

# BLUESTONE ELEMENTARY SCHOOL

Harrisonburg City Public Schools

## Executive Summary

Harrisonburg, Virginia is a refugee resettlement community experiencing tremendous growth. Over 35% of Harrisonburg City Public School (HCPS) students identify as English Language Learners, representing over 60 countries and speaking 58 languages. **Guiding principles of Bluestone Elementary School's design included celebrating this amazing diversity, fostering a sense of inclusion, and offering flexible learning opportunities in a net-zero energy ready environment that's able to evolve and expand with the growing school community.**

Celebrating diversity began with designing for the endlessly different needs of students. Bluestone Elementary School provides a variety of spaces and scales for differentiated learning opportunities while also creating welcoming public areas that embody the school's commitment to learning in an inclusive environment. An active landscape and wayfinding system celebrating Harrisonburg's unique geography and ecology empower the diverse population of students to become stewards of this special place and help them feel connected to the larger world around them.

Equity at all scales was a driving force for the design. At the local level, prioritizing equity meant aggressively pursuing a compact building footprint to provide equivalent student/open space ratios to other HCPS campuses. At the regional scale, recognition of the Chesapeake Bay's watershed health led to a site design that uses a combination of "soft" and "hard" stormwater infrastructure to exceed local retention and treatment requirements. At the global scale, commitment to net-zero energy recognizes the Harrisonburg community's role in combating climate change and its responsibility to propose solutions for this and future generations.

VMDO worked with the Center for the Built Environment (CBE) to develop a custom post-occupancy evaluation module to evaluate how well the design realizes key project goals: promoting a sense of safety and community among occupants, a culture of wellness among staff, environmental awareness and engagement. While reading this document, you will see statistics and feedback from this survey incorporated, showcasing how the design of the school is making a difference for the city of Harrisonburg and the Bluestone community of learners.

“At Bluestone, we’re learning to take care of ourselves, to take care of each other, and to take care of our school. The students understand this is a special place. **It inspires stewardship.**”

Anne Lintner, Bluestone Principal

103,000 sq ft  
10.8 acres

# Welcome to Bluestone

## Be Active

- Gymnasium and Fitness
- K-2 Play Lawn
- 3-5 Playground
- 6-8 Play Terrace
- 2-5 Playground
- Recreational Sports Field
- Open + Free Play
- Artists + Community Garden Lawn
- Outdoor Classroom
- Horticult Play Area
- Art Court
- 1.6 Mile Walking Circuit

## Find the Water

- Water Feature
- Water Court
- Geothermal Water Field

## Explore Nature

- Native Meadow
- Art Terrace + Garden Courtyard
- Business Drive

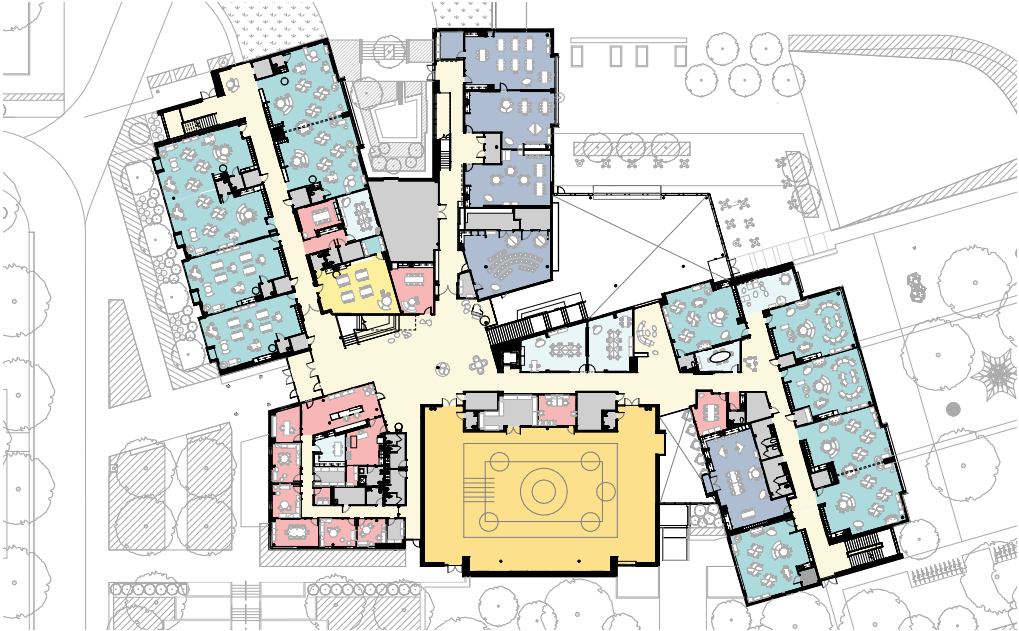
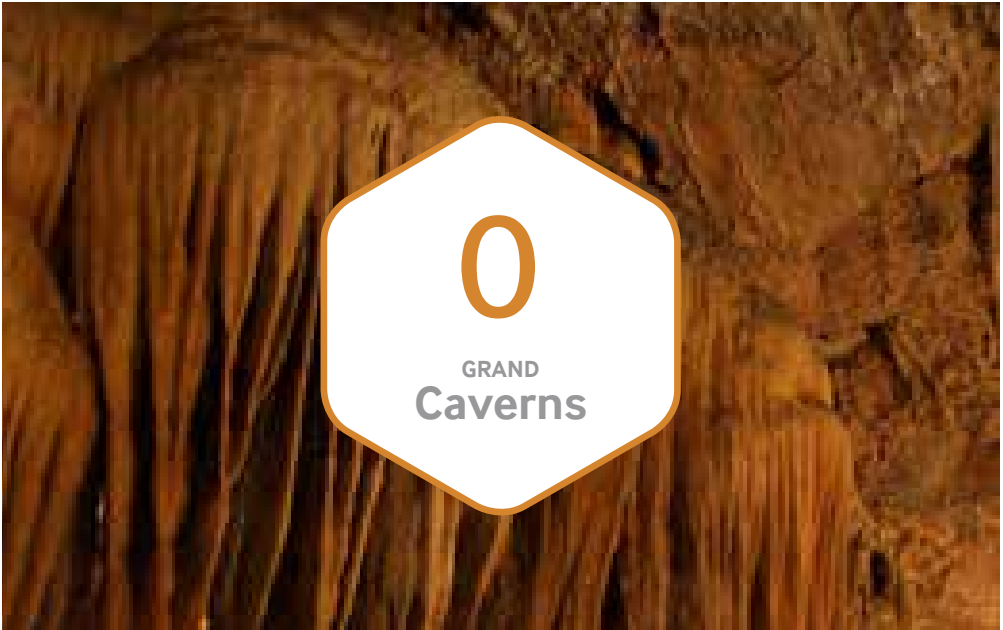
## Eat Healthy

- Living Commons
- Artists Garden
- Play Field
- Outdoor Dining
- Fruit Trees



0 50 100 200'





**“It is an amazing building and space.** I really enjoy moving throughout the buildings + the views through the expansive windows.”

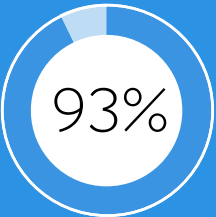
Bluestone Educator





# ECOLOGY

93% of the buildings users said that the building makes them feel **connected to nature + the outdoors.**



Bluestone Elementary School’s 10.8-acre site is a unique post-agricultural landscape, bounded by a public golf course and residential properties and along a major road. Most of the site was grassland, with a varied topography, rock outcroppings, few existing trees and two abandoned residential gardening plots.

The school’s three-story massing maximizes site area for play and outdoor learning. The landscape creates a communal, active, and bio-diverse habitat that supports human and ecosystem health. Boulders and trees harvested during construction are re-purposed as natural play features and are paired with native grasses, trees, and wildflowers that make visible water conservation and stormwater management.

Educational gardens irrigated by a demonstration cistern connect students to the site’s history as well as the community’s agricultural heritage. Expansive views to the surrounding mountains abound.

The school’s wayfinding and educational graphics emphasize the school’s geographic and natural context, organized by floor: Grand Caverns (Level 0), Shenandoah Valley (Level 1), and the Blue Ridge Mountains (Level 2). The rooms on each floor are identified by local fauna within that ecosystem.

In honor of the nearby trails in Shenandoah National Park, wayfinding across the school recalls hiking trails and trailheads to support navigation and a sense of adventure among students.

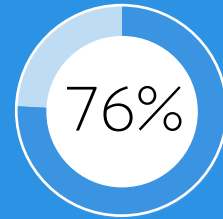


The efficient design of Bluestone's kitchen saves **15 kBtu/sf/year** and eliminates fried foods from the menu.



# WELLNESS

76% of building users said  
that the **building makes**  
them feel happy



The project team incorporated strategies throughout to promote occupant health, including making stairs and physical movement spaces visible; exposing kitchen prep and cooking areas; providing abundant access to drinking water; creating a school garden, a site walking circuit, and exterior learning and nature-based play spaces; providing a variety of ergonomic and dynamic seating and work surfaces that encourage wiggling and proper posture; and embedding environmental graphics throughout the school that promote healthy behaviors.

A network of 81 lab-quality sensors monitor CO2 in every regularly occupied space; additional fresh air is supplied when CO2 levels exceed a 700ppm differential to outdoor conditions and can be adjusted to lower thresholds.

Low-emitting materials were used throughout. Daylighting and abundant views to the surrounding Shenandoah Valley increase occupants' connection to the outdoors and support healthy circadian rhythms.

VMDO worked with school administrators to move Bluestone Elementary School from Type 1 ventilation hoods, which are required for fryers and grills, to all Type 2 hoods, which are used with appliances that produce heat and steam but no grease or smoke. Type 2 hoods require less energy to operate and reduce the volume of air that moves through the kitchen. As a result of this shift, the school kitchens are all combi-ovens, resulting in food that is either fresh, baked, or steamed —not fried.



## Healthy Minds, Healthy Bodies

Our classroom furniture allows us to be active and healthy! The brain relies on the body to get its needed fuel – oxygen and glucose – to the brain. Move more for brain health!

Movement and exercise are beneficial for our brain.



Improves Coordination and Motor Skills



Increases Bone Density



Improves Self-Esteem



Prompts Growth of New Nerve Cells and Blood Vessels



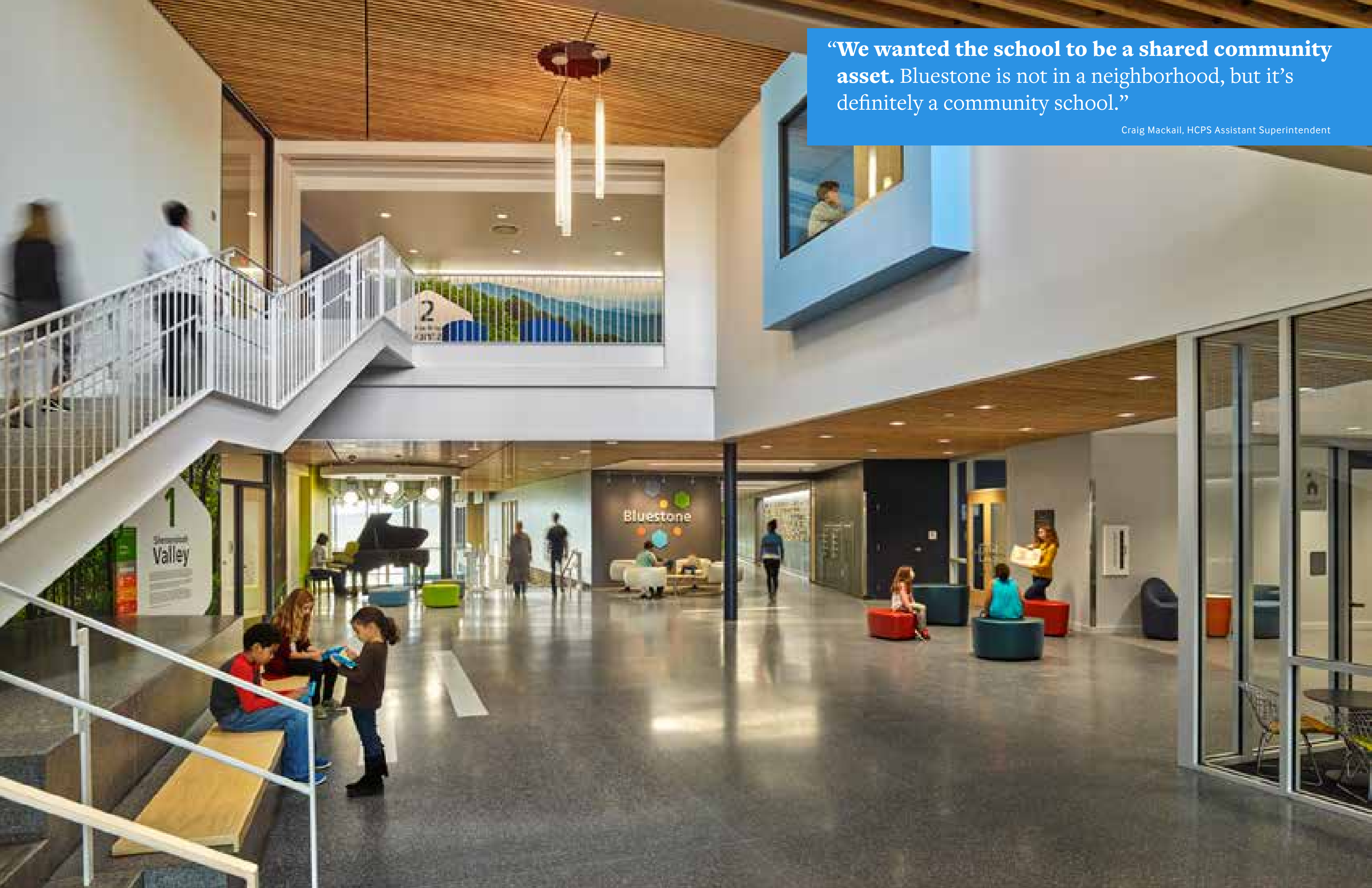
“I can’t overstate how much of a difference it makes to see the mountains, the sunrise, + the sunset from my classroom. **It is so calming to me and to the students.**”

Bluestone Educator



**“We wanted the school to be a shared community asset.”** Bluestone is not in a neighborhood, but it’s definitely a community school.”

Craig Mackail, HCPS Assistant Superintendent





# COMMUNITY

80% of building users said  
the building **enhances their  
connections with students**

80%

As soon as you enter the school, you know that you are welcome. This generosity of spirit is modeled by Principal Anne Lintner, expressed in the way teachers, students, and staff treat one another, and reinforced by the way people interact with the building, as if it belongs to everyone. A lot of this attitude has to do with the care and camaraderie demonstrated by the teaching staff, who were critical to the design process. For many staff members, it was important for the design to celebrate cultural diversity and global contexts while supporting personalized learning needs, including the need to belong. As a result, all social and physical elements of the building were designed to help students relate to the larger world while feeling part of a community designed just for them.

Public spaces radiate outward from the lobby and create a welcoming arrival sequence. One of the first things visitors see upon entering the lobby is a representative international flag exhibit that highlights the diversity of the student population. This global celebration is complemented by extensive wayfinding highlighting local geography and strategic views to nature showcasing the unique beauty of the Shenandoah Valley. Stepping down a level from the lobby, a welcoming Dining Commons features local wood and stone details that create a unique sense of place and emphasize the significance of dining, sharing, and gathering as a community. Windows in entry-level shared spaces overlook the Commons and enhance visual connections within the school environment.



“So many schools seem to isolate children and teachers; **this school brings people together and contributes to a sense of trust.** That was our goal from the beginning.”

Anne Lintner, Principal



## CONSERVATION

- 1 BUILDING ENVELOPE
- 2 SOLAR ORIENTATION
- 3 LIGHTING
- 4 SENSORS
- 5 ALL ELECTRIC KITCHEN
- 6 SHADING

## PRODUCTION

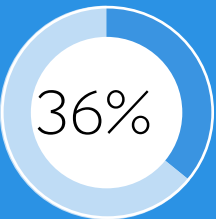
- 1 PV-READY ROOF DESIGN
- 2 BUILDING MASSING
- 3 GEOTHERMAL

Bluestone's net-zero ready design saves HCPS **\$136,000** in avoided utility costs when compared with other HCPS elementary schools.



# ENERGY

Absentee rates per teacher at Bluestone are 36% lower than at the surrounding elementary schools.



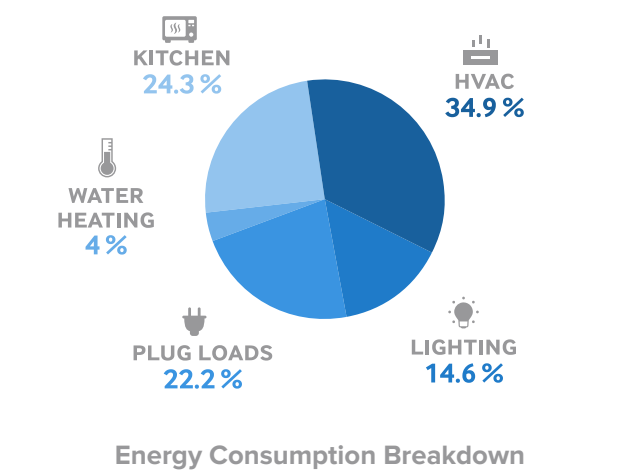
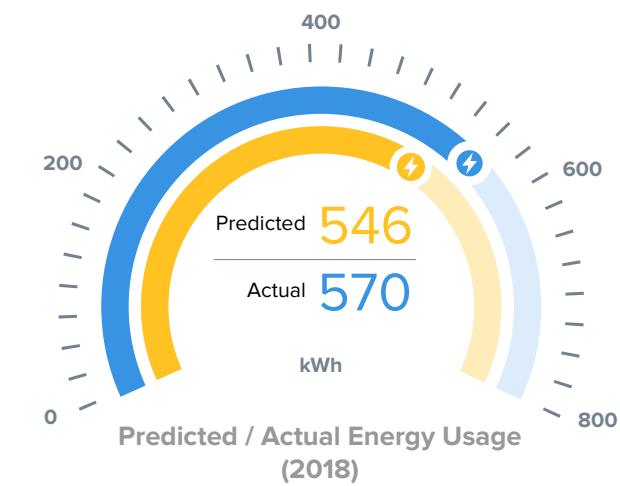
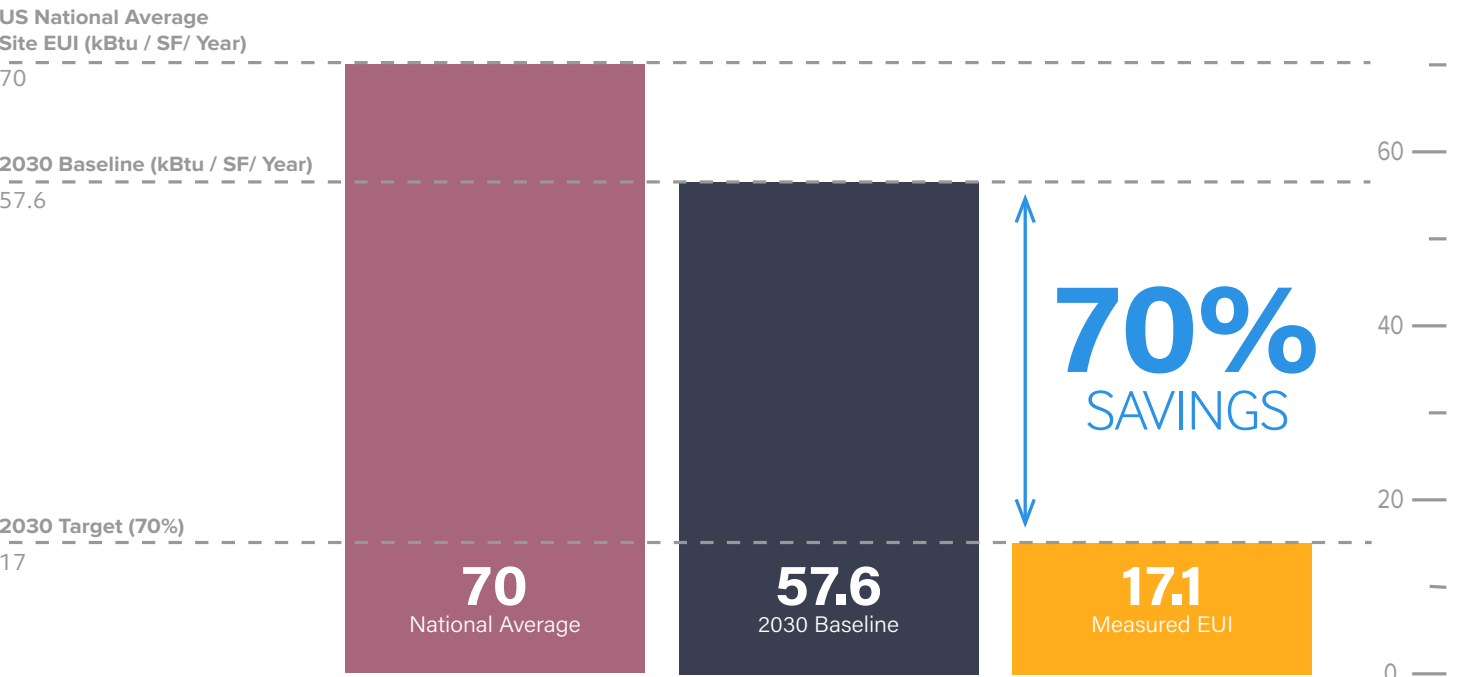
Net zero energy performance was particularly challenging given the orientation of key views from the site and the project’s three-story massing (most K12 net zero schools are two stories with large roofs to maximize PV array size). To deliver the best building performance possible, the building uses shading, roof overhangs, glass treatments, and careful placement of instructional spaces to mitigate less than ideal solar orientation. It also steps down towards the south to maximize the area available for roof-mounted photovoltaics.

The project employs a high-performance building envelope, integrated daylighting/LED lighting, a geothermal heat pump

system and demand-controlled ventilation using a dedicated outdoor air system (DOAS).

Based on the most recent results, actual energy performance (17.1 EUI) is lower than modeled results (18 EUI), and reflects a 70% reduction from the zero tool baseline, meeting the 2030 goals without renewables. Bluestone’s 450 kW PV array was not included in the final construction budget, so it is not yet a net zero energy facility. However, the project catalyzed the conversation district-wide, and in December 2018 the Harrisonburg School Board announced that they have begun talks with a provider to install arrays at all six HCPS schools in 2019.

## ENERGY PERFORMANCE



“Bluestone is our sixth elementary school. Our oldest school was built in 1911. When the issue of parity comes up, I respond that we’re building up. **We’re building for our future.** We’re committed to doing the best that we can for kids. We’ve raised the bar, and everyone benefits from that.”

Craig Mackail, HCPS Assistant Superintendent





“The three-story design allowed us to preserve and maximize site space for outdoor learning and movement. **Every design decision was intentional to promote community and learning and health.**”

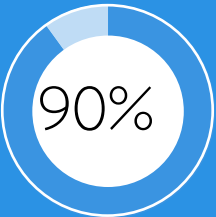
Craig Mackail, HCPS Assistant Superintendent





# WATER

90% of building users feel this building fits with the surroundings environment.

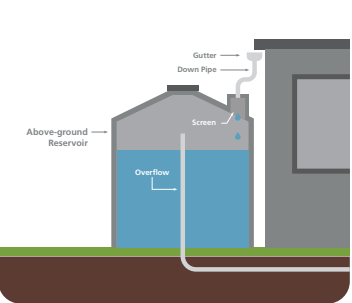


Given its location within the Chesapeake Bay watershed, and the downstream erosion and outflow issues stemming from Harrisonburg’s already overburdened infrastructure, stormwater runoff was a priority for the project from the outset. Through a combination of bioswales, three bioretention areas and one underground detention facility, the site can retain 100% of a one-year storm and 72% of a two-year storm, while also removing 93% of the Total Suspended Solids (TSS)—far above local requirements.

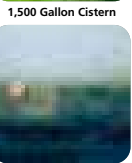
The building’s systems were designed to minimize potable water use. A closed-loop geo-exchange system for heating and cooling eliminates the need for cooling towers (and thus the need for regular makeup water).

Given a robust local composting program (and the need for effective soil amendments in the surrounding agricultural industry), dishwashing was provided for pots and pans only while plates and trays are made of compostable materials. Low flow fixtures further reduce potable water demand, and the landscape is designed to require no permanent irrigation. The combined effect of these strategies is an actual water use at Bluestone Elementary School that is a 71% improvement over the national average for K12 schools (based on HCPS 2017-2018 data).

## Capturing Blue Gold



Rainwater from the school's roof is collected and stored in this cistern. The water drains from the roof into a central drain and flows into a vortex filter to keep unwanted leaves and debris out of the water. It only takes about an inch of rainfall to fill the 1,500-gallon cistern. In an average month, it rains enough to fill the cistern 2-3 times! You can use this water for the garden and plants around your school.



Water is Reused to Water Plants



## Water Cistern

“The building overall has made me more aware of ways in which I can be more **environmentally conscious.**”

Bluestone Educator



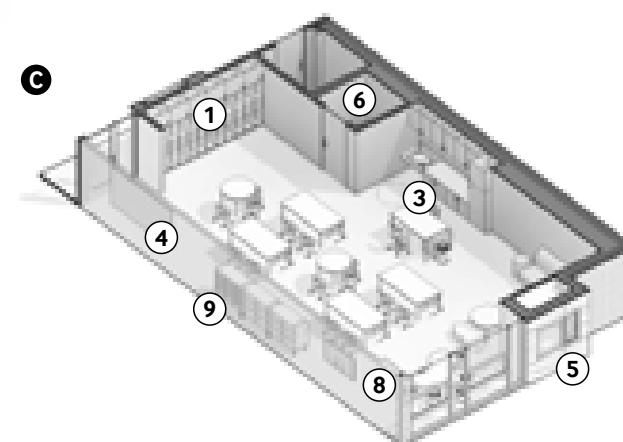
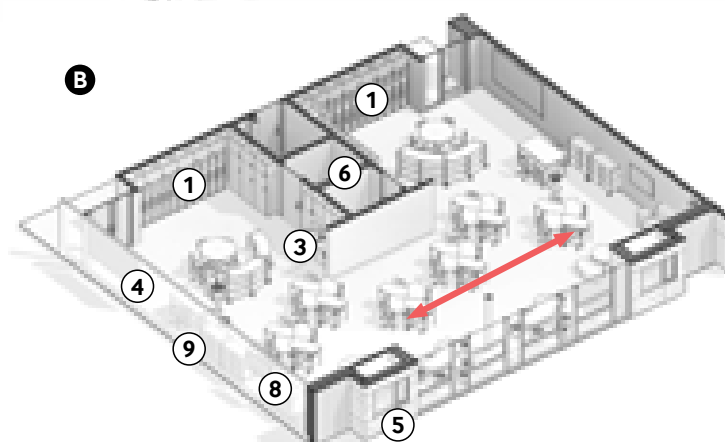
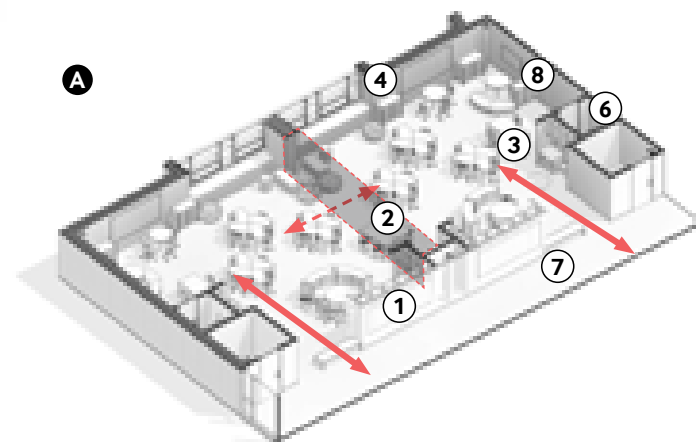
Bluestone's dynamic learning neighborhoods maximize flexibility through open areas, reconfigurable spaces, and transparency, **allowing for better teaching in less space.**



- A** OPEN STUDIO
- B** SUPER STUDIO
- C** SINGLE STUDIO
- D** SHARED STAFF RESOURCE / MEETING
- E** SMALL GROUP RESOURCE

- FLEXIBLE CONNECTION
- PERMANENT CONNECTION
- MOVABLE PARTITION

- 1** STUDENT + TEACHER RESOURCE STORAGE
- 2** MOVABLE PARTITION
- 3** SINK + RESOURCE AREA
- 4** TACKABLE SURFACE
- 5** READING WINDOW NOOK
- 6** STUDIO TOILET (K/1)
- 7** THRESHOLD BENCH
- 8** INTERACTIVE TECHNOLOGY
- 9** WRITABLE WALL



# RESOURCES

86% of building users  
responding to the CBE survey  
said that the **school is a  
community asset**

86%

In addition to the environmental benefits of right-sizing the building program, the embodied energy of the project was further reduced by switching the exterior wall construction from CMU with stone facing (typical construction practice in the area) to metal stud backup—without sacrificing building performance. Overall, the building achieves a 39% reduction in embodied energy when compared to the educational building type average published by the MIT Building Technology Program.

Although the building is certifying under LEED 2009 for Schools and was thus not including EPDs in its documentation criteria, a post-construction analysis of the project specification shows that 25 products specified have environmental product declarations.

In general, strategies employed to reduce environmental impact included limiting the materials palette and using building material as finish where possible (e.g., polished concrete floors); choosing durable, low maintenance materials and finishes (high-impact, high-recycled content gypsum interior partitions; linoleum); and using local materials where possible.

Building flexibility and adaptability was also viewed through the lens of maximizing material value. Teaching spaces employ movable furniture and equipment, enhancing building longevity/adaptability and lengthening renovation cycles.





# PROJECT TEAM + COST

## 01 Project Team:

Prime Architect: **VMDO Architects**  
Mechanical, Electrical, and Plumbing Engineering: **CMTA Engineers**  
Structural Engineering: **Fox & Associates**  
Civil Engineering: **Gay & Neel**  
Landscape Architecture: **JJM Design**  
Foodservice Design: **Foodservice Consultants Studio**  
Geotechnical Engineering: **Froehling & Robertson**

## 02 Project Cost:

Owners Budget	\$26,020,000
Actual Bid	\$25,220,000
Add Alternate	\$690,767 *
Final Bid	\$25,910,767
Final Construction	\$26,682,344
Project Cost	\$31,055,000

\* Due to the building coming in under budget, three additional classrooms were able to be added to the scope of work

