

# REVERT!

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a resilient *landscape design process* towards typhoon and  
flooding in Cam Kim Island, Hoi An - Vietnam



Oktaviana Miffatulani



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*A RESILIENT LANDSCAPE DESIGN PROCESS TOWARDS  
TYPHOON AND FLOODING IN  
CAM KIM ISLAND, HOI AN - VIETNAM*

*Oktaviana Miffatulani  
Msc Thesis Landscape Architecture  
Wageningen  
July 2018*

REVERT!

## COLOPHON

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Landscape Architecture Group, 2018

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*This publication is written as the final MSc Thesis in Landscape Architecture at Wageningen University, the Netherlands.*

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*This research had been realised with the support of LPDP and Stichting NH Bos*





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## ABSTRACT

*The extreme dynamics of estuary landscape makes it vulnerable towards risks of natural disaster and climate change impact affecting human habitat. Such exposure has driven this type of landscape into an unfavorable place to settle in terms of spatial planning. However, the bond between human and their habitat, called home, are inseparable and that connection has been nurtured spiritually and manifested in their daily lives. The research aimed to study a reciprocal relation between landscape layers, local coping mechanism, and current landscape situation to reduce the risk of typhoon and flood in Cam Kim Island, Vietnam. This study was started by finding the literature to give a better understanding in resilience landscape meaning and identified resilience principles that was possibly used in this study. There are modularity, redundancy, managing variables and feedbacks, and diversity. As a landscape architect, the usage of layer approach was used to identify the most important landscape characteristics of the island. Interview activity was conducted to verify the landscape dynamic in the island. After finding information based on science and local knowledge, new fourteen principles are obtained. Later, this principles were cultivated into three different conceptual design and re-identified into each resilience principles. At last, a new conceptual design that managed to enhance resilience principles called Revert! was created and manifested into design that is focused on improving soft elements and turned it into landscape infrastructure.*



*Nhất nước, nhì phân, tam cần, tứ giống*

FIRST WATER, SECOND FERTILIZER, THIRD DILIGENCE, FORTH VARIETY

*Vietnamese Proverb*

## ACKNOWLEDGEMENT

*I would like to thank people that helped me during my Thesis:*

*First of all, I would like to thank my supervisor dr. Ir. Rudi van Etteger from Wageningen University for his support, wisdom, and patience. A special thanks goes to An Nhien Farm Crew: Ngo Ti Bich Dao, Vu Ti Mi Hanh, Bui Tran Hieu, and Trinh for welcoming me, sharing the knowledge, helping me to do the interviews, and offering me an immersive experience of Vietnamese culture. Moreover, I would also like to thank Huynh Thi Ngoc Chau and Thao Minh Tranh who are also introduce me to inspiring people during the site visit.*

*I would also like to thanks to the inhabitants of Cam Kim Island for a very warm greetings and also Stephanie Geertman who also linked me with a lot of people during my site visit in Vietnam. Lastly, I want to thank Prof. Dr. Adri van den Brink who helped me giving feedback during my entire thesis process.*

*The last, I would also thank my parents and longlife partner for their endless support and also Moerbeek family for the cordiality of living in Amsterdam.*

*Thank you.*

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Fig 01. Flooding Before Typhoon Damrey Hit Cam Kim Island



*CHAPTER01//*

# INITAL DESCRIPTION

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*1.1 Background*

*1.2 Problem Description*

*1.3 Research Introduction*

*1.4 Significance*

Number of weather-related disasters reported per country (1995-2015)

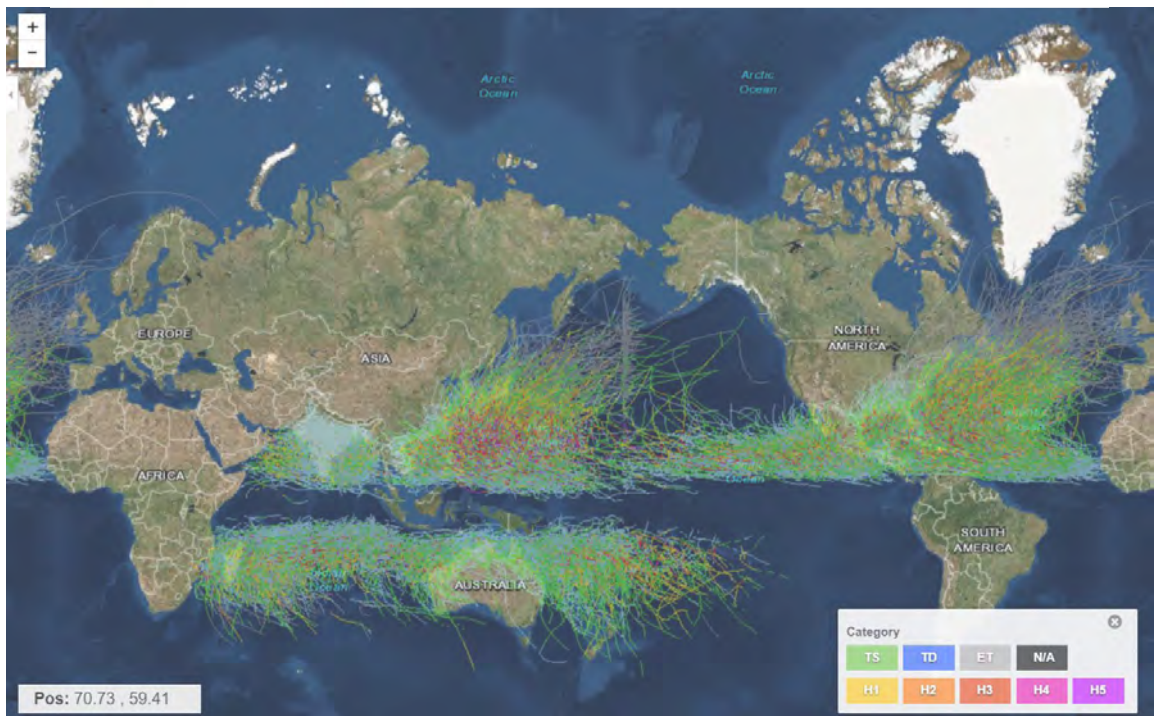
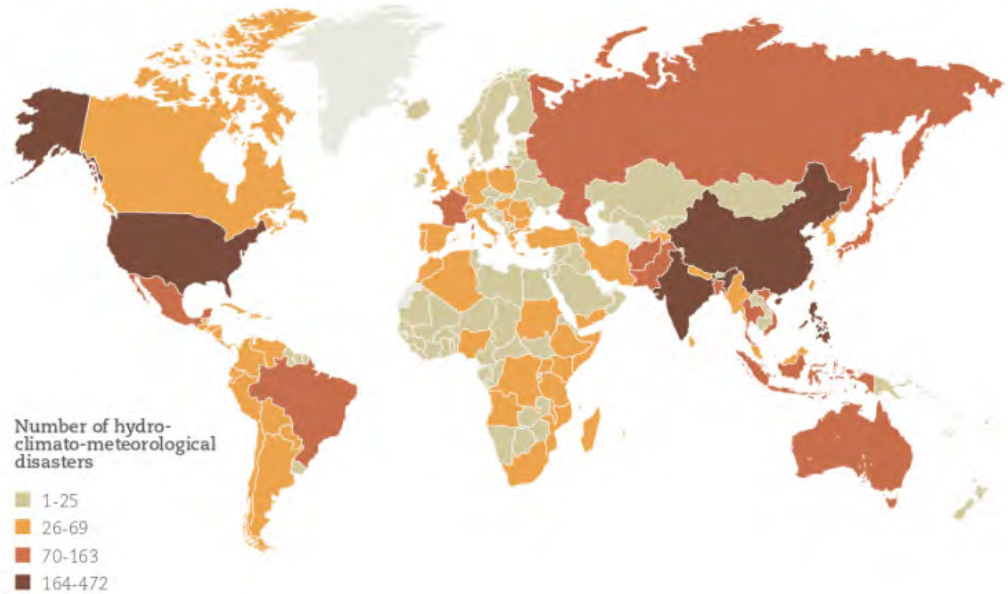


Fig 02. Number of Hydro-Climate-Meteorological Related Disaster Reported per Country (UNSIDR/CRED 2015)  
- Above

Fig 03. Historical Track of Storms All Over the World from 1955-2015 (NOAA 2017) - Below

# 1.1 PREFACE

---

## 1.1.1 TYPHOON EXPOSURE AS A BACKGROUND

According to UNSIDR (2015), Asia has the most influential weather-related disaster compared to other continents in the world (Fig 02). *'The Human Cost of Weather Related Disaster 1995-2015'* report mentions that the weather-related disaster has increased and the number of floods and storms are 14% higher than in the previous decade. Since 1955 up to now, the National Oceanic and Atmospheric Administration, has tracked hundreds of tropical storms occurring all over the world (Fig 03). Tropical storms refer to a generic term used by meteorologists to describe an intense rotating-circular storm that originates over warm tropical ocean and characterized by low atmospheric pressure, high wind, low level circulation, and heavy rain (Zender 2017; NOAA 2015). This natural phenomenon may bring a severe impact to coastal cities. Unpredictable occurrence of storms and its aftermath affects the landscape and living qualities.

Vietnam is a country that has been struggling with reoccurring tropical storm or typhoon every year. It has a shore line of 3,000km in length. There are six main centrally controlled cities in Vietnam and most of them are situated in a river delta and exposed to the Gulf of Tonkin and South China Sea. Every year, almost every city in the country had been battered by a different magnitude of typhoon and lately, this natural disaster has become even more extreme with the tendency to advance southwards before it ends (Schmidt-Thome et al, 2015). Therefore, most of the typhoon passing by Central Vietnam has a category two or three hurricane.

In November 2017, Typhoon Damrey, a category two typhoon, hit Central Vietnam. Japan Meteorological Agency (JMA) indicated a weak tropical depression in the western part of Cebu, Philippines which was later named Ramil by the Philippines on the 31st October 2017. Ramil rapidly grew into Typhoon Damrey within two days above the Pacific Ocean and headed to Central Vietnam. It reached its peak, a severe tropical storm after its structure turned and became more symmetric with a much deeper convection and improved radial outflow (Fig 05). Vertical wind shear was also very low at around 5 knots, which is favorable for a cyclone to develop even further and shift towards southern Vietnam (NOAA 2017).

By November 3rd, it was classified as a Category 1 Typhoon after satellite imagery depicted a well defined circular 'eye feature'. Afterwards, JMA declared that Typhoon Damrey would reach its peak intensity with wind

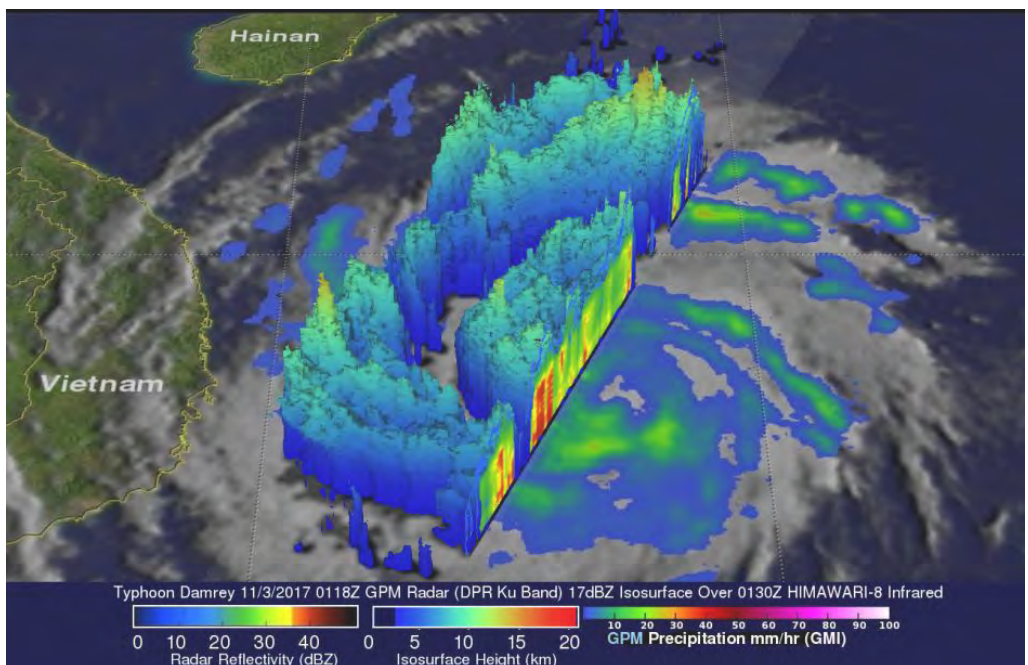
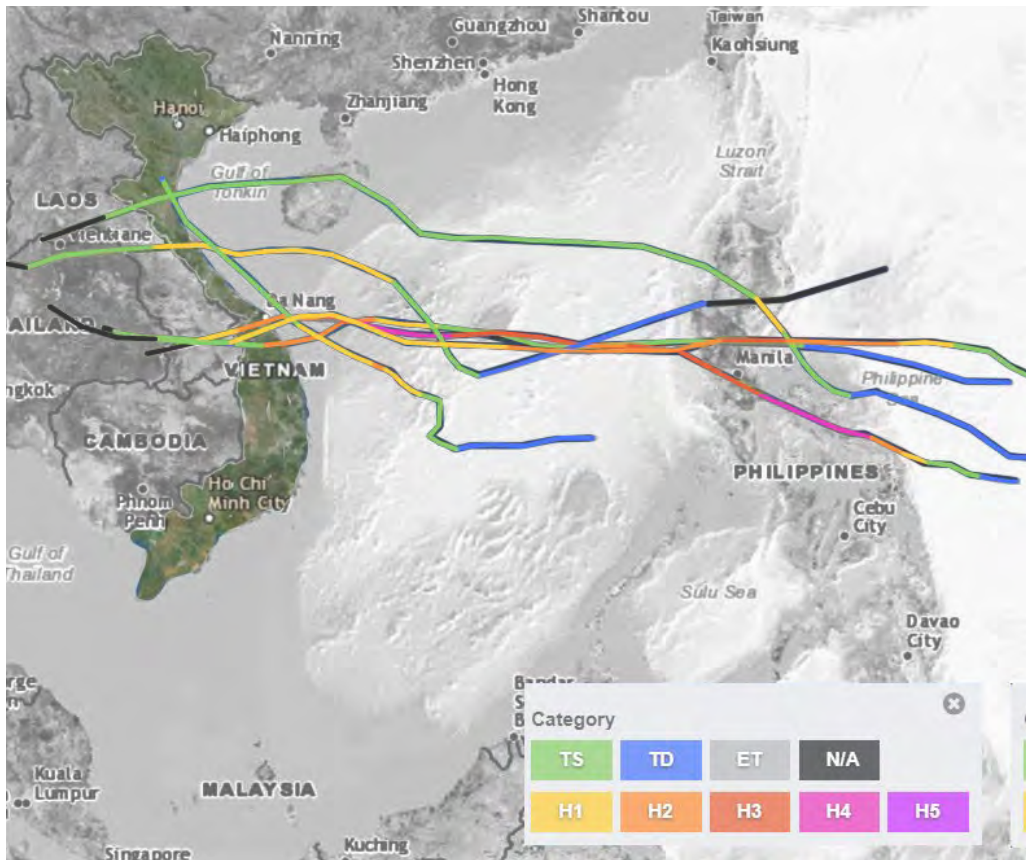


Fig 04 Historical Typhoon for the Past One Decade (NOAA 2017) - Above  
 Fig 05. Typhoon Damrey Occurrence on South China Sea (NASA 2017- Below



velocity reaching 130km/h or 80 mph and minimum pressure of 970 hPA. This means that a measure of the force is applied by the weight of air above the area. The next six hours, this typhoon kept intensifying and was soon categorized as level two typhoon with sustained winds of 165km/h (105mph). The next day, this typhoon made landfall and contributed to many severe damage of flooding both in highland and lowland.

According to UNCT Vietnam (2017), 4.33 million people are affected in 15 provinces. Moreover, 305 thousands of houses were damaged and 3,500 houses were completely destroyed. The Government of Vietnam estimated the economic loss to be US\$ 630.5 Million. The storm aftermath drove into a new acute problem for recovery process, for instance food security and agricultural livelihoods, water and sanitation, and shelter emergency needs. The people that needed assistance most were those who lived in the coastal area. Most of the people there experienced extreme flooding caused by storm surge, tides, waves, and fresh water input from the river basin. However, as a continuation effect; saline intrusion, sedimentation, and erosion will follow as an accumulative water problem and risk to live in the delta.

### 1.1.2 LIVING IN THE DELTA

De Jonge (1996) claimed that the main cultures attach great value to the delta. It has a very dynamic landscape: an extremely rich and varied biotope showing a number of gradients. The combination of the water type and flow, the mild climate, the rich soil, and the accessibility via the sea and the river offers favourable conditions for human development. The need for food and fresh water were the main factors for survival in the past. In the neolithic period, people started to evolve from hunting-gathering method to produce their own food by generating food-production techniques. The community tried to modify their natural environment by cultivating soil nearby the river. For instance, Mesopotamia Civilization begun by the occupation of landscape of The Fertile Crescents (later known as west and north Syria, SE Turkey, and northern Iraq). Various river, land, sea, and climate exposure in the crescent area generated an alluvial valley beneficial for agricultural activities (Laurence et al. 2017). Later on, the resource found in the delta became important to the world economy (De Jonge 1996). Further needs of living expanded into trading activities within the region. Not only throughout the crescent, but also to other parts of the world.

The delta's strategic setting will always be an attraction for the traders. There are many manifestations of the delta and its landscapes with various functions of land use, nature, history, and culture incorporated together and



Fig 06. HFloods During Typhoon Damrey

possibly shaping the future landscape of its delta (De Jonge 1996). With that exposure, the future of landscape delta might tangle between its functions and necessities. Nowadays, most port cities has transformed into a new urban or metropolitan area and changed the port city into the most prosperous and economically sustainable for its inhabitants.

For the Dutch, they see their delta as a complex system in which numerous subsystems influence each other and are dependent on one another. This complex system is also influenced by its constantly changing environment (Dammers et al. 2015). Even though the Dutch delta has many decent technologies in its water systems, the effects of floods is still inevitable. In contrast with magnificent technocratic approach in its landscape system, how can a city in a developing country overcome all those risks? Rapid urbanization, high intensity of development, and natural disaster with its uncertainties become a major challenge for every urban delta environment. Moreover, climate change has a new role as a catalyst for hydro-meteorological disaster based all over the world.

According to Zandvoort et al. (2017) the study of risk and climate change addressed so many notions in the uncertainty of spatial planning. In Vietnam, climate change also contributes to this phenomenon. In 2015, the Ministry of Natural Resources and Environment produced a Special Report on Emissions Scenario. With IPCC's study as the basis, they created four emissions scenario classified as low (B1), medium (B2, A1B), and High (A2, A1F1). Along with extreme events, climate change will also influence the fresh water resource availability. The increase of water discharge will happen in the Northern part of Vietnam and the decrease will occur in the Central and Southern part of Vietnam. Furthermore, flood events of most rivers tend to increase 2-4% in the period 2040-2059 and by 5-7% in the period 2080-2099 (Schmidt-Thome et al., 2015). Recently, most Vietnamese people are concerned with climate change issues. They recognize the climate change implication and natural hazard risk that will increase the complexity of living in the river delta. Therefore, a resilient design is needed to overcome these issues.

# Vietnam braced for second storm after devastating impact of Typhoon Damrey

As 400,000 people in coastal communities await emergency assistance after first deadly cyclone, aid workers warn Typhoon Kaikui will inflict further misery

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▲ A woman wades past buildings flooded by Typhoon Damrey in the town of Hoi An in Vietnam's south-central coast region. Photograph: Kham/Reuters

## Typhoon Damrey floods Vietnam's tourist city Hoi An as death toll rises to 69



Fig 07. Headline News about Typhoon Damrey (Source: Global Development & SBS News 2017)



## 1.2 PROBLEM INTRODUCTION

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Hoi An is located in the Thu Bon River estuary where three main rivers in Central Vietnam: Thu Bon River, Truong Giang River, and Ba Ren River form its confluence. Since the 15th century, this city has become a port city where traders from across Asia gathered. The town reflects a fusion of indigenous and foreign cultures (Chinese, Japanese, and later French influences) that combined to produce their unique characteristics. Later in 1999, UNESCO awarded this city as a cultural preserve example of a South-East Asian trading port. After this acknowledgement, the whole city responded by becoming a complete touristic package. While the people took their roles in generating a new product of place making, the city infrastructure has not been supporting the idea yet. However, infrastructure development in Hoi an somehow tries to retrofit the current needs of tourism itself without considering the infrastructure's robustness to flooding and typhoon. There are some new infrastructures constructed by local municipality, but it might not be resilient enough to cope with those risks in this urban delta type.

Cam Kim Island preserves its cultural and natural beauty because water isolates its land. Unfortunately, situation has turned this land into a less valuable human habitat in Hoi An City. This island used to shield the surrounding estuary from annual flooding. But the unpredictable occurrence of typhoon and high intensity rainfall will deteriorate the landscape of the island. All this time, the ideal landscape system of this estuary will work as its natural function and provide less risk disturbance in human habitat. In the dilemma of 'tourism minded' landscape development, obvious natural disaster effect, and enhancing the local's living quality, this island has been growing its own complexities for future development.

With all of its complexity and uncertainty, the landscape absorbing risk capacity is questionable for these island. Though this island had less preconditions in its design, but all its landscape layers are still in need to prepare for future natural disaster and its impact. A new landscape design incorporating local resilience in this island is necessary to encounter and reduce the risk uncertainty. Thus, the risk can be folded in a certain new system without growing extra risks in the future.

## 1.3 RESEARCH INTRODUCTION

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### 1.3.1 RESEARCH OBJECTIVE

This master thesis aims to study the reciprocal relation between landscape layers, local coping mechanism, and current landscape situation to reduce the risks in Cam Kim Island. The approach has to incorporate the knowledge from the inhabitants together with the facts and natural processes of everything that happens in landscape system of the delta. Thus, a more preventive and/or protective strategy can be developed in the landscape system.

The design objective of this project is to propose a design strategy for Cam Kim island to solve issues triggered by natural hazard (typhoon) and the after effects happening in the island. The approach used for this research is research for design.

### 1.3.2 SIGNIFICANCE

The use of research for design for this master thesis is significant for Cam Kim Island and Thu Bon River estuary as an alternative to design the landscape focusing on the soft elements and incorporate it together with its current infrastructure. A design strategy is generated in the end by using a more dominant soft approach than hard infrastructure the main design component and taking into account the local experience during typhoon and floods. By showing the solution based on landscape potential and local knowledge, this case study can be a lesson learned for landscape architect in general. Moreover, it is also presenting an alternative to 'hard approach' design in shaping a landscape design based on resiliency.

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*Fig 07. Fishing Activity by the Locals*

CHAPTER02//

# RESEARCH FRAMEWORK

---

*2.1 Theoretical Framework*

*2.2 Knowledge Gap*

*2.3 Research Questions*

*2.4 Research Method*

This chapter is divided into four sub-chapter. The first sub-chapter explains about the theory that relates to resilience landscape and its challenges. This theoretical framework generates a strong understanding about the study that can be used to identifying the knowledge gap and creating research questions. At last, a research method is described to illustrate how the process of this study.

## 2.1 THEORETICAL FRAMEWORK

---

### 2.1.1 HUMAN HABITAT AND LANDSCAPE

*"... the earth's surface continually worked its way, by trial and error, towards the condition of climate and racial groupings that existed at the beginning of recorded history. The length of time it took to do so is beyond comprehension: if the evolution of the world since creation corresponded in time to one year, then civilized man would have been upon it for only one minute...."*

*-Jellicoe & Jellicoe, Landscape of Man-*

In his book *Design with Nature*, Ian McHarg (1969) created a metaphorical landscape architecture work similar to medical works where both professions have the same goals in providing health for both humans and their environment. He believed that ecology is a body of knowledge that brings together so many aspects of nature that necessarily comes late upon the scene. He argues that nature is a process that is interactive, responds to laws, represent value and opportunities for human use with certain limitation and even prohibition. Accordingly, the concept of ecological design and planning of natural environment is necessary to come up with the most convenient location for humans to live in. But then other questions arise with the dynamic process of nature.

Koh (1982) explained that ecological design is characterized by a holistic

view of the human-environment system and by an evolutionary and open-ended view of culture, design and building. Landscapes also offer a scale where social and physical processes and patterns can become evident (Steiner 2002). We see landscapes and all our senses react to their well-being. Those reactions manifested in the landscape together with a natural cycle that intersects with human intentions. Therefore nature influences cultural establishment, and vice versa, which makes them inseparable (Steiner 2002). To provide a better ecology for human, Steiner (1999) also introduces a new approach concerning the social equity and ecological parity. He stated that this approach could assist in analyzing the problems of a region as the national and local political & economical structure. The notion is a modified layer-cake model introduced by McHarg before,



but having the human layer above the biotic and abiotic layer in a design or planning process. The most important concepts in associating nature with human settlement are a set of connected stuff (the extent of how its relationship occur in nature to human system, the scaffolding of place and change, and adjust to change/adaptation (Steiner 2002).

## 2.1.2 DISCOURSE OF RESILIENCE

Steiner (2014) claimed that delta communities around the world are especially at risk for extreme climate events including tropical cyclones and hurricanes, typhoons, tsunami, and flooding, all of which can lead to damage of crops, salinization of water, risks of death by drowning and infectious disease, and disruption of settlements. Frerks et al. (1999) also mentioned that the risk of a disaster evolving is the outcome of the combination of such a phenomenon with the vulnerability of the population, communities, households, or individuals that are affected and it actually occurs at the interface of hazard and vulnerability. Davis (2015) commented that it is impossible to frame the future through the lens of risk because it is everywhere and manifests itself in environmental vulnerabilities and climate change. Risk and climate change study had addressed so many notions of uncertainty, and it includes as the main factors in spatial planning.

Resilience was originally defined by Holling (1973) as “a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationship between populations or state variables”. Carpenters (2001)

mentioned there are three properties which are the amount of change the system can undergo and remain within the same domain of attraction, the degree to which system is capable to self-organization, and the extent to which system can build the capacity to learn and adapt.

Folke (2006) classified several perspectives on resilience, which are engineering, ecological, and social ecological. Engineering resilience refers to Holling’s original definition of resilience which is applying the term of stability in his concept. Ecological resilience defined by Gunderson (2000) as the magnitude of disturbance that can be absorbed before the system redefines its structure by changing the variables and processes that control behavior. Meanwhile social ecological resilience is interpreted as the combination of engineering and ecological resilience within the degree to which the system is capable of self organization and its ability to build and increase its capacity to learn and adapt (Folke, 2006). It can be seen in the Figure 08.

Therefore, social ecological system represents high vulnerability when the risk is happening. Vulnerability is

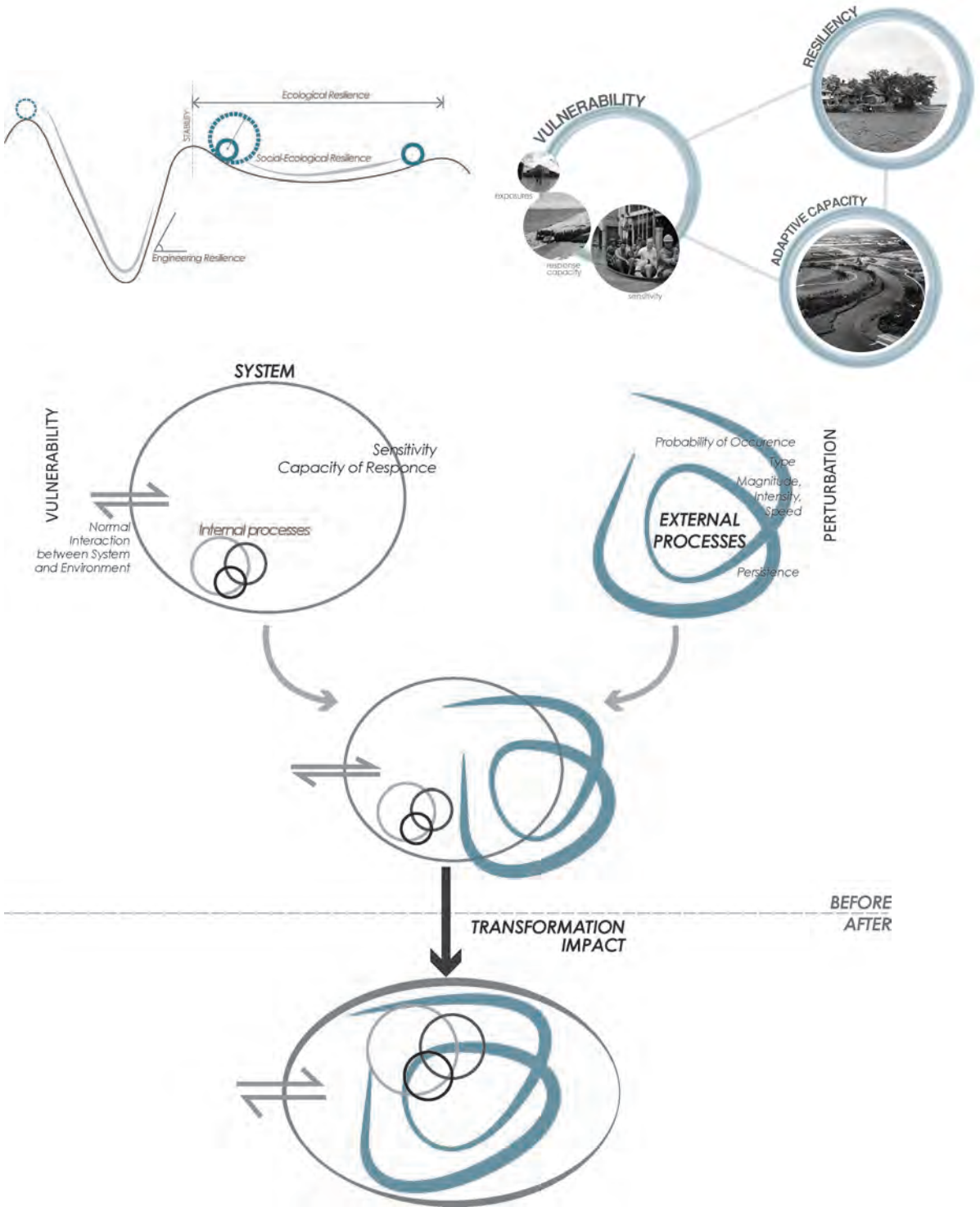


Fig 08. Classification of Resilience (Gunderson 2000; Folke 2006) - Top Left

Fig 09. The Linkage Between Vulnerability, Resilience, and Adaptive Capacity (Gallopín 2000) - Top Right

Fig 10. Transforming Risk into a System (Gallopín 2000)- Below



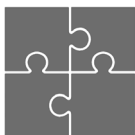
the degree to which a system, subsystem, or system component is likely to experience harm due to exposure to a hazard, either a perturbation or stress/stressor (Turner et al. 2003). According to generic relations in the Figure 09, vulnerability is a function of the system's sensitivity and capacity of a response, and the transformation suffered by the system is a function of its vulnerability, the properties of perturbation, and the exposure of the system towards perturbation (Gallopín 2006). Even though his papers argued that the relationship between the concept of adaptive capacity and resilience are more unclear in general, the link between vulnerability, resilience, and adaptive capacity becomes more visible when they are taken together (Figure 10).

However, Hodgson et al. (2015), argued that the representation of resilience should be updated because the current meaning of resilience has ambiguity in representing its application. There are two points that is needed to refine, there are the unit of measurement of potential energy of a complex natural system and endogenous dynamic of a system to recovers quickly. They argued to those components because there is a trade-offs existence between resistance and recovery and it implies to the disturbance on a landscape. Therefore, to transform the risk into a design, a deep understanding of current landscape resistance and recovery must be taken into account to produce more resilience landscape in the future.



#### 1. Redundancy

Redundancy is common in engineered infrastructure system (both hard and soft) and biological system. This principle indicates overlapping functions within distributed and centralized systems. Together with modularity principles, it will be the principles which avoid putting 'all your eggs in one basket' and for preparing and pre-planning for when (not if) a system fail.



#### 2. Modularity

Modularity provides a system with different functional modules that can evolve somewhat independently. Modules may be loosely linked by design so that failure of one module does not severely affect with another. It is achieved when multiple elements provide the same, similar, or backup functions. Sufficient links between modules are designed so that modules might learn from the activities occurring within other modules. This principle spreads the risks - across time, across geographical area, and across multiple systems.



### 3. Manage Slow Variables & Feedbacks

It is important to maintain social ecological regimes that underlie the production of desired ecosystem services. However, there are substantial practical difficulties in identifying possible regime shifts and their consequences for ecosystem services, as well as component variables which may slowly trigger change.



### 4. Diversity

This principle does not simply refer to variety, but includes three interrelated and distinct components: variety (how many different elements), balance (how many of each element), and disparity (how different the elements are from one another). Diversity also provides for components with similar function but different responses to disturbance.

By applying those design principles, it is expected that adaptive capacity of an area will enhance during and after the storm surge in the future. It also applies in every loop of adaptive capacity focusing on the relationship of nature connectedness and local resilience, which includes exploitation, conservation, release, and reorganization phases (Holling & Gunderson 2002).

## 2.1.3. THE CHALLENGES DESIGNING WITH RISK

Steiner (2014) claimed that delta communities around the world are especially at risk for extreme climate events including tropical cyclones and hurricanes, typhoons, tsunamis, and flooding, all of which can lead to damage of crops, salinization of water, risks of death by drowning and infectious disease, and disruption of settlements. Frerks et al. (1999) also mentioned that the risk of a disaster evolving is the outcome of the combination of such a phenomenon with the vulnerability of the population, communities, households, or individuals that are affected and it

actually occurs at the interface of hazard and vulnerability. Davis (2015) commented that it is impossible to frame the future through the lens of risk because it is everywhere and manifests itself in environmental vulnerabilities and climate change. Risk and climate change study had addressed so many notions of uncertainty, and it includes as the main factors in spatial planning. It offers possible heuristic interventions and normative implications for navigating and uncertainty for those characters to be applied in a planning activity (Zandvoort et al. 2017).

## 2.2 KNOWLEDGE GAP



Fig 11. Positioning Knowledge Gap for This Study

In this study, an obvious void between theoretical framework, spatial information, and local knowledge of disaster in Cam Kim Island are generated. The understanding of providing a better habitat for human in high-risk-prone region and folding the risk itself in the landscape becomes a knowledge that should be obtained. By recognizing how to

transform a threat, exposure, and vulnerability of a risk, an impact of typhoon and floods can be transformed in a system that executed in a landscape design. Moreover, the application of resiliency principles are helping this study to sort the best strategy that is likely applied in a landscape setting by considering its spatial information. This spatial information acquired through previous study about this region and asking directly the local about the island's spatial changes. Fortunately, local's experience is the best wisdom of all to understand their direct respond before, during, and after the typhoon and floods occurrence. It is also expecting that the locals will be able to depict their future landscape. Those components (principles of resilience, spatial information, and local knowledge) are supporting the current gap of this study which later tried to be solved in a spatial planning and design way. Next, these knowledge generate an intermediate way to contribute a soft approach to enhance the resiliency in Cam Kim Island without abandons its challenges of designing with risk.

## 2.3 RESEARCH QUESTIONS

A set of question which consists of one design question and three research questions.

### MAIN DESIGN QUESTION

How can the resiliency of Cam Ki Island towards typhoon and floods can be enhanced by using science and local's knowledge?

### RESEARCH QUESTION 01

What is resilient landscape and its principles that could possibly be used to construct new design principles for Cam Kim Island?

## RESEARCH QUESTION 02

What are the most crucial landscape characteristics of Cam Kim Island in reducing the risk of typhoon and floods?

## RESEARCH QUESTION 03

To what extent do local coping mechanisms transform the impact of typhoon and flood in its landscape and design?

# 2.4 RESEARCH METHOD

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The research and design process are determined to study this topic, It relates to a qualitative method which is elaborated in the phases below. The steps for this research is a modification of trace concept in landscape architecture (Giro 1999) and the relationship between main design question and research questions which can be seen in Figure 12.

### 1. Scoping

I started this study by scoping theoretical framework and choosing a place as my case study. Scoping process is useful to select and narrow down what type of problem is needed to focus on for this research.

### 2. Landing and Grounding

This step consisted of three steps: problem identification and desk study, spatial data collection, and on-field activities (by site visit, observation, and conducting interviews). Giro (1999) defined landing as the first act of site acknowledgment which reacts to the difference between the preconceived idea of a place and the reality that appears during the first steps of a visit. This step, together with direct observation and the interview, has managed to obtain local knowledge in dealing with natural disaster, while grounding focuses more on drawing and modeling the result from landing step which subsists by evaluating and quantifying the data into spatial information. The results of these steps are the main input for the next step.

All spatial informations were obtained from all type of drawings or imageries. The uses of maps, photographs, aerial photographs interpreted the current landscape characteristis in this study. The layer approach, introduced by Ian Mc Harg, successfully simplify the information based on abiotic, biotict, and social/human layer (later added by Steiner. Even though this approach gave the designer a pragmatic way to generate planning, but it is still the best way to understands the complexities of the landscape.

### 3. Finding

This step refers to the process of searching and discovering new knowledge from landscape characteristics and the local's knowledge. In this research, I used spatial analysis and coding-memoing to convey a distinct quality of the site. This method gave an important role to validate and acquire current information on previous adaptation action on site.

I conducted 13 interviews (list of questions see Appendix B) with the locals between different group of ages: three childrens, six productive age people, and four elders. The distribution of the educational backgrounds did not vary. Only three of them had a higher education background, while others were high school graduate and the children are in elementary school. Afterwards, I gave them 15 questions in three different sections. The questions are related to landscape of Cam Kim Island's perception; daily landscape utilization; and preferable island's

Every interviews are video recorded and later was separated by the audio (dialogue), video graphic, and landscape sketches/graphic. The video graphic supported the audio when it came to re-examine a statement and its expression. When it comes to a serious facial expression, the statement needed extra consideration to be analyzed. Landscape sketches/graphic helped me to generalize the wants and needs of the locals for their future landscape. I created nine quick sketches that showed the preferably future adaptation function for the island's inhabitants.

After the audios were transcribed, it decoded into 9 sub-category. There are feelings, respond, effect, experience, adaptation, spatial changes, knowledge, future development, and preferable future landscape. I used coding to. Then, memoing was conveyed to discover the relationship between spatial analysis and local knowledge. By the two sub-steps, sub research questions are answered. Moreover, the results are also linked to the four main resilience principles that is used: redundancy, modularity, diversity, and managing slow variables and feedbacks.

Next, the answers of all those questions had to be visualized. Thus, it was easier to take into account the preferable strategy as input for design exploration. Afterwards, this step answered the main design question by generating several landscape strategy options for the site. Each landscape strategy during design exploration always reflected and valued back to resiliency principles obtained from scoping activity.

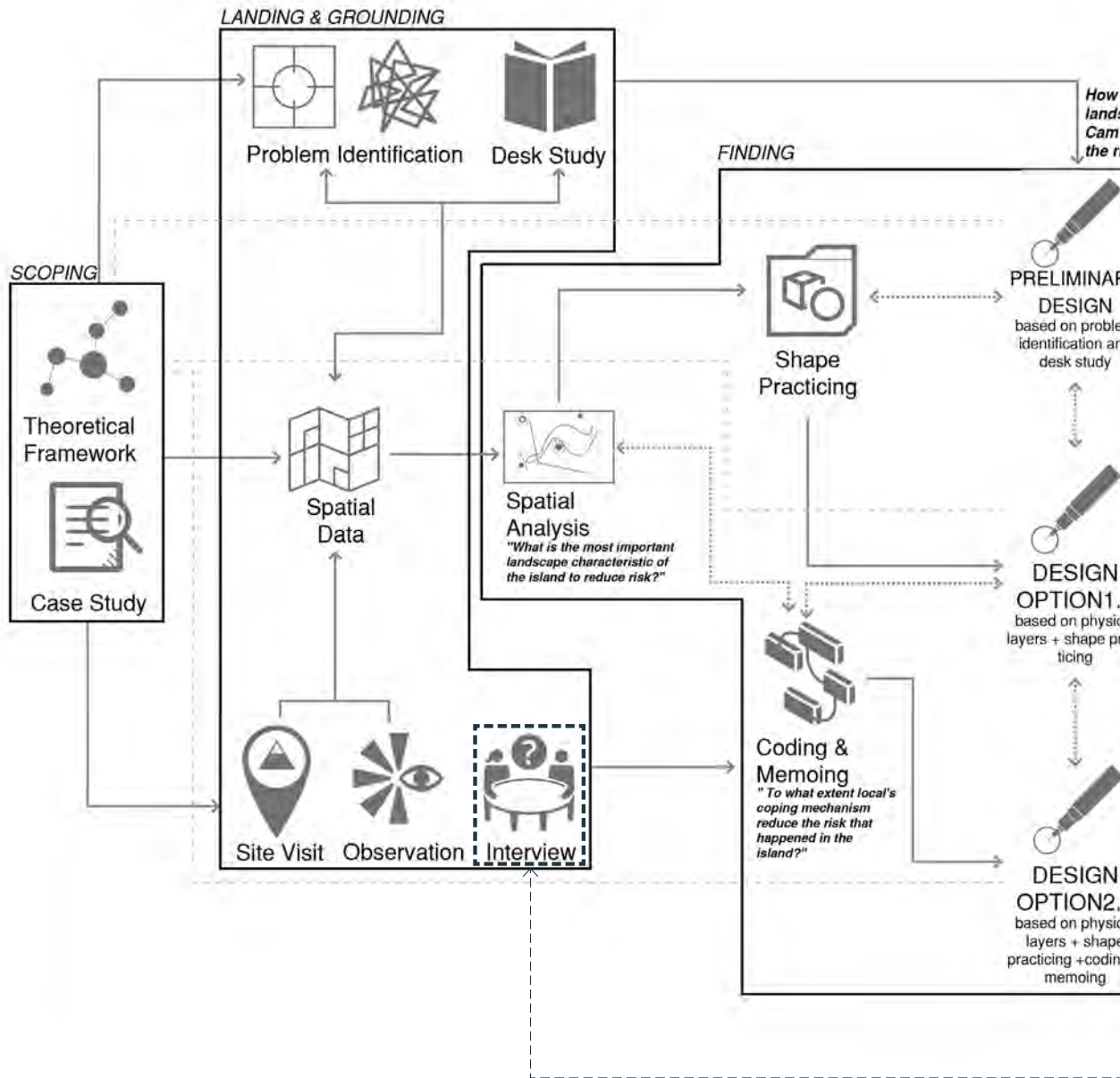
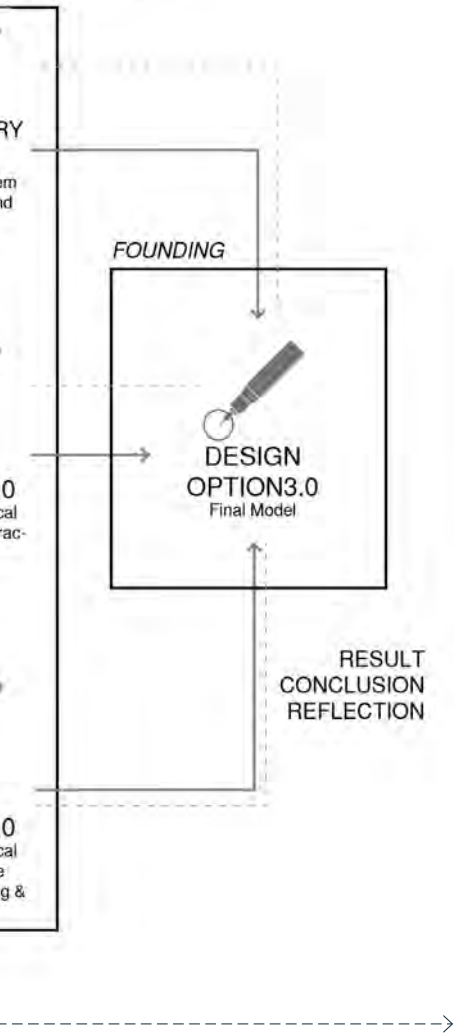
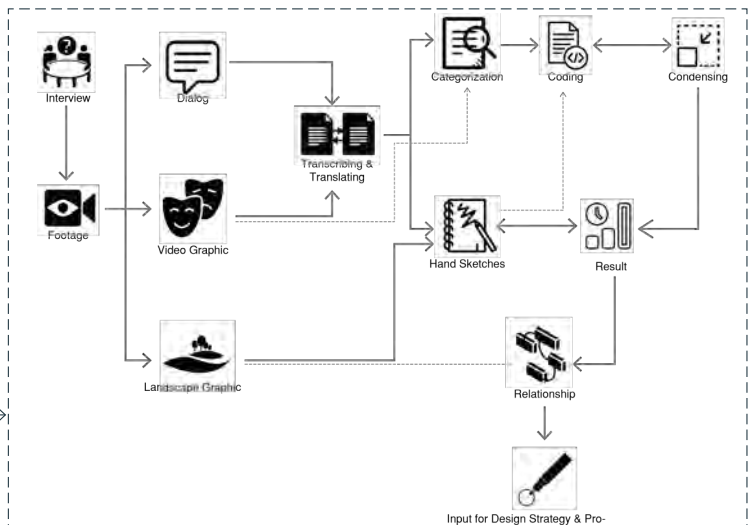


Fig 12. Research Flow Diagram (adapted from: Girot 1999)

to enhance  
scape resiliency of  
Kim Island towards  
risk?



Detailed Interview Process



#### 4. Founding

Founding comes at the moment when the previous three acts are synthesized into a new and transformed construction of the site. It has potential to drive a place into something that refers to some past event of circumstance (conservative) or importing something new to a place (innovative). However, in this stage, landscape design options 3.0 was generated. It pointed to the most possible options that covered all preferable resiliency principles to the site location. Moreover this step also pointing out one final model for the site with compilation of the best strategy by design explorations based on design options 3.0.

#### 5. Finalizing

This is the last part of the design process where the final design ideas were generated and represented in several type of drawings. It manifested in plan, axonometry, section, and montage to explain the vision of Cam Kim Island to enhance their resiliency from typhoon and floods. After the results explained in visual forms, reflections of the design process, explanation of limitation and relevance of the design, and conclusions were made to clarify design process.

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*Fig 13. Worship Place for Gods of the Sea*

CHAPTER03//

# RESEARCH FOR DESIGN

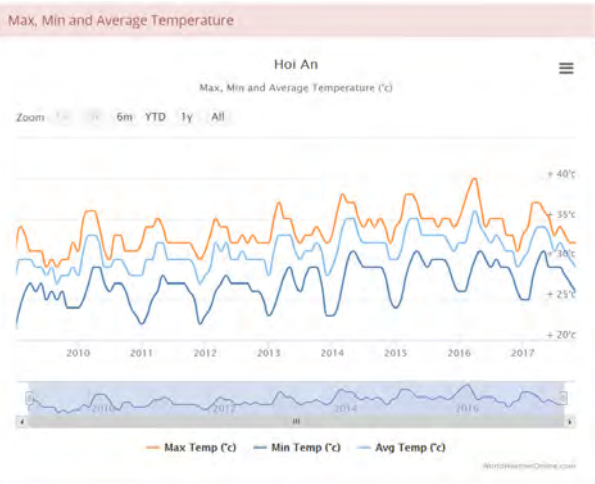
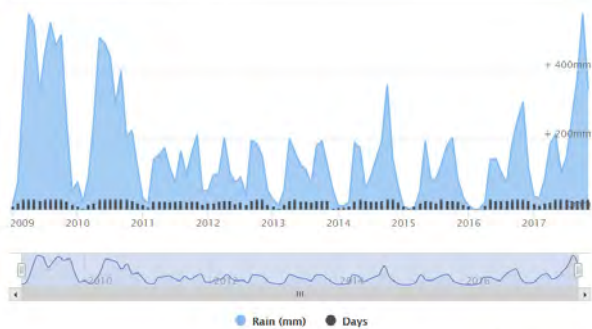
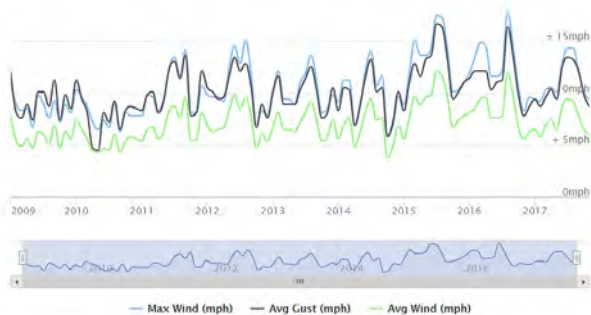
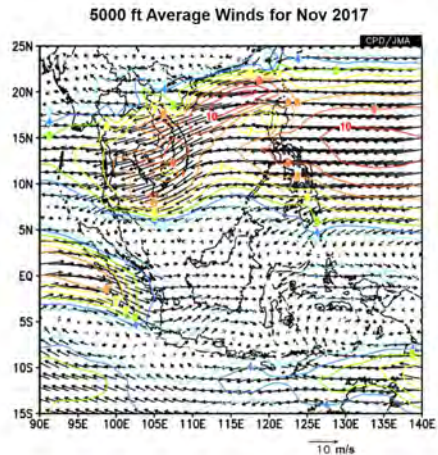
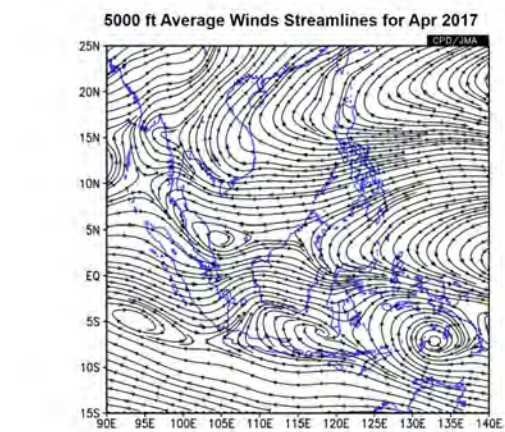
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*3.1 Into Thu Bon River*

*3.2 Growing Risk of Thu Bon River*

*3.3 UNderstanding the Site*

*3.4 Conclusion: From Facts to Sketches*



## Wind Frequency Rose

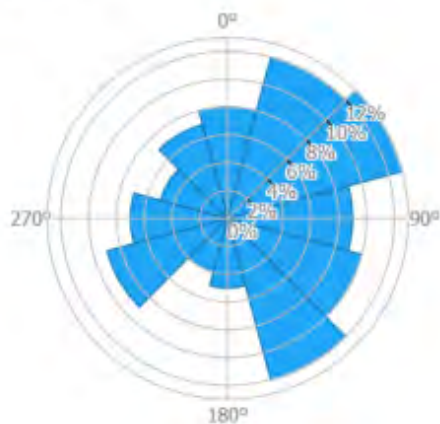


Fig 14. Climate Information of Central Vietnam Region (Source: Asian Specialized Meteorological Center 2017 and Global Wind Atlas 2017)



## 3.1 INTO THU BON RIVER DELTA

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To realize the landscape of the region, the study about general information of the region is needed. In this section, understanding climate regime, river delta type, delta transformation, and Thu Bon River Management is substantial. All these information, later, will construct the basic argument of chosen site for this study.

### 3.1.1 CHARACTERIZING CLIMATE REGIME OF CENTRAL VIETNAM

Vietnam has a tropical climate and is influenced by the monsoon system. It goes through the rainy season from November to February and the dry season for the remainder of the year. Annual rainfall ranges from 700-5,000mm, with northern and windward mountain areas receiving more than the south (USAID, 2017). With northern wind influence, the range of mean temperature in Central Vietnam varies between 20-26.6 Celcius degree. During dry season, this area has a warmer temperature ranging between 23-31 Celcius degree. According to USAID (2017), climate trends observed since 1960 has increased the annual mean temperature (+0.5 Celcius degree) with a rate of increase more rapidly during the dry season. It is obvious that wind factors in Central Vietnam, especially Hoi An City is influenced by sea wind. Annual average wind speed in 50m height is 5.69m/s (Global Wind Atlas, 2017) and easily intrudes this low-laying city.

### 3.1.2 DISTINGUISHING THU BON RIVER DELTA TYPE

Thu Bon River is the biggest river system in Central Vietnam. The basin is located in Quang Nam and Quang Ngai Province. The various levels of elevation of its basins directs all its streams northwest and ends its system in South China Sea at Hoi An City. Most of the soil type along the riverine is dominated by Arenosol, Fluvisol, and Solonchak type with Unconsolidated Sediment as its geological base (Führer, 2016). Arenosol and Fluvisol indicate little or no profile differentiation where it is mostly covered by younger deposits

(sandy and stratified fluvial or marine and lacustrine sediments). Fluvial soil provides the surrounding riverine with a fertile land for agriculture. The agricultural type for this area are mostly paddy rice field and annual cropping. Meanwhile the Solonchak type indicates high concentration of soluble salts in the soil layer (mostly in the delta). In this type of soil, most of the land has been utilized for aquaculture activities rather than agriculture.

Thu Bon River itself is classified into

flow direction (Makaske 2001). In this river, the avulsion (Figure 16) is primarily driven by aggradation of the channel belt. According to Rosgen (1994) classification, this type of river is complex and has low sediment supply which includes suspended and bed load sediments from the upstream. In the preceding decades, the sediment transport however has decrease due to the construction of large hydro power dams and bank protection along the river (Ponsion 2015)

The delta is the most interesting part where the lake plains and lagoon are easily identified in Hoi An City. With the lagoon and lake plains presence, the natural landscape of the delta is even more varied. Based on its depositional system, Thu Bon River Delta is classified as low tide and wave dominated delta. With low co-tidal level (average level 0.65-1.25m) sea water exposure is less influencing on this river delta, so future treatment for soil is needed for future agriculture system in this region. This type of river also has symmetrical individual mouth batrs and radial bar in the river delta formation is obvious (Bhattacharya 2006). The architecture of this delta consists of sediment deposits carried by water stream. However, the mouth bar that turned into the island is also beneficial as natural groyne of the river. Thus, it will be able to catch more deposits in the future if the natural surrounding is preserved.

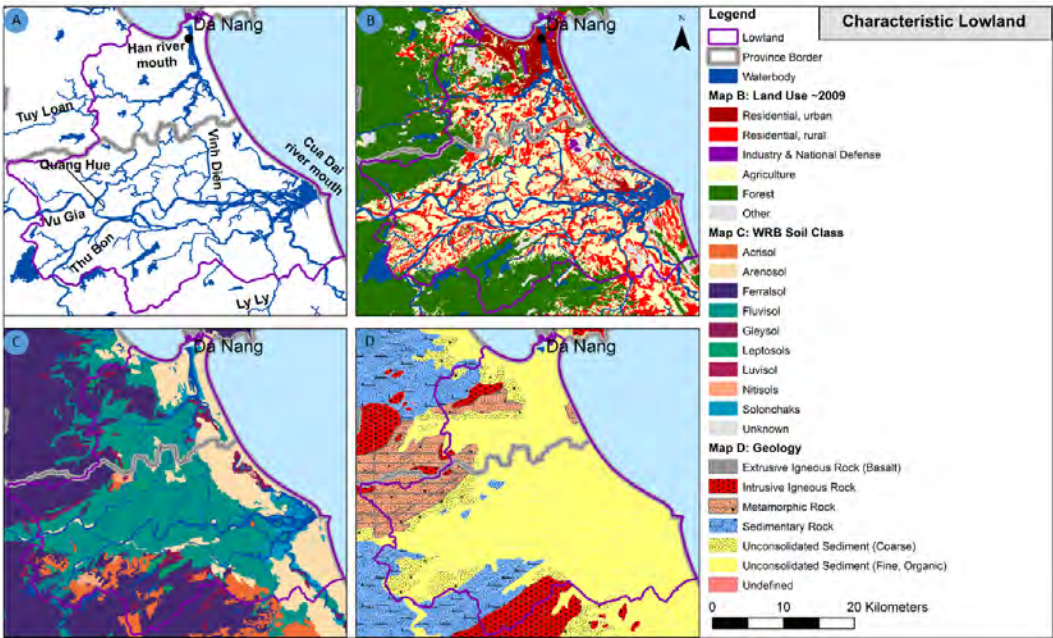
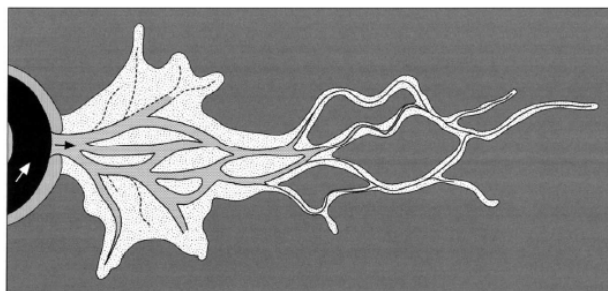
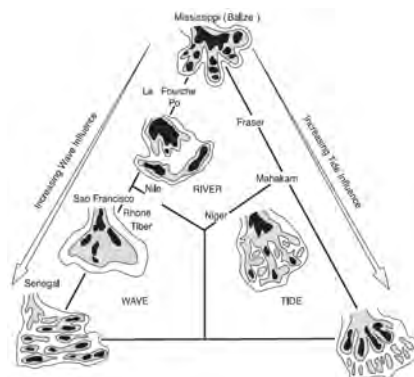


Fig 15 Ground Characteristics of Thu Bon River Delta (Source: F hrer, 2016)



**Legend**

- trunk channel
- natural levee
- active crevasse channels
- abandoned crevasse channels



DOMINANT SLOPE RANGE	Aa+ >10%	FLOOD-PRONE AREA ----- BANKFULL STAGE -----							
		A 4-10%	B 2-4%	C <2%	D <4%	DA <0.5%	E <2%	F <2%	G 2-4%
CROSS-SECTION									
PLAN VIEW									
STREAM TYPES	Aa+	A	B	C	D	DA	E	F	G
Dominant Bed Material	A	B	C	D	DA	E	F	G	
1 BEDROCK									
2 BOULDER									
3 COBBLE									
4 GRAVEL									
5 SAND									
6 SILT/CLAY									
ENTR.H.	<1.4	1.4-2.2	>2.2	N/A	>2.2	>2.2	>2.2	<1.4	<1.4
SIN.	<1.2	>1.2	>1.4	<1.1	1.1-1.6	>1.5	>1.5	>1.4	>1.2
W/D	<12	>12	>12	>40	<40	<12	<12	>12	<12
SLOPE	.04-.099	.02-.039	<.02	<.02	<.005	<.02	<.02	<.02	.02-.039

Fig 16. Anastomosing channel pattern within developing avulsion belt (Makaske, 2001) -Top Left

Fig 17. Classification of Delta Types (Bhattacharya, 2006) - Top Right

Fig 18. Classification of Natural River by cross section and plan view (Rosgen, 1994) - Middle and Bottom



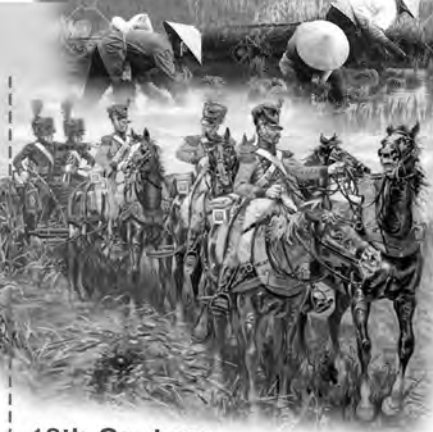
### 3.1.3 TRANSITION OF THU BON RIVER DELTA

Thu Bon River Delta experienced massive changes in each era. Most of the changes here was related to land edges and sediment deposit that influenced the flexibility of its delta system. Since 13th Century, Thu Bon River Delta became the most important harbour of Champa Kingdom. For over centuries, this area known

15th Century



18th Century



Natural Environment



as Fai Foo, meaning 'peaceful', remained the major international dockyard of Southeast Asia, Chinese, Japanese, Dutch, Portuguese, Spanish, Indian, Filipino, Indonesian, Thai, French, British and Americans (Nhu Mai 2015). Thus, this delta turned into an enormous melting point for overseas trading and cultural diversity.

Fig 19 Comparing Historical Climate Change, Natural Environment, and Human Activity



In summary, obvious activity changes in Cam Kim Island is identified in this diagram. The comparison from time to time is reflected into its natural environment condition, climate change, and human occupation in the island. It is indicated that when this region turned into port the human activity increased slowly and remained increase until the French occupation in 18th Century. Even though the idea of industry revolution is there, the locals are not really understand global climate situation, but indeed climate change had been started terrorizing our earth.

Fig 20. Thu Bon River Delta in 17th Century

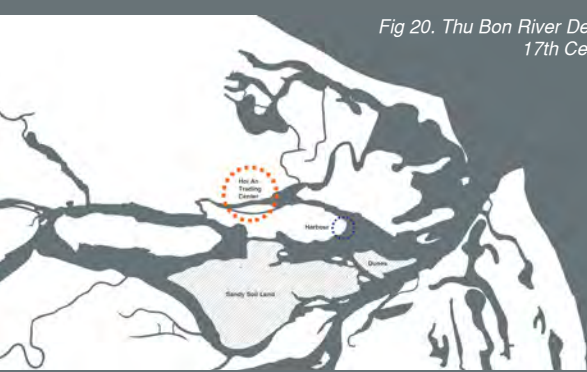


Fig 21. Thu Bon River Delta in 18th Century

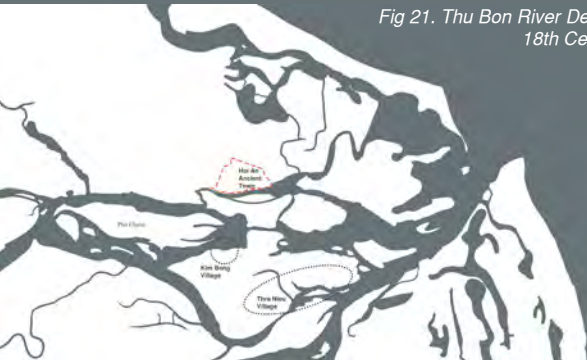


Fig 22. Thu Bon River Delta in 1951



Fig 23 Thu Bon River Delta in 1964



## 17th Century

In this era, there were only two main important point in Thu Bon River. There were Hoi An Trading Center and Harbour. The other islands in the mouth of Thu Bon River consisted of large dunes and sandy soil land as the main component. The island's parcels are relatively big and more lagoons were founded on the both sides of the main land.

## 18th Century

The shapes of the island's parcels were not changed too much, but the river started to intrude the islands and main land more. Thus, more fragmented island were created on the western part of the delta. Kim Bong Village started its growing as a boat carpenter village for this area.

## 1951

The main infrastructures are started to develop for transporting goods and connects Hoi An Old Town to Da Nang where it was the main port at that time. The islands on the river are inhabited with another two village. Unfortunately, no infrastructure connected these villages. Thus, it can only be accessed by the boat. At this era, some of area of the delta, especially the mainland, started to grow paddy as their common food source.

## 1964

In 1964, Thu Bon River Delta experienced a massive destruction by floods (Figure 17). The water level at the port reached almost six meter. It was referred as the worst flood of 20th Century in Vietnam. At that time, every houses were destroyed and 80-100% crops were damaged. Without proper infrastructure, rescue operations were



scarce at the time (Saigoneer, 2016). Moreover, prevention and preparation were unavailable because of war status. The locals referred this disaster as a blessing catastrophic in Dragon Year.

Flooding effect in this year altered land margin massively. Most of the island pushed forward to the delta mouth and separated archipelago turned into one big island in the river. The stream now was divided into two main diversion and small channels in the islands were occurred. Lagoon on one side of the river stream were missing and turned into large dunes. However, natural landscape configuration of the islands remained the same with marshes and aeolian dunes.



Fig 24. Thu Bon River Delta in 1984

1984

From the satellite image, this country was in a very bad drought. It is obviously seen from the map that the river stream was shrinked. More lands are generated and sand spit in the river mouth was noticeable. In 1999, An Trach barrage were constructed to elevate the water level and divert Vu Gia River flow for irrigation and 1984

From the satellite image date, it is indicated that the country was in a very bad drought. It is obviously seen from the map that the river stream was shrinked. More lands are generated and sand spit in the river mouth was noticeable. In 1999, An Trach barrage were constructed to elevate the water level and divert Vu Gia River flow for irrigation and domestic uses. Even though the way of managing water was applied but yearly flooding risk were still obvious for this delta. The outcome of generating infrastructure for water management and natural disaster subtracted the water stream and led to more sedimentation in the river stream. The land area were gained but still it was useless for the people in the delta because it will struck over and over

again by typhoon and floods. Later the sediments will be brought to the sea because it could not hold the force during the disaster occurrence.

In 1999, UNESCO awarded Hoi An as a cultural preserved of 16th century port. This recognition from world level organization was a 'wake up call' for Hoi An people. It was impressively switched local thoughts which was only focused

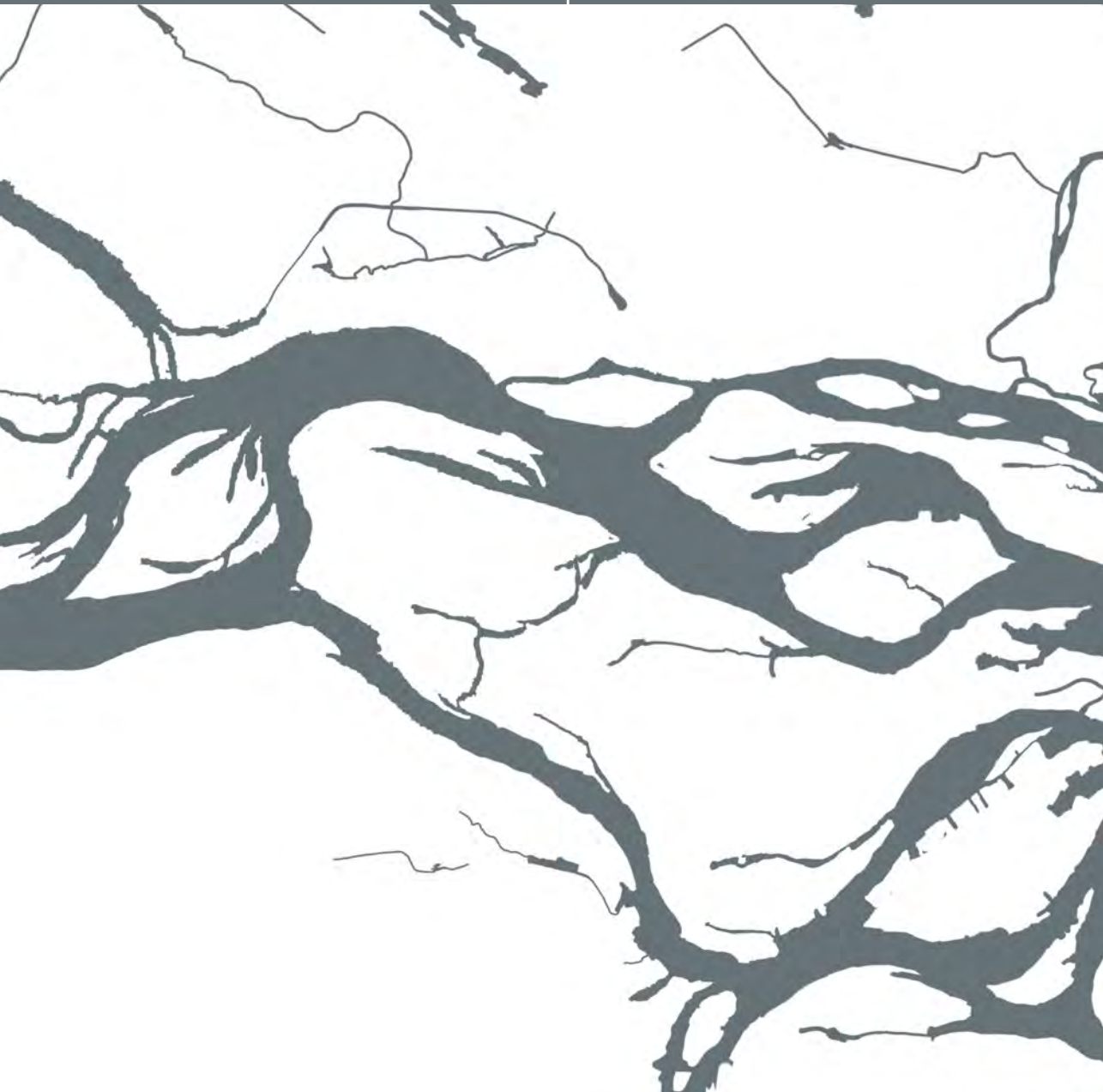
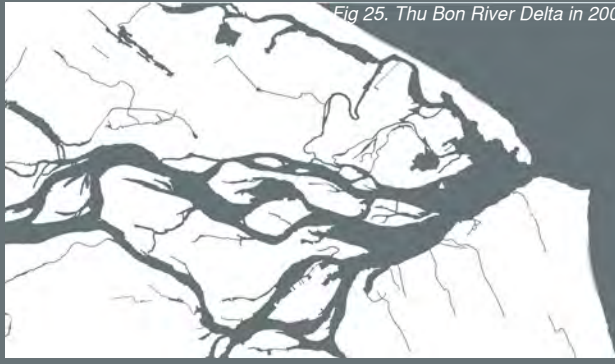




Fig 25. Thu Bon River Delta in 2002



on agricultural production into a giant tourism empire of the country. With tourism hat, everything that related to ancient structure, culture, and local way of living were preserved and turn all the cities into a living museum of Vietnam.

2002

Started from this years, the settlements grew massively in the island. More water channels were seen in there, yet the landscape character configuration remained the same from the previous decade. The floods and typhoon occurrence still hit the delta. More tourism activity, driven by UNESCO designation, started to flourish in the island. On every corner of the islands, a group of cycling tourist can be encountered.

2017

The latest situations of the delta are not having much different compare to 2002's situation. The landscape configurations ranged on paddy rice field, aeolian sands, bamboo forest, and emergent wetlands with *Nypha fruticans* as the main plants that grows in there. Moreover, each villages now themed up with the labels of eco-tourism or eco-village without showing their real specialities, except so-called traditional living in there.



Fig 26. Thu Bon River Delta in 2017

### 3.1.4 THU BON RIVER MANAGEMENT

The government of Vietnam is focusing their river management in several sectors. There are agricultural, energy, water supply, and tourism. More than 2 billion people depend their life on the Thu Bon River Delta in various fields. This delta also serves 25 thousand hectares of rice paddy field that supports national food supply and economy. However, the river management governance system is too structural and disconnected between the organization and local residents. Ribbe et al. (2007) mentioned in his report: Land Use and Climate Change Interactions in Central Vietnam, there are no functional river organization existing. In the report, it is also added, informational exchange between institutions are not systematic and not centrally coordinated.

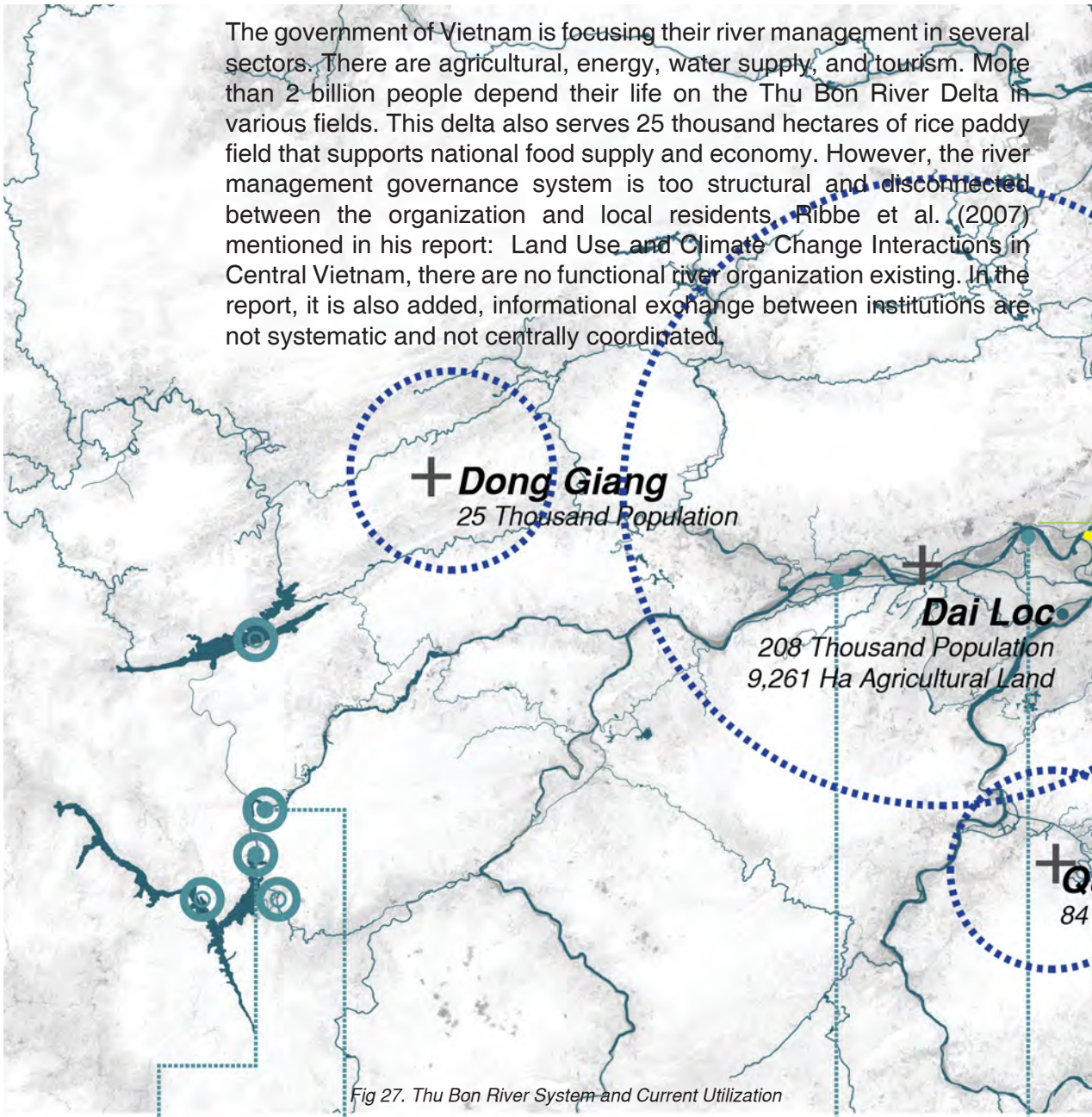


Fig 27. Thu Bon River System and Current Utilization

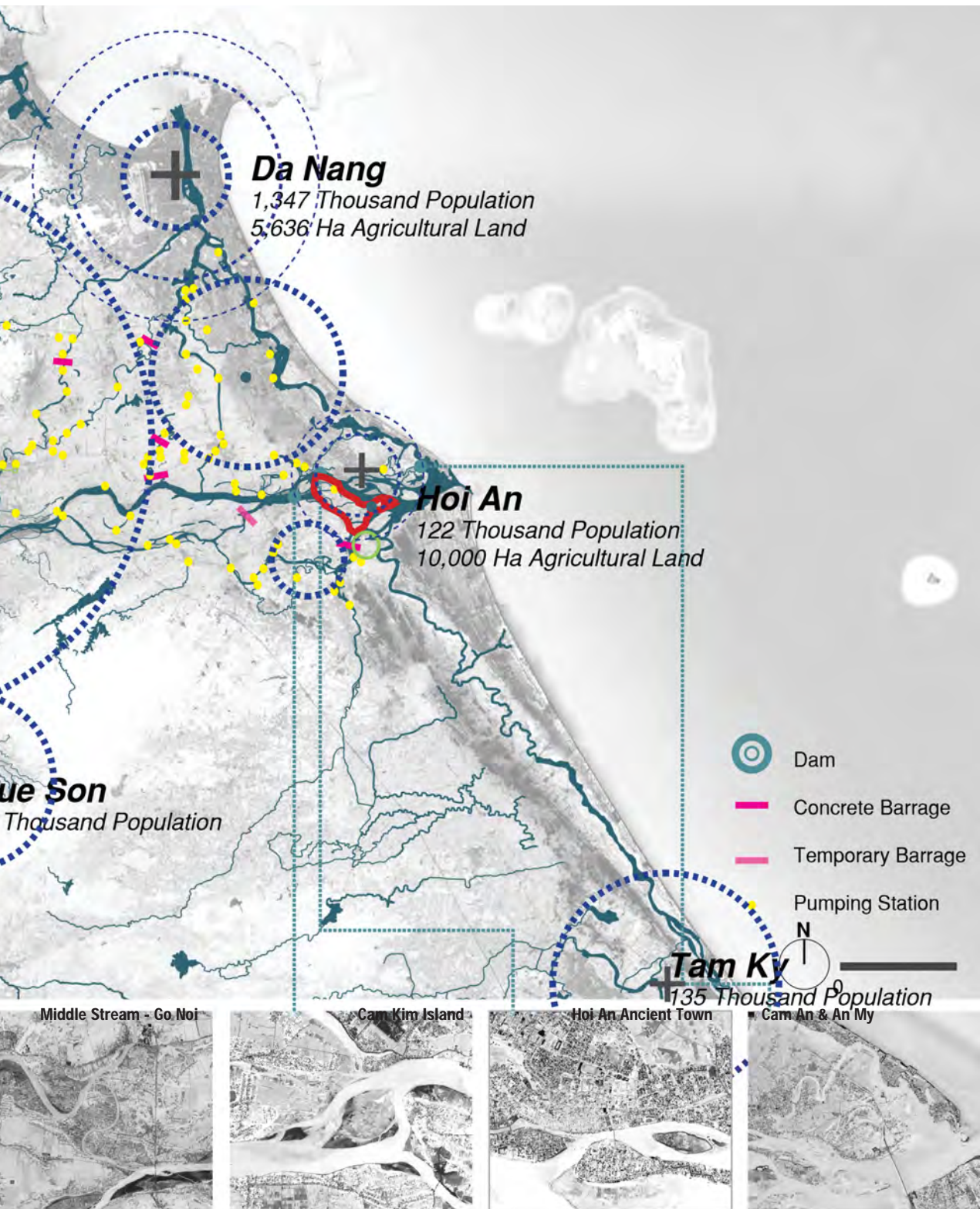
Hydropower Song Tranh2

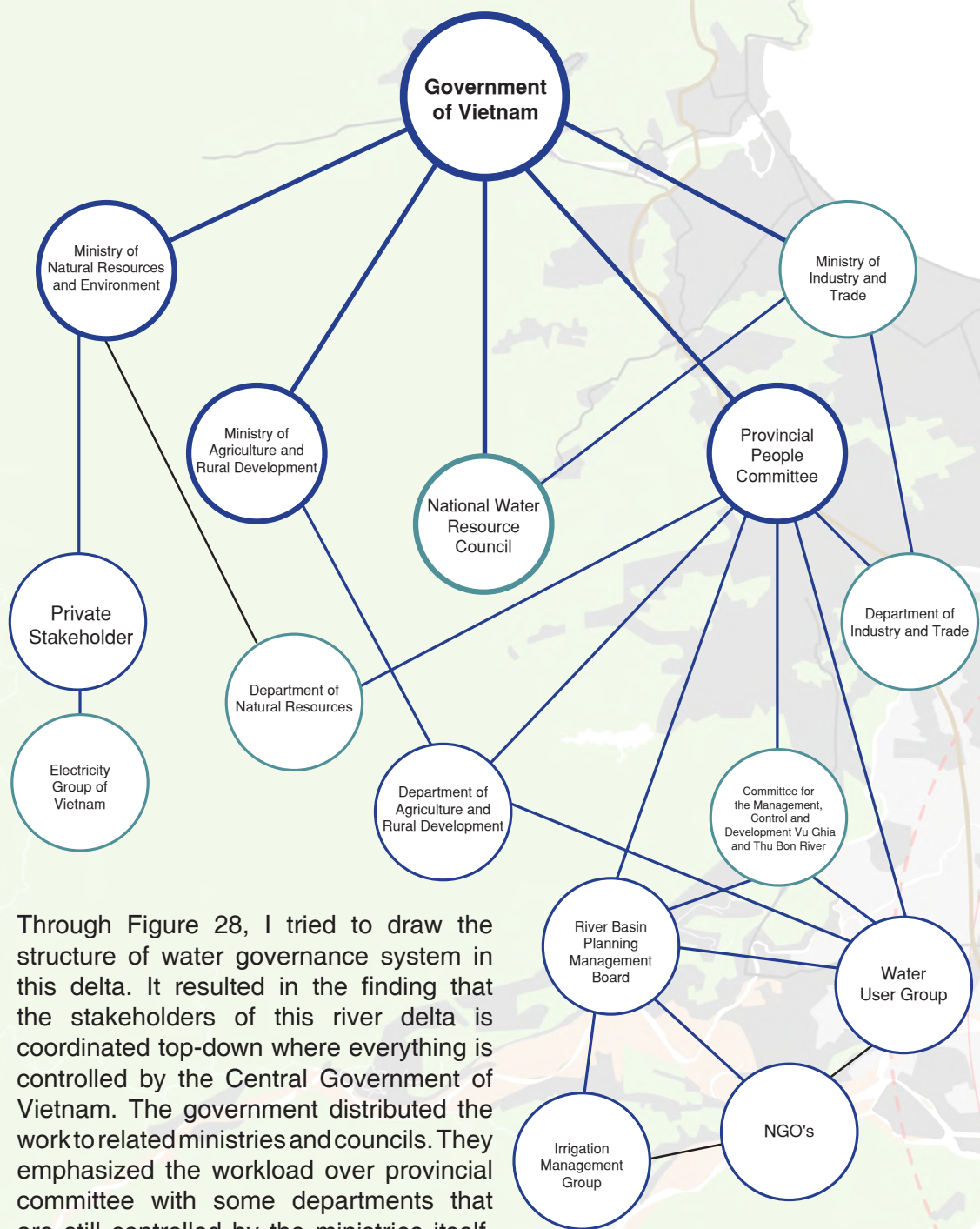
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Middle Stream - Quang Dai









Through Figure 28, I tried to draw the structure of water governance system in this delta. It resulted in the finding that the stakeholders of this river delta is coordinated top-down where everything is controlled by the Central Government of Vietnam. The government distributed the work to related ministries and councils. They emphasized the workload over provincial committee with some departments that are still controlled by the ministries itself. Unfortunately, departments working under provincial committee are also not associated to one another.

Fig 28. Thu Bon River Governance Organization System (Modified from: Ribbe et.al 2015)

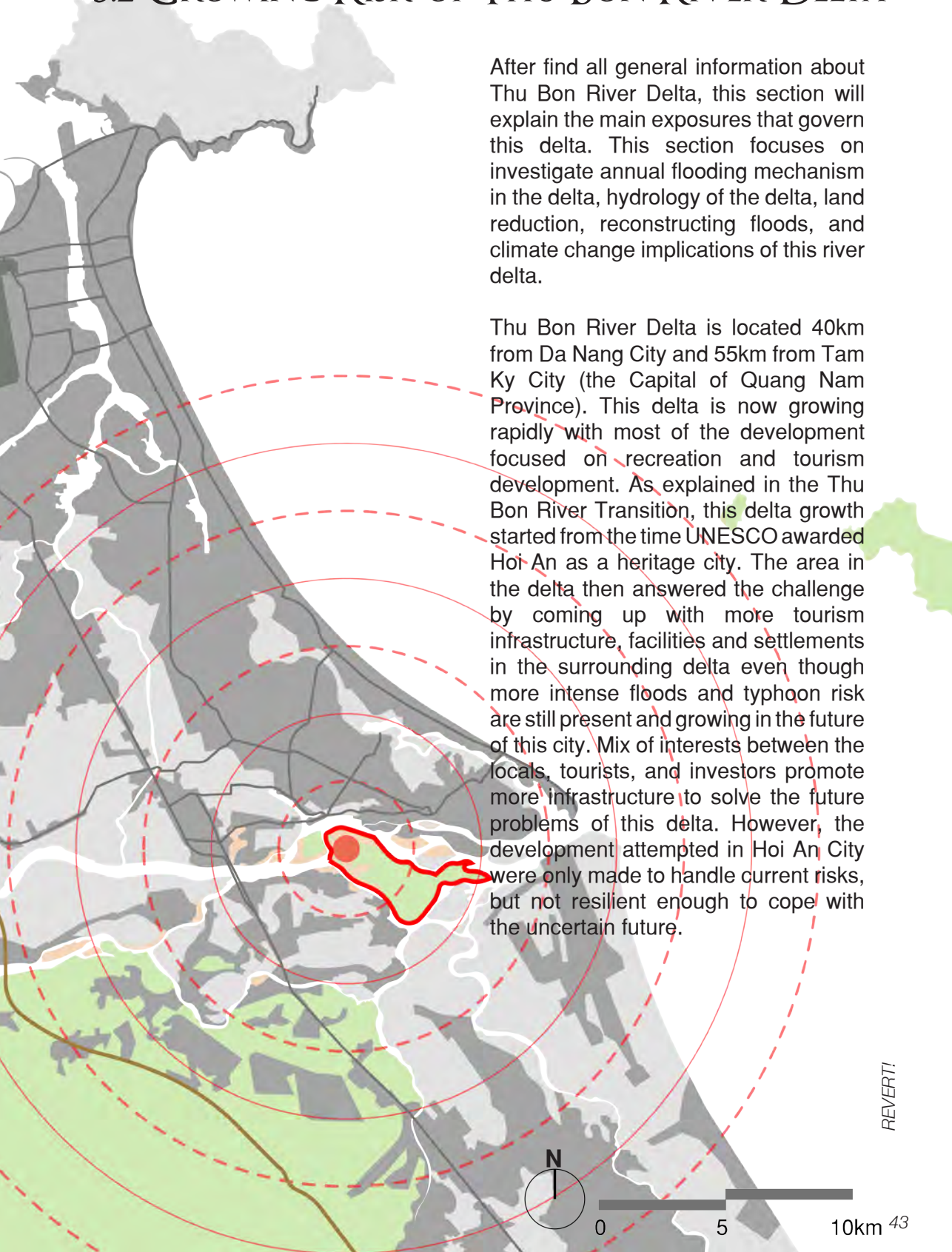
Fig 29. Design Focus: Cam Kim Island - Right



## 3.2 GROWING RISK OF THU BON RIVER DELTA

After find all general information about Thu Bon River Delta, this section will explain the main exposures that govern this delta. This section focuses on investigate annual flooding mechanism in the delta, hydrology of the delta, land reduction, reconstructing floods, and climate change implications of this river delta.

Thu Bon River Delta is located 40km from Da Nang City and 55km from Tam Ky City (the Capital of Quang Nam Province). This delta is now growing rapidly with most of the development focused on recreation and tourism development. As explained in the Thu Bon River Transition, this delta growth started from the time UNESCO awarded Hoi An as a heritage city. The area in the delta then answered the challenge by coming up with more tourism infrastructure, facilities and settlements in the surrounding delta even though more intense floods and typhoon risk are still present and growing in the future of this city. Mix of interests between the locals, tourists, and investors promote more infrastructure to solve the future problems of this delta. However, the development attempted in Hoi An City were only made to handle current risks, but not resilient enough to cope with the uncertain future.





### 3.2.1 ANNUAL FLOODING MECHANISM

The Living Landscape book (Steiner 2000) explained that flooding is the general and temporary condition of a partial or complete inundation of normally dry land areas either from the overflow of streams, rivers, and other inland water. It is also a result from severe storms, hurricanes, or tsunamis. For Thu Bon River Delta, flooding occurs from time to time. The people of Thu Bon River Delta think that lately (for the past decade), the flood that is happening in this region is the product of hydropower and dam construction in the upstream. They strongly believe that by tearing down the forest in the upstream results in severe floods. Following is the flood records that was happened in Thu Bon River Delta (Figure 30).

According to Quang Nam Statistica Yearbook (2016), the highest water level rate in Thu Bon River Delta was 4.55m (in 2013 ) and the lowest was -0.73m (in 2012) for the past five years. During the same period, the flow of the river reached the peak with volume amounting 40 thousand barrels and was discharged to South China Sea every second. However, even though the water was supposed to discharge to the sea, in several conditions, this becomes irrelevant. During the rain season, the average rainfall rate reaches 800mm/day.

Most flooding occurrences begin with continuous rain. In the built environment, especially in the urbanized area, more preconditions are applicable to deal with natural hazards and disasters due to the infrastructure built to support the livelihood. In order to verify the occurrence of the annual flooding mechanism, I conducted an informal group discussion with the locals. I found that the elderly and those in their productive age who were living there were completely aware with nature's sign. The signs help people determine what kind of response they should conduct in which is explained in the next sub-chapter. However, there are three main natural signs that make the locals become aware of floods in place of continuous rain.

#### 1. Rainbow in the Northwest

An elder explained that a rainbow (called: mong) will appear for several days in the Northwest of West of Hoi An City. According to them, the rainbow in the west indicates heavy rainfall in the highlands or upstream. By then, they start to stop all agricultural activities because they know the water will start to overflow their agriculture land



as a beginning to the rising water level of this delta. This occurrence may happen for about 1-2 weeks depending on rainfall rate during the time.

### 2. Full moon Phase



The locals understand that the full moon has a gravitational power to pull the tides higher than usual. Even if this phase only happens for a number of days within a 40 day cycle, the impacts are evident. The locals are also aware that the higher tides lead to the seawater blocking the discharge from the water upstream. By the time they get high enough, the supposed discharge will have overflown the city of Hoi An.

### 3. Gio Chuong (Bad Winds)



The way the locals understand a typhoon differs from the scientific understanding of the typhoon process. However, when they point out how the wind moves towards the mountain, they start to think that they need to recondition the structure of their homes to provide a safe space & storage for their belongings. They realize the ‘Bad Winds’ will bring more water to their lands and that water will be staying for several days until the winds push them away to the South Western part of the city. They regard the appearance of this type of wind as the

worst sign of flooding. The water level will remain high and more debris may fill the canals, drainage, and rivers. The delta will no longer be productive and the livelihood is down for a while.

The way the locals translate this natural phenomena demonstrates their cultural way in reading their landscape. The high understanding of the environment and the way of living results in the peoples appreciation towards the landscape that they live in. Unfortunately, the group that I discussed with consisted only of elderly and productive age locals. Thus, the local’s knowledge on the flooding mechanism between generations in this

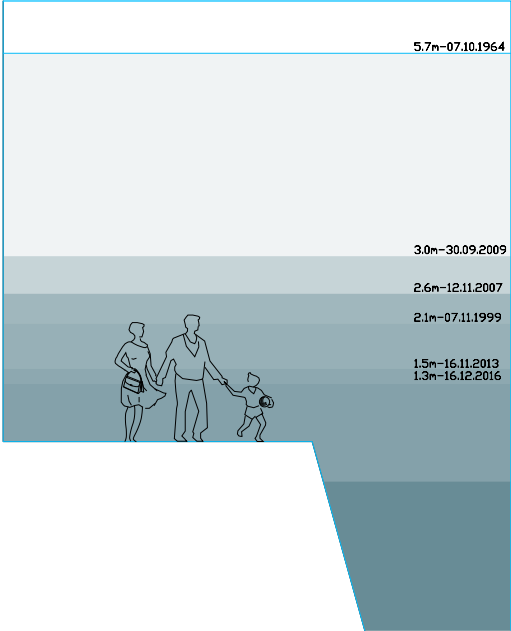


Fig 30. Flood Records in Thu Bon River Delta from 1964-2016

delta is unknown. Every year, the people of Thu Bon River Delta experiences this natural disaster over and over again. They have therefore gotten used to 'live with the floods'.

### 3.2.2 STREAM FLOW OF THE RIVER: HYDROLOGY AS THE MAIN COMPOSER

Hydrology is an important inventory element that illustrates water movement through the landscape, both on the surface and in the ground. In coastal areas like Thu Bon River, this hydrology inventory may be replaced or supplemented by an analysis of oceanography and/or estuarine ecology (Steiner, 2000). In this case study, the delta has two different water sources, both sea and upstream. These two types of water sources influence this delta region differently and become the main factor of the water problems in the delta.

To understand the hydrology mechanism, I tried to visualize the river flow in different seasons (Appendix F). The aerial photo from every angle were set to understand different water influence. During the dry season, the upstream started to dry up and less water flowed to the sea. While the tides remained the same height, sea water started to intrude the delta and the water surface salinity level increased. When salinity level increases, the soil is denied from gaining the best result of rice harvesting. Then, during the wet season, the volume of the river highly increases and pushes the seawater back to the sea. Furthermore, some avulsions form and most of them are utilized by the locals as a water reservoir for their agriculture land. The dynamic of saline intrusion can be seen in the figure 31.

### 3.2.3 FACTS OF LAND REDUCTION

The development of this delta has potentials to grow into an even more dense urban area with a focus on tourism. Being the ideally perfect fringe for the main urban development, Da Nang City has caught quite some attention from the local municipality. The major problem overseen by the municipality is land and coastal erosion in the delta. The adaptation action implemented in the delta is conducted sporadically and mainly focused on the most important spots for their economical growth. According to Figure 32, land reduction kept on changing the land edges from time to time.

I compared maps by the decades and calculated the length of the island edge changes. It showed tremendous changes from time to time, yet the land reduction has been slower than the previous four decades. In 1950-1964, the land edge has moved forth but is still separated by vast water

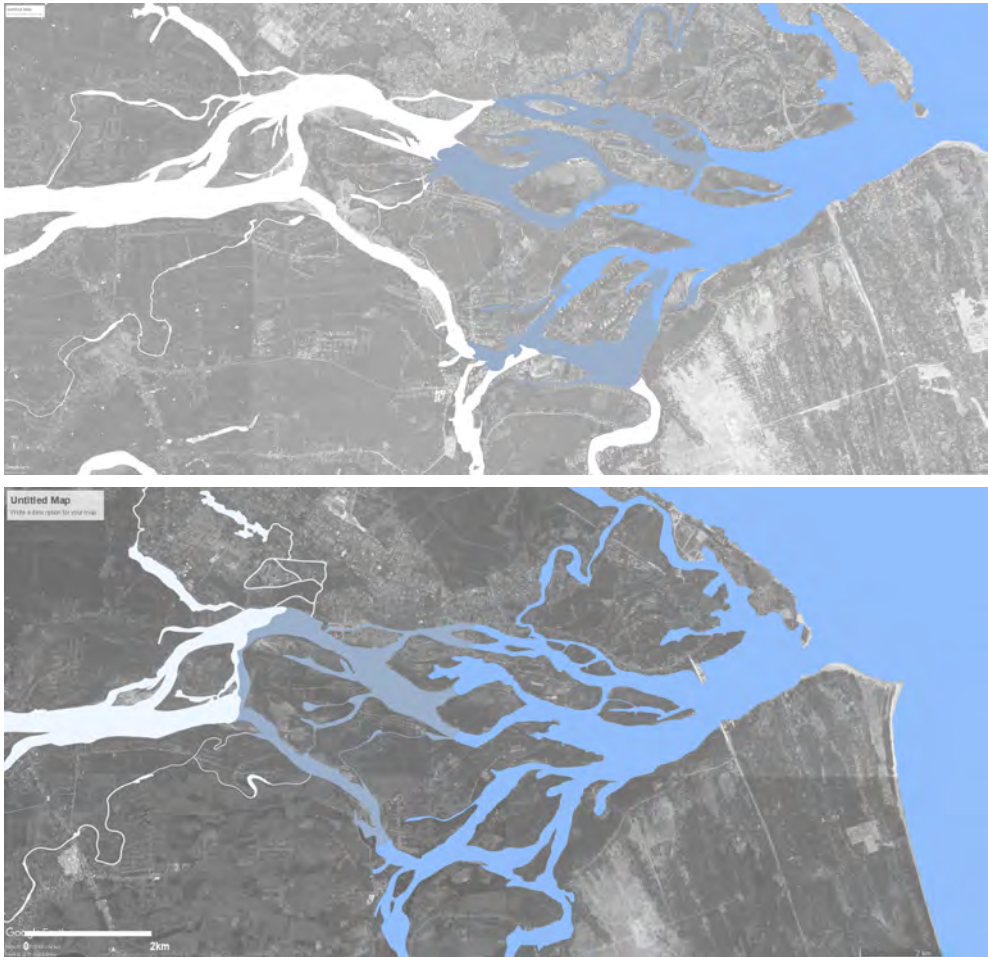


Fig 31. Saline Intrusion in Thu Bon River Delta based on Seasonal Water Flow (Top: Wet Season & Bottom: Dry Season)

body. The changes in the island edge shows that the stream pushes the deposits onward for around 160m. The next period, 1964-1986, the map pictures immense changes of the land with an average movement reaching 333m. This year, a devastating flood has occurred causing a disastrous impact for its inhabitants. Without sufficient water system management and infrastructure, the flooding forces immense change in the delta. The land edges move towards the river mouth and form a new profile. The next two periods, showed slower island edge movements. The average are 62m and 44m, respectively in the 1986-2002 and 2002-2017 period. Compared to the previous period, this current situation shows a more solid form of the land. Even though erosion and sedimentation are apparent, the influence and change on land form is less compared to the previous period.`

According to all facts that acquired and translated into several drawings, Thu Bon River Delta is a very dynamic landscape type of estuary. The river flow drift its sediments movement. Climate regime and layer base of the region had shifted the lands massively throughout centuries. Moreover, human intervention in managing river turns a tangled situation across borders: provinces, cities, commune, and village. Managing activity is definitely needed in every kinds of human occupancy, yet not every one could balance its landscape utilization. The sensitivity in conceive river flow is required to forecast what will happened with Cam Kim Island with all continuous growing future exposures. However, to establish more well set how is flood risk in the delta, visualization of floods occurrence is explained in the next section.'

### 3.3.3 RECONSTRUCTING FLOODS IN THE DELTA

In order to understand how the flooding mechanism works, I tried to illustrate the water rise spatially according to the last Damrey Typhoon according to my experience (Figure 33). I compared the water rise, timeline, and elevation of the delta. At the end, the mechanism of the flooding will be acquired and this spatial information will indicate the urgency of phases in generating the design later. I assumed  $\pm 0.00\text{m}$  as the standard water level. It took several days in order to reach  $+1.00\text{m}$  rise in this delta. During this time, most of the paddy field had been flooded and most of the agricultural production had changed into fishing activities. The next day, the water started to rise rapidly within hours. According to Cau Lau Water Station, the discharge reached a peak of  $510\text{m}$  at water station. It is categorized as level 4+1 flood which is considered dangerous by the local authorities. At this rate, most of the islands were covered by the water and the people had nowhere to go but to stay in their own homes. Most of them stayed in their attics, second floor, or went to the communal housing in the temple.

After 24 hours non-stop rain, the water debit is gradually released to the sea. The actual rate that I estimated during the flood was  $40\text{cm/hour}$ . At the end of the next day, the water was completely off the lands, but still some water inundate in the lowest part of the island and it took several days until it was completely dried out. However, at this rate, locals reacted swiftly to this annual occurrence. This interpretation is made to give the idea how fast is the floods when the typhoon came and when the typhoon passed by. This is the situation during Typhoon Damrey, but uncertain typhoon and flood in the future cannot be predicted and about to get worse.



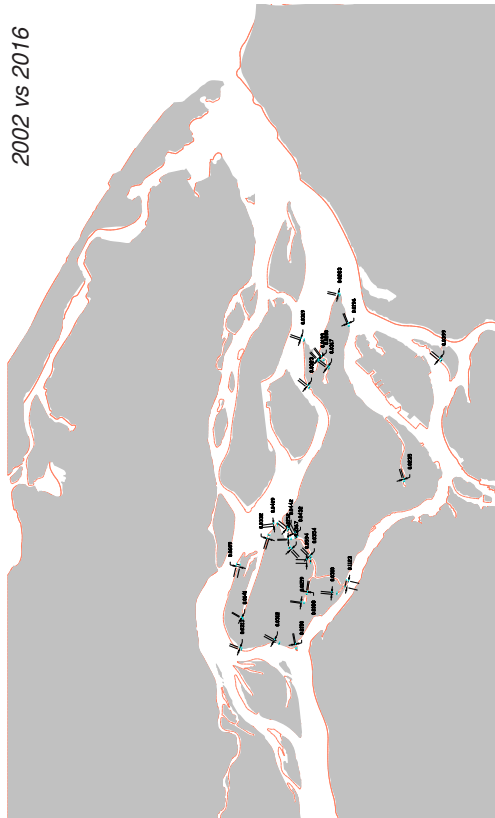
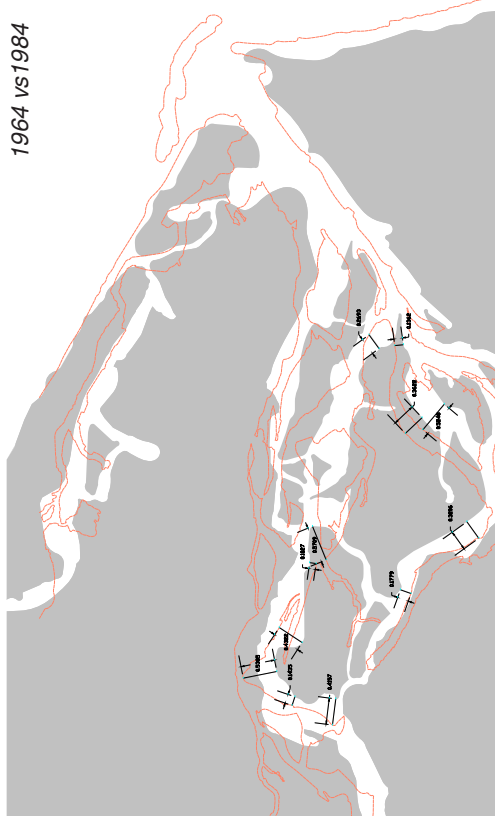
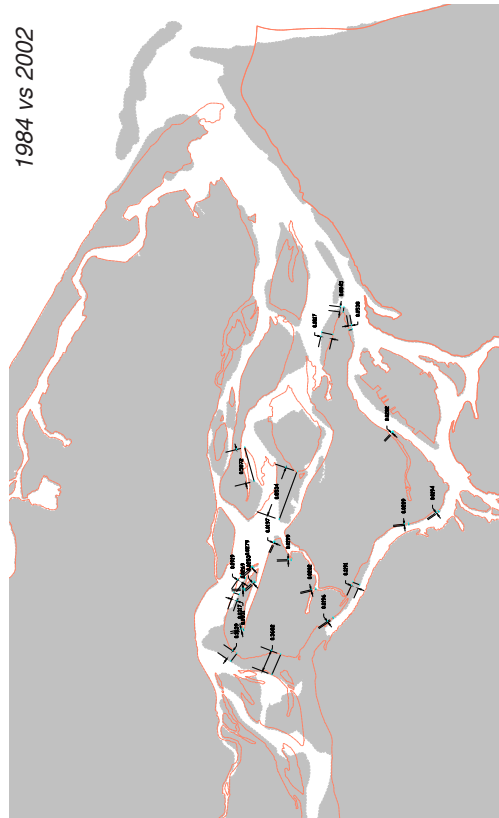
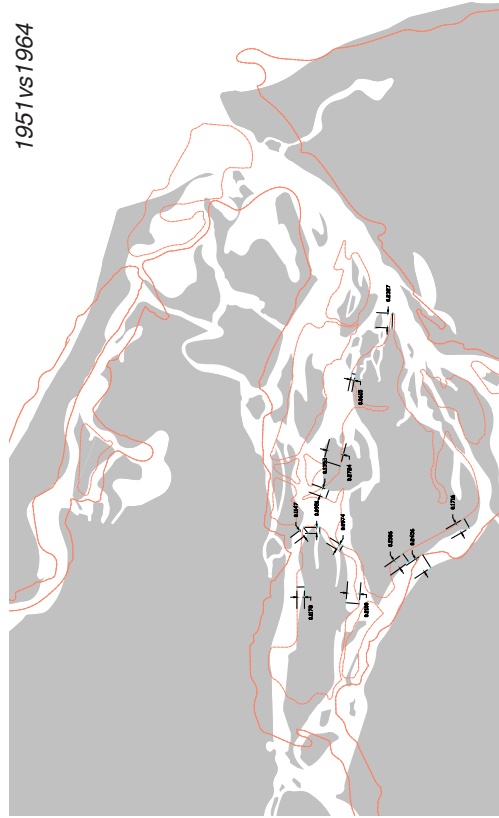
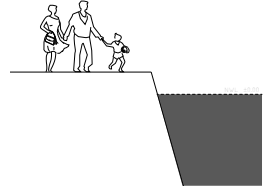


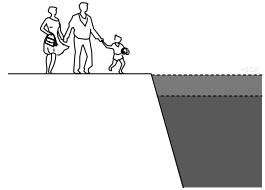
Fig 32. Changes of Land Edges from 1951-2017

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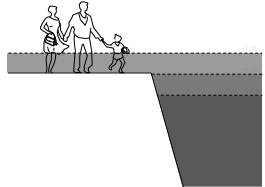
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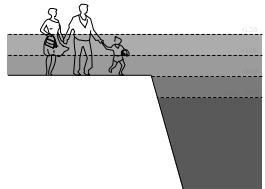
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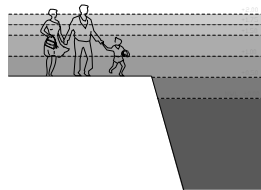
  
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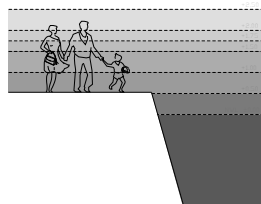
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Fig 33. Reconstructing Floods During Typhoon Damrey November 2017

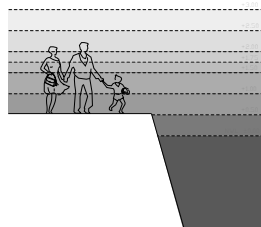
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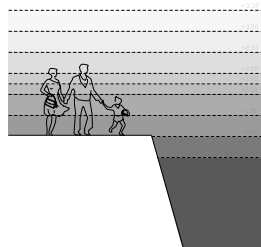
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### 3.2.5 CLIMATE CHANGE IMPLICATIONS

Even though the locals get used to flood and typhoon, they cannot pretend that they are facing bigger problems that called climate change. Climate change became obvious terror for every delta cities in the world because the first impacted places for this risk are delta cities. This section explained previous study about climate change impact in Thu Bon Delta.

Schmidt-Thome et al. (2015) considered Vietnam as one of the countries to be severely affected by climate change and thus response to climate change is of crucial importance to Vietnam. It is reported that changes in temperature varied in the range between -3 to 3°C and -5 to 5°C. It directly affects the average river runoff and annual distribution of peak flows (both high and low). The same report also mentioned that the climate change and sea level rise scenario for Vietnam are based on different greenhouse gas emission scenario of 4th IPCC Report, namely a low scenario (B1), medium scenario (B2, A1B), and a high scenario (A2, A1F1). The climate change website shows the difference of sea level rise with different green house gas emmissions. It shows insignificant result of sea level rise up until 2050, but in a projection of 2100 it showed a very bad impact to the the delta. The comparison between carbon cuts scenario and sea level rise is shown in Figure 34 and 35.

Some studies related to climate change tried to predict the possibilities happening between the scenarios. It can be read in the dissertation reports on evaluating fluvial flooding (Führer 2015) and estimating impact of climate change (Viet 2014). Both of these researches use Geographic Informational System as a simulation tool for the different scenarios based on the Vietnam Climate Change Scenario. By evaluating the spatial protection goals, Fuhrer (2015) emphasized that most of the delta region failed to apply their protection goal and more damage will occur in the settlements within a different scenario (Figure 32). Saline intrusion is also estimated by assessing the areas vulnerable to saline intrusion. It can be seen in Figure 37.

In 2012, the UN Habitat generated a report on Cities and Climate Change Initiatives in this Delta, specifically for Hoi An Ciy. It is concluded that there are four main wards in this delta which are vulnerable to the impact of climate change (Figure 38). Furthermore, the number of storms have been predicted to increase in the future because of direct consequences of climate change.



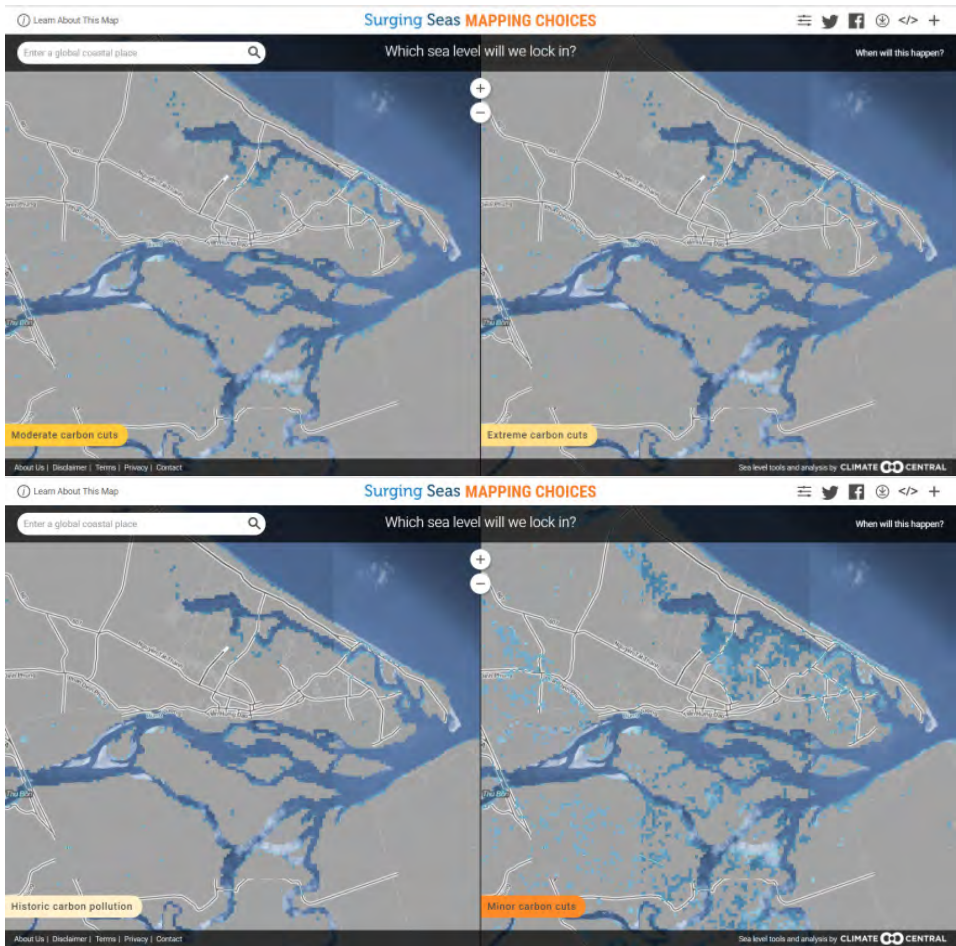


Fig 34. Sea Level Rise Forecast in 2050 in Moderate Carbon Cuts and Extreme Carbon Cuts - Above  
 Fig 35. Sea Level Rise Forecast in 2100 in Moderate Carbon Cuts and Extreme Carbon Cuts - Below  
 (Source: Climate Central 2017)

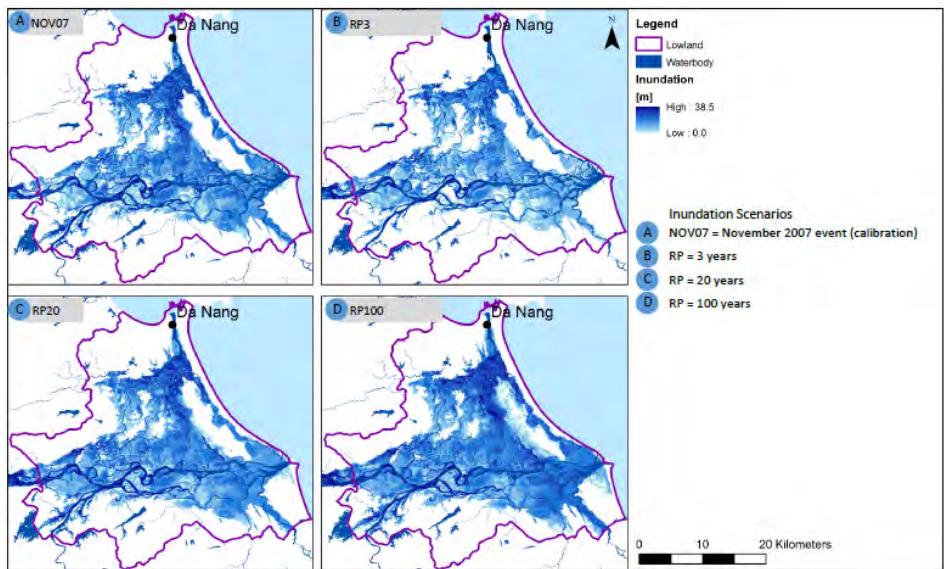


Fig 36. Future Fluvial Flooding Study (Fuhrer 2016)



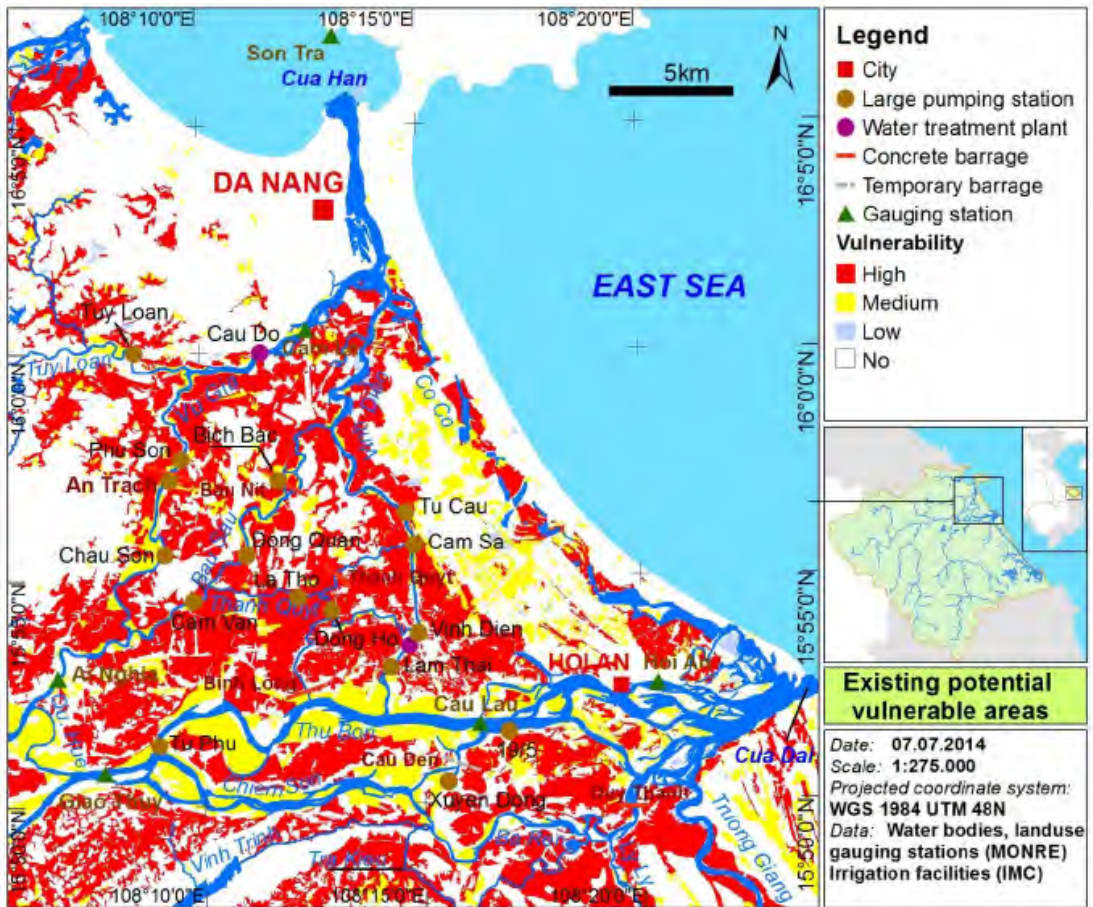


Fig 37. Vulnerability Area of Saline Intrusion for Existing Situation (Viet 2014)

Fig 38 The Most Vulnerable Wards of Hoi An City (UN Habitat 2014)

## 3.3 FINDING THE DYNAMICS

### 3.3.1 DESIGN FOCUS LOCATION

Referring to the research questions, this research's Main Design Question is focused on enhancing the resiliency of Cam Kim Island. This island is selected as a case study because according to UN Habitat Report (2014), the wards in this island are vulnerable and highly exposed to flooding which happens four to five times a year. This island is divided into three different municipalities. There are Thanh Ha, Duy Vinh, and Hoi An City. It makes the coordination between the wards even harder when the island is exposed to flooding and typhoon. However, being unsupported by proper technology in disaster warning system, the evacuation information has always been late. During the latest Damrey Typhoon, evacuation order was published ten hours after the water rose. The local municipality distributed this information over social media (mostly from Facebook). Even though the information distributed were lacking, the loss of the locals living in the island was less than the number of people living in the outer part of the island. The strong attachment between the locals and their natural landscape had turned a reciprocal relationship to survive during the flooding and typhoon. However, this area is being considered less by the municipality, and all the attention of damage focused on Hoi An City Center and Cua Dai Beach. Therefore, this island had become forgotten, and instead have their own survival guide conducted by the locals.

landscape of the island is consisted of an estuary type of ecology which is influenced by intertidal subsystem. The island portrays a Vietnamese traditional way of life where most people live their lives as farmers, fishermen, or handcrafters. The interaction between human and landscape might not be revealed yet. The confluence of water and land culture are obviously seen in this island. The eastern side which is more influenced by inter tidal system drives most people there to become fishermen. Emergent wetlands and flooded grass plain dominates the eastern and northern part of the island. Meanwhile the south and western part are dominated by agriculture

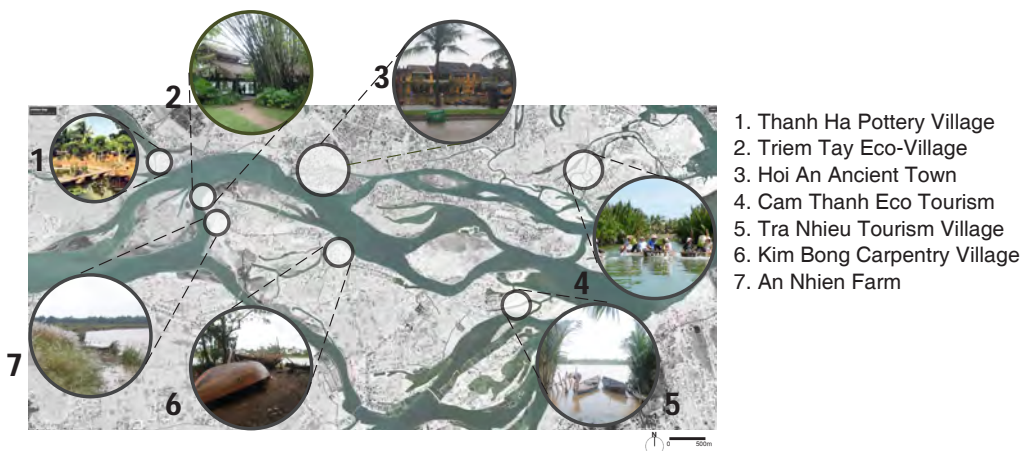


Fig 39. Tourism Objects in Thu Bon River Delta

based landscape and a combination of aeolian dunes and bamboo forest. Many people also raise cattles, but not for industrial production. More to fulfill their own needs for living. A temple marks the entrance of each village and smell of incense fills most of the houses on the island. Moreover, edible trees and flowery plants cover the small roads (2.5-3.5m size) on the island.

### 3.3.2 LANDSCAPE LAYER INVESTIGATION

The method of Steiner and Mc Harg focuses on preserving natural landscape and generating the best landscape adjustments for human beings to live. However, in this specific case study, the separation between natural landscape and human settlements are inevitable. The very long range of interaction between human and the landscape of this island has established a subtle and unconscious new landscape form because everything seemed to grow autonomously in both its nature and settlements. To identify the most important landscape component of each layer, I separated each component and tried to figure out the correlation between those characteristics (Figure 41). Later, it is also verified from the interview result.

To investigate the landscape dynamics, I overlaid the most possible components related to each other. I printed out the map in A3 sized paper and traced in to see how far each component influenced each other (Figure 36). However, climate and weather pattern is also taken into account but not manifested spatially. After figuring out several connections, I translated

the components into words and generated threads between them. Over 70 threads were created to show the reciprocal relationship between the landscape components. In this layer analysis, biotic layer represents by three components. There are soil type, elevation, and water surface and flow. Biotic layers consists of two layers, there are habitat type and vegetation layer. Lastly, human layer consists of land use layer, infrastructure layer, irrigation layer, and material building layer. After knows all the landscape layer, the relationship between layers were analyzed per component.

Figure 42 reveals the reciprocal relationship between landscape layer and elements. Each connections are represented by a number threads which correlates to the element's existence. Over 70 threads were generated and if one element had more than three threads, it meant that its existence is essential for this site. It showed 14 landscape elements consisted of 11 most important elements and six less important yet essential for the landscape of Cam Kim Island. By understanding these connections, I can also conclude that the most





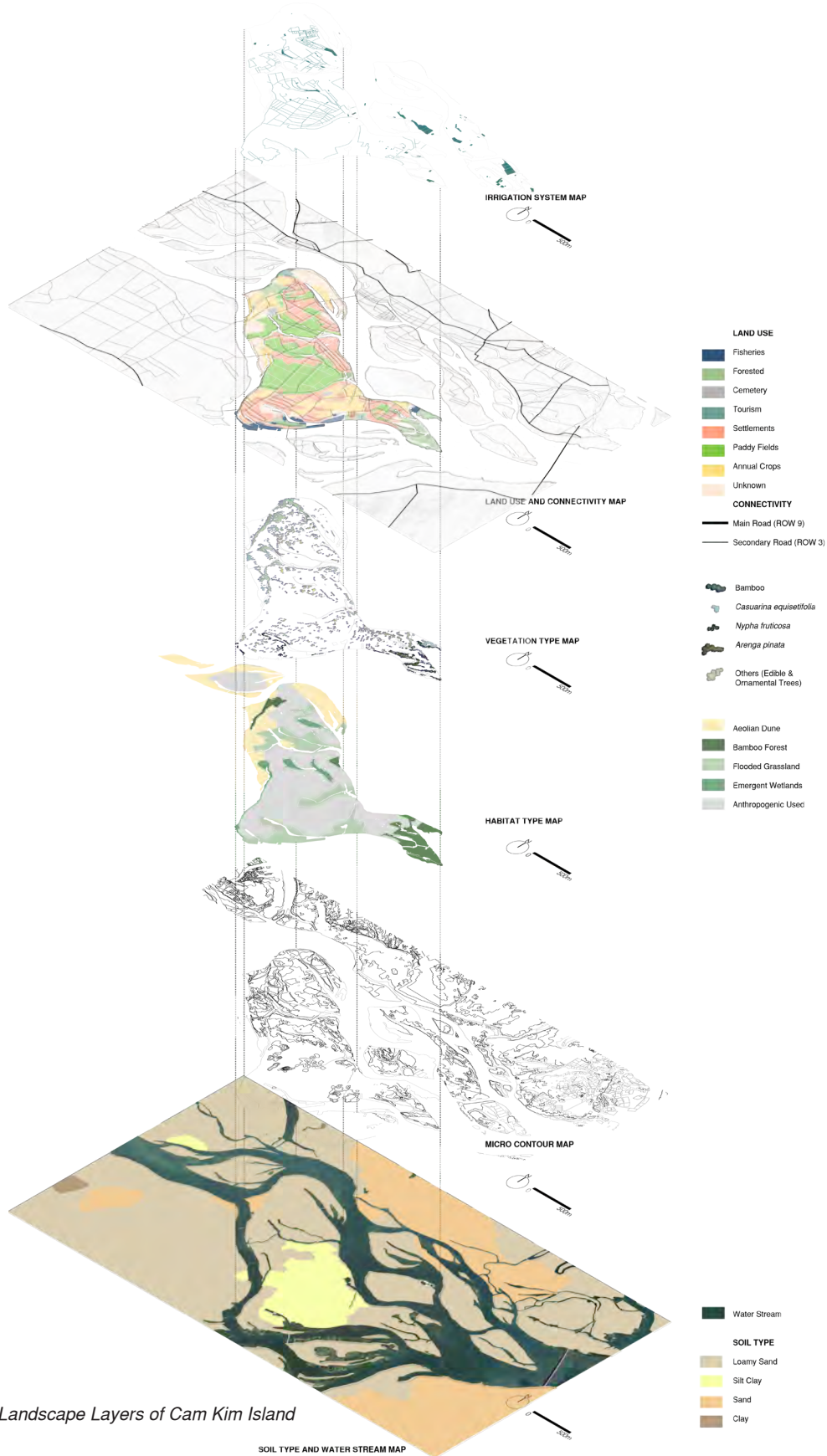


Fig 41. Landscape Layers of Cam Kim Island



important layers for this site is elevation layer, water surface layer, and habitat type. In dutch planning approach, these layers are known as ‘ondergrond laag’ or subterrain layers that has low dynamics and formed over 100 years or more. However, the existence of this component interaction needs to be respected and considered in the future design strategy.

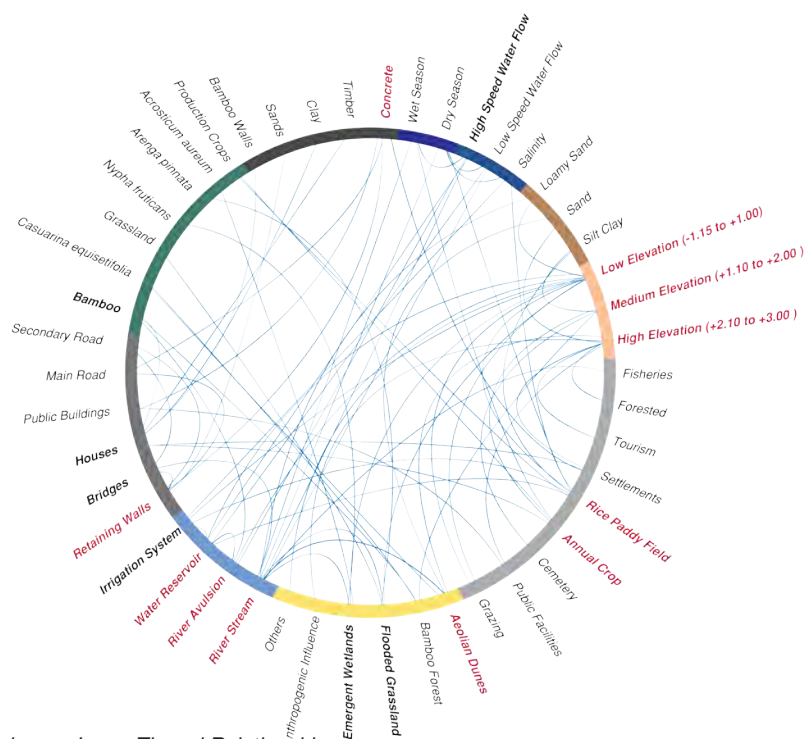


Fig 42. Landscape Layer Thread Relationships

### 3.3.3 SPECULATING THE FUTURE OF CAM KIM ISLAND

The lack of spatial information on sedimentation and erosion necessitated a speculation of the future possibility of the delta. This speculation idea is based on by analyzing the imagery maps from Google Maps throughout both wet and dry season. In that imagery, the stream flow, surface type, and elevation maps were compared from USGS. Re-checking maps and aerial photos from different angles are necessary to triangulate the information. The future of sedimentation is then retrieved (See Appendix F). Thus, future erosion and sedimentation deposit can be identified in several locations, but it does not show the amount of land loss and extension in the future. However, most erosion happened in the area without retention and the deposit found nearby public infrastructure, for instance decks and bridges. Moreover, the current

river avulsions in the island might be shorter and have less water in the future, thus it will not be available as a water reservoir in the future.

The changes are not only occurred by the natural dynamics of the delta, but also land use changes in the future. Even though the prediction of land use are not obtainable at the moment, the locals have their own understanding to depict changes of land use. The locals kept mention about productive age local's scarcity who stayed in the island and believe that tourism is the only way to survive in this delta. Nowadays, the youngsters send to the city to study and were expected by their parents to have better earning in the future while the parents kept working in the island. The economical situation drift

the younger generation to leave the island and left the older generation to take care whole island.

This attitude, however, will possibly influence the future land use with a huge gap of land usage. The elderly may only know the basic knowledge of utilizing natural landscape of the island, yet tourism demands more than that. It is predicted by the locals that in the future, more settlements and infrastructures will grow in the future. With those autonomous developments, natural landscape of the island will be reduced and 'museumized' landscape will grow. Later, most of activities that relates to the landscape will only be on producing massive tourism service for the visitors.

### 3.3.4 HUMAN AND LANDSCAPE INTERACTION : PRIMARY TOOLS TO SHAPE THE FUTURE LANDSCAPE

To verify the reciprocal relation between landscape and human interaction, I conducted interviews with the locals. In this study, interviews become essential to verify and gather more precisely how the locals are able to shape and survive with this highly dynamic landscape of the region. Moreover, natural disaster occurrence is also an interesting thing to understand through the local's knowledge, thoughts, and way of living. Thus, I did 13 interviews with locals between different age groups: three children, six productive aged people, and four elders. The distribution of the educational background did not vary. Only three of them had a higher education background, while the others were high school graduates.

According to the locals, the flood and typhoon understandably is a very bad experience for them. They explained how hard they recovered their private and public structure, landscape, and arised their economic stability. However, among them, a group of people who were not part of the locals tried to rebuild the island. They introduced the locals to very specific techniques in terms of

erosion reduction and claimed that it worked. They tried to bridge the gap with their knowledge and collective acts, but somehow the locals know the process and real occurrence of this natural disaster better than the others.

During typhoon and floods, they shared the same emotion to express their experience. I found that there were 17 types of emotions (See Appendix G) expressed which were mixed between positive and negative feelings. Mainly, there are three expressions (both negative and positive) that appeared mostly, but were contradictive. The people felt it was convenient to live in the island, yet were uncertain about it during a disaster; they appreciate their landscape, yet desperate to cultivate it; and they felt adaptable with the flood, yet worried when the typhoon came and water filled their houses. These contradictions might happen because of the strong local's belief. More than 80% of Vietnamese populations are non-believers, they circulate their activities around Buddhism, Confucianism, and Taoism senses. Xia and Schonfeld (2011) mentioned this thinking provides an alternative model of being-in-the-world, and in contrast to the unsustainable practices that shape civilization and later it will not collapse under its own weight but instead simply allow human to continue, evolve, and flourish as a civilization.

This way of thinking appeared under Chinese famous philosophy that emphasized living with harmony: Tao. In the book *Tao Te Ching* (Tsu 1972) mentioned 81 verses that explains keystone work of Taoism philosophy. The basic of Taoism view of the world is every thing-event is what it is only in relation to all others. Watts (2010) is also mentioned that the principles is that if everything is allowed to go in its own way the harmony of the universe will be established because every process in the world can 'do its own thing' only in relation to all others. Meaning that the followers have to be flexible enough when they deal with their relationship between human and nature. Some of the verses are explaining about living flexibly with nature which expresses in verse 76 (Tsu 1972).

*When a man is alive, he is soft and supple.  
When he dies, the body becomes hard and stiff.  
When a plant is alive, it is soft and flexible.  
When it is dead, it becomes dry and brittle.  
Therefore, hard and rigid shall lead to death.  
Soft and gentle shall lead to life.  
Thus, a strong army with rigid force shall not win.  
A thick and big tree will be cut down for its use.  
The big and strong will take an inferior position.  
The soft and gentle will take superior position.*

The verse above explains flow with life by following nature's guidance and

it indicates flexibility in way of thinking spiritually and mentally that refer to trees in the nature condition. It says that tree are highly adaptive with its surrounding situation and so the locals way of living. From 7 out of thirteen persons, the locals mentioned the importance of being flexible with nature. For instance, one of educated interviewee said that she must learn to accept the loss because nature will always want something back when you could work on its land and earn something from the nature. To her, it is one way to live harmoniously with the nature.

Those statement represents the thinking and how to appreciate nature even though nature give you unfortunate condition. This kind of thinking shaped daily life of the locals. The roots of Taoism are attached strongly in the society's mind. The locals mentioned that they have never been regret to live in the island even though it is vulnerable to natural disaster. Therefore, a term of reconcile with the nature for this society is practically realized in this island. The strong attachment shaped attitudes towards annual typhoon and flooding risk and led the locals to their wisdom in living with floods in Cam Kim Island.

With that strong thinking, the response countered by the locals are mainly to do things for themselves as a part of natural systems. By cleaning the environment where they live, they feel that they contribute something to their nature and afterwards, they came up with reinforcing their personal belonging. They did it collectively and some expertise helped them to convince and translate the idea of protecting the island edges by their own way. It happened to be good, but there are no such a perfect plans which always led them to failure and loss annually. With a noble intention, these stakeholder is also trying to get advantage by promoting traditional living of Cam Kim Island that later used to enhance the tourism sectors of the island.

The role of these expertise who dedicates their live are to help the locals to coordinate with the adaptation action they conduct even though the locals knowledge on landscape dynamics and floods are verified. They understand how the flooding mechanism works and the climate regime shapes their daily landscape. Unfortunately, the local knowledge on climate change is insignificant. They only know the basic understanding about the sea level rise, temperature rise, disease outbreak, and other things that affect their agricultural and fishing result. The limited understanding on climate change needs to be elaborated further. Thus, they will comprehend more resilient action in the future.

The expertise may think ideally according to their fusion thoughts about

Vietnamese culture and knowledge that they have. but the local's perception in avoiding floods and typhoon is slightly different from them. According to them, they indicate a successful typhoon and flooding adaptations by improving their landscape with firm structures to obtain a cleaner and drier environment. This contemporary approach had been using by European countries which manifested by dyke constructions along the river, yet it reacted to a larger future risk because of technocratic system that they applied to the natural environment. However, this will is contradictory with the local way of living but the main problem is they have no idea how to integrate their local coping mechanism into their landscape setting. Thus, they are just let it go whatever happened to them for every typhoon and floods occurrence.

These typhoon and floods occurrence led to spatial changes in the island. In the previous section, a collective facts of land reduction, landscape quality, land use changes, and brief description of water management is constructed current situation of the island. Most of those facts were also verified by the interviewee, yet the result only showed a few collective awareness in maintaining the landscape. At the end, the locals were only responded this situation to their own house and home garden. Even though they realized the impact of erosion, the locals do not have any idea how to solve this problem because they kept seeing the bad impact of each improvement. The inhabitant's settlements are mostly located on the highest ground (>2.00m) with loamy sands as their base. This soil type is considered as a good type to support foundation. The locals fill it in from the soil they get from the edge of the island which is considered as aeolian dunes. A long time ago, there were two brick factories in this island which slowly stopped functioning because more people tend to export material source from the city instead of the island.

Landscape utilization of the island is ranged on agricultural use that turned the island into a productive landscape during the dry season. Paddy rice field and various type of herbs, fruits, and tubers are ready to consume when it comes to harvesting time. Those products provide the locals for their daily life during dry season. When it comes to rain season, the locals will prepare their adaptive ability to deal with the floods and typhoon. This preparedness is not only occurred because of their life time relationship with the floods, but again return to their philosophy of Taoism.

Verse 46 (Tsu 1972):

*When the Way governs the world,  
The proud stallions drag dung carriages.  
When the Way is lost to the world,*



*War horses are bred outside the city.*

*There is no greater crime than desire.  
There is no greater disaster than discontent.  
There is no greater misfortune than greed.*

*Therefore:  
To have enough of enough is always enough.*

The message in the verse above is about to know the limits of our needs and oppressed the greed in ourselves to utilize nature. This verse is also telling about offering to greed will make the greed is stronger. So, the way of controlling nature may also manifest by the way to control the people without giving much exposure and limitation to the natural landscape to grow. Reflected to interview result, this verse represents modesty in local's life. In spite of low understanding of climate change, the local had been used the landscape wisely by planting plants to support their food supply and to beautify their own front yard. The locals are completely aware of their landscape quality in the village, therefore they want to have a peaceful environment for their own where they can have fresh air to breath, quiet surroundings, and less flooding effect in the future.

When it comes to asking for future potential, interviewees were quick to answer that Cam Kim Island is compatible to be a tourism based development. Most of the answers mentioned their culture as their best asset for tourism development. On the contrary, when it came to the future landscape of the island, the interviewee also answered that they realized that their place is the best natural place in the river. It is obvious that the locals here want to live simultaneously with the nature for their future.

To prove the relationship between the locals thoughts and understanding, a relationship threads were visualized. It resulted a mixed cause and effect between feelings, efforts, responds, and experience before, during, and after flood and typhoon. Later, it is also linked to the local knowledge, spatial changes, and adaptation action that summarized in the Figure 43.

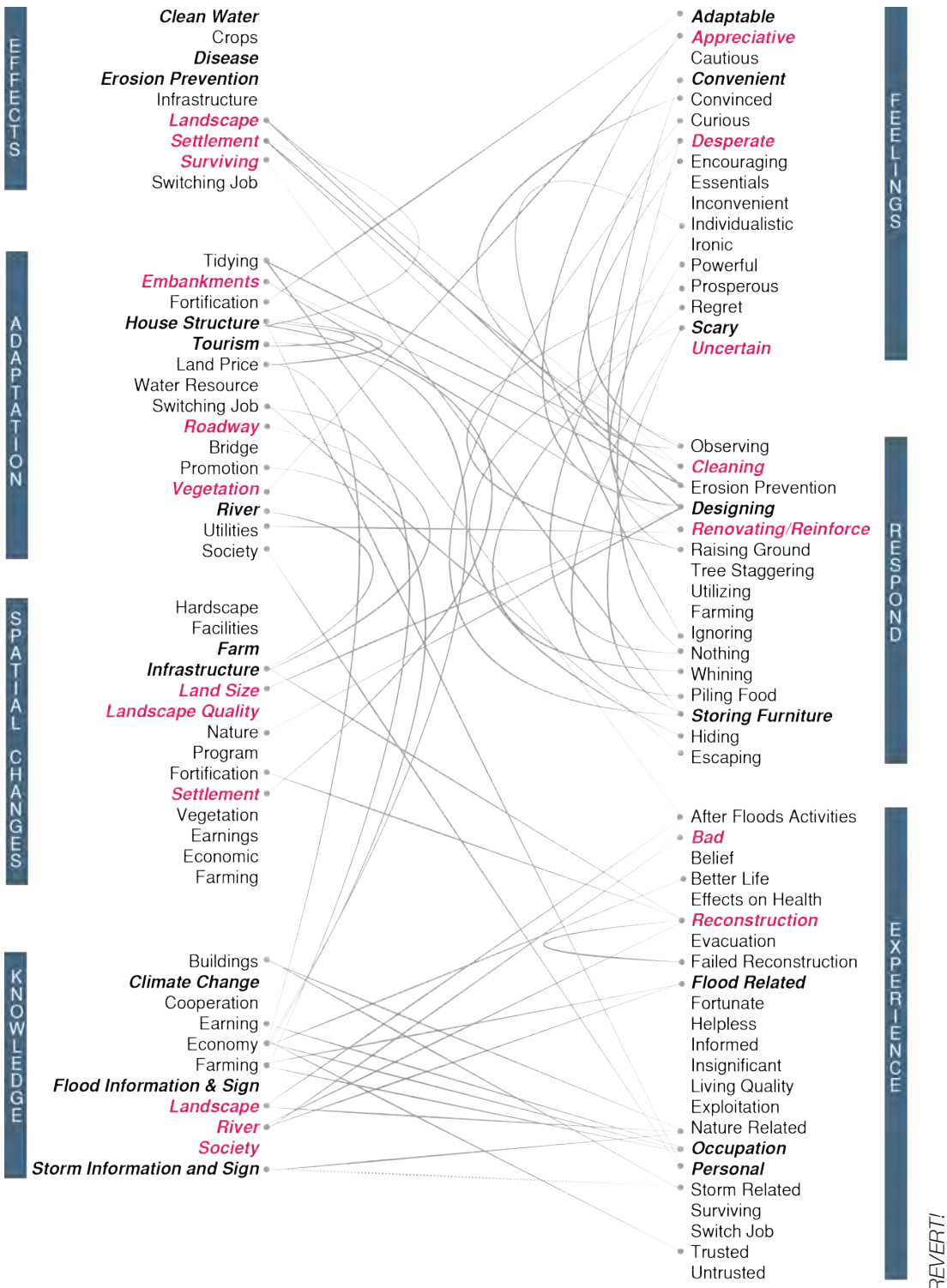


Fig 43. Finding Relationship for Interview Result

## 3.4 CONCLUSION : FROM FACTS TO SKETCHES

This chapter tries to collect and identify a basic understanding of Thu Bon River Delta that later considered as the site location and answer for main design question. Through research for design, some spatial information about dynamic landscape of the delta is retrieved and translated into drawings. The finding mentions that the delta had been changed rapidly for centuries. Immediate erosion, sediment transport, material deposit, and anthropogenic pressure consolidates an actively shifted landscape of the delta. Moreover, global phenomenon of climate change effect had shifted the trend of natural disaster occurrence in the delta and become a collective exposure that govern future landscape layer in this delta.

Rather than arranging and thinking to solve all the problems, the needs of zooming in and out the site is the most logical approach to analyze this site and figure out the inter-relations from layer-to-layer. So, more detail landscape characteristics are retrieved and must be considered for proposed design. From spatial information, I can understand that elevation/contour, water surface, and natural habitats are the most substantial things for the landscape of Cam Kim Island. Even though constructive landscape layer is acquired, the main users of the island -inhabitants- must be taken into account to establish traditional coping mechanism in the island.

To understand the local's thoughts, interview activity was conducted. By asking the locals, interpretive strategies start from the recognition that the

meaning of objects, events, words, actions, and images are not always plain and obvious, and they require the investigator to actively engage in "making sense" of the phenomena they encounter. In this study, I conducted interviews to the locals to perceive their local coping mechanism to transform impacts of risks during typhoon and floods. Even though the interview result showed that some irrational traits take place in the emotional part, it becomes the main key for the greatest findings about them. The locals there just wanted to stay longer in their homeland, because their attachment to their natural landscape. It is part of locals belief from their ancestors that is partially belong to Taoism to live together with nature and reconcile with nature even though when it gets on its bad side. So, their way of developing their landscape are always respecting the natural habitat and the changes are mainly located in the settlement area.

Figure 44 shows how the people worked on their annual landscape settings. Their belief to the nature will provide the best for them if they treat their environment well. This has helped shape the locals into the best 'nature's reader' in their island. They adapted their settlement by filling in the land. Thus, higher ground is created in their surrounding home. Moreover, for wealthy people, they started to construct two floor houses and place their personal belongings on the second floor. Poor people are mostly evacuated to their nearest wealthy neighbor or to a pagoda with a communal house.

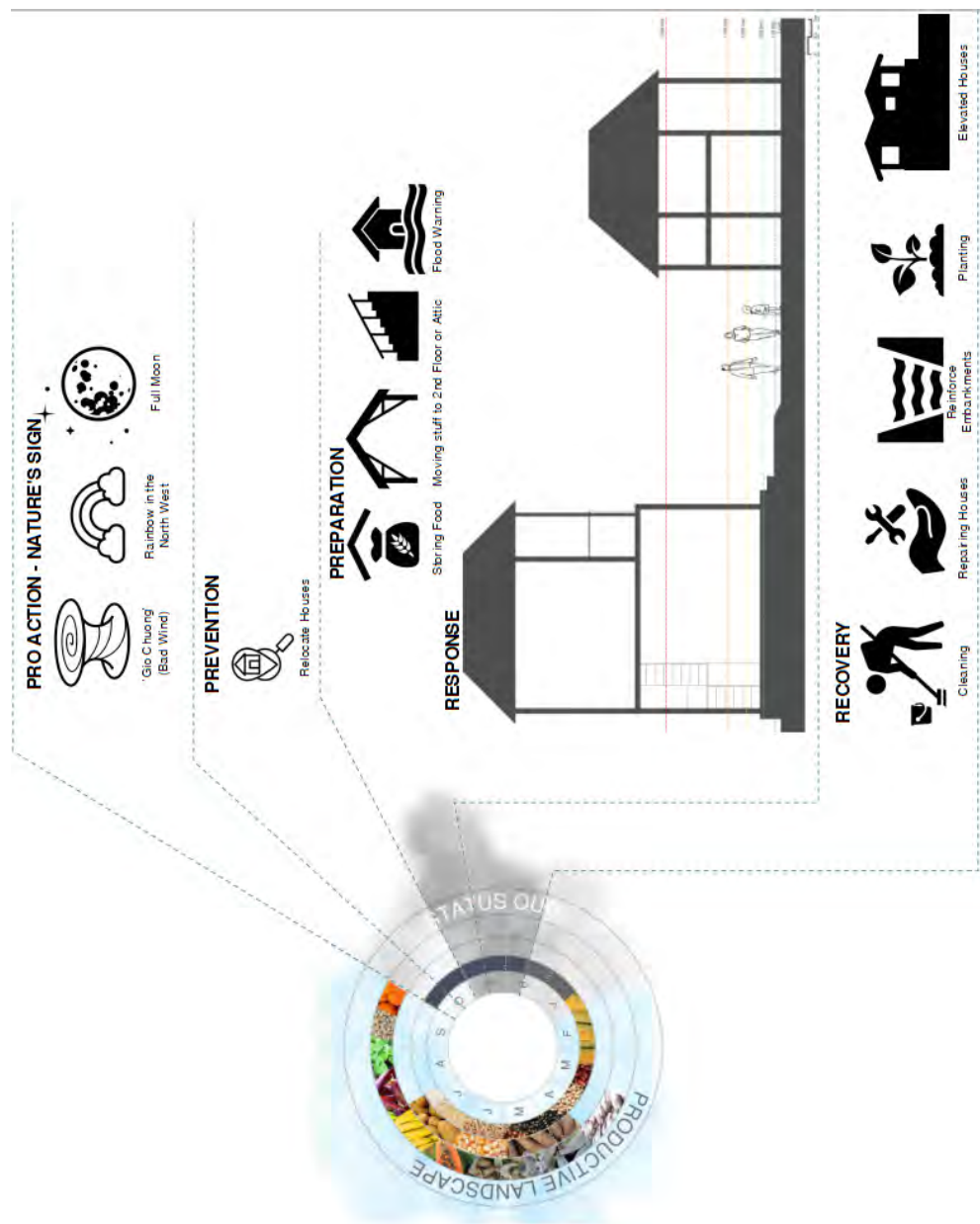


Fig 44 . Tourism Objects in Thu Bon River Delta  
REVERT!

According to Millburn & Brown (2003), a research seems to have two key roles: influencing the concept generation process and the application concept on site. In this study, concept generation is obviously essential. In this design process, I used analysis-synthesis model as the ground understanding of the site dynamics. However, it resulted interdependence between landscape layer and local's adaptation action. The main findings of this research are linked with the theory of resilience towards the adaptation and spatial changes of

Cam Kim Island (Figure 40). This finding shows that redundancy and modularity are the most used resilience by the locals in this moment. Moreover, the result of this chapter shows which location in the island that needs the most improvement. The priority is based on flooding reconstruction during Typhoon Damrey and future landscape speculation. The information can be seen in Figure 45. The higher number means that it has to be prioritize in enhancing resilience landscape in the island.

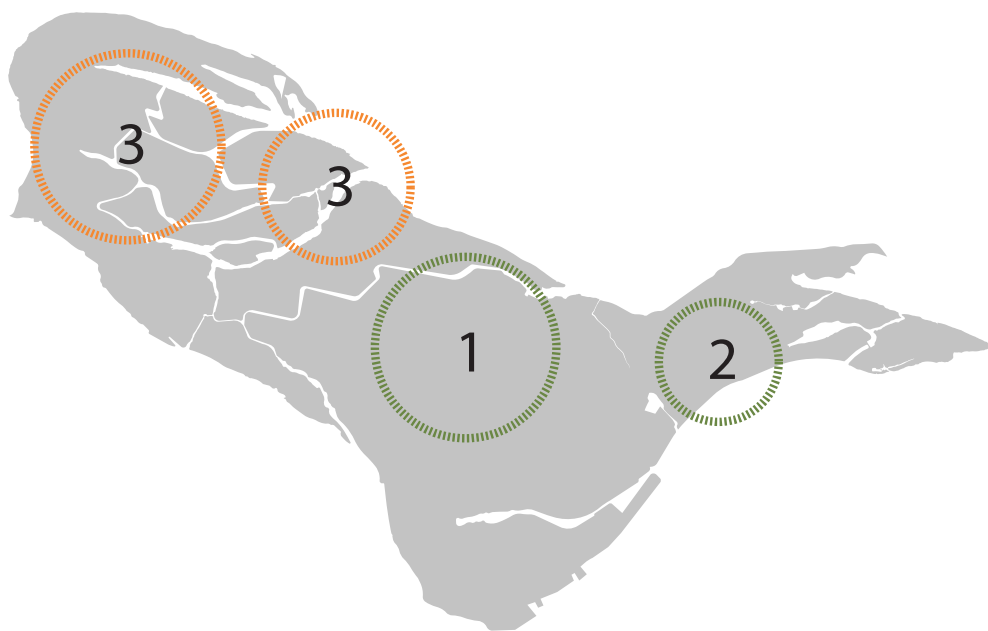


Fig 45. Development Priority of Cam Kim Island



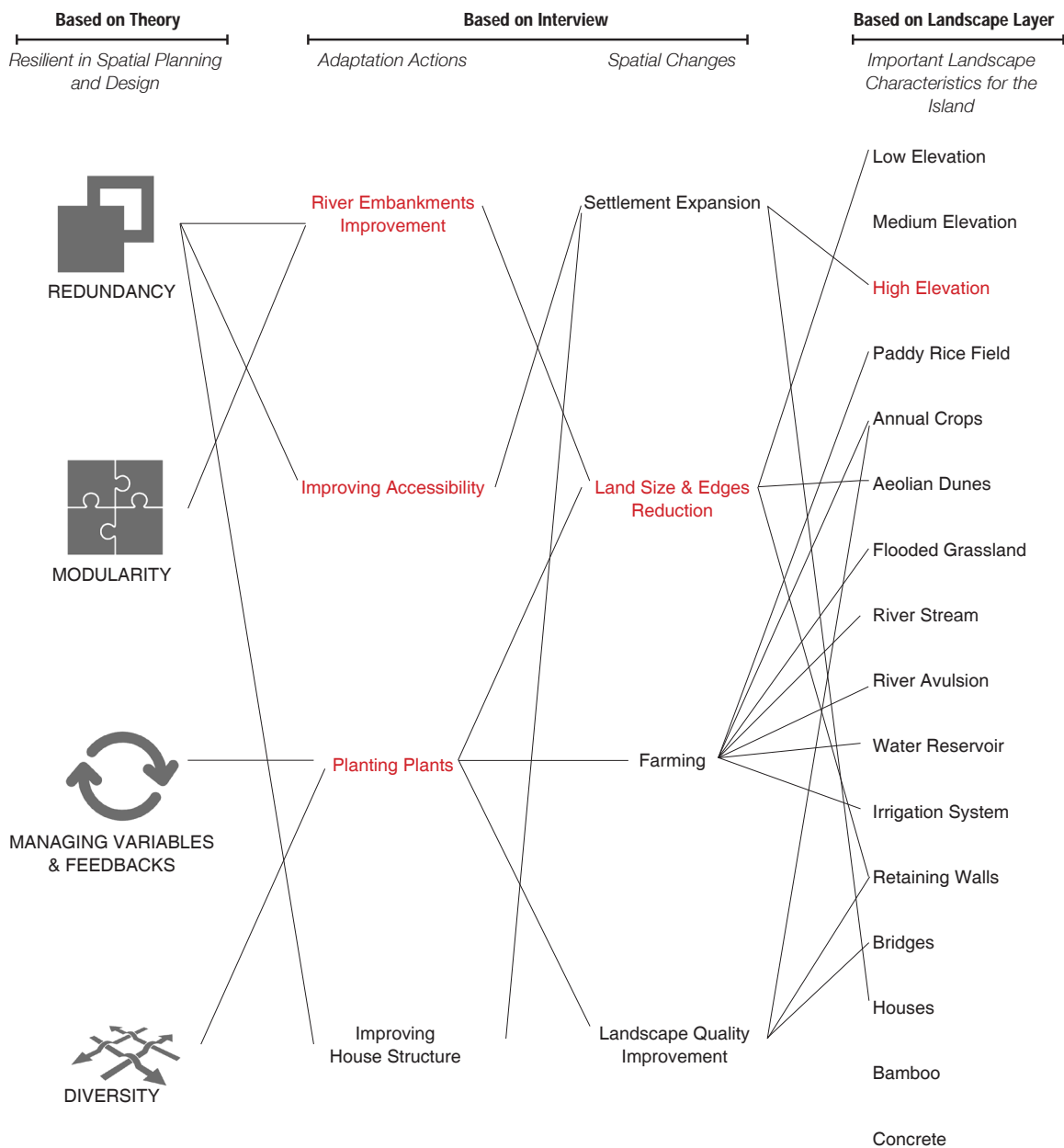


Fig 46. Linking Theory, Actual Adaptation Actions, Spatial Changes, and Landscape Characteristics

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CHAPTER04//

# DESIGN PROCESS

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*4.1 Introduction: Design Focus & Goal*

*4.2 Reference Study*

*4.3 Design Principles Idea*

*4.4 Revealing the Answer*

*4.5 Model Exploration*

*4.6 Final Landscape Design*

*4.7 Opportunities for Future Development*

*4.8 Design Process Reflection*

This chapter explains how to tackle problems, beginning with the landscape layer information and the locals direct experiences from the typhoon and floods into a design strategy to reduce an expanded future risk. It is clear in this disaster prone area, that spatial planning and design is needed to propose the best strategy for Cam Kim Island. The previous chapter explains facts on the Thu Bon River Delta and identifying the relationship between landscape characteristics and the locals' experience. The information were then summarized into the answers of the three sub-research question.

*SRQ1 : What is resilient landscape and its principles that could possibly be used to construct new design principles for Cam Kim Island?*

Answer: Resilient landscape is the ability to resist and recover from disturbance in a spatially bounded setting where the entities are heterogenous in many key elements and processes. There are four main resilient principles that is used for this study: redundancy, modularity, managing variables and feedbacks, and diversity.

*SRQ2: What are the most crucial landscape characteristics of Cam Kim Island in reducing the risk of typhoon and floods?*

Answer: There are three characteristics: elevation, water surface and flow, and natural habitat

*SRQ 3 : To what extent do local coping mechanisms transform the*

*impact of typhoon and floods in its landscape and design?*

Answer: The local coping mechanism transformed the landscape based on personal belief on Taoism which is to respect nature and go with its flow. Therefore, the landscape characteristic changes are to be happening mainly in their settlement area. Most coping mechanisms they did were embankment improvement, constructing infrastructure (roadway), improve housing structure, and improve landscape quality through planting. These treatments represent two main resiliency principles, there are redundancy and modularity.

After those sub-research questions were answered, reference studies were undergone to understand how design through resiliency is applied in the real world. It is explained through theoretical framework section that there are four main principles that should be improved in this study: redundancy, modularity, management of slow variables and feedbacks, and diversity. Even though the first two principles are achieved in this island, the other two principles must be incorporated for an integrated landscape design strategy. By applying these principles, it is expected that future resiliency for this island could be achieved.

## 4.1 INTRODUCTION: DESIGN FOCUS & GOAL

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Currently, the main problems occurring at the Thu Bon River Delta is the unpredictable annual natural hazard (typhoon and floods) which forces inhabitants to persevere from time to time. It seems that the locals did not even attempt any resolution and were just trying to carry on living their normal daily lives, yet were strong enough to survive with the dynamic landscape mechanism.

Along with the main design question “How to enhance landscape resiliency of Cam Kim Island towards typhoon and floods?” the focus is on how to utilize the current side effects of those natural hazards into a beneficial landscape design strategy and scale down to expanded future risk in the Thu Bon River Delta system. The landscape design strategy that I proposed focused on generating

a soft landscape approach for the island to reduce typhoon and flood effects by enhancing the natural landscape potential of the island and strengthen the application of resilience theory in spatial design and planning.

By understanding the reciprocal action between the landscape characteristics and local coping mechanism, it is expected that the design goal will be achieved in this thesis. The design goal is to develop a strategy for the landscape of Cam Kim Island to overcome or reduce growing exposures of typhoons and its after effect that might deteriorate the landscape quality of the island. Therefore, the inhabitants of Cam Kim Island may be living in a more flexible and resilient landscape setting in the near future.

## 4.2 REFERENCE STUDY

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In order to generate ideas for my landscape design goal, I listed out projects applying the four principles of modularity, redundancy, diversity, and managing slow variables and feedbacks. These four principles are mainly manifested in a large-scale project in different continents and provide an adaptive design to reduce the climate change effect or resilient design for future risk of natural hazard and disasters.



## 4.2.1 EUROPEAN APPROACH: AVOIDING FLOOD RISK AND MULTIFUNCTIONAL USE OF LANDSCAPE

The Netherlands is acknowledged as a country that has overcome flood risk. Raising dykes, decent water system and mechanization, and lately providing room for water are design components that is shaping this country. This approach is followed by other European Countries that later manifested in creating dykes as a protection form from river overflow.

The latest landscape project, Room for the River, is located in 34 different points starting from the IJssel, Nederrijn-Lek, de Waal, and other lower rivers. This is a national project under Ministerie van Infrastructuur en Waterstaat, Rijkswaterstaat (RWS): Ruimte voor de Rivier (RvR). The goal is to give the river more room to manage higher water levels for a longer term. Its succeeding goal is not only to provide more room, but also to assess the landscape quality of each project. These qualities are achieved by integrating the contextual features for each project where ecological, cultural and historical value, and important scenic value merge into the design. It later represents a certain multi function landscape use. The design approach used in these projects mainly circulates among widening the river flow, generating more natural floodplain, constructing new water bypass, broadening accessibility, moving dykes, etc (Programmabureau Ruimte voor de Rivier 2018). On the other hand, the idea of Room for the River somehow tries to reverse the current (most) canalized riverine into more natural river forms, yet maintaining its defensive flood principles when necessary.

A more ambitious idea is presented by LiFE project (Long Terms Initiative for Flood-risk Environments) in River Wandle-Hackleborough, London, the United Kingdom (Barker and Coutts 2009). The idea is similar with the Dutch project through the making of more space for water, but in this case, the committee (the UK Government's Chief Scientist and the UK Government's Department for Environment, Food, and Rural Affairs) introduces three main approaches that are slightly different. They are: living with the water, making space for the water, and zero carbon. With these non-defensive floods risk management, the committee assessed the areas most likely to be flooded or most susceptible to change. Thus, the settlements are protected from the floodplain. Moreover, sufficient energy production is also proposed by integrating Biomass Combined Heat and Power (CHP), and Solar Photovoltaics (PV).

Both projects show how they apply resilience principles in their approaches. The combination of redundancy, modularity, diversity, and managing slow variables and feedbacks are noticeably arranged in the design. For instance, in Room for the River project, redundancy and modularity is shown in how much the project is replicated all over the river networks of the Netherlands in an effort to restore the natural form of the river. The same conditions are also applied in the LiFe project in the UK.

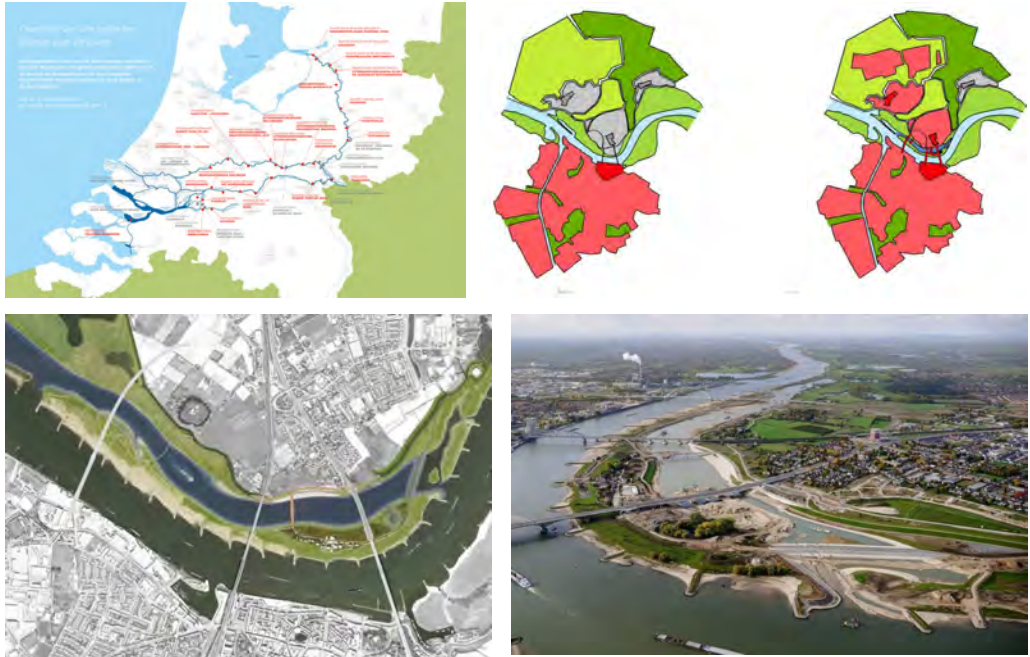


Fig 47. Example of Room for the River Project by H+N+S Landscape Architect (H+N+S Landscape Architect 2017)

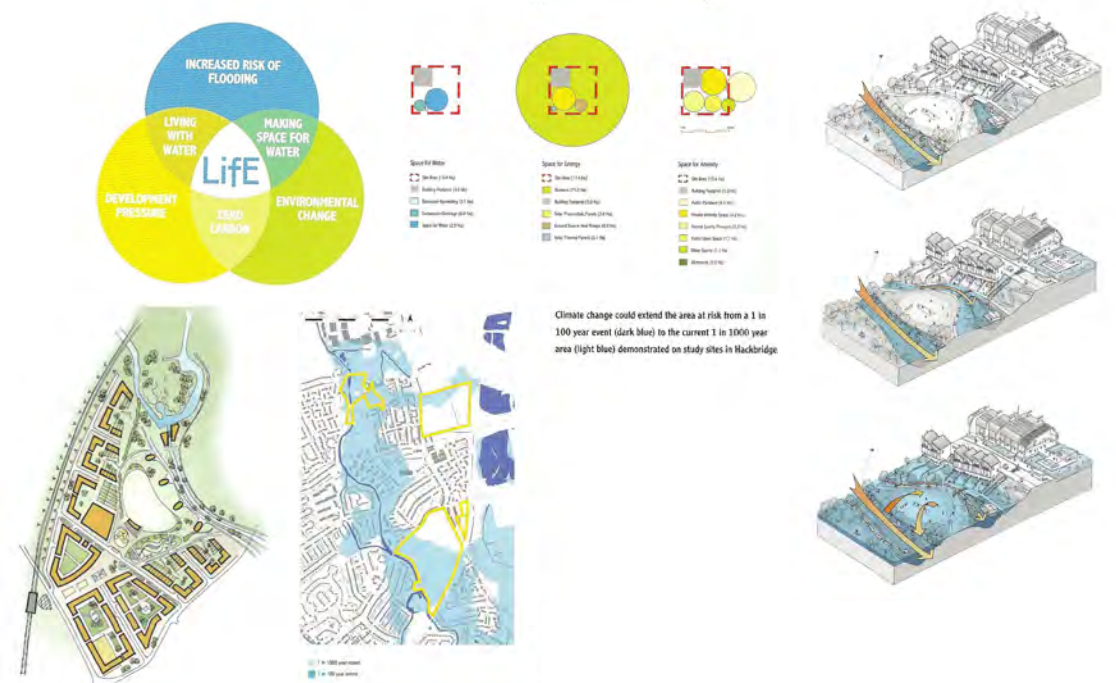


Fig 48. Example of LiFE Project by Making Space for Water (MSW) Programme (Barker & Coutts 2009)

### 4.3.2 AMERICAN APPROACH : LANDSCAPE DESIGN WITH COMMUNITY TO PREVENT HURRICANE IMPACT

The West and East coast of the United States of America (USA) are highly vulnerable to hurricanes. In 2005, New Orleans was hit by a category 5 hurricane called Katrina. Hurricane Sandy (category 3) in 2013 and Hurricane Irma (category 5) in 2017 also damaged New Jersey-New York and Florida, respectively. These natural disasters quickly turned into nightmares for coastal cities in the USA. The loss was uncountable and caused destructive impacts to the landscape and environment such as the chemical spillway after hurricane Sandy in 2013.

After Hurricane Katrina, a group of scientists in the USA made a design initiative of a team of engineers, architects, planners, professors, and students to imagine the transformation of New York-New Jersey upper bay in the face of climate change (Nordenson et al. 2010). It resulted in a compilation project with title 'On the Water: Palisade Bay' which was later awarded the 2007 Latrobe Prize, a biennale research grant from the American Institute of Architects College of Fellows.

The idea for this project was to synthesize solutions for storm defense and environmental enrichment along the coast. A package consisting of outstanding data and analysis was showed in the report but was unfortunately lacking human presence in its design. The design strategies focused on the edges, generating new habitat, energy production, and improving the transportation system of the region. Those series of approaches were apparently not realized in the real world, but the data and analysis still showed pre-eminent possibilities in the design.

After Hurricane Sandy in 2013, Barack Obama - former president of the US, made a special decree to create a special team called 'Rebuild by Design' to overcome the 'hurricane' concerns. This initiative is supported by Rockefeller Foundation moving towards minimizing the impact of hurricanes happening almost every year. The goal is to raise the bar for response, preparedness, and resilience by using collaborative, design-driven, problem-solving schemes to help communities and cities build resilience. This special team came up with a competition accommodating ideas to solve the complexity, uncertainty, and growing impact of climate change by multi-disciplinary expertise. Therefore, a more resilient future in New York-New Jersey-Connecticut Tri State Area is foreseeable and a new free place that is embedded and running, is innovated against a backdrop of despair (Ovink & Boeijinga 2008). The output for this competition is manifested in different locations and approaches where each team proposed different ideas according to their views in generating spatial planning and design.



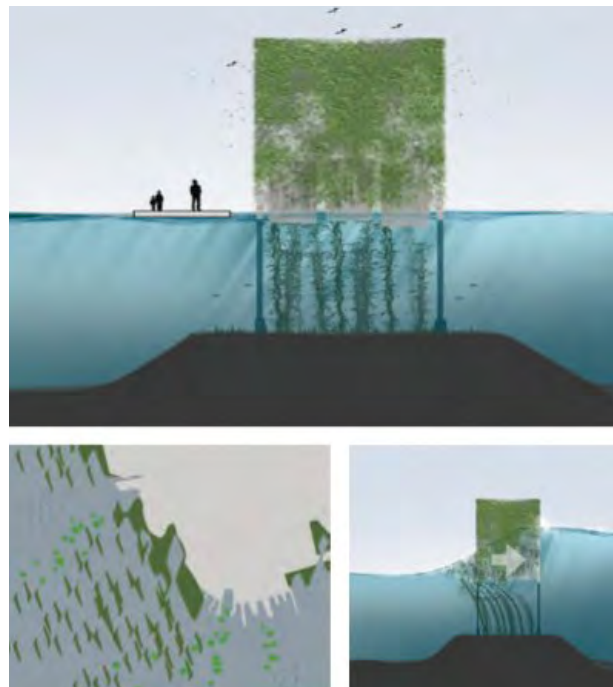
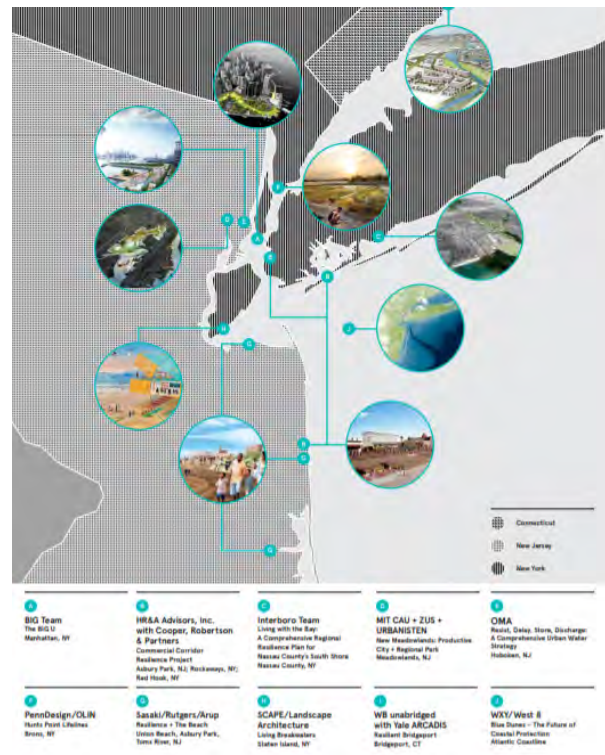


Fig 49. Rebuild by Design Task Force Design Output in New York-New Jersey-Connecticut Tri State Area (Rebuild by Design, 2015) - Left  
Fig 50. Palisade Bay (Nordenson, Seavitt, & Yarisky 2010)

For instance, Public Sediments-conducted by SCAPE- is now in implementation phase to activate Alameda Creek as a new free space to prevent an annual flood and storm surge effect from hurricanes. Under the concept of public sediment, SCAPE team proposed the idea of making an ecological infrastructure by utilizing sediments as the main design component. The idea is realized by harvesting and retrofitting the dam, unlock tributary channel, and test the mud placement so that the inhabitants are also able to make use of it. Thus, the more significant impacts of climate change for the delta region, such as land subsidence, sea level rise, risk of natural hazard and disaster, etc, can be solved.

Most of the ideas proposed by competition participants tried implementing the four resilience principles used as the design theory of this thesis. Those projects tried solving the complexities and uncertainty of living in disaster prone area and reflect landscape as a medium that can help the community to be more versatile in surviving the hurricane and its after effect.

#### 4.3.3 ASIAN APPROACH:

##### A SERIES OF WATER SENSITIVE LANDSCAPE IMPLEMENTATION

Three projects are highlighted in this section. They are the Blue-Green Infrastructure-Singapore and porous City Network-Thailand. These projects are similar in construction design & planning which focuses on the urban setting. However, most Asian countries are still currently going through major developments in infrastructure, but the idea of flood prevention is still the main problem for most Asian countries. The approach of most projects is shows a sectional development and is somehow unconnected with its landscape characteristics and greater scale of design.

Blue-green infrastructure is applied in Bishan-Ang Mo Kiao Park Singapore. The idea is to provide an infrastructure to the great respect of water (Dreisettl 2009). This project successfully overcame the incredible dynamics of monsoon season by generating a stormwater passage manifested in ABC Guidelines (Active, Beautiful and Clean). By removing concrete from the canal, the designer tried to reuse it to create a hill and put an artwork as an appreciative action for the landscape. Moreover, the current water stream also functions as a natural playground.

Porous City Network (PCN) is an initiative by the Bangkok Metropolitan City. The goal is to increase urban resilience and adaptability in vulnerable communities through a built network of permeable public space project and expand knowledge (Voraakhom 2017) which is undeniably a great vision





*Fig 51. Porous City Network Program*



*Fig 52. Ang Mo Kiao - Bishan Park Blue and Green Infrastructure by Atelier Dreiseitl (Dreiseitl 2009)*

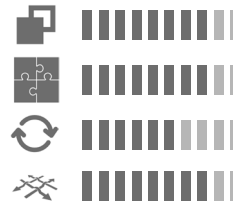
for a city. In order to prevent flooding, PCN offers some strategies including canal restoration, green linkage, detention ponds, urban farming, urban forest, rain garden, pocket park, rice field, and retention pond. This project seemed inclined to solve all those water issues in the city without providing a clear site location on where to apply the interventions.

#### 4.3.4 LESSON LEARNED

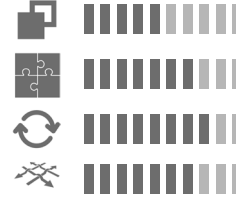
Each continent seem to be facing the same problems: climate change effects, floods, and hurricanes or typhoons. Even though they have similar problems, the approaches in resolving risk in landscapes are completely different. These projects are examples on how to tackle natural disasters and climate change effects by design. The similarities of the projects are how these problems shall be solved, by taking the regional scale in consideration and trying to solve the problems by design in the most ideal spots, except for Asian approach. Regional design is defined as a strategic design approach in landscape architecture that envisions desirable future situation (settlements, infrastructure, water feature, natural resources, and other land use) for a region in which the spatial situation is under pressure and needs adaptation (Kempenaar & Van den Brink 2017). Most of these approaches gravitate towards restoration and or create new ecological value on site to generate a subtle protection yet adaptive to risks, but they also try to expand the nature as their adaptive barrier in the living landscape. The study comparison between resilience principles of each projects are summarized in the Figure 53.



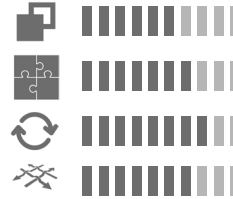
# Room for the River - NL



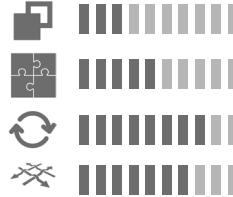
# LiFe Project - UK



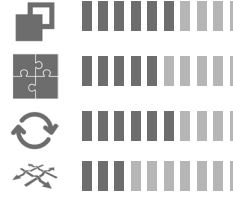
# Rebuild by Design - USA



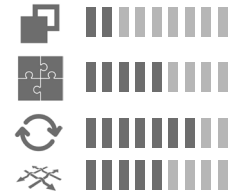
# Palisade Bay - USA



# Porous City Network - TH



# Bishan Park - SG

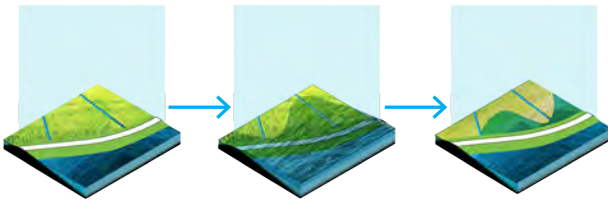


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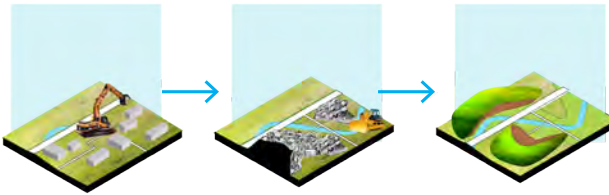
Fig 53. Summary of Valuing Resiliency Principles Application for Each Reference Study

## 4.4 DESIGN PRINCIPLES IDEA

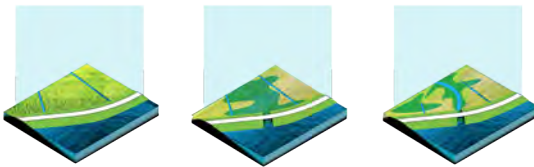
This section addresses various options that are possible to apply with the situation on site and accommodate the locals preference within their own land based on the landscape characteristics and interview result. In its process, each strategy were composed of its own specialties and complexities within the approach. Fourteen principles were generated to come out with one landscape strategy of various approaches. It varies from soft to hard approach for design application.



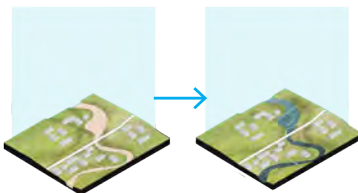
1. Let the water wash the land edges  
Aim: create new habitat type  
Detail approach: let the land become wet and dry on its own to generate more landscapedynamics along the island's edges.



2. Demolish settlements and turn it into natural features  
Aim: catch future sediments brought by the floods  
Detail approach: move settlements into a safer place, turn the rubble into a construction base of natural features (moundings) to catch the sediments brought by the floods.

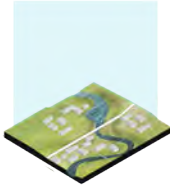


3. Growing aquatic landscape in the island  
Aim: create new aquatic landscape type  
Detail approach: create a small bypass for the river to flow into the Island



4. Constructing new creeks  
Aim: create brackish water habitat  
Detail approach: excavate the land by 50cm for the new water stream and let the brackish water penetrate nearby ground





5. Integrating water system management in the village  
Aim: provide clean water for the locals

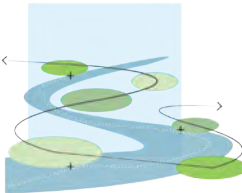
Detail approach: clustering the village and generate new integrated piping system for water disposal pipes. At the end of the pipes, a wetland will be constructed to provide better water quality before going into the river



6. New evacuation point

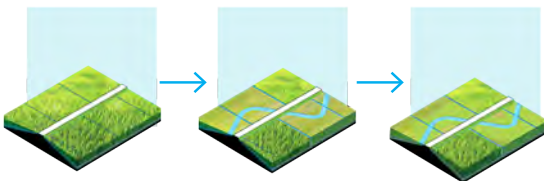
Aim: to accommodate a safe place for the locals during the typhoon and flooding

Detail approach: select higher ground to build a storage and semi-structure for evacuation using local materials



7. Linking and constructing accessibility  
Aim: improve connectivity within the island

Detail approach: construct wider roadway and direct access to the main land and connect the different landscapes of the island



8. Returning the paddy field into flooded grass plain

Aim: expand flooded grassland in the island

Detail approach: let the paddy field dry and fill up with rain and flood water

9. Remove obstacles for evacuation

Aim : provide safety for evacuation processes

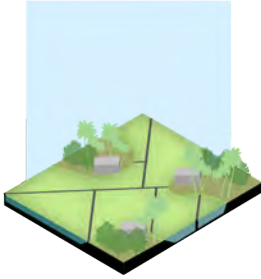
Detail approach: create more open space and clearance 1.5 meter for every side of the road.



#### 10. Facilitate tourists

Aim: invite more visitors to the island

Detail approach: place resting point every 400 meter radius on the main access



#### 11. Enhance agricultural production

Aim: maximize paddy field and annual cropping production as the main supply prior to flooding

Detail approach: provide plots for both annual crops and paddy rice field grids, thus intensive crop production in the fertile land will generate maximum and diverse productions



#### 12. Elevate the ground level

Aim: buy time for the floods

Detail approach: excavate sand around the island and use it to raise the current level around the settlements



#### 13. Construct a retaining wall

Aim: reduce erosion effect

Detail approach: construct the wall around the island



#### 14. Generate bio-engineering system

Aim: reduce erosion effect and restore ecosystem damage

Detail approach: replicate the function of mangrove as a natural barrier in the estuary.

Those approaches then reflected in the axis and ordinate that addressed the level of regional development (as axis) and the future water system development (as ordinate). The next, each strategy is positioned on the axis to see which approach has that might be able to support the future landscape of the island. It can be seen in the picture below. Afterwards, three new conceptual landscape design were generate: Escape (blue), Mitigate (green), and Dominate (grey).

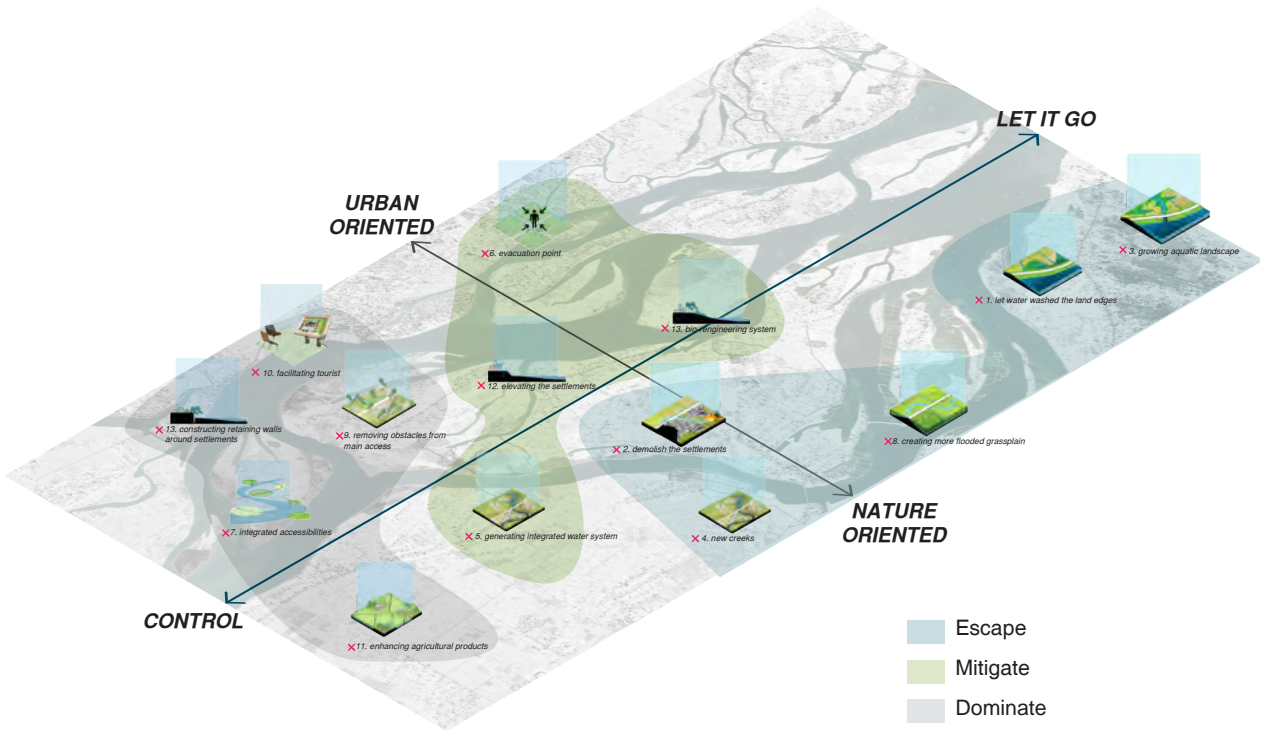


Fig 54. Projecting Idea for Future Development of Cam Kim Island

#### 4.4.1 ESCAPE

The objective of this concept is to generate more biodiversity in the island. It leads to the provision of a more nature oriented development which is most suitable corresponding to the futures lack of water system control. It consists

of five design strategies which includes letting water wash the land edges, grow aquatic landscape, construct new creeks, expand flooded grassland, and demolishing the settlement.



Escape concept brings evacuees living in the most obstructive area during the floods to a safer place in the mainland. The evacuated parts are later turned into a new estuarine habitat representing most of the aquatic species of the island. This approach encourages nature to grow dynamically. Brackish water exposure of the island will bring more biodiversity in Cam Kim Island. This island will be the development paradox of Hoi An city itself where new habitats, comprehensive diversity, and people live together in one place. Moreover, this island will contribute more on the development of conservation area for Vietnam in the future.

For starters, the objective of the concept is to abandon the island by letting the edges be washed by the floods. To start an aquatic landscape within the island, a small bypass will be created by creating (making) pipe holes on the edge of the island, next to the river. Then, a creek is made by filling a 50 cm ditch with water. The

northern part of the island is identified as the area most vulnerable towards water intrusion. Therefore, settlements located in the area must be relocated to higher grounds. The remains of the settlements will then will demolished and turn into rubble. The rubble can be re-used as a structural base for new natural features such as moundings to catch sediments. Time wise, this strategy is more time consuming, but will give a significant result in flood and typhoon resiliency.

#### Legend





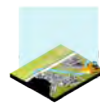
-  New Aquatic Habitat
-  New Creeks
-  Sediment Catcher
-  Main Road

Fig 55. Conceptual Design Option 01 : Escape



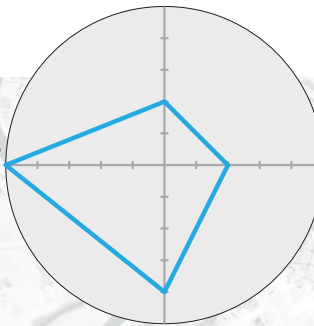


4. new creeks



2. demolish the settlements

R



D



8. creating more flooded grassplain



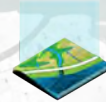
3. growing aquatic landscape

VF

M



4. new creeks



3. growing aquatic landscape



8. creating more flooded grassplain



3. growing aquatic landscape



1. let water washed the land edges



By returning the island into a natural groynes, this concept will promote new ecological services and succession.

In regard with resilience principles, this concept works effectively in generating diversity and maintaining slow variables and feedbacks, while modularity and redundancy are not efficient enough in its initial situation. By applying this concept, an amount of 1.37 km<sup>2</sup> will become a new landscape type influenced by brackish water. Mangrove vegetation and other tropical low land estuary plants may also grow in the island. Moreover this place can be a new home for aquatic and migrating fauna.

REVERTI



## 4.4.2 MITIGATE

To mitigate is to develop a robust approach for each village during typhoon and floods. All design strategies focuses on protecting the village by raising the ground level and provide ecological - engineering approaches. If the situation gets worse during typhoon and flooding, the highest elevation in each commune will provide an evacuation semi structure to give protection from the floods. Every village is assigned with an evacuation point supported by an integrated water management system.

The planning of new creeks are still to be considered, but not as much as the previous concept. The new creeks will support integrated water management system in every commune. In total, there will be 1.82 km<sup>2</sup> of settlement area protected by the elevation of the ground level of around 1-1.5 meter, depending on the current existing level, and applying ecological engineering in the natural habitat. There are then seven spots located in the elevation level of 2-2.5 meter which will be appointed as the evacuation points planned to accommodate 250-300 inhabitants.

However, most mitigation actions done by the locals have not been showing a significant outcome. The island will always be drenched every year during the rain season and inevitable effect of floods are destructive to its inhabitants. Nevertheless, this concept offers 31.94 ha of new flooded grassland habitat.

Coming back to the resilience principles, this approach has an even score for its every principles. Four of them have been successfully applied, but in terms of effects, it is still insignificant to deal with the current situation and after effects of floods and typhoon which led them to a less sustainable landscape strategy.

Fig.56: Conceptual Design Option 02 : Mitigate





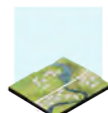
12. elevating the settlements



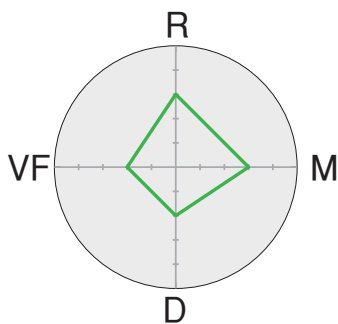
13. bio-reengineering system



6. evacuation point



5. generating integrated water system



12. elevating the settlements



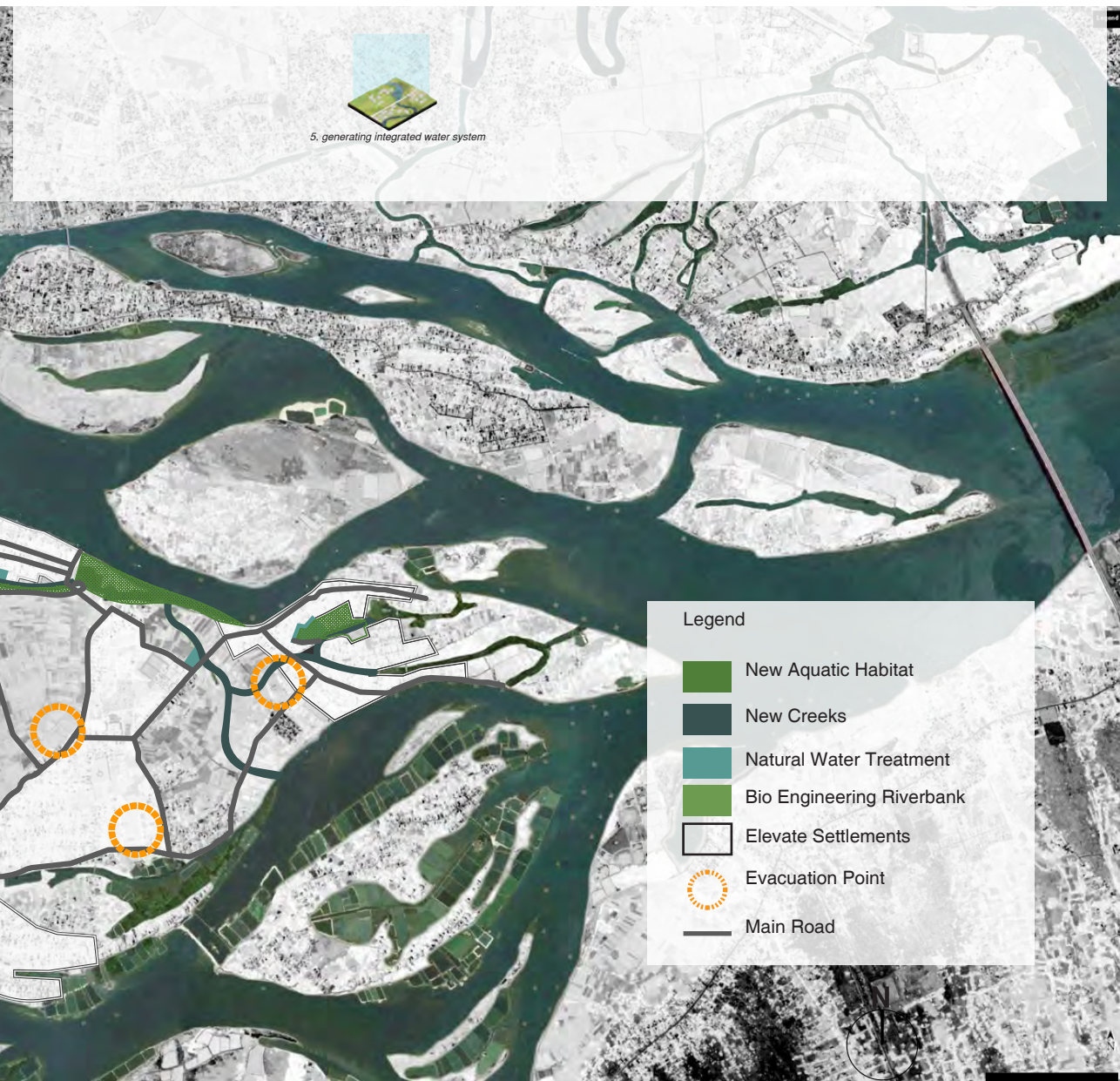
13. bio-reengineering system



6. evacuation point



5. generating integrated water system



#### Legend

- New Aquatic Habitat
- New Creeks
- Natural Water Treatment
- Bio Engineering Riverbank
- Elevate Settlements
- Evacuation Point
- Main Road



#### 4.4.3 DOMINATE

To dominate is an approach directed on the maximum utilization of locals living in the area. This island has transformed following the same direction as the city of Hoi An and is turning into a highly developed tourism area. In response to the situation, the dominate concept will offer a design strategy that supports both the visitors and the locals. A wider roadway will facilitate visitors and link different landscape types in the island. The locals will follow the demands of the tourism market and provide facilities for the tourists. In every 400 meter radius, a resting point must be provided. Sign systems and interpretation boards become essential in this concept.

However, to cope with the flood and typhoon, there are several things to be prepared by the locals. First, food production is essential in this platform. To enhance food production, a new type of farming intensification should be generated, so during the eight month dry season they would be able to maximize their agricultural production. It can be done by generating a small

island in the paddy fields that are able to reproduce annual cropping. By the end of the season, the island will have a very diverse type of food production and also some extras to cope with the flood.

Secondly, a clearance along the road and open parks are needed for evacuation purpose. I assumed that this concept had the most locals living a prosperous life because of the high exposure towards tourists. Thus, most of them live in two storey homes. People will stay indoors during the floods and a road clearance would be conducted in the course of a level 5+ warning and typhoon level 4. Lastly, a robust protection is also proposed to protect the island from erosion effect and if water levels of the river keep rising, a dyke construction will also be proposed.

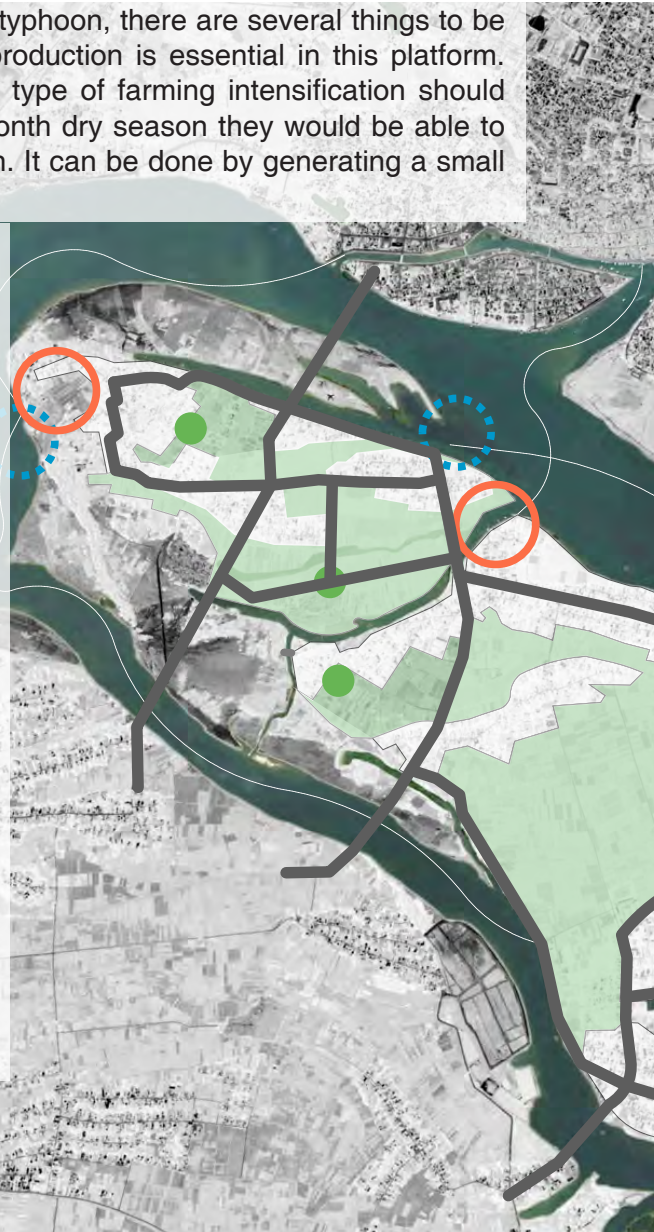


Fig 57. Design, Option 03 : Dominate

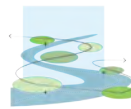




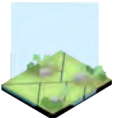
10. facilitating tourist



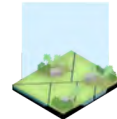
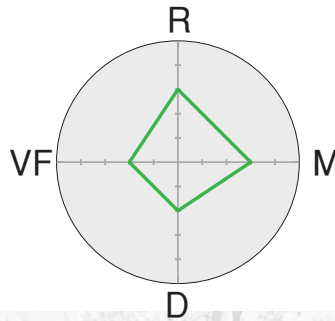
13. constructing retaining walls around settlements



7. integrated accessibilities



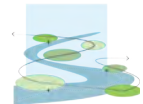
11. enhancing agricultural products



11. enhancing agricultural products



9. removing obstacles from 7. integrated accessibilities main access









7. integrated accessibilities

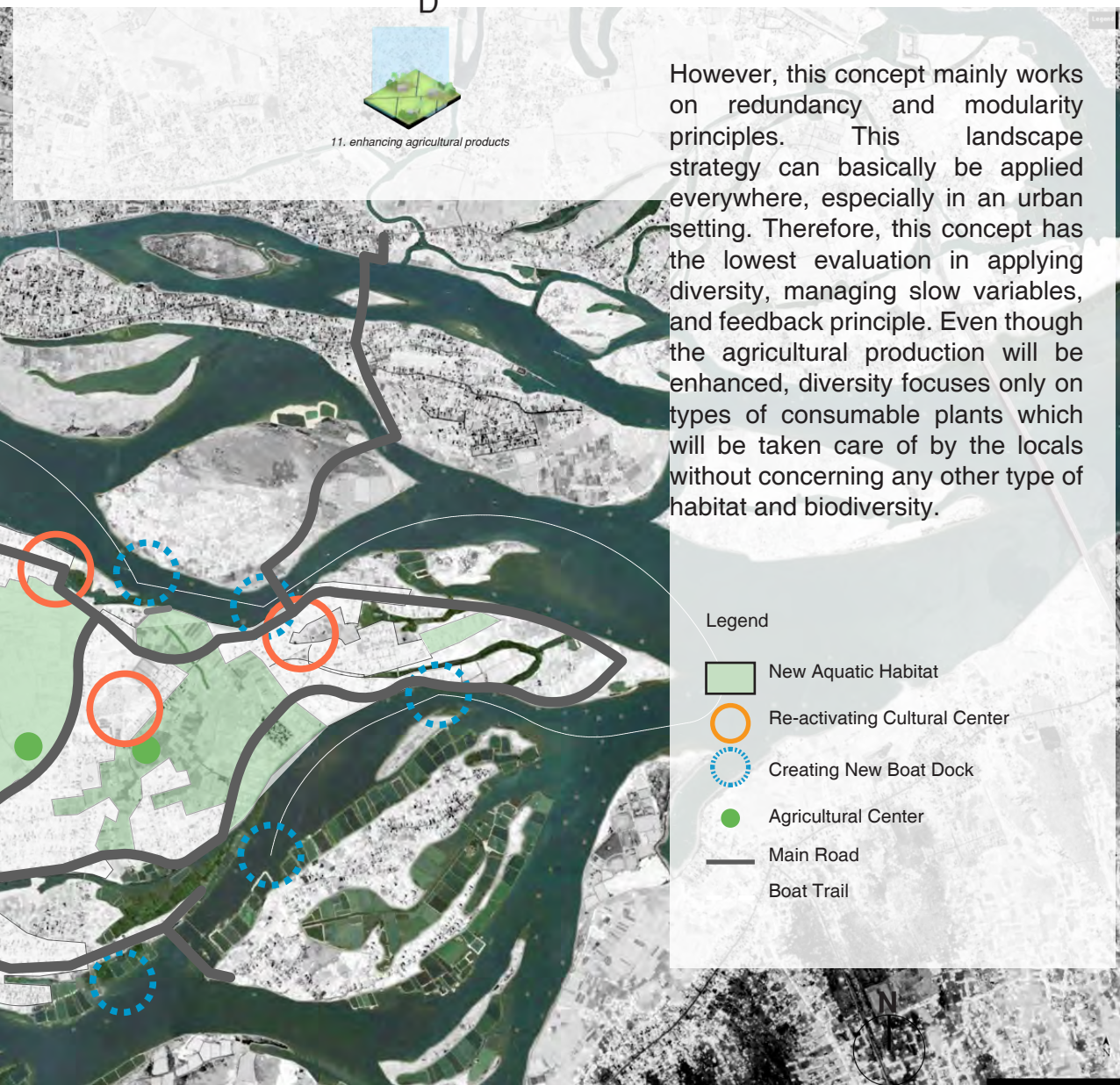


11. enhancing agricultural products

However, this concept mainly works on redundancy and modularity principles. This landscape strategy can basically be applied everywhere, especially in an urban setting. Therefore, this concept has the lowest evaluation in applying diversity, managing slow variables, and feedback principle. Even though the agricultural production will be enhanced, diversity focuses only on types of consumable plants which will be taken care of by the locals without concerning any other type of habitat and biodiversity.

#### Legend

-  New Aquatic Habitat
-  Re-activating Cultural Center
-  Creating New Boat Dock
-  Agricultural Center
-  Main Road
-  Boat Trail



## 4.5 REVEALING THE ANSWER OF “HOW TO ENHANCE THE RESILIENCY OF CAM KIM ISLAND?”

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The design option is revealed in the previous section which resulted in the categorization of design principles and discovering possible future water management and development of the island within each design concept. After a redundant process of evaluating the concepts, I would like to introduce a new hybrid option of five main design principles as the result of the best design combination that represents resilient principles in redundancy, modularity, managing slow variables and feedbacks, and diversity.

The mitigation concept shows us a middle ground application for each principle, but it just leads the island into becoming a more urbanized development orientation. According to the interview result, the local people favored living alongside nature and the mitigation concept seemed fitting, but the facts have proven it to be less significant. The dominate option seemed too far to foresee because I expected the water system management in this concept to have been measured properly with a highly controlled use in its water system infrastructure along Thu Bon River. While the escape concept seemed to be a non-favorable concept for the locals.

The design methods from each concept, later, is listed and counted for how many times it appears in more than one resilience principle (See Figure 58). It is found that there are four main design methods repetitively coming out for every resilience principle. They include creating new creeks, making more grass plains, generate aquatic landscape, and constructing evacuation points. There are also three acceptable design methods that shows in four resilience principles: constructing a bio-engineering system, elevate the land, facilitate tourists, and creating integrated accessibility within the island.

The main design principles that had appeared was to make a new natural habitat in the island and coming up with an evacuation point in every village in the island. To create a natural landscape habitat in the future, the construction of a new creek is the best design method to create more spaces for nature to grow. With the composition of new creeks, brackish water intrudes the island easily and in some way develop a new aquatic habitat in the island. Thus, a new home for a mangrove habitat is able to grow on site and naturally protect the island

when it comes to floods and storm surge.

The acceptable methods are used to support the main design principles. For this hybrid concept, a stand alone method does not give an effective result to overcome the typhoon and flood exposure. Therefore, an integrated spatial design must be proposed for this situation, so an optimal reciprocal relation can be achieved. Most acceptable methods focuses on constructing adaptive infrastructure for the island. A new system must be introduced for the landscape design idea. By considering the locals strong attachments to their natural habitat, it is impossible to ask them to leave the island. The locals believe that the future of the island is determined by their attitude in nurturing their own habitat. Thus, the hybrid idea for this concept is Revert!

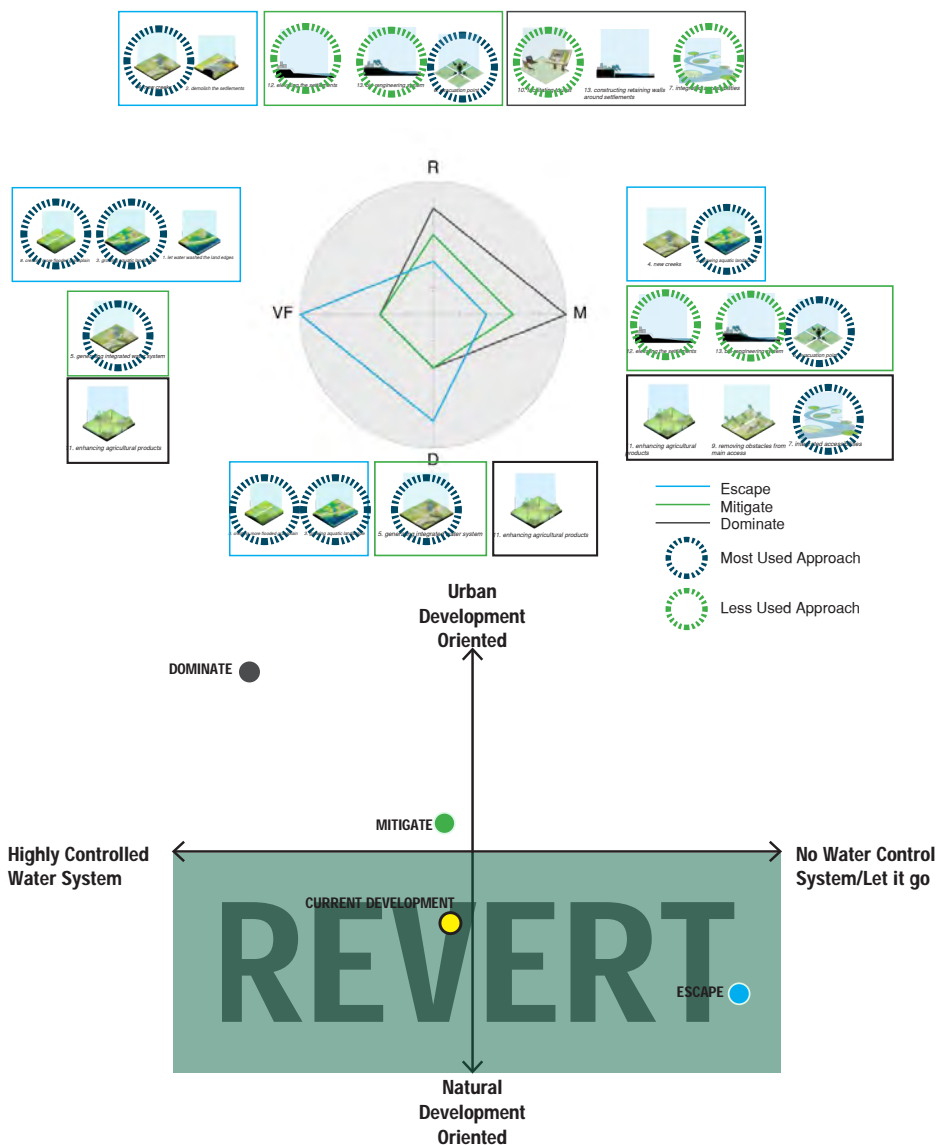


Fig 58. Determining Design Principles for the Design





### Legend

1. New Access to The Island
2. Dune and Bamboo Forest
3. Triem Tay Farming Village
4. Wetland
5. Kim Bong Carpentry Village
6. Mangrove Forest
7. Duy Vinh Agricultural Villaget
8. Flooded Grassplain
9. Trha Nhieu Fishery Village



0 500m



## Revert

/rɪˈvɜːʃən/ - phrasal verb with revert  
to go back to how something was before  
Return to (a previous state, practice, topic, etc.)  
Indian no object Reply or respond to someone.  
archaic with object Turn (one's eyes or steps) back.



Fig 59. Landscape Design Plan for Cam Kim Island

The naming for this hybrid concept comes from choosing the right word to simplify the design idea. As explained above, revert has a general meaning to return, respond, and take a step back. By re-naturalizing the island into a new aquatic habitat, I came to an understanding that this would be the most suitable word to represent the concept. The idea of Revert! does not literally convert everything into new aquatic habitat, but preserve and defend the villages' existence in the island. So the people are able to contribute in developing and maintaining their future landscape and have the new aquatic habitat development as their shield to survive before, during, and after floods. To ensure the possibilities of this concept, I reflected the idea into the aforementioned axis and ordinate. The result shows that this Revert! concept is highly flexible for any type of river management.

## 4.6 FINAL LANDSCAPE DESIGN

Revert! concept has taken form in the determined area based on Research for Design result. With this concept, a series of water intrusion tested on site and several conceptual schemes are made to support the resilience principles for Cam Kim Island. Even though the exact number of surface water is unidentified in this study, a design speculation is created based on flood reconstruction. This section breaks down principles application on site and compare its situation during dry and wet season.

### 4.6.1 PROTECTING THE SETTLEMENTS

In this island, there are four main villages which are assigned under different municipality and province. As a starting point, those villages area need to preserve by creating a clear boundary for each neighborhoods. Those are bounded by natural creek that is explained in the next section.

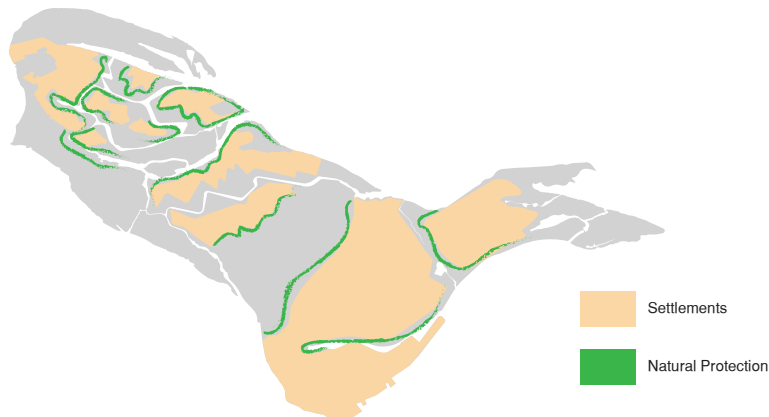


Fig 60. Settlement Protection with New Creeks and Greeneries



#### 4.6.2 CREATING NATURAL CREEK AND NEW ELEVATION

To start the revert process, the island needs to be connected with Thu Bon River through channels in selected areas. There are ten new opening channels considered for this revert process. The openings are chosen based on layer analysis where the area that contains salty clay soil type must remain there with 1.5 meter width. Less fertile soils (sandy and loamy sand soil) will be converted into a new landscape type. Afterwards, engineering activity will take over for a while to dredge the new channel itself. The dredging activity digs the soil for 50 cm depth. The aim of opening direct channel to Thu Bon River is to catch the brackish water into the area, so that the natural dynamics will be created. Moreover, it is expecting that by letting in water equals to 4.4 volume of olympic swimming pool size from Thu Bon River. Therefore, a future aquatic natural habitat will be developed.

The next step is generating new contour for the island and turn it into spatial warning during the typhoon and flooding occurrence. The contour intervals set into 50 cm and the highest elevation is on +3.00 meter. This level assigns as the highest elevation which is located in the village area. However, by improving the elevation, the island does not mean to be dry and to be damaged by typhoon and flooding effect. At least, a new warning system that is indicated by the landscape form is applicable. It can be seen in the diagram below. The water threshold for village's safety according to the flood analysis is when the water reached +1.75 meter. At the same time the water debit height will reach 3.75 meter in Cau Lau Water Station. By creating a new elevation, it is easier for the locals to realize what kind of action that they should take.

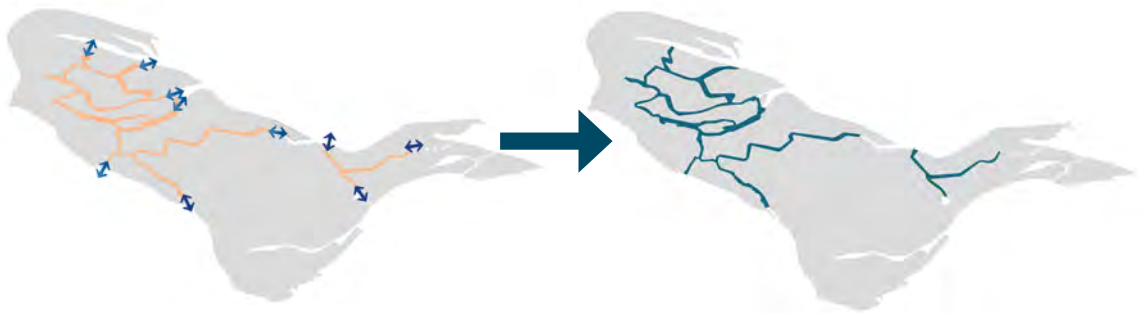


Fig 61. Transforming New Creeks :  
Opening New Ten Pipes and Connect it to the River

### 4.6.3 IMPROVING ACCESSIBILITY

Infrastructure is also an important investment for this island. However, in order to generate a more integrated system of connectivity, combination of land and water transportation is generated. Reconstructing a new bridge implies to the number of island visitors. Currently, the visitors reached the island by motorbike or bicycle. Some of them are also using boat to visit some spots. However, this infrastructure will support the evacuation plan for the inhabitants.

#### 1. Main roadway - ROW 13

The main roadway dimension is having 13 meter width right of way. It connects the island to the main land to Hoi An and Tam Ky. It renovates two current bridges and other two new bridges. Moreover, the roadway is having 8 meter for automotive vehicles and 2.5 meter width of pedestrian and bike path are assign on the each sides. Therefore, those infrastructure generates a better accessibility to the island.

are getting bigger.

#### 3. Nature trail - ROW 3

This trail consisted of two types, there are sturdy pathway and wooden deck. Each of the roadway has 3 meter width. The sturdy pathway connects to different habitat type and evacuation point, while the wooden deck is associating the network between freshwater habitat.

#### 2. Culture trail - ROW 3

This trail is connecting the trails in the village with cultural values on it, for instance: shrines, church, farms, and other cultural features within the island. It is utilizing the existing road with the renewal material with 3 meter width. This trail is located in the village part. Currently, some of the roads were so poor especially after the floods. However, to reduce the damage and cleaning activities after floods, dirt and pebble stone is the best material for the village. Palm trees and small trees (height : 3-8 meter) is planted on the roadside with the clearance 1.5 meter from the tip of the roadway. The aim is to prevent difficulties during the boat evacuation if the typhoon and floods



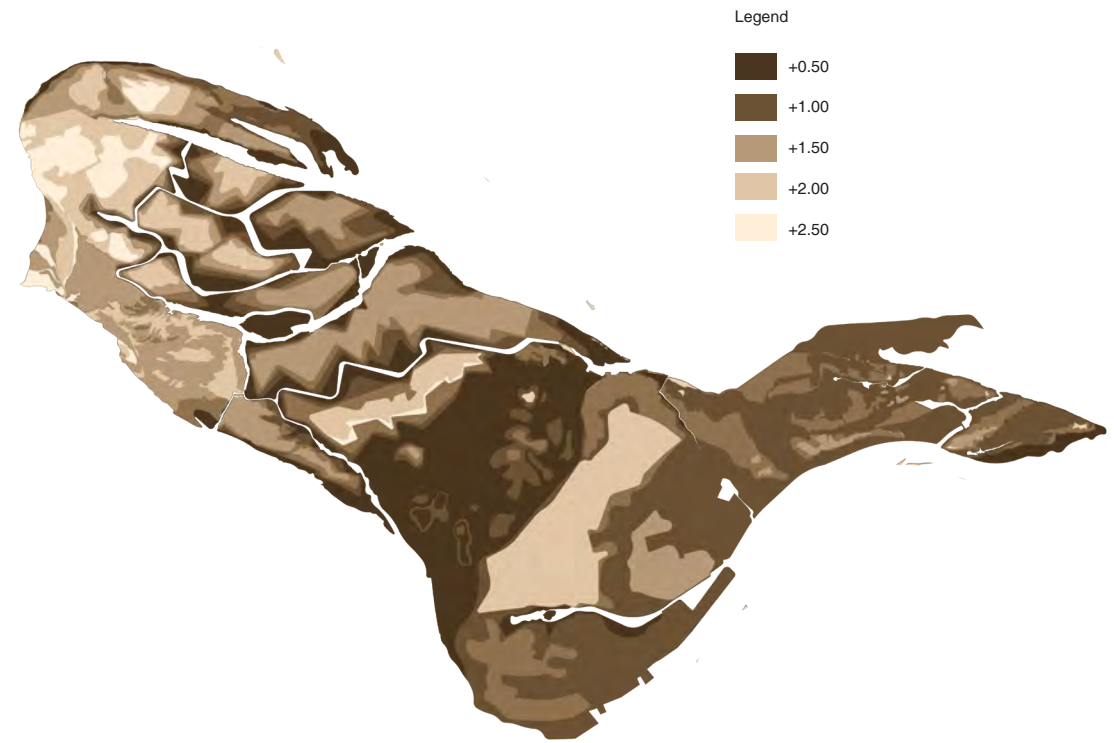
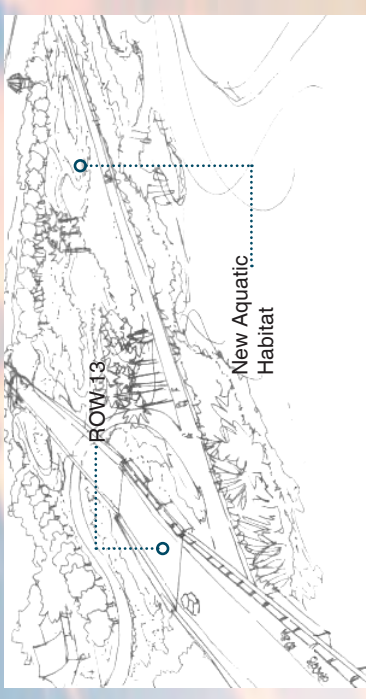


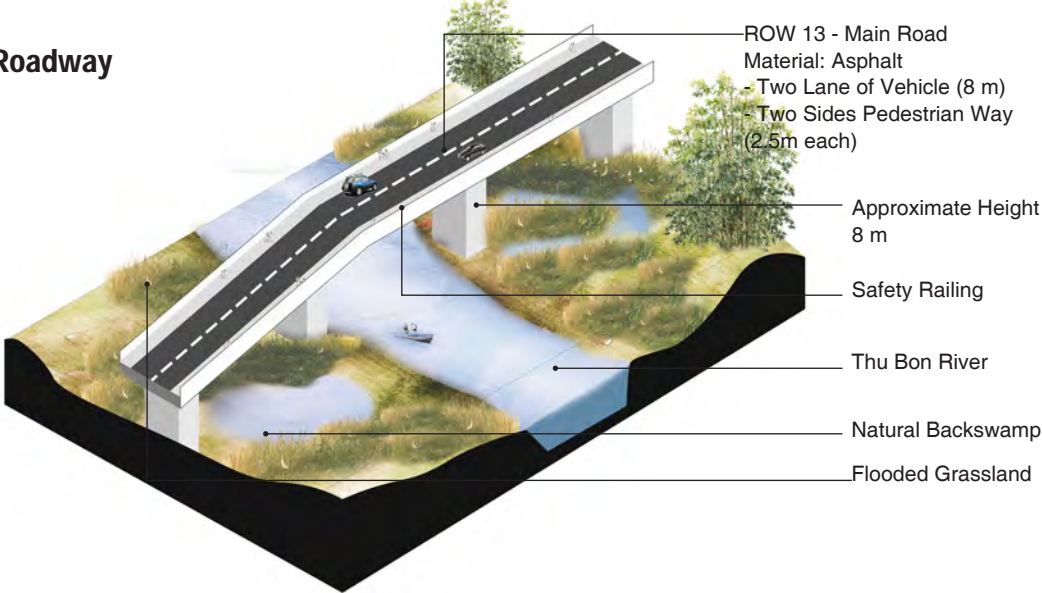
Fig 62. Modifying the Elevation - Top  
 Fig 63. Connectivity Typology in Cam Kim Island - Bottom



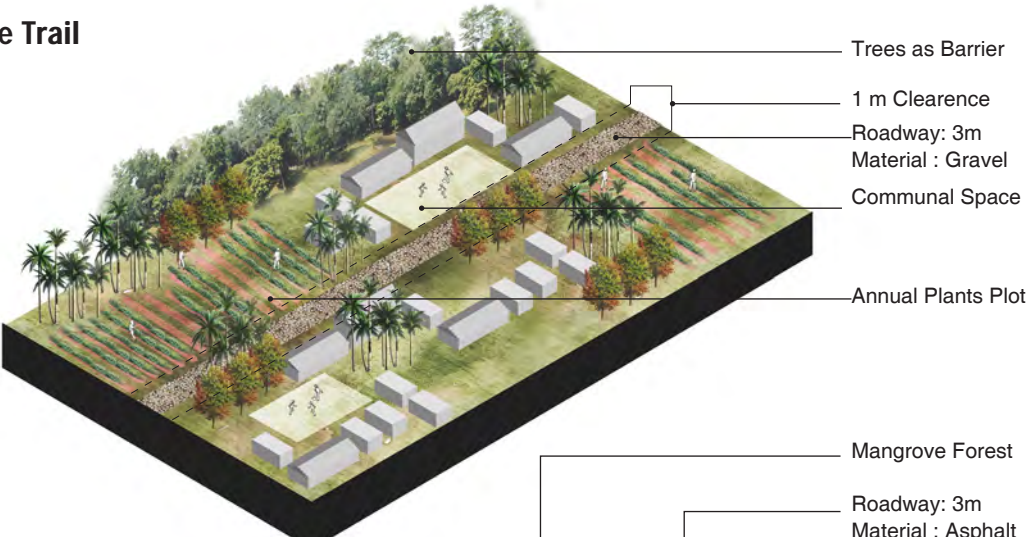
Fig 64. Sketches and Impression for Island's Main Entrance



# Main Roadway



# Culture Trail



# Nature Trail

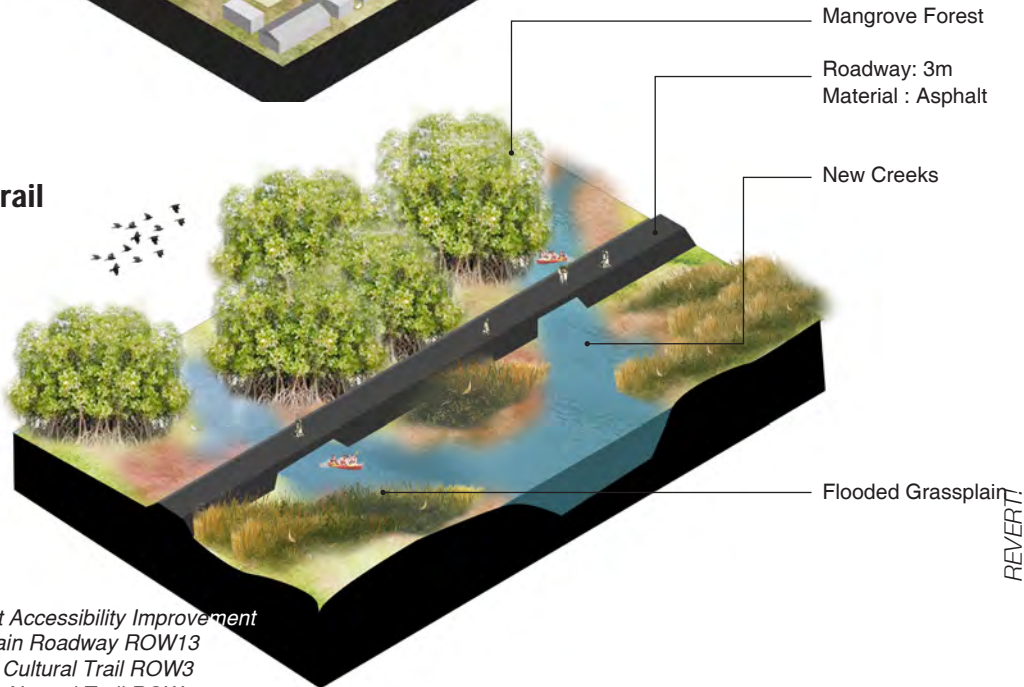


Fig 65. Different Accessibility Improvement  
 Top - Main Roadway ROW13  
 Middle - Cultural Trail ROW3  
 Bottom - Natural Trail ROW3



#### 4.6.4 NEW EVACUATION POINT

Some action plans for further developments of evacuation are determined. Each village will have a semi-structure building that combines local material (bamboo and bricks). This building will function as a communal building to accommodate the locals in times of disaster. The placement of evacuation building is determined by indicating the highest ground in each village. However, flooding mechanism analysis is ultimately important for this evacuation plan. Therefore, each evacuation point will have a watch tower constructed every 800 meter radius. An old fashioned evacuation plan is integrated in the island.

First of all, the tower position is constructed together with the evacuation building. There is a precaution that the height of the tower must be at least 15 meters with an unobstructed view of the area. It should ideally be able to be observed from at least two towers. The tower will be occupied by 3-5 persons and includes a boat for escaping. Therefore, watchers have an important role as an informer for the local people during any occurrence. If the watchers spot recurring bad wind and other natural phenomena's indicating a typhoon or floods, they should leave the tower with the boat and burn the tower to inform other watchers in the island. This scheme is needed because during the disaster the communication system will be completely cut-off, so that the municipality may take an action to evacuate all the inhabitants. In that sense, traditional method is the most effective technique to steer clear of the natural disaster.

During the safe season, the evacuation point can be a multi functioned to accommodate the local culture. It can be operated as a local market selling their annual agricultural products and also as an education center for traditional agricultural cultivation during the dry days. Later on, these semi-permanent buildings also holds potential for to become a cultural tourism spot with different themes for each village. It can be seen in the figure below.



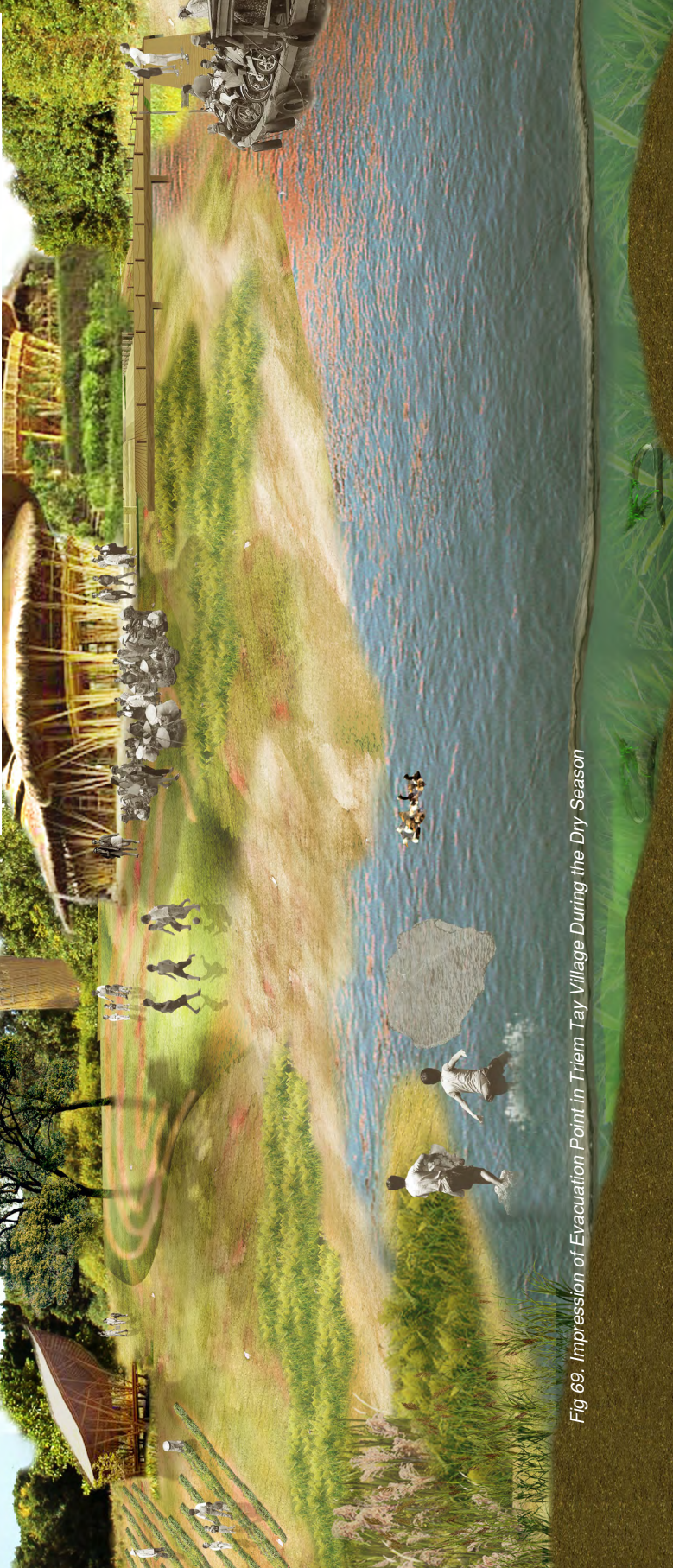
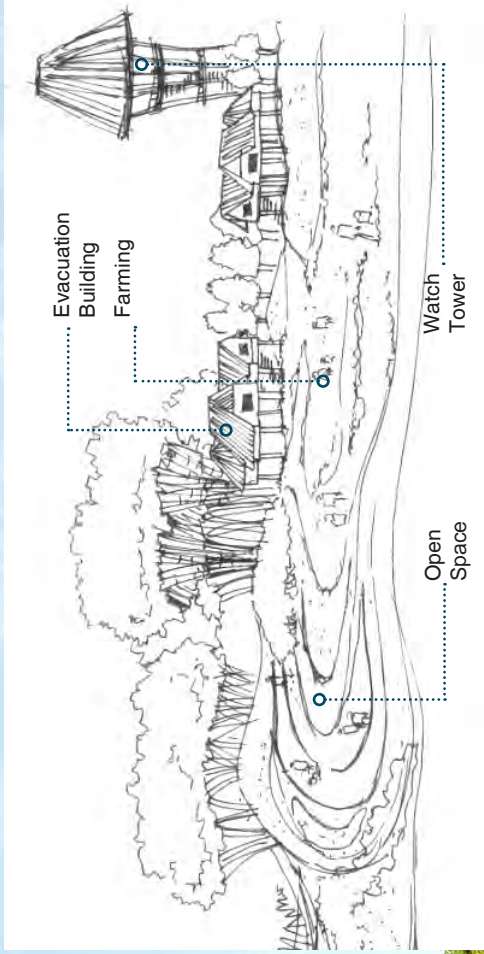


Fig 69. Impression of Evacuation Point in Triem Tay Village During the Dry Season



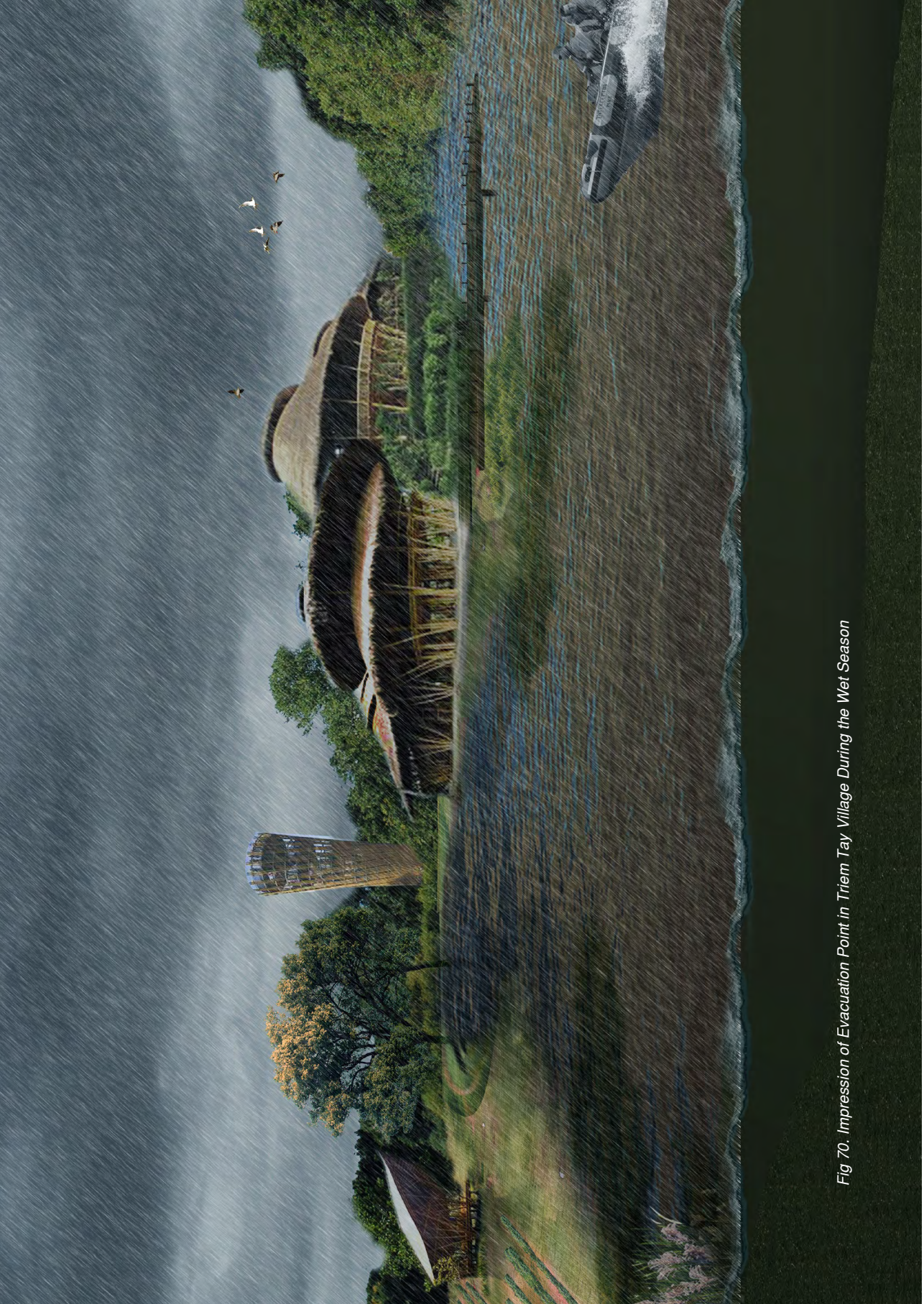


Fig 70. Impression of Evacuation Point in Triem Tay Village During the Wet Season



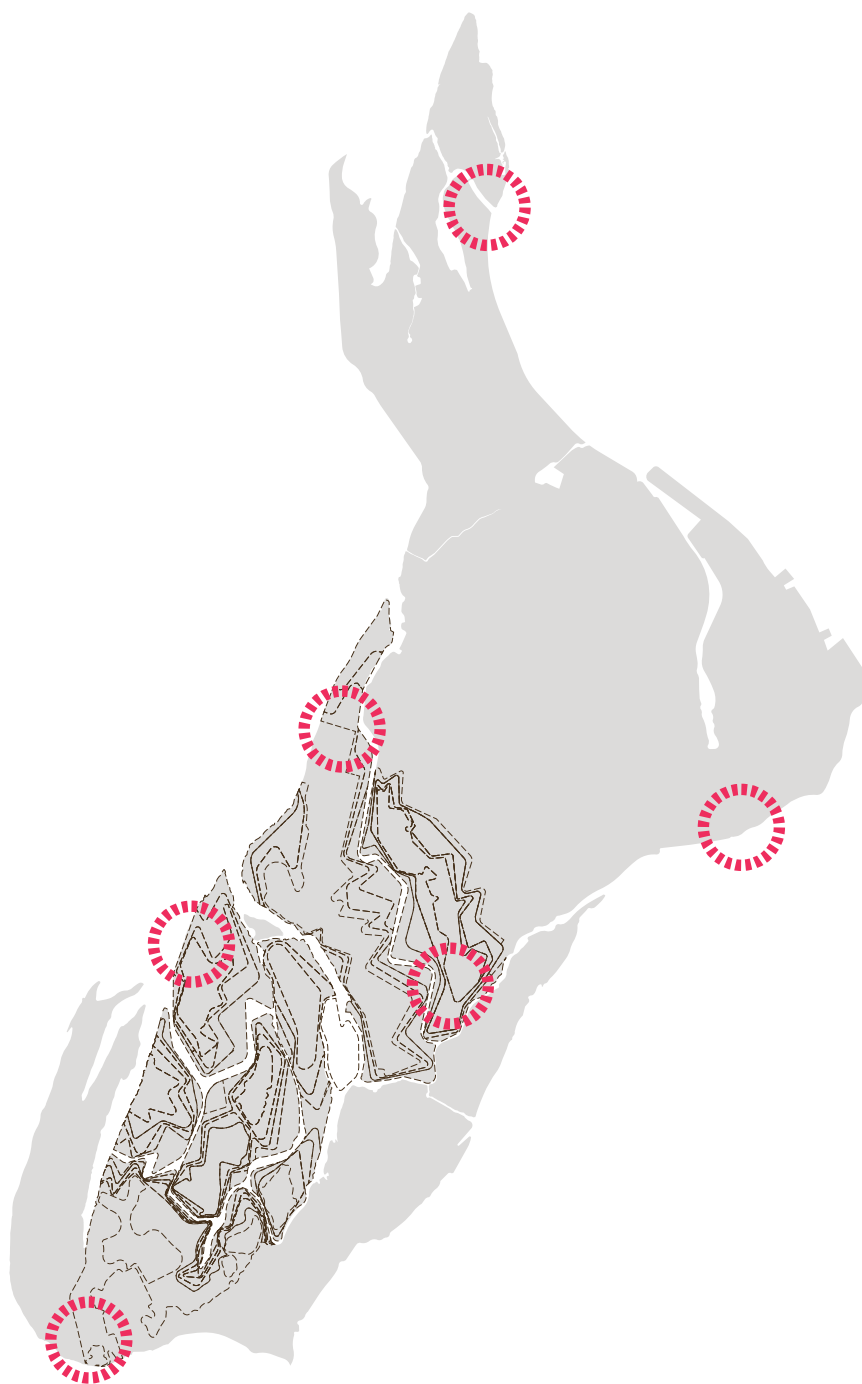


Fig 71. Location of Evacuation Point in the Highest Point of Each Villages

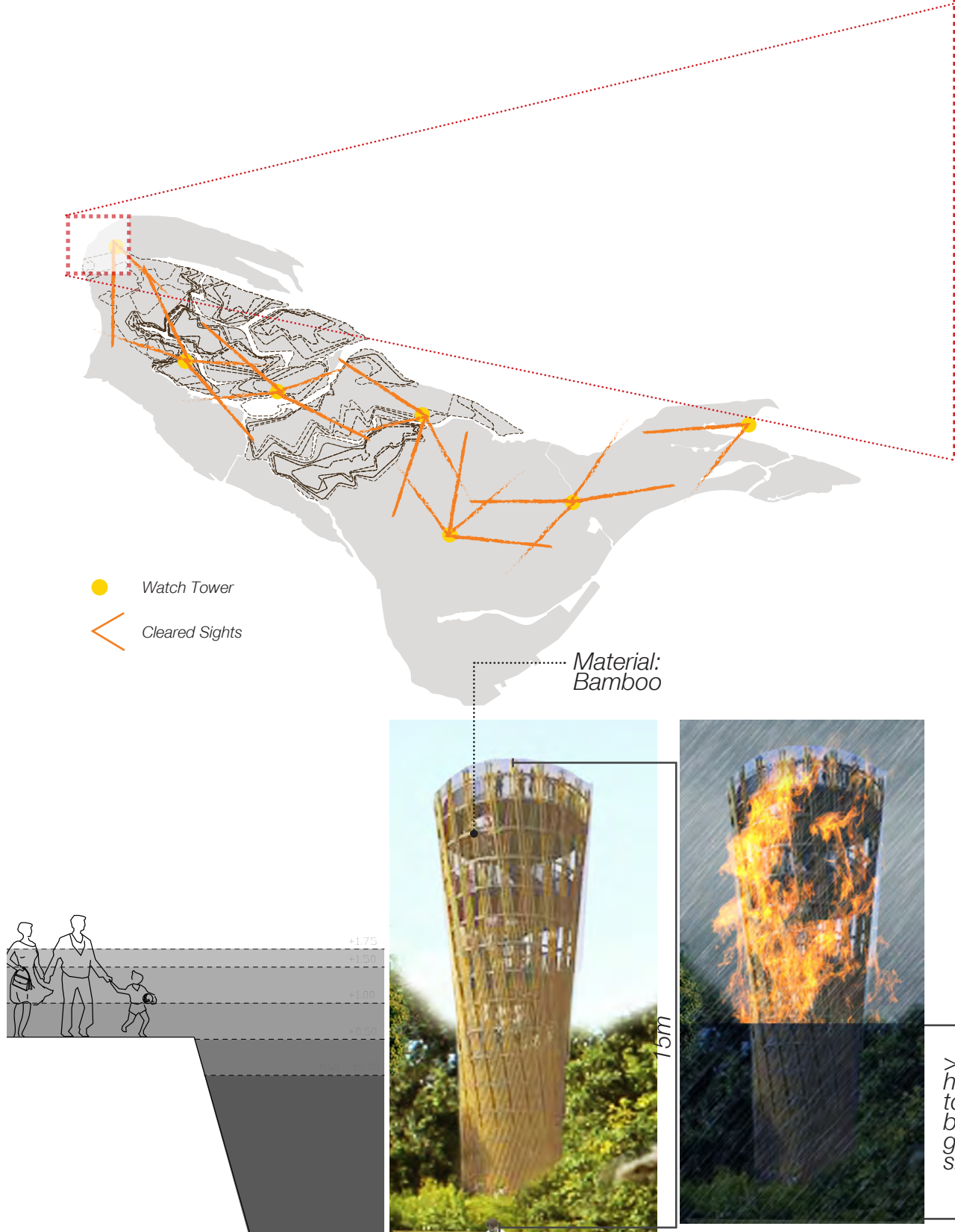


Fig 72. Tower Placement in the Island

Fig 73. Evacuation Mechanism of Cam Kim Island

if the water reached 1.75 meter, the locals must go to evacuation building and 3-5 persons must observe their surroundings. If the water height reached >5meter, the watcher should warn the other village by burning the tower



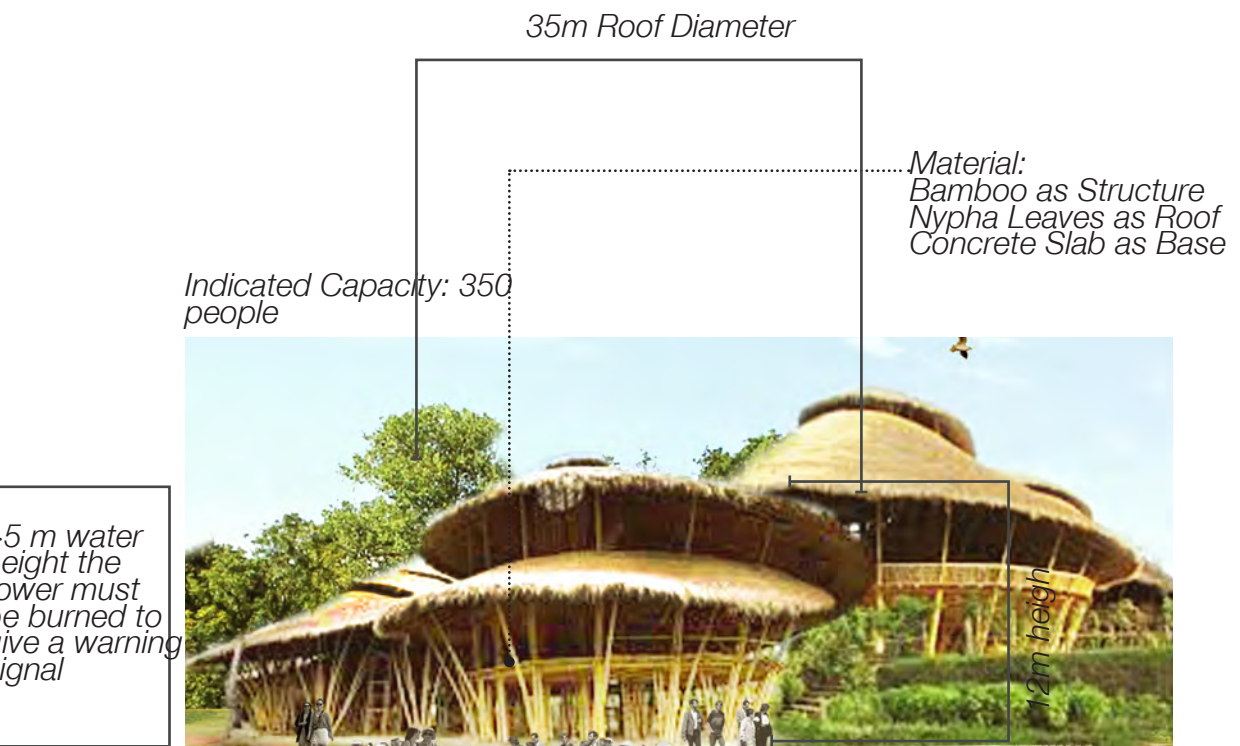
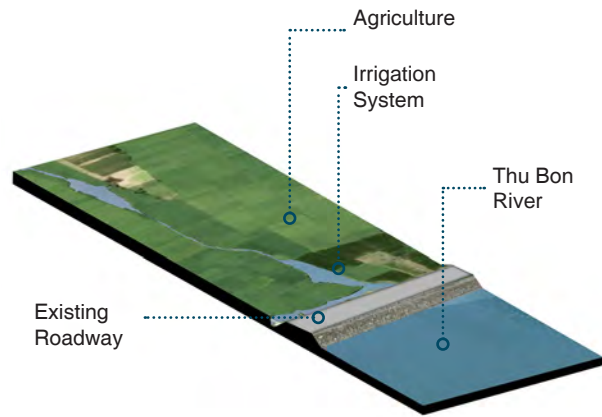


Fig 74. Design of Evacuation Point in Triem Tay Village

Fig 75. Detail of Evacuation Building (Source: Green School Bali) and Watch Tower

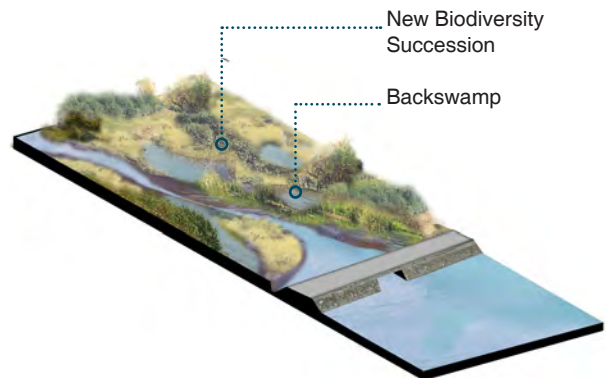
#### 4.6.4 NEW AQUATIC HABITAT

This sub-chapter explains how to Revert the current agricultural landuse to new aquatic habitat. It is expecting that the new natural habitat will be a new biodiversity vault for Hoi An City, It is dominated with natural dynamic where the saltwater intrusion will contribute to grow a new habitat type. Later, it is also expecting either to be a flooded grassplain or mangrove forest in a certain range of time.



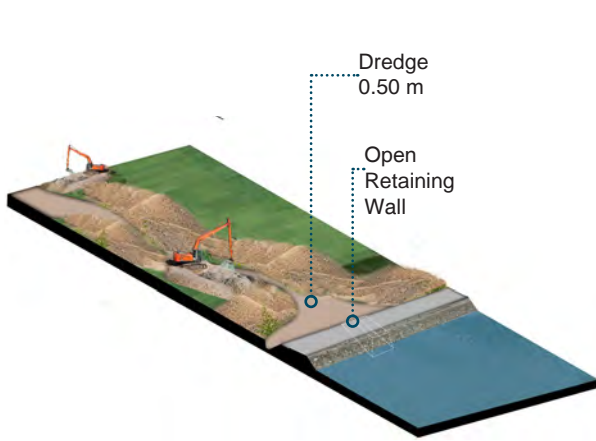
##### 1. Ground Zero - Circa 0 year

Ground zero defines current situation where most of the landuse is dominated by settlements and agricultural use. At this rate, the design will shift 52.29% of agricultural land into fresh water habitat.



##### 4. Natural succession - Circa 5 years

It is expecting that the nature force will respond the surrounding land. The reciprocal action between fresh water, brackish water, and ex-agricultural lands are foreseen as seedling process of fresh water habitat creation. Small gullies is seen along the new channel and new type of vegetation will grow. Since the saltwater intrudes more the land, mangrove species will be able to grow in this landscape type.



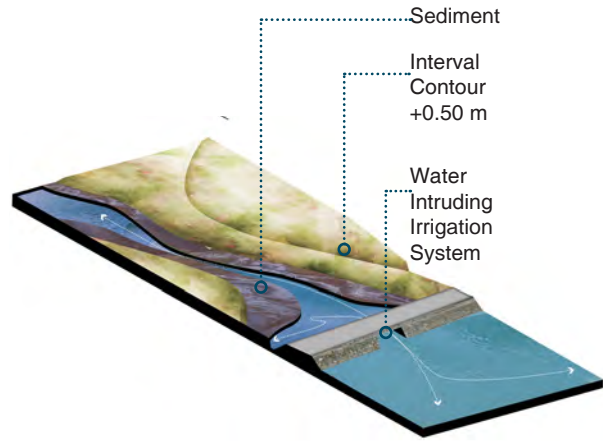
## 2.Dredging - Circa 1 year

The first step should be taken to generating new nature is dredging the channel. This channel construction is having 8 - 20 meter width and equal depth 0.50 meter in the determine location. The channels placed in the agricultural area because the tendency of people to cultivate the rice paddy field had decreased. Instead of it, the farmers there prefer to cultivate their own annual crops which are more beneficial for the locals daily life.



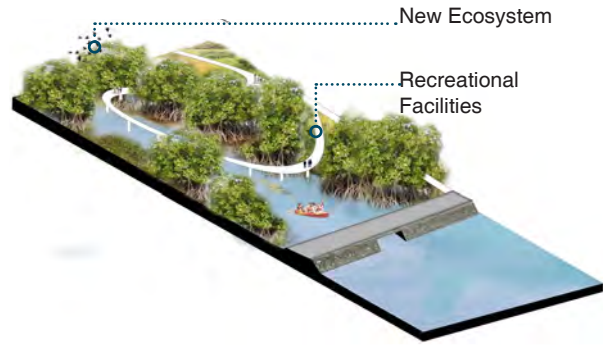
## 5.Tidal Process - annual processes

The rise and decline of saltwater intrusion will influence the number of biodiversity in the new habitat. Moreover, human activity in this time will be limited, especially during the rise of water.



## 3.Shaping Lands and Saving Sediments - Circa 3 year

After the dredging activity is finished, shaping lands are essential to create a future flooding measurement. The highest elevation of the land is planned in +3.00 from normal water level with interval 0.50 meter for the contour. While the earthworks are doing, the base structure of the road or so called 'dyke' are open and let the water penetrated the agricultural land. Afterwards, the water flow starts to interact with the soil and slowly piling the debris and sediment.



## 6.Recreational Features - 10 years

A mature habitat will manage its natural slow variables and feedback that later is admitted to be adaptive with the water force dynamics. Moreover, various landscape elements can be added to support recreational activities in Gam Kim's landscape.





Fig 77. Sketch During Design Process & Impression of New Aquatic Habitat in Cam Kim Island





#### 4.6.5 RE-STRUCTURING NEW TOURISM POTENTIAL

As a paradox urban development of Hoi An, this concept also offers an integrated tourism activities ranging from natural to cultural tourism. With larger area of natural landscape, the island is expecting to offer more diverse aquatic species in the island's system. Thus, ecological resiliency for this island can be obtained and turns the landscape into the local signing system for natural disaster. Each village assigns based on its specialities of natural and cultural attraction. Triem Tay Commune assigns as a rustic farming village because most of its inhabitants utilize

the sediment deposit on the island to sustain their annual farming and food production. Moreover, future aquatic habitat is also placed in this village. Kim Bong Village assigns as a cultural village where most of the inhabitants mastering wood carving and this village is the first village in this island. Duy Vinh village assigns more into brick production and rice paddy field cultivation together with its product varieties. Lastly, Tra Nhieu assigns as the water village because the strong bonding with local aquaculture.

### 4.7 OPPORTUNITIES FOR FUTURE DEVELOPMENT

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This part explores some opportunities for future development and it divides into three parts. There are Revert as a regional scale design, new contra development: biodiversity vault, and restoring future leisure and tourism in the island

*"Revert!" as a regional scale design*

The Thu Bon River, however, holds an important roles to generate the landscape of Central Vietnam. Unbalance growth of water infrastructure between urban-rural region turned the river into a deadly weapon for human living in the region. Moreover, the damage and future risk is growing even bigger and at the end the impact just pours when it rains. In landscape architecture, design has assumed as a prominent position in current regional design planning and development. It addressed all the tasks, application, and values that emerged in an existing landscape and turned it into important considerations in determining whether designing could be visible in planning (Kempenaar et al. 2016). Thus, a collaborative design is essential to generate various forms of opportunities in regional design (Westerink et al. 2017).

The opportunity of generating regional landscape design in South East Asia countries is an open door to generate a better landscape quality and living. To enhance the landscape and living quality on Thu Bon River, a system approach





Fig 78. Re-Structuring Tourism Feature in Cam Kim Island

REVERTI





Fig 79. Sketch During Design Process & Impression of Mangrove Forest in the Island



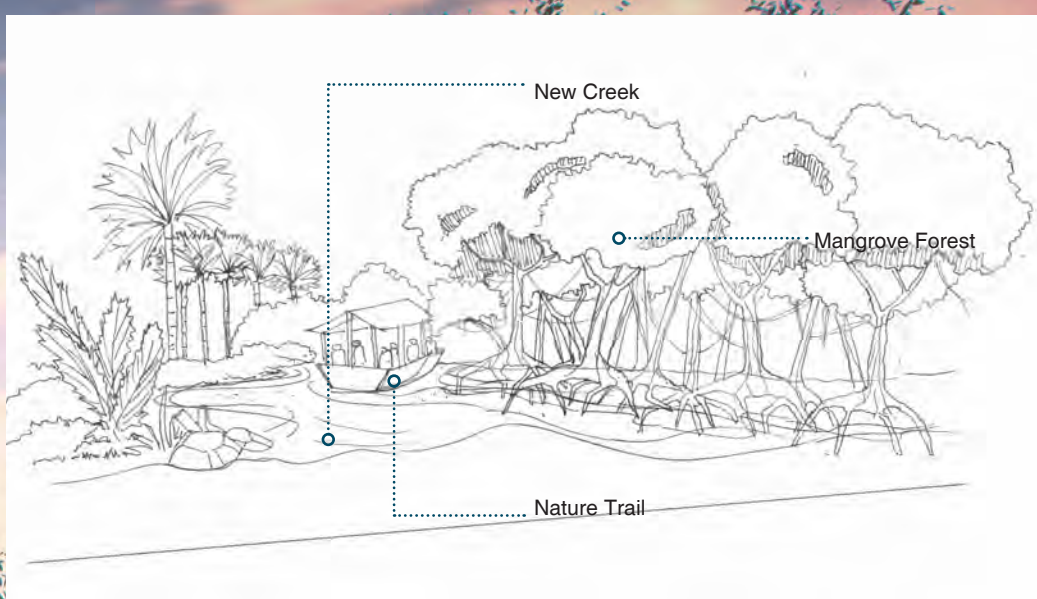






Fig 80. Impression of Culture Trail in Cam Kim Island







is needed. With the raise of profound experiments by Ian McHarg in regional planning, architecture by Buckminster Fuller, and landscape architecture by Field Operation, system thinking has been explored in the broad field of sciences to generate a new framework for non-linear, non-rational decision making and planning (Berger & Sijmons 2009). By taking into account the risk and addressed it in a system thinking, a broader scales of design were needed along the river. Thus, this concept is potentially aiming to reduce future risk's expansion. The process of generating form to object or space on various levels and scale is a part of designing which includes the creation of design (Lenzholzer et al. 2013).

According to reference study, most of the examples are showing the form of spatial planning and design in state-scale or even country-scale to overcome the complexities of living in the delta and disaster-prone area. Moreover, to prove the effectiveness and excellent design, most of the projects are showing how to translate the landscape characteristics and turn it into a tools to reduce the effect of future risk in various disciplines, scales, and levels. Thu Bon River Delta, specifically Cam Kim Island is a perfect examples to expose a series of landscape design principles that transformed into a design to solve the impact of natural hazards that happened in SEA country setting. All exposures which came from its natural settings and pressure of urban growth had transformed the trend of human habitat for over centuries in this delta and so the reference study in the previous section showing the same or even more complex trends that keep growing.

Based on important landscape character of Thu Bon River Delta, I projected possible of further Revert concept application at some point along the river stream. To generate a good regional design product, a multi-disciplinary design approach is needed so that the complexities that happened along the river system can be solved. Expertise in geology, hydrology, botany, anthropology, civil engineer, and other science based knowledge are important to figure out the real problems and formulate their best way for those tangled problems. Thus, a further study and assembly those knowledge then translate it into a design will help the locals who lives along the stream to cope with the future risk of flood and typhoon.

*New contra development in the city: biodiversity vault*

The power of human has adequately altered the hydrological regime of Thu Bon River delta. Grids of irrigation turned the lagoon and swampy area into an intensive landscape for rice production. With the pressure of urbanization and risk of natural disaster, Hoi An natural landscape is slowly diminished. Most of current development only focus on placing infrastructure that managed water utilization. Moreover, the idea of turning Hoi An into the heart of tourism in Central Vietnam had driven this city into a new form of 'theme park' which is selling its cultural

and historical value with less consideration of local people. The local seemed 'museumized' and somehow 'eco-tourism' term is putting them in the safe state of economic, yet threatening on its landscape setting.

Hoi an has been an example of historical preserved town in Vietnam. However, the idea of preserve is somehow not just keeping everything there and protect it. The core ancient town of Hoi An might be a new thing to trigger rural gentrification of Central Vietnam. As the urbanized area is only nearby the ancient town and the beaches, the rest of Hoi An is transforming into a new form place without real identity.

To prevent that, a paradox of development with this idea is proposed. The idea is turning the rest of Hoi An into a new biodiversity fault which is started from Cam Kim Island with Revert! Concept. This type of development surely offers more flexible and adaptive nature form yet highly controlled in land utilization. The countries in the tropical belt has its blessing from its climate regime, where the sun shines intensively and growing plants are somehow easier compare to another part of the world. Therefore, the conceptual approach is framing the opportunity of making new nature while the current natural landscape in Vietnam's urban setting is declining.

By unlocking the new potential of being a new fresh water habitat, Cam Kim Island is expecting to be a home where harmonious relationship between human and nature. The locals principles in utilizing landscape are pleasant traits to consider in managing their living landscape and producing new mechanism to cope with future extended risk by making use of nature. Moreover, this opportunity will bring more species type into this island and will grow spontaneously to create more resilient landscape mechanism and environment.

#### *Leisure and Recreation for future landscape*

Designing landscape is dealing with a numerous factors that arise from problems and/or opportunity, then incorporate it with deliberate analysis and locals involvement to explore the design and planning (Steiner 2000). Even though the analysis is always started with the layers approach, designing landscape function in the future is needed a high accuracy to forecast social phenomenon in the landscape. The overcome of expanded risk may be achieved, but the society as the main 'machine tools' in landscape usage may give different maneuver to the future landscape. Therefore, in the proposed design, a multifunctional use of Cam Kim Island landscape is introduced.

The chance to extend the current tourism state is beneficial for future leisure activity in Cam Kim Island. By deciding what is last and changes for this type of landscape, the leisure and recreational activity is necessary not only for the tourist,

but also inhabitants. In Dutch context, leisure was considered to be inherently integrated in landscapes, especially for landscape designer who worked more in rural landscape context (Brinkhuijsen 2008).

Therefore, the idea of making multifunctional landscape for Cam Kim with Revert! concept is accomplished. The multifunctional landscape is manifested in the evacuation point where it has several different function depends on the season itself. It can be a perfect new melting pot for the locals, the tourists, and the landscape interaction. Moreover, when it comes to flood and typhoon, it can be a sanctuary for the locals. The usage of local materials, bamboo is proposed, is presenting that local material can be used to cope with the disasters. At the end, by highlighting these possibilities, the new terms of tourism based on local wisdom is able to introduce to the island's users.

This study resulted regional design for Cam Kim Island. Ideally, this type of study needs to support by other kind of discipline, for instance hydrology, geology, agricultural sciences, and oceanography. It will give a multidisciplinary solution of reducing the impact of natural disaster, specifically floods and typhoon. Unfortunately, the notion of having multidisciplinary design practice for the site are out of the way. The information that found during the study are very general. Piles of report and study about the direct and forecast its impact to Thu Bon River is easily found. The findings of those study resulted very good result in predicting probable action in the future, yet hardly linked and fit in to a smaller site scale. Therefore, this study needed another relation enhancement with the future user of the site.

To acquired validity of this study, direct observation and knowing the local thoughts are matter for this study. Luckily, during the field trip, Damrey typhoon and the floods were struck the site. By observing directly during the occurrence, a complete personal experience were obtained. The water movement and direct impact were captured hourly and later it can be simulated into an actual dynamic situation by drawing. Moreover, interview is another way to triangulate the impact of the typhoon and floods because the locals know the best about their surrounding landscape. The local actions before-during-after the natural disaster were translated into drawing and opt future program for their future landscape.



## 4.8 DESIGN PROCESS REFLECTION

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This thesis presents a natural hazard prone river delta landscape design process in the context of Vietnam. It combines the science on life in the delta along with foreseeable future risks and local wisdom in dealing with the annual occurrences of typhoon & floods. I very much enjoyed working on this specific case study and learned a lot in relation with landscape resiliency and comprehension on typhoon and flood risk. I also hoped that I can contribute this conceptual landscape design for the region that integrates scientific information and local wisdom and experience into the design.

Research for design is required for this study to find answers to the research questions. Van den Brink & Bruns (2014) stated that research term in research for design was somewhat vague because it often refers to landscape analysis based on finding and applying existing knowledge. In this study, more aspects in regard to the social context of local coping mechanism appears in the research questions and acquired through interviews. These important inputs were used to compose the principles and knowledge about coping mechanism which was later supported by the facts of Cam Kim Islands' growing risk and vulnerability. During the site visit, I experienced how quickly the landscape had been transformed by typhoon and flooding and back to its original state. With unbelievable landscape flexibility, this island and its inhabitants are able to recover immediately from typhoon and flood risk, but the landscape actually has not been resistant enough against those risks.

It is necessary to study the local wisdom and gain new perspective to develop a landscape principle applicable as a future design for Cam Kim island in order to enhance the landscape resilience. The saying that, "locals knows what's best" is somehow true because they know every inch of their land, but lack in scientific material. As a landscape architecture student in the process of learning, I am capable of bridging scientific material with user's first hand experience, and can synthesize the information and turn it into a new design that will broaden my personal landscape understanding within the context of a developing country along with their complexities and develop my ability in decision making to come up with better design ideas for both society and their landscape.

The topic of this master thesis is the common trends in spatial planning and design world nowadays. The needs to address risk in planning and design is necessary to generate resilient landscaping in the future. After Katrina Hurricane, the need to address typhoon and flood exposure in design are

more intense in the United States. The Netherlands have even included an integrated water management in a rather less safe landscape settings before, so that they are able to switch peat land into a new productive landscape. With uncertain flood and typhoon risk, it is very hard to predict the occurrence in the future. It is even worse with climate change effect which impacts the livelihood of the delta directly. It is therefore a new challenge for a landscape architect to take into account the uncertainties in future projects.

The risk from natural hazards and disasters does not only belong to the developed countries. Every part of the world are experiencing an even impact of climate change and its uncertainty. In this case study, which refers to a developing country, the idea of adaptive planning and design is sometimes a mere proposal. Meaning it is hardly being realized on site because of the many complexities that goes along with the population. The idea of raising a dyke and making a lot of polder or sluis are unfitting with the Vietnamese because they prefer to live harmoniously alongside nature, not to repress it. This mindset applies with the older people since they would rather accept and reconcile with the impact of typhoon and flood. So a more subtle landscape intervention is proposed for this region to respect their belief and cultural background.

In general, this thesis discloses that a landscape architect is able to bridge the knowledge between science and the local perspective and experience into an integrated landscape design to reduce the impact of typhoon and flood. Through research for design, the ultimate understanding in a brand new landscape type and setting is achieved. Moreover, appreciation towards a different culture and landscape relationship is improved.

A typhoon had hit during my site visit and had become the most unimaginable and unpredictable experience I ever had. But without this experience, I wouldn't have been able to provide the best of solutions for the people. I might have instead disregarded the actual landscape and provided them with an incompatible design solution. I highly appreciate the way the local people spoke with me, I cannot have been able to comprehend the real problem without their help.

A landscape architect would generally work according to a physical condition of an area by considering the layers of characteristics of the landscape. For instance, the Dutch way of designing goes from looking at the main landscape layer, which is later classified into underground layer (representing the abiotic system, biotic system, and water system), network layer (representing infrastructure, open spaces, and energy), and land use system. In this thesis,

the interview becomes the main source of information. Through sketch proposals, translating the local knowledge into drawings, and discussing the landscape and personal experience is of most importance to be able to imagine and understand the landscape dynamics. The information is then set to be compared with scientific information and selected theories to come up with new design principles.

Before the final design is proposed, it is essential to understand the current development of the island. Thus, as a landscape architect, it is easier to identify which principles based on resilience theory need to be emphasized and how to manifest it into design principles. The next step is also to identify how the new design principles that are acquired through the research is implementing principles based on theory. Therefore, a gap in between the two is obtained and a more resilient landscape can be enhanced based on science and local knowledge.



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CHAPTER05//

# CONCLUSION & DISCUSSION

*5.1 Conclusion*

*5.2 Discussion*

## 5.1 CONCLUSION

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The main idea of this thesis is to understand how the society in a developing country is able to survive from annual typhoon and flood exposures without certainty and enough information on adaptation actions. The obtained information were then translated into design principles for Cam Kim Island. As a landscape architect using spatial approach to solve the issue, I tried to even out the design result by applying both technical and artistic approach in the design . To construct a strong



Fig 76. Bird Eye View Cam Kim Island During Typhoon with Final Landscape Design



understanding of the site, the objective of this research is to study the reciprocal relation between landscape layers, local coping mechanism, and current landscape situation to reduce the risks of typhoon and floods in Cam Kim Island.

The extreme dynamics of estuary landscape makes it vulnerable towards risks of natural disaster and climate change impact affecting human habitat. Such exposure has driven this type of landscape into an unfavorable place to settle in terms of spatial planning. However, the bond between human and their habitat, called home, are inseparable and that connection has been nurtured spiritually and manifested in their daily lives.



I addressed one main design question and three sub-research questions to achieve the aim of this research. To give answers to those research questions, I conducted a literature review that led me to an understanding of the human habitat and landscape, classification of resilience, the concept of resilience, vulnerability and adaptive capacity, resilience principles in planning and design, and current challenge of designing with risk (See Chapter 2). After gathering the related theory, I continued my desk research to identify and gain more information on the river stream's characteristics. It is also supported by the scientific research about the future growing risk of the region and addressing the vulnerability of the location. I also took into consideration the local's way of overcoming the risk of typhoon and floods which has always been an unpredictable occurrence bringing greater risks for the future. Cam Kim Island is selected as the study area because of the areas' vulnerability towards natural disasters (typhoon and floods). Living in the disaster prone area has prompted the local people to come up with their own coping mechanism. This mechanism however only focuses on the capability in maintaining homes and personal belongings. Thus, landscape design strategy must be developed for this area to reduce the crucial impacts of the typhoon and floods growing risk in the future (Chapter 3). I then tried to identify the relationship between the components of landscape characteristics, local coping mechanism, and resilience principles that had been applied on the selected site and turned the newly acquired knowledge on composing landscape into new design principles validated by principles of resilience and reference study I did in Chapter 4. Finally, by finding the answer to the sub-research question, new design principles were determined and was later integrated to the final design of Cam Kim Island.

Addressing risks in spatial design and planning is necessary for future development anywhere in the world. It offers possible heuristic interventions and normative implications for navigating and uncertainty for those characters to be applied in a planning activity (Zandvoort et al. 2017). Therefore, to identify possible intervention for this island, there are three sub-research questions that needs to be answered for this study.

*SRQ01: What is resilient landscape and its principles that could possibly be used to construct new design principles for Cam Kim Island?*

In this study, resilience is defined as the measure of the persistence of system and of their ability to absorb change and disturbance and still maintain the same relationship between population or state variables. For a resilient landscape, the knowledge of resistance and recovery to one specific location is necessary because natural systems provided human with clear ecological services. So, human values will determine whether they want a system that



resists disturbances, recovers quickly, or avoids tipping point. (Hodgson et al. 2015). To identify a deeper understanding about resilience, I completed a literature study to find the most used resilience principles in spatial design and planning consisting of redundancy, modularity, managing variables and feedbacks, and diversity. These were the most important basic principles chosen to enhance resilience landscape on site. Redundancy indicates an overlapping function within the distributed and centralized system. Modularity provides a system that can evolve independently. Manage Slow Variables and Feedbacks are important in identifying possible regime shifts. Diversity covers three different components, variety, balance, and disparity to respond disturbances

*SRQ02: What are the most crucial landscape characteristics of Cam Kim Island in reducing the risk of typhoon and floods?*

Landscape layer approach is an ultimate tool used by landscape architects to identify the landscape characteristics of a specific site. The idea of a landscape layer approach is to map all the landscape elements and identify the relationship between each layers. In this study, I used Steiner method which overlays all landscape characteristics based on abiotic, biotic, and human layer which has always been changing from time to time. The result of this study shows that there are three important landscape components for Cam Kim Island: elevation, water surface, and natural habitat. These characteristics are most substantial and shapes the current island. To design a landscape with flood risks as its design motive, addressing river dynamic into the design will increase the quality of life and through design, the landscape can help people to enjoy the water and stay alert altogether (Bax et al. 2012).

*SRQ03: To what extent do local coping mechanisms transform the impact of typhoon and flood in its landscape and design?*

The local coping mechanism of the island has manifested their survival action toward floods and typhoon in their annual daily activities. Their daily activities were based on traditional agricultural life influenced by the monsoon tropical climate. This region is mainly divided into two seasons, the dry and wet season. The island turns into a productive landscape for eight months and grows various crops to support their subsistence needs. When it comes to the rain season, they develop their own experience based mechanism and ability to 'read nature'. This ability is later recognized as a pro-action in natural hazards and disaster cycle. The rain season brings extra amount of water to the island in which the river flow increases several weeks before the flood and typhoon are coming. If the locals experience a combination of rainbow in the northwest, full moon phenomena, and bad winds, they start their preparation. Most of them store food for a week or so, move their



personal belongings to the second floor, and spread flood warnings to others. Next, water will start to fill the island and quickly cover the land surface. This situation is worsened by the typhoon occurrence which gives the island more water as an after effect. The locals respond to the floods by comparing the water height to their body size. They recognize their threshold when the water reaches their waist which they would then stop their activities. After the water flows over the island and pass through to the sea, the locals starts to recover their landscape. They clean, repair, and elevate their houses. Because everybody does this, it becomes a collective action of the island to keep their surroundings clean. Moreover, if they see a greater damage to their landscape, they will start to reinforce their embankments. They believe that by replanting the island and reinforcing their embankments in a natural way (not against nature), they already contribute and reconcile with natures' force and that it will make them a better person for their next life. This action is also supported expertise with on built environment. Therefore, the ideal natural-rustic Vietnamese living is later possibly realized for this island.

With the high pressure of tourism growth and urbanization of the area, the development of the island had transformed from a productive landscape into a profitable landscape. To follow up with that notion, a new landscape development insight must be proposed for Cam Kim Island. Research showed that the people want to live harmoniously alongside nature and maintain the landscape characteristics of the island. By considering scientific data and local coping mechanism, three design options had come up to represent each principle found and confirmed during the interview. It is categorized into three design options: escape, mitigate, and dominate. Each design option, are later reflected into possible future development and future water management. The application of each principle in the design are also reflected in the resilience principles. With this systematic way of designing and redundant process of reflection into theory of resilience, a composite or hybrid design is generated. This new conceptual design is called Revert!

This concept tries to incorporate the landscape characteristics of the island and local coping mechanism to preserve the island. It takes a subtle approach generating new natural landscape in the island, proposing a new infrastructure to enhance the accessibility of the island, generating a new evacuation point for survival during the disaster, and coming up with new programs for tourism activities. Each idea were tested in drawings to give a picture on the future development of Cam Kim Island. The concept applied theory into design, where redundancy and modularity were manifested in generating evacuation points and propose new accessibility to the island; showing diversity in providing the locals and other users of the island (tourists) various facilities

to understand the area more; and managing slow variables and feedbacks were shown by actual interaction between brackish water and the land itself to generate a new aquatic habitat that is adaptive and responsive to typhoon and flood occurrence.

The drawing consists of one master plan that is showing landscape improvement after design principles were applied in this island. Nine axonometric drawings were created to represent landscape dynamics and tested the future infrastructure for the future. Five montages were created to make impression of the area during before and after the occurrences. The aim of making these drawings are to show the future landscape of Cam Kim Island. Therefore, the locals will be able to recognize the real potential landscape by living with the flexible water-sediments that later turned into new biodiversity vault for Vietnam and sustain their life by tourism.

## 5.2DISCUSSION

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As shown in the result of this study, the key issues in coming up with a design for Cam Kim Island is based on the understanding of reciprocal action between landscape layers and humans as its main user of the landscape. Even though the basic knowledge on landscape may be obtained through identifying landscape layers and the local's perspective as a result from interviews, the idea of generating a landscape vision for this versatile landscape is still far from the designers' ideal vision. According to Crossl (1982), designers tend to seek or impose a primary generator which both defines the limits of the problems and suggest the nature of solutions. The final design represents the solution of designing landscape in a highly dynamic context. However, in this discussion section, I would like to point out several take home message for future improvement of landscape architects when they have to develop this unique landscape type.

### 5.2.1 DESIGNING DISASTER PRONE LANDSCAPE IN SOUTH EAST ASIA

Based on the outcome from this study, the idea of designing disaster prone landscape in South East Asia (SEA) was constructed by theoretical framework related to resilience. The dilemma nowadays are rapid urbanization and economic growth which altered most of its natural landscape development into an urban metropolitan or highly productive landscape (agriculture and fisheries) nowadays. The design based on this study proposes a versatile landscape that can be cultivated and taken advantage of for their future.

Therefore, the main idea is to create a new form of landscape of the island but still consider and possibly avoid the 'Swiss Cheese Model' impacts in the future development of Thu Bon River.

Development of big cities in Vietnam is always related to hydrological regime. Swampy, half-liquid, half stable area was transformed into fertile plains for wet paddy cultivation (Shannon & De Meulders 2012). The Vietnamese Government are currently trying to install extra hydro powers and dams to control its water system. I believe the goal is to get along with the central government to enhance their electricity and food production for the country.

It is good that river management policies lead to the creation of highly regulated nature. When a typhoon hits this region again, its magnitude can be reduced if it had taken different routes away from Cam Kim and cause a landfall earlier before it reached this region. The disaster outcome this year might not be that bad, yet in the future, there are possibilities that the effects grow and worsen. Therefore, it would be wise to consider the current infrastructure in the upstream and put it in the maximum state of safety to alleviate future impact in the downstream. Otherwise, the downstream of Thu Bon River just acts as the ultimate flush cubic meter of water and Hoi An City will be destructed by water. The landscape beauty itself will vanish forever.

In reflection to those possibilities, the future development of Thu Bon River Delta must remain flexible. Even though the current landscape development stands on profitable landscape, designers should consider all these future possibilities because they are about to build something in a disaster prone area. As a landscape architect, it is definitely important to consider and apply resilience principles. For future career, landscape architect or designers should design the landscape based on the capability of the landscape itself. Thus, input from the locals are important to understand their threshold to the habitat. For Cam Kim Island, each principle were represented in its design components explained in the previous section.

As a landscape architect, something that we often forget in our design thinking process is linking theory to the real world. A designer may say that theory is an unrealistic thing, but apparently, a landscape architect finds that 'ill-problem' and insufficient information in a multidisciplinary way of thinking and designing are not achievable for spatial planning and design, and principles based on theory is the best way to delimit the proposed design of a landscape. In the future, it is also possible to expand more principles based on theory for this type of landscape in SEA countries.



Involving the society into design is the best way to approach and understand the main problems of the region. From there, a landscape architect can learn how deep is their understanding is and make use of their landscape which they are more familiar with. Then, the interview result should be translated into drawings to understand and fit it in to the proposed landscape design. Unfortunately, in most SEA landscape or urban development, the peoples' thoughts were torn apart from the design in which later that piece of land was given to the private sector. Thus, the potential landscape of an area were ripped off from the the native people and later turned into something else that pleases the new owner.

## 5.2.2 UNDERSTANDING THU BON RIVER DELTA AND ITS COMPLEXITIES

Most studies were a result of a regional study projecting the future impact of climate change. Outstanding research were produced to see the probable scenario in the future and it is all revealed in the report. Before I went for the field trip, I really did consider all the papers that showed critical parts of the region. In fact, those maps are only a piece of the whole picture and the actual condition was the other way around. Some reports say that the most vulnerable parts are spread in some critical points, but when it comes to typhoon and floods, the whole island is vulnerable because water washes everything and the magnitude is unpredictable from time to time. These crises were often driven to confusion to understand the real problem of Thu Bon River Delta.

After all the scientific inputs shows us how bad the impact is, the next question is how to convey it to the local people and provide them with an impersonal solution, one that is less pragmatic and an integrated way out of spatial design and planning. Since landscape architects mostly work through sketches, the best way to reveal the complexities of Thu Bon River Delta was by presenting maps or sketches. It does not have to be a decent drawing, but at least it has to be understood by the people. They will then be able to receive the message on the impact and type of development.

According to this study experience, the best way to understand the actual landscape complexities and its damage is by observing the site directly when the disasters occur. In that sense, a landscape architect is able to identify and assess how damaging it is to the landscape and society. This information would thus be simplified into drawings on the idea of the existing situation during typhoon and floods. Even though this idea of rendering landscape situation into drawings sounds simple, but the process is highly uncertain because as a landscape architect and a researcher, one must understand

the surrounding landscape of the site so that unexpected danger occurring during and after floods can be reduced.

The idea of understanding the landscape of Thu Bon River Delta can also be clarified through the local people. By taking into account their knowledge and past experience, the nature of the island and the developments' complexity can be obtained through it. The limitation of doing this is how the interviewee did not really answer the main questions, yet kept on adding more material asking for the researchers justification for what they thought was important to enhance the island's resilience. The skill of being a wise landscape architect is thus needed in this case. People will always talking about their problems and ask for better solutions, but as a landscape architect, I should filter the immediate points of importance to enhance the main design goal.

### 5.2.3 COMMUNITY AS THE CLIENTS

In this study, the locals are the key figure. They are primary clients and also significant informants. In the beginning, I only focused on the interview questions and the way I video recorded the interview.

Sticking on to the plan was important but improvisation was even more needed for this interview process. After four interviews, I found that I was dissatisfied with the result. The locals hardly expressed their thoughts and opinions. Moreover, since everything was video recorded, most people that I interviewed were nervous and resulted in predominantly revolving around their fears and troubles during and after the disasters and they were also always 'caught between two stools' during the interview. By the end of their statements, they always felt grateful that they were still able to earn a living after the floods. To turn the tables with more condensed answers from them, I tried to put down my camera and ask them in a more relaxed discussion. With the help from my Vietnamese colleague, I asked the people directly and drew the result on a piece of paper.

Digging information from the locals was not easy. They bluntly expressed their thoughts and feelings. Their experience living with the floods and typhoon had turned the local's perspective to consider the disasters as a 'normal' thing to expect annually. This kind of attitude was also manifested in their Buddhism and Confucianism belief that everything is a cycle and in push and pull (Yin-Yang principles). Thus they 'turn the other cheek' on typhoon and flood and came into the conclusion that it was something they had to pay for maximizing their landscape utilization during the dry season.

In the world of landscape architecture, the main assignment is to generate a design for the people so that they may survive in the exposure towards natural disasters. To collect the information that supports the design proposal, we have to respect the local belief and culture. This is one way to achieve trust from the locals and understand their thoughts which was relatively simpler than I expected. Even though the main limitation here is obviously the language, it does not mean that this limitation reduced the quality of information from the locals. By decoding the transcript, a sharp message related to this topic can be obtained and later interpreted through the design options.

#### 5.2.4 RELIABILITY AND VALIDITY IN RESEARCH FOR DESIGN

This study tries to explain a systematic design process and investigate how resilient landscape principles are manifested into a design. Before it comes to a final design, all the design options were tested on site, Cam Kim Island-Vietnam. To come up with a conclusion that this framework is able to replicate in a broader context, I would like to explain its reliability and validity in designing a landscape.

To gain information, analysis, and construct synthesis, there were several methods used. First of all, direct observation and interview is the key to conduct this study. Direct observation gave me a lot of insight to develop a creative way to translate on site experience. During the site visit, I experienced the typhoon and 3.5 meter of flood in Cam Kim Island. In this situation, I tried to translate all my experience into drawings to create an easier communication media with the locals to gain more information. To keep a log on daily occurrences, I recorded videos, drew, and took photographs to get more active insights.

I also experienced the lack of spatial information because this region is not prioritized by the local government to be developed. Therefore, some of the maps are only based on direct observation during and after the floods and typhoon. As a landscape architect, the demand to think spatially is needed. We should be able to emphasize the problems beyond the actual landscape. Meaning, that a landscape architect must be able to 'transcribe' landscape characteristics and comprehend the relationship between its characteristics through literature review from other fields, for instance hydrology, geology, urban planning, agriculture, etc. So, the landscape dynamic is easier to recognize for this study.

Interview result and spatial information reflects the reliability of this thesis.



From the interview result, I am able to get a rich description and triangulate the science and the actual situation on site. Meanwhile, the spatial information gave me clarification on the bias on spatial information.

Time has always been an eternal constraint for every study. In this thesis, time limitation affected the level of detail in testing different concepts into the site. This caused the final landscape product to not cover the whole area. It focused on the spots based on hybrid design principles for Cam Kim Island. Even though the final product for this study gave more ideas for future development, this case study is a good example to apply resilience concept in a South East Asian context. Later, the idea of Revert by taking into account local experience and science into design will be able to be applied in a broader context of spatial planning and design in Vietnam. Moreover, this thesis can be a lesson for landscape architects to consider the local inhabitants or users of the site before they construct an area and turned it into a totally new fabricated landscape.

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## LIST OF APPENDIX

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## APPENDIX A –Field Observation Protocol

Date :  
Time Began :  
Time Ended :

1. Preparation  
Checklist:
  - Permission Letter (if needed)
  - Stationary
  - Camera
  - Tripod
  - Relevant maps
2. Subject of observation:
3. Procedures:
  - a. Mark the location on the printed map
  - b. Take pictures and indicate the view direction
  - c. Check how many pictures that had been taken and note down the picture file number/name
  - d. Double check at home regarding to the marked location and the file name of the pictures
4. Fill in the tabel as the note descriptor for the field observation

Research Questions	Subject	Number of Pictures Taken	File Name	Comments
What are the landscape character of Thu Bon River estuary?	<ol style="list-style-type: none"><li>a) Land characteristics</li><li>b) Physical Condition (Problem, Threat, Opportunity)</li><li>c) Evident of Natural Processes</li><li>d) Landscape Type</li><li>e) Water Surface and Elevation</li></ol>			
How do the resident of Cam Kim Island perceived flood and erosion as their landscape dynamics?	<ol style="list-style-type: none"><li>a) The evident of landscape situation based on interview</li><li>b) Local ways of living</li><li>c) Local coping mechanism</li><li>d) The photos of interviewee</li></ol>			



## APPENDIX B – Interview Protocol

### INTERVIEW PROTOCOL IDENTIFYING THE LOCAL COPING MECHANISM TO THE NATURAL HAZARD AND LOCAL PERCEPTION OF LANDSCAPE DYNAMICS IN CAM KIM ISLAND, HOI AN - VIETNAM

### GIAO THỨC PHÒNG VẤN XÁC ĐỊNH CƠ CHẾ ỨNG PHÓ CỦA ĐỊA PHƯƠNG TRƯỚC SỰ XÂM HẠI TỰ NHIÊN VÀ NHẬN THỨC VỀ CẢNH QUAN TỔNG THỂ TẠI ĐẢO CẨM KIM, HỘI AN – VIỆT NAM

---

Date / Ngày:

Location/ Địa điểm:

Name interviewee/ Tên người trả lời phỏng vấn:

Institution/ Đơn vị:

Name interviewer/ Tên người phỏng vấn:

---

#### INSTRUCTION

*Good morning/afternoon. My name is Oktaviana Miffatulani. Currently, I am doing Master of Landscape Architecture and Planning in Wageningen University. Thank you for coming. This interview will take for 20-25 minutes and will involve three parts. The first part is introductory question related to your identity and actions that you did during and after the tropical cyclone hit this region. The purpose is to get your perception of the landscape dynamics in Cam Kim Island. The second part is related to daily landscape utilization. The third part is to get future design perception from the local. There are no right or wrong or desire or undesirable answers. I would like you to comfortable with saying what you really think and how you really feel.*

#### GIỚI THIỆU

Xin chào, tôi tên là Oktaviana Miffatulan. Hiện tôi đang học Thạc Sĩ ngành Kiến Trúc và Quy hoạch Cảnh quan tại Đại học Wageningen. Cảm ơn vì đã đến tham dự buổi phỏng vấn hôm nay. Buổi phỏng vấn dự kiến kéo dài từ 20-25 phút, gồm 2 phần. Phần đầu tiên gồm những câu hỏi liên quan đến nhận biết và hành động của anh/chị trước và sau khi cơn bão nhiệt đới đổ bộ tới khu vực này. Mục đích nhằm thu thập thông tin về nhận thức cảnh quan tổng thể của anh chị tại khu vực Đảo Cẩm Kim. Phần phỏng vấn thứ hai liên quan đến việc sử dụng cảnh quan trong sinh hoạt hằng ngày. Phần trả lời sẽ không đánh giá theo tiêu chí đúng hay sai, không ủng hộ hay đồng tình. Tôi mong muốn anh/chị cảm thấy thoải mái nhất khi trả lời phỏng vấn, về những điều anh/chị thực sự suy nghĩ và cảm nhận.

#### VIDEO RECORDER INSTRUCTIONS

*I hope it will be okay for you to record our conversation. The aim of this is I can get all details and in the mean time I am able carry on attentive conversation with you. I assure you that all of your comments will remain confidential. I will be compiling the transcript which will contain all interviewees without any reference to individual.*

### **GHI HÌNH PHÒNG VẤN**

Tôi hy vọng anh/chị cho phép tôi được ghi hình lại buổi nói chuyện hôm nay. Tôi mong muốn thu thập được đầy đủ thông tin chi tiết và có thể nắm bắt được trọng tâm của cuộc nói chuyện với anh/chị. Tôi xin đảm bảo những chia sẻ của anh/chị sẽ được giữ bí mật. Sau đó, tôi sẽ biên soạn tất cả câu trả lời vào văn bản mà không đề cập chi tiết về bất cứ cá nhân nào.

### **CONSENT FORM INSTRUCTION**

*Before we get started, please take a few minutes to read this preamble and sign this consent form. (Hand in the consent form, after the consent form signed and returned, turn on the video recorder)*

### **HƯỚNG DẪN BIÊN BẢN CHẤP THUẬN PHÒNG VẤN**

Trước khi bắt đầu, anh/chị vui lòng đọc lời mở đầu và kí vào biên bản chấp thuận phỏng vấn. (Gửi biên bản chấp thuận, kí tên và nộp lại, bắt đầu ghi âm cuộc phỏng vấn)

## INTERVIEW CONSENT FORM/ BIÊN BẢN CHẤP THUẬN PHÒNG VẤN

MSc Research Title/ Tên đề tài nghiên cứu:

Research Investigator/ Cá nhân điều tra:

Research Participants Name/ Người tham gia:

The interview will take 25-30 minutes. We do not anticipate that there are any risks associated with your participation, but you have the right to stop the interview or withdraw from the research at any time.

Buổi phỏng vấn sẽ kéo dài từ 25-30 phút. Chúng tôi có thể không lường trước được những rủi ro có thể xảy ra cho anh/chị khi tham gia phỏng vấn. Anh/chị có quyền ngưng buổi phỏng vấn và từ chối trả lời bất cứ lúc nào.

Thank you for agreeing to be interviewed as part of the above research project. Ethical procedures for academic research require that interviewees explicitly agree to being interviewed and how the information contained in their interview will be used. This consent form is necessary for us to ensure that you understand the purpose of your involvement and that you agree to the conditions of your participation. Would you therefore read the accompanying information sheet and then sign this form to certify that you approve the following:

Cảm ơn anh/chị đã dành thời gian để trả lời phỏng vấn cho bài nghiên cứu của tôi. Theo quy định về đạo đức làm nghiên cứu, tôi cần sự đồng ý của anh/chị cho việc phỏng vấn và việc sử dụng thông tin phỏng vấn. Biên bản chấp thuận là cần thiết để anh/chị hiểu rõ được mục đích tham dự phỏng vấn và anh/chị thật sự đồng ý thuận với điều kiện tham gia. Anh/chị vui lòng đọc kỹ thông tin hướng dẫn và ký tên vào biên bản chấp thuận như sau:

- a) The interview will be recorded by video recording and a transcript will be produced.
  - b) You will be sent the transcript and given the opportunity to correct any factual errors.
  - c) The transcript of interview will be analyzed by Oktaviana Miffatulani as research investigator
  - d) Access to the interview transcript will be limited to Oktaviana Miffatulani, academic colleagues, and researchers with whom she might collaborate as part of research process.
  - e) The actual recording will be kept.
  - f) Any variation of the conditions above will only occur with your further explicit approval
- Or quotation agreement could be incorporated into the interview agreement.

- a) Người phỏng vấn sẽ tiến hành ghi hình và lưu lại
- b) Anh/chị sẽ được gửi bản ghi hình cuộc phỏng vấn và có cơ hội sửa lại nếu có thiếu sót
- c) Bản ghi hình cuộc phỏng vấn sẽ được phân tích bởi Oktaviana Miffatulani (điều tra viên)
- d) Việc truy cập tài liệu phỏng vấn sẽ được giới hạn bởi Oktaviana Miffatulani, đồng nghiệp cùng nghiên cứu, và những nghiên cứu viên mà Oktaviana phối hợp trong quá trình nghiên cứu
- e) Bản gốc ghi hình của cuộc phỏng vấn sẽ được lưu giữ lại
- f) Bất cứ thay đổi nào khác với những điều kiện kể trên sẽ phải thông qua sự đồng ý của anh/chị.

Hoặc việc trích dẫn thông tin có thể được thỏa thuận trong biên bản phỏng vấn

*Quotation Agreement/ Thỏa thuận trích dẫn*

I also understand that my words may be quoted directly. With regards to being quoted, please initial next to any of the statements that you agree with.

Tôi đồng ý rằng những lời nói của mình có thể được trích dẫn trực tiếp. Vui lòng đánh dấu vào những nội dung mà anh/chị đồng ý bên dưới.

	I wish to review the notes, transcript, or other data collected during the research pertaining to my participation
	Tôi mong muốn được xem lại những ghi chép, bản ghi hình phỏng vấn hoặc những thông tin



	khác được thu thập trong quá trình nghiên cứu có liên quan đến sự đóng góp của tôi
	I agree to be quoted directly Tôi đồng ý để trích dẫn trực tiếp lời nói của mình
	I agree that the researchers may publish documents that contains quotations by me Tôi đồng ý để nghiên cứu viên công bố những tài liệu có trích dẫn của mình

All or part of the content of your interview may be used/ Nội dung cuộc phỏng vấn có thể được sử dụng cho:

- a) In MSc Thesis Report/ Báo cáo luận văn Thạc Sĩ
- b) On other feedback event/ Cho những phản hồi khác
- c) In an archive of the research noted above/ Để lưu giữ lại cho nghiên cứu đã nêu trên

By signing this form, I agree that:

1. I am voluntarily taking part in this project. I understand that I do not have to take part, and I can stop in any time.
2. The transcribed interview or extracts from it may be used as described above.
3. I have read the information sheet.
4. I do not expect to receive any benefit of payment for my participation
5. I can request a copy of the transcript of my interview and may make edits I feel necessary to ensure the effectiveness of any agreement made about confidentiality.
6. I have been able to ask any questions I might have, and I understand that I am free to contact the researcher with any questions I may have in the future.

Bằng việc kí tên vào biên bản, tôi đồng ý rằng:

1. Tôi tình nguyện tham gia vào dự án và hiểu rằng mình có quyền từ chối không tham gia và có thể ngưng phỏng vấn bất cứ lúc nào
2. Nội dung của cuộc phỏng vấn có thể được trích dẫn và sử dụng cho mục đích kể trên
3. Tôi đã đọc đầy đủ thông tin liên quan
4. Tôi không mong muốn nhận được bất kì lợi ích nào liên quan đến việc tham gia phỏng vấn
5. Tôi có thể yêu cầu một bản sao ghi hình cuộc phỏng vấn và có thể thay đổi nội dung nếu cần thiết, để đảm bảo tính bảo mật của thông tin
6. Tôi có thể được hỏi bất cứ câu hỏi nào và có quyền liên lạc với nghiên cứu viên để giải đáp những thắc mắc trong tương lai.

\_\_\_\_\_  
Printed name/ Tên người được phỏng vấn

\_\_\_\_\_  
Participant Signature (Kí tên)

\_\_\_\_\_  
Date (ngày)

\_\_\_\_\_  
Researcher Signature (Nghiên cứu viên – kí tên)

\_\_\_\_\_  
Date (ngày)

PART 1

1. Could you introduce yourself (mention your name, age, job title, and primary function of your job)?
2. Tell me what happened when cyclones strike the island?
3. What is the most important factor that impacted the island during the storms?
4. How bad was the cyclone's aftermath?
5. What did people do after the storm?
6. How did you and society in the island respond to this occurrence?
7. How did you involve in rebuilding this island after the cyclones?
8. Do you know and understand the climate change issue and its impact to the island? Please describe it.
9. Tell me about your opinion, do you think this island has a lot of potential in the future?

PHẦN 1

1. Vui lòng giới thiệu về bản thân (tên, tuổi, nghề nghiệp và vai trò chính trong công việc của anh/chị)
2. Điều gì đã xảy ra khi bão tiến vào khu vực đảo?
3. Ảnh hưởng lớn nhất mà bão mang đến cho hòn đảo là gì?
4. Hậu quả của cơn bão như thế nào?
5. Người dân khu vực làm gì sau khi bão xảy ra?
6. Anh/chị và dân cư khu vực đảo làm gì để ứng phó với bão?
7. Anh/chị đóng góp gì trong việc tái xây dựng đảo sau cơn bão?
8. Anh/chị có hiểu biết gì về biến đổi khí hậu và tác động của nó đến khu vực đảo? Vui lòng giải thích.
9. Ý kiến của anh/chị về tiềm năng của hòn đảo trong tương lai?

PART 2

10. Tell me about your job and daily activity. How does your job relate to the landscape of Cam Kim Island?
11. Tell me about the changes of the island that you have experienced. How do you describe it?
12. Why do you choose this island as your home? Do you feel safe living here?
13. What do you expect to the effect of recent city development as local residents of Cam Kim Island?
14. To what extent did the society do some improvements to the island? Tell me if there is any.

PHẦN 2

10. Anh/chị vui lòng cho biết về công việc hằng ngày của mình. Công việc của anh/chị có ảnh hưởng đến cảnh quan khu vực đảo Cẩm Kim hay không?
11. Xin vui lòng cho biết những thay đổi của khu vực đảo mà anh/chị quan sát được?
12. Tại sao anh/chị lựa chọn sinh sống ở khu vực này. Anh/chị cảm thấy cuộc sống ở đây như thế nào?
13. Như là một cư dân trong khu vực. Anh/chị có mong đợi gì trong việc phát triển thành phố?
14. Cộng đồng dân cư có tác động cải thiện khu vực đảo hay không? Mô tả nếu có.

### PART 3

The researcher will show some sketches that relate to the idea and principles of resilient landscape design to the locals and ask their preferences according to those principles.

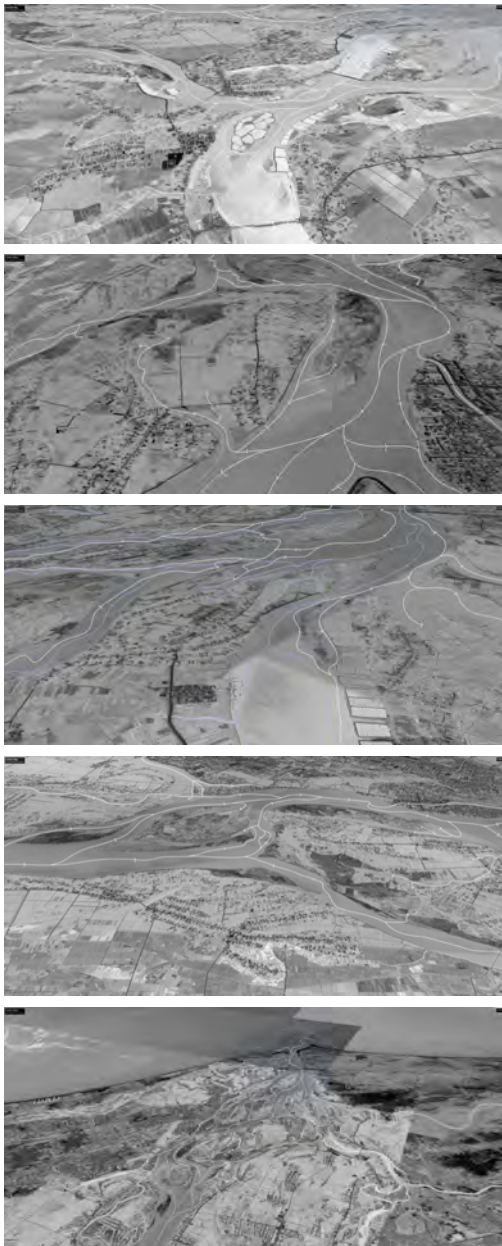
### PHẦN 3

Điều tra viên sẽ đưa ra những bản vẽ liên quan đến ý tưởng thiết kế cảnh quan thích ứng với điều kiện tự nhiên khu vực và thăm hỏi ý kiến dựa trên thiết kế đó.

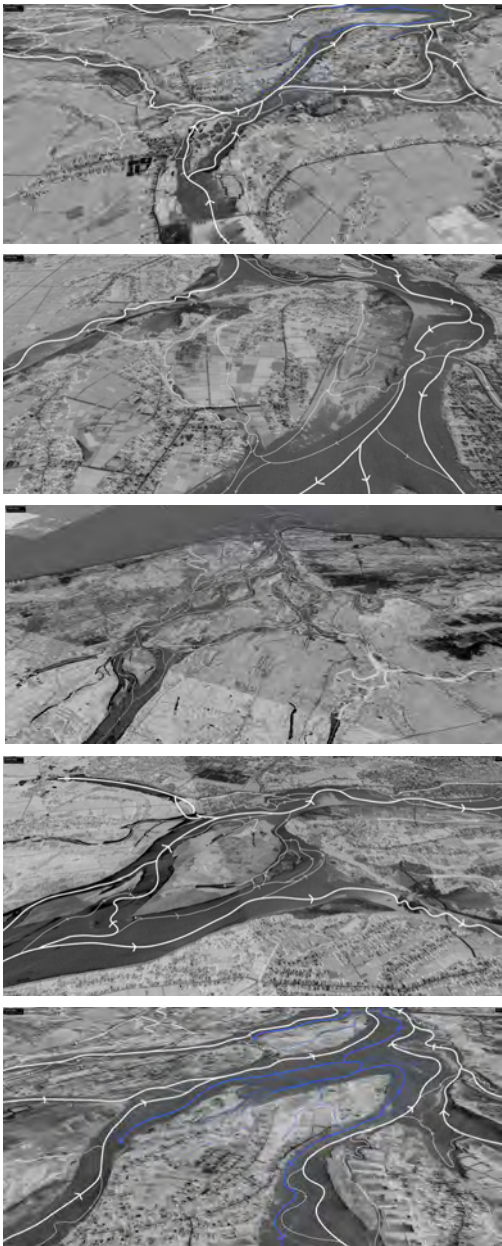


APPENDIX D - RIVER FLOW STUDY

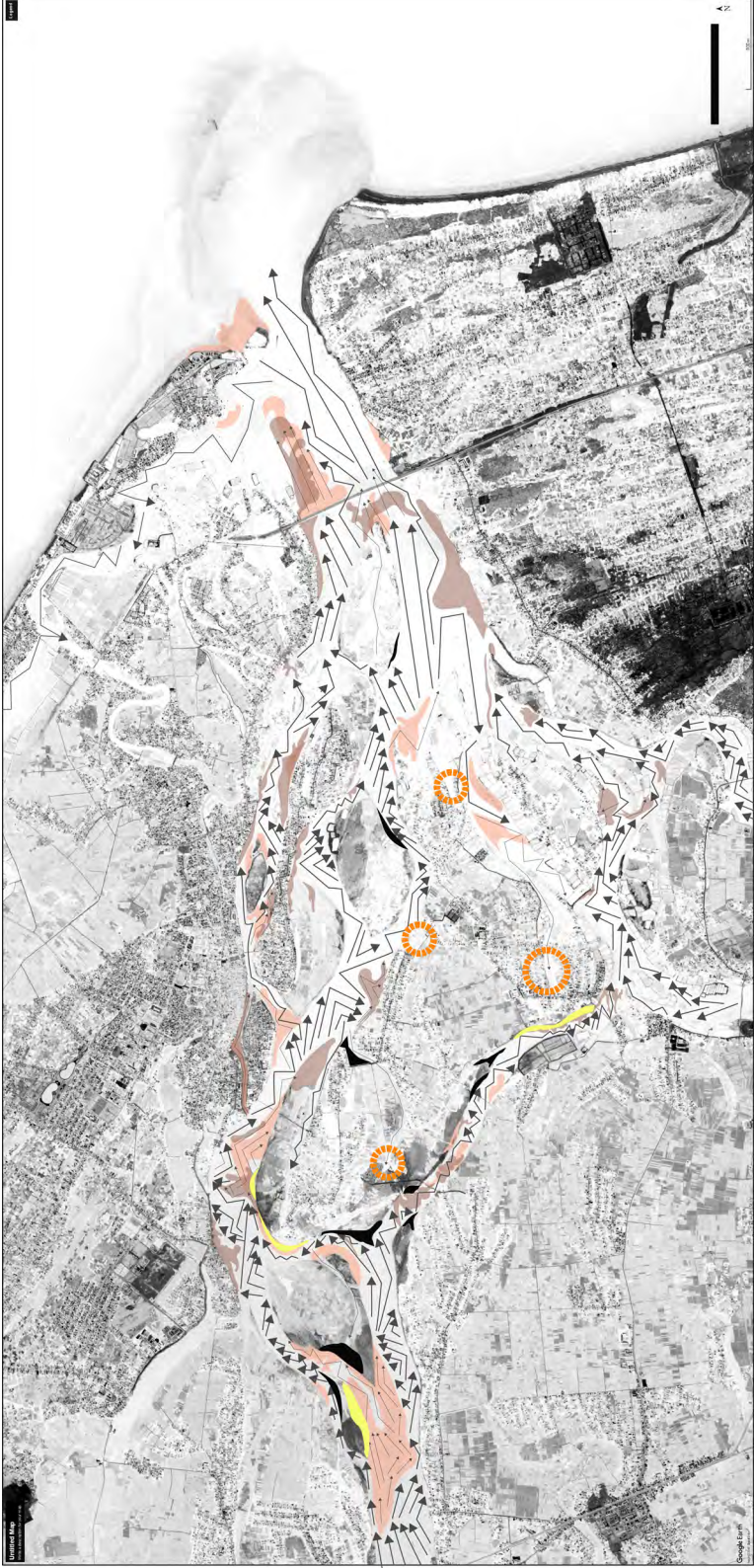
Dry



Wet

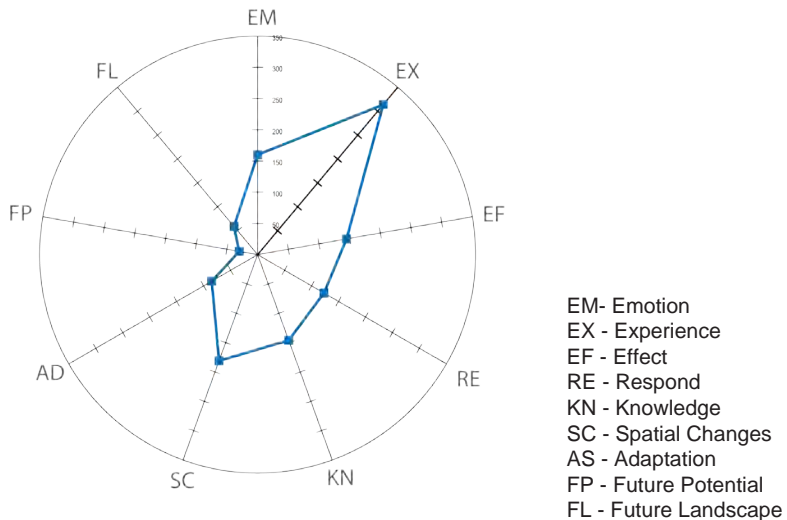


APPENDIX E - SPECULATING FUTURE FO CAM KIM ISLAND



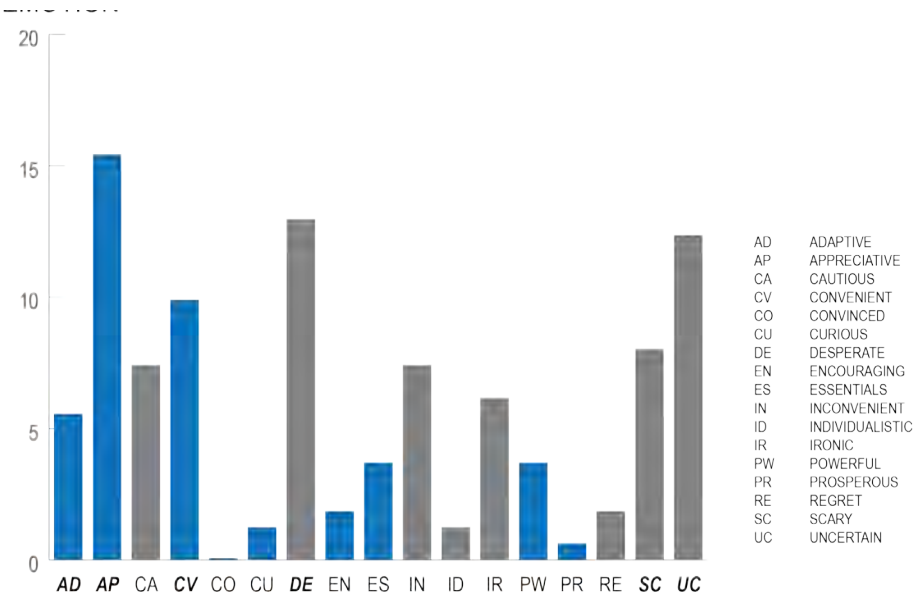
## APPENDIX F - INTERVIEW RESULT

### 1. Interview result distribution



Coding Type	Total Counted	Percentage
Emotion	160	14.00%
Experience	314	27.47%
Effect	145	12.69%
Respond	123	10.76%
Knowledge	146	12.77%
Spatial Changes	81	7.09%
Landscape Improvement	85	7.44%
Future Potential	30	2.62%
Future Landscape	59	5.16%
Total	1143	100.00%

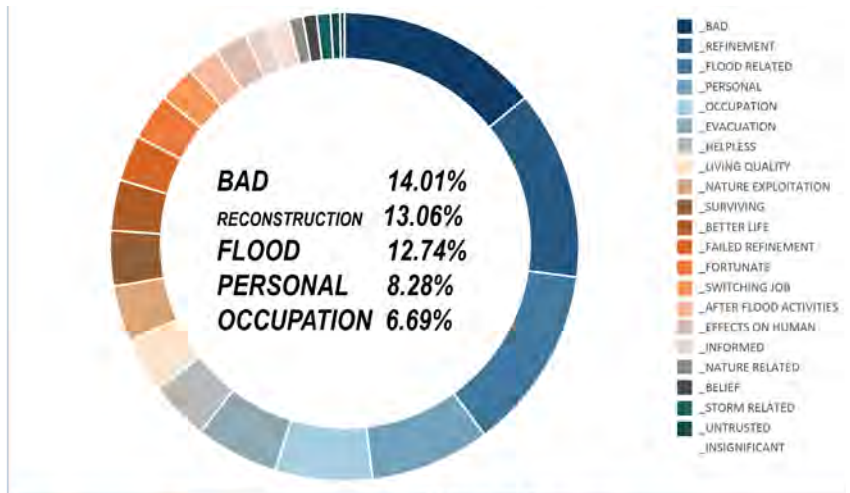
2. Result of Coding Emotion



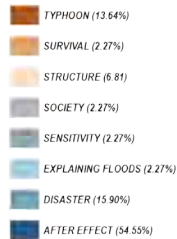
Types	Feeling	%
+	_ADAPTABLE	5.56
+	_APPRECIATIVE	15.43
-	_CAUTIOUS	7.41
+	_CONVENIENT	9.88
+	_CONVINCED	0.62
+	_CURIOUS	1.23
-	_DESPERATE	12.96
+	_ENCOURAGING	1.85
+	_ESSENTIALS	3.70
-	_INCONVENIENT	7.41
-	_INDIVIDUALISTIC	1.23
-	_IRONIC	6.17
+	_POWERFUL	3.70
+	_PROSPEROUS	0.62
-	_REGRET	1.85
-	_SCARY	8.02
-	_UNCERTAIN	12.35
TOTAL		100



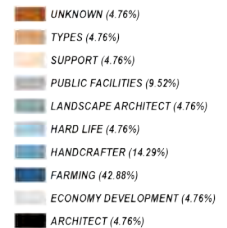
## 2. Result of Coding Experience



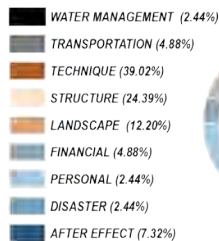
BAD



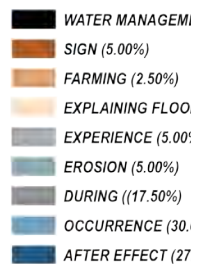
OCCUPATION



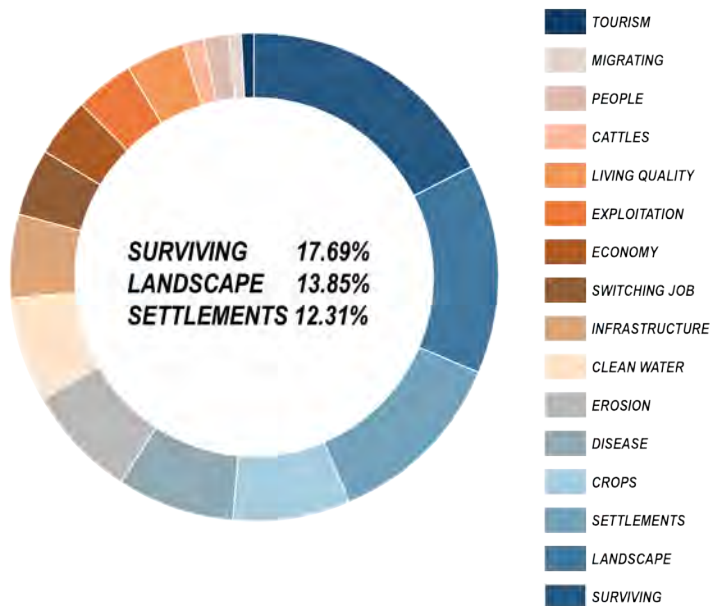
RECONSTRUCTION



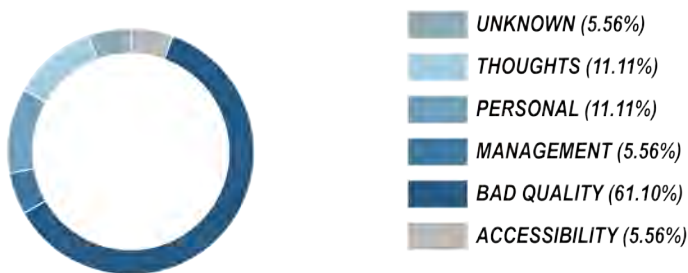
FLOOD RELATED



3. Result of Coding Effect

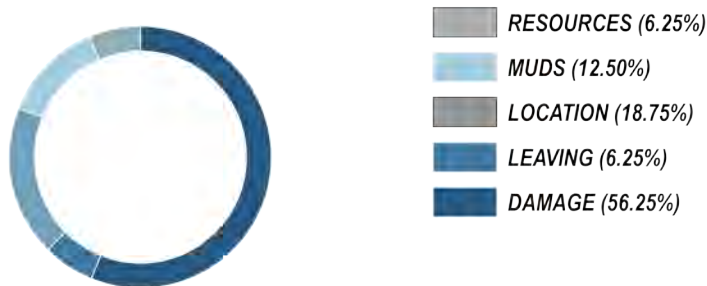


LANDSCAPE

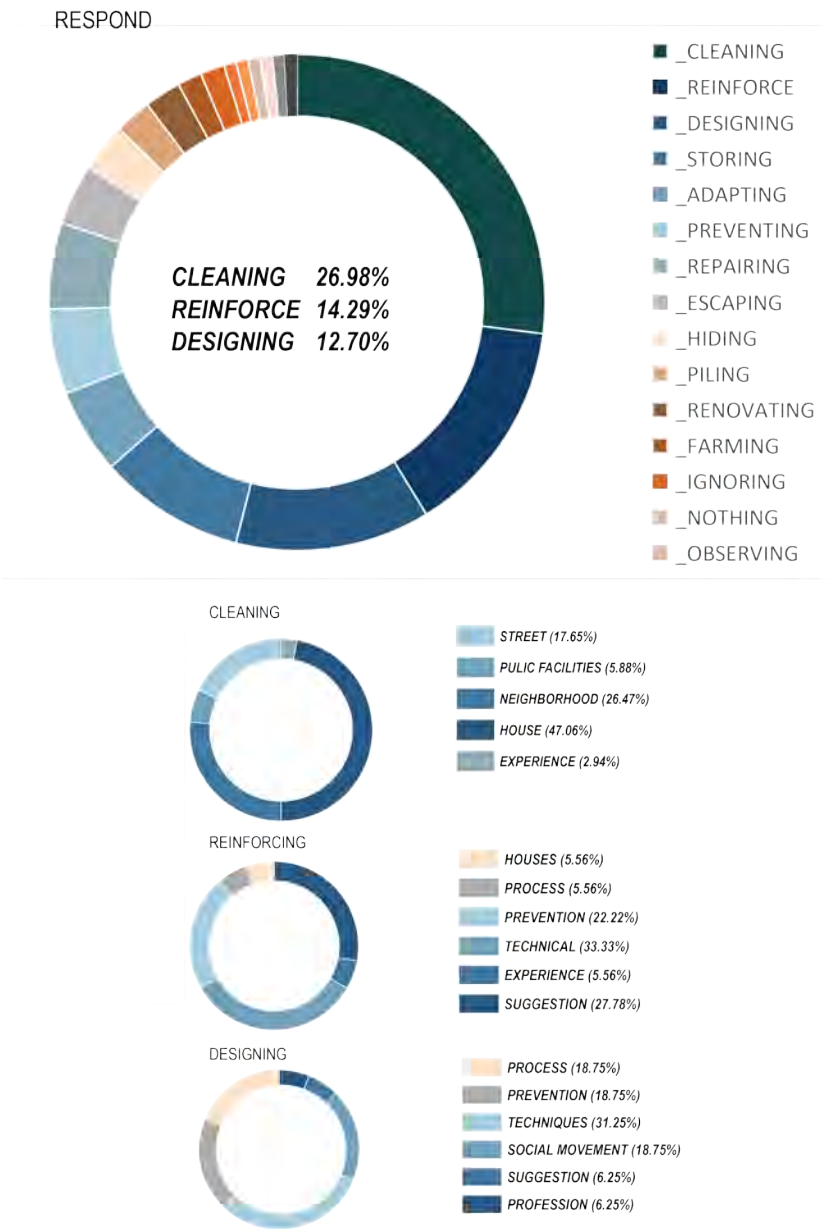


SETTLEMENTS

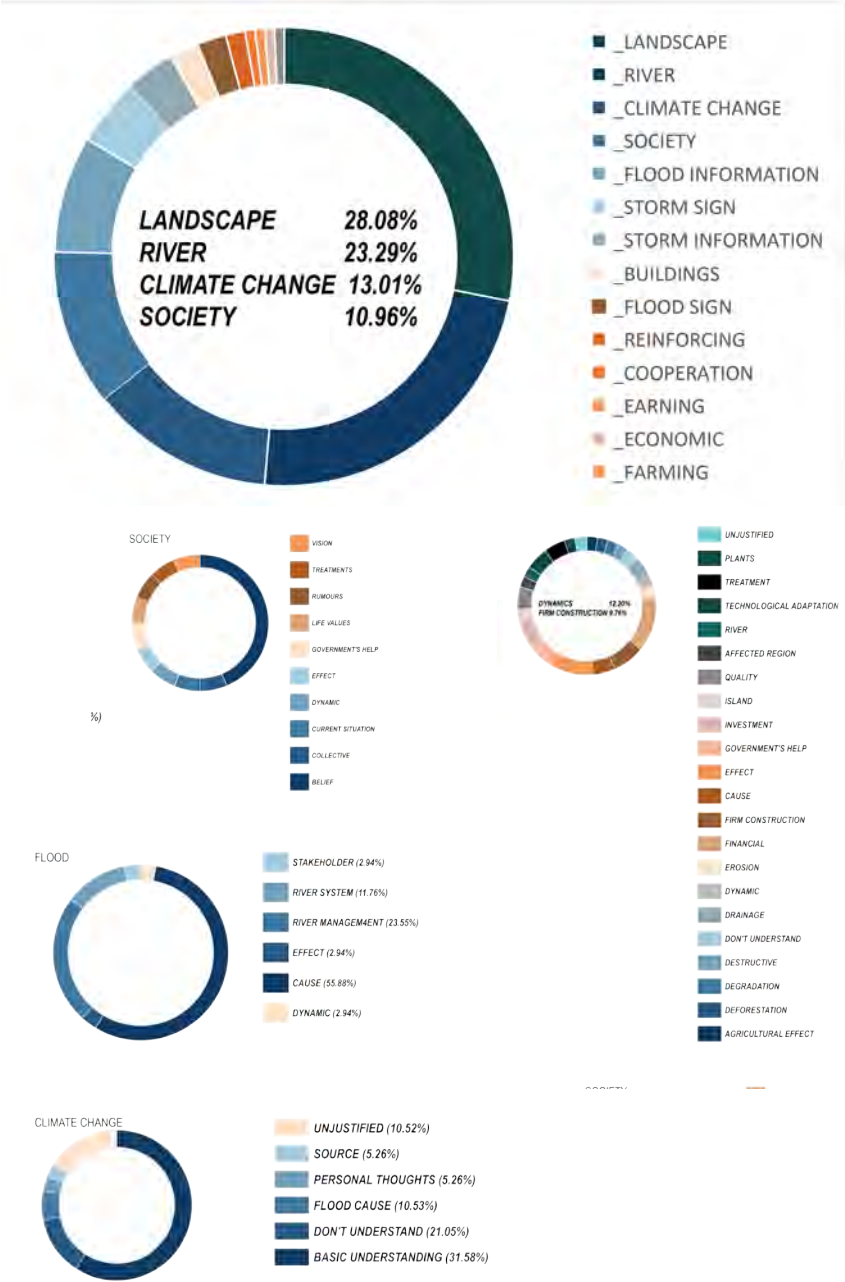
E



4. Result of Coding Respond

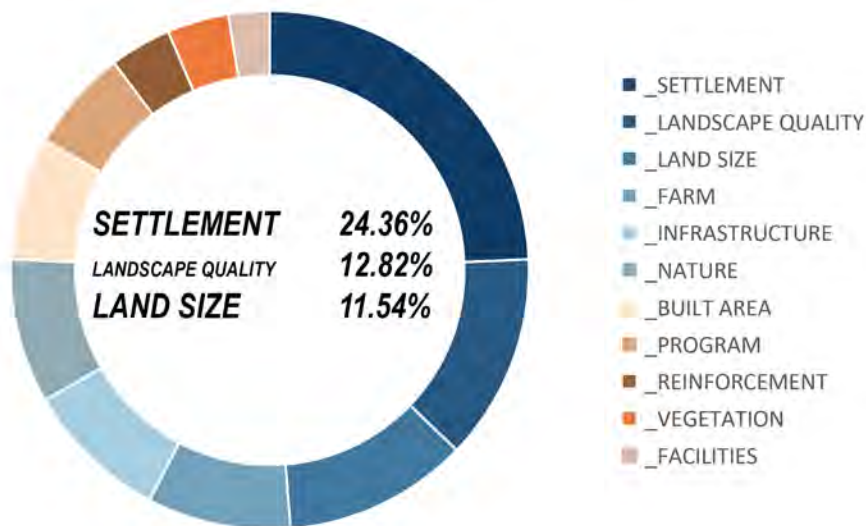


5. Result of Coding Knowledge

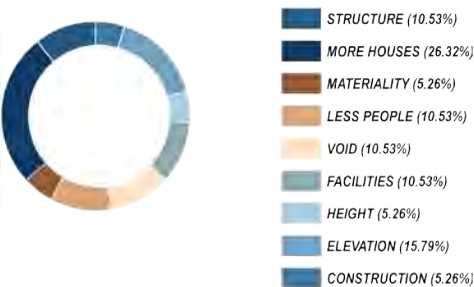




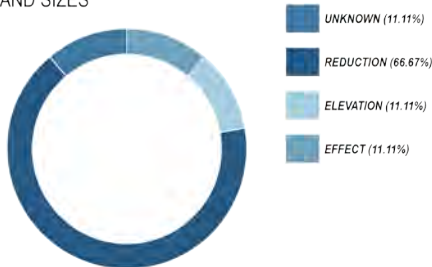
6. Result of Coding Spatial Changes



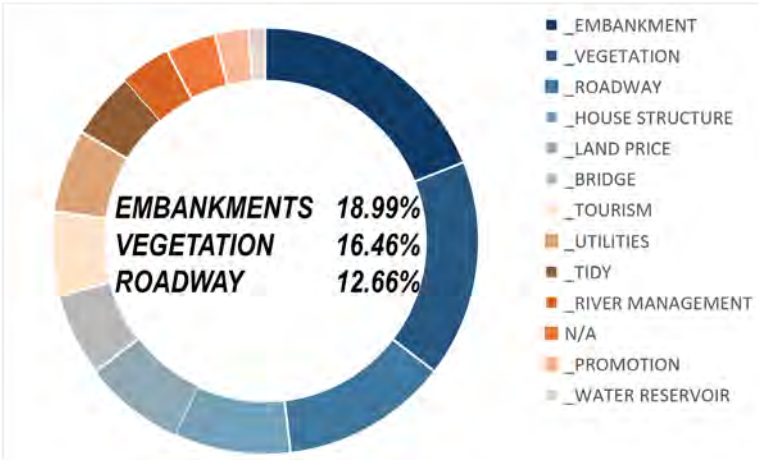
SETTLEMENTS



LAND SIZES



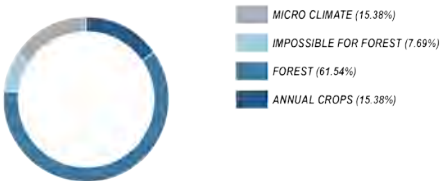
7. Result of Coding Adaptation



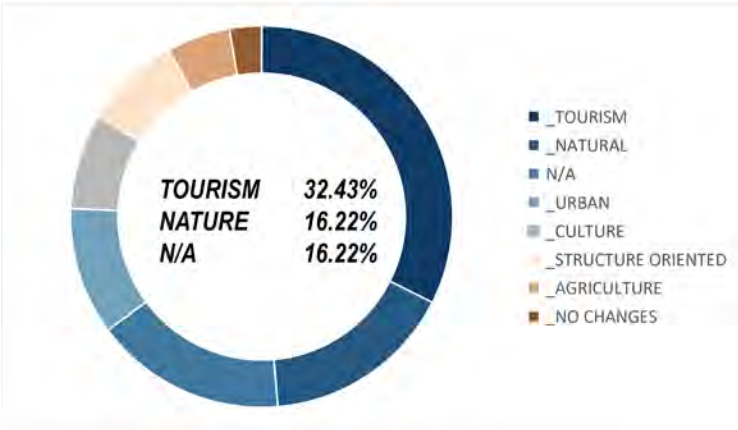
EMBANKMENTS



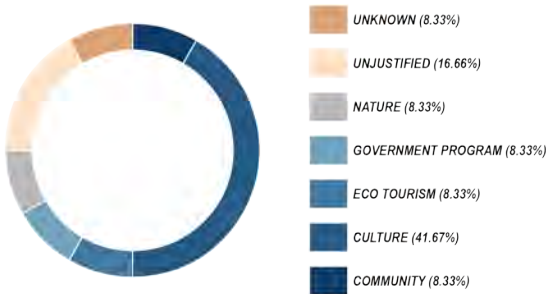
VEGETATION



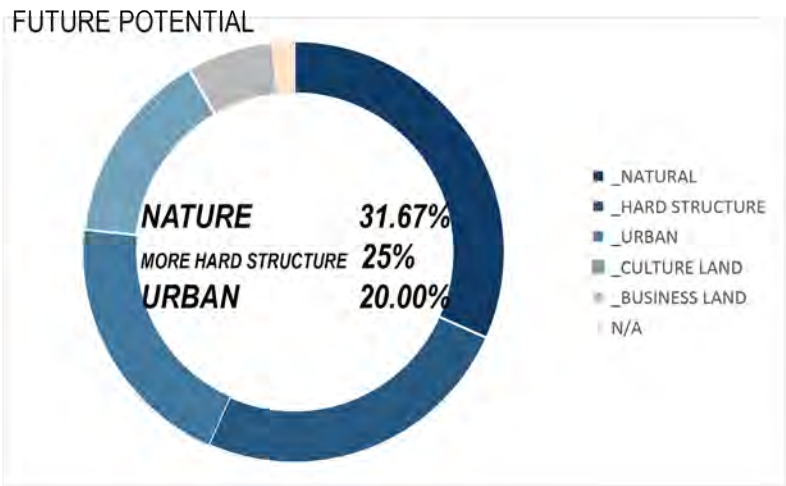
8. Result of Coding Future Potential



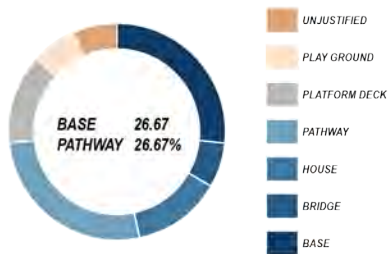
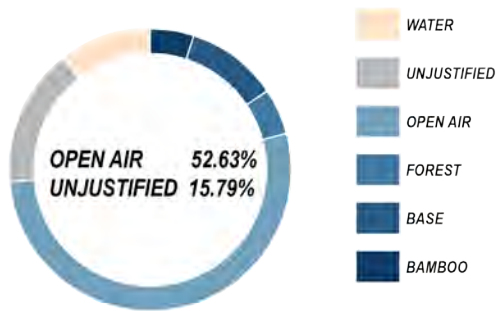
TOURISM



9. Result of Coding Future Landscape

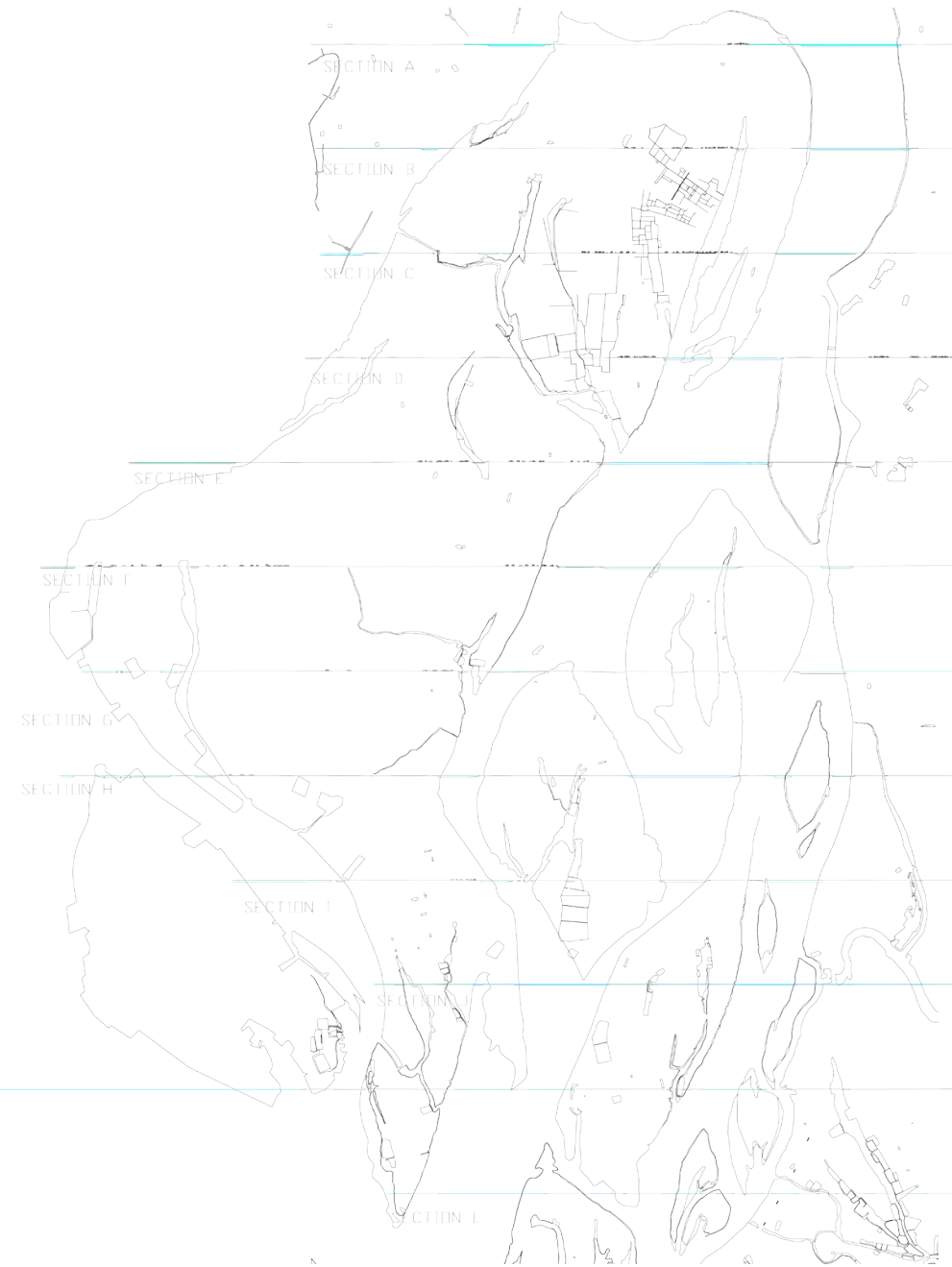


NATURE





APPENDIX G - SECTION STUDY



APPENDIX H - MODEL EXPLORATION



