



THE OMEGA CENTER FOR SUSTAINABLE LIVING

OMEGA INSTITUTE
RHINEBECK, NEW YORK
NOVEMBER 15, 2007

PROJECT TEAM

OWNER: Omega Institute for Holistic Studies

Skip Backus

ARCHITECT: BNIM Architects

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Steve McDowell, FAIA

ECOLOGICAL DESIGN / ECO MACHINE:

Jonathan Todd, Michael Carr - **John Todd Ecological Design**

Michael Ogden, Erin English - **Natural Systems International**

LANDSCAPE ARCHITECT: Conservation Design Forum

Trish Beckjord

Tom Price

Gerould Wilhelm

David Yocca

STRUCTURAL ENGINEER: Tipping Mar + associates

David Mar

Marc Steyer

MEP ENGINEER: BGR Engineers

Katrina Gerber

CIVIL ENGINEER: Chazen Companies

Jim Beninati

BUILDER:

Dave Sember Construction

The Omega Institute and BNIM Architects are the proud recipients of the **2007 Living Building Competition** “On the Boards” Award for The Omega Center for Sustainable Living.

ABOUT THE 2007 LIVING BUILDING COMPETITION

The U.S. Green Building Council, in partnership with the Cascadia Region Green Building Council, presented the Greenbuild 2007 Living Building Competition, based on Cascadia’s Living Building Challenge (www.cascadiagbc.org). This groundbreaking competition celebrates the highest level of environmental performance currently achieved in buildings in the United States. It follows the six performance categories, or “petals”, outlined in the Living Building Challenge: Site, Materials, Energy, Indoor Quality, Water, and Beauty and Inspiration. Each petal represents an integral component of a Living Building. This year’s competition acknowledges those existing buildings that earn one or more of the “Living Building Petals” as a way to recognize the incredible projects that already meet aspects of the program and to determine how close we already are to building a living building. In addition, the competition will award one prize to a project that is “on the boards” – in design or construction with the intent of meeting the Challenge. Winners were announced at Greenbuild 2007 in Chicago, on USGBC Member Day, November 6.

GENERAL PROJECT INFORMATION

THE OMEGA CENTER FOR SUSTAINABLE LIVING PROJECT OVERVIEW:

In 2006, the Omega Institute commissioned BNIM Architects to design a new 6,200 square foot facility to serve as a new and highly sustainable wastewater filtration facility. The primary goal for this project was to overhaul the organization's current wastewater disposal system for their 195-acre Rhinebeck campus by using alternative methods of treatment. As part of a larger effort to educate Omega Institute visitors, staff and local community on innovative wastewater strategies, Omega decided to showcase the system in a building that houses both the primary treatment cells and a classroom/laboratory. In addition to using the treated water for garden irrigation and in a greywater recovery system, Omega will use the system and building as a teaching tool in their educational program designed around the ecological impact of their campus. These classes will be offered to campus visitors, area school children, university students and other local communities.

Preliminary engineering work was done for the project by John Todd Ecological Design (wastewater engineer) and Chazen Companies (civil engineer). This early investigation was invaluable to the full design team in the early design phases for the building and site.

To achieve the client's vision and goals for the project, the design team first sought to reduce energy and water requirements throughout the basic design of the building and then to embrace appropriate technologies in an effort to reduce or eliminate negative environmental impact from the required loads. The team accomplished this primarily by integrating collaborative solutions between all the design and engineering disciplines.

The building's design is intended to meet the U.S. Green Building Council's LEED Platinum standards and achieve certification as a Living Building. A goal for the project is to be the first Living Building in the region, if not the nation. To achieve this, the process is relying on a highly collaborative team of experts in wastewater, civil, landscape, mechanical and structural design with a history of working together on high-performance buildings. Through periodic all-team meetings and on-going collaboration, the team aims to produce a highly integrated design and ultimately highly integrated building and site, regardless of the Living Building moniker.

LOCATION

Rhinebeck, New York

SIZE

6,200 Square Feet

4.5 acres

COST

\$1,650,000

COMPLETION

Est. 2008

SUSTAINABLE STRATEGIES:

- Appropriate building massing and solar orientation
- Daylighting to minimize glare and unwanted solar heat gain
- Thermal mass for passive heating and cooling
- Natural ventilation
- Geothermal heat pump system
- Photovoltaics and wind power (the Omega Institute currently purchases 50% of their power from an off-site wind power source) to achieve a net zero energy building
- Rainwater collection and reuse
- On-site ecological wastewater treatment system - Eco Machine
- Outdoor constructed wetland and under-parking treated water dispersal field
- Bioswales and native plantings in the parking lot and around the building for on-site stormwater management, including some treatment of stormwater from off-site
- Use of treated water for garden irrigation
- Restoration of existing parking lot through strategies noted above
- Zero stormwater discharge from site
- Limited development and preservation/restoration of habitat
- Prohibiting the use of PVC, mercury, CFCs, HCFCs, neoprene, and other toxic materials
- High use of salvaged and/or FSC-certified wood
- Choice of materials based on local/regional availability
- Account for embodied carbon footprint of the project's construction through one-time carbon offsets
- Adherence to Living Building Challenge guidelines for limits on construction waste
- Separate ventilation where appropriate
- Interior finishes and adhesives to follow SCAQMD 2007/2008 and California Standard 01350 for IAQ emissions
- Healthy air change rates, dependent on use
- Educational signage, plus access to building systems for pedagogical purposes

GENERAL PROJECT INFORMATION

INTRODUCTION

Founded in 1977, Omega Institute for Holistic Studies is the nation's most trusted source for wellness and personal growth. As a non-profit organization, Omega offers diverse and innovative educational experiences that inspire an integrated approach to personal and social change. Located on 195 acres in the beautiful Hudson Valley, Omega welcomes more than 20,000 people to its workshops, conferences, and retreats in Rhinebeck, New York and at exceptional locations around the world.

Through innovative educational experiences that awaken the best in the human spirit, Omega provides hope and healing for individuals and society.

The Omega Center for Sustainable Living (OCSL) will serve as the heart of Omega's ongoing environmental initiatives. Omega's Rhinebeck, New York campus will serve as a model of environmental sustainability. The center will include a classroom, laboratory, greenhouse, water garden, and a constructed wetland. The building will be built in such a way that its systems can be seen, understood, and replicated in the hope that others will be inspired to help protect our clean water—a precious and dwindling resource, and adopt sustainable living practices.

APPROACH

Though at its most fundamental level a wastewater filtration facility, this building and adjacent site has the potential to become a powerful example of transforming Omega Institute's vision and values into the form of an integrated landscape and building that serves the campus both functionally and pedagogically.

The location of the building on the site comes from a desire to link the sanctuary building at the "top" west edge of the campus with this facility. Use of water at both locations, both functionally and symbolically, help make this connection. Though the two buildings are not directly linked, they form the ends of an axis that runs through the campus. Locating the building along this axis, which starts at the Omega campus entry point proved an important step in bringing the story of sustainability to the rest of the campus.

The orientation of building comes from both this primary campus axis as well as a response to optimizing solar orientation for the building. In this case, a long east-west axis for the building allows more control over access to sunlight and heat gain.

BUILDING FORM/DESIGN

The building form largely evolves from the practical need to serve the plants that do the work of wastewater treatment in the Eco Machine as well to provide an inviting and comfortable place for those who use or visit the building. Early research revealed that typical greenhouse design attempts simply to maximize the sunlight to the plants. This defies the desire, in this instance, to maintain comfortable internal temperatures for the workers maintaining the system and educational visitors to the facility. Recognizing that the plants used in the Eco Machine reach a light saturation point at around 30,000 lux-- that is, the maximum amount of light they can physically use-- the goal became to flatten the amount of light falling on the plants' surfaces during the summer months to this level in order to minimize the heat taken on by the space. Conversely, during the colder months of the year, the amount of light allowed to penetrate the building envelope is maximized, in order to warm or help warm the space.

Similar to the manner in which the building meters light for the plants' needs, the building form and layout work to meter and orchestrate a visitor's experience of the systems at work within. Thus the experience becomes that of passing through a series of layers; each layer "talking" about a portion of the bigger ecological puzzle. These layers of building become an articulation of a path from the Omega campus down to the lake edge, parallel to the path the water takes from the campus, eventually returning to the ground and ultimately to the lake.

Water, as the primary inspiration for the new building, takes on a ubiquitous role throughout the building and site. Its natural presence on the site, its uses on site and within the building, its movement through the site and building and its treatment and reuse systems are all transparent and highlighted. In this way, water becomes the impetus for a series of integrated design features that serve their intended functions but that also present valuable and inspiring learning and teaching opportunities. In one particular instance, a fountain is introduced into the main lobby to remind each visitor of the acoustic and tactile qualities of water. This feature, using rainwater captured from the roof, is intended to provide a soothing entry sequence into the building. The final form of the fountain will rely on both the team's initial design as well as the craftsmanship of the local builder.

SITE

INTEGRATED WATER AND LANDSCAPE SYSTEMS

Every element of the Omega Institute site development and infrastructure is designed to reinforce an educational and inspirational experience for all who work at and visit the campus while suggesting a “water sensitive” relationship between the built and natural environment. This phase of improvements includes arrival and drop-off space, parking facilities, wastewater recycling and reuse facilities, and connecting walkways and paths. Since this space is the first experience for visitors to Omega, a thoughtful approach to its design is critical. Underlying the design team’s approach is an appreciation that all water is a precious resource that nurtures all residents. To achieve this quality, site improvements must meet or exceed traditional regulatory, functional and programmatic requirements, be didactic in form, holistic in function, and above all, create beautiful, inspiring landscapes within the ecological and cultural context of the campus.

The integration of water and landscape systems supports and reinforces the fundamental mission of the Omega Institute: “Through innovative educational experiences that awaken the best in the human spirit, Omega provides hope and healing for individuals and society.”

The proposed site improvements begin to lay a visible framework for how these connections can occur. The water-sensitive theme will be

communicated in educational programming developed over time that will utilize site elements as demonstrations. In addition, site elements will also provide opportunities for independent exploration and reflection. Thematic expression will be embodied in subtle landscape patterns and features near the welcome area, classroom building and in the immediate environs. With this in mind, the design team has treated all site, building and infrastructure improvements, as well as operations and maintenance, as learning opportunities. The site programming is based upon the sustainable site principles adopted by the design team:

1. Treat all water as a precious resource; never squander it as a waste product.
2. Restore health and stability to the site and surrounding landscape through the redevelopment process.
3. Utilize integrated design to achieve multiple objectives with each element of site infrastructure.

RESULTS

The Omega Center for Sustainable Living (OCSL) will embody and propagate the Institute’s commitment to holistic well-being. Functioning like a cycle found in nature, the Center will use natural resources to turn its waste into food -- literally, for reuse and re-growth on site, and metaphorically, to foster new and greater growth in the form of heightened awareness and positive change for each of its visitors.



Rendering: Aerial Perspective

ENERGY

The energy strategy for The Omega Center for Sustainable Living is to first minimize the total energy required to operate the building; then provide all required energy via three photovoltaic collectors (PV arrays) integrated into the building.

Energy reduction was achieved in the greenhouse by throttling the light entering the building during the hotter months to the light saturation point (the maximum amount of light the plants can physically process) of the Eco Machine plants. During the colder winter months the building opens up to let in as much solar radiation as is available for passive heating. Walls and floors are of high thermal mass to help flatten day/night and day/day temperature swings.

Using a building energy model (eQUEST), the OCSL's average daily energy use is estimated to be 139.73kw/day.

The PV array size is validated based on the following assumptions:

- Average Daily Solar Radiation (DSR): 4.35kw/m²/day
- Average PV Panel Efficiency (PE): 15%
- South Collector (SC): 100.42 m²
- Canopy Collector (CC): 63.17m²
- Roof Collector (RC): 62.71m²
- System Efficiency (SE): 95% or 5% inefficiency

Average Daily Array Output = ((PE(SC+CC+RC))DSR)*0.95
= 140.28kw/day

Therefore, 139.73kw/h < 140.28kw/h
or Estimated Energy Use < Average Daily Array Output

INDOOR QUALITY

Material selection for the building seeks to minimize the potential off-gassing from various construction materials. Where a finish is required, materials were evaluated for longevity, environmental impact, and impact on indoor air quality.

Operable windows are provided in each occupied space for both the health and enjoyment of guests in addition to being part of the passive heating and cooling strategy for the building.

MATERIALS

The architectural expression of materials is one of simplicity and transparency and is heavily influenced by the colors and textures of the region. No effort is made to mask the nature of a material, but every effort is made to express the unique beauty of each. Overall, the strategy is to render the building as a background or a lens through which the Eco Machine and surrounding landscape can be viewed and understood. Areas in which people will come into contact with the building are treated with more refined materials and detailing.

- Local wood rainscreen siding: Treated as a rainscreen for breathe-ability and allowed to weather to a warm grey hue over time.
- Standing seam metal roof: Chosen for its longevity and natural resistance to decay, with recycled content material.
- Concrete with local aggregates: Used throughout the building for durability, its desirable thermal mass, and as an expression of connectedness to the earth. Concrete is also used in the construction of the greenhouse walls for its resistance to moisture and its thermal mass properties.
- Local stone: Used as a sitting wall around the rainwater collection pond and as an inlay in the concrete floor, expressing the passage from lobby to the greenhouse or classroom.

The team made every effort to eliminate materials on the Living Building Challenge Materials Red List from the project. Some materials, of course, were more difficult to replace than others, as expected. Availability of some specialty plumbing components and rare inclusion in some of the smaller subcomponents of a larger assembly may make it unfeasible to be 100% true to the intent of this prerequisite at the time of construction, but the design team and builder continue to work towards viable alternatives prior to construction.

The owner has committed to offsetting the embodied carbon footprint of the building's construction through a one-time carbon offset, which will be calculated after construction is complete.

WATER

The project site sits atop an aquifer that is connected to a lake that is contiguous to Omega's campus. Wastewater from the entire campus is treated prior to returning to the aquifer by way of The Omega Center for Sustainable Living's biological treatment facility. Though potable water will be from municipal sources, 100% of the water used for toilet-flushing will come from harvested rainwater. This wastewater from the building will then enter the Eco Machine and its treatment process.

The 1,800 gallon rainwater cistern is based on a 25-year simulation where 100% reliability is achieved, i.e., the building never runs out of rainwater based on design usage. Inside the building, all fixtures are low-flow. The one urinal is waterless and the toilets are dual-flush to reduce water needs within the building.

One hundred percent of stormwater and building water discharge is handled on-site by an integrated system of bioretention swales, rain gardens, re-integration of native species into the parking lot, constructed wetlands and other areas not requiring paving. Primary strategies include: conserving water resources, avoiding surface water runoff, avoiding surface and groundwater contamination and making water systems transparent. The following narrative further explains the site rainwater and landscape approach used to restore the land and protect water use and quality.

PARKING LOT

The parking lot is designed to serve the facility with an easily navigable, attractive arrival and parking experience. The parking spaces are located within bays oriented from north to south, leading to the drop-off and main pedestrian walkway. The bays are spaced 12' to 30' apart, and these irregular-shaped spaces will be landscaped to provide multiple benefits. They will serve as filter strips for runoff water from the parking bays and be graded to allow surface water to be slow, cleansed, and cooled. Overflow water will migrate to the southeast, towards a series of rain gardens on the north side of the classroom building. These rain gardens are then directed towards a series of level spreaders stepping down the hillside to the east, which then ultimately overflow to a small rain garden/basin on the south side of the constructed wetland cells. The vast majority of the rainwater falling upon the parking lot will be absorbed and infiltrated within these zones, mimicking natural hydrology. The filter strip areas will also be planted with trees and other plantings to provide shape, screening, and habitat. They will serve to break up the overall parking lot into smaller, human-scaled parking "rooms", surrounded by plants.

RESTORED NATIVE LANDSCAPES

The landscapes associated with the area of site and building improvements will be designed as rainwater management systems

such as filter strips, rain gardens, and bioswales. Rich landscape features adjacent to pedestrian space will be planted with native or adaptive drought-tolerant plants to avoid the need for intensive care or irrigation. Any irrigation of these areas during stress periods or drought will be recycled water harvested from the Eco Machine.

The areas outside of the zone of parking, constructed wetland cells, and buildings will transition to restored native landscapes -- woodlands, wetlands, and prairie as appropriate. These native landscape systems will be restored and managed with low-input cultural practices commensurate with their natural habitat, and will serve to restore stability and healthy hydrology to the surrounding area. Little or no surface runoff will be generated from these ambient landscapes.

CLASSROOM BUILDING

The OCSL's building houses the Eco Machine greenhouse space, classroom space, restrooms, and support space. Runoff water from the hard surface roof will be directed towards rain gardens on the north and east side of the building, where it will be utilized by the plants and seep slowly into the ground. In addition to using captured rainwater for toilet-flushing, a vibrantly landscaped water feature will utilize stored rainwater and be re-circulated using solar or wind power. If the rain gardens/cistern become full (only in extremely heavy, concentrated, or long-duration rain events), excess water will be routed through a series of level spreaders or conveyed by runnels for diffused discharge into the surrounding landscape.

CONSTRUCTED WETLAND CELLS

There are four constructed wetland cells located south of the OCSL. These wetlands are a part of the wastewater recycling/ treatment process located in the greenhouse portion of the classroom building. Water will pass through gravel beds within these wetlands and then will be gradually released into subsurface areas north of the classroom building. The wetland cells will be terraced down the southern slope. The overall effect of the space will be very diverse, colorful and garden-like. The diverse palette of perennial plants will provide habitat for a variety of birds and beneficial insects as part of the overall landscape system. Paths will provide access to these spaces for learning opportunities.

EROSION AND SEDIMENT CONTROL

During construction and landscape establishment, soil erosion and sediment control practices will be deployed that meet or exceed local and state requirements and avoid the movement of soil/sediment materials off of the portion of the site under construction.

1 SEPTIC TANKS - The first step in the process, this is where the majority of suspended solids in the water are separated out. Naturally occurring microbial organisms living in the water work to digest the sludge that settles to the bottom of the tanks and the now partially clarified water is skimmed off into the Anoxic Tank.

2 ANOXIC TANK (aka ANAEROBIC TANK) - Here further settling and a process known as anaerobic digestion occur.

3 CONSTRUCTED WETLANDS - Here the water flows through the root structure of wetland plants. The plants remove nitrates and reduce the Biological Oxygen Demand (BOD - a measure of the rate at which biological organisms use up the available oxygen) and suspended solids in the water.

4 AERATED LAGOONS - In this step, additional wetlands plants are suspended in an Aerated Lagoon. In a symbiotic relationship, the plant roots act as a habitat for microbial populations that further scrub the water.

5 SAND FILTER - This stage is the final “polishing” of the water prior to being reintroduced to the environment. Microorganisms living on and between the grains of sand are fed by any remaining organic compounds in the water.

6 SUBSURFACE DISPERSAL - At this stage the water is reintroduced to the soil via a subsurface network of chambers. The chambers are flooded with the processed water and allowed to percolate into the soil.

7 RAIN GARDENS - Here water running from the building roof is temporarily detained during a rain shower while plants work to cleanse the water of contaminants before it enters the Rainwater Cistern or is absorbed into the soil.

8 RAINWATER CISTERN - Water is stored here to fulfill the Center’s yearly water needs.

9 DEMONSTRATION WASTEWATER LAGOON

10 ENTRY VESTIBULE - This feature works to reduce heating and cooling needs for the buildings conditioned spaces by acting as a buffer between indoor and outdoor conditions. It also helps to reduce the amount of dirt tracked into the building on the shoes of guests.

11 LEARNING LAB - Part of the Classroom, this area provides a place for visiting students (everyone is a student here) to perform tests and experiments on the water.

12 PHOTOVOLTAIC COLLECTORS - While being strategically located to reduce the buildings power needs (by shading the building from the summer sun), Photovoltaic collectors provide all of the buildings power needs.

13 METAL ROOF - Made from recycled metal, the reflective properties keep the interior spaces cooler and mitigate the “heat island” effect.

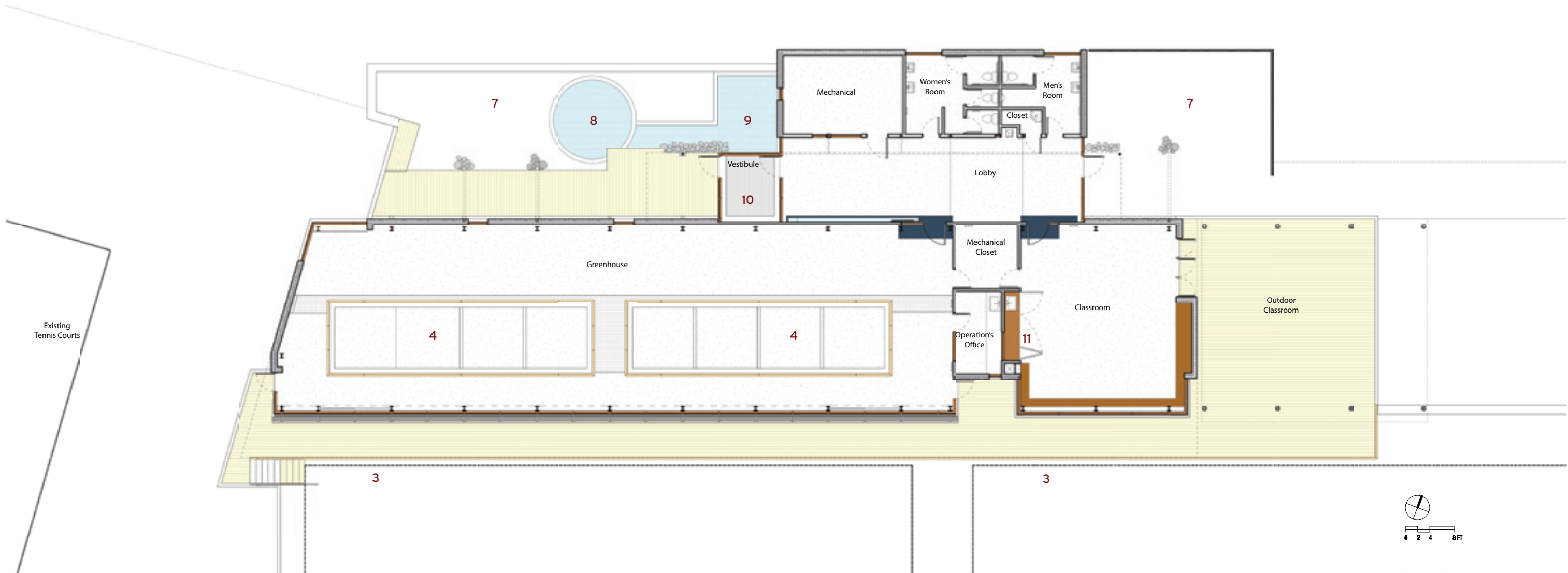
14 GREEN ROOF - This living roof system provides additional thermal insulation for the building while protecting the waterproofing material from the elements.

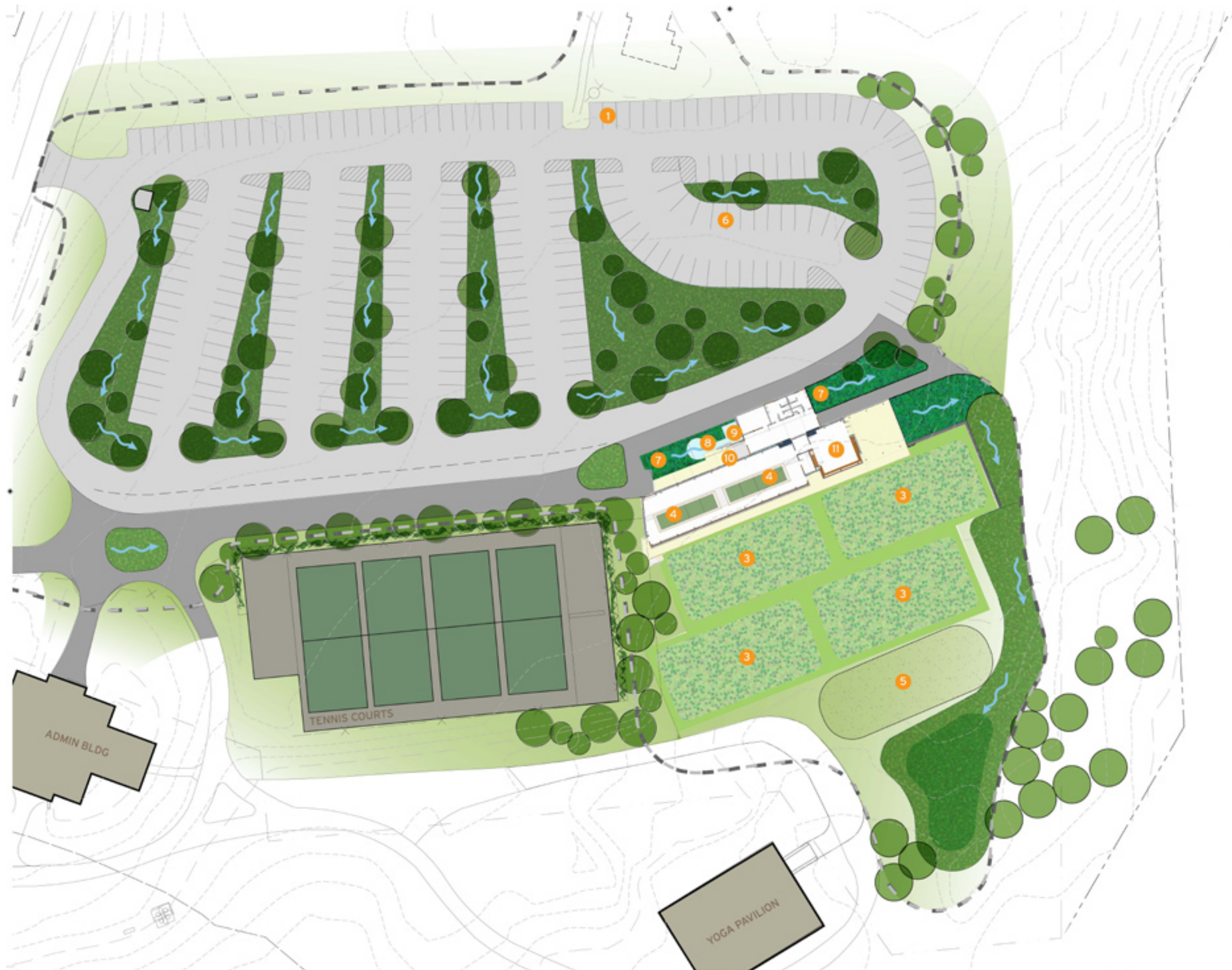
15 WOOD RAINSCREEN SIDING - Either from FSC Certified or Reclaimed wood, this wall systems allows the building skin to “breathe” and eliminates the need for painting. The wood will weather naturally to a gray color.

16 AUTOMATIC VENTILATION WINDOWS - To facilitate passive cooling of the Greenhouse, vent windows open automatically when the inside temperature reaches a set level.

17 INTERIOR FINISHES - Building materials, such as the concrete floor and unit masonry walls, are left exposed and unfinished where possible minimizing the amount of material and the overall embodied energy of the building.

NOTE: Grayed items are shown on other diagrams.





- BIOSWALE
- OVERFLOW
- TREATMENT CELL
- RAIN GARDEN
- GRAVEL PATH
- GRAVEL PARKING SURFACE



Site Plan



ECO MACHINE / WASTEWATER TREATMENT

1 SEPTIC TANKS --

The first step in the process, this is where the majority of suspended solids in the water are separated out. Naturally occurring microbial organisms living in the water work to digest the sludge that settles to the bottom of the tanks and the now partially clarified water is skimmed off into the Anoxic Tank.

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At this stage the water is reintroduced to the soil via a subsurface network of chambers. The chambers are flooded with the processed water and allowed to percolate into the soil.

BUILDING COMPONENTS

7 RAIN GARDENS --

Here water running from the building roof is temporarily detained during a rain shower while plants work to cleanse the water of contaminants before it enters the Rainwater Cistern or is absorbed into the soil.

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Part of the Classroom, this area provides a place for visiting students (everyone is a student here) to perform tests and experiments on the water.

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While being strategically located to reduce the buildings power needs (by shading the building from the summer sun), Photovoltaic collectors provide all of the buildings power needs.

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Made from recycled metal, the reflective properties keep the interior spaces cooler and mitigate the "heat island" effect.

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This living roof system provides additional thermal insulation for the building while protecting the waterproofing material from the elements.

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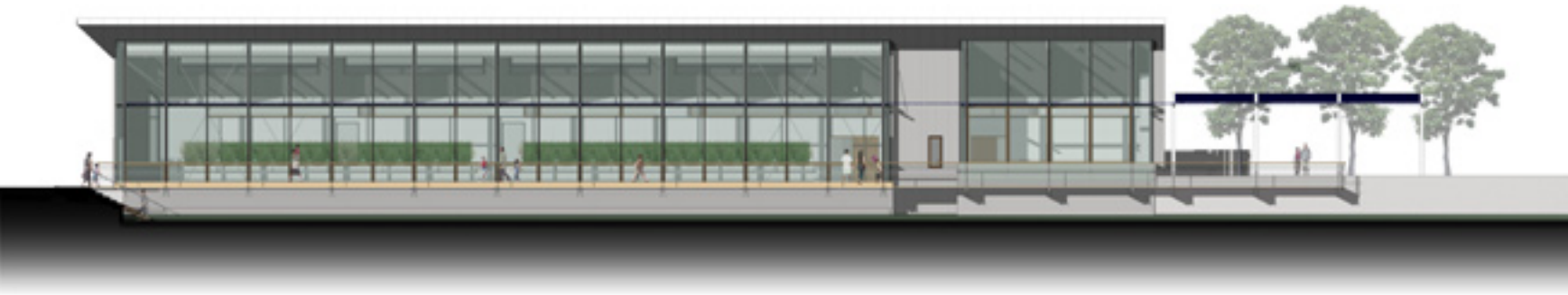
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Section Perspective

Section Perspective



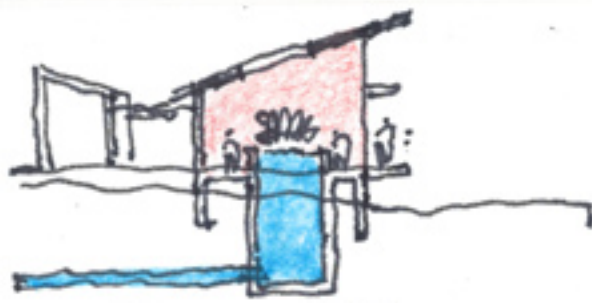
South Exterior Elevation



North Exterior Elevation



West Exterior Elevation



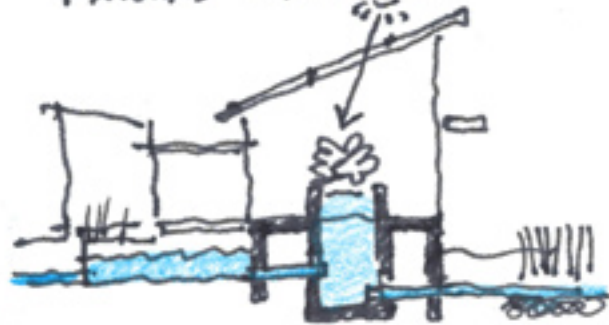
THERMAL MASS OF H₂O



NATURAL VENTILATION



LOCAL MATERIALS



WATER CLEANING



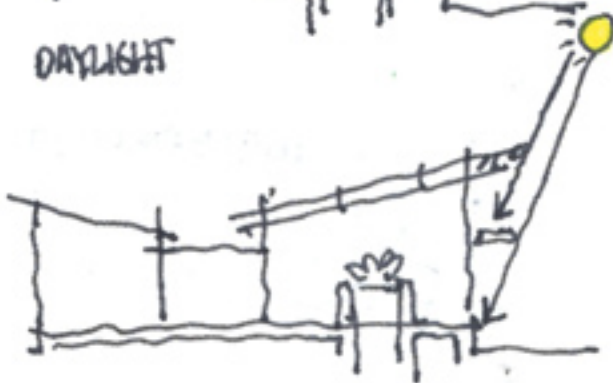
PASSIVE COOLING



DAYLIGHT



PASSIVE HEATING



SHADING

ABOUT BNIM ARCHITECTS

BNIM Architects is a multidisciplinary architecture and design firm founded in 1970 in Kansas City, Missouri, with offices in Houston, TX, Des Moines, IA, and Los Angeles, CA. The firm is committed to its community while establishing a national presence as an innovator of design methodologies, sustainability and new technologies in architecture, planning and workplace design.

BNIM's mission is to improve the quality of life for the owner, user and surrounding community by balancing social, economic and environmental concerns. The foundation of BNIM's continued growth and success has been the individuals – client and designer – who share a common vision and find purpose in creating works of extraordinary quality and utility.

Through a process of integrated design, which is both an organized collaboration between disciplines and an interweaving of building systems, BNIM creates designs that are both environmentally responsible and that achieve the highest level of design excellence. This philosophy, Deep Design Deep Green, is embraced by all members of the firm.

As pioneers in the sustainable movement, BNIM and its associates are known as thought leaders in the industry and beyond. Through early involvement in the U.S. Green Building Council, national committees and demonstration projects, BNIM's work helped establish the national AIA Committee on the Environment, the USGBC's LEED rating system and the Living Building concept.

BNIM's projects embody the concept of restorative design, which aims to maximize human potential, productivity and health while increasing the vitality of natural systems. The firm designs buildings and spaces that have a benign or healing impact on the site while being environmentally responsible, experientially rewarding and deeply educational. Their projects demonstrate a belief that buildings and communities should be seamlessly integrated with the natural world. This results in structures that interact with their environment as living systems, celebrating light, water, landscape and natural materials.

Through research and investigation, the use of cutting-edge technology and the execution of solution-driven design, BNIM Architects has gained a reputation for design excellence. BNIM's multidisciplinary projects have won numerous design awards from the AIA and other respected organizations. Included among them are national AIA/COTE Top Ten Green Projects Awards and recognition from the General Services Administration, the American Planning Association, the International Interior Design Association and the American Society of Landscape Architects to name a few.