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.

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
Welcome to Bluestone

Be Active
- Gymnasium and Fitness
- K-2 Play Lawn
- K-2 Playground
- K-2 Play Tennis
- Varsity Playground
- Recreational Sports Field
- Open Air Play
- School's Community Open Area
- Sports Field
- Basketball Court

Find the Water
- Woodsman Garden
- Water Feature
- Geothermal Well Field

Explore Nature
- Native Meadow
- Art Terrace + Garden Courtyard
- Botanical Garden

Eat Healthy
- Dining Commons
- Kitchen Garden
- Picnic Area

103,000 sq ft
10.8 acres
“It is an amazing building and space. I really enjoy moving throughout the buildings + the views through the expansive windows.”

Bluestone Educator
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.

93% of the buildings users said that the building makes them feel connected to nature + the outdoors.
The efficient design of Bluestone’s kitchen saves 15 kBTu/sf/year and eliminates fried foods from the menu.
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 or 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.

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76% of building users said that the building makes them feel happy.
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
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
Bluestone’s net-zero ready design saves HCPS $136,000 in avoided utility costs when compared with other HCPS elementary schools.
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.

“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 Mackall, HCPS Assistant Superintendent
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).

“...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.
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.

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

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