Amplifying Aquatic Thresholds:
A Great Lakes conservation & research center on Washington Island, WI

By: Rachel Gemlo
Amplifying Aquatic Thresholds:
A Great Lakes conservation & research center on Washington Island, WI
A Design Thesis Submitted to the Department of Architecture and Landscape Architecture of North Dakota State University

By

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In Partial Fulfillment of the Requirements for the Degree of Master of Architecture

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This Thesis titled “Amplifying Aquatic Thresholds: A Great Lakes conservation research center on Washington Island, WI” investigates the question, “how do natural formations influence the way we interact with a site as a whole?” Natural formations can include but are not limited to islands, bluffs, forests, and lakes. A unique structure allows for holistic design around natural formations, working with their complexities rather than ignoring them. The unifying idea that guides my research is maximizing economy and eco-sustainability by encompassing natural forms with structural elements to sustain an island lifestyle. A conservation research center for the Great Lakes on Washington Island, WI will expand the island’s eco-tourism and create an outlet for facilitating a sustainability movement for further development.

keywords:

research
preservation
great lakes
how do natural formations influence the way we interact with a site as a whole?
Great Lakes preservation and research center

A unique structure allows for us as designers to holistically design around natural formations and work with their complexities rather than ignore them.

Research and preservation require certain programmatic features while still being able to educate the public as well as maintain and enhance the natural softscape.

natural formations inform combined design solutions that keep users interested.

A fluid framework mirrors the beauty and dynamics of natural ecosystems and allows for passive sustainability.

Unique forms and functions will explore the use of structural elements, mirroring the natural ecosystem.

maximizing economy and eco-sustainability by encompassing natural forms with structural elements to sustain an island lifestyle which will bring the issues of Great Lakes water conservation to public attention.
Washington Island, off Wisconsin’s Door peninsula offers a unique and powerful setting with great potential for bringing issues of Great Lakes water conservation to public attention. With the current economic issues, a recovering shipping industry relies heavily on the passages that run throughout the Great Lakes. This year’s arid summer has played a major contributing factor in slowing down shipping along the Mississippi River as well as the Great Lakes region. “Thanks to the drought of 2012, the Great Lakes are approaching and may fall below the lowest levels ever recorded, back in the 1960’s.” (Sanburn, 2012). To create a facility that will help with the preservation of these lakes will not only economically rebound the shipping industry but it will also give the islanders more jobs, revenue, and tourism.

This thesis seeks to use an architectural model that will mirror that of the surrounding landscape. Boyers Bluffs is an exciting and visually intriguing site location. Its natural beauty vividly expresses the natural forms mentioned in the problem statement. Its pertinence, as well as other natural elements will only enhance the design ideals leading this thesis. These features include a nearby limestone beach and resounding wooded areas.

In Door County, WI, this research facility serves as a demonstration of the leading technologies and ideals of the future. The straight-laced rigidity of the science world combined with the beauty and grace of the natural world create a unique and uninhibited aesthetic of design that will lead the area into a whole new world of possibilities.
users include, but are not limited to: visitors, tourists, local islanders, researchers, scientists, and ecologists.

owners: the primary owners of the facility would be the governing bodies of Washington Island. Peak usage would occur during the day Monday through Friday for the scientific staff. Reception staff, tourists, and visitors would utilize the space Monday through Saturday. All universal design guidelines will be addressed for any and all users with special needs or disabilities. A private parking area for staff would be available while public parking will be provided for all other users. Special considerations will be made for delivery trucks as well as boat docking.

The secondary owners would be local artists in the surrounding area. This would be a short term facility agreement that will encourage community ties and create economic benefit.

client: the staff and researchers are the primary clientele who will be using the facility on a regular basis. The administrative staff will handle the business matters, while a small team of maintenance staff will monitor the safety and cleanliness of the grounds as well as the facility itself.
**labs:** a scientific space used for sample testing as well as research functions.

**gift shop:** space to raise money for the cause as well as sell souvenirs.

**offices:** private spaces for the research technicians and scientists.

**galleries:** space for local artists to display artwork, as well as for educational purposes pertaining to the great lakes.

**maintenance:** all maintenance equipment, janitorial facilities, security systems, and temperature regulation apparatus.

**mechanical:** all environmental control systems and their operation easily accessible.

**lobby:** a public lounge, reception desk, and vestibule that will comply to the needs of visitors.

**parking:** public parking for visitors, as well as private parking for staff of the facility.

**restrooms:** sufficient restrooms for all staff, administrations, private, and public areas according to universal design regulations.

**class rooms:** break out spaces used for educational purposes, such as presentations to groups touring the facility and surrounding island attractions.

**break rooms:** for researchers and other staff.
Region: Proposed site location is in northeastern Wisconsin. Warm summers and ice cold winters are common.

City: Washington Island is a city in Door County, which is Wisconsin’s peninsula. Door County is a popular tourist destination, particularly for residents of Wisconsin, Illinois, and Minnesota.

Site: The site is the northwestern peninsula on Washington Island. Currently Boyers Bluff Lighthouse is on the site. My site has bluffs located around the North, East, and West side. Located off Main Road, my site is a short distance from the recently completed Trueblood Performing Arts Center.

Notes:
Population: 27,961
Area: 2,370 square miles (largest county in Wisconsin)
% land: 20.37%
% water: 79.63%
Shoreline: 298 miles of shore
Figure 4: Location neighborhood

- Detroit Island
- Plum Island
- Door County Peninsula
- Washington Island
- Rock Island
Bring forward the issues of Great Lakes water conservation to the attention of the public by creating a unique structural element mirroring natural formations to maximize eco-sustainability and help to sustain the island.
**Research Direction:** Research will follow the direction of the theoretical premise and will help towards a holistic design approach. Structural technologies will also be a critical research point. An analysis of site history and climate conditions will inform the process to come about material type and building systems. Programmatic features of a research and preservation facility will also be necessary for project completion.

**Design Methodology:** The design method will be the mixed method or qualitative/quantitative approach. All data will be documented simultaneously, while applying a whole-building design methodology.

**Documentation:** All significant research discoveries, design process work, and pertinent project decisions will be documented chronologically. These documents will then demonstrate a thorough thought process, project changes, design methodology, and any and all progression. This will include scanning all two-dimensional sketches, vignettes, or other productions; and photographing all three-dimensional model making. All digital work will also be compiled and stored on multiple hard drives providing insight into all design decisions.
fall 2009
Darryl Booker
teahuise: north dakota
boat house: minnesota

Spring 2010
Steven Wischer
twin house: north dakota
airport expansion: north dakota

Fall 2010
Milton Yergens
masonic temple: north dakota
snow symposium: canada
interpretive center: canada

Spring 2011
Steve Martens
children’s museum: north dakota
dinosaur museum: north dakota

fall 2011
David Crutchfield
mixed use highrise: california
kke/dlr group: minnesota

Spring 2012
Don Faulkner & Frank Kratky
marvin windows competition: north dakota
kindred masterplan: north dakota

fall 2012
Paul Gleye
fargo urban renewal: north dakota

Spring 2013
Steve Martens
design thesis
Water is everywhere, and maybe because there is so much of it, it’s also the biggest reason we take it for granted. This thesis will bring the issues of Great Lakes water conservation to the forefront of public attention. Creating a unique structural grid that mimics natural formations, conserving one of the largest bodies of fresh water in the north American region, and how it all relates back to architecture are the main topics that will be covered. The most abundant natural element in our world is water, how do you use it?

Firstly, Architecture can be described in a wide variety of ways. For the purposes of this thesis it is pertinent to explain it from a holistic, ecological, and scientific standpoint. We should not just merely look at all of nature and human activities from the viewpoints of an ecologist, but also see things as a participant. By combining the cold, dry, colorless world of science with the vivid color, passions, emotions, and feelings of life – all things that make humans superior to computers – the things that could be created and formed are beyond that of the current structural concepts.

Patterns in nature are obvious and visible reoccurring regularities of forms found in the natural world. “We humans are pattern seeking organisms, symmetry has always fascinated us.” (Graham, 2012). All of these patterns are modeled mathematically and recur in many different contexts. These patterns can contain multiple different
arrays such as symmetries, stripes, spirals, cracks, and so on. “Understanding these patterns comes from looking at both the architectural and the dynamic relationships within these networks.” (Graham, 2012). Mathematics, chemistry, and physics can explain on multiple different levels these structural concepts within all living things. Human beings view these patterns as “pleasing, proportioned, balanced, and harmonious.” (Graham, 2012). One of the more common patterns found in nature is the mathematical Fibonacci sequence, which creates a spiral pattern, one such example is the seed head of sunflowers that have multiple spirals within spirals.

“The study of network architecture seeks to understand the organization of relationships, or connectivity, between the pattern junctions (nodes) in a dynamic...
system.” (Graham, 2012). Being able to take such systems into account will help immensely in understanding the importance of the relationships between structures. A good analogy to go by is that the network is “like the spider’s web, there are many different ways to get from one intersection to another. But only certain pathways are advantageous.” (Graham, 2012). Such structural reoccurrences in nature are a large driving force for this thesis. Being able to replicate and Infuse these natural elements into a structural and spatial program will be a challenging yet intriguing goal to strive towards.

Secondly, The surface of the Earth is 71% water, with only 3% of that water being fresh and an even smaller portion of that being in its liquid form. The other 29% consists of the built and un-built land masses inhabited by the beauties of nature. One would think, “why do we need to conserve water? There is significantly more water than there is land on this planet!” So let’s analyze that question. What do we use water for? We use water for drinking, keeping our bodies clean, growing our food, creating energy, controlling fires, shipping products, etc. but most importantly we need water to survive.

Man’s life is bound with the forces of nature and we should treat it as a friend, for without nature we lose our abilities to thrive as a nation and as a culture. The average human being can only last three to five days without water before...
the effects of dehydration strip us of life. Humans are very successful when it comes to wasting water. We waste water at a much faster rate than the world can naturally replenish it. To conserve this precious resource should be of the highest priority. As populations increase, water shortages will become more and more abundant, especially because the amount of available fresh water will remain the same. Conservation will become even more important in the future as climate change and lack of sufficient knowledge continue to plague our world.

Research has been done on trying to take the 68% of salinated water and turning it into fresh potable drinking water. According to the World Wildlife Fund (WWF) “making drinking water out of sea water is a growing trend, but it also poses a potential threat to the environment that could exacerbate climate change.” Regions such as Australia, the Middle East, the UK, and the US are turning to desalination options with China and India not far behind. The following is some examples of the extreme water usages by these nations:

“It is estimated that around 60% of freshwater needs in the Arabian Gulf are met through desalination, and the Australian city of Perth may be looking to
source one-third of its freshwater the same way. Spain is devoting an astonishing proportion of its desalinated water to agriculture - at 22% the highest level in the world - as well as to holiday resorts in arid areas.” (Hadeed, 2007).

Most of these nations have a history of damaging natural resources in general and abuse much of these materials with little to no thought about the repercussions of their actions. Some of the impacts of this process would be devastating to the planet over all. Brine build-up, increased greenhouse gas emissions, and even less emphasis put towards conserving current fresh water supplies are just a few of the many consequences stacked against this outlet.

Not only is the desalination process harmful to the environment, it is also an expensive and extremely energy intensive process. With most of the world being indebted to each other, the cost of such efforts leads to more nations failing and an even more unstable environment. Similarly to other big issues the negative impacts occur far too late in the process to be repaired with just too little too late. Irreversible damage, paid for by the people, ruin our natural elements such as, but not limited to, lakes, rivers, and wetlands that purify and provide fresh water already.

Design needs to accommodate for protecting these natural resources. “Industrialization and urbanization have transformed the human habitat,
it is only during the last half century that any systematic effort has been made to determine what constitutes a balanced and self-renewing environment, containing all the ingredients necessary for man’s biological prosperity, social cooperation and spiritual stimulation.” (Mcharg, 1992).

Lastly, why do we build? “In an obvious practical sense because we have to; but more originally and perhaps more fundamentally, we build out of gratitude, memory, and transcendent hope.” (Smith, 2010). Architecture’s relationship to man has grown immensely since its beginnings. One theory states that, “architecture originated in the human orientation toward sacred order.” (Smith, 2010). Meaning, architecture began because we built things such as temples, tombs, and sacred spaces out of respect for the gods. Within that respect someone made the connection that “if we can build houses for the gods then we can build houses for human beings.” (Smith, 2010) Not only did architecture get its beginnings as a place of offering, but looking at it now, architecture has essentially become an offering to man. It creates the platforms of human life, essentially the stage that our dramas play out on. It is in this ideal that we have the beauty of current architecture.

Since the beginning of architecture, the needs of society have changed. As previously mentioned, at the time, all that was necessary was shelter and worship but now that we have a steadily increasing populous and an ever present need for design solutions, architecture
as a whole needs to change and grow with its people. Just as its people need to understand the stage that is architecture and grow with it. This change creates the need developed in this thesis. With so many people on this planet and each one of those people requiring a certain amount of resources to survive, the need for architecture to sustain those resources becomes even more pertinent.

Current architecture systems rely on a cradle-to-grave base, but to take that idea one step further and bring architecture into the ideal of a cradle-to-cradle system would mean every material could support life. “Materials designed as biological nutrients provide nourishment for nature after use; technical nutrients circulate through industrial systems in closed-loop cycles of production, recovery, and remanufacture.” (McDonough & Braungart, 2003)). Being able to have such a system for this thesis would not only keep in line with the organic nature of the project but also allow for such benefits as maximizing material use, generating a range of economic values, and creating a diverse social and ecological standpoint for the developing island.

In conclusion, site design, water preservation, structural patterns, and growth are all key components to this thesis. Through the creative use of site and materials, this thesis will engage with the locals of Washington Island as well
as visiting tourists. The application of the knowledge gained in this research will help me to accomplish my thesis goals set forth in the upcoming pages. To be able to effectively implement these strategies and others in the field of architecture, would allow the profession to create a more holistic design solution that takes into account more than just a provincial gain.
The Summary...
Research helps to create a plan of action and provokes a well versed response. Only from thoughtful analysis will a successful idea flourish.

The main points of interest for the thesis research was structural patterns found in nature, the importance of water preservation, and how architecture needs have changed over the past millennia. All of these topics hold pertinent information that will help me in decision making when it comes to the design process.

Nature holds an abundant amount of information that we are still learning. One of the things about nature I find most intriguing, is how mathematically sound every element is. You can pick up a leaf, dried and fallen to the ground, and yet still be able to examine every vein that once spread life. It is in this ideal that even the smallest piece helps to create a whole, for you can’t have a tree with no veins.

My second topic was that of water conservation. Yes, our planet may be seventy-one percent water, but only three percent of that is actually potable. As human beings begin to take over the Earth and deplete it of its natural resources, we will soon find ourselves lost. It is important that we take action sooner rather than later.
for the sake of our younger generations. Through this thesis program I hope to raise awareness and shed some light at the issues at hand.

Lastly the needs and why's of architecture have changed greatly over the years. Starting out with simple desires out of respect, then making the connection to greater things this profession has made many a great leap. The need for architecture to change yet again is fast approaching. As our cultures change and our needs change, so must the built environments we inhabit.

All of these issues will keep me informed on creating a holistic design solution for this thesis. With efficient material use and site specifications it is possible to create an inspiring space that allows for creativity, knowledge, and growth to blossom and inspire the next generation.
[site]

[structure]

[typology]
House W - dmvA - Holsbeek, Belgium

case study: 01/05
architect: dmvA
project: house W
typology: home
location: holsbeek, belgium
size: 3100 sqft
date: 2011
House W is a private residence deep in the forests of Holsbeek, Belgium. Seeing as how the house was built in such hilly country it required a humble architectural solution. The architect made the decision that the house must merge with the surrounding landscapes. Far from your typical home, this space is a relatively long skinny living space that is transversely placed against the hills contours taking on the form of the slope. Another interesting feature of this case study, is that the material used to create the facade of the building is far from typical. The intention was to essentially create a living wall that grows with the surrounding landscape. The significance behind this case study was to see the relationship between such dense site restrictions and an architectural solution.

Structure: The building’s structure is comprised of a natural mesh material that allows the surrounding plants to “grow” into the house.

Geometry: The geometry of the structure and facade can be understood by a single rectangle allowing for clear way-finding.

Natural Light: Natural lighting for this building is created through a series of port holes along the sides and roof. With a large picture window running along the stairs. The large portholes in the roof allow for interesting light patterns integrating into the space.

Circulation: The circulation plan is not your typical house floor plan. Comprised of a singular rectangle, there is clear pathway from the front of the home to the back.

Hierarchy: The sloped form cut into the contours of the landscape create a subtle hierarchy mimicking that of the landscape.

Massing: The massing reads as a series of rectangles all similar in size, placing no dominance on any singular area of the home.

Section to Plan: Section to plan analysis reveals the home to have a matching height to width ratio. The design language carries the rectangular ideal throughout the entire process.

This unique home deals with certain characteristics of site that will hold fast when trying to deal with issues of design site integration. Creating a unique design that successfully joins land with structure will be an interesting challenge for this thesis.
Nine Bridges - Shigeru Ban - Yeoju, South Korea

case study: 02/05
architect: shigeru ban
project: nine bridges
typology: country club house
location: yeoju, south korea
size: 172,000 sqft
date: 2010
Shigeru Ban Architects created this beautiful structural piece for Haesley Nine Bridges golf club. Although not typologically in line with this thesis, the unique structural elements will prove to be an interesting addition. The building itself is composed of three installations that are then, in turn composed of three different structural systems. The main focus on this case study though is the wooden hexagonal grid roof shell and columns. This innovative feature is made completely out of wood and exposed to the entirety of the interior spaces. By using this layout and design concept, the designers were able to efficiently use material so as not to cut down or waste any more wood than absolutely necessary. Not only does the structure perform well it also allows for natural ventilation to be used more successfully. As shown in figure 15 the columns allow for natural light to diffuse into the space as well as allow for the ventilation to escape through the hexagonal grid.

**Structure:** The unique structural grid is comprised of wooden beams, steel shells, and lightweight concrete. The distinctive column design is reminiscent of the surrounding trees. Figures 17 and 18 show the grid pattern of the columns, as well as showing how the roof sections interact between each column. Each of the columns spans from floor to ceiling which has a height of over three stories.

**Geometry:** The geometrical patterns are a severely grided layout. If one were to take the columns and lay them flat it would create a perfectly hexagonal grid of varying sizes.

**Natural Light:** Each column has a skylight placed in the center of the structure. This opening allows for natural light to diffuse evenly into the open spaces.

**Circulation:** Circulation within the building is comprised of a main entrance as well as a large glass shutter that opens the main space up to the courtyard.

**Hierarchy:** There is a three-tiered hierarchy composed of the columns flourish, the stone base walls, and finally the intersecting ground plane that successfully establishes itself as a base to building.

This case study is important to this design thesis because of its unique structural elements. One of the main goals of this thesis is to create a unique structural element that mimics that of the surrounding landscapes and this case study has successfully illustrated that ideal. In accordance with this structure, this thesis plans to delve deeper into this exceptional example of structure and create an equally impressive match.
generic laboratory programs:

“laboratory zoning permits air to be recirculated in the office and atrium zones, reducing energy use.” (Watch, 2008)

“generic chemistry laboratory unit showing hoods, prep benches, support rooms, and a write-up area with views into the lab” (Watch, 2008)
This series of case studies was done based solely on a typological stand point. Each one of the following examples has a different spatial layout that coincides with different laboratory uses. To the left, figures 18 and 19, show two generic lab layouts that are centered around main hallway access points. The next two pages consist of three different spatial layouts: two corridors, a racetrack corridor, and finally a single corridor system.

Case Study: 03/05
Figure 21

This first study is based on the NASA science research wing designed by Perkins + Will. This is an aeronautics and science based research facility. Its organizational patterns allow for people to enter from the west into an atrium. When in the atrium the user must make a choice, either the corridor to the left or the corridor to the right. Although this layout allows for more spaces per floor, it can cause the two wings to feel disjointed. This confusion can then lead to miscommunication between employees and can make work life more hectic. Seeing as how this thesis project is relatively small in comparison, this layout style may not be well suited for what is necessary.

Case Study: 04/05
Figure 22

North Carolina’s College of Engineering is the second typological study reviewed for this thesis. Also built by Perkins + Will, this facility has a racetrack style corridor. Being a smaller facility works well for this style of setup. Similarly to the previous study though, a double-corridor layout impedes ease of access for wayfinding and splits up the populous. On the other hand because this thesis is smaller it could have potential to work relatively well.

Case Study 05/05
Figure 23

The John A. Burns School of Medicine is the final typological study looked at. This floor plan consists of a single corridor that clearly leads to all access points of the facility. With a north south directionality it also allows for plenty of light to diffuse into the spaces. Each laboratory has a recessed alcove off the main corridor that allows for plenty of room when moving large equipment. This single corridor also makes wayfinding extremely easy and keeps the populous on the same page.

Each one of these three studies has its advantages and disadvantages. When taking into account size and accessibility, either the second or third option may be the most efficient when designing for this thesis project.
"This research building organizes all wayfinding around a clear entry from the west, leading into an atrium overlooked by circulation areas on the upper floors. On each corridor, one wall is along the exterior for natural light and excellent views, and the other wall provides access into the labs. The end of each corridor leads to fire stairs open to the exterior." (Watch, 2008)

“A racetrack corridor is best suited for smaller laboratory spaces with program space in the middle. The double-corridor setup, however, can split the population and impede wayfinding. Here, a central atrium surrounded by common amenities and exterior views at the end of the corridor support good wayfinding.” (Watch, 2008)
“In this floor plan, a single corridor clearly leads to all program spaces to the north or south. The corridor widens to the west with informal seating, view, and egress to the exterior. The east corridor is secure, and lab entry alcoves are recessed for safety and to provide space for equipment to swing through the doors from the corridor. An exterior view in the east corridor provides orientation and helps define an egress to the exterior space and an adjacent building.” (Watch, 2008)
Each one of these case studies has their own intrinsic value. House W, Nine Bridges, and each of the individual typological studies have greatly influenced how my theoretical premise and unifying idea will be put into effect in the coming design process.

Although each case study does not typologically match the other, they all inform on different key aspects of my thesis idea. Instead of sticking solely with typological examples, I wanted to look at other studies as well that focused on essential ideas that I thought were of value to my knowledge base.

House W by dmV in Belgium is a beautiful example of how to interact with dense site specifications. Built into the side of a hill, the home itself becomes one with the nature surrounding it. Not only is the house built into the hill, the materials chosen allow for the surrounding landscape to eventually grow up and around the house securing it within the landscaping. I too want to create something that will integrate with the landscape and create a design that does not hinder the natural aesthetic of my site.

Haesley Nine Bridges, a golf club house designed by Shigeru Ban Architects, focused on another aspect that I felt had intrinsic value to my thesis project. The intricate use of wooden beams to create such a dynamic and eye-catching structure will prove to be of great value.
to my design process. Not only do these structures have an exciting design, but they are also efficient in material use, passive cooling, and structural development. All three of these ideals are important to my unifying idea and theoretical premise.

Finally, the three case studies based solely on typology are as follows: The NASA aeronautics lab, North Carolina’s School of Engineering, (both created by Perkins + Will), and the John A. Burns School of Medicine (designed by Architects Hawaii Ltd.). Each one of these cases has a different spatial layout that works specifically for the intended size and programmatic requirement. Although some of the layouts are far too large and disjointed for my thesis, it was necessary to look into all options and types for design purposes. When looking back at each one of the examples, I feel as though the single corridor layout, demonstrated at JABSOM, will work the most efficiently for my thesis.

There are multiple lessons to be learned from each of these case studies, that will all be compiled and enhanced for this design idea. Firstly, to combine functions and create a smaller footprint that will not disturb site features too much. Secondly, create a unique structural grid that allows for effective material and passive strategy usages. Finally, the use of effective layout plans that do not hinder work flow, but still allow for successful and inherent design processes.
Where did this all begin? It is by studying the past that we as designers can come to shape the ideals of our futures. This thesis intends to learn from previous experience to create a unique design statement that will benefit future generations.

The town of Washington has not always been called such. The islands have a rich history that is constantly growing. The next few pages will attempt to answer the questions: how does this project relate to similar projects throughout history? How does this project relate to social trends or developments within our society? And, what is the physical and social context within which the project is set?

The idea behind this thesis is to effectively help to sustain life on the island, as well as bring issues of water conservation to light. Although I could not find any specific examples of projects that are in line with this thesis, there are many examples that strive towards resource conservation and sustainability. Some strategies put into effect are as follows, green roofs, rainwater harvesting, ponds and wetlands, and lastly energy-efficient building.

Green Roof: Green roofs, or as some would call it a living roof, is a roof of a building that is either partially covered or completely covered with vegetation. Some of the environmental benefits of having a green roof are reducing heating and cooling costs, reduce storm water runoff,
here is an example of the many layers that are applied to one type of green roof. Each layer has a specific function and is necessary in performing properly.
filter pollutants, and creates a natural habitat. Something of this nature would be a useful component for this thesis.

Rainwater Harvesting: Harvesting of rainwater is the accumulation and storage of rainwater for reuse before that water reaches the aquifer. Benefits of this idea include reduced treatment, pumping, operation, and augmentation costs, as well as reduced greenhouse gas emissions.

Ponds and Wetlands: These two examples are natural filters for water. They create ideal habitats for animals as well as natural water storage. On the other hand this thesis site is not very well suited for this type of preservation.

Energy-efficient Building: This refers to a structure that is environment responsible and resource-efficient from cradle to grave. The benefits to this are outstanding. These buildings are developed and designed to reduce the overall impact of the built environment on the natural environment. This step will be very important in the design process for this thesis.

All four of thesis options are viable for this thesis, although some more than others will be more effective and appropriate. Being able to understand each one of these processes and aptly apply them will be a very important step in creating the final thesis vision.
Secondly, sustainability has been a social trend on the rise over the last few years. The green building ideal is going mainstream. People are beginning to realize that our planet has a finite number of resources. These resources are depleting and we are the cause of it. Before it becomes “too little too late” as it were, the green design program needs more emphasis and it is only recently that this architectural trend has sprouted.

One such example of this is in California. “The latest anecdotal evidence comes by way of California’s CalGreen building code, which takes effect January 1.” (Sullivan, 2010). According to Sullivan this means that it will be mandatory to include green building practices that were previously only voluntary. Such examples as rainwater collection, permeable hardscapes, and even passive solar design are on the rise on the west coast. It will not be long before these trends sweep across the nation and begin to burrow themselves in building codes across the country.

Lastly, the site itself has a rich history. This small group of islands is actually the end string of the Niagara Escarpment stretching across most of Lake Michigan, Lake Huron, and between Lake Erie and Lake Ontario. Washington Island is located about seven miles off the tip of Door County. It is likely that the island was once part of the mainland, but has since become isolated. Of all the islands in this
outcropping, Washington Island has the most intriguing past, and the most promising of futures.
The strait between Green Bay and Lake Michigan is one of the most treacherous in North America. It is littered with remnants of ships from every era, named by early French explorers as Porte des Morts, meaning “Death’s Door.” This name carried through history and gives Door County and Door Peninsula their names.

The town of Washington was the first settlement in the state of Wisconsin. Most of the people who settled in the area were of Scandinavian descent, especially from Iceland. According to the Washington Island visitors guide, the island is one of the oldest and largest Icelandic communities in the United States outside of Iceland itself.

The cool summers, good fishing, and beautiful scenery attract tourists from all over the midwest to the Island, creating what is now their main industry. There are a plethora of cottages scattered across the island, as well as vacation homes, a campground, and even hotels. This thesis plans to take advantage of all these opportunities and monopolize on the right conditions to support Island economy.

The past holds the keys to our future. Being able to study and learn from our mistakes and our advancements allows problem solving to succeed. Without failure there is no progress. Now it is our time to take the knowledge we have gained and the experiences we have grown from to create an even brighter future for the town of Washington. It is truly amazing what a little will power can do, so let’s put that faith into the future and create something truly beautiful.
the following are my personal, professional, and academic goals for the duration of this design thesis process:

Develop a theoretical premise, unifying idea, and project justification that provokes interest and holds importance to my past, present, and future.

Provide an intriguing and engaging statement of intent that is easily understood.

Finish all material at a proficient pace so as to avoid submitting sub-par or incomplete work.

Avoid procrastination and rushing deadlines.

Demonstrate a holistic understanding of design (structural, mechanical, experiential, and theoretical).

Complete a well polished final thesis to the best of my capabilities.

Create graphics that are visually compelling and are sufficient in explaining all information pertaining to the project.

Continue the development of my own personal design strategies that will help me progress and grow as a future architect.
site analysis

north

south
There has always been something about being out in the beauty of nature that thoroughly intrigues me. The vastness of the night sky and all its flickering stars unaltered by the lights of the urban sprawl. The sounds of animals in their natural habitats, even the smell of damp leaves lingering in the air makes you feel more alive. This feeling of content guided me in choosing a site that was untouched by the clawing hands of progression just for progresses sake.

The journey to the site is more than just a simple car ride away. Coming from the east or the west, requires drivers to take the freeway all the way up to Green Bay. Once in Green Bay a slower two lane freeway directs visitors north passing smaller cities and villages along the way. Tree canopies line both sides of the road and Green Bay and Lake Michigan are barely visible in spots. Sturgeon Bay, Egg Harbor, and Sister Bay are just three of the small villages drivers pass through on their journey. Finally at the most northern tip of the peninsula, visitors must take the island ferry to Washington, passing Pilot, Plum, and Detroit Island along the way. After getting off the ferry you are greeted by yet another small village teeming with life and vitality. Another short drive north under canopy of tree lined, slow winding roads and you arrive at the site.

Arrival to the location is distinguished by an old surveyors mark along the road leading up to my direct site. Greeted by the chirping of birds you
site analysis
arrive in a small clearing. Its presence is calm and very serene, the soft peck of a woodpecker in the distance is all hear as your senses readjust to the rural scenery. A total feeling of relaxation washes over you as you take in the site as a whole. During my visit there were no other people present on the site, and there was very little surrounding structure.

Although it was cold and cloudy at the time of my visit, strolling through the fallen leaves and hearing their soft rustle under my feet was quite enjoyable. Patches of soft spongy moss covered the ground and were actually quite fun to bounce on. There were no other sounds of the hustle and bustle of busy city life. The cool breeze blowing in off the lake was calm and not over powering. Hearing the waves crash upon the bluffs below gave the site a nautical atmosphere that created quite the escape from my typical urban surroundings.

The site itself is centered rather far away from the main goings on of the island. In the summer months, the town of Washington is overflowing with people and things to do. The island is rather small, so when I visited the site over the summer there were people running, playing at the beaches, renting scooters, and a mix of other outdoor activities as far as the eye could see. As opposed to the cooler months, or the off season as locals call it, half the local stores were closed and you would be hard pressed to find someone who was not from the area.

The opportunity for this facility to be built upon the island will not only benefit the locals but will also benefit the efforts toward saving the Earth’s fresh water supply. Which to me, is a rather worthy goal.
dense tree cover / bluffs / Lake Michigan / mossy leaf strewn ground / drainage
Noise: Noise is primarily generated from the waves crashing upon the bluffs surrounding the northern edge of the site. Even then this noise is still relatively soft. Secondary noise can be heard from the streets running along the east and south sides of the site, but because population density is so low in this area noise is kept at a minimum.

Existing Grids: Currently the built environment occupies the southern most portion of the site. Surrounding buildings are all residential, although, the Trueblood Performing Arts Center is located a few miles down the road.

Geometries: Surrounding built forms are smaller residential homes to the south. They are typical pitched gable roof homes proportional to their site allotments. All the built features are hidden by dense tree cover, and can only be seen briefly through patches of driveway.
point & linear noise
Light Quality: The quality of light on the site is rather dense. Depending on where you are standing will depend on how intense the natural lighting is. The dense tree cover is more prominent on the east and west sides of the site.

Vegetation: The vegetation on the site is a wide variety of things, ranging from coniferous and deciduous trees to small brush and moss. Other than the tree moss seems to be one of the most prominent vegetative features of the site. (upper right image)

Water: The site is surrounded on three sides by Lake Michigan. The lake is a permanent feature, although water levels have been steadily declining. The only other water sources on the site are from when a heavy rain comes through and drains down to the Lake.

Wind: The strongest winds come from the North off Lake Michigan. It is a warm summer breeze from June through October, and a blisteringly cool gust from November through May.

Human Characteristics: Human intervention is present on the site. The upper left image is of the Boyer’s Bluff Lighthouse. It is used only as a beacon and is maintained by the Coast Guard. When on my site visit there were also signs of loitering. Signs of bonfires and beer bottles were strewn around the leaves, showing it is a popular hang out spot for teens.

Distress: There are few signs of distress but they are still present. Signs of erosion and split cliffs are visible in areas. Another sign of distress is that of the fallen trees, although this characteristic is natural for a wooded area such as this.
Above: This is the view from lookout tower, the highest point on the island. It is covered with the names of people who have climbed it. Not far from my thesis site, this is one of the many tourist attractions on the island.

Left: The Trueblood Performing Arts Center is a recently developed site on the island. It is a non-profit, multipurpose performance venue that also lends itself out to the island school as well as off-island talents. It is the home for the Island Players, which is the Washington Island community theater for the last 25 years.
School House Beach is one of the most popular tourist sites on the island. This beach is usually the main reason people even come tour the island. The entire beach is made up of large, round, smooth limestone rocks and is one of only five beaches like it in the entire world. Its location is just around the bluff from my thesis site.
ApC: Alpena gravelly sandy loam, 0 to 12 percent slopes, occupies 42.3 acres, 15.1% area of analysis

KmB: Kiva sandy loam, 2 to 6 percent slopes, occupies 0.1 acres, 0.0% area of analysis

LoB: Longrie loam, 2 to 6 percent slopes, occupies 22.7 acres, 8.1% area of analysis

OmB: Omena sandy loam, 2 to 6 percent slopes, occupies 17.6 acres, 6.3% area of analysis

OmC: Omena sandy loam, 6 to 12 percent slopes, occupies 23.4 acres, 8.4% area of analysis

Ra: Rock outcrop, occupies 20.2 acres, 7.2% area of analysis

Uo: Udorthents, cobbly, occupies 0.9 acres, 0.3% area of analysis
CS - PRD
planned residential development
cliff side

RR - 1B
one-family rural residential
climate data

sunshine

percentage

jan  feb  mar  apr  may  jun  jul  aug  sep  oct  nov  dec

average

US average

solar diagram (45 north latitude)

solar elevation

12 pm

5 am

7 pm

30 180 330

east  solar azimuth  west

table 1

table 2
education
class rooms
10 sq ft x person
20 people
200 sq ft each
600 sq ft total

gallery
10 sq ft x person
150 people
1500 sq ft total

support
maintenance
250 sq ft

public
bathroom
men’s & women’s
300 sq ft each
600 sq ft total

lobby & lounge
10 sq ft x person
150 people
1500 sq ft total

gift shop
300 sq ft

reception
150 sq ft

courtyard
2500 sq ft

vestibule
100 sq ft

office
laboratories
300 sq ft each
1500 sq ft total

scientists’ offices
100 sq ft each
1000 sq ft total

conference room
150 sq ft
300 sq ft total

break room
100 sq ft

bathroom
men’s & women’s
100 sq ft each
200 sq ft total

mail
150 sq ft

program requirements

private

public

table 9
Total 12,900 sq ft
<table>
<thead>
<tr>
<th>Lobby &amp; Lounge</th>
<th>Reception</th>
<th>Mechanical</th>
<th>Employee Bathroom</th>
<th>Maintenance</th>
<th>Gift Shop</th>
<th>Courtyard</th>
<th>Mail</th>
<th>Conference Rooms</th>
<th>Laboratories</th>
<th>Scientists Offices</th>
<th>Break Room</th>
<th>Gallery Space</th>
<th>Class Rooms</th>
<th>Public Bathroom</th>
<th>Drinking Fountains</th>
<th>Storage</th>
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<td>Necessary</td>
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</tbody>
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The following pages are a compilation of my process work. When beginning this process there were a few areas that I really wanted to focus on. Some of those areas were pace, structure, patterns, and light. One of the main things I focused on was integrating the patterns of natural elements cohesively into the structure of my building to create a unique experience.
concept sketch

- pace
- structure
- unique
- nature
- pattern
- light
- movement
- flow

Hierarchical?
Built into the cliff face?
Just cut over cliff??

Structural pattern/grid
The map to the left shows the linear progression towards my site. Each pit stop is labelled with a green asterisk, ending finally with my actual thesis site.
To the right are some initial floor plans. From top to bottom is: roof plan, upper level, floor level.
WOOD STUD

SHEATHING PANEL

WOOL INSULATION BETWEEN STUDS

KASOTA STONE

PLASTER BOARD

BRICK WALL TIE

WOOD BASE

EXTERIOR WALL DETAIL
SUNLIGHT

COMPRESSION RING

ROOF

STRUCTURAL DETAIL OF NORTHEAST FACADE
How do natural formations influence the way we interact with a place or a landscape?
Above is the digital board of my midterm presentation. Starting with my thesis question and working my way towards my design solution towards the right. At the time of my presentation it was very helpful to get the amount of feedback and support from my peers which in turn lead to my final design solution on the following pages.
a. lobby/reception/gallery - 11,500 sqft
b. classroom (x3) - 500 sqft
c. water closet (x4) - 150 sqft
d. circulation/lounge - 8,500 sqft
e. lab (x3) - 600 sqft
f. office (x9) - 150 sqft
g. break room - 180 sqft
h. small conference room - 180 sqft
i. large conference room - 280 sqft
j. presentation space - 350 sqft
k. mechanical (x2) - 110 sqft

total square footage: 26,350
balcony perspective
entryway perspective
To the right is my installation on the fifth floor of Renaissance Hall.
models
The next seven pages consist of my final oral presentation. Each page has four presentation slides. They read in order from left to right and top to bottom. The final thank you slide is not shown.
Amplifying Aquatic Thresholds:
A Great Lakes conservation & research center on Washington Island, WI

By: Rachel Gemlo

Problem Statement:

how do natural formations influence the way we interact with a site as a whole?

**typology**
Great Lakes preservation and research center

**claim**
A unique structure allows for us as designers to holistically design around natural formations and work with their complexities rather than ignore them.

**premises**
Research and preservation require certain programmatic features which we did not want to ignore, but instead were able to educate the public while maintaining and enhancing the natural softscape.

natural formations inform combined design solutions that keep users interested.

A fluid framework mirrors the beauty and dynamics of natural ecosystems and allows for passive sustainability.

**theoretical premise & unifying idea**
Unique forms and functions will explore the use of structural elements, mirroring the natural ecosystem.

**project justification**
maximizing economy and eco-sustainability by encompassing natural forms with structural elements to sustain an island lifestyle while bringing the issues of Great Lakes water conservation to public attention.

...we waste water at a much faster rate than the world can naturally replenish it...

...we build out of gratitude, memory, and transcendent hope...


figure 7

figure 10

figure 13

figure 14

figure 15

figure 16

figure 17

figure 18
figure 19

figure 20

figure 21

figure 22

figure 23

figure 24

figure 25
“A ship in harbor is safe, but that’s not why ships are built.”

fortune cookie

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