Threading Water: Relief Housing and Estuary Regeneration

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Rapid Site Preparation: Infrastructural Threads And Barge Patches

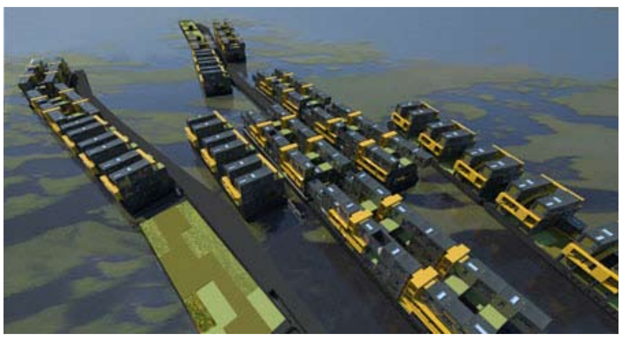

Figure 1 Barge neighborhood and landscape barge.

Threading Water recognizes the current need for sustainable and rapidly-deployable post-disaster housing. Natural disasters and community rehabilitation have become crucial environmental and social topics worldwide, and changing global weather conditions have imposed a demanding task on the design fields. [1] Hurricane Katrina and the Indian Ocean tsunamis, for instance, have clearly articulated the need for quick response in providing well-designed, temporary housing that will allow displaced residents to return to their communities.

As proposed by the brief of the "What If New York City" Post-Disaster Housing Design Competition"[2], even a category 3 hurricane would likely cause catastrophic damage to manmade structures close to the waterline. We believe such an event can also provide the impetus to remediate the struggling estuarine ecosystems of urban shorelines. This proposal provides a solution for people displaced by hurricanes as well as regeneration of a shoreline ecology nearly eliminated by two centuries of industrialization. Around New York City, the Hudson and East Rivers have lost much of what was once a thriving wetland habitat for shellfish, sea grasses, and aquatic and aerial wildlife. Threading Water is NOT a temporary solution, but rather a continual process of renewal and replacement that aims to reinvigorate the shoreline ecology, culture, and economy by breaking down the boundary between land and water.

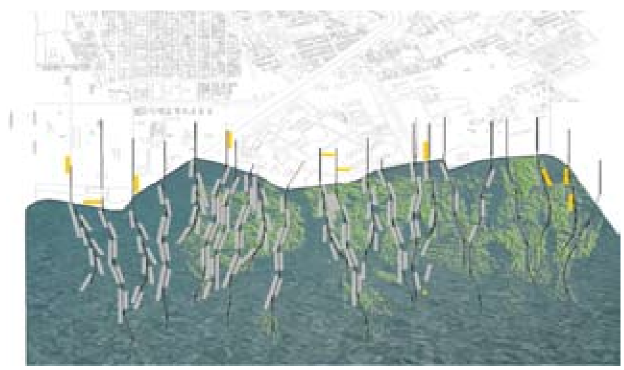

Figure 2 Site Plan.

The design proposes a rapidly deployed, mass-produced and pre-fabricated system of environmentally responsible housing. Prefabricated panelized housing components are and delivered to an undamaged port facility along the Eastern Seaboard where they are assembled into living units. Gantry cranes group the units into high-density temporary housing on a shipping barge.

The barge neighborhoods are then delivered to the disaster site and docked (fully operational) within days rather than weeks. This allows residents to immediately return to their shore bound neighborhoods, if not their homes. By siting the temporary

Figure 3 Gantry cranes install units, barge neighborhood is towed to site

housing ofshore unobstructed debris removal and permanent housing reconstruction on land is facilitated allowing for a rapid return to permanent housing. The system also allows the mobilization of a large population of relief workers without actually transporting them to the site reducing the strain on the limited resources of a disaster area. [3]

The clearing operation is focused on sorting debris for appropriate reuse, reducing disposal to a minimum. The organic material is appropriated to regenerate green spaces, while the concrete and stone is placed in the water along the pier threads to provide a foundation for the estuarine habitat.[4]

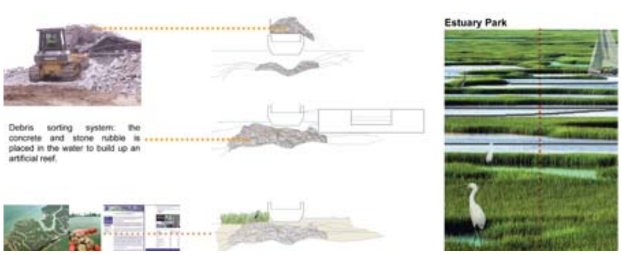

Figure 4 Estuary regeneration system

Toxin free construction rubble is a good alternative substrates for oyster restoration and fishery repletion efforts. This will lead to reintroducing salt marsh plants that are an exceptional regenerative ecosystem.

Components And Unit Assembly

To construct the housing units a cubic module is assembled by joining lightweight composite panels together to form a variety of programmatic modules. These are combined to create tubular units. Two types of panels are used to construct walls, floors, and roofs of the housing units. Panel type "A" is a faceted form with internal cells that are filled with super-insulating foam. Panel type "B" is a frame infill that caps the ends of the square tube structure. The panels are produced using three-dimensional weaving technologies that integrate foam insulation in a polymer textile fabric. When resin matrix is added, the composite material is molded into rigid, self-structuring, lightweight, and super-insulated wall/floor/roof panels. Implementing lightweight composites results in significantly less energy (fuels and human exertion) consumed during construction and delivery.

Within these tubular units, self-contained kitchen and bathroom units (Blue Boxes) are inserted. The Blue Boxes act as vertical members that connect the individual units to one another and the barge. They contain all the services that plug into the barge's centrally maintained service infrastructure. End panels are inserted into the tubes integrating them into the access components (ramps and stairs). Exterior floor platform components are installed on a barge grid, and once on site, concave components are filled with soil for garden plots.

Figure 5 Unit components

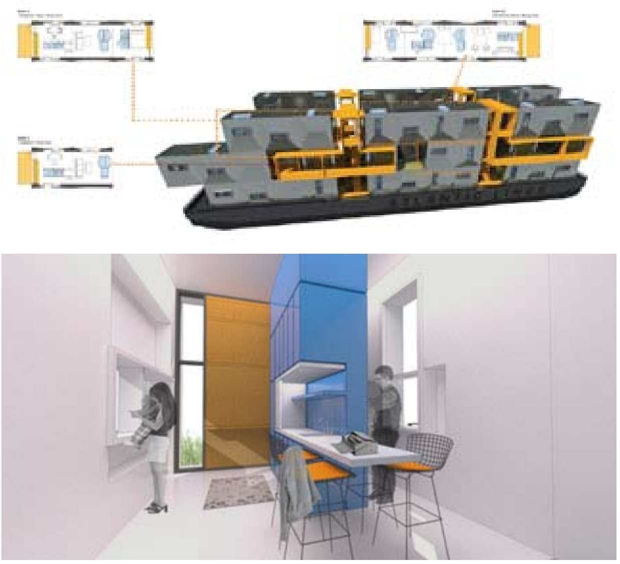

Figure 6 Barge assembly, unit plans, interior view

The barges are moored to thread-like piers that provide a pedestrian pathway between the barges. Once permanent housing is rebuilt on land the threads can remain as a system of recreational paths through a reemerging salt marsh.

Hydrological And Electrical Systems

While facilitating clearing and reconstruction efforts by keeping the housing off the land, the system aims to reduce the infrastructural needs of temporary housing deployment by keeping it off the electrical grid as well. At the unit scale, the Blue Boxes perform water and waste management duties that allow the units to have a zero ecological footprint. They generate energy for heating water through photovoltaic panels and collect rainwater from the faceted roof. They are equipped with a water filtration system that operates at low gravity pressure and is capable of providing about 40 liters of rainwater per hour. [5]

At the scale of the building, each barge houses the service infrastructure and power generating components. They are equipped with PV modules, wind turbines, and a connection to the hydro turbines installed at the end of each pier. This hybrid power system will permit the units to have continuous electric power. They also house cisterns and short term sewage containment.

At the scale of the pier, the barges are networked

Figure 7 Barge courtyard

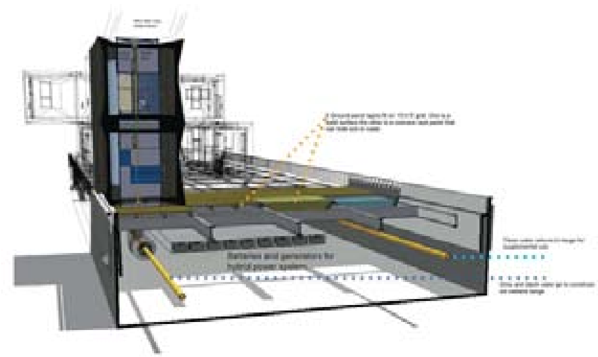

Figure 8 Barge containing infrastructure and blue box section

to provide consistent waste, water, and power management. Because of its water-bound context the system not only requires an autonomous power source (provided by the barges), but also needs onsite wastewater management. A strand of barges will utilize the connecting pier to move waste into the "landscape barge". This is a water filtration plant that utilizes a sub-surface flow constructed wetland to purify the wastewater.[6] The need to equip these units with self-sustaining technology can suggest similar developments in permanent land bound architectures.

Regenerative Solutions

The generative force behind this project is the examination of how component-based housing systems can be aggregated to create regenerative landscape and ecological systems. Threading Water hopes to address ecological issues of temporary disaster-relief housing, and focus on component-based, prototypical housing that generates carbon-

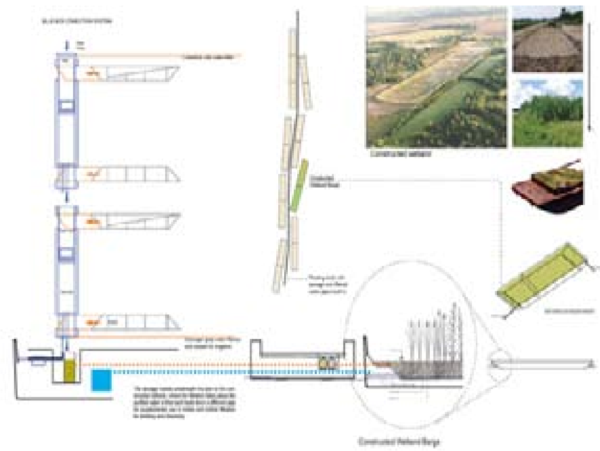

Figure 9 Landscape Barge system

neutral, zero ecological footprint urban environments. Such environments are characterized by their ability to provide "off the grid" power supply and on-site black- and gray-water treatment and reuse. They provide a means of synthesizing architecture with the environment in a symbiotic relationship that lowers (or eliminates) a dependence on energy sources such as coal and nuclear plants while containing the use of water in an onsite cycle. There is a need to develop built environments (architecture, landscapes, communities) that reinvigorate rather than deplete natural resources and wildlife habitats. Eventually, this integration might lead to new paradigms in managing water and energy in the urban environment through conscientious planning and design.

Endnotes

1. *Disaster assistance: better planning needed for housing victims of catastrophic disasters : report to congressional addressees* [Washington, D.C.] : U.S. Govt. Accountability Office: Washington, D.C. 2007. P.1
2. In 2007-8 The New York Office of Emergency Management sponsored "What if New York City...", a post-disaster housing competition.

3. Fagnoni, Cindy. 2008. *National disaster response: FEMA should take action to improve capacity and coordination between government and voluntary sectors*. UnitedStates Government Accountability Office., http://www.gao.gov/new.items/d08369.pdf.

4. *Alternative Substrates,* NOAA Chesapeake Bay Office,http://chesapeakebay.noaa.gov/alternativesubstrates.aspx
5.
6. Placed in ports around the U.S., the landscape barges can be active while they wait for deployment: they can serve as filters for waste from ships' septic tanks. On the barges, the average water consumptions projected to be between 30 and 40 gallons per person per day. The typical barge of about 150 residents should produce between 4500 and 6000 gallons of waste water per day. Fifteen barges with an average of one hundred and fifty people per barge will, at 30 – 40 gal/person/day, produce between 67,500 and 90,000 gallons of waste water per day. Assuming part of this is used for drinking or lost before running into the sew-age lines, the average is probably closer to 67,500. At 8.33 lbs/gallon, this water use per day weighs about 562,300 lbs. The barges, if 12 feet deep, can hold 3,033 tons (728,000 lbs.) That means that the HRT (hydraulic residence time) in the constructed wetland can be no more than 1.3 days if only one barge is used. Between 2 and 4 days is recommended, so 2 "constructed wetland" barges per strand of 15 barges is optimal.