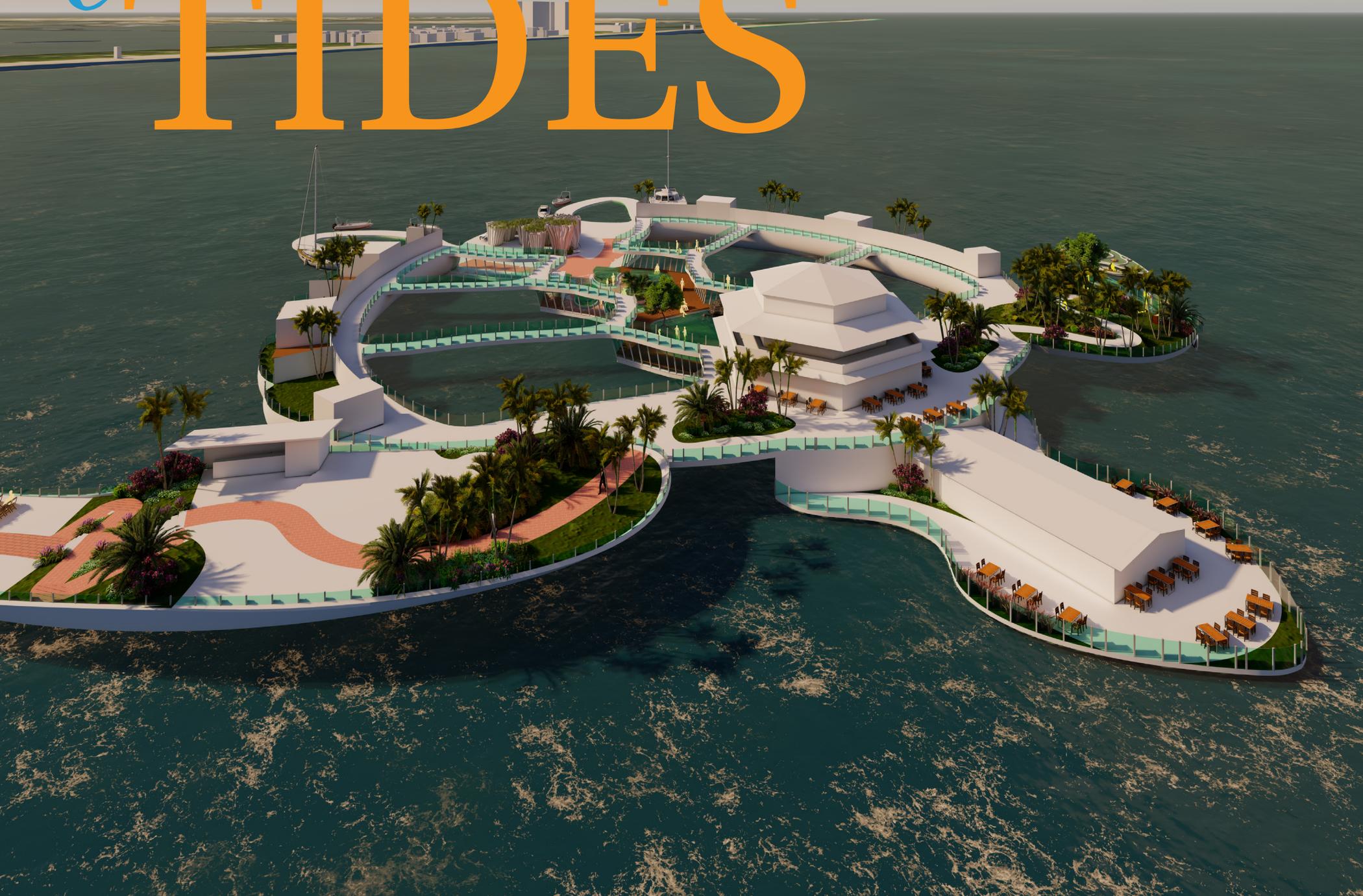


*On the*  
**TIDES**



# ON THE TIDES

## A Resort Raising Awareness of Coral Reefs through Environmental Intimacy and Accessible Exploration Off Hollywood, Florida's Coast

A Design Thesis Submitted to the  
Department of Landscape Architecture  
of North Dakota State University

By

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

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# Abstract

Reef ecosystems around the world are facing threats from all sides. They see destruction and physical damage from careless people participating in destructive practices such as improper fishing, dredging, or even people removing coral themselves. It isn't just from water however, urban development along coasts has changed the ecosystem in the water. Nutrients from agriculture finds its way into runoff. Urban stormwater as well as inadequately treated sewage makes its way into the oceans via our coastal cities. Overfishing can alter the delicate food chain the most reefs rely on for survival. This already fragile ecosystem is under a barrage of environmental threats

and needs support. Coral reefs support 25% of sea life and do a tremendous amount for Florida as a whole. Reefs provide about \$8 Billion to Florida's economy and supports 70,000 jobs. This might not be the extent of what's damaged though as the reefs support up to \$2.7 Trillion to Florida's coastal economy and 50% of all tourism jobs. Coral reefs also break waves further away from shore so that the shoreline is protected and saves Florida about \$1.8 billion in flood protection and helps 120,000 properties at risk for frequent tidal flooding.

The development of this resort will look into the viability of such overwater

construction around an artificial reef. It will show the economic feasibility of such a project in hopes that private developers can be added to the list of numerous non-profits and research groups that are fighting the decline in reefs. This research will explore the factors that are essential in propagating a reef ecosystem and analyze the Florida and surrounding coastlines for a viable spot to propagate a reef as well as provide essential infrastructure for a resort.

*Keywords:* Reefs, Coral, Florida, Resort, Ecosystem

# Narrative

Coral Reefs play a vital part in the world's seas and oceans. They support over 4,000 species of fish and 25% of all ocean life, and they provide a buffer against harsh waves for many of our coastlines. As kids I'm sure many of us were captivated by the wild and bright colors of the coral and filled with joy when we saw it in the setting for Disney's Finding Nemo. It goes without saying that this uniquely beautiful, and incredibly important ecosystem needs protection and support.

this battle and prove itself a valuable ally. The engagement with the reef will make this project a destination point that people will want to visit. It will have recreational activities to engage with the reef as well as an education facility to learn about revitalization efforts as well as get close to certain reef species. This project is meant to excite people about coral reefs, engage them with the ecosystem, and allow them to explore it for themselves.

The issue I see is that any efforts I find that are meant to aid these ecosystems are being pursued by non-profits and publicly funded entities. I believe that the private sector would be an essential tool in

# Project Typology

Resorts and Hospitality	processes related to coral reef restoration
Over-water Bungalow Resort	close together. A public access area will
Environmental Planning	allow people to get up close to the different
Built around the site of high-risk coral reefs	processes being utilized in restoration efforts.
Ecological Design & Restoration	Its location next to the Miami metropolitan
Provide coral nurseries and facilities for coral propagation	area aids in its mission to promote awareness of coral reef deterioration and restoration efforts. An over-water resort will also be designed with the purpose of making this place a destination spot for eco-tourists as well as to help support the restoration efforts financially, much in the same way Brooklyn Bridge Park receives financial help from some residential buildings on the site.

This project will span several types of typologies in relation to the rebuilding of coral reefs, the awareness of coral reef threats and restoration efforts, and the financial support thereof. A reef propagation facility, including area for research purposes, as well as in water coral nurseries will be provided to convenience researchers by keeping the

# T y p o l o g i c a l

## Precedents

Living Breakwaters in New York City they had to study was the angle of the by SCAPE design is a great precedent in construction to still allow light underneath restoring a marine ecosystem. They took to not disturb the fish habitat. measure to protect the coastline by adding barriers away from shore. These barriers doubled a marine habitat and the acres of land between them and the shore has returned to a thriving oyster field.

Pier 55 in New York demonstrates a very unique method of overwater construction. The forms leave plenty of room for building in the water below while still being able to support a massive amount of weight on top. One of the biggest things

# Major Project

## Elements

### Artificial Reef and Coral Nursery

#### Nursery

Provide places in and around the resort waters that researchers can use to propagate coral. The idea behind the close proximity of both of these features is to make this resort a place like no other, where nature and architecture collide and people can enjoy the unique coral environment, which makes up only 0.1% of the Earth's surface.

### Resort Housing Units

I would design these much like James Rose' Environmental Complex idea so that it does not feel disconnected with the site around it, but rather like it was always a part of the site.

### Reef Education Programming

The public area of my site will be catered to teaching the public about the environmental factors affecting coral reefs, the efforts being utilized to try and combat those threats, and what they can do to help save the precious ecosystem.

### Coral Propagation Facility

To scientists working on restoring coral reefs, every minute in the water matters. This facility would give them a location close to one of the most endangered reef sites on the coast of Florida. This will decrease transportation time of materials to dive locations.

Susie Johnson - Age 7

Sarah Fernson - Age 28

- Student at Greynold's Park - Teacher at Greynold's Park

## User

## Client

Elementary School, Miami, FL

Elementary School, Miami, FL

## Description

Little Susie's favorite movie is Finding

Sarah was searching for good

Nemo. Her mom has hung more than her fair

material to use to teach her students about

The main clients would be coastal

share of Nemo and Dora crayon drawings on

the ocean and coral reefs but struggling to

and resort developers as well as coral reef

the fridge. Susie runs around her classroom

obtain the funds for anything worthwhile.

researchers, mainly in the Florida area. The

singing, "Just keep swimming." Her teacher

She was ecstatic to find that the resort helps

ideas and design I hope to make flexible

is taking her 3<sup>rd</sup> Grade class at Greynold's

fund school field trips as a part of their Aqua

enough to accommodate other uses if built

Park Elementary School to this resort to

Awareness Initiative. She filed immediately

in other areas. By this I mean that if another

tour the facilities. The field trip is all Susie

for the grant and brought it forth to here

suitable area is identified it may be used for

has been able to talk about for the past

administrator as soon as it was approved.

a research facility as opposed to a resort. The

two weeks at home, ever since she brought

For the past week she has been using the

main audience would include eco-tourists

home the permission slip. She was excited

material sent to her by the head researcher

interested in this unique ecosystem. I also

to hear that there will be "Nemos" there. She

at the resort to prepare her students for the

envision schools utilizing the site to educate

will be thrilled to see the vast array of coral

trip. The material includes information on a

kids about this fragile ecosystem. Kayakers

and "Sea enemies" being nursed within the

few of the thousands of species of marine life

recreational divers will also be able to enjoy

facilities too.

supported by the reef and what researchers

this one of a kind water site.

do to help them catered to her 3<sup>rd</sup> Grade

class.

**Gerald Finn - Age 43 -**

**Kyle Littenbaum - Age 16**

**Rick Stansbury - Age 45 -**

**Teacher at North Miami Beach High School, Miami, FL**

Gerald was at a meeting with some fellow teachers in his area of Miami and heard about the success Sarah had with her 3<sup>rd</sup> Grade class at the resort. He decided to see if they had any material that may suit his sophomore class. He found a plethora of information on their site and was able to obtain material perfect for his Microbiology unit he was getting ready to go over with his students. Gerald was able to teach his students about the many types of algae vital for the survival of a Coral Reef and what causes coral to expel this algae in bleaching events. On their trip to the facilities they were able to see how field researches measure the health of corals and view the propagation facility where they nurse coral before bringing it to the reef.

**Sophomore at North Miami Beach High School, Miami, FL**

Kyle has always grown up with an interest in marine life. He spends his weekend surfing different beaches around Miami. He hopes after high school to attend The University of Miami for Marine Biology. He was ecstatic to hear that his Biology class was taking a field trip to the resort to tour the work they are doing on the reef. He talked to a researcher there and learned about the numerous summer internship opportunities he can participate in through their Youth Involvement Program.

**Lead Researcher at the Resort**

Rick has spent much of his life studying coral reefs and the thousands of fish that rely on this delicate ecosystem. He says that 25% of marine life relies on the reefs at some point in their life and that drives him to restore these reefs. He has been distraught at how few people know the dangers facing our reefs today. The resort and public access area within it have allowed him to reach a greater number of people, many of which had no idea just how bad the reefs are doing, especially off of their own shore in Miami. He is more than happy to host field trips and teach kids of all ages about the reefs, as well as train interns and volunteers in the methods and practices utilized to revitalize the reefs.

# The Site

My site is along the coast of North Beach, Miami. Miami best suited the resort due to the heavy tourist population that flocks to Miami year-round. In 2019 Miami recorded 24.2 Million visitors to their city with 16.3 Million staying overnight. Of these overnight visitors 53% were visiting for leisure. 15% were visiting friends or family, and 6% originated from cruises. 68% of these visitors stayed at some form of a Hotel or Resort. People who chose to stay in a hotel favored the Miami Beach area which attracted 38% of people. 46% of people also took the time to visit the Miami Beach area.

This site is also close to a section

of the reef labeled at very high risk by the World Resources institute. This is a vital part of the reef to be able to research as scientist can closer examine local threats which affect 70% of reefs in the Atlantic/Caribbean region. It also allows them to effectively measure and move against natural threats like disease.

# Project Emphasis

## Ecosystem Restoration

Reestablish reef ecosystems and marine habitat around the resort.

Establishing an artificial reef in proximity to the resort while providing researchers the proper facilities to maintain, study, and build onto the reef. This provides

## Education

Educate visitors on marine habitat importance and threats.

Provide a public access area where people can get interact with reef components and see what these researchers are doing

to mitigate coral dieback and restore these reefs. They can also learn about a few of the thousands of species these reefs support. boards, and scuba equipment.

## Recreation

Maximize engagement with the reef through safe water activities, kayaking, canoeing, paddle boarding, diving, etc.

Make sure there are safe and non-intrusive ways for people to get close to the reef and the supporting facilities. My goal is to remove inessential barriers between visitors, the reef restoration efforts and the reef itself. I plan to use methods reflective of Japanese gardens as they were designed to take in a beautiful representation of nature from a single viewing point, usually the back patio of a house. I will also provide access to equipment such as kayaks, canoes, paddle

# Goals of the Thesis

## Project

### Laws & Regulations

Study and learn laws and regulations for coastal development. Florida allows minimal over-water construction, mostly limited to piers, docks, and boardwalks. I will show why these laws, mainly put in place to protect marine habitat, may be worth amending when it comes to ecosystem focused designs.

### Educate and Engage

Develop an education area to engage the visitors in reef die back and restoration. With this people can learn about the exact thing they are looking at in the water and in a way put a face to the name of things affected by their actions. With this being in a fairly populated area it may discourage people from harmful practices like polluting the beaches. The education program will span beyond the resort though. Programs will be developed for teachers of all grades to use within their classrooms to educate kids. Guided field trips can then be utilized to cap off the unit and engage the next generation of citizens in the ecosystem that will play a vital role in their lives, directly or indirectly.

### Marine Wildlife Zones

Study what different environmental factors cater to different species of marine life located in the Miami area. This will provide a basis for underwater construction techniques that will be employed within the site. The goal will be to reintroduce some of these species and create a thriving habitat around the resort for researchers to study and people to enjoy.



# Research

# A Plan for Proceeding

My plan is to look at different methods for propagating coral and constructing artificial reefs and develop a plan around my site that is integrated with or situated near my resort.

I will document the design process by recording sketches developed throughout the early stages. On these will be notes as to why certain decisions were made and pros of different layouts and designs.

## Research Results

My research included looking into contemporary Japanese gardens to utilize the main forms and general rulesets in the layout of my reef. It also involves finding information on the various means of construction of artificial reefs.

## Japanese Gardens Results

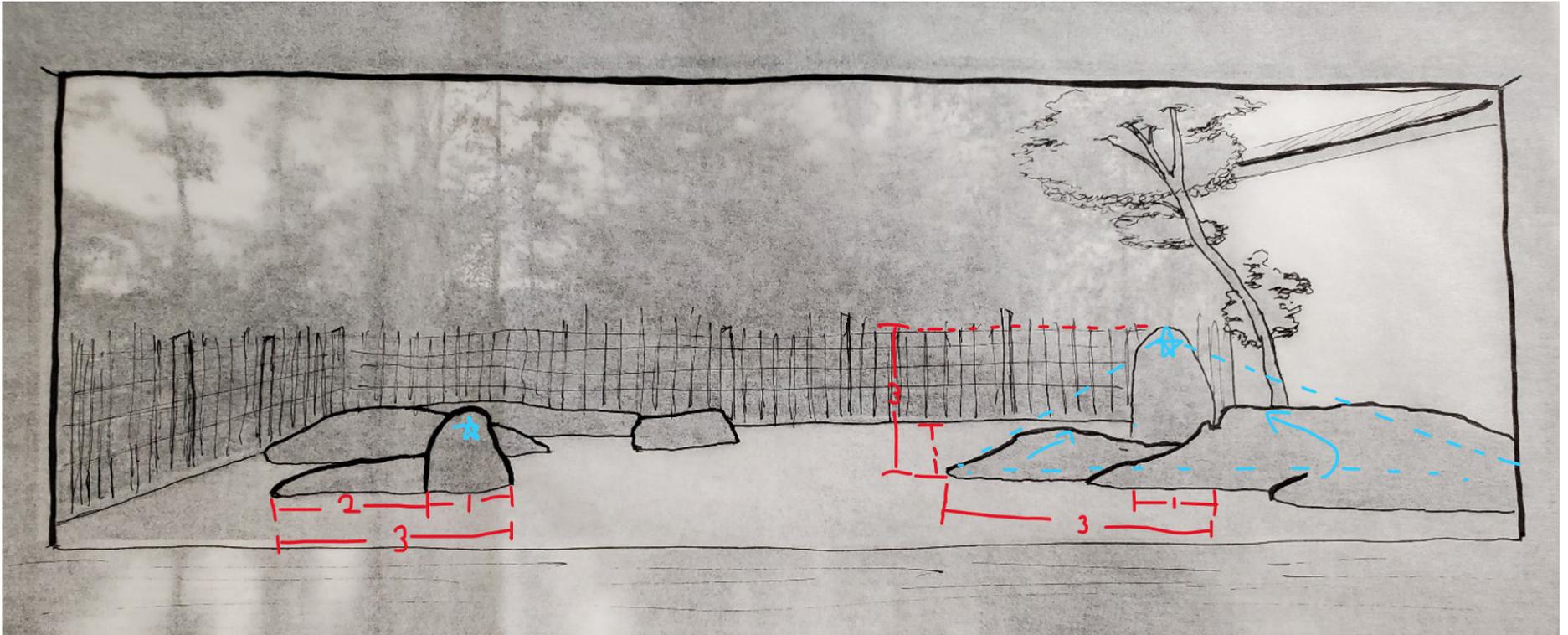
There are a few main characteristics I am taking a look at. I will look at the number of rocks in a grouping as well as the height and size relations of those rocks. A significant aspect of Japanese design is the size relation. Greeks relied heavily on the golden ratio, 1 to 1.618 roughly. Japanese gardens utilize ratios based on three. The main stone in a grouping is usually the tallest or widest and is therefore the three. Complementary rocks will then be one-third of the height or width, or two-thirds of either. Height can also relate to the width and vice versa. The width of a rock may be two-thirds the height of the main rock.

The rocks themselves have grains like wood. These grains give them a direction,

one that guides the eyes and adds movement to a stationary landscape. Some rock's shape point in a direction, whether that be by leaning or a literal point. This can create contrast in a landscape by going in opposite directions. It can create several focal points or emphasize a foreground, mid ground, and background. They can also all establish one main focal point.

That leads me to the last characteristic I am looking into. I am analyzing the visual directions of the rock sets as a whole. I am looking at where my eyes naturally flow in the compilation. Is there one focal point? Where does that focal point lie? If there are several, where are they?

My goal is to see if there are aspects of



Ohiroma Hall | Proportion and Motion Analysis

traditional Japanese garden design that are still prominent, what things have changed, or what things don't play a role in contemporary Japanese design. My plan is to then take this information and translate it into a coral garden in my project. I do, however, not want a traditional Japanese looking garden as my site is in Miami, Florida. I want to represent a more contemporary style that is more prominent in the Miami area.

I will look at a few pictures of gardens by Masuno and draw over top of them comparing visual relationships between rocks. Noting the scale relations, framing of the views, and visual directions of the rocks. The first garden I looked at was the Ohiroma Hall, a karesansui, or dry garden. There are two main groupings within this garden. A lesser on the left, and a greater on the right. On the left there is a grouping of

five rocks. Three of these make up a coherent group in the front, two closer, and the one behind filling in blank space so it seems that the two horizontal rocks stack to be as tall as the focal rock. Looking at the width of the rocks in the front of this grouping the horizontal one is two parts to the focal rock's one part for a total of three parts, staying in line with traditional Japanese gardens.

The second grouping on the right

contains three rocks, two slightly larger than the rocks from the first grouping and one that is so large it spills off of the view port. The relations between the first two rocks follows the one to three ratios as well. The width of the tall focal rock in the rear is one part to the second rocks three parts. The height is exactly inverse. The horizontal rock is one part to the focal rock's three parts.

The focal rock on the right is established by it's greater height, but also because it creates the top of a triangle within that composition. Supporting this is the directionality of the complimenting rocks guiding a viewers eyes to the focal rock.

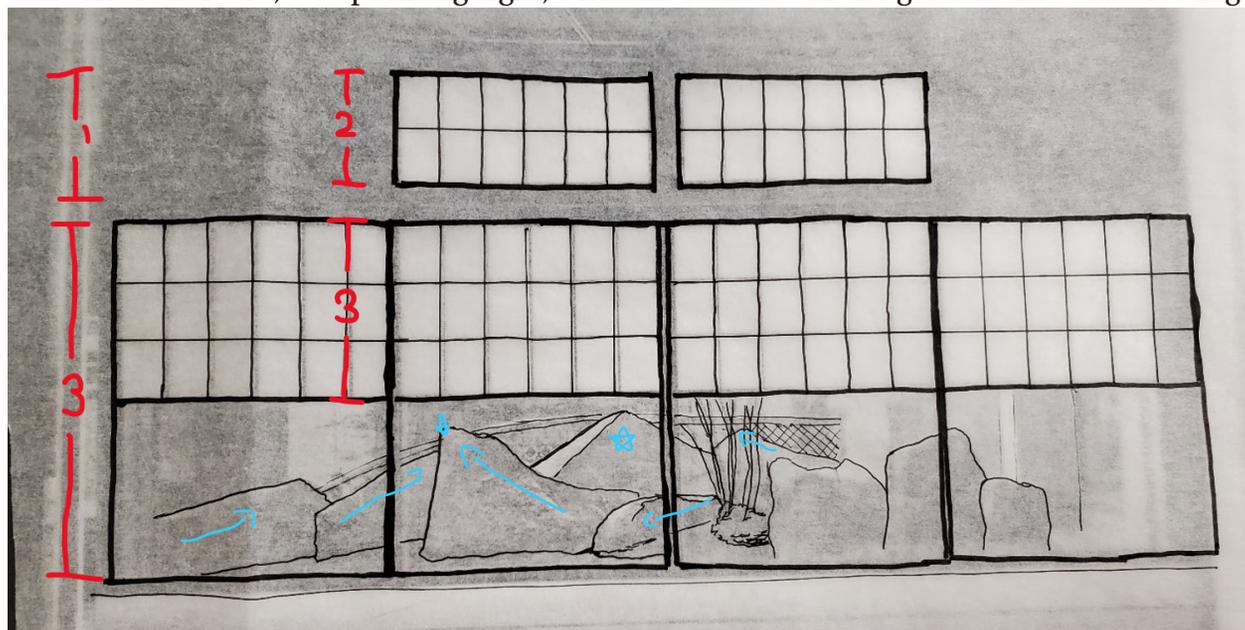
Yukima-shoji means snow-viewing and is properly named for the opaque windows under which you view this garden. This garden lacks any strong height and width relations with the rocks but is strong with the windows. The upper opaque windows are two panels tall, the ones beneath are three, creating a two to

three ratio. The clear windows beneath are the same size as the opaque ones above therefore one can infer that they too are three panels tall to the opaque glass total of five panels tall. Although we move away from a one, two, three relationship we move closer to the golden ration. Three and five are consecutive numbers in the Fibonacci sequence and farther along than 1, 2, 3, and therefore closer to the perfect ratio.

The rocks create a more turbulent garden beyond the window. The Background contains four rocks, two pointing right, one

pointing left, and one whose sides copy the rock respective to each one and having no direction itself while being framed just left of center becomes the focal point. The mid ground contains two rocks, one short and long leading into a rock with a sharply rising point guiding eyes towards another focal point while framing the one in the background.

Flanking the composition to the right are three upright, very stationary rocks that stand in contrast to the conflicting movements in the garden. The are a resting



Yukima-shoji | Proportion and Motion Analysis

point, a safe harbor for the eyes on the storm of this garden. They contain no strong height or width relations, nor do they establish any strong focal point but they are pleasing to the eye non-the-less.

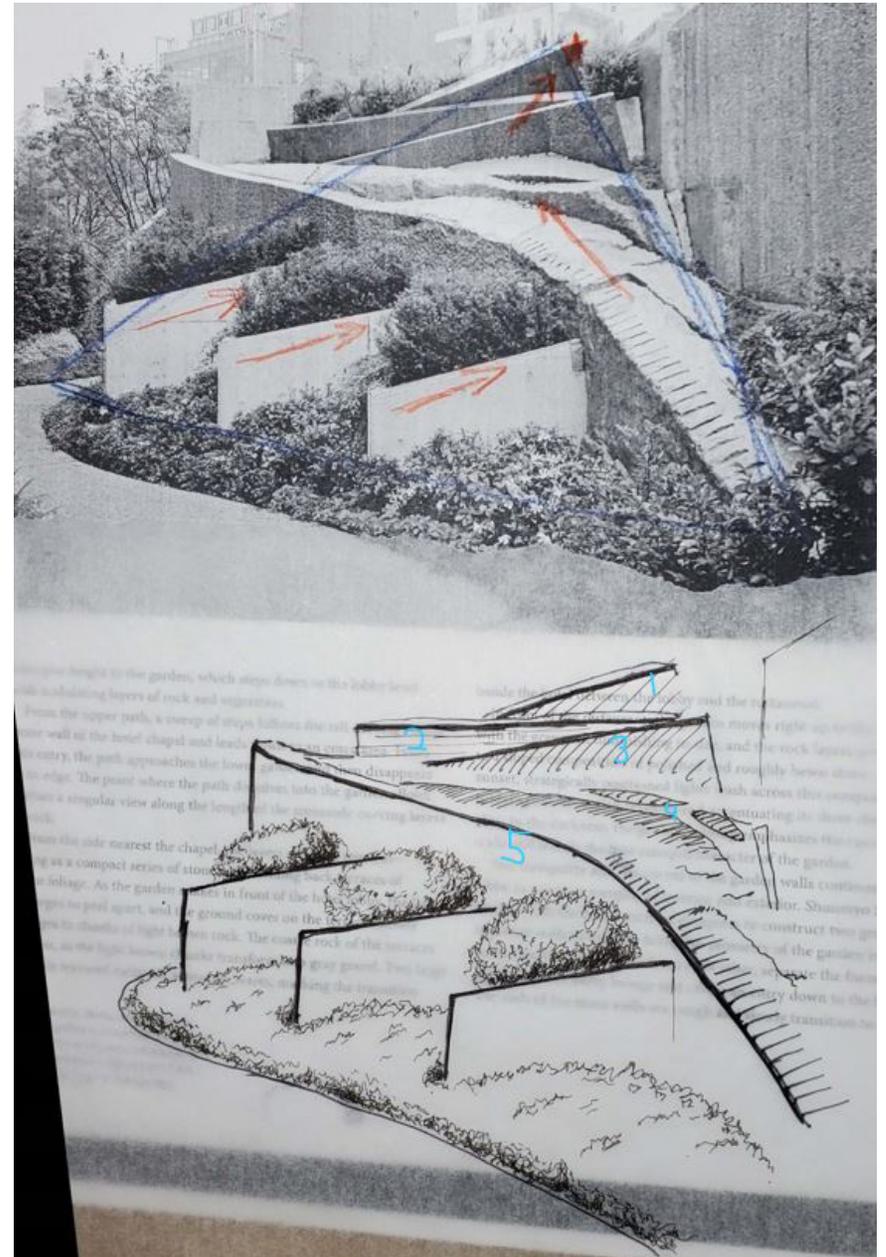
At the Cerulean Tower Tokyu Hotel gardens there lies a fantastic composition of stone and concrete, planters and pathway. As the path winds to the left your eyes are drawn by a repetition of three planters angled towards the composition. From there your eyes are guided naturally to the very peak of the composition through very lateral moving rocks, the lowest shooting up and to the left and than a series of almost horizontal rocks zig zagging back and forth to the focal point. The movement of these individually is lateral, but together is vertical. The whole thing establishes a loose triangle engulfing the composition of stone and concrete, natural and constructed while being softened by natural plantings. Repetition plays a big role in this composition. The

natural stone stacks with five main stones, the lower of which has a repeating notching pattern leading towards the top. The planter also sit in a repetition of three. Three similar horizontal stones sit at the top differing mostly in the angle they rest.

While Masuno embraces the traditional aspects of gardens that he grew up admiring, he strays from the guidelines established in those gardens. He employs height and width ratios somewhat minimally and tends to focus heavier on repetition and movement. One or two focal points seem to be utilized as well as designing for a viewer to

read the garden from left to right.

To design a Japanese garden with contemporary inspiration someone doesn't



Cerulean Tower Tokyu Hotel | Motion Analysis

need to adhere completely to the traditions but instead embrace aspects so that the structure is not totally lost. Triangles should be established to maintain structure, groupings should be odd numbers, mainly three and five. Nothing should be too large or too small and if ratios of 1, 2, 3, can be established they should, otherwise they should at least be related consistently in the design

## Artificial Reefs

Three main types and functions of objects making up an artificial reef.

Substrate Blocks - provide substrate for attaching organisms like seaweeds, cracks service shrimp, abalone, sea urchins, and fish. They are usually placed in shallow water at a depth that allows light intensity to be ideal for local seaweed and animals and used in areas of strong waves and currents

Chamber structures - increase

habitat complexity by providing vertically defined spaces. They are usually taller, placed in deeper water where they can't be bashed by waves. Chamber structures are good for migrating squid and fish

Breakwater blocks - They change current and wave patterns while protecting the coastline from erosion.

Concrete is the most common material used for most of these structure given it's low cost and ease of production as well as its longevity in the water. However, natural stone is lighter and has been used since the 1600's to build up fish habitat.

Just placing rocks in a soft sediment area has proven effective as it is one of the oldest methods of building up fish habitat. A single layer is good enough for kelp and most seagrasses, but piles create cracks and crevices for fish and sea life such as Abalone, snails, sea urchins, saltwater crayfish, and sea cucumbers.

Layers of rocks piled to about 0.5 meters are commonly used for immature sea urchins and abalone. Higher than this and the pile will attract fish and fish fry. As a general rule, the higher the pile, the better it is at attracting fish.

The size of the rocks ranges from 15cm to 50cm in diameter.

Larger stones - abalone and crayfish

Smaller stones - sea urchins and snails

30-40kg stones - sea cucumber spawning area

Rocks can turn and tumble in stormy seas. When this happens creatures can become trapped or crushed, so it is imperative that rocks are stabilized when they are going to be exposed to rough seas. One of the more popular ways of going about this is by putting the desired rocks for the targeted species in a "futon" cage.

A futon cage is just a cage in the shape of a Japanese floor mattress stuffed with rocks, typically 4 meters long and 1.2 meters wide, while varying between 0.4 meters and 0.6 meters in height. A few problems with these however is that kelp that grows on the top of the rocks inside may start to rub the metal mesh and get themselves cut off, and these units are so heavy, sometimes an upwards of 4.4 tons, they sink into the sediment and a whole layer of rocks is buried. The latter is avoidable however as sometimes futon cages are placed on mats as to prevent sinking.

Futon cages are better placed where currents are strong. When currents are weak silt gathers and harmful organisms establish themselves, but a good current encourages growth of food organisms for fish.

An efficient way of placing these cages is to create a large rectangle where the perimeter is made up of these futon cages, then the inside is filled with loose rock which is stabilized by the outer perimeter of

cages. While futon cages still see widespread use there have been more durable methods established as well. One of these is fiberglass reinforced plastic (FRP) bands that they weave together into cylinders. They too are filled with rocks, then tied together into a single layer. Unlike futon cages they do not conform to the sediment they sit on and the open areas underneath have been proven to increase water flow and decrease silting.

## Substrate Blocks

Substrate blocks will be the most important aspect of my design. This will be what coral latches onto to begin growing a reef. There are many factors that play into the design of a substrate block depending on the environment, here are a few:

### Stability-

When building in turbulent water whatever structure is placed there need to

be able to resist overturning. This will be especially important when establishing the reef crest as that is where the reef takes the brunt of the ocean as it breaks waves and protects the shoreline.

### Streamlining-

Where sediment is moved around a lot, sand may pile up and cause silting along structures. These structures need to be streamlined to allow water current to flow around these structures and prevent silting.

### Voids and Crevices-

This refers to the complexity of the substrate block's shape, mainly the cracks and crevices included as little niches for smaller more vulnerable marine species to establish a home. "V" shaped crevices tend to allow species like abalone to grow and still provide habitat throughout their lifespan.

Silting-

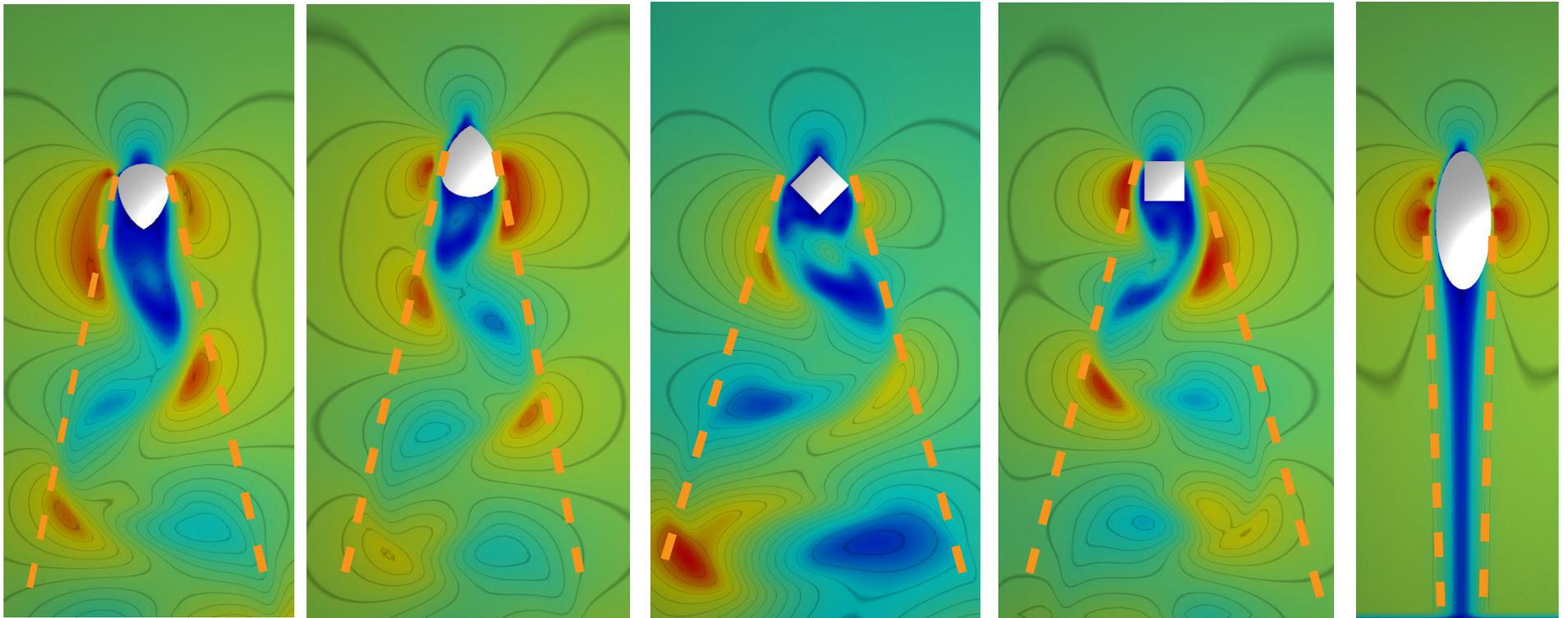
The negative effects of this were discussed earlier but the severity of this issue was not. Even a small layer of silt can prevent the growth of benthic diatoms. Where sediment occurs crevices should be on the underside as to limit silt buildup. Blocks should also be streamlined as to limit the forming of eddies in the current which encourage silting.

Visualized below are possible profiles

for the piers that hold up the resort. I put these models into AutoCAD Flow Design so I could visualize the eddies that would form. The Blue visualizes the area of low velocity water that will create that harmful sedimentation. Although four on the left look to be better than the one on the right they actually produce more sedimentation that is easier to visualize in the video. I have tried to make it easier by highlighting the

are of sedimentation with the orange dotted

lines. Seeing the results, piers utilized for the resort should be shaped like the one on the right and be made out of an eco-concrete with plenty of nooks for marine life so that although we are building on top of habitat we are also providing more habitat that what we are infringing on.





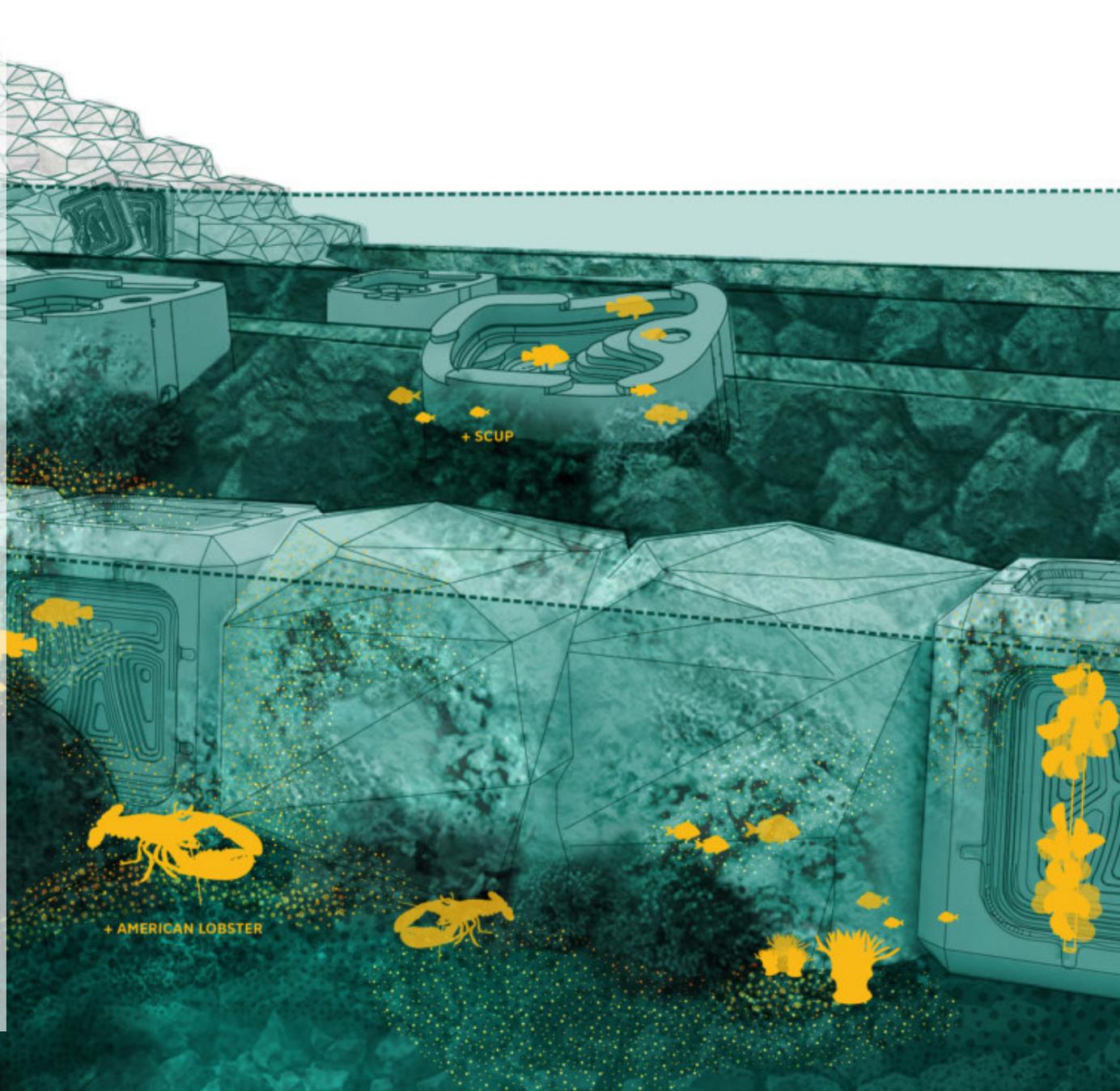
# Case Studies

## Living Breakwaters

Living Breakwaters is an ecological restoration project off the coast of Staten Island, New York City, New York developed a Living Breakwaters Curriculum open to the public.

While residing on the water like the Little Island the primary focus of this is ecological restoration as opposed to public park space. It uses several ecological design strategies from ecologically-enhanced concrete units to “reef ridges” and “reef streets” that all work coherently to reestablish a diverse ecosystem on the coast of Staten Island.

The work being done here doesn't lie solely in the water however. SCAPE's other goal along with the ecological side is to build social resiliency. They are doing this through educational programs with schools in partnership with the Billion Oyster Project as well as working with a group of local stakeholders, the Citizen's Advisory Committee. Through this collaboration they



## Little Island

Little Island is an environmental planning project at Pier 55 in New York City, New York. It is a 2.4 acre park suspended above the harbor. This project is unique in that it is entirely suspended on 132 concrete “tulips” or piers residing over the old Pier 54 pillars that remain as habitat for aquatic life.

It is a unique look at overwater construction with minimal interference in the aquatic habitat below the site, which lines up perfectly with the goals of my project.



# Project Justification

My project is important to me for several reasons. Personally this type of project attracted me because I like water and waterfront designing. I've always loved coral reefs and unfortunately I haven't been able to see one in person. Hearing that coral bleaching events as well as improper water treatment was killing coral on the Florida coast troubled me because I might lose my chance to ever see one. Environmentally it's important because it provides an additional remedy for the coral crisis. Professionally it puts me closer to my professional goal of becoming a consultant in coastal design. I eventually want to start my own firm specializing in consulting for coastal design because I have always enjoyed it and it allows for more flexibility in my schedule throughout the year. This should provide more knowledge into aspects of coastal design as far as marine habitat, constructing

over the water, and other issues relating to the Florida coast.

Economically the project functions much like Brooklyn Bridge Park. There will be a public aspect to it so that the general public can interact with the reef and facilities that aid it. Helping to fund the research and revitalization of the reef will be a private resort centered around the reef.

Environmentally it is justifiable because there are many different non-profits that are trying to revitalize the reefs and this would just aid and organize those efforts into a tangible goal as well as set the framework for similar projects in the area.

My site location is on North Miami Beach, Miami, Florida. This is an area in need of coral revitalization. Given its proximity to Miami it may also raise a lot of awareness for this cause and garnish more public interest. Miami would also have the populace and infrastructure to support both a resort and park.

## Social Context

This is a fairly unique project. I haven't seen anything resembling it. There have certainly been project the come close like many of the bungalow resorts that dot the islands in the South Pacific. Even those, however, fail to touch on the ecological aspect of the very waters they sit on and profit from. There are definitely many revitalization projects designed to restore aquatic habitat. That has been going on since at least the 1600's when the Japanese would dump piles of rocks into the water for fish to establish a population and thus generate more food for the Japanese population. Most of those projects fall short in the interactive and immersive experience that mine aims to achieve. Currently to see a coral reef you will most likely have to pay for a guided tour or obtain diving resources and a boat to reach one. My project aims to lessen that gap and make the reef more accessible to the public.

## Site Context

Miami is one of the most popular tourist destinations in America with 7.9 million visitors staying overnight in the Miami area. My site on Miami Beach is the most popular destination for visitors to visit and stay.

In 2019 Miami recorded 24.2 Million visitors with 16.3 Million staying overnight 53% were visiting for liesure (8.6 Million) 6% originated from cruises (9.8 Million) 68% stayed at some form of Hotel or Resort (11 Million)

It is close to a section of reef labeled at very high risk by the World Resources Institute.

## Performance Criteria

My resort should be two acres, with a three acre public access area. The resort should have twelve bungalows for guest. A performance stage should be included that accommodate 150 people. The public access area should include coral and fish nurseries. A dock should be provided for two research vessels, a dive boat, and 5 public mooring spots for guests and visitors. There should be a revitalization plan for at least one mile of coral reef along the coast of the beach.

# *On the* **TIDES**



# Spring 2022 Design Semester

## Project Goals

### **Ecological Recreation**

Promoting recreational activities that engage the participant with the natural environment around them. It also aids in awareness of the effects we have on the environment and seeks to show how we can go about our activities in a way that is not harmful to the environment.

### **Environmental Intimacy**

Creating a project that embraces the environment it resides in. It does not design around but rather promotes the interaction and exploration of the elements that make its site so unique. It seeks to remove the feeling of disconnect between the person and the natural world around them.

### **Accessible Exploration**

Eliminating barriers between the person and the opportunity to explore the environment. This means giving and creating opportunity to partake in activities not readily available to the average person as well as creating space for individuals with conditions limiting their ability to take part in those activities.

# Site Context/Analysis

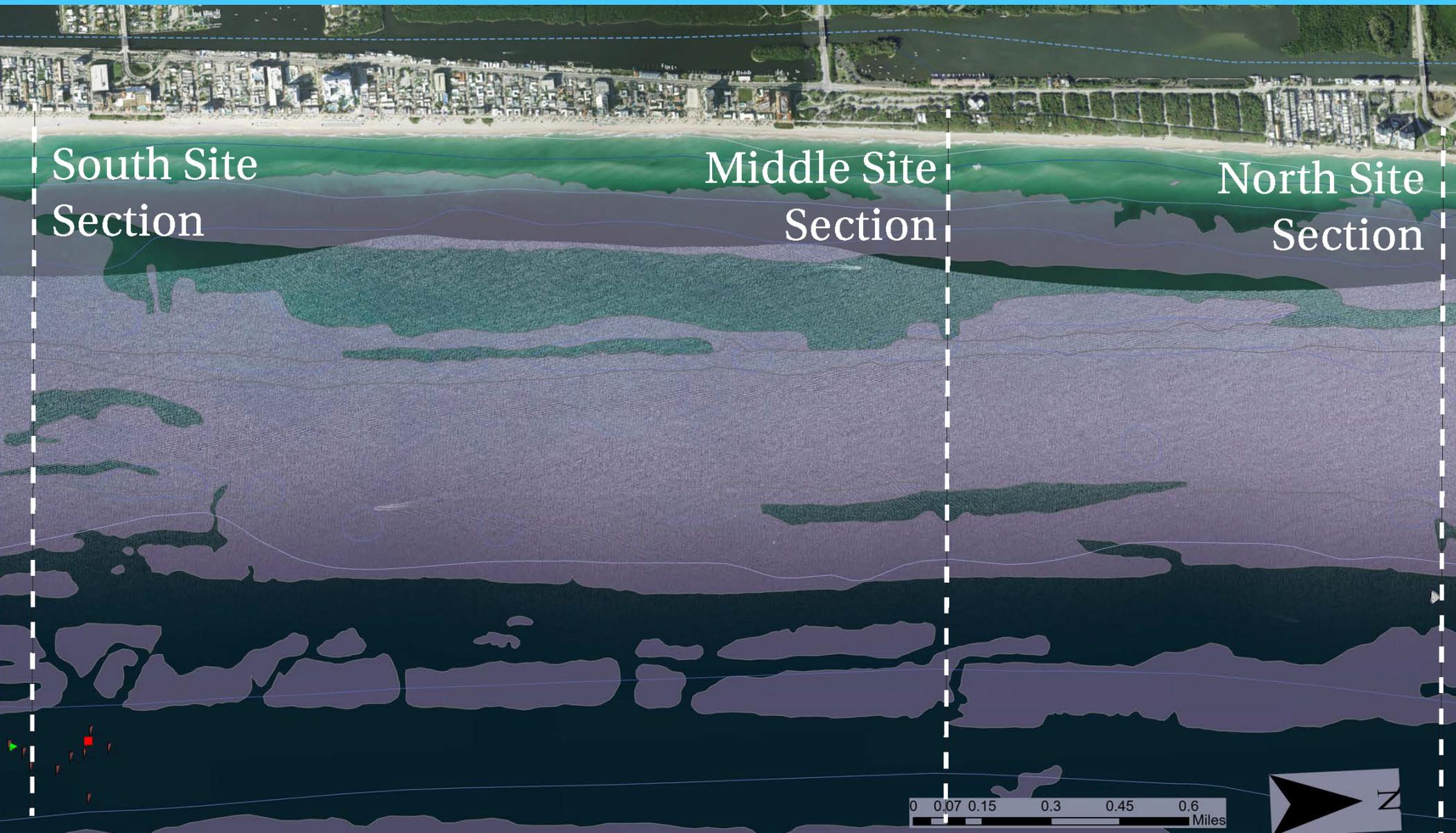


Florida | United States

Fort Lauderdale

Hollywood

Miami



Site Context



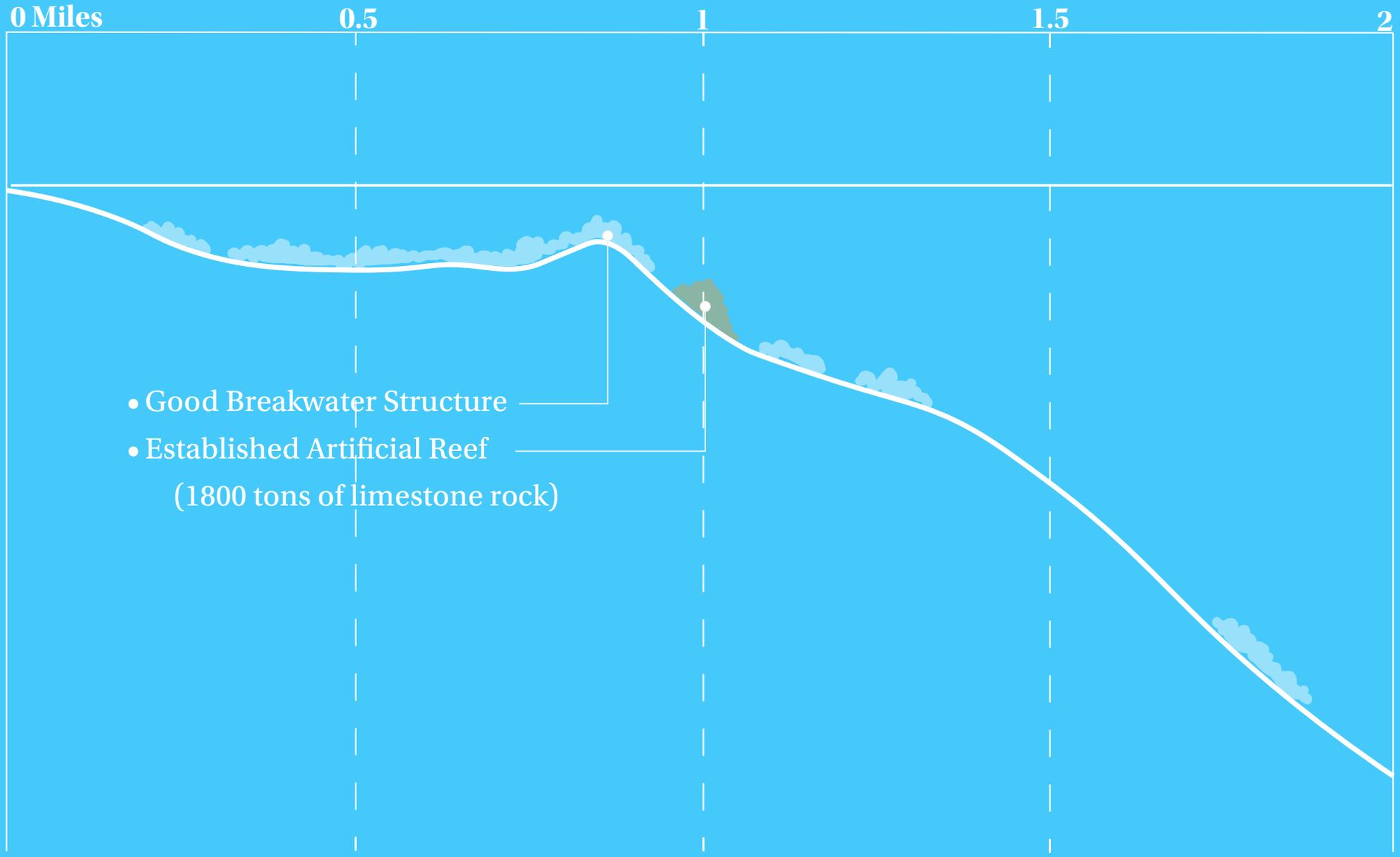
North Site

## North Site Section

The land side of this section has very little room for development without infringing on the current parking lot serving the pier.

It is close to Florida Atlantic University however and the underwater side has a good bit to offer. It has good breakwater structure and well as a good amount of established natural reef and an artificial reef.

However there is little room to build and not much need for establishing a new reef.





# Middle Site Section

This section provided some good land for development while being able to utilize public beach parking for a majority of visitors. Across the bridge lies a wildlife reserve whose proximity aids me in my goals for accessible exploration and environmental intimacy.

The underwater parts of this section are the worst of the three, there is very little breakwater structure, and the reef itself is in patches along here. This does however provide room for construction and justify the need for establishing an artificial reef.

This section would ultimately be the one chose for the resort for these reasons.





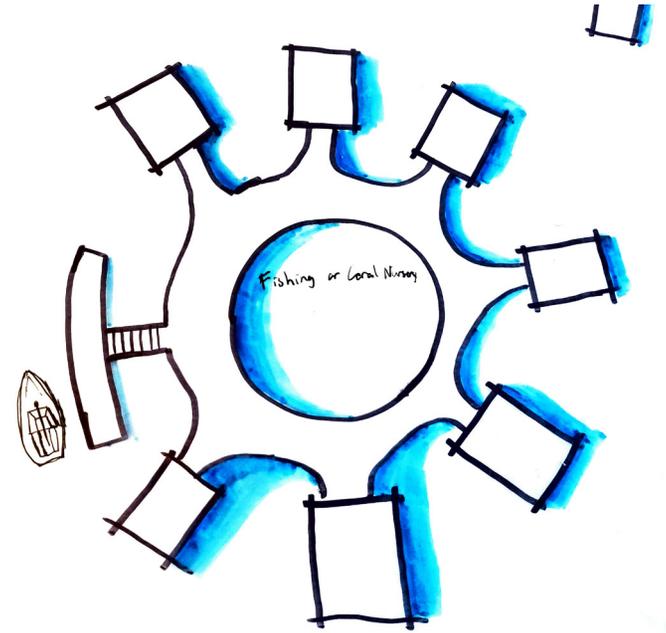
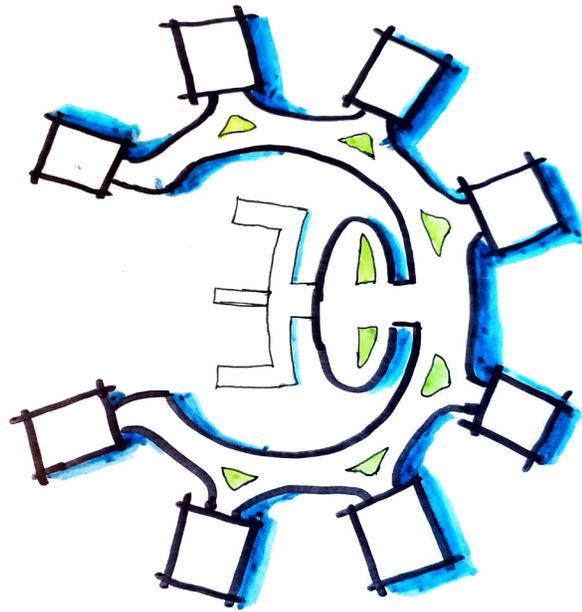
## South Site Section

The southern-most section I looked at has very little to offer on the terrestrial side. There is little room for development. It is close to docks utilized by many cruise ships and its proximity could prove valuable in attracting tourists.

In the water lies perhaps the most enticing aspects of this section of coastline. There lies 11 shipwreck reefs in close proximity. All of these are about 60' of depth, within the range for amateur SCUBA divers. There is also a 160' vessel at 110' in depth for more experienced divers.

The site I chose is close to this so that diving excursions can be lead from the resort.





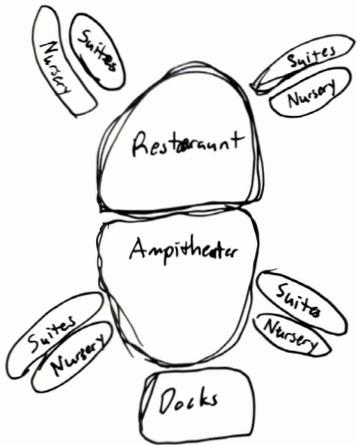
Suite Pods

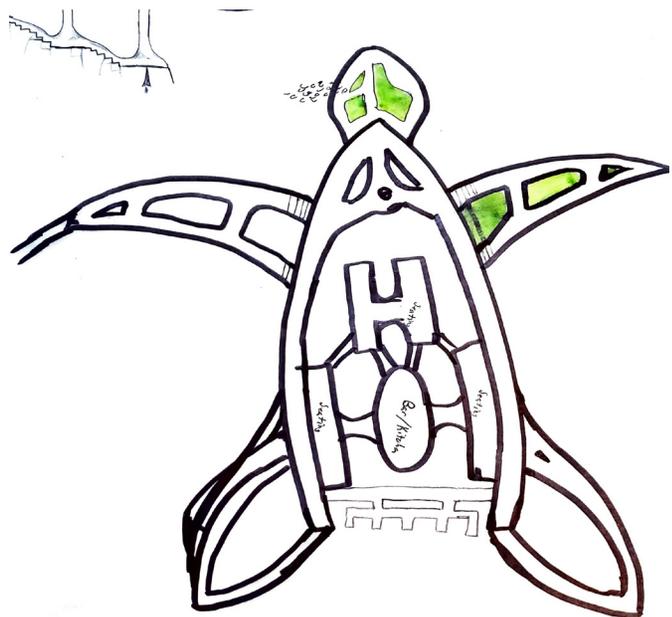
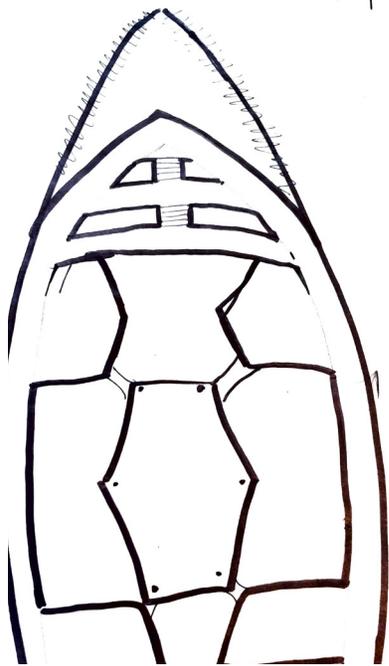


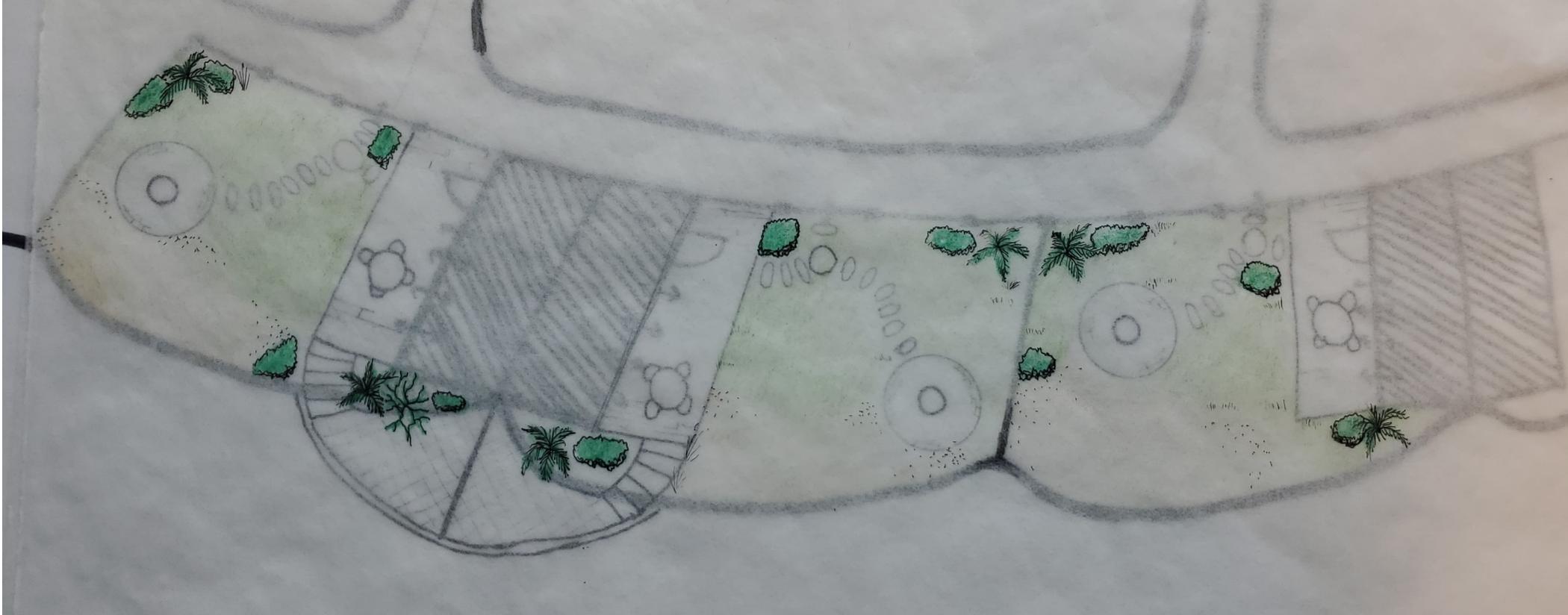
Dive Site Po



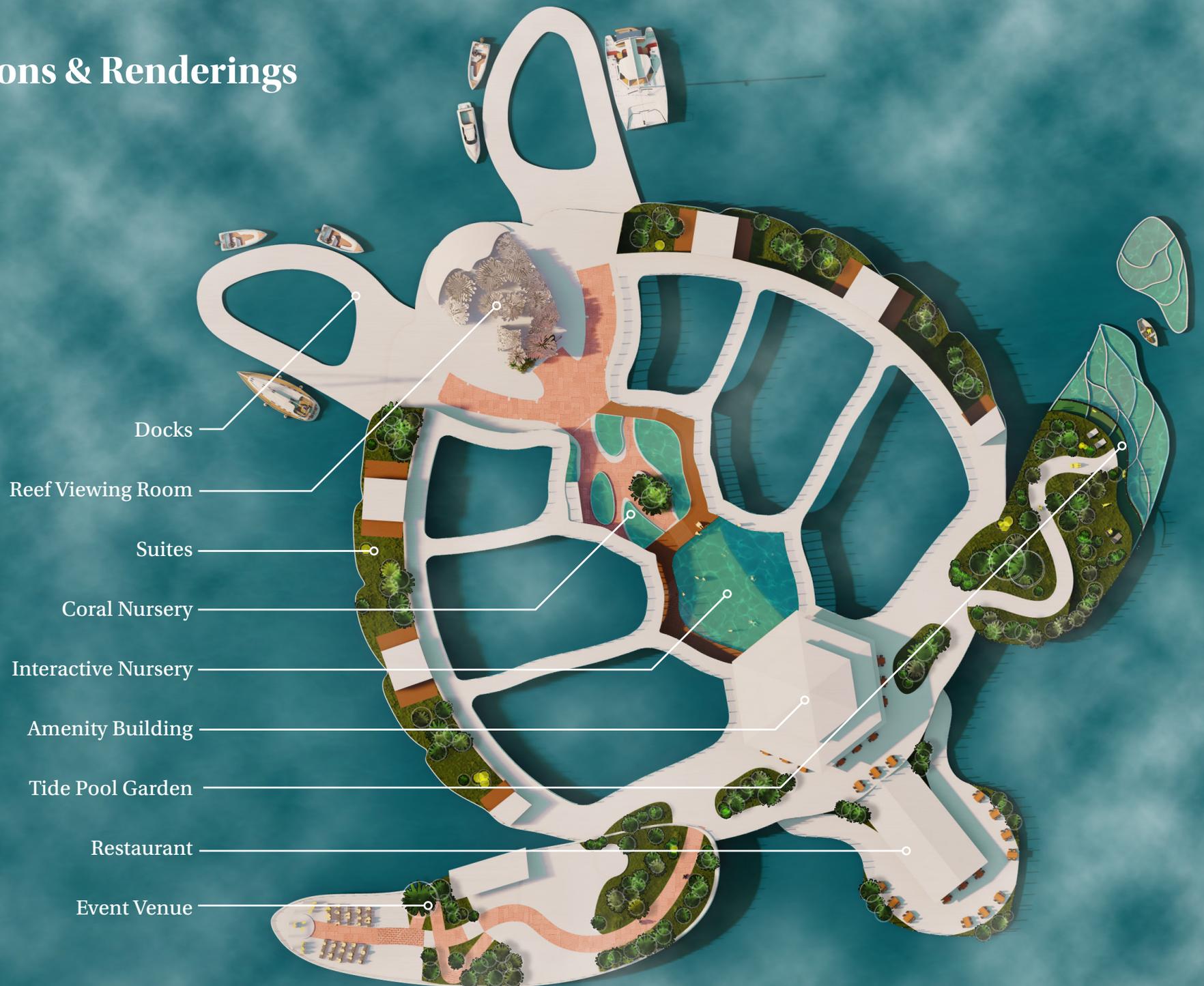
Main Structure







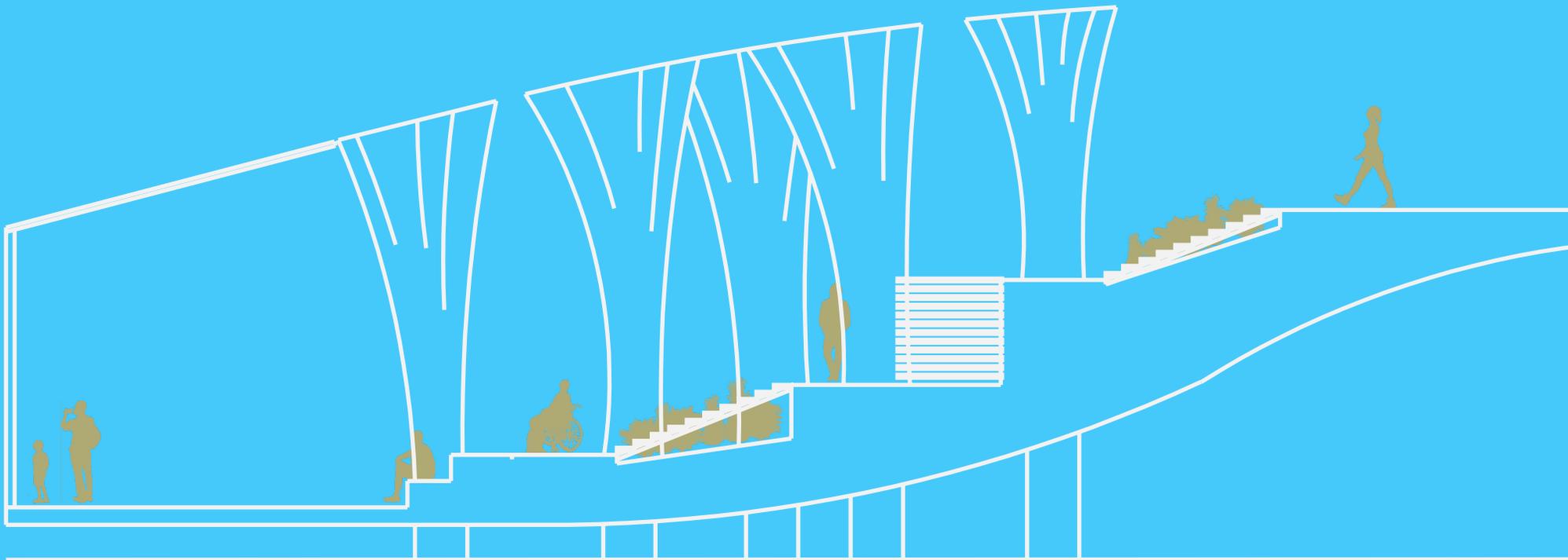
# Sections & Renderings





## Reef Viewing Room

The perspective above is looking into the reef viewing room from the water itself. Seen in the room are many large, unique columns. These columns are meant to emulate the natural growth of coral, they get wider as they approach the top yet they never touch allowing a unique lighting pattern to shine through. There are benches so people are more comfortable as they spend time there as well as an ADA accessible ramp that gives everyone a chance to view the reef.



The section of the reef viewing room shows how the unique columns also serve as support for the resort and hold the structure a few feet off of the seabed. This is done for a few different reasons. One reason being

that as sea levels rise, these columns could be jacked up and shimmed higher so the structure can adapt to that rise.

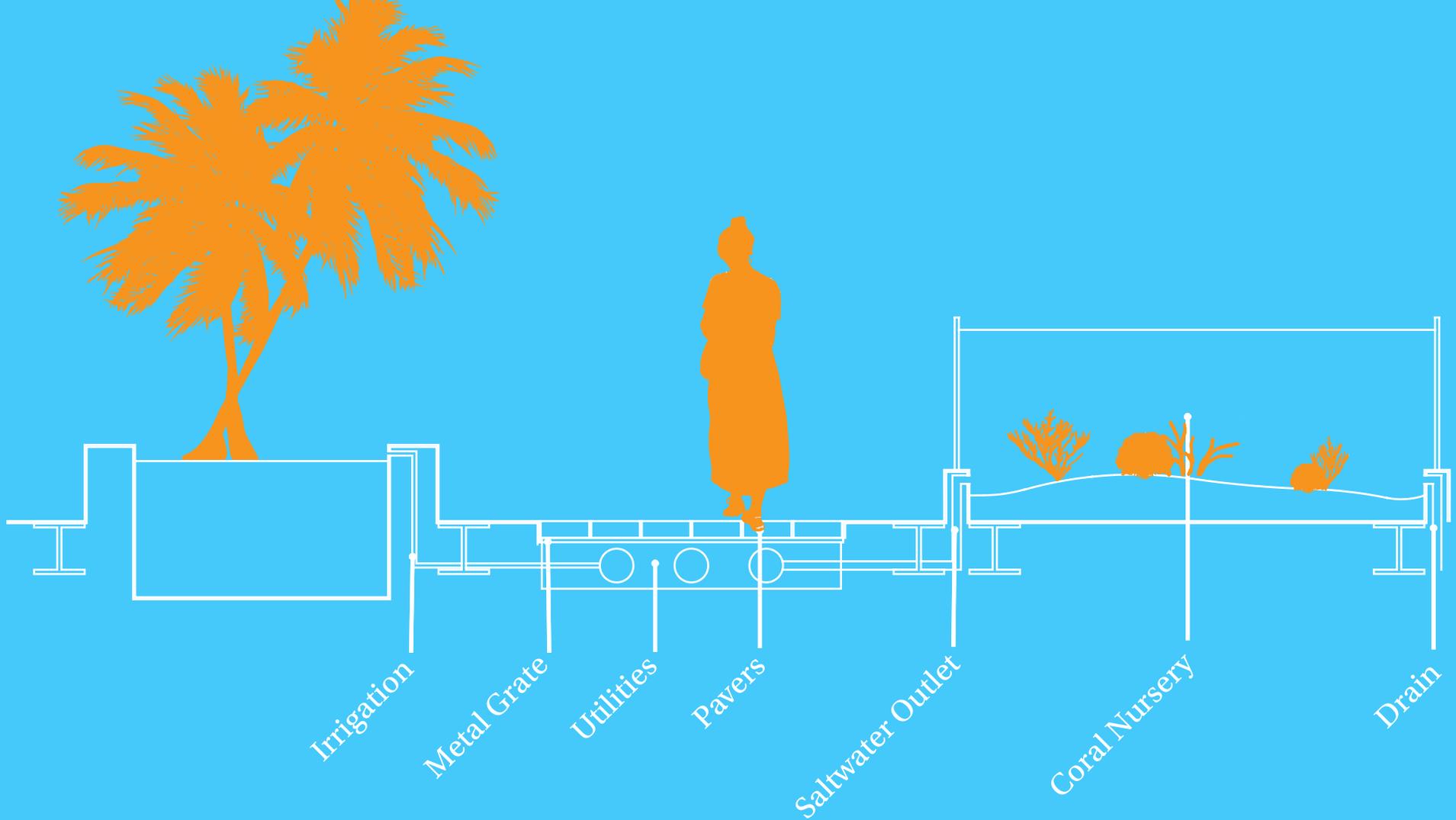
The second reason is to mitigate a harmful factor in reef die-back, silting.

Silting is cause when eddies form behind obstacles in the water. This allows water to flow underneath the structure and eliminates any eddies that would otherwise form.



## Coral Nursery

The coral nursery serves as a spot for people to see what researchers are doing to propagate coral and is a lens into the fight to save our reefs. A walkway on the side guides people along the outside and to the interactive nursery. Patrons are able to walk among the tanks and view the numerous species being propagated.



Underneath the coral nursery grate underneath to get to the utilities. ensures saltwater is constantly being rotated pathways lies the utilities for this section. Utilities running here include through, not letting the tank overheat as well When maintenance needs to be performed, irrigation for the planter as well as a supply as acclimatising coral to th waters they will they are able to remove the pavers and metal line for saltwater for the coral tanks. This be placed in, increasing success rate.



## Interactive Nursery

The interactive nursery is the union of space between research and recreation. It allows people to aid researchers in different processes in an intimate way not commonly

available to most people.

The rock layout in the back is inspired by Japanese gardens, with three large faux stones all following the 1, 2, 3 proportions

as well as the motion created by them and the mangrove tree leading the eyes up and towards the building.

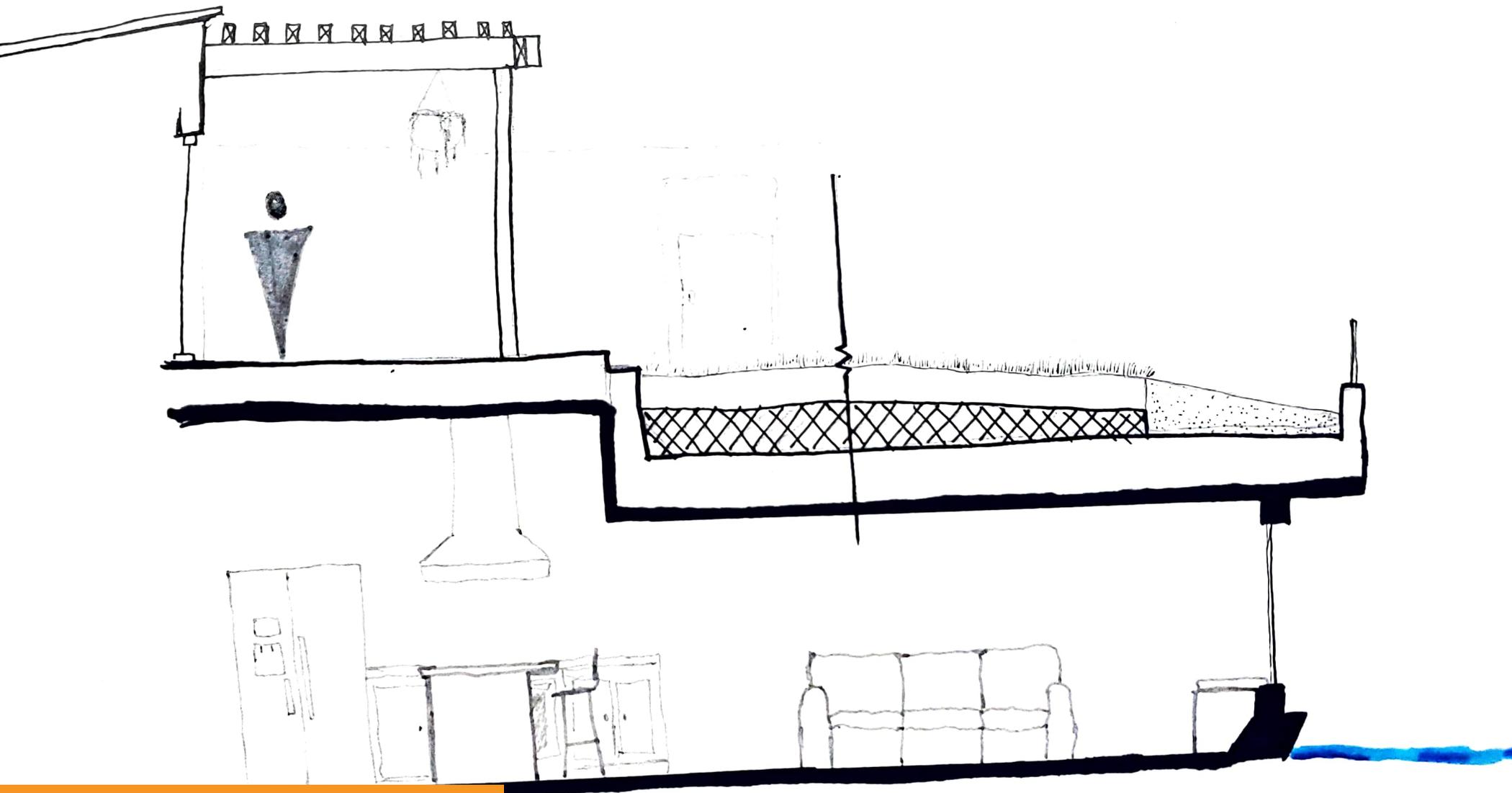


## Tide Pool Gardens

The tide pool gardens is a more observational space. The path winds through plantings commonly found on the beach and you'll find yourself on a glass walkway over a series of tide pools.

The pools are designed to catch waves and the lower ones to be sunk when the tide rises. This provides a tide pool habitat where people can view a variety of marine species. The cut through the middle provides a

place for kayakers to view the pools in an intimate way as well as giving the structure a sense of motion with the fin being partially "submerged."



## Suite Section Concept

Here is a sketch of a concept for the suite section, which is more or less how it is still. The outdoor section is hosted on top with a grassy lawn and a beach section. Underneath lies the living space, closer to water level. It is a way to eliminate the barrier between the people staying here, whether it be researchers or guests, and the environment they want to experience.



## Suite Yard Plan

In plan view the yard and beach sections are more clearly defined. Closed in on three sides by the building and privacy fence, the area opens towards the ocean. The angle chosen for the infinity edge jacuzzi and deck is inspired by the lines used by James Rose at his private residence. It guides guests views from the building towards the ocean.



## Event Reception Space

Here you can see a small concert where one sides is an active area to enjoy that can also be utilized for catering and taking place in the back of this space and the event, the other is a more passive space other event necessities. patrons enjoying music. The path curves where people are sitting down to eat and through the space and divides it into two, talk. The back left hosts a sunken bar area



## Wedding/Event Venue

The tip of the same fin hosts the event venue. Here we see a wedding taking full advantage of the one of a kind views of the sunset over Hollywood. That is why this fin was strategically placed facing West. The space can host anywhere from 60 to 100 patrons.

# What I've Learned

Having gone through the process, I liked. I would've pushed myself out of the have realized some things I would've done 3D modeling phase sooner and done more differently. detail drawings. It would've also allowed

I would've narrowed down my me to find metrics for my resort like how research. This would've afforded me more many people can be on it, how much rooms time to get into detail with it. As it sits now could be rented for, months it could be used, it is very generalized. I would've been able among other things. to look more in depth into artificial reefs and the strategies used in the construction, layout, and placement of them.

I also would've explored the design earlier. I didn't have a solid design picked out until almost midterms. Had I had an idea during the research phase it would've directed my research better.

Hand drafting was an oversight on my part. I wish I would've spent more time sketching out ideas. I would've been able to go through more designs and ideas that way.

My project was also still in more of a conceptual phase than what I would've

# APPENDIX

## References

- Anticipating Future Sea Levels. (n.d.). Retrieved December 16, 2021, from NASA Earth Observatory - Home website: <https://earthobservatory.nasa.gov/images/148494/anticipating-future-sea-levels>
- Climate change will continue preventing coral reef growth in subtropics | U.S. Geological Survey. (n.d.). Retrieved December 16, 2021, from USGS.gov | Science for a changing world website: [https://www.usgs.gov/center-news/climate-change-will-continue-preventing-coral-reef-growth-subtropics?qt-news\\_science\\_products=1#qt-news\\_science\\_products](https://www.usgs.gov/center-news/climate-change-will-continue-preventing-coral-reef-growth-subtropics?qt-news_science_products=1#qt-news_science_products)
- D'itri, F. M. (2018). Artificial Reefs. CRC Press.
- Florida is in for more dead corals, sea rise and floods, says new UN climate report. (n.d.). Retrieved December 16, 2021, from Florida's Sea Level Rise - Sea Level Rise. (n.d.). Retrieved December 16, 2021, from Sea Level Rise website: <https://sealevelrise.org/states/florida/>
- Locher, M. (2012). Zen Gardens. Tuttle Publishing.
- Miami, Florida | Flood Factor. (n.d.). Retrieved December 17, 2021, from Flood Factor website: [https://floodfactor.com/city/miami-florida/1245000\\_fsid](https://floodfactor.com/city/miami-florida/1245000_fsid)
- reporter, G. (2020, November 18). "Dire outlook": scientists say Florida reefs have lost nearly 98% of coral | Coral | The Guardian. Retrieved December 16, 2021, from the Guardian website: <https://www.theguardian.com/environment/2020/nov/18/coral-reefs-florida-dire-outlook>
- Slawson, D. A. (2013). Secret Teachings in the Art of Japanese Gardens. Vertical Inc.
- student, M. D.-G. (2021, September 12). The Dying Coral Reef in Florida. Retrieved December 16, 2021, from ArcGIS StoryMaps website: <https://storymaps.arcgis.com/>