MISSISSIPPI RIVER PLUG-IN

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An Honors Thesis submitted to the Gerald D. Hines
College of Architecture and Design
in partial fulfillment of the requirements for the degree of

Bachelor of Architecture

in Architecture Major

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University of Houston
April 2022

Senior Honors Thesis
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Date of Oral Defense: _____ Location: _____

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Project Data

Mississippi River Plug-In
New Orleans, Louisiana
Topics: Climate Change, Coastal Resilience, Floating Architecture, Infrastructure, and Urbanism.

Preface

The Mississippi River Plug-In project seeks to extend the urban fabric of the French Quarter onto the Mississippi River. It does not provide solutions to the issues of climate change, but rather explores how architecture can allow for coexistence in a time where climate change becomes the most urgent question of our generation.

Big Picture: Climate Change

Climate Change is one of the defining factors of our generation's times. While the cause and effects of climate change are well studied, how we deal with — or rather — how we live with climate change is filled with uncertainty. The landscape of the world continues to change as a result, and a solution is far out of reach, perhaps even impossible within the next several generations.

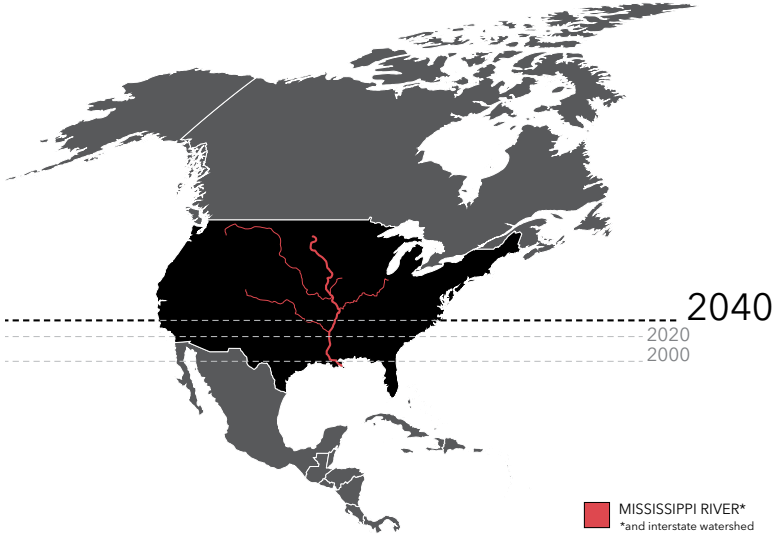
The key understanding of climate change is that it is not isolated; it has factored in with issues that lie on a spectrum from global development of third-world nations to the response of the daily consumption of consumers, none of which has correct answers, only a limitless amount of perspectives.

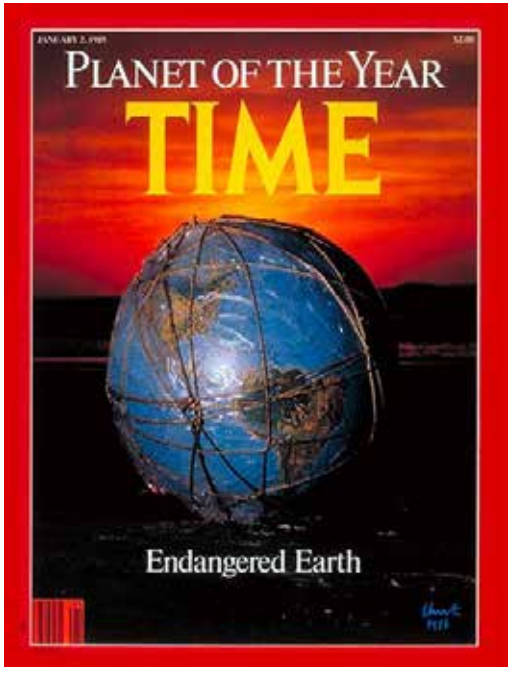
Simply stated: climate change will continue to develop, despite the best efforts of global treatises. Developing nations do not have the infrastructure to adopt renewable energy sources, and it would be unrealistic and inequitable to stunt the growth of these nations through preventing the use of cheap fossil fuels.

However, leaders across the world do recognize the dangers and effects of climate change; many of which have already committed to achieving sustainability goals. This is done through zero-net carbon projects, subsidies in the renewable energy market, and investments in infrastructure and technology to advance renewable energy. Such awareness is the bare minimum in recognizing obtainable goals, a great first step in creating tangible change.

Climate change will continue to develop; the climate around the world will continue to fluctuate, sea levels will rise, and weather will become more extreme and unpredictable. Coastal cities are at immediate risk, with already an increasing numbers of climate related events, including the increased intensity of weather related events such as hurricanes and tropical storms.

Things will get better, but until then, finding a way to live with climate change will be a realized necessity for the current and future generations.





A 2019 Time Magazine issue (Left) devoted entirely to climate change, coming 30 years after their first call to action in 1989 (Right).

Big Picture: The Mississippi and Louisiana

The Mississippi River is a critical infrastructure that runs the length of the United States. Both historical and geopolitical, the river holds great importance and is a great economic boon; numerous industries and cities rely on this river.

However, the Lower Mississippi River is victim to sea-level rise and land loss. The ongoing loss of the Louisiana Coast and the Mississippi River Delta is compounded by human activity through both engineered alterations and ecological catastrophes such as oil spills and industrial pollution. Addressing this coastal crisis can be countered through specific and focused efforts that address long term restoration plans to preserve the natural barrier of the delta.

To specify a targeted approach, it begins with recognizing the Mississippi River in its entirety, a transnational body of water: then to the Lower Mississippi River, a region; Louisiana, a state; New Orleans, a city; and finally the French Quarter, a district; specifically the riverfront within the French Quarter.

Such a pyramid model-tiered approach allows for focus on one specific community, amongst the hundreds along the river, to apply a defined approach which responds to its context without diverging from the big picture.

MISSISSIPPI RIVER

(Left) Mississippi River overflowing from its banks between Mississippi and Louisiana.
(Right) New Orleans looking south beyond Algiers Point, the curvature of the Mississippi River is well defined.

NEW ORLEANS

(Left) New Orleans looking north-east, with Lake Pontchartrain in the background.
(Right) New Orleans city skyline and riverfront.

FRENCH QUARTER

(Left) Jackson Square in the French Quarter, vendors have set up on the pedestrian street.
(Right) Bourbon Street in the French Quarter, an active and packed night life.

The Lower Mississippi River

PAST, PRESENT, AND FUTURE FOR THE LOWER MISSISSIPPI

The Lower Mississippi River runs downstream of Cairo, Illinois to the the Gulf of Mexico, passing through southern Missouri, southern Kentucky, Tennessee, Arkansas, Mississippi, and New Orleans. The river defines the borders of these states and also contributes to the economies as the most heavily traveled component of the Mississippi River System.

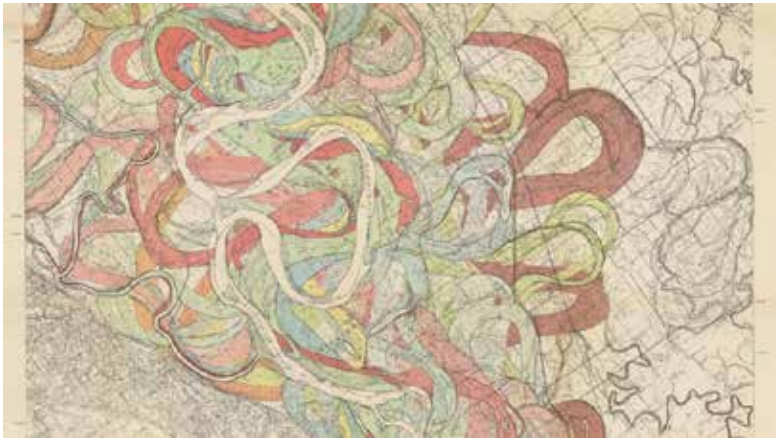
The Lower Mississippi River is heavily engineered and industrialized. It is constrained by levees, dikes, and mechanical systems that control the flow of the river and flooding of the channel. Without these measures in place, it is hypothesized that the river will shift, or meander, in a phenomenon known as river avulsion.

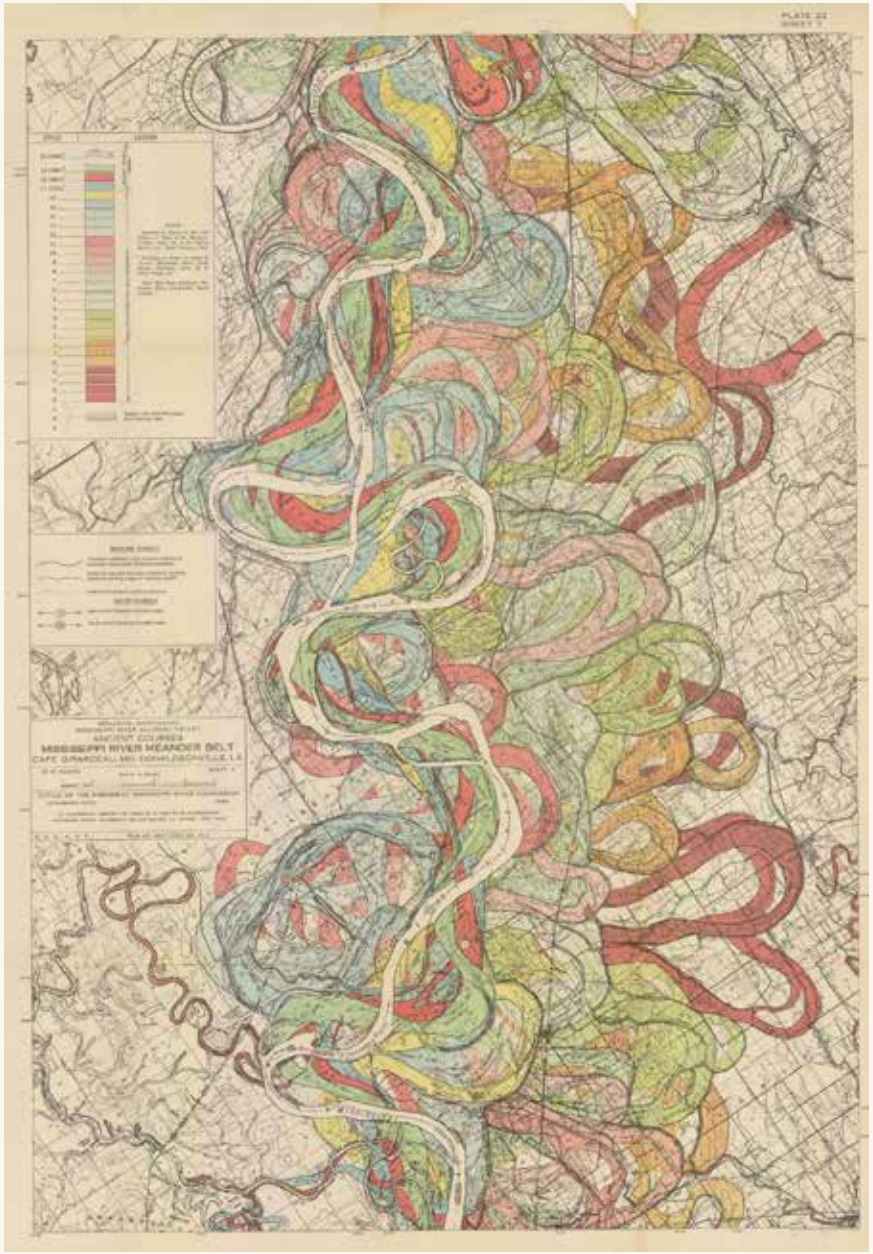
The river is also home to many habitats and is an ecological hotspot and is involved as a part of a migratory cycle and breeding cycle to many mammals that exist upstream across the United States.

As mentioned in the *Big Picture*, the Lower Mississippi River is victim to sea-level rise and land loss, an issue compounded by human activity with engineered and industrialized non-natural emplacements and pollution. This has caused a decline of the Louisiana Coast and the Mississippi River Delta which have great ramifications to both humans, fauna, and flora.

Resilient solutions aim to control the river while also restoring the habitats and natural landscape that rely on the river. With the river shifting, or natural barriers eroding, the effects can result in a chain of events that expose the communities and habitats along the river to dangers of climate change, loss of land, and economic and ecological disasters as well.

To reflect on its history, as a part of a geographical survey conducted by the U.S. Army Corps of Engineers, cartographer Harold Fisk drafted numerous maps of the river's avulsion. These maps compress thousands of years of history, resulting in expressive ribbons of art and history that remain significant to the river's present and future state.

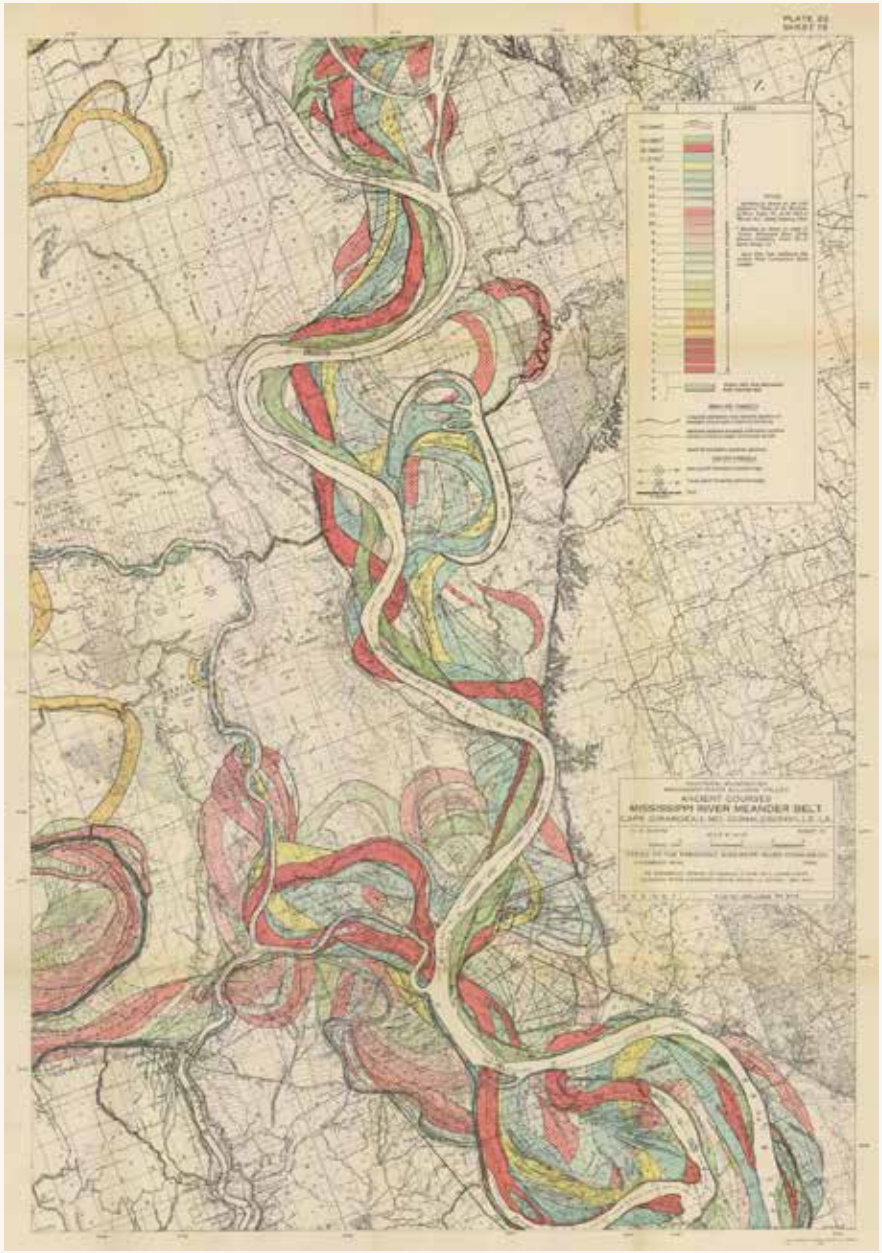




12 - Lower Mississippi River

ANCIENT COURSES MISSISSIPPI RIVER MEANDER BELT

Plate 22, Sheet 7
Harold Fisk, U.S. Army Corps of Engineers cartographer
1944



14 - Lower Mississippi River

ANCIENT COURSES MISSISSIPPI RIVER MEANDER BELT

Plate 22, Sheet 13
Harold Fisk, U.S. Army Corps of Engineers cartographer
1944

Ecology and Commerce

The Mississippi River Delta and Coastal Louisiana are recognized zones of ecological importance, contributing to the wellbeing to the greater economies and ecosystems along the Mississippi River including Louisiana and beyond. These two regions account for 40-percent of coastal wetlands found in the United States, but is currently undergoing rapid land loss and coastal recession due to human impact and climate change.

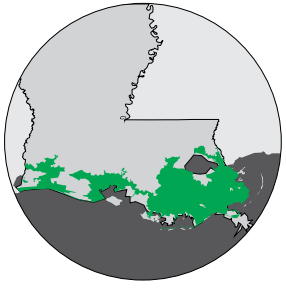
These “critical landscape features”, as dubbed by the Army Corps, are wetland buffers that provide storm protection. However, with their depletion, protection wanes and the situation becomes exponentially worse, exposing inhabitants along the Mississippi River to danger. To protect these regions, projects to create marshes and other island barriers through sediment diversion and marsh creation projects have been proposed to maintain the integrity and protection of the delta land and coastal border.

The loss of these lands can be attributed to the practice of canal dredging, man-made levees, commercial and industrial navigation channels, wave exposure, subsidence, sea level rise, and natural erosion and recession of the shoreline. This compounded with the salt water permeation in the marshes has caused significant impact to the coastal wetlands.

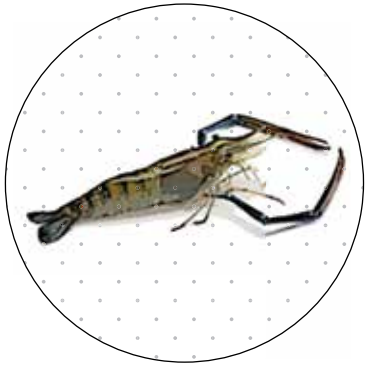
With so much relying on the vitality and stability of the Mississippi River Delta and of Coastal Louisiana, there has been great initiative to propose solutions for a sustainable and resilient future for people, wildlife, and industries that exist in these rich regions. A healthy wetland buffer would provide flood protection and resilience for many species and communities along the river.

Golden Triangle Marsh

New Orleans East Landbridge

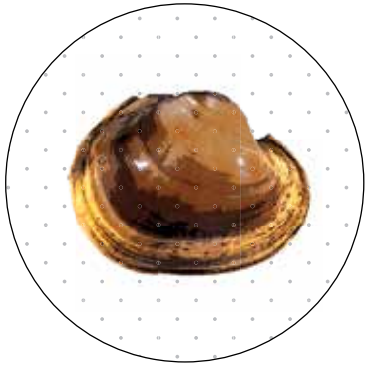


Louisiana Coast Restoration



RIVER SHRIMP

Sufficiently abundant in the Lower Mississippi River and is fished locally as a staple to Farmers' Market in Louisiana and local seafood cuisine.



FAT POCKETBOOK MUSSEL

An endangered species found in the Lower Mississippi River. These mussels, like oysters, are natural pollution filters and can be found in flowing water.

CATTAIL

Well recognized plant species and abundant in shallow water. They are important to ecological habitats and is a food resource to many wetland birds and insects.

ARROWHEAD FLOWER

Found in shallow water areas around the Mississippi River. They are a abundant food resource that is especially important to turtles, rodents, and wetland birds during migration.

BALD CYPRESS TREE

An easily identifiable tree located in swamplands. Cypress swamps are fundamental to the protection of coastal areas along the Gulf of Mexico and are excellent barriers to erosion and flooding.

PORT OF NEW ORLEANS

The Port of New Orleans is the only deep water container port in Louisiana. It also has an annual capacity of 840,000 TEU, making it the 4th largest port in the United States.

CRUISE SHIP TERMINAL

The cruise ship terminal, under jurisdiction of the Port of New Orleans, recorded 1.2 million passenger movements in 2019, brining in great economic benefits to the city through tourism.

New Orleans

New Orleans

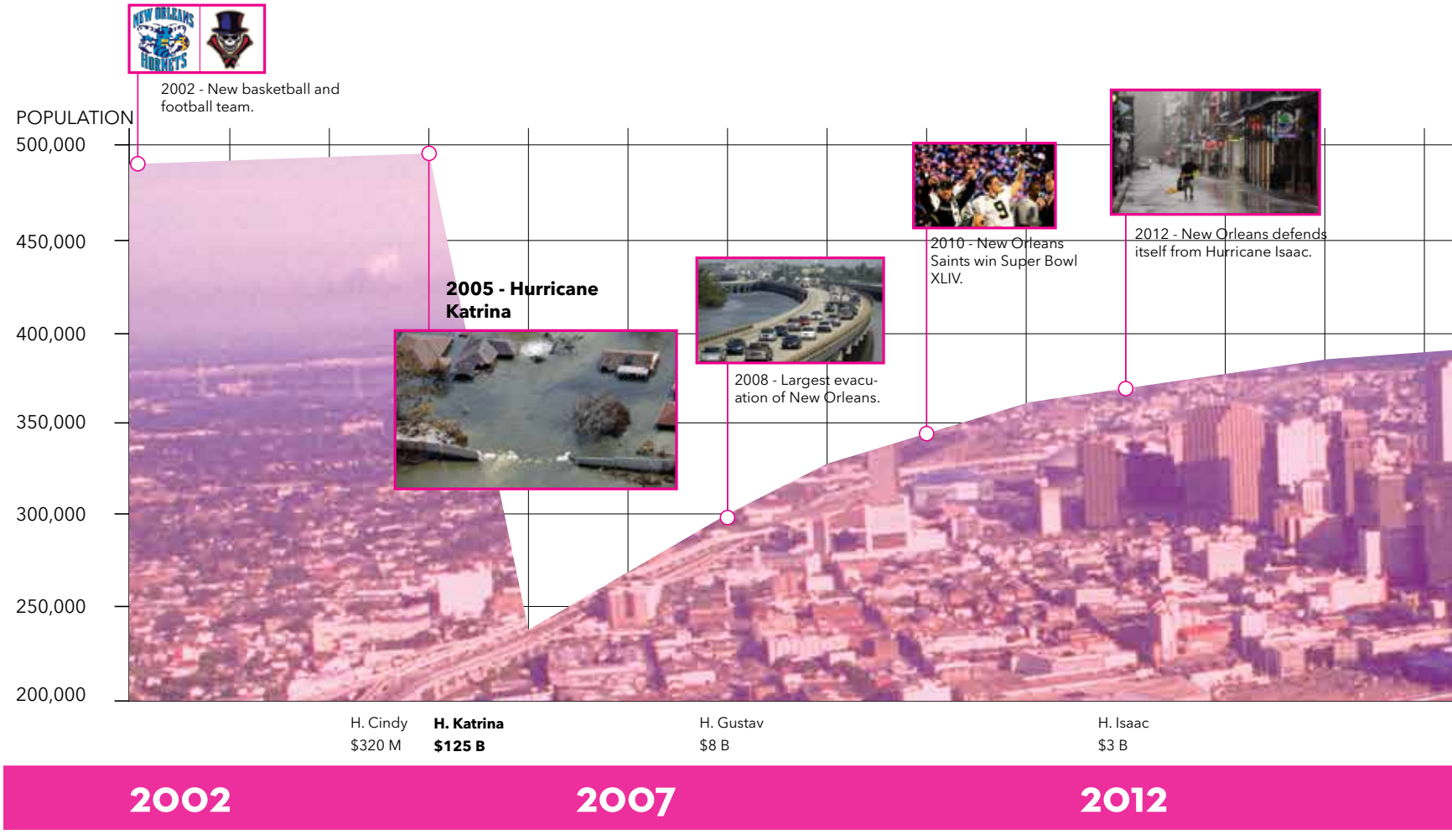
New Orleans has become Home for nearly 400,000 people and is the most populous city in Louisiana, nearly equaling the combined population of Baton Rouge and Shreveport, the second most and third most populated cities in Louisiana respectively.

Vibrant New Orleans has made a name for itself that attracts tourists and festivities alike. The streets come to life with art and music in many forms and has become a destination where citizens and tourists alike gather to engage with the city. The traditions of the city, its people, the music, and cuisine, and nightlife has earned New Orleans the name "Big Easy," a direct reference to New York's "Big Apple."

The history of New Orleans is well known in American history as a rich delta land of the Mississippi River colonized by the French and Spanish and established as a port city and trading station. In 1800, it was sold as a part of the Louisiana Purchase, but the region retained its French, Spanish, and Creole heritage.

In the 1800s, New Orleans thrived as a port city and as a sugar and cotton exporter. The late Victorian period witnessed the emergence of Jazz which would become New Orleans's greatest cultural contribution to the world. In 1960s, the Civil Rights movement swept through the city - in the 1980s an oil bust caused the city's economy to fill in gaps left by the exit of port activity and shipping jobs - and in 2005 the infamous Hurricane Katrina left much of New Orleans devastated, with some remains still abandoned to this day. It's geography has remained a part of the city's wellbeing since its conception, but has become a pain point in the city's continuity.

Floods, hurricanes, and storms have weakened the city's attitude of its status as a coastal city. The accumulating effects of the rising sea level has put the wellbeing of the city and its citizens in jeopardy. Along with a population stall, the energetic New Orleans has an uncertain future ahead of itself, and the urban fabric has begun to shrink.


POPULATION
500,000
450,000
400,000
350,000
300,000
250,000
200,000
2002 - New basketball and football team.
2005 - Hurricane Katrina
2008 - Largest evacuation of New Orleans.
2010 - New Orleans Saints win Super Bowl XLIV.
2012 - New Orleans defends itself from Hurricane Isaac.
H. Cindy
$320 M
H. Katrina
$125 B
H. Gustav
$8 B
H. Isaac
$3 B
2002
2007
2012

2017 - Confederate monuments removed.

2021 - Hurricane Ida passes the city with no major damage.

H. Nate
$787 M

H. Barry
$600 M

H. Zeta
$4.4 B

H. Ida
$75 B

2017

2022

Hurricane Katrina and Recent History.

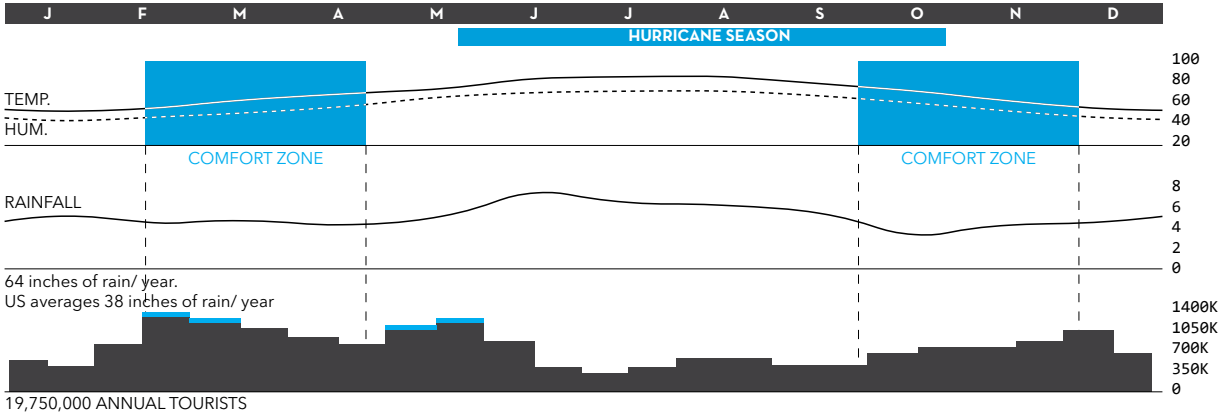
Hurricane Katrina is one of the most investigated, researched, and referenced incident in recent history in regards to hurricanes and flooding in New Orleans. It had absolutely devastated the population and the economy of the city. They have still not yet recovered to pre-Katrina population numbers.

However, New Orleans and its residents are ready to move on. It has been 17 years since Hurricane Katrina, and they no longer want to be tied down, regardless of the scars that remain from that incident.

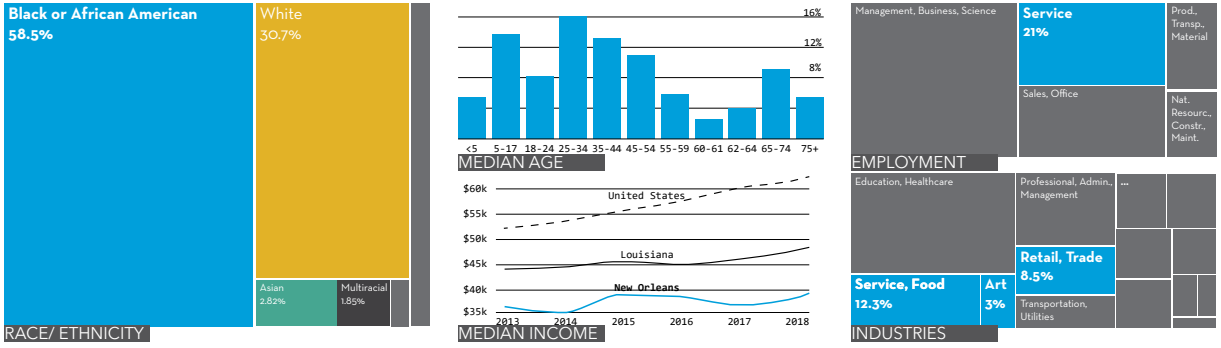
Hurricane events are becoming more frequent as a result of climate change, and with each hurricane, New Orleans holds its breath in preparation and the world watches to see if the city can weather the storm.

Hurricane Ida, 2022, was the most recent, and after a $14-billion investment, the city successfully weathered the storm and escaped relatively unscathed.

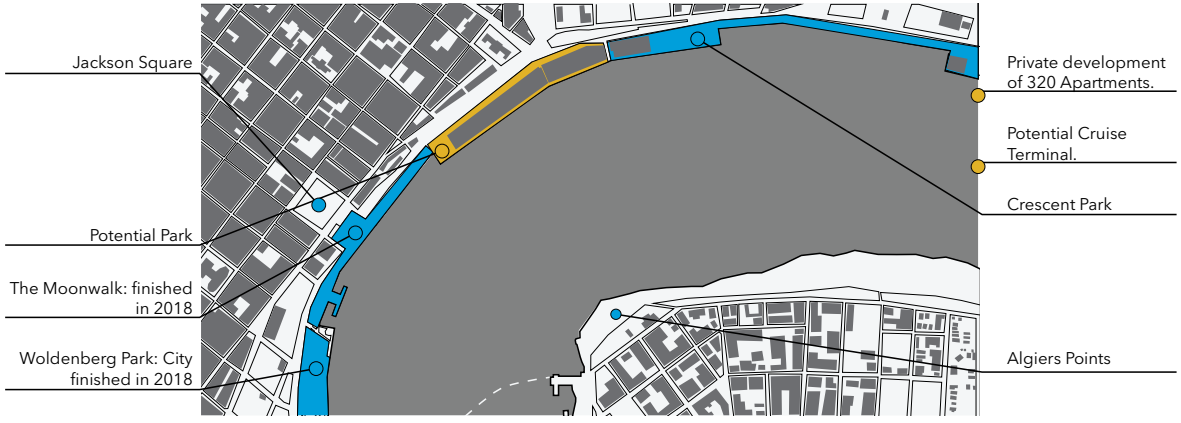

MAPPING EXERCISE
Levees/Sea Walls
Delta Land affected by Rising Sea Levels
Green Spaces
Points of Interest
Extents of the City Limits



New Orleans has an active and important tourist industry which is vital to the city's economy. Tourism is influenced by the climate, weather, and events that take place throughout the year. February through May is the peak season of tourism for New Orleans, highlighted by Mardi Gras and the annual New Orleans Jazz and Heritage Festival. This is followed by an off-season between June and September where inclement weather and hot and humid climate deters tourism.

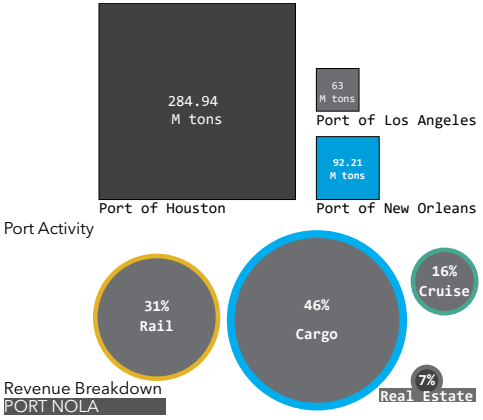


General information of New Orleans. A predominantly black community with an aging population and low median income to the rest of Louisiana and the United States. Despite this, the amount of jobs is growing in New Orleans, with the second most common job held by residents is Food Preparation & Serving Related Occupations; an important metric that helps programs the Mississippi River Plug-In project.



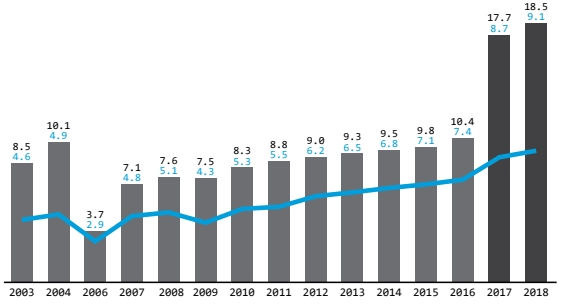
In an effort to revitalize New Orleans and utilize the historic riverfront, the city has decided to transform 5-miles of land between the city and the Mississippi River. This master plan introduces new parks, public works, and major private developments that will redefine the river. The riverfront development is already underway, however some plans and projects have been slowed or stalled. The Mississippi River Plug-In project respects this development and has a stake in the master plan.

New Orleans has four major economic sectors: oil/gas, tourism, the port, and aerospace manufacturing. Of these four, tourism and the port of New Orleans can be tied directly to the Mississippi River and each other. New Orleans is positioned as the gateway to the interior United States up the Mississippi River. As a result, the Port of New Orleans generates and supports economic growth far beyond its city limits including through cargo, industrial real estate, and passenger cruise terminals.



PORT NOLA

Tourism is a billion dollar industry to New Orleans, generating nearly $10 B and serving more than 18 million visitors in 2019. For New Orleans, tourism is the largest employer of residents. Furthermore, though immeasurable, the tourism industry sustains the unique festival culture of New Orleans, supporting independent businesses and local creatives to create a multi-cultural community.

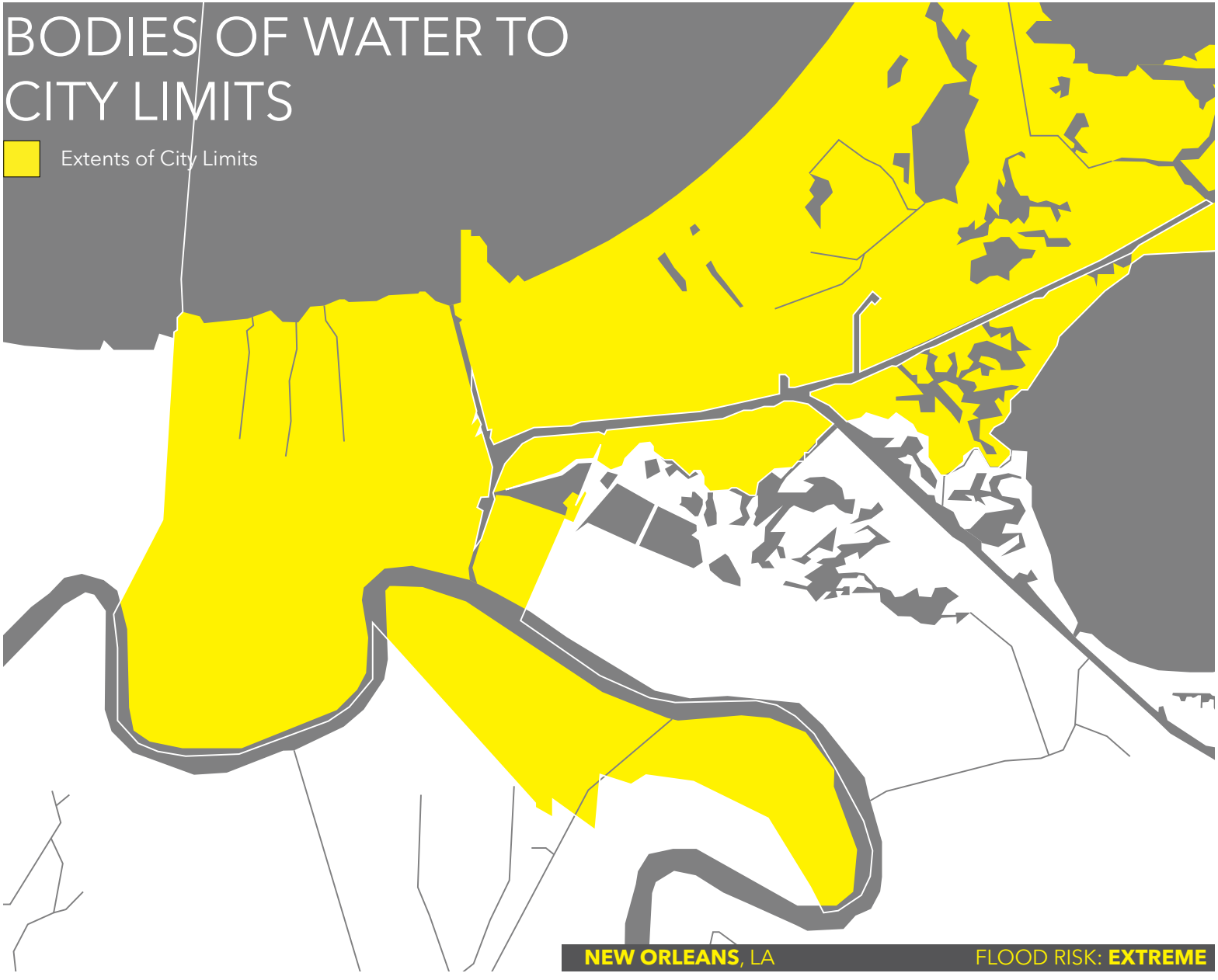


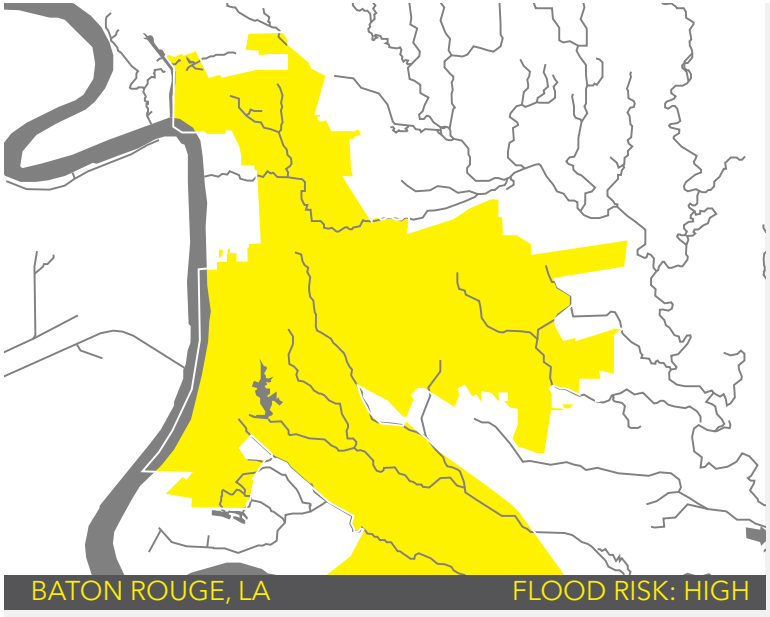
TOURISM

The Mississippi River is symbolic vitality to New Orleans. The Plug-In project takes advantage of this geography to expand semi-permanent floating platforms out onto the river from the French Quarter. It is an economic opportunity for the city and redefines what is known as "life along the Mississippi". The floating Plug-In is a contextual response and expands the footprint of the city and makes the city more resilient to the potential effects of climate change.

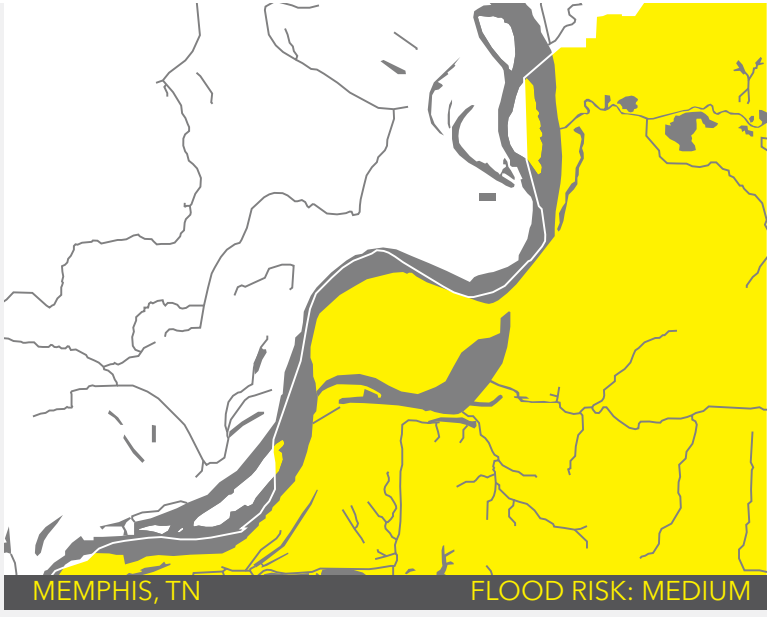
The City of New Orleans, and the Mississippi River. Lake Pontchartrain in Distance. By Currier & Ives, taken from the Library of Congress, 1885.

MISSISSIPPI RIVER

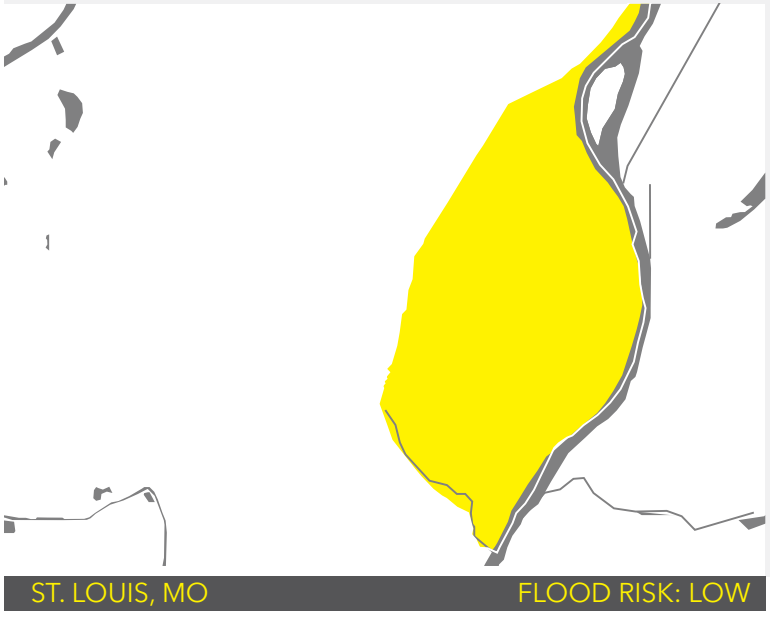

BODIES OF WATER TO CITY LIMITS
Extents of City Limits
NEW ORLEANS, LA
FLOOD RISK: EXTREME



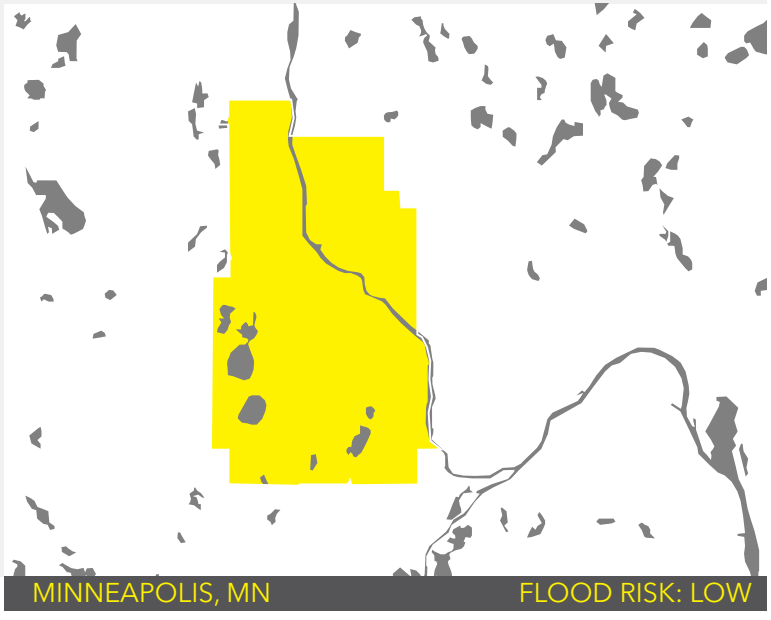
BATON ROUGE, LA FLOOD RISK: HIGH



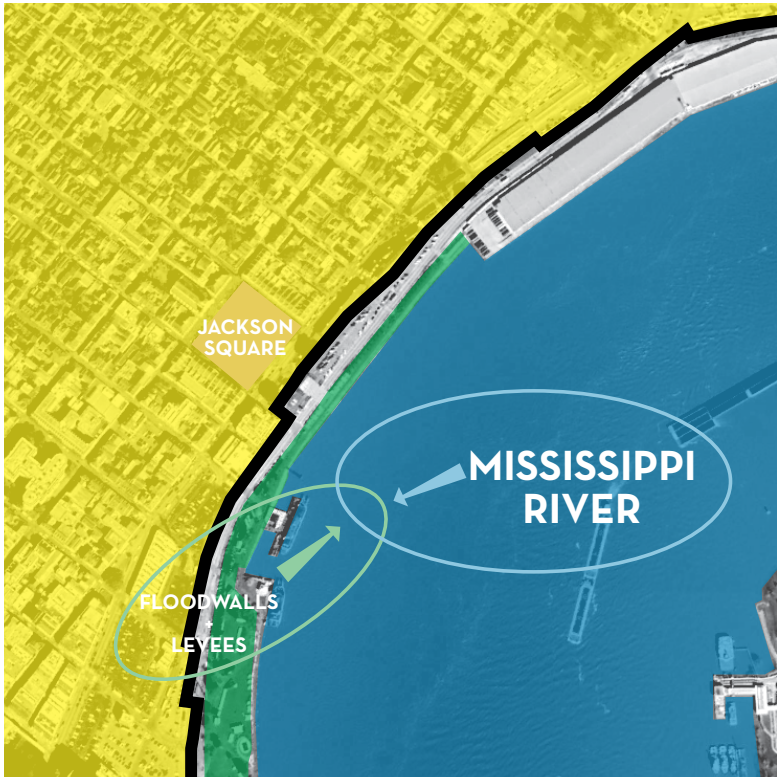
MEMPHIS, TN FLOOD RISK: MEDIUM

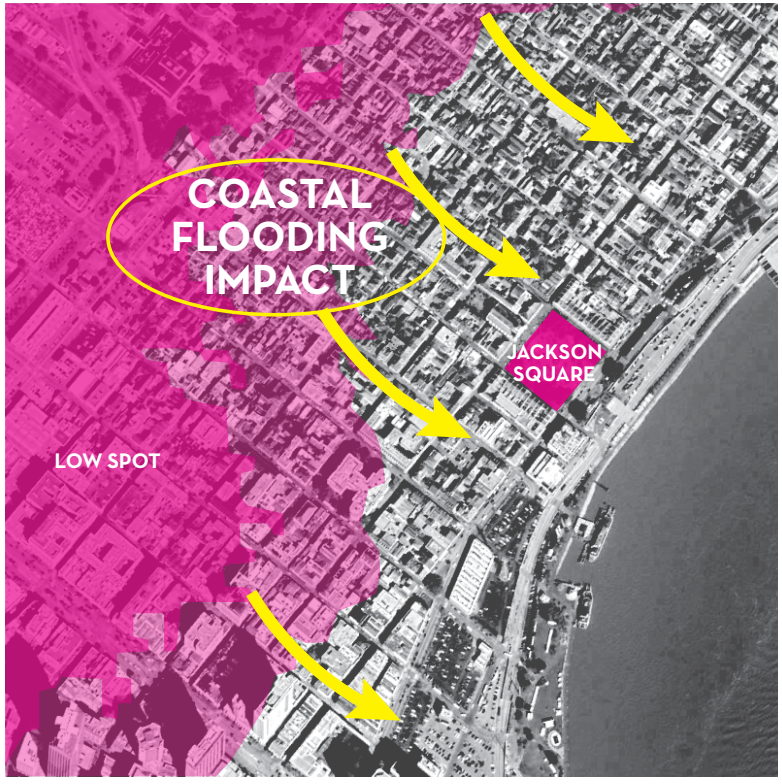


ST. LOUIS, MO FLOOD RISK: LOW



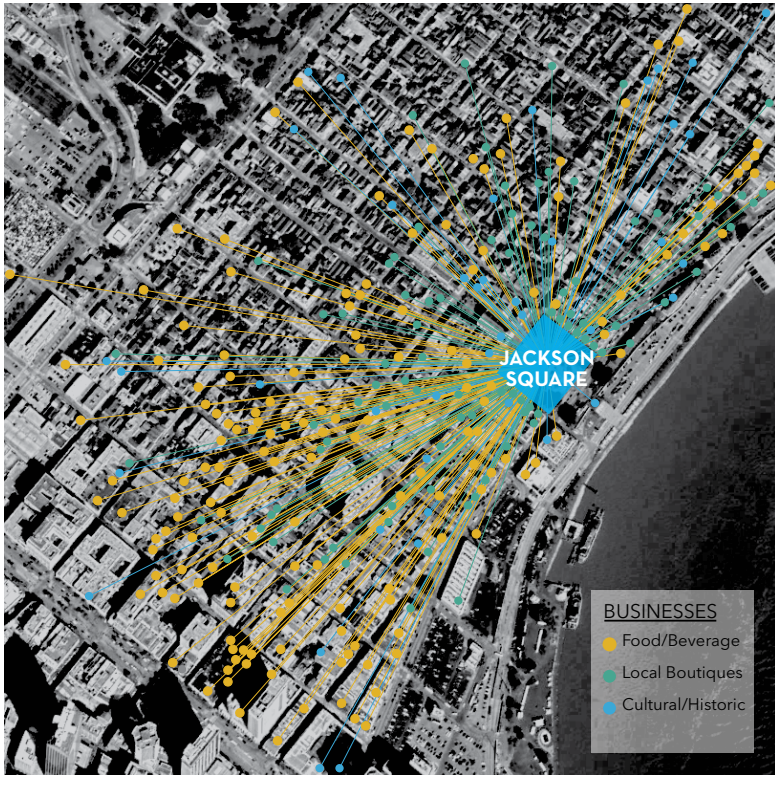
MINNEAPOLIS, MN FLOOD RISK: LOW





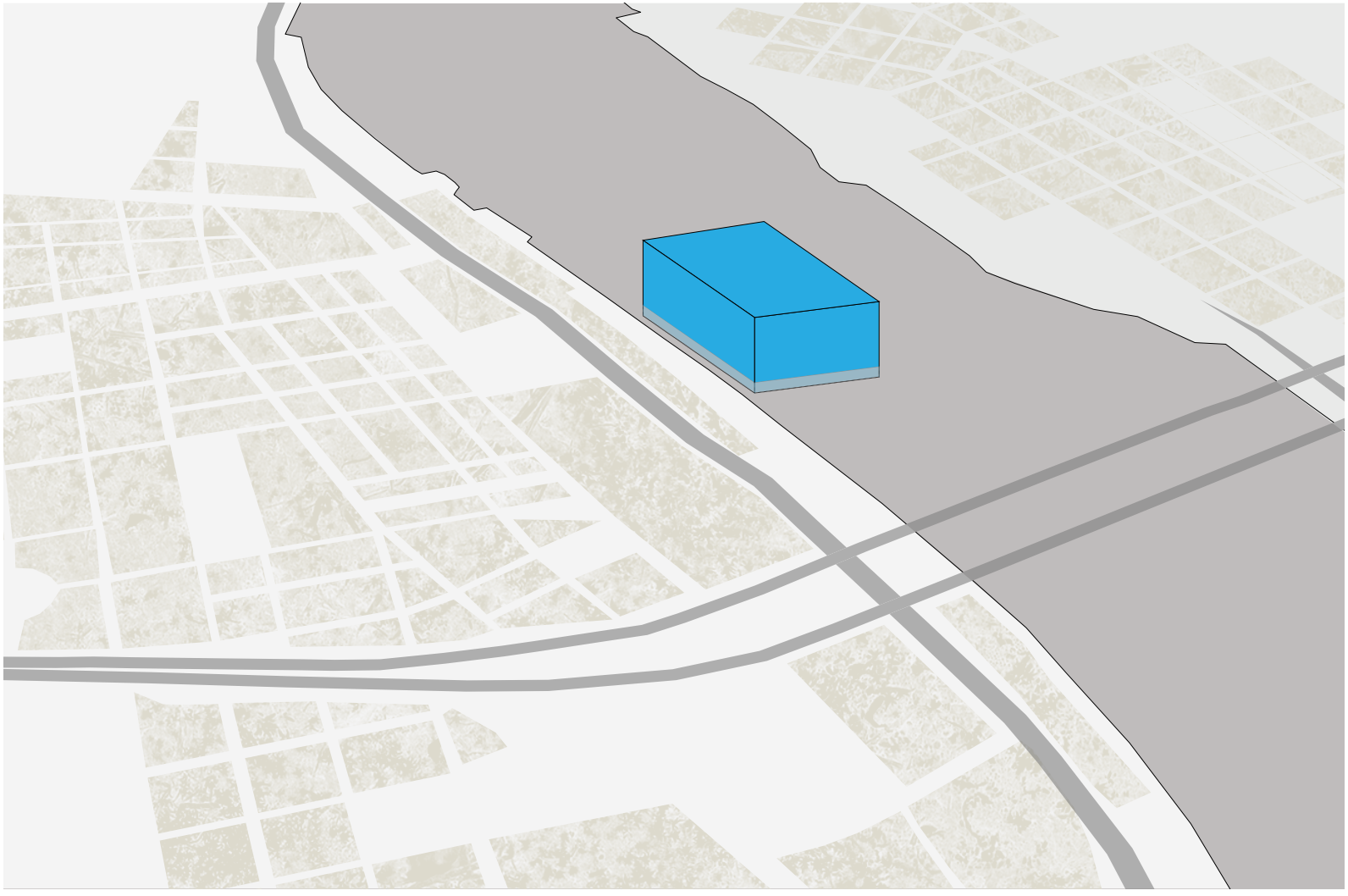
(Left) Division between City and Water
(Right) Flooding Concerns and Shrinkage of City

At a glance, the French Quarter is heavily separated from the Mississippi River due to a necessary flood barrier. This division is effective, but there is growing concern of growing flooding concerns where the quarter is dense with local creatives and independent businesses.



(Left) Overwhelming City Density
(Right) Urban Constraints

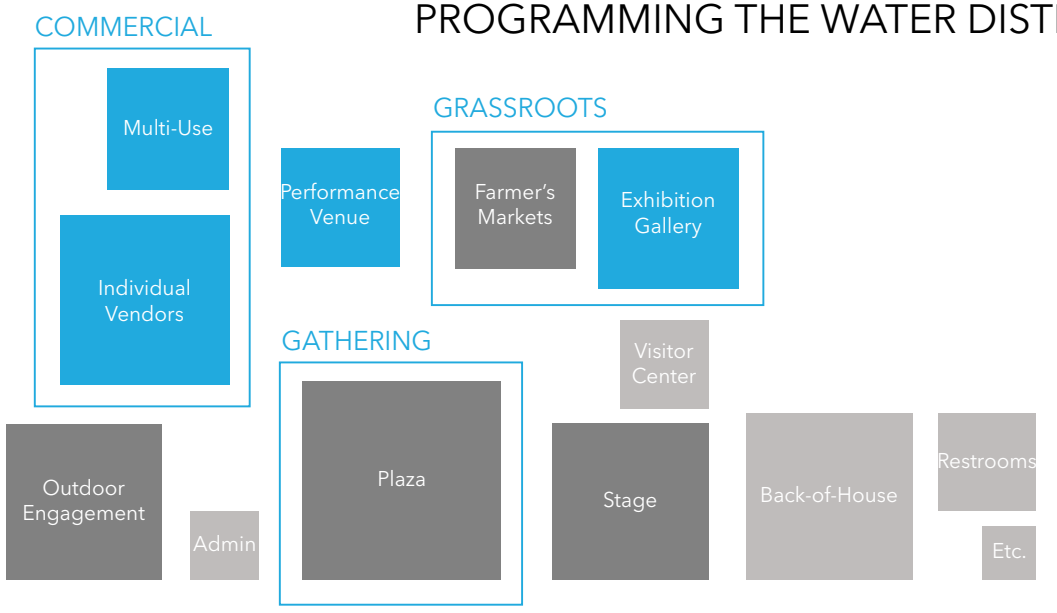
There is difficulty in suggesting expansions in the already dense French Quarter because of its historic ties and geographic location. However, with growing flooding impact, stretching out into the water becomes a reasonable solution.

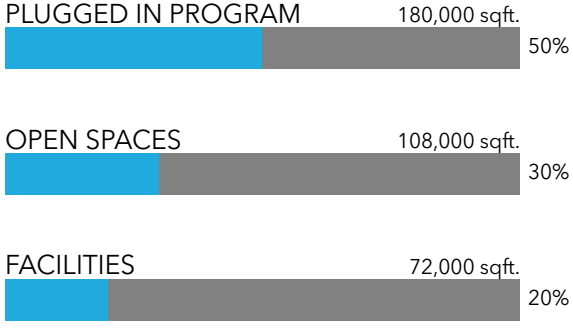


Project Proposal

INITIAL ASSUMPTIONS

PROGRAMMING THE WATER DISTRICT





IDENTIFIED PROGRAMS

PLUGGED IN PROGRAM
Individual Vendors
Visitor Center
Performance Venue
Exhibition Gallery
Multi-Use Adapted Space

OPEN SPACES
Plaza
Stage
Farmer's Markets
Outdoor Engagement

Facilities
Restrooms
Administration
Back of House

Proof of Technology

Floating Farm Dairy/Goldsmith Company
Rotterdam,Netherlands

The Floating Farm Dairy is located near Rotterdam's center in unused space along an industrial wharf in the Port of Rotterdam. Floating architecture is not a new concept to the Netherlands; land is limited and sea levels are rising, the adoption of floating architecture has become more appealing. It is an evolution of the floating markets commonly seen in Southeast Asia and adaptation to the expected consequences of climate change and population growth. It is a proven technology historically and now in modernity. As a result of projects such as this dairy farm, there is a growing number of floating projects, become precedent and proof of concept to a world that will soon need to live with the effects of climate change.

In the Netherlands, with scale enlargement and automation, the industrial district and port have shifted west, closer to the mouth of the Atlantic Ocean. As a result, the decline of traditional harbor activities has opened up space within the wharf – increasing the amount of residential and urban developments in the area. The empty and unused space in a increasingly dense city has prompted the city to look at projects that can benefit the urban community: the solution is the introduction of floating architecture in the once-populated wharf.

The Floating Farm Dairy is a compact stacked structure that merges agricultural processing and production installations in a single floating platform; it produces, processes, and distributes dairy products. It brings a new (and sustainable) industry to a normally inaccessible area for the city. The success of the farm relies on more than novelty, and its design is a proof of concept, technology, and practicality. To produce fresh food in a climate-adaptive way is the immediate goal of the project.

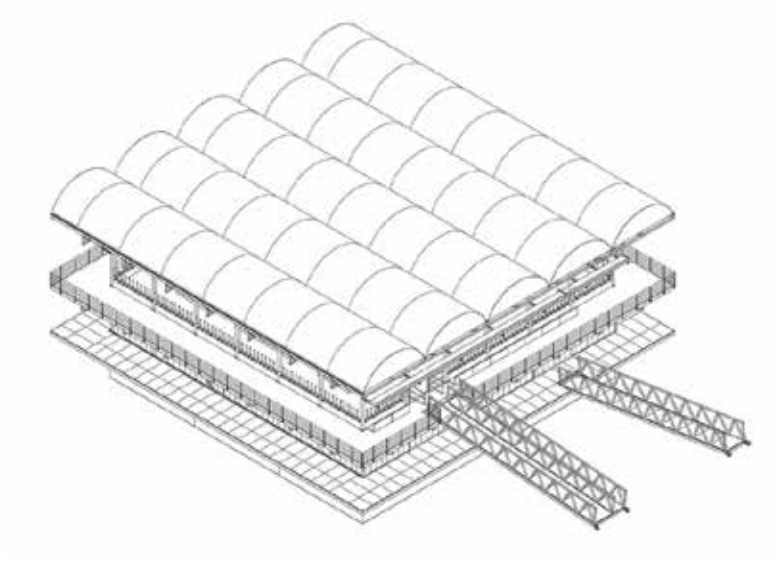
(Above) Completed farm with cows occupying the project already.

The project was initially met with skepticism from city residents: thinking the project as weird, funny, or unbelievable. However, the solution was a simple one: a floating concrete foundation.

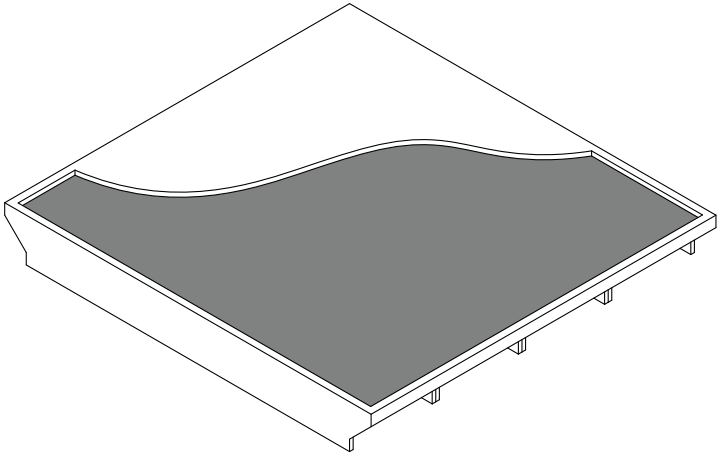
The 4,843-sqft. project is built on a series of concrete pontoons anchored by two steel beams driven 65 feet into the seabed; this allows for the platform to move vertically with varying tides, but never tilt more than one foot – even in 70 mph winds. The concrete pontoons are a construction of buoyant styrofoam blocks encased in concrete and rebar for durability and stability; the heavier the platform, the more stable it is against the ebb and flow of the waves. The project is connected to local sewer and power lines.

The project in Rotterdam is a greater precedent for other cities built near or along water. Concerns of flooding and rising sea level is the leading reason for the endorsement of floating architecture, but population growth, land use, and urbanism have become valid following reasons to utilize rivers, deltas, and bodies of waters as extensions of buildable surface.

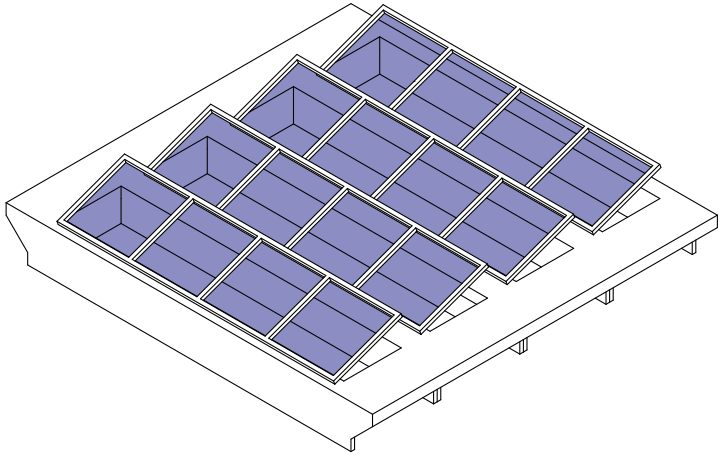
Notable precedents: Floating School in Makoko, The Hasle Harbour Bath, Canal Swimming Club, DD16, Floating House, The Floating Kayak Club, Sjøbad.



(Above) Construction in progress of the Floating Farm Dairy.
(Below) Axonometric drafted illustration.



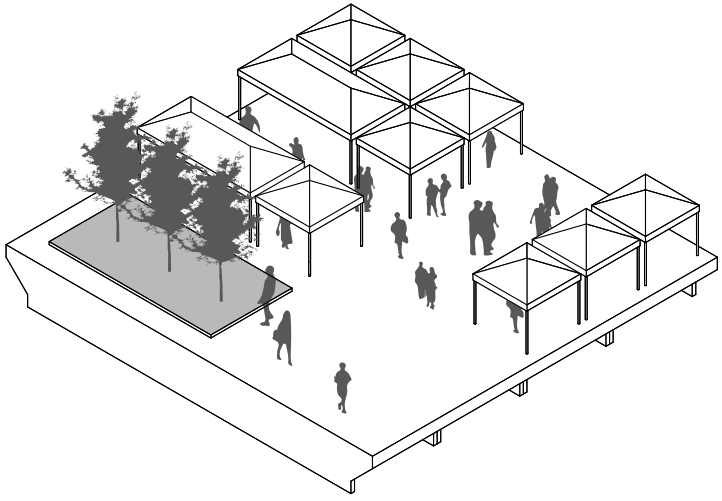
General Construction



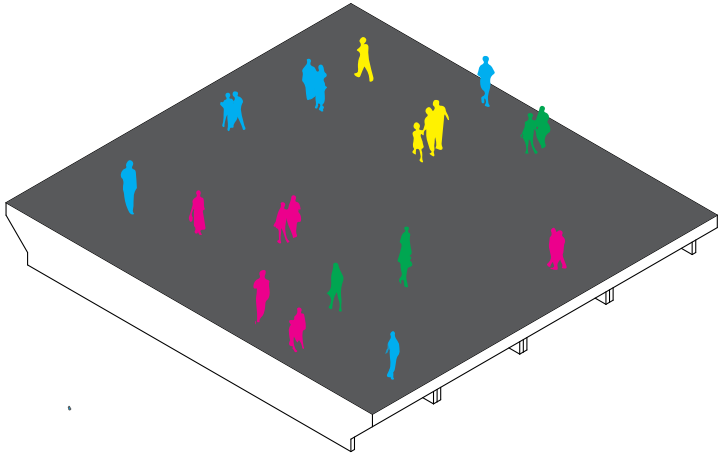
Solar Collection Platform

APPLICATION OF PRECEDENT

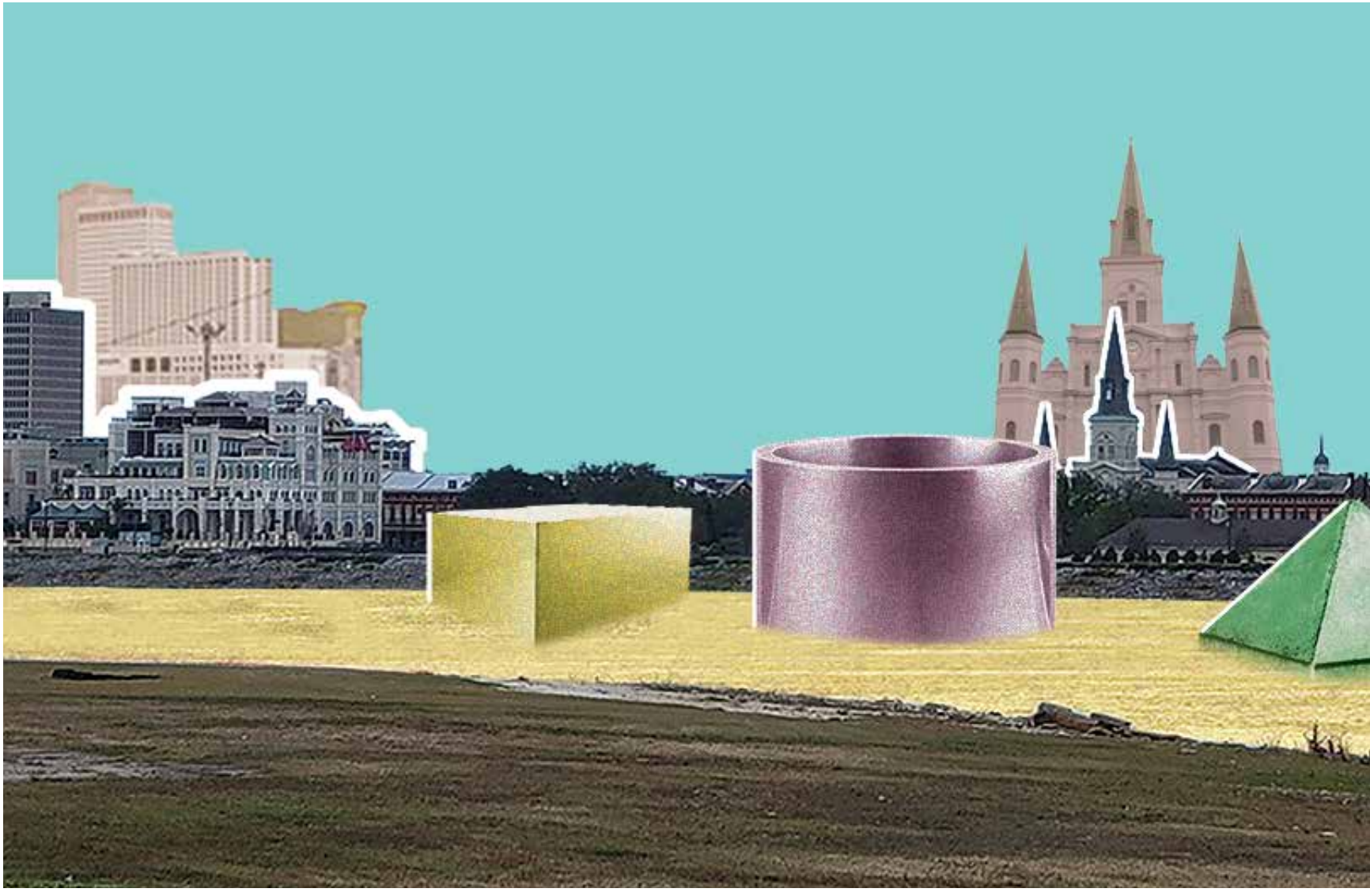
Using known technology of EPS styrofoam encased in a concrete shell to create floatable concrete pontoons able to be adapted.



Plug-In Program

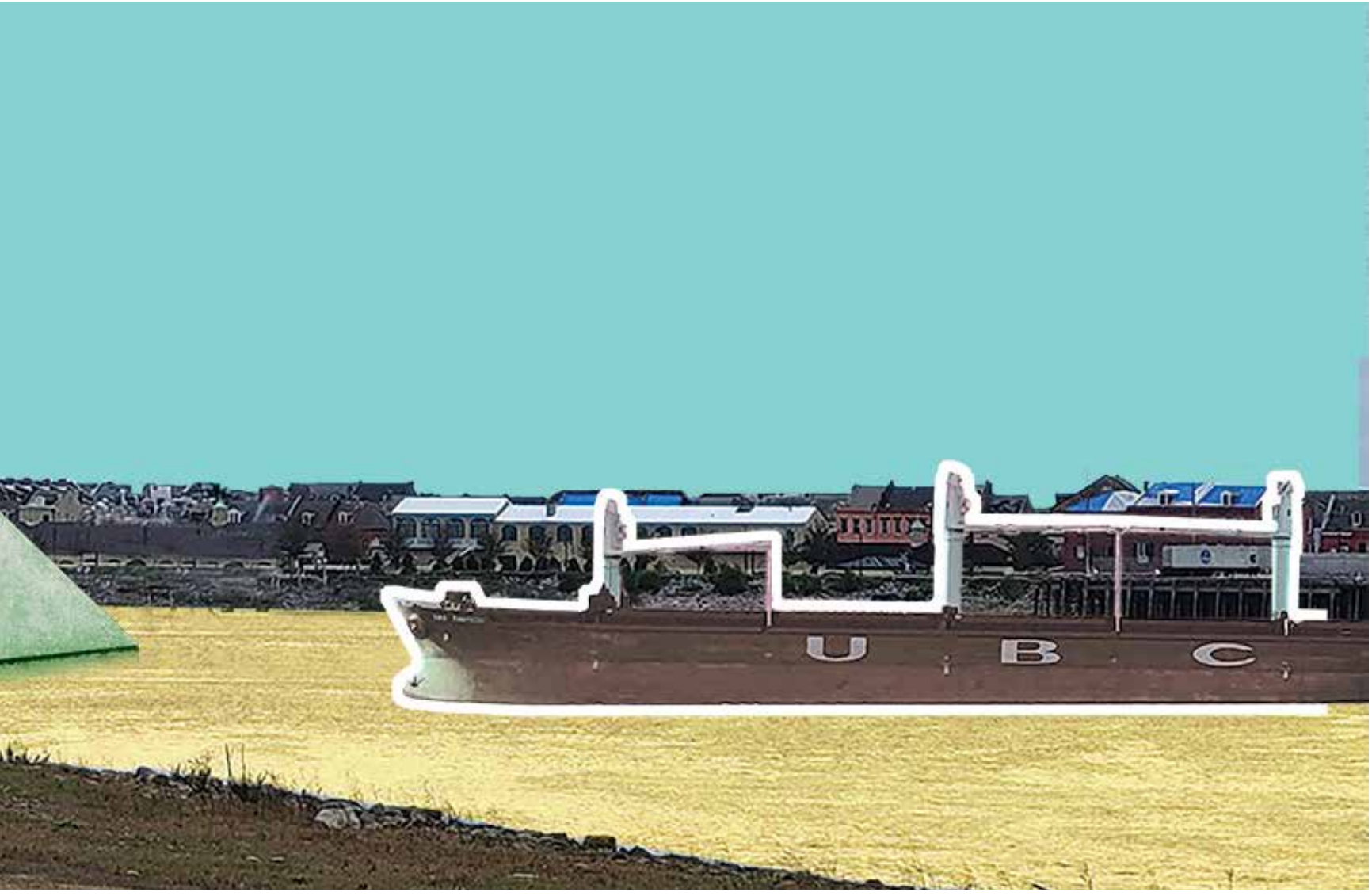


Open Stage



BOULLÉE IN WONDERLAND (COLLAGE)

A fantastical vision of the purity and innocence of the Plug-In through ambiguous shapes.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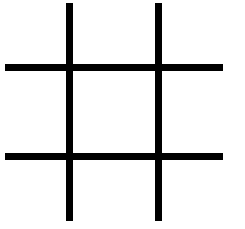

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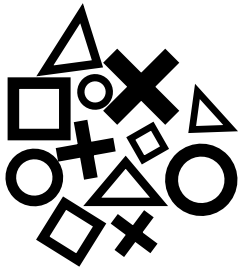
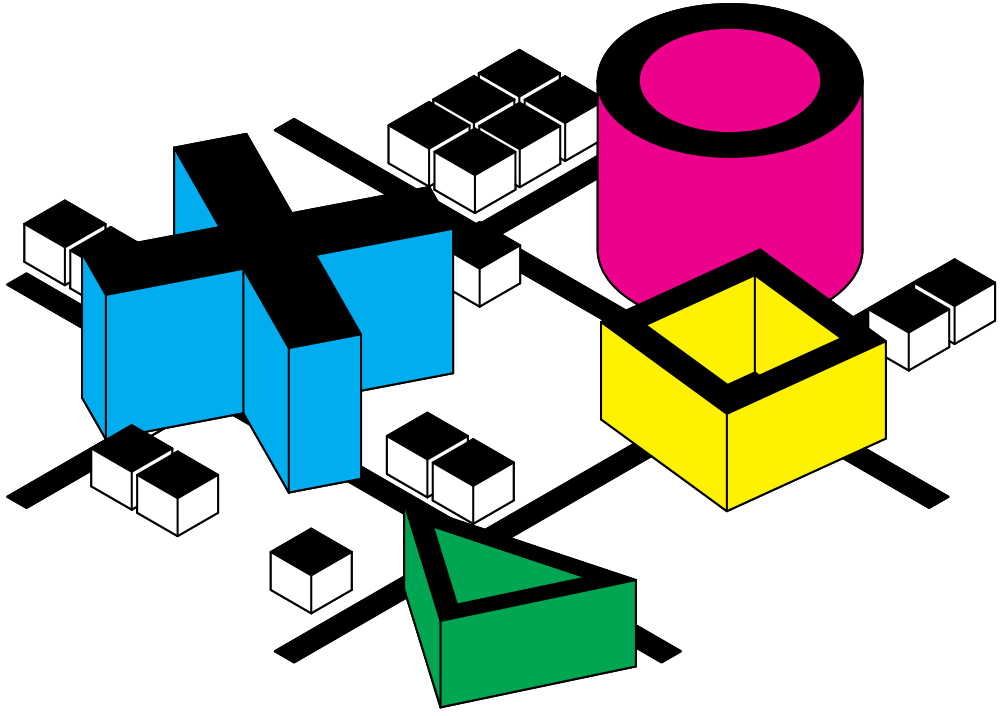
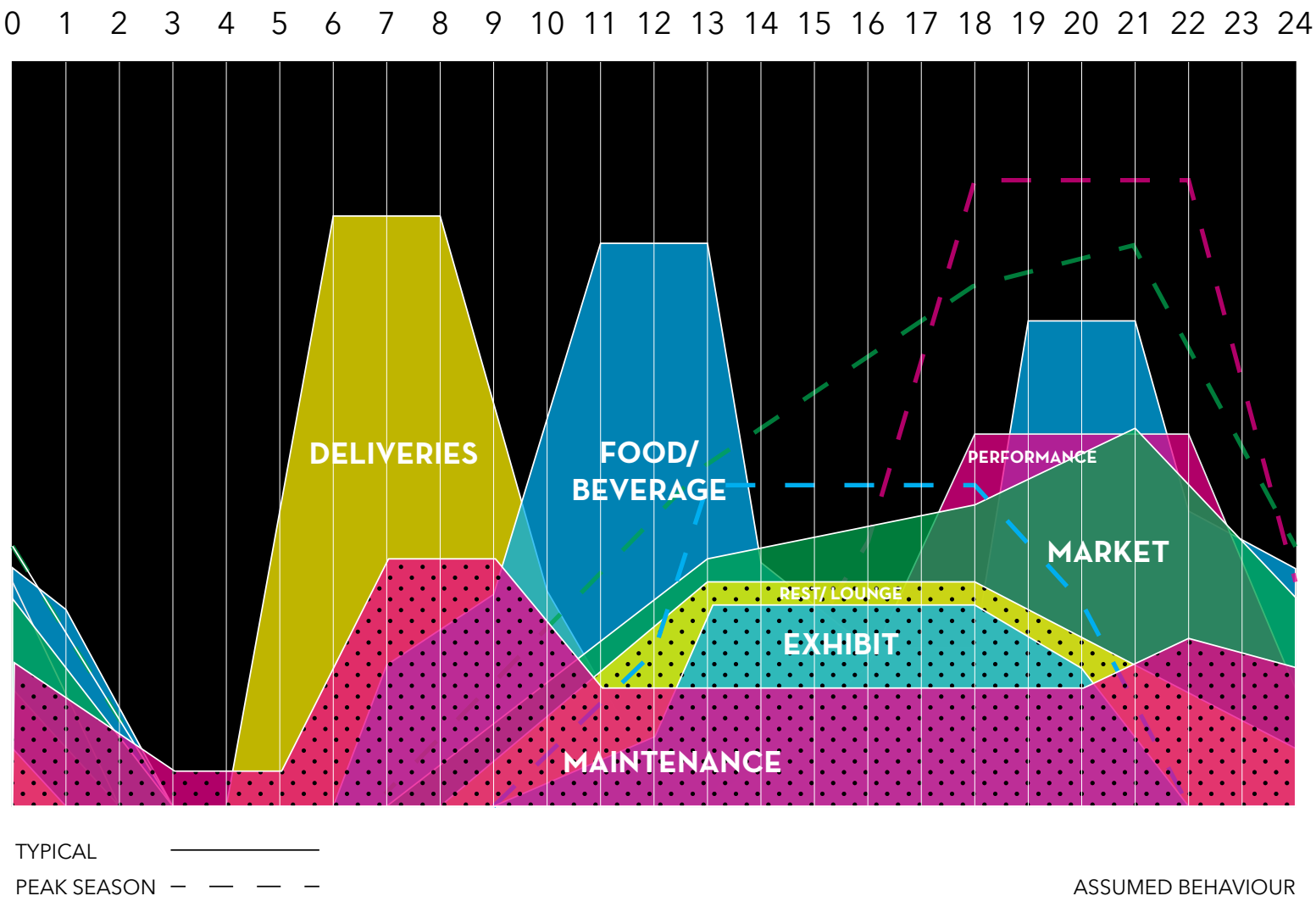
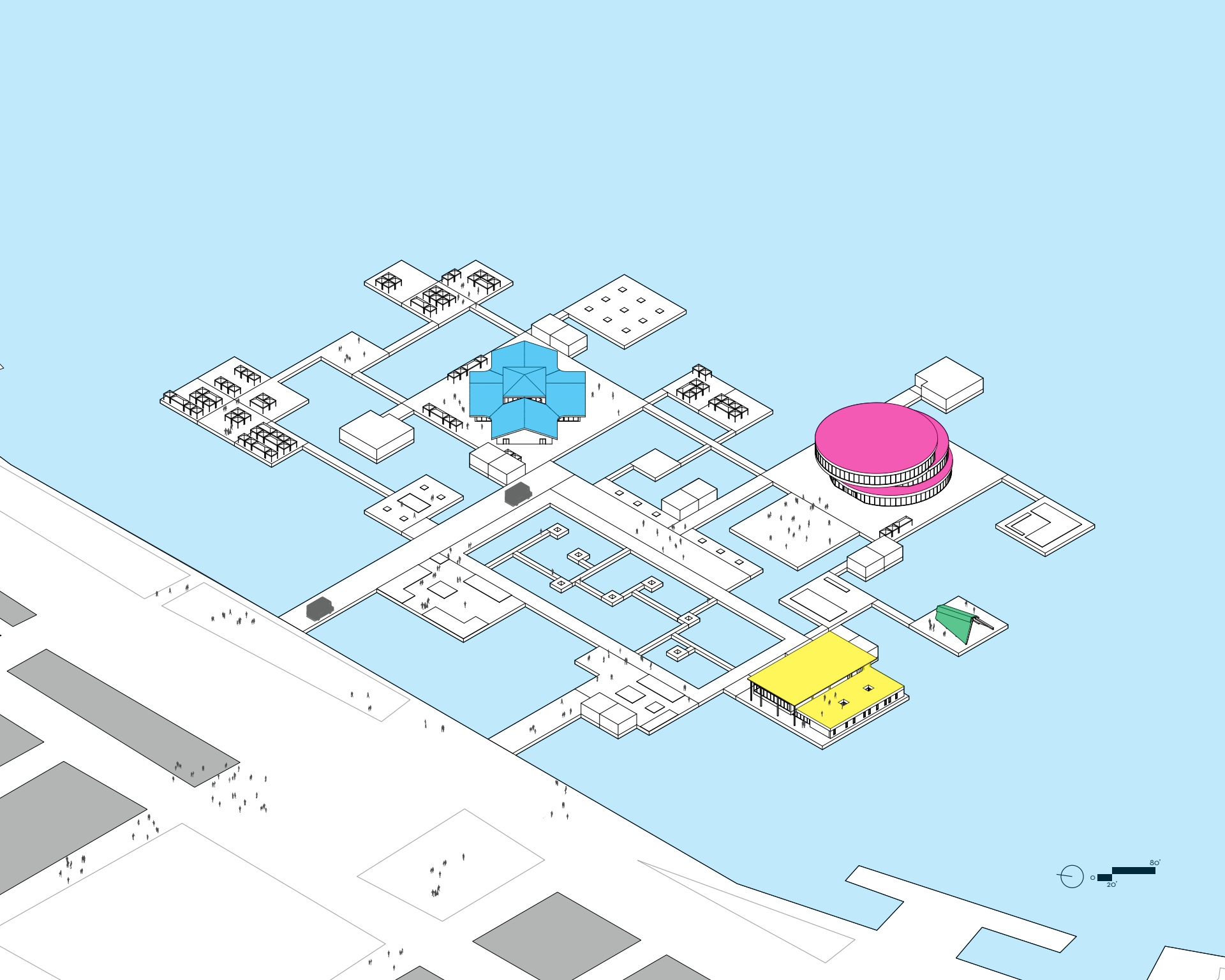




Simple Grid + *Assorted Program* = *Plug-In Framework*


0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
DELIVERIES
FOOD/
BEVERAGE
PERFORMANCE
MARKET
REST/ LOUNGE
EXHIBIT
MAINTENANCE
TYPICAL
PEAK SEASON
ASSUMED BEHAVIOUR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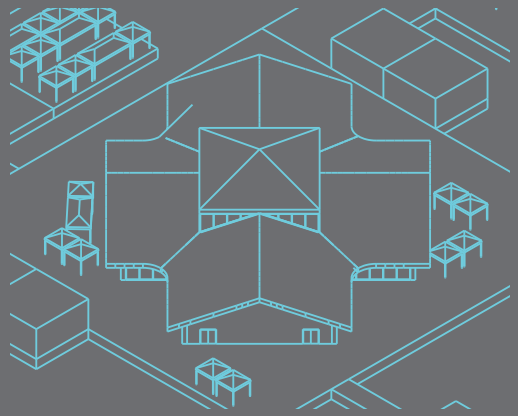
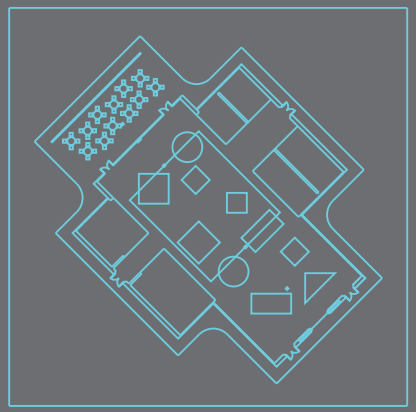




X

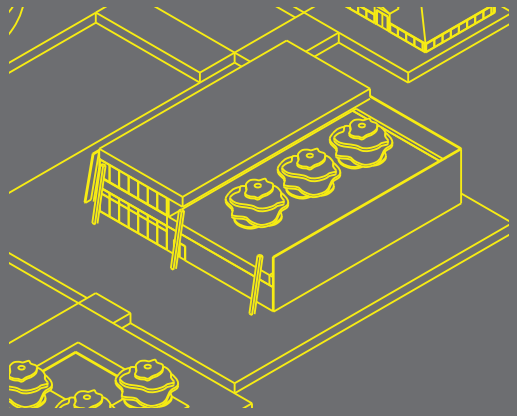
market

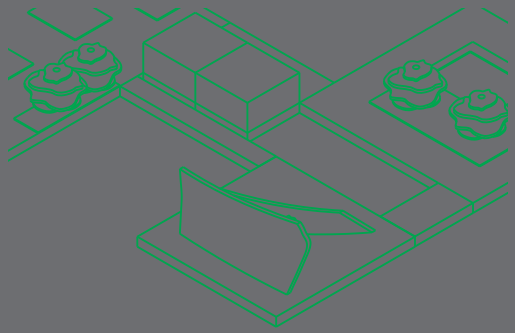
O

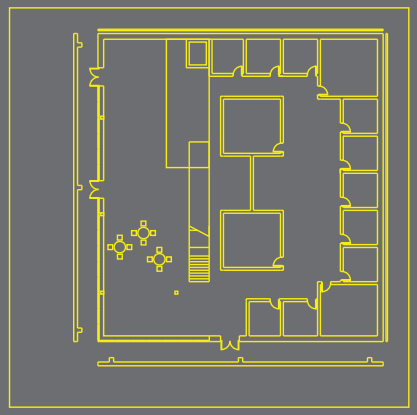
performance

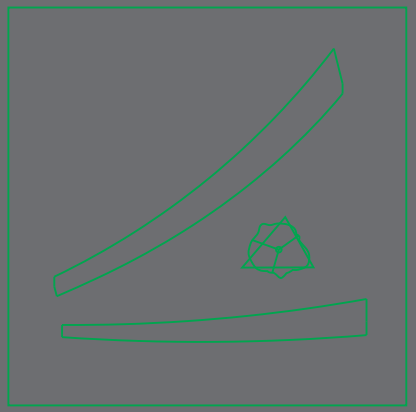
The market provides a space for local businesses to occupy and foster a community between businesses owners and their customers without relying on brick-and-mortar buildings.

New Orleans is packed with culture and performance. The performance hall in this project is another platform for that culture to be displayed as a part of the plug-in program.







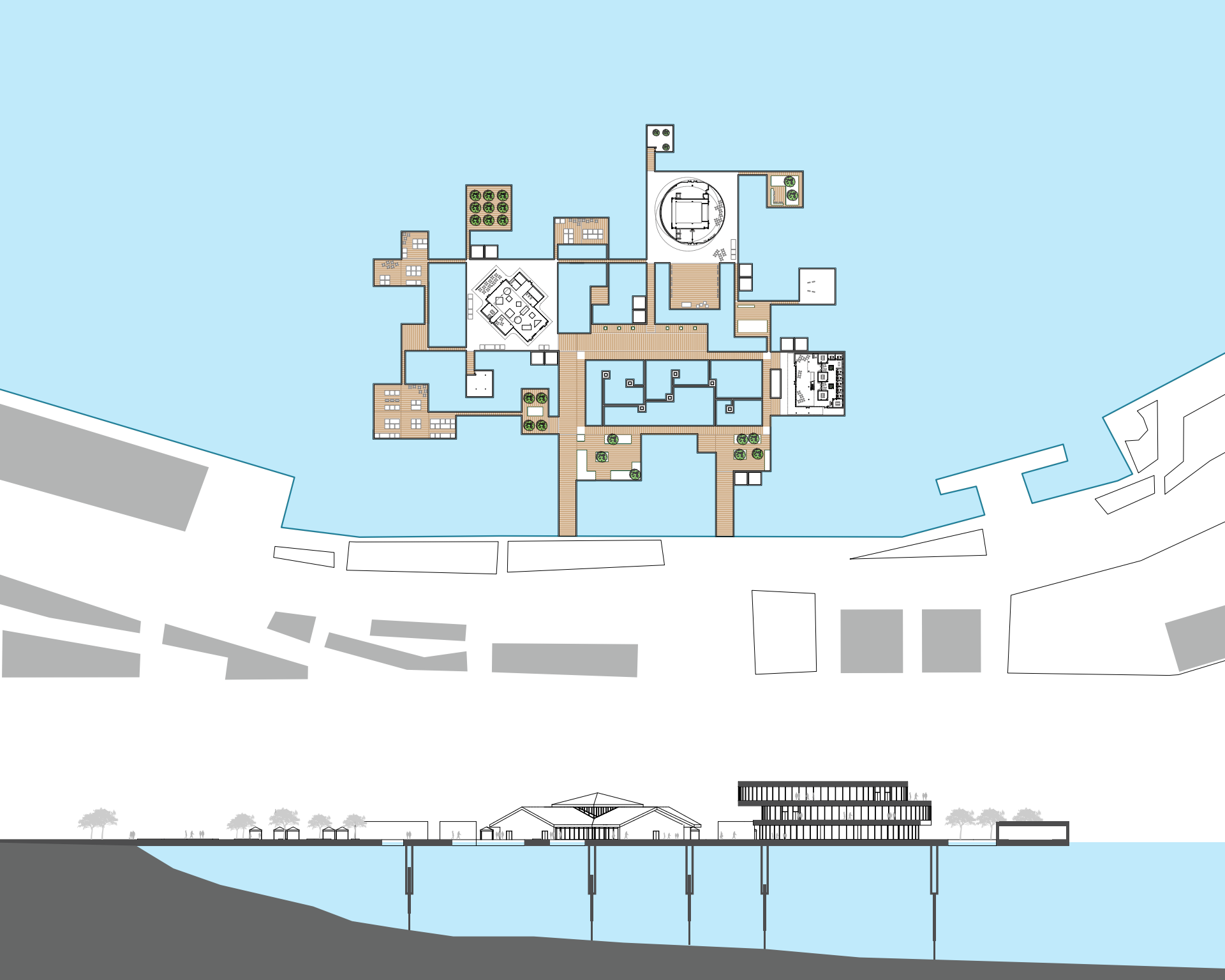


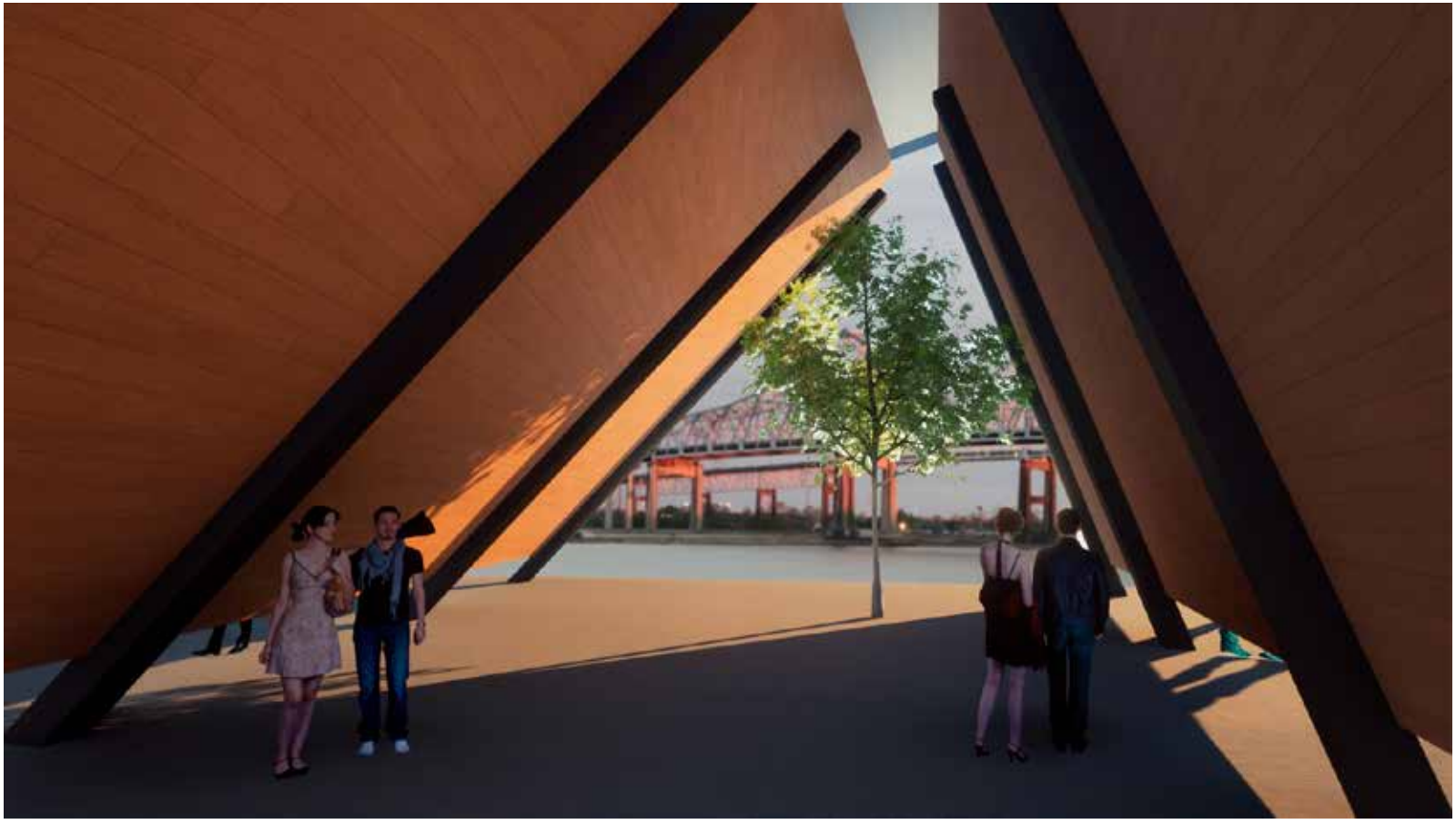
The collab space is the living room for the community; intended to be a place to rest within the busy district - a rarity.

The pavilion is a platform for expression through art and architecture. It is intended to be a flexible platform for local and abroad creatives with intention for physical spaces.

collab

pavilion





Pavilion
The pavilion is a platform for expression through art and architecture. It is intended to be a flexible platform for local and abroad creatives with intention for physical spaces.

Pavilion plug-in looking south towards bridge Crescent City Connection. A meditative and isolated installation that frames a view.

Market
The market provides a space for local businesses to occupy and foster a community between businesses owners and their customers.

Individual stalls and vendors during a daytime function, the platforms support the market hall, a formal plug-in building seen in the back.

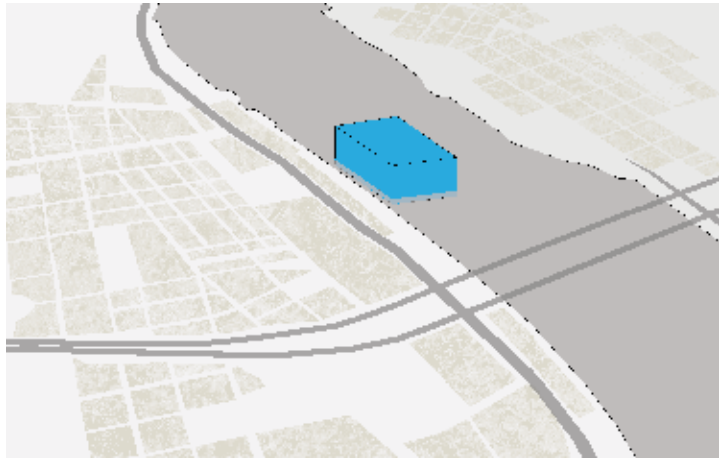
AUGMENT

2022

1

phase 1

The City of New Orleans
Mississippi River Plug-In



The Coastal Fun Palace

Finalization: A Plan For the Future

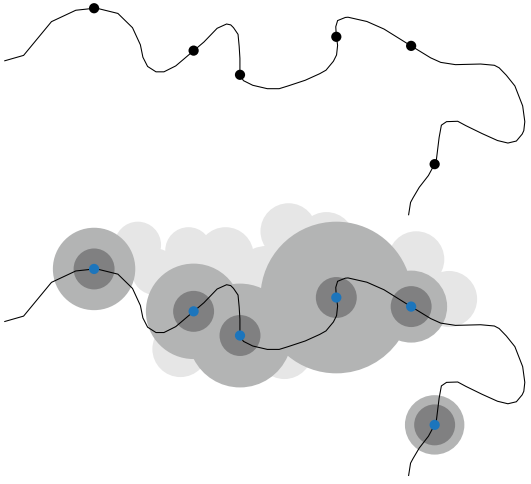
AMPLIFY

2040

2

phase 2

New Orleans Wetline
River Plug-In(s)



Activated Wetline on the Mississippi River

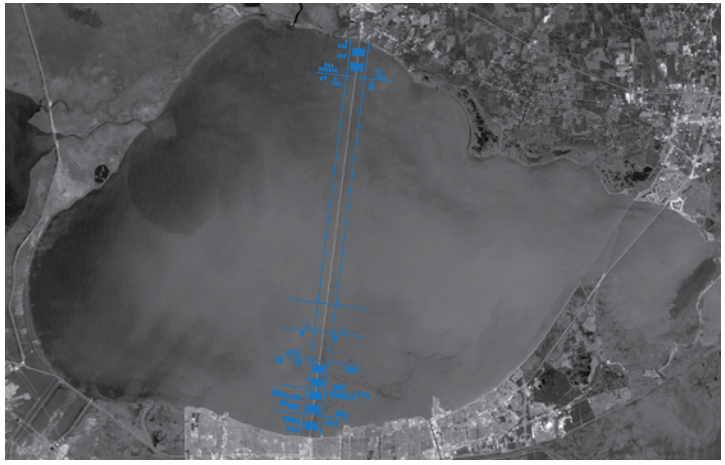
TETHER

2060

3

phase 3

Lake Ponchartrain Plan
Amenity Nexus
The Artificial Coast



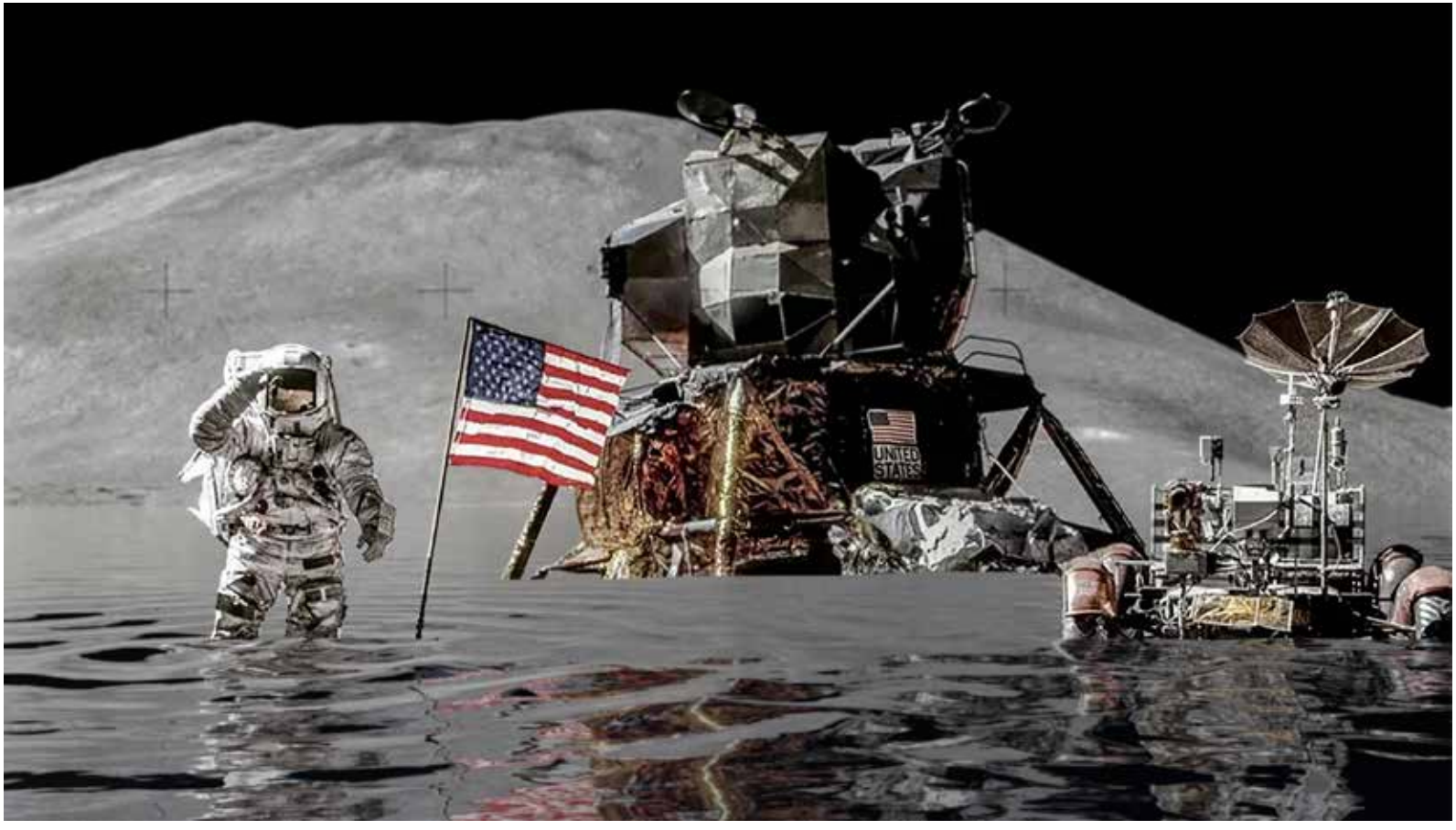
A Lake Ponchartrain Plan, modeled after Kenzo Tange's 'PLAN FOR TOKYO'.

4 STABILIZE 2100

phase 4

21st Century Manifest Destiny

The ultimate goal of the Mississippi River Plug-In is to provide precedent and become a precursor to a 21st Century Manifest Destiny; the next frontier in the journey of expansion. It is not as romantic or exciting as venturing out into the unknowns of space, rather it deals with the reality of climate change here on Earth. Instead of retreating from coastlines, we should consider recapturing and coexisting with the consequences of global climate change.


UNITED
STATES

Afterword

Personal Thoughts

The project was initially conceived as a coping method to climate change. NOLA (New Orleans, Louisiana) was a target site because it had already experienced the effects of climate change in ways that threatened the vitality of the city. After exploring its context, its history, and its urban culture, it became clear that instead of a coping method, a proposal to float architecture along the Mississippi became an opportunity instead.

Through the Mississippi River Plug-In: A Water District for NOLA, research of the Mississippi River revealed several opportunities to revitalize the river; an installation, or series of installations, could activate the riverfront off of the French Quarter in accordance with an existing Mississippi Riverfront Master Plan to do so. The Water District could become an extension of the livelihood of the city and could grow, physically, alongside the city as it recovers from the effects of natural disasters.

Cities such as Galveston, New York City, and Miami are also preparing their own methods to preserve their way of life and protecting their city from the concerns of growing impacts of climate change. Taking precedent from European countries already experiencing the effects of sea level rise, floating architecture onto water is a realistic and logical solution. It is an idea that is continuing to be expanded upon, and is at the cusp of reality for coastal cities at risk.

Bibliography : Works Cited

"10 Ways Tourism Helps New Orleans." New Orleans and Company, 31 Mar. 2017, community.neworleans.com/10-ways-tourism-helps-new-orleans/.

"Best Time to Visit New Orleans." Best New Orleans Hotels, www.bestneworleanshotels.com/travel-tips/best-time-to-visit-new-orleans#:~:text=The%20most%20popular%20time%20to,Gras%20season%2C%20January%20through%20March.

Campanella, Richard. New Orleans: A Timeline of Economic History. Tuleane University, richcampanella.com/wp-content/uploads/2020/02/article_Campanella_New-Orleans-Timeline-of-Economic-History_NOBA.pdf.

CARLIE KOLLATH WELLS | Staff writer. "2020 Hurricane Season Officially Ends; Here Are the Records It Set." NOLA.com, NOLA, 30 Nov. 2020, https://www.nola.com/news/hurricane/article_d17ea1e2-2e5b-11eb-bcf4-f70bcbd968ee.html.

CARLIE KOLLATH WELLS | Staff writer. "When Was the Last Time New Orleans Was Hit by a Hurricane? See This List of Recent Storms." NOLA.com, NOLA, 28 Oct. 2020, https://www.nola.com/news/hurricane/article_c9e05c8e-1928-11eb-8049-ffcb38f27cb8.html.

"Charts Show How Hurricane Katrina Changed New Orleans." Science, National Geographic, 3 May 2021, https://www.nationalgeographic.com/science/article/150828-data-points-how-hurricane-katrina-changed-new-orleans.

"Economy of New Orleans." Encyclopædia Britannica, Encyclopædia Britannica, Inc., www.britannica.com/place/New-Orleans-Louisiana/Economy.

Editor, DAN SWENSON | Graphics. "Flood-Katrina-Map.jpg." NOLA.com, 20 Aug. 2019, https://www.nola.com/image_6a3a0a22-c37b-11e9-867c-037f316a3170.html.

"Floating Farm Dairy in Rotterdam by Goldsmith Architects." ArchEyes, 27 May 2020, archeyes.com/floating-farm-dairy-goldsmith-company/.

Frank, Thomas. "After a $14-Billion Upgrade, New Orleans' Levees Are Sinking." Scientific American, Scientific American, 11 Apr. 2019, https://www.scientificamerican.com/article/after-a-14-billion-upgrade-new-orleans-levees-are-sinking/.

Frearson, Amy. "Floating Farm in Rotterdam Is Now Home to 32 Cows." Dezeen, 10 July 2019, www.dezeen.com/2019/05/24/floating-farm-rotterdam-climate-change-cows-dairy/.

Gibbens, Sarah, and Laura Parker. "How Hurricane Ida Could Reshape New Orleans' Future." Environment, National Geographic, 30 Aug. 2021, https://www.nationalgeographic.com/environment/article/how-hurricane-ida-could-reshape-new-orleans.

History of New Orleans, https://www.neworleans.com/things-to-do/history/history-of-new-orleans-by-period/.

Kiefer, Philip, and climate change hurricane season hurricanes Science. "New Orleans' Billion-Dollar Levees Survived Hurricane Ida. Can They Handle What's Coming?" Popular Science, 9 Sept. 2021, https://www.popsci.com/science/new-orleans-levees-hurricane-upgrade/.

Lentes, Morgan. "'We're Going to Get Back to the 19 Million Visitors plus': City, Tourism Leaders Celebrate Progress." WDSU, WDSU, 24 June 2021, www.wdsu.com/article/were-going-to-get-back-to-the-19-million-visitors-plus-city-tourism-leaders-celebrate-progress/36611108#.

"Market Pulse: New Orleans, LA." HVS, 16 Apr. 2018, https://www.hvs.com/article/8238-Market-Pulse-New-Orleans-LA.

McIntyre, Douglas A. "This Is Why New Orleans Is Still Struggling to Regain a Third of Its Population." 247 Wall St, 24/7 Wall St., 12 July 2019, https://247wallst.com/economy/2019/07/12/this-is-why-new-orleans-is-still-struggling-to-regain-a-third-of-its-population/.

Michaels, Samantha. "Maps: 10 Years after Katrina, Nola's Poor Neighborhoods Are Still Largely Abandoned." Mother Jones, 10 Aug. 2015, https://www.motherjones.com/politics/2015/08/maps-10-years-after-hurricane-katrina-uneven-recovery-new-orleans/.

McLindon, Chris. “Changing Course - Historical Avulsions and the Old River Control Structure.” McLindon Geosciences, LLC, McLindon Geosciences, LLC, 12 Apr. 2020, www.mcgeo.me/blog/changing-course-historical-avulsions-and-the-old-river-control-structure.

“Mississippi River Water Quality: Implications for Coastal ... - Lacoast.gov.” LACoast.gov, www.lacoast.gov/new/Data/Reports/ITS/MRWQ.pdf.

“New Orleans District Website.” New Orleans District, U.S. Army Corps of Engineers, https://www.mvn.usace.army.mil/About/.

“New Orleans, LA.” Data USA, datausa.io/profile/geo/new-orleans-la/.

“New Orleans, Louisiana Population History 1840 - 2019.” New Orleans, Louisiana Population History | 1840 - 2019, 28 Oct. 2021, https://www.biggestuscities.com/city/new-orleans-louisiana.

“New Orleans: Economy.” New Orleans: Economy - Major Industries and Commercial Activity, Incentive ProgramsNew and Existing Companies, www.city-data.com/us-cities/The-South/New-Orleans-Economy.html.

“Port Nola Drives Local, State and National Economy, Creates Jobs and Tax Revenue.” GNO Inc., 20 July 2020, gnoinc.org/news/port-nola-drives-local-state-and-national-economy-creates-jobs-and-tax-revenue/#:~:text=NEW%20ORLEANS%20%E2%80%93%20The%20Port%20of,conducted%20by%20the%20LSU%20Economics%20%26.

Restore the Mississippi River Delta. mississippiriverdelta.org/.

“The River.” Lower Mississippi River Conservation Committee, 2 Mar. 2022, www.lmrcc.org/the-river/.

Trejo, Rebeca. “Why Is New Orleans Known as ‘The Big Easy?”.” Culture Trip, The Culture Trip, 20 Sept. 2016, https://theculturetrip.com/north-america/usa/louisiana/new-orleans/articles/why-is-new-orleans-known-as-the-big-easy/.

SCHLEIFSTEIN, MARK. “Corps Oks Money to Finish Deepening of Mississippi River Channel to Allow ‘Panamax’ Ships.” NOLA.com, 22 Jan. 2021, www.nola.com/news/business/article_4d1d6bb0-5b59-11eb-bd48-df47178deb40.html.

Bibliography : Images Cited

https://grist.org/article/time-magazine-devoted-an-entire-issue-to-climate-change-again/

https://jotot.com/maps-legends-harold-fisks-beautiful-mississippi/

https://kottke.org/19/06/the-marvelous-mississippi-river-meander-maps

https://www.audubon.org/news/our-blueprint-resilient-lower-mississippi-river

https://www.flickr.com/photos/145229933@N08/27263843617

https://www.flickr.com/photos/161545269@N02/45100487294/

https://www.researchgate.net/figure/New-Orleans-between-Mississippi-river-right-and-Lake-Pontchartrain-left-looking-to_fig1_263159331

https://www.usatoday.com/story/news/nation/2021/08/04/apollo-15-remastered-photos-show-more-details-mission-moon/5490619001/