LICK-WILMERDING HIGH SCHOOL
Historic Renovation & Expansion

OWNER/CLIENT
Lick-Wilmerding High School

ARCHITECT
EHDD Architecture

GENERAL CONTRACTOR
Truebeck Construction

CIVIL ENGINEER
BKF Engineers

LANDSCAPE ARCHITECT
GLS Landscape/Architecture

STRUCTURAL ENGINEER
Forell/Elsesser Engineers

MECHANICAL/PLUMBING/ELECTRICAL
Integral Group

LIGHTING CONSULTANT
Architecture & Light

ACOUSTICAL CONSULTANT
Charles M. Salter Associates

DAYLIGHTING CONSULTANT
University Of Washington—Integrated Design Lab

COMMISSIONING CONSULTANT
Guttman & Blaevoet

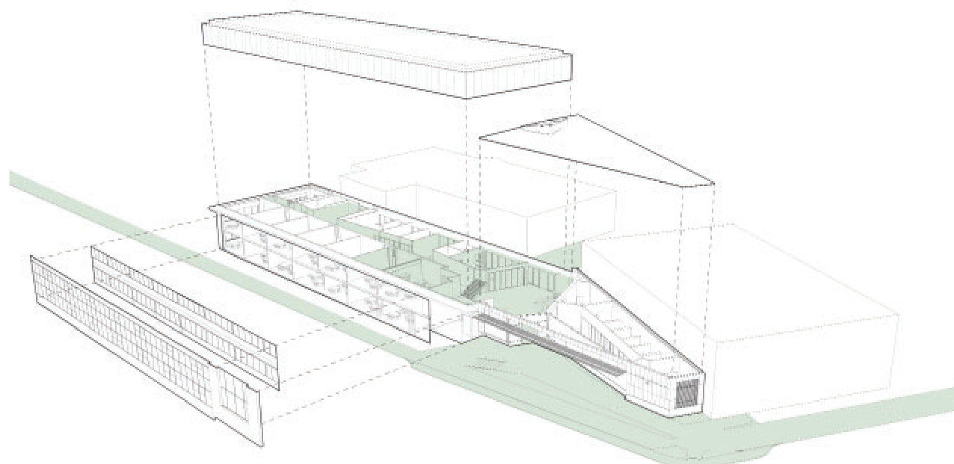
AIA California
2020 Merit Award
Winner

The original classroom building was designed by William Merchant, a well-respected local architect, and incorporated the most technically modern systems of the day. Over the decades, the city urbanized intensely around the site. Where the building had once sat prominently along a bucolic city block, it now felt lost against the scale and activities of its current surroundings.

The Board of Trustees wanted a new entry and identity that demonstrated its strong relationship with the community, both physically and internally. Its existing entrance was hidden mid-block and physically disconnected from the rest of the campus. Moving the main campus entry to the street block corner enhanced the school's presence in the community with direct access and views into the heart of the school and campus beyond.

Additional classroom and office program was needed to allow for increased student enrollment. The required space was achieved with a new glassy addition that rests lightly on top of the historic glassy classroom building, setback slightly out of deference.

The existing building had been operating under declining conditions, with poor air quality, substandard daylighting, and dark maze-like corridors. The single-pane wood curtain wall provided little acoustic buffer against the constant street traffic and was even worse for thermal comfort.



The school was committed to updating the building to be a truly livable building to reflect the cutting edge of our time. The historic and new building envelope was designed to high thermal, acoustic, and air quality standards based on the site adjacencies to major transit thoroughfares. The energy use intensity was critically analyzed from the beginning of the project to target Net Zero energy with solar PVs on campus along with continued efforts to fine-tuning mechanical systems, equipment, lighting choices, and plug loads.

The interior spaces are designed to allow for both learning and public spaces that foster interaction, social connection, and multi-functional uses for interdisciplinary collaboration. A variety of spaces were designed for small to large group interaction inside rooms and within the corridors by angling walls, opening up gathering spaces, and providing daylight and views.

The new classroom building now acts as a model of the school's commitment to fostering an awareness of best practices in sustainable design and lifestyle within the entire school community.

LICK-WILMERDING HIGH SCHOOL

Historic Renovation & Expansion

We worked closely with students, faculty, staff, alumni, parents, and community to embed their goals and values into the renovation design. The school has a strong commitment to cultural and socioeconomic inclusion. Twenty-eight percent of the school's operating budget is dedicated to their flexible tuition program, in which more than 1 in 3 students are enrolled, averaging over 70% of the cost. First-generation college students average 10% of the student body, and 56% of students self-identify as students of color.

This commitment is facilitated by the school's strong urban interface along major public transit thoroughfares with dedicated bike routes, bus lines, light rail trains and BART. By providing zero student parking, the school actively encourages alternate means of transportation for all students and is able to attract a diverse student population throughout the entire San Francisco Bay Area.

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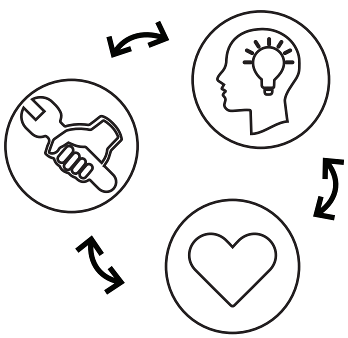
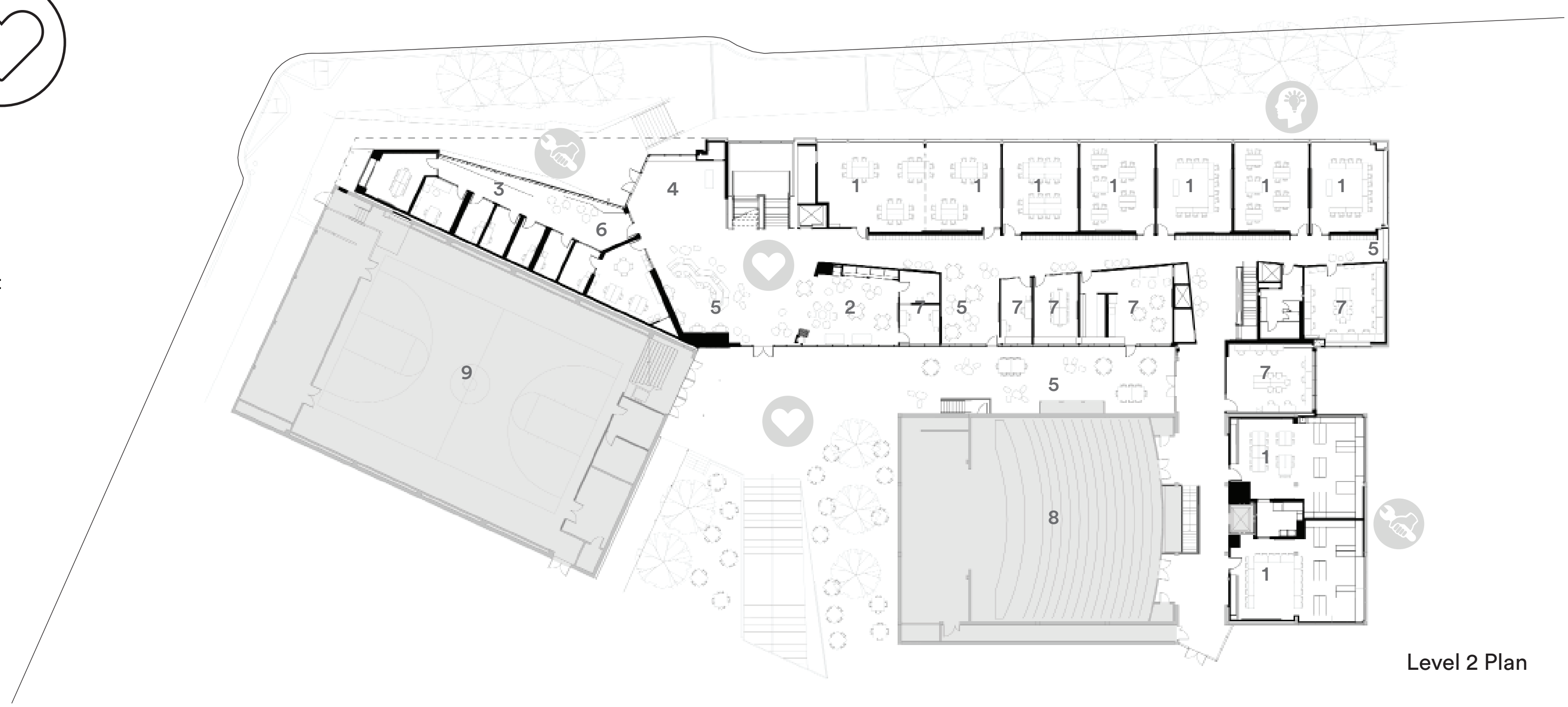
A private school with public purpose, Lick-Wilmerding High School develops the head, heart, and hands of highly motivated students from all walks of life, inspiring them to become lifelong learners who contribute to the world with confidence and compassion. This mission was integrated through the design to showcase and support these values in a way that actively engages the local and school community.



Level 3 Plan



Level 2 Plan

1 Classroom
2 The Center for Civic Engagement
3 Student Work Display Wall
4 Lobby
5 Breakout Area
6 Dean's Area
7 Office
8 Existing Theater
9 Historic Gymnasium
10 Existing Roof

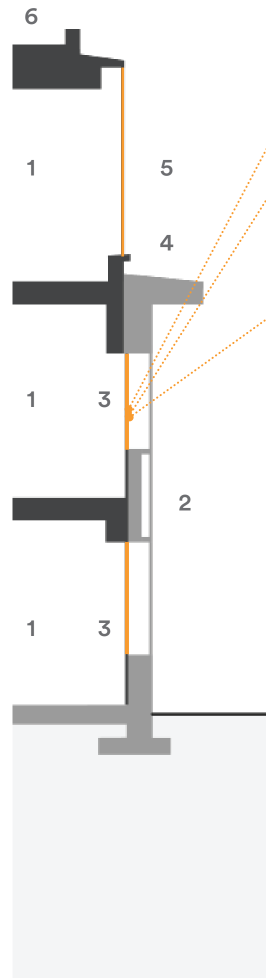
Building Area 50,488 SF

N

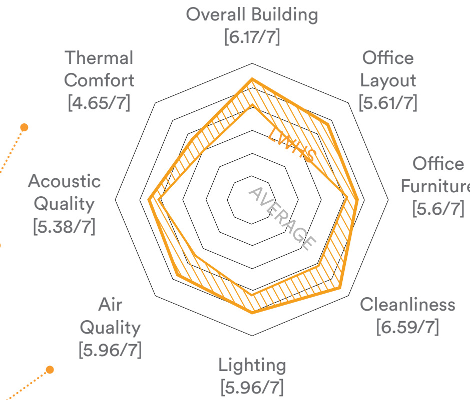
0 | | | | 56ft

North Elevation

N 0 | | | | 12ft



Wall Section



Preserving a mid-century glass box had its unique challenges. The historic facade consisted of a delicate single-pane wood curtainwall that offered poor energy performance. In addition, thermal discomfort and heavy traffic noise were a constant distraction from learning.

To overcome this, the project added an interior acrylic glazing system with a magnetic frame, allowing the lightweight acrylic to be easily removed for maintenance of the historic curtainwall, while helping the project achieve energy and acoustic goals. The magnetic frame also allowed for thin intermediate joints, making it nearly invisible behind the restored historic curtainwall, maintaining the original aesthetic qualities.

These strategies resulted in a direct link between facade design, energy performance and user satisfaction.

1 Classroom
2 Restored Historic Wood Curtainwall
3 New Interior Glazing
4 Historic Eave
5 New Curtainwall
6 New Roof

The new campus entry is moved to an active urban corner, where it not only becomes physically accessible, but also establishes a much stronger public presence. The entry recedes to provide a public plaza, and a display gallery features a rotating selection of students' artwork.

The emphasis on transparency, and the additional use of natural materials including zinc metal panels, thick cedar wood benches, and a custom perforated zinc screen by a school alum artist anchor this busy intersection, creating a warm and welcoming environment.

An extremely light custom fabricated canopy made of thin steel rods references the historic canopy, while countering its heaviness, maintaining a strong horizontal linearity and referencing the school's long history in industrial and technical arts.

INTERSECTION OF HISTORIC AND NEW

On top of the historic classroom facade, the new addition was set back and detailed to be as light as possible. While the historic curtainwall facade was flanked by heavy solid walls, the new addition features a seamless structurally-glazed glass plane all around. To contrast the historic building's heavy roof overhang, the new addition's roof pulls back with only a thin aluminum edge visible.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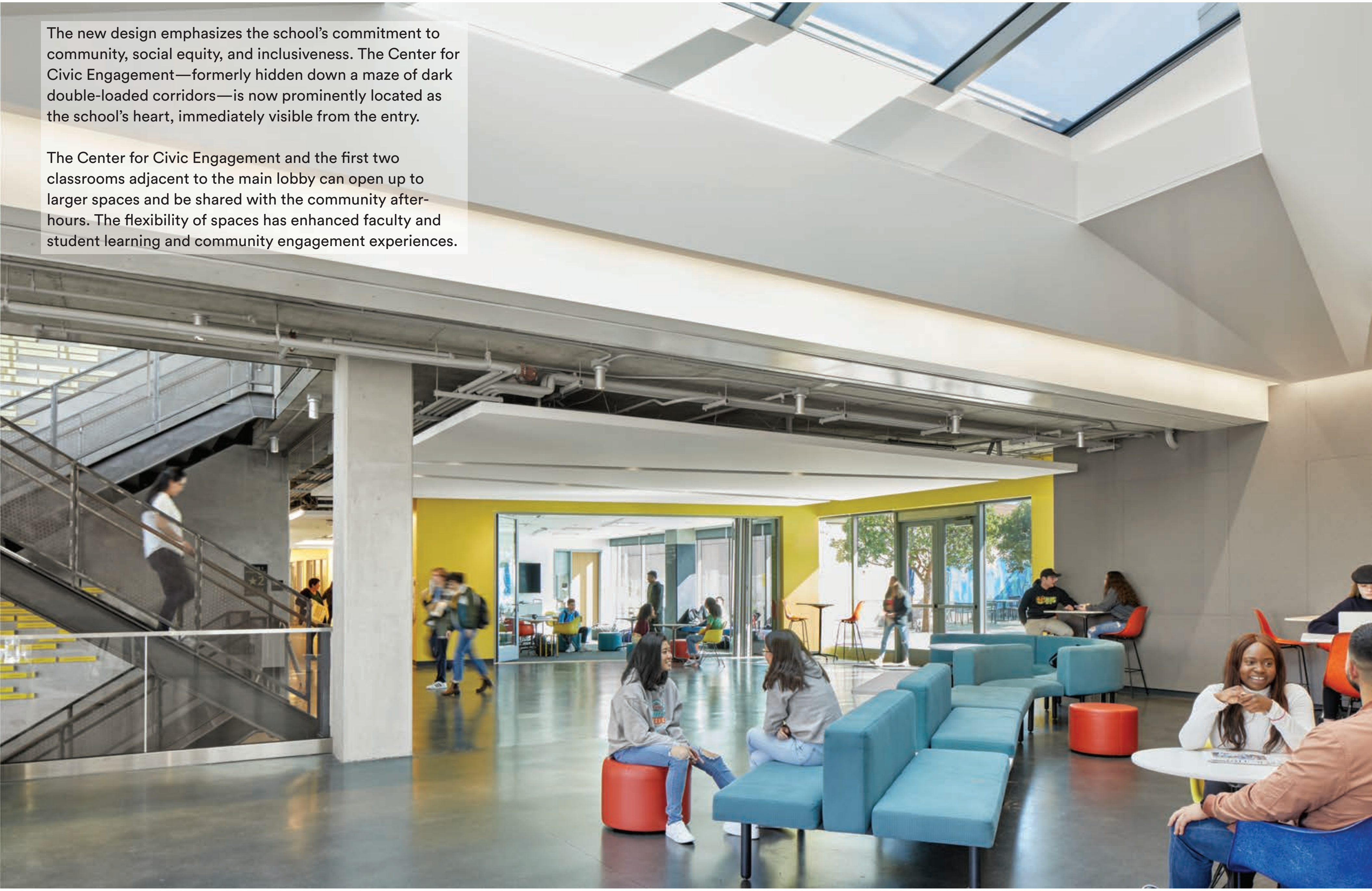
The new design emphasizes the school's commitment to community, social equity, and inclusiveness. The Center for Civic Engagement—formerly hidden down a maze of dark double-loaded corridors—is now prominently located as the school's heart, immediately visible from the entry.

The Center for Civic Engagement and the first two classrooms adjacent to the main lobby can open up to larger spaces and be shared with the community after-hours. The flexibility of spaces has enhanced faculty and student learning and community engagement experiences.




Español 4
→Entregar proyectos
→Compartir con compañeros de clase
→Discutir los requisitos para un puesto de gerencia
→El método - el escenario del mundo pos nuclear

The interior spaces are designed to provide daylighting and access to exterior views in all directions. Additionally, balanced acoustic treatment and localized temperature controls allow the many flexible open areas to truly function as collaborative learning spaces.

The structure was left exposed where possible to reference the school's industrial spirit. Low-emitting materials were selected with considerations for longevity and low-maintenance, and finishes were purposefully minimal to encourage students to take over the space for their work and experiments.

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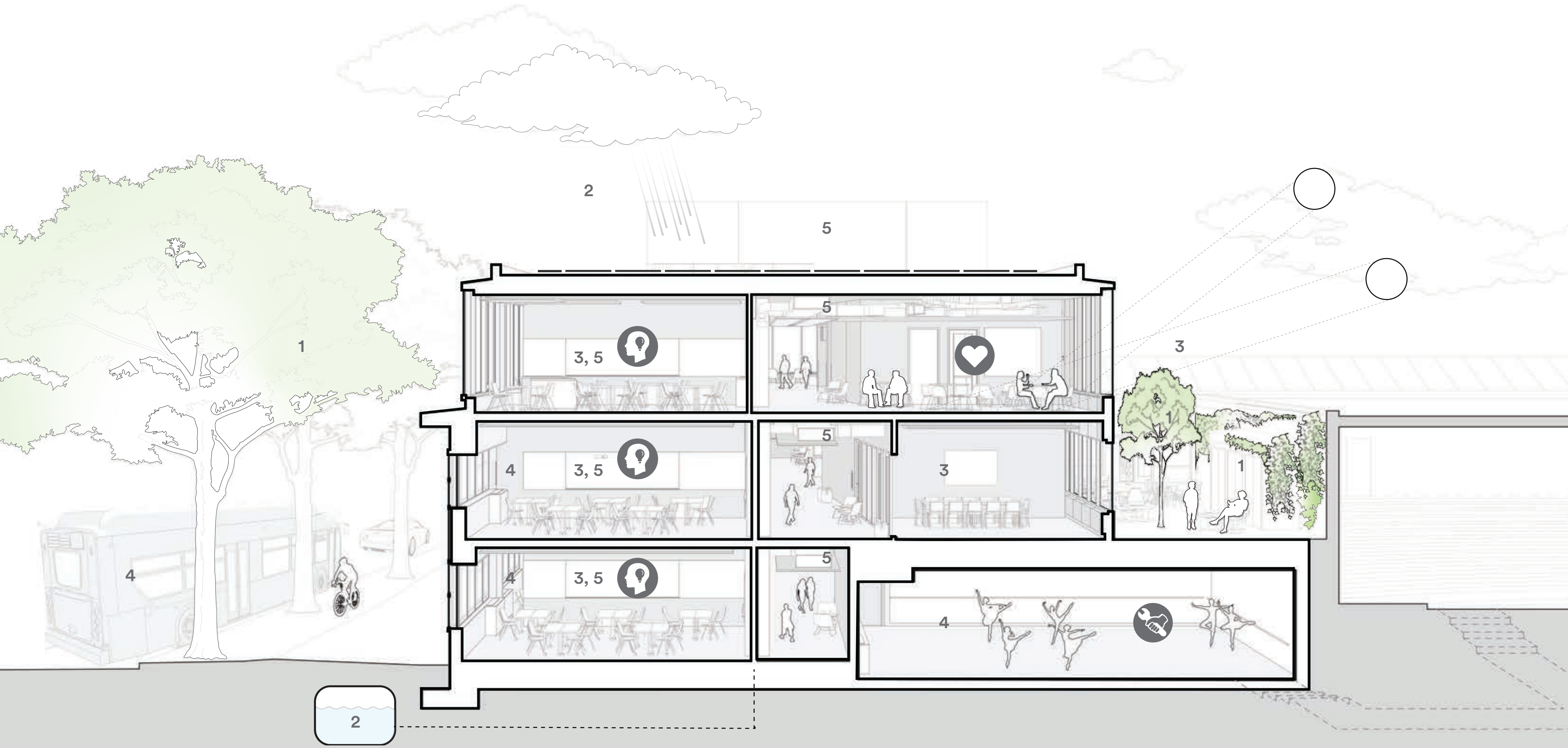
HEALTHY ENVIRONMENTS FOR LEARNING



1 Ecology
- Preserve existing street trees
- New trees and drought-tolerant landscaping at the street
- New tress in courtyard
- Green wall for views of landscape from classrooms

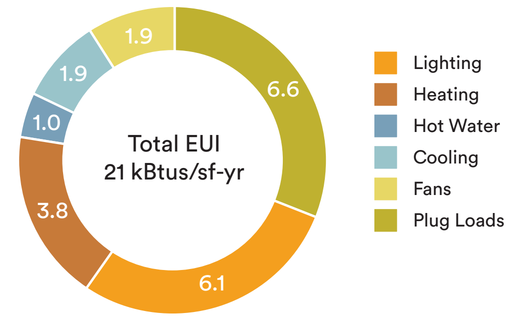
2 Water
- Building water use reduction by 35%
- Stormwater design 2% reduction of 2-year peak flow for the design storm event and a 10% reduction in 2-year storm runoff volume through permeable paving and onsite retention

3 Daylighting and Views
- Classrooms located on North facade for indirect sunlight and to reduce glare
- Desired solar gain from south on a particularly foggy site
- Connection to views and natural light from all directions

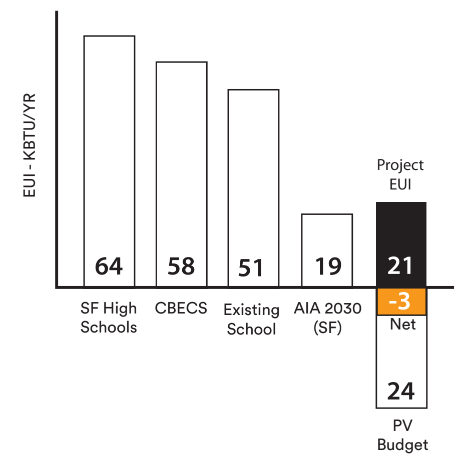
4 Acoustic Performance
- Added layer of interior glazing to historical facade to reduce transit noise
- Full acoustic isolation provided at sensitive spaces

5 Air Quality and User Comfort
- High indoor air quality through material choices and 100% fresh outside air system (DOAS) monitored by CO_2 sensors in all classrooms
- Air intake with high MERV filters to filter particulates, mechanical systems for air distribution and temperature are adjusted to ensure comfort levels
- Earned 17 IEQ points in the LEED rating system
- The school will educate the users on how the building functions to increase user satisfaction and experience

N 0 | | | |14ft



Plug load and lighting energy use accounted for nearly two-thirds of predicted energy use. Careful planning was provided during the design phase followed by commissioning of lighting and day-lighting controls. The school continues this effort through sustained education for its users about the building systems and operations.



We achieved a lower EUI through lower lighting loads, adjusting fan pressures and terminal box controls, and glazing selection on the third floor for better thermal performance. Different densities of ceramic frit were carefully calibrated for the laminated insulating glazing units on facades with southern and western exposure.

We also added interior acrylic windows at the historic facade to increase thermal performance. We worked with a commissioning agent early in the design process and throughout construction and continue to tune the systems during building operation to ensure our design is on target and functioning as intended.

The building was designed to achieve 5% net positive energy through new solar PV panels on the roofs of the main classroom building, adjacent gym, and café. The energy use intensity (EUI) of the building is 21 kBtu/sf-yr; among the top 10% most energy-efficient K-12 schools in San Francisco and significantly lower than the 51 EUI for the existing building before renovation.

A carbon emissions assessment was performed to look at strategies for mitigating both embodied and operational carbon.

By looking at structural systems, massing, energy efficiency, electricity generation and landscaping, we were able to look at many ways to improve our carbon performance and understand how impactful each strategy was.

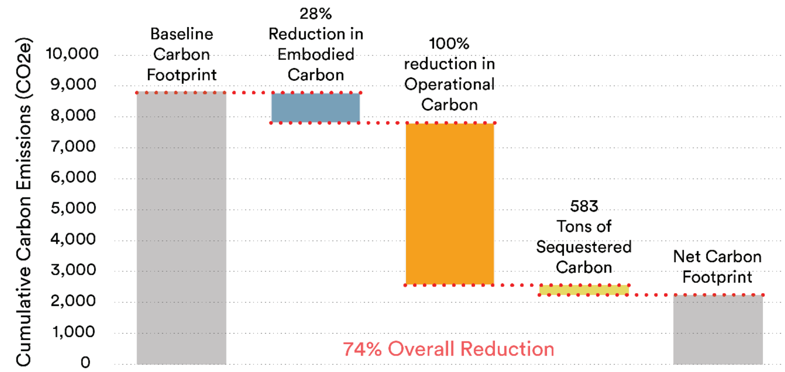
On the low end of the spectrum, while high-fly ash concrete was considered for a variety of benefits, we realized that its impact on carbon sequestration was actually not as impressive as we had anticipated.

We managed to reuse about 40% of the existing building facade and structure, which along with selecting plants for high sequestration did offer notable reductions in embodied carbon. These strategies accounted for 38% improvement in embodied carbon emissions and sequestration.

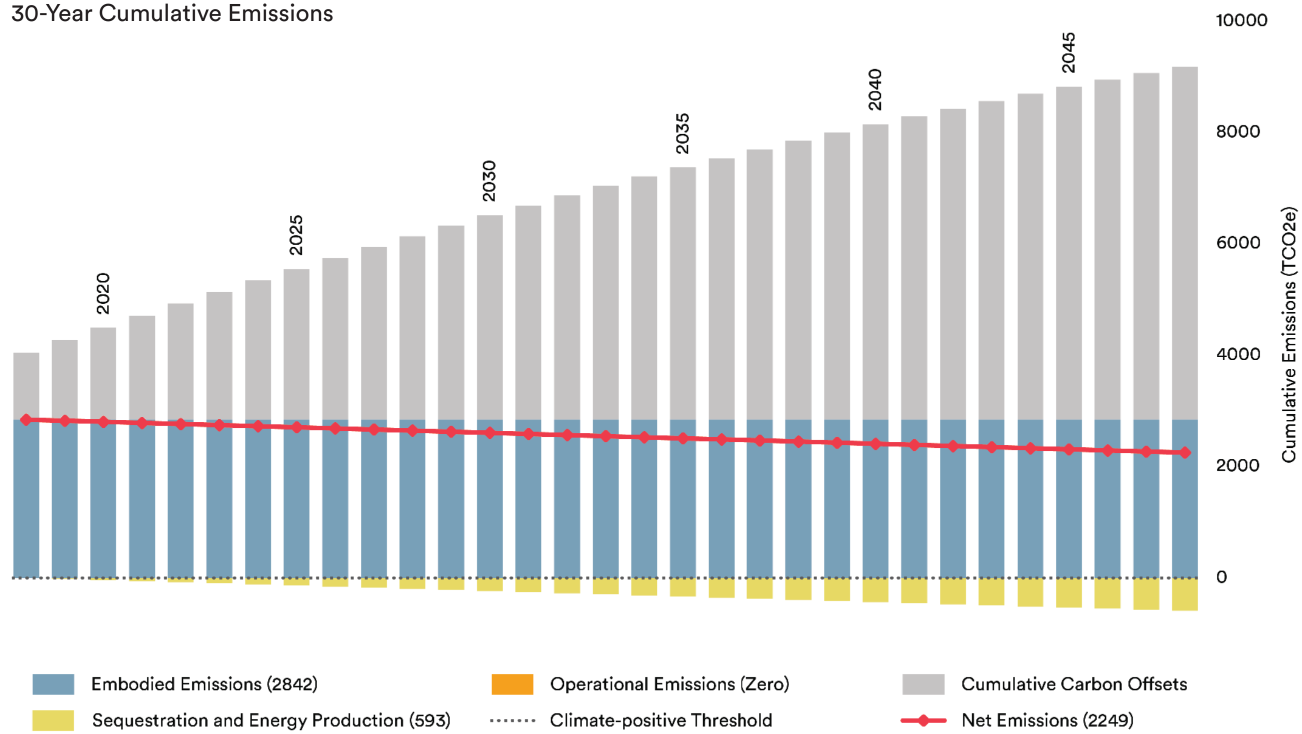
On the high end of the spectrum, providing onsite electricity generation to surpass net-zero energy use, total electrification with zero gas use and reducing EUI had the most significant impact on operational carbon. These strategies reduced operational carbon emissions by 100%.

Overall this project enabled the cumulative reduction of carbon emissions by 74% from baseline over a period of thirty years.

Contributions to Climate Positive Target Over 30 year Period



30-Year Cumulative Emissions



Lick Wilmerding

82	11	17	LEED NC 2009 for Schools Total Project Score	Possible Points 110

Sustainable Sites — Possible Points 24 (19 | 1 | 4)

Y	?	N			
Y			Prereq 1	**Construction Activity Pollution Prevention**	
Y			Prereq 2	**Environmental Site Assessment**	
1			Credit 1	Site Selection	1
4			Credit 2	Development Density & Community Connectivity	4
		1	Credit 3	Brownfield Redevelopment	1
4			Credit 4.1	Alternative Transportation, Public Transportation Access	4
1			Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
2			Credit 4.3	Alternative Transportation, Low-Emitting & Fuel-Efficient Vehicles	2
2			Credit 4.4	Alternative Transportation, Parking Capacity	2
		1	Credit 5.1	**Site Development**, Protect or Restore Habitat	1
	1		Credit 5.2	Site Development, Maximize Open Space	1
		1	Credit 6.1	Stormwater Design, Quantity Control	1
		1	Credit 6.2	Stormwater Design, Quality Control	1
1			Credit 7.1	**Heat Island Effect**, Non-Roof	1
1			Credit 7.2	Heat Island Effect, Roof	1
1			Credit 8	Light Pollution Reduction	1
1			Credit 9	Site Master Plan	1
1			Credit 10	Joint Use of Facilities	1

Water Efficiency — Possible Points 11 (3 | 2 | 6)

Y	?	N			
Y			Prereq 1	Water Use Reduction - 20% Reduction	
	2	2	Credit 1	Water Efficient Landscaping, Reduce by 50%	4
				Reduce by 50%	*2*
				No Potable Water Use or Irrigation	*4*
		2	Credit 2	Innovative Wastewater Technologies	2
3		1	Credit 3	Water Use Reduction	4
				Reduce by 30%	*2*
				Reduce by 35%	*3*
				Reduce by 40%	*4*
		1	Credit 4	Process Water Use Reduction	1

Energy & Atmosphere — Possible Points 33 (30 | 2 | 1)

Y	?	N			
Y			Prereq 1	**Fundamental Building Systems Commissioning**	
Y			Prereq 2	Minimum Energy Performance	
Y			Prereq 3	Fundamental Refrigerant Management	
19			Credit 1	Optimize Energy Performance	19
				12% New / 8% Existing	*1*
				14% New/10% Existing	*2*
				16% New/12% Existing...	*3*
				48%+ New/44% Existing	*19*
7			Credit 2	On-Site Renewable Energy, 2.5%	7
				1% Renewable Energy	*1*
				3% Renewable Energy	*2*
				5% Renewable Energy...	*3*
				13% Renewable Energy	*7*
2			Credit 3	**Enhanced Commissioning**	2
		1	Credit 4	Enhanced Refrigerant Management	1
2			Credit 5	**Measurement & Verification**	2
	2		Credit 6	**Green Power**	2

Regional Priority Credits — Possible Points 4 (2 | 2)

SSc4.1, SSc7.1, WEc2, WEc3 (40%), IEQc8.1, EAc2 (1%)

Y	?	N			
1			Credit 1.1	Regional Priority: SSc4.1	1
1			Credit 1.2	Regional Priority: SSc7.1	1
	1		Credit 1.3	Regional Priority: IEQc8.1	1
	1		Credit 1.4	Regional Priority: EAc2	1

Materials & Resources — Possible Points 13 (5 | 2 | 6)

Y	?	N			
Y			Prereq 1	Storage & Collection of Recyclables	
		2	Credit 1.1	**Building Reuse**, Maintain Existing Walls, Floors & Roof	2
				Reuse 75%	*1*
				Reuse 95%	*2*
		1	Credit 1.2	**Building Reuse**, Maintain 50% of Interior Non-Structural Elements	1
2			Credit 2	**Construction Waste Management**	2
				50% Recycled or Salvaged	*1*
				75% Recycled or Salvaged	*2*
		2	Credit 3	**Materials Reuse**	2
				Reuse 5%	*1*
				Reuse 10%	*2*
1	1		Credit 4	**Recycled Content** (post-consumer + 1/2 pre-consumer)	2
				10% of content	*1*
				20% of content	*2*
1	1		Credit 5	**Regional Materials**	2
				10% of content	*1*
				20% of content	*2*
		1	Credit 6	**Rapidly Renewable Materials**	1
1			Credit 7	**Certified Wood**	1

Indoor Environmental Quality — Possible Points 19 (17 | 2)

Y	?	N			
Y			Prereq 1	Minimum IAQ Performance	
Y			Prereq 2	Environmental Tobacco Smoke (ETS) Control	
Y			Prereq 3	Minimum Acoustical Performance	
1			Credit 1	Outdoor Air Delivery Monitoring	1
1			Credit 2	Increase Ventilation	1
1			Credit 3.1	**Construction IAQ Management Plan**, During Construction	1
1			Credit 3.2	**Construction IAQ Management Plan**, Before Occupancy	1
1			Credit 4.1	**Low-Emitting Materials**, Adhesives & Sealants	1
1			Credit 4.2	**Low-Emitting Materials**, Paints & Coatings	1
1			Credit 4.3	**Low-Emitting Materials**, Flooring Systems	1
1			Credit 4.4	**Low-Emitting Materials**, Composite Wood & Agrifiber Products	1
1			Credit 5	Indoor Chemical & Pollutant Source Control	1
1			Credit 6.1	Controllability of Systems, Lighting	1
1			Credit 6.2	Controllability of Systems, Thermal Comfort	1
1			Credit 7.1	Thermal Comfort, Design	1
1			Credit 7.2	Thermal Comfort, Verification	1
3			Credit 8.1	Daylight & Views, Daylight 75% of Spaces	3
				75% of Classroom spaces	*1*
				90% of Classroom spaces	*2*
				75% of Regularly occupied spaces	*3*
	1		Credit 8.2	Daylight & Views, Views for 90% of Spaces	1
1			Credit 9	Enhanced Acoustical Performance	1
	1		Credit 10	Mold Prevention	1

Innovation & Design Process — Possible Points 6 (6)

Y	?	N			
1			Credit 1.1	Innovation in Design: Green Building Education	1
1			Credit 1.2	Innovation in Design: Green Cleaning	1
1			Credit 1.3	Innovation in Design: Exemplary Performance	1
1			Credit 1.4	Innovation in Design: Title	1
1			Credit 2	**LEED™ Accredited Professional**	1
1			Credit 3	The School as a Teaching Tool	1

40-49 points = Certified
50-59 points = Silver
60-79 points = Gold
80-110 points = Platinum

A primary concern for this location include poor air quality due to seasonal fires and the immediate adjacency to Ocean Avenue and 280 Freeway.

For the last several years, the San Francisco Bay Area has experienced severe smoke events from wildfires in the fall. Schools and businesses have had to shut down on occasion due to air quality concerns. The new classroom building needed to address air quality from the associated freeway with high MERV filtration, which also significantly improves indoor air quality due to smoke events.

The mechanical system is also designed with enhanced ventilation that performs 30% above ASHRAE. There are CO_2 sensors in all classrooms to control ventilation via a dedicated outdoor air system (DOAS), so that air is never recirculated.

While these strategies were not designed with a pandemic in mind, the DOAS system has proven to be a critical component in keeping the building occupiable.

The building structure and massing were designed to provide for seismic resiliency, material conservation and future flexibility.

For seismic design, we compared a steel versus concrete structure early in the project. The concrete shear wall structure was used, which is more resilient against earthquakes as it is a stiffer, stronger, and more reliable system than a steel moment frame system. The building uses a post-tensioned structural system that allowed lower floor-to-floor structural heights, yet still allowed us to fit increased ceiling heights within the existing historic framework. Without any beams in the way, the post-tensioned system offers a flat uniform surface for flexible and improved utility layouts.

The long span capacity of the post-tensioned slab, in conjunction with a minimal and simple structural grid, allows increased flexibility for future architectural changes, as anchorage to the structure is uniform and simplified.

The structural system allowed the floor to floor height to be reduced from 14' to 12'. The project also preserved over 75% of the exterior facade along with other portions of the building. These strategies combined to produce significant initial material and costs savings and also translated into long-term reductions in carbon emissions and energy usage.