



# **PREVENTION OF FLOODS VS. LIVING WITH THEM**

STRATEGIES FOR THE DEVELOPMENT OF THE RIVERSIDE  
URBAN AREAS ALONG THE RED RIVER IN HANOI.







**POLITECNICO DI MILANO**

**SCHOOL OF ARCHITECTURE AND SOCIETY**

**MASTER OF SCIENCE IN URBAN PLANNING AND POLICY DESIGN**

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# TABLE OF CONTENTS

ACKNOWLEDGEMENTS	4
ABSTRACT	6
ABSTRACT ( ITALIAN )	8
INTRODUCTION	10
<b>I GEOGRAPHY AND NATURE OF THE RED RIVER DELTA</b>	<b>14</b>
1.1 THE RED RIVER BASIN	15
1.2 THE DYKE SYSTEM	21
1.3 MAJOR ISSUES IN THE RED RIVER DELTA	27
<b>II DEVELOPMENT OF HANOI AND THE RIVERSIDE URBAN AREAS</b>	<b>40</b>
2.1 HISTORY AND PERIODS OF GROWTH	41
<b>III THE RIVERSIDE URBAN AREAS (RUA)</b>	<b>56</b>
3.1 LOCATION AND HISTORY	57
3.2 ADMINISTRATIVE AND LEGAL STRUCTURE	61
3.3 SOCIAL STRUCTURE. FORMALITY AND INFORMALITY IN RUA)	69
3.4 DISASTER AND FLOOD RISK	77
3.5 MAIN ISSUES IN THE RIVERSIDE URBAN AREAS	83
3.6 EXISTING PROJECTS.	88
3.7. RUA IN PHOTOS	94
3.8 FINAL REMARKS	111

<b>IV ALTERNATIVES TO DEALING WITH THE PRESENCE OF WATER IN RUA?</b>	<b>114</b>
4.1 ELEMENTS OF RUA	115
4.2 WHAT FUTURE FOR THE RIVERSIDE URBAN AREAS?	122
4.3 AN ALTERNATIVE SOLUTION TO THE DYKE?	130
4.4 AMPHIBIOUS LIVING. DEFINITION AND EXAMPLES	135
4.5 STRATEGY FOR RUA'S DEVELOPMENT	143
<b>V CONCLUSIONS</b>	<b>170</b>
LIST OF ACRONYMS	177
LIST OF DATA SOURCES IN TEXT	177
LIST OF TABLES	179
LIST OF GRAPHS	179
LIST OF FIGURES	180
LIST OF IMAGES	182
BIBLIOGRAPHY	184

#### REMARKS

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Thank you all !

*FIG. 1 ( On next page ) The riverside view to Chuong Duong and Long Bien bridges from Phuc Tan Port, April 2014*





## ABSTRACT

The focus of this thesis work is moving from the scale of the Red river basin, down to Hanoi and its Riverside areas, urbanised in the past century, despite the presence of frequent floods. Located in the heart of the Red River Delta, Hanoi is a city with a population of about 3 million people officially living within the city limits\*, with an extreme density of about 18 200 inh./sq. km, while the province of Hanoi (Hanoi Capital) accounts for about 6.9 million out of which about 49% living in the rural areas of the province. In a free market economy which is on its way to go through tertiarization, with a GDP growth of 5% per year, and 60% of the population under the age of 30, it is clear that in the time plans are being elaborated urbanization is already a fact. Located on the banks of the Red River the city has for centuries had a very strong relationship with it, due to its important transportation functions in the past. Since its establishment more than 1000 years ago, Hanoi has continuously suffered the consequences of severe floods, due to the specific climate and the hydraulic regime of the Red river. That has led to construction of the existing today extensive system of dykes, dams and reservoirs to protect the entire Red river delta from the fluctuating levels of the river between the dry and rainy season.

The dyke stretching along the river banks in Hanoi has cut the link of city with the river, but especially significantly after the construction of the 2 m wall on top of the existing dyke, separating visually and physically the historical core of Hanoi from the growing urbanisation in the flood plain on the other side of the dyke. Despite the flood risk the areas outside the dyke started getting urbanised during the mid 20th century and boomed after the country's switch to a market economy -The Doi Moi in 1986. Today the Riverside Urban Areas (RUA) represent a dense urban fabric, in some areas denser than the one in the old part of the city, with diverse problems needing to be taken care of. The main issue, the authorities are looking for a solution for, is the semi-formality of the urbanisation in RUA and the flood risk. A few projects have been proposed but, however all of them see the solution in constructing a new dyke to protect these settlements to be therefore able to legalise them. That has a lot of downsides in terms of economical and environmental sustainability.

My work evaluates the situation and proposes an alternative approach to dealing with the urbanisation in RUA in a sustainable manner. Instead of fighting to keep water away, design solutions to live in balance with it, considering the current situation. and future possibilities..

*\*The city limits are referred to the limits of the Urban districts of Hanoi Province.*



## ABSTRACT ( ITALIANO)

La tesi sviluppa il proprio percorso dalla scala territoriale del bacino idrografico del Fiume Rosso, fino alla città di Hanoi e al suo sistema di aree spondali, urbanizzate nel secolo scorso nonostante la presenza di frequenti inondazioni.

Situata nel cuore del delta del Fiume Rosso, Hanoi è la capitale del Vietnam, una città di circa 3 milioni di abitanti, che ufficialmente vivono all'interno dei confini cittadini, \* e con una densità abitativa di circa 18.200 ab/kmq; la provincia di Hanoi invece conta una popolazione di circa 6,9 milioni, di cui circa il 49% vive in aree rurali. Pienamente immersa in un'economia di mercato, fortemente avviata sulla strada della terziarizzazione, con una crescita annua del PIL del 5% e con il 60% della popolazione al di sotto dei 30 anni, la città ha un ritmo di crescita tale per cui tutti i suoi piani di urbanizzazione e sviluppo elaborati nel tempo risultano ampiamente superati.

Localizzata sulle sponde del Fiume, la città ha avuto per secoli un rapporto intenso con il fiume, soprattutto per la rilevanza del trasporto fluviale. Fin dalla sua fondazione, più di 1000 anni fa, Hanoi ha subito continuamente le conseguenze delle gravi inondazioni, a causa del particolare clima e del regime idraulico del Fiume Rosso. Ciò ha portato alla costruzione di un vasto sistema di argini, dighe e serbatoi per proteggere l'intero delta dalle fluttuazioni dei livelli del fiume tra la stagione secca e quella piovosa.

L'argine che si estende lungo la riva del fiume all'interno della città di Hanoi ha reciso il legame tra la città e il fiume, ma è stata la creazione di un muro di 2 metri in altezza sopra lo stesso argine a separare drasticamente, sia visivamente che fisicamente, il centro storico di Hanoi dalla crescente urbanizzazione che si è sviluppata nella pianura alluvionale sul lato opposto dell'argine.

Nonostante il rischio d'inondazione, le aree della pianura alluvionale sono state oggetto di un'urbanizzazione crescente durante la metà del 20 secolo, esplosa nel 1986 con il passaggio del paese a un'economia di mercato, il cosiddetto "Doi Moi". Oggi le "Riverside Urban Areas" (RUA) sono caratterizzate da un tessuto urbano denso, in alcune parti addirittura più denso che nella parte storica della città, con diversi problemi urgenti.

I principali dei quali, a cui le autorità locali tentano di dare risposta, sono la natura semi-illegale di queste aree e il rischio di loro inondazione. Diversi progetti sono stati proposti in proposito: quasi tutti prevedono di costruire nuovi argini per proteggere gli insediamenti e di affrontare il tema della legalizzazione degli insediamenti in un secondo momento. Si tratta di soluzioni particolarmente costose e con un forte impatto ambientale.

La presente tesi analizza le condizioni attuali di contesto, avanza delle valutazioni circa le soluzioni presentate e cerca di proporre un approccio alternativo per affrontare l'urbanizzazione nelle RUA in maniera più sostenibile. Sostanzialmente, invece di progettare un modo per mantenere l'acqua lontana, si propongono soluzioni per vivere in equilibrio con essa tenendo in considerazione la situazione attuale e le possibilità di sviluppo futuro.

*\* I limiti della città sono identificati con i limiti del distretto urbano della provincia di Hanoi.*



# INTRODUCTION

Located in the Red river Delta, Hanoi has grown from a village more than 1000 years ago to being the capital of Vietnam today. The territorial characteristics of its location have allowed the development of a strong agricultural tradition, crafts and fluvial trading opportunities. However the climate particularity and water regime of the river delta has its disadvantages. The annual fluctuations of the Red river between dry and rainy season, have many times destroyed the production and left the delta areas flooded many times. During the centuries, Vietnamese started building dykes to protect the low lying delta from the annual floods, every time heightening the them, when an extreme flood has overflowed the existing ones. With experience they learned that a heightening the dykes isn't unlimited and expanded their water management to controlling the upstream water flow by constructing reservoirs and dams creating a more integrated method of water management. However there are consequences of the dyke protection measures on the urban structure of Hanoi that create urban issues needing a solution. The construction of dykes to protect Hanoi has created a physical barrier between the city and the river that however has become an attractive part of the city when the Hanoi started growing and space close to the city center was only available outside the dyke where the Red river flood plain is. Due to the lack of regulations and control from the authorities these areas got urbanised fast and mostly spontaneously by the population looking for a cheap piece of land in the city, and are today considered as semi formal or informal. One of the main issues are the floods and that these settlements aren't protected as the rest of the city and therefore can't be considered legal parts of the city despite its over 160 000 inhabitants.

**The Objectives** of this thesis are to understand the situation at all levels and scales, analyse the issues, evaluate the existing proposals on how to deal with those issues and propose an alternative strategy to river fluctuations and urbanisation in the flood prone areas in Hanoi.

**Structure** - The thesis is structured in 5 parts: Chapter I to V. The organisation of the parts is based on scale, starting from the international scale and geography of the river, going through the Hanoi city scale with its historical development, followed by a descriptive analysis of the Riverside Urban Areas (RUA). After having analysed the development of Hanoi, the causes for urbanisation of the riverside areas and the issues present today there, a strategy for its future is proposed in Chapter IV. The last part is devoted to wrapping up the whole and explaining why the proposed strategy is considered better than the existing already proposals and what is necessary to implement it.

**1st Chapter** - the main elements of the Red river context are introduced, explaining the development of water management, the major issues in the Red river delta, finally underlining the necessity of a new expanded integrated water management in the whole Red river basin.

**2nd Chapter** follows the development of Hanoi since its establishment and underlines the fast growth in terms of urban and administrative territory as well as very fast population increase in the past 60 years. This part also explains when and how the urbanisation of the Riverside areas started and some of the causes for its urban condition today.

**3rd Chapter** - goes in depth with the history and growth of RUA analysing the legal and administrative aspects of its urbanisation, identifies the main issues in RUA divided in 4 categories - Environmental, Social, Urban and Management and Governance, explains the social structure of RUA and the formality and informality of the settlements, the presence of flood risk and the perception of the population and at the end presents the projects proposed for these areas in the past decade.

**4th Chapter** - This part starts with the presentation of the main ele-





ments representing RUA followed by an evaluation of the projects for RUA, presented in the previous chapter which serve as a base for the creation of an alternative scenario for the future of the riverside urban areas.

## **Methodology**

For the creation of this work a number of things were necessary, such as data collection through an internship, interviews and field research and photographs.

Getting introduced to the Vietnamese context and Hanoi Capital Region was part of my 5 months internship in the Institute d'Aménagement et d'Urbanisme en Ile de France in Paris last year. During that time I got interested in Hanoi and its flood issues and decided to base my thesis on that with the advice of my internship tutor Mr. Laurent Perrin and the confirmation of my academic tutor Prof. Antonella Bruzzese. Defining precisely the topic took a long process of understanding the flood issues in Hanoi and the reading of a vast number of research papers, reports, books and articles. What was crucial to the final structuring and execution of this thesis was a two and a half months period in Hanoi, Vietnam, during which the urban reality and terrain research helped me define the issues to be addressed, think of possible solutions and understand the local culture. This was also the time I had the opportunity to meet the local planners, architects who work or have worked on the issues, discuss with them and collect as much data as possible available in a European language. Data collection especially in Vietnam is a challenge itself as in many cases institutions do not give public access to it. Despite the language barrier, and the fact that it's not legal to conduct interviews without a permission, with the help of a language student Le Thu Ha, I managed interviewing several of the inhabitants of the Riverside Urban Areas to understand their point of view on the flood issue and the quality of life in RUA.

Last but not least the field work allowed me to take photographs which served in visualizing the urban reality in Hanoi in my work.

[Document Research, Period of Thesis abroad in Hanoi, Interviews with Planners and Locals, Internship on the Hanoi Capital Region Plan 2030-2050 in IAU-Idf]

## **Hypothesis**

My work is looking for an alternative to the dyke in dealing with semi legal urbanisation in the Red river flood plain, through integrating water dynamics into urban life and transforming the existing settlements into resilient ones and introduce amphibious living to cope with eventual future floods. By introducing a strategy for a balanced life with the natural conditions of the river, I propose a new paradigm - living with water, which I believe is one part of the possible solutions for urbanised areas with flood risk in the climate change global context.

## **Key Words:**

Riverside Urban Areas, Hanoi, Fluvial Floods, Living with water, Amphibious development, Resilient reconstruction,



Y U N N A N

A N N A M

Lao Kay

Son La

SONTAY

HANOI

HUNG HOA

PHU LY

NINH BINH

HAI PHONG

HAI PHONG

Cao Phong

Nguyen Binh

Thay Ninh

Na Cham

Dong Xuan

Chu Xuan

Phu Xuan

Phu Xuan

Phu Xuan

Phu Xuan

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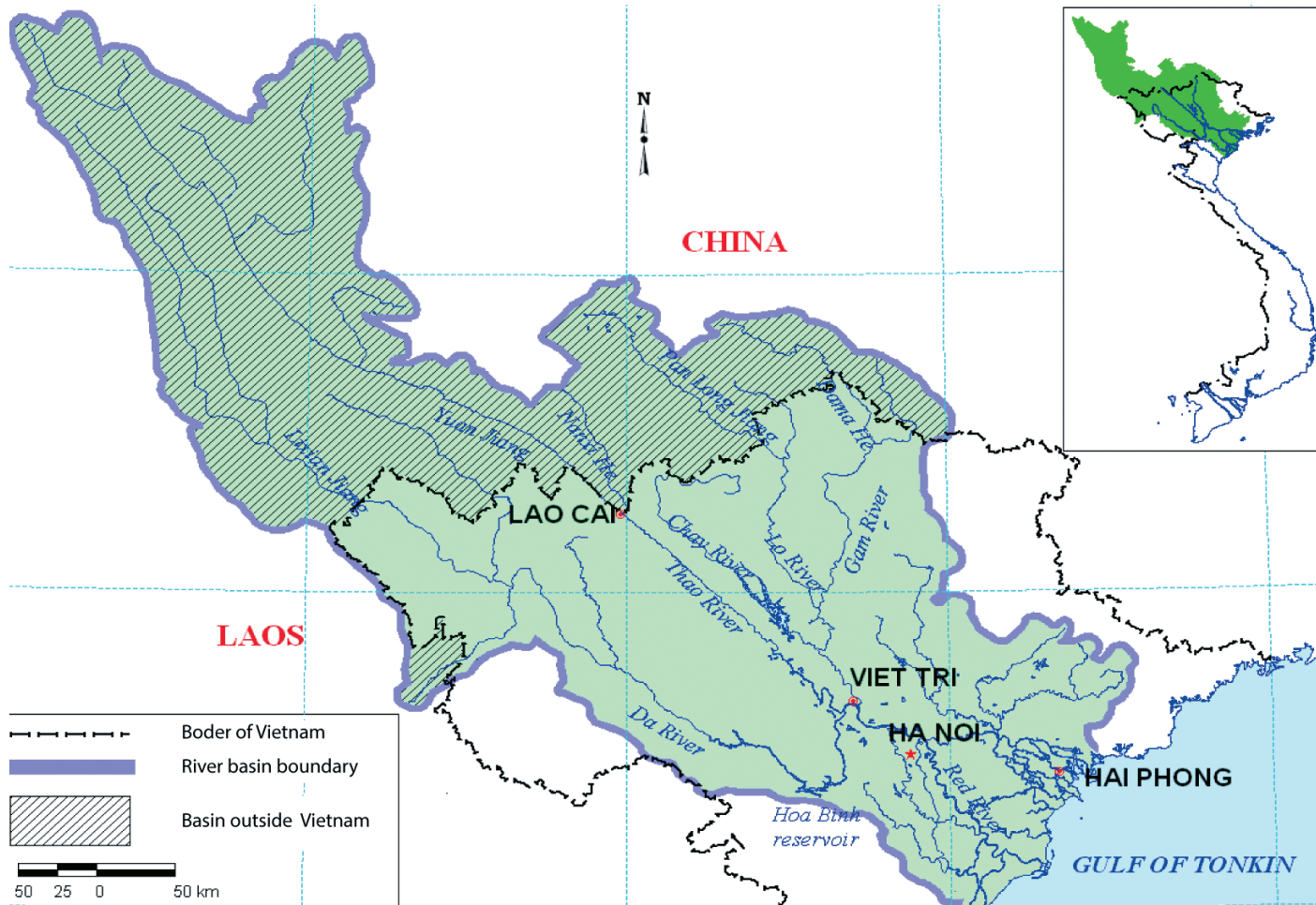
Phu Xuan



# GEOGRAPHY AND NATURE OF THE RED RIVER BASIN

FIG. 1.1 (previous page) Hanoi 1896, Centre des archives d'outre-mer, Aix-en-Provence, provided by E. Cerise, IMV-Hanoi

FIG 1.1.1 The Red River Basin  
Source: Plaxis Bulletin 2013, original Khoi [2010]



## GEOGRAPHY

The Red River Basin (RRB) is one of the world's largest with a total area of approximately 170,000 km<sup>2</sup>, covering North of China, small part of North East Laos and the North of Vietnam and finally flowing into the Gulf of Tonkin. [FIG. 1.1.1] Half of its territory – 86,660 km<sup>2</sup> or 51%

is in Vietnam, determining a specific geography and environment of 26 provinces with a total population of 28 million people.<sup>1</sup> Part of the RRB where the capital Hanoi is located, lies in the eastern part of the North Vietnam, which borders the Gulf of Tonkin and covers approximately 15,000 km<sup>2</sup> and is known as the Red River Delta (RRD).

# THE RED RIVER

1.1

Vietnam's territory can roughly be described as 2/3 of its territory covered by mountainous areas stretching from north-west to south-west of the country. The rest of the territory is divided between the flat plains of two big deltas - the Mekong and the Red River delta, connected by the country's long plain coastline. (FIG. 1.1.2)

## HYDROLOGICAL REGIME

Specific character of the Red River and its influence on the territory it crosses is determined by the particular weather conditions. Vietnam has two seasons - dry and rainy. The rainy season is between May and September, the dry season lasts from October to April. Notably 65% to 90%<sup>2</sup> of the annual rainfall occurs during the rainy season. Such distribution of rainfall causes one of the major issues in the Red river delta - floods and draughts leading to the necessity of precise water resources management. The part of the Red river flowing through China then carries down around 40% of the Red river surface water, to the delta<sup>3</sup> in Vietnam. That means that its quality and quantity highly depends on the upstream management - in this instance on China.

Many reservoirs and dams have been constructed in the recent years in the Chinese and Vietnamese part of the RRB. According to Ha 2010, China is planning to construct 52 hydroelectric plants in the upstream Red river basin.<sup>4</sup>

## CLIMATE CHANGE IMPACT

Weather forecasts have it that the climate change is likely to increase the contrast between the two seasons. Rainfall during the rainy season is expected to increase by 1-4% while the dry season is forecasted to have a downward tendency.<sup>5</sup> Altogether the above mentioned factors will have very serious consequences on the nature and regime of the Red river. More dams and hydro electrical

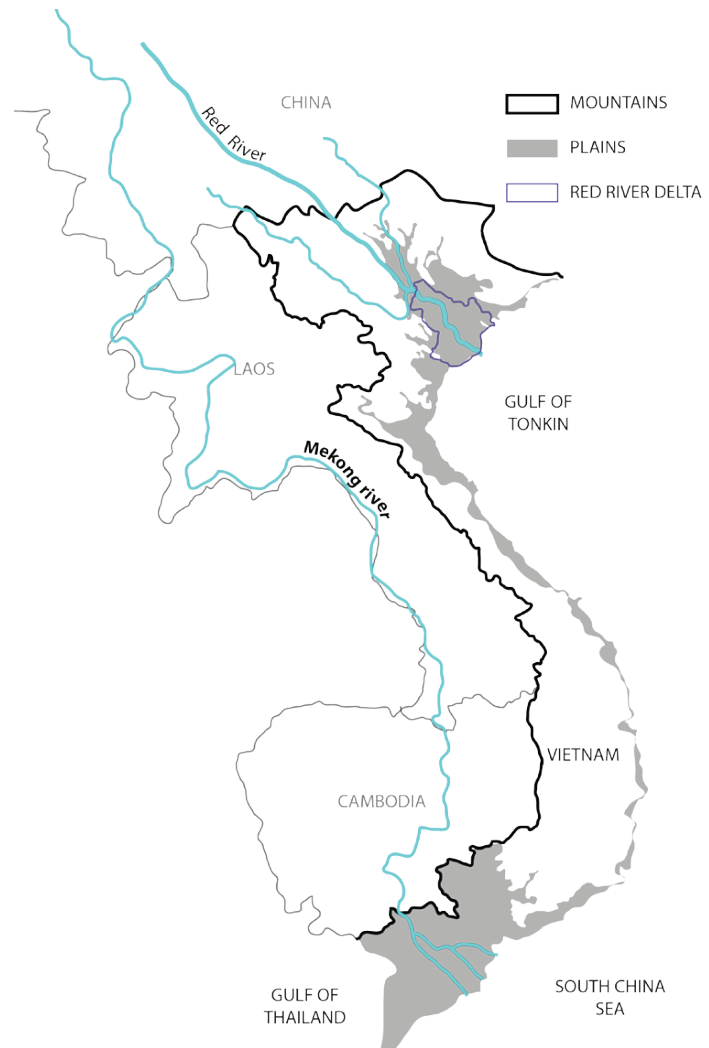


FIG 1.1.2 Vietnam topography interpretative map

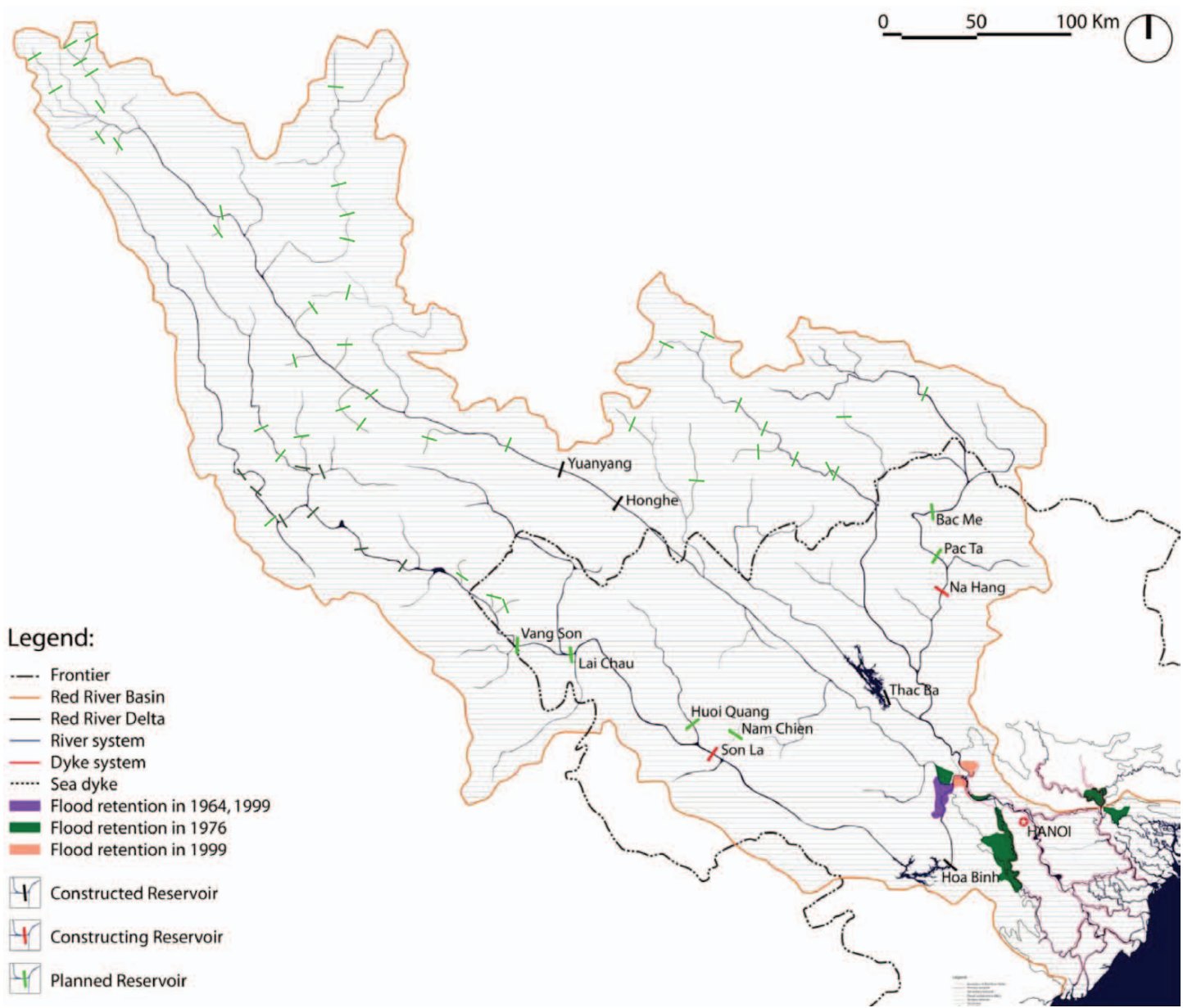


FIG 1.1.3 Red river basin. Existing and planned river works in China and Vietnam

Source: Tuan Pham Anh 2013

plants upstream means more water being held during the end of the dry season. That would mean lower water level of the river, which is already critical during the dry months and causing problems for navigation. At the same time lowering the river water level will allow for higher saltwater intrusion in the delta, which will destroy its agricultural capacity. Currently two river deltas of Vietnam - Mekong and Red river - are the major rice cultivators and since Vietnam is the 2nd country exporting rice worldwide, that will mean a serious economic loss. According to a recent study by the World Bank, the first meter of the sea level rise will cause an economic loss of \$17 billion per annum (90% of the annual GDP).<sup>6</sup>

## WATER MANAGEMENT

The complexity of the water regime of the Red river speaks for the necessity of smart water management. The river is crossing 2 countries - China and Vietnam, and both have taken their own initiatives in water management, such as dams and reservoirs construction lacking, however, a clear vision and open communication between the two for the future of the Red river. Such lack of partnership and information exchange between the two countries puts Vietnam and especially the Red River delta in a very insecure situation in terms of eventual flood circumstances. Not only on the international level is communication on water management an issue but also at the regional level between the provinces and actors involved. The country's governance is centralised and it is the government that takes decisions and then the lower administrative levels can take actions. In critical situations such as water management, effective and fast communication is of extreme importance. However, the Vietnamese settled in the Red river delta more than 1,000 years ago and established today's capital Hanoi and

the water regime of the river was generally similar to the one we have today. The name Red river comes from the fact that during the rainy season the river flow carries a large amount of sediment which gives it a reddish colour. The sediment is distributed in the floodplain where the river overflows naturally and enriches the soil, making the delta a fertile heaven for agriculture. Agriculture though requires irrigation during the dry winters and protection from the flood water in summer when monsoon season arrives to save the rice production from being destroyed.

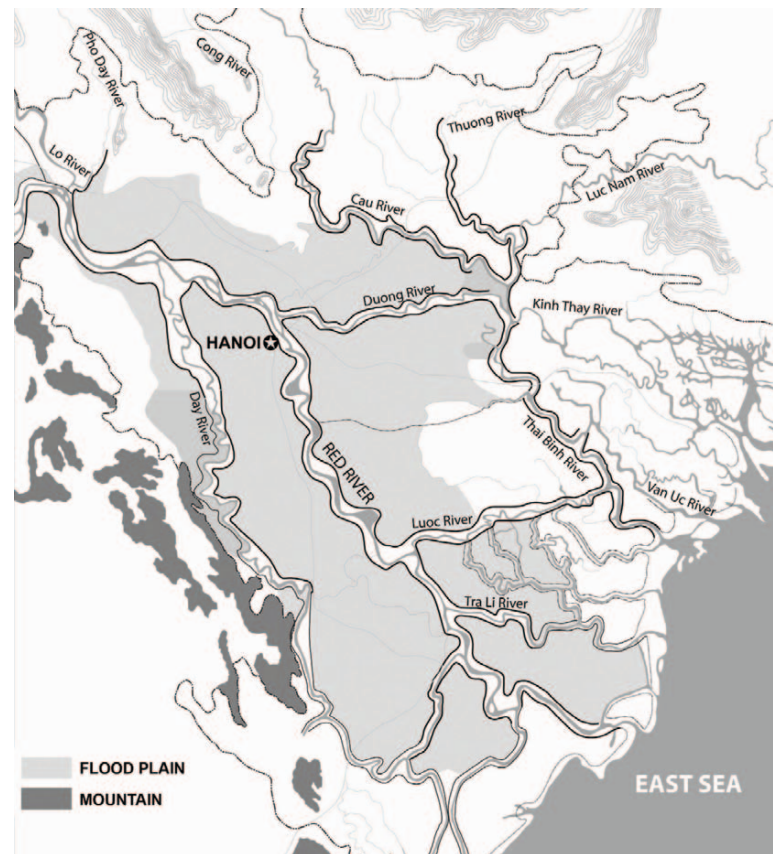


FIG 1.1.4 Red river delta. Dyke system and flood plain  
Source: Tuan Pham Anh 2010, adapted from Gliedman J. 1972, p. 217

Throughout the centuries this has led to the development of an extensive network of canals and dykes which are today indispensable in the delta's water management. Floods in the Red river delta are a consequence of the flow collection from upstream tributaries Da and Lo river and Thao river ( upstream name of Red river ) [FIG 1.1.1], which gather at the confluence of Viet Tri and become a direct threat for the flood security of Hanoi lying beneath. That is why except for the extensive system of dykes wrapping the whole RRD and the developing network of upstream dams and reservoirs, there is a plan B for the protection of Hanoi from exceptional flood events. Generally the flow converging in Viet Tri is naturally diverted to other rivers - Duong, Nhue and Day river. Day river plays a very important role in the water management during both rainy and dry season. The lower lying areas in the delta get water supply during the dry part of the year through the Day river, that is directing a part of the Red river flow to provide for the vast agricultural needs. However the Day river is also a strategic tributary for the water management of the Red river in rainy season when it helps control a safe level downstream by diverging a part of the flow through its basin. However in case of a flow reaching alarm situation the Day river basin can be used as a flood retention area to protect Hanoi. [FIG 1.1.6] Created in 1972-1973 after the devastating flood of 1971 when the Day and Nhue rivers were already cut from the Red river by the construction of the Day Dam and the Lien Mac Sluice (Nhue river) and therefore the inflow from the Red river could be controlled. With a number of sluices and dams today the Day river flood retention area is still considered as an evacuation corridor in exceptional cases, however in a conversation with arch. Tuan Pham Anh he explained that in the 2 times that the retention area was used it didn't prove to be efficient enough as the flow could not discharge well through the sluices and

dams as they weren't properly located and there were large quantities of sediment layering around them blocking the flow. However the areas designed to be the flood retention area are actually covered with spread urbanisation of villages and vast agricultural fields. Saving Hanoi from eventual floods by using the day retention basin means flooding thousands of homes and hectares of agricultural land..

Recently as a part of the upgrade of the dyke system project in the RRD of the Northern Hydraulic Institute of Vietnam, started implementation in 2010, the Day river basin is to be reduced of its current capacity to flood. That makes the flood retention area insufficient as such, due to the narrow space left for water. [FIG 1.1.5]

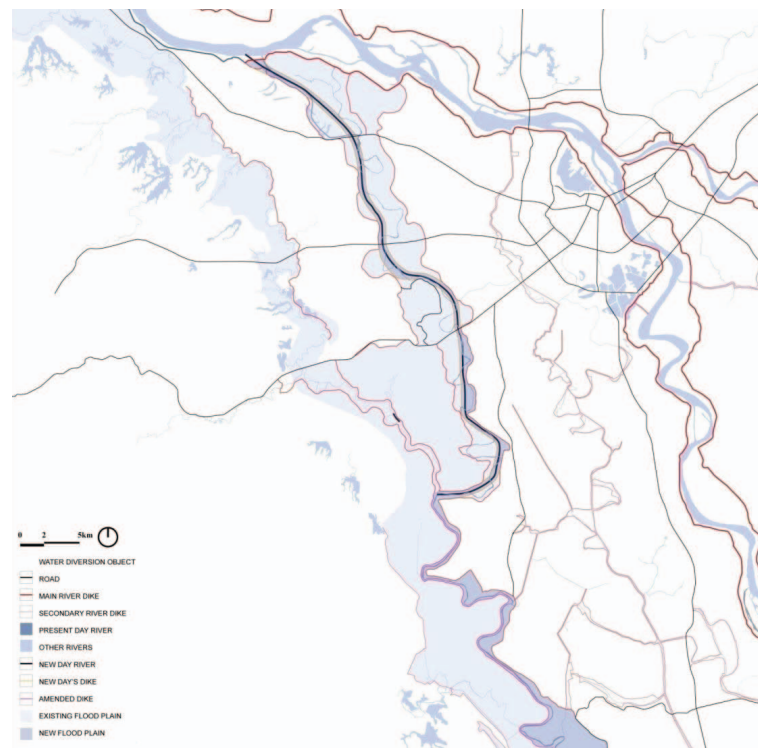


FIG 1.1.5 Red river evacuation corridor in case of extreme flood events

Source: Tuan Pham Anh 2011, Water Urbanism to Respond to Climate Change, Belspo-MoST Research Project 2010-2012, 3rd workshop



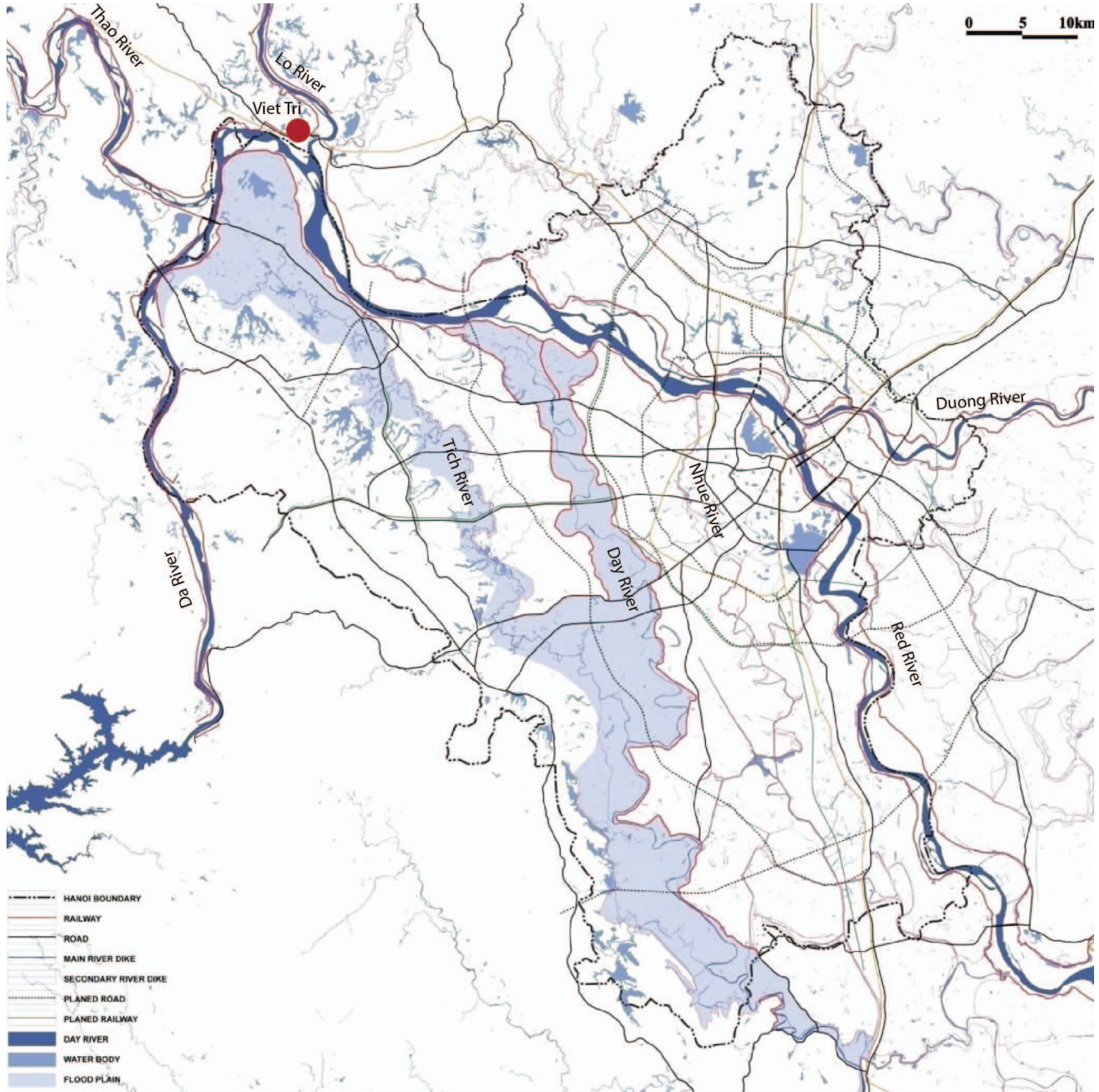


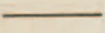


FIG 1.1.6 Evacuation corridor in case of extreme levels of the Red river.  
 Source: Tuan Pham Anh 2011, Water Urbanism to Respond to Climate Change, Belspo-MoST Research Project 2010-2012, 3rd workshop



CARTE DES DIGUES

LEGENDE

-  Digues principales
-  Digues secondaires
-  Digues maritimes

# THE DYKE SYSTEM

# 1.2

Ever since the Red river delta has been inhabited, agriculture was the main source for the economy hence the water management was a major concern. Over the centuries that lead to the construction of 10 800 km of irrigation canals, 9 300 km of drainage canals, 4300 drainage sluices 3212 irrigation pumps and 3200 drainage pumps and 8000 km of river and sea dykes<sup>8</sup>, to keep the land dry when necessary and irrigate only wherever needed. However, the irrigation canals were used for navigation as well. The dyke system in the delta is designed to protect 14 425 km<sup>2</sup> of land of which 8793 km<sup>2</sup> are agricultural.<sup>9</sup> If the dyke system didn't exist, two thirds of the red river delta would be submerged during the rainy summer season of monsoons.

The construction of dykes though, has had an effect on the natural spread of the river sediment in the flood plain. Constructing such a system of basically walls drastically reduced the flood plain of the river to the area within the dykes. This means that sediment is only layered in the available flood plain areas, and with the centuries this process has lead to heightening the elevation of the riverbed and the city protected by the dykes is lying 3-5 m lower than the regular annual flood level during the summer months.

The dykes are organized in categories - III, II, I and "special" as the difference in category defines the level of safety for the area protected. In Hanoi area the dikes of I class and "special" have a length of more than 250 km out of 470 km for the area.<sup>10</sup>

The protection and water management system were not built in a day but with the years of experience of disasters and floods after which the dykes were improved and

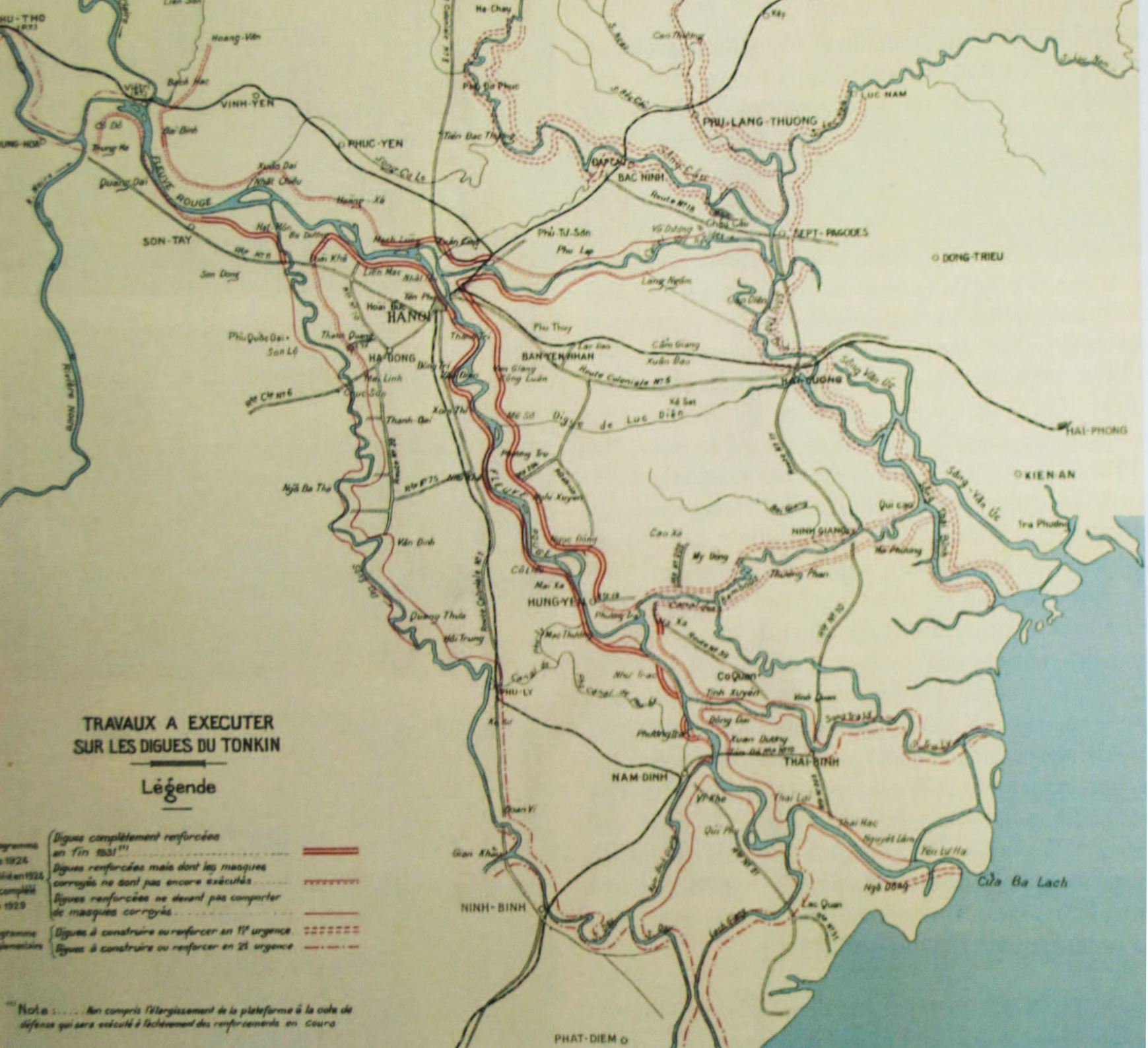


FIG 1.2.1 Red river delta dyke system, [date unknown]

Source: *Institute de metiers de la ville - IMV-Hanoi*

FIG 1.2.2 Red river delta dyke system

Source: Tuan Pham Anh, (2011)<sup>11</sup>



**TRAVAUX A EXECUTER  
SUR LES DIGUES DU TONKIN**

**Légende**

- Programme 1924  
1924  
1924  
1924  
1924  
1924
- Digues complètement renforcées en fin 1924 ———
- Digues renforcées mais dont les maques corroyés ne sont pas encore exécutés - - - - -
- Digues renforcées ne devant pas comporter de maques corroyés - · - · -
- Digues à construire ou renforcer en 1<sup>re</sup> urgence - · - · -
- Digues à construire ou renforcer en 2<sup>e</sup> urgence - · - · -

Note . . . . . Non compris l'élargissement de la plateforme à la cote de défense qui sera exécuté à l'échéance des renforcements en cours

FIG 1.2.3 Dyke works 1924 - 1931 Red River Delta

Source: provided by Tuan Phan Ahn [Pouyanne 1931 NLV/M8-6386]

heightened and especially after extreme floods that had caused great losses for the society and the economy of the country.

Evidence of the first dyke works in the delta date back to 767 AD when Hanoi's first citadel was constructed, but the first evidence according to historical documents of the state, controlled dyke construction date back to 1077 when it was proclaimed that the red river dykes affected interest and stability of the state, shortly after Hanoi was chosen for the capital of Vietnam in 1010.

The first dyke around the city of Hanoi was built in the 8th century while the first one along the red river in 1108, known as the Co Xa dyke which is still one of the most important ones for the protection of Hanoi.<sup>12</sup>

During the centuries the dyke system expanded and its construction and maintenance was executed by the people. Vietnam got to have its first dyke development policy

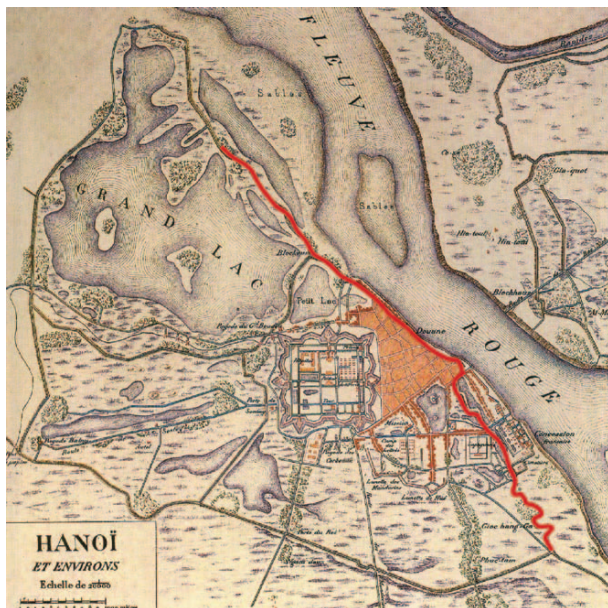


FIG 1.2.4 First Red river dyke in red called Co Xa. Map of Hanoi 1882

Source: <http://www.tuanvietnam.net/thuong-nho-tay-ho>

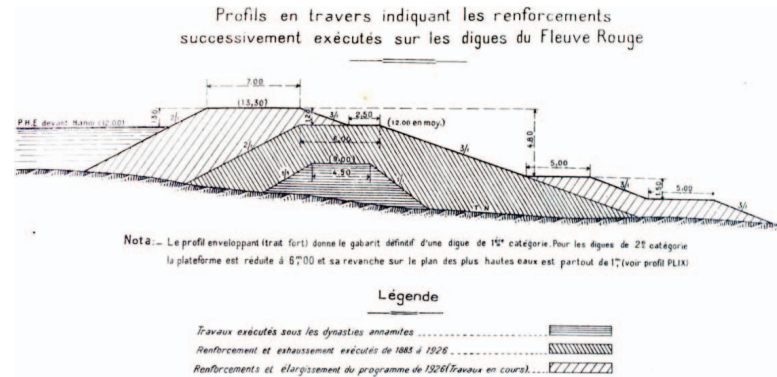


FIG. 1.2.5 Profile of the dykes of the Red river showing their evolution and enforcements

Source: [J. Gauthier 1930. Digués du Tonkin, M6409-National Library of Vietnam]

under the Nguyen dynasty in 1809 when dykes were categorized depending on the river size they ran along.

By the time the French came to Vietnam the Red river delta the Vietnamese already had a good idea on how to do water management. French colonizers were initially not disturbed by water management until they experienced an economical impact of several natural disasters. One of their first strategies was to strengthen and heighten the existing dykes executed between 1918 and 1931 (FIG 1.2.3). Further in the mid 20th century they introduced the step dyke, which was 6m wide on top. (FIG. 1.2.5) A new classification for the dykes was made as well, putting them in 2 categories depending on their height. Nonetheless the dyke system during the French colonial period wasn't able to sustain flood waters higher than 12m, whereas in 1926 the water management system was designed for 13.30m of flood waters.<sup>13</sup> The final compliment to the existing today dyke system in the Red river was a consequence of the devastating flood in 1971. The flood levels reached 14.13m and the government decided to construct a concrete wall all along the river in Hanoi, and heighten the dykes in the rural areas to increase protection.<sup>14</sup> (FIG. 1.2.6 & 1.2.7). Today's height of the dyke in Hanoi is 15 m and thus can support a flood height like the one in 1971, but the urbanisation in the floodplain outside the dyke isn't in the category "protected". A second issue that causes is the stability of the dyke threatening its and Hanoi's security.



*FIG. 1.2.6 The dyke along the Red river in Hanoi before its extension ( unknown date of photo)  
Source: p. 106 Clément (Pierre), LANCRET (Nathalie), Éditions Recherches,  
Les Cahiers de l'Ipraus, Paris, 2001*



*FIG. 1.2.7 Red river dyke extension wall all along the city and the river. Typical for Hanoi "Tube" Houses have developed behind the wall  
Location Long Bien Bridge  
April 2014*

## Floods. Typology and Frequency

The level of the Red river can change drastically from 1.41m in dry season to the maximum of 14.3m in 1971. The water in the river though rises generally slow except for the cases of typhoons when in 24 hours water can rise by 4m. <sup>15</sup>In order to have adequate water management to deal with floods it is important to understand their nature and cause. There are many reasons causing floods and therefore **their typology is diverse as well.** Floods naturally occur due to extreme meteorological and hydrological conditions but due to human activity as well. That can be a heavy rain or flow as well as unplanned development in the flood plain or due to over urbanisation in cities where water discharge systems are no longer capable of dealing with the rainwaters that were previously absorbed by the unbuilt land. The World Bank report "Cities and Flooding"<sup>16</sup> distinguishes 6 types of flood with numerous causes, out of which these apply to Hanoi area and the Red River Delta.

## Urban Flood

This type of flood occurs quite often if not every year over the last several years in Hanoi due to the increase in density, population growth, bad planning of the land use and filling of lakes for urban development, insufficient drainage system and extreme torrential rains. (FIG 1.3.1) Like the case in 2008 of over 500mm<sup>17</sup> of rain in one day, when the city of Hanoi and many parts of the Delta were flooded. (FIG. 1.3.3) The frequency of such floods will depend mostly on the environmental conditions. In the case of

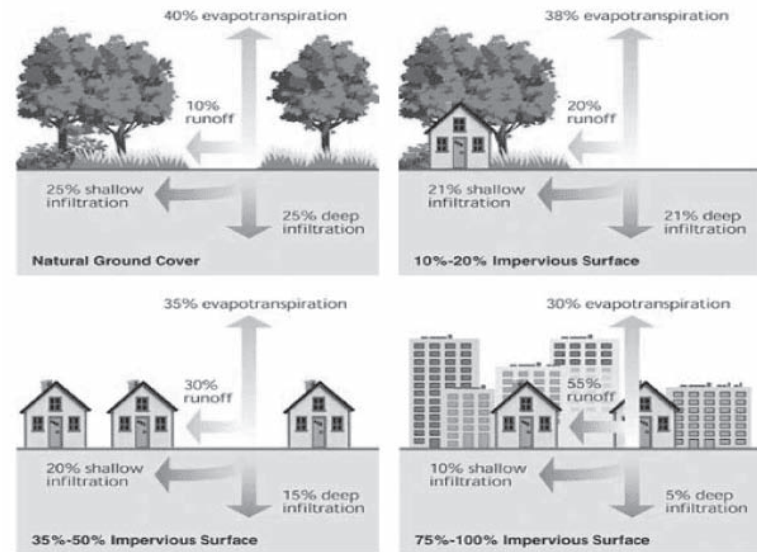


FIG. 1.3.1 Difference between natural and urban surface runoff water  
Source: [http://www.lakesuperiorstreams.org/understanding/stormwater\\_hydrology.html](http://www.lakesuperiorstreams.org/understanding/stormwater_hydrology.html)

Vietnam the climate change forecasts are previewing more frequent and stronger torrential rains which in bad storm water management might lead to future urban floods.

## River of fluvial flood

Fluvial floods happen when the quantity of water in the riverbed doesn't fit into the riverbed or artificially defined boundaries such as levees and dykes and hence overflows into adjacent areas that aren't usually submerged. (FIG. 1.3.2) The frequency of such floods can differ, in the RRD due to the extensive dyke system, dams and reservoirs extreme

FIG.1.3.2 Red river flood 1929  
Source: <http://belleindochine.free.fr/>





river flood didn't happen since 1996. But in case of Hanoi fluvial floods can happen even when the levels have not reached the maximum of their provided flood plain, because in some areas urbanisation has happened in the flood plain itself. Numerous villages in the RRD have been located there for centuries and in Hanoi city due to the urbanisation boom large parts of the outside dyke areas are already urbanised. In this case flood can happen more often than the 125 year return period of the highest flood the delta has known. These floods are caused by heavy rainfall which distributed downstream through all tributaries and can cause higher levels that during the regular rainy season. They have different return periods depending on the river levels.

### Flash Flood

This kind of flood is caused by torrential rains and defined as flood that happens within 6 hours from the onset of the rain. Such floods are likely to happen in the urbanised areas since the water filtration ratio is very low due to highly paved roads, parking buildings etc. and surface runoff appears very quickly. These floods are particularly dangerous mainly because they are hard, if not impossible, to forecast. In October 2008 a torrential rain caused rapidly a flood in numerous points in Hanoi city due to the amount of rainfall and a continuous non-stopping rain. [FIG. 1.3.3] This is turning into a constant problem for Hanoi every year during May till October when the most of the annual rainfall is distributed. These floods might last from several hours to several days depending on the rain continuity and discharge capacities of the drainage systems.



FIG. 1.3.3 Hanoi Flash/Urban floods, October 2008

Source: VNExpress, VietNamNet

### Flood caused by failure of artificial systems

As nature can cause extreme floods so can human mistakes as well in the artificial water management systems.

Floods can be caused by a broken dam or reservoir which can be extremely dangerous, as water volume and speed tend to be very high, but also by the break of the dyke system. In that case large quantities of water will enter a vast terrain previously protected herein the speed and volume will be as well high. These cases are dangerous since water has very few of no chances of evacuation and floods can last longer thus creating many problems for the population as well as economic losses.

The dyke system in the RRD has failed many times in the past due to insufficient height, low maintenance etc. The frequency of such floods will depend on the reliability of the artificial water management systems, maintenance, monitoring, precise forecasting of weather conditions to be as prepared as possible.

FIG. 1.3.4 Red river arm along Hanoi, Dry season April 2014



## DROUGHTS

Since the weather conditions predefine the dry season by having up to 80-90 % of the annual rainfall during the rainy season, the months from October to April can be very dry with some exceptions of extreme weather of course. The driest months are December and January, when the Red river level is the lowest. In March 2010 the Red river has experienced the worst drought since 100 years time with virtually no rainfall and high temperatures the level of the red river reached 0.68m in some areas which wasn't sufficient for navigation and even more importantly for agricultural irrigation. Droughts are calamities that arrive due to extreme weather conditions such as lack of rain, high temperature and high evaporation. In that case water from reservoirs and dams upstream was released but it wasn't sufficient to meet the needs of agriculture and put the hydropower production at risk.<sup>18</sup> According to MONRE climate change effects on Vietnam will increase temperatures during the winter, and rainfall will decrease and consequently rainfall will increase during summer.<sup>19</sup> That basically means higher chances of serious droughts and consequently floods in the different seasons.

## RESERVOIR REGULATIONS

Currently in the RRB several reservoirs are in use as a part of them have been built with the purpose of flood control, hydropower and water supply as a few more are in construction in Vietnam with the same objective. In China a large number of medium sized reservoirs, dams and hydropower plants have been completed by 2007<sup>20</sup> and projects for more than 50 more are in place. The regulation of water discharge from the Chinese part of the RRB can be critical in dry and rainy season as following.

Dry season<sup>20</sup> - hydropower plants in China continue to release the flow downstream to produce electricity which doesn't contradict the release policy on the Vietnamese side, but what can be critical is the fact that reservoirs in the Chinese part of the RRB start collecting water in the late period of the dry season around April which can reduce drastically the inflow downstream and in the delta and be a premise for droughts.

Rainy Season<sup>20</sup>: in the Chinese part of the RRB flood control is not an issue hence reservoirs serve for water collection. On the Da river catchment collection is between June and July which means in the peak of the rainy season in August they might have already reached their maximum capacity. In that case a release of large amounts of unexpected water flow downstream Da river can put in risk the flood control capacities of the Son La and Hoa Binh reservoirs in the Vietnamese part of the RRB.

### **The lack of communication and collaboration between China and Vietnam in any case is critical for the water management in the RRB.**

In the Vietnamese part two major reservoirs Son La and Hoa Binh are responsible for the flood control and Tuyen Quang on the Gam river which has a lower capacity and Thac Ba which has negligible contribution to flood control. The problems in reservoirs regulation is the conflict



FIG. 1.3.5 Reservoirs in the Vietnamese part of the Red River Basin  
Source: [http://baobab.elet.polimi.it/iwrmwiki/IMRR:WP3\\_1\\_introduction/en](http://baobab.elet.polimi.it/iwrmwiki/IMRR:WP3_1_introduction/en)

FIG. 1.3.6 Evacuation of wastewaters from RUA without treatment, directly in the Red river  
Location: RUA, areas behind Long Bien market, March 2013



between the water needs during dry season when larger amounts of water has to be released downstream to answer the agriculture demands which affects negatively the hydropower production. As in rainy season the issue is that keeping the water in the reservoirs also reduces the hydropower production.

## POLLUTION

Pollution of the waters in the Red river is an issue depending on numerous lists of factors and actors. Starting upstream industrial and urban pollution is directly discharged in the river and it's been carried downstream. Arriving in Vietnam water is stored in Reservoirs to meet the agricultural, industrial, hydropower production and urban needs for the provinces in the RRD. According to a research the major water pollutant in Vietnam are industries located upstream and a considerable share is due to untreated urban wastewaters. Currently Hanoi has only one treatment plant [Yen So] of used water whose capacity is insufficient for the growing population and water use of the capital. The used waters that aren't treated are directly evacuated in the red river or other smaller rivers close by. That same water is used directly or downstream for irrigation of agricultural lands. [FIG 1.37]

That is putting at risk as well the fauna in the red river and consecutively the health of the population eating the production irrigated with polluted water. Another issue is the fact that the sewage system of Hanoi hasn't been designed to separate storm water from grey water and therefore in case of urban floods the sewage system overflows with both of them are a premise for many problems.

## GOVERNANCE

The RRD is part of 3 countries with a different repartition

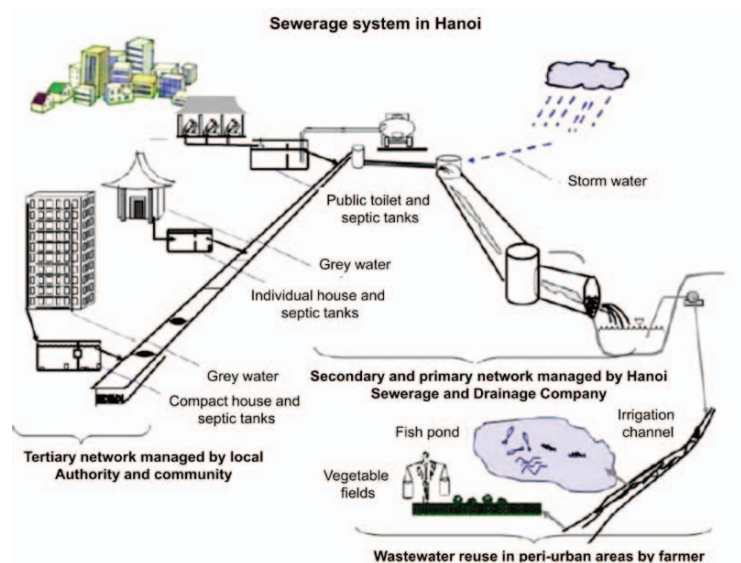


FIG. 1.3.7 Schematic wastewater system of Hanoi

Source: *Urban Flood Risk Management*<sup>21</sup>

of its territory as following: China - 48 % of the RRB, Laos 0.65% and Vietnam 51.65%. Hence the issues in terms of governance appear to be quite complex in this international context. I can divide them into two large groups: International and National level of governance of the RRB in particular Vietnamese part of RRB.

**International level :** In terms of international structure for the water management in the basin no data for any kind of cooperation or exchange of information between the countries has been found. Each country has its own governmental structure and bodies responsible for the water management completely separate from one another.

**National level :** the RRB part in Vietnam is part of 26 provinces one of which is the capital Hanoi province. The water management structure has been undergoing changes for years but mainly in 1986 during the Doi Moi period, known as the Vietnamese for "Renovation"<sup>22</sup> the opening of the Vietnamese economy. One of the first steps has been the Law

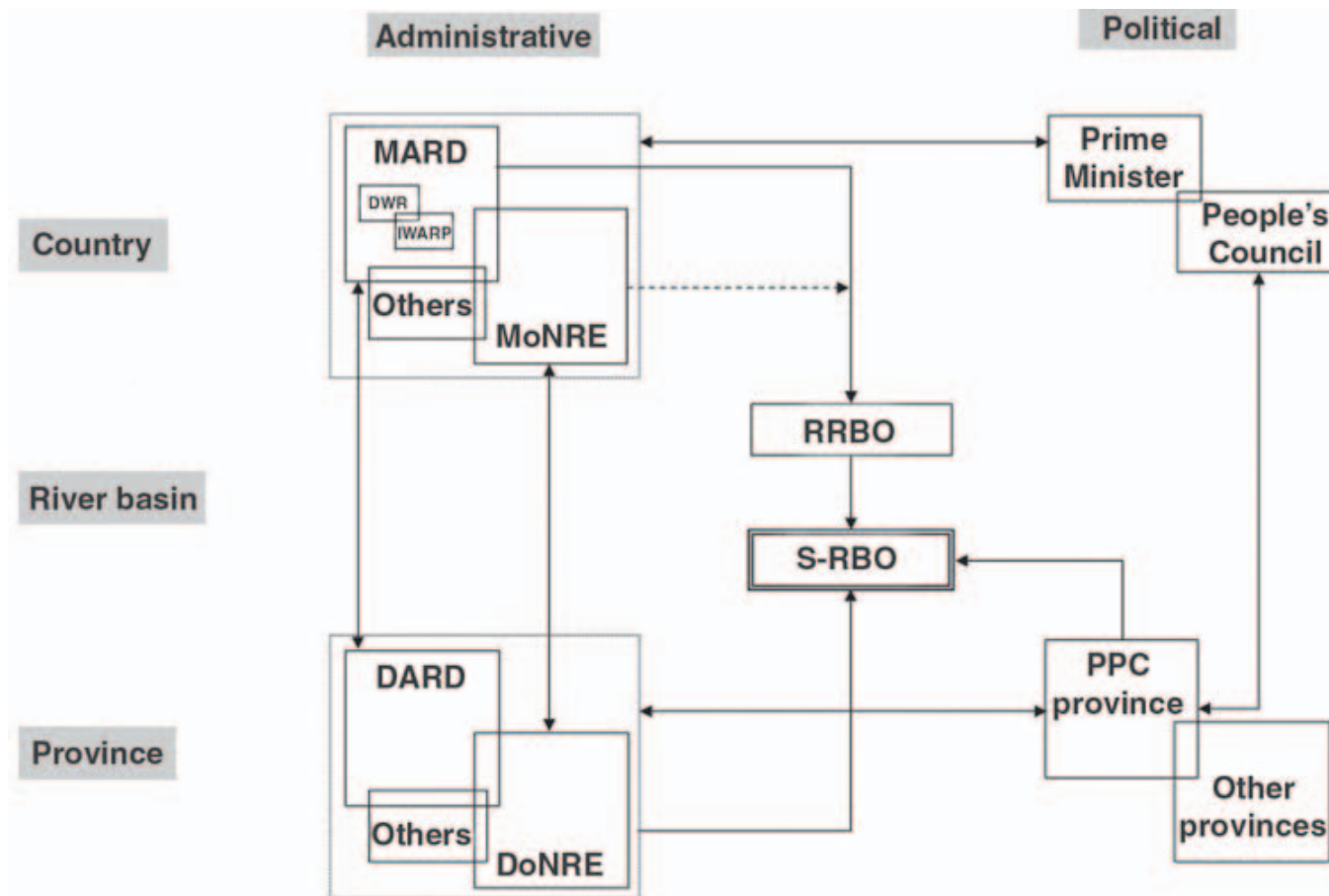


FIG. 1.3.8 Articulation of governance levels in the Red River Basin [Vietnam]

Source: p.23 François Molle, Chu Thai Hoanh<sup>26</sup>

on water resources (LWR) approved in 1998. Next step was promoted by the Asian Development Bank (ADB)<sup>23</sup> and was the creation of the Red River Basin Organisation (RRBO) in 2001 under the control of the Ministry of Agriculture and Rural Development (MARD)<sup>24</sup>[FIG 1.3.9] The

aim of the organisation is to help managing and planning the water resources in the RRB (in Vietnam) as well as to improve coordination between provinces. In 2005 and 2006 MARD established advisory bodies for the flood water management in the Cau and Day river, sub basins of the RRB: Cau sub Basin Organisation CSBO and Day sub basin organisa-

tion (DSBO) which were under the direct control of RRBO.  
<sup>25</sup>[FIG.1.3.9] They happened to be more effective in terms of Integrated water resource management (IWRM) and identifying specific issues in their range than their control body RRBO, which turned out to be hard, ineffective and involving 25 provinces which don't share the same issues for IWRM, can be considered unnecessary. The RRBO still exists under MARD but with a very low budget defined by

the state which isn't sufficient for the performance of its responsibilities and functions <sup>27</sup>

As it's clear from the structural representation in [FIG. 1.3.8] it becomes clear that the RRBO has no political power and is under the control of MARD Ministry of natural resources and environment [MoNRE]. For an efficient governance and integrated water resources management for the Red River Basin a restructuring of the functions and levels of control of the actors needs to be done. Before that though there has to be a clear

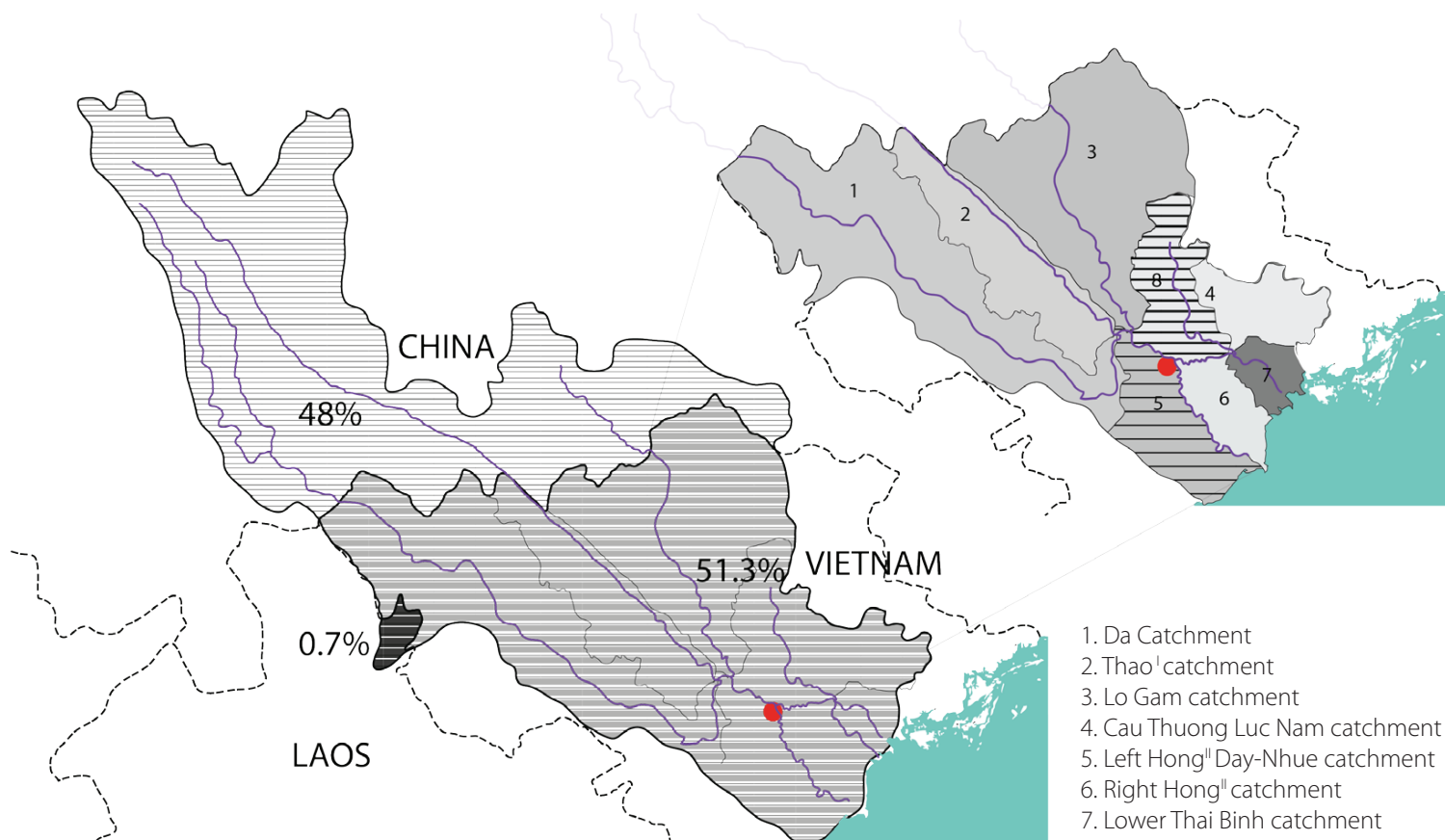


FIG. 1.3.9 Red river basin in 3 countries. Division of the RRB in Vietnam in sub river basins



list of issues in the basin, whom they are concerning, at which level they can be directly confronted and at which level a strategy for the development of the RRB should be made. It is crucial to create and maintain an information database with everything that concerns the water management in the delta and to make communication and information exchange between provinces and countries easy and instant.

Maybe the North of Vietnam can use the example of the Mekong delta water management initiatives and the trans boundary international organisation for the Mekong river basin countries.

## THE MEKONG RIVER COMMISSION

Vietnam has a fortune or misfortune to have two river deltas on its territory. In both of them the two major cities are located in terms of economical and political power as well as important shares of agricultural production, hence large portions of the population. The Mekong delta has been dealing with high tides and floods due to the hydraulic regime of the river since its existence, but climate change and bad water management is making the problem even more complex.

The Mekong river is stretching over 4000km from China through Myanmar, Laos, Thailand and Cambodia to reach Vietnam at it's delta. Managing the river crossing such number of countries is a challenge that was taken by the Mekong River Commission established in 1995. Four countries join the commission - Laos, Thailand, Cambodia and Vietnam with the mission to have an economically prosperous, socially just and environmentally sound Mekong River Basin<sup>28</sup>. Even though Myanmar and China aren't members of the commission they are dialogue partners from 1996 and have an agreement to provide hydrological information for the upstream Mekong basin.

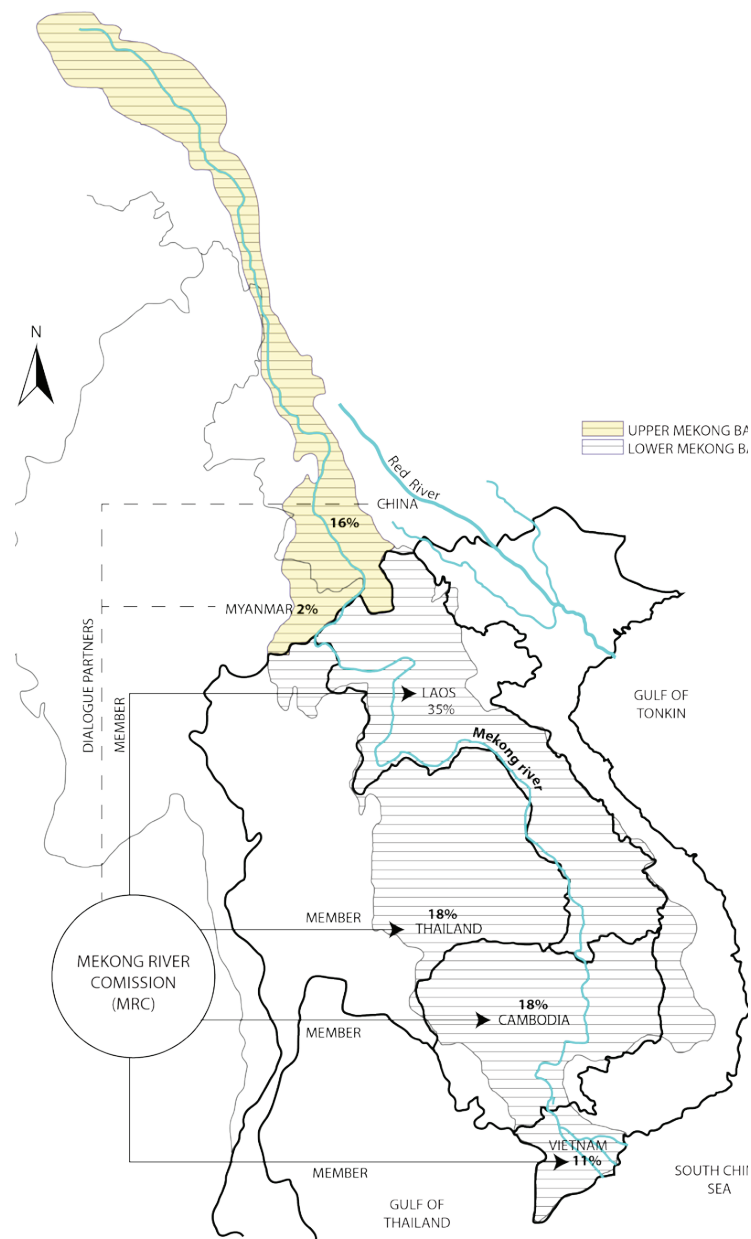


FIG. 1.3.10 Structure of the Mekong River Commission

( FIG. 1.3.10 )

Recently in 2011 the MRC has developed 2 strategies - Integrated water and resource management for the MRB and Strategic Plan for sustainable development of the MRB.

The presence of the Mekong river commission is evidence that such collaboration is possible at the international level and experience and know-how is available in Vietnam. Hence a similar initiative in the Red river basin isn't impossible and moreover it's recommendable for a balanced water management and sustainable development in the basin in all the countries concerned.

## FINAL CONSIDERATIONS

The geography of the Red river, defines it's political division which is a premise for a lot of problems with water management especially in Vietnam. Located almost half in China and half in Vietnam the RRB is a vast natural resource . Vietnam has a downstream part of the RRB and it's delta where for more than a 1000 years settlements make the most of the resources it provides. However, the inhabitants of the RRD have long had to deal with the consequences of living in this geographical area having a climate defined by a rainy and dry season. The delta territory is lying lower than the high river levels during the rainy season, which has lead to a history of development of water management practices in the RRD. The first approach created a direct protection of the valuable land by constructing dyke walls to protect the city. Further on, in order to increase agricultural production capacity and protect it, a whole system of dykes protecting the whole RRD was built through the centuries. Dyke heights were upgraded after disastrous events and the height was increased several times until in the 1990's it reached 15

metres in Hanoi. However, in the 20th century the Vietnamese realized that water management couldn't rely only on protection walls but rather needs to be able to control the amount of water coming from upstream as well in order to control the river level peaks throughout the seasons. Advancement in water management in the Vietnamese part of the RRB was marked by the creation of reservoirs, hydropower plants and dams to become a part of an integrated system of water management in Vietnam. In the Chinese part of the RRB problems with floods do not exist and therefore they are using the river resources for industrial use, hydropower production and water provision through the creation of reservoirs and dams upstream. That affects the flow of the Red river and it's tributaries downstream in Vietnam and can cause severe problems to water management system and in case of failures of water protection infrastructure inflict disastrous damages for the RRD.

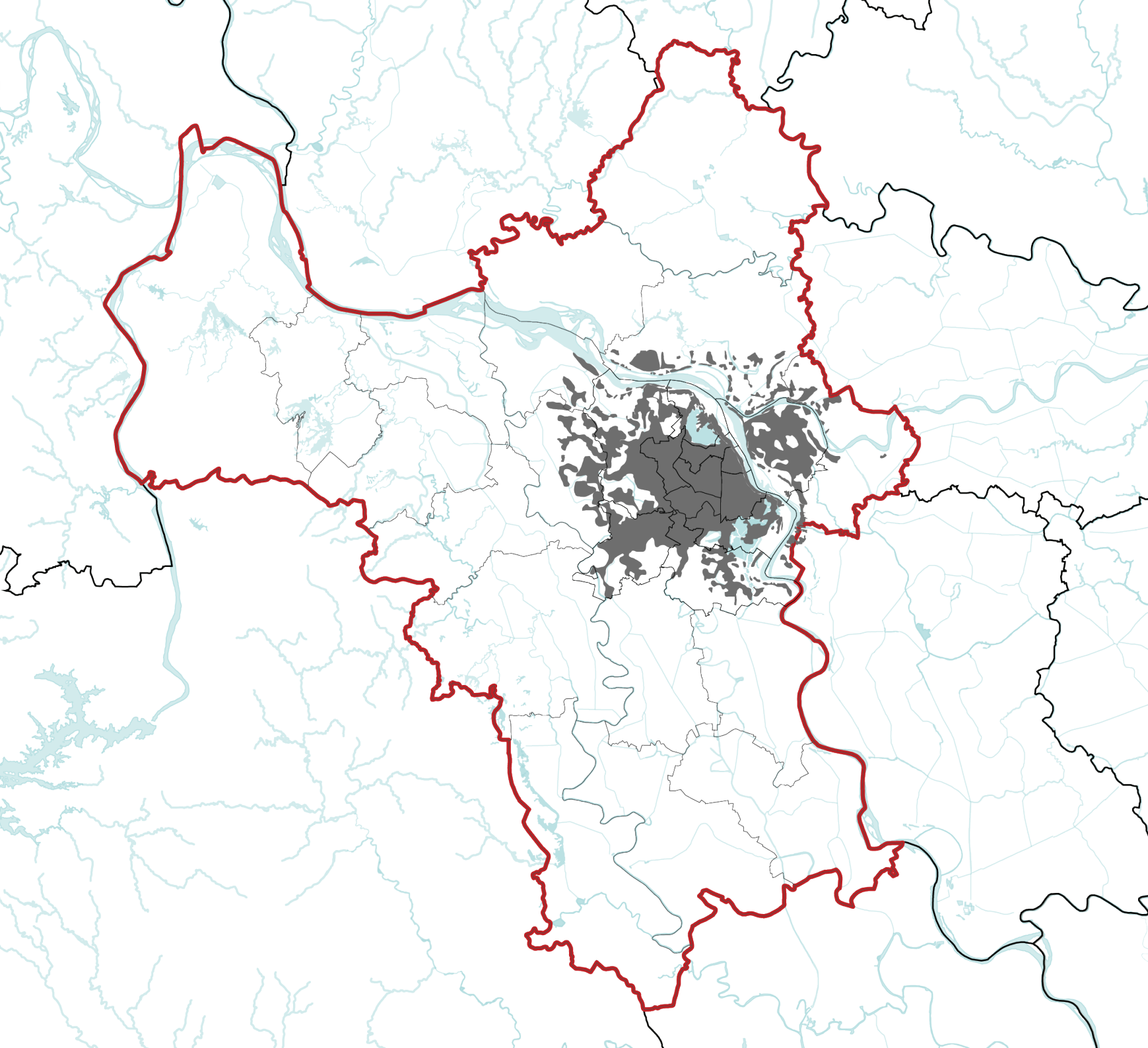
It is important to underline that in the last 10 years instead of having problems with floods the Red river delta is experiencing serious draughts, that haven't been present until now. The reasons are a combination of natural and human factors and that is causing numerous problems such as not enough water for agriculture, electricity production by the hydropower plants and especially very low levels of the river cause problems with the fluvial navigation.

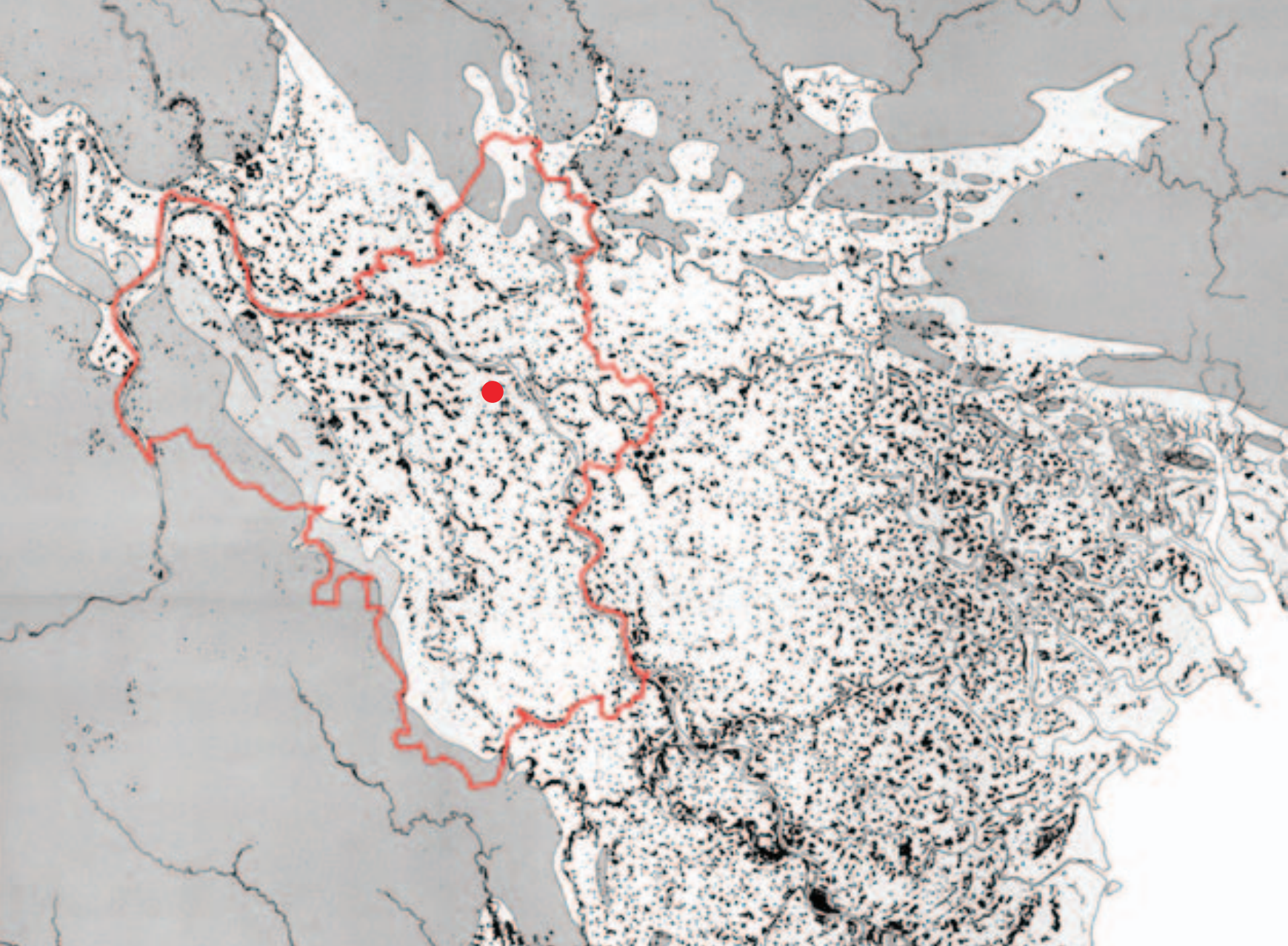
It is the time for Vietnam to extend its integrated water management approach to an international level where the cause for some of the risks and issues in the RRD come from. Collaboration for water management of the RRB water resources is extremely necessary in order to deal with the future climate change impact but also to provide security and sustainable development for the river in the future.

What I am suggesting is that similar collaboration to the Mekong river commission initiative is extremely necessary for the water management and development strategy for the Red River basin. The main problem in that case is the political dialogues between China, Vietnam and Laos who need to get to a consensus for their benefits of such eventual collaboration.



*FIG. 1.3.11 Arm of the Red River on the side of Hanoi and the Riverside Urban Areas*





## **DEVELOPMENT OF HANOI AND THE RIVERSIDE URBAN AREAS**



## PERIODS OF GROWTH AND PLANNING

## 2.1

Established in 1010 with the name Thang Long, today Hanoi is a city with 1000 years of history throughout which there were periods of growth and stagnation one followed by the other. For a very long time until the beginning of the 19th century the limits of the city didn't extend further than the royal citadel and the quarter adjacent to it and known as the "36 streets" which today as in the past is a vital part of the city for goods exchange. However, the following periods of its urban growth and transformation can be distinguished for the millennium development of Hanoi.

### The Feudal Period (before 1873)

Since its establishment in 1010, Hanoi was a city which even though had no formal planning system, had been influenced by the Chinese model of structuring and feng-shui principles<sup>29</sup> which people still follow in building and organizing their homes today. In that philosophy water and green spaces were fundamental elements of an urban environment. Green spaces were believed to give value, attractiveness and bring people close to nature. In that time the relationship between the city and the royal citadel was direct and was crucial for its competitiveness and economical development.

What is very interesting is the fact that the settlements in the flood plain can be identified on the map of Hanoi of 1873. [FIG 2.1.1]. The importance of the link between the city and the river is presented by the number of boats in the river and the streets linking the Thang Long citadel to the river through the 36 streets quarter.

In the years to come, unfortunately, during the contemporary development period these ancient principles were somehow abandoned in the urban planning approaches. Development has led to a continuous abandonment of the environmental values for the population.



FIG. 2.1.1 Map of Hanoi 1873,

Source: Centre des archives d'outre-mer, Aix-en-Provence, provided by IMV-Hanoi

### The French Colonial Period (1873-1954)

In 1902 Hanoi becomes the capital of French Indochina, which marks an important period for its urban growth and relationship to open spaces and water. Urban plans are developed and Hanoi is expanded with the so-called French quarter adjacent to the citadel and the 36 streets quar-

FIG. 2.2 (Page 40) The red river delta and its villages in black. On top outlined in Red the current administrative limits of Hanoi Province. Source: E. Cerise<sup>29</sup>

FIG. 2.1 (Page 39) Hanoi province administrative boundaries and the spread of urbanisation of the urban core today

ter. [FIG 2.1.2] Two development plans for the expansion of Hanoi were drawn by the French architects in that period. The first one in 1924 drawn by Ernest Hébrard and the second one in 1943 by Louis-Georges Pineau. [FIG . 2.1.3] In the early plan of Hébrard the areas outside the dyke weren't considered for the development. George Pineau's plan was quite extreme in terms of change in the urban structure of Hanoi and thus never got realised, but one



FIG. 2.1.2 Map of Hanoi 1925. Occupation of the riverside areas is becoming present

Source: Archives nationales. Institut français d'architecture. Archives d'architecture du XXe siècle, Paris (AN/IFA), provided by IMV-Hanoi



FIG. 2.1.3 Comparison of (1) 1924 Hébrard and (2) 1943 Pineau Plan for Hanoi ; Source: E. Cerise 2009<sup>30</sup>



FIG. 2.1.4 Image of the floods in 1929 close to Long Bien bridge. Fixed homes flooded but floating ones undamaged from the flood  
Source: [www.hanoilaville.com](http://www.hanoilaville.com)

thing that we can see and that actually happened later on, is the extension of the city and infrastructure network to the areas outside the dyke.

One very significant construction during this period was the first bridge over the Red river - Long Bien in 1902, designed by Gustave Eiffel, at that time the longest bridge in Indochina [FIG.2.1.6]. That has settled for the development of Hanoi on the opposite bank as well which is represented by the 1924 plan of Hébrard and in further future plans. Important part of the French influence on Hanoi planning is the detail to quality of public spaces and green areas in which style the French quarter was designed and built.

### The Post Independence Period (1955-1985)

This period is marked by the independence from the French power and will of the new government to show strength and provide the necessary things for the city's development. The main aim of planning in that period



FIG. 2.1.5 Hanoi riverside areas. Quai of Commerce. An elevated path to the boats provides access between the levels and in case of raising waters. (no date)  
Source: [www.hanoilaville.com](http://www.hanoilaville.com)



FIG. 2.1.6 Riverside areas at the newly constructed Long Bien bridge (no date)  
Source: [www.hanoilaville.com](http://www.hanoilaville.com)



was to provide the necessary housing for the expected demand including public housing projects, part of which located in the areas outside the dyke. It was the first phase of projects 1955 - 1960<sup>31</sup> known as KTT - type of housing, representing a collection of equally sized flats in the same building where hygiene and other services were shared by the inhabitants.<sup>32</sup> Even though these are the first planned developments, occupation in the outer dyke areas (RUA) is present and in different periods the island close to the Hanoi was occupied by the villages. [FIG 2.1.7]

Due to the still strong relationship with the river at the beginning of the 20th century, RUA got attractive to the population looking for a good location at a very low price, which RUA represented. The public housing programs were stopped due to the destructive flood of 1971 when the river reached 14,13m in Hanoi overflowing the dyke and causing great social and economic damage. During the French domination in the riverside areas a floating community involved in trade and fishing existed [FIG. 2.1.8, 2.1.9, 2.1.11 ]. Such communities are present today as well but the context of their occupation has changed. Now living on water is perceived as only for people who can't afford to own land. [FIG. 3.3.7 p. 78]

During this period a number of urban development plans were proposed 1954-1960; 1960-1964; 1968-1974; 1981. The plan proposed in 1954 aimed at stabilizing the city immediately after French withdrew. It concentrated on existing part of Hanoi and kept it compact with the current population of 436,624 inhabitants: All the following plans focused on the opposite side of the River proposing the expansion of Hanoi on both sides. The second bridge over the red river Chuong Duong, in proximity to Long Bien was constructed in 1985 which improved the link and would be a premise for the city's further development on the opposite side.

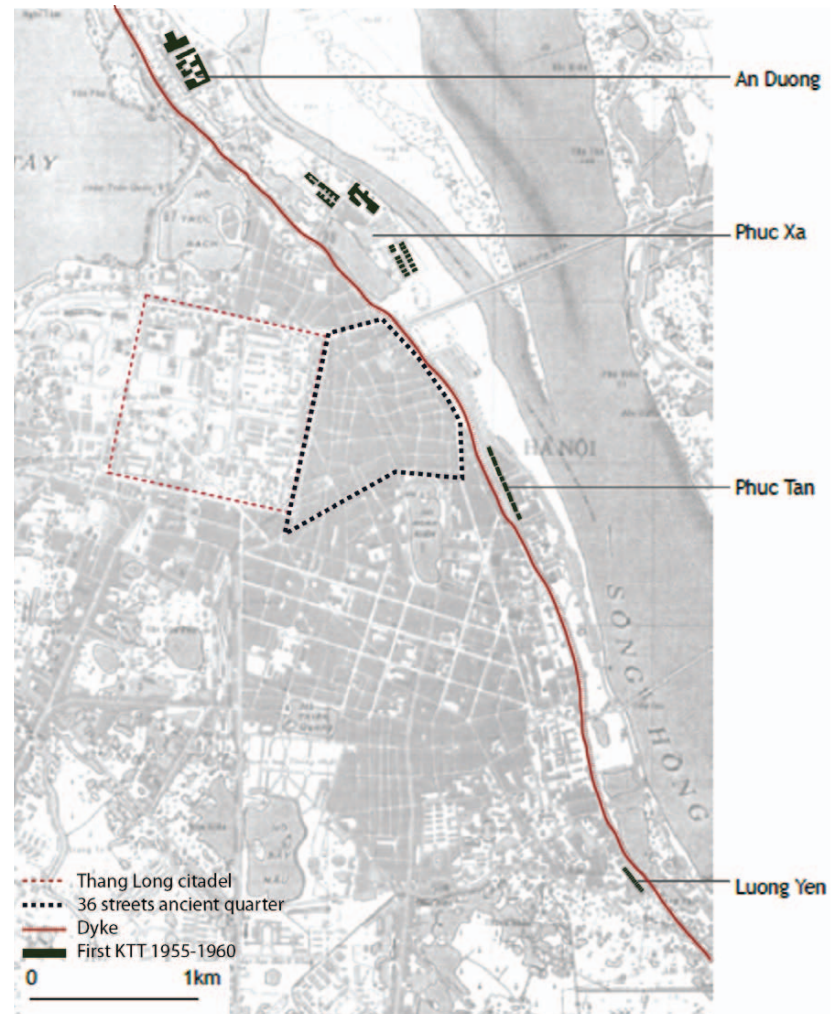


FIG. 2.1.7 First public housing 1955-1960, located in the areas outside the dyke  
 Source: Map and KTT by E. Cerise 2009 p. 188, adjustments - Author.

GRAND LAC

(TAY HO)



**INDICES NATIONALES**  
Région Centre-Nord  
**CARTOTHÈQUE**

**LÉGENDE**  
VILLE

A Nouvelle Résidence impériale	N Magasin Central
B Hôtel de la Brigade	O Banque de l'Inde-Chine
C Bâtiment des Postes Publiques	P Collège
D Palais de l'Épiscopat	Q Ministère
E Palais	R Consularat
F Mairie	S Commissariat de Police
G Cathédrale	T Garde Indigène
H Commissariat de la Marine	U Douane
I Services Administratifs	V Sociétés Philanthropiques
J Consulate	W Théâtre
K Palais de Justice	X Cercle
L Chambre de Commerce	Y Marché
M Conseil de Guerre	Z Châtellenie d'Annam

**CONCESSION**

a Hôtel du Gouvernement	f Place
b Résidences impériales	g Transit
c Bâtiment des Mairies	h Casernes de Génie
d Hôtel de la Résidence	i Châtellenie d'Annam
e Hôtel Meyer	j Hôtel

**CITADELLE**

A Casernes d'Infanterie de Marine	10 Fortifications
B Arsenal	11 Casernes Indigènes
C Direction d'Artillerie	12 Poste Télégraphique
D Casernes d'Artillerie	13 Casernes
E Parc d'Artillerie	14 Annexe
F Parc d'Artillerie	15 Palais National

**PRINCIPALES PAGODES DE HANOI**

1 Chaie Chien Vôt	21 Chaie Huy Yên
2 Chaie Long Chue	22 Chaie East Môc
3 Chaie Phô An (Chau An)	23 Chaie Leung Sô
4 Chaie Linh Son	24 Chaie Linh Cuong
5 Chaie Tay Long (Pagode de Chaie)	25 Chaie Kim Lien
6 Chaie Phô An	26 Chaie Hiep Hoa
7 Chaie Già Ding	27 Chaie Thiep Hoa
8 Chaie Bach Mê (Cathédrale)	28 Chaie Quoc Hoa
9 Chaie Hoi Quen	29 Chaie Phuc Ôc
10 Chaie Phuc Kien (Pagode de Chaie)	30 Chaie Truong An
11 Chaie Tam Thach	31 Chaie Kieu Mui
12 Chaie Bà Kien	32 Chaie Đức Viên
13 Chaie Vô Lê	33 Chaie Tô Ong
14 Chaie Phô Long	34 Chaie Hiep Dong
15 Chaie Bà Bô	35 Chaie Kim Ba
16 Chaie Hiep Hoa	36 Chaie Bà Thach
17 Chaie Phô An	37 Chaie Vô Thach
18 Chaie Tô Thach	38 Chaie Mui 19c
19 Chaie Tô Thach	39 Chaie Mui
20 Chaie Tô Thach	40 Chaie Tô Thach
21 Chaie Tô Thach	41 Chaie Tô Thach
22 Chaie Tô Thach	42 Chaie Tô Thach
23 Chaie Tô Thach	43 Chaie Tô Thach
24 Chaie Tô Thach	44 Chaie Tô Thach
25 Chaie Tô Thach	45 Chaie Tô Thach
26 Chaie Tô Thach	46 Chaie Tô Thach
27 Chaie Tô Thach	47 Chaie Tô Thach
28 Chaie Tô Thach	48 Chaie Tô Thach
29 Chaie Tô Thach	49 Chaie Tô Thach
30 Chaie Tô Thach	50 Chaie Tô Thach



## The Contemporary Period (1986 to 2008)

In 1986 the government took a decision to switch from a subsidised state driven economy to a market driven one.<sup>33</sup> The effect of this major transformation took a few years to be perceived while a few laws that shaped the city's future development were approved. In 1989 the free market pricing was approved, 1991 gave the start to privatisation of housing and the government built its last collective public housing at the beginning of the 1990's. The Doi moi 'Rennoveau' also opened Vietnamese economy to foreign investments which lead to a fast urban growth that surpassed the capacity of the authorities to catch up with the necessary infrastructure. The fact that the state reduced to a minimum public housing construction couldn't meet the housing demand, self-construction was somehow tolerated in order to do so. The public housing constructions finished during this last period and were slightly different than the KTT. They provided different types of apartments in the same building and a part of those developments were located in the outer dyke areas [ FIG. 2.1. 10]

That was the time that the Riverside areas became more attractive than ever for the population seeking to settle or resettle in Hanoi. A price for a 40 m<sup>2</sup> apartment right next to the dyke on the protected side in Hanoi could be exchanged for a 700m<sup>2</sup> plot on the other side and still leave the money to build a house on the plot.<sup>34</sup> This extreme difference in prices, the growing demand for housing, the right to buy land and self construct and the lack of control for construction in the flood plain and on the dyke lead to its fast urbanisation.

In this period the city had two urban development plans: 1992 planning up to 2010 and 1998 up to 2020.



FIG. 2.1.8 Riverside areas floating communities in Hanoi for trade, living on their boats  
Source: [www.hanoilaville.com](http://www.hanoilaville.com)

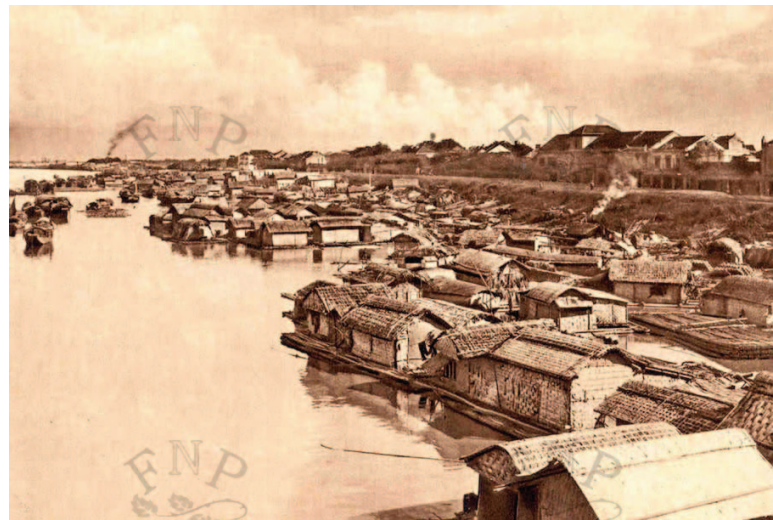


FIG. 2.1.9 Riverside areas floating community close to the dyke during high waters.  
Source: [www.hanoilaville.com](http://www.hanoilaville.com)

FIG. 2.1.11 (Page 45) Map of Hanoi 1898, Settlements in the Riverside areas outside the dyke and a floating village  
Source: Centre des Archives d'outre-mer, Aix-en-Provence, provided by E. Cerise, IMV- Hanoi

## The Expansion period (2008 till now)

In 2008 the first regional plan for Hanoi was made, which included Hanoi and 6 of its adjacent provinces - Hoa Binh, Ha Nam, Hung Yen, Hai Duong, Bac Giang, Bac Ninh. Based on this plan a more than threefold expansion of the administrative limits of Hanoi was decided joining the Ha Tay province with a final a population of 6.5 million inhabitants. [FIG. 2.1.14] This marks a period of greater expansion for Hanoi and the province receives a special statute of a province – a city - Hanoi Capital. [FIG. 2.1.13] In 2013 the Ministry of Construction demanded a revision of the regional plan and expanded its boundaries, adding 3 more provinces adjacent to Hanoi - Vinh Phuc, Phu Tho, Thai Nguyen. [FIG. 2.1.15] This is now called Hanoi Capital region but it represents only a planning entity rather than being an administrative one. It is meant to define the development of the capital for 2030 with a vision for 2050. In 2010 a master plan for Hanoi capital for 2030 and a vision for 2050 was designed, which envisages a great expansion of the city and its population. 5 satellite cities are planned to accommodate the growth of population expected to be 10 million inhabitants in 2030 and reach 14 million in 2050.<sup>35</sup> [FIG. 2.1.13]

The ambitious plan though has not considered the issues the city is having with the uncontrolled development in the riverside areas and their current use in a sustainable manner. The proposal of the plan concerning the regulation of the river and flood protection includes measures and regulations such as flood control plan, demolition of illegal structures in the flood plain, expand and dredge the river to isolate flood, create curves to reduce flow, introduce ecological facilities in the flood plain, create a swamp park removing current agricultural activities, increase the use of high lands and create a natural embank-

FIG. 2.1.10 Location of Khu Tam collective public housing projects between 1982- 1992

Source: E. Cerise 2009 p.220, adjustments by Author



FIG. 2.1.12 (Page 46) Map of Hanoi 1963, Settlements in the Riverside areas outside the dyke are increasing

Source: www.berkley.edu

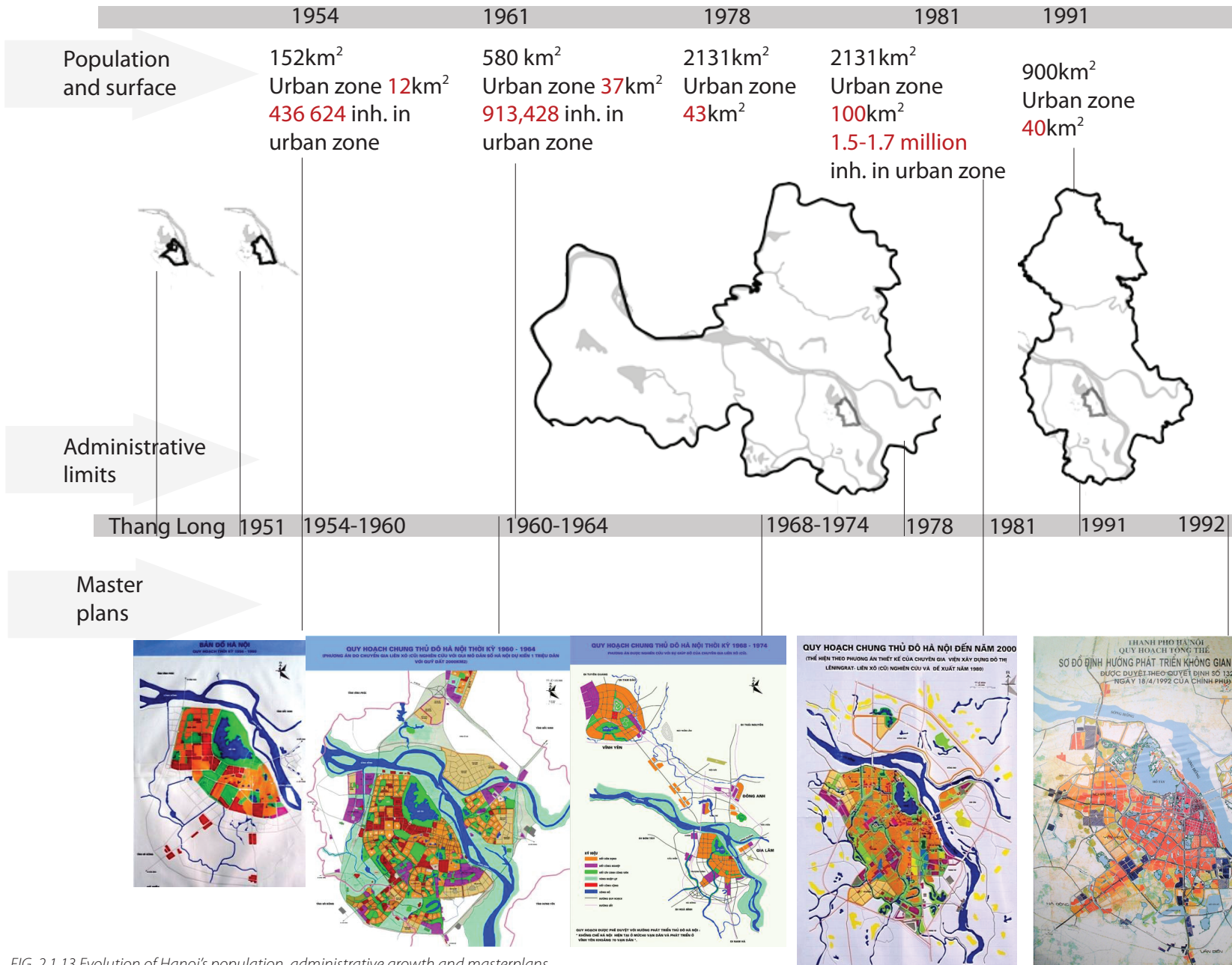


FIG. 2.1.13 Evolution of Hanoi's population, administrative growth and masterplans

Source: Masterplans - VIAP, Population data Do Thi Ngoc Chau (2013)<sup>10</sup> Administrative limits maps, surface data- E. Cerise (2009)<sup>11</sup>,



inhabitants whose right to occupy the land has not been cleared and no solution for their resettlement has been proposed. On the other hand the proposed expansion areas are going to consume many times the amount of land of the historical part of Hanoi or the land currently occupied by RUA's population to accommodate very small numbers of population, compared to the one in the urban core.

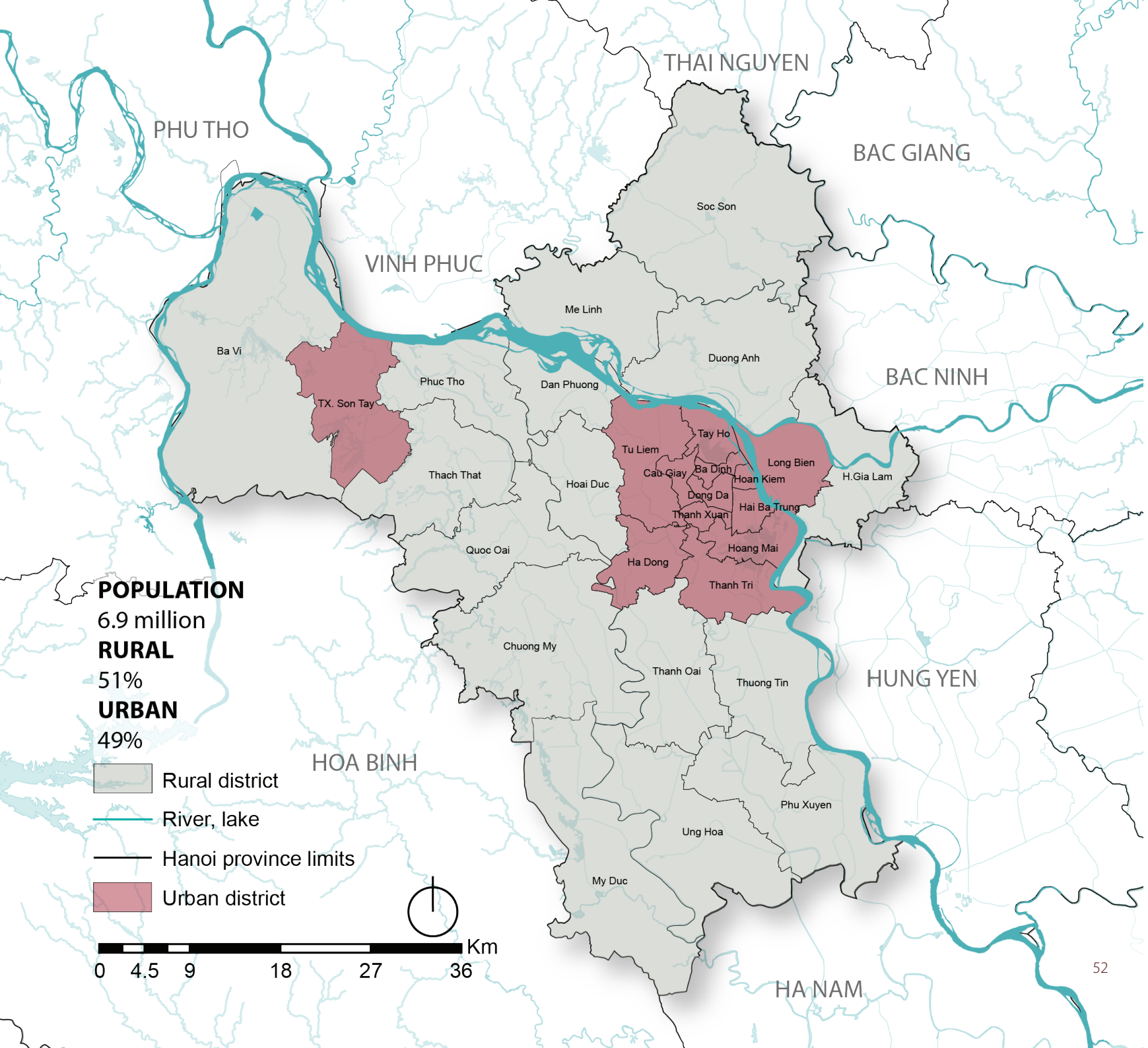
Currently, Hanoi is a city with a special status - a city and a Province at the same time. The total surface of the Province today is 334 ha with a population of 6.9 million inhabitants, where it's important to underline the fact that the population distribution in Hanoi is concentrated in the urban district around 3.5 million. [ FIG. 2.1.13] According to the plan it will slowly start to decentralise but the density of the main population will remain in the urban core surrounding the historical center.



FIG. 2.1.14 Hanoi regional masterplan approved in 2008  
Source: IAU-IDF

FIG. 2.1.15 Hanoi province administrative division







## FINAL REMARKS

Looking at the development of Hanoi since its establishment one can follow the speed of urbanisation it has undergone in the last 60 years. From a city with 152.2 km<sup>2</sup> of surface and 436,624 inhabitants<sup>37</sup> in 1954 right after the French were gone to a doubled number of population and fourfold increase in its surface in 1960. The expansion of the Hanoi province in 1978 expanded the numbers and in 1981 Hanoi had between 1.5- 1,7 million inhabitants in the inner city. The rapid urbanisation at that time started to attract inhabitants in flood prone areas due to their attractive location, low prices and government public projects. The boom, though, comes in 1986 with the Doi Moi change to an open market economy in Vietnam. That came along with many new laws and rights for land ownership that boosted self-construction, regulations weren't clear enough and took long to implement by the authorities. The result was a messy spontaneous urbanisation of areas such as the riverside outer dyke ones. Following up in time, by 2003 the population of Hanoi has increased to 1.9 million<sup>38</sup> in the inner city and the population of RUA doubled. [FIG. 2.1.13; 3.1.1]

In the numerous plans for the development of the capital during these years of urbanisation and enormous growth of the economy and population in the capital, no attention was paid to the particularity of urbanising the flood

plain adjacent to Hanoi, and the risks it might bring in the future for the city and its inhabitants. Government driven developments for collective housing were implemented from the 1950's until 1992 but no clear strategy or plan for the riverside areas as a whole was in place. Regulations would restrict where to build but it didn't define the type of constructions to be allowed in the areas that constructions weren't banned.

No flood management plan for Hanoi and the region was proposed until the last plan approved in 2010 in which attempts to introduce sustainable development and care for the environment were introduced. However, in the latest master plan for Hanoi the riverside areas are considered to a certain extent but the proposed actions aren't clear and ignore the existing population settled in those areas in the last century.

For a capital that is setting its standards as high as to be the "first sustainable capital of the world".<sup>39</sup> Hanoi needs to set a strategy to deal with the results of its urbanisation process in a sustainable manner, which has to consider the complexity of its elements. With the bar set as high as having 10 million inhabitants in 2030, having a market driven real estate market and a growth of population that certainly will not be able to afford it, areas in risk zones will keep attracting new inhabitants. There is an urgent necessity for a precise strategy on the future vision of the flood plain in Hanoi province and especially in the areas adjacent to the historical core in order to avoid in future transforming the valuable riverside into a slum, destroying its environmental qualities and moreover taking away the last natural area close to the city center.





# THE RIVERSIDE URBAN AREAS



## LOCATION AND HISTORY

## 3.1

The Riverside urban areas known as RUA are located on the riverbanks between the dyke and the river in Hanoi, which used to be cultivated in 1920's. [FIG. 3.1.3 & 3.1.4] Located outside the dyke protecting the city of floods, the areas are part of the flood plain of the Red river and were for centuries considered dangerous to inhabit due to the flood risk. The use of land was good for agriculture due to the fertile soil maintained by the large amounts of sediment the river carries with every annual flood and disposes on the flood plain. Floods were part of people's life back then as well as today, and there were people living in boats on the water or in floating houses made by them. On many ancient maps and photos one can see floating communities. However, unfortunately not much information about that is available .

With the control improvement over the river, like the construction of the Hoa Binh reservoir, and the heightening of the dyke, more and more people started considering the riverside to be not so risky areas for living since it was assumed that the reservoir will keep them dry, and started slowly urbanising from the 1950's onwards. Until the first part of the 20th century the dykes weren't high enough to support flood levels higher than 12.5 m<sup>41</sup> , which brought devastating consequences on the capital

further in history. First official projects for the urbanisation of the riverside areas in proximity to Hanoi's center were for housing and public buildings for the state. Decisions were taken by the new government at that time which in 1956 decided to create collective flat housing for the employees in the public sector and newcomers in Hanoi <sup>42</sup>. Part of those collective housing projects were located in the wards of Phuc Xa, Chuong Duong and Bach Dang part of RUA since they were adjacent to the city center.3 [FIG 3.2.7] Further on thousands of families were relocated from Van Hoa ( in the south of Hanoi ) to Yen Phu and Phuc Xa ward to construct a government office complex. All those government driven developments in RUA were put on hold after the disastrous flood event of 1971. The lack of public driven projects didn't stop the interested in building on their own, neglecting the risk of living in the flood plain. After 1986 when the Vietnamese economy boomed and started promoting private investments, together with the land ownership rights being obtained by more and more people, houses began to get improved. However, in RUA the lack of monitoring and planning resulted in plots being divided and sold to sponsor the expansion and construction of housing. <sup>43</sup> The urbanisation happened faster than ever expected and the authorities couldn't catch up with control, infrastructure and regulation of that process. Between the year 2000 and 2004 the population of RUA increased more than twice. [ FIG 3.1.1]Official data for the number of inhabitants today is not available but it has definitely increased a lot

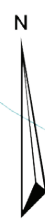
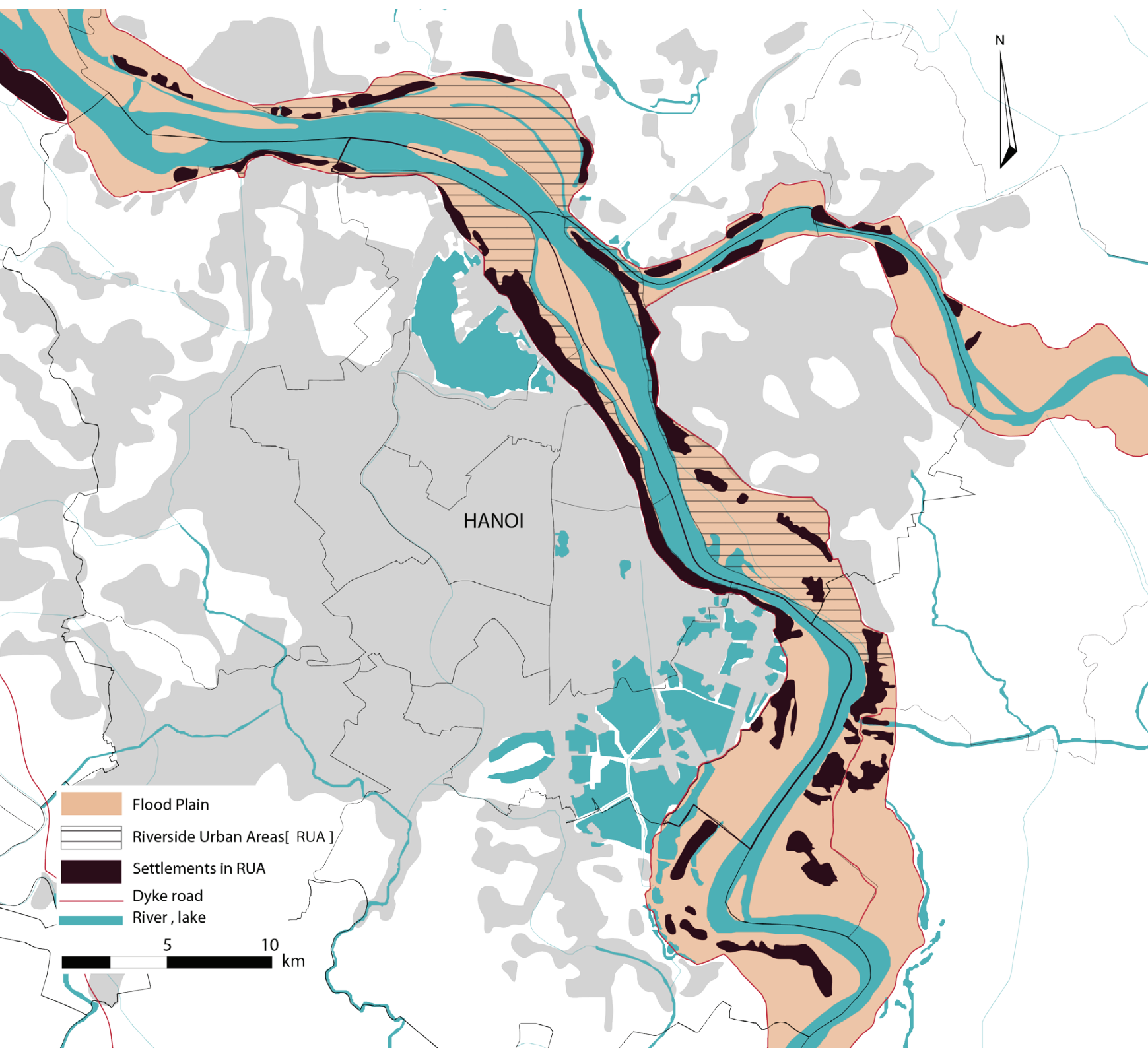
	1925	1955	1975	1996	2000	2001	2004
<b>Population</b>	0	Negligible	33,476	75,202	107,634	140,425	160,602
<b>Houses</b>	0	Negligible	n.a.	12,533	19,569	27,700	32,012

FIG. 3.1.1 Number of population and houses in RUA since 1925

Source: Uyen ( 2002) and Hung (2005), taken from Hoang 2007 <sup>40</sup>

FIG. 3.1 (Pages 60-61) Arm of the Red River on right bank - the side of Hanoi's historical center and the Riverside Urban Areas, March 2014

FIG. 3.1.2 Localization Riverside Urban Areas, Interperation of [HUNG 2009]<sup>44</sup>



HANOI






-  Flood Plain
  -  Riverside Urban Areas [ RUA ]
  -  Settlements in RUA
  -  Dyke road
  -  River, lake
- 5 10 km



FIG.3.1.3 Riverside Urban Areas early 20th century - empty flood plain, village on the island  
source: <http://www.hanoilavie.com/>





*FIG. 3.1.4 Riverside Urban Areas early 20th century - empty flood plain, village on the island*  
source: <http://www.hanoilavie.com/>

### ORDINANCE OF THE DYKE

The development of Hanoi has been spreading in all the available land around the historical core including the areas outside the dyke due to their proximity to the CBD. With the opening of the Vietnamese economy in 1986 [Doi Moi] in the following years a fast urbanisation commenced and that was the time the outside dyke areas had a strategic place with their cheap land. In the 1990 with Hoa Binh reservoir entering into operation it was considered that flood risk had been reduced significantly. Also in the 1990 the dyke along the Red river in Hanoi was strengthened and transformed into an important highway and a dyke extension wall of about 2 m was built in order to increase the flood protection to 15 m. The wall completely cut the riverside areas from the city and control over the development activities was hard to be performed. What further caused the over urbanisation of RUA was from one side the lack of control from the local authorities but on the other hand the imprecision of the regulating document such as the first Ordinance of the dyke, approved in 1989, which even after a decree added a year later, still could not be implemented. Another issue was that in the master plan for Hanoi some of the areas in RUA were considered as favourable positions for the development and thus different regulations were contradicting each other.

Finding information about the legal documents in a language other than Vietnamese is a hard task. Here are the existing legal documents I have managed to find in English, which the concerned authorities have to use to control development in RUA today:

1. "Ordinance on Dyke and Dyke Maintenance", No. 26/2000/PL-UBTVQH10 issued on 07/9/2000
2. "Stipulating in Detail the Implementation of Some Articles of the Dyke Ordinance", No.171/2003/ND-CP issued

on 26/12/2003

3. Law on Dykes ( chapter IV dyke protection ) Issued in November 2006
4. The dyke Law and the Decree no. 113/2007/NĐ-CP dated 28/6/2007 of the

Government stipulates in details and instructs to implement some clauses in the dyke Law

The ordinance of the Dyke approved in 2000 can be schematically represented as in [FIG. 3.2.1]

1. Dyke protection area
- 2 From boundary of the dyke protection area towards the river course where the presence of houses does not directly influence annual flood water drainage capacity of the river
- 3 Next to the river bank where the presence of houses directly influence the annual flood water drainage capacity. .<sup>45</sup>

3 Years later a Decree No.171/2003/ND-CP was accepted aiming at the removal of all constructions that do not comply with its regulations and are under 10.5 m elevation. Only existing constructions were allowed to stay in the specified zones provided that they obeyed the dyke safety regulations. All the attempts to implement the above decree failed due to the lack of a precise map of the locations of those structures designated for removal as well as many offenders filled up their land to the necessary heights.

The City people's committee and the city's newspapers recorded as many as 11762<sup>45</sup> illegal constructions according to the Ordinance but eventually many other have stayed out of the authority's sight.

The ordinance and the decree approved in 2003 weren't effective in

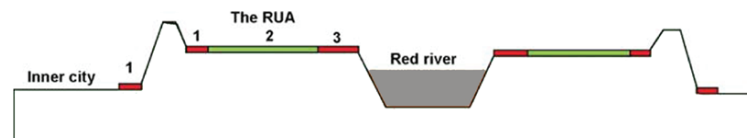
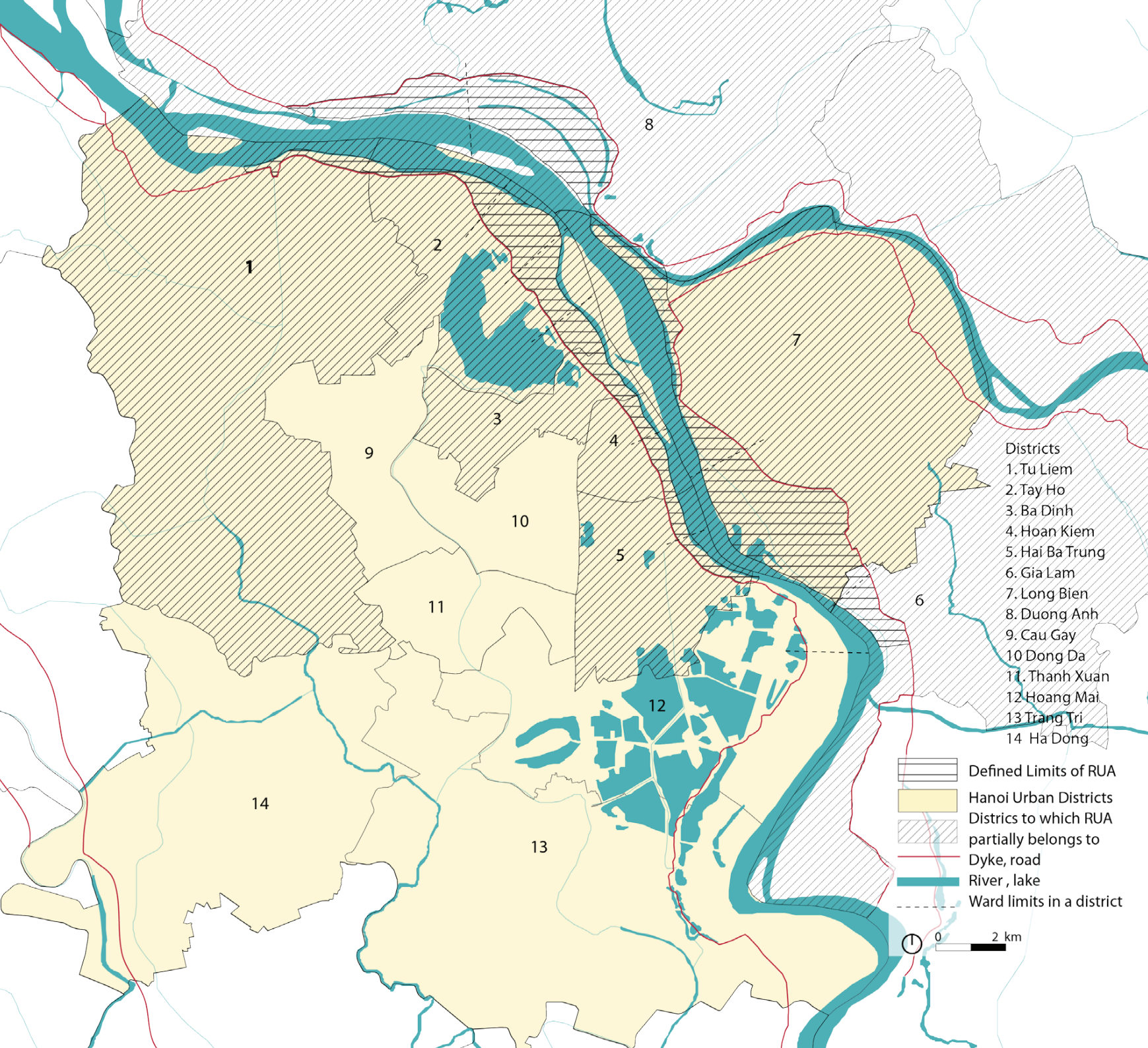


FIG. 3.2.1 Ordinance of the Dyke 2000 construction regulations

Source: Hoang 2007<sup>45</sup>

FIG. 3.2.2 Administrative structure of RUA and location in Hanoi



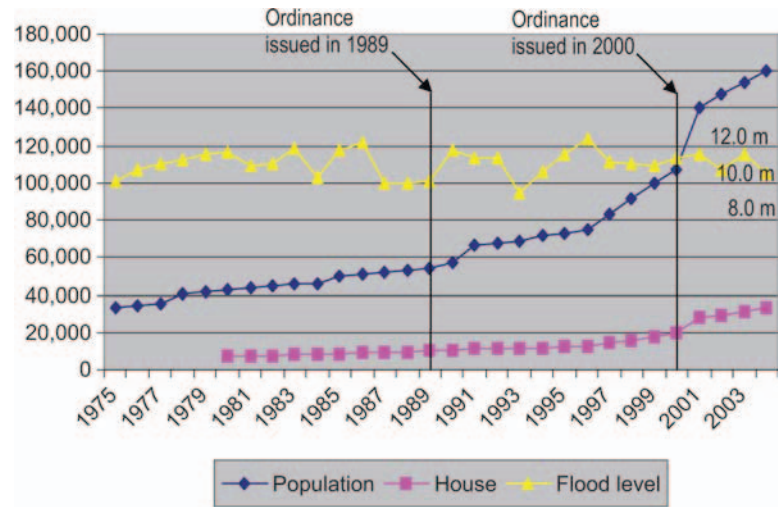
## 3.2

reducing the urbanisation in the risky outer dyke areas. No matter what attempts for regulation the government made or the regular sometimes very high floods, it is clear that from the first Ordinance in 1989 until the decree in 2003, population in RUA has increased 2 and a half times according to the official data available. [FIG . 3.2.3]

These ordinances were followed by the Law on Dyke approved in November 2006 with a decree added in 2007. The law organised and regulated activities of the dyke protection during the rainy season and in case of accidents with the dykes. Individuals or organisations breaking the rules were to be sanctioned as prescribed by the law. The dyke law seems to be quite new as in research papers from 2007 and 2010 concerning the ordinances and construction regulations in RUA it isn't mentioned.

However, during my stay in Hanoi and my field studies I stumbled upon many current constructions in areas prohibited by the Ordinance of the dyke where no land use certificates or building permits could have been granted. [FIG 3.2.4] That situation shows that local authorities seem to be closing their eyes to what is happening and laws and ordinances are getting dusty on their shelves. Until today population in RUA has most probably increased and especially settled in the areas threatening the security of the dyke but even more in lower lying areas and sometimes in the riverbed itself.

According to HAIDEP, 25 m from the dyke wall and 30 m from the foot of the dyke is prohibited for construction. The list of legal papers necessary to prove ownership of a construction and right of land use is profuse and also the regulations have changed, so nobody has a clear idea of the legal and illegal constructions in RUA today. That has become a serious problem that needs a solution as soon as possible.



Sources: Uyen (2002); CCFSC (2004); Hung (2005)

FIG. 3.2.3 Changes of population and housing in the RUA during 1975-2004 and impacts of the Ordinances on Dyke and flood situation

Source: Hoang 2010<sup>47</sup>

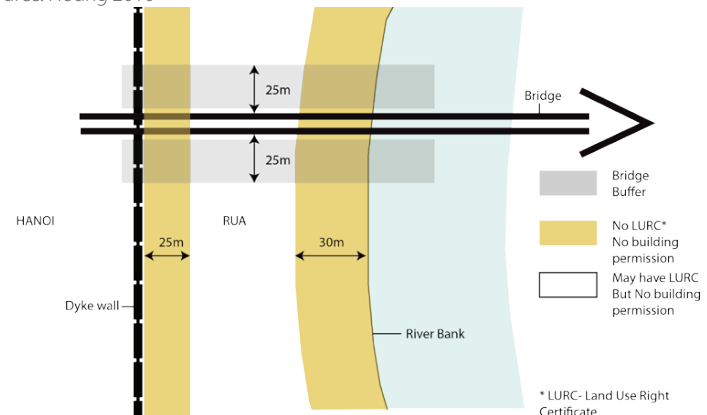
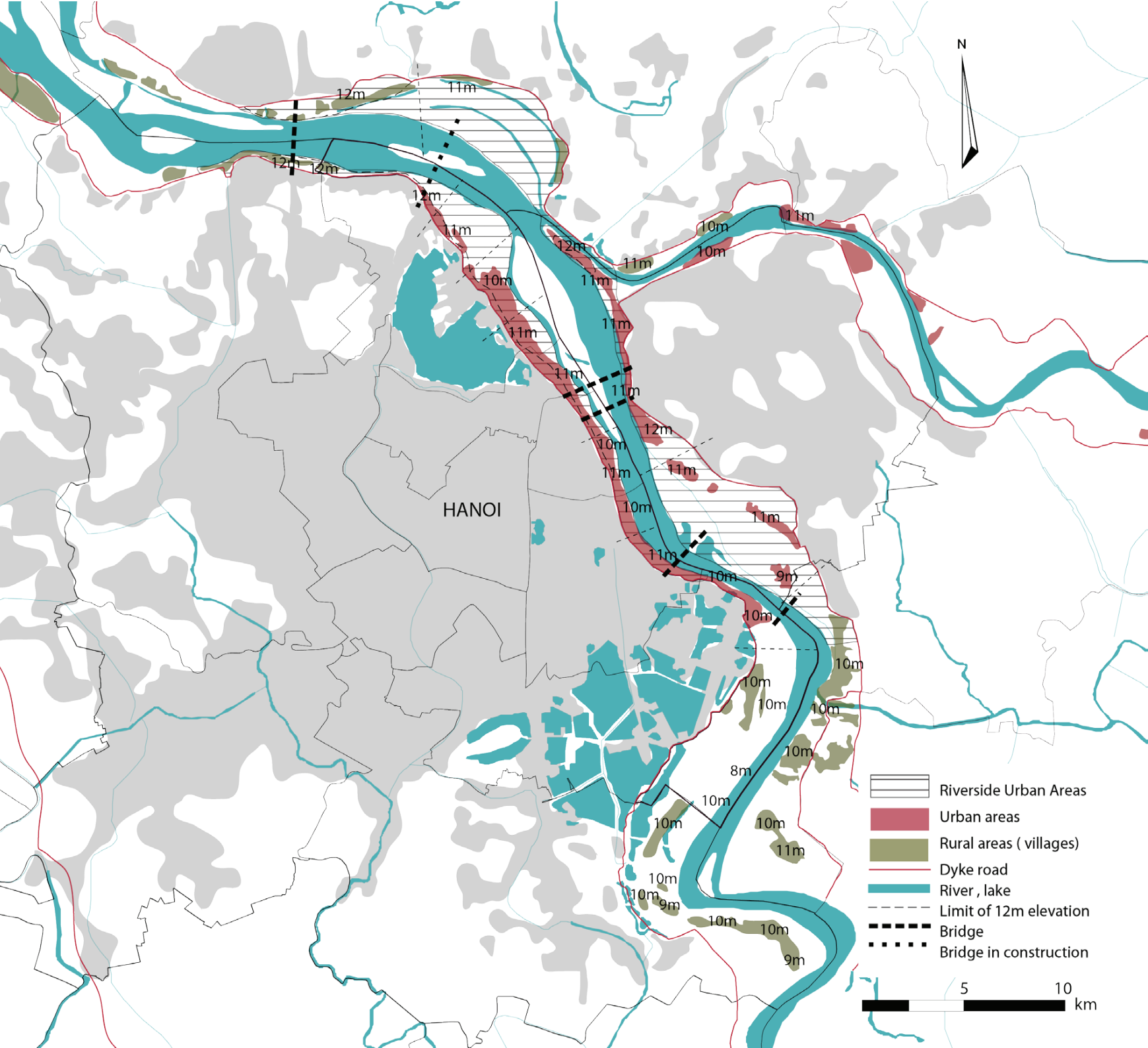


FIG. 3.2.4 Scheme of the applications of Land Use Right Certificate

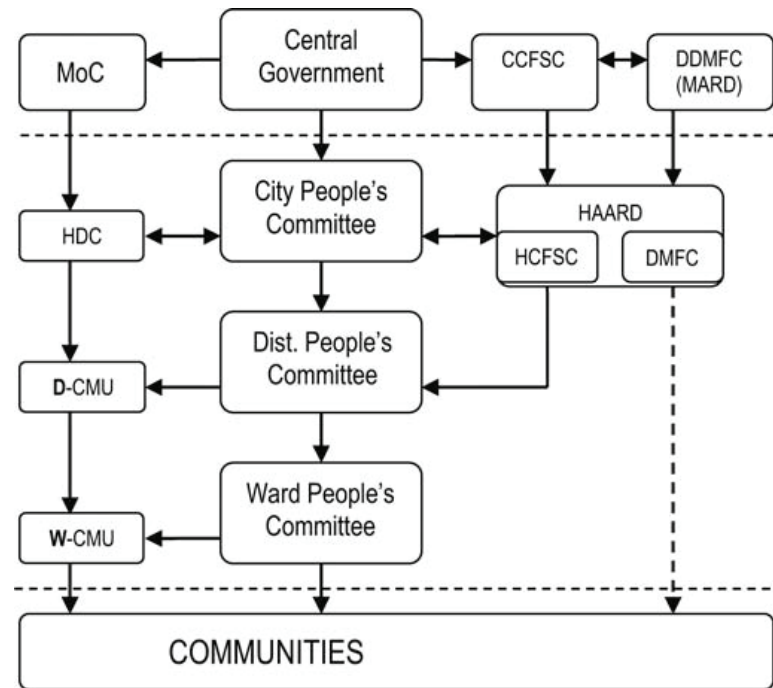
Source: Adopted from HAIDEP<sup>46</sup>

FIG. 3.2.5 A The Riverside Urban Areas and their division between the wards in each district



## ADMINISTRATIVE STRUCTURE

The government structure in Hanoi is centralised and the state takes all decisions and distributes them down the hierarchy: the city followed by the district and the smallest one - ward - responsible for implementing the laws and regulations and performing the control over squatting and illegal constructions. Administrative limits of Hanoi city are equal to those of the province. On the other hand the province is divided in rural and urban districts, hence the limits of the urbanised and dense parts of Hanoi are directly represented by 12 urban districts covering that territory. [FIG 3.2.2]. The riverside urban areas are located all along the Red river in proximity to Hanoi's urban and some adjacent rural districts and their governance is divided between those districts and their wards. The district people's committee has the power to take decisions at the local level exceeding that of the ward and providing communication between the ward people's committee and the city people's committee. The ward is actually the link between the state and the people but the communication vertically for the implementation of regulations is complex. In terms of control over squatting and illegal constructions, for example, the wards officials are tasked to control them but when they perform their monitoring of such actions they have to report it to the district level. At that point they are entitled only to give a temporary revocation to the offenders but they have no right to take actions for demolition without the final decision of the district. Given that, the decision-making process is long and restricted, orders are rarely obeyed and once the construction is finished demolition becomes a bigger problem. An attempt was made to give more power to the wards and give them the right to demolish illegal construction if they catch them "in action" but this isn't very effective since offenders finish their construction during



**Note:** MoC: Ministry of Construction  
**Source:** VNNA (1994)

FIG. 3.2.6 Governance structure

Source: Hoang 2010<sup>48</sup>

holidays or at night thus avoiding the risk.<sup>47</sup> But in RUA if the illegal constructions are interfering with the dyke safety the local authorities have to still consult the district. On the other hand the Department of Dyke Management and Flood Control (DDMFC) and its branch (DMFC) at the city office are responsible for dyke protection.

'They do their inspections and in case illegal constructions are detected they have to pass it to the wards and land use management in the RUA to deal with it. However, at district and ward levels, DMFC do not have branches to deploy its tasks. Instead, it has to use its limited staff for the

FIG. 3.2.7 The Riverside Urban Areas and their division between the wards in each district

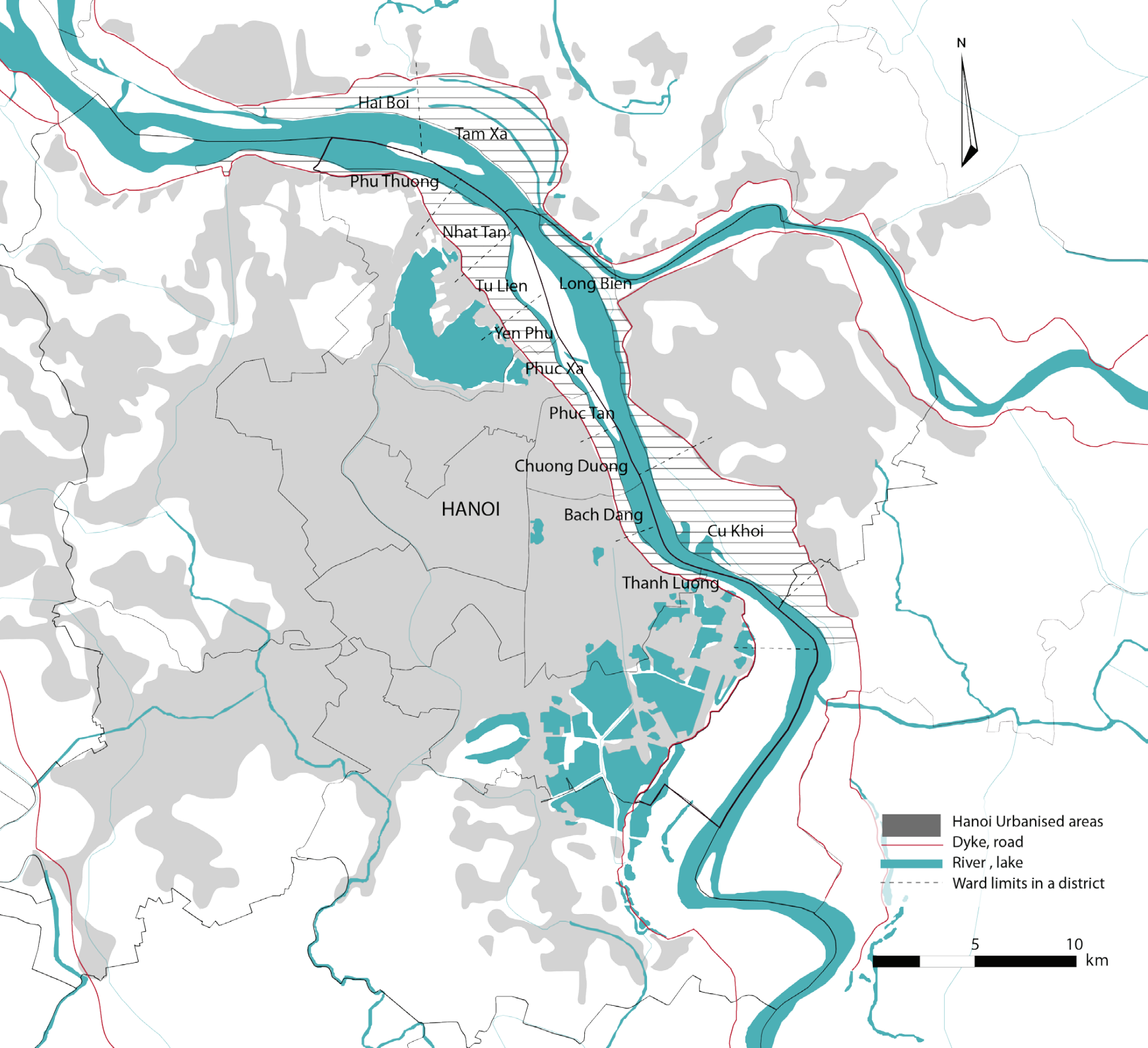
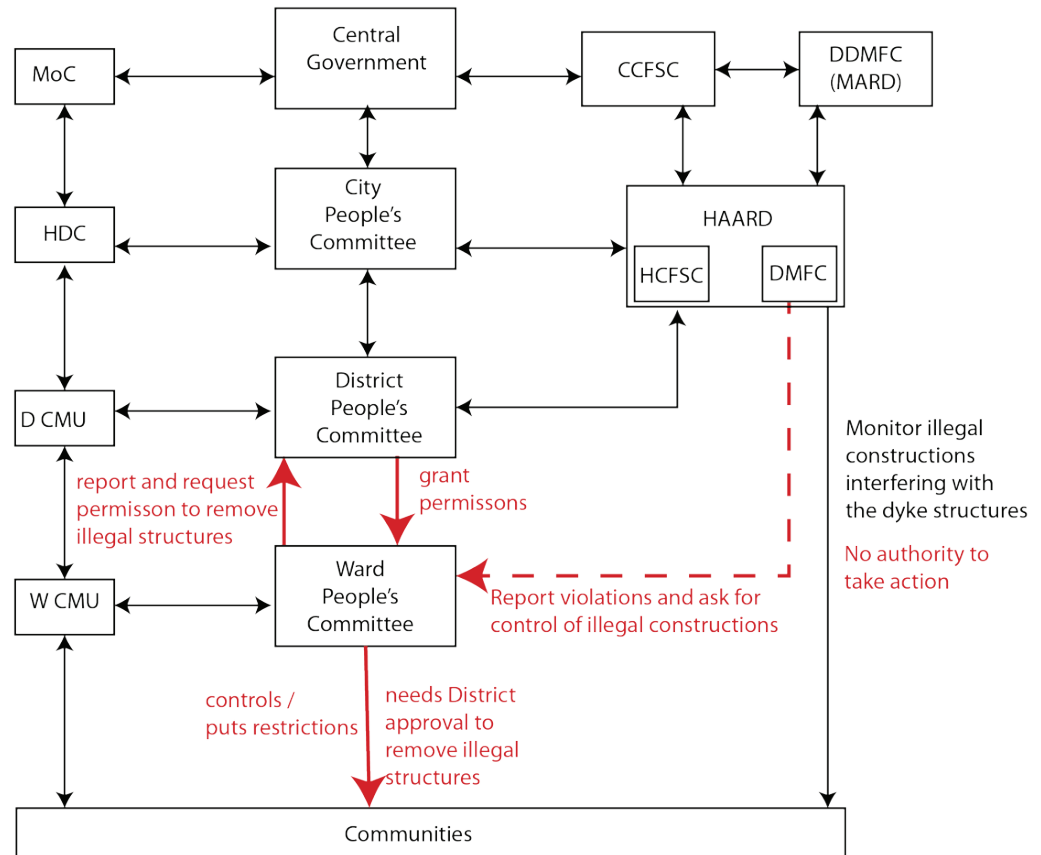


FIG. 3.28 Illegal construction control - malfunction of the governance system;  
Source: Interpreted scheme adopted from Hoang 2010<sup>48</sup>.

MoC - Ministry of Construction  
D(DMFC) - Department of Dyke management and flood control  
CCFSC - Central Committee for flood and and storm control



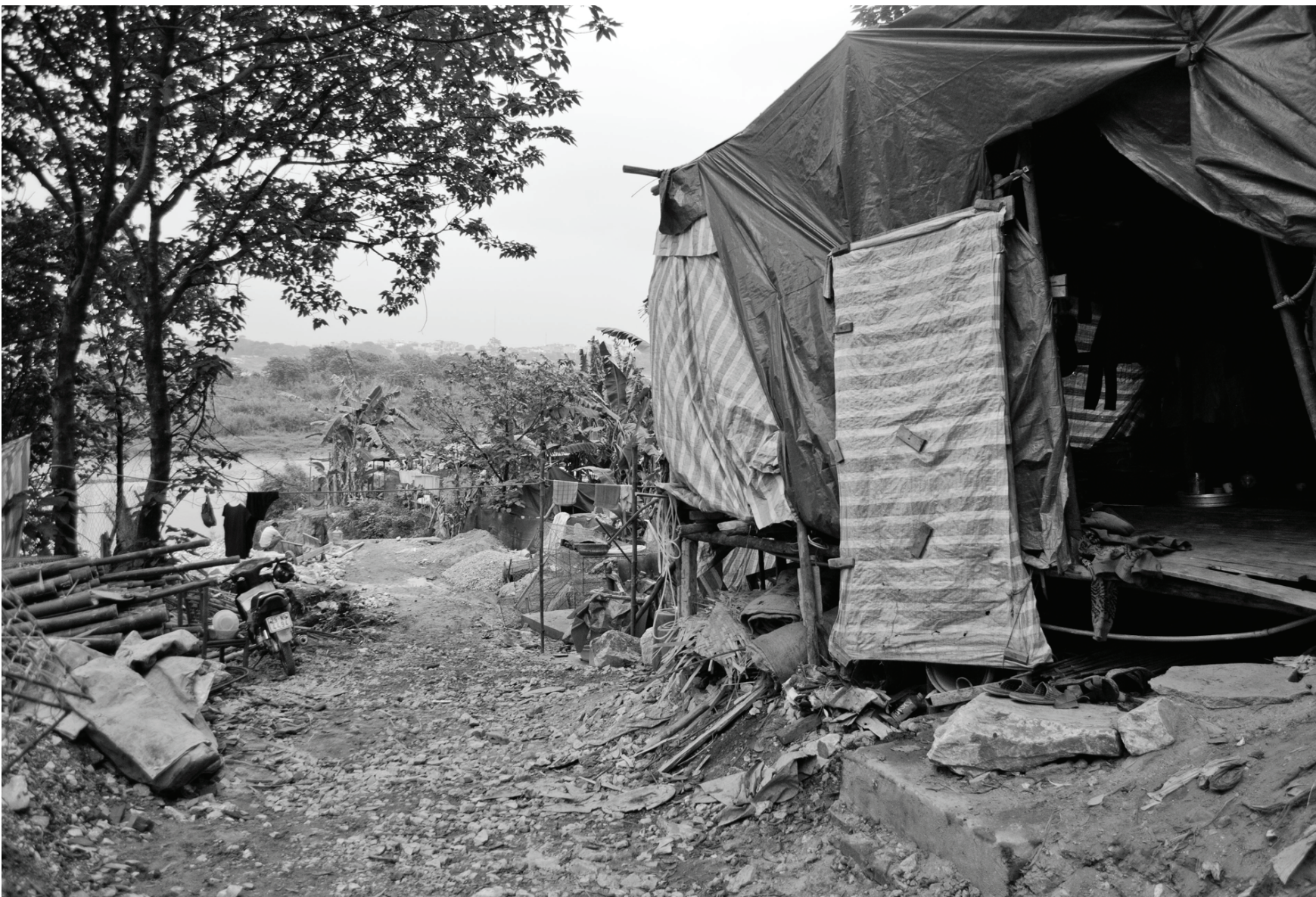
inspection of dyke protection areas and depend on the ward'

Hoang 2010, [ FIG 3.2.7]

From the scheme one can clearly see the lack of a direct communication between the WARD - the only body directly implementing regulations, and the DMFC that just controls presence of illegal constructions. The levels of

governance directly involved in controlling the situation have no representative structures of DMFC which makes the process long and further on uncontrollable. All the above shows that regulations such as the ordinances and laws aren't effective enough due to being unclear and non-specific, the governance and administrative structure upon which RUA is dependent, is complicated and malfunctions thereby creating obstacles for the proper control over the development .





*FIG. 3.2.8 Illegal self made construction in the prohibited areas at the foot of the dyke  
Location: At the limit of the dyke and the Red Rived Bed, Phuc Xa Ward, April 2014*

### SOCIAL STRUCTURE

The population currently living in the riverside areas represent a mix of different social groups, such as people who have always lived in Hanoi and simply, moved to RUA as well as immigrants from other provinces coming to look for jobs and opportunities. Those last ones have usually very little choice of where to settle due to the rocketing price of real estate in Hanoi and RUA is the cheapest and closest to the city center area where they can settle in any conditions without being disturbed by the authorities. According to a study of HAIDEP from 2004 the

**total number of inhabitants in the outside dyke areas is around 244 000 inh.<sup>49</sup> as those that are considered as part of the urban areas account for 160 000<sup>50</sup>.**

[According to HAIDEP survey in 2004<sup>49</sup> the number of Inhabitants in the urban areas of RUA were 130 000, but since no precise information is available it is quite possible that this number increased significantly in the last 10 years due to rural to urban migration being observed in Hanoi. ] According to my interviews with some of the inhabitants in Phuc Xa and Phuc Tan ward in the last 3-5 years a migration of people from other provinces to RUA has increased and consequently the squatting in the area as well. Some settle in the edge of the dyke sometimes embanking it, where they self construct their houses with occasionally found materials. Some have decided to not take the risk of an eventual flood and have directly constructed their houses on the water with a kind of a light floating self made construction which rises with the levels of the river.

Density in the urban parts of RUA is quite high as the highest one is in Chuong Duong ward with 24 000 inh/km<sup>2</sup> <sup>51</sup> The population in RUA has almost doubled in the last 10 years <sup>52</sup> [FIG. 3.3.1] due to many factors such as the

economic growth of the capital attracting more investments and therefore move rural to urban migration.

### INFORMALITY OF RUA

One of the biggest issues in RUA's urbanisation is the lack of control in the process and no planning to assure the safety of the population and the quality of life provided by the necessary infrastructure, public spaces, wastewater collection and treatment and etc. The lack of control and the attractiveness of the riverside areas despite the flood risk has caused and continues to expand it's urbanisation. But after the destructive flood of 1971 no planning and urbanisation activities have been supported by the government. That raises the question whether the existing today urbanisation is legal or not and how can it be defined.

**According to the HAIDEP study of 2005 the following description of an informal or illegal settlement can be given based on the existing legal documents.**

1. Structures built on flood prone areas
2. Structures constructed without official documents after the enforcement of the dyke ordinance came into effect
3. Structures constructed with no legal documents at all

Following this classification in the conducted by HAIDEP study none of the existing structures have all the necessary legal documents, 41 % of them have a certificate transferred from person to person and the rest 59% are classified as "others" who can basically be considered as illegal and 36 % of those structures have been evaluated to be located in very high risk flood areas and have to be relocated.

The quality of structures though doesn't always speak of their legality. For example a house built before the update of the ordinance of the dyke has the right to get renovated since it has been at that time legally constructed, if it doesn't break the rules of the new law. [ FIG 3.3.5] Another case is an informal and low quality housing located on a land which the owner has constructed on and renting to people with low

Commune Name	Area (ha)	Population				Population Density (person/ha)				Population Growth		
		1989	1999	2003	2020	1989	1999	2003	2020	1989-1999	1999-2003	2003-2020
Nhat Tan	349.53	5,237	7,104	8,106	14,811	15.0	20.3	23.2	42.4	3.10	3.35	3.61
Tu Lien	311.83	4,856	7,095	8,290	9,140	15.6	22.8	26.6	29.3	3.86	3.97	0.58
Yen Phu	141.42	13,054	17,652	19,660	20,993	92.3	124.8	139.0	148.4	3.06	2.73	0.39
Phuc Xa	100.29	11,647	15,767	18,641	13,049	116.1	157.2	185.9	130.1	3.08	4.28	-2.08
Chuong Duong Do	100.87	12,092	20,508	21,969	15,378	119.9	203.3	217.8	152.5	5.42	1.74	-2.08
Phuc Tan	69.67	8,851	14,199	14,830	10,381	127.0	203.8	212.9	149.0	4.84	1.09	-2.08
Bach Dang	106.03	12,881	16,402	17,618	13,309	121.5	154.7	166.2	125.5	2.45	1.80	-1.64
Thanh Luong	141.95	12,098	18,797	21,143	15,727	85.2	132.4	148.9	110.8	4.51	2.98	-1.73
<b>Total</b>	<b>1321.58</b>	<b>80,716</b>	<b>117,524</b>	<b>130,258</b>	<b>112,788</b>	<b>61.1</b>	<b>88.9</b>	<b>98.6</b>	<b>85.3</b>			

Source: Hanoi Statistical Year Book, MONRE

FIG. 3.3.1 Population Density and growth by Urban center

Source HAIDEP<sup>2</sup>

income coming from other provinces. [FIG. 3.3.6] It is true though that low quality constructions in the areas prohibited for construction by the Ordinance of the dyke can easily be defined as illegal as most of that development can be considered as recent in the last several years. However construction is still happening today in areas that are prohibited by the ordinance and it isn't always squatting but however the legal aspect of it is hard to define.

The case of the floating housing in RUA is a similar example. A floating low quality housing will be found in very inaccessible areas where the local authorities will not go to control [FIG. 3.3.7] as per good quality of floating housing, even though very rare, would be located in easily accessible parts of RUA such as the Phuc Tan port, where they have the legal right to be located there and even receive electricity supply from the city.<sup>53</sup> [FIG. 3.3.8]

Information and maps of RUA detailing which parts of it are considered formal I could not find probably because

they do not exist.

**Detailing all the constructions existing in RUA and mapping their legal status is necessary in order to have the reality of the situation and be able to develop a strategy and eventually new policies to deal with the issue.**

## PERCEPTION OF FLOODS BY THE POPULATION

That is of major importance, is the knowledge and perception of floods by the population living in RUA. A survey regarding this issue was performed in 2004<sup>54</sup> in 5 of the wards in the riverside areas - Chuong Duong, Hai Boi, PhuThuong, Yen Phu (former An Duong) and Cu Khoi, [ FIG. 3.2.7] with 588 participants altogether from diverse age groups. Questionnaires were based on a different indicators as I consider the following as the most significant: satisfaction with living in RUA- advantages and disadvantages of living in the Riverside Urban Areas, flood experience and perception of floods and living conditions.

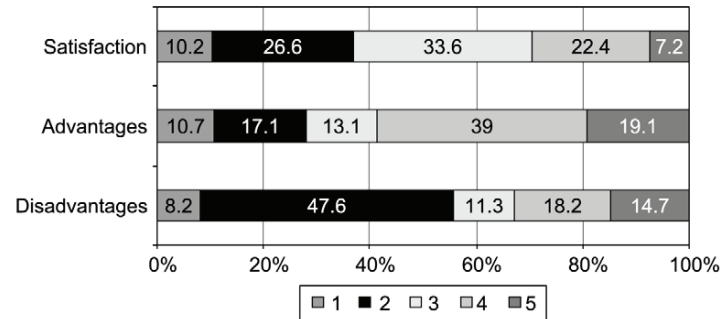
## Advantages and disadvantages

Inhabitants identified a few advantages of living in RUA such as the cheap land and house prices, the fresh air, proximity to the CBD and in some of the further located closer to the rural areas wards the livelihood options of cultivation of vegetables and flowers which are then sold in Hanoi. As per the disadvantages flood was considered rather an inconvenience that a threat as only 8.2% of the participants classified floods as dangerous for their life. [FIG 3.3.2] During my interviews, the inhabitants shared similar point of view regarding the extreme floods such as the one in 1996 when water was up to 13 m. They weren't afraid for their lives but for the loss of their belongings and the inconvenience of having to move out for the duration of the flood, since they couldn't access their houses, no electricity or drinking water was available and the pollution of the water was high.

## Flood experience

Results from the survey show precisely that almost everyone living in RUA have had experience with regular floods - 97.6% and 71.4% of coping with one. [FIG 3.3.3]. That is very important in defining a strategy for the future of RUA as the perception of the inhabitants is simply that floods are something normal and part of their life, that even though brings them inconveniences they find the advantages of living there, overweighting the disadvantages. I would say that is a clear indicator of the continuous growth of RUA and if no measures to control it and find a sustainable solution for quality of life in balance with the natural conditions takes action, the situation will get harder to control.

It is though important that the majority of the people liv-



**Satisfaction** – 1: Very good, 2: Good, 3: Fair, 4: Poor, 5: Very poor; **Advantages** – 1: Proximity to the CBD, 2: Cool air, 3: Suitable livelihood, 4: Cheap land price, 5: Do not know; **Disadvantages** – 1: Flood as danger, 2: Flood as inconvenience, 3: Lack of public facilities, 4: Poor infrastructure, 5: Do not know

FIG. 3.3.2 Satisfaction levels of respondents about the living conditions in RUA  
Source Survey 2004<sup>55</sup>

ing in RUA and have never experienced a flood such as the one in 1971 have lower expectations on the level of a future flood than the realistic one's of those who have experienced it. (0.5m versus 1.5 -2m )That speaks for the unpreparedness and lack of knowledge and information between the most concerned group - the inhabitants of the outer dyke areas. In this line of thoughts what is necessary is the adequate information distribution and training for the concerned. A part of the participants - 20.5% believed a future flood is unlikely to be disastrous as they believed the existence of the Hoa Binh reservoirs will keep their

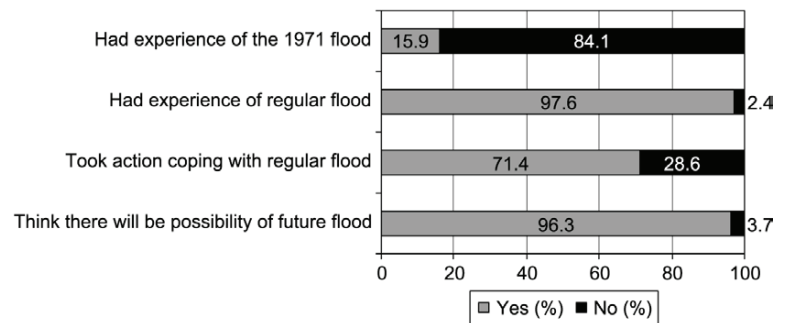


FIG. 3.3.3 Flood experience and perception among the respondents  
Source Survey 2004<sup>55</sup>



FIG. 3.3.4 Inhabitants of RUA in Phuc Xa ward telling their stories about the floods in 1971 and 1996.  
Source Fieldwork interviews with the help of Le Thu Ha, March 2014

houses safe. In Vietnam statistical or information related to flood issues is one of the hardest things to have. If for researchers and people in the field it is a challenge then the regular people living in the zones with risk chances close to impossible to get to it. For them it needs to be easily accessible and to have a precise place

for obtaining it available in the area and presented in a simple and clear way. The availability of information will between the population will improve their preparedness and their willingness. to know more about the risks in their living environment.



FIG. 3.3.5 High quality housing right behind the dyke wall  
Location Bach Dang ward, February 2014



*FIG. 3.3.6 Low quality housing/ squatting / according to the inhabitants for rent by the owner of the land. Location: Phuc Xa ward, Unclear formal/informal status, March 2014*



*FIG. 3.3.7 Low quality floating housing/ squatting ; self constructed,informal , hard to access  
Location Phuc Xa ward, March 2014*





*FIG. 3.3.8 Single family floating house in Chuong Duong ward. The family moved to live on the river in search for less pollution and noise from the city and to be closer to nature. Has the legal right to be there according to the owners who have been living there for 10 years now. Location Chuong Duong ward, April 2014*

## HISTORICAL FLOODS IN RUA

Located in the outside of the dyke area the Riverside urban areas are considered a zone with high risk of flood. The Red river with its specific hydrological regime is defining the specific environmental conditions of these areas. The monsoon climate is the reason for the uneven distribution of rainfall throughout the year [ with up to 80% of the rainfall during May-October and sometimes 40% concentrated in August ] <sup>56</sup> and consequently the great difference in the flow during the seasons, changing from its peak of 11 000 m<sup>3</sup> /s in July- August and dropping down to 2000m<sup>3</sup> /s in December - January. In extreme conditions as when the river rises after tropical storms intensity of the flow can be much higher as the highest for now has been recorded in 1945 of 13 000 m<sup>3</sup> /s.<sup>2</sup> This characterises the Red river as the one with highest specific flow, even though normally **the rise of the river is slow sometimes after typhoons when it can rise with up to 4 m in 24h hours.**<sup>57</sup> In the

1000 year history of Hanoi the city has suffered many floods and the dykes have been broken hundreds of times. One of the most devastating floods in the 19th century was in 1983 when flood waters reached 13 m in Hanoi causing heavy damages <sup>58</sup>

In the 20th century floods in the RRD were regularly happening but two of them in 1945 and 1971 caused extreme damages to the people and the city.[ FIG. 3.4.3] Those two disastrous events were evaluated as catastrophic events of the 20th century. The waters in Hanoi in 1971 reached 14.13 m - a record level that was never reached in the millennium history of the capital affecting 3 million people and causing a loss estimated at 5.7% of the country's GDP [ \$79.9 million as the exchange rate of 1990].<sup>58</sup> The estimated level of that flood in case no dyke brakes had occurred, would have been 14.6 m<sup>60</sup> which would be have been hardly supported even by the existing today dyke with its height of 15 m in Hanoi. During the 20th century 76% of annual floods in the delta have not gone higher than 11.5 m, which has probably been one of the reasons for the urbanisation of RUA further on. [FIG. 3.4.2 ] Most urbanised parts of the urban part of RUA are located between 10 m and 12 m over the sea level which means that regular floods aren't a problem for a large part of that particular population. According to the General Statistics Office of Vietnam

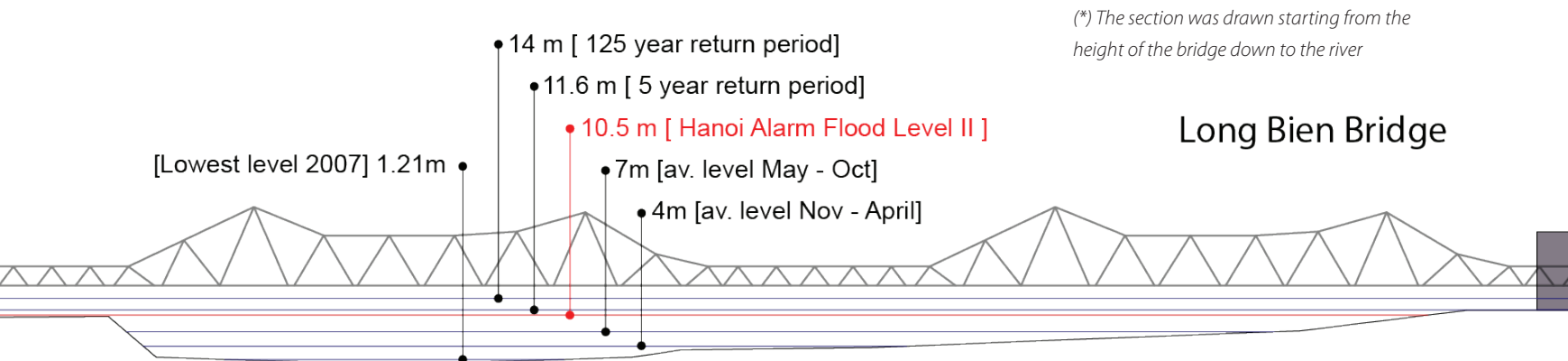
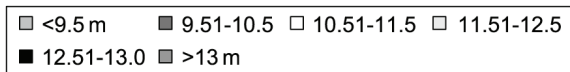
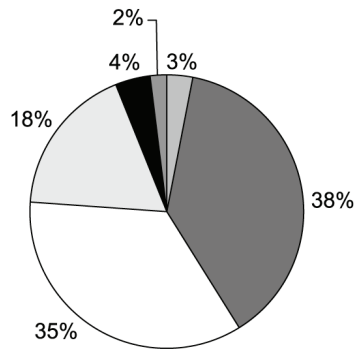


FIG.3.4.1 Section of the Red River through Long Bien Bridge. Levels of the Red River in dry and rainy season. Major floods return period.

Source: Section created after terrain measurements with the assistance of Tristan Morel and complementary references <sup>59</sup>



**Sources:** MWR (1994); Nghia and Chau (2001); Uyen (2002)

FIG.3.4.2 Flood frequency in Hanoi 1902-2001 (as per water level)

the average level of the Red river during October - April is around 4m but in the last 10 years it tends to be very low as in 2007 reached 1.21m<sup>61</sup> [FIG. 3.4.4]

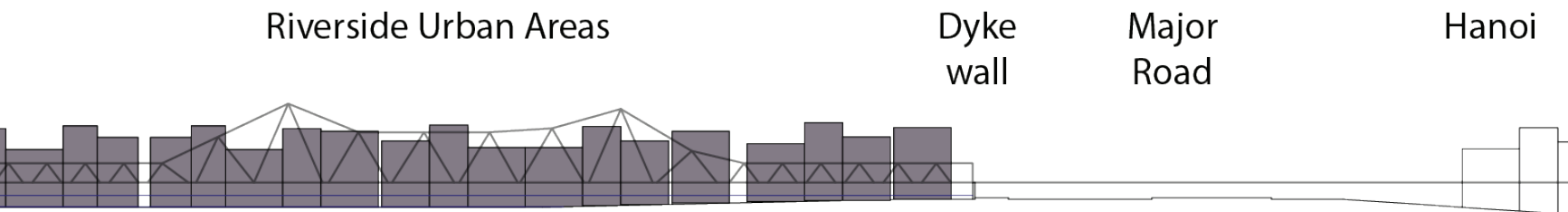
Average annual levels during rainy season are considered around 7m but they can range up to 12m and in extreme cases more than 13 m. The return period of floods over

Year	Flood water level (m)	Flood duration (days)	Note*
1893	10.5 (13)*	7	9
1915	12	12	10.5
1945	13.5	5	10.5
1971	14.6	5	11.5
1996	12.9 <sup>62</sup>	23	11.5
Future* <sup>2</sup>	14.9	16	11.5

FIG. 3.4.3 Major historical floods in the RRD

Source: Stability analysis of the dyke system, Plaxis Bulletin 2013, [www.plaxis.nl](http://www.plaxis.nl)

13m is estimated to 100 or more years. [ FIG.3.4.1] The last calamitous flood was in 1996 and it lasted for 23 days which compared to the previous ones is double the time. During my interviews with inhabitants of RUA people who had experienced it shared that they were forced to move out of their houses since no water or electricity was available as well as they could only access by boat and had their first floors flooded partially or completely. Since 1996 though there is a tendency of lower and lower levels of the Red river due to numerous factors such as the



\*<sup>2</sup> Flood duration is calculated following a threshold level (here, alarm level 3~11,5m at Hanoi)

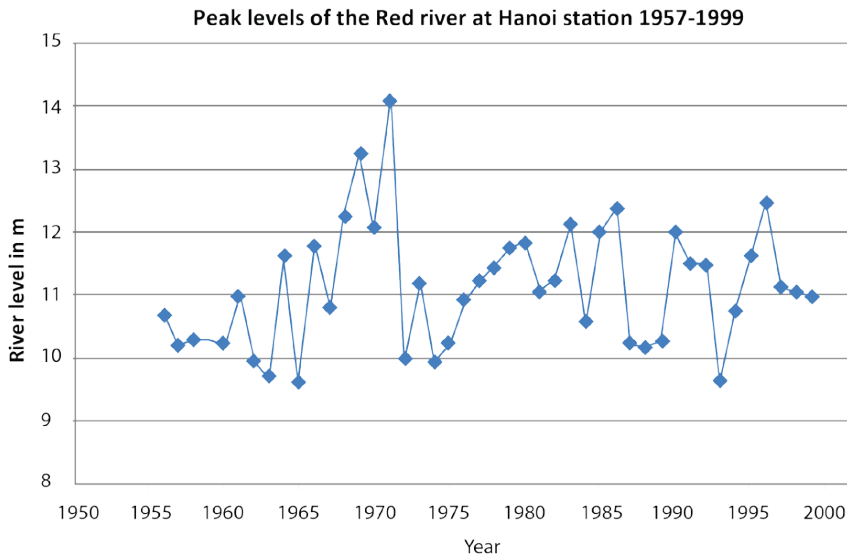


FIG. 3.4.4 Peak water levels of the Red river at Hanoi station between 1957 - 1999  
 Source: adopted from - Jan Willem Vrolijk 2002<sup>1</sup>

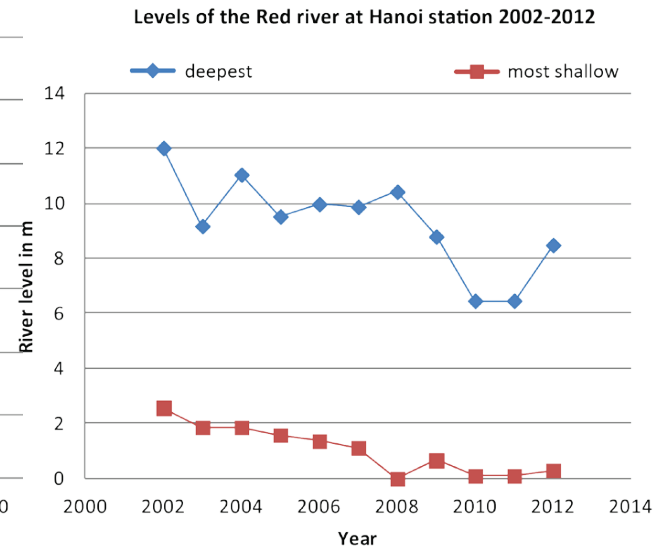


FIG. 3.4.5 Annual highest and lowest levels of the Red river at Hanoi station between 2002 and 2012  
 Source: Data from General Statistics Office of Vietnam

construction of reservoirs and hydropower plants in the Chinese part of the RRB and the lack of collaboration for water management between Vietnam and China but also due to some of climate change consequences such as less rainfall during dry season which causes extreme draughts. What is sure is that due to those different conditions natural and artificially caused floods aren't a things of the past but something that the population in the red river delta has to be prepared for. In the report of the Stability analysis of the Red river dyke in 2013, an estimation

of 14.9 m level [ FIG.3.4.3] for a future flood in Hanoi is made which is extremely dangerous and putting at very high risk not only the Riverside Urban areas but inner Hanoi and the whole delta population. With the urbanisation and expansion of the areas outside the dyke large parts of the flood capacity of the river has been take off and the flood level are being heightened as well as the uncontrolled development has put the stability of the dykes at risk. In the last 60 years the flood level has increased by 0.8 m as in an incredibly fast increase of 0.6 m can be observed in the period 1970-2000. (Nghia&Chau,2001; Uyen,2002).<sup>62</sup>

## FUTURE DISASTERS AND POPULATION PREPAREDNESS

With the climate change scenarios of increase of rainfall during the summer months in the future, the unbalanced and lacking national and international collaboration in water resources management as well as unpredictable events of flows, higher than the capacities of the existing reservoirs such as Hoa Binh and Son La that might result in their failure future calamities in the RRD are possible. The urbanisation and extension of Hanoi in the flood plain additionally are the cause for a lower flood capacity of the river and of course put at risk a population of 160 000<sup>63</sup> living in the outside dyke areas and huge economic loss. The city is considering numerous solutions to the problem such as constructing a second dyke in order to legalise and protect the already existing population in RUA, as well as a very radical one such as displacing everyone from the areas. Those ideas are both costly and in the first case decreasing the flood capacity of the river and hence increasing the risk of higher floods that might

not only affect RUA but Hanoi and its surroundings. The second case is not only costly as the city has to compensate the people with some kind of documents proving their ownership, but also since the city continues to grow extremely fast there isn't a place to relocate a population equal to a whole district. What is clear is that a strategy for the development of the riverside urban areas is not only necessary but urgent, and the people have to be prepared to react to any eventual disaster since it will affect directly their daily life, personal economy, comfort and safety. As mentioned before the population perception of a disastrous flood is quite low as only 8.2 % of the population considers floods as a big disadvantage of living in these areas. The low perception of risk of the population and the lack of information of the nature of floods defines a low preparedness of the population to respond to any eventual ones in the future. Additionally a large part of the population living in RUA has never experienced disastrous floods such as the one in 1971 which defines their low expectations of future ones and their knowledge of the nature of the environment they happen to be inhabiting.

The riverside urban areas are a complex urban / rural development between the city and the nature that has served as the link between the city and the river in the past. When river transportation was a major mean to connect people and goods. The occupation of these areas have existed for centuries but unfortunately no official data is available except for the ancient maps and later on photos of the riverside settlements. In the years before the Doi Moi the riverside areas were still a vital part of Hanoi and were starting a very active process of urbanisation. But the possibility of disastrous floods has led to the decision to build the wall, that today separates the city of Hanoi and the so called RUA. In my opinion that has led to many of the complex grid of problems we can identify today in the outer dyke areas which continue to be attracting more inhabitants despite the its extreme density and flood risk. According to HAIDEP there are **three reasons for the continuous development of RUA today:**

- its strategic location can't be underestimated neither by the inhabitants nor by the developers pitching at economic benefits.

- The weak governance and legal system can't find a solution for the resettlement of such a number of people. Hanoi is growing and demand for development land is consuming all adjacent agricultural land available. The current regulations aren't clear if the people have the right to stay but neither can someone force them to leave.

- The historically developed communities exist and define the identity of the areas.

### ENVIRONMENTAL ISSUES

#### 1. Flood risk

The first on the list of major issues for the development or redevelopment of the riverside areas outside the dyke wall. The dense urban fabric and its residents have to deal with the regular floods which won't always impact everyone but the preparedness of the community and infrastructure have to be in place to provide for the security of the 160 000 people living there. As mentioned before the perception of a disastrous flood by the population is low which though doesn't correspond to the scientific forecasts for climate change and its impact on the rainy quantities and the levels of the rivers in the Red river delta. The flood levels in RUA are dependent on the water management of China and Vietnam which is suffering from the lack an integrated approach to guarantee safety for the reservoirs capacities and the controlled flow of the rivers. Another serious issue is the lack of information for the population and their preparedness in case of a flood.

#### 2. Erosion and degradation of the dyke and the river banks

Urbanisation continues in the riverside areas in both high and low quality constructions but according to the current regulations none of them is allowed. Most of the new development is happening of the edges of the dyke which is threatening its safety. [ FIG. 3.5.1 ] As the administrative process to control that situation by local authorities is a lengthy the government seems to not be taking any actions. There needs to be a strong control over the safety of the dyke and measures to stop its degradation. There can be a landscape approach to strengthening the structure by planting trees and vegetation which will also increase the recreation values of the banks.



*FIG. 3.5.1 River banks and dyke edge destruction due to undefined constructions.  
Location: Phuc Xa ward, Red rived edge, April 2014*

### 3. Pollution -

I divide the pollution as per its cause.

- First there is the pollution coming from the upstream industries in Vietnam and China which release in the Red river and its tributaries pollutants that further downstream affect seriously the quality of water and the flora and fauna in the river. That directly affects the water quality and of course in rainy season when floods cover the agricultural fields along the river, the quality of the soil and the products of soil that are sold in the Hanoi street markets and consumed by the population.

- The second source of pollution is RUA itself. Since it is a uncontrolled and with a few exceptions during the 60's and 70's unplanned development it has a wastewater system which is completely separated from the one of Hanoi on the other side of the dyke wall. It is made out of horizontal and vertical canals which converge in many places and are directly evacuated in the red river without any treatment. Those same evacuation "canals" are open and crossing the land used for agriculture. During floods high waters can enter the wastewater system and cause all the waste water to mix with the flood waters and become a risk factor for the health and hygiene of the inhabitants. On the other hand the areas where the "canals" reach the urbanised limits they are open and smelly creating a "convenient" place for the inhabitants' garbage. These two factors of pollution work on a different scale, have different causes and responsible organizations but they both have a destructive impact for the environment of the Red river and its valuable qualities that have been recognized by many research and planning teams. There is a need for serious measures to be taken before it's too late to intervene.



*FIG. 3.5.2 Canal for wastewater evacuation, consequently turned into a garbage area with a nice view to the historical Long Bien bridge designed by Gustave Eiffel in 1898  
Location: Phuc Tan ward, March 2014*

## URBAN ISSUES

### Fragmentation

The fragmentation of RUA from the city is clearly perceivable just walking by the dyke wall dividing it from the city but that sensation is strengthened by the major connecting road running on top of the dyke as a supplementary barrier. [FIG. ] On the other hand the other side of the wall is also lined by a road which confirms the division. Walking through the gate of the dyke one may feel like entering a new city on its own. The fragmentation isn't only perceivable on that level though, there is a clear discontinuity of infrastructure and accessibility between the adjacent wards and especially when the wards belong to neighbouring districts. That shows a clear fragmentation and lack of communication between



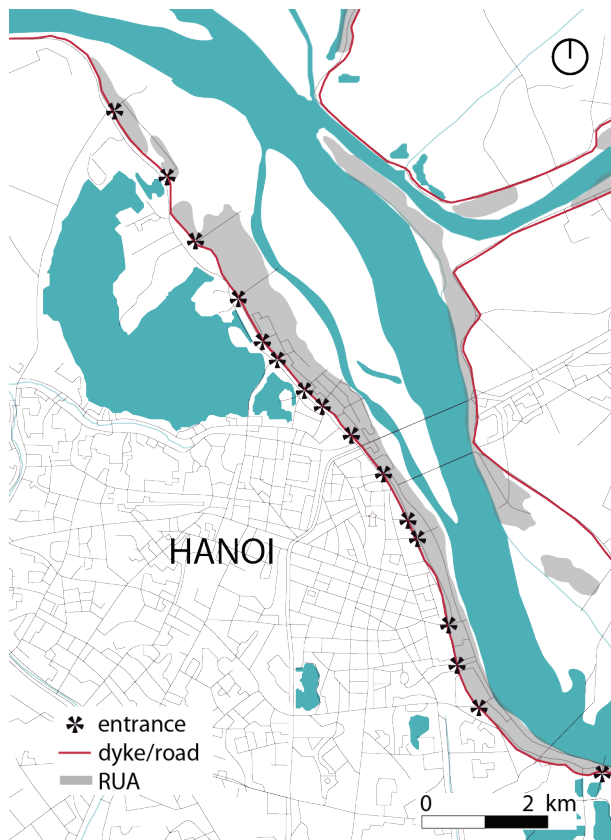


FIG. 3.5.2 Location of the entrances on the dyke wall in Hanoi.

the district authorities. However that isn't the only reason for physical division of the neighbourhoods, one of the major problems is the spontaneous, rapid and unplanned establishment of the settlements with which the authorities couldn't catch up with to provide the necessary facilities and infrastructure to meet the populations' needs.

### Accessibility of the river and RUA

The protective dyke wall along the Red river dividing Hanoi and its river-side now urbanised areas has however some entrances which are constructed in a way that can be closed in case of an alarm level of flood. Those entrances are located in some major junctions but are not sufficient enough to provide the necessary accessibility to the residents neither to provide access the river. [FIG. 3.5.3] The visual accessibility is an important factor as well to attract the attention of the people living on the other side. Currently RUA can be seen from the Long Bien bridge, which is the only pedestrian access to the opposite bank of the river. Unfortunately there is no access from the bridge to the riverside neighbourhoods. The only place where one can get off the bridge is the island where in the 1930's a small village existed. [FIG 3.1.3] If access from the bridge is provided there is an opportunity for more people to get to the isolated neighbourhoods and riverbanks to explore. Pedestrian accessibility needs to be improved to attract the attention of locals and tourists.

### Negative Image

Not only visibility is necessary, but a good image of the area. Currently almost nobody who doesn't live in RUA has any reason to go there. One of the reasons is the fact that the areas on the other side of the dyke wall are a place for low income groups and slums, dangerous due to the flood risk. Being hidden behind a physical obstacle a place where backstage, underground activities - such as drugs, prostitution etc., take place at night when almost no light is there. Of course there are part of RUA which have wealthier communities and less sense of safety issues but changing that image is a hard task and will take a big effort from the authorities and the population itself. In other cities located on rivers the riverfront is a valuable part of the city valorized and appreciated by its citizens. But in order to bring the people to the river there has to be an appropriate access to it and transforming the river landscape for the good of the environment. That will not only improve the image but will give opportunities for the development of tourism and therefore for better economic development opportunities.

## Extreme density

The density of some of the wards is so high that windows of a building are facing another one on 10-15 cm and the “streets” dividing them, are about a 1 m wide. This causes problems in case of fire emergencies since in most of the places cannot reach the building but also in case of floods since no evacuation corridors reach to all the buildings. Even small boats will have a difficulty to enter. That is highly reducing the quality of life of the inhabitants as well as the extreme densities have taken away all the available ones spaces for public and open space. Density has to be reduced selectively and open spaces and better accessibility needs to be provided. Improving urban quality and public spaces will immediately improve the general perception of the areas and increase its value.

## Lack of sufficient infrastructure

The existing infrastructure has been constructed more or less when the population was 3 times or more less than it is today, as well as the density. There aren't many streets where cars can access, as for the rest the motorbike is the mean of transport for anything you can imagine. Housing quality in some cases is very poor and informal so infrastructure isn't considered by the local authorities. Access to the river is very limited in most cases one has to be extremely determined to reach and try all tiny roads leading to the next private gate. In fact very few streets arrive directly to the riverbanks and have free access to it, the rest has been overtaken by urbanisation. The riverfront has to be for everyone and is a public and environmental asset.

## SOCIAL ISSUES

### Degrading cultural heritage

In the past the riverside areas were a place for exchange of goods, where crafts villages developed and was a vital part of the city's life. In the areas adjacent to Hanoi some important cultural assets exist - as the flower market in the north close to the west lake, the Long Bien bridge, lived through many struggles of the Vietnamese history and yet was destroyed and reconstructed. Currently it is the only place which attracts tourists and locals because of the fresh air and view to the river it provides. Another one of the very important places is the Long Bien market located right next to the foot of the bridge. That area precisely used to be the gate to the Thang Long citadel and place where crafts and goods used to arrive by boats. All of the mentioned above places are still important for the community but they have been left with no maintenance and are degrading for years now. Improving the conditions of the markets, the bridge and providing recovering a part of the history will not only revive the area but will be an economical activator and attract the attention of locals and tourists.

### Understanding people's culture and perception of the natural environment

What is interesting is the way in Vietnamese people perceive a space. Through my observations and one more time confirmed by the expert report for the water purification of Hanoi, the perception of spaces and the way they are being treated by people is defined by their productive capacity. Classified as usable and useless spaces. Usable spaces are those cultural, commercial spaces that are contributing to the quality of life are considered as useful - such as the street where they have their business, the place where their children play etc as for useless spaces are considered the nature and environment - second rank spaces, useless and to serve as “garbage spaces”. [FIG 3.5.3 & 3.5.4] I believe understanding how their mind set works is crucial to finding the right development strategy which will provide a useful function to what for them is



FIG. 3.5.3 Useless space - River banks with wastewater evacuation transformed into a non regulated garbage disposal; Location: Tu Lien ward, April 2014



FIG. 3.5.4 Useful space - Major street in RUA, serving for a daily market Location: Phuc Xa ward, March 2014

now not and hence they simply do not care about it.

## **MANAGEMENT AND GOVERNANCE**

### **Illegal settlements**

In order to start up any process be it for improvement of urban quality, redevelopment of the areas and complete resettlement or any other the legal status of the inhabitants have to be defined. The regulations today state that no construction in those areas is allowed. People mostly haven't got all the necessary documents for their property and the government has no solution for that at the moment. Neither can they be all resettled since no available place for that many people is there nor should they be allowed to continue to consume what is left of the dyke. A solution to this problem will kickstart a new redevelopment project for the better of RUA and Hanoi.

### **Lack of data about RUA**

In order for a project to be precisely defined precise data has to be available. In those terms RUA is having a big issue. No maps of the precise urbanisation are available, neither the distinction of semi formal and informal settlements. Monitoring maps of the flood levels are necessary and they have to be made available to the public so that inhabitants can know the risk for their property and themselves. Such kind of data is indispensable in implementing a strategy or plan or in applying any kind of control over illegal developments.

### **Lack of development strategy**

The development in these areas has already taken place with the lack of any control but with all the mentioned

above issues are the consequences of it. The question of RUA becoming a part of Hanoi is lying in finding the solution to at least a part of those issues. However any redevelopment of such a vast areas needs to have a strategy and implementation plan to make sure the execution won't fail.

### **Malfunctioning legal and governance system**

On the last place but certainly not least the governance fragmentation has to be resolved as well as any further regulations and law have to be clear in how they are supposed to be implemented with precise plans, targets and who is to be responsible. Maybe power has to be given to the local authorities to a certain extend in order to stop squatting but they have to be obliged to follow the larger development scheme.

## PROJECTS FOR RUA

## 3.6

The areas considered having so many problems but however some advantages, have attracted the attention of some institutions and three projects concerning the future of the Riverside Urban Areas have been proposed in the last 10 years:

### 1st Vietnamese Northern Hydraulic Institute project -

concerning the upgrading of the whole Red river system of dykes to the new classification and in particular the construction of a new future dyke for RUA.

### 2nd South Korea project -

Concerning only the redevelopment of RUA in the limits of Hanoi's urban districts, by the construction of a new future dyke to protect the riverside urban areas and pursue new urban development in the newly protected areas.

### 3rd Japanese project -

Considering only the redevelopment of RUA in the limits of Hanoi's urban districts, by the construction of reduced new dyke in some areas and remove settlements from the areas with flood risk.

**The main common element** of all the three projects is the fact that all of them find the solution for the future of the Riverside urban areas in the **construction of a second dyke** to protect part of the existing settlements or develop new ones. [ FIG 3.6]The first project wasn't directly made to answer the issues of RUA as its scale concerns all the RRD, but it will however directly influence its future if the second dyke gets built. Project two and three are on the contrary especially designed to answer the issues with the future of RUA and have some common elements - such as resettlement of large parts of RUA to leave space for new urban development in the newly protected areas by the dykes all the above projects are proposing.

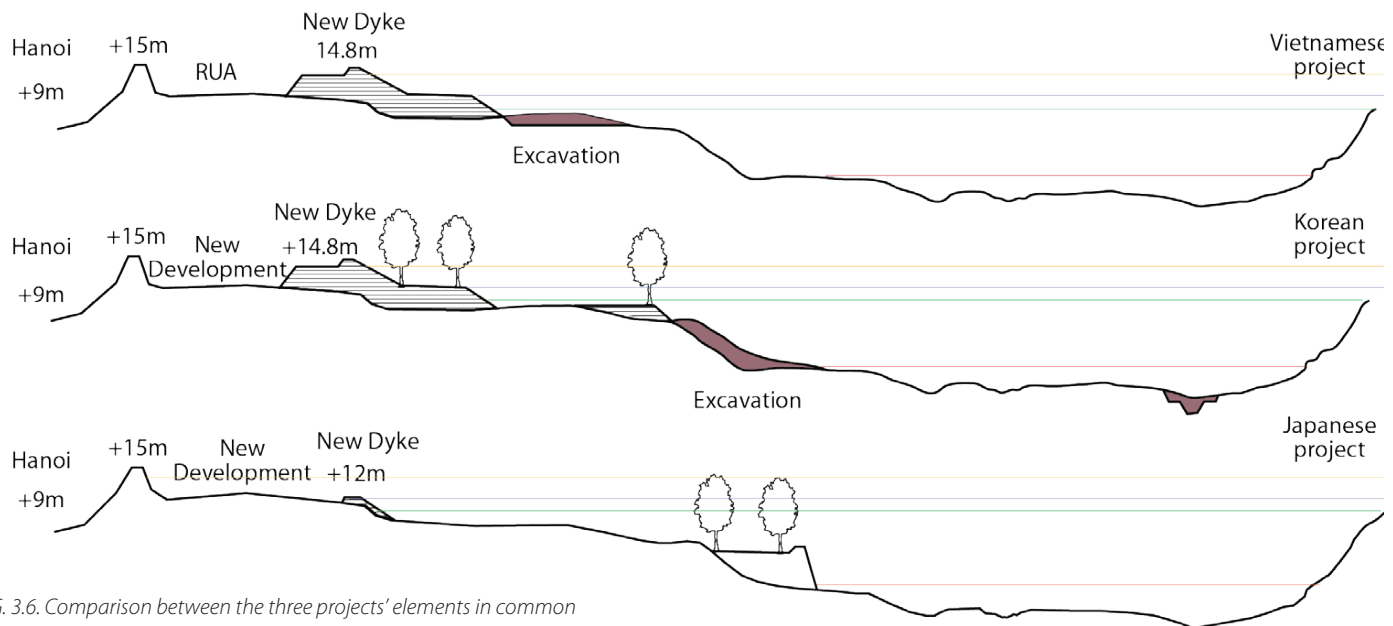
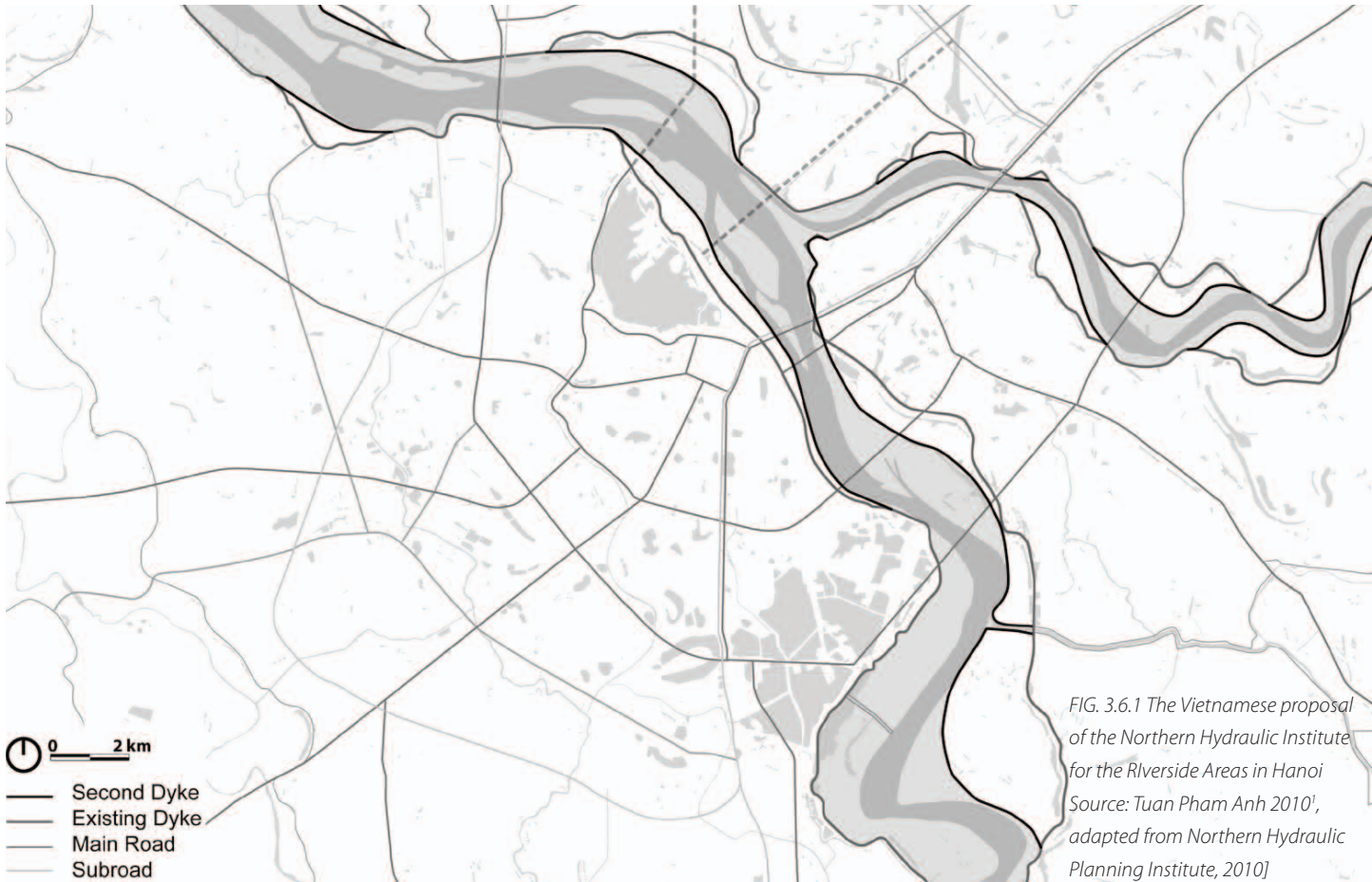


FIG. 3.6. Comparison between the three projects' elements in common  
Source: Tuan Pham Anh 2013



## THE VIETNAMESE PROJECT

The project of the Northern Hydraulic Planning Institute has proposed for flood control in the Red river is a whole strategy for upgrading the dyke system in the RRD to the new classification was to begin implementation in 2010. It concerns not only the Red river but all the rivers in the

delta. The ambition of the project is to upgrade all dykes along the right banks of the Red river and widen them to 15m and on the left banks to 12m. A 1.5 m wall is to be erected on top of all dykes on both sides of the Red river. Stone embankments are to be constructed where the river banks are most vulnerable to floods.

The project proposes a second dyke parallel to the existing one, concerning directly the Riverside Urban Areas. [FIG 3.6.1 ]. All the actions

in the project are threatening the flood capacity of the Red river by reducing its already narrow flood plain and those of its tributaries. That would eventually mean that the thread for a future disastrous flood that might affect Hanoi would become higher if the project is fully implemented.

On the other hand the government is desperately searching for a solution to legalize the enormous urbanization outside the dyke. The proposal of a second dyke will eventually allow for the legalization of a part of the existing already neighbourhoods, and allow further improvements and development between the 2 dykes. However the implementation on this project haven't taken over and moreover other 2 projects proposing solutions to deal with RUA's urbanisation have been proposed,

## THE KOREAN SKYSCRAPER CITY ON THE RED RIVER

The project derives from a collaboration for exchange of knowledge between Seoul's Han river and the Red river experience of Hanoi. In it's root the idea for this project was to create a riverfront for Hanoi in order to bring the river closer to the city and reestablish the relationship with, as well as improve water management and flood control and boost economic development and recreation along



FIG. 3.6.3 The Korean proposal for the Riverside Areas in Hanoi .

Source: <http://vietbao.vn/>

the river. The project is proposing a second dyke, which on top will include an arterial road to provide good access to the planned skyscrapers development. The urban development is to happen between the two dykes, as the new one will have a height of 14.8 m, which for the moment is high enough to keep the areas dry even with the highest for the moment flood of 14.13 m with a return period estimated at 125 years. [FIG 3.6.2]

Since the project is proposing a high rise development in the areas of intervention and construction of a second dyke **all the current inhabitants will be forced to be resettled**. Since for a large part of RUA the legal status for the ownership and land use isn't clear it is possible that a large number of them won't be compensated for the relocation, but a considerable part of them will be and that will **increase the cost of the project interventions** . That is a social aspect of the

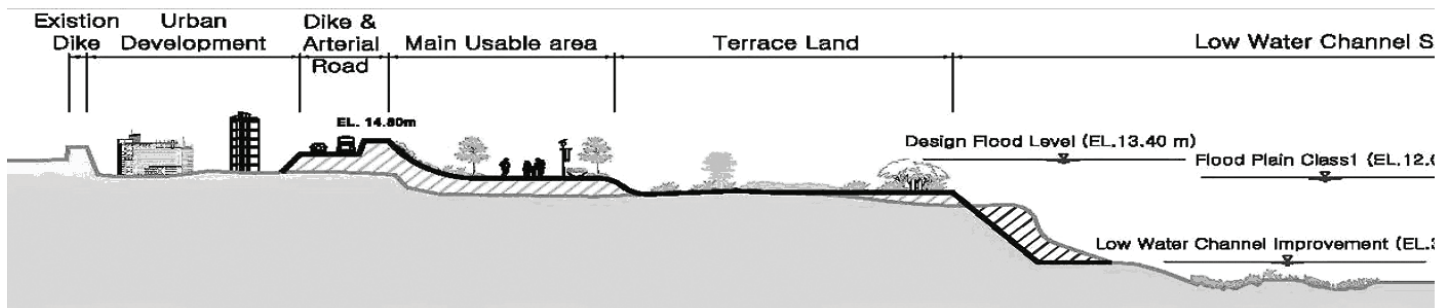


FIG. 3.6.2 The Korean proposal for the Riverside Areas in Hanoi , section showing the second dyke and modification of the river bed.

Source: Tuan Pham Anh 2010', [Red River Project Team, Main Report. 2007]

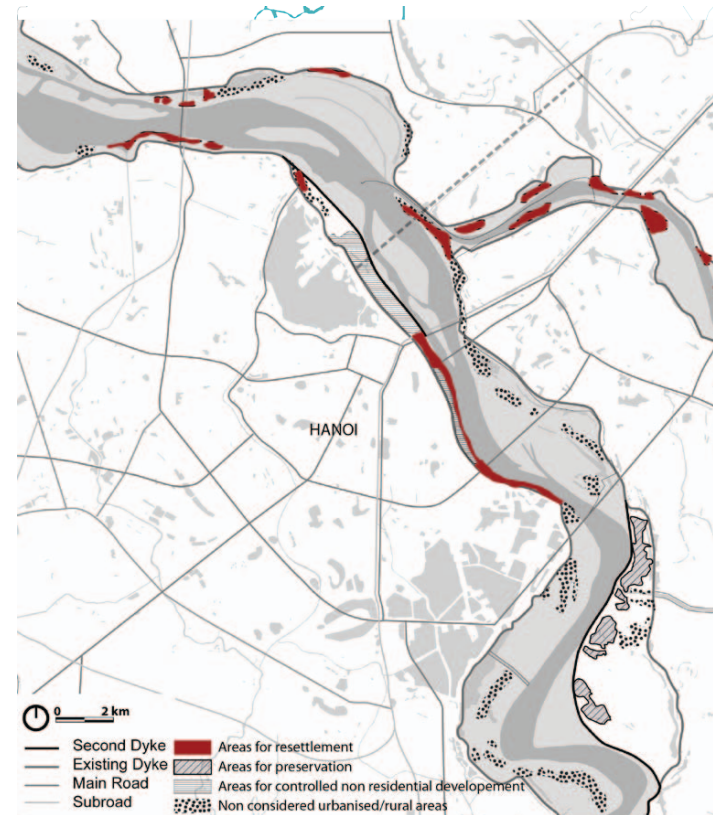


FIG. 3.6.5 Plan of the Japanese proposal for the Riverside Areas in Hanoi .

Source: Interpreted map adapted from Tuan Pham Anh 2010<sup>64</sup> and HAIDEP<sup>65</sup>

FIG. 3.6.4 Plan of Korean proposal for the Riverside Areas in Hanoi . Even though not as offensive for the river as the project of the National Hydrology institute the proposal is restricting the river in the limits of Hanoi to a narrower and artificial corridor/canal. That can be considered completely destructive for the environment and nature, not to mention the social impact of such a resettlement project. The only areas previewed to be preserved is the Bat Trang ceramic crafts village downstream south.

Source: [Tuan Pham Anh 2010<sup>64</sup>, adapted from Red River Project Team, Main Report, 2007]



project that has not been taken care of in the Korean proposal. But that isn't the only issue though, this project, as the one of the Northern hydraulic institute is proposing a scheme which is treating the natural conditions of the river with a very abusive artificial approach completely **against any sustainable development**. The construction of a second dyke in this case as well as in the previous one **will reduce the flood plain** of the Red river, even though in some places excavation of the banks has been previewed in general the capacity of the flood plain will be drastically reduced which consequently will increase the flood risk for Hanoi and the future urban development of RUA between the two dykes.. [FIG 3.6.3].

## THE JAPANESE PROJECT

What I am calling the Japanese project is in fact a collaboration between the Hanoi People's Committee and Japan International Cooperation Agency ( JICA ) for a new development program for Hanoi Capital between 2004 and 2007 They developed a project named as the "The Comprehensive Urban Development Programme in Hanoi Capital City of the Socialist Republic of Vietnam (HAIDEP)" of which a part was Pilot Project C: The Improvement Plan and Strategy for The Outside-of-dyke. The project looked at a 40 km stretch of the Red river Banks in proximity to Hanoi that have been illegally constructed in the past decades.

In its nature and strategy out of the 3 projects I am exploring, I can say this one is the least offensive towards the nature and environment of the river. In the strategy and goals of the project the main point is to **valorize the qualities of the Riverfront and the natural landscape** as at the same time turning the riverfront areas to the backbone for culture and recreation of Hanoi. The project has well **explored the cultural and**

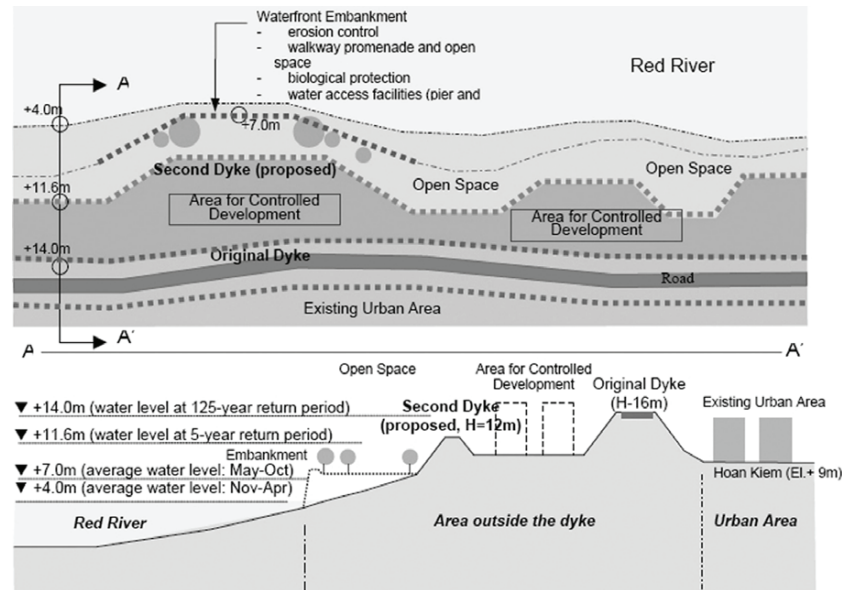


FIG. 3.6.6 Detail plan and section of Japanese proposal for the Riverside Areas in Hanoi .

Source: HAIDEP<sup>65</sup>

**historical characteristics of the existing settlements and recognise the need for some of them to be preserved.** But at the same time huge parts of **the most dense areas of RUA are planned for forced resettlement.**

[FIG. 3.6.5] As the previous 2 projects this one has the strategy of building a second dyke not far from the first one, but only in 2 places and the height of it is planned for 12 m. That is considered to be the 5 year return period for extreme floods over that height. Another difference is that the areas between the 2 dykes are for **non residential controlled development**. [FIG 3.6.6] Those areas corresponding now to the wards of Tu Lien, Yen Phu and Phuc Xa are densely populated and the **resident's have to also be resettled in order to implement the project.** Controlled non residential development will allow for any other kind of activities such as offices, cultural facilities as the areas are considered stra-

tegie in terms of having historical traces of crafts villages, and others. What I am concerned about is that the lack of residents might create a deserted situation during the night which therefore will reduce the safety perception in the area and create further security problems. A positive side of the project is that they are **keeping the areas outside the dyke for agriculture and green spaces which is already the case in RUA.**

## FINAL CONSIDERATIONS

The development potential of RUA is strong and not only its inhabitants have discovered it but all development and planning teams whose project I have presented above have seized the economic benefits of urban development in the outside dyke areas. **The problem is they are all trying to give solutions that go against the nature of the river and without considering the real possibility of resettling a 160 000 or probably much more inhabitants from those areas.** Climate change scenarios have not been considered in any of the projects and as I have already discussed in Chapter I all forecasts are predicting more rain and higher risk of disasters. Not only the proposals are socially and environmentally destructive but extremely costly and the country's economy is not a state that can afford such an intervention.

*FIG. 3.7.1 Entrance to RUA through the dyke wall. In case of a flood emergency, the gate is closed to protect Hanoi from floods and RUA is cut for traffic.*

*Location: Long Bien market, Phuc Xa ward, Hanoi, March 2014*





FIG. 3.7.2 The 2 meter tall dyke wall built during the 90's to increase the protection of Hanoi to floods as high as 15m is separating the historical center of Hanoi from the Riverside Urban Areas  
Location: Long Bien bridge, Phuc Tan ward, March 2014



*FIG. 3.7.3 A floating house, with a vegetable garden located in the flood plain and a floating one in the river. The access to land is through a tiny wooden path bridge, or by boat.*

*Location: Phuc Xa ward, April 2014*



FIG. 3.7.4 Access to RUA in front of Long Bien market. A woman carrying goods to sell in the city. In the background the Long Bien Bus Station major Exchange node in Hanoi and the dyke road with its never ending traffic of motorbikes



FIG. 3.7.5 Kind playing in the existing promenade along the Urban limits meeting the flood plain of the Red river in the Riverside Urban Areas.  
Location: Phuc Tan ward, March 2014



*FIG. 3.7.6 High Quality floating house part of the Phuc Tan port in Chuong Duon ward during dry season. Access is provided by adapted to float metal path which at this period is partially sitting on dry ground;*





*Location: Phuc Tan Port, Chuong Duong ward, April 2014*



FIG. 3.7.7 View from Long Bien bridge towards the Long Bien market and Hanoi historical center in the background. The areas under the bridge are underused and separated with fences. March 2014



*FIG. 3.7.8 View from Long Bien bridge towards the River. The areas under the bridge are occupied for the purposes of the Long Bien market adjacent to the bridge. Urbanisation has reached the wall separating the residential area from the bridge. The market has spread to the bridge using its buffer space. April 2014*



*FIG. 3.7.9 Riverside urban areas viewed from the Long Bien bridge over the river looking towards the historical center of Hanoi. Strong urbanisation to the limits of the dyke. The extra land revealed by the river during the dry season is occupied for agriculture. Location Phuc Tan ward, March 2014*



*FIG. 3.7.10 Squatting in the lower lying areas in the flood plain of the Red river. Self constructed houses whose inhabitants are mainly cultivating the available land of the floodplain. Located at the foot of the step dyke they are threateting the safety of the dyke  
Location: Tu Lien ward, April 2014*





FIG. 3.7.12 Floating community adjacent to the island crossed by the Long Bien bridge. Background in construction Nha Tan bridge  
Location: Island in the Red river, Phuc Xa ward, March 2014



FIG. 3.7.13 Natural sand landscape revealed during dry season in the red river flood plain. Locals using the space to relax of urban noise, pollution and motobikes  
Location: Red river flood plain, Tu Liem ward, April 2014





*FIG. 3.7.14 Young group of teenagers enjoying the sandy river landscape and organize parties.  
Location: Red river flood plain Tu Liem ward, April 2014*



FIG. 3.7.15 Phuc Tan port. Floating pontoon staying on ground during dry season still providing access to the floating structures.  
Location: Chuong Duong ward, April 2014



FIG. 3.7.16 View from Phuc Tan port  
Location: Chuong Duong ward, April 2014

The development of Hanoi after 1954 when the french colonisation was over, started strong with expansions of the city, including the flood plain of the Red river due to it's attractive location and traces of history. The riverside areas were given the urbanisation green light by the government projects that started in the 1950's with some public housing projects, which at that time were not expected to one day become a part of the issue in RUA. With the Doi Moi and the years of fast economic growth and migration towards the city, the advantages of proximity to the city center and low prices in RUA continued attracting more and more newcomers as well as Hanoi-ans willing to have more space for a lower price, or those who were broke and had no money to build elsewhere as well as some who had inherited land use rights from their ancestors. At that time yet no regulations or plans existed for the urbanisation of RUA. The first one came in 1989 - the Ordinance of the Dyke with the aim to bring order and control the development. Squatting and illegal constructions were already becoming a problem during the 1970's and which aggravated in the future decades. The unclear for implementation ordinance and the clumsy administrative system couldn't succeed much in dealing with the problem at that time. In the years when the population in RUA doubled ( 2000- 2004 ) a new attempt for dealing with urbanisation there was made, by issuing a second Dyke ordinance in 2000 and a decree to it in 2003 to clear up some "black holes"of the regulation. That didn't bring much of a hope neither, as the decision making process by the authorities was too long and none of the offenders was respecting the restrictions. Meanwhile a number of serious issues have grown in those "new" parts of the city and the authorities seem to have no clue of how to deal with the emerged urban mess. Flood risk and lack of regulation and control seem to be the main issues. Another problem is that in the master plan for the development of Hanoi till 2030, these areas' development

isn't mentioned and no strategy or actions for their future have been proposed. Hanoi is planned to grow on both sides of the river, and that will put the Red river and RUA in the center of the growing capital. The ambition of the government for Hanoi gaining more economic power in Vietnam and attracting investments, visitors and inhabitants is not considering the necessity to invest in urban quality and environment in what is to become the center of the capital - RUA . Furthermore the lack of public spaces in Hanoi has diminished due to the increased density over the years. The riverside needs to be valorized and preserved.

Moreover growing awareness of climate change and possibility of future floods is pressing the government to find a solution to the out of control and regulation RUA. A few projects have been developed proposing on one hand similar to one another projects. All of them rely on the strategy of constructing a second dyke along the existing one in order to protect the existing constructions in the floodplain and provide a way to clear their legal status. Those proposals are taking away from the flood capacity of the river in case of very high waters and put not only the outer dyke areas at risk but Hanoi itself as well. A solution is of course necessary but I believe it has to be one that doesn't go against the nature of the river and it's environment but work with it and allow the cohabitation of many uses in the same place over the different seasons. Realistically looking at the number of inhabitants in RUA and the fact they do not **perceive floods as something more than just an inconvenience it's clear that they have found a way to adapt to those conditions** resettling them all might not be the best solution. **The government is looking for a solution for their safety in order to legalize that development** but such an operation is barely possible as the costs for resettlement will be very high and in the current situation with housing stock and available land for development in Hanoi resettling a population equal to a district doesn't seem to be anything close to a wise decision.

What I suggest can be done instead is improve control and issue new regulations as well as facilitate decision making and give power to the relevant authorities to exercise the necessary control. On the other hand a more sustainable approach and **a strategy for RUA is necessary along with forward thinking, that considers issues such as**



**climate change, pollution, energy, food etc.** The riverside urban areas need to have a separate strategy and integrated land use and development plans due to their specific nature and a large number of inhabitants

on a limited land surface with particular environmental conditions. Re-thinking governance, strategy and environment will play a crucial role to Hanoi becoming an example for sustainable development for the years to come.

*FIG. 3.8.1 Living on the boat, on the background Chuong Duong Bridge and a new urban development in Long Bien district on the left bank of the Red river  
Location: Phuc Tan ward, Hanoi, April 2014*



***“Vietnam will have only one chance to get urbanization right. If we fail at urbanization, we will fail at industrialization and modernization.”***

*-- Deputy Prime Minister Nguyen Sinh Hung, speaking at the Vietnam National Urban Conference, November 6th-7th, 2009.*

## **ALTERNATIVES TO DEALING WITH THE PRESENCE OF WATER IN RUA?**

## **IV**

In the long history of existence of Hanoi the areas outside the dyke have been mostly occupied by agricultural activities and crafts villages that were located there for different strategical reasons such as the presence of raw material, river transportation ect.. After 1986, Hanoi started growing fast attracting more and more inhabitants part of which found the riverside areas to have advantages overweighting the flood risk of living there and developed new communities with their relative activities. However after the construction of the wall and the urban highway on top of the dyke RUA got physically separated from Hanoi's center.

What we find today is great mixture of old and new, tradition and new practices and the inseparable part of it all - the landscape of the Red river.

From the historical part major cultural landmarks are the still existing but under maintained and devalued. Long Bien wholesales market, the famous in Hanoi flower market in Tu Lien ward, the numerous pagoda's spread around close to the historical villages. One of the major landmarks of RUA is the Long Bien Bridge - the first bridge over the Red river. [FIG 2.1.6] It was partially destroyed during the American war but was reconstructed and represents an important element of the Red river landscape recognized by everyone. Today it is one of the major tourist attraction and daily visited by many locals in search for the romantic view and the natural breeze one can feel from the river.

One of the most famous craft villages in Hanoi is the ceramic craft village Bat Trang located south in the flood plain in RUA. It is a famous tourists attraction but however is still not well maintained and access to it by the river isn't a common practice.

One of the predominant activities in RUA is still the agriculture and it's spread all along. A part of the production is being sold directly in the Long Bien market or on the bridge. The Long Bien Market is also known as the night

market, due to the fact it opens at midnight to provide the goods sold in the city markets throughout the day. Located right next to the Long Bien bridge, it creates a vibrant area changing faces 24 hours a day. The streets of the wards in RUA are full of activities of any kind occupying the little amount of space between the buildings The Riverside Urban Areas and especially the areas around the market suffer from bad image of being insecure as during the night, remaining always cut from the city view and lacking light in the narrow lanes, illegal activities emerge.

Close to the ancient quarter Phuc Tan port is located which isn't an industrial one but rather a small one for certain deliveries and fishing. In it's vicinity a number of floating houses can be spotted which tend to be rather good quality constructions.

The hot point for the urban activities is Long Bien bridge having the market on its left and a large sports center on it's rightm which is though, hard to access. That place is the closest to the ancient citadel and to the ancient quarter - big touristic attractions in Hanoi located right on the other side of the wall. Right in front of Long Bien Market a major bus exchange hub is located as well as the Long Bien train station.

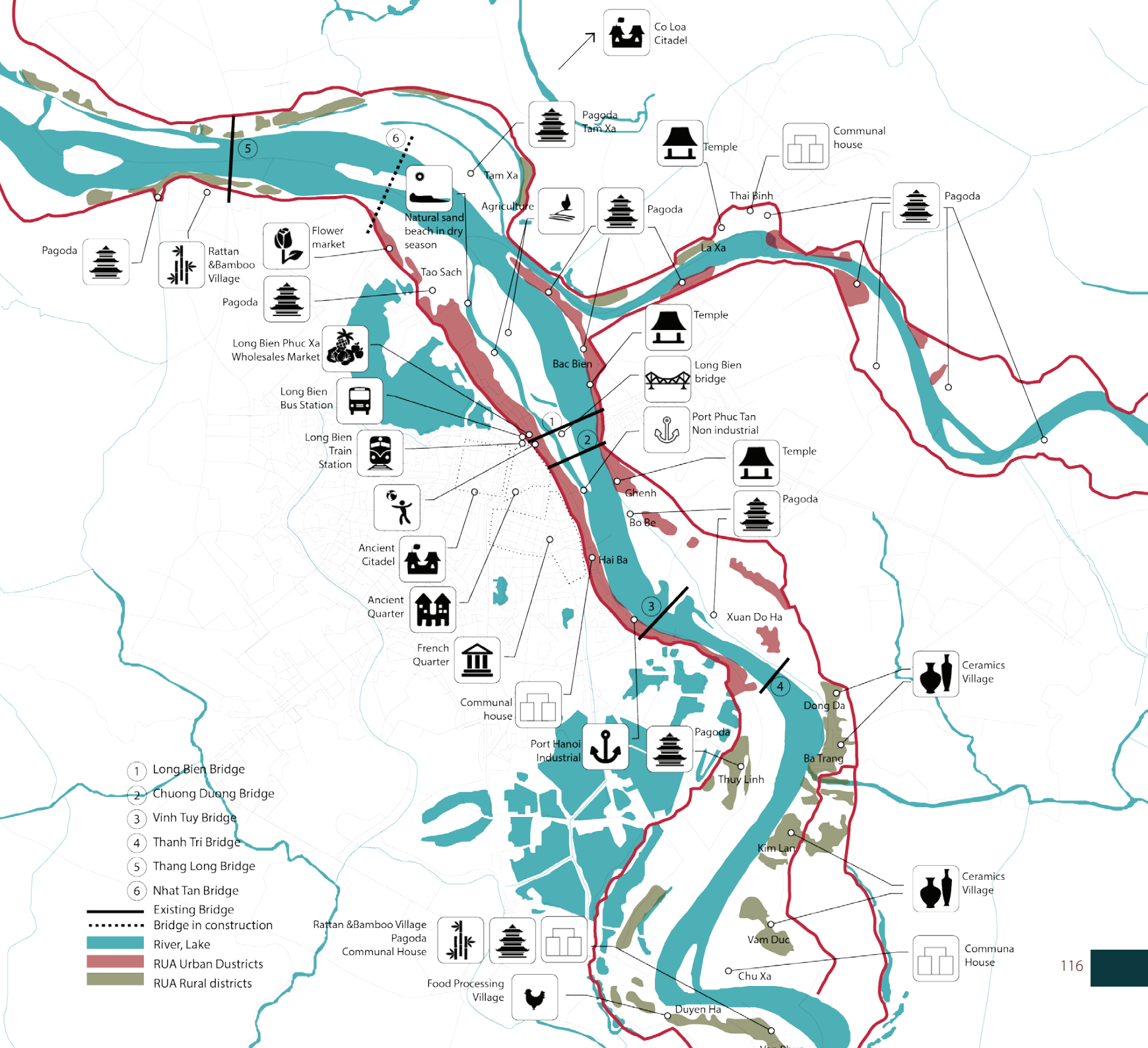
All these make this area quite interesting for further experiment of urban improvements in RUA.

In the areas further away from the central part of RUA we find the famous flower market of Hanoi, and bamboo crafts village. The natural landscape of the river during dry season reveals large plains full of sand where locals have found a nice place to take a break from the city but that still remains hard to access. [FIG. 3.7.13 & 3.7.14]

In the south of Hanoi right next to Vinh Tuy bridge the large Hanoi port is located. It is dedicated to industrial activities with it's adjacent areas in RUA. Large parts of RUA are full of mixed use houses where locals live and do business. A few government offices can be spotted in the areas where development was promoted before the 1992.

All these elements speak for an established community which has valuable cultural and environmental assets which are unfortunately not appreciated by the city and it's people. It is necessary to gather all these elements to redefine their value and design a new future for the riverside urban areas.





- ① Long Bien Bridge
- ② Chuong Duong Bridge
- ③ Vinh Tuy Bridge
- ④ Thanh Tri Bridge
- ⑤ Thang Long Bridge
- ⑥ Nhat Tan Bridge

- Existing Bridge
- - - Bridge in construction
- River, Lake
- RUA Urban Districts
- RUA Rural districts

Co Loa Citadel

Pagoda Tam Xa

Temple

Communal house

Pagoda

Rattan & Bamboo Village

Flower market

Natural sand beach in dry season

Tao Sach

Agriculture

Pagoda

Temple

Thai Binh

Pagoda

Long Bien Phuc Xa Wholesales Market

Pagoda

Long Bien Bus Station

Long Bien Train Station

Bac Bien

Temple

Long Bien bridge

Port Phuc Tan Non industrial

Temple

Ancient Citadel

Ancient Quarter

French Quarter

Communal house

Port Hanoi Industrial

Pagoda

Ghenh

Bo Be

Hai Ba

Pagoda

Xuan Do Ha

Ceramics Village

① Long Bien Bridge

② Chuong Duong Bridge

③ Vinh Tuy Bridge

④ Thanh Tri Bridge

⑤ Thang Long Bridge

⑥ Nhat Tan Bridge

— Existing Bridge

- - - Bridge in construction

— River, Lake

— RUA Urban Districts

— RUA Rural districts

Rattan & Bamboo Village  
Pagoda  
Communal House

Pagoda

Communal house

Food Processing Village

Food Processing Village

Port Hanoi Industrial

Pagoda

Thuy Linh

Pagoda

Kim Lan

Ceramics Village

Ba Trang

Vam Duc

Communa House

Chu Xa

Duyen Ha

## INFRASTRUCTURE CONCERNING RUA

Major role in the future of the riverside urban areas might play the big infrastructure projects that are being elaborated. According to the master plan of Hanoi 2030 - 2050 a number of bridges are to be constructed in the coming decades. Considering that currently Long Bien is the only bridge to provide pedestrian access, it is of great importance to adjust the plans for the new bridges to integrate that to allow a better and safer accessibility for slow traffic such as pedestrian and bikes and link their access to RUA. One important issue with the construction of new bridges will be the necessity to resettle a number of RUA's inhabitants. However that can be used as an opportunity to integrate the surroundings of the new bridges as a revitalization of the areas in order to improve the quality of the environment and provide quality public spaces and access to RUA and the river.

Currently in discussion is the future of Long Bien bridge as it is in a very bad condition and it is necessary to substitute its function as a railway bridge with a new upgraded one, that will have the necessary capacity to carry passengers and goods in the future. The ministry of construction is to take a decision of where the new bridge will be located and a few proposals are on the table. Three of them are that it should be built adjacent to Long Bien on 30, or rather on 100 or 500 m away and keep the old one to adapt it for the metro or light rail, necessary to provide public transportation to link Hanoi's both sides. In any case the Long Bien bridge is an important landmark for Hanoi and the Minister of Construction have taken an official decision. The french government is ready to invest in a renovation project for the bridge which will be another opportunity to revitalize the area around it. However all those projects are still only discussions and have not materialized in a defined project yet. There is an interesting project by the urbanist Nga Nguyen that proposes to renovate the Long Bien and transform it into a contemporary art museum 2.4 km long on the bridge. The project has

a lot of supporters but many do not agree that taking the purpose of the bridge of carrying passengers is the best solution as per the limited amount of bridges in Hanoi at the moment.

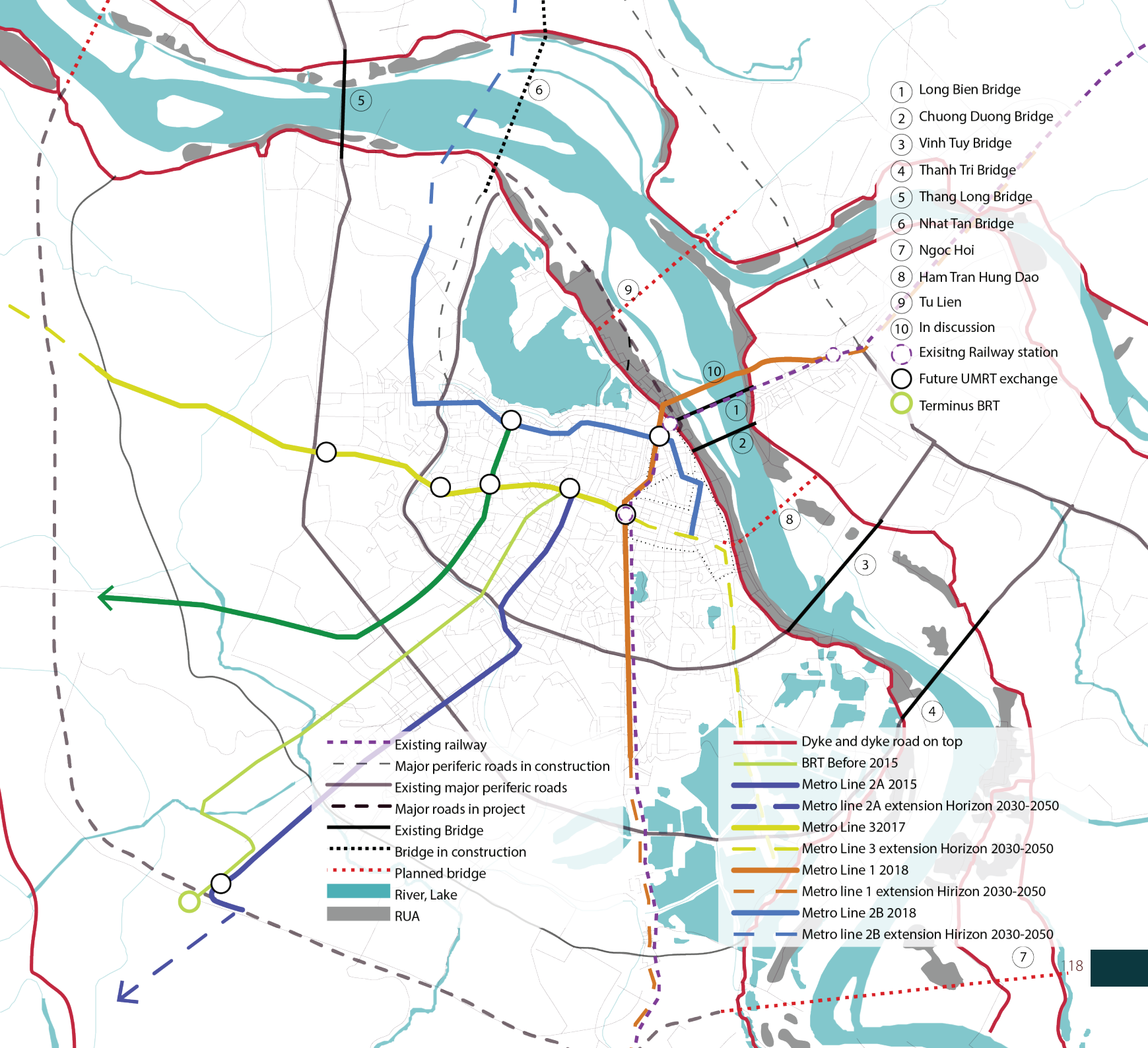
Currently Hanoi is building its metro network to improve the mobility and accessibility by public transportation in the growing capital. What is to become line one of the Hanoi metro is supposed to be finished by 2018 and cross the Riverside Urban Areas. Depending on how the exchange node will be designed and where it will be located and what access there will be regarding the RUA, it can have a positive or a negative effect on the urban environment. In all cases accessibility and an inviting urban environment has to be provided equally for all the surroundings of the new metro stations. Also very important is to preview a station on the island and provide access to it since it is a place that is getting more and more frequented by people searching for the nature in the city .



FIG. 4.1.5 Major interchange station Long Bien, background view of the bridge and market, Source: IMV- Hanoi

FIG. 4.1.4 Major infrastructure in Hanoi. Projects concerning the Riverside urban areas

Source: Drawing by author, data collected from Tristan Morel 2013 and Hanoi Capital Construction Plan 2030-2050



- ① Long Bien Bridge
- ② Chuong Duong Bridge
- ③ Vinh Tuy Bridge
- ④ Thanh Tri Bridge
- ⑤ Thang Long Bridge
- ⑥ Nhat Tan Bridge
- ⑦ Ngoc Hoi
- ⑧ Ham Tran Hung Dao
- ⑨ Tu Lien
- ⑩ In discussion
- Existing Railway station
- Future UMRT exchange
- Terminus BRT

- - - Existing railway
- - - Major periferic roads in construction
- - - Existing major periferic roads
- - - Major roads in project
- - - Existing Bridge
- - - Bridge in construction
- - - Planned bridge
- River, Lake
- RUA

- - - Dyke and dyke road on top
- - - BRT Before 2015
- - - Metro Line 2A 2015
- - - Metro line 2A extension Horizon 2030-2050
- - - Metro Line 3 2017
- - - Metro Line 3 extension Horizon 2030-2050
- - - Metro Line 1 2018
- - - Metro line 1 extension Hirizon 2030-2050
- - - Metro Line 2B 2018
- - - Metro line 2B extension Hirizon 2030-2050

# HYDRAULIC ASSESSMENT OF THE RED RIVER

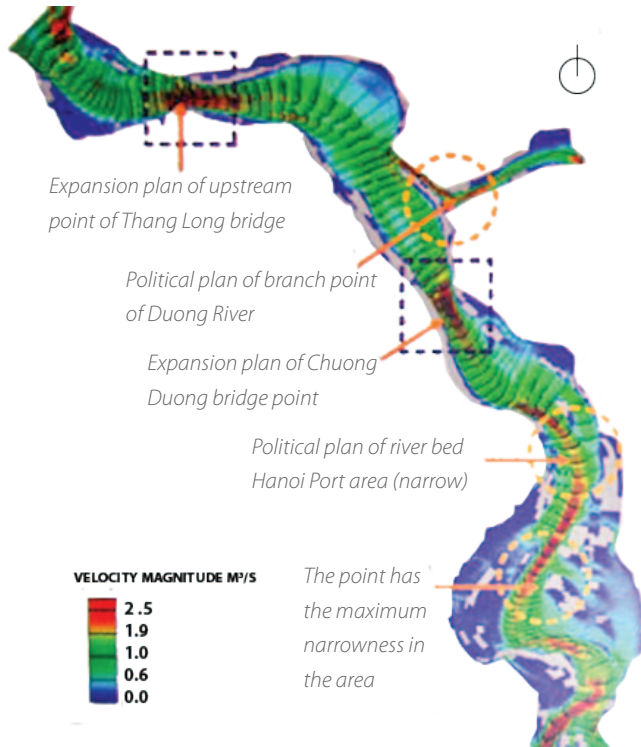


FIG. 4.1.6 Hydraulic assessment of the Red river - current situation  
Source: [www.ashui.com](http://www.ashui.com), Translation Do Thi Ngoc Chau

The above images represent the Red river flow designed using a computer technology. [FIG 4.1.6] is representing the current situation of the river flow according to its velocity. The image consists of the whole Red river flood plain in the limits of the Riverside Urban areas. What is clearly visible are the existing today settlements in grey. It is important to remark the fact that the velocity of the river flow is high at the center of the river and reducing

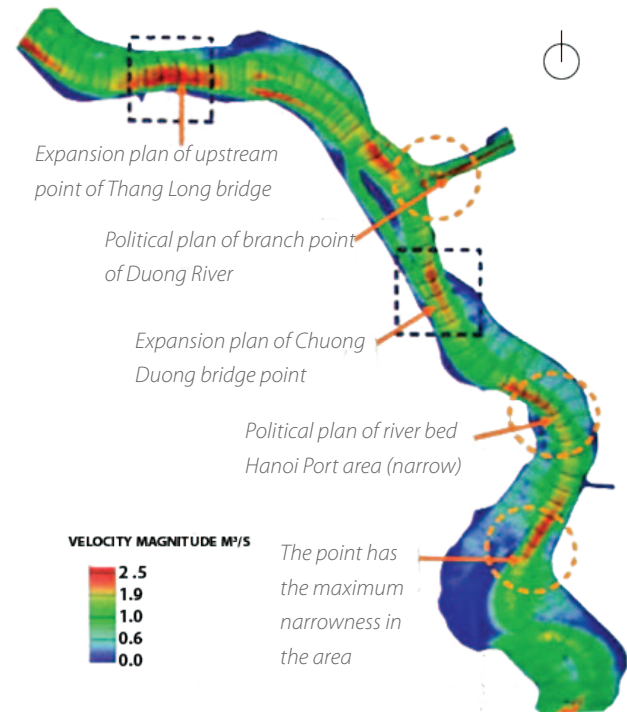


FIG. 4.1.7 Hydraulic assessment of the Red river - planned in the Korean project; Situation of the river flow after the new dykes construction  
Source: [www.ashui.com](http://www.ashui.com), Translation Do Thi Ngoc Chau

to zero in the extremities. That explains the fact that the RUA has urbanised and continues because the flood conditions and velocity of the flow in the periphery of the river allow a certain safety for the inhabitants. It is also interesting to mention that some of the floating communities present in the waters of the Red river are sometimes located closer to the higher velocity flow but they seem to have chosen areas that have protection barriers breaking the flow and keeping the floating structures safe. [FIG. 4.1.9]

## PROPERTY MARKET. RUA COMPARED TO HANOI

Fast economic development in the last 20 years brought large amount of people and continues to, while the property market is still unable to answer the demand for accommodation. In 2003 a new land law regarding land use and property was issued, which defined the switch from a government controlled to a market based system. That caused some major problems one of which is the emergence of prices in Hanoi higher than the real values due to speculations and lack of knowledge about the real estate market.

Depending on the established prices in 2008 Hanoi can be divided in 5 zones<sup>66</sup>- the ancient quarter - known as the 36 streets, The French quarter, areas built between 1960 -1990( after the leave of the French), areas built after 1990 (the Doi moi and the big expansion of Hanoi), Outer Dyke Area ( RUA),

**The ancient quarter** exists since the establishment of Hanoi and is the place where the highest concentration of residential, manufacturing and trading activities in Hanoi, where usually people live and develop their business in the same place. It has however reached the density limits and infrastructure isn't sufficient for that. It is however very attractive and popular tourist destination combining the old tradition and the dense trading center of Hanoi. Those factors make it the most expensive part of Hanoi [FIG. 4.1.3] despite the decreasing quality of the urban environment.

**The French quarter** -built during the french colonisation period, it has a distinctive character of wide avenues and western architecture, accommodating most of the governmental buildings and embassies in Hanoi. It accommodates business, residential and government official areas. The quality of infrastructure is good, maintained, the urban structure as well, combining a diversity of activities and with it's proximity to the ancient quarter it becomes the second most expensive area in Hanoi at

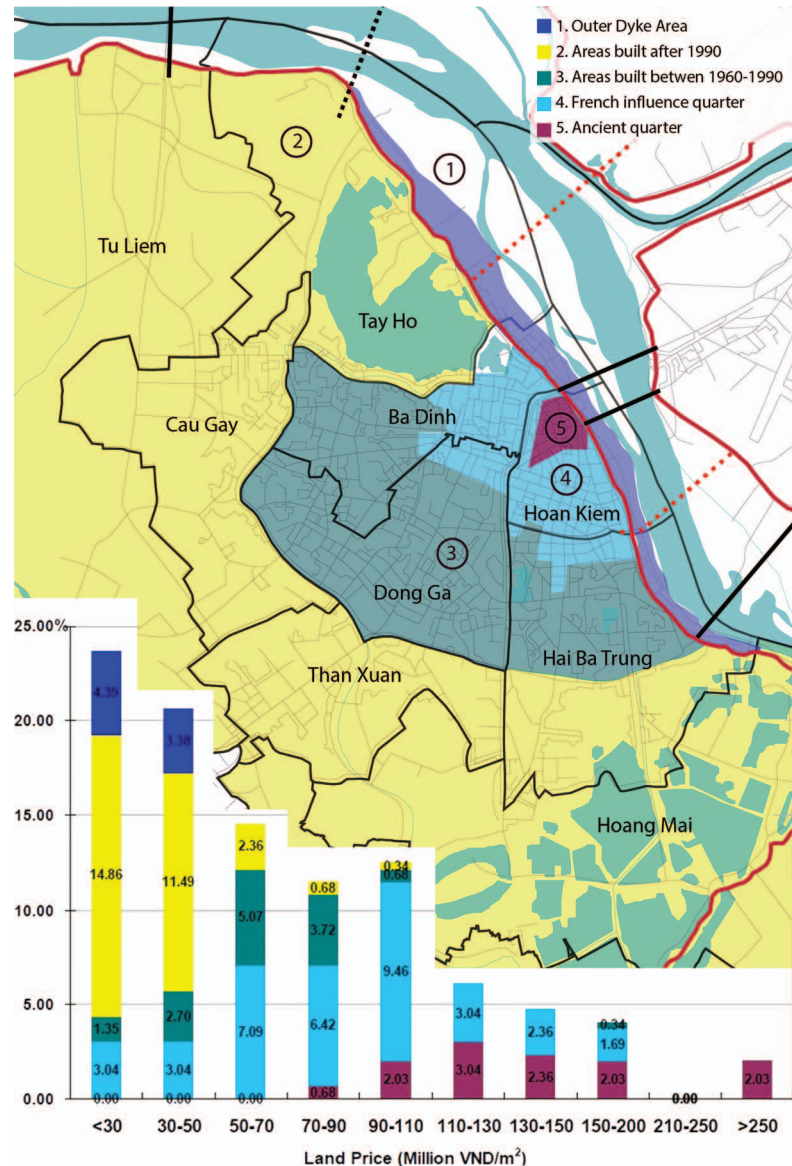


FIG. 4.1.8 Property values in Hanoi

Source: Hironori Kato, Le Hong Nguyen, (2008)

times reaching the old quarter. [ FIG. 4.1.3]

**The areas built between the 1960 - 1990** are a combination of a planned development and integration of already existing villages into the urban structure of Hanoi. The integration of villages was however not done in an infrastructure efficient way and is today causing traffic congestion due to the old and narrow paths in the villages structure. These areas however are still attractive in terms of price due to their location in the urban core with relatively good infrastructure and accessibility and therefore their value on the property market is however elevated in comparison to the areas built after the 1990s and the outer dyke areas.

**The areas built after the 1990's** are generally new urban developments offering high quality of living and facilities. Their infrastructure network is at times not sufficient enough and especially no proper public transportation is provided for the proper integration of the new distant from the urban core areas. This is bringing their

values down in comparison the central urban core. [FIG 4.1.3]

**The outer dyke areas ( RUA)** as already mentioned have developed intensively without any master plan or strategy and according to the Ordinance of the Dyke a large part of the constructions there are illegal. Infrastructure is largely insufficient and quality of living is poor in many parts of RUA. However these areas have been attracting more and more inhabitants due to their location - adjacent to the urban core, and its lowest prices in Hanoi, which is still the case today. The reasons for that is the mixture of unclear legal aspects of the area, the low quality of the urban environment, the insufficient infrastructure and flood risk. The mixture of activities in RUA is consisting of residential mixed with business, some industries and government offices as well as agriculture.

**This property analysis shows clearly the undeniable advantages of the Riverside Urban areas in the property market of Hanoi and its potential for improvement if the right strategy is defined.**



*FIG. 4.1.9 Concrete pillars breaking the water flow  
Location: Island in the Red river, Long Bien ward, April 2014*

## WHAT FUTURE FOR THE RIVERSIDE URBAN AREAS?

## 4.2

The Riverside Urban Areas have today become an urban phenomena in the city of Hanoi that in some way represent another city by itself. A combination of traces of historical villages, crafts, nature, river, it's water regime and the new urban fabric that emerged to a certain extend planned but however largely self organised that make RUA an inseparable part of Hanoi accommodating the population equal to a whole district. Having presented the issued those areas have today for their inhabitants and for the authorities, and the 3 projects proposed in the last years, I propose to look at them from a critical angle by using a comparison method for their evaluation.

### The evaluation is based on 3 main criteria :

- **Social Sustainability**
- **Economical Sustainability**
- **Environmental Sustainability**

The evaluation is done by taking the proposed measures from each project, applying them to the existing population, flood plain and general cost of the operations in the comparative basis with between the 3 projects, to define which one is more sustainable than the other according to the 3 criteria mentioned above which is therefore a qualitative approach for evaluation. However it is important to underline that the evaluation of the projects is based on the available information I have managed to collect from papers, interviews articles and on my personal observations from the situation and the context of RUA and Vietnam.

After evaluating the existing proposals, based on the their sustainability results and the explored in the previous chapters issues in RUA, I propose a possible scenario for the future development of the riverside urban areas, following the same 3 criteria for its evaluation. Since the

extend of RUA is quite large, based on the proposed scenario and on my field work in Hanoi, a strategy for a part of RUA is developed.

The choice of area for the strategy was made by evaluating the urgency to react in dealing with the increasing problems in RUA such as:

- **continuous uncontrolled urbanisation**
- **extreme density**
- **lack of waste water treatment**
- **lack of accessibility**
- **lack of precise regulations**
- **existing communities and their needs**

The development of the scenario and strategy are based on the experience from around the world of floating and amphibious living that I have gone through exploring and especially on the experience of the Netherlands. The Dutch government launched a program for the development of amphibious housing in 15 destinations in the country all located in flood prone areas outside the protection of dykes. I consider the case or RUA as a potential destination for such type of experiment. One example of the implemented projects is explored in this part along with the case of the floating communities in Hanoi.

The strategy is broken down to actions necessary for its implementation. At the end, the actions proposed in the strategy are reviewed for their applicability to the rest of the riverside urban areas and other similar natural , cultural urban conditions.



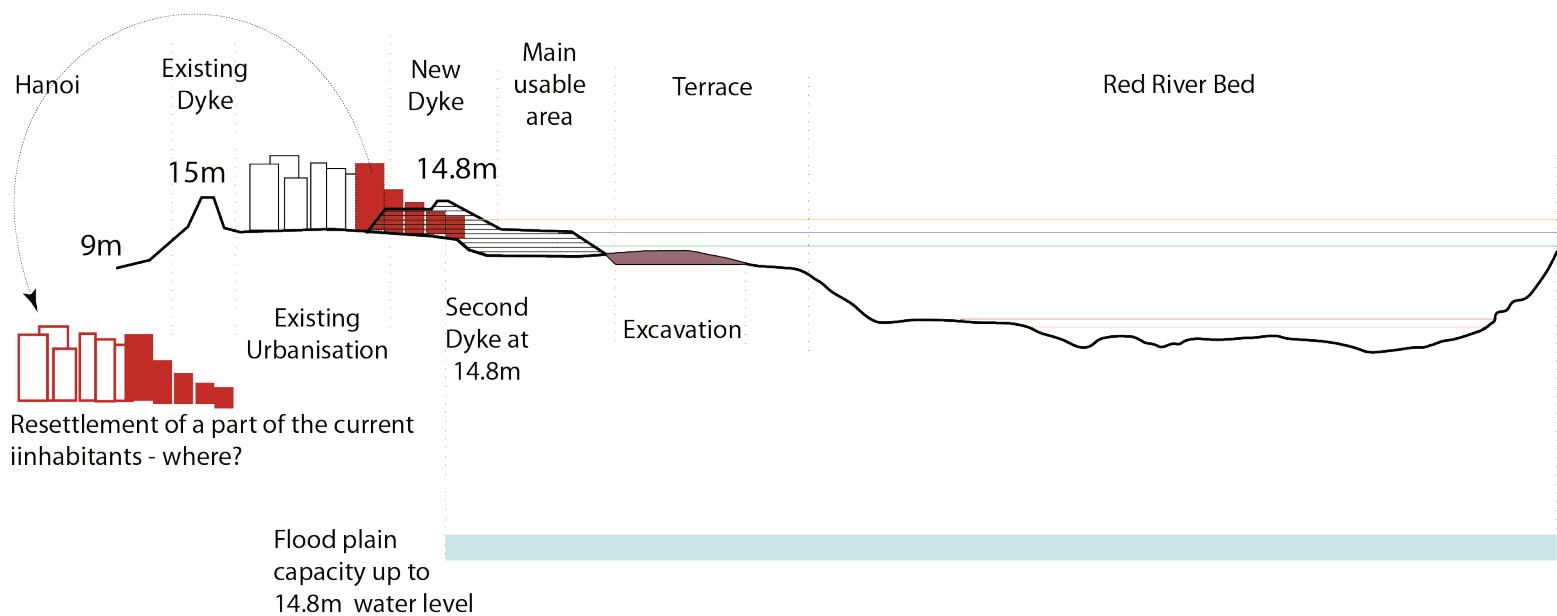
Socially sustainable



Economically **UN** sustainable



Ecologically **UN** sustainable



+14 m Flood Level [125 years return period]    +11.6 m Flood Level [5 years return period]    +10.5 m Alarm Level II for Hanoi    +2.7 m Navigation Channel

Resettlement of existing inhabitants   
 Flood Plain in 12m floods   
 Normal Red river bed   
 Preservation of existing settlements   
 Existing Dyke   
 New Dyke



# CANALIZATION OF THE RED RIVER. VIETNAMESE PROJECT EVALUATION

Considering that the project proposal of the Norther hydraulic institute is chosen for implementation what the consequences would be in terms of:

## 1. Social sustainability

The project is combining a number of water management tools for flood protection. The major one that is affecting RUA is the construction of a second dyke parallel to the existing one in some areas. That is going to be in favour to the **existing settlements that will now be protected from annual floods and possibly legalised.** The rest of the settlements located outside the new dykes will still remain illegal and will eventually have to resettle, however the project is focused on the water management infrastructure and do not define the future of those settlements. As the evaluation is also made on a comparison basis between the 3 projects , in this case the least amount of current inhabitants will be forced to resettle. [FIG. 4.2.3].

## 2. Economic sustainability

In terms of economic sustainability my evaluation is only regarding the value of the dyke construction as a solution to protect the existing urbanisation. Therefore a construction of around than 40km of dykes with over 14m height will cost more than \$ 3 billion <sup>1</sup> [ VietnamNews ], which a very **high value for infrastructure for no considerable returns** planned in the project.

## 3. Environmental sustainability

Such costly infrastructure has to be very carefully planned in order to fulfil its purpose as well as not be destructive

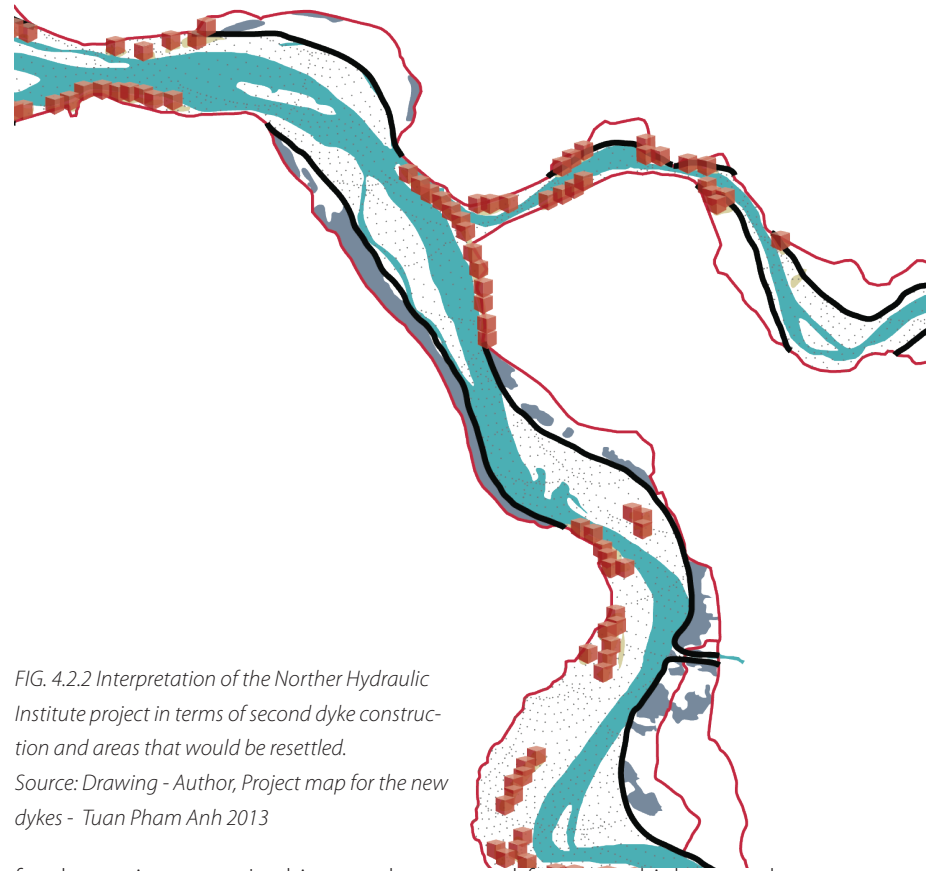


FIG. 4.2.2 Interpretation of the Norther Hydraulic Institute project in terms of second dyke construction and areas that would be resettled.  
Source: Drawing - Author, Project map for the new dykes - Tuan Pham Anh 2013

for the environment. In this case the proposal for a very high second dyke will actually **take off the flood capacity** of the Red river by blocking parts of the currently available flood plain. Another issue of the project is the **artificial approach to protecting the dykes**, by creating stone embankments instead of choosing a more natural treatment of the issue.

PROJECT II IF THE KOREAN PROPOSAL IS IMPLEMENTED ?



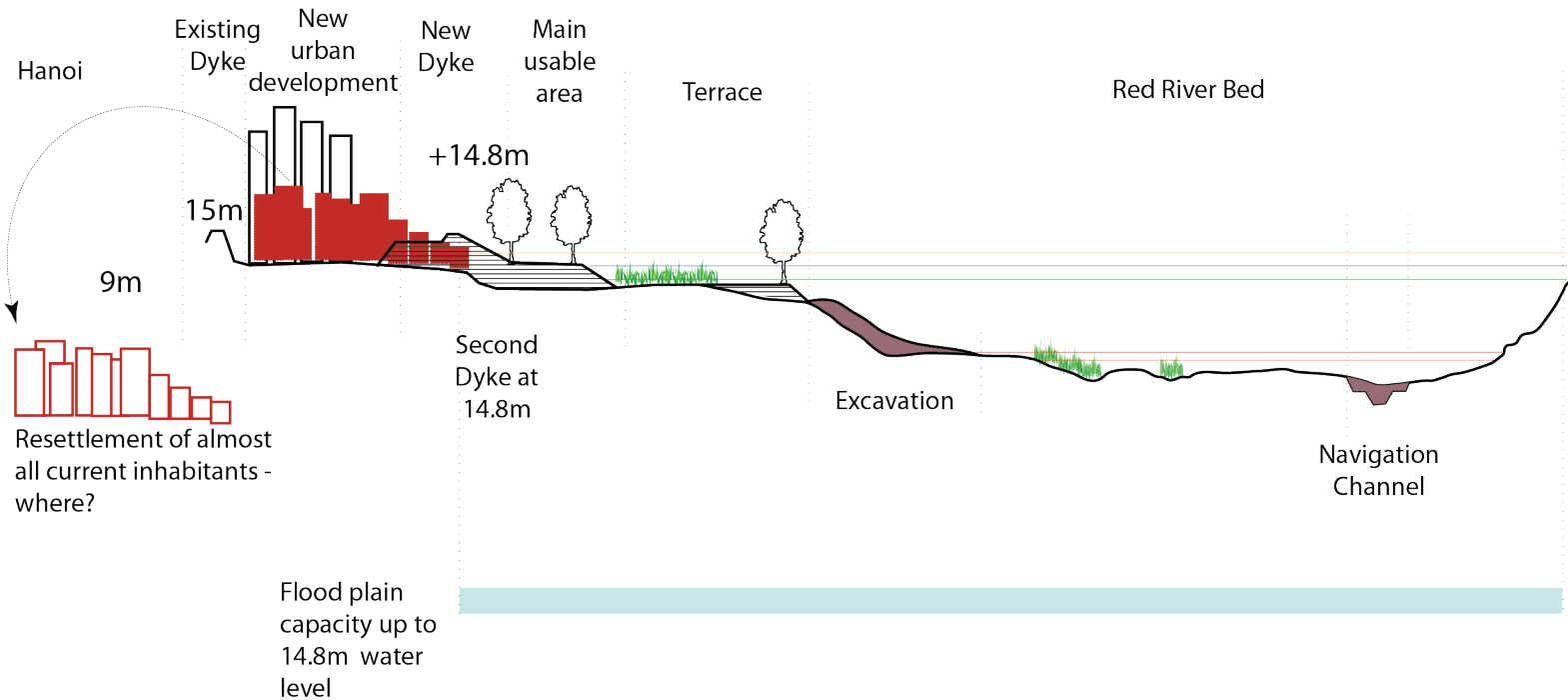
Socially **UN** sustainable



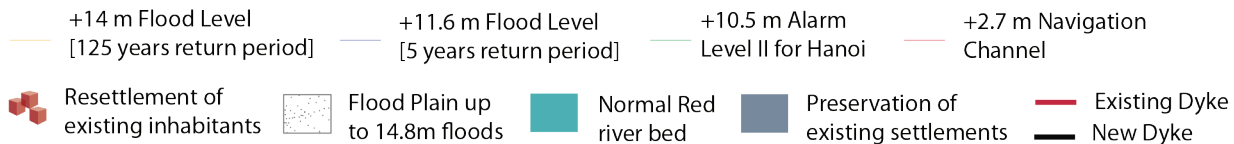
Economically Sustainable



Ecologically **UN** sustainable



Resettlement of almost all current inhabitants - where?



# THE SKYSCRAPER CITY ON THE RIVER. KOREAN PROJECT EVALUATION

Considering that the project proposal of the Korean organisation is chosen for implementation what the consequences would be in terms of:

## 1. Social sustainability -

The proposal's main feature is the second dyke as in the previous example, however this time the areas to be protected by the second dyke are less. Those areas, currently occupied by a population living there for a few decades, are to become a modern part of Hanoi prevailing in high rise development for high tech, business, commercial residential and recreational activities. Consequently for that to happen a resettlement of the current inhabitants is planned and a budget of \$1.5 billion is previewed. Meaning that in all the project boundaries settlements will be paid to move away and give space for a new modern development. However **the project doesn't provide a possible solution for the some 170 000<sup>2</sup> people or 42 000 households, that have to leave RUA** and find a place to live in overcrowded and expensive Hanoi where their compensation won't be enough to buy a similar size of housing they had before. Therefore a conclusion in the evaluation of the social aspect is that the project is socially unsustainable.

## 2. Economic sustainability

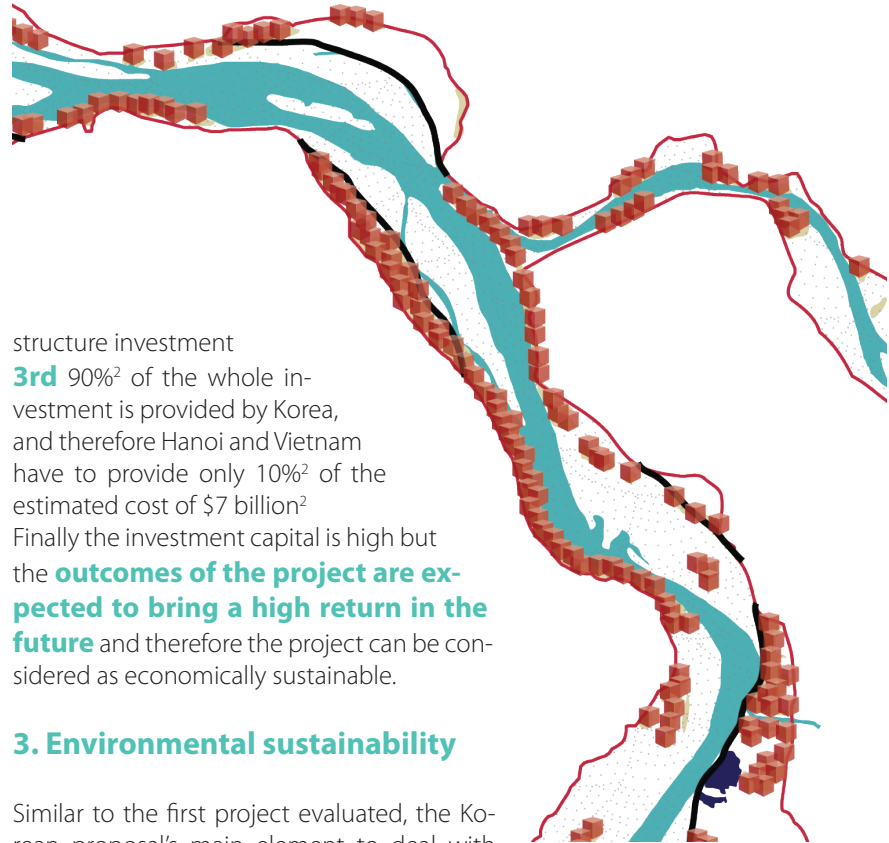
In terms of economic sustainability the project can be considered as sustainable for a few reasons:

**1st.** The costly construction of 17km<sup>2</sup> of dykes estimated at \$1,4 billion<sup>2</sup> will transform an invaluable today piece of land into a protected from floods part of Hanoi and real estate prices will sky rocket.

**2nd** All planned development is high quality high rise offices, residential and recreational areas which will be very high priced and therefore cover a part of the infra-

FIG. 4.2.4 Interpretation of the Korean project in terms of second dyke construction and areas that would be resettled.

Source: Drawing - Author, Project map for the new dykes - Tuan Pham Anh 2013



structure investment

**3rd** 90%<sup>2</sup> of the whole investment is provided by Korea, and therefore Hanoi and Vietnam have to provide only 10%<sup>2</sup> of the estimated cost of \$7 billion<sup>2</sup>

Finally the investment capital is high but the **outcomes of the project are expected to bring a high return in the future** and therefore the project can be considered as economically sustainable.

## 3. Environmental sustainability

Similar to the first project evaluated, the Korean proposal's main element to deal with floods in RUA is constructing a second dyke at the height sufficient enough to provide security for at least 500 years return period of floods. Height of 14.8 m which is only 0.2m lower than the existing dyke, meaning that the flood plain of the Red river will be reduced by the areas where second dyke will be constructed. That will lead to a heightening of the flood level in Hanoi and increase the risk not only for the new high rise development but for Hanoi as well.

PROJECT III IF THE JAPANESE PROPOSAL IS IMPLEMENTED ?



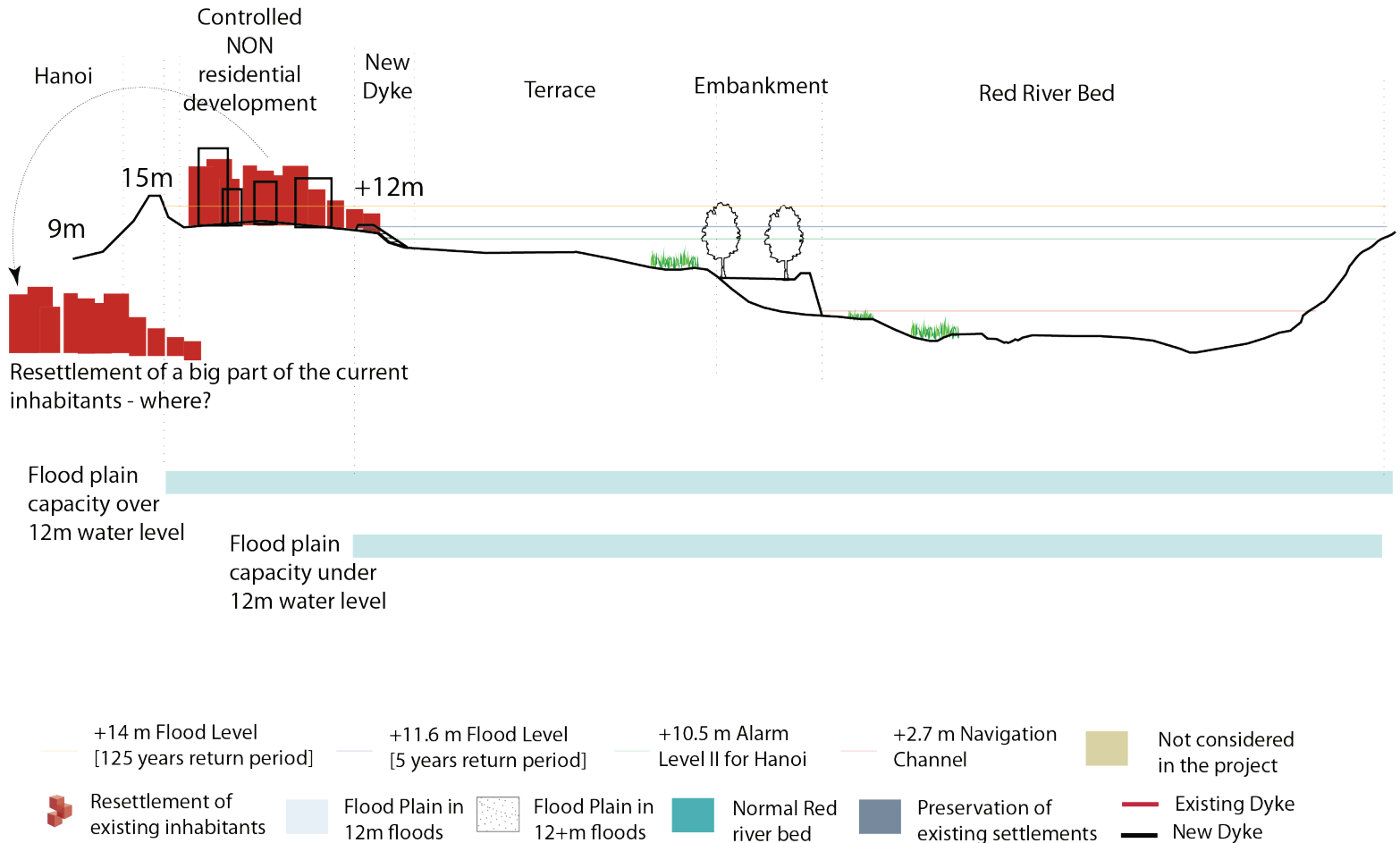
Socially **UN** sustainable



Economically **UN** sustainable



Ecologically sustainable



# LIGHT FLOOD INFRASTRUCTURE. JAPANESE PROJECT EVALUATION

Considering that the project proposal of the Japanese International Cooperation Agency is chosen for implementation, what the consequences for RUA would be in terms of:

## 1. Social sustainability -

The project proposes a scenario in which the outer dyke areas shouldn't be used for living but for, recreation, culture, agriculture, etc. The main tool to dealing with the flood issues in RUA is again the construction of a second dyke, however in this case it's lower - 12m and is just in two main areas - part of the areas adjacent to Hanoi and where historical crafts villages are located. Nevertheless a large part of the current inhabitants - **79 000 inh. are planned for forced resettlement with compensation** in the first stage together with the construction of the second dyke - another **28 000 inh.** In the mid long term with a subsidy - **113 000 inh more.** and at last **25 000 inh.** <sup>4</sup> Despite the fact that people will be moved with a compensation such a large number will be a great problem to find place to locate in Hanoi's growing real estate overcharge. In these circumstances the project is evaluated as socially unsustainable not having considered the aspects for resettlement of the existing inhabitants.

## 2. Economic sustainability

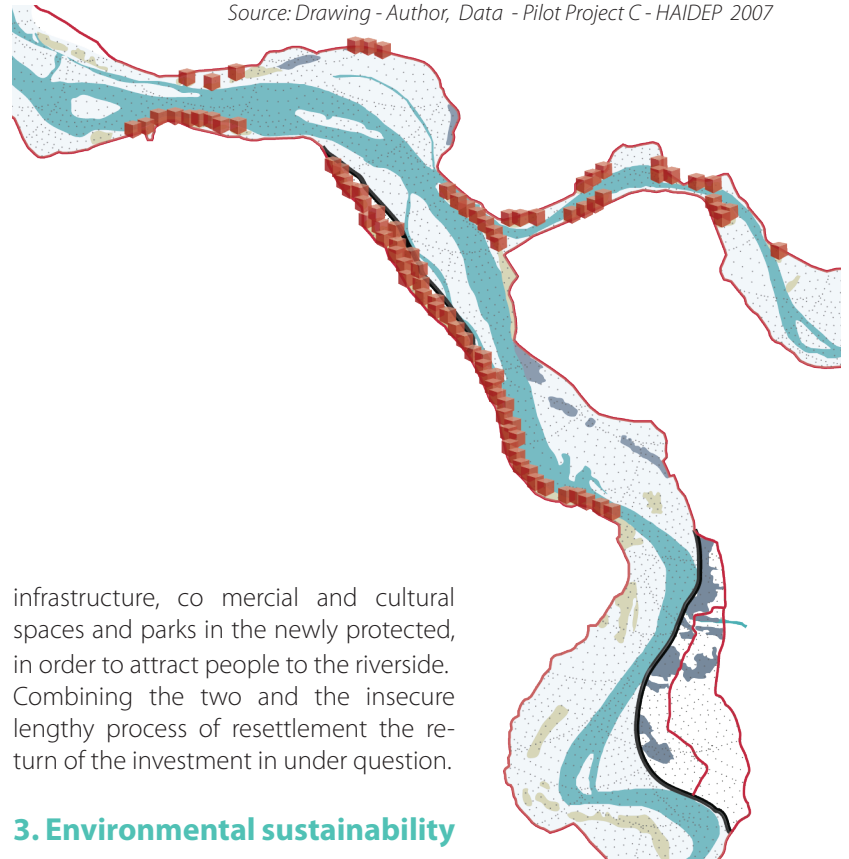
From an economic point of view the project is very high risk in terms of return of investment.

1st. **Resettlement is a very costly** operation and takes time to implement

2nd The **capital investment requires the construction of a new dyke at 12m,** followed by new

FIG. 4.2.6 Interpretation of the Japanese project in terms of second dyke construction and areas that would be resettled.

Source: Drawing - Author, Data - Pilot Project C - HAIDEP 2007



infrastructure, commercial and cultural spaces and parks in the newly protected, in order to attract people to the riverside. Combining the two and the insecure lengthy process of resettlement the return of the investment is under question.

## 3. Environmental sustainability

However, the environmental part of the proposal has been taken into consideration. Since the new dyke will only be elevated at 12 m the flood capacity in case of an extreme flood (over 14m) will remain unchanged. Removing a large part of the settlements from the riverside areas will also contribute to the flood capacity. Terraces of the flood plain are designated for agriculture, nature and recreation bringing a quality urban space for Hanoi closer.

**“Modern flood management is about  
living with rising water, not blocking  
it out”**

*Robert Barker,  
THE ARCHITECTS' JOURNAL,  
VOLUME 227, ISSUE 5*

## AN ALTERNATIVE SOLUTION TO THE DYKE?

4.3

After evaluating the existing proposals for the future of the riverside urban areas, it is clear that till this moment no alternatives to the dyke in order to protect from floods have been considered as possible. What if we look at the river's nature of changing levels between seasons as an advantage instead of the opposite?

People in those areas have lived with floods and will continue to but there is a way to transform their living conditions into a valuable feature and attraction and change their image. In the following pages I am proposing a scenario whose idea is to embrace the water as a main feature for the development and redevelopment of RUA while trying to find a solution for the already existing population on how to become a resilient part of the city. Instead of going against nature I look for ways to live in balance with it. Since RUA's population has chosen to live with the inconvenience of flood as the large part of them define it as, authorities have to find a way to improve their living conditions and turn those areas to a benefit of Hanoi instead of the opposite.

The scenario is then evaluated using the same criteria used for the previous projects evaluation in order to make a final comparison at the end.

## LIVING WITH WATER

The "Living with water" scenario is proposing a new vision for the existing settlements - balancing life between dry and rainy season.

Comparing their elevation to the average levels of floods in order to decide which areas are critical to be dealt with a number of tools is defined.

The scenario is proposing to deal with some of the major issues of RUA - floods, extreme density, accessibility to the

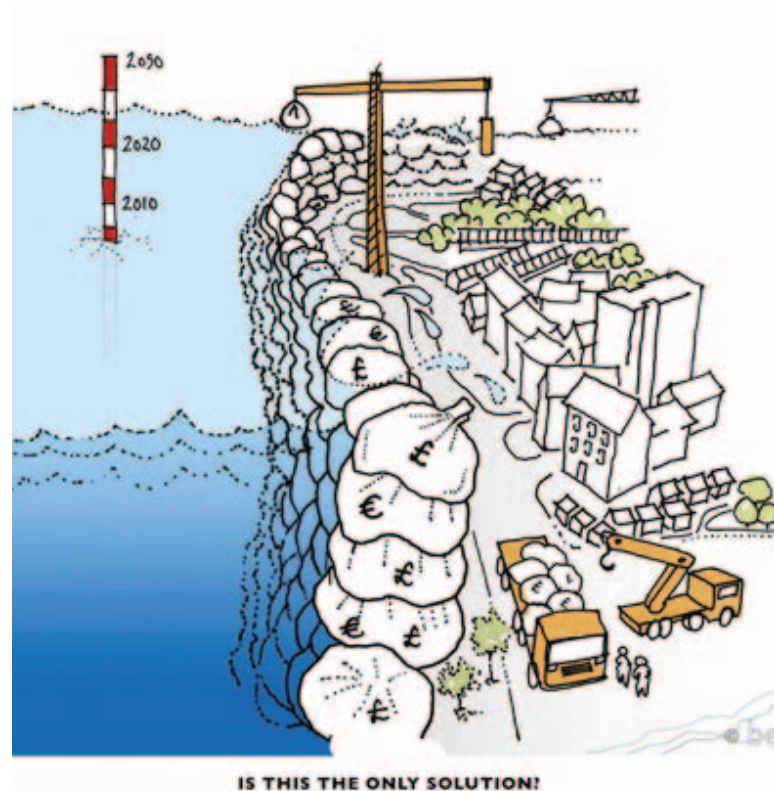


FIG. 4.3 Sketch by Baca Architects representing the current flood management measures around the world.

Source: Baca Architects

river, erosion and safety of the dyke, bad image of the area, illegality to find a sustainable future for these areas. These issues are faced using an environmental approach to deal with the dyke safety and flood nature, and a critical reconstruction for the existing urban areas.

However, an evaluation of the current structures, their legal status, location according to the dyke safety and elevation for the flood safety is necessary before any actions can be taken.

A number of action tools are at the core of the scenario:

SCENARIO LIVING WITH WATER



Economically Sustainable



Ecologically sustainable



Socially sustainable

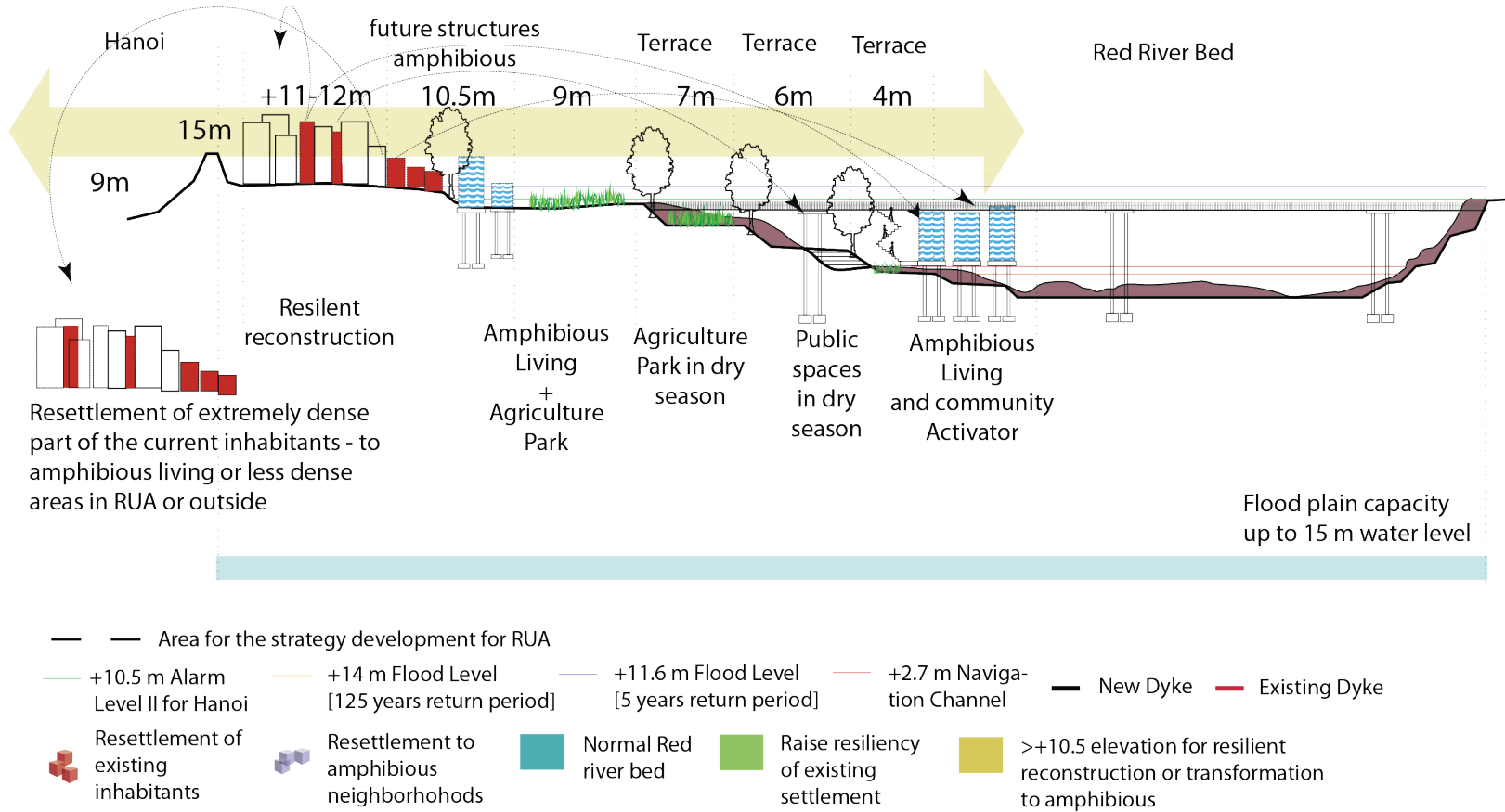


FIG. 4.3.1 Alternative to the dyke -Scenario Living with Water



# AN ALTERNATIVE SOLUTION TO THE DYKE? LIVING WITH WATER

## Resilient reconstruction

After an evaluation of the existing neighbourhoods and monthly flood levels it is decided that settlements located higher than 10.5m elevation will need to undergo a resilient reconstruction in order to better cope with floods since at that height they happen every 5-10 years or more. Constructions in that elevation that conflict with the safety of the dyke will be removed but proposed an alternative. All settlements located on lower elevations than 10.5 will be allowed to stay going through the resilient reconstruction but in the long term no new construction shall be allowed and if any house is being rebuilt it will have to be transformed into **amphibious** to be able to cope with the climate change and eventual more frequent floods.

## Reduce density

Density in some part of RUA is as extreme as 24 000inh / km<sup>2</sup> in Chuong Duong. These extremes cause numerous problems such as accessibility in emergency cases, lack of quality of life for the inhabitants, lack of infrastructure and public spaces. The scenario proposes after the evaluation of the existing neighbourhoods is done to propose a re-settlement program in which inhabitants will be moved to areas close to their current home, but in an amphibious mini neighbourhood. Programs will be voluntary to some extend but in order to restructure RUA certain structures will be chosen for this program. It will not only include a resettlement to an amphibious community but each community will have the function of an activator for the area and new settlers will have to perform the activities defined for their area which is intended to help economic and tourism development.

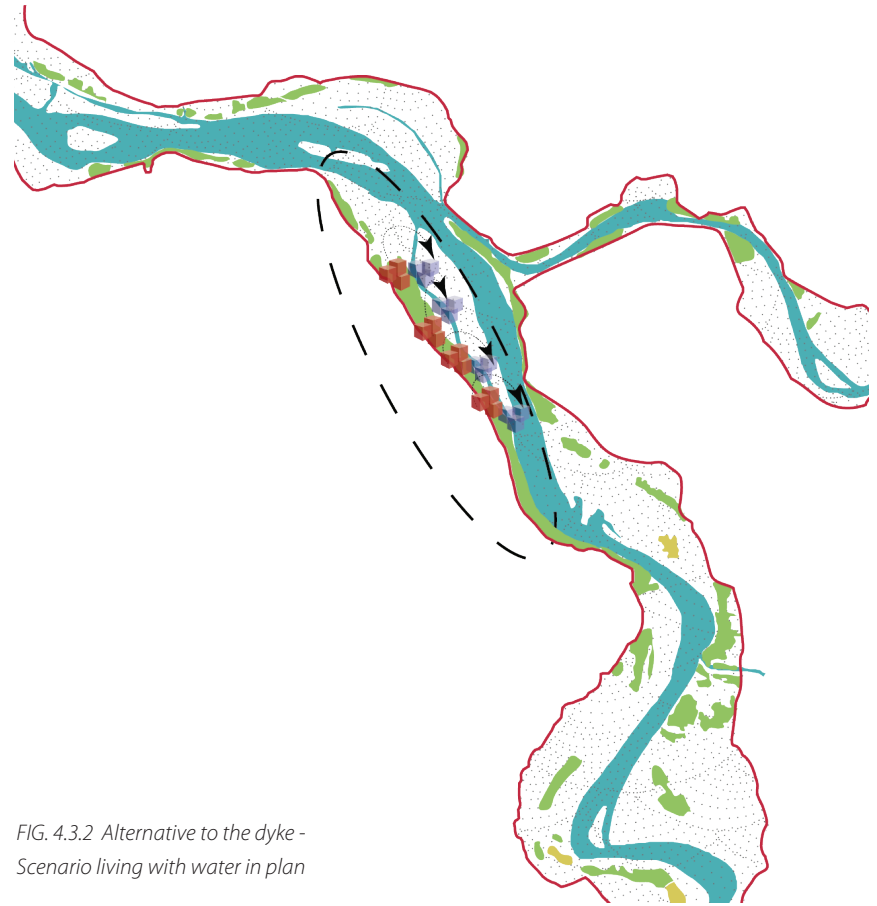


FIG. 4.3.2 Alternative to the dyke - Scenario living with water in plan

## Reestablish the link Hanoi Red river

Reducing the density will provide space to improve infrastructure and especially clear the way to the riverside that is currently quite inaccessible due to the constructions creating a wall.

## Terrace the flood plain

The Red river has a diverse water regime between seasons and therefore leaves land for temporary use during dry season and covers it during the summer months. To provide better distribution of the spaces for temporary use, terracing the flood plain where it's possible to 2 or 3 terraces corresponding to different levels throughout the year **will give rooms for temporary activities** such as agriculture which is already present, for public spaces and allow to have a riverside boardwalk all year long changing the levels. Terracing will also serve as a **natural way to strengthen the dyke** by planting flood resistant trees and vegetation at the foot of each terrace.

## Transform the useless spaces by creating activities

Currently many parts of the river flood plain are considered useless by the population since they do not improve their quality of life or are useful for their business. This perception of space is very important because it's what defines how people will treat the spaces. The current perception of uselessness of the those areas is degrading them and turning them into dumping areas.

Providing access to nature, quality public spaces, activator amphibious communities, recreation activities and agriculture and tourism will give value to the flood plain and change perception of people which will be in favour for the environment and for the people.

## EVALUATION BY THE THREE CRITERIA

### 1. Social sustainability

The proposed scenario has a social approach to solving the problem with living in the riverside urban areas. The proposed actions include **resettlement of only a part of the current inhabitants proposing them an alternative - living in an amphibious community, close to their old house** with an opportunity to become part of a program to boost economic development of the areas by recovering traditional activities such as crafts and fishing and adding a the dimension of ecological tourism. The **transformation of the areas will include the participation of all the inhabitants**. However inhabitants who completely disagree with the amphibious scenario will be compensated to voluntarily move to liberate the necessary space for infrastructure and public spaces. However the density reduction has to be decided on the basis of an evaluation in each particular ward. That will allow for a much lower number of inhabitants that will be resettled compared to the proposals evaluated before and therefore the scenario can be considered as socially sustainable.

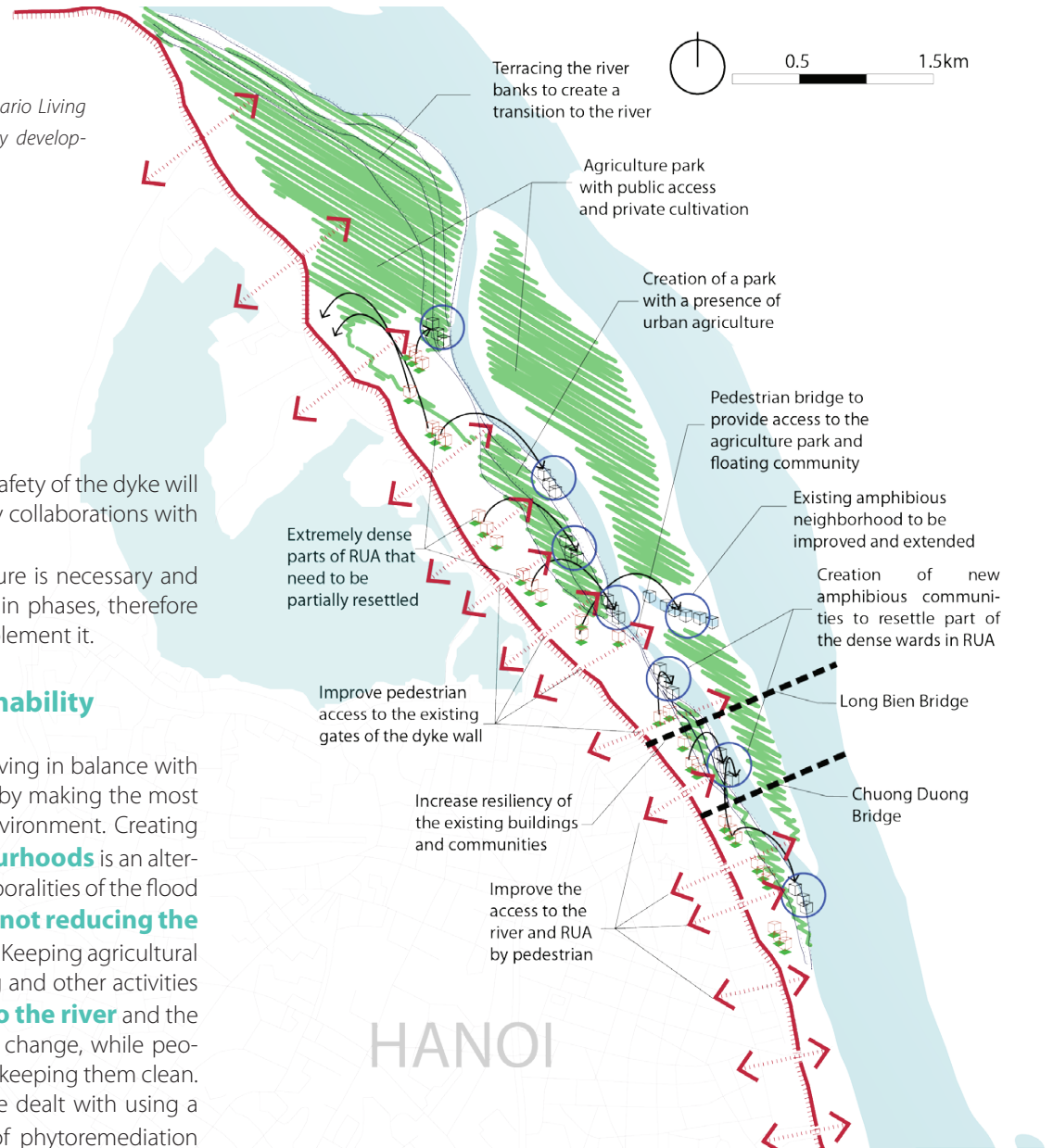
### 2. Economic sustainability

The scenario developed into a project shall be divided in phases, which will allow its implementation. A few main points defining the economic feasibility of the living with water scenario are:

**1st** All the land in the flood plain is owned by **the state which can provide the land use right free of charge for a certain period of time to private investors for free to develop the amphibious mini neighbourhoods**. They will have to employ locals for the constructions and dedicate a part of the structures for the resettlement of a part of the families and keep the rest for rent and personal profit.

**2nd** Improvement of the existing settlements is the duty of their owners and therefore at no cost for the state. Resettlement of the inhabitants

FIG. 4.3.3 Alternative to the dyke -Scenario Living with Water, Studied area and strategy development.



to reduce density and improve safety of the dyke will be compensated by the state by collaborations with private investors

**3rd.** No costly dyke infrastructure is necessary and the strategy can be developed in phases, therefore Hanoi can have a budget to implement it.

### 3. Environmental sustainability

The concept of the scenario is living in balance with the changing levels of the river by making the most of it for the people and the environment. Creating **amphibious mini neighbourhoods** is an alternative to using at 100% the temporalities of the flood plain spaces as at the same time **not reducing the flood capacity of the river**. Keeping agricultural activities and supporting fishing and other activities will bring a **useful function to the river** and the perception of those spaces will change, while people will start paying attention to keeping them clean. Treatment of wastewater will be dealt with using a **natural filtration system** of phytoremediation using different basins located in levels

## AMPHIBIOUS LIVING. DEFINITION AND EXAMPLES

## 4.4

In order to understand the Living with water scenario it is necessary to explain the nature of an amphibious living and structures. The work amphibious comes from Latin 'amphibious' and means something designed for operation on both water and land. Therefore if I need to give a description of an amphibious community it will be one designed to be operational on both land and water

adapting to the fluctuations of the river. An amphibious structure will be one that originally sits on land but is designed to float in case that is necessary. According to the book "Amphibious housing in the Netherlands", this type of dwellings are built in flood prone areas such as close to rivers and flood sensitive areas like retention areas for excess flooding which is the case of the riverside urban areas. Seemingly similar to a floating structure, however there are a few main differences between floating and amphibious type of dwellings.

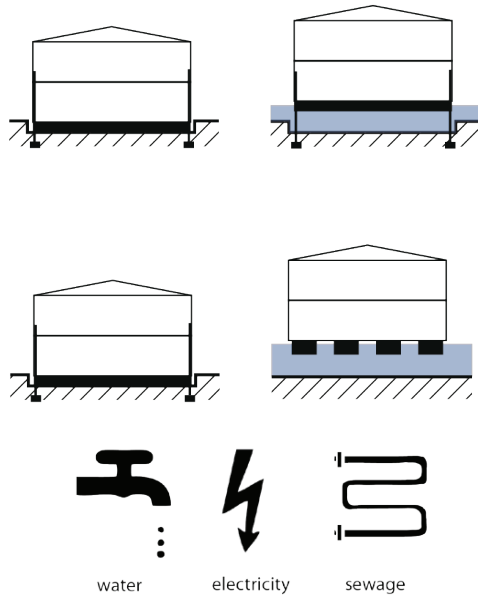


FIG. 4.4.1 The three main distinctive elements of amphibious structures

The moving of the amphibious dwelling up and down with the water fluctuations if made possible by installing Mooring poles are used to fix the structure into place and only allow vertical adjustment to the water level. The height of those poles has to be designed depending on the elevation of the land and the expected highest wa-

**First** of all amphibious structures are able to stay on land and that is the time their distinctive character reveals. Its base caisson is made out of a foam or plastic and is hidden in the ground to avoid exposure to the environmental conditions.

**Second** important thing is that the caisson of an amphibious dwelling is smaller and more robust in comparison with the floating one due to the forces on the structure while on dry land.

**Thirdly** the most distinctive difference between amphibious and floating is the accessibility to the rest of the city and connection to the sewers and electricity.

ter level. In some of the latest projects those poles are hidden in the structure and design of the building. In order to explore the examples of such amphibious neighbourhoods implemented I will look at a few European examples and the case of Vietnam and the red river living on water communities.

## Maasbommel, Gouden Kust , Netherlands

In 2005 a project for 34 homes on water was completed in Maasbommel as a part of the experiment with adaptive and flood proof construction of the Dutch ministries of Traffic and Water Management and Housing, Spatial development and Environment as one of the 15 locations for the experiment.<sup>67</sup> Located in the recreation basin Gouden Kust that is linked to the Maas river a mixed neighbourhood, consisting of 20 amphibious and 14 floating dwellings, was built. The link with the river is a premise for considerable fluctuating levels of Gouden Kust. The 34 water dwellings were constructed outside the dyke and the 20 amphibious ones sit on land but are adapted to float in case of change of the water levels. At the time the project was developed the amphibious



FIG. 4.4.2 Plan of the amphibious development in Maasbommel  
Source: Adopted from "Amphibious housing in the Netherlands"<sup>68</sup>



FIG. 4.4.3 Floating dwellings in Maasbommel development

Source: <http://worldoceanreview.com/>

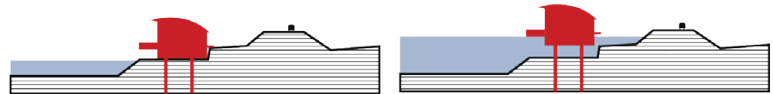


FIG. 4.4.4 Section of the structure of the amphibious dwellings in Maasbommel

Source: Adopted from "Amphibious Housing in the Netherlands"<sup>68</sup>

homes were expected to raise with the high waters once every 5 years. . Both the floating and amphibious dwellings are grouped by two to increase their stability on water. The amphibious dwellings are located at the foot of the dyke at the limit between land and water. During the time the water level stays normal the dwellings can be accessed by land with no problem. [FIG 4.4.5] During high waters the dwellings stay connected by a pontoons that floats with them attached to the back of the dwellings. [ FIG. 4.4.6] During high waters the houses raise and they stay connected to sewer and electricity thanks to a flexible system of pipes, however in case of exceptional flood neither the floating nor the amphibious homes can't be accessed by road, as in extreme events it gets completely submerged.

The houses are built on a 1.5m<sup>69</sup> concrete caisson, that serves as a pontoon and can be used as a cellar. The structure is made as light as possible to improve the buoyancy when floating. The poles that keep each two dwellings fixed in one place and allows them to move vertically when water levels change, are designed higher than the adjacent dyke to make sure homes be safe in any over extreme conditions that might be expected.

The first time that the amphibious development had the chance to be tested was in 2011 when during 3 days the waters rose to +7m.<sup>70</sup> The community was warned and all vehicles were moved to higher ground. The only complaint people had was the lack of direct connection with the ground, since they had to use a boat to reach it. The test for this experiment was considered successful since after the waters went down all constructions went down to their foundations without any problem occurring.

This amphibious experiment proves the fact that such an approach can be a tool to tackle water fluctuations and allow development in flood prone areas. However one major issue has to be considered in cases that floods last longer than a few days and happen more frequently, is to provide the necessary comfort in terms of accessibility for the amphibious inhabitants. Else the quality of life for living on water cannot be compared to any other give the facilities necessary for that.

### **Amphibious / Floating communities in Hanoi**

The case of the floating communities in Hanoi is a complete opposite to the one in the Netherlands and that is why it is so interesting to explore both of them.

First of all I would like to underline the major differences between the two cases.



FIG. 4.4.5 Floating homes in Maasbommel, normal water level

Source: Panoramio, Hans van der Poel (2007)



FIG. 4.4.6 Amphibious homes, Maasbommel, normal water conditions

Source: Panoramio, Hans van der Poel (2007)



FIG. 4.4.7 Amphibious homes, Maasbommel, above - normal water conditions, below during flood 2011

Source: Project review, FLoating Homes 'De Gouden Kust'<sup>9</sup>

## 1st Planning and legal aspect

- **Maasbommel** was a planned community, which determines the legal aspect of the houses making their owners legal citizens of Maasbommel

. - **Hanoi's** floating communities are self organized and self built by their inhabitants by upcycling found materials. Their inhabitants have no legal right to be using the water to built their houses and have no documents proving their ownership, which means they aren't considered legal citizens of Hanoi

## 2nd Accessibility

- **Maasbommel's** amphibious development is located along the dyke road and planned in a way that during normal water levels the inhabitants have access to the road, which means they can access the city by car or transport without any difficulty

- **Hanoi's** floating communities, since they aren't legally allowed in the areas they inhabit are located in very hard to access areas where the local control organs will have a difficulty to reach them. Another issue about their accessibility is the fact that they haven't been planned and therefore no accessibility is planned for something that legally doesn't exist.

## 3rd Facilities

- **Maasbommel's** development is no different from any other normal house in the Netherlands considering the access to facilities such as water, electricity and sewage. Houses have been linked to the city's system by flexible pipes allowing them to float without interrupting the services.

- **Hanoi's** floating communities have no access to clean water, sewage or electricity. Some of the houses have private electricity generators, but for the water supply they mostly use the water from the River and all their waste goes back to the river.

## Floating / Amphibious communities in Hanoi

Historically floating communities existed on the Red river in Hanoi since the city activities had a strong link to the fluvial traffic of goods and transport. The floating communities existing today on the Red river banks have a different story in the growing urban development of the



FIG. 4.4.8 Polystyrene to make the base for the floating structure. Background a floating house in Nha Van Hoa, on the island (#1 on 4.4.9)

city. People who come from other provinces or can't afford to buy land in Hanoi have found a way to stay close to the city without the need to live precisely in the legal limits of it.. There are numerous small communities along the Red river banks but the largest is the Nha Van Hoa located on the island's crossed by Long Bien and Chuong Duong bridge. The island is sometimes submerged during rainy season and the water has created a water body in the middle of it that is sometimes linked to the river and sometimes cut during dry season. [ FIG. 4.4.9] Other two communities are located on both sides of the island directly in the waters of the Red river. It seems that the number of houses in the Van Hoa community stays stable, but the others increase or decrease.

The reasons for that might be a few such as:

- Problems with the authorities due to the illegality of the communities,
- their houses are mobile so they can move to a place where they can find a job
- They move with the water - in dry season they move away from the banks because more land gets dry, and in rainy season they get closer to the banks when water goes up and allows them to locate closer to existing infrastructure.

These communities are very poor, predominantly without education or citizenship, having a difficulty to find a job in the city. They do mostly unqualified jobs such as agriculture or fishing and sell their production in Long Bien market or work in the market as workers etc. Being excluded from the city they have no access to electricity, sewage, drinking water or waste collection. In consequence they throw their garbage around the places that they inhabit and use the water from the river for their daily needs. The accessibility of these communities to urban infrastructure and facilities is extremely limited due to their location on water. The Van Hoa community can reach Hanoi through the only access to the Long Bien bridge by going up the stairs. [ FIG. 4.4.12] All paths are dusty and narrow which during rainy season make it a challenge to drive on. The kids born and living there have no access to school and therefore dooms their future chances to improve the quality of life of their families..

That kind of living is completely ignored by the citizens of Hanoi and the authorities and therefore its image is completely negative due to the precarious conditions in which people live. But they certainly have





FIG. 4.4.9 Location of some floating communities on the island and Red river banks in Hanoi.

1. Nha Van Hoa, 2 Long Bien bridge, 3. RUA, 4 Other Floating communities

one big advantage in comparison with the people living in RUA especially - in case of flood their houses raise with the water leaving to consequences. These communities are somewhat the amphibious neighbourhoods of Hanoi that everyone closes eyes to their existence. Instead they should serve as inspiration for the ways to deal with the fluctuations of the river and living in the flood prone areas in Hanoi.



FIG. 4.4.10 Floating houses in Nha Van Hoa community, background Red river and Long Bien district Hanoi



FIG. 4.4.11 Floating houses in Nha Van Hoa community, from the pathway. April 2014

The quality of the constructions varies from a family to another depending on their economic situation and how much they can spent for materials. Since they are constructing the houses themselves creativity of the used materials isn't lacking. Most of the floating constructions sit on cubes of polystyrene blocks or on empty barrels that allow the structure to float. Very basic houses are made with timber and covered with nylon on the roof and outside walls to protect from the humidity and rain. [ FIG. 4.4.10 & 4.4.11 ]

From my research, however, two higher quality floating structures exist in Hanoi, located close to Phuc Tan port in Chuong Duong ward. They have the legal right to be there because their owners have the right to use the adjacent terrains. They also have access to electricity and water according to one of the families living there. One of the buildings belongs to the port and access is provided by a floating path whereas the owners of the second house have built their own floating path and garden to access to the higher land and existing infrastructure. [ FIG. 4.4.13 ]

### Examples comparison remarks

Looking at the above examples one from Europe and second from Vietnam many striking differences are evident. However there is one similarity - the fact that living on water gives the advantages of being able to adapt to fluctuating water levels be it every 5-10 years or annually which makes living on water possible. Taking ideas from both example ideas can be generated to improve the quality of life on the Red river and introduce a new paradigm of living for the future - living with water.



FIG. 4.4.12 Only access to the island and the Nha Van Hoa floating community

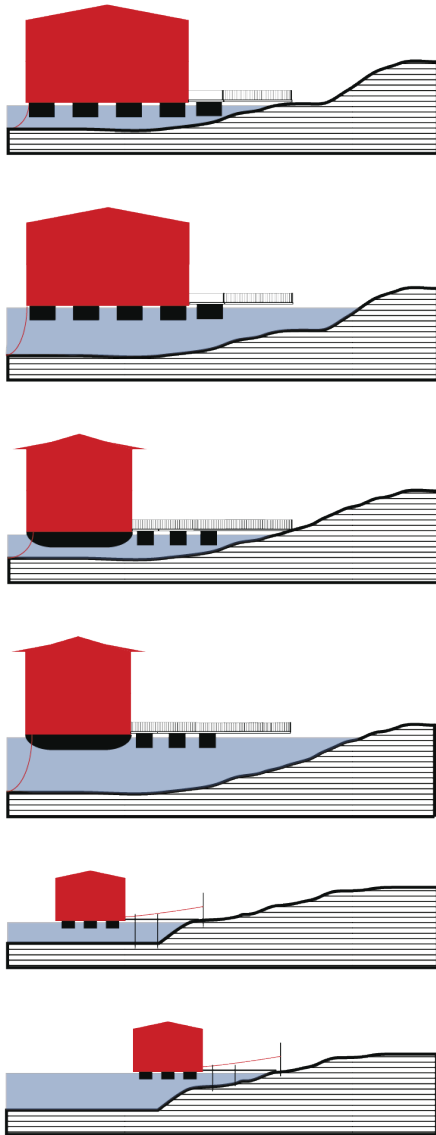


FIG. 4.4.13 Schemes of the 3 types of floating dwellings on the Red river in Hanoi.

## Floating building types in Hanoi

### 1. Phuc Tan Port building ( high quality) [FIG. 3.7.6]

Floating on a base of metal cubes placed underneath the body of the building. A two storey high with electricity and water access from Hanoi's network. Electricity is linked through an elevated flexible length cable. Stabilized in place with anchors. Access is provided by a floating metal path which structure is the same. In case of raising level of the river the structure can float up to any level together with its adjacent path. Depending on the water elevation, eventually secondary paths can be added to provide access to the dry ground. Wastewater goes directly to the river.

### 2. Floating family house close to Phuc Tan port ( High quality) [FIG.3.3.8]

In this case a boat is used for a base to allow the house to float. The house is constructed on top of it in two floors, fixed in one place by an anchor. Access to land is provided by a floating path constructed by the family. In case of increase in the level of the river the house simply floats up. Access paths can be added if necessary to reach land. Linked to electricity and water from Hanoi, while wastewater is directly disposed in the river.

### 3. Typical low quality floating house on the Red river ( low quality) [FIG. 3.3.7]

The typical structure of the low quality houses which are the majority on the red river in Hanoi is the following: Blocks of polystyrene or empty barrels are put together in a net to provide the base for the house to float. The house itself is made of wooden or recycled materials found in Hanoi. In some cases some a bit more expensive material can be seen. Roofs are generally covered with nylon to protect from the rains. Access to land is provided by tiny narrow wooden bridges fixed on bamboo piles grounded in the riverbed. When water levels go up usually houses are moved closer to the land. The structures are fixed in place with ropes tied to bamboo piles grounded on dry land.

## 1. Improve resiliency

The strategy of what to do to improve resiliency is translated into actions explaining how that can be done. First the most important is clarifying the legal aspect of the buildings in RUA and defining clear laws and regulation regarding the future of RUA. That has to include regulations not about **not what is not** allowed to be constructed in RUA but instead what **is** allowed and in

## 2. Improve accessibility

RUA is physically cut from Hanoi after the construction of the two meter dyke wall to increase the protection of the city from floods. In order to increase accessibility the existing roads have to be made pedestrian friendly, the dyke road transformed into an urban boulevard to be easier to cross and access to the public transportation corridor located in the middle. Infrastructure in RUA needs to be

## 3. Preserve the Red river landscape

The river landscape adjacent to Hanoi is part of the step dyke protecting the city. There are areas with vast land pieces available during dry season which can be optimised and preserved with a few interventions. First of all dredging the river bed where necessary to provide depth for the water to be stable between seasons and balancing the dredged volumes on the adjacent flood

## 4. Reduce density

Some of the wards in RUA have density higher than the historical center of Hanoi. That is reducing the accessibility to the buildings, is not safe for the dyke, lacks public spaces and generally reducing the quality of life in RUA. An evaluation of the different wards has to be done to define the structures to be demolished to provide space for public spaces and necessary infrastructure. All structures

what conditions. Resiliency measures for the allowed structures such as elevating the entrances of buildings, turning flood proof the ground floor, installing flood gates which can be used in case of flood alarm to avoid the water entering the building, have to be implemented and controlled by the specified in the regulations authorities. In the long run all constructions located on elevations lower than 10.5m have to be replaced by amphibious ones in case of reconstruction or building a new house.

improved to allow the access of emergency vehicles. The next step is allow access to the riverside which is currently blocked by the dense urbanisation creating a wall to the river. The creation of a riverside walkway and link it to the access links to the rest of Hanoi. The only pedestrian bridge over the Red river crosses RUA but it isn't accessible from there. Staircases have to be installed to allow people to access the bridge from RUA and the opposite. Any further bridges over RUA, that will allow pedestrians should have a connection with the adjacent wards by stairs.

plain will allow for the creation of terraces with different levels. That will provide more elevated spaces where agriculture can continue to be developed by the locals, and other recreation activities can be located in the lower terraces for temporary use during the time they stay dry. Terraces can be enforced with trees and vegetation creating a new green space for Hanoi. Terracing can be used for the natural treatment of RUA's wastewater by creating purification pools directing the water down through the gravity and leaving it flow into the river clean.

threatening the safety of the dyke structure need to be removed. The inhabitants that will have to be resettled will be provided the option to move close to their current location but in amphibious or floating neighbourhoods which will be connected to the infrastructure and have all necessary living conditions. Those communities will serve as an activator for the new activities along the river and will be part of the strategy to change the image and the paradigm of living in Hanoi.

## WHAT ?

### STRATEGY

- Improve resiliency to floods of the RUA communities



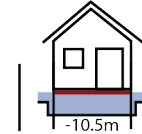
new law for constructions in RUA



elevated entrance

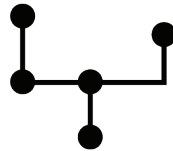


flood gate and hydroisolation

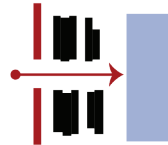


resettle communities lower than +10.5m to amphibious structures

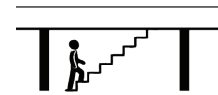
- Improve accessibility to RUA and the riverside areas



develop necessary infrastructure



provide accessibility to the river

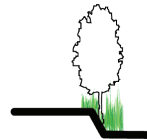


provide pedestrian access to the existing and future bridges

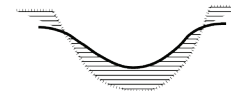
- Recover and preserve the landscape of the Red river



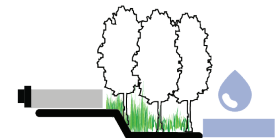
terrace the flood plain



enforce terrace with vegetation to protect from erosion



dredge the arm of the river bed to provide water all year



natural treatment of RUA's wastewater

- Reduce density in RUA



resettle to amphibious or low density areas



remove constructions threatening the dyke safety

## HOW ?

### ACTIONS

FIG. 4.5.1 Strategy and major actions to be taken in order to answer the strategy requirements. Strategy (WHAT?) Actions (HOW?)

## 5. Revitalize culture and history and activate tourism

In some part of RUA close to Hanoi there are traces from historical crafts villages which needs to be paid attention to and investment in their development is necessary. For the Vietnamese, community life is extremely important and that is why they have a community house in each village or neighbourhood. It serves as a meeting point of the inhabitants and a place where all traditional activities and celebrations take place. Some very well known and of major importance markets are located there but very

## 6. Enhance economic development

Revitalizing culture and tourism will bring more people to the riverside and therefore move opportunities for economic development. The exiting culture of cultivation in the flood plain needs to be supported and continued to continue providing fresh local production for the city and revenue for the locals. Development of

## 7. Improve the image

Finally the riverside urban areas in Hanoi have a very bad image, being hidden behind the dyke wall. Many illegal activities happen in the narrow streets of the dense neighbourhoods. The lack of reason for people who do not live there to go is a premise for the segregation from the rest of the city of Hanoi. Introducing activities for

little attention is being paid to their quality. Long Bien market is located right next to Long Bien bridge and is the wholesales night market of Hanoi. Up north the Flower market of Hanoi is located. These important for the community and the city elements need special attention and reconstruction to promote a new image and give place for culture to happen. Improvement of urban quality and enhancement of crafts and events will attract the attention of tourists bringing them where they will never go today - RUA. One very important part of living there in the past was trading and fishing. The new floating communities will have the duty to keep the history of fishing communities on the Red river.

floating communities will eventually enhance the creation of a floating market which will not only be handy for the floating inhabitants but also attract the attention of visitors and tourists. More activities and people in the riverside urban areas, more business opportunities for the locals living there. The culture in Vietnam is linked to family business and therefore all people living there will have the chace to start their own economic activity matching the demand of the market.

Hanoians and providing accessibility and quality urban environment will slowly help change the image of the areas and boost their attractiveness. The presence of tourists will give the perception of security and will bring more locals in the newly created activator areas. Hanoi has been protecting itself from the river for his millennium existence but the time has finally come to integrate the riverside as a part of the city and learn how to live in balance to get the benefits of having such a natural resource a few steps away from the city center.

## WHAT ?

### STRATEGY

■ Revitalize culture and history and activate tourism development



provide community houses and promote events

## HOW ?

### ACTIONS

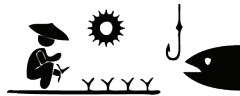


promote crafts and art development



restructuring of historical markets

■ Enhance economic development in RUA



support fishing and agriculture development



floating market for the local production



develop local business opportunities

■ Improve the image of the Riverside urban areas



develop recreation activities



develop ecological riverside and river tourism



develop water sports



provide quality public spaces

FIG. 4.5.2 Strategy and major actions to be taken in order to answer the strategy requirements. Strategy (WHAT?) Actions (HOW?)

# FLOOD RESILIENCY IN RUA. ACTIONS

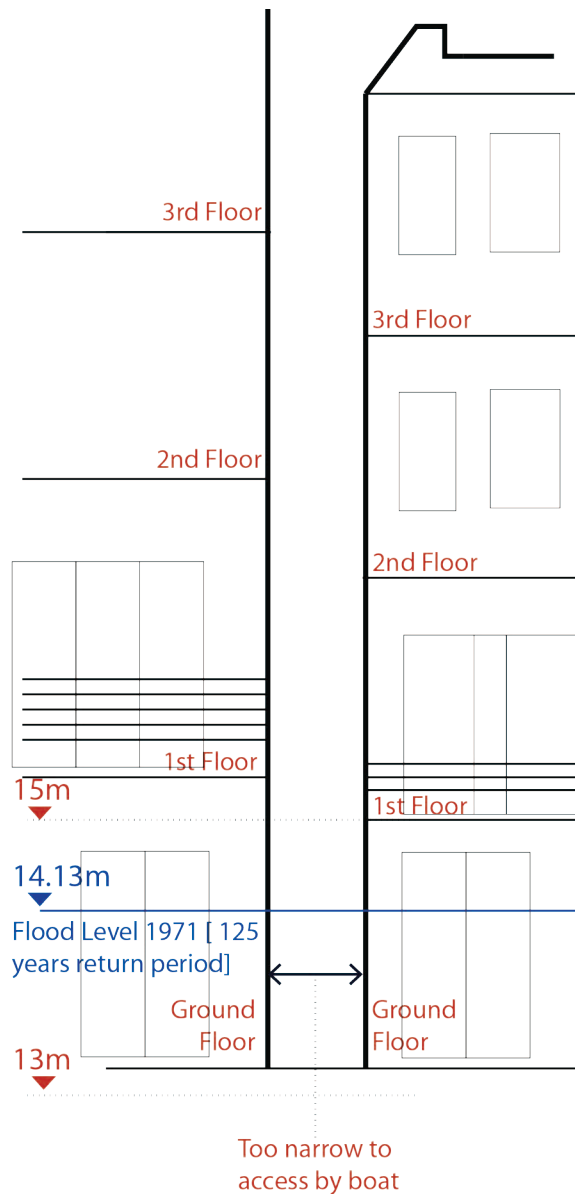


FIG. 4.5.3 Simulation of the eventual level of future extreme flood such as the one in 1971 in the higher located areas in RUA. Location Bach Dang ward, February 2014





Analysing at the housing located adjacent to the dyke wall, we observe the level of an eventual flood of 125 years return period, related to the height of the buildings and what part of them will be affected. [FIG 4.5.3] The land outside the dyke wall is slightly elevated compared to the one on the side of Hanoi where the road sits. Generally the elevation varies from around 13.5 to 12m which then goes down to 11, 10m etc. in a slope following the step dyke and reaching the river bed.

On elevations in RUA between 13.5 and 12m, **regular floods up to 12 m would rarely affect these constructions** and therefore the measures to protect them can be smart and economically less costly than a second dyke. In the case of an extreme flood such as the one in 1971 of 14.13 m which is evaluated to have a return period of 125 years, the first floor will be partially submerged to 1-1.5m of water. To be able to protect these constructions we need to take further measures to make their ground floors resilient to floods. Most of the existing constructions in RUA are already adapted to a certain extend to flood occasions.

- They have no, or highly located and narrow windows on their ground floors. [ FIG. 4.5.4, 4.5.5, 4.5.6 ]

- Usually the ground floor is slightly elevated and serves mostly as a garage for the motorbikes of the family or is occupied by business. [ FIG. 4.5.4, 4.5.5, 4.5.6 ]

In that case with minimum interventions such as installing a flood gate at all the entrances, elevating the electricity networks on ground floor and applying proper hydro isolation on the ground floor walls, a better flood resiliency can be achieved. A flood may last from a few days up to a month. That means that every day life of RUA's inhabitants will change for that period and to allow them to stay in their homes and live "normally" electricity, water and sewage and access have to be assured to be functioning in order provide the to a certain extend normal living conditions despite the flood.

Those measures should be the required minimum to protect the constructions from getting flooded but however the accessibility to the buildings in case of an extreme flood has to be provided.

Installation of exterior evacuation stairs reaching a balcony or a window door on the first floor can be a possible solution which will provide access to the buildings in case of flood but also serve as an evacuation in case of fire.





FIG. 4.5.5 Slightly elevated door in case of a flood.  
Location: Phuc Tan ward, March 2014



FIG. 4.5.6 Wide doors to allow space for motorbikes to be parked on ground floor  
Location: Phuc Tan ward, in the background Long Bien bridge, March 2014



\* 11.6m is estimated as a 5 year return period of the floods in Hanoi but however in the last 12 years it haven't reached this height and there is a tendency for a lower level of the Red river in the past decade [FIG. 3.4.5]

FIG. 4.5.7 Simulation of the eventual level of future extreme flood such as the one in 1971 and the 5 year return floods in the lower located areas (11m) in RUA. Location: Phuc Tan ward, March 2014

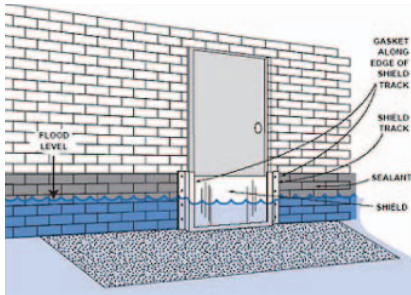


FIG. 4.5.8 Flood Gate example  
Source: <http://www.wbdg.org/>

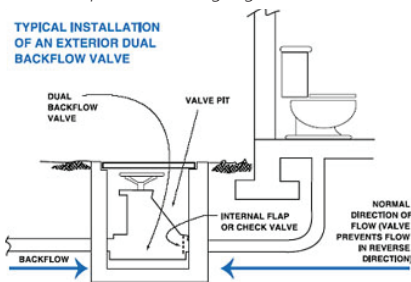


FIG. 4.5.9 Sewage valve to protect from flood waters  
Source: <http://www.wbdg.org/>



FIG. 4.5.10 Adjustable ladder to install on balconies or window doors on first floor to provide access in case of flood  
Source: [www.pwplatforms.com](http://www.pwplatforms.com)

## Flood gate, Entrance elevation and Hydro isolation

As already the case for a number of buildings in RUA elevated entrance on ground floor can be the rule for all buildings located there in the future. Three stairs in combination with a flood gate will allow the areas located lower at 10.5 - 11m to avoid water getting into their ground floor. The flood gate is consisting of a permanent metal track around the door, on which in case of flood alert can be inserted water shields [ FIG. 4.5.8]

Further protection of the building is the application of hydro isolation layer on the walls of the ground floor. This will complete the sealing of the building in case of flood

## Electricity, Sewage and Water access during floods

All buildings have to be provided with electricity during flood events. That means that the electricity network has to be readapted to meet the needs of the inhabitants. Water and sewage systems have to be adapted to be fully functional during floods. Special dual valves need to be installed in all buildings in order to allow the use of water and it's evacuation while protecting the building from being flooded through the sewage system.

## Accessibility in case of submerged ground floor access.

Depending on the level of floods and the location of the buildings in RUA access can vary on different flood levels. When the ground floor is partially or fully submerged, inhabitants have to install permanent or temporary stairs or ladders in order to get out to get a boat. Usually during floods which exceed 50 cm, the business for boat taxi transport, self organized by the inhabitants of RUA is developing. People can get a boat to reach their destination point. All buildings need to have an access door or window sized as a door towards a balcony or a little extension to attach and access a boat taxi.

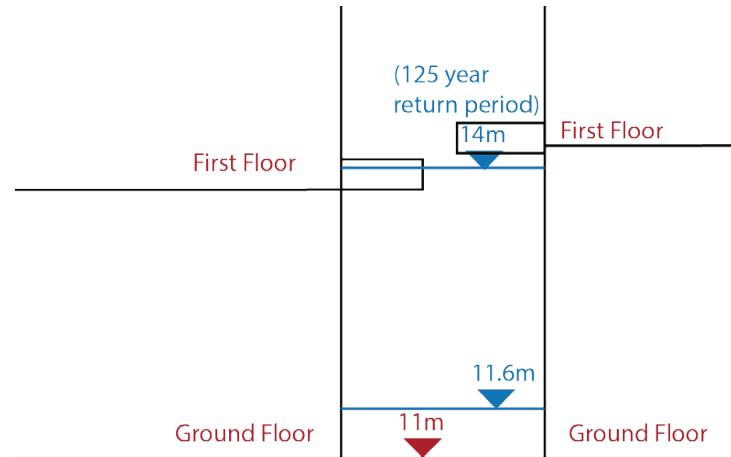


FIG. 4.5.11 Scheme of the present density in RUA. These lanes which are the only access to the buildings located there. On ground floor they are stepping off to leave space for the «street» and from the second floor up they extend to eventually almost face the neighbours. Photo and scheme drawn from the photo. Location: Phuc Xa ward, April 2014

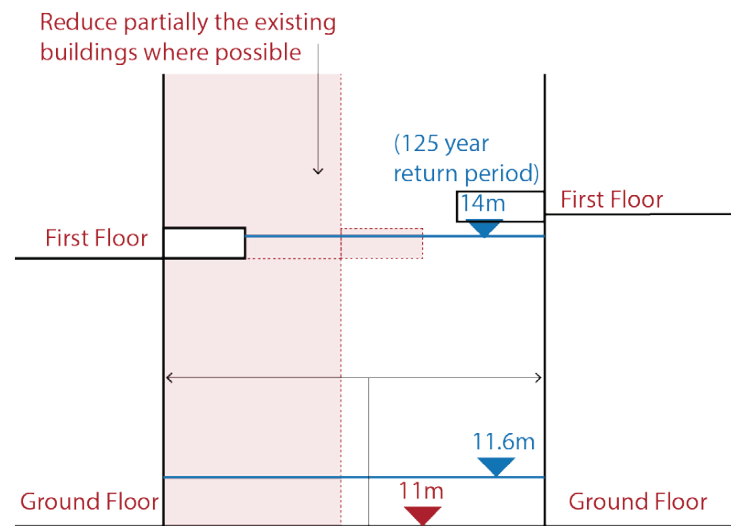
## REDUCE DENSITY IN RUA. ACTIONS

In order to improve the living conditions in the Riverside Urban Areas and to provide the necessary infrastructure, and accessibility, a certain reduction of the density in the areas where it is influencing the quality of life is necessary. The urban structure excluding the projects implemented during the 1950's and 1980's are single buildings quite typical in architecture for Hanoi, know as the tube house. That means that the houses are very narrow in the front facade but very long to compensate the space. They are usually built on a number of floors and in the different parts of RUA that varies from 2 to 7 floors. [FIG. 1.2.7, p.26] That can be considered as an advantage for the implementation of the strategy as in some places where it isn't necessary or it's avoidable to remove a whole building only a part of it can be removed. That is a common view currently in Hanoi as there are many infrastructure projects ongoing and many of them have required the resettlement of part of or whole buildings. The reduce of density has to also be performed by removing all structures threatening the dyke security as a number of structures recently built at the edge of the dyke, modifying it without permission.

The people to be resettled will become a part of the "living with water" development along the red river. That will allow for a lower cost resettlement to be paid by the government in case that is required and if that isn't required then the resettled inhabitants will be proposed to scheme in which to still be part of the resettlement with a certain rent or payment depending on their occupation. If they agree to develop some of the activities part of the strategy to support the development of activators in the newly developed areas, or participate in their construction, then a special program has to be devised for them.



Too narrow to provide access



Widen the 'street' to provide access in emergency cases and floods

FIG. 4.5.12 Section of the situation with a possible solution for density reduction.

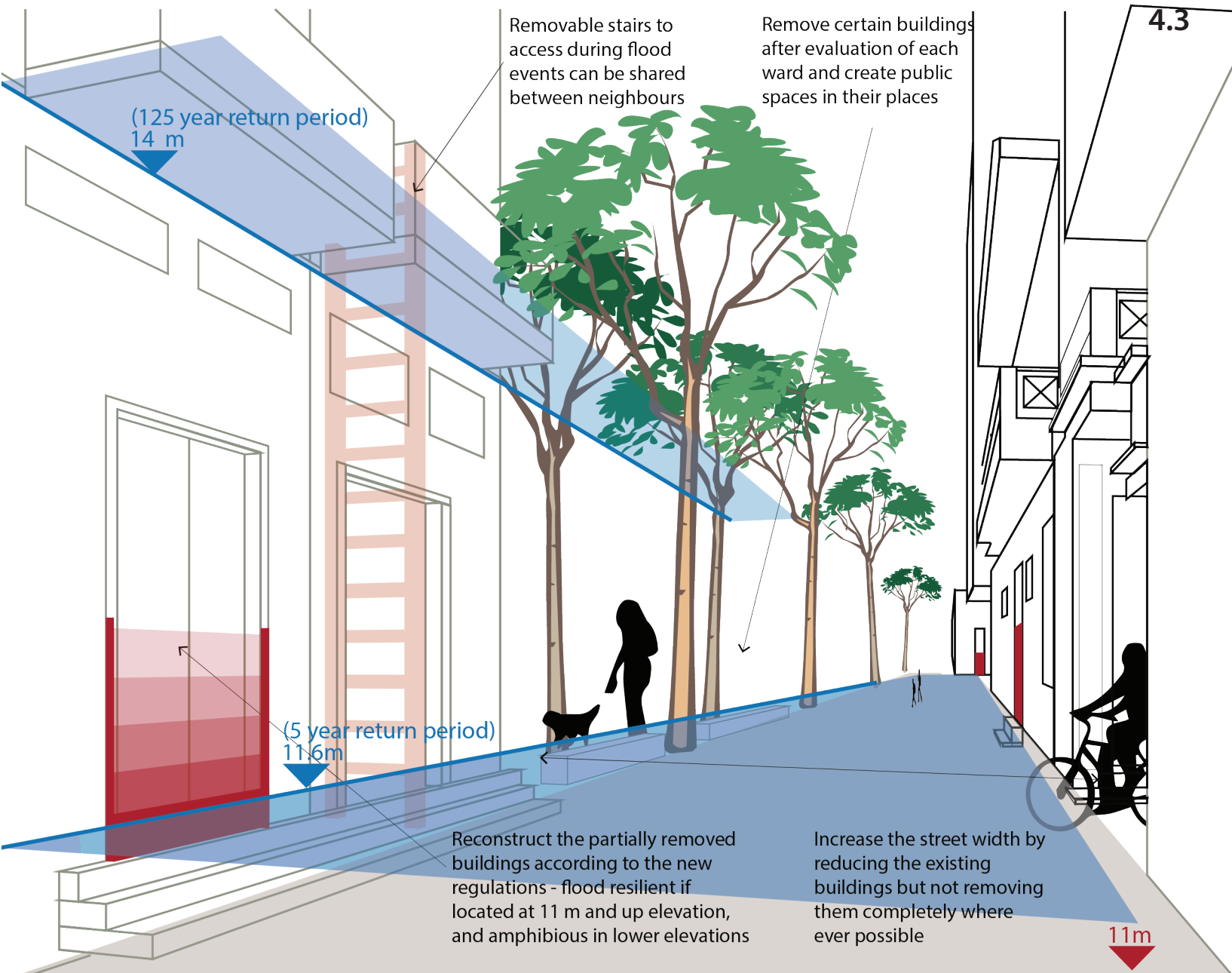


FIG. 4.5.13 A possible image of the same lane, transformed into a street with some buildings reduced and others removed to leave space for the community's public space.



## IMPROVE ACCESSIBILITY AND IMAGE. ACTIONS

Access to the river and RUA is limited to the dyke entrances, but wherever one wants to reach the riverside a labyrinth of houses and narrow lanes which arrive in dead end lanes usually take you nowhere close seeing it. Getting to the river has to be the privilege of everyone as its a public natural asset for Hanoi. However there are areas which can provide direct access to the river and the riverside areas, which little interventions that will not only transform the experience to go to take a walk by the riverside but will improve the image of the concerned areas and will bring opportunities for economic development.

### General actions to improve accessibility depending on the location and possibilities.

- Revitalize existing riverside walkways in RUA
- Create new riverside paths
- Provide access to the existing and future bridges from and to RUA
- Create clearly defined corridors for slow mobility from Hanoi through RUA to the riverside using the already existing dyke entrances and other access points [ FIG. 4.3.3 ]
- Enlarge some of the narrow lanes and streets by reducing density [ FIG. 4.5.11 FIG 4.5.13 ]

For example the buffer space around the Long Bien bridge, which is currently occupied by trucks only during the night to serve the wholesales market right next to it. Considering the possibility those areas to be cleared and the market activity transferred to the other side of the market these areas can be used to create the first in Hanoi pedestrian corridor to the Red river. [ FIG. 3.7.8 & FIG 4.5.14 ]

Such an intervention will include the clearance of all walls

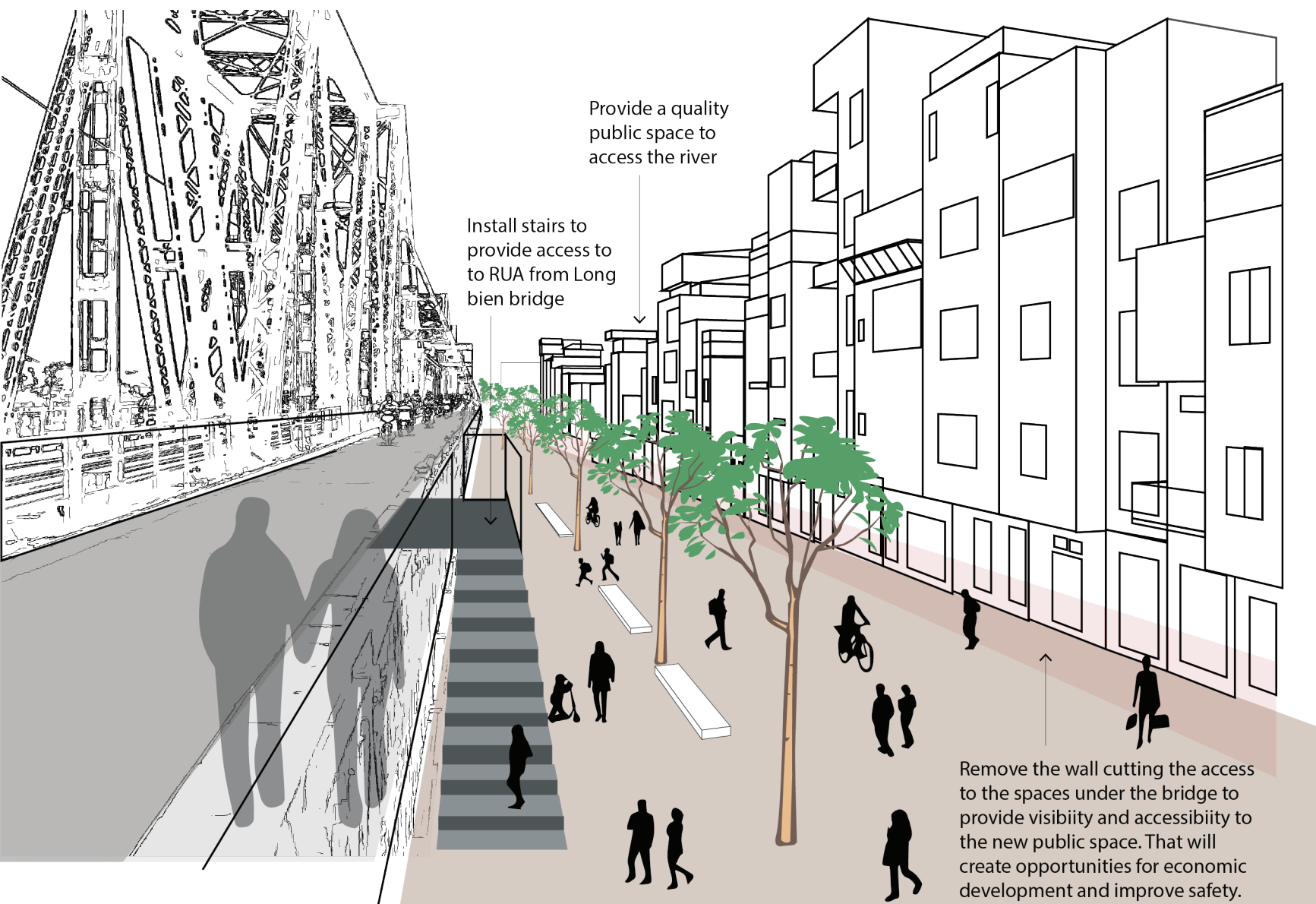
surrounding the area which will open a new perspective to the existing buildings and create a direct relationship between the market and the new urban space. That can be a premise for the extension of the market activities during the days and attract more people to the newly created public space. Providing several staircases to go up and down the Long Bien bridge, which is currently visited by many locals and tourists will open a new door to explore - The Riverside Urban Areas.

The combination of little interventions will finally not only improve accessibility and image but boost economic activities and change the whole face of the area for good. Finally by investing in quality of public spaces the general quality and image of the surroundings will improve as a consequence. [ FIG. 4.5.14 ]

### Actions to help improve image [ FIG 4.5.20 ]

- Create public spaces
- Install street lightening
- Create events for the city on the riverside
- Improve the general urban environment
- Recreate the relationship with the nature through RUA
- Develop diverse recreational activities
- Improve access

The actions to improve the image of RUA are directly linked and dependent on the actions to improve resiliency, provide accessibility, recover, preserve the Red river landscape and especially to the living with water paradigm that is to be promoted by the amphibious projects for resettlement.



## RECOVER AND PRESERVE THE LANDSCAPE. ACTIONS

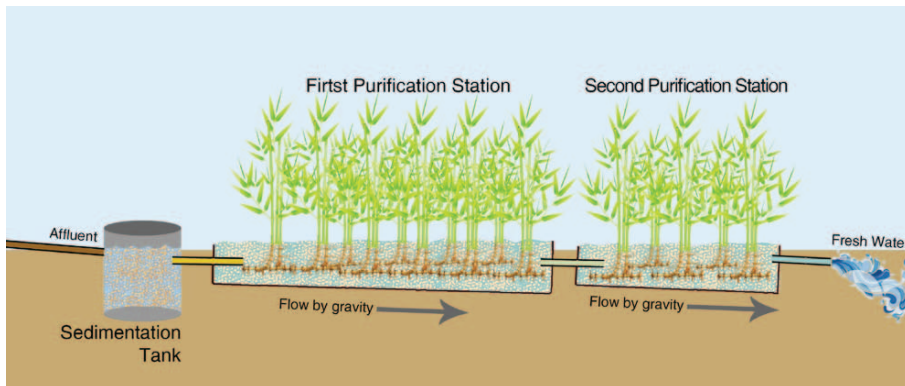


FIG. 4.5.15 An example of a section representing a natural purification system relying on gravitation to move the flow and on vegetation with purifying qualities to extract the pollutants from the water.  
Source: <http://theotherdada.wordpress.com>



FIG. 4.5.16 Example of implemented natural purification station in Chongqing, China  
Source: <http://elkkidsnews.wordpress.com/>

One of the very important issues to face and find a solution for is preserving the landscape of the Red river and dealing with pollution. One approach of is to deal directly with the pollution caused by RUA in terms of garbage and wastewater directly evacuated in the river without treatment. Considering the economical cost of constructing a water treatment plant, plus the sewage infrastructure, and the time it will require, a fast, low cost and especially natural solution to the problem in RUA can be applied instead.

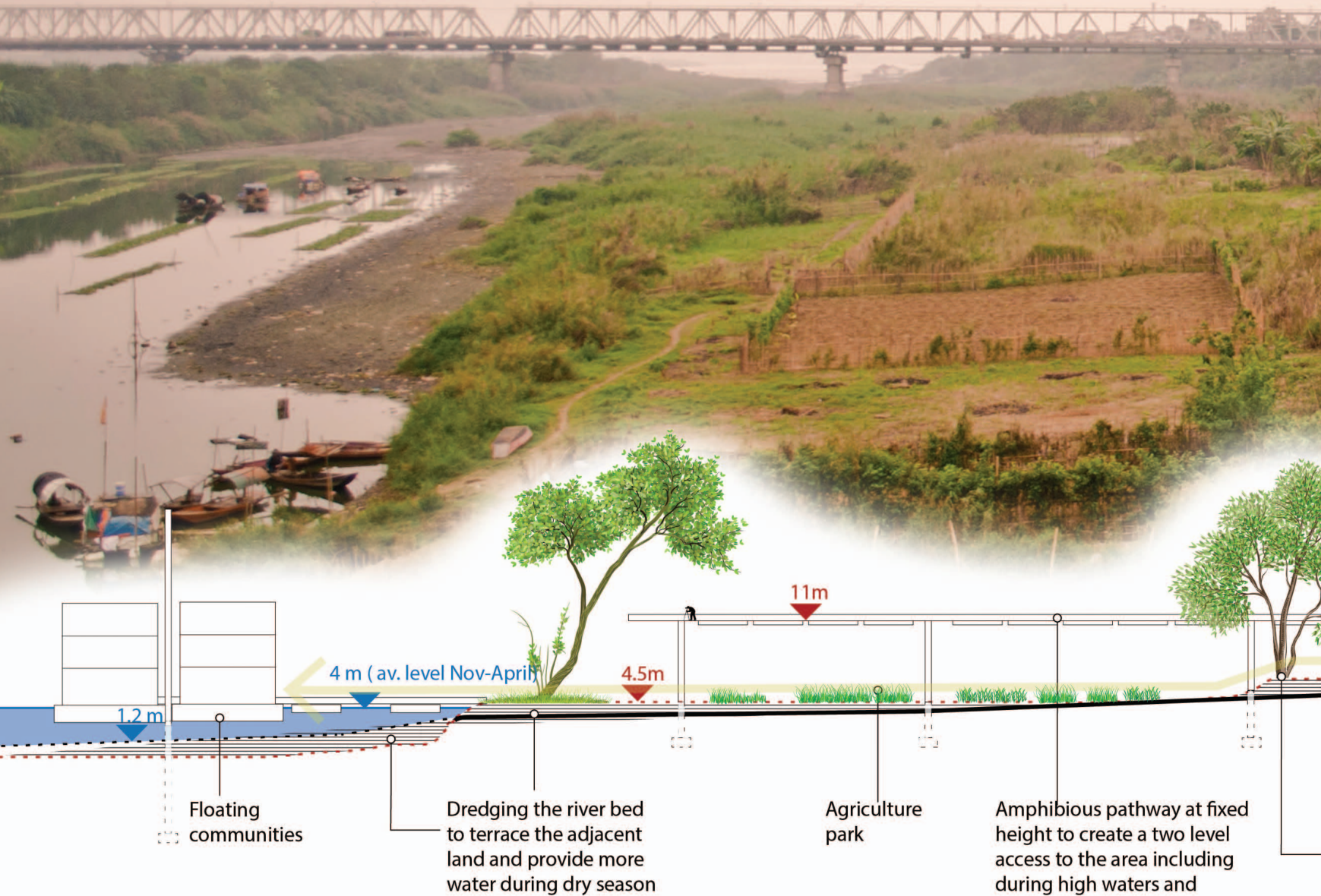
Since a part of the strategy is terracing the flood plain [FIG. 4.3.17] wherever that is possible, in many of the areas where a sewage canal is directly flowing into the flood plain, a natural treatment system can be installed. The natural system consists of a sedimentation tank to collect the large particles of the flow and two "purification pools"

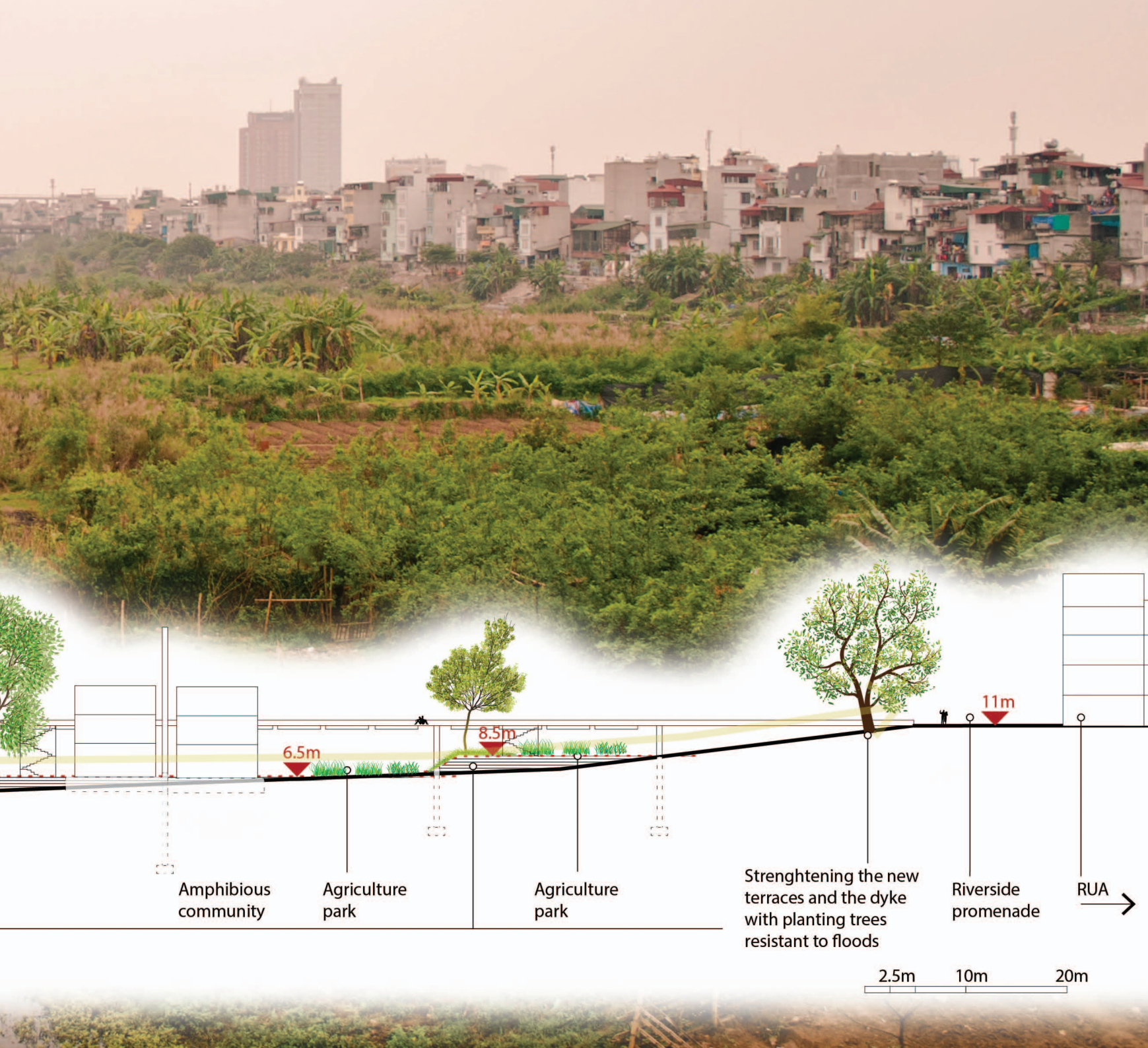
or stations located in two different levels or terraces to allow the flow of the water by gravity. In the purification stations a proper for the climate plant with bacteria absorptions abilities is densely planted. [FIG. 4.3.15] As the water flows naturally from one pool to another, the flowing at the end water is clean and ready to be reused or safely evacuated into the river.

In the case of the riverside areas the purified water can be used for irrigation of the agricultural fields that are and will continue to be part of the riverside landscape. One of the advantages of such treatment system is that this becomes a part of the landscape and no smell is present around the purification stations. Such practices are applied successfully in many countries such as this example in China. [FIG. 4.5.16]

It will completely transform the image of the currently polluted and overflowing of garbage sewage channels in RUA, but will also change the perception of the people for the nature from being a useless asset to being a useful one as it will contribute to their well being.

FIG. 4.5.17 Terracing the Red river plain in areas where possible. Define areas for amphibious living. Background image Chuong Duong bridge and Phuc Tan ward, March 2014





Amphibious community

Agriculture park

Agriculture park

Strengthening the new terraces and the dyke with planting trees resistant to floods

Riverside promenade

RUA →

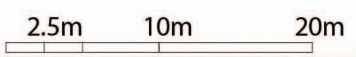
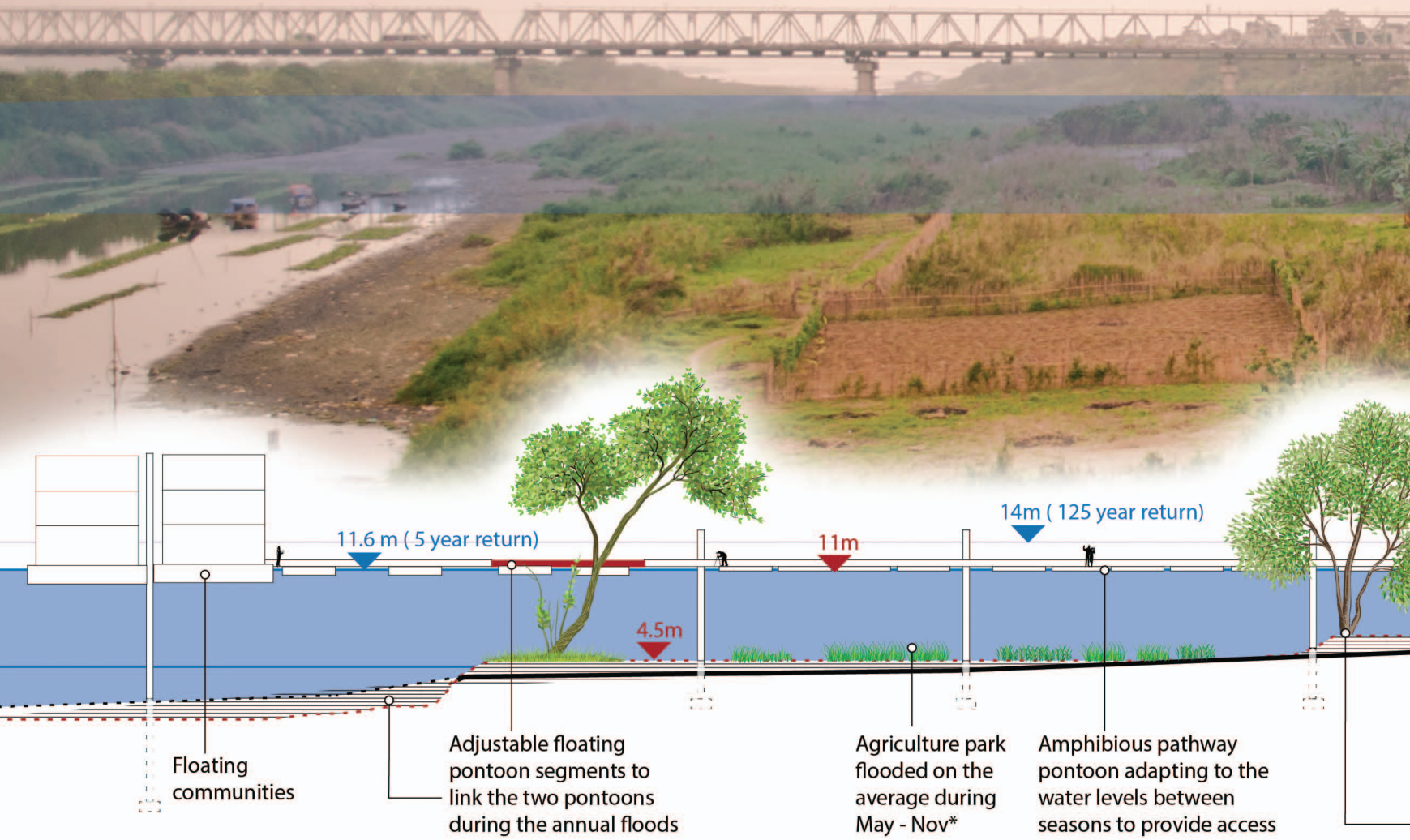
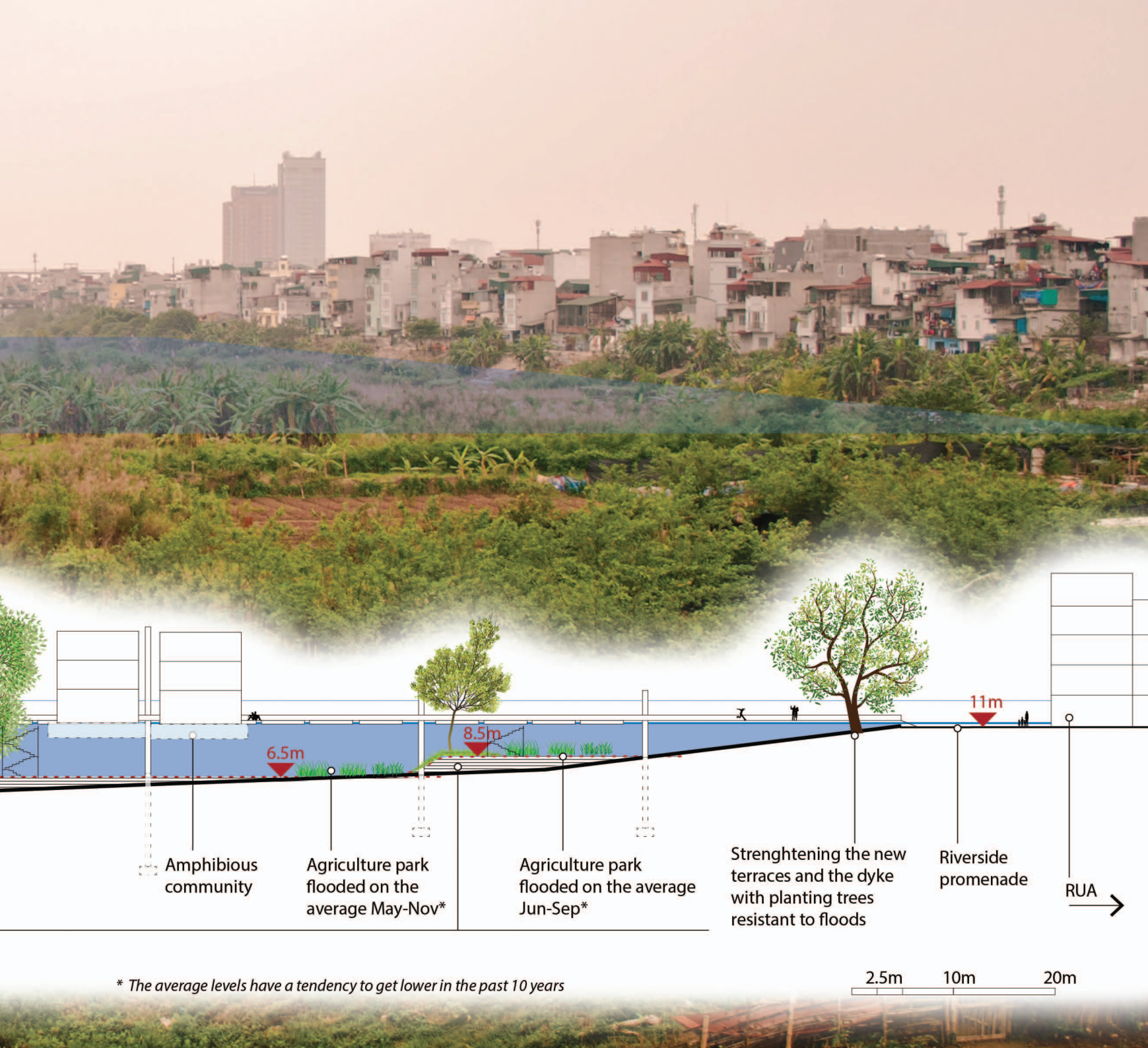


FIG. 4.5.18 Example of terracing the flood plain with the presence of amphibious communities during high water in forecasted 5 year return period.  
Background image Chuong Duong bridge and Phuc Tan ward, March 2014





Amphibious community

Agriculture park flooded on the average May-Nov\*

Agriculture park flooded on the average Jun-Sep\*

Strengthening the new terraces and the dyke with planting trees resistant to floods

Riverside promenade

RUA →

6.5m

8.5m

11m

\* The average levels have a tendency to get lower in the past 10 years

2.5m 10m 20m

## TERRACING AND AMPHIBIOUS LIVING

**Amphibious** living means creating an environment which is adaptable to the changing levels of the river and therefore allows for different activities and experiences between the seasons. The strategy is proposing the living with water idea as a possible solution in dealing with the issues in the Riverside Urban Areas and hence thinking of creating a resilient and adaptable to the climate change and environment city in the future.

The actions of the strategy need to overlap in order to achieve that resilience. Creating the amphibious communities is a part of the living with water program that the people whose homes will have to be removed to reduce the density in RUA will be redirected to close to their current location areas but closer to the water. Each of those communities will have a main function and combine a number of functions in order to serve as an activator for the area. Each of the amphibious communities will also need to have a social mixture to provide a diverse experience and services for everyone.

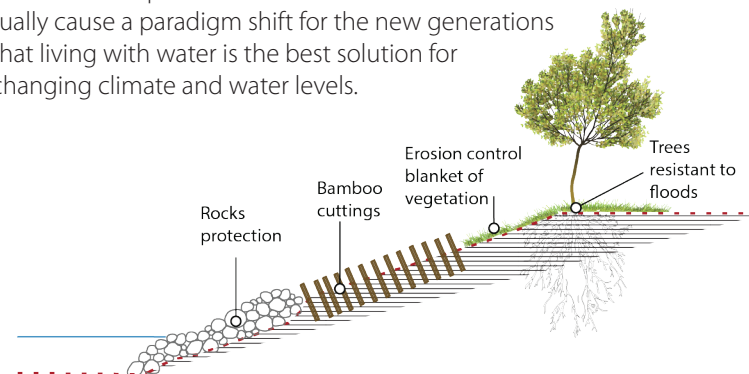
Those communities are to be located pretty much adjacent to the current limits of RUA but on the lower lying terrace and provided with permanent access by ground and elevated to 10.5 -11 m by amphibious pontoons. They will become part of the amphibious landscape changing with the raising waters together with the housing giving a new experience of water and changing perception of it being dangerous but rather exciting and valuable to live close to.

**Terracing** the flood plain is to be done by dredging the Red river bed at certain point where it is too high and sometimes blocking the water during dry season, and balancing the it to the adjacent ground to create the terraces. Depending on the location and land available they can be arranged in 2 or 3 levels, slowly going down to the maximum low level expected - 4 m in Hanoi. On each terrace a riverside path is to be created and the terraces strengthened by a technique of planing trees, vegetation

and that can support the longest flood period as well as stone and bamboo materials to avoid erosion or destruction. [FIG.

On the highest and closest to the urban fringe or RUA terrace an agriculture park is to be maintained with access provided for the public and with parts dedicated to different recreational activities. On the second level in some areas amphibious communities are located. An average elevation of 6-7 m will allow for the houses to stay on ground during the dry season for 5-6 months and raise slowly with the water and the access paths during the rest of the time. Such variability will increase the adaptability of the people living there or visiting and turn living with water into the new normal. On the lowest level of the terraces agriculture can still take place as well as a riverside path to provide proximity to the water during the periods with the lowest water levels. Right next to that last level of terraces in the water a floating community is to be located. Located directly on water and adapted for that this kind of living will attract nature lovers and people looking for a healthier living environment close to the urban core. Those areas will be linked to the lowest ground level adjacent to them and have floating pontoons attached to them which when water will rise will rise together with it and can be attached to the rest of the amphibious network to provide accessibility. However the floating community has the privilege of having their boats and being able to move around freely when water rises to reach dry ground.

An amphibious environment is in fact and adaptable and resilient to water fluctuations one that allows the people to stay comfortably living on the water and provide a solution for the resettlement of RUA and eventually cause a paradigm shift for the new generations that living with water is the best solution for changing climate and water levels.



4.5.19 Strengthening the terraces to prevent erosion



# PRIORITY OF ACTIONS

## PRIORITY OF ACTIONS FOR THE STRATEGY IMPLEMENTATION

In order to implement such a territorial strategy involving a number of actions dependent one on another it is necessary to define the priority of their order. However the territory should be divided into smaller projects so that the diversity of the results will be high enough to evaluate the results and define the successful and unsuccessful ones. However a certain priority of general actions need to be taken before the start of any real project implementation. Below is their order and the actors responsible.

### GENERAL ACTIONS BEFORE THE IMPLEMENTATION OF ANY PROJECTS

1. Evaluation of the existing structures in RUA and their legal status according to current regulations
2. A new dyke law and regulation about construction in the flood plain and on water
3. Define structures that needs to be removed regarding the safety of the dyke and the reduction of density to meet the new regulations
4. The rest of the structures that can stay have to undergo a resilient reconstruction with minimum improvements to cope with any future floods
5. Terracing the flood plain thought a balance of earth masses - dredging the river bed and dispose the stilt to create the terraces. This will give depth of the river during dry season.
6. Strengthen the terraces and the dyke with vegetation to protect from erosion
7. Treatment of the wastewater of RUA currently directly discharged in the Red river using natural filtration methods
8. Improve accessibility to RUA by making it more pedestrian friendly and human scale accessible
9. Start of the resettlement program with work shops involving the local authorities, inhabitants, private investors and planners and designers

### ACTIONS ALONG WITH THE IMPLEMENTATION OF PROJECTS

1. Start the implementation of two pilot projects for amphibious communities as an experiment for the strategy.
2. Together with the two pilot projects start implementing the diverse activities previewed in the strategy for those areas to activate them
3. Provide access to the riverside and facilities to the new activity areas
4. Promote events to attract people to explore the riverside

*\* The colors of the actions priority relate to the actors responsible for their implementation. They are listed on the following page of Political feasibility with the relevant colors for each actor*

# POLITICAL FEASIBILITY

## POLITICAL FEASIBILITY

The project aim is to find an alternative to the second dyke to formalise urban development in RUA and transform it into a resilient to floods urban area in balance with the river fluctuations. The **first goal** is to analyze the current state of the settlements, evaluate them according to the safety of the dyke, density and terrain elevation. **Second step** is to define a new law for the Dyke and development in flood prone areas. **followed by** designing a program for the resettlement of the problematic structures, involving the concerned population, local authorities and private actors to identify the possible solutions. **Lastly** a resilient reconstruction of the existing structures has to be performed to reply to the demands of the new regulations for living in RUA.

ACTORS	RESCOURCES	BENEFITS
Hanoi People's Committee	Political, Economical, Land	Find a solution to control urban development in RUA and create a new part of Hanoi including the river
MARD -> Department of Dyke Management and flood control [DDMFC]	Legal, Political, Economical,	Ensure the stability of the dyke and flood protection of Hanoi
Wards and District authorities of RUA	Legal, Political, Economical,	Improve urban quality of living and resiliency of the buildings and the communities. Attract activites and economic development in RUA's wards.
Local inhabitants on land and water formal or informal	Cognitive	Establish a new identity and image for the community and share knowledge of living with the river to create better living coditions during floods
Private investors	Economical	Economic benefits of the projects development as well as the chance to develop from scratch with the legal support of the authorities
Design and Planning experts	Cognitive	A chace to experiment a new approach to living in flood prone areas learning from the local's knowledge and experience creating a new pradigme for living in Hanoi.

# SOCIAL FEASIBILITY

## SOCIAL FEASIBILITY

The social feasibility of the proposed strategy is evaluated by the criteria of **who** will participate, **how** they will be involved, **when** regarding the stage of involvement, **what** are the issues to be solicited and **how much** power the public authorities will have over the strategy implementation.

### GOALS

- Increase resiliency of the communities to floods
- Improve quality of life
- Free space for public spaces
- Build a new image
- Improve accessibility
- Bring activities to the riverside areas
- Create opportunities for economic development

### OBSTACLES

- Legal aspects of the existing urbanisation
- Necessity of a new law for the dyke and constructions and land use in flood prone areas
- Bad image of living on water
- Urban Pollution
- Cultural aspects concerning the strategy
- Malfunctioning administrative system
- Lack of infrastructure and access to the river

### WHO I Participate

All residents in RUA without concern of their legal status including illegal floating communities without citizenship registration.

### HOW I Participate method

- Collaborative workshops of locals and experts to exchange knowledge of the areas and try to find the best solutions that will improve the quality of life in RUA and creative solutions to cope with future-flood events.
- Seminars to educate and inform the inhabitants about floods, risk, regulations and how to secure their houses to resist the river fluctuations.
- Special workshops for the people who have to be resettled with the local authorities and planners, to propose a living with water resettlement program and exchange ideas, solutions and needs to be met.

### WHEN I Stage of involvement

Throughout the whole process of planning and development, followed by postdevelopment and project evaluation

### WHAT I Issues to be solicited

- Cultural aspects
- Perception of living on water
- Bad image
- Security and accessibility

### HOW MUCH I Public Authority

They have control on what kind and duration of activities and where they will be located concerning the safety of people during floods.

## WHAT AND WHERE ? ACTIONS OF THE STRATEGY

The living with water strategy is a combination of many actions that take the river back to Hanoi and Hanoi back to the river. Seeking to answer the major issues in the Riverside areas it combines a number of actions

**The Resilient reconstruction** is to be applied to all the existing constructions in RUA that are not evaluated for removal. It is to be applied to all constructions at all elevations, however at elevations lower than 10.5m on the long term all constructions have to be substituted with amphibious ones to avoid the inconvenience of more frequent floods at these elevations and to restore the flood capacity of the river.

**The density reduction** is to be performed in most parts of RUA but still needs to be defined with a detailed evaluation of the current situation in each ward. It has to be a part of the whole strategy integrated with the accessibility improvement and providing better infrastructure as well as according to the safety of the dyke and improvement of quality of the urban environment.

**Strengthening of the dyke and new terracing** is to be implemented all along the river banks to ensure the safety of the dyke and avoid destruction of the landscape in case of flood.

**Access to the river** is provided in a number of ways. First by clearing the density of structures breaking the access currently, secondly by providing river long pathways on a few levels to ensure the river experience during the year, and thirdly by improving access from the city to the Riverside Urban Areas.

**Amphibious communities** to accommodate a part of the displaced population from RUA and to attract tourists, artists, students and Hanoians looking for a natural living in the city. Those communities location is selected by a few criteria such as the current presence of floating communities, the elevation of the land and the available land in the flood plain. Locations where a floating com-

munity exists are considered as the improvement of the quality of services and facilities can integrate the poor floating communities to enhance their quality of life. Amphibious communities will be mixed use to serve as activators for the areas but mostly providing recreational uses such as sports center, schools, aquaculture, artist studios, performance spaces, restaurants and bar etc. In Vietnamese culture the community house is a very important element and therefore all of the amphibious communities will have a community house floating or amphibious to provide space for the traditional and modern society activities not only for the amphibious communities but for all RUA since there community houses are rare.

The areas that might be considered as pilot projects are those in which today floating communities exist such as the Phuc Tan Port, The Van Hoa community on the island and the one the flood plain in proximity to Long Bien bridge. They can serve as experimental areas to test the living with water strategy.

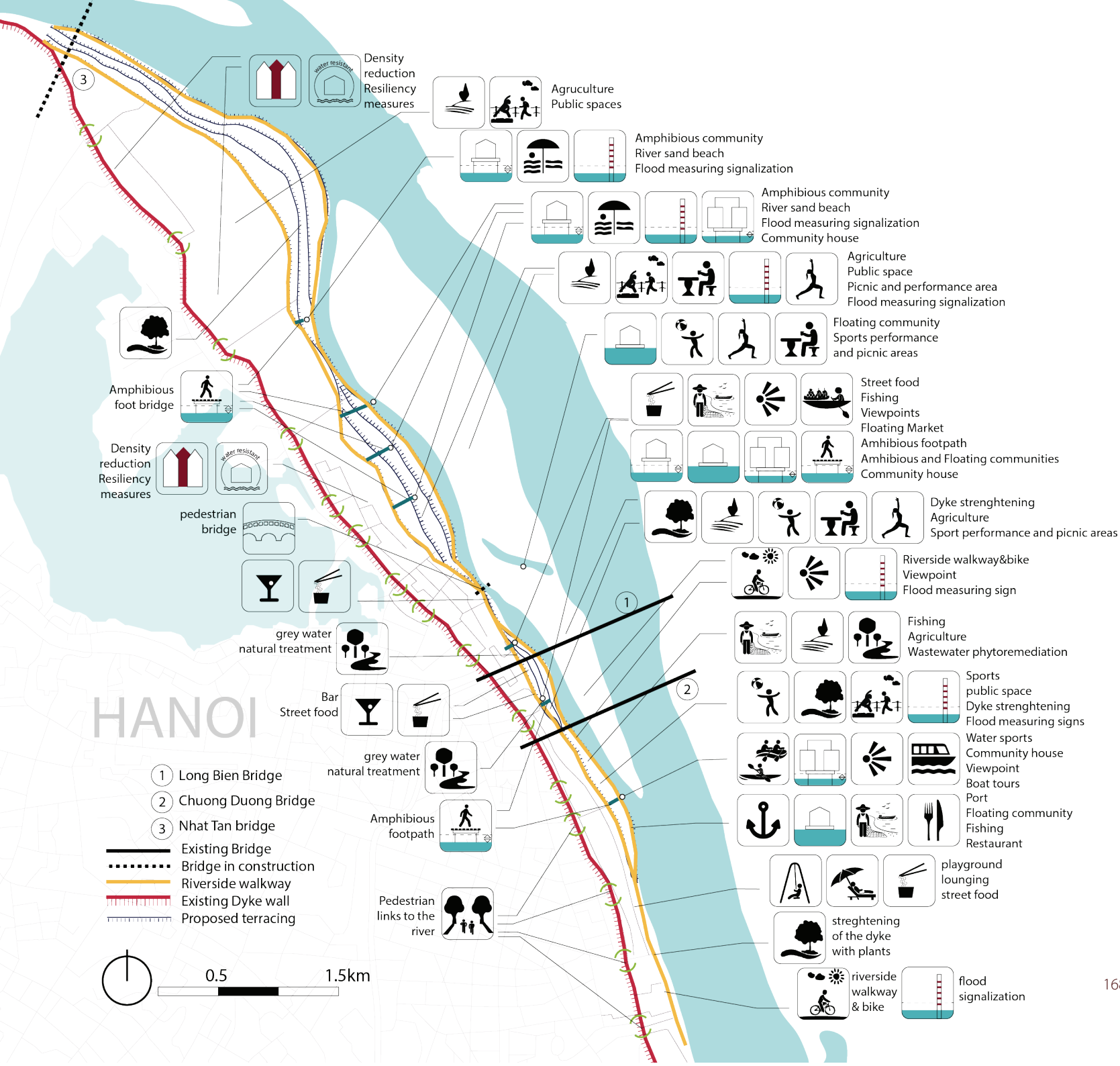
### **Agriculture Fishing and Floating market**

Agriculture development in RUA is currently existing as well as fishing but they need to be developed to become more productive and be part of the floating market which will provide the necessary for the floating communities but as well become an attraction for locals and tourists.

Agriculture will become a part of an agriculture park where public access will be designed to not interfere with the private production but rather provide business opportunities for the production to be sold in place.

### **Public space, Paths, Sports areas , Natural Beach and Floods signalization**

All the mentioned are to be provided in the agriculture park and the terraced flood plain. In all areas a visible signalization for the measurement of the water level has to be installed to provide on the spot visual information for the people using the space or living there. That will allow for the fast spread of information between the people in RUA and allow the protection measures, where those are applicable, to be applied



Density reduction  
Resiliency measures

Agruculture  
Public spaces

Amphibious community  
River sand beach  
Flood measuring signalization

Amphibious community  
River sand beach  
Flood measuring signalization  
Community house

Agriculture  
Public space  
Picnic and performance area  
Flood measuring signalization

Floating community  
Sports performance and picnic areas

Street food  
Fishing  
Viewpoints  
Floating Market  
Amhibious footpath  
Amhibious and Floating communities  
Community house

Dyke strenghtening  
Agruculture  
Sport performance and picnic areas

Riverside walkway&bike  
Viewpoint  
Flood measuring sign

Fishing  
Agruculture  
Wastewater phytoremediation

Sports public space  
Dyke strenghtening  
Flood measuring signs

Water sports  
Community house  
Viewpoint  
Boat tours

Port  
Floating community  
Fishing  
Restaurant

playground  
lounging  
street food

strengthening of the dyke with plants

riverside walkway & bike  
flood signalization

Density reduction  
Resiliency measures

pedestrian bridge

grey water natural treatment

Bar  
Street food

grey water natural treatment

Amphibious footpath

Pedestrian links to the river

- ① Long Bien Bridge
- ② Chuong Duong Bridge
- ③ Nhat Tan bridge

- Existing Bridge
- Bridge in construction
- Riverside walkway
- Existing Dyke wall
- Proposed terracing



HANOI



**CONCLUSIONS**

**v**





## CONCLUSION

Starting this work with the very large scale of the international and national issues of the water management in the Red river basin, was important to explain, that local problems in RUA can't be just seen as such, and solutions for them have to be looking outwards to the major sources to be able to define them. The large scale exploration allowed for the definition of the problems on the different scales directly or indirectly linked to each other, influencing the life in the Red River Delta. Major problem on the scale of the Red River Delta as well as the Riverside Urban Areas are floods, and water management throughout the seasons. On the large scale - nationally in order to reduce the risk of floods, that the system of dykes and reservoirs won't be able to support, is necessary to look for an integrated water management solution including the source of 40% of water the water downstream - China. However nowadays as long as the flood risk is a fact there is an increasing risk of more droughts partially due to climate change and largely due to non coordinated management of the water resources in the Red river basin. Those large scale issue are directly concerning the population of the Red river delta in terms of its economical development and quality of life. Floods as well as droughts cause enormous economic losses in terms of agricultural production, industry, fluvial navigation etc. The battle in the thousand years of existence of the Red river settlements is however against floods. A whole dyke system wrapping the low lying land of the delta is protecting Hanoi and its surroundings from the annual fluctuations of the Red river. The capital of Vietnam was built on the banks of the Red river and it was a vital part of its existence and growth, majorly because of growth of rice and river transportation of goods. The centuries of battling high water levels had lead to the improvement and heightening of the dyke system, where especially the dykes protecting Hanoi were heightened the most to provide better pro-

tection. Today's dyke protecting Hanoi is consisting of the step dyke in the height of 13m on top of which a 2 m wall was constructed to increase protection after the floods in 1971. However since that time Hanoi is experiencing a fast growth period, where in the last 60 years its population has increased from 436 624 inh in 1954 to over 3 million in 2010. Accommodating this growth in a city with the necessary speed to respond the demand for housing, for a country with no such experience, as still 70% of its population is rural, reveals its turndowns today.

Different reasons in between which, the switch to an open market economy, liberalisation of the property market values and laws inviting for self construction, combined with unclear or lacking regulations and authorities unable to control for their implementation, as well as attractive location and low prices has lead to the urbanisation of areas located in the flood plain outside the dyke protection wall. In 2004 the estimated population in those areas in the urban districts of Hanoi was estimated at 160 000 inhabitants as in the whole riverside urban areas including the rural districts the numbers reached 224 000 inhabitants. Today even though a clear statistics of the population in those areas isn't available, after another 10 years of strong growth of Hanoi the attractiveness of RUA is still very highly attractive for immigrants looking for jobs in Hanoi as it offers low prices and strategic location. As the territory of the flood plain is limited the density in the urban parts is in some cases higher than in the historical quarter. This puts the question on **why those people have chosen to live in an area with flood risk and how the authorities that failed in preventing this of happening can find a way to deal with the issues in those areas?**

Regarding the question why people chose to live with the flood risk, is the fact that mostly urbanisation has happened in areas elevated on 10m or higher where flood water used to raise to annually but however that is only considered as an inconvenience for the concerned inhabitants rather than a life threatening risk. A second very important reason is the fact that RUA is located in a strategical position adjacent to the city center and due to the flood risk its property prices are much lower. However the authorities need to find a way



to formalize this largely unplanned development to be able to provide the necessary facilities for a quality urban environment. Therefore a solution to either resettle over 160 000 people, or a way to formalize their way of living already adapted to a certain extent to the water fluctuations of the Red river is necessary. I propose that the second option is to a large extent much more sustainable in the economical, social and environmental aspect is a strategy for the development of RUA is defined with clear actions to be taken and actors to be responsible for their implementation. I believe that this is an approach that will answer the needs of the population and the authorities and that is what urban planning is generally seeking to achieve. I also think realistically of the situation of a population equal to a medium size European city to be moved from the environment they have already adapted to live in, and to find a real place to move them to, in the context of a growing city, already urbanizing all available agricultural land around Hanoi and undergoing a property market crisis. These are the reasons that make me believe an alternative solution is necessary and therefore find ways to live with the natural regime of the river in a way that will be valuable for the river and for the population inhabiting its flood plain. The proposed in this thesis strategy is a way to test if such an approach can meet the needs of the inhabitants, improve their resiliency, provide better quality of life and at the same time boost economic development and help the authorities define better rules for living in RUA.

The strategy proposes that the existing urbanisation in RUA is to stay under certain conditions and is to undergo a resilient reconstruction. First and indispensable action is to issue new regulation in which to define not where and what **isn't** allowed to build in RUA but instead what and where and under which conditions **is** allowed to be built or legalized. The conditions are what is necessary for the

transformation of RUA in a resilient to floods area.

Further important actions are to provide better accessibility to RUA and to the river and reduce the density of its the most crowded parts, to provide better infrastructure and quality of life for the inhabitants. The major approach of the strategy is living with water and that is one of the solutions to the density reduction. Reducing the density will inevitably cause the resettlement of different parts of RUA and in order to find a place for those people, the amphibious communities as an experiment are proposed. This is a solution that will provide a place for the concerned residents, to move but still stay close to their current location as the amphibious communities will be built on lower lying land in the flood plain or directly on water. The paradigm of living with nature that used to exist centuries ago and was continuously abandoned with the modernization and industrialization needs to be revitalized and transformed into a culture of living with water. The areas to be resettled are to be defined by a precise evaluation in each ward and community workshops with the concerned actors are to be held in order to explain to the inhabitants the benefits of such living and learn from their experience of living with the changing river levels and how they have learned to adapt to them.

Living with water is a strategy that will allow to create the first flood resilient community in Vietnam that is well prepared and informed on the risks of the environment that they inhabit and adapted so that when floods occasionally happen they have the means to continue their daily routines in a more comfortable way. The amphibious communities will serve as an experiment to such type of living and construction in flood prone areas and will eventually define a new amphibious future for RUA and why not in other parts of Vietnam with the same issue

In a context of climate change forecasts floods of increasing sea level and larger quantities of rainfall floods will continue to be a part of life in Hanoi and its riverside. Improvement of integrated water management might achieve a certain control over such events and allow for efficient information distribution to the population. That however is a future assumption and experimenting on alternative



solutions such as living with the water might bring new opportunities and ideas for the future.

In order to achieve the feasibility of this strategy though it is necessary that the authorities are willing to experiment on new solutions and get to a bottom up approach instead of the dominating top down one. It is necessary to be ready to make changes in the administrative and legal structures and give more power to the authorities to exercise control. The authorities have to stop seeking their personal interest but rather that of the people and take decisions that will benefit not only the riverside urban areas but in fact all Hanoi by revalorizing the river as a natural asset of the city and making it a part of it again.

It is necessary to make a strategy, define the actions, break it down into small projects, get the stakeholders and invite investors to turn it all real.

The strength of such a strategy and approach is the fact that it seeks to use the overlaying of diverse problems - social, economical, environmental administrative, urban etc to deal with the whole through integrated interventions that will influence not only one of the issues but a number of them simultaneously. It isn't a specialistic or sectoral approach that would divide the attention to the often distinguished fields or urban planning, but rather an integrated one that tries to involve actions on different levels and different types of knowledge and power to achieve the results.

## ACRONYMS

RRD - Red river delta  
RRB - Red river basin  
LWR - Law on water resources  
ADB - Asian Development Bank  
RRBO - Red River Basin Organisation  
MARD - Ministry of Agriculture and Rural Development  
CSBO - Cau sub Basin Organisation  
DSBO - Day sub basin organisation  
IWRM - Integrated water resource management  
MoNRE - Ministry of natural resources and environment  
LURC - Land Use Right Certificate  
DDMFC - Department of Dyke Management and Flood Control  
DMFC Dyke Management and Flood control  
CCFSC - Central committee for flood and storm control  
MoC - Ministry of Construction  
HPC - Hanoi People's Committee  
HDC - Hanoi District Committee  
HAIDEP - The Comprehensive Urban Development Programme in Hanoi Capital City  
JICA - Japan International Cooperation Agency  
CBD - Central Business District  
HOC Housing Ownership Certificate

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## LIST OF TABLES

FIG. 3.1.1 Number of population and houses in RUA since 1925, Source: Uyen ( 2002) and Hung (2005), taken from Hoang 2007 40, p. 57

FIG. 3.3.1 Population Density and growth by Urban center, Source HAIDEP 2, p.70

FIG. 3.4.3 Major historical floods in the RRD. Source: *Stability analysis of the dyke system*, Plaxis Bulletin 2013, www.plaxis.nl, p.78

## LIST OF GRAPHS

FIG. 3.2.3 Changes of population and housing in the RUA during 1975-2004 and impacts of the Ordinances on Dyke and flood situation, Source: Hoang 2010 47, p63

FIG. 3.3.2 Satisfaction levels of respondents about the living conditions in RUA, Source Survey 2004 55, p.71

FIG. 3.3.3 Flood experience and perception among the respondents, Source Survey 2004 55, p.71

FIG. 3.4.2 Flood frequency in Hanoi 1902-2001 (as per water level), p.78

FIG. 3.4.4 Peak water levels of the Red river at Hanoi station between 1957 - 1999, Source: adopted from - Jan Willem Vrolijk 2002 1, p.79

FIG. 3.4.5 Annual highest and lowest levels of the Red river at Hanoi station between 2002 and 2012, Source: Data from General Statistics Office of Vietnam, p.79



## LIST OF FIGURES

FIG. 1.1 ( previous page) Hanoi 1896, Centre des archives d'outre-mer, Aix-en-Provence, provided by E. Cerise, IMV-Hanoi, p.13-14

FIG 1.1.1 The Red River Basin. Source: *Plaxis Bulletin* 2013, original Khoi [2010] p.15

FIG 1.1.2 Vietnam topography interpretative map p.16

FIG 1.1.3 Red river basin. Existing and planned river works in China and Vietnam, Source: Tuan Pham Anh 2013, p.17

FIG 1.1.4 Red river delta. Dyke system and flood plain, Source: Tuan Pham Anh 2010, adapted from Gliedman J. 1972, p. 21<sup>7</sup> p. 18

FIG 1.1.5 Red river evacuation corridor in case of extreme flood events Source: Tuan. Pham Anh 2011 , *Water Urbanism to Respond to Climate Change*, Belspo-MoST Research Project 2010-2012, 3rd workshop. p. 19

FIG 1.1.6 Evacuation corridor in case of extreme levels of the Red river. Source: Tuan Pham Anh 2011 , *Water Urbanism to Respond to Climate Change*, Belspo-MoST Research Project 2010-2012, 3rd workshop, p. 20

FIG 1.2.1 Red river delta dyke system, [date unknown]. Source: *Institute de metiers de la ville - IMV-Hanoi*, p.26

FIG 1.2.2 Red river delta dyke system. Source: Tuan Pham Anh, (2011)<sup>11</sup> p.21

FIG 1.2.2 Red river delta dyke system, Source: Tuan Pham Anh, (2011) 11, p.22

FIG 1.2.3 Dyke works 1924 - 1931 Red River Delta. Source: provided by Tuan Phan Ahn [Pouyanne 1931 NLV/M8-6386] p. 23

FIG 1.2.4 First Red river dyke in red called Co Xa. Map of Hanoi 1882. Source: <http://www.tuanvietnam.net/thuong-nho-tay-ho>, p.24

FIG. 1.2.5 Profile of the dykes of the Red river showing their evolution and enforcements. Source: [J. Gauthier 1930. *Digues du Tonkin*, M6409-National Library of Vietnam] p.24

FIG. 1.3.1 Difference between natural and urban surface runoff water , Source: [http://www.lakesuperiorstreams.org/understanding/storm-water\\_hydrology.html](http://www.lakesuperiorstreams.org/understanding/storm-water_hydrology.html) p. 27

FIG. 1.3.5 Reservoirs in the Vietnamese part of the Red River Basin, Source: [http://baobab.elet.polimi.it/iwrmwiki/IMRR:WP3.1\\_introduction/en](http://baobab.elet.polimi.it/iwrmwiki/IMRR:WP3.1_introduction/en) p.31

FIG. 1.3.7 Schematic wastewater system of Hanoi , Source: *Urban Flood Risk Management*<sup>21</sup> p.33

FIG. 1.3.8 Articulation of governance levels in the Red River Basin[Vietnam] Source: p.23 François Molle, Chu Thai Hoanh<sup>26</sup> p.34

FIG. 1.3.9 Red river basin in 3 countries. Division of the RRB in Vietnam in sub river basins, p.35

FIG. 1.3.10 Structure of the Mekong River Commission, p.36

FIG. 2.1 ( Page 39) Hanoi province administrative boundaries and the spread of urbanisation of the urban core today, p.39

FIG. 2.2 (Page 40)The red river delta and it's villages in black. On top

outlined in Red the current administrative limits of Hanoi Province. Source: E. Cerise<sup>29</sup> p.40

FIG. 2.1.1 Map of Hanoi 1873, Source: Centre des archives d'outre-mer, Aix-en-Provence, provided by IMV-Hanoi, p.41

FIG. 2.1.2 Map of Hanoi 1925. Occupation of the riverside areas is becoming present. Source: *Archives nationales. Institut français d'architecture. Archives d'architecture du XXe siècle*, Paris (AN/IFA), provided by IMV-Hanoi, p.42

FIG. 2.1.3 Comparison of 1 - 1924 Hébrard and 2 - 1943 Pineau Plan for Hanoi ; Source: E. Cerise 2009<sup>30</sup>, p.42

FIG. 2.1.7 First public housing 1955-1960, located in the the areas outside the dyke, Source: *Map and KTT* by E. Cerise 2009 p. !88, adjustments - Author, p.44

FIG. 2.1.10 Location of Khu Tam collective public housing projects between 1982- 1992, Source: E. Cerise 2009 p.220, adjustments by Author, p.48

FIG. 2.1.11 (Page 52) Map of Hanoi 1898, Settlements in the Riverside areas outside the dyke and a floating village, Source: Centre des Archives d'outre-mer, Aix-en-Provence, provided by E. Cerise, IMV- Hanoi, p.45

FIG. 2.1.12 ( Page 53) Map of Hanoi 1963, Settlements in the Riverside areas outside the dyke are increasing, Source: [www.berkley.edu](http://www.berkley.edu), p.46

FIG. 2.1.13 Evolution of Hanoi's population, administrative growth and masterplans , Source: *Masterplans - VIAP, Population data Do Thi Ngoc Chau ( 2013)*<sup>10</sup> Administrative limits maps, surface data- E. Cerise (2009)<sup>11</sup>, p.49-50

FIG. 2.1.14 Hanoi regional masterplan approved in 2008, Source: IAU-IDF, p.51

FIG. 2.1.15 Hanoi province administrative division, p.52

FIG. 3.1.2 Localization Riverside Urban Areas, Interperation of [HUNG 2009]<sup>44</sup> p. 63

FIG. 3.2.1 Ordinance of the Dyke 2000 construction regulations, Source: Hoang 2007<sup>45</sup> p.61

FIG. 3.2.2 Administrative structure of RUA and location in Hanoi , p.62

FIG. 3.2.4 Scheme of the applications of Land Use Right Certificate, Source: Adopted from HAIDEP<sup>46</sup>, p.63

FIG. 3.2.5 A The Riverside Urban Areas and their division between the wards in each district , p.64

FIG. 3.2.6 Governance structure , Source: Hoang 2010<sup>48</sup>, p.65

FIG. 3.2.7 The Riverside Urban Areas and their division between the wards in each district , p.66

FIG. 3.2.8 Illegal construction control - malsfunction of the governance system;, Source: *Interpeted scheme adopted from Hoang 2010<sup>48</sup>.*, p.67

FIG.3.4.1 Section of the Red River throught Long Bien Bridge. Levels of the Red River in dry and rainy season. Major floods return period. , Source: Section created after terrain measurements with the assistance of Tristan Morel and complementary references<sup>59</sup> , p.77-78

FIG. 3.5.2 Location of the entrances on the dyke wall in Hanoi., p.84

FIG. 3.6. Comparison between the three projects' elements in common Source: Tuan Pham Anh 2013, p.88

FIG. 3.6.1 The Vietnamese proposal of the Northern Hydraulic Institute for the Riverside Areas in Hanoi , Source: Tuan Pham Anh 2010<sup>1</sup>, adapted from Northern Hydraulic Planning Institute, 2010], p.89

FIG. 3.6.2 The Korean proposal for the Riverside Areas in Hanoi , section showing the second dyke and modification of the river bed. , Source: Tuan Pham Anh 2010<sup>1</sup>, [Red River Project Team, Main Report. 2007], p.90

FIG. 3.6.4 Plan of Korean proposal for the Riverside Areas in Hanoi . Source: [Tuan Pham Anh 2010<sup>64</sup>, adapted from Red River Project Team, Main Report, 2007], p.91

FIG. 3.6.5 Plan of the Japanese proposal for the Riverside Areas in Hanoi .Source: Interpreted map adapted from Tuan Pham Anh 2010<sup>64</sup> and HAIDEP<sup>65</sup>, p.91

FIG. 3.6.6 Detail plan and section of Japanese proposal for the Riverside Areas in Hanoi . Source: HAIDEP<sup>65</sup>, p.92

FIG. 4.1.3 Major elements present in the Riverside urban Areas, p.116

FIG. 4.1.4 Major infrastructure in Hanoi. Projects concerning the Riverside urban areas, Source: Drawing by author, data collected from Tristan Morel 2013 and Hanoi Capital Construction Plan 2030-2050, p.118

FIG. 4.1.5 Major interchange station Long Bien, background view of the bridge and market, Source: IMV- Hanoi, p.117

FIG. 4.1.6 Hydraulic assessment of the Red river - current , Source: www.ashui.com, Translation Do Thi Ngoc Chau, p.119

FIG. 4.1.7 Hydraulic assessment of the Red river - planned in the Korean project; Situation of the river flow after the new dykes construction, Source: www.ashui.com, Translation Do Thi Ngoc Chau, p.119

FIG. 4.1.8 Property values in Hanoi, Source: Hironori Kato, Le Hong Nguyen, (2008), p.120

FIG. 4.2.1 Interpretation of the Vietnamese proposal of the Northern Hydrology institute, Source: Drawing - Author, Data about the project - Water Urbanism in Hanoi, Tuan Pham Anh 2013, p.123

FIG. 4.2.2 Interpretation of the Norther Hydraulic Institute project in terms of second dyke construction and areas that would be resettled. Source: Drawing - Author, Project map for the new dykes - Tuan Pham Anh 2013, p.124

FIG. 4.2.3 Interpretation of the Korean proposal - The Red river project, Source: Drawing - Author, Data about the project - Water Urbanism in Hanoi, Tuan Pham Anh 2013, p.125

FIG. 4.2.4 Interpretation of the Korean project in terms of second dyke construction and areas that would be resettled. Source: Drawing - Author, Project map for the new dykes - Tuan Pham Anh 2013, p.126

FIG. 4.2.5 Interpretation of the Japanese proposal - The Red river project, Source: Drawing - Author, Data about the project - Water Urbanism in Hanoi, Tuan Pham Anh 2013, p.127

FIG. 4.2.6 Interpretation of the Japanese project in terms of second dyke construction and areas that would be resettled. Source: Drawing - Au-

thor, Data - Pilot Project C - HAIDEP 2007, p.128

FIG. 4.3.1 Alternative to the dyke -Scenario Living with Water, p.131

FIG. 4.3.2 Alternative to the dyke - Scenario living with water in plan, p.132

FIG. 4.3.3 Alternative to the dyke -Scenario Living with Water, Studied area and strategy development. p.134

FIG. 4.4.1 The three main distinctive elements of amphibious structures, p.135

FIG. 4.4.2 Plan of the amphibious development in Maasbommel , Source: Adopted from "Amphibious housing in the Netherlands"<sup>65</sup>, p.136

FIG. 4.4.9 Location of some floating communities on the island and Red river banks in Hanoi . 1. Nha Van Hoa, 2 Long Bien bridge, 3. RUA, 4 Other Floating communities, p.140

FIG. 4.4.13 Schemes of the 3 types of floating dwellings on the Red river in Hanoi. p.142

FIG. 4.5.1 Strategy and major actions to be taken in order to answer the strategy requirements. Strategy ( WHAT?) Actions ( HOW?), p.144

FIG. 4.5.2 Strategy and major actions to be taken in order to answer the strategy requirements. Strategy ( WHAT?) Actions ( HOW?) p.146

FIG. 4.5.3 Simulation of the eventual level of future extreme flood such as the one in 1971 in the higher located areas in RUA., Location Bach Dang ward, February 2014, p.147-148

FIG. 4.5.7 Simulation of the eventual level of future extreme flood such as the one in 1971 and the 5 year return floods in the lower located areas (11m) in RUA. Location: Phuc Tan ward, March 2014, p.151

FIG. 4.5.8 Flood Gate example, Source: <http://www.wbdg.org/>, p.152

FIG. 4.5.9 Sewage valve to protect from flood waters , Source: <http://www.wbdg.org/>, p.152

FIG. 4.5.10 Adjustable ladder to install on balconies or window doors on first floor to provide access in case of flood, Source: www.pwplatforms.com, p.152

FIG. 4.5.11 Scheme of the present density in RUA. These lanes which are the only access to the buildings located there. On ground floor they are stepping off to leave space for the «street» and from the second floor up they extend to eventually almost face the neighbours. Photo and scheme drawn from the photo. Location: Phuc Xa ward, April 2014 p.153

FIG. 4.5.12 Section of the situation with a possible solution for density reduction. p. 154

FIG. 4.5.13 A possible image of the same lane, transformed into a street with some buildings reduced and others removed to leave space for the community's public space. p.155

FIG. 4.5.14 Sketch representing actions to improve accessibility to the river and RUA, by transforming already existing corridors into public spaces accessible for everyone and leading to the riverside. (Sketch drawn using FIG 3.7.8 as a background), p.157

FIG. 4.5.17 Terracing the Red river plain in areas where possible. Define areas for amphibious living. Background image Chuong Duong bridge and Phuc Tan ward, March 2014, p.159-160

FIG. 4.5.18 Example of terracing the flood plain with the presence of amphibious communities during high water in forecasted 5 year return period. Background image Chuong Duong bridge and Phuc Tan ward, March 2014, p. 161-162

4.5.19 Strengthening the terraces to prevent erosion , p.163

FIG. 4.5.20 Summary of the actions that are suggestet by the strategy and the possible areas of their location., p.168

## LIST OF IMAGES

FIG. 1 ( On next page ) The riverside view to Chuong Duong and Long Bien bridges from Phuc Tan Port, April 2014, p.5-6

FIG. 1.2.6 The dyke along the Red river in Hanoi before its extension ( unknown date of photo), Source: p. 106 Clément (Pierre), LANCRET (Nathalie), Éditions Recherches, Les Cahiers de l'Ipraus, Paris, 2001, p.25

FIG. 1.2.7 Red river dyke extension wall all along the city and the river, Location Long Bien Bridge April 2014, p.26

FIG.1.3.2 Red river flood 1929, Source: <http://belleindochine.free.fr/>, p.28

FIG. 1.3.3 Hanoi Flash/Urban floods, October 2008 , Source: VNExpress, VietNamNet, p.29

FIG. 1.3.4 Red river arm along Hanoi, Dry season April 2014, p.30

FIG. 1.3.6 Evacuation of wastewaters from RUA without treatment, directly in the Red river, Location: RUA, areas behind Long Bien market, March 2013, p.32

FIG. 1.3.11 Arm of the Red River on the side of Hanoi and the Riverside Urban Areas, p.38

FIG. 2.1.4 Image of the floods in 1929 close to Long Bien bridge. Fixed homes flooded but floating ones undamaged from the flood, Source: [www.hanoilaville.com](http://www.hanoilaville.com), p.43

FIG. 2.1.5 Hanoi riverside areas. Quai of Commerce. An elevated path to the boats provides access between the levels and in case of raising waters. ( no date), Source: [www.hanoilaville.com](http://www.hanoilaville.com), p.43

FIG. 2.1.6 Riverside areas at the newly constructed Long Bien bridge ( no date ), Source: [www.hanoilaville.com](http://www.hanoilaville.com), p.43

FIG. 2.1.8 Riverside areas floating communities in Hanoi for trade, living on their boats, Source: [www.hanoilaville.com](http://www.hanoilaville.com), p.47

FIG. 2.1.9 Riverside areas floating community close to the dyke during high waters. , Source: [www.hanoilaville.com](http://www.hanoilaville.com), p.47

FIG.3.1.3 Riverside Urban Areas early 20th century - empty flood plain, village on the island, source: <http://www.hanoilavie.com/>, p.59

FIG. 3.1.4 Riverside Urban Areas early 20th century - empty flood plain, village on the island, source: <http://www.hanoilavie.com/>, p.60

FIG. 3.2.8 Illegal self made construction in the prohibited areas at the foot of the dyke, Location: At the limit of the dyke and the Red Rived Bed, Phuc Xa Ward, April 2014, p.68

FIG. 3.3.4 Inhabitants of RUA in Phuc Xa ward telling their stories about the floods in 1971 and 1996. , p.72

FIG. 3.3.5 High quality housing right behind the dyke wall , Location Bach Dang ward, February 2014, 73

FIG. 3.3.6 Low quality housing/ squatting / according to the inhabitants for rent by the owner of the land. Location: Phuc Xa ward, Unclear formal/informal status, March 2014, p.74

FIG. 3.3.7 Low quality floating housing/ squatting ; self constructed,

Informall , hard to access, Location Phuc Xa ward, March 2014, p.75

FIG. 3.3.8 Single family floating house in Chuong Duong ward. The family moved to live on the river in search for less pollution and noise from the city and to be closer to nature. Has the legal right to be there according to the owners who have been living there for 10 years now. Location Chuong Duong ward, April 2014, p.76

FIG. 3.5.1 River banks and dyke edge destruction due to undefined constructions. , Location: Phuc Xa ward, Red rived edge, April 2014, p.82

FIG. 3.5.2 Canal for wastewater evacuation, consequently turned into a garbage area with a nice view to the historical Long Bien bridge designed by Gustave Eiffel in 1898 , Location: Phuc Tan ward, March 2014, p.83

FIG. 3.5.3 Useless space - River banks with wastewater evacuation transformed into a non regulated garbage disposal; Location: Tu Lien ward, April 2014, p.86

FIG. 3.5.4 Useful space - Major street in RUA, serving for a daily market , Location: Phuc Xa ward, March 2014, p.86

FIG. 3.6.3 The Korean proposal for the Riverside Areas in Hanoi .Source: <http://vietbao.vn/>, p.90

FIG. 3.7.1 Entrance to RUA through the dyke wall. In case of a flood emergency, the gate is closed to protect Hanoi from floods and RUA is cut for traffic., Location: Long Bien market, Phuc Xa ward, Hanoi, March 2014, p.94

FIG. 3.7.2 The 2 meter tall dyke wall built during the 90's to increase the protection of Hanoi to floods as high as 15m is separating the historical center of Hanoi from the Riverside Urban Areas, Location: Long Bien bridge, Phuc Tan ward, March 2014, p.95

FIG. 3.7.3 A floating house, with a vegetable garden located in the flood plain and a floating one in the river. The access to land is through a tiny wooden path bridge. or by boat, Location: Phuc Xa ward, April 2014, p.96

FIG. 3.7.4 Access to RUA in front of Long Bien market. A woman carrying goods to sell in the city. In the background the Long Bien Bus Station major Exchange node in Hanoi and the dyke road with it's never ending traffic of motorbikes, p. 97

FIG. 3.7.5 Kind playing in the existing promenade along the Urban limits meeting the flood plain of the Red river in the Riverside Urban Areas., Location: Phuc Tan ward, March 2014, p.98

FIG. 3.7.6 High Quality floating house part of the Phuc Tan port in Chuong Duong ward during dry season. Access is provided by adapted float metal path which at this period is partially sitting on dry ground; , Location: Phuc Tan Port, Chuong Duong ward, April 2014, p.99-100

FIG. 3.7.7 View from Long Bien bridge towards the Long Bien market and Hanoi historical center in the background. The areas under the bridge are underused and separated with fences. March 2014, p.101

FIG. 3.7.8 View from Long Bien bridge towards the River. The areas under the bridge are occupied for the purposes of the Long Bien market adjacent to the bridge. Urbanisation has reached the wall separating the residential area from the bridge. The market has spread to the bridge using it's buffer space. April 2014, p.102

FIG. 3.7.9 Riverside urban areas viewed from the Long Bien bridge over the river looking

towards the historical center of Hanoi. Strong urbanisation to the limits of the dyke. The extra land revealed by the river during the dry season is occupied for agriculture. , Location Phuc Tan ward, March 2014, p.103

FIG. 3.7.10 Squatting in the lower lying areas in the flood plain of the Red river. Self constructed houses whose inhabitants are mainly cultivating the available land of the floodplain. Located at the foot of the step dyke they are threatening the safety of the dyke, Location: Tu Lien ward, April 2014, p.104

FIG. 3.7.11 Floating community in the hardly accessible areas in the flood plain, Location Phuc Xa ward, March 2014, p.105

FIG. 3.7.12 Floating community adjacent to the island crossed by the Long Bien bridge. Background in construction Nha Tan bridge, Location: Island in the Red river, Phuc Xa ward, March 2014, p.106

FIG. 3.7.13 Natural sand landscape revealed during dry season in the red river flood plain. Locals using the space to relax of urban noise, pollution and motobikes, Location: Red river flood plain, Tu Liem ward, April 2014, p.107

FIG. 3.7.14 Young group of teenagers enjoying the sandy river landscape and organize parties. , Location: Red river flood plain Tu Liem ward, April 2014, p.108

FIG. 3.7.15 Phuc Tan port. Floating pontoon staying on ground during dry season still providing access to the floating structures., Location: Chuong Duong ward, April 2014, p.109

FIG. 3.7.16 View from Phuc Tan port, Location: Chuong Duong ward, April 2014, p.110

FIG. 3.8.1 Living on the boat, on the background Chuong Duong Bridge and a new urban development in Long Bien district on the left bank of the Red river, Location: Phuc Tan ward, Hanoi, April 2014, p.112

FIG. 4.1.5 Major interchange station Long Bien, background view of the bridge and market, Source: IMV- Hanoi, p.117

FIG. 4.1.9 Concrete pillars breaking the water flow  
Location: Island in the Red river, Long Bien ward, April 2014, p.121

FIG. 4.3 Sketch by Baca Architects representing the current flood management measures around the world., Source: Baca Architects, p.130

FIG. 4.4.3 Floating dwellings in Maasbommel development, Source: <http://worldoceanreview.com/>, p.136

FIG. 4.4.5 Floating homes in Maasbommel, normal water level, Source: Panoramio, Hans van der Poel (2007), p.137

FIG. 4.4.6 Amphibious homes, Maasbommel, normal water conditions, Source: Panoramio, Hans van der Poel (2007), p.137

FIG. 4.4.7 Amphibious homes, Maasbommel, above - normal water conditions, below during flood 2011, Source: Project review, Floating Homes 'De Gouden Kust', p.138

FIG. 4.4.8 Polystyren to make the base for the floating structure. Background a floating house in Nha Van Hoa, on the island (#1 on 4.4.9), p.139

FIG. 4.4.10 Floating houses in Nha Van Hoa community, background Red river and Long Bien district Hanoi, p.140

FIG. 4.4.11 Floating houses in Nha Van Hoa community, from the pathway. April 2014, p.140

FIG. 4.4.12 Only access to the island and the Nha Van Hoa floating community, p.141

FIG. 4.5.4 No windows on ground floor. Wide doors to allow space for motorbikes to be parked on ground floor, Location: Narrow alley in Phuc Tan ward, March 2014, p.149

FIG. 4.5.5 Slightly elevated door in case of a flood. , Location: Phuc Tan ward, March 2014, p.150

FIG. 4.5.6 Wide doors to allow space for motorbikes to be parked on ground floor Location: Phuc Tan ward, in the background Long Bien bridge, March 2014, p.150

FIG. 4.5.15 An example of a section representing a natural purification system relying on gravitation to move the flow and on vegetation with purifying qualities to extract the pollutants from the water.

Source: <http://theotherdada.wordpress.com>, p.158

FIG. 4.5.15 Example of implemented natural purification station in Chongqing, China, Source: <http://elkkidsnews.wordpress.com/>, 158

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#### **Interviews and meetings**

1. Emmanuel Cerise - architect/urbaniste co- director of IMV Hanoi
2. Tristan Morel IMV – IAU- IdF representative in Hanoi
3. Laurent Perrin – architect/urban planner IAU- IdF, France
4. Nguyen Dinh Minh Assoc. Prof., Assoc. Chair and Deputy Director Dept. of Cartography, Hanoi University of Science, VNU
5. Vuong Toan Thun living in RUA from 1990 to 2005,
6. Soo Kim architect/Sustainable urban environment advisor at Vietnam Green Building Council VGBC
7. Interviews with the people living in RUA proximity to Long Bien with the help of Le Thu Ha, student of foreign languages volunteered to translate for me
8. Nguyen Nga architect/urbanist
9. Luu Duc Cuong, Ph.D, M.Eng. Arch. Director Institute for Environmental Planning and Urban-Rural Infrastructure (IRURE) Viet Nam Institute for Urban-Rural Planning (VIUP) Ministry of Construction (MOC)
10. Hoang Vinh Hung, PhD, Head of Division of Urban Development Management, Urban Development Agency, Ministry of Construction
11. Dr Arch. Pham Thuy Loan University of Civil Engineering Hanoi

12. Dr.Arch.Tuan Pham Anh - PHD thesis at Leuven University Belgium  
– Water Urbanism in Hanoi. An Investigation into Possible Interplays  
of Infrastructure, Urbanism and Landscape of the City's Dyke System.  
Head of Department of Urban Forestry, Forestry University Hanoi
13. Arch. Le Cuong
14. Arch. Hien Nguyen – teaching in the Hanoi Architecture University  
-Phuong Đông.
15. Torsten Illingen - director of Inros Lackner architecture office in  
Hanoi.
16. Interview with a family living in a floating house in Choung Duong  
ward.
17. Interview with Vuong Toan Thuc 3rd March 2014, Lived in RUA 1990  
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18. Field measurements with a laser to create the section Yuliya Geor-  
gieva and Tristan Morel. 18/04/2014
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Hans Peter Hagens, 20th Feb 2014, Hanoi
20. Conference, Phuong Dong University, Faculty of Architecture and  
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This book offers an insight of the water management in the Red river delta and the development of Hanoi's Riverside Urban Areas. It proposes an alternative strategy for **Living with Water** as the future for those areas, instead of fighting it, as it's the case today. Inspired from the experience of countries as the Netherlands with water in the city but however trying to integrate the local culture and experience of living with the water. It offers solutions especially designed for Hanoi's context of the **Riverside Urban Areas**, but those can certainly be adapted to diverse areas and cultures as long as the current situation is explored and its elements are integrated into the strategy.

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