EXPLORING BROWNFIELDS: REVITALIZATION WITH WETLANDS AND GOLF COURSES

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PAPER

EXPLORING SUSTAINABLE BROWNFIELDS Revitalizing Brownfields through the Creation of Wetlands and Golf Courses

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ABSTRACT

The idea of building a golf course near natural wildlife and complex ecosystems can be a controversial topic to the general public. Many believe that the chemicals used to balance the turf grass systems on the courses can be toxic to the natural wildlife and damaging to plant life. These same believers have considered the possibilities of amphibian mutation between the species living in these habitats, as well as the potential for causing droughts among these once vast and lush wetlands. But, what about areas of land that have already been damaged? What if there was a way to bring wildlife and greenery back to a better state than it was before it became a toxic, undeveloped area of land? What if we could revitalize brownfields in a sustainable way through the use of wetlands, and accompany them by the beauty of golf courses? Is it possible to merge these three factors in a natural way?

The goal of this study is to educate the public about the possibilities of greening brownfields in a natural way by sustainably merging a natural and man-made environment that compliments its surrounding habitats, promotes good health, and educates the public about natural ecosystems.

KEYWORDS

Brownfields, Wetlands, Golf Courses, Sustainability, Ecosystems, Natural Wildlife, Landscape

INTRODUCTION

Since the mid-15th century, individuals have adopted a sport that has many significant aspects behind it. These aspects pertain to the influences of the landscape, the facilities around the landscape, and the company of others during a single round. This adopted sport is known as golf. It is a game that I have played since I was 7 years old. When I am stressed and need to get away, I run to the

golf course for inspiration and peace. The nature of the course soothes my thoughts and takes my mind off of the outside world. It brings me to a place of meditation. The natural surroundings and vibrant wildlife are pleasing to the eye and eventful to watch. To many, this statement is very true. To others, quite the opposite. Some of these "others" believe that golf courses are toxic to the environment.

They have also considered the idea of golf courses causing genetic mutations towards certain amphibians and forcing other natural wildlife to flee their nesting grounds.

While many people do not understand the impact of golf courses on nature, golf course superintendents do. As a golf course superintendent, it's their job to manage the materials, courses, time, finances, maintenance, and functions. These professionals have established a society to protect the natural wildlife and make a statement to fix certain problems. This society GCSAA (Golf known as Course Superintendent Associate of America). GCSAA also holds a philanthropy that is involved in environmental golf courses. "The Institute Environmental for Golf collaborative effort of the environmental and golf communities, dedicated to strengthening the compatibility of golf with the natural environment. The Institute concentrates on delivering programs and services involving research, education and outreach communicate the best management practices of environmental stewardship on the golf course."1

This paper will educate the public about wetlands, brownfields, and golf courses. It will analyze the impacts of each system on one another and evaluate the potential prospects of revitalizing brownfields through methods of wetlands. Golf courses will be added to the equation in hopes of successfully merging the three while protecting its natural surroundings. Greening a brownfield through means of wetlands and golf courses, will give back to nature while providing extra-curricular activities and educational facilities to the public.

RESEARCH APPROACH

This research will take place by investigating natural wetlands, exploring old brownfield sites, and enjoying as much golf as needed to conduct an adequate understanding of these ecosystems.

Understanding wetlands can be very difficult and complex. Knowing which type of wetland to use near golf courses, and how effective each one is to the environment, is a key component to merging golf courses with

wetlands. By researching natural wetlands and understanding how they function, can help provide the best approach to a sustainable course. This research will analyze types of soils, chemical-to-water ratios, different plant life to maintain the natural surrounds, and understanding key wildlife species that greatly impact theses environments. Not only will the plant life and wildlife be analyzed but also the effects of water runoff and the surrounding obstacles that might be faced when including golf course turf grass and pesticides near these wetlands. Understanding how brownfields work and how they can be revitalized is the biggest issue that will be faced, because choosing multiple sites means evaluating the amount of chemical residue and toxic soils in the surrounding areas.

HOW DO WETLANDS WORK

A wetland is an area of land that is saturated with water and attracts a diverse amount of animal species and plant life. Wetlands are an ecosystem that plays a number of roles in the environment. They can act as a water purification system, regulate flood control, storm protection and shoreline stability. They act as recreational uses for the public and nesting centers for the wildlife. They can be artificial or natural and seasonal or year-round. Wetlands can be found in any climate and are under a threat for extinction due to mining, dumping waste, and humans filling them in for recreational lakes and road beds.2 primary uses that golf courses can benefit from aroundwater replenishment, purification, and recreational uses. These uses are the main focus in a successful merge between golf courses and wetlands. The wetlands collect water from outside sources such as water run-off, creeks, and large bodies of water, i.e. ocean. After the water is collected it filters into the wetland stream where certain plants, usually cattails and bulrushes, are used to break down fertilizers and oils into proteins that plants can use for nutrients as it filters the water. Pollutants are then absorbed and converted into gases that get transmitted back in the Earth's atmosphere. Once the water has been purified it continues down a path and gets absorbed into the soil to replenish the ground water supply. 3

Several other benefits that wetlands provide to the environment are an abundant source of wildlife and plant species. These benefits are a part of a larger cycle in this advanced ecosystem. Certain species of fish are added to the wetlands to reduce the amount of insects and also help filter water molecules. More plants are then added for the fish to feed on, and a ripple effect happens because of this. Once those main ingredients are stable in the wetlands. More species of animals such as amphibians, reptiles, and birds begin to inhabit the area. Once this happens more trees and plants are produced as a natural cycle of nature.



1: Everglades National Park, FL

WHAT ARE BROWNFIELDS? HOW DO THEY IMPACT THE ENVIRONMENT?

Brownfields make up more than "5 million acres of abandoned industrial sites"4 They range from all over the United States, many pertaining to the Midwest regions deal with oil plants and steel mills, while regions around Texas focus mainly on oil plants.5 Brownfields are areas of land that were previously used for industrial purposes such as oil plants, steel mills, commercial use, gas stations, dry cleaners, or any areas of land that have been contaminated by low concentrations hazardous waste and pollution. These areas of land must have the potential for reuse once they have been cleaned up. Usually clean ups happen when a developer wants to revitalize the area for public parks or business development and reuse for commercial strips.

It can be rather difficult for developers to purchase and clean-up brownfields. The Environmental Protection Agency (EPA) has strict rules and regulations for the clean-up procedure. These regulations help to ensure the proper clean-up before buildings, residents, or parks are allowed to provide public access to the area. EPA has established these rules so that developers do not build on toxic land. If residents are built on these areas, they must be properly cleaned for greenery and waterlines to filter through the area. If parks are developed in the area, these spaces need to be cleaned up so plant life and wildlife can survive without being poisoned or damaged.

Redevelopment of brownfields can impact the environment in multiple ways. They can provide growth to the economy through means of development. They can give back to nature's eco-systems by greening these spaces and land through restoring the means revitalization. While it can be extremely costly and a high risk of law suits, revitalization and redevelopment of brownfields do have positive incentives to the individuals trying to clean-up these spaces. The US Government provides incentives and tax deductions to those interested in developing these regions. As discussed the greening of brownfields have a major impact on the economy, but also a huge impact on the Earth's eco-system. Greening these gives brownfields back to environment by bringing its natural landscape back to, if not better, than what it was before it became a contaminated area of land.



2: Image of Brownfield run off into a creek

HOW DO GOLF COURSES WORK?

A golf course is, in some ways, similar to the wetland ecosystem. They both provide an atmosphere suitable for many animal species

and plant life. Golf courses require a large amount of water, not to collect like the wetlands do, but to provide irrigation for the course. Golf course layouts are almost as intricate in concept and programming as wetlands are. Although the only thing that many people see is the course layout and design, which just scratches the surface of the courses, the main controller behind a successful course depends on the irrigation system and the hands-on manicure treatments that are controlled by the irrigation systems.

The irrigation system is spread out along the entire length of the course, and it provides water and drainage to the areas of refuge. This system is set up with a main pumping station located off site or near the clubhouse. Water sprinklers are then placed in strategic locations, not to interrupt the players' game, but to evenly distribute water on and off the course. Water is then absorbed through the soil.

When the soil has enough water and nutrients the excess water is properly drained back to the pump where it is then treated and filtered. This treatment systems tests the pH levels, sodium levels, chorine levels, TOC levels, and other chemicals that could be broken down to provide nutrients to plant life.6 Once these chemicals have been tested, they are sent through a second filtering pump before the water flows back to the irrigation pump and reused on the courses. Although this system is very intricate and requires much attention and structure, these filtering systems are very similar to the types of plants and wildlife used in a natural wetland.

CASE STUDY 1 MERGING GOLF COURSES AND WETLANDS

Costa Mesa Golf Club (CMGC) is located in Southern California. This course resides several hundred feet away from Fairview Parks,7 a recently developed man-made wetland and recreational park. While this course has been around longer than the current wetland, it provides a rich source of community use and economic revenue to Orange County, CA. Fairview Park has a team of Engineers, Biologists, and the community working together to recreate an ecosystem similar, to what they think, was around 3 million years ago. This park is a 37-acre project that cost more than \$5.2 million.

The community hopes to enlighten its past by bringing back wildlife to the area. This park now inhabits species such as tree-frogs, western toads, lesser yellowlegs, killdeer, redtailed hawks, western bush rabbits, coyotes, pocket gophers, king-snakes, gopher snakes, lizards, and many more animals. These wetlands also accommodate plant life such as grassland plants, coast live oaks, arroyo willow, California rose, mulefat, buckwheat, back sage, and cholla cactus.8

This 37-acre man-made wetland has been vital to its animal and human community. Since it's opening in February 2013 many natural wildlife species have accumulated in this region. Cyclists, joggers, and eager parents have been taking their children to this park for knowledge, relaxation, and simply to enjoy nature. Naturally the animals that have nested in this area are free to come and go as they please, however, most have managed to stay in the area building a life of their own.

A key component to this project is the pumping system from a nearby channel. This facility "pumps water into the first of six ponds, where it begins a natural filtration process,"9 as explained in the article. After entering the first pond, it flows downstream to the other ponds. Each pond has different plant and wildlife in them to maintain a certain filtration process. These different types of plants absorb certain bacteria and protein from the water. As the water flows downstream the plants will filter chemicals such as nitrates from the metals and fertilizers. Engineers are expecting 40 million gallons of annual runoff that will either flow into the ocean or the Huntington Beach treatment plant. With this wetland system the U.S. Army Corps of Engineers are hoping to capture some of that runoff and re-filter it back through the wetlands as a natural filtration process and possible use such as a gray water system.

CASE STUDY 2 IMPACTS OF GOLF COURSES ON WETLANDS

Studies are being done in Sweden that prove golf course ponds and wetlands attract more natural species than those around residential areas and man-made park regions. These courses are located in the greater central Stockholm regions and have shown golf course

habitats to shelter 11 more amphibian species than those in residential areas.10 studies also show that courses can contribute to the support and conservation of wetlands, animal life, and plant life. The larger number of invertebrates' macro species are between permanent freshwater surveyed on the golf course. The ponds that were surveyed away from the golf courses showed higher levels of chemical intake that can be harmful to the natural species. These researcher found no evidence of a connection to the sizes of the ponds. GIS in Sweden have found that these fresh water ponds provide over a quarter of all natural water to the Stockholm region. Based on the research done in this area, it is clear that golf courses have successfully created natural wetlands and have increased natural fauna. This study proves that residential ponds are more of a threat than golf course ponds, thus courses and wetlands can successfully be merged in a natural way.



3: Image of a golf course surround natural Wetlands

CASE STUDY 3 MAN-MADE EDUCATIONAL WETLANDS AND NATURAL PARKS

Hong Kong Wetland Park is a 61-acre natural wetland park located in Hong Kong, China. This park thrives on wildlife, plant life, and tourists. Although many wetlands are undisturbed and left alone for nature, this park is unique in ways that educates the public and allows for natural habitats to occur. There are several different wetland parks in this facility, each adapting to different species of animals. Sitting off the coast of the Deep Bay near the Shenzhen Bay lies the city of Hong Kong, and within the city is the park for local residents,

traveling tourists, and educational facilities. "The mission of the Hong Kong Wetland Park is to foster public awareness, knowledge, and understanding of the inherent values of wetlands throughout the East Asian region and beyond, and to marshal public support and action for wetland conservation. The Hong Kong Wetland Park will also be a world-class ecotourism facility to serve both local residents and overseas tourists."11

When this park opened in May 2006 the engineers assumed many of the local wildlife would migrate to this ecological center. Since its grand opening there has been a flourish of diverse wildlife in the region. In 2013 a parkwide survey was conducted and found that more than 246 birds had migrated to the area. Making up more than 47% of these birds are water birds or birds that rely on survival through the wetland ecosystem. Other species such as mammals, freshwater fish, reptiles, amphibians, and other plant life have emerged in this area, as well. The quality of water has also improved tremendously in the area. The pH levels, nitrates, and other chemicals have been tested at excellent levels for wetland migration and reproduction.12 Also "in 2013, the Hong Kong Wetland Park attracted about 440,000 visitors, including approximately 61,000 overseas tourists. During the year, the Park provided over 4,700 guided tours for about 77,000 visitors. In addition, the Park organized 95 educational talks attracting about 5,200 participants."13

This park hopes to maintain this natural ecosystem and conserve them for as long as possible. The Hong Kong Wetland Park also hopes to create a facility that complements and supplements its natural surroundings. In doing so, this concept has pertained to interactive awareness of wetlands and their main functions. These wetlands do provide positive aspects for Hong Kong. To list several, they are to store, filter, protect, provide, and shelter. They store massive amounts of water runoff, filter waste and break down pollutants, protect shorelines against floods, erosion, and storm waves, provide food, medicine and natural materials, and shelter the living organisms. This facility all around brings wetlands back into the region, provides education to everyone, and boosts the local economy in a healthy way.



4:Hong Kong Wetland Park

CASE STUDY 4 REVITILIZATION OF BROWNFIELDS

Pennsylvania has some of the largest mine fields and steel mill plants in all of the United States. Currently there are 51 brownfields located in the state of Pennsylvania.14 Many activist groups and businesses are exploring ways to clean up these old and abandoned sites. One excellent example is located in Vintondale, PA. This site is approximately 320 acres wide and houses approximately 400 residences.15

This small 5:Map of the existing Brownfields town was

once a mining field and now just sit empty polluting the natural rivers and wildlife that flows through the area. In 2000, the U.S. Army Corps of Engineers raised money to restore the vast lands and protect the remaining wildlife. By doing so, a group of developers and activists got together to clean-up this coalmine by introducing wetlands to the area. By adding wetlands, this construction took about 3 years to complete. There were four phases of this project. The first was to dig up the top soil from the coal-mines and replace it with compost items, cow manure, saw dust, dredged material, and bony. The second and third phases included digging ponds for wetlands to be created. These ponds act as a cleaning mechanism that would remove toxic waste from the coal-mines. Once the land was clean and finally approved by the U.S. Environmental Protection Agency (EPA) to build a public park, phase four was started. This last phase included the addition of walkways and trails for the public around the wetlands, a ballpark for the community to gather, and a treatment facility to educate the public about their clean-up restorations and efforts. In

2007, researchers tested the water-to-chemical ratios. As expected there was a reduction of coal-mine sediment and the water in the fourth pond was clean enough to reuse for the towns grey water system. After researching Vintondale Park's efforts to restore the soil in the mine-fields and revitalize them by constructing wetlands, this is evident that sites with less soil damage will be a possible site for my thesis around the coastal regions of the United States.

DISCUSSION OF FINDINGS

After researching and understanding the key components of golf course, wetlands, and brownfields, this persists to a problematic question. Can these three systems be merged together in a successful way? Will this merge hurt the environment and will this impact the economy?

Above I have analyzed four different case studies dealing with golf courses with wetlands and brownfields into wetlands. Based on these case studies it is very evident that they can successfully be integrated. By revitalizing a brownfield through means of clean up, in the

form of wetlands. The wetlands will help cleanup the areas and remove the toxic chemicals and waste in the soil, once these areas have been cleaned-up a golf course will be added to boost the economic revenue, add physical and community activity to the area, and educate the public about greening environment in a sustainable way.

These three additives provide a unique opportunity for architecture to play a role in the clean-up process. Building a club house that is sustainable and friendly to the environment will act as an educational facility to those in the local and tourist community, bring in funds to pay for the clean-up, and act as a centralized treatment facility for the wetlands.

POTENTIAL SITE - SPARROWS POINT, MD

Sparrow's Point is a community located South-East of Baltimore, Maryland, just North of the Old Road Bay. This community is no longer active and has been abandoned since 2005. Sparrow's Point is considered one of the largest industrial brownfields on the east coast stretching more than 4 miles at 385 acres of unusable land.16 This site was used for making steel and building industrial ships.

Originally, Sparrow's Point was a marshland for the Native American tribes, until it was granted to an English settler named Thomas Sparrow, who started developing the land around 1652. In the early 1700s this area grew larger and larger from incoming settlers, building homes, raising farms, and hunting lodges for those traveling through the area. By 1887, Sparrow's Point became a key location for industrial ships to port. Engineer Frederick Wood designed a master plan that would be bought out by the Pennsylvania Steel Company. These once vast marshlands were ruined and destroyed to of the largest establish one steel manufacturing and shipbuilding plants on the east coast.

Today this site run-down and no longer in use. Ships still dock here and there are reminisces of factories and damaged lands. The current owner, Severstal, which is a Russian company, bought the land outright for \$810 million dollars. This would make an excellent site to revitalize and bring back its marshland history. With 385 acres of land, it could successfully maintain a golf course and incorporate a vast amount of natural wetlands.



6: Sparrow's Point, MD

CONCLUSION

Wetland ecosystems are very complex in such a way that it cannot be controlled, only predicted. They provide essential value to the environment and natural wildlife through means of protection, filtration, security, and entertainment. Wetland systems also clean-up areas of refuge from factories, steel mills, oil plants, etc. There intricate systems can filter toxins and pollutants from the soil revitalizing its surrounding areas. These complex systems can be beneficial to their surrounding areas by complementing programs such as golf, both educationally and economically. Based on my research above, I do believe it is possible to merge brownfields, golf courses, and wetlands in a natural way. Rather than building on existing healthy land, it seems more feasible to green already damaged areas of land.

Based on the case studies above, golf courses do not harm the natural wetlands, and the courses could benefit from the wetlands. The studies also prove that brownfields can be revitalized through means of wetlands. These intricate systems allow for architecture to play a different role in the world of golf. Once the brownfields have been cleaned up, the soil can utilize the wetlands water purification system, the course can collect water runoff and reuse it for irrigation purposes. The wildlife and plant life will flourish the area creating a natural ecosystem for all golf courses.

The architecture role comes into play by designing a club house as a centralized treatment facility. It will also be a community center to help educate the public on the uses of wetlands and brownfields. This community center will cater to the public for benefits, functions, conferences, field trips, etc... While the club house aspect of the facility will provide convenience for the golfers and club members. The club house will also educate its members and act as the main water treatment and storage plan as a backup for the wetlands. Water will be pumped into the wetlands as a buffer system before being transferred to in the club house. This concept allows for architects to think in a different way to protect the environment, cater to the golfing population, and provide economic growth for the community of locals and tourists.

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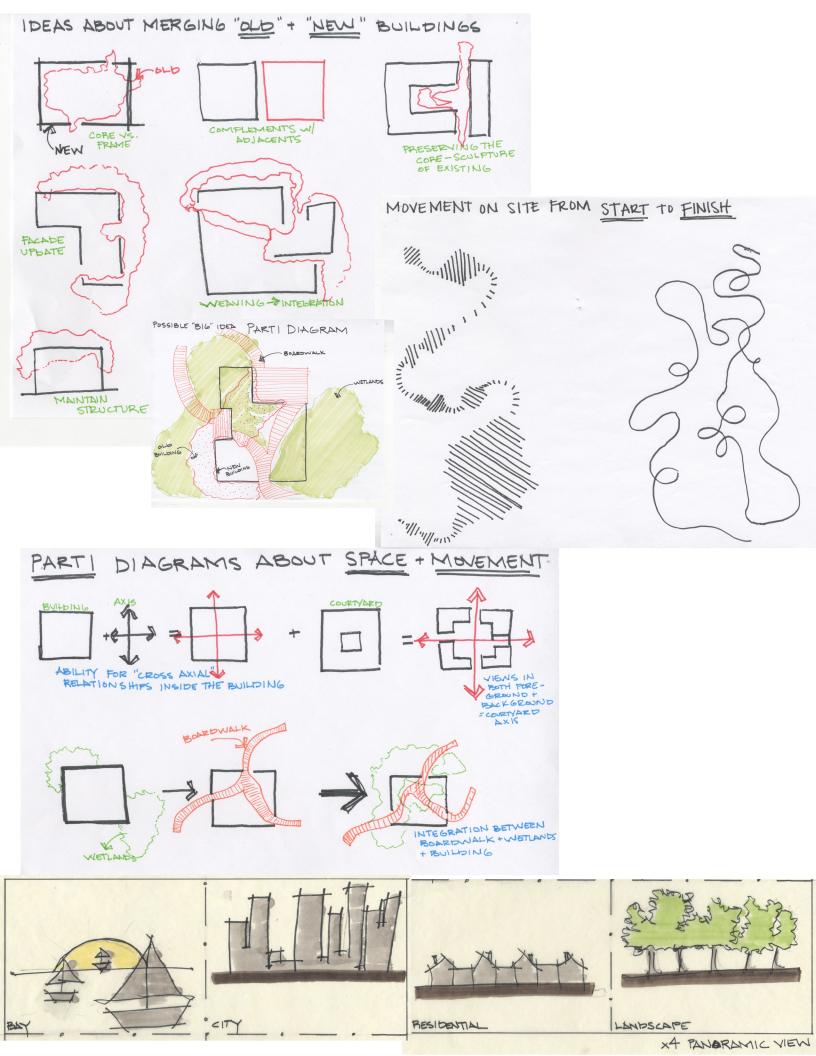
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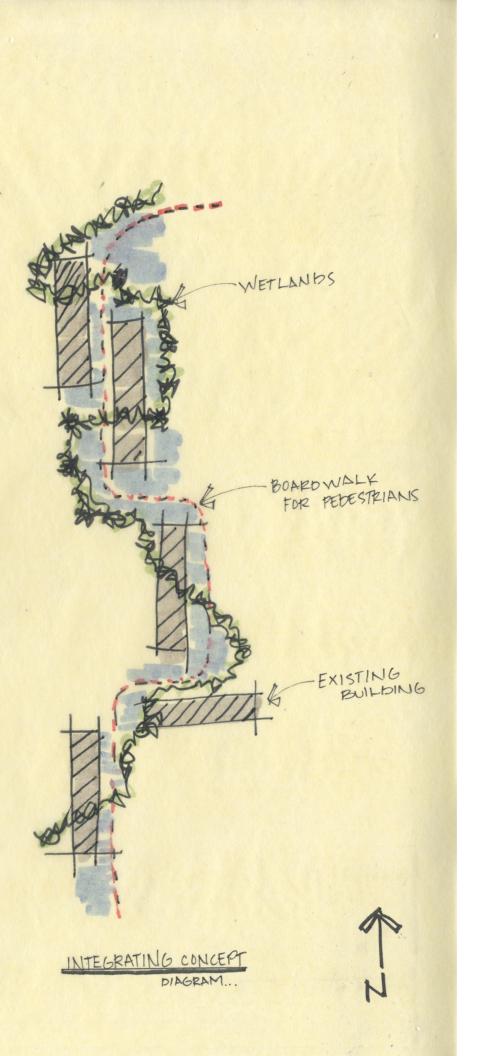
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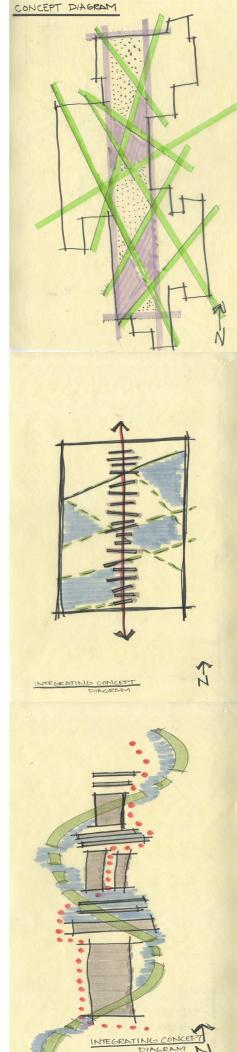
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PROCESS WORK + DIAGRAMS







TYPICAL PROGRAM

- LOBBY | 1,500 sq/ft
 - o Entrance
- R
- Receptionist desk
- Lounge chairs for guest waiting
- o Break room
- Pro Shop | 5,000 sq/ft
 - Merchandise
 - o Register
- O Display cases
 - o Training Facility | 30,000 sq/ft
- Kitchen | 5,000 sq/ft
 - Multiple stoves
 - o Grill
 - o Dishwasher
- 2 o Sinks
 - Dry storage
 - Cold storage
 - o Prep area
- Restaurant + Bar | 10,000-15,000 sq/ft
- Bar topTables + Chairs
- O Hostess stand
 - Access to the Kitchen
 - Liquor storage
- Lounge (2) | 3,000 sq/ft
 - o Chairs
- Coffee tables
 - Televisions
 - Wet bars

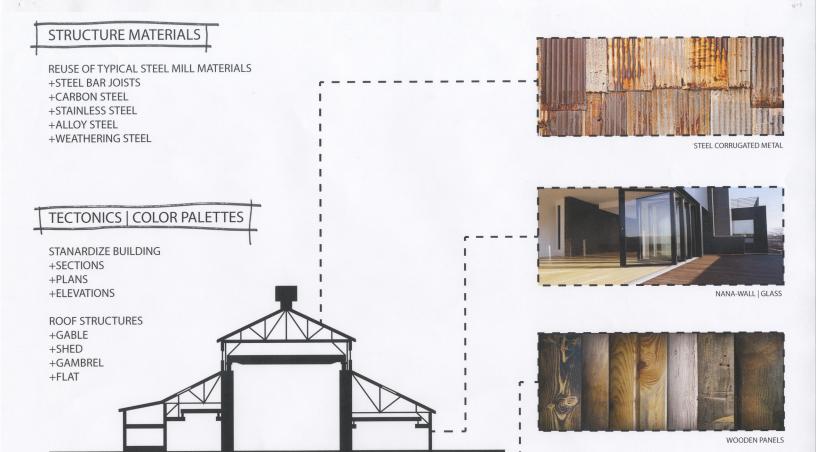
- Ballroom | 10,000 sq/ft
 - Tables + Chairs
 - O Dance floor
- Educational Center | 70,000 sq/ft
 - o (5) Classrooms | 5,000 sq/ft
- o (3) Labs | 5,000 sq/ft
 - Lecture Hall | 10,000 sq/ft
 (3) Offices | 1,000 sq/ft
 - o (2) Restrooms | 1,000 sq/ft
 - Research room | 15,000 sq/ft

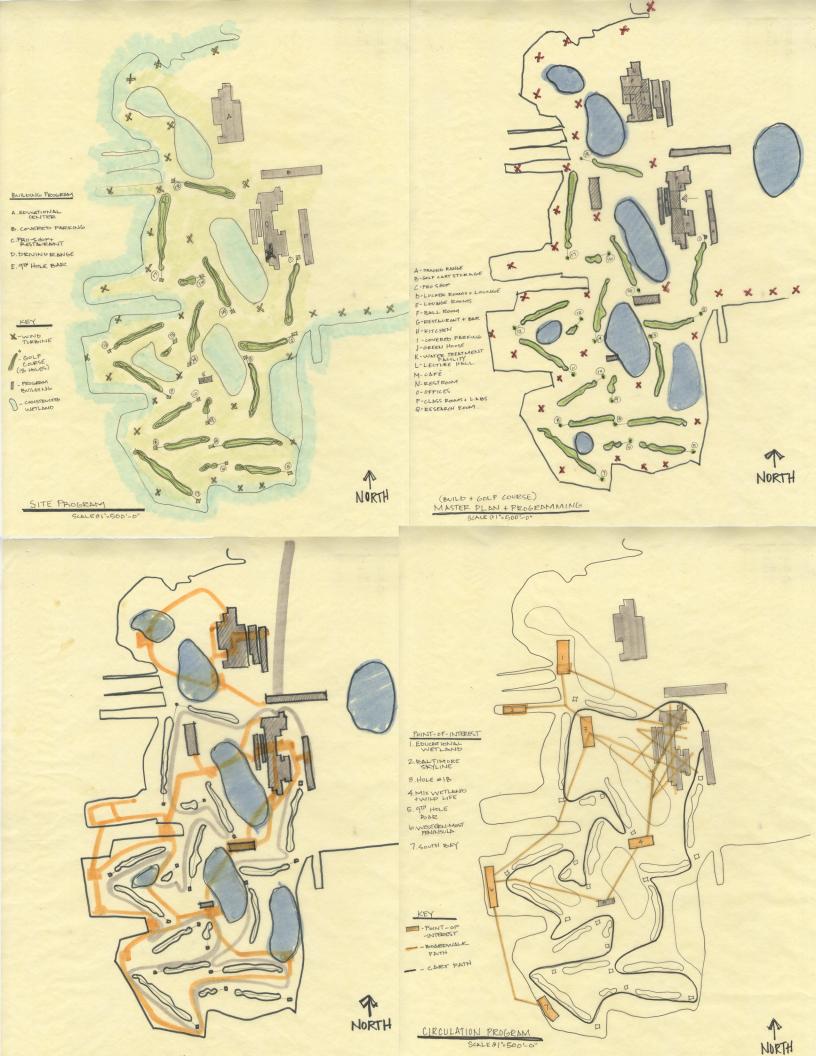


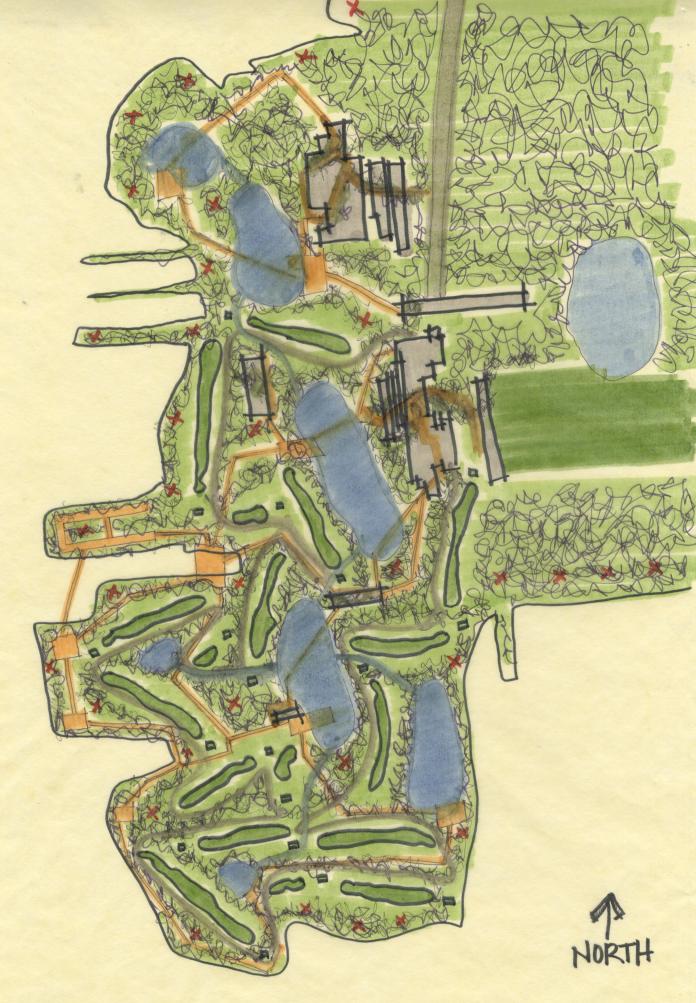
Storage Room | 20,000 sq/ft

- Locker Rooms (2) | 5,000 sq/ft
 - o (2) Restrooms | 1,000 sq/ft
 - o Showers | 500 sq/ft
 - O Dressing Areas | 500 sq/ft
 - o Lounge | 1,000 sq/ft
- R Cart Storage | 50,000 sq/ft
 - Water Pump Facility | 100,000 sq/ft
 - Treatment facility
 - Silos for water storage
 - Engineering stations
 - Observatories

R=RECREATIONAL PROGRAM E=EDUCATIONAL PROGRAM

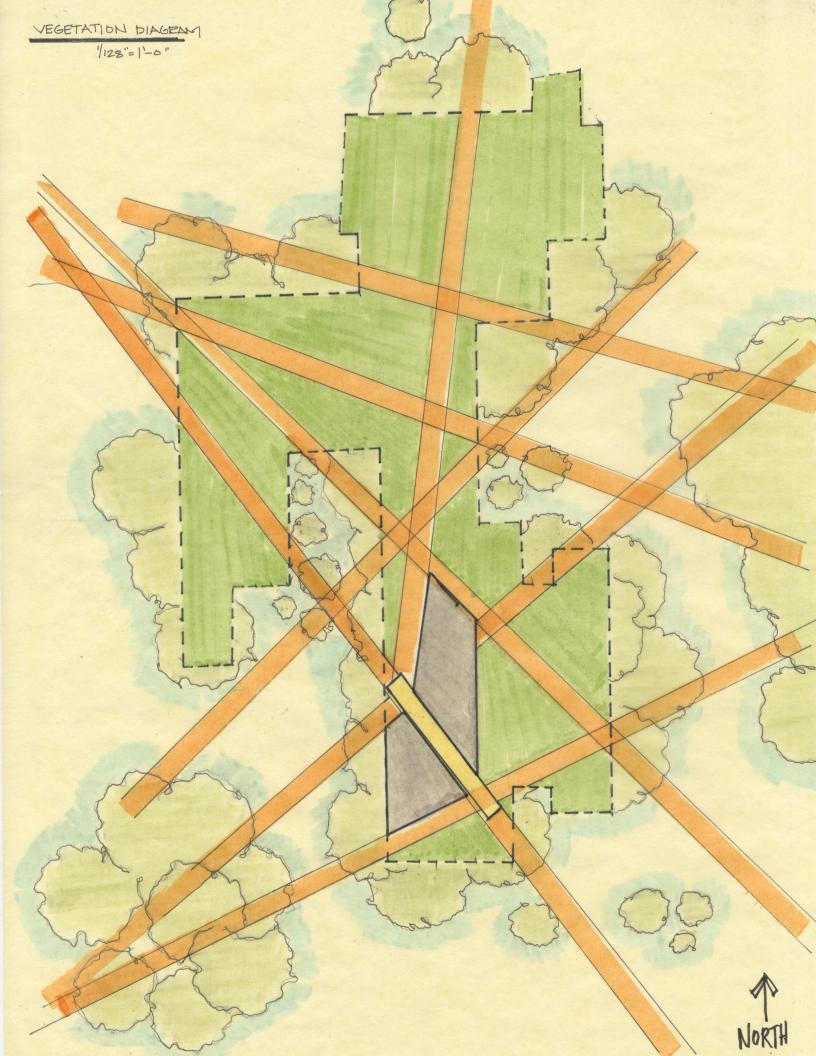


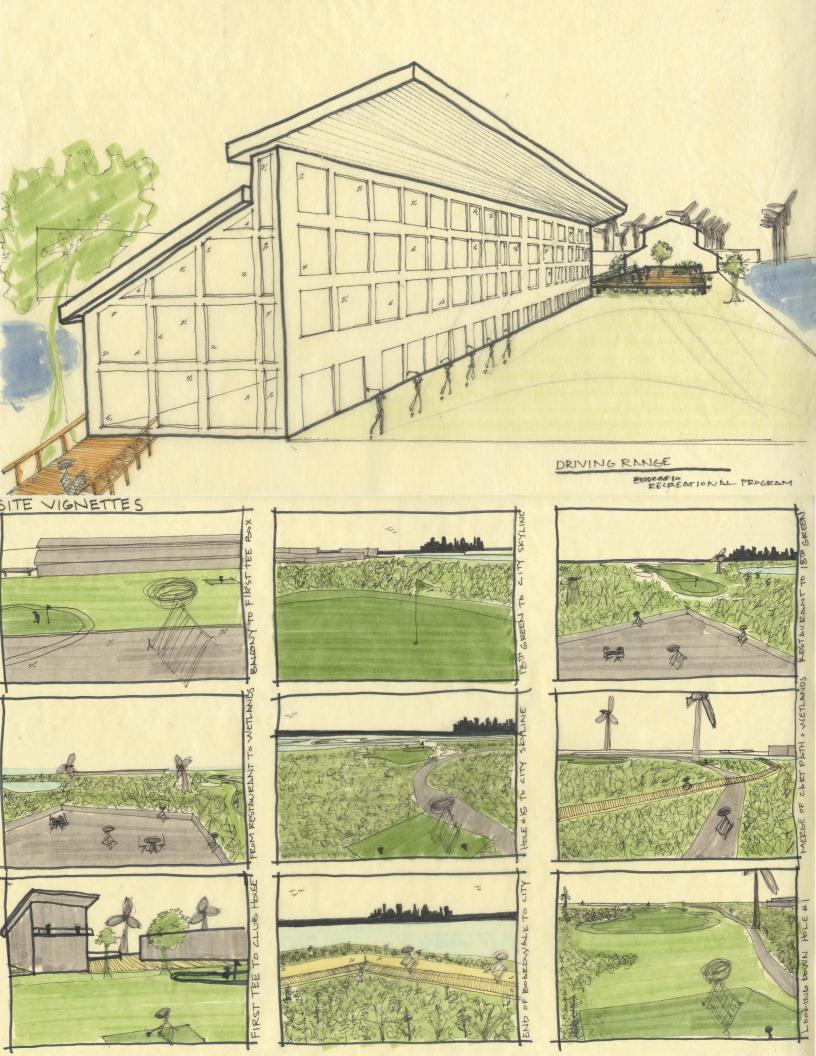




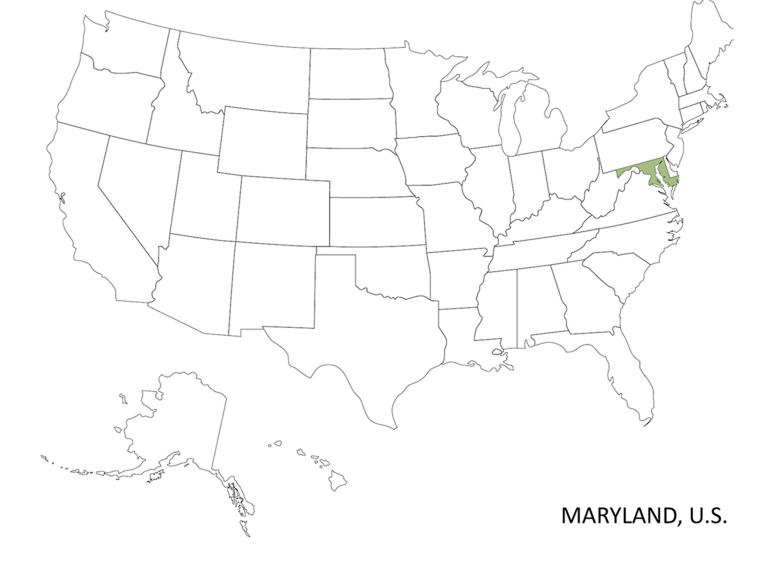
INTEGRATED MASTER PLAN

SCALE@ 1"=500'-0"



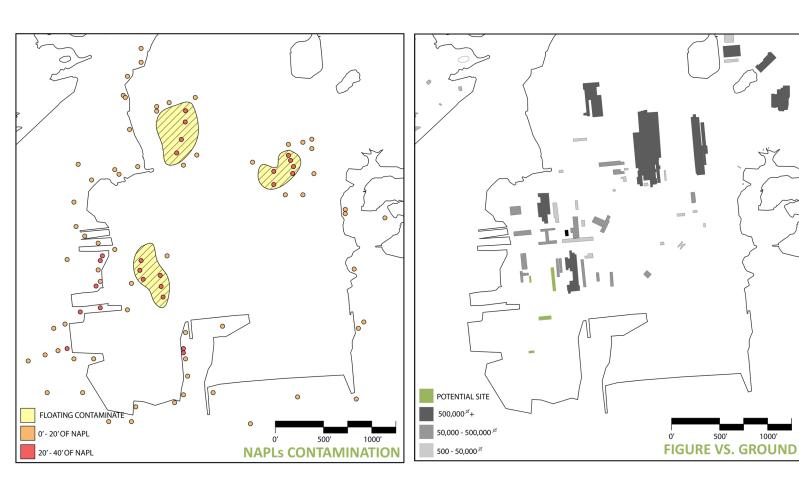


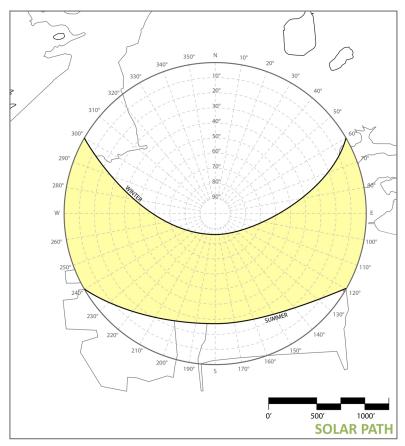
FINAL BOARDS LAYOUT





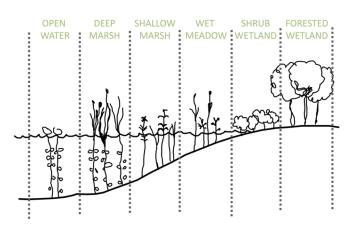






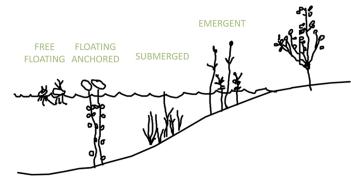






VEGETATION OPTIONS

WOODY



GROWTH FORMS







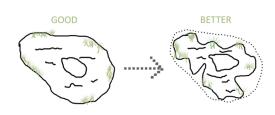


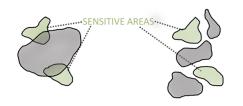


MUD FLAT

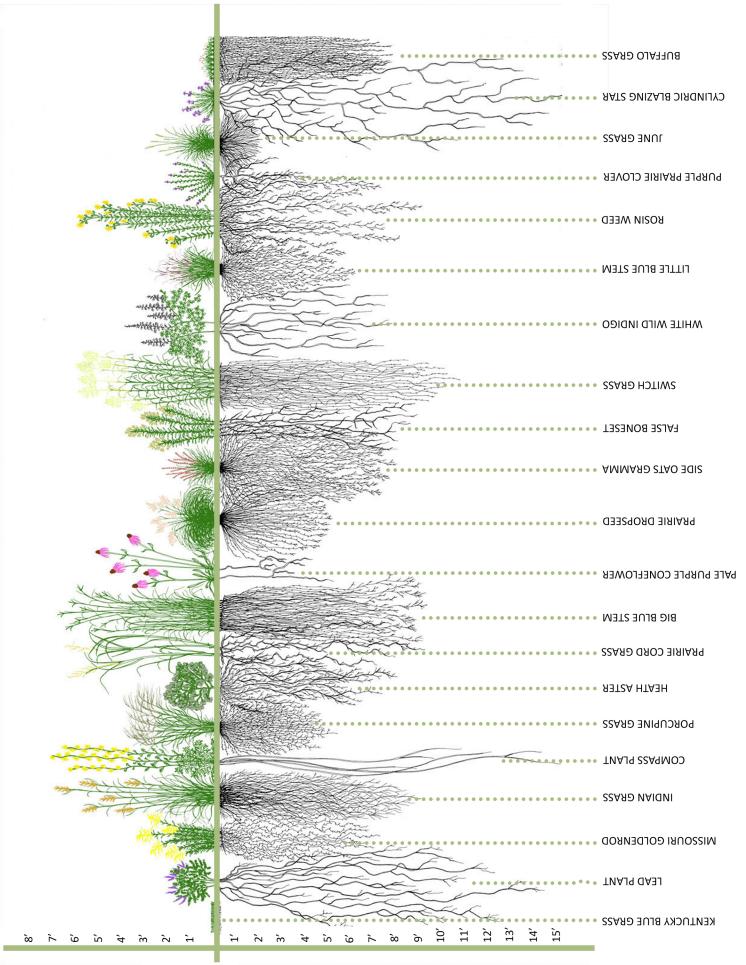
WET MEADOW DEEP OPEN WATER SHALLOW MARSH

SEQUENCING



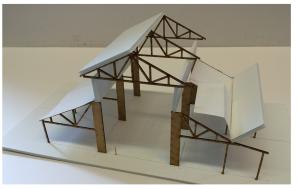


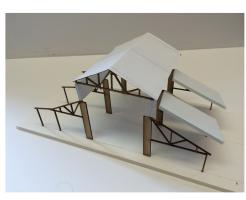
TYPICAL PRAIRIE WETLAND PLANTS

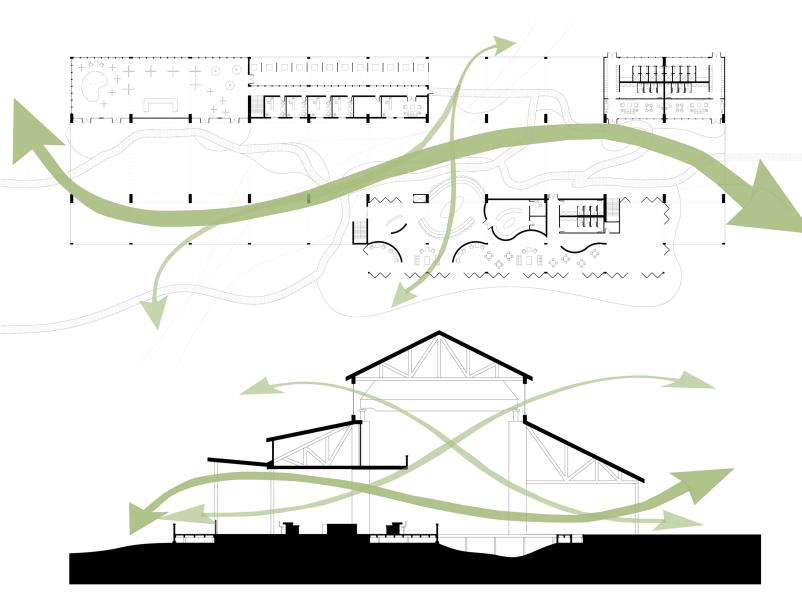


PROCESS MODELS

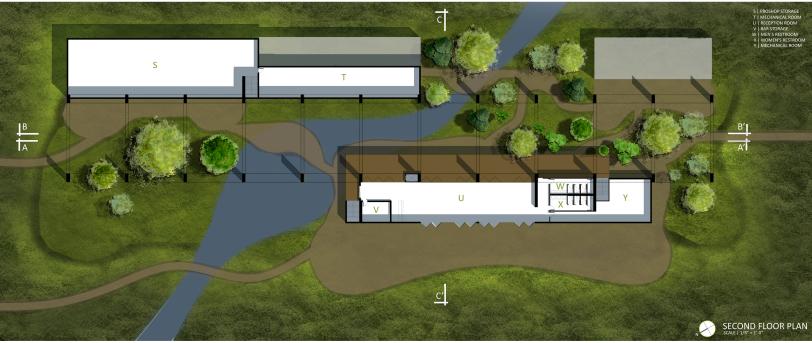




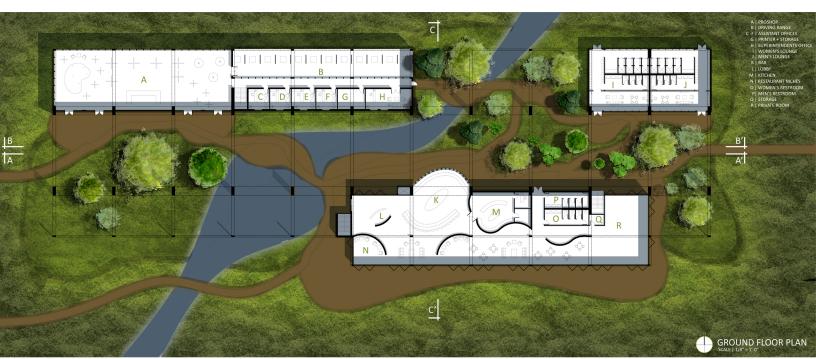








SECOND FLOOR PLAN



GROUND FLOOR PLAN

ELEVATIONS



NORTH ELEVATION



EAST ELEVATION



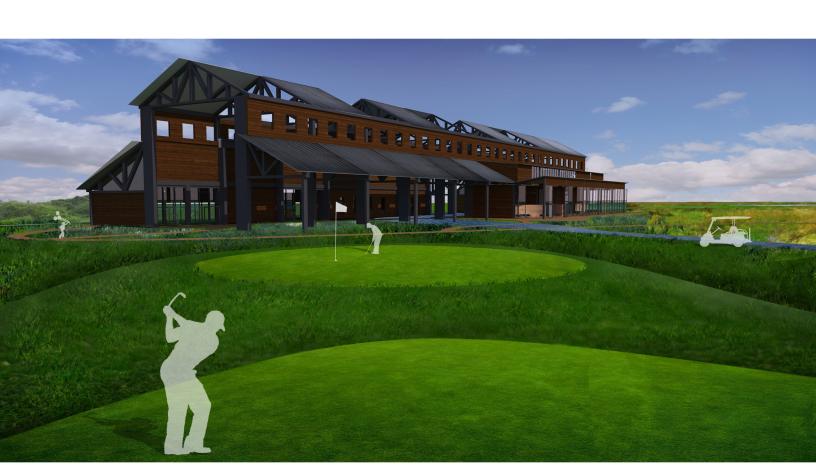
SOUTH ELEVATION













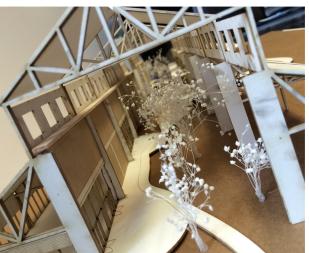








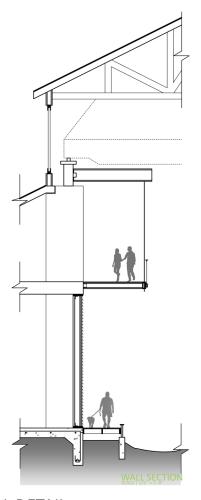














WALL DETAIL

SECTION C-C'



SECTION A-A'



ADDENDUM

EXPLORING SUSTAINABLE BROWNFIELDS Revitalizing Brownfields through the Creation of Wetlands and Golf Courses

ADDENDUM

After focusing my energy and research on wetland designs and golf course impacts on the environment. I have come to the conclusion that at the end of the day the two recreational and ecological uses can successfully be merged. My final results in creating a golf course that is surround by wetlands can mix quite beautifully. Some more research that took place after writing this paper, was understanding the history and life of the steel mill workers that used to once flourish these marsh lands. Much continued research came about in the form of the golf industry going 'green', understanding what products are ecofriendly and how left over golf equipment can impact the wetland parks.

FUTHER EXPLORATION

I would have liked to explore along the side of business and actually understand how much revenue this park would bring in and how much money it would cost to build the golf courses successfully. I would have liked to explore more transportation options from the City of Baltimore to my site. How successfully was public transportation in the area? How many stops and how many minutes did it take from the center of the city to the center of my site? Would people come on their lunch breaks from the city?

UNDERSTANDING FINAL CRITQUES

Some of the comments that were received during my final critique were how well I understood the history of the workers and what all the building components were. Angela Watson suggested I added more upper level special experiences throughout my buildings. Not just for groups of people but individuals to explore and gain an understanding of this amazing site raised 75 feet above the ground. Some reviewers inquired about the other buildings on the site and what they would be used for. If I had more time to explore the revitalization of all the buildings on site, I would do so. I would create a new city within a city on my abandoned site. Others suggested more case studies that I should have looked into to better my designs.

OVERALL PERSONAL EXPERIENCE

Overall this was an amazing experience that I would not change anything about other than adapting to the reviewers comments. I am completely satisfied with the final outcome of my designs, explorations and research during the overall process. All-in-all I would say this is one of my best accomplishments throughout my seven years of school and I would like to continue pushing this design forward in the future, or maybe one day actually buy this land and make my thesis a reality.