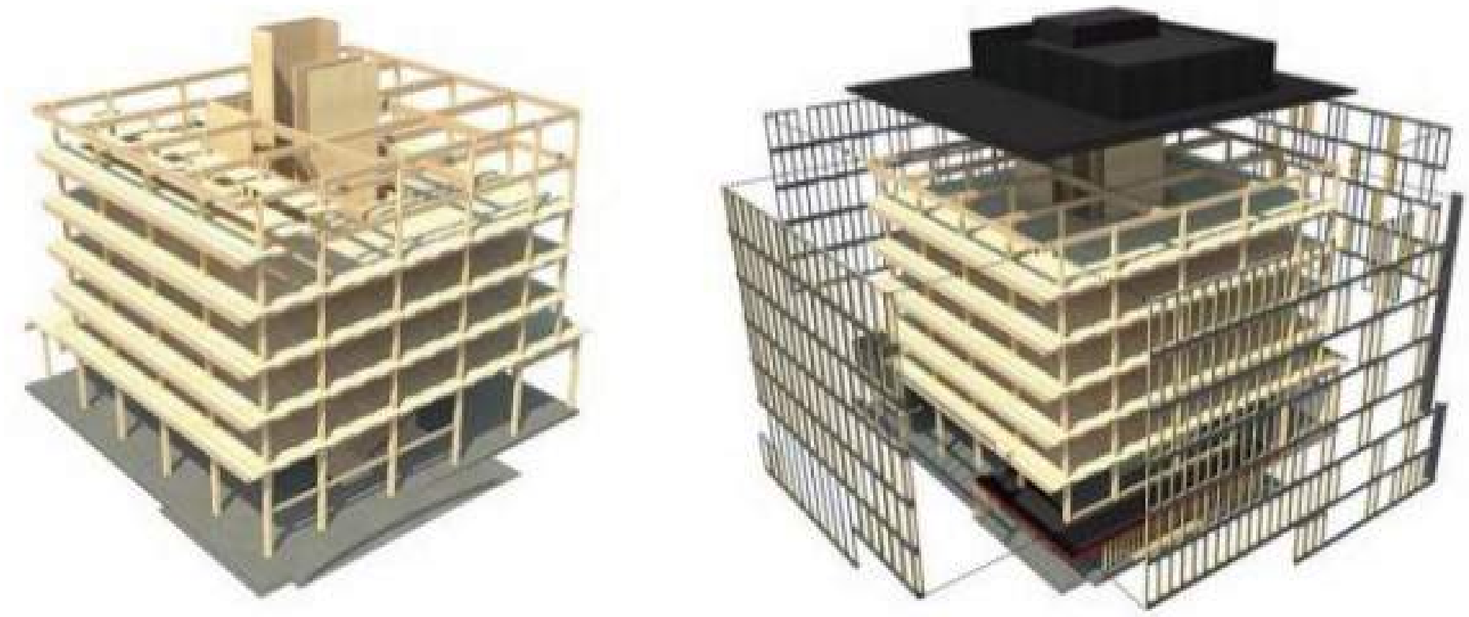
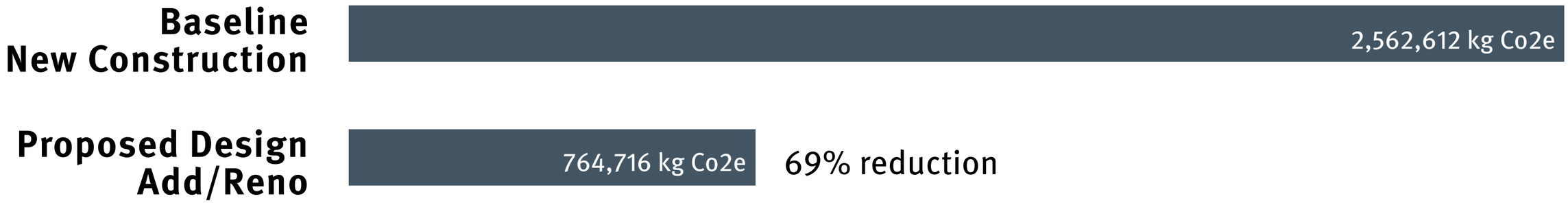


Image Credit: MGA - Wood Innovation Design Centre

HIGH CARBON MATERIALS
CONCRETE

LIFE CYCLE ASSESSMENT
RESULTS - BUILDING REUSE



BASELINE

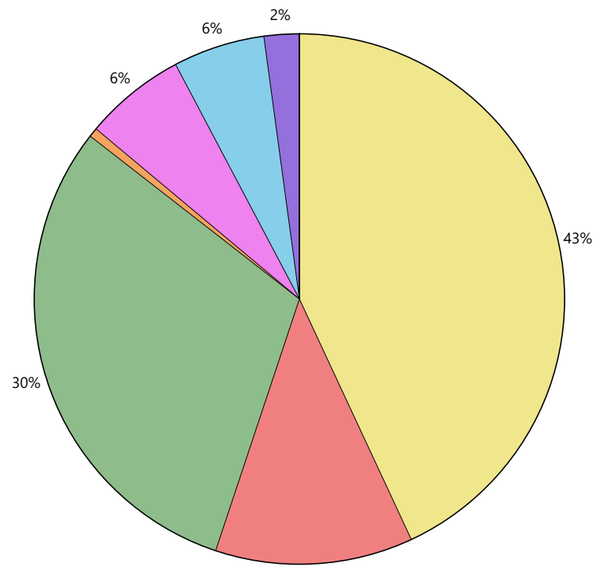
- Typical new construction components instead of reuse

PROPOSED DESIGN

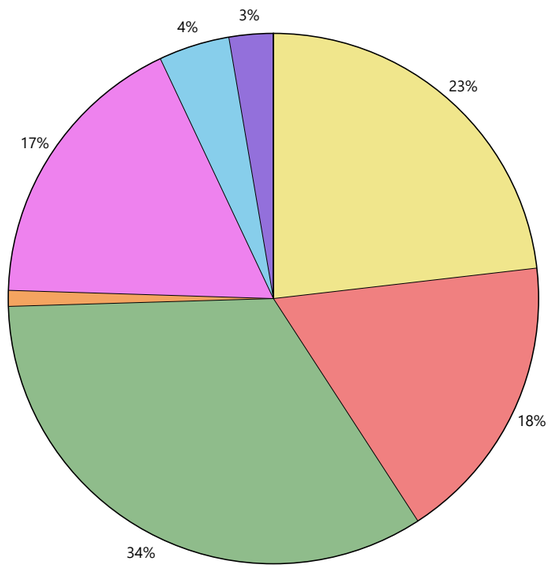
- Reused majority of existing structure and facade
- New addition

LIFE CYCLE ASSESSMENT
RESULTS - BUILDING REUSE

Baseline



Proposed Design



Divisions

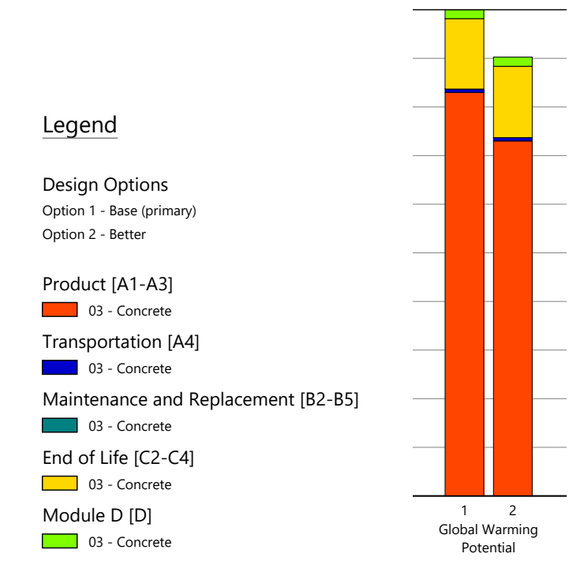
- 03 - Concrete
- 04 - Masonry
- 05 - Metals
- 06 - Wood/Plastics/Composites
- 07 - Thermal and Moisture Protection
- 08 - Openings and Glazing
- 09 - Finishes

CURRENT DESIGN

- **Regional Average 20% Supplemental Cementitious Material (SCM)**

ADDITIONAL SCM DESIGN OPTION

- **Foundations: 50% SCM**
- **Slabs: 30% SCM**



LOW CARBON DESIGN ELEMENTS

- **Brick cladding on addition**
- **Mineral wool insulation above grade**
- **Carbon capture CMU**
- **Low carbon drywall**
- **Exposed ceiling in library**
- **Durable, long-life, extended producer programs for interior finishes**
- **Design for deconstruction**

EMBODIED CARBON WOOD CONSTRUCTION ALTERNATIVES

	STEEL FRAME CONSTRUCTION TYPE IIB NON-COMBUSTIBLE, UNPROTECTED BASE DESIGN	HEAVY TIMBER CONSTRUCTION TYPE IV 1-HR RATED STRUCTURE	WOOD FRAMING & HEAVY TIMBER CONSTRUCTION TYPE V & IV COMBUSTIBLE & 1-HR RATED	WOOD FRAMING & STEEL FRAME CONSTRUCTION TYPE V &IIB COMBUSTIBLE &NON-COMBUSTIBLE
EMBODIED CARBON	**MOST**	**LESS**	**LEAST**	**LESS**
CONSTRUCTION COST	**$$** **$65/sf**	**$$$$** **$80/sf** Does not include potential added costs to fire-rating existing steel structure & floor acoustics	**$$$** **$70/sf** Includes added costs for fire wall. Does not include floor acoustic measures.	**$$** **$65/sf** Includes added costs for fire wall. Does not include floor acoustic measures.
DESIGN/SPACE FUNCTIONALITY	**CURRENT DESIGN** • Structure readily accommodates large spans in Gym, Library, and Lobby • Composite metal & concrete floors provide good acoustic properties • Materials and manufacturers are plenty and easily available • Less structural depth • Performance is better (deflection & vibration) • More flexibility for future renovation & expansion	**MODERATE IMPACT TO CURRENT DESIGN** • Structure can readily accommodate large spans in Gym, Library, and Lobby • Concealed connections detailing required • More structural depth which will impact ceiling heights & MEP • Second floor acoustic measures require topping slab & possible acoustic mat • Materials and manufacturers have greater complexity/limited sourcing. Potential for delays	**NEGATIVE IMPACT TO CURRENT DESIGN** • Gym required to be long-span structure (heavy timber and glue-lam.) • Current building geometry is not optimized for wood (no stacking, span is not appropriate, deeper structure) • Requires double height shear walls impacting windows/openings • More structural depth which will impact ceiling heights & MEP • Second floor acoustic measures require topping slab & possible acoustic mat • Fire wall and rated vestibules required between Addition & Existing Building • Materials and manufacturers have greater complexity/limited sourcing. Potential for delays	**NEGATIVE IMPACT TO CURRENT DESIGN** • Gym required to be long-span structure (steel frame and long span joists) • Current building geometry is not optimized for wood (no stacking, span is not appropriate, deeper structure)) • Requires double height shear walls impacting windows/openings • More structural depth which will impact ceiling heights & MEP • Second floor acoustic measures require topping slab & possible acoustic mat • Fire wall and rated vestibules required between Addition & Existing Building • Materials and manufacturers have greater complexity/limited sourcing. Potential for delays • Mix contractors, complexity with coordination