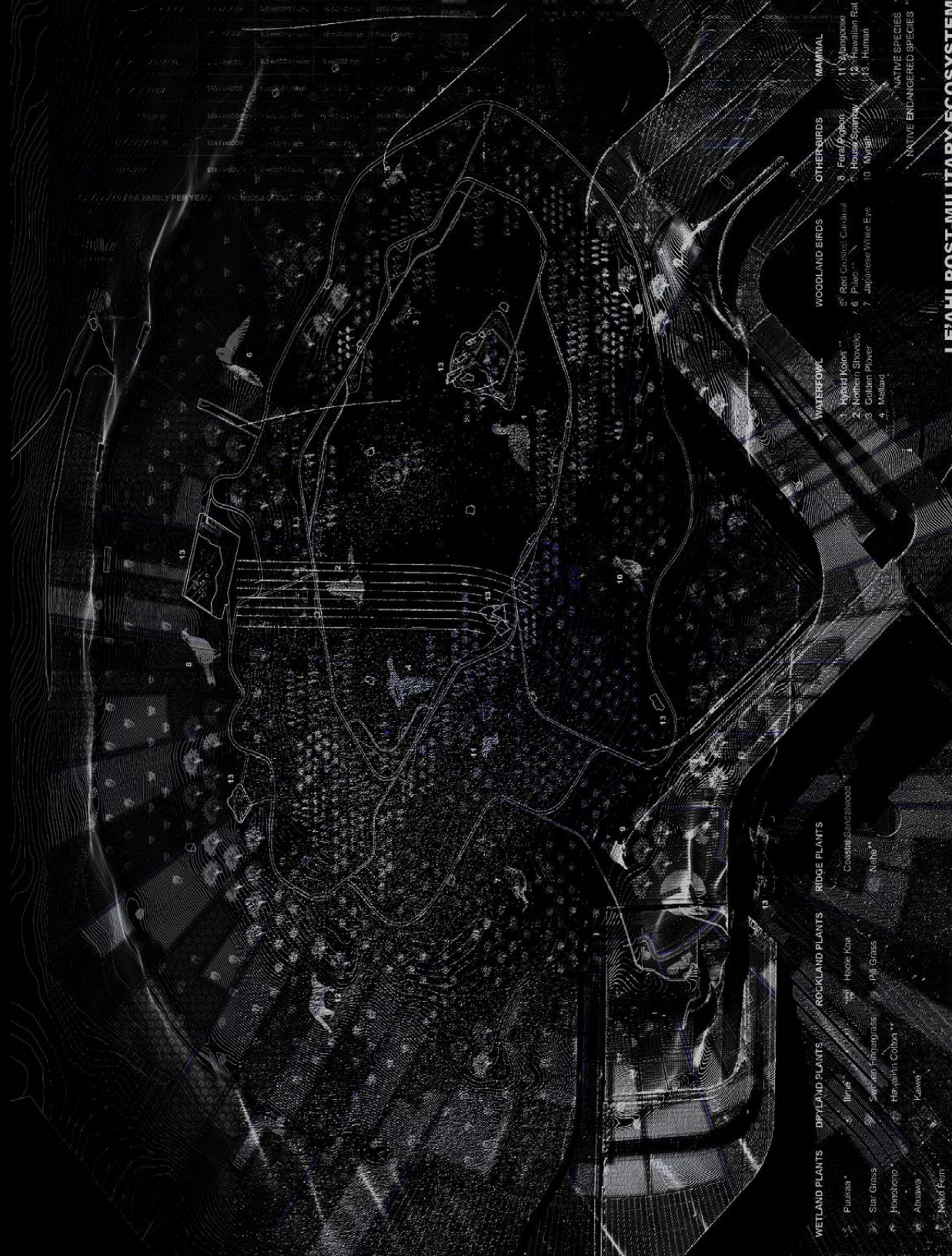


ZIDA LIU
GRADUATION PORTFOLIO
COLUMBIA GSAPP AAD



WETLAND PLANTS
Puaeaea *
Star Grass
Honohono *
Ahuwaw
Weka Fern

DEFLAND PLANTS
Ilirio
Sawm Fern
Hawaiian Cotton **
Kaliwa

ROCKLAND PLANTS
Hoole Koa
Pili Grass *

RIDGE PLANTS
Cassia Standalwood **
Naha **

WATERFOWL
Apuia Koter **
Northern Shovels
Golden Plover
Mallard

WOODLAND BIRDS
Red Chokebird Cardinal
Pua
Japanese White Eye

OTHER BIRDS
Feral Pigeon
House Sparrow
Myrtle

MAMMAL
Mongoose
Hawaiian Rat
Human

NATIVE SPECIES
NATIVE ENDANGERED SPECIES **

CONTENT

THE CARBON OFFSET PROJECT	1
SEPULVEDA EQUALIZER	14
LE'AHU WETLAND RESTORATION	38

THE CARBON OFFSET PROJECT

GROUP WORK WITH WEI-CHUN CHOU

NAHYUN HWANG

2021 FALL

REFERENCE

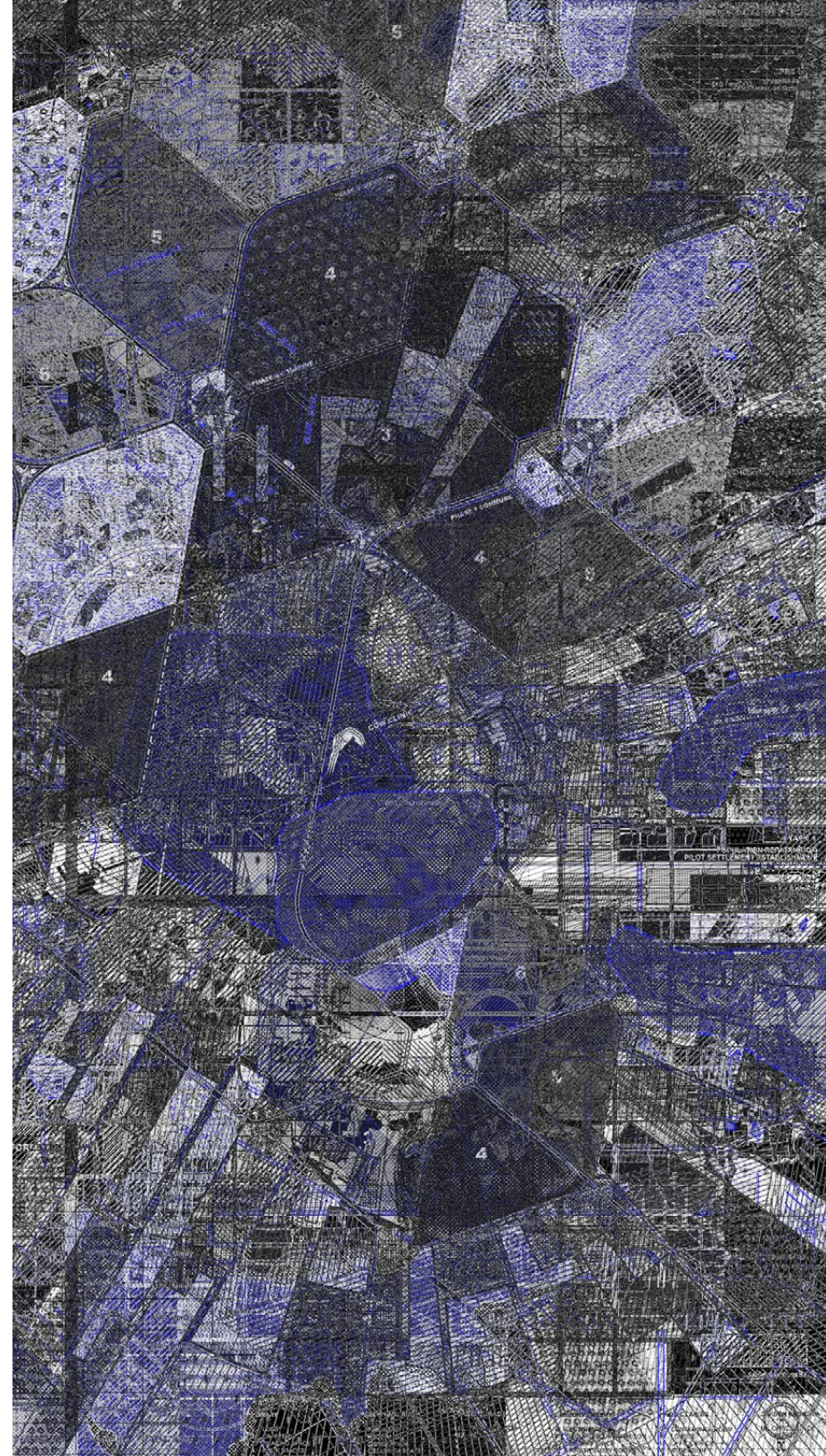
Brazil: Plantar's 'new' eucalyptus projects advance towards CDM validation.
World Rainforest Movement. (n.d.)

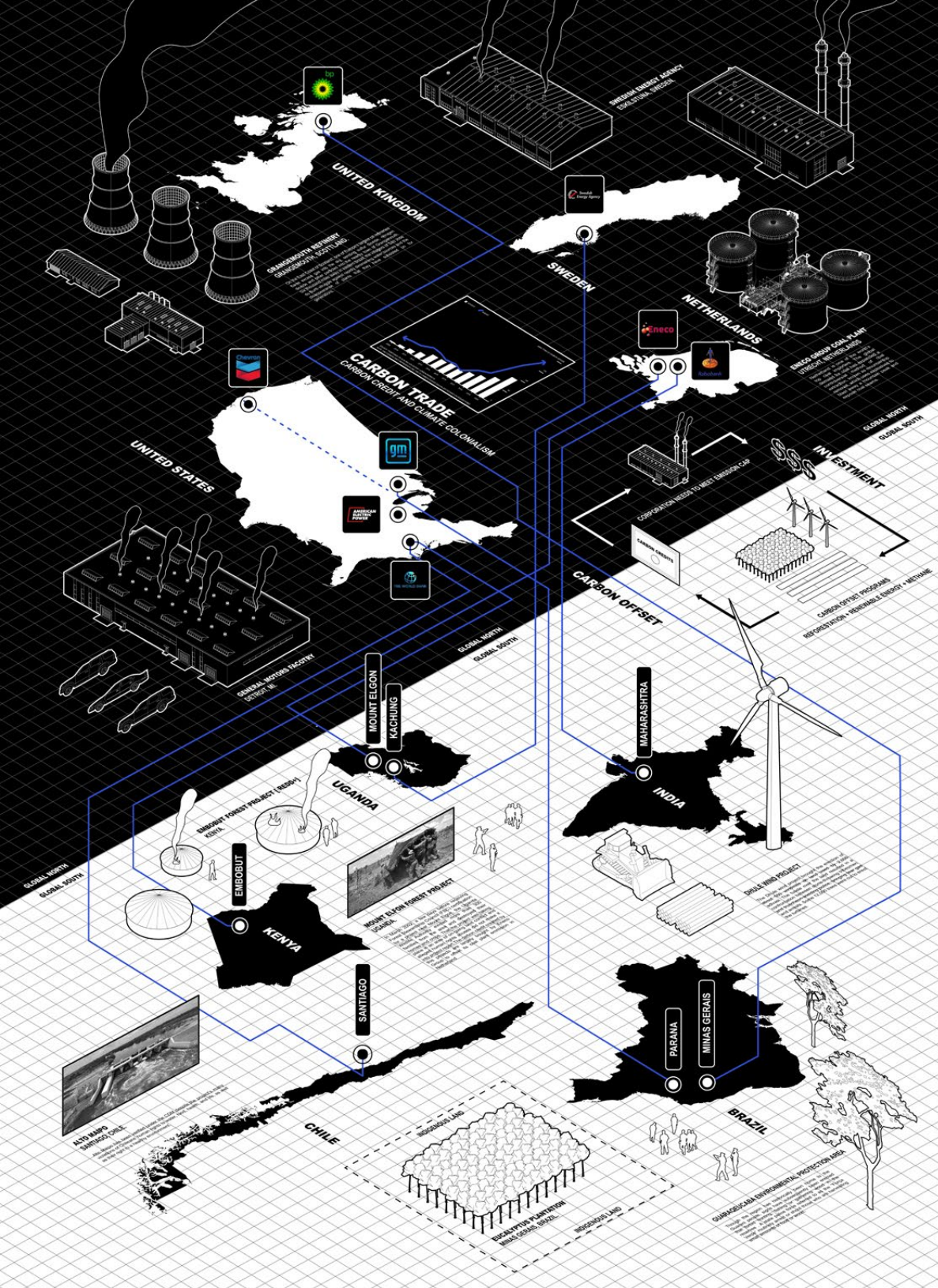
Controversial CDM project "Plantar" deemed to be rejected (Newsletter #7)
Carbon Market Watch. (n.d.)

Gouvello, C. D., Diewald, C., & Marques, F. (1970, January 1). Project to Global Public Good : The story of the Plantar Group – World Bank partnership: Semantic scholar. undefined.

Lohmann, L., Hällström Niclas, Österbergh Robert, & Nordberg, O. (2006). Carbon trading: A critical conversation on climate change, privatisation and power. Corner House.

Redman, J. (2008). World Bank: Climate profiteer. Sustainable Energy & Economy Network.

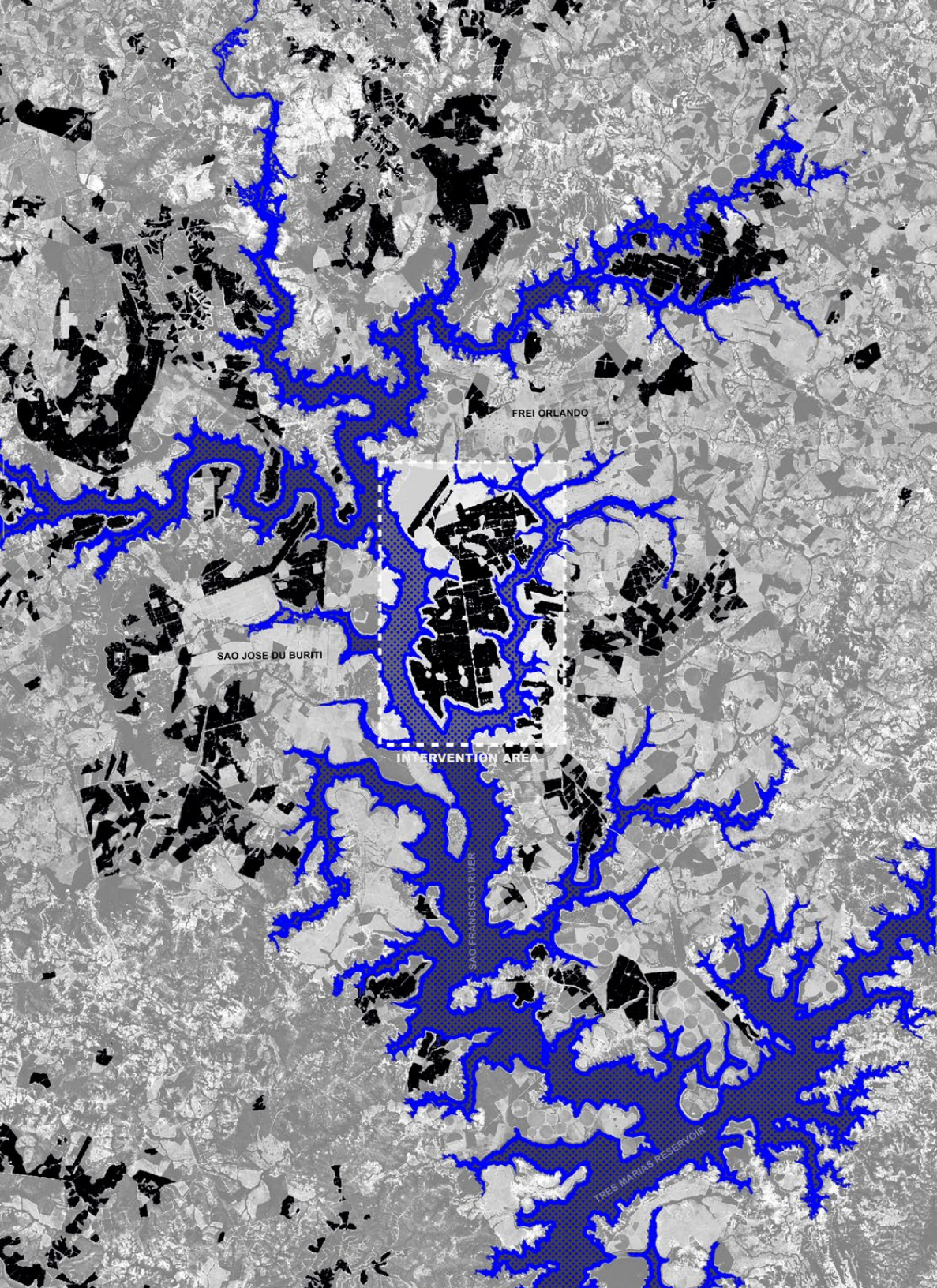




THE CARBON MARKET

The global carbon market has witnessed significant growth in recent decades. In this seemingly benign profit chain, multinational corporations from the global north invest in various carbon offset projects, primarily located in the global south, to yield carbon credits and offset their carbon emission in pursuit of carbon neutrality. Many of these carbon offset projects are sponsored by the United Nations and validated through the Clean Development Mechanism (CDM).

However, in many cases, multinational corporations and regional governments manipulate the carbon trade system as a tool of climate colonization and land grab. For example, in the case of the Mount Elgon project, the Uganda government violently vacated 6000 indigenous people in nine days to make room for reforestation sponsored by Dutch Electricity Generating Board to offsets its emission. In another case, Argentina's highly controversial Alto Maipo hydropower scheme, which has flooded numerous communities and caused forced eviction, was also a certified source of carbon credits with multiple buyers from the global north. In India, the Dhule Wind Project, which has torn down large areas of forests and evicted residents, was partially funded by the carbon credits potential it has.



PLANTAR EUCALYPTUS PLANTATION

This project focuses on the Eucalyptus plantation offset projects in Minas Gerais, Brazil. Minas Gerais has been the home of Eucalyptus production for a long time. There are 12300 hectares of plantations in the municipality, and over a third of them are monoculture Eucalyptus plantations. Among all of the corporations that own Eucalyptus plantations, Plantar Group stands out as one of the biggest. Locals were forced to sign a twenty-year lease with Plantar Group in 1970s under the dictatorship government of Brazil, which supported the expansion of plantation practices. The lease was extended indefinitely, which led to the permanent eviction of the locals from their land.

After the 1997 Kyoto Protocol, during which carbon credits were coined to incentivize emission reduction, Plantar Group actively sought to register its Eucalyptus plantation as carbon offset projects to yield more profits while greenwashing itself. Through relentless lobbying and threatening, CDM approved two of the four applications Plantar submitted. These projects are reported to have the potential to generate **65 million** dollars worth of carbon credits throughout the year.

Project 2569 : Reforestation as Renewable Source of Wood Supplies for Industrial Use in Brazil

Host Parties	Brazil , involved indirectly approval (343 KB) authorization (343 KB) Authorized Participants: Plantar S/A Planejamento, Técnica e Administração de Reflorestamentos , Plantar Carbon Ambiental Ltda
Other Parties Involved	Netherlands , involved directly approval (146 KB) authorization (146 KB) Authorized Participants: International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF) (withdrawn as of 29/05/2019) , Netherlands' Ministry of Infrastructure and the Environment (IenM) (withdrawn as of 18/03/2019) Ireland , involved directly approval (77 KB) authorization (77 KB) Authorized Participants: Government of Ireland-Department of the Environment, Community and Local Government (withdrawn as of 28/07/2016) Spain , involved directly approval (2714 KB) authorization (2714 KB) Authorized Participants: Kingdom of Spain - Ministry of Agriculture, Food and Environment and Ministry of Economy and Competitiveness (withdrawn as of 28/10/2016) , Zeroemissions Carbon Trust, S.A (withdrawn as of 26/07/2016) , International Bank for Reconstruction and Development (IBRD) as Trustee of the BioCarbon Fund (BioCF) (withdrawn as of 18/03/2019) , International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF) (withdrawn as of 29/05/2019) Luxembourg , involved directly approval (247 KB) authorization (247 KB) Authorized Participants: Ministry of Sustainable Development and Infrastructure (withdrawn as of 18/08/2016) , International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF) (withdrawn as of 29/05/2019) Japan , involved indirectly approval (4757 KB) authorization (4757 KB) Authorized Participants: The Tokyo Electric Power Co., Inc. (withdrawn as of 19/07/2016) , Japan Petroleum Exploration Co., Ltd. (JAPEX) (withdrawn as of 19/07/2016) , Japan Iron and Steel Federation (JISF) (withdrawn as of 19/07/2016) , Sumitomo Chemical (withdrawn as of 19/07/2016) , Sumitomo Joint Electric Power Co., Ltd. (withdrawn as of 19/07/2016) , Idemitsu Kosan Co., Ltd. (withdrawn as of 19/07/2016) , Sunbury Holdings Limited (withdrawn as of 19/07/2016) , The Okinawa Electric Power Co., Inc. (withdrawn as of 19/07/2016) France , involved indirectly approval (374 KB) authorization (374 KB) Authorized Participants: Eco-Carbone S A S. (withdrawn as of 06/04/2017) Italy , involved directly approval (224 KB) authorization (224 KB) Authorized Participants: Ministry for the Environment, Land and Sea (withdrawn as of 23/09/2016) , International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF) (withdrawn as of 29/05/2019) Switzerland , involved indirectly approval (188 KB) authorization (188 KB) Authorized Participants: Syngenta Foundation for Sustainable Agriculture (withdrawn as of 28/10/2016) Finland , involved indirectly approval (53 KB) authorization (53 KB) Authorized Participants: Ministry of Foreign Affairs of Finland (withdrawn as of 11/12/2018) Sweden , involved directly approval (29 KB) authorization (29 KB) Authorized Participants: Swedish Energy Agency (withdrawn as of 11/12/2018) Norway , involved indirectly approval (2059 KB) authorization (2059 KB) Authorized Participants: Equinor ASA (withdrawn as of 18/03/2019) , Ministry of Foreign Affairs (withdrawn as of 19/11/2018)
Sectoral scopes	14 - Afforestation and reforestation
Activity Scale	LARGE
Methodologies Used	AR-AM0005 - Afforestation and reforestation project activities implemented for industrial and/or commercial uses

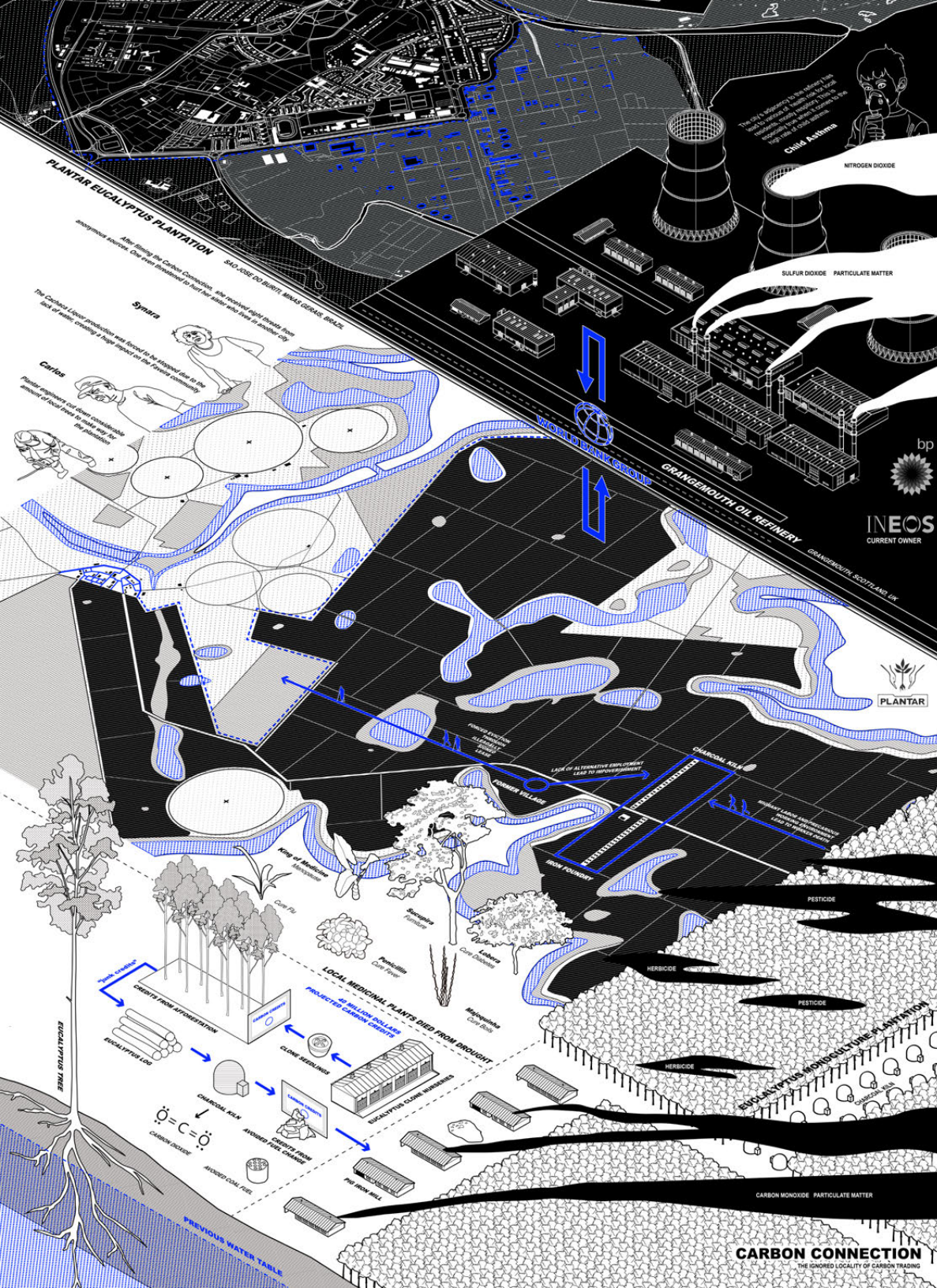
Project 1051 : Mitigation of Methane Emissions in the Charcoal Production of Plantar, Brazil

Host Parties	Brazil , involved indirectly approval (337 KB) authorization (337 KB) Authorized Participants: Plantar S/A ; Plantar Carbon Ambiental Ltda
Other Parties Involved	Sweden , involved directly approval (500 KB) authorization (500 KB) Authorized Participants: Government of Sweden - Swedish Energy Agency (withdrawn as of 21/11/2018) France , involved indirectly approval (115 KB) authorization (115 KB) Authorized Participants: GDF Suez (withdrawn as of 07/02/2019) Japan , involved indirectly approval (4657 KB) authorization (4657 KB) Authorized Participants: Chubu Electric Power Co., Inc. (withdrawn as of 16/08/2018) , Japan International Cooperation Agency (JICA) (withdrawn as of 07/02/2019) ; Kyushu Electric Power Co., Inc. (withdrawn as of 17/07/2019) , Mitsubishi Corporation (withdrawn as of 10/08/2018) , MIT Carbon Fund Co., Ltd. (MIT) (withdrawn) , Shikoku Electric Power Co., Inc. (withdrawn as of 03/05/2019) , Tohoku Electric Power Co. Inc. (withdrawn as of 13/03/2019) , The Tokyo Electric Power Company, Incorporated (withdrawn as of 20/03/20) , The Chugoku Electric Power Co., Inc. (withdrawn as of 10/08/2018) , Mitsu & Co., Ltd. (withdrawn as of 21/06/2018) Norway , involved directly approval (2309 KB) authorization (2309 KB) Authorized Participants: Government of Norway - Ministry of Foreign Affairs (withdrawn as of 21/11/2018) ; Norsk Hydro ASA (withdrawn as of 21/11/2018) ; Equinor ASA (withdrawn as of 07/02/2019) Netherlands , involved directly approval (278 KB) authorization (278 KB) Authorized Participants: Electrabel S. A. (withdrawn as of 28/11/2018) , Netherlands' Ministry of Infrastructure and the Environment (IenM) (withdrawn as of 15/04/2019) ; Netherlands' Ministry of Economic Affairs, Agriculture and Innovation (EL&I) (withdrawn as of 07/02/2019) ; International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF) (withdrawn as of 20/03/2020) United Kingdom of Great Britain and Northern Ireland , involved indirectly approval (231 KB) authorization (231 KB) Authorized Participants: BP Alternative Energy International Ltd. (withdrawn as of 20/03/20) ; Deutsche Bank AG (withdrawn as of 21/11/2018) Canada Party withdrawn from KP effective 15/12/2012 , involved directly approval (367 KB) authorization (367 KB) Authorized Participants: Government of Canada - Ministry of Foreign Affairs and International Trade Finland , involved indirectly approval (189 KB) authorization (189 KB) Authorized Participants: Fortum Corporation (withdrawn as of 07/02/2019) ; Government of Finland - Ministry of Foreign Affairs (withdrawn as of 21/11/2018) Germany , involved indirectly approval (180 KB) authorization (180 KB) Authorized Participants: RWE Power AG (withdrawn as of 14/08/2018)
Bilateral and Multilateral Funds	Prototype Carbon Fund (PCF) Managing company: International Bank for Reconstruction and Development (IBRD) as Trustee of the Prototype Carbon Fund (PCF)
Sectoral scopes	4 - Manufacturing industries
Activity Scale	LARGE
Methodologies Used	AM0041 - Mitigation of Methane Emissions in the Wood Carbonization Activity for Charcoal Production

source: cdm.unfccc.int

THE BUYERS AND THE PROFITEERS

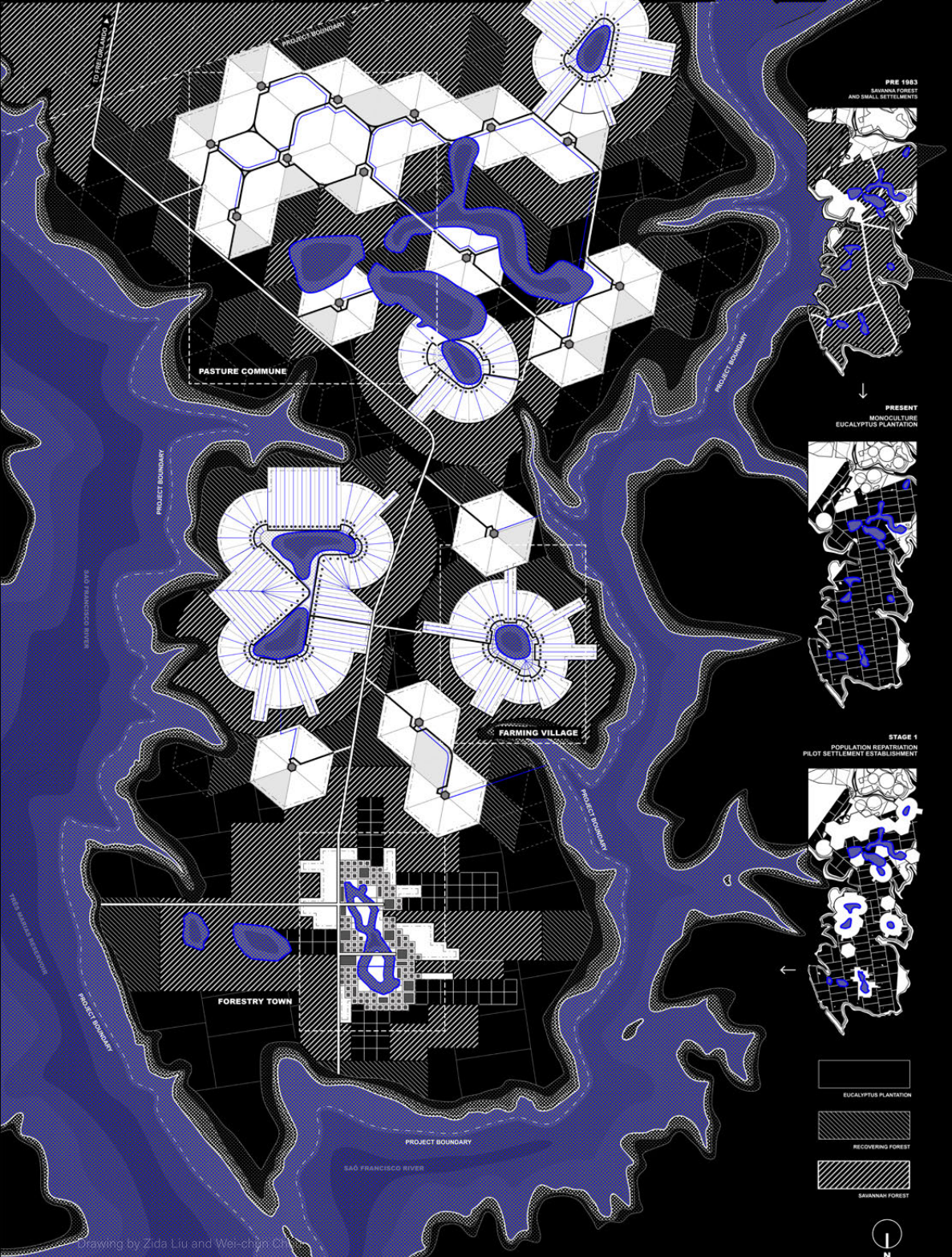
The Plantar eucalyptus plantations are registered as two carbon offset programs under CDM: Project 2569 and Project 1051. The former focuses on justifying the Eucalyptus plantation as a form of reforestation, while the latter focuses on the charcoal produced by the Eucalyptus tree as a renewable energy source for pig iron production. There are fifty entities from fourteen countries that have invested and purchased carbon credits produced by Plantar. Three entities in Brazil, including one governmental organization, have profited from these two projects.



CONSEQUENCES

The establishment of Eucalyptus plantations has profound impacts on local residents. Plantar's illegal dispossession of people's land has destroyed their livelihoods and formed a monopoly over the local economy. Due to the lack of alternative employment options, impoverished locals are forced to work for Plantar Group as exploited labor under appalling conditions. Multiple deaths and numerous abuses are reported in Plantar's plantation and pig iron production operations. Locals who attempted to reveal these human rights abuses were threatened with violence by Plantar.

On the other hand, the plantations also destroyed the local ecosystem. The monoculture plantation wiped out the local biodiversity while the pesticides used on Eucalyptus polluted the nearby soils and water sources. Furthermore, Eucalyptus trees rely on a large amount of water to maintain their growth, and the presence of these plantations dried up the local water ponds, which both residents and wildfires rely on as essential sources of water. While Minas Gerais locals suffer from Plantar, the carbon credits produced from these plantations enable corporations from the north to pollute more blatantly. This chain of reaction was recorded in the documentary called the Carbon Connection.



Drawing by Zida Liu and Wei-chun Chen

PILOT CARBON OFFSET COMMUNITIES

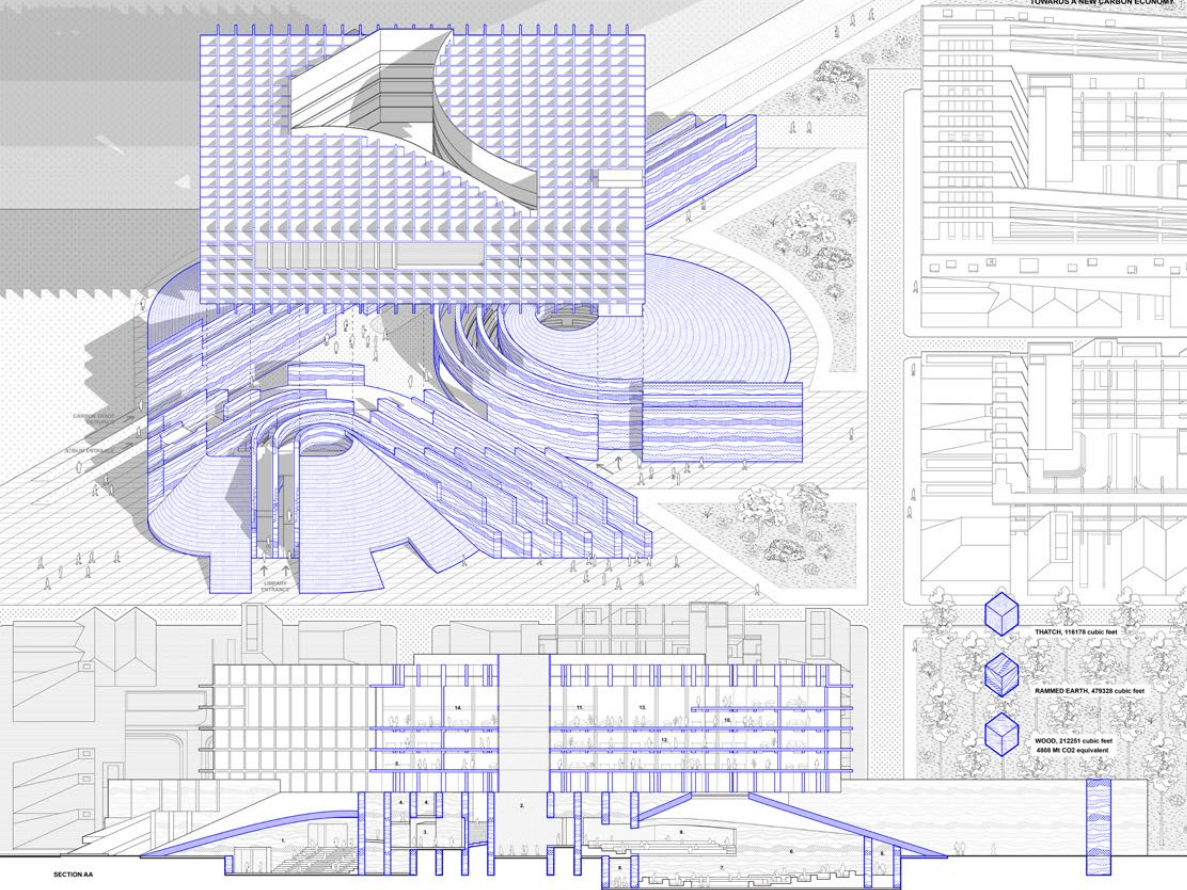
THE CHALLENGE AGAINST THE ESTABLISHED GLOBAL CARBON CREDITS PRODUCTION

PROJECT PROPOSAL

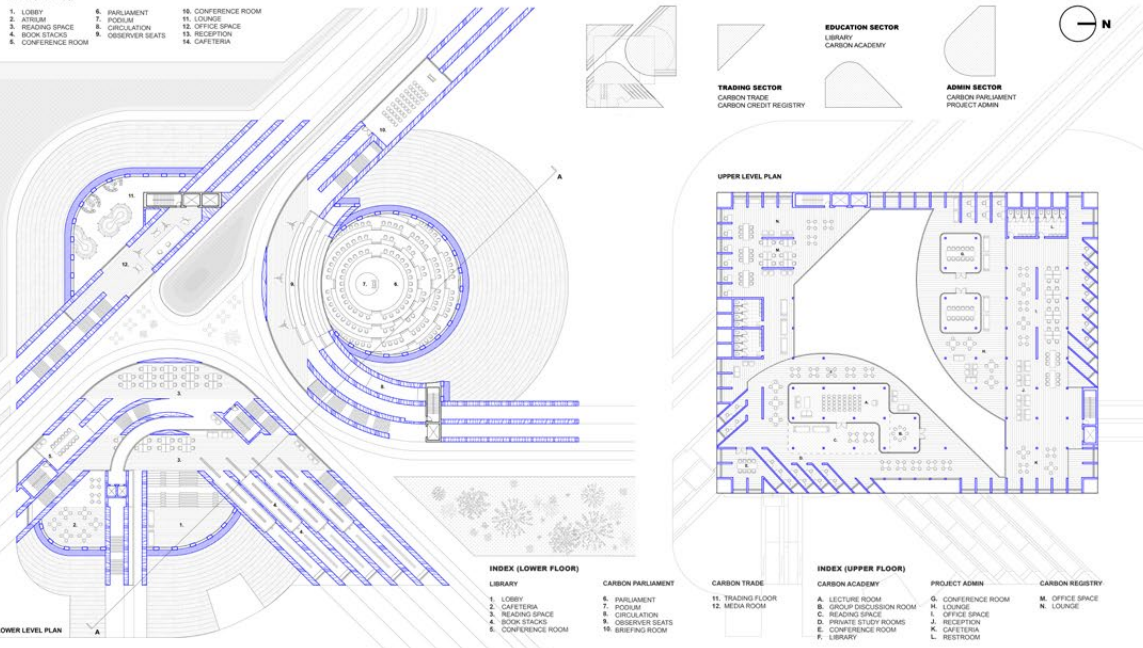
From the preliminary research, the power dynamic between big corporations and local residents is the primary reason why locals suffer so much from the seemingly benign global carbon trade system. And this power dynamic is mainly produced by the ownership of the carbon offset projects and the ownership of lands. These types of ownership are also known as carbon rights.

As a result, this project intends to use the carbon trade system's rules to turn victims into beneficiaries and help communities in Minas Gerais to regain their carbon rights while at the same time restore the local ecosystem. First of all, the project plans to enforce the long-expired lease between Plantar and the locals and help return the land to the locals' hands. A pilot plot is then proposed in which **carbon credits become primary source of income** and are used to jump start the economy of local communities. Finally, three types of communities are planned, experimenting with three different types of ownership: **private, commune, and union**. Within each community, an architectural typology is designed using a **unique carbon-rich material** to emphasize carbon sequestration further.

CARBON TRADE CENTER
TOWARDS A NEW CARBON ECONOMY



- SECTION AA**
- INDEX (SECTION)**
- | | | |
|--------------------|-------------------|---------------------|
| 1. LOBBY | 6. PARLIAMENT | 10. CONFERENCE ROOM |
| 2. ATRIUM | 7. PODIUM | 11. LOUNGE |
| 3. READING SPACE | 8. CIRCULARS | 12. OFFICE SPACE |
| 4. BOOK STACKS | 9. OBSERVER SEATS | 13. RECEPTION |
| 5. CONFERENCE ROOM | | 14. CAFETERIA |



CARBON TRADE CENTER

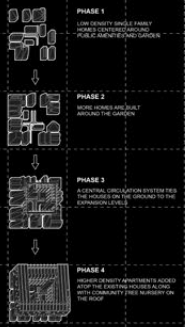
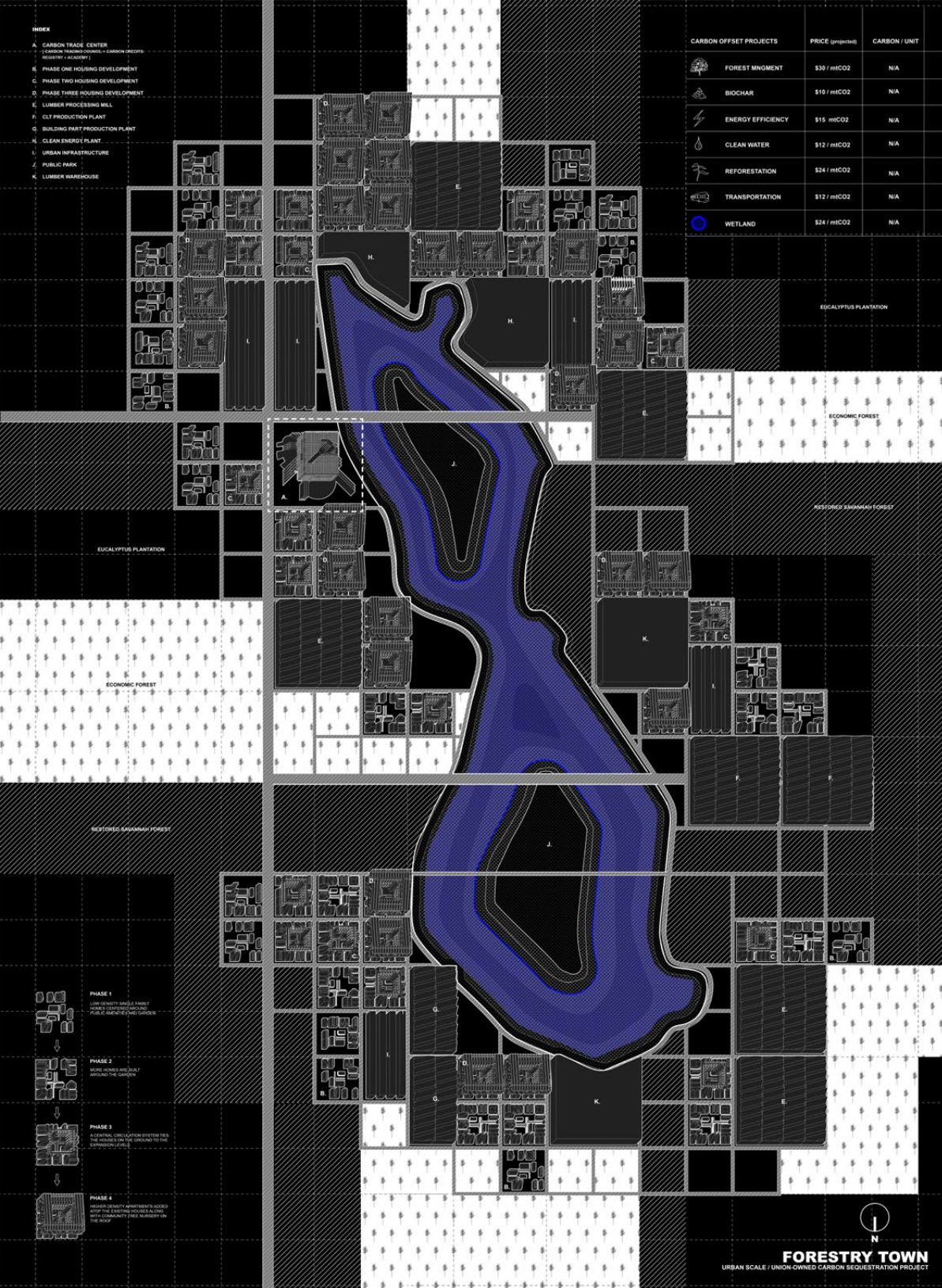
Located in the center of the forestry town, the Carbon Trade Center is made up of three programs: trading, education, and administration. The education sector provides necessary carbon trading knowledge to equip residents better. The trading sector collects and verifies carbon credits generated from each community and sells them to potential buyers. The admin sector provides a democratic space that enables bottom-up decision-making.

The material of this building combines three carbon-rich materials from each building typologies found in different communities: eucalyptus CLT, rammed earth, and thatch.

INDEX

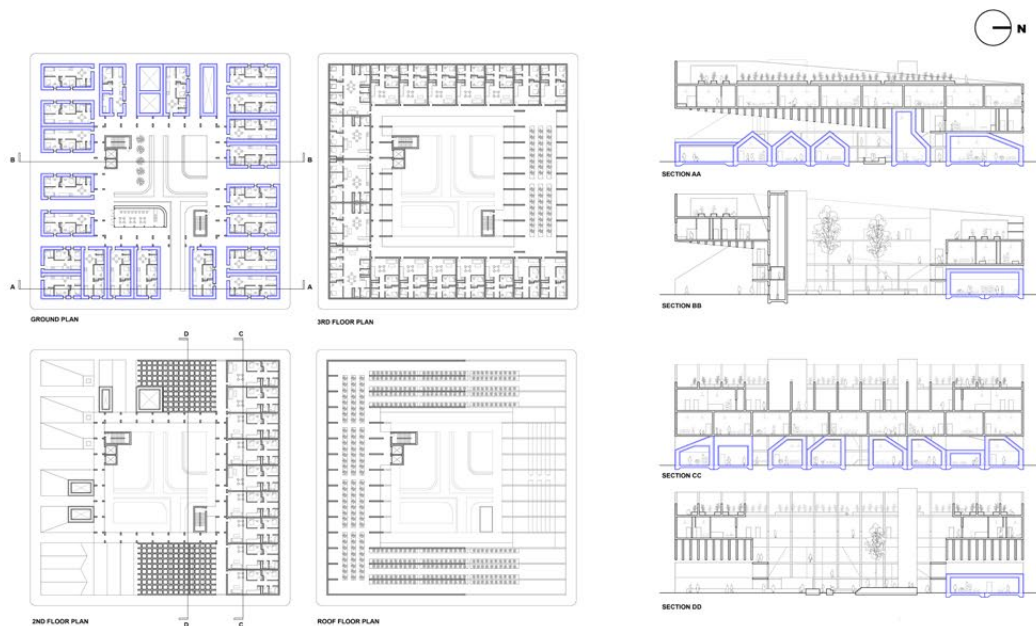
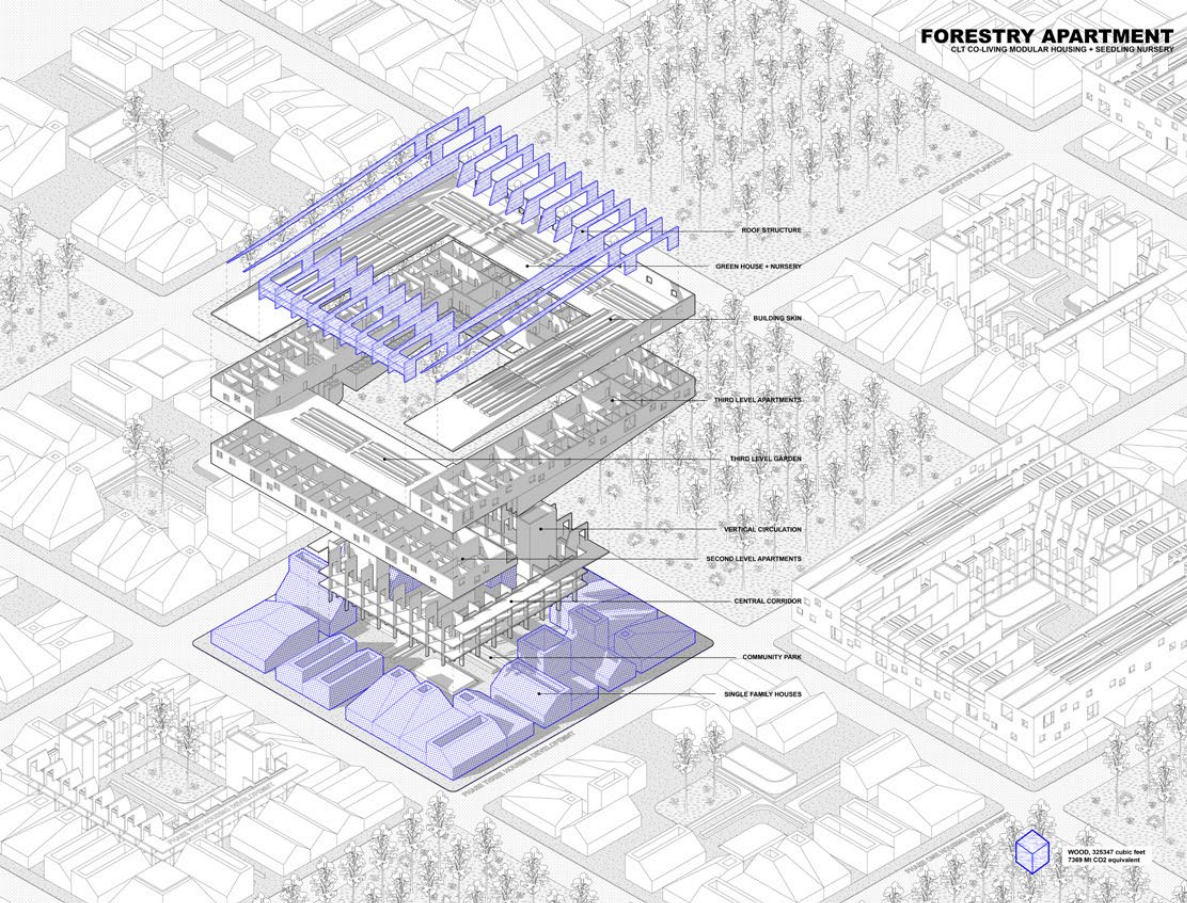
- A. CARBON TRADE CENTER
(CARBON TRADING OFFICES + CARBON CREDITS REGISTER + AGENCY)
- B. PHASE ONE HOUSING DEVELOPMENT
- C. PHASE TWO HOUSING DEVELOPMENT
- D. PHASE THREE HOUSING DEVELOPMENT
- E. LUMBER PROCESSING MILL
- F. CLT PRODUCTION PLANT
- G. BUILDING PART PRODUCTION PLANT
- H. CLEAN ENERGY PLANT
- I. URBAN INFRASTRUCTURE
- J. PUBLIC PARK
- K. LUMBER WAREHOUSE

CARBON OFFSET PROJECTS	PRICE (projected)	CARBON / UNIT
FOREST MNGMNT	\$30 / mtCO2	N/A
BIOCHAR	\$10 / mtCO2	N/A
ENERGY EFFICIENCY	\$15 / mtCO2	N/A
CLEAN WATER	\$12 / mtCO2	N/A
REFORESTATION	\$24 / mtCO2	N/A
TRANSPORTATION	\$12 / mtCO2	N/A
WETLAND	\$24 / mtCO2	N/A



FORESTRY TOWN

The forestry town will be the first community to be constructed in this plot. Each residential building complex is a union that collectively shares the responsibility of cutting down the plantation, making eucalyptus logs into CLT, and restoring the original savannah forests while generating carbon credits. As more CLT is produced, more residential complexes will be constructed.

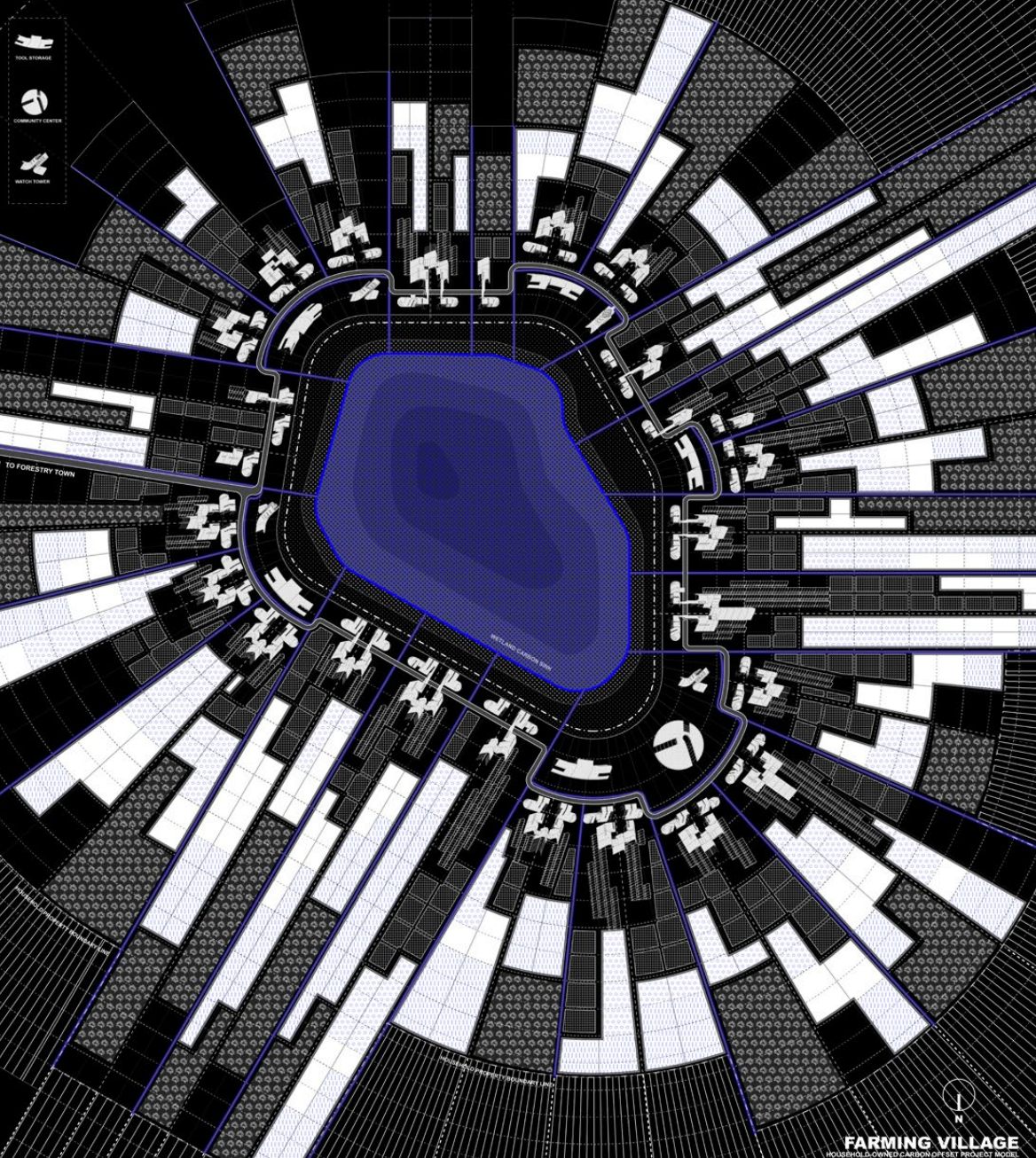
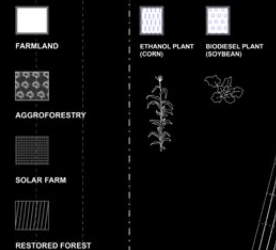


FORESTRY APARTMENT

The forestry apartment is constructed with eucalyptus CLT, which is produced in nearby union factories. The building is a combination of forest nurseries and residential units. While seedlings of savannah trees activate the communal space in the building, grown trees will be transported to reforest nearby areas.

**ARCHITECTURAL CARBON SEQUESTRATION:
7369 mtCO2**

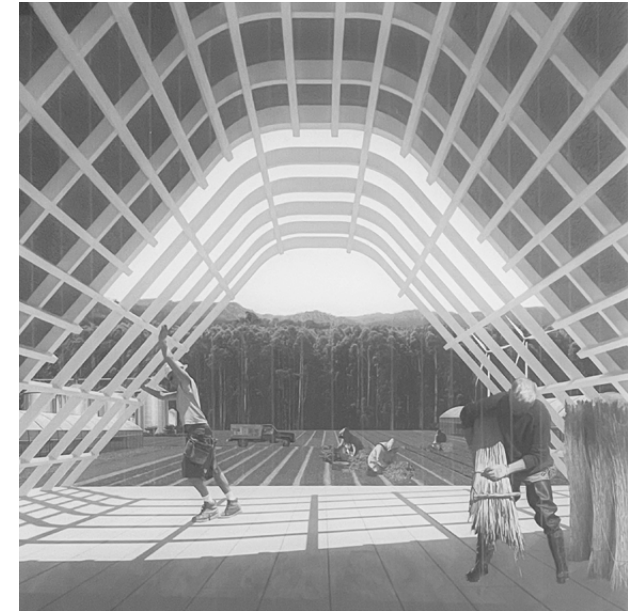
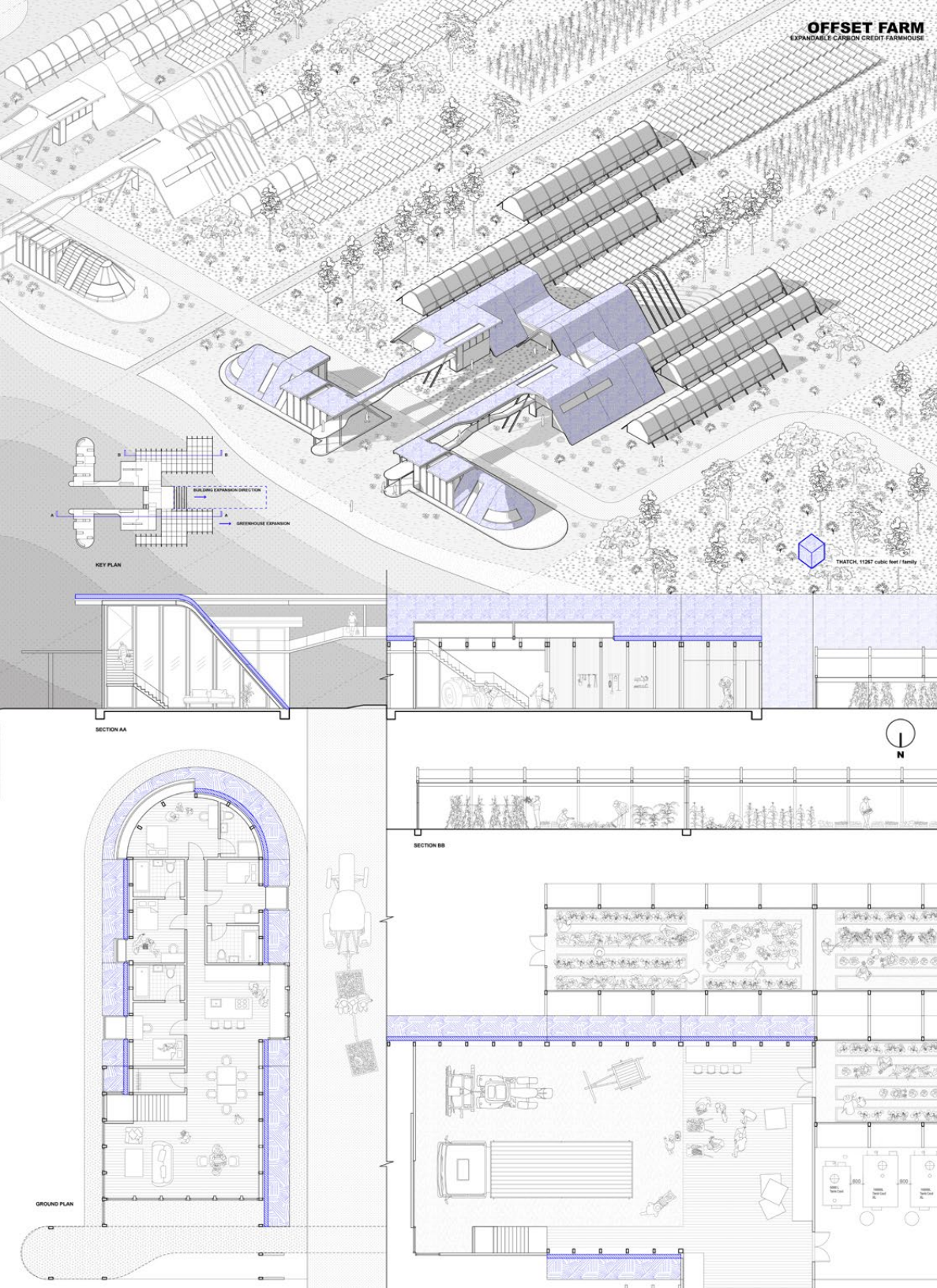
CARBON OFFSET PROJECTS	PRICE (projected)	CARBON / UNIT	OFFSET	PROFIT
NO-TILLAGE FARMING	\$30 / mtCO2	0.5 mtCO2 / acre	10 mtCO2 / yr	\$300 / family
COVER CROPS	\$30 / mtCO2	0.5 mtCO2 / acre	10 mtCO2 / yr	\$300 / family
BIOMASS/BIO DIESEL	\$15 / mtCO2	0.3 mtCO2 / acre	6 mtCO2 / yr	\$90 / family
SOLAR ENERGY	\$45 / mtCO2	1 mtCO2 / 1MWh	50 mtCO2 / yr	\$2250 / family
AGROFORESTRY	\$30 / mtCO2	1 mtCO2 / acre	15 mtCO2 / yr	\$450 / family
REFORESTATION	\$24 / mtCO2	4 mtCO2 / acre	50 mtCO2 / yr	\$1200 / family
WETLAND	\$36 / mtCO2	2 mtCO2 / acre	6 mtCO2 / yr	\$216 / family
SUM:	\$4806 PER FAMILY PER YEAR		147 mtCO2 OFFSET / HOUSEHOLD	



FARMING VILLAGE

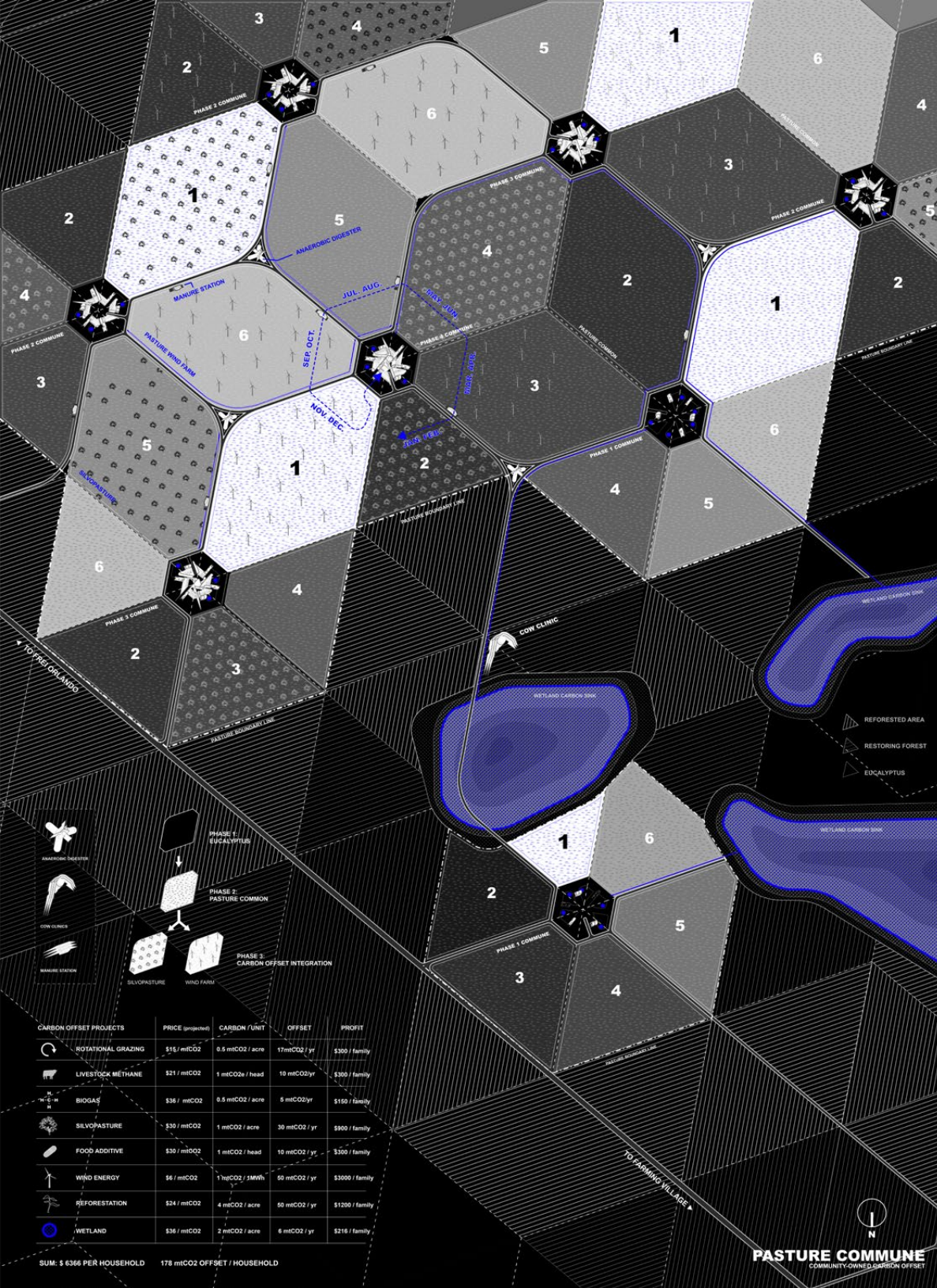
The farming village consists of single-family homes surrounding the restored water pond. This community experiments with household-owned carbon offset projects. Each household is given a strip of land on which they could invest in various carbon offset projects.

\$4805 per household per year
147 mtCO2 yearly offset per household



OFFSET FARM

The offset farm has two parts: a residential unit located on the lakefront and a workshop complex on the other side of the road. The expandable thatch modules enable the residents to expand and upgrade their practices, allowing them to be less dependent on carbon credits over time so that they can be self-sufficient when the world reaches carbon neutrality and carbon credits are not needed anymore.



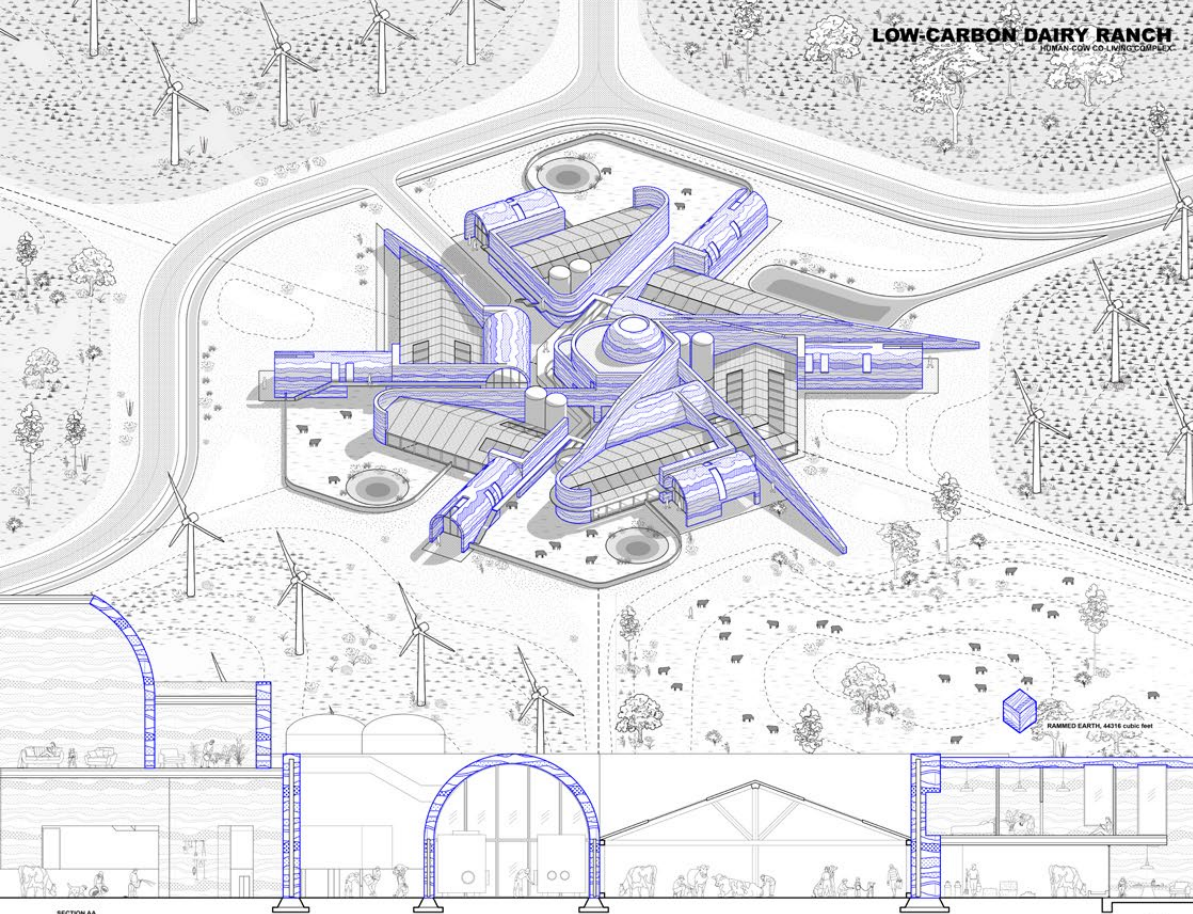
PASTURE COMMUNE

Before the plantation was established, pasture was the most dominant form of economy in the local area. The pasture commune intends to bring back the pasture industry with some slight twists, which will allow the pasture farm to generate carbon credits. The pasture lands are organized as hexagons to enable rotational grazing, a primary way of producing credits in pasture farms. Each side of the hexagon represents a family, and together, a hexagon becomes a commune that produces carbon credits collectively.

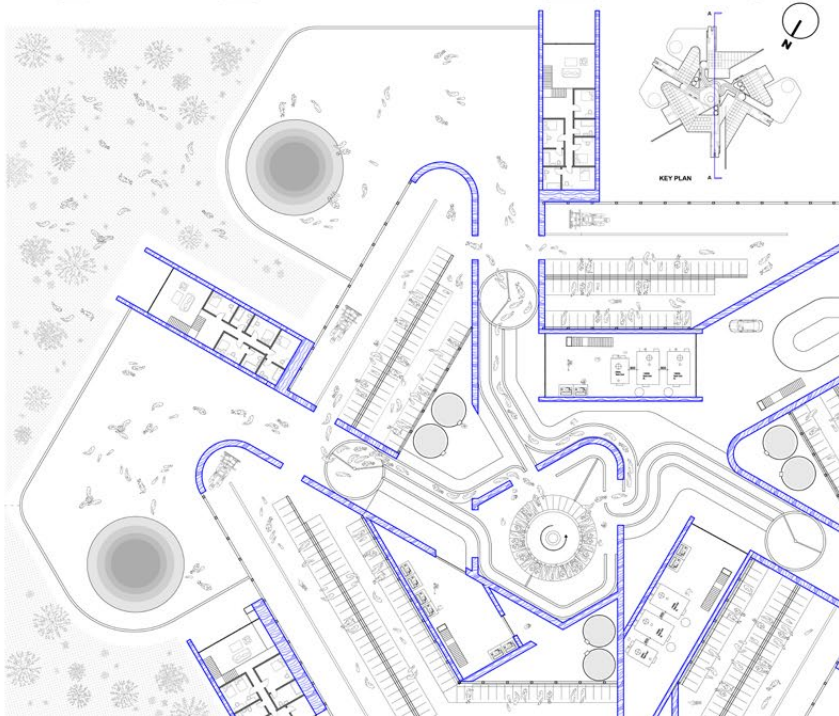
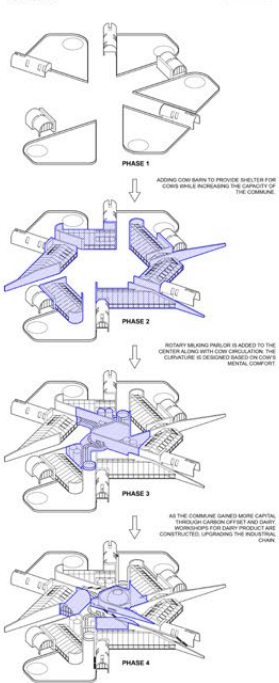
\$6366 per household per year
178 mtCO2 yearly offset per household

LOW-CARBON DAIRY RANCH

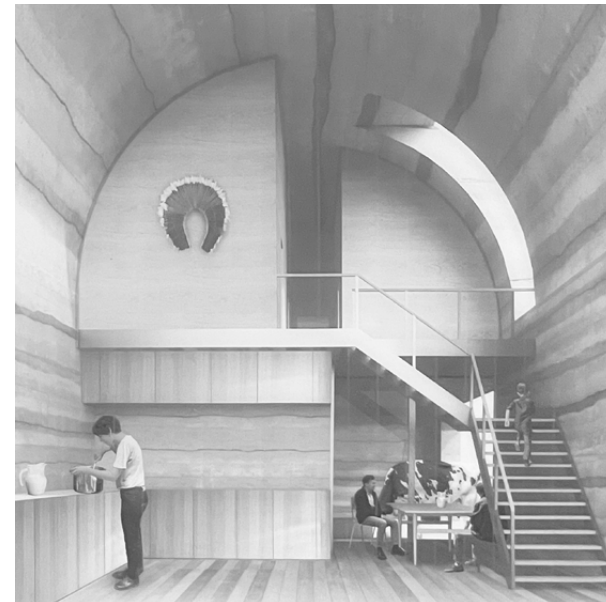
HUMAN-COW CO-LIVING COMPLEX



SECTION AA



KEY PLAN



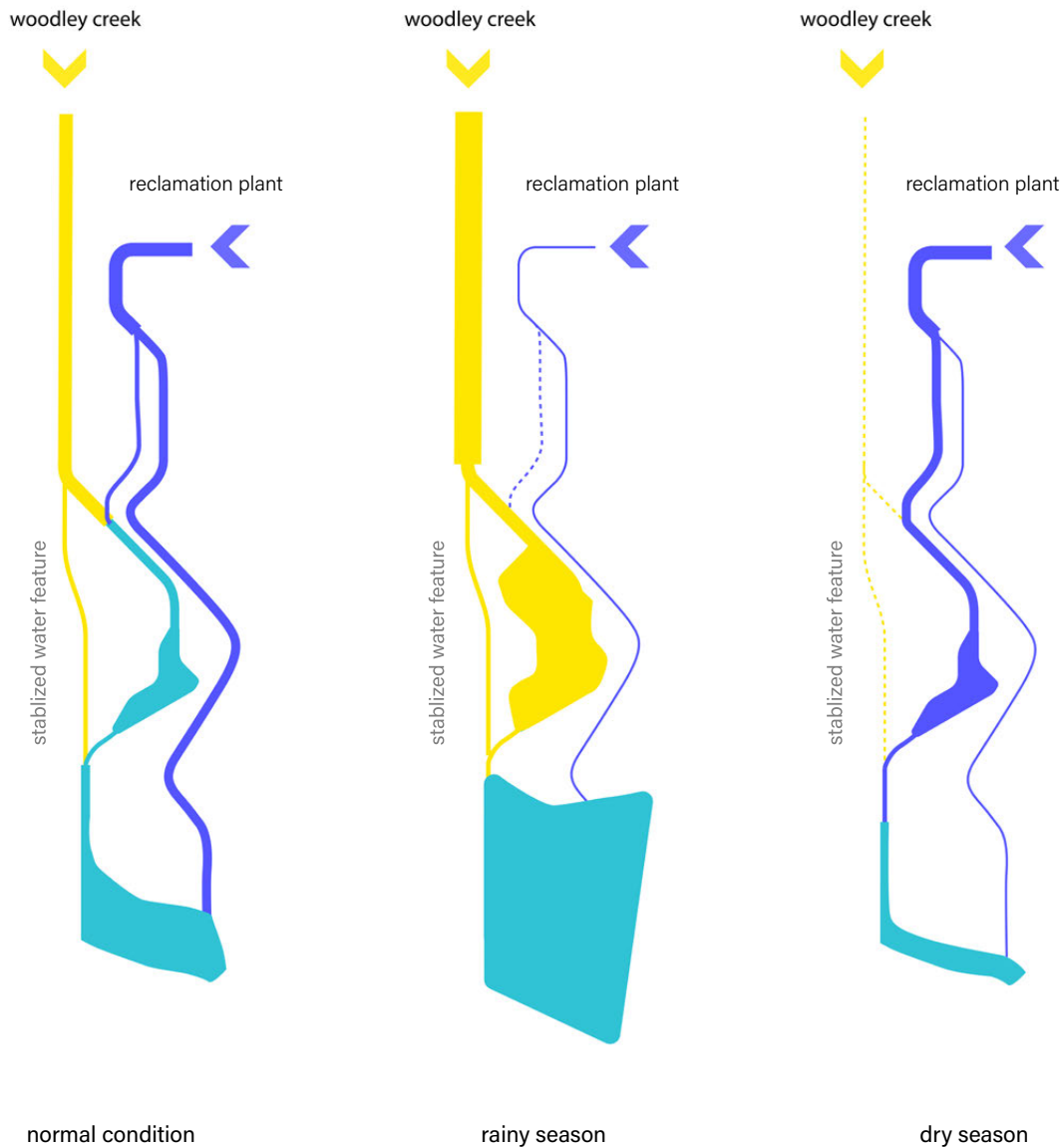
LOW-CARBON DAIRY RANCH

The farm building intends to create an environment for the co-existence of cattle and humans. The work of Temple Grandin, who developed a circulation method that prioritizes the psychological comforts of cattle, inspires the curvy tracts that take cattle from barns to the rotary milking parlor in the middle. The cattle barn and houses are physically attached and with a direct visual connection to strengthen their relationship.

SEPULVEDA EQUALIZER

INDIVIDUAL PROJECT
LAURIE HAWKINSON
2022 SPRING





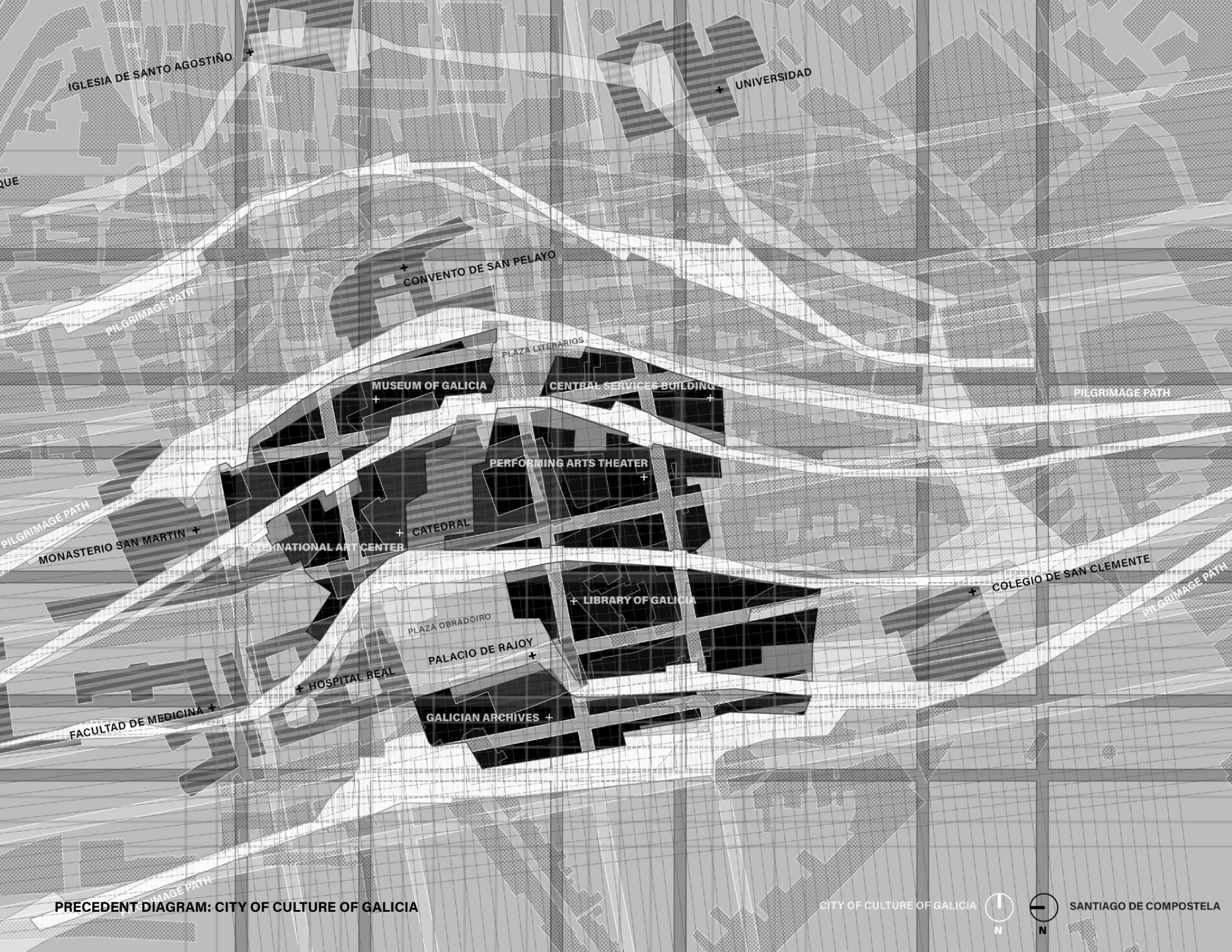
■ urban runoff
 ■ reclaimed water
 ■ mixed water

WATER AND CULTURAL EQUALIZER

This project is located inside the Sepulveda basin, a flood control basin in Los Angeles. The precipitation in LA is extremely uneven throughout the year. While there could be no rain in months, there could be severe floods resulting from concentrated rainfall in a few days. As a result, the Sepulveda basin either has too much water or too little, making it exceptionally unstable when creating public space.

To create a stabilized public space activated by constant water flow, Sepulveda Equalizer is strategically placed next to the Donald C Tillman Water Reclamation Plant. The project proposes to bring the treated water to the surface as a highly controlled water source. The urban runoff passes through Woodley Creek into the LA river concurrent to the treated water canal. These two water channels branch out and merge in a lake in between, which will become a stable water feature during the dry season and a retention pond during the rainy season. In this way, the site could be supplied with water year-round, better animate the site in return.

The architecture contains multiple cultural programs and functions as a cultural equalizer parallel to the water equalizer. It stands against the idea of San Fernando Valley as an assimilation machine and intends to create an inclusive space for all cultures to thrive.

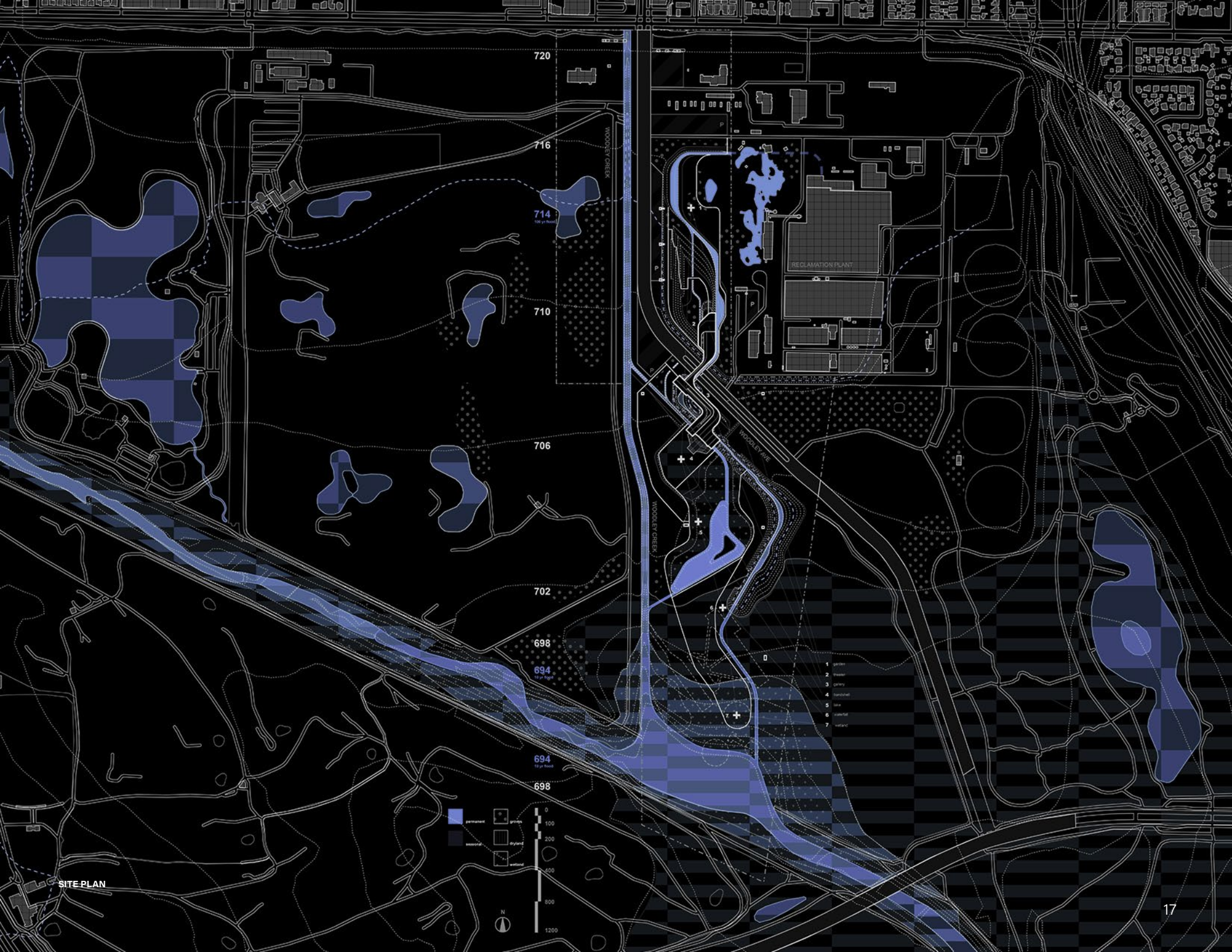


PRECEDENT DIAGRAM: CITY OF CULTURE OF GALICIA

CITY OF CULTURE OF GALICIA



SANTIAGO DE COMPOSTELA



720

716

714
10 ft above

710

706

702

698

694
10 ft above

694
10 ft above

698

RECLAMATION PLANT

WOODLEY LAKE

WOODLEY GREEN

WOODLEY GREEN

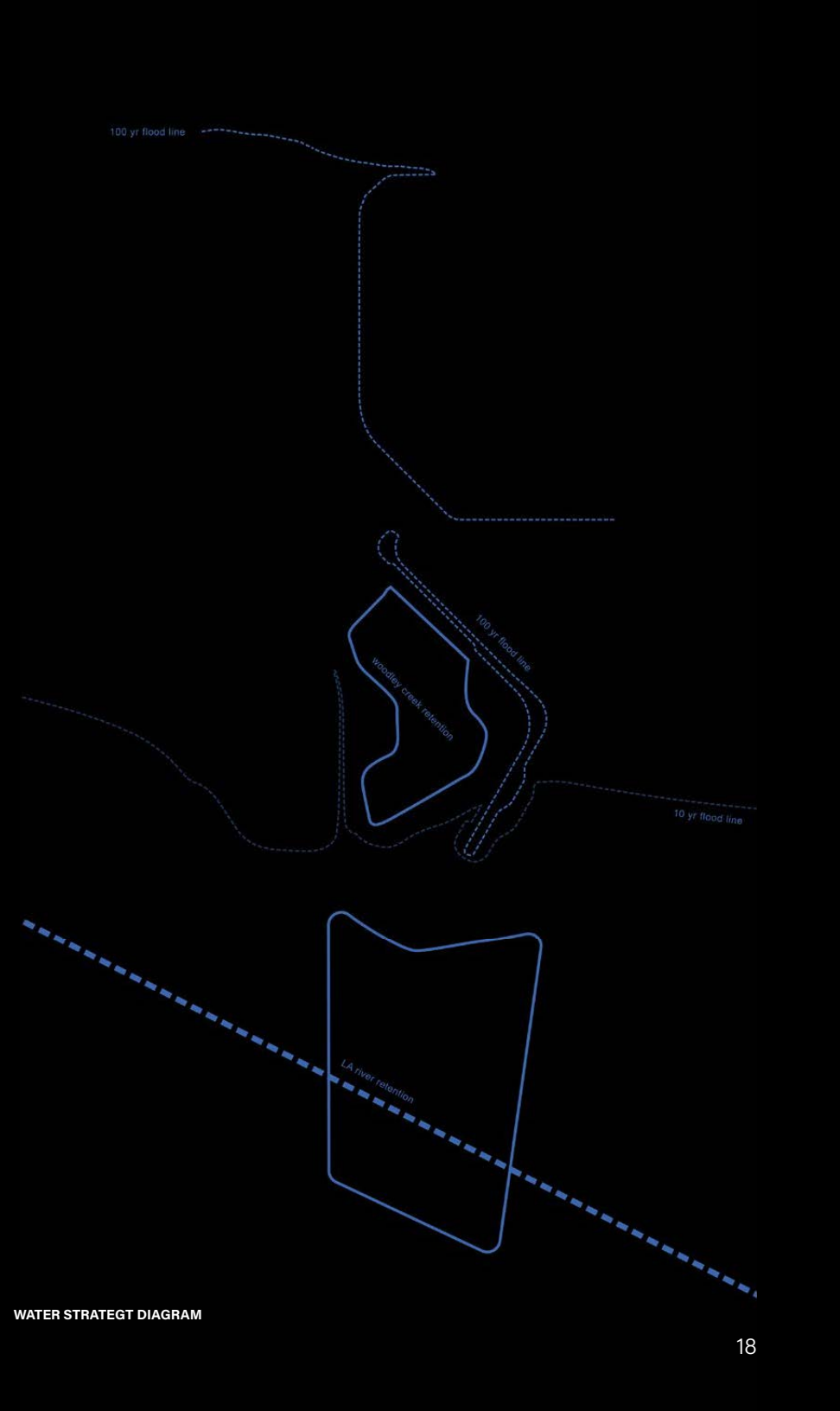
- 1 garden
- 2 meadow
- 3 quarry
- 4 woodland
- 5 lake
- 6 meadow
- 7 woodland



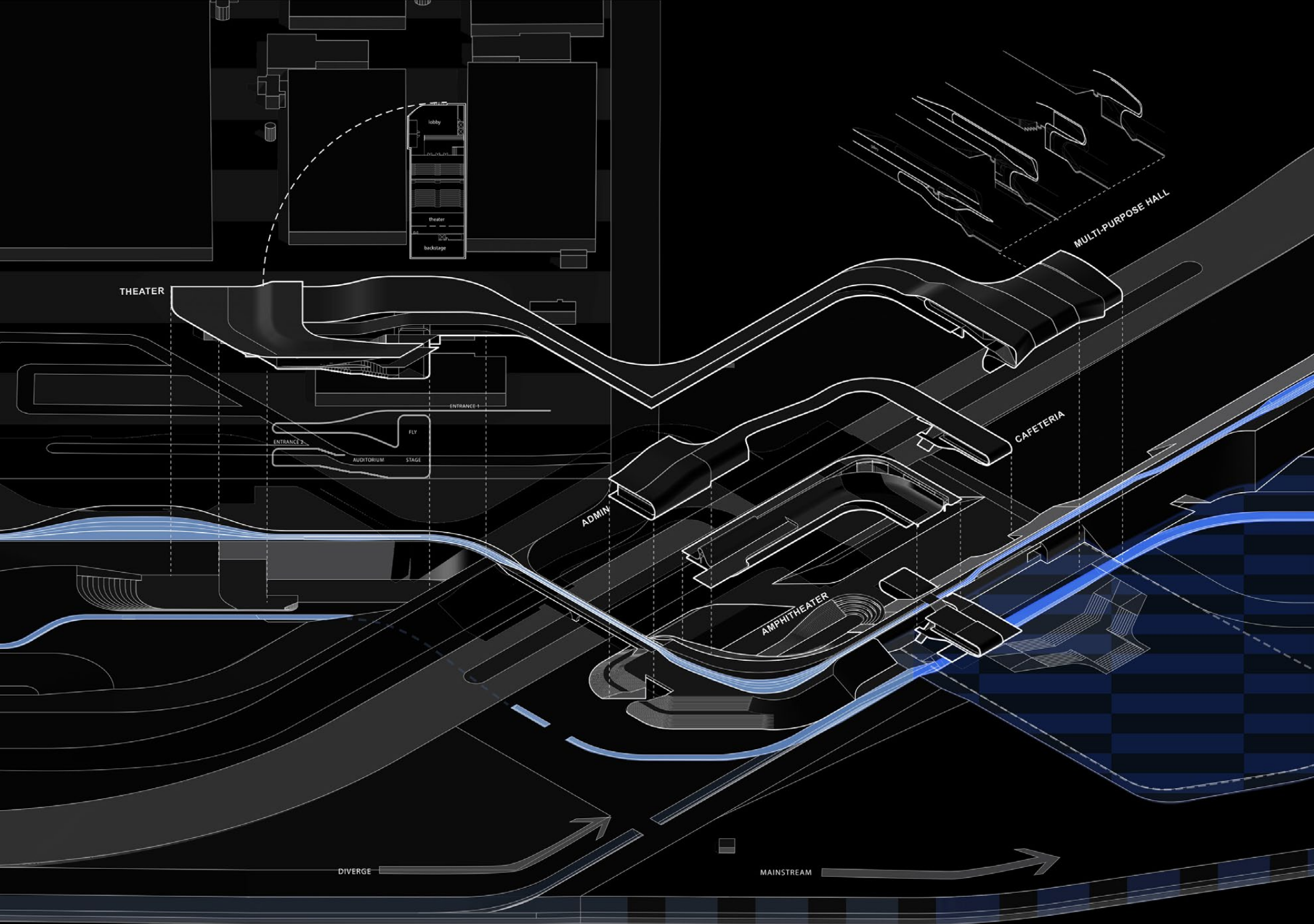
SITE PLAN

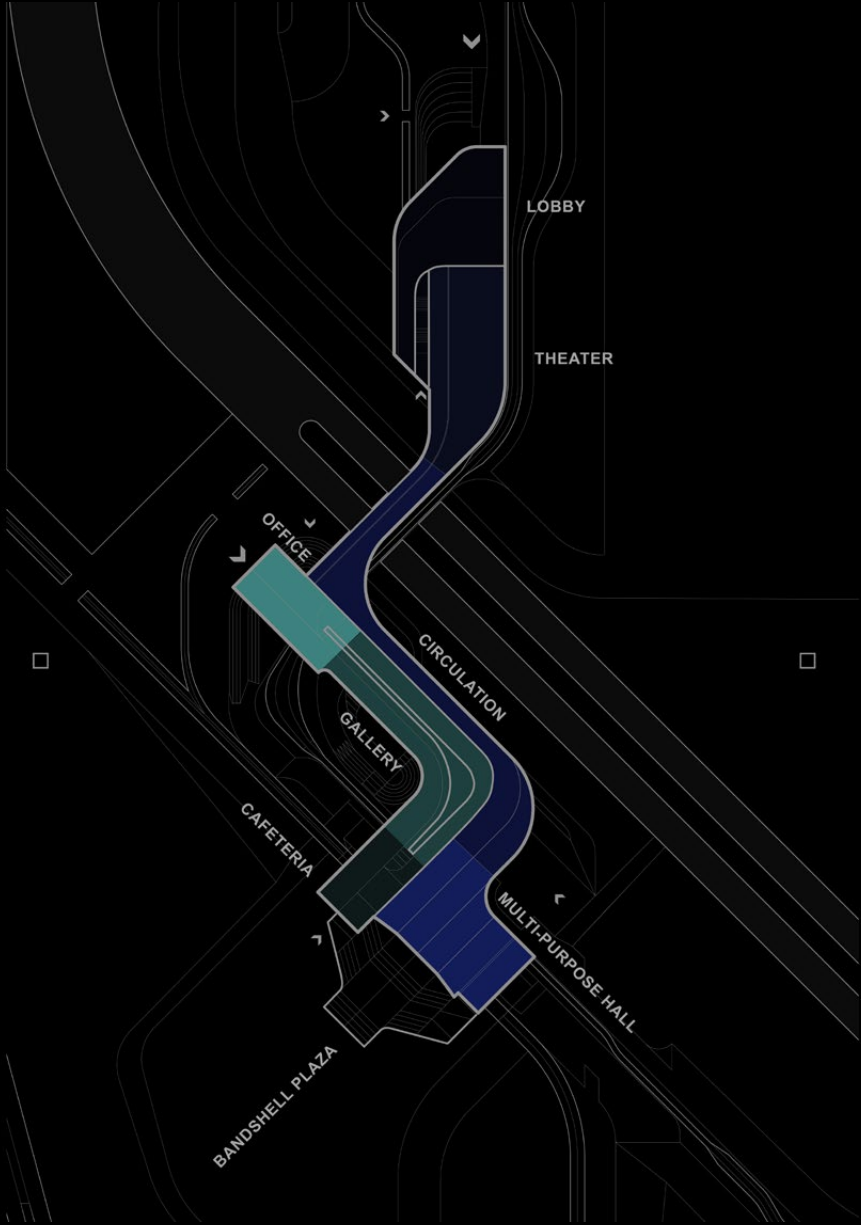


FLOOD MAP

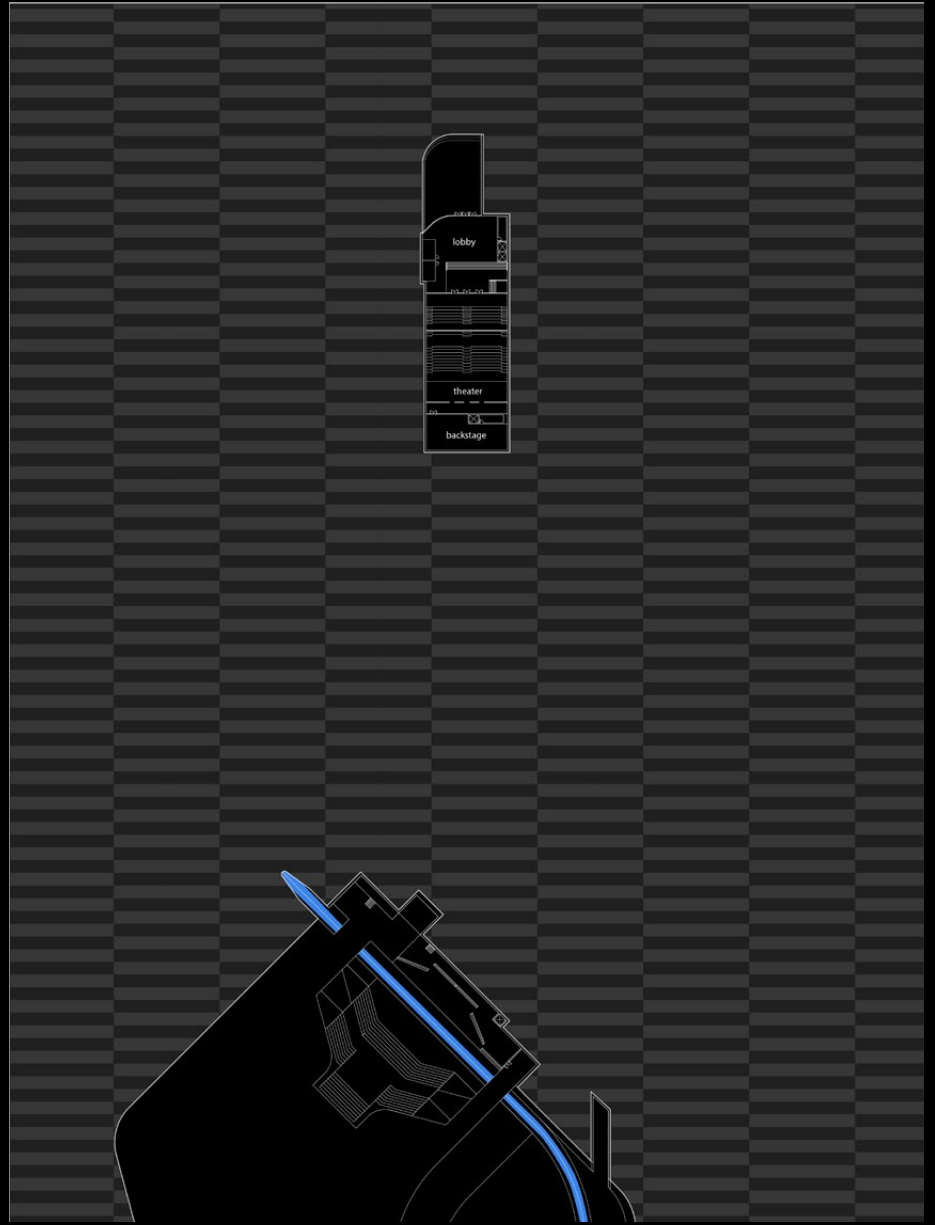


WATER STRATEGT DIAGRAM

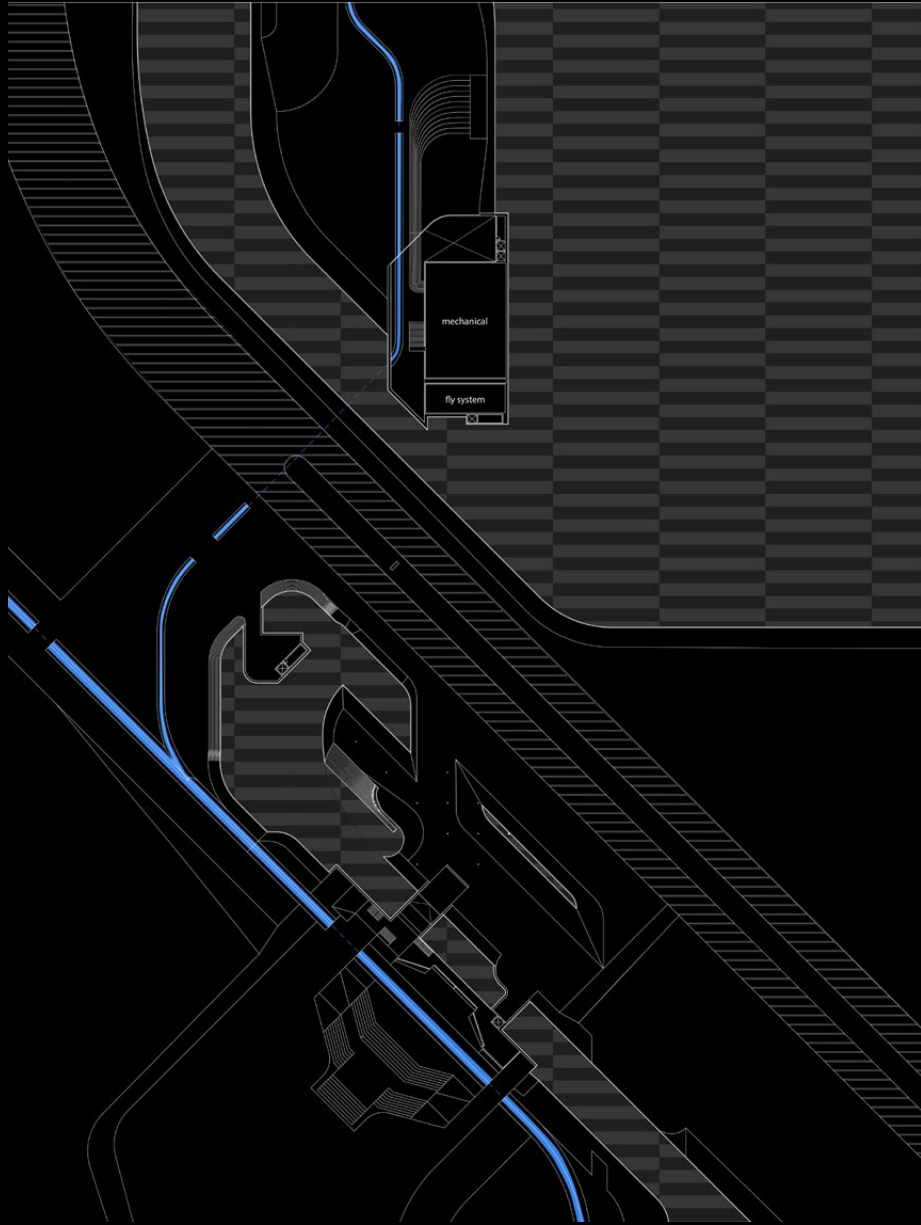




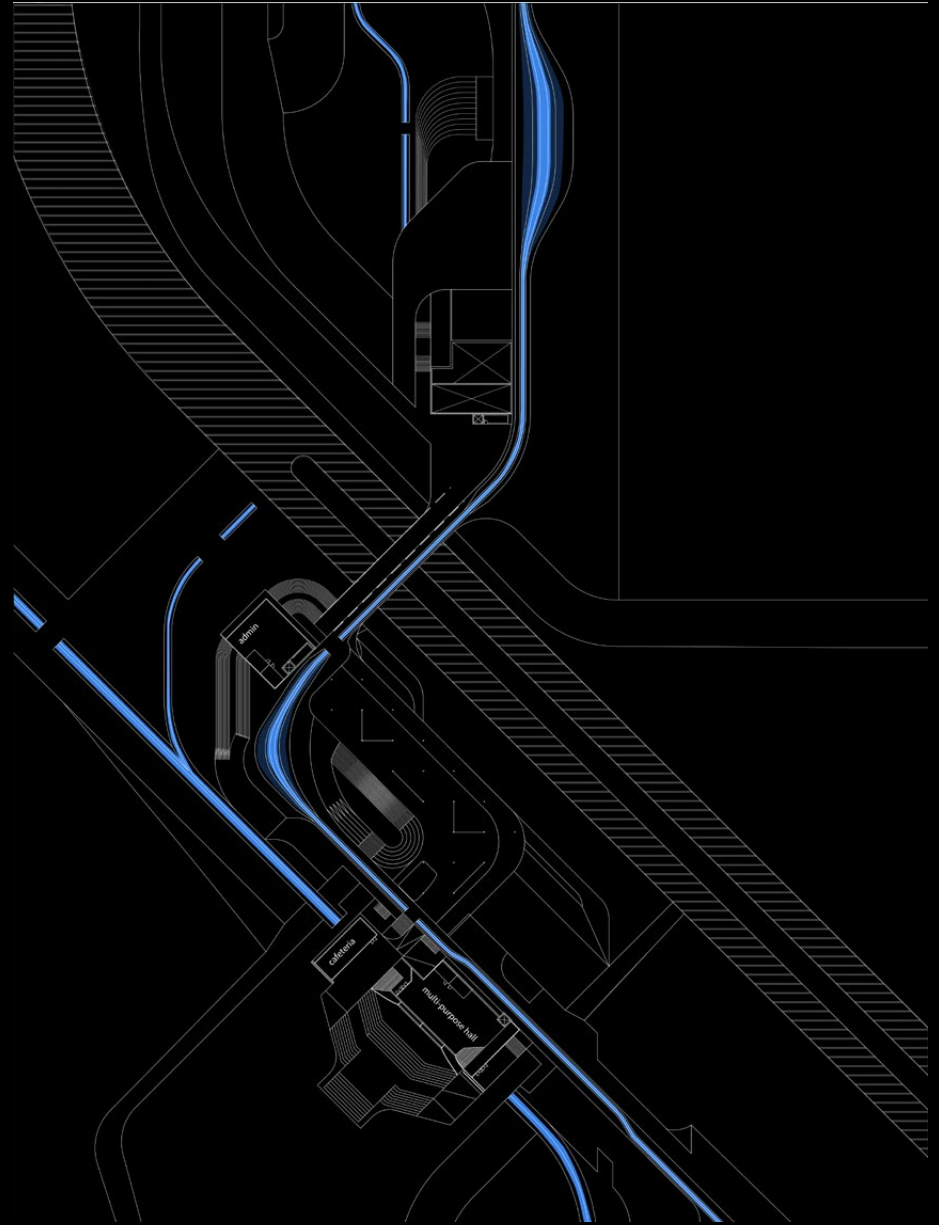
PROGRAM DIAGRAM



BASEMENT PLAN



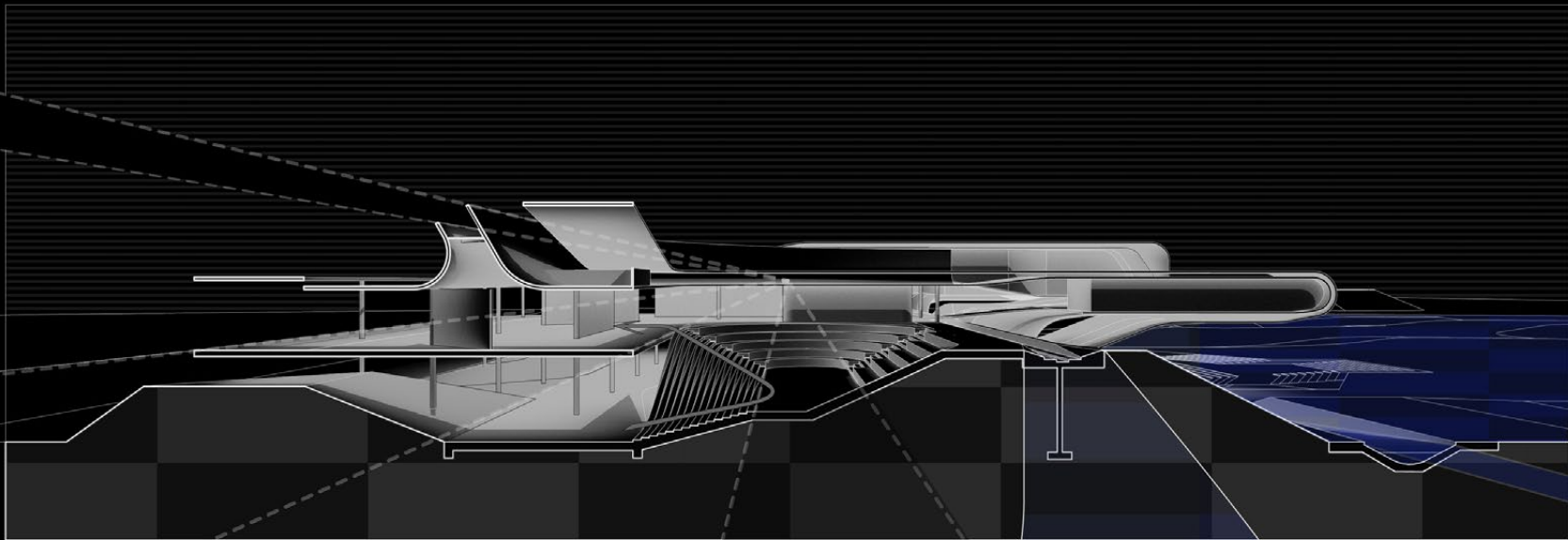
GROUND FLOOR PLAN



TYPICAL FLOOR PLAN



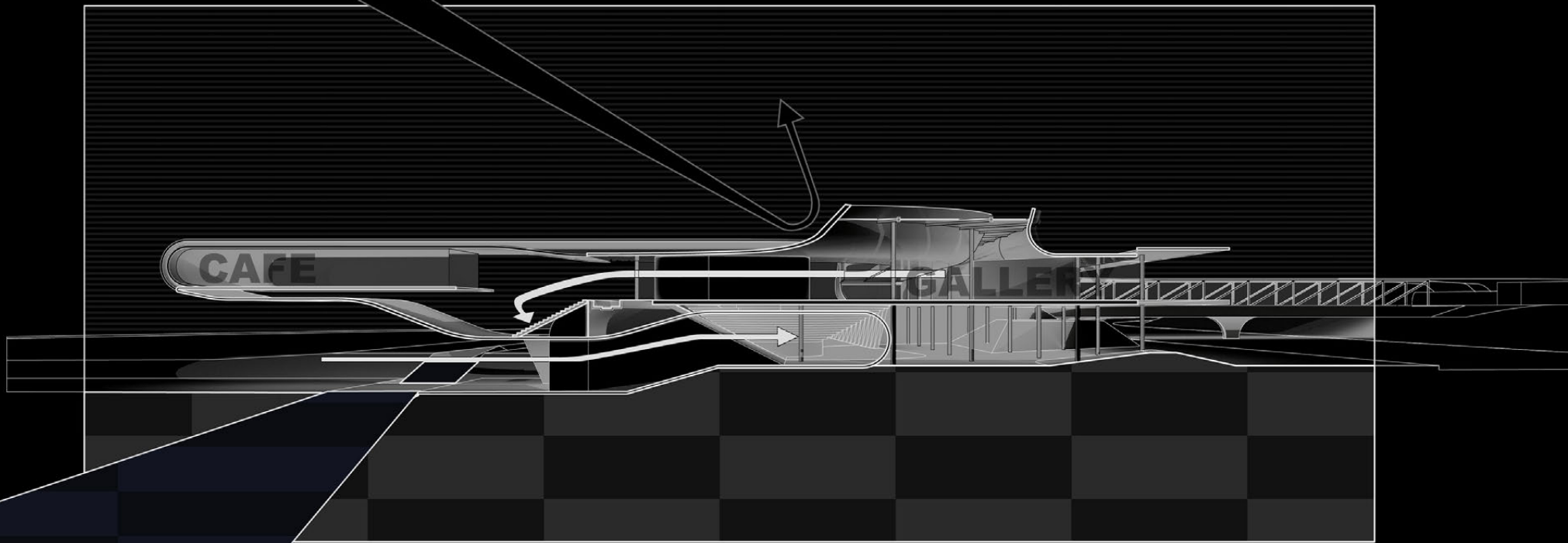
SKYLIGHT



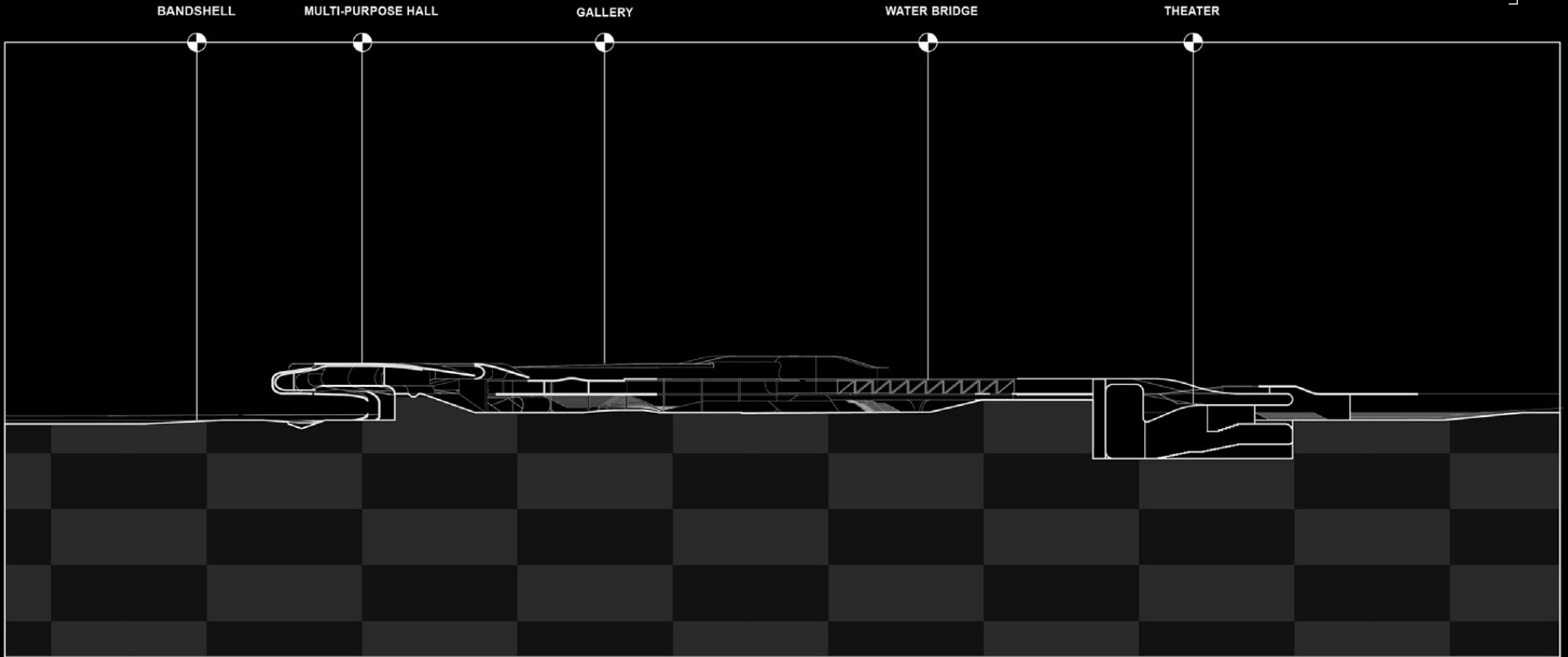
GALLERY

AMPHITHEATER

SECTION PERSPECTIVE 1

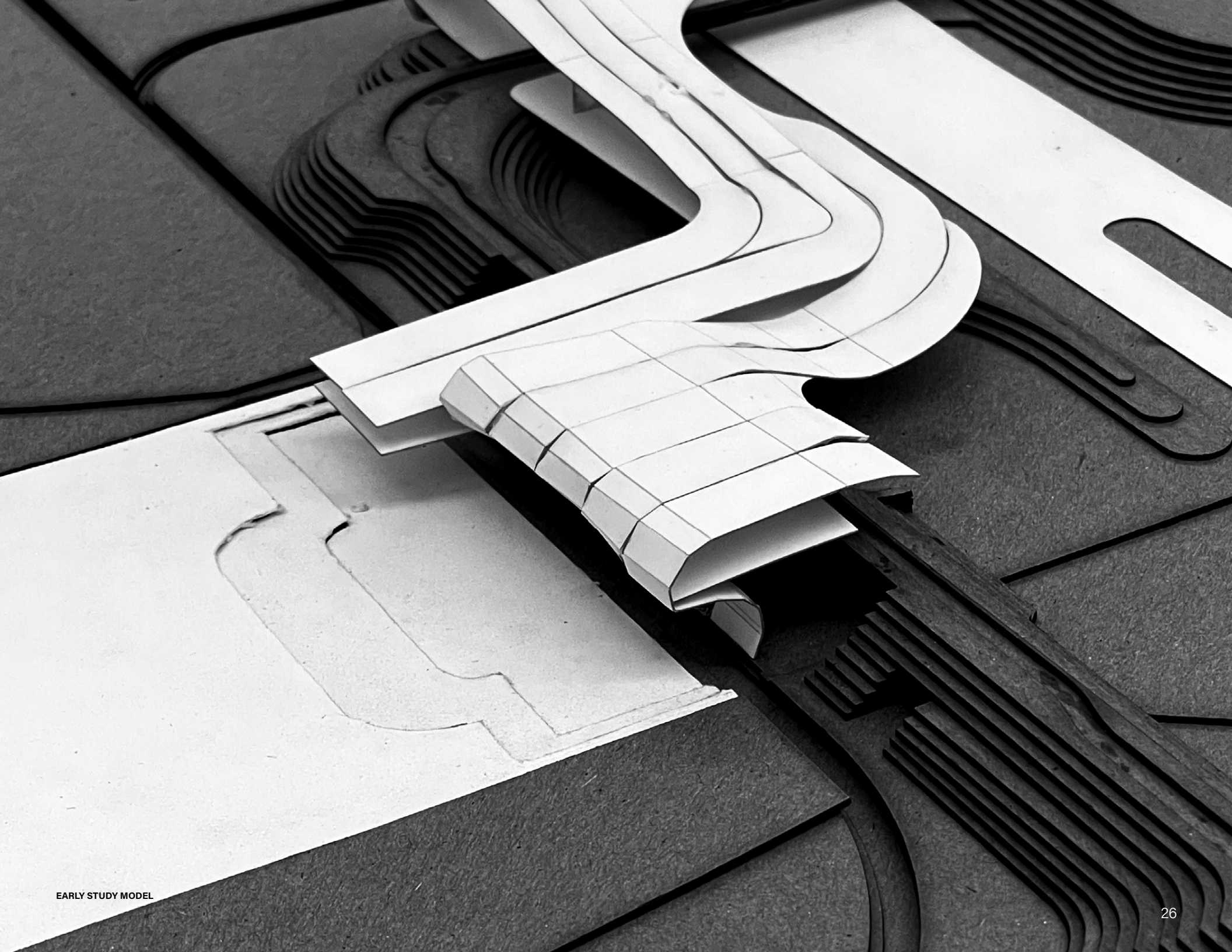


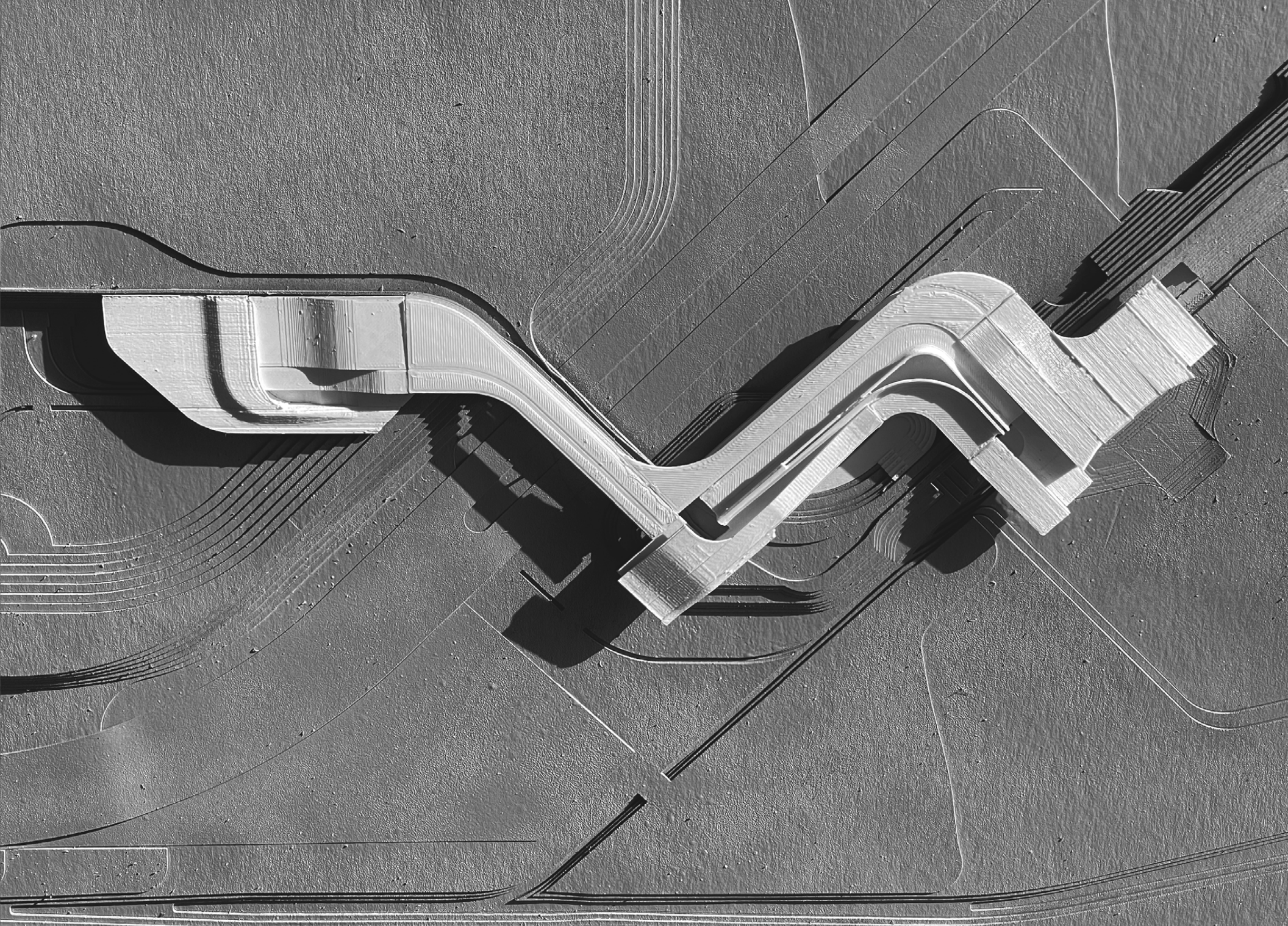
SECTION PERSPECTIVE 2



LONG SECTION







1/64" = 1'-0" MODEL

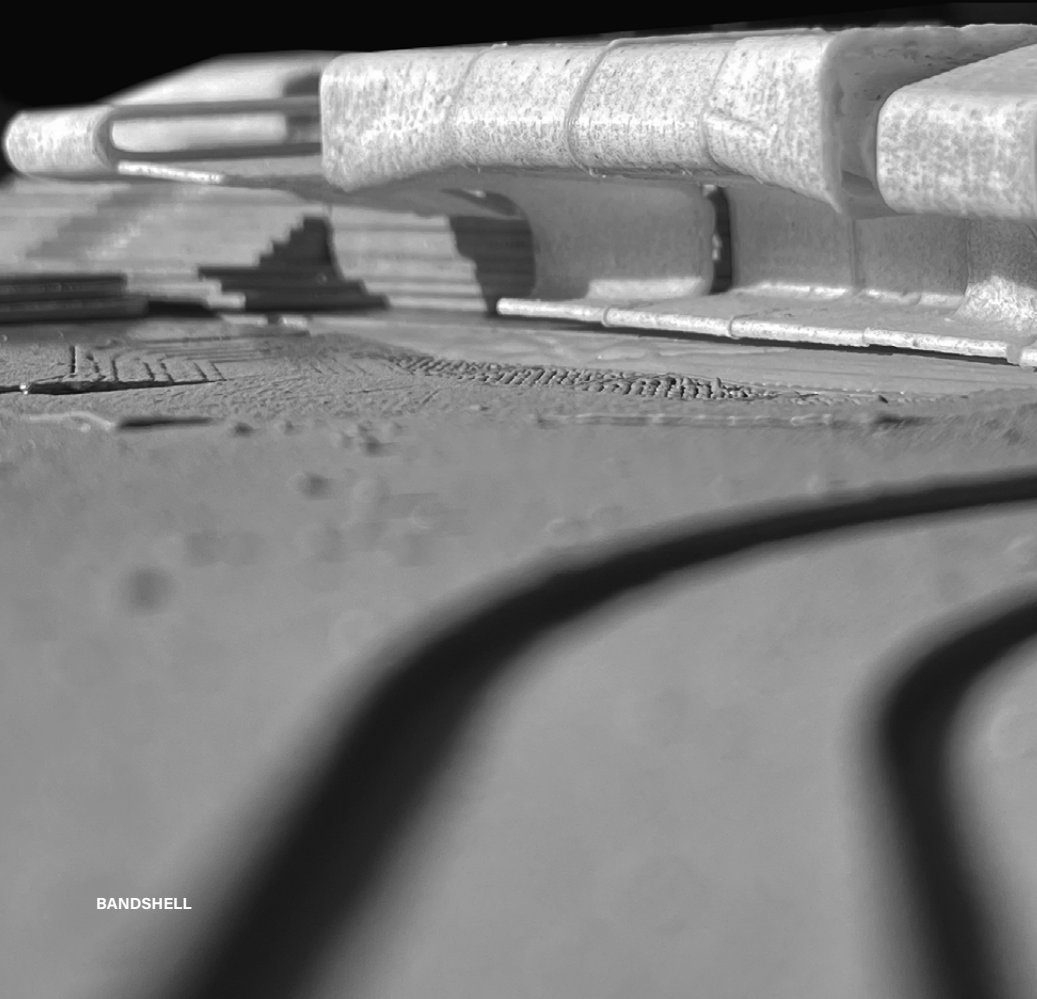




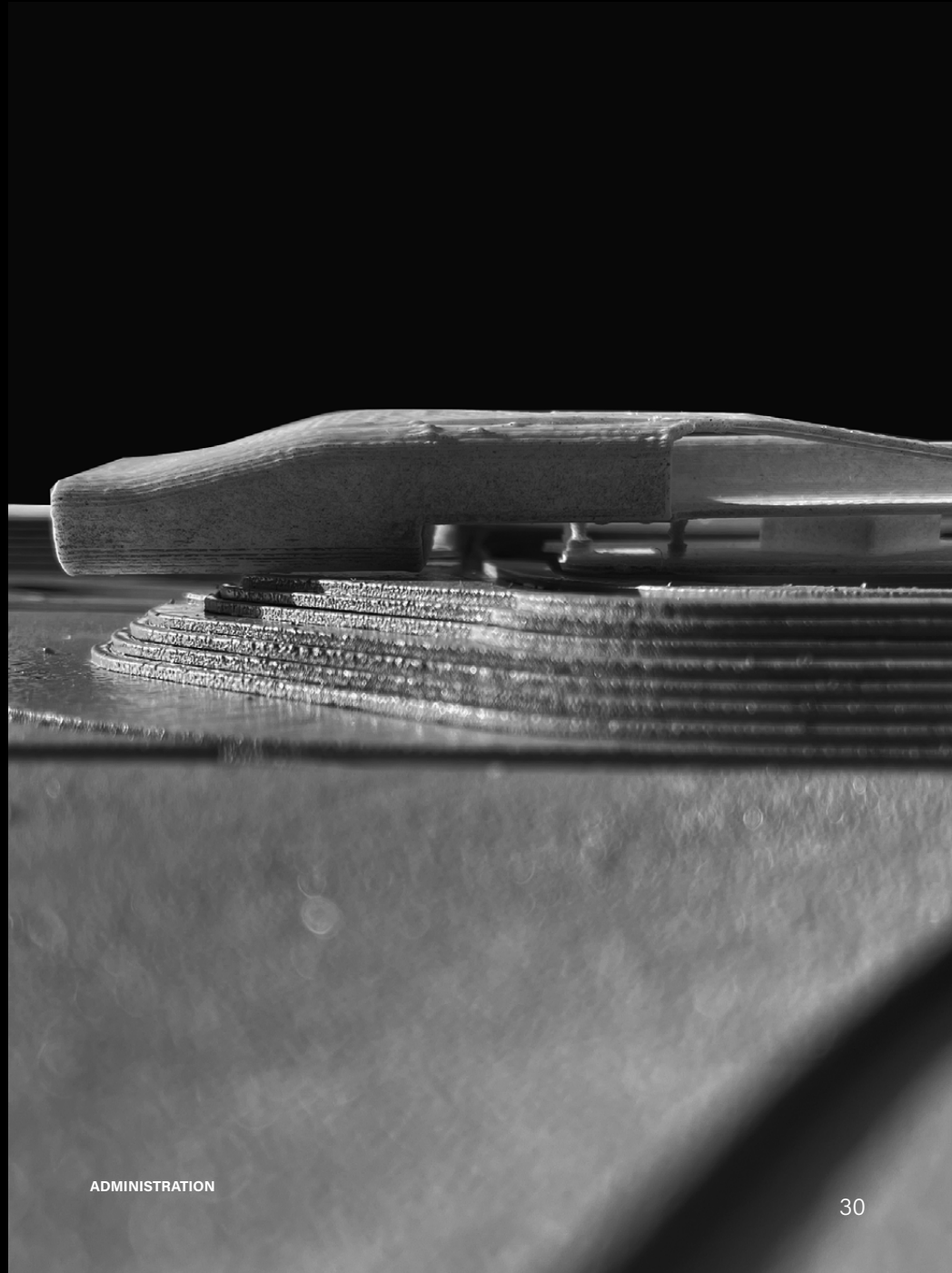
MULTI-PURPOSE HALL



THEATER



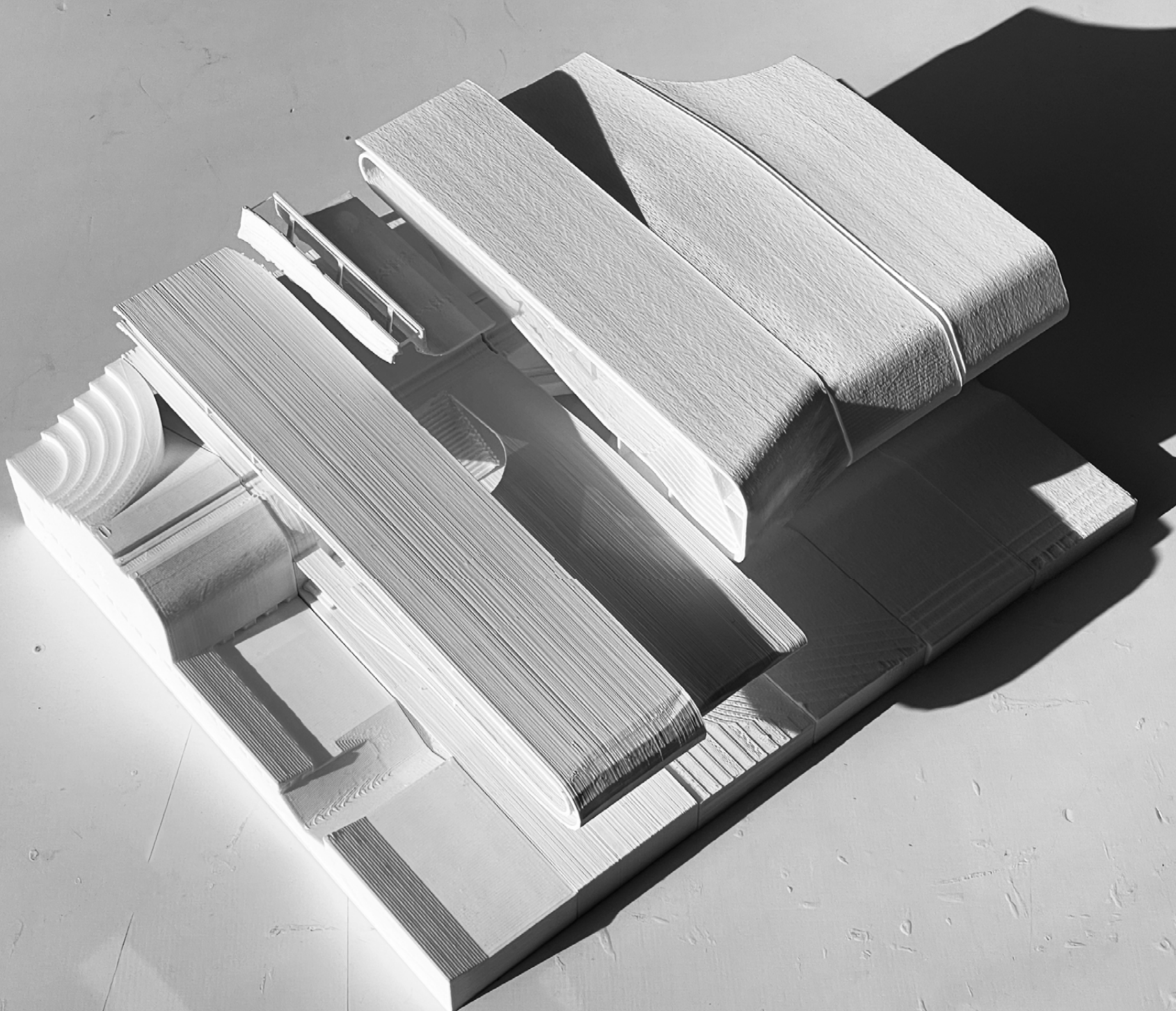
BANDSHELL



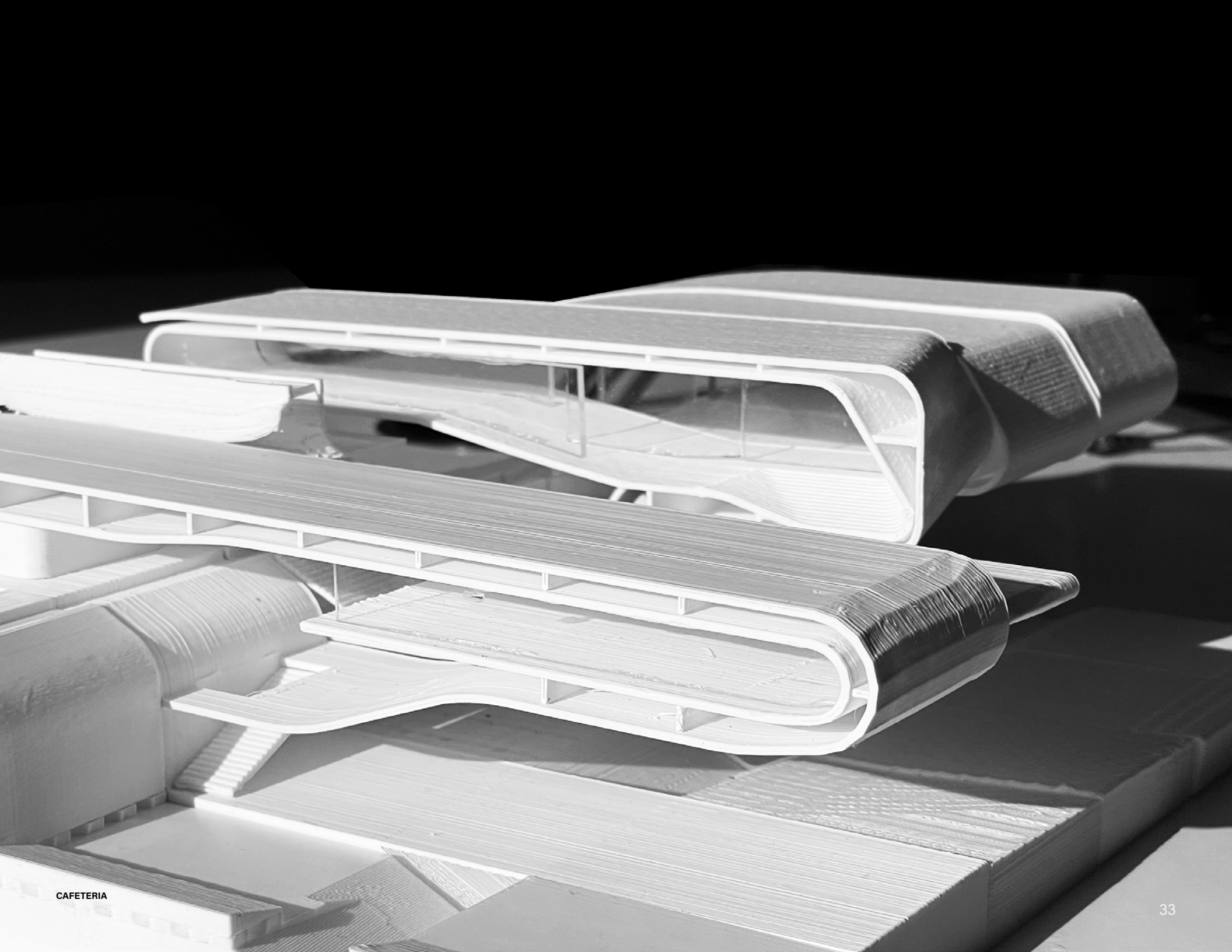
ADMINISTRATION



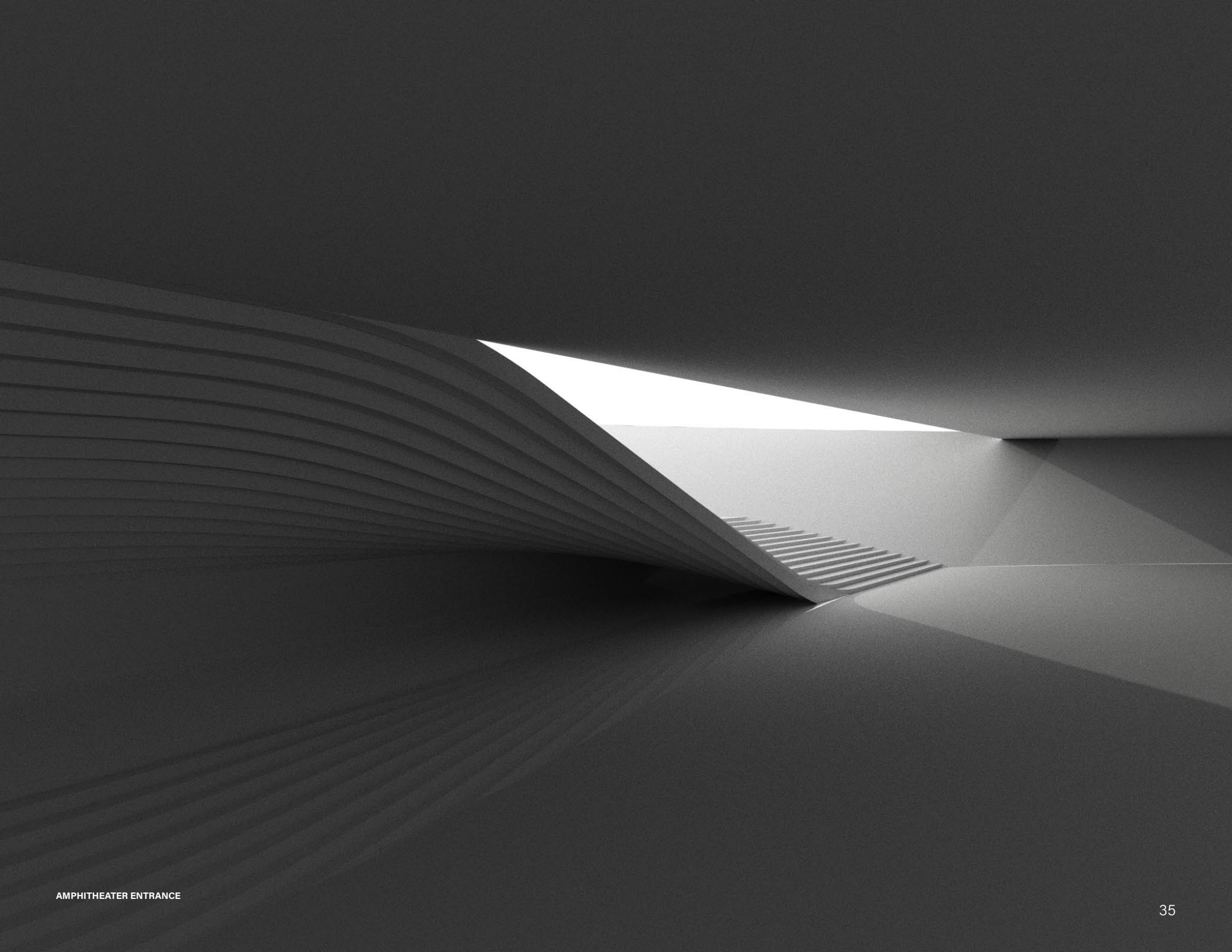
1 / 16" = 1' - 0" SECTION MODEL

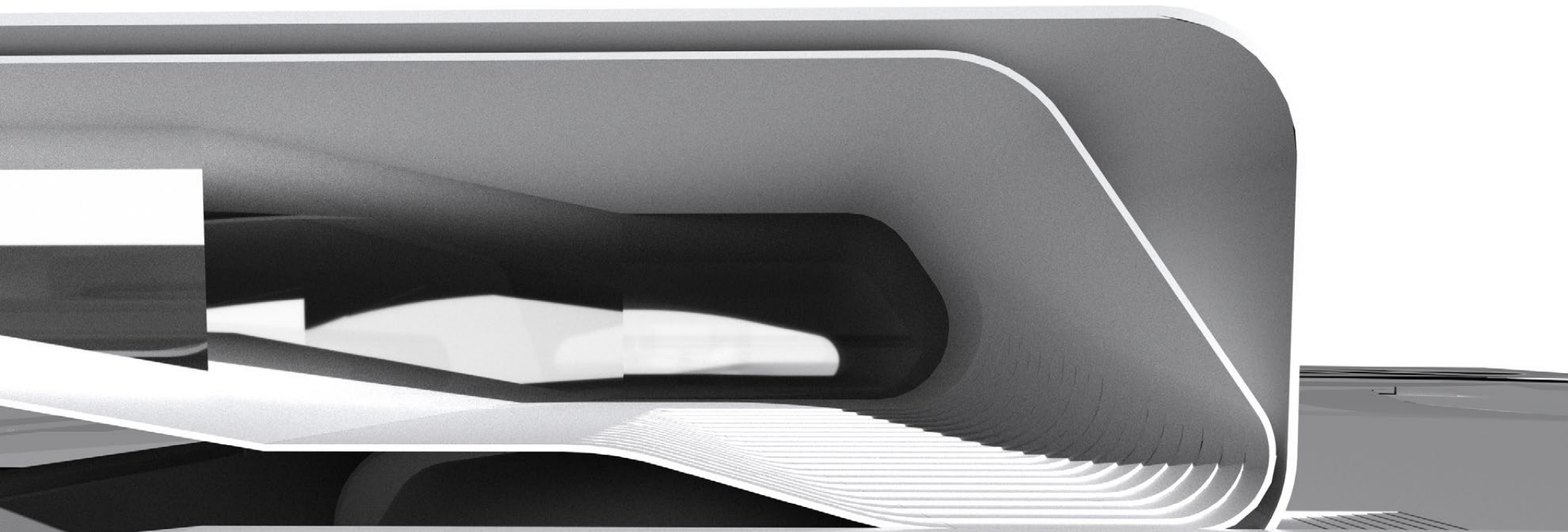


1 / 16" = 1' - 0" SECTION MODEL





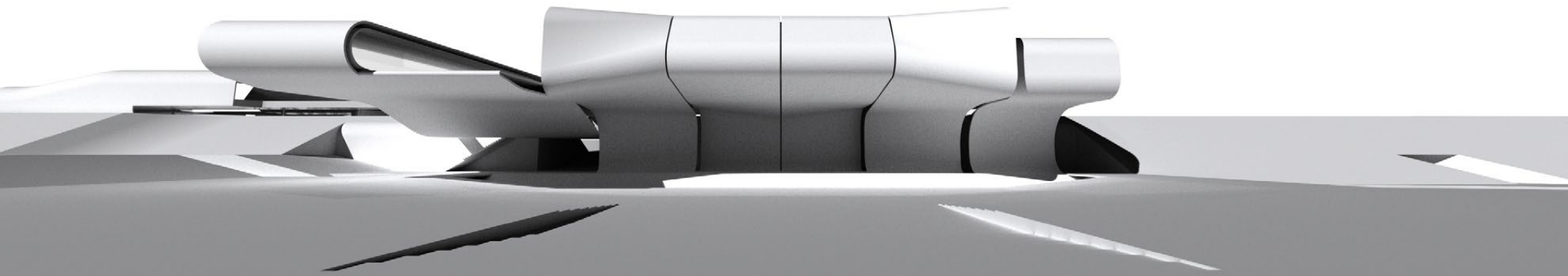




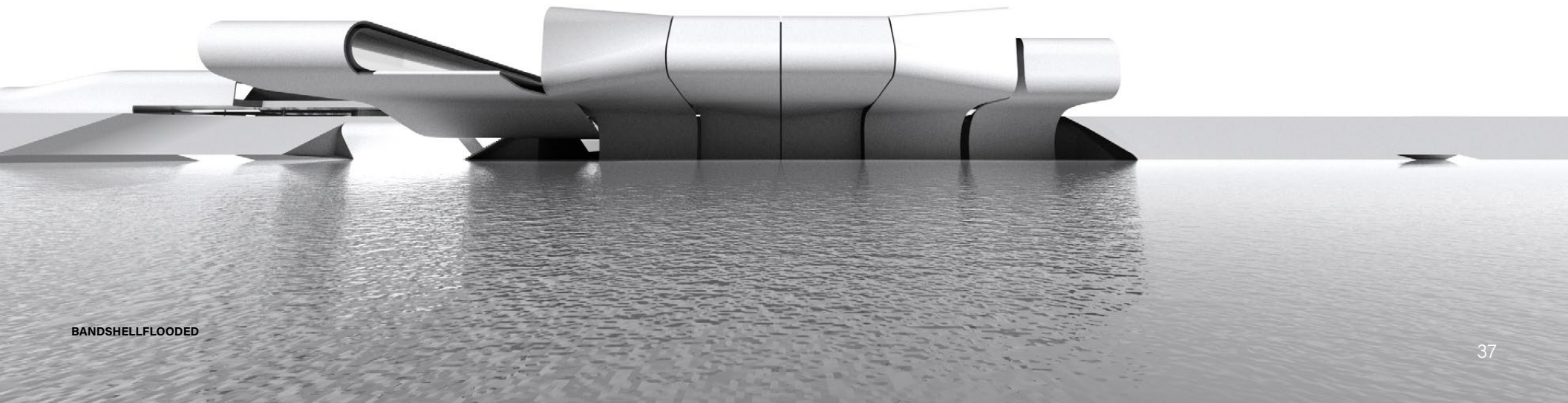
MULTI-PURPOSE HALL ENTRANCE



GALLERY INTERIOR



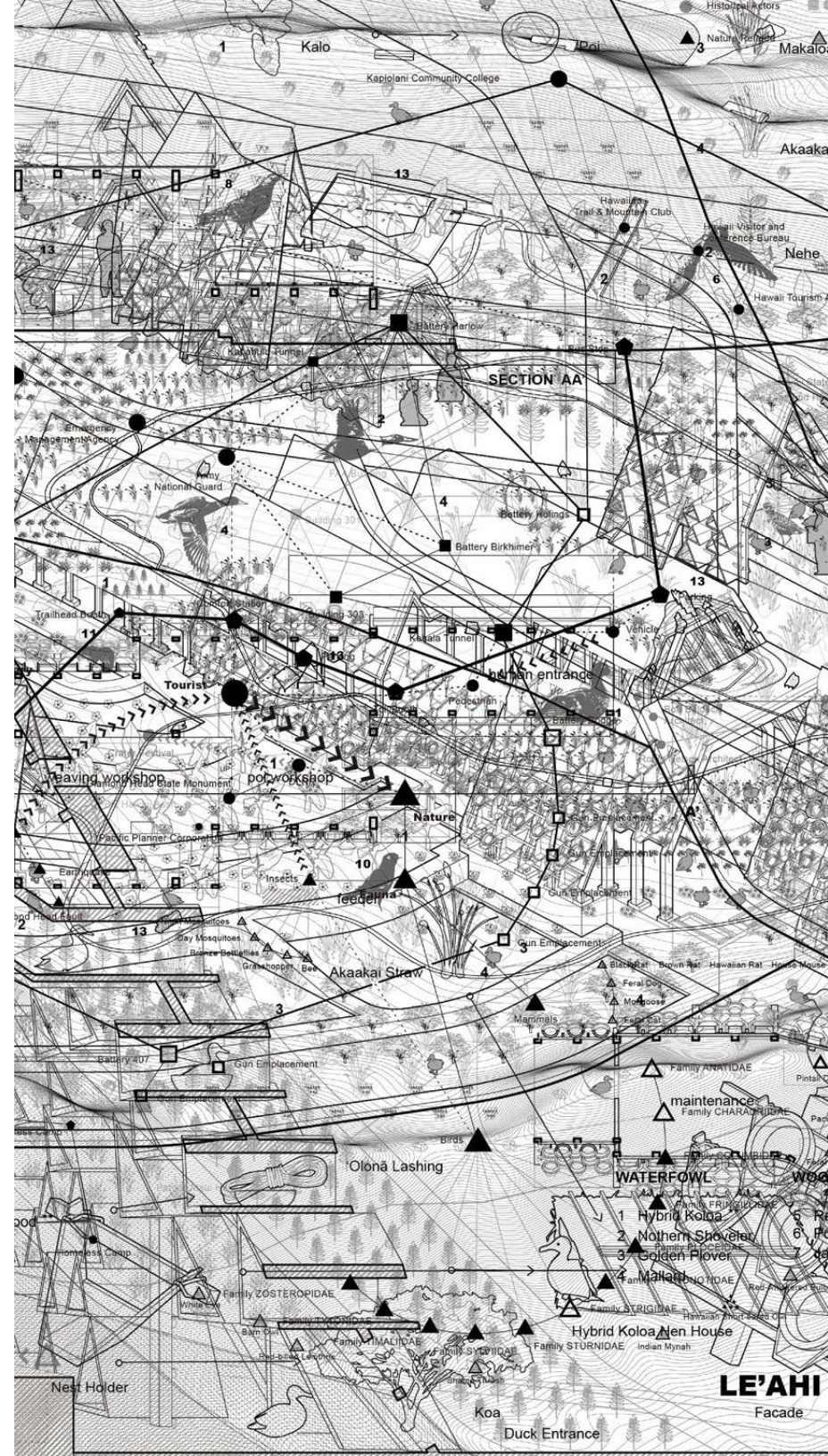
BANDSHELL NORMAL

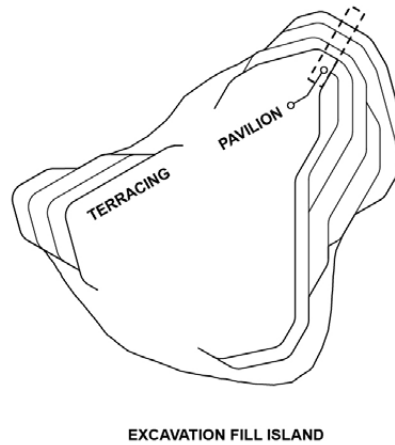
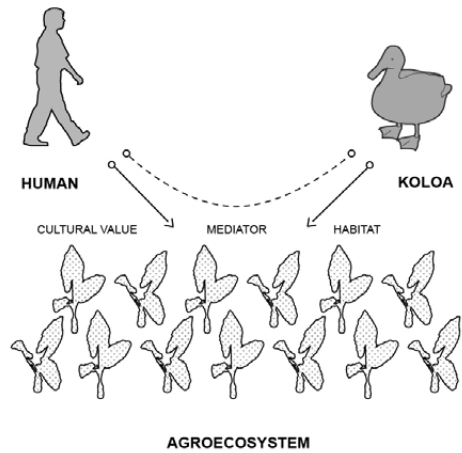


BANDSHELLFLOODED

LE'AHI WETLAND RESTORATION

GROUP PROJECT WITH WEI-CHUN- CHOU AND SHELLY XU
DOMINIC LEONG / SEAN CONNELLY
2021 SUMMER

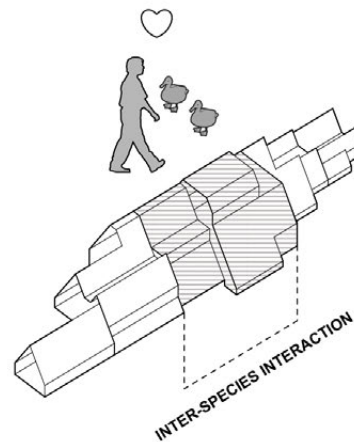
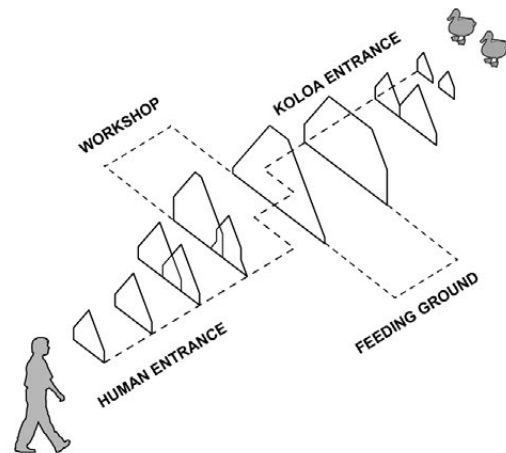




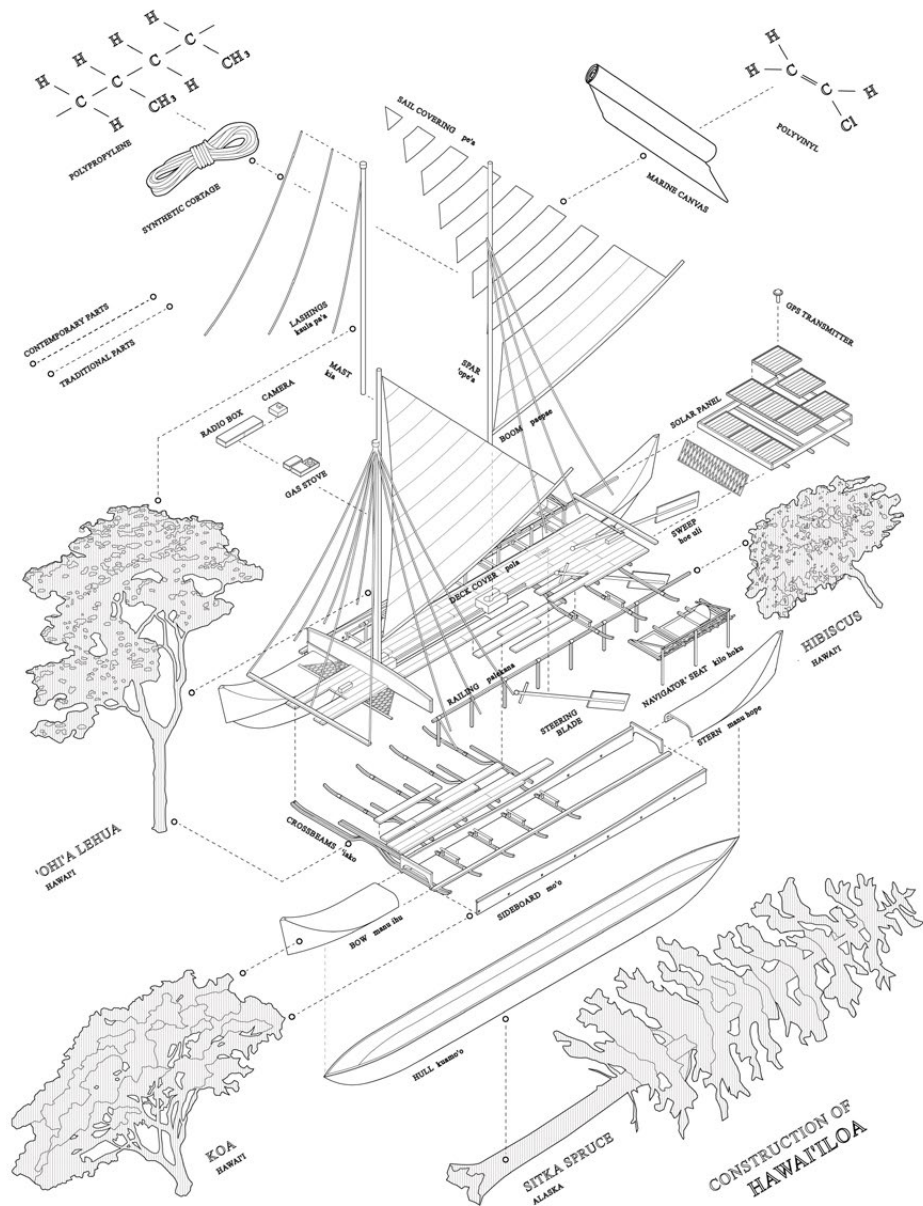
DECOLONIZE LE'AHU CRATER

In light of the discussion of Hawaii's demilitarization, this project intends to reverse the damage the US military has done in the Diamond Head crater and reestablish the wetland ecosystem. Koloa, or Hawaii Duck, is an endangered endemic waterfowl in Hawaii. The arrival of colonizers destroyed Koloa's habitat, and the introduction of mallards pushed Koloa close to extinction.

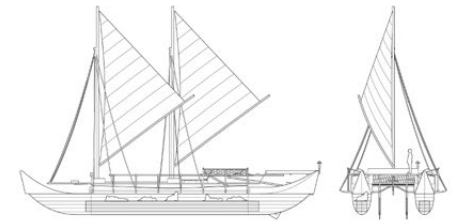
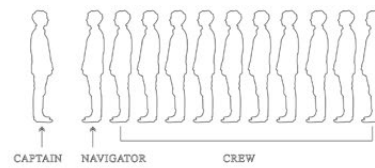
This project recognizes the shared fate Koloa has with indigenous Hawaiian people and tries to recover Koloa's wetland habitats as a way to decolonize Le'Ahi Crater. During the process, human and non-human's connection will be strengthened based on the indigenous Hawaiian epistemology of 'Aina, constant observation, and care.



The Koloa pavilion invites Koloa as an active designer and builder of the pavilion. Several hen houses are placed around the main pavilion, creating a haven for Koloa to lay their egg. Once the eggs are hatched, the nest will be abandoned by Koloa. The nests will then be taken out from the hen houses and used as roof material for the main pavilion. Over time, the more completed the main pavilion becomes, the better the preservation status is.



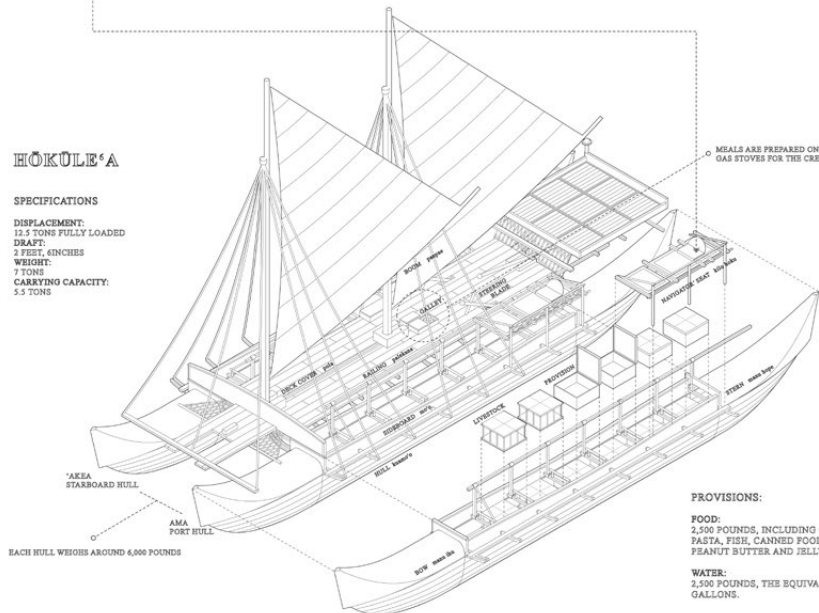
CREW



SLEEPING COMPARTMENTS
FIVE BOARDS ARE PLACED ACROSS THE HULL ACCESS PANELS WHERE PROVISIONS ARE STORED. SLEEPS FIVE CREW MEMBERS ON EACH SIDE OF THE HULL.

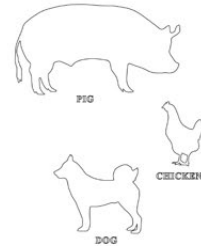
HŌKŪLEʻA

SPECIFICATIONS
DISPLACEMENT: 12.5 TONS FULLY LOADED
DRAFT: 2 FEET, 4 INCHES
WEIGHT: 7 TONS
CARRYING CAPACITY: 2.5 TONS



PROVISIONS:
FOOD: 2,500 POUNDS, INCLUDING CHICKEN, PASTA, FISH, CANNED FOODS, FRUITS, PEANUT BUTTER AND JELLY CRACKERS.
WATER: 2,500 POUNDS, THE EQUIVALENT OF 250 GALLONS.

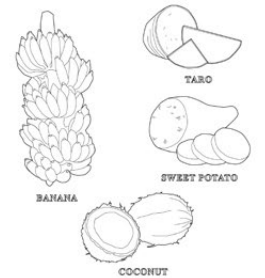
LIVESTOCK

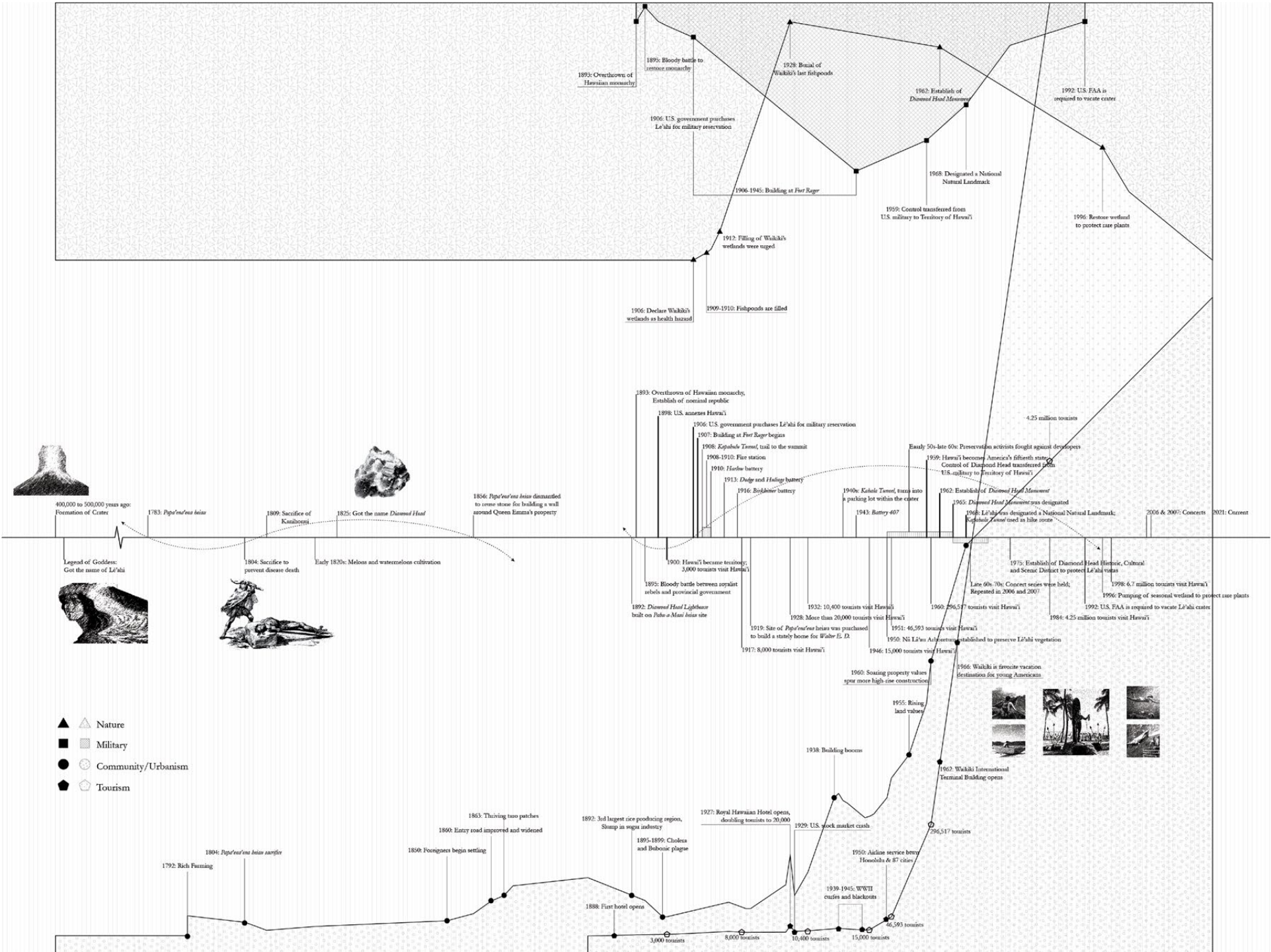


MISCELLANEOUS

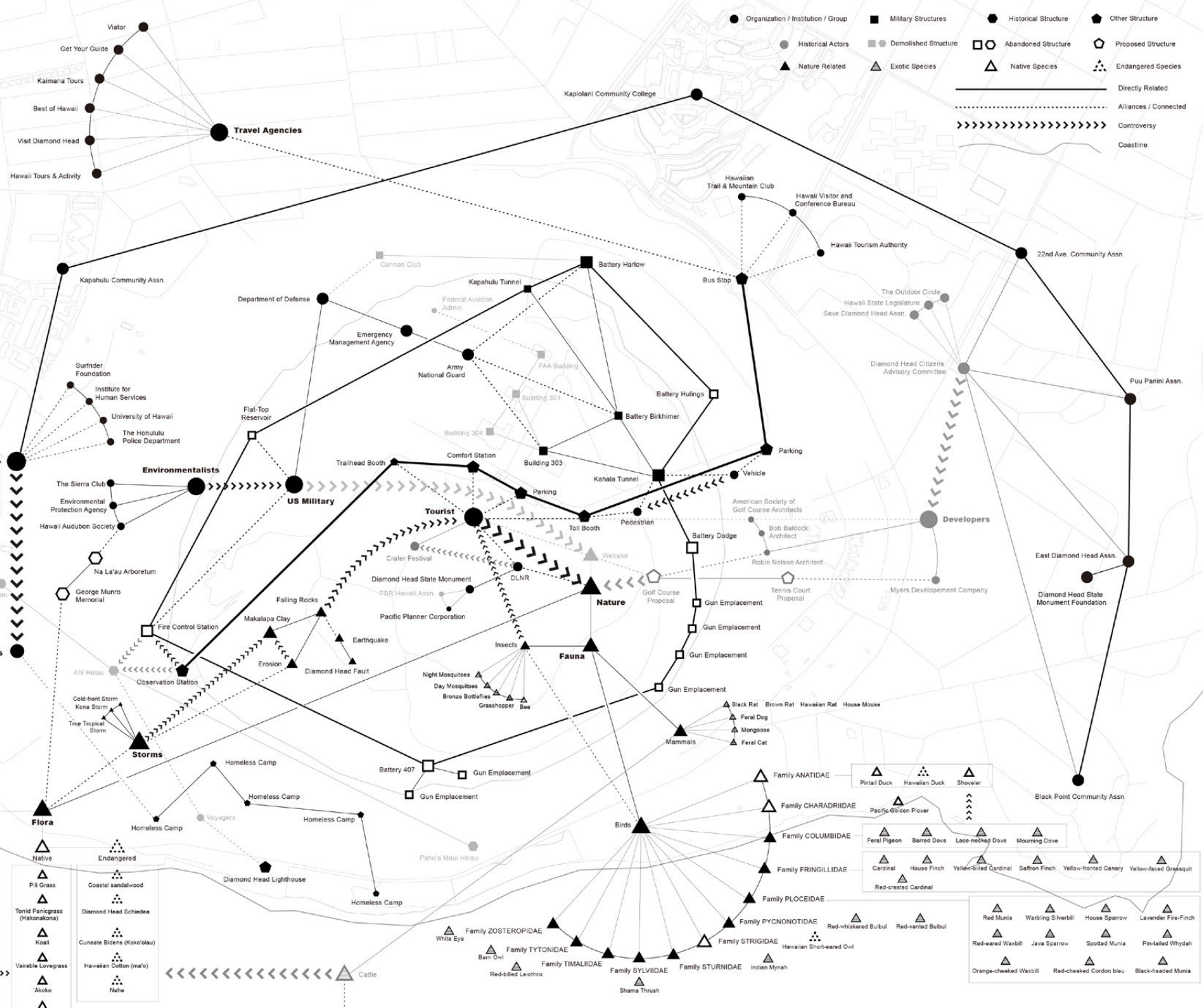


FRUIT





**DIAMOND HEAD
ACTOR-NETWORK SYSTEM**



- | | |
|------------------------|----------------------|
| Spiny Amaranth | Hairy merremia |
| Bristly foxtail | Guinea grass |
| West Indian Beggartick | Cow pea |
| California Grass | Weava's Snout |
| Star Grass | Red Spiderling |
| Swollen Fingergrass | Billy Goat Weed |
| Hairy Hornhono | Florida Tasselflower |
| Wild Cucumber | Fairy mallow |
| Sticky Galinsoga | Garden Spurge |
| Slender Mimosa | Cocklebur |
| Jungle Rice | Holeia Koa |
| Floras Paintbrush | Kiawe |

- | | |
|------------------------------|----------------------------|
| Exotic | Native |
| Pill Grass | Coastal sandalwood |
| Torrid Fanogras (Hakonakona) | Diamond Head Schiedea |
| Koali | Cuneate Bidens (Koke'olau) |
| Variable Lovegrass | Hawaiian Cotton (ma'oa) |
| 'Akoko | Nehe |
| 'Ilika | |

- | |
|--------------------|
| Endangered |
| Endangered Species |
| Cattle Feed |

- | |
|-------|
| Flora |
| Flora |
| Flora |

- | |
|--------|
| Storms |
| Storms |
| Storms |

- | |
|-------|
| Fauna |
| Fauna |
| Fauna |

- | |
|-------|
| Birds |
| Birds |
| Birds |

- | | | | |
|---------------------|--------------------------|-----------------------|------------------------|
| Family ANATIDAE | Pintail Duck | Hawaiian Duck | Shoveler |
| Family CHARADRIIDAE | Pacific Golden Plover | | |
| Family COLUMBIDAE | Feral Pigeon | Barred Dove | Lace-necked Dove |
| Family FRINGILLIDAE | Cardinal | House Finch | Yellow-billed Cardinal |
| Family PLOCEIDAE | Saffron Finch | Yellow-fronted Canary | Yellow-faced Grassquit |
| Family PYCNONOTIDAE | Red-whiskered Bulbul | Red-vented Bulbul | |
| Family STRIGIDAE | Hawaiian Short-eared Owl | | |
| Family ZOSTEROPIDAE | White Eye | | |
| Family TYTONIDAE | Barn Owl | | |
| Family TIMALIIDAE | Red-billed Leothrix | | |
| Family SYLVIIDAE | Shama Thrush | | |
| Family STURNIDAE | Indian Mynah | | |

- | | | | |
|---------------------|--------------------------|-----------------------|------------------------|
| Family ANATIDAE | Pintail Duck | Hawaiian Duck | Shoveler |
| Family CHARADRIIDAE | Pacific Golden Plover | | |
| Family COLUMBIDAE | Feral Pigeon | Barred Dove | Lace-necked Dove |
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| Family TIMALIIDAE | Red-billed Leothrix | | |
| Family SYLVIIDAE | Shama Thrush | | |
| Family STURNIDAE | Indian Mynah | | |

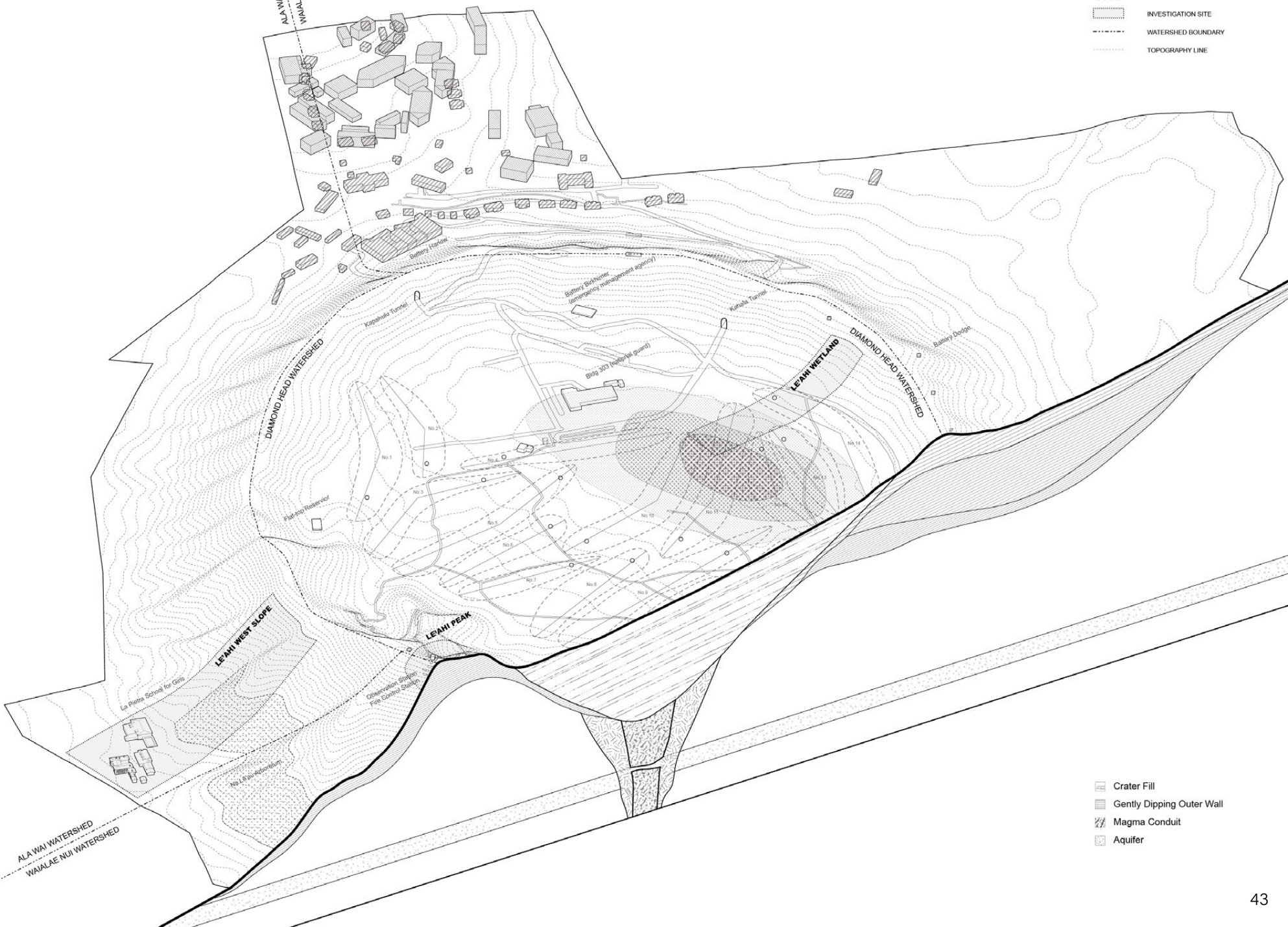
- | | | | |
|------------------------|-------------------------|--------------------|---------------------|
| Red Munia | Warbling Silverbill | House Sparrow | Lavender Fire-Finch |
| Red-eared Waxbill | Java Sparrow | Spotted Munia | Pin-tailed Whydah |
| Orange-cheeked Waxbill | Red-crowned Cordon bleu | Black-headed Munia | |

LE'AHl ACTOR NETWORK DIAGRAM

LE'AHU CRATER

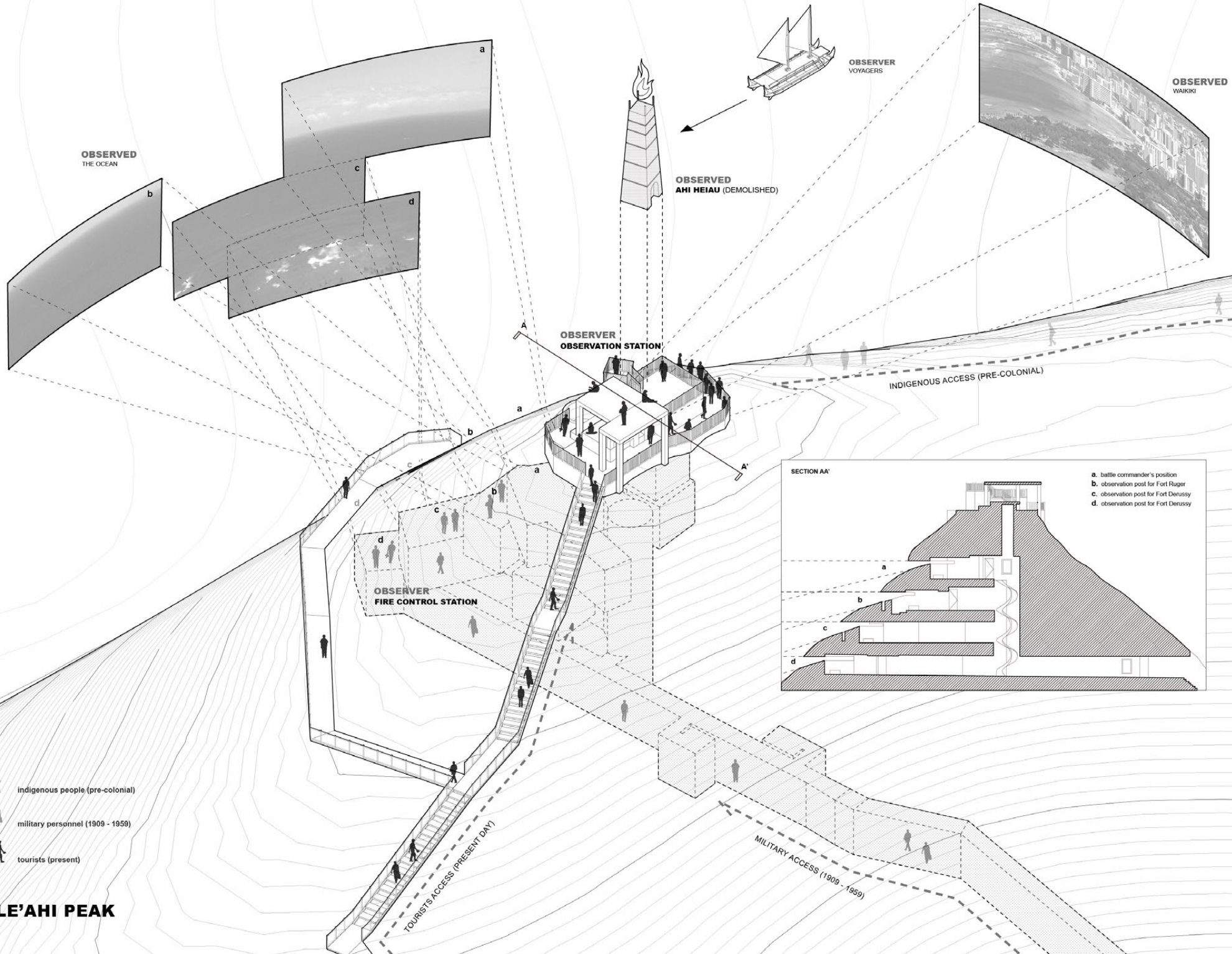
ALA WAI WATERSHED
WAIALAE NUI WATERSHED

-  WETLAND
-  KAPILANI COMMUNITY COLLEGE BLDG
-  FORT RUGER BLDG
-  PROPOSED GOLF COURSE
-  INVESTIGATION SITE
-  WATERSHED BOUNDARY
-  TOPOGRAPHY LINE



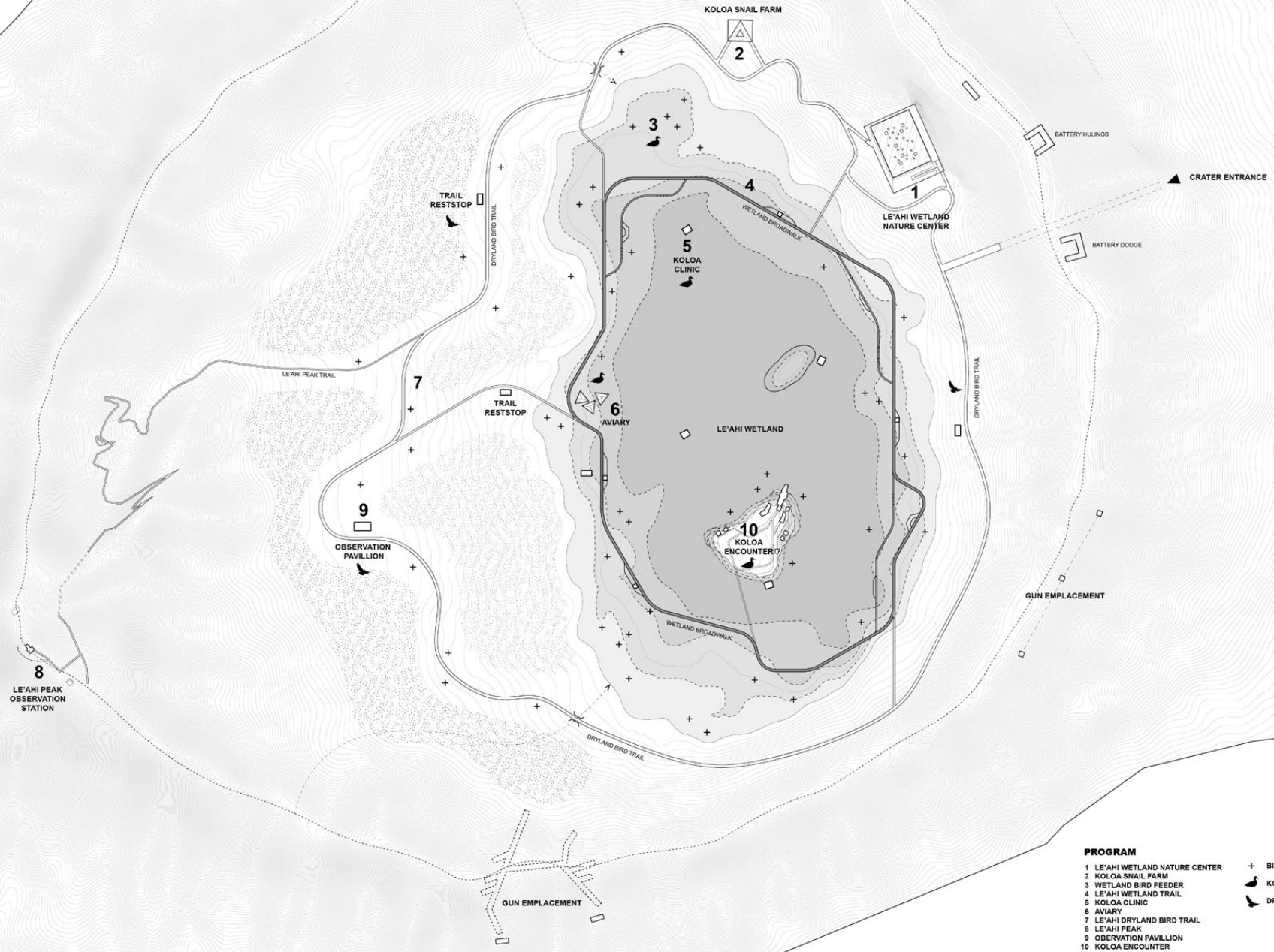
ALA WAI WATERSHED
WAIALAE NUI WATERSHED

-  Crater Fill
-  Gently Dipping Outer Wall
-  Magma Conduit
-  Aquifer



LE'AHU PEAK

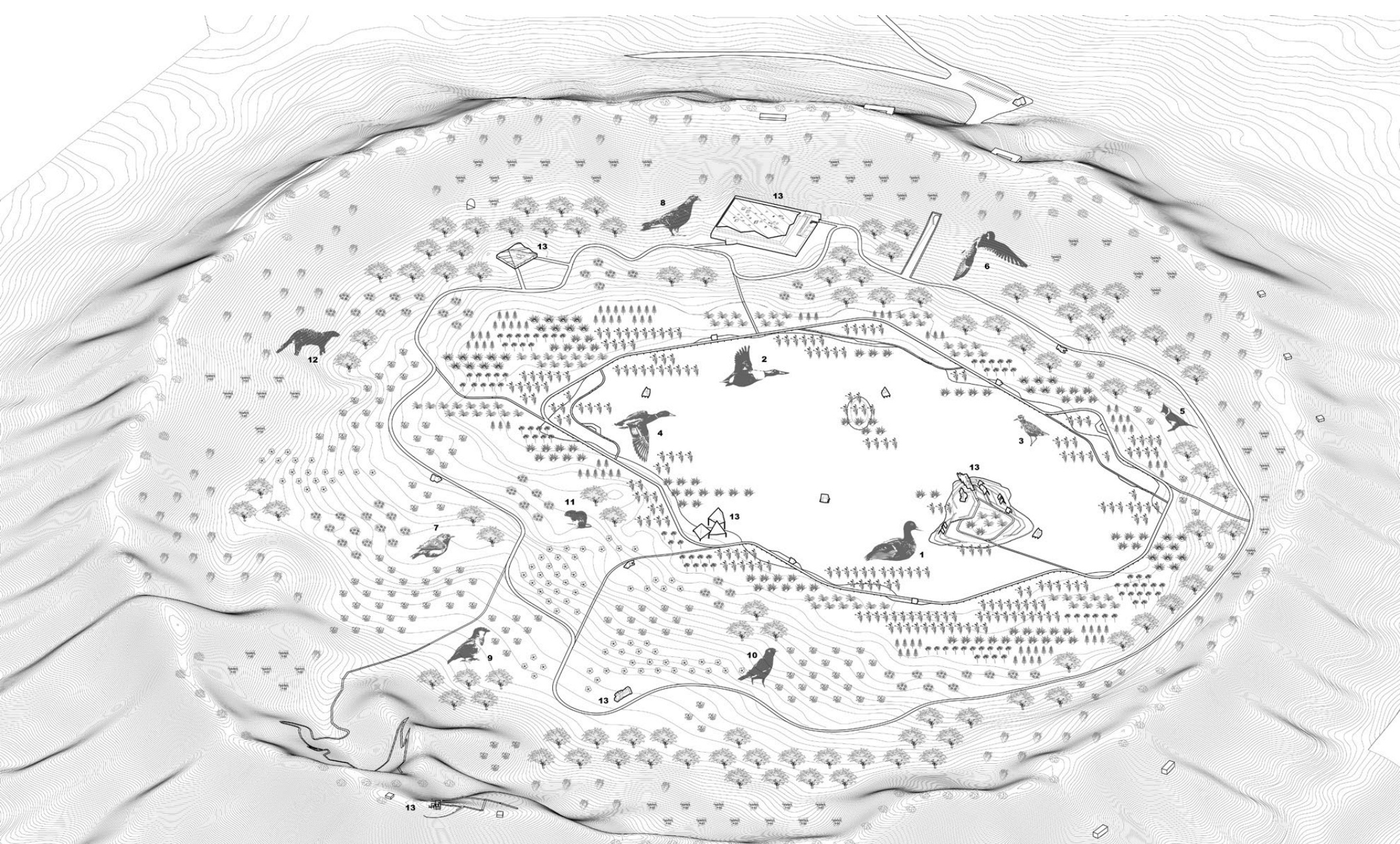
LE'AHU WETLAND RESTORATION PLAN



PROGRAM

- 1 LE'AHU WETLAND NATURE CENTER
 - 2 KOLOA SNAIL FARM
 - 3 WETLAND BIRD FEEDER
 - 4 LE'AHU WETLAND TRAIL
 - 5 KOLOA CLINIC
 - 6 AVIARY
 - 7 LE'AHU DRYLAND BIRD TRAIL
 - 8 LE'AHU PEAK
 - 9 OBSERVATION PAVILLION
 - 10 KOLOA ENCOUNTER
- + BIRD FEEDER
 - ☛ KOLOA SIGHTING
 - ☛ DRYLAND BIRD SIGHTING





WETLAND PLANTS

- Puukaa *
- Star Grass
- Honohono *
- Ahuawa *
- Neke Fern *
- Guinea Grass

DRYLAND PLANTS

- Ilima *
- Swollen Fingergrass
- Hawaiian Cotton **
- Kaiwe *

ROCKLAND PLANTS

- Haole Koa
- Pili Grass *

RIDGE PLANTS

- Coastal Sandalwood **
- Nehe **

WATERFOWL

- 1 Hybrid Koloa **
- 2 Nothern Shoveler
- 3 Golden Plover
- 4 Mallard

WOODLAND BIRDS

- 5 Red Crested Cardinal
- 6 Pueo **
- 7 Japanese White Eye

OTHER BIRDS

- 8 Feral Pigeon
- 9 House Sparrow
- 10 Mynah

MAMMAL

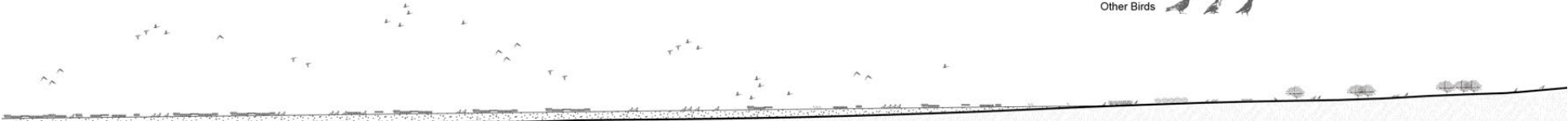
- 11 Mongoose
- 12 Hawaiian Rat *
- 13 Human

NATIVE SPECIES *
NATIVE ENDANGERED SPECIES **

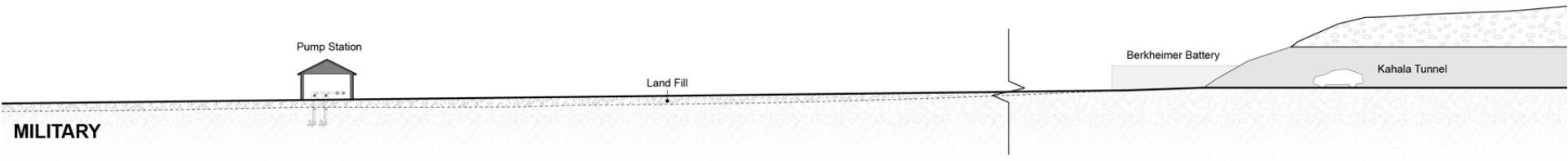
LE'AHU POST-MILITARY ECOSYSTEM

LE'AHU ECOSYSTEM TRANSFORMATION

BIRDS		PLANTS	
Waterfowl		Wetland Plants	
Woodland Birds		Dryland Plants	
Other Birds			



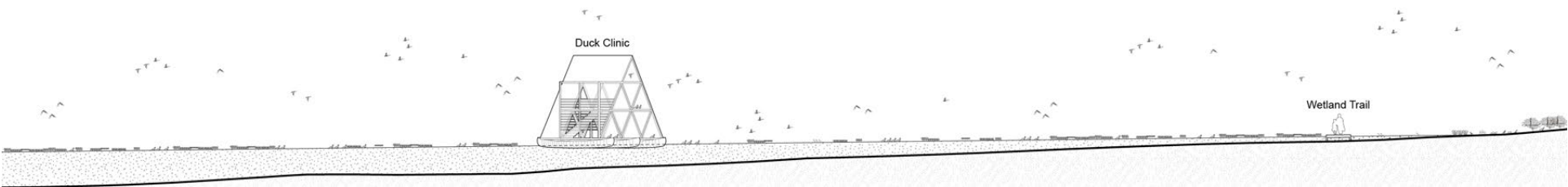
PRE-MILITARY



MILITARY



EXCAVATION

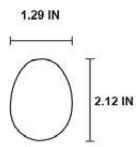


STORM

KOLOA OBSERVATION

- [1] Malachowski, C. P., & Dugger, B. D. (2018). Hawaiian duck behavioral patterns in seasonal wetlands and CULTIVATED TARO. The Journal of Wildlife Management, 82(4), 840–849. <https://doi.org/10.1002/jwmg.21429>
- [2] Swedberg, G. E. (1967). The Koloa; a preliminary report on the life history and status of the Hawaiian Duck (*Anas wyvilliana*). prepared as part of The Koloa restoration project, Division of Fish and Game.
- [3] Greer, N. M. (2005). Ethnoecology of taro farmers and their management of Hawaiian wetlands and endangered Waterbirds In taro agroecosystems.

NESTING PATTERN [2]



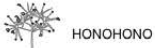
+ KOLOA EGGS



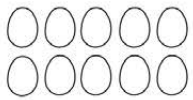
+ KOLOA NESTS

NESTING SEASON: DECEMBER TO MAY

+ NESTS MATERIAL

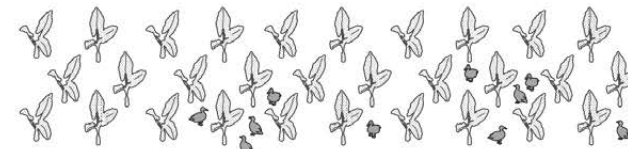


DOWN AND BREAST FEATHERS

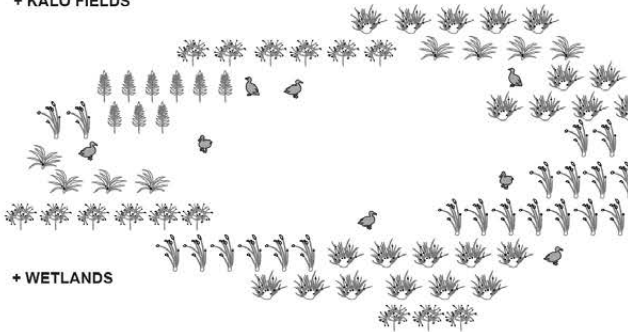


2-10 EGGS PER CLUTCH

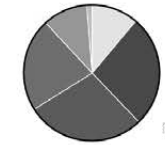
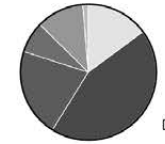
HABITATS [1] [3]



+ KALO FIELDS

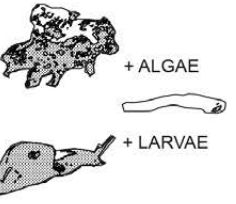


+ WETLANDS

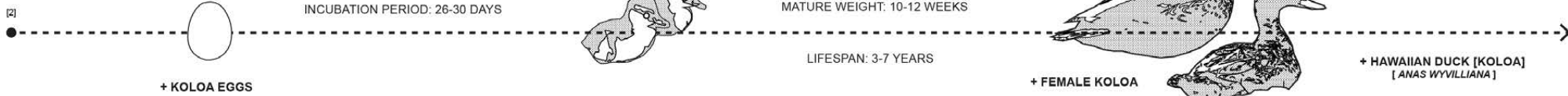


FOOD [2]

- + SNAILS
- + DRAGONFLY LARVE
- + EARTHWORMS
- + GRASS SEEDS
- + RICE
- + GREEN ALGAE



+ SNAILS

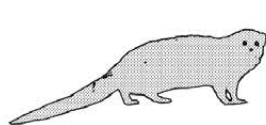


DISEASE [2]

- PARASITE**
- + LOUSE
 - + TAPEWORM

- BACTERIA**
- + BOTULISM
 - + AVIAN INFLUENZA
 - + AVIAN MALARIA
 - + CHOLERA
 - + DUCK PLAGUE
 - + RIEMERELLA ANATIPESTIFER

PREDETORS (DUCKLINGS) [2]



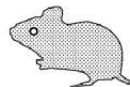
+ MONGOOSE



+ FERAL CAT

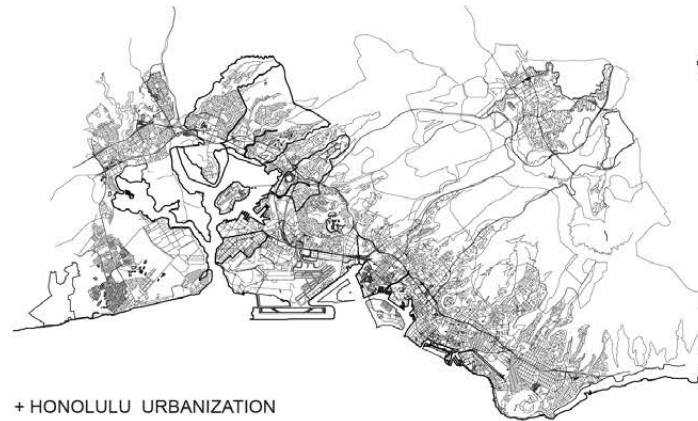


+ CATTLE EGRET



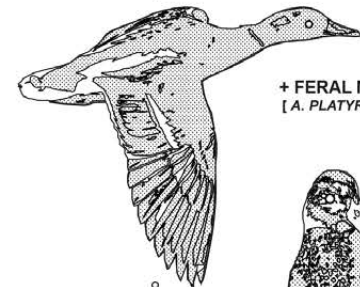
+ RAT

HABITAT LOSS [3]



+ HONOLULU URBANIZATION

HYBRIDIZATION [2]

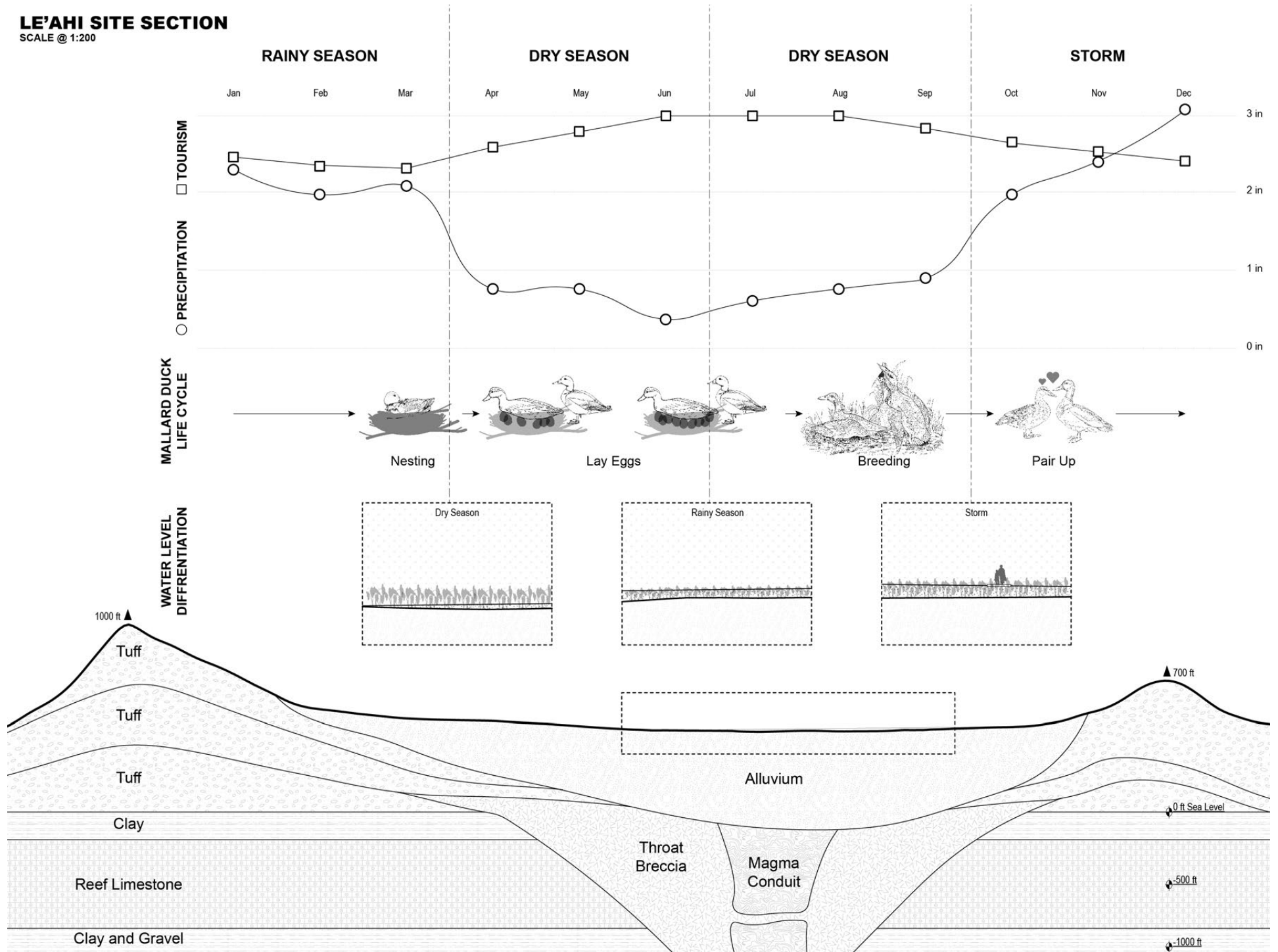


+ FERAL MALLARD [*A. PLATYRHYNCHOS*]

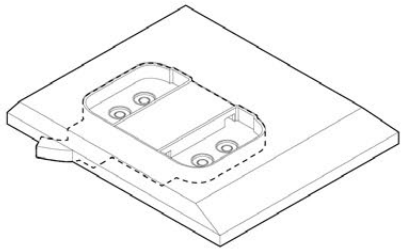
+ HYBRID MALLARD-DUCK

LE'AHU SITE SECTION

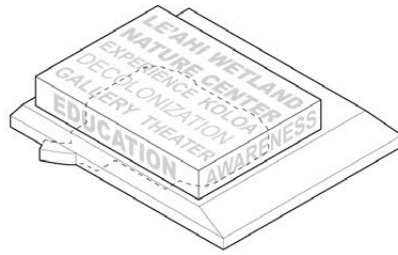
SCALE @ 1:200



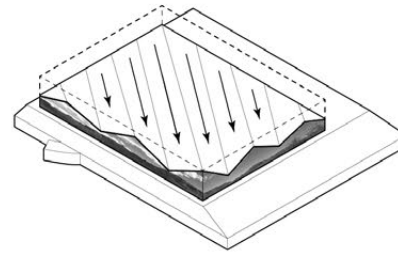
LE'AHU WETLAND NATURE CENTER



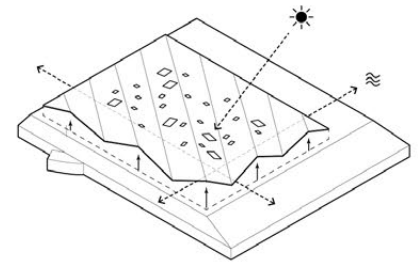
**EXISTING MILITARY STRUCTURE:
BATTERY BIRKHIMER**



NEW PROGRAM OVERLAYS BUNKER

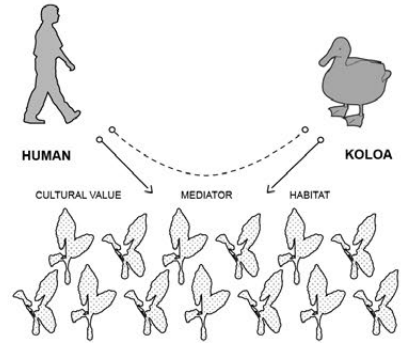


**PITCHED ROOF ACCENTUATE
VIEW OF THE LE'AHU PEAK**

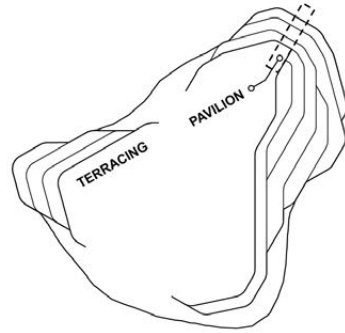


**OPEN STRUCTURE CONNECTS
BUILDING TO ENVIRONMENT**

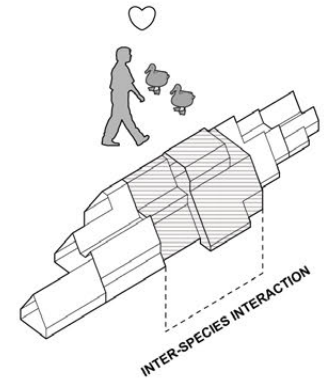
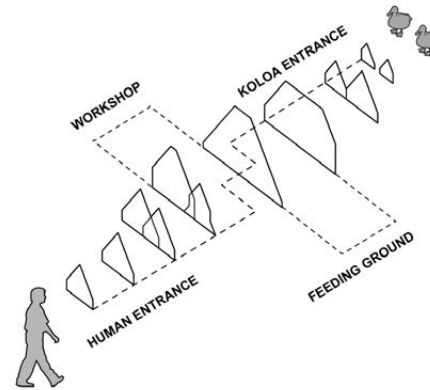
KOLOA PAVILION



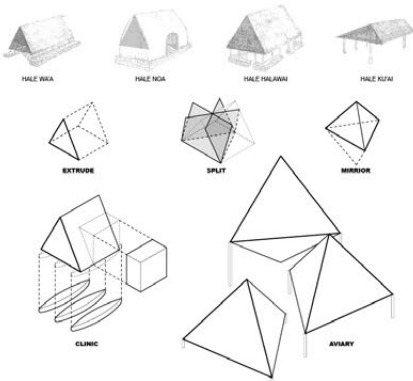
AGROECOSYSTEM



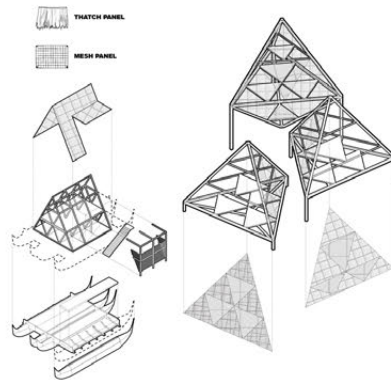
EXCAVATION FILL ISLAND



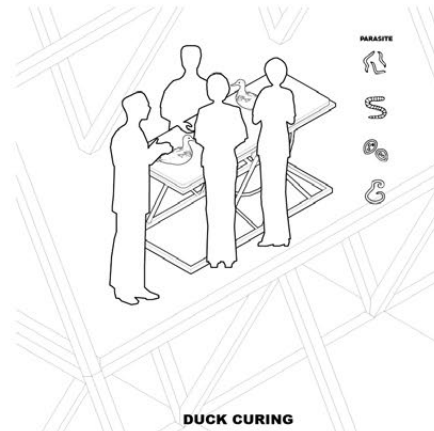
KOLOA CLINIC



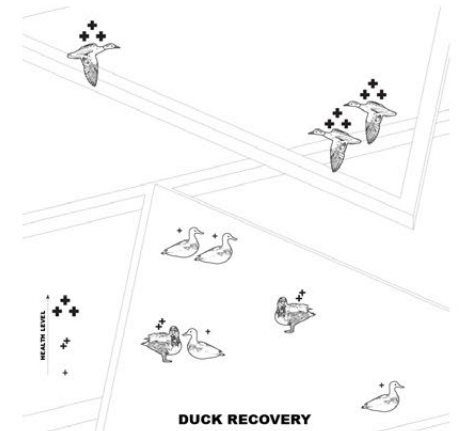
TRIANGULAR SHAPE EXTRACTION



SPATIAL | MATERIAL

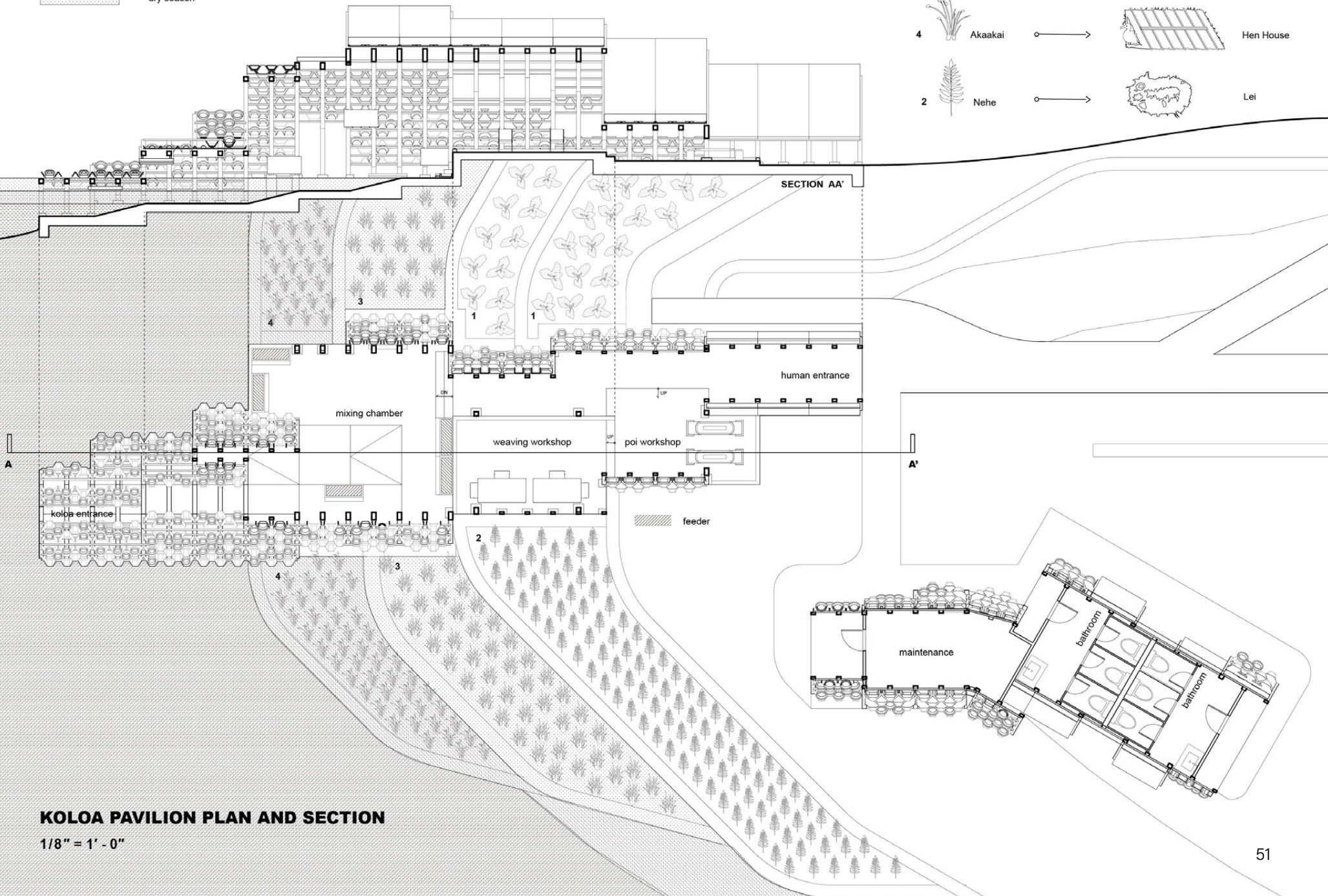
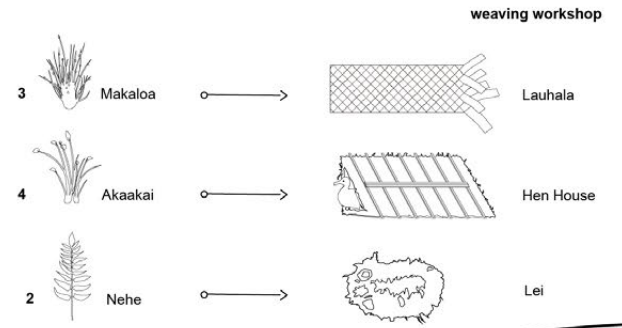


DUCK CURING



DUCK RECOVERY

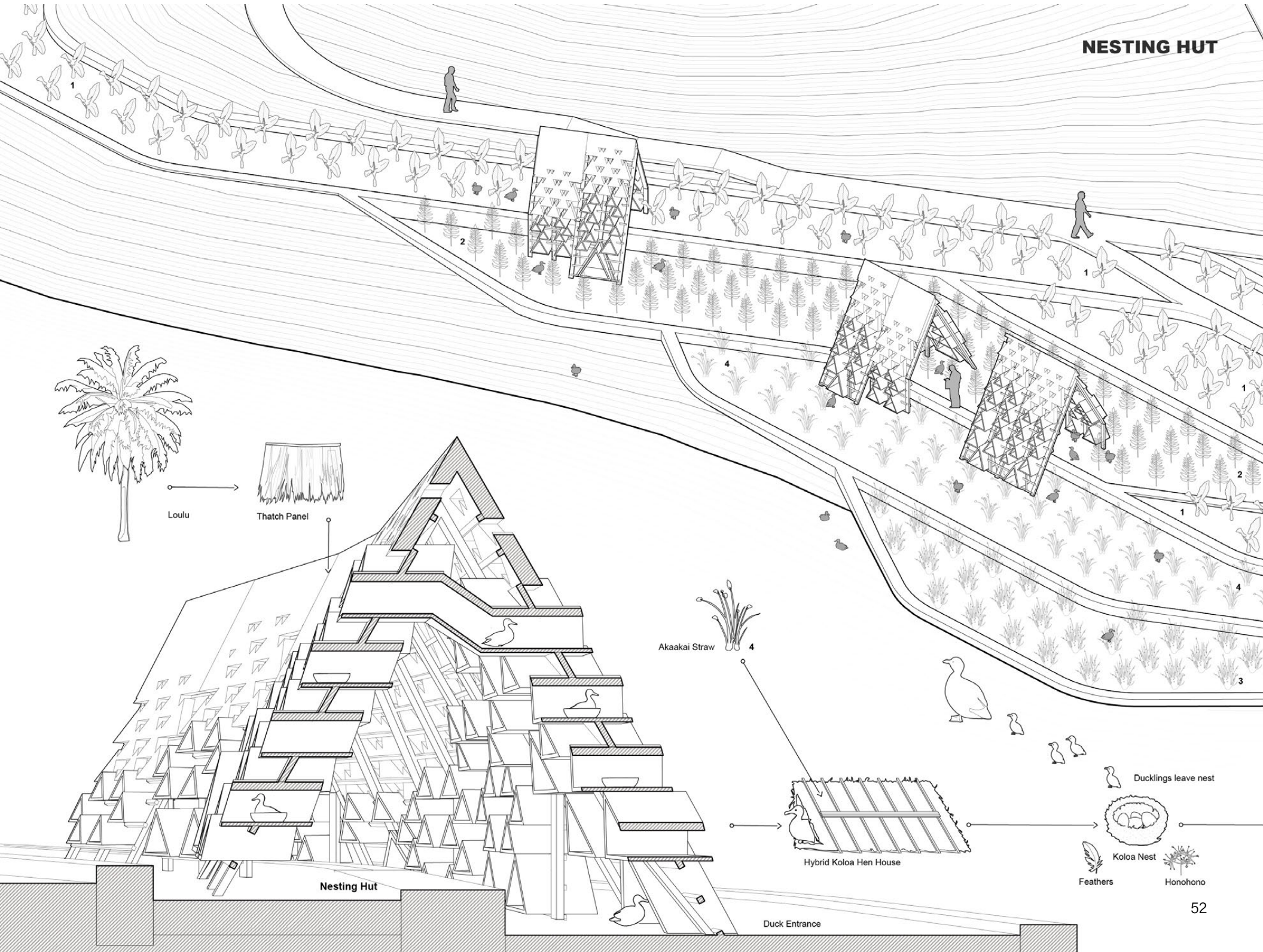
-  storm
-  wet season
-  dry season

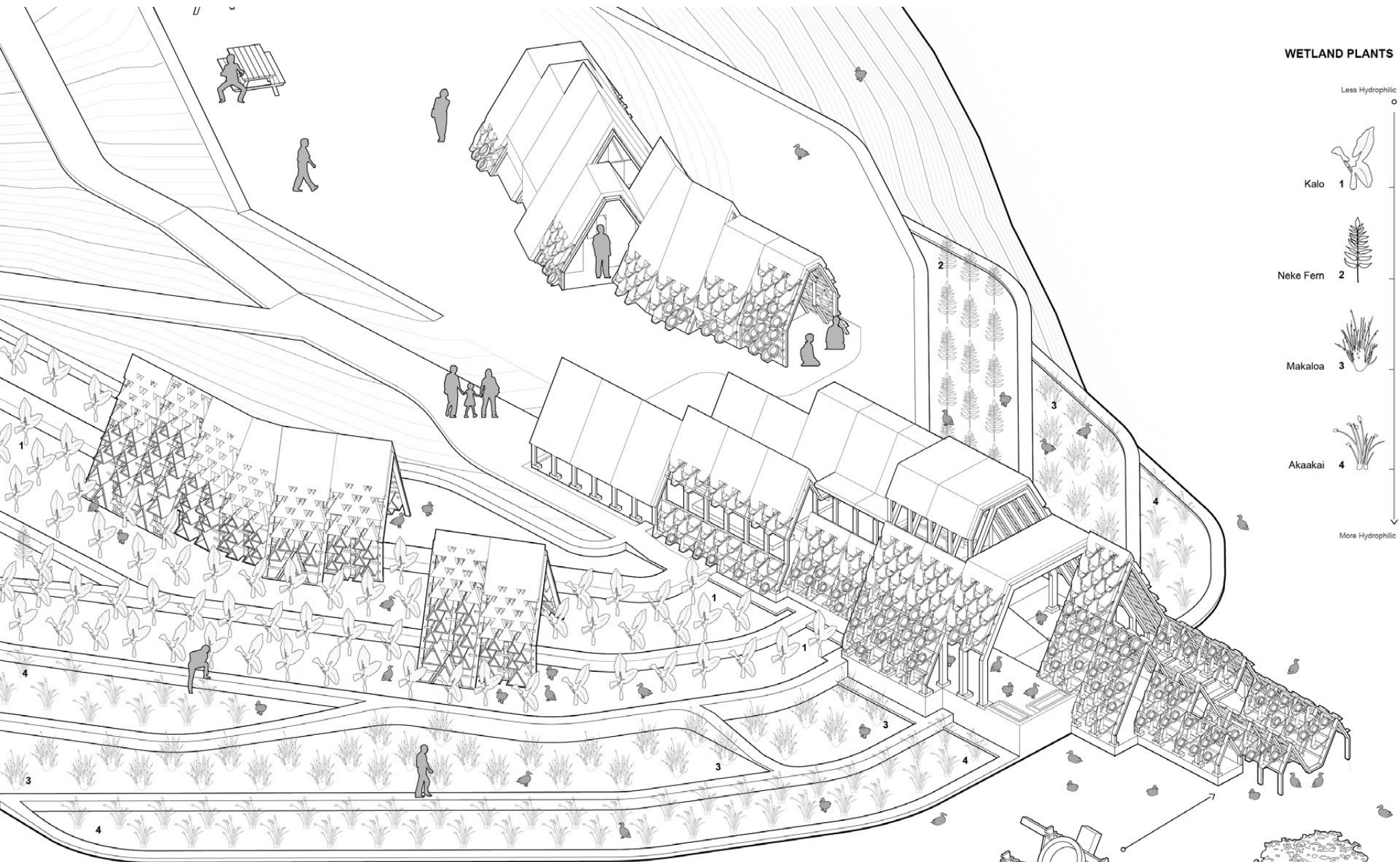


KOLOA PAVILION PLAN AND SECTION

1/8" = 1' - 0"

NESTING HUT





WETLAND PLANTS

Less Hydrophilic



Kalo 1



Neke Fern 2



Makaloa 3



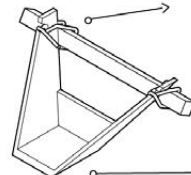
Akaakai 4

More Hydrophilic



Abandoned Nest

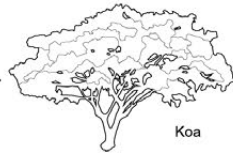
Nest as Building Material



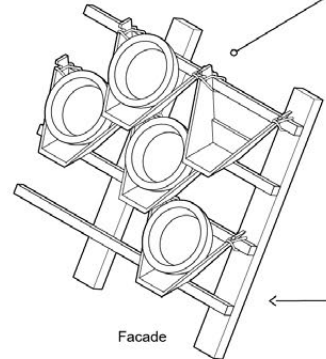
Nest Holder



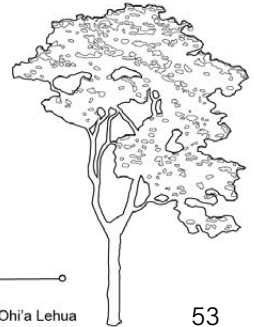
'Olonā Lashing



Koa



Facade



'Ohi'a Lehua

KOLOA PAVILION



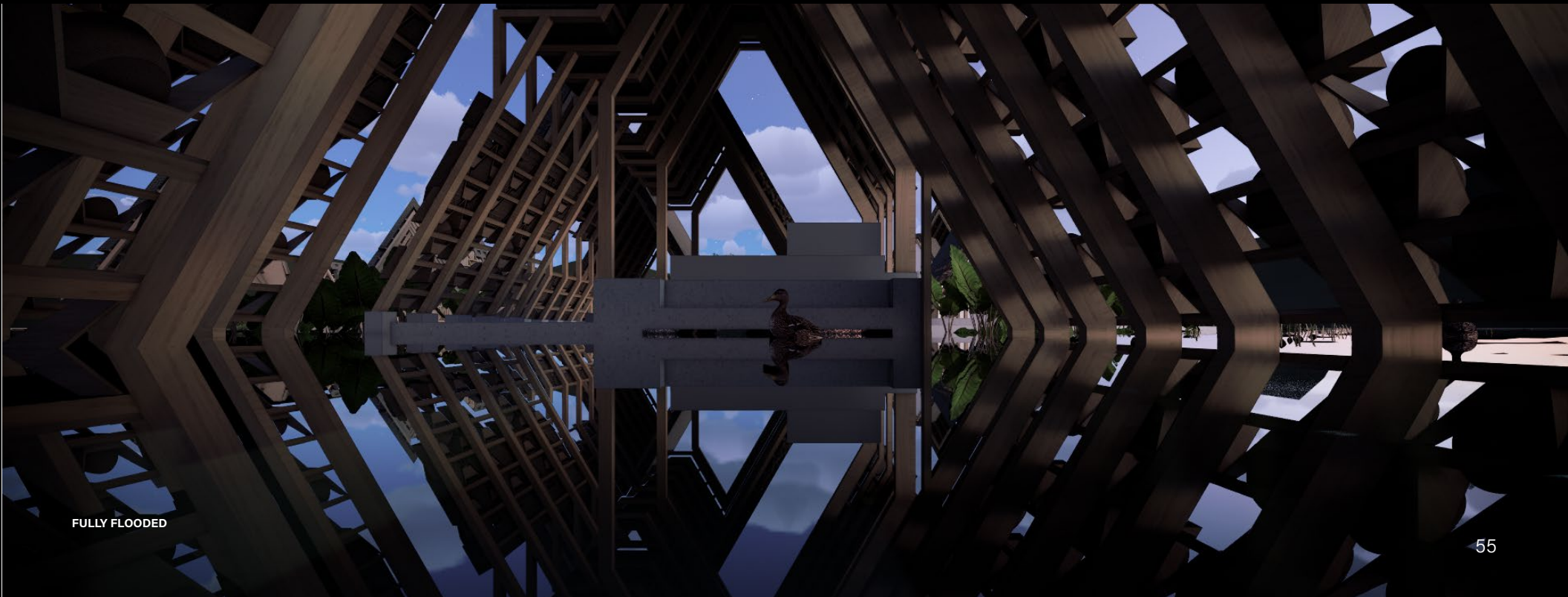
NORMAL CONDITION



SEMI-FLOODED



STORM



FULLY FLOODED