



RESURGENCE

TANMAY SHETTY

4th Year Architecture
Auburn University



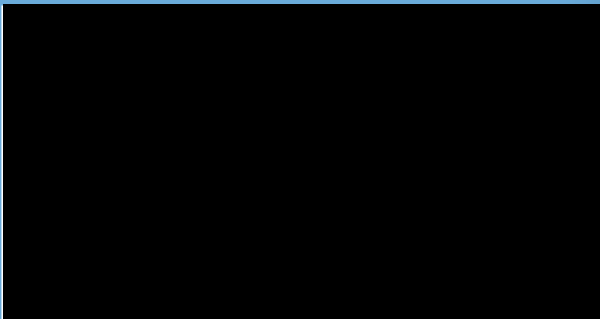
DANIEL MEJIA

4th Year Architecture
Auburn University





Daniel Mejia



m11arqui

SOFTWARE

Adobe Suite
Rhino 3D
SketchUp
Revit
Lumion

LANGUAGES

English
Spanish
French

ACTIVITIES

Philosophy
Reading
Soccer
Chess

MY CHARACTER

A natural leader who enjoys collaborating with others and developing radical or unexpected creative ideas. My most valuable traits are my ambition, passion, and dedication. I am always eager to learn, explore, and improve myself and I am more than willing to work hard for it.

EDUCATION

Auburn University
Bachelor of Architecture 2018 - 2023

EXPERIENCE

Goodwyn, Mills, and Cawood Inc.
Architecture Internship Summer 2020, Summer 2021

INVOLVEMENT

American Institute of Architecture Students
Chapter Freshmen Education Chair 2019 - 2020
Member 2018 - Present

National Organization of Minority Architecture Students
President 2022
Member 2018 - Present

Auburn University International Cultural Center
Recognized Member 2022

AWARDS

2nd | IDEA State Revit Competition 2018
3rd | AIAS National Photography Competition 2019

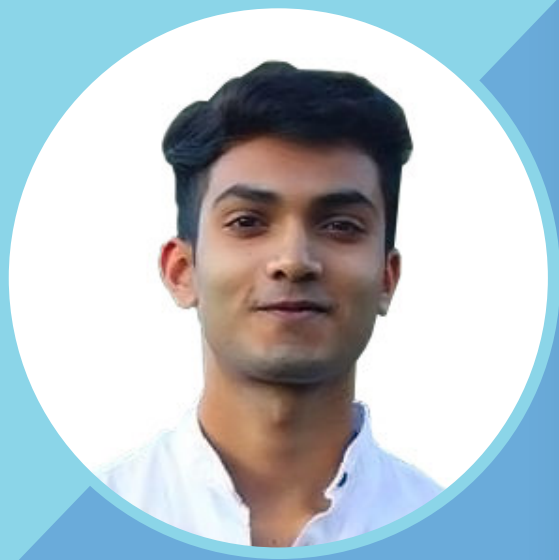
“The only true wisdom is in knowing you know nothing”
- Socrates

The son of two Colombian immigrants, I was raised in the margins between two very different worlds. As a result, I learned to understand and appreciate the differences between cultures, lifestyles, ways of thinking and opinions. I strongly believe in the importance of seeing the world through different perspectives. Reality is a mental construction built by a web of perspectives that come together like a puzzle. The more perspectives you see through, the more complete the puzzle is.

This has also cultivated a love for exploring the radical and unexpected. There is so much potential in the world for new and great ideas. The future isn't tomorrow, it's today. It starts when we decide it does. Greatness was born from crazy minds that believed in dreams and had the ambition to make them come true. Life is about taking risks, the more you fail the more success you will find. I approach design with this mindset.

Aside from architecture, I have a passion for philosophy. I especially enjoy reading ancient philosophy, but I spend more time practicing it by self reflecting and observing the world. There is so much to think, so much to dream.





Tanmay Shetty



 tanmayshetty

SOFTWARE

Adobe Suite
Rhino 3D
Enscape
Revit
Lumion

LANGUAGES

English
Hindi
Marathi
Tulu

ACTIVITIES

Soccer
Hiking
Sketching

MY CHARACTER

I enjoy collaborating and exchanging ideas from different backgrounds, cultures and experiences. I strongly believe in the importance of sustainable design and protecting our environment.

EDUCATION

Auburn University

Bachelor of Architecture

2019 - 2023

EXPERIENCE

Seay Seay & Litchfield

Architecture Internship

Summer 2022

INVOLVEMENT

National Organization for Minority Architecture Students

Competition

2018-2019

Member

Auburn Global Student Ambassador

Auburn Global

2018-2020

Member

International Student Organization

Outreach

2018-2019

Member

AWARDS

SPIRE Student Design Competition Finalist

2022

“I wish the world was twice as big and half of it was still unexplored”

- David Attenborough

It is exciting to know that we are members of a new millenium of human evolution. We are leading the way to a brighter future full of incredible technological innovation and feats of engineering. However, it also means that we must deal with the consequences of the irresponsibility and ignorance that has permitted global warming. From record breaking temperature highs in my home country India, to thousands of animal species facing extinction worldwide, it is necessary to understand that the damage being caused to our planet will only be viciously returned back, since we are in tandem with nature.

It is the responsibility of our generation to acknowledge the fundamental value of working with nature, as opposed to using it. I am passionate about how sustainability in architecture can be used to further progress humankind and is the only solution that can alter the course of our tragic trajectory.

I live life for the adventure, learning and exploring whenever possible. Moving from India to the United States taught me to appreciate comfort, but seek out discomfort.





Site Selection

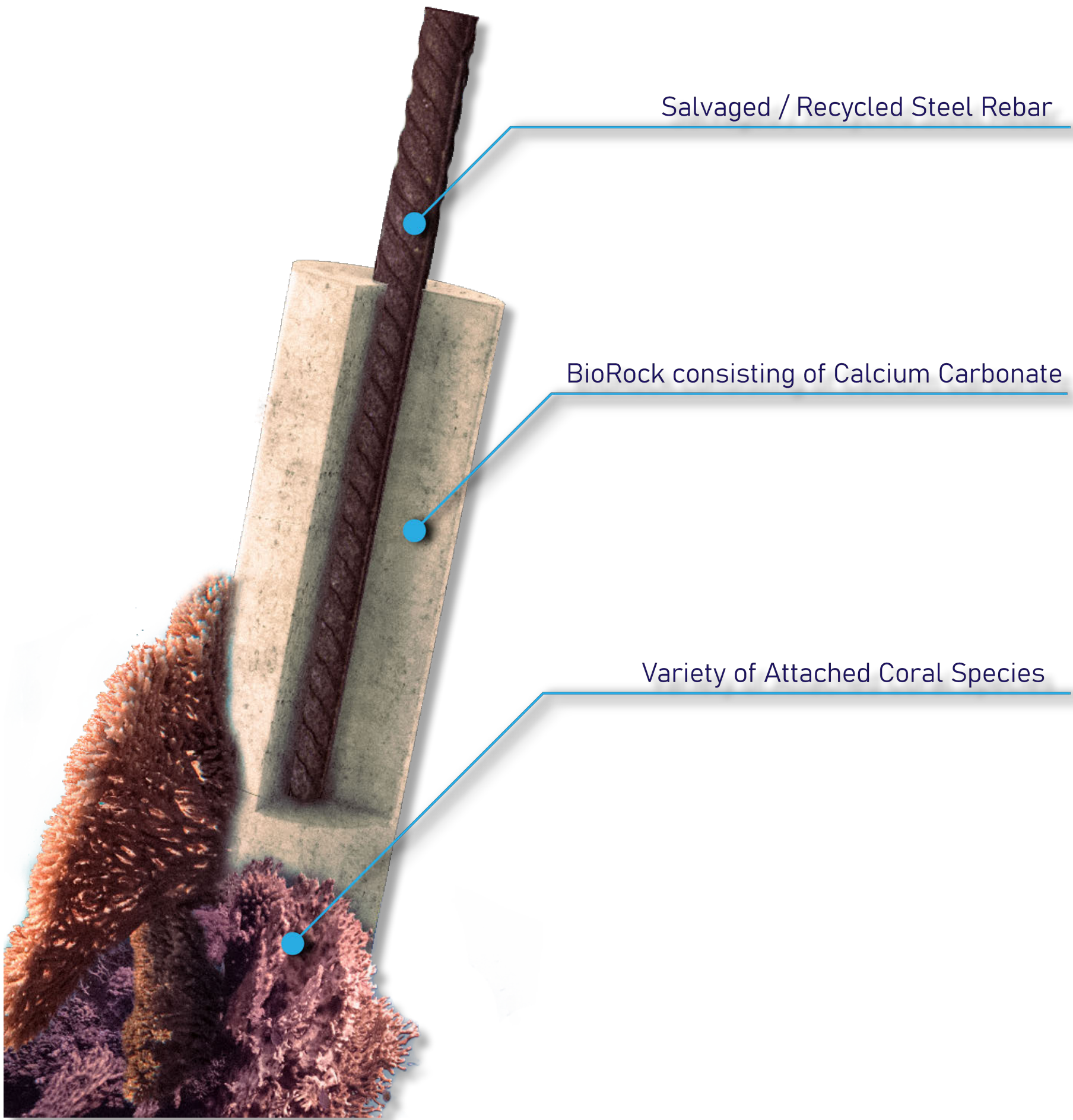
Our planet has fallen ill, and the symptoms are becoming more and more severe every year. From temperature increases, extreme weather patterns, and extinction of wildlife and vegetation, these symptoms are negatively impacting each and every nation in the world. However, there is one nation that is often referred to as most in danger.

The Maldives are a series of coral atolls built up from the crowns of a submerged ancient volcanic mountain range. All the islands are low-lying, none rising to more than 1.8 meters (6 ft) above sea level. Coral reefs surrounding the islands have historically always protected them from destructive monsoons and storms. However, global warming has contributed to the degradation and disappearance of these coral reefs, leaving the Maldives open to ocean-induced threats.

The country's longstanding culture and traditions bear witness to a melting pot of different demographics. The islands are believed to have originally been inhabited by Buddhists traveling from Sri Lanka in the early 5th century. Their lifestyle was entirely dependent on the ocean, their main source of food being fish, predominantly tuna. During the age of Western colonization, control of the islands was overtaken by many different European powers: the Portuguese in the 16th century, the Dutch in the 17th century, and the British in the 19th and 20th centuries. It wasn't until 1965 that independence was earned from Britain.

Today, the Maldives are thriving as its tourism revenue soars, surpassing its traditionally primary industry of fishing. However, the islands' greatest danger lies in rising sea levels. Scientists fear that the islands will become submerged by the end of this century.



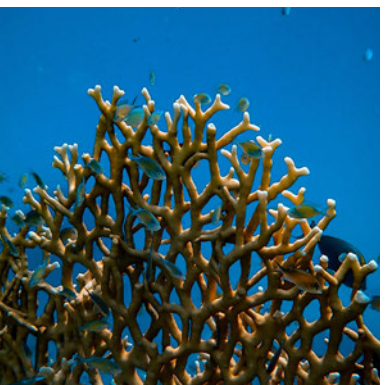
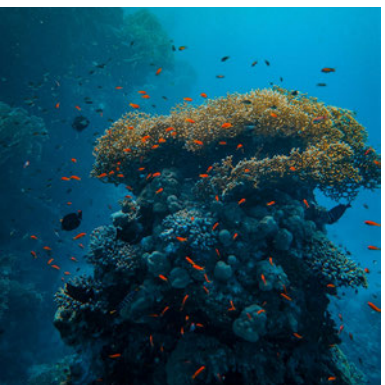
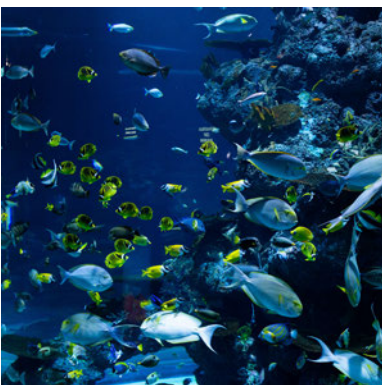
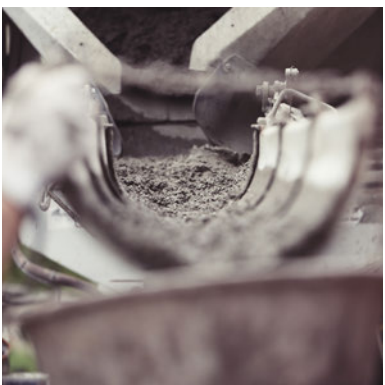
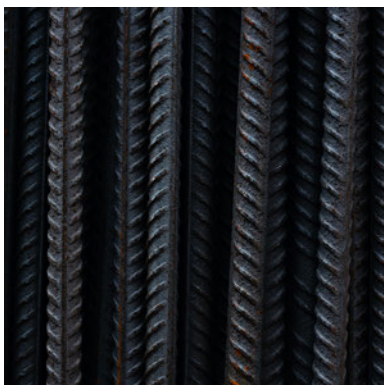


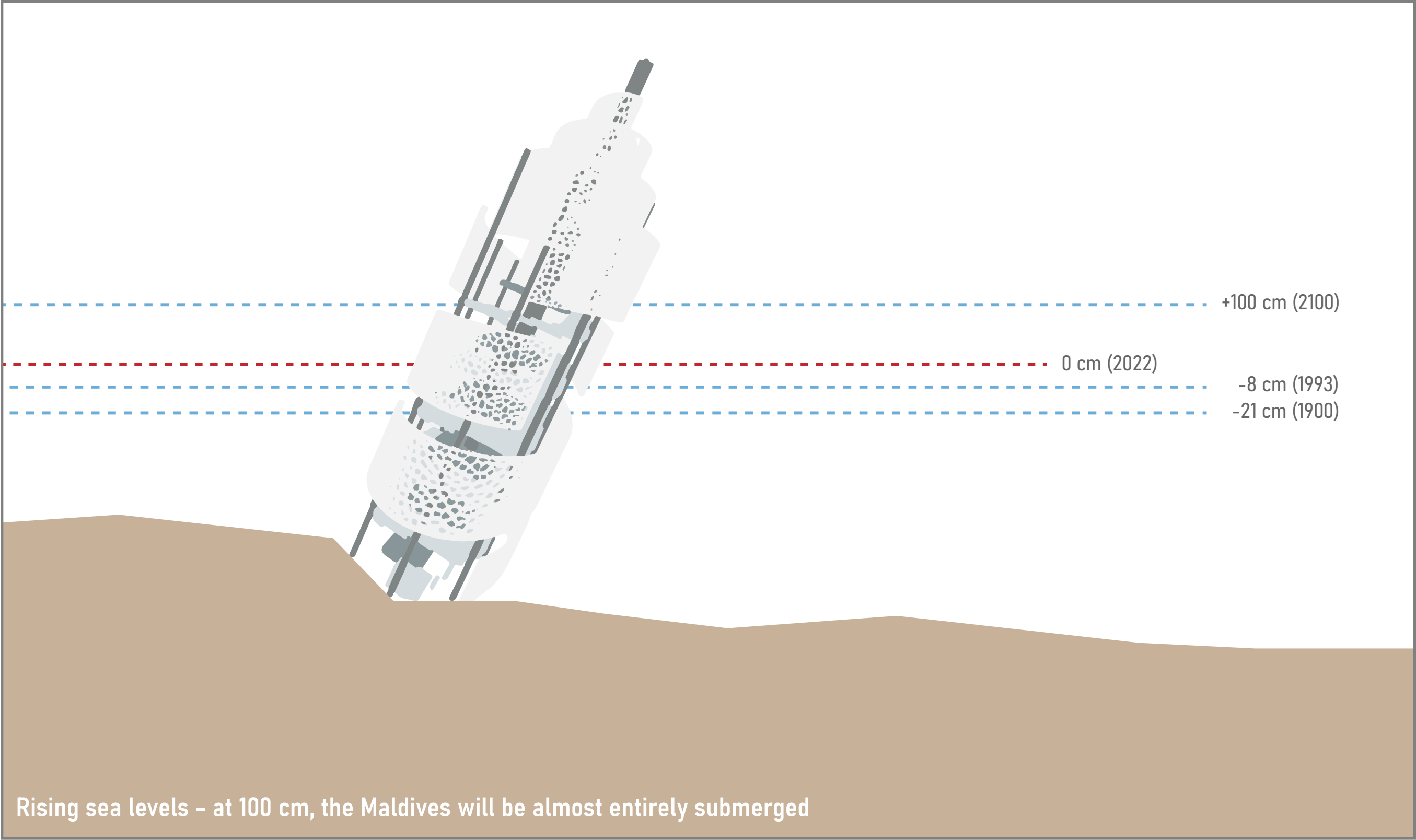
1. Describe the proposed materials used to build/install your structure

Recycled steel rebar imported from India is used to create the structural frame. Being such a small island nation, most construction materials are imported anyways. Cables, waterproofed electrical conduit, and photo-voltaic panels are needed to power the system. Concrete will be mixed on the island of Malé and used for the foundation piles as well as the stairs. Creating an electrical voltage on the steel will result in the natural formation of BioRock, which will be the main structure. Coral will be grown on the BioRock, acting as the building skin.

2. What is the estimated build/setup time?

The transportation of materials to the location will take up to two weeks, since the steel must come from India. Then the construction of the steel rebar frame will take only two months. The concrete stairs will be precast off-site and will finish within that same time frame. The frame will then be completely submerged into the sea for about half a year so that the Biorock grows thick enough to be structurally stable. Finally, the foundation piles will be poured on site, the frame will be attached to the foundation, and pieces of coral will be attached to the BioRock. The total estimated build time will be around a year, however, the Biorock that is exposed to seawater will continue to thicken indefinitely and the coral will become a haven for marine life.





3. How was collaboration utilized in realizing the design?

A sanctuary is a haven that protects that which is within from that which is without. This design acts as both a cultural and ecological sanctuary, protecting the cultural footprint of the Maldives from disappearing as well as the single most important influence on Maldivian culture, the ocean ecology. Due to climate change, the seas are warming up and the sea level is rising rapidly. Marine life such as coral which are crucial for a healthy marine ecosystem, are rapidly dying due to the increase in water temperatures. The disappearance of coral reefs means a decline in available seafood options, devastating ocean-dependent economies such as the Maldives.¹

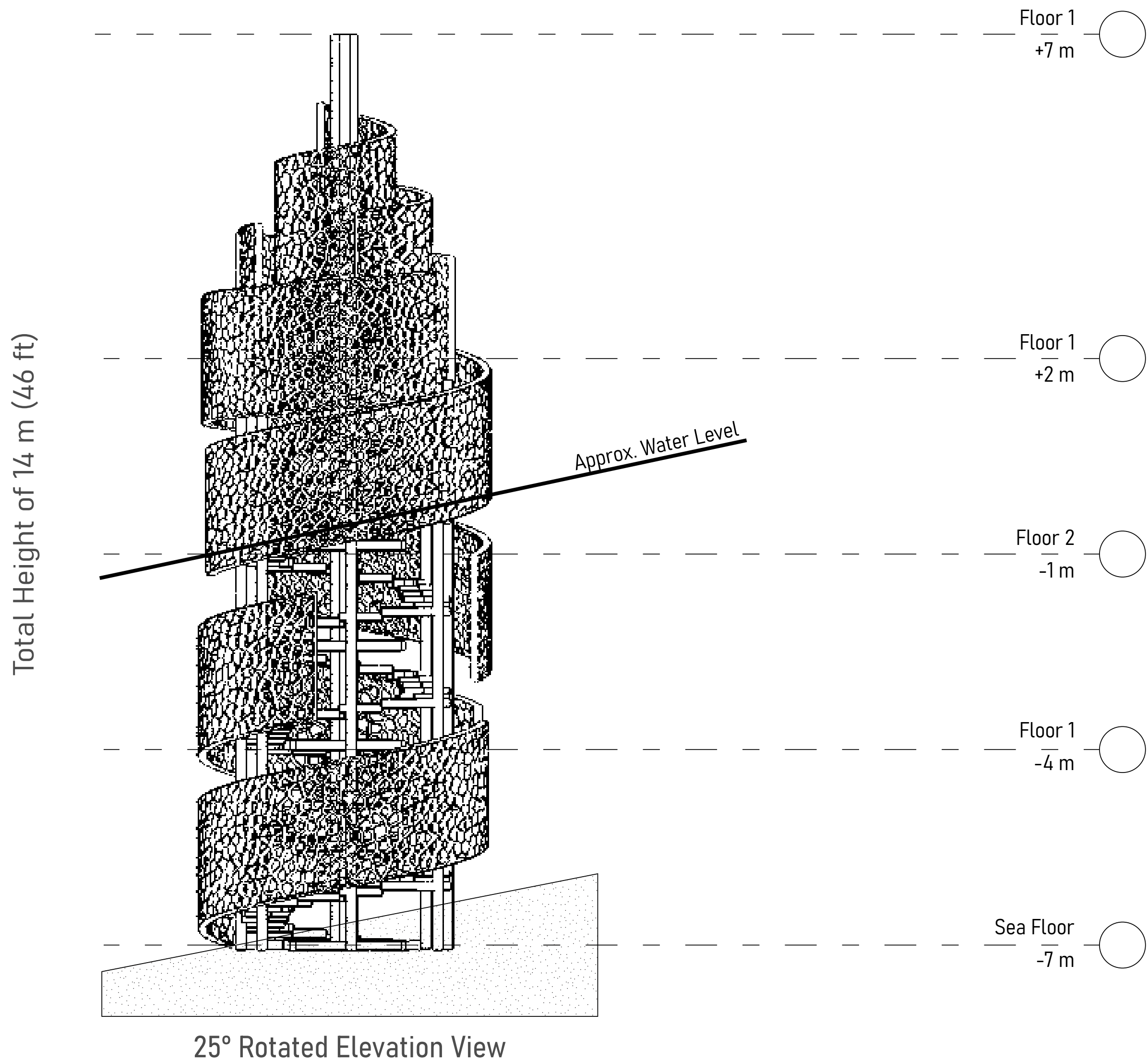
It also means there is nothing to protect beaches from erosion nor tropical storms. As a result of global warming, storm surges, flooding and tropical storms have increased in intensity, causing more damage on property and human lives.² Eventually, rising sea levels will cause the Maldives to be the first country in the world to disappear beneath the waves; the history, culture, and people of this country becoming nothing more than a memory for all the aristocrats who vacation here.³

This project acts as a warning to the dire consequences of climate change if we continue to do nothing. It is a call to action for all of the human race to come together. Collaboration will be necessary to save the Maldives, collaboration will be necessary to save our marine ecosystems, collaboration is necessary to save our planet.

1. "Ministry of Environment, Climate Change and Technology." Ministry of Environment Climate Change and Technology, Maldives, <http://www.environment.gov.mv/v2/en/>.

2. "Climate Change Indicators: Weather and Climate." EPA, United States Environmental Protection Agency, <https://www.epa.gov/climate-indicators/weather-climate>.

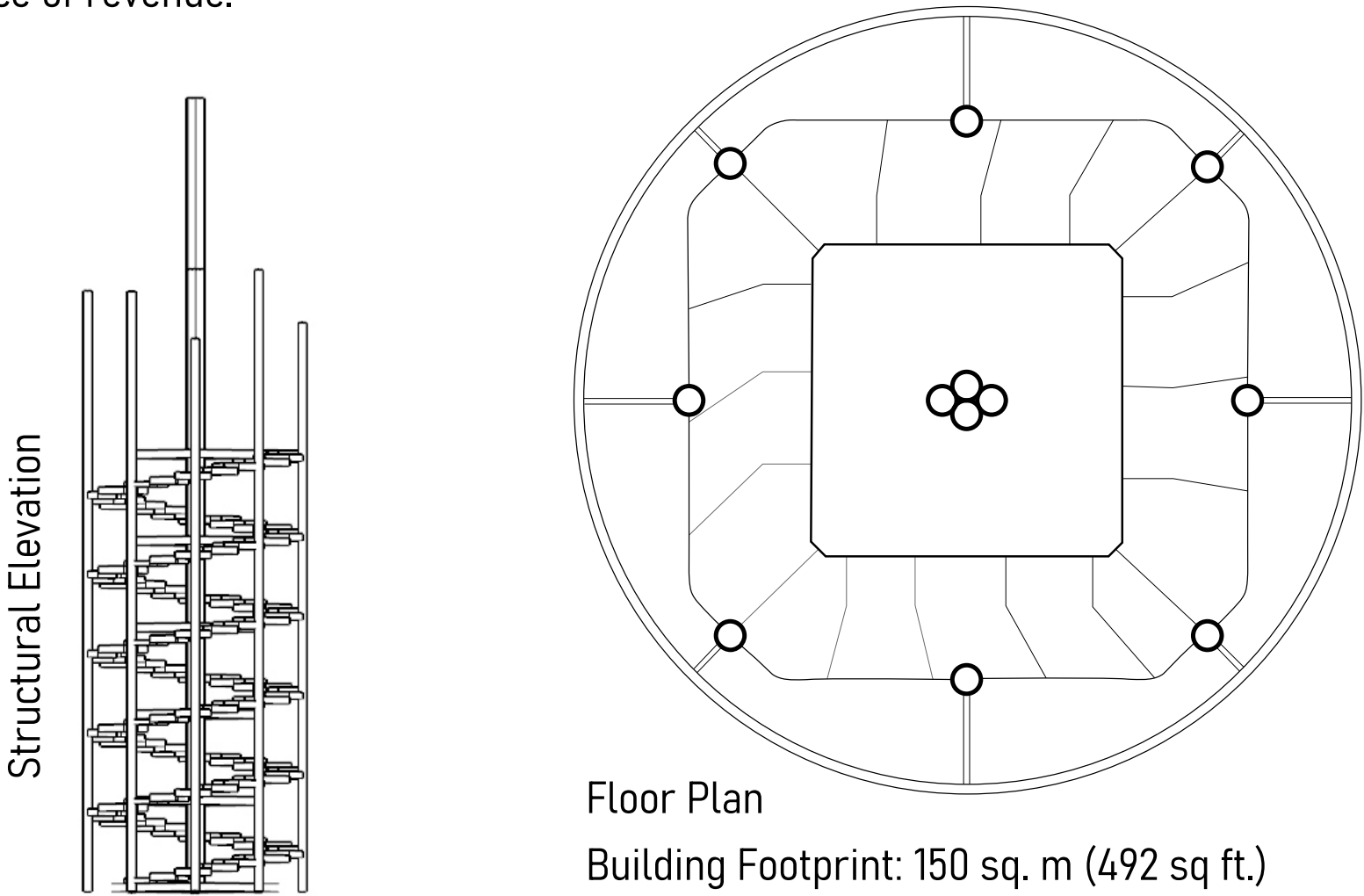
3. Person. "Climate Change in the Maldives." The World Bank, World Bank Group, 12 Nov. 2012, <https://www.worldbank.org/en/news/feature/2010/04/06/climate-change-in-the-maldives>.



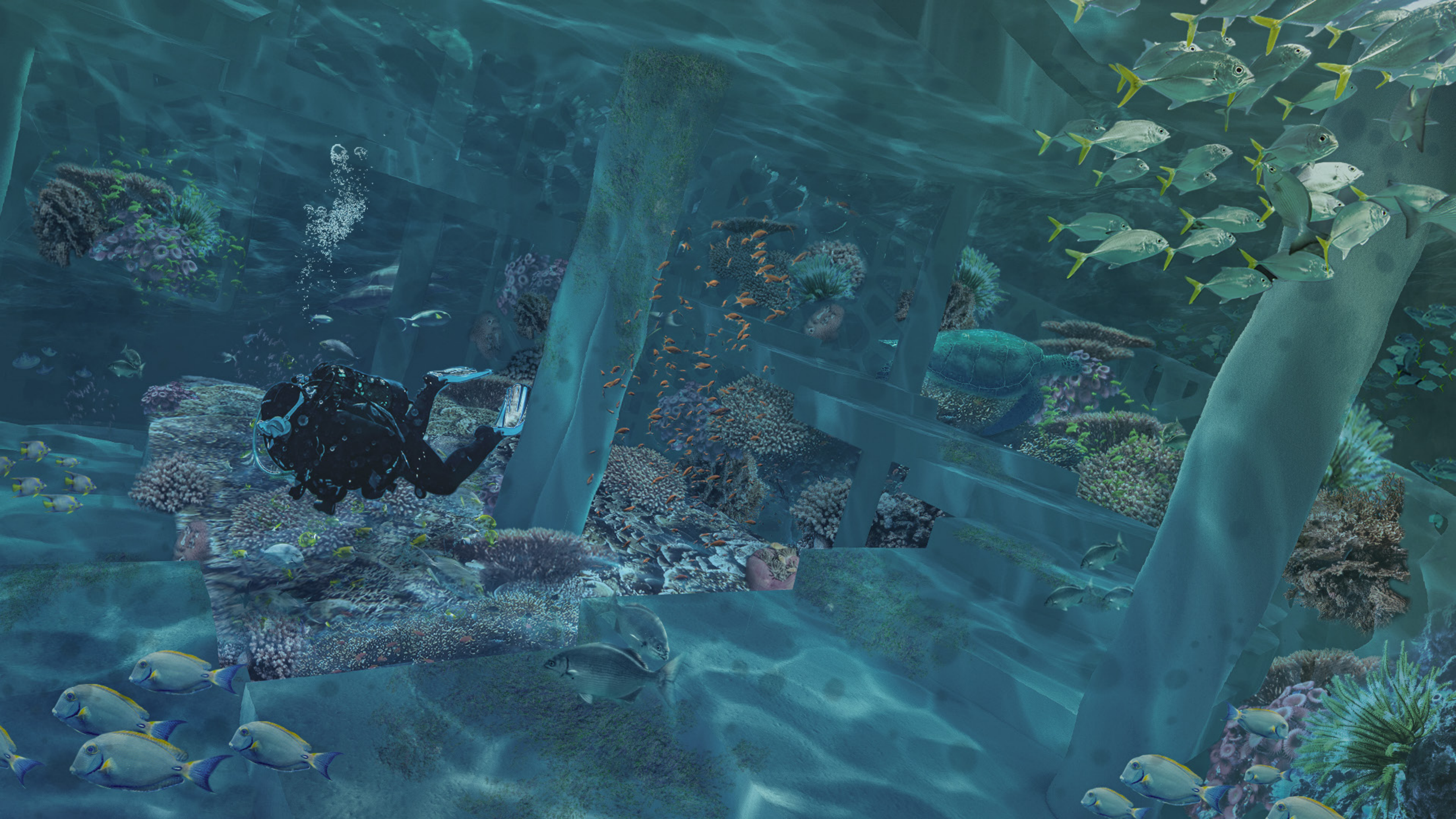
4. How will your structure/installation be used by the public?

One of the most popular activities to do when vacationing in the Maldives is to go scuba diving. Due to the advanced technology being used to transform the structure into a living oceanic hotspot, it will have an abundance of marine life that scuba divers will be able to visit and experience. Also, since the technology renders the coral reef to be more resilient, there will be little danger of scuba diving damaging the coral reefs.

The structure is tall, rising almost 12 meters above sea level, so that it can be visible from the island. A silent reminder of global warming. The form of the structure and its skin was inspired by coral, serving as a reflection of the importance of the ocean in Maldivian culture. However, the minimalism and use of parametric design are inspired by flashy modern resorts being built in the Maldives as tourism becomes their greatest source of revenue.⁴



4. Maldives Budget 2022, <https://www.budget.gov.mv/en/summary>.





Vehicles stuck in the floodwater in Sylhet, Bangladesh, May 17, 2022. Many roads have been submerged due to continuous high rains for several days.
Photo by Md Rafayat Haque Khan | Eyepix Group | Getty Images

5. How does the structure address the climate in which it would reside?

The structure is specifically designed to rejuvenate the deteriorating ocean ecology and address climate change. Though the extensive research for this project has focused specifically on the Maldives and its climate-induced challenges, the whole continent of Asia is very at risk as a result of extreme weather and water-related consequences.

As a sanctuary from climate change, the structure will be capable of withstanding extreme weather, including cyclones and surges which are becoming more intense and prevalent, threatening millions of Asians living near the coast. It is estimated that about 60 % of Asians live within 400 km of the coast.⁵ China is experiencing extreme coastline erosion, with 49 % of its sandy beaches already eroded.⁶ Currently, India and Bangladesh have been trending on world news due to catastrophic flooding. Extreme rainfalls in Asia have increased by more than three times since 1950 due to climate change.⁷ Indonesia and the Philippines have suffered greatly as a result of intensifying cyclones in the pacific. An estimated 8 million people have been affected by extreme weather in the South West Pacific between 2000 – 2019; meanwhile, in 2020 alone there were 11 million people affected.⁸ Extreme weather causes damage / destruction of property, the loss of human lives, the spoiling of food crops and freshwater sources, and inaccessible roads.

5. Hinrichsen, Don. The Coastal Population Explosion. <http://kula.geol.wvu.edu/rjmitch/coastalpopulation.pdf>.

6. Cao C, Cai F, Qi H, Liu J, Lei G, Zhu K and Mao Z (2022) Coastal Erosion Vulnerability in Mainland China Based on Fuzzy Evaluation of Cloud Models. *Front. Mar. Sci.* 8:790664. doi: 10.3389/fmars.2021.790664

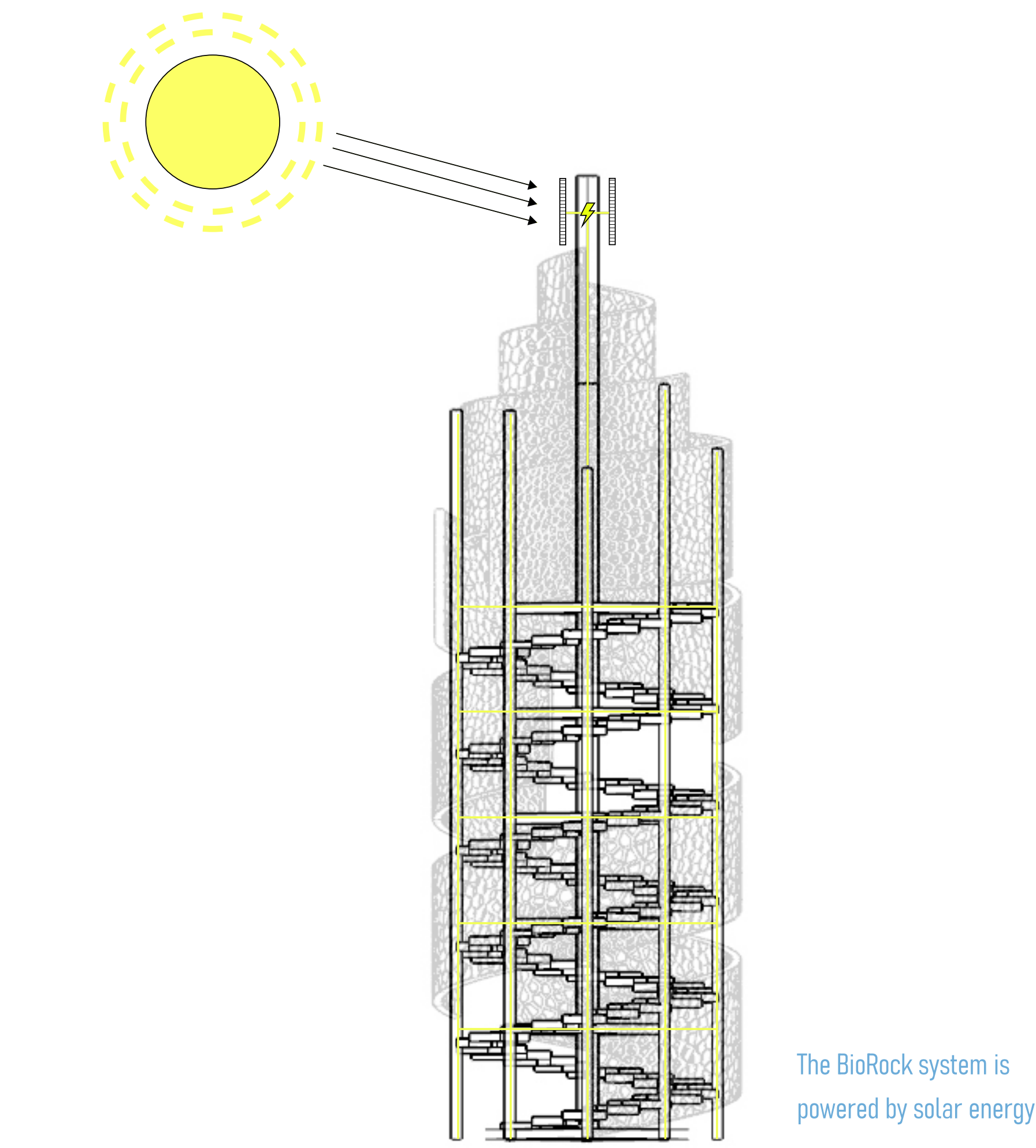
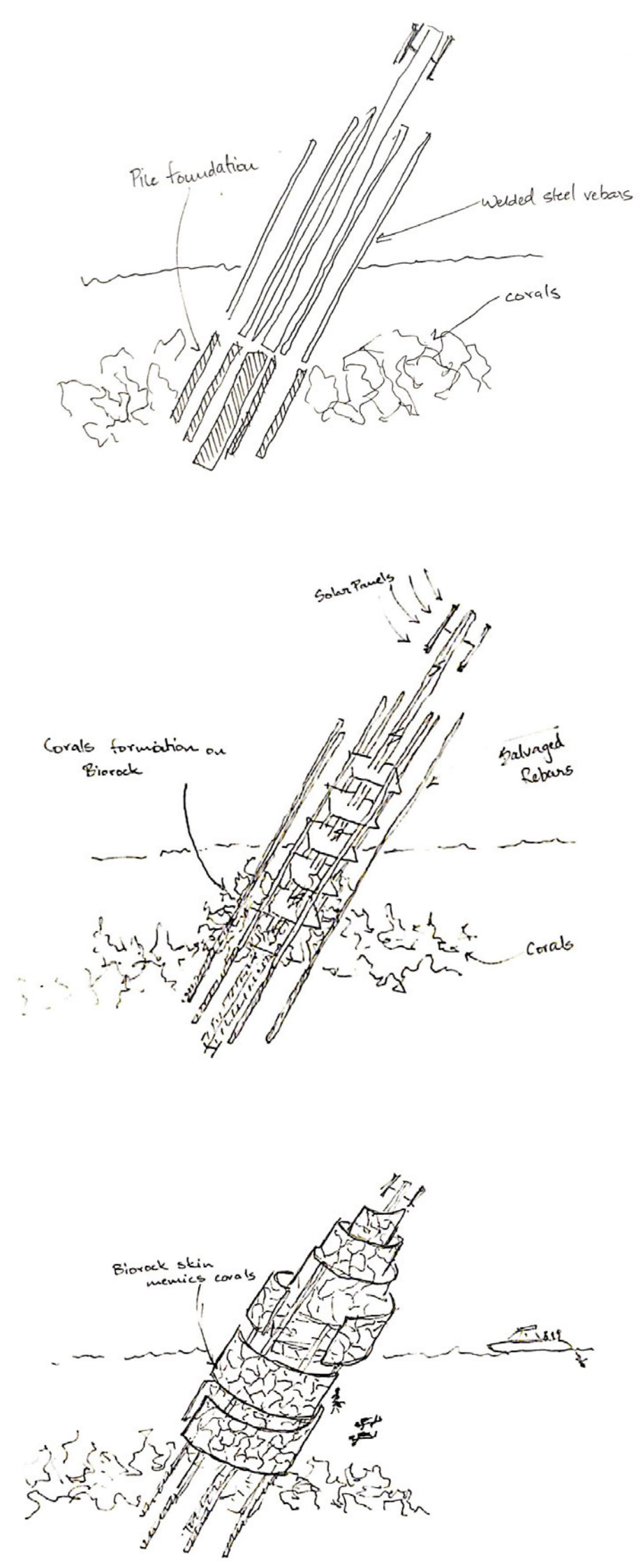
7. Roxy, M.K., Ghosh, S., Pathak, A. et al. A threefold rise in widespread extreme rain events over central India. *Nat Commun* 8, 708 (2017). <https://doi.org/10.1038/s41467-017-00744-9>

8. "Climate Change Increases Threats in South West Pacific - Indonesia." ReliefWeb, World Meteorological Organization, 11 Nov. 2021, <https://reliefweb.int/report/indonesia/climate-change-increases-threats-south-west-pacific>.

6. What type of technology is implemented in your design?

First, steel is inserted into oceanwater. A power source is attached to the steel, supplying it with a low voltage ranging from 1.5 – 6 V. The steel acts as the cathode while a non-corrigible titanium mesh is used as the anode. The low voltage causes mineral accretion, which results in the buildup of minerals that are naturally found in seawater, mainly calcium carbonate, that then clump together onto the steel. Eventually a rock layer consisting of the minerals forms around the steel, protecting the steel from rust and corrosion while also hardening to be 3x stronger than concrete. As long as the biorock remains powered, it will continue to grow stronger, making it the only marine material to grow stronger as it ages, not weaker, as well as being self-repairing.⁹ It can be used to create underwater structures or extracted for overworld use and it is cheaper to produce than concrete. Since the voltage is so low, it is safe for marine life and for swimmers. Though any form of steel can be used to produce BioRock, it is best to use a steel mesh made from rebar as the porousness of the structure will allow water to flow through the mesh without damaging the structure. This is very important as the structure may at times have to bear with powerful typhoons and rogue waves. Studies conducted by the Global Coral Reef Alliance have proven the effectiveness of the rebar mesh + biorock against storms.¹⁰

BioRock has the additional benefit of being perfect for rapid coral growth. Coral has to spend a great portion of its energy creating the right biochemical conditions (a high pH) for its growth and survival. However, the biorock process creates these conditions allowing coral attached to it to instead use its energy on tissue growth, reproduction and resisting environmental stresses, growing 2 – 10 times faster, being more resistant to hot water, pollution, and coral bleaching while having up to a 5000% higher chance of survival than normal.¹¹ This method is the only known method of protecting coral from global warming. Other methods of coral regeneration are only viable under perfect water conditions. BioRock corals are also healthier – they are more brightly coloured and extend their tentacles more often. The corals also attract other marine life, becoming an oasis in the sea: a true coral reef. These coral reefs are crucial for sustaining a healthy ocean ecology.



The BioRock system is powered by solar energy

9. Goreau, Tom. "Biorock." Global Coral Reef Alliance, Global Coral Reef Alliance, 22 Dec. 2019, <https://www.globalcoral.org/biorock-coral-reef-marine-habitat-restoration/>.

10. Goreau, Tom. "Biorock Electric Coral Reefs Survive the Most Severe Hurricanes with Little or No Damage." Global Coral Reef Alliance, 7 Sept. 2018, <https://www.globalcoral.org/biorock-electric-coral-reefs-survive-severe-hurricanes-little-no-damage/>.

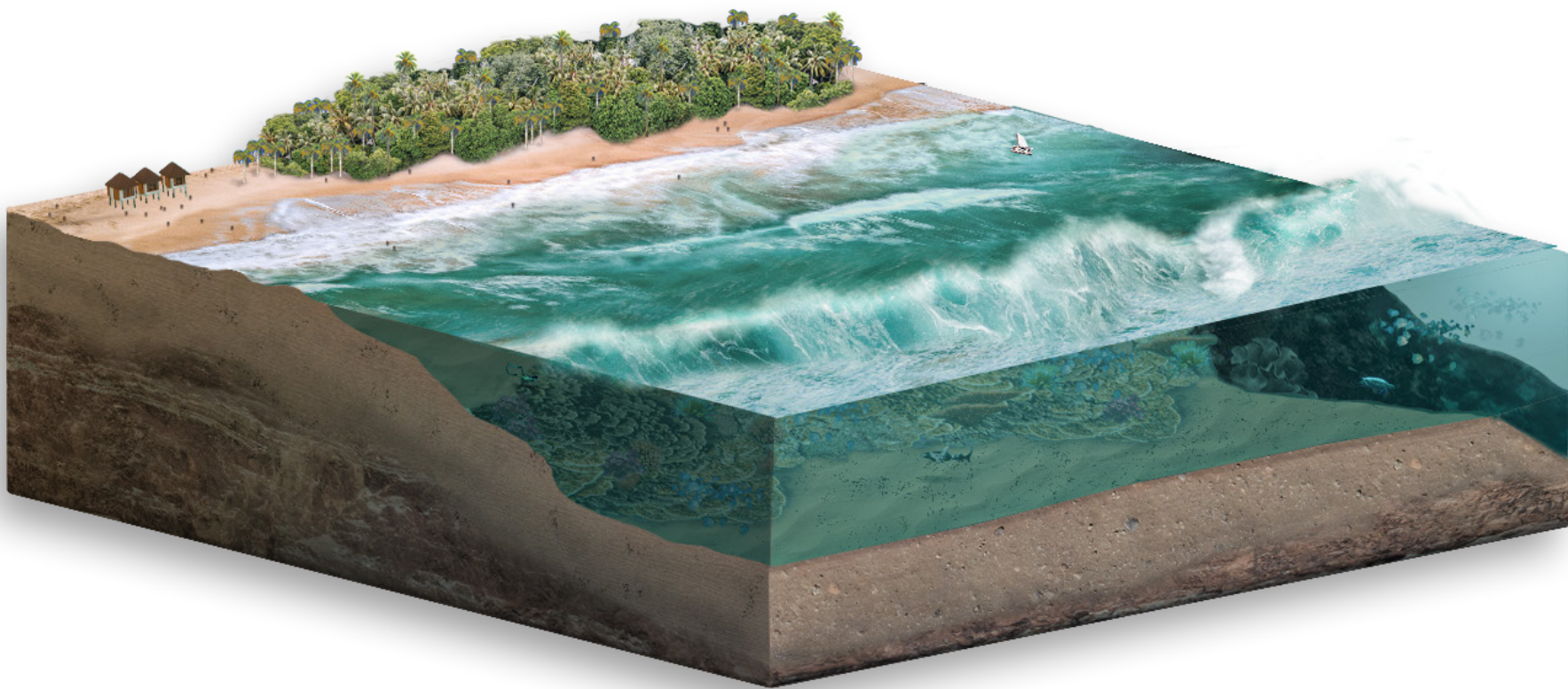
11. Breen, Richard. "Material Research and Growth Experimentation: The BioRock Book." Bartlett School of Architecture, 19 June 2016, <https://issuu.com/richardbreen/docs/binder1>. Accessed 9 July 2022

7. What makes the design environmentally friendly / sustainable?

As a sanctuary for marine life, one of the principal objectives of the design is to be extremely environmentally friendly. The BioRock and coral make up the majority of the structure and cladding, meaning it is a true example of interweaving architecture and nature. In other words, the design is practically built by nature, therefore keeping resource expenditure and pollutants to almost nothing. Since the design calls for the growth of coral, it will eventually grow into an entire reef that will be home to thousands of different sea creatures and vegetation. Ocean acidification, coral bleaching, and rising sea levels are worldwide issues that are devastating aquatic communities.¹² Since maintaining a coral reef is vital for maintaining a healthy marine ecosystem, the design will result in a resurgence of marine life with more resilient coral which will prevent marine species from potential endangerment or extinction. Keeping our oceans in good condition is crucial for the fight against climate change. “The ocean generates 50 percent of the oxygen we need, absorbs 25 percent of all carbon dioxide emissions and captures 90 percent of the excess heat generated by these emissions.”¹³

Coral reefs also protect shorelines from erosion, saltwater intrusion, storm surges and destructive waves. As a result of global warming, tropical storms have become more intense, more dangerous, and cause more damage. Coral reef protection is worth billions of dollars in collateral damage and countless human lives.¹⁴ They are also much more cost effective than breakwaters in shoreline protection.¹⁵

Most importantly, the design conveys a message to the world of the urgency of global warming. By 2100, which today’s younger generations will live to see, the Maldives is estimated to be almost completely submerged, 70-90% of the world’s corals will disappear, there will be a 1.5 million tons less fish caught annually, and more than half of the world’s marine species will stand on the brink of extinction.¹⁶ The design symbolizes the impending apocalypse that is a very real threat and is much closer than it may appear. However, the message is not pessimism but instead an attempt to spread awareness and a call to action. Together, we are capable of saving our planet, but we need to understand the urgency and do something about it.



Coral reefs are capable of drastically reducing wave speed and height, allowing for safer and more protected shorelines

Benefits of Coral Reefs



Protection from Surges



Food and Medecine



Recreation

12. “How Is Climate Change Impacting the World’s Ocean.” United Nations, United Nations, https://www.un.org/en/climatechange/science/climate-issues/ocean-impacts?gclid=Cj0KCQjwzqSWBhDPArisAK38LY-3ALfJTstUKVF1WSVi8gJPHxa1Ytast0iiTe59zu_xX_pzDGJoMYaAv7xEALw_wcB.

13. “The Ocean – the World’s Greatest Ally Against Climate Change.” United Nations, United Nations, <https://www.un.org/en/climatechange/science/climate-issues/ocean>.

14. Beck, Michael. “Coral Reefs Provide Flood Protection Worth \$1.8 Billion Every Year – It’s Time to Protect Them.” The Conversation, 29 June 2022, <https://theconversation.com/coral-reefs-provide-flood-protection-worth-1-8-billion-every-year-its-time-to-protect-them-116636>.

15. Ferrario, F., Beck, M., Storlazzi, C. et al. The effectiveness of coral reefs for coastal hazard risk reduction and adaptation. Nat Commun 5, 3794 (2014). <https://doi.org/10.1038/ncomms4794>

16. “Climate Change Is Killing Our Ocean.” The Economist, The Economist Newspaper, <https://ocean.economist.com/innovation/articles/climate-change-is-killing-our-oceans>.



Maldivian President Mohammed Nasheed in scuba gear as he signs a document in Girifushi, Maldives, on October 17, 2009, that calls on all countries to cut down their carbon dioxide emissions ahead of a U.N. climate change conference.

Photo by Mohammed Seeneen / AP

8. How is the warning of the planet's doom reflected in the project design?

The project is not only a sanctuary but a memorial to the Maldives. It is an enormous stadiometer, with markings showing where the sea level is as of now, and how much it will take to rise for the Maldives to disappear. In the future, it will be the only indicator of where the Maldives used to be. The tilt in the towering form creates an illusion of sinking, mimicking a shipwreck, in order to emphasize the urgency and to make the rise in sea level appear more noticeable.

9. Estimated Budget

Use	Categories	Cost (\$)
Stairs and Foundation	Cement	950
Frame	Steel	2 000
Electrical Connection	Electrical Fittings	150
Power Source	Solar Panels	2 000
-- -- --	Contractors & Shipping	4 500
-- -- --	Foundation Work	4 200
	Total Estimation	13 800

Bibliography

1. “Ministry of Environment, Climate Change and Technology.” Ministry of Environment Climate Change and Technology, Maldives, <http://www.environment.gov.mv/v2/en/>.

2. “Climate Change Indicators: Weather and Climate.” EPA, United States Environmental Protection Agency, <https://www.epa.gov/climate-indicators/weather-climate>.

3. Person. “Climate Change in the Maldives.” The World Bank, World Bank Group, 12 Nov. 2012, <https://www.worldbank.org/en/news/feature/2010/04/06/climate-change-in-the-maldives>.

4. Maldives Budget 2022, <https://www.budget.gov.mv/en/summary>.

5. Hinrichsen, Don. The Coastal Population Explosion. <http://kula.geol.wvu.edu/rjmitch/coastalpopulation.pdf>.

6. Cao C, Cai F, Qi H, Liu J, Lei G, Zhu K and Mao Z (2022) Coastal Erosion Vulnerability in Mainland China Based on Fuzzy Evaluation of Cloud Models. *Front. Mar. Sci.* 8:790664. doi: 10.3389/fmars.2021.790664

7. Roxy, M.K., Ghosh, S., Pathak, A. et al. A threefold rise in widespread extreme rain events over central India. *Nat Commun* 8, 708 (2017). <https://doi.org/10.1038/s41467-017-00744-9>

8. “Climate Change Increases Threats in South West Pacific – Indonesia.” ReliefWeb, World Meteorological Organization, 11 Nov. 2021, <https://reliefweb.int/report/indonesia/climate-change-increases-threats-south-west-pacific>.

9. Goreau, Tom. “Biorock.” Global Coral Reef Alliance, Global Coral Reef Alliance, 22 Dec. 2019, <https://www.globalcoral.org/biorock-coral-reef-marine-habitat-restoration/>.

10. Goreau, Tom. “Biorock Electric Coral Reefs Survive the Most Severe Hurricanes with Little or No Damage.” Global Coral Reef Alliance, 7 Sept. 2018, <https://www.globalcoral.org/biorock-electric-coral-reefs-survive-severe-hurricanes-little-no-damage/>.

11. Breen, Richard. “Material Research and Growth Experimentation: The BioRock Book.” Bartlett School of Architecture, 19 June 2016, <https://issuu.com/richardbreen/docs/binder1>. Accessed 9 July 2022.

12. “How Is Climate Change Impacting the World’s Ocean.” United Nations, United Nations, https://www.un.org/en/climatechange/science/climate-issues/ocean-impacts?gclid=Cj0KCQjwzqSWBhDPARIsAK38LY-3ALfjTstUKVF1WSVi8gJPHxa1Ytast0iiTe59zu_xX_pzDGJoMYaAv7xEALw_wcB.

13. “The Ocean – the World’s Greatest Ally Against Climate Change.” United Nations, United Nations, <https://www.un.org/en/climatechange/science/climate-issues/ocean>.

14. Beck, Michael. “Coral Reefs Provide Flood Protection Worth \$1.8 Billion Every Year – It’s Time to Protect Them.” *The Conversation*, 29 June 2022, <https://theconversation.com/coral-reefs-provide-flood-protection-worth-1-8-billion-every-year-its-time-to-protect-them-116636>.

15. Ferrario, F., Beck, M., Storlazzi, C. et al. The effectiveness of coral reefs for coastal hazard risk reduction and adaptation. *Nat Commun* 5, 3794 (2014). <https://doi.org/10.1038/ncomms4794>

16. “Climate Change Is Killing Our Ocean.” *The Economist*, *The Economist Newspaper*, <https://ocean.economist.com/innovation/articles/climate-change-is-killing-our-oceans>.

