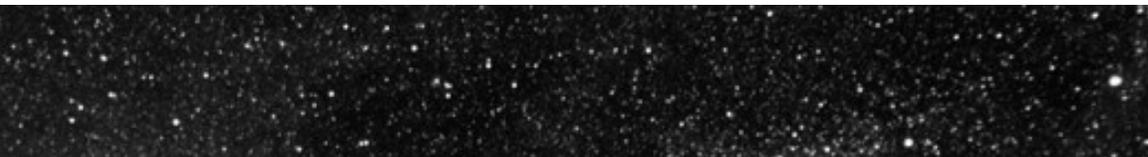


PERCEPTION OF  
NATURE



Acknowledging the Tides  
Through the Renewable  
Energy of the Moon

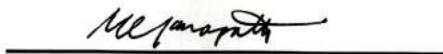
# Influencing perception of our world through experience

A design thesis submitted to the department of Architecture  
and Landscape Architecture of North Dakota State University

BY

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May 2018

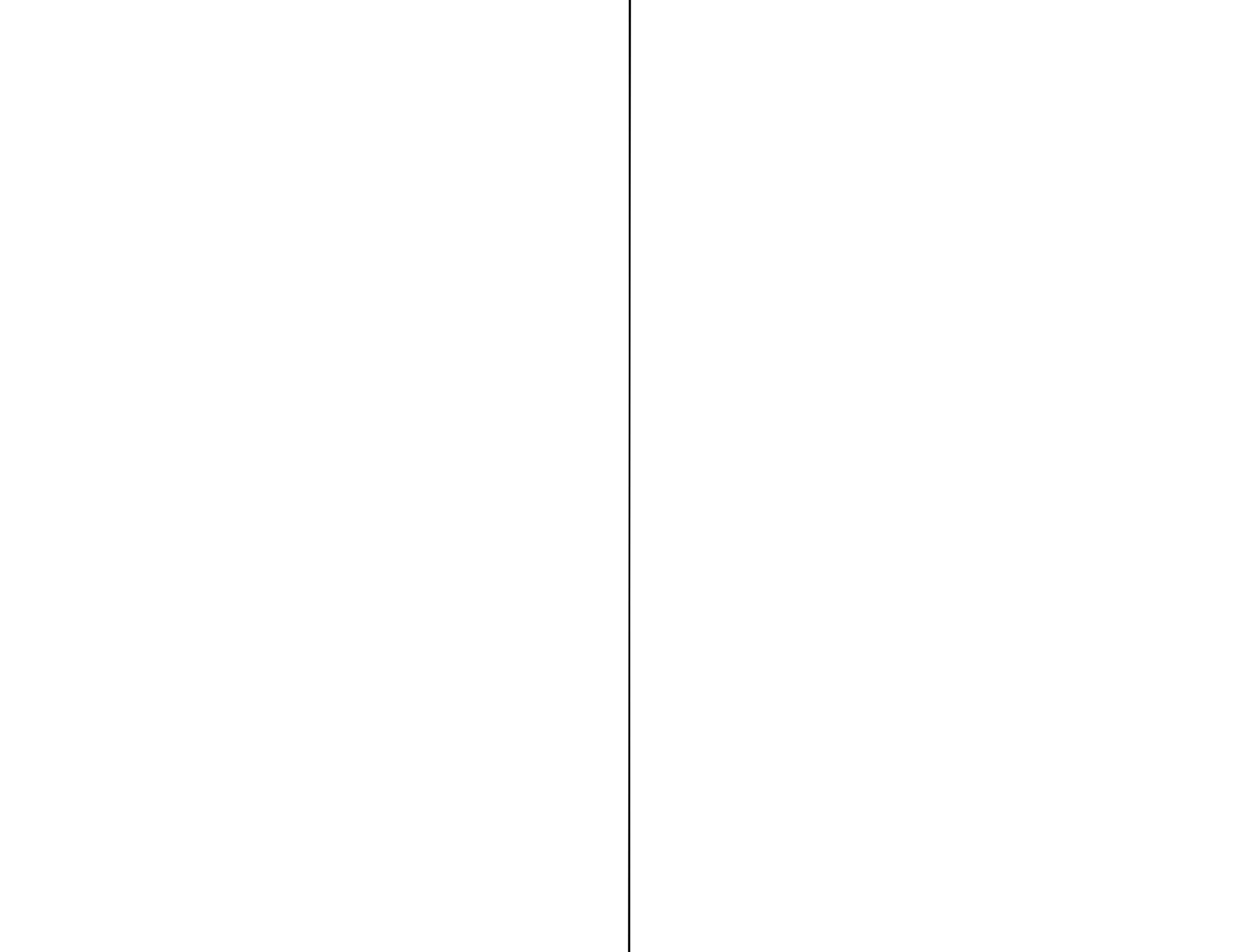
Fargo, North Dakota

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# LUNA

*There was once a woman in the sky who could be seen by everyone fore we were all children. Though she was shy, she would talk to us late at night about what was to come and what has happened. When we were young we loved her for she promised to share the secrets of the seasons.*

*Her presence was accepted by all of man and nature. Every time she showed her beautiful face we promised her a new month as she promised us. In our youth, we celebrated these times with her, and though she was far we felt her stimulating touch. Our relationship with her was boned together like metal welds, fore her love was so strong you could not be sane if she looked at you directly.*

*As we became older we began to document her arrivals. As we grew so did our aspirations. She will never turn her back to us, yet we cannot say the same. We once thought she would never be forgotten for we knew she was our foundation. But her original blue prints could not have helped but to have been bared as we developed our own. The older we got the less we could hear her, though she was surely still there. Now we have replicated her in our own language, for now everything must be our own.*

*Though she can still be seen in our current age, her beauty can only be perceived as a moon, and no longer a woman. It seems the sea is her only true lover. Twice a day he reaches out his hand for her in hopes to detach himself from the earth he has become a prisoner. Twice a day he longs for her, though they can never be. And only through his love for her can we still see her connection to this world.*

*“We know that the white man does not understand our ways. He is a stranger who comes in the night and takes from the land whatever he needs. The earth is not his friend, but his enemy, and when he’s conquered it he homes on. He kidnaps the earth from his children. His appetite will devour the earth and leave behind a desert. If all the beasts were gone, we would die from a great loneliness of the spirit, for whatever happens to the beasts happens to us. All things are connected whatever befalls the Earth, befalls the children of the earth.”*

*-Seattle American Indian Chief*

## ABSTRACT

A restructure of energy generation and architectures ability to transform power plants into a beacon of culture. This project seeks to reawaken a lost perspective of nature through the acknowledgment of the entwined relationship between our planet and the cosmic forces through the creation of a Tidal Lagoon in Seattle Washington.

# Narrative

This thesis aims to showcase a new type of renewable energy generation and its ability to involve the community with architectural design. Through an exploration of how architecture and culture have been directly connected through out the course of history, the project will seek out how to continue this tradition through the examination of the cosmos and their effect on earth. The moons ability to create the tides in unison with the sun will be highlighted through out the design. Creating an architecture that is created around the cycles of nature, new experiences are created that allow us to reflect back on ourselves, and the cosmos. A Reflection Park, Gallery of Change, and an Event Center have been designed along the causeway, each adapting to the workings of the tide in a unique way. The changing phases of the moon reflect the levels of the tide. This Celestial ritual can be found through the design, inducing the effect of celebrating our achievements and rituals alongside that of nature.

# PROBLEM



Figure 1

## GLOBAL WARMING

Global warming occurs when carbon dioxide (CO<sub>2</sub>) and other air pollutants and greenhouse gases collect in the atmosphere and absorb sunlight and solar radiation that have bounced off the earth's surface. Normally, this radiation would escape into space—but these pollutants, which can last for years to centuries in the atmosphere, trap the heat and cause the planet to get hotter. That's what's known as the greenhouse effect. In the United States, the burning of fossil fuels to make electricity is the largest source of heat-trapping pollution, producing about two billion tons of CO<sub>2</sub> every year. Coal-burning power plants are by far the biggest polluters. The country's second-largest source of carbon pollution is the transportation sector, which generates about 1.7 billion tons of CO<sub>2</sub> emissions a year. Over the past 50 years, the average global temperature has increased at the fastest rate in recorded history. And experts see the trend is accelerating: All but one of the 16 hottest years in NASA's 134-year record have occurred since 2000.

The U.S. Energy Information Administration produces annual charts for energy generation by source. Their findings show that renewable energy is on the rise but is still far behind in terms of total energy generation.

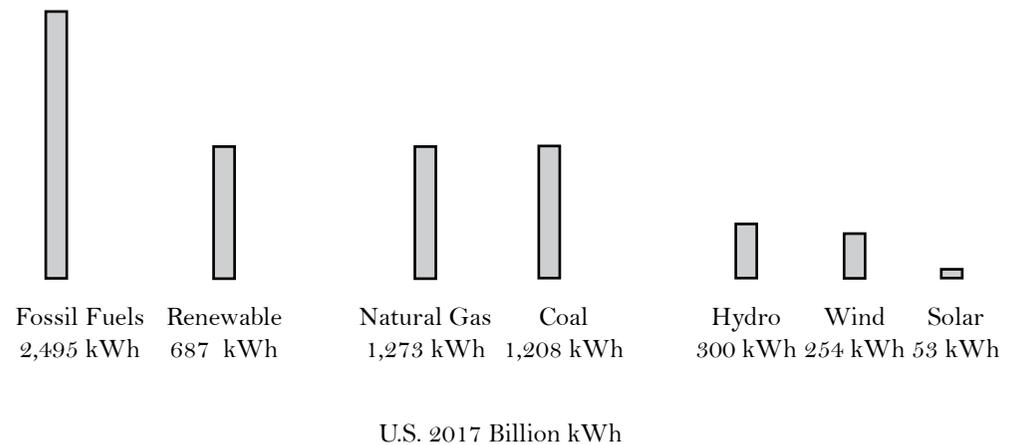




Figure 2

## POWER PLANT DESIGN

When looking at other forms of energy generation such as solar power. The power plants are cut off from the community and go unnoticed. Too often cities will hide the undesirable aspects of their communities such as landfills and power plants on the outskirts of the city which leads people to forget about their overall impact on this planet. Solar energy is good, but placing them in an empty field might not be the best option. It is important that we do not overlook how we are generating the power we use every day, and that power plants become an integral part of our communities. Power plants should go beyond just energy generation but also engage the people through action to acknowledge the gifts we obtain from the earth and to further enlighten and inspire the community.

## SUSTAINABLE BUILDINGS

Recent studies have shown that around 40 percent of global emissions are produced from buildings. As a response Architects and Engineers have developed sustainable architecture and biophilic design. Sustainable buildings perform very well on a functional level compared to other modern buildings, but lack in regards to influencing users to care more about the environment. We move from inefficient buildings to efficient buildings without even noticing the change. We never actually experience the sustainability or the coinciding with nature happening. It is important that our architecture helps influence an appreciation for nature through its design so the community can come to respect nature and develop cultural norms that help the environment on a functional and philosophical level.



Figure 3

## TIDAL LAGOON

A tidal lagoon works by creating a man-made lagoon that is constructed by dredging the oceans crust forming a causeway in the water. The lagoons walls will extend out from the shore and reconnect to it miles away creating a container for the water to fill into. Water will be contained inside the lagoon and as the tidal ranges rise and fall the lagoons gates will open and close. Once their is a water level difference of 4 ft between the interior of the lagoon and the ocean the gates will open and energy will be generated. This will happen at mid point where the tidal barrage is located which will generate energy as water to comes in and out. This form of tidal energy is currently the most efficient in terms of power generations and sustainability. There are 2 high and low cycles a day allowing for four energy cycles a day.

The importance of the tide lagoon is that it does not produce any carbon emissions which will aid in preventing global pollution and help accomplish the carbon neutral goal of 2030. When thinking of global warming and climate change some may think it means very noticeable changes, but the problem is when the global tempters rise like they are now, the sea temperature rise as well. This effects massive ecosystems such as coral reefs which go on to affect many others on land. It is these small chain reactions that come to have the greatest effect. Therefore, we must keep energy generation local and emission free so it is not affecting people all over the globe.



Figure 4

## SEATTLE, WASHINGTON

The lagoon finds its home in Seattle Washington due to Elliott Bay's mix of high tidal changes, slow currents, and connection to a major city.

A four mile long cause way will be constructed in Elliott bay linking Discovery Park, to the 32ave west boat launch located in the Magnolia neighborhood. The entire 4-mile path will be accessible to the public via walking and biking.

The first 2,000 ft of the path that extends off of the 32ave West boat launch will be designed with a park, gallery, and event space. These spaces will come to symbolize the moon and showcase architectures ability to work with nature to enhance your experience of the architecture, giving a greater appropriation for the cycles of nature through exposure.

## GOALS

The projects goals are to find a feasible solution to reduce the amount of non-renewable energies used, along with designing architecture that is cultural and works alongside nature and not against it to better influence the community. The design will give acknowledgment to the forces that create the tide so the community will not over look the natural processes through per amazement of our own creation. The acknowledgment of nature and the gifts we receive will be highlighted so the community can always keep the cycles of nature close in their hearts.

Projects such as the Tidal Lagoon are now beginning to be proposed throughout the globe. It is important to study the possible effects of new technology in a scientific and philosophical level to insure way we are

## JUSTIFICATION



Figure 5

creating our tidal power plants in a positive way. We must do the research to understand how this new technology can have the greatest cultural and environmental impact and not act premature and face other impacts. Doing more in-depth research on other green and renewable energy is very important in developing a future that is more sustainable. By generating ideas on how this technology should be used before it is relied on will help make sure it stays in the realm of art and culture and does not just become a tool for economical gain that disregards the culture or environment.

## IMPORTANCE

This project very important on various levels that include cultural, historical, social, and economical. Because we have become so dependent on industry it is important that we generate energy and use materials in a safe way that puts less stress on our environment. Historically it is important that we understand how humans viewed the world in the past to remember important views that were lost through the changes in technology. Culturally this project is very important, for civilization to live in peace with the earth by developing a new ideology about how we use the earth. The project will bring back the wonder of nature to people and realize how the earth is all giving and we should be thankful for its gift.

## KNOWLEDGE GAINED

This project has helped me gain important knowledge in green and renewable energy. I have a much greater understanding in way mankind extracts materials used for building and the extraction of energy. Researching sustainable architecture not only in terms of active and passive systems but buildings that influence people culturally and embrace the life of nature in a poetic way. Throughout my readings I have gained a much better understanding of natural processes and which



Figure 6

processes were used by humans throughout our time on this planet and understanding the spiritual connections to this planet and other.

## THE PROFESSION

This project is of the up most importance as we begin to understand the harmful impacts that man has contributed to the planet. Tidal and wave energy are now beginning to be developed and are expected to compete with other nonrenewable energies. My project marks itself as a blue print for future tidal generation and energy generation in general. Too often when generating energy, it is a hidden process that the general public in not involved in which has created a lack of appreciation for energy and the planet we live on. My project acts a model to engage the general public on the process of making energy which is a direct communication between us and our planet. Through engaging people with the making of their energy they will learn to appreciate the energy they have and the way it is produced. I believe it would show how architecture can be designed to influence people to see the planet with in a new light but also show how power plants should be designed. Great architecture can come from anywhere and it is more important that private practices are more open to the public so we do not disregard what is truly important.

## ECONOMIC

The project will not only generate money through the making of energy but will also provide aqua farms and commercial spaces. The visitors center will dual as event space that will be able to be reserved to celebrate our own accomplishments along with the gifts of the earth. The project will generate thousands of jobs in engineering, industrial, aquaculture, construction, manufacturing, fine arts and many more. Because of the projects wide range of program elements many jobs will be created for years to come.



Figure 7

Research

## HISTORICAL CONTEXT



Figure 8

## DAWN OF SUSTAINABILITY

For thousands of years ancient people were nomadic. They followed the flows of the environment tending to the areas that best provided a sustainable life. The ancient hunters eventually had to change their methods after a long period of intense drought. They learned to plant crops and domesticate animals which gave them a secure food supply and allowed them to plan for the future.

Ancient people still had to practice their own form of sustainability. Once humans started to form settlements and no longer relied on caves they began to build permanent structures. To them sustainable meant a structure that could stand the test of time. They also believed buildings should be made from natural materials that surrounded the site, and when they buildings collapses it should return back to its natural state. They still faced the same problems as we do today in terms or agriculture which is one of the biggest causes of loss of habitat, depletion of natural resources, and pollution. Because the Egyptians relied so heavily on the Nile and worked with the its natural flows their civilizations could thrive for thousands of years, though they did experience hard times with in those year. It is believed if they built damns they would have changed the flow of the Nile which would have ultimately led to a quicker extinction of their civilization.

### JERICHO 8000 B.C.

An example of this is the city of Jericho in 8000 B.C. It is regarded as the first documented example of a truly permanent community and center of trade. Jericho was a major supplier of grain in the ancient world and saw the controllers of the gain markets as God like people. The culture seemed to have a well-developed sense of environmental

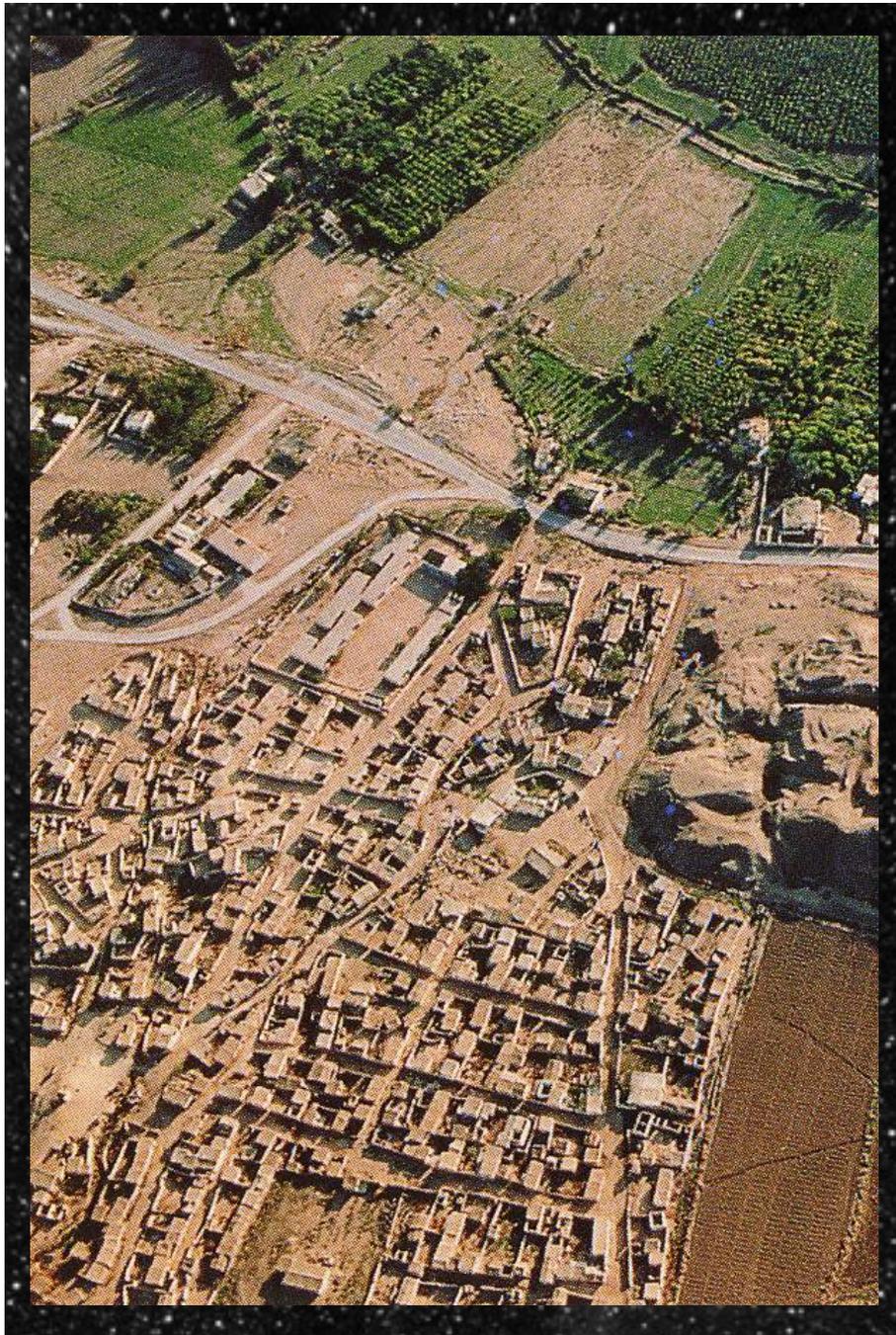


Figure 9

stewardship, and there is physical confirmation that the community built an elaborate – but discretely controlled – system of irrigation canals, which kept a sustainable balance between farmland and natural vegetation, and understood the principles of soil conservation. But in 3000 B.C. Jericho was taken over by the Sumerians. Through economic greed and a desire to radically increase the marketplace for gain, the invaders expanded the network of canals to a point where arable land was reduced and no provisions were made to filter out the saline deposits left by seasonal rains and overflow activity. As a result, essential drainage was eliminated, the canals filled in with silt and vast areas of fertile soil were rapidly depleted. In a very short time a once flourishing agricultural economy came to a halt, and the entire culture went into decline. It must be understood that the Sumerians still built an economy around the value of water and then sacrificed everything for short-term profits.

## NATURE IN CULTURE

Ancient societies are some of the only people to achieved a complete connection to nature in a few ways. Aboriginal cultures used the concept of, “totemism” where the tribal member at birth assumes the soul and identity of a part of nature. This is called animism this rich connection creates the idea that if you harm the earth you are harming yourself. They celebrated everyone’s origin in nature and relied on the preservation of tribal myths to connect them back to their ancestors. Another way this was done was by giving gods the power of nature which often represented half humans half animals as seen in the Egyptians and Mesopotamians religions. They believed they directly affected nature flows for nature directly affected them. To them every element in the world was alive and unique

Everything experienced in nature by ancient civilizations were understood and passed down through myths and rituals. Henry Frankfort writes in his book, *Before Philosophy, the Intellectual Adventure of Ancient Man*, “The thought of the ancient Near East appears wrapped in imagination.” “They dramatized the knowledge they received from nature acknowledging in them a special virtue which could be activated by recital.” This was their form of give and take, for it was not enough to only be a good farmer for a successful harvest, but also depended on their rituals which gave something to nature in hopes to receive once again. It is important to understand that ancient people saw all natural events as a direct result of their actions. In Mesopotamia if the Tigris river did not rise, Gudea the king went to sleep in the temple in order to be instructed in a dream as to the meaning of the drought. For the Egyptians, they would give offerings to the Nile around the time it was due to rise. Ancients festivals and celebrations often happened at the beginning of biological cycles to insure a good season. Nature did not simply happen or change on its own, it had to be a direct result of human action. Because they understood nature directly effects human life, human



Figure 10

life must directly affect nature.

The Egyptians are considered the first people to incorporate ornamentation into their architecture. Ornamentation has no functional purpose but is to be looked at as a work of art such as sculpting and painting. The Palmette (image on the left) is a motif that resembles the fan-shaped leaves of a palm tree, stemming from a curled based thought to represent scrolls or eyes. Some believed it represented the rising and setting of the sun on the horizon of the mountains. Alois Riegl did extensive research on Eusaian ornamentation and came to find that the plants and animals depicted in them changed from culture to culture depending on their region. The Greeks came to adopt this ornamentation into their column orders, using the Acanthus plant in their designs which was abundantly found around their region. These styles of ornamentation can be found throughout the history of architecture often symbolizing beauty and sophistication, increasing and decreasing in popularity throughout time.

### SHIFT IN PERCEPTION

When natural disasters would occur, ancient people believed it was the gods doing. This led to the building of massive temples and specialized professions to appease the gods. Jams Wines discusses in his book Green Architecture that a hierarchy of classes was developed such as priests, whose job it was to try to appease the gods and prevent natural disasters from happening. They found they had complete control of the land and in decided which monuments should be built as a result the lower classes was easily compliant for they feared divine retribution.

Wines continues to explain that a major shift in our connection to nature came in the 5th century when Leucippus and Democritus purposed the concept of “atomism.” “Greek philosophy seems to have been the origin

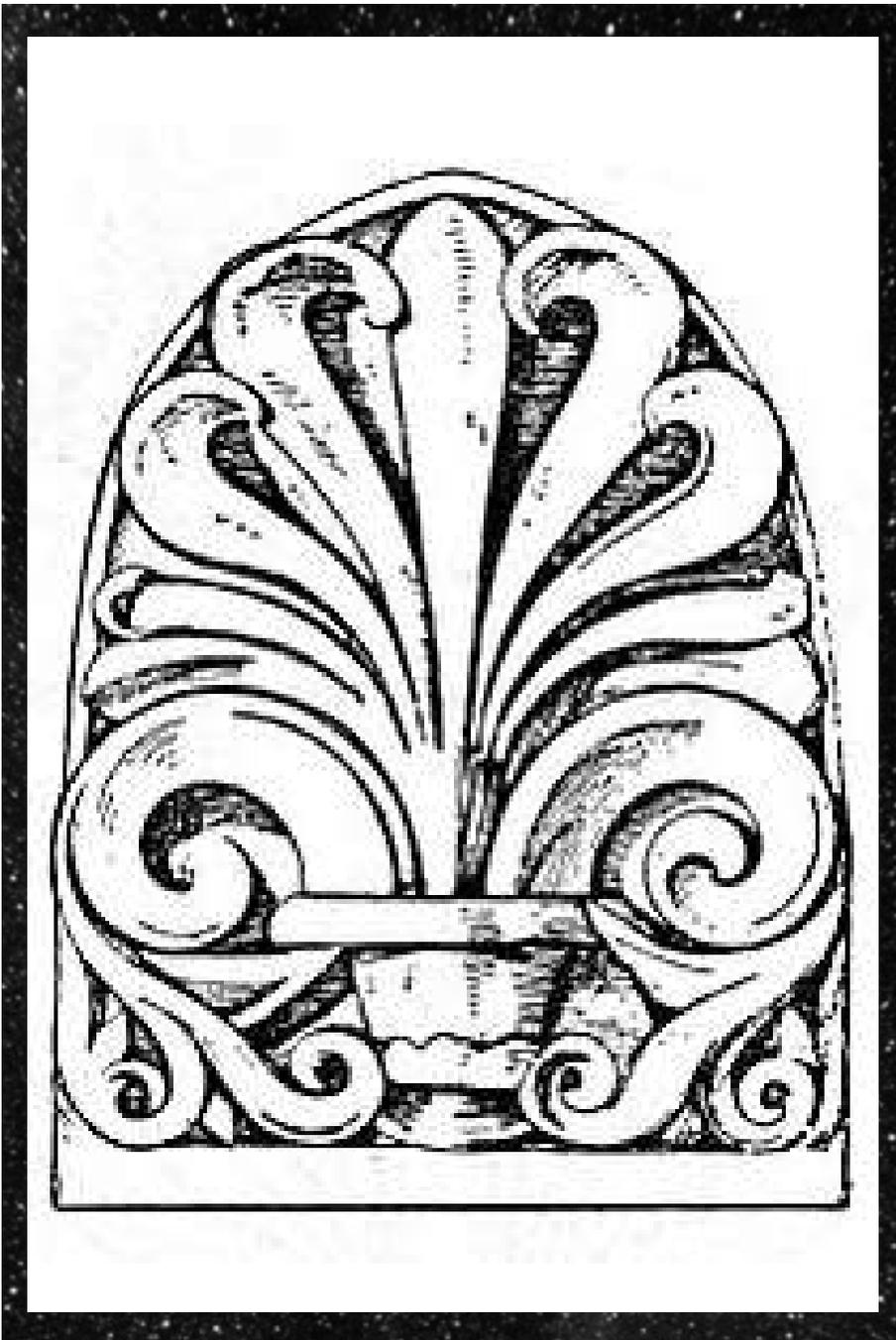


Figure 11



Figure 12

of the imperious single-track western idea of Man over nature.” For the first time, we were thinking of ourselves as being something of our own.

The superiority of mind over matter was reflected in all aspects of Greek culture: the building of massive temples where form, scale, proportion, and geometry became the ultimate measure of aesthetic standards; the treatment of landscape as a functional surface to be exploited (thereby causing one of history’s recorded ecological disasters through the deforestation of Athens). These buildings and temples were to represent the natural gods but also established social and political agenda that expanded ego-centrism throughout the population. The origins of democracy also stem from the Greeks, and laid down the foundation for future liberties such as private ownership of property, freedom of expression, and the cult of individuals. Ironically the freedoms we value most are also associated with environmental decline.

## ANCIENT CONTRAST

We must first understand the difference of the ideologies of modern man to the ideologies of ancient man, more specifically the ancient Egyptians and Mesopotamians. This is explained through Henry Frankfort’s theory of ‘IT’ vs “THO’. As modern people, we see the world around us as an ‘IT’ and to the ancients everything as a ‘Thou.’ ‘Thou’ sees the world as full of life, and because of this, ancient societies and cultures were embedded into nature and the cosmic flows, depending on them to reveal the workings of the world and how to live in harmony with the earth. Therefore all of ancient gods represented natural events and elements.

Our modern thought cannot think or accept information as true if it cannot be explained by scientific definition. As a result, we typically see the world as an ‘IT’ full of intimate objects, leaving us emotionless and desensitized to the world; seeing the world as merely resources for us to exploit.

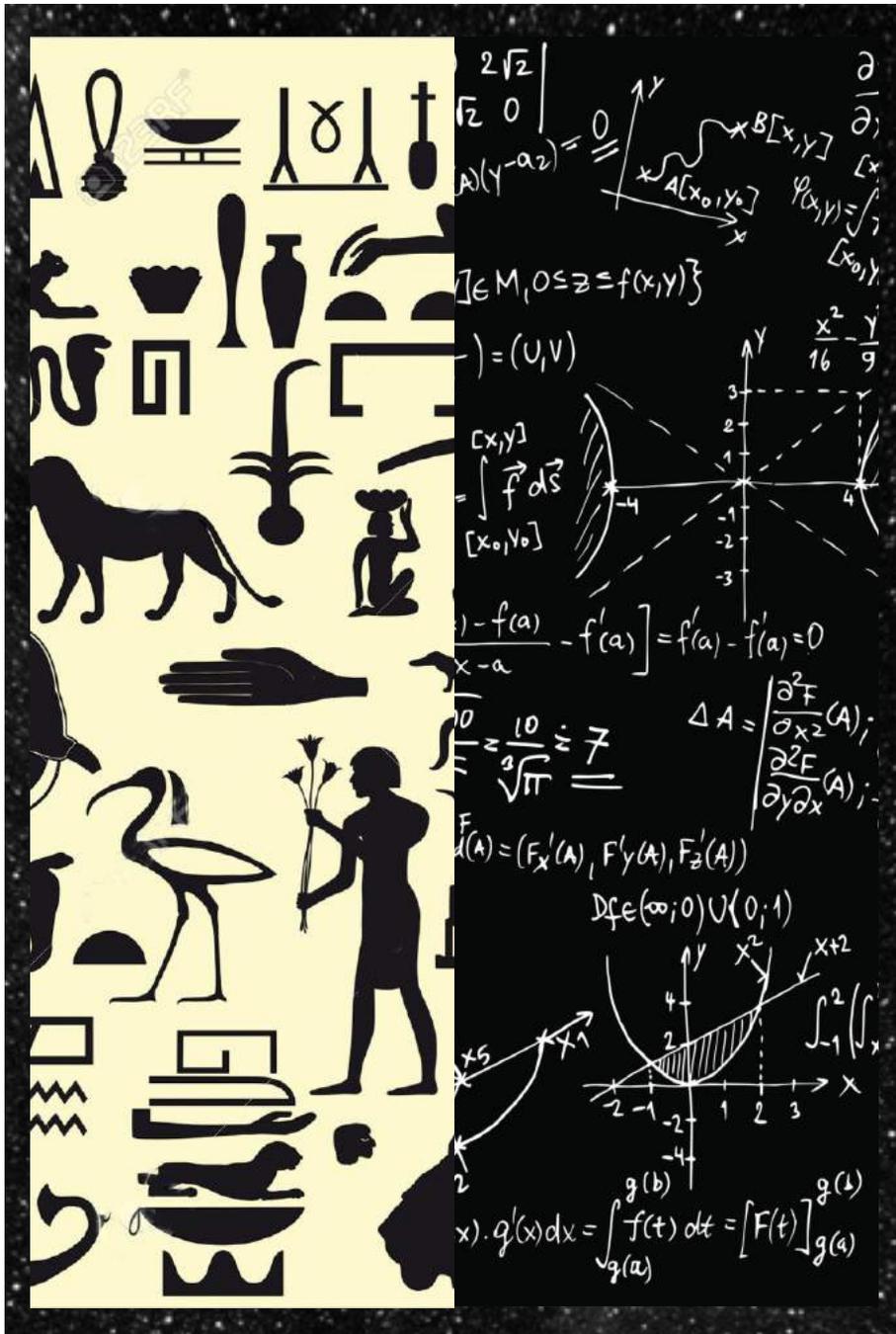


Figure 13

Do to scientific thought we tend to place things into categories and groups, making it easier for us to comprehend and predict, thus making diverse things similar.

'Thou' thinks of everything as unique and having its own character, 'Thou' allows the experience with the thing to reveal its character, always gaining an emotional connection to the thing. What the ancients learned through their experiences were considered absolute truth.

## TECHNOLOGICAL CHANGE

*"Man's reaction to nature are often conditioned by his culture and hence, finally, by history" - Mircea Eliade*

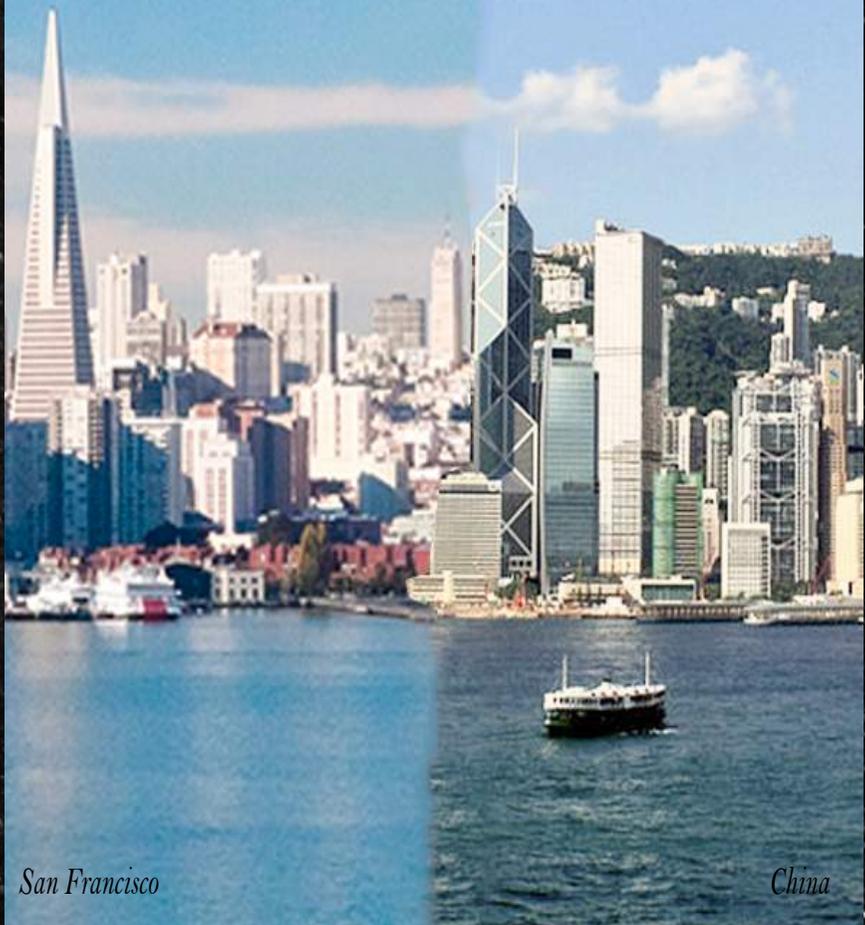


Figure 14

## INTERNATIONAL CULTURE

The second industrial revolution brought many new technologies that would shake the world forever. In architecture, these advancements were in steel, glass, and precast concrete. Architects such as Le Corbusier, Walter Gropius, and Mies van der Rohe with these new advancements pursued a rational, minimalist approach to architecture. In 1932 Philip Johnson and Henry-Russell Hitchcock dubbed this the "International Style". Mass production helped make everything cheaper and easier, further grow our obsession with possession and consumption. Alberto Perez Gomez states, "The acquisition of goods and services, even when they are ridiculously superfluous, becomes humanity's most serious quest, fueled by the belief that it will bring fulfillment and happiness." Architecture no longer found itself rooted in a particular culture but rooted in world industry. The skylines of San Francisco and Hong Kong can effortlessly be blended together, though their culture and histories are much different. The obsession with the new has left everyone wanting, and left cultural traditions behind. We gained a stronger connection to other humans and societies but intern lost our connection to culture nature.

Lester Brown president of world watch institute and James Wines both agree we need to change from an ego-centric to eco-centric. Because our economy thrives on industrial routes James Wine suggests, "As a result of designers' obsessive desire to maintain the stylistic imagery identified with the 20th century's earlier industrial and technological dream, buildings have continuously displayed characteristics reminiscent of everything from factories to dirigibles, turbines, carburetors, oil derricks, ocean liners, rockets, and space stations- in fact communicating a whole range of associations other than connection with the earth itself"(Wines 16). The industrial and technological influences that launched this century were rooted in cultural and economic change, giving little concern for the environment.

## EFFECTS OF TECHNOLOGICAL SHIFT

In 1902 the first modern electrical Air-conditioner was invented, called “man-made weather”, liberated modern architecture from nature. The technology of electrical heating and cooling allowed architecture to take the edge off nature to such a degree it left us forgetting about its macro-climate in exchange for our personal bought micro-climates in our buildings. These additions are not free, resulting in architectural elements that did not have a function purpose such an ornamentation to be left out. These buildings featured an entirely new language of smooth-skinned glass held by steel frames without operable windows, ventilators and in some cases even sunshades. When comparing two steel builds such as Louis Sullivan’s 1896 Guaranty building to Mies van der Rohe’s 1958 Seagram Building we can notice the big shifts in architecture. Sullivan strives to connect the building with the natural world. He tried to achieve this with his ornamentation for the Guaranty Building inspired by flowers, seedpods, and, at the top of the building, the spreading of tree branches. The four facades of the building were mostly Terra cotta, often used by the early 19th-century architects, both for ornamental and as a fire-retardant features. The Seagram Building was built 60 years after and truly displayed the technologies of its time. Steel and glass piercing the earth from top to bottom, allowing it to rise up two times as tall as Sullivan’s Guaranty Building. The building featured no operable windows or hints for natural or cultural elements. A modern type of ornamentation was added, I beams with no functional purpose were added to the exteriors of the windows to give the building more character and to lead the eye from bottom to top.

These innovations called for more energy and the need for more energy brought the concern of climate change. It is no coincidence that the environmental movement came at the peak of modern architecture.

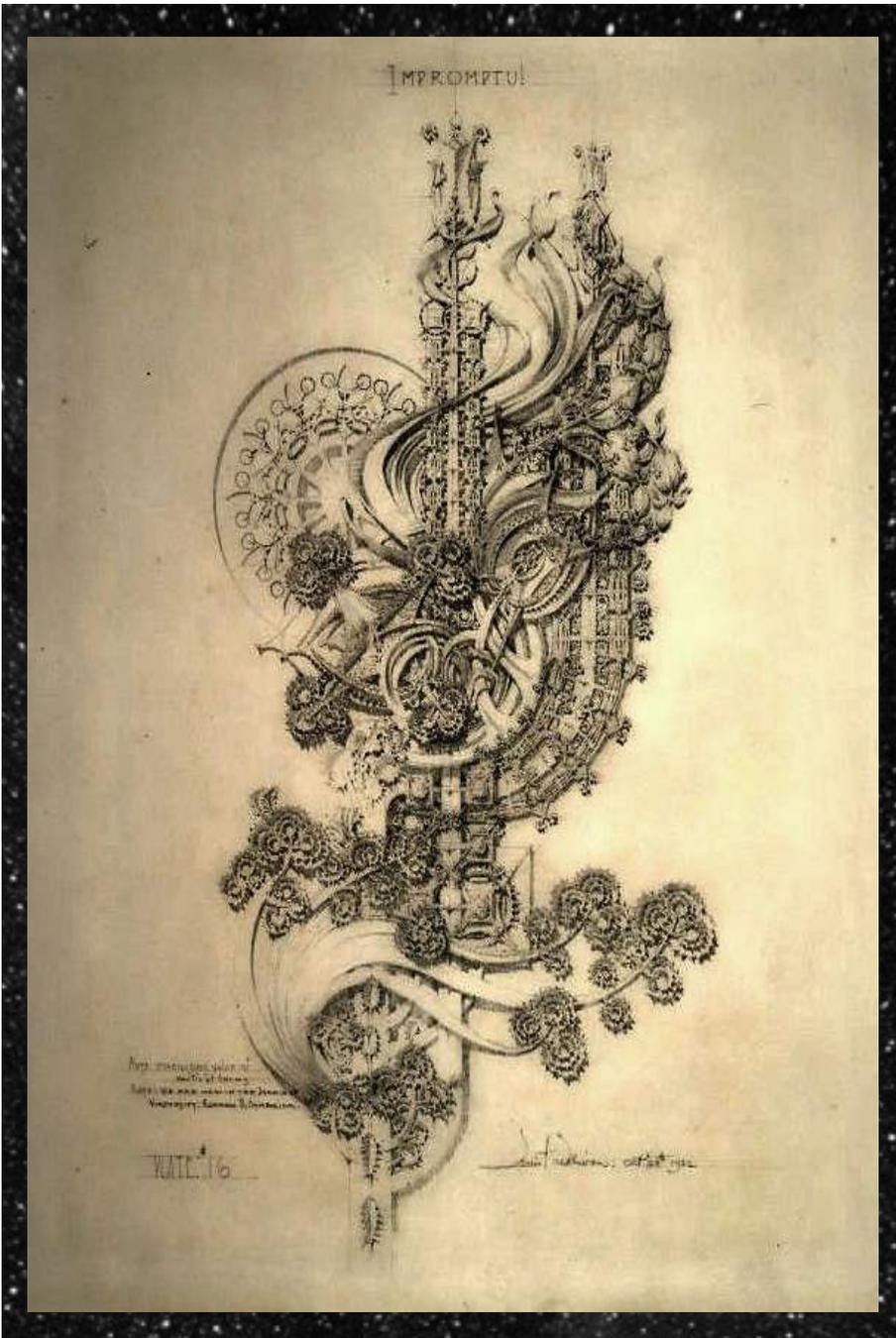


Figure 15



Figure 16

From Guy Callender's 1938 research of CO<sub>2</sub>'s effect on global warming to 1976's finding of methane's contribution to greenhouse gases the people of the world began to be concerned about climate change and global warming and its effects on the Antarctic ice sheets. Because buildings were found to be 40 to 50 percent responsible for global emissions a new more sustainable architecture keeping all of its active systems were now in need. The human race was reminded once again of the ability to directly affect nature, proving this time scientifically that every choice we make does directly affect nature and that those choices can make nature more directly affect us. We are currently experiencing some of the most natural disasters in history and are experiencing the hottest global temperatures on record. The most recent examples being the three hurricanes in the Florida keys, Wildfires in the west, and drought conditions thought out America. It is important that we learn from these events and ask ourselves why they are happening.

Because of this new need for sustainable buildings due to the use of more technology. Other technologies were being made that could transform buildings into automatic, self-regulating systems which could produce a subtly changing and modifying environment at apparently little energy cost. However, sustainable design is more than a technological add-on or modern engineering. It should be done in an architectural way that stimulates creativity and spirit while preserving culture and nature. Just as being a good farmer was not enough for the ancients for a successful harvest good engineering should not be enough for sustainable buildings. For example these two buildings are both LEED platinum the highest level of sustainable architecture. Because they are not inspired by nature and only wish to preserve it for economic gain they do not reflect the regions nature and historical culture and only good engineering.

## SUSTAINABLE ARCHITECTURE

One way of examining how sustainable a building is is through LEED certification (Leadership in Energy and Environmental Design). In spite of this positive certification The New York Times reported on the controversy surrounding the energy performance of LEED certified buildings. Studies have shown that many LEED building receiving certification actually poorly perform when it comes to energy efficiency. An example is the federal building in Youngstown, Ohio which would have failed to obtain U.S. EPA's Energy Star rating even though it was LEED certified. The building's cooling system, a major gas guzzler, was one culprit. Another was its design: to get its LEED label, it racked up points for things like native landscaping rather than structural energy-saving features, according to a study by the General Services Administration, which owns the building. Because a sustainable building includes so many factors such as multiple environmental benefits and power saving benefits and the importance of one over the other in a specific area it is almost impossible to have a general ranking system for overall sustainability when it varies so much on the sites condition. Furthermore sustainable buildings do not often tend to influence people or even make them aware that the building is more sustainable. We move from inefficient buildings to efficient buildings without even noticing the change. We never actually experience the sustainability happening until it is to late. Communities that once had heavy air pollution that changed to more suitable factories and buildings have seen a positive change in air quality.



Figure 7

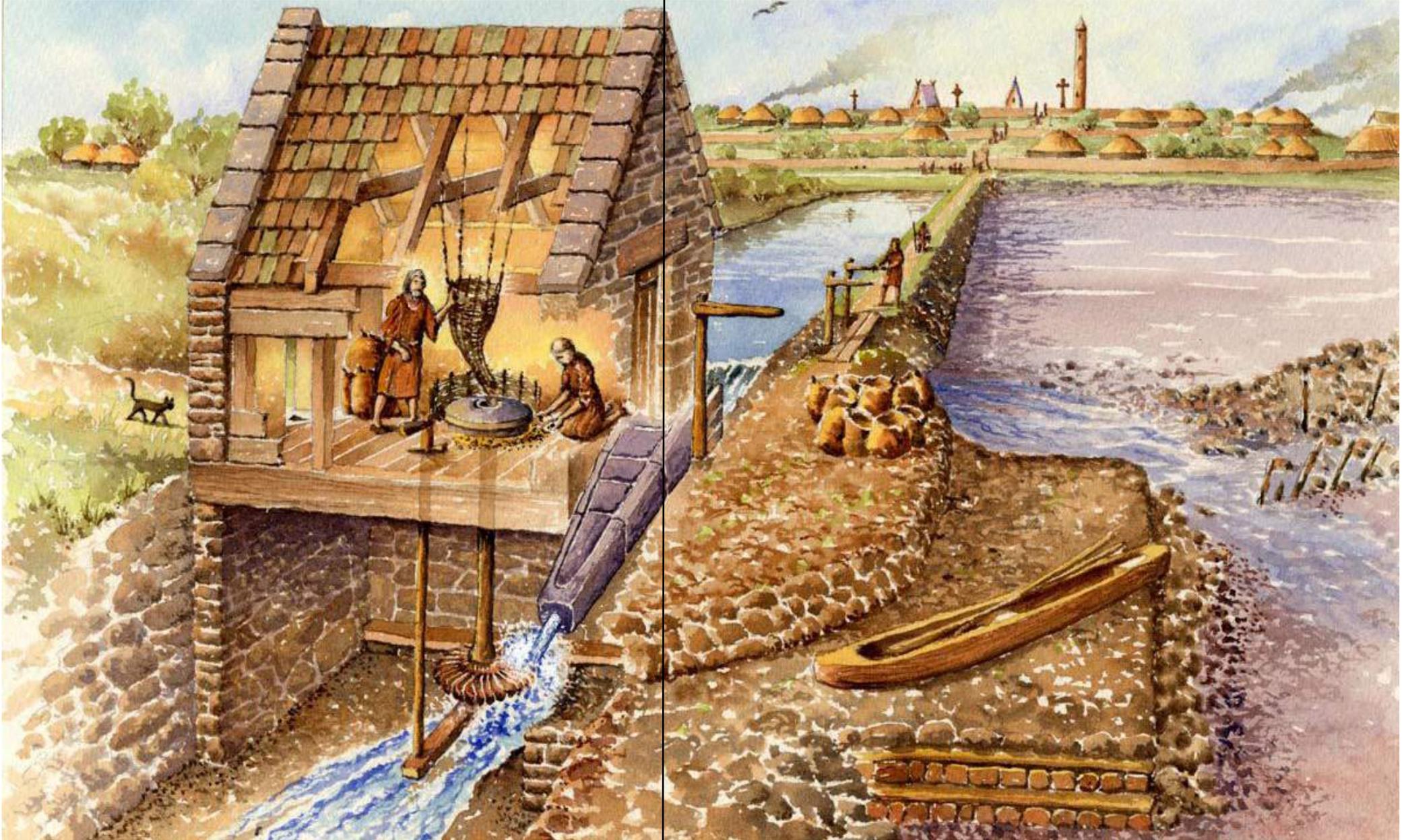


Figure 18

Nendrum Monastery

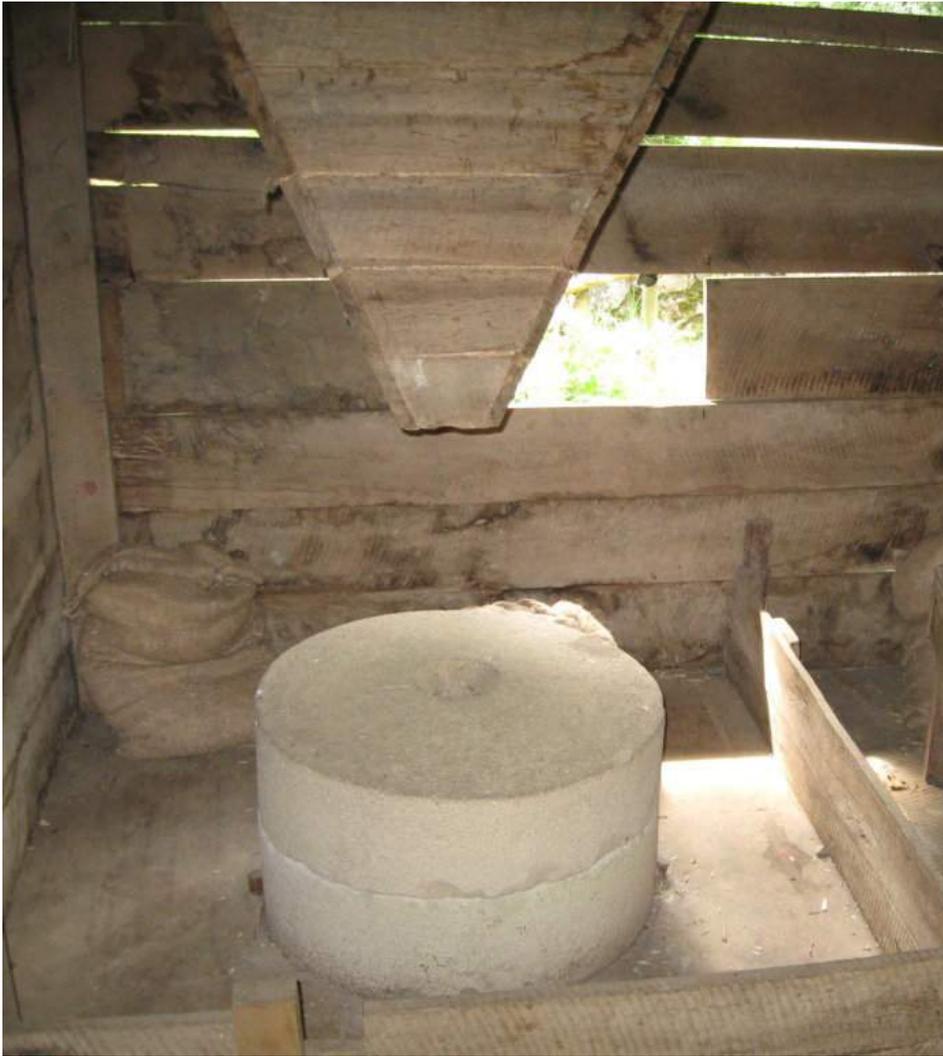
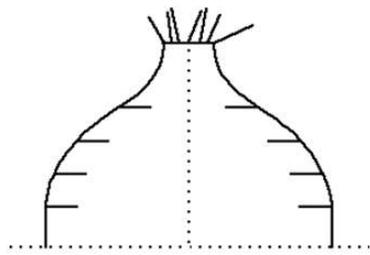


Figure 19

The first evidence of tidal energy is seen at the Nendrum Monastery in Northern Ireland, who tapped into the power of the tides to grind grain. A twin flume horizontal-wheeled tide mill dating to c. 630 was excavated on Little Island. Alongside it, another tide mill was found which was powered by a vertical undershot wheel. The Nendrum Monastery mill from 787 was situated on an island in Strangford Lough in Northern Ireland. Its millstones are 830mm in diameter and the horizontal wheel is estimated to have developed 7/8HP at its peak. Remains of an earlier mill dated at 619 were also found at the site.

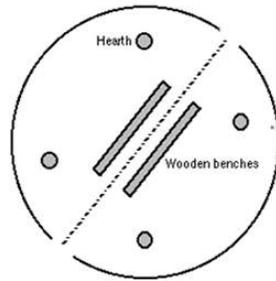
At one time there were 750 tide mills operating along the shores of the Atlantic Ocean: approximately 300 in North America,<sup>[8][9]</sup> including many in colonial Boston over 150 years, 200 in the British Isles, and 100 in France. By the mid 20th Century the use of water mills had declined dramatically.

# KOGI CULTURE



The four shelves under the roof represent the four upper worlds - the 'sun worlds' or nyui-nulang.

It is imagined that the nuhue extends downwards also, where the four nether worlds - the 'night worlds' or seinu-lang - exist.



The four hearths represent the four clans.

Hammocks are slung from the stronger wooden side supports of the nuhue, which is the only building in a village with two entrances.

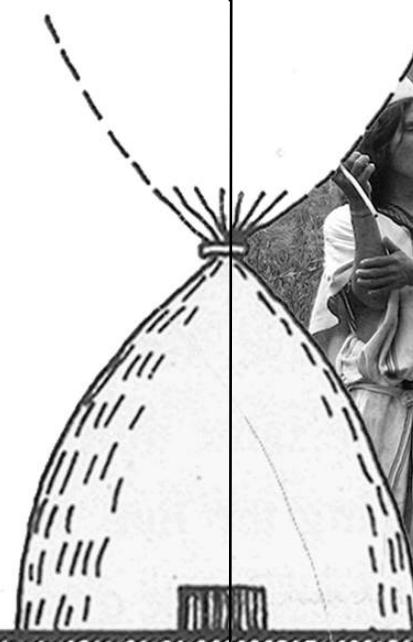


Figure 20

An example of passing cultural beliefs through activity and architecture is the Kogi people in the mountains of Colombia. The Kogi have been reluctant to establish permanent contacts with western civilization, and reject commercial-trade of cloth and insist on using their own textiles and traditional methods. For Kogi people, the Spindle and Loom showed a sense of rhythm and the notion of continuity that appear in the world they have experienced.

As for their architecture the kogi temples symbolized a small-scale model of the cosmos. At the top of the roof was a circle letting in sunlight, as the day changed the position of the light would move with geometric precision and at noon when the sun directly pierced the middle of the temple, the circular temple floor was thought to represent the whorl, and the near vertical sunray that fell upon it as the spindle. This simple design connects their temples back to the universe and constantly reminds their people of the cosmic presence.



Figure 21

## SWANSEA BAY TIDAL LAGOON



Figure 22

Swansea bay was the basis for my inspiration and allowed me to see energy generation in a new light. The West Coast of Britain is home to some of the largest tidal ranges in the world and saw there situation as an opportunity to generate energy. Not only seen an a power plant the community at Swansea Bay is being used as a research facility along with housing marine farms a visitor center and interactive art pieces. Because the city still depends on a large amount of fossil fuels for power they found it necessary to take new action to change this reality.



Figure 23

.The lagoons will have a walking path placed on top of the lagoons walls allowing people to walk, run, and bike the entire distance of the lagoon. Many interactive features are being designed along the path to make a favorite destination for locals and visitors. The path total distance is just short of 5 miles. Sculptures will be placed along the path which will interact with the rising and falling of the tides.



Figure 24

Power will be generated as water rushes through 60m long draft tubes, rotating a hydro turbine with a diameter of 7.2m. There will be a total of 16 hydro turbines with a 9.5km breakwater wall. The turbines will allow generate enough energy to power 155,000 homes for the next 120 years. Independent reports have been made and predict that around 2,232 construction and manufacturing jobs will be directly sustained by the build, supporting thousands of future jobs in wider Welsh/UK economy. The project is estimated to add 76 million pounds of gross value to the Welsh economy every year after is construction.

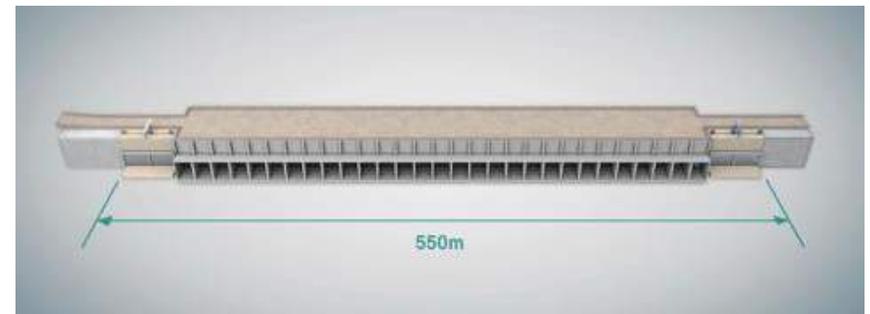


Figure 25

The lagoon will also be used as a form of flood protection. The rising levels of the ocean will soon effect many coastal communities and Swansea bay is no different. Peek tide season often cause damage due to flooding of the main land. The project will prevent this damage from taking place saving money while also producing peek energy turning an unwanted natural occurrence into a desired one.

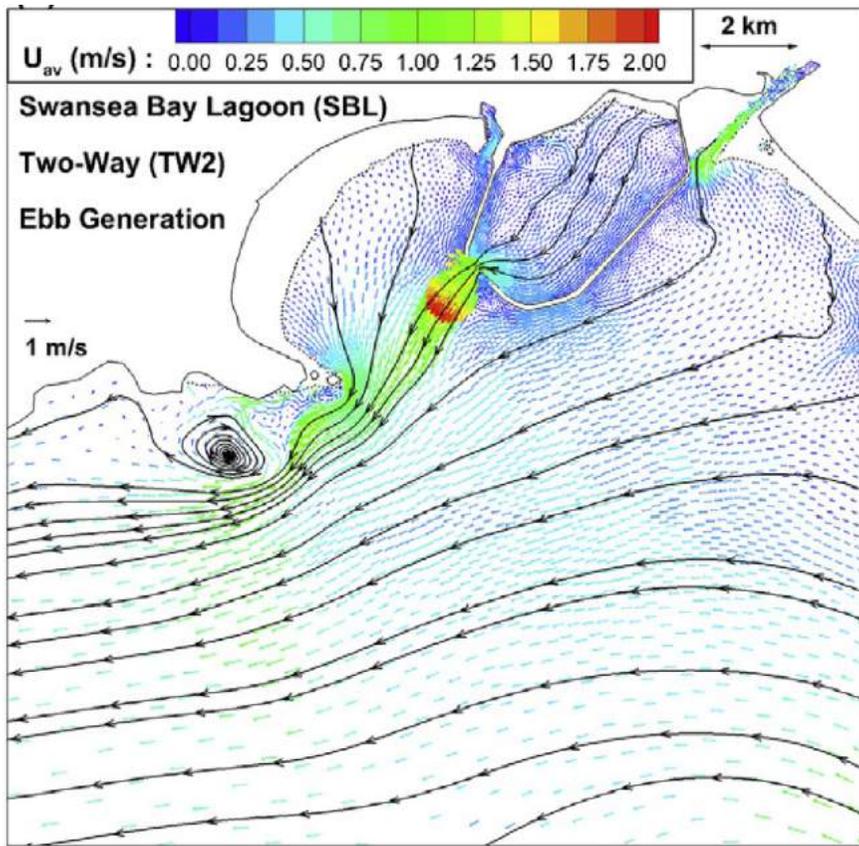


Figure 26

In depth research of potential tidal lagoons in Scotland has been done by the Hydro-environmental Research Centre, School of Engineering at Cardiff University. The researchers have found that the speed of the water coming in and out of the lagoon has increases the amount of sediment movement by the barrage's gates. It is important the location of the tidal lagoon does not have fast moving currents that could increase in speed as the water funnels in and out of the lagoon causing sediment build up.

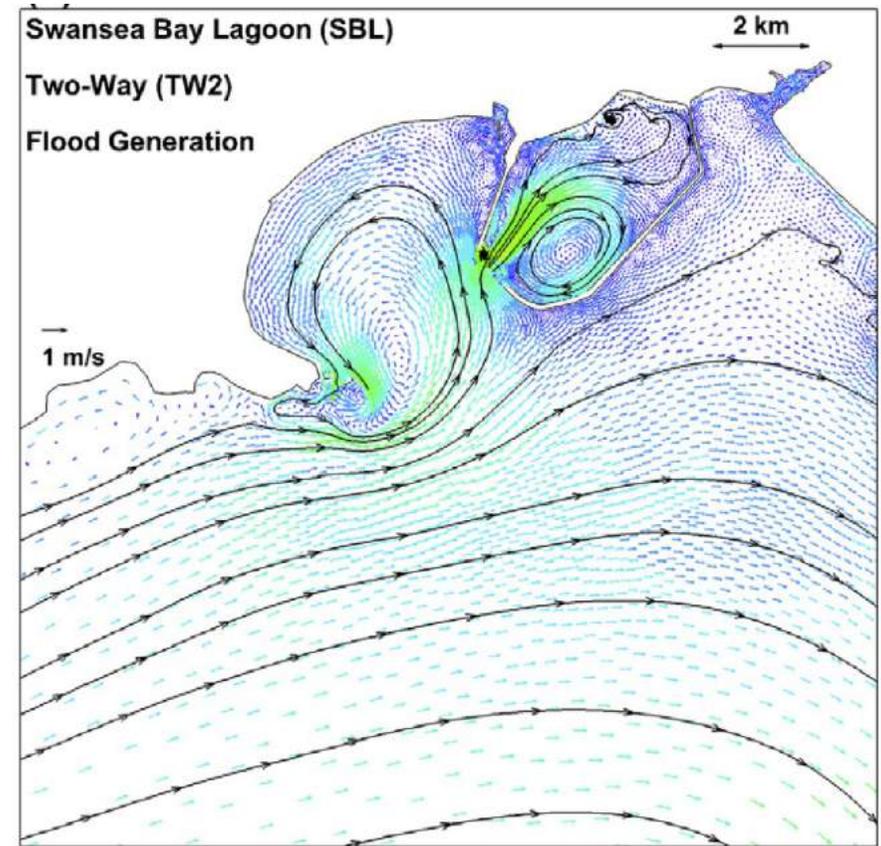


Figure 27

“As the scale of the projects increase, so do the relative hydrodynamic impacts” (345). Because the size of the lagoon directly effects the change in the surrounding environment tidal lagoons should only be constructed in areas with high tidal ranges such as Scotland. Scotland experiences tidal changes as strong as 17-19 feet which are some of the largest in the world.

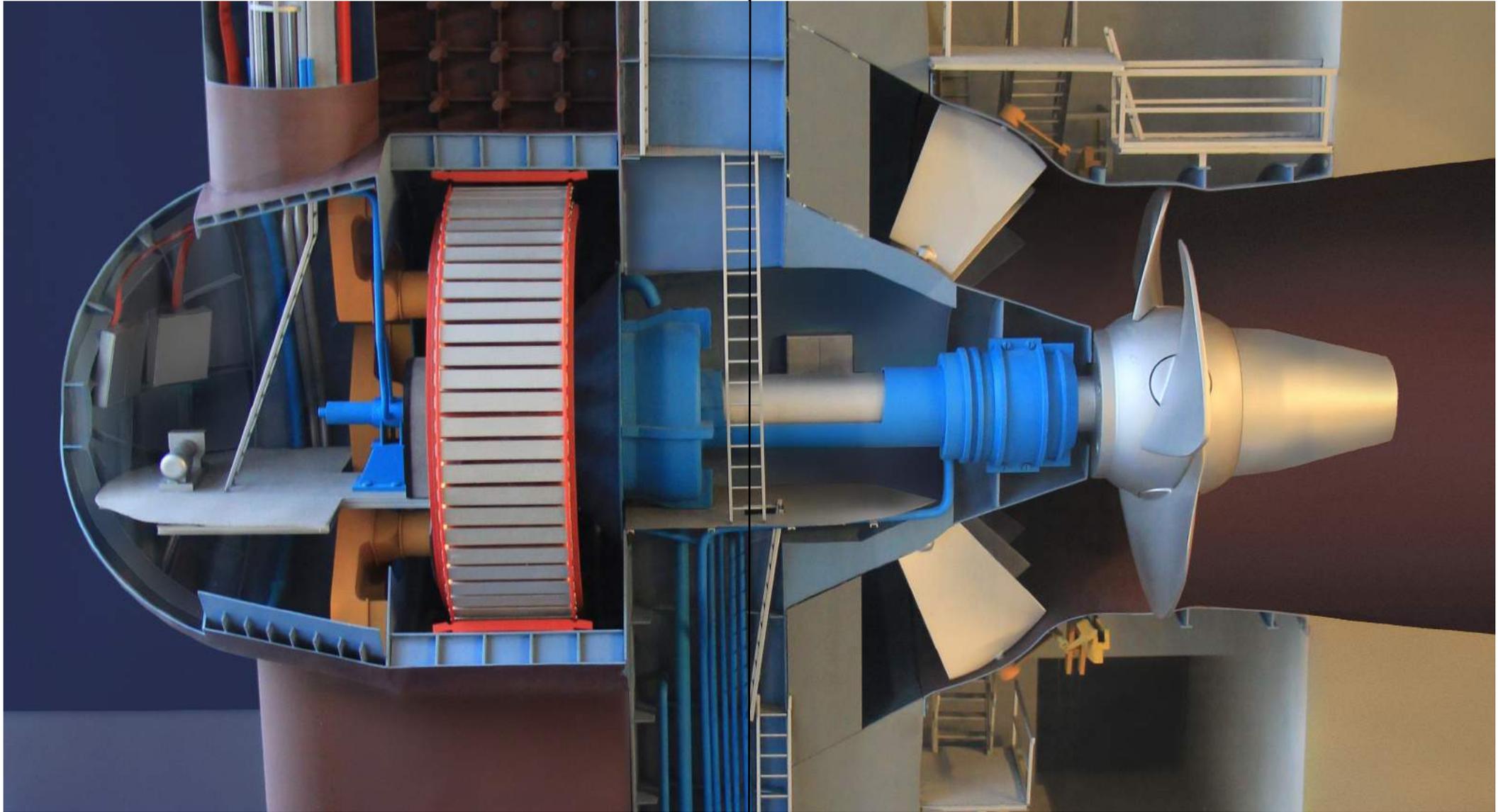


Figure 28

The generators used are two-way operational, meaning energy can be generated on entry and exit. Two-way generators are not as efficient as one-way generators but offer much less environmental changes which are due to the movement of sediment causing build up at the entry and exit of the gates. If sediment builds up it will need to be re-dredged overtime, and preventing this from happening very important for the integrity of the site.



Figure 29

## Enoura Observatory



Figure 30

A modern example of architecture that celebrates the cycles in nature is Hiroshi Sugimoto's Enoura Observatory. "It is the combination of art and architecture", says Sugimoto. "It was purposefully placed to face directly south. So, on midsummer days, the sun come up from the ocean...and then light begins to find its journey straight down into the 100-meter gallery." In designing the observatory, the way it will look in four thousand was very important. The building is seen as being a ruin and techniques are used to make it seem as it has belonged on the site for years. Fascinated with the coming of a human conscious Sugimoto believes when ancient people started at the cosmos and experienced the cosmic cycles people came to have consciousness and therefore ancient civilizations all did things like worship the sun and celebrate the winter solstice. The observatory is a celebration to the cosmos for the gift it has given humans and recreates those ancient festivals and stone monuments as art in order to re-experience the spirituality of ancient peoples. "As I head toward death, I feel as though I'm part of a cycle, that I'm returning to something primeval."



Figure 31

Sugimoto's Enoura Observatory has inspired me to design in a way to re-experience the spirituality of ancient peoples. Through a park that allows you to only use certain modern equipment you will have no choice to experience the land as ancient people once did. Leaving the car behind and emerging from the earth into a land that was once heavily touched by people is now being re-consumed by nature.



Figure 32

Jason DeCaires Taylor



Figure 33

Sculptures have played a crucial part in culture since the beginning of civilizations, and have been constructed to represent our values and beliefs. Jason Taylor has taken a new approach to traditional sculptures by placing them into a new environment, one that is not in the realm of human. His most famous works can be found in the bottom of the world's oceans and seas. One famous work is *Crossing the Rubicon*, which consists of 35 life-sized human figures walking towards a 30-metre-long wall and gateway. The atmosphere in which the sculptures have been placed transforms the human statues into something much greater. To view the art, you must be snorkeling; here humans are no longer in control, and you are truly in the realm of the wild once more. As you approach the statues the sight of humans walking on the bottom of the ocean floor evokes imaginative thoughts. Are they dead? Where are they going? Why are they here? The imagination cannot help but to fill in the missing pieces. Our true humanity comes into existence as you witness the statues submitting to the environment, and changing overtime with no control. The environment creates a world of fiction, allowing the viewer's imagination to be free from the constraints of his knowledge. The ocean provides unlimited possibilities for the art work and how one experiences it. The pure mystery of the ocean and the wildlife that lives in and around the art work give the sculptures the possibility for unknown anomalies that could completely alter your perception of the work. The area can be full of life or completely barren, filled with light or the looming darkness of the abyss; the natural world transforms your imagination bringing to light unknown meanings, thoughts, feelings, and ideas.

When examining each sculpture, the true message of the art piece comes to light. The sculptures vary from gender, race, and age. The outfits of each person are very familiar and modern, you may begin to see yourself through them for they dress and look the same.



Figure 34

A closer look at each will reveal they are all looking at cellphones and tablets, or their eyes are closed. They are all walking in the same direction yet no one is looking to see where they are going. To some, the crowd may seem to be moving like a machine with no purpose but to walk forward. Looking even closer the body language of the statues also reveals another story.

Some have the look of hopelessness, some the look of perseverance, and others the look of privilege and unamused. The faces of the statues may bring up passed memories and emotions. The people of the ocean relate to you even more than the ones on land. This is described by Paul Ricoeur as augmenting reality and iconic augmentation, which is the power an image has to condense, spell out, and develop reality.

The statues are all heading towards a giant wall. The for most represents a boarder, a line that people on one side cannot cross. All the statues are blindly walking to the wall, perhaps for all different reasons. To the wild life the wall has no importance. Fish freely swim over and through the wall as if it is not even there. The creations of man cannot contain them in their aquatic world. The natural world has no boundaries no lines that clam area, for this is not the law of the natural world. Humans have become blind or distracted form this fact, and have transformed into something almost unnatural to this planet. Yet in the sea the statues must adapt to natures demands and the wall of nations has a gateway for all to walk through for this is the true law of nature.

# ANALYSIS

# TIDAL AND LUNAR RESEARCH

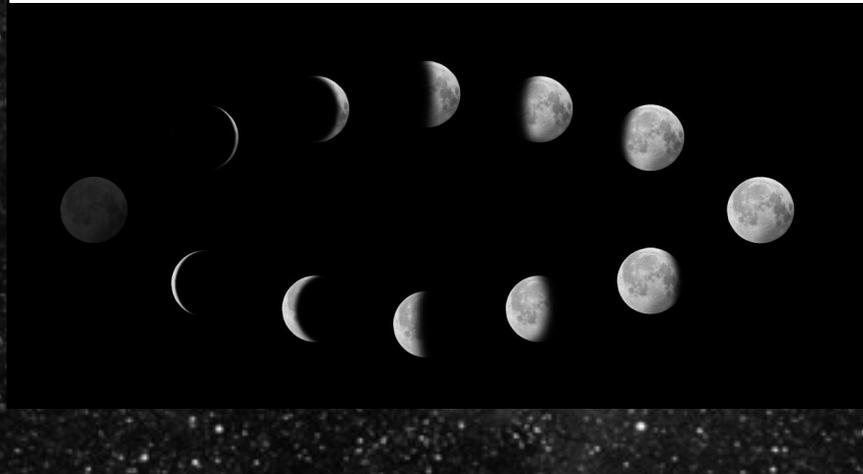
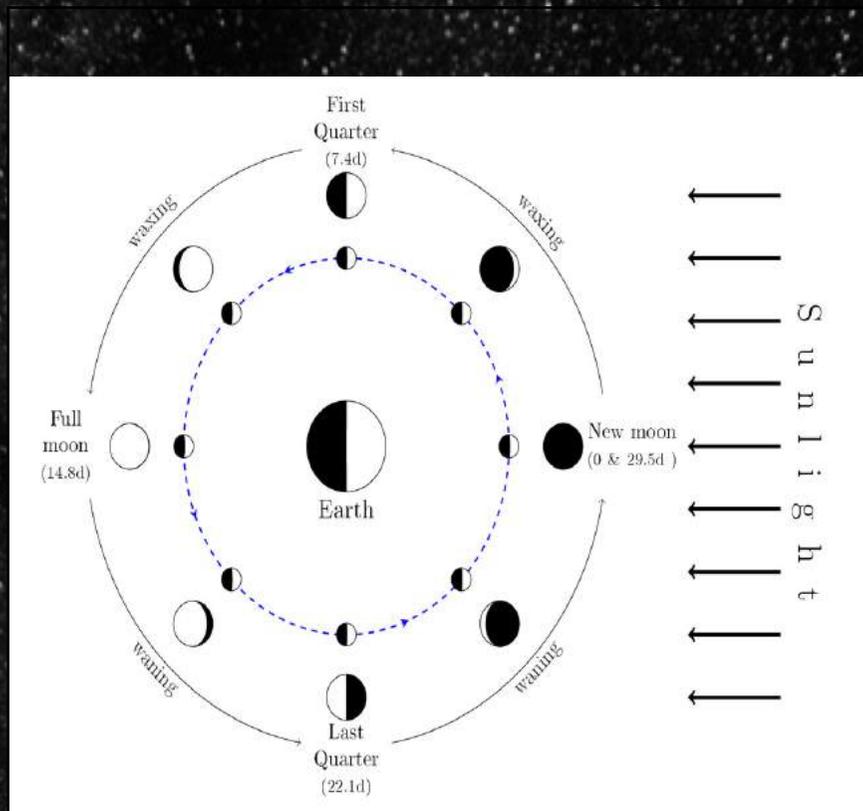


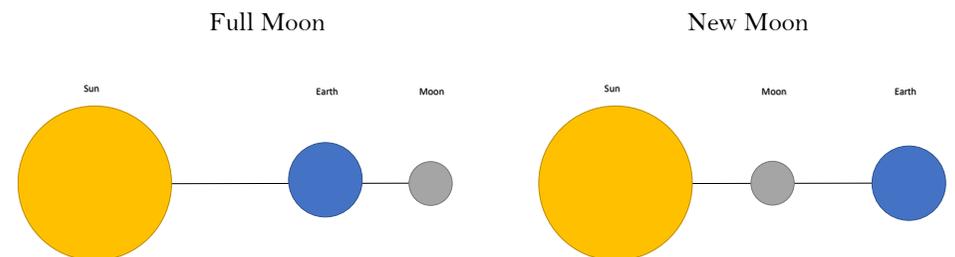
Figure 35

## TIDES

The motion of the tides is due to the gravitational attraction of the moon. As the moon becomes closer to different areas of the world those areas of the oceans begin to bulge out or are pulled into the direction of the moon. Another bulge occurs on the opposite side, since the Earth is also being pulled toward the moon the earth pulls away from the water on the opposite side of the moon creating a budge. Ocean levels fluctuate daily as the sun, moon and earth interact. As the moon travels around the earth, and as they travel together around the sun, the combined gravitational forces cause the world's oceans to rise and fall. Since the earth is rotating while this is happening, two tides occur each day usually 12 hours and 25 minutes between the two high tides. This makes tides very constant and predictable.

## Moon Phases

The phases of the moon are directly connected to the phases of the tide. The strongest tides occur when the Sun, Earth, and Moon become aligned, creating the Full and New moon. A full moon occurs when the moon is directly behind the earth and is able to reflect all of the suns light that bends around the earth allow us to completely see one side of the moon. A new moon occurs when the moon is directly in-between the sun and the earth, and is not visible in sky because the suns light can not be reflected by the moon, leaving it black.



## TIDAL AND LUNAR RESEARCH



Figure 36

## LUNAR RELATIONSHIP

Egyptologist and Archaeologist Henry Frankford writes of ancient civilizations observations of natural phenomena, as direct experiences, and their experiences of these phenomena told them who they were and where they came from. They deeply depended on the cosmic flows to reveal answers they could use in everyday life. As for the moon, she gave them the gift of time. As she showed her face to the ancient Sumerian's and Egyptian's they tracked her arrivals in the form of a calendar dividing a year into 12 lunar months of 29 or 30 days. Each month began with the sighting the full moon. The term calendar itself is taken from the Roman verb calare meaning, "to call out", which refers to the calling out, or the announcement that the full moon has just been seen. The understandings of these gifts took the form of myths so generations to come would know their stories.

Subconsciously the moon has always been with us. Indeed, the words "lunacy" and "lunatic" come from the Roman goddess of the moon, Luna. For thousands of years, doctors and mental health professionals believed in a strong connection between mania and the moon. In fifth century B.C. Hippocrates, who is considered the father of modern medicine, wrote that "one who is seized with terror, fright and madness during the night is being visited by the goddess of the moon." Even up to 18th-century England, people on trial for murder could campaign for a lighter sentence on grounds of lunacy if the crime occurred under a full moon. Even today many people have rituals for the different phases of the moon weather it involves writing down your desires, to listing your grievances.

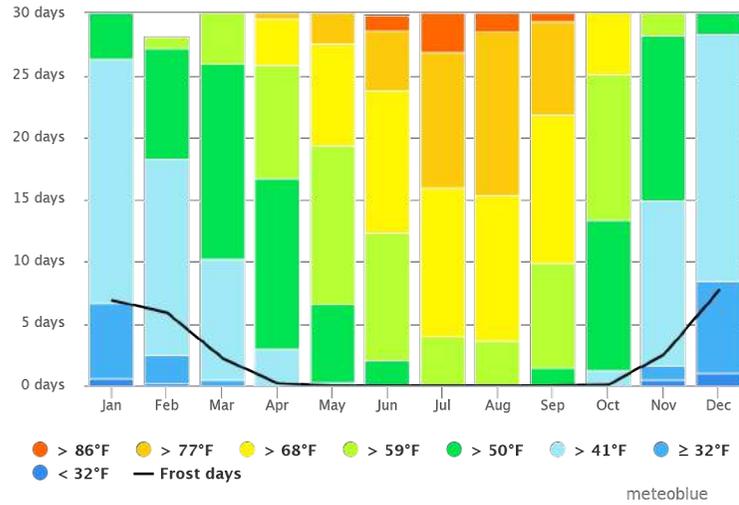
# SITE ANALYSIS



Figure 37

SEATTLE WASHINGTON

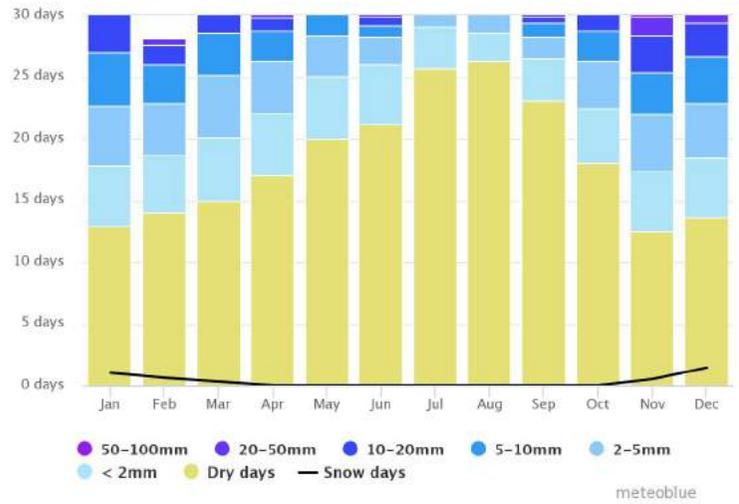
## TEMP



## CLIMATE

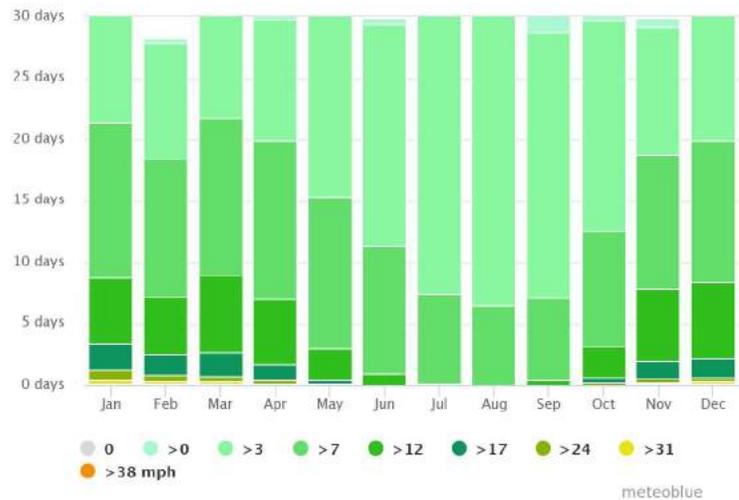
The tidal lagoon is being designed to be accessible to the public throughout the whole year. It is important to know the changes in the climate as the year develops to create an environment that is comfortable for users to experience nature all year round.

## PRECIP



Due to Seattle's rainy seasons and information of wind patterns I will be able to construct walls that will block out the rain and allow it to come in when the design calls for it. The lagoon's main focus is to change or open up a new view of the natural world and understanding the climate pattern will allow me to have full creativity when designing with the climate.

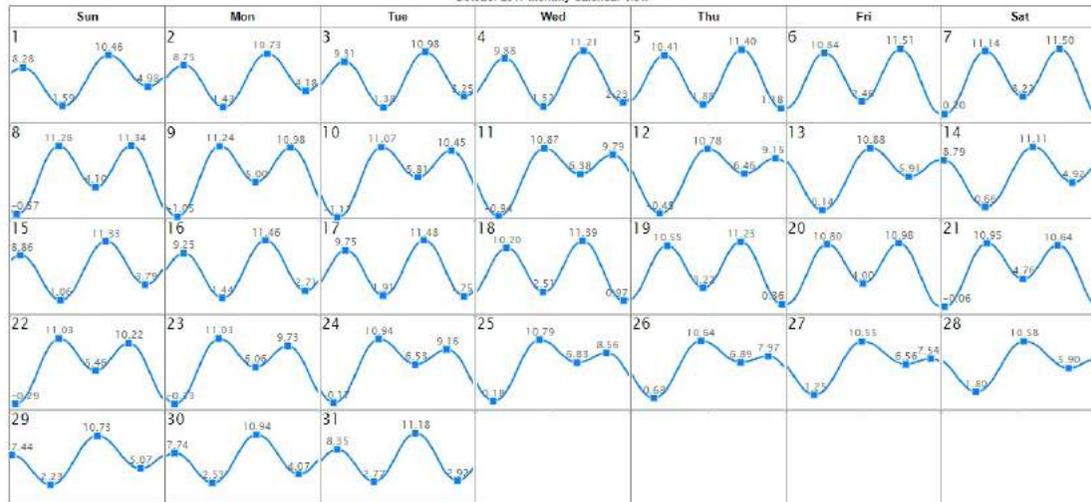
## WIND



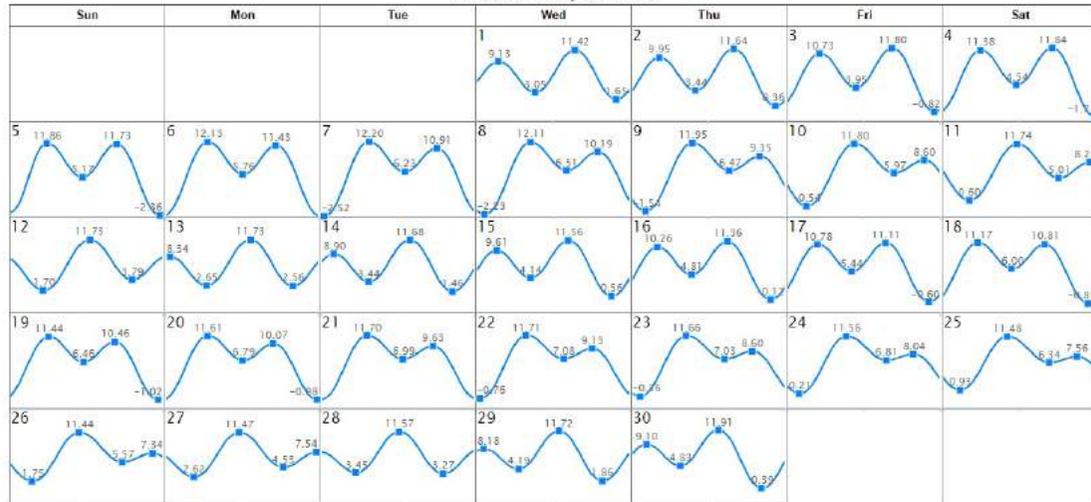
The prevailing winds on the side will come from the Puget Sound blowing from the south to the north. The main gathering spaces along the causeway will have to be designed with a wind barrier on the north side of the building.

Special lights will be designed along the causeway that will symbolize the alignment of cosmic bodies. It is important the community has access to the lagoon at night when the moon is showing in the night sky.

Figure 38



November 2017 Monthly Calendar View



December 2017 Monthly Calendar View

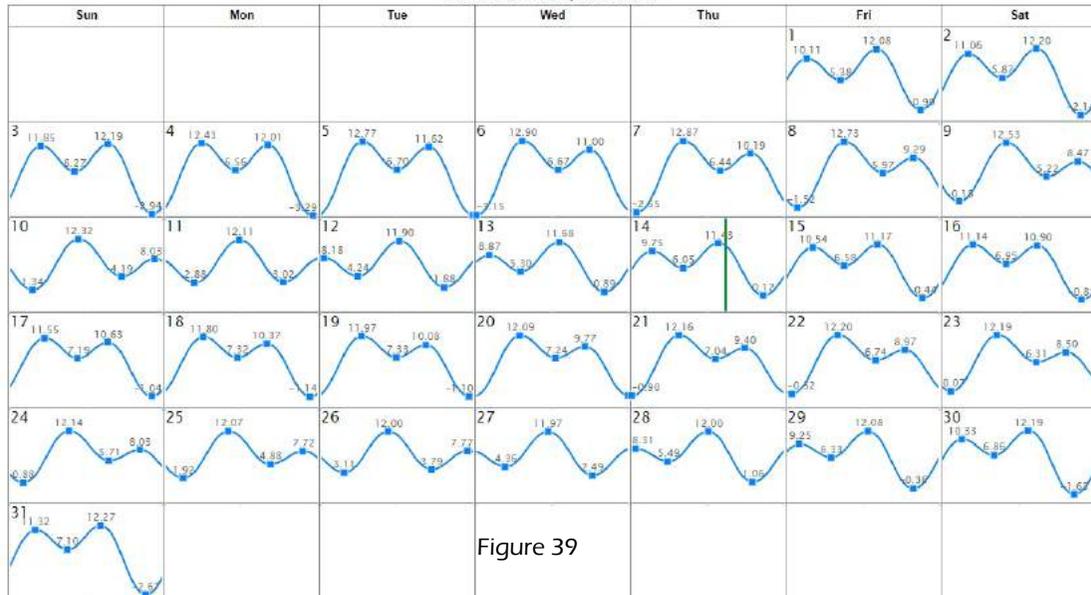


Figure 39

## TIDAL RANGE CHARTS

Elliot Bays wide range of tidal ranges the main premise behind the decision to construct a tidal lagoon. Though tidal energy is a great form of renewable energy it is not meant for everyone. To predict if tidal energy is a proper source of power generation you must look at your areas tidal ranges. The National Oceanic and Atmospheric Administration provides tide charts to every coastal city in the United States and what used in this project. Though comparing and contrasting different tide charts I was able to pick a site that would utilize tide energy in the most efficient way.

The charts show the levels of high tide and levels of low tide given in feet. The ranges can have a difference as much as 15 feet at peak high and low tides. It is important to calculate the exact time of each low and high tide. Using specific calculation the barrage will be able to use most of the tides potential energy will little energy waste.

The tidal ranges deeply depend on the cycles of the season and the phases of the moon. The largest tidal changes appear at the beginning and middle of the month during the full and new moon. This important connection to the moon to the tides will be celebrated through out the design.

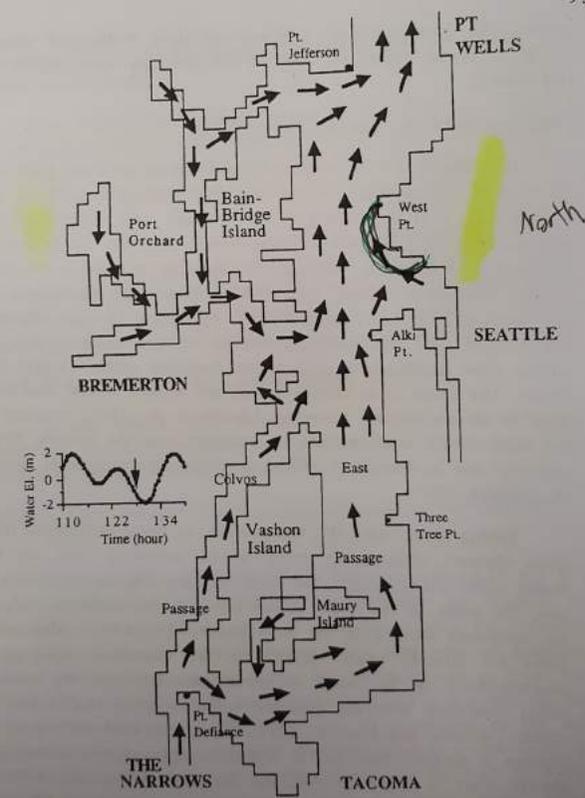


Fig.5.10a General surface layer flow pattern in Central Puget Sound at ebb tide

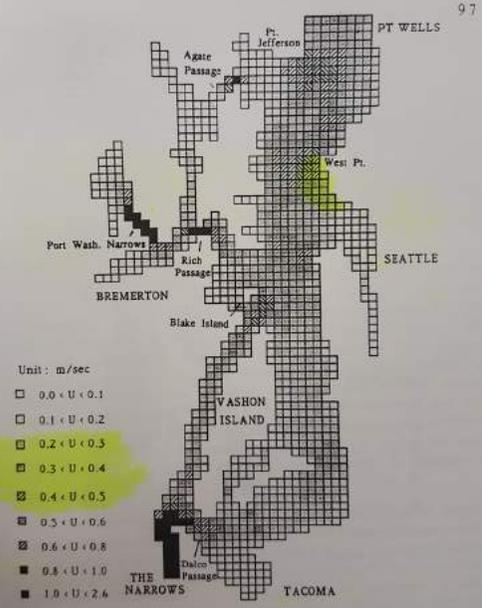


Fig.5.11a First layer maximum current speeds in Central Puget Sound (for the 5th tidal cycle of Fig.5.2).

### WATER CONDITIONS

The Department of Civil and Environmental Engineering at the University of Washington has done extensive research in their essay on Puget Sound and Elliot Bay. Their research has found the waters current in Elliot Bay is .2 to .5 meters per second which are good conditions for preventing extensive sediment movement at the barrage gates.

### BARRAGE LOCATION

The location of the barrage is at the middle of the causeways path adjacent to the movement of the water. Because the water flows in the direction of the ebb and flood tide the water will not gain extra momentum by entering directly in or out of the lagoon. Another reason for choosing the middle of the causeway was do to the oceans depth. The depth at the middle is the deepest better preventing the change of sediment building up at the gates which could cause possible re-dredging.

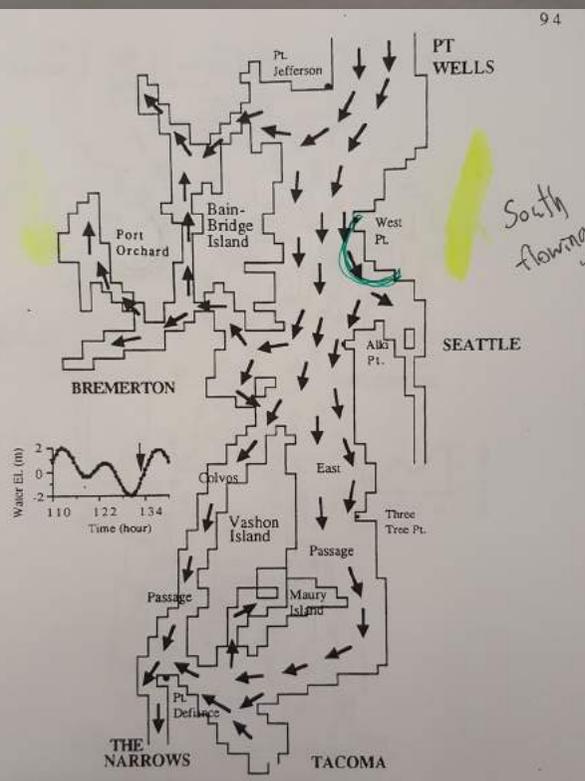


Fig.5.10c General surface layer flow pattern in Central Puget Sound at flood tide

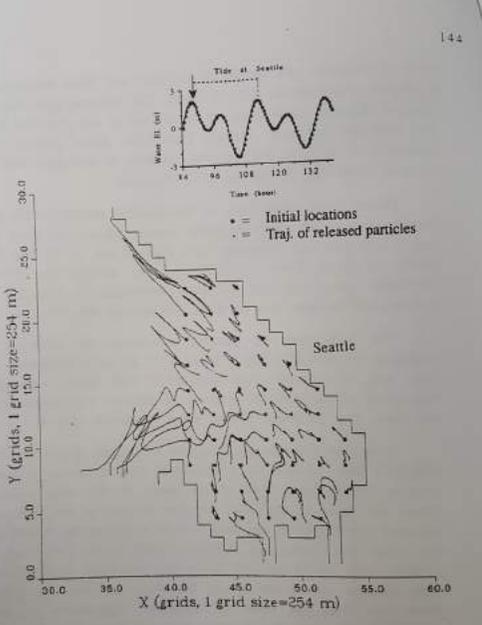


Fig.5.32 The trajectories of particles (released at higher high tide) during one tidal cycle

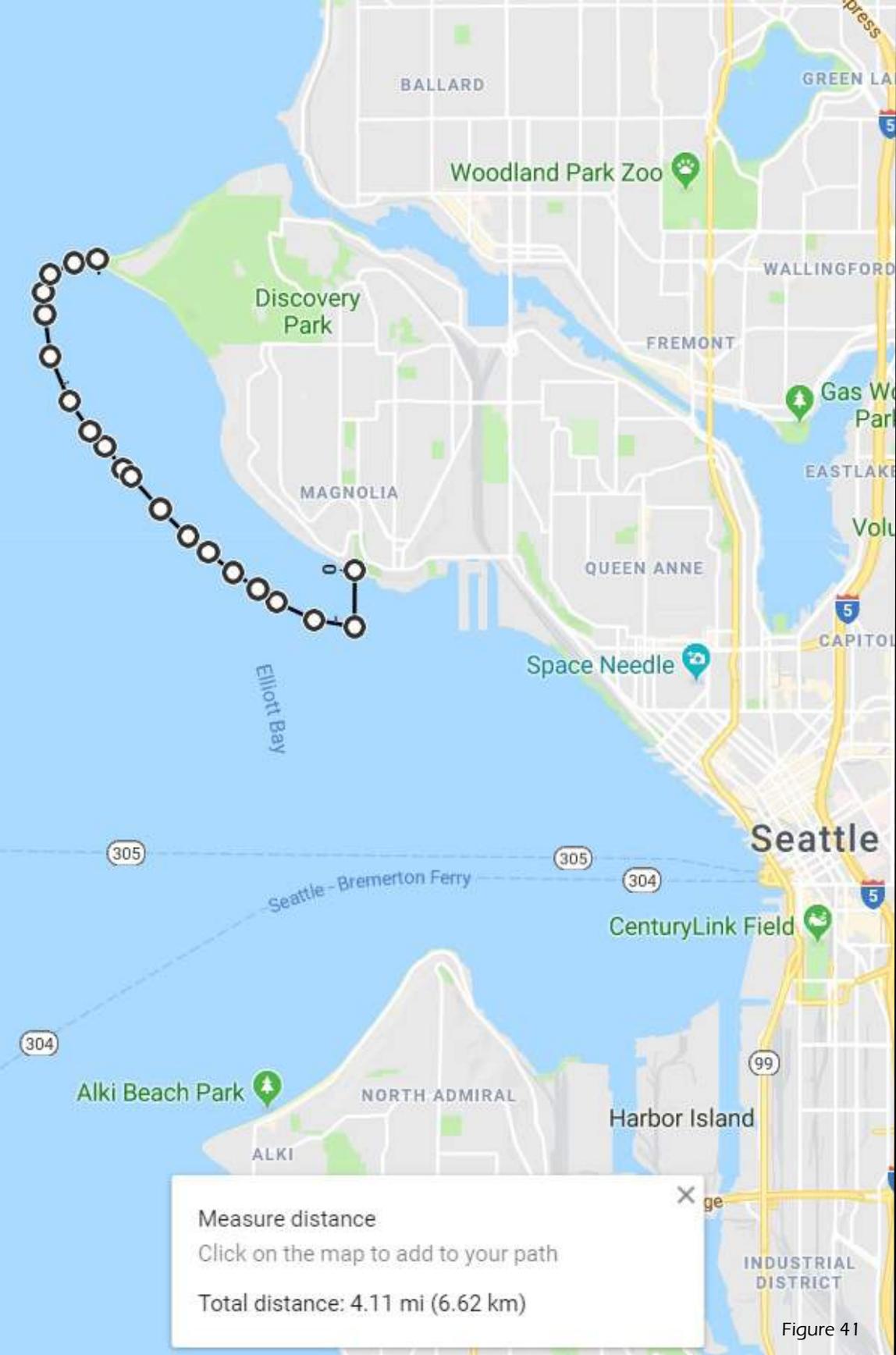


Figure 41

## LAGOON LOCATION

The location of the lagoon has been chosen based on the Elliott Bay's topography. Because Elliott Bay is very deep the lagoon had to be constructed along the shallowest areas of the bay which is located along the Magnolia Neighborhood. The causeway is constructed along the 30 ft contour line to prevent the need of intense dredging. The causeway will run a distance of four miles and encompass over a square mile of water.

## VIEW OF DOWNTOWN SEATTLE

It was important that the lagoon is not hidden away from the public eye so the main portion of the lagoon will be designed off of the 32 Ave boat launch. The portion of the causeway will be visible to Seattle's downtown, insuring the lagoons Event Center will always have a permanent preciseness as the people of Seattle look out into the bay. The Event Center symbolizes the moon and the moons permanent presence.

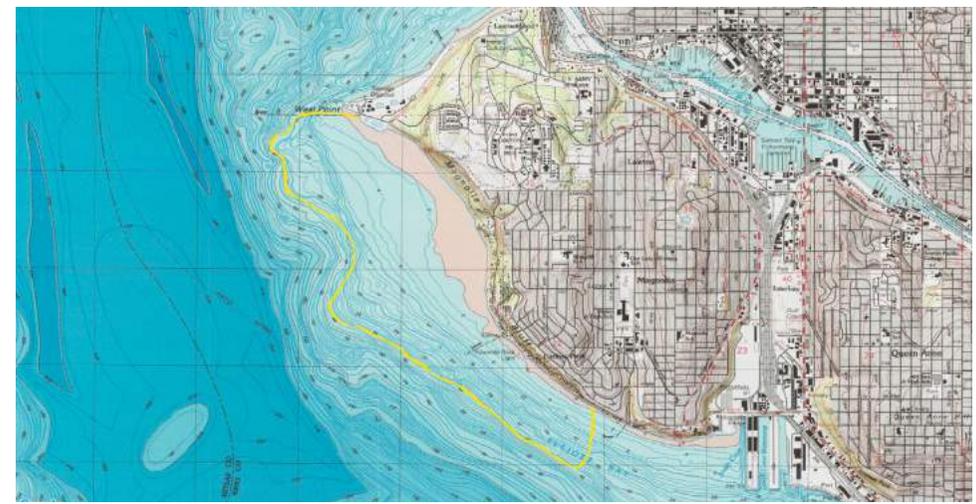
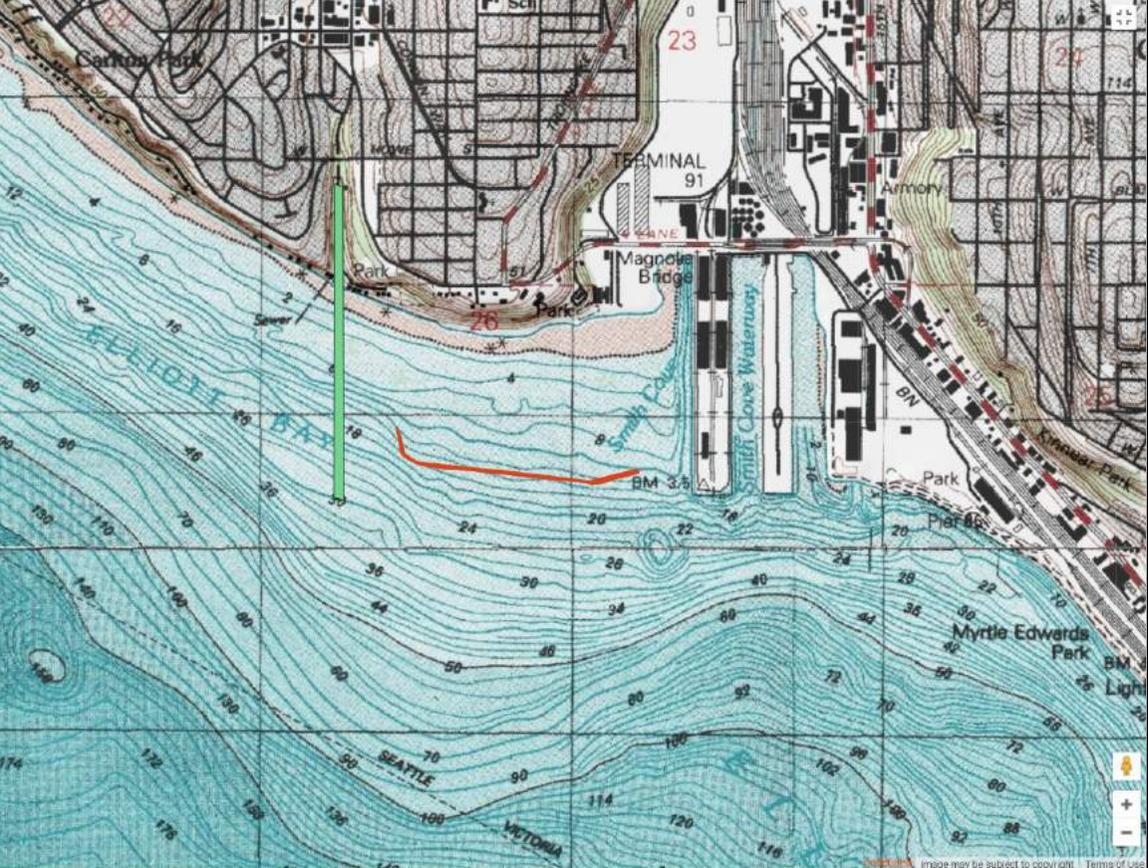


Figure 42



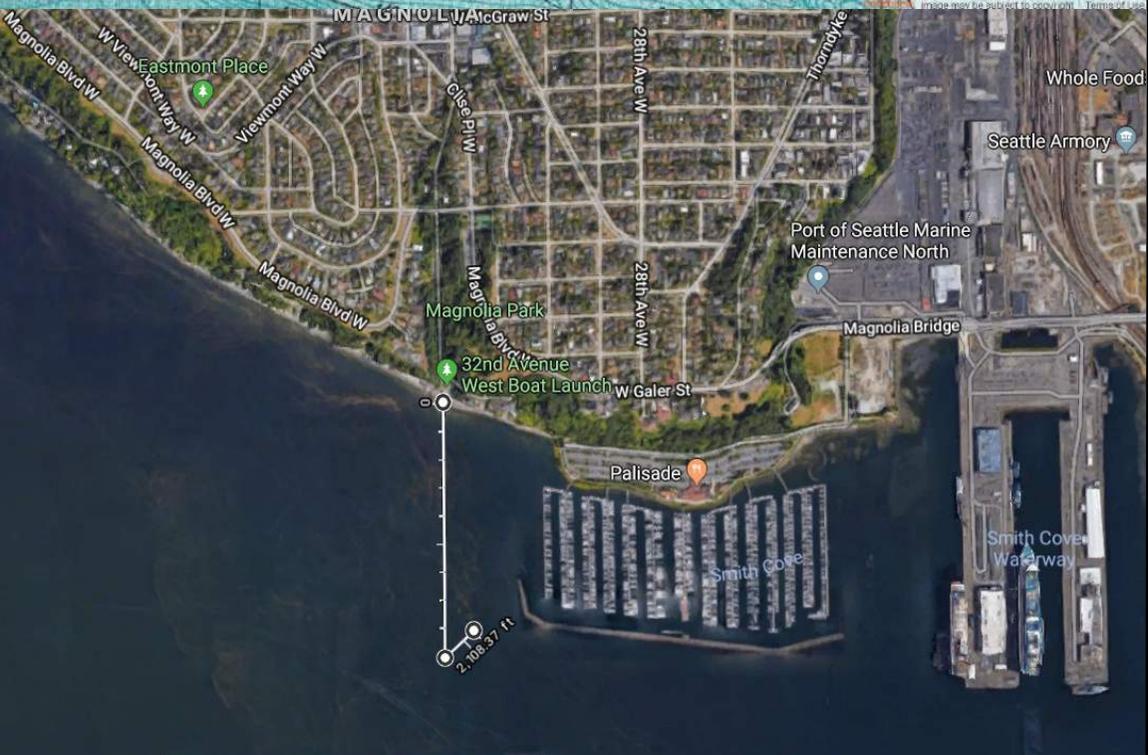
## Lunar Path

The lunar path extending off the 32 ave boat launch will consist of a Park, Gallery Space, and an Event Center.

Park Location - 100 ft from shore

Gallery Location - 900 ft from shore

Event Center Location - 1,800 ft from shore



Measure distance  
 Click on the map to add to your path  
 Total distance: 2,108.37 ft (642.63 m)

Figure 43



Facing North



Facing South

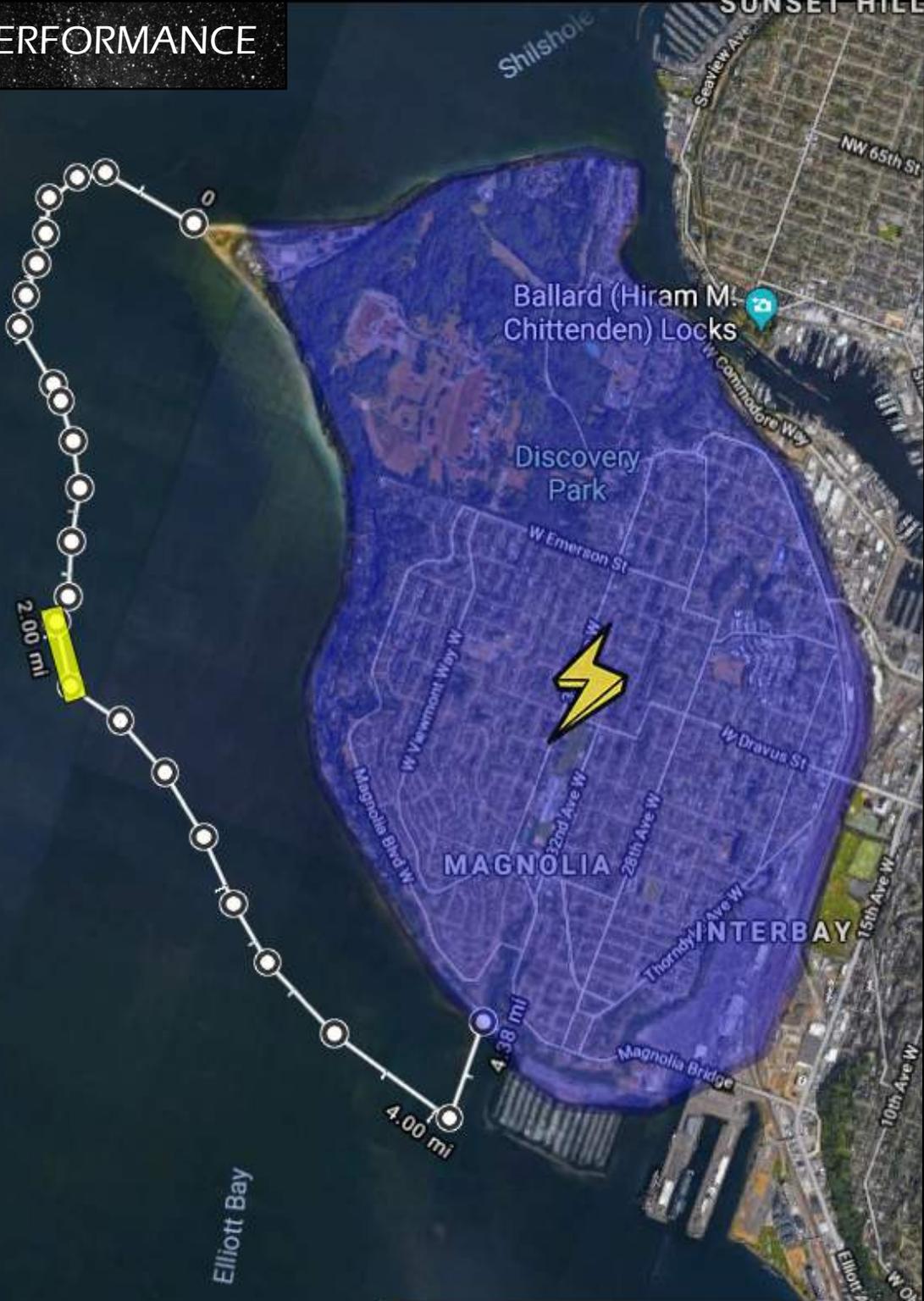


Facing South

Figure 44

### SURROUNDING CONTEXT

As you can see from figure 44 of the west boat launch shows there is a natural valley were the path will begin from. This area will provide the needed parking and other amenities.



Measure distance  
Click on the map to add to your path  
Total distance: 4.38 mi (7.05 km)

## PERFORMANCE MEASURE

The amount of energy that can be generated by the lagoon can be calculated using the formula below. The formula gives you the estimated energy of one generator in a tidal barrage. If ten generators were installed in Elliot Bay it could potentially generate 2 MW or energy a day. If 16 generators were installed it would have enough energy to power the entire Magnolia neighborhood which is currently the second largest in Seattle. This would greatly reduce the need for other non-renewable energies in Seattle.

$$E = \frac{1}{2} A \rho g h^2$$

- $h$  is the vertical tidal range
- $A$  is the horizontal area of the barrage basin,
- $\rho$  is the density of water = 1025 kg per cubic meter
- $g$  is the acceleration due to the Earth's gravity = 9.8 meters per second squared.

# DESIGN SOLUTION

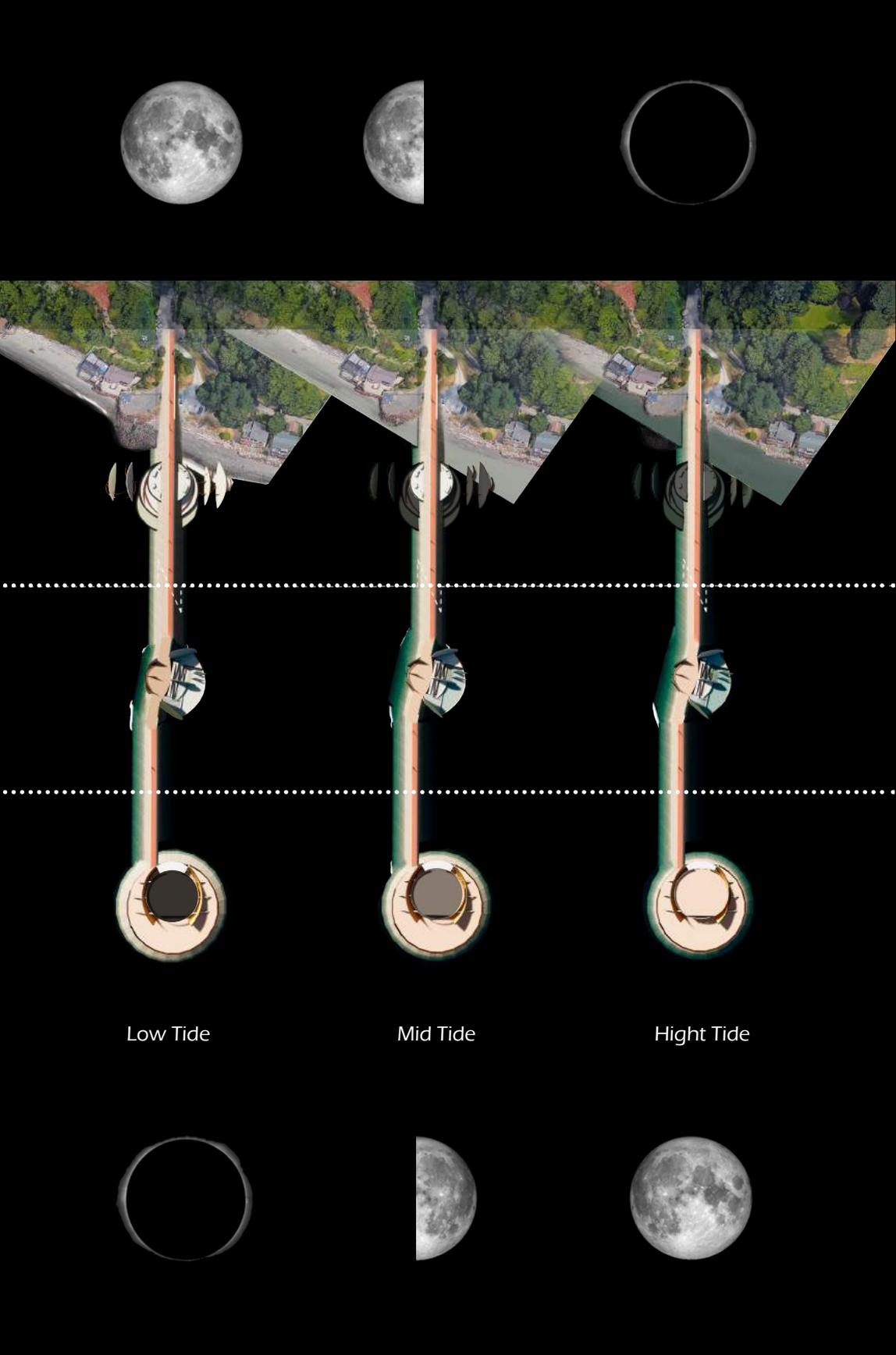


## ARTIFACT

For the beginning stages of the project it was important to create a project that worked with nature instead of against it. To understand how to do this through design I began with the creation of an artifact. My artifact is constructed by freezing black water in cylinder tubes. Black water was purposefully chosen to place the focal point of the artefact on its natural desire to melt. As the ice melts the artifact comes alive. In the artefact you can see the melting of the polar caps, the depth of the unknown sea, and the spilling of oil. As the black water begins to pool up on the floor it starts to reflect the sky. This revealing is a metaphor for how everything in our universe is connect. The ice begins as a solid, and then changes into something new, and through this change reveals something that is not of itself but still connected. The ceiling that is being reflected is not directly connected to the artifact but still makes up the atmosphere which causes the artifact to melt.







## CAUSEWAY DESIGN

The purpose for designing three different areas along the causeway is to give acknowledgment to the comic alignment that happens in the sky. The path comes to symbolize that changing phases of moon to celebrate its ability to create the tides from which we generate energy. Depending on low or high tide the Path is always symbolizes the new, half, and full moon. These effects are most noticeable during the full and moon as the park duals as a representation of the moon and also a messenger for the community announcing the full and new moon are here.

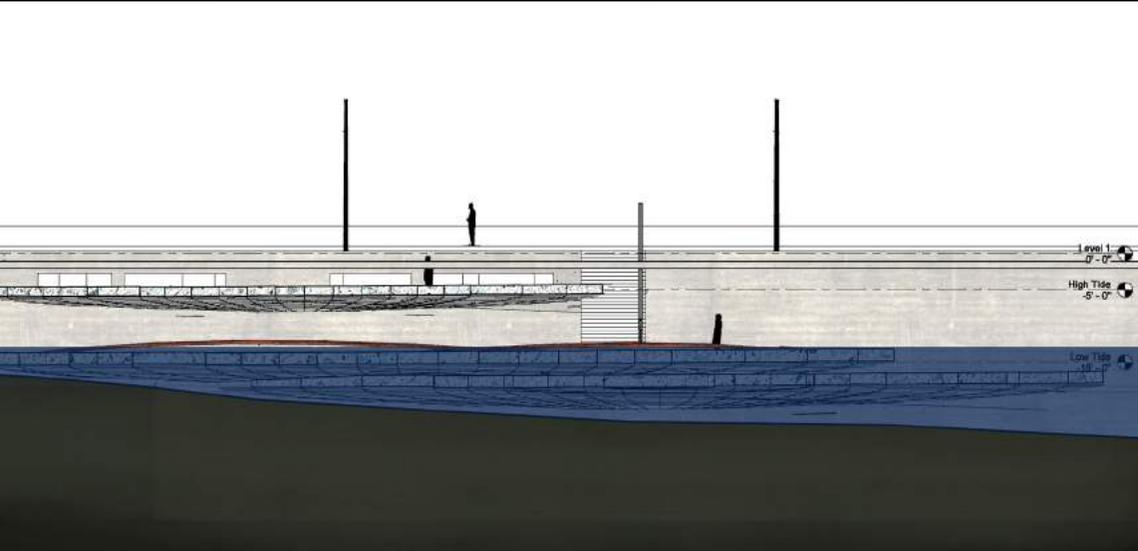
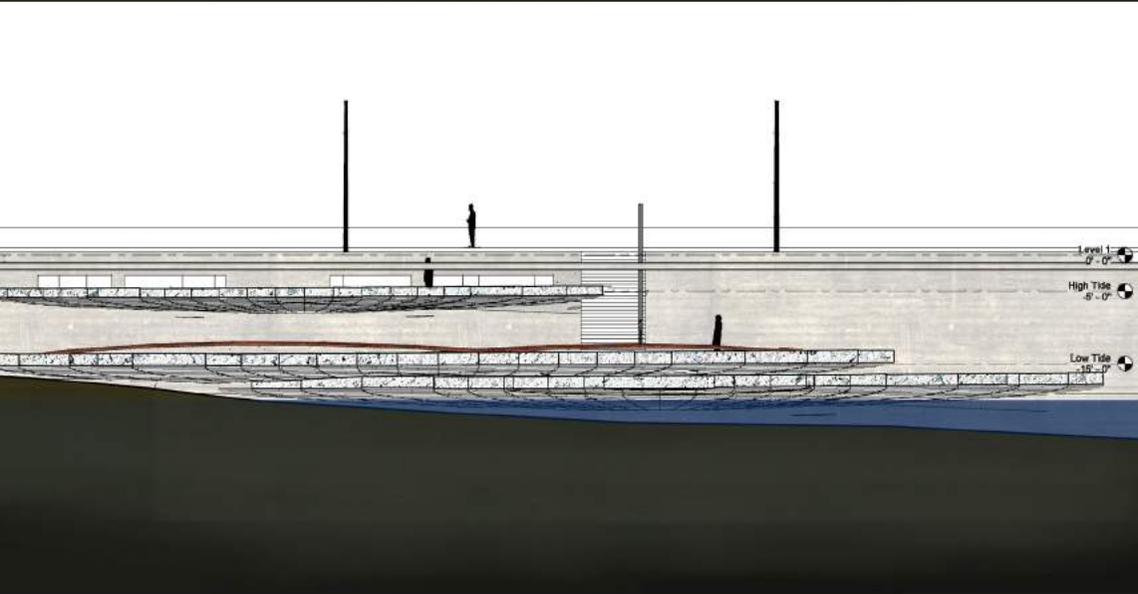
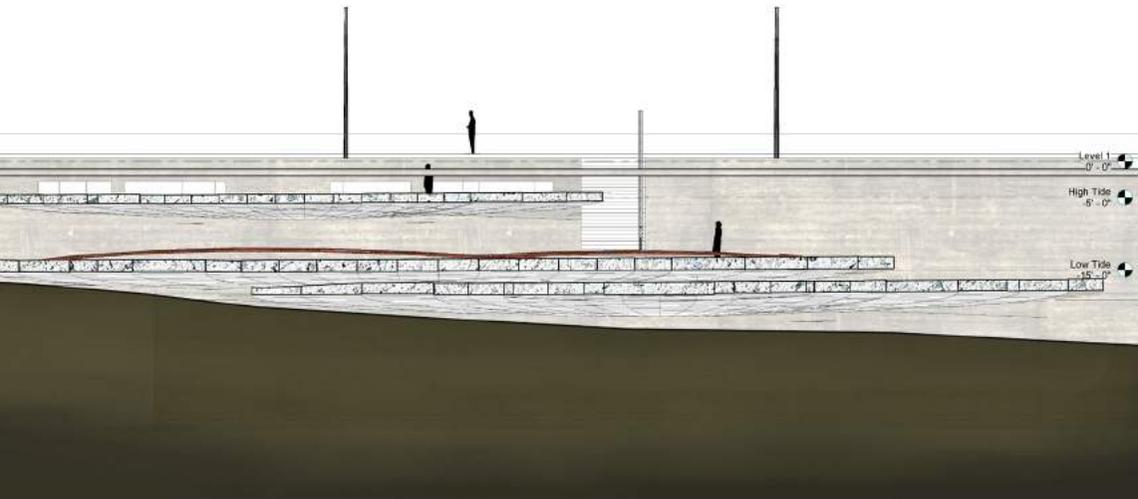
### LOW TIDE

During low tide the fully visible park symbolizes the full moon and the sunken event center symbolizes the full moon.

### HIGH TIDE

During high tide the submerged park which is not visible now symbolizes the new moon and the fully erected event center now symbolizes the full moon.

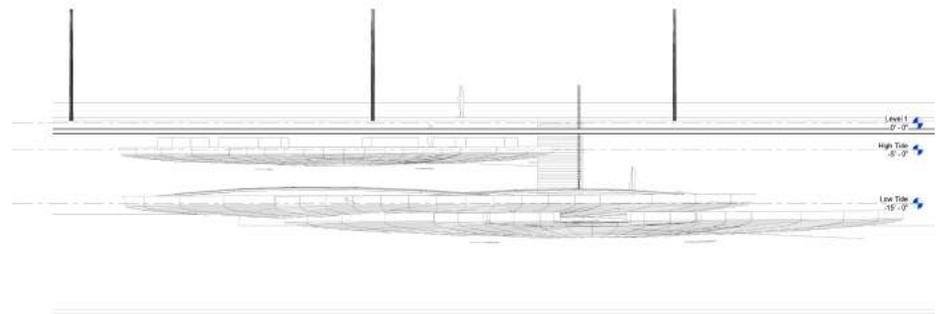
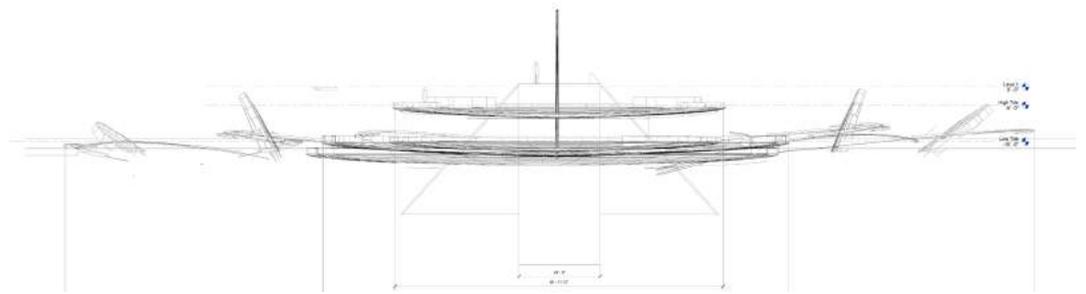
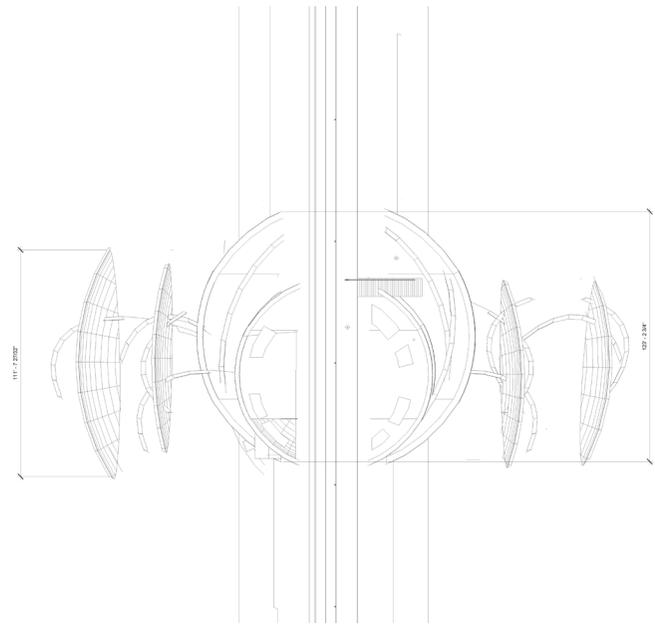
The architecture's ability to recognize the moon's phases and work alongside the movement of the tides creates the effect that every event along the path is coexisting with nature. Architecture that acknowledges and celebrates the process of nature indirectly makes every event held there a celebration of nature as well. As people come and go they will be able to feel, hear, and see the changes of the tide and its correlation to the moon. Because the low and high tide effect the experience of the lagoon people will be encouraged to look at moon phases and tidal charts to experience the park how they would like to. If they choose not to they may be able to judge the current moon phase based off the level of the

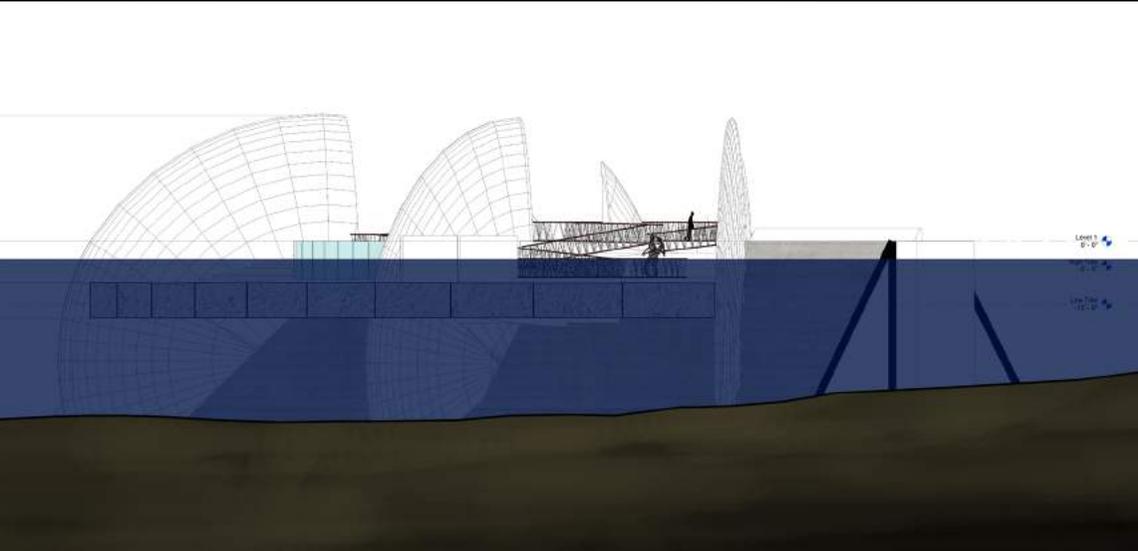
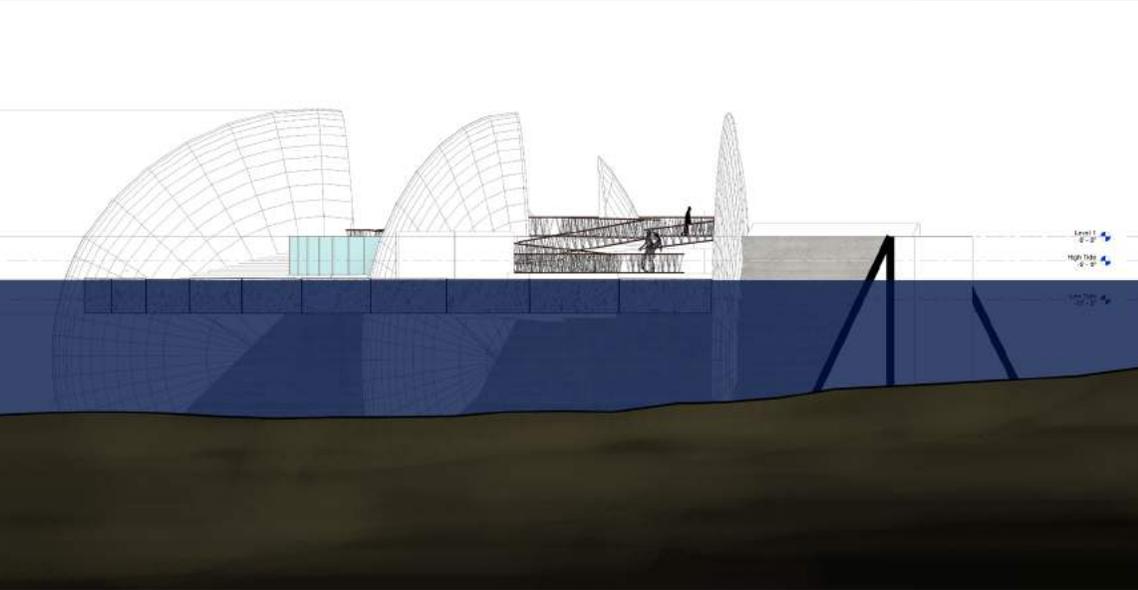
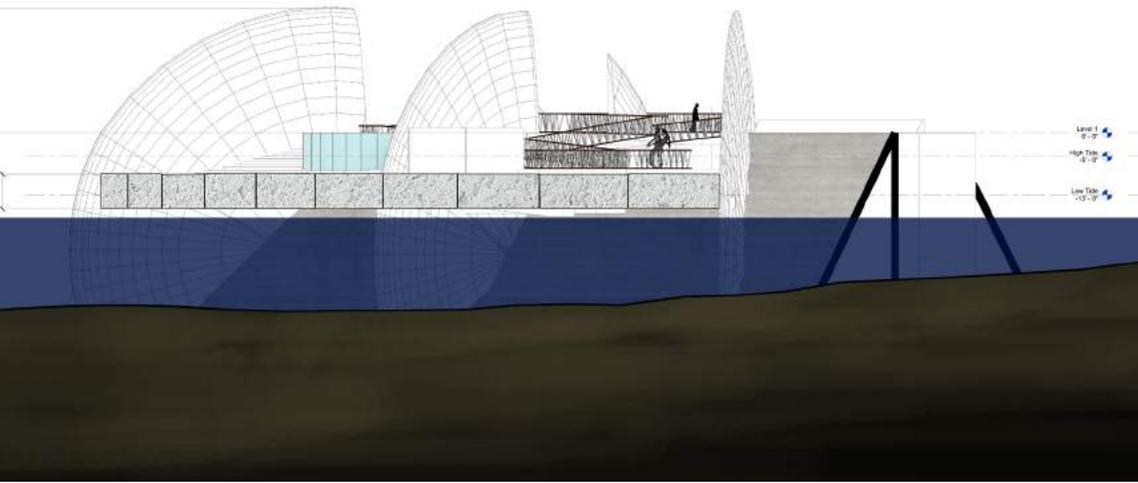


## PARK

As you begin to leave your car and start your journey along the causeway you will first encounter the park. Located 100 ft from the shore the park is built with three different tiers made out of precast concrete and accessible with concrete staircase. Your experience of the park will depend on the current tidal level. The park is designed below the Mean High High Water (MHHW) allowing the park to be completely submerged during the peak high tides that occur during the full and new moon. At the tidal levels change the three tiers will be revealed and submerged allow for different experiences each visit, The water of the high tide covers the park just as the sun's light covers the moon during the full moon. The moon then pulls back the water during low tide to reveal the entirety of the park just as the full moon is completely visible in the night sky.

There are many different places to sit, lay, eat, and explore at the park, some shaded and others exposed. The bottom tier which is only visible during low tide holds in the receding water to create a reflection pool. This water is filtered and exchanged every tidal cycle insuring the water in the reflection pond is always fresh. Gaston Bachelard writes in his essay, *Water and Dreams* that when one looks into water to see their reflection they can not help but to think about themselves and nature as well. The water a pure form of nature and your reflection is connected to it, at the park people will be able to reflect on their own thoughts and also that of the world and the universe. Moments like this are important for the community so they become closer to nature not in only a physical sense but a mental sense as well. The different tiers also allows you to get close enough to the water at all levels of the tide, people will be able to kick their shoes off and dip their feet into the water no matter the levels.



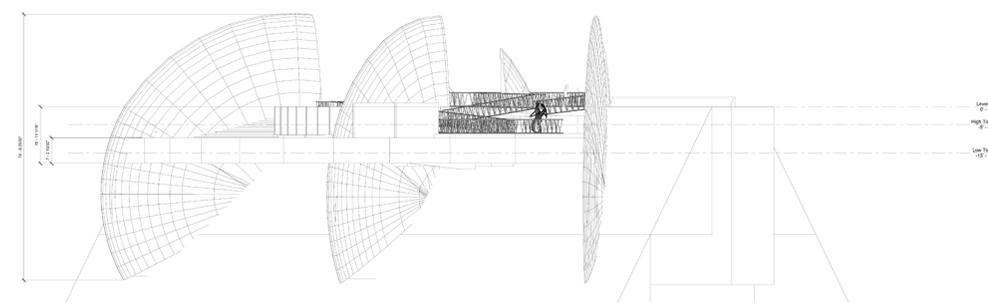
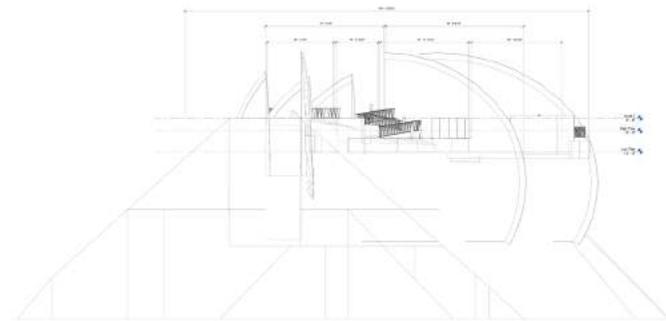
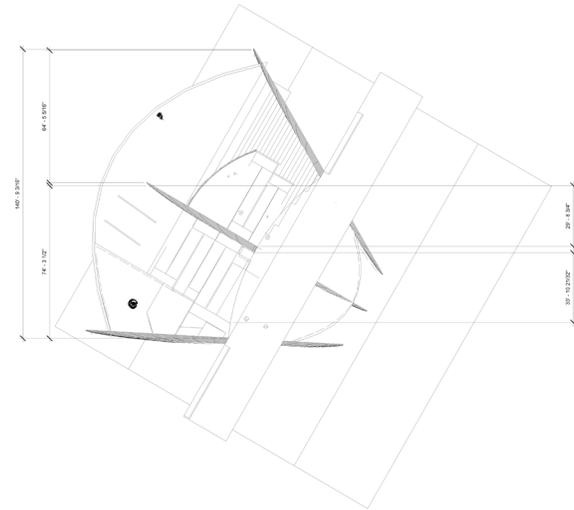
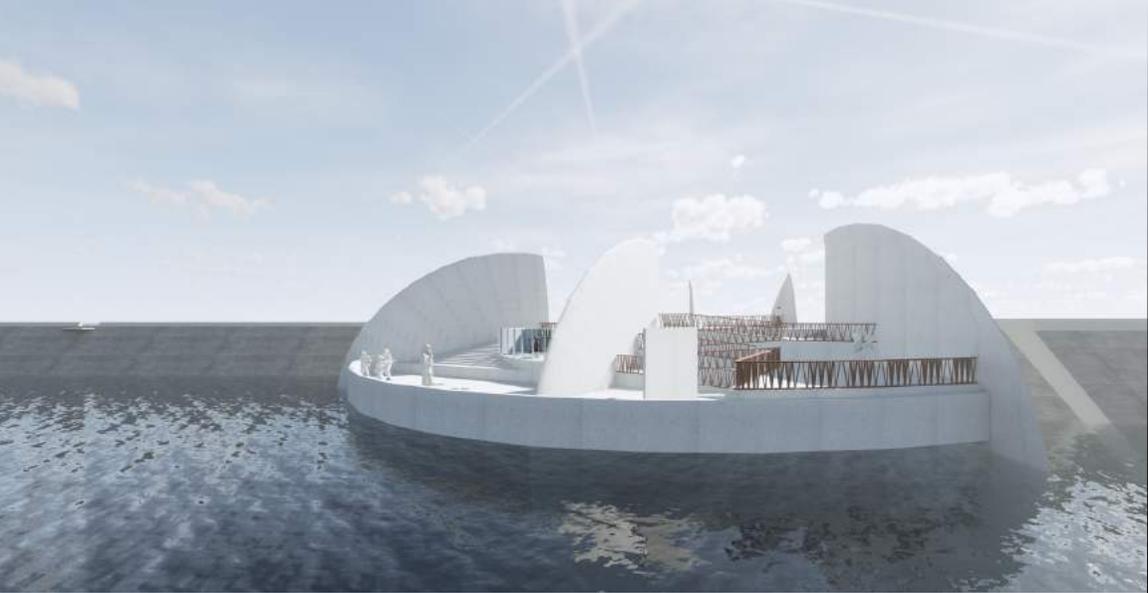


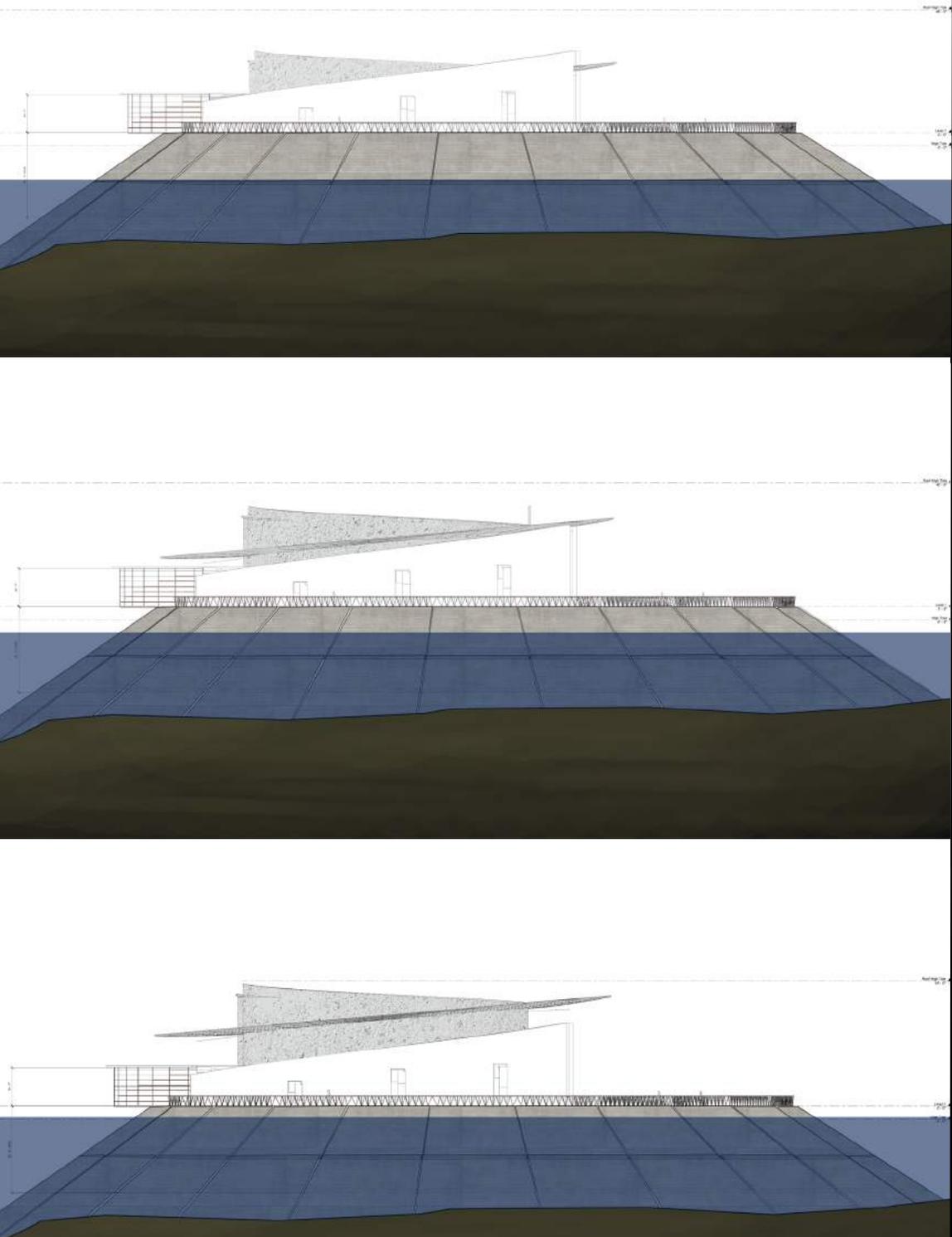
## Gallery

At the gallery the structure of the space is always partially-visible to symbolizing the half-moon. The half-moon represents a change in a cycle, the gallery is shifted to capture the view of Seattle's skyline, which is a metaphor for how human have shifted the course of nature to own benefit. The power of the gallery and the art it contains comes to life as the water breaches the gallery floors and floods the art work. At low tide the park will be completely accessible by ADA certified ramp. As the water slowly rises the gallery space will become submerged. The space invites in the rising water to change and enhance the experience of the art work. Means and metaphors you have created about the art work will change as you view it on each level of the tide. During high tide you can snorkel or scuba dive to see the submerged art. There is also a glass wall that will allow views to stay dry while viewing an area of the submerged art gallery.

There is a wide stair case that faces the city allow for people to rest as they take a break at the mid point of the Lunar Pathway. The park allowed for reflection on nature through the ponds and the gallery allows you to reflect on the city as you see its powerful skyline. A contrast between nature and society may arise as people experience the different spaces that allow nature in and work in unison.

The art that will be displayed at the gallery will be designed for that specific space and new art will be circulated every so often. The power of nature is also shown in the wearing away of the galleries walls. As the white concrete becomes stained by the circulating water algae will begin to grow showing nature will always take back what it has given to us. The steel rails will become rusted and our finite reality will come into existence.

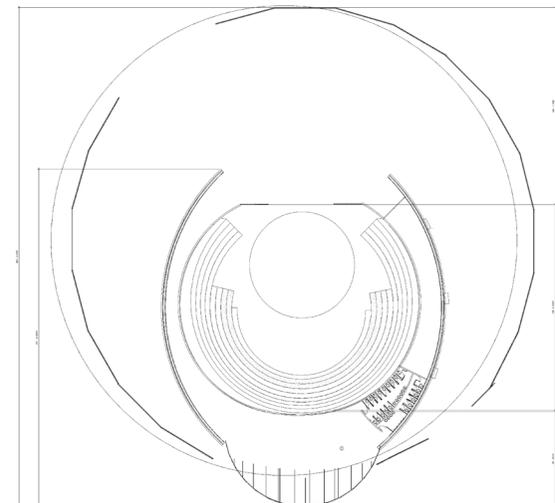
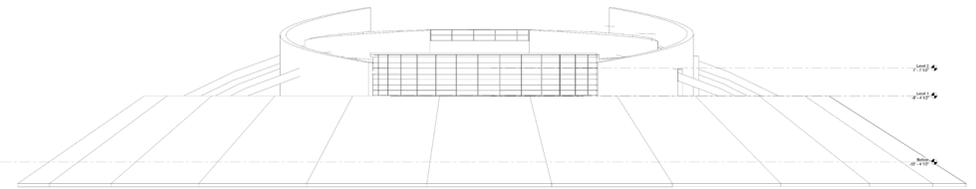
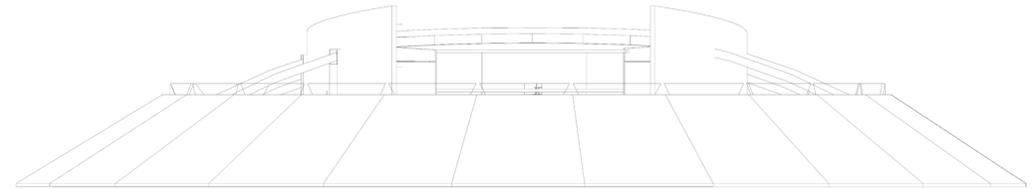
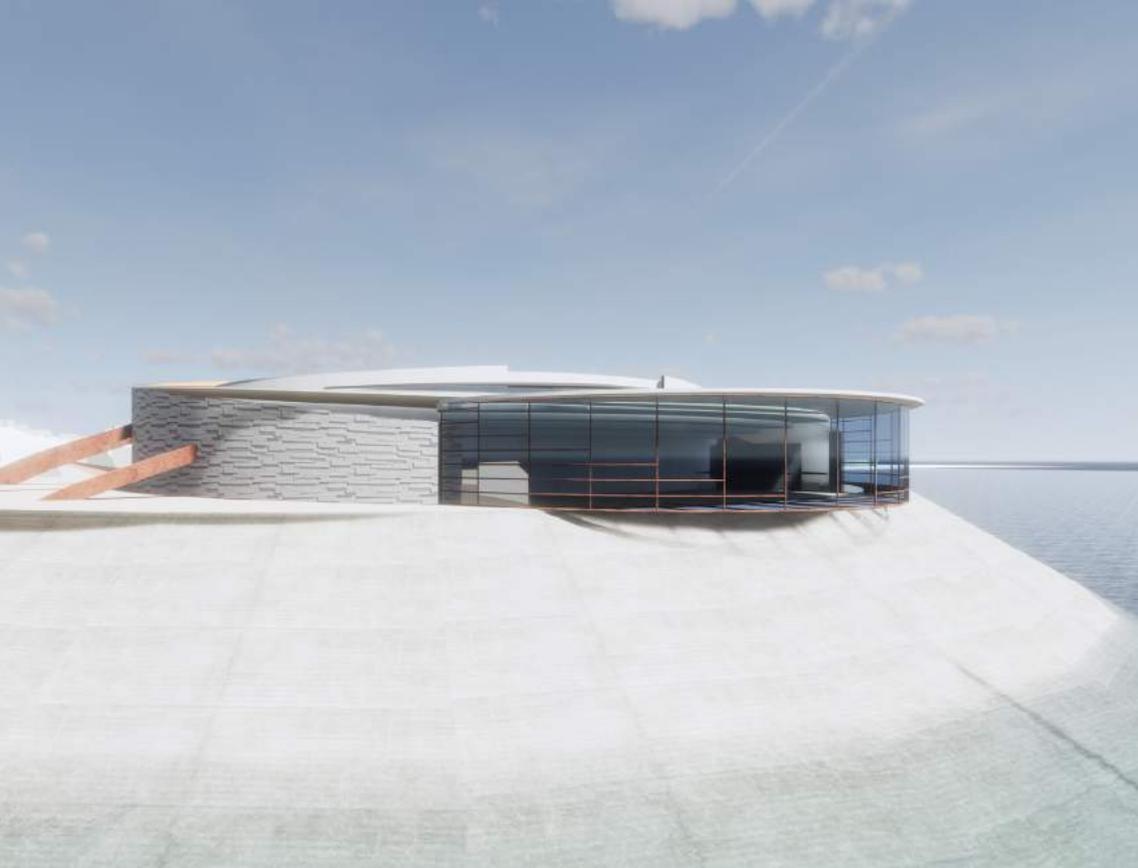




## Event Center

The final piece of architecture is the event center. Here the moon performs for us as it lifts and lowers the main event space that floats upon the water. During the high tide the space rises to its peak height symbolizing the full moon and falls on low tide symbolizing the new. The rising and falling here is opposite to the park. This is done so the path always reflects the cycles of the moon, celebrating its ability to change the tides. An event center was chosen as the final space along the Lunar Pathway to reconnect our rituals back to nature. We have so many celebrations and ceremonies that we have almost forgotten of their true meaning. Humans used to celebrate all they have accomplished alongside nature and gave thanks to the earth and the cosmos for they new they were their creator. Society has become so amazed at our own work we now only praise ourselves and no long the events in nature, which has lead to a destructive society.

Celebrations should not be held in a hallow shell that has no meaning. The space of the celebration should represent something in our culture so enhance the overall experience and meaning. We are not meaningless creatures and architecture should express this. As the events go on the main space will rise with the tide physically showing the power of the moon. Every viewer is directly experiencing the moon and an architecture that not only symbolizes it but is effected by it. The though of the moon will be inescapable as you see the stage and the seating rise into the air.



# THE JOURNEY

PARKING AND ENTRANCE



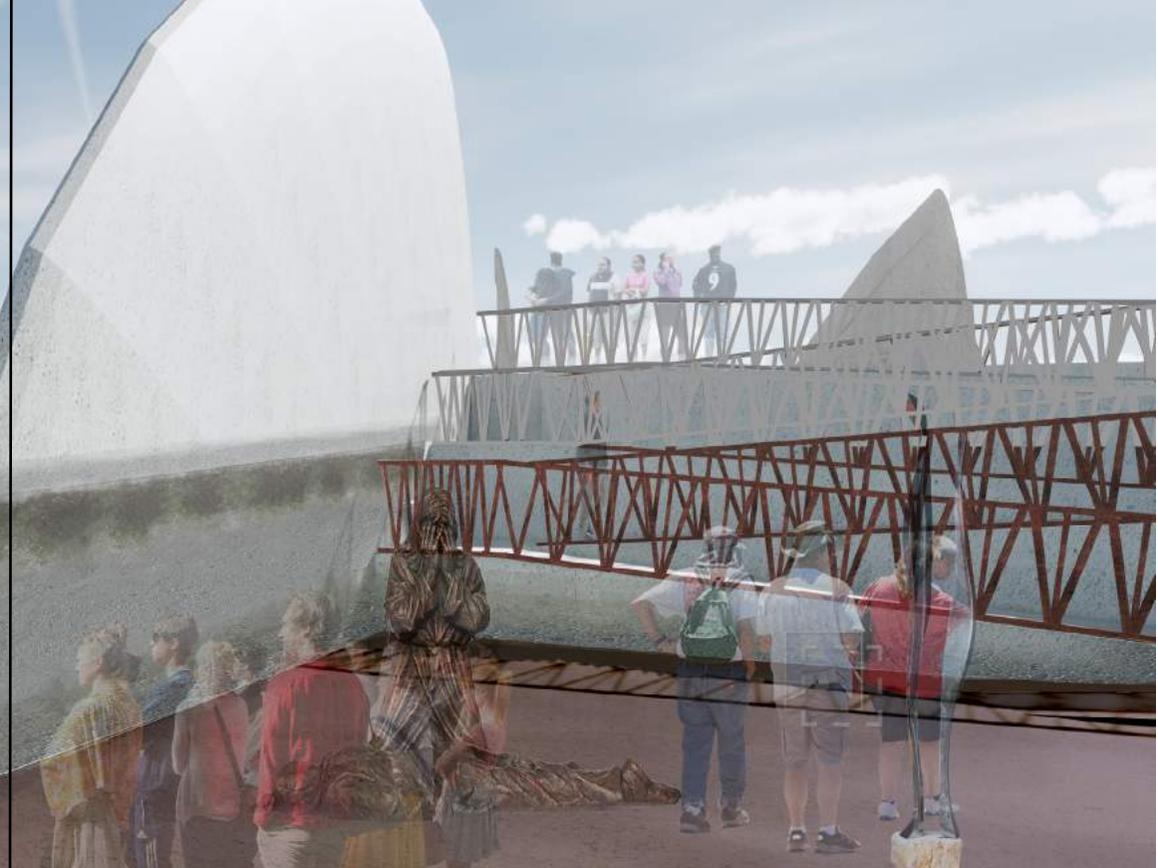
The Park at low tide



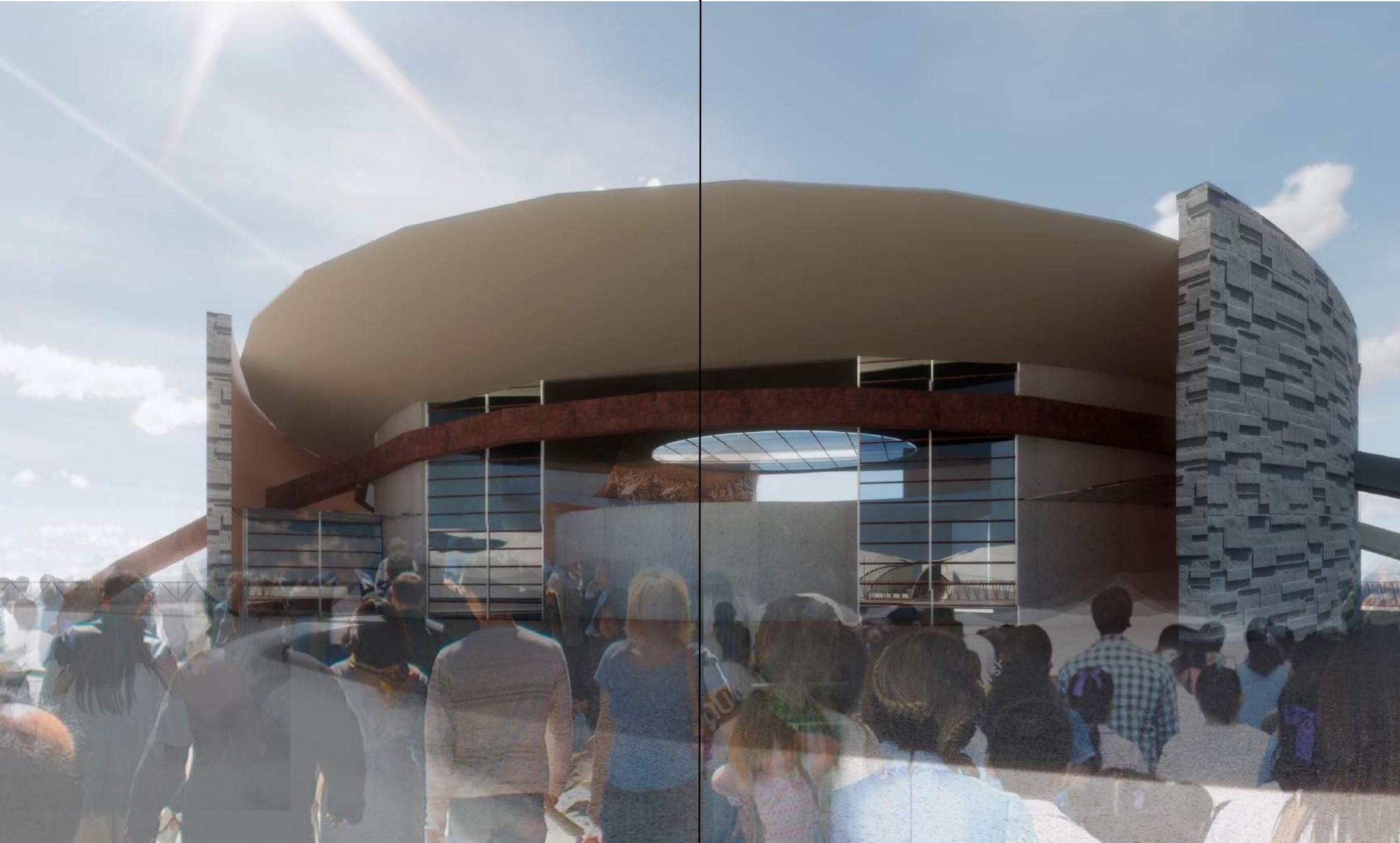
The Gallery at low tide



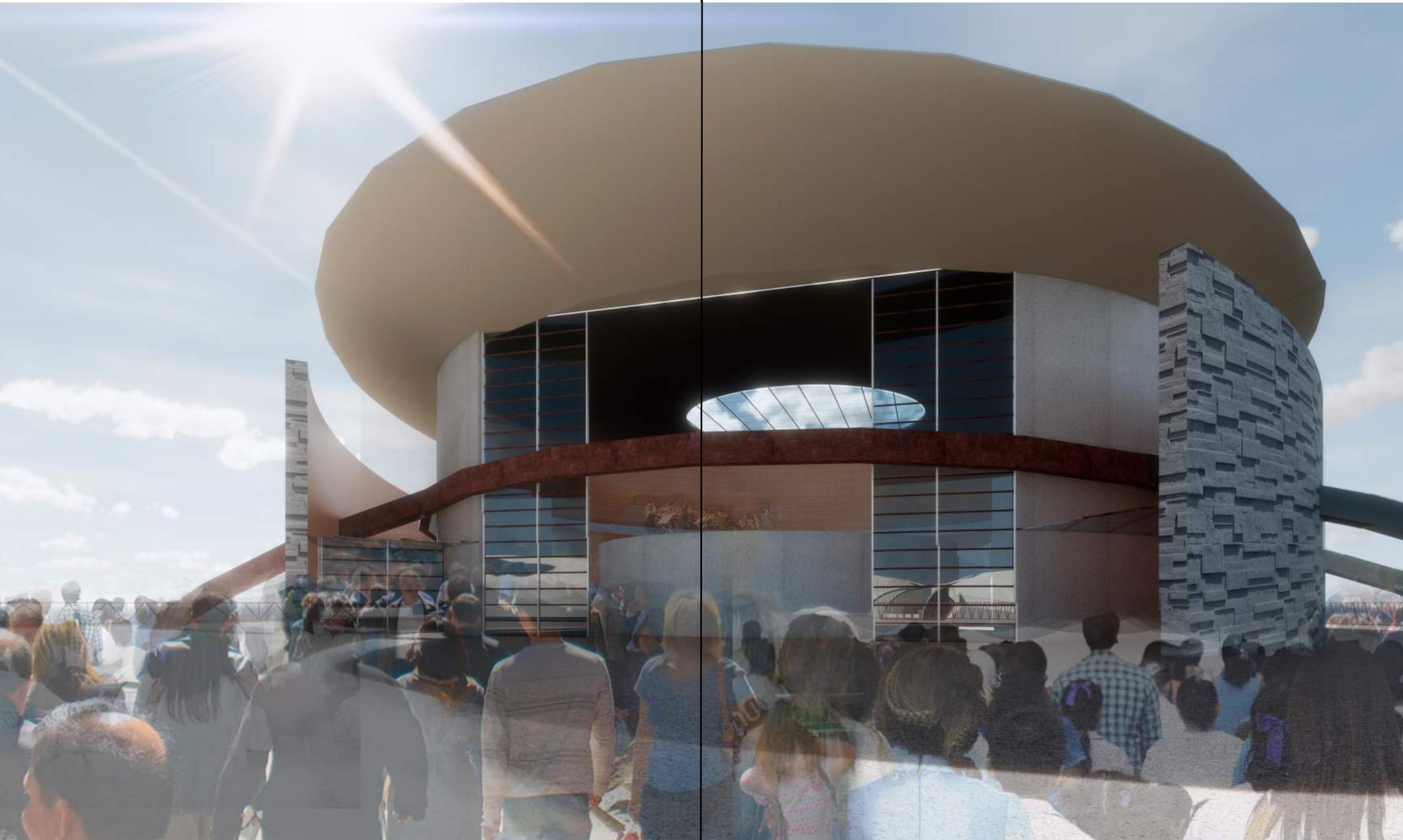
The wearing away of the Gallery



The Event Center at low tide



The Event Center at high tide



The Gallery at high tide

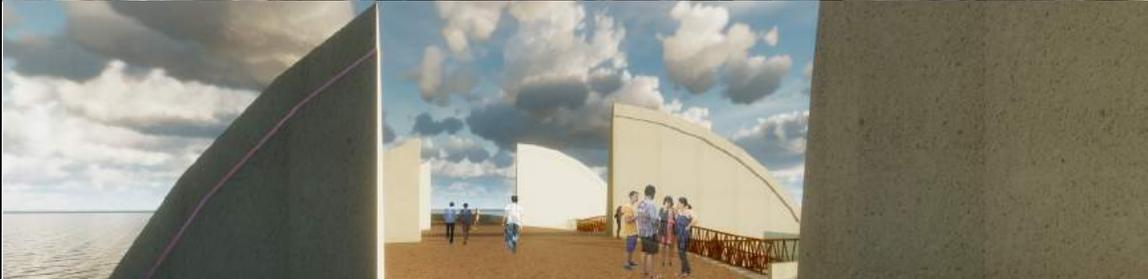


The Gallery at high tide



The Park at high tide









THESIS APPENDIX

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# DREW WOLF



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## SECOND YEAR

### FALL:

Daryl Booker - Tea House and Boat House

### SPRING:

Joan Vorderbruggen - Montessori School, Bird House Project, Dwelling Project.

## THIRD YEAR

### FALL:

Adam Beck - Urban infill New York, Art museum Fargo.

### SPRING:

Mark Barnhouse - Appario Project Fargo, ND, Sanford Same Day Surgery Clinic Fargo, ND.

## FORTH YEAR

### FALL:

Bakr Aly Ahmed - High Rise Project San Fransisco.

### SPRING:

Paul Gleye - Urban Redevelopment Project Brussels Belgium.