

A Water Garden: Celebrating the Beauty of Nature

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Thesis submitted to the faculty of the Virginia Polytechnic Institute and
State University in partial fulfillment of the requirements for the degree of

Master of Architecture

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“The best of men is like water.

Water benefits all things and does not compete with them.

It dwells in (the lowly) places that all disdain - wherein it comes near to the Tao.

In his dwelling, (the Sage) loves the (lowly) earth;

In his heart, he loves what is profound;

In his relations with others, he loves kindness;

In his words, he loves sincerity;

In government, he loves peace;

In business affairs, he loves ability;

In actions, he loves choosing the right time.”

—Lao Tzu, *Tao Te Ching*, 4th-3rd cent. B.C.



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Abstract

Nature, as the major consideration of the Organic Architecture of Frank Lloyd Wright, has constantly been favored as a path for a pure soul to communicate with the spiritual. Inspired by Wright's Organic Architecture and Traditional Chinese Garden, this thesis celebrates the beauty of Nature in Pandapas Pond, Giles County, VA, where a "Water Garden" is created on the open space defined by its water. Formally, the whole garden complex takes the inspiration from lotus flowers floating on the water, which could be thought of as an "organic system of architecture."



Acknowledgements

Lao Tzu once mentioned in Tao Te Ching:

He gives them life, but does not take possession of them;

He acts, but does not appropriate;

Accomplishes, but claims no credit.

It is because he lays claim to no credit

That the credit cannot be taken away from him.

This book is dedicated to those who had “accomplished” me but “claimed no credit”, my parents, Dr. Humberto Rodríguez-Camilloni, Professor H. Scott Gartner, Professor David Dugas, as well as my friends and colleagues. Your patient effort and support enlightened not only my thesis, but also my life. It was also an extraordinary journey to explore myself, where did I start, and where should I go. Thanks to your kindness and advice along the way, I could make it towards my goal without losing myself. This book will imbed the most unforgettable memories when I shared my best time with the most adorable people as well. Credit that you never claimed will never ever leave you.

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Introduction

As Frank Lloyd Wright once recommended, architecture should bring beauty to complete a site, so as to become one harmonious unit with it. This thesis project aims at achieving this symbiosis with nature and its intrinsic beauty.

Responding to this ultimate goal, the site of Pandapas Pond becomes the major and prior consideration in the design process. Through inspections, it turns out that the pond has long been requisite locality for fishing. Its being selected is not solely attributed to the beautiful natural surroundings, but also from the “concert of water and nature”. The constantly moving water creates many waterfalls in the pond, playing vivid music of nature from time to time. Being involved, visitors could freely enjoy its meditation while retreating from their busy life. Therefore, the question ends up with how to elevate this experience of enjoyment without altering its nature. In the meantime, the rainy day might cause some real problems. The muddy trail would completely ruin this experience, aided by no shelter available. When it turns dark at night, the pond seems to fall asleep totally. Substantially, these problems pose several challenges towards the design, exposing the incompleteness of the site.

Rather than challenges, it, however, can be recognized as a design opportunity as well. By the design of the pathways above the water, visitors could be provided with comfortable docks for fishing, and “music of water” along the way. The pavilions that are channeled by pathways and walls will in turn grant shelters on a rainy day. Meanwhile, the night scene has been specially designed with unique light fixtures, making the pond another world at night. Penetrating all through these design processes, the “three distances” theory and “scene” theory can be regarded as the inspiration from traditional Chinese Gardens. In approaching all these, the site can be completed with an organic unit -- architecture becomes a part of nature.

Site

The Pandapas Pond has a site plan with multiples angles. Each of them could give a beautiful view from different perspectives, making them appropriate locations for the pavilions. In fact, there have been quite an amount of existing retreat places with tables and chairs. They could also serve as confirmation of the design.



Site

In the early morning, the mist raises up from the pond, waving around, only to make it a paradise of nature. To set a pavilion in mist, it also answers to the idea of the “deep distance” in traditional Chinese painting -- use of cloud, mist or water to reveal the distance and spacial relationship. In this sense, the pavilions above the water can look like a picturesque painting.



Site

In order to provide visitors with places for fishing, some fences have been built to produce “rigid” banks. However, it proves that they are never rigid, especially after a heavy storm. Besides, they are even much more dangerous than being expected. Therefore, this project could settle such problems at the same time as well.



Site

In terms of the facilities, there have been an existing restroom in the site. It might need some maintenance or re-construction in according to the whole design.





Survey for the Site

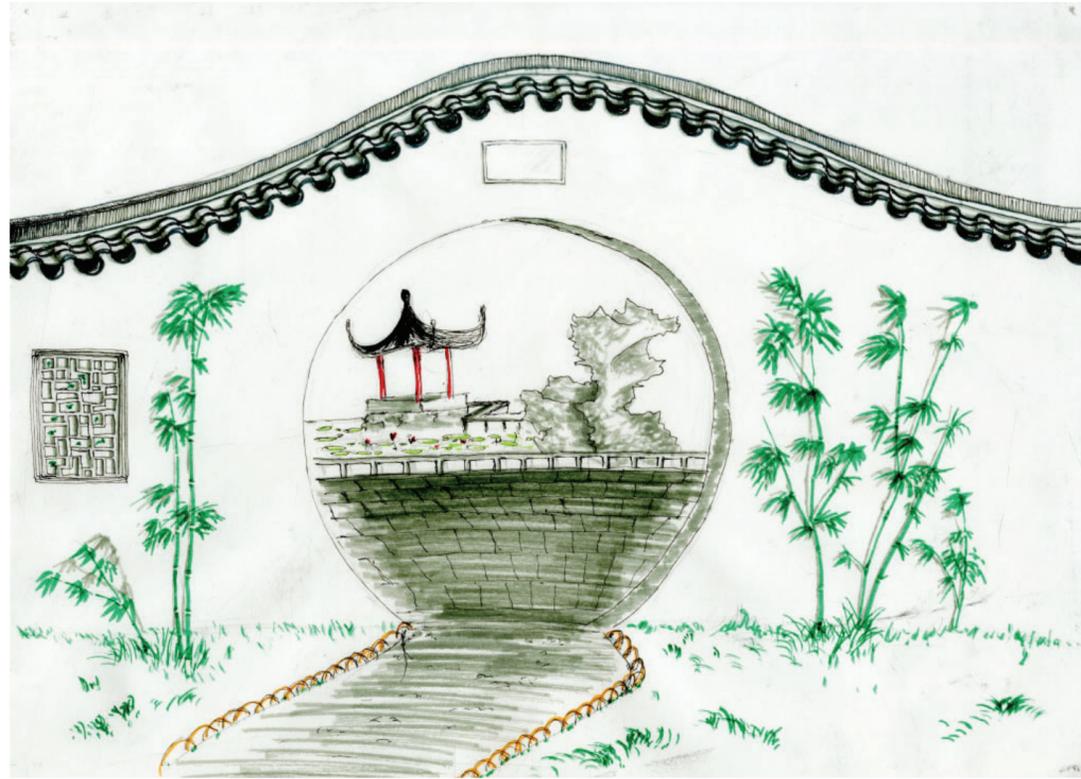
Inspirations

Chinese Traditional Garden

It has been a dramatically long history for Chinese Traditional Gardens to employ the “scene” theory in their layout. The “scenes” are those certain spots with fantastic views or spectacular architecture imbedded in nature. Visitors could normally observe and enjoy those “scenes”, but hardly can they find a direct path towards the “scene”. It indicates that nature is to enjoy and to respect rather than to touch or to change. Consequently, it often occurs that people could figure out a path going nowhere, as they follow the path and walk on, suddenly the view opens up for them, usually rewarded with a beautiful “scene”. The enjoyment of visiting comes from the motivation to explore.



Some “Scene” Examples of Chinese Traditional Gardens



Chinese Traditional Gardens

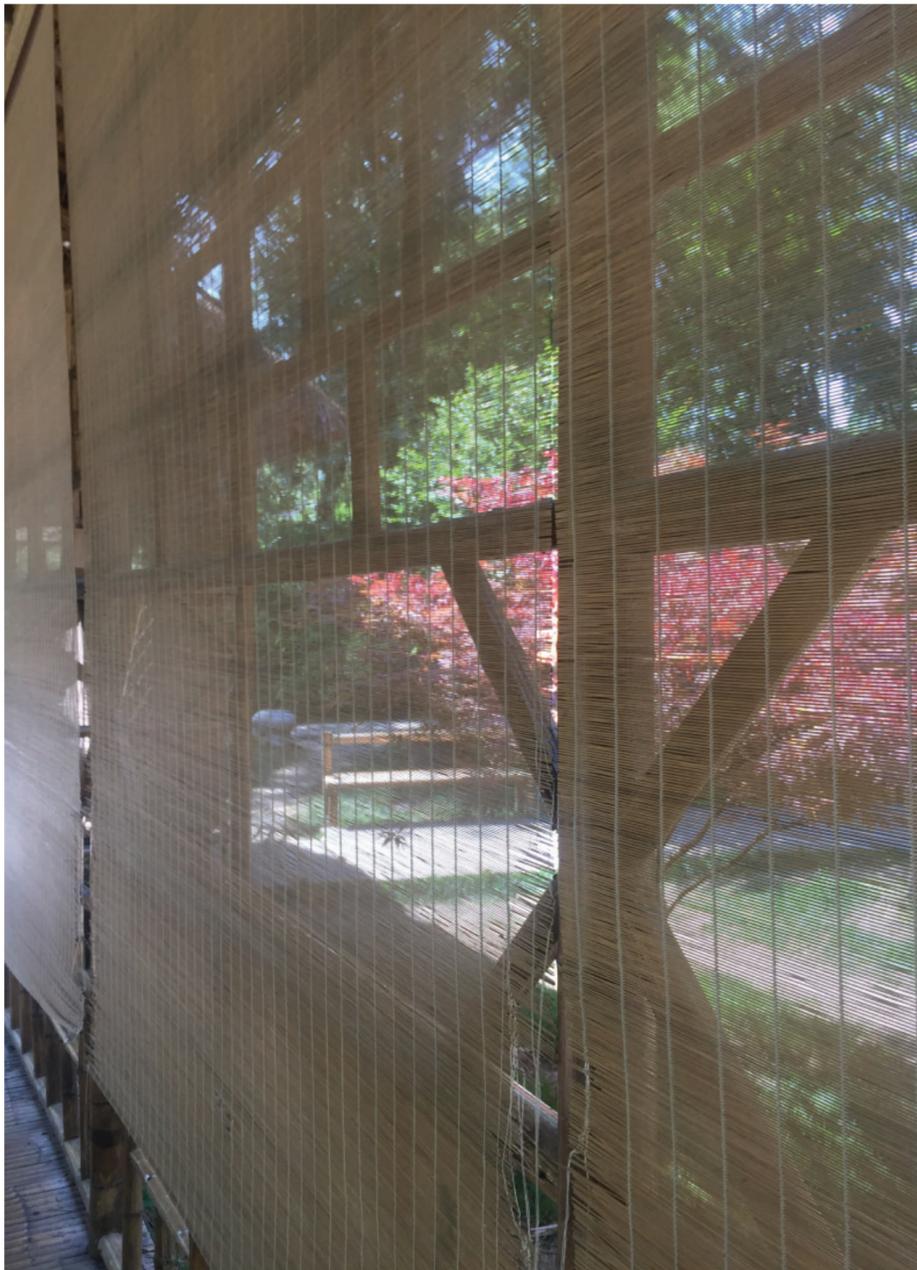
For materials, bamboos are chosen as the major components since they are the most natural materials for construction which Mother Nature favors most. Meanwhile, they grow very fast with tremendous stiffness stronger than steel. Exposed to the humid environment, bamboos tend to be more water-proofed than steel. Its lightness in weight is another advantage for construction. Due to all of the above, quite an amount of Chinese Gardens employed bamboos in their pavilion construction.

The “Flight Roof” is also an important element in Chinese Traditional Gardens. Some of the roofs seem to be ready for flying like birds.



Chinese Traditional Garden

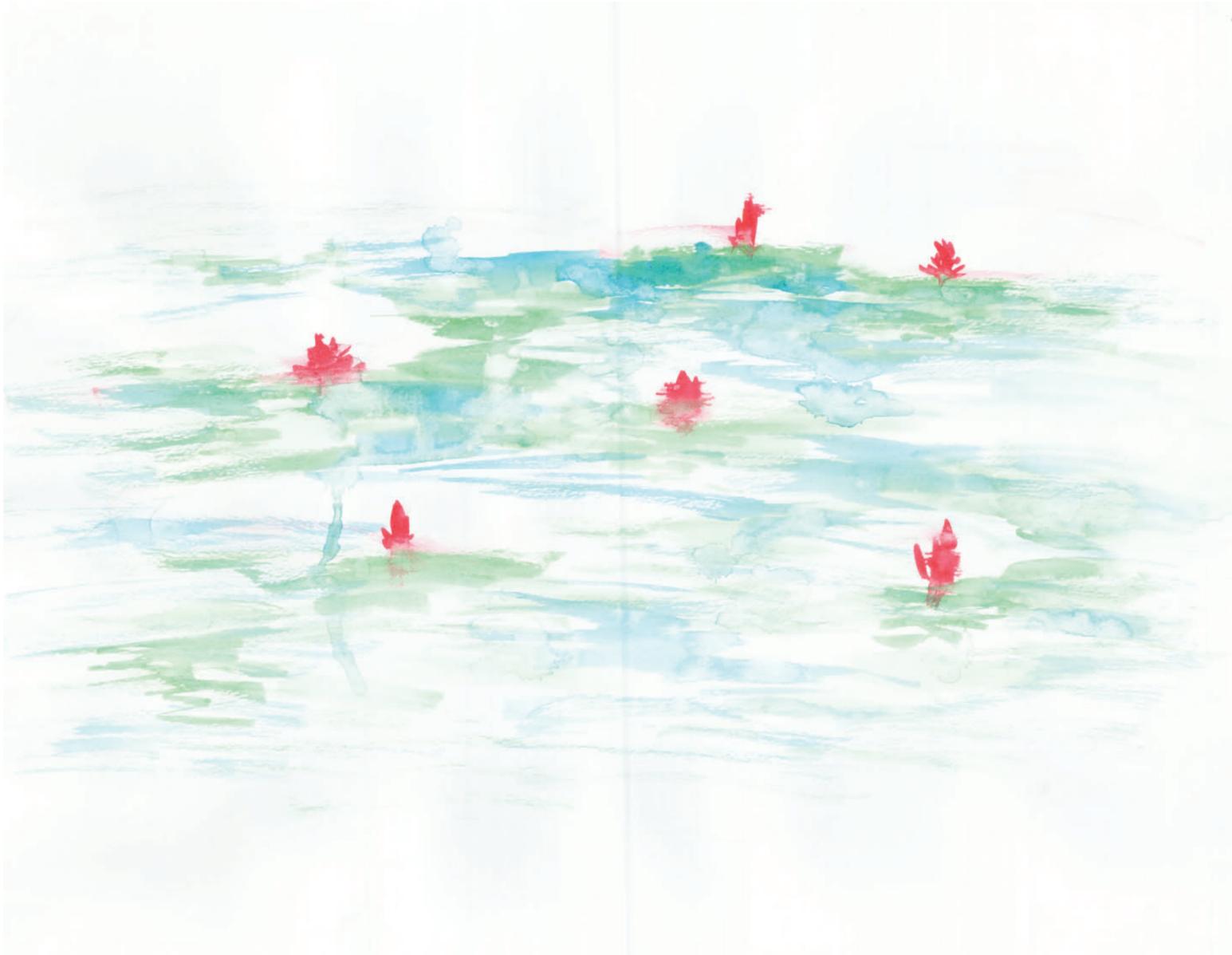
Another feature that appears frequently in Chinese Traditional Gardens is the bamboo screen. A light-weighted screen that could let in sunshine and fresh air while keeping out insects and rain can really be installed everywhere in a pavilion.



Inspirations

Watercolor

In traditional Chinese painting, the skills of watercolor are often applied to express the beauty of nature in an abstract way. It has been recognized as an endless resource of inspiration for both art and architecture.



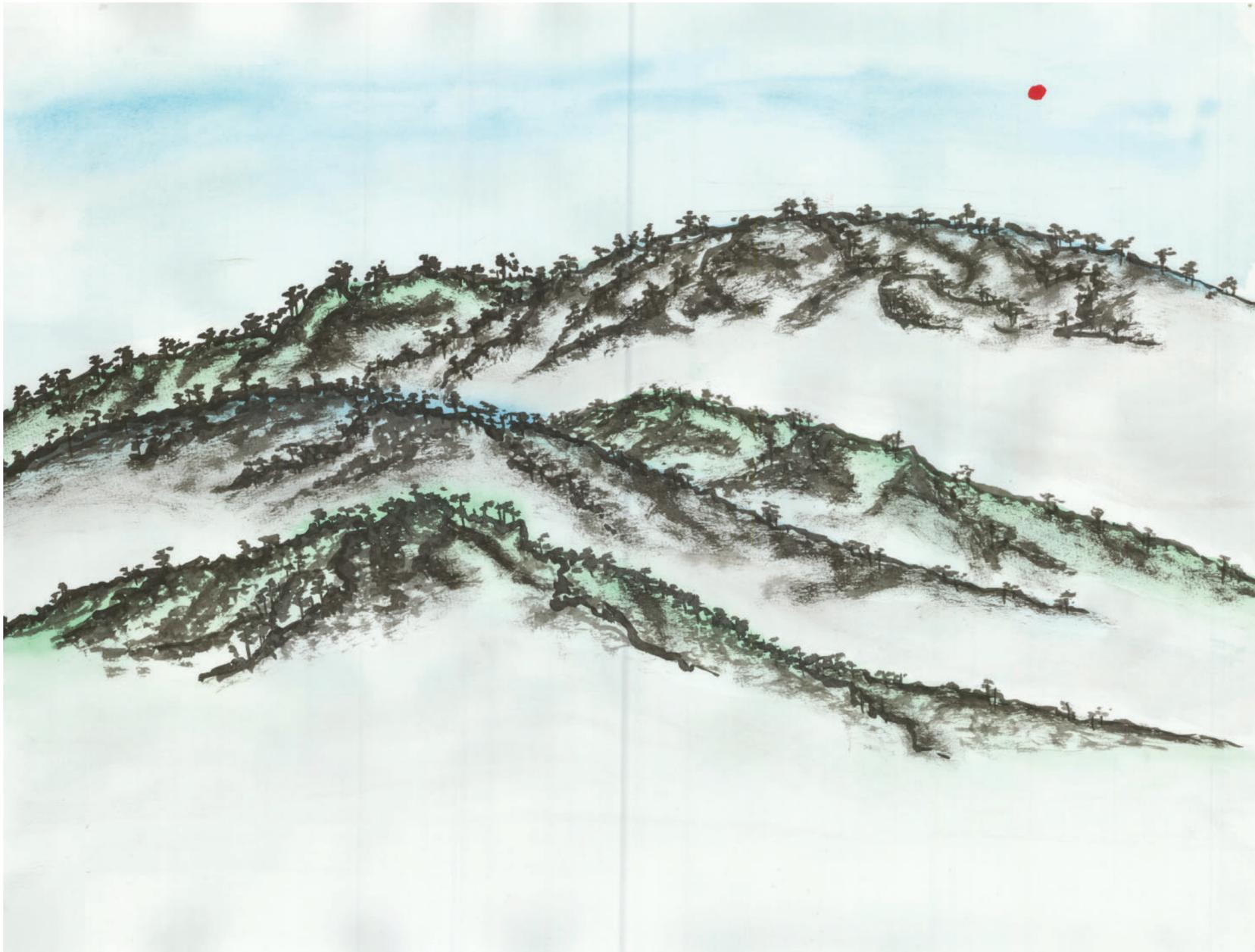
Watercolor



Watercolor



Watercolor



Watercolor



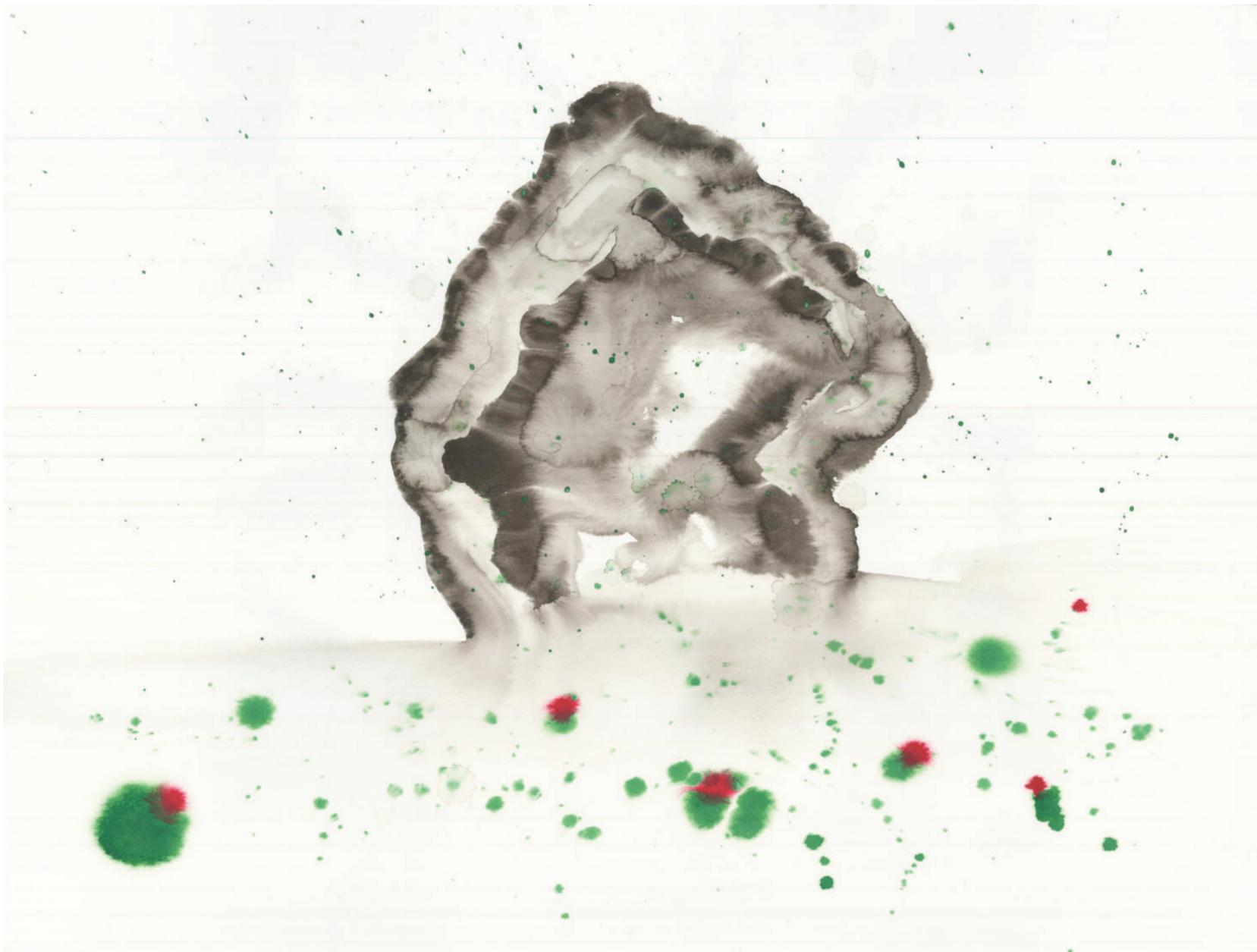
Watercolor



Watercolor



Watercolor



Watercolor



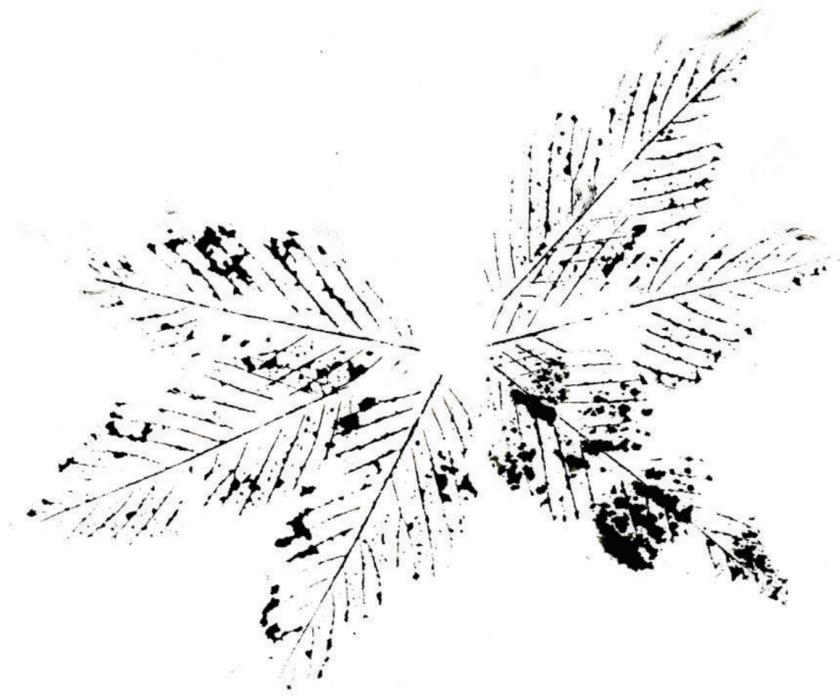
Watercolor



Inspirations

Leaf Prints

The appreciation of nature is always a guideline for organic architecture. Leaves, “the babies of trees”, could sing and dance on a piece of paper. Each of them has stories to tell. Combined together, they could compose a sonata of art and architecture.



Leaves Prints



Leaves Prints



Leaves Prints



Leaves Prints



Leaves Prints



Leaves Prints



Leaves Prints



Leaves Prints



Leaves Prints



Leaves Prints



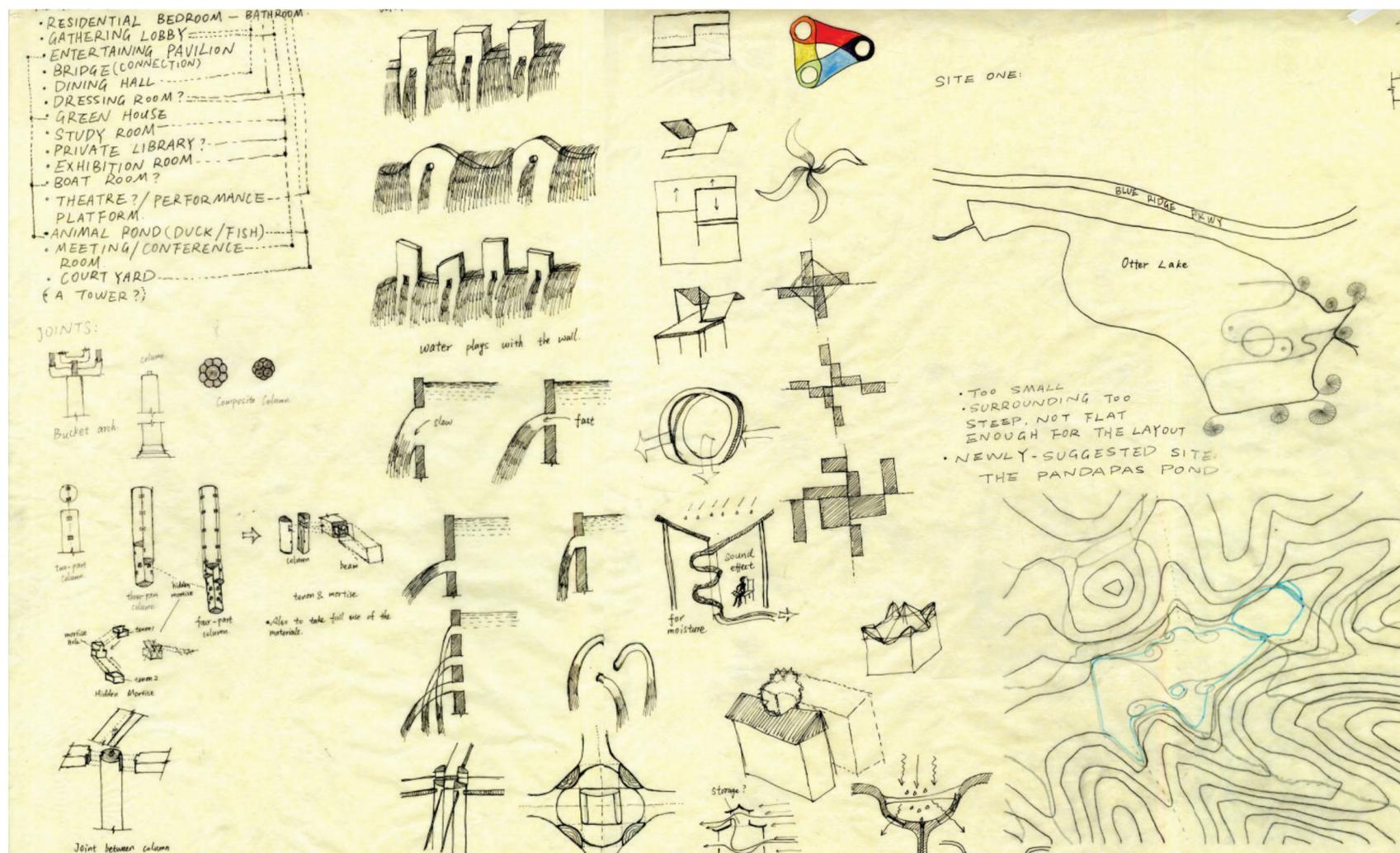
Leaves Prints



Design Concepts

Sketches

These are the sketches that were collected to reveal how the thesis project has been developed. It is quite interesting to review how the design has changed from time to time, until its final version.



Sketches

4-COLUMNS

5-COLUMNS

5-COLUMNS

5-COLUMNS

6-COLUMNS

6-COLUMNS

6-COLUMNS

6-BAMBOO-COLUMNS

BAMBOO FACADE (CURVED)

- LOW FIRE RESISTANCE

- DIFFICULTY IN MAKING & DESIGNING JOINTS

- VERY FRAGILE & LOW EXTENSIBILITY WHEN BENT TO ITS BROKEN POINT

• AVERAGE COMPRESSIVE STRENGTH OF VARIOUS BAMBOOS

SPECIES	σ (N/mm ²)	E (N/mm ²)	P (kg/m ³)
BAMBUSA BALCOOA	69	-	820
BAMBUSA BAMBOS	61	-	710
BAMBUSA NUTANS	75	-	890
BAMBUSA PERVARIABILIS	79	10300	-
BAMBUSA POLYMORPHA	32.1	-	-
BAMBUSA SPINOSA	57	-	-
BAMBUSA TULDA	79	-	910
DENDROCALAMUS GIGANTEUS	70	-	740
DENDROCALAMUS HAMILTONII	70	-	590
DENDROCALAMUS MEMBRANACEUS	40.5	-	-
GIGANTOCHLOA APUS	27.3-48.6	-	-
GIGANTOCHLOA ATROVIOLOACEA (BLACK)	35.7	-	-
GIGANTOCHLOA ATTER (BLACK)	31-32.9	-	-
GIGANTOCHLOA MACROSTACHYA	71	-	900

SPECIES	σ (N/mm ²)	E (N/mm ²)	P (kg/m ³)
GUA DUX ANGSTIFOLIA	86.3	-	- (SOUTH AMERICA)
MELOCHNA BACCIFIRA	69.9	-	-
PHYLLOSACHYS BAMBUOIDES	63	-	730
PHYLLOSACHYS EDULIS	117 (60.3)	9400 (-)	- (603)
PHYLLOSACHYS PRAECOX	79.3	-	827
THYRSOSTACHYS OLIVERI	58	-	-

* Dendrocalamus Hamiltonii (Hamilton's bamboo) is a species of bamboo, 12-15cm (4.72 - 5.91 inch) in diameter and 15-18m (15-59 ft) tall, found in South Asian countries.

* Phyllostachys Edulis could be as tall as 28m (92 ft), and is native to China and Japan. It is starting to be cultivated in Florida in 2016. (MOSO BAMBOO)

JOINT:

* NODES - CONNECTION

* NO NAIL. NYLON, STEEL OR VEGETAL CORD RECOMMENDED

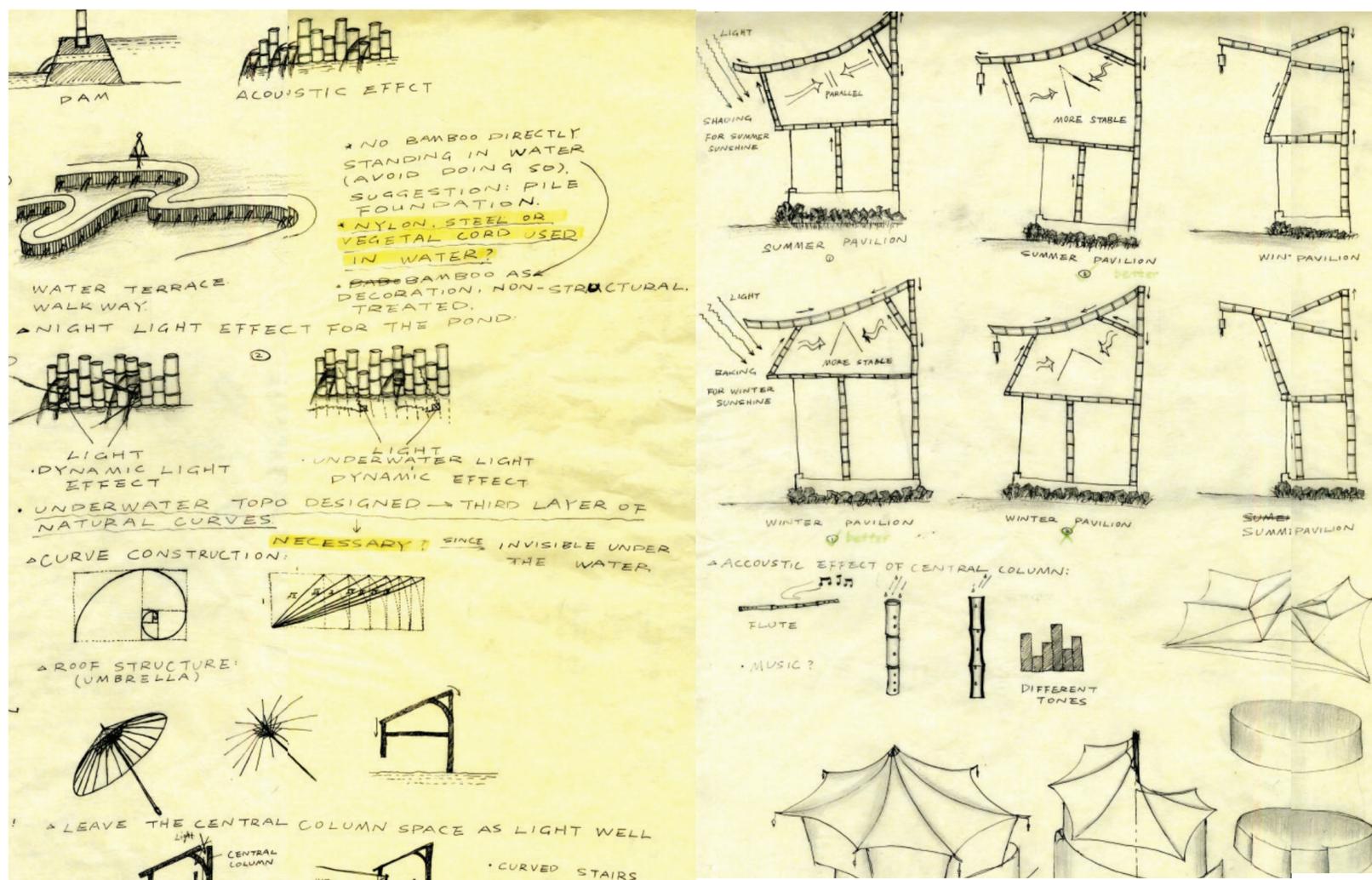
* COMPRESSION!

• BUT BAMBOO HAS ITS OWN STRENGTH AND WEAKNESS.

• STRENGTH:

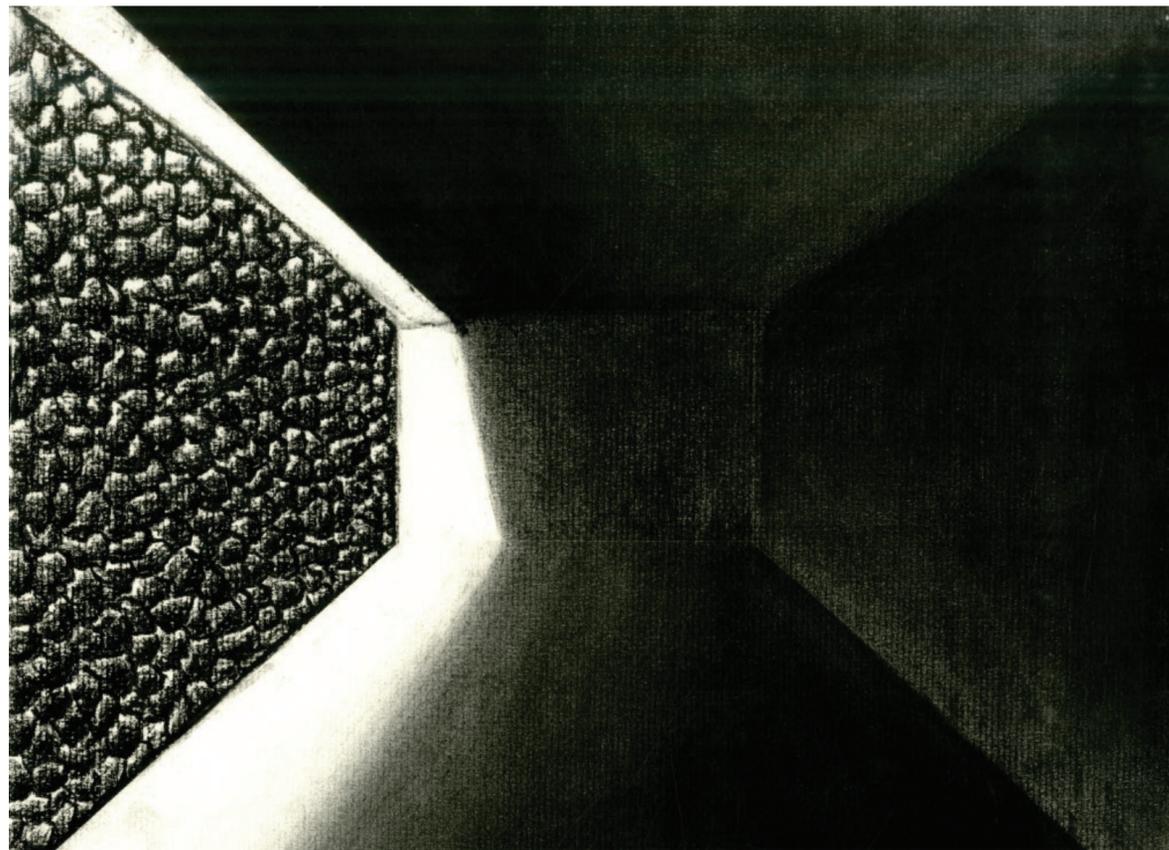
- STRONG MATERIAL
- TOUGHNESS & ELASTICITY
- MOISTURE RESISTANCE - DURATION
- LIGHT-WEIGHT
- COULD MAKE NATURAL CURVE
- VERY HIGH TENSILE STRENGTH
- HIGH BENDING STRENGTH

Sketches



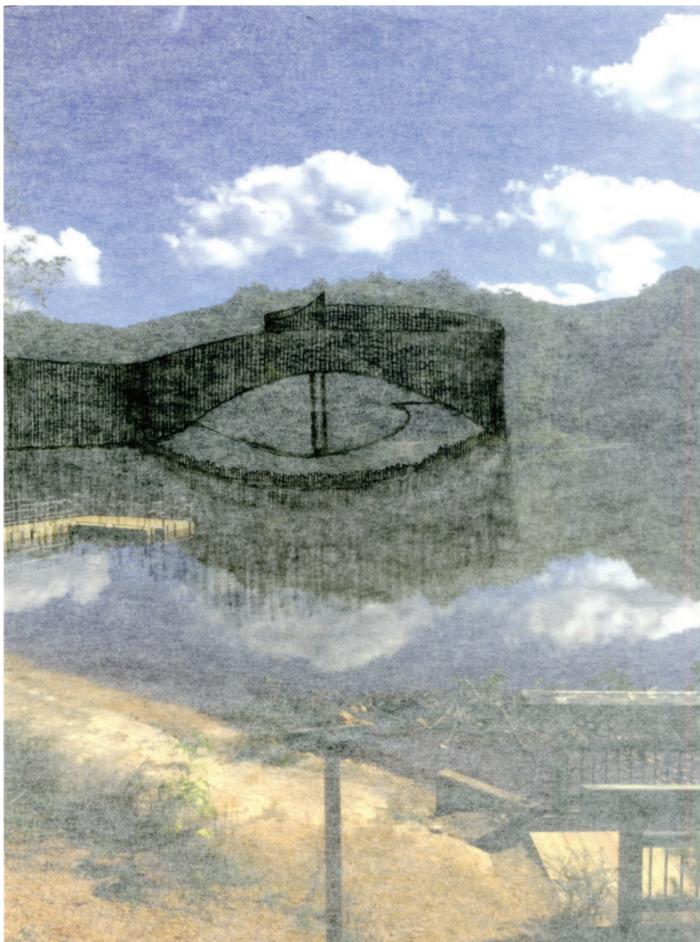
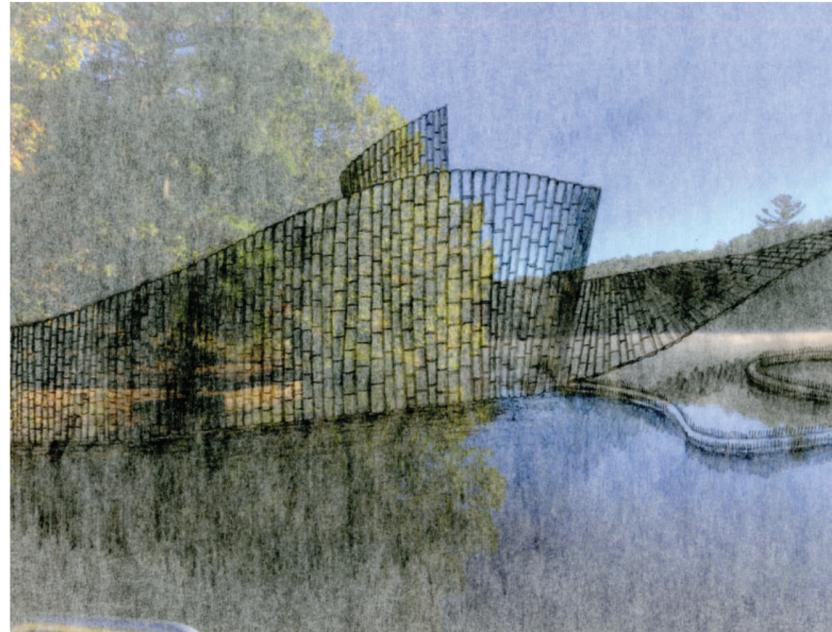
Drawings & Models

The stone wall is another feature of these pavilions. This charcoal drawing mainly suggests the effects that a stone wall interacts with water and light. After a drizzle in the early morning, the stone wall has its surface wet with some mosses on it. Suddenly a beam of light shines on its rugged surface, reflected into the interior space. Standing right in front of it, one could even hear the stones whispering. Perhaps only after being washed by water, could stones be alive and start to tell their own tales.



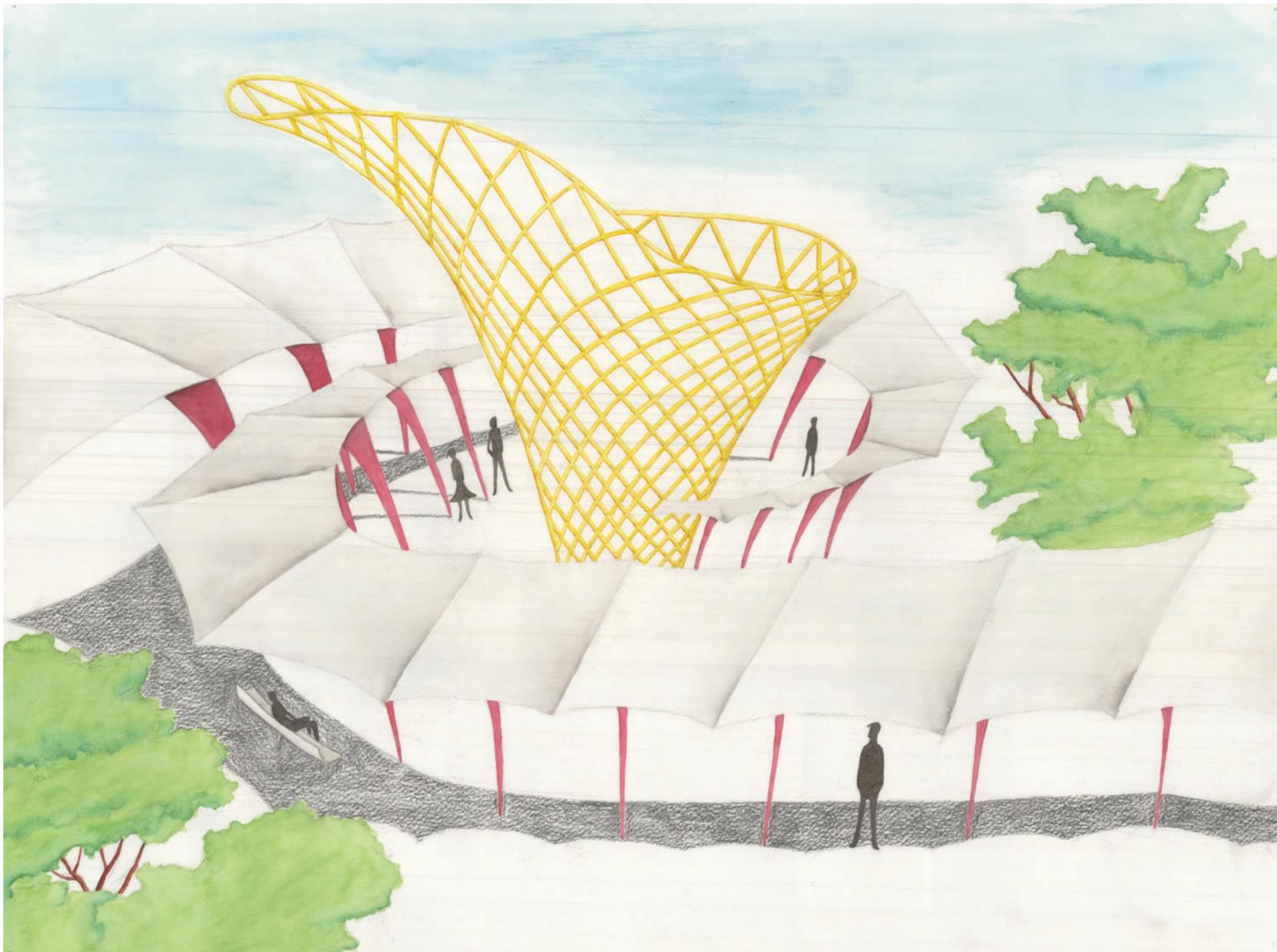
Drawings & Models

Tracing on the photographs of the site, some bamboo structures have been erected as the preliminary ideas of the design. The dynamics of curves used to be the concentration. Aided by the textures of bamboo, these curves could be better expressed like notes. The whole pond seems to be dancing with the melody of these “notes”.



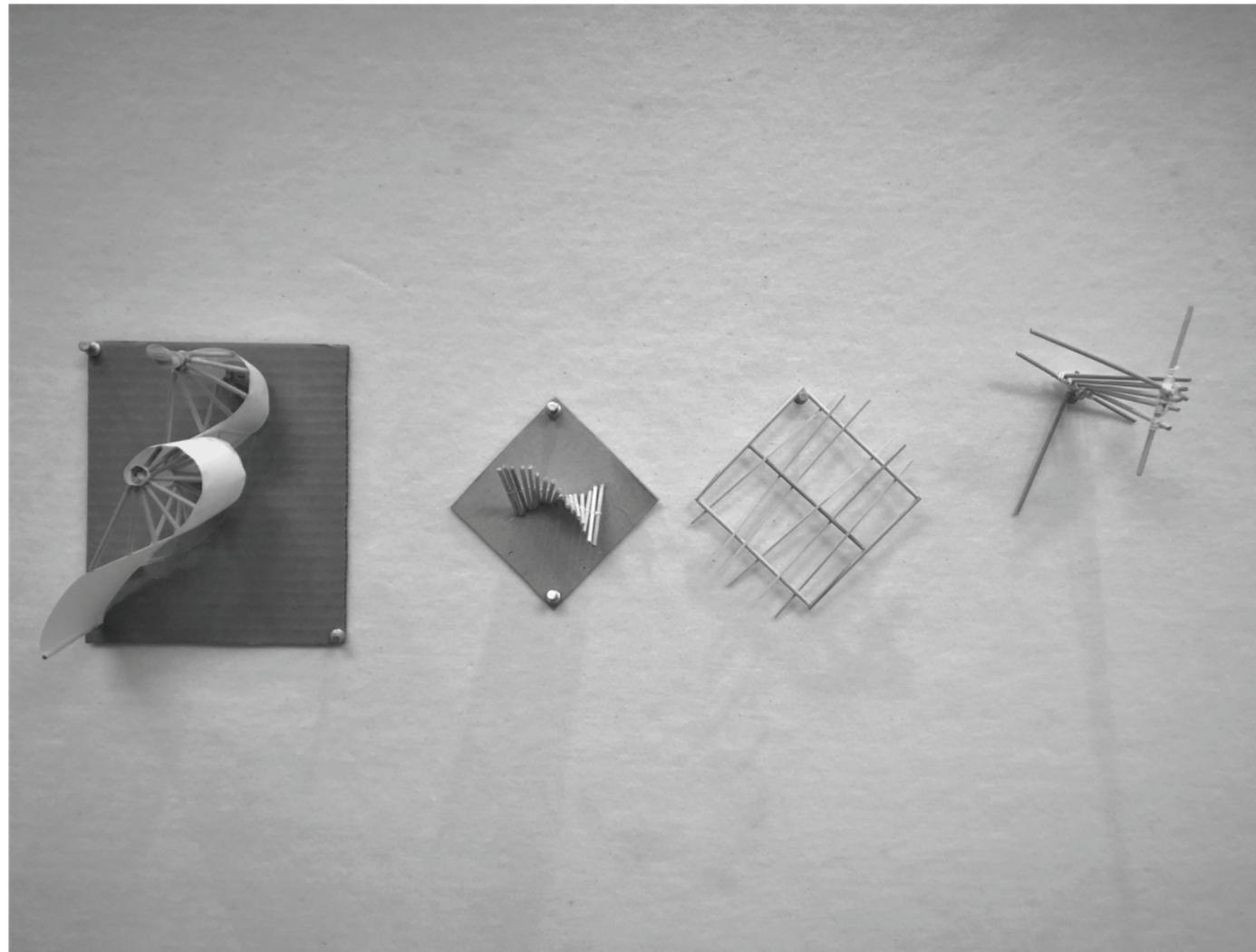
Drawings & Models

The idea of the central “lotus leaf” pavilion is actually inspired by the Expo Axis built in Shanghai. Springing from a narrow base, the whole bamboo structure opens up like a lotus leaf above the water. It provides visitors with some shelter and shading. A large circular dock under it is designed as a locality for fishing.



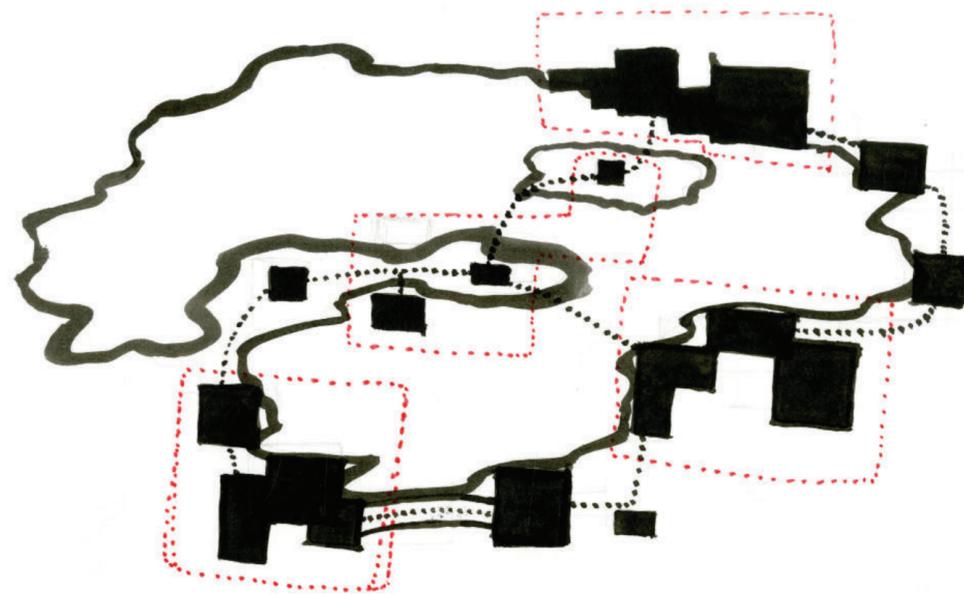
Drawings & Models

Some models that study bamboo structures are presented below. Due to its unique properties of both stiffness and elasticity, walls that are made of bamboos could be quite flexible and variable. Personally, I regard it as an opportunity for design. Moreover, it proves that to make use of its elasticity has its limitations. Therefore, the elasticity property of bamboo is such a critical element to consider.



Preliminary Site Plan

Based on the studies of Chinese Traditional Gardens and the survey of the site, the idea of seasonal regions emerges. In Chinese Traditional Gardens, the pavilions are usually designed for different seasons with variable scenes. In corporation with this idea, the whole garden keeps in harmony with nature in both spacial scale and chronic scale. Similarly, the pavilions in this thesis project will be distributed into summer ones and winter ones.



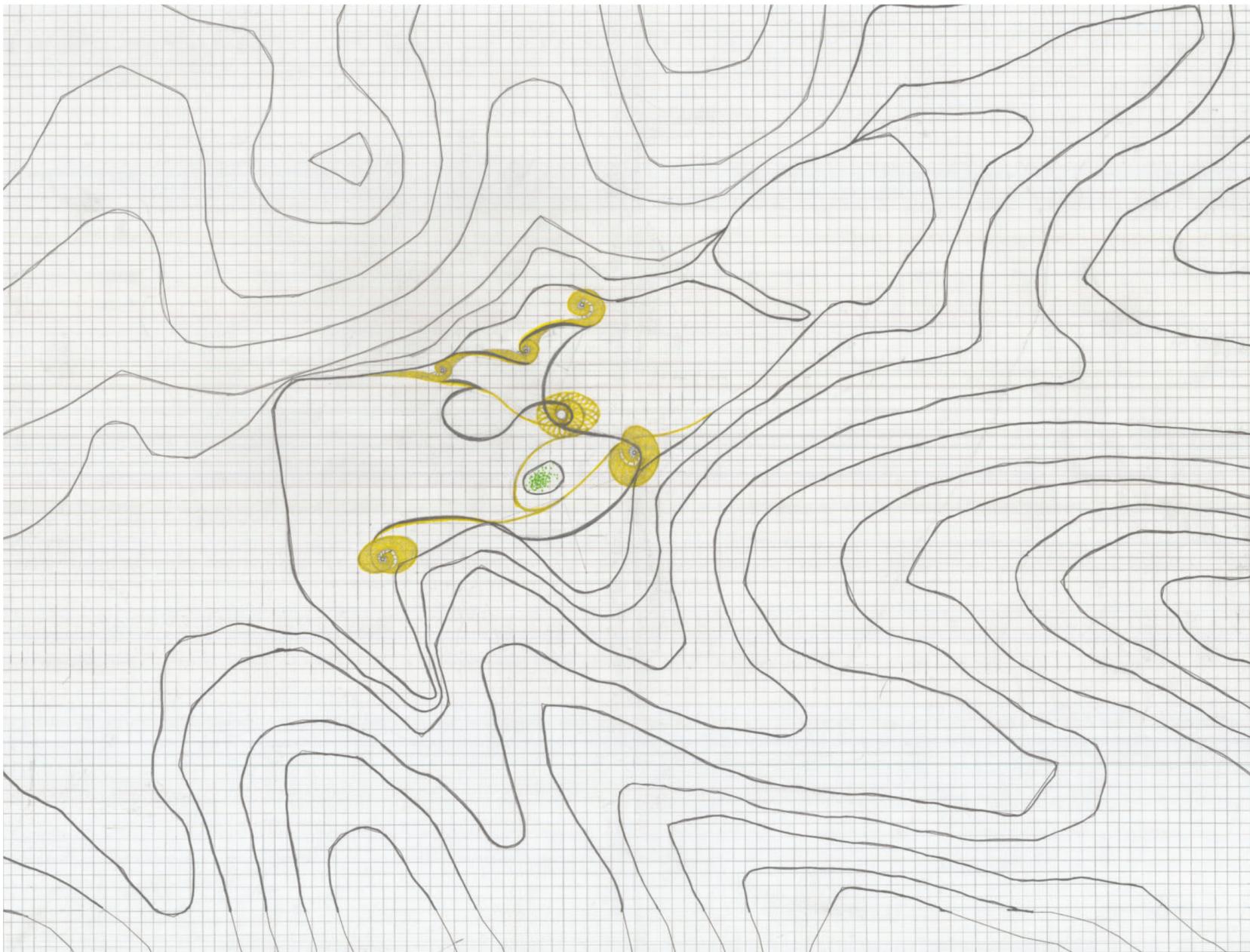
Preliminary Site Plan

The northern bank of the pond receives the best sunshine most time of a year, while the southern bank is a wonderful shading area. Then the northern pavilions will be defined as winter pavilions, when the southern ones as summer pavilions. Meanwhile, in considering the moving water, the whole pond area will be divided into three regions based on their water level. Thus a considerable amount of waterfalls will be created through the dams. Consequently, the music of water will come from these waterfalls, making one of the most significant characteristics of this project.



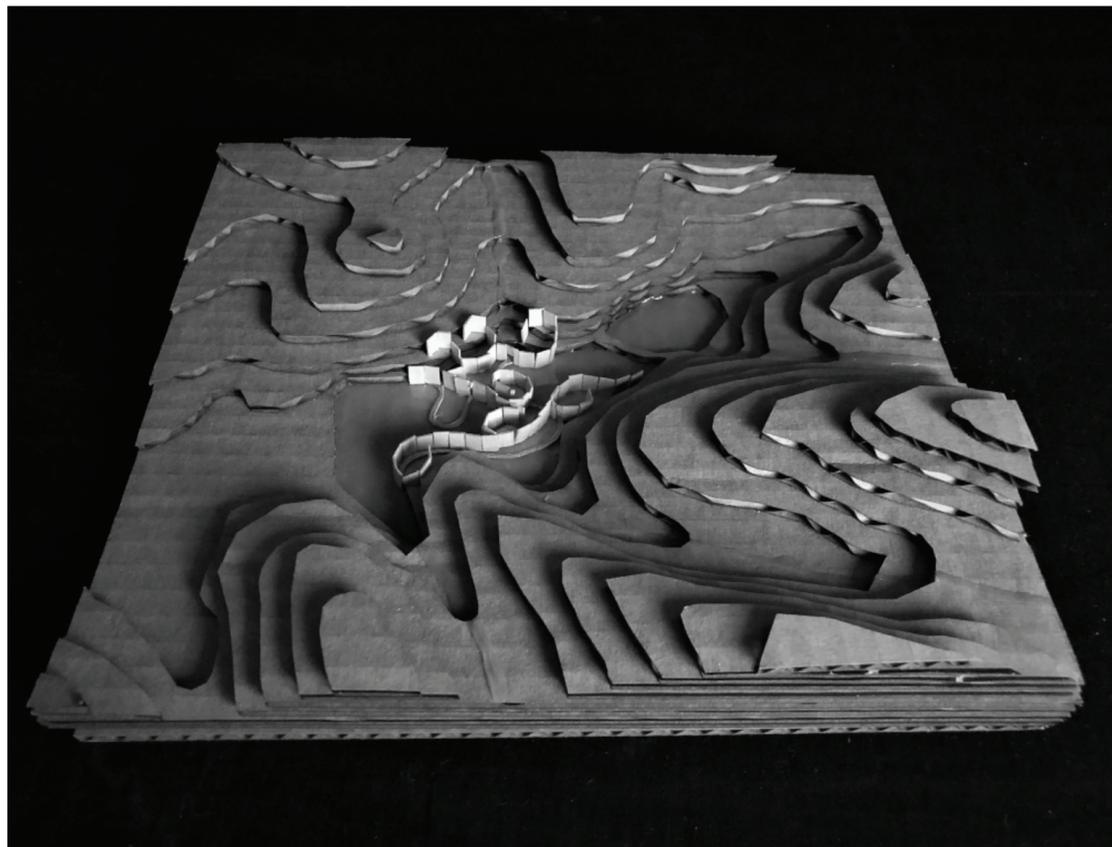
Preliminary Site Plan

After several adjustments, the pavilions start to be established as spirals, shaped as circles or ellipses. All the pathways and walls are along the tangent of the topographical diagrams of the site, creating a comparatively flat landing for the entrances and exits of these pathways. The small island in the pond will be carefully designed as a special scene.



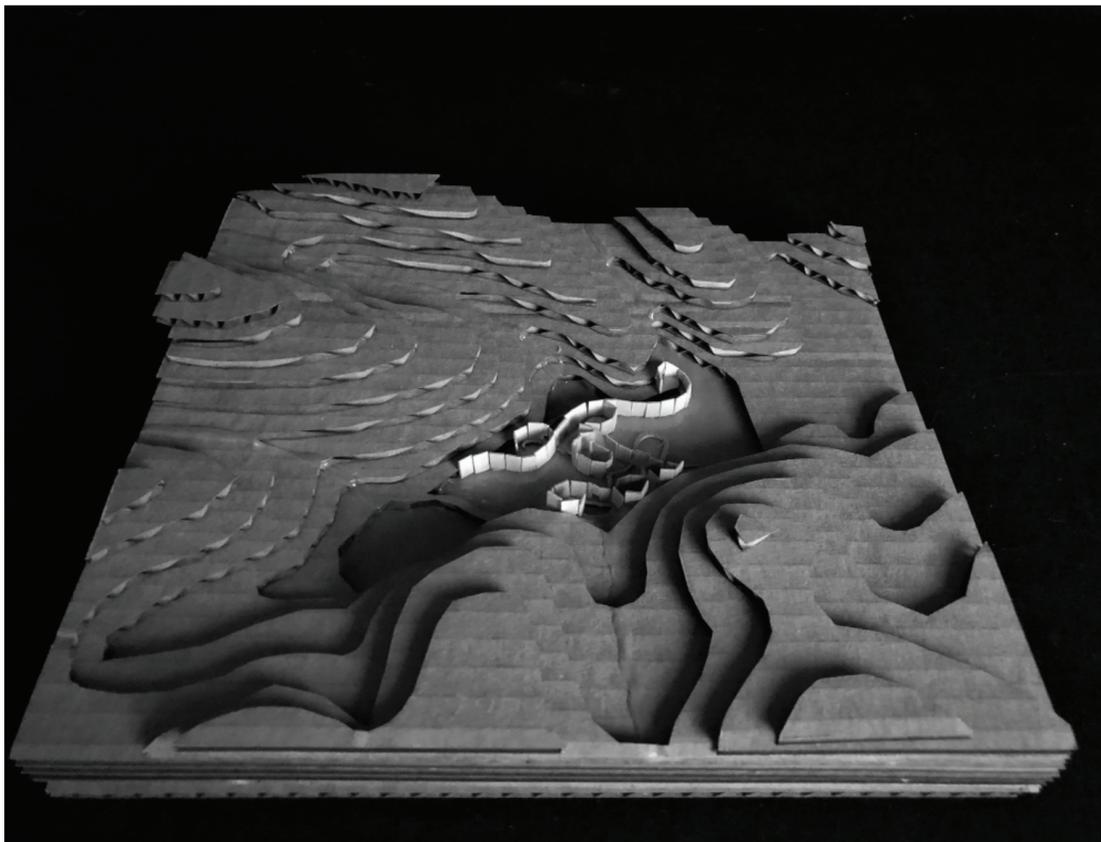
Preliminary Site Plan

Here is a preliminary model for the site. The curved walls have been placed to show their relationship with the land and the water.



Preliminary Site Plan

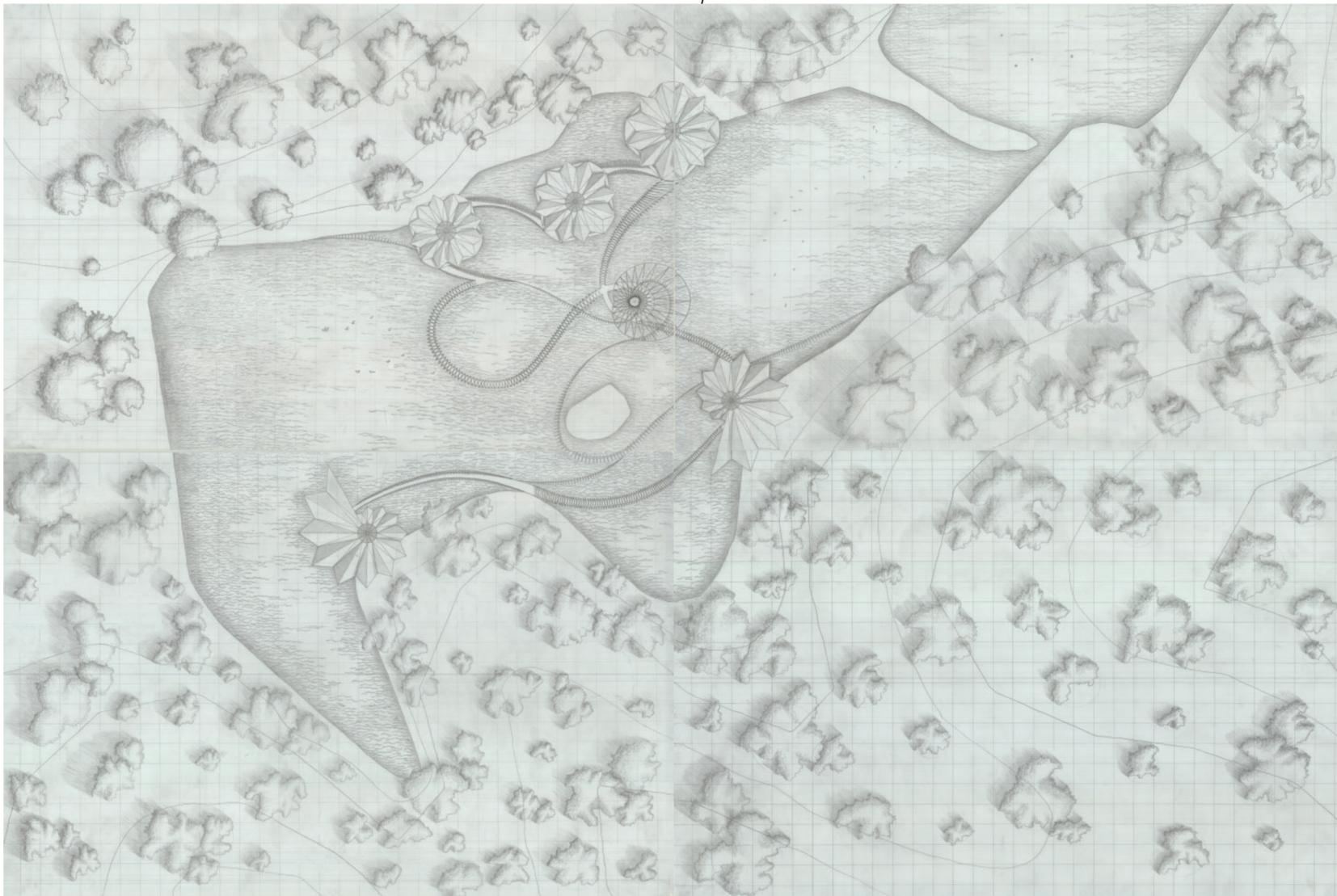
This is another perspective of the same site model.



Final Site Plan

In the final version of the site plan, all the pavilions bloom like lotus flowers; the central pavilion springs out as a gigantic lotus leaf; the pathways and framing walls make the stems of these flowers. It brings coolness to its visitors as an organic unit, especially in the hot summertime.

Site Section

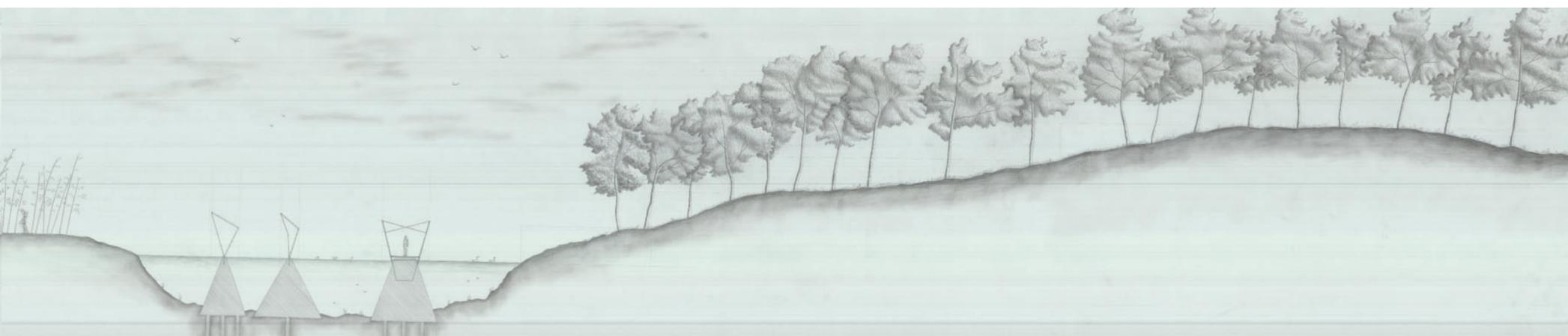


Site Section

Final Site Section

In the site section, the dimensions of the winter pavilion and the central pavilion have been revealed, as well as their relationship with the land. There is a small pool inside each pavilion, channeling water from one region to another. On a rainy day, visitors can choose to go through these pathways and pavilions on the bamboo floors with their bare feet. A specially designed sculpture that featured the idea of spiral is set on the island inside the bamboo forest.

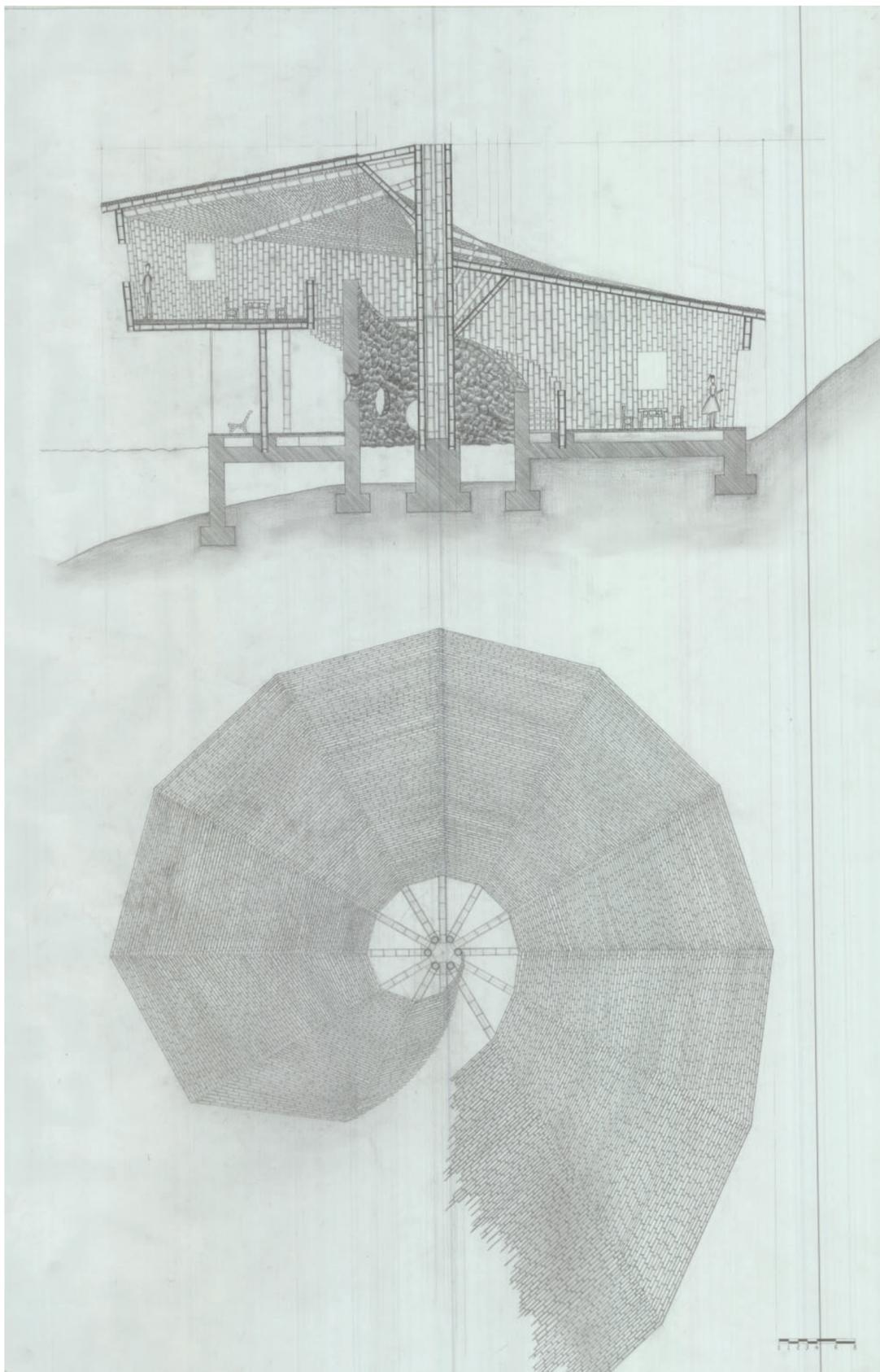




Construction Drawings

The Preliminary Section of a Pavilion

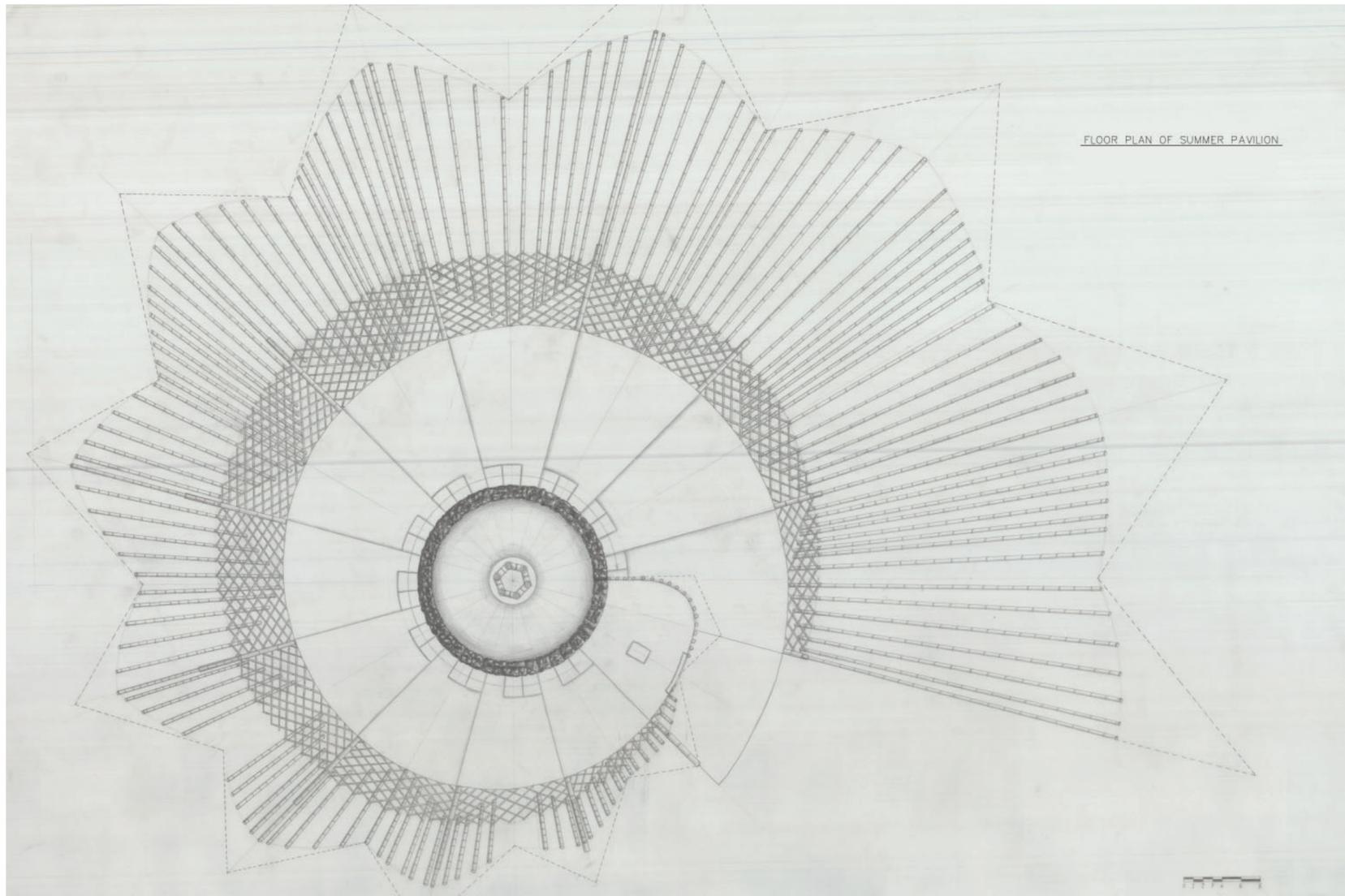
This is one of the earliest sections of a pavilion before it starts to change later on. A spiral roof was clearly expressed as an inspiration from an umbrella. Windows were simply set on the bamboo walls for a good view. Half of the first floor was enclosed by a glass curtain wall to make another view from a different perspective. On the central stone wall there were some circular openings for visitors to take a look at the central pool.

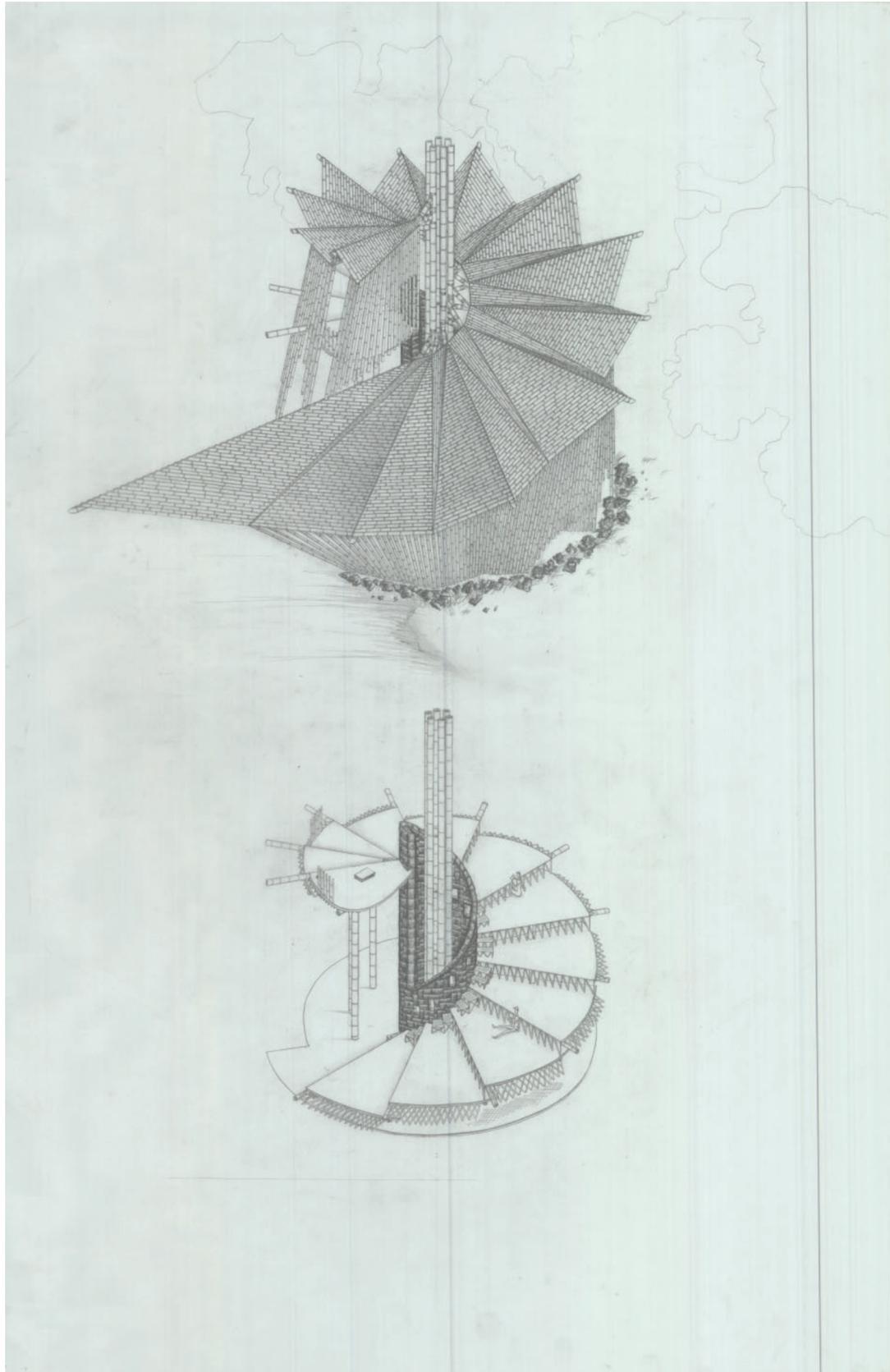


Construction Drawings

The Summer Pavilion

Since it serves for the summertime, the pavilion is designed comparatively smaller than the winter ones. In this way, the heat could be much easier to exhaust and the space will be much cooler. The fact of smaller volume could also encourage the air exchange like a natural air conditioner. The roof is made zigzag to express the idea of dynamics and to look more like a lotus flower.

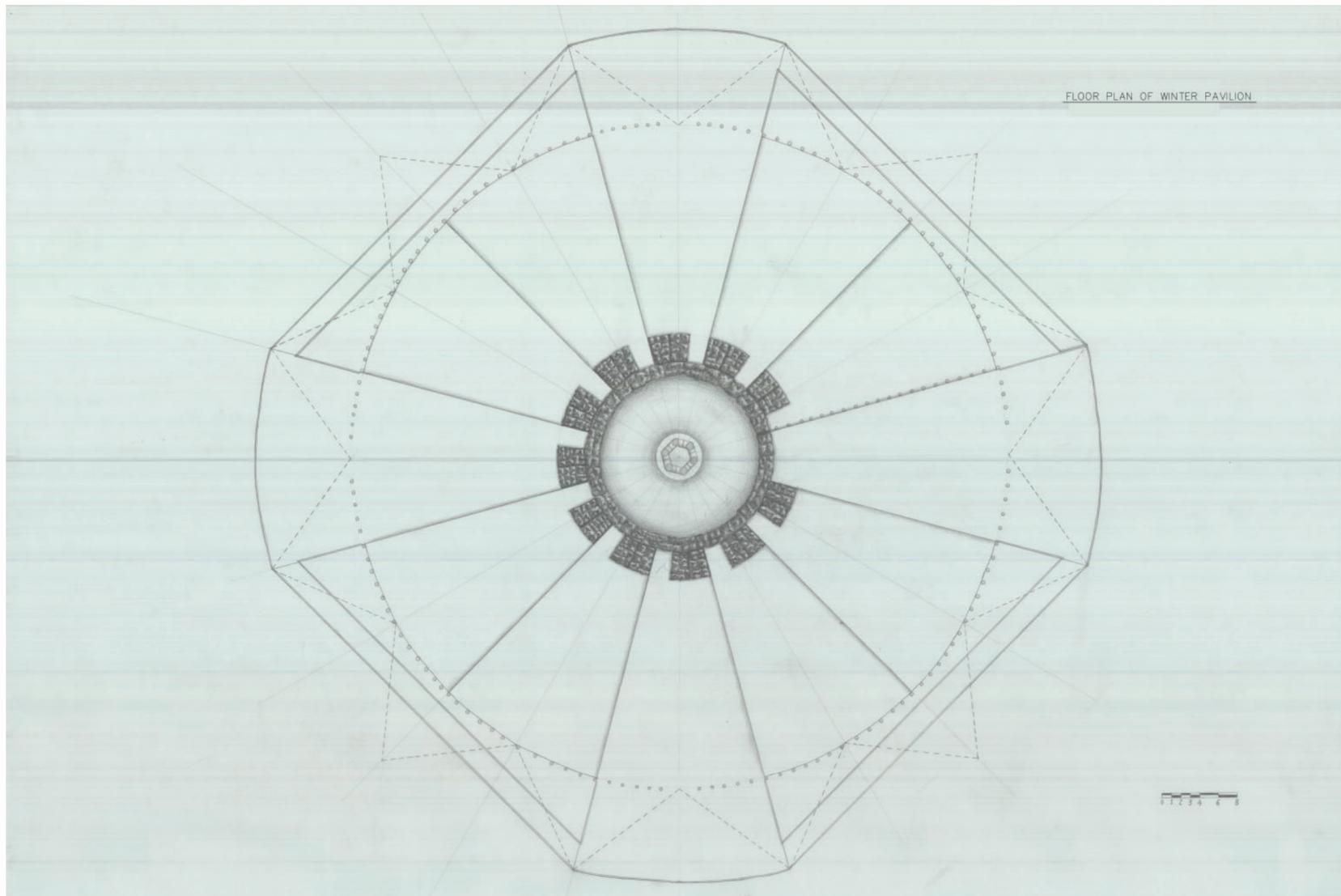


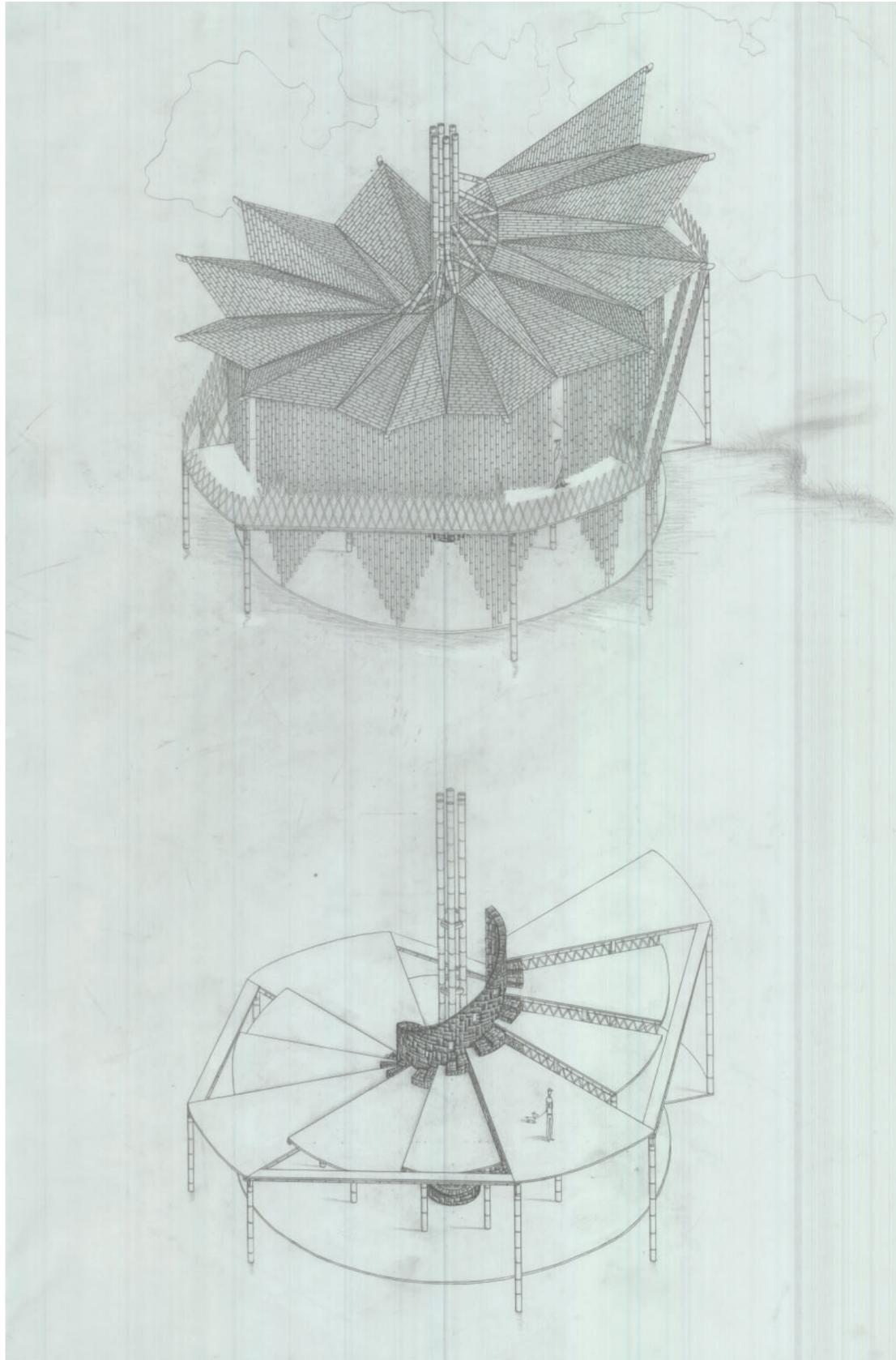


Construction Drawings

The Winter Pavilion

Similar to the summer pavilion, the winter pavilion uses a big volume to store more heat in the wintertime. The roof that goes up towards its end comes from the inspiration of Chinese Traditional Pavilions - “Flight Roof”. And the platforms that emerge every three floors are connected with a bamboo ramp, to render another possibility for visitors to go up and down.

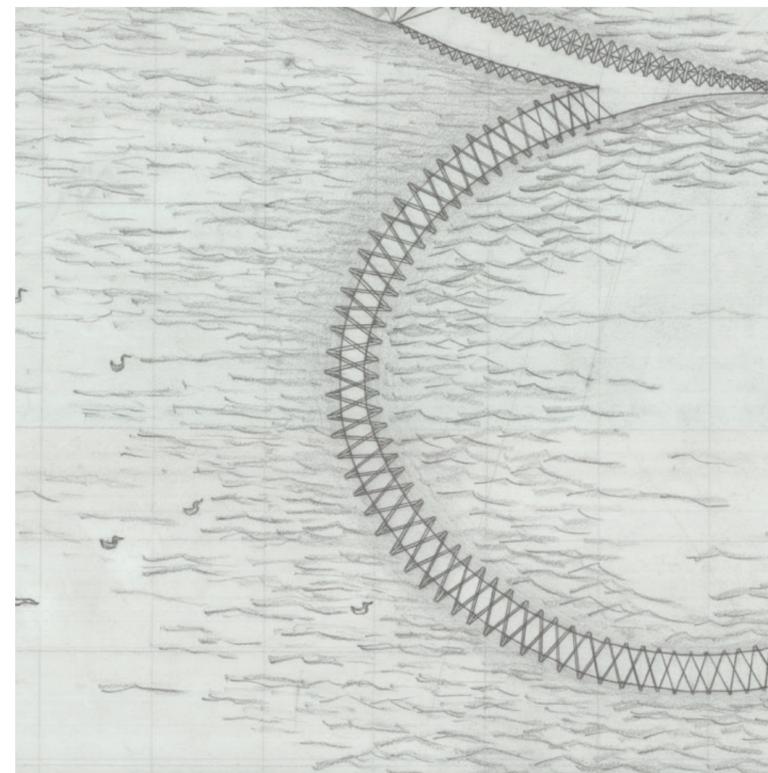
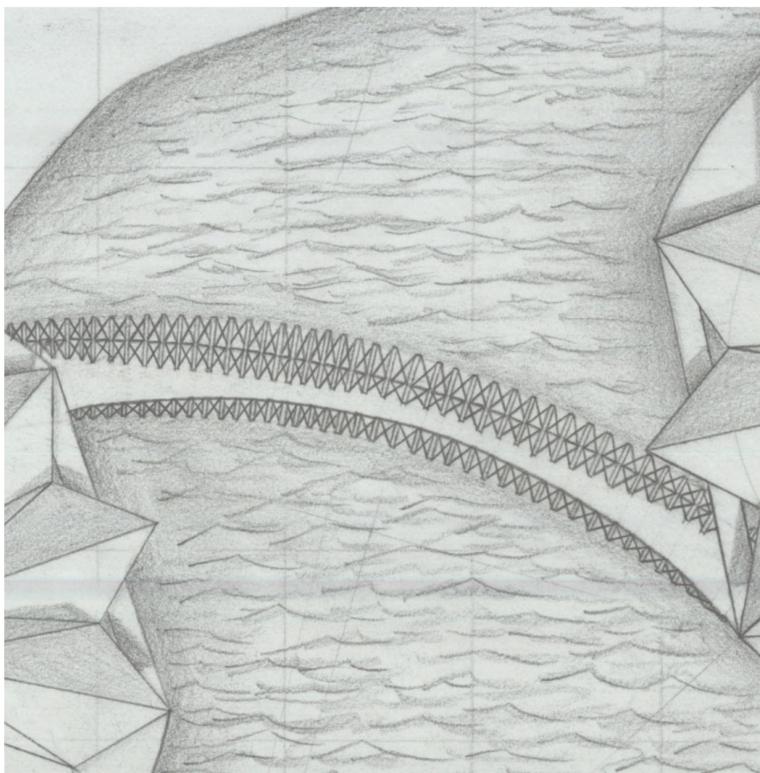


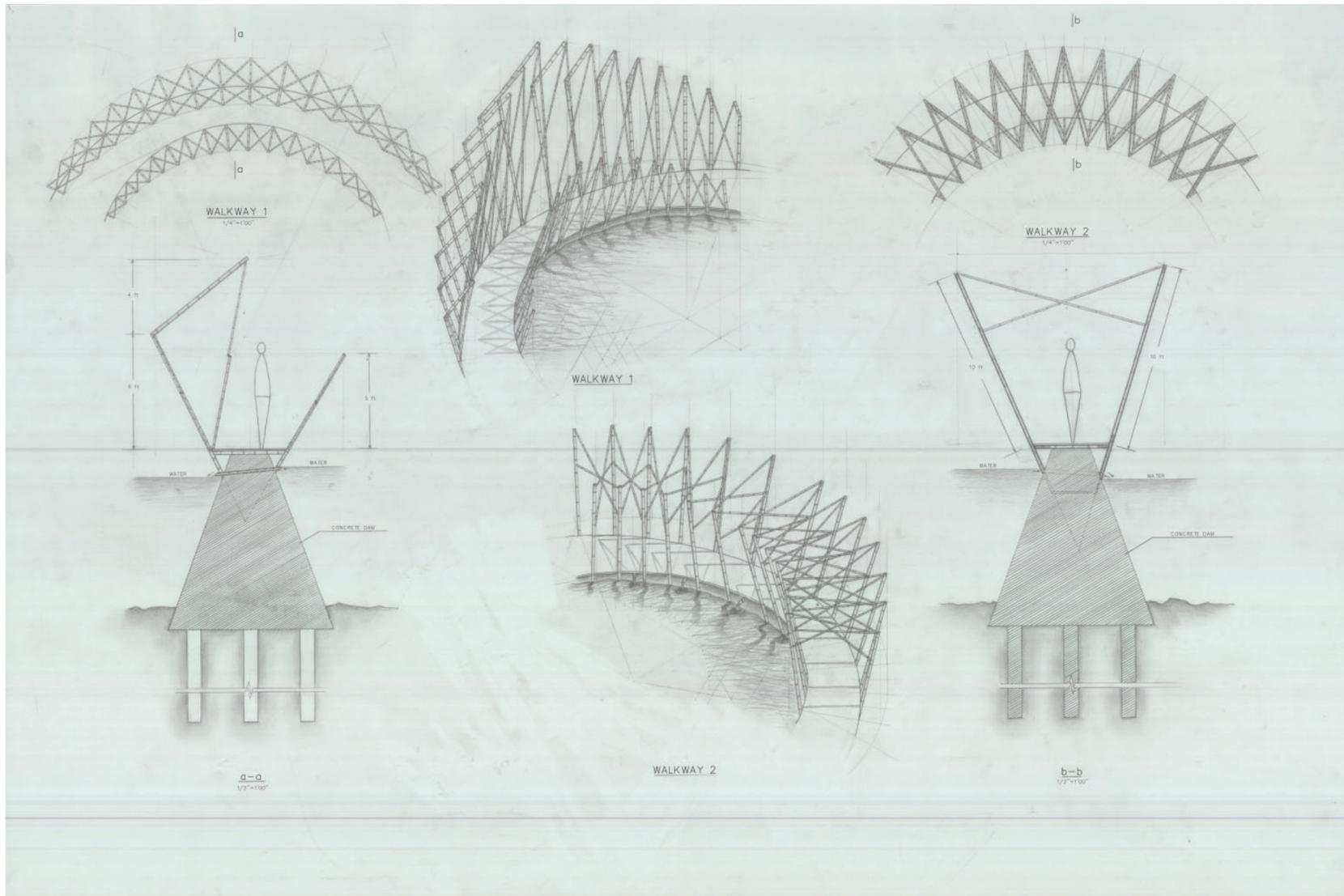


Construction Drawings

The Pathways

There are two types of pathways in this project. Each of them has a bamboo flute channeling water every 10 feet in their foundations. When visitors pass by, they could actually hear not only the vivid music of water, but also the distance effect of this music. The fact that water knocks on the bamboo could compose different tones as well. In this sense, the journey through these pathways becomes an enjoyment of a natural concert.

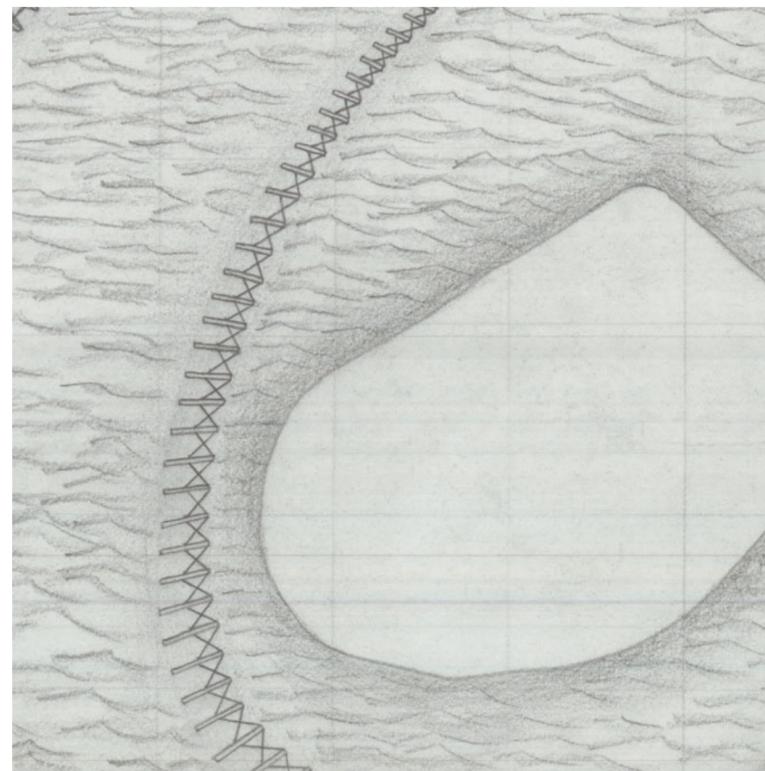


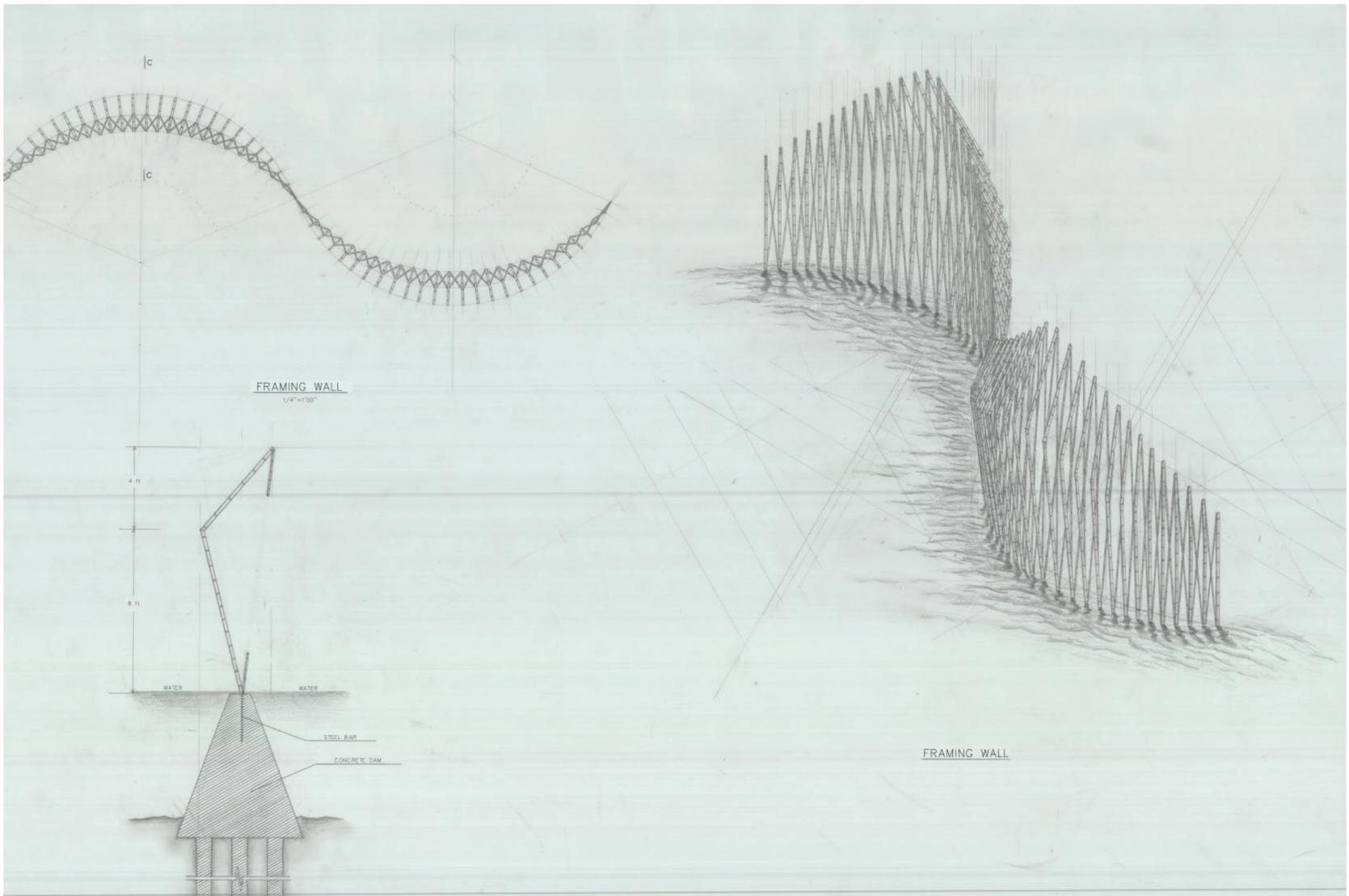


Construction Drawings

The Framing Wall

These wall frames help to make scenes above the water. They span across the pond, intersecting with the pathways at some points, then leaving, and back forth, like a welcoming friend. Their reflection on the water surface could bring breathtaking beauty to the whole organic unit.

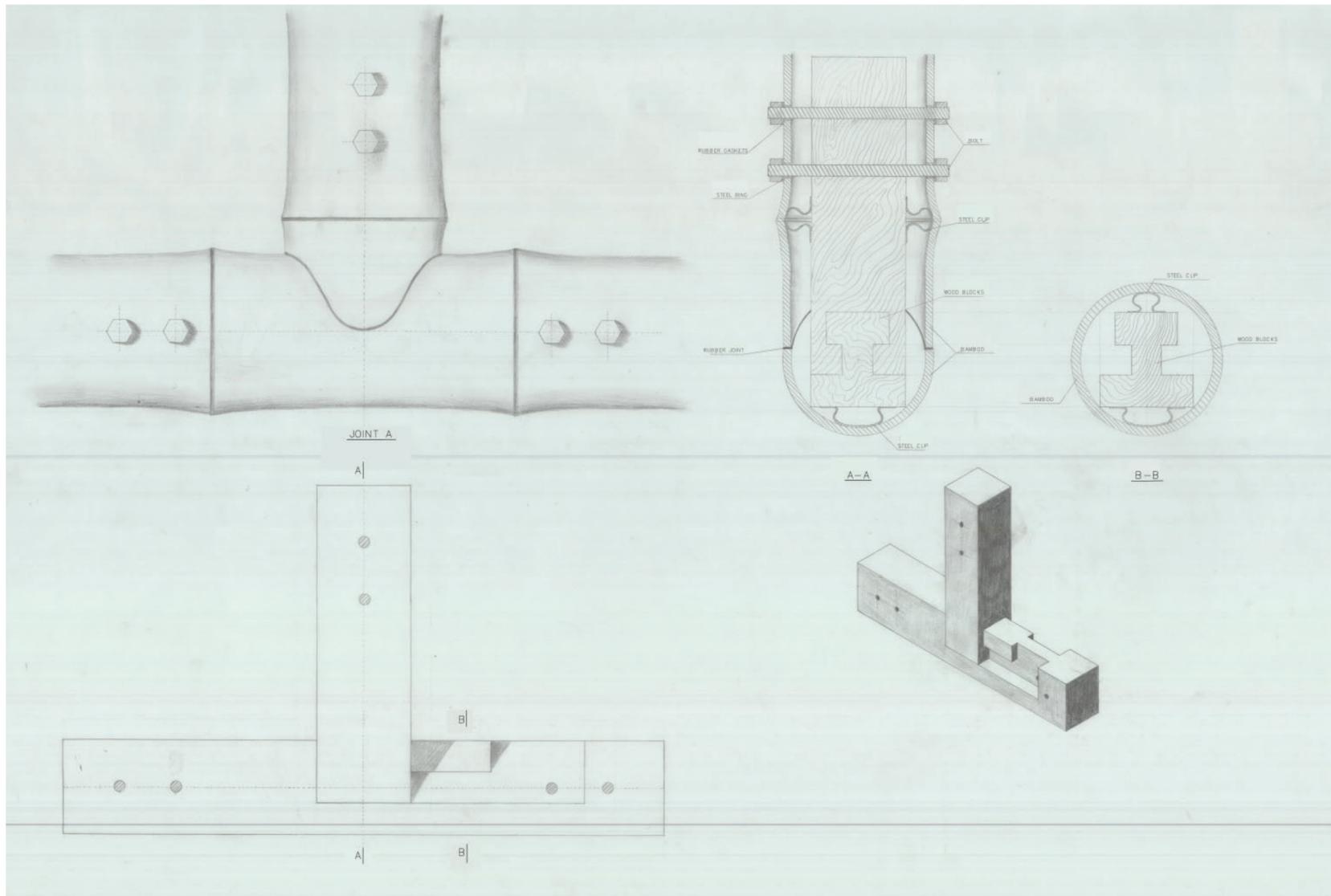


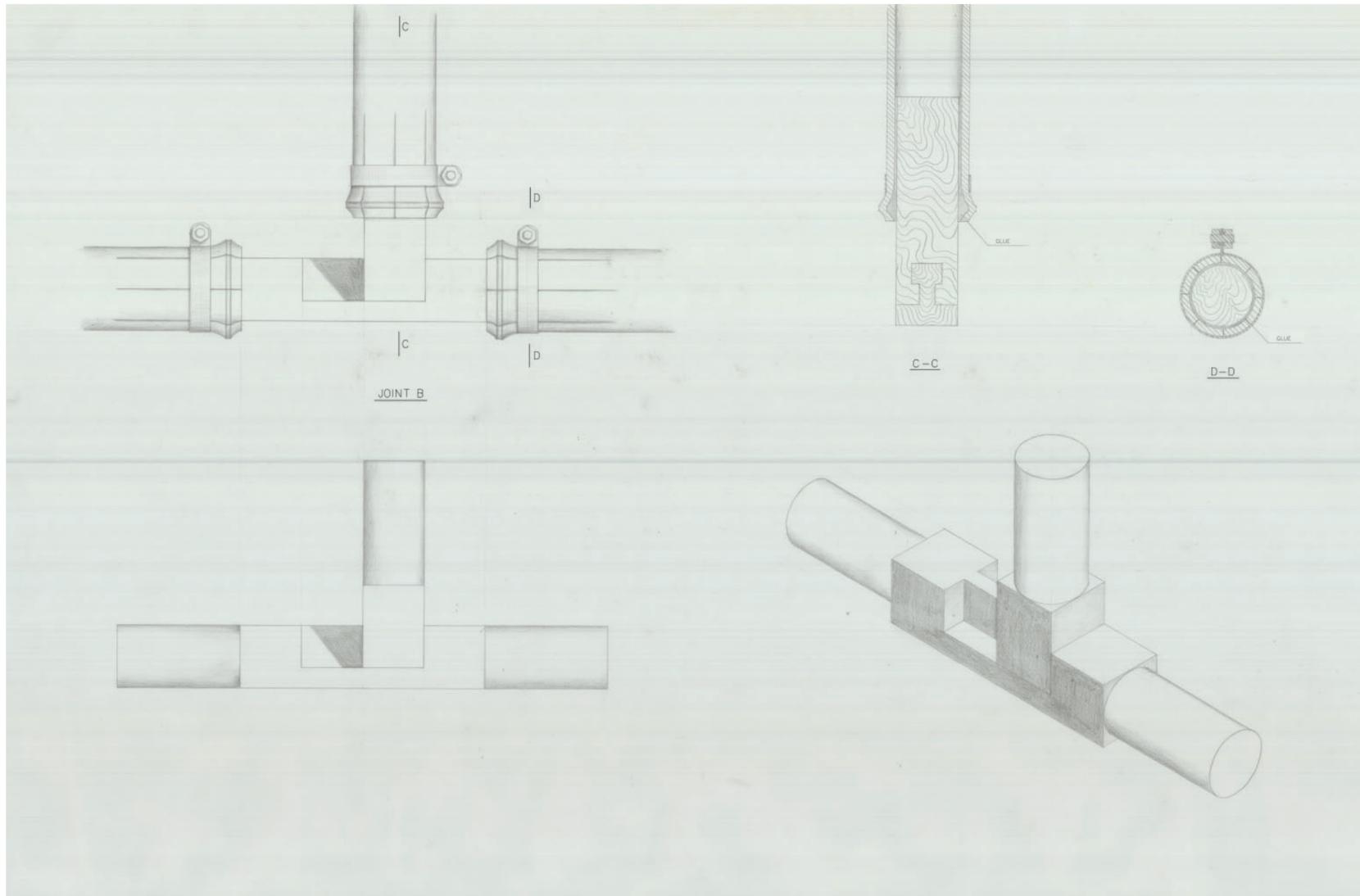


Construction Drawings

The Bamboo Joints

Here are two thoughts for the bamboo joints. Both of them make use of wood joints to connect, and the latter one which exposes the wood parts has been selected for this project eventually. The circular section of wood joints could fit into the bamboo perfectly. In case that bamboos might have different diameters, the tip of the bamboo is cut vertically and locked with a hoop. Glue might be applied in between the bamboo and the wood to make a strong joint.



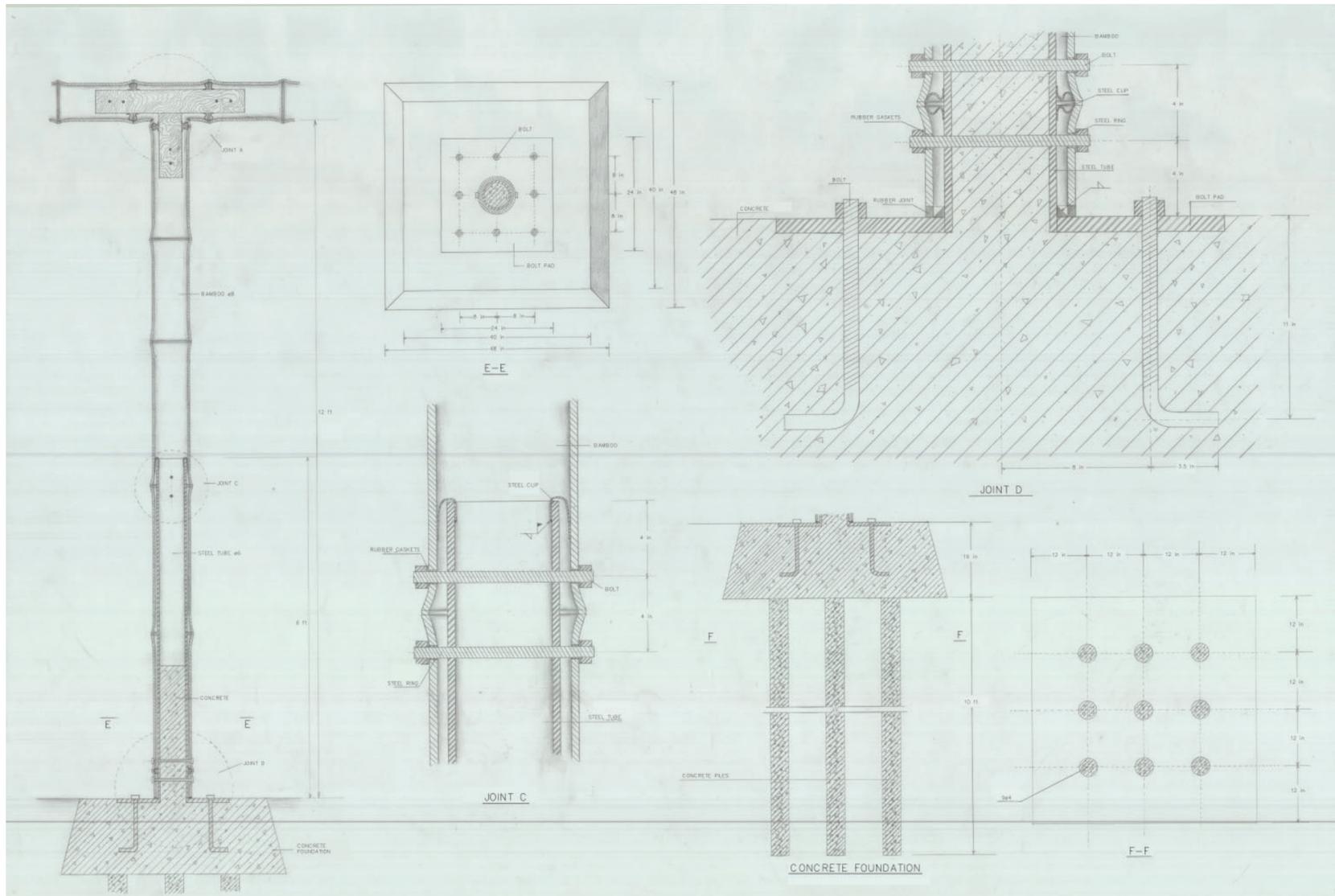


The Bamboo Joint that is selected for this project

Construction Drawings

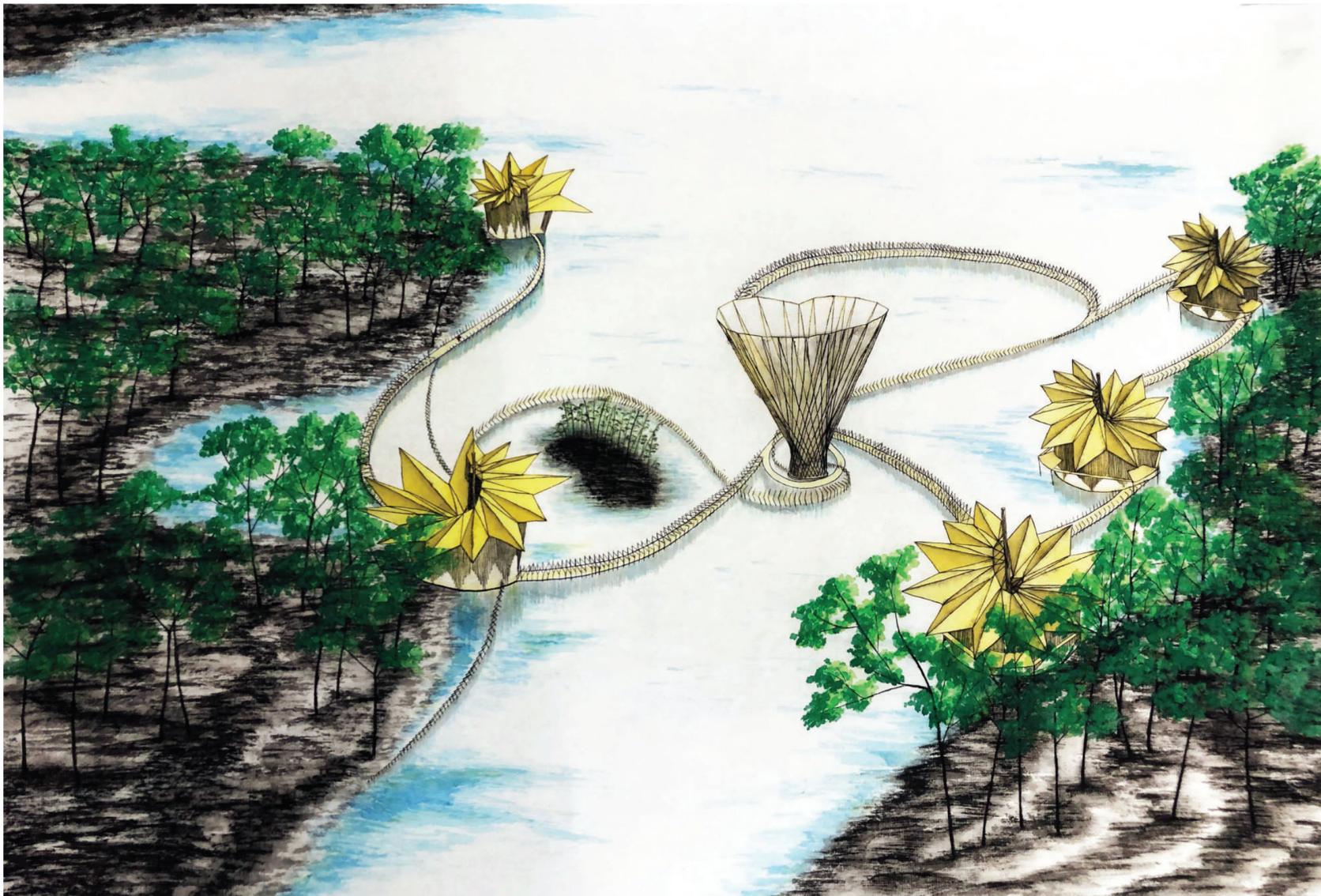
The Foundation Joints

The main idea for foundation joints is to insert a steel tube inside the bamboo to lock it up as a column. In the meantime, pile foundations shall be used since this project is built in the water. Additional protection might be needed for the steel tubes in case they get rusty.



Day Scene

In the daytime, the whole water garden is hugged by the vast forest. It acts more as a pearl loved and hidden by nature itself. As Frank Lloyd Wright (1957) once mentioned, “To make anything beautiful is to make it naturally lovable, for it to have charm, for it to be genuine, for it to be an expression of all that is worth having or worth living for in our universe today.”



Night Scene

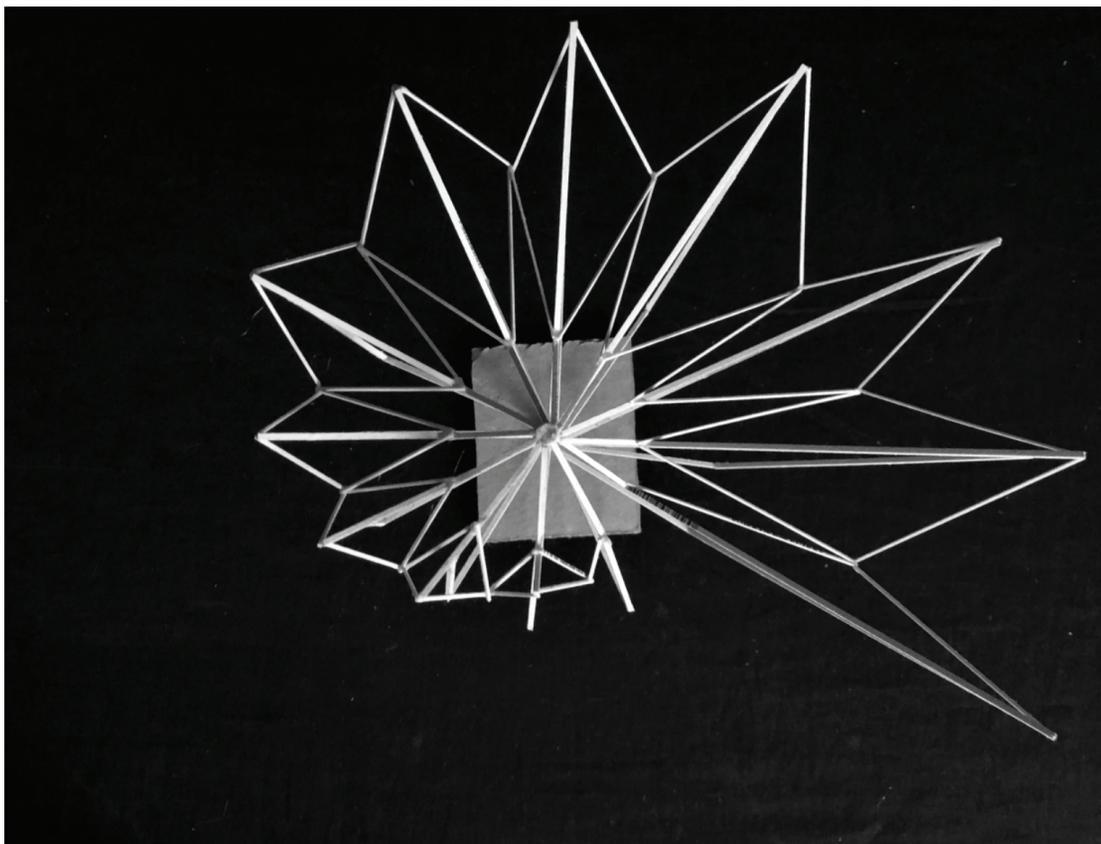
When it turns dark, the whole water garden suddenly becomes a paradise of light and dream. Each pavilion performs like a lotus lantern floating on the water. The design of the enclosure walls of the pavilions touching the water surface in a zigzag way makes each pavilion dance to the music of water.



Structure Analysis

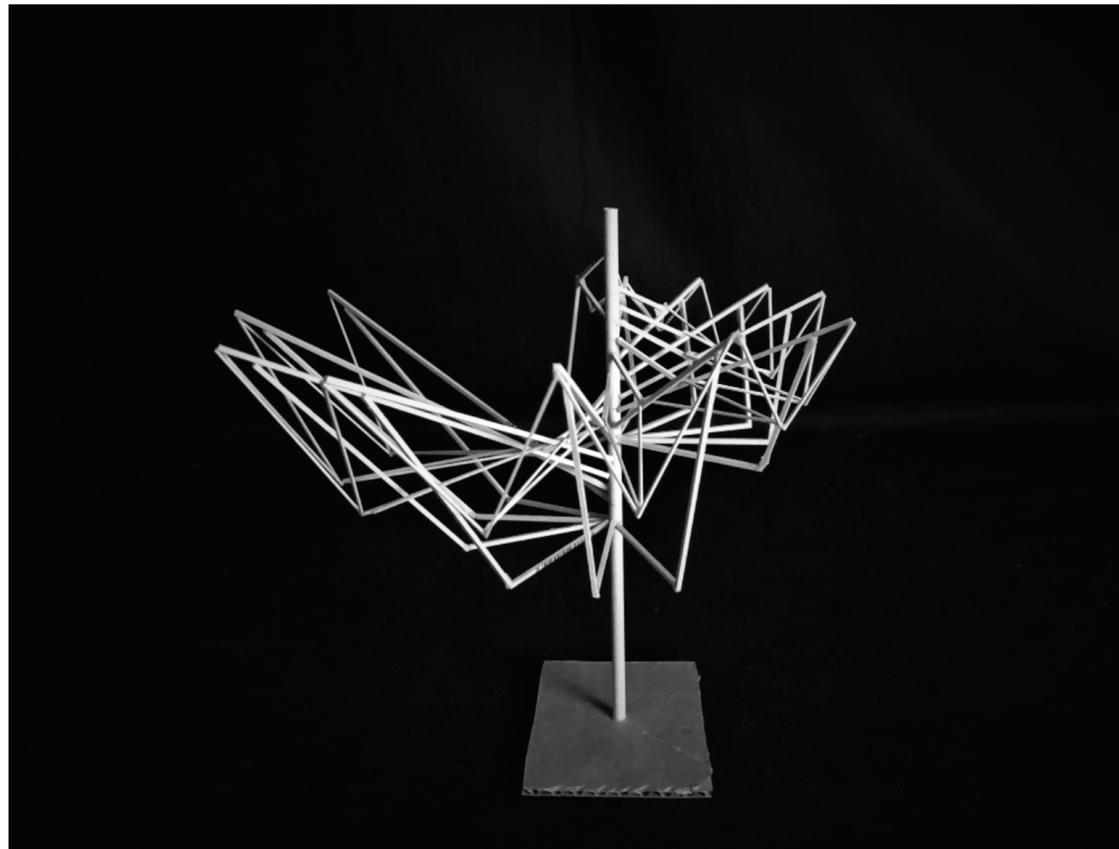
The Structure of the Summer Pavilion

In designing this structure, the idea of “Flight Roof” combined with the spiral was considered. Although the bamboo can be bent for the “ Flight Roof”, the problem of elasticity limitation forcees me to solve it in a structural way. It ends up in such an organic geometry as a flower.



Structure Analysis

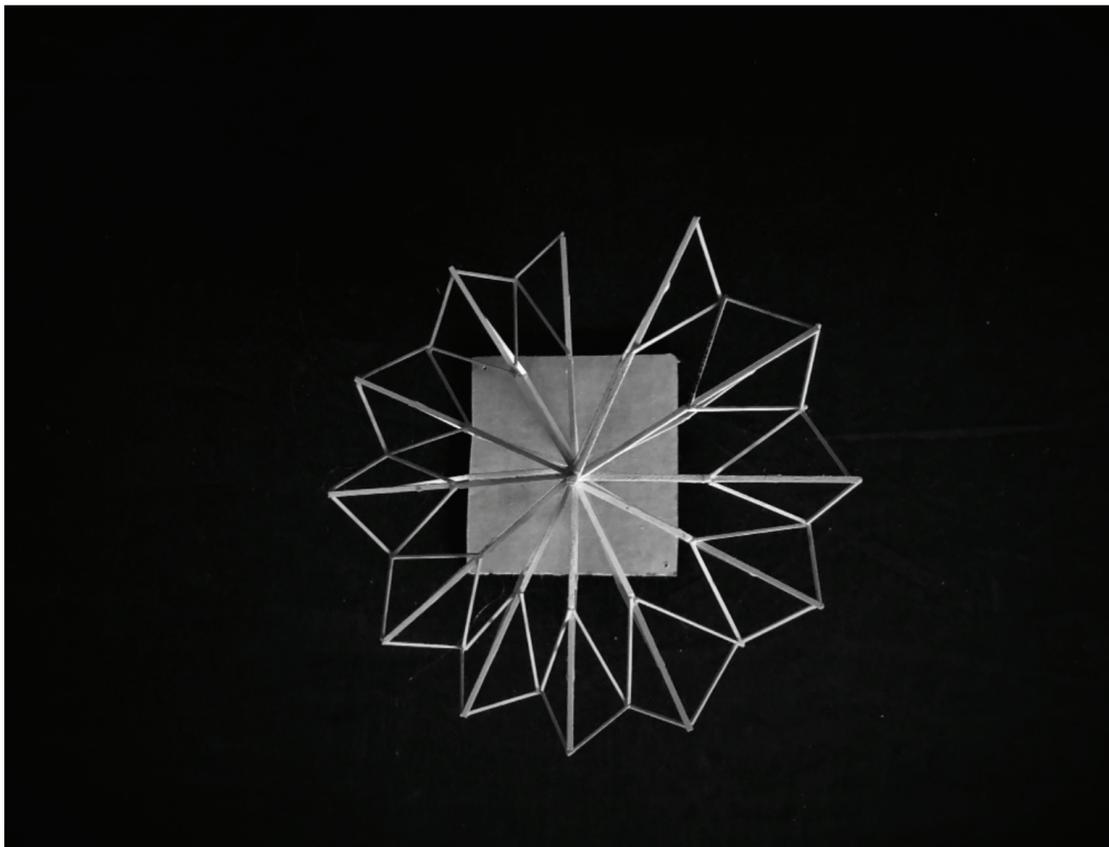
The Structure of the Summer Pavilion



Structure Analysis

The Structure of the Winter Pavilion

In quite a similar way as the summer pavilion, the structure of the winter pavilion was developed. The only difference lays on the geometry applied -- the summer one is composed as a spiral, while the winter one as a circle.



Structure Analysis

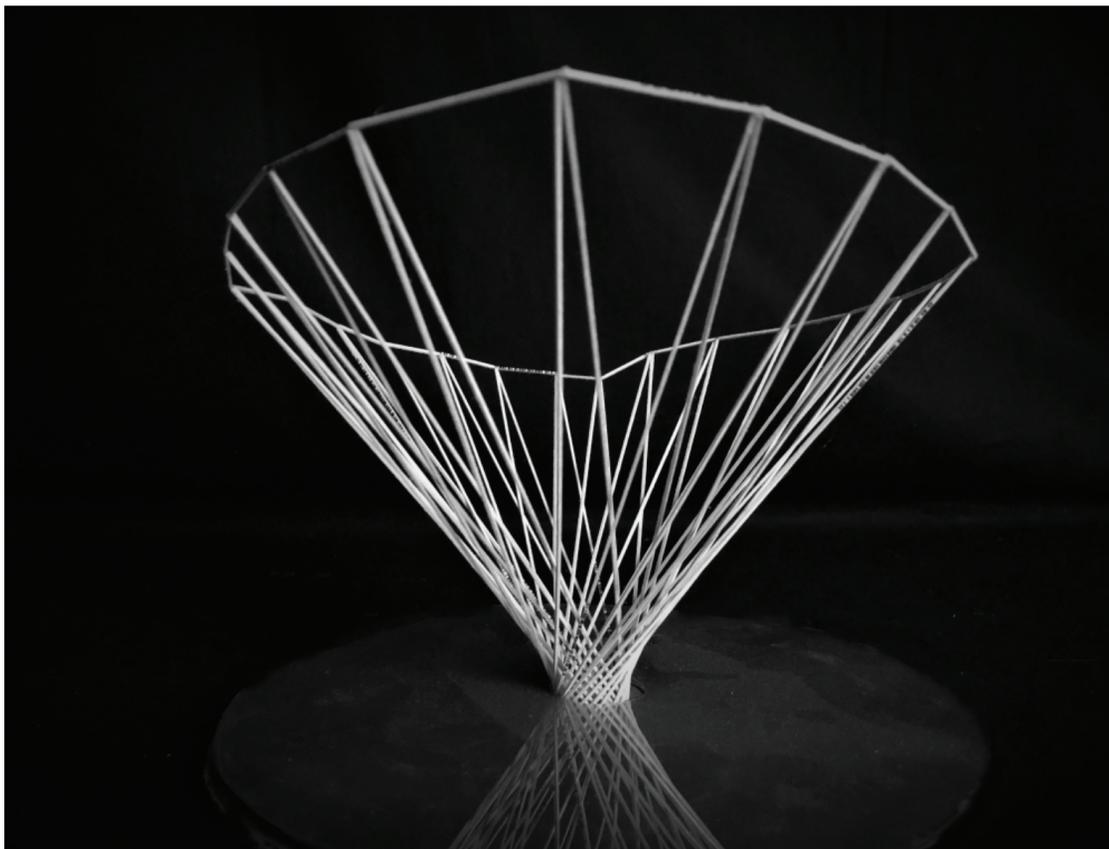
The Structure of the Winter Pavilion



Structure Analysis

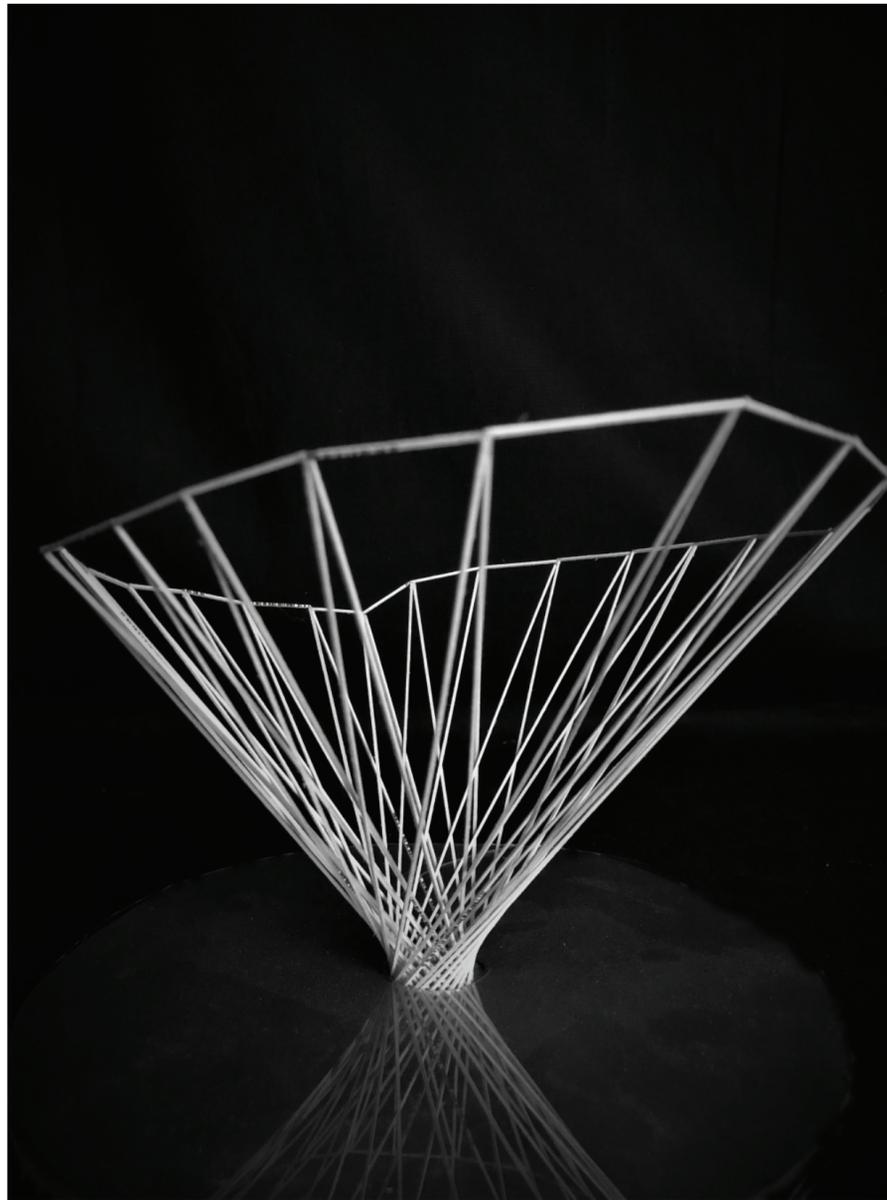
The Structure of the Central “Lotus Leaf” Pavilion

The design of this unique structure also comes from the idea of a spiral and rotation. Patterns that come in a natural way could reflect on the water to produce an elegant scene.



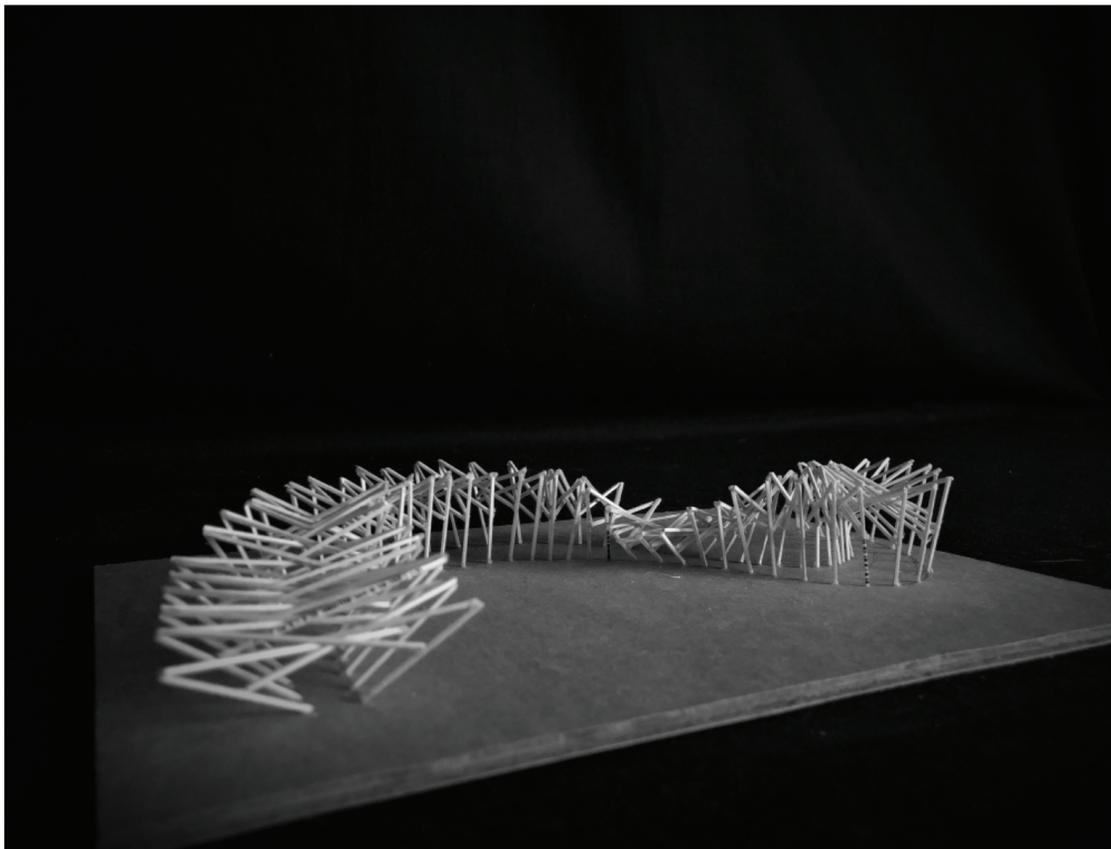
Structure Analysis

The Structure of the Central “Lotus Leaf” Pavilion



Structure Analysis

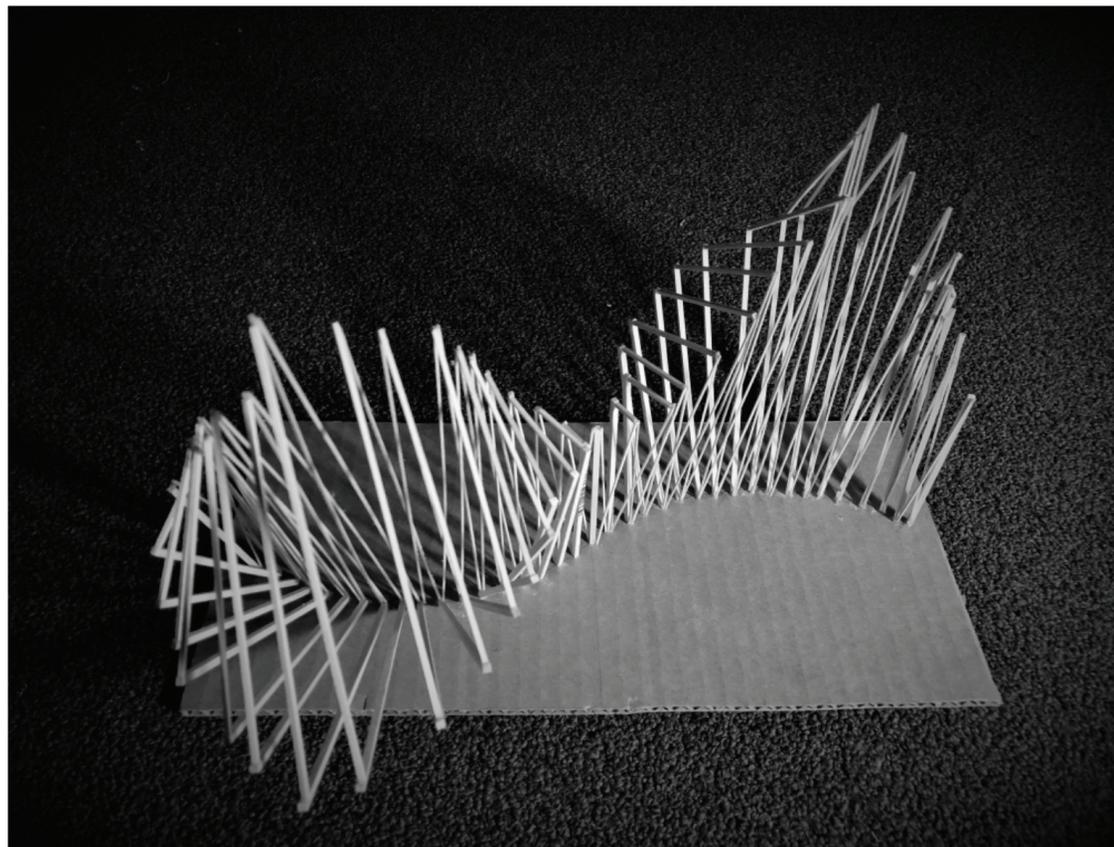
The Structure of the Pathways



Structure Analysis

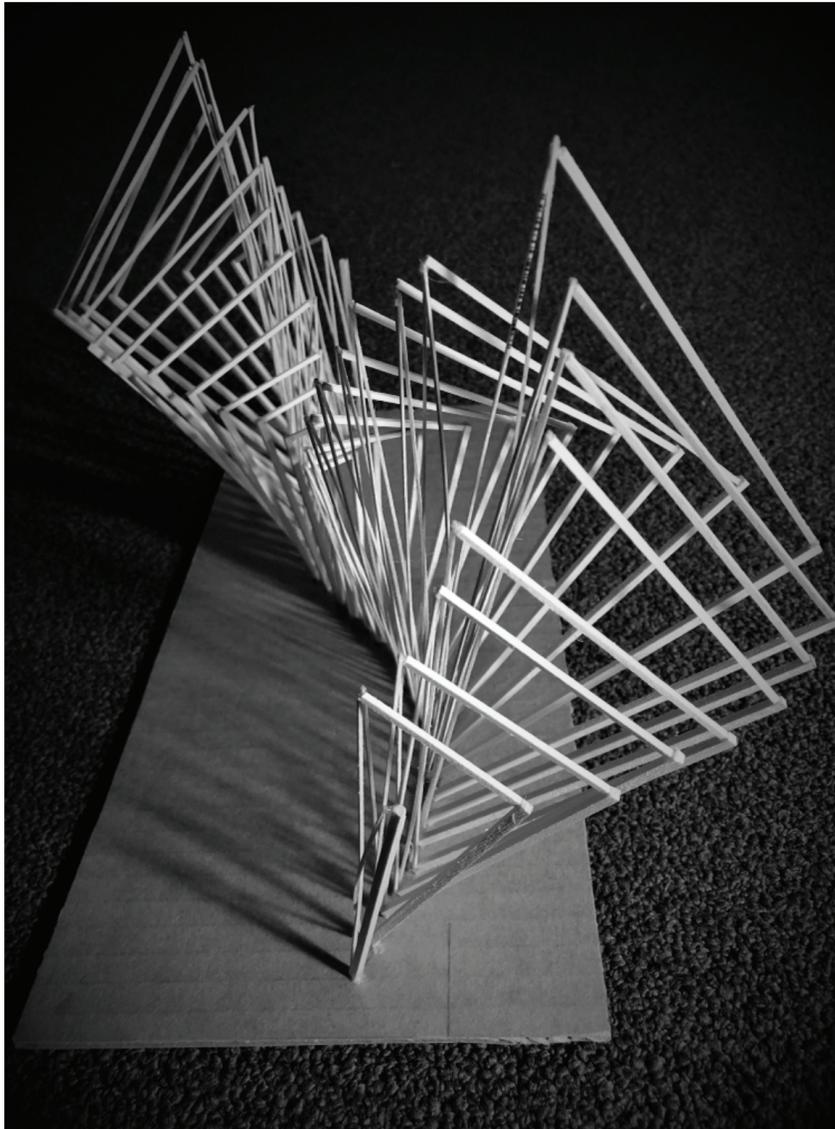
The Structure of the Framing Walls

The design of the framing walls actually comes from the model-making. The elegant shapes of the walls are constructed in a comparatively random way, but still make it naturally beautiful.



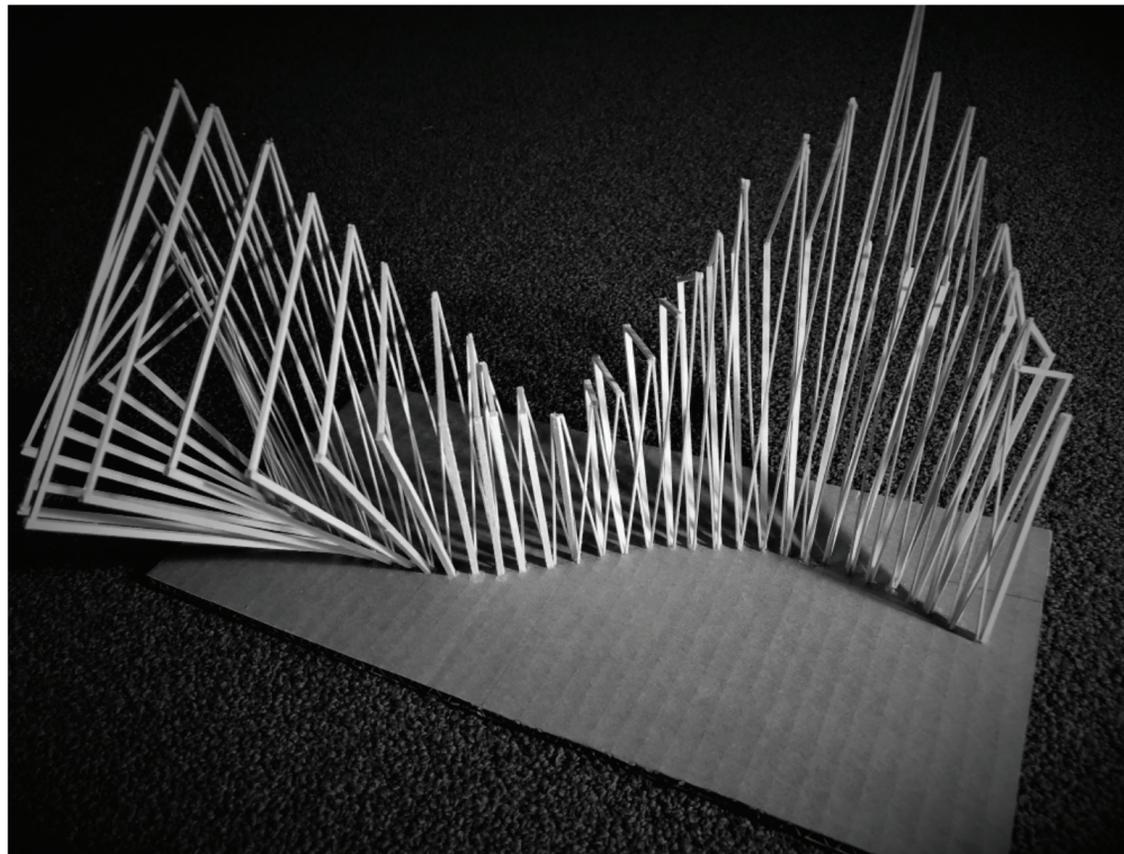
Structure Analysis

The Structure of the Framing Walls



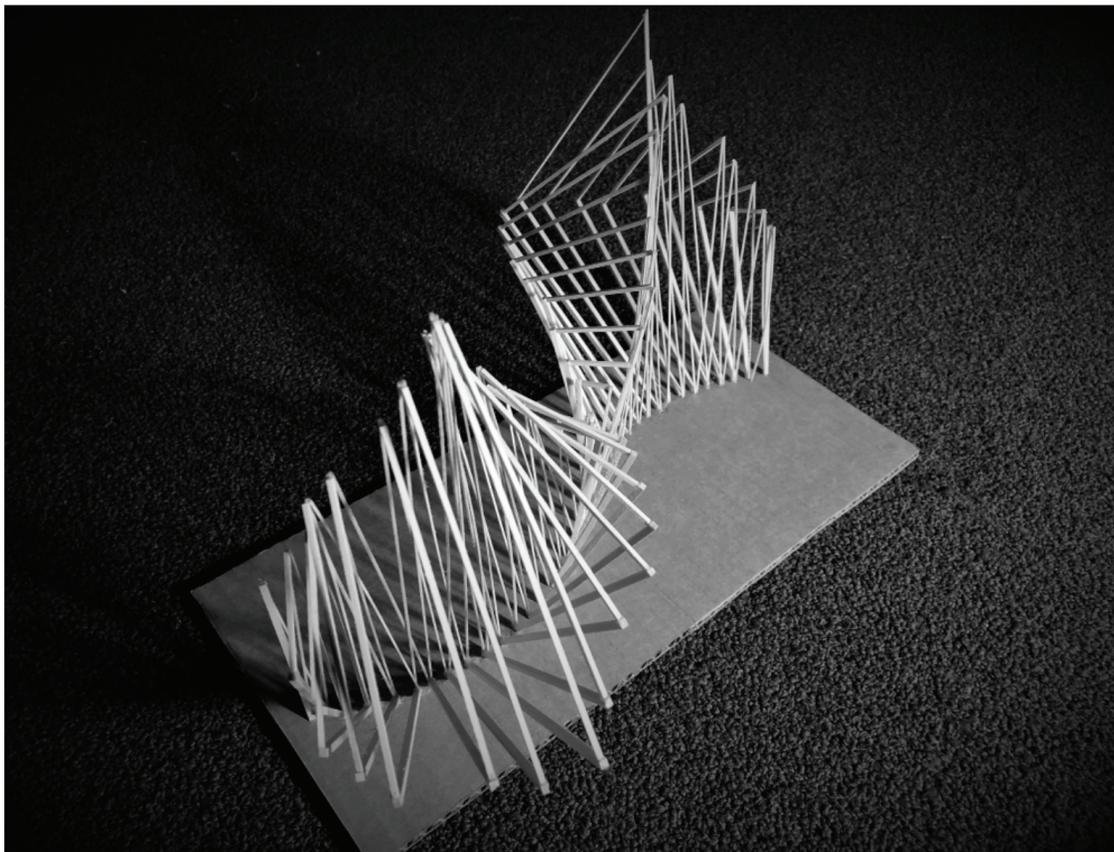
Structure Analysis

The Structure of the Framing Walls



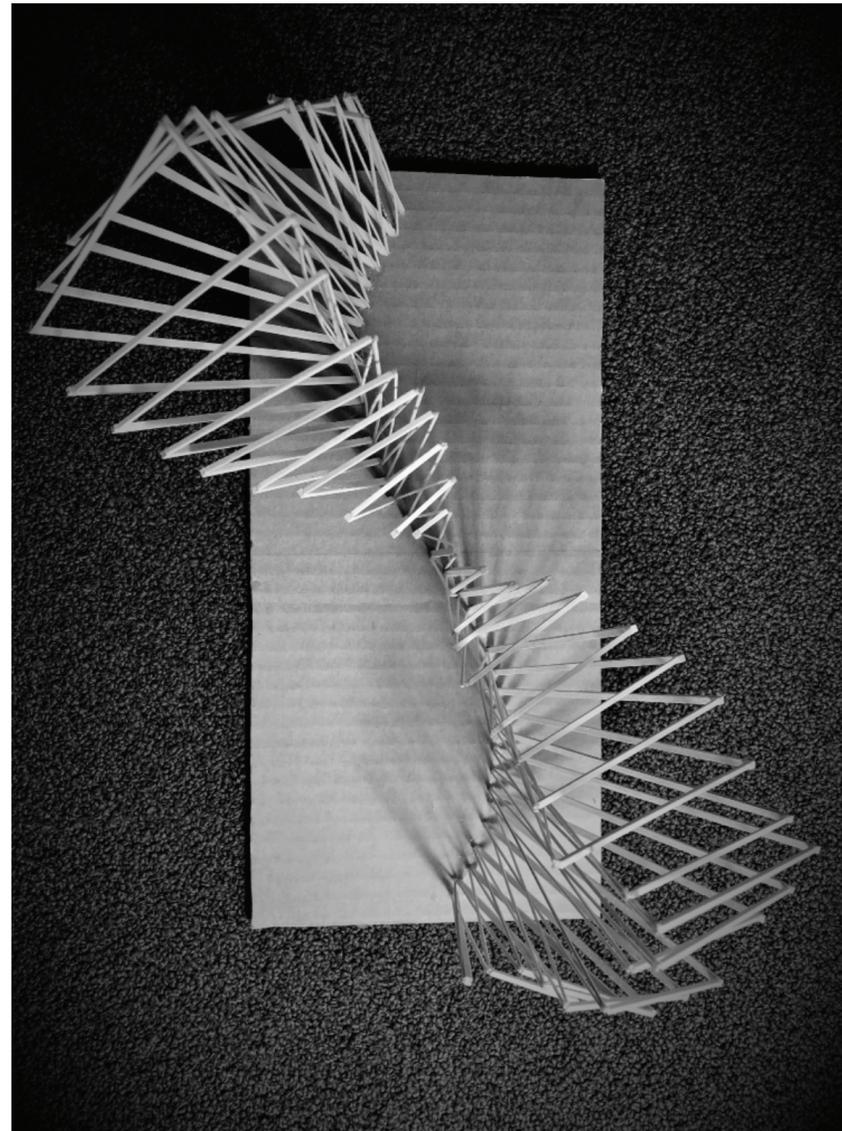
Structure Analysis

The Structure of the Framing Walls



Structure Analysis

The Structure of the Framing Walls



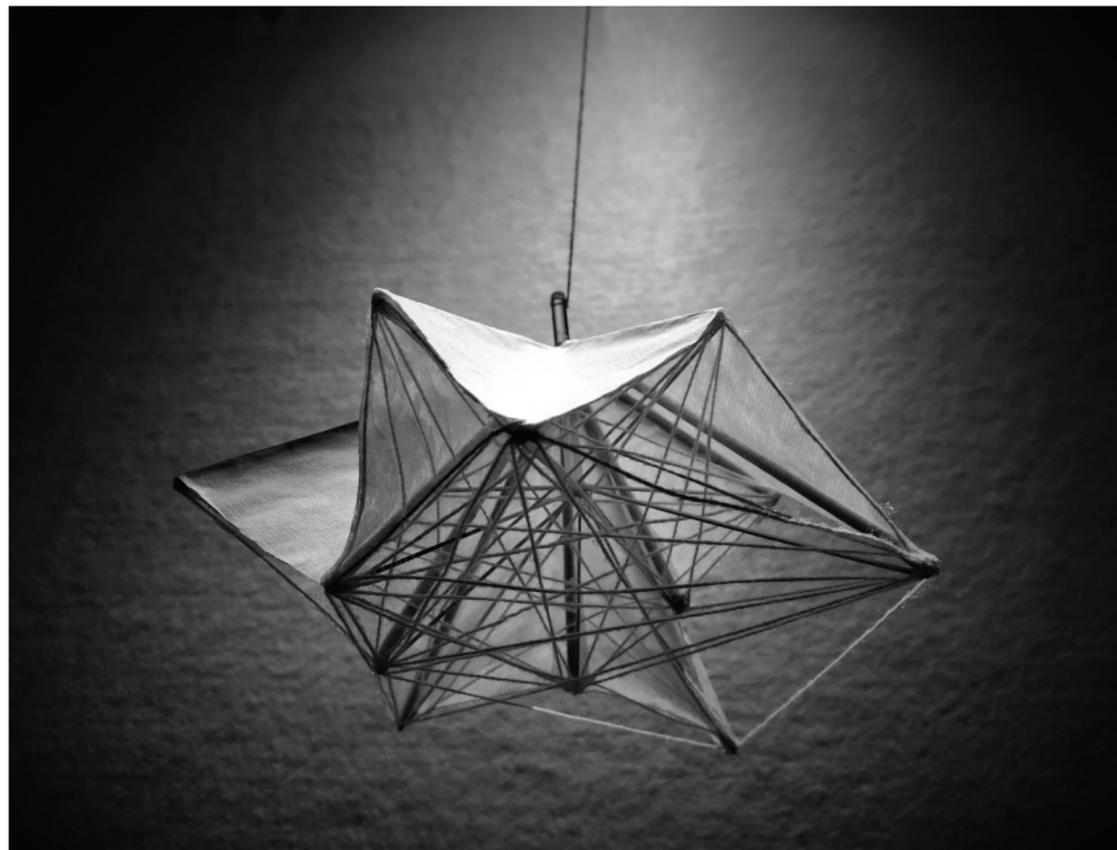
Structure Analysis

The Structure of the Bamboo Joints



Light Fixture Design

This light fixture is designed specially for the pavilions. Still, the idea of a spiral and rotation penetrates through all of the design process. Two rows of rational sticks rotate in opposite directions in a spiral way to make its shape. The strings that connect all the points would cast interesting shadows on the floor.



Light Fixture Design



Light Fixture Design

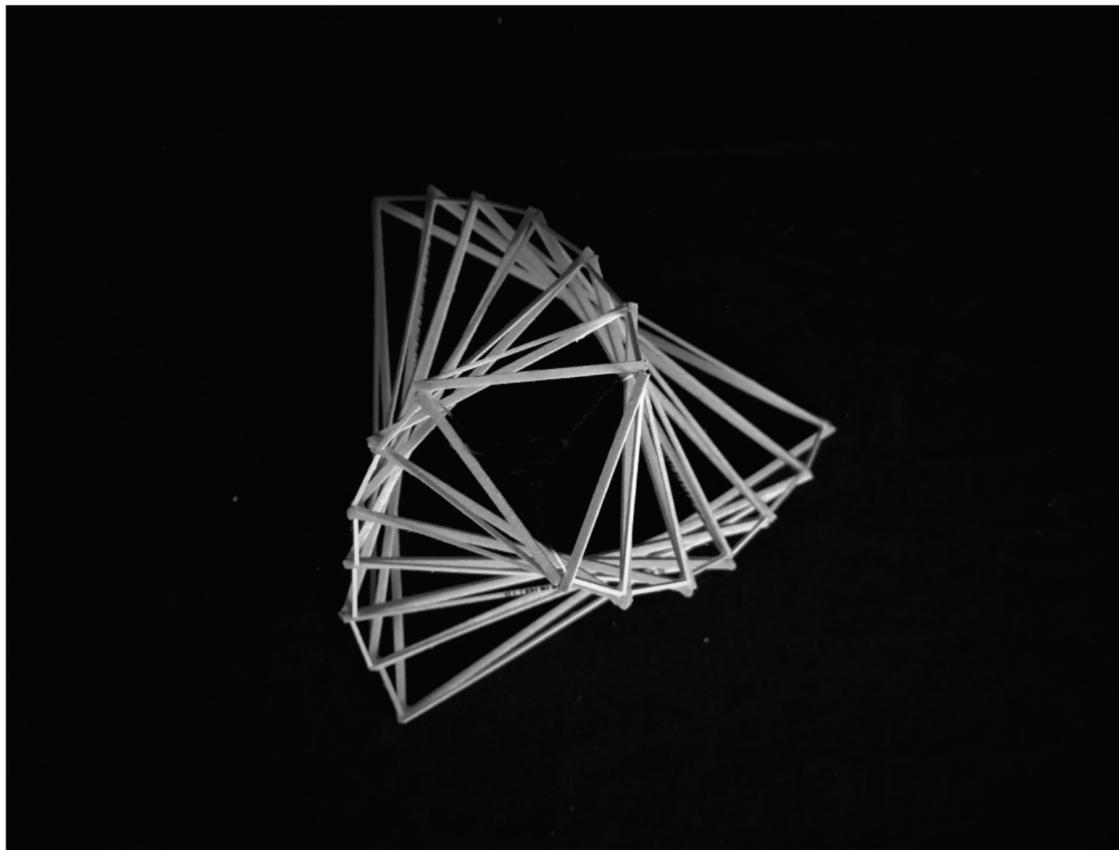


Light Fixture Design

Another light fixture that employs the idea of rotation and spiral. It could be so identifiable that it is designed for this water garden.



Light Fixture Design

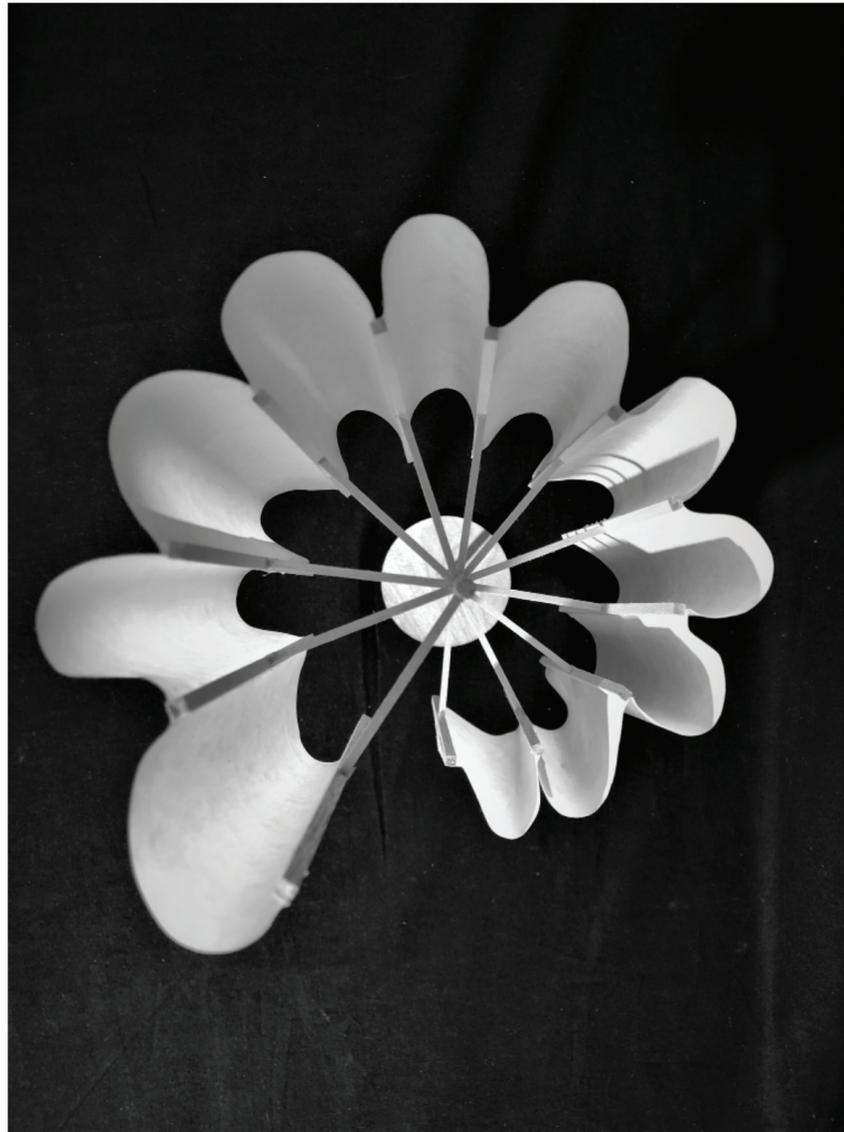


Light Fixture Design

This light fixture is designed as a lantern on the floor. Rice paper is applied to reveal the idea of rotation.

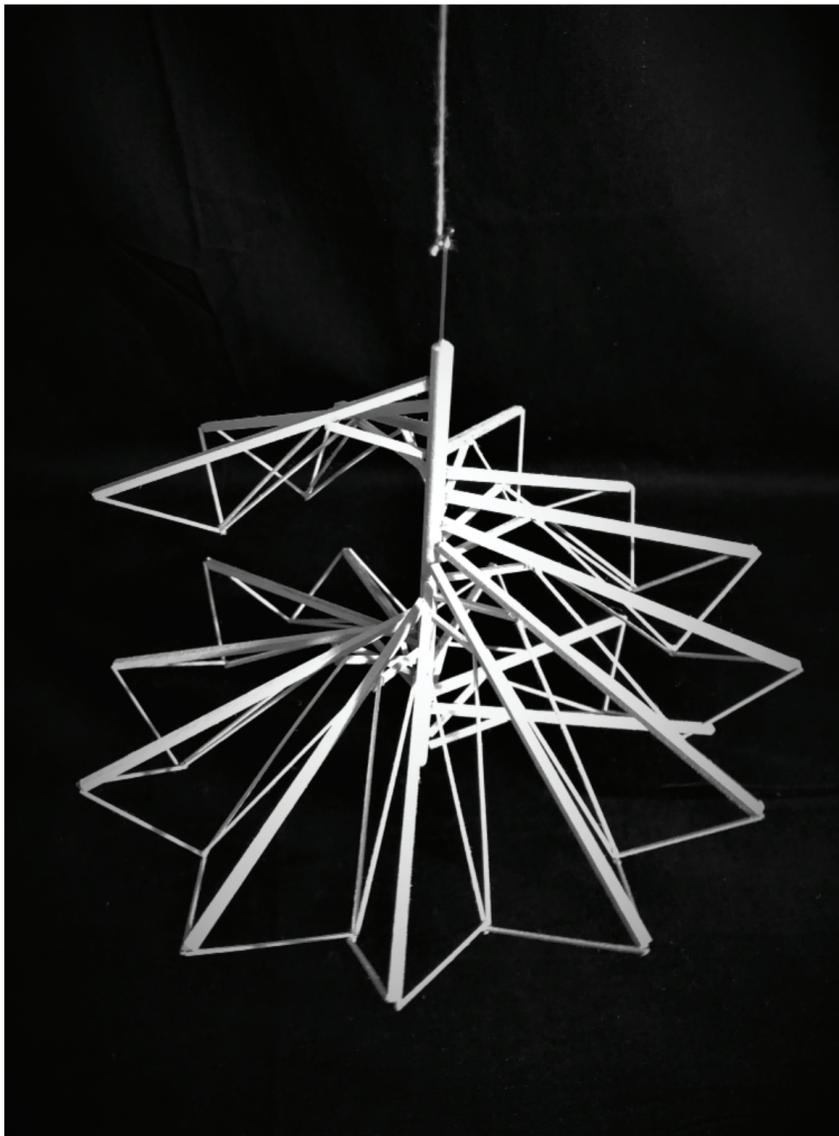


Light Fixture Design



Light Fixture Design

In the design of this light fixture, the roof structures of the pavilions are reintroduced to contribute to the organic unit of this whole project.

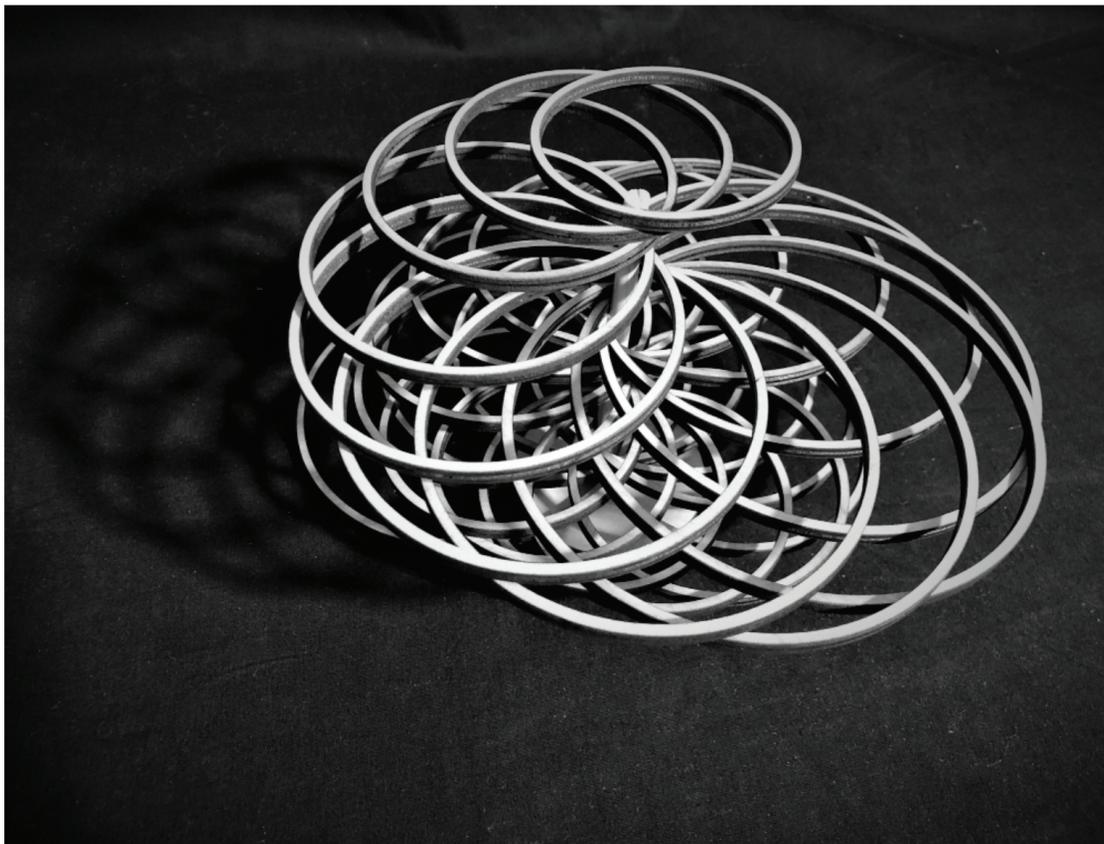


Light Fixture Design

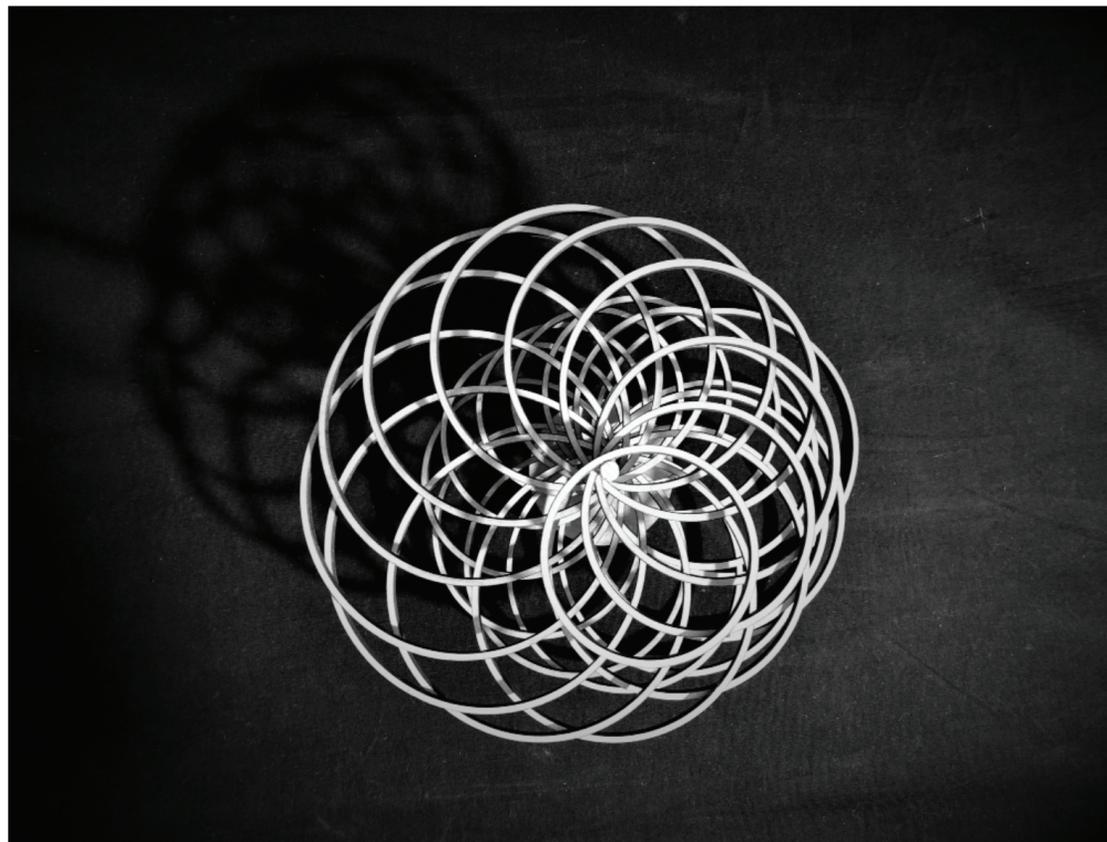


Sculpture Design

This sculpture is set for the island and will be surrounded by a bamboo forest. As one of the most important parts of this project, it has to answer to the idea of rotation, where the project starts.



Sculpture Design



Sculpture Design



Conclusion

This Water Garden could also be regarded as an appreciation of the organic architecture by Frank Lloyd Wright. Great architecture should and must respect Mother Nature since she is where we, human beings, came from, and will necessarily be where we have to go. True quality is stored in the wild nature, whose resources of organic intelligence will never dry up. She encourages us to explore when we are thirsty for new thoughts. She can instruct us on what is true beauty and where to earn it as well. She will never leave us anytime we need her. As Wright (1949) expounded, “It is the quality in things that should make them desirable and beautiful, the joy forever that is ever and will always be the most important thing to mankind”.

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