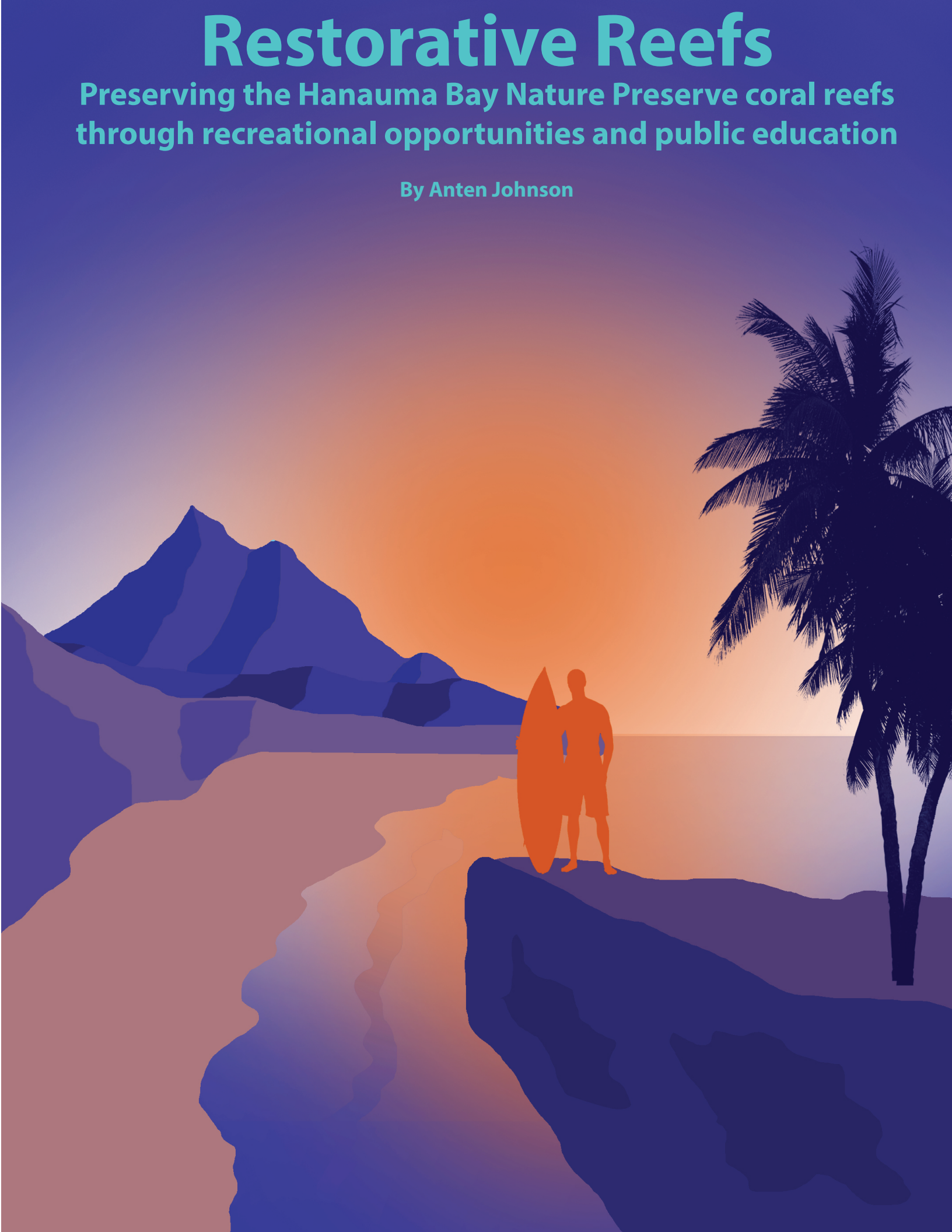
Restorative Reefs

Preserving the Hanauma Bay Nature Preserve coral reefs through recreational opportunities and public education

By Anten Johnson



Restorative Reefs

Preserving the Hanauma Bay Nature Preserve coral reefs through recreational opportunities and public education

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

By

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Primary Thesis Advisor

Secondary Thesis Advisor

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THESIS ARCHIVAL NOTE

The following thesis project, entitled **Restorative Reefs, Prerserving the Hanauma Bay Nature Preserve coral reefs through recreational opportunities and publicneducation**, was composed over the course of the 2017-2018academic school year. The Thesis Program, as contained here, was initiated and completed in the fall semester as a part of the LA 563: Programming and Thesis Preparation course. Supplemental material, including the Thesis Boards and the Thesis Presentationdocuments, were generated in the spring semester as a part of the LA 572: Design Thesis studio. Any inconsistencies between the different documents, in terms of research and design, should be excusedper the evolution of the project across the two semesters

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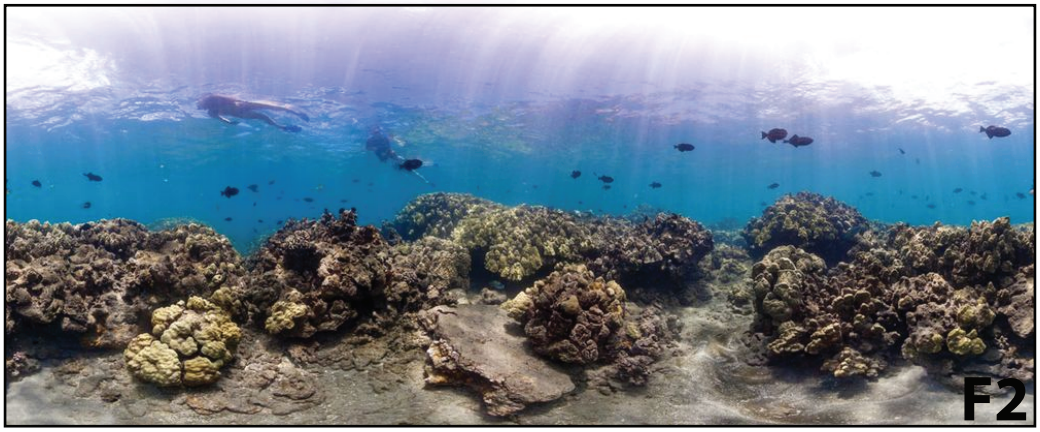
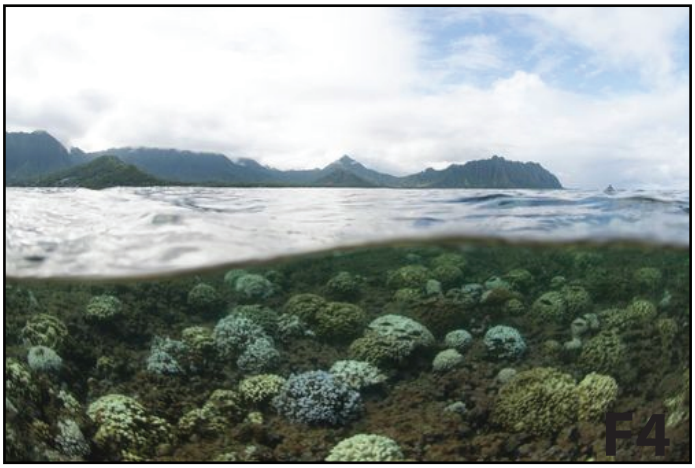
Abstract

In my thesis I will be going over ways in which as a landscape architect we may develop a solution to the destruction of our oceans. I will be diving deeper in the way we could design a way to help rebuild coral reefs help manage the amount of run off that enters the ocean. Providing a learning opportunity that could be in the forms of a boardwalk system along with a snorkeling and diving excursion. In doing so I will have to research the effects people have on marine life, what types of run off are most harmful to coral reefs and marine life, along with what types of planting could help clean up the run off and how to turn a living ecosystem into a learning experience. The project typology is waterfront and also ecological design and restoration. The major project elements would be the coral reef restoration either saving an existing reef or helping to rebuild some already destroyed reef and rebalancing the ecosystem. Also providing a learning and cleaning aspect to the water so that no more damage is done to the reef. The client or users would be any one who enjoys being around the ocean, anyone who is interested in marine life, and who ever uses the ocean as a resource weather that for food, income, play or inspiration. The site at this point has still yet to be determined. The project emphases is really on helping to clean and protect our oceans because they are such a major part of this world and if we keep destroying them we won't be able to survive with out them.



Narrative

The ocean is the earth's most valuable natural resource, the ocean and its occupants are in danger. Run off and trashed produce by humans are just some of the things that we do to contribute to the destruction of our oceans. People are the leading cause of harm to the ocean and marine life in my thesis I will be looking at remedies in which people can help the ocean instead of just taking from it, giving back to it in a positive way. Coming up with a way that people can interact with the ocean in a more positive way learning about it and even exercising it in a new creative opportunity. Proving a boardwalk system, view and learning platforms, and a diving and snorkeling activity's. From and economic stand point we get gas, oil, minerals and, renewable energy all from the ocean. If we think about how the ocean provided ecological benefits it supplies us with fisheries, sand, gravel, CO2 capture and storage, nutrient cycling, water circulation and exchange, habitats, and climate regulation. The ocean also provides a big social aspect with marine tourism, fishing, sports and hobbies. In the article "Hawaii's most popular coral reefs are in big trouble" the author Kendra Pierre-Louis discourses the threat of climate change and how it is damaging coral reefs. She continues on by saying "warming waters are not the overarching reasons for global coral bleaching, local human impacts- from agricultural pollution to physical destruction- cannot only magnify the impact of warming event, but also make it harder for the reefs to recover afterwards". Through the design and research process I will look in to some of the most harmful way we hurt the ocean and then look at would can be designed to help prevent or slow down the process of pollution along with looking into coral reef restoration.



Typology

Ecological Design & Restoration

Waterfront

Environmental Planning

The typology of this project will be mostly coastal water front due to the nature of the projected I will be dealing with mostly things in and around the coastal edge whether that be plants, animals of the water content its self. I will also deal with ecological design looking at factors that can affect coral reefs such as water tempter, sea level and ocean currents while also looking at restoration after I find what the problem is whether it be pollution climate change or disease. I will have to deal with what can be done to help restore the damaged ecosystem and also help the ecosystem be rebuild and come back ever stronger and last longer than before. Coral reefs can live over hundreds of years and be homes to hundreds of thousands of sea animal so the ecological point will be a very important focus of mine.

Case Studies

MOTE Marine Laboratory & Aquarium

Project type: Coral reef restoration

Location: Florida Keys

Size: 20,000 corals

Distinguishing characteristics of the case: Growing coral from fragments of coral, replanting and rebuilding coral reefs to their former glory

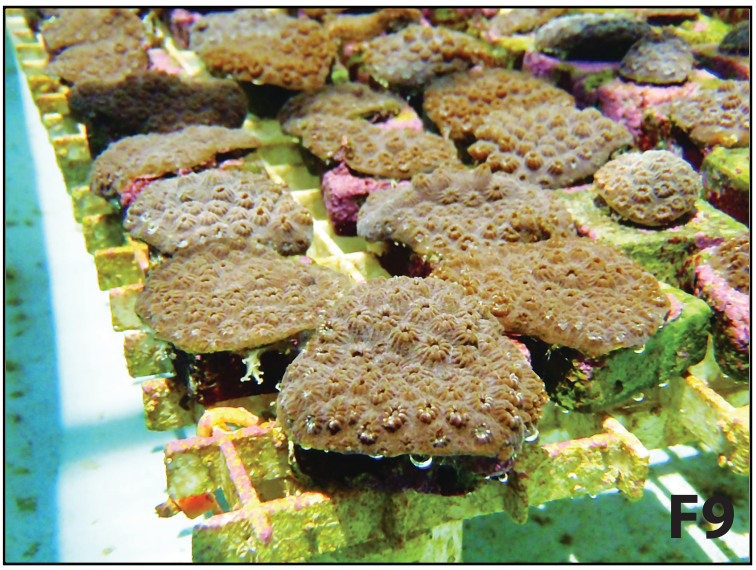
Program elements: Developed a micro-fragmentation and fusion method so speed the grown

Common with other case studies: Working with restoration and

Uncommon with other case studies: Re growing coral focused more on the research and science side of the projects

Environmentally: Re growing coral in tanks to speed up the process, planning coral back in damaged reef systems

Socially: Educating people on how coral reefs are being harmed and teaching people what can be done to help the ocean ecosystem



Coral restoration-This study shows what is being done in the field of restoration. The fact that over 20,000 coral fragments have been grown and reintroduced to the ocean is incredible and could play a big role in my design. The fact that my sites reef is in danger and could be saved by coral restoration and teaching people about how coral is affected by people

Education- On site they have learning opportunities showing people how they are growing and reintroducing coral. Have aquariums and exhibits het up on site to show people what has been up would help educate people and teach them what can be done to help the reef on my site.

Diving tours- Allowing people to have a guided tours of the coral reefs in the water teaching them how to interact with the fragile ecosystem and shows hot the new coral can be introduced to a new reef is a very viable activity that could be add to my site. Having the same idea of a learn and play aspect would make the site more of a destination

Crosswinds marsh wetland interpretive preserve

Project type: Nature preserve, wetland, creation/ restoration

Location: New Boston, Michigan

Size: 1050 acers

Characteristic: One of the largest self-sustaining wetlands projects with multiple public uses

Program elements: Diversity of wetland habitats, no pumps dykes or artificial methods are required to maintain the natural system, serves as an ongoing research facility,

Common with other: Wetland research

Uncommon: Fresh water systems, marsh wetlands

Environmentally: Over 300,000 native aquatic plants, 10,000 seedlings and 300 acres of wetland seeds were added, the site is self-sustaining, decreased up and downstream flooding

Socially: Provides opportunities for more the 15,000 visitors

Culturally: Restored historical wetland habitat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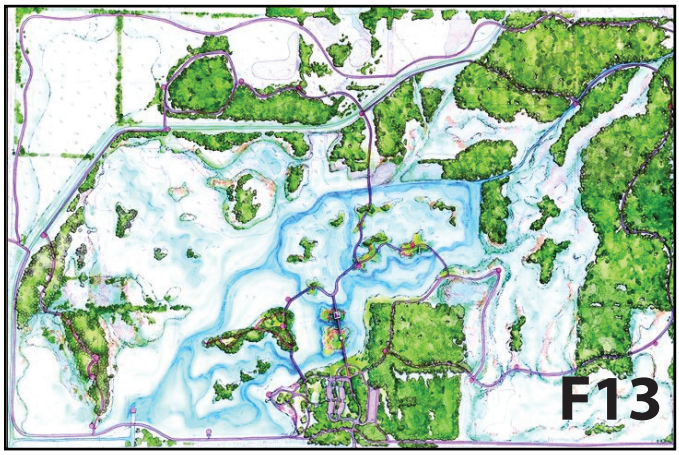
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Grading- Crosswinds focused a lot on grading of the site to make sure the water flowed perfectly. They also where dealing with flooding problems up and down stream that with grading has helped solve that flooding problem. All though my site problem won't have to worry about flooding I will be dealing with runoff and other water flow problem that with good grading will solve those problems.

Ongoing Research- even after completion of the site there is still studies and research performed on the site that help people continue to learn and grow from it. Research done on the site about seed, water flow, water quality, the plants and animals on the site. This continuing research can be related to my site and how it would be important on my site to continually researching how the sea life is doing.

Variety- Crosswinds added over 300,000 plants and 10,000 new seed to the site. Adding all those new plants is one of the reasons why the site is self-sustaining. I think a similar technique could be used on my site by introducing maybe a wider variety of corals to the reef this will bring in my sea animal and will keep the reef healthy and living longer and better.

Case Studies

The Infinite Bridge

Project type: Water front

Location: Aarhus

Size: 60 meters in diameter half in the sea and half on the beach

Characteristic: Circular sculptural board walk, 2 to 3 meter above water depending on the tide

Program elements: A connection between past and present, reconnection to forgot viewpoints, experiencing the changing landscape of the bay

Common with other:

Uncommon:

Environmentally: Connects the city with the magnificent landscape of the bay

Socially: You enter a space of social interaction

Culturally: Connect the past site of a forgotten view point to the new site

Simple Shape- the way the boardwalk is just a simple circle shape is an interesting design choice something so simple but they way it was place to be half in the water and half on land depending on the tide. The way it creates a set of space on the circle so people can walk around and another I the circle a more intimate space where people can interacted more closely with the water is amazing. This simple deign I feel could play a role in my site design coming up with a simple boardwalk system will be a main focus for me.

Historical Preservation- the side had an older boardwalk on it that people would coming to the town by steam boat and enjoy the town. The steam boat is no longer active on the site so that is why the redesign of the board walk was done and why it is now the infinity bridge. This is a good take away from this case study because my site also had some historical events and feature on the site that I would like to preserve or revamp.

Limitless- there are no railing on the boardwalk this give people the freedom to put their feet in the sea and be a part of the site more. It also mean there is nothing blocking the view of the site from any angle. This is a design feature that could be very useful on my site because one of the positive on my site is the view and those should be enhanced through the design.

Yellowstone National Park boardwalk

Project type: Nature preserve, restoration

Location: Yellowstone National Park

Size: 14 miles

Characteristic: A system of board walks circulating around monuments throughout the national park

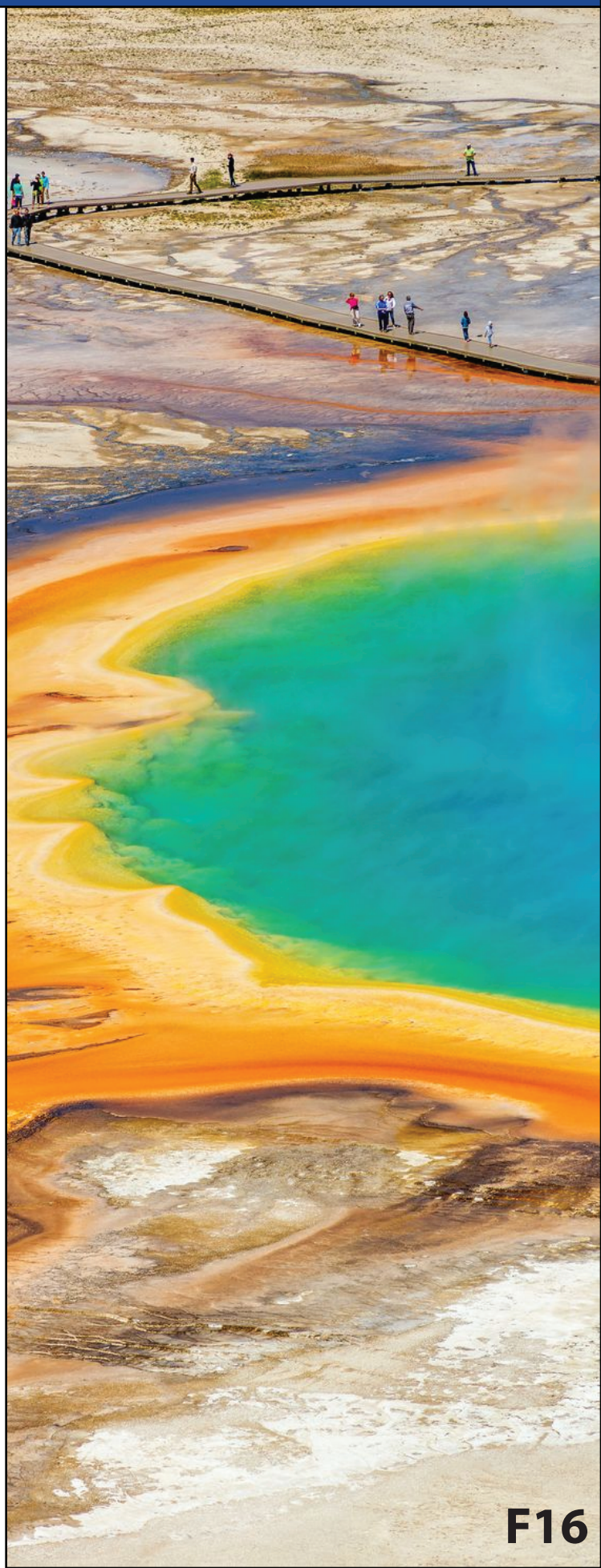
Program elements: Giving people a place to stand in close proximity to the pools while not disturbing the fragile ecosystem

Common with other: Raised walking platforms, restoration project

Uncommon: Located in a park not along the water's edge

Environmentally: The board walk keeps people of the ground and preserves the ecosystem

Socially: Allows people to gather and walk together while they view the pools



Boardwalk System-this national park has one of the best boardwalks and trails the boardwalk alone is 14miles and gets toy up close to some really amazing landscapes. This would be an excellent feature to have on my site not just a board walk to get people close to the water but a trail systems that takes people in and around the site and gets people moving would help promote health opportunities

Preservation- when making all the boardwalk trails they did so always keeping in mind preservation of the natural environment. Keeping people off of the areas that might be dangers for people and also keeping people of the area that are more sensitive. This will be key for my site because I will want people to be close to the reefs and the water but I will want to also preserve them and not let any harm come to them.

Views- on this boardwalk there is no railing this give people clear view to see out over the landscape and down in to the pools. This technique could play a role in my project so that people can put their feet in the water and splash around. Along with no railing this mean the person eye can wonder around the landscape freely allowing them to take in the whole site.

Project Elements

I liked to focus on the coral restoration elements the most for instance using coral fragment to regrow and strengthen section of the reef that maybe damaged, how plants and design can be used to take toxins out of the water so they don't even make it in to the ocean. At the same time come up with a way to get people to come to the site and learn how they can help take care of the ocean. Along with a reef system in the water that can be used has home for the sea creator, and can be used as a diving, site seeing place where people scuba dive to real experience the ocean life and feel along with creating opportunities on the beach for people to gather, a hiking trail, and board walk system so people can experience the water without having to go in it. Creating a bond between the people and the sea life one that won't be broken and will in turn make people realize that this amazing ecosystem needs to be protected.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Client

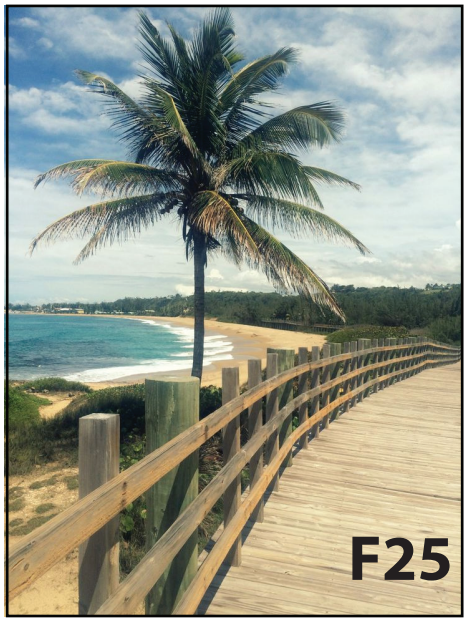
The client will be for the people living on the island for them to enjoy and who are interested in the ocean, along with it will be for the tourist and travelers that come to the island and for the people researching coral and sea life and who are interesting in keeping it clean and healthy, people that are interested in being in and around the ocean, any one that might work with or on the ocean, and people that use the ocean as a fun activity. I really wanted this site to be open to the public and to be able to be available for any one. One of the best feature of the ocean is that anyone can utilize is and I would like to keep that theme in my project as well so the client for me is really and one that loves the ocean. This space will be able to accommodate for large number and may groups at once.

Site

My site is Hanauma Bay, Oahu on the Southeast corner of the island just outside the city of Honolulu. This is a site of interest because it is a nature preserve and see on average 3000 visitors a day. The area was formed in a volcanic cone and offers a pristine marine ecosystem. The site is located just off of Oahu's highway 72. The site has a parking lot connected to the site with an overlook over the beach.

Emphases

My emphasis for this site will to be help rebuilding the reef and educating people on what can be done to help protect these delicate ecosystems. This unifies the whole site because without these reefs the site could not exist. Another point of interest would be a board walk system this would give people who might fear the ocean of not like swimming to observe and learn about the ecosystem without having to be in it. Really emphasizing the view of the site the island is a beautiful place with increasable view and perceiving these view by having outlook and places for photo opportunities will be another focus.



Goals

My first goal is to provide pollution control for the site having the pollution be stopped before it can make it to the ocean and damage the reef and pollute the water. Secondly human interaction having people be about to interact with coral reefs and he sea life that will be surrounding them. Coral restoration if the coral is already damaged or dead having a plan or system to restoring the part of the reef that need help. Keeping the beach and the trails clean of trash and personal property that could be harmful to the water and its inhabitances.

Plan for Proceeding

Research Direction

The overall unifying idea for my thesis is coral restoration. I will look in to ways that coral restoration is being done now then relate those way or restoration back to my site and design for people to interact with the site and the sea life. I will also be researching ocean elements like currents, wave patterns, and tide changes. Those will be key factors to account for in my design. Lastly I will have to look into the history of the site see what has been done on site before and see way that it can be improved.

Design Methodology

Mixed method quantitative/ qualitative analysis I will collect information on the ocean environment as it applies to my site after gathering said data I will compile the data in to a graphic format. Then taking that data and using to as an influence to my overall design of the site. The statistical data will be gathered from library resource as well as online sources. The scientific data will be gather through experiments or through a search. For the qualitative data will mostly be gather throw observations as well as surveys.

Design Process

When compiling the documentations I will uses a set of graphic and photo to display my process. It will be preserved digitally and in many copies just in case something get corrupted or is found to be not important and need to be removed. For any one that is interested in my work it will be made available through a web link. I will make a digital presentation with an amount of board that is undetermined at this time and will show the board while I give an oral presentation.

Work Plan

weeks 1-2: Gather inventory and analyses of site and areas around site

Weeks 3-4: Using inventory and analyses start creating concepts for site

Weeks 5-6: develop plans, section, perspective and graphics for site

Literature Review

Overview

The article "Climate Change and Active Reef Restoration- Ways of Constructing the Reefs of Tomorrow" begins by discussing the current status of tropical coral reefs in the past couple of decades. Going over some of the pressures that are causing the coral reefs harm like over exploitation, physical destruction, pollution, and eutrophication, sediment loads from agriculture, urbanized terrestrial catchment and coastal development. Motioning that all of those factor might be just secondary to the overall biggest problem which the article claims is climate-change. Climate change is putting coral reefs all over the world in danger from elevating sea water temperature to extreme weather events, these factors cause major coral bleaching and damaged the reef ecosystem, health of the reef the and resiliency.

The conservation of reefs and effective management of reef rehabilitation is a primary focus in the article. The technique that they found to be most successful was reef "gardening" this technique is a two-step act, the first step is "developing a large coral development of large stocks of coral colonies in mid-water floating nurseries each of the farmed colonies is created from a coral nubbin. The second step entails the transplantation of nursery-farmed coral colonies that have reached suitable sizes onto degraded reef areas" Baruch Rinkevich (pg. 113). When using this style of restoration they found a very high success rate with more than 86 coral species.

Continuing to talk about the technique of "gardening" and how there still will be some challenges when dealing with climate-change, the author says that two "gardening logics" can be formed. One is that when selecting corals to put in the nursery refrain from using coral species/coral genotypes that are less tolerant of climate-change. This act will making the reef stronger he says but will changes the existing reefs look and feel. Second logic calls for "maintaining the highest available genetic coral diversity in nurseries" Baruch Rinkevich (pg. 116). He goes on to say that even if some of the corals in the nurseries aren't as tolerant to global climate change you need a variety of different corals for it to be a well-functioning reef. These techniques where than used in a studies on the Philippines, they took up to 8 different coral species from the farm and transplanted them on to an existing reef. These reefs where then severely influenced by a series of environmental stressors such as monsoon, record precipitation, typhoon, water temperature elevation and unusually low tides. With all these tropical storm events stressing the reef there was still some bleaching happing but what wat learned was some take home lessons. The studies showed that there are some way that might work to protect these nursery corals like possibly lowing them to deeper depths of the water when there is a storm or increase water temperatures. So even in a study where it seemed as if there experiment didn't work they still walked away learning something.

Coral nurseries are then discussed and their effectiveness for be their own habitats for local sea life. The author goes on to talk about how mid-water coral nurseries managed to attracted and develop there of floating ecosystem. Along with that they mention that because these nurseries are in protected locating and floating that during storms then can be lowered to deeper depths to protect them from harm.

In closing the article goes over the benefits of the "gardening" coral technique saying that " transplant colonies displayed better reproductive capacities than the natal colonies for at least 8 years" Baruch Rinkevich (pg. 120). This makes the claim that the "gardening" for corals is a viable option when it comes to restoring damaged reefs. They also support the idea that using more the one approach to reef restoration would lower the doubts and improve the success of reefs.

Reef Stressors (not related to climate change)

What I will be coving in the section is some of the biggest stresses that are harming reefs in the ocean today. In the article it talked about how over-exploitation, physical damage, pollution, and coastal development are some of the main direct problems.

About a third of the world's marine life is threatened by over-exploitation. Many species relies on reefs all the way from fish and lobsters, to seahorses and sponges and the reef also relies on those millions of different species. So by over-exploitation the creator in the reef the reef will slowly start to die out because those species are no longer living and taking care of the reef and its ecosystem.

Next is physical damage these could be boats running into reef or even just people breaking off a segment of coral can be a big problem. Diving near coral reef can have a number of problems if you bump a coral head it can affect the health of the reef, even bubbles from the diver mask can get trapped in caves and over hangs and kill delicate sea life. Pollution has always been a huge problem not only for reefs but everything that live in the ocean. Pollution that comes from agricultural runoff can have many very different effects on coral. For example runoff can make the water cloud meaning much less sunlight is able to reach the coral. Another example some time the runoff has speed the growth of algae's that are do damage to reefs. Beside the more chemical runoff there is also human waste or garbage to worry about. Waste like, cans, bottles, bags and other plastic or rubber materials are a great threat to coral reefs. These items could get wrapped around the coral harming it, items could break the coral, or throw off the balance of the ecosystem the reef has.

Coastal development around 2.5 billion people like within 60 miles of the coast tis puts enormous pressure on coastal ecosystem such as reefs. Coastal construction can cause water flow and runoff which can affect the growth rate and health of coral also just killing the coral. Some reefs are just removed to affect erosion, put in dikes and other construction projects. As more people move out along the coast these problem will only get worse and worse.

Reef Stressors (related to climate change)

Global climate changes has one of the biggest impacts on coral reefs around the world. The main factors of climate change on the ocean and coral reefs are the rising of sea water, increased sea water temperatures and extreme weather events. In this section I will contain to talk about how climate change is affecting coral reefs, and what is being done to these reefs because of the events listed above.

Rising sea water is cause by the heating of the ocean water, when water is expanding due to it being warm. This cause sea levels to rise about one-eighth of an inch per year. Not only that, but the warming of the water increases the melting of ice based land masses like glaciers and ice sheet. The rising water affect reefs but throwing off there natural ecosystem. Reefs thrive at certain depths of water depending on coral types and other factors. So if the water begins to get deeper it affects how much sun the coral get, the food source for the reef the temperature of the water and, even the pressure on the reef.

Ocean temperature have been rising since 1901 and on average have risen .13 degrees up to 2015 says the article. These changes in temperature could be caused by heat trapping carbon dioxide. That trapped heat cause a rise in the average global temperature as well as a rise in the average sea surface and to depths of about 2,300 feet where most marine life is. The rising ocean temperature affects the relationship the coral has with the algae on it causing the algae to dissipate and the coral to become bleached.

Gardening

In this article is speaks about the aspects of coral restoration and one of the techniques that many be able to help solve the dying reefs problem is "gardening". This style of reef restoration is still in the nascent stages which mean this forms two logics says Rinkevich one being "to refrain from the use of coral species/ coral genotypes that are less tolerant of climate conditions", this means using a stronger type of coral one that can with stand higher water temperatures. The seconded logic is "maintaining the highest available genetic coral diversity in nurseries, including endangered and threated species that are seemingly less tolerant to climate change". This just means that we should have a wide variety of coral on hand no matter if they can stand the rising temperatures just to keep the reefs as diverse as possible. The article contains on talking about the aspect of floating garden bed and how that can be used to start bring back damaged coral reef. Then discussing why the gardening technique would be a useful technique to use when it comes to reef restoration. The gardening has a twostep restoration act one the nursey phase and two the transplant phase. The first step the nursery phase starts by developing a large stock of coral in a mid-water floating nurseries. Step two the transplants phase takes nursery farm coral that has reaches a stable size and bring it to a degraded reef site. While the this technique of coral gardening is great the main goal should be to keeps reefs healthy and living, but the problem is reefs are degrading worldwide so this techniques many need to be scaled up and put in to action much sooner then we think.

Conclusion

In conclusion the oceans reefs all over the world are in extreme danger of being destroyed. The reef stressors that aren't related to climate change continue to grow every day. From garbage and pollution to over-exploration and physical damage people are destroying reef and the ocean ecosystem. While the article didn't talked about many way we could slow or prevent these actions from happening. I feel as though if we do not stop harming reefs soon the oceans ecosystems will become unbalanced. Along with that the fact that climate change stressors are a huge problem to reef many changes the whole reef ecosystem forever. The main goals should be to prevent reef death but it may be too late for that. The rate of bleaching reefs is not slowing down. There for we must start applying these reef restoration solution right way. Solution like coral gardening system that will help keep reefs alive. The problem of these techniques being still very new and very limited may slow this proses but form what I have researched they are the best bet for helping bleaching reef. While problems still remain like finding different species of coral that can with stand the rising ocean temperatures the diversity of coral reefs may never be the same. This may be one of the biggest impacts of reef dying out, is that once that have begun to go some techniques of restoration can bring them back but the historical reefs of today will never be the same as the once where.

Literature Review

Overview

In the article "coral reef ecosystem research plan" it goes through it goes through two research priorities, the first being "Importance of mapping and monitoring" and the second part being "jurisdiction- wide Research needs". In the first research priorities it goes through talking about reef what they are, how they work in the ocean and how they relate to us and a little bit on the laws that have to do with coral reef. Then it talks about the scope of NOAA coral reef ecosystem research plan they are going to cover. Form there they dive right in to the "importance of Mapping and Monitoring" saying "Mapping and monitoring provide information fundamental to understanding the history, current state, and future condition of coral reef ecosystems and are cornerstones to ecosystem-based management" (pg. 10). This will allow people to talk more about the reef from start to end and make sure the reef is healthy and thriving. They believe that mapping and monitoring is one in the most important data collecting they can do. After this they touch on fishing for a small portion of the article. Going into areas of pollution what it is and what can be done about it. Talking about coastal uses how the coast are doing and what people have done along the coast in the past couple of year. Invasive species is an important section talking about how things are being put in the ocean that should not be there and other marine life is suffering because of it. Climate change is a big issue like in other article mentioning how climate change is a major threat. Getting to protected areas and habitat restoration and how that area can really help bring reef back to their natural state of close to it. Part two is introduces after the "jurisdiction- wide research needs" this just breaks up the areas discussed in part one fishing, pollution , invasive species, etc.… and dives deeper in to each area that need to be research for said area. Breaking these areas down by ocean starting with the Atlantic and looking at the Florida area talking about reef location and the research need for said area. Then looking at areas in the gulf and talking about the need and uses and what can be done in those area. The Pacific Ocean is the next area of study focusing around the main Hawaiian island and the "commonwealth of the northern Mariana island" about how the Mariana ecosystem doing and what has been going on in the past couple of years. Then it wraps up by talking about the research need for the "pacific freely associated state" and the republic of the Marshall Islands.

Interdiction

In the interdiction of the article "coral reef ecosystem research plan" they begin by stating the importance of reef and there ecosystem. Mentioning the biological, ecological, cultural and economic resources as well as their aesthetic qualities saying that "Worldwide, coral reef ecosystems provide over $30 billion in annual goods and services and yet cover less than 1% of the earth's surface" (pg.1). Going to show the importance reefs have worldwide and then adding to that saying that the resent decline of these reef is a huge threat to the world's ecosystem. Continuing on about laws that past president and congress has enacted to help conserve these great underwater landscape, and how new organization where created and have been working harder and harder to protect reefs. The purpose is for this article is also in the introduction this talks about they wanted to set up specific goals and guild lines for the NOAA when planning to identify the research, allowing this plan to be flexible and be easy added to by others if farther research was done. The scope in the project is introduced saying they aim to focus mostly on shallow coral reef in the jurisdiction of the United States and the pacific freely associated starts. In those area they plan to address the major threats to coral reefs and look at others research, workshop reports, direct input, etc.…

Importance of mapping and monitoring

Management of reefs is a key factor in collecting data about reef and information on their status. Collecting base line information like economic, cultural, institutional, and social values around the reef also human patterns, reef boundary's and physical characteristics makes the mapping processes much more necessary to the over all research. Mapping and monitoring the historical, current, and future state of the reef and its ecosystem is a huge part of the data collected. Knowing past storm event and even growth habits will let them know how hardy the coral and where is started and will allow them to make judgment of how the reef will grow and survive in the future. Know if the reef had any previous damage done to the reef and how it reacted and healed. Placing all the of the data on the reef they gather and putting it into their data frame work to then come to a conclusion on how the reef is doing base on the frame work.

Fishing and Over fishing

W ell balanced reef has habitat for fish to live and where humans can conducted there fishing activities. Fishing plays a big social and culture role among ay island communities, and a diverse reef system supports that areas where people live and fish. When over fishing is present among these reefs it has a huge impact on the fish community as well as the people community. When reefs are over fished they began to die out because a many part of their ecosystem is gone.

Atlantic Ocean

Florida Keys, southeast Florida, eastern Gulf of Mexico, flower garden banks, Puerto Rico, U.S. Virgin Islands and Navassa are the main area of reef for the Atlantic Ocean side of the research. In each area the article goes in to specific detail on which sent of problem each reef in the given area is encountering. Placing each site on a table and connecting each site to each problem. Then looking in to management objective and how they can prevent these problems form continuing but looking at key research data.

Pacific Ocean

Hawaiian Islands, commonwealth of the northern Mariana Island, Guam, American Samoa, U.S. pacific remote insular areas and pacific freely associated states are the focus for the Pacific Ocean areas. These area are having major issues with coral bleaching and the results of which can be seen worldwide. In the article they place climate change as one of the biggest issue surrounding the coral reef in this section. The Hawaiian Islands being in some of the most remote locations in the pacific make is even harder to collect the date need. Along with that most of the city of the island area on the coast line next to reefs make the reefs an easy target for pollution, invasive species and over fishing. Going on to talk about the CNMI and the reef ecosystem and how it looks to be in good condition. How eve do to the ocean geography this reef system could not be treated as one entity. In conclusion the pacific reefs seem to be more isolated for major land problem buy do to the location of the island cities and the ocean geography the reef are still suffering from major coral damage.

Project Justification

Why is this project important to me?

This project is important to me personal because I have always been drawn to the ocean I have always had a great interest in coral reef and how they support the huge under water ecosystem. The balance that flows throughout the ocean and the marine life is incredibly interesting. The ocean just has any incredible power over people, and for as long as people have been around people have always been draw to it and yet there is still so much about the ocean we don't know.

Why is this impotent at this stage of my academic/ professional career?

I feel as though this project is important to do at this stage in my academic career because up until this project I have never done anything like this before. Doing this beach front reef restoration project now give me a chance to explore a new outlook in the field of landscape architecture. Making this a showcase project for people to see in the future maybe even inspiring future classes to explore something they have always wanted to.

How will this project add to my knowledge?

The knowledge I will gain from all the research I have done will be unlike everything I have learned in school so far. For this site I am learning about a new geological location unlike any I have done so far in school. The climate is vastly different to the project I have work on that are normally located in North Dakota and Minnesota. The plant palate will have to deal with plants from different zone that require much different care then what I have already learned about. In addition to working with species in the ocean different coral and marine plants and animals, this will add a new dimension to what I know as a designer.

How will this add to my skills as a designer?

This project will challenge my skills challenging my research abilities, to find case studies and pull out conclusions on what might work for my site and how I will implement those ideas. It will challenge my problem solving abilities, to come up with new and creative idea on how I will solve the problem of decaying reef and how to restore them while making the a place for people to still come, enjoy and be educated. And it will challenge my graphic abilities coming up with new ways to show my designs and display them for the public in such a way that make them interesting to the general public.

Why is this important for our profession?

I feel as though our profession has not done many project like this one. It seem like in many project along coastal edge the project stop as soon as they reach the water's edge. That leave this whole under water landscape untouched and unthought-of. Where in my project the underwater landscape will be just as important as the above water landscape. I think our profession should start moving in the water and thing about theses delicate ecosystems that need help before it is too late.

Economically justify the project

Economically the ocean has many rescores that we need to survive. A wide variety of renewable and nonrenewable rescore come from the ocean. Economically the ocean is one of our biggest providers worldwide for food and energy. That being side the reef play a huge role in providing the fish in the ocean with livable habitat so if the reefs disappear so will a lot of the worlds food supplies.

Where might the Funding come from?

The funds for this project can be justified but the people that are draw to the ocean. This site is in a prime snorkeling, swimming, fishing and ocean viewing location. People have been coming to this site for years and will continue to come if it is maintained. I could see the funds for this project coming from the city of even the government because this site is in a nature preserve the founding should be dedicated to the site easily. The return on the investment would come from the people coming to the site this could be somewhat of a private beach in the persevere, people might have to pay a fee to get in along with if they wanted to rent any gear or get snacks anything like that.

Environmental impact of the project

The environmental impacts of the project could be extremely positive for the coral reef in the bay. Re constructing the parts of the reef that are dead or dying with have a great impact for the bay. The reef will be brought back to its natural state, which mean better habitat for fish and other sea creator which will bring balances back to the bays ecosystem. Over all restoring the reef but also looking at what can be done on land to help the environment making the beach more clean and sustainable so the whole site become a destination for people and wildlife.

Technology that will be used

Some technologies that might be used on site might have to deal with some of the techniques for reef restoration. There might some tanks for housing reef fragments, floating reef beds, and some technology that deal with water flow to keep the hot water from staying in one spot for too long. Will have to use some technologies to help with storm water management and deal with tilde change.

Social context of project

Socially the site will be a great place to bring people together having scheduled events that could contribute to the community and its people. As well as it will be a site that will be an educational experience, for people that are interested in reef and all that they contribute to the ocean and even to the bay that the people can then go out and experience the reef up close and personal.

Cultural context of project

Culturally the people of the Hawaiian island have always been well connected to the ocean whether it be through sailing, surfing, fishing, or diving. The people on the island love the water and everything that deal with it. So for the site protecting an area that is rich with cultural history and provides an excellent connection to the ocean. The site plays a big role culturally it was used in the past for royalty as their own private beach for hosting gathering and fishing. So preserving the natural beauty of the site and reconnecting it to some of the rich history that theses Island have make this site a great cultural location.

Why this location

This site is the perfect location a protected bay in a nature preserve on o'ahu. The bay is protected by a large volcanic cliffs on both sides. But also on the site is very good conditions for reefs to grow, it have clear shallow water, with lots of sun and good flowing water. What also make this site good for my project is that in the last couple of year there have been signs of coral bleaching. Which is not good for the coral but it give me the opportunity to come up with a way to fix this problem.

How might this project advancing the profession

This project will advance landscape architecture to place it hasn't really goes before. The sea floor is a pretty uncommon place for our field to design in but I feel it has a lot of potential. The opportunity are endless when it comes to design on the sea floor it's up to us as designer to see the possibility that this underutilize area can become. I think my project is a good start on the right path to unlocking those possibilities.

Is this project Imperative or option

This project is imperative because of the rate the ocean is changing is happening at an alarming rate. The rising temperatures in the sea water is a major problem when it come to the reef and the temperature is only going up so this problem will only get worse. The decline of reefs is something that needs to be solve and I believe landscape architect could be a key player in solving the reef problem.

Can someone else solve this problem if so why

This project could be left for someone else to solve it is a massive project that could have a whole team working on it. Trying to solve a problem that is being caused by climate change is a pretty big problem to be solving. I think I should be the one solving this problem because I have so much passion for the ocean it only makes sense that it's me to try and help solve this problem of coral reef bleaching.

Historical Context

Hanauma bay located on the south east side of O'ahu as an island has a rich historical background. This site is located within O'ahus nature preserves and has been since 1967 when the state division of fish and game labeled it a marine protected area. O'ahu has nine heritage sites that showcase the significant of the islands historical, cultural, and environmental attributes. Some of these historical site can even be related in some ways back to my site. The park Leahi or Diamond Head is a 760 foot tuff crater in one of Hawaii's most famous landmark. Historical British sailor thought they found diamonds along the slops of the crater but these "diamonds" turned out to be shinny calcite crystals that had no value. Leahi and Hanauma bay are similar in that they both are located right on the edge of the water, they both provide hiking trains to scenic over looks, and are both somewhat of national landmarks for the island. Another site that is a heritage site that is closely related to my site the Pearl Harbor memorial. The Pearl Harbor memorial is five historical sites the USS Arizona Memorial, battleship Missouri memorial, USS bowfin submarine museum & park, USS Oklahoma memorial and the pacific aviation museum. Much of these sites are located in the water because of the sunken battle ships have been turned into museums or memorials. Much like what I want to do on my site where I turn the reef I to a sort of living exhibited for people to learn about the reef and it ecosystem. This I think is becoming more of a social trend to have more interactive museum exhibits, having exhibits that are more alive and people can really experience the place and know how it should be or how it was in the past. This aspect of having a more physical exhibits plays a huge role in today's society the more people can see and feel how there action my impact this natural coral reef ecosystem the more I think they will take away from it. Physical seeing how the reef is being bleached due to human impacts will help teach the people coming to the site about what they can do to help prevent the death of their very important ocean ecosystems.

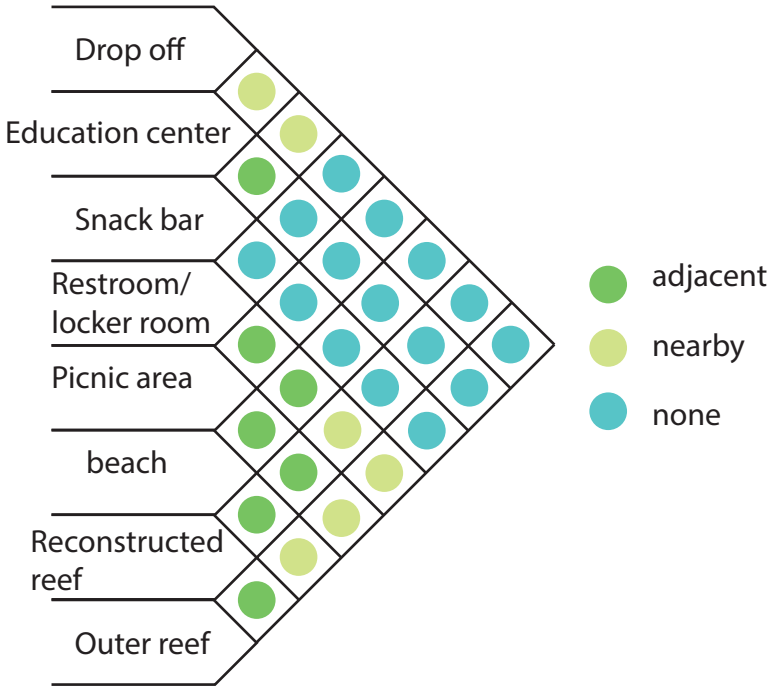
Social Context

Socially this project will relate to with around the island by being a projected out door area that will have group and private activities. Throughout the history of Hawaiian people have been going to the ocean for recreation and economic use. My site is similar to all the coastal park and public beaches on O'ahu located on the water's edge this gives the social aspect of people coming together to gather in larger group setting or in smaller more intimate setting. This bay is a popular place for fishing, swimming, snorkeling, and other beach activity's all of with are a huge part of Hawaii's society. This project relates t scale developments because it will be right along the water's edge. People have always been and will always be drawn to water so my project being a beach front project meant have a great deal of pressure to keep the social aspect of the ocean there and alive. Many boardwalk, pears or water front development are made to bring people close to the water and interact with it and each other my site has the added bonus of have a reef that will make it easier for people to get in and explore the water in social event they can do together or on their own. The physical context within my site is a tropical beach setting in a volcanic bowl that on either side has large rising cliffs, just off of the highway my site is fairly easy to access by car. The social context of the site will fairly open to what the user wants it to be the site area could be used for many different and creative social events, ideally people will come here and interacted with every one they can learning about the place, the people and the location they are in. Taking in to consideration what they can do to keep this site alive and thriving for year to come.

Cultural Context

Hawaiian has always had a rich culture full of tradition that stretch back for years and years. From the spirit of aloha to the shaka the Hawaiian people have such a great cultural background. The dance, food, art, beliefs, and song in this area run deep with every people on the island whether that be a local or just the people coming to the island to vacation. And on my site I plan to really in body this culture I think the site is a great location for the custom and cultures of Hawaii to come to life. I feel that my site being so closely related and impacted by the water will only help this connection of culture. The native Hawaiians have always been drawn to the water in olden time they were known for the incredible craftsmanship of building canoes. A canoe was a very valued possession it was meant for transportation, running errand and fishing in the open ocean, not only that but it was also a display of strength of the islands armies. Building of the canoe was considered a very important life activity for the family they would each have different role as the canoe was being constructed. The air of building one of these boats would be passed down from generation to generation with the boat being unique in many ways depending on the family. A lot of the Hawaiian culture has been built or inspired by the ocean and I plan to take that same inspiration for my site. Looking at native Hawaiian tradition and culture and developing my site around some of those aspects.

Preformance Criteria



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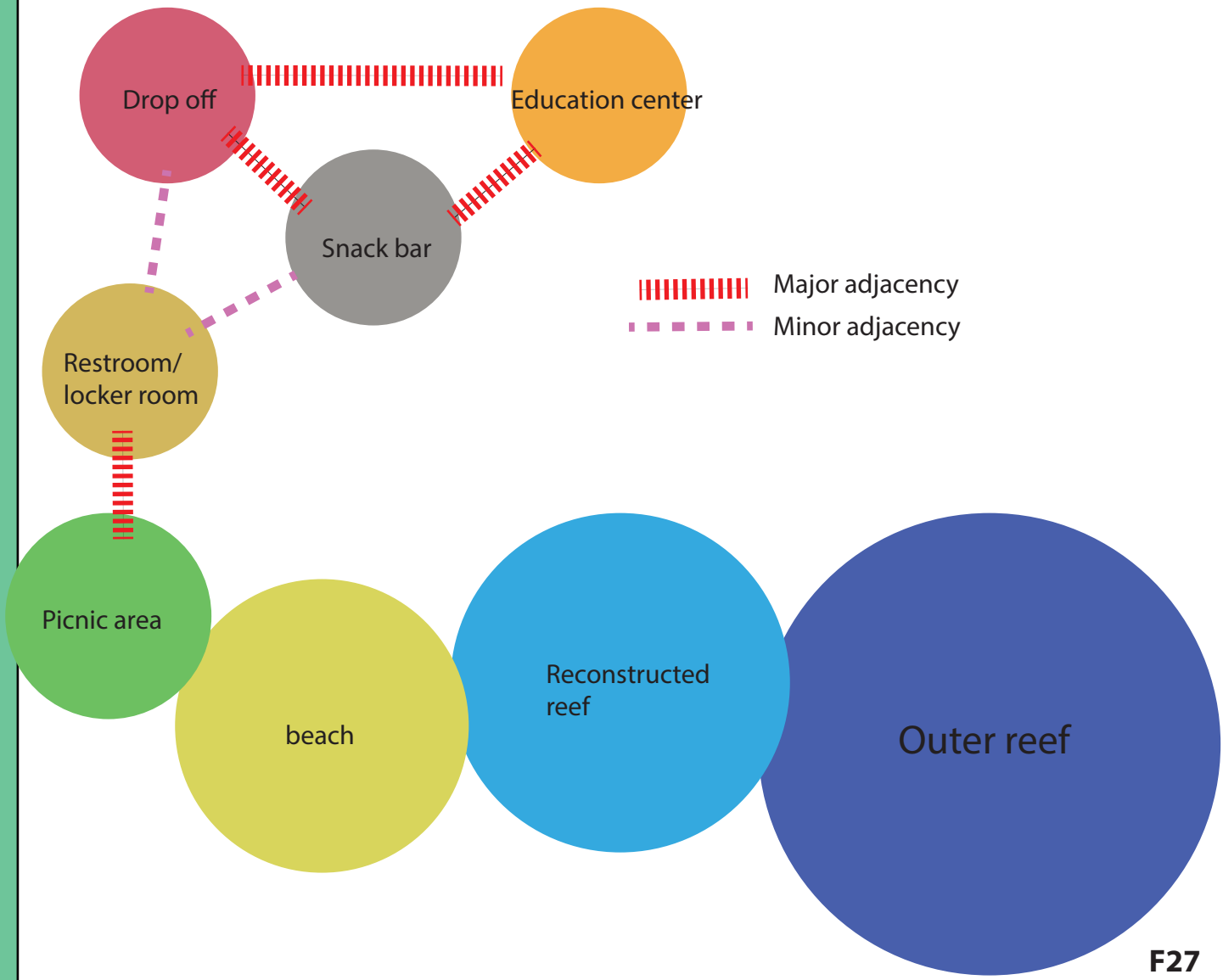

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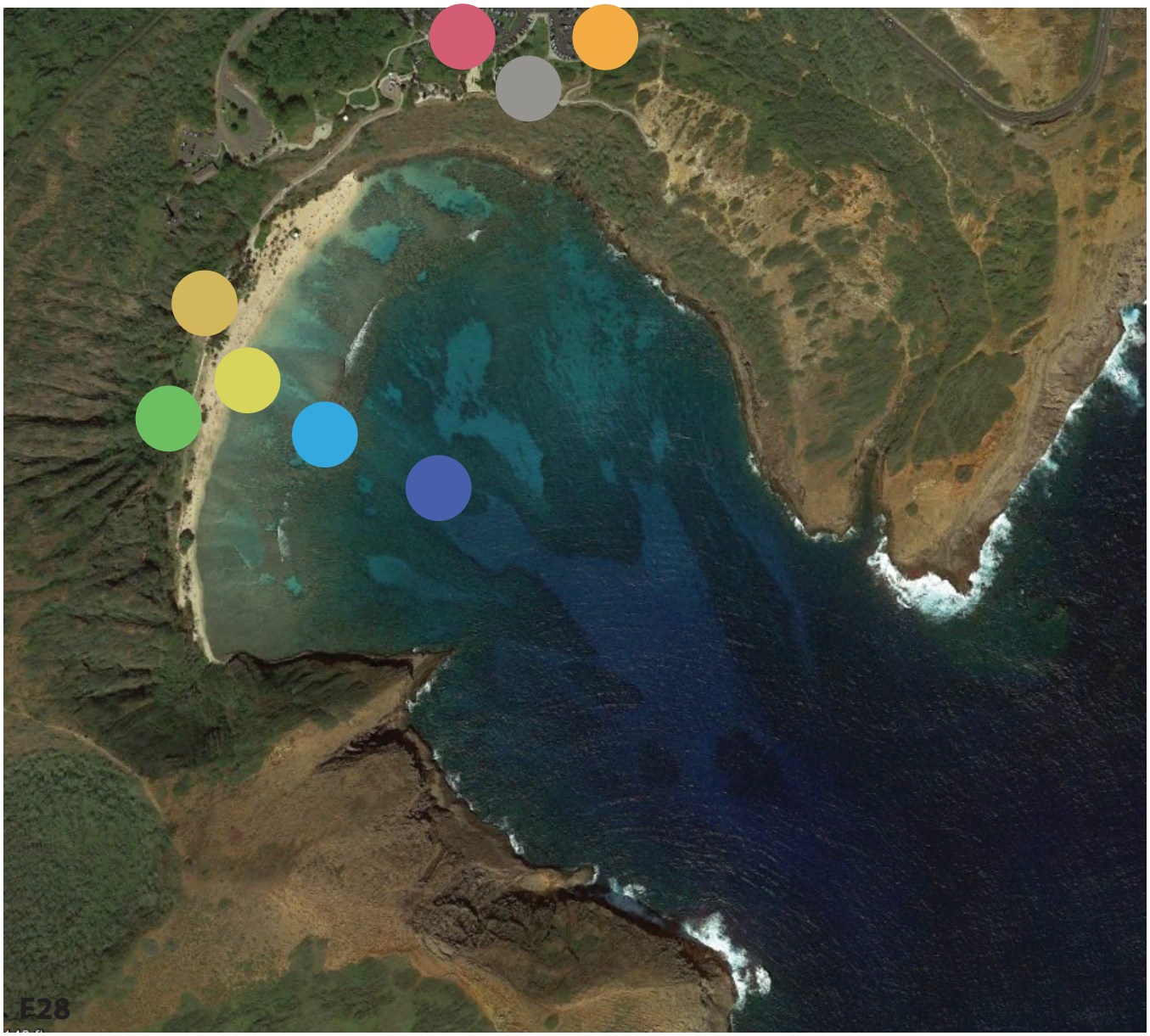
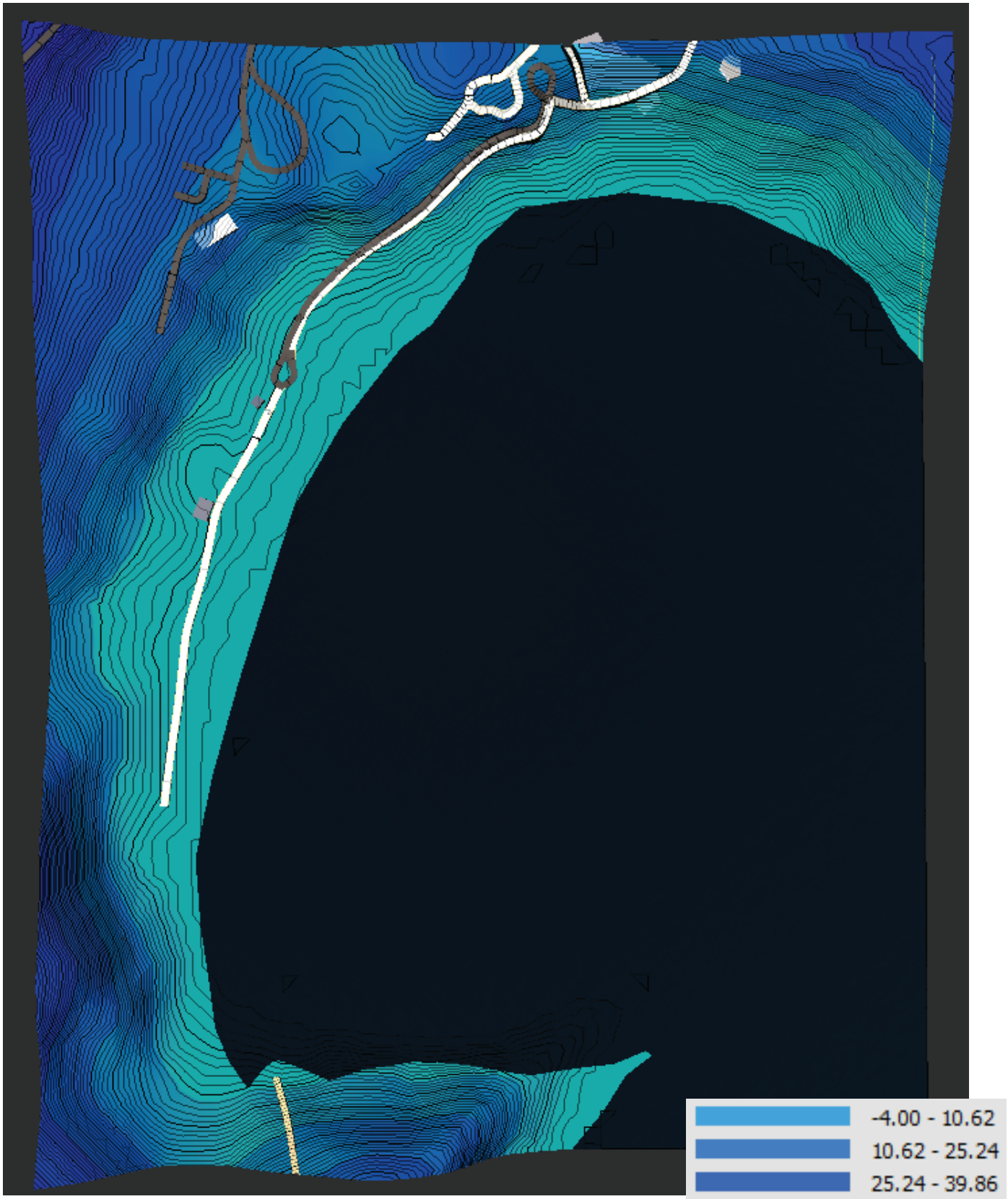

E28

Topo

F29

Elevation



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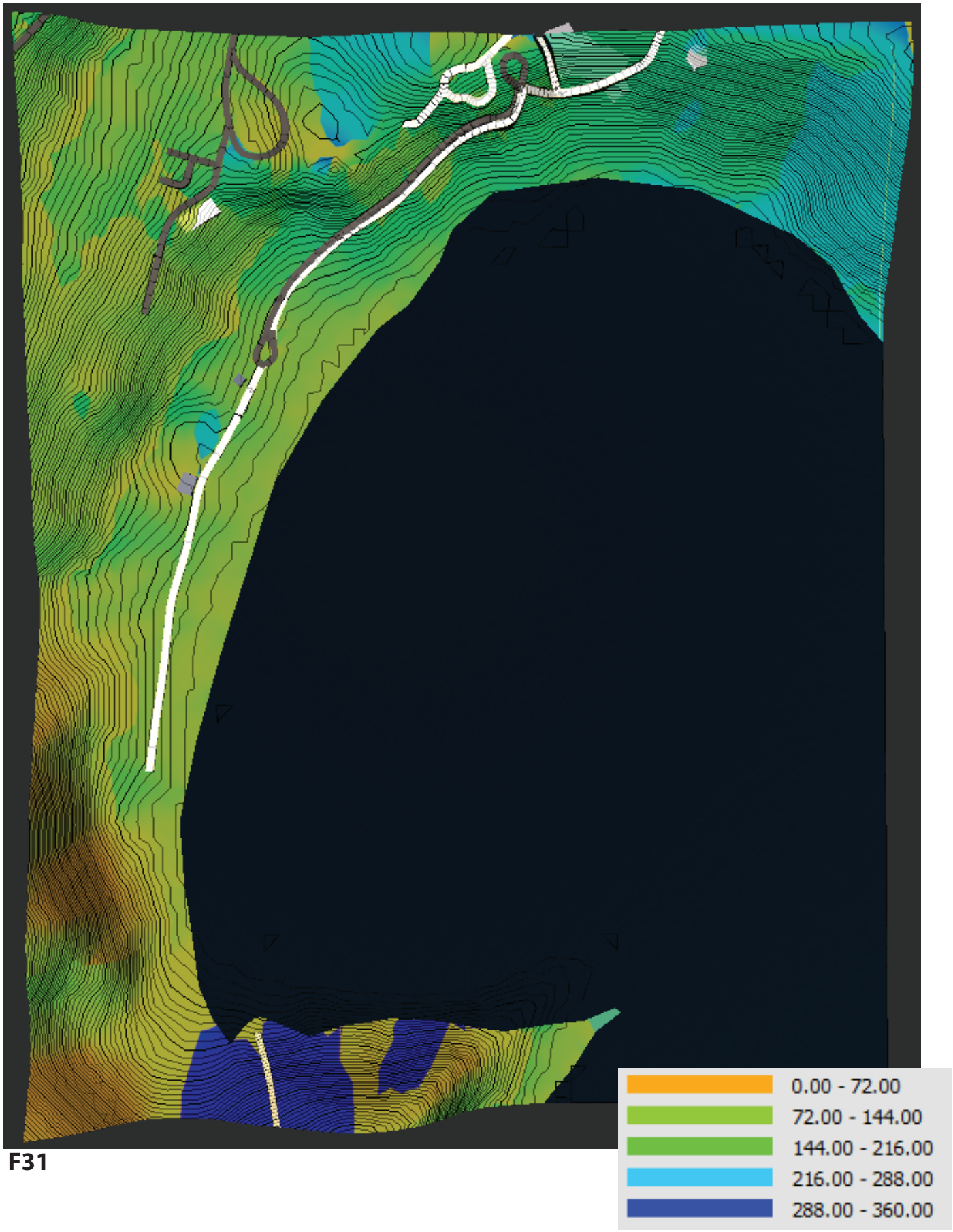
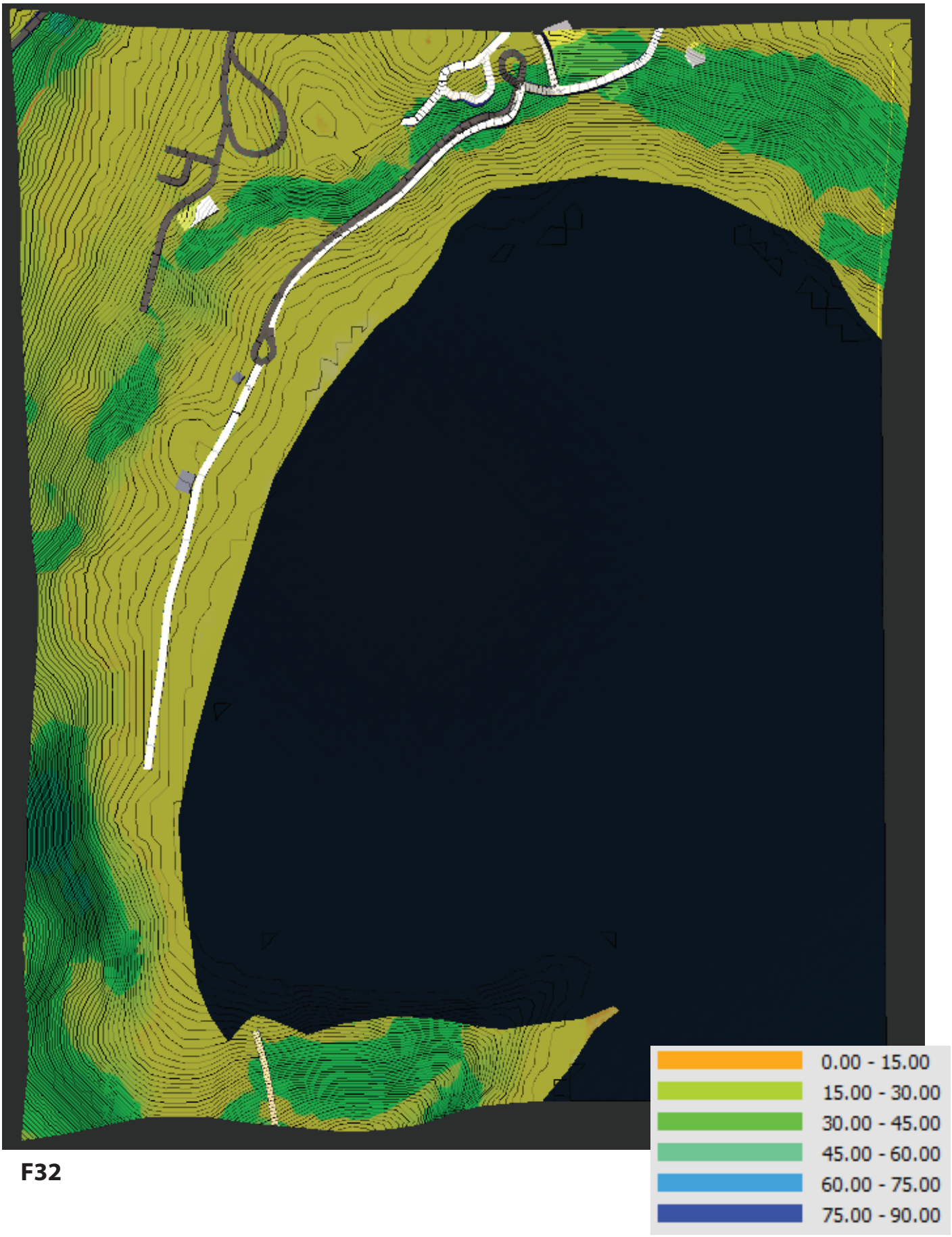
Aspect



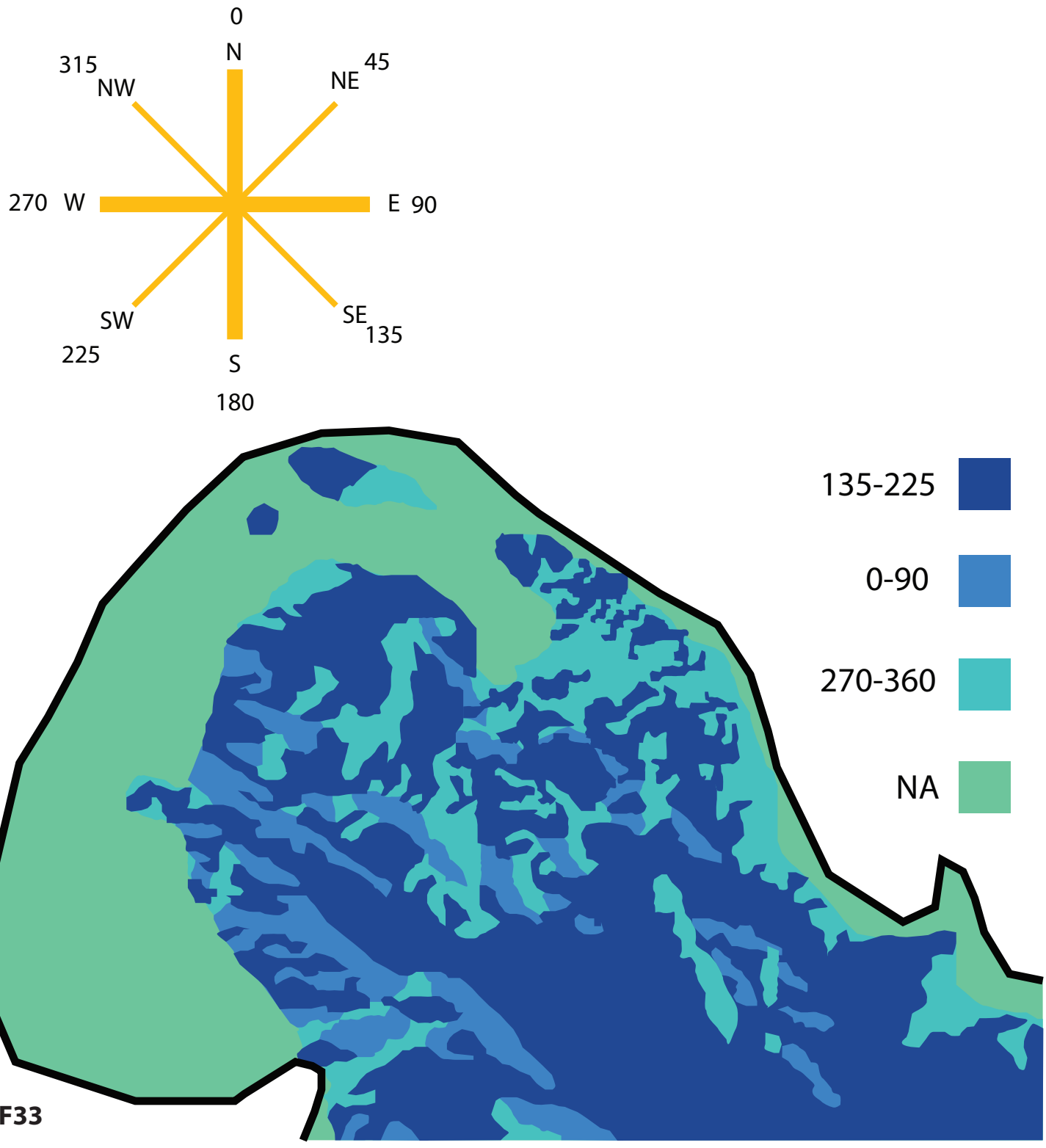
F31

Slope



F32

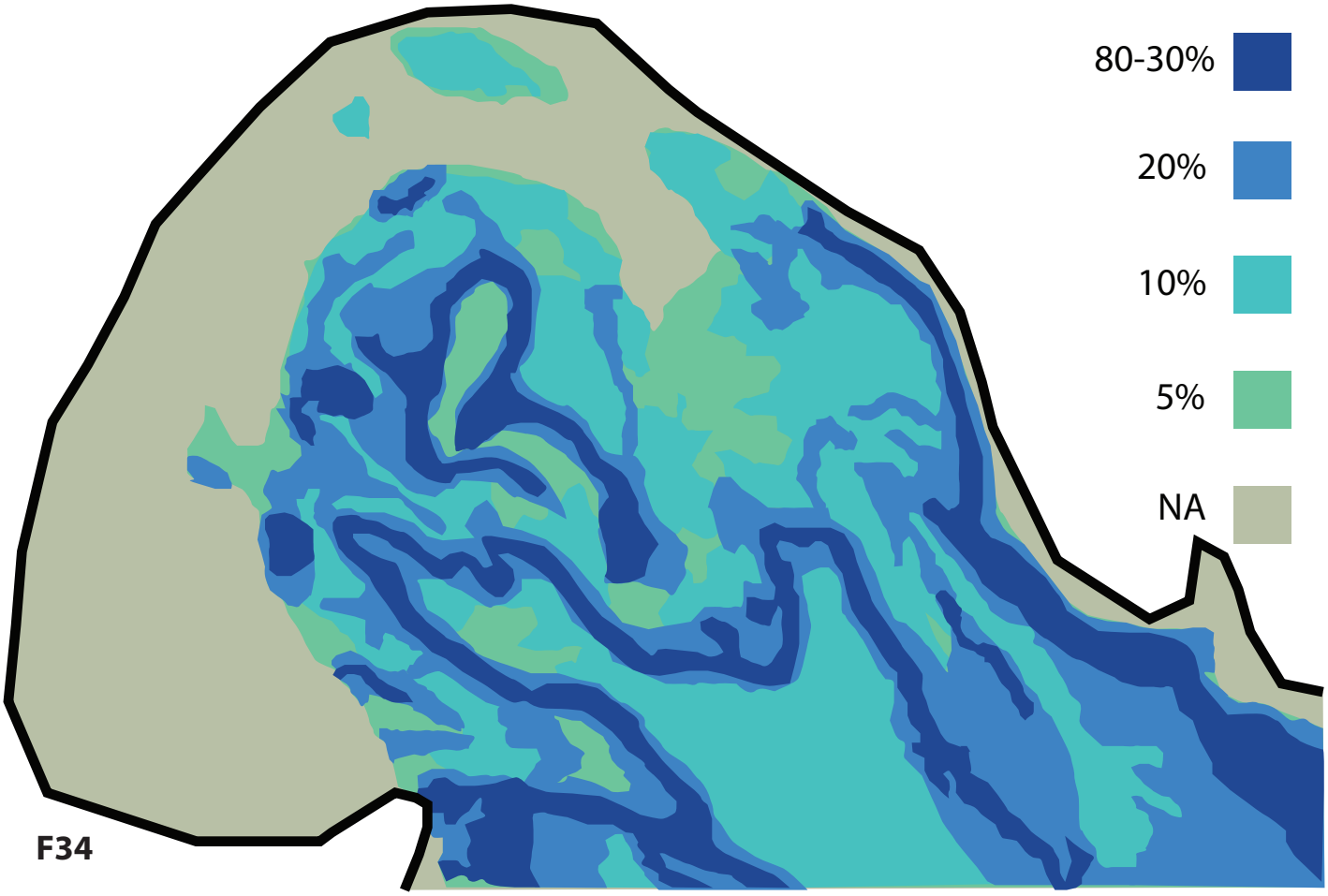
Bay Aspect



F33

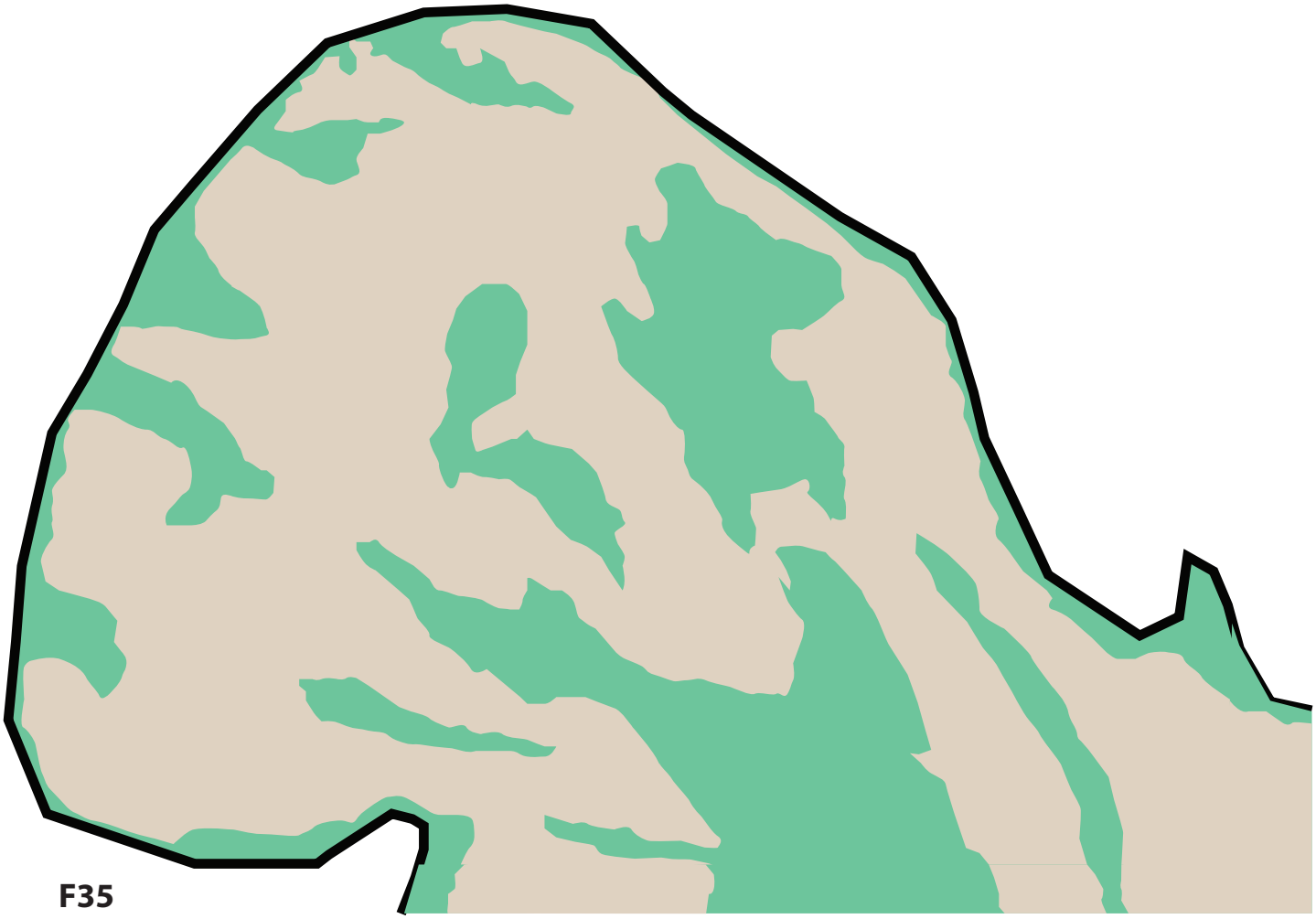
This map shows which direction the ground is face the darkest shade of blue are the area that are facing 135 degrees to 225 degrees which mean those are the area that will be in direct sunlight for the longest period of time.

Bay Slope

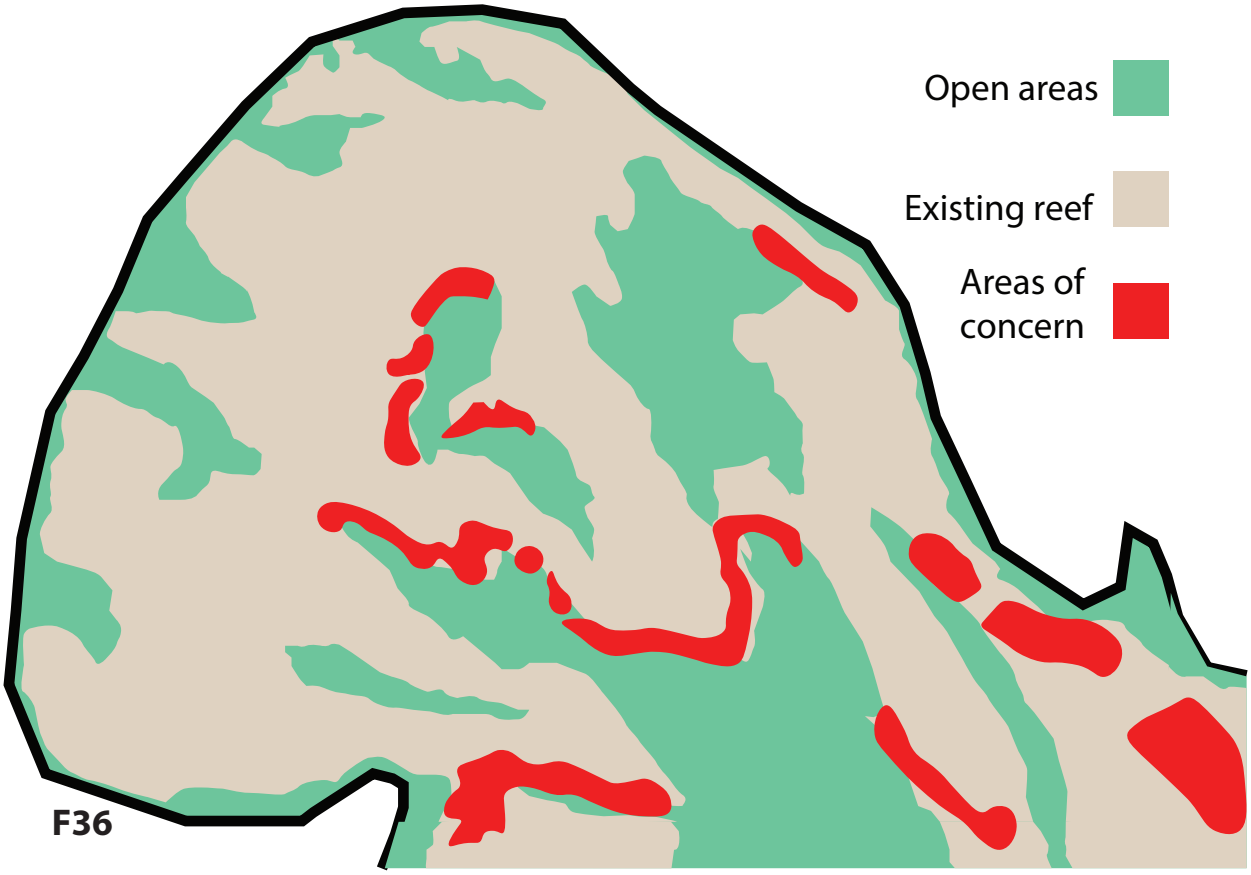


This map looks at the slope of the ocean floor the steepest slopes shown in the dark blues slope at about 30-80 % which mean these area are very steep and will be hit with stronger currents.

Reef Map



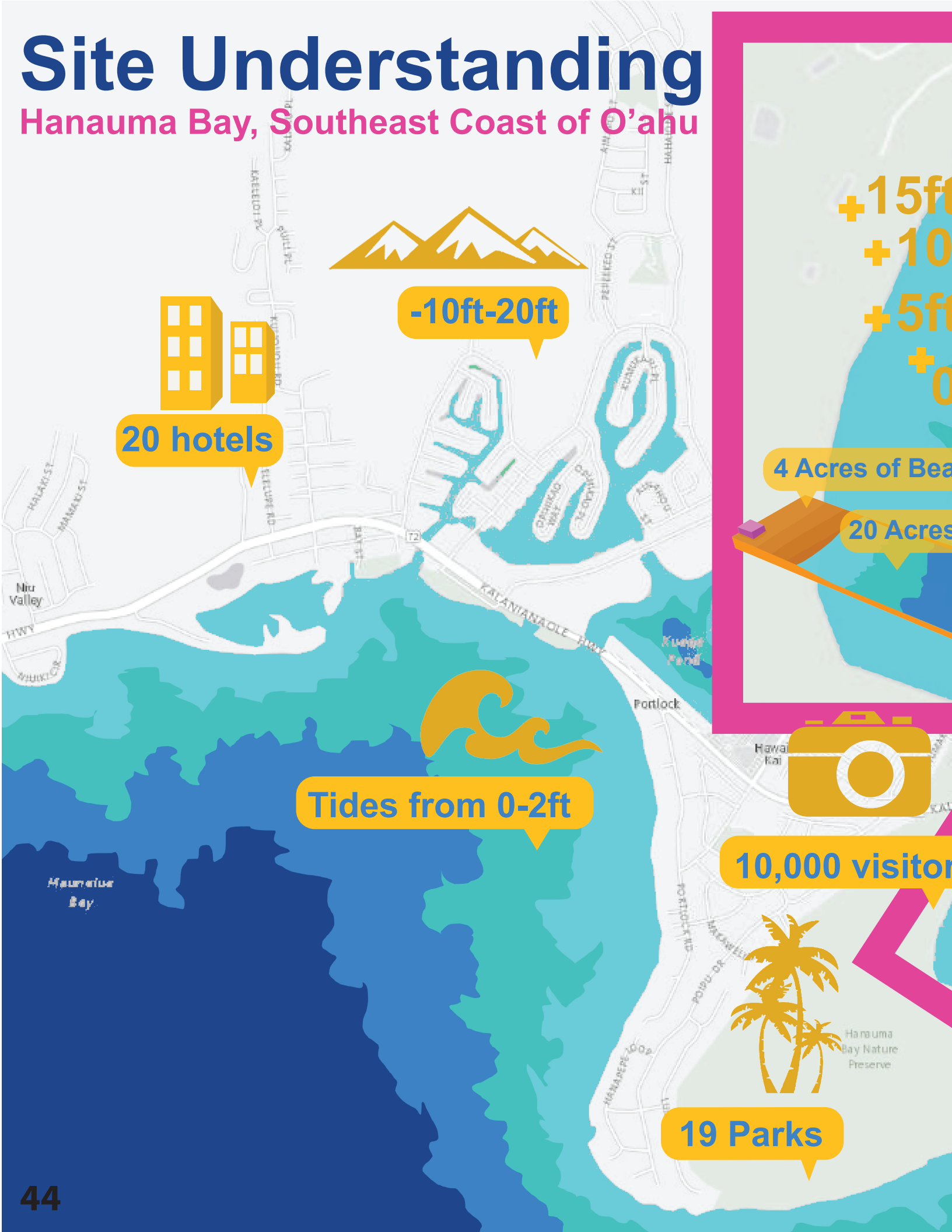
Reefs in Greatest Danger

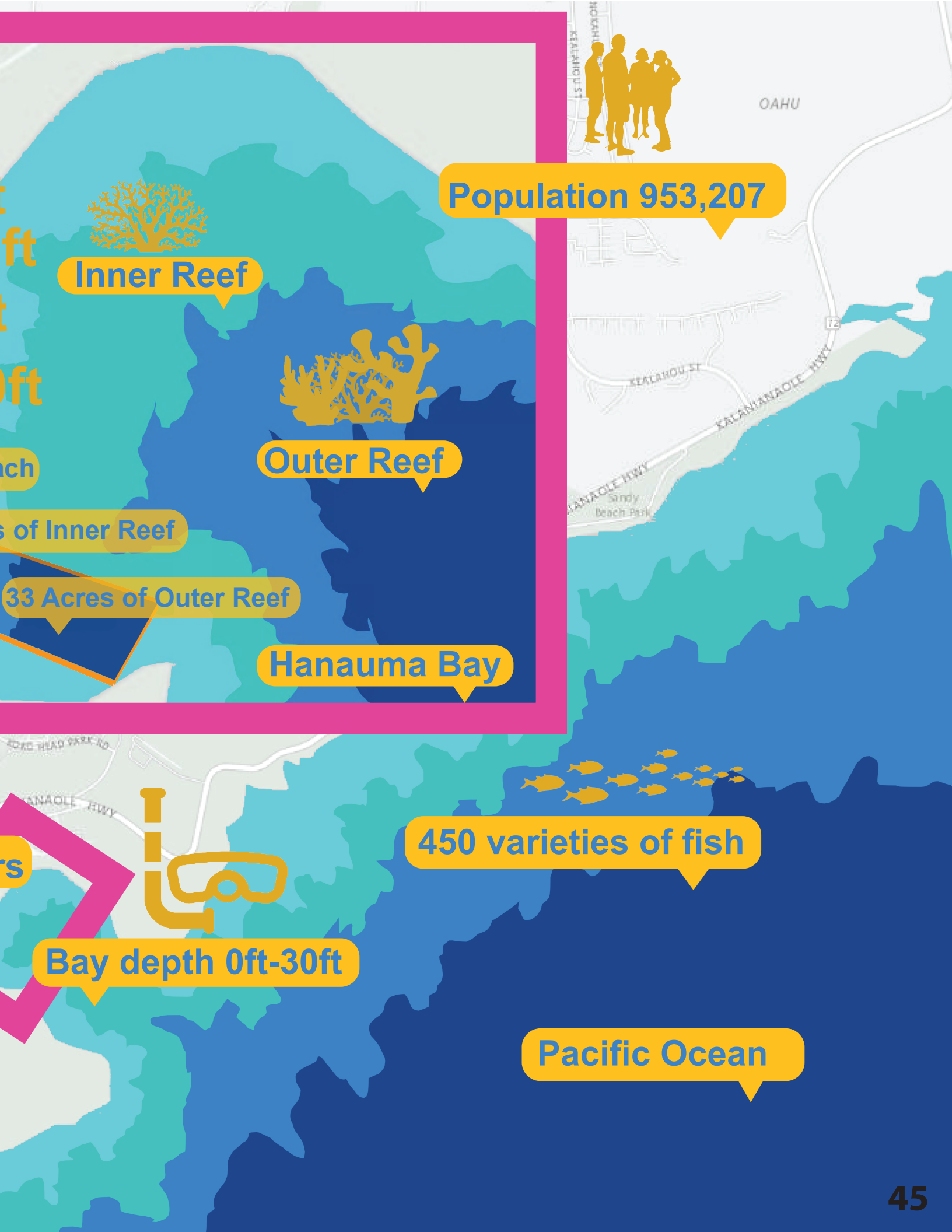


This map shows the location of the reefs in tan and the areas of open space in green. The area in red are where reefs are located facing direct sunlight for long periods of time and where reefs are on the steepest slopes. These area of the reef I feel are in the greatest danger of bleaching due to these conditions.

Site Understanding

Hanauma Bay, Southeast Coast of O'ahu




OAHU
Population 953,207
Inner Reef
Outer Reef
of Inner Reef
33 Acres of Outer Reef
Hanauma Bay
450 varieties of fish
Bay depth 0ft-30ft
Pacific Ocean