Executive Summary:

The new HVAC unit that serves the main building of Grice Marine Lab produces a large volume of condensate (up to 1 gallon per minute in mid-summer) that is piped from the roof to the ground and then pools by the side of the building, potentially damaging the building foundation. We propose to make constructive use of this water by piping it into a small pond populated with aquatic plants and animals, and from there directing it to a peat bog garden, a wetland garden, and a percolation garden. These new garden areas will expand the scope of Grice Marine Lab’s Green Teaching Garden, and will offer the added benefit of being located in a highly-visible area close to the main entrance of the Grice building. The plant species used in this garden will be native to the Carolinas, selected for educational value, sustainability and aesthetics. The peat bog garden will feature native carnivorous plants, including pitcher plants, sundews, and Venus fly traps. Educational signage with information about the four habitats, conservation challenges, and HVAC condensate, as well as plant identification signs, will be posted throughout the garden to engage visitors.

General Plan for Garden Components:
PROJECT WORK PLAN

Goals and Objectives:
- Capture and utilize condensate from the new HVAC system at Grice Marine Lab
- Expand the scope of the Green Teaching Garden
  - Pond with aquatic plants and animals
  - Peat bog garden
  - Wetland garden
  - Percolation garden
- Educate the public on wastewater repurposing and garden habitats

Scope of Work

The Grice Marine Lab HVAC Condensate Native Plant Garden will be positioned by the southeast corner of the main laboratory building, where it will be close to the condensate downspout on the east side of the building and clearly visible to students, faculty and visitors approaching the building from the parking lot to the south. A bog garden was chosen as a suitable solution to the problem of excessive condensate because it will support a collection of water-loving plants; one such group of plants are the intriguing carnivorous plants, which grow in humid, sunny areas with wet, acidic soil. The selected location will receive several hours of direct sun each day, which combined with peat moss, high humidity and a constant water supply will provide a suitable habitat. Slightly taller plants surrounding the carnivorous plant region will mitigate the effects of saline winds while still allowing full sun for much of the day. A series of interpretive signs will be installed throughout the garden with information about bog habitats, conservation challenges, the unique lifestyles of carnivorous plants, and the advantages of repurposing HVAC condensate. These signs will identify the funding source and the year the garden was established. Smaller signs throughout the garden will identify native plants by common and scientific names. The Grice Marine Lab HVAC Condensate Native Plant Garden will be featured regularly during public events, including a “grand opening” in Spring 2015 as part of the annual Grice Marine Lab Marine-ival event. As the garden matures, it will ideally become home to a variety of coastal South Carolina fauna, such as tree frogs, toads, dragonflies, butterflies and birds.
Methodology/Approach

The overall design of the Grice Marine Lab HVAC Condensate Native Plant Garden consists of the following components. First, a pipe will direct water from the HVAC condensate outflow to a small, 2-foot deep pond via a small waterfall feature. Pond water will be kept well-aerated with a solar fountain, and mosquito larvae will be controlled by resident mosquito fish. Second, the pond outflow will be directed to the remaining components via several underground PVC pipes. Third, an acidic bog region will be set apart in a submerged plastic container, and populated with native carnivorous plants; an adjacent non-acidic bog region will contain other water-loving species. Finally, a surrounding percolation garden will take up any extra water, and will be planted with native coastal plants. (See cover page for rough sketch)

Supplies for the initial garden setup will be purchased from Lowe’s, Amazon and Home Depot, including PVC pipes, bulkhead fittings, PVC glue, PVC elbows, soaker hose, solar powered pond pump, shovels, work gloves, garden cart, tarps, peat moss, flagstones for the walkway, and landscape waste bags. Truck deliveries of hardwood mulch, compost, and gravel will be arranged through All Seasons Landscape Supply. The Grice Marine Lab has tools needed to construct the garden system and Lab Manager Greg Townsley will assist us with the connections between sections of the garden area.

The College of Charleston Physical Plant will provide piping of the HVAC condensate to the pond. Stones will be repurposed from Grice Beach to landscape the pipe into a waterfall feature. Sharleen and Rebecca, with guidance from Greg Townsley, will run PVC and soaker hoses from the pond to distribute water throughout the garden areas. Signs will be designed by College of Charleston students and ordered from a local sign supplier.

Some native plants can be transplanted at no cost from the Green Teaching Garden, SCDNR Rain Garden, and Sharleen Johnson’s yard. Other plants will be sourced locally from Hyam’s Garden Center, Roots and Shoots Nursery, and the South Carolina Native Plant Society Lowcountry Chapter’s Spring Plant Sale. Harder-to-find plants will be obtained from Plant Delights in Raleigh, NC. Mosquito fish will be purchased from Carolina Biological Supply (or another more local or less expensive source if one can be identified).

Members of the Marine Biology Graduate Student Association and CofC undergraduate Biology Club will be recruited by graduate students Rebecca Balazs and Sharleen Johnson to help with the initial installation of the garden. After the garden infrastructure is in place, plants will be purchased from local and regional nurseries (as well as transplanted from local gardens), and planted by student volunteers, coordinated by Rebecca and Sharleen. The garden launch party will be incorporated into the MBGSA annual Marine-ival event.

TEAM MEMBERS

- Rebecca Balazs
  - Member Type: Project Co-Leader
  - Contact Info: sampsonrj@g.cofc.edu; 520-285-7353
  - Educational Info: Masters Candidate, Graduate Program in Marine Biology. Expected graduation date: May 2016.
  - Project Role: Coordination of Volunteers, Purchasing of Supplies, Coordination of Sign Design and Ordering
Experience and Qualifications Relevant to the Project: Current Grice Green Teaching Garden volunteer coordinator, home gardening experience, 8 years as a science educator at middle and high school levels.
Integration with other Responsibilities: These responsibilities will blend well with my current role as GTG coordinator.

- **Sharleen Johnson**
  - Member Type: Project Co-Leader
  - Contact Info: johnsonsp3@g.cofc.edu; 843-762-8854
  - Educational Info: Masters Candidate, Graduate Program in Marine Biology. Expected graduation date: May 2015.
  - Project Role: Coordination of Volunteers, Purchasing of Plants and Supplies, Assistance with Irrigation Setup
  - Experience and Qualifications Relevant to the Project: Served as the Grice Green Teaching Garden volunteer coordinator in 2013-2014, 12 years of gardening experience, 2 years as a community garden coordinator, led gardening workshops for the Boston Natural Areas Network.
  - Integration with other Responsibilities: I work for SCDNR on the Fort Johnson campus, and have flexible hours.

- **Greg Townsley**
  - Member Type: Advisor and Continuity Point Person
  - Contact info: townsleyjg@cofc.edu; 843-953-9174
  - Project Role: Assistance with PVC and soaker hose installation; Long-term advisor for the project to keep it sustainable after Sharleen and Rebecca graduate.
  - Educational info: Graduate of the College of Charleston Master of Environmental Studies Program.
  - Experience and Qualifications Relevant to the Project: Built and maintained ponds for algal biofuel research for 4 years. Experience with habitat restoration.
  - Integration with other Responsibilities: Greg is the Grice Marine Lab Manager, and one of the responsibilities of that position is to advise and assist students with the Green Teaching Garden and similar projects.

**TIMELINE**
January 2015:
- Work with CofC art students to design interpretive signs
- Purchase garden supplies
- Arrange for compost and mulch deliveries
- Use stakes and twine to delineate garden areas
- Garden workday #1 (food provided for student volunteers)
  - Remove grass from garden area and place in landscape waste bags for county compost program
  - Dig holes for pond, peat bog garden, and wetland garden, and install Rubbermaid containers
- Pile excavated soil on tarps
- Add several inches of gravel to the bottom of the pond container
- Remove soil from garden area, 1.5-2 feet deep, and place on tarps
  - Drill holes in sides of Rubbermaid containers and install bulkhead fittings and PVC
  - Install and test water distribution system

February 2015:
- Facilities: Pipe water to pond
- Finalize design of signs and place orders
- Garden workday #2 (food provided for student volunteers)
  - Mix 50% excavated sandy soil + 50% peat moss to fill the peat bog container
  - Mix 50% excavated sandy soil + 50% compost to almost fill the wetland container, and top with hardwood mulch
  - Mix sandy soil with compost to fill garden area, and top with 3” of hardwood mulch
  - Use remaining soil from tarps to create a berm around the percolation garden, and to fill holes in the parking area
  - Place flagstones around peat bog, wetland, and pond gardens to provide access for viewing and maintenance
  - Thoroughly water all of the garden areas to prepare the soils for later planting

March 2015:
- Monitor water distribution system and adjust as necessary
- Purchase plants
- Coordinate planting of plants by student volunteers

April 2015:
- Install signs

April/May 2015:
- The Grice Marine Lab’s Pond and Wetland Garden grand opening at Marine-ival!

BUDGET (see attached line-item budget)
Supplies (for installation of the new gardens and maintenance of new/established gardens):
- Smartpond 1100-gallon Rubber Pond Liner for non-acidic bog garden
- 300-gallon rubbermaid tank for pond
  [http://www.amazon.com/Rubbermaid-4247-00-BLA-300GAL-Black-Stock/dp/BoooB4JWOQ/ref=sr_1_1?ie=UTF8&qid=1413516321&sr=8-1&keywords=rubbermaid+300+gallon](http://www.amazon.com/Rubbermaid-4247-00-BLA-300GAL-Black-Stock/dp/BoooB4JWOQ/ref=sr_1_1?ie=UTF8&qid=1413516321&sr=8-1&keywords=rubbermaid+300+gallon)
- 100-gallon rubbermaid tank for acidic bog garden
  [http://www.amazon.com/Rubbermaid-Commercial-FG424288BLA-Structural-Capacity/dp/Bo6OVJHUAW/ref=sr_1_1?ie=UTF8&qid=1413516389&sr=8-1&keywords=rubbermaid+100+gallon](http://www.amazon.com/Rubbermaid-Commercial-FG424288BLA-Structural-Capacity/dp/Bo6OVJHUAW/ref=sr_1_1?ie=UTF8&qid=1413516389&sr=8-1&keywords=rubbermaid+100+gallon)
- 5 shovels
  [http://www.lowes.com/pd_99758-302-1554300_izovjvn+1zowgd0?productId=1155675&Ntt=shovels&Ns=p_product_qty_sales_dollar|1&pl=1&currentURL=%3FNtt%3Dp_product_qty_sales_dollar%26C1%26Ntt%3Dshovels%26page%3D1&facetInfo=In%20Store](http://www.lowes.com/pd_99758-302-1554300_izovjvn+1zowgd0?productId=1155675&Ntt=shovels&Ns=p_product_qty_sales_dollar|1&pl=1&currentURL=%3FNtt%3Dp_product_qty_sales_dollar%26C1%26Ntt%3Dshovels%26page%3D1&facetInfo=In%20Store)
- 1 flat-bladed spade for edging
- A metal short-tined rake (for raking mulch level)

- **12 pairs of garden gloves** [http://www.amazon.com/Womens-Garden-Gloves-assorted-colors/dp/B004W8RRK2/ref=sr_1_1?ie=UTF8&qid=1413336382&sr=8-1&keywords=garden+gloves](http://www.amazon.com/Womens-Garden-Gloves-assorted-colors/dp/B004W8RRK2/ref=sr_1_1?ie=UTF8&qid=1413336382&sr=8-1&keywords=garden+gloves)

- **Several large, sturdy tarps (for collection of removed soil as well as compost and mulch delivery)** [http://www.lowes.com/pd_186798-M14140810_0?productId=3115785&Ntt=tarps&pl=1&currentURL=%3FNtt%3Dtarps%26page%3D1&facetInfo=In%20Store](http://www.lowes.com/pd_186798-M14140810_0?productId=3115785&Ntt=tarps&pl=1&currentURL=%3FNtt%3Dtarps%26page%3D1&facetInfo=In%20Store)

- **Fafard 3 cubic feet Organic Peat Moss** [http://www.lowes.com/pd_322730-10799-1310503_0?productId=3319744&Ntt=peat+moss&pl=1&currentURL=%3FNtt%3Dpeat+moss%26product_avg_rating%3C%3DI&facetInfo=](http://www.lowes.com/pd_322730-10799-1310503_0?productId=3319744&Ntt=peat+moss&pl=1&currentURL=%3FNtt%3Dpeat+moss%26product_avg_rating%3C%3DI&facetInfo=)

- **Truckload delivery of compost (for non-acidic bog garden) and hardwood bark mulch (to cover most of the garden) and gravel (for bottom of pond) from All Seasons Landscape Supply in Johns Island** [http://charlestonlandscapesupplies.com/products/premium-hardwood-bark-mulch/](http://charlestonlandscapesupplies.com/products/premium-hardwood-bark-mulch/)


- **Twine** [http://www.lowes.com/pd_138870-52487-831299_o?productId=50243443&Ntt=twine&pl=1&currentURL=%3FNtt%3Dtwine%26product_avg_rating%3C%3DI&facetInfo=](http://www.lowes.com/pd_138870-52487-831299_o?productId=50243443&Ntt=twine&pl=1&currentURL=%3FNtt%3Dtwine%26product_avg_rating%3C%3DI&facetInfo=)

- **Landscape waste bags** [http://www.lowes.com/pd_127552-51856-38098_4294599023?productId=50049693&Ntt=landscape+waste+bags&pl=1&currentURL=%3FNtt%3Dlandscape+waste+bags%26product_avg_rating%3C%3DI&facetInfo=](http://www.lowes.com/pd_127552-51856-38098_4294599023?productId=50049693&Ntt=landscape+waste+bags&pl=1&currentURL=%3FNtt%3Dlandscape+waste+bags%26product_avg_rating%3C%3DI&facetInfo=)

- **Pizza/Subs for garden work days**
- Interpretive signs from local supplier or [http://envirosigns.com/](http://envirosigns.com/)
  - **Plant ID signs**
  - **Using HVAC condensate**
  - **What is a bog?**
  - **The unique lives of carnivorous plants**
  - **Freshwater pond ecosystems**
  - **Percolation/rain gardens**


- **Solar fountain for pond aeration** [http://www.amazon.com/Majestic-Solar-Power-Fountain-Brushless/dp/B00J59EIXW/ref=sr_1_2?ie=UTF8&qid=1413515435&s=lawn-garden&ie=UTF8&qid=1413515435&sr=8-1&keywords=solar+fountain](http://www.amazon.com/Majestic-Solar-Power-Fountain-Brushless/dp/B00J59EIXW/ref=sr_1_2?ie=UTF8&qid=1413515435&s=lawn-garden&ie=UTF8&qid=1413515435&sr=8-1&keywords=solar+fountain)

**Plant sources:**
- **Free Transplants**
Grice Marine Lab Green Teaching Garden
- Brown-eyed Susan (*Rudbeckia fulgida*)
- DNR Outdoor Classroom Rain Garden
  - Blue mistflower (*Conoclinium coelestinum*)
- Sharleen’s yard
  - Swamp sunflower (*Helianthus angustifolius*)
  - Purple coneflower (*Echinacea purpurea*)
  - Swamp lily (*Crinum americanum*)

Roots and Shoots Nursery, West Ashley, SC
- [http://rootsandshootsnursery.com/](http://rootsandshootsnursery.com/)
  - Cardinal flower (*Lobelia cardinalis*)
  - Scarlet Hibiscus (*Hibiscus coccineus*)
  - Southern Marsh Canna (*Canna flaccida*)
  - Swamp milkweed (*Asclepias incarnata*)
  - Orange milkweed (*Asclepias tuberosa*)
  - Narrowleaf evening primrose (*Oenothera fruticosa*)
  - Beebalm (*Monarda*)

Charleston Aquatic Nursery, Johns Island, SC
  - Native aquatic plants for the pond

The South Carolina Native Plant Society Lowcountry Chapter’s Spring Plant Sale

Hyam’s Garden Center, James Island, SC

Plant Delights, Raleigh, NC (Carnivorous plants and other hard-to-find species)
  - Pitcher Plants
  - Tracy’s sundew (*Drosera tracyi*)
  - Dense blazing star (*Liatris spicata*)
  - Grasses (*Carex cherokeensis*)

Native plant resources:
- Building a Bog Garden: [http://www.bbg.org/gardening/article/a_bog_garden](http://www.bbg.org/gardening/article/a_bog_garden)

**Total Request Amount:** $4,995.97

**INTEGRATION**
Grice Marine Lab - Bob Podolsky (Director)--permission
CofC IACUC - Pete Meier (Grice IACUC Liason)--IACUC protocol #2013-001
CofC Grounds - Paty Cowden (Director)--permission/collaboration
CofC Physical Plant - Roland Craft (Engineer responsible for GML)--permission/collaboration
Carolina Clear - Kim Counts--collaboration
Dear Sharleen and Rebecca,

As Director of Grice Marine Lab, I am writing in support of the project you have outlined in your sustainability proposal, to install a pond and wetland garden by the southeast corner of the Grice Marine Lab main building, with approximate dimensions of 20' x 15'. Grice Lab Manager Greg Townsley and Marine Operations Manager Pete Meier will be available to assist as needed. Letters of support from Paty Cowden, Director of Grounds, and Roland Craft, Physical Plant engineer with responsibility for Grice Marine Lab, are included below.

Thank you for taking on this initiative and I wish you success with the project.

Bob

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Robert D. Podolsky, PhD
Director, Grice Marine Lab
Associate Professor of Biology
College of Charleston
205 Fort Johnson Rd.
Charleston, SC 29412
843.953.9186 (o) .9199 (f)

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From: Cowden, Paty Spearmen
Sent: Wednesday, October 15, 2014 4:51 PM
To: Podolsky, Robert David
Subject: Re: Grice rain garden & HVAC runoff - meeting Wed @ 9:00 AM

Bob, I have read the proposal and would be happy to help out. Let me know when and how you need our assistance.

Paty

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From: Craft, Roland R
Sent: Monday, September 29, 2014 9:20 AM
To: Podolsky, Robert David
Cc: Sharleen; KIMBERLY A COUNTS; Balazs, Rebecca Joy (Student); Townsley, Greg; Bailey, James M; Cordray, John A
Subject: RE: Question about Grice rain garden & HVAC runoff
Bob: The Physical Plant will support your use of the condensate water, assuming that either your department or Sustainability will cover the cost of the collection and irrigation systems. We will pipe to the collection tanks and provide an overflow drain.

Roland

CONTINUATION

This project will be maintained by the Green Teaching Garden Coordinator (a volunteer elected position held by a graduate student in the GPMB program) in coordination with MBGSA and other student organization volunteers. Continuity and sustainability support will be provided by Greg Townsley, the Grice Lab Manager. A College of Charleston Grounds person will assist with limited weekly maintenance of the garden; because the HVAC condensate is constantly produced in all seasons, minimal work may be needed other than weeding and plant upkeep. Garden work days will be planned each semester for both the Green Teaching Garden and the HVAC Condensate Native Plant Garden; volunteers will assist with seasonal upkeep (pruning, transplanting, re-mulching, etc.) on these days. In the first year of implementation, condensate flow rate will be monitored carefully to identify times of bog desiccation risk (low water flow or high evaporation rate), and maintenance practices will be adjusted accordingly. To encourage continued visitation of the garden, its location and purpose will be included in the Grice walking tour brochure available at the front office.