

THE DICHOTOMY OF ATMOSPHERE AND NATURE

The Layers of Houston: The atmosphere of Houston is broken into the categories of Human and Mechanical. This combined with nature allows for the analysis of Houston in a layered approach. Broken down into six layers: Sky, Smog, Highway, Canopy, Ground, and Water.



HIGHWAY: Concrete division lines throughout the city



WATER: Connection between industry to city and nature.



GROUND: Link between water, canopy, and highway layers.



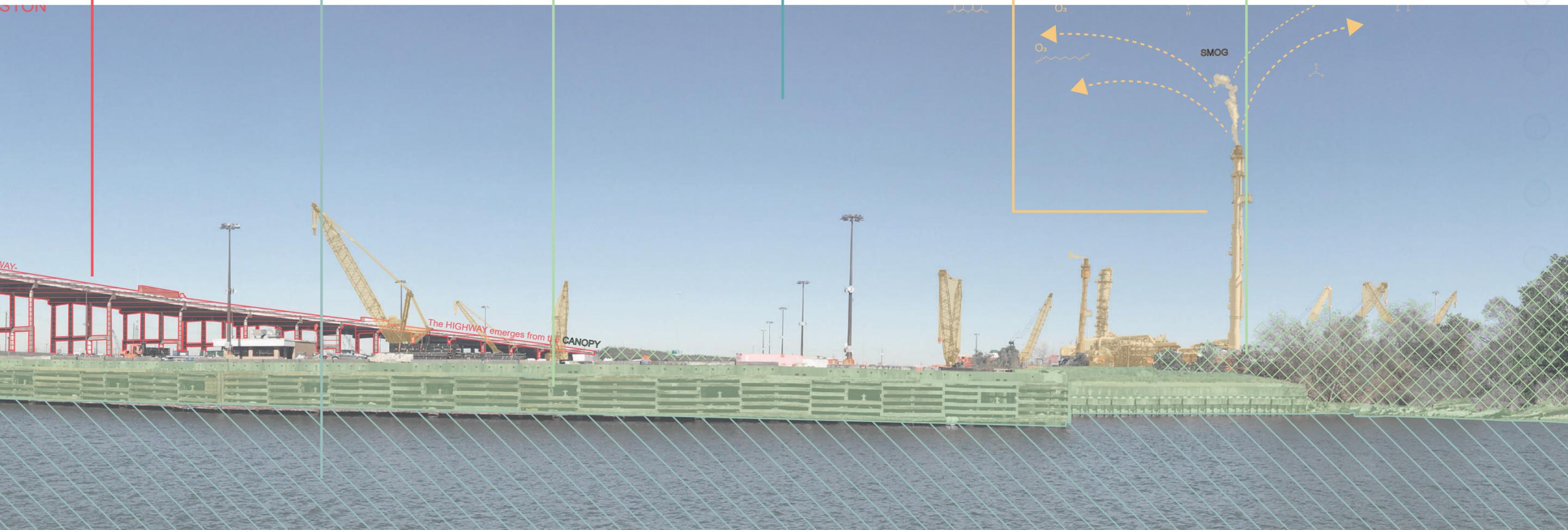
SKY: Free space that allows for a connection between smog, canopy, and highway.



SMOG: Byproduct of industry and highway layer. Obstructs the sky layer.



CANOPY: Hides highway, ground, and water layers from view, and remedies the smog layer.



Layers: SKY

Making up the majority of the view of Houston. It is impeded only by downtown Houston, hurricanes, smog, highways, and the canopy



HIGHWAY LAYER

This layer hides behind the canopy layer but at overpasses and bridges it rockets into the sky layer.

SMOG LAYER

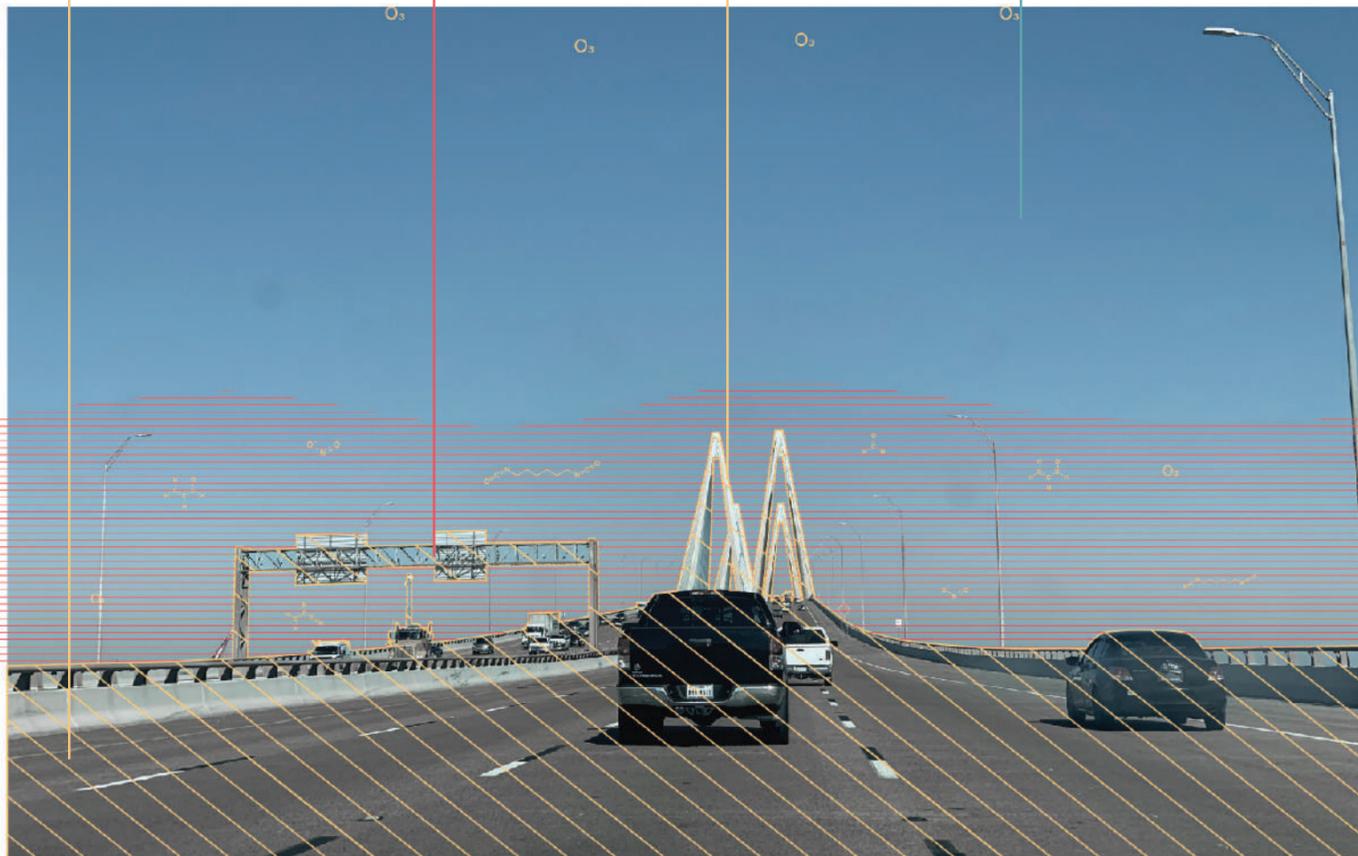
Made up of VOCs and NOx the Smog layer obscures the sky layer.

FRED HARTMAN BRIDGE

Accommodating 200,000 vehicles a day. This bridge is Texas icon for cable stayed bridges.

OPEN SKY

Top layer allowing for freedom and openness. This area is where migratory birds travel along with planes and clouds.



SUN

The basis of all biological life, allowing plants to grow. The sun can be utilized to generate electricity as the basis of all LIGHT on site.



RAIN

Freshwater that allows plants to grow and replenishes waterways. Can be collected for irrigation and consumption.



GOOD OZONE

The natural layer of Ozone is high in the sky protecting the earth from harmful UV rays from the sun. This can be utilized in a design to create protective elements.



Layers: SMOG

Consisting of the accumulation of different chemicals from Ozone, NO_x, VOCs and more. It contaminates the air, soil, and water. The most obvious is the air in the form of a haze.



BAD OZONE

Ground level ozone is created when fossil fuel byproducts react with the sun and form ozone on the ground. Remediation plants can clean this out of the air.



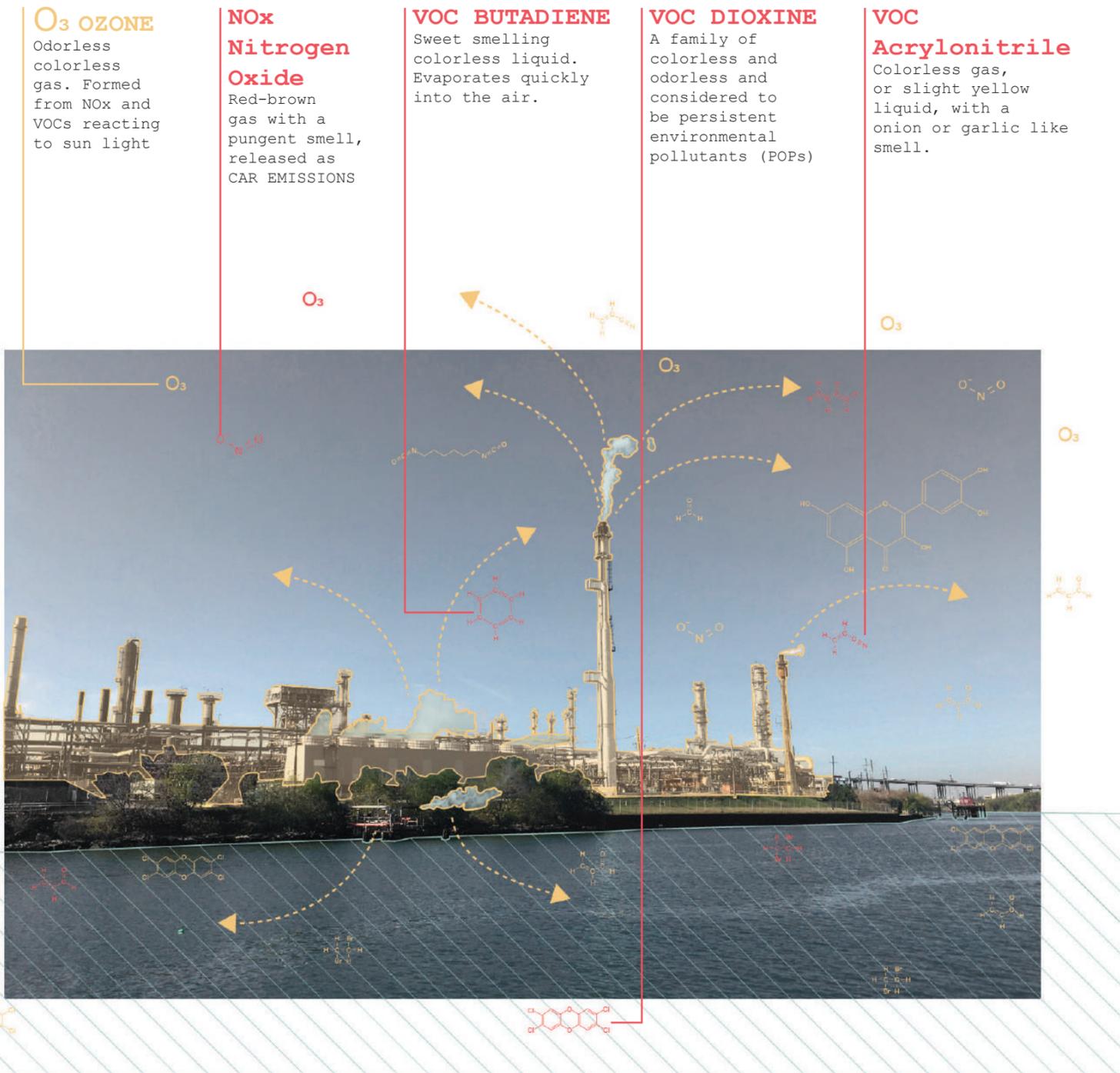
ACID RAIN

Water that has absorbed bad ozone and pollutes water ways and erodes soil. Remediation can assist in cleaning this.



HAZE

Pollution creates a haze that obstructs view. This can be used to create areas that are unseen.



Layers: **HIGHWAY**

The main connector of Houston. Not seen except when it is being used. It hides in the canopy except for when it reaches up towards the sky as overpasses and bridges.



POWER LINES

Power lines typically travel parallel to highways. It a convenient area of cleared land to run power.

CANOPY LAYER

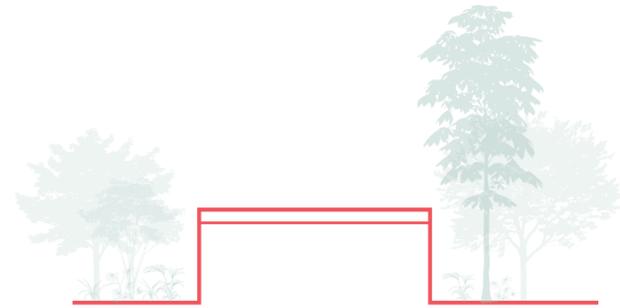
The Highway normally peaks out of the canopy layer. From a distance the highways are hidden behind a wall of trees.

FRED HARTMAN BRIDGE

Accommodating 200,000 vehicles a day. This bridge is Texas icon for cable stayed bridges.

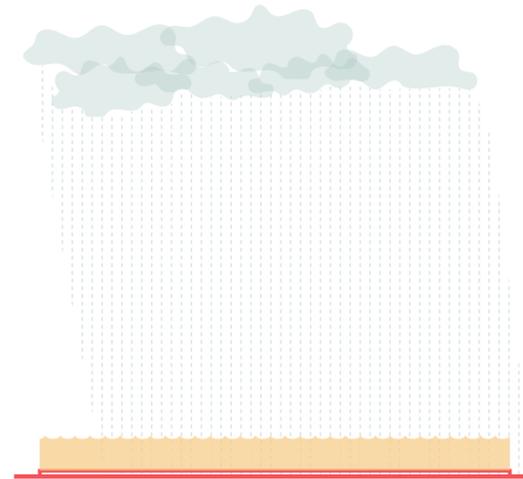
OZONE CREATION

The Highway layer creates a large amount of emissions, recently passing Chicago with more than 40 million metric tons of CO2 emissions.



BARRIER

Large roads prevent wildlife and people from being able to easily travel on foot. The idea of barrier can be utilized in the building to create places that are separated



FLOODING

Stops rain from being able to seep back into the ground contributing to flooding. This can be resolved by lifting buildings to allow for draining.



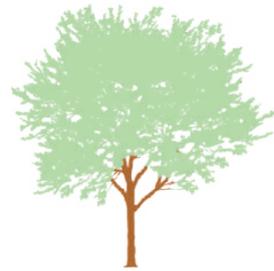
POLLUTION

The constant large population of cars on the road lead to a constant release of large amounts of CO2 leading to ground level Ozone. Remediation can address this problem.



Layers: **CANOPY**

Composed of trees that are extending from the ground layer. The canopy is sometimes disturbed by highways or technology extending out from the canopy.



ROADS

The roads intermingle with the canopy layer. Mixing with it clearly visible in plan but invisible in elevation.

INDUSTRY AND TECHNOLOGY

Things like power poles, street lights, wireless towers, and bridges sometimes pierce the layers of the canopy. Shooting out the top of the canopy and into view.

CANOPY

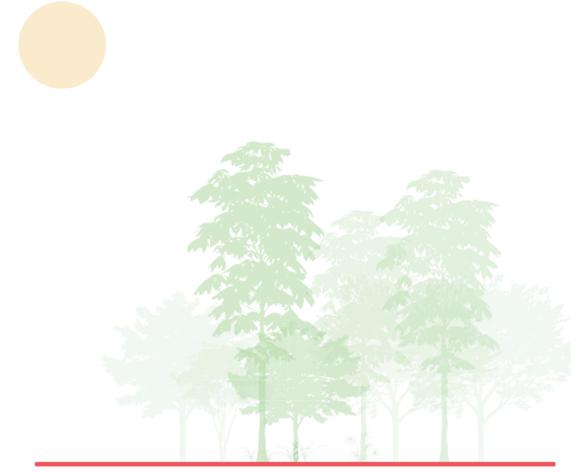
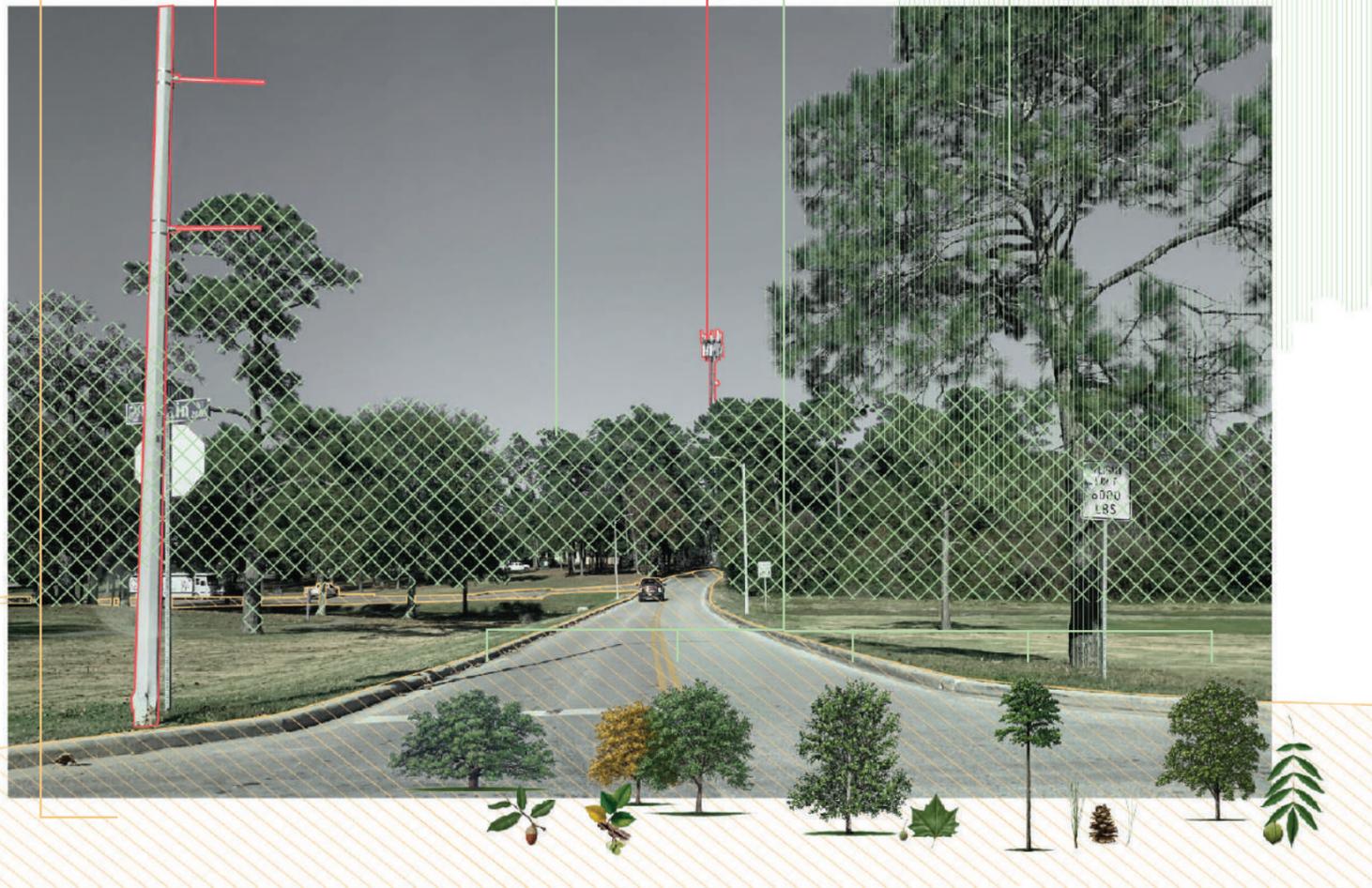
The canopy is made up of dense trees mostly. The combination of the different types of trees, evergreens and deciduous, make the canopy dense year-round

MAIN CANOPY TREES

(From Left)
-Live Oak
-Cedar Elm
-Mexican Sycamore
-Loblolly Pine
-Pecan

CANOPY REACH

Trees from the canopy sometimes grow in the space between the canopy and the road. On the ground layer.



PROTECTION

During rain or intense sun the canopy provides protection to the ground and water layers. This can be utilized by incorporating protective elements into the building.



WILDLIFE HABITAT

The canopy creates habitat for migratory birds and many other animals who use the canopy to hunt and to live in. This should be considered in the design of the wildlife habitat

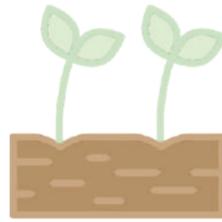


OXYGEN

The canopy converts greenhouse gases like ozone into Oxygen. This cleans the air of harmful gases and feeds the trees needed nutrients.

Layers: GROUND

Made up of a gradient. Starting at the road the gradient goes from road to short grass, to taller grass, then connects to the canopy layer. The gradient grasses are man-made near the road edge and then natural in the fields.



CROW ROAD IN BAYTOWN NATURE CENTER

The ground links to the roads making the experience of the ground layer typically connected to a road. This road links to the port that will take researchers to the Island.

SHORT GRASSES

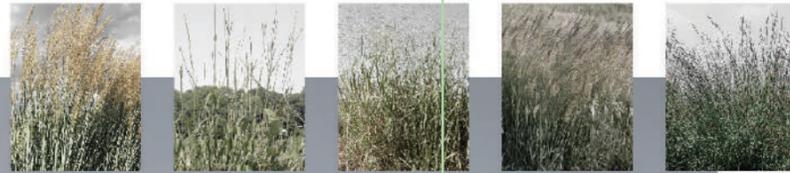
The ground links to the roads making the experience of the ground layer typically connected to a road. This road links to the port that will take researchers to the Island.

FIELD GRASSES

Control soil erosion, retain water, replenish aquifers, and provide natural wildlife habitat. (From Left) Big Bluestem, Sideoats Grama, Switchgrass, Eastern Gamagrass, Indian Grass

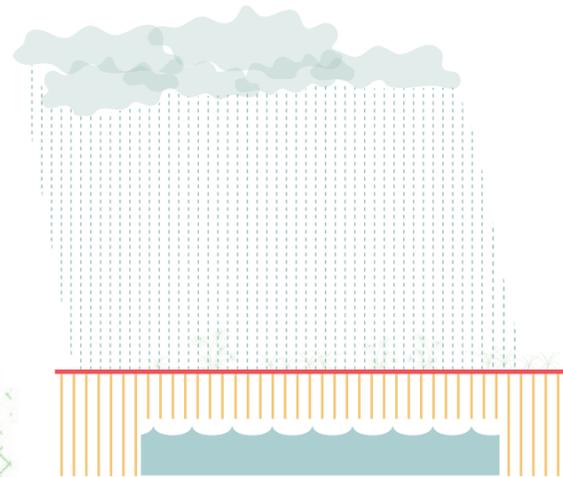
TALL GRASSES

Final layer before reaching the canopy. This layer is composed of tall grasses that have been undisturbed by mowing or fire or grazing.



GROWTH MEDIUM

Dirt is the basis of plant life, providing critical nutrients to grow and flourish. Plants also aid the ground layer by providing stability with their root structures. This can be utilized for landscape and dune conservation.



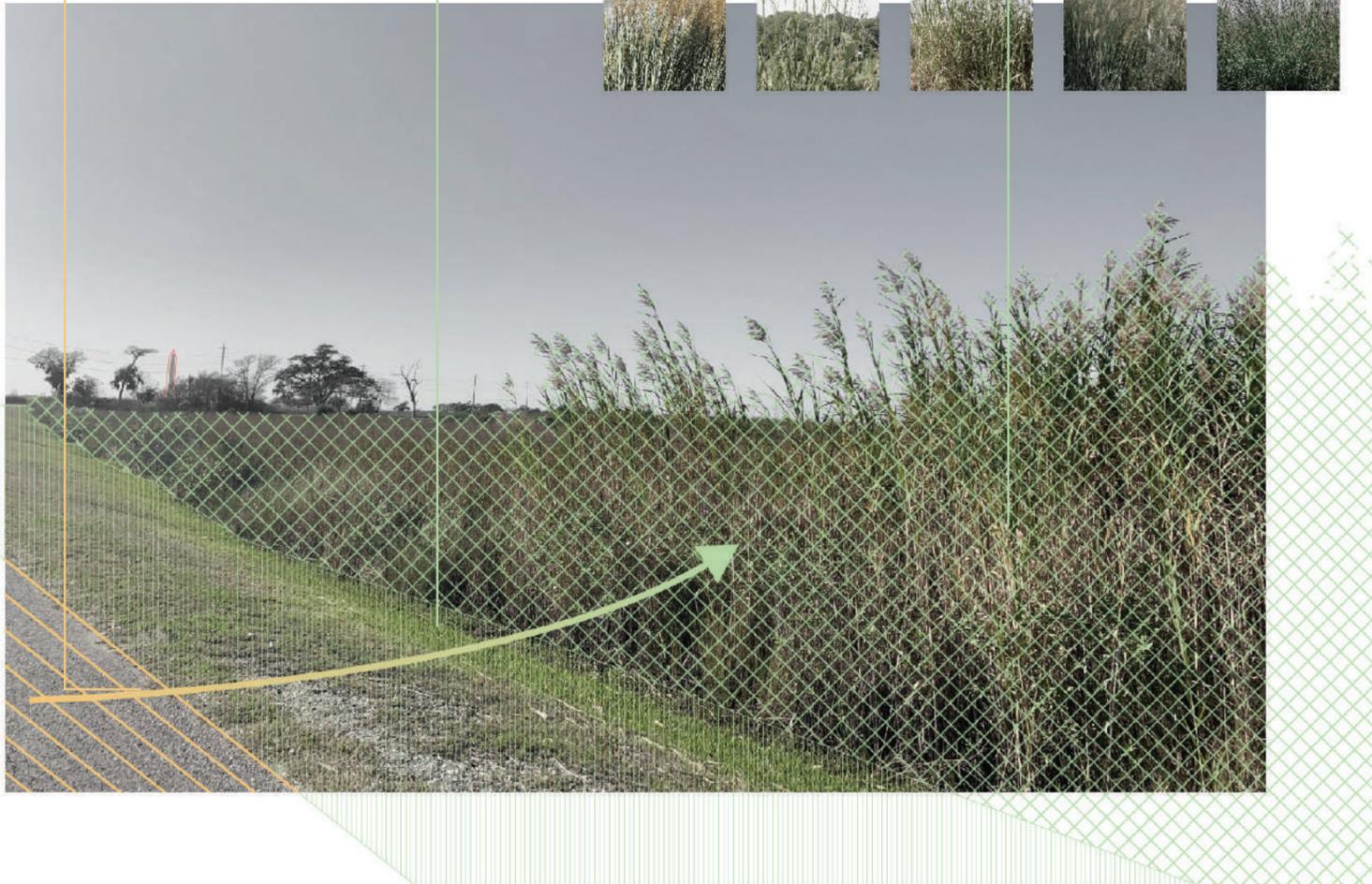
WATER SEQUESTRATION

Rain water as it falls is absorbed into the ground, reducing flooding by absorbing a percentage of water that is dropped from rain. A rain collection system on a building will create a the same effect.



WILDLIFE HABITAT

Ground is the life line for many native species. Migratory birds rely on it for food during their travels north and south. Native plants also flourish in their native Texas habitats



Layers: WATER

This layer consists of the backbone of the petroleum industry in Houston. Where the ship channel makes up Houston's largest connection to the world. Water also causes the flooding that has come to define this city in a different way.



ALLIGATOR SNAPPING TURTLE

Eats mostly fish causing it to consume large quantities of dioxins and other pollutants. It is listed as threatened species according to the TPWD.

BLUE CRAB

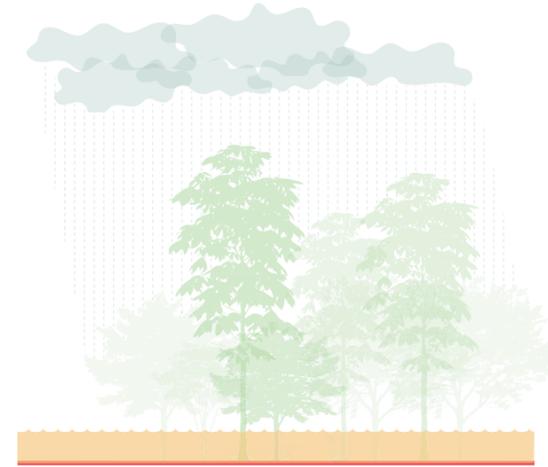
A filter feeder that sifts through mud for food, causing it to intake a large quantity of chemicals that pollute the floor of the ship channel. Children and pregnant women are advised to avoid all fish and crab from the port because of the pollution.

OIL TANKER

Every year more than 247 million tons of cargo travel in and out of the Port of Houston, on 8,200 vessels and 215,000 barges.

MUD CATFISH

A filter feeder similar to the blue crab consumes large amounts of pollutants in the water. It is recommended by the Galveston Bay Foundation to not eat more than 8 ounces of fish because of the high levels of dioxins.



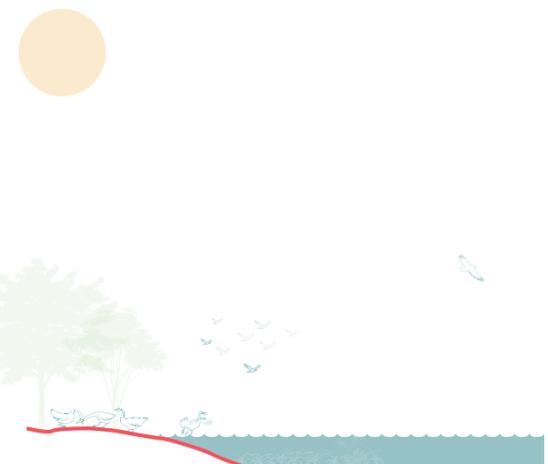
FLOODING

When rainfall overwhelms the bayou system flooding occurs destroying homes and property. Flooding should be considered when designing a building in Houston



PLANT LIFE

Water is needed as the basis of all plant life. This can be utilized in green houses and water collection systems



WILDLIFE HABITAT

Water is the life line for many native species. Migratory birds rely on it for food during their travels north and south. Fish and crabs rely on the water and can be greatly effected by changes to it.



Program: **HUMAN**

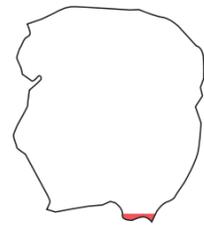
Buildings for use by humans to live and work in. These programs relate in scale and function to what a human needs.

RESEARCH LABORATORIES

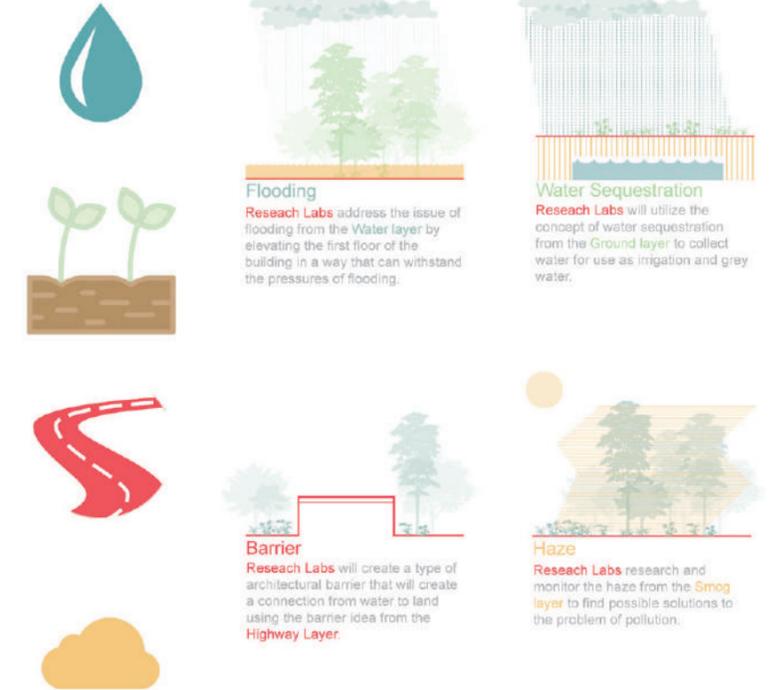
The research laboratories objective is to analyze, document, and find solutions for pollution in the air water and soil of the Houston Ship channel. By combining chemistry research and biology research the labs can be suited for multiple challenges. The labs will identify

- Square Footage 75,000 sq ft
- Acres 1.7
- Occupancy Type B
- Water Closets 1 per 50
- Drinking Fountains 1 per 100
- Energy Usage 5,625,000 kwh per year
- Workers 90 Researchers

Goal: Research the effects that the petrochemical industry is having on the surrounding water, air, and soil



- Collecting data of chemicals and animals that are in the air
- Looking at what chemicals are being released and how controlled they are upon release
- Seeing what the soil is made of and how to make use of it
- Monitoring the water in terms of pollution levels and flood levels

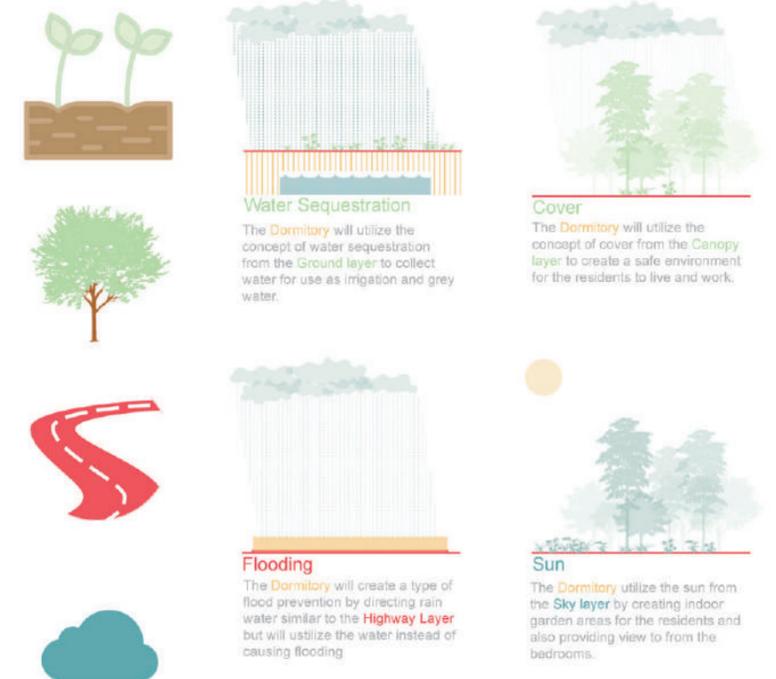
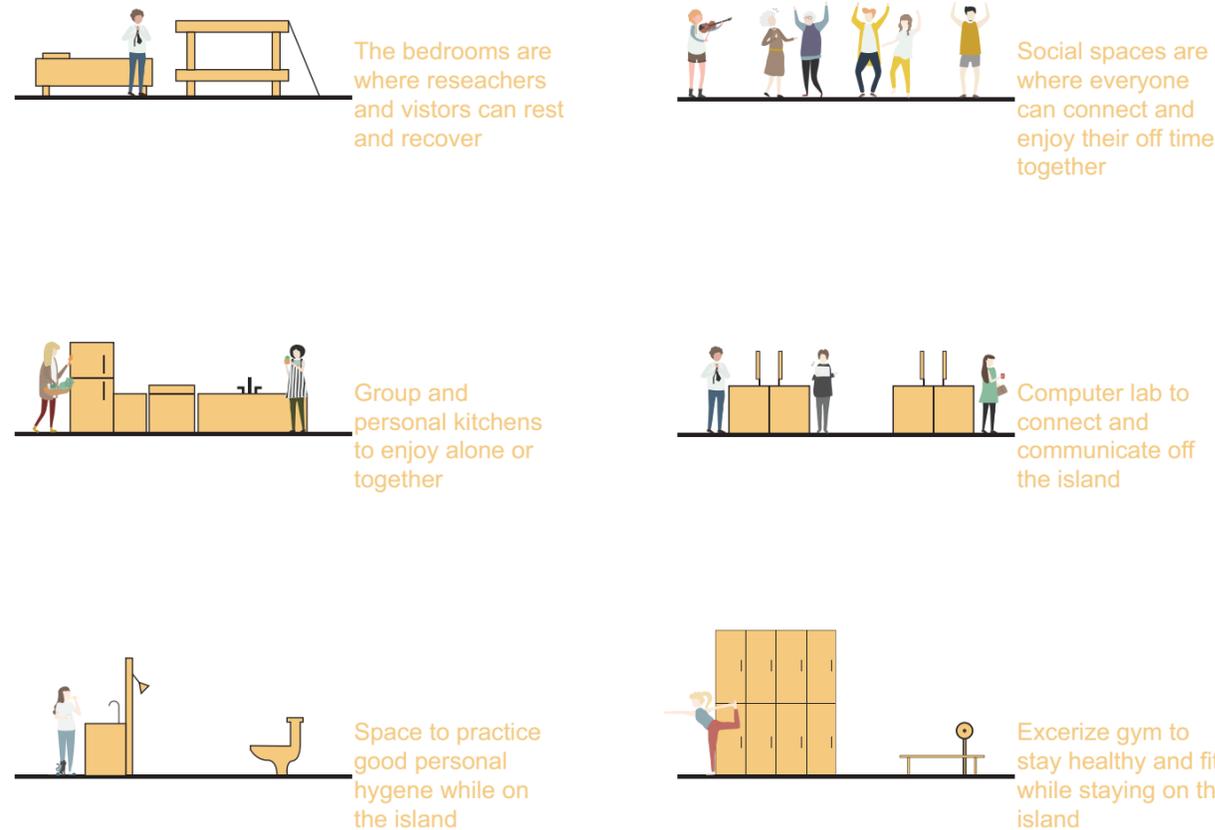
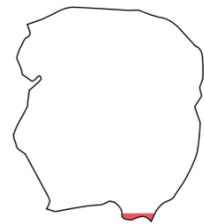


DORMITORY

The Dormitory serves as sleeping for the researchers who live on the island as well as any visitors that wish to frequent the island. The Dorms contain the dining hall, the bedrooms, bathrooms, gym, and lounge. This is where the researchers can relax in their off time,

- Square Footage 60,000 sq ft
- Acres 1.4
- Occupancy Type R-2
- Water Closets 1 per 10
- Drinking Fountains 1 per 100
- Energy Usage 105,000 kwh per year
- Residents 150 people

Goal: Provide the residents a safe and relaxing place to enjoy their time on the island.



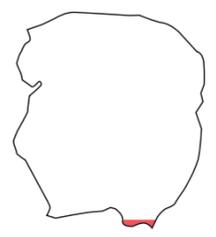
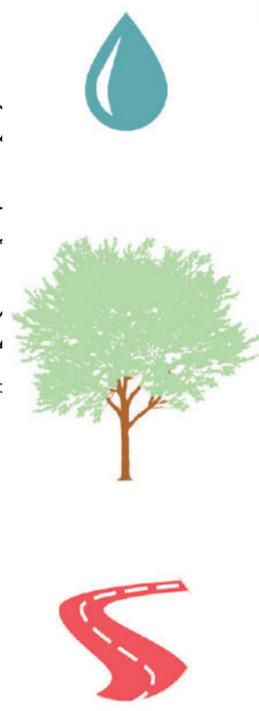
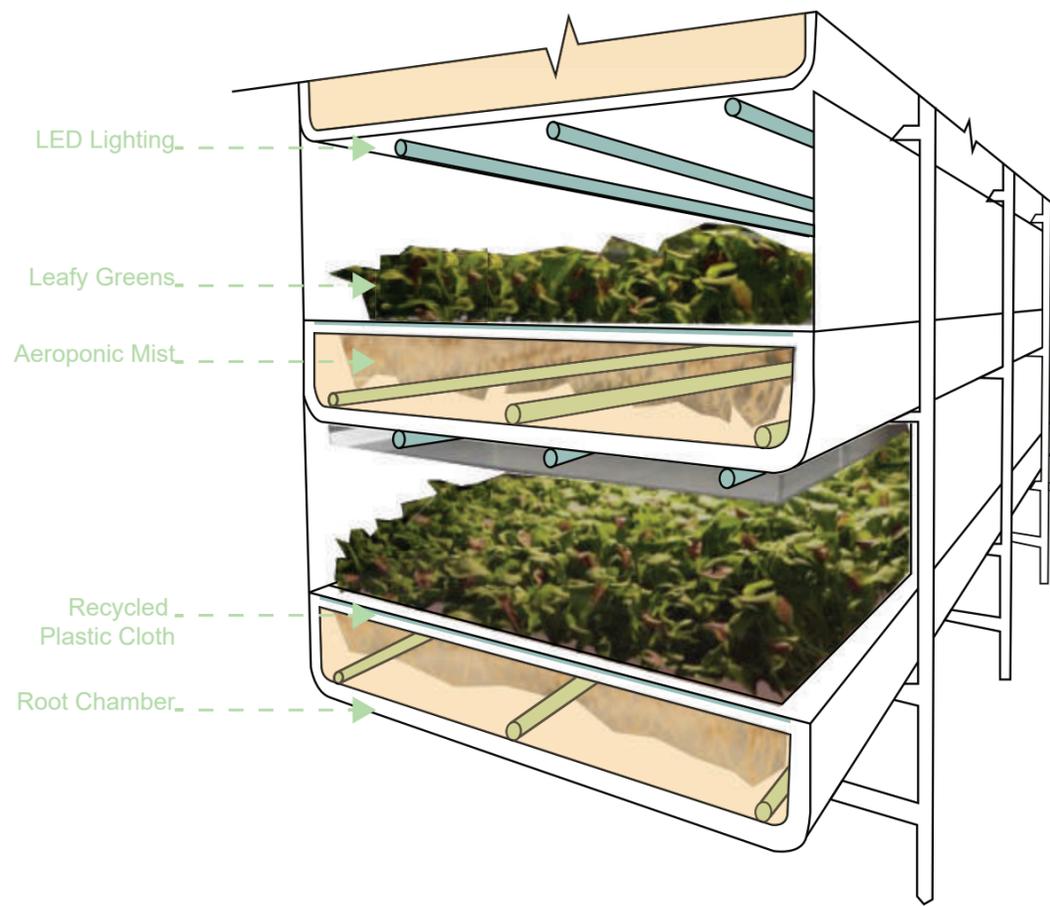
Program: **MECHANICAL**

These programs relate to function that are mechanical in nature. Utilizing technology to be more sustainable in farming and solar energy.

VERTICAL FARMS

The vertical farm uses a recycled plastic cloth to grow the plants. The roots grow into the root chamber to be misted with water. This process reduces water consumption by up to 95% compared to traditional farming. The plants are grown under LED lights that cause the farms to consume large amounts of energy. The best plants to grow are leafy greens and herbs.

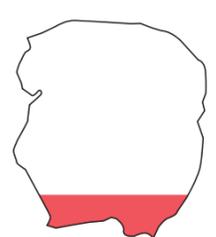
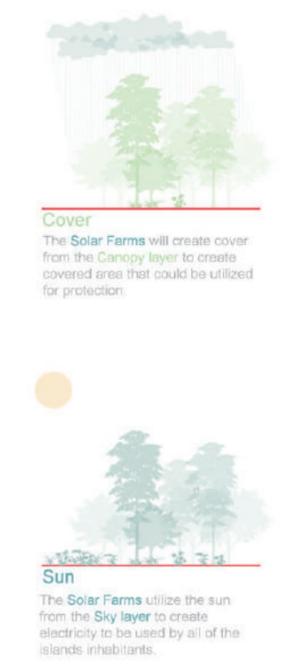
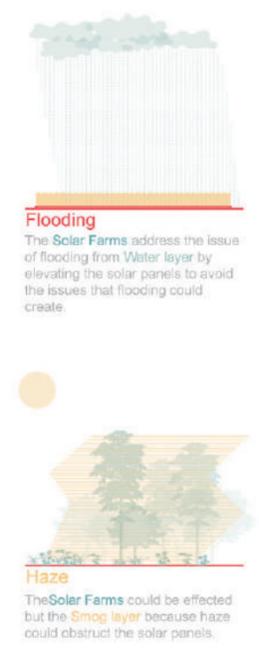
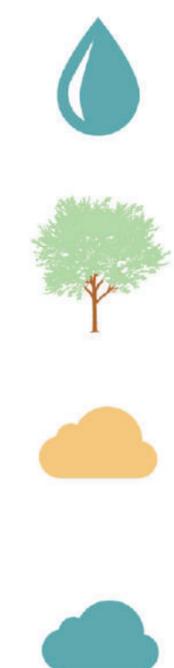
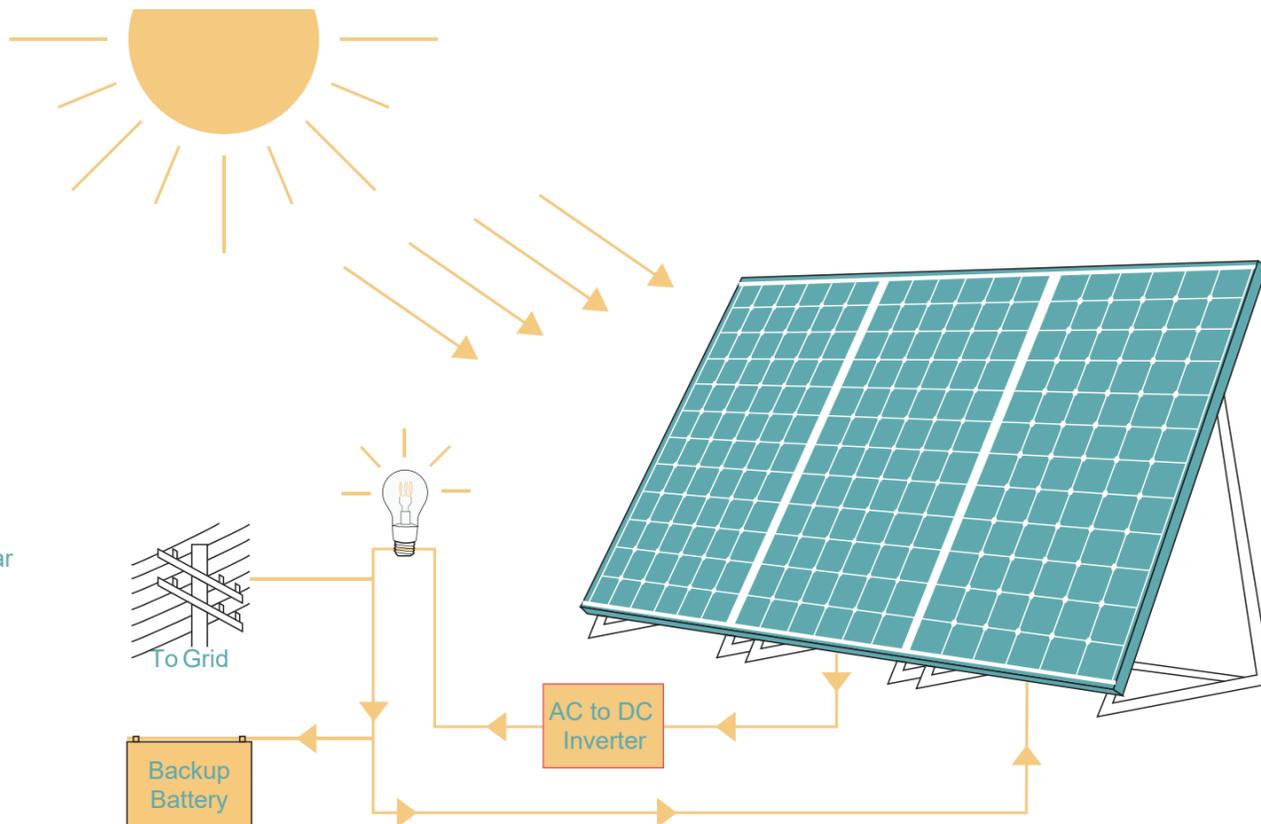
- Square Footage: 70,000 sq ft
- Acres: 1.6
- Occupancy Type: F-1
- Water Closets: 1 per 100
- Drinking Fountains: 1 per 400
- Energy Usage: 24,500,000 kwh per year
- Water Use: 520,257 L per year
- Goal: Grow food for the residents of the island in a sustainable and responsible way



SOLAR FARMS

Creating on average 1 MW per 5 acres the solar farm can power the entire island with around 100 acres. 1 MW is the equivalent of 1.7 million kwh per year. The island would use a max of 30,305,000 kwh per year, the solar farm would create 34,000,000 kwh per year. The spare could be sold back to the grid as there is already power connected to the island.

- Square Footage: 4,356,000 sq ft
- Acres: 100
- Occupancy Type: N/A
- Water Closets: N/A
- Drinking Fountains: N/A
- Energy Production: 34,000,000 kwh per year
- Water Use: N/A
- Space for creating energy for the entire island to utilize.



Program: **NATURE**

These programs relate to nature, looking at the relationship of native species of plants animals and soil in the context of the Houston Ship channel.

REMEDIATION FARM

The Remediation Farm is intended to filter water, air, and soil by planting native plants that have phytogetic properties. Sunflower is one that is able to remove large amounts of pollution from the soil. Poplar trees absorb large amounts of water and in the process the impurities in it. Willow trees remove gas and other impurities. These plants combined will filter the island.

Square Footage
15,041,268 sq ft

Acres
345

Occupancy Type
N/A

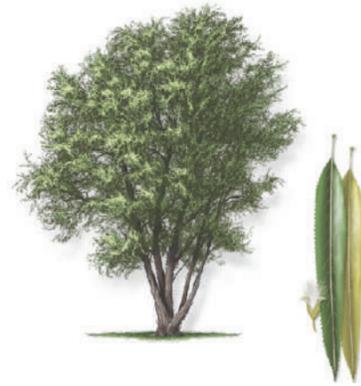
Water Closets
N/A

Drinking Fountains
N/A

Energy Usage
N/A

Water Use
-Native plants are grown requiring no water.

Area of land that is intended to filter impurities out of the air, water, and soil.



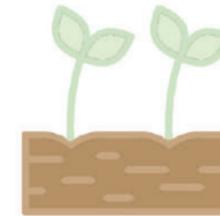
Black Willow is native to Texas.

Absorbs:
-diesel fuel
-Metals like Cd, Ni, and Pb



Sunflower is a plant seen dispersed along Texas roads as well as in fields.

Absorbs:
Heavy Metals like Pb, Zn, N, P, Cd, Cu, Mn
Radioactive metals like Dioxins.



Growth Medium
The Remediation Farm will utilize the Ground Layer as a growth medium to foster a generation of plant life that will revitalize the soil.



Wildlife Habitat
The Remediation Farm will create wildlife habitat from Ground layer to provide animals an area of safety and protection.



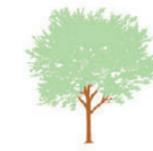
Easter Cottonwood is a Texas native Poplar tree. Takes in large amounts of water.

Absorbs:
-tetrachloride
-benzene
-toluene
-o-xylene



Buffalo Grass is found on Texas roadsides.

Absorbs:
-benzene
-toluene
-o-xylene
-Pesticides
-Herbicides



Cover
The Remediation Farm will create cover from the Canopy layer to retain the soil and fill it with nutrients while the plants grow.



Haze
The Remediation Farm will clean the haze from the Smog layer creating air that is safe to breathe.



WILDLIFE HABITAT

Square Footage
17,420,000 sq ft

Acres
400

Occupancy Type
N/A

Water Closets
N/A

Drinking Fountains
N/A

Energy Usage
N/A

Water Use
-Native plants are grown requiring no water

Provide resting grounds for migrating birds and creates habitat for local fish, birds, and shellfish



Huisache Tree (Acacia Farnesiana)
Highly salt water resistant and a native Texas tree.



CRABS
Blue Crab
Stone Crab
Hermit Crab
Mud Crab
Fiddler Crab
Horn Shell
Mussel



WADING
American bittern
Black rail
Black-crowned night-heron
Cattle egret
Clapper rail



Coastal Live Oak (Quercus Virginiana)
Salt water resistant and natural habitat



Fish
Hardheaded Catfish
Southern Flounder
Atlantic Croaker
Black Drum
Red Drum
Spotted Seatrout



EGRETS
Great blue heron
Great egret
Green heron

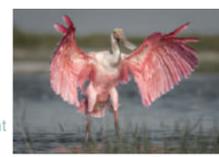
HERONS
King rail
Little blue heron



Dwarf Pampas (Sabal Minor)
Holds soil together and creates habitat



DIVING
American white pelican
Anhinga
Brown pelican
Common loon
Cormorants
Double-crested cormorant
Loons
Neotropic cormorant
Pelicans



RAILS
Reddish egret
Roseate spoonbill
Sandhill crane
Snowy egret
Sora
Tricolored heron



Saltmarsh Cordgrass (Spartina Alterniflora)
Hold soil together and adds nutrients to the soil over time.



GULLS
Black skimmer
Caspian tern
Forster's tern
Gull-billed tern
Laughing gull
Least tern
Royal tern
Sandwich tern



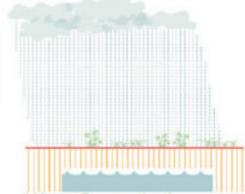
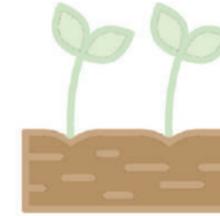
WADING BIRDS
White ibis
White-faced ibis
Wood stork
Yellow rail
Yellow-crowned night-heron



Wildlife Habitat
The Wildlife Habitat will utilize the Water layer as a wildlife habitat that can attract and provide water born animals and plants with shelter.



Wildlife Habitat
The Wildlife Habitat will create wildlife habitat from Ground layer to provide animals an area of safety and protection.



Water Sequestration
The Wildlife Habitat will allow water to filter through the soil from the Ground layer to sequester water underground in aquifers when it would normally flood.

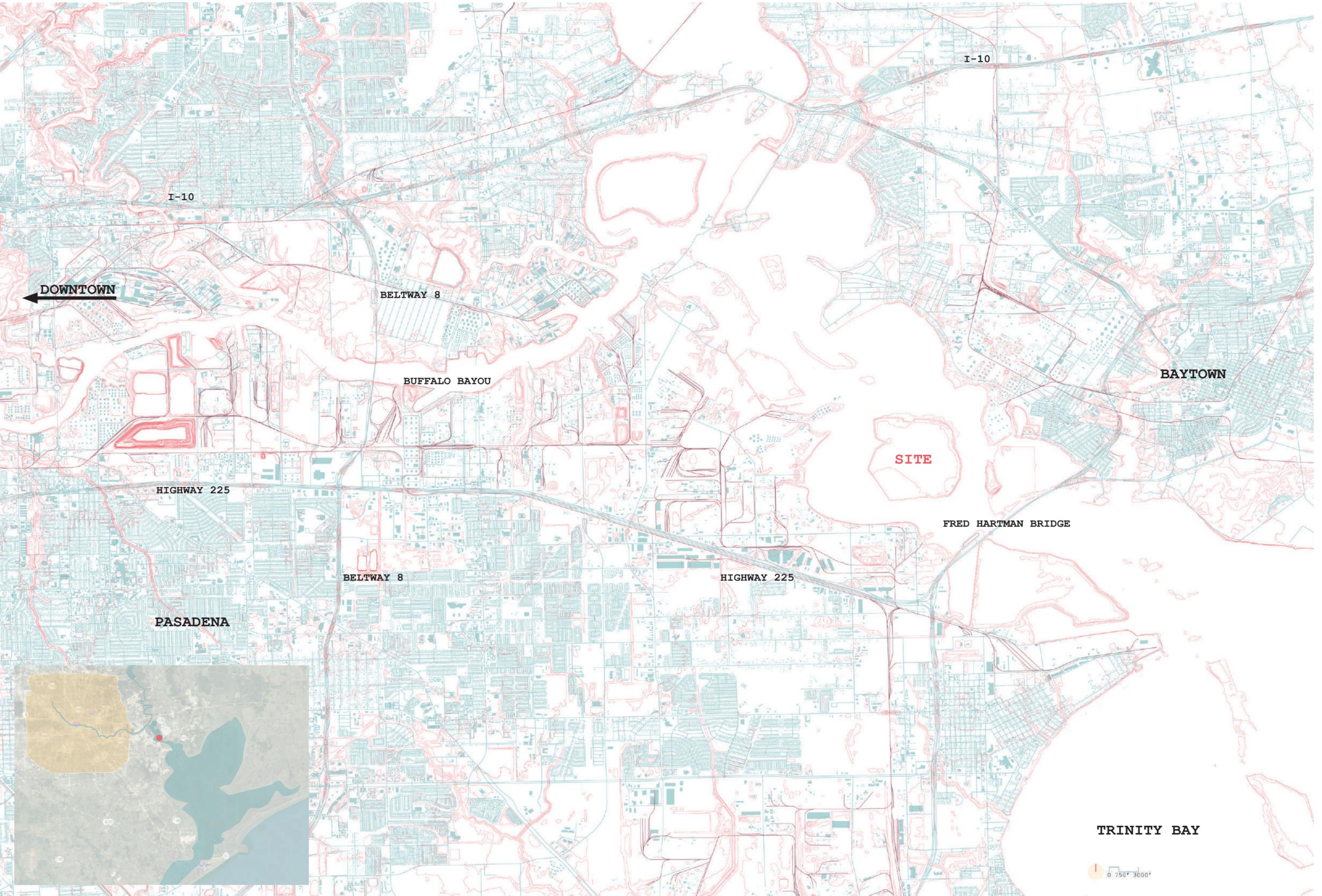


Cover
The Wildlife Habitat will provide protection, in the form of cover from the Canopy layer, to the soil and wildlife on site.



SITE

Down stream of Buffalo Bayou and up stream of Trinity bay the site sits at a key point between Houston and the Gulf of Mexico.



Site: **SITE PLANING**

The site is Alexander island in the middle of the Houston shipping channel. Right outside of Baytown city limits the site is surrounded by many industrial complexes.

SOLAR FARM

The solar farm makes up 5 acres of the site and generates over 34 million kwh per year. This is enough to power the entire site and sell back to the grid.

WILDLIFE HABITAT

Using native species of trees and grass that are resistant to salt water and can add nutrients back into the soil. This will foster a sanctuary for migratory birds and native fish and crabs.

ISLAND ROAD

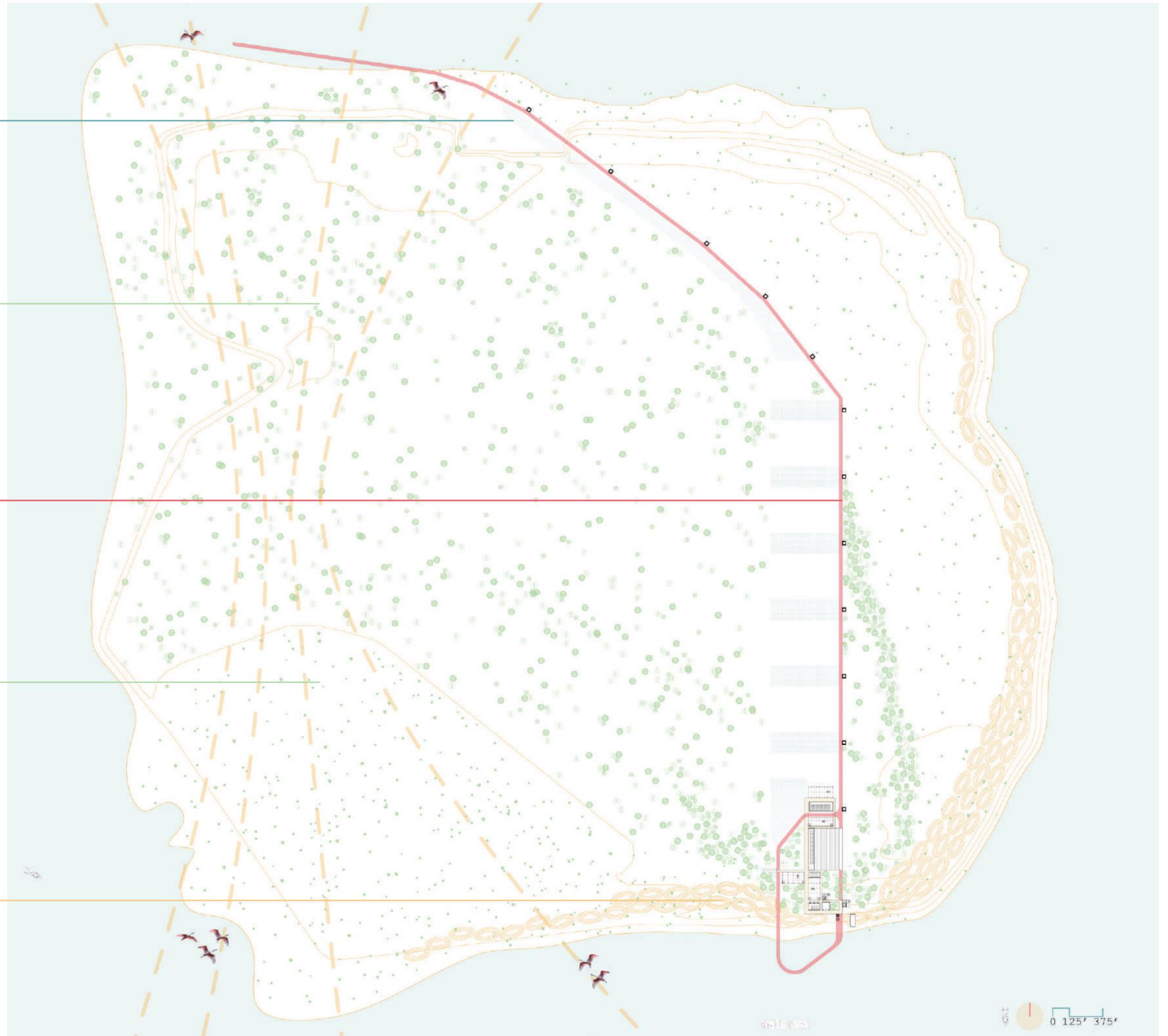
On site the Island Road would serve as connection to the different areas of the site. The loop around the buildings is exactly .5 miles ideal for a running track as well as a road.

REMEDIATION

This area would consist of seaweed bales on the perimeter to create dunes that can resist storm surges, along with an assortment of native plants that filter heavy metal pollution out of the soil and water.

SEAWEED BALES

Seaweed bales are brought in to strengthen sand dunes and provide added support to incoming storm surges and flood events.



Site: **SITE PLAN**

The building complex utilizes opportunities from all of the layers of Houston to integrate with the site.

SOLAR FARM

The solar farm makes up 50 acres of the site and generates over 34 million kwh per year. This is enough to power the entire site and sell back to the grid.

RESEARCH LABS

Research labs that focus on biology. These labs will analyze microbe in the soil and water to see how it is responding to efforts.

ISLAND ROAD

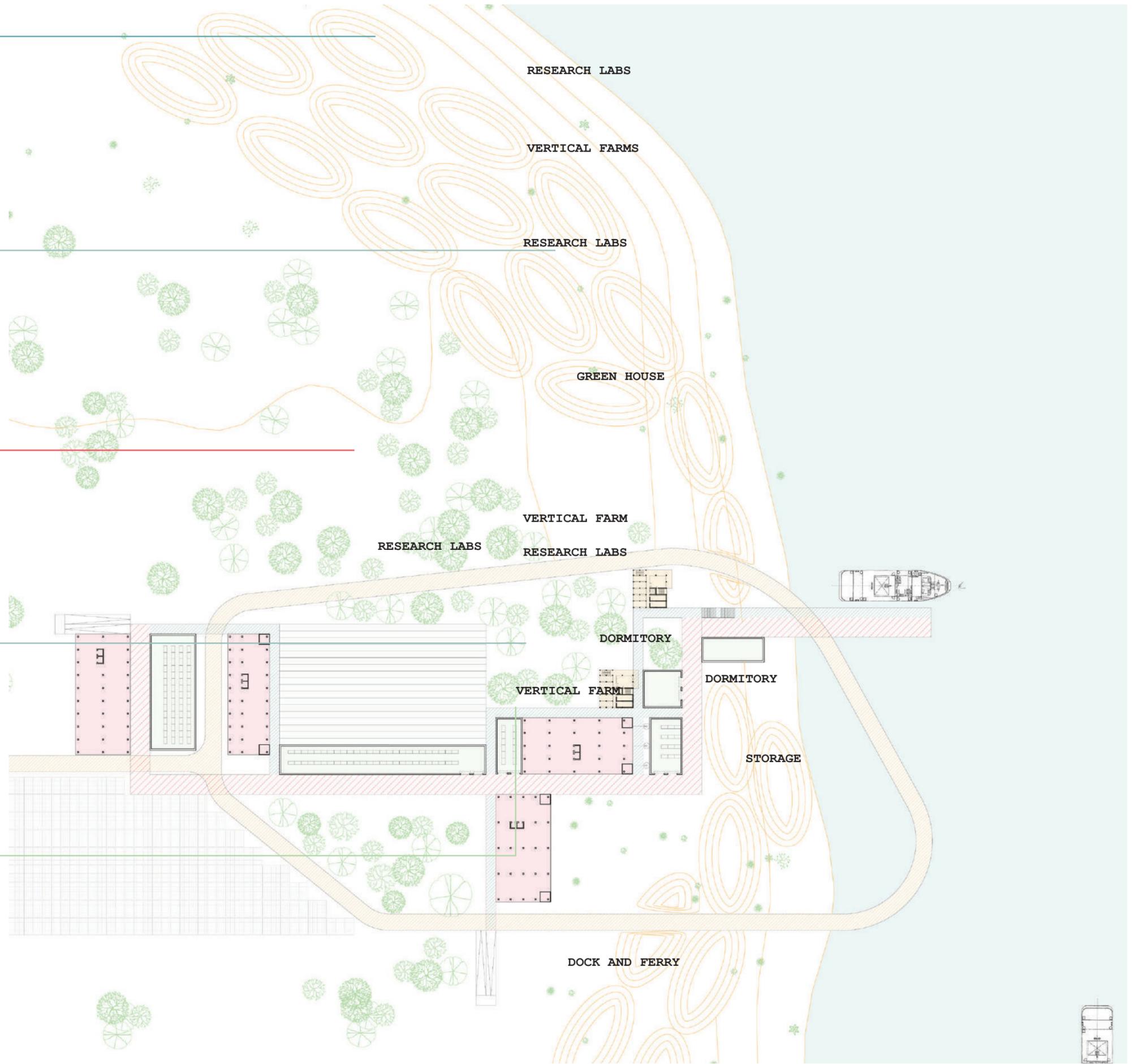
On site the Island Road would serve as connection to the different areas of the site. The loop around the buildings is exactly .5 miles ideal for a running track as well as a road.

RESEARCH LABS

Research labs that focus on Chemistry. Look at the molecular makeup of chemicals and how they are broken down through various processes.

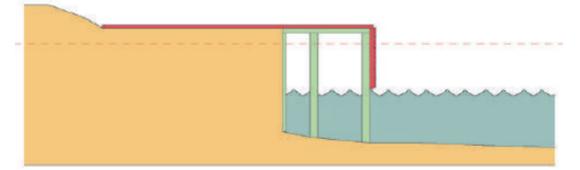
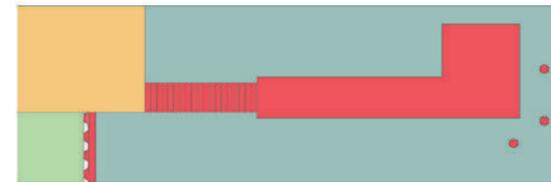
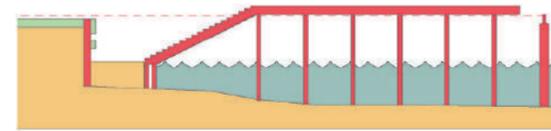
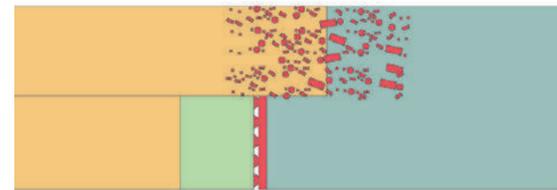
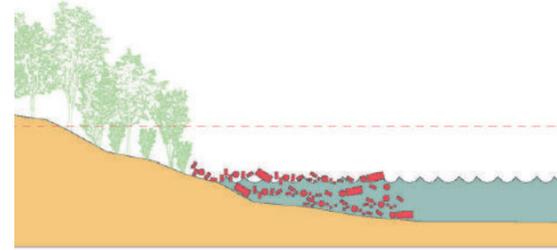
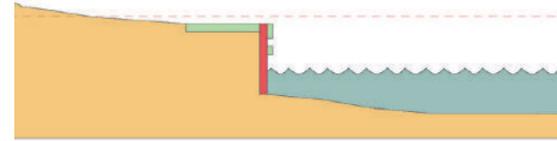
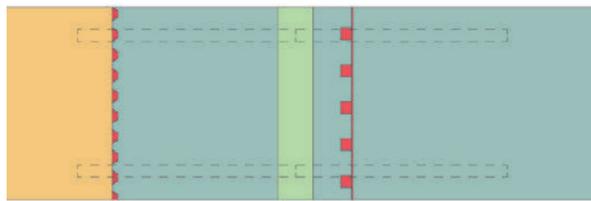
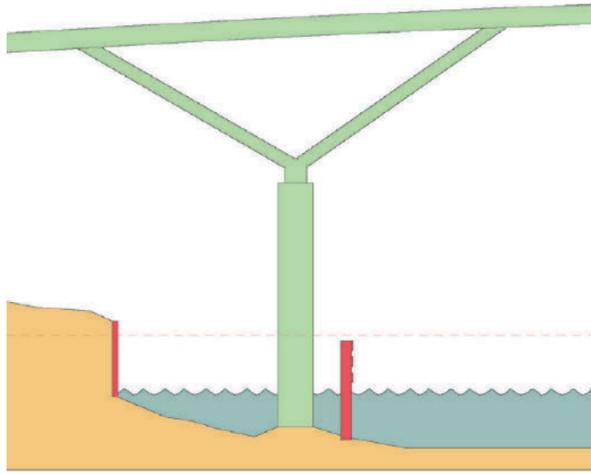
VERTICAL FARMS

Indoor farms that run entirely on electrical light but use 80 percent less water than traditional farming. Solar power on site would be able to create the power needed.



EDGE CONDITIONS

Different edge conditions are found throughout the Port of Houston. These examples are the most prevalent and are a combination of the different Houston layers in different ways.



BRIDGE MERGING WITH WATER

The bridge structure drops down from the above overpass and links into the water layer. The overpass itself sits on the highway layers and extends out of the canopy layer

HARD AND SOFT EDGE CONDITION

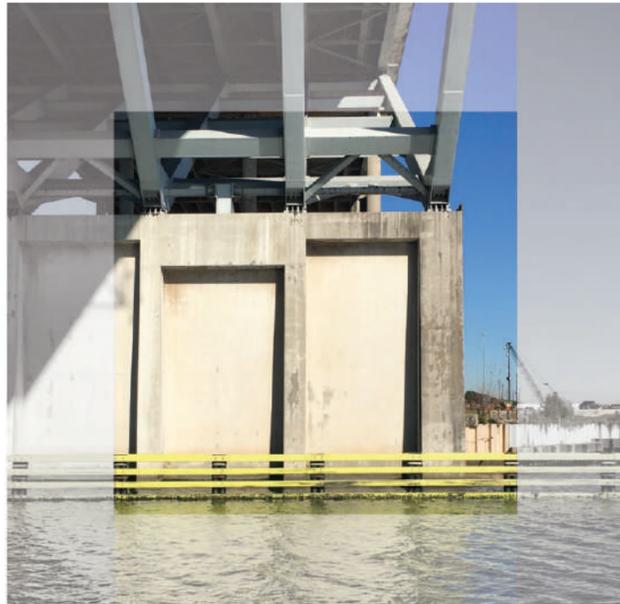
The hard edge is made out of steel and concrete preventing soil erosion and allowing boats to approach the ground's edge. The soft edge is uncontrolled with the soil eroding into the water and trash accumulation merging the ground and water.

DOCK EDGE

The dock edge is an extension of the ground layer reaching out over the water layer creating a tension between the two. This alters as the water layers fluctuates.

FOLDED HARD EDGE

The hard edge made of steel and concrete folds from a concrete floor that merges into the water layer.



Entry Sequence: **VIEW STANDING ON DOCK** looking North

Entry to the site would start at the dock. This view is from the south dock looking at the building complex.

VERTICAL FARMS

Inset into the ground layer this building resists storm surges with its rigid concrete structure. Links the ground, canopy, and highway.

RESEARCH LABS

The labs are elevated to the canopy layer to avoid flooding. Linking the canopy, highway, smog, and sky.

PASSIVE STRATEGIES

The lab buildings and dormitory utilize passive strategies that collect water. The Labs also passively cool themselves through a large thermal wind tower that pulls cool air into the building.

DORMITORY

Multi floor residential tower that uses shipping containers that are found on an abundance in the Port. They will be re-purposed into a modular living tower.

ENTRY DOCK

The dock links the ground layer to the water layer looking back at the edge conditions of the Port.



DORMITORY

Dormitory for researchers and island visitors. The elevated structure and the shipping container rooms make the dorm the least permanent building type on the island. Allowing for changes over time as the site needs.

SHIPPING CONTAINER ROOM

The shipping container can be re-purposed to fit a queen bed room and a kitchen.

PUBLIC BATHROOM AND SHOWERS

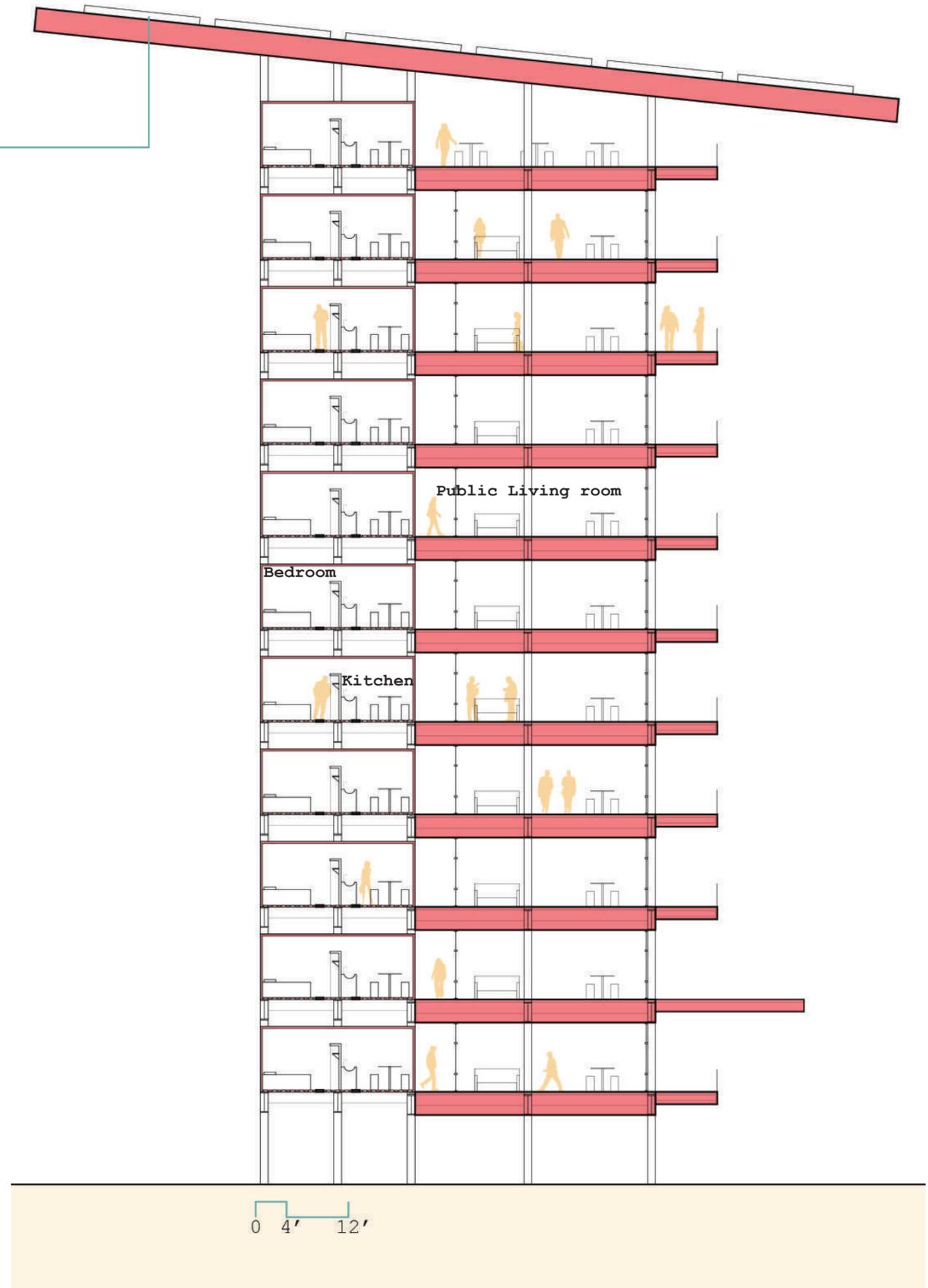
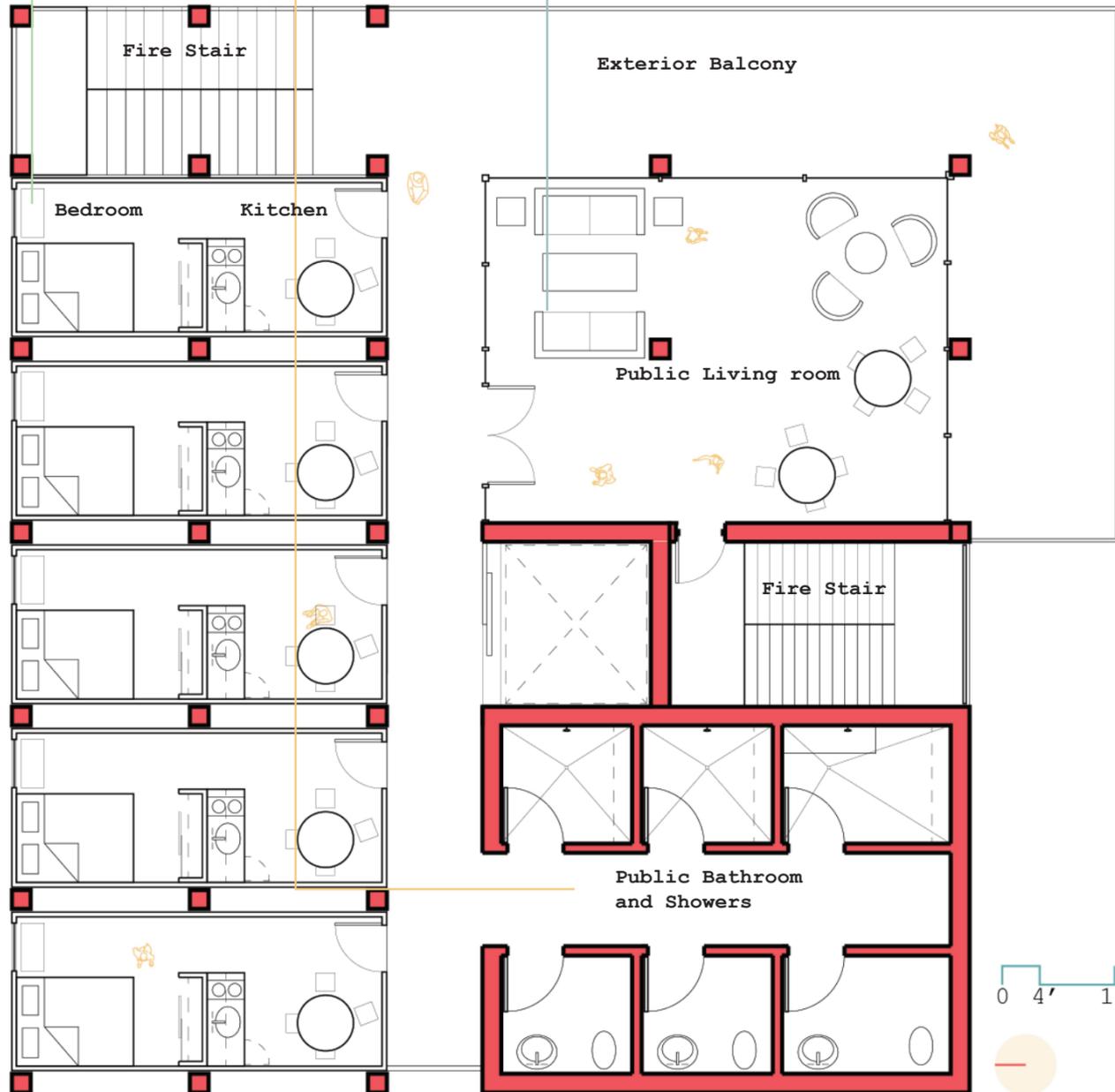
Showers and bathrooms are public to be accessed by the residents of the floor.

PUBLIC LIVING

Public gathering and living space. A spec for residents to gather together and interact.

SOLAR ROOF

The roof of the dormitory is a 5 degree angle facing south to allow for optimal sun angles.



VERTICAL FARMS

Indoor farms that will grow leafy greens and herbs for the island and resale at all times of the year. Running on solar generated electricity and using water collected on site the vertical farms will completely self dependent. The concrete structure makes it resilient and the most permanent building type on the island.

POWERED LIFT

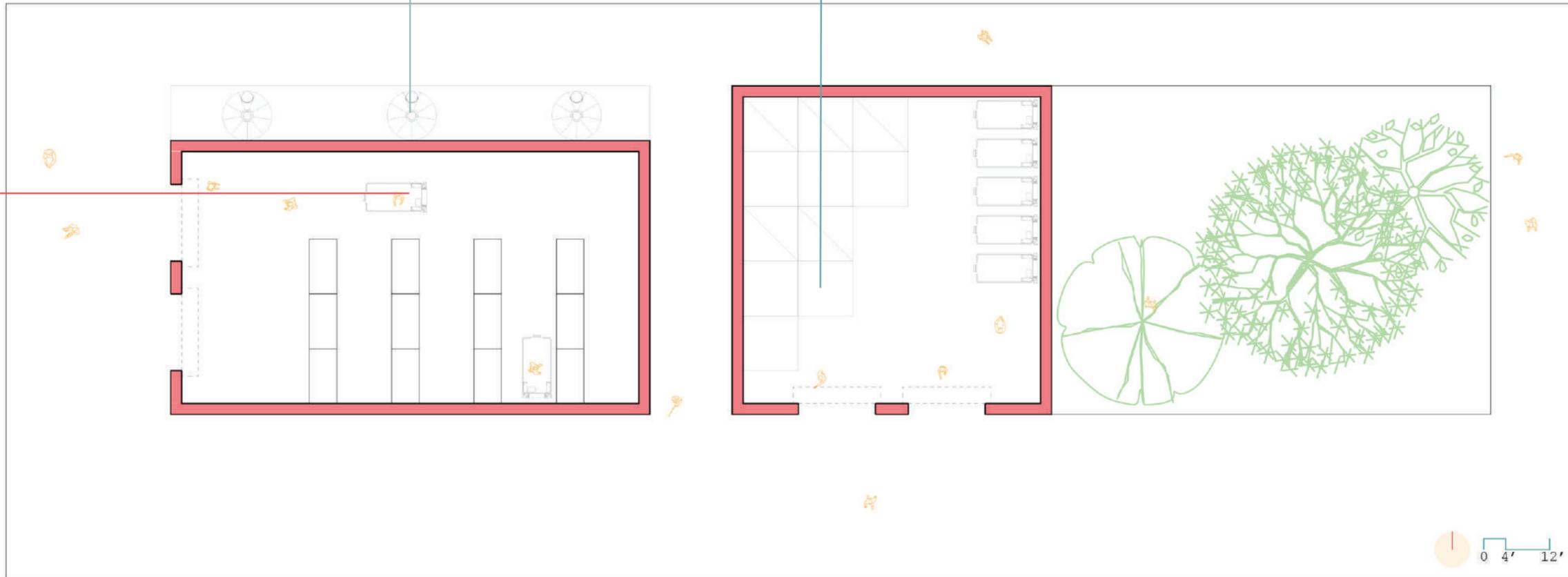
To access all of the planting tray as powered lift will be utilized.

WATER STORAGE

Water gathered on the roof of the research labs will be stored in three 10,000 gallon tanks.

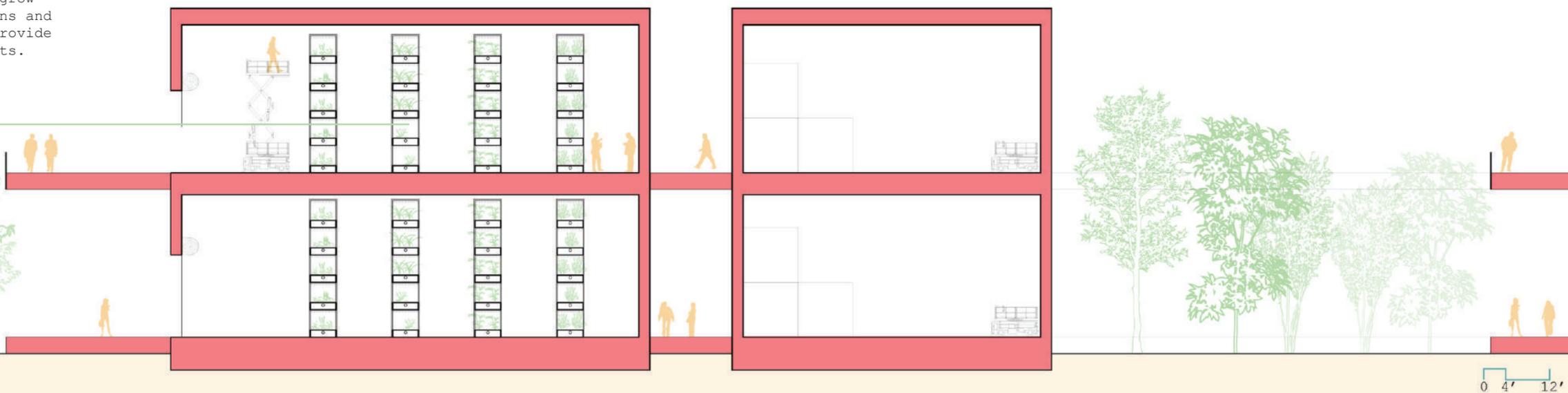
STORAGE

The roof of the dormitory is a 5 degree angle facing south to allow for optimal sun angles.



LEAFY GREENS

The vertical farms will primarily grow leafy greens and herbs to provide to residents.



RESEARCH LABORATORIES

The research labs seeks to look at problems of the Port of Houston and how to address them. The building type is elevated creating a strong rigid structure that can last floods and hurricanes. This is the second most permanent building type.

FOOD

DISTRIBUTION

Food grown on site and brought to the site would be given to the researchers in the cafeteria.

THERMAL CHIMNEY

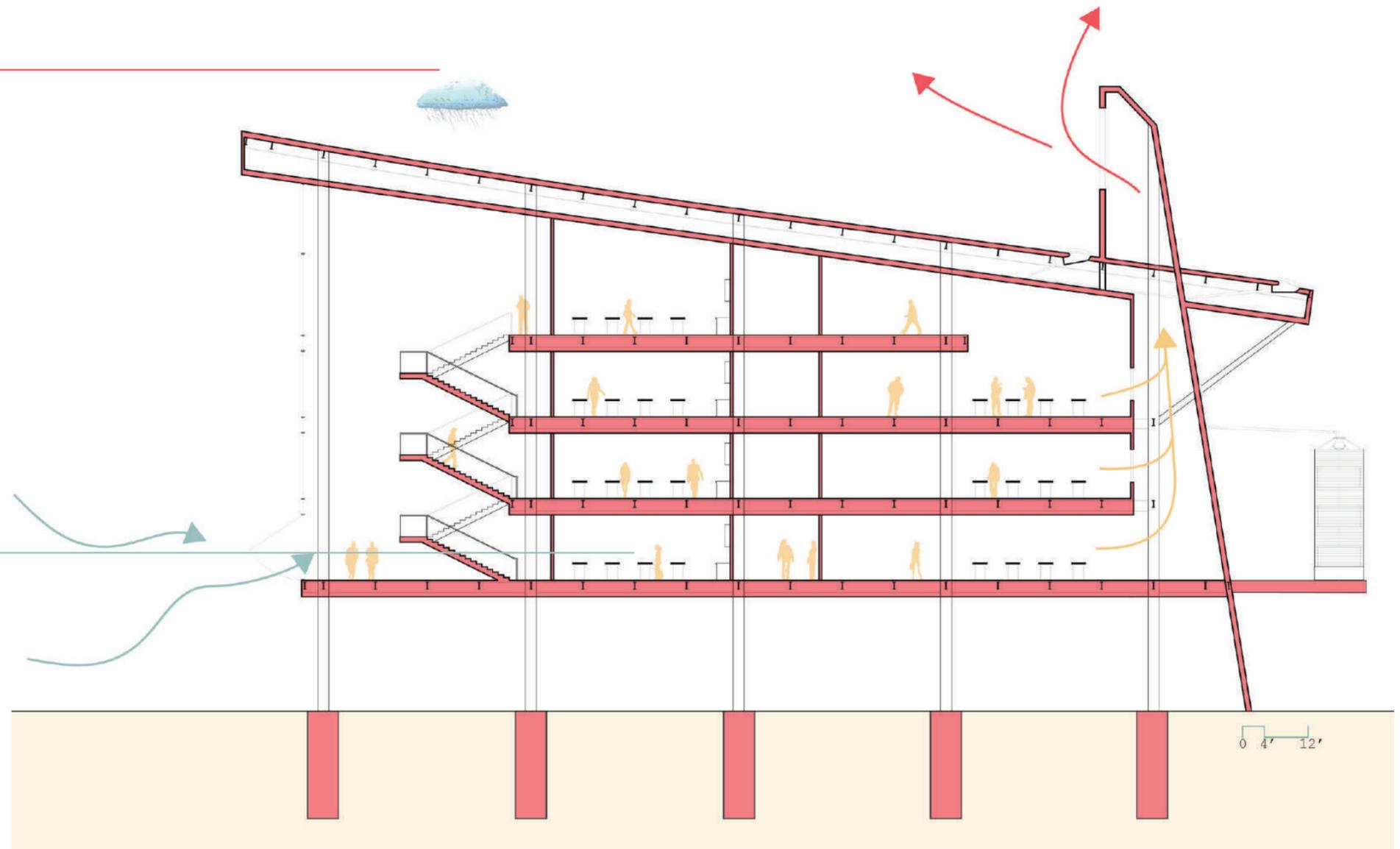
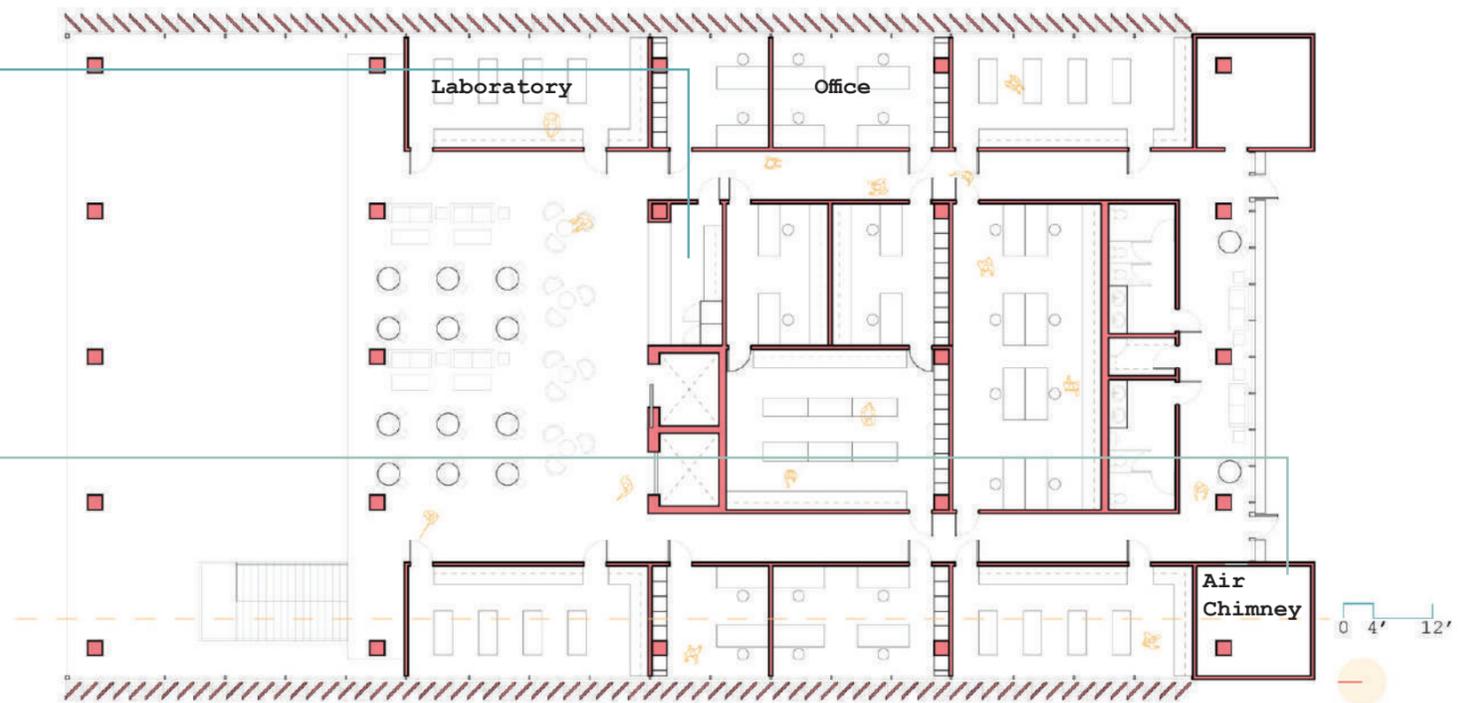
The thermal chimney heats up under the sun and warms the air inside of it. This creates a draft that pull cool air into the bottom and ejects the hot air out of the top.

RAIN COLLECTION

The rain on site would be collected on the roof of the research buildings. Each roof would be able to collect 800,000 gallons of water per year to provide for the entire site.

COOL AIR

Cool air is pulled into the building by rising hot air creating a cooling effect throughout the building.



RESEARCH ISO SECTION looking East

The research building is meant to be as efficient as possible. Utilizing thermal wind towers to cool the building and a water collection roof that will collect 851,000 gallons of water per year.

VERTICAL FARMS

Inset into the ground layer this building resists storm surges with its rigid concrete structure. Links the ground, canopy, and highway.

RESEARCH LABS

The labs are elevated to the canopy layer to avoid flooding. Linking the canopy, highway, smog, and sky.

PASSIVE STRATEGIES

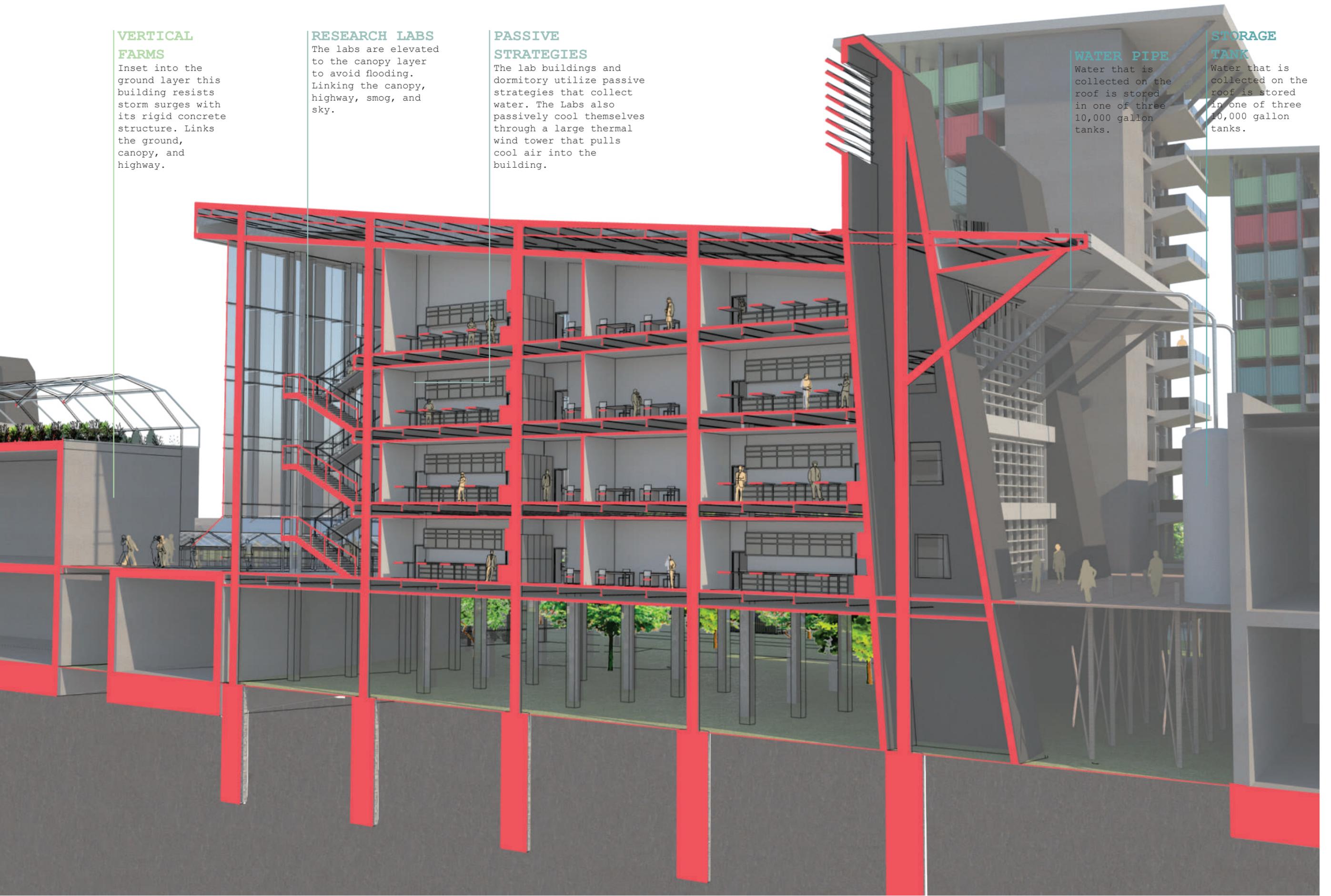
The lab buildings and dormitory utilize passive strategies that collect water. The Labs also passively cool themselves through a large thermal wind tower that pulls cool air into the building.

WATER PIPE

Water that is collected on the roof is stored in one of three 10,000 gallon tanks.

STORAGE TANK

Water that is collected on the roof is stored in one of three 10,000 gallon tanks.



ISO VIEW OF ALEXANDER ISLAND



SKY



SMOG



HIGHWAY



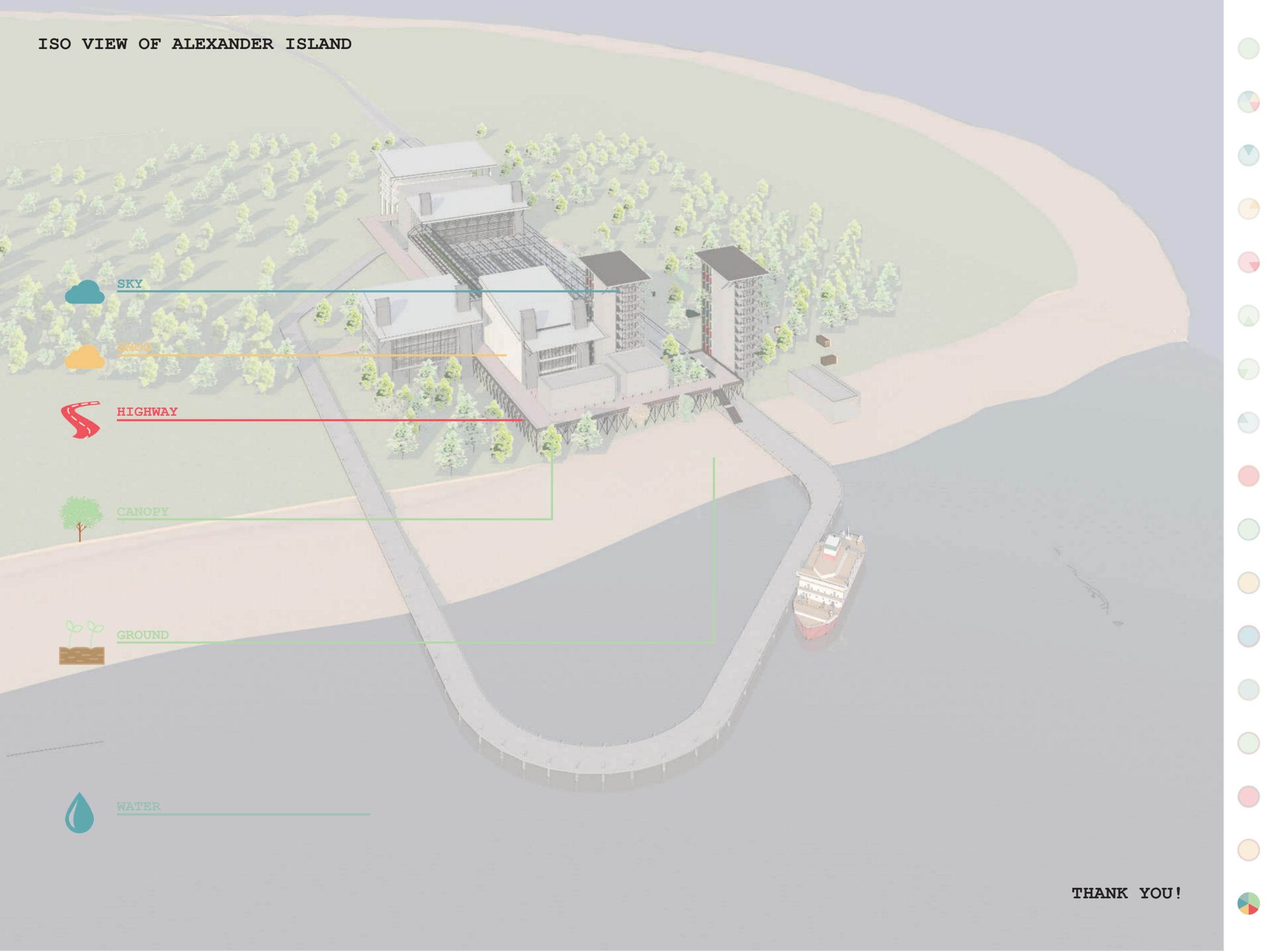
CANOPY



GROUND



WATER



THANK YOU!

