Pemodelan Arsitektur & Perkotaan

STUDIO AKHIR DESAIN ARSITREKTUR

Arsitektur Departemen

2024

HYDROSCAPE

MADIRDA LAKE, BERJO VILLAGE

Designing Water Education Tourism with Concept-Based Design Strategy and Parametric Approach

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PROGRAM S1 ARSITEKTUR INTERNASIONAL

HYDROSCAPE

MADIRDA LAKE, BERJO VILLAGE

Designing Water Education Tourism with Concept-Based Design Strategy and Parametric Approach

Department of Architecture

Faculty of Civil Engineering and Planning

Universitas Islam Indonesia

2024/2025

HYDROSCAPE

DANAU MADIRDA, DESA BERJO

Perancangan Wisata Edukasi Air dengan Strategi Desain Berbasis Konsep dan Pendekatan Parametrik

Arsitektur Departemen

Fakultas Teknik Sipil dan Perencanaan

Universitas Islam Indonesia

2024/2025

VALIDATION SHEET

Final Architectural Design Studio entitled:

HYDROSCAPE
Designing Water Education Tourism with Concept Based Design Strategy and Parametric Approach

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Has been evaluated and agreed on : 20th August 2024

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Hanif Budiman Ir. M.T. Ph.D.

Dipindai dengan CamScanner

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University : UII (Universitas Islam Indonesia)

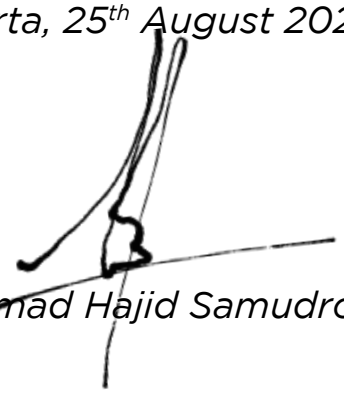
State that all parts of this thesis work/final project entitled:

HYDROSCAPE

Designing Water Education Tourism with Concept-Based Design Strategy and Parametric Approach

This work is entirely original, except for the sources cited in the references, and no assistance was received from any other party, either in whole or in part, during its creation. The final product is submitted to the Department of Architecture at the Islamic University of Indonesia for educational and publication purposes, while the intellectual property rights remain with the author.

Yogyakarta, 25th August 2024



Muhammad Hajid Samudro

PREFACE

Assalamualaikum Wr. Wb.

Praise and gratitude are given to Allah SWT. For his blessing so that this thesis can be completed through various process that has been passed. The thesis project which i raised is titled “HYDROSCAPE, Designing Water Education Tourism with Concept Based Design Strategy and Parametric Approach”

The process of completing this thesis was indeed demanding, requiring considerable commitment, and resilience. However, this accomplishment would not have been possible without the support and encouragement of those around me, both physically and mentally. Therefore, I wish to formally extend my deepest appreciation and sincere gratitude to:

1. The Almighty God Allah Swt, who has given me various forms of guidance to complete this final project

2. My Parents, my mother Nur Ulfah, and my father Heri Wahyu Setiyarso who has given me various supports so that I can fulfill my obligations to study up to the Department of Architecture, Universitas Islam Indonesia.

3. Prof. Dr.-Ing. Ar. Ir. Ilya Fadjar Maharika, M.A., I.A.I., as supervisor who has given me various guidance to me in completing this thesis since the beginning of the proposal submission with various inputs and insights until the completion of this project.

4. Wiryono Raharjo Ir., M. Arch., Ph.D as 1st Jury, and Johanita Anggia Rini, Ph.D. as 2nd Jury who has given loads of inputs, comments, criticisms, and advices so that the content of this thesis can be improved.

5. My friends of the same supervisor. Mas Faiz, Ni’mal, and Mas Fadli, whom have helped me and encouraged me in carrying forward to finish this thesis

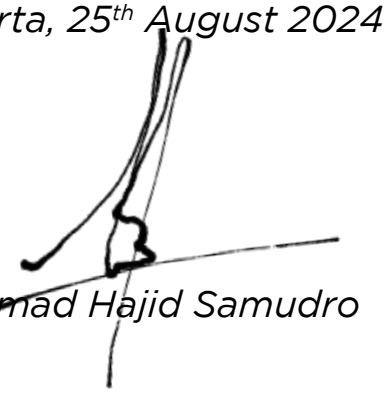
6. My friends, Alisya, Kinan, Devi, Zabrina, Amal, and Fitri as table, and discussion mates who has given me support through the days until I had passed this thesis project.

7. Lastly, I would like to take a moment to acknowledge and thank myself for the dedication, perseverance, and hard work that made the completion of this thesis possible. Hopefully, I will be able to carry this same determination and effort into all my future endeavors, striving to achieve even greater goals ahead.

As the author, I fully acknowledge that this report is far from perfect and has room for improvement. Despite my best efforts, there may be areas that could benefit from further refinement. Therefore, I welcome and greatly appreciate any constructive criticism and suggestions that can help enhance the quality of this work.

Wassalamualaikum Wr. Wb.

Yogyakarta, 25th August 2024



Muhammad Hajid Samudro

HYDROSCAPE

MADIRDA LAKE, BERJO VILLAGE

Designing Water Education Tourism with Concept-Based Design Strategy and Parametric Approach

Department of Architecture
Faculty of Civil Engineering and Planning

Universitas Islam Indonesia
2024 / 2025

ABSTRACT

For a long time, the utilization of natural resources has supported the needs of surrounding ecosystems, especially in areas rich in such resources, like Berjo village in Karanganyar. Water, as a vital natural resource, plays numerous roles in sustaining life, supporting agriculture, and fostering recreational activities. In Berjo village, the abundant natural water sources have been developed into several tourism sectors, attracting many visitors.

Madirda Lake, a natural water spring in Berjo village, was established as a tourism area in 2020 and continues to improve its tourism activities. Beyond its role as a scenic attraction, Madirda Lake is a crucial water resource that supports both tourism and the local ecosystem. The lake also houses a water treatment facility that utilizes the spring water as mineral water. This dual-purpose use highlights the multifaceted importance of water in both daily life and environmental sustainability.

Given the increasing number of tourists each year, there is a growing opportunity to use Madirda Lake as an educational platform. Integrating water education into the lake's tourism activities can transform it into an eco-study destination. Visitors can learn about the various functions of water, including its role in sustaining ecosystems, its importance in daily life, and the processes involved in water treatment and conservation. This approach not only enhances the tourist experience but also promotes awareness and responsibility towards water conservation and sustainable usage.

By positioning Madirda Lake as a center for water education, Berjo village can provide valuable insights into the significance of water. This innovative strategy can foster a deeper understanding of water's essential functions and the importance of preserving this critical resource for future

Keywords: Water Education, Parametric Design, Eco-tourism

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INTRODUCTION

1.1 The Future of Water: Issue

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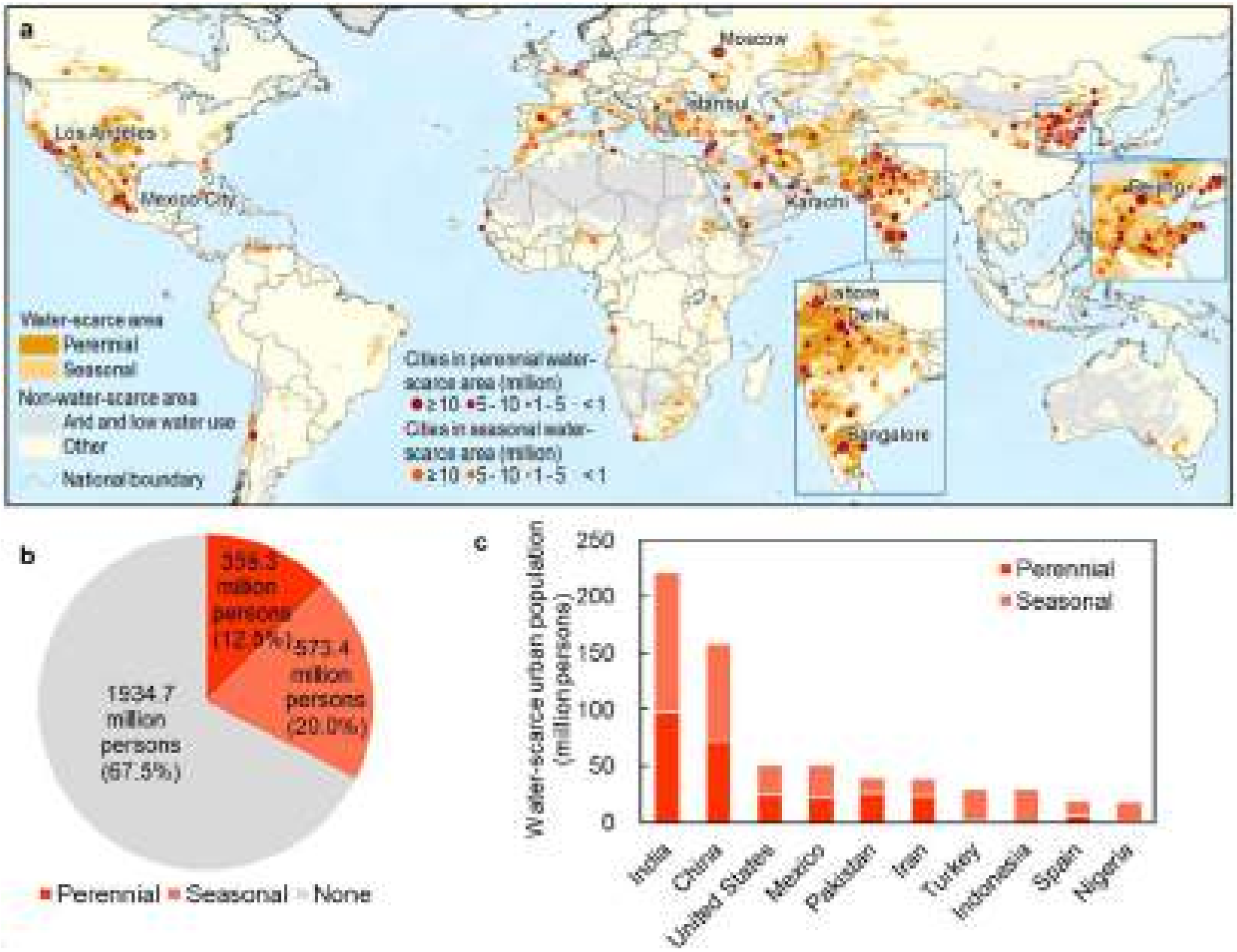


Figure 1.1 Current Urban Water Scarcity; a spatial patterns of large cities in water-scarce areas (cities with population above 10 million in 2016 were labeled). B Water-scarce urban population at the global scale. c Water-scarce urban population at the national scale (10 countries with the largest values were listed). Source: *https://www.nature.com/articles/s41467-021-25026-3; 2021*

As the world's population continues to grow, projected to reach nearly 10 billion by 2050, the strain on our planet's most vital resource, water, intensifies. This rapid growth, coupled with industrialization and urbanization, is increasing water problems, such as water scarcity and pollution. The consequences are profound: vital ecosystems are degrading, and millions face the dire reality of limited access to clean water. The future of water is thus a pressing issue, where the balance between human needs and environmental stewardship will dictate the sustainability of our global water supply.

According to the article "Future global urban water scarcity and potential solutions," currently, approximately 933 million urban residents, which is about 32.5% of the urban population, reside in regions with insufficient water supply. Among them, 359 million (12.5%) experience year-round water scarcity, while 573 million (20.0%) face seasonal shortages. However, projections suggest a steep rise in urban water scarcity by 2050, with an estimated 2.065 (1.693–2.373) billion people, marking a 121.3% (81.5–154.4%) increase. Among these, approximately 840 million (476–905) individuals are expected to confront perpetual water scarcity, while around 1.225 billion (0.902–1.647) will contend with seasonal shortages.

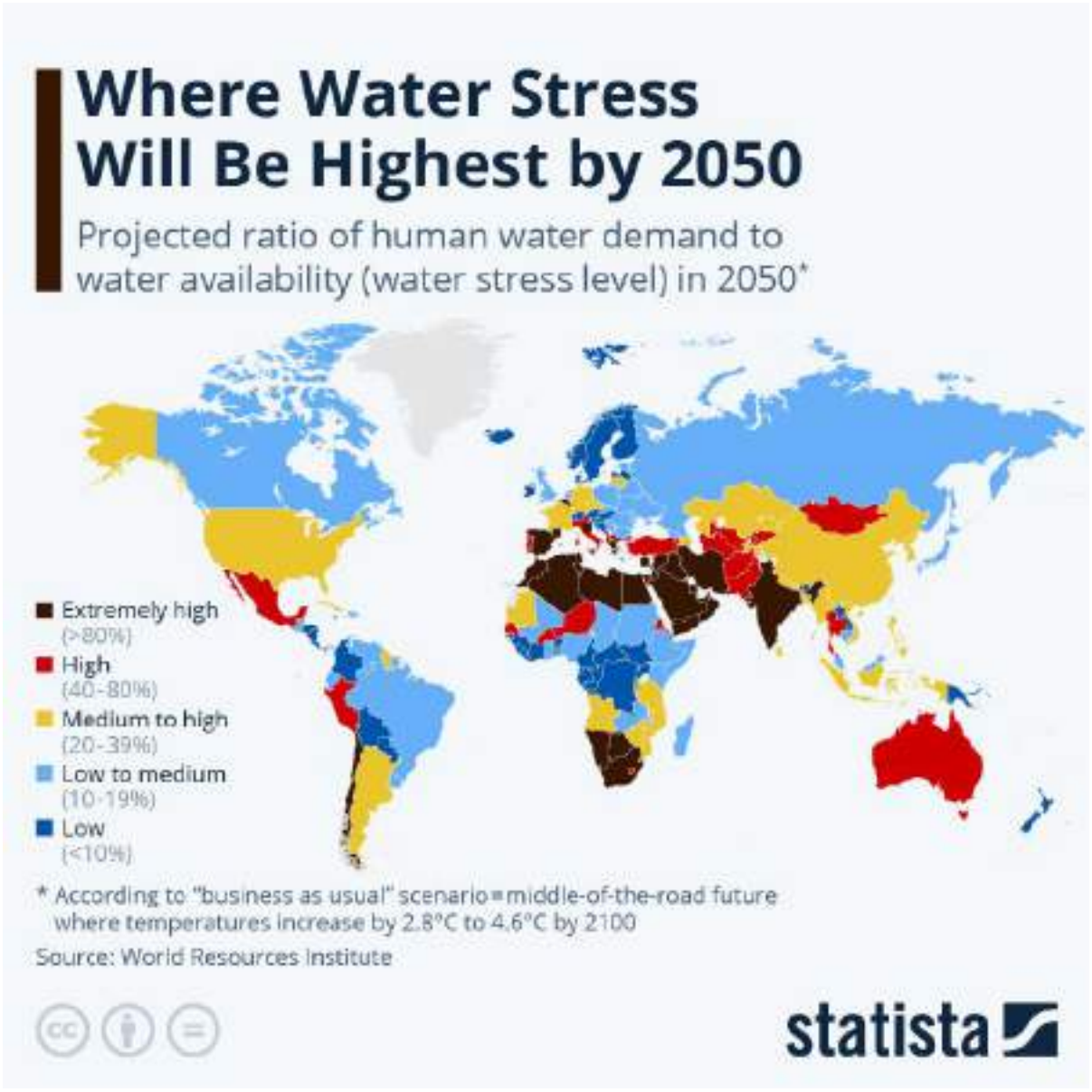


Figure 1.2 Where Water Stress Will Be Highest by 2050; Source: Statista, */https://www.statista.com/chart/26140/water-stress-projections-global/; 2024*

As the world's population continues to grow, projected to reach nearly 10 billion by 2050, the strain on our planet's most vital resource, water, intensifies. This rapid growth, coupled with industrialization and urbanization, is increasing water problems, such as water scarcity and pollution. The consequences are profound: vital ecosystems are degrading, and millions face the dire reality of limited access to clean water. The future of water is thus a pressing issue, where the balance between human needs and environmental stewardship will dictate the sustainability of our global water supply.

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1.2 BERJO WATERSCAPE : CASE

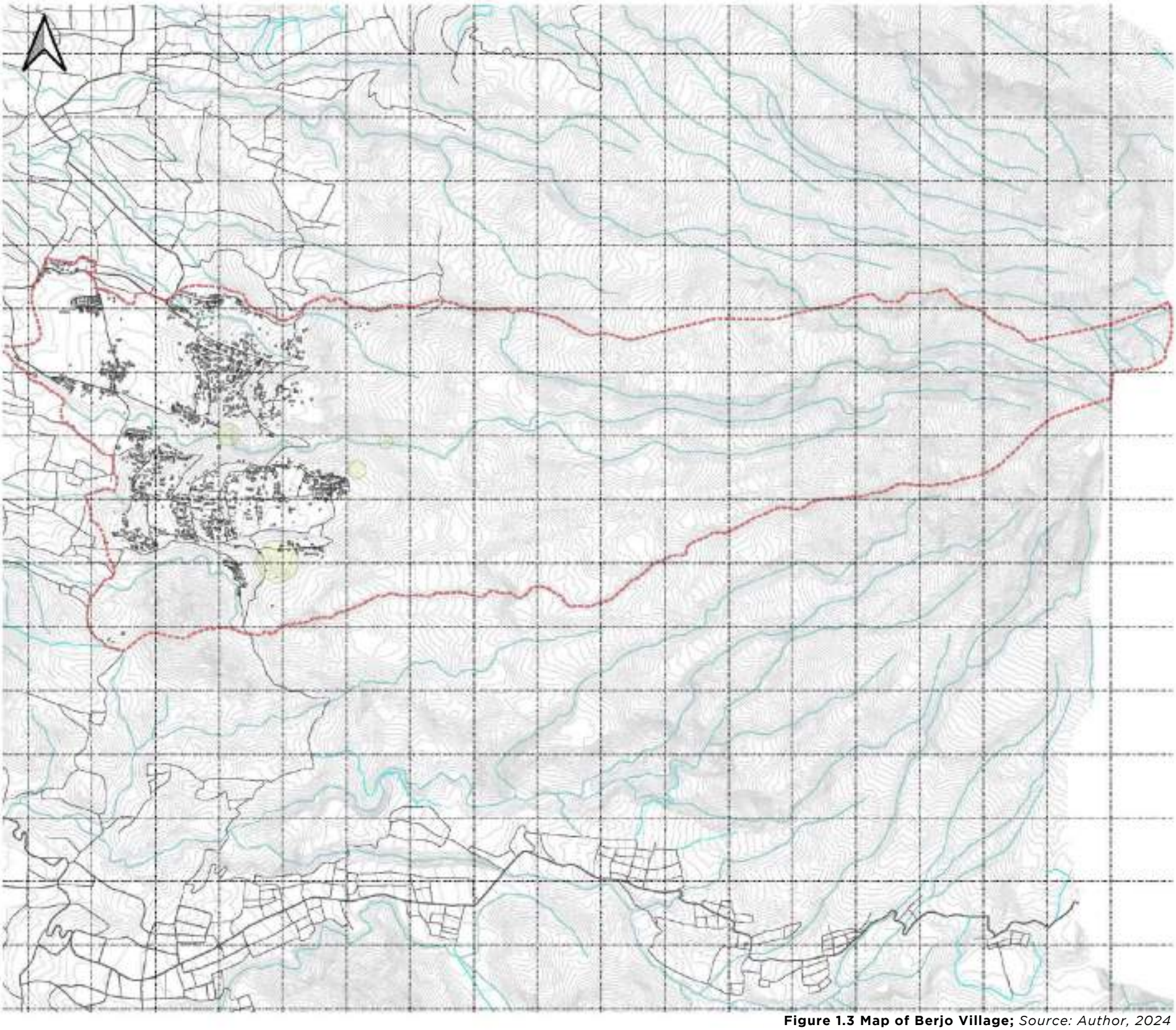


Figure 1.3 Map of Berjo Village; *Source: Author, 2024*

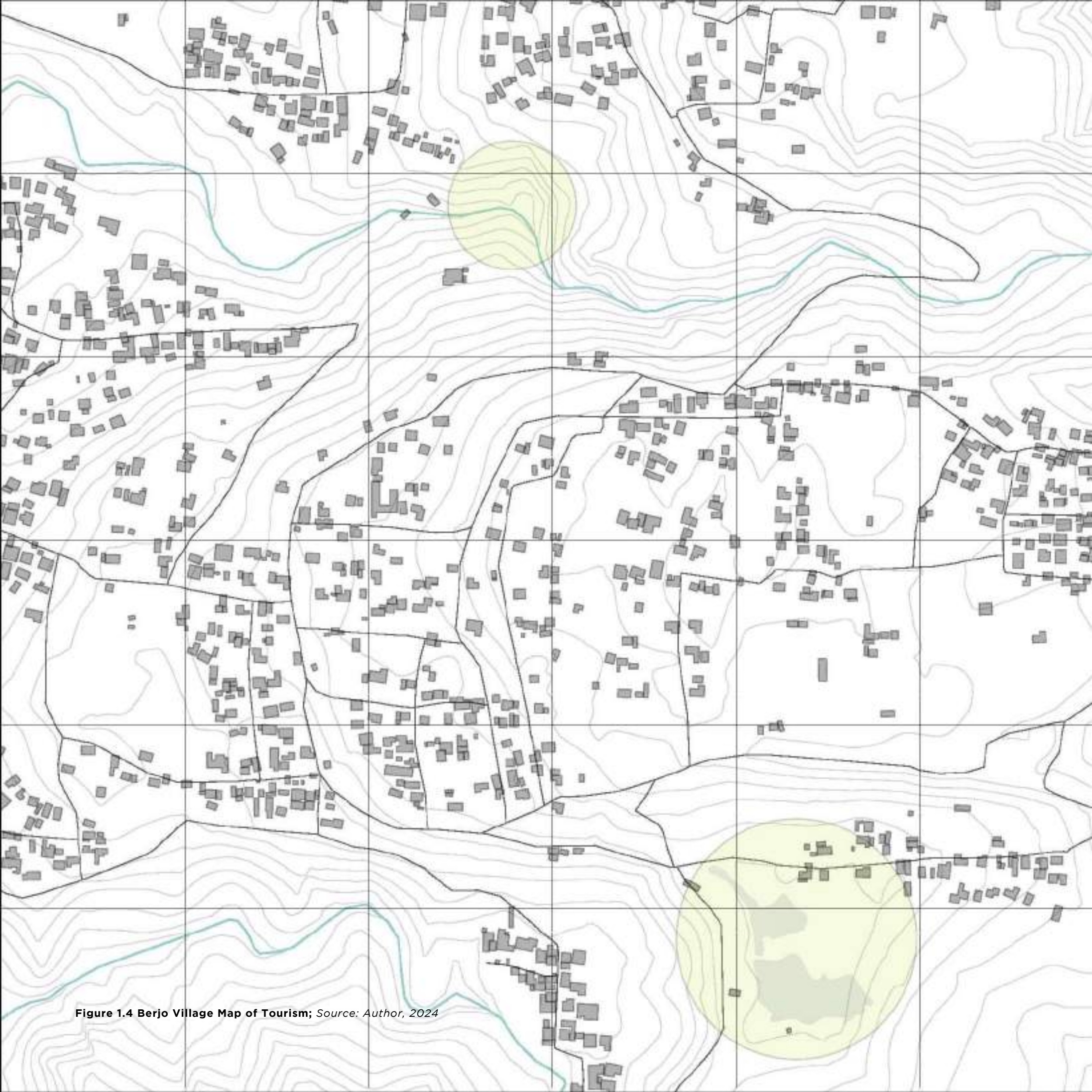


Figure 1.4 Berjo Village Map of Tourism; *Source: Author, 2024*



1.2 BERJO WATERSCAPE : CASE

Berjo Village

Berjo is a village in Ngargoyoso subdistrict, Karanganyar district, Central Java, Indonesia. This village is located on the slopes of Mount Lawu. Berjo Village has topography in the form of a high area, at an altitude of 3 1,500 meters above sea level, with an average air temperature of 3 22 °C to 32 °C and a tropical climate. Berjo Village has an area of 1623,865 Ha and has the following territorial boundaries: to the north Berjo Village is bounded by Girimulyo village, to the east by Lawu forest, to the south by Tawangmangu sub-district, and to the west by Puntukrejo village.

Most of the land use and area of Berjo village is homestead land in the form of moorlands/gardens, covering an area of 1,918,650 Ha, and the rest is in the form of yards/buildings covering an area of 817,120 Ha, state forest covering an area of 1,236 Ha, and irrigated rice fields covering an area of 84 Ha. The majority of Berjo village residents make their living as farmers. Their agricultural land is mostly in the form of fields/gardens, covering an area of 1,918,650 hectares and the rest is rice fields cultivated with irrigation.

Based on the Karanganyar Regent's Regulation Number 13 of 2018 concerning Guidelines for Determining Tourism Villages, Tourism Villages are a form of integration between attractions, accommodation and supporting facilities in preserving nature and the community's traditional cultural nodes to promote prosperity. The development of tourist villages is not only oriented towards increasing cultural and tourism potential but also empowering local communities to be responsible in managing their environment

Berjo Village is a tourism village located in Karanganyar Regency, precisely on the slopes of Mount Lawu. Located at an altitude of + 1,500 meters above sea level, with an average air temperature of +22°C to 32°C. Berjo Village is famous as a tourist destination in Karanganyar Regency and Indonesia. The economic ramifications of the Covid-19 pandemic on communities, particularly those with tourist attractions like Berjo Tourism Village in Karanganyar district, Central Java, are undeniable. Berjo Village, renowned for its natural beauty and cultural significance, offers diverse touristic experiences especially connected to its nature such as water springs, and waterfalls. The large number of tourist visits to the tourist attractions makes Berjo Village's BUMDes have the largest (richest) income in Karanganyar Regency. Within one year, Berjo Village BUMDes can earn an income of 2 – 4 billion rupiah, which does not include income from parking tickets and vendor stall rentals.

Madirda Lake

BUMDes Berjo, situated in Ngargoyoso District, Karanganyar Regency, operates a business unit engaged in the processing of bottled drinking water, utilizing spring water sourced from Telaga Madirda as its primary raw material. The overarching objective of this endeavor is to enhance community welfare while concurrently augmenting revenue streams derived from tourism units under the purview of BUMDes Berjo, encompassing Jumog Waterfall, Telaga Madirda, and Tambak Campground.

Presently, BUMDes Berjo is equipped with a Reverse Osmosis (RO) machine, graciously provided by several universities, which facilitates the conversion of spring water into bottled drinking water. Rigorous laboratory testing procedures have been implemented to ascertain the quality of the bottled drinking water products, ensuring compliance with prevailing health standards. Moreover, meticulous attention has been accorded to the licensing process for product marketing, thereby ensuring legal compliance in the sale and distribution of the product.

This developmental initiative signifies a commendable stride towards local economic empowerment and environmental stewardship. Beyond merely providing the community with access to premium-quality drinking water, BUMDes Berjo spearheads employment creation and income generation through the sustainable management of natural tourist attractions. Through the synergistic integration of bottled drinking water processing and tourism management, BUMDes Berjo unequivocally contributes to the economic and social upliftment of the surrounding community.

The potential risks of water pollution stemming from tourism activities in Berjo Village, Karanganyar, warrant thorough examination and mitigation measures. As tourism flourishes in the village, particularly around attractions such as Telaga Madirda, Jumog Waterfall, and Tambak Campground, the flow of visitors brings with it the possibility of increased environmental risks. One significant concern is the improper disposal of waste by tourists, including plastics, packaging materials, and other non-biodegradable items. Inadequate waste management systems could result in the contamination of water sources, adversely affecting both local ecosystems and the health of the community relying on these water bodies.

Moreover, the heightened human activity associated with tourism, such as recreational activities and accommodation facilities, may contribute to soil erosion and sedimentation in water bodies. This sedimentation can degrade water quality by introducing pollutants and reducing the overall ecological health of aquatic ecosystems. Furthermore, the increased demand for water resources to support tourism activities, such as for sanitation, food preparation, and recreational purposes, may exacerbate water scarcity issues, particularly during peak tourist seasons. Over-extraction of water from local sources can lead to diminished water availability for both the community and the environment, potentially impacting agriculture, biodiversity, and overall ecosystem health.

To address these water pollution risks, collaborative efforts involving local authorities, community stakeholders, and tourism operators are essential. Implementing effective waste management strategies, promoting responsible tourism practices, and investing in sustainable infrastructure for water supply and sanitation are critical steps towards mitigating the adverse impacts of tourism on water quality in Berjo Village. Additionally, raising awareness among tourists about the importance of environmental conservation and responsible behavior can help foster a culture of respect and stewardship towards the village's natural resources. While tourism has the potential to create negative effects, it also has the capacity to spur sustainable growth. When carefully organized and overseen, sustainable tourism has the ability to enhance livelihoods, promote inclusivity, safeguard cultural heritage and natural resources, and foster global cooperation and understanding (Ocean Panel, 2023).

Water pollution is contaminating water bodies, such as lakes, rivers, oceans, and groundwater, by harmful substances or energy that negatively affect their beneficial use or natural functioning (Britannica, 2024). Some examples of water pollutants are chemicals, trash, microorganisms, heat, radioactivity, oil, and sediments that might come from the visitors that visit the village's tourist areas. Illegal dumping of waste and littering near water spring areas can introduce pollutants such as plastics, chemicals, and organic waste into the environment. These pollutants can leach into groundwater or be carried by surface runoff into water springs, contributing to water pollution (Benedetti et al., 2020).

This can have serious consequences for the health of the local people, the environment, and the sustainability of tourism activities. Therefore, it is important to develop strategies to prevent and reduce water pollution in the Berjo village while also not reducing the amount of tourism activities in the village.

1.2 BERJO WATERSCAPE : CASE



Figure 1.5 Map of Madirda Lake; *Source: Author, 2024*

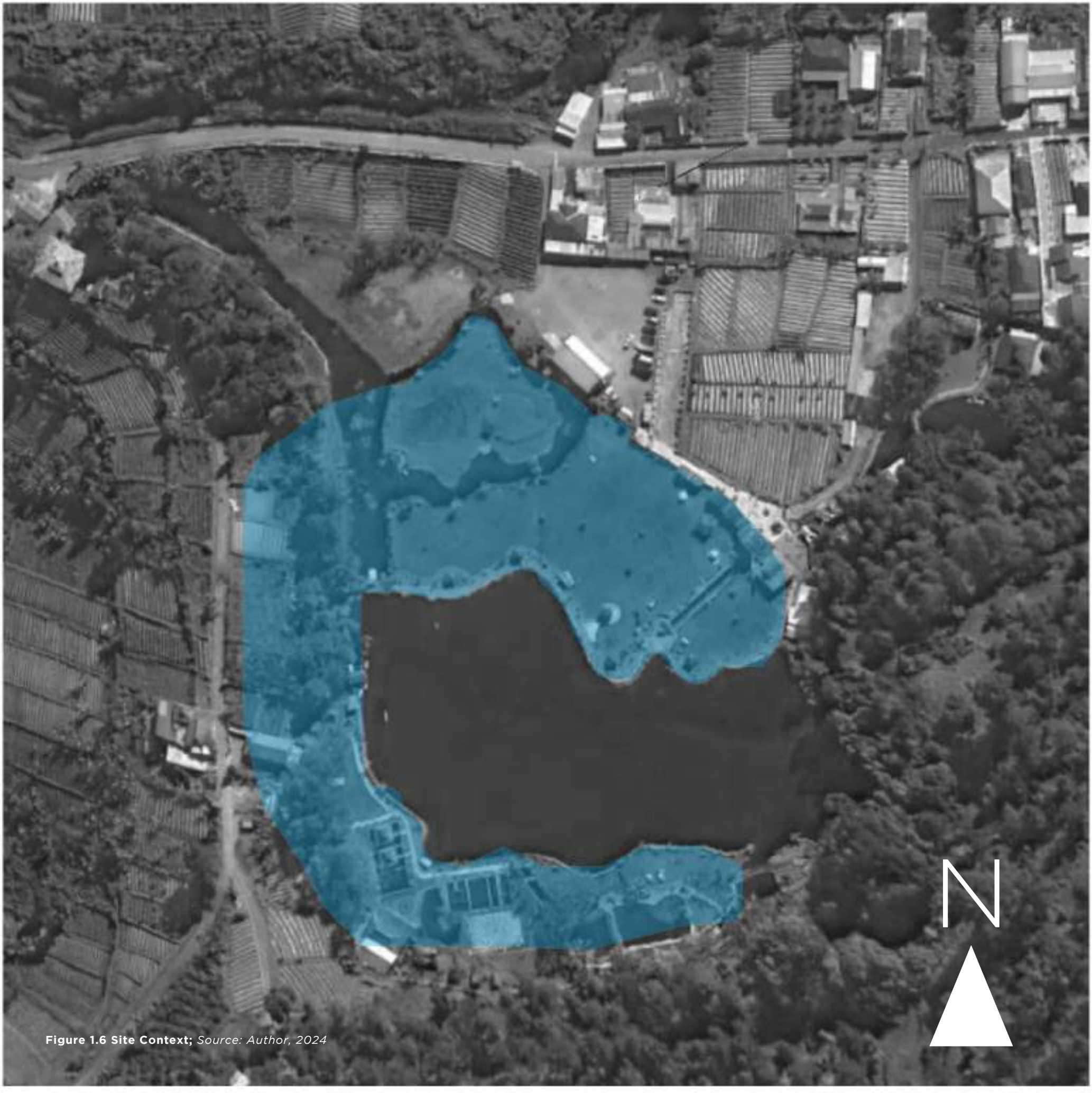


Figure 1.6 Site Context; *Source: Author, 2024*

Site Context

Total Madirda Lake Area :
31,000 m2
Area of Development :
16,200 m2

1.3 MATRIX OF DESIGN PROBLEM

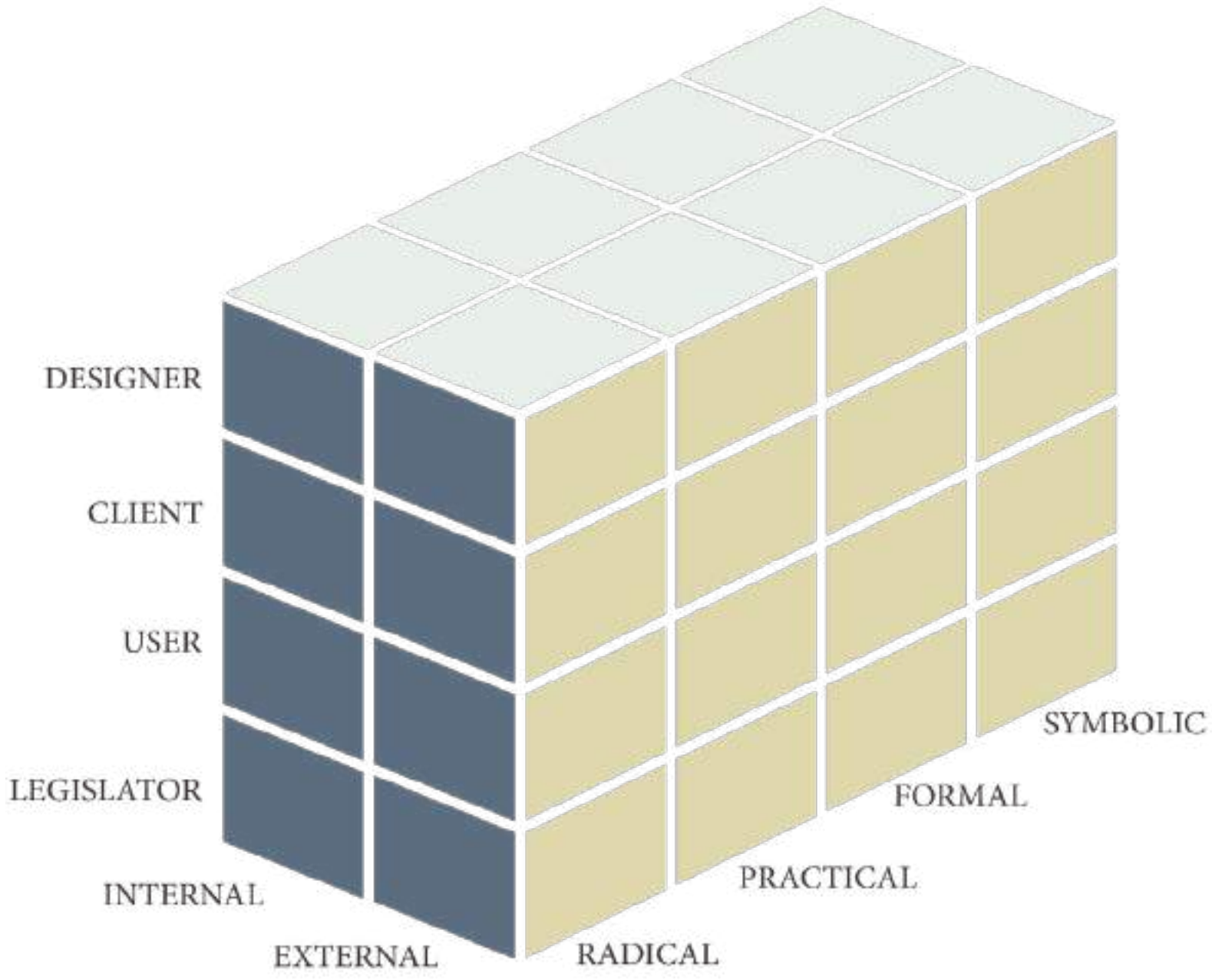


Figure 1.7 Matrix of Design Thinking Cube; *Source: Author, 2024*

The classic design thinking method, image design, and the combination of design and science were all described. The thinking technique that blends design and science broadens the design process and allows for scientific evaluation.

MATRIX of Design Thinking	PRACTICAL PROBLEM	RADICAL PROBLEM	SYMBOLIC PROBLEM	FORMAL PROBLEM
REGULATION **LAWS OF KARANGANYAR REGENT NO. 13 YEAR 2008** **REGULATION OF THE MINISTER OF TOURISM OF THE REPUBLIC OF INDONESIA NUMBER 14 OF 2016** *Regent of Karanganyar Central Java Region Regulation*	**LAWS OF KARANGANYAR REGENT NO. 13 YEAR 2008** Guidelines for Determining Tourism Villages *Chapter 1 Verse 5 :* A tourism village is a form of integration between attractions, accommodation and supporting facilities in the area preserving the natural environment, ecosystems and cultural nodes traditional society with no inhibitions development of its citizens to improve welfare lives through a tourism business.	**REGULATION OF THE MINISTER OF TOURISM OF THE REPUBLIC OF INDONESIA NUMBER 14 OF 2016** Guidelines for Sustainable Tourism Destination *Chapter 2 Part D Verse 1 :* The established system, be it policy or local wisdom, in form of official or unofficial institution to reduce the negative potential disruption to the environment as impact of tourism development. Aside from that, the system also include prevention and solution to environmental damage	**REGULATION OF THE MINISTER OF TOURISM OF THE REPUBLIC OF INDONESIA NUMBER 14 OF 2016** Guidelines for Sustainable Tourism Destination *Chapter 1 Part A Verse 10 :* Cultural conservation means the cultural heritage which has character is the form of items, structures, sites, districts of cultural conservation on land and/or in the sea which need to preserved due to have main values to a history, science, religion and/or culture through decision-making process.	**REGULATION OF THE MINISTER OF TOURISM OF THE REPUBLIC OF INDONESIA NUMBER 14 OF 2016** Guidelines for Sustainable Tourism Destination *Chapter 1 Part A Verse 11 :* Preservation means a dynamic element, whereas every related part is functioning towards other parts and can also be referred as a holistic inseparable system of protection, development, and the utilization of a tourism destination.
USER *Locals and Tourists*	**Water Education** Creating a gathering space that could attract tourists to learn the essence of water, its profound connection to the local community, and why it should be preserved.	**Enhanced Experience** Tourists can enjoy a more authentic and immersive experience in destinations where the environment is protected and local cultures are respected, and the clear substance of water is visible, leading to a more meaningful travel experience.	**Environmental Connection** Establishing an environment where visitors have the opportunity to engage and connect with their surroundings, fostering a sense of belonging and deeper appreciation for the space.	**Spatial Integration** Crafting interconnected spaces with a diverse functions that is able to blend together, forming a new design elements that elevate the user experience to new levels of depth and immersion.
CLIENT *Water (Lake Madirda)*	Creating a space that enhances the surrounding water environment while ensuring minimal disruption to its existing conditions.	Designing an environment that prioritizes water-friendly principles, facilitating the free and unrestricted circulation of water throughout the area, promoting sustainability and harmony with the ecosystems.	Crafting architectural designs that not only reflect the deep-rooted history and vibrant culture of Berjo Village but also celebrate its harmonious connection with water, creating a deeper appreciation for the village's heritage and natural surroundings.	A tourism village is a form of integration between attractions, accommodation and supporting facilities in the area preserving the natural environment.
BUMDes of Berjo Village, Karanganyar	Developing a tourism area that boosts the economic opportunities for BUMDes of Berjo Village, helping to support the local community's financial well-being	Crafts an authentic and unparalleled tourist experience that stands apart from other tourism villages.		Establishing a versatile space that serves as a tourism destination, a water treatment facility, and a community hub, offering manifold benefits to both visitors and locals alike.
DESIGNER *The Architect*	Designing a multifunctional space that effectively meets the requirements of water management, tourism, and local community engagement.	Crafting a design that places water as its focal point, prioritizing its significance as the central element around which all other aspects revolve. This intentional focus on water serves as a guiding principle throughout the design process, influencing not only the physical layout but also the overarching philosophy and purpose of the space.	Forging a fresh and harmonious narrative rooted in the longstanding bond between the village and water, shaping a new chapter of history that celebrates their intrinsic connection and mutual influence.	Incorporating the concept of aquatic architecture to craft architecturally dynamic structures that beautifully capture the fluidity and essence of water, seamlessly embodying its shape, movement, and clarity to showcase the essence of water and its benefits to the ecosystem.

ORIGINALITY

The final project with the theme Water Education Tourism with Concept Based Design Strategy and Parametric Approach has never been initiated by any party. Several design project themes are quite related in terms of typology and the focus. The approach, as well as the design method is different from the final project proposed by the author. By making this final project report in order to avoid plagiarism of ideas, here are some related project references:

1. Sagan Community Centre Di Wilayah Gondokusuman (Water Conservation Sebagai Dasar Metode Perancangan)

Author : Dryo Ahmad Belanof
Institution : Universitas Islam Indonesia
Publication : 2017
Similarity : Water Conservation
Difference : Design Method, Building Function, Location

The similarity between these two projects lies in their shared focus on water conservation. Both aim to address the issue, albeit from different perspectives—one emphasizing the need to conserve water for residents, and the other aiming to raise awareness about the importance of water conservation. However, the projects has some differences in their design approach and building function. The Sagan Community Centre prioritizes community engagement, while the Hydroscape project centers on landscape integration.

2. Pengembangan Desain Fasilitas Perusahaan Air Minum di Buaran Jakarta Timur dengan Penerapan Water Gallery Center Berbasis Edukasi dan Rekreasi

Author : Widho Falen Kusuma
Institution : Universitas Islam Indonesia
Publication : 2016
Similarity : Water Treatment Facility, Water Education Center
Difference : Design Method, Location, Area Development

The similarity between these two projects lies in the facility, both serving as water galleries and education centers aimed at raising environmental awareness. Their shared goal is to enhance public sensitivity, awareness, and understanding of water-related processes. However, they differ in their approaches to achieving this objective. The Water Gallery Center employs a strategy that combines educational and recreational elements, focusing on both learning and enjoyment. In contrast, Hydroscape adopts a concept-based design strategy, which is thematic and immersive. While Hydroscape's approach overlaps with educational and recreational strategies, it stands out by emphasizing the creation of a cohesive and unified thematic experience.

3. Wahana Aquarium Sebagai Fasilitas Rekreasi dan Edukasi di Tepian Sungai Kapuas Zonasi Kehidupan Biota Air dan Analogi Shark Attack Sebagai Elemen Pembentuk Ruang dan Citra Bangunan

Author : Firli Fajarriadi
Institution : Universitas Islam Indonesia
Publication : 2004
Similarity : Water Education
Difference : Design Method, Location, Area Development, Building Function

The similarity between these two projects lies in their shared goal of raising public awareness about water. However, the contexts behind each initiative differ significantly. The Aquarium Center was established to address an ecological issue within the water ecosystem, stemming from a lack of understanding in landscape creation. The approach taken by the Aquarium Center is ecological, focusing on creating a space that showcases the biotic life within water ecosystems.

DESIGN PROBLEM STUDY

GENERAL PROBLEM

How can the design of Madirda Lake area with the concept-based design strategy, and parametric approach helps, and be effective in preventing future water problems in Berjo Village?

GOALS

- Designing a water-centric space that serves as a bridge between water and its inhabitants while offering advantages to both
- Preserving the water quality while preventing future problems of water pollution in the tourism area of Berjo Village
- Educating individuals about the importance, properties, and various aspects of water to enhance their understanding and awareness of this vital resource

PROBLEM STATEMENT

After analyzing the provided background information, various problem statements have been identified.

SPECIFIC PROBLEM

- How to create an area that can integrates between its function of water education, tourism, and water treatment facility?
- How to design a tourism area that can adapt as according to the waterflows without damaging the ecosystem?
- How to effectively organize and integrate the water education facility within the tourism area to ensure seamless coordination between its interactive exhibits and the operational requirements of the water treatment plant?

OBJECTIVE

Create an innovative water-centric space that seamlessy integrates with its environment, offering immersive educational experiences while proactively addressing the importance of water to people

DESIGN LIMITATION

- Using the Concept-Based Design Strategy allows the development of innovative designs,however the strategy itself has some risks such as subjectivity, and abstraction. Therefore it requires careful consideration of practical aspects, clear communication, and a balance between aesthetics and functionality.

- Priotizing its environment, the design is specifically created following the base site area of Madirda Lake, as a result this project may not be applicable to differing locations.

- The parametric design approach, using algorithms to generate complex forms, offers creativity and efficiency but comes with limitations. It can be time-consuming, risk over-complication, and may underperform in some areas. Careful consideration is needed to balance the benefits of automation with practical and creative design aspects.

DESIGN APPROACH

2.1 Concept-based Design Framework

2.2 Hydrosocial Values of Berjo Village

- Social
- Cultural
- Technical

2.3 “Design Hyphothesis”

2.4 Exploring Design Criteria : Precedent Study

- Water as Conservation
- Water as Education
- Water as Form Inspiration
- Water as Tourism Attraction

2.5 Design Criteria

CULTURAL

HYDROSOCIAL CYCLE

SOCIAL

TECHNOLOGY

Exploratory THINKING

What will characterize or drive the formation of the architecure proposal?

Hydroscape

BERJÒ

Concept-Based Design Framework

DESIGN HYPHOTHESIS

DESIGN CRITERIA EXPLORATION

- Water as Conservation
- Water as Education
- Water as Form
- Water as Attraction

DESIGN CRITERIA

Evaluative THINKING

How might those be considered as a single idea, primary forces or analogical information?

Exploratory/ Evaluative THINKING

What are the elements needed to achieve the idea, analogy, or principle?

CONCEPT-BASED DESIGN FRAMEWORK

The Concept-based Design Framework is a design approach that involves several steps in order to create a complete design. It considers various perspectives, including social, cultural, and technical factors, which are then integrated to form a cohesive hypothesis. This framework has been selected as the foundational approach for this project to improve comprehension of the design process and provide a clearer explanation of design thinking.

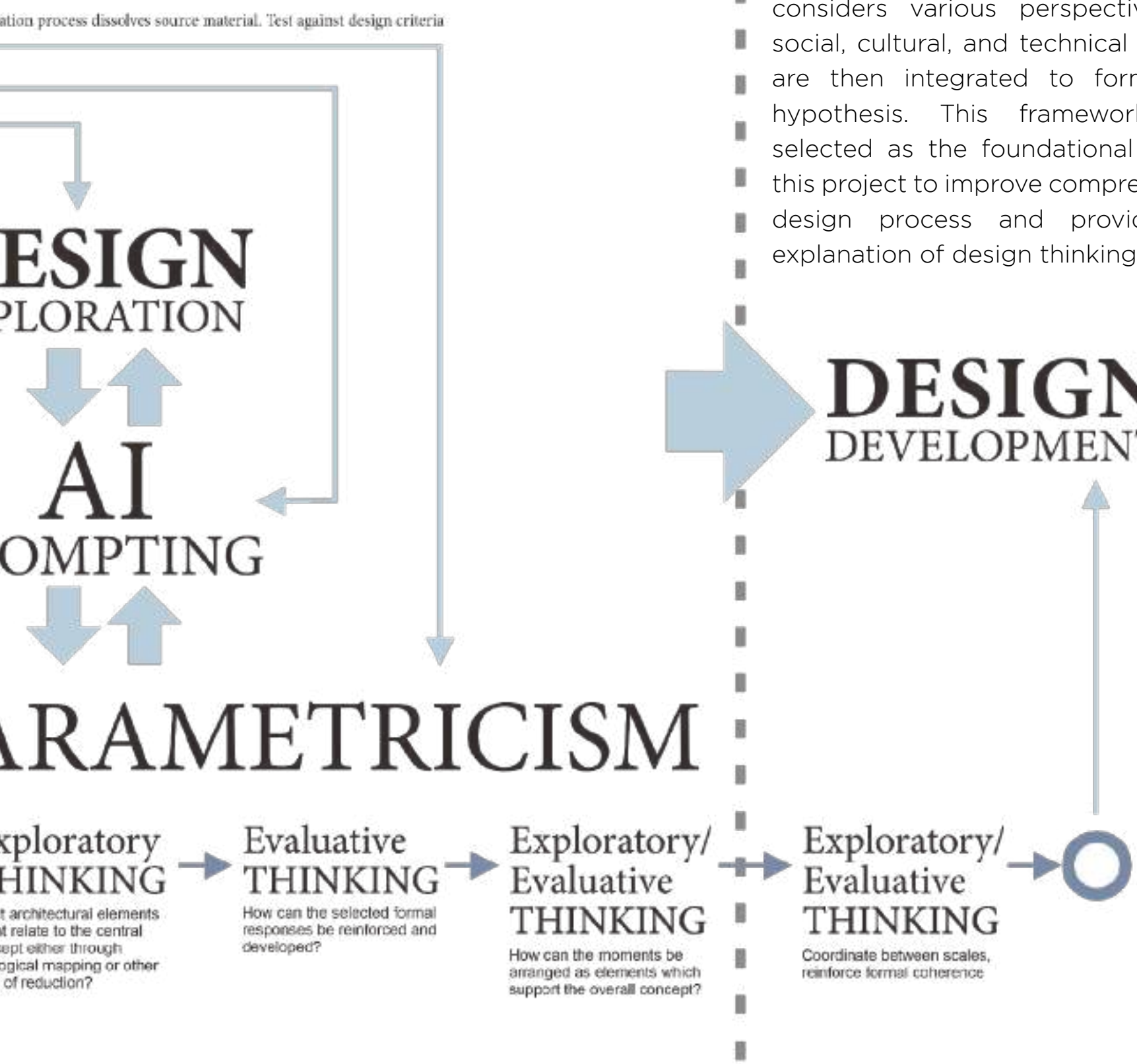


Figure 2.1 Concept-Based Design Framework; *Source: Author, 2024*

HYDROSOCIAL CYCLE

Of Berjo Village



SOCIAL

Water as a social construct focuses on how people and institutions affect how we manage water. Water, considered as a social construct, presents opportunities for establishing connections with other parties to foster collaboration, thereby contributing to the profitability of the community. The natural resource of water can facilitate numerous partnerships aimed at advancing the concept of water conservation. These partnerships may involve collaboration among esteemed players in the water industry, international organizations, and the local community itself, all working towards the shared objectives of conserving and effectively managing the water source, while also deriving economic benefits from these endeavors.

Contextualization
In order to bring this idea into realization, some collaborations are needed, such as:

Water Industry Professional as Key Partner

AQUA

Offers financial support or in-kind contributions such as equipment and facilities for educational purposes, which will be beneficial to both parties.

Government of Berjo Village

Acts as the regulators of the idea. Promote water-saving practices through regulations, incentives, and awareness campaigns.

UNESCO's *International Initiative on Water Quality* ***(IIWQ)***

IIWQ aims to improve the knowledge base on water quality, particularly in developing countries, for its economic, social, and ecological benefits

Madirda Lake's Community ***(Paguyuban Telaga Madirda)***

The local communities that would take care of the facilities, and ensuring its functionalities.



Water as a cultural construct is the idea that water is not only a natural resource or a physical substance, but also a product of human meanings, values, practices, and institutions. Water as a cultural construct reflects how different societies perceive, use, manage, and relate to water in various ways, depending on their historical, geographical, ecological, political, economic, and religious contexts. Water as a cultural construct also implies that water is not a fixed or static entity, but rather a dynamic and contested one, that can change over time and space, and that can be influenced by human actions and interactions.

The lake and the river's cultural values are deeply rooted in the practices and livelihoods of the local communities, such as its agriculture. Whereas the local communities regularly use the natural water source as irrigation for their fields. This also impacts how the community has developed norms that respect and protect the water resources, such as avoiding pollution, over-exploitation, and waste. The community also has a rich oral tradition that narrates the history and legends of the lake and the river, and that transmits the knowledge and wisdom of water management to the younger generations.



Water as a technical construct refers to the material and technological aspects that enable and constrain water flows and access. It includes aspects such as water infrastructure, water engineering, water measurement, and water innovation. The technical category analyzes how water is controlled, regulated, and manipulated by various devices, systems, and techniques, and how it affects and is affected by environmental conditions, processes, and changes.

In the case of Berjo Village, the technical aspect can be observed in their management of irrigation required for agriculture. Additionally, the lake serves as a source of mineral water, where a reverse osmosis machine is employed to purify the water for consumption. This means that both traditional and modern technologies are used to manage the water use in the area.

Figure 2.2 HydroSocial Cycle of Berjo Village; *Source: Author, 2024*

DESIGN HYPHOTHESIS

In the case of Berjo village in Ngargoyoso district, Karanganyar regency, water is an integral part of the local culture and livelihoods, as it is used for domestic, agricultural, religious, and recreational purposes. Water is also a source of pride and identity for the villagers, as they have developed various institutions to protect and manage their water resources. Water is also a potential asset for the development of environmentally-minded tourism, as the village has a scenic landscape and rich biodiversity.

However, water is also a source of challenges and conflicts, as the village faces various threats, such as deforestation, pollution, climate change, and external interventions, that may affect the quantity and quality of their water resources, and their access and rights to water. Therefore, it is hypothesized that an enhanced understanding among people regarding the essence of water, encompassing its technical, social, and cultural dimensions, will lead to heightened awareness and appreciation of its values. This, in turn, is expected to foster a better approach to water resource management, incorporating traditional knowledge, community practices, and adaptive strategies, thus propagating the idea of sustainable development.

Education tourism, also known as educational tourism or edutourism, refers to a form of travel where individuals or groups visit destinations primarily to gain knowledge, skills, or experiences related to educational or learning purposes. This type of tourism often involves visits to educational institutions, cultural sites, museums, historical landmarks, workshops, or immersive learning experiences in various fields such as history, science, culture, language, or arts. Education tourism aims to combine leisure travel with educational opportunities, providing participants with enriching experiences and deeper insights into the destination's heritage, traditions, and learning resources.

In developing the tourist village, a key focus will be on ensuring that each destination offers educational value to visitors, enriching their experience with knowledge about the concept of water, and its values to the environment. This educational aspect could be presented through various means such as dedicated rooms, installations, or objects. Telaga Madirda, which is famous for its water springs, could turn its water filtration technology used to produce bottled drinking water from the lake as an attraction for visitors.

By focusing on the most educational values presented in Telaga Madirda, the broad outline would be to create a water education architecture which would be a comprehensive framework designed to educate individuals and communities about various aspects of water, including conservation, management, pollution prevention, and sustainability, while also intimacy between the visitor and water, providing comfort, uniqueness, as well as the place’s charms to keep the visitors interested, and educated.

2.3 Exploring Design Criteria:

Precedent Study



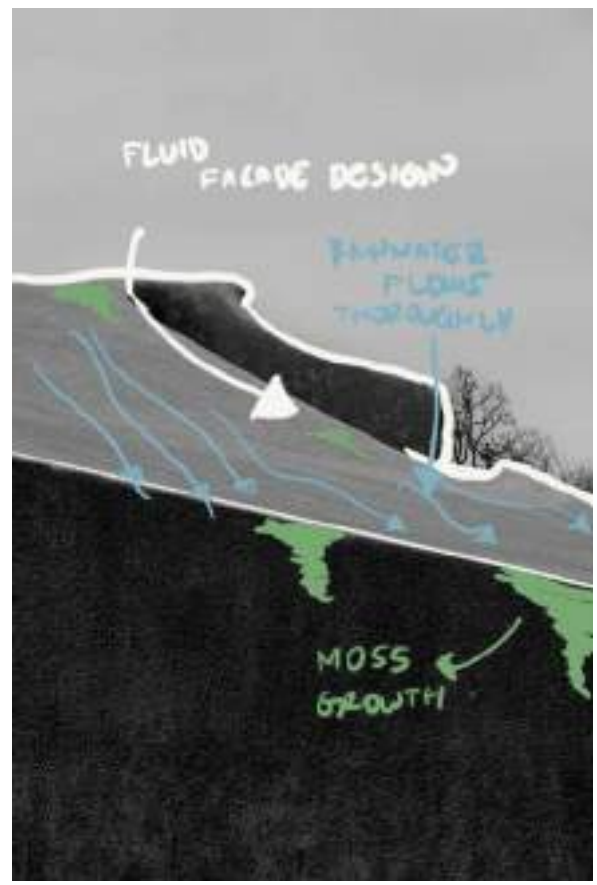
Water as

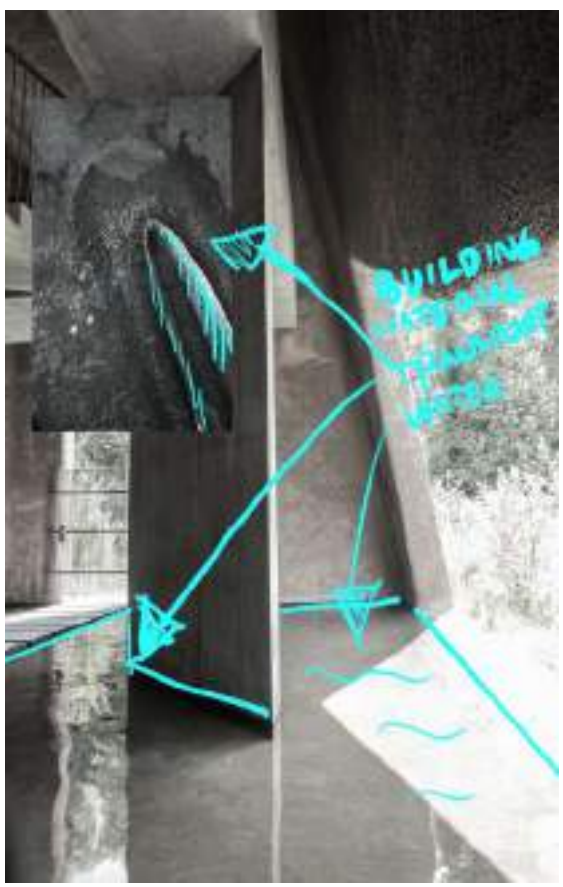
Conservation

Arranged between a forest and industrial parks, this extend incorporates an instructive region outlined to clarify the complex decontamination prepare in a pushed environment. The drinking water treatment plant points to ended up a modern point of interest for Muttenz and the Basel zone. The architecture's reason is to put through cutting-edge innovation with the normal environment and highlight the centrality of the refinement handle. The building is settled in a lavish green timberland by the waterway Rhine, and this differentiate between the characteristic and mechanical environment is reflected in its plan. The plant employments a **state-of-the-art, three-phase process to supply the most elevated quality water to Muttenz inhabitants.**

A open space permits guests to explore the perplexing process and celebrate water through all their senses. The instructive involvement is improved by a spatial narrative that guides them through diverse zones and stages of the method. A central open stage serves as a gathering space and introduction arrange. This room, open to the exterior, sits on a water pool, reflecting sunshine and collecting water from the roof. Depending on the time and season, the space can feel damp, cold, and supernatural, permitting guests to involvement water in different ways. The differentiating components of the environment are energetically coordinates into the building's façade, which is made from shotcrete blended with nearby clay. This fabric gives the façade a special surface, with water streaming down and advancing greenery development, persistently **changing the building's appearance and mixing it with its environment.** The structure maintains a steady discourse with the scene, built in agreement with nature instead of ruling it.







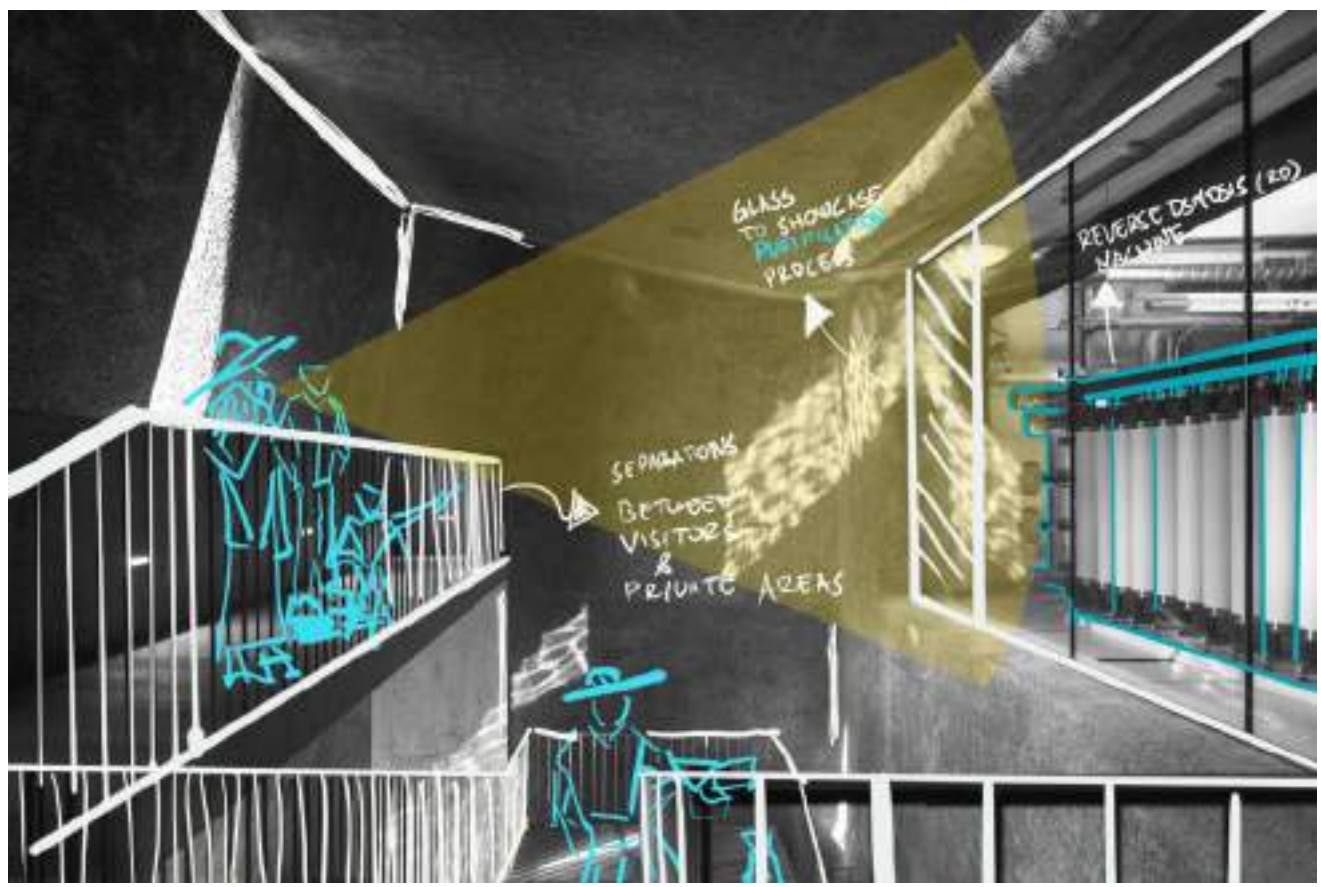


Figure 2.3 Muttenz Water Purification Plant / Oppenheim Architecture + Design; *Source: Archdaily; https://www.archdaily.com/918824/muttenz-water-purification-plant-oppenheim-architecture-plus-design*

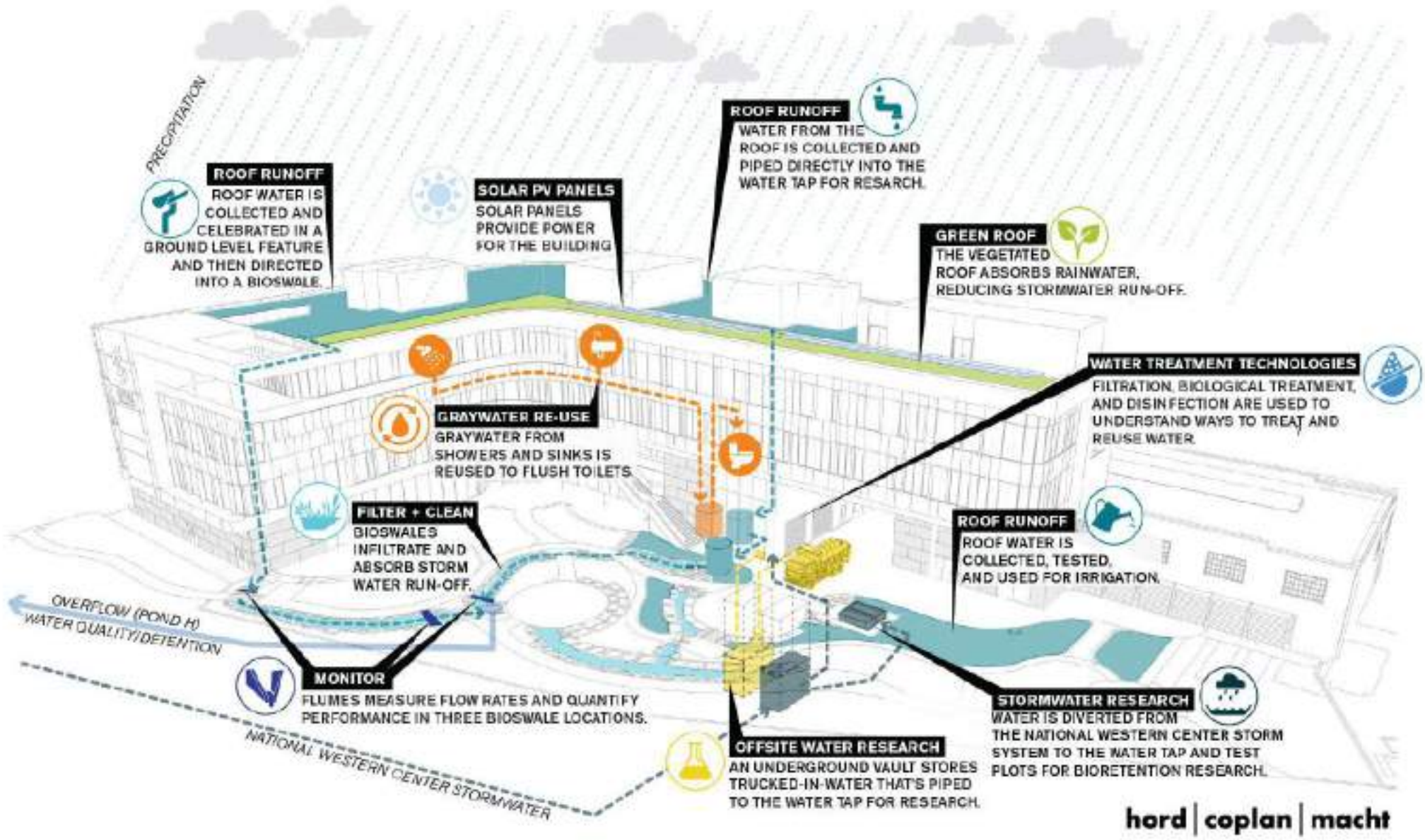
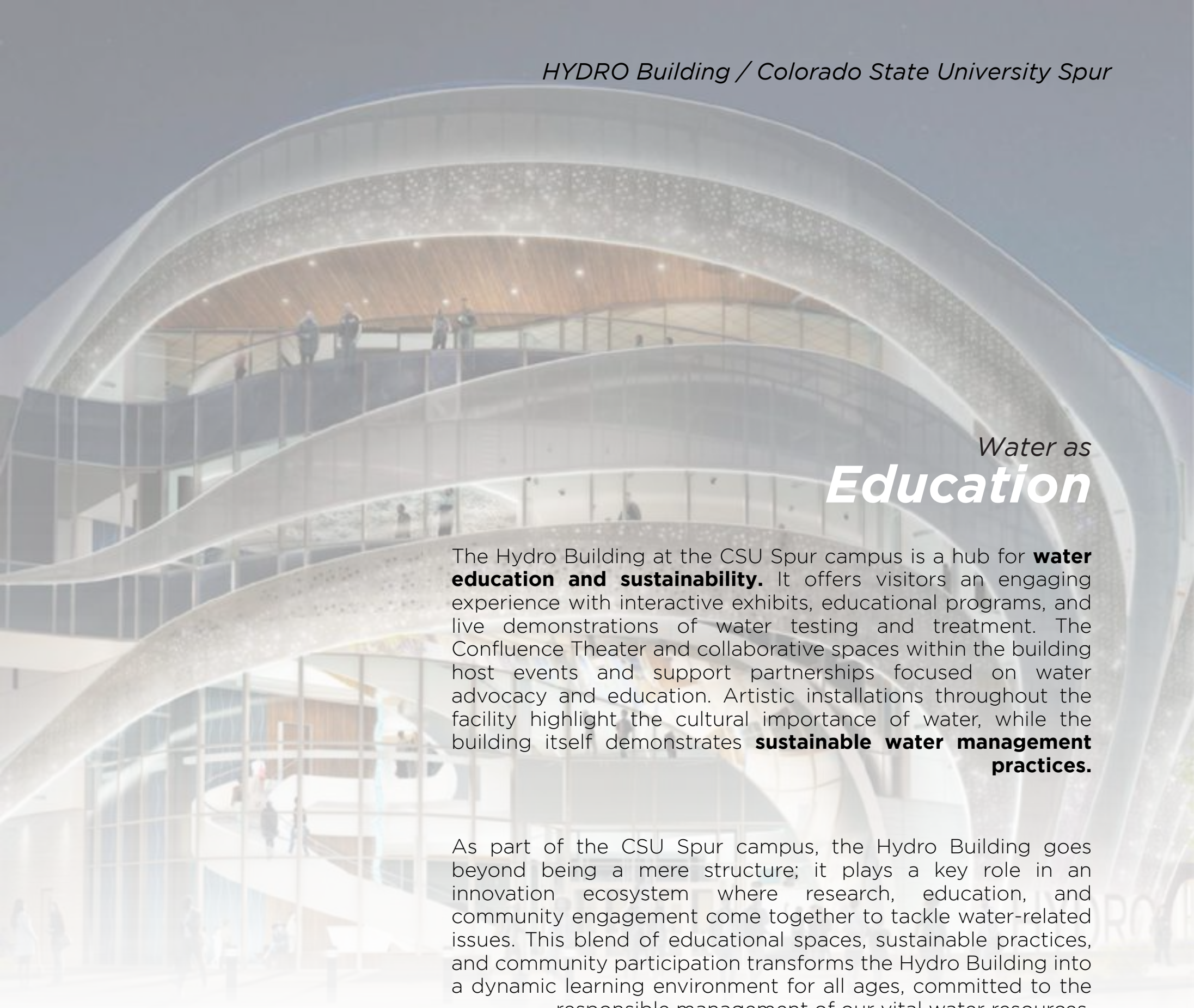


Figure 2.4 HYDRO Building/CSU Spur - Building as part of its education exhibit; Source: Archdaily; *https://archello.com/news/hydro-building-where-water-innovation-and-education-flow-together*



Water as

Education

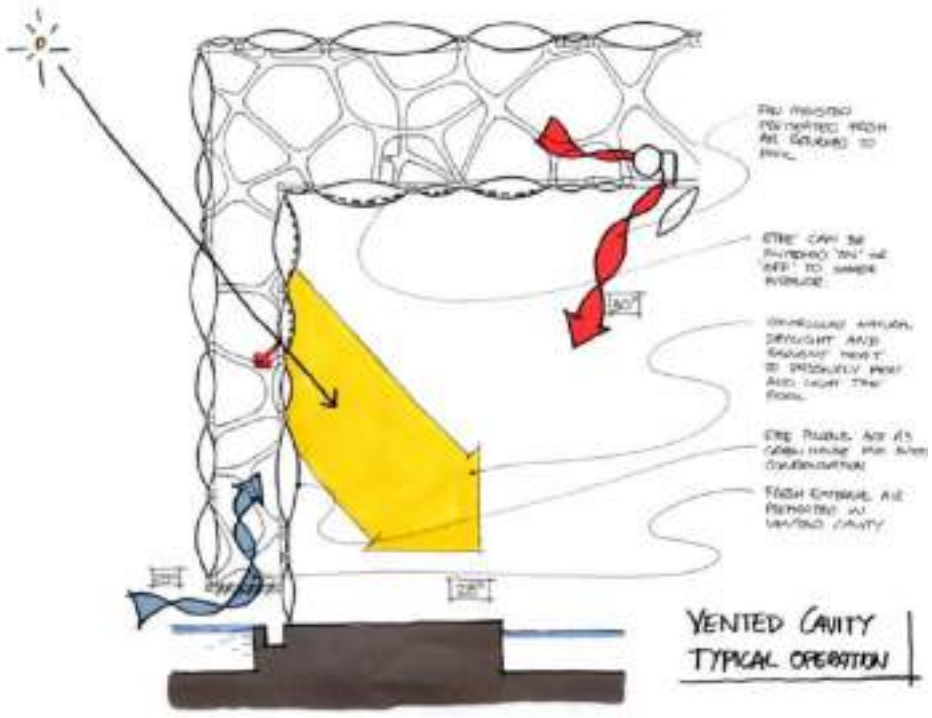
The Hydro Building at the CSU Spur campus is a hub for **water education and sustainability.** It offers visitors an engaging experience with interactive exhibits, educational programs, and live demonstrations of water testing and treatment. The Confluence Theater and collaborative spaces within the building host events and support partnerships focused on water advocacy and education. Artistic installations throughout the facility highlight the cultural importance of water, while the building itself demonstrates **sustainable water management practices.**

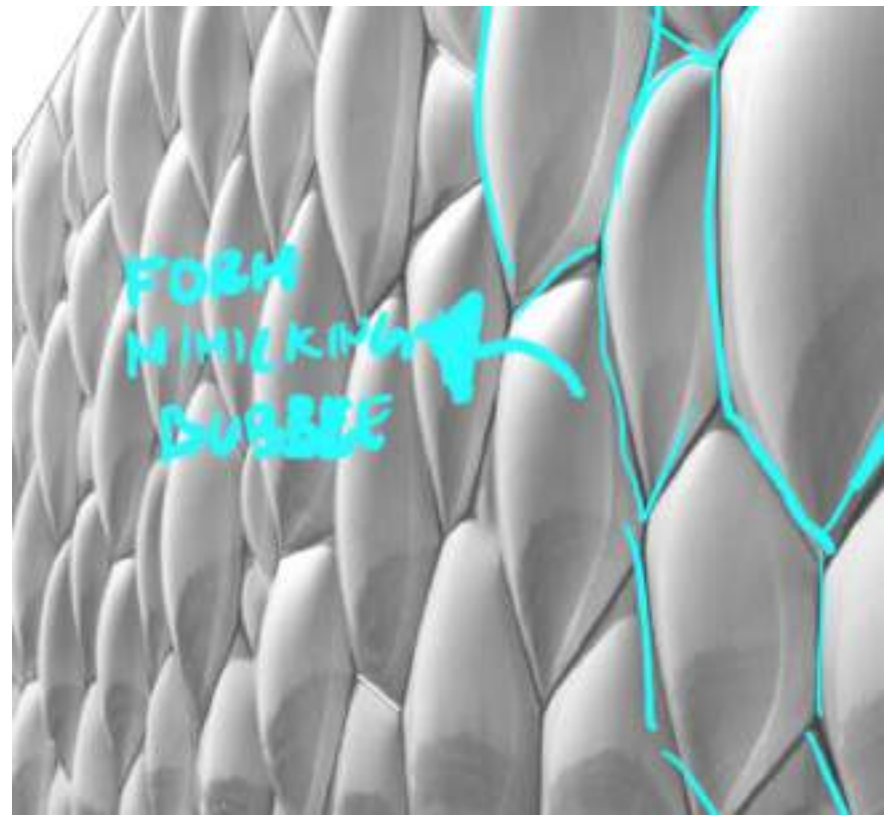
As part of the CSU Spur campus, the Hydro Building goes beyond being a mere structure; it plays a key role in an innovation ecosystem where research, education, and community engagement come together to tackle water-related issues. This blend of educational spaces, sustainable practices, and community participation transforms the Hydro Building into a dynamic learning environment for all ages, committed to the responsible management of our vital water resources.

Water as
Motive

The design incorporates advanced technology and materials to create a building that is **not only visually impressive but also energy-efficient and environmentally sustainable.** The unique "Watercube" structure maximizes energy efficiency by utilizing natural light and solar energy to heat both the interior spaces and the pools. The concept draws inspiration from the appearance of water bubbles and the square, a fundamental shape in Chinese culture that represents the home. Given Beijing's limited water resources, a building that symbolizes water has significant importance to the city's residents. The design skillfully combines intricate structural elements with a straightforward overall form.

The building's exterior is made of a transparent double-layer ETFE (ethylene-tetrafluoroethylene) cushion system, which resembles bubbles and provides excellent thermal efficiency.





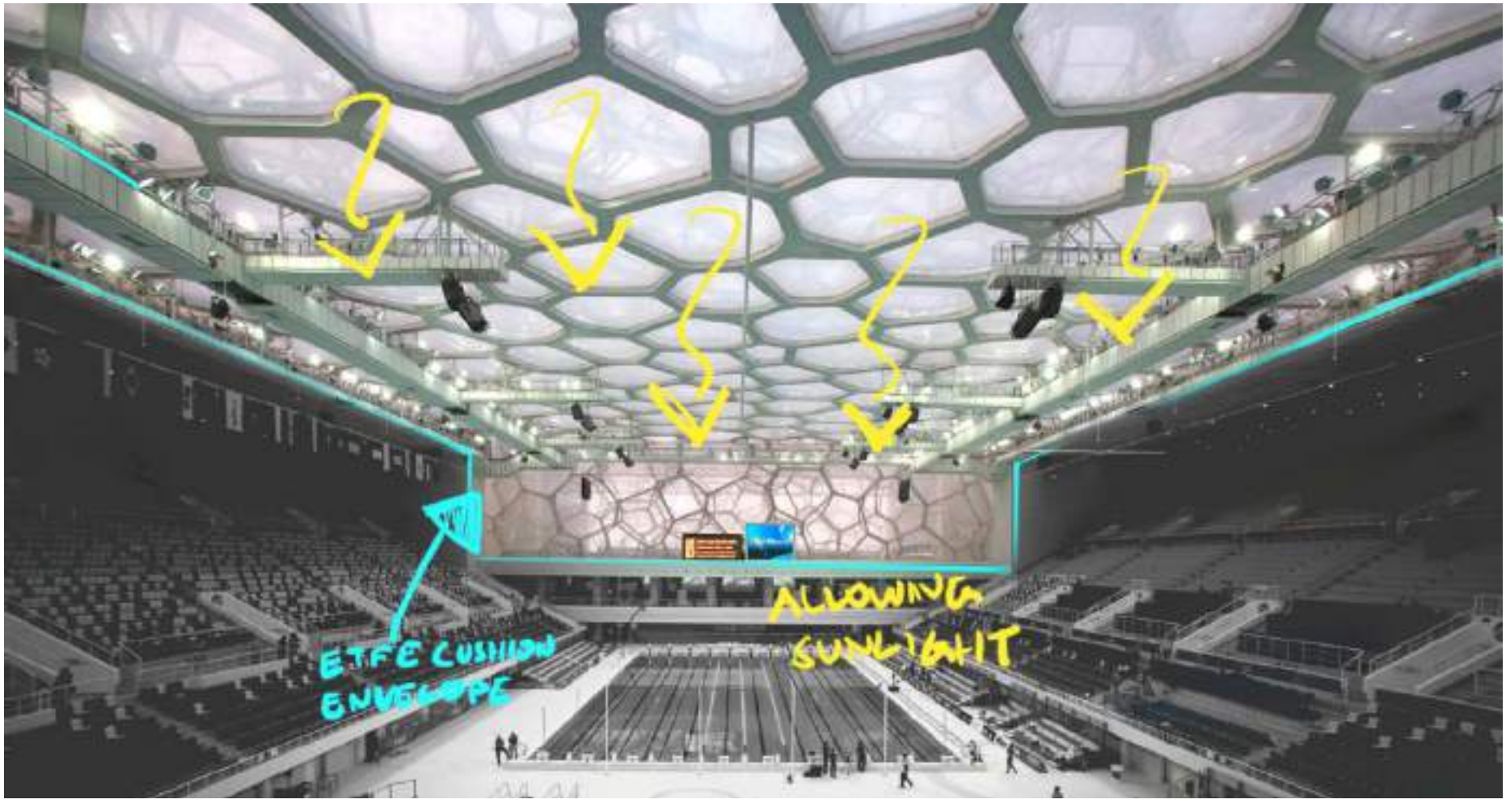
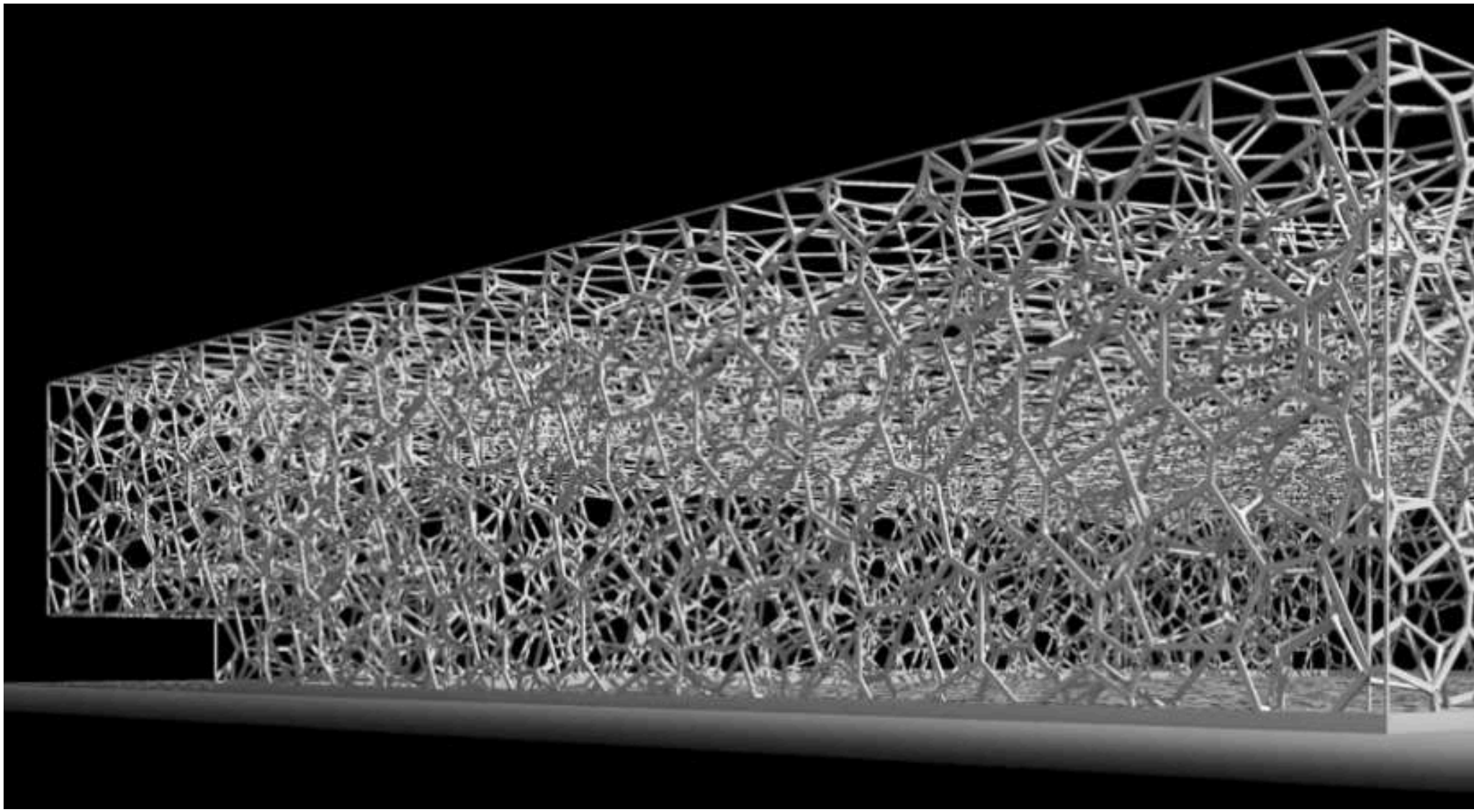
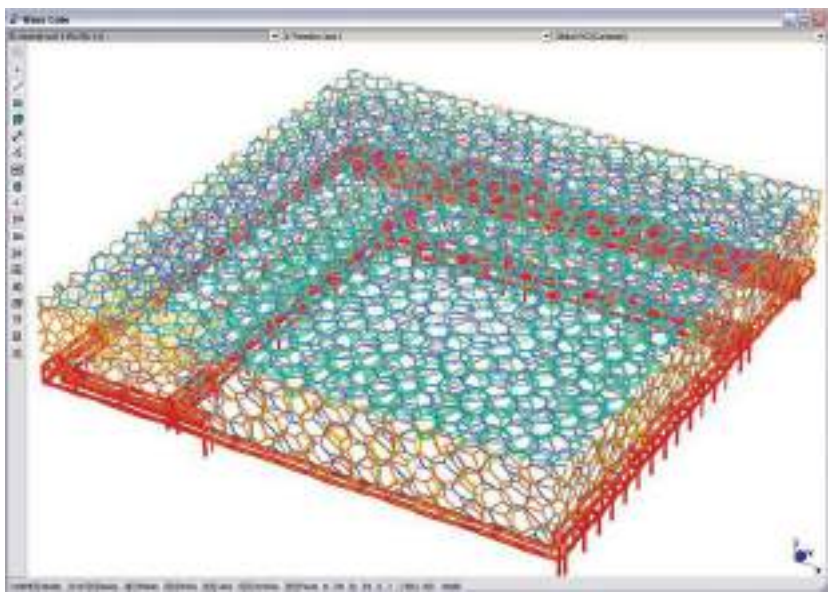


Figure 2.5 Watercube National Swimming Centre / PTW Architects; Source: Dezeen; https://www.dezeen.com/2008/02/06/watercube-by-chris-bosse/





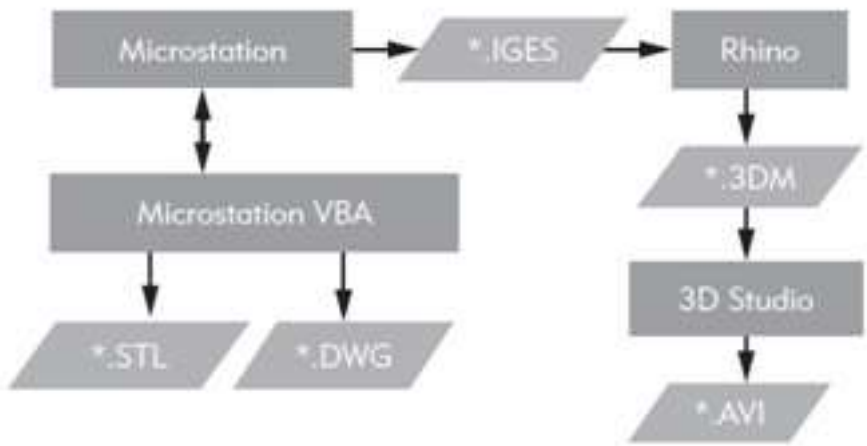
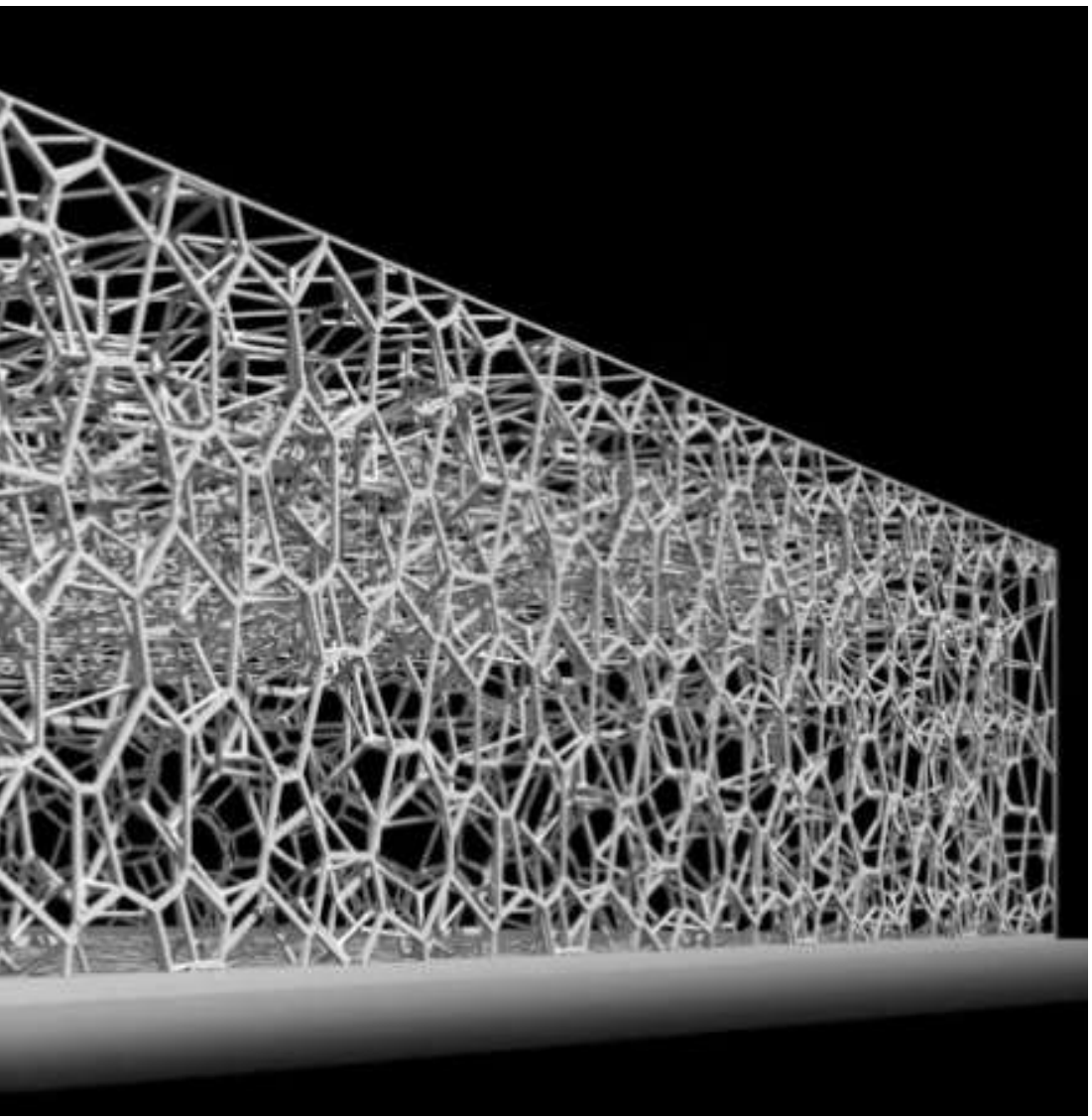
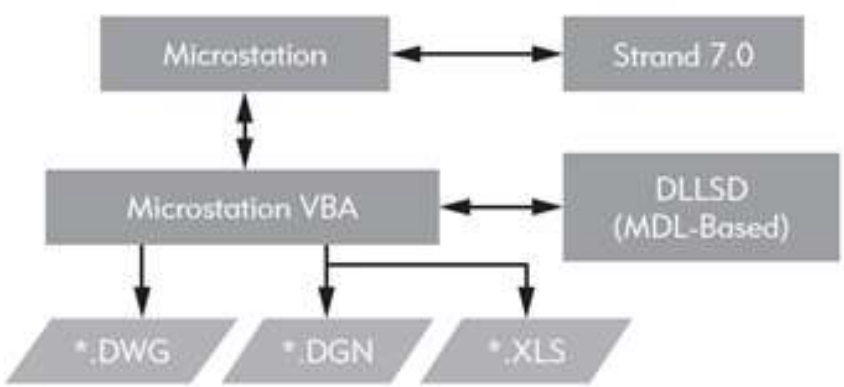


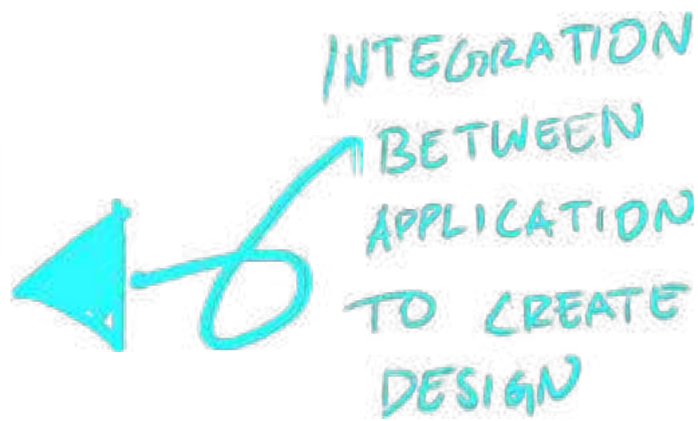
Figure 2.6 BIM AND SCRIPTING : BEIJING NATIONAL AQUATICS CENTER ; Source: *https://yeswebim.wordpress.com/2015/04/13/bim-and-scripting-beijing-national-aquatics-center/*



Watercube National Swimming Centre

BIM and Scripting





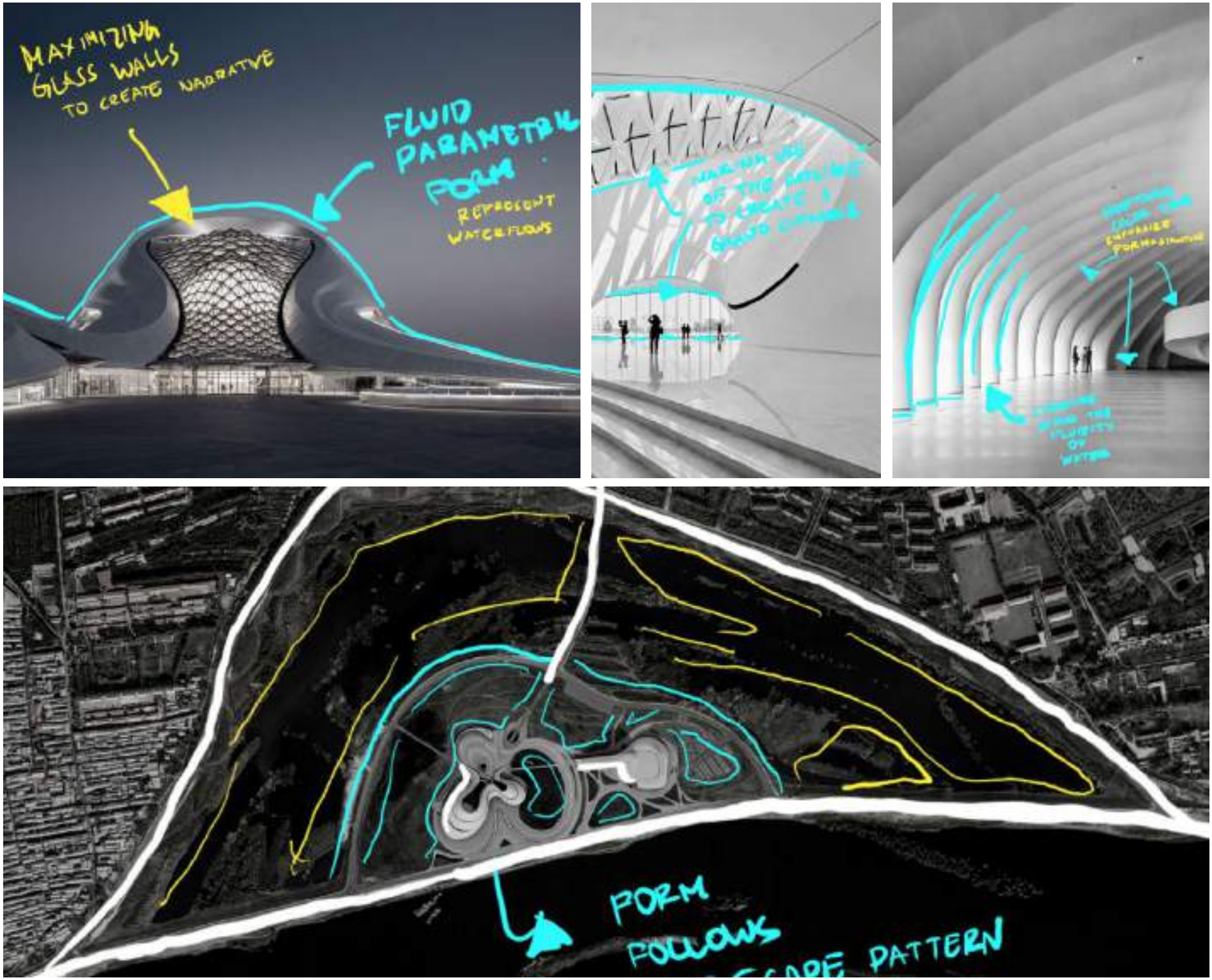
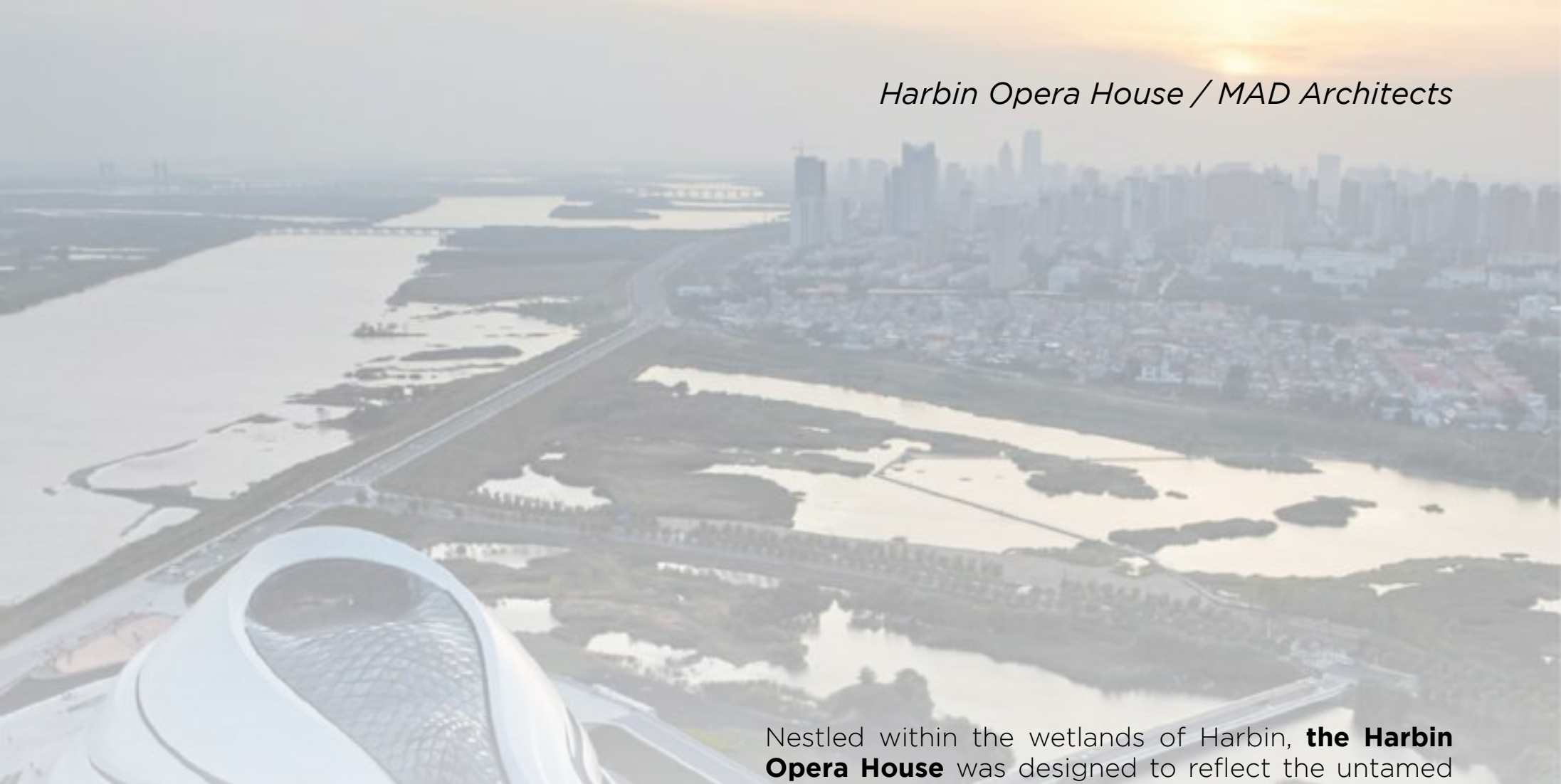


Figure 2.7 Harbin Opera House / MADArchitects ; Source: Archdaily; *https://www.archdaily.com/778933/harbin-opera-house-mad-architects*

Harbin Opera House / MAD Architects



Nestled within the wetlands of Harbin, **the Harbin Opera House** was designed to reflect the untamed wilderness and cold climate of the northern city. The building appears as though it was sculpted by natural forces like wind and water, harmoniously integrating with the landscape and terrain.

The architectural journey through the building creates a narrative that transforms visitors into active participants. Upon entering the expansive lobby, visitors are greeted by large transparent glass walls that connect the curvilinear interior with the sweeping exterior and plaza. A striking glass curtain wall, supported by a lightweight diagrid structure, soars above the lobby.

Going beyond the traditional opera house design, MAD Architects crafted a building inspired by nature, infused with local culture, and rich in artistic expression. The Harbin Opera House enhances the public's emotional connection to the environment, creating a theatrical experience both through its spatial narrative and its **integration with the surrounding landscape.**

Water as

Attraction

The Sea Organ is an architectural structure and an experimental musical instrument located on the western coast of the Zadar peninsula in Croatia. It consists of a series of pipes beneath large marble steps, where sea waves create air pressure, resulting in random yet harmoniously arranged tones.

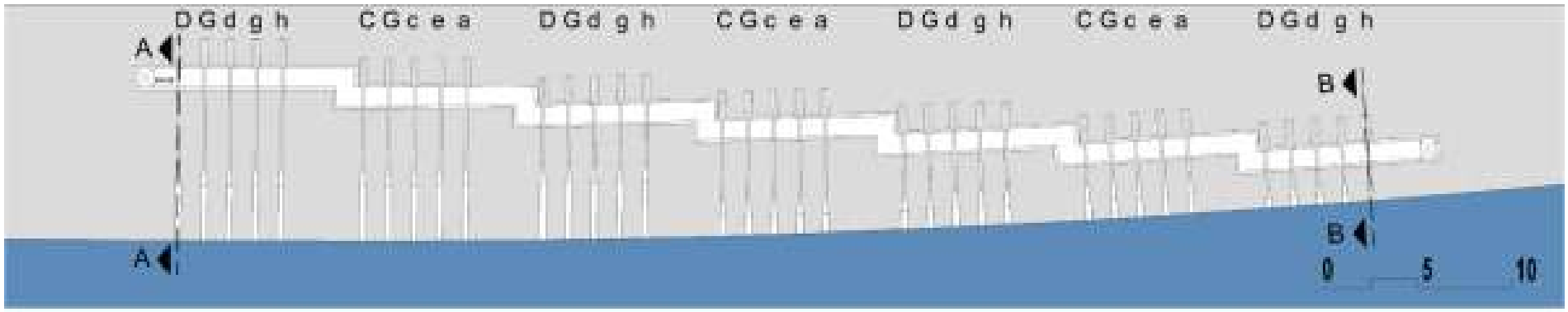
Technical Details

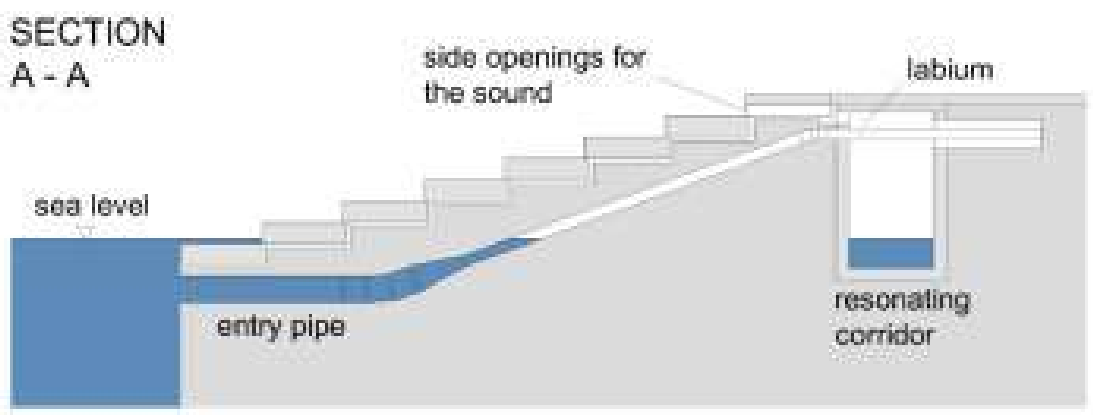
The organ studio "Heferer" provided calculations for the flutes (the slits that produce the sound). Due to concerns about corrosion potentially damaging the flutes, initial considerations involved using ociten tubes. However, because ociten is thermally unstable and unsuitable for maintaining the sound quality at the labium (the mouthpiece), Goran Jezina proposed using ociten tubes in the system and stainless steel for the flutes themselves, which can be finely tuned and processed.

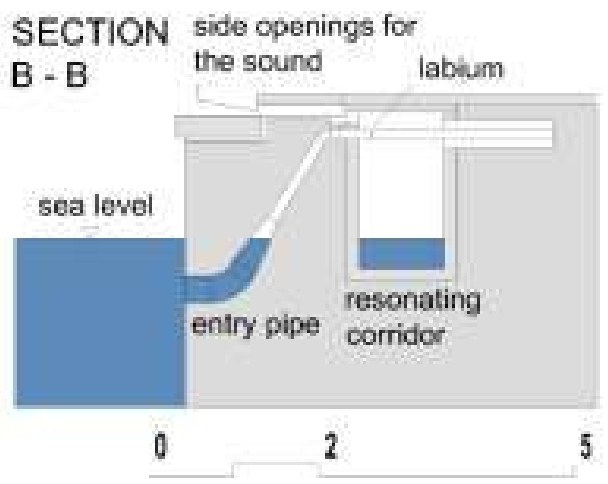
Musical Aspect

Acoustician and musician Ivica Stamac arranged seven sound clusters based on two major chords (G and C6) that alternate in sequence. The selection of tones and chords was influenced by the musical structure of traditional klapa songs.

Figure 2.8 The Sea Organ; Source: Architectuul; *https://architectuul.com/architecture/the-sea-organ*







Cross section of "The Sea Organ" showcasing how water can be utilized to produce sounds



Water as

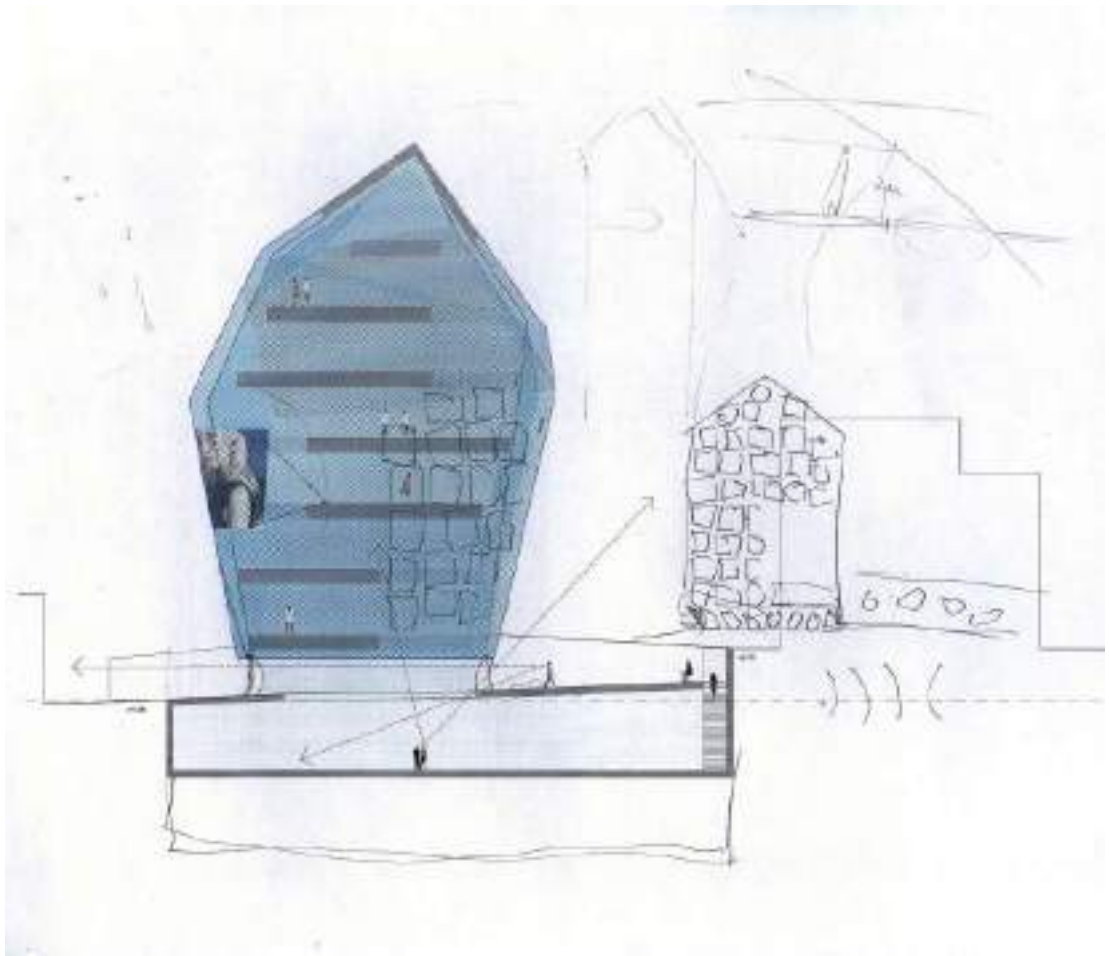
Structural Pattern

The Prada Aoyama Building in Tokyo, designed by Herzog & de Meuron and completed in 2003, is an excellent precedent for a building that follows a structural pattern due to its innovative use of geometry, material, and structural logic.The Prada Aoyama Building in Tokyo, designed by Herzog & de Meuron and completed in 2003, is an excellent precedent for a building that follows a structural pattern due to its innovative use of geometry, material, and structural logic.

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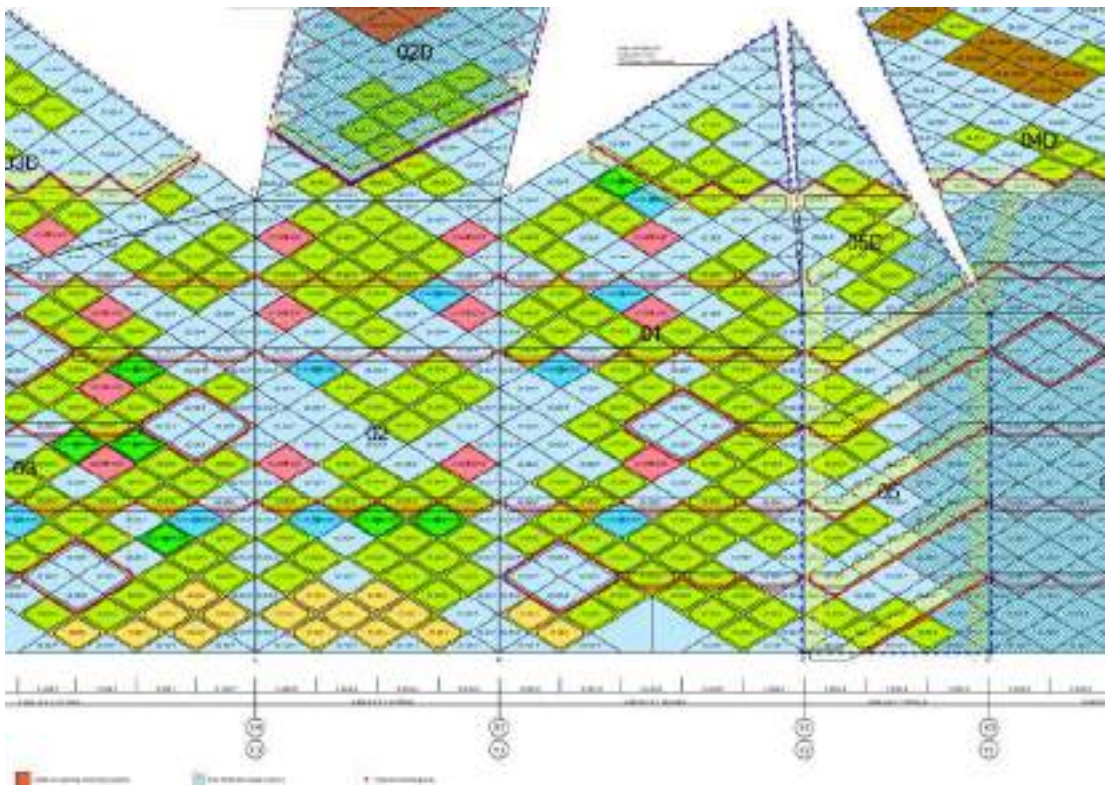


Figure 2.9 178 Prada Aoyama; Tokyo, Japan; *Source: Archdaily; https://www.archdaily.com/918824/muttenz-water-purification-plant-oppenheim-architecture-plus-design*

2.5 Design Criteria

What	How	Value
Alternative 1 **Hydro-Treatment Center** A Building designed to serve as a state-of-the-art water treatment facility for harnessing the pristine waters flowing from natural springs.	The concept of a water treatment building consisting of facilities that are needed in order to treat the water. This facility uses the natural flow of water as part of its treatment process. Water flowing towards the building undergoes a series of treatments, culminating in final treatment procedures within the confines of the facility. Through this integrated approach, the facility not only optimizes the treatment process but also maximizes the efficiency of utilizing natural water resources, ensuring the delivery of clean and safe water for various purposes.	Provide essential services related to water treatment, and conservation. Ensures the purification and treatment of water, making it safe for consumption and other uses, thereby addressing public health concerns related to waterborne diseases.
Alternative 2 **Water Education Hub** A facility that serves as a central hub for learning, awareness, and engagement regarding water-related issues.	Provides a platform for educational programs, interactive exhibits, workshops, and community events focused on topics such as water conservation, pollution prevention, watershed management, and sustainable water use practices.	Fostering knowledge, awareness, and action regarding water-related issues. The value extends to encompass awareness building, behavior change, empowerment, youth engagement, collaboration, policy influence, and resilience building, making it a crucial asset for promoting water security, sustainability, and resilience in communities.
Alternative 3 **Eco-Tourism Park** Designated landscape area of land that is managed to preserve and protect natural ecosystems while also providing recreational opportunities for visitors.	Establishes a dedicated landscape area committed to conserving the natural environment. The landscape design harmonizes seamlessly with the existing natural surroundings, ensuring minimal disruption and instead, actively contributing to its enhancement.	Multifaceted contributions to environmental conservation, recreation, and community well-being. Promoting sustainable development and enhancing quality of life in communities.
Accumulation of 3 **Hydroscape Communal Center** A multifunctional complex integrating a state-of-the-art water treatment facility harnessing pristine waters from natural springs,a central hub for water education, and a designated landscape area preserving natural ecosystems while offering recreational opportunities for visitors.	Employing parametric design principles to seamlessly integrate with the surrounding natural environment, including waterways and vegetation patterns, while also establishing an educational facility where visitors can immerse themselves in the authentic essence of water.	Integration of space, benefitting both people and nature. This innovative center creates interaction within a carefully crafted environment that harmonizes with its surroundings. By incorporating essential facilities, it not only facilitates human activities but also serves a crucial role in preserving and enhancing the water circulation within the area. The Hydroscape Communal Center promotes environmental stewardship, community engagement, and sustainable water management practices, thus enriching the well-being of individuals and the vitality of the ecosystem.

Figure 2.9 Building Typology Analysis; *Source: Author, 2024*

Clay (3D Printed) / Shotcrete coated

Clay has been a staple in construction for centuries due to its wide availability, versatility, and natural attributes. This fine-grained material can be easily molded when wet and hardens upon drying or firing. The capability to 3D print clay allows for the creation of smooth, fluid forms.

Shotcrete involves projecting concrete at high speeds onto surfaces, particularly vertical or overhead ones. When appropriately designed, mixed, and applied, shotcrete is effective in various construction applications, including water treatment. One of its key benefits is the ability to create detailed shapes and structures that are difficult with conventional concrete, making it ideal for complex architectural designs.

In this scenario, combining clay with shotcrete will produce a robust structure characterized by fluid forms and a striking aesthetic. Although these materials can encourage moss growth, this feature can actually enhance the structure's appearance, allowing it to blend more harmoniously with its natural environment.

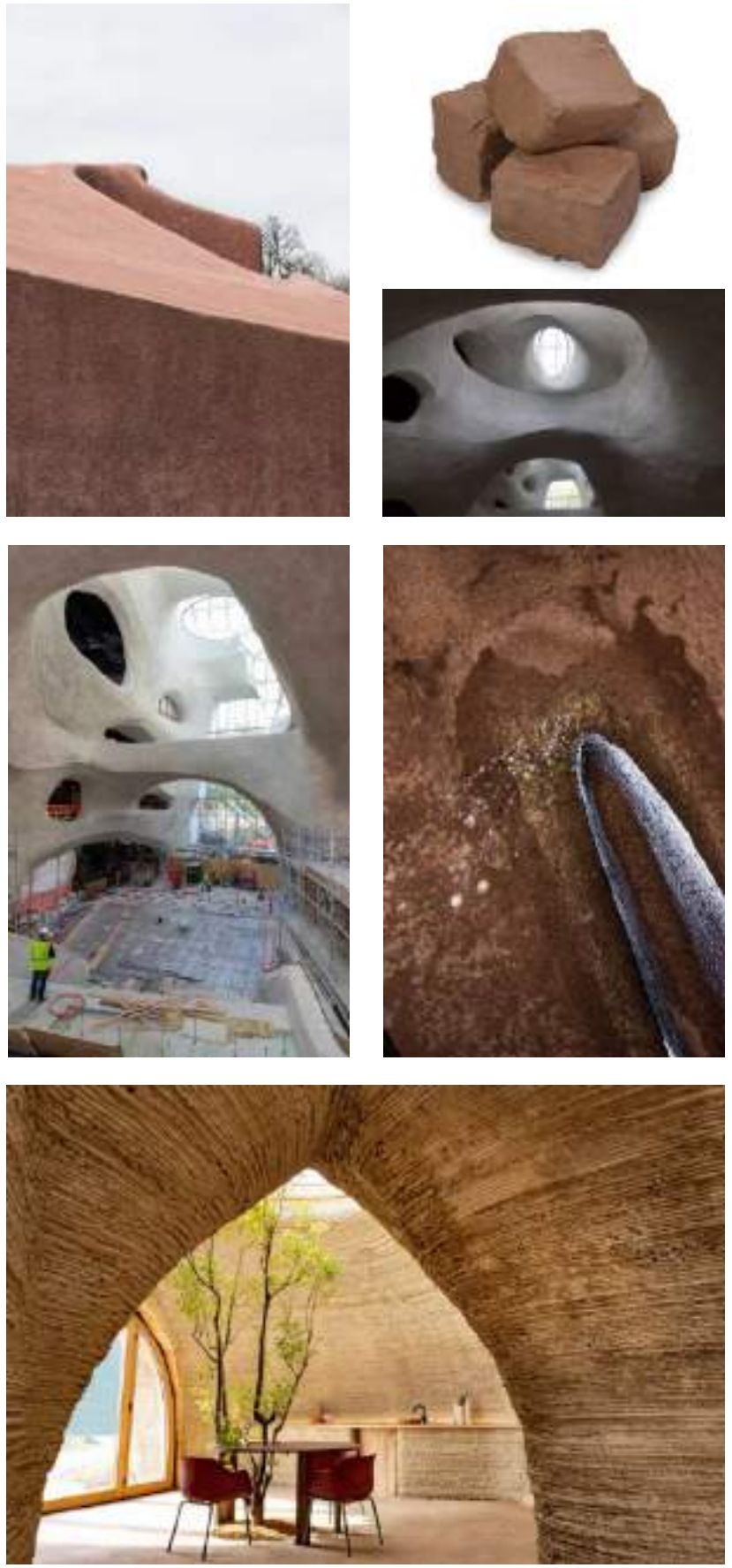


Figure 2.10 Clay / Shotcrete Building Material; *Source: Google, 2024*

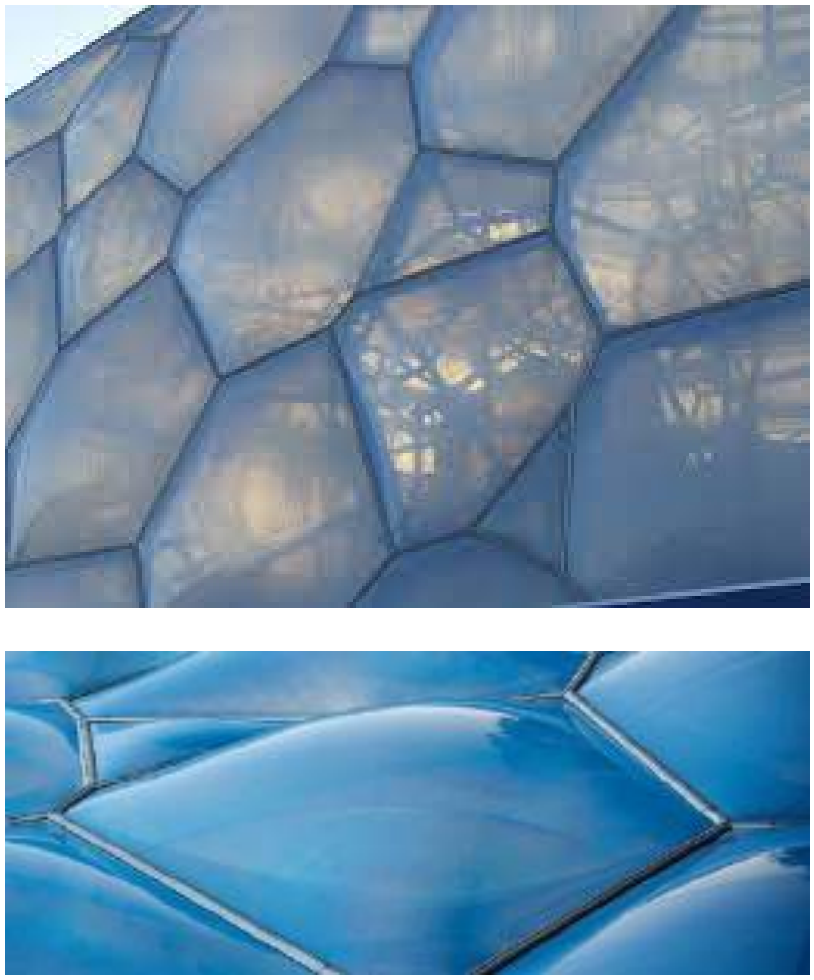


Figure 2.11 Transparent Dual-ETFE cushion envelope; *Source: Google, 2024*

Transparent Dual-ETFE cushion envelope

Transparent dual-ETFE (Ethylene Tetrafluoroethylene) cushion envelopes are a high-performance building material used for cladding systems in modern architecture. ETFE is a type of fluoropolymer, which is a class of plastics offering high corrosion resistance and strength over a wide temperature range. The dual-ETFE cushion envelope typically consists of multiple layers of ETFE film that are pneumatically stabilized and fixed by an aluminum profile system.

Transparency: ETFE cushions offer exceptional clarity, allowing for superior natural light transmission. This transparency is consistent across the entire solar spectrum, making ETFE ideal for settings where natural light is essential, such as in enclosed spaces or biospheres.

Structural Performance: ETFE's high tensile strength and flexibility make it a robust building material. It supports the construction of lightweight yet durable roofing and façade systems.

Design Flexibility: ETFE's adaptability allows for the design of unique and dynamic shapes, particularly in large-span structures. Additionally, it can be customized with patterns to diffuse light and provide sun protection, enhancing both functionality and visual appeal.

Maintenance and Durability: ETFE's self-cleaning properties minimize maintenance, and its durability ensures a long lifespan, often exceeding 25 years.

ETFE is an excellent material choice for creating aesthetically pleasing environments that emphasize sustainability. Its transparency and lightness facilitate natural lighting, which helps reduce dependence on artificial lighting and promotes energy efficiency.

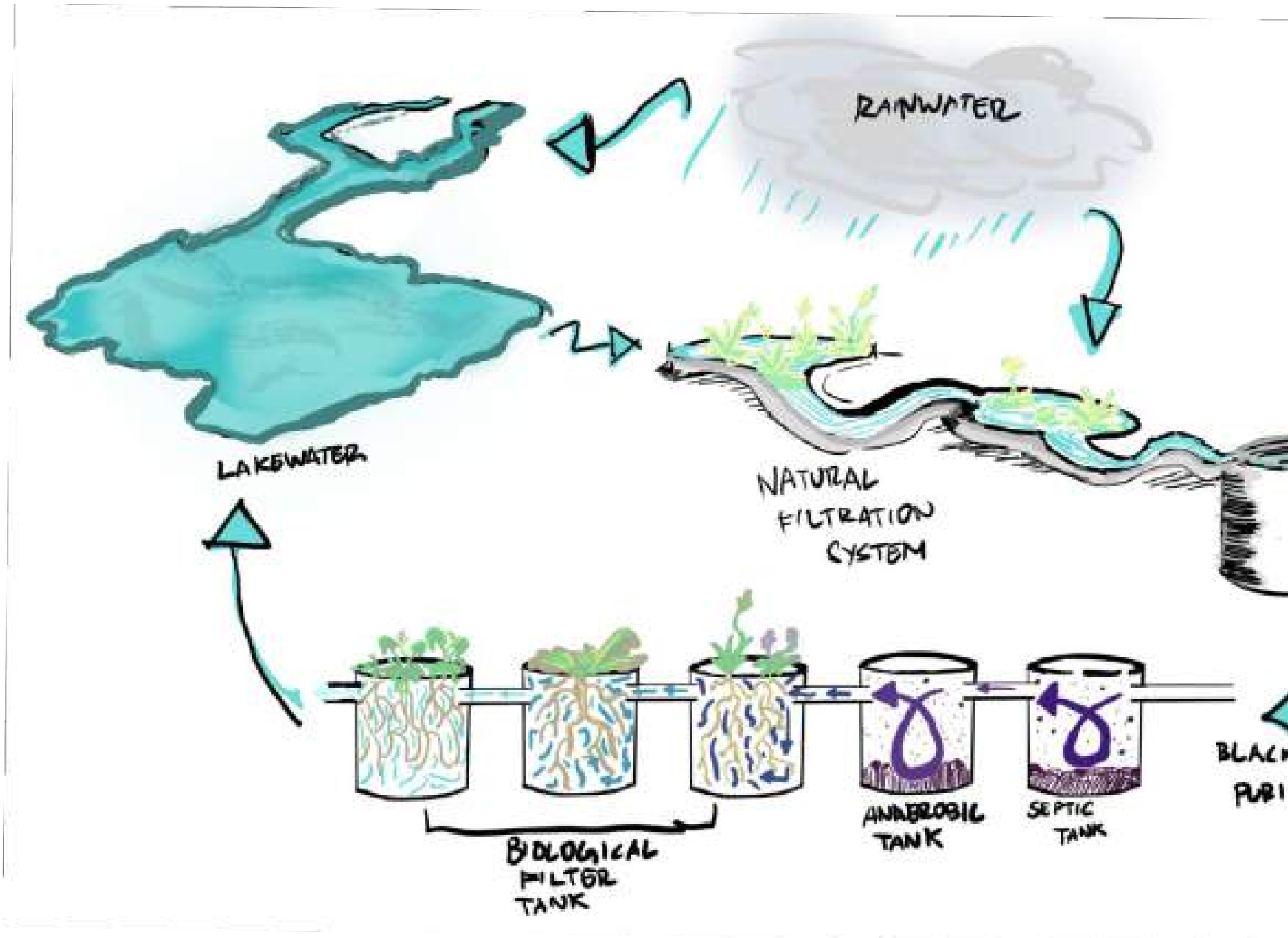
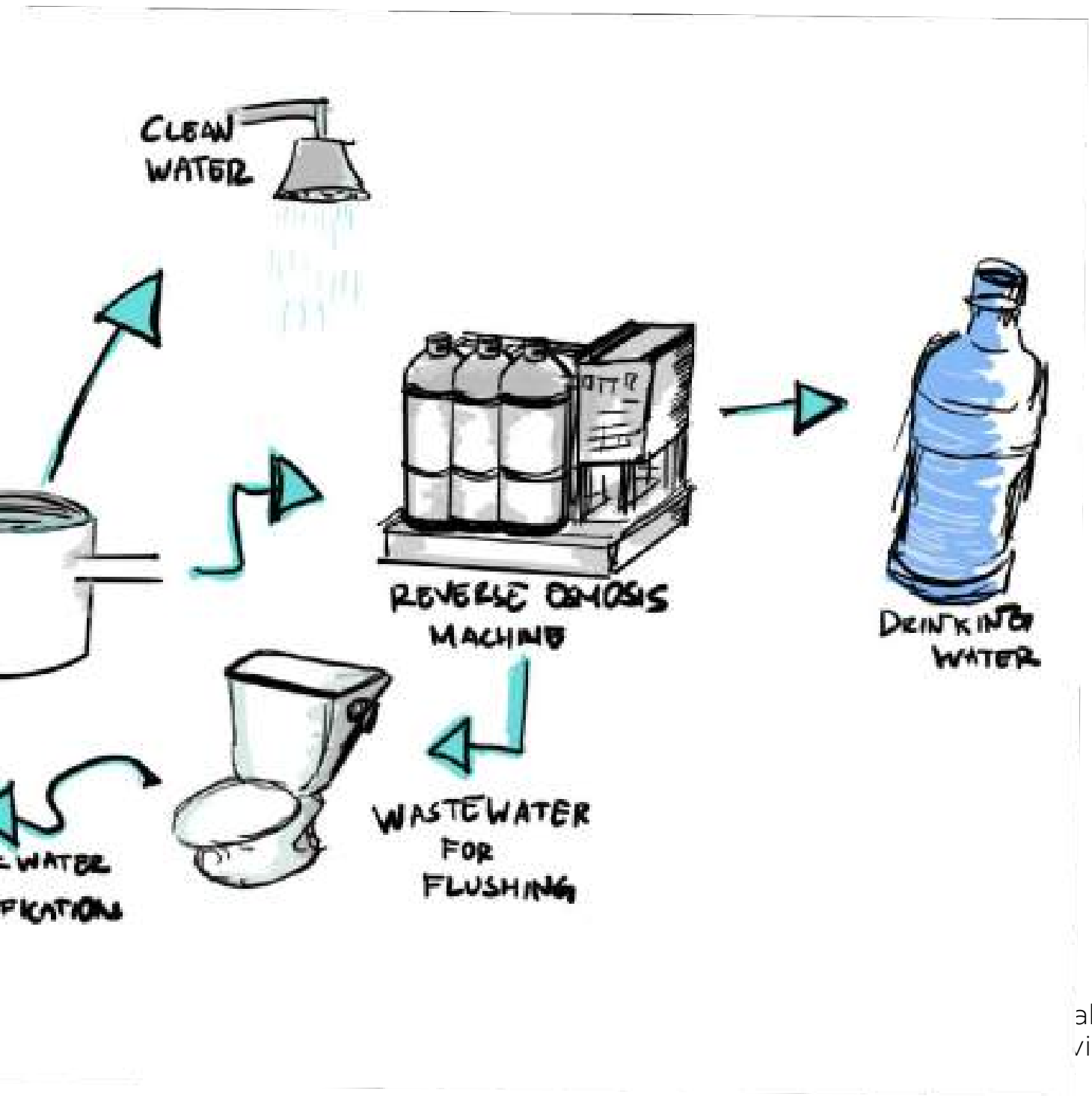


Figure 2.12 Continous Water Flows; *Source: Author, 2024*



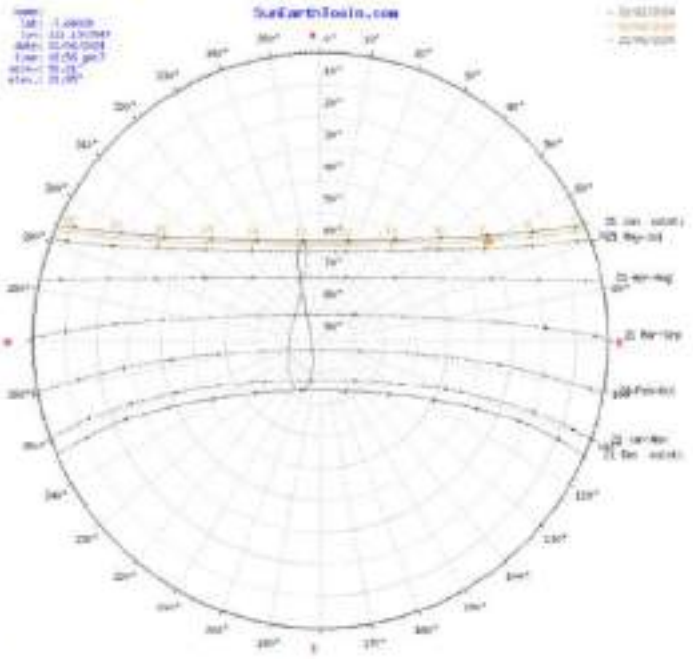
Continous Water Flows

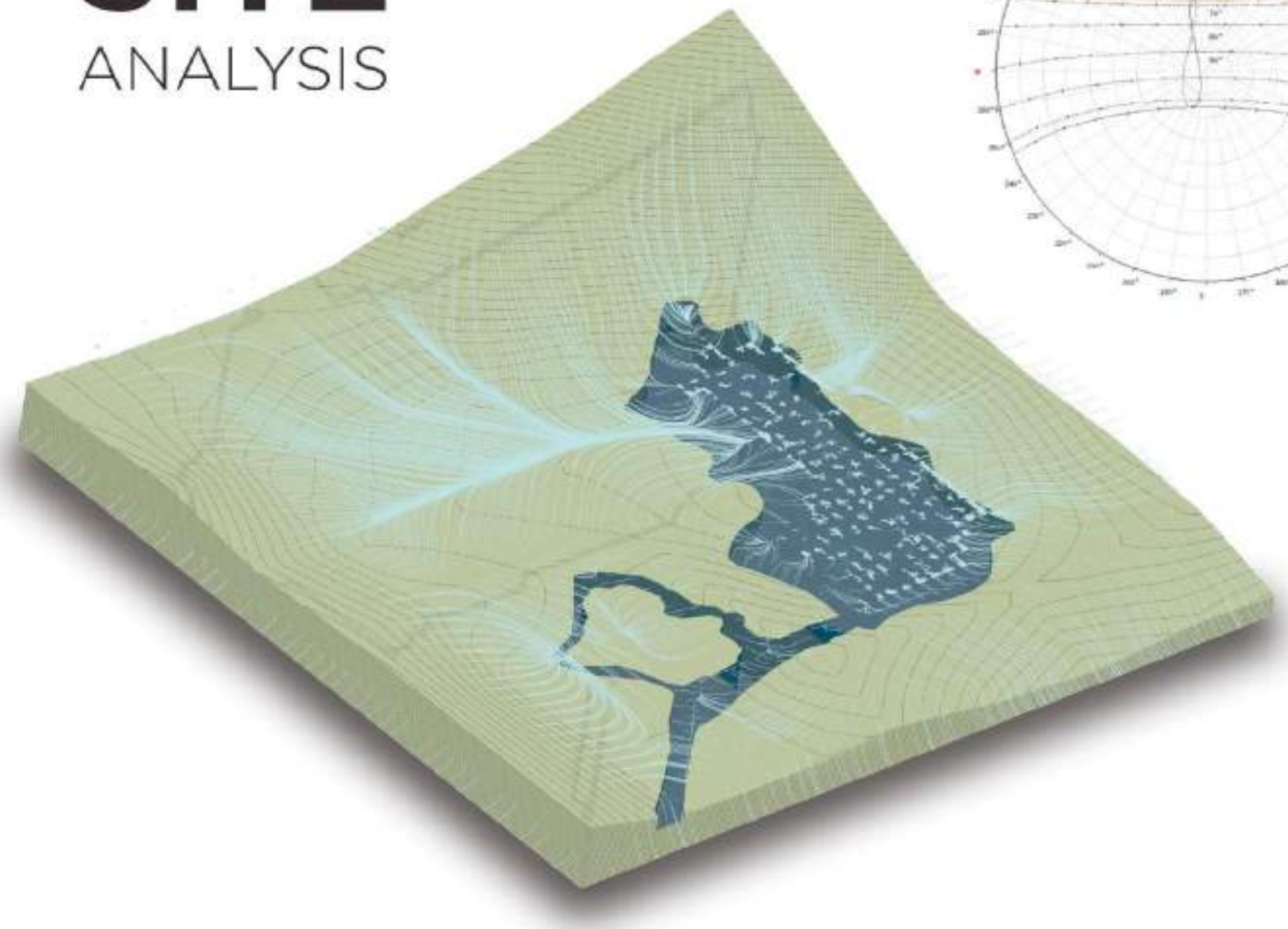
ally harnessed to benefit the local
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can be channeled through a purposefully constructed natural filtration system, wherein it will undergo purification along the watercourse.

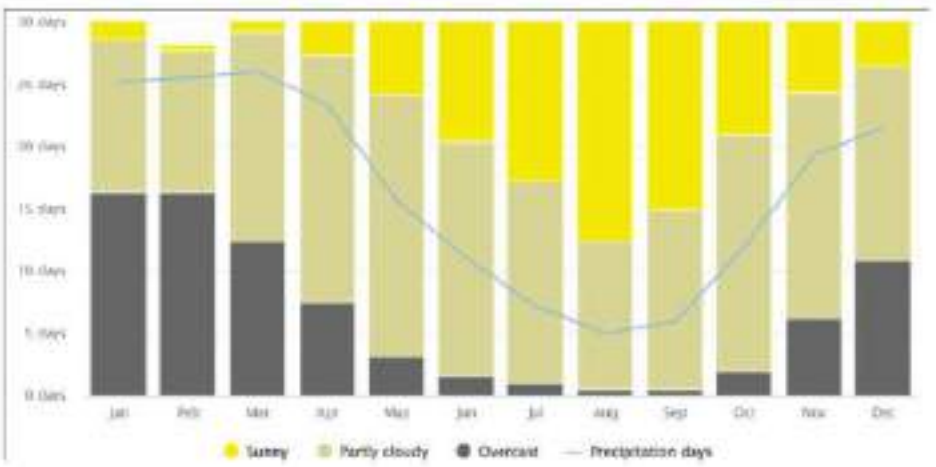
This system culminates at the lowest slope, where the water can be utilized either in its purified form or further processed into drinkable water. The wastewater generated during purification can be repurposed as greywater for flushing toilets or irrigating plants. The residual water from this process then undergoes blackwater treatment, resulting in clean water that is reintroduced into the lake.

2.5 DESIGN CRITERIA

SITE
ANALYSIS

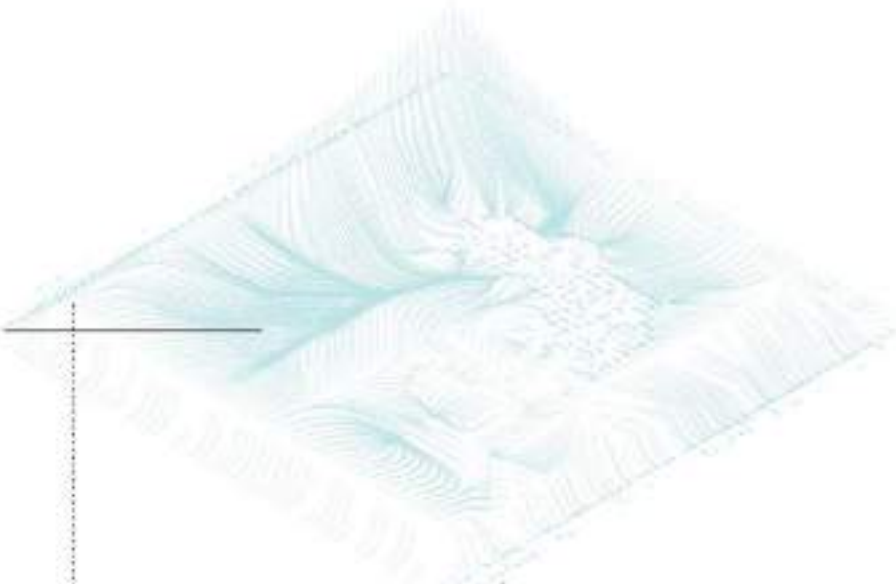


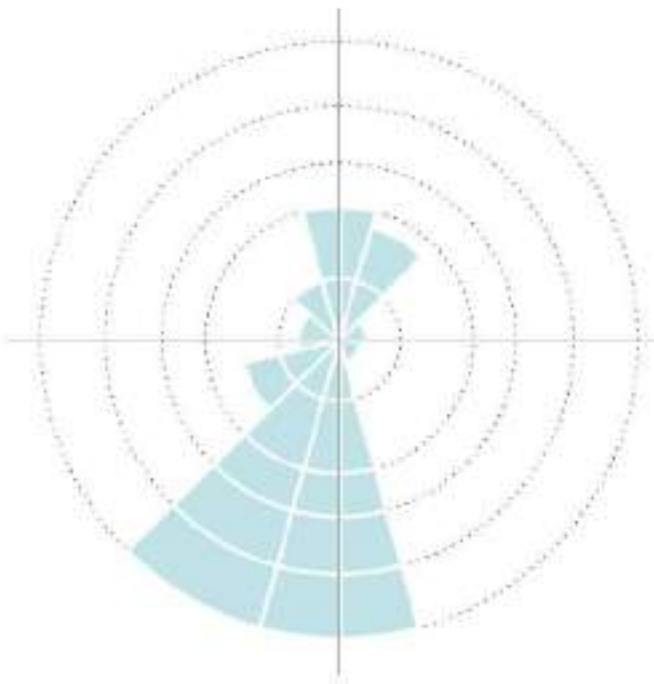






WATERFLOW ANALYSIS



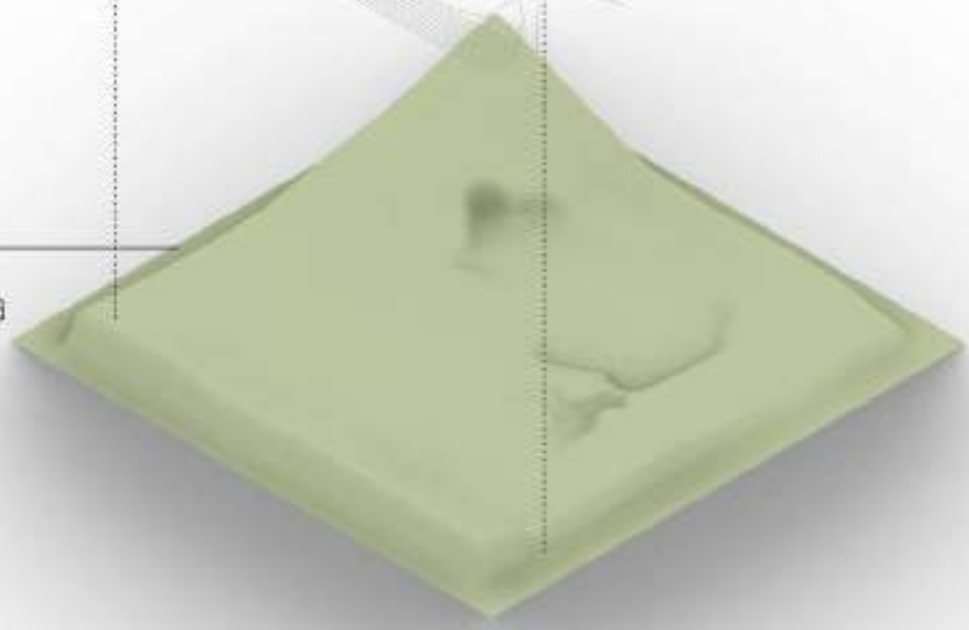


WATER SOURCE
Madirda Lake



CONTOUR LINES
Highest : 47, 900

BASE SITE
Telaga Madirda



DESIGN EXPLORATION

3.1 AI Prompting as Exploration Tool
3.2 Design Parametrics as Exploration Tool
3.3 Design Strategy
3.4 Schematic Design Exploration




Modular
Fluid
Modular
Bar
Hydroponics
Comfy
Many
Filtration
Areas
Water

BING COPILOT | DESIGNER

IMAGE GENERATION





PROMPTING:

Architectural concept of a water education center with more fluid forms, harmonizing with a serene lake in a mountainous area, capturing water's fluidity through parametric design, including facilities for Exhibits on Water Conservation, Interactive Water Cycle Demonstrations, Interactive Water Play Areas, Outdoor Demonstrations and Nature Walks, and Art and Multimedia Installations.

BING COPILOT | DESIGNER

IMAGE GENERATION







PROMPTING:

Architectural concept of a water education center with fluid forms spread throughout the area, harmonizing with a serene lake in a mountainous region, capturing water's fluidity through parametric design, including facilities for Exhibits on Water Conservation, Interactive Water Cycle Demonstrations, Interactive Water Play Areas, Outdoor Demonstrations and Nature Walks, and Art and Multimedia Installations, following the waterflow pattern of the area, incorporating permaculture ponds as part of its education facilities, and using transparent materials for the water flow architecture.

3.2 DESIGN PARAMETRICS AS EXPLORATION TOOL



PROMPTING:

Interior spaces of a water education center with fluid forms, transparent materials, and facilities for exhibits on Water Conservation, Interactive Water Cycle Demonstrations, Interactive Water Play Areas, Outdoor Demonstrations and Nature Walks, and Art and Multimedia Installations.

WATERFLOW

Site Pattern

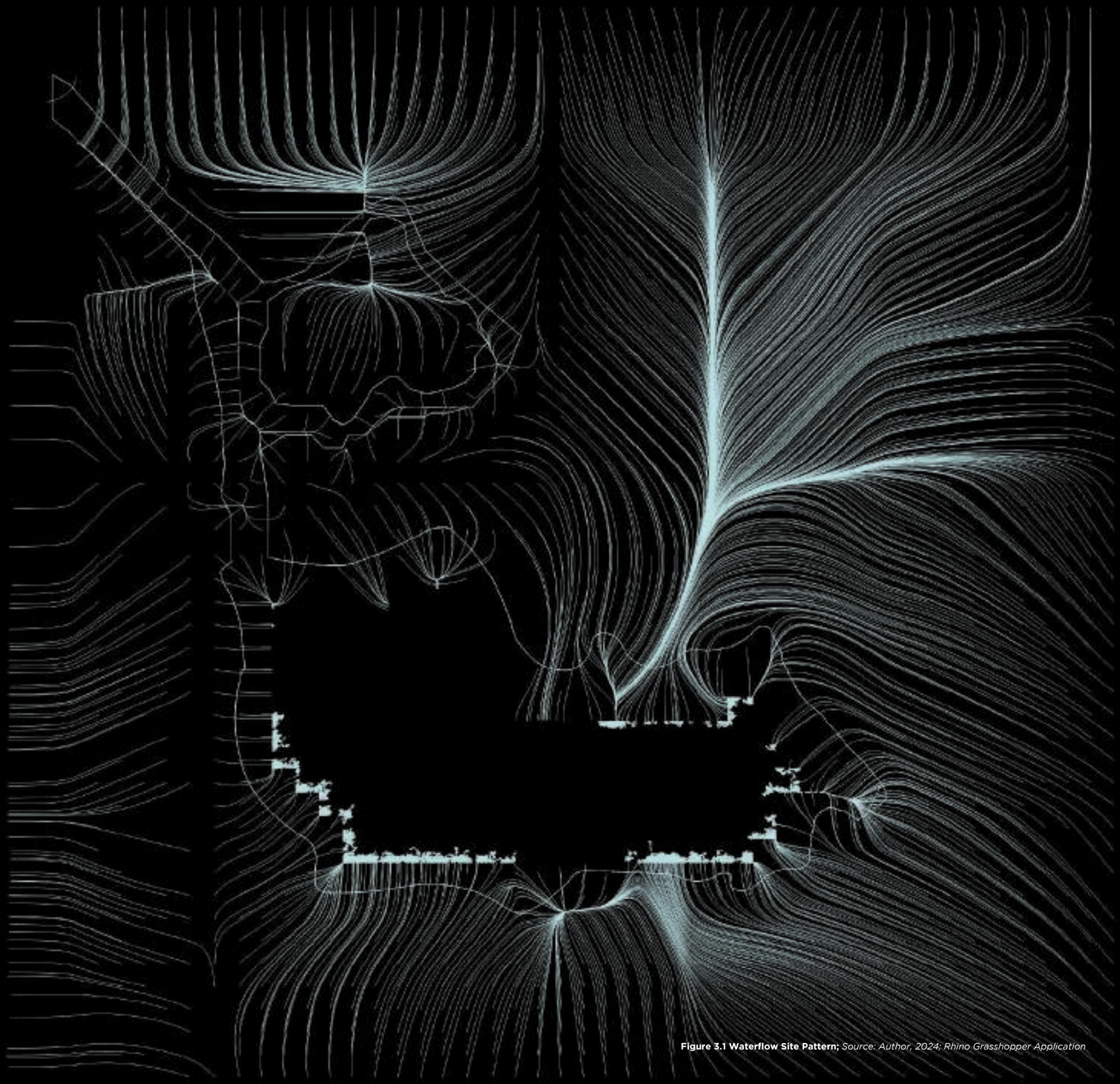


Figure 3.1 Waterflow Site Pattern; *Source: Author, 2024; Rhino Grasshopper Application*

3.2 DESIGN PARAMETRICS AS EXPLORATION TOOL

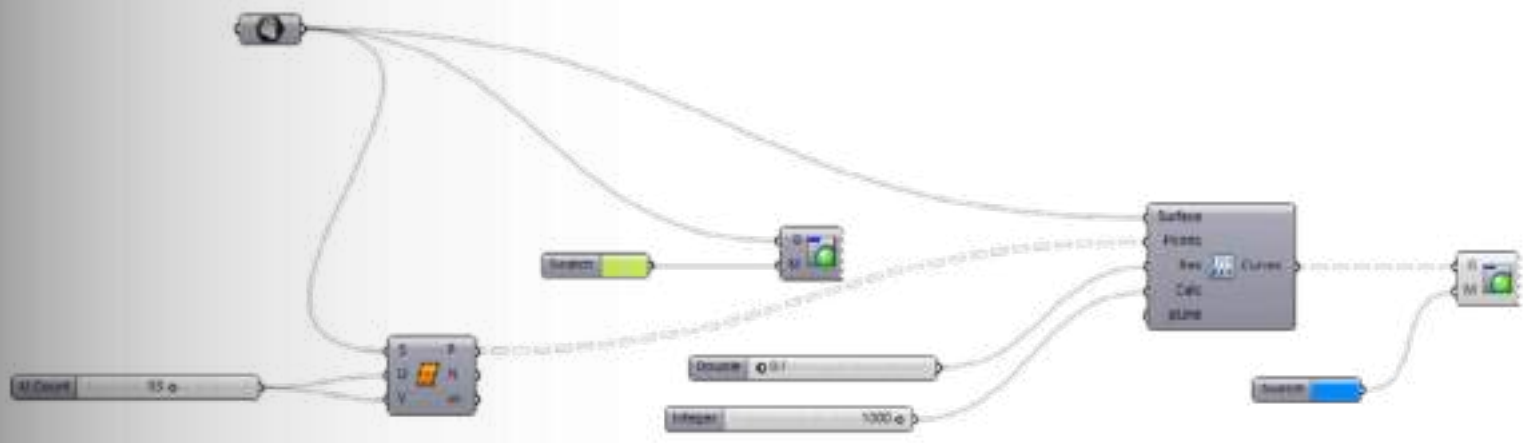


Figure 3.2 Waterflow Analysis; *Source: Author, 2024; Rhino Grasshopper Application*

Waterflow Analysis

The site's waterflow analysis was done using the "Mosquito" plugin on the Grasshopper Rhino application. sing the elevation data, the plugin can compute the slope (steepness) and aspect (direction) of the terrain, which are crucial for understanding how water will flow over the surface. The flow direction grid indicates the direction water will flow out of each cell, and the flow accumulation grid shows the amount of water flowing into each cell, helping to identify potential watercourses and accumulation points.

By analyzing the flow direction and accumulation grids, the plugin can delineate catchment areas, which are regions where all precipitation collects and drains through a common outlet.

3.2 DESIGN PARAMETRICS AS EXPLORATION TOOL

Water Intersection

The results of waterflow analysis have revealed distinct patterns within the site, identifying several key locations where water accumulates before continuing its flow towards the lake. These locations, termed "water intersections," are critical points where water converges. Recognizing these intersections is integral to developing strategies for enhancing water flow management within the area. By optimizing these natural convergence points, it is possible to improve water distribution, which can provide substantial benefits to both the water, and the locals.

WATERFLOW

Site Pattern Analysis

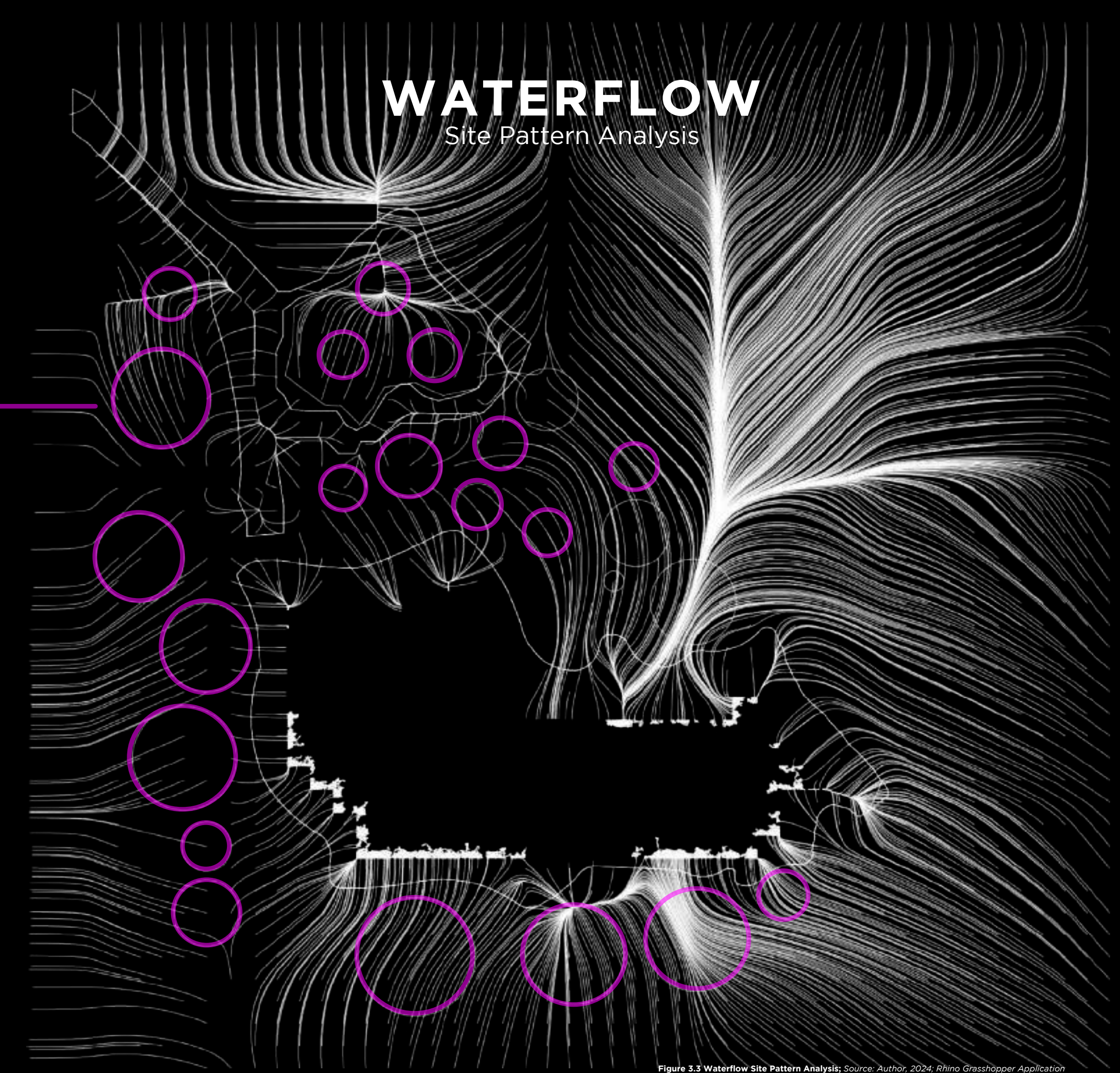
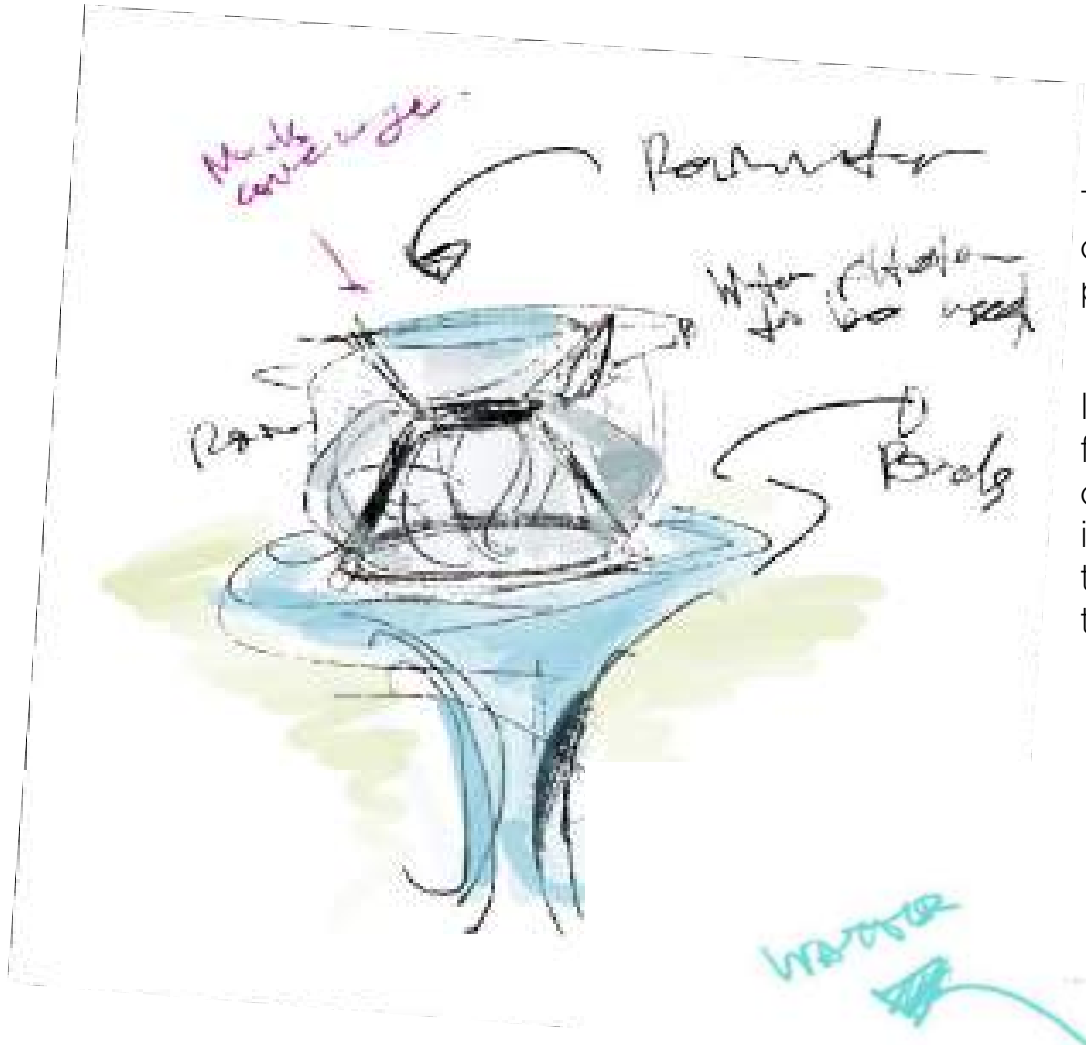


Figure 3.3 Waterflow Site Pattern Analysis; *Source: Author, 2024; Rhino Grasshopper Application*



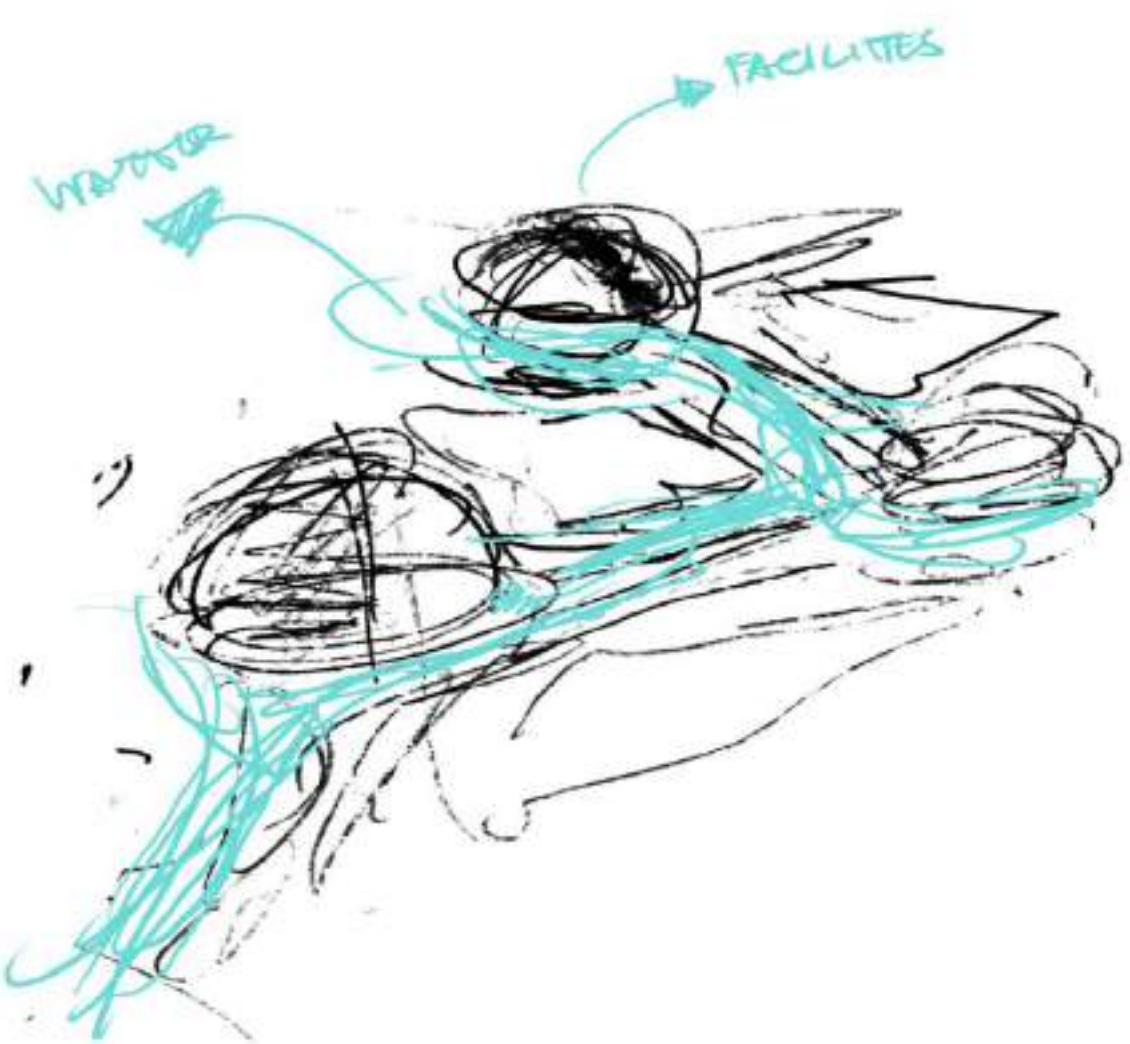


Figure 3.6 Design Exploration; *Source: Author, 2024; Rhino Grasshopper Application*

Place follows Water

The main purpose of the design itself is to celebrate the being of water, therefore the place, shape, function, all will be regulated through the existence of water.

In order for the water to be able to roam much faster than before, then some man made connections that is able to connect from one intersection to another could be added, therefore creating a much more constant, and torrential waterflows throughout the area which can also be beneficial to the people.



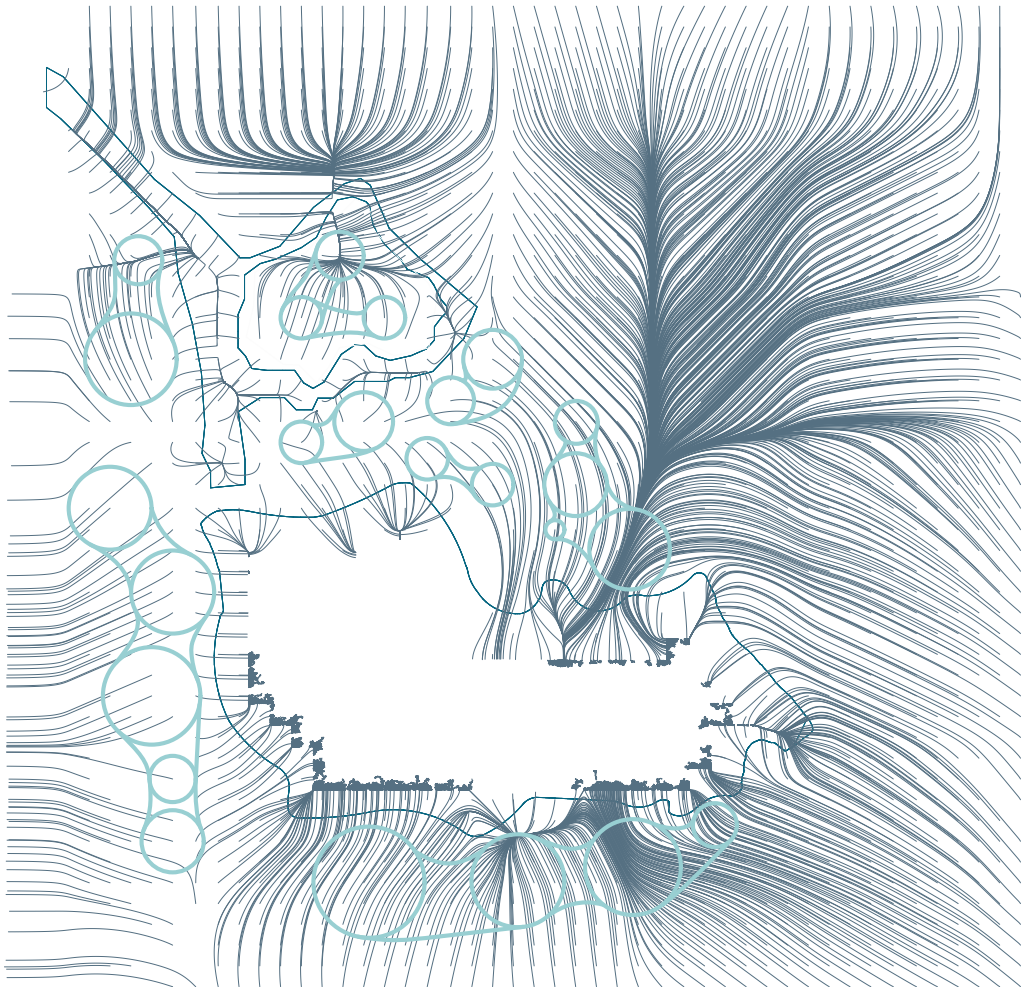
Figure 3.7 Design Exploration; *Source: Author, 2024; Rhino Grasshopper Application*

Aquatic Architecture / Parametricism

Design approach draws inspiration from aquatic environments and elements, incorporating fluid shapes, organic forms, and sustainable design principles that mimic the natural patterns found in water. Aquatic architecture may involve the use of materials that are resistant to water damage or that evoke the textures and colors of water, such as glass, translucent panels, or reflective surfaces. This style of architecture aims to create spaces that evoke a sense of fluidity, tranquility, and connection to nature, whether they are located near water bodies or not. Examples of aquatic-inspired architecture include buildings with undulating facades, wave-like roof structures, or interiors that incorporate water features and natural lighting to emulate the ambiance of underwater environments.

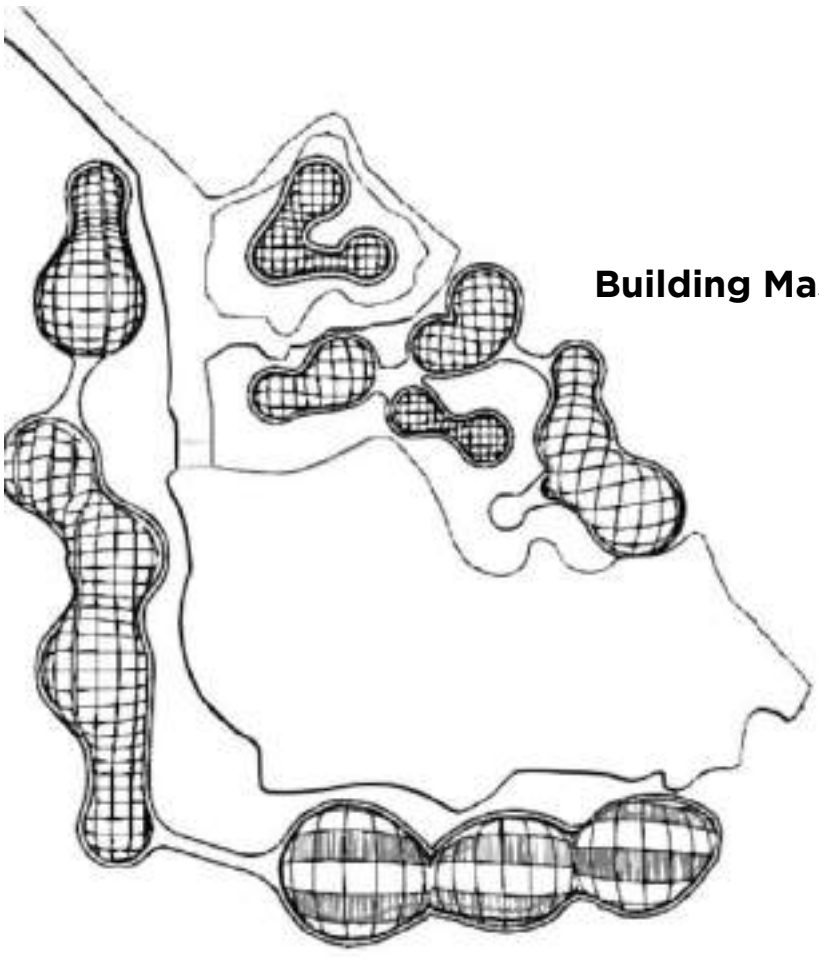
3.4 SCHEMATIC DESIGN

EXPLORATION



Waterflow Pattern Development

The intersection points are then connected creating forms that acts as a base of the facilities building masses.



Building Mass

Figure 3.8 Design Exploration; *Source: Author, 2024; Waterflow Pattern Development*

SITEPLAN

1:1000

MASTERPLAN

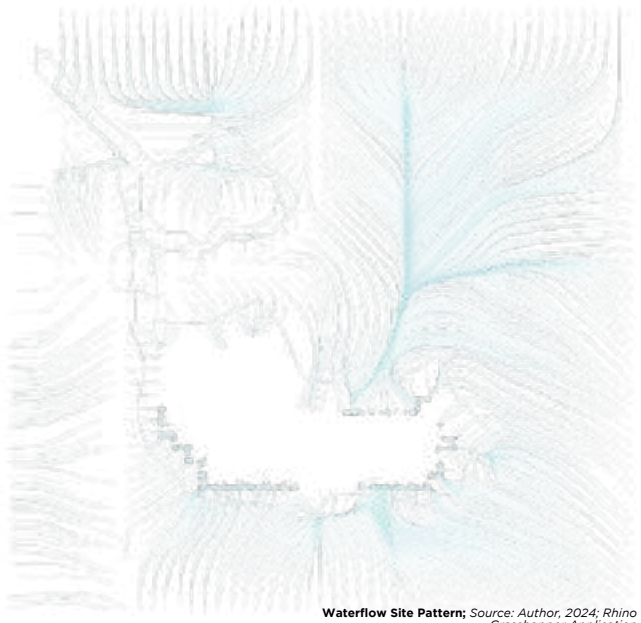
1:1000



Contour Data

Water Pattern



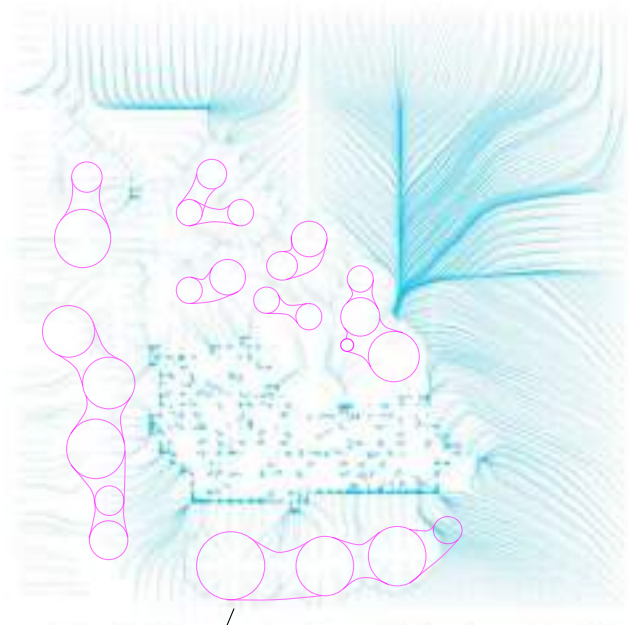


Waterflow Site Pattern; *Source: Author, 2024; Rhino Grasshopper Application*





Waterflow Site Pattern Analysis; *Source: Author, 2024; Rhino Grasshopper Application*



Creating Centralized Flow



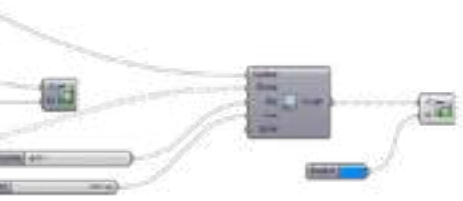
Waterflow Site Pattern Connection; *Source: Author, 2024; Rhino Grasshopper Application*

The site's waterflow analysis was
on the Grasshopper Rhino applic
plugin can compute the slope (s
of the terrain, which are crucial f
flow over the surface. The flow dir
water will flow out of each cell,
shows the amount of water flo
identify potential water

By analyzing the flow direction a
can delineate catchment areas
precipitation collects and

The results of waterflow analysis
within the site, identifying seve
accumulates before continuing i
locations, termed "water intersec
water converges. Recognizing t
developing strategies for enha
within the area. By optimizing the
is possible to improve water
substantial benefits

After the intersections are analyz
done to check whether the inters
creates a new water distribution.
now able to be distributed surro
means the waterflow would circul
path is then created alongside t



Waterflow Analysis

done using the “Mosquito” plugin
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for understanding how water will
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and the flow accumulation grid
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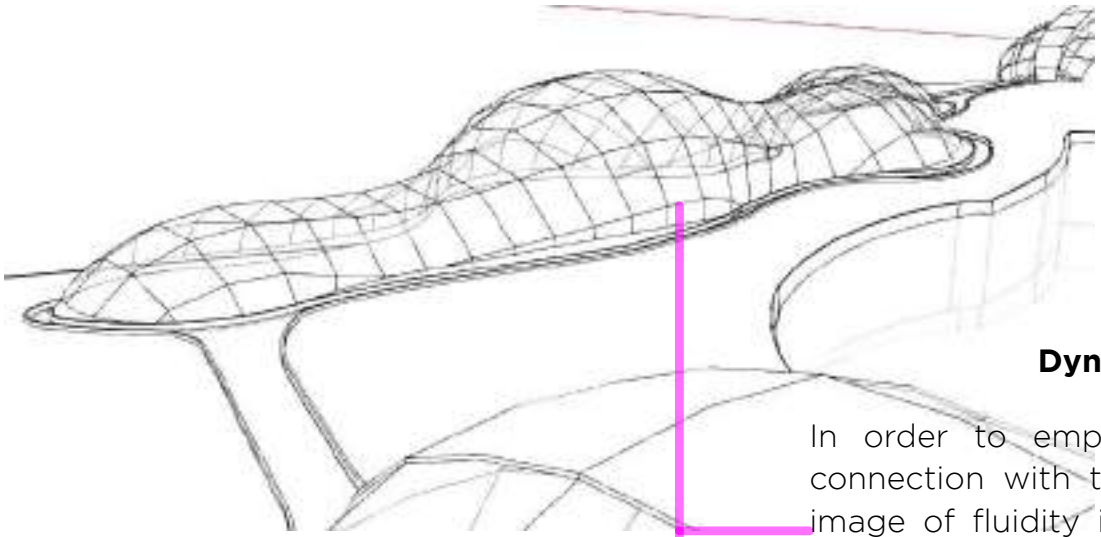
nd accumulation grids, the plugin
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drains through a common outlet.

Water Intersection

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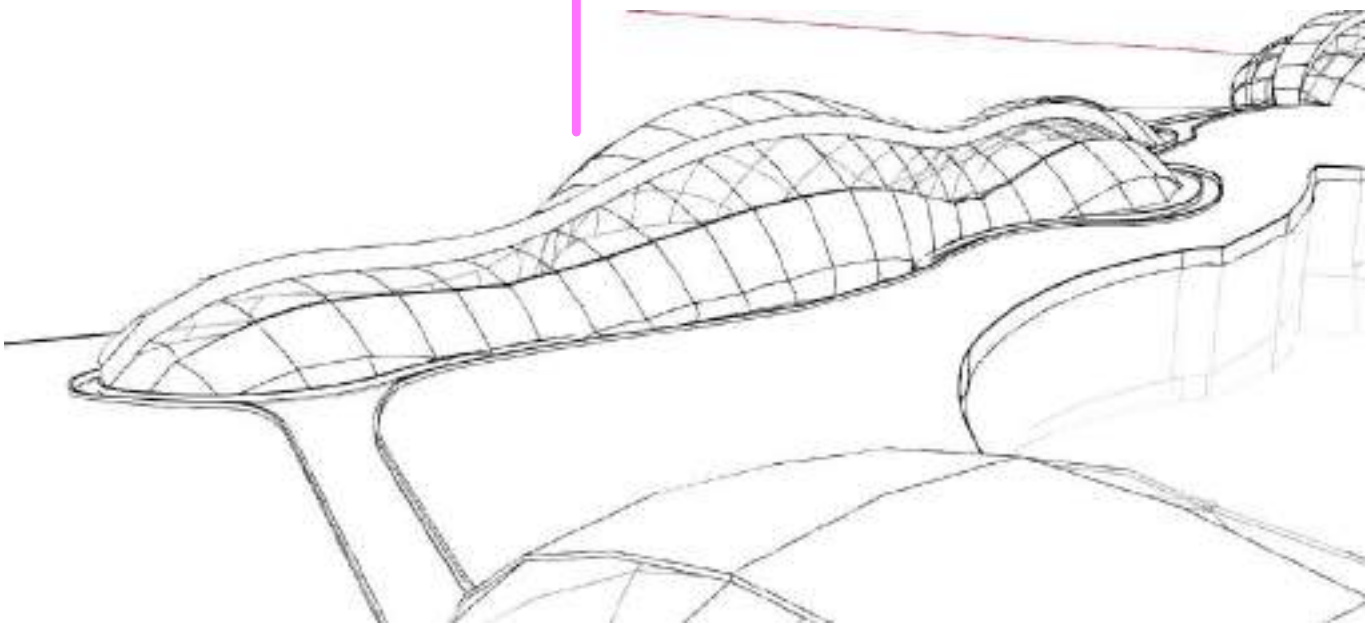
Water Connection

ed, a new waterflow analysis was
section created would succesfully
The result shows that the water is
ounding the intersection, which
ates around it. A continous water
the intersection to connects the
waterflows accross the buildings.



Dynamic Building Facade

In order to emphasize the building’s connection with the form of water, an image of fluidity is added as the main idea of the building’s whole facade design.

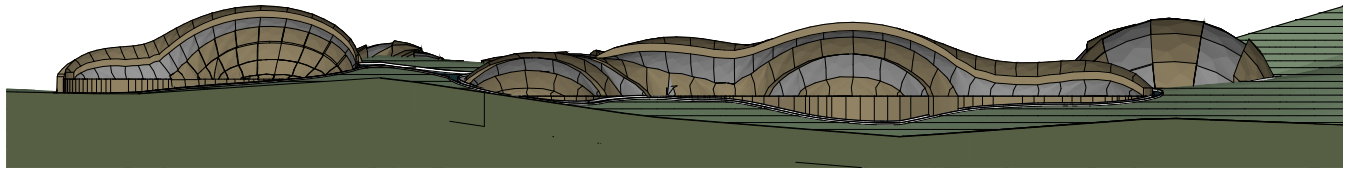


NORTH ELEVATION

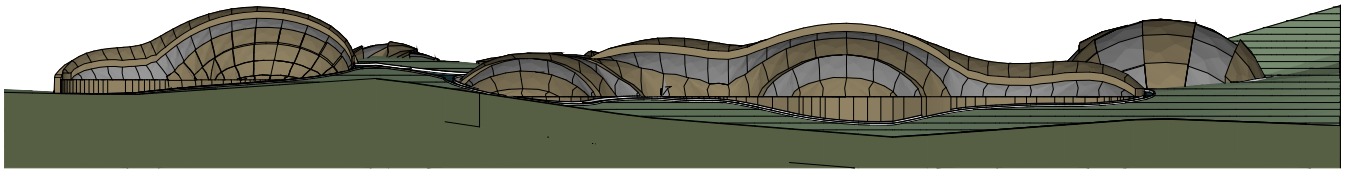


SOUTH ELEVATION

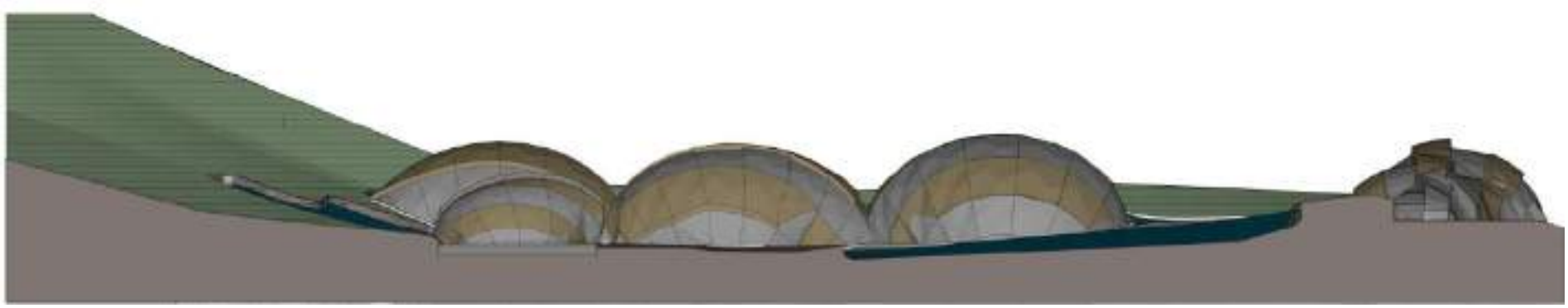




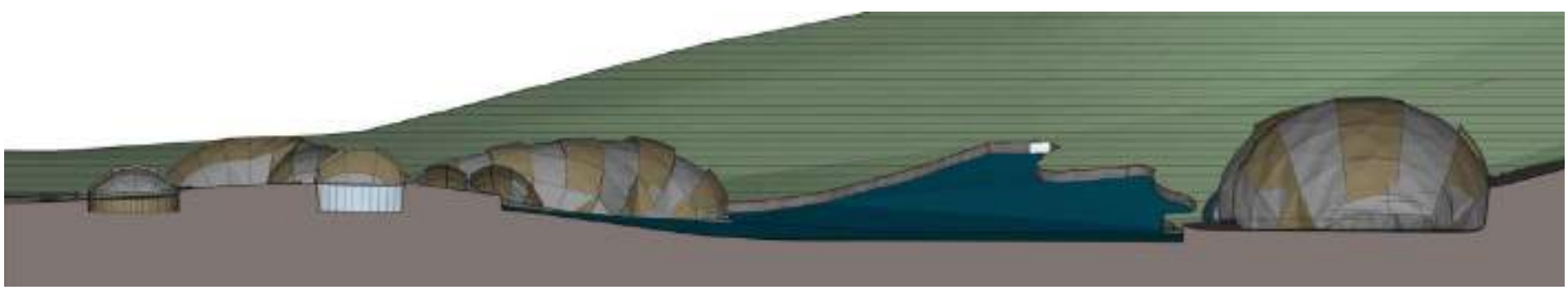
EAST ELEVATION



SECTION A



SECTION B

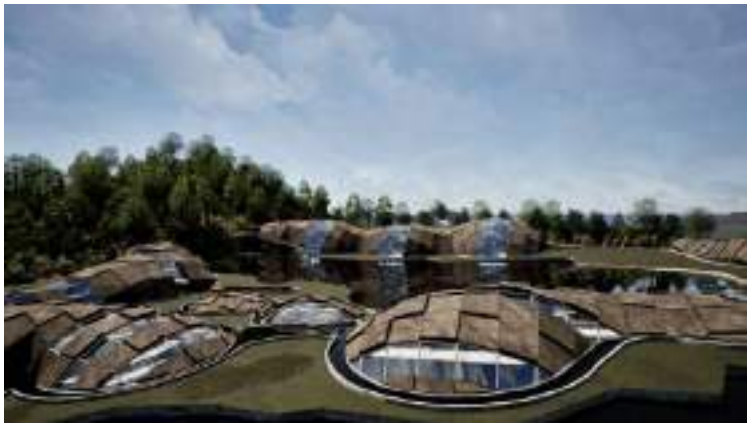




3.4 SCHEMATIC DESIGN EXPLORATION



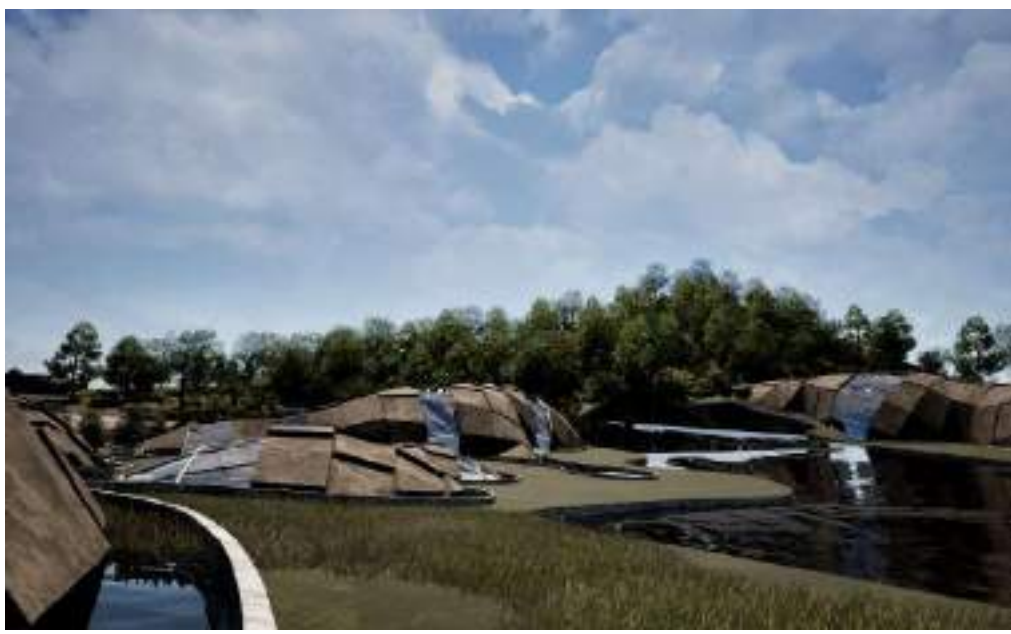
















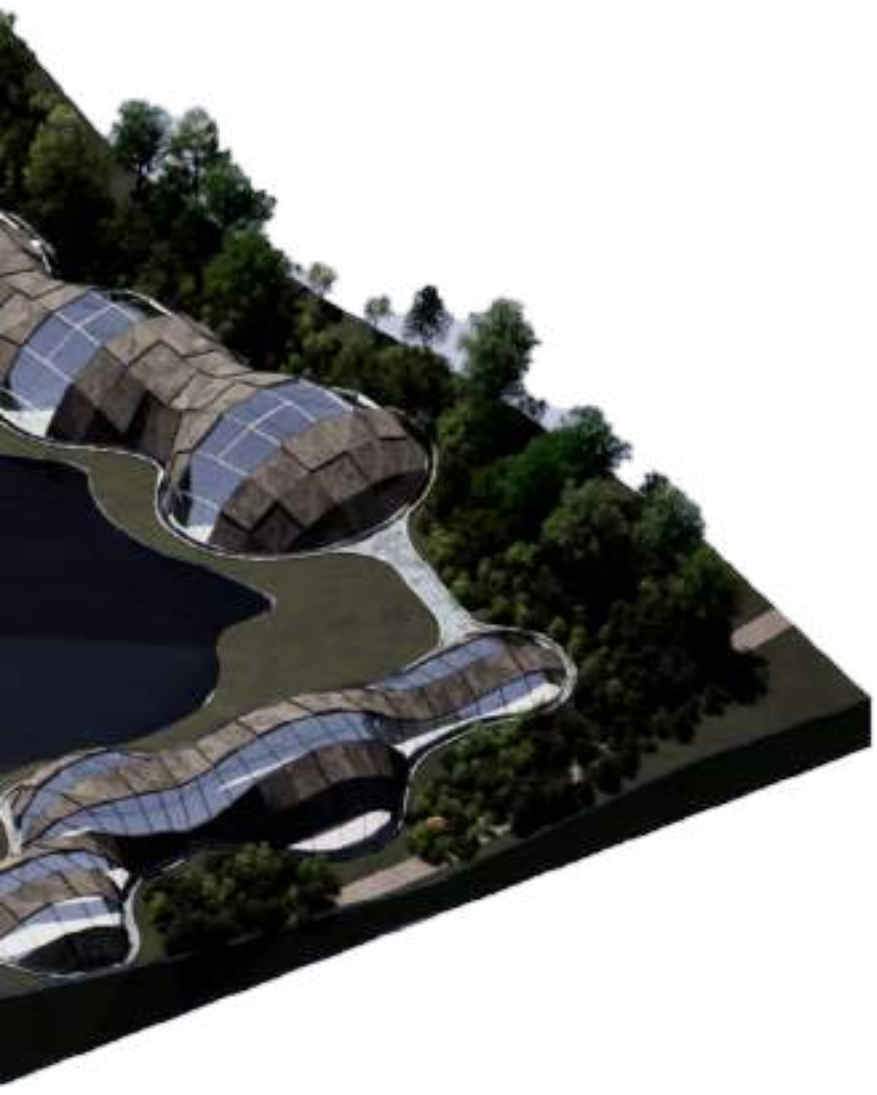








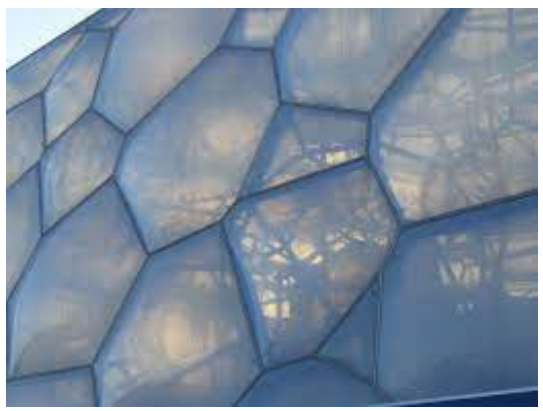
3.4 SCHEMATIC DESIGN EXPLORATION







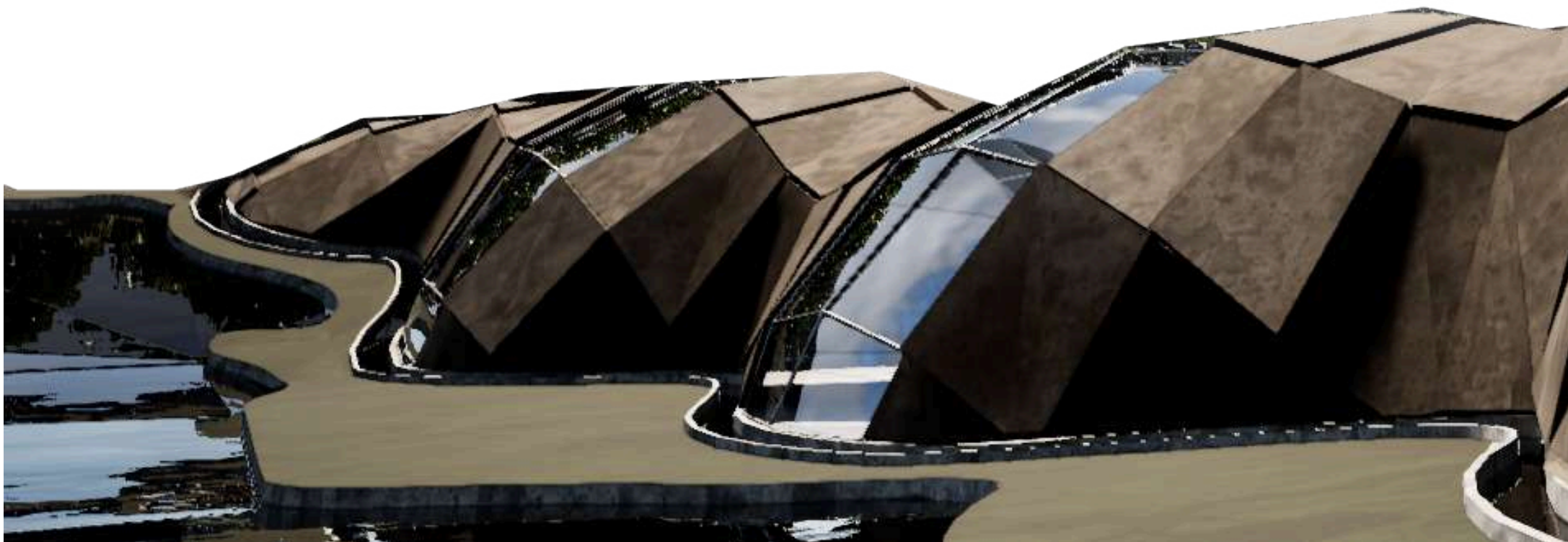






Transparent Dual-ETFE cushion envelope

Transparent dual-ETFE (Ethylene Tetrafluoroethylene) cushion envelopes are a high-performance building material used for cladding systems in modern architecture. ETFE is a type of fluoropolymer, which is a class of plastics offering high corrosion resistance and strength over a wide temperature range.







Clay (3D Printed) / Shotcrete coated

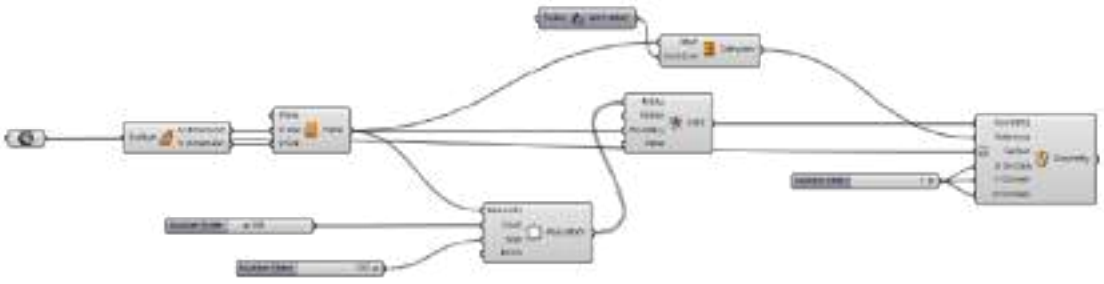
Clay can be 3D printed which would make it easier to construct fluid forms.Shotcrete is a versatile construction method that involves applying concrete projected at high velocity primarily onto vertical or overhead surfaces. Shotcrete can be used effectively in water treatment applications if it is properly designed, mixed, and placed. One of the significant advantages of Shotcrete is its design flexibility. It can be used to create intricate shapes and structures that would be challenging with conventional concrete.

DESIGN DEVELOPMENT

4.1 Parametric Voronoi Facade
4.2 Plug-in Walls System
4.3 Hydroscape Masterplan
4.4 Hydroscape Buildings
4.5 Water System Plan
4.6 References



PARAMETRIC VORONOI FACADE





Following the development of the building, buildability is also a concern. To create a fluid shape that correctly follows water, the building could incorporate a Voronoi pattern as part of its skin. This design approach not only enhances the aesthetic appeal but also aligns with natural patterns found in water, making the structure appear more harmonious with its environment. The Voronoi pattern's organic geometry can help distribute stress more evenly across the structure, increasing its durability and resilience.

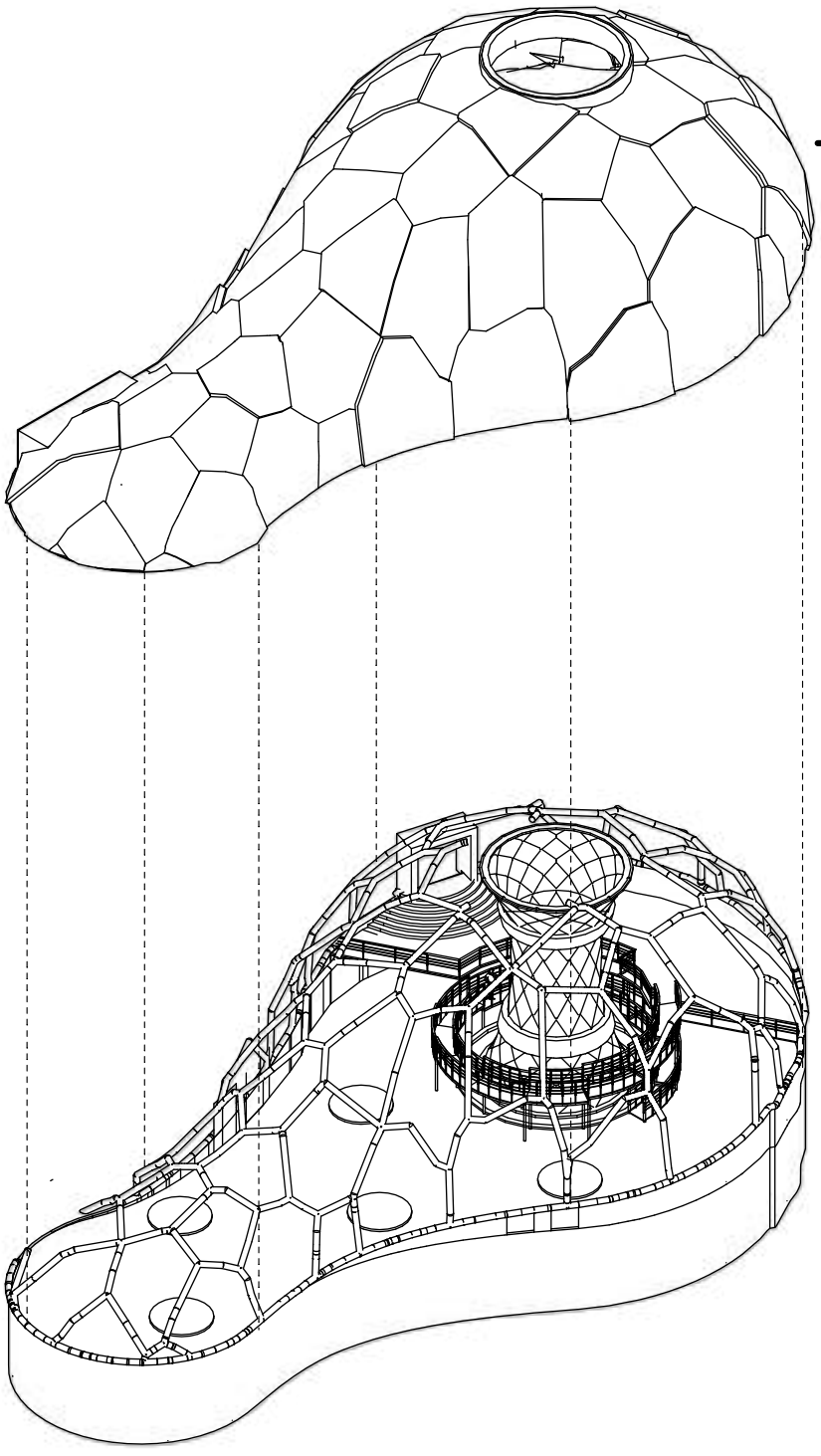
By applying this pattern, the building can better resemble water reflections while also forming the base of its structural system. The Voronoi pattern is added to the extruded part of the building using Grasshopper scripting within the Rhino application. Once applied, the pattern is given thickness and used as a framework for the steel structure. The spaces between the lines serve as a basis for the prefabricated plug-in walls.

BASIC SHAPE --> VORONOI SCRIPTING --> VORON



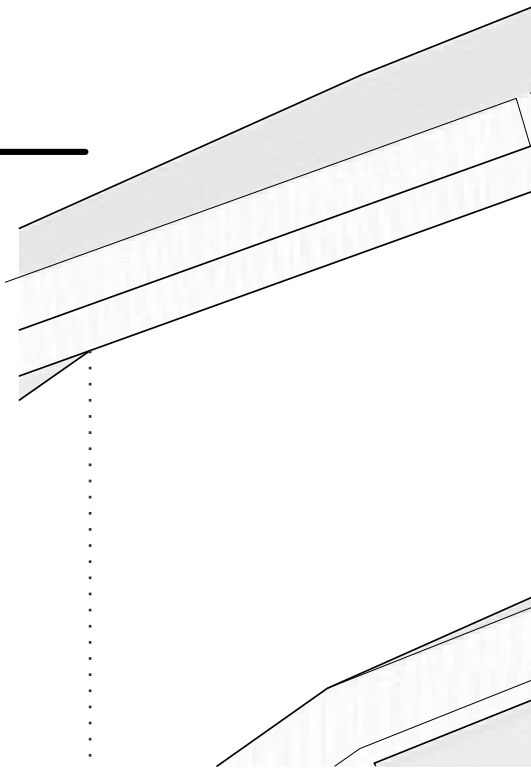
OI LINES --> STEEL STRUCTURE --> PLUG-IN WALL

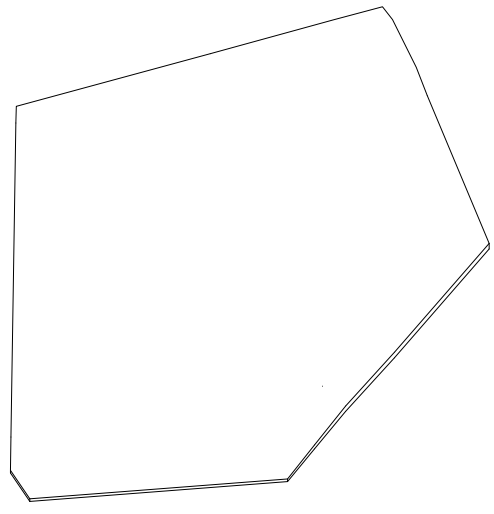
PLUG-IN WALLS SYSTEM



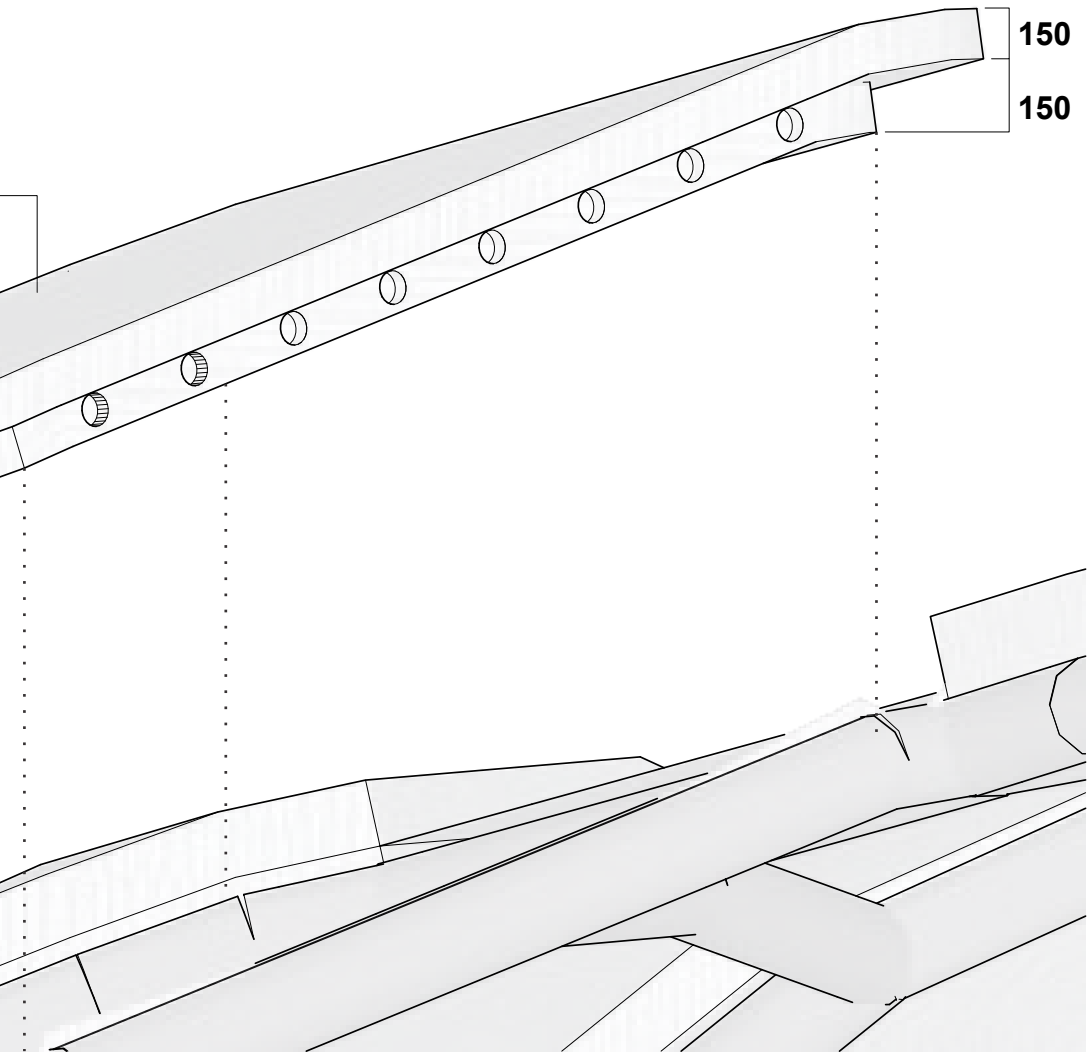
EXHIBITION HALL EXPLODED AXONOMETRY

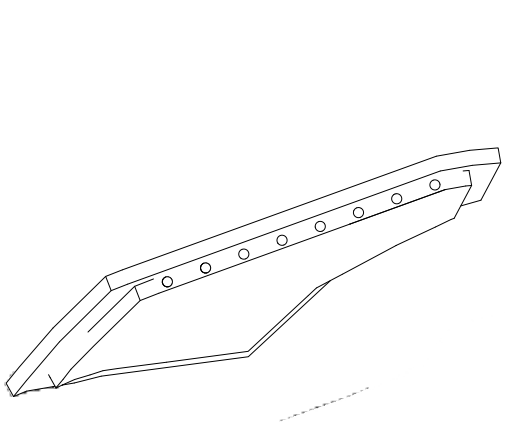
PRECAST FABRICATED CONCRETE



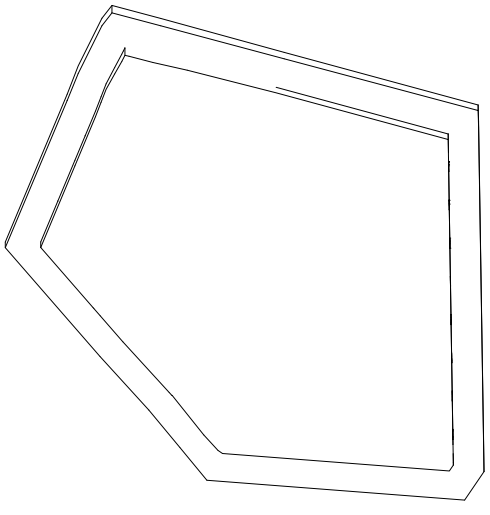


TOP VIEW





SIDE VIEW



BOTTOM VIEW

Plug-ins Wall System

Precast concrete is a construction product produced by casting concrete in a reusable mold or "form" which is then cured in a controlled environment, transported to the construction site and maneuvered into place. Due to it being manufactured outside of the site, it can be said that this material is environmentally friendly.

The concrete is able to reabsorb up to 40 percent of the carbon over the structure's life. In addition, there's minimal waste during manufacture and what are otherwise waste products like fly ash and slag are used. At the end of its life precast structures can be fully recycled.


1
2
3
4
5
6
7
8
8



HYDROSCAPE

MASTERPLAN

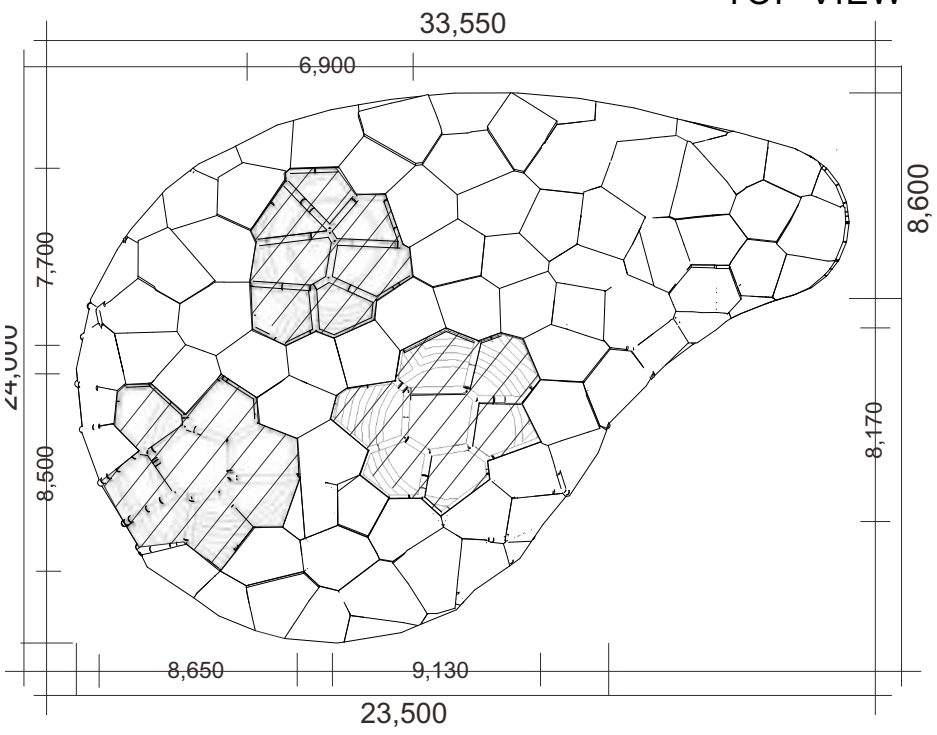
1. *Parking Lot*
2. *Main Lobby*
3. *Exhibition Hall*
4. *Main Filtration Center*
5. *Recreation Hub*
6. *Villa Lobby*
7. *Villa Area*
8. *Boat Dock*



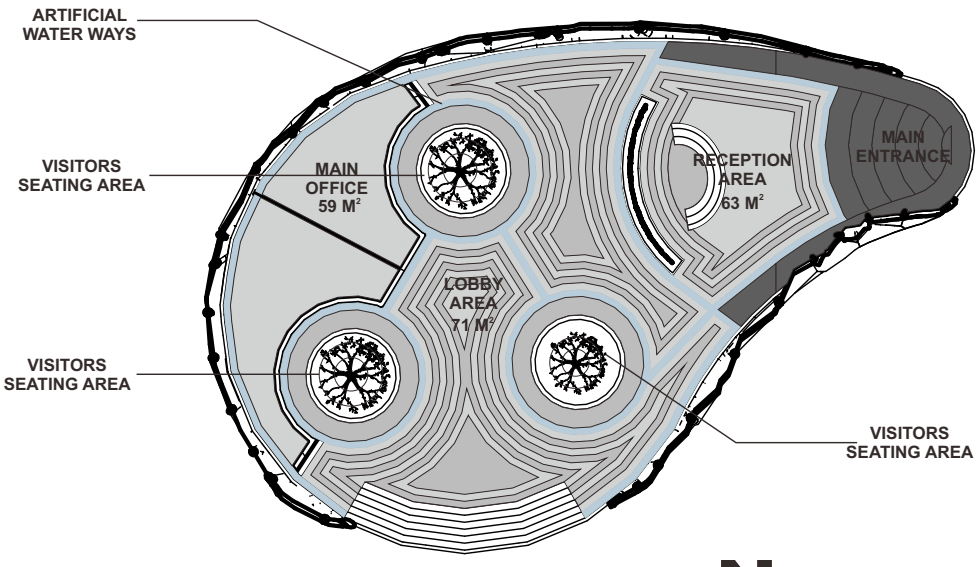
Main Lobby

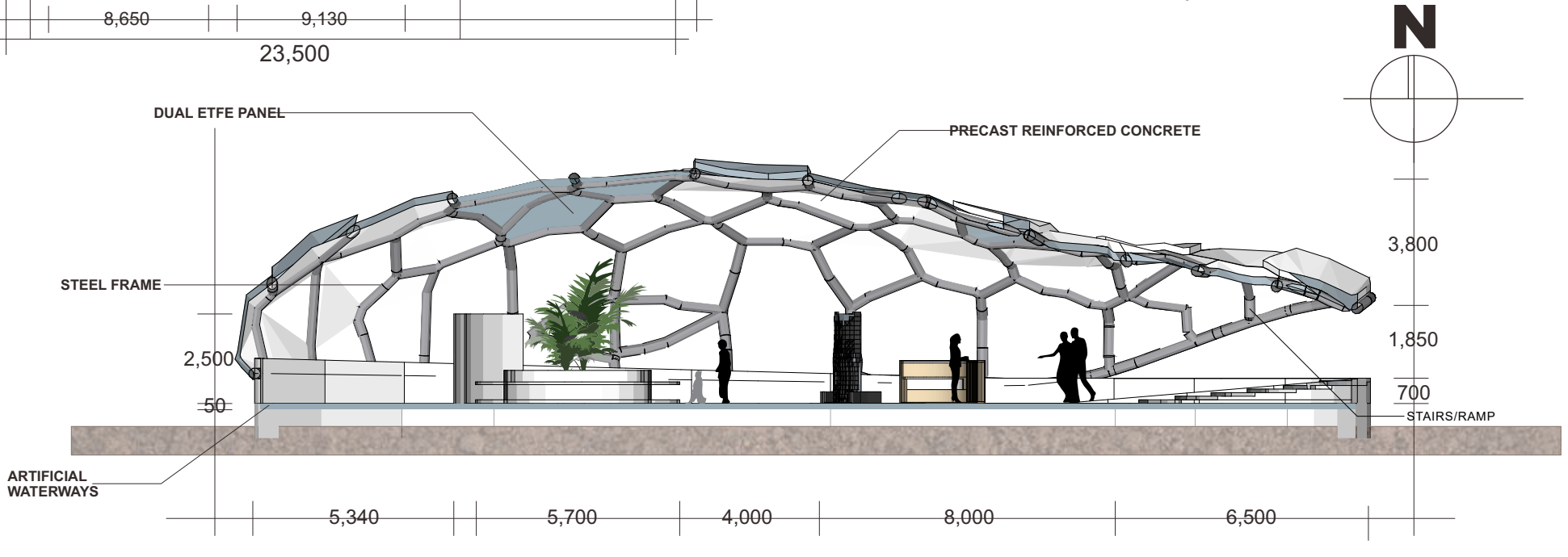
Located on the most northen side of the area, The main lobby acts as the main access point for the visitors that comes to the area. The Lobby can be divided into three areas, Main Entrance, Reception Area, and Lobby Area.

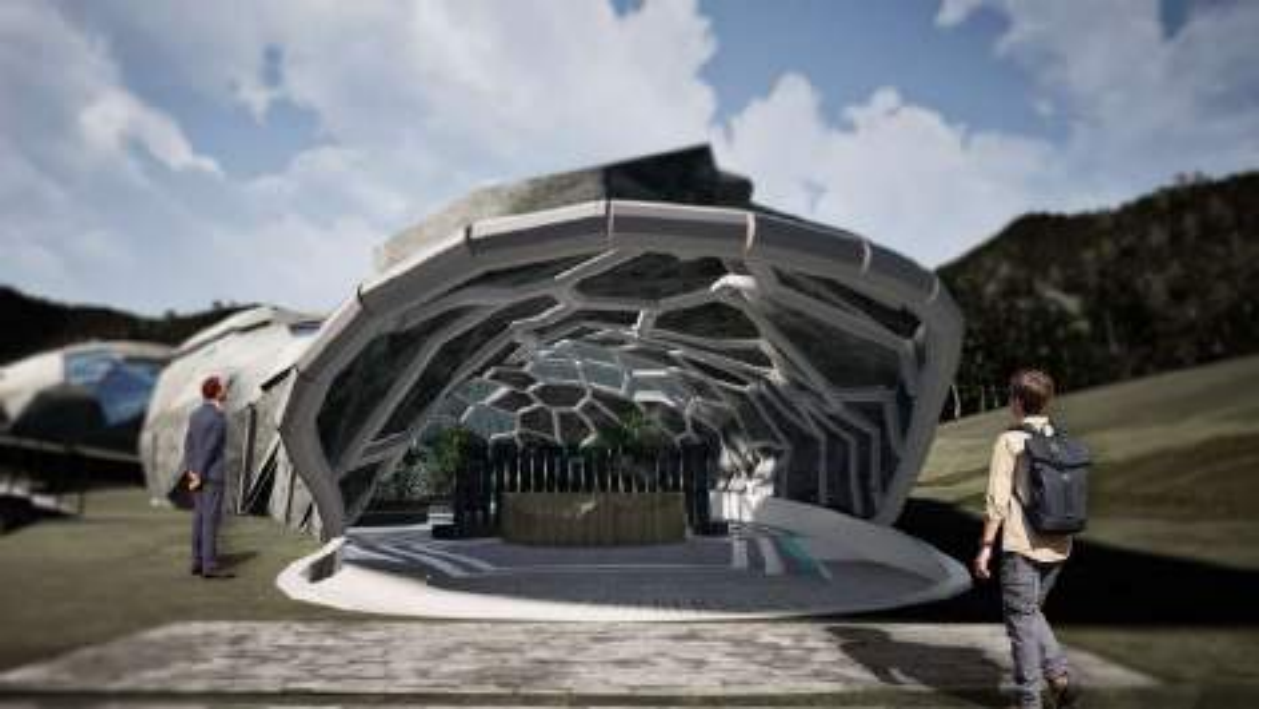
TOP VIEW



FLOORPLAN







Main Entrance

Upon arriving from the parking area, visitors step into a captivating transition zone that leads them to the Hydroscape Water Education Center. Here, they are met with the stunning parametrical design of the main lobby entrance, a dynamic and inviting gateway that promises an extraordinary experience ahead.



Reception Area

Upon enteriing the Main Lobby, the visitors are greeted by the receptionists on the reception desk. Here the visitors are able to admire the intricate interplay of waterways that weave through the space, hinting at the seamless fusion of architecture and water that defines the entire building. This dynamic introduction sets the stage for an immersive journey through the harmonious integration of space and water.



Lobby Area

This area serves as a vibrant three-way junction where visitors can relax in comfort while awaiting their water education tour, or seamlessly transition to the villa area if they’re ready to embark on a refreshing vacation surrounded by water-centric landscape.

Main Entrance

By crossing the bridge located on the southeast of the main lobby, the visitors are greeted by the main entrance of the villa lobby.



Reception Area

In this reception area, the visitors are able to make reception for the villa room. Whilst waiting for the process, they are able to admire the scenery of combination between building, and water. This lobby takes advantages of the water surrounding it, and turns it into spectacle, such as waterways, and the waterwalls.



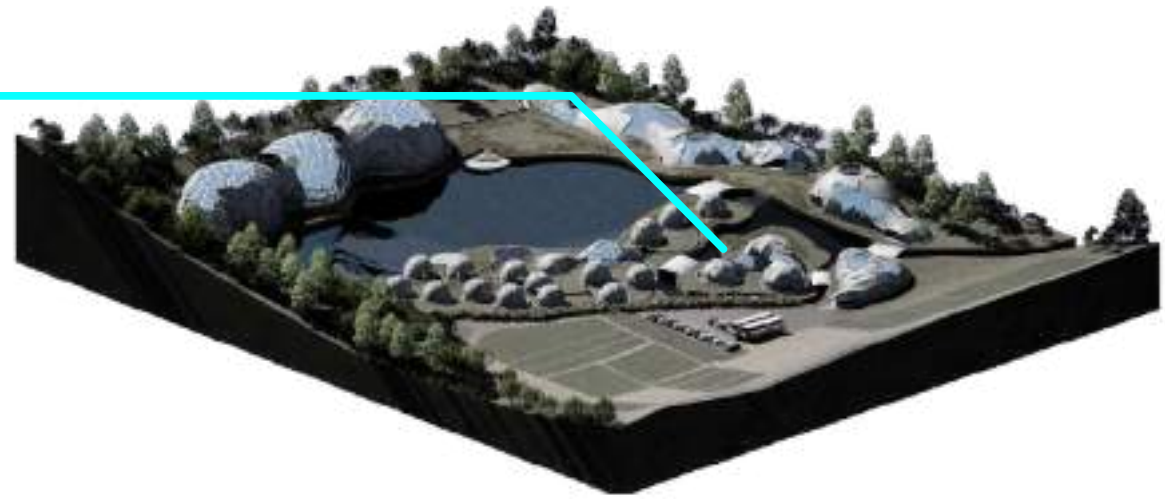
Villa Dining Hall

The villa lobby doubles as a charming dining hall for guests, where the use of a Transparent ETFE cushion envelope for the building's facade allows ample natural daylight to flood the space while minimizing excessive heat and glare. This design ensures a bright, inviting atmosphere that enhances the dining experience.

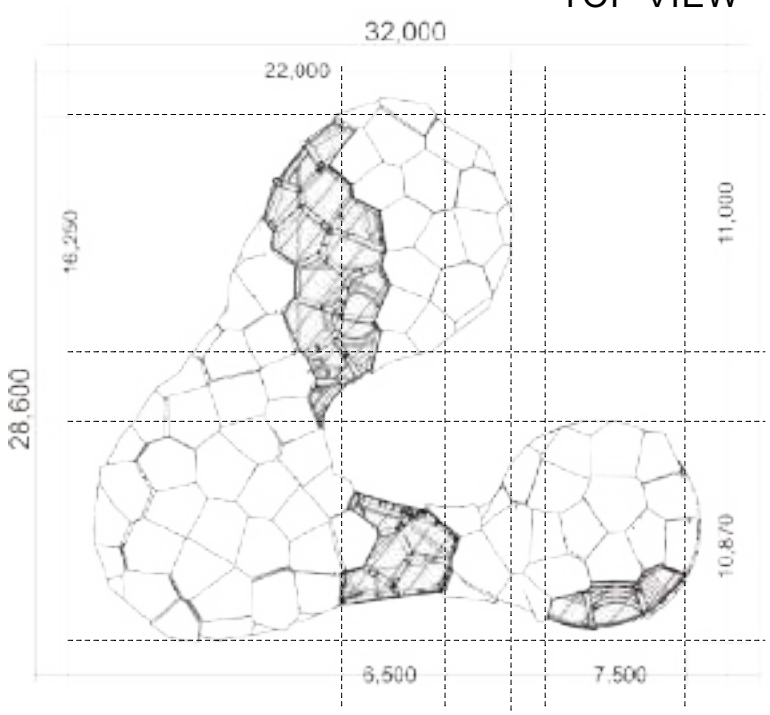


Villa Lobby

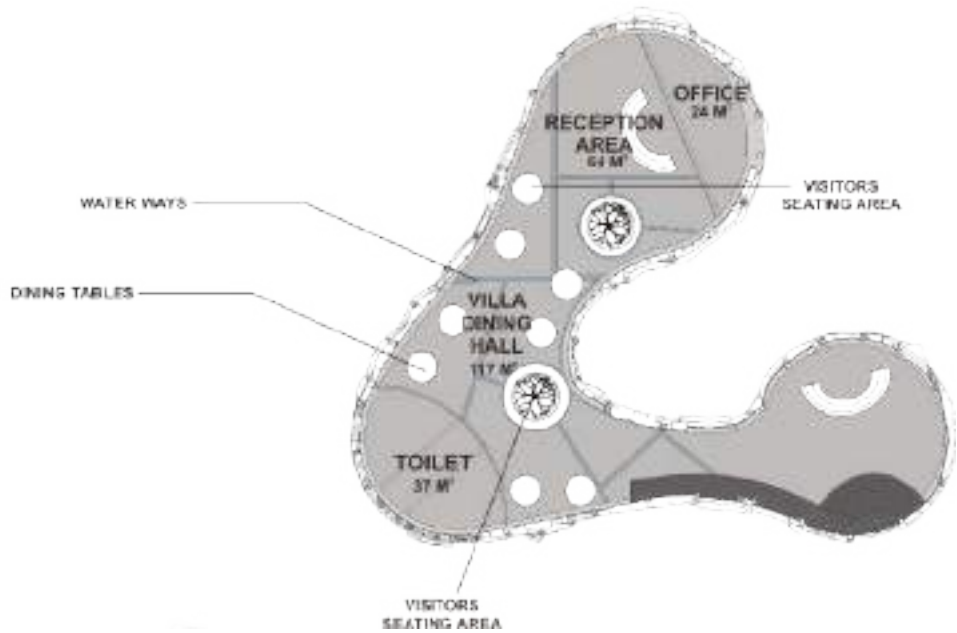
Located on the southeast from the Main Lobby, the Villa Lobby acts as an entrance, and divider between the villa area, and the exhibition area.

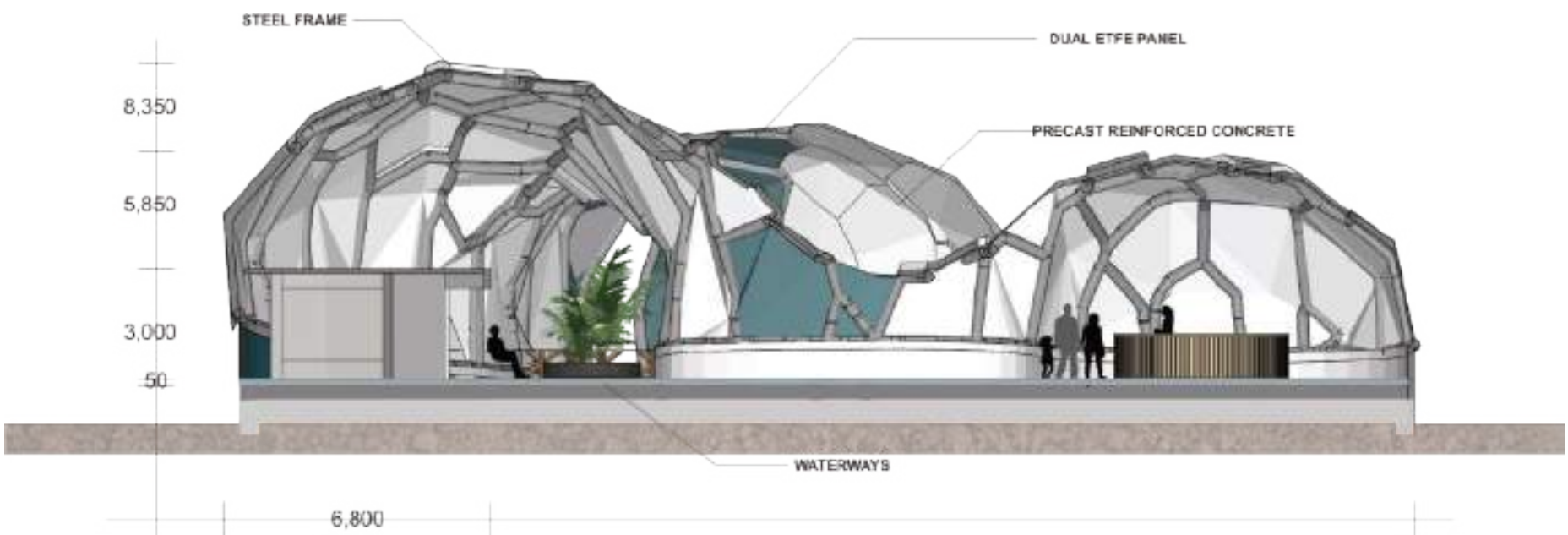


TOP VIEW



FLOORPLAN







Villa Area

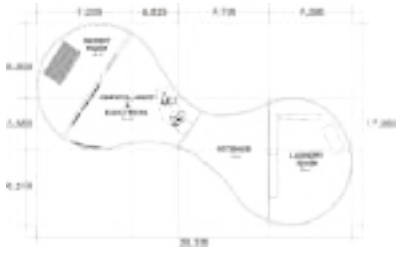
Located on the southeast from the Main Lobby, the Villa Lobby acts as an entrance, and divider between the villa area, and the exhibition area.

Area Size : 3,355 m²

No, of Rooms : 15

Size / Rooms : 64 m²







Utility Building

The Villa Utility Building, centrally located, functions as the hub for essential services. It ensures the efficient operation of systems such as heating, cooling, water supply, and electrical distribution, supporting the villa's overall functionality and comfort.

Boat Dock

The boat dock, situated along the serene shores of Madirda Lake, offers visitors a tranquil spot to embark on boat rides and fully immerse themselves in the breathtaking scenery. It serves as a peaceful retreat, providing access to the lake's natural beauty and the opportunity to enjoy the surrounding landscape from the water.





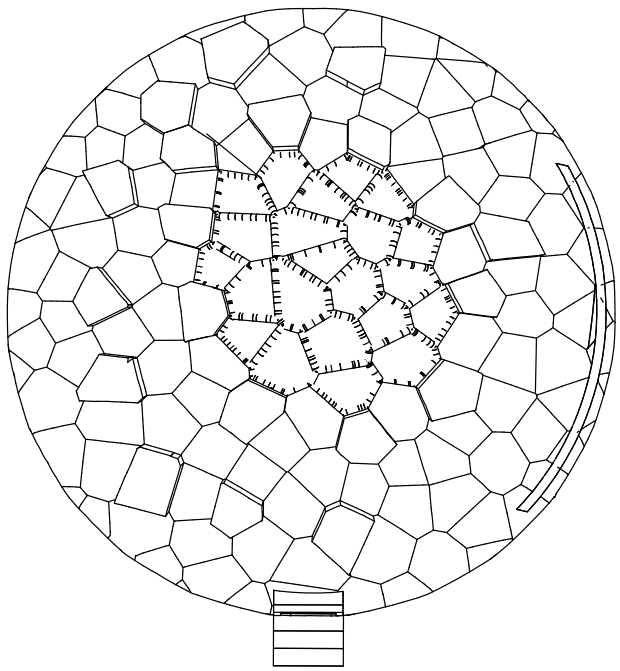
Villa Area

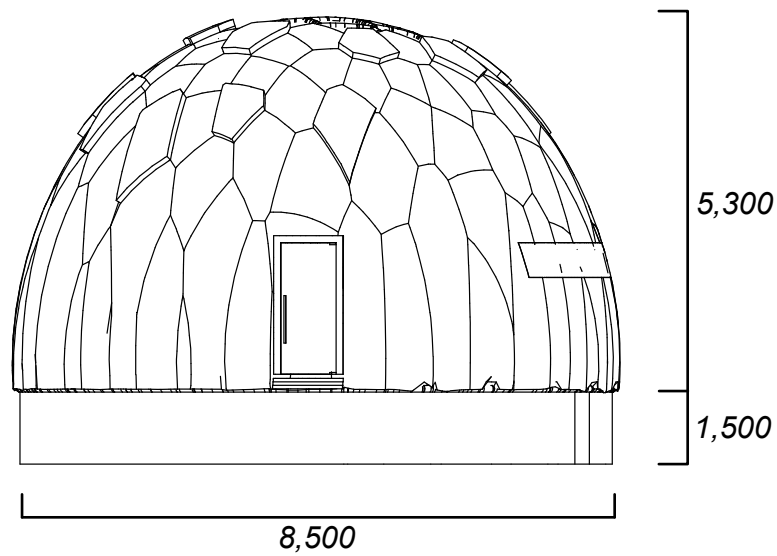
With a total area of 64 square meters and comprising 15 units, the villas are thoughtfully arranged in clusters that follow the natural flow of the water. Each villa offers guests a unique experience, enveloped by the soothing sounds of water from their private inner gardens.

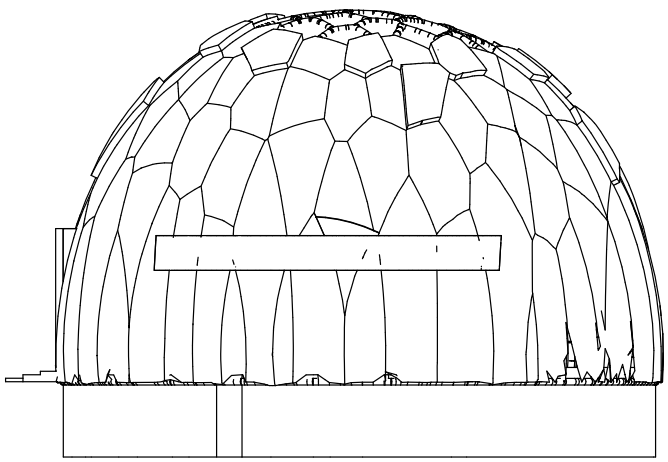


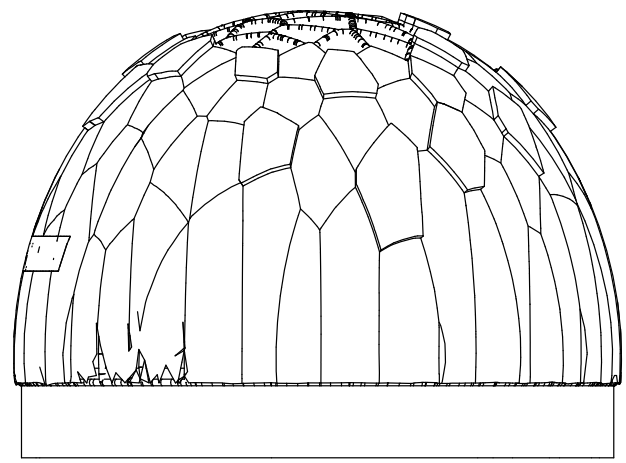
Central Pond

The villas are surrounded by green landscapes, ,allowing visitors to deepen their connection with the surrounding nature. At the southernmost point of the villa area lies a central pond, where the villa's waterways converge. This serene spot also serves as a gathering place for guests.



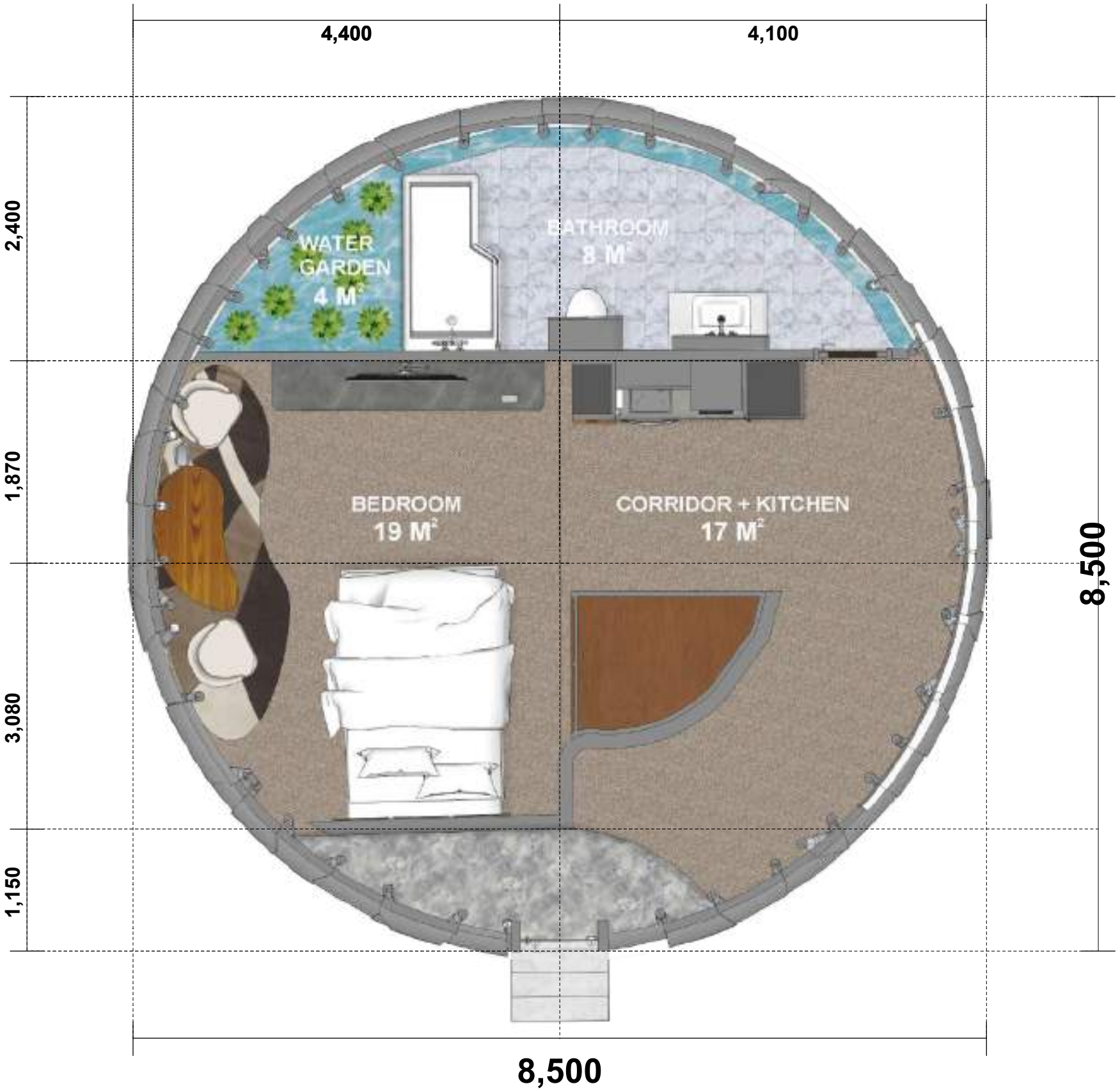






Villa Elevations

Villa Floor Plan

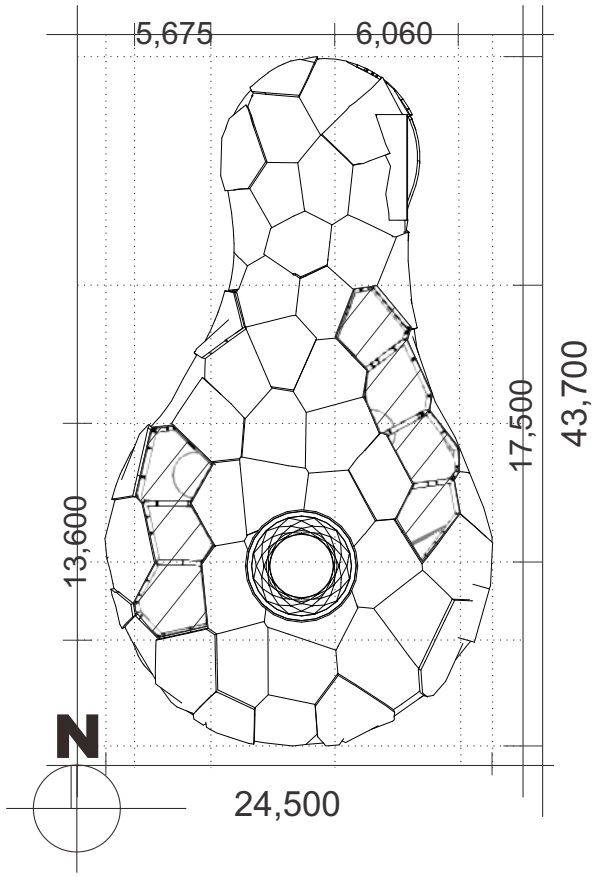




Exhibition Hall

Situated southwest of the Villa Lobby, the exhibition hall is a purpose-built venue designed to educate visitors on the essential nature of water. The hall features four main exhibits, each exploring the critical importance of water in our world. As visitors move through the space, they are enveloped in an immersive environment, surrounded by elements of water—including gentle steam and a shallow pool—that create a tranquil and reflective atmosphere, reinforcing the profound message of the exhibits.

TOP VIEW
1:200





"The Three States of Water: A Versatile Substance"

This exhibit is designed to give visitors a tangible understanding of the three states of water—solid, liquid, and gas—and how they transition between these states. The installation is interactive and multi-sensory, providing both visual and tactile experiences.

Installation Components:

Temperature-Controlled Display Cases:

- Solid State (Ice): A transparent, insulated display case houses a block of ice. The case is temperature-controlled to maintain the ice in its solid state.
- Liquid State (Water): A clear, water-filled basin with a circulating pump that keeps the water in constant gentle motion, mimicking natural bodies of water.
- Gaseous State (Steam): A transparent chamber where water is heated to produce steam. The steam rises and fills the chamber, which is periodically vented to maintain visibility.

"The Vital Flow: Why Water Must Keep Moving"

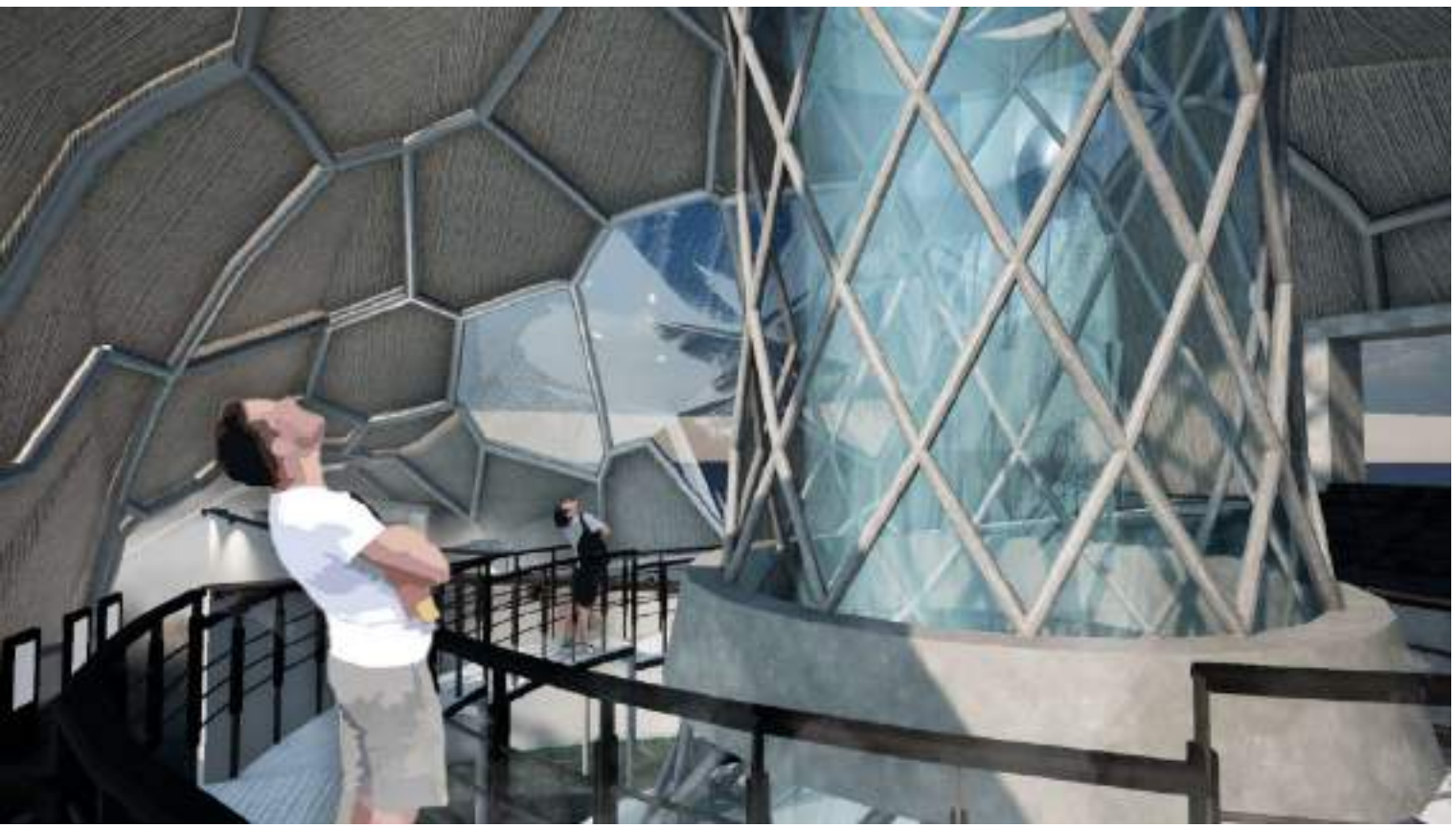
This interactive exhibit explores the crucial role of water movement in sustaining life, maintaining ecosystems, and supporting human activities. Through a combination of dynamic displays, simulations, and hands-on activities, visitors will understand why the continuous flow of water is essential for the environment and society.



"Shaping the Landscape:
Interactive Terrain and Water Flow"

This exhibit invites visitors to explore and manipulate a "Topographic Sandbox" or "Augmented Reality Sandbox" that reflects the unique geographical features and water flow patterns of the specific location it represents.

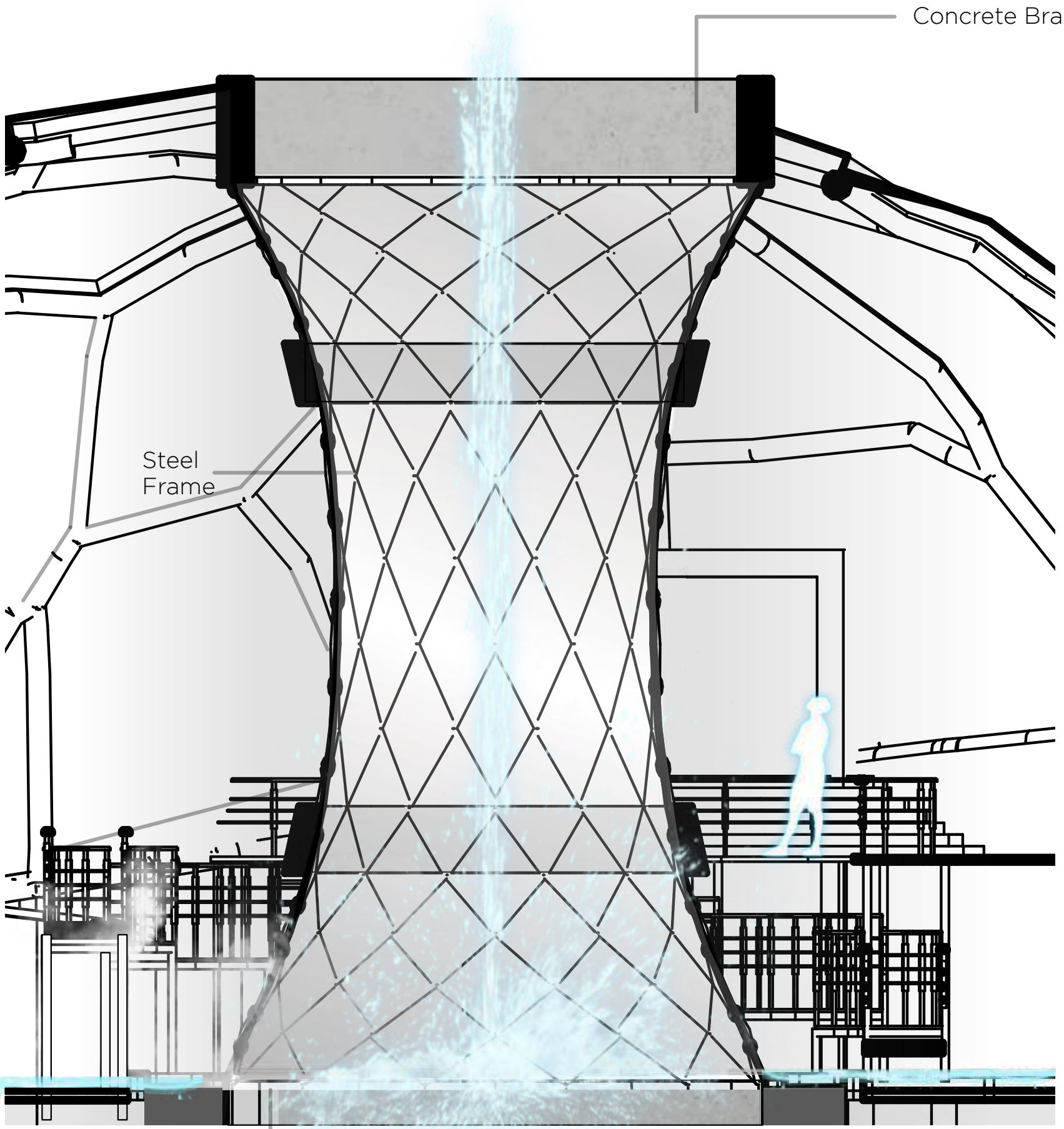


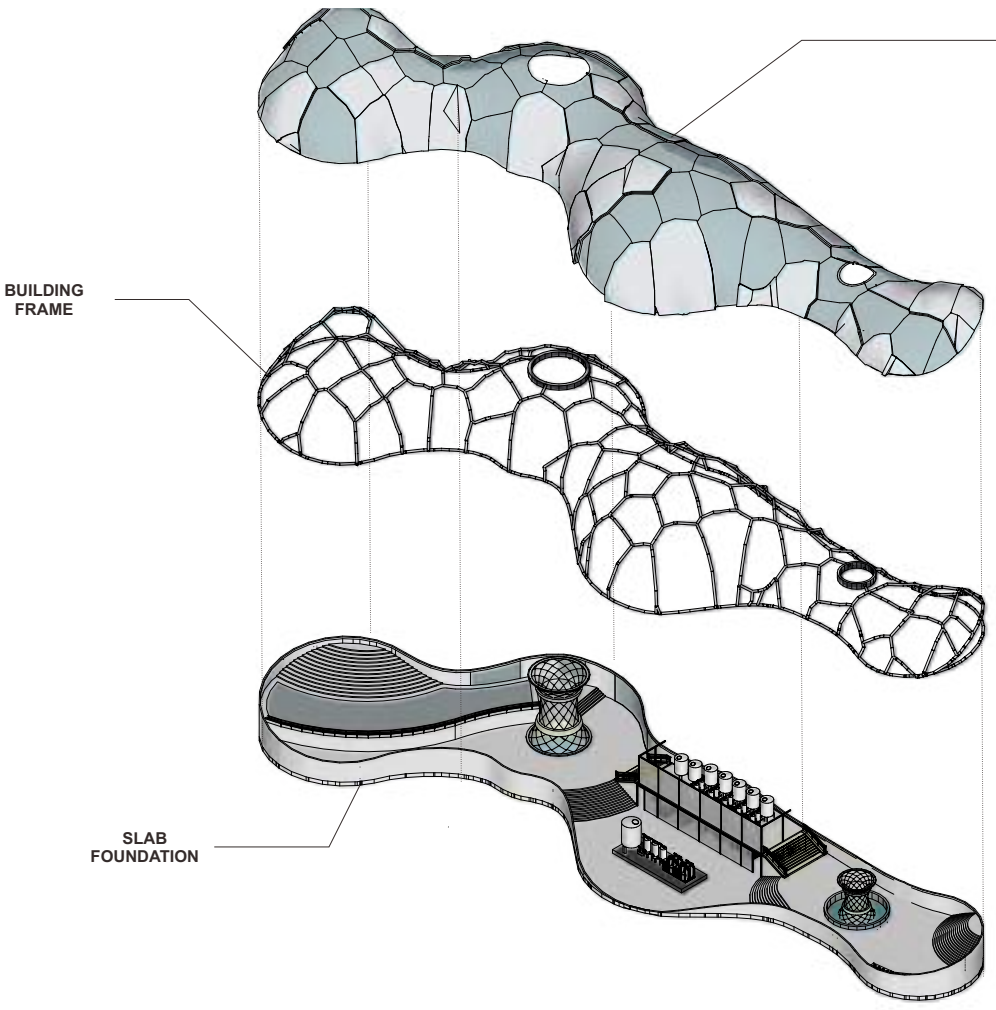


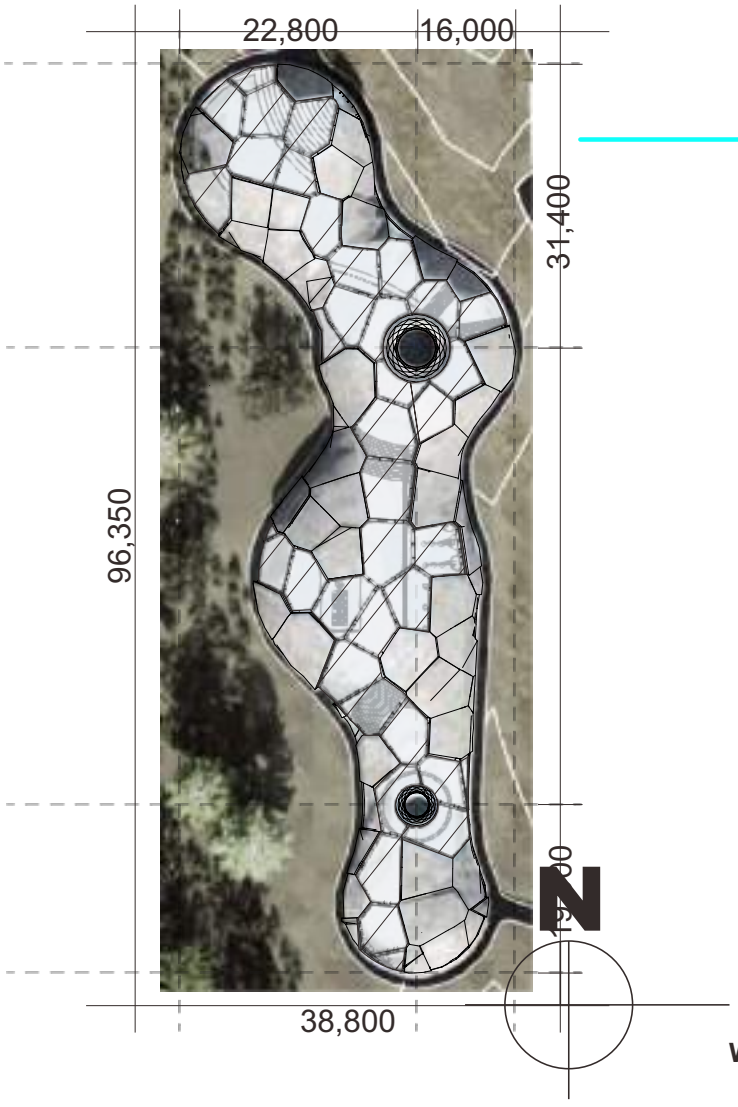
"The Glass Tree:
Water Purification Tower"

This exhibit showcases an innovative water filtration system housed within a large, tree-like structure made of glass and steel. The structure, reminiscent of the iconic waterfall at Changi Airport, doubles as a rainwater catchment system, demonstrating how nature-inspired designs can be harnessed for sustainable water management.



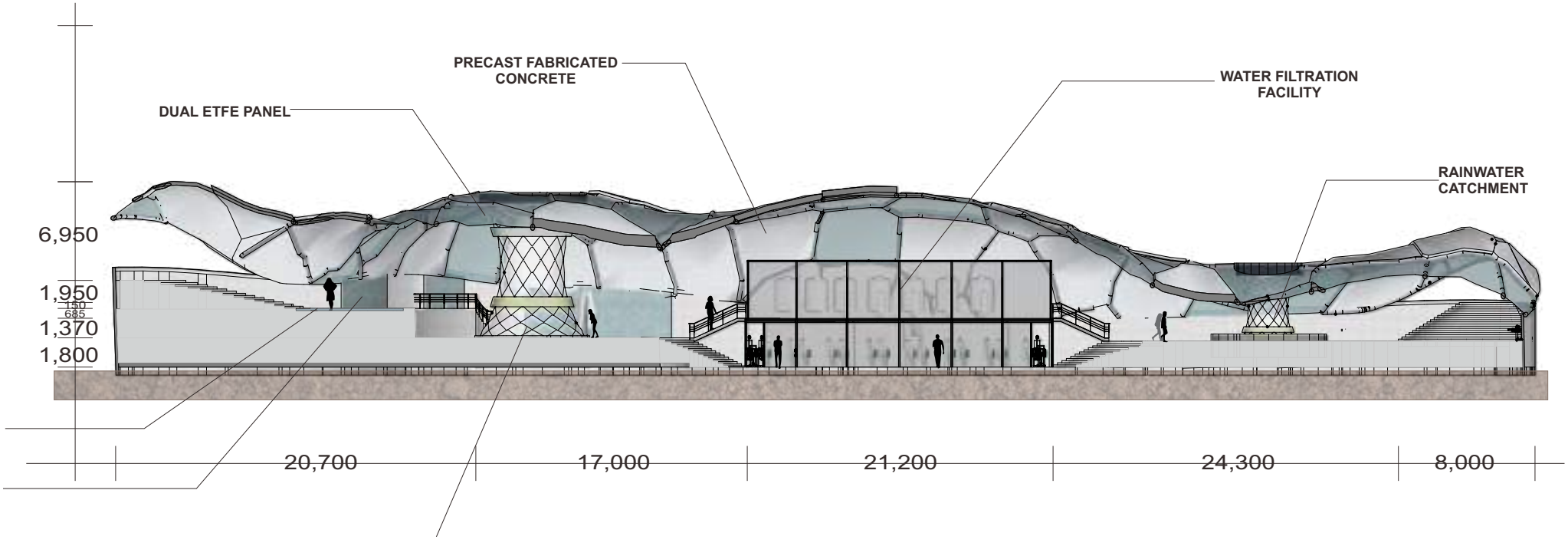

Concrete Bracing
Steel
Frame
Water Catchment
Pool





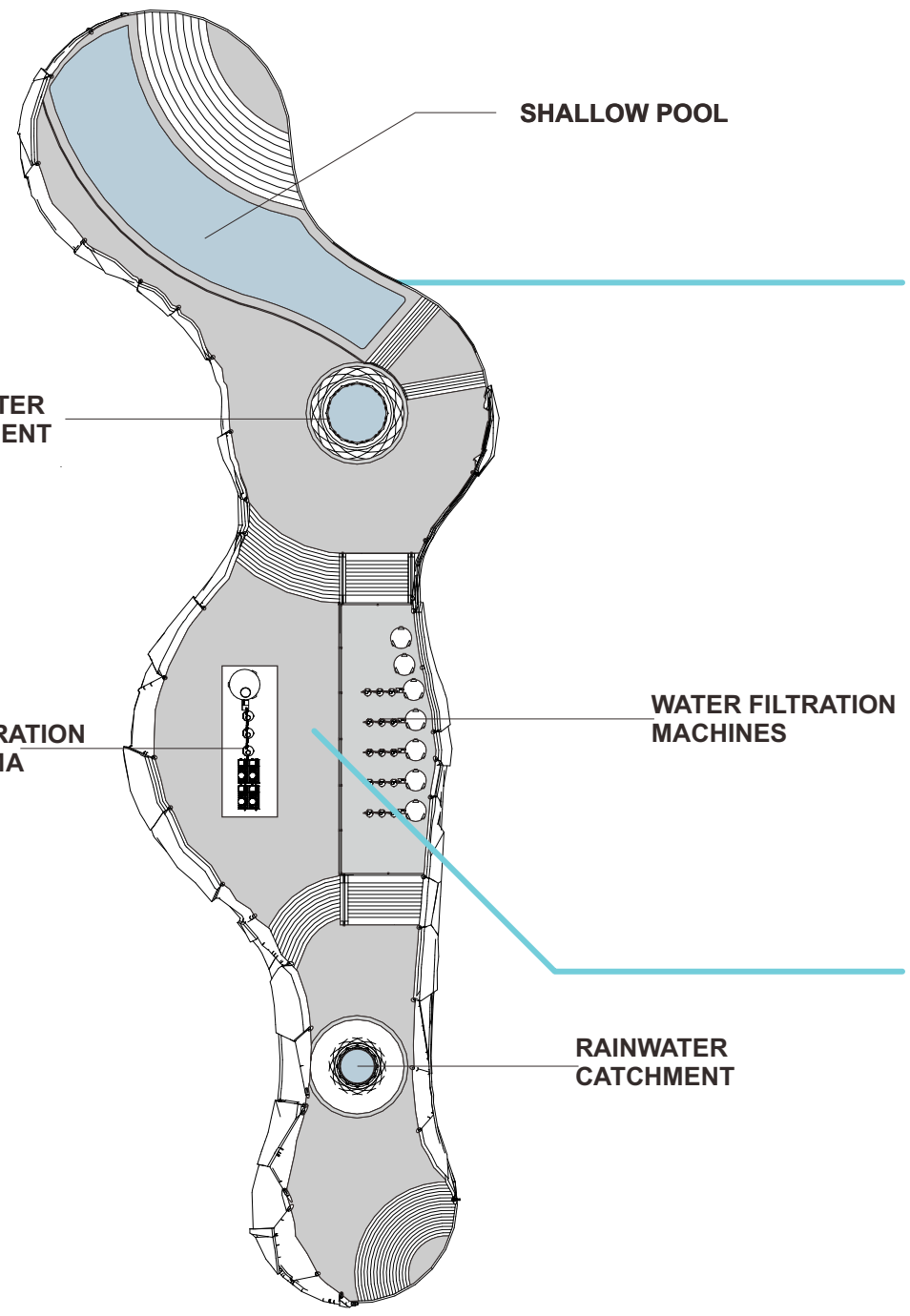
RAINWAT
CATCHM

WATER FILTR
DIORAM



Water Filtration Center

1747 M^2





Main Entrance



As the heart of the area's water filtration system, this central location greets visitors with a shallow pool that serves both as a sanitation feature and a striking visual attraction, marking the entrance to the filtration center.

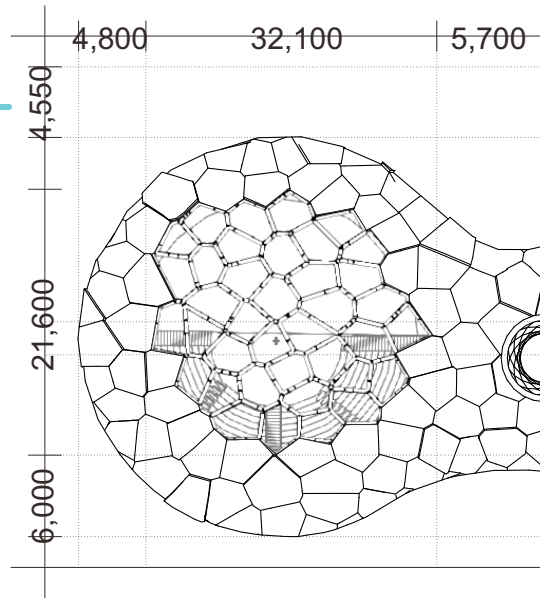
Filtration Area



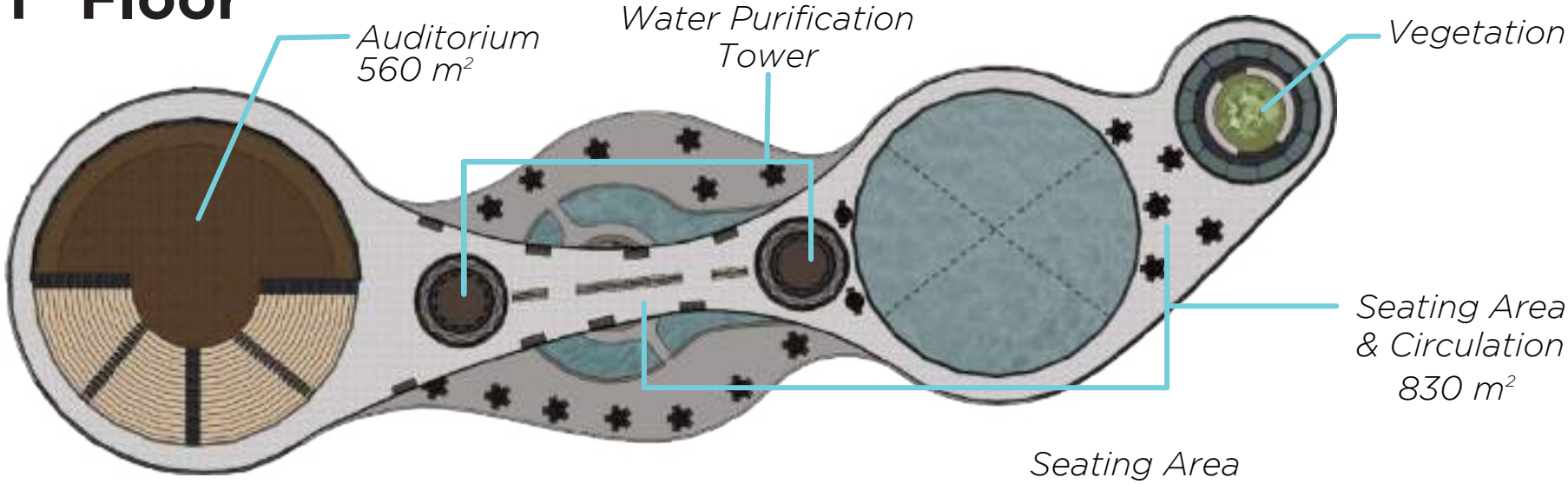
The filtration area features a mezzanine that provides access to the filtration machines, including the reverse osmosis system. Visitors can observe the filtration process from a safe distance, ensuring that all procedures are carried out correctly. Additionally, they can explore the detailed diorama and admire the impressive water purification towers on display.

Recreation Hub

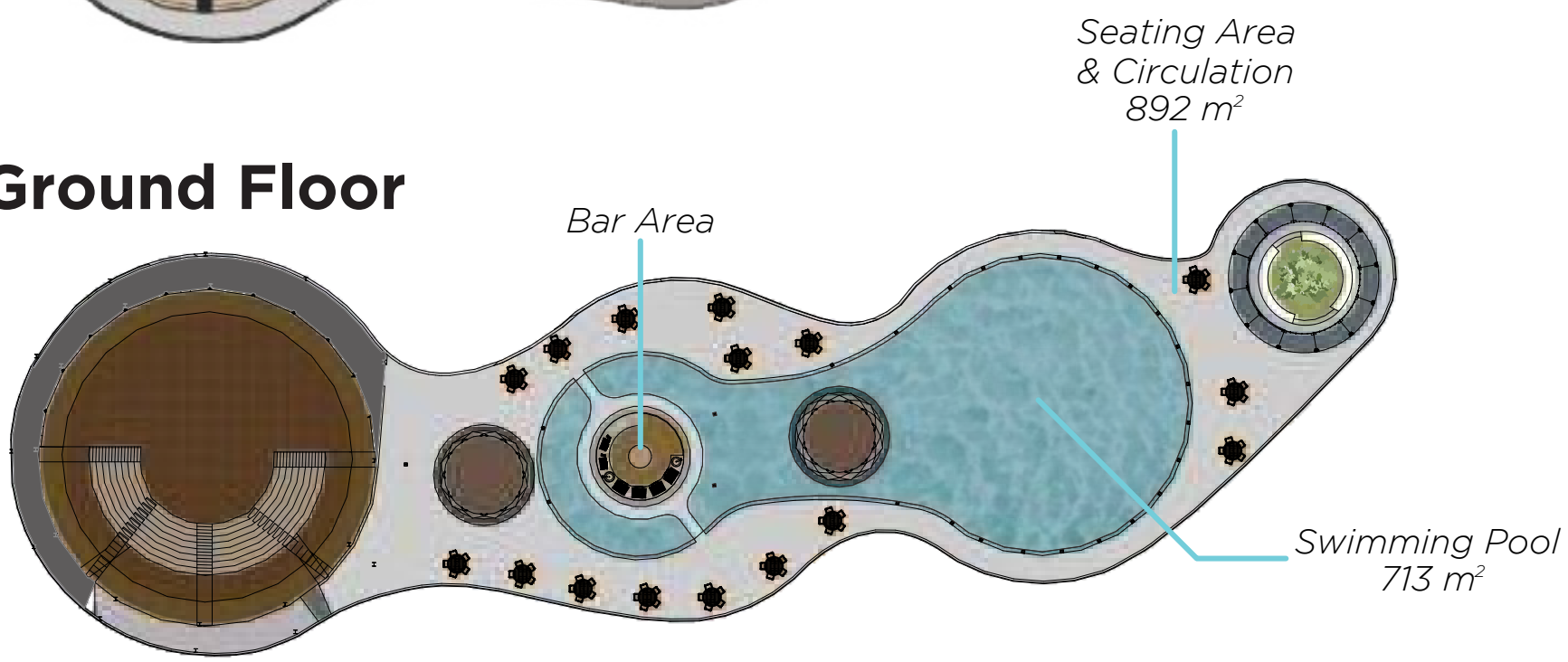


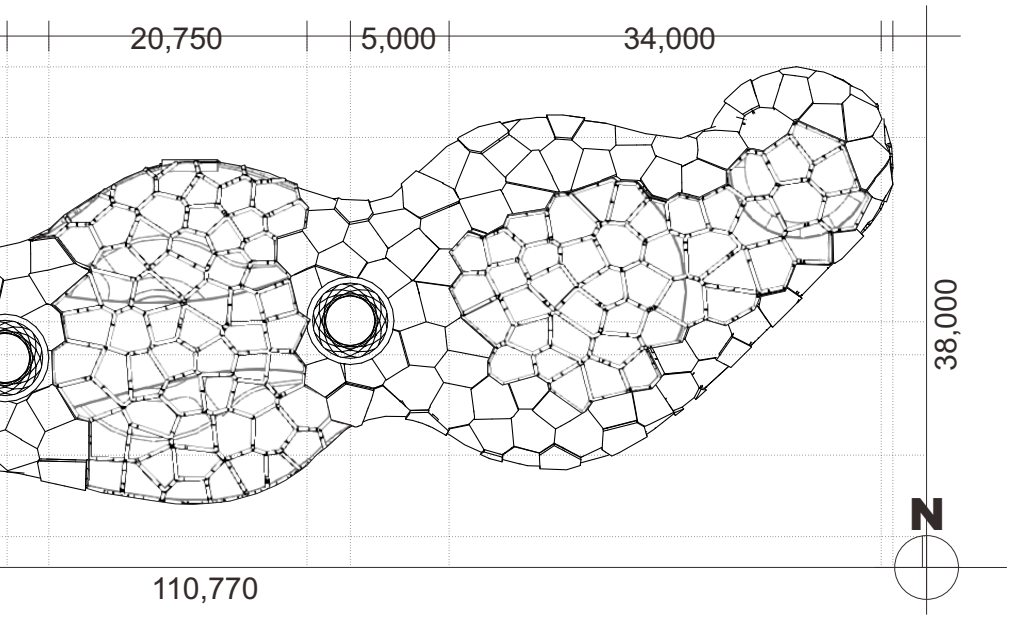


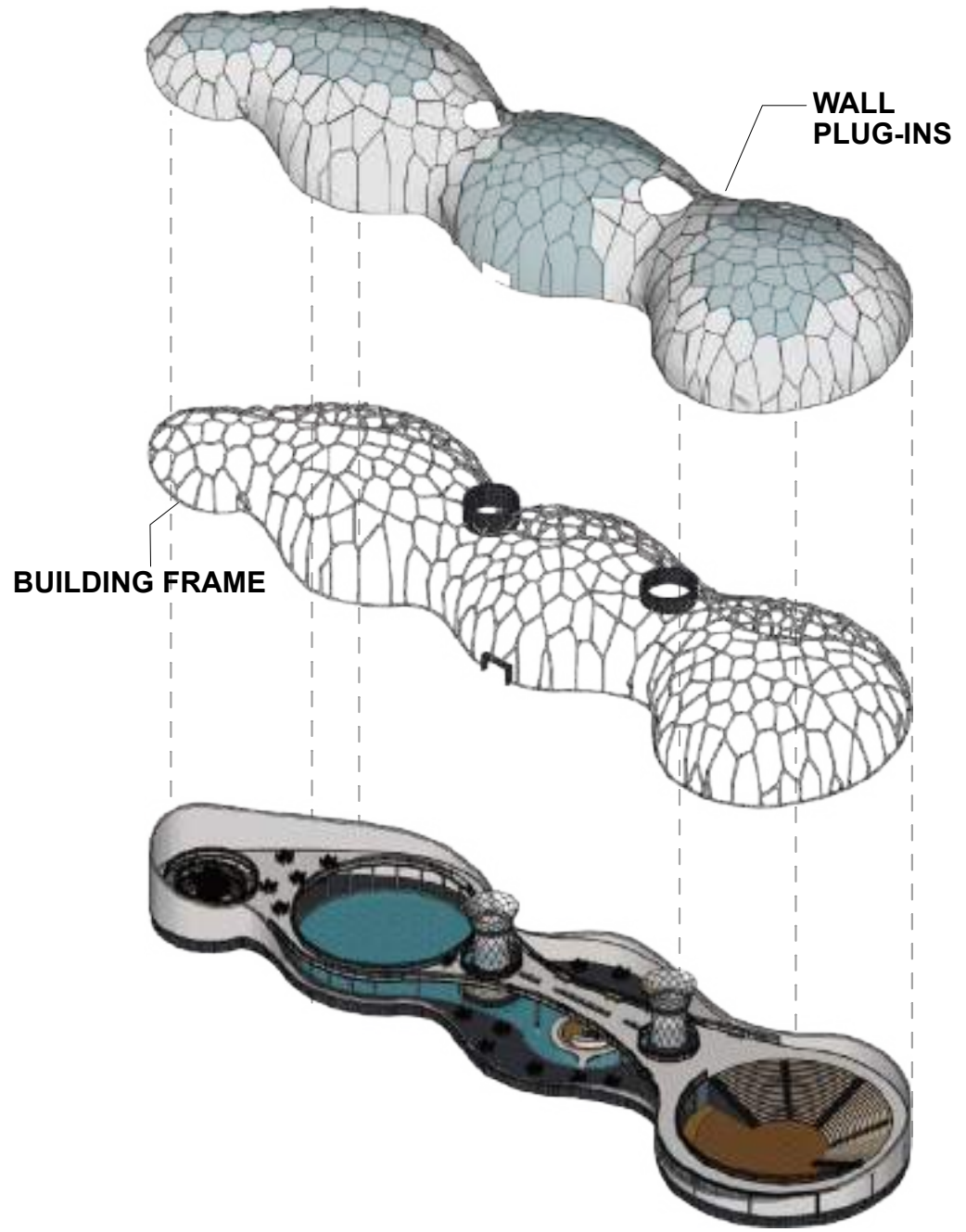
1st Floor



Ground Floor







Auditorium



The Recreation Hub features two distinct spaces. The first is an easily accessible auditorium, conveniently connected to the building's west entrance. This auditorium is designed for hosting public events and ceremonies.

Pool Cafe



The second key area of the Recreation Hub is the pool café, designed to cater to guests and visitors. This space offers a unique experience where guests can swim, dine, and take in the stunning views of Madirda Lake.













3D RENDERING

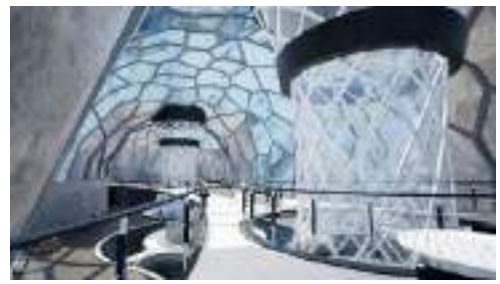






3D RENDERING











DESIGN EVALUATION

Evaluation Review

Based on the evaluation results, the examiner and supervisor provided several comments to enhance and optimize the design. Here are some of the recommended improvements:

Comments :

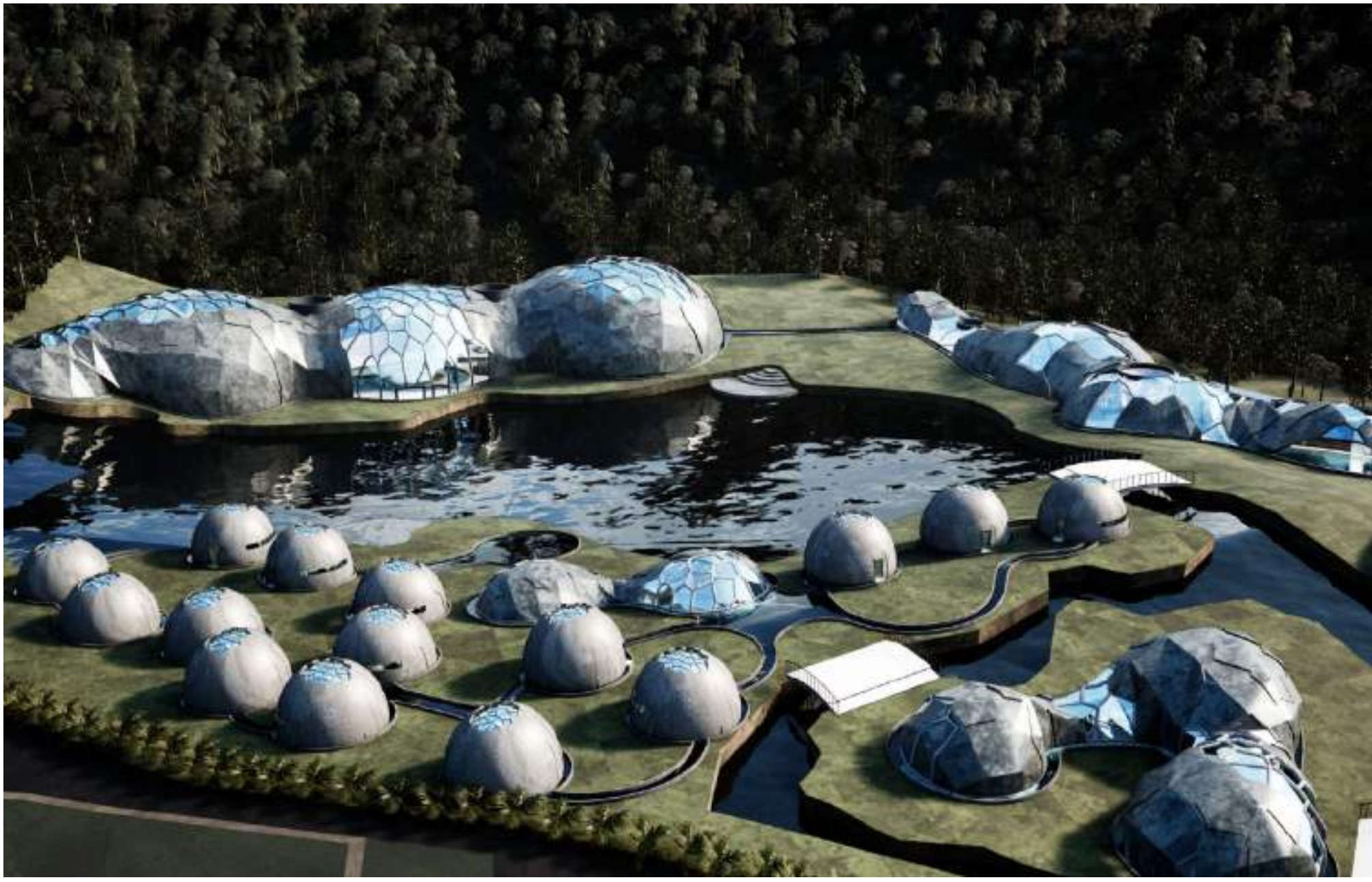
1. The overal feeling of the design somehow reduces the natural ambience of the location

2. Incorporate the site's narrative, detailing how visitors will experience and explore the location.

3. Make sure to fulfill the basic function of each facility. disclaimer about the custom made/size of structure and material.

Comment 1:

The overal feeling of the design somehow reduces the natural ambience of the location



The design's impact on the natural ambiance is evident in the exterior render. In the image, the building contrasts sharply with the surrounding landscape, despite its intent to blend harmoniously with nature. This effect may be due to the rendering technique, which overly emphasizes the building's materiality, making it too clean, and tidy.



Response:

The design has been re-rendered with adjustments to the building materials, incorporating a more earthy brown tone and visible green moss—a key concept intended to integrate the building with its natural surroundings. This revision aims to make the structure appear more grounded and harmonious with the environment, rather than standing out too prominently.

Comment 2:

Incorporate the site's narrative, detailing how visitors will experience and explore the location.

To address this feedback, a visitor route could be added, outlining the various paths and experiences available for exploring the area, utilizing the masterplan of the design.

From the masterplan, we can see the route a visitor could take going to the site by looking at the numbers of each building. Each of the numbers represent hoiw many steps the visitor would take to reach its place.

1 - *Starting Point / Parking Lot*

Place where the visitors could park their vehicle, located just outside of the design

2 - *Main Lobby*

Straight from the parking lot, the visitors would then enter the main entrance directly to the lobby where visitors would be greeted by the receptionist, and be asked whether they would like to take a tour of the place or goes straight to the villa.

3 - *Exhibition Hall*

If the visitors agrees to take the tour, they will be guided to the lobby area where they take off their shoes, and wait for the tour to start. They will then head to the exhibition hall and experience the ambience of being around water.

4 - *Water Filtration Center*

Continuing their journey from the exhibition hall where they learn of the essence of water from the exhibit, they will then continue their journey to the water filtration center, where they would learn about the technicalities needed in order to purifies water, such as filtration processes through the three-steps filtration tanks, and the reverse osmosis machines.

3 - *Villa Lobby*

If the visitors would like to take a stay vacation, they could go directly to the villa lobby reception to rent a room at the villa area.

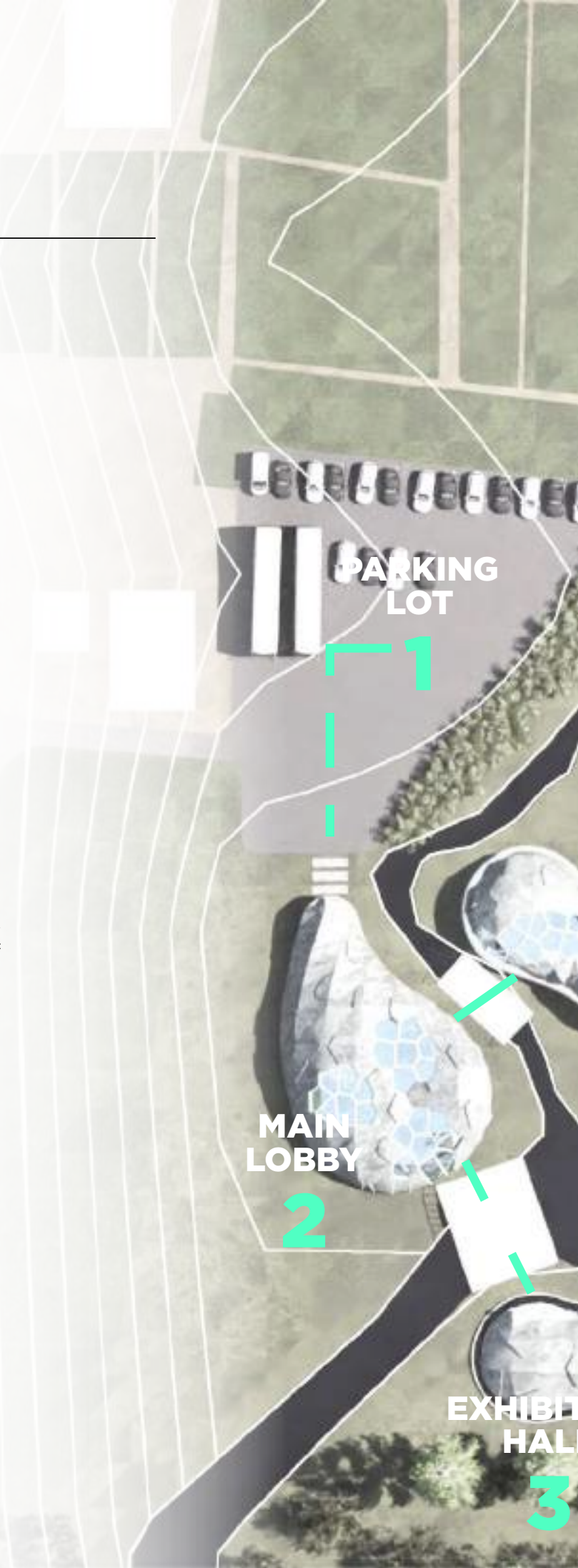
4 - *Villa Area*

Here the visitors could enjoy their vacation while observing the scenery of the lake.

Boat Dock

5 - *Recreation Hub*

Place where the visitors could do some recreational activities, such as swimming in a pool surrounded by water catchment tower adding to the aesthetic, while they could also order some snacks from the restaurant located at the middle of the pool itself. There is also an auditorium that could be used to held events, and shows for the visitors.




VILLA AREA
4
BOAT DOCK
RECREATIO
HUB
5
VILLA
LOBBY
3
BOAT DOCK
WATER
FILTRATION
CENTER
4
ION
L

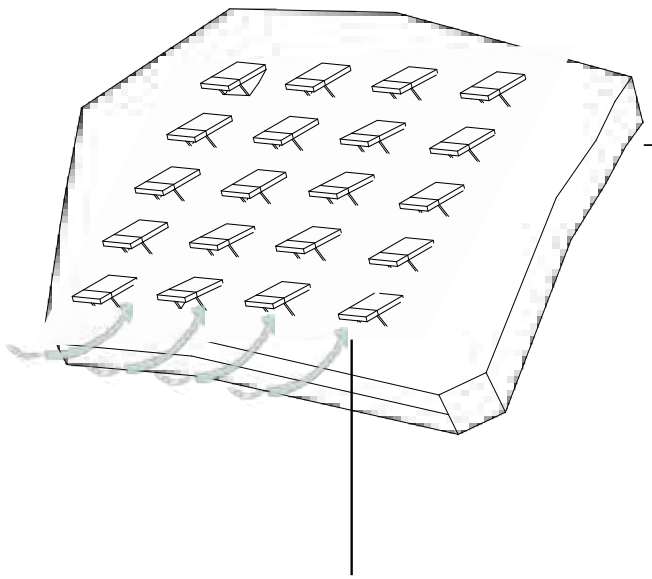
Comment 3:

Make sure to fulfill the basic function of each facility. disclaimer about the custom made/size of structure and material.

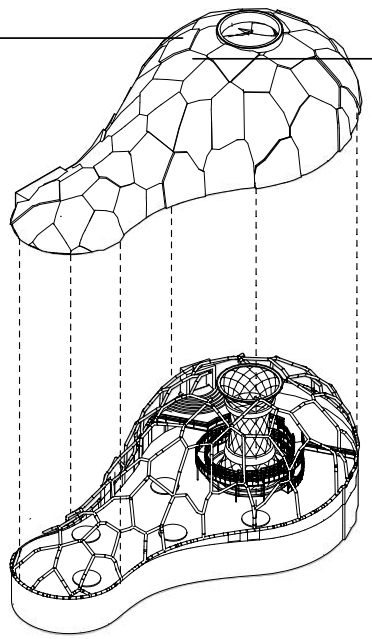
To address this feedback, it's essential to focus on the basic functions of each facility, such as ventilation. Therefore, some of the plug-in walls will be customized to effectively fulfill this function.

PLUG-IN WALLS SYSTEM

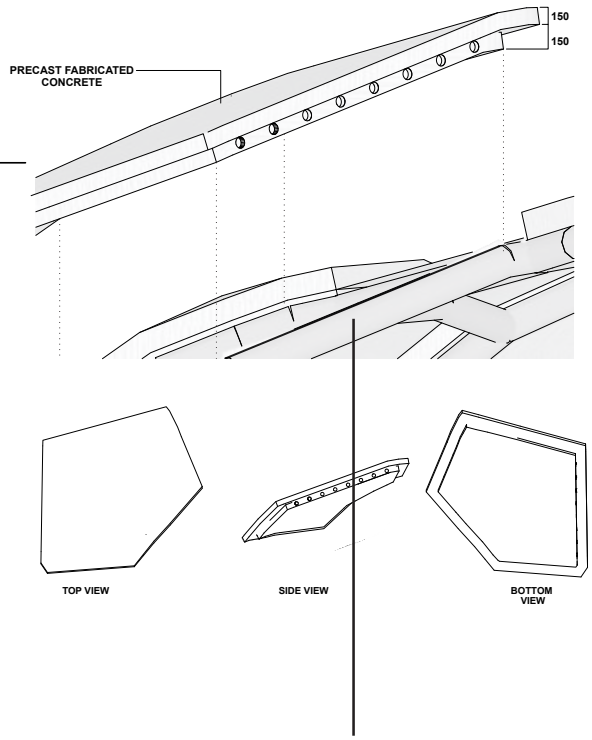
VENTILATION



The plug-in walls can be equipped with ventilation by adding small, shaded holes to prevent water from entering. These ventilated plug-in walls placement can be alternated with the regular ones.



EXHIBITION HALL EXPLODED AXONOMETRY



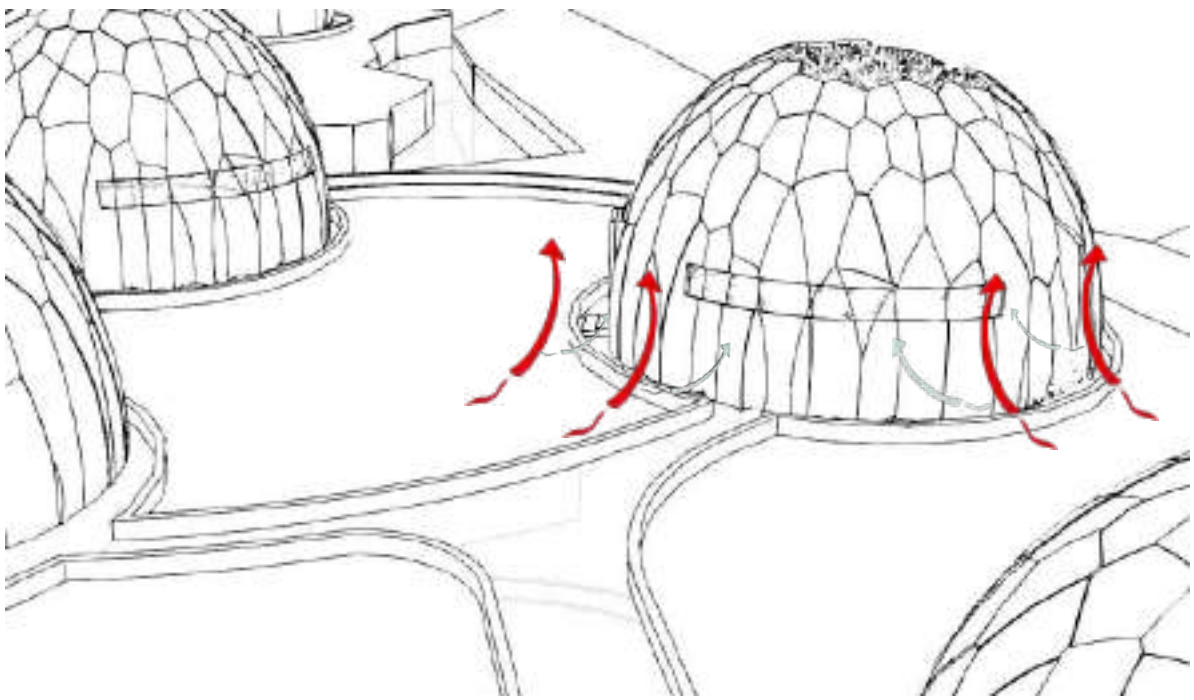
SIZE OF STRUCTURE / MATERIAL

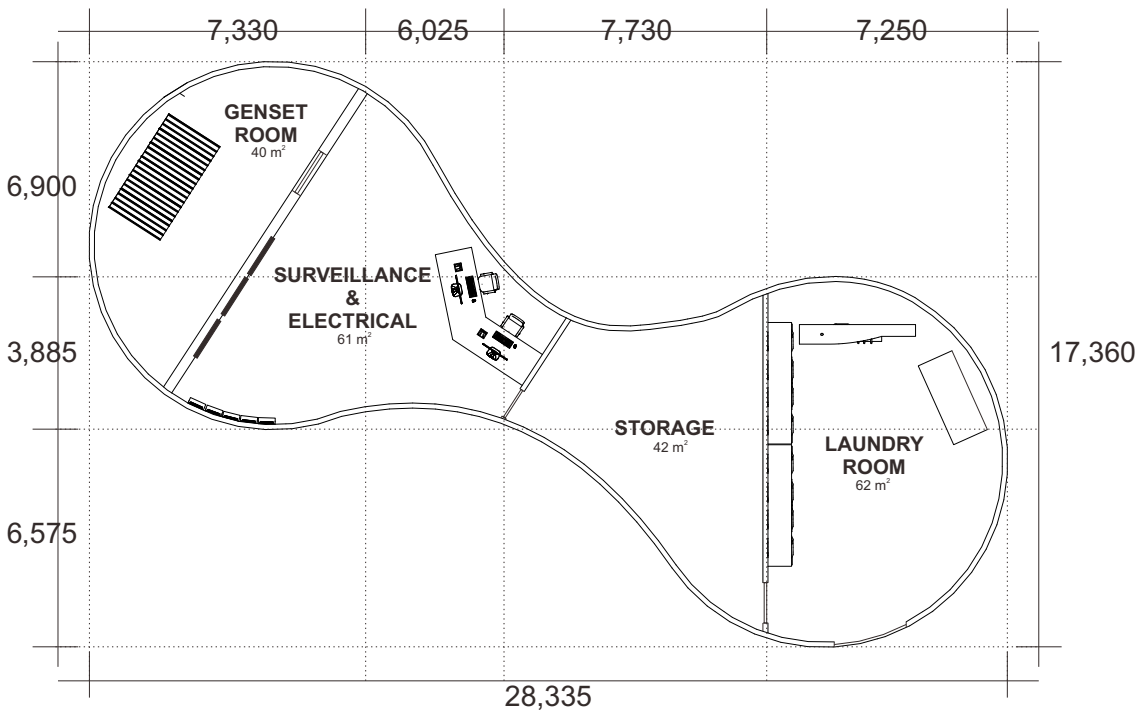
To ensure structural firmness, the steel frames have been standardized to a thickness of 300 mm.

EVAPORATIVE COOLING

Evaporative cooling through the waterways surrounding a room is a passive cooling strategy that leverages the natural cooling effect of water evaporation to lower the room's temperature, thereby enhancing the effectiveness of natural ventilation.

As the sun heats the water, it begins to evaporate, absorbing heat from the air above it and cooling the surrounding air. This cooler air is then drawn into the room through the ventilated plug-in walls, further contributing to the natural cooling of the space.





VILLA UTILITY AREA

Another basic function of the facility is the utility area for the villa. In this case, a floor plan has been provided for the utility area, detailing the various functions it serves within the space.

ATTACHMENTS

PLAGIARISM CHECK

Direktorat Perpustakaan Universitas Islam Indonesia
Gedung Moh. Hatta
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F. (0274) 898444 psw.2091
E. perpustakaan@uii.ac.id
W. library.uii.ac.id

SURAT KETERANGAN HASIL CEK PLAGIASI
Nomor: 2424129514/Perpus./10/Dir.Perpus/VI/2024

Bismillaahirrahmaanirrahiim

Assalamualaikum Wr. Wb.

Dengan ini, menerangkan Bahwa:
Nama : Muhammad Hajid Samudro
Nomor Mahasiswa : 20512037
Pembimbing : Prof. Dr.-Ing. Ilya Fadjar Maharika, Ar., Ir., MA., IAI
Fakultas / Prodi : Teknik Sipil dan Perencanaan/ Architecture
Judul Karya Ilmiah : HYDROSCAPE MADIRDA LAKE, BERJO VILLAGE

Karya ilmiah yang bersangkutan di atas telah melalui proses cek plagiasi menggunakan **Turnitin** dengan hasil kemiripan (*similarity*) sebesar **5 (Lima) %.**

Demikian Surat Keterangan ini dibuat untuk dapat dipergunakan sebagaimana mestinya.

Wassalamualaikum Wr. Wb.

Yogyakarta, 7/29/2024
Direktur

Muhammad Jamil, SIP.

HYDROSCAPE

MADIRDA LAKE, BERJO VILLAGE

Designing Water Education Tourism with Concept-Based Design Strategy and Parametric Approach

For a long time, the utilization of natural resources has supported the needs of surrounding ecosystems, especially in areas rich in such resources, like Berjo village in Karanganyar. Water, as a vital natural resource, plays numerous roles in sustaining life, supporting agriculture, and fostering recreational activities. In Berjo village, the abundant natural water sources have been developed into several tourism sectors, attracting many visitors.

Madirda Lake, a natural water spring in Berjo village, was established as a tourism area in 2020 and continues to improve its tourism activities. Beyond its role as a scenic attraction, Madirda Lake is a crucial water resource that supports both tourism and the local ecosystem. The lake also houses a water treatment facility that utilizes the spring water as mineral water. This dual-purpose use highlights the multifaceted importance of water in both daily life and environmental sustainability.

Given the increasing number of tourists each year, there is a growing opportunity to use Madirda Lake as an educational platform. Integrating water education into the lake's tourism activities can transform it into an eco-study destination. Visitors can learn about the various functions of water, including its role in sustaining ecosystems, its importance in daily life, and the processes involved in water treatment and conservation. This approach not only enhances the tourist experience but also promotes awareness and responsibility towards water conservation and sustainable usage.

By positioning Madirda Lake as a center for water education, Berjo village can provide valuable insights into the significance of water. This innovative strategy can foster a deeper understanding of water's essential functions and the importance of preserving this critical resource for future

Keywords: Water Education, Parametric Design, Eco-tourism



PRESENTATION BOARD



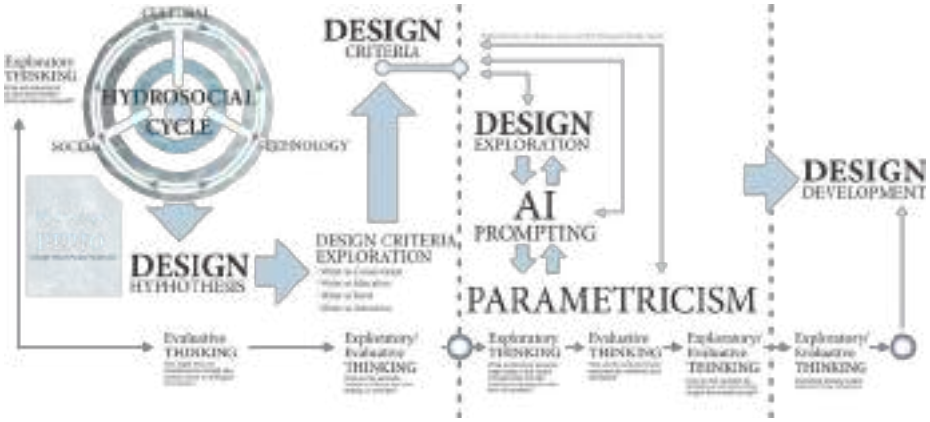
Site Context

Total Madirda Lake Area :
31,000 m2
Area of Development :
16,200 m2

Madirda Lake

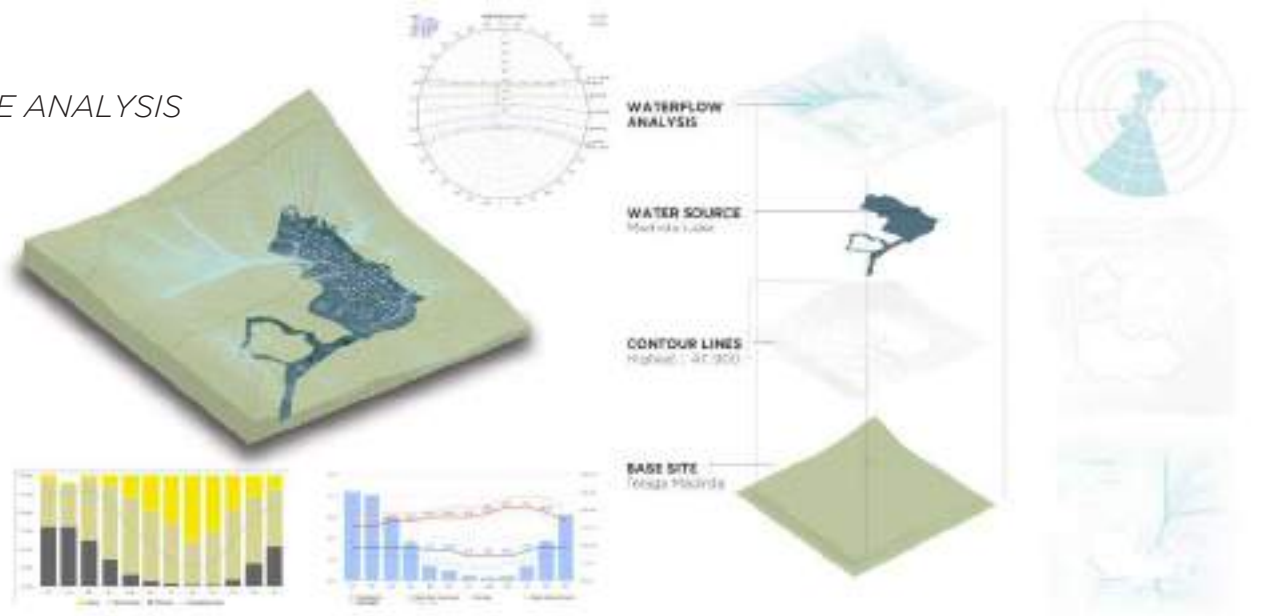


CONCEPT-BASED DESIGN FRAMEWORK



The Concept-based Design Framework is a design approach that involves several steps in order to create a complete design. It considers various perspectives, including social, cultural, and technical factors, which are then integrated to form a cohesive hypothesis. This framework has been selected as the foundational approach for this project to improve comprehension of the design process and provide a clearer explanation of design thinking.

SITE ANALYSIS



1. *Parking Lot*
2. *Main Lobby*
3. *Exhibition Hall*
4. *Main Filtration Center*
5. *Recreation Hub*
6. *Villa Lobby*
7. *Villa Area*
8. *Boat Dock*

HYDROSCAPE

Masterplan

N



Contour Data

Water Pattern



Waterflow Site Pattern: *Source: Author, 2024, Rhino Grasshopper application*



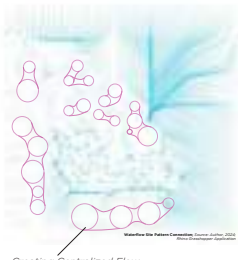
WATERFLOW ANALYSIS

Waterflow Analysis

The site's waterflow analysis was done using the "Mosc on the Grasshopper Rhino application. sing the elevati plugin can compute the slope (steepness) and aspec of the terrain, which are crucial for understanding ho flow over the surface. The flow direction grid in direction water will flow out of each cell, an accumulation grid shows the amount of water flowir cell, helping to identify potential watercourses and a points.

By analyzing the flow direction and accumulation grid can delineate catchment areas, which are regions precipitation collects and drains through a common o

Parametricism
WORKFLOW



Waterflow Site Pattern Connection: *Source: Author, 2024, Rhino Grasshopper Application*

Creating Centralized Flow



PARAMETRIC VORONOI

BASIC SHAPE

VORONOI LINES

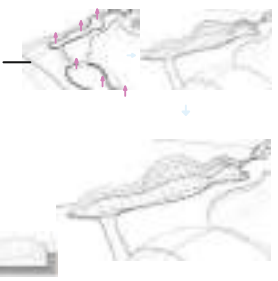
PLUG-IN WALL

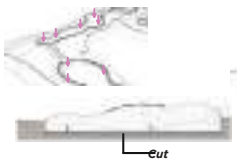
Following the develo is also a concern. To follows water, the bu pattern as part of it only enhances the ae natural patterns fou appear more harmo Voronoi pattern's org stress more evenly a durability and resilien

Bubble Skin Building Facade

In order to emphasize the building's connection with the form of water, an image of fluidity is added as the main idea of the building's whole facade design.

The water intersections are used as the base of the building, which were then extruded usingto create a dynamic look of the building which resembles a bubble. The maximum height of the buildings are also adjusted so that it would not be too high, and can still be connected to the surroundings.





Cut

In order to emphasize the building's connection with its surrounding, the cut and fill

PLUG-IN WALL SYSTEM

Precast concrete is a construction product produced by casting concrete in a reusable mold or form which is then cured in a controlled environment, transported to the construction site and maneuvered into place. Due to it being manufactured outside of the site, it can be said that this material is environmentally friendly.

The concrete is able to reabsorb up to 40 percent of the carbon over the structure's life. In addition, there's minimal waste during manufacture and what are otherwise waste products like fly ash and slag are used. At the end of its life precast structures can be fully recycled.



PRESENTATION BOARD



Waterflow Site Pattern Analysis; Source: (author, 2024) Rhino Grasshopper Application

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Water Intersection

The results of waterflow analysis have revealed distinct patterns within the site, identifying several key locations where water accumulates before continuing its flow towards the lake. These locations, termed "water intersections," are critical points where water converges. Recognizing these intersections is integral to developing strategies for enhancing water flow management within the area. By optimizing these natural convergence points, it is possible to improve water distribution, which can provide substantial benefits to both the water, and the locals.



Water Connection

After the intersections are analyzed, a new waterflow analysis was done to check whether the intersection created would succesfully creates a new water distribution. The result shows that the water is now able to be distributed surrounding the intersection, which means the waterflow would circulates around it. A continous water path is then created alongside the intersection to connects the waterflows accross the buildings.

STRUCTURE

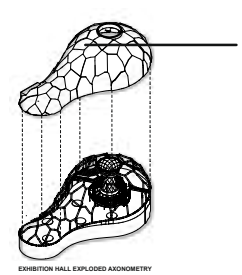
-> VORONOI SCRIPTING **-->**

S **-->** STEEL STRUCTURE **-->**

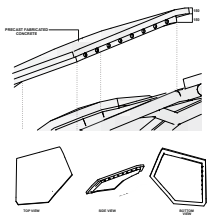


pment of the building, buildability
create a fluid shape that correctly
ilding could incorporate a Voronoi
s skin. This design approach not
esthetic appeal but also aligns with
nd in water, making the structure
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ganic geometry can help distribute
across the structure, increasing its
nce.

By applying this pattern, the building can better resemble water reflections while also forming the base of its structural system. The Voronoi pattern is added to the extruded part of the building using Grasshopper scripting within the Rhino application. Once applied, the pattern is given thickness and used as a framework for the steel structure. The spaces between the lines serve as a basis for the prefabricated plug-in walls.



EXHIBITION HALL EXPLODED AXONOMETRY





Villa Area

With a total area of 64 square meters and comprising 15 units, the villas are thoughtfully arranged in clusters that follow the natural flow of the water. Each villa offers guests a unique experience, enveloped by the soothing sounds of water from their private inner gardens.



Central Pond

The villas are surrounded by green landscapes, ,allowing visitors to deepen their connection with the surrounding nature. At the southernmost point of the villa area lies a central pond, where the villa's waterways converge. This serene spot also serves as a gathering place for guests.



Auditorium

The Recreation Hub features two distinct spaces. The first is an easily accessible auditorium, conveniently connected to the building's west entrance. This auditorium is designed for hosting public events and ceremonies.



Pool Cafe

The second key area of the Recreation Hub is the pool café, designed to cater to guests and visitors. This space offers a unique experience where guests can swim, dine, and take in the stunning views of Madirda Lake.



Main Entrance

By crossing the bridge located on the southeast of the main lobby, the visitors are greeted by the main entrance of the villa lobby.



Reception Area

In this reception area, the visitors are able to make reception for the villa room. Whilst waiting for the process, they are able to admire the scenery of combination between building, and water. This lobby takes advantages of the water surrounding it, and turns it into spectacle, such as waterways, and the waterwalls.



Main Entrance

As the heart of the area's water filtration system, this central location greets visitors with a shallow pool that serves both as a sanitation feature and a striking visual attraction, marking the entrance to the filtration center.



Filtration Area

The filtration area features a mezzanine that provides access to the filtration machines, including the reverse osmosis system. Visitors can observe the filtration process from a safe distance, ensuring that all procedures are carried out correctly. Additionally, they can explore the detailed diorama and admire the impressive water purification towers on display.



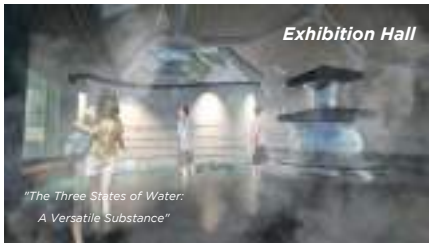
Main Entrance

Upon arriving from the parking area, visitors step into a captivating transition zone that leads them to the Hydroscape Water Education Center. Here, they are met with the stunning parametrical design of the main lobby entrance, a dynamic and inviting gateway that promises an extraordinary experience ahead.



Lobby Area

This area serves as a vibrant three-way junction where visitors can relax in comfort while awaiting their water education tour, or seamlessly transition to the villa area if they're ready to embark on a refreshing vacation surrounded by water-centric landscape.










MOCKUP
SCALE 1 : 400
UNIVERSITAS ISLAM INDONESIA
Pemodelan Arsitektur & Perkotaan
NAME
SUPERVISOR
PROJECT TITLE
HYDRO CAFE



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FINAL ARCHITECTURAL STUDIO

Department of Architecture

2024