This Project Case Study is partial compliance for LEED submission of Innovation in Design : Green Building Education, Project ID 1000002661, LEED-NC v2009, May 6, 2014 by Frank Harmon, Isaac Panzarella & Tim Martin

REPASS OCEAN CONSERVATION CENTER - **PROJECT CASE STUDY**

SUMMARY OF LEED POINTS AND ASSOCIATED DESIGN PRIORITIES

		Design Priority (*the "why" of design*)		Protect Coastal Landscape	Protect Water Quality	Protect Local Ecology	Conserve Energy	Renewable Energy Production	Use Materials Wisely	Provide Interactive Space	Prospect and Refuge
		Priority description (from Minutes of Design Workshop #1)		"Trees on Piver's Island don't survive the harsh southern winds. Summer rain falls quickly, which is not good for vegetation."	"Site is surrounded by signifcant natural coastal resources and maritime cultural heritage. Existing development and bulkheaded sandy soils of Piver's Island yields high stormwater runoff which threatens surrounding ecosystem."	"Site is at end of Neuse River Water Basin and part of a sensitive martine ecosystem."	"Consider natural strategies for indoor thermal and visual comfort before supplementing with efficient mechanical systems."	"Site has abundant natural systems to be harnessed for on-site energy production."	"Building material and scale should be sympathetic to other buildings on campus, and appropriate to coastal environment of drying winds, sea spray, harsh sun and driving rain."	"A place for various social interaction and close proximity is important for our community."	"Desire to look out to the water, historic town and island preserve while being sheltered from the hot sun and mosquitoes of summer, and the cold winds of spring and winter."
		Corresponding Design Strategy (*what*)		*Integrate Building and site*	*Green roof and Cistern*	*Courtyard Infiltration Garden*	*Orientation and Profile*	*Solar Photovoltaics*	*Durable & Regional Materials*	*Community Commons Space*	*Sheltering Porch with Views*
		Benefits of each strategy (*how, where & when*)		Maritime trees are sheltered from damaging and drying south winds by constructed vegetated dunes, and nurished by water flows from roof, cistern and courtyard garden.	1,200 sf green roof of laboratory wing provides summer thermal load reduction, stormwater retention, increased life of roof membrane, promotes biodiversity, improves viewshed of adjacent building. Cistern provides water during drought.	2,600 sf courtyard garden filters roof runoff pollution from Commons and Lecture Hall, recharges local groundwater and courtyard plants, reduces stormwater runoff, promotes biodiversity, and provides aesthetic amenity and privacy from boat traffic.	Building orientation and profile provide all major spaces with abundant, controlled and balanced daylight. Natural ventilation during spring & fall in Commons area. Exterior shading on all windows. Minimize windows on north and west, except clerestory for daylight. Geothermal and heat-recovery systems.	13 kW photovoltaic array provides about 20% of building's energy needs without contributing to climate change, habitat loss, or reduction in air and water quality.	Structural framing is of local pine. Cladding is local cedar shake and reflective cement panels. Green roof assembly is extracted and manufactured or grown regionally. Generous roof overhangs and/or breathable rain-screen help keeps cladding dry. Long-life metal roof.	Fully daylit and naturally ventilated space where students, staff and visitors gather for informal interaction, celebrate DUML activities and observe local ecology.	Generously shaded space on leeward side of vegetated dune and courtyard garden provides pleasant outdoor work environment with views of natural and cultural surround.
		LEED Credits and Pointed Achieved									
SS	1	Site Selection	1								1
SS	4.2	Alt. Transportation: Bicycle Storage and Changing Rooms	1								
SS	4.3	Alt. Transportation: Low-Emitting and Fuel-Efficient Vehicles	3								
SS	4.4	Alt. Transportation: Parking Capacity	2								
SS	5.1	Site Development: Protect or Restore Habitat	1	1	1	1	1				1
SS	5.2	Site Development: Maximize Open Space	1	1		1	1				1
SS	6.1	Stormwater Design: Quantity Control	2	2	2	2	2				2
SS	6.2	Stormwater Design: Quality Control	1	1	1	1	1				1
SS	7.1	Heat Island Effect: Non-Roof	1	1		1					1
SS	7.2	Heat Island Effect: Roof	1		1			1	1		
SS	8	Light Pollution Reduction	1			1	1			1	1
WE	1	Water Efficient Landscaping	4	2	2	2	2				2
WE	3	Water Use Reduction	5		2	2					
EA	1	Optimize Energy Performance	19		3		9		3	5	4
EA	2	On-Site Renewable Energy	8				2	8			
EA	3	Enhanced Commissioning	2								
EA	4	Enhanced Refrigerant Management	2								
EA	5	Measurement and Verification	3								
EA	6	Green Power	2								
MR	2	Construction Waste Management	2						1		
MR	3	Materials Reuse	1							1	
MR	4	Recycled Content	2		1				2		
MR	5	Regional Materials	2		1				2	1	1
IEQ	1	Outdoor Air Delivery Monitoring	1								
IEQ	2	Increased Ventilation	1				1				
IEQ	3.1	Construction IAQ Management Plan: During Construction	1								
IEQ	4.1	Low-Emitting Materials: Adhesives	1						1		
IEQ	4.2	Low-Emitting Materials: Paints and Coatings	1						1		
IEQ	4.3	Low-Emitting Materials: Flooring Systems	1						1		
IEQ	5	Indoor Chemical and Pollutant Source Control	1				1				
IEQ	6.1	Controllability of Systems: Lighting	1				1			1	
IEQ	6.2	Controllability of Systems: Thermal Comfort	1				1				
IEQ	7.1	Thermal Comfort: Design	2				1		1		
IEQ	7.2	Thermal Comfort: Verification	1								
IEQ	8.1	Daylight and Views: Daylight	1	1			1			1	1
IEQ	8.2	Daylight and Views: Views	1	1		1	1			1	1
ID	1.1	Innovation in Design: Green Building Education	1	1	1	1	1	1	1	1	1
ID	1.2	Exemplary Performance: EAc2 On-Site Renewable Energy	1					1			
ID	1.3	Innovation in Design: EAc1 Optimize Energy > 50%	1		1		1			1	
ID	1.4	Exemplary Performance: Regional Materials	1		1						
ID	2	LEED Accredited Professional	1								
		Total LEED Points Achieved	86								
		Estimated LEED Points Associated with each Design Priority		11	17	13	28	11	14	13	18
		Percent of Total LEED Points Associated with each Design Priority		13%	20%	15%	33%	13%	16%	15%	21%

The above chart shows how a robust set of project design priorities for human and environmental health benefits can start an integrated, authentic approach to building and site design that also results in strong LEED credit achievement. Each design priority was defined initially by the client, then integrated and implemented by the design and construction team, and facilitated by the LEED certification process throughout. Enter the chart at the top for each priority to see it's corresponding design strategy, related benefits and associated LEED points achieved across three to five unique LEED Credit areas. In preparing this chart, part or all of the LEED point(s) from the final list of LEED credits achieved (left column) were assigned under each design priority (on the right) based on the question, "Did the design priority, strategy or feature contribute directly or indirectly to the achieving the LEED credit?" If it directly contributed to, or was strongly associated with the credit then the priority received full point(s) value, or if only indirectly then it subjectively received partial point(s) value. Comparing the total LEED points achieved (86) with the total estimated LEED points associated with each design priority (135, by adding points along the bottom of the chart) suggests that the LEED point system may not be accounting for all of the human and environmental health benefits of the project.

APPLICANT ORGANIZATION

The users for the Marguerite Kent Repass Ocean Conservation Center (Repass Center) are the staff, faculty, students and visitors of the Duke University Marine Laboratory (DUML) who focus on education, research, and service to understand marine ecosystems, including the human dimension, and to develop approaches for marine conservation and restoration. Architect selection and design and construction approval were coordinated through the Office of the University Architect, the Facilities Management Department and the DUML's parent organization, the Nicholas School of the Environment, the Owners of the project.

BUILDING HISTORY

The project was conceived in the early 1990's as an ocean science teaching center with laboratory and lecture settings, and developed by DUML faculty and Marine Lab Advisory Board under the leadership of former marine lab Director, Joe Ramus, PhD. By 1998, a tentative site and draft design concept were selected and funding of $900,000 had been raised, with the goal of $1.5 million.

Mike Orbach, PhD assumed the Director position in 1998, and the design concept was re-evaluated to include green building initiatives consistent with the mission of the Nicholas School and Duke University. With the new green concept came a naming gift of $1 million in 2003 from Duke engineering alumni, Randy Repass, and a new estimate of construction of $2.2 million.

With project scope and green initiatives identified and initial funding raised, Duke University Architect, John Pearce introduced Dr. Orbach to Raleigh architect Frank Harmon in the spring of 2004 during a design workshop that he and his design team were holding with faculty and students of the Pratt School of Engineering for the Duke Smart Home project. Design for the Repass Center began in the spring of 2004. Construction started in the fall of 2005 by local contractor, Joyce and Associates, and was substantially completed in August of 2006.

A grant from the Wallace Genetic Foundation helped fund LEED design and construction services, and in November of 2008 the Repass Center was awarded a Gold level certification under LEED for New Construction by the United States Green Building Council.

Originally priced as Alternates and phased out of the scope of original construction, the green roof and cistern were later completed in 2010. With changes in design team members and LEED rating system, the Repass Center met LEED-NC 2009 Platinum criteria in 2013.

APPLICANT PROJECT TEAM

The project team consisted primarily of North Carolina design professionals including: LEED associate professionals, architect and landscape architect, structural and PME engineers, green roof and daylighting consultants, all of whom were committed to listening and sharing their disciplinary knowledge in a clear, common language to empower the client to understand and join the design process. Participating members included:

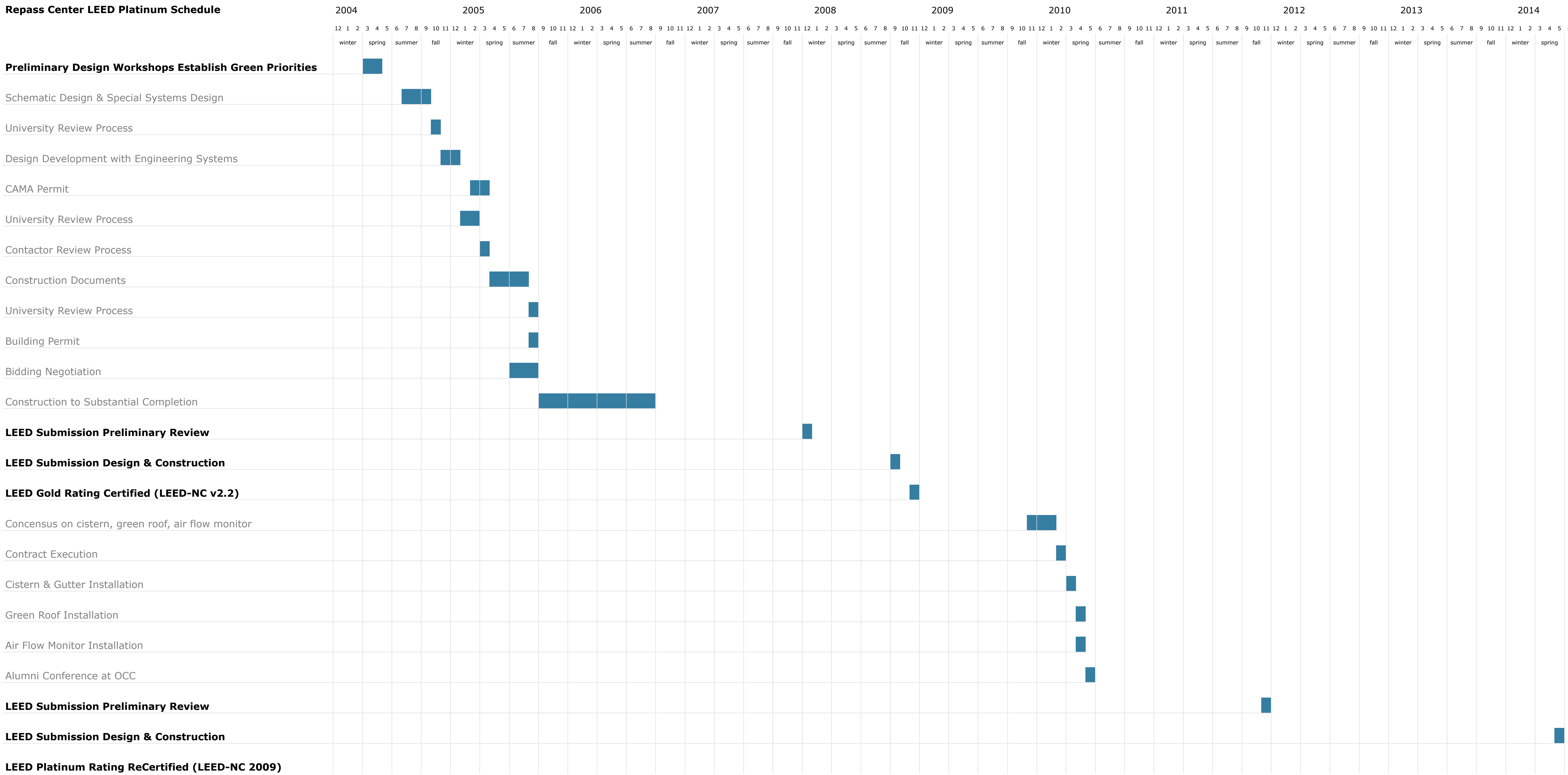
Duke University Marine Laboratory
Cindy Lee Van Dover, PhD., Current Director of DUML
Michael Orbach, PhD., Owner Representative and former Director of DUML
Joe Ramus, PhD., Original Project Coordinator and former Director of DUML
Belinda Williford, Administrative Assistant to the Director

Duke University
John Pearce, University Architect
Leonard Smith, Project Manager
Audrey Frasca, Project Manager

Frank Harmon Architect, PA
Frank Harmon, FAIA, Building Design
Matt Luck, Architect Intern, Building Design, Project Manager
Sara Glee Queen, Architect Intern, Building Design
David Swanson, RLA, Landscape Design
Isaac Panzarella, PE, LEEP AP, PM&E Design, LEED Coordinator
Tim Martin, PE, Structural Design, Eco-design Consultant
Richard Kaydos-Daniels, PE, Structural Engineer
Carl Simmons, PE, Civil Engineer
Dale Brentrup, AIA, IES, Daylighting Consultant
Michael Mantia, Commissioning Agent
Chris McClure, AIA, Specifications Consultant
Emilio Encaya, GRP, Plant Ecologist, Green Roof Design-Builder
Carlie Bullock-Jones, ASID, LEED AP, LEED Coordinator

Joyce & Associates Construction, Inc.
Pat Joyce, President
Richard Hall, Construction Estimator and Manager
Millard Thorne, On-site Supervisor

TIME LINE FOR PREPARING LEED CERTIFICATI CERTIFICATION



Three efforts to create a sustainable project and substantial challenges:

1. COLLABORATIVE DESIGN PROCESS

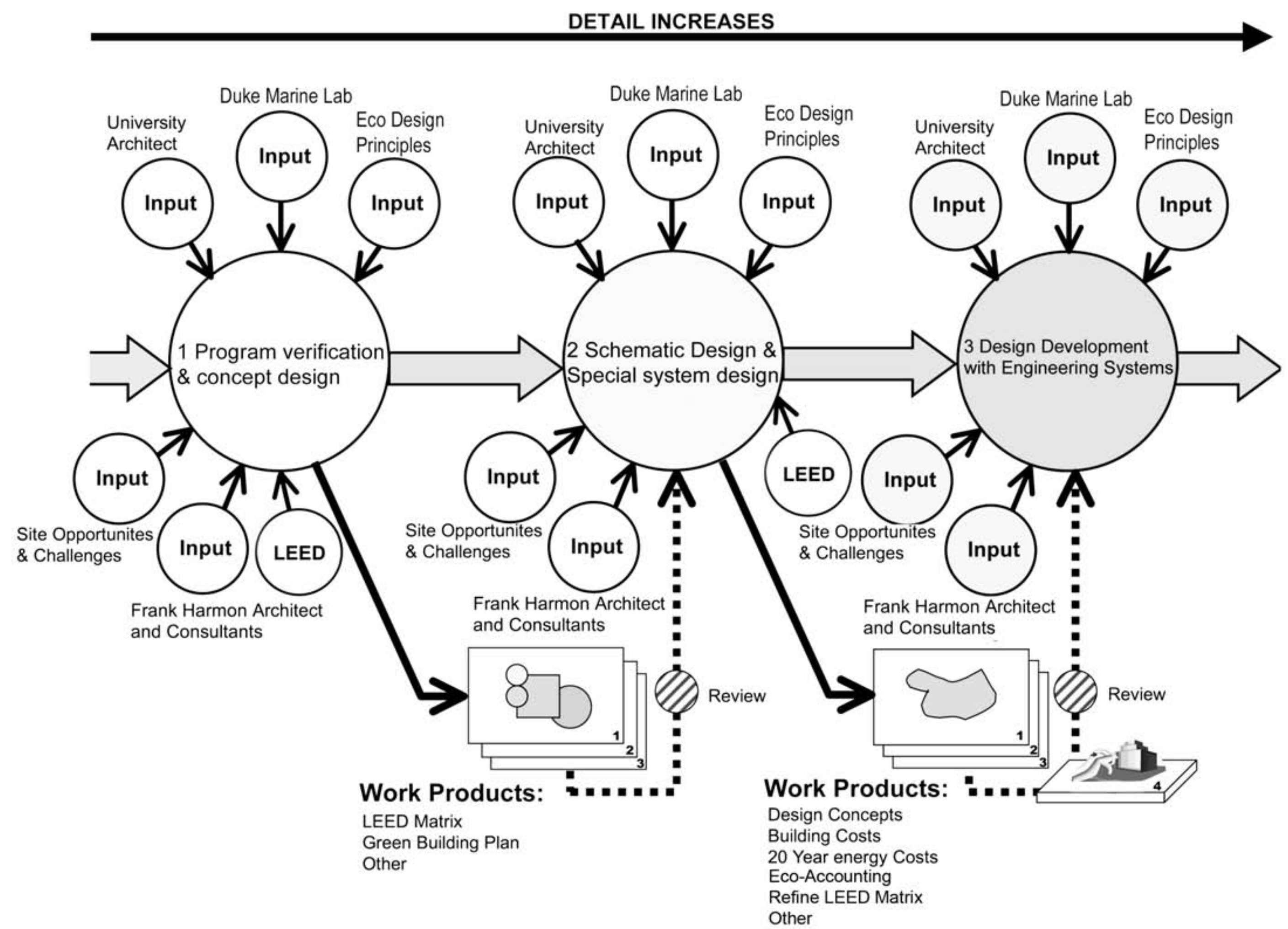
The design process was collaborative and interdisciplinary with the client from the beginning, involving all members of the design team with the staff, faculty and students of DUML. We facilitated three design workshops at the marine lab, establishing goals and priorities and reaching consensus on a concept design. The design team lived on the oceanside of the site during this time, and walked with the students and faculty around Pivers Island to assess building location, aspect and views. The clients shared their building program needs, green initiatives, and experiences from the site and existing buildings on DUML campus. We shared our research in climate patterns and experiences in local building vernacular and LEED principles.

As a result of the Design Workshops we established a clear understanding of the client's environmental goals. We translated these goals into design values and priorities, which became the basis for our design concept, LEED strategy checklist and ecological accounting in subsequent design phases. These strategies are included below (see Matrix of strategies and credits on page 12 for details):

- Stormwater management, rainwater harvesting, and water budget analysis for ecosystem health and water conservation, related to LEED credit for Sustainable Sites (SS) and Water Efficiency (WE).
- Sun and wind patterns, building orientation and profile for cross ventilation and shelter, related to SS, Energy & Atmosphere (EA), and Indoor Environmental Quality (IEQ) credit.
- Vernacular building materials and ecological impact from extraction to final recycling of components, related to LEED credit for Materials & Resources (MR).
- Sun path, building orientation and profile for interior daylight, and exterior shading to reduce electricity used for lighting, heating and cooling, related to EA and IEQ credit.
- After passive strategies, efficient building systems were employed for WE and EA credit.
- Sun and wind patterns, building orientation and profile, and energy modeling for on-site renewable energy production, related to EA credit.
- Highly visible community space that facilitates social interaction and sharing of DUML research, green building features and surrounding natural and cultural resources of the site, related to Innovative Design (ID) credit for Green Building Education programs.

A significant challenge to this process was overcoming preconceptions of how the building should look, so that the design could develop from shared values and principles to corresponding strategies and solutions. Orbach's strong support of the consensus-based approach however, allowed the project to move steadily forward. *"I really do see a little bit of almost everybody's point of view. I don't think anybody has the corner on good ideas." An Entrepreneur of the Social Sciences, Marine Lab Director Brings an Anthropologist's View and a Connection to the Sea to the Facilitation Table. By Monte Basgall. Duke Environment Magazine, Spring 2005.*

Below: Diagram of the Process for Preparing LEED Certification for the Repass Ocean Conservation Center



Left: Photo of participants in a schematic design workshop for the OCC.

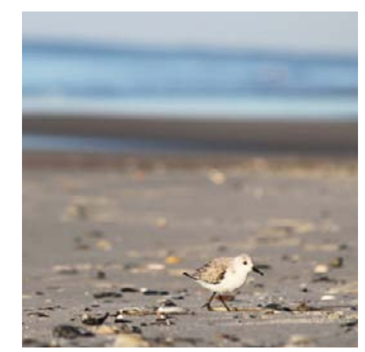
2. RESPONSE TO PLACE

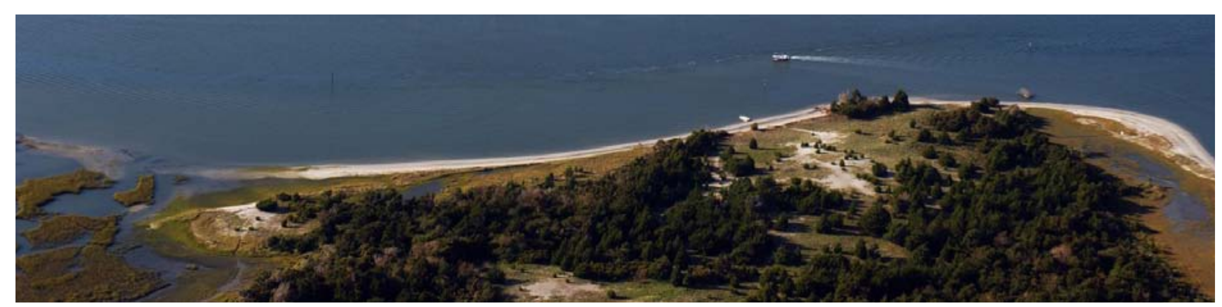
The Repass Center at DUML is located in Beaufort, North Carolina, one of the oldest towns on the eastern seaboard on the United States. Founded in the eighteenth century, the town is a living museum of indigenous sustainable design. The majority of houses in Beaufort face southwest, to capture the cool and relatively constant southwest breeze in summer. Typically porches and trees are located on the southwest and southeast sides of the Beaufort houses, the remaining sides have roof overhangs to protect the walls. Originally all houses had cisterns to collect rainwater, and windmills were built to grind corn. Local materials were used to construct the houses, including long leaf pine for studs and joists and Atlantic white cedar for shingles and siding. Properly maintained these buildings have served their occupants for over 200 years.

Left: Beaufort boats shaped by their environment. Above: Coastal porch with deep overhangs. Below: Traditional Beaufort home with porch and trees to the southwest.

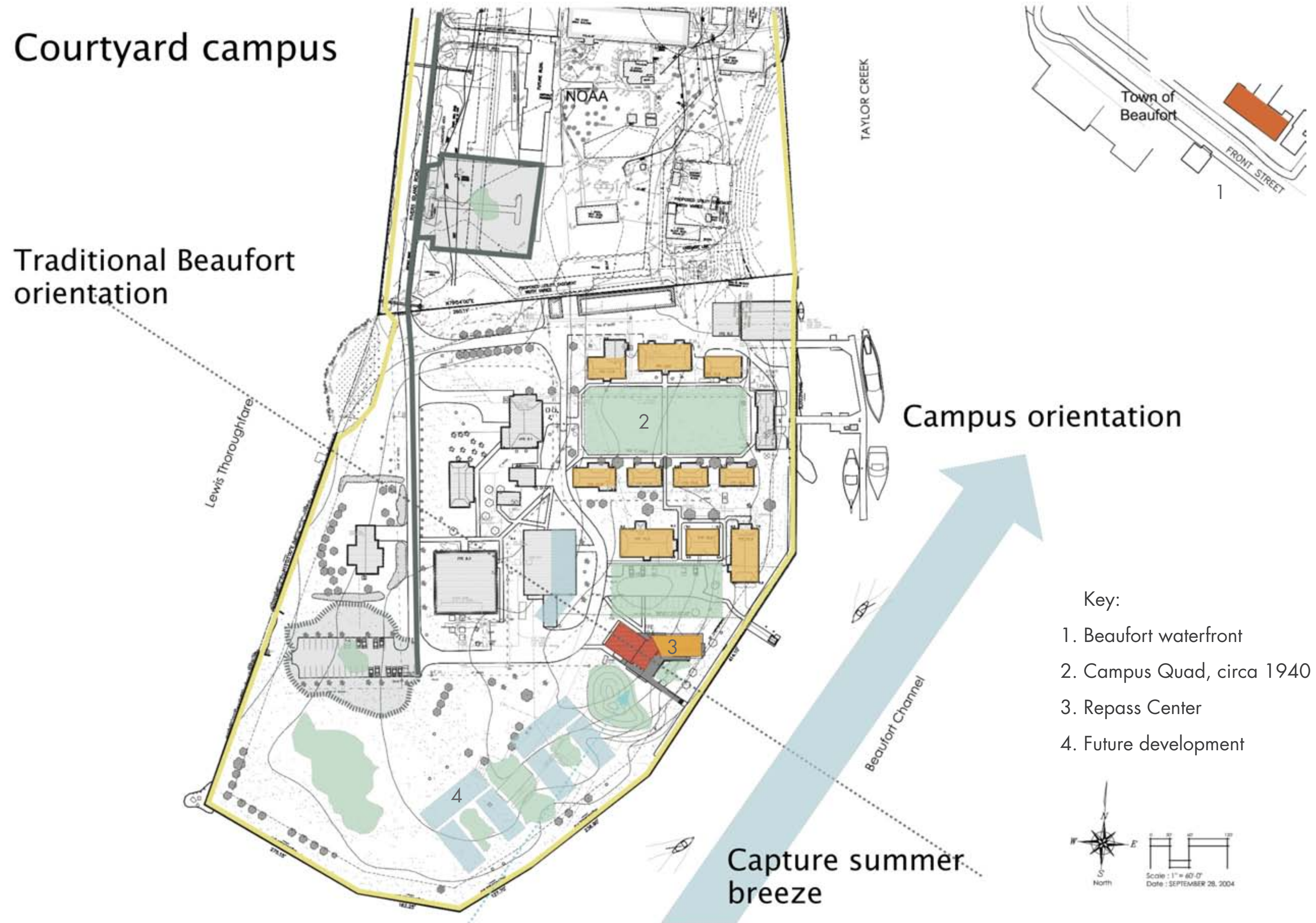
The site for the Repass Center is a barrier island. Barrier islands in North Carolina are shaped by wind and tide, creating patterns of plant and animal life, both terrestrial and waterborne, particular to junction of land and sea. Our goal was to integrate the Repass Center into the ecosystem of the barrier island. The site is in a high wind zone frequented by hurricanes, with wind gusts of up to 150 mph.

Above: Sketch of Beaufort from Piver's Island. Right: Piper's Plover in spring. Below: Northern edge of Rachel Carson Estuarine Reserve. Left: Coastal trees shaped by their environment.





Schematic Design Phase



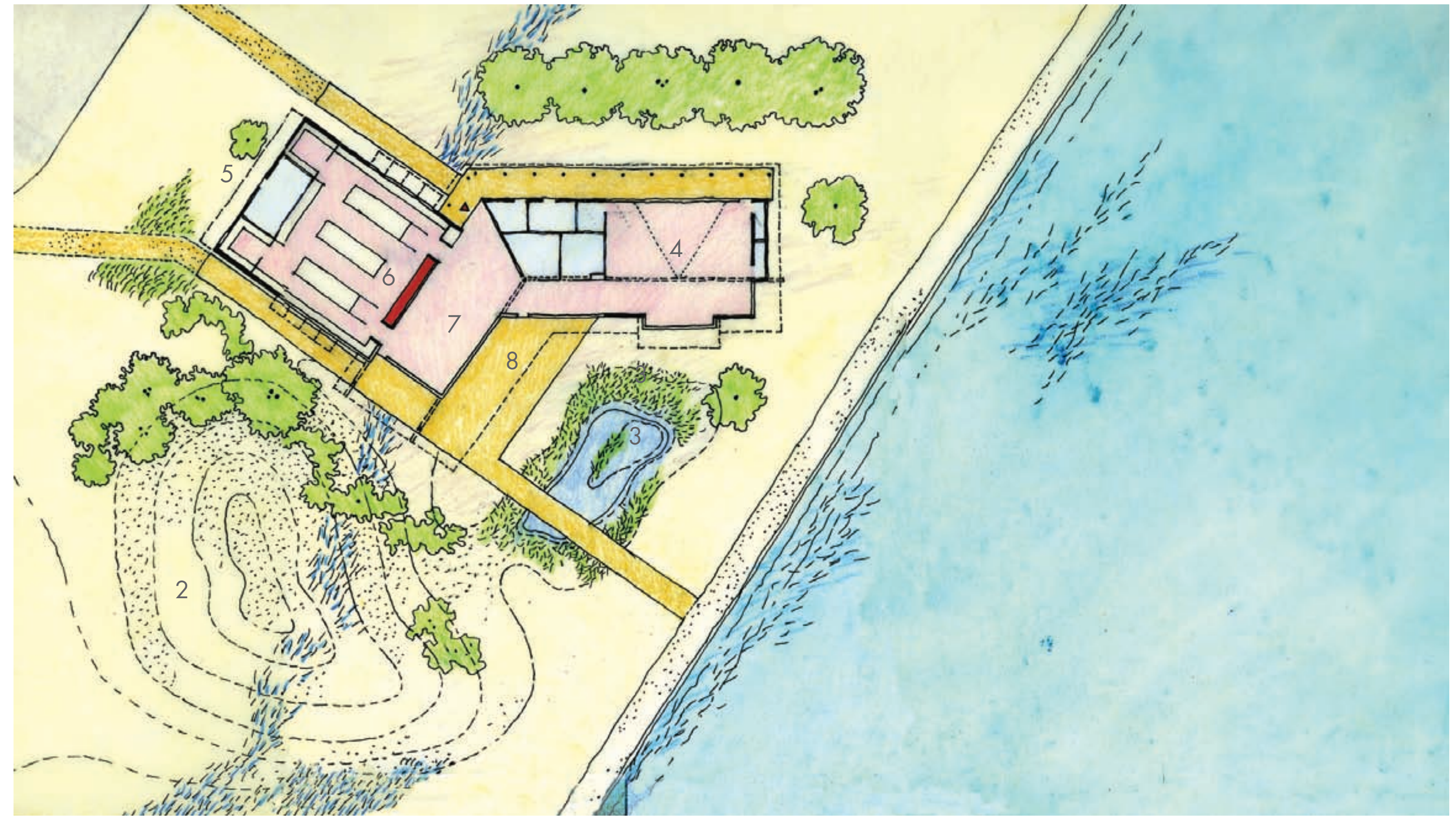
Above: Like the original historic houses of Beaufort we oriented the Repass Center to the southwest breeze. All major rooms with windows on two and sometimes three sides permit cross ventilation and daylighting. 82% of the regularly occupied space meets LEED performance criteria for indoor environmental quality for daylighting. Left: The community commons and lecture rooms look out over the Rachel Carson Estuarine Reserve.

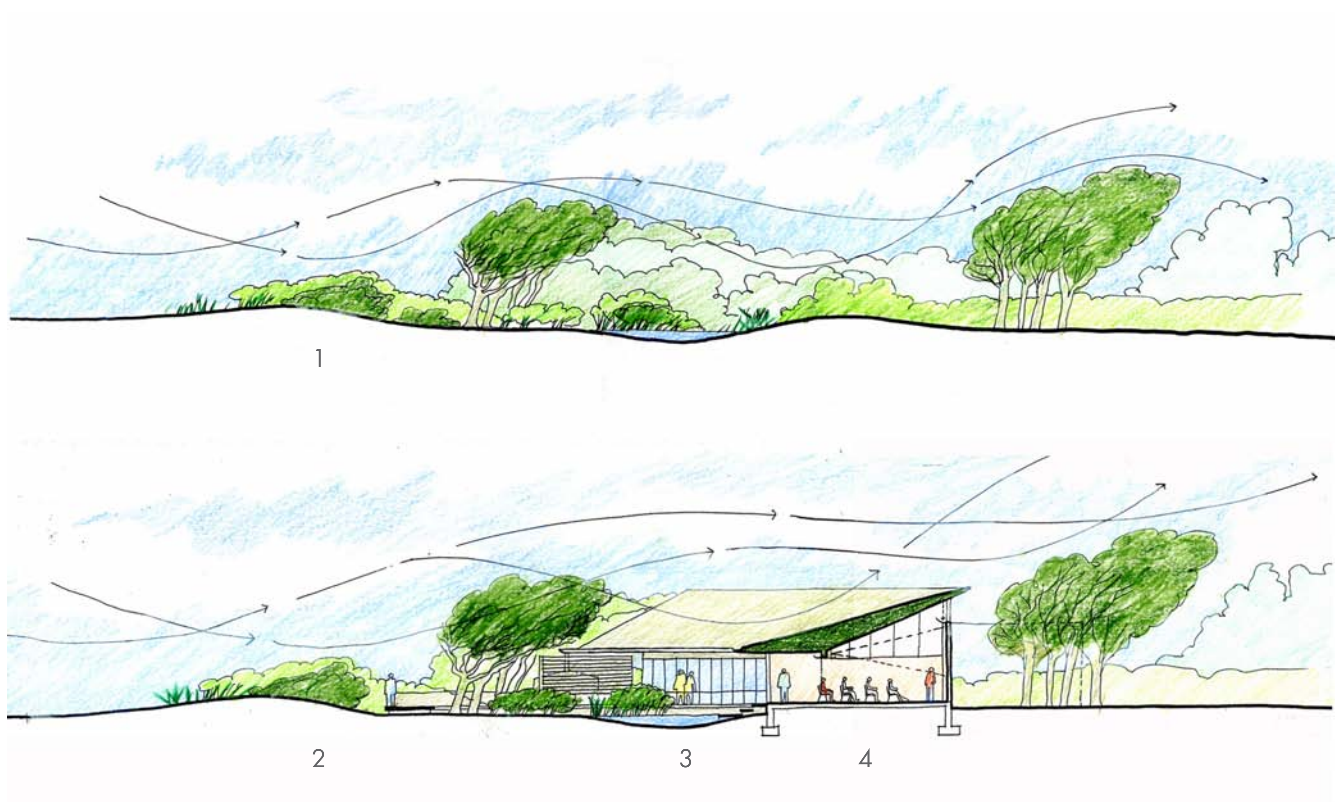
"That's really a new concept on the island. Everything before has been inward-directed —inside your laboratory, inside the quad. We've never really looked out at this beautiful environment we're in." Michael Orbach, for the Duke Environment Magazine, Basgall, 2005.

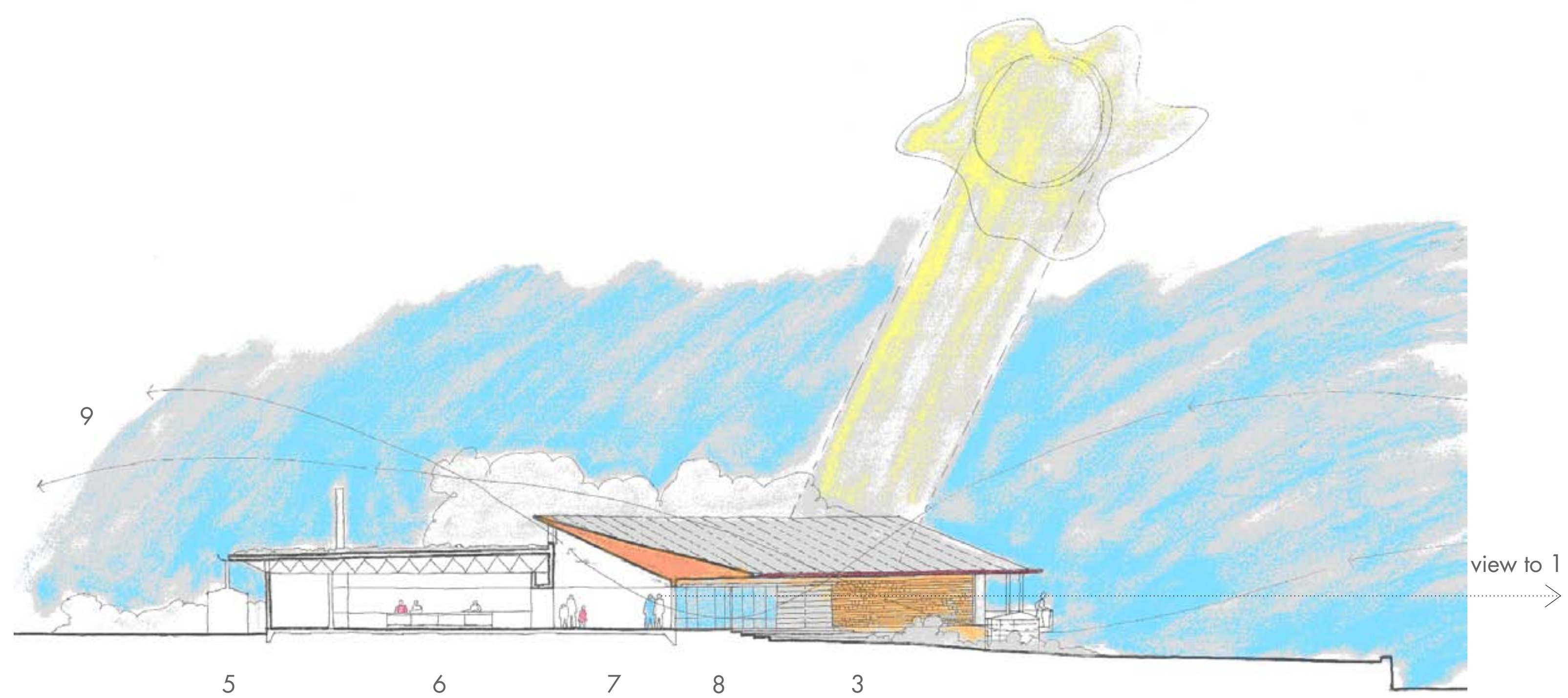
Lower left & Upper right: We nestled the building into the wind shaped barrier island landscape, creating a vegetated dune and courtyard garden to shelter the porch and clean stormwater. All stormwater is collected in cisterns or is allowed to filter into the porous soil of the site, reducing the volume of surface runoff and associated pollutant loads to surface waters. Upper left & Lower right: A generous front porch on the southeast side has become a favorite place for staff, faculty and students. Like the old houses of Beaufort, it captures the summer breeze, and is a pleasant place to sit on a sunny day in winter, when the building blocks the cold northeast wind.

Key:

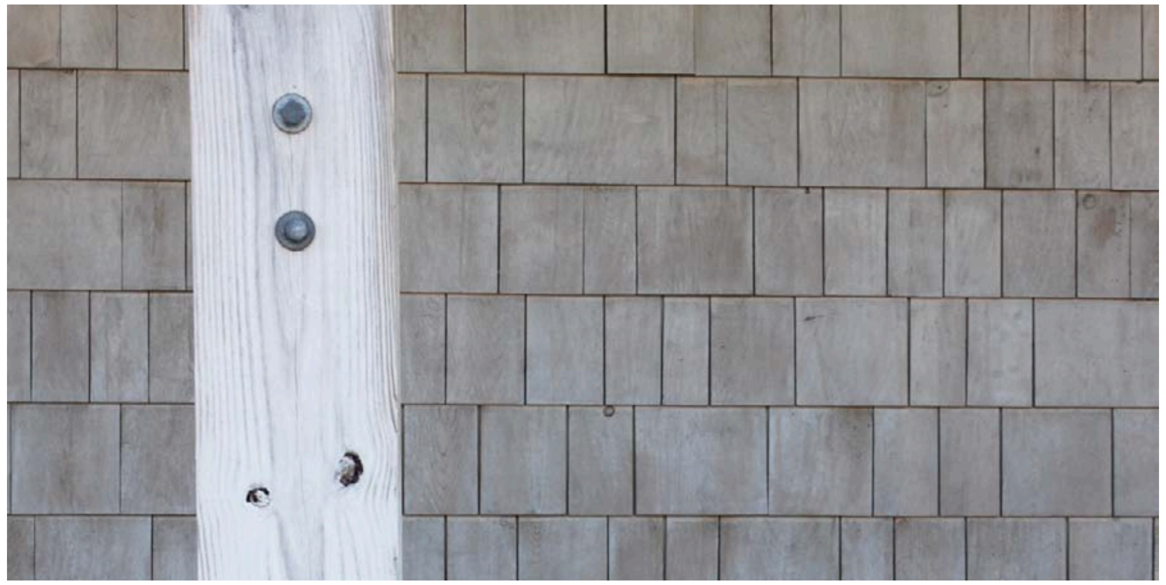
1. barrier island landscape
2. constructed vegetated dune
3. courtyard garden
4. lecture hall
5. cistern
6. teaching lab & green roof
7. community commons & entry
8. south-facing "front" porch
9. natural ventilation



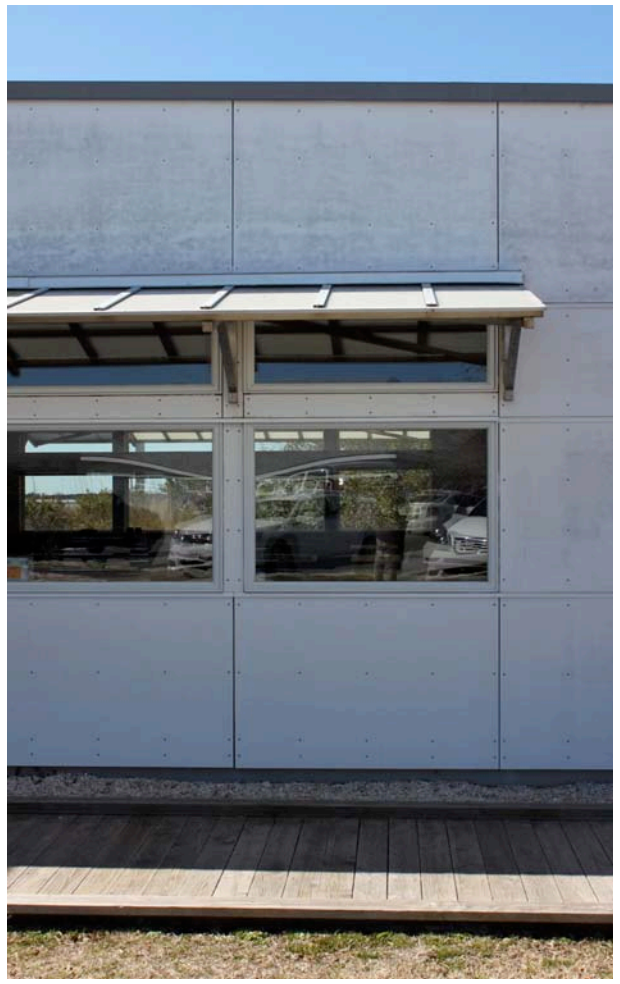


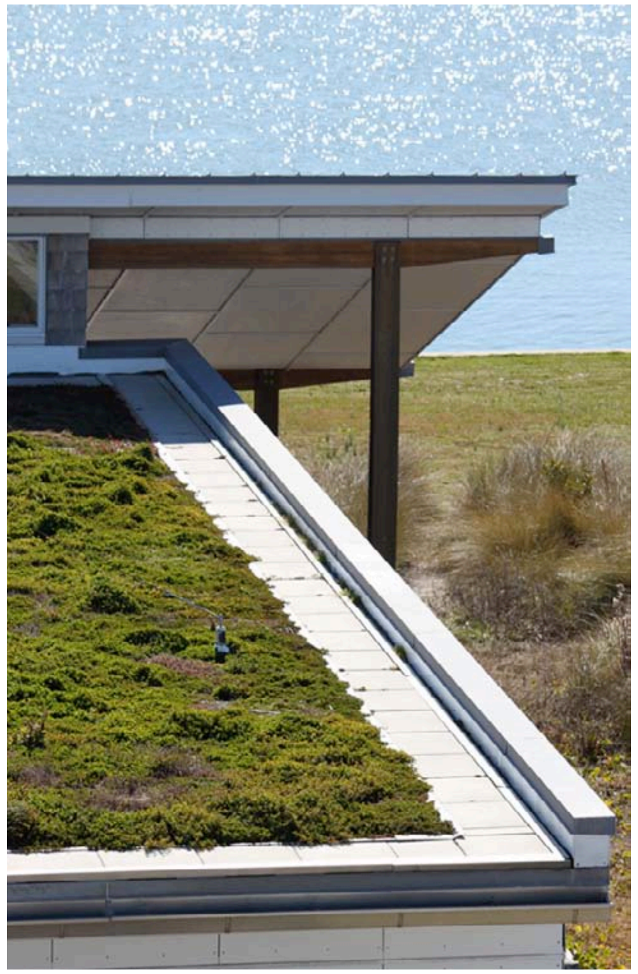


Below: We used southern yellow pine for the structure and Atlantic white cedar shingles for the siding of the lecture room wing. Right: We used 90% heat and light reflective cementitious panels on a breathable rain screen to clad the laboratory wing, a 21st century variant to the traditional cedar siding (right). Regional materials were used wherever possible. The building structure is built of components that can be dismantled and reused in the future. Wood columns, for example, have bolted connections to wood beams and trusses.



Below right: Because the site is in a high wind zone frequented by hurricanes, the structure was designed to survive 150 mph wind gusts. The green roof was designed to accommodate high winds, and is the most exposed vegetated roof in the south Atlantic seacoast.





Ecological accounting informed the design decisions about building siting and rainwater harvesting, structure and envelope, energy modeling and renewable energy production, regional materials and daylighting.

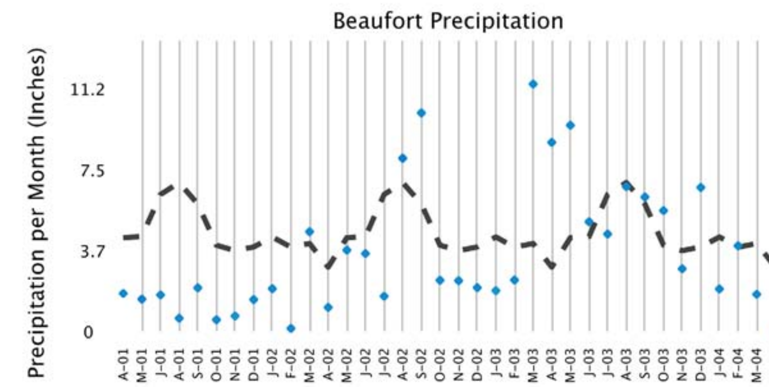
Stormwater Design

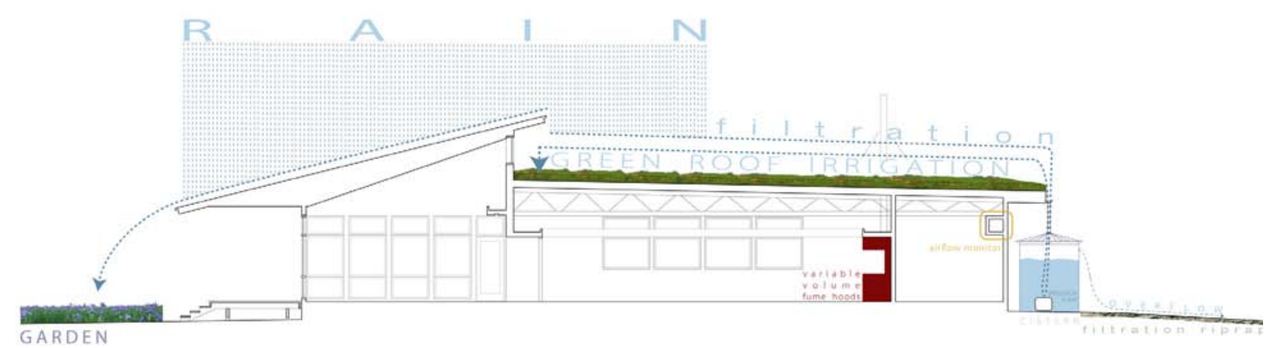
Disruption of the island's natural hydrology were limited by controlling the quantity and quality of stormwater runoff from the Repass Center. A constructed coastal dune, courtyard infiltration garden, cistern and green roof together reduce the volume of stormwater runoff and the associated pollution load to surface water, resulting in no more appreciable runoff than an unbuilt, green field site.

Water Efficiency

The 3,000 gallon cistern was sized to store enough rainwater from the laboratory roof overflow to keep the green roof plants hydrated during a potential month-long drought. The water budget calculation (right) was based on historically available precipitation supply versus a summer irrigation rate of approximately one inch per week, per square foot of green roof area. The green roof in turn protects the underlying roof membrane from damage from UV sunlight and seagull's clam shell droppings intended for pavement.

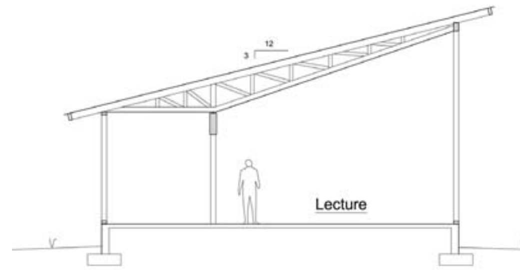
Green Roof Requirements		
Green Roof Area	1,750	square feet
Irrigation Rate, Summer	1.0	in/week
Irrigation required	145.8	cubic feet/week
Irrigation required	1,096	gallons/week
Cistern Balance		
Irrigation returned to cistern (33%)	329	gallons/week
Net weekly rainwater requirements	767	gallons/week
Drought period up to -	4	weeks
Required Cistern storage	3,068	gallons

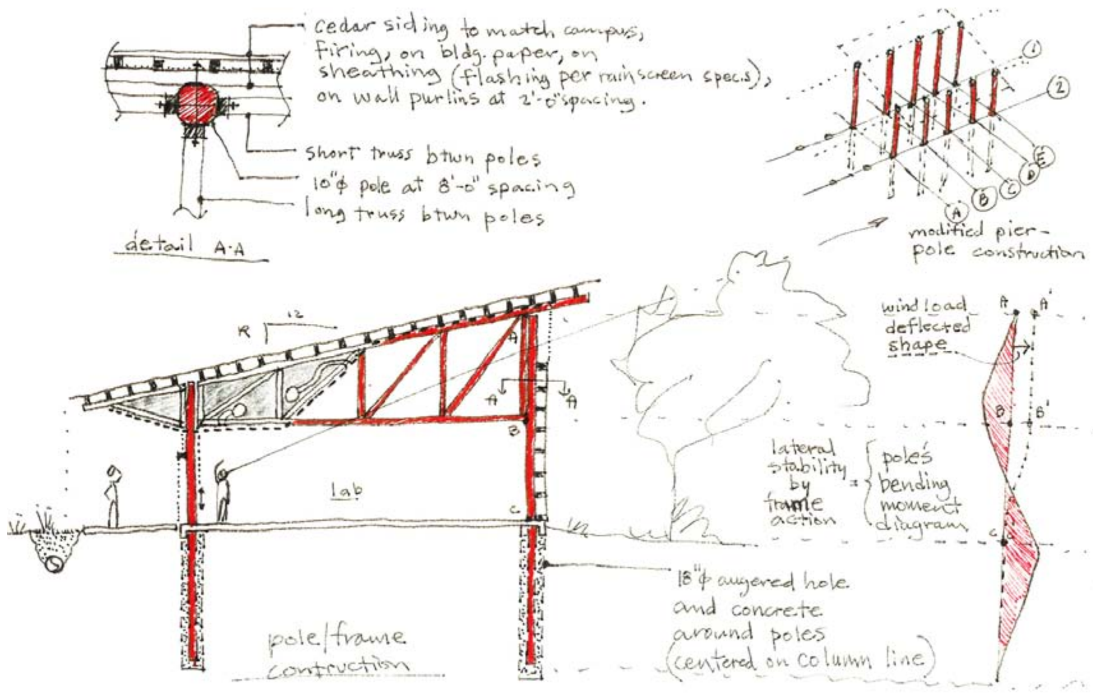




Structure

We evaluated several cost effective timber structures to provide all major rooms with ample windows for daylight, views and strong connection to the hurricane prone site. The inverted pre-fabricated roof trusses and highly reflective, pre-finished ceiling panels allow diffused daylight from high. Below: schematic framing concept. Right: design development building section.

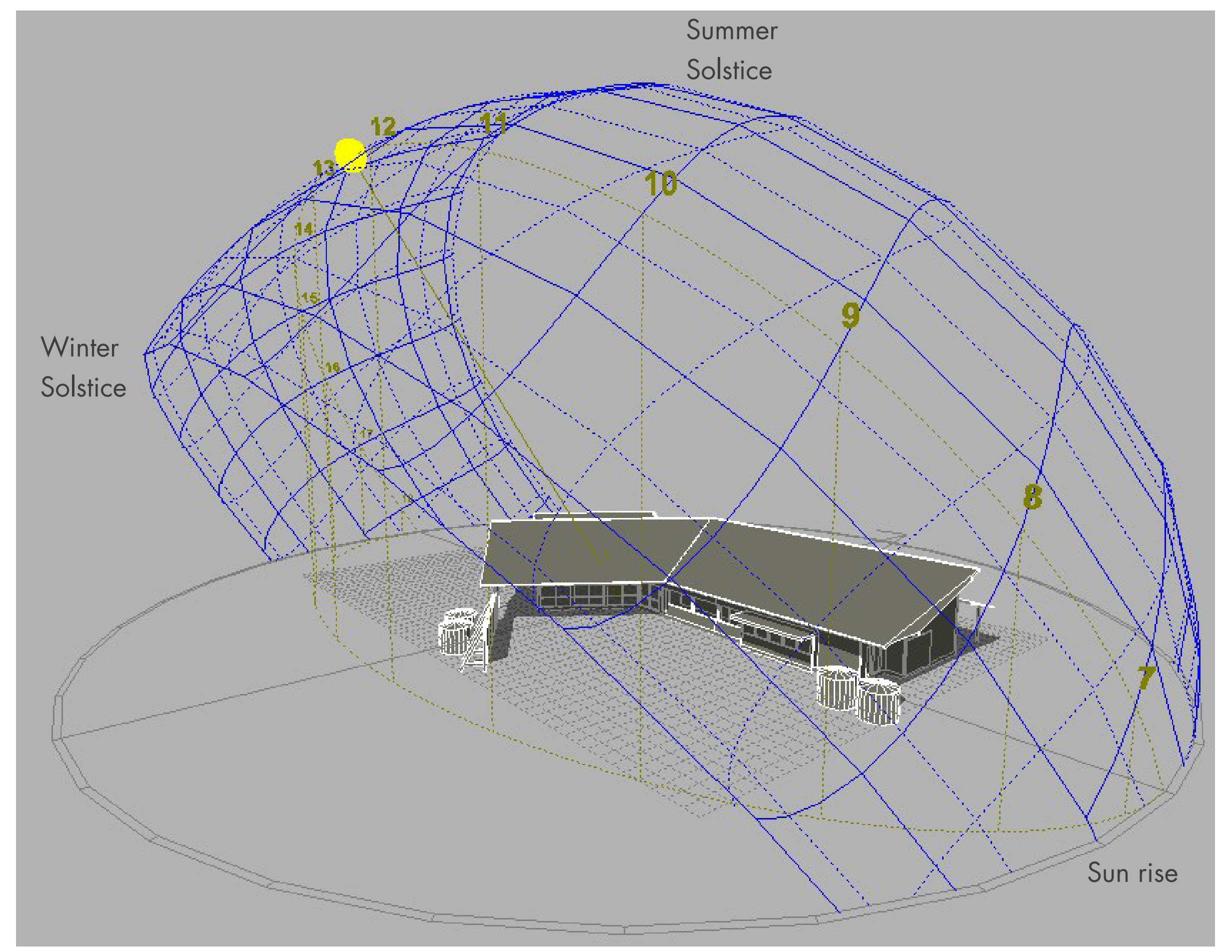




Commons area with operable windows.

Daylighting

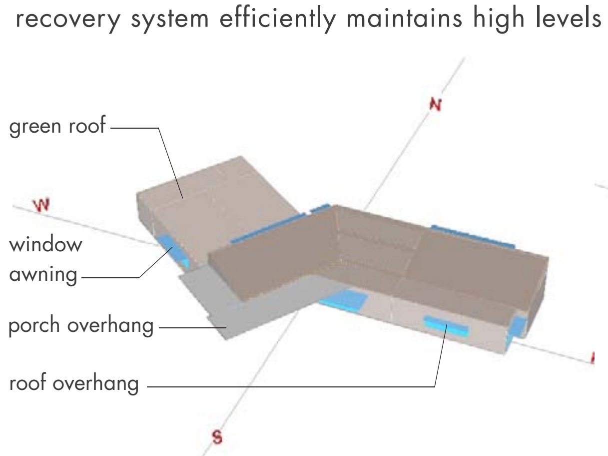
A computer model of sun exposure and building daylight performance informed the size and location of windows, roof overhangs and window fenestration such as awnings outside the teaching laboratory (right). Views to the site were maximized while limiting excess summer heat gain.



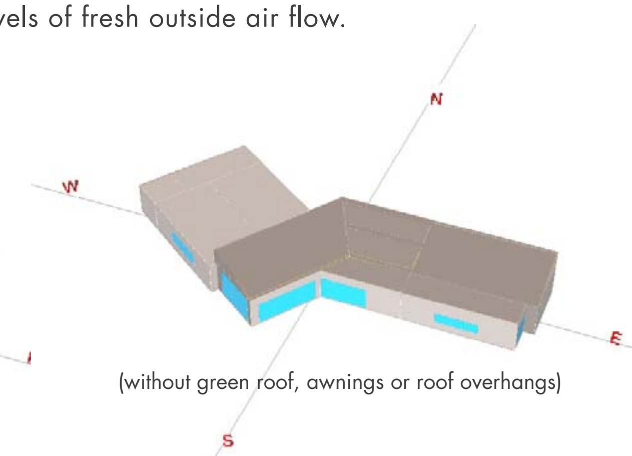
Computer model of schematic building under daily sun path throughout the year.

Energy Conservation

The Repass Center has high performance geothermal heat pump and air-to-air energy recovery systems to help it achieve a total energy savings of 60% over a typical code compliant building. The closed-loop geothermal system was selected for it's relative longevity in the salt-air environment, quiet performance, and heat pump's 40% efficiency increase. The energy recovery system efficiently maintains high levels of fresh outside air flow.

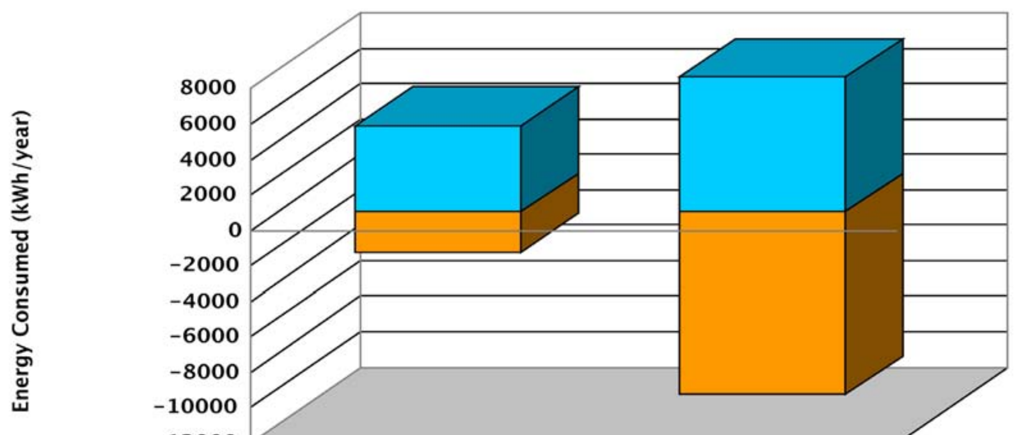


Design Case Energy Model



Baseline Case Energy Model

The images above come from the energy modeling software, Equest, that was used to estimate the energy consumption of the Design and Baseline buildings for the purpose of validating the benchmarked energy cost savings for the project. The Design Case model image visibly illustrates the external shading devices and porch, green roof and light-colored cladding materials, which along with high performance insulation and windows, and daylighting, make up the passive energy strategies that minimize the energy consumption of the building's lighting and mechanical systems.

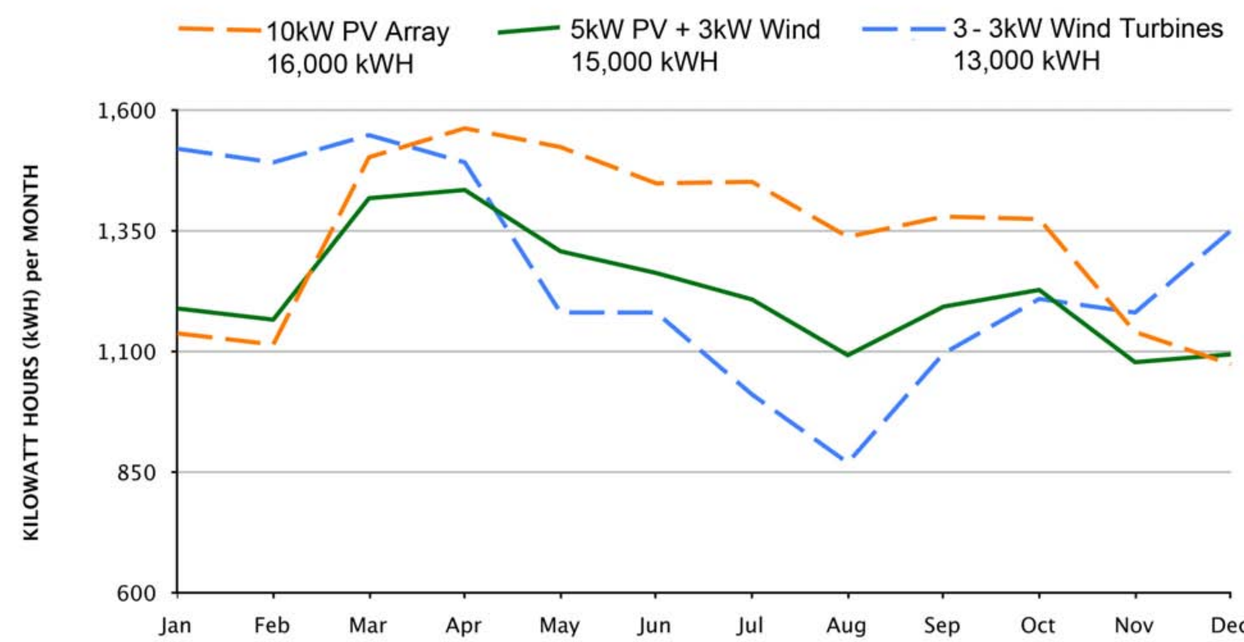


	Design Case - Geothermal Heat Pumps (kWh)	Baseline - Air-to-air Heat Pumps (kWh)
Heating	-2265	-10303
Cooling	4869	7606

Chart above shows the difference in energy consumption for the mechanical cooling and heating systems in each case. The net energy savings for the Design Case is 10,775 kilowatt-hours per year, for an annual cost savings of $963.

Renewable Energy Production

Three scenarios of on-site renewable energy production were considered for the OCC. The first scenario was a 10-kW photovoltaic array. The second was a 5-kW photovoltaic array combined with a 3-kW wind turbine to balance available winter winds and summer sun. The third scenario was three 3-kW wind turbines. Monthly energy production by each system is shown below. All three scenarios were priced near the $120,000 construction budget, and provided roughly 20% of the building's annual energy needs. While the second option was found to be most feasible, with shortest payback of 70 years, or 32 years with the NC Green Power Program, the Owner did not want wind turbines at the time because of the potential hazard to the site's migratory bird populations. The first system was selected. Incidentally, the Adubon Society has since endorsed wind turbines for the clean energy benefit as a trade-off to increased risk of bird deaths, citing that global warming would be more detrimental to bird populations and patterns than turbines.



REPASS CENTER LESSONS

The Repass Center stands on the banks of one of the most heavily used waterway on the East coast of America. It's location gives an educational presence unmatched in North Carolina. The goal of our design was to make a building that teaches, especially in the context of coastal barrier islands.

What are the lessons that the Repass Center teaches:

1. Every site is important, every site is different. At Pivers Island an offshore wind pattern has determined the ecological and human patterns for centuries, shaping the hulls and sails of ships, determining the orientation of dwellings, towns and cornfields and sculpting shorelines, vegetation and animal life. Our design for the Repass Center combines natural ventilation with shaded outdoor areas in summer, and provides sheltered sunny spaces in winter.
2. Environmentally sustainable buildings can be warm and friendly. Although the Repass Center uses advanced technology, photovoltaic panels and rain screens for example, it combines new technology with familiar, time tested materials such as Atlantic white cedar shingles, which have been used to build cottages, barns and shrimp boats for over two hundred years.
3. Learn from what is around you. At nearby Beaufort builders for 200 years have obeyed the dictates of climate: southwest facing houses, porches on the south or southwest sides, thin buildings with windows on two sides of every room, local materials time tested for durability, deep roof overhangs and rainwater collection. We learned from these principles and applied them to a modern building.
4. The most important sustainable elements of a building are free. Many people think that sustainable buildings require exotic technologies and greater cost. At the Repass Center we demonstrate that site plan, orientation, the paths of the sun and wind can be used to create an energy efficient and delightful work and learning space at no additional cost.
5. While many important sustainable elements of the building were free, high-performance alternatives that increased LEED credits such as geothermal, solar photovoltaics, green roof, cistern and efficient mechanical systems increased the total project cost by approximately 10%. And administrative services associated with LEED Certification increased the total project cost by 2.1%, however engaging the LEED credit criteria with a breadth and depth of knowledge of the integrated design team provided a process where decisions for human and environmental health benefits and associated project costs were informed by quantitative and qualitative feedback metrics.
6. Sustainable design creates a sense of well being. Students, faculty and visitors experience pattern of daylight inside the Repass Center, the quality of fresh air, and the sense of openness with the natural surroundings. Compared to many of the dark and energy extensive buildings on campus, the new center creates a feeling of being at ease in the natural world. We think this may be the most important result of the project: a better environment that people notice without being told that it's sustainable. And they enjoy being there!
7. Get your highest LEED rating when the project is built. Because of value engineering a number of our original objectives such as the vegetated roof were not built in the original construction period. Building these features later has been more expensive and time consuming.
8. Listen to the client, listen to the land. We held memorable design meetings with the students, faculty and major donors on the site of the new building. This allowed us to draw on the client and user's energy and wisdom, and gave the students and faculty a sense of ownership of the design. Ownership of the design was a powerful tool in fundraising. Our collective respect for the wind and sun, sand and water of Pivers Island were fundamental to the design and collegial realization of the Repass Center.

SUMMARY OF INVESTMENTS IN HIGH-PERFORMANCE GREEN BUILDING ALTERNATIVES

REPASS CENTER Project Design & Construction Budget:

Total Project Design & Construction Cost (Completed 2006)	$2,300,000
Total Design & Construction Cost for Green Bldg System Improvements (2009)	$100,000
Total Project Design & Construction Budget	$2,400,000

High-Performance Green Building System Alternatives:

Geothermal (2006)	$41,000
13 kW Solar PV System Design & Installation (2006)	$139,000
2,400 sf Extensive Green Roof (2009)	$41,000
4,000 Gallon Cistern (2009)	$8,000
Variable-speed Fume Hood (2009)	$10,000
Total Investment of High-Performance Green System Alternatives	$239,000

Total Green System Alternatives Cost to Project Total Budget	10%

LEED Administrative Services:

LEED Administrative Services for Gold Certified from 2005 to 2008	$28,000
LEED Admin. Services for Green System Improvements from 2009 to 2010	$12,000
LEED Admin. Services for completion of Platinum Criteria from 2011 to 2013	$10,000
Total Investment of LEED Administrative Services	$50,000

Total LEED Administrative Cost to Project Total Budget	2.1%

Minutes from Design Workshop 1

Ocean Science Teaching Center - Duke University Marine Laboratory, Beaufort, NC

WORKSHOP 1 March 29, 2004 9:00am - 5:00pm

Persons Attending: John Pearce, Mike Orbach, John Pearce, Frank Harmon, Judy Harmon, Sara Queen, Erin Sterling, Tim Martin, Isaac Panzarella, David Swanson, Terri Swanson, Dan Rittschof, Dick Barber, Lisa Campbell, Richard Forward, June Gutknecht, Joe Ramus, Pat McClella-Green, Dominick Brugnolotti, Valerie Chan, Zoe Meletis, Mike Hiscock, Josephine Langley, Karen Eckert

Introduction: Mike Orbach, DUML Director and Frank Harmon, Design Team Leader

General Site Information:

- Average rainfall is 60" (90" in 2003)
- Rain mostly falls in the summer. It comes fast, which is not good for vegetation
- Highest rainwater recorded was at Hurricane Hazel in about 1954 where water came over the bulkhead, but didn't reach the Quad or any other buildings
- The island uses well water
- Trees don't tend to survive on the island
- Winds that shape the trees are from the southeast and southwest. Salt spray kills the buds in the spring on the side of the tree exposed to these salt-laden winds
- Grasses survive fine on the island
- Drain fields and septic fields are still on the island, but the DUML is now connected to the municipal sewer
- The island was septic until 1997
- The island was bulkheaded in 1969
- The island has a 35' CAMA setback
- There are a couple of live oaks and an elm tree in the Quad which have survived and done well probably because they are protected from the harsh southeast and southwest winds

Siting the Ocean Science Teaching Center (OSTC):
What are the primary assets and potentials for the OSTC? What features are the most valuable? Which features should be exploited in the development of the site and center?

People present shared their thoughts and ideas.

- Coastal location
- Viewscape (looking south from the Beaufort Inlet, the next land you see is Exuma Island in the Bahamas)
- Island surrounded by water
- Intimacy of the island especially in areas like the Quad
- Rachel Carson Sanctuary is adjacent
- Proximity to the National Seashore
- Strong tidal flow
- Important to the town of Beaufort
- We need to pay attention to prospect and aspect
- Trees around the building that could block the view can be an issue
- We like the way the Quad works with its consistency and use of shingles to blend in with the environment
- We like the view of the natural landscape. Some like the view of the boat yard and the historic town of Beaufort. Some feel that the different views are equally nice for different reasons. No one likes the view to the 7 story condos to the west
- Commercial tourist traffic passes the island all the time and therefore the DUML is very visible to the public
- Water traffic can sometimes be a problem because it is difficult to cross the channel
- The concrete seawall was built in 1969, but it is not "green". It is built very well
- Prospect and aspect: this building is going to be a statement for Duke University Marine Lab and for Green Buildings in general

How does sustainability fit in with the fact that the island used to contain natural sand dunes, maritime forest, etc. but was bulkheaded in 1969 creating few contours not allowing for much vegetative buffer?

- One idea is to convert the entire southern portion of the island to a maritime forest
- Part of the bulkhead on the western side was removed to recreate a wetland/marsh. This process may be continued

What are the sustainable issues?

- OSTC needs to be informed and educated on what is sustainable and what is not
- OSTC wants to know what makes economic sense: short term and long term
- Strong tidal flow could be used as an energy source
- Windfields could be used as an energy source
- Solar panels could be used as an energy source

Principle User - User Groups:
Who will the primary visitor - user groups be? Where will they come from? How

frequently will they visit? What ages? What interests?

- Matriculated students. Undergraduates, professional masters students. Mostly juniors, some seniors and some sophomores.
- Visiting classes from Duke from the Durham campus and other universities. These groups will stay anywhere from a couple days to 10 weeks in the dorms.
- About 90 middle schoolers with the TIP program at Duke
- Televideo from Durham or anywhere else in the nation
- Occupants are present for Fall and Spring semester as well as for Summer sessions. Just about every week with the exception of a couple throughout the year
- In the fall, spring and summer there are typically anywhere from 50-60 students. 50 is usually the minimum and 100 is the maximum (there are 141 beds)
- Public lectures take place on campus as well

How do people move on the site?

- Students move from the dorms to the dining hall to classes and labs
- Evening groups park and walk to class or lectures

Things to consider for OSTC design :

- If the building(s) are integrated into the landscape, we need to know our landscape requirements
- We want to be sure in the master plan not to put a building where a maritime forest could go
- In science buildings, the interaction of humans is important in maintaining intimacy amongst the faculty. Bookhout, for example has contributed this with the high concentration of offices. With everyone at such close proximity, people have to interact
- At present, students hang out in the yard at the Quad and under the trees in the summer partly because the buildings shelter them from the wind there
- Inside functions for the students are studying and going to class and labs, whereas outside learning activities occur far away from the island on a boat in the water where they gather materials to bring back
- Other hang out places are the boat house dock, picnic tables outside of the Dining Hall, porches in front of the dormitories particularly on the north side, the croquet court, and the volleyball court
- It would be nice for people who enter the site by car to see the new OSTC and know what it is since part of the building's use is for lectures attended by visitor's less familiar with the site
- Consider trails, exercise paths for running and walking around the island
- Screen porches have pros and cons about them (pro-bug protection unless porch is on the windy side of a building; con-obstruction of view off island)
- Car access is important
- Clean-up and recycling issues

Impact of the OSTC on each of the user groups:
What should each visitor go away with as a result of their visit? What should the general feeling of the place be for each group?

- We would like to use the OSTC for social functions so it should be a pleasant place perhaps with an artistic edge to it
- The building won't be so public in terms of bringing people in to teach them what goes on here (NOAA has outreach programs)
- Visitors are focused on DUML activities rather than the general public
- We would like to use the building as a fund-raiser so it should be attractive to capture the attention of potential donors
- Support functions for catered events
- The lab area in the building should be secure to visitors for various safety reasons
- We want people to experience the "green function" in that it is an educational experience in and of itself
- Intimacy of the educational experience is very important
- We want to have pride in what the building represents
- Connectivity to the rest of the marine lab with a strong sense of traditional aesthetics
- It should be used. Things are happening in it. It's active. People should want to hang out in the spaces
- It should be able to be used in many different ways at many different times but in some ways specific
- Psychological well being is important. This is a campus and we need to meet many needs
- Distinguished from other labs
- We do not want to make this building all things for all people because other buildings will be built in the future
- We would like to have a displays of the energy use/production, for example, in the OSTC to show savings versus production cost, etc.

After lunch and a quick charrette, the design team presented ideas about the site master planning and issues to focus on for the OSTC. Those attending responded:

- There was concern about the footprints of the new buildings (if they are one story) in the master plan taking up valuable space which could be used for a maritime forest or vegetative buffer since.
- We value the animals and birds that share the island with us
- However, it was agreed that Bookhout being 3 stories seems out of place on the island
- Consideration for another Quad was mentioned due to the overwhelming success of the existing Quad
- Maybe the fourth wall of a new Quad could be conceived as the sea wall
- Two story buildings are more efficient and more economic in many cases
- Consider salt water marsh/wetlands
- Could OSTC be tucked in with the other buildings?

- Consider walking distances for students
- Think about how the OSTC will affect future development
- Consider re-creating a barrier berm to support a maritime forest
- Parking consolidation to make it more of a pedestrian campus
- OSTC could be thought of as a perimeter building in terms of its placement in the master plan. It could be a "bookend" to the island's development.
- Consider the fact that the deck was endowed to specifically be a "vista deck" with a very special view

Ideas for how the building could respond to the site as well as other programmatic needs were presented and discussed:

Four site specific issues were demonstrated – AIR, SOLAR, WATER, EARTH

AIR

- Wind could be used to naturally ventilate the building
- This could pose a problem with the aerosols in the air coming into the building and damaging computers and other sensitive equipment
- Windmills could be used to capture and use the energy it provides, but noise and birds must be considered
- The Hawaii Convention Center in Honolulu was sited as an example for looking at its pliable roof membrane which changes with varying air pressures

SOLAR

- Photovoltaics could be used and possibly even be integrated into the structure of the roof
- Solar thermal
- The building could have a passive orientation
- Consider daylighting
- Consider steam driven air conditioning

WATER AND EARTH

- Rainwater could be collected and used for toilet flushing and maybe eventually for sinks and drinking fountains
- Greywater/blackwater system
- Collected rainwater could be used to irrigate and support a vegetative buffer/maritime forest
- Runoff could be naturally filtered into the earth and eventually back into the water
- There are many pros and cons to treating water on the site versus using city sewer
- Geothermal wells could be used to heat and cool the OSTC
- Tidal energy could be harnessed and used at the OSTC. May be difficult to do.
- Materials should be considered for OSTC in terms of being environmentally friendly
- Siting is extremely important for the OSTC in how it engages, manipulates, and takes advantage of the landscape and its natural surroundings
- Landscaping could essentially be part of the building in the way that it affects certain aspects of the buildings. They don't have to be independent of one another

What are the next steps in the design programming phase? What are the next tasks to be accomplished? When? By whom?

Next meeting's focus will focus on design concepts based on information gathered at today's workshop, and will be presented by the design team

Next Meeting:

Monday April 12, 2004
9:00am - 12:00noon
Location: Duke University Marine Lab Auditorium

Workshop close