AC 2010-365: SHANGRI LA: A LEED PLATINUM PROJECT

Enno Koehn, Lamar University

Enno "Ed" Koehn is Professor of Civil Engineering at Lamar University. Dr. Koehn has served as the principle investigator for several research and development projects dealing with various aspects of construction. He also has experience in the design, scheduling, and estimating of facilities. He has authored/co-authored over 200 papers in engineering education, as well as the general areas of civil and construction engineering. Dr. Koehn is a member of ASEE, AACE International, ASCE, NSPE, Chi Epsilon, Tau Beta Pi, Sigma Xi, and is a registered Professional Engineer and Surveyor.

Nishant Shah, Lamar University

Nishant Shah was enrolled in the College of Graduate Studies and the Department of Civil Engineering at Lamar University. He was awarded the Master of Engineering (ME) Degree in 2009.

John Koehn, Chadron State College

James F. Koehn is an Assistant Professor in the Department of Business and Economics at Chadron State College, Nebraska, where he is also the Director of the Nebraska Business Development Center. Koehn currently serves on the Education Advisory Committee of the Nebraska Board of Public Accountancy. He holds Bachelor of Arts and Master of Accounting degrees from Rice University and earned a Juris Doctor from Baylor University. Koehn has worked for an international accounting firm in both their Houston and New York City offices, and he practiced tax and corporate law in Austin, Texas. Dr. Koehn is a member of the American Institute of Certified Public Accountants, Texas Society of Certified Public Accountants, and the State Bar of Texas.

SHANGRI LA: A LEED Platinum Project

Abstract

Over the years Shangri La has represented a place of beauty, peace and enlightenment. Today, nestled within 252 acres in the heart of Orange, Texas, Shangri La Botanical Gardens and Nature Center is a program of the H.J. Lutcher Stark Foundation, whose mission is to improve and enrich the quality of life in Southeast Texas and encourage and assist education. The unique ecosystem of Shangri La presents an ideal opportunity to further that mission as well as carry on the vision of H.J Lutcher Stark, the man who originally developed it more than 60 years ago.

Shangri La Botanical Gardens and Nature Center is the first project in Texas and the 50th project in the world to earn the U.S. Green Building Council's Platinum certification for LEED®-NC[1], which verifies the design and construction reached the highest green building and performance measures. Specific green features are included in the LEED section of this paper.

As one of the most earth-friendly projects in the world, Shangri La Botanical Gardens and Nature Center offers a glimpse of how people can live in harmony with nature. The combination of gardens and nature at Shangri La presents a serene oasis for retreat and renewal. It also gives civil and construction engineering students the opportunity to explore, discover and learn the concepts of sustainability.

Introduction

“Gardening requires lots of water - most of it in the form of individual perspiration”. Without gardens the world will be like a black and white movie. This, now-a-days no one would like to prefer. There are lots of other forms of entertainment today. However, nothing can replace gardens and forest woodlands. They give us immense satisfaction and peace. They also help in reducing environmental hazards.

Shangri La is one such kind of a garden. It is a botanical garden which covers 252 acres land in the heart of a city. This garden has more than 300 plant species which attracts tourists, botanists, etc.

Shangri La

'Shangri La' is a place of beauty, like a paradise on earth. In 1942, lumberman and philanthropist Lutcher Stark began designing and constructing his own Shangri La on a 252-acre site along Adams Bayou, a cypress/tupelo swamp in Orange[2], at the far southeastern corner of Texas near its border with Louisiana. By 1950, as national magazines gave the place widespread exposure, thousands of people were visiting the site. Unfortunately, in 1958, a snowstorm also visited the town, destroying and eventually closing the garden for approximately 50 years.

In 2002, the Nelda C. and H. J. Lutcher Stark Foundation[3] decided to rebuild the botanical garden. The foundation hired noted landscape architect Jeffrey Carbo, of Alexandria, La., and terrestrial ecologist Michael Hoke, (Fig. 1) recipient of a presidential teaching award and founder

of the Nature Classroom (an environmental education program in Orange), as the managing director.

Fig. 1. With Mr. Michael Hoke (Managing Director)

Supportive of an open programming process, the Stark Foundation allowed design discussions and site discoveries to affect the project's scope, saying only that they wanted it to be "as green as possible." Carbo researched Lutcher Stark's history and his philosophy of art, particularly its connection to nature. He also studied Stark's seemingly endless artifact collection, of which many pieces were eventually incorporated into the construction. As the magnitude of the effort and the educational possibilities revealed themselves, the potential of a equally important architectural component was recognized. Carbo suggested Lake/Flato Architects of San Antonio as an obvious addition to their team. Together, the firms designed the reclamation of the site, formalized its use with an architecture of minimal environmental impact, and defined the unique hybrid-botanical garden/nature center. In 2005, when Hurricane Rita imposed a level of chaos requiring a six-month cleanup, the team took all necessary changes in stride as change is the role of nature.

Orientation

When visiting the site, guests park remotely and are bused to the Orientation Center an assembly of program specific spaces that includes a volunteer headquarters, garden shop, and café skirting

a formally edged lawn. Entry to the Orientation Center and view of the lawn occurs in the shade between the Administration Building and a water draped Meditation Pavilion that serves as a preamble to the Exhibit Hall and Discovery Theater. Here, visitors witness the history of Shangri La through clever displays and enlarged replicas of paintings commissioned by Lutcher Stark of his utopia. After walking through a cool "fog wall" (reminiscent of the Lost Horizon portal), visitors experience a video on the philosophy and beauty of the site. Afterwards, as a blackout screen rises to reveal a dramatic view into the actual site, visitors choose between exploring the two distinctly different parts of Shangri La: the Botanical Gardens and the Nature Discovery Center.

Walking along the edges of the Wetlands Demonstration Area, which represent nature's swamp cleaning methods, (Fig. 2,3,4 & 6) visitors are drawn toward the Botanical Gardens through a newly constructed gable joining two fully restored greenhouses (Fig. 7) built in the 1950s with aluminum and glass above brick bases. Beyond, two oval, granite rimmed frog ponds from Lutcher Stark's construction anchor the arrival point.

Fig. 2. Water getting cleared by plants

Pond #1

The water coming in from Ruby Lake is cloudy and full of nutrient wastes created by years of bird droppings, but the sedges, bulrushes, lizard tail and other plants in this pond will begin a filtering process that will clean this water up!

Nitrate levels in this water are ten times higher than in drinking water, and oxygen levels are only one-fifth of what they should be.

Nutrient Removal in Wetlands

Wetlands help move nutrients like phosphorus and nitrogen from out of the water, where they don't belong, to deep into the soil, where they do belong. Good bacteria in wetlands also process the nitrates into nitrogen gas, part of the air we breathe.

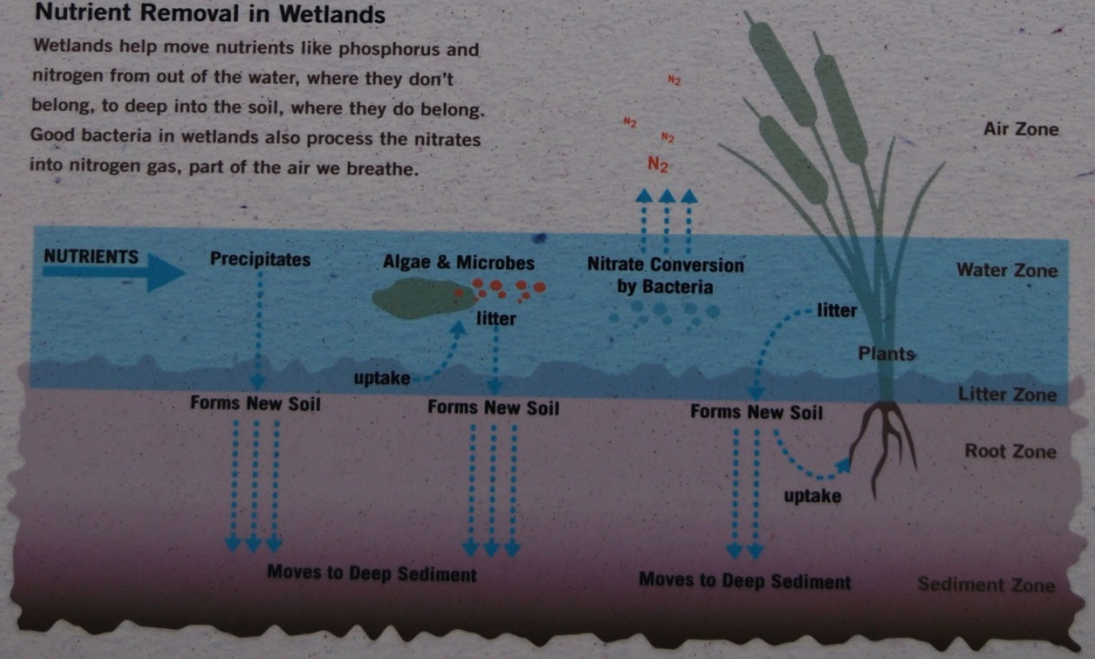

Fig. 3. Pond # 1

Fig. 4. Clear Water

Fig.5. Pavement

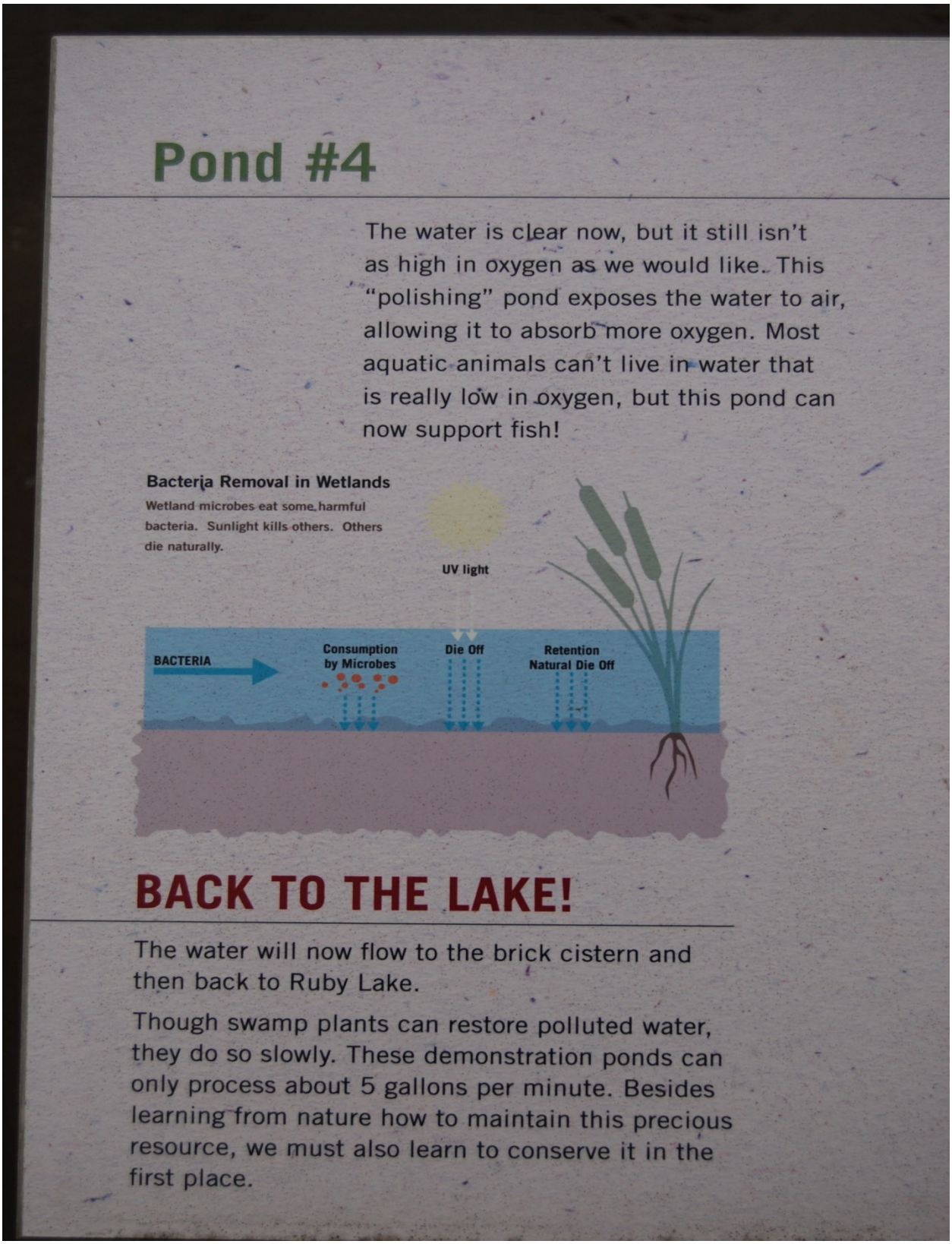

Fig. 6. Pond # 4

Fig.7. Green House

Gardens

Exhibiting over 300 species[4], (Fig.8,9 & 10) the gardens are organized along a primary path. To the left of the path, the landscape is described in five garden "rooms." A more intimate circulation system based on leaf patterning and veining moves the observer through the rooms named for design elements of art Line, Shape, Texture, Pattern, and Color. Right of the main path, biofiltration, hosting native plants, channels water back to Ruby Lake, and visitors can choose to enter the Hanging Gardens, a rain shelter, or a shadow slatted blind reached from behind a thickly planted landscape buffer best described as a people blind.

A water feature anchoring the garden's most urban southeast corner the path stops at the Cypress Gate, built from some of Rita's largest downed cypresses. The Gate (Fig. 11) appears to float and frames a potential sunset view from the middle of the pond. Here, Stark's interest in the reflective qualities of water are introduced as azaleas many salvaged from the original garden begin to drape the perimeter.

Fig.8 Contrast Garden

Fig.9 Contrast Garden

Fig10 Contrast Garden

Fig. 11 Gate

Here visitors can experience four additional sculpture garden rooms designed by Canadian artist Linda Covit, whose work examines the connection of art and nature by thematically incorporating graphic figures reflected in plant forms Spiral, Branching, Circle, and Stripe. The Magnolia Terrace then brings visitors back to the point where the alternate experience of the site can happen.

Conceived as an educational experience for all ages, the Nature Center includes the "Here We Grow" children's area (Fig. 12, 13 & 14) built around a third Stark greenhouse. Dotted with cobalt bottle trees an allusion to the Deep South and Stark's antique birdhouse collection, the area allows budding horticulturalists to trace the planting cycle from germination through full bloom.

Fig.12. Children Garden

Fig.13. Children Garden

Fig.14. Bottle trees in Children garden

Environmental Planning

South of the children's area and halfway to Adams Bayou, sits a screened in, hands on classroom and science lab at the start of the nearly mile long boardwalk system extending into the wetlands. Appearing to hover, although supported by steel helical piers carefully twisted in place for minimal tree disruption, the boardwalk leads toward the boat dock at the water's edge. Boat excursions along the bayou, past a 1,300 year old cypress dubbed "The Survivor," ferry visitors to two educational outposts. Each features a unique learning shelter efficiently situated at the verge of three eco-zones swamp, forest, and grassland.

As mentioned before, Shangri La is the first project in Texas and the fiftieth in the world to earn the U.S. Green Building Council's Platinum Certification for LEED New Construction. (Fig.15)

Significant to the environmental master planning strategy was the decision to use new landscaping to filter and restore the water quality of the formerly nitrogen-stuffed, oxygen-starved pond and wetlands, which are nesting grounds for numerous species of water fowl. The vegetated wetland system takes approximately three months to filter the entire volume of Ruby Lake, running its water through the gardens and returning it in clean condition.

The Wetlands Demonstration Area educates visitors to this process and further cleans the water in a visible way.

Fig.15 Green

Green Sustainable Design

Utilizing many green design strategies to first reduce the energy requirements of the built structures, the architectural design along with high efficiency equipment and lighting reduces energy costs by 70 percent. Well considered orientation of the buildings for passive solar heating and cooling, optimized overhangs, and window placement all contribute to energy savings. High albedo roofing, (Fig.16) chosen to reduce heat island effects, also collects rainwater for flushing plumbing fixtures and landscape irrigation systems. In addition, much of the approximately 14,000 square feet of buildings include open air structures. Facilities that are air conditioned employ a highly efficient closed loop geothermal system that use the deep earth's more consistent and cooler temperatures.

Building material selections support the decision to make Shangri La a resource conserving project. External choices included brick, cypress, cedar, and galvanized steel, (Fig. 17) which, rather than requiring the application of a possibly deteriorating secondary finish, should sustain themselves with low maintenance. Also it has a waterless urinals which saves 45,000 gallons of water annually.

Fig.16. Roofing

Fig.17. Recycled material used for chairs

Almost 13 percent of the building materials comprise recycled content: reclaimed brick (compatible with the existing greenhouses) originated in a 1910 Arkansas warehouse; 41 percent fly ash is substituted for Portland cement in concrete; Louisiana sinker cypress became siding, slats, and exterior fencing; boardwalks (Fig. 19) were manufactured from an eco-friendly product of recycled plastic and wood; and pervious parking areas re-used asphalt from nearby repaving efforts in Orange. And when Hurricane Rita destroyed over 55,000 trees on the site in 2005, much of the cypress was used for benches and tables at Shangri La.(Fig.18)

Fig.18 Destroyed Trees Used

LEED

Green Design Strategies

Shangri La Botanical Garden and Nature Centers building complex is a certified Platinum LEED building by the United States Green Building Council. Green features include[1]:

- The Restricted Parking Lot is recycled asphalt from Green Avenue and Simmons Drive, Orange, TX.
- Bike racks are available to encourage visitors and employees to bike to Shangri La.
- Metal cisterns collect rainwater to irrigate the courtyard area and flush the toilets.
- Thirty six solar panels at Shangri La produce 300 watts of electricity. When the sun shines the panels produce 40% of the electricity required to run the orientation center buildings. Energy is also purchased from green sources - wind power plants in west Texas.
- A geothermal well system provides the heat sink for the heating and cooling units. 34 closed loop wells are utilized along with one 700' deep well. This allows Shangri La to take advantage of the consistent temperatures deep within the earth.
- The metal roofing reflect heat which allows for more than 50% reduction in energy usage.
- Each waterless urinal saves 45, 000 gallons annually.
- Floor coverings are made from easily renewable materials such as corn. The corn based carpet is laid in two foot squares so small areas may be replaced as necessary.
- Sinker cypress was used in some areas.
- Large building windows allow daylight to flow into the office.
- Fallen trees from Hurricane Rita were incorporated into the construction. Large cypress trees felled by the storm were milled on site using mobil milling equipment to create benches, a boardwalk in the Pond of the Blue Moon and a rustic folly.
- Concrete foundations are 40% fly ash, a mineral resulting from the combustion of coal which is usually burned off into the atmosphere. This reduces the amount of cement used and reuses fly ash that would otherwise go to a landfill.
- The plastic walkways throughout Shangri La look like wooden boards. They are made from recycled plastic and recycled wood. The amount of plastic recycled for this job equals 1.1 million milk jugs or 3.6 million plastic bags. It's 50% plastic and 50% wood fibers.
- Soy-bean based insulation is used in the walls and ceilings throughout the buildings.
- Bricks at Shangri La were salvaged from an old warehouse built in Arkansas in 1910.
- Organic products and beneficial insects are used instead of synthetic pesticides or fertilizers.

Future

Shangri La's Future

With its spring 2008 opening, Shangri La has the resources and mandate to become an outstanding botanical garden and nature center. With its goal of Platinum certification in LEED®-NC achieved, Shangri La will continue to practice what its staff preaches and to teach what its staff practices to a variety of audiences.

Ecological Restoration

In September 2005, Hurricane Rita wreaked havoc on Southeast Texas, including Shangri La. The Category 3 hurricane furiously blasted wind gusts of 167 miles per hour and straight-line winds of more than 120 miles per hour, destroying more than 30,000 trees in Shangri La. In an effort to restore Shangri La and the entire area, the facility has and continues to strive towards ecological restoration. Immediately after the storm, with assistance from Temple Inland, Orange, a reforestation was commenced with the planting of more than 15,000 Longleaf Yellow Pines. This effort will continue through a grant from the U.S. Fish and Wildlife Service in which an additional 4,000 native trees will be planted in Shangri La during the winter of 2007-2008. Mother Nature will make the largest impact on this effort as she begins the process of plant succession in Shangri La, adding thousands of new plants and increasing the biodiversity of Shangri La significantly.

Invasive Species Removal

One facet of ecological restoration is the removal of invasive species, including the Chinese tallow tree, Chinese privet, and water hyacinth. This process entails removing invasive species and replanting with native plants that thrive in the native environment. Native plants contribute a tremendous amount to the area while requiring fewer resources to maintain, making this process beneficial not only to all native wildlife but also to the community.

Fig.19. made from recycled milk jugs

Summary and Conclusion

There is a huge influx of Civil and Architecture students, teachers, and design aficionados, all of whom are willing to travel across the state to visit the new platinum certified project and carry home lessons learned. Also contractors and suppliers have a new, locally established network. The high level of expertise culminating in this project can only help stock the region's toolbox of sustainable design strategies and techniques.

Restoring the gardens of Shangri La to their original condition would be cause enough for celebration in Orange, but the newly rediscovered Shangri La goes much further. In giving back a reconnection to nature that is not only viewable, but usable, educational, and kind, the Stark Foundation has provided a deeper lesson: nature deserves continuous respect.

Bibliography

1. http://www.shangrilagardens.org/About-Shangri-La.aspx (accessed - 13th October'09)
2. http://en.wikipedia.org/wiki/Shangri-La (accessed - 13th October'09)
3. http://www.shangrilagardens.org/The-Stark-Foundation.aspx (accessed - 13th October'09)
4. http://www.shangrilagardens.org/Visit.aspx (accessed - 13th October'09)
5. http://www.shangrilagardens.org/getattachment/c503793a-4f41-4669-ba77-4daef316d6ff/Volunteer-Handbook.aspx (accessed - 15th October'09)
6. Mr. Michael Hoke (Managing Director of Shangri La)

Acknowledgement

The authors wish to recognize Ms. Linda Dousay for her assistance with the production activities involved in preparing this paper.