

U R B A N  
A C U P U N C T U R E &  
D W E L L I N G F O R M A B I L I T Y

Regeneration of Coastal Informal Settlements in Manila

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Architecture

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GISELLE J. ALTEA

University of Washington

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Chair of the Supervisory Committee:  
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Architecture

*“The best architecture and urbanism mediates between large and small, between rich and poor, between formal and informal.”- Teddy Cruz*

Slum communities are considered an eyesore in the urban landscape, yet 44% of Metro Manila’s population is living in them. These settlements grafted on the fringes of the city core are fragmented, plugged away from the services of the city center. Slums are made up of the urban poor and have substandard housing in squalor conditions. Affordable housing within the city is lacking and so the expansion of these blighted areas are increasing.

The increasing density in this third world city have forced a number of migrants from the countryside to the periphery of the city where residents have relocated along the riverbanks. Baseco Bay, a slum community made up of 56 hectares of partially reclaimed land is a community threatened by rising sea levels. This thesis will consider how floating architecture can exist, how it addresses the sprawling urban density and responds to natural disasters and long-term sustainable recovery.





Source: Altea, G.



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## I N T R O D U C T I O N

*“When the modern city does not adapt to the people...the people will adapt to the city.”- Iwan Baan*

### *Problem Statement*

This thesis focuses on regenerating a slum area called Baseco Bay in Manila, Philippines. Rather than demolishing to begin anew, shedding a new and positive light on socially unjust living conditions is key. But also proposing a new housing typology in an area that can become a test ground for a floating community to exist—one that doesn't only address the sprawling urban density but also responds to the natural disasters and long-term sustainable recovery.

The project will investigate urban issues related to existing informal settlements common in third world cities. The root of slum formation will be identified along with existing models of slum upgrading that have been implemented to develop an urban landscape and a housing typology that will address the growing population and the individual needs of its users.

This thesis will look at urban issues of the formal city landscape in relation to Baseco Bay in order to balance the quality of living and optimize density. While slums are dirty and chaotic, they are also one of the most efficient urban forms of settlements because their informality allows for ad hoc development. Could emergent settlement tendencies as seen in slums of the third world become more than a problem, can it be a new way of living and an example to learn from? In a community that is always in flux—the dry land that is threatened by rising sea levels and the persistence of rising water lines, can a coastal informal settlement become a test ground for a floating development to exist that not only addresses the sprawling urban density but also responds to natural disasters and long-term sustainable recovery? Can shedding a new and positive light on socially unjust living conditions bring the removal of the stigma through regeneration of the existing conditions rather than demolishing to begin anew? By applying sustainable strategies like urban storm water techniques and waste disposal manage-

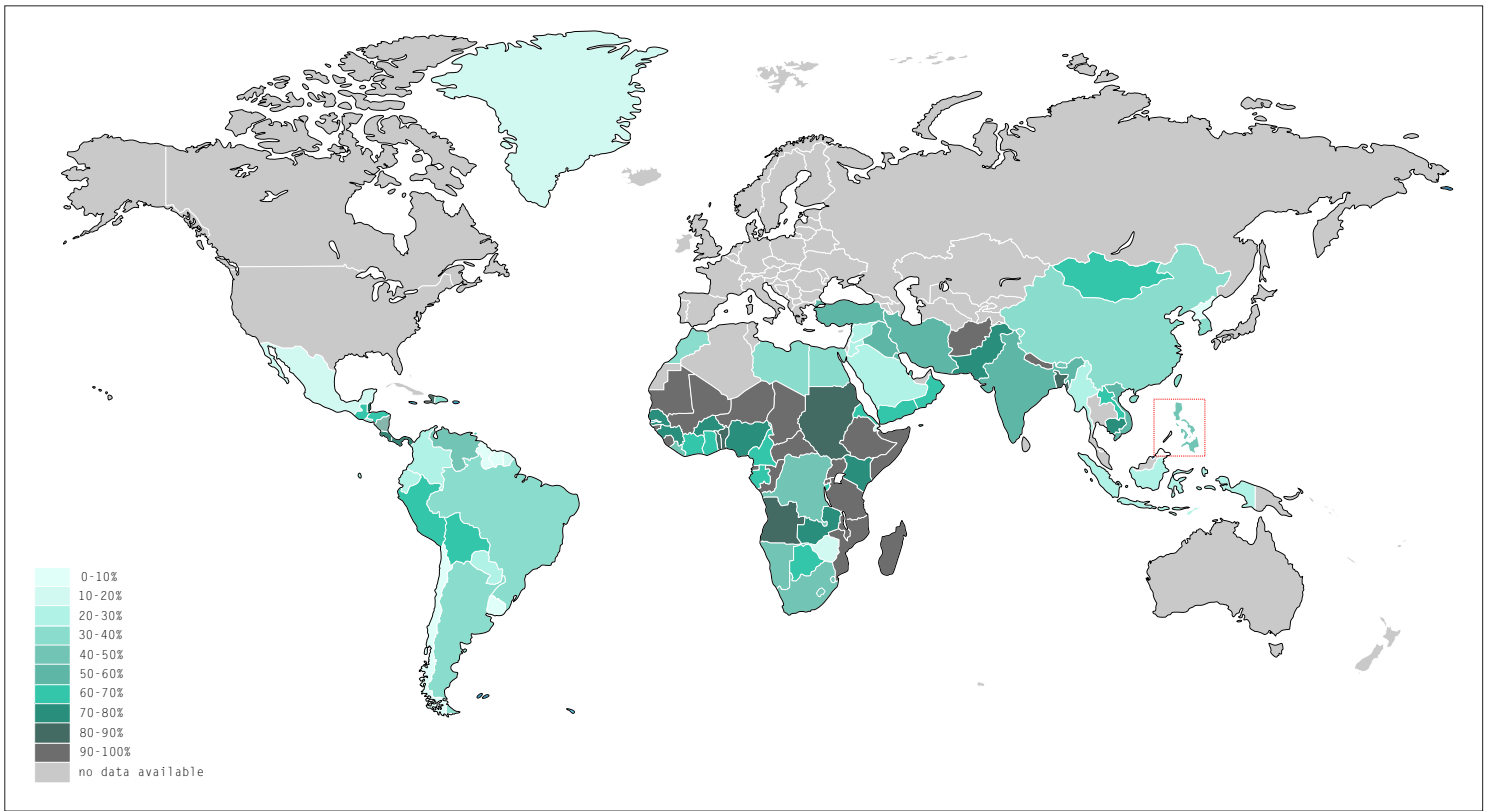


Fig.1.1 Urban Population Living in Slums

Source: UN-Habitat, "State of the World's Cities, 2006-07," <http://www.unhabitat.org>

ment, can these informal settlements begin to establish a sense of permanency that will give the residents the desire to maintain the area they call home? By using the waterfront as a catalyst to create a sense of place that will rationalize the sprawling slums and establish an identity to their region by the preservation of the rich cultural tradition of this place, can the waterfront become a paradigm for more sustainable and affordable developments for the future that is closely tied to the rich resources of the city?

### *Project Rationale*

The world is urbanizing at a rapid pace and 80% of urban dwellers will reside in cities of the developing world in 2030, particularly in Asia and Africa<sup>3</sup> (Fig.1.1). Urban migration in Manila is forcing the city to transform at a rate that is precarious to existing housing and infrastructure. Over the last 50 years third world cities began this transformation generated by overpopulation as a major impetus for informal settlements. Third world cities are experiencing a gradual increase in density in centralized areas where both public amenities and social collaboration are superfluous. As these dense areas reach their maximum limit, migrants are forced from the city core to the city periphery and into slum settlements.

Slum communities like Baseco Bay begin to form, sequestered from the city elements and are considered an eyesore in the urban landscape exhibiting unsanitary conditions in a congested environment. Due to their physical distance and disconnection from the city, these informal settlements exist in isolation with the rest of the city. The poor have constructed their dwellings around urban centers of the rich and powerful and as maximum capacity has reached in central areas, migrants have been forced to the periphery of the city. Slum settlement patterns in Metro Manila are generally scattered over 526 communities<sup>4</sup>, located wherever there is available space. A country with almost 77 million people, 12 million reside in Metro Manila<sup>5</sup> (Fig.1.2). There are over 4 million slum dwellers in the metropolis and 15% of those live in danger zones such as waterways, riverbanks and railroad tracks<sup>6</sup>. About 90% of the world's largest cities are situated on the waterfront and while the Philippines has the third longest coastline in the world<sup>7</sup> it has been used as an outhouse for garbage rather than a 'front door' for development<sup>8</sup>.

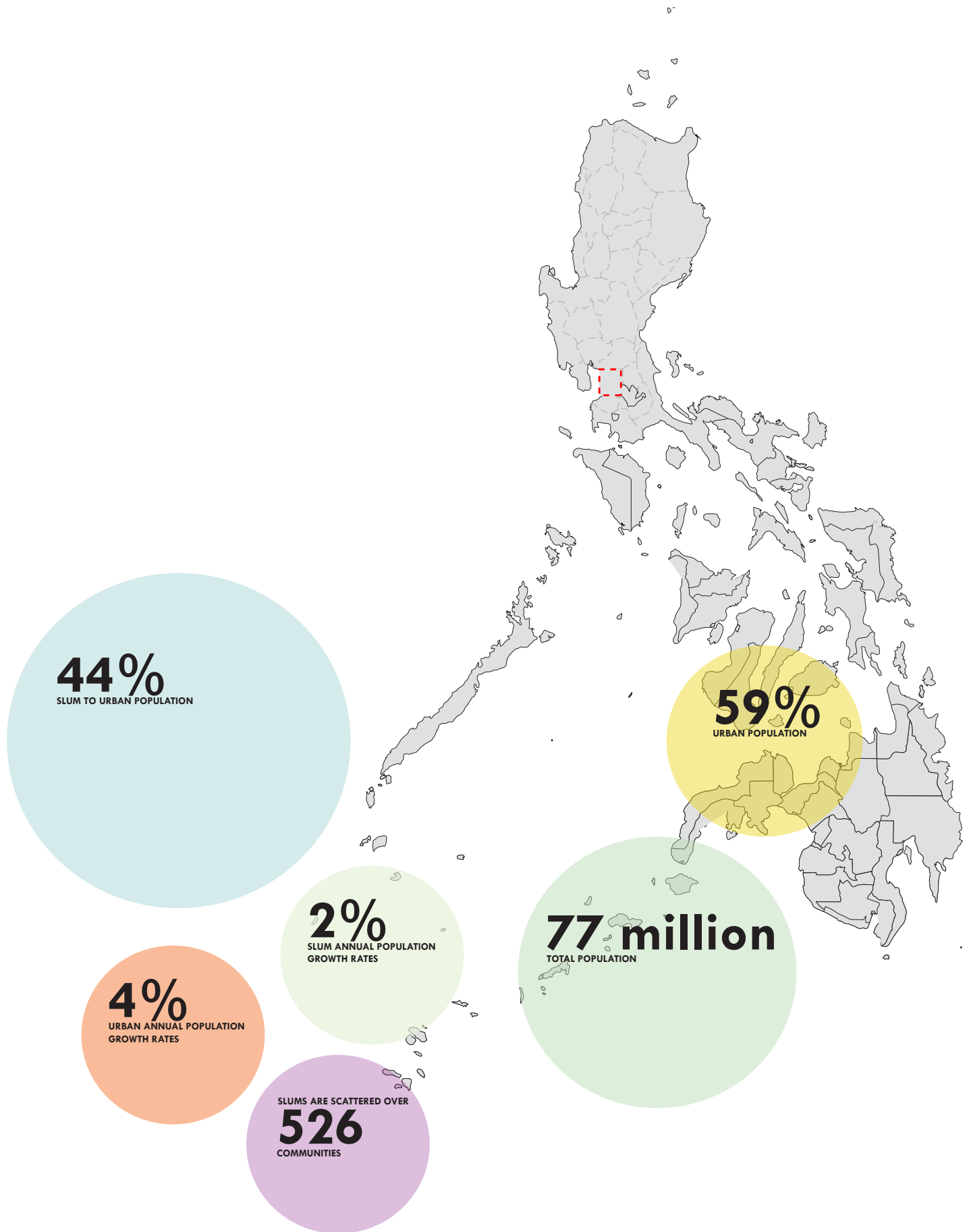


Fig.1.2 Slum Statistics

Source: UN-Habitat, "State of the World's Cities, 2006-07," <http://www.unhabitat.org>

Manila's slum communities that are living in conjunction with water have an opportunity to reclaim its coastline by rethinking how to create affordable housing built by its residents.

Historically, going as far back as the 1930's, the Pasig River was an integral part of economic activity of the city. It was evident that while economic activity was at its peak, a pre-existing floating community of houseboats called 'lanchas' was used as a means of transportation and shelter on the river (Fig.1.3). The economic activity of the Pasig River slowly declined through the years as a major means of transportation, water source for domestic and industrial uses and place for recreation and shelter to aquatic life. The degeneration of the river is owed much to the weak water and waste disposal management<sup>4</sup>.



Fig.1.3 Lanchas on Pasig River

Source: Reese, Albert, "Wanderings in the Orient." <http://www.gutenberg.org/files/26707/26707-h/26707-h.html>

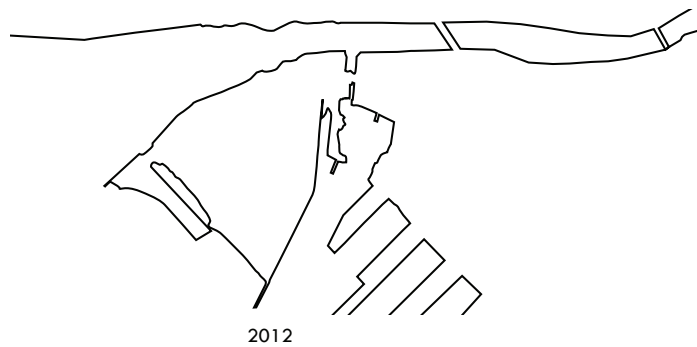
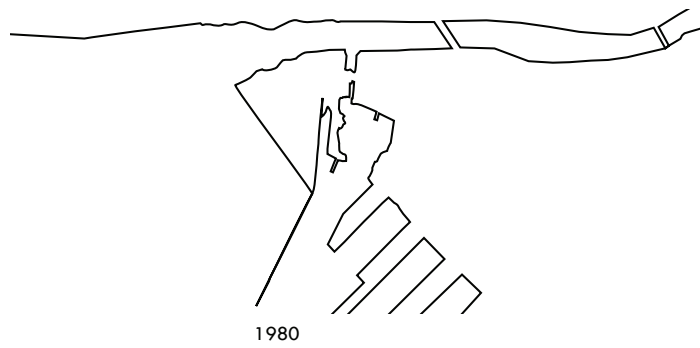
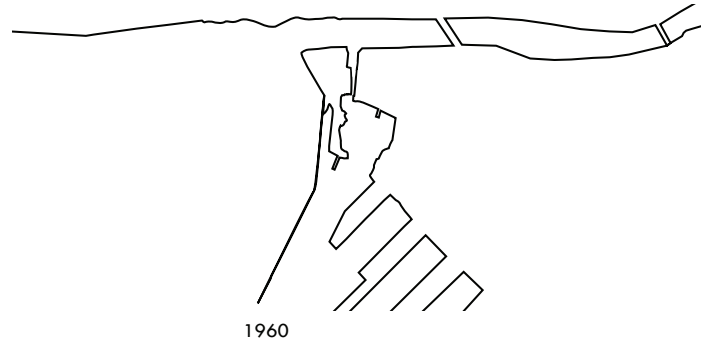
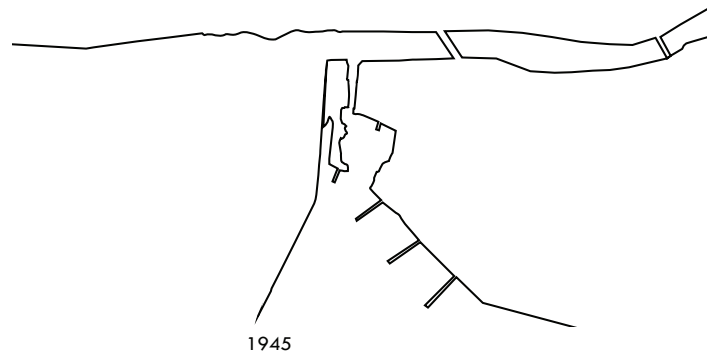


Fig.1.4 Historical Growth in Basuco

Source: Horen, Basil van. *Informal Settlements, Upgrading And Institutional Capacity Building in Third World Cities*. Asian Urban Research Network. Vancouver: The University of British Columbia, 1995.

From its inception, Baseco Bay was created through an infill from a mixture of land, waste, demolished concrete and debris from the nearby Public Works and highways. This informal settlement has expanded through land reclamation, which over the years since 1945 has grown into a 56 hectare compound for 7,000 residents (Fig.1.4). Due to the unstable landform created by landfills, methane gas and fires are susceptible to this area.

The coastal settlement of Baseco Bay is an urban landscape that continues to be consistently inconsistent. A product of the location of the site, it is also threatened by rising sea levels and flooding (Fig.1.5). The decline of the Pasig River can be owed much to the frequent flooding in Manila. The island also sits on a typhoon belt and is vulnerable to hurricanes, tsunamis, liquefaction and ground shaking. Approximately 20 typhoons hit the Philippines each year with an average of 3.7 typhoons touching down in Metro Manila<sup>22</sup> (Fig.1.6).

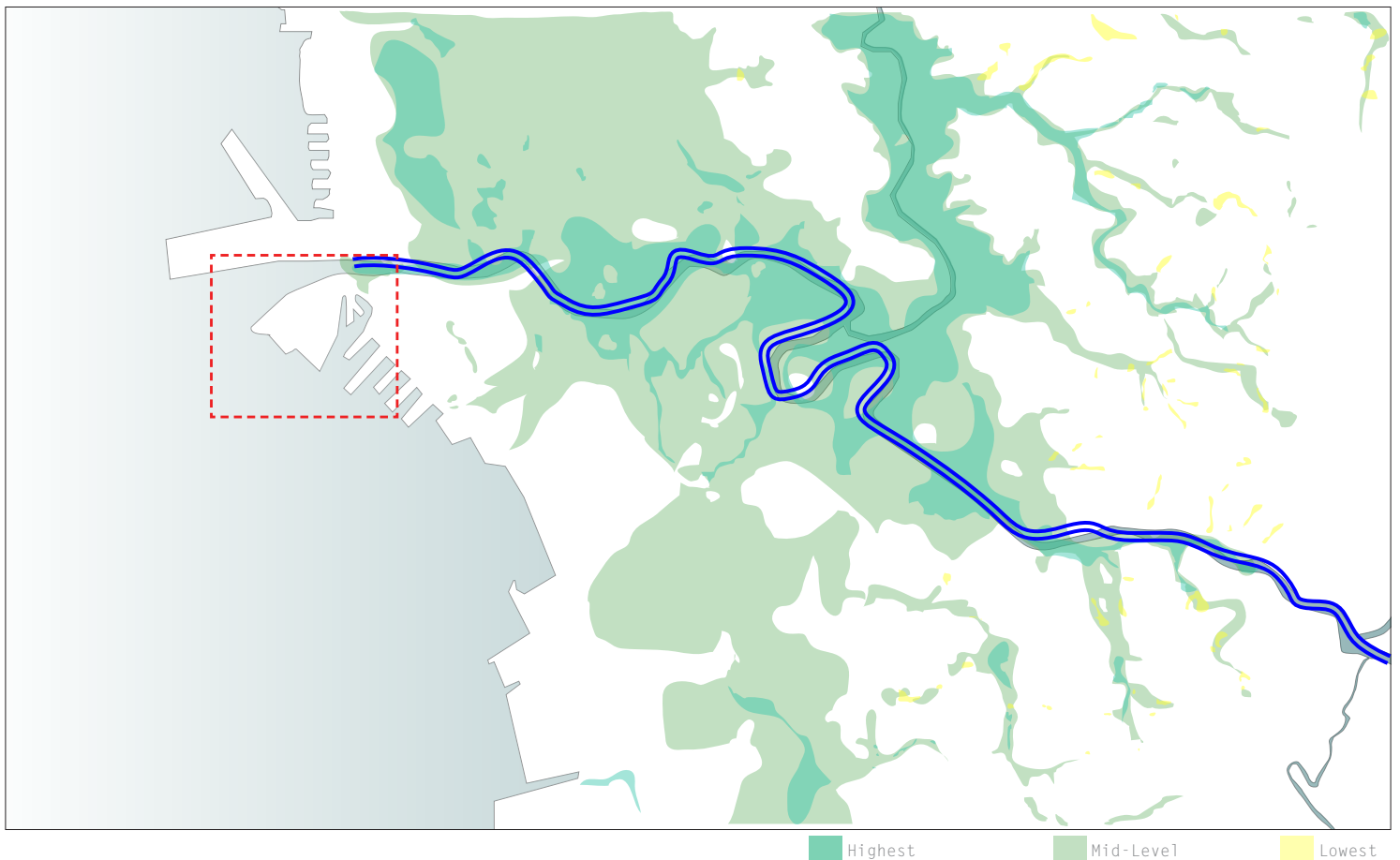


Fig.1.5 Flood Levels in Metro Manila

Source: Luege, Timo. "Street by Street Mapping of Flooding in the Philippines." <http://sm4good.com/2012/08/27/street-street-mapping-flood-risks-philippines/>

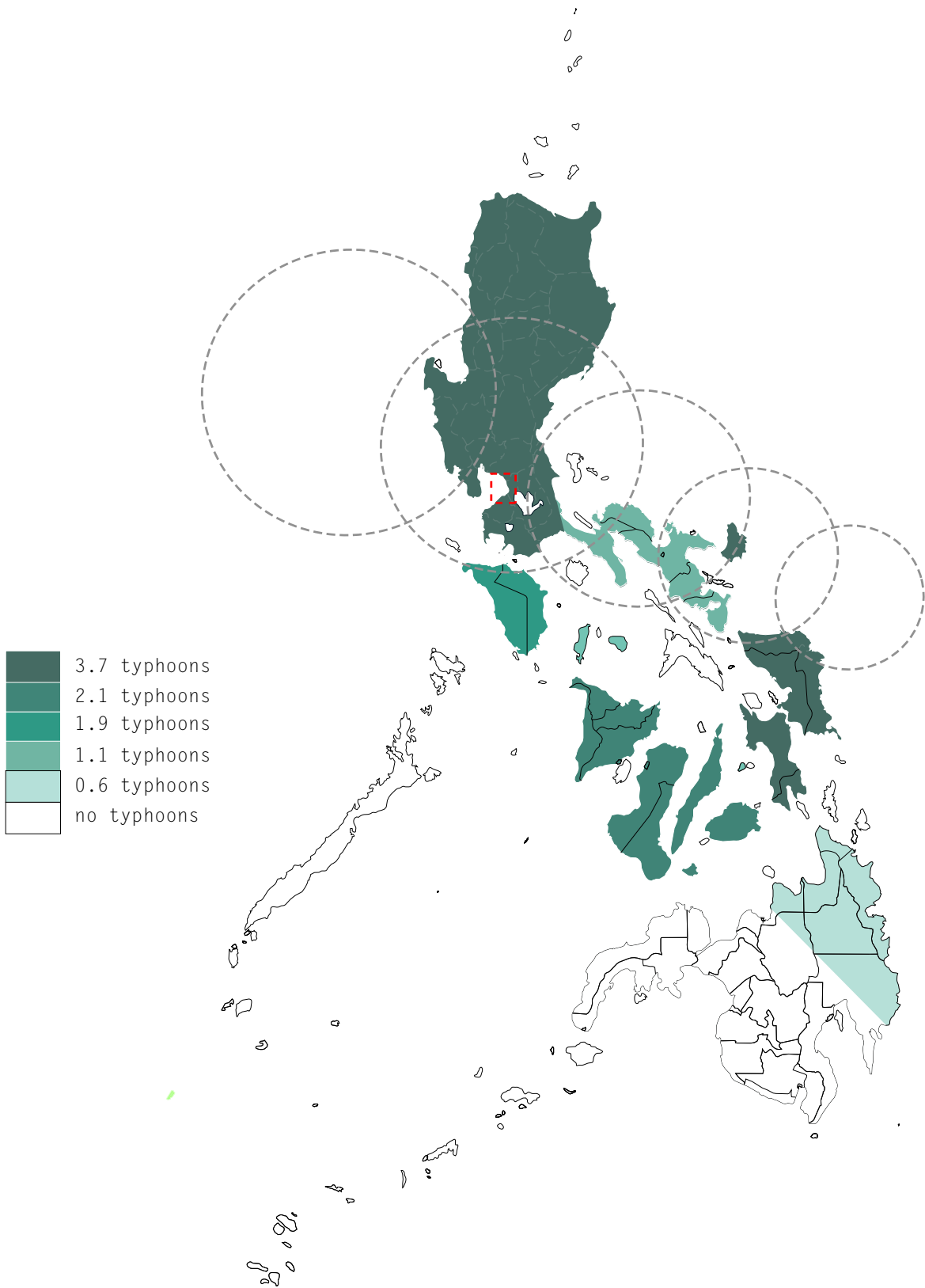


Fig.1.6 Typhoon Frequencies

Source: Asian Disaster Preparedness Center. "Citizenry-Based & Development-Oriented Disaster Response." 10 December 2013. <<http://www.adpc.net/pdr-sea/cbdo-dr/chapter1-2.html>>.

### *Thesis Overview*

Due to the future climate change concerns, the issue of rising waters is becoming increasingly relevant and thus proposes new design challenges. There is an opportunity for architecture to begin to address these environmental issues through a sensitive response to the challenging site and the needs of the slum community. A new housing typology that responds to rising sea levels but also responds to sustainable recovery is the goal of the thesis. By integrating informality with the rest of the city by proposing a basic infrastructure and amenities, its people can begin to establish an identity and a sense of permanency to their region.

### *Methods/Strategies*

This thesis approaches the regeneration of informal settlements through on-site upgrading and improvement with the objective of integrating Baseco Bay into the larger urban context. By implementing small “acupuncture” insertions to “expansive infrastructural improvements [through] government-led programs to designer-initiated projects”<sup>9</sup>. Small and localized interventions that provide basic infrastructure and amenities can retain the economic and social networks that residents have established for themselves. These interventions include an urban perspective—the preservation of existing major pathways to create a commercial corridor that caters to Baseco’s storefronts. Within these primary street corridors, public hygiene stations will become the hub of a communal gathering space. Additionally, by maintaining the “clustered” environment that exhibits slum communities, these spaces will become nodes of social activity and interaction among Baseco’s residents. Sustainable strategies such as urban storm water techniques, rainwater harvesting and community composting, will be integrated within the community. Moreover, creating an artificial mangrove along Baseco’s shoreline can become a source of protection from inclement weather that constantly plagues the Baseco community. On the other hand, this thesis focuses extensively on slum architecture—an improved dwelling unit that accommodates the needs of each individual and the growth of each family within the larger context of the Baseco compound. The shelter will provide a means to support the growing culture of storefronts in Baseco, a flexible structure that expands with each growing family and an amphibious structure that combats the rising waters.

## SCOPE | SURVEY OF FIELD

*“The city is not prepared for the people, and the people are not prepared for the city<sup>10</sup>.”- The Perez Family, Caracas, Venezuela*

### *Slum*

The term ‘slum’ at its simplest is “a heavily populated urban area characterized by substandard housing and squalor...A slum is often not recognized and addressed by the public authorities as an integral or equal part of the city”<sup>11</sup>. There are seven main characteristics of slums that are recognized nationally and locally by governments. These include: lack of basic services, substandard housing or illegal / inadequate structures, overcrowding and high density, unhealthy living conditions and hazardous locations, insecure tenure / irregular or informal settlements, poverty and social exclusion and minimum settlement size<sup>11</sup>. Dwellings in such settlements are impermanent structures with limited or no accessibility to basic services such as water, electricity, sanitation and proper infrastructure. The definition of the term ‘slum’ includes housing areas that were once desirable but its original residents have moved to better areas of the city. The term ‘slum’ can be categorized into two different parts—‘slums of hope’ and ‘slums of despair’. ‘Slums of hope’ are progressing illegal settlements that are usually self-built but new structures due to a slum upgrading<sup>11</sup>. ‘Slums of despair’ are diminishing neighborhoods in environmental conditions and domestic services are undergoing a process of degeneration<sup>11</sup>.

The notion of slums first appeared during the 1820’s as part of the miserable workers’ districts in London and was used to identify the poorest area of housing in the filthiest conditions<sup>11</sup>. At the end of the 19<sup>th</sup> century the term ‘slum’ was a “street, alley, court, situated in a crowded district of a town or city and inhabited by people of a low class or by the very poor”<sup>11</sup>. In the 1880’s the word described a concept of a dwelling unfit for human occupation and became the bounding of ‘slum areas’ in the city for planning purposes. During the 20<sup>th</sup> century, the word became antiquated and terms such as ‘tenement house’, ‘tenement district’ and ‘deteriorated neighborhood’ became a technical and legal definition

for the eradication of slums<sup>11</sup>. The new movement then generated words such as ‘neighborhoods’ or ‘communities’ in the attempt to rename these socially decrepit areas. In time, other substitutions for the word ‘slum’ emerged—‘neighborhood’ became ‘hood’ in the youthful arena of Los Angeles. Presently, the term has many connotations and meanings that imply an offensive undertone. But in developing countries, the term ‘slum’ means low-quality, informal housing and is closely linked with perceptions of poverty. The term slum, shanty, squatter settlement, informal housing and low-income community were used conversely among authorities. Today, the ‘slum’ term vary by region—“Gecekondur” in Turkey, “Compounds” in the Middle East, “Favelas” or “Invasoes” in Brazil, “Barrios” in Caracas, “Bidonvilles” in the French speaking world, “Werften” in Namibia, “Tondos” in the Philippines, “Kampung” in Jakarta and so on<sup>10</sup>.

Slum settlements are inevitable in all cities where the degree, proportion and character vary by income level and socioeconomic status. Ironically, the absence of a legal structure and its application is not the only factor for the formation of slum settlements—its very existence can inhibit their efforts to acquire land and prevent their growth. Slums “mark the success of a city” because their formation is an “integral part of the process of growth and development of a city.”<sup>12</sup> While each part of a city does not necessarily go through a process of deterioration and revitalization, there are sections of the city that are in constant renewal and improvement. Demanding a city without slums with the absence of affordable housing is denying the very group that is so fundamental in urban success, the rural migrant.

#### *Urban Informality: A Typology*

Urban informality has become the catalyst for the dynamism present in our city rather than a perception that is only temporal in nature and a residual component of the city. Ananya Roy represented the rapid growth of urban informality as a mode— “Informality, once associated with poor squatter settlements, is now seen as a generalized mode of metropolitan urbanization”<sup>12</sup>. As a mode, informal urbanization is tolerated and embedded economically, socially and culturally. As a result “informality is back on the agenda of international development and urban planning”<sup>13</sup>. The nuances of informality can be described as a simultaneous

process of integration and social exclusion according to Asef Bayat<sup>12</sup>. Comparable to that of what Roy calls the “negotiation of poverty”, Bayat focuses on “quiet encroachment” as a way to dispel the “myth of powerlessness” and to understand how those that depend on the informal structure do have means<sup>12</sup>. This encroachment has direct and long-term consequences—a “prolonged mobilization with episodic collective action”—that does not only affect the spatial organization in urban areas but as well as the political perspective and methods of both formal and informal authorities<sup>12</sup>.

Furthermore, informality has the ability to influence political agencies that have a large role in the organization of urban spaces. The role of informality in municipal governments is rooted from the “recognition by government institutions and political parties that their own political survival rests on carefully choreographed balance between the liberalization of (land, real estate) markets required to promote a globally competitive city and the political gestures of support to those unable to access its benefits<sup>14</sup>.” As Roy points out, political parties rely on informality to sustain and reproduce social and spatial inequalities<sup>12</sup>. A selection of squatter settlements is chosen to extract political concession and resources for the development of infrastructure. Informality is also used as a tool of coercion. Through a political perspective, it provides political authorities the control of basic services and land acquisition, while informal settlers use this form of power as resistance. Hernando de Soto argues that legalization (liberalized) of informality is the only way to develop a proper establishment that controls private developers to acquire land within informal spaces<sup>12</sup>.

According to Cathy Rakowski, urban informality can be divided into two groups—the structuralists and the legalists. The legalists encourage underground economy (also known as the black market), rejecting dualism and focusing on “forms of production, productive units, technologies, and workers”<sup>11</sup>. The structuralists viewed the informal sector as a “status of labor” (undeclared and non-contractual, lacking benefits, paid less than minimum wage, a condition of work)<sup>12</sup>. The significance of the structuralist approach is that from an outsiders perspective it is the unequal disposition of capitalist development. The legalist approach is viewed by neo-liberalist that place emphasis on legal matters of divisions between

formal and informal economies.

The dualistic divisions of the formal/informal binary are produced at different scales between global cities and mega-cities. “For many, that city embodies two dichotomous...worlds: on the one hand, a pre-modern, indigenous, informal, poverty-based squatter culture; and on the other hand, a hyper-or post-modern, multi-cultural, tele-connected, globalized or world city.”<sup>34</sup> This distinction can be abstracted as “the sewer versus the metro.”<sup>34</sup> Overcoming the formal-informal binary involves less integration of one on the other, which becomes “synonymous with homogenization”<sup>34</sup>. Rather than imposing the formal city and its rules into the informal spaces of the city, an attempt to create “a city of integrity that is multiple and diverse”<sup>34</sup> can exceed such binaries.

Moreover, in an attempt to understand the urban structure without binaries, the concept of rhizome<sup>15</sup> created by Deleuze and Guattari can be attributed. “Unlike a tree, in which everything is structured through the single trunk, a rhizome can grow a shoot at any point, extending along ‘lines of flight’ to connect a multiple, decentralized, range of locations. It is ‘a type of structure that...refuses the notion of hierarchical order, that possesses a patchwork quality, a radical heterogeneity”<sup>16</sup>. Slum settlements can be described in organic terms—shooting up like plants growing in the middle of the street, creating a “plant-city”<sup>17</sup>. The arbitrary placement of the slums produces “in between spaces”<sup>34</sup>. The shelters are in constant flux, rather than dwelling in permanence. It is also the ephemeral, rather than the fixed and substantial.

The notion that informality is an “unplanned” or spontaneous occurrence is one of the foremost myths about urban informality<sup>34</sup>. While a clear borderline between informal and formal parts are seen in some slum cities, informal settlements can develop in areas that are identical to its surrounding counterparts. Take for example Mexico City where the extension of its existing street grid is continuous without apparent edges between the formal and informal parts of the city<sup>18</sup>. Nevertheless, these informal and formal settlements still exist worlds apart in terms of “their own laws and codes”<sup>34</sup>. The barrios in Caracas, Venezuela are populated by the poor whose “way of life and cultural framework are antithetical to

urbanity”<sup>19</sup>. On the other hand, Rio de Janeiro’s legal structure is “culturally homogenous”<sup>34</sup>.

*Urbanization & Urban Migration*

Developing countries are urbanizing at a faster rate than ever before. It is estimated that 60% of the world’s population will be urbanized by 2030<sup>20</sup> (Table 2.1). The increase in urban population in these developing countries is a product of the wealth and economic development that it offers and thus creates ‘megacities’. These ‘megacities’ are characteristic of urban areas with a population of 10 million or more<sup>10</sup> where over half of the world’s megacities will be in Asia. The number of megacities has increased from two in 1950 to twenty in 2005<sup>10</sup>. Furthermore, 17 out of the 20 megacities in the world are located in developing nations<sup>10</sup>.

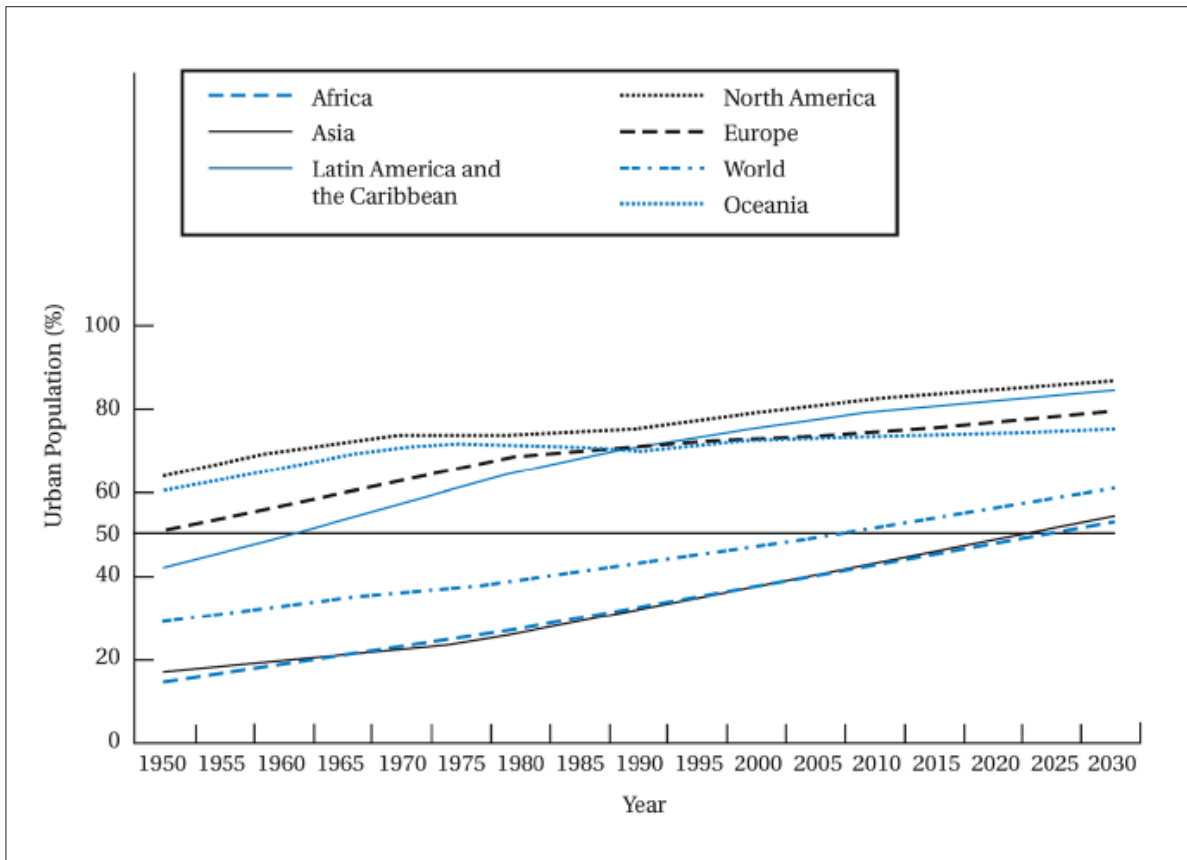


Table 2.1 World Urbanization  
 Source: UN-Habitat, “State of the World’s Cities, 2006-07,” <http://www.unhabitat.org>

These growing megacities are in part due to a mass urban migration. As Mike Davis explains, slums cannot be resolved through traditional modes of aid but sees such programs as the cause of an imbalance due to urban migration and industrialization<sup>20</sup>. The contemporary situation is that “95% of this final build out of humanity will occur in the urban areas of developing countries, whose populations will double to nearly 4 billion over the next generation<sup>21</sup>”.

The process of growth requires the process of erasure—land that is cleared to make way for possible future expansions<sup>10</sup>. This notion of subtraction (leveling topography and demolishing buildings) or addition (filling existing water bodies), results in a dramatic amount of space that is often times formless. Ironically, while current growth starts with erasure, this “undifferentiated space lacks the necessary elements and resiliency that it strives to erase”<sup>10</sup>. These spaces called “urban villages” are the combination of the rural (includes farmers) and the urban (includes city people). Overtime, these areas have quickly dissolved through urban expansion. Preserved only in form, these spaces have lost its functionality and power. While some spaces adapt to new conditions of its adjacent counterparts, there is still a lack of services and infrastructure. It is evident that using both bottom-up and top-down methods in the same urban space can create spatial, social, economic and political conflict<sup>10</sup>.

### *Climate Change Impacts*

As cities grow increasingly complex, this rapid urbanization has social, economical and ecological consequences that are fueled by human needs, activities and aspirations. Additionally, urbanization is contributing to climate change impacts. Informal settlements are especially vulnerable to climate change as they are usually located in high-risk areas—low-lying areas, steep slopes and ravines. Lacking infrastructure such as roads, drainage, water and sewerage, slum settlements have reduced mobility in the event of flooding, their shelter is at risk and health impacts are at its greatest<sup>19</sup>.

“The 20 largest cities consume 80% of the world’s energy and urban areas generate 80% of greenhouse gas emissions worldwide<sup>10</sup>.” Temperature increase caused by carbon emissions is intensified in urban areas. Due to the *urban heat island ef-*

fect, this creates a warmer climate in urban areas as opposed to the surrounding rural areas<sup>19</sup>. The cause of this heat effect is the alteration of land surface materials into materials that retain heat. Furthermore, waste heat that is produced by using energy is another contributor. The global surface temperatures have increased approximately 1.5 degrees Fahrenheit over the past century. As the urban population increases, greater areas are modified and in turn create a rise in average temperature<sup>19</sup>.

Additionally, due to global warming, an unstable atmosphere produces extreme weather such as an increase in cyclone activity in the Pacific Ocean. The Philippines receives approximately 20 typhoons annually with an average of 3.7 typhoons hitting Metro Manila<sup>22</sup> (Fig.1.6). The Philippine islands are part of the Circum-Pacific seismic belt and sits between two major tectonic plates. The movement of these plates is responsible for creating mountain ranges, islands, volcanoes, earthquakes and tsunamis<sup>19</sup>. The high occurrence of typhoons brings in heavy rains from June to September during monsoon season<sup>23</sup>. Storm surges are followed by extreme flooding that have the greatest impact on low-lying coastal areas.

Furthermore, flooding in Metro Manila is the most pervasive and chronic climate impact. Approximately 18-20 flood events occur each year in Manila<sup>20</sup>. "Floods directly affect 190,000 households in the metropolis and inconvenience almost 70% of its total population.<sup>20</sup>" The rapid urbanization and expansion has created impervious spaces in the city, which has increased the event of flash floods. Flood prone areas reach the coastal areas of Manila, Navotas and Malabon, as well as the banks of San Juan and Pasig Rivers<sup>20</sup>. Large-scale initiatives to combat flooding were launched in 1974. This included raising the river walls along the Pasig River to accommodate a water level of 14 meters—the expected depth of flood with a 10 year return period<sup>20</sup>. In 1997, 12 pump stations were placed in major waterways and estuaries in order to limit flooding to approximately 0.2 meters<sup>20</sup>. Additionally, the Napindan Hydraulic Control Structure is a large spillway dam that has been created to control water levels in Laguna Lake and Pasig River<sup>20</sup> (Fig.2.1). Furthermore, the Manggahan Floodway has redirected excess water flow from Marikina River into Laguna de Bay. During high water levels in Marikina, the floodway structure is closed. Moreover, there are future plans to pump water

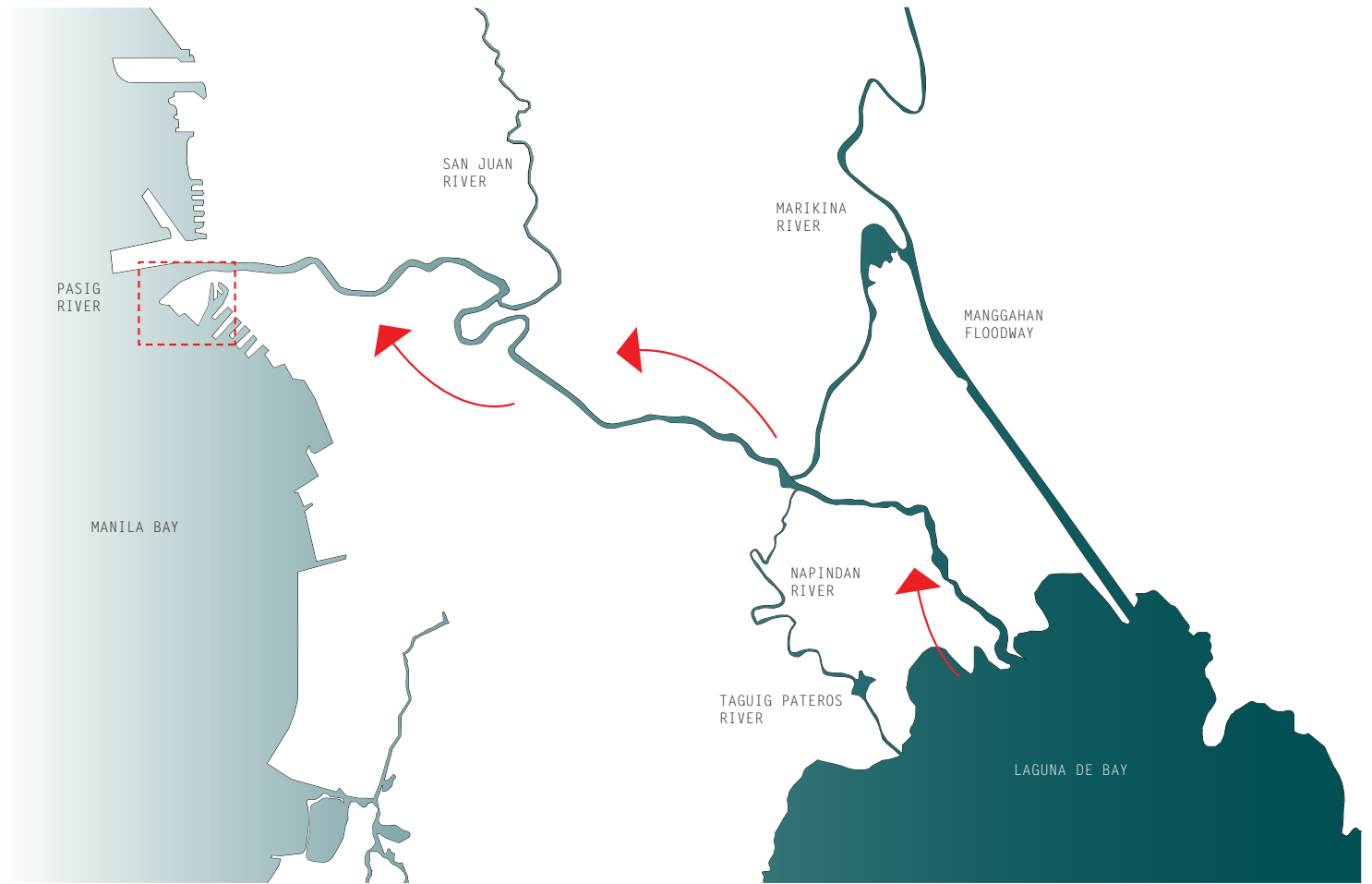


Fig.2.1 Water Flow

Source: "Rapid Urbanization and Mega Cities: The Need for Spatial Information Management - Zunia.org." RSS. N.p., n.d. Web. 10 Dec. 2013.

out of Laguna de Bay during dry season to allow more room during rainy season. The construction of dikes on the lakeshore are also in planning and the proposal to build silt containment dams on the lake's tributaries in order to decrease siltation<sup>20</sup>.

Moreover, a rise in sea level will devastate 3,351 coastal cities in low elevation and will affect 634 million people (10% of the global population) in which 384 million of those people are living in the developing world<sup>24</sup>. Approximately 23% of the world's population lives within 60 miles of the coast and at less than 350 feet of elevation<sup>19</sup>. Within the Low Elevation Coastal Zone (LECZ), which is defined as less than 33 feet in elevation, about one person in ten resides here<sup>19</sup>. Highly at risk to the effects of sea level rise are deltas, which are large sedimentary deposits. Deltas are also vulnerable to stresses imposed by human intervention of catchment areas and delta plain land use<sup>19</sup>. Most of which are undergoing natural subsidence and suffer the effects of ground water extraction<sup>19</sup>. Furthermore, sea level rise can directly affect freshwater resources by seawater intrusion into surface water and coastal aquifers. This can lead to salt water into estuaries and coastal river systems, higher levels of flooding, an increase in storm surges inland and coastal erosion<sup>19</sup>. The rise in sea level over the past 150 years has increased approximately 10 inches with a dramatically increasing rate of 1/8<sup>th</sup> inch per year<sup>19</sup>



Fig.2.2 Dharavi Slums

Source: "Inside Dharavi Slums". <http://www.not-home.com/2012/03/inside-slums-of-mumbai.html>

## *Precedent Studies*

### *Dharavi- Mumbai, India*

Mumbai is one of the largest coastal mega cities in the world in terms of population and ranks 4<sup>th</sup> just after Tokyo, Mexico City and New York<sup>25</sup>. Located on the western coast of India and made up of a cluster of seven islands, the region encompasses rich natural resources and land forms of hills, lakes, coastal water, forests, and mangroves. The island is vulnerable to flooding as it sits 10-15 meters above sea level surrounded on three sides by water—the Arabian Sea to the west, Harbor Bay in the West and Thane Creek in the east<sup>8</sup>. Mumbai's tropical climate is susceptible to heavy monsoon rainfall of more than 2100 mm a year and relative humidity. As a result, coastal erosion landslides and flash floods are a natural occurrence. Moreover, Mumbai falls in the seismic zone III, a moderate damage risk zone. Of the 276,000 dwellings, 60% are largely non-engineered construction and make up the slum settlements. The increasing population of Mumbai slums continues to rise as approximately 56% of the slum population is projected to increase.

“Dharavi is a city within a city with a culture and lifestyle that has developed over generations...it is a unique home that has a full community, unique spatial structures and an innovative use of resources that is horizontally spread over many acres and can be traversed vertically and horizontally along terraces, roofs, canopies and courtyards<sup>26</sup>.” (Fig.2.2) Once a mangrove swamp inhabited by Koli fishermen, Dharavi became the most diverse of slums due to the migration of people from the south who opened tanneries, some who migrated to work in the textile industry and others establishing a potter's colony <sup>27</sup>. The Dharavi settlements have a certain structural definition and spatial pattern that is definitive of their everyday life. The edges of the city are delineated by waterways and canals while more permanent and solid structures are found within the center of the Dharavi community. Dwellings are about 12x12, which often house many members of the extended family.

Similar to Manila slums, the slums of Dharavi are deprived of clean water sanitation and supply. The Dhobi Ghat, a communal washing station that has been around



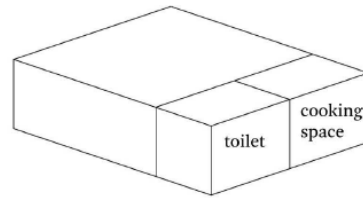
Fig.2.3 Makoko Floating School by Kunle Adeyemi Lagos, Nigeria  
Source: "Inside Dharavi Slums". <http://www.not-home.com/2012/03/inside-slums-of-mumbai.html>

for centuries is now infested with dirty and untreated water (Fig.2.2). Nevertheless, the daily life in Dharavi is reminiscent to the close and intimate social sphere in Manila slums. While this is true for both, unlike Manila, nothing in Dharavi is considered garbage. Every article of trash is recycled whether it is a cardboard box or a 55-gallon oil drum. Each piece is recycled and reused for some use within the community.

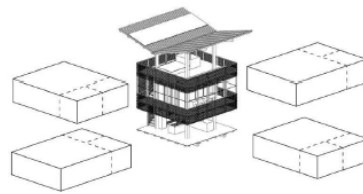
#### *Makoko- Lagos, Nigeria*

“By 2015 Lagos will be the third largest city in the world but it has less infrastructure than any of the world’s other largest cities<sup>11</sup>.” The informal settlement of Makoko is descriptive of a true coastal community. Canoes are the main way for transportation within and around this water informal settlement (Fig.2.3). Original settlers of Makoko are fishermen that have migrated to start a business but rarely catch a single fish due to the polluted water<sup>28</sup>.

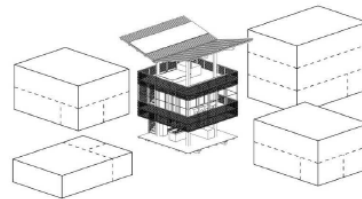
Kunle Adeyemi of NLE Architects designed the Makoko Floating School, one of three developments that will become part of a floating slum community (Fig.2.3). Located on Lagos Lagoon, on the fringe of Nigeria’s largest city, Lagos, the school will serve as an extension for the one primary existing school they have. The use of local materials and resources reflect the needs and culture of the community. The triangular wooden design holds classrooms on the second tier with an open playground on the first level. Adjustable louvered slats are also used to control light and air. A rainwater catchment system is integrated within the architecture to employ storage for excess water and to be used as a floatation device for the structure itself. The plastic barrels allow the structure to float independently or interconnected with more than one structure. Its broad base and narrow top is designed to be durable during storms<sup>29</sup>. The end vision is a floating community of sustainable housing and community-shared spaces that hopes to combat unpredictable climate and global sea level changes.



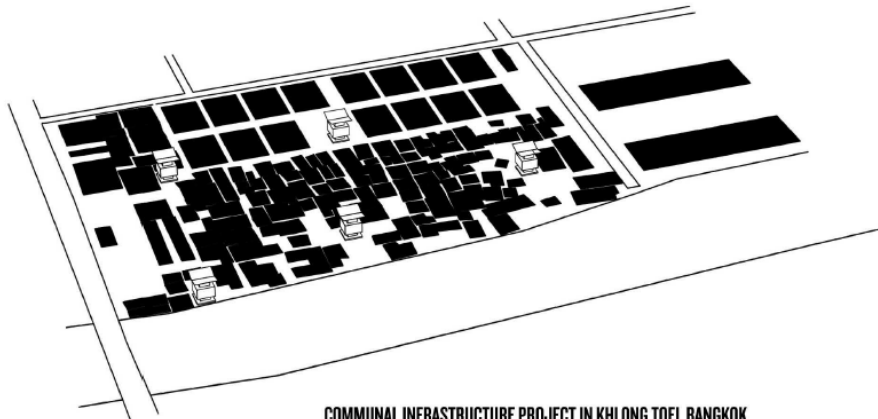
**TYPICAL SLUM HOUSE**



**INDIVIDUAL INFRASTRUCTURE BECOMES OBSOLETE**



**POTENTIAL GROWTH LEADS TO HIGHER DENSITY**



**COMMUNAL INFRASTRUCTURE PROJECT IN KHLONG TOEI, BANGKOK**

Fig.2.4 Communal Infrastructure *Bangkok, Thailand*

Source: "Asian Mode." S.L.U.M. Lab: Sustainable Living Urban Model 7 (2012): 1-100. Slum Lab. Future Cities Laboratory. Web. 8 Sept. 2013.

### *Bangkok, Thailand*

Along with the Philippines, Cambodia and Laos, Thailand's average rainfall during 2011 led to major flooding and has affected more than 8 million people. The most recent flooding in the Chao Phraya River and nearby watersheds has brought national attention to the need for better water management practices<sup>10</sup>. Bangkok is the largest urbanized area in Thailand of 20 million people with a central delta surrounded by an industry led community<sup>10</sup>. The threat of sea level rise has drastically changed Bangkok's infrastructure in urban areas with the poor communities experiencing the most severe impacts of all. Bangkok's informal settlements are typically located around canals, railways and public lots. The water is a challenge for those that live along the canals. What was once a positive relationship with their watery surroundings has become "residual space without any added value"<sup>10</sup>.

Khlong Toei is an informal community that is situated along the canal. With the lack of public spaces and activities and the attempt to address the flooding issues, Khlong Toei's waterfront is becoming increasingly underutilized. Saskja Odermatt and Lionel Epiney have proposed a waterfront that links riverside connections in order to make stronger networks between different communities<sup>10</sup>. Integrated in these networks are designated workspaces for different public activities. The aim is to understand the needs of each individual of the community and provide them a space that allows their work to flourish in a visible public realm. The contact between interior and exterior is boundless and is open to a larger community of people that reside both along and outside the canal. On the other hand, proposing a fortified wall against the rising waters and one that also serves as a functional platform for different activities can strengthen the waters edge<sup>10</sup>.

Furthermore, Svenja Egge and Lino Moser proposed an alternative method to slum clearance and forced relocation through a system of communal infrastructure to retrofit existing informal settlements<sup>10</sup>. "By concentrating services and resources for multiple families outside of the individual houses...[it will yield] synergies between existing social structures and the flexibility of the informal economy<sup>10</sup>." Open kitchens will fill the streets where most families purchase meals

to save money, washing machines operate in public forums and other shared services that function in small structures are readily available to the community<sup>10</sup>. Waste services are also treated in small scales that make it easy to be transported out of the community. These small interventions are inserted into existing narrow paths and open spaces that become main nodes. “Communal infrastructure is a system, and not an architectural design<sup>10</sup>. The homes were made of bamboo, a natural, local, abundant and easily transported material. On site building and repair of these structures bolster community involvement and preserve vernacular building methods<sup>10</sup>.

Communal infrastructure can channel growth in a community that is constantly improving. By providing specific programs and offering a “first push of development”<sup>10</sup>, this can be an effective way to start upgrading slum settlements in a smaller scale and thus become a prototype for future urban structure.





Fig.3.1 Baseco Bay Site Map  
Source: Owner

## M E T H O D S | S T R A T E G Y

*“In recent years, prevailing strategies for addressing non-formal settlements have shifted away from large-scale slum clearance and relocation, which have been demonstrated to cause massive social disruptions. The approach favored today is on-site upgrading and improvement, with the goal of integrating low-income communities into their larger urban contexts”<sup>30</sup>.*

### *Site Criteria*

Slum communities in Metro Manila are dispersed across 526 communities. It was important to select a site that could address the global climate issues relevant to the Philippines today. In addition, the objective was to select a site that was unique to other slum settlements seen in Manila. From an outsider’s perspective, Baseco Bay is an informal settlement that is not visible to the foreigner but rather only visible on the map. With only one entrance to the compound, Baseco Bay is only accessed on foot and by car through one main street corridor (Fig.3.1). Bounded by water on all sides, Baseco Bay is the only accessible beachfront in Metro Manila situated along two very significant bodies of water—the Pasig River and Manila Bay. Both bodies of water remain important in the vitality of the economic activity of the city. Situated at the mouth of the Pasig River, it is a main thoroughfare for ships to transport goods and was once classified primarily for fishing and recreation. Manila Bay to the south is the hub of the main shipping port of the city and characteristic of a coastal wetland (Fig.3.1). Its location near the main shipping port has made Baseco an attractive site to workers and migrants from other surrounding islands.

The site contributes to a unique group of informal settlers that have adapted to a waterfront that is subjected to very harsh environmental impacts such as typhoons, hurricanes, rising water levels and flooding. Once a habitat for mangroves, the site is much more vulnerable to these climate changes and therefore the severity of the impact is greater on this coastal informal settlement. Aside from environmental impacts, this settlement is also subjected to site issues—a land built

on trash, the pollution in the water and the densely packed shanties, all create squalor living conditions.

Furthermore, due to the increasing urban population of Manila, it has resulted in the reclamation of land along the coastline to accommodate a group of people that have migrated from rural areas. Baseco Bay's unique physical makeup is due to the reclamation process that has grown to accommodate the growing population of this informal sector. As a result, the inception of this community was built on the need of space without any real infrastructure.

#### *Design Methods*

To address both the communal issues of Baseco Bay and the individual needs of its residents, the design can be summarized into two methodologies:

##### *Urban Intervention*

In Baseco, very few systems and infrastructure exist. Determining the existing infrastructure or lack thereof and how well it functions in the community can introduce new and/or improved programs of services and resources. By providing a 'communal infrastructure' of specific program elements, this can provide a foundation for an organized system of shared spaces within a tight-knit community. In doing so, efforts to maintain a healthier, cleaner and livable community can be easily adapted and accessed in slum communities. By preserving existing major pathways and street corridors, within these spaces, the small interventions can be placed. This will ensure equal allotment of certain types of infrastructure within each street block. The major spine can become a commercial corridor that caters to the storefronts and street kitchens of Baseco. Moreover, preserving the notion of "clustering" that is characteristic of slum communities, nodes of social engagement and interaction can be established. Within these nodes, smaller infrastructural elements can be placed based on the need of each "cluster". These clusters are formed through close family relationships and/or bonds with neighbors and friends. Shared infrastructure can also provide more living space in the home, thus giving the individual the opportunity to tailor the house to their specific needs.

The impacts of climate change have greatly affected the Baseco community. The regeneration of existing mangroves on the site can also add protection to the community from typhoons, hurricanes and sea level rise.

#### *Dwelling Intervention*

In Baseco, the shanties are built from found, discarded materials. Lacking the proper structure and protection from the harsh exterior elements, a vernacular building method can be the solution for a coastal informal settlement. The goal is to understand the basic needs of the individual and the needs of the family unit as a whole. A modular housing typology that can grow and expand to the needs of each family will be the catalyst for densifying the community. Additionally, a dwelling that becomes an extension of the exterior landscape will retain the intimate social network that is already present in the Baseco community.

In response to the severe natural disasters and global climate changes, a flood resistant house can provide a safe shelter. A unit that can be self-contained from high winds and the rising water is essential for sustaining the house. Choosing the right building material that is easily available, abundant, locally produced and can be constructed on site can establish an efficient building strategy. The dwelling will also be naturally ventilated and provide shelter from the extreme weather of rain and heat.



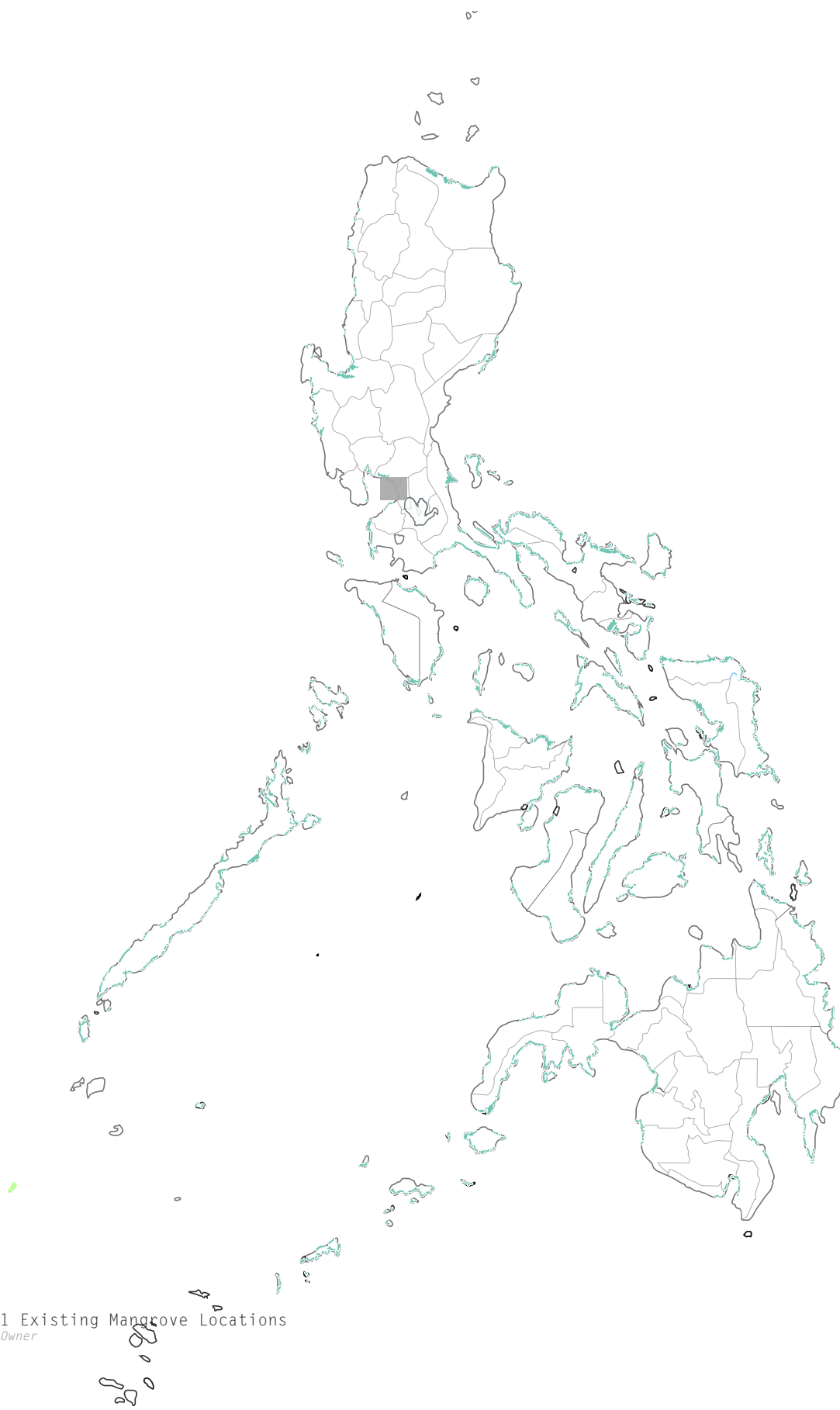


Fig.4.1 Existing Mangrove Locations  
Source: Owner

## P R E L I M I N A R Y F I N D I N G S

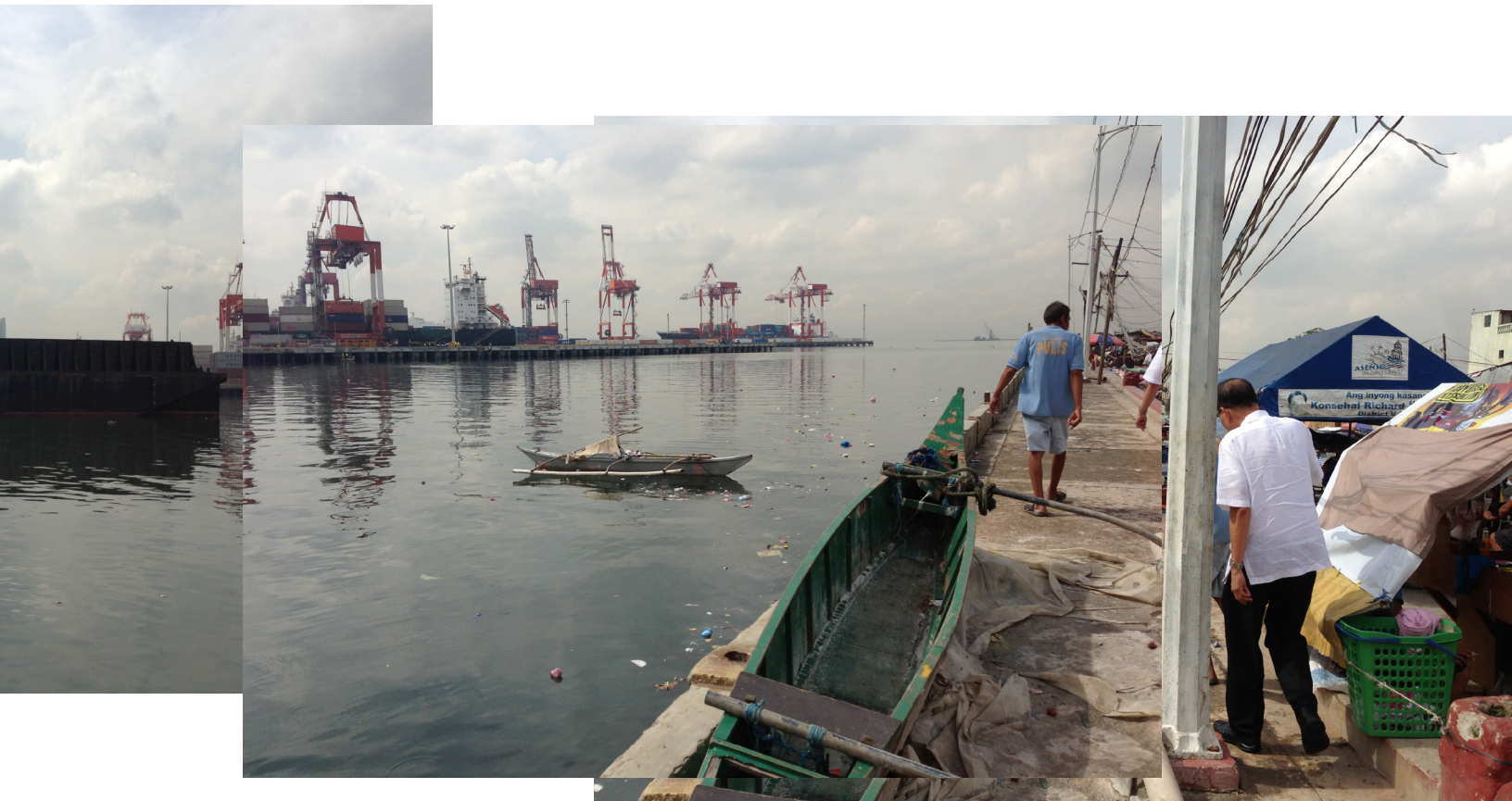
### *Site Analysis*

The Philippines coastal region is a central location to the country's economic growth with its commercial, industrial, agricultural and aqua-cultural activities. Typical of warm, humid and tropical conditions, the climate has changed and has resulted in major effects of global warming and in turn an alarming accelerated sea level rise. With a coastline of 34,000 km, the country is vulnerable to inundation of its low-lying wetland and dryland regions<sup>31</sup>. As a result, the effects of erosion, salt-water intrusion, increased risk of flooding and storm damage brings uncertainty to the city's coastal infrastructures and socio-economic growth. The destruction and degradation of mangrove habitats have shown a loss of nearly three quarters of the mangrove forests (Fig.4.1). Manila's topography is relatively flat with some portions actually below sea level so during high tide, the sea water goes about two kilometers inland along the Pasig River.



Fig.4.2 Manila Bay Port  
Source: Owner

The target of the project is Baseco Bay, a large slum area near the outlet of the Pasig River and is bounded by Manila Bay, the country's main port of maritime trade and travel to the west and the Manila Bay port to the east (Fig.4.2). Baseco Bay became one of the largest informal settlements in the early 21<sup>st</sup> century. The Pasig River stretches east to west, north of the Baseco Compound and connects to Laguna de Bay, the largest fresh water lake in the country (Fig.4.3). Home to approximately 54,000 people<sup>35</sup>, in the next 20 years, the population growth is projected to double, with the area expanding vertically to accommodate the growing population. Among its many problems including overpopulation and poverty it has a low load bearing capacity, making it even more difficult to develop. The slum area is named after Bataan Shipyard and Engineering Corporation and was a former dumpsite in the Manila port.



### *Pasig River*

The Pasig River is the hub of economic activity of the metropolis and provides a major means of transportation, water sources for domestic and industrial uses, and a place for recreation and shelter to a large variety of fish and other aquatic life<sup>324</sup> (Fig.4.4). The watershed conditions of the Pasig River is largely affected by the inflow of both fresh and salt-water from Manila Bay and Laguna de Bay, where its direction of water flow depends on the water level difference between the two bodies of water (Fig.2.1). The flow through the urban areas comes from its upstream portion of Laguna de Bay and moves through the Napindan Channel and continues towards the Marikina River (Fig.2.1). During dry season (from March to July), the water flow in Laguna de Bay is low discharging a volume of 12 m<sup>3</sup>/sec. During wet season (from August to November) the flow of water is high and travels upstream from Laguna de Bay into Manila Bay (Fig.2.1).



Fig.4.3 Pasig River looking into the city.  
Source: Altea, G.



Fig.4.4 Pasig River looking North.  
Source: Altea, G.



The annual average volume of water flowing into Manila Bay is 6.6 million  $m^3$ <sup>334</sup>. This tidal estuary is linked to three major tributaries—the San Juan River, Marikina River and Taguig Pateros River (Fig.2.1). Along with 47 other tributaries, the Pasig River is the only outlet that drains water from the landlocked Laguna de Bay<sup>9</sup>. The shallowest portion is at the mouth of Manila Bay while its deepest portion is 4.5 meters between Guadalupe Bridge and C6 Bridge. The river is approximately 27 km long with an average width of 91 m and depths ranging from 0.5-5.5<sup>4</sup>. The river is classified primarily for fishery, recreation and supply for manufacturing processes and thus its location is vital for the thriving ecosystem.

“In the years before large-scale development of metropolitan Manila, the Pasig was compared to the Grand Canal of Venice as it ‘Serpented inland, framed on either side by patches of lush greenery, its waters clear and unimpeded by waste or debris’”<sup>34</sup>. While the river was once a prosperous site, the decline of the river goes as far back as the 1930’s. In 1990, ecologists declared the Pasig River as dead and incapable of sustaining marine life<sup>4</sup> (Fig.4.5). Fish migration started to diminish. Bathing activities dropped, people no longer used it for washing clothes and ferryboat transport began to decline. During the 1970’s the river gave off an offensive smell especially during its dry season. Eventually, all fishing activity was no longer possible.



Fig.4.5 Pasig River looking south.  
Source: Altea, G.



### *Waste Disposal*

“Metro Manila is in the absence of a functional system of waste reduction, reuse, recycling, and disposal”<sup>35</sup>. The garbage crisis is primarily due to the forced closure of two main disposal facilities and as a result, slum areas have become target locations for the disposal of trash. The history of the garbage crisis goes back to 1991 when Smokey Mountain, a dumpsite in Manila, closed its doors due to the mounting public pressure to improve waste disposal<sup>10</sup>. As a result, two other dumpsites opened its doors, San Mateo and Carmona, which presented similar design construction and operation standards as Smokey Mountain. The decline of the garbage operation in these dumpsites brought on heightened public opposition until Metro Manila exhausted its resources for disposal and waste went largely uncollected. Immediate relief was sought after by the government but each plan to barge



Fig.4.6 Manila Bay from southern edge of Baseco.  
Source: Altea, G.

waste was fiercely met with public opposition. Since 2001, additional controlled dumpsites have been developed to alleviate the crisis. There is a widely held perception that the crisis has somehow subsided but the reality is Metro Manila has less than 2 years disposal capacity<sup>10</sup> and the garbage crisis still lingers.

The current conditions of all waterways of Metro Manila are heavily polluted (Fig.4.6). Pasig River is considered the “sink for waste in the catchment areas”<sup>9</sup> due to large amount of waste being dumped regularly. Domestic waste accounts for approximately 60% of the total pollution in the Pasig River while industrial wastes accounts for 33% which include tanneries, textile mills and food processing plants, distilleries, chemical and metal plants as well as solid waste (7%)<sup>4</sup> (Fig.). The continuous dumping of garbage has turned the riverbed into silted organic matter and non-bio-



degradable garbage producing 7,000 tons of trash per day<sup>36</sup>. Textile and food manufacturing industries have been the greatest water polluters from the industrial sector<sup>4</sup>. Additionally, contributing to the waste are 88% of the 4.4 million people living in the Pasig River catchment area without proper sewerage system<sup>4</sup>. A concentrated population of slums settles along the banks of the river. The contaminated Pasig River is devoid of any but 6 marine species of fish and 2 types of plants that still thrive in the polluted water. Moreover, the lack of a proper sewage system has created a large amount of sewage to accumulate in its riverbed, choking the drainage system in the river tributaries.

“The incessant deterioration of the water quality...is an effect of its failure to adopt an integrated and holistic approach in addressing the inherently interrelated issues for the development and management planning, implementation and operation of water pollution control, as well as watershed and groundwater protection”<sup>4</sup>. The current water management lies with insufficient funding which has resulted in weak implementation.

#### *Baseco Bay*

As Metro Manila's most central harbor front, Baseco sits adjacent to the port of Manila in close proximity to the financial district and industrial service sector. Baseco is built directly on, behind and on top of the sea wall and has grown through an infill of land and waste (Fig.4.7). Once a natural mangrove, the 56 hectares site is now home to families that live in houses made of discarded trash and other materials. Residents of Baseco have built their houses on stilts in the swampy area among a pile of garbage (Fig.4.8). The unsanitary conditions have made the area susceptible to a series of fires over the years and have rendered over 2500 families homeless<sup>35</sup>.

The people of Baseco are a diverse group of informal settlers that have adapted to a certain way of living along the water. Their proximity to the main shipping port has created local jobs such as stevedoring, while others work in shops or make their own living selling goods out of their own homes. According to the



Fig.4.7 Breakwater path in Baseco.  
*Source: Altea, G.*



Fig.4.8 Houses sit on a pile of garbage.  
*Source: Altea, G.*

2010 census, there are 51,216 in total population in Baseco with approximately 12,212 families.<sup>37</sup> A typical family can include 2-4 members and extended families of 5-10 members. The people of Baseco are the poorest of the poor. Described by the Republic Act 8425 from 1997, the poor are “individuals and families whose income fall below the poverty threshold as defined by the government and/or those that cannot afford in a sustained manner to provide their basic needs of food, health, education, housing and other amenities of life.” Nevertheless, whether it is carrying a bag of rice, or shaving ice, or transporting goods across the compound or washing laundry for the family– it is a community where each person plays a role (Fig. 4.9). The everyday life of people in Baseco is driven by work in order to survive. It is a community that finds more satisfaction in the social interaction with each another. Living within the community are also people that work and live in the Habitat for Humanity or Gawad Kalinga homes. They too are



Fig.4.9 Life in Baseco  
Source: Altea, G.



Fig.4.10 Existing Infrastructure in Baseco  
Source: Altea, G.

part of the percentage of people living below poverty. This depressed area is not only haven for the poor but also some of the most dangerous criminals in the city. Although seemingly isolated from the rest of the formal city, the people of Baseco operate as their own city. "Informal settlements are worlds apart, 'with their own laws and codes'."<sup>43</sup> The town is recognized by the local government and functions with their own 'Barangay', a Filipino term that means an administrative division. The structure of the Barangay is quite organized, complete with a chairman, council members, secretary and treasurer and committee members for various organizations<sup>35</sup>.

Like any other city, in the least depressed areas of Baseco, there are a few infrastructures that help the community to thrive. On the northern part of the compound exist schools (elementary and high schools), a covered, outdoor recreation area, an evacuation center, a Barangay meeting hall, and a church (Fig.4.10). A police station is stationed at the gate entrance. Along the main street corridor is a commercial avenue of repair shops and food venues (Fig.4.11). On the north end of the site, the Philippines Habitat for Humanity and Gawad Kalinga (GK), a local organization, has built approximately 2,000 homes for informal settlers. The Gawad Kalinga houses makes its presence by the colorful houses which take up several rows on the northern edge of the site, while Habitat for Humanity homes are located to the east of the site (Fig.4.13, 4.14). The whole compound is walking distance although there are main roads that use vehicular transportation.



Fig.4.11 Baseco Storefronts  
 Source: Altea, G.



Fig.4.12 Spatial Analysis | Housing Typology

Source: Altea, G.



Fig.4.13 Gawad Kalinga Houses  
Source: Altea, G.



Fig.4.14 Habitat for Humanity Houses  
Source: Altea, G.

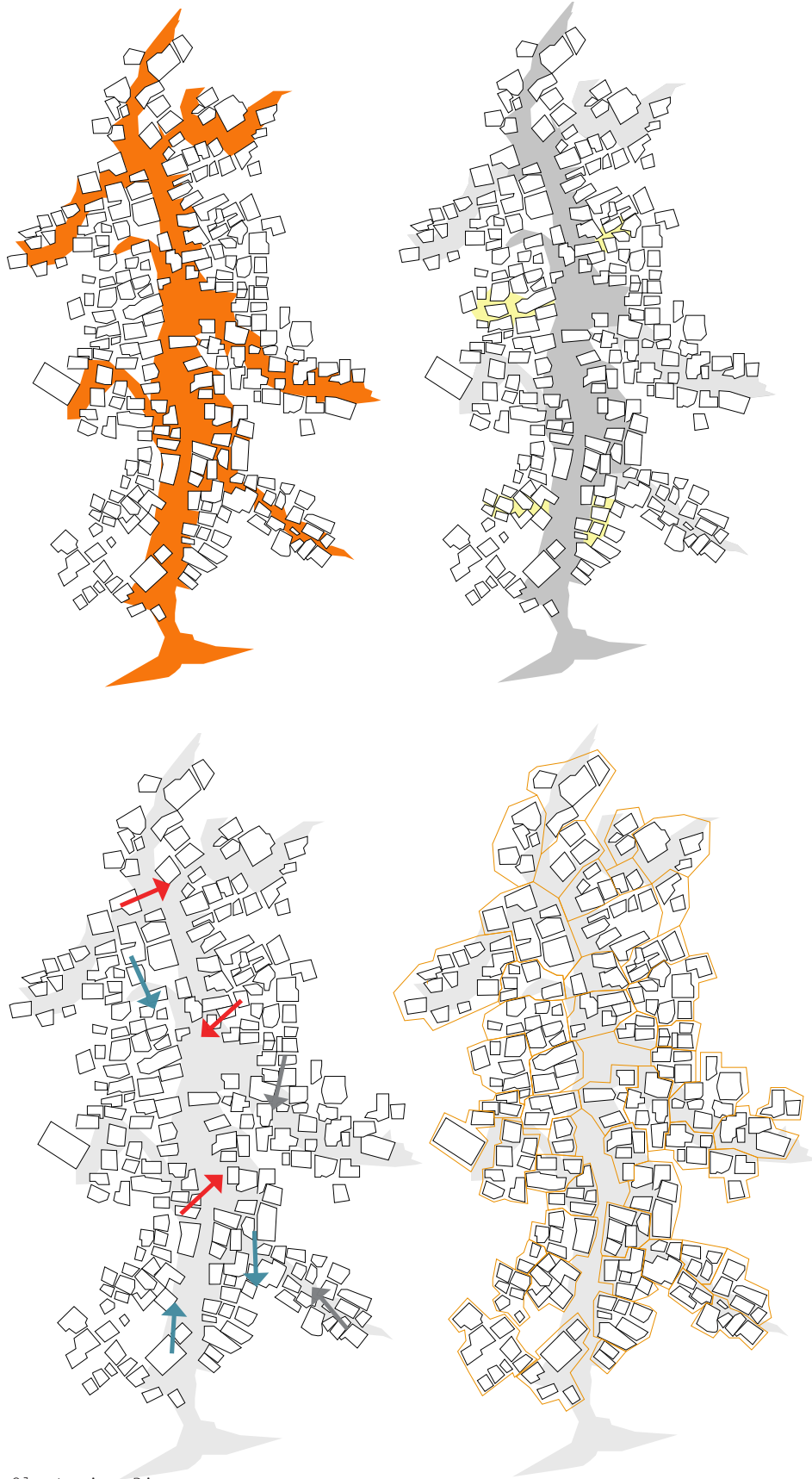


Fig.4.15 Clustering Diagrams  
Source: Altea, G.

On the most depressed section of Baseco, the southern portion of the site is where most of the shanties are located (Fig.4.12). In Fig.4.15, this clustering study shows 120 dwellings in a block arranged around a commercial path. Secondary paths diverge from the central path to form public, semi-public and private paths. These paths lead into clusters that comprise of 2-10 dwellings. The dwellings that are clustered face inwards and within the clusters. Some dwellings face a common path of movement while others face a public path. This study shows that there is a sense of spatial organization present among the shanty villages.

#### *Description of Users*

The people of Baseco consist of a highly family oriented group that varies in age and gender. The typical family includes 2-4 members of a father and mother with two small children. The extended family includes 8-10 members of a father, mother, grandparents, and children. There is an equal ratio between children (under the age of 12) and the elderly where both groups share a home<sup>35</sup>. The users are people that live below poverty.

#### *Program of Spaces*

“Facilities that don’t inspire a sense of community ownership are soon degraded or vandalized”<sup>30</sup>. The program corresponds with the needs of the individual residents of Baseco and their families. A flexible and shared living area that will serve as a kitchen, dining room and sitting area will accommodate the needs of the growing family (Table 4.1). The kitchen is the heart of the home and is the central space in which all activity surrounds. Additionally, storefronts called *sari-sari* for the selling of personalized goods and cooked food will be integrated with the house to bring a sense of ownership and life to the coastal neighborhood. Elevated linear storage spaces are integrated within the structure of the house for protection from rising waters. Additionally, sleeping quarters will be the most private space in the house as it will be located on the second story. The program is meant to improve the living conditions for each individual and family in Baseco Bay through a sufficient and stable structure.




| <p style="text-align: center;">USERS</p>  <p>Informal settlers/<br/>Single-families (2-4 members)<br/>Extended families (5-10 members)</p> | <p style="text-align: center;">NEEDS</p>  <p>Housing/<br/>A place to..<br/>eat<br/>sleep<br/>sell goods<br/>store things<br/>shelter from the harsh<br/>natural elements</p> | <p style="text-align: center;">PROGRAM</p>  <p>Living area<br/>Kitchen<br/>Storefront<br/>Storage<br/>Sleeping areas</p> |
|---|---|---|
|---|---|---|

Table 4.1 Program Elements  
Source: Altea, G.



## F I N D I N G S

In order to gain a better understanding of Baseco, this thesis takes a closer look at a smaller portion of the site. The focus area is located on the southern part of the compound where it is most disconnected from the city grid (Fig.5.1). This portion of Baseco is free of amenities that are otherwise available to the rest of the compound. This area is completely void of running water, electricity, a sewage system and a clear infrastructure of roads and designated pathways.

### *Design Process*

The design process began with looking at how the dwelling units would sit on the site. It was important to keep the forms dense in order to retain the character of shanty living. The idea of stacking and building vertical (Fig.5.2) would give options to form a street grid creating major, secondary and tertiary streets. Additionally, studying different ways clusters can be structured around a node by creating linear and circular forms (Fig.5.3). Moreover, taking a closer look at these forms individually and how they interact with another unit to form links and nodes (Fig.5.4, Fig. 5.5). A typology can be created with extensions and/or additions to create various forms on the site. Finally, studying different structural methods for this dwelling unit so it can be integrated with an extension or addition (Fig.5.6).



Fig.5.1 Site Plan with Interventions  
 Source: Altea, G.

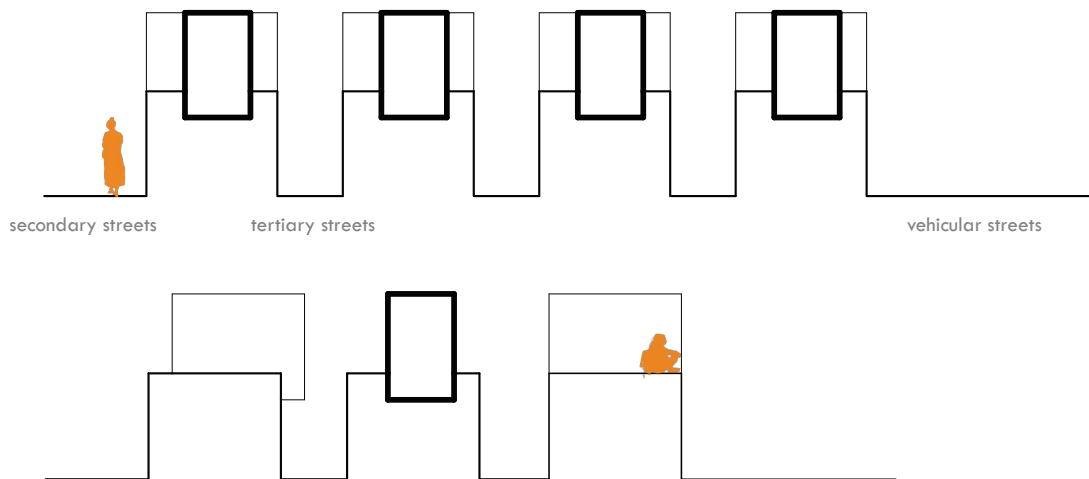
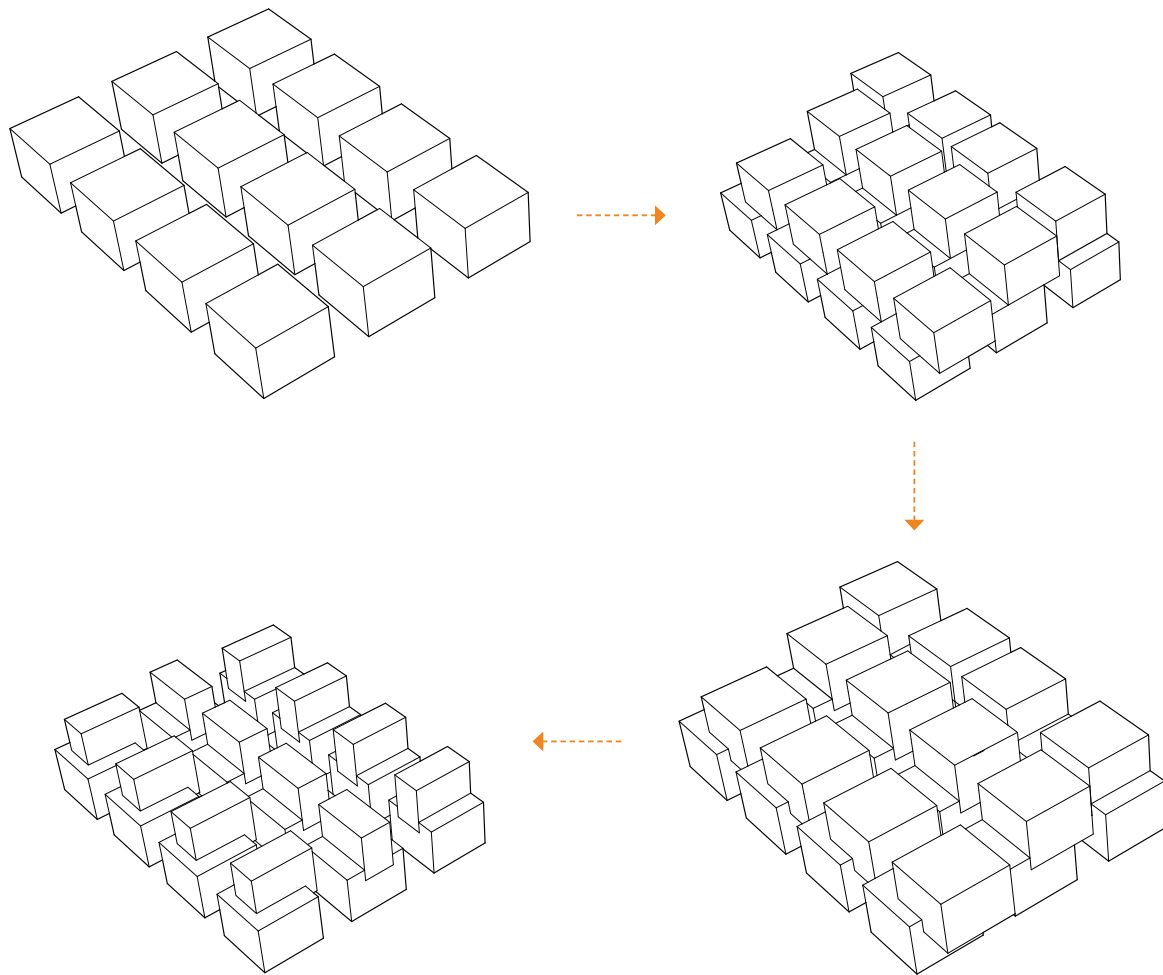


Fig. 5.2 Stacking Diagram  
 Source: Altea, G.

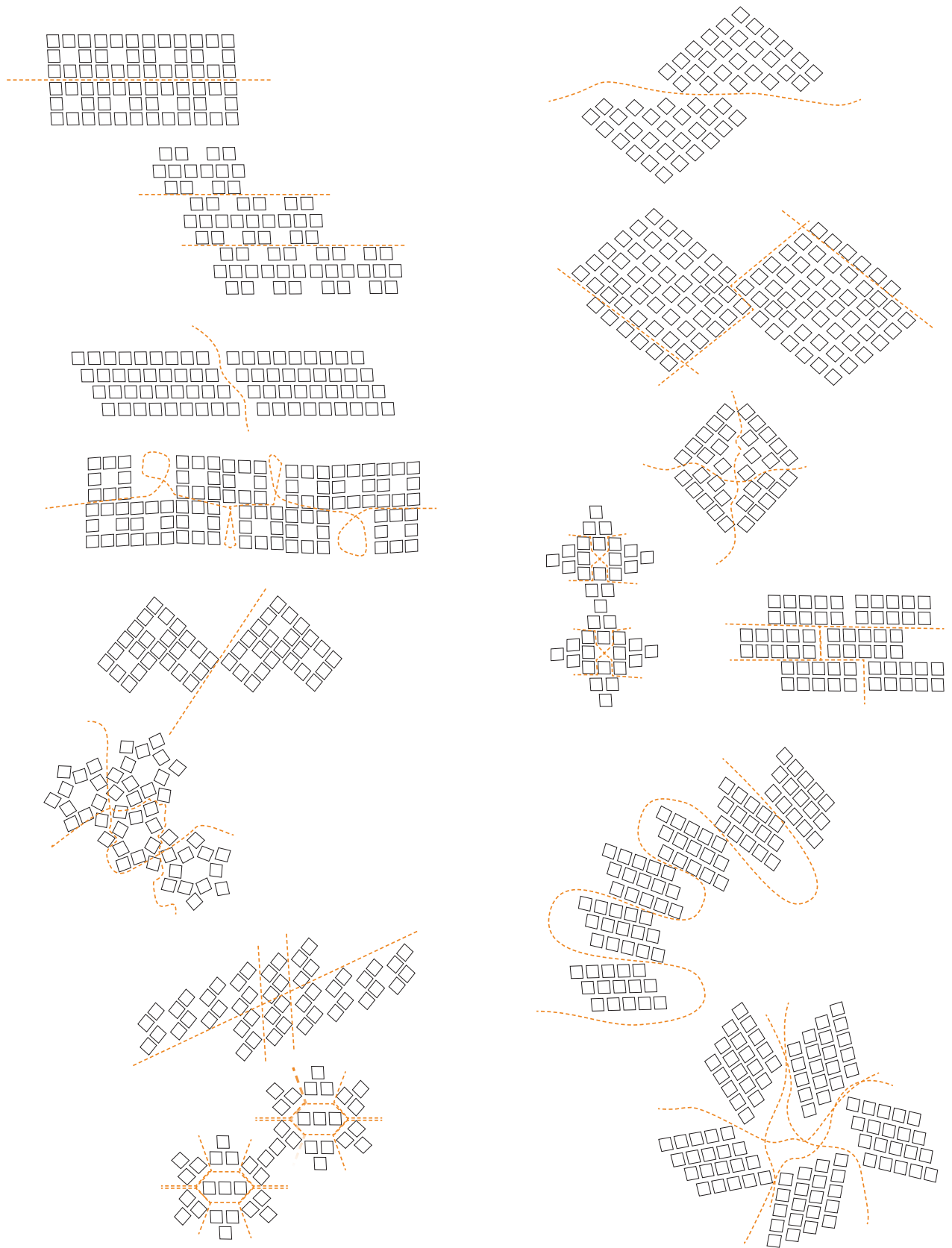
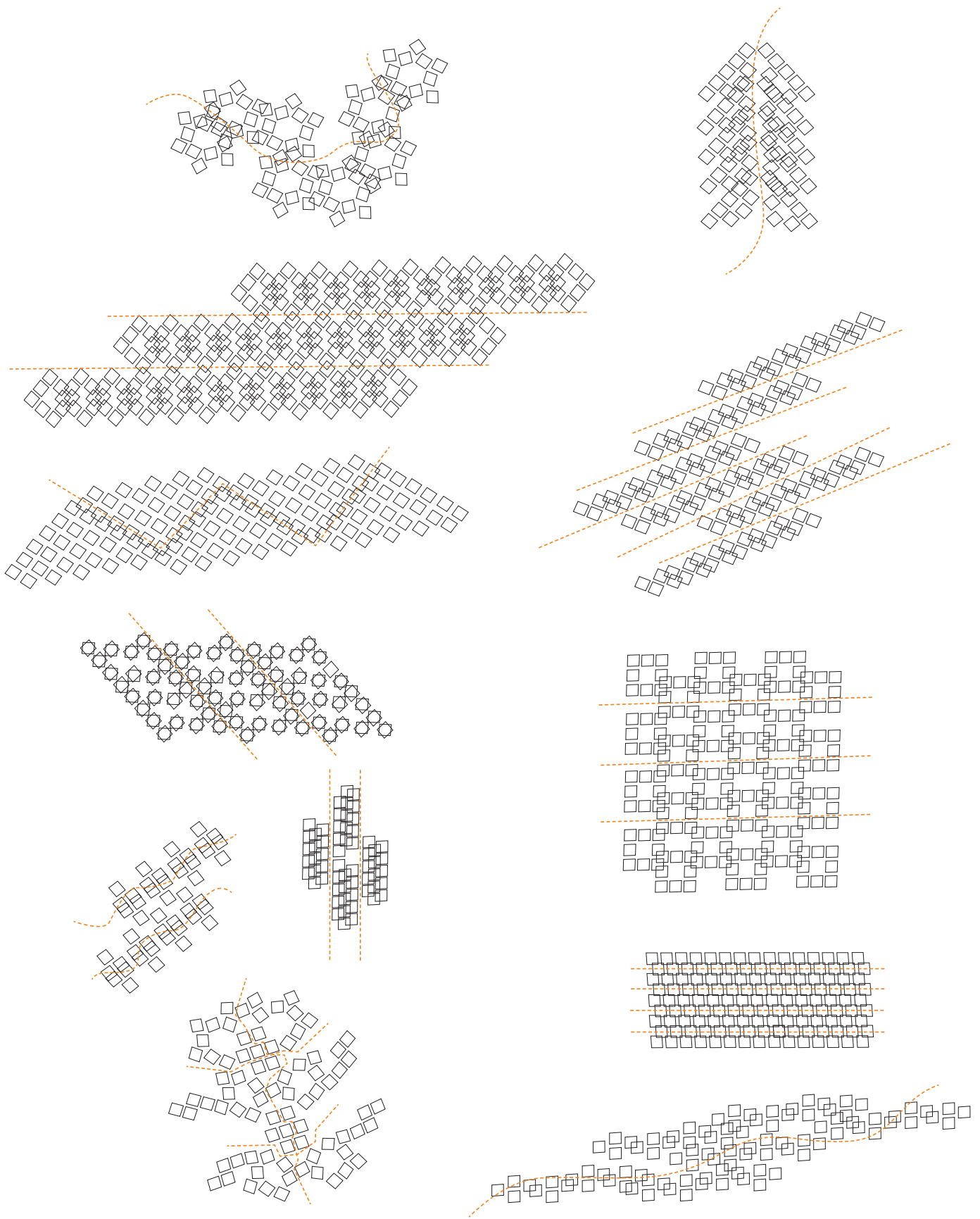


Fig.5.3 Clustering Studies  
Source: Altea, G.



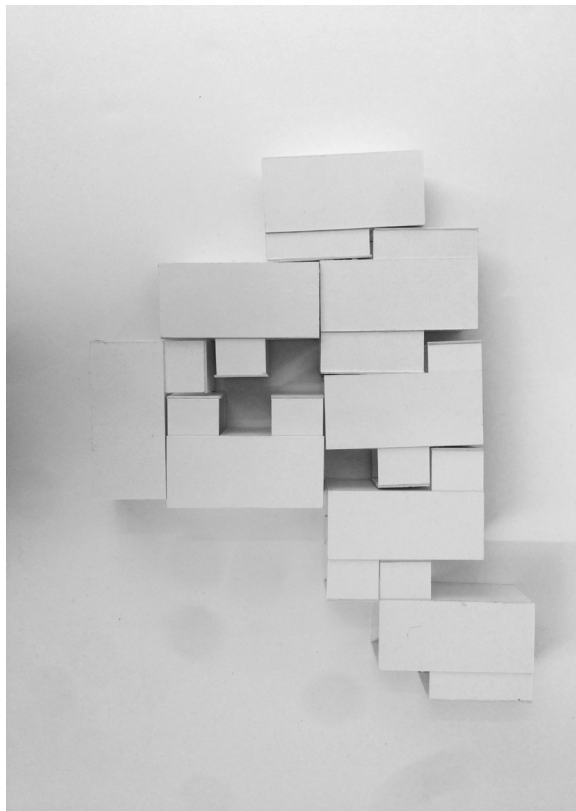
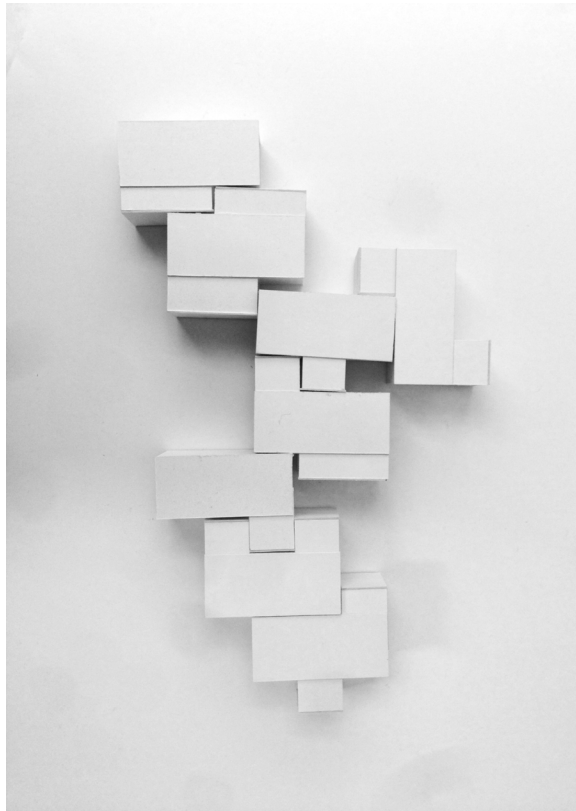
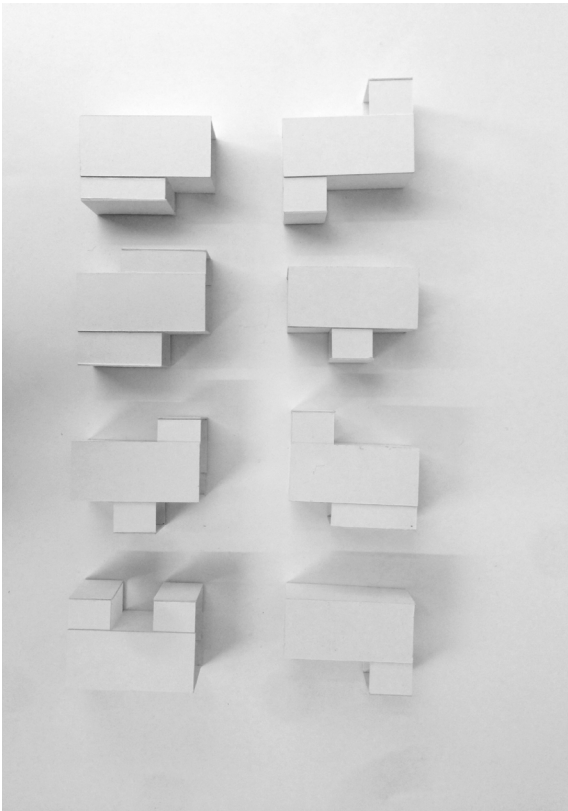


Fig.5.4 Clustering Studies  
Source: Altea, G.

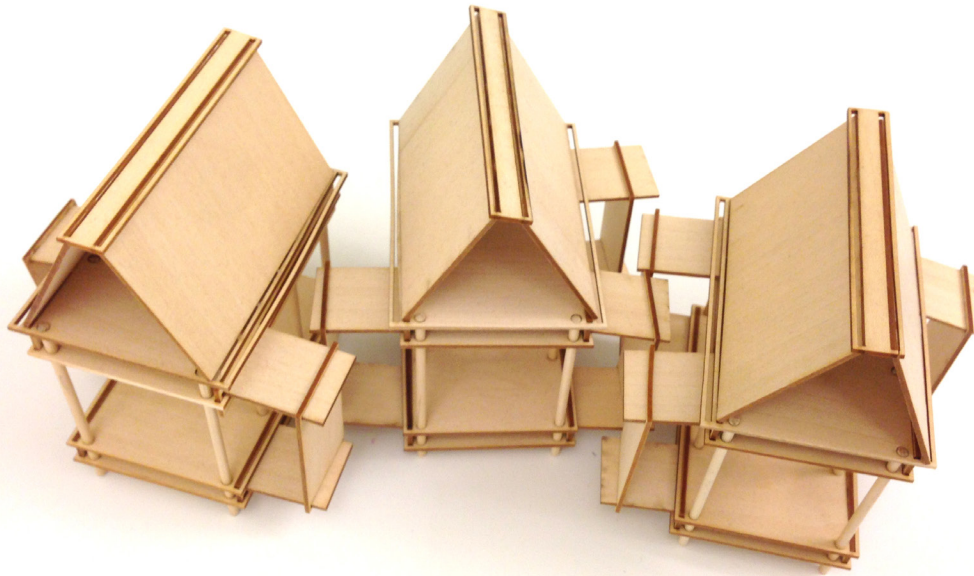


Fig.5.5 Clustering Studies  
Source: Altea, G.

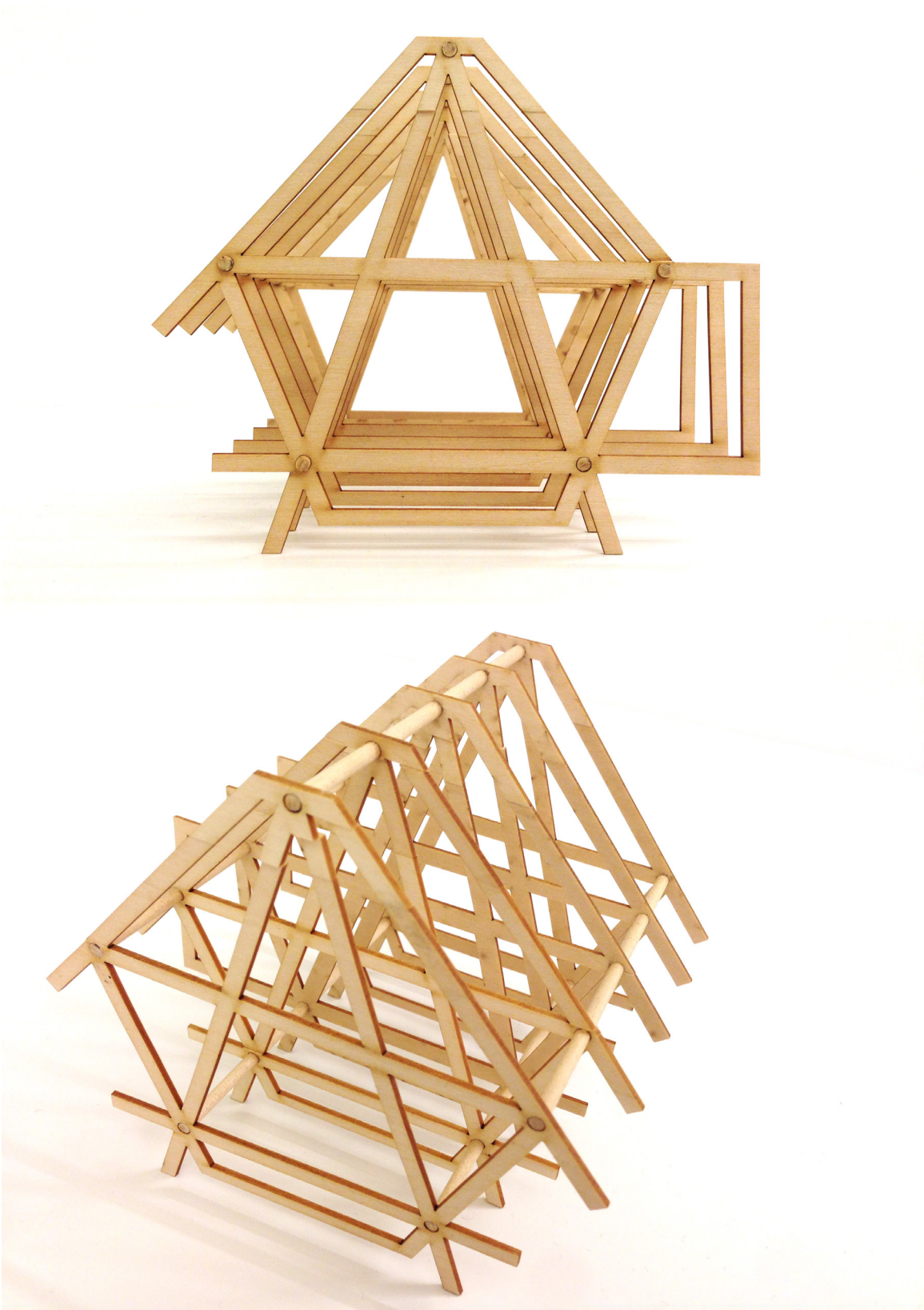


Fig.5.6 Structural Study Model  
Source: Altea, G.

### Urban Intervention

A strong social network starts with a clear demarcation of a major avenue that serves as the hub of the community and provides links to different communities (Fig.5.1). The existing spine that connects the northern part of the site to the water becomes a commercial corridor. Along the main spine, a commercial entity of storefronts and street kitchens face out into this major street. This will display the unique storefront or *sari-sari* culture that exists in the Baseco community. The programmatic elements of the communal infrastructure start with the



Fig.5.7 Site plan showing clusters and nodes.  
Source: Altea, G.

insertion of Hygiene stations along the main street corridor. These stations are placed on the site within distance from the next in order to accommodate a certain amount of people in each block. The stations are equipped with toilets, showers and outdoor troughs for washing laundry. The Hygiene stations not only provide basic amenities but also create a social hemisphere that perpetuates sharing and maintaining of these services.

The secondary paths that diverge from the major paths provide access into the “cluster” of homes that form a social haven of interaction (Fig. 5.7). These clusters are characteristic of dense and tightly spaced units, some of which become interconnected with one or more dwelling units. Within the clusters, the dwelling units face out into each other and create a node of open space or green spaces. These nodes are shared gathering spaces where religious festivities can take place. It can also serve as an opportunity to cultivate and grow food. The clustering of units reinforces a strong network of community ties that are linked back to the physical infrastructure of the neighborhood.

### *Incremental Infrastructures*

#### *A. Biogas Generators*

In each Hygiene station, it can contain 16 or more sets of toilet and shower units. As an integrated unit, together it functions through a gravity fed rainwater harvesting catchment system (Fig.5.8). A backup system of running water is also used as an alternative incase there is insufficient water supply in the rainwater basin. On the other hand, the toilets function through a biogas generator that not only tackles the slum’s sanitation issues but also creates, clean and free energy in the process. This retrofitted septic tank can utilize the existing septic tank and equip them with a new waste entry pipe that releases oxygen from the decaying process<sup>38</sup>. When waste decomposes “without oxygen, the germs die and the mixture produces a combustible gas<sup>36</sup>.” This mix of carbon dioxide and methane gas can be stored to be converted into energy to power stoves, heat homes and generate electricity (Fig.5.8)<sup>36</sup>. This retrofitted generator is cheap to build requiring only plastic pipes, sand and cement. Olatunbosun Obayomi uses Lagos, Nigeria as a testing ground for the biogas generator and states that

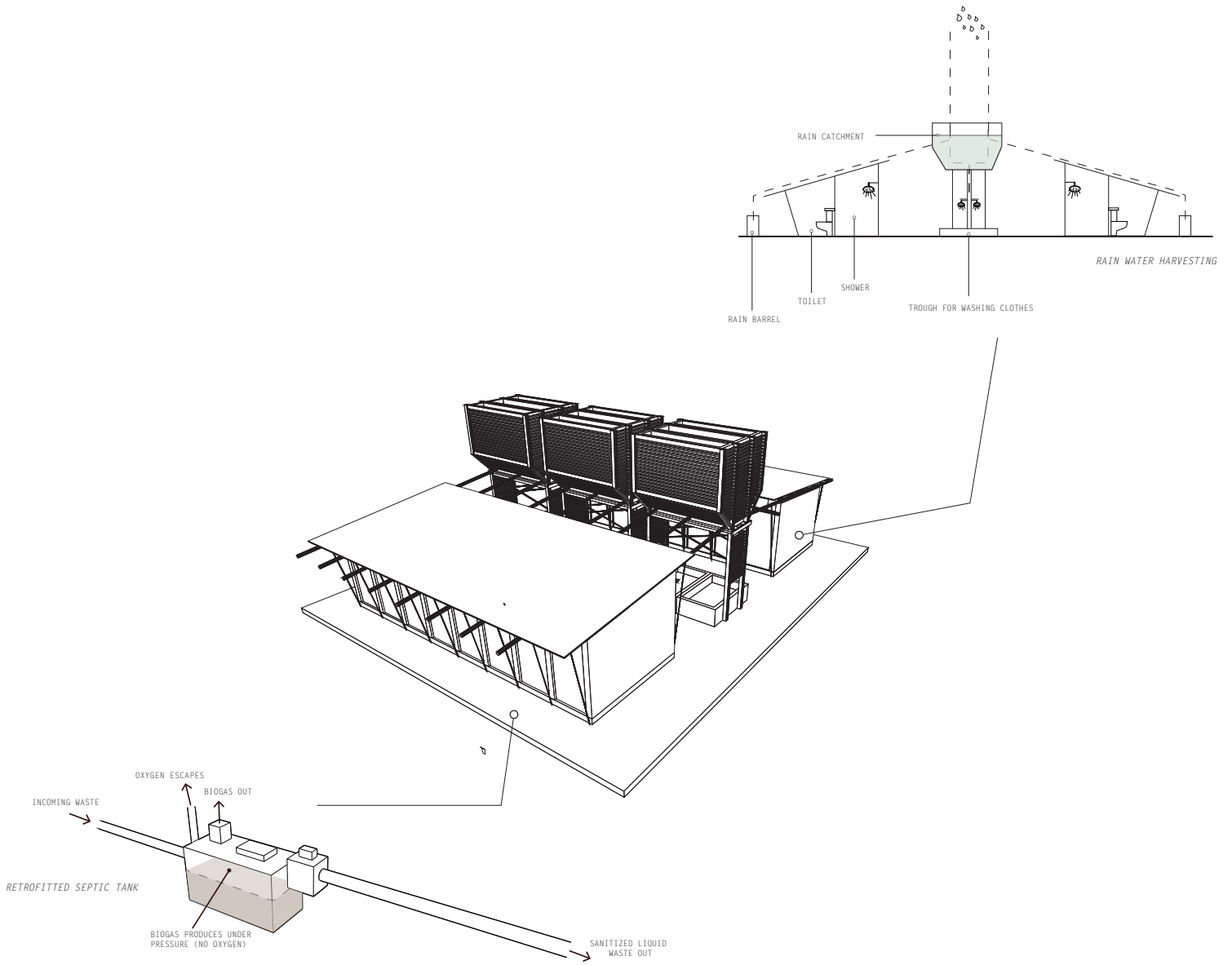


Fig.5.8 Communal Infrastructure  
 Source: Altea, G.

this can be integrated with the street grid system, water management system and energy system<sup>39</sup>. The system can be implemented within a street block that is linked to a central waste system that treats its own wastewater, produces green energy, and produces potable water<sup>37</sup> (Fig.5.9).

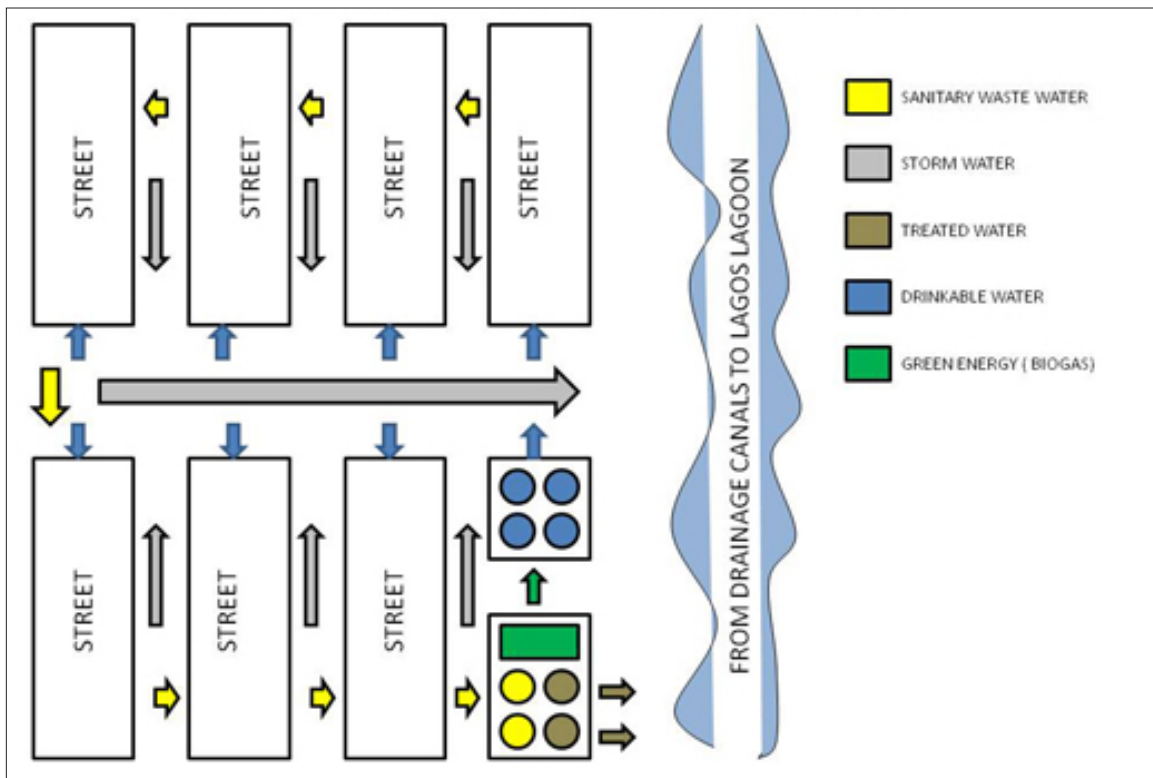


Fig.5.9 Waste Water Treatment Linked to Clean Water Provision  
 Source: <http://bioapplications.blogspot.com/2011/11/poor-urban-infrastructure-of-human.html>

### *B. Community-based Composting*

Additionally, a community-based composting system is present within each node (Fig.5.2). Composting is a process of optimizing the environment in the waste microbial activity to decompose organic matter into valuable nutrients for the soil<sup>40</sup>. Composting happens in three stages—preparation of the waste by adjusting its size, moisture content and carbon-nitrogen ratio; degradation of waste in pits, piles, or vessels; and finally curing the finished compost and screening<sup>38</sup>. Residents place their food scraps into these metal composting barrels that sit on concrete bases (Fig.5.10). These barrels can be shared among each cluster of 8-10 families. This system has been implemented in Dhaka, Bangladesh where 80% of its waste is organic<sup>41</sup>.



Fig.5.10 Community Composting in Dhaka, Bangladesh.

Source: <http://www.sswm.info/category/implementation-tools/wastewater-treatment/hardware/solid-waste/co-composting-small-scale>

### C. Re-Planting Mangroves

Following the recent global impacts of climate change, efforts to replant coastal zones with mangrove forests is essential in the protection of the shoreline and its people. Baseco was once a location of existing mangroves and so it can take advantage of this approach as its first line of defense against future storms. Moreover, mangroves also prevent the erosion of Baseco's shoreline, which is constantly subjected to harsh environmental conditions, and also serve as carbon sinks against global warming. Due to these long-term benefits, this thesis proposes re-planting of mangrove forests along the shoreline to the south of site, close to the intertidal bay, provided that it will become a 'no build zone'(Fig.5.1, 5.11). Growing mainly in tropical and subtropical regions in fine, salty sediments, mangroves can shield cities and towns from rising seas and storm surges thus creating a natural barrier between land and ocean. Mangroves, along with salt marshes and other wetlands, can mitigate global climate change since it can sequester carbon more efficiently than terrestrial forests<sup>42</sup>. The rehabilitation of mangroves must be done in brackish-water aquaculture pond environments, the original habitat of mangroves. On the southern portion of the site exist an intertidal zone with a mudflat, a possible planting location on the bay (Fig.5.11). Since Baseco is a natural habitat for mangroves, Rhizophora seedlings also known as the red mangrove, can flourish



Fig.5.11 Mangrove Rehabilitation on Manila Bay  
Source: Altea, G.



### *Dwelling Intervention*

A modular housing typology that can grow and expand to the needs of each family is an ideal intervention that facilitates and connects without imposing and emerges literally from the community it serves while connecting back to the infrastructure of the rest of the compound (Fig.5.12).

The design program caters to single families of 2-4 members and extended families of 5-10 members. The housing unit provides a place to sleep, eat, store person-



Fig.5.12 Baseco community with new shelters.

Source: Altea, G.

al items, sell goods, and shelter from harsh elements (Fig.5.13). The program includes living areas that become a flexible space. These spaces can be used as a kitchen, for sitting and sleeping. The kitchen doubles as a storefront, which serves as the extensions of the module. A linear storage space is integrated under the floorboards of the second story for protection from the water. The private sleeping areas are located on the second story, separated from the public spaces below (Fig.5.14).



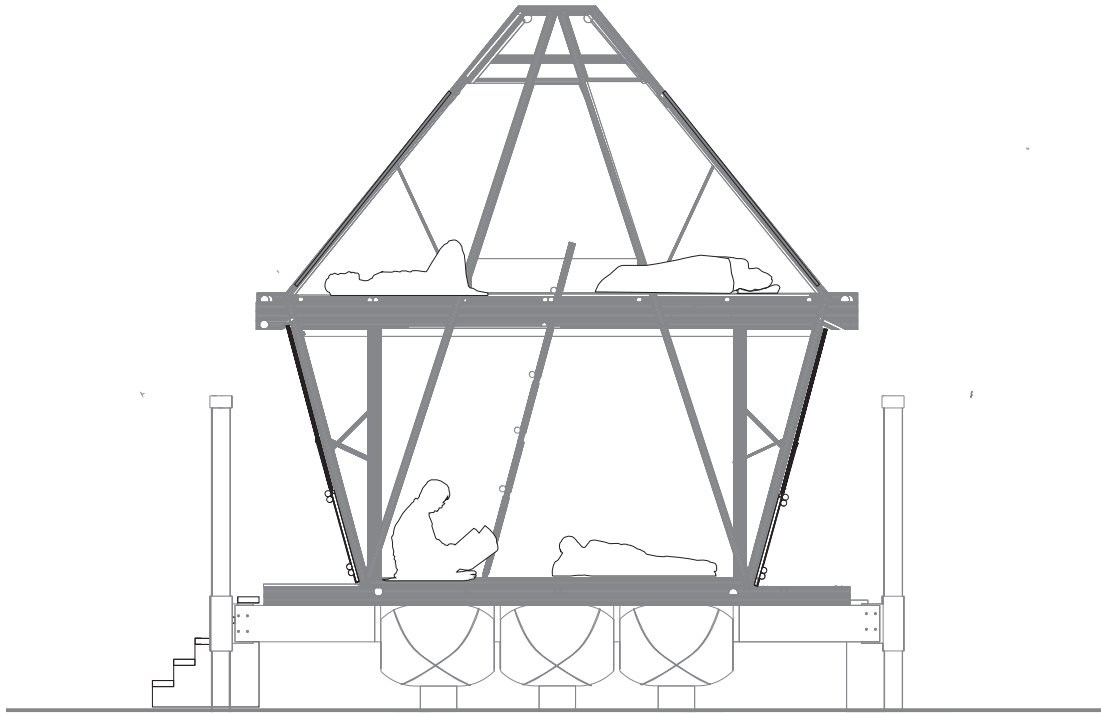


Fig.5.13 Typical dwelling unit without additions.  
Source: Altea, G.

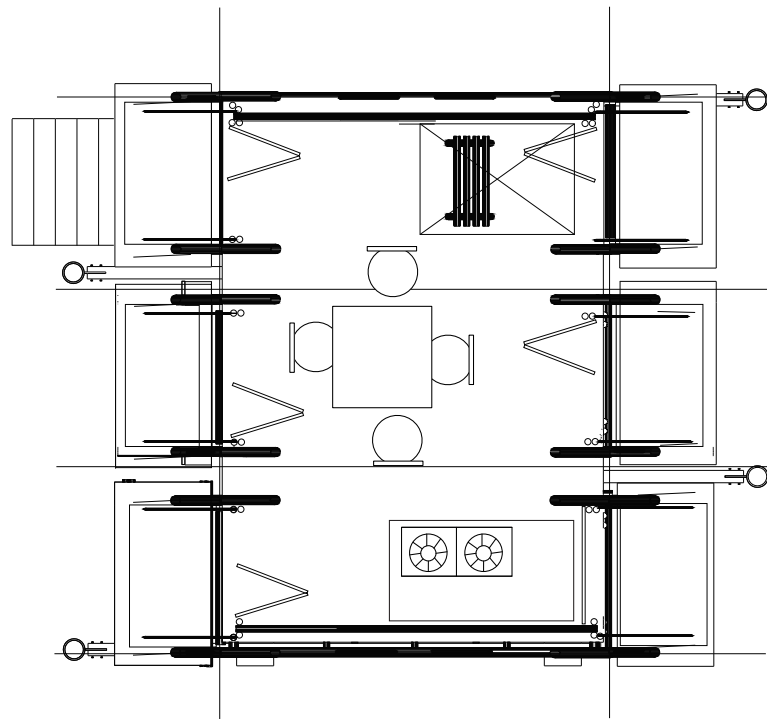
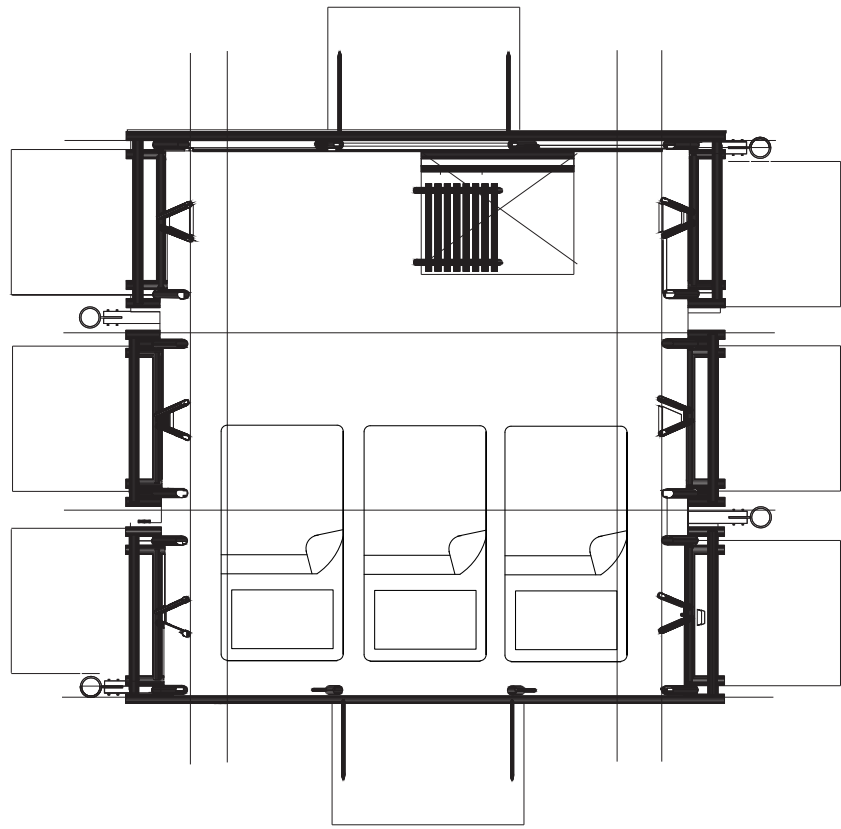


Fig.5.14 Ground and Upper Floor Plans  
Source: Altea, G.

The open plan is designed to accommodate a growing family that is true of each family in Baseco. The typical layout of the basic and smallest dwelling unit is 10' x 15' (Fig.5.13). Extensions can be made on each module with 4' x 5' separate additions that attach to either side of the module (Fig.5.15,5.16).

These dimensions are derived from observing “squatter” postures in relation to the spaces that surround them. In the squatters typical crowded space, twisting and squatting is a natural body experience (Fig.5.17). Small spaces can serve as an advantage for these users—objects are close and within reach and provides a sense of security.



Fig.5.15 Dwelling unit with two additions.  
Source: Altea, G.

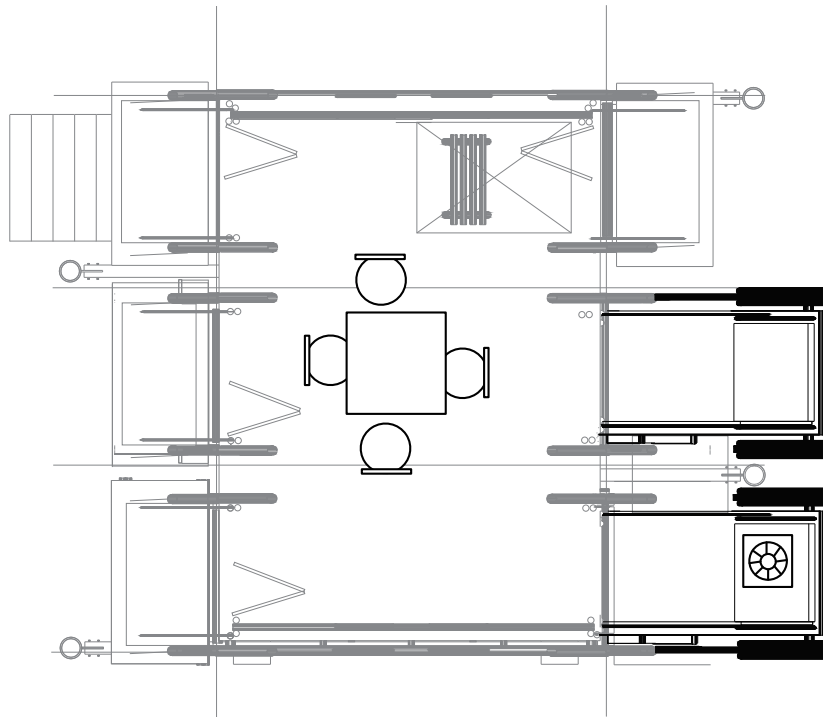
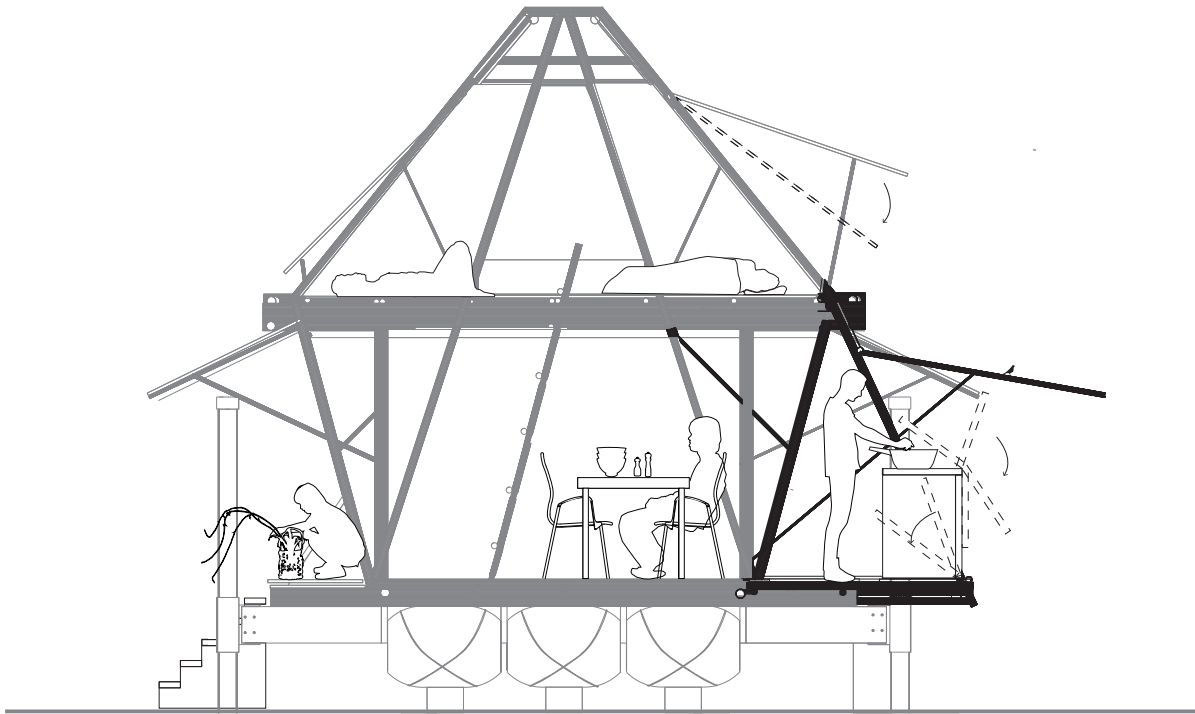


Fig.5.16 Ground floor plan and section of dwelling unit with two additions.  
 Source: Altea, G.

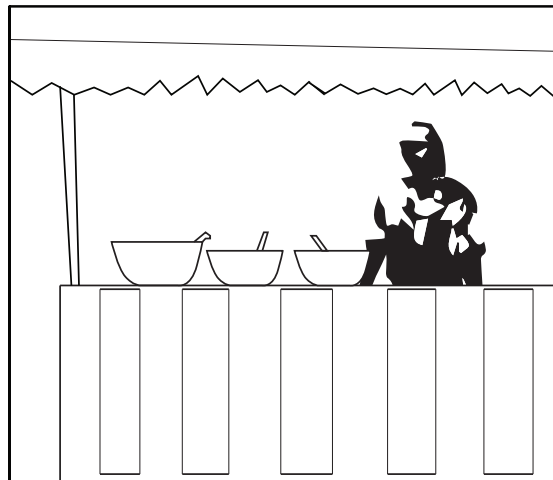
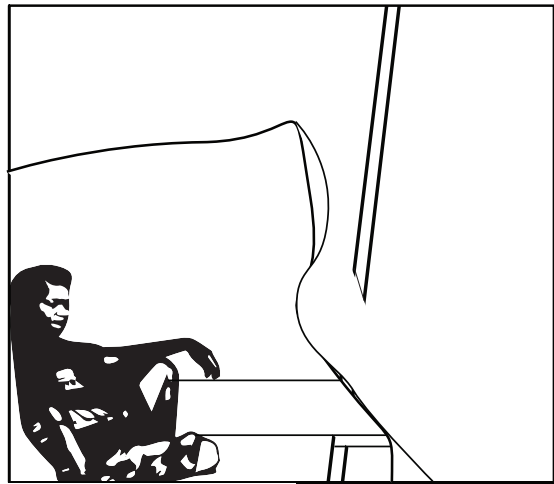
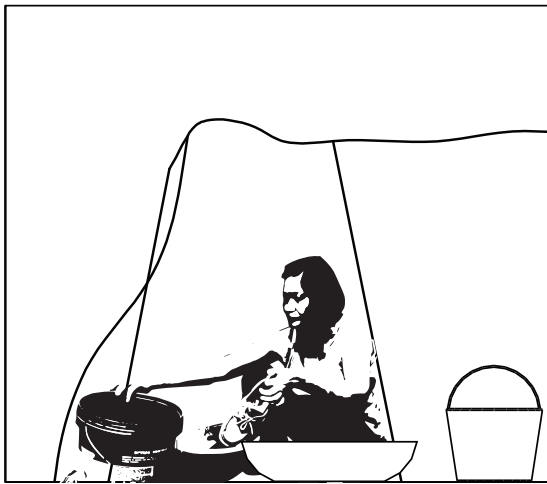
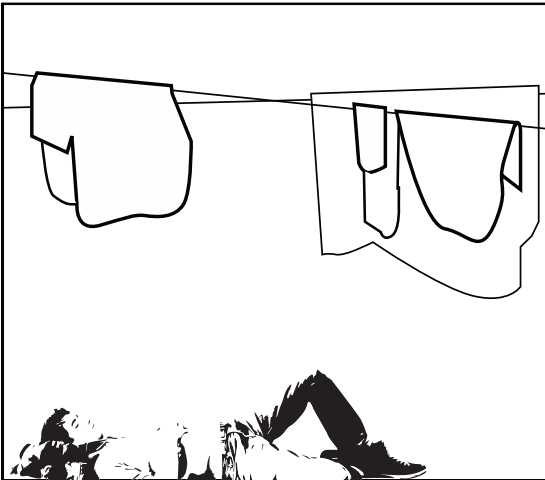
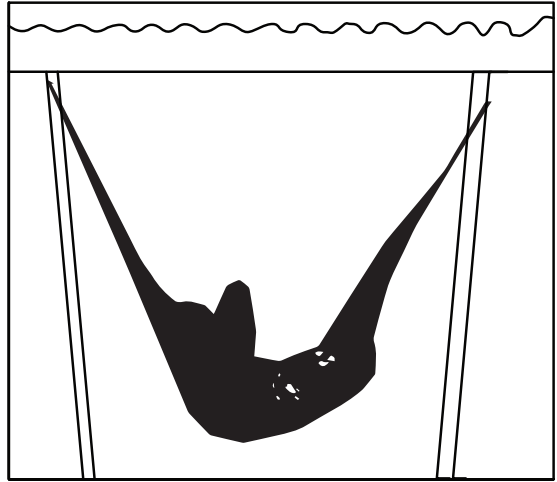
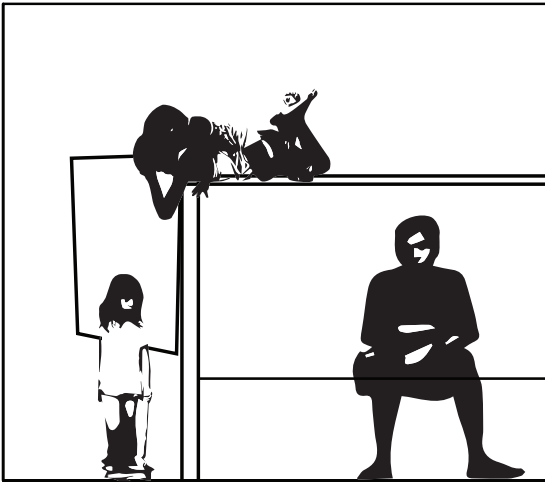


Fig.5.17 Squatter poses.  
Source: Altea, G.



The additions can be tailored specifically to each home based on the needs of each family. It can be utilized in multiple ways—a storefront in which the user can sell the goods and food that they make for their customer, or it can be used as an extension of the kitchen (Fig.5.18, 5.19). In Baseco, the kitchen is the most utilized space of the home and provides a place of engagement, while to others it is a venue for a meager source of income (Fig.5.18, 5.21).



Fig.5.18 Dwelling unit with three additions.  
Source: Altea, G.

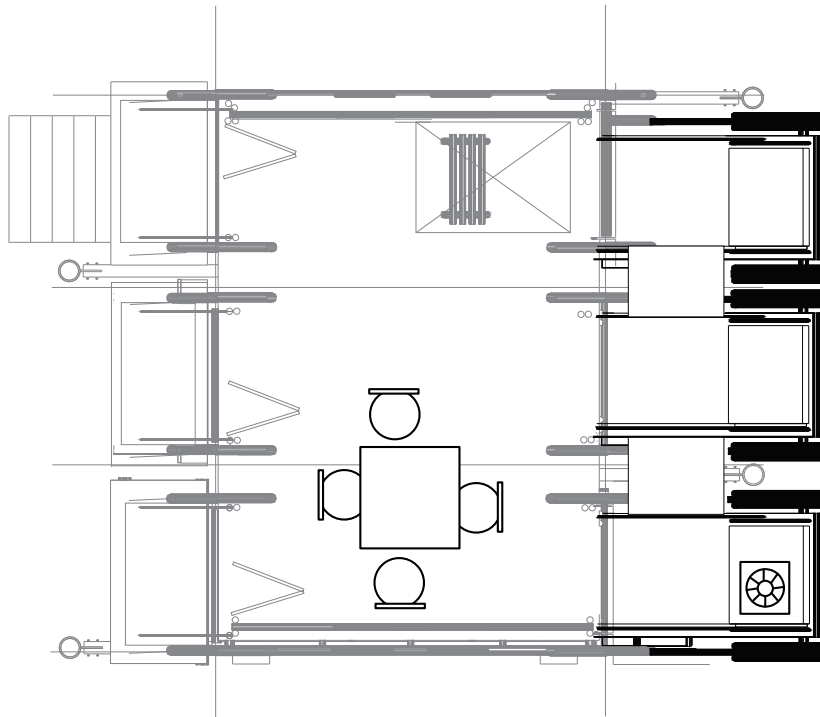
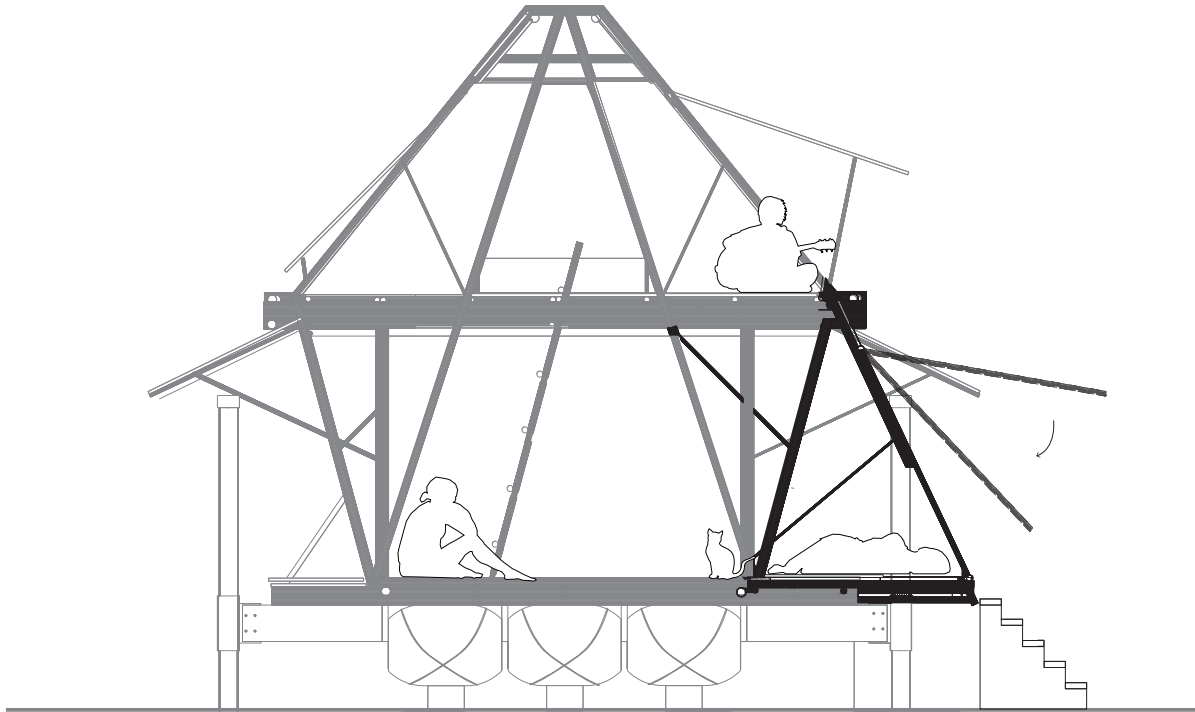


Fig.5.19 Ground floor plan and section of dwelling unit with three additions.  
 Source: Altea, G.



Fig.5.20 Dwelling unit with three additions.  
Source: Altea, G.

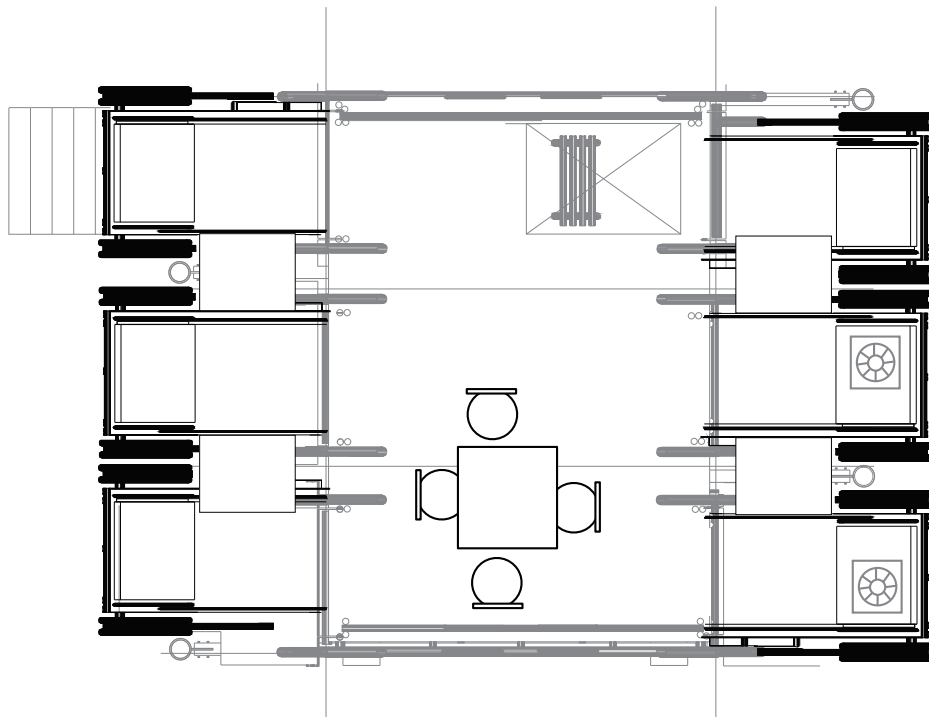
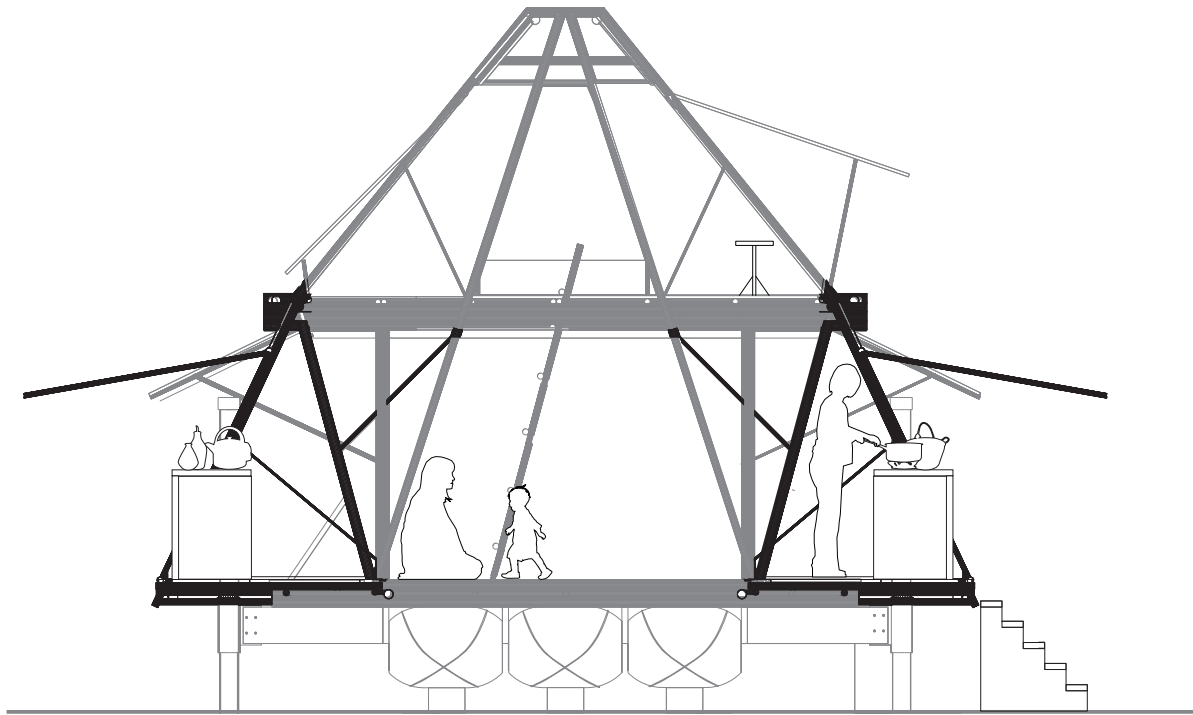


Fig.5.21 Ground floor plan and section of dwelling unit with six additions.  
 Source: Altea, G.

### *Materials*

The structure's framework is made from different sizes of bamboo—a local, overabundant and underused material in the Philippines. Bamboo underlies so much of the Philippine culture as it is part of every ceremony, traditions, and beliefs. Use of bamboo in construction of houses in Manila has not been extensive since the grass is not recognized as a conventional construction material under the building code<sup>44</sup>. Many foresee the rise of bamboo in the property industry as timber replacement due to the lack of scarcity of wood. Bamboo is a larger type of grass that grows with thick stems and made up of additional culms (stems). The strength and support of bamboo is very high with its tensile strength per weight compares favorable with tree wood and even steel. The lightweight structure combined with its strengthening properties makes bamboo an ideal building material to use for an area that is prone to high winds.

Bamboo stalks of 3"-4" in diameter is used to build the framework. The wall material is made up of bamboo and a nylon sheet that is used as a rain shield. Thinner bamboo stalks are used for wall, floor and roof coverings. This type of cladding is suitable for the local climate.

The base frame is constructed in a different material to withstand water damage. The base is made of laminated timber with steel tension rods for added strength. Much like a floating pier, the base is attached to steel piles that keep the house anchored to the ground. Plastic recycled water barrels are attached to the frame for buoyancy.

### *Construction & Building Methods*

The construction of the house is designed to be built on site by local residents. It is composed of a kit of parts that can be assembled in sections. The house is made up of three parts—the house, the base frame and the foundation. While the base of the house rests on a set of poured in place concrete foundation when not floating (Fig.5.22), the steel pylons, which serve, as a vertical guide for the house to rise with the changing water levels, is also the foundation in which the house is kept elevated

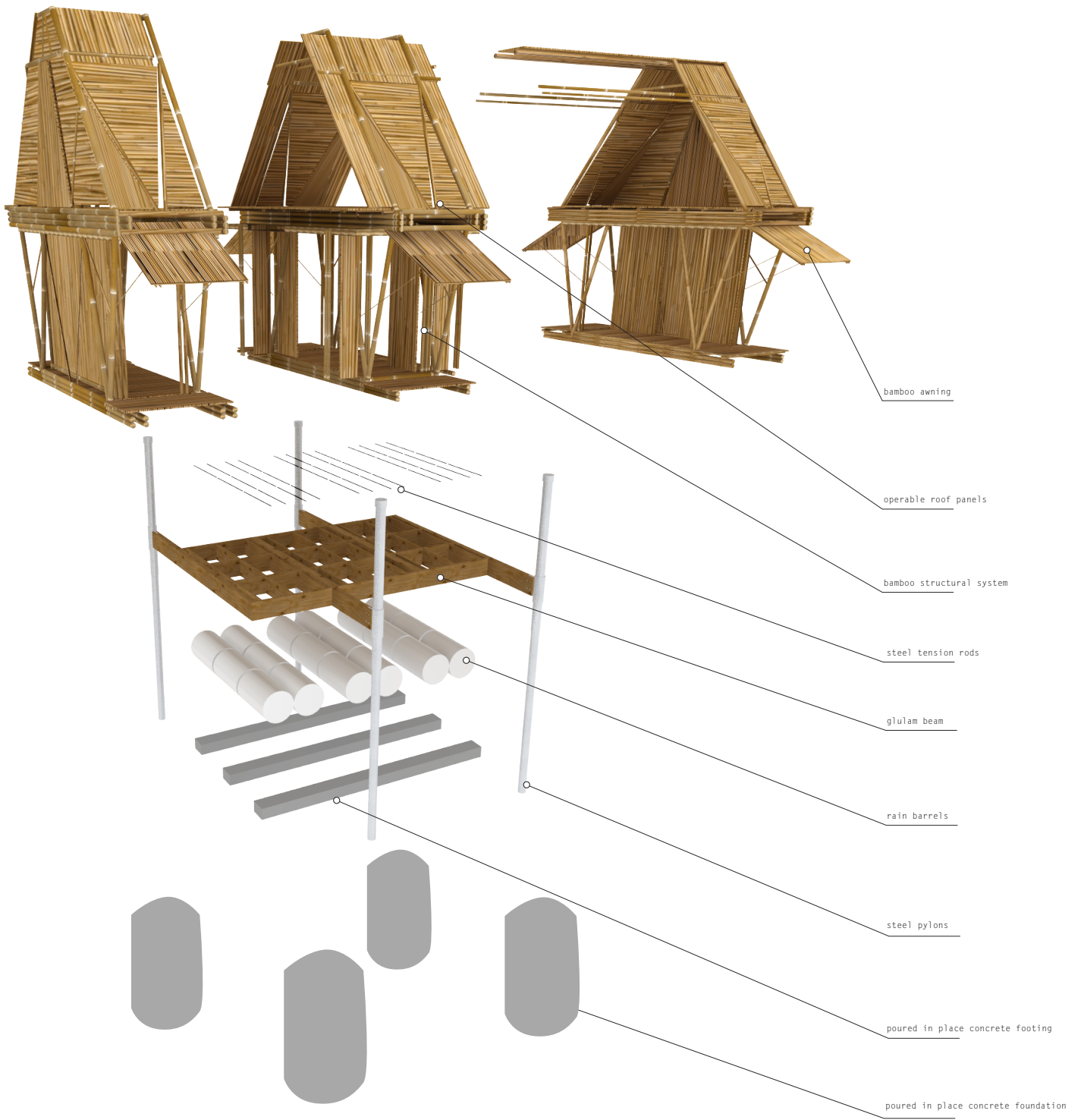


Fig.5.22 Kit of Parts  
 Source: Altea, G.

from the ground. Attached to the base frame of the house are empty plastic water barrels used as a floatation device (Fig.5.22). The dwelling unit consists of 3 bays of 5' x 10' sections that are 14' in height (Fig.5.23). The simple 'A' frame shape allows for minimized wind exposure during typhoons and hurricanes (Fig.5.23). Triangular cut outs on the roof open on either side to allow for natural ventilation (Fig.5.28).



Fig.5.23 Kit of Parts  
Source: Altea, G.

In a typical dwelling unit, the patio floors and awnings on the periphery of the house close during turbulent weather. In each bay, these can be changed out for the modular addition. The additions also have openings that become awnings and close during inclement weather (Fig.5.19). If more than one addition is used on the same side of the house, the walls can be removed and the floors can be extended to allow continuous movement inside. Up to 6 additions can be made to the module depending on the needs of the family (Fig.5.26). These additions also play an important role in densifying the community. The culture of extended families is quite common in Baseco, therefore these houses can be linked to each other by using these additions.



Fig.5.24 Dwelling unit without additions.  
Source: Altea, G.



Fig.5.25 Dwelling unit with additions.  
Source: Altea, G.

Bamboo building techniques and joinery are utilized in the construction of the house. The bamboo members are assembled by bolting, binding, and lashing. The columns of the house are made up of 2 members of bamboo that are joined by using dowels and clamping (Fig.5.27). The beams are formed by 4 or 6 members of bamboo where the top row is separated from the bottom by wood slats (Fig.5.28). Double rafters are secured by stacking and lashing in place while corner joints use dowels and clamping fitters (Fig. 5.29). Splicing of bamboo to create an external union is used to attach the additions on the module (Fig.5.30).



Fig.5.26 Dwelling unit with all additions.

Source: Altea, G.

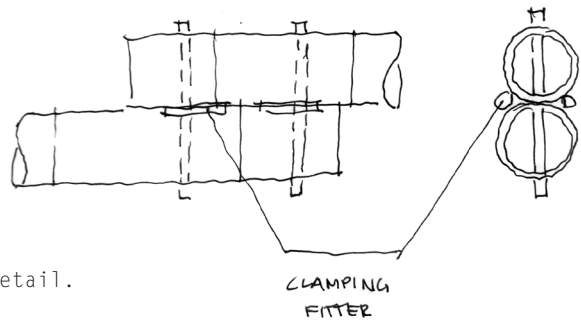
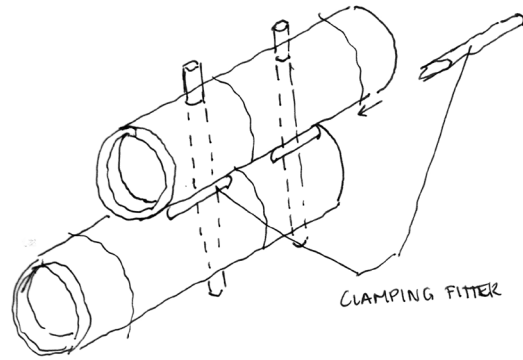


Fig.5.27 Column detail.  
Source: Altea, G.

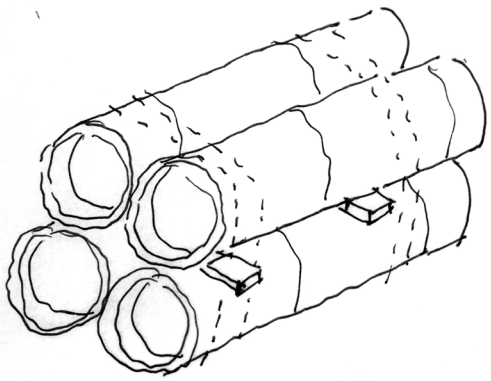
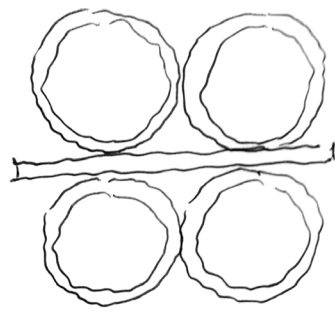


Fig.5.28 Beam connection detail.  
Source: Altea, G.

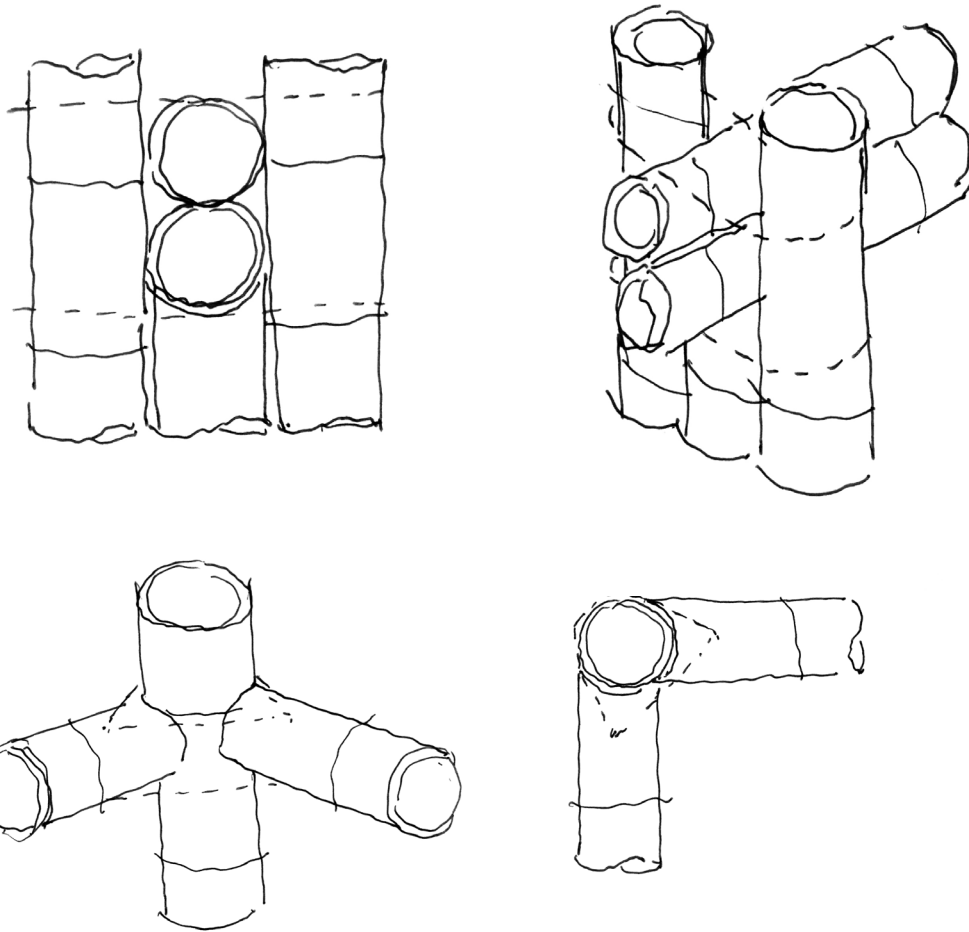


Fig.5.29 Double rafter connection detail.

Source: Altea, G.

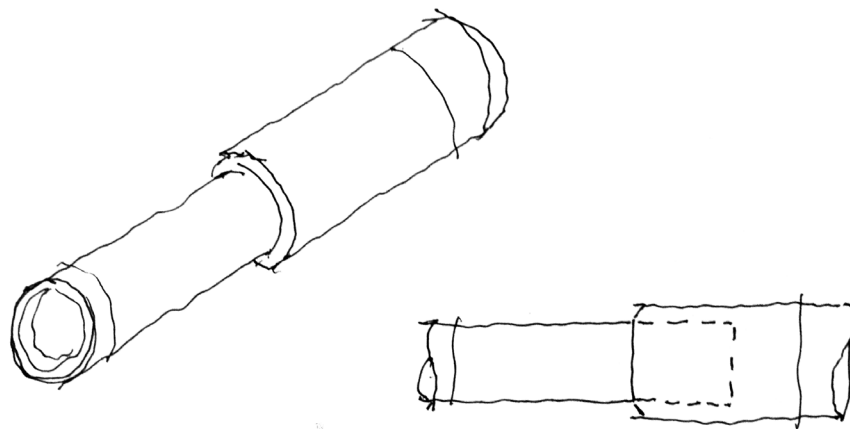


Fig.5.30 External union detail.

Source: Altea, G.

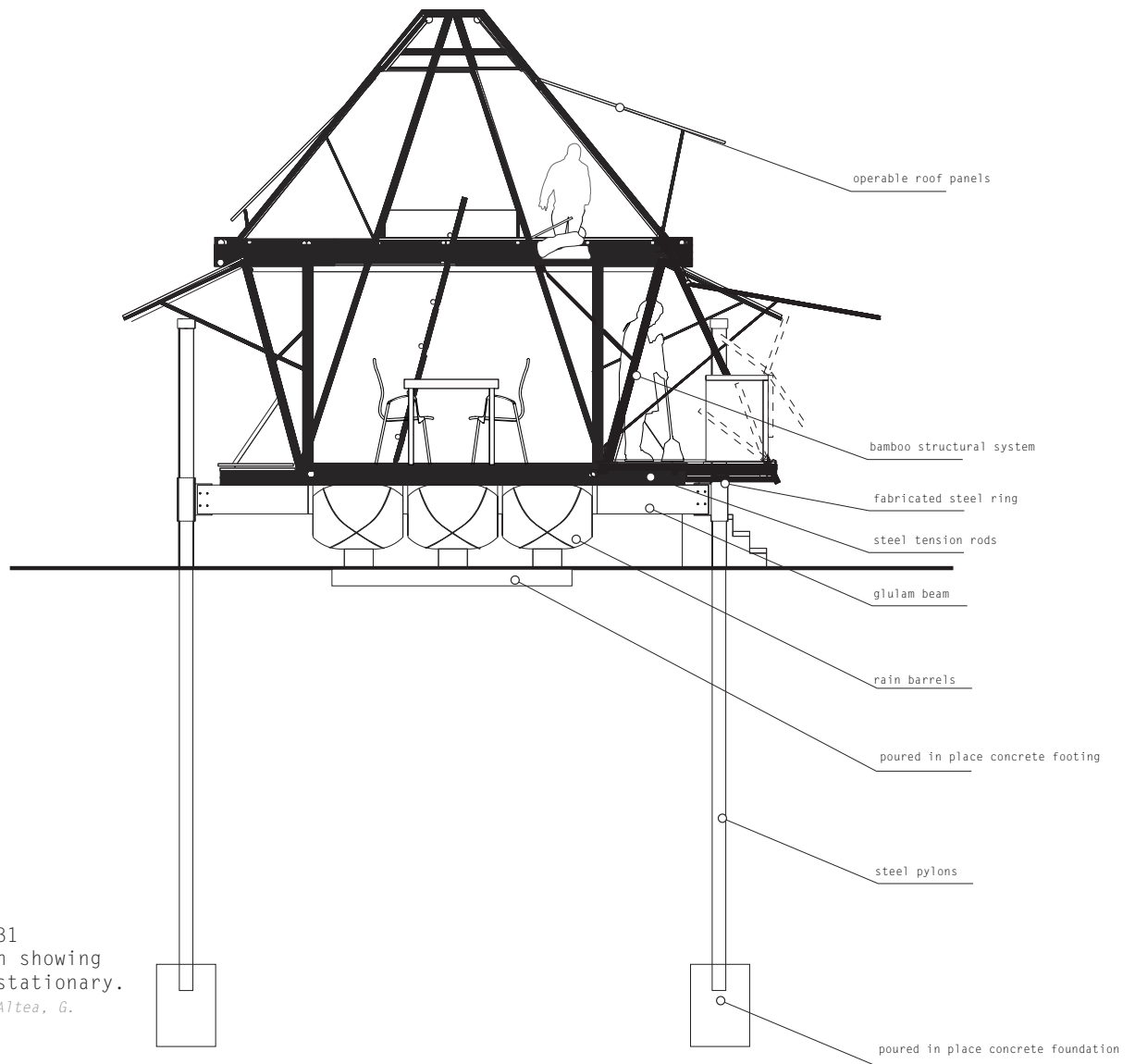
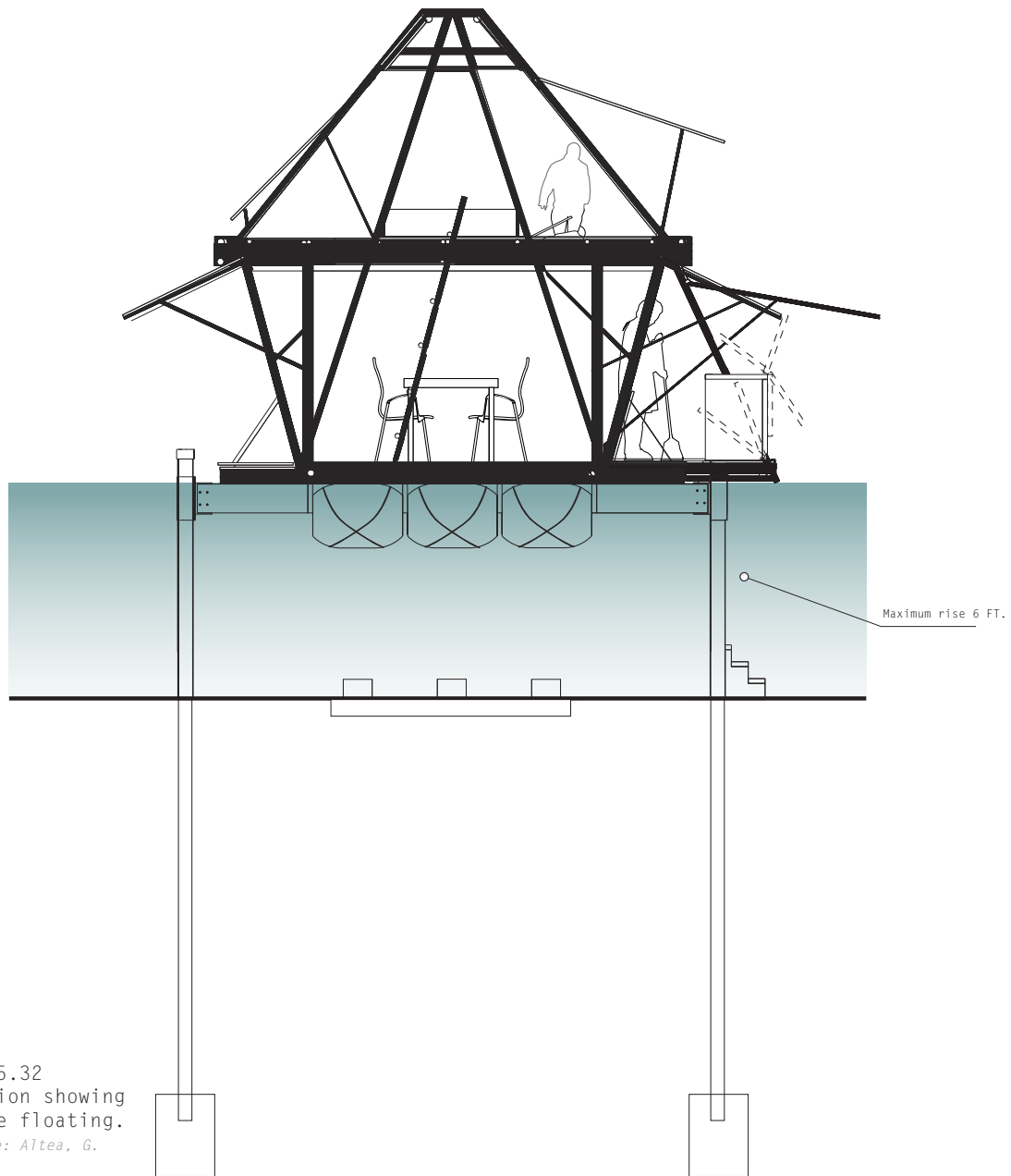


Fig.5.31  
Section showing  
house stationary.  
Source: Altea, G.

### *Anti-Flooding System*

In response to the frequent flooding in Baseco, a flood resistant home that can rise and fall with the water levels during high floods can provide a safe shelter and protect the house from damage. This amphibious structure is anchored to a set of steel pylons that provide a vertical guide for the dwelling unit to move up and down (Fig.5.31, 5.32, 5.34). As water levels rise, the house is lifted from its concrete base and floats by means of the water barrels located on the underside of the base. The steel columns act as a vertical guide to keep the house tethered in place while rising up to a maximum height of 6'. The steel pylons are embedded in concrete columns



that are driven about 10' into the ground. All 4 steel anchors are placed on alternating sides in each bay to prevent twisting. The glulam base of the house is longer on either side so it can attach to the vertical steel guides. The joint that connects the laminated timber to the steel pylons is the only pre-fabricated piece in the module (Fig.5.33). The fabricated steel ring allows the house to rise up and down in time of flooding. The initial design proposal integrated the vertical steel guides within the structure of the house. However, keeping the vertical guide system separate from the house would allow easy repair and change of parts if needed. The sizing of the steel columns and concrete foundation is still being explored in this thesis.

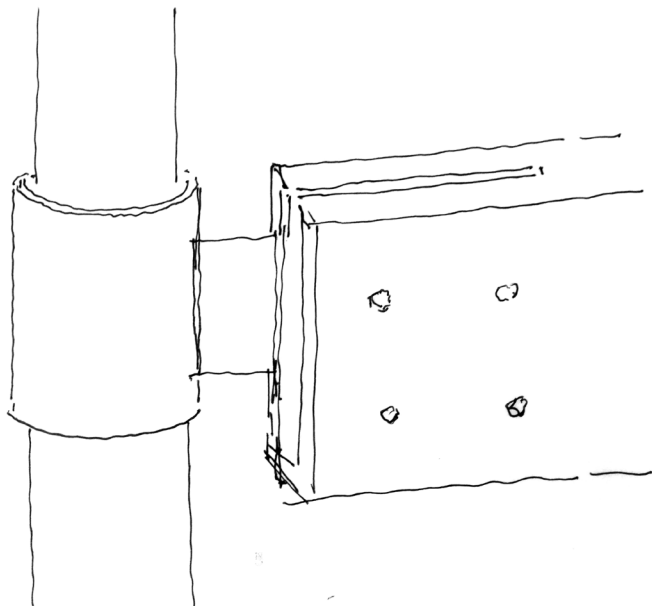


Fig.5.33 Fabricated steel ring detail.  
*Source: Altea, G.*

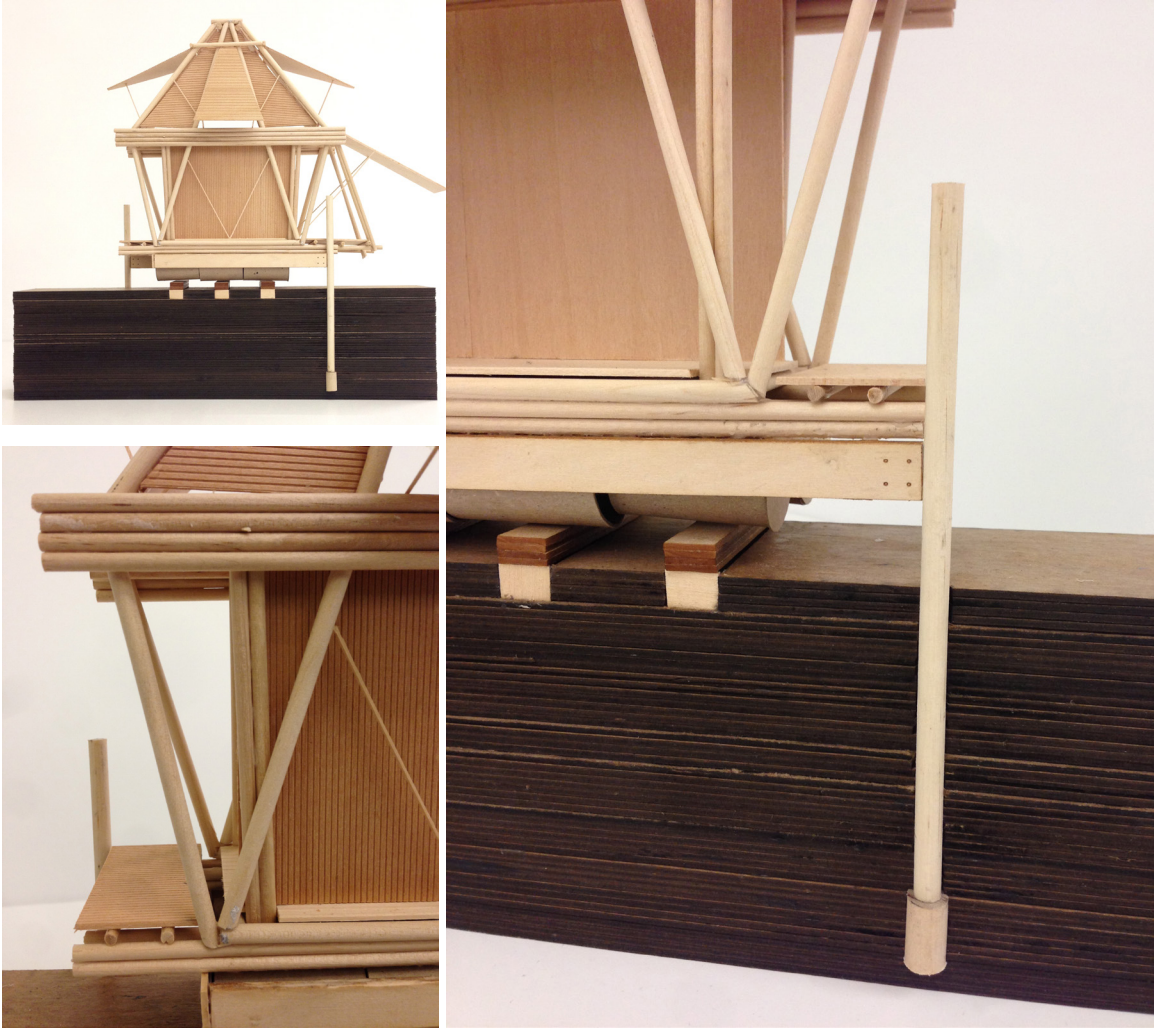


Fig.5.34 Sectional Model  
Source: Altea, G.

## C O N C L U S I O N

*“The problem is not architecture. The problem is the reorganization of things which already exist.”<sup>2</sup>- Yona Friedman*

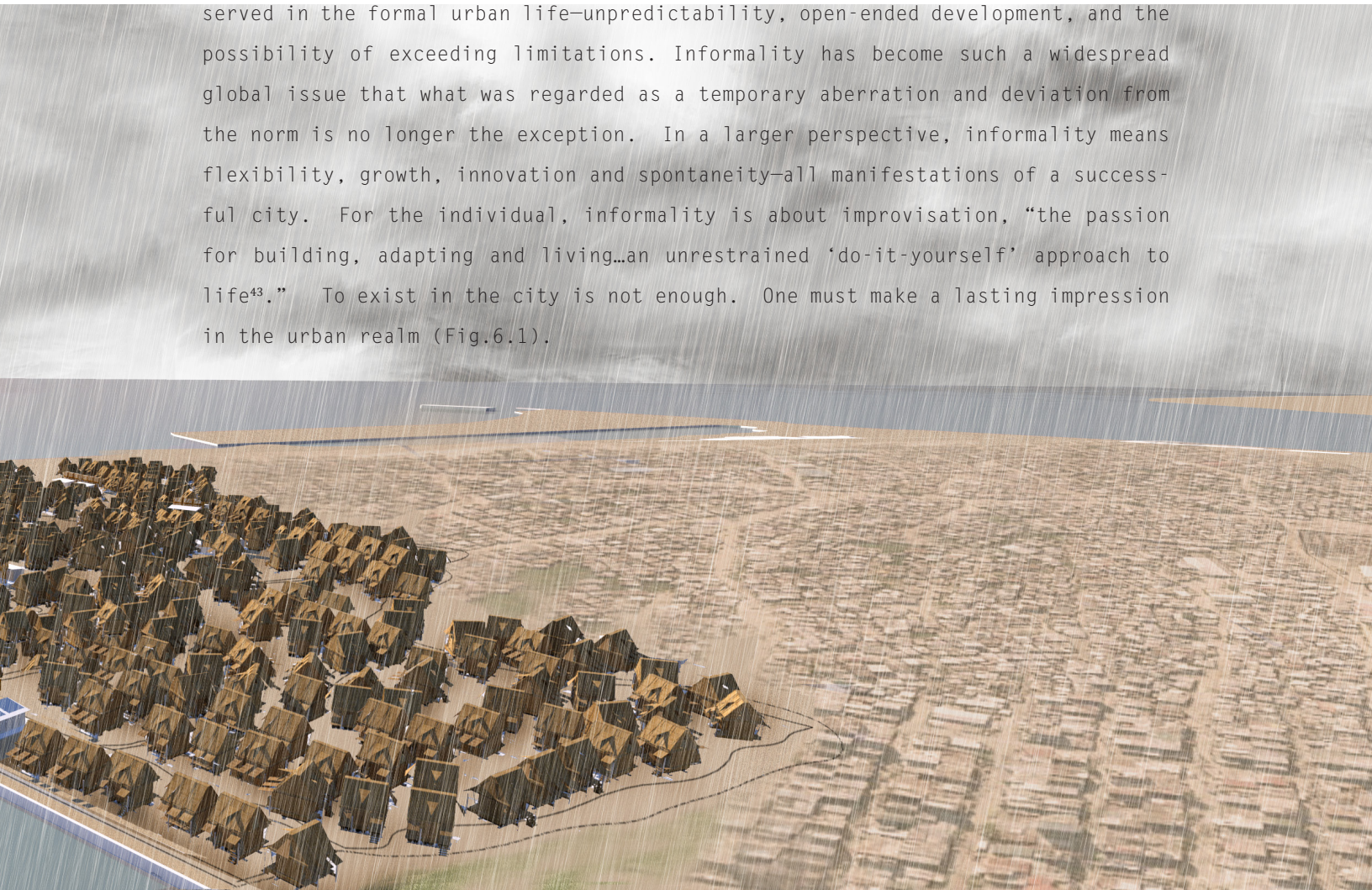
It is evident that slum rehabilitation cannot begin with architecture alone, but rather it is about contributing to a larger vision. This larger vision is part of a long-term maintenance that is significant in slum upgrading. It is true that “the sewer is the conscience of the city”<sup>45</sup> and that the insertion of communal infrastructure for slum communities is a starting point for rehabilitation. In the end, the architecture becomes a supporting system to the whole, a kind of incremental infrastructure. The larger vision for this intervention is not only to create a sustainable system of public sanitation, but also make sense of the largely unplanned city by making interventions that reinforce the public realm.



Fig.6.1 Aerial view of site with communal infrastructure and new modules.  
Source: Altea, G.

Baseco Bay represents the potential to challenge and test the inevitable. *“Building on water is the solution to shortage of space: water provides space without having a negative effect on existing functions.”* Baseco is a community built on this very idea and continually embraces the transformations disposed to them. Such as these acupunctures—the resilient floating house that echoes the floating community of the past, the utilization of an indigenous material with traditional building methods and the incremental infrastructure that builds on the essential facilities. Can an evolving community that is “temporary in nature” hold on to these vernacular traditions that has been set for them? Can this be the catalyst that helps link an informal settlement to the resources of the formal city?

There is much to learn from informality and many of which are qualities also observed in the formal urban life—unpredictability, open-ended development, and the possibility of exceeding limitations. Informality has become such a widespread global issue that what was regarded as a temporary aberration and deviation from the norm is no longer the exception. In a larger perspective, informality means flexibility, growth, innovation and spontaneity—all manifestations of a successful city. For the individual, informality is about improvisation, “the passion for building, adapting and living...an unrestrained ‘do-it-yourself’ approach to life<sup>43</sup>.” To exist in the city is not enough. One must make a lasting impression in the urban realm (Fig.6.1).



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