ISI & ZPH
Online Conference

Nov. 17-18, 2021

EQUITABLE + SUSTAINABLE INFRASTRUCTURE

DELIVERING MERIT AND CLIMATE RESILIENCE

ISI/ZPH Conference Proceedings

Posters and Networking Session

Nov. 18, 2021 from 1:45 p.m. – 2:45 p.m.

Institute for Sustainable Infrastructure
ZOFNASS PROGRAM FOR SUSTAINABLE INFRASTRUCTURE
Harvard University Graduate School of Design

Special thanks to all participants and the Zofnass Program Sustainable Infrastructure Advisory Board (SIAB).

SUSTAINABLE INFRASTRUCTURE ADVISORY BOARD "SIAB"

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John Williams,Chairman and CEO, Impact Infrastructure, Inc. and Board Chair, Institute for Sustainable Infrastructure

ISI/ZPH Conference Proceedings: Accepted Submissions

The Zofnass Program (ZPH, http://research.gsd.harvard.edu/zofnass/) and the Institute for Sustainable Infrastructure (ISI: http://www.sustainableinfrastructure.org/) invited students and professionas to submit a board or media to the ISI/ZPH Conference Poster and Networking Session, to be held on November 18, 2021, 1:35 - 2:45 pm (EST). The call for boards looks for projects, ideas, and research on all types of sustainable and equitable infrastructure. The boards should explore the topic of the conference in taking a 360-view of what it means to design, build, and implement infrastructure systems that deliver merit, climate action, and provide equitable services to communities.

Each entry completed includes a questionnaire based on the checklist of the Envision rating system. The answers to the questionnaire help to give a measure on the sustainability performance of the project. The submissions have been reviewed by ZPH and ISI for acceptance into the poster session on their quality and sustainability merit. The best poster award has been selected by a Sustainability Expert Panel composed by members of the ZPH Sustainable Infrastructure Advisory Board. The best poster will be announced in the conference during the Closing Remarks.

The interactive Poster and Networking session is an opportunity to engage with poster presenters and conference attendees using the Remo platform. The poster session features innovative sustainable infrastructure ideas and projects. Join and support the submissions accepted to the conference.

The 'SIAB' Sustainability Expert Panel

The ZPH SIAB, Sustainable Infrastructure Advisory Board, represents an an innovative collaboration between the academia and the private sector. since the beginning of the Zofnass Program. The SIAB expert members have provided invaluable support to the Zofnass Program and have come together in the Sustainability Expert Panel to review and select the submissions.

Marty Janowitz
MES, ENV SP
Vice President of Sustainable Development (Retired), Stantec

As Stantec's Vice President, Sustainable Development (10+ years), Marty was responsible for guiding Stantec to become a cutting-edge innovator and exemplary model of sustainability. Over twenty-five years he played a prominent role in the emergence of sustainable infrastructure within integrated urban systems, optimized for lifecycle triple bottom line benefits. He has written, presented and participated widely in policy-forward events and initiatives.

In addition to being an early contributor to Envision and member of the SIAB, Marty serves as a member of the Institute for Sustainable Infrastructure's Board of Directors, Envision Review Board (technical supervisory), and as an authorized Envision Verifier and Trainer. As a hands-on practitioner, he was senior advisor on the first two Canadian Envision verified projects and for more than a dozen Envision-related designs, reviews, and verifications. Marty was selected as a founding member of Canada's Clean 50 - outstanding contributors to sustainable development and clean capitalism.

Karen Lutz
Corporate Sustainability Director, TRC

Ms. Lutz has 30 years' experience in environmental and sustainability consulting in both the public and private sector. Areas of expertise include ESG/sustainability advising, facilitation of strategy development, and reporting/communications. Utilizing a variety of standards and benchmarking tools, she assists clients in in developing measurable solutions that bridge economic, social and environmental goals.

As TRC's Sustainability Director, Karen also leads her company's corporate sustainability program. Her responsibilities include integration of sustainability into TRC's business systems, internal and external communications and reporting, and advancement of market facing services, including sustainable infrastructure, clean energy, and sustainability/ESG advisory services.

Ashley Metius
ENV SP
Senior Environmental Specialist, NV5

Ms. Metius is an Environmental Specialist with 14 years of professional experience including ten years of progressive experience in municipal planning in New York City government, Department of Environmental Protection. She is experienced in the environmental permitting process on federal, state, and local levels. She is very familiar with state and federal wetland and stormwater regulations. Throughout her career she has managed large, complex projects and fosters collaboration among multidisciplinary team members. More recently she is serving as the lead ENV SP (Envision Sustainability Professional) in the NYC NV5 office in which there are four NYC capital projects actively pursuing Envision verification.

Deepa Sathiaram
LEED Fellow, IGBC Fellow
USGBC & WELL Faculty
Executive Director, En3 Sustainability Solutions

Deepa is a leading international sustainability, HVAC and wellness design professional. Deepa has been named as one of "India's Top 15 Nature's Keepers" for actively spearheading India's green movement in the last 20 years. She has also been recognized and featured as one of the "Top 5 Women in Sustainability in the World" by USGBC+.

Deepa is the Founder & Executive Director of En3, India's largest specialized sustainability and wellness consulting firm currently working on 500 million square feet of buildings world-wide.

Deepa is a USGBC LEED Fellow (2013), IGBC Fellow and an international recognized USGBC and WELL Faculty. She is the recipient of several awards including USGBC Leadership award (2018), IWBI Leadership Award (2019) and WELL Community Award (2020).

She serves on several technical committees for USGBC, ASHRAE, ICC, IAS and IGBC. She is also a Past President of ASHRAE South India Chapter and Past National Environment Chair of Young Indians arm of the Confederation of Indian Industry (CII).

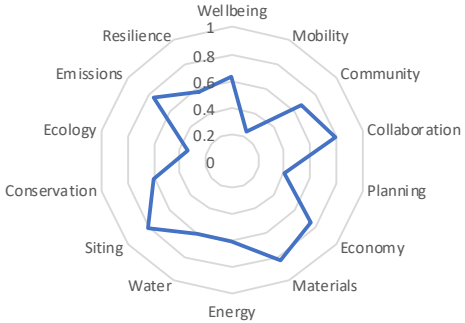
Jim Sparber, P.E.
Vice President, Engineering for Greenprint Partners

Jim is the Vice President, Engineering for Greenprint Partners (WBE, B-Corp), a green infrastructure project development and consulting firm that delivers equitable, community-driven, multi-benefit stormwater solutions. Jim draws on 25 years of experience in the planning, design and construction of municipal infrastructure to lead Greenprint Partners' engineering and construction management work. As a consulting engineer, Jim has managed multi-million dollar projects ranging from stormwater collection and management system design, and roadway reconstruction, to water supply and distribution and sanitary sewer collection systems. Jim is a registered professional engineer in the states of Illinois and Michigan and holds a BS in Civil Engineering from Valparaiso University and a MS in Environmental Management from the Illinois Institute of Technology.

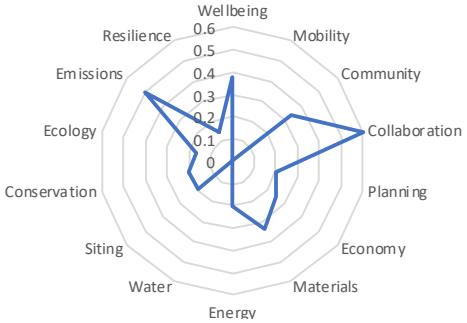
Envision-based questionnaire responses in summary

Each submission completed an Envision-based questionnaire. All the responses are included below in the summary figures by subcategory, and detailed in the following sections of this ISI/ZPH Conference Proceedings: Accepted Posters. While the questionnaire responses indicate the potential sustainability strengths of the projects, the zero/none responses may be due to non-applicable criteria.

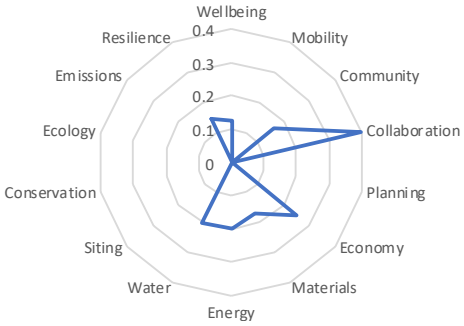
Baseco Children's Playhouse



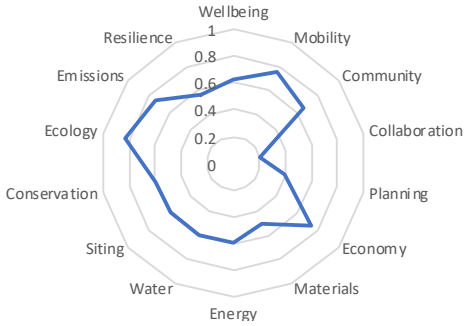
From Trash to Fish: A Sustainable Infrastructure Framework for Marine Debris Problem



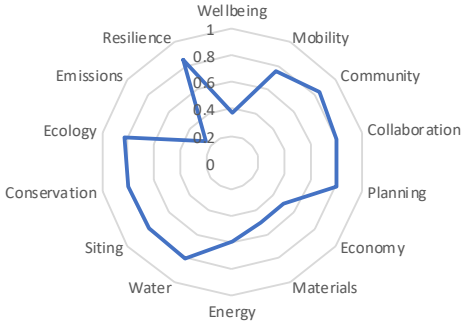
Redefining Relationships During the Project Pursuit Phase - Teaming Frameworks and the Role of Agencies



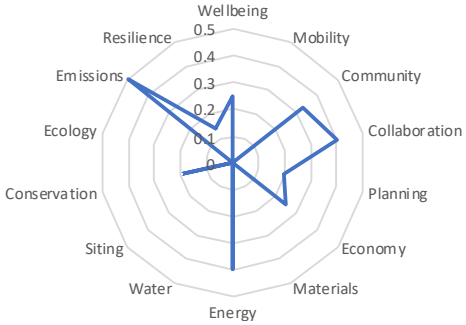
Resilient Hub



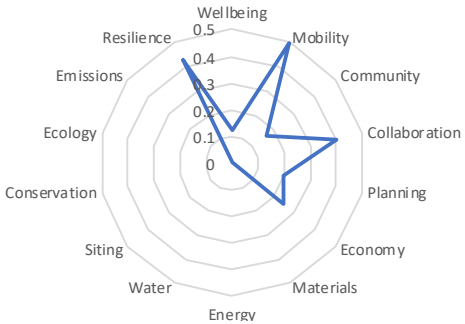
HEAL + : A regenerative design and implementation framework for localizing SDG in Covai



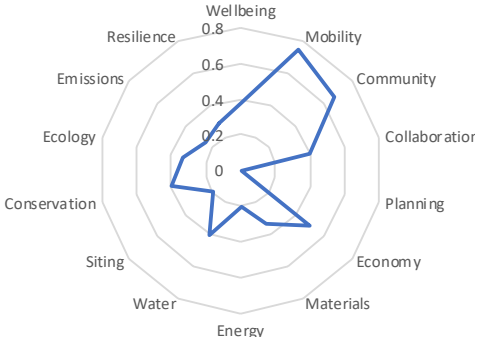
Park-And-Thrive



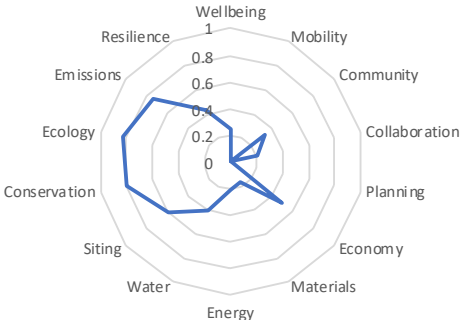
Smartphone Community for an Urban Noise Monitor tool



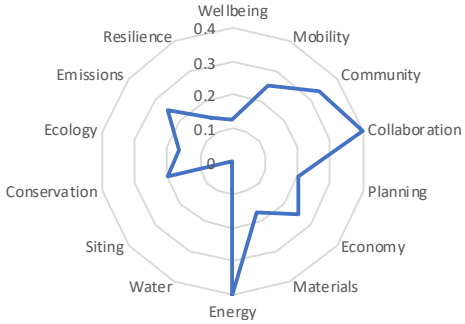
The Table that Makes the City



VACANCY & OPPORTUNITIES



ZONE ZERO DELRAY



ACCEPTED SUBMISSIONS
in detail
(shown in alphabetical order)

ACCEPTED BOARDS

Submission Type: STUDENT

Group project

Baseco Children's Playhouse

Infrastructure type: Commercial or institutional facilities
Stage: Construction
Location: Baseco, Port of Manila, the Philippines

The Baseco Children's Playhouse is a small-scale sustainable learning and playing space for children constructed in the informal settlement of Baseco, an infamously urban poor community in the port of Manila, the Philippines. The playhouse is a real-scale prototype, designed and built together with the community in 14 days. Throughout the process, the community was engaged in the design and construction stages of the project. This sustainable bottom-up strategy in upgrading the site allows the community and its stakeholders to identify, take ownership of, and in the long term maintain the playhouse.

The budget for this small-scale institutional project was only US$1,200. A wooden structure was proposed. Materials have been sourced locally and are mainly second-hand recycled woods formerly used for shipping boxes. Locally sourced recycled joists are used for primary and secondary structure. Recycled timber from shipping boxes, easily found in Manila's port district, are used to create the floor, façade, and roof. Façade pieces were cut from 1200 mm x 600 mm standard size shipping box wooden boards. Primary and secondary structures are spaced at 1200 mm and 600 mm respectively to adjust to the unit size of wooden boards. The façade has been designed to be permeable, allowing for cross-ventilation of the space. At the same time, it can be used by children to climb around the building, making it into a playhouse.

Goals:
- To introduce low-cost solution with architectural merit to a disadvantaged community;

- To create a precedent that shows that architecturally qualitative solutions are possible with limited budget, in particular to show alternatives to future neighborhood upgrade projects the Philippine government may undertake;

- To create a precedent for the community on how to integrate elements of sustainability and passive design strategy in building designs;

- To teach the local population the skill of how to build with timber and create economic opportunities.

Robin Albrecht (MArch I 2025, Harvard Graduate School of Design);
Penny Chan (School of Architecture, The Chinese University of Hong Kong);
Venus Chau (School of Architecture, The Chinese University of Hong Kong);
Noah Deng (School of Architecture, The Chinese University of Hong Kong);
Javee Lam (School of Architecture, The Chinese University of Hong Kong);
Susan Law (School of Architecture, The Chinese University of Hong Kong);
Vivien Lee (School of Architecture, The Chinese University of Hong Kong);
Timothy Lei (School of Architecture, The Chinese University of Hong Kong);
Sally Li (School of Architecture, The Chinese University of Hong Kong);
May Luo (School of Architecture, The Chinese University of Hong Kong);
Jaesok Surh (School of Architecture, The Chinese University of Hong Kong);
Kristal Tam (School of Architecture, The Chinese University of Hong Kong);
Christine Wong (School of Architecture, The Chinese University of Hong Kong);
Jessie Wong (School of Architecture, The Chinese University of Hong Kong)

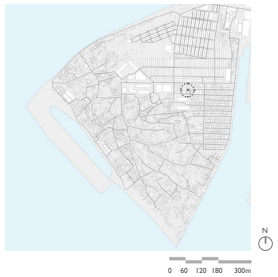
Baseco Children's Playhouse

Baseco, Manila, The Philippines

Group project supported by the Chinese University of Hong Kong
Scope: Conceptual design, planning and design development, construction
Collaborateurs: Robin Albrecht, Penny Chan, Venus Chau, Noah Deng, Javee Lam, Susan Law, Vivien Lee, Timothy Lei, Sally Li, May Luo, Jaesok Surh, Kristal Tam, Christine Wong, and Jessie Wong
Supervision: Professor Francesco Rossini

The playhouse is a placemaking project realized in the informal settlement of Baseco, an urban poor community in the port of Manila. The playhouse is a real-scale prototype designed and built in two weeks and is a collaboration between the Chinese University of Hong Kong, UCSI Kuala Lumpur, and the University of Santo Tomas Manila. The community was engaged in the design and construction stages of the project to better understand and address their needs.

This sustainable bottom-up strategy in upgrading the site allows the community and its stakeholders to identify, take ownership of, and in the long term maintain the playhouse. The budget for the construction of the project has only been USD 1200. Materials have been locally sourced and are mainly second-hand recycled woods formerly used for shipping boxes. As a real-scale prototype, the playhouse introduced the merits of architectural design to the community.



From idea to construction

Concept design, design development, and construction

Cutting and preparing of building materials offsite from construction site

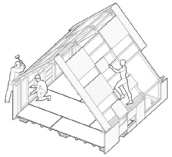
Cleaning up site and laying foundation

Erecting primary and secondary framing

Adding flooring and roof structure

Adding the envelope

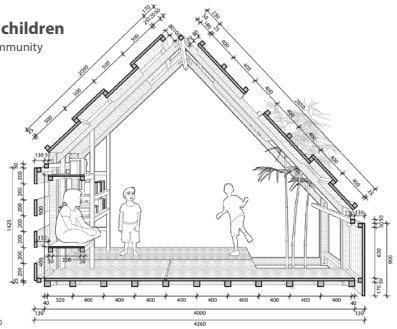
Adding furniture and a bamboo tree

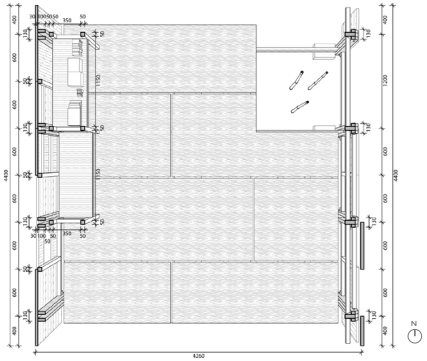


Playhouse as social infrastructure for children

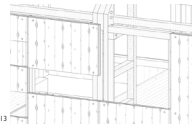
Introducing architectural design to a disadvantaged community

Baseco is a poor urban community in the port of Manila. Most buildings in the neighborhood are built to provide shelter from the elements. Newer buildings in the area include Philippine government housing (image below). Although the newer buildings are built to upgrade the living conditions for the residents of the informal settlement, they are described as uninhabitable by residents due to their concrete walls, low ceiling height, and metal roofs all making it too hot inside.



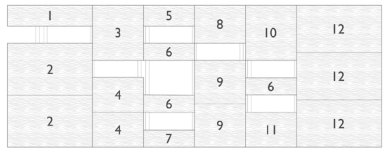


The playhouse offers a stark contrast to the housing project by the Philippine government. The playhouse introduces a low-cost solution with architectural merit to Baseco. The façade has been designed to be permeable, allowing for cross-ventilation of the space. At the same time, it can be used by children to climb around the building, making it into a playhouse. This creates a precedent in which the community can use in future negotiations with the government.



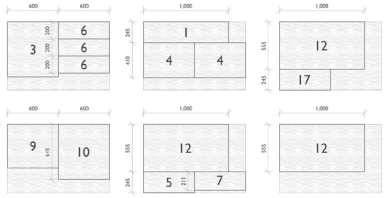
Sourcing timber locally from shipping boxes and pallets

Locally sourced recycled timber



1 1000x245
2 1000x610
3 600x645
4 600x410
5 600x245
6 600x200
7 600x215
8 600x445
9 600x510
10 600x645
11 600x415
12 1000x555

Instead of a concrete building with a metal roof, a wooden structure is proposed. Locally sourced recycled joists are used for primary and secondary structures. Recycled timber from shipping boxes, easily found in Manila's port district, are used to create the floor, façade, and roof. Façade pieces were cut from 1200 mm x 600 mm standard size shipping box wooden boards. Primary and secondary structures are spaced at 1200 mm and 600 mm respectively to adjust to the unit size of wooden boards.



1 View of Baseco Playhouse
2 Site map of Baseco, Manila
3 Community engagement when preparing wood
4 Preparation of building materials
5 Furniture in use by children
6 Photodocumentation of construction progress
7 Documentation of construction steps
8 Model photo
9 Recent government housing in Baseco
10 Section
11 Plan
12 Façade in use
13 Façade detail
14 Partial plan
15 West Elevation
16 Wood cutting plan
17 Recycled wood shop
18 View of western façade

Institute for Sustainable Infrastructure

ZOFNASS PROGRAM FOR SUSTAINABLE INFRASTRUCTURE

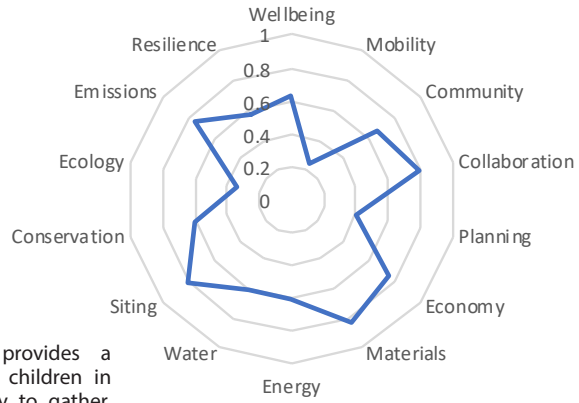
Equitable and Sustainable Infrastructure

Delivering Merit and Climate Resilience

ISI and ZPH Conference, Nov. 17-18, 2021

Envision-based questionnaire responses

Baseco Children's Playhouse



Overall performance by Envision subcategory

Quality of Life

The project provides a first space for children in the community to gather, play, and learn. The project has been planned and constructed in close cooperation with the local community and the Kabalikat organization, a local group that provides services in this otherwise informal community. Community leaders enjoy that the project creates a public place for children to play, the first of this kind in the neighborhood. The bottom-up strategy in upgrading the site allows the community and its stakeholders to identify, take ownership of, and in the long term maintain the playhouse.

Wellbeign

- The project improves the net quality of life of all communities affected by the project and mitigate negative impacts to communities.
- The project protects and enhances community health and safety during operation.
- The project enhances public and worker safety during construction.
- The project minimizes light pollution (reduces backlight, uplight, and glare) without jeopardizing safety during operations.
- The project minimizes or eliminates the temporary inconveniences or impacts associated with construction.

Mobility

- The project improves access and wayfinding by designing it to provide safe and appropriate access in and/or around the project in a way that integrates the project with the surrounding community.

Community

- The project improves community mobility and access, through planning the project as part of a connected network that supports all transportation modes for the efficient movement of people, goods, and services.
- The project helps advance equity and social justice by ensuring that equity and social justice are fundamental considerations within project processes and decision making.
- The project preserves or enhances the physical, natural, and/or community character of the project site and its surroundings.
- The project helps enhance public space by improving amenities and publicly accessible spaces to enhance community livability. accessible spaces to enhance community livability.

Leadership

The community was part of the planning and construction process from day 1 to day 14. By taking part in the entire process, not only could we teach community members construction skills they can use for future economic opportunities, but also to identify, take ownership of, and in the long term maintain the playhouse. Although we assisted in the planning and construction, community members could feel as if this is their own project.

Collaboration

- The project provides effective leadership and commitment to achieve project sustainability goals.
- The project enhances sustainability through interdisciplinary collaboration and teamwork.
- The project provides for early and sustained stakeholder engagement and involvement in project decision making.
- The project pursues by-product synergies by critically reconsidering whether traditional waste streams can be beneficially reused.

Planning

- The project plans sustainable communities by incorporating sustainability principles into project selection/identification in order to develop the most sustainable project for the community.
- The project plans for long-term monitoring and maintenance by putting in place plans, processes, and personnel sufficient to ensure that long-term sustainable protection, mitigation, and enhancement measures are incorporated into the project.

Economy

- The project stimulates and supports economic prosperity and sustainable development by including job growth, capacity building, productivity, business attractiveness, and livability,
- The project develops local skills and capabilities by expand the knowledge, skills, and capacity of the community workforce to improve their ability to grow and develop.
- The project has conducted a life-cycle economic evaluation by utilizing economic analyses to identify the full economic implications and the broader social and environmental benefits of the project.

Additional/other Leadership criteria

- Project has not just been planned but also constructed together with the community, so capacity could be built among community members through learning timber construction skills for future use.
- Also, the project could be expanded to develop a recycled timber processing facility within the neighborhood that could create additional economic opportunities.

Resource Allocation

The project only used locally available recycled materials. Indeed, the project is dimensioned to minimize waste among standardized shipping boxes that are used for façade and secondary structural elements.

Materials

- The project supports and develops sustainable procurement policies and programs to source materials and equipment from manufacturers and suppliers that implement sustainable practices.
- The project uses recycled materials by reducing the use of virgin natural resources and avoid sending useful materials to landfills by specifying reused materials, including structures, and material with recycled content.
- The project reduces operational waste and divert waste streams from disposal to recycling and reuse.
- The project reduces construction waste by diverting construction and demolition waste streams from disposal to recycling and reuse.
- The project balances earthwork on site by minimizing the movement of soils and other excavated materials off site to reduce transportation and environmental impacts.

Energy

- The project reduces operational energy consumption by conserving energy by reducing overall operational energy consumption throughout the project life.
- The project reduces construction energy consumption by conserving resources and reducing greenhouse gases and air pollutant emissions by reducing energy consumption during construction.
- The project meets operational energy needs through renewable energy sources and/or generation.

Water

- The project preserves water resources by assessing and reducing the negative net impact on fresh water availability, quantity, and quality at a watershed scale to positively impact the region's water resources.
- The project reduces overall operational water consumption by encouraging the use of greywater, recycled water, and stormwater to meet water needs.
- The project reduces construction water consumption by minimizing potable water consumption during construction.

Natural World

The project has been built on a site that was previously fenced off and full of construction waste and rubbish. The first step in our construction process was to clean the site before construction could start. Indeed, we involved community members in the cleaning to instill a sense of ownership over this soon-to-be rejuvenated space.

Climate & Resilience

Other than the transportation of the project team, almost no energy has been consumed in this building project as the main materials were from old shipping boxes found in local shops from the nearby Port of Manila. In its operation, the project doesn't consume energy.

Siting

- The project preserves sites of high ecological value by avoiding placing the project and temporary works on a site that has been identified as being of high ecological value.
- The project protects, buffers, enhances, and restores wetlands, shorelines, and waterbodies by providing natural buffer zones, vegetation, and soil-protection zones.
- The project preserves prime farmland by identifying and protecting soils designated as prime farmland, unique farmland, or farmland of importance.
- The project preserves and conserves undeveloped land by locating projects on previously developed land.

Conservation

- The project reclaims and remediates brownfields by locate projects on sites classified as brownfields.
- The project manage stormwater by minimizing the impact of development on stormwater runoff quantity, rate, and quality.
- The project preserves water resources by preventing pollutants from contaminating surface water and groundwater and monitoring impacts during construction and operations.

Ecology

- The project uses appropriate noninvasive species, and controls or eliminates existing invasive species.
- The project protects soil health by preserving the composition, structure and function of site soils.

Emissions

- The project reduces net embodied carbon by reducing the impacts of material extraction, refinement/manufacture, and transport over the project life.
- The project reduces greenhouse gas emissions during the operation of the project, reducing project contribution to climate change.
- The project reduces emissions of air pollutants: particulate matter (including dust), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, lead, and volatile organic compounds.

Resilience

- The project avoids unsuitable development by minimizing or avoiding development on sites prone to hazards.
- The project evaluates risk and resilience by conducting a comprehensive, multi-hazard risk and resilience evaluation.
- The project supports increased project and community resilience through the establishment of clear objectives and goals.
- The project maximizes resilience by increasing resilience, life-cycle system performance, and the ability to withstand hazards by maximizing durability.

ACCEPTED BOARDS

Submission Type: STUDENT

Individual project

From Trash to Fish: A Sustainable Infrastructure Framework for Marine Debris Problem

Infrastructure type: Landscape (i.e. green infrastructure, nature-based)
Stage: Ideas or conceptual stage
Location: Madagascar

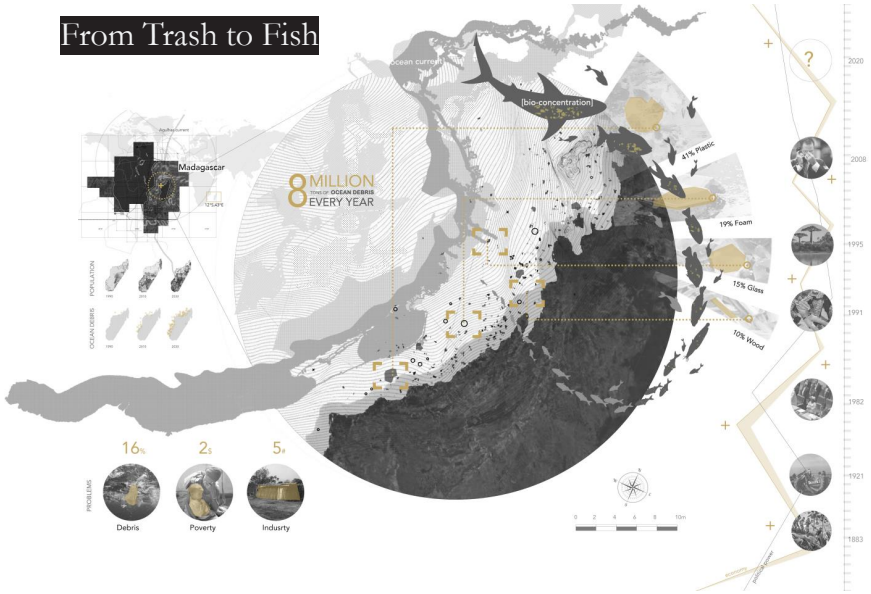
In recent years, with the depletion of land resources and the development of science and technology, people have gradually turned their attention to the ocean. Various technologies for developing marine energy sources have emerged one after another. However, people may not realize that the ocean has become the world's largest garbage dump. Every year, millions of tons of garbage are poured into the sea. With the convergence of ocean currents, five garbage belts have been formed, and the area of the largest garbage belt has exceeded the area of Europe.

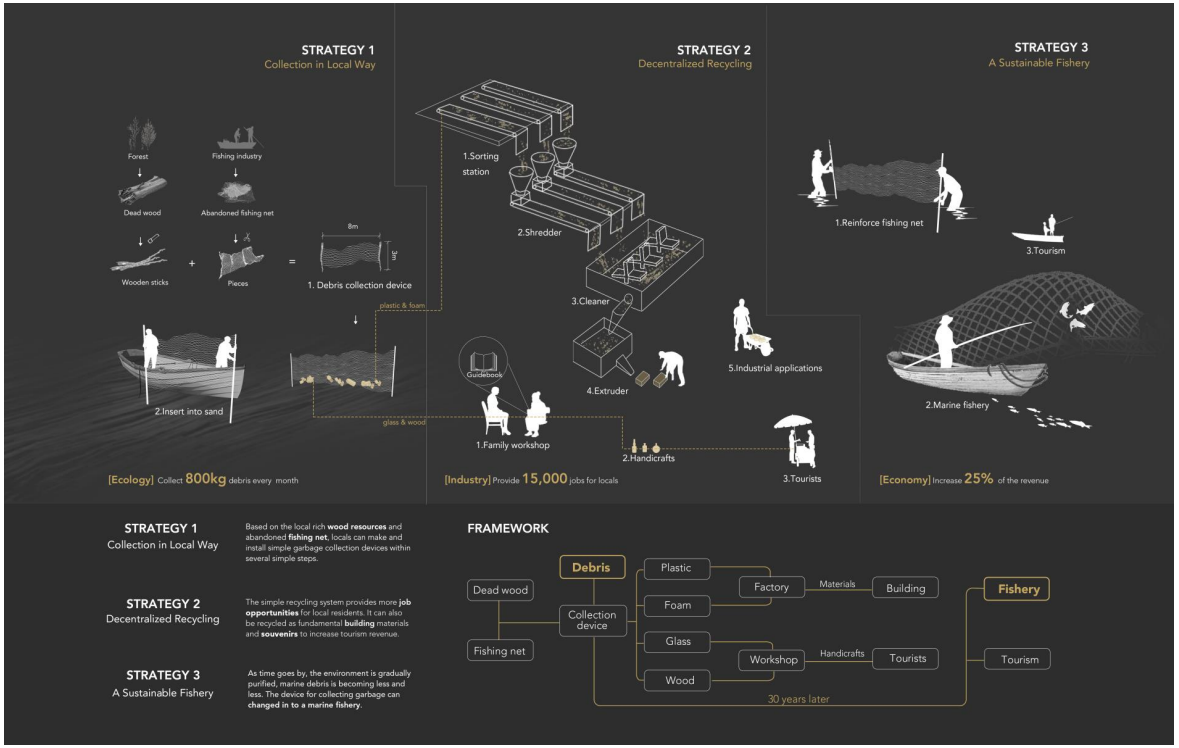
Due to the influence of the Mozambican ocean currents, marine debris in the Indian Ocean gradually gathered on the west side of the island of Madagascar, seriously affecting the local ecological environment, fishery, and tourism, which undoubtedly impacted the development of the African country which was lagging behind.

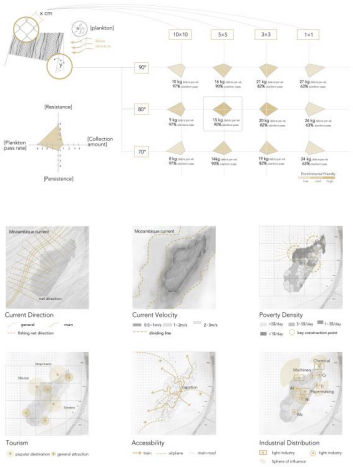
This project aims to find a simple but powerful way which can be sustainable and also help local people alleviate poverty. Available raw materials are very convenient for locals and the decentralized recycling process provides local infrastructure for the construction industry. When the marine environment is gradually purified, this original device can be used to build marine fisheries, providing a sustainable strategy for the local economy.

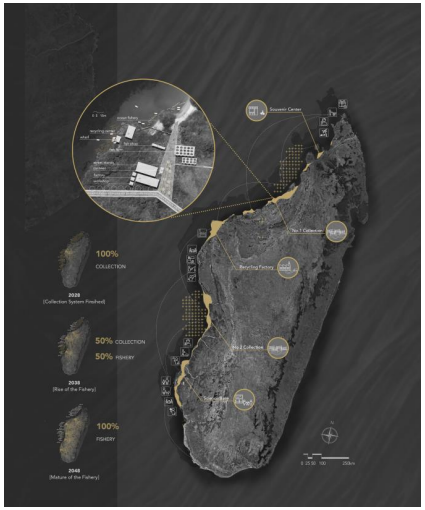
Xue Bai (Master of Landscape Architecture I, Master in Design Studies Candidate 2023', Harvard Graduate School of Design)

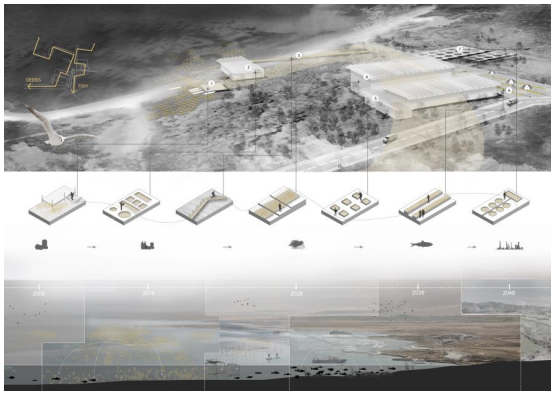
From Trash to Fish

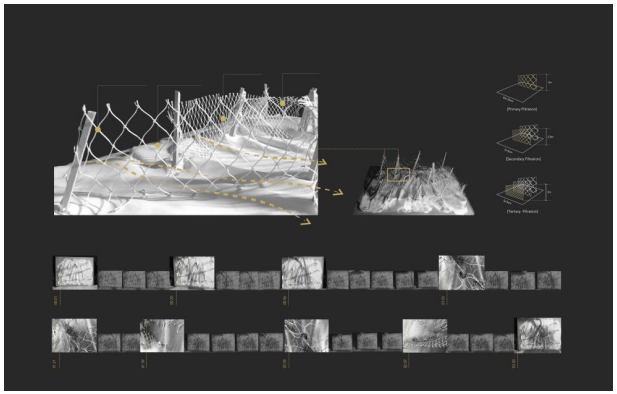






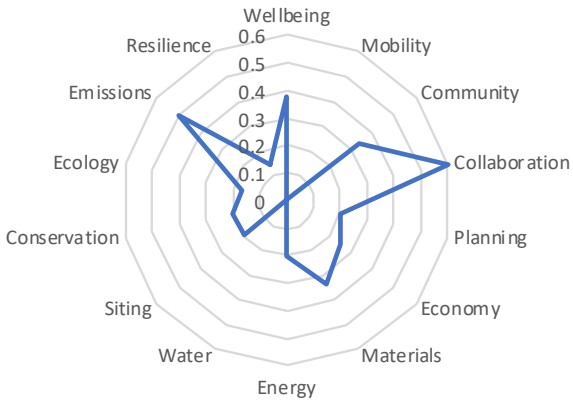






Envision-based questionnaire responses

From Trash to Fish: A Sustainable Infra-structure Framework for Marine Debris Problem



Overall performance by Envision subcategory

Quality of Life

This project aims to find a simple but powerful way which can be sustainable and also help local people alleviate poverty. Available raw materials are very convenient for locals and the decentralized recycling process provides local infrastructure for the construction industry.

Wellbeign

- The project improves the net quality of life of all communities affected by the project and mitigate negative impacts to communities.
- The project protects and enhances community health and safety during operation.

Leadership

It is a collaboration between landscape architects and local community. When the marine environment is gradually purified, this original device can be used to build marine fisheries, providing a sustainable strategy for the local economy.

- The project improves community mobility and access, through planning the project as part of a connected network that supports all transportation modes for the efficient movement of people, goods, and services.

Mobility

- None / not applicable

Community

- The project helps advance equity and social justice by ensuring that equity and social justice are fundamental considerations within project processes and decision making.
- The project preserves or enhances the physical, natural, and/or community character of the project site and its surroundings.

Collaboration

- The project provides effective leadership and commitment to achieve project sustainability goals.
- The project enhances sustainability through interdisciplinary collaboration and teamwork.
- The project pursues by-product synergies by critically reconsidering whether traditional waste streams can be beneficially reused.

Planning

- The project plans sustainable communities by incorporating sustainability principles into project selection/identification in order to develop the most sustainable project for the community.

Economy

- The project stimulates and supports economic prosperity and sustainable development by including job growth, capacity building, productivity, business attractiveness, and livability.

Resource Allocation

Based on the local rich wood resources and abandoned fishing net, locals can make and install simple garbage collection devices within several simple steps. The simple recycling system provides more job opportunities for local residents. It can also be recycled as fundamental building materials and souvenirs to increase tourism revenue.

Natural World

As time goes by, coastal planning will bring great benefits to the entire island and the recycling of marine debris and the establishment of marine fisheries will prompt the development of the entire country.

Climate & Resilience

Collecting marine debris through the device to purify the marine environment. After the environment is restored, use the old device to build a marine fishery to raise fry. The fishery provides a lot of jobs and helps the local community to develop in the long run.

Materials

- The project uses recycled materials by reducing the use of virgin natural resources and avoid sending useful materials to landfills by specifying reused materials, including structures, and material with recycled content.
- The project reduces operational waste and divert waste streams from disposal to recycling and reuse.

Energy

- The project reduces construction energy consumption by conserving resources and reducing greenhouse gases and air pollutant emissions by reducing energy consumption during construction.

Water

- None / not applicable

Siting

- The project protects, buffers, enhances, and restores wetlands, shorelines, and waterbodies by providing natural buffer zones, vegetation, and soil-protection zones.

Conservation

- The project preserves water resources by preventing pollutants from contaminating surface water and groundwater and monitoring impacts during construction and operations.

Ecology

- The project maintains and restores the ecosystem functions of streams, wetlands, waterbodies, and their riparian areas.

Emissions

- The project reduces net embodied carbon by reducing the impacts of material extraction, refinement/manufacture, and transport over the project life.
- The project reduces greenhouse gas emissions during the operation of the project, reducing project contribution to climate change.

Resilience

- The project maximizes resilience by increasing resilience, life-cycle system performance, and the ability to withstand hazards by maximizing durability.

Submission Type: STUDENT

Group project

HEAL + : A regenerative design and implementation framework for localizing SDG in Covai

Infrastructure type: Master plan or program
Stage: Ideas or conceptual stage
Location: Coimbatore, India

HEAL+ is an operational and design framework, this proposal bridges the gap between top-down framing of urban development goals and bottom-up upgradation design initiatives, making the process 'explicit' in the missing gap between people and policy. It is a framework to localize the SDG ground up: H=Health and Sanitation - Water Management, Non-Motorized Transit Network for a healthy lifestyle; E=Environment - Waste Management and Use of Renewable Energy; A=Agency - Community Participation enabled by information infrastructure; L=Livelihood - Infrastructure for economic mobility; and a "+" to encapsulate other aspects of holistic living to create regenerative sustainable cities. The framework provides a toolkit that embeds design interventions within the larger operational process across fields.

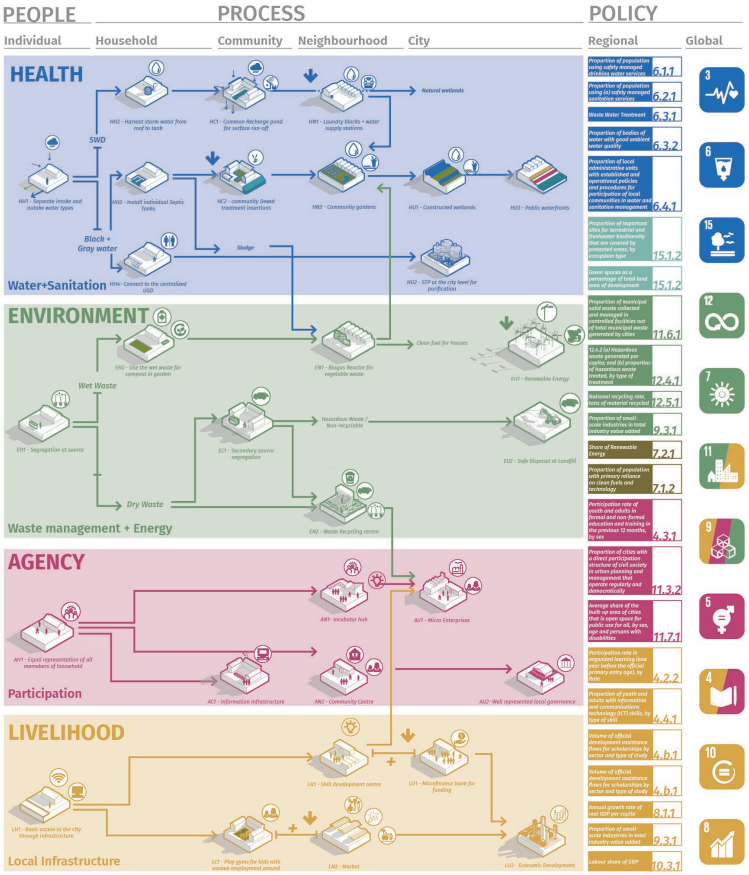
Coimbatore is at the nexus of flow of ideas and capital in the southern district. This project re- imagines the dormant industrial core as an innovation hub-model that promotes growth within the city, as opposed to SEZ, integrating the government, academia and industry to a single model of development.

The project proposes a physical and social transformation of the place through in-situ acupuncture upgradation for the existing informal settlements. This is supported by addition of Underground Drain (UGD) and centralized infrastructure. On the other, the project creates surgical interventions, eg: Communal Laundry units that celebrate quotidian activities with a social space for interactions for women. The incremental vision of the settlement is accompanied by an incremental transformation plan for the canal with a spectrum of imagination of the edge. We extend the role of public from a passive recipient of a survey to an active decision maker. This could be amplified with an digital tracking and monitoring interface application. Hence, the small household level decisions are mapped through performance indicators to achieve the SDGs.

Naksha Satish (Urban Designer, Master of Architecture in Urban Design (MAUD) 2022', Harvard Graduate School of Design);
Srinivas Karthikeyan (Architect, Yale University);
Keshava Narayana (Computational Designer, IAAC University)

HEAL+

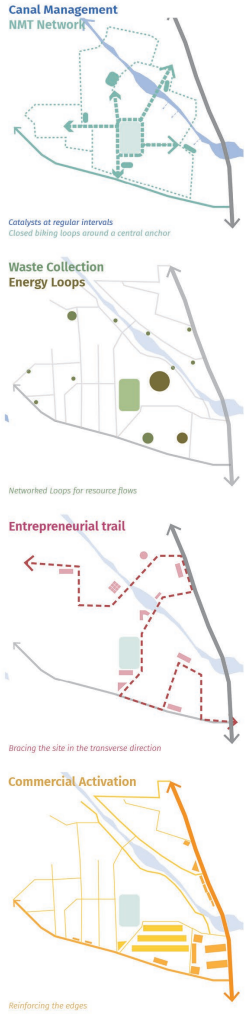
A regenerative design-implementation framework for Coval Innovation Hub



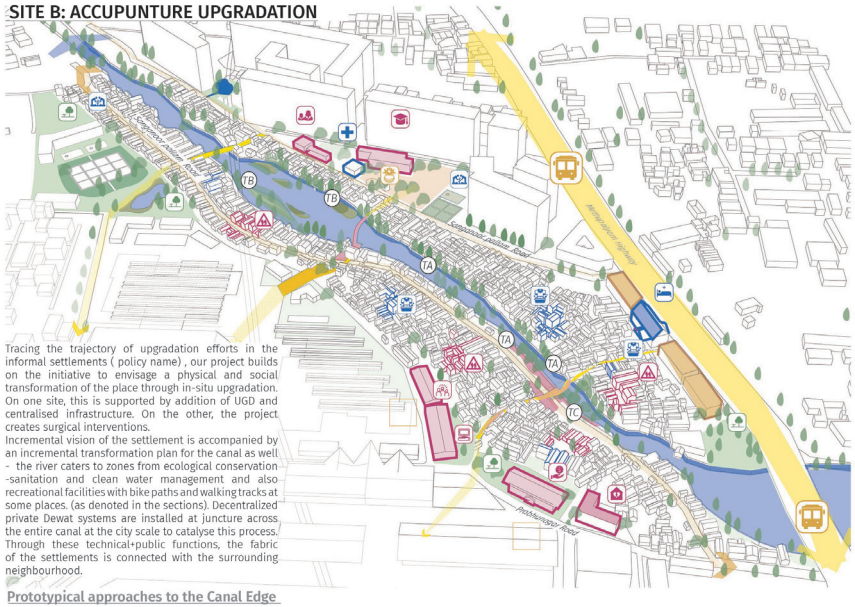
Metrics of changing performance of various aspects of HEAL monitored across scales and supported by various schemes and stakeholders

Implementation with an ICT led tool that creators a cyclic mechanism between individual and policy makers - through an interactive app - HEAL+

PROGRAM



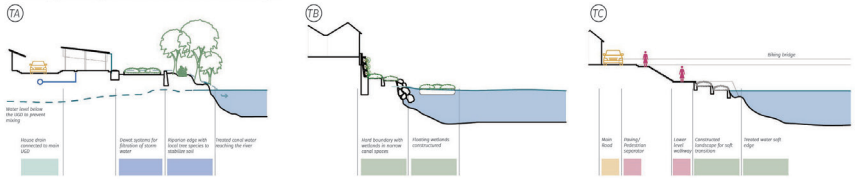
SITE B: ACCUPUNTURE UPGRADATION

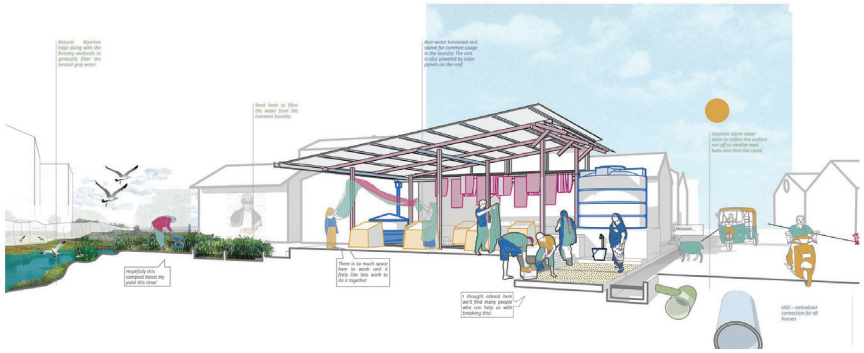


Tracing the trajectory of upgradation efforts in the informal settlements (policy name) , our project builds on the initiative to envisage a physical and social transformation of the place through in-situ upgradation. On one site, this is supported by addition of UGD and centralised infrastructure. On the other, the project creates surgical interventions.

Incremental vision of the settlement is accompanied by an incremental transformation plan for the canal as well - the river caters to zones from ecological conservation -sanitation and clean water management and also recreational facilities with bike paths and walking tracks at some places. (as denoted in the sections). Decentralized private Dewat systems are installed at juncture across the entire canal at the city scale to catalyse this process. Through these technical+public functions, the fabric of the settlements is connected with the surrounding neighbourhood.

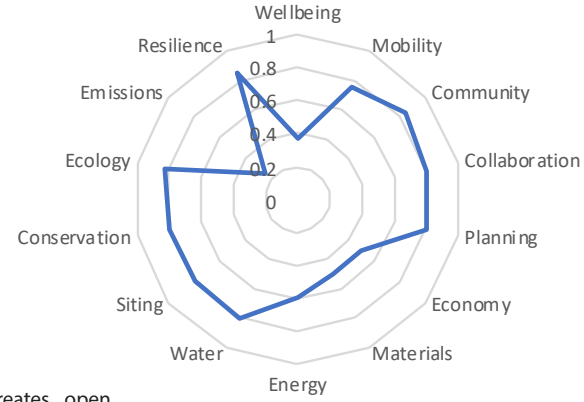
Prototypical approaches to the Canal Edge





Envision-based questionnaire responses

HEAL + : A regenerative design and implementation framework for localizing SDG in Covai



Overall performance by Envision subcategory

Quality of Life

The project creates open spaces and public parks that better physical health. The project also advocates for cleaning up the water in the canal to ensure better sanitary conditions.
The project inserts non-motorized transit network which is affordable and sustainable connecting across the last mile radius.
Local governance is encouraged by creating community groups and organizations; the project creates information infrastructure that enables creation of agency.

Wellbeign

- The project improves the net quality of life of all communities affected by the project and mitigate negative impacts to communities.
- The project protects and enhances community health and safety during operation.
- The project improves community mobility and access, through planning the project as part of a connected network that supports all transportation modes for the efficient movement of people, goods, and services.

Mobility

- The project improves community mobility and access, through planning the project as part of a connected network that supports all transportation modes for the efficient movement of people, goods, and services.
- The project helps encourage sustainable transportation by expanding accessibility to sustainable transportation choices including active, shared, and/or mass transportation.
- The project improves access and wayfinding by designing it to provide safe and appropriate access in and/or around the project in a way that integrates the project with the surrounding community.

Community

- The project improves community mobility and access, through planning the project as part of a connected network that supports all transportation modes for the efficient movement of people, goods, and services.
- The project helps advance equity and social justice by ensuring that equity and social justice are fundamental considerations within project processes and decision making.
- The project preserves or enhances the physical, natural, and/or community character of the project site and its surroundings.
- The project helps enhance public space by improving amenities and publicly accessible spaces to enhance community livability.

Additional/other Quality of Life criteria

- The project creates jobs that co-relates with financial well being and creating community wealth. It creates employment that eventually account for sustainable neighbourhoods avoiding excessive migration.

Leadership

The project integrates the Leadership aspects not only in the built form but as a part of the planning process as well beyond the implementation itself. The HEAL+ app interface helps in monitoring and tracking the individual decisions made by the residents of that community. It invites collaboration of not just multi disciplinary experts but also community members in co-creating meaningful spaces. The Incubation hub in the project accounts for creating opportunities for small local entrepreneurs and scaling businesses. Planning is not limited to the zone and extend beyond the neighbourhood to the entire city.

(Cont. Leadership)

Collaboration

- The project provides effective leadership and commitment to achieve project sustainability goals.
- The project enhances sustainability through interdisciplinary collaboration and teamwork.
- The project provides for early and sustained stakeholder engagement and involvement in project decision making.
- The project pursues by-product synergies by critically reconsidering whether traditional waste streams can be beneficially reused.

Planning

- A project team has created a project sustainability management plan that can manage the scope, scale, and complexity of a project seeking to improve sustainable performance.
- The project plans sustainable communities by incorporating sustainability principles into project selection/identification in order to develop the most sustainable project for the community.
- The project plans for long-term monitoring and maintenance by putting in place plans, processes, and personnel sufficient to ensure that long-term sustainable protection, mitigation, and enhancement measures are incorporated into the project.
- The project plans for end-of-life by ensuring that the project team is informed by an understanding of the full impacts and costs of the project's end-of-life.

Economy

- The project stimulates and supports economic prosperity and sustainable development by including job growth, capacity building, productivity, business attractiveness, and livability.
- The project develops local skills and capabilities by expand the knowledge, skills, and capacity of the community workforce to improve their ability to grow and develop.

Additional/other Leadership criteria

- Leadership is enabled by engaging with community members in the process. This enables agency within the community - especially for management of commons and utilization of shared resources.

Resource Allocation

The Materials, Energy and Water are integral to the Environment aspects of the project. It has a park that is built on a mass of solid waste dump. It has a huge solar park that harvests energy and also accomodates gardening below the panels. The water in the canal is treated. Further with the insitu upgradation of the settlements, water is filtered by reedbed filters and then discharged. All these techniques are passive energy based and dont consume more than bare minimum. The project also creates a loop to ensure best use of resources along its LCA.

Materials

- The project uses recycled materials by reducing the use of virgin natural resources and avoid sending useful materials to landfills by specifying reused materials, including structures, and material with recycled content.
- The project reduces operational waste and divert waste streams from disposal to recycling and reuse.
- The project balances earthwork on site by minimizing the movement of soils and other excavated materials off site to reduce transportation and environmental impacts.

Energy

- The project reduces operational energy consumption by conserving energy by reducing overall operational energy consumption throughout the project life.
- The project meets operational energy needs through renewable energy sources and/or generation.
- The project commissions and monitors energy systems by ensuring efficient functioning and extend useful life by specifying commissioning and monitoring of energy systems.

Water

- The project preserves water resources by assessing and reducing the negative net impact on fresh water availability, quantity, and quality at a watershed scale to positively impact the region's water resources.
- The project reduces overall operational water consumption by encouraging the use of greywater, recycled water, and stormwater to meet water needs.
- The project reduces construction water consumption by minimizing potable water consumption during construction.
- The project improves operational performance by including water systems monitoring capabilities.

Additional/other Resource Allocation criteria

- The canal edges are treated with husk and reeds that are compressed to stabilize the soil. These natural draining and filter methods allow for space of the seasonal change of water quantity. The project also has a recycling centres ; collection units and a waste hub on site that collects waste from the entire city.

Natural World

Project is located within the city and builds on all the existing amenities and resources. It advocates for insitu upgradation as opposed to clearing of the settlements and relocation. It reuses the vacant land into better use. through the rejuvenation of the canal, this invites birds that are on the migratory path in the regional context.

Siting

- The project preserves sites of high ecological value by avoiding placing the project and temporary works on a site that has been identified as being of high ecological value.
- The project protects, buffers, enhances, and restores wetlands, shorelines, and waterbodies by providing natural buffer zones, vegetation, and soil-protection zones.
- The project preserves prime farmland by identifying and protecting soils designated as prime farmland, unique farmland, or farmland of importance.
- The project preserves and conserves undeveloped land by locating projects on previously developed land.

soils.

Additional/other Natural World criteria

- It is sensitive to micro and macro neighbourhood ecology - allows for natural draining of water into the canal as well as create natural habitat for migratory birds.

Conservation

- The project reclaims and remediates brownfields by locate projects on sites classified as brownfields.
- The project manage stormwater by minimizing the impact of development on stormwater runoff quantity, rate, and quality., The project reduces non-point-source pollution by reducing the quantity, toxicity, bioavailability, and persistence of pesticides and fertilizers.
- The project preserves water resources by preventing pollutants from contaminating surface water and groundwater and monitoring impacts during construction and operations.

Ecology

- The project preserves and improves the functionality of terrestrial (land) habitats.
- The project maintains and restores the ecosystem functions of streams, wetlands, waterbodies, and their riparian areas.
- The project maintains and preserves floodplain functions by limiting development and impacts of development in the floodplain.
- The project uses appropriate noninvasive species, and controls or eliminates existing invasive species.
- The project protects soil health by preserving the composition, structure and function of site

Climate & Resilience

The project, through the SDG goal targets aims for resilience at all levels - socially economically and ecologically. The project also creates a monitoring and evaluation frame pre and post implementation that helps track the progress. Emissions are reduced since the non-recylable trash that would be send to the landfill for incinerations is now resused to form a mound that operates as a park.

Emissions

- The project reduces net embodied carbon by reducing the impacts of material extraction, refinement/manufacture, and transport over the project life.
- None of the above.

Additional/other Climate & Resilience criteria

- The project integrates all these aspects spatially to create an integrated holistic performance.

Resilience

- The project avoids unsuitable development by minimizing or avoiding development on sites prone to hazards.
- The project assesses climate change vulnerability by developing a comprehensive climate change vulnerability assessment.
- The project evaluates risk and resilience by conducting a comprehensive, multi-hazard risk and resilience evaluation.
- The project supports increased project and community resilience through the establishment of clear objectives and goals.
- The project maximizes resilience by increasing resilience, life-cycle system performance, and the ability to withstand hazards by maximizing durability.
- The project improves infrastructure integration by enhancing the operational relationships and strengthen the functional integration of the project into connected, efficient, and diverse infrastructure systems.

ACCEPTED BOARDS

Submission Type: STUDENT

Group project

Park-And-Thrive

Infrastructure type: Energy (i.e. generation, storage)
Stage: Ideas or conceptual stage
Location: Cross Point, Lowell, MA

Solar-And-Thrive is a multipurpose modular solar distributed power generation system integrated with recreational public space and community gardening to facilitate public awareness, appreciation, and participation of local energy transitions as well as engaging the private sector. The project uses the underutilized parking lot of a large local cinema to generate clean electricity, offset energy bills, facilitate corporate sustainability and marketing in the face of the declining business prospect during COVID.

Aijing Li (Master in Urban Planning Candidate, Harvard Graduate School of Design);
Claire Chenyu Wang (Master in Urban Planning Candidate, Harvard Graduate School of Design)

Park-and-Thrive

Modular Solar Parking Lot Greening Design and Sustainable Neighborhood Reintegration Programming

Problems

Extensive Underutilized Parking Space
Between two entities with non-overlapping peak demands
Only 5 to 60% of the Parking Space Occupied

Lowell's net zero progression for Paris Agreement
Leading in public facility conversion but lag behind with private participation

29.5% VS 7.2%
Public GHG Reduction
Private city-wide

WE ARE STILL IN

Solutions

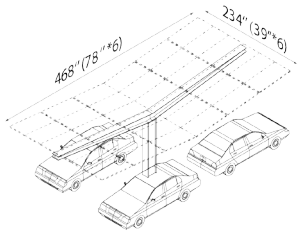
Traditional solar canopy

Studio NAB green carport

Modular solar carport with landscape and entertainment venues

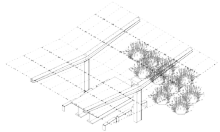
- **Sustain-ability**: Solar Panel; Permeable Ground
- **Greenery**: Greenway Connection; Community Garden
- **Entertain-ment**: Outdoor Dining; Event Space

Design

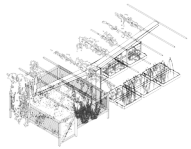


Single Module
Effective area: 760 sqft
System capacity: 8.4 kw

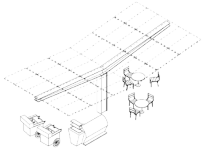
Total Proposed Area
Gross Area: 837116 sqft
Effective Area: 439517 sqft
~583 modules
~ 4900 kW



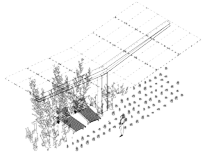
Urban Farming



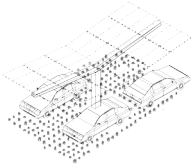
Outdoor Dining



Kiosk



Recreation



Permeable Parking

Feasibility Analysis

Financially feasible and economically viable solution to the declining cinema

Baseline

Cost	Dollar value
Cost of PV ($1000/kw)	(4899864)
Structure cost of a canopy ($4.5/sq. ft)	(1977830)
Federal Tax Credit - 22%	1077970
Total cost	(5799724)
Revenue	
Annual solar generation in kwh	5719051
Annual solar generation in $ (commericial electricity: 7.38¢/kWh)	422066
Payback period (years)	13.7

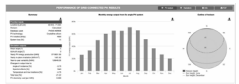
Additional incentives
- Modified accelerated cost recovery system (MACRS)
- Solar Massachusetts Renewable Target
- Municipal Light Plant Solar Rebate

Additional Revenue
- Lower electricity rate
- Parking sharing payment
- Event hosting
- Outdoor dining

Environmental benefit

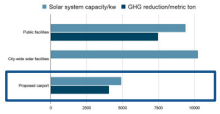
4900 KWP solar capacity

Yearly PV: 5719051 KWH



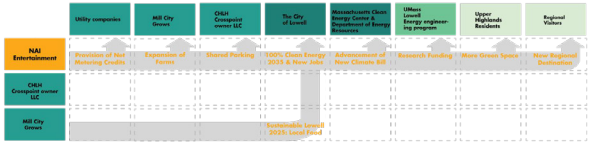
4,053 Metric tons CO2 Eq

A big step to Net-zero goals

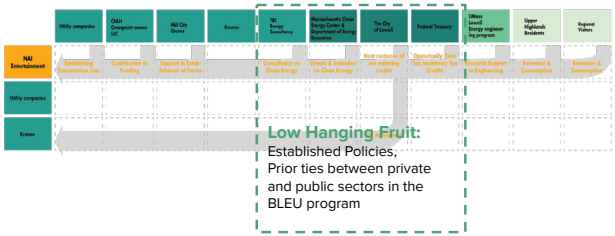


Equitable stakeholder framework

A wide range of benefits for the community



Implemented with inputs from various stakeholders



Institute for Sustainable Infrastructure

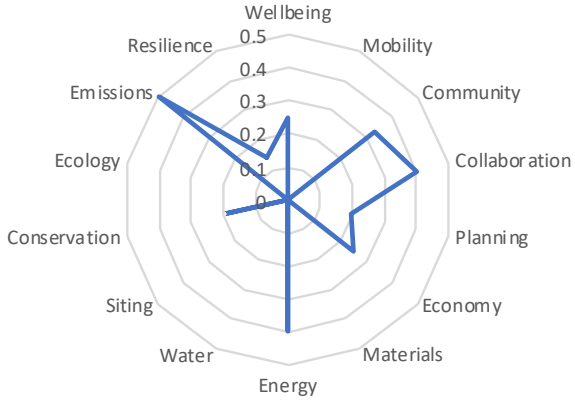
ZOFNASS PROGRAM FOR SUSTAINABLE INFRASTRUCTURE

Equitable and Sustainable Infrastructure
Delivering Merit and Climate Resilience
ISI and ZPH Conference, Nov. 17-18, 2021

Claire Chenyu Wang, MUP'22
Aijing Li, MUP'22
Spring planning core studio 2021

Envision-based questionnaire responses

Park-And-Thrive



Overall performance by Envision subcategory

Quality of Life

The project provides public recreational space and community gardening opportunities for local citizens.

Wellbeign
- The project protects and enhances community health and safety during operation.
- The project minimizes light pollution (reduces backlight, uplight, and glare) without jeopardizing safety during operations.

Mobility
- None / not applicable

Community
- The project preserves or enhances the physical, natural, and/or community character of the project site and its surroundings.
- The project helps enhance public space by improving amenities and publicly accessible spaces to enhance community livability.

Additional/other Quality of Life criteria
- Combining renewable generation with recreation.

Leadership

The project facilitates the energy transition at the city scale and raised public awareness of the issue through their experience in physical space.

Collaboration
- The project provides effective leadership and commitment to achieve project sustainability goals.
- The project enhances sustainability through interdisciplinary collaboration and teamwork.

Planning
- The project plans sustainable communities by incorporating sustainability principles into project selection/identification in order to develop the most sustainable project for the community.

Economy
- The project stimulates and supports economic prosperity and sustainable development by including job growth, capacity building, productivity, business attractiveness, and livability.

Resource Allocation

The project generates clean electricity on site and has the potential to transfer back to the grid.

Materials
- None / not applicable

Energy
- The project meets operational energy needs through renewable energy sources and/or generation.
- Other energy criteria.

Water
- None / not applicable

Natural World

The project includes permeable parking and rain gardening elements that enhance flood control and management.

Siting
- None / not applicable

Conservation
- The project manage stormwater by minimizing the impact of development on stormwater runoff quantity, rate, and quality.

Ecology
- None / not applicable

Climate & Resilience

The project creates a microgrid that can withstand blackout events.

Emissions
- The project reduces greenhouse gas emissions during the operation of the project, reducing project contribution to climate change.
- The project reduces emissions of air pollutants: particulate matter (including dust), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, lead, and volatile organic compounds.

Resilience
- Other resilience criteria

Submission Type: STUDENT

Individual project

Redefining Relationships During the Project Pursuit Phase - Teaming Frameworks and the Role of Agencies

Infrastructure type: Developer Teaming Structures within Infrastructure Projects
Stage: Ideas or conceptual stage
Location: Based off of typical teaming frameworks on New York infrastructure projects

As agencies find opportunities within the $1.2 trillion infrastructure bill and the application of the Envision framework to projects that will catalyze or develop as a result, consideration needs to be put towards project teaming frameworks to ensure that climate goals are addressed for a variety of projects. Agencies should reconsider the type and evolution of teaming structures that requests for proposals (RFPs) require to accommodate a redefining of relationships between the designer, constructor and associated entities with the goal of creating an integrative project team for the application of the Envision framework. Through four predominant teaming frameworks, evolving bid-build teams to be more integrative and conducive to the Envision framework as well as asking questions to streamline other teaming frameworks can create projects that reflect Envision values at various scales. As a result of the efficiencies created through teaming evolution, projects can focus on implementing systems that deliver on climate resilience and provide equitable services to communities. This conversation focuses on common teaming structures in the civil infrastructure industry but is based on project experience stemming from New York project pursuits.

Ethica Burt (MDes Ecologies Candidate, Harvard Graduate School of Design)

Redefining Relationships During the Project Pursuit Phase - Teaming Frameworks and the Role of Agencies

Ethica Burt, MDes Ecologies Candidate, Harvard Graduate School of Design

Idea Abstract

As agencies find opportunities within the $1.2 trillion infrastructure bill and the application of the Envision framework to projects that will catalyze or develop as a result, consideration needs to be put towards project teaming frameworks to ensure that climate goals are addressed for a variety of projects. Agencies should reconsider the type and evolution of teaming structures that requests for proposals (RFPs) require to accommodate a redefining of relationships between the designer, constructor and associated entities with the goal of creating an integrative project team for the application of the Envision framework. Through four predominant teaming frameworks, evolving bid-build teams to be more integrative and conducive to the Envision framework as well as asking questions to streamline other teaming frameworks can create projects that reflect Envision values at various scales. As a result of the efficiencies created through teaming evolution, projects can focus on implementing systems that deliver on climate resilience and provide equitable services to communities. This conversation focuses on common teaming structures in the civil infrastructure industry but is based on project experience stemming from New York project pursuits. +

Teaming Considerations Matrix

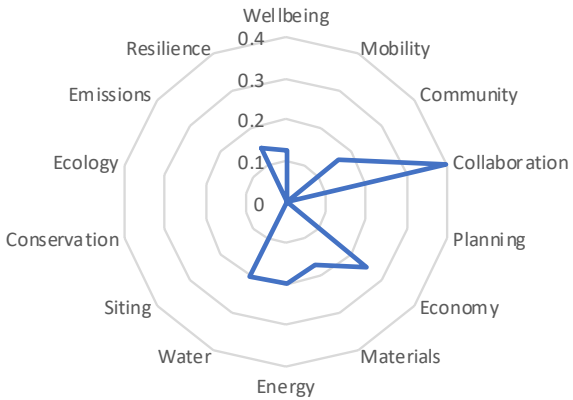
Increasing Integration →

Construction Teaming Frameworks	[Design] Bid-Build	Design-Build	Design-Build-Operate-Maintain (DBOM)	Public-Private Partnership (P3)
Description	Agency conducts the design phase with a designer before bringing the project to bid with a constructor.	Developer consists of a design and construction team that jointly works to design and construct the project. Agency is responsible for Operations and Maintenance.[1]	Developer consists of a design and construction team that will also hold primary responsibility of operating and maintaining (O&M) the project asset.	DBOM team where the developer has an investment stake in the project.
Potential Teaming Evolution	Integrate potential constructors for a project when the designer is first engaged in order to facilitate collaboration. By collaborating at an early stage, climate considerations and the involvement of Envision can occur more seamlessly.	Integrative conversation between the designer and constructor that includes Envision engagement and environmental goals addressing climate as early as possible or during project kickoff. Subsequent agency-developer meetings should include talking points to engage the agency with the system.	Early focus on defining the teaming structure with agency feedback in order to develop a clear understanding of the O&M entity and responsibilities beyond the typical design-build scope. Additional design-build project evolution should occur with a focus on operations and maintenance impacts within the Envision framework.	Early collaboration between the Developer team and the agency to agree on preliminary allocations of risk for a project through its life cycle will help the project team bypass critical risk issues and focus on more collaborative aspects of the project.
Questions to Consider to Create an Integrated Envision Team	• How can a contractor ask questions to evolve the teaming structure in a closed bidding process? • If the designer and constructor phases remain separate, when should the Envision process be catalyzed? • How can agencies create a more engaging teaming structure for these projects to encourage collaboration towards an envision framework?	• Are there any risks from the design-build phase that should also be apparent during the operations and maintenance phase? • How can the developer engage with the agency in order to kickoff a discussion on pursuing Envision? • To what extent can the developer team engage the agency during the pursuit process?	• Who takes responsibility for O&M risks? • How is this risk better addressed by the developer than by the agency? • What should the O&M entity look like?	• Who takes responsibility for each risk after project commissioning? • How is this risk better addressed by the developer than by the agency? • Post-COVID, how can we evolve the developer's relationship within a P3 to mitigate revenue disruptions due to similarly unforeseen circumstances?

[1] What is design-build? DBIA. (2020, July 23). Retrieved October 29, 2021, from https://dbia.org/what-is-design-build/.

Envision-based questionnaire responses

Redefining Relationships During the Project Pursuit Phase - Teaming Frame-works and the Role of Agencies



Overall performance by Envision subcategory

Quality of Life

By creating integrated teaming structures and addressing critical considerations, projects will be able to focus on the tenets of Envision including Quality of Life.

Wellbeign
- The project minimizes or eliminates the temporary inconveniences or impacts associated with construction.

Mobility
- None / not applicable

Community
- Other community criteria.

Leadership

The board describes teaming considerations. Projects that address these considerations will be able to more effectively collaborate and focus on project sustainability goals.

Collaboration
- The project provides effective leadership and commitment to achieve project sustainability goals.
- The project enhances sustainability through interdisciplinary collaboration and teamwork.

Planning
- None / not applicable

Economy
- Other economy criteria.

Resource Allocation

As the board describes teaming considerations, projects that address these considerations will be able to more effectively collaborate and focus on resource allocations. However, the board does not specifically address a project example with this.

Materials
- Other materials criteria.

Energy
- Other energy criteria.

Water
- Other water criteria.

Natural World

As the board describes teaming considerations, projects that address these considerations will be able to more effectively collaborate and focus on Natural World related envision criteria.

Siting
- None / not applicable

Conservation
- None / not applicable

Ecology
- None / not applicable

Climate & Resilience

As the board describes teaming considerations, projects that address these considerations will be able to more effectively collaborate and focus on Climate and Resilience.

Emissions
- None / not applicable

Resilience
- Other resilience criteria.

ACCEPTED BOARDS

Submission Type: STUDENT

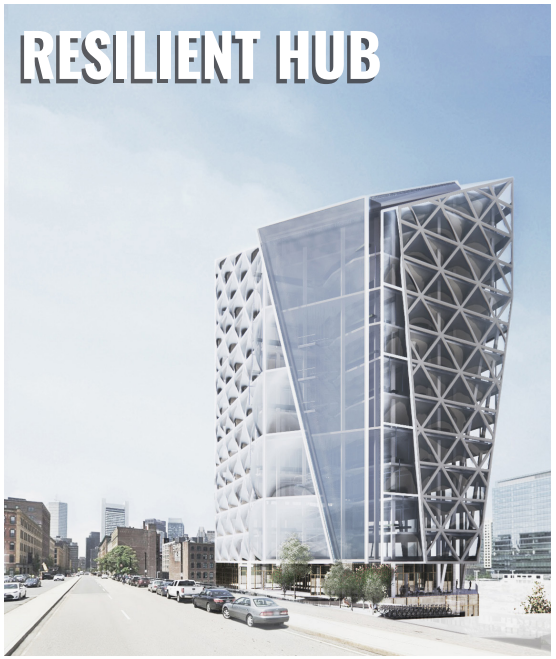
Group project

Resilient Hub

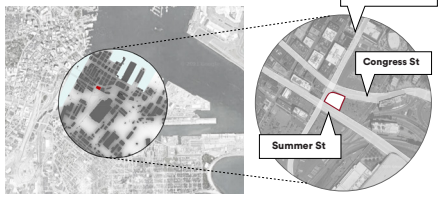
Infrastructure type: Commercial or institutional facilities
Stage: Ideas or conceptual stage
Location: 391 Congress St, Boston, MA

In this era of Anthropocene, buildings will be subjected to rising temperatures and increased risk of natural disasters. In addition, a growing population and strong urbanization trend will increase the density of our cities. These environmental changes will have a considerable effect on future building performance. ResilientHub, situated in the Seaport District of Boston, Massachusetts, USA, is a future-ready building that maintains the highest energy efficiency and occupant comfort level possible throughout its lifetime. The proposed building design accommodates thirteen floors office space, in addition to retail, restaurants, a daycare center for children of office employees, and underground parking on the lower floors. The office floors are expected to cater to a diverse range of corporate users from the life sciences, technology and financial sector. Adaptable ETFE pillow façades optimize solar heat gain and daylight access in response to daily and seasonal weather changes, and future global warming and urbanization. A solar chimney, placed prominently at its most optimal position for solar heat gain, provides buoyancy-driven natural ventilation and significantly lowers the building's cooling loads with future rising temperatures. A series of indoor atria supply the office spaces with a healthy level of natural daylight and provide a space for informal social interaction. Situated in a flood zone, the building employs building and landscape-integrated strategies to mitigate flood levels and delay, resist and discharge flood water. The innovative, high-performance design solutions ResilientHub employs are directly applicable to the vast majority of the future global building stock that will be affected by the same environmental changes.

Lara Tomholt (Doctor of Design candidate '22, Harvard Graduate School of Design(GSD));
Kritika Kharbanda (Master of Design Studies Energy & Environment (MDes EE) '23, Harvard GSD);
Kuan Ting Chen (MDes EE '21, Harvard GSD);
Sihui (Iris) Chen (MArch I '21 & MDes '23, Harvard GSD);
Andrew Gibbs (MDes Real Estate '21, Harvard GSD)



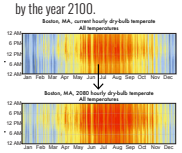
LOCATION - SEAPORT DISTRICT, BOSTON



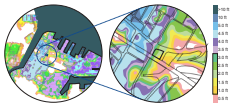
KEY DESIGN DRIVERS

1 RAPID URBANISATION
By 2050, Boston's population and number of jobs is projected to increase to 801,000 (from 656,000 in 2014)

2 CLIMATE CHANGE
Models by Stackhouse et al. predicted Boston, MA will change from ASHRAE climate zone 5 to climate zone 4 or 3 by the year 2100.



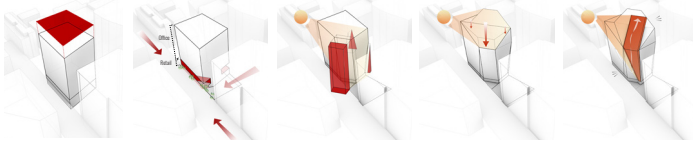
3 FLOODING
By 2030 the sea level is expected to rise 9 inches, and 40 inches by 2070.



4 COMMUNITY
Boston green space/resident ranked among the nation's lowest

FORM EVOLUTION

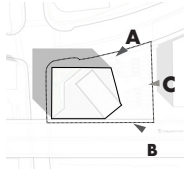
1. Maximising the FAR
2. Responding to the Context
3. Daylight Optimisation
4. Energy Generation
5. Hybrid Ventilation System



Site Plan

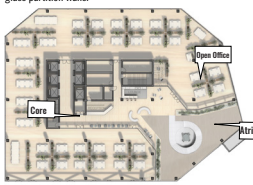
Access to the building is on all the three public levels:

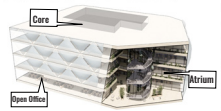
A. Through Congress St
B. Through Summer St (most busy)
C. Through the public plaza

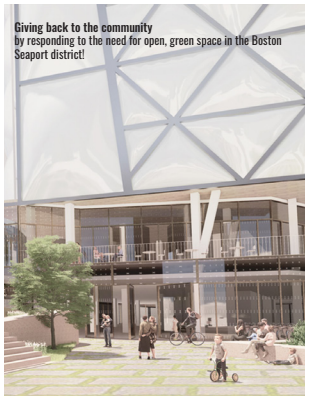


Interior Layout

1. **30%** improvement in Daylight Autonomy experienced due to atrium
2. With the three atria having different sizes, each atrium has its own **spatial identity**.
3. **Flexible modular design** that replaces conventional glass partition walls.

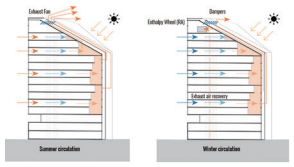




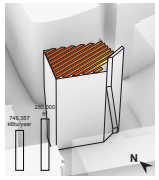


Environmental Features

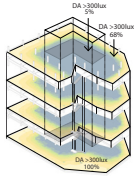
68% higher energy savings by using a solar chimney



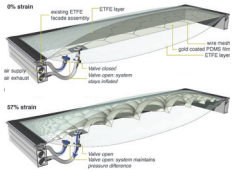
3.39 kBtu of solar renewable energy/ft2 of gross floor area



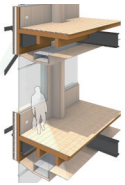
Increased daylight autonomy from 64% to **87%**



Adaptive **ETFE pillow façades** reduce energy consumption by **28%**



Hybrid steel-CLT structure reduces GWP by **55%**



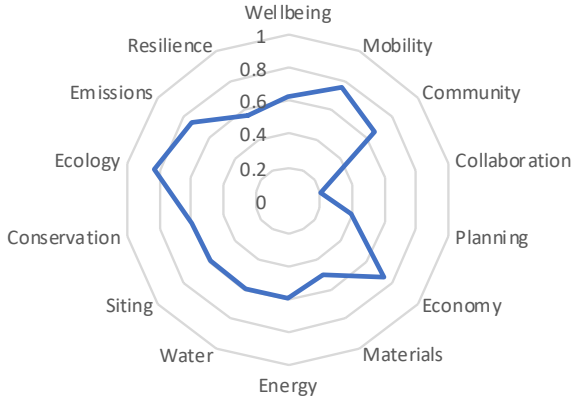
Institute for Sustainable Infrastructure

ZOFNASS PROGRAM FOR SUSTAINABLE INFRASTRUCTURE

Equitable and Sustainable Infrastructure
Delivering Merit and Climate Resilience
ISI and ZPH Conference, Nov. 17-18, 2021

Envision-based questionnaire responses

Resilient Hub



Overall performance by Envision subcategory

Quality of Life

We recognized three major requirements this office building's anticipated tenants will have. Firstly, with different tenants moving into and out of the building, or changing work trends, the indoor space should be able to adapt to different user preferences. Secondly, companies are increasingly placing importance on their employees' mental and physical well-being. This reduces absenteeism, that ultimately results in overall company growth.

Studies have shown that with sufficient natural daylight (>300 lux), worker productivity can increase up to 18%. Additionally, introduction of ample greens in the office space and views to the outside allow an employee to rest their eyes, away from the screen and can increase their mental functioning and memory by up to 10-25%. By maximising daylight autonomy and views to green, we ensure a high quality of life for the employees.

In addition, gender equity in the workplace should also tackle the gender-discriminating bias in the perceived thermal comfort: in most offices, the temperature set is based on a decades-old formula that uses the metabolic rates of men, leaving many women feeling chilly. By adopting an adaptive comfort model, the number of natural ventilation hours per year can be increased, and consequently energy consumption for heating and cooling can be reduced, and the indoor environment will be more comfortable for both men and women, contributing to a gender equal work environment.

Wellbeign

- The project improves the net quality of life of all communities affected by the project and mitigate negative impacts to communities.
- The project protects and enhances community health and safety during operation.
- The project minimizes noise and vibrations during operations to maintain and improve community livability.
- The project minimizes light pollution (reduces backlight, uplight, and glare) without jeopardizing safety during operations.
- Other wellbeing criteria.

Mobility

- The project helps encourage sustainable transportation by expanding accessibility to sustainable transportation choices including active, shared, and/or mass transportation.
- The project improves access and wayfinding by designing it to provide safe and appropriate access in and/or around the project in a way that integrates the project with the surrounding community.
- Other mobility criteria.

Community

- The project helps advance equity and social justice by ensuring that equity and social justice are fundamental considerations within project processes and decision making.
- The project preserves or enhances the physical, natural, and/or community character of the project site and its surroundings.
- The project helps enhance public space by improving amenities and publicly accessible spaces to enhance community livability.

Additional/other Quality of Life criteria

- Spatial diversity - Indoor gathering spaces like the atria and the outdoor public space can be used by employees during lunch breaks or for informal meetings. A change of scenery boosts mental health and increases productivity. During Boston's cold winters, when the outdoor public space is too cold to be used, the atriums double up as winter gardens, trapping the heat of the sun, thus providing an informal, green space all year round.
- Urban heat island mitigation - The landscaped outdoor public space was also designed to combat the issue of urban heat island. The space provides an oasis of green "solace" in the concrete jungle, with the vegetation reflecting light, providing shade and transpiring.
- Privacy - The movable, space-dividing planters (see Section 2.1.4) impart a sense of "enclosure" around desks in the open office work space. Moreover, plants reduce noise propagation and improve the privacy of any conversations made.

Leadership

The project was developed as part of seminar at Harvard GSD, instructed by Prof Holly Samuelson in a team of 5 students pursuing graduate studies in varied domains, including architecture, engineering, sustainability and real estate. Through several iterations and dicussions, our interdisciplinary team looked at the project holistically across social, environmental and economic sustainability. We also consulted several industry professionals at different stages of the concept development, including Chris Schaffner, Founder and CEO of The Green Engineer, Andrew Hall - Principal at John Moriarty & Associates, Aphroditi Panagiotopoulou - CEO of Studio Root, Yanni Tsipis - Lecturer at MIT, Vice President at WS Development and the architecture team at Henning Larsen Architects.

Collaboration

- The project enhances sustainability through interdisciplinary collaboration and teamwork.

Planning

- The project plans sustainable communities by incorporating sustainability principles into project selection/identification in order to develop the most sustainable project for the community.
- The project plans for end-of-life by ensuring that the project team is informed by an understanding of the full impacts and costs of the project's end-of-life.

Economy

- The project stimulates and supports economic prosperity and sustainable development by including job growth, capacity building, productivity, business attractiveness, and livability.
- The project has conducted a life-cycle economic evaluation by utilizing economic analyses to identify the full economic implications and the broader social and environmental benefits of the project.
- Other economy criteria.

Additional/other Leadership criteria

Financial Feasibility:

- Roughly 60% of the increases in construction cost will be offset by the incremental value gain from the annual reduction in utility costs (i.e. in the form of capitalizing higher rents per ft2). To ensure that the project could be funded with unsubsidized private capital, the property should be expected to earn a minimum of 20% IRR to investors upon stabilization. In line with current market trends, we expect half of the office building to be pre-leased during construction, with the remaining property stabilizing in 2024-2025. Assuming an exit market cap rate of 5.0% and 75% of construction costs are financed with a senior construction loan, our pro forma financial statement showed that ResilientHub would generate over a 21.7% levered IRR and a 2.16x equity multiple, proving that despite higher construction costs than a typical office building, ResilientHub is still an attractive investment opportunity and, thus, financially feasible.

Resource Allocation

Materials: The results from the study performed with the software Athena highlighted that the building saves 28% of embodied carbon in the full envelope system compared to the baseline building. The aggregate Global Warming Potential (GWP) of the proposed façade is 89,800 kg CO2-eq per m2, compared to 1,12,550 kg CO2-eq per m2 for the baseline façade. A hybrid cross laminated timber (CLT) and steel structure was vital in creating the most environmentally-friendly and user-friendly solution for this building, reducing the Global Warming Potential by a substantial 55%.

Energy: The building's site energy use totals to 9.82 kBtu/ft2 (30.99 kWh/m2). This is roughly four times lower than Boston's current most energy-efficient large-scale office building. The sloped roof (which is optimized for energy production by photovoltaics) is able to accommodate 10,806 ft2 (1004 m2) of photovoltaic (PV) panels. This amounts to an annual energy generation of approximately 4.99 kBtu per ft2 (15.75 kWh per m2) of office floor area.

Water: The building permanent occupancy is 900 for the first year, which is equivalent to 5200 gal of water/year/person. The on-site rainwater collection system in the landscaped podium levels can cover the full indoow irrigation and part of the toilet fixtures, saving 15-20% of the total water usage.

Natural World

The building site lies in a zone with risk of flooding, that will continue to increase in the future. This building's flood-proof building design uses strategies to delay, mitigate, block and remove flood water.

The landscape was designed to delay floods. The public space surrounding the building has plenty of exposed soil, permeable surfaces and plants to absorb the first water approaching the building. Interlocking pavers made of residual fly ash from industries, for pedestrian walkways will allow for infiltration of stormwater runoff. In addition to reducing surface runoffs, such paving systems can also trap suspended solids,

Materials

- The project supports and develops sustainable procurement policies and programs to source materials and equipment from manufacturers and suppliers that implement sustainable practices.
- The project uses recycled materials by reducing the use of virgin natural resources and avoid sending useful materials to landfills by specifying reused materials, including structures, and material with recycled content.
- Other materials criteria.

Energy

- The project reduces operational energy consumption by conserving energy by reducing overall operational energy consumption throughout the project life.
- The project meets operational energy needs through renewable energy sources and/or generation.
- The project commissions and monitors energy systems by ensuring efficient functioning and extend useful life by specifying commissioning and monitoring of energy systems.

Water

- The project preserves water resources by assessing and reducing the negative net impact on fresh water availability, quantity, and quality at a watershed scale to positively impact the region's water resources.
- The project reduces overall operational water consumption by encouraging the use of greywater, recycled water, and stormwater to meet water needs.
- The project improves operational performance by including water systems monitoring capabilities.

Siting

- The project preserves sites of high ecological value by avoiding placing the project and temporary works on a site that has been identified as being of high ecological value.
- The project protects, buffers, enhances, and restores wetlands, shorelines, and waterbodies by providing natural buffer zones, vegetation, and soil-protection zones.
- Other siting criteria, please provide details in your narrative response below.

Conservation

- The project manages stormwater by minimizing the impact of development on stormwater runoff quantity, rate, and quality.
- The project reduces non-point-source pollution by reducing the quantity, toxicity, bioavailability, and persistence of pesticides and fertilizers.
- The project preserves water resources by

allowing additional filtration of the pollutants from stormwater.

When the pervious surfaces become saturated, and the flood level rises, a valve is opened and flood water is allowed to flow into the lowest basement level, which will function as a floodwater harvesting "bathtub", collecting roughly 2,007,708 gallons of water. Once the tide starts to ebb back, the mechanical barriers open again, and the basement "bathtub" is emptied by pumping the water out.

Further, to support the pattern of migratory birds by introducing local flora and fauna, In the outdoor public space, deciduous tree species suitable for the Boston climate (American yellowwood, North American beech and scarlet oak) are placed, and additional flowering small trees and plants (rose-acacia, Katsura and the eastern redbud) have been proposed.

Climate & Resilience

Resilience through adaptable façade system: Energy simulations performed with both current and 2080 weather data have shown that, in addition to reducing the heating and cooling load with the façade in the early years of the building's life by 44% (and the overall building load by 18%), the façade will adapt to global warming and urban development in its later years and still save 40% of energy in these thermal zones compared to tinted low-e glazing. The adaptable ETFE facade does not sacrifice natural daylight access in order to achieve high thermal performance.

Resilience to flooding: This building's flood-proof building design uses strategies to delay, mitigate, block and remove flood water by simple and easy-to-implement interventions with long-term functionality. The flood-protection strategy consists of three major design components: landscaping, movable barriers and a dual function of the building's basement.

Natural ventilation with a solar chimney: With the current Boston weather profile, the solar chimney reduces the building's cooling load by about 68%, compared to about 56% for wind-driven cross ventilation. The cooling capacity of natural ventilation reduces as global temperatures rise, due to both a reduced number of hours suitable for natural ventilation, and the lower cooling capacity of warmer air. Estimated future cooling capacities also show a higher performance for the solar chimney: a 41% (2050) and 32% (2080) cooling load reduction.

preventing pollutants from contaminating surface water and groundwater and monitoring impacts during construction and operations.

Ecology

- The project preserves and improves the functionality of terrestrial (land) habitats.
- The project maintains and restores the ecosystem functions of streams, wetlands, waterbodies, and their riparian areas.
- The project maintains and preserves floodplain functions by limiting development and impacts of development in the floodplain.
- The project protects soil health by preserving the composition, structure and function of site soils.
- Other ecology criteria

Emissions

- The project educes net embodied carbon by reducing the impacts of material extraction, refinement/manufacture, and transport over the project life.
- The project reduces greenhouse gas emissions during the operation of the project, reducing project contribution to climate change.
- The project reduces emissions of air pollutants: particulate matter (including dust), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, lead, and volatile organic compounds.

Resilience

- The project avoids unsuitable development by minimizing or avoiding development on sites prone to hazards.
- The project assesses climate change vulnerability by developing a comprehensive climate change vulnerability assessment.
- The project supports increased project and community resilience through the establishment of clear objectives and goals.
- The project maximizes resilience by increasing resilience, life-cycle system performance, and the ability to withstand hazards by maximizing durability.

Submission Type: PROFESSIONAL

Group project

Smartphone Community for an Urban Noise Monitor tool

Infrastructure type: Information (i.e. digital, data management)
Stage: Ideas or conceptual stage
Location: Switzerland

The project aims to track noise pollution in urban areas and it explores a novel approach that involves the smartphone user community to monitor the prevalent noise. The system consists of a smartphone client application that records noise, processes the information, communicates to a server, and shares visual noise levels on Google maps.

The application registers 24h/24h the decibels that the phone owner is exposed to daily, contextually it can also produce a daily report indicating for how many times during the day the decibels trespassed a warning level.

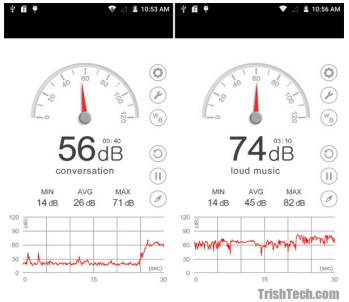
This pilot project could show the impact of user community participation in monitoring noise pollution. Based on the community data, the application could also automatically suggest better itineraries to avoid noise areas.

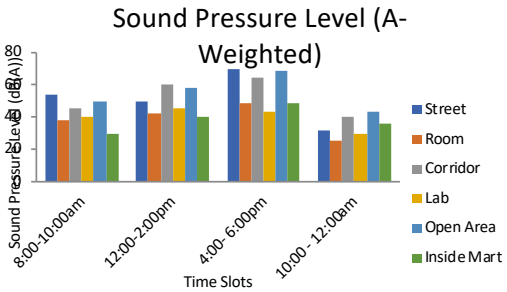
The project aims to provide data to improve the acoustic comfort of people and improve the quality of life of people living in an urban area that is usually more subject to noise pollution than countryside areas.

Francesco Perlini, Graduate MDP '21, Harvard Extension School
Danio Campanelli, Project Manager, World Trade Organization

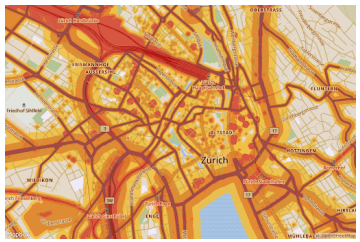
Data management for Smartphone User Community to monitor Urban Noise Pollution

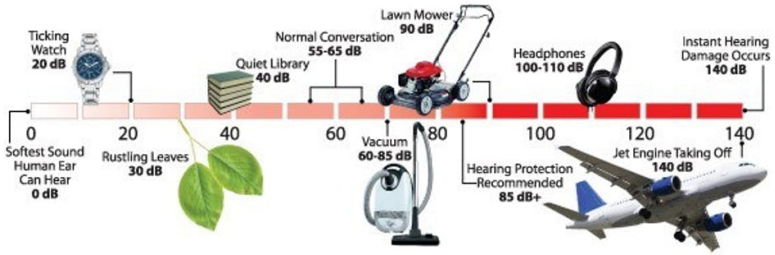
- a smartphone client application records noise, processes the information, communicates to a server, and shares visual noise levels on Google maps.
- The application registers 24h/24h the decibels and
- The application produce a daily report indicating for how many times during the day the decibels trespassed a warning level.
- User community participation in monitoring noise pollution.
- Common database
- **Itineraries to avoid noise areas.**
- **improve the acoustic comfort of people**
- **improve the quality of life of people living in an urban area**





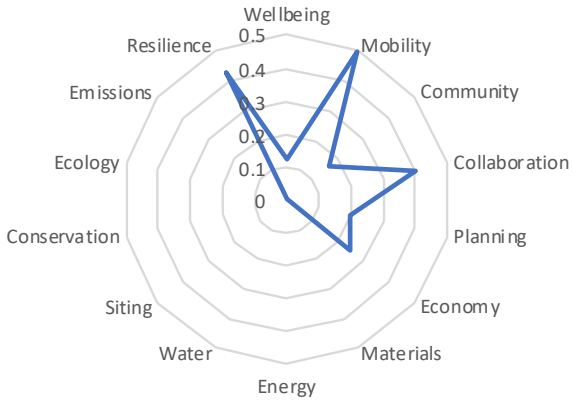
N_i (dB(A))	Linguistic Variables	Colour code
<a (55)	Insignificant	Green
>=a;<b (60)	Somewhat Significant	Yellow
>=b; <c (65)	Significant	Cyan
>=c; <d (70)	Very Significant	Blue
d>70	Extremely Significant	Red





Envision-based questionnaire responses

Smartphone Community for an Urban Noise Monitor tool



Overall performance by Envision subcategory

Quality of Life

The Project aims to develop an application to create a common database to track noise pollution within any urban community. Via a server connection, the application can display data and report to each user daily. Such reports will show the moments and the venues where decibels trespassed the warning area. Similarly, thanks to its database, the application can display the itinerary on google maps where the noise pollution is within pre-set acceptable standards.

Additional/other Quality of Life criteria

- Currently, Google Maps shows, thanks to a user community data collection, info on traffic congestions. This project aims to integrate this functionality with data on noise pollution and make ad hoc reports to help the user reduce its exposure to acoustic urban stress.

Leadership

The project aims fundamentally to create a database of noise pollution thanks to the data interaction coming from the smartphone user community within an urban metropolitan area. Therefore, stakeholder involvement is the basis for the success of the application and consequently to return sufficient and reliable information to the community. Thanks to such information, the community will take appropriate decisions on livable solutions (i.e. where to live, where to go to avoid noise pollution as well as how to reduce noise pollution in the daily activity).

Wellbeign

- The project minimizes noise and vibrations during operations to maintain and improve community livability.

Mobility

- The project improves community mobility and access, through planning the project as part of a connected network that supports all transportation modes for the efficient movement of people, goods, and services.
- The project improves access and wayfinding by designing it to provide safe and appropriate access in and/or around the project in a way that integrates the project with the surrounding community.

Community

- The project helps enhance public space by improving amenities and publicly accessible spaces to enhance community livability.

Collaboration

- The project enhances sustainability through interdisciplinary collaboration and teamwork.
- The project provides for early and sustained stakeholder engagement and involvement in project decision making.

Planning

- A project team has created a project sustainability management plan that can manage the scope, scale, and complexity of a project seeking to improve sustainable performance.

Economy

- The project has conducted a life-cycle economic evaluation by utilizing economic analyses to identify the full economic implications and the broader social and environmental benefits of the project.

Additional/other Leadership criteria

- The project needs its stakeholders and will produce results and information for the stakeholders.
- The application works in a client-server framework to collect and measure road traffic noise levels. In the central server, the information is processed to generate noise indices. Based on this noise indices, noise pollution maps are generated and shared with the users on Google® maps..

Resource Allocation

The project does not have a material impact in terms of resources as it is more focused on data management to enhance livable solutions for the community. It is focused on using applications collecting data on decibels and linking them with google maps to track and design areas where noise pollution is harmful to the community.

Materials

- None / not applicable

Energy

- None / not applicable

Water

- None / not applicable

Natural World

As it is more focused on noise pollution within urban community I do not see connection with the enhancement of the Natural World.

Siting

- None / not applicable

Conservation

- None / not applicable

Ecology

- None / not applicable

Climate & Resilience

The project enhances community resilience as it provides data and useful information to improve the quality of life within an urban area (in terms of noise pollution). Noise pollution affects the community in several ways: increased exposure to noise causes annoyance and irritation, disturbed auditory mechanisms, various behavioral problems, and in extreme cases high blood pressure and coronary artery disease. Prolonged exposure to high level of noise may cause transitory hearing disorders that can develop into permanent deafness. Road traffic noise is one of the major sources of noise pollution, especially in cities and metropolises.

Emissions

- None / not applicable

Resilience

- The project avoids unsuitable development by minimizing or avoiding development on sites prone to hazards.
- The project evaluates risk and resilience by conducting a comprehensive, multi-hazard risk and resilience evaluation.
- The project supports increased project and community resilience through the establishment of clear objectives and goals.

ACCEPTED BOARDS

Submission Type: STUDENT

Group project

The Table that Makes the City

Infrastructure type: Housing
Stage: Ideas or conceptual stage
Location: Cape Town, South Africa

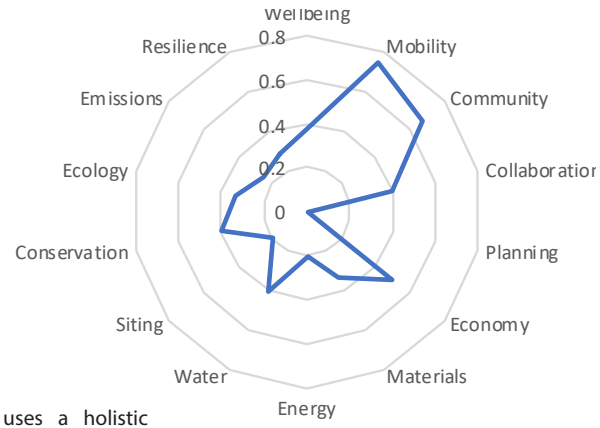
'The Table that Makes the City' presents an imagined urban future for how fundamental material and immaterial infrastructures can facilitate rapid urbanization and create a future and just city. Spatial justice and land rights have historically been a topic of contestation, especially on public lands with private interest (such as golf courses, and bowling greens) throughout the city of Cape Town, South Africa.

Cape Town is a city where people build for themselves, and the proposal works on the premise that a group of revolutionary forces are eager to devise a radical reclaiming of land, re-imagining what a new city could look like for working and middle-class citizens.

Building new infrastructures upon existing ones, the city is re-imagined. As opposed to an extensive pre-planned masterplan, the city is built by the citizens themselves through a series of rules, delivering housing and infrastructure to fulfill the basic needs of everyday life. The utilized tools of scenario planning, VR and storytelling are used to enhance our understanding, as designers, of the new city's coming to being.

Natasha Harkison (Master of Landscape Architecture in Urban Design (MLAUD) 2022', Harvard GSD);
Iris Kim, (Master of Architecture in Urban Design (MAUD) 2021', Harvard GSD)

Envision-based questionnaire responses



Overall performance by Envision subcategory

The Table that Makes the City

Quality of Life

The project uses a holistic approach of history, culture, and a series of scenario planning strategies that use a bottom-up approach to town planning.

Wellbeign
- The project improves the net quality of life of all communities affected by the project and mitigate negative impacts to communities.
- The project protects and enhances community health and safety during operation.
- The project improves community mobility and access, through planning the project as part of a connected network that supports all transportation modes for the efficient movement of people, goods, and services.

Mobility
- The project improves community mobility and access, through planning the project as part of a connected network that supports all transportation modes for the efficient movement of people, goods, and services.
- The project helps encourage sustainable transportation by expanding accessibility to sustainable transportation choices including active, shared, and/or mass transportation.
- The project improves access and wayfinding by designing it to provide safe and appropriate access in and/or around the project in a way that integrates the project with the surrounding community.

Community
- The project improves community mobility and access, through planning the project as part of a connected network that supports all transportation modes for the efficient movement of people, goods, and services.
- The project helps advance equity and social justice by ensuring that equity and social justice are fundamental considerations within project processes and decision making.
- The project preserves or enhances the physical, natural, and/or community character of the project site and its surroundings.
- The project helps enhance public space by improving amenities and publicly accessible spaces to enhance community livability.

Leadership

The project aims fundamentally to create a database of noise pollution thanks to the data interaction coming from the smartphone user community within an urban metropolitan area. Therefore, stakeholder involvement is the basis for the success of the application and consequently to return sufficient and reliable information to the community. Thanks to such information, the community will take appropriate decisions on livable solutions (i.e. where to live, where to go to avoid noise pollution as well as how to reduce noise pollution in the daily activity).

Collaboration
- The project provides effective leadership and commitment to achieve project sustainability goals.
- The project enhances sustainability through interdisciplinary collaboration and teamwork.

Planning
- None / not applicable

Economy
- The project stimulates and supports economic prosperity and sustainable development by including job growth, capacity building, productivity, business attractiveness, and livability.

- The project develops local skills and capabilities by expand the knowledge, skills, and capacity of the community workforce to improve their ability to grow and develop.

Additional/other Leadership criteria
- Team members works together to envision a community plan that would be resident-led and community generated. The community works together with other constituents and stakeholders in the city to achieve planning strategies that benefit the whole neighborhood.

Resource Allocation

Site grading, drainage, and land cover sensitivity were all taken into account in the planning and design of the scenario. The land would be built on top, as is, so as to minimize construction efforts and disruptive environmental practices.

Materials
- The project uses recycled materials by reducing the use of virgin natural resources and avoid sending useful materials to landfills by specifying reused materials, including structures, and material with recycled content.
- The project balances earthwork on site by minimizing the movement of soils and other excavated materials off site to reduce transportation and environmental impacts.

Energy
- The project reduces operational energy consumption by conserving energy by reducing overall operational energy consumption throughout the project life.

Water
- The project preserves water resources by assessing and reducing the negative net impact on fresh water availability, quantity, and quality at a watershed scale to positively impact the region's water resources.
- The project reduces overall operational water consumption by encouraging the use of greywater, recycled water, and stormwater to meet water needs.

Natural World

The project preserves the existing floodplains and natural systems in order to create a sustainable and resilient community. Stormwater and drainage flows are also accommodated for with proper block to unit siting.

Siting
- The project protects, buffers, enhances, and restores wetlands, shorelines, and waterbodies by providing natural buffer zones, vegetation, and soil-protection zones.

Conservation
- The project manage stormwater by minimizing the impact of development on stormwater runoff quantity, rate, and quality.
- The project reduces non-point-source pollution by reducing the quantity, toxicity, bioavailability, and persistence of pesticides and fertilizers.

Ecology
- The project maintains and restores the ecosystem functions of streams, wetlands, waterbodies, and their riparian areas.
- The project maintains and preserves floodplain functions by limiting development and impacts of development in the floodplain.

Climate & Resilience

The project considers climate and resilience to natural disasters in particular. As shown through the scenarios in the storyline, natural disasters are planned for on an immediate attention basis, depending on low-cost methods of care.

Emissions
- The project reduces greenhouse gas emissions during the operation of the project, reducing project contribution to climate change.

Resilience
- The project supports increased project and community resilience through the establishment of clear objectives and goals.
- The project improves infrastructure integration by enhancing the operational relationships and strengthen the functional integration of the project into connected, efficient, and diverse infrastructure systems.

ACCEPTED BOARDS

Submission Type: STUDENT

Group project

VACANCY & OPPORTUNITIES

Infrastructure type: Landscape (i.e. green infrastructure, nature-based)
Stage: Ideas or conceptual stage
Location: Cincinnati, Ohio

Cincinnati is located near the state line of Ohio and Kentucky and is bordered to the south by the Ohio River.The Mill Creek Watershed runs through the center of the city and has a large barrier dam at the outlet to the river. The city has a lack of tree cover, large amounts of impervious surfaces and a large number of vacant lots in a plethora of areas. This location provides an opportunity to create a more sustainable environment and introduce methods to reinvigorate the communities within. Planting trees and other plants in areas with little shade reduces heat island effect and erosion of soils in certain locations. More trees also mean less CO2 pollution and have been studied to improve healthy living, both physically and mentally, to those within viewing vicinity of green spaces. The current vacant lots supply potential spaces for introducing green infrastructure improving Cincinnati's economic and environmental conditions creating better connections between areas and surrounding districts and producing a more sustainable urban fabric for the city of Cincinnati. With the vast number of vacant lots, the city could take on a regenerative project with these spaces. Opportunities could include making the lots public green spaces, local vegetable gardens, small forest plantings, and other green initiatives to help cool the city and offer clean spaces for residents.

Emilee Poehner (Master of Landscape Architecture (MLA), University of Cincinnati);
Maddi Nuss (MLA, University of Cincinnati);
Nathan Delong (MLA, University of Cincinnati);
Gauri Patil (MLA, University of Cincinnati);

VACANCY + OPPORTUNITIES

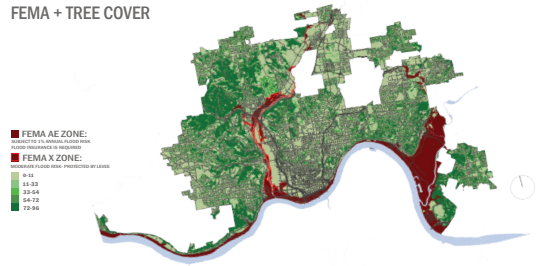
Cincinnati is located near the state line of Ohio and Kentucky and is bordered to the south by the Ohio River. The Mill Creek Watershed runs through the center of the city and has a large barrier dam at the outlet to the river. The city has a lack of tree cover, large amounts of impervious surfaces and a large number of vacant lots in a plethora of areas. This location provides an opportunity to create a more sustainable environment and introduce methods to reinvigorate the communities within. Planting trees and other plants in areas with little shade reduces heat island effect and erosion of soils in certain locations. More trees also mean less CO2 pollution and have been studied to improve healthy living, both physically and mentally, to those within viewing vicinity of green spaces. The current vacant lots supply potential spaces for introducing green infrastructure improving Cincinnati's economic and environmental conditions creating better connections between areas and surrounding districts and producing a more sustainable urban fabric for the city of Cincinnati. With the vast number of vacant lots, the city could take on a regenerative project with these spaces. Opportunities could include making the lots public green spaces, local vegetable gardens, small forest plantings, and other green initiatives to help cool the city and offer clean spaces for residents.

LAND 7043: SUSTAINABLE SITES II
RECLAIMING THE URBAN LOT:
RESPONSIVE LANDSCAPES TO ENHANCE LOCAL RESILENCY

TEAM
EMILEE POEHNER
MADDI NUSS
NATHAN DELONG
GAURI PATIL
SANG CHO FACULTY ADVISOR

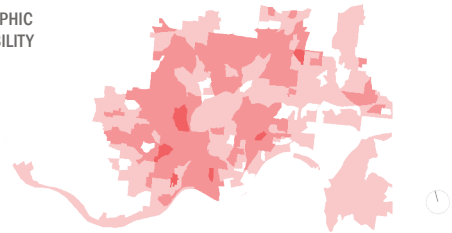
School of Planning | College of Design, Architecture, Art, and Planning | University of Cincinnati

FEMA + TREE COVER

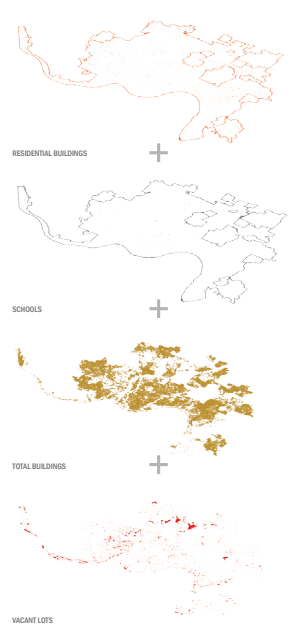


HEAT ISLAND

DEMOGRAPHIC VULNERABILITY



Multi-criterial decision based analysis



METHODOLOGY

WEIGHTED OVERLAY ANAYLSIS OF 40% MINORITY POPULATION,
30% PERCENTAGE OF RESIDENTS IN LOW INCOME,
30% PERCENTAGE OF PEOPLE WITH LESS THAN A HIGH SCHOOL EDUCATION.

115,112 TOTAL BUILDINGS

RESIDENTIAL BUILDINGS 47,916

SCHOOL BUILDINGS 129

VACANT LOTS 21,587

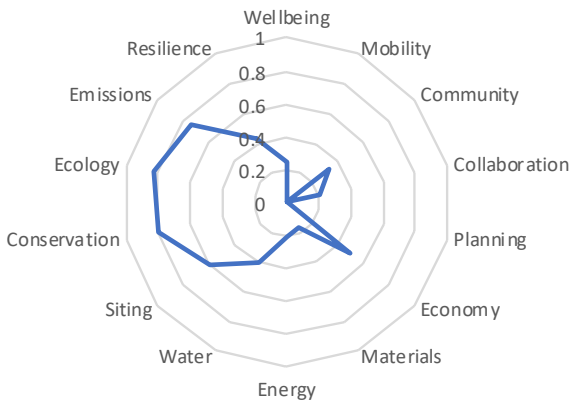
Institute for Sustainable Infrastructure

ZOFNASS PROGRAM FOR SUSTAINABLE INFRASTRUCTURE

Equitable and Sustainable Infrastructure
Delivering Merit and Climate Resilience
ISI and ZPH Conference, Nov. 17-18, 2021

Envision-based questionnaire responses

VACANCY & OPPORTUNITIES



Overall performance by Envision subcategory

Quality of Life

Our project is helping enhance quality of life by addressing pollution related health problems, air quality issues and heat island related issues by creating new opportunities in vacant lots around the area.

Wellbeign
- The project improves the net quality of life of all communities affected by the project and mitigate negative impacts to communities.
- The project protects and enhances community health and safety during operation.

Leadership

Our project could help create an innovative green identity to the city of Cincinnati, while providing new attractive entertainment spaces that can bring jobs and enhanced work productivity to the city.

Resource Allocation

By providing tree coverage and implementing sustainable designs we can help mitigate excess stormwater in the city.

Mobility
- None / not applicable

Community
- The project preserves or enhances the physical, natural, and/or community character of the project site and its surroundings.
- The project helps enhance public space by improving amenities and publicly accessible spaces to enhance community livability.

Collaboration
- The project provides effective leadership and commitment to achieve project sustainability goals.

Planning
- None / not applicable

Economy
- The project stimulates and supports economic prosperity and sustainable development by including job growth, capacity building, productivity, business attractiveness, and livability
- The project develops local skills and capabilities by expand the knowledge, skills, and capacity of the community workforce to improve their ability to grow and develop.

Materials
- The project supports and develops sustainable procurement policies and programs to source materials and equipment from manufacturers and suppliers that implement sustainable practices.

Energy
- The project reduces operational energy consumption by conserving energy by reducing overall operational energy consumption throughout the project life.

Water
- The project preserves water resources by assessing and reducing the negative net impact on fresh water availability, quantity, and quality at a watershed scale to positively impact the region's water resources.
- The project reduces overall operational water consumption by encouraging the use of greywater, recycled water, and stormwater to meet water needs.

Natural World

By reclaiming brownfields and vacant lots around the city and waterbodies of Cincinnati, we can provide and enhance the natural ecosystem of native plants and species.

Siting
- The project preserves sites of high ecological value by avoiding placing the project and temporary works on a site that has been identified as being of high ecological value.
- The project protects, buffers, enhances, and restores wetlands, shorelines, and waterbodies by providing natural buffer zones, vegetation, and soil-protection zones.
- The project preserves and conserves undeveloped land by locating projects on previously developed land.

Conservation
- The project reclaims and remediates brownfields by locate projects on sites classified as brownfields.
- The project manage stormwater by minimizing the impact of development on stormwater runoff quantity, rate, and quality.
- The project reduces non-point-source pollution by reducing the quantity, toxicity, bioavailability, and persistence of pesticides and fertilizers.,
- The project preserves water resources by preventing pollutants from contaminating surface water and groundwater and monitoring impacts during construction and operations.

Ecology
- The project preserves and improves the functionality of terrestrial (land) habitats.
- The project maintains and restores the ecosystem functions of streams, wetlands, waterbodies, and their riparian areas.
- The project maintains and preserves floodplain functions by limiting development and impacts of development in the floodplain.
- The project uses appropriate noninvasive species, and controls or eliminates existing invasive species.
- The project protects soil health by preserving the composition, structure and function of site soils.

Climate & Resilience

Converting the vacant lots to green spaces we will help reduce carbon emissions and greenhouse gas emissions, while providing cleaning air within the city. By developing these lands within the floodplain we can help minimize the spread of the flood zone and help address the concerns of families in low income areas who are faced with high flood insurances.

Emissions
- The project reduces net embodied carbon by reducing the impacts of material extraction, refinement/manufacture, and transport over the project life.
- The project reduces greenhouse gas emissions during the operation of the project, reducing project contribution to climate change.
- The project reduces emissions of air pollutants: particulate matter (including dust), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, lead, and volatile organic compounds.

Resilience
- The project assesses climate change vulnerability by developing a comprehensive climate change vulnerability assessment.,
- The project supports increased project and community resilience through the establishment of clear objectives and goals.
- The project maximizes resilience by increasing resilience, life-cycle system performance, and the ability to withstand hazards by maximizing durability.

ACCEPTED BOARDS

Submission Type: STUDENT

Individual project

ZONE ZERO DELRAY

Infrastructure type: Energy (i.e. generation, storage)
Stage: Planning and design stages
Location: Delray, Detroit, MI

This proposal projects a utopian future set within the paradigms of carbon neutrality, energy recovery and zero waste. Drawing influence from the industrial ecology of Kalundberg in Denmark, I proposed a series of synergistic programs within Delray that imagine an active future for existing industries in decline. This constellation of industrial activities are imagined to be operating within a model of industrial succession: where existing programs and their related material flows are interconnected by the circulation of raw materials, by-products of their waste streams and recoverable energy, diagram, process In this context, the cultivation of new remedial and recycling programs intentionally produces a new urban assembly that gives temporary expression to indeterminacies, fluxes, possible futures. In particular, future urbanism is seeded by a set of industrial byproducts - a new set of urban artifacts around which future urbanism might be staged.

Yunsong Liu (Mdes Narratives, Harvard Graduate School of Design)

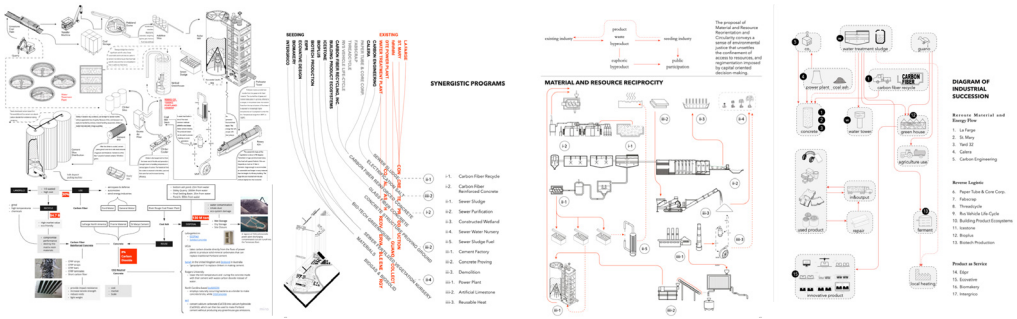
Project: Zone Zero Delray

Name: Yunsong Liu

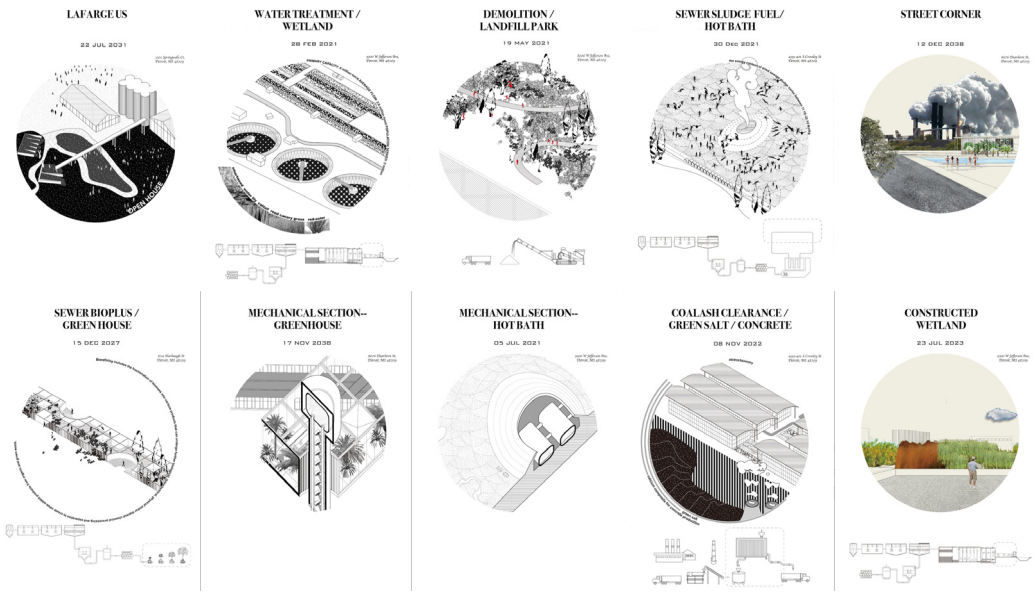
Affiliation: GSD, Mdes Narratives

This proposal projects a utopian future set within the paradigms of carbon neutrality, energy recovery and zero waste. Drawing influence from the industrial ecology of Kalundberg in Denmark, I proposed a series of synergistic programs within Delray that imagine an active future for existing industries in decline. This constellation of industrial activities are imagined to be operating within a model of industrial succession: where existing programs and their related material flows are interconnected by the circulation of raw materials, by- products of their waste streams and recoverable energy, diagram, process In this context, the cultivation of new remedial and recycling programs intentionally produces a new urban assembly that gives temporary expression to indeterminacies, fluxes, possible futures. In particular, future urbanism is seeded by a set of industrial byproducts - a new set of urban artifacts around which future urbanism might be staged.

Decarbonization Processes

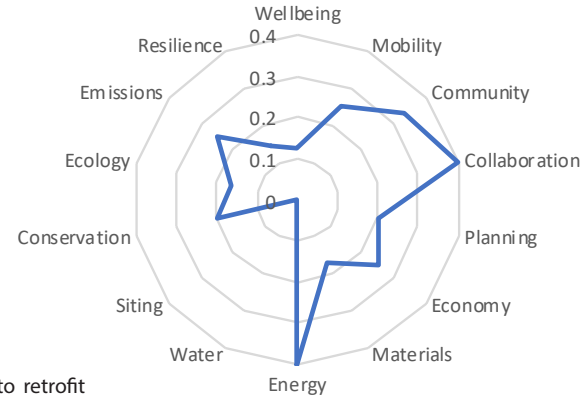


Euphoric Moments



Envision-based questionnaire responses

ZONE ZERO DELRAY



Overall performance by Envision subcategory

Quality of Life

The method is to retrofit the current resource-energy structure for civic engagement and civil rights as to deposit for environmental and social sustainability and to gain recognition in political economic dimensions. Through the integration of public outreach programs in the testing field of Delray, this multi-agency field of actors propels citywide participants and a global audience for models of sustainable industrial futures.

Leadership

My early research began with a focus on existing cement production processes and their intersections with three major socio-ecological issues:

1. Closed loop integration of waste carbon fiber, (that is commonly used by car manufacturers General Motors and Ford, with a low utilization rate of less than 70%, carbon fiber recycling possess a high market value1 and current research suggests this material could greatly enhance concrete's performance.

2. Coal ash disposal and reuse, which is generated in the power plant near Delray, it will be shut down by 2022, coal ash is one of the additives in cement production. And promising for harvesting carbon dioxide.

Wellbeign
- The project improves the net quality of life of all communities affected by the project and mitigate negative impacts to communities.

Mobility
- The project improves access and wayfinding by designing it to provide safe and appropriate access in and/or around the project in a way that integrates the project with the surrounding community.

Community
- The project helps advance equity and social justice by ensuring that equity and social justice are fundamental considerations within project processes and decision making.
- The project helps enhance public space by improving amenities and publicly accessible spaces to enhance community livability.

Collaboration
- The project provides effective leadership and commitment to achieve project sustainability goals.
- The project provides for early and sustained stakeholder engagement and involvement in project decision making.

Planning
- The project plans for long-term monitoring and maintenance by putting in place plans, processes, and personnel sufficient to ensure that long-term sustainable protection, mitigation, and enhancement measures are incorporated into the project.

Economy
- The project stimulates and supports economic prosperity and sustainable development by including job growth, capacity building, productivity, business attractiveness, and livability

3. Emerging industry-wide aspirations for a carbon neutral concrete, that have been explored through carbon sequestration models, yet currently remain proven at a laboratory scale restricted by feasibility and CO2 supply chains.

The proposal shifted to synthesize a series of existing industries of competing and complementary vested interests, in order to introduce a new urban metabolism with regard

Resource Allocation

In phase two, I propose to introduce a circular economy of material and biotech innovation and product life span extension driven by reverse logistics catalyzed by the construction of the Gordie Howe bridge and in dialogue with Detroit's industrial inheritances and the current aspirations within Southeast Michigan as a regional center for advanced manufacturing.

With the incremental transformation of industry and enhancement of the desirability of the living environment conditioned by bio-tech greenhouse innovation and energy circularity, The project anticipates several [possible futures for Delray - each potential would respond locally to the strategy of byproduct "seeding" in different ways:

1. possible intensification of Industrial Ecology,
2. attraction and competition for new clean-tech manufacturers and research activities forming an intensified regional boarder cluster
3. modified environmental conditions staging the production of new residential fields

Materials
- The project uses recycled materials by reducing the use of virgin natural resources and avoid sending useful materials to landfills by specifying reused materials, including structures, and material with recycled content.

Energy
- The project reduces construction energy consumption by conserving resources and reducing greenhouse gases and air pollutant emissions by reducing energy consumption during construction.
- The project commissions and monitors energy systems by ensuring efficient functioning and extend useful life by specifying commissioning and monitoring of energy systems.

Water
- None / not applicable

Natural World

The project proposes alternative use of coal ash which is detrimental to the water body. Coal ash disposal and reuse, which is generated in the power plant near Delray, it will be shut down by 2022, coal ash is one of the additives in cement production. And promising for harvesting carbon dioxide.

Siting
- None / not applicable

Conservation
- The project reduces non-point-source pollution by reducing the quantity, toxicity, bioavailability, and persistence of pesticides and fertilizers.

Ecology
- The project preserves and improves the functionality of terrestrial (land) habitats.

Climate & Resilience

The project reroute the material and energy flow for multiple reuses, especially green house air.
- Constructed wetland for the purification of sewer water, at the same time, functions as habitat for frogs and wetland lovers.

Emissions
- The project reduces greenhouse gas emissions during the operation of the project, reducing project contribution to climate change.

Resilience
- The project maximizes resilience by increasing resilience, life-cycle system performance, and the ability to withstand hazards by maximizing durability.

-Demolition of the vacant lot as a landfill park and concrete recycle site
-The remaining energy from sewer sludge recycled to heat the water for a hot bath
-La Farge company exploring in the concrete industry
-The reuse of coal ash from power plant, an artificial limestone factory will be constructed
- As part of the water treatment plant, bioplus utilizes the sewer water as fertilizer
-The water treatment plant, the water tower and the greenhouse forming a system of reuse and repurpose
-The sublime beauty of heavy industrial image and caesuras of repose
-Landfill park constructed out of demolition concrete, generating a green space regardless of income
-Hot bath in the open air winter, resembling Blue Lagoon
-Constructed wetland linked to external pathway
-Pigeons feeding on grass seeds on asphalt ground, the asphalt aggregate site will be a place to collect guano

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