SCALING FOR CARBON

GSAPP SELECTED WORKS
2022-2025

ERIC HU

The question

for me

has been

how do we

SCALE

to combat

climate change

and decarbonize?

If we are serious about climate change and decarbonisation, we have to design pathways from prototype to impact at scale.

David Benjamin

GRADUATE SCHOOL OF ARCHITECTURE, PLANNING, AND PERSERVATION

MASTER OF ARCHITECTURE

SELECTED WORKS ARE FROM

ADVANCED STUDIO VI: THE STRAW TRANSITION
CORE STUDIO II: STATION SOCIALS
CORE STUDIO III: LIBRARY OF THINGS
CORE STUDIO I: SYMBIOTIC TRIBUTARIES
CORE STUDIO I: SELF-SUFFICIENT SUPERBLOCKS
ADVANCED STUDIO IV: SALTMARSH TAPESTRIES
ADVANCED STUDIO V: WATERSCAPES

CONSTRUCTION ECOLOGIES
SEMINAR OF SECTION
TECH V: CONSTRUCTION AND LIFE CYCLE SYSTEMS

CLASSES MENTIONED BUT NOT INCLUDED
NET-ZERO HOUSING
RESILIENT CITIES + LANDSCAPES
CLIMATE, TECHNOLOGY, & SOCIETY

01

THE STRAW TRANSITION
ESCAPING THE GRAIN TRAP

Spring 2025 | Advanced VI Studio
Location: India
Purpose: Systems, Housing
Critic: David Benjamin

Since India's Green Revolution, a monoculture of rice and wheat has dominated the agriculture of India and the livelihoods of farmers. Deeply embedded in the nation's food security, wheat and rice monocultures generate millions of tons of food and byproducts. These grains are used in critical food security program that annually provides food for over half of India's enormous population. The country's dependence on wheat and rice for these food programs has led to a cyclical monoculture:

High-yield seed varieties are genetically modified to be more productive and resistant to pests while demanding increased amounts of water and chemical fertilizers. When harvested, the residual straw is frequently burned in place, a practice that degrades soil health and accelerates the demand for stronger fertilizers and pesticides. This dependency reinforces the need for increasingly GMO'd seed varieties, all of which is draining India's already overexploited groundwater reserves.

In addition, the government sets the grain at low prices, locking farmers into a vicious loop of diminishing returns and environmental degradation—a system that is both unsustainable and must change.

A critical point of contention lies in the cultivation of rice in northwestern India, where much of the crop is produced for distribution to other parts of the country. There is growing consensus that rice cultivation in this region must be significantly curtailed or phased out altogether, given the alarming rate at which local groundwater resources are being depleted.

And so, faced with the dilemmas of crop burning and impending desertification from the grain monoculture, India must look for other means to provide food for its food security while shifting away from its grain monoculture.

However, the reality is that to provide food for the millions of people reliant on the grain, this existing grain monoculture remains a necessity for the next 10-20 years.

My proposal is partnered with this reality. It exists in the necessary transition period from the grain monocultures, to whatever future agricultural solution there is, be it cereals or horticulture. This transition period will see that straw is not burned but utilized in the construction of their lives.

IMAGES CAPTURED DURING KINNE WEEK TRIP TO PUNJAB INDIA

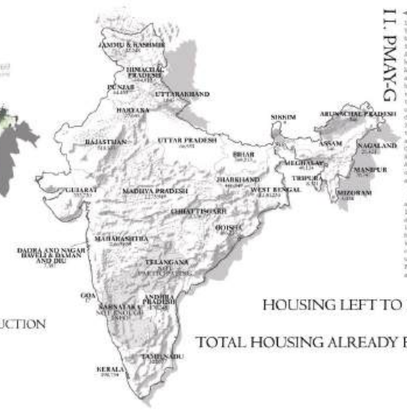
THE STRAW TRANSITION
ESCAPING FROM THE GRAIN TRAP

Since the Green Revolution in the 1960s, India has been immensely dependent on their monocultures of rice and wheat to provide food for over half of its population. Deeply embedded in the nation's food security programs which provide food for a staggering 813.5 million people (59.81% of India's population), wheat and rice monocultures generate millions of tons of food and straw. However, due to increasing economic times and the necessity of food, the byproduct of the grains are commonly and frequently burned in place, severely polluting India's air and ground.

It is possible and a necessity to rethink the burning of the agricultural byproduct. According to estimates, within 25 years, due to excessive reliance on the wheat-rice monoculture, Punjab is predicted to become a barren desert. The monocultures of Punjab must begin to change, but the nations dependence on Punjab's rice (which produces 31.43% of India's wheat and 23% of India's rice despite being only 1.5% of India's total land) means this system must stay intact until a new one can be introduced. By redesigning the system of this agricultural byproduct we can take the initiative to transform waste into opportunity - where fields no longer burn, but instead, build our futures.

110 MILLION TONS
27% OF WORLD PRODUCTION

115 MILLION TONS
15% OF WORLD PRODUCTION



I. CYCLICAL MONOCULTURE

India has rolled heavily on the monocultures of wheat and rice, a direct result of the Green Revolution. While this shift significantly boosted food production and secured India's grain supply, it has also led to severe ecological and economic challenges. The dominance of these two crops has resulted in soil degradation, groundwater depletion, and declining biodiversity. High-yield varieties of wheat and rice require intensive irrigation, depleting India's, more specifically Punjab's, watertable at alarming rates. Economically, India's dependency on wheat and rice monoculture has trapped farmers in a cycle of diminishing returns. Government policies, including minimum support prices, favor these staple crops, discouraging diversification. However, alternative approaches, such as introducing crop rotation, agroforestry, and utilizing wheat and rice straw for sustainable construction, offer potential solutions. Reimagining India's agricultural system is critical for long-term sustainability. By integrating ecological practices and innovative uses for agricultural byproducts, India can reduce environmental damage while maintaining food security. A shift towards diversified, sustainable farming practices is essential to restoring the region's ecological balance and securing its agricultural future.

India's reliance on wheat and rice monocultures has made seed research essential for long-term agricultural sustainability. Continuous cropping of these staples has led to soil depletion, pest resistance, and declining yields, making innovation in seed development critical. Research into drought-resistant, pest-tolerant, and climate-adaptive seed varieties can help mitigate the ecological strain caused by monoculture farming.

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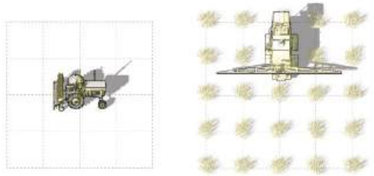
2. SEEDS

Farmers purchase seeds through a mix of government agencies, private companies, and informal local markets. The National Seeds Corporation and state seed corporations supply certified, high-yielding varieties, often subsidized by the government. Private seed companies offer hybrid and genetically modified seeds, catering to commercial farming needs. Many small-scale farmers, however, rely on informal seed sorting and exchange within their communities. While government initiatives promote quality seeds, issues like affordability, accessibility, and counterfeit seeds persist.

Wheat Variants	Rice Variants
HD3123 PUSA1121	
HD3043 PUSA1509	
HD3086 PUSA1718	
WB1105 PUSA1885	
HD3767 PUSA1979	



3. SOWING

Traditional broadcasting involves scattering seeds by hand or machine, but it often leads to uneven germination and requires more water. Zero-tillage, or no-till farming, is gaining traction, where seeds are directly sown into untilled soil, reducing soil erosion and preserving moisture. The Happy Seeder, a tractor-mounted machine, allows farmers to sow wheat directly into rice stubble without burning it, improving air quality while maintaining soil fertility.

10. SURVEILLANCE

Satellite-based surveillance has become a key tool in monitoring crop residue burning in India, particularly in states like Punjab, Haryana, and Uttar Pradesh. Using remote sensing technology, agencies such as ISRO and NASA track thermal anomalies and detect fire hotspots in near real-time. These data are used by the Central Pollution Control Board and state governments to enforce environmental regulations, issue advisories, and impose penalties. While satellite surveillance provides crucial evidence for policy action, its effectiveness depends on timely local enforcement and ground-level interventions.

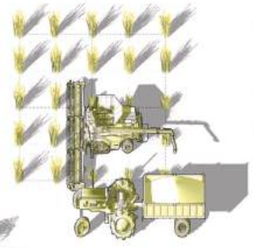
OPEN-FIELD BURNING RELEASES 7,300 kgCO₂eq PER HECTARE

4. EARLY CARE

The excessive use of pesticides and water-intensive irrigation for grain cultivation, especially wheat and rice, has led to severe environmental and health challenges. Farmers rely heavily on chemical pesticides and fertilizers to maximize yields, but this has resulted in soil degradation, water contamination, and rising cancer rates. Additionally, the cultivation of water-intensive rice in a semi-arid region has caused a dramatic decline in groundwater levels, with many wells running dry. The combination of pesticide overuse and unsustainable irrigation threatens both food security and long-term agricultural sustainability.

5. HEADING

The wheat growing cycle begins with germination, where seeds absorb moisture and sprout, establishing roots and shoots. During tillering, the plant develops multiple stems, crucial for yield. In the jointing and stem elongation stage, the main stem grows rapidly, forming nodes and internodes. Booting and heading follow, as the wheat head develops within the flag leaf sheath and then fully emerges. Flowering and pollination occur next, with mostly self-pollinating flowers, a stage highly sensitive to weather. Finally, during grain filling and maturity, the kernels accumulate starch, and the plant turns golden, signaling it is ready for harvest.



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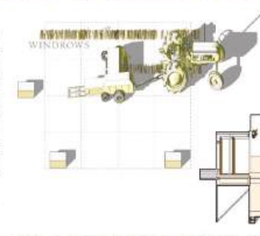
7. BALING

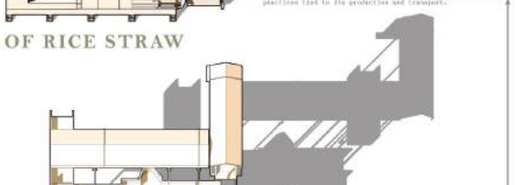
Baling the straw on the fields created an estimated 940 rupees per hectare. By replacing the brick with straw bale, we find a use for the straw that rests on the fields of the farmers. Farmers who engage in this new system would be able to use their straw as construction materials, and if they are not selling the straw to build they would be able to sell it as construction material. By doing this we can help them transform the negative value straw into revenue while also encountering carbon into the typical PMAY-G Scheme. The houses would in fact more remain the same if not expanding to account for optimal bale positioning. Well thicknesses would greatly change, allowing the building to have thermal mass and protecting the inhabitants from the scorching days.

The designer of the proposed PMAY-G housing scheme would similarly match existing PMAY-G housing schemes for consistency. Like the existing schemes of brick and concrete, these houses of bale are implementable Now at this moment.



8. INDUSTRIAL BALING

As industrial baling becomes more decentralized in factories across the Indian countryside, the traditional bale stores sourced directly from farms are undergoing a transformation. Historically, Indian farmers produced small, manually tied bales-optimized for local labor conditions and transport. However, with the rise of mechanized harvest in rural processing facilities, there's a shift toward larger, standardized bale formats that prioritize logistical efficiency, compact storage, and compatibility with steam buildings. This evolution marks a key material and infrastructural shift, altering not only the scale of the bale but also the rural economies and labor practices tied to its production and transport.

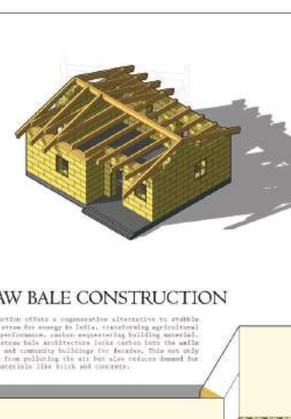


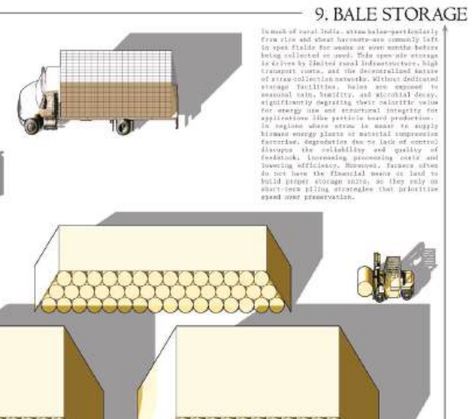
8. COMPRESSION FACTORY

Across the Indian countryside, a network of industrial compression factories-such as those operated by Stone-Sure-are transforming agricultural residue like straw into high-performance particle boards for architectural use. These decentralized facilities compress post-harvest biomass into durable, low-carbon panels, offering a sustainable alternative to conventional interior wall systems. By redirecting crop waste from open burning into building materials, these factories not only reduce environmental harm but also forge a new supply chain linking rural production with urban construction. The result is a bio-based architecture that is both materially grounded and symbolically regenerative.

9. BALE STORAGE

In much of rural India, straw bales-particularly from rice and wheat harvests-are commonly left in open fields for weeks or even months before being collected or used. This open-air storage is driven by limited rural infrastructure, high transport costs, and the decentralized nature of straw collection networks. Without dedicated storage facilities, bales are exposed to seasonal rain, humidity, and microbial decay, significantly degrading their calorific value for energy use and structural integrity for applications like pesticide board production. In regions where straw is meant to supply biomass energy plants or material compression factories, degradation due to lack of control disrupts the reliability and quality of feedstock, increasing processing costs and lowering efficiency. Moreover, farmers often do not have the financial means or land to build proper storage sheds, so they rely on short-term piling strategies that paradoxically speed over preservation.





I.1. PMAY-G

Launch on 1st April 2016, Pradhan Mantri Awaas Yojana Gramin (PMAY-G) is centre's flagship mission by the Ministry of Rural Development (MoRD), Implemented by the Ministry of Housing and Urban Affairs (MoHUA), PMAY-G aims at providing a pucca house, with basic amenities, to all homeless households and those households living in kutcha and dilapidated house. PMAY-G addresses the rural housing shortage and bridges the housing deficit in rural areas of India, contributing significantly to the mission of "Housing for All". The minimum size of the houses under PMAY-G is 25 sq.m including a dedicated area for hygienic cooking. As of 27th Sept 2022, 2.56 crore houses have been constructed out of the total target of 2.72 crores. The beneficiaries are identified using the Socio-Economic and Caste Census (SECC) parameters and verified by the Gram Sabhas. The amount is transferred directly to the Aadhaar linked Bank account / Post-Office Account of the beneficiary. PMAY-G has been extended for another two years, i.e. till 31st March 2024.

PMAY-G aims to provide a pucca house with basic amenities to all homeless households and households living in kutcha and dilapidated houses in rural areas by 2024. The immediate objective is to cover 1.08 Crore households in rural areas, that are homeless or living in kutcha / dilapidated houses, in three years from 2014-17 to 2019-20 and ensure construction of quality houses by the beneficiaries using local materials, designs and trained masons. For house to become home, adoption of a habitat approach through convergence is proposed.

HOUSING LEFT TO BE BUILT BY 2029
10,762,319 UNITS

TOTAL HOUSING ALREADY BUILT BY PMAY-G
27,182,942 UNITS

10. STRAW BALE CONSTRUCTION

Straw bale construction offers a regenerative alternative to stubble burning or burning straw for energy in India, transforming agricultural residue into high-performance, carbon-sequestering building material. Unlike combustion straw bale architecture locks carbon into the walls of homes, schools, and community buildings for decades. This not only diverts crop waste from polluting the air but also reduces demand for carbon-intensive materials like brick and concrete.

154.0 MILLION TONS OF WHEAT STRAW

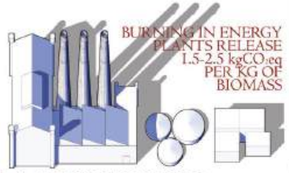
126.6 MILLION TONS OF RICE STRAW

NORTHEASTERN INDIA DERSERTIFICATION EXACERBATED BY GROUNDWATER RELIANCE → THE RICE MUST STOP

PUNJAB ESTIMATED TO BECOME A DESERT IN 25 YEARS
IN 2018, 180,000 HECTARES UNDERWENT DEGRADATION/DESERTIFICATION

9. ENERGY BURNING

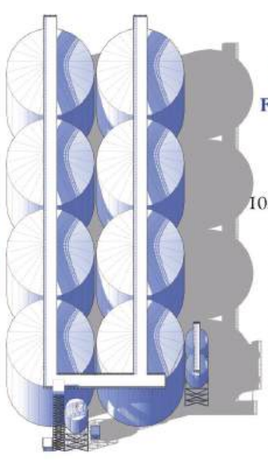
In recent years, a shift has emerged in India's approach to managing agricultural residue-particularly rice and wheat straw-as farmers increasingly opt or incentivize contractors to remove straw from their fields and transport it to biomass energy plants, rather than burning the straw in open fields, which causes severe air pollution and health risks. the material is now being directed to industrial-scale biomass power plants where it is burned in controlled environments to generate electricity or thermal energy. It offers farmers a fast and relatively clean solution to clear their fields, reduces open burning, and provides a renewable feedstock for India's growing biomass energy sector. On the other hand, the combustion of straw at energy plants still emits substantial carbon dioxide.



BURNING IN ENERGY PLANTS RELEASE 1.5-2.5 kgCO₂eq PER KG OF BIOMASS

8. STUBBLE BURNING

Burning stubble is a widespread agricultural practice in India, particularly in the states of Punjab, Haryana, and Uttar Pradesh. Farmers set fire to the leftover crop residue after harvesting paddy to quickly clear fields for the next planting season, mainly wheat. However, this practice contributes significantly to air pollution, releasing particulate matter, carbon monoxide, and other harmful pollutants. It is a major cause of Delhi's severe winter smog, exacerbating respiratory diseases and environmental degradation. An estimated 91 million tons of stubble are burned yearly.



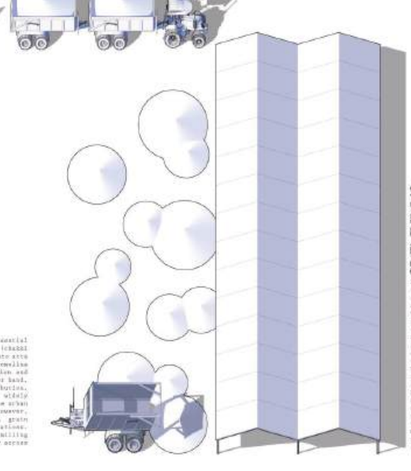
FOOD SECURITY SCHEMES FEED
813.5 MILLION PEOPLE
•ABOUT 2.5 TIMES THE POPULATION OF THE UNITED STATES
•ABOUT 70 MILLION MORE THAN ALL OF EUROPE

10. STORAGE

The Indian government purchases grain primarily through the Food Corporation of India and state agencies under the Minimum Support Price system. After procurement, the wheat is stored in grain silos and traditional godowns managed by FCI. Modern steel silos, equipped with aeration and temperature control, help prevent spoilage, pest infestations, and grain loss, ensuring long-term storage efficiency. These silos are gradually replacing conventional open storage methods to improve food security and minimize wastage. While traditional storage methods, such as covered warehouses and bunds and plinth storage, have been widely used, they are highly susceptible to pest infestations, moisture damage, and spoilage, leading to significant grain loss. Rodents, insects, and fungi can infiltrate poorly maintained godowns, compromising food quality and reducing the stock available for distribution under welfare schemes like the Public Distribution System.

9. MILLING

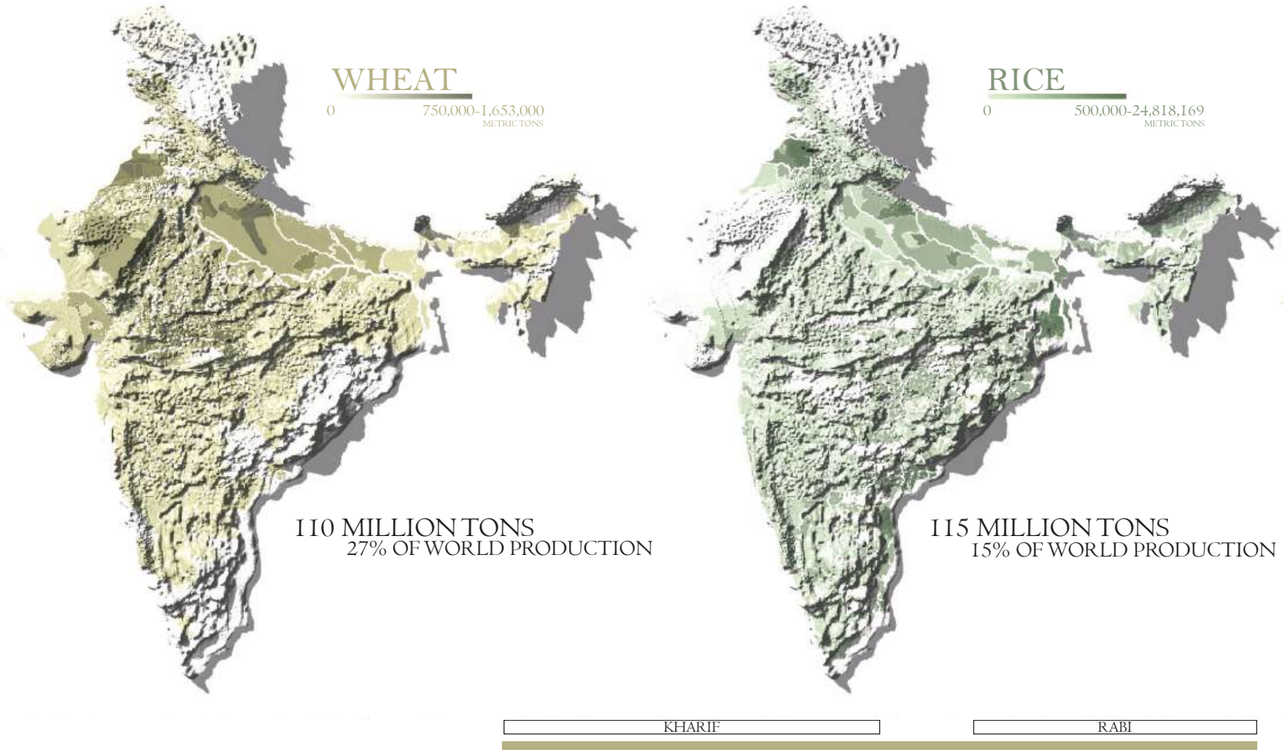
Transforming raw wheat and rice into flour and other essential food products, grain must be milled. Flour mills (chakki atta) and large-scale roller mills process wheat into atta (whole wheat flour), maida (refined flour), and semolina (sooji/rawa), catering to both household consumption and commercial food production. Rice mills, on the other hand, remove husks and polish rice grains for distribution. While traditional stone mills (chakki) are still widely used in rural areas, modern automated mills dominate urban markets, ensuring higher efficiency and quality. However, challenges like inconsistent electricity supply, grain wastage, and storage limitations impact milling operations. Strengthening infrastructure and adopting advanced milling technology can enhance efficiency and food security across India.

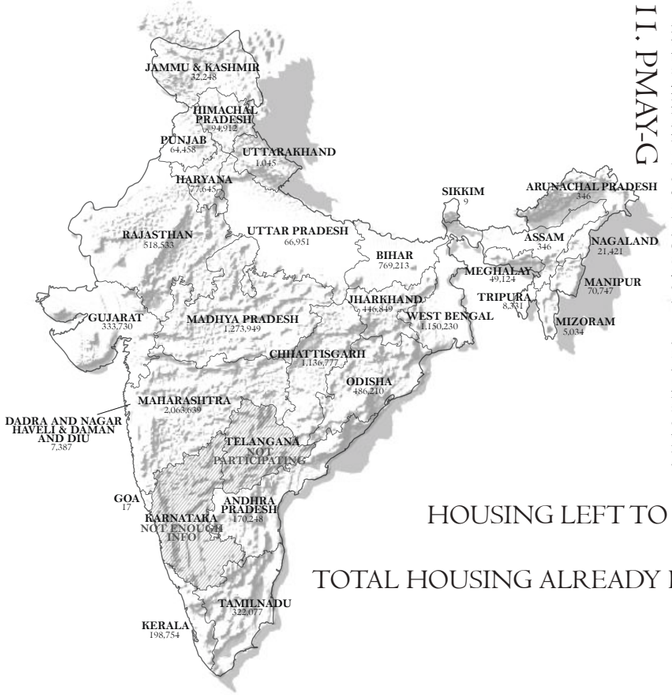


8. MANDIS

In India, mandis, or agricultural marketes, play a crucial role in the grain harvest and supply chain, acting as the primary link between farmers and consumers. These regulated markets, established under the Agricultural Produce Market Committee system, ensure fair trade, price regulation, and quality control for staple crops like wheat and rice. During the harvest season, farmers bring their grain to mandis, where it is weighed, inspected, and auctioned to government agencies, private traders, or millers. The government, through agencies like the Food Corporation of India, procures wheat and rice at the Minimum Support Price to maintain food security and distribute grain through the Public Distribution System. Traders and millers purchase additional stocks for commercial processing and export. Mandis help stabilize grain prices by preventing exploitation and ensuring that farmers receive fair compensation. However, challenges like middlemen, delayed payments, and lack of modern storage facilities affect efficiency and economic security.

Enlarged Selected Excerpts Next Page





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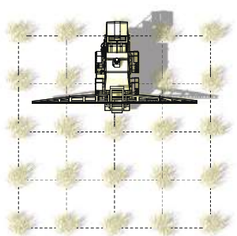
WHEAT



3. SOWING

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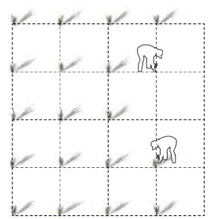
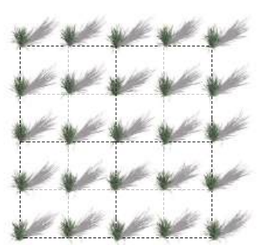
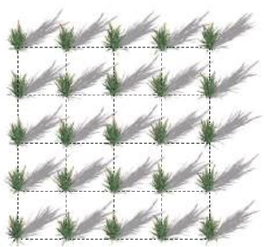
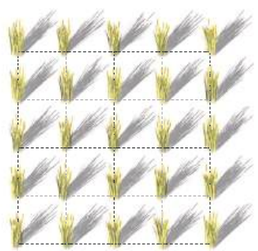
RICE









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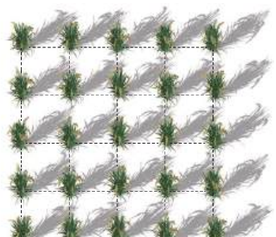

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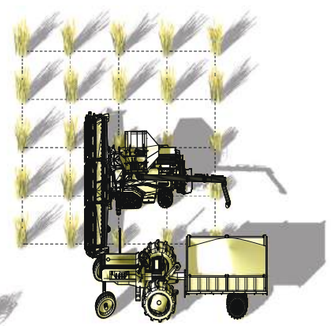

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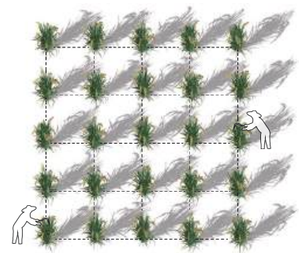
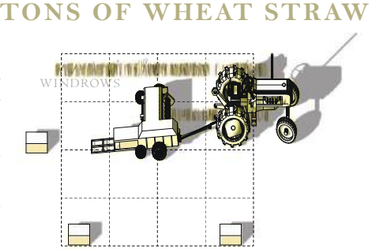


154.0 MILLION TONS OF WHEAT STRAW

7. BALING

Baling the straw on the fields costed an estimated 900 rupees per hectare. By replacing the brick with straw bale, we find a use for the straw that rests on the fields of the farmers. Farmers who engage in this new system would be able to use their straw as construction materials, and if they are not utilizing the straw to build they would be able to sell it as construction material. By doing this we can help them transform the negative value straw into revenue while also sequestering carbon into the typical PMAY-G Scheme. The houses would in floor area remain the same if not expanding to account for optimum bale positioning. Wall thicknesses would greatly change, allowing the building to have thermal mass and protecting the inhabitants from the scorching days.

The designs of the proposed PMAY-G housing schemes would similarly match existing PMAY-G housing schemes for continuity. Like the existing schemes of brick and concrete, these houses of bale are implementable NOW at this moment.

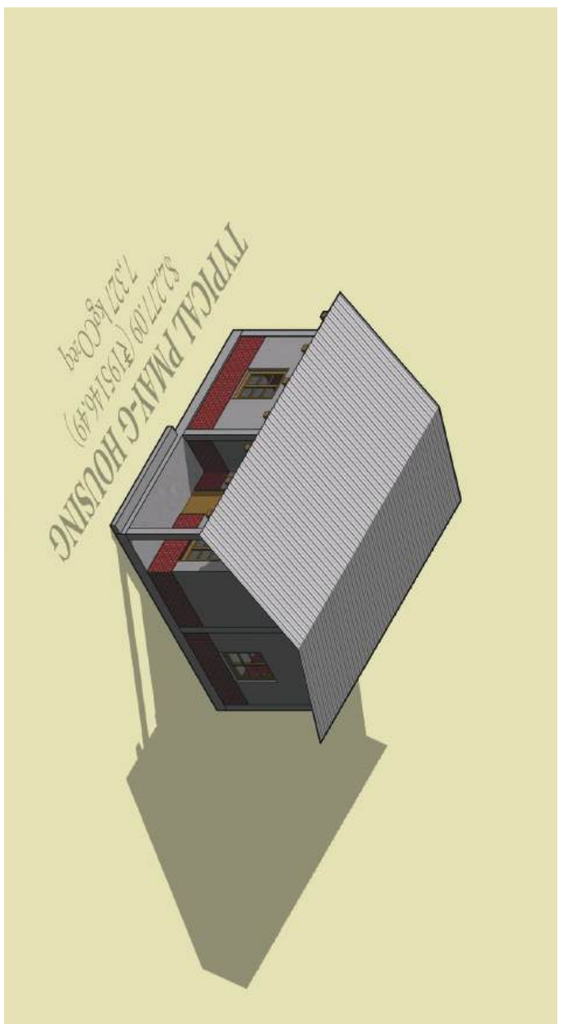


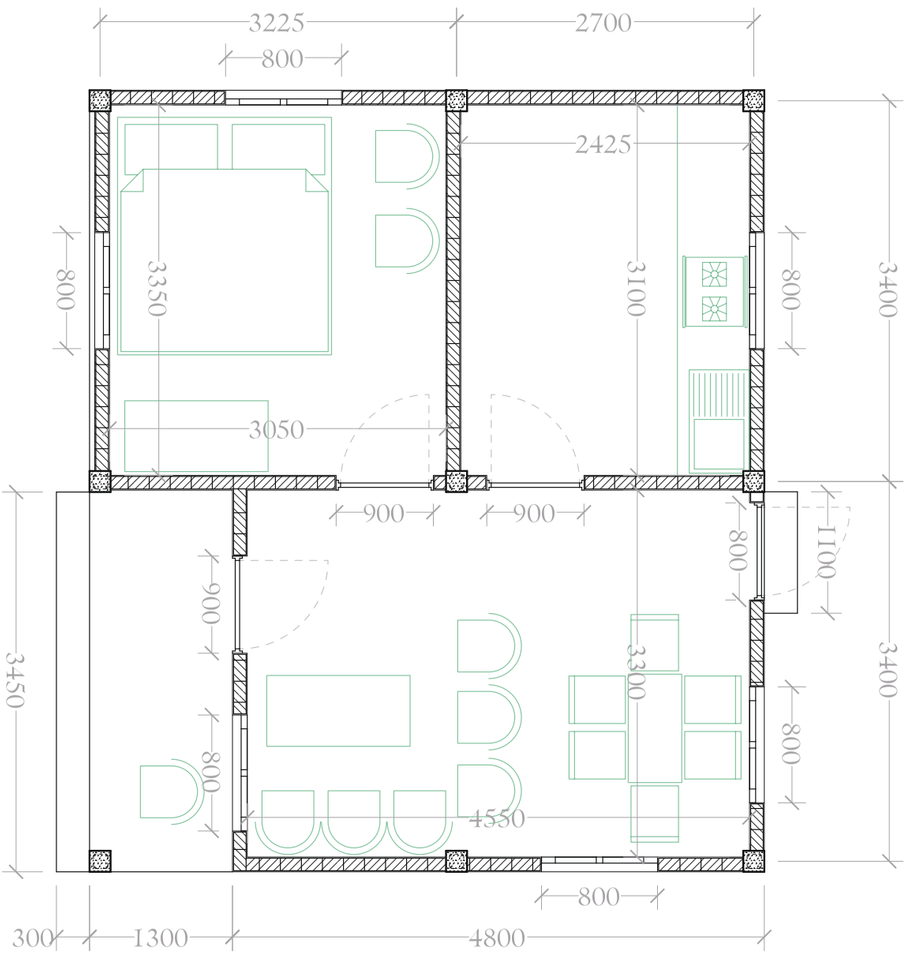
126.6 MILLION TONS OF RICE STRAW

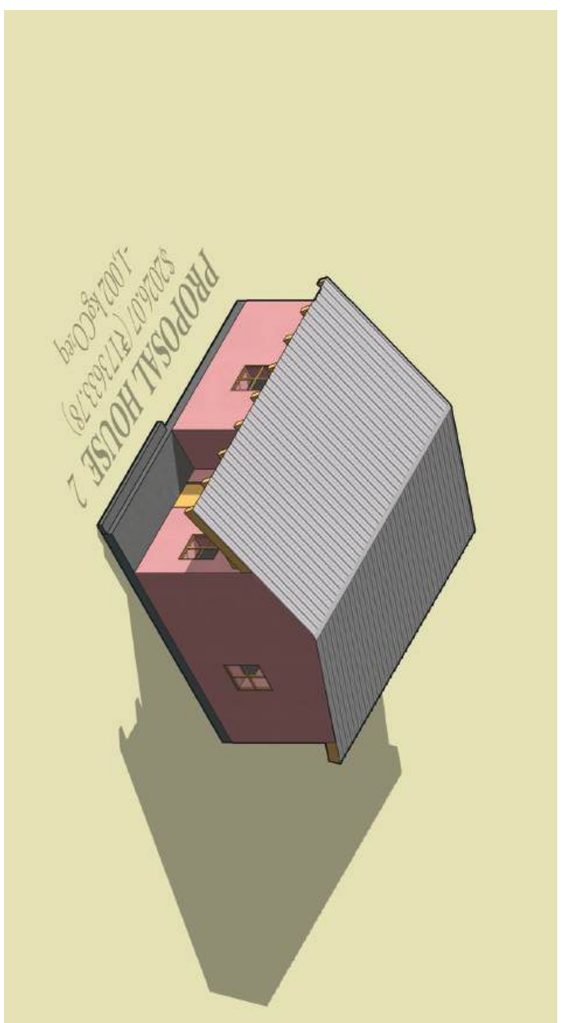
NORTHEASTERN INDIA DERSERTIFICATION EXACERBATED BY GROUNDWATER RELIANCE → THE RICE MUST STOP

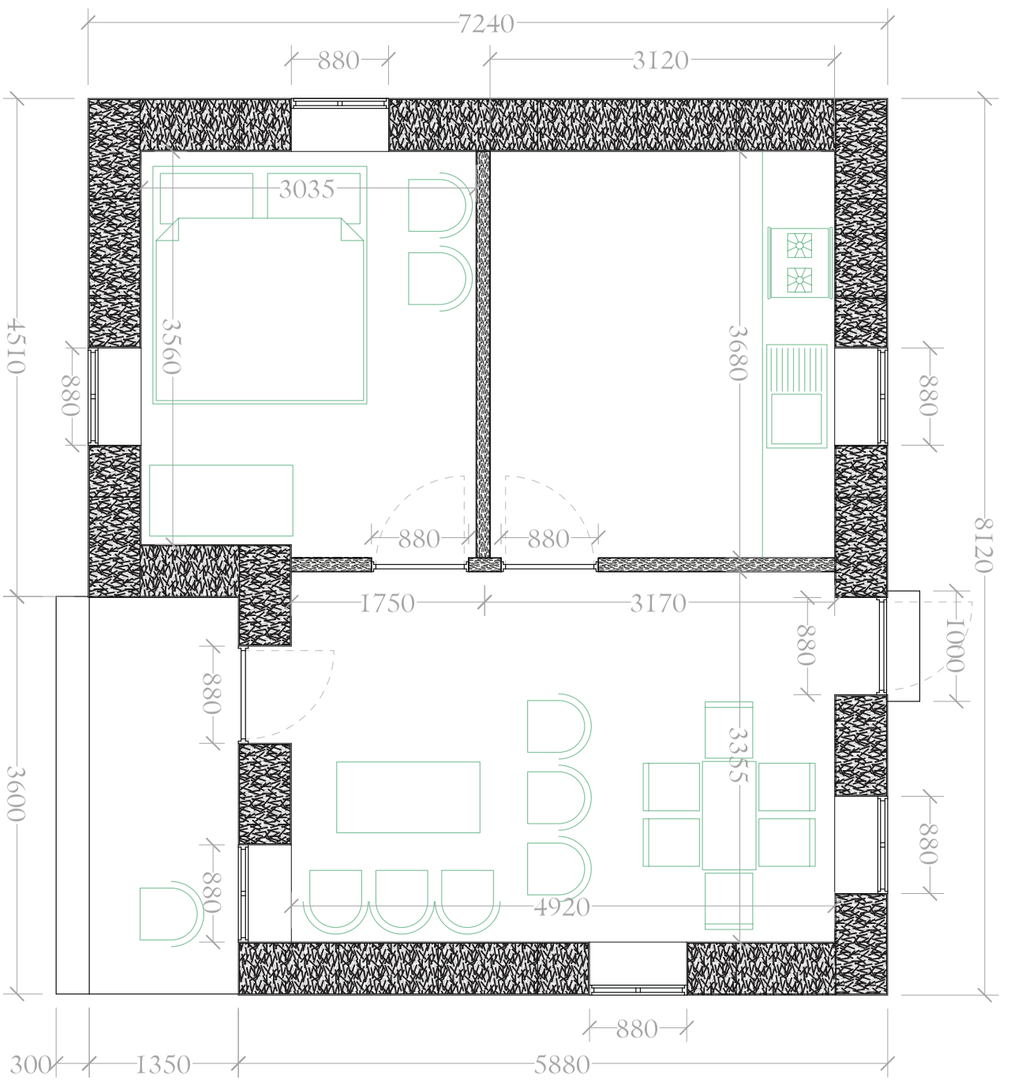
PUNJAB ESTIMATED TO BECOME A DESERT IN 25 YEARS
IN 2018, 180,000 HECTARES UNDERWENT DEGRADATION/DESERTIFICATION

BRICK
(CURRENT)



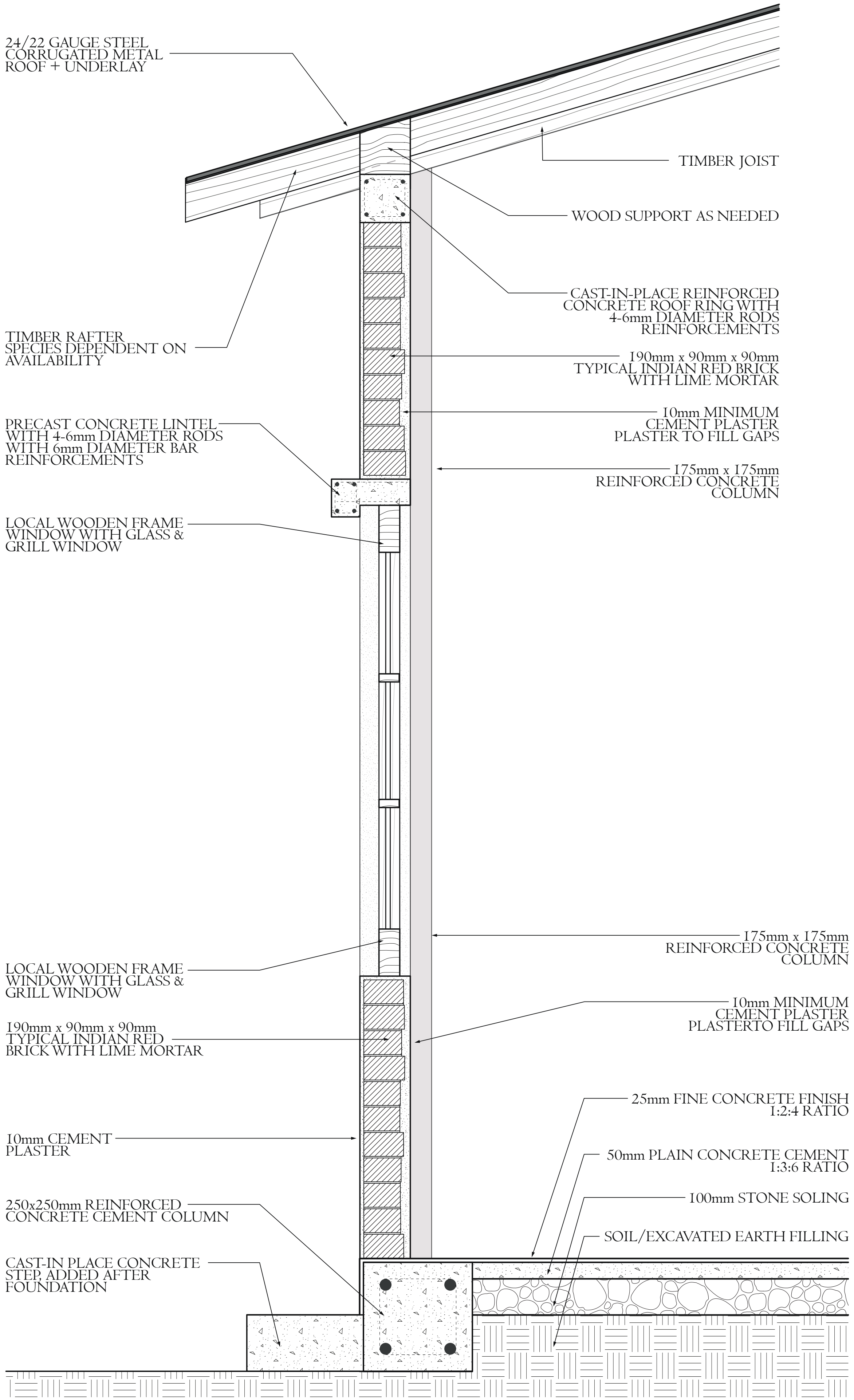




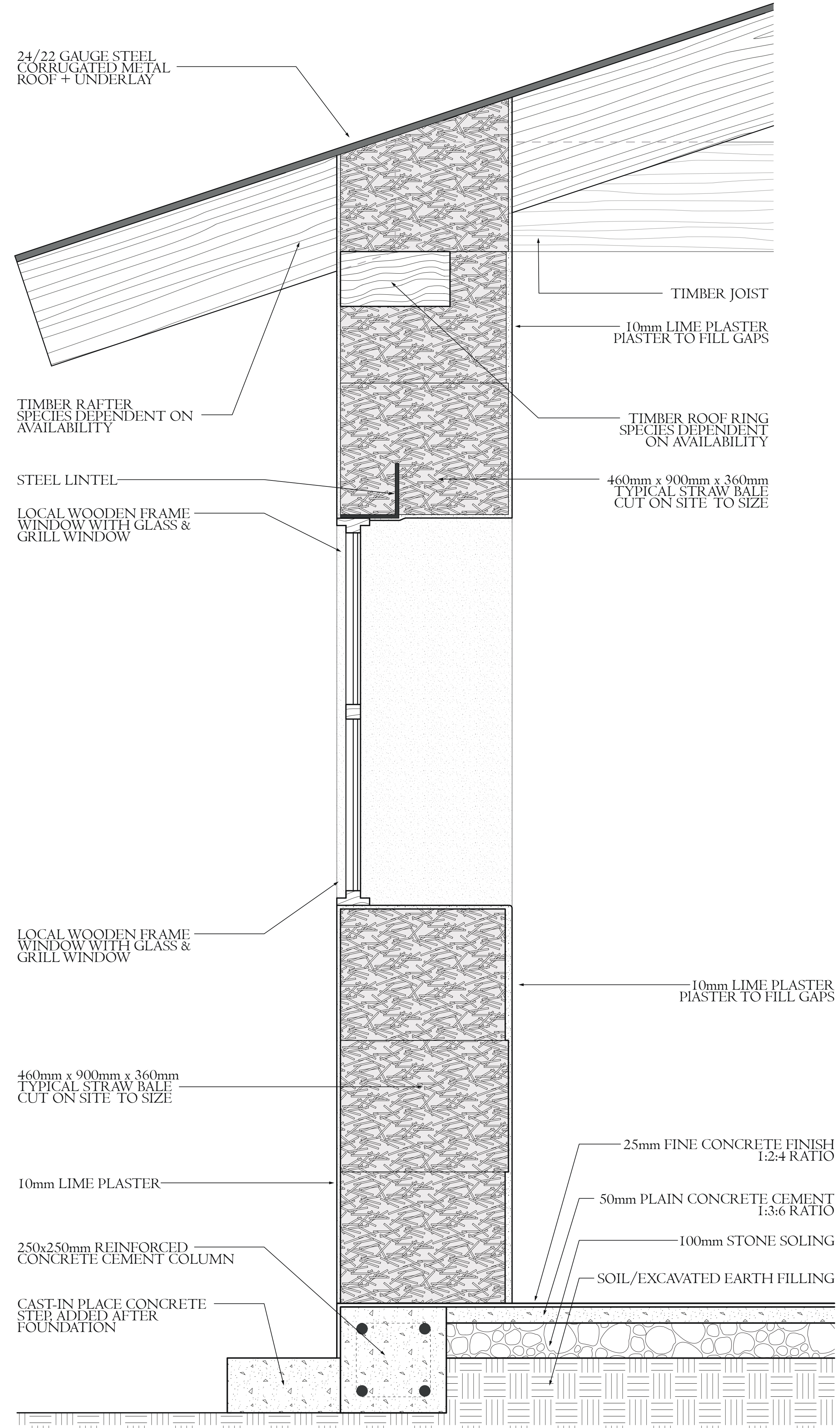


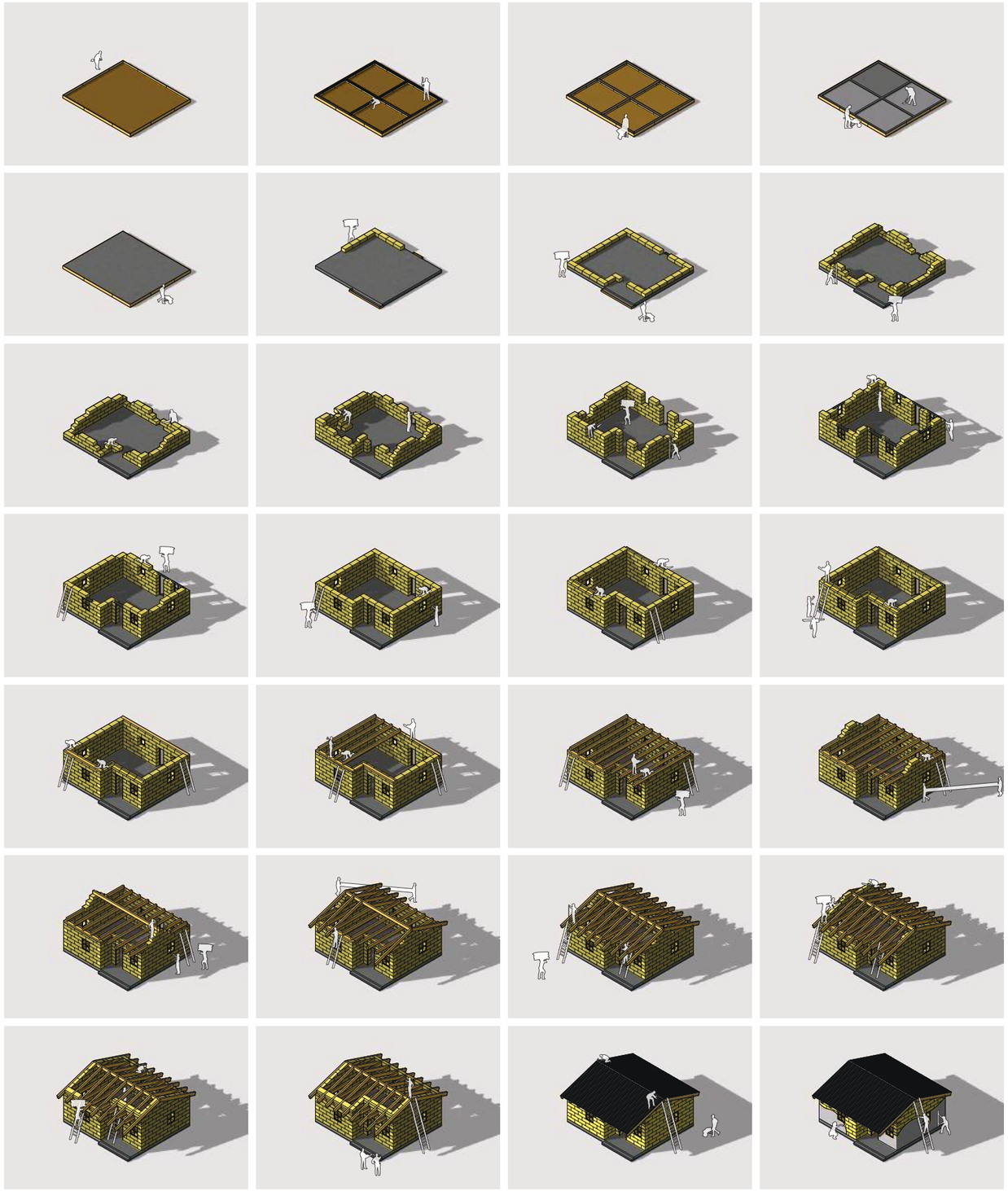
(PROPOSED)
STRAW

BRICK (CURRENT)

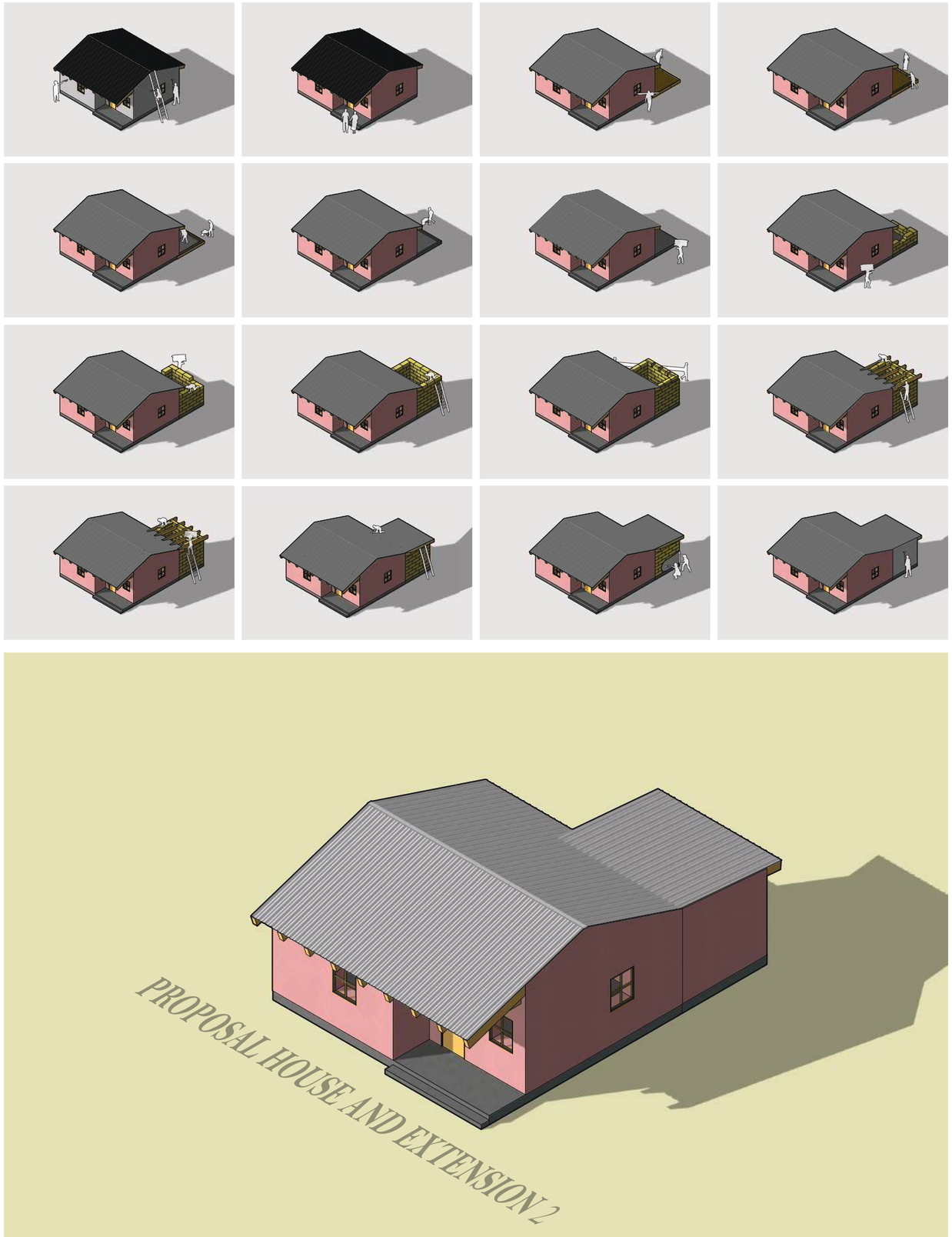


STRAW (PROPOSED)

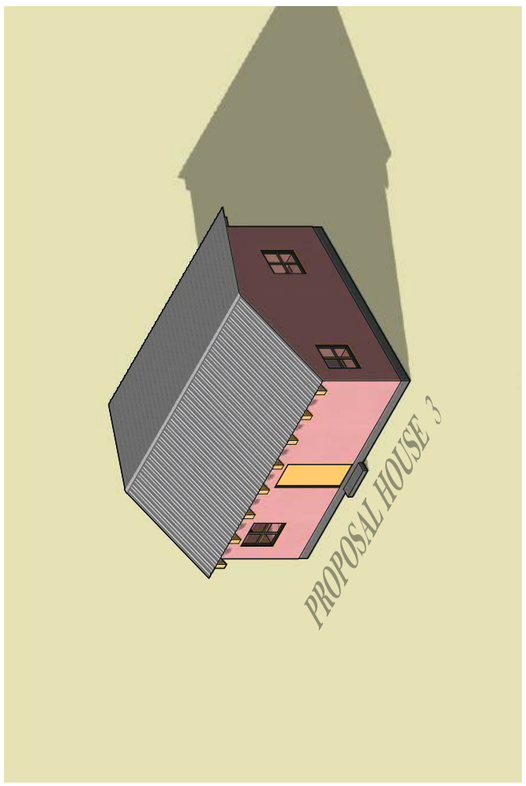




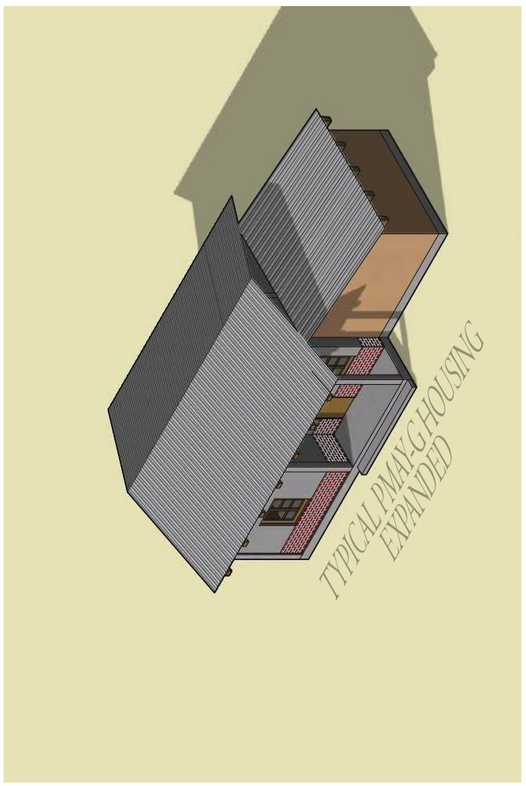
STRAW BALE CONSTRUCTION PROCESS



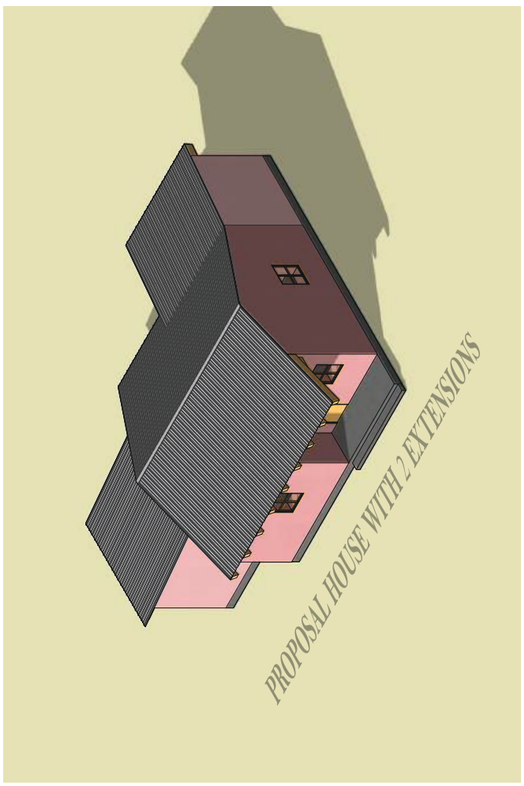
TYPOLOGIES



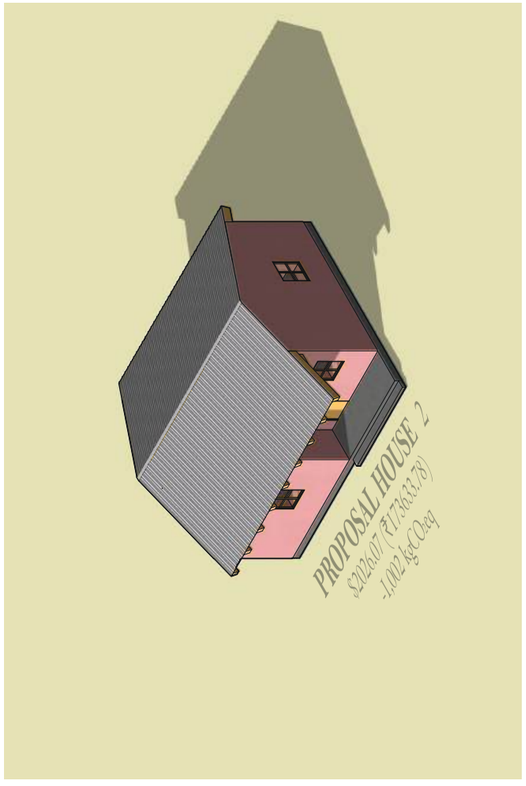
PROPOSAL HOUSE 3



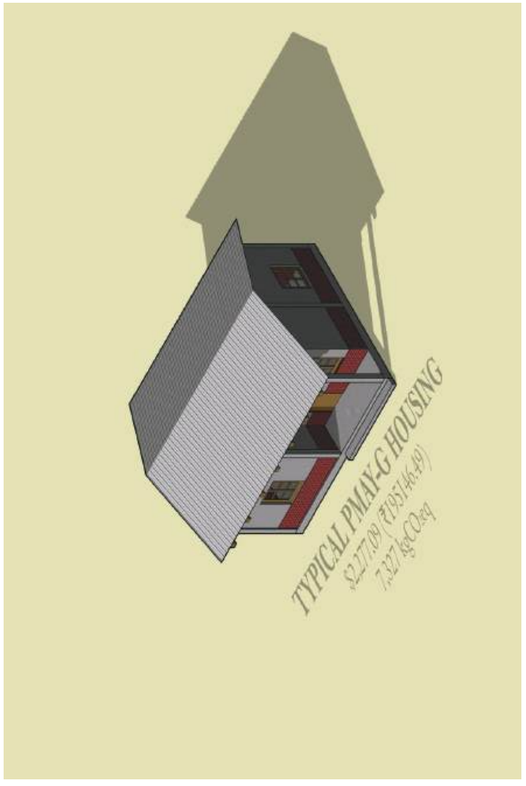
TYPICAL PMAY-G HOUSING
EXPANDED



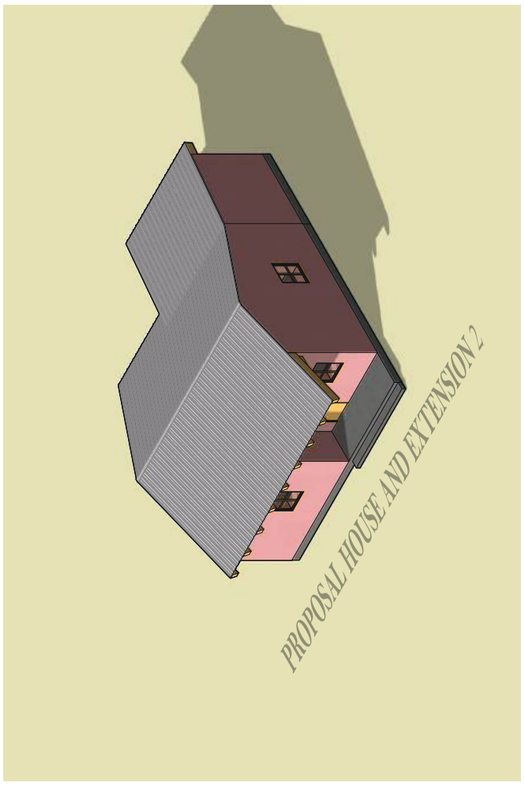
PROPOSAL HOUSE WITH 2 EXTENSIONS



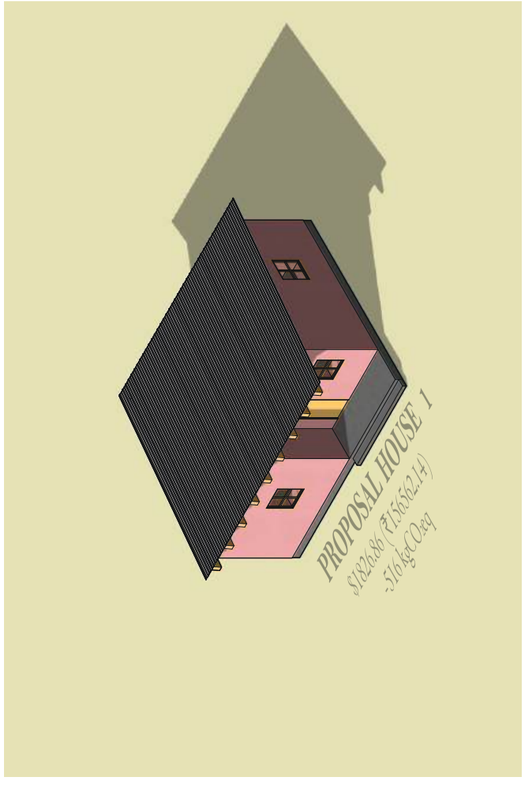
PROPOSAL HOUSE 2
$202a.07 (₹17633.78)
1.002 kgCO2eq



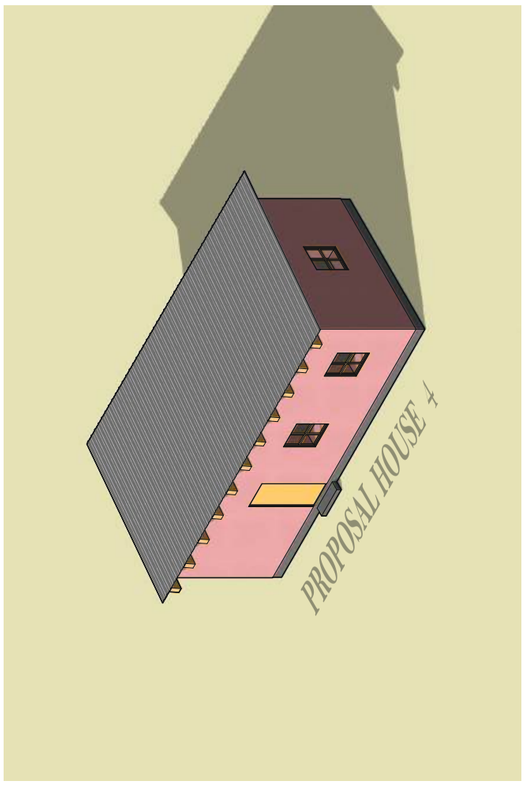
TYPICAL PMAY-G HOUSING
$2.27(08) (₹195146.49)
7.357 kgCO2eq



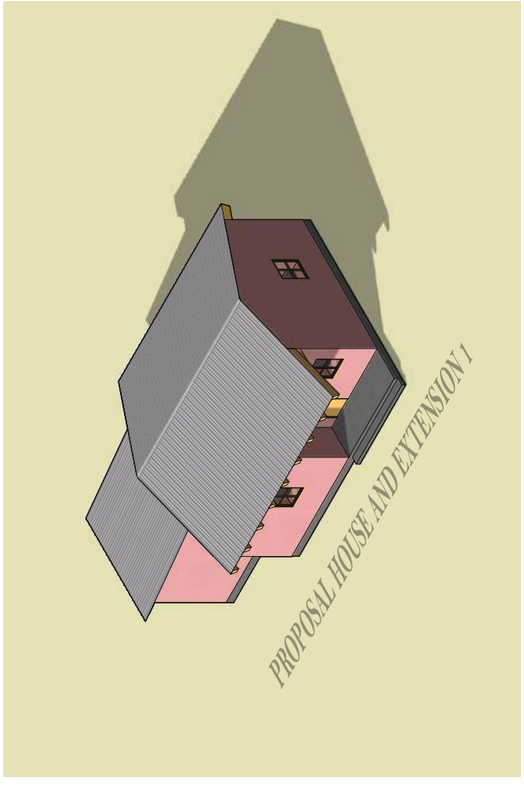
PROPOSAL HOUSE AND EXTENSION 2



PROPOSAL HOUSE 1
$182a.86 (₹15656.214)
.51o kgCO2eq

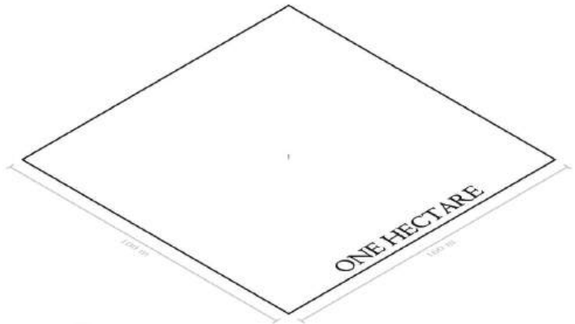


PROPOSAL HOUSE 4



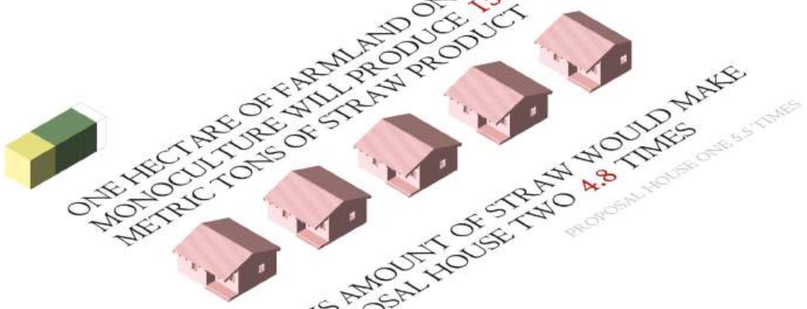
PROPOSAL HOUSE AND EXTENSION 1

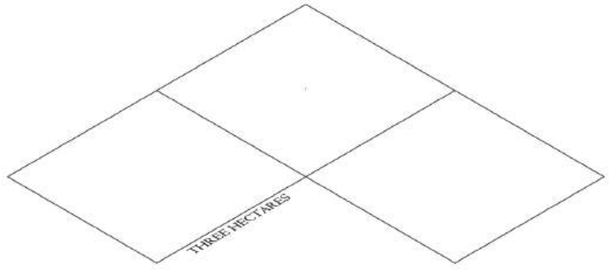
SCALING

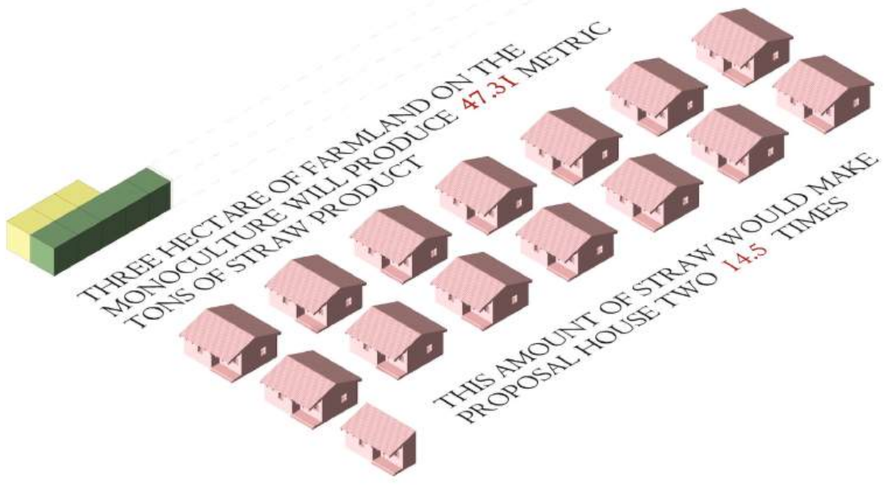


6 METRIC TONS OF WHEAT STRAW
HIGHER-YIELDING FARMS YIELD 7.5 TONNES PER HECTARE

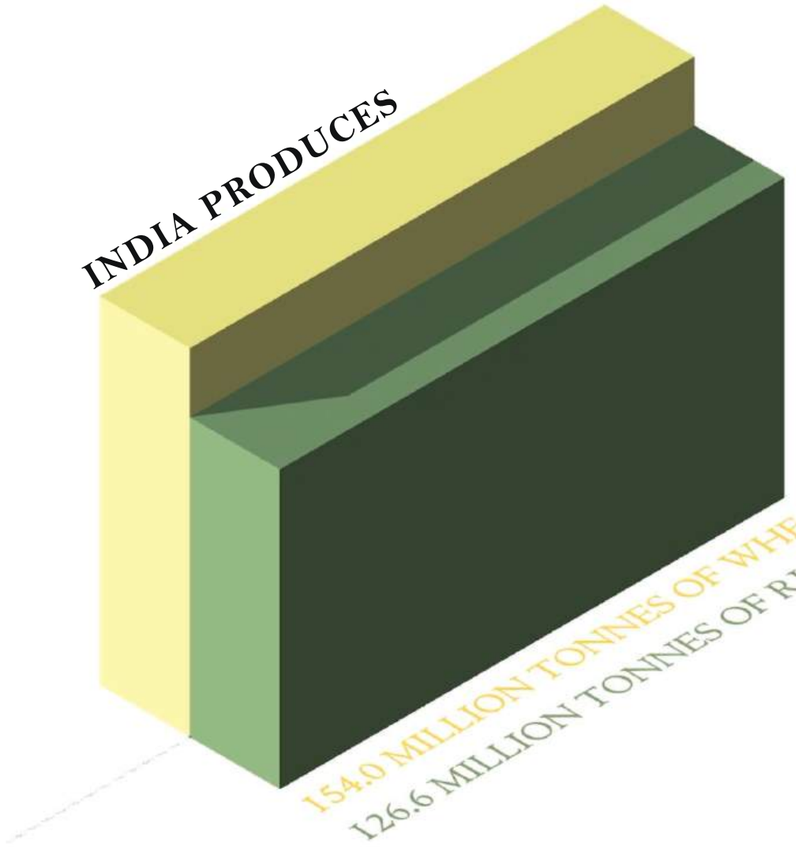
9.77 METRIC TONS OF RICE STRAW







INDIA PRODUCES



86,073,620 PROPOSAL HOUSES COULD BE BUILT

PMAY-G'S ALLOCATED GOAL BY 2029 IS 11 MILLION MORE HOMES.
TOTAL OF 38 MILLION HOMES SINCE FORMATION SINCE 2016

WE HAVE ENOUGH STRAW TO BUILD THAT 8 TIMES OVER

IF WE BUILT THE REMAINING 10.8 MILLION HOMES PLANNED OUT OF STRAW:

POTENTIAL SAVINGS RANGE FROM $2.7 to $4.85 BILLION
₹232 to ₹415 BILLION

CARBON SEQUESTRATION OF 10,783,706 TONNES CO_2eq
0.0108 GIGATONNES

COMBINED WITH SAVINGS FROM REPLACING THE REMAINING TYPICAL PMAY-G CONSTRUCTION, THE TOTAL CHANGE DELTA IS 89,636,752 TONNES CO_2eq
0.0896 GIGATONNES

THIS CALCULATION DOES NOT INCLUDE THE EMISSIONS FROM BURNING FIELDS

THE EQUIVALENT OF 11% OF INDIA'S ANNUAL CARBON EMISSIONS

SEE THE ANIMATION HERE

02

STATION SOCIALS
CONVERGING COMMONS

Spring 2023 | Core II Studio
Location: Little Neck, New York
Purpose: Train Station; Community Hub
Critic: Benjamin Cadena

This intervention, Station Socials, reimagines the isolated train station not just as a means of traveling to and from Greater New York, but as community hubs and focal points for their respective neighborhoods.

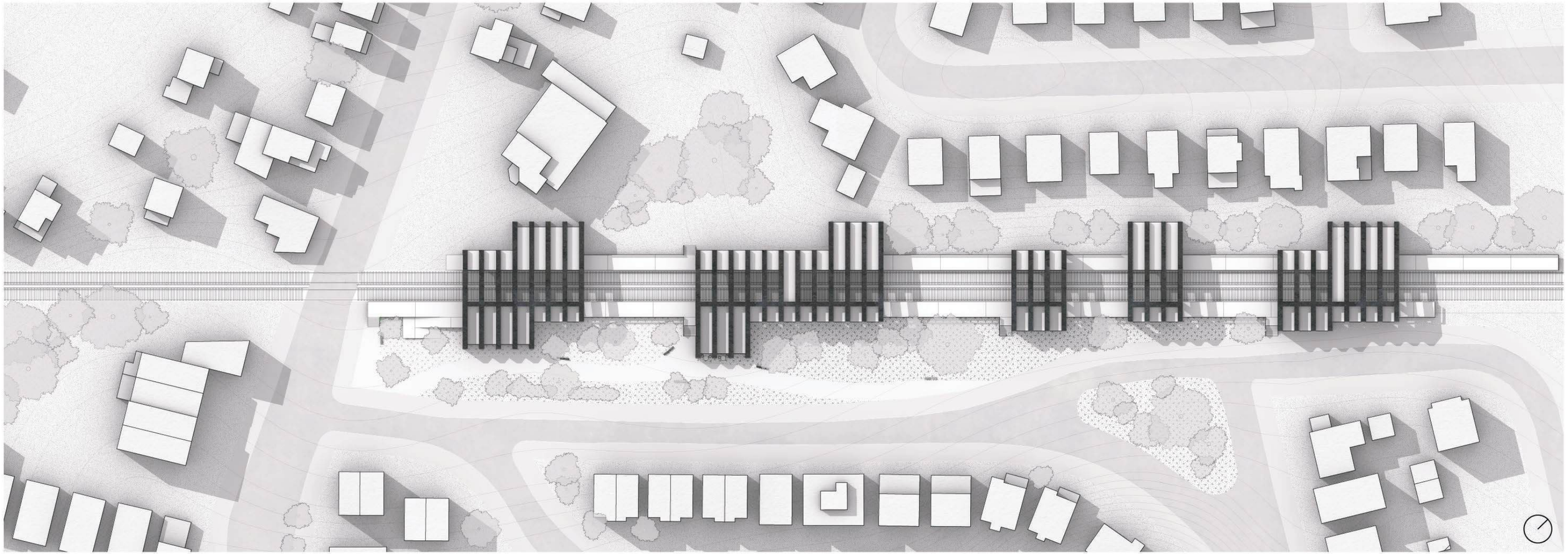
For my sites, I chose the various train stops of the Port Washington Branch of the Long Island Rail Road (LIRR). My project as a system of frames able to be replicated on the two of the different typologies of stations: the standard platform, generally raised four feet from the ground, and the sunken platform. These stations are spread out liberally in Queens: a borough which has long been marred by suburban sprawl and disruptive urban infrastructures. The irony of transit infrastructure is that in the mission of connecting distant neighborhoods, too often these infrastructures create split and demarcated neighborhoods

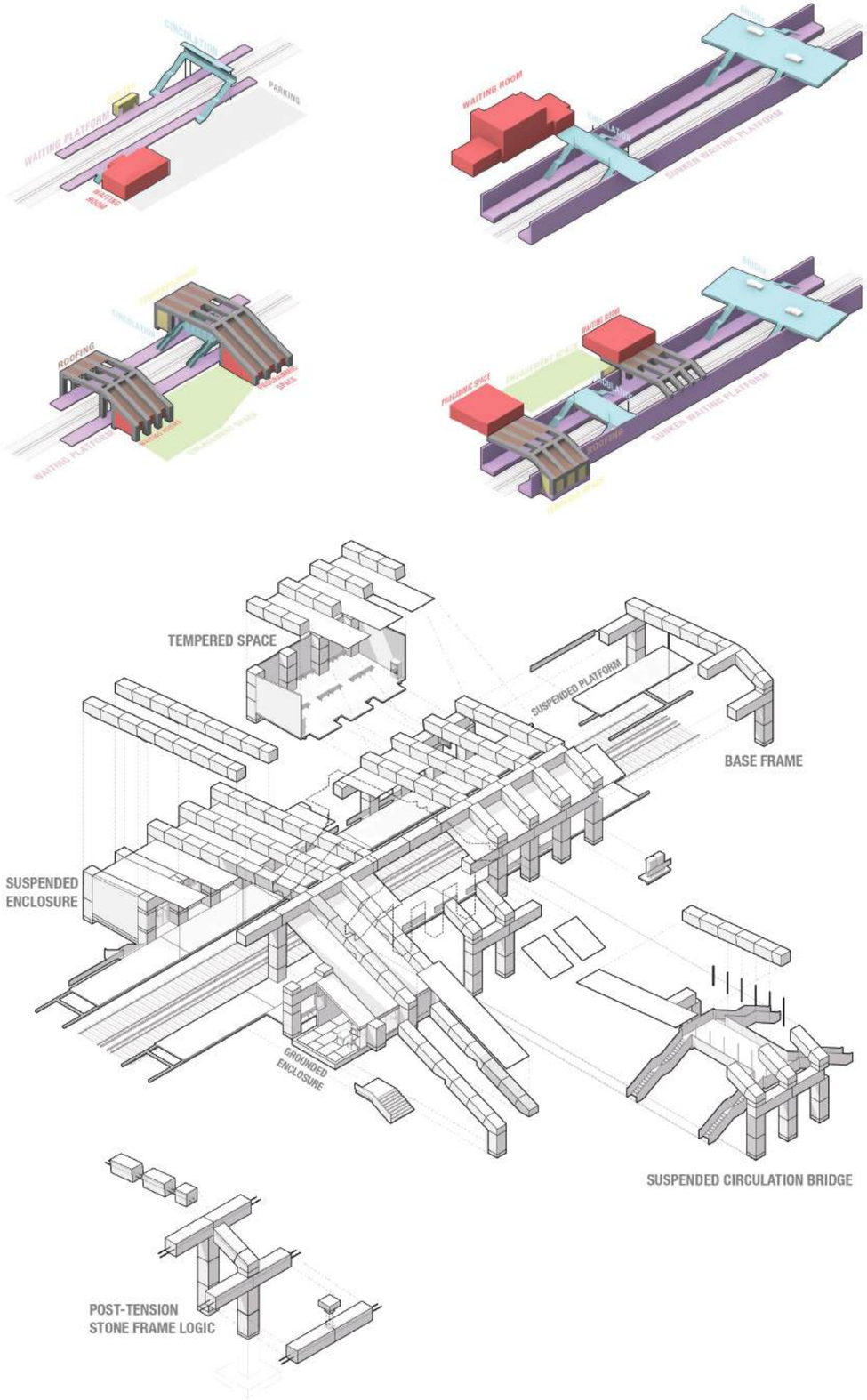
Station Socials proposes that the underutilized train stations of the LIRR serve as these community hubs. By introducing a system of indoor waiting spaces, outdoor 'tempered' spaces, and zones of engagement, my proposal renegotiates the physical divide the train station imposes. In doing so, Station Socials seeks to create a dialogue between the station and the community that promotes the narrative of decentralizing infrastructural economies to support local community hubs rather than the investment of major train terminals.

The project heavily relies on the 'post-tension stone beam'. These beams, in my case made from blocks of granite, are post-tensioned with steel cables and mortar to reinforce their structural capabilities, allowing them to take on the capabilities of steel beams while remaining a low embodied carbon alternative (research shows a 15% embodied carbon cost to steel). By creating a framework using post-tension stone, the thermal capabilities that stone inherently can be utilized to create tempered spaces.

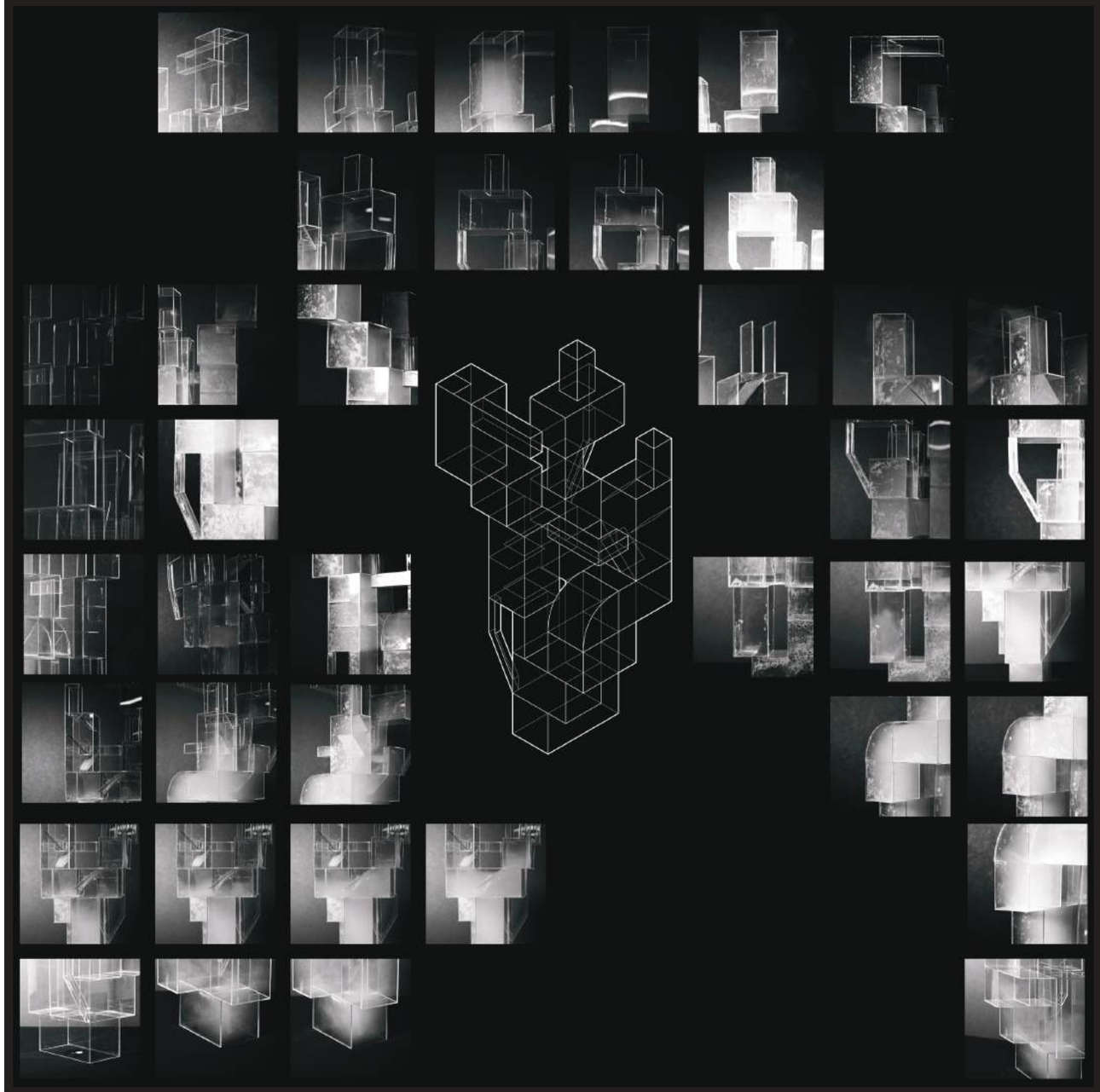
The stone framework also serves to allow the support of suspended circulation bridges and roofing, allowing easy mobility and comfort to the passengers of the station, and support for waiting stations and other programmic space that will serve the communities. It also expands with the addition of its enclosures and tempered spaces creating pockets of engagement in between the spaces. This space is the 'commons' - by providing park space for the community it will transform the occupancy of the stations to not just commuters, but to the average person in the neighborhood.


CLT Roof to Wall Detail:
Pitched roof, treated wood
Stainless steel supports with holes for drainage
Timber Support for Pitching
Damp proof membrane
8" cellulose insulation
Vapor control layer
CLT 6" thick structural panel
Metal Bracket for connecting CLT
4" screws
2"x2" Timber support for drainage
Initial wood support for drain
Wood cladding
Roofing between Post-Tension Stone
Treated waterproofed wood panel
Steel bracket for attachment
Post-Tension Beam Connection
Pre-cut Granite Stone beams
Steel rods
Mortar
Steel bracket
1/2" screws
Post-Tension Stone Beams
Pre-cut Granite Stone blocks
Steel rods drilled into the stone blocks
Mortar
LITTLE NECK
Post-Tension Stone Beams
Pre-cut Granite Stone blocks
Steel rods drilled into the stone blocks
Mortar
Long Island Rail Road
Support Girder
Steel girder, precrilled with 1/2 inch holes
Steel bracket attached to stone-pillars
Attachment Foundation
Prefabricated concrete foundation
Steel bracket attached to verticle stone pillars
Steel support running through from piller to piller
Support Girder
Steel girder
Steel bracket attached to stone pillars
Cantilevered Waiting Platform
Steel girder, predrilled with 1/2" holes
1/2" steel rods fastened into girder
Concrete slab
Mortar
Curtain glass facade and door
Single-paned glazed glass facade
All glass frameless door
Wall to foundation CLT
6" CLT structural panel
Vapor control layer
8" cellulose insulation
Timber support for drainage
Damp proof membrane
2"x2" timber battens
Concealed metal plate connection of structure to foundation
4" screw
Batton support
Air gap
Drainage gully





EXPLORATION ON CONDENSATION FLOW



CORE II

03

THE LIBRARY OF THINGS
INTERGENERATIONAL AND 'LIVING' HOUSING

Fall 2023 | Core III Studio
Location: West Harlem, New York City
Purpose: Housing, Storage
Critic: Gary Bates
In Collaboration: Norman Arthur Keyes III

Housing is an insatiable dilemma that permeates all of society. The generation of wealth for families is primarily inherited, and thus, intergenerational housing was our primary focus for this studio semester. Our concern with intergenerational housing was the ability to generate wealth and thus, the solution we propose was a system of consolidation of storage and objects to serve and supply the inhabitants of the Library of Things.

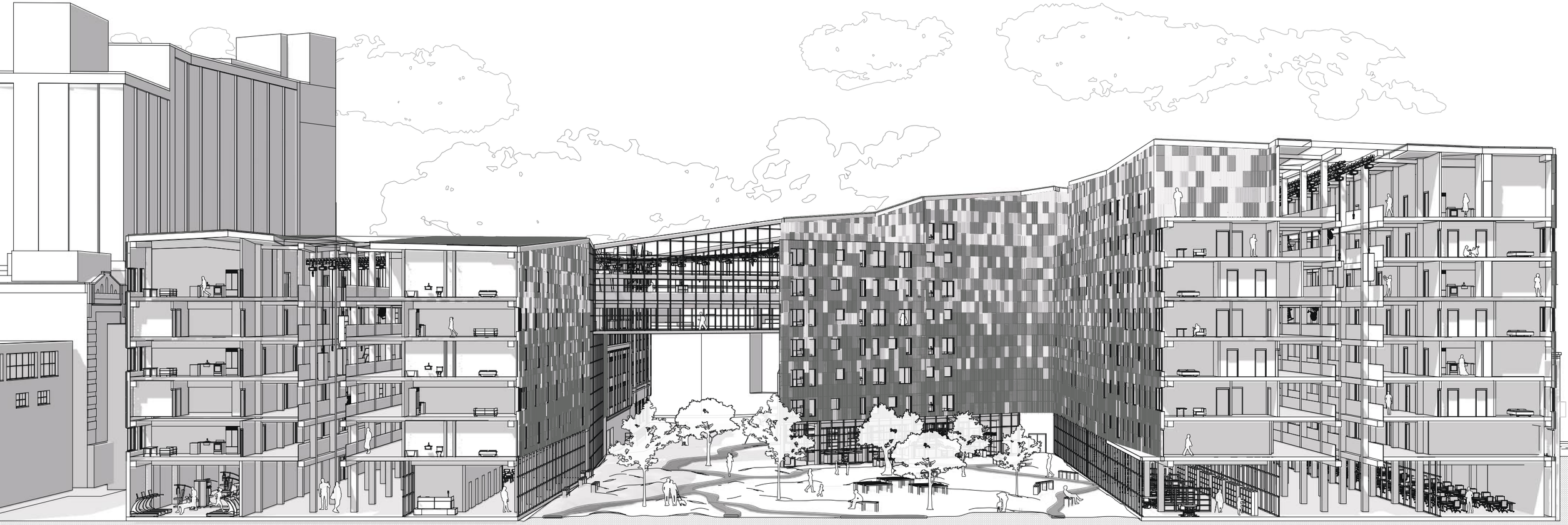
To address the complexities of intergenerational housing, we propose "The Library of Things". From baby strollers, to hobby equipment, to walkers, when people at different stages live together, their demands for space and for things fluctuate and evolve over time. The organizing principle for this scheme is a central "library" that offers families "things" and space as they need it with the ability to return them after.

Our proposal features a moving storage system that supplies anything within the storage system to these families to reduce their need to spend money to purchase these tools. In addition the consolidation of public spaces, such as a public kitchen, laundry space, gyms, and other amenities, allow us to provide the highest grade equipment and supplement them with our storage system.

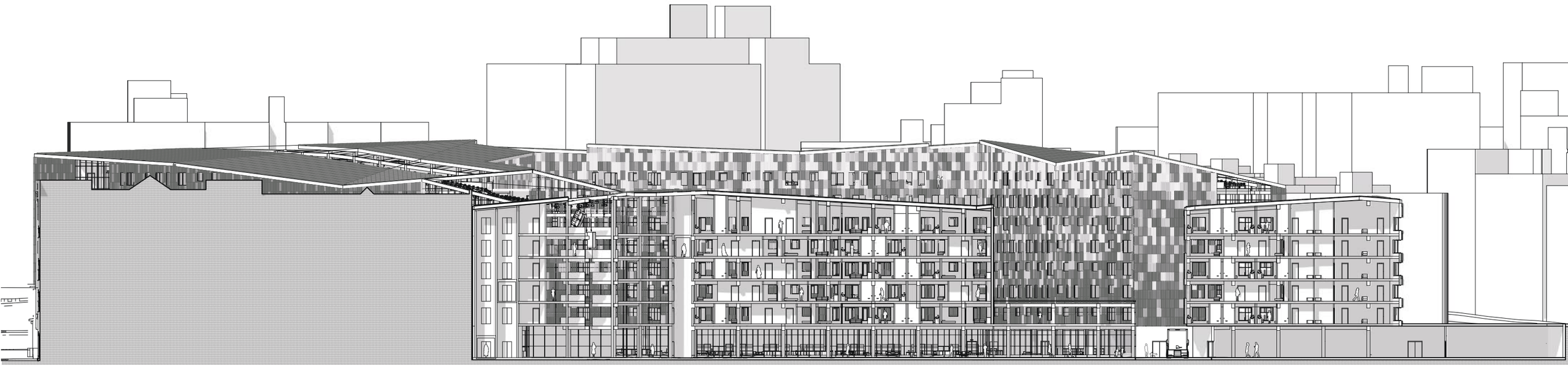
The project had particular emphasis on the timeline of housing, and the timeline of living. In terms of timeline, the garden of the project focuses on remediation until it can be used and the units themselves were also thought along a timeline of usage: How does the apartment change throughout the use of the apartment? What furniture moves? This is supplemented by the inclusion of MURPHY-esque furnitures in our storage system. The units also can be altered to expand into the hall space, intersecting with the library's pathways to create this dialogue between the library and the units.

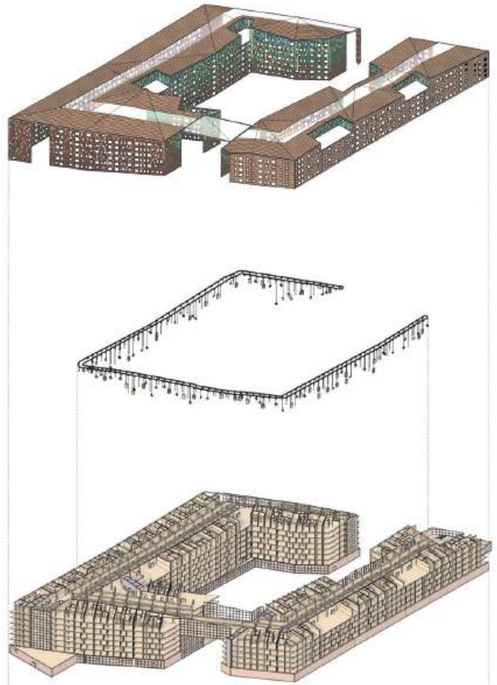
The south-eastern corner of the building pulls back from the facade of the old MTA bus depot to create a welcoming front garden. Following under the bridge that connects the north and south blocks reveals the central garden that connects the people, flora, and fauna from Convent to Amsterdam avenue.

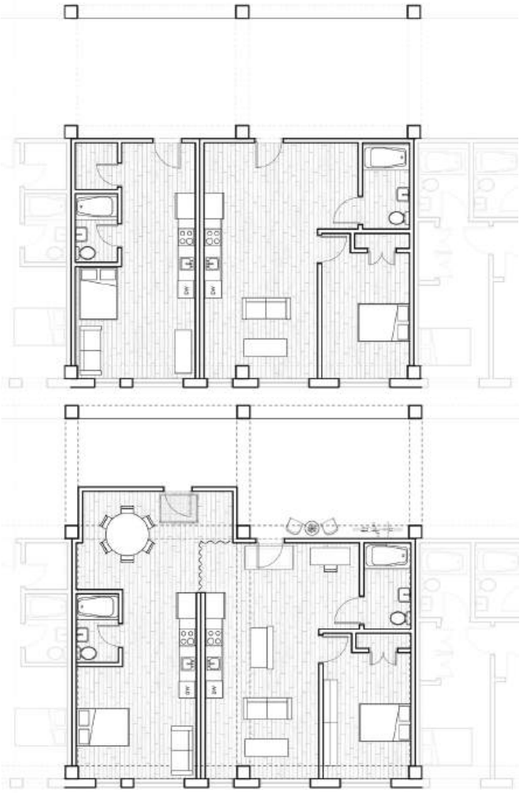
SECTION PERSPECTIVE



SECTION







UNIT PLANS
Original Plan, Topmost
30 Year Plan, Above

A major consideration was how our units would interact with the library of things. The most major of which is the joining of units to create a single unit to house intergenerational families. Expansion into the amply-spaced hallway to create more space for units for families to live.

EXPLODED AXONOMETRIC, LEFT
Terracotta Shell
Gantry System
Mass Timber Structure
Site

04

SYMBIOTIC TRIBUTARIES
BROADWAY STORIES

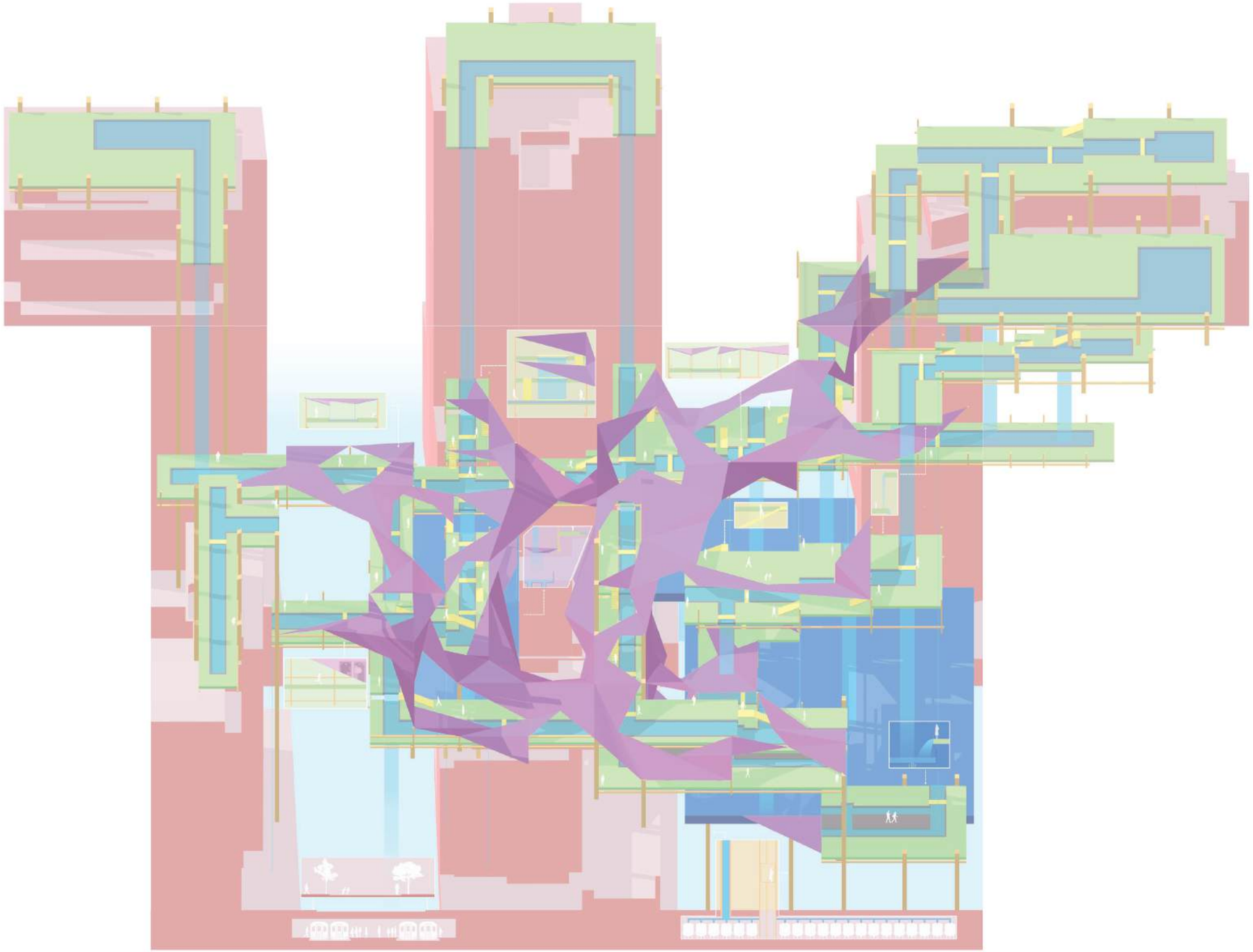
Fall 2022 | Core I Studio
Location: New York City
Purpose: Superblocks
Critic: Carlyle Fraiser

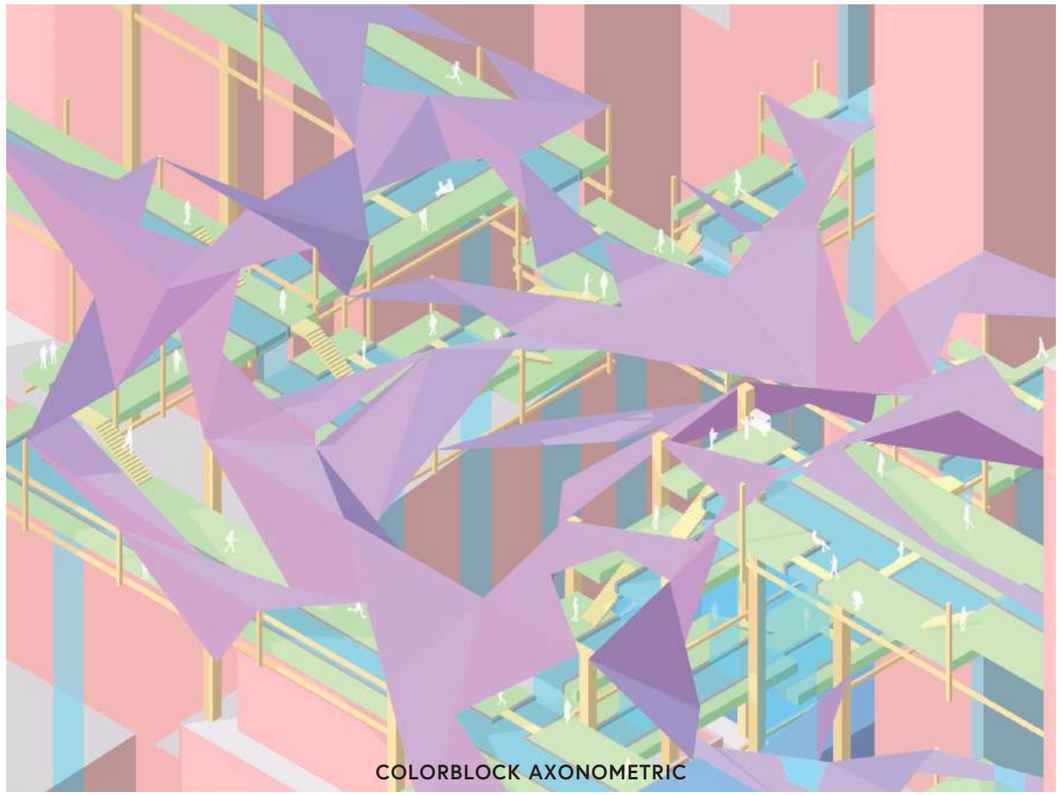
Symbiotic Tributaries seeks to address the excessive consumption of water and electricity in New York City, namely water and electricity by introducing a system that supplements these resources. In 2021, New York City consumed 979 million gallons of water, its record lowest since 1970. Despite this "record", New York City unsurprisingly still ranks as the world's most wasteful megacity in water consumption. Overconsumption is the word that can best describe New York City's relationship with resources, and this overconsumption must be addressed.

As water continues to become a more and more valuable commodity, our dependence on carbon [especially emissions] continues to disrupt the delicate balance of systems in this world, causing both subtle and evident ecological shifts.

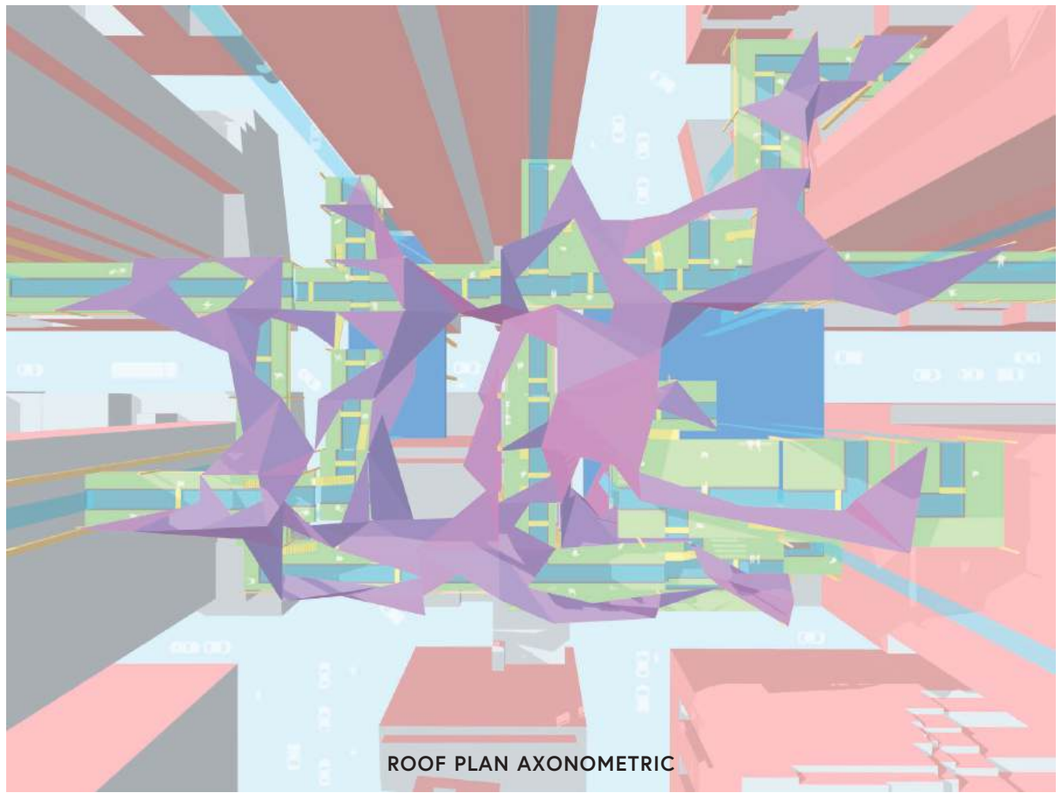
This proposal attempts to address this excessive consumption of resource through the collection and recycling of rainwater while bolstering clean energy production, and reimagines the way we utilize the city's air space by introducing an expandable, templated, cantilevered structure that can both redirect acidic rain to purification systems and supplement clean electricity to the buildings the system is a part of. It provides public space as a walkable "garden" and relaxation area to the surrounding area, a private plane from the noise and bustle of the city, while still keeping the surrounding intact. This template relies on structural support from its surrounding buildings, the taller buildings will provide water collection systems to the lower structure, that will redirect water to collection pools to be filtered by an underground filtration system.

The system utilizes a series of cantilevered roofs for solar panel and collecting rainwater. The rainwater would then flow through dedicated river paths through tiered platforms into large collection pools. The rainscreens redirect water into the riverbeds and away into the water collection pools. The pools drain into the underground filtration system.

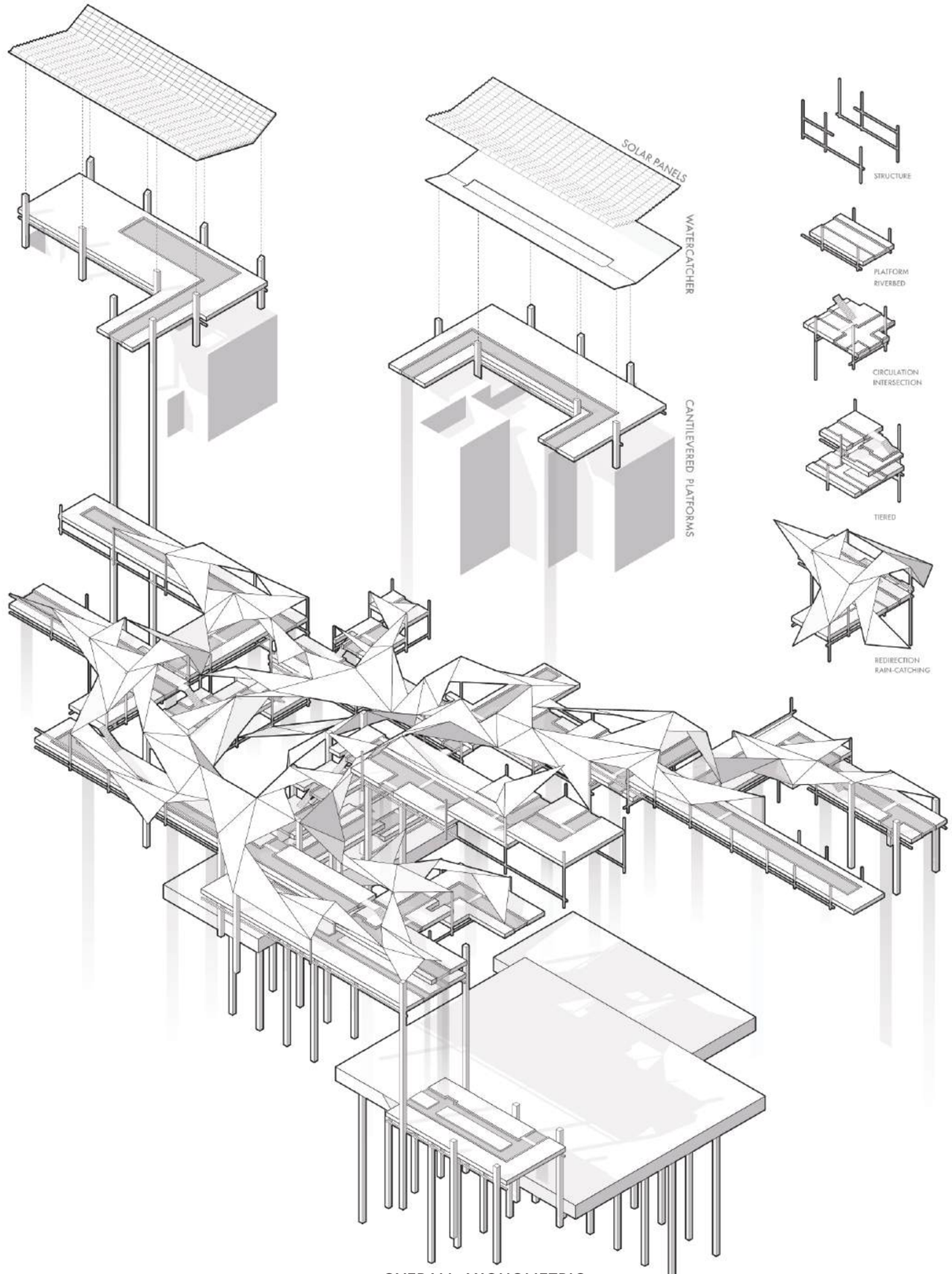




COLORBLOCK AXONOMETRIC



ROOF PLAN AXONOMETRIC



OVERALL AXONOMETRIC

04.5

SELF-SUFFICIENT SUPERBLOCKS

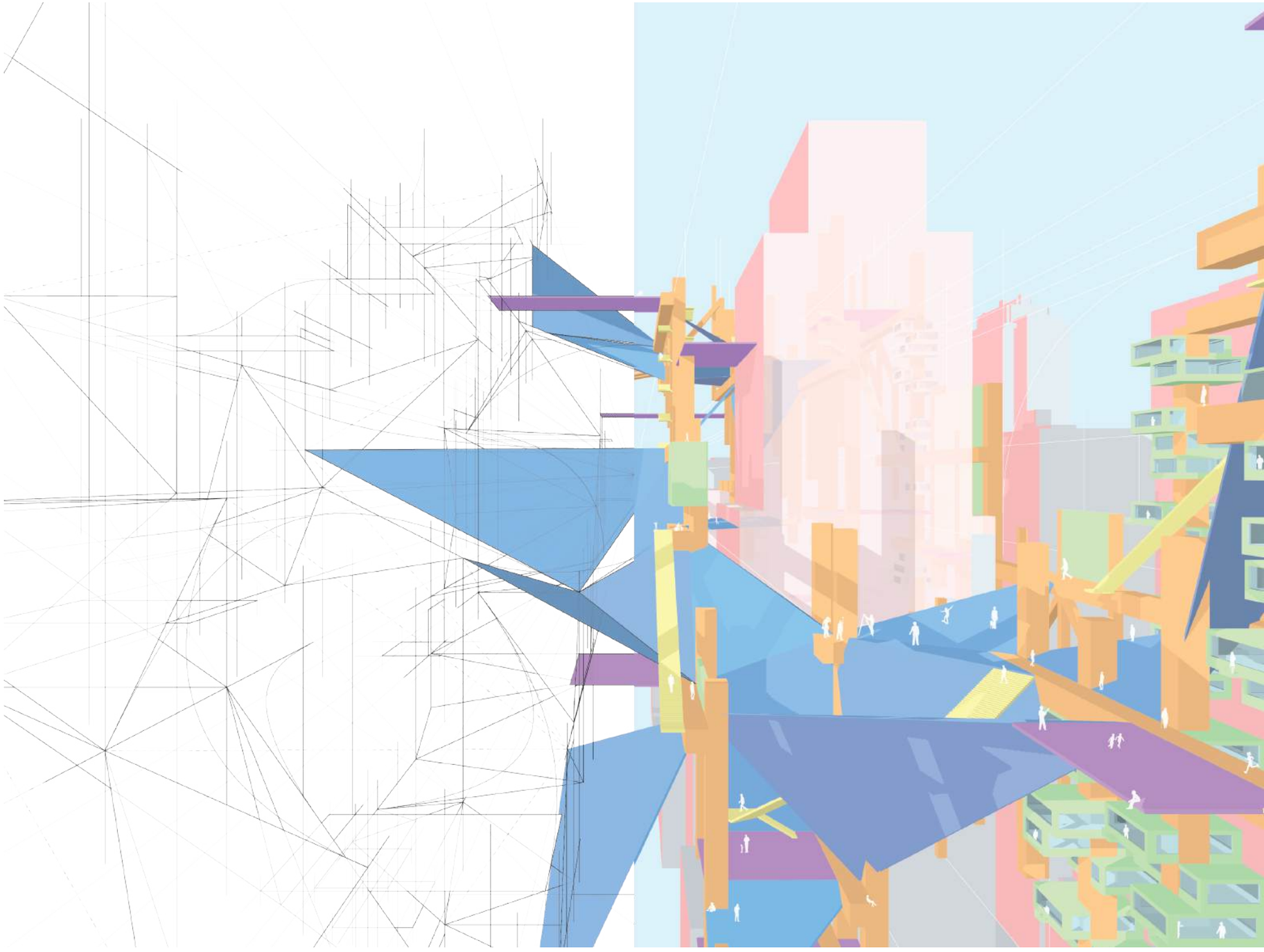
BROADWAY STORIES

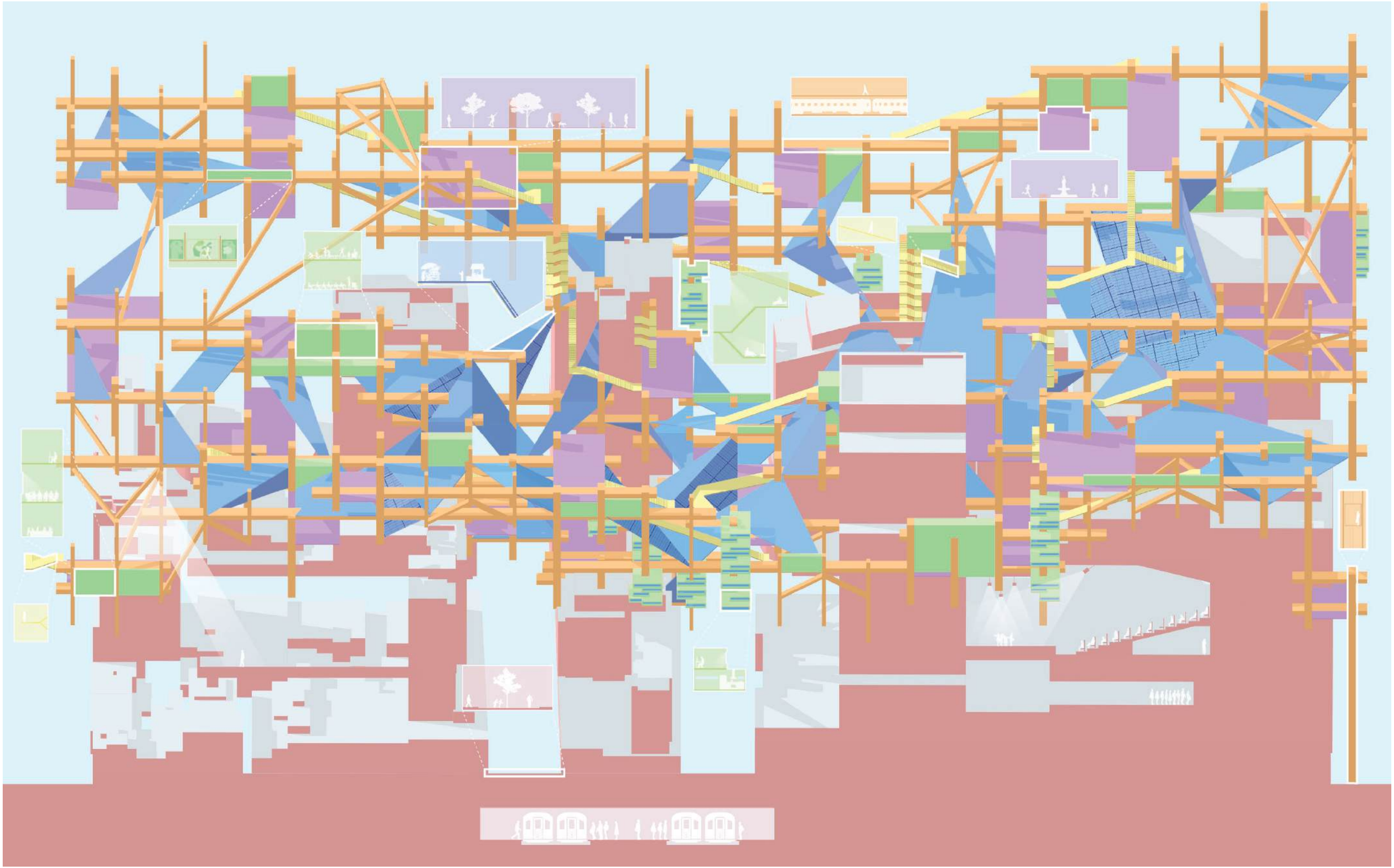
Fall 2022 | Core I Studio
Location: New York City
Purpose: Superblocks
Critic: Carlyle Fraiser

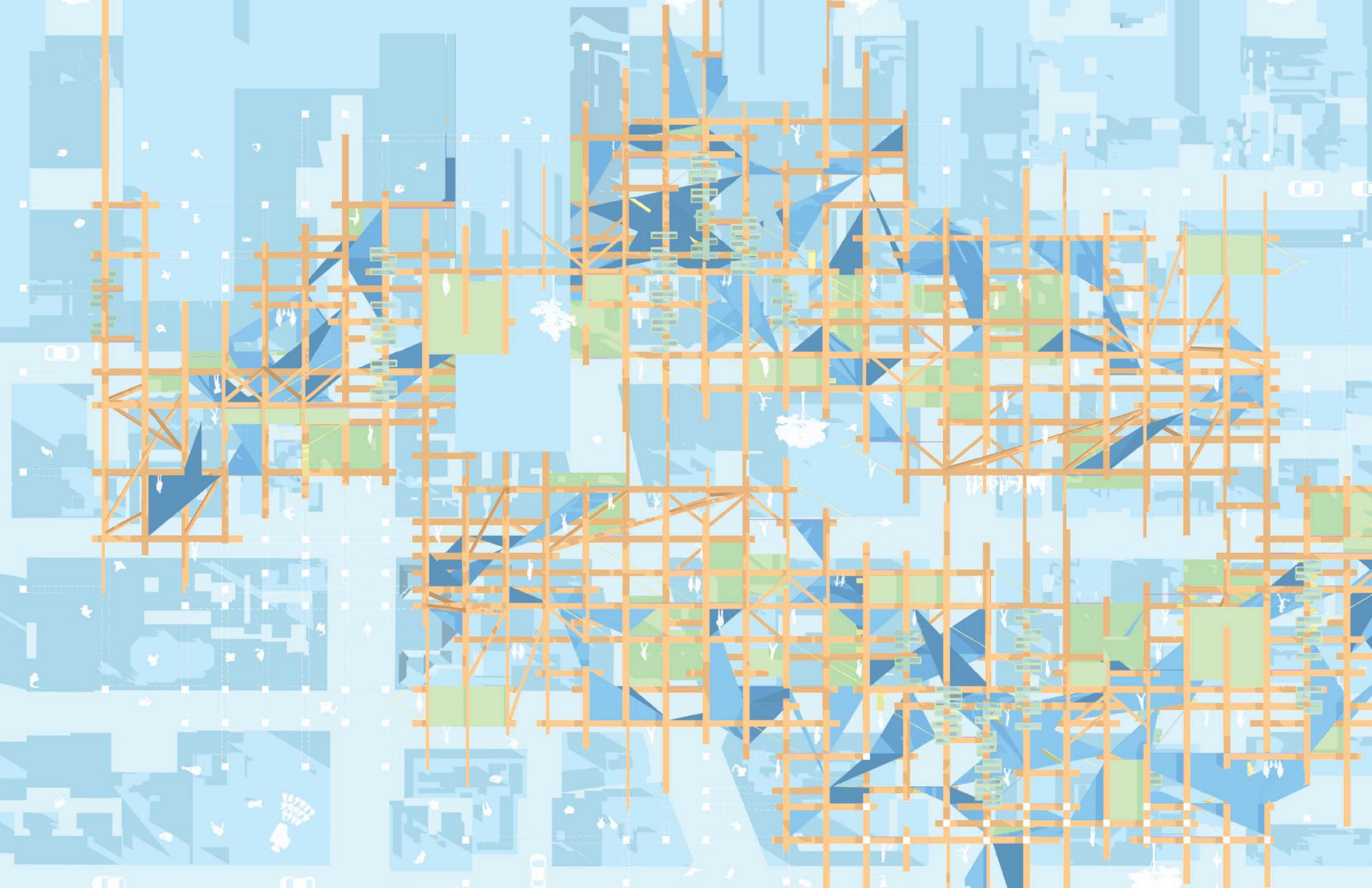
In a city as compact as NYC, any interruption, alteration, or modification of a city grid must be done with judicious deliberation, but are often not done with the inhabitants of the affected blocks in mind. Superblocks have long been a typology formed by disrupting the city grid – they are often capitalistic, wasteful, and self-aggrandizing. Superblocks have a long history of displacement and financial inequity (think Rockefeller or Lincoln Center).

This proposal rethinks the idea of a superblock from a block that is born from the removal of the city grid, to one that is influenced by both the intangible and tangible elements of its surroundings, existing in parallel with the grid on a completely different plane. This new version of the existing typology serves as a template that redefines the displacement that Superblocks cause – the grid survives, and the buildings it encompasses survive, preserving the cultural identity that already exists and adding public space and housing that can be used by its inhabitants.

This superblock will exist with a symbiotic relationship with its surroundings and shall enhance the identity of Broadway, and in turn maintain its own identity as a self-sufficient community. Able to generate its own energy, foster its own community, and house its own economy, this superblock template can incorporate itself into the existing infrastructures of its site and cultural identity of its site while remaining both independent and dependent from the rest of Broadway.







05

SALTMARSH TAPESTRIES
FLOATING LOOMS

Spring 2024 | Advanced Studio IV
Location: Bridgeport, Connecticut
Purpose: Remediation System
Critic: Rachely Rotem

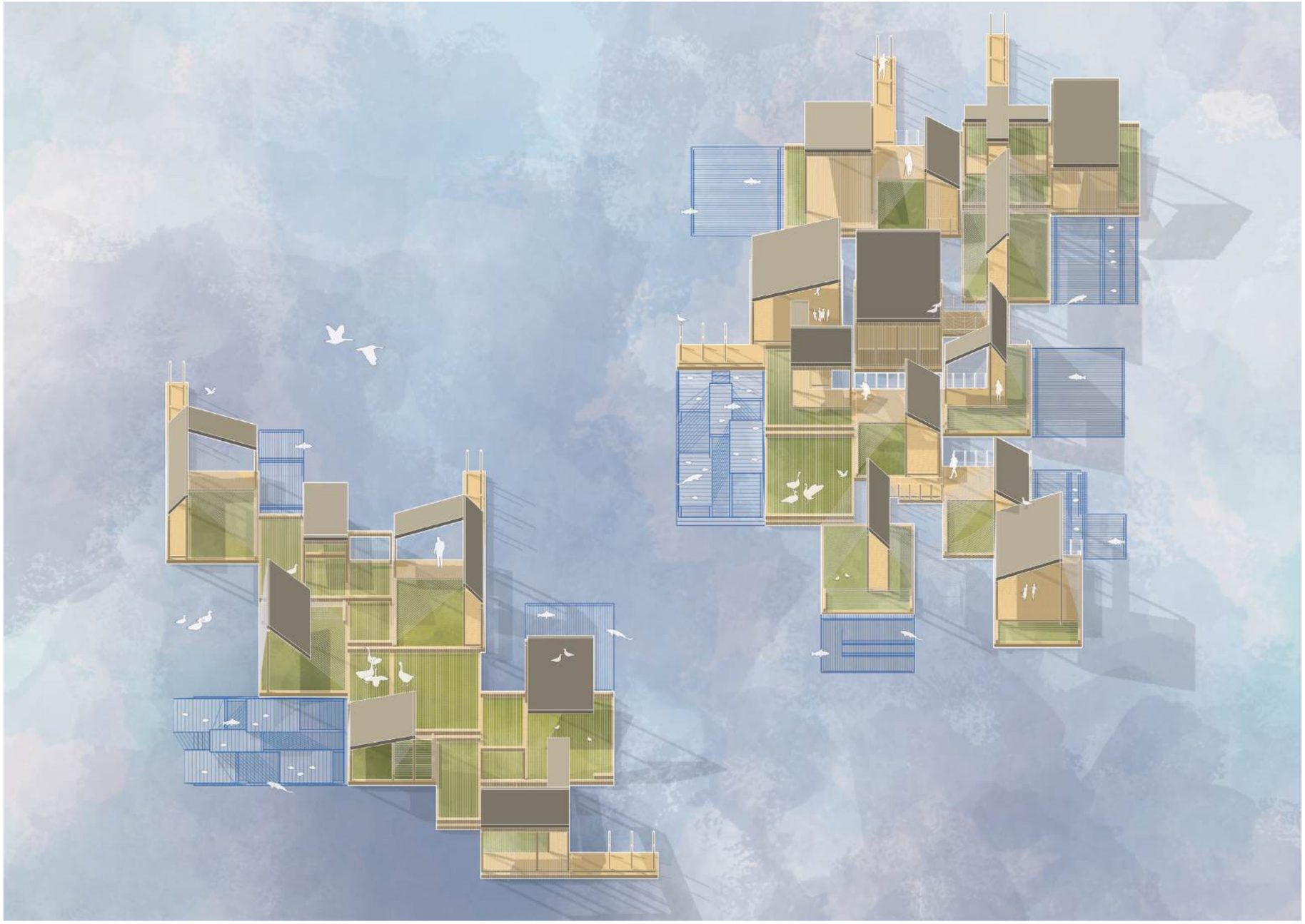
In today's world, where climate change poses unprecedented challenges, designing with/for uncertainty is imperative. Uncertainty is embedded within our everyday lives. We must recognize that air, earth, and water have become incalculably thicker with matter/things, and an inescapable part of both the environment and built environment. The complexity of an ecosystem that understands this must be designed with a degree of delicate uncertainty that acknowledges our inability to know for sure what exactly is around us at all times.

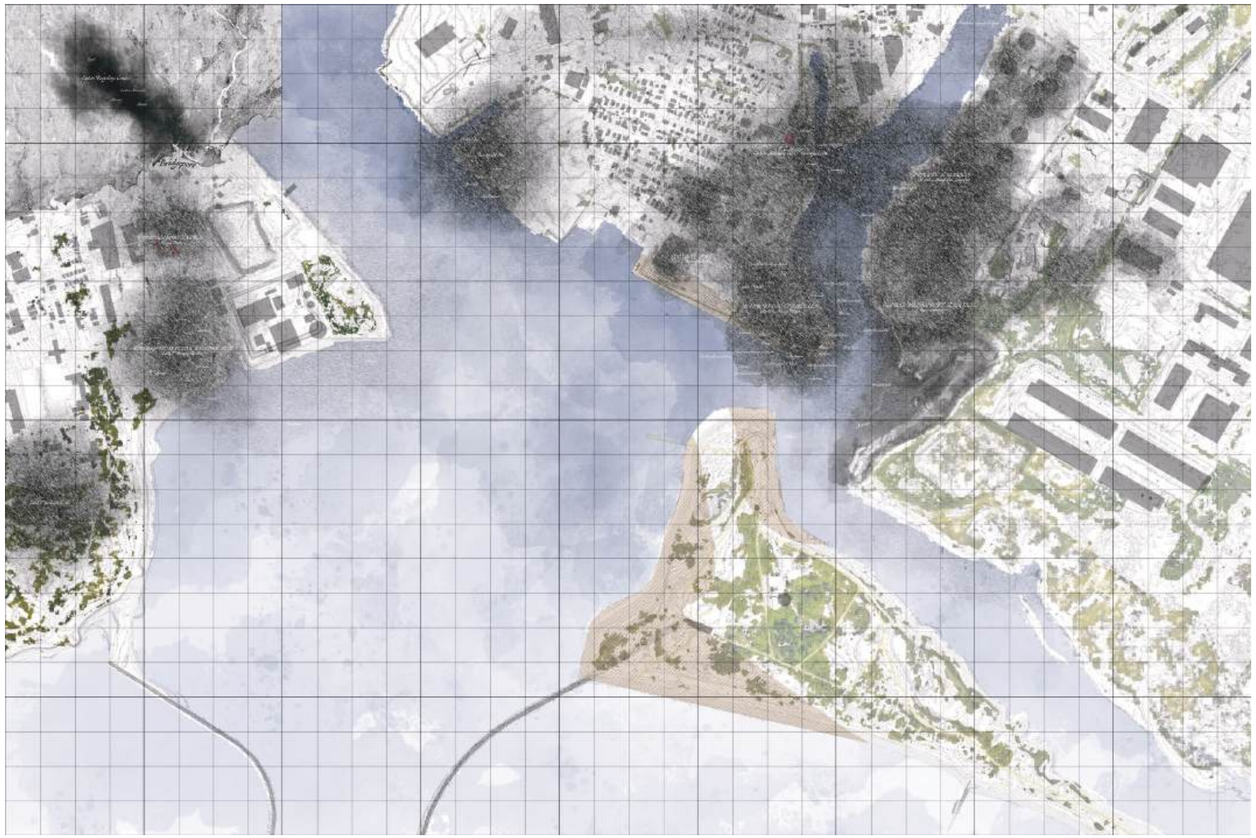
In that sense, the philosophy of designing with delicate uncertainty requires an approach that acknowledges the intricate dynamics of nature, animals, and humans. Understanding interconnected ecologies and the intricate interplay between nature, animals, and humans is critical to approach and address the ever-increasing ambiguity that climate change will bring.

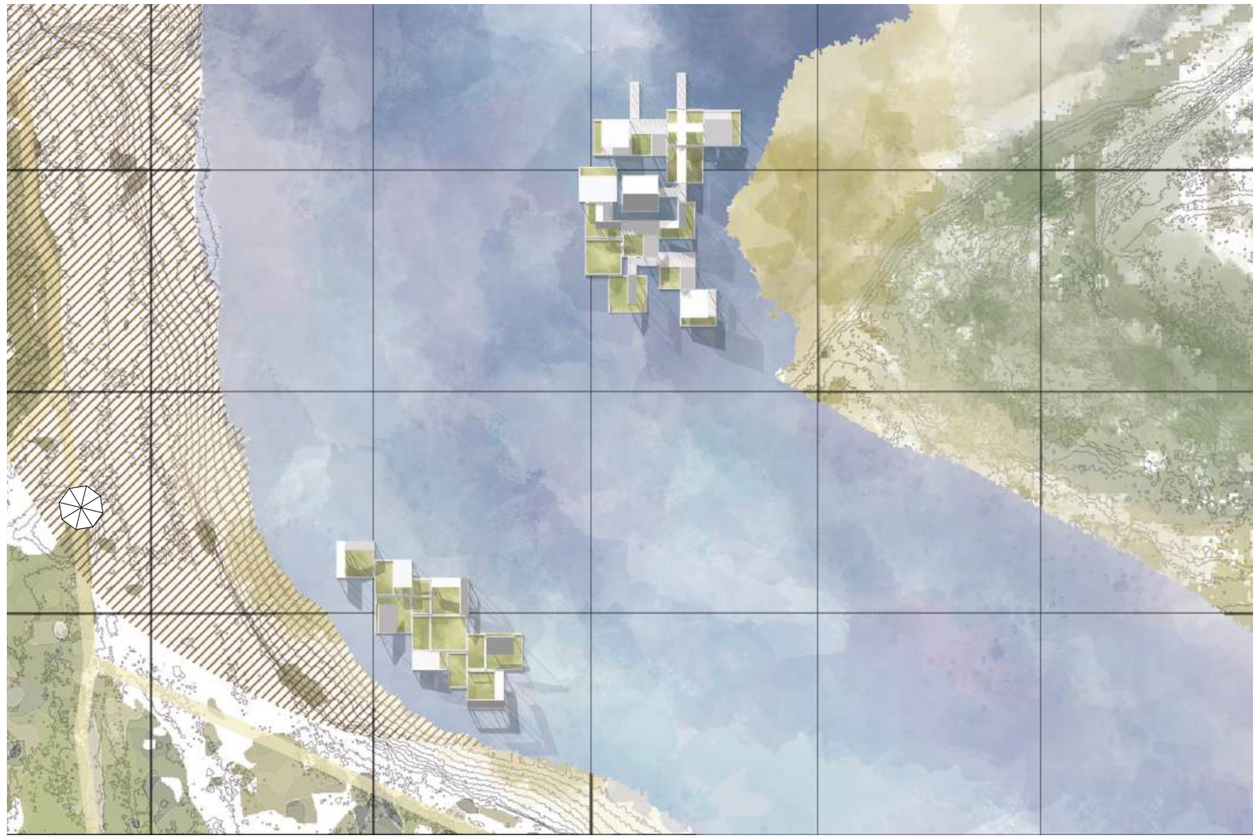
My approach contends that designing with delicate uncertainty offers a holistic and regenerative approach to design, one that embraces the inherent beauty and complexity of the natural world and its systems. It proposes a system of floating islands (pixels) with a recycled plastic matrix capable of being used by humans and nonhumans. These floating islands aim to remediate their sites and are situated to engage with their surroundings. Saltmarsh cordgrass, the main plant cultivated on these islands, have strong remedial properties, and are capable of fielding vibrant ecosystems by utilizing its rhizobium to generate healthier ecosystems for the animals under.

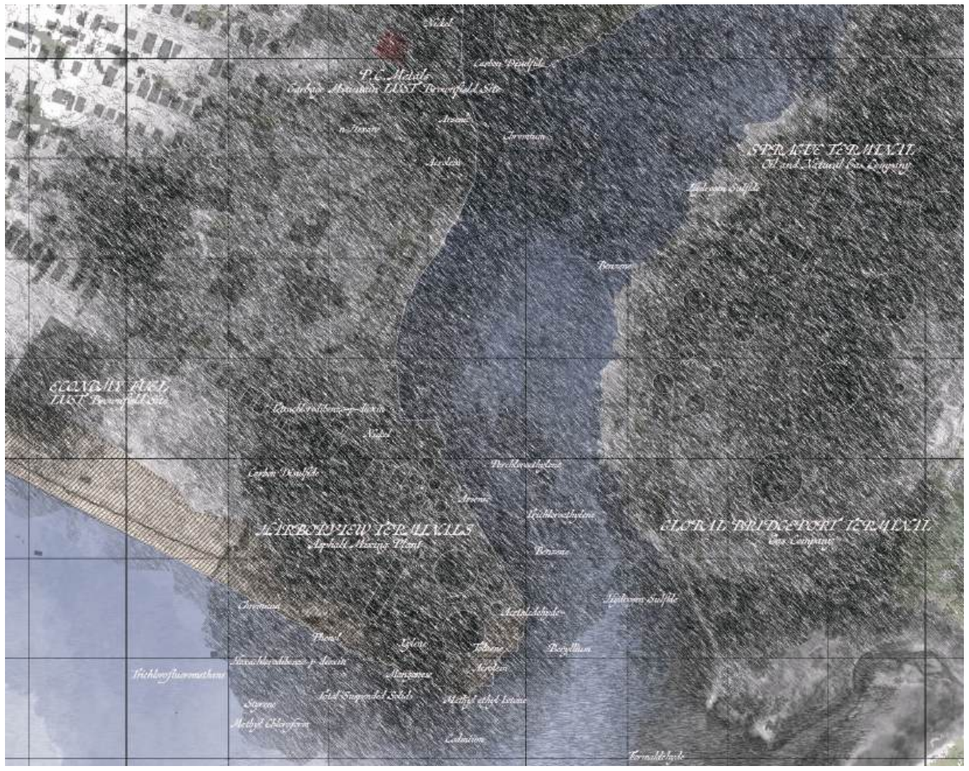
This network would have three programmatic distinctions: One for humans, one for non-humans, and one that allows for cohabitation between both. The system would respond to its location's dwellers by being designed in a way to both allow and disallow engagement.

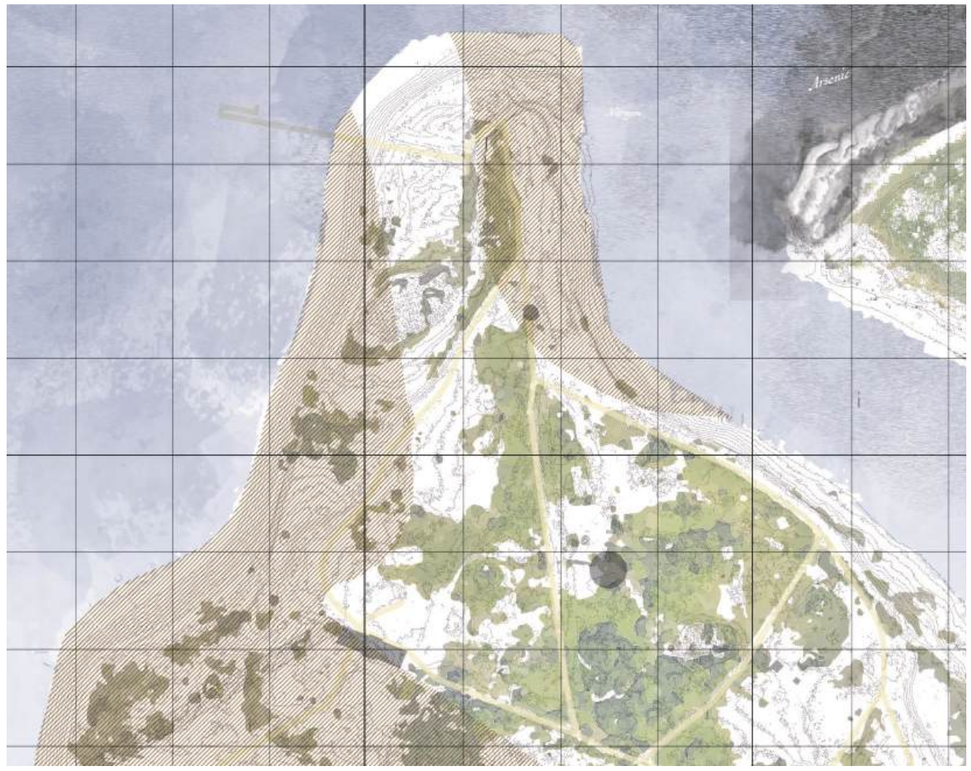
In doing so, Floating Tapestries aims to create small-scale local ecosystems that are capable of sustaining and promoting a thriving microcosm in the context of their surroundings, be it heavily polluted or not. This is done to create these weaved plots that offer the wildlife and people of Bridgeport a local space that remediates and can benefit their lives, while also addressing pollution in the micro-scale.











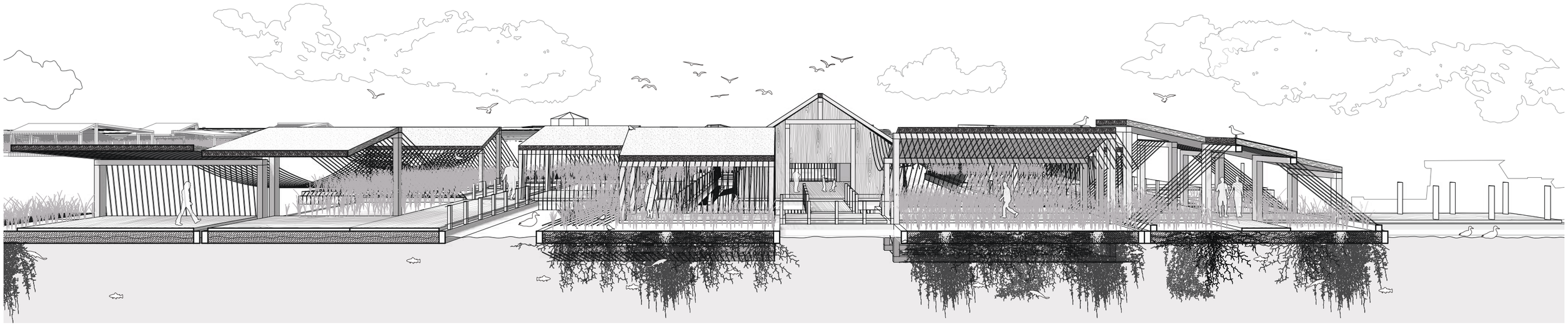
Intervention on Site, Above

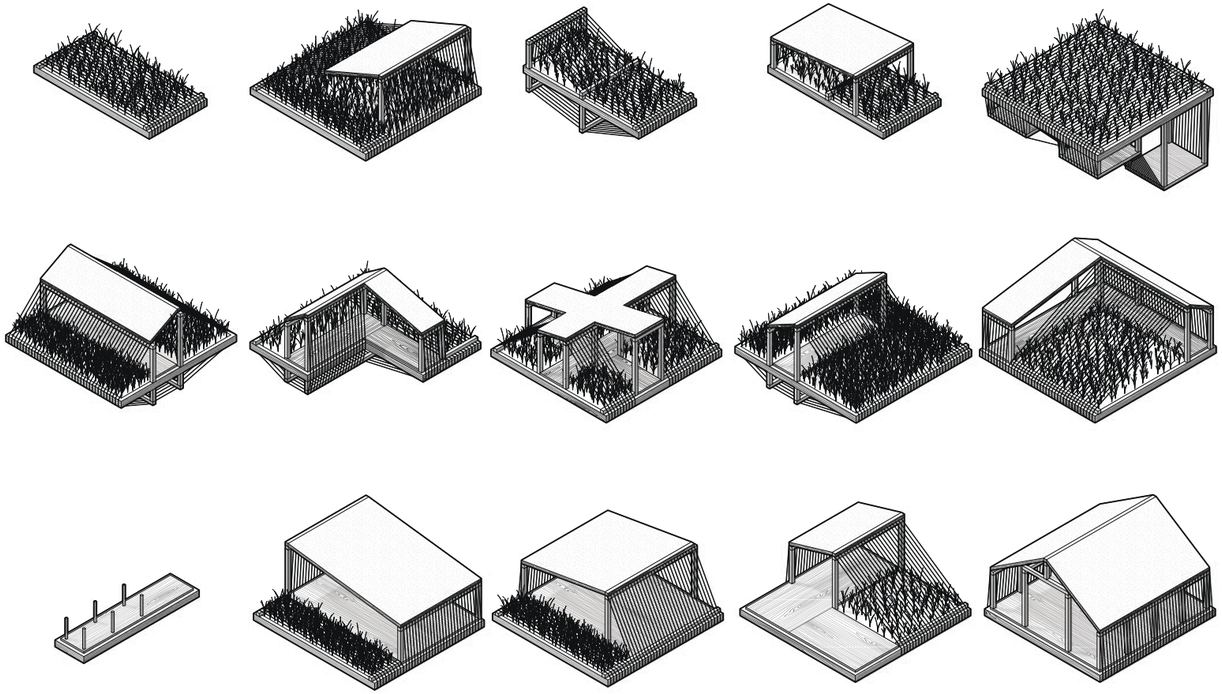
Bridgeport, Site Plan, Top Left
As we take a look at East End, Bridgeport, we see that there are extensive polluters near pleasure beach. We must highlight this inescapable yet continuously present factor of pollution near our site. A zoom in on the pollution from current industrial actors in East End and historic industrial scars that continue to bleed pollution into the Atlantic showcase the different pollutants that bleed into the water from the earth. The range of pollutants include heavy metals, such as mercury , chromium and nickel, to VOCs, chemical compounds, and more. Directly south is Pleasure Beach. We can see its proximity as a recipient to this pollution from East End, along with the intervention of man on the expansion of the island (represented by a brown hatch). And as we consider the ecosystems that permeate our site, we must consider this interaction between man and nature.
Bridgeport, Site Plan Close Up, Left

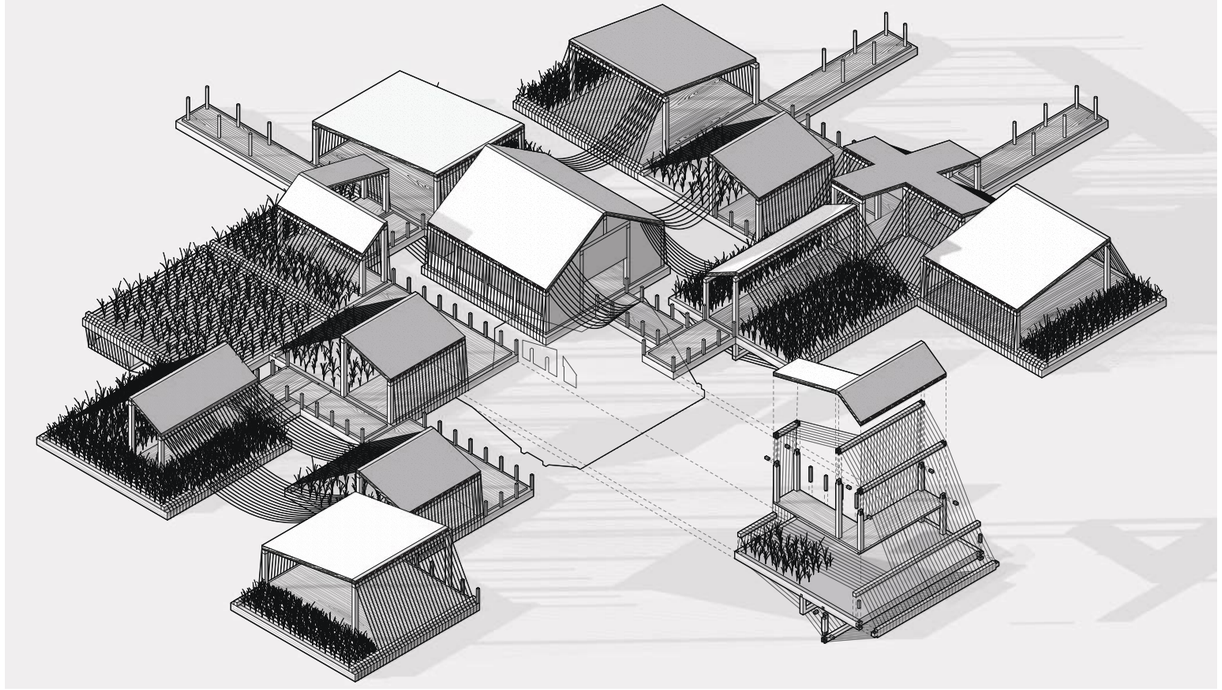
Section Perspective, Next Page Above
These floating islands aim to remediate their sites and are situated to engage with their surroundings. Saltmarsh cordgrass, the main plant cultivated on these islands, has strong remedial properties, such as eutrophication, removing excess nitrogen and phosphorus that dominate the water in or Site, and also very slowly removing heavy metals, and are capable of fielding vibrant ecosystems by utilizing its rhizobium to generate healthier ecosystems for the animals under.
In doing so, Floating Tapestries aims to create small local-scaled ecosystems that are capable of sustaining and promoting a thriving microcosm in the context of their surroundings, be it heavily polluted or not. This is done acknowledging the delicate uncertainty of ecosystems to create these weaved realities that offer the wildlife and people of Bridgeport a local space that remediates and can benefit their lives, while also addressing pollution in the tiniest of scales.

Typologies, Next Page Bottom Left
Saltmarsh Tapestries incorporated various typologies of human, human-non-human, and non-human plots, all serving different functions. Variation between the typologies served to create a vibrant and changing ecosystem.

Axonometric and Building Logic, Next Page Bottom Right
The typologies designed merged to create a larger ecosystem that could continuously expand to accomodate its areas' needs. Their assembly would be basic and the system would be held by rope in tension and suspension.







06

WATERSCAPES

SUPERCONDUCTING SUPER COLLIDER THOUGHT EXPERIMENT

Fall 2024 | Advanced Studio V
Location: Waxahachie, Texas
Purpose: Watershed
Critic: Lindy Roy
In Collaboration: Xiaotao (Albert) Mo and Jiwon Kim

Waterscapes is a thought experiment that considers water's critical role in the Trinity River Basin. We propose a system of redundancies that uses the abandoned technomass of the SSC to safeguard against hydrological failure. Our site reads as a living geostory—where topography, geology, and water shape and reshape human intention. The land isn't passive; it exerts its own agency, revealing material vitality and planetary-scale forces. Water is never static. It erodes, deposits, evaporates. It actively reshapes the land, carrying both memory and matter across time, and must be understood as relational and agentic within ecological systems.

We must consider how Earth perceives itself. Geological time dwarfs human timelines. Rocks and minerals tell stories that precede us—embodying a material memory that situates our interventions within a longer planetary continuum. These speculative cartographies visualize material vibrancy and hint at the Earth's own ways of seeing and knowing.

The watershed flows through our site with a force of its own, carving both terrain and time. It offers a lens to understand ecological interdependencies and the physical shaping of the land. This thought experiement sought to provide landscaping tools to faciliate the repair and remediation of the already stretched watershed of the Trinity Basin and for the inhabitants of Waxahachie.

The proposal was a combined strategy of water capture, water direction, and water storage using the abandoned Superconducting Super Collider Tunnel. This partnered with a potable water converter and a waste-water filtration plant sought to repair the land, the earth, and benefit the inhabitants of Waxahachie.

TRINITY WATER BASIN

MIDLOTHIAN

SOIL CONSERVATION SERVICE SITE 5 RESERVOIR

SOIL CONSERVATION SERVICE SITE 1 RESERVOIR

SOIL CONSERVATION SERVICE SITE 26 RESERVOIR

NORTH PRONG CREEK

SOIL CONSERVATION SERVICE SITE 6 RESERVOIR

SOIL CONSERVATION SERVICE SITE 20 RESERVOIR

HI-VIEW RANCH LAKE

SOIL CONSERVATION SERVICE SITE 7 RESERVOIR

SOIL CONSERVATION SERVICE SITE 16 RESERVOIR (WOOTEN'S LAKE)

N25

SOIL CONSERVATION SERVICE SITE 21 RESERVOIR

RED OAK CREEK

N24

DIAMOND J RANCH LAKE NUMBER 2

SOIL CONSERVATION SERVICE SITE 8 RESERVOIR

SOUTH PRONG CREEK

HIGHWAY 287

MID-WAY REGIONAL AIRPORT

N13

SOIL CONSERVATION SERVICE SITE 10 RESERVOIR

SOIL CONSERVATION SERVICE SITE 17 RESERVOIR

SOIL CONSERVATION SERVICE SITE 9 RESERVOIR

LONG BRANCH

WAXAHACHIE CREEK

SOIL CONSERVATION SERVICE SITE 11 RESERVOIR

WILLOWS CREEK

SITE OF THE CANCELLED SUPERCONDUCTING SUPER COLLIDER

SOIL CONSERVATION SERVICE SITE 12 RESERVOIR

LONE ELM BRANCH

SOUTH GROVE CREEK

SOIL CONSERVATION SERVICE SITE 13 RESERVOIR

S INTERSTATE 35 E

SOIL CONSERVATION SERVICE SITE 15 RESERVOIR

SOIL CONSERVATION SERVICE SITE 14 RESERVOIR

KATY LAKE

CRYSTAL LAKE

WAXAHACHIE

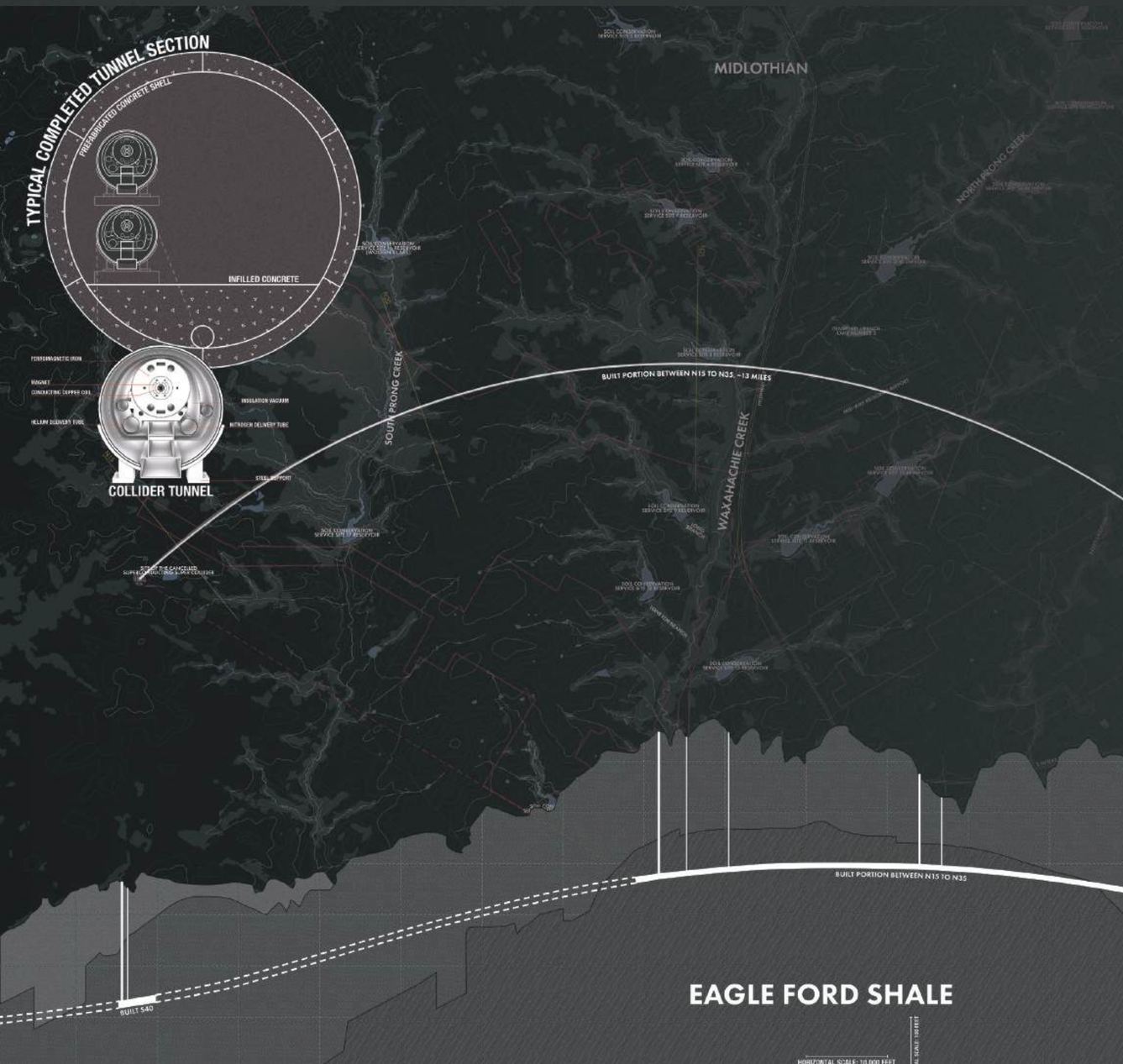
1 MILE

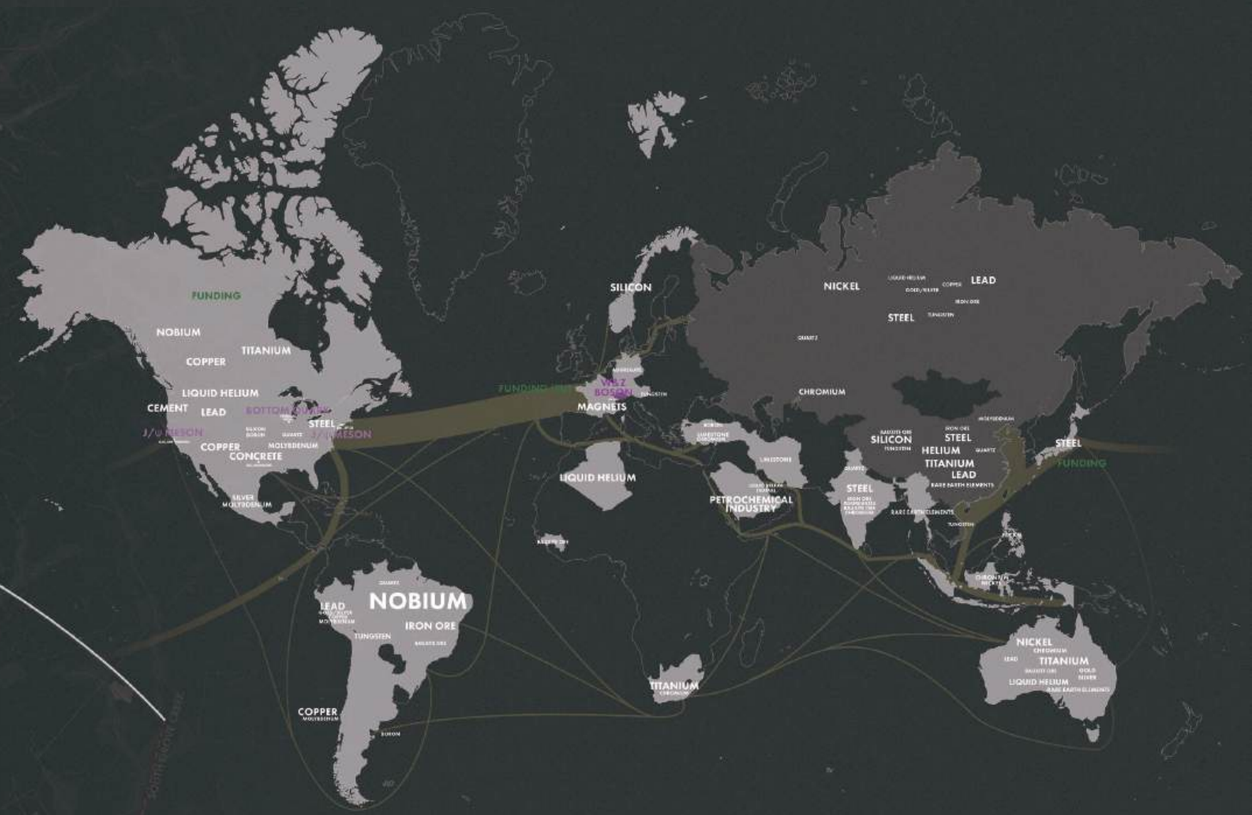
10,000 FEET

CONSTRUCTION ECOLOGIES

THOMAS SCHAPERKOTTER

The built components of the SSC represent a monumental construction ecology — an assembly of concrete, steel, and earth-moving that reoriented an entire landscape. This infrastructure, though now abandoned, embodies an industrial-scale manipulation of geology and hydrology, revealing how architecture can act as both a conduit and constraint for ecological flows. As we track the material sourced for this giant project we find that our lives are ever more entertwined globally.





STRUCTURE ~2,500,000 TONS
- CONCRETE
  - LIMESTONE
  - AGGREGATE
- STEEL
  - IRON ORE

ELECTROMAGNETICS ~10,000 TONS
- NIOBIUM-TITANIUM ALLOY
  - NIOBIUM
  - TITANIUM
- COPPER
  - ALUMINUM
  - BAUXITE ORE
- STEEL
  - IRON ORE
- CHROMIUM
- NICKEL

COOLING & VACUUM ~2,100 TONS
- HELIUM, LIQUID
- STEEL
- ALUMINUM
  - BAUXITE ORE
- NITROGEN

RADIATION SHIELDING ~60,000 TONS
- LEAD
- BORON/POLYETHYLENE

ELECTRONICS ~2,000 TONS
- SILICON
- GOLD
- SILVER
- COPPER

OTHER INFRASTRUCTURE ~77,600 TONS
- TUNGSTEN
- QUARTZ
- RARE EARTH ELEMENTS
- STEEL
- COPPER
- ALUMINUM

TOTAL PROJECT TONNAGE: 2,651,700

N20

N25

N330

SEDIMENT ISLAND SECTION

HALF MOON SECTION

100 FEET

RESEVOIR

WATER OVERFLOW INTO THE RESEVOIR

GREEN EXPANSION & GROWING TREES

15 FEET

26 FEET

WATER OVERFLOW INTO THE HALF-MOONS

DECAY OVER TIME

15 FEET

24 FEET

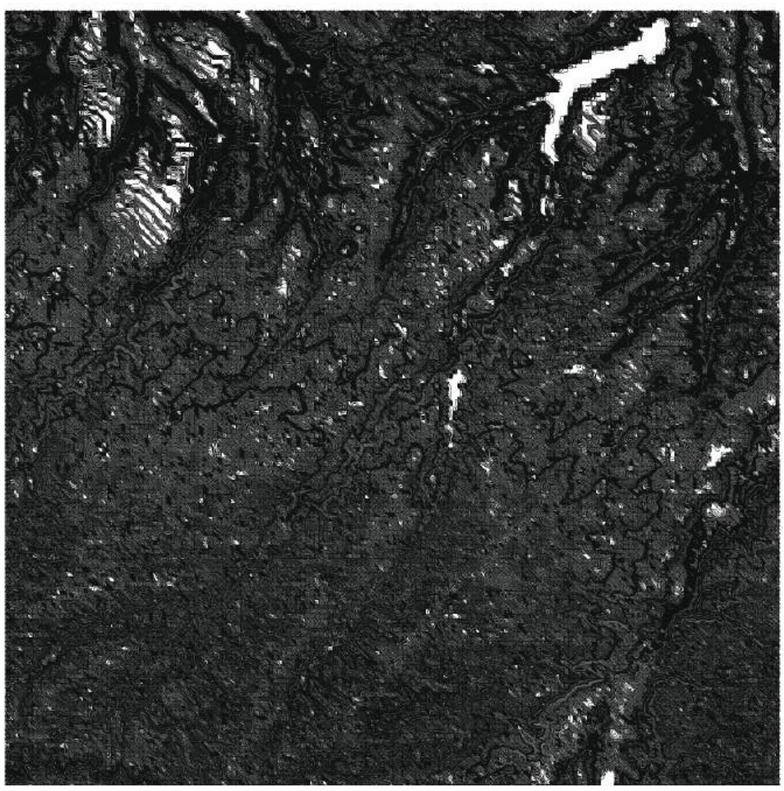
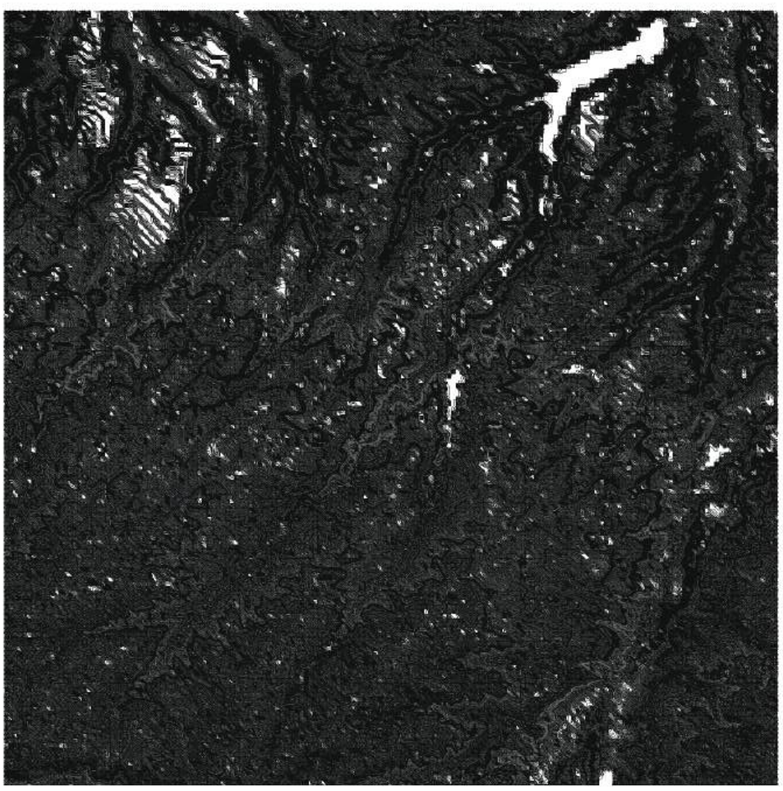
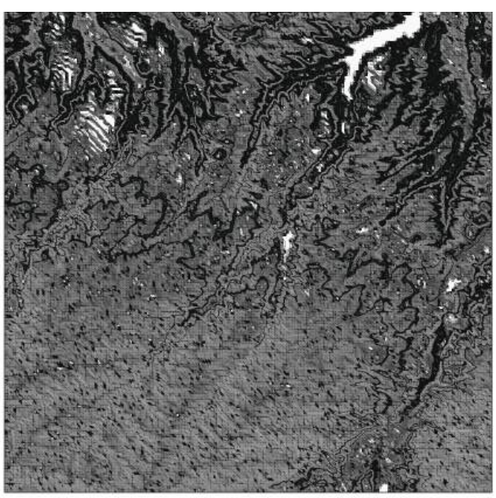
SEDIMENT DIAMONDS

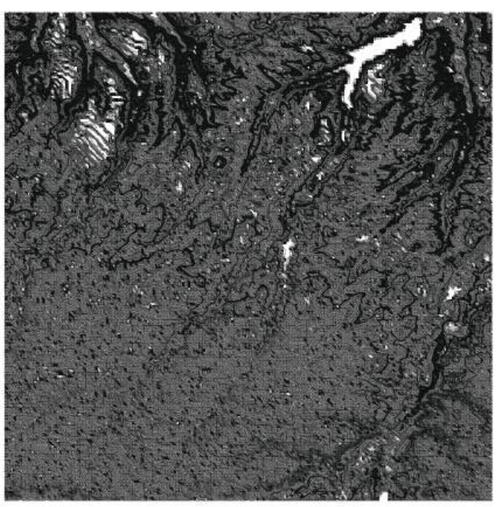
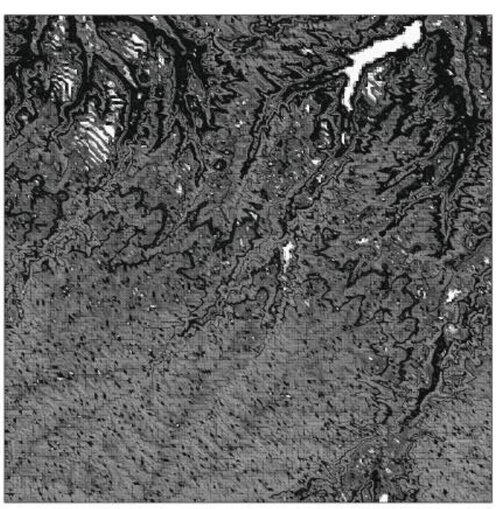
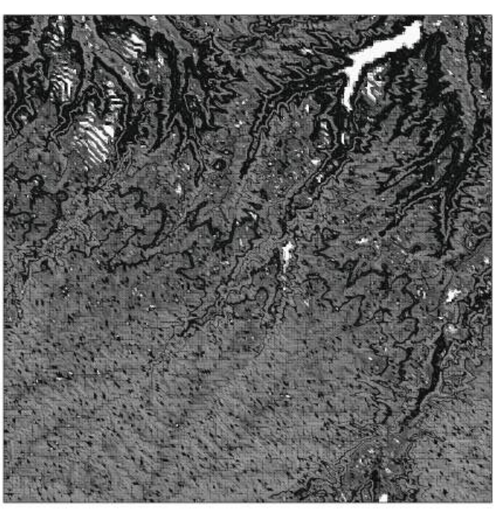
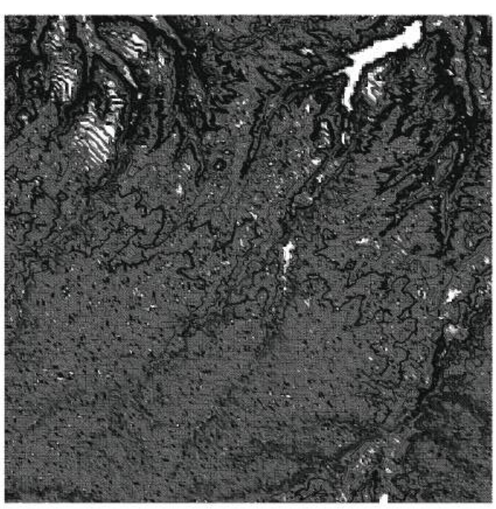
STEPPED EDGE

SEDIMENT MOUND BUILD UP

SHAFT FOR WATER INTAKE

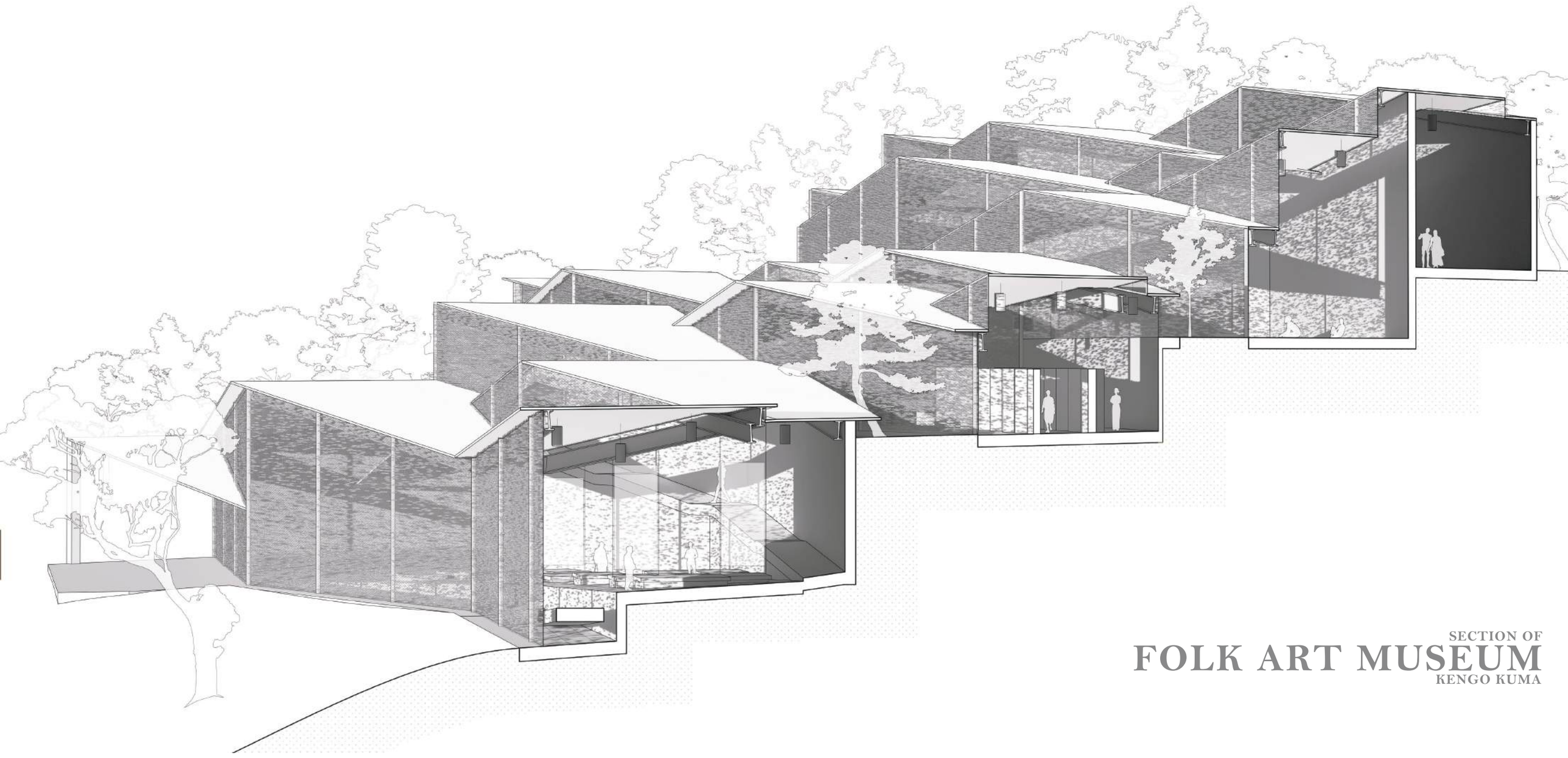
GEOSTORIES

SEMINAR OF SECTION

MARK TSURUMAKI



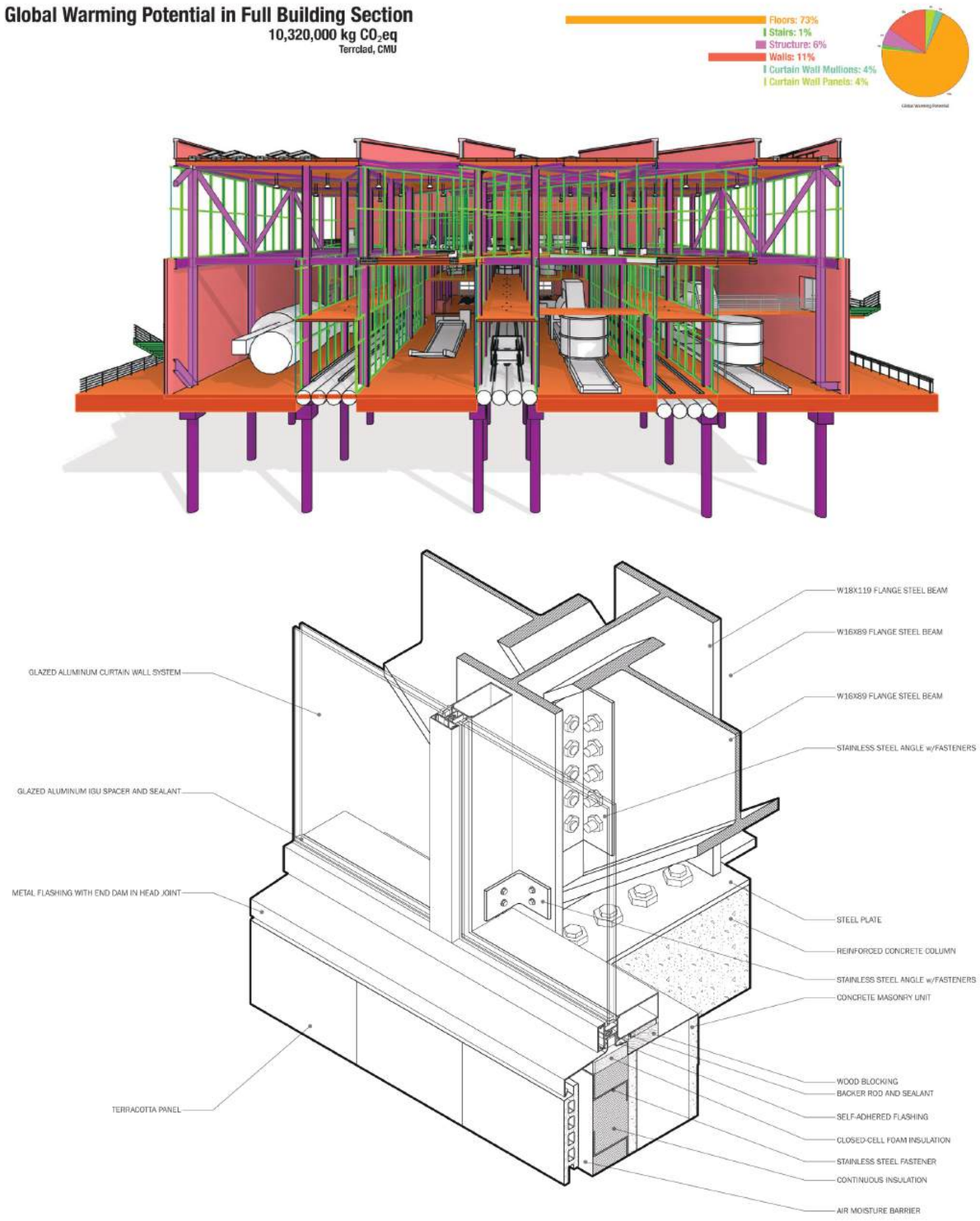
SECTION OF

FOLK ART MUSEUM

KENGO KUMA

TECH V: CONSTRUCTION AND LIFE CYCLE SYSTEMS

RACHEL BEN ALON & THOMAS SCHAPERKOTTER



THANK YOU