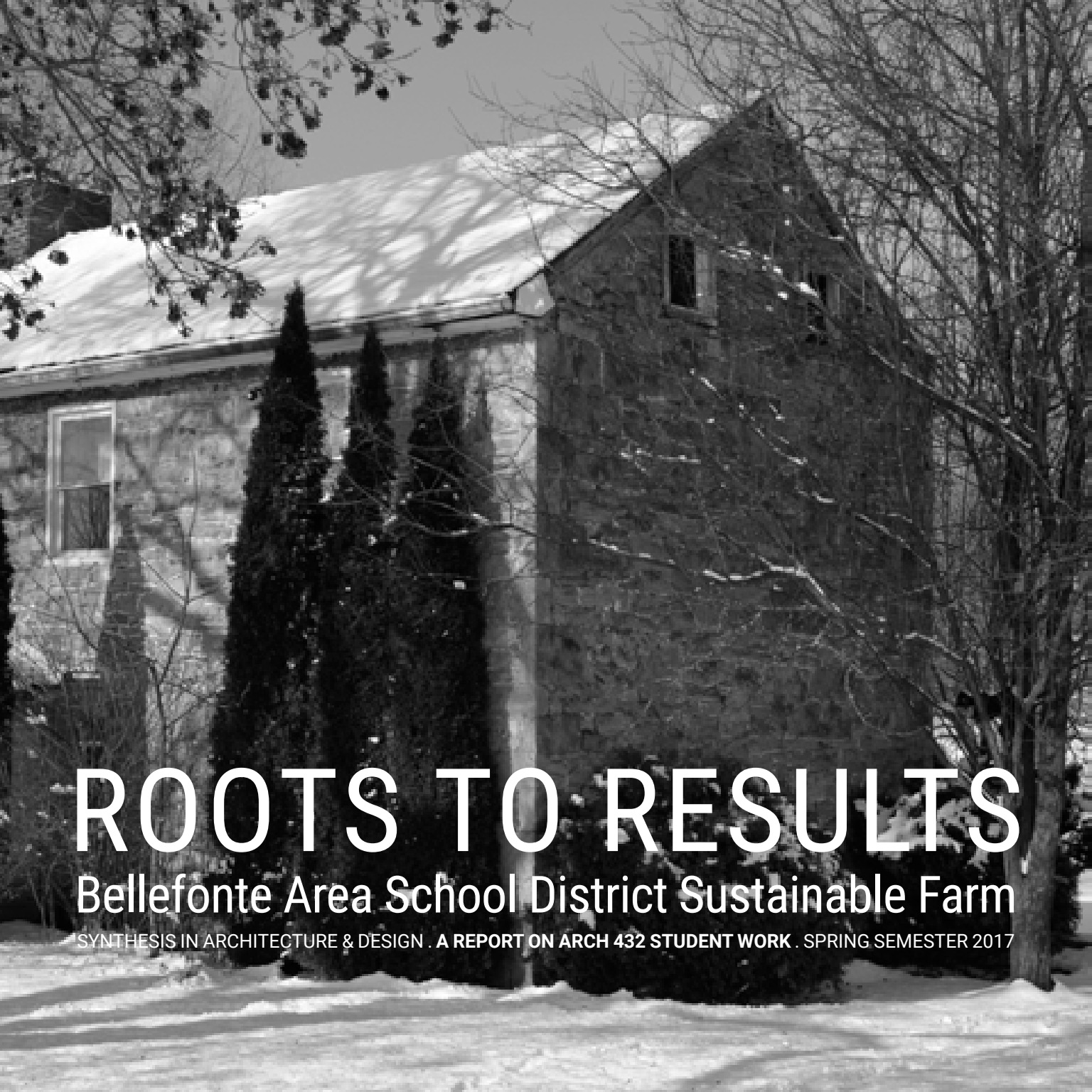

ROOTS TO RESULTS

Bellefonte Area School District Sustainable Farm

SYNTHESIS IN ARCHITECTURE & DESIGN . **A REPORT ON ARCH 432 STUDENT WORK** . SPRING SEMESTER 2017

THE PENNSYLVANIA STATE UNIVERSITY
ARCH 432 Architectural Design VI SYNTHESIS in ARCHITECTURE & DESIGN
SPRING 2017

ROOTS TO RESULTS: Bellefonte Area School District Sustainable Farm

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Sustainable Communities Collaborative Partners

The Sustainable Communities Collaborative (SCC) connects University Park faculty, students, and staff with local communities to address sustainability challenges through an engaged, collaborative effort.

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Special thanks to Myken Poorman *and her students.*

Special thanks to Christopher Hazel *for his assistance documenting and drawing existing conditions for the farmhouse structure.*

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CONTENTS

1 Course Objectives

"Making the simple complicated is commonplace; making the complicated simple, awesomely simple, that's creativity."

Charles Mingus, Mainliner 1977

A key strategy related to sustainable, environmentally conscious building design is Integrative Design. Integrative design is related to the integration of building systems and the process through which integrated projects are designed. Integrated buildings synthesize the building site, program, structural and environmental systems, building assemblies and envelope, life-safety provisions, and principals of sustainability with the project parti – thus simplifying the complex. The Integrative Design Process establishes common goals and objectives for the building project that all members of the multi-disciplinary team coordinate around. To achieve this simple, poetic result the architect serves as both visionary and facilitator – roles.

As a design research studio, students were encouraged toward active exploration, information collection, analysis and synthesis. Instruction consisted of faculty input through interactive critiques, in-class discussions and workshops, and guest and instructor presentations and reviews of design projects. Students participated in research assignments, analysis of information, site visit(s), interviews, topical lecture/discussions, interim presentations and documentation. Several project development workshops were realized with our community partners and professional consultants.

The student work results from a studio that emphasized ability to:

- Assess the implications of patterns and conditions on a subsequent design.
- Relate technical and material aspects of a building design to spatial and performance intentions.
- Integrate multiple issues to develop a logical ordering system; Develop the continuity of this logic across the scales of a building.
- Cooperate and collaborate in research and design.
- Demonstrate an understanding of the comprehensive nature of the design and decision-making process.

2 Project Brief

"…Many of us yearn for experiences that take us out of the narrow human world and reconnect us with the less constrictive, richer and in a sense more hopeful world of Nature. The Green movements emerging today testify to this need, as do trends in architecture that emphasize sustainability and the pre-eminence of the organic. It is a mistake to consider them as strictly pragmatic."

Lebbeuswoods.worldpress

Some early 20th century architects in North America worked explicitly to create buildings that promoted harmony with the natural world. The work attempted to be uniquely American and specifically appropriate to geology and climate. The ideas for designing with nature connected back to 19th century thinkers and designers and eventually influenced 20th-century modernism globally.

Considering the design with nature in the early 21st century, students worked in teams of 2-3 to design a project that celebrates and tells a story of building with nature…a living, working lab for the public, students, farmers, school aged children, and learners of all ages.

Living Building

"The Living Building Challenge is the world's most rigorous standard for green buildings. Going above and beyond LEED certification, Living Buildings strive for net-zero or net-positive energy, are free of toxic chemicals, and lower their energy footprint many times below the generic commercial structure."

living-future.org

Student projects were designed to follow the standards set fourth by The Living Building Challenge (LBC). To be certified under the Challenge, projects must meet a series of performance requirements. Net positive water and net positive energy are standards for which there is no LBC compromise. All public and workspaces must be humanely designed incorporating access to exterior views, controlled day-lighting and natural ventilation whenever possible. All spaces may be open to the public and are to be fully ADA accessible and Universal Design compliant. Egress and building design must be International Building Code compliant.

Project Site

The project site comprises about two (2) acres of 100 acres of farmland recently purchased by the Bellefonte Area School District. The site includes a small existing farmhouse that is over 100 years old and an index of the agricultural and geological history of the region.

Program

Access Walking path from school, car, emergency access and parking.

Gardens Produce production, including green house, and on-site research; considering the connection of the project site to the larger 100-acre field (and site of a future elementary school). This can include storage for equipment, composting, produce preparation and possibly teaching and community outreach facilities.

Renewable energy systems Water, sun, wind, etc.

Existing house retrofit The house will be a model for green design, alternative energy and used for education in building trades.

It will comprise:

- A test kitchen for education
- Instruction/production space for lectures and experimentation
- Indoor/outdoor extension for larger gatherings
- Back of house facilities (somewhere on the site) such as toilets, storage and mechanical spaces should be considered part of the overall agenda of reconnecting with nature.

Community Outreach

The architectural implications of Community Supported Agriculture (CSA) are considered. CSA is a farming model in which community members pledge support to the farm at the beginning of the season. In return, they receive a share of the harvest. The growers and members provide mutual support in their food production and share in the risks and rewards of small-scale farming (e.g. weather, disease, pests vs. fresh, nutritious and bountiful veggies). CSA restores the lost connection between people and agriculture by providing an opportunity for members to be directly connected to how their food is grown.

The proposed program and architecture should allow the community to interact with and benefit from this project, extending its use beyond class and school schedules.

Some possibilities for that include a produce stand or market, event spaces, performance spaces, small business, production or studio space.

Site Panoramic Photo Montage

Existing farmhouse front facade

Rear of farmhouse with attached “summer kitchen”

Photo of farmhouse attic space

Detail of the two-acre project site adjacent to the Bellefonte Area High School

3 Community Workshops

School Visioning and Site Visit Workshop

On January 19 of 2017 the Arch 431 students, faculty and representatives from SCC visited Bellefonte High School hear school and community perspectives on the future vision for the student farm education center and to share initial design ideas. Following the workshop, students visited and documented the project site and existing stone farm house.

Project visioning workshop at Bellefonte High School Photos of Penn State architecture students and Bellefonte High School students collaborating on ideas for the School garden and education facility.

Tour and documentation of the existing farmhouse and property

Project Development Workshop

On March 23 of 2017, High School teacher Myken Poorman, some of her studetns and representatives from SCC visited the architecture studio in the Stuckeman Family Builiding to further collaborate on the design for the School garden education center. The eight student design teams presented site designs and models of there respective projects for comparison and discussion. Guests then circulated to each student teams' work areas to further discuss project designs and brainstorm ideas.

Photos of SCC and Bellefonte High School community partners at Stuckeman School of Architecture and Landscape Architecture

4 Final Exhibition and Design Review

On April 28, 2017, a public exhibition of student projects was held in the Stuckeman Family Building. The exhibition was followed by the final project reviews.

Arch 432 Spring 2017 Students

Project reviewers (from left to right): Matthew Mindrup, Pep Aviles, Robyn Engel, Chauntel Duriez and Darla Lindberg.

Myken Poorman and Bellefonte High School students participating in architecture final presentations.

Student teams presenting their design work for the Bellefonte "Roots to Results" project on April 28, 2017.

Student teams presenting their design work for the Bellefonte "Roots to Results" project on April 28, 2017.

Student teams presenting their design work for the Bellefonte "Roots to Results" project on April 28, 2017.

5 Student Projects

THE B.E.A.C.H.

Tyler Corbley, Paige Geldrich, Andrew Cacchio

The B.E.A.C.H is an educational center that aims to bring students, the community, and aspiring gardeners/farmers together. Harnessing natural resources, this model for sustainability acts as a destination where groups gather and classes are taught. The Bellefonte Education and Community Hub fosters a relationship between people and the environment. The series of gates form a procession through the site, compressing and decompressing as they go depending on the space needed. The facade between each gate protects the interior rooms, but can be opened creating immediate inside/outside connection. The B.E.A.C.H. is led by its relationship to nature and the environment.

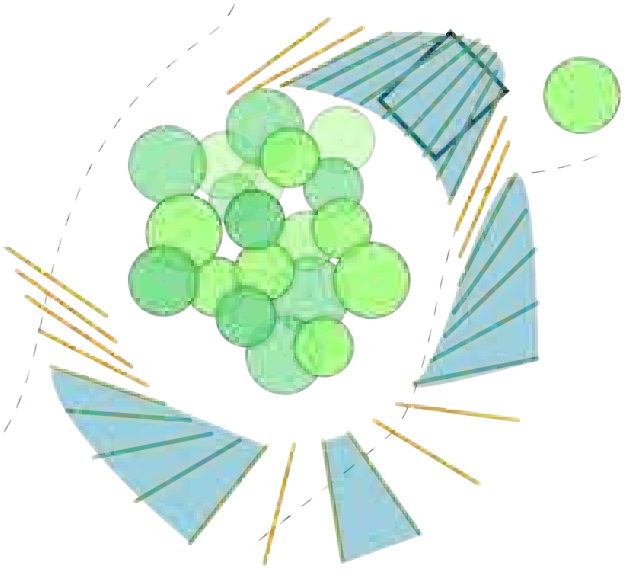
PLACE

The built environment of the B.E.A.C.H. merges seamlessly with its environment, never hiding its connection to nature. It responds to the topography of the site and surrounds a wooded area adjacent to the existing farmhouse. Even the farmhouse itself is treated as site.

The building is surrounded by student run gardens as well as an orchard. Proposed farmland is allocated for future site development. The placement and scale of minimal parking encourages pedestrian and bicycle traffic to and from the site.

Site Plan This plan shows the approach to the B.E.A.C.H. from the high school as well as the main road, and how it is situated on the site.

Conceptual Diagrams Building around the existing farmhouse, the building arrays a set of timber gates and forms a protective layer around it and other conditioned spaces.



Conceptual Integration The concept meets reality and responds to conditions that already exist on the site such as a wooded area at its center and two hills formed by the topography.

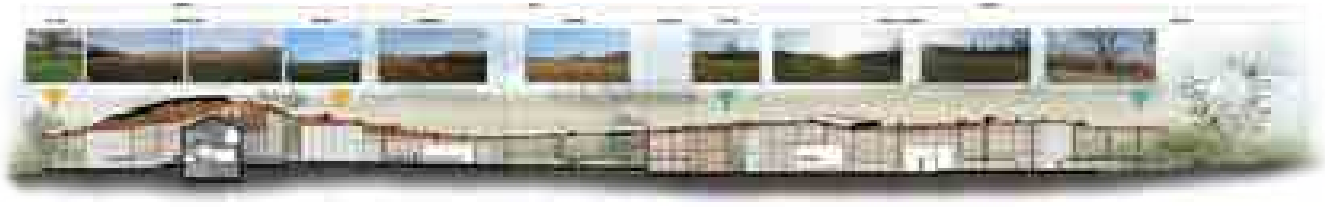
North and South Elevation The B.E.A.C.H. responds to the topography of the site. These elevations show how it rests in the landscape.

East Elevation The B.E.A.C.H. offers a dynamic elevation due not only to the changing topography, but the undulation of its sweeping roof.

West Elevation The site offers a changing landscape of arable land and wooded areas.

WATER

Water was a crucial consideration while designing the boardwalk at the heart of the B.E.A.C.H. Because of its importance on the site, it was decided that the boardwalk be elevated in order to allow the natural flow of water on the site. The site forms a natural valley with a depression in the center of the wooded area. This is where water on the site travels. Roof run-off water is either collected and purified or is used for field irrigation.



Unrolled Section This exploratory section shows how the building meets the ground, and how lifted portions allow the natural flow of water.

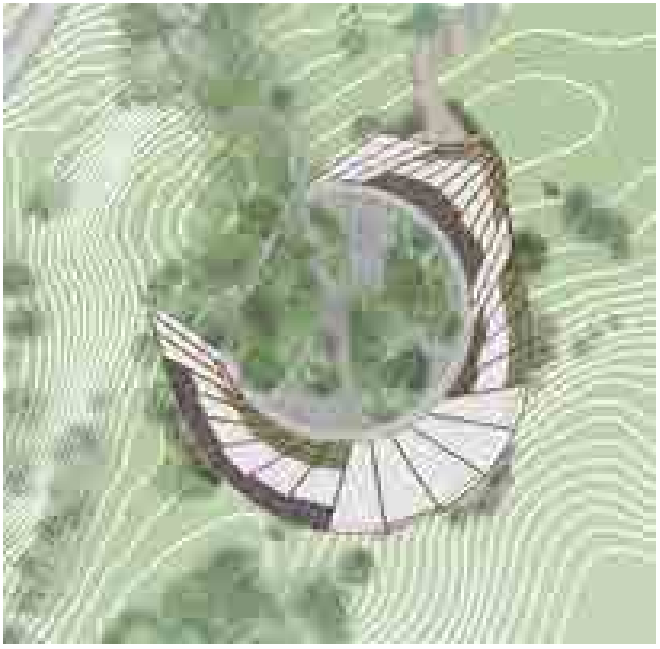
Section Facing Existing Farmhouse This section shows the natural low point that exists in the topography, and where water collects.

-

Monthly Rainfall Research was done to investigate how much rain on average Bellefonte received, as well as how water most likely moves on the site.

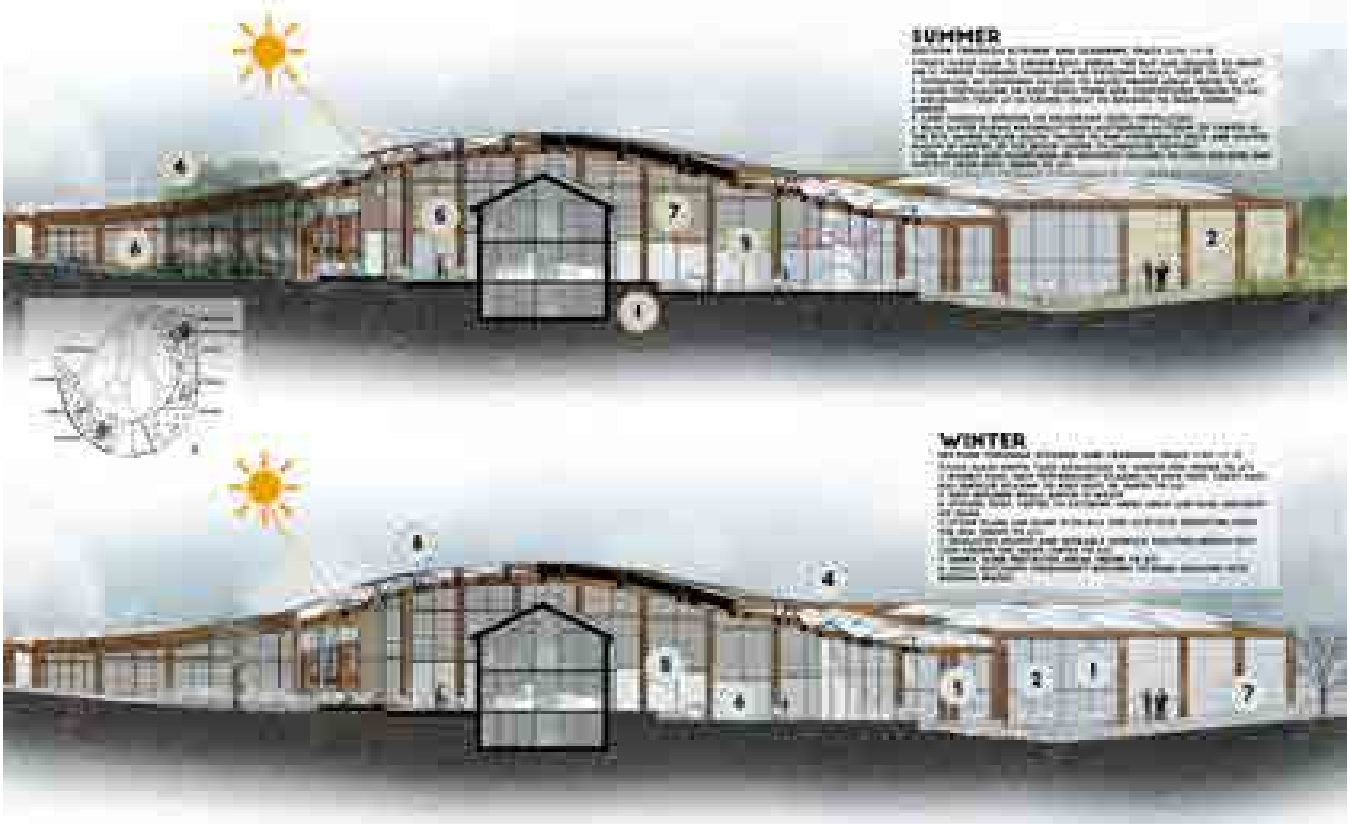
ENERGY

Natural resources are harnessed using a set of passive and active systems. These systems were explored in both summer and winter scenarios. Each system was not meant to solve every energy obstacle, but instead cooperate with others in order to take care of the energy requirements and output of the B.E.A.C.H. as a whole.



Roof Plan The roof plan shows the use of systems like photo-voltaic panels and green roofs integrated with skylights.

Active Systems Reuse of collected water, photo-voltaic panels, and ground coupled heat pumps are just some of the active systems.



Passive Systems Thick floor slabs, cross ventilation, and a pitched roof are just some of the passive systems the B.E.A.C.H. takes advantage of.

Active Systems

HEALTH & HAPPINESS

The B.E.A.C.H. thrives on its connection to the outside. operable glass walls at ground level allow the shell to completely open up and join inside and outside. Choosing a curtain wall as well as abundant skylights allow us to flood the interior spaces with light. Operable windows also allow for ventilation throughout the building.

Outdoor spaces surround unconditioned areas, which then in turn surround conditioned programmatic interiors. These conditions make for a very pleasant, well lit space that opens up and promotes the health and happiness of the B.E.A.C.H.'s occupants.

View of Outdoor Seating Area Alternating indoor/outdoor spaces allow for freedom of movement between both.

View From Boardwalk Developed outdoor spaces like the boardwalk allow for visitors and students to meander outside and appreciate the small forest the B.E.A.C.H. surrounds.

Harnessing the Sun Harnessing solar energy has influenced many aspects of the B.E.A.C.H. including the angle of the roofs, the use of shaders, and the placement of program.

MATERIALS

Much of the facade and structure is comprised of reclaimed wood from a supplier in Harrisburg. The B.E.A.C.H. utilizes timber construction for the overall frame and in smaller assemblies such as the green roof and overhang. These materials are effective in transparency, aesthetic, function, and cost. High efficiency glass is used for the skylights as well as the curtain wall and operable windows/walls. The boardwalk and paths that lead to the building are made using beech wood. The combination of these materials result in a very natural and open building that can adapt to the weather.

New Wall Section This section shows the meeting of various reclaimed and high efficiency materials.

Existing Farmhouse Section The existing farmhouse is rich in materiality; admirable are its 18" stone walls. These materials were left intact as the proposed building envelops the farmhouse.

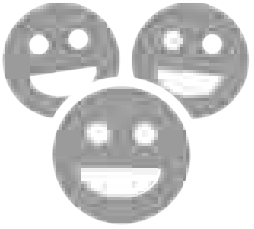
Proposed Facade A curtain wall system between heavy timber gates supports reclaimed wood shaders and a reclaimed wood rainscreen.

EQUITY

The B.E.A.C.H. is building designed and accessible for all. While the building is technically only one story, varying building pad heights required the use of ADA compliant ramps. The program allows for different functions to happen simultaneously. Classes can be taught for the high school, farming can done and storage utilized, and learning seminars for gardening can all take place. The community is free to explore and meander about the site, taking in the beautiful views and exploring the program inside the building.

View of Education Center and Student Kitchen This view displays the use of ADA compliant ramps inside the building.

Ground Floor Plan Program organized around education and social nodes invite all community members and all students regardless of what classes they are taking.



COMMUNITY offers
supply of varied talents,
interests, and skills,

The local technical school, CPI, can gain
expierence and help create the BEACH.
Area farmers can loan knowledge and expierence.
Community members are anxious to
support the project monetarily.
Bellefonte students offer skills in business,
math, advertising, graphics, agriculture,
videography and more!

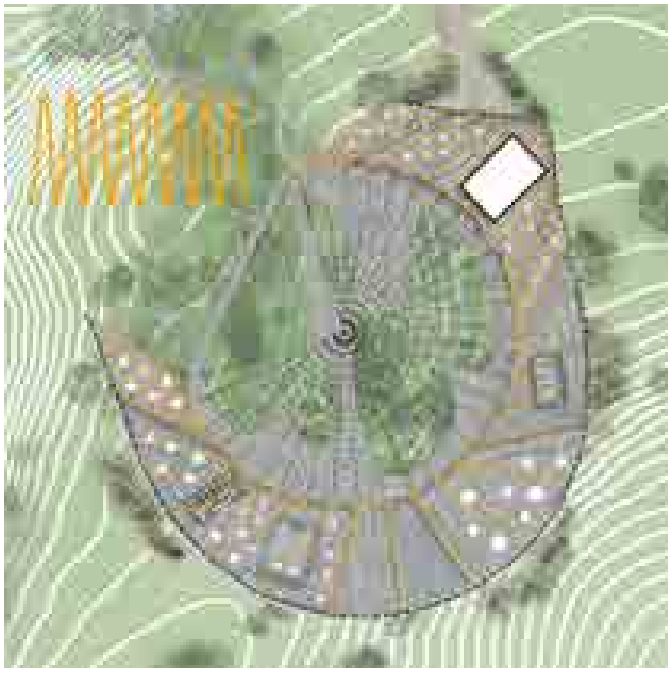
together, COMMUNITY
creates the BEACH.

Community as a Resource The B.E.A.C.H. has been community driven from the start. The local schools and the larger community are treated as key assets in making this education hub successful.

BEAUTY

The B.E.A.C.H. from the beginning aimed to be a destination the people of Bellefonte would seek out for a host of activities. As such, it had to be iconic, inspiring, and a model for sustainability. It also seeks to celebrate the potential of the community by providing education and social spaces for them to gather. The B.E.A.C.H. achieves this in its elegant form and response to the existing site conditions. The sweeping roof is essential to the design and covers an orchestrated geometry underneath. Lighting as well as shade and shadow were explored using a series of light studies and rendered views of the site during various times of the day and year.

Panoramic View of The B.E.A.C.H. from the Fields This view from the corn fields depicts the B.E.A.C.H. as an inspiring icon of Bellefonte.



Geometry Diagram Much of the beauty was in the details. The B.E.A.C.H. has a rich underlying radial geometry that governs the form of the building.

View of Education Center and Student Kitchen at Night The lighting scheme was a critical part of the design allowing for beautiful spaces, even in the evening.

THE HOMESTEAD AT HEIRLOOM FARMS

Elizabeth Rothrock, Mark Yeakey

Homestead is defined as a farmhouse and it adjacent outbuildings. A center with outstanding pieces. Our homestead strives to be a place that is greater than the sum of its parts. In this scheme the historic farmhouse, a new bakery, brewery, and barn become integral parts to the design and growth of the site over time. Together, these buildings sustain and provide a learning and functional environment for the students and the community.

PLACE

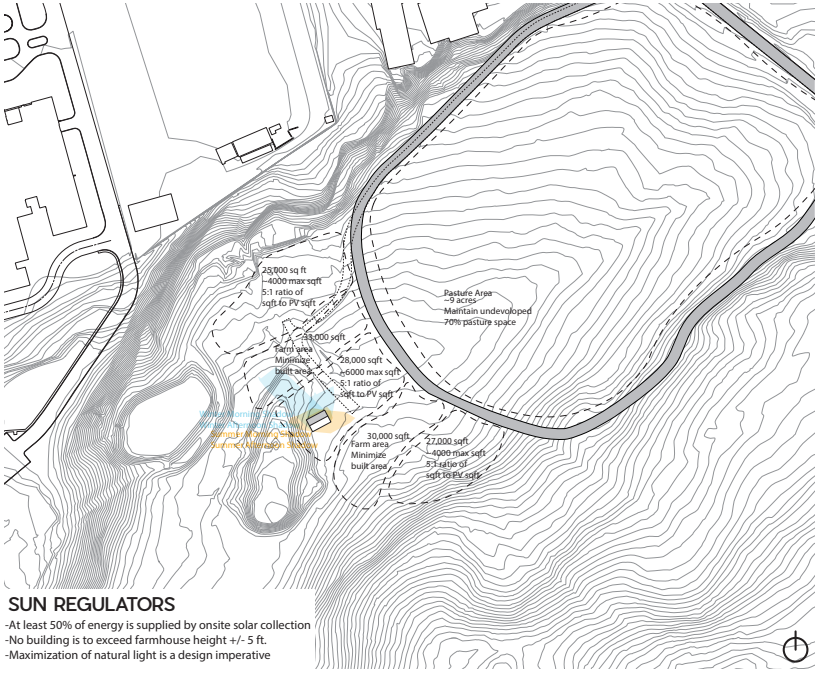
Our approach to the site focused on the understanding of data, context, and climate. Bellefonte is a place that strives to be recognized. With the high school as a support system this site aims to be an example of sustainability and efficiency in both the local area and the nation. Using weather data and climate inside of weather computation software we were able to predict, model, and design for weather situations during the entire year. Places like the coldframe around the farmhouse are prime examples of how elements of sun, wind, and earth come together to power and sustain the building and the people that occupy it.

Pennsylvania **Centre Country** **Bellefonte**

Inside the Coldframe The coldframe becomes the central gathering, growing, learning space for students year around.

Bellefonte Area Site context of Bellefonte proper and the area of the site within the context of the city and surrounding county

Site Collage A existing site photo collage

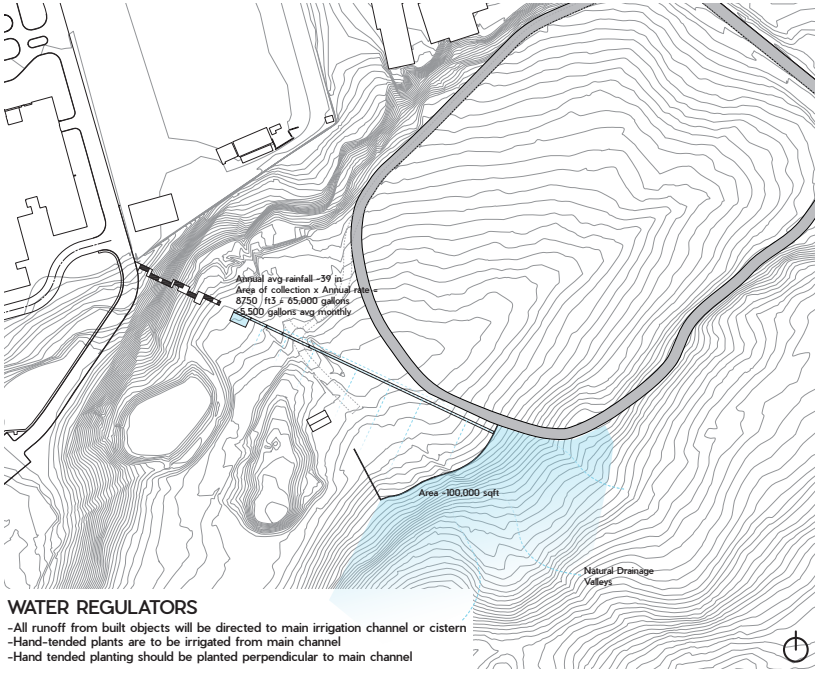


SUN REGULATORS

-At least 50% of energy is supplied by onsite solar collection
-No building is to exceed farmhouse height +/- 5 ft.
-Maximization of natural light is a design imperative

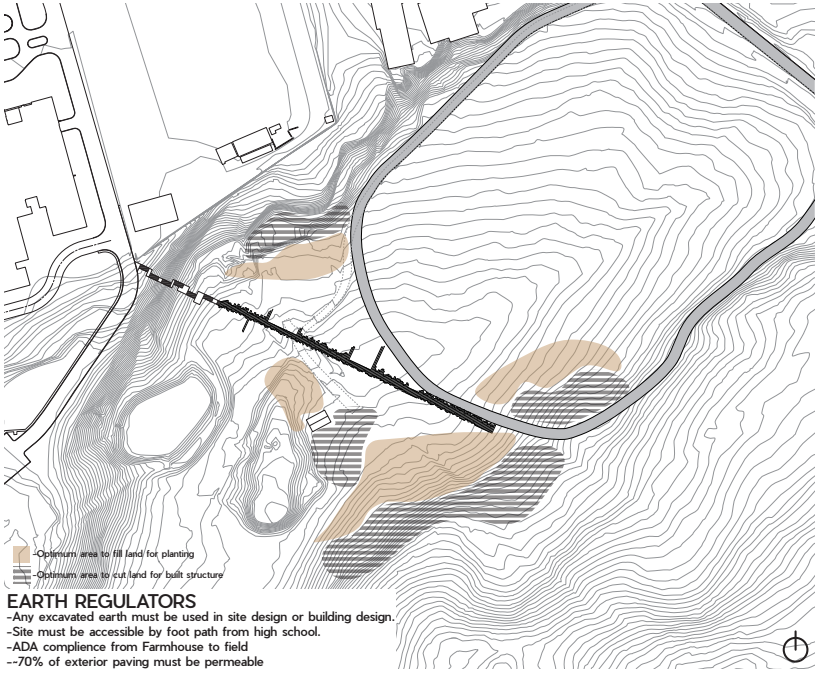
Sun Master Plan Using sun diagramming and weather data we analyzed the sunpath and shadows of the farmhouse in order to gain the most amount of energy passively from the sun as well as ensure proper garden and growing space for plants on the site.

Water Master Plan In order to understand the rain drainage and runoff of the site to allow for proper site design and consideration of water collection and reuse throughout the site.



WATER REGULATORS

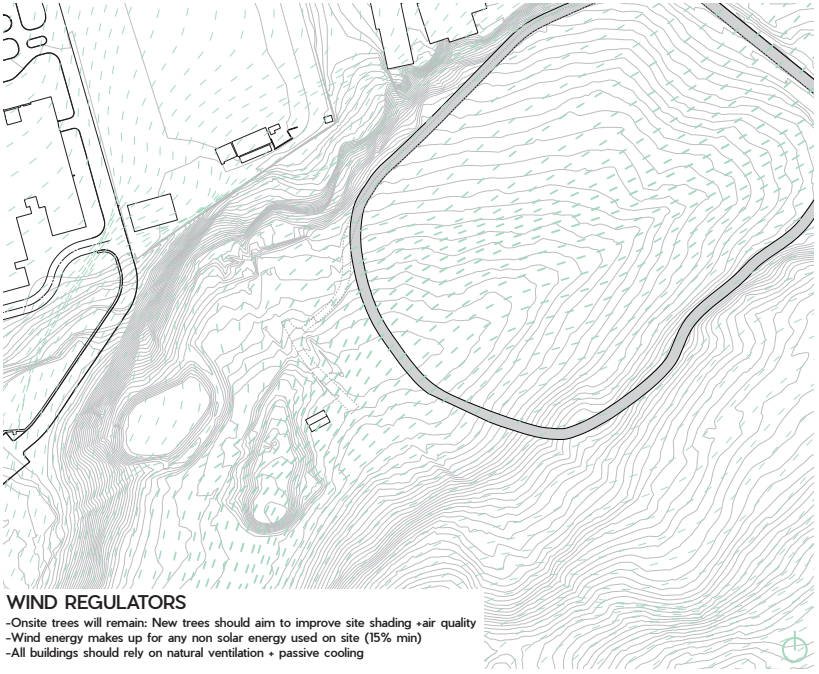
-All runoff from built objects will be directed to main irrigation channel or cistern
-Hand-tended plants are to be irrigated from main channel
-Hand tended planting should be planted perpendicular to main channel



EARTH REGULATORS
-Any excavated earth must be used in site design or building design.
-Site must be accessible by foot path from high school.
-ADA complience from Farmhouse to field
--70% of exterior paving must be permeable

Earth Master Plan Using site topography as a resource, the site can be maximized for the energy potential of earth and the insulative use of ground as a renewable energy

Wind Master Plan Wind is a intergral part of the site and its topography. Located in a small valley the site is rich for wind collection and wind power as well as natural ventilation of buildings.



WIND REGULATORS
-Onsite trees will remain: New trees should aim to improve site shading +air quality
-Wind energy makes up for any non solar energy used on site (15% min)
-All buildings should rely on natural ventilation + passive cooling

WATER

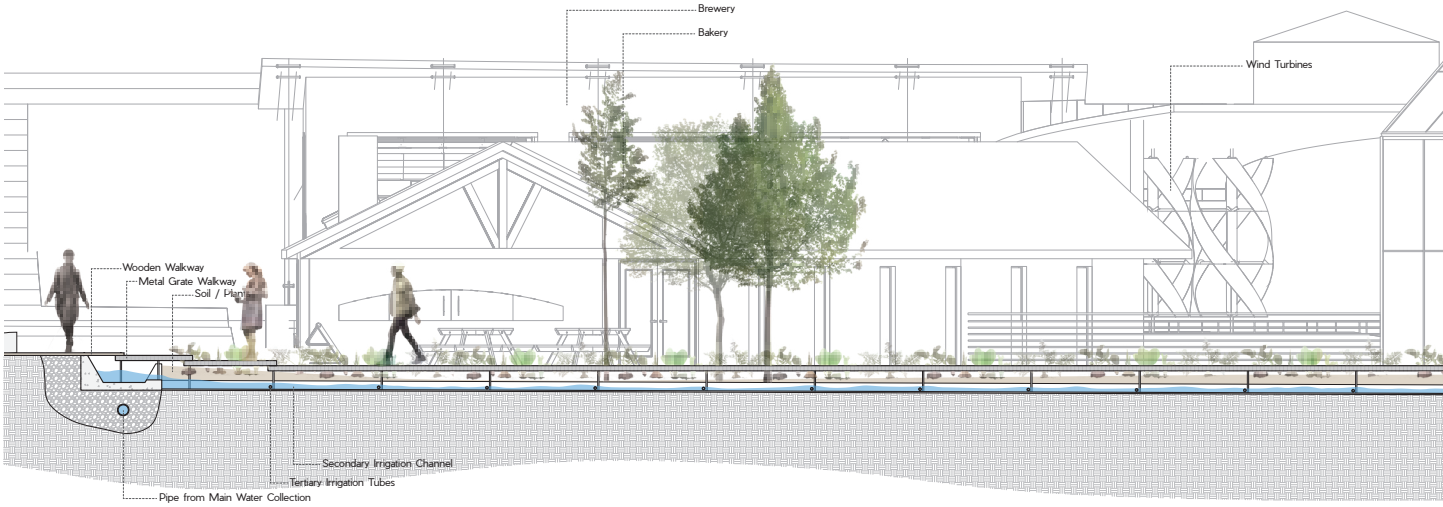
There is high rainfall and snow melt in this area of Pennsylvania. Since this farmland is located in a valley there is a chacne to harvest and utilize the site runoff. In coordination with our site design we looked at water as a starting point for site circulation. The water makes its way from the fields to the main collection area on the retaining wall of the brewery. Then it travels through the site to the main water basin along the path. Reusing the water for crop irrigation is a key aspect of our design.

There is the opportunity for interaction with the water by visual connection and physical tracking. A visitor can see where the water comes from and how it is moved through the site design.

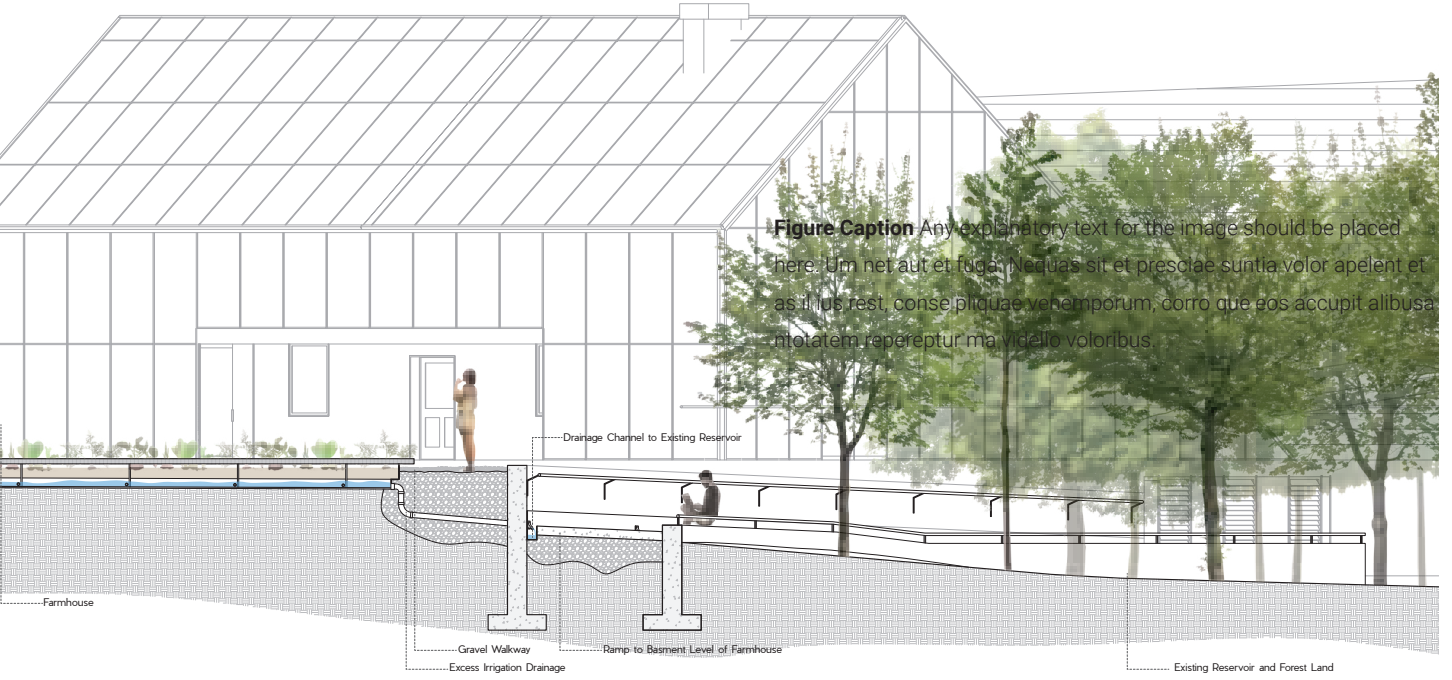
Site Plan Site irragation and contour farming allow for the site to use and reuse the maximum amount of water the site has to offer.

Farmhouse Epicenter The collision of farming and food create a space for community to gather, buy, learn, and grow together.

Water at Night The presence of water on the site also becomes relevant at night when the collection pathway is illuminated with a glow to guide vistors along the site between the buidlings of the homestead.



Site Irrigation Water runs like veins within the site to irrigate the crops



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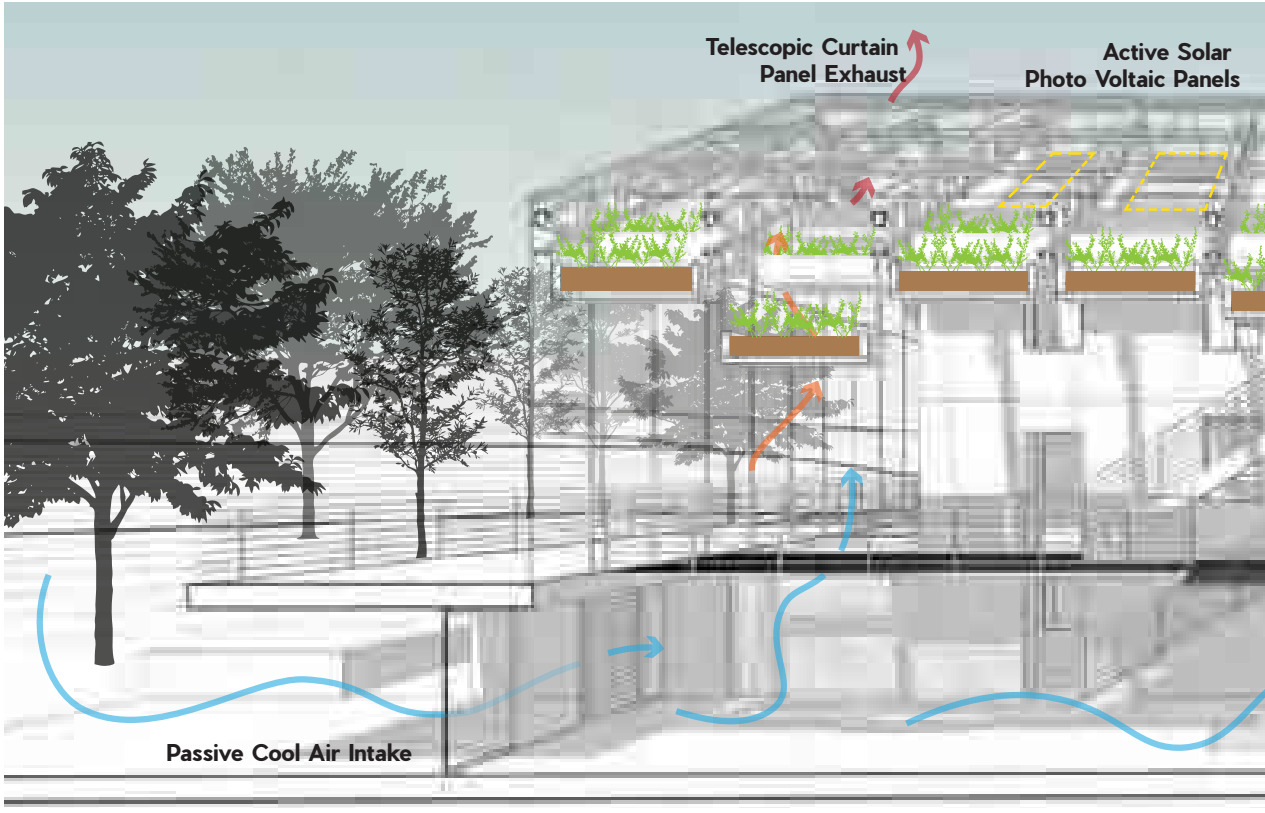
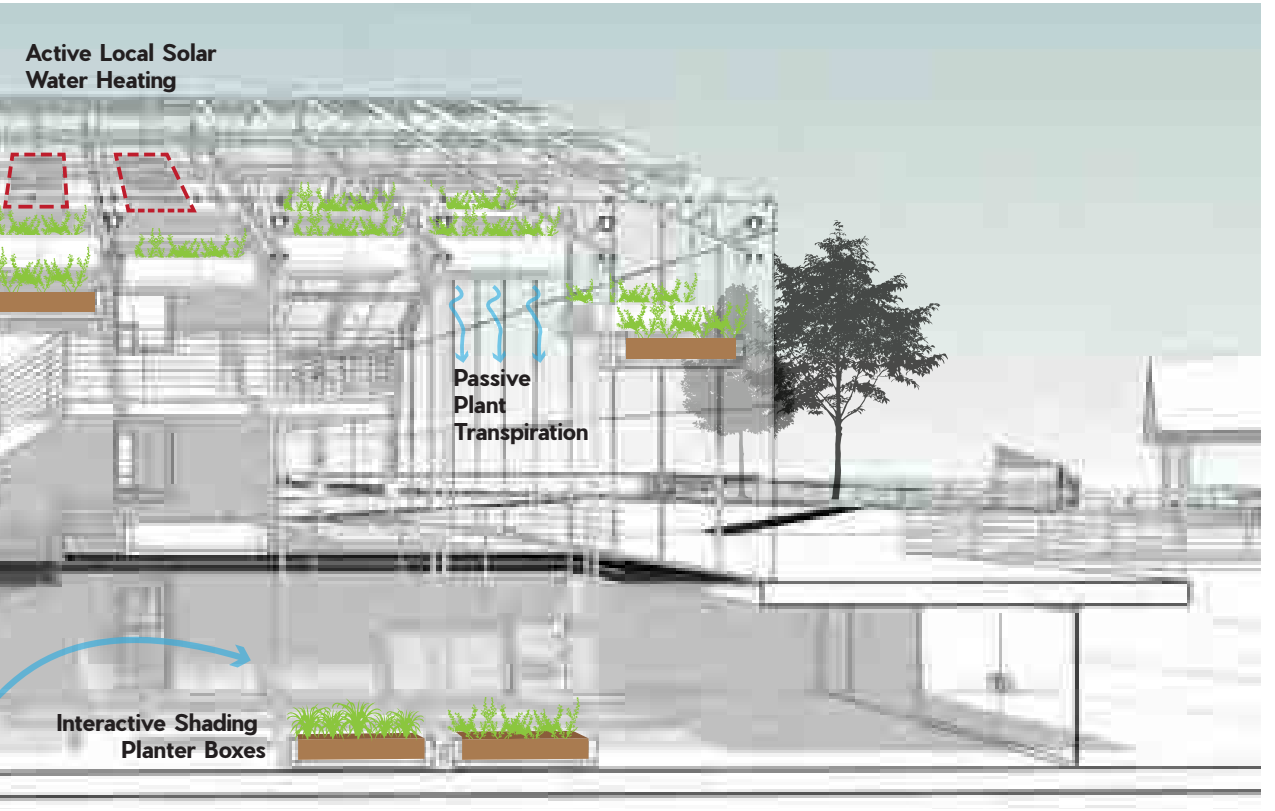
ENERGY

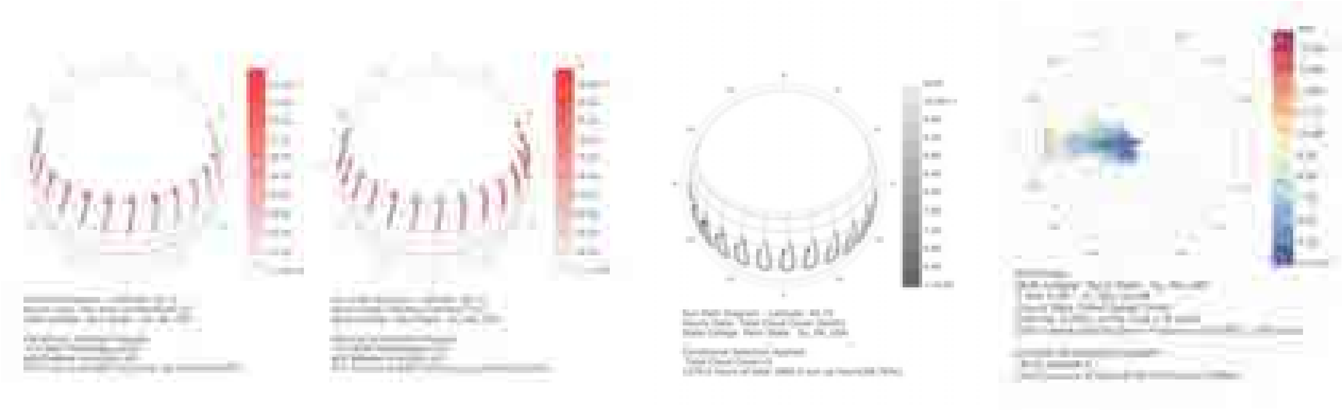
Energy is a cycle in our design consideration. Much of the energy of our site focuses on making the most of passive weather in Bellefonte. We focused on the use of sun and wind primarily in our design. Sun giving us the most of our heating in winter and wind giving us most of our ventilation during the summer. The highs and lows of the climate require air conditioning and heating but by prioritizing the passive over the active we aim to minimize the use of active systems and use renewable energy sources to power the remaining active energy needed on site.



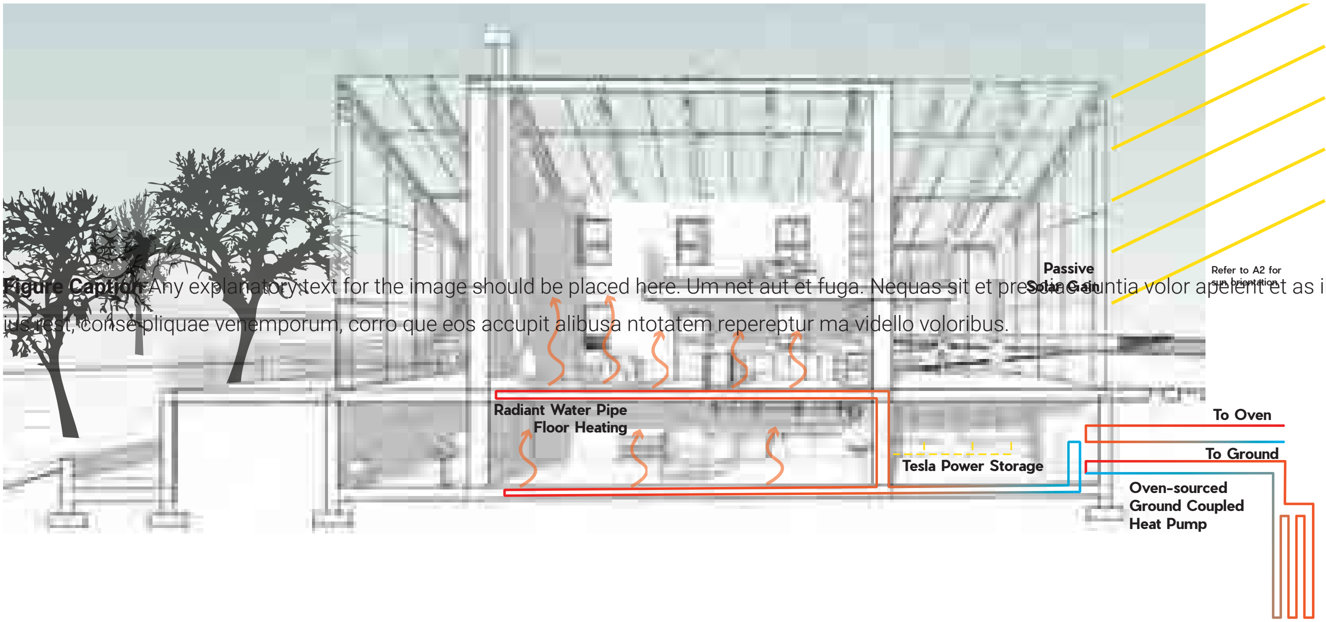
Summer Section Passive and active systems within the farmhouse ensure maximum use of sun, wind, and plant growth.

Building Plan





Climate Data Parametric modeling software plays an intergral role in understanding the site and its complex weather relations.



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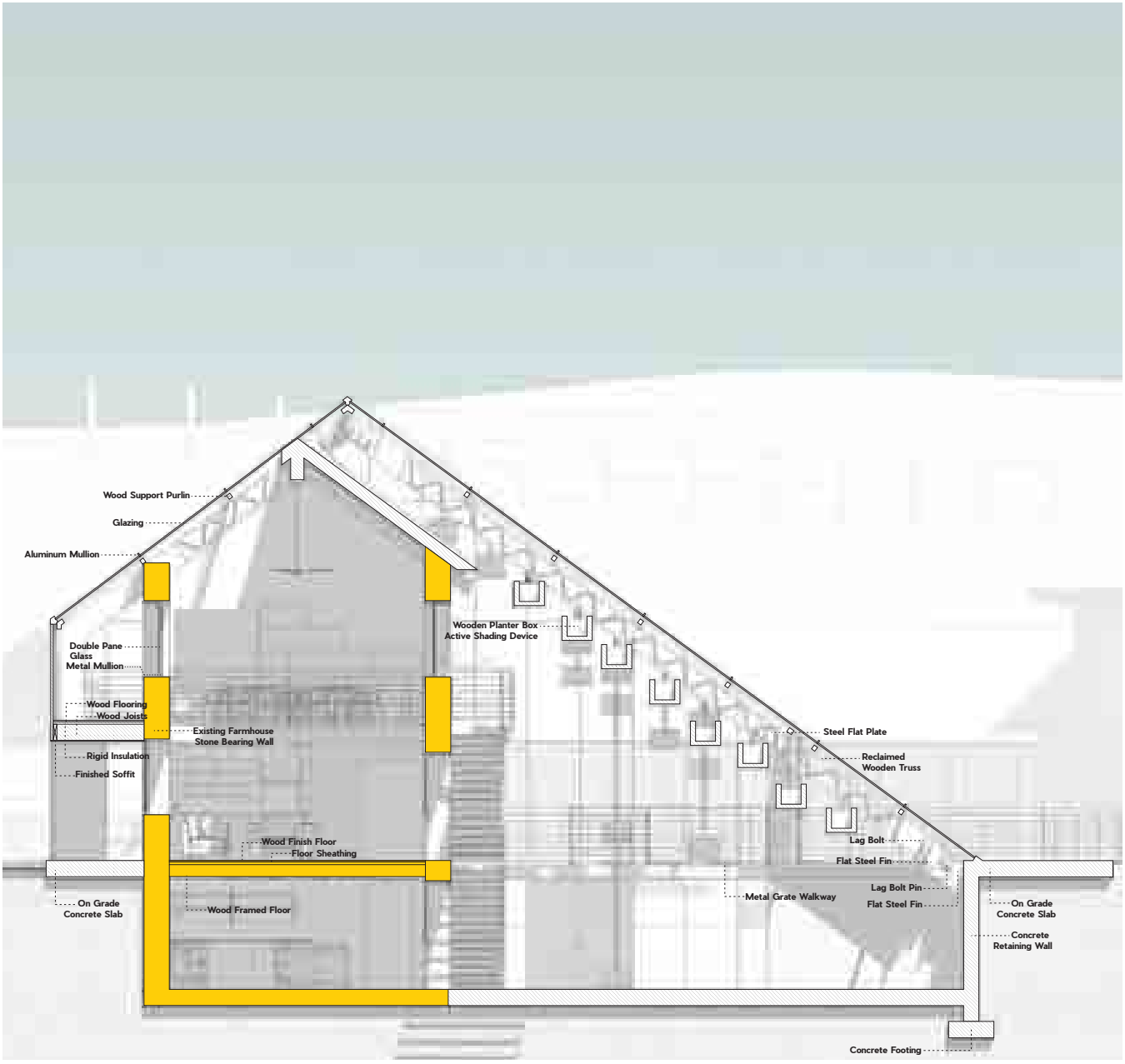
Winter Section During the winter the farmhouse is heated by both the passive solar gain of the sun as well onsite elements such as the oven



Farmhouse Cross Section Operable planter boxes allow for control of environment inside the coldframe year around

HEALTH & HAPPINESS

Farm to table involves an understanding of food cycles and food use. The aims to be a guide and direct example of these cycles as the exist in the world. The buildings then aim to become diadactic spaces for education and information about food, cooking, harvesting, and preserving. Spaces like the brewery and bakery look to inform and educate students and community members about the use of grown products on the site as well as a culture of education and tradition that can be passed down over the course of generations to reignite and revitalize many of the underappeciated processes of the local region.

Brewery Growing Locating hand tended fields in close proximity to buildings allows to the act of growth, harvest, and care ensures involvment from multiple aspects of the community.

Farmhouse Kitchen The farmhouse serves as the hub for food preparations and gathering to enjoy a meal as a community.

Bakery Oven A hearth for the site inspires involvement from students and locals to gather and eat together, spread knowledge, and grow as a commmunity.

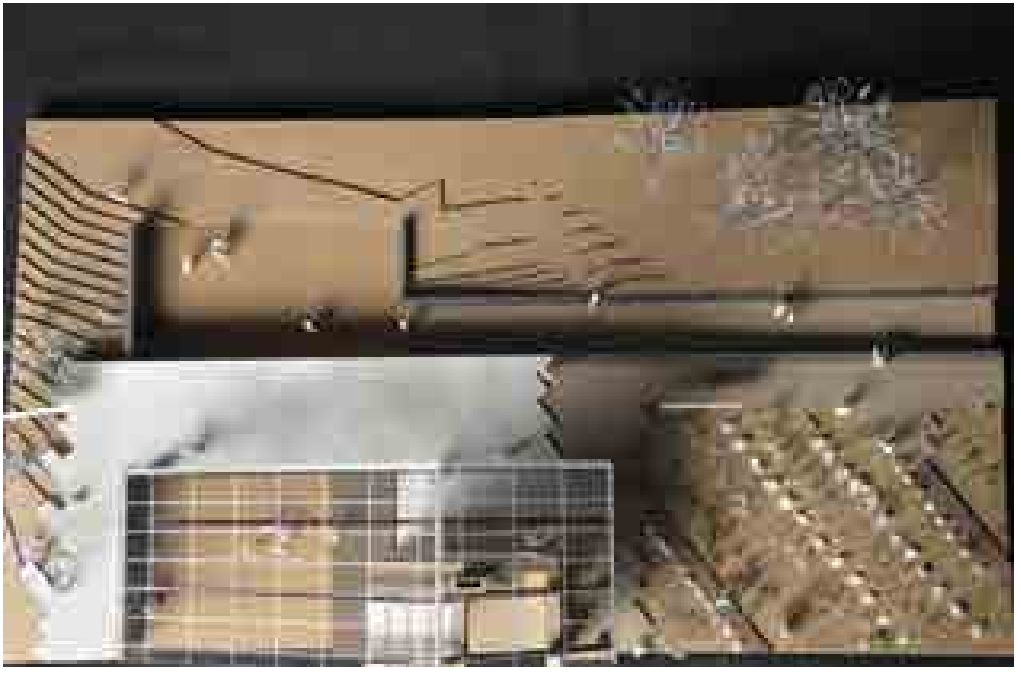
MATERIALS

Design of the site and the buildings within it consulted with the idea of farm materials. The farmhouse, the stone, the fields, and the path all exist as parts of the material mosaic that is our site. Keeping these materials mind allow for connection to the past, recalling the site, its history, its legacy, and the power that materials play in memory.

Stone Preservation Keeping the historic value of the farmhouse stone intact allows for connection between past and present.

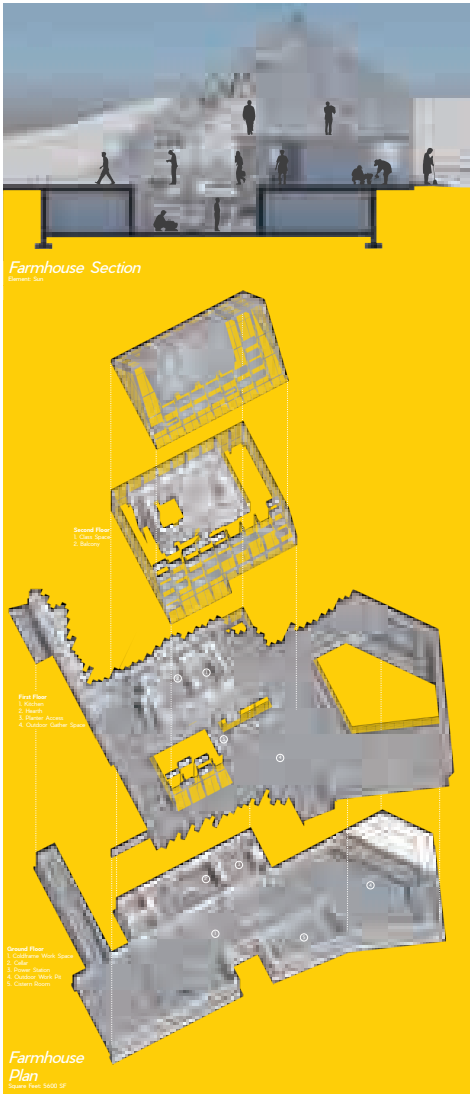
Adaptive Reuse Reusing much of the site timber structural trusses are erected to hold the cold frame as well as enclose the exisiting farmhouse.

Site as Material Built objects are the only material considered in the site design. Much of the materiality of the site exists with the farmland. The soil, plants, crops, and trees become the materials the change annually and allows the site to grow and change yearly.



EQUITY

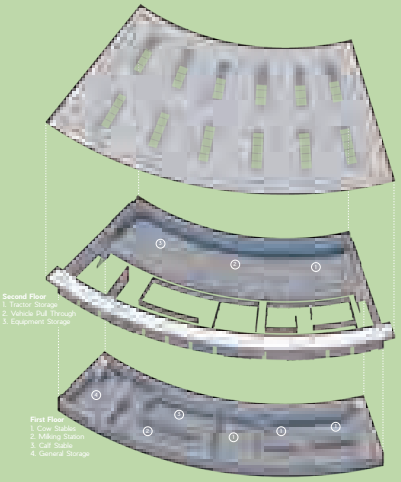
Equity in our design seeks to give all programs an equal ground and equal place. The farmhouse along with the bakery, barn, classroom, and brewery each entail different uses and programs as so each is given the building it deserves. Equity of the desing aims to ensure that all the groups that interact with the site feel they have a space they deserve. To give architecture that inspires pride and ownership over the area and give legacy to the spaces created.



Building Plans Exploded plans of each building showcase the use and uniqueness of each program. The sections above show the relation to ground, site, and student.

Barn Section

Element: Earth

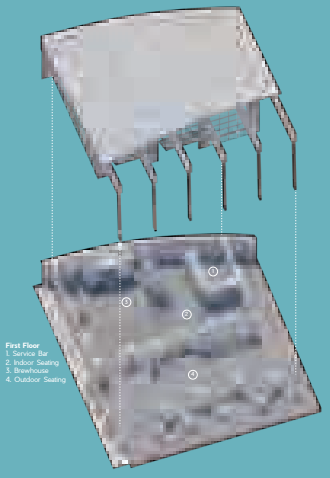


Barn Plan

Square Feet: 5,000 SF

Brewery Section

Element: Water

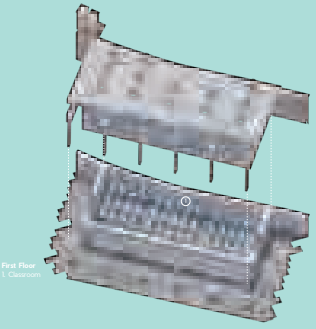


Brewery Plan

Square Feet: 3,500 SF

Classroom Section

Element: Water



Classroom Plan

Square Feet: 1,700 SF

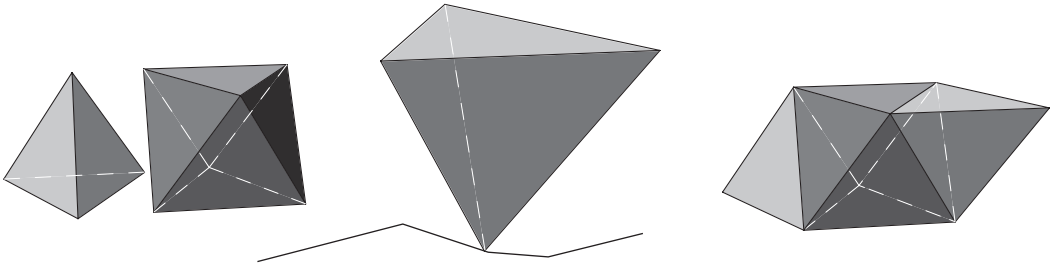
BEAUTY

Beauty of design rests in many aspects of our design but most it shines with connection. Using the site and its program not just as a space to do individual things but more so to work together across space and program to create something greater. To understand the water, earth, sun, and wind in a place to unique and appreciated that it can only be described as beautiful.

Spring at the Homestead A site with beauty and connection creates a space for all the come, eat, enjoy, learn, and live with new ideas inspired by a true example of sustainability and community.

RE-IMAGINED GROWTH

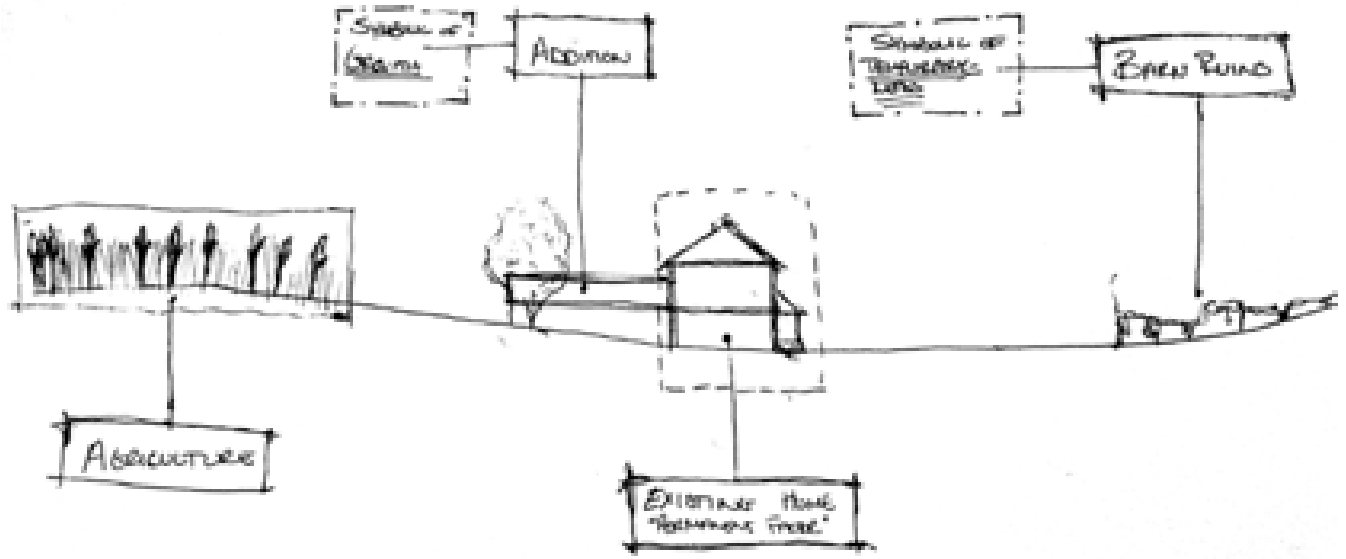
Hannah Breidenbaugh, Stephanie Rakiec, Nathan Sauter



With a growing demand for new, innovative, and environmentally friendly agricultural methods and technologies this proposal creates a series of networks to foster a modern educational approach to agricultural research and training through architecture. A system of modular components and pavilions are created for the site to provide a flexible building system to allow for modification and growth by the students and community. The architecture allows for a “Do It Yourself” (D.I.Y.) and sustainable approach emphasizing science, technology, engineering, and community involvement. This D.I.Y. approach comes from the historical architecture found on farms where communitiy members come together to build, grow and cultivate. Through modest architectural internvention - a light touch on the land - we hope to educate + innovate + grow the Bellefonte Area community.

PLACE

An ADA accessible ramp was designed from the Bellefonte Area High School down to the existing farm house, limiting vehicle access to the site by using the existing parking at the school. Along the ramp pedestrians **journey** through the wooded steep hillside coming across a new water feature that **honors** the old barn that once stood there. The ramp takes folks to the existing farm house that was **preserved** on the exterior and **renovated** on the interior. The house becomes an area to prep and store crops grown on site to be used for teaching purposes or to be used in the high school cafeteria. The site is **enhanced** with concrete pads that allows for a light D.I.Y. construction of research/ greenhouse pavilions for the high school community to innovate, learn and grow.



Initial Concept Sketch The sketch above depicts the ideas of growth, permanence and temporariness.

Site Plan Shows new context added, such as accessible ramp, barn ruin park, gardens, etc. and how modest the architectural interventions are on the site.

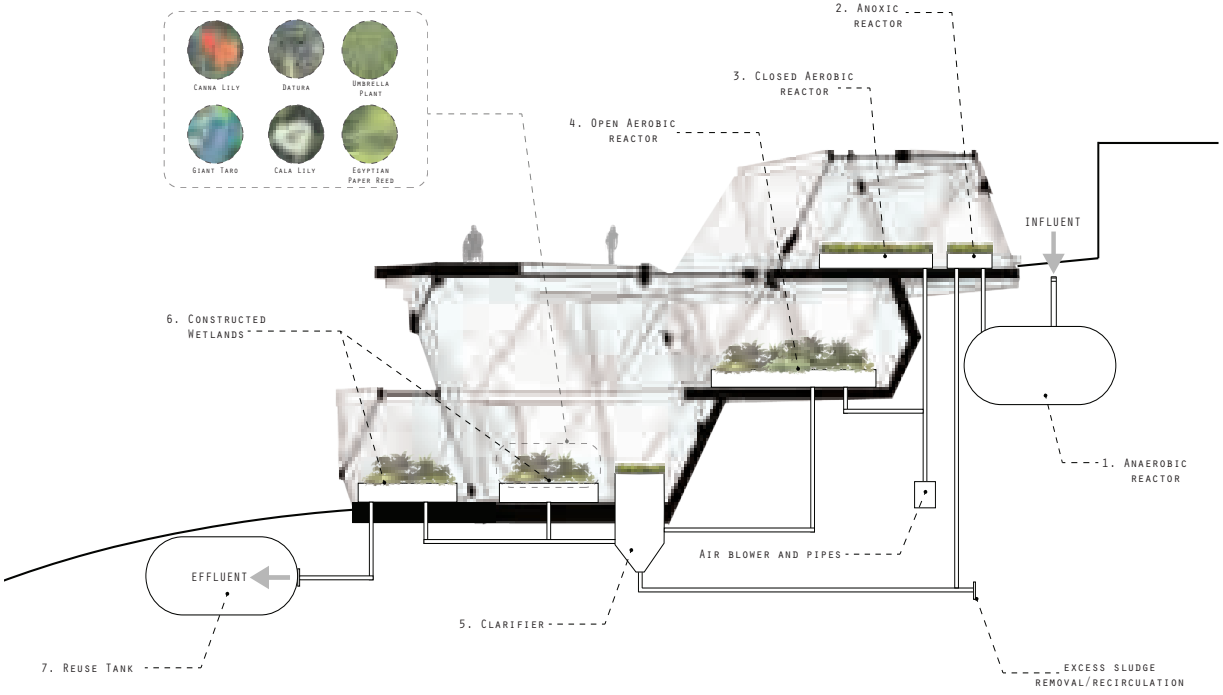
ADA Accessible Ramp Connects the high school to the newly aquired land. The journey down through the trees acts as a transitional space for visitors to transition from the urban/suburban scape to the quiet rural fields of the site.

Barn Ruin Park Honors the old barn ruins with a water feature and seating spaces amongst the garden.

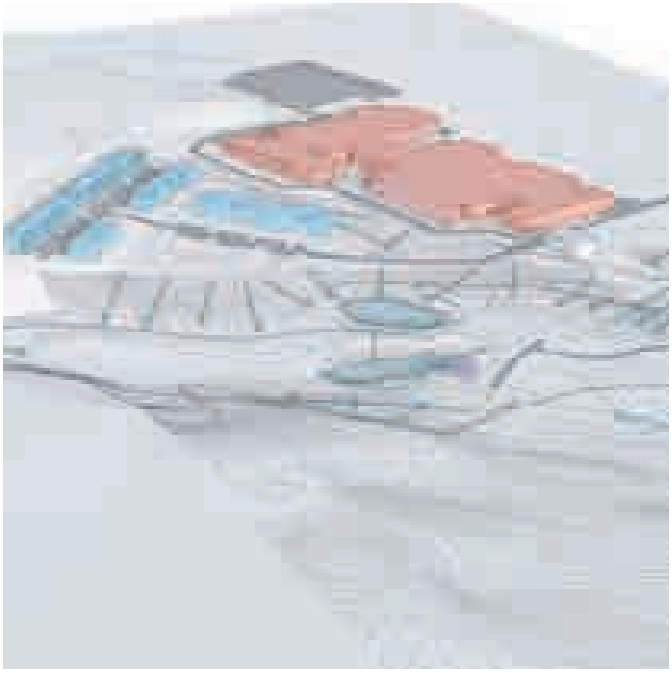
View from Ramp Beginning of the journey down the ramp to the farmland.

WATER

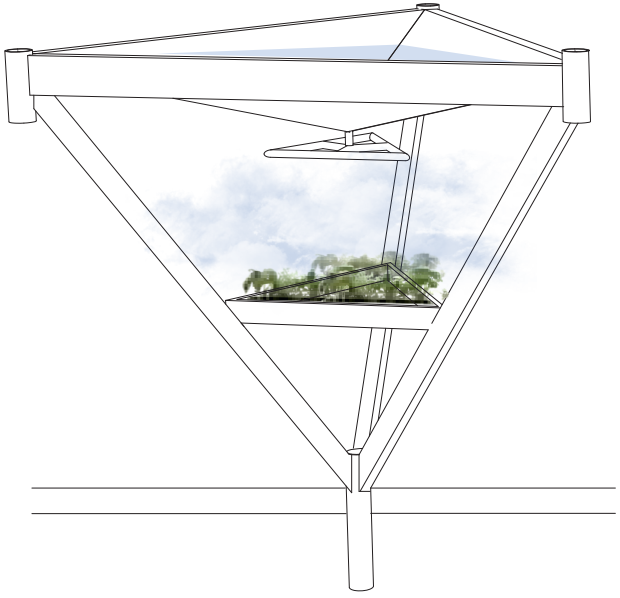
With the **steep hill** at the site and the high precipitation rate of central PA, the topography of the land allows for **natural rain water collection**. To avoid flooding on the site, the depression located next to the house will be a constructed wetland to collect rainwater to be filtered into the aquifer. The excess rainwater can be collected and used to irrigate the crops that are being grown. The bathroom pavilion will self sustain its water usage through the use of a **Living Machine**.



Living Machine Diagram As the site develops there are plans to implement a living machine building to help with the recycling of sewage on the site and to be used as a learning tool. Above shows the steps and different areas that compose a living machine.



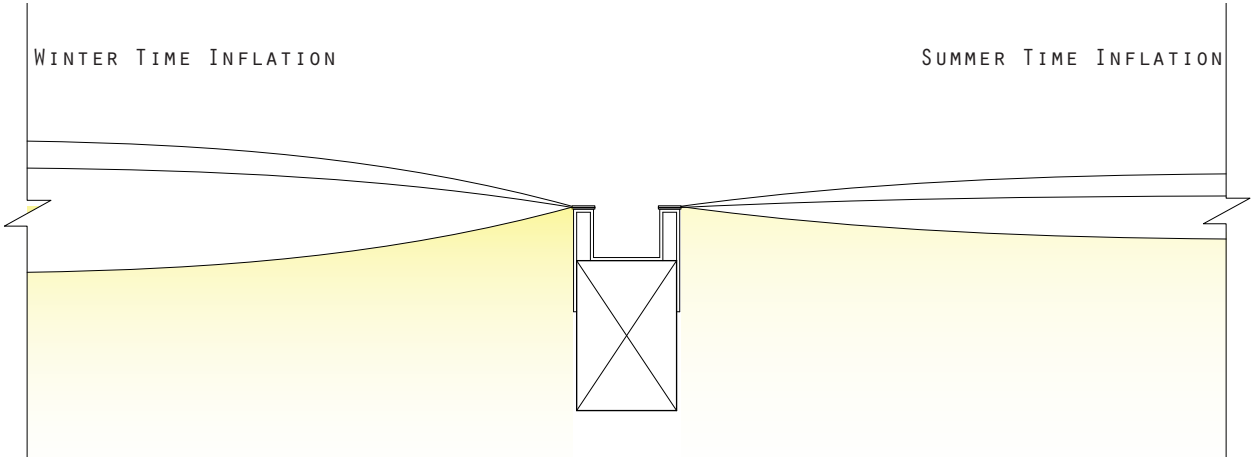
Site Runoff Arrows depict how the water drains down to the site into the two depressions. The depression next to the farmhouse will be a constructed wetland to filter water back into the aquifer.

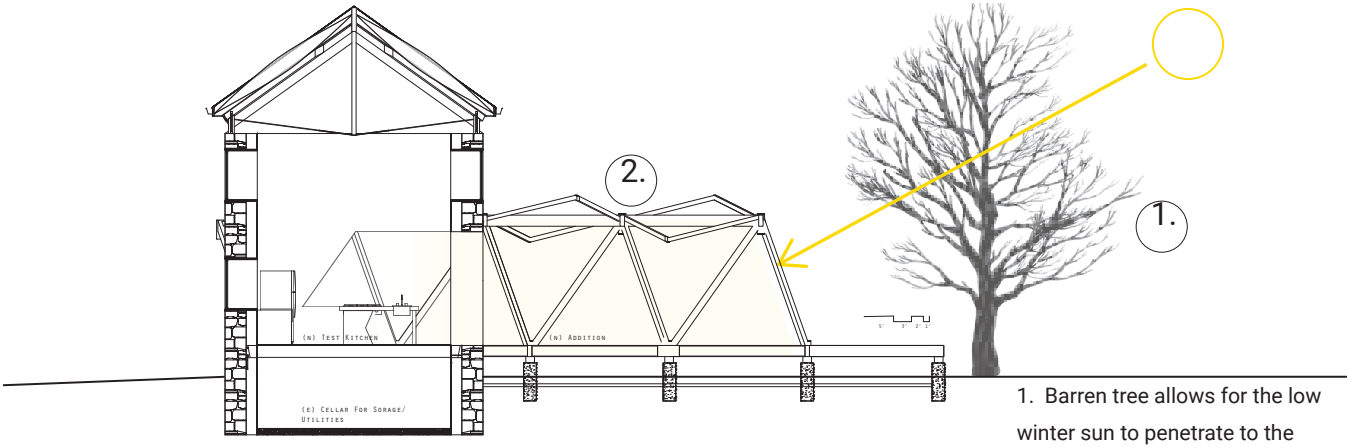


Rainwater Colllector The new flexible building. system allows for rainwater collection on roof to be used to irrigate herbs in greenhouses.

ENERGY

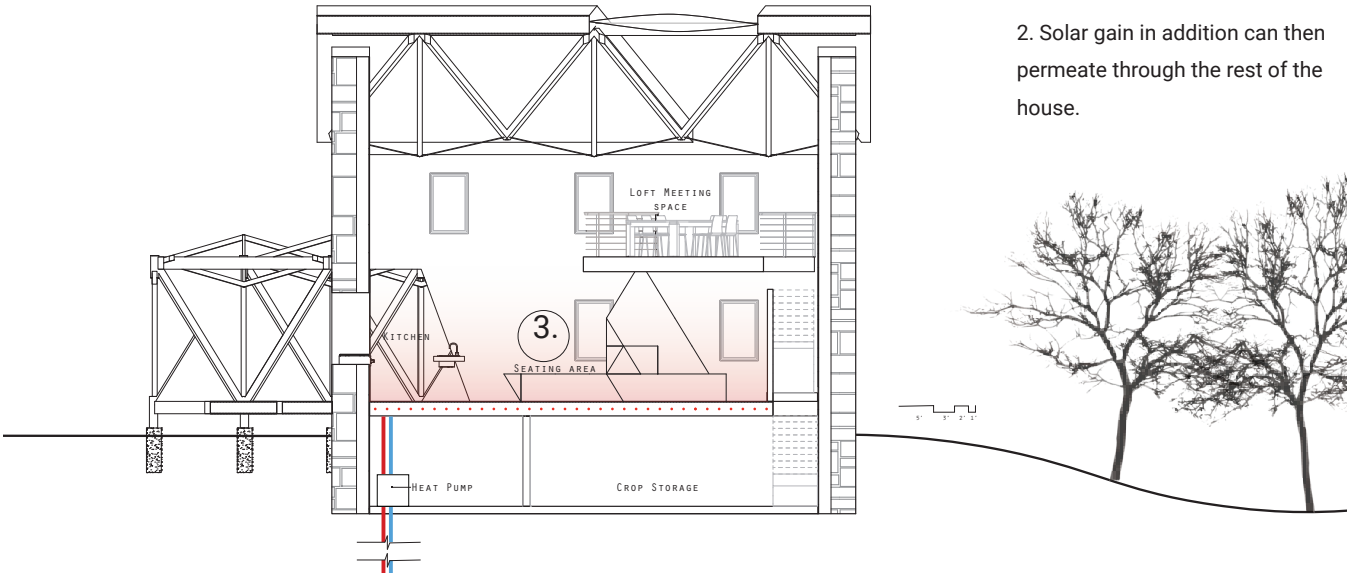
The new architecture implemented on the site allows for **optimal** usage of **passive** solar and cooling. Since we are located in an area that has extreme highs and extreme lows throughout the year, we must use some mechanical help to help equalize the extremes. **Fans** have been placed in the existing house to help circulate air during the hot summer months. **Geothermal**, radiant floor heating is used during the winter months; on the extreme days a ceremonial **masonry heater** will burn very hot for a short time allowing for the heat to dissipate through the space. To help power the electricity used by mechanical systems, the new roof will contain **Tesla solar shingles** to collect solar power to be stored and used during extreme conditions.

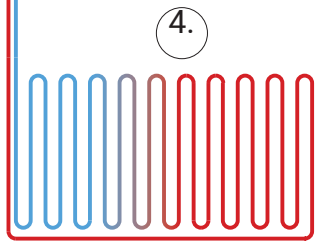




1. Barren tree allows for the low winter sun to penetrate to the addition.

2. Solar gain in addition can then permeate through the rest of the house.





3. Ceremonial masonry heater periodic burning of wood heats space at a constant temperature for a period of time.

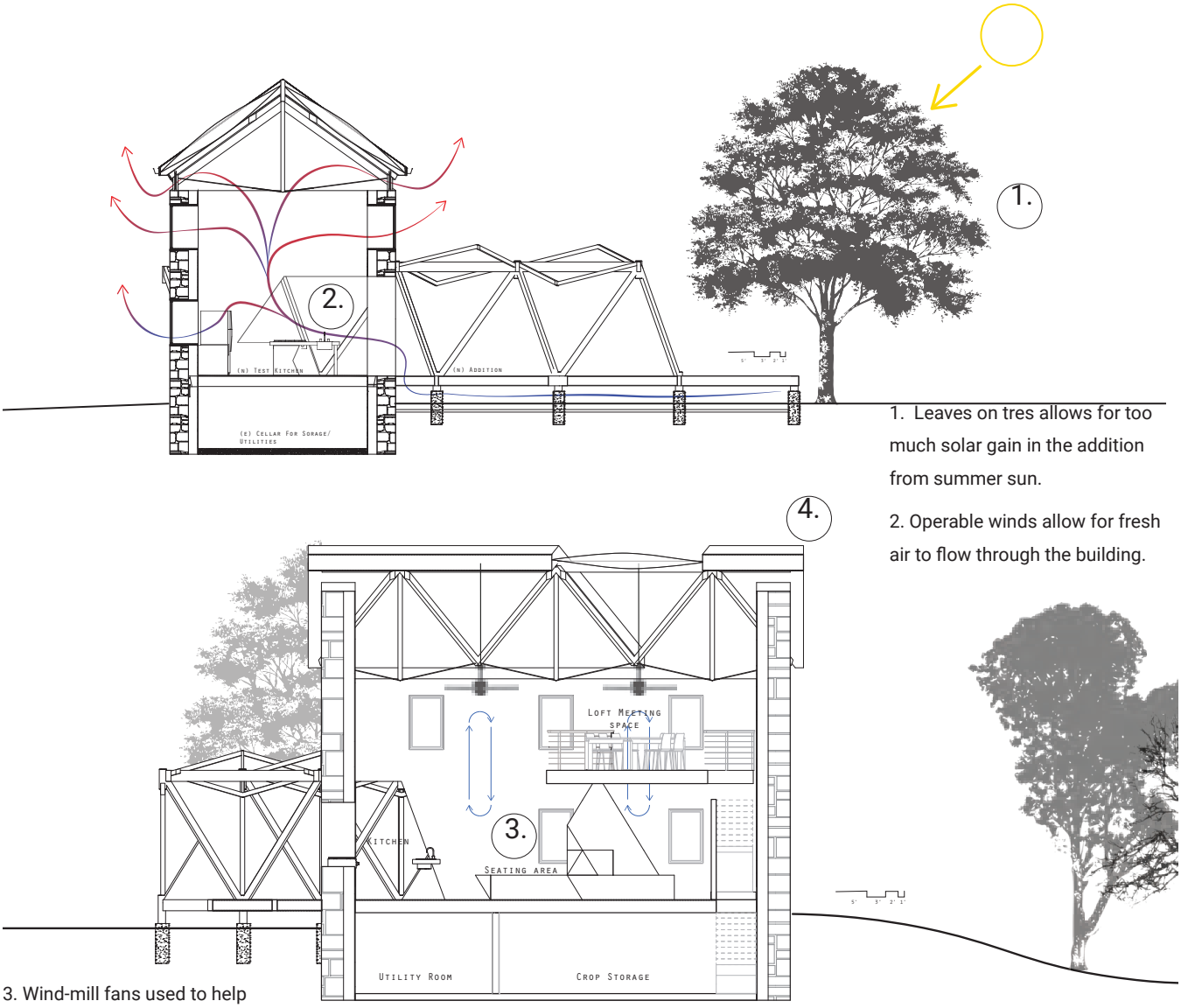
4. Ground coupled heat pump radiant floor.

Heating Strategies Winter heating strategies above. Refer to Health+Happiness petal for summer strategies.

HEALTH & HAPPINESS

The renovated existing house contains operable windows to allow the users to control the flow of **fresh air** through the building. The new addition is comprised of ETFE, a translucent material that allows for optimal **daylighting** while reducing solar gain. The new module used for new buildings is composed of tetrahedrons and octahedrons, which are **patterns** inherently found in **nature**.

Farmhouse Kitchen Interior ETFE allowing daylight in the kitchen.



1. Leaves on tres allows for too much solar gain in the addition from summer sun.

2. Operable winds allow for fresh air to flow through the building.

3. Wind-mill fans used to help circulate the fresh air through the building.

4. Tesla Solar shingles used to collect solar energy.

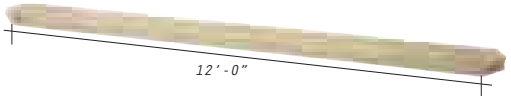
Cooling strategies Summer cooling and fresh air stratesgies.

MATERIALS

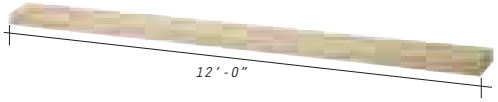
The materials used for any new construction are made of **locally** sourced timbers, contain no red lists items, and create new **transparencies** for users and industries to experience. All materials are easily transported to the site and also around the site for users to assemble and disassemble structures.

DIY Greenhouse Can be built by a group of students to grow and research plant types. Uses materials found on the next paige.

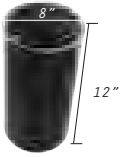
1 Angled 4x6 Member



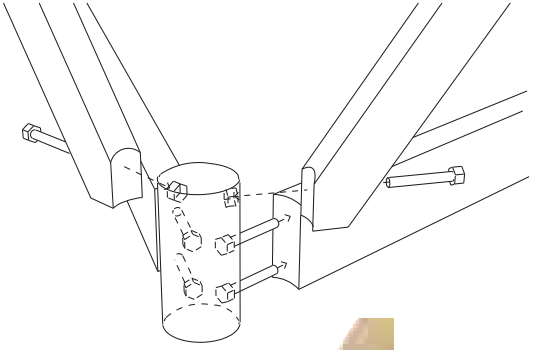
2 Flat 4x6 Member



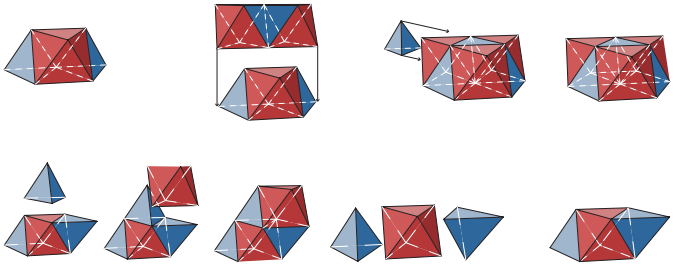
3 Steel Pipe Connector



4 Brackets and Bolts



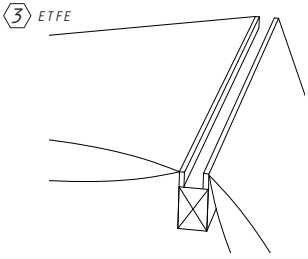
Structural Materials The materials to the left make the tetra-hedron and octa-hedron modules to form strctures demonstrated in the diagrams below.



1 Structural Insulated Panels

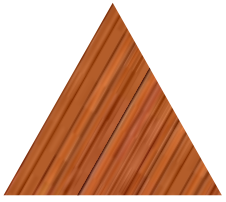
Cladding Materials The materials below can be used as wall panels, roofing panels, and floor panels.

3 ETFE



3 Corrugated metal siding

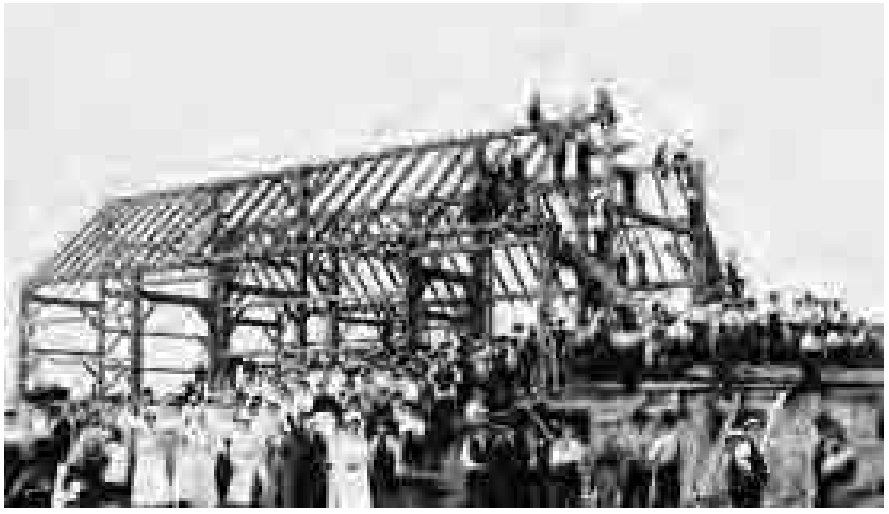
4 Wooden Cladding



EQUITY

By allowing for a flexible growing system to inhabit the site we encourage a diverse group of communities to come together. Different subject areas from the high school are encouraged to set up their outdoor pavilion structure in the designated areas; along with local businesses who are willing to set up a pavilion to conduct their own research or teach the new agricultural students of the 21st century. The site and architectural typology help promote the idea of community and togetherness by going out and building together, sharing ideas or harvesting crop

High School Plan Shows where Ms. Poorman's classroom and the school's woodshop are located in relation to the site.



Barn Raising Historically barn raising (above,left) was a community effort. With this idea in mind, an architectural typology was created by testing the idea of erected a structure with a groupd of people (above,right).

Single Module Pavilion Community members within the school district can create their own structure on designated areas on the site, allowing them to make their mark on the site in their own way.

BEAUTY

The architectural design concept, between old and new helps to educate the public on how one can **preserve** a sense of **history** on the site while still keeping up with the times. The heavy field-stone shell of the house is preserved as it has a sense of permanence on the site. The renovated interior has elements that create a **delicate** approach to introducing the new with the old. Any new element is slightly raised or pulled away from the exterior shell, to create a light airy appearance within the heavy field-stone walls. Even the new constructions of the addition and the pavilion structures are assembled using **light** weight timbers as to not have a heavy building impact on the agricultural site.

Addition Interior New addition space made of light weight modular construction system.

Farmhouse Interior New open interior farmhouse with loft meeting area and raised roof.

IN, ON, AND ABOVE

Andrew Ahr, Miranda Esposito, Jon Libman

The project system is a combination of three topographic manipulations of being in, on, and above the ground. Together, these rules help to create:

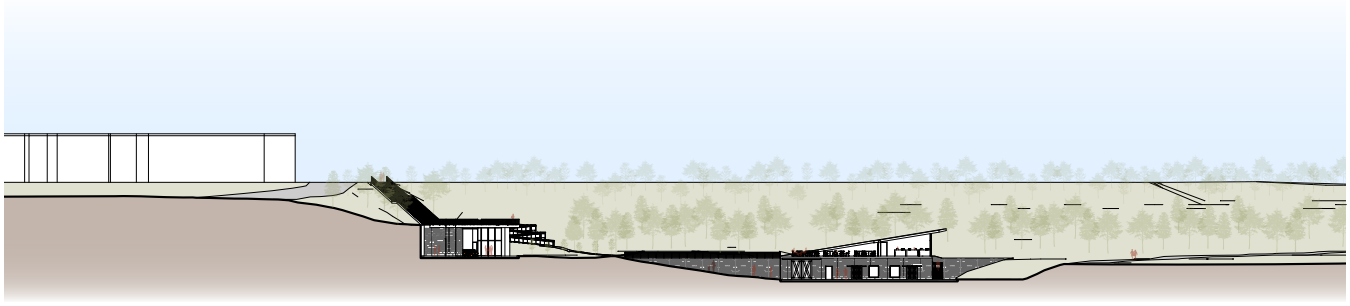
- An underground classroom for students to study the plant roots
- An existing farmhouse retrofitted for cooking
- A Community Supported Agriculture Facility to store food

These spaces work in unison to highlight a close relationship between the Bellefonte Area School District and its community; cultivate architecture that promotes interaction with an agricultural, sustainable environment; enriches education curriculum though Community Supported Agriculture (CSA) models; and constructs pathways and building with sustainability standards set forth by The Living Building Challenge.

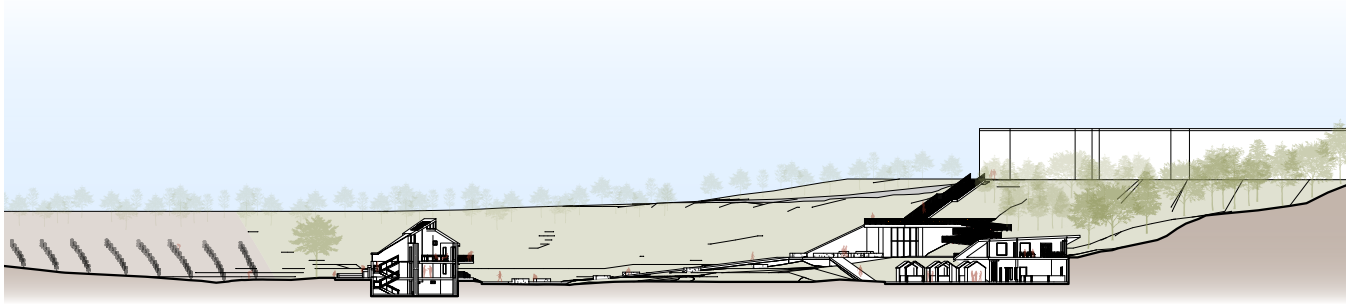
PLACE

The intent of the Place Petal is to bring people closer to the Bellefonte environment. Our proposal involves a series or architectural and natural paths that guides the community throughout the site. There is an emphasis on walking rather than driving to the site. Along the paths, people will find places to sit, eat, and relax. Overall, this is a site to learn about local agriculture.

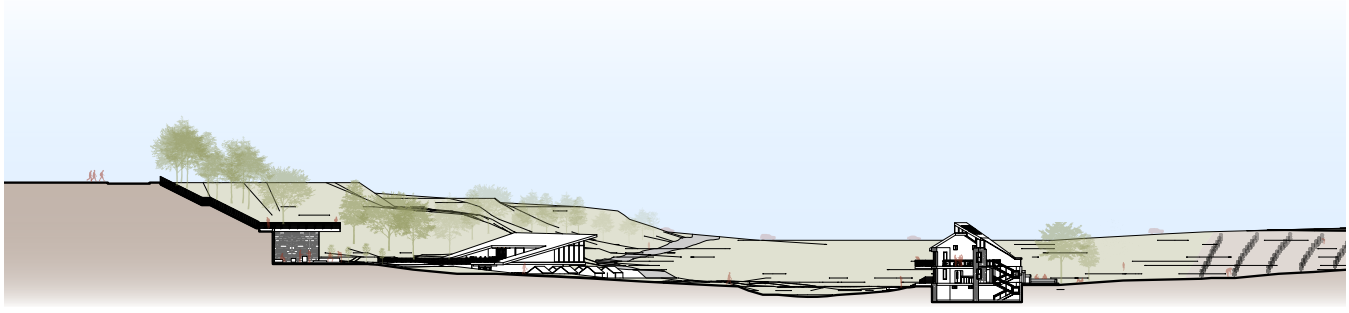
Site Plan An overview of the existing site with its proposed interventions



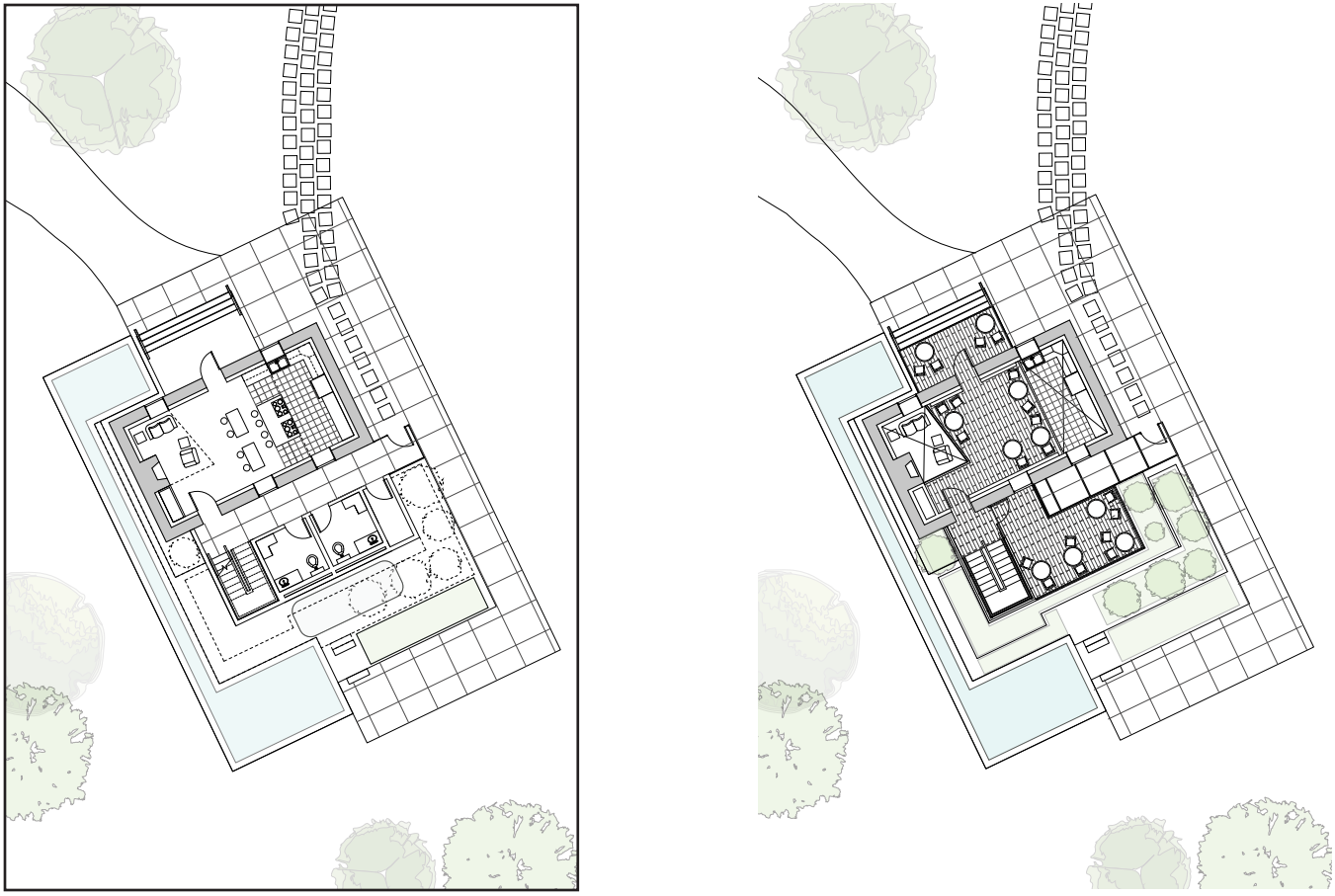
Site Section A Section cut though Underground Classroom and Community Supported Agriculture (CSA) Facility



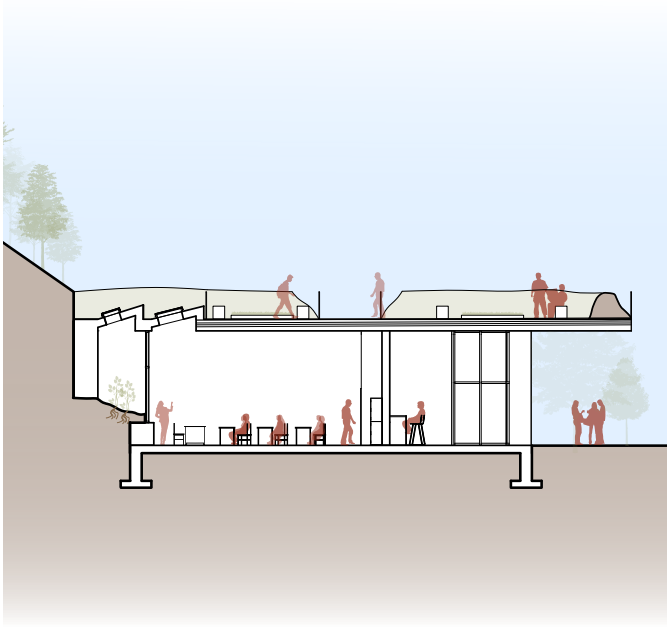
Site Section B Section cut through the existing farmhouse and Community Supported Agriculture (CSA) Facility



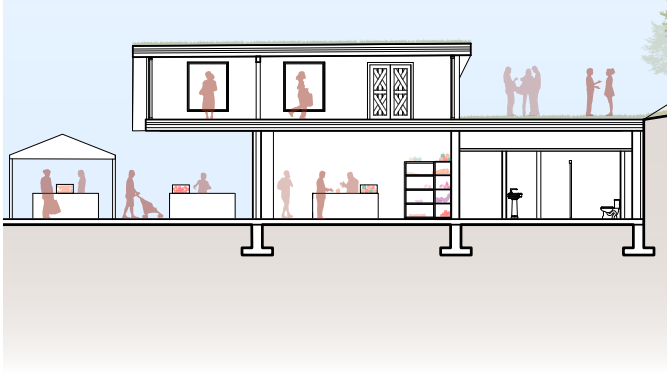
Site Section C Section cut through the Underground Classroom and existing farmhouse



Existing Farmhouse Plans The first floor of the exisiting farmhouse (located on the left) includes a kitchen for students to cook food that is grown on the site. The second floor of the existing farmhouse (located on the right) inlcudes a mezzanine for students to relax.



Underground Classroom Section The Underground Classroom is engaged in the hill to provide a glimpse of existing root systems. On the first floor, students can learn about these root systems. The roof is accessible and has areas to sit.

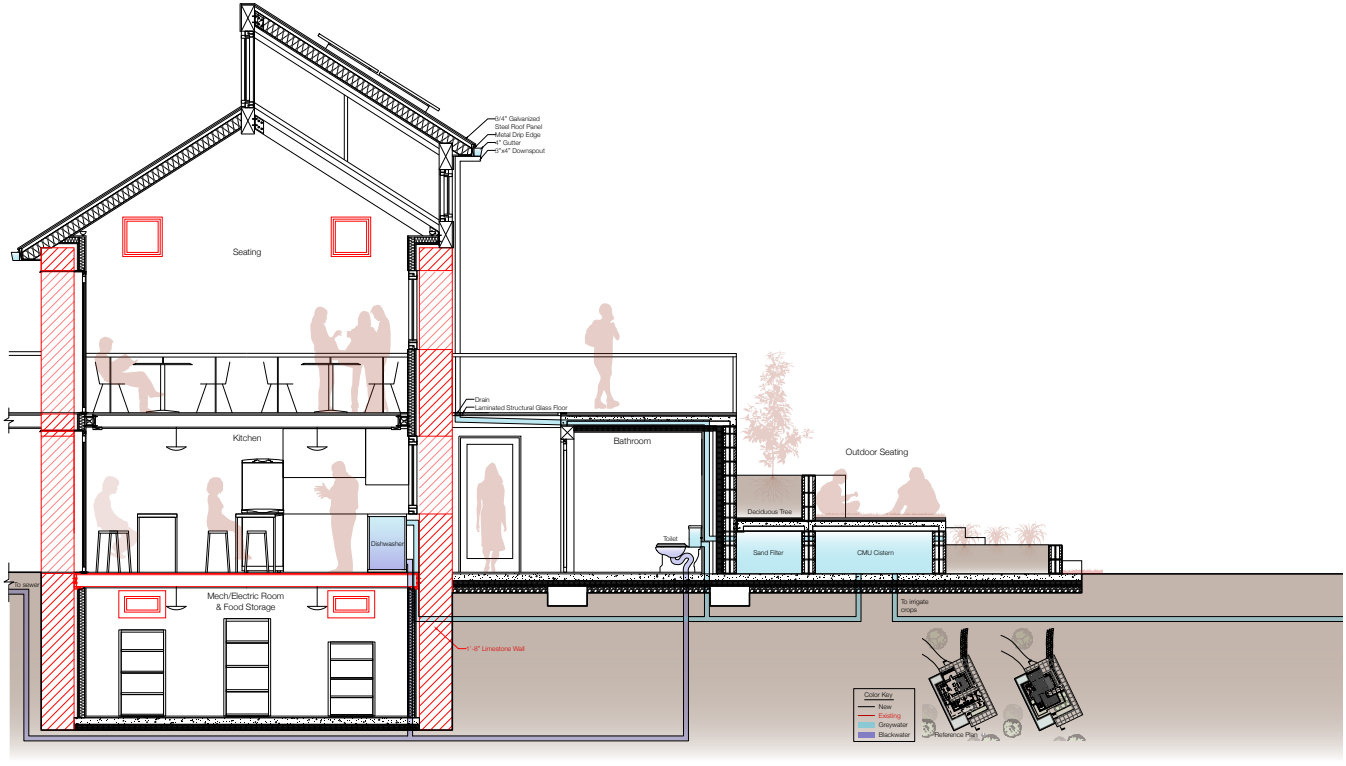


CSA Facility Section The CSA Facility has storage to house food that is locally grown on site. It is a place where members of the community can interact with students and teach them about agriculture.

WATER & ENERGY

The intent of the Water Petal is to propose new ways for people to use and reuse water. Our design creates a system that will teach the community how water can be retained to meet the demands of its user. In the existing farmhouse, rainwater will be collected from the building's surfaces, stored in a cistern, and distributed to the kitchen and restroom. Then, all greywater is transported away from the site through pipes.

The intent of the Energy Petal aims to conserve as much energy as possible. Buildings should utilize renewable energy resources that do not harm the environment. Our design places emphasis on natural ventilation and daylighting schemes. When these sources of energy are not enough, an air-conditioning unit is used in the winter and a ground-coupled heat pump is used in the fall.



Site Section of Farmhouse The Existing Farmhouse has a forum added to its rear. This space houses a cistern that collects and stores rainwater. The section shows how water is distributed throughout the building.

Winter Energy System During the summer, the farmhouse's atrium is designed to let light into the building. The sun angle is 27.7 on December 21 at noon.

Summer Energy System During the summer, the farmhouse's atrium is designed to prevent light from entering the building. The sun angle is 68.6 on June 21 at noon

HEALTH & HAPPINESS

The intent of the Health & Happiness Petal is to design conditions that allow productivity and interaction to flourish. This language creates an emphasis on both inside and outside spaces. Though, our proposal encourages the community (when weather permits) to be outside as much as possible. Our site is created for the community to enjoy nature. In many ways, these people should feel a connection to nature through a biophilic environment.

Farmhouse Mezzanine The roof of the farmhouse is lifted on one side, allowing natural daylight to enter. This sun study was taken at noon during the spring season.

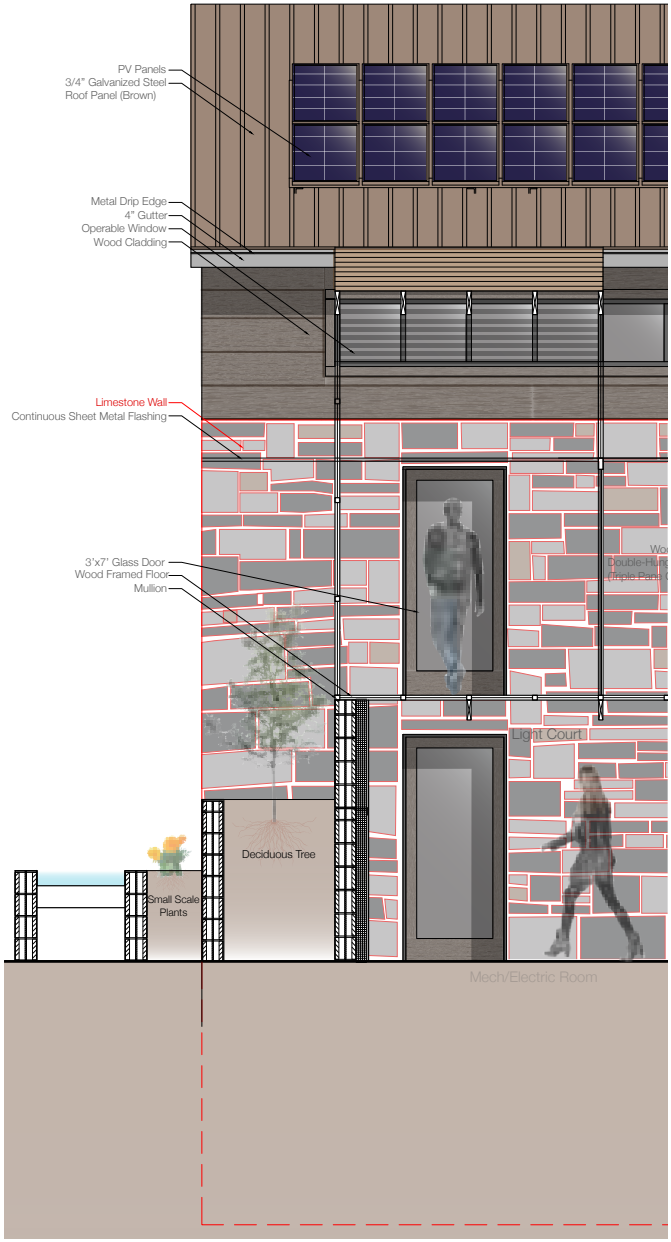
Forum Seating Located in the rear of the farmhouse is a forum for people to sit. The forum is designed with planters that grow local agriculture and vegetation.

Underground Classroom The Underground Classroom has outdoor seating where members of the community can relax. The roof seating provides a great view of the rolling farmlands and existing farmhouse.

MATERIALS

The intent of the Materials Petal is to use materials that do not damage the environment. In many ways, it is encouraged to use materials that are already existing on or near the site. Our design proposes to use limestone and timber that is located in the Belelfonte area. The limestone that is used will be taken from the existing farmhouse. The lumber that is used will be reclaimed from trees that are cut down during the construction phase.

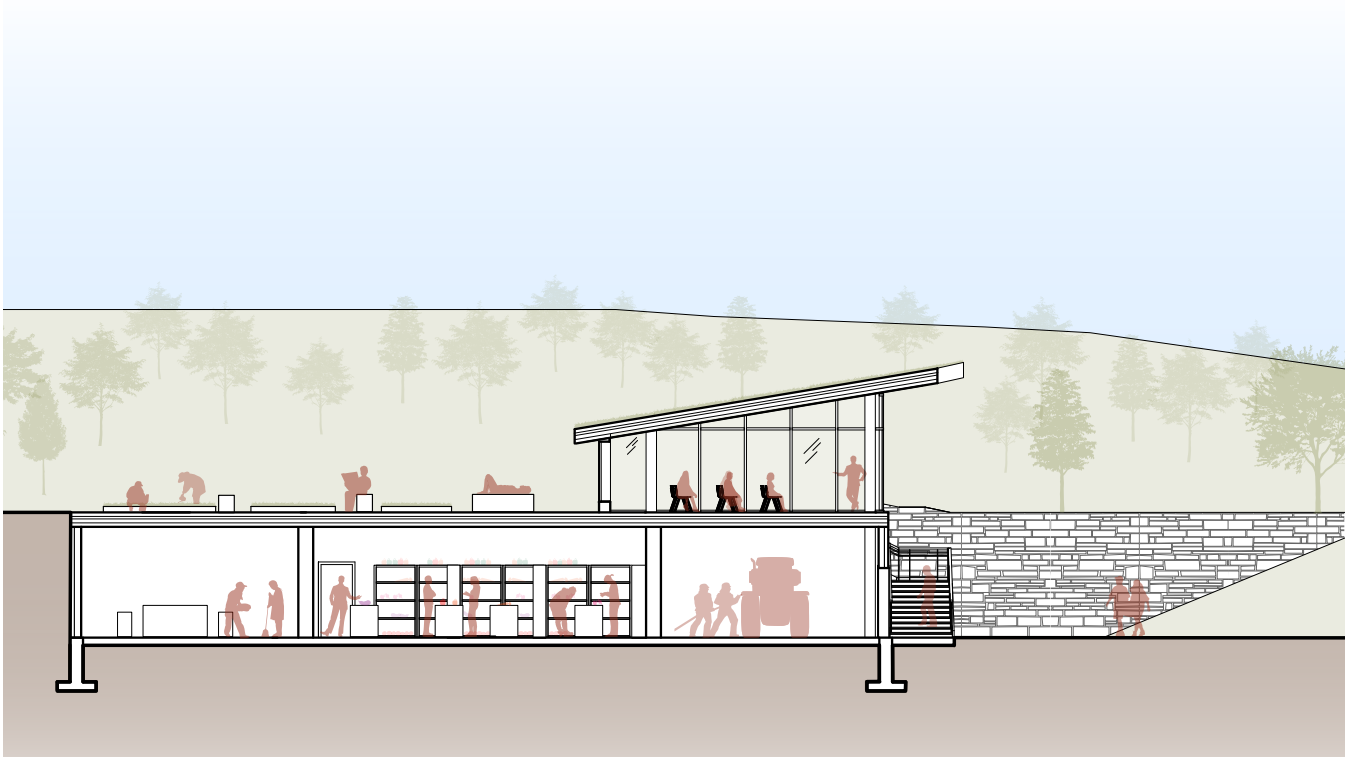
Existing Materials Located on the site is a vast amount of limestone (left image). Also located on the site is an existing foundation for a barn (right image).



Farmhouse Elevation

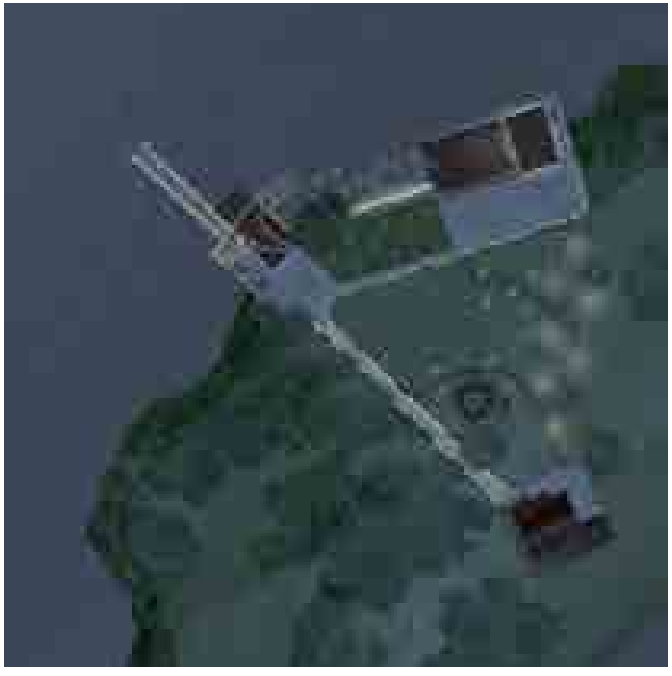
EQUITY

The intent of the Equity Petal is to create an environment that brings a diverse group of people together. Its emphasis is on human interaction removed from social media. It is about getting to know people who are different. It should not matter if you are a student, teacher or community member; this space is for you. Our design proposes areas that are universally accessible to anyone and everyone. It is out hope that these guidelines will allow the culture of Belefonte to grow.



Community Supported Agriculture (CSA) Facility Section This space is where students, teachers, and community members come together to interact. The program includes spaces to store food and equipement. It also includes spaces to teach about local agriculture.

Art Mural Located near the Community Supported Agriculture (CSA) Facility is an art mural. The mural is a combination of high school student work and vegetation.



Night Site Plan Our design is to be used throughout the day and night. Thus, lighting is placed along the architectural and natural paths. The community can come together to catch fireflies, roast marshmallows and bond.

BEAUTY

The Living Building Challenge does not put a limit on this category. It encourages designers to create spaces that are beautiful. As architects, we care about the aesthetics of our buildings. We care not only about what we think, but also what others think is beautiful. Through thoughtful design and community input, we have proposed spaces that the Bellefonte area will enjoy for years to come.

Site Rendering This image is taken from to the left of the existing farmhouse. It captures a view of the whole site including the Community Supported Agriculture (CSA) Facility, Underground Classroom, and Bellefonte Area High School.

Community Supported Agriculture (CSA) Facility Model

Underground Classroom Model

EARTH MANIPULATION

Jon Gutt, Becca Newburg, Kate Stuewe

How do we live with nature?

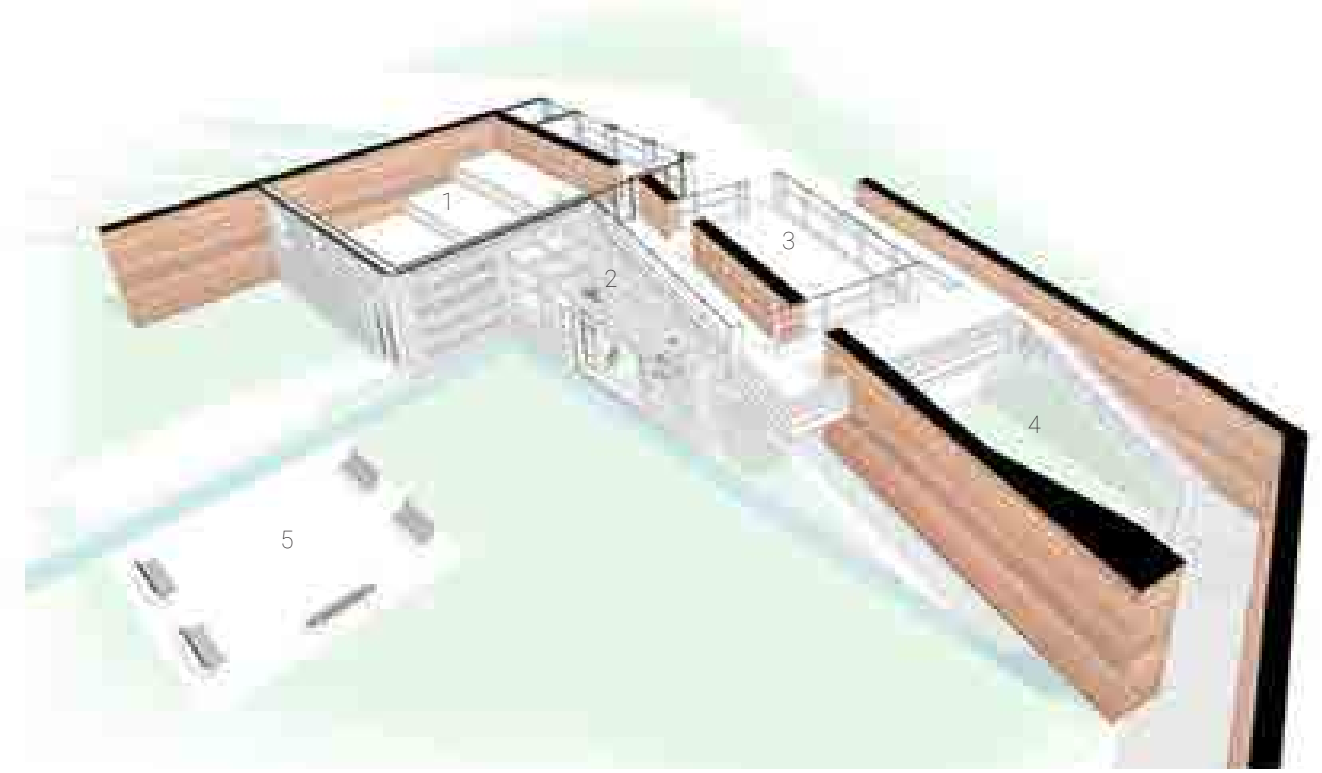
Our intention is:

- To utilize earth as a resource through our substantial rammed earth walls.
- To foster a connection between food production and food preparation.
- To educate Bellefonte students about healthy lifestyles through sustainable farming and building methods and physical fitness infrastructure.
- To connect students to the community through a test kitchen in the farmhouse and by creating a new space for local members of the craft community to teach and demonstrate.
- To inspire participation with a dynamic and inviting landscape.

PLACE

Our project is called Earth Manipulation because we consider earth as our biggest resource. The earth that forms our rammed earth walls comes directly from the site. The excavation of the terraces and the building form the walls that make up main aspect of our project. Being surrounded by earth reminds us of our place and impacts how we live with it.

1. Terraced classroom
2. Indoor courtyard
3. Greenhouse
4. Outdoor classroom
5. Gathering space
6. Mechanical room
7. Irigation lagoon/ice rink
8. Farmhouse/test kitchen
9. Orchard



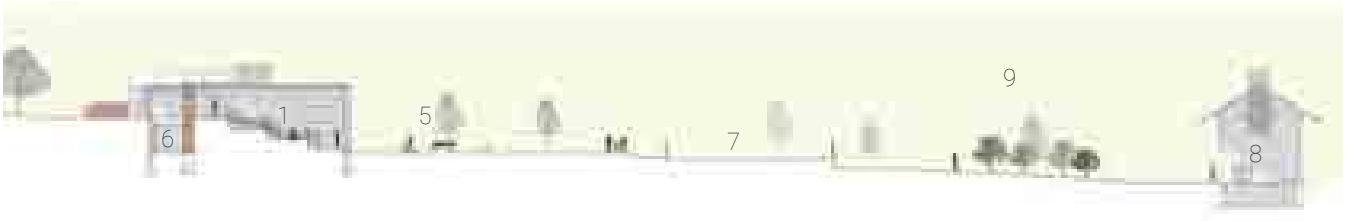
This axon plan show the layout of the building and how it realtes to the rammed earth walls and the immediate site.

Lower plan of building showing the mechanical room.

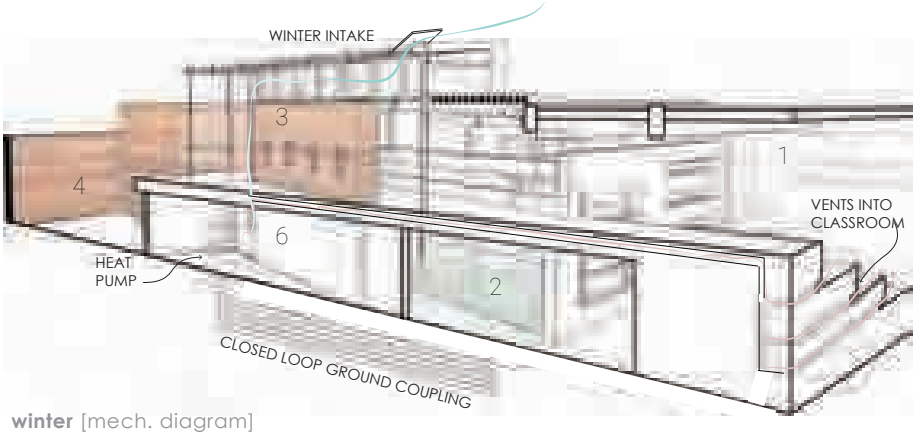
Upper plan of new building and farmhouse showing the kitchen, classrooms and greenhouse and the realtionship between the two structures.

1. Terraced classroom
2. Indoor courtyard
3. Greenhouse
4. Outdoor classroom
5. Gathering space
6. Mechanical room
7. Irrigation lagoon/ice rink
8. Farmhouse/test kitchen
9. Orchard

Solar study of the student lounge. Because of the placement of the lounge, rammed earth walls and windows, this space is comfortable all year. The sun hits the wall in the winter and is shaded in the summer.

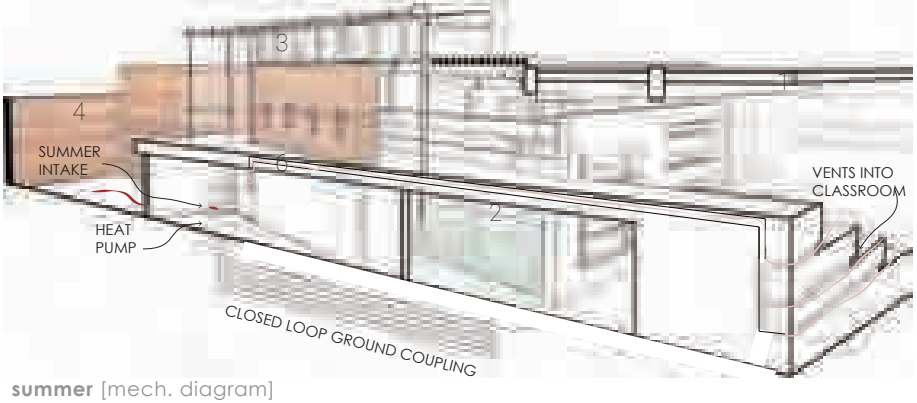


Above: A section taken through the site and both buildings showing the terraced classroom and farmhouse kitchen.



winter [mech. diagram]

This axon shows our mechanical winter heating strategy. By using the temperature of the ground through closed loop groud coupling, the heating load is reduced.



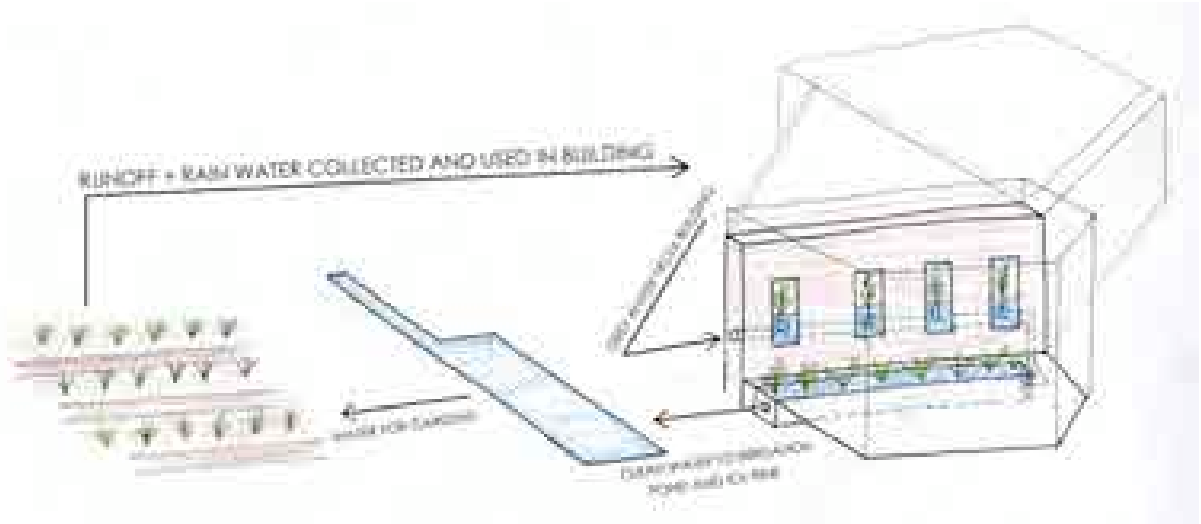
summer [mech. diagram]

This axon shows the mechanical cooling straeggy for the summer. Again, by using the ground's constant temperature, the cooling load is reduced.

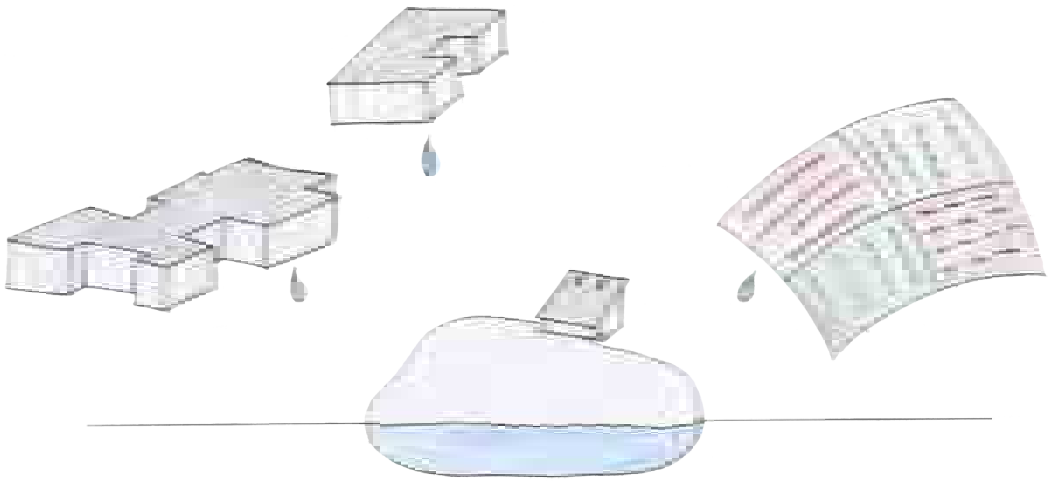
WATER

Water not only serves as a physical connector between the farm house and the new building but also as a learning tool and recreational facility. Rainfall is collected from the roofs and used throughout the building. The grey water from the building is filtered on site; the water is piped through the rammed earth wall in the greenhouse where it is filtered with plants that are in tanks embedded into the walls. The water flows through a second row of tanks and, when clean, falls down into the outdoor classroom, under the rammed earth, through site, and into the irrigation lagoon. From there, it can be used in the gardens or keeps flowing to the farmhouse. additionally, the water in the lagoon can be used for irrigation in the summer and as an ice rink in the winter.

This view is taken from the orchard look towards the new building. You can see the channel of water connecting the farm house to the new building as well as the ice rink.



This sketch showing the path of the water as it moves through the project.

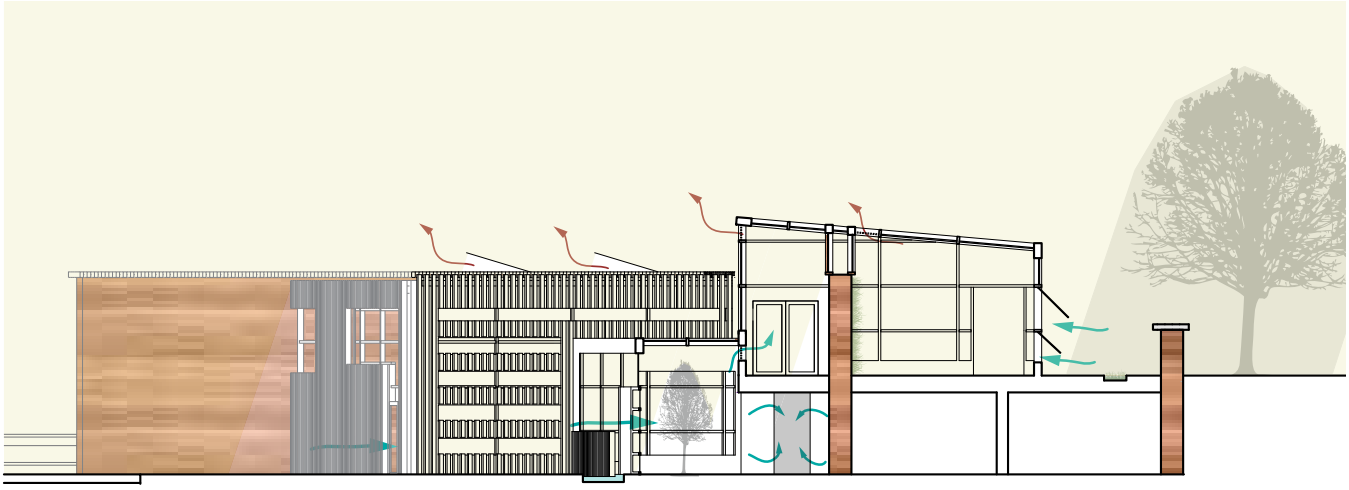


This is an early concept sketch showing the sources of water to be collected for the lagoon: rain water from the highschool, prospective elementary school, and new building and the runoff from the land itself.

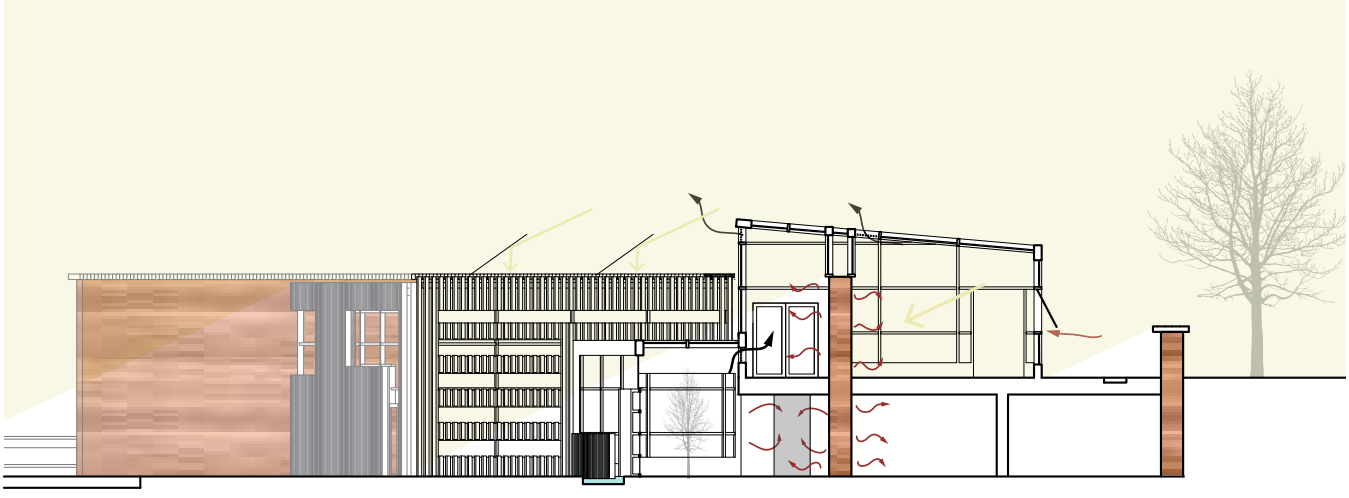
ENERGY

Our key system for practical passive climate management is the use of earth as a resource through our substantial rammed walls. Their materiality is sourced locally which cuts down on emissions and energy waste that would accumulate through the transportation of materials to the site. Additionally, their existence in the space helps to better utilize solar energy as a heat source in the winter and regulate humidity throughout the summer.

Many of the rammed earth walls are fully enclosed within a conditioned space allowing them to function as a trombe wall. Here you see the rammed earth wall inside the courtyard that provides stored heat in the winter and is vented out of the courtyard in the summer.



In the summer months, on top of the terraced classroom green roofs provide passive cooling and solar panels harness the sun's energy. Strategically placed operable windows allow for passive cooling.



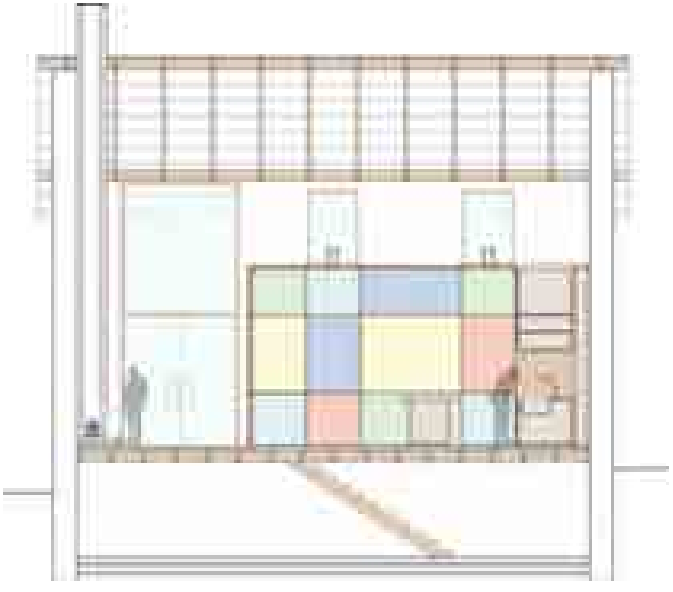
In the winter months, a glass tube on top of the rammed earth wall in the greenhouse warms the winter air intake. The rammed earth walls store and release heat.

HEALTH & HAPPINESS

Health and happiness are intrinsically linked; through increased physical health, promoted by healthy foods and exercise, mental health and happiness are given a more firm foundation. The program of a sustainable farm gave us a fantastic starting point in regards to promoting physical health through healthy eating. By producing food on site and encouraging students and the community to get hands on with their food production we encourage healthy eating, however, less overtly, we boost mental health and happiness through a human connection with the soil and the nurturing process of produce. We also provide a series of walking trails and running courses open for school functions and community use to encourage physical health through exercise.

The test kitchen located in the existing stone farmhouse provides a space to educate both students and community groups on healthy food preparation and uses for the fresh produce grown on site.

The red depicts vehicle and emergency service access routes, the green is a 5k neighborhood loop that can be used for school sporting events, the blue is a 1.5 mile loop that encircles the perimeter of the property, the orange is a .5 mile inner loop, and the yellow is an unobtrusive walking trail around the immediate site.

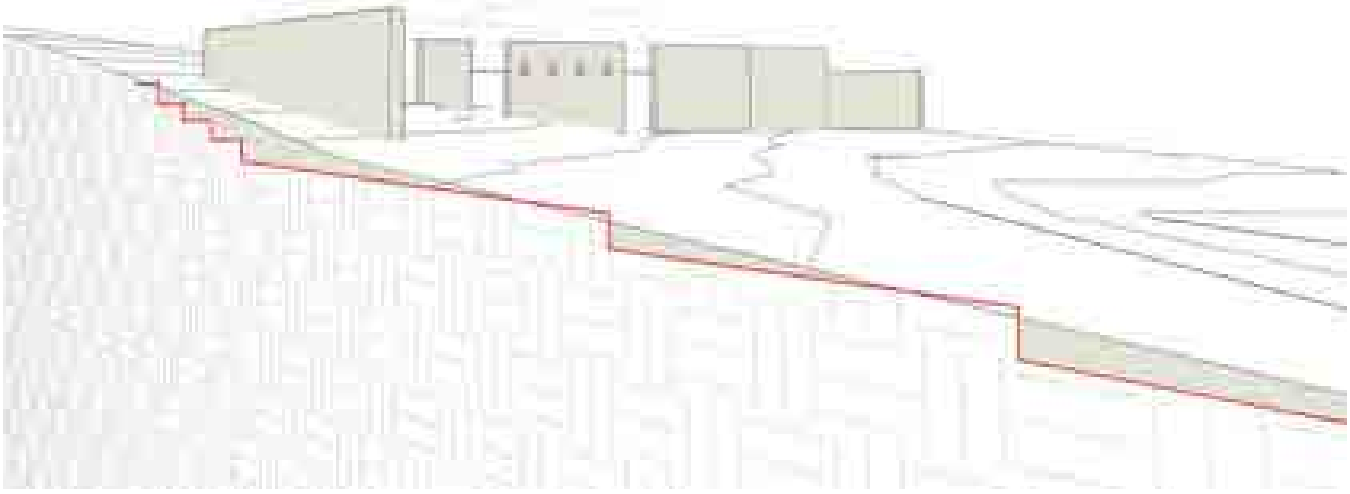


Here you can see more detail of what is purposed in the test kitchen render. The glass box enclosed a range, a sink and kitchen storage. The original cellar is preserved for additional produce storage.

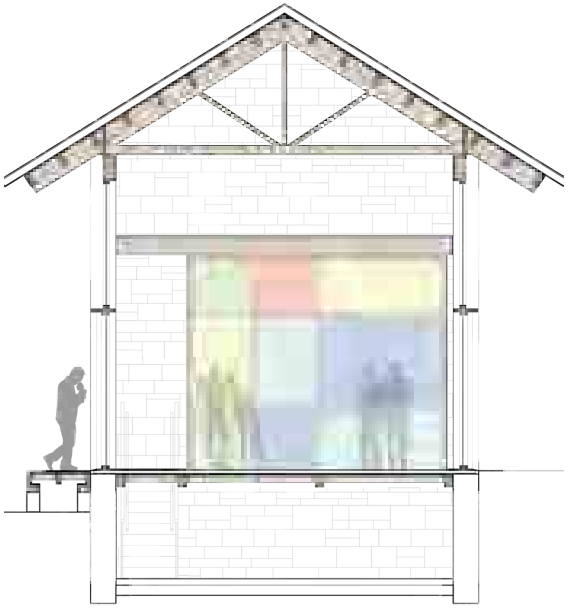
MATERIALS

The main material we use in our project is the earth itself to express the environment from which all things come from. Rammed earth walls were used throughout the building to display earth around the students. Clt walls were used as a structural element and to provide a natural setting along with the rammed earth. The use of wooden slats act as cladding for our clt walls and offset themselves by being a darker color. The stone that is incorporated in the farmhouse was used as a accent wall for the outdoor classroom. Within the farmhouse, we used curtain walls so the stone was still seen being in any room.

Welcoming view indicating rammed earth wall from CLT walls and wooden mullions.



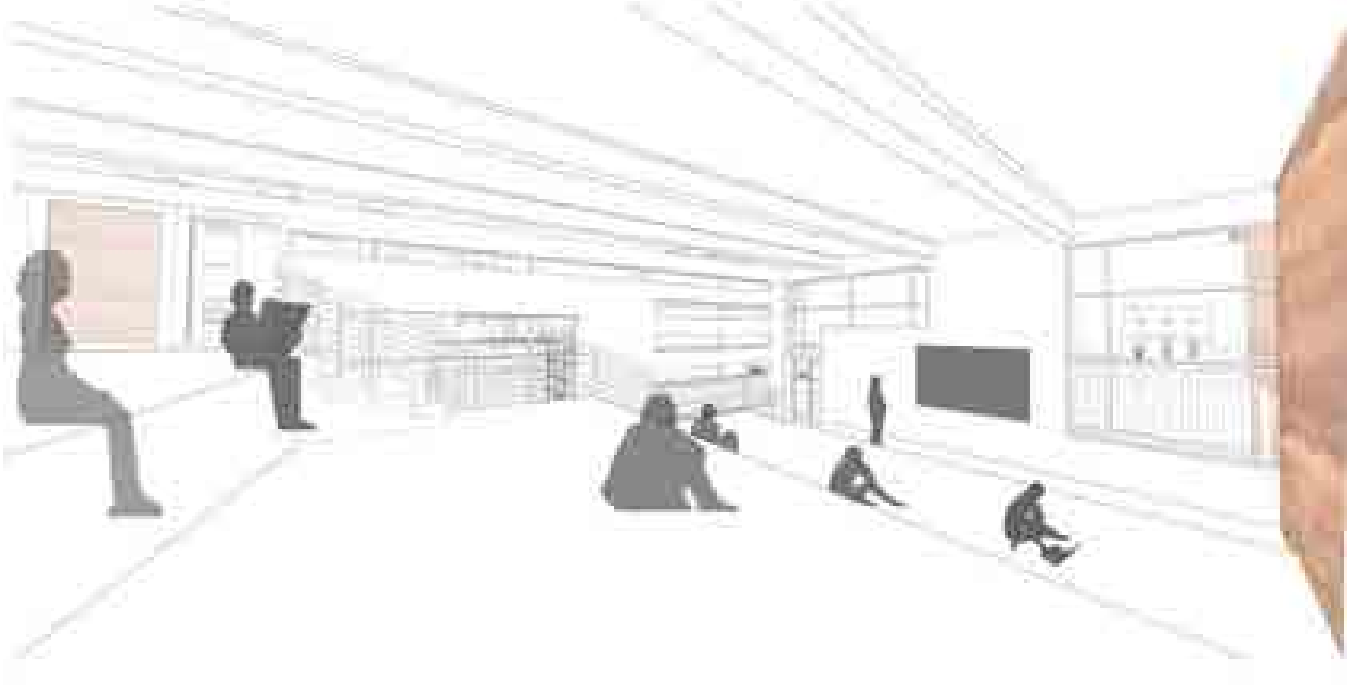
Excavation diagram showing the earth being manipulated into rammed earth walls.



Section showing painted glass walls that also show the structure fitted for the farmhouse.

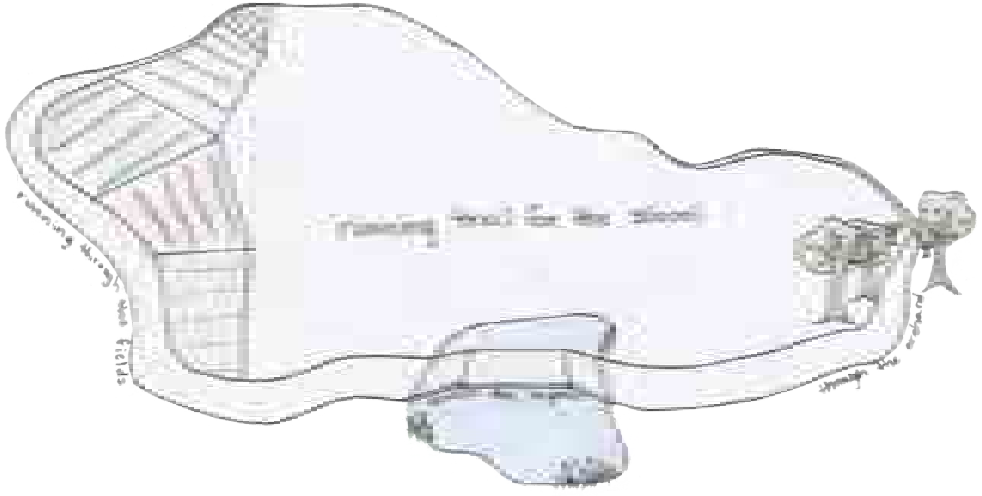
EQUITY

Paths around our project are used to express the nature around us. The paths consist as slopes to bring easy access around our proposed environment. A elevator is installed in the classroom to allow ADA access from the lower level to the greenhouse level. Program such as soccer fields were incorporated to allow entertainment among the students. A orchard is also provided as a resource and a learning aspect for the students. A lagoon that runs throughout the project freezes itself in the winter time and acts as a skating rink for the community.



Classroom view showing the difference in levels and why an elevator is applicable.

A central path way where visitors can explore the outer boundaries of the site.

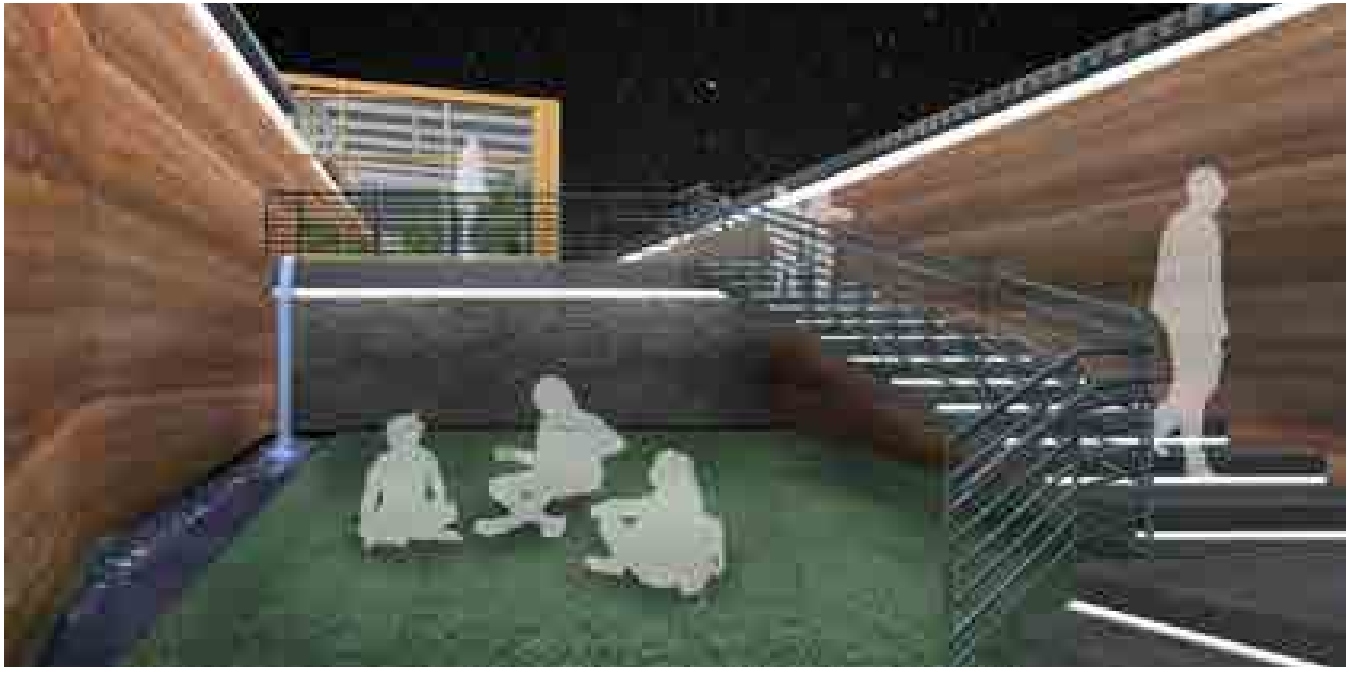


Concept drawing showing the different aspects within the site that include the irrigation lagoon, cornfield, and orchard.

BEAUTY

In this project, we let the beauty of the materials speak for themselves. Rammed earth was not only our main component for sustainability but also for beauty. Wherever possible, we aimed to expose as much of the rammed earth as possible and let the other materials play off the walls. Our lighting scheme emphasizes the horizonal pattern of the walls and terraces and leads people through the project.

Above: View from inside the greenhouse. **Top right:** View from inside the terraced classroom showing the nighttime lighting scheme. **Bottom right:** View of the outdoor "underground" classroom showing the water feature and the lighting scheme.



STAGES

Shannon Daugherty, Jordan Swartz, Caroline Wilson

A circulation based site experience that provides learning opportunities through a series of interventions.

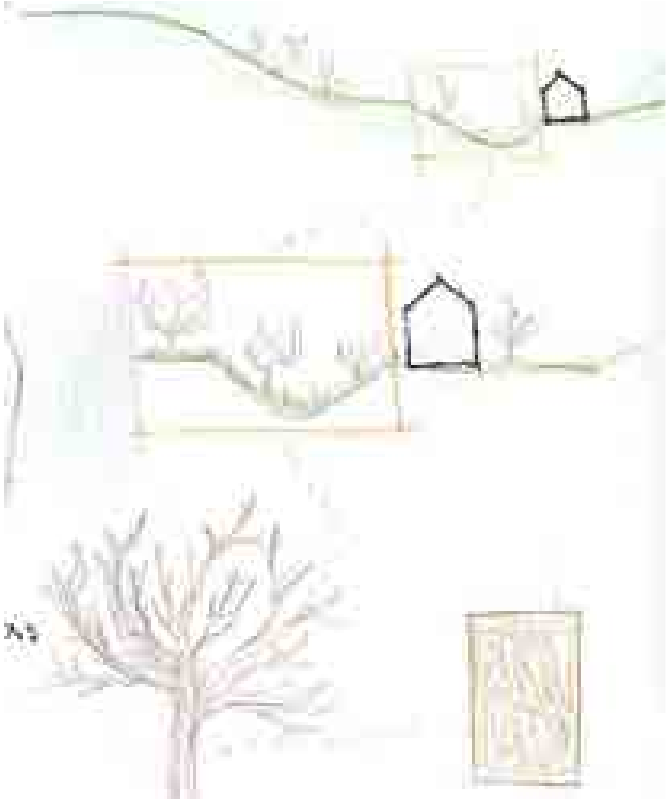
An old farmhouse in a picturesque field was transformed into a sustainable farm system for the Bellefonte High School students and Bellefonte community.

PLACE

The overall site interventions in this project are small. We wanted to keep the feeling and purity of the site alive. With the beauty of the trees, fields and open area, we kept the design very open with our paths working with the original topography. Along with the original integrity of the site, the existing farmhouse is maintained and there is very little land manipulation. On a smaller scale, our designs used the idea of biophilia to connect with the existing site. Biophilia is the urge to associate with other living things. Through the idea of biomimicry our design mimics the site through the brush and trees throughout the site. The screens in the addition to the farmhouse cast simlar shadows to that of looking through the brush and trees on the site. Our structure, with occasional skylights, represent looking up at the canopy of trees above you, allowing some sunlight to shine through. The farmhouse's original stone walls are maintained in the farmhouse teaching kitchen to represent the heart and history of the site.

Myken's View (View 1) - The view from the platform at the level of Bellefonte High School This will be the place where Myken will be able to advocate for the site and explain the ideas behind her program and how the site is used.

Site Plan The project is focused around the views of the site, or the Stages. On the site plan the views are emphasized while also giving an idea of the differences between the two paths on the site.

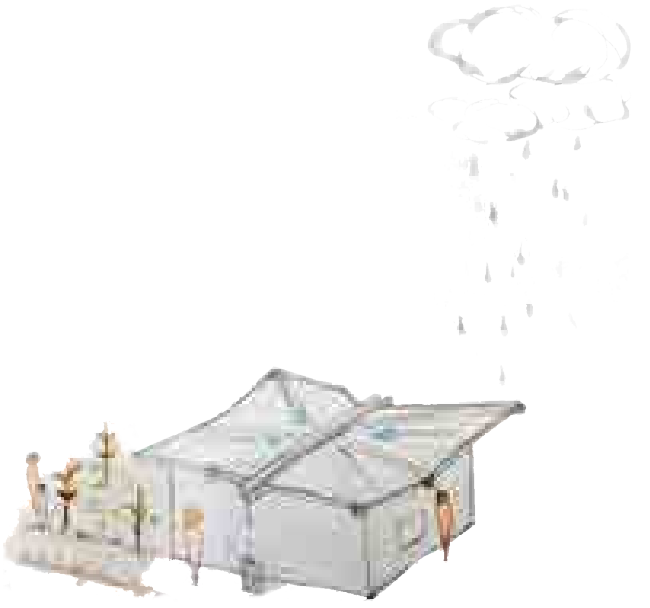


Biophilia Diagrams These sketches describe the ideas between our designs and how they connect with the ideas of Biophilia or the urge to associate with other living things.

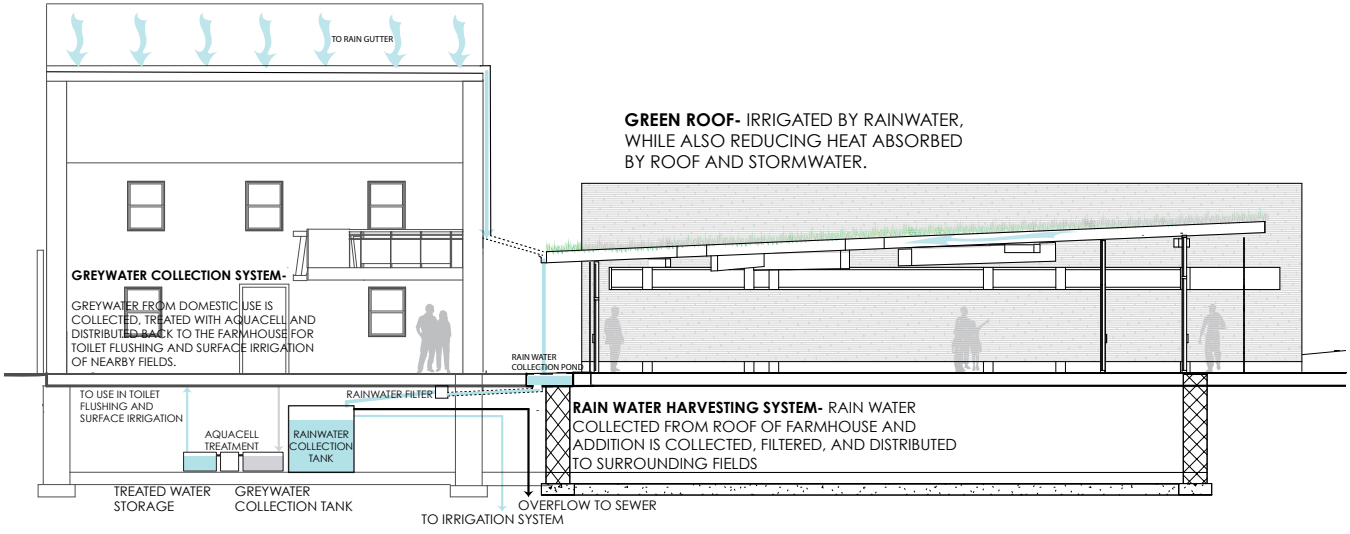
WATER

Rainwater is collected from the roof of the farmhouse and the addition through the pitched roof designs and a rain gutter system. The green roof on the farmhouse addition is irrigated by rainwater, while also reducing the heat absorbed by the roof and stormwater. The stormwater is collected, filtered, and distributed to surrounding fields. Greywater from domestic use is collected, treated with aquacell and distributed back to the farmhouse for toilet flushing and surface irrigation of nearby fields. The design of the student reflection space was largely focused on the collection and reuse of water for the student fields nearby. The structure of the building was specifically designed to catch rainwater and drain to the center beam which doubles as a gutter which empties into a large rain collection barrel to the site of the building. The students are able to use this water for the fields and smaller beds.

View from Community Path to Student Reflection Space (View 7) Shows the differences between the Community Path and the Student Path while also showing the slightly pitched roof of the Student Reflection Space used to collect rainwater.



Student Reflection Space Water Collection Diagram Shows the pros of the roof design collecting rainwater, draining to the central beam which doubles as a gutter, and drains into a rain water barrel for student use.

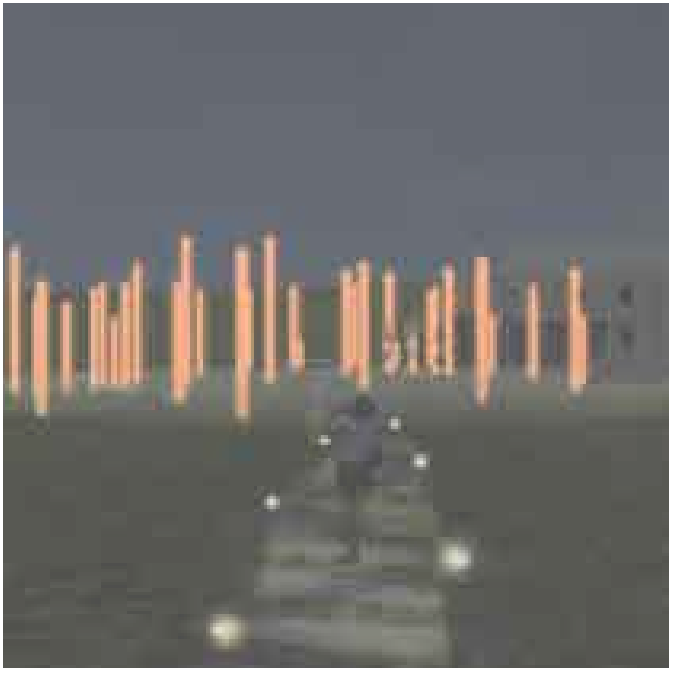


Farmhouse & Addition Water Collection Diagram Showing the water collection system from the roofs as well as how it will be treated and stored for use.

ENERGY

Reuse and renewable energy has been very important to our design from the beginning. We focused heavily on using passive systems over active at every point of the year. We have designed a borehole system, which stores the heat from our site during the warmer months through our other ways of collecting heat such as solar thermal, and stores it for use in the winter time when the heat is welcomed. The Borehole system is represented on the surface through the Light Park which acts as a teaching tool for the students and community about our passive energy systems. The poles glow orange during the colder months and blue during the warmer months to represent the output energy at the time of year. The students will be able to learn about the systems through an interactive, beautiful intervention on the site. Through our current passive systems, the active systems should never have to be put to use.

Light Park (View 2) is used to reflect the borehole system underneath in a way that encourages creatice interactions. Within the timeline of highschool, this area will welcome freshman to the site and allow them to create important friendships.



Light Park Night View (View 3) The poles glow, representing the heat stored below the ground in the borehole system.

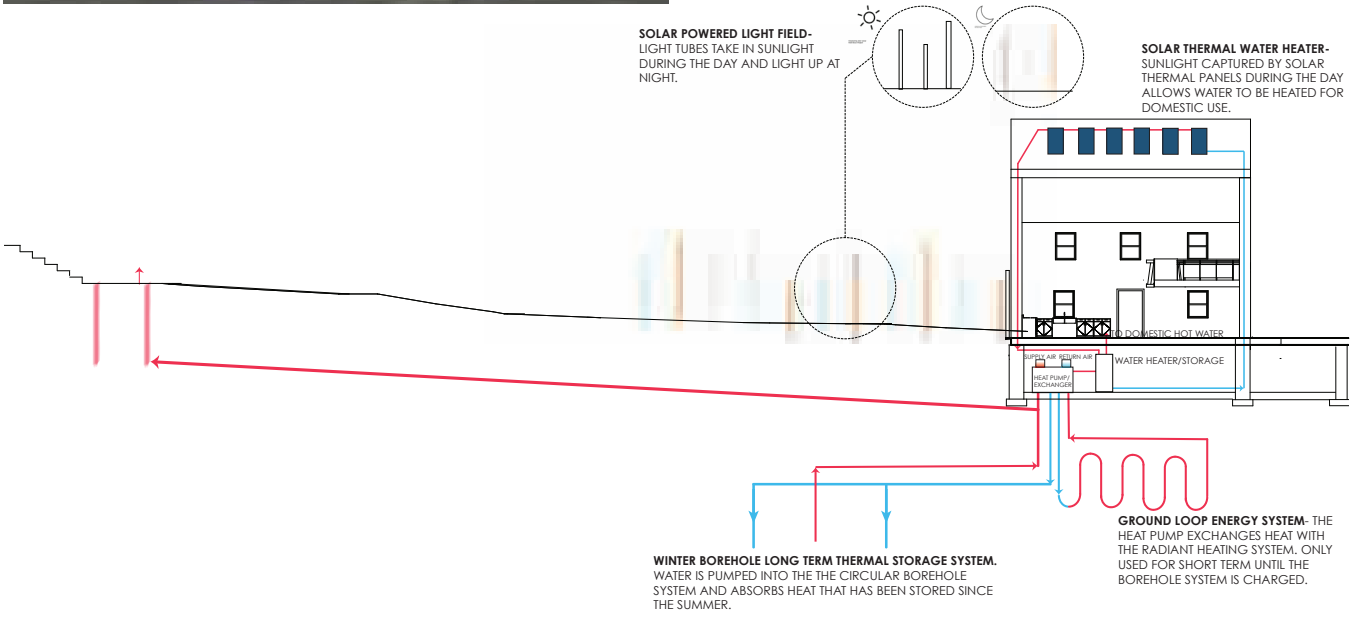
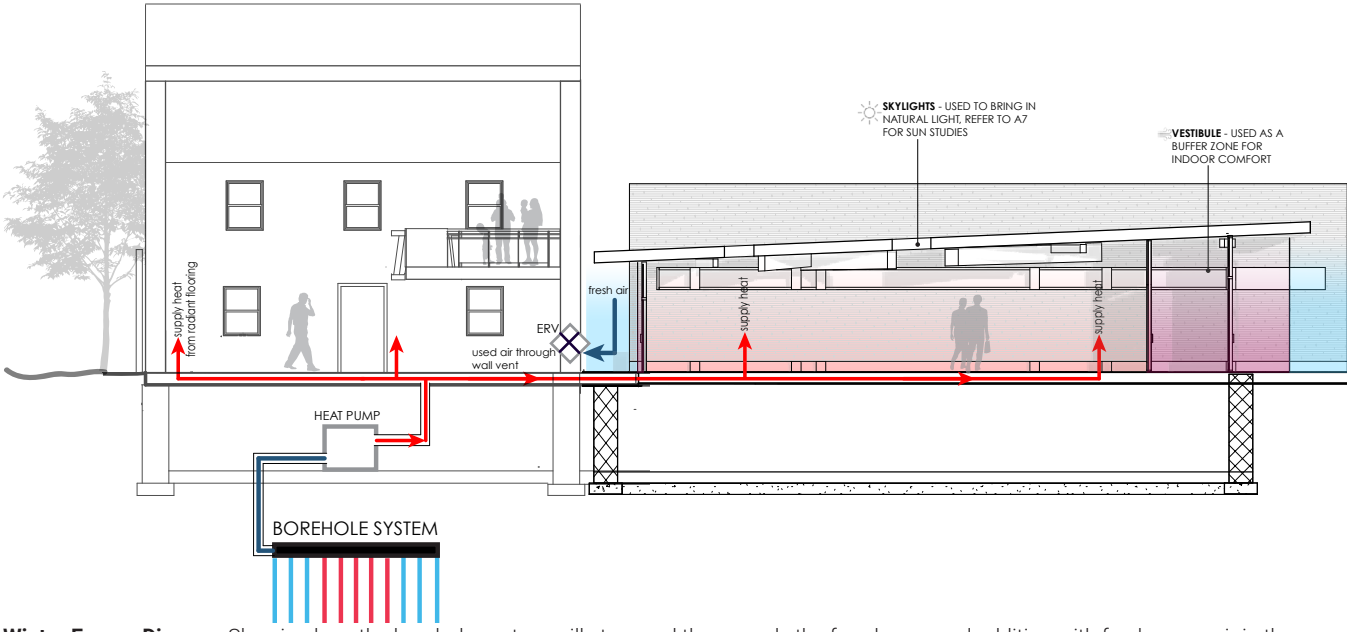


Diagram of Borehole and Energy Systems Shows how the heat is captured by solar thermal panels during the summer months and stores the heat for use during the winter months.

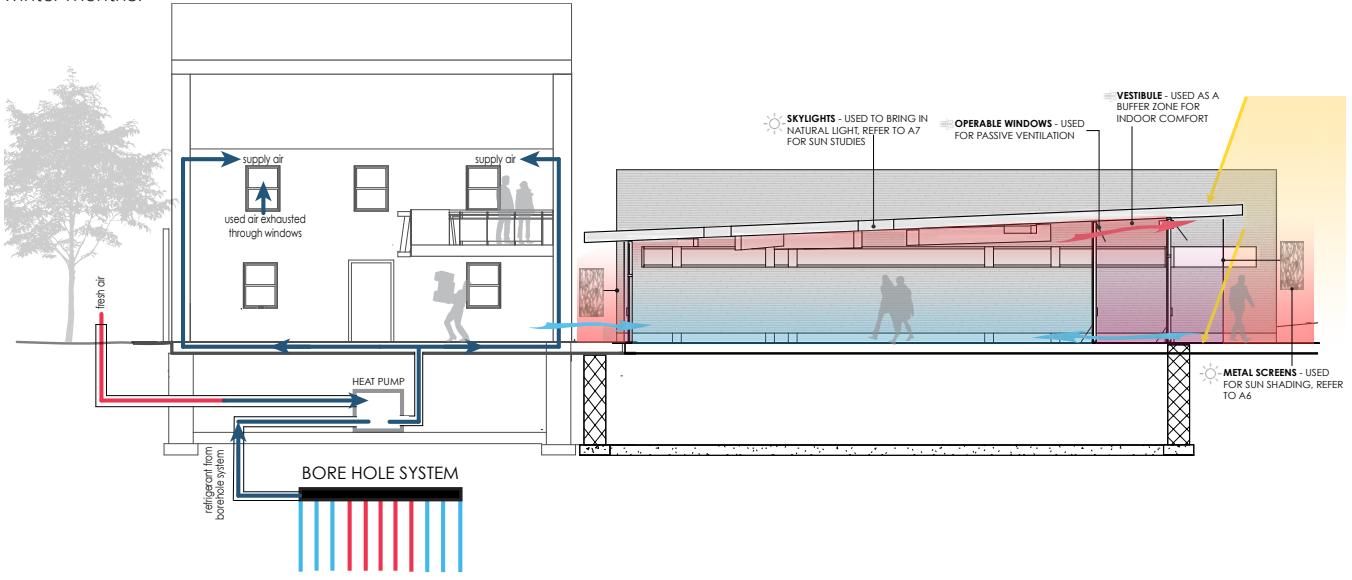
HEALTH & HAPPINESS

Biophilia has played a huge role in the project design. The design of the screens, which are used to cool the farmhouse addition space mimic the brush and trees you see throughout the current site. The structure of the farmhouse addition and the stduent reflection space are similar to looking up at the canopy of trees and seeing the braches with occasional spots of sunlight shining through. We have maintained the original stone walls of the farmhouse because they are representative to what was on the site originally and are sourced directly from the site many many years ago. The student reflection space's design also brings the student together with nature, focusing the students on the horizon and the fields they have learned to cultivate themselves as well as being settled slightly underground, showing the soil they are learning to work within through the glazed wall facing the student fields. Each of our interventions are grounded within the existing site as well as with nature itself.

Interior View of Farmhouse Addition (View 6) - The interior of the farmhouse addition provides a flexible space for community and student gatherings while also mimicing the sites various trees through beam organization and screen pattern. Junior level students can use this space to work through problems and discuss new ideas for the farm.



Winter Energy Diagram Showing how the borehole system will store and then supply the farmhouse and addition with fresh warm air in the winter months.

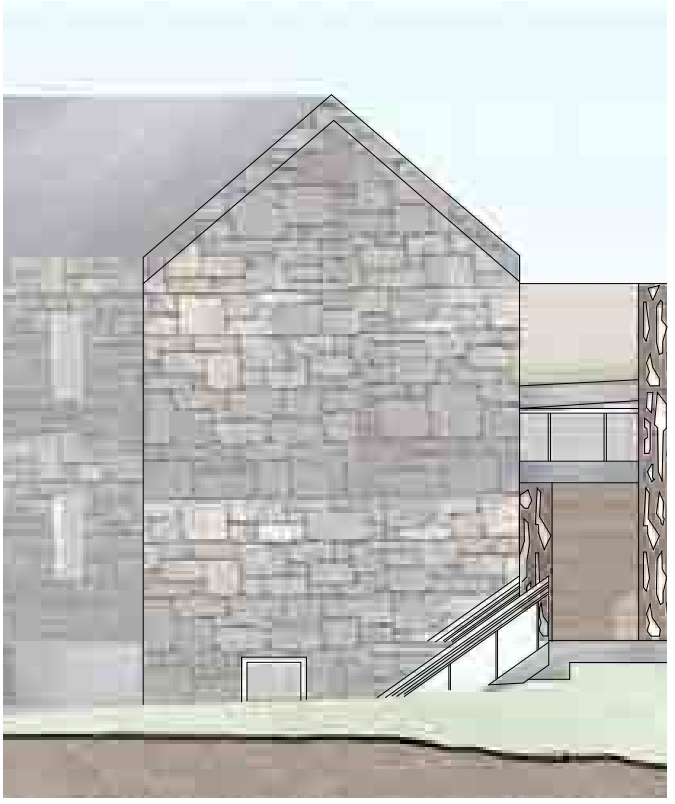


Summer Energy Diagram Showing how the borehole system will store and then supply the farmhouse and addition with fresh cool air in the summer months.

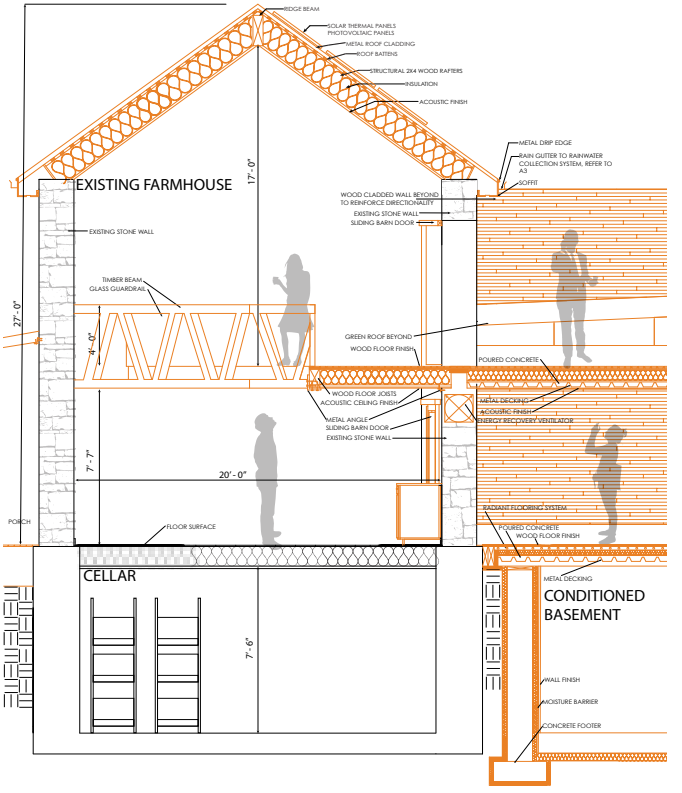
MATERIALS

The materials for this design consist of existing stone from the farmhouse and new wood, glass and metal screens. Each of the new materials is a Declare product, with the exception of the metal screens. The wood could be ABODO Vulcan+, and the glass could be from Duxton windows. The metal screens are products from Parasoliel, which is a company already using sustainable materials and could be contacted to upgrade their materials to Declare standards. All materials are based within the limits of travel distances. The new materials will be integrated with the existing stone of the farmhouse to combine old and new.

Exterior View of Farmhouse and Addition(View 4) The view emphasizes the divergnece of the two paths after progressing through the light park. The view shows the both exisitng and new materials at the same time.



Side Elevation This elevation emphasizes the meeting point of the existing stone walls of the farmhouse and the new materials of the addition. These materials include wood cladded walls, metal screens and a green roof.

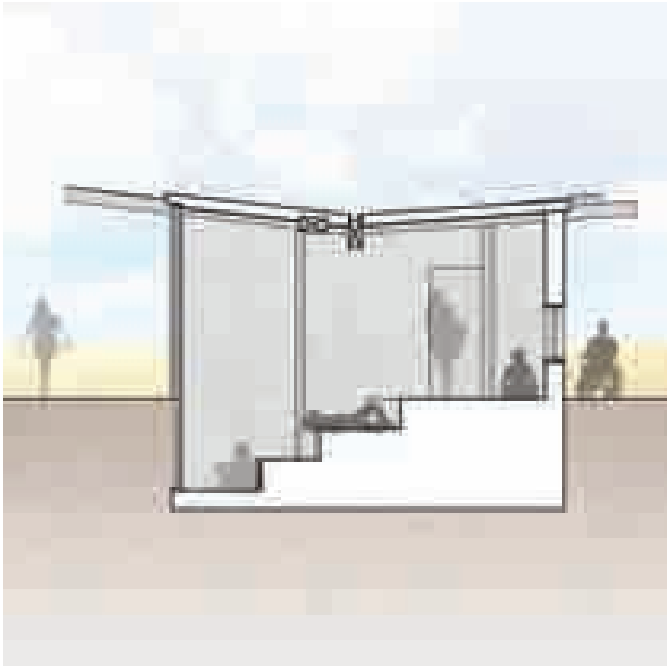


Wall Section This section details the connection of the new materials of the addition to the existing stone walls of the farmhouse.

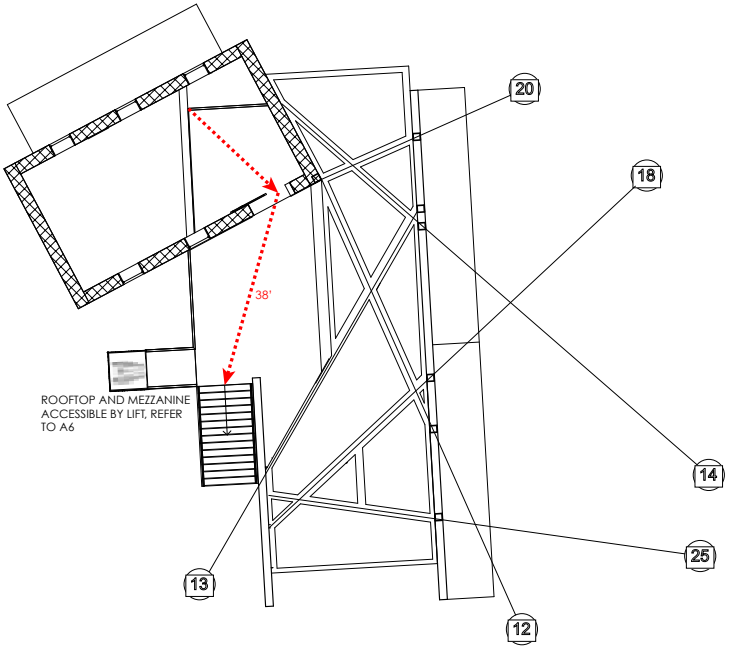
EQUITY

Since this project is part of both the L2 Rural Agriculture zone and the L3 Village or Small Campus zone, noise and pollution are not large problems. The site does contain a sinkhole and storm water collection site, however, the design does not interfere with these areas. The main addition is a place for gathering and interaction, accessible only by foot or bike from the main parking area at the north east of the site. Two paths allows for connection between the greater community and the buildings on the site, which are also only accessible by foot and bike. All paths and buildings are ADA accessible and allow for disabled persons to experience the site in a similar way. Lastly, the community path features a light park and places for sitting and conversing along the way.

Interior of the exisitng farmhouse (View 5) was transformed into a collaborative kitchen where students can prepare meals from produce they've grown in the adjacent fields. This space is paired with the sophmore level to integrate them into the process of the site.



Section of Reflection Space The section of the reflection space emphasizes the ADA accessibility of the space despite being underground. A disabled person can still see the view from a window on the path.



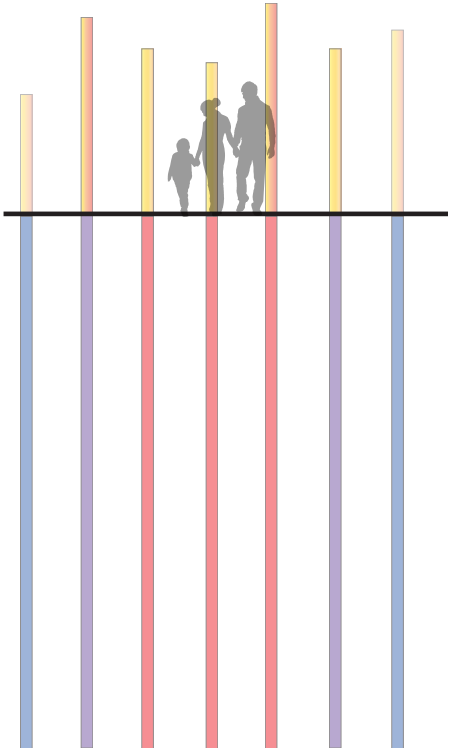
ADA plan of addition The plan shows that the addition to the farmhouse is ADA accessible from the outside path and a lift is provided for disabled persons to reach the occupiable roof.

BEAUTY

The main addition to the site will serve as a community space where community events, such as art exhibits, meetings, and markets can be held. The light park on the site serves as an interactive teaching tool about energy, accessible to the public and students. The existing farmhouse will serve as a teaching kitchen to teach visitors how to prepare and cook with plants that come from the gardens on site. The paths and reflection space placed on the site will also allow for exploration into nature and a chance to experience the beauty of the site.

This small building gives the students a place to reflect on the hardwork they have done as they gaze over their product. As the final view of the site, this is a triumphant space that is associated with the final year of highschool.

Elevation The elevation showcases the meeting of the old and new building. Both can be used not only by the students, but the community as well. The spaces will be used for teaching and learning for the students and community, while also serving as spaces for exhibts or markets.



Borehole Relationship The borehole energy system underground is represented above ground as an interactive light park. The light park allows for education about the energy systems and serves as an art installation. People can choose to walk through the park or relax on benches provided on the outskirts.

INTERACTIVE SYSTEMS

A. Brianne Aveta, Megan Ross, Haley DeNardo

Our proposed sustainable farm focuses on providing a interactive and multi-functional classroom space, a cooking and learning kitchen, a greenhouse, gardening spaces, located within an addition that showcases sustainable strategies. The circulation includes cycles of energy, water, plants, and people. The historical central farmhosue has a specific language of materials and construction that informs the addition. Outdoor classrooms and main gardening areas are placed near the students walkable pathway from the high school. Other programing on the site includes a market, an orchard, bees and chickens, growing fields, and several pathways.

PLACE

The site that was chosen for this project has many opportunities for sustainable and agricultural design. The existing stone farmhouse is an important part of the site, which made it necessary to incorporate in the design. We wanted to keep the building small, to ensure that it would only leave a small footprint and keep costs low. The site which surrounds the bulding will only consist of foot paths, so there are no vehicles around the building and students. There is a small turn-around parking area near the major road, but the rest of the site is walking paths through and around the farming areas. The site plan shows the proposed site layout, which includes a market area, student gardens, community gardens, and outdoor classroom and the farmhouse with the new addition. All paths are conscious of the site and the farmland around it, which allows the land to be used by the students and community as they wish.

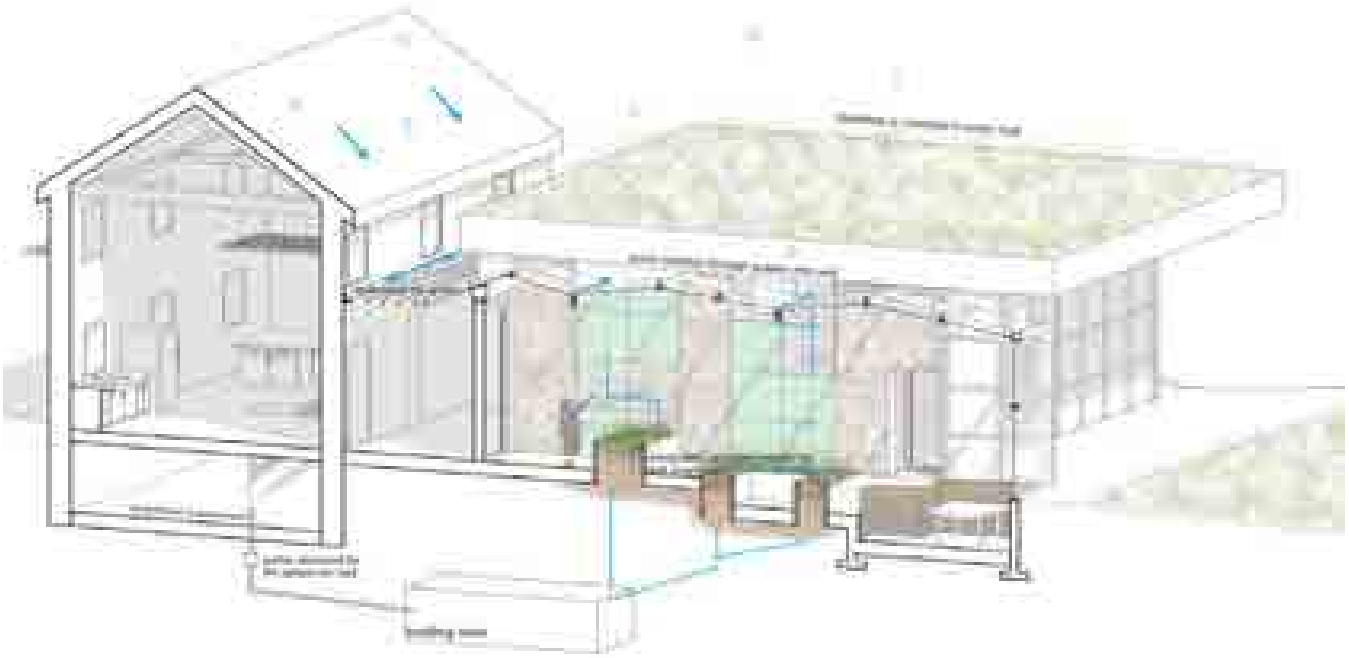
Site Plan The site plan and the plan show the nature of the site around the proposed building and the school. Most areas of the site are proposed for a future masterplan, except the farmhouse and pathways around it.

Plan

WATER

Our building has a unique way of collecting and reusing water through sustainable systems. The use of water, whether it be for planting or or use throughout the building, is a large part of our design. An agricultural system collects water from the roof of a greenhouse, cycles it to planting beds and a green wall inside the building, where some of it is filtered and brought back through a filter so it can be used in the building. The water that is brought to the planting beds waters the plants that

are being used for food in the farmhouse. Our goal was to create a building that exhibits sustainable strategies for the students to learn and see the effects of each system. The water runs through the interactive systems wall and displays the pipes for the students to see how the plants are being watered. With these systems, not only is the building saving water, but it is also providing a way for the plants to be watered without too much energy.

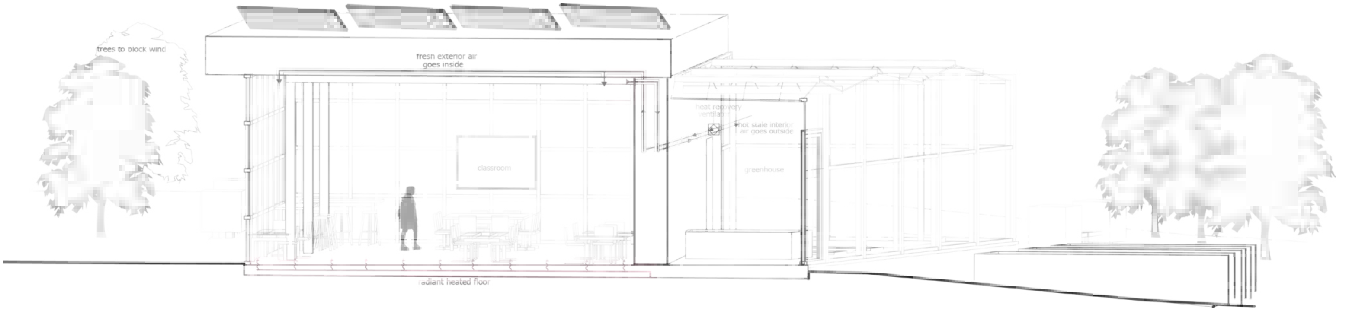


Water System Section This Section demonstrates how the water is collected from the roof and then brought into the greenhouse and farmhouse. The watver goes through planting beds inside the greenhouse, and down to a holding tank that would then go back into the farmhouse.

Site Resources In the drawing above, the land is shaded blue to show the areas that would accumulate the most water after rain, the yellow shows the areas with the most sun exposure. Our building is in the perfect location to utilize the amount of water that builds up in the area.

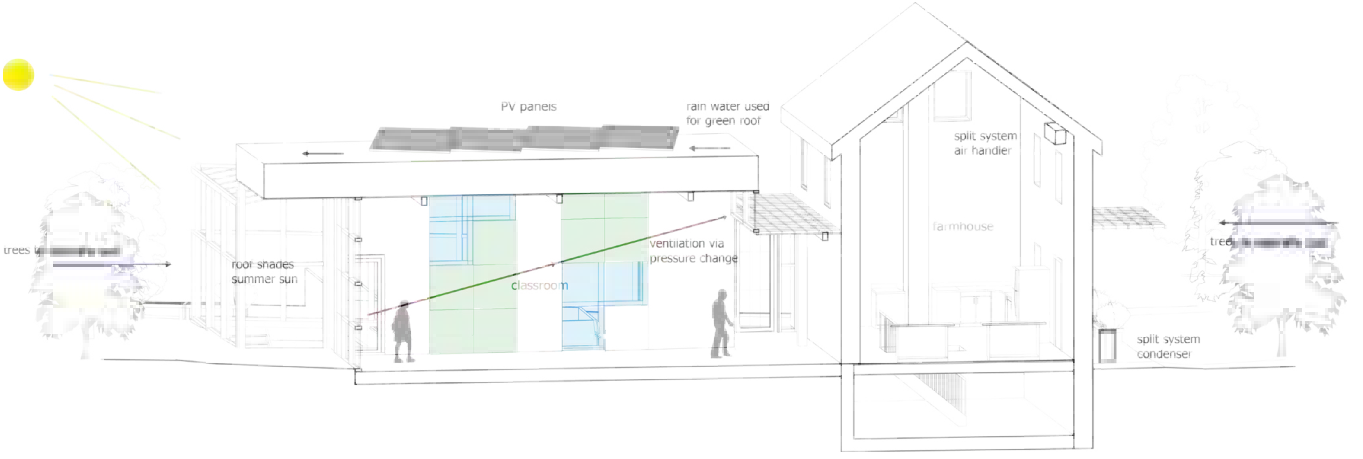
ENERGY

There are many different systems used for reunable energy in the building. As shown in a series of sections, the classroom and farmhouse has radiant heated floors for the winter, as well as thermal heat provided from the ground. To get fresh air in the winter, there are two HRV systems installed in both the farmhouse and the classroom. The greenhouse has operable windows to let out stale air. Solar thermal panels are placed on the farmhouse and the greenroof for more energy in the farmhouse and addition. The solar thermals serves the purpose of supplying energy to the water heating system, for a continuous loop of energy throughout the entire building.



Transverse Winter Section This image is showing radiant heated floors that run through the classroom floor and the HRV system.

Winter Systems Section Displayed is the section showing how the heat pump is generated, and supplies heat to the radiant floors in the building. Also featured is the HRV system and the solar thermal energy that heats the water heater.

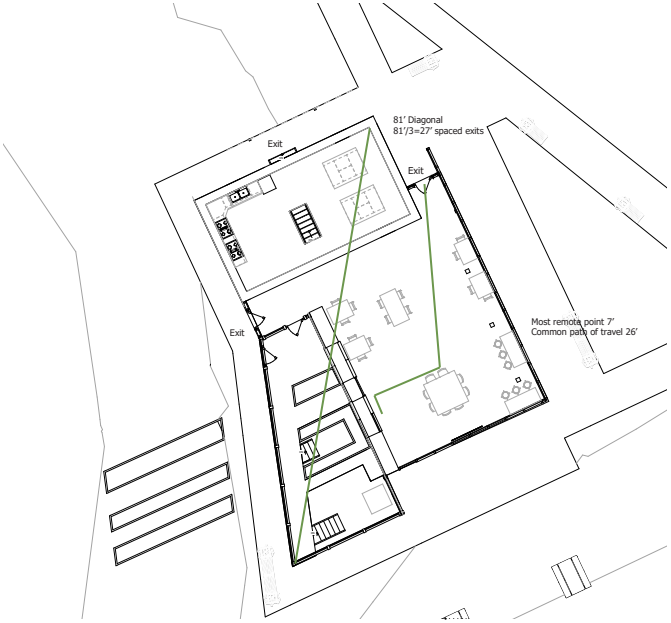


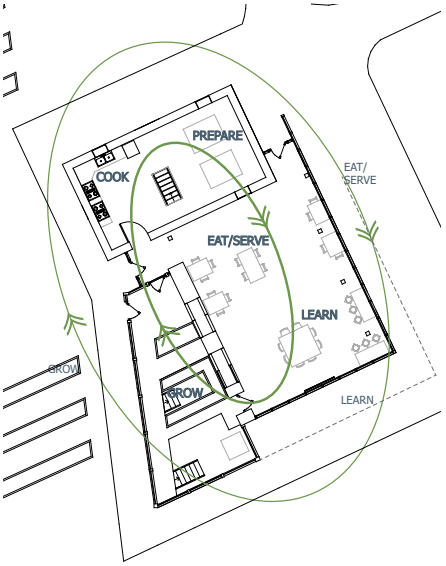
Summer Passive Heating and Cooling The building is cooled in the summer naturally by trees for shading, but also by a split system condenser and operable windows. The roof is a green roof to also help with cooling inside the building.

HEALTH & HAPPINESS

The interior of the building is designed for ease of use and for multiple ways of collaboration within the school. The building has doors that pivot open and walls that fold open to allow for larger working space and ventilation. With HRV systems installed in both the classroom and farmhouse, fresh air can be brought into the building and stale air exhausted out of the interactive systems wall. The tables within the classroom are designed based on the modular grid, so they can be moved around and arranged in many different ways. The building is also small and only one floor so that in case of emergency, the exit is easily accesible.

Interior Classroom View The classroom is designed to be arranged for any class that wishes to use it. There is access to the patio outside, the greenhouse and the kitchen in the farmhouse.





The circulation of the building is meant so that the students can access either the farmhouse or the greenhouse at any time. The rooms can be used for any class, such as agriculture, english, cooking classes, or more.

Interior View of the Farmhouse The interior of the farmhouse features the trellis, which gives like over the cooking tables. The second floor of the farmhouse was removed to give more room to the students while they work.

MATERIALS

The materials in the building are all supplied by local sources. The panels of the facade are either reclaimed wood, or locally sourced glazing. The interior systems wall is also structured by fieldstone, to match the extisting farmhouse. All of the structural materials are reclaimed wood, except for mullions which are metal. The materials of the building are meant to blend in with the site and not distract from the area. None of the materials are on the red list, so they are not harmful to the site.

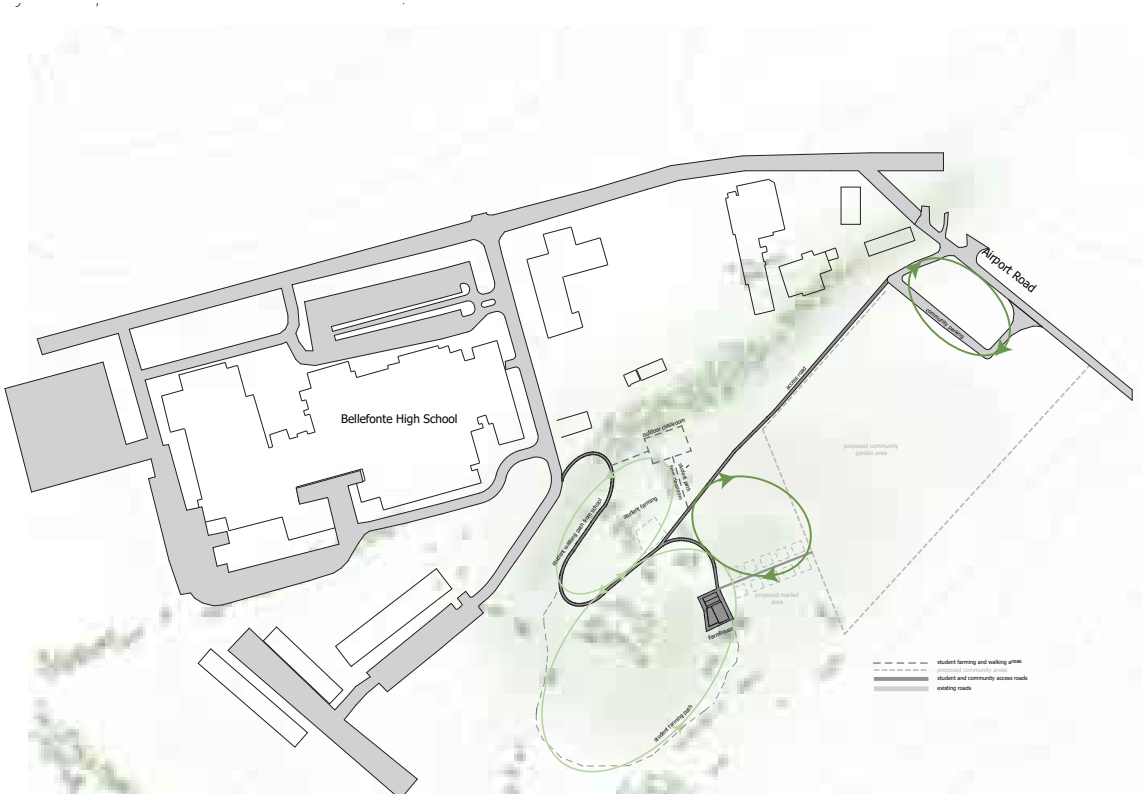
Elevation of the Greenhouse

Elevation of the Classroom Facade

Elevation of the Classroom and Greenhouse

EQUITY

To keep accessability and ease of circulation in mind, our building is only one floor, with no stairs or steps. Our intentions were to make sure the building was accesible to anyone, not just students and faculty. It is a space that might eventually be expanded upon and used for the community as well as for classes in the school. In the circulation diagram, the paths around the building are all level for ADA and can access any point on the site. The community is important in this site as well, because in the future the school wishes to implement a community garden or market where the students might also be able to sell the produce they grow. There are several picnic areas and places to relax as well as work during class time. At night, anyone can also enjoy the lighted pathways and farmhouse, making it accessible at any hour of the day.



Site Circulation Diagram The paths from the school and the Airport Road lead directly to the farmhouse and throughout the site.

Longitudinal Section The building is one level to make sure that anyone is able to enter or exist with ease.

BEAUTY

It is important that the essence of the old farmhouse was preserved in the new addition. We used the same materials in the addition so that there is no disconnect from one part of the building to the other. The interior lighting is not overwhelming, which makes it enjoyable to work in. The main parts of the building, such as the interactive systems wall, incorporates systems, but also displays materials and greenery that is pleasing to the eye and not distracting from the work that is being done.

A nice feature of the wall is that one can look through to the other side to see the different activities happening throughout. From the side of the greenhouse, you can also look into the classroom. The complimentary affect of the reclaimed wood against the glass and stone matches that of the site and the farmhouse.

Interior View of the Greenhouse The view is facing back towards the entrance of the greenhouse. This view is important to show how the interactive wall and the gardening beds follow the same language.

Interior View of the Greenhouse The view is facing the cornfields, showing that the greenhouse is open to the rest of the site. The greenhouse is meant to frame the site when you're inside to make it seem like you are directly connected with nature.

THE HEARTH OF BELLEFONTE

Andrew Chesakis, Ali Pugliese

The Hearth of Bellefonte is a place for the students of Bellefonte High School to gather together and pursue a “hands on” agricultural education. The heart of this project is the existing farmhouse located on the site. Upon renovation this beautiful and historic building becomes a central dining space for students and people of the community to come together and bond over the experiences of working the land while sharing a meal together. Through this ritual of “breaking bread,” students and community members foster friendships and connections that will provide the sustenance needed to keep the farm going. The supporting spaces that branch off of the dining room are a greenhouse, kitchen, and market. The greenhouse, located to the south, provides an environment for the students to grow different crops that can be cooked in the kitchen or donated back to the school cafeteria. The market also houses a CSA for the students and faculty of Bellefonte High School and is supplied by the surrounding fields and a pop-up greenhouse in summer. The spaces of learning, growing, and gathering work together to form the core of the project in the farmhouse; a place to gather, reflect, and share a meal among friends.

PLACE

The Hearth of Bellefonte aims to anchor the students and community members to the site and reflect the area of rural Pennsylvania. The building does this through its use of the vernacular form seen throughout the region while also taking a minimal approach to the landscape.

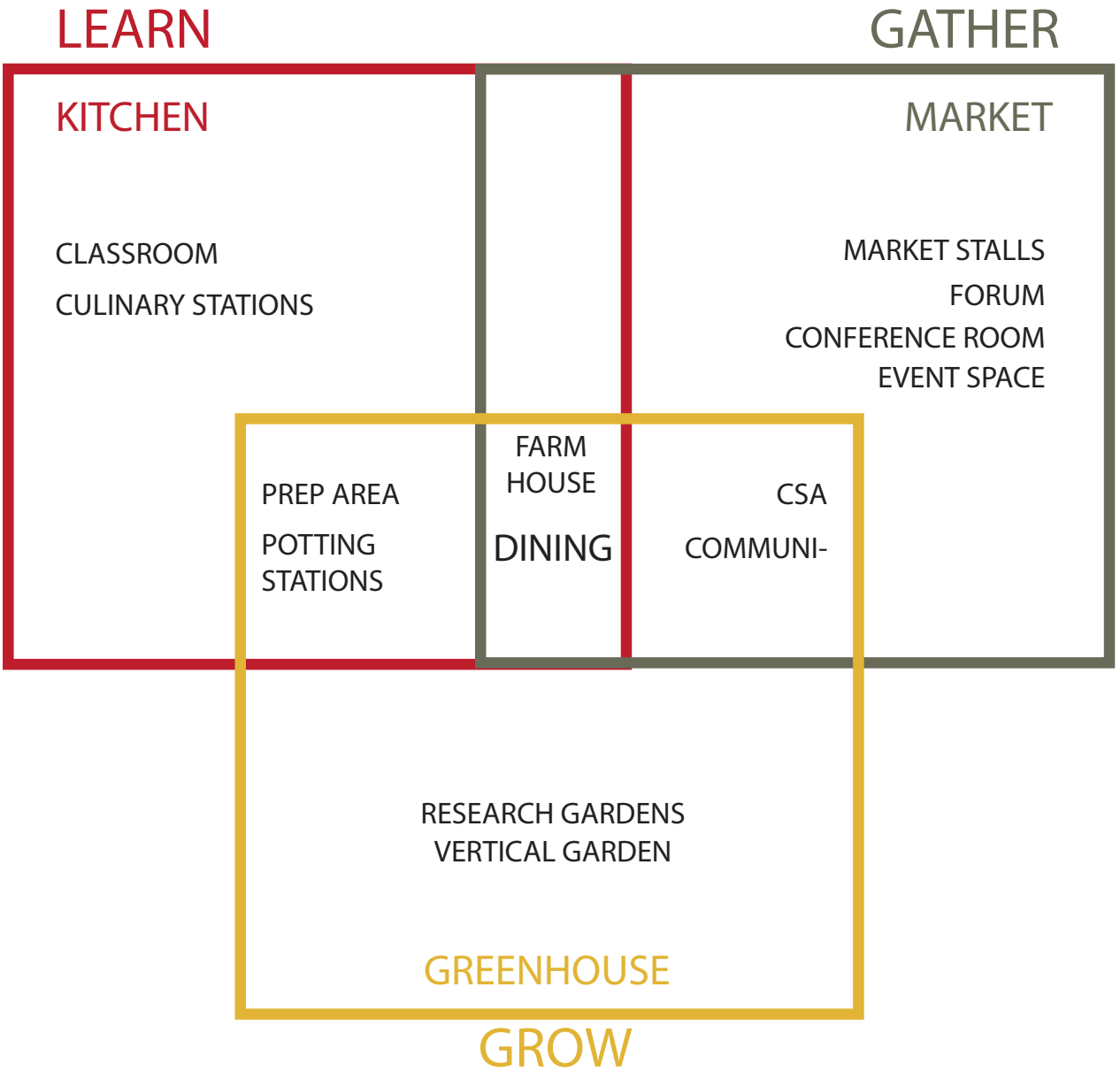
In order to achieve this sense of place, the design uses the exisiting form of the 19th century farmhouse located on site to expand program. The implementation of a succession of frames reminescent of the past and how homesteads expand, allows the students and community to connect to the past while looking toward a sustainable future. Using this vernacular form allowed for the project to “hover” above the landscape so that the integrity of the site remains intact.

Taking this minmal approach to site design with the intervention placed on top of the land, The Hearth of Bellefonte respects the beautiful landscape in which it is placed.

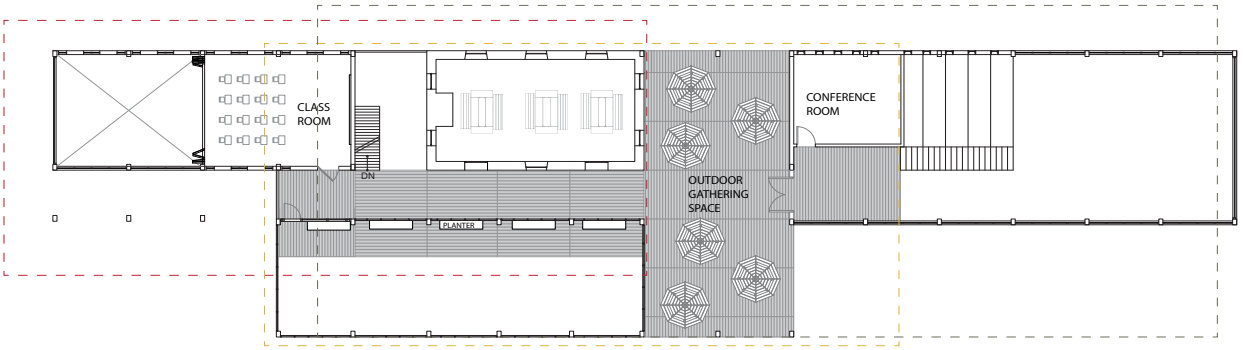
Site Plan shows the footprint of the building, pedestrian and vehicular pathways, as well as the surrounidng context of the site.

Photo of the existing 19th century Farmhouse on site.

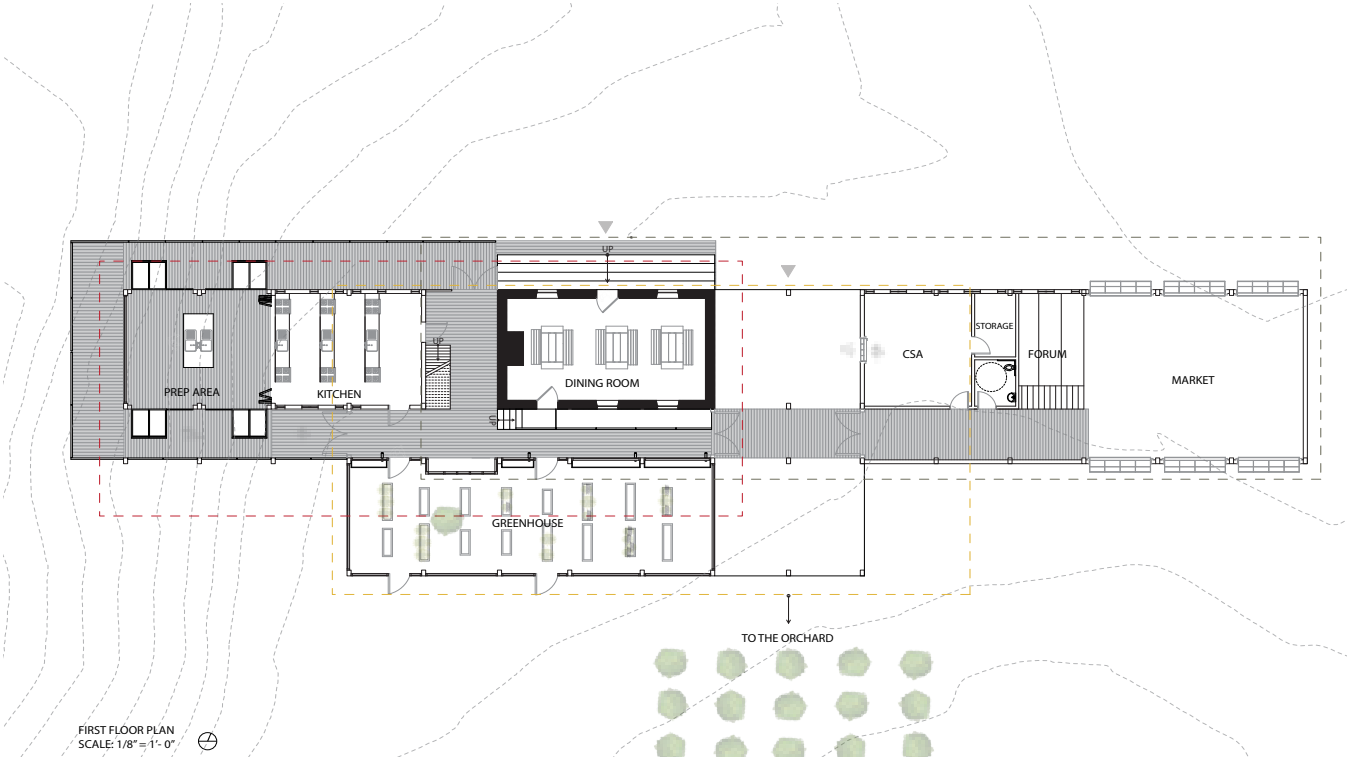
Exterior rendering of the intervention approaching from the North.



LGG Diagram Learn, Grow, Gather program diagram that defines the spaces within the project based on these categroies. This diagram served as the building block for the project and design decisions were made based on the analysis of this daigram.



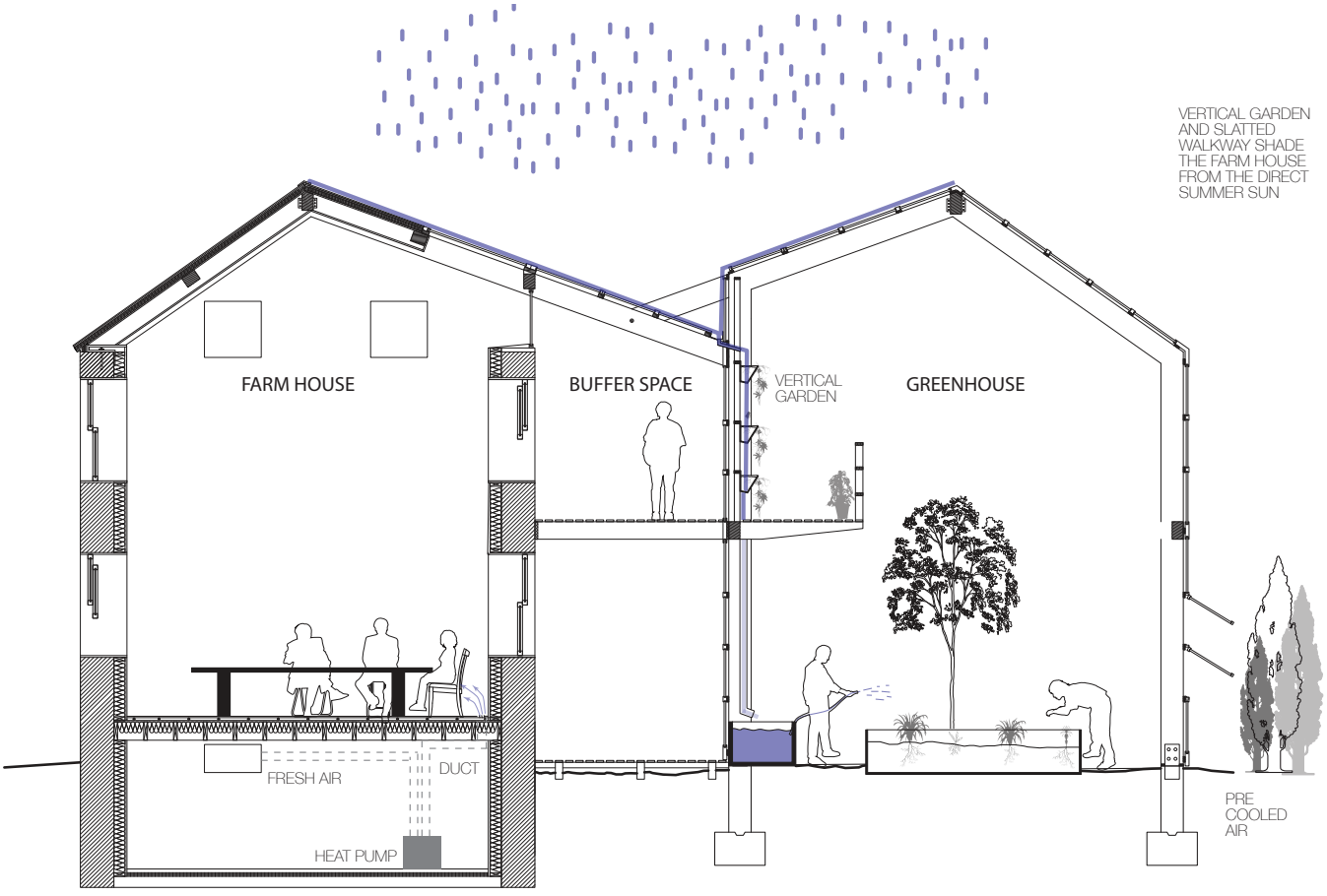
SECOND FLOOR PLAN
SCALE: 1/8" = 1'- 0"



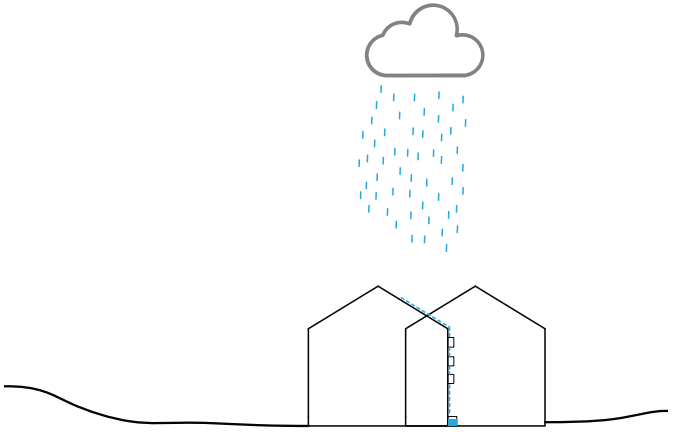
FIRST FLOOR PLAN
SCALE: 1/8" = 1'- 0"

WATER

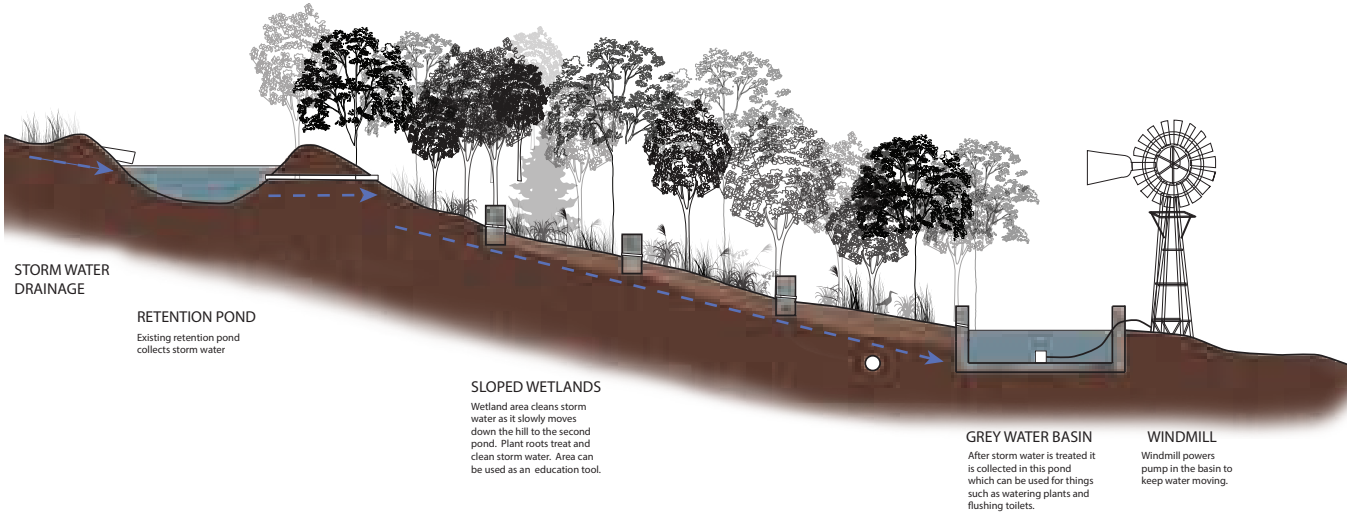
Due to the agriucultural nature of this project, the use of water is very important. In order to achieve net zero water we designed a rain collection system that will be used to water the green wall inside the greenhouse as well as the planters located on the ground. To store the water that is not immediately used to water the planters, there are basins located at the base of the greenwall that will house the unused water.



Sustainable Water Diagram This section shows the movement and collection of water throughout the building. The rainwater collection system in the greenhouse is used to water the greenwall that provides shade during the summer.



Rainwater Collection Diagram As the rain falls, it is collected in a gutter system running along the southside of the buffer space and funnelled down the green wall to water the planters. The excess water is captured at the bottom in a collection basin.



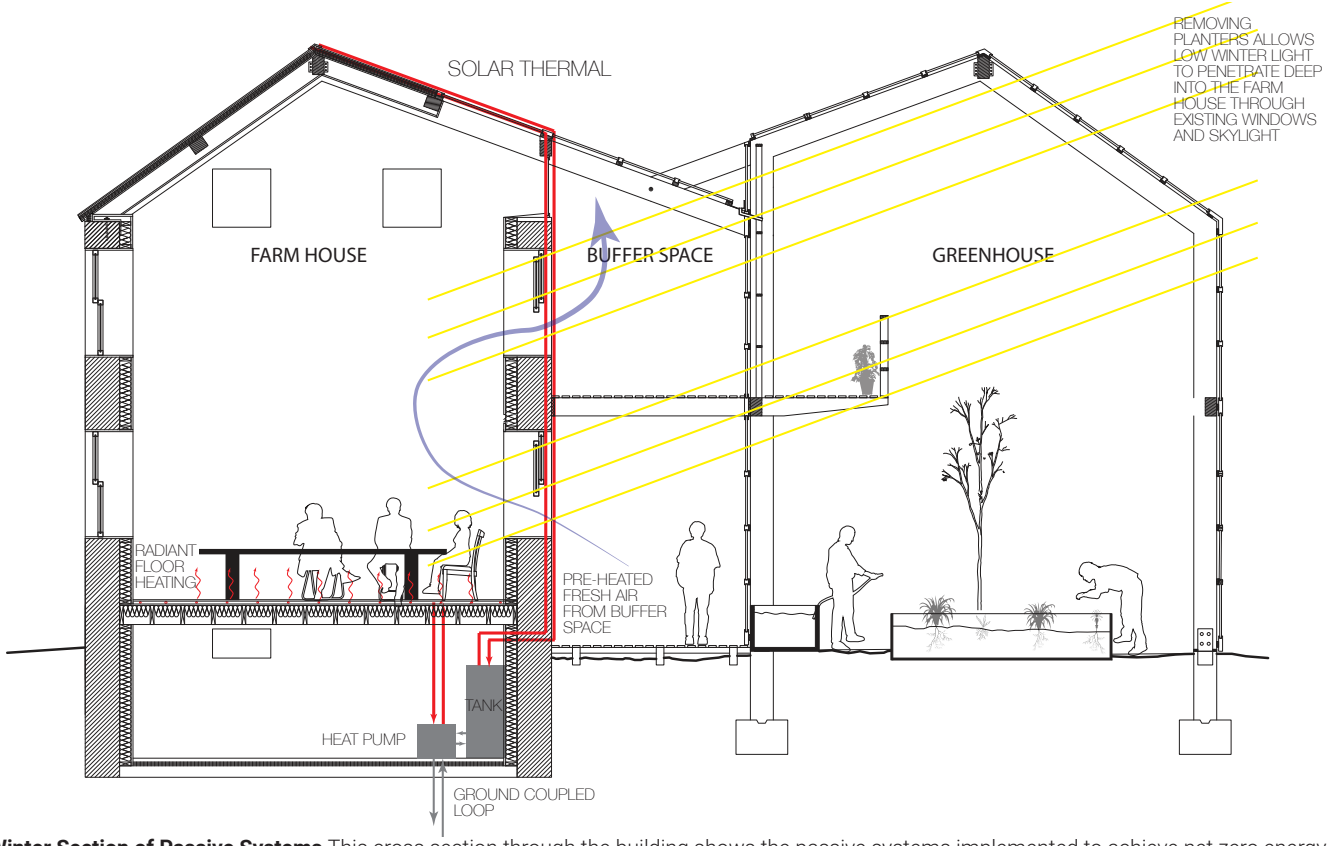
Wetland Construction Although not executed in the project, we propose a constructed wetlands originating at the storm water collection basin and ending down the hill at the base of our intervention. The water collected may be used for irrigation and cooling the building.

ENERGY

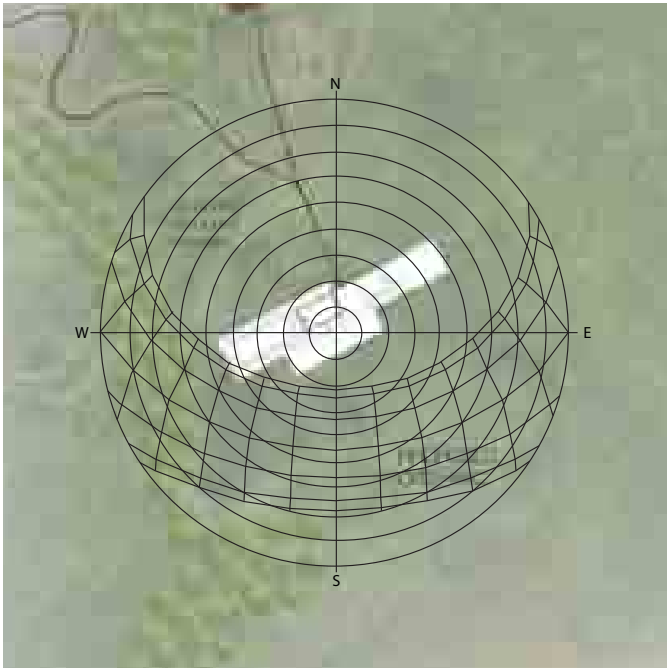
Through the use of passive systems and daylight, The Hearth of Bellefonte aims to meet the requirement of net zero energy. In order to achieve this, we have stragetically placed the intervention so that it will receive maximum daylight on the southside. With this ample light the required energy needed to light the building is no longer required.

In order to climatize the building, we have proposed three different zones. The first zone is the unconditioned climate located on the south side in the greenhouse. The solar heat gained in the greenhouse allows the next zone, the buffer zone, to receive heating creating a steady envirnoment of 50-70 degrees Fahrenheit that does not require the use of a mechanical system.

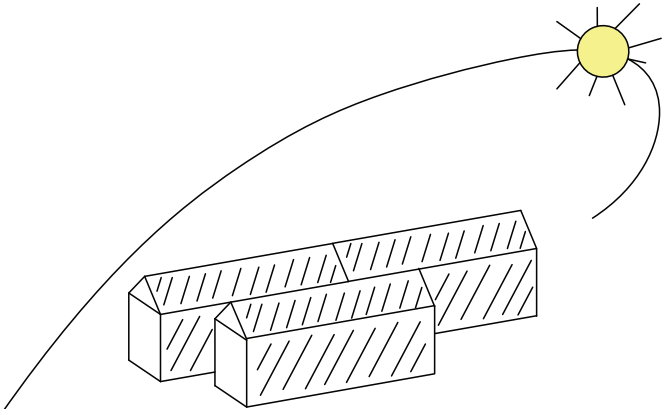
To regualte the conditioned environment located in the farmhouse, we have implemented a radiant floor heating system.



Winter Section of Passive Systems This cross section through the building shows the passive systems implemented to achieve net zero energy with minimal use of a mechanical radiant floor heating system.



Sun Exposure Diagram This diagram shows the path of the sun on site throughout the year.



Sun Tracking Diagram This diagram show the path of the sun as it moves across the sky and heats the building. We placed the greenhouse on the south side to achieve maximum exposure to sky and provide heating and daylight to the rest of the spaces.

HEALTH & HAPPINESS

To achieve a healthy and happy environment we have maxmized our use of natural daylight in regularly occupied space without over heating. The use of natural light through many operable windows also allows for the spaces to receive fresh air from outside. By bringing in the fresh,cool air from outside, the building receives a constant turnover of fresh air improving the air quality throughout the spaces. This use of fresh air also aids in reducing the amount of energy needed to regulate the air in the building.

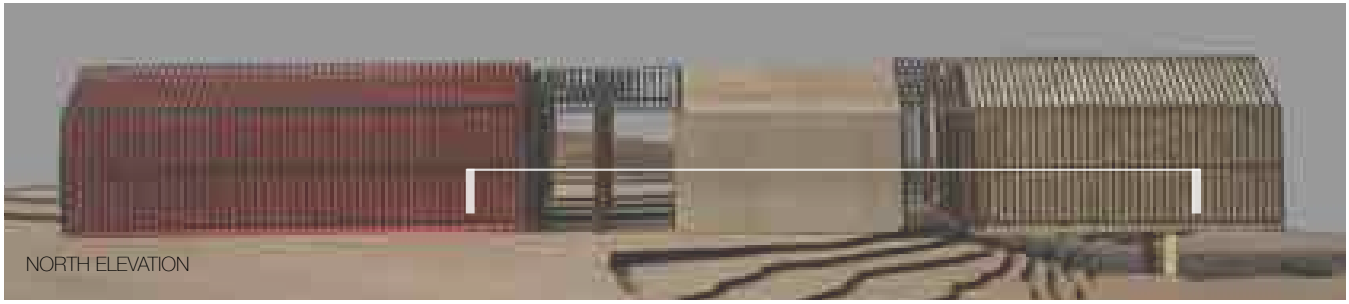
To engage the users in a biophilic envrionment we have the learning component of the greenhouse in addition to the large opening doors in the kitchen and market. By opening these door we have created an open air marketplace that allows people and goods to “spill out” into the site and engage with the natural landscape. Opening up the kitchen creates an outdoor kitchen that allows the users to reflect on the food they prepare.

Interior Kitchen View Interior look into the kitchen- a place where the students can prepare the food they harvest and learn about healthy lifestyle eating while enjoying a beautiful view of the site.

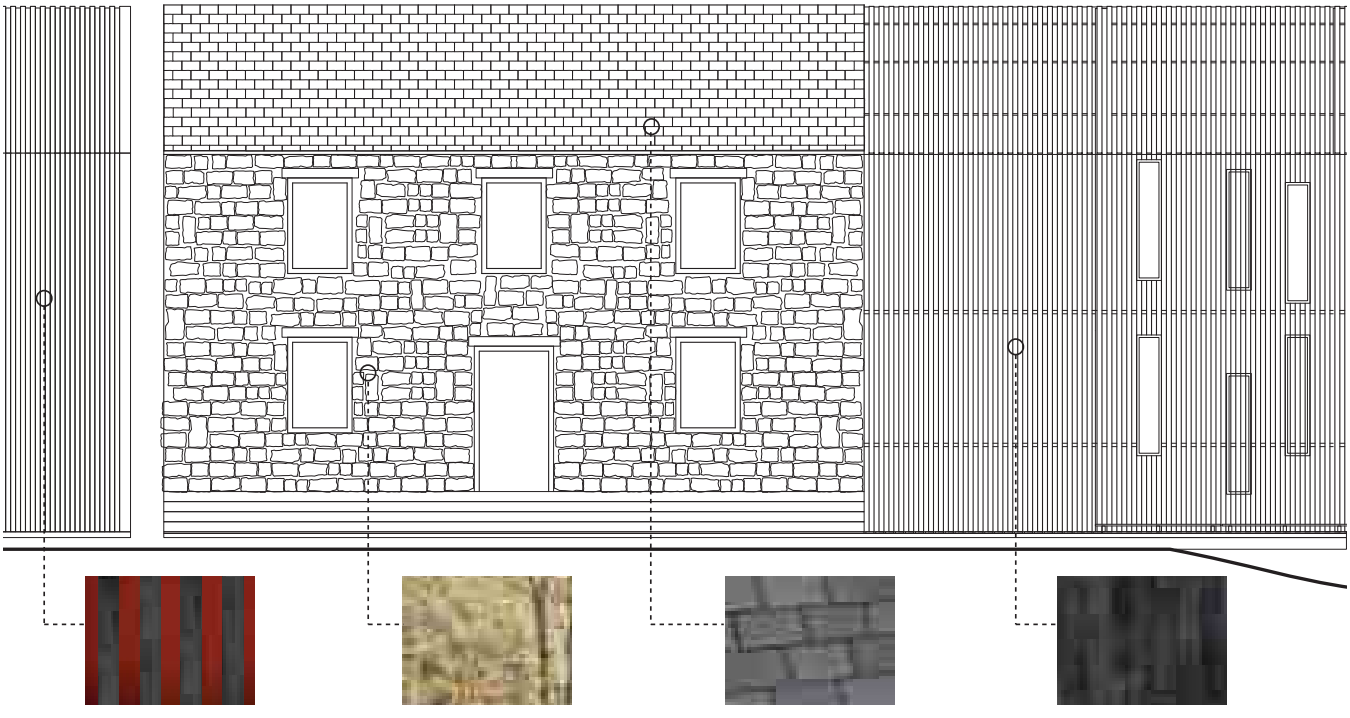
Interior View of the Greenhouse A look into the greenhouse where students can practice different growing methods in the raised garden beds.

MATERIALS

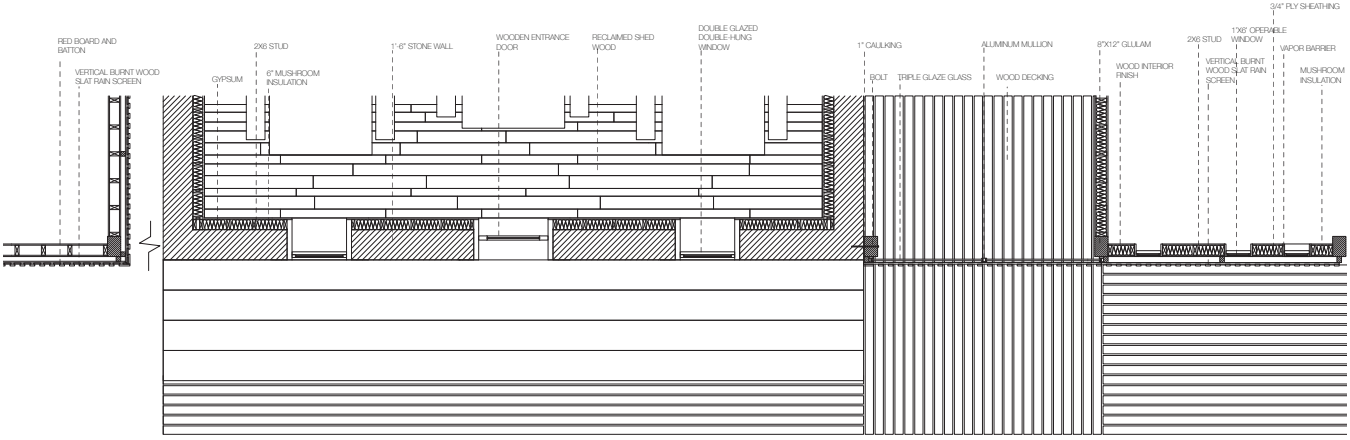
In compliance with the materials petal, we have carefully chosen products that will not produce harm to the environment over time nor to the occupants inside. Our main structure is made of CLT frames. The rest of building is built with standard wood construction so that materials may be easily sourced in the surrounding area. The exterior facade is composed of a rainscreen with a burnt wood screen for fire proofing and water protection. By burning the wood, it does not a chemical treatment to protect is from water damage, fire, or insects.



North Elevation of Concept Model The model shows the three spaces of Learn, Grow, Gather through material choices. The three blocks represent the three spaces with the wood screen linking them all together.



NORTH SIDE ELEVATION OF FARM HOUSE, KITCHEN, & MARKET



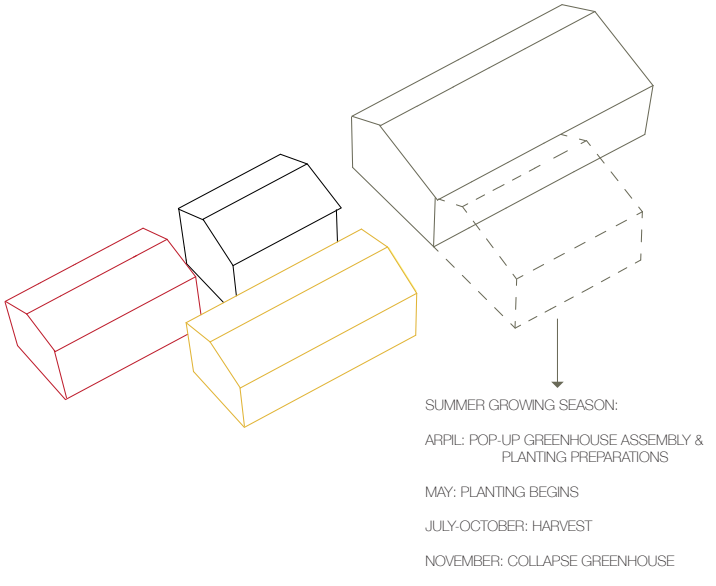
SECTION OF FARM HOUSE, KITCHEN, & MARKET

EQUITY

The Hearth of Bellefonte achieves equity in many ways but the two primary equitable spaces are the Farmhouse and CSA. The Farmhouse achieves equity through its inclusive nature where everyone shares a seat at the table and is able to enjoy a meal together after a long day of hard work. The CSA is an equitable space in that it provides a place for the students and faculty members of the school to enjoy in the harvest and eat healhty, fresh foods. The Hearth of Bellefonte fulfills the equity more holistically by providing spaces for both students and members of the community to gather together as a whole and learn about agirculture and sustainable strategies so that the farm may continue to grow.

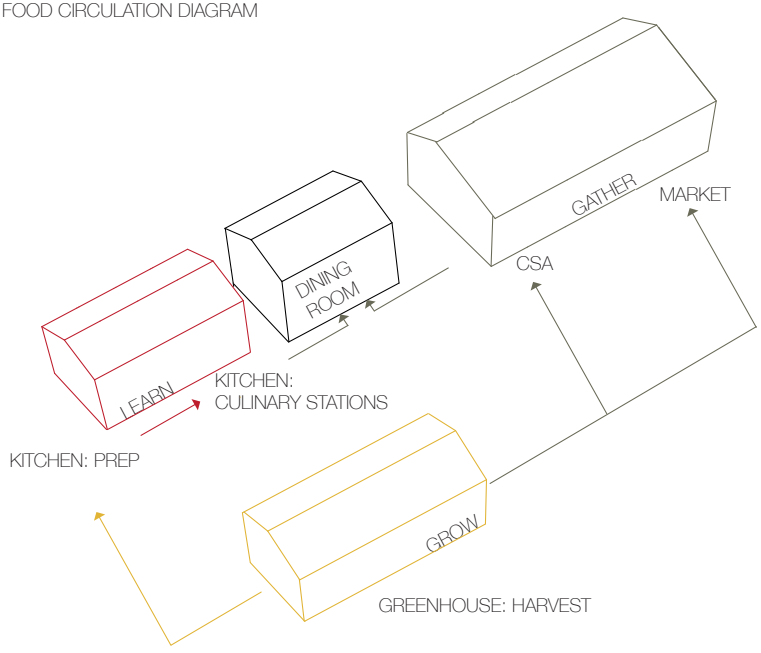
Exterior Perspective from the South This view shows the open air marketplace where students, faculty of Bellefonte High School, and local memeber of the community may come together and purchase some of the harvest grown on site.

POP-UP GREENHOUSE FOR CSA AND MARKET



Temporary Greenhouse Expansion During the summer months it is proposed to expand the greenhouse by implementing a pop-up greenhouse for the CSA Program and Marketplace.

FOOD CIRCULATION DIAGRAM



Food Flow Diagram This diagram shows the movement of food through the spaces starting from the greenhouse and moving through the ktichen and marketplace and ultimately ending in the dining room.

BEAUTY

The Beauty petal is unique in that it aims to inspire people to live sustainably and appreciate the environment we inhabit. From the beginning of this project, the client wanted the building to serve as a sustainable model for the students and community. To achieve beauty we provided a program focused on learning, growing, and gathering. The space is divided amongst these three programs but ultimately work together to achieve beauty. The learning components (kitchen and classroom) provide an area for the students to prepare the food they grow and learn about different growing strategies. The greenhouse and fields surrounding the building are for the students to implement the strategies they learned and grow crops using new methods. The market, CSA, and dining room bring the students and community members together to share in the efforts from learning and growing. As these three programs work together, students and community members have an equal opportunity to practice a sustainable and healthy lifestyle.

Interior View of Dining Room Interior perspective of the renovated Farmhouse converted into a grand dining hall. The central space brings students and members of the community together to share a meal and forge friendships and connections through living sustainably.

Buffer Gathering Space The buffer space located between the greenhouse and farmhouse allows for small gatherings where students can talk with each other and relax. These spaces are located on both the ground floor and second floor.

Photo of Arch 432 architecture class and community partners

ROOTS TO RESULTS

Bellefonte Area School District Sustainable Farm

This report is a result of a community-university initiative between the Bellefonte Area School District, specifically the high school, and a Penn State fourth-year architecture class. It presents the result of a design research studio where students were encouraged toward active exploration, information collection, analysis and synthesis of the paramount relationship between food, water, and energy.

The project site is located on a farmland recently purchased by the Bellefonte Area School District. The site includes a small existing farmhouse that is over 100 years old and an index of the agricultural and geological history of the region. Ideas generated for a sustainable agriculture education center are compiled herein.

PennState
College of Arts
and Architecture

STUCKEMANSCHOOL

HAMER CENTER

sustainable communities