CLIMATE- RESILIENT HOUSING SOLUTION TOOLBOX & ARCHITECTURAL DESIGN

THE TRANSFERABILITY OF CLIMATE- RESILIENT STRATEGIES AND MEASURES FOR HOUSING TYPOLOGIES IN THE DUTCH DELTA AND THE VIETNAM DELTA

GRADUATION PROJECT 2013

Delft University of Technology, The Netherlands
Master of Architecture, Urbanism and Building Sciences
Discipline: Master track of Architecture
Studio DELTA INTERVENTIONS
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NGUYEN, HONG HANH

CONTENT

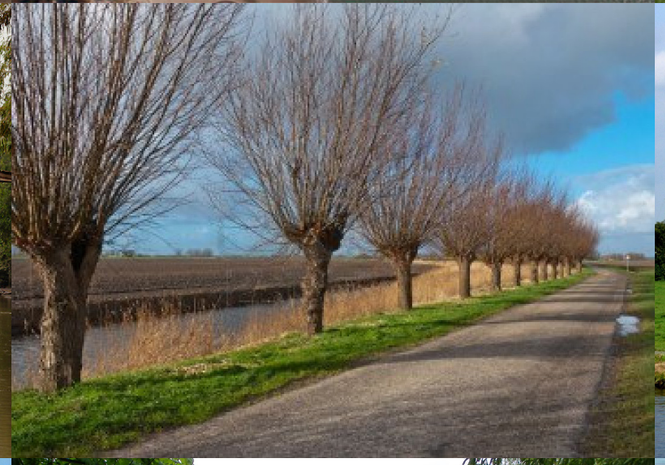


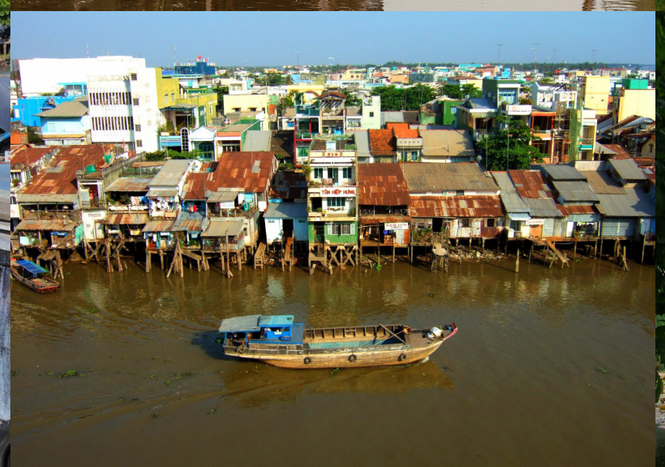










1.1 RESEARCH QUESTIONS

What are the effects on living conditions due to climate change in the Dutch Delta and the Vietnam Del-

What are the climate- resilient strategies concerning housing in the Dutch Delta and the Vietnam Delta?

How can the knowledge for climate- resilient strategies be transferred to a generic strategic Solution Toolbox and Architectural Design?

1.2 RESEARCH FOCUS

URBAN DELTAS

Mekong Delta
Red River Delta

[Source: VARCC, 2009|

Rotterdam
Dordrecht

[Drawing: Carvalho, 2013|

[Drawing: H.H. Nguyen,

1.3 TWO FINAL PRODUCTS

CLIMATE RESILIENT HOUSING SOLUTION TOOLBOX

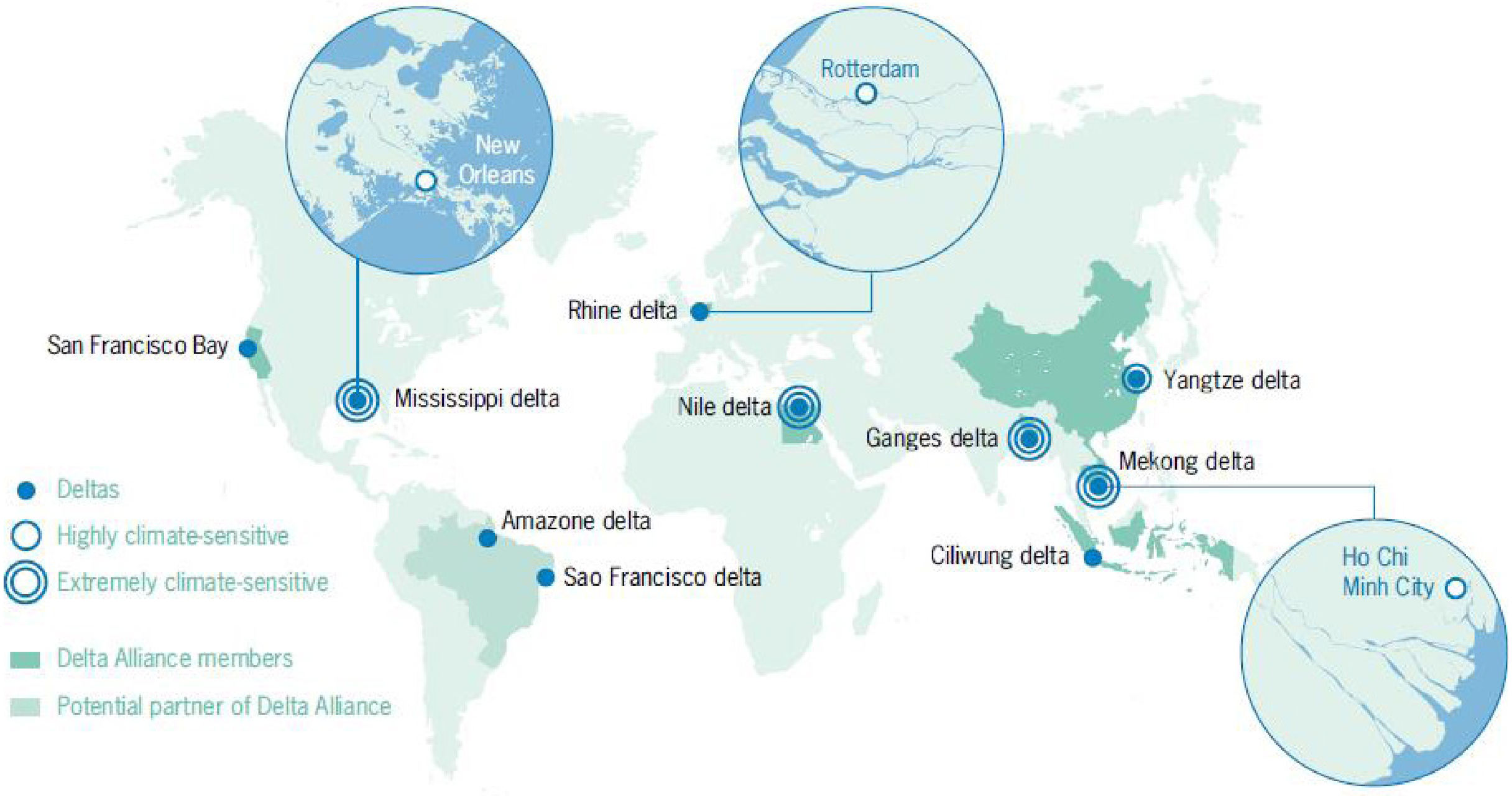
ARCHITECTURAL DESIGN

[Drawings: H.H. Nguyen, 2013]

1.4 TRANSFERABILITY

Why Vietnam?

DELTA ALLIANCE AND CLIMATE CHANGE



[Source: Delta Alliance, 2010|

1.5 GLOBAL CLIMATE CHANGE IMPACTS

“Global climate change is a significant and lasting change in the statistical distribution of weather patterns over periods ranging from decades to millions of years. Global climate change is commonly known as global warming and related to sea level rise. “

- Sea Level rise – increases risk of flooding and ground settlement;

- Less frequent Storm events, but more intense;

- Larger winter floods on the major rivers;

- More severe droughts in summer;

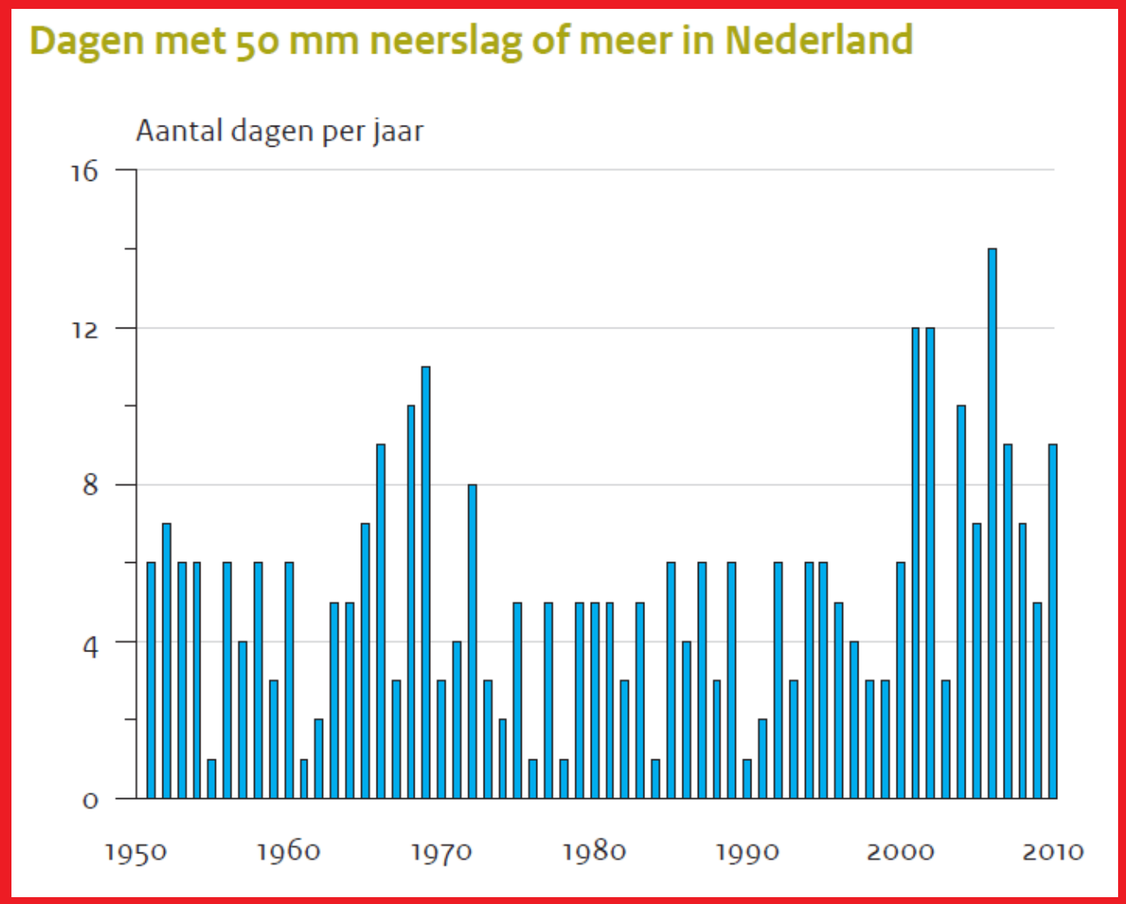
- Salt water intrusion affecting agriculture and fresh water supply.

[Source: Deltacommissie, 2008]

1.6 HISTORY DUTCH DELTA

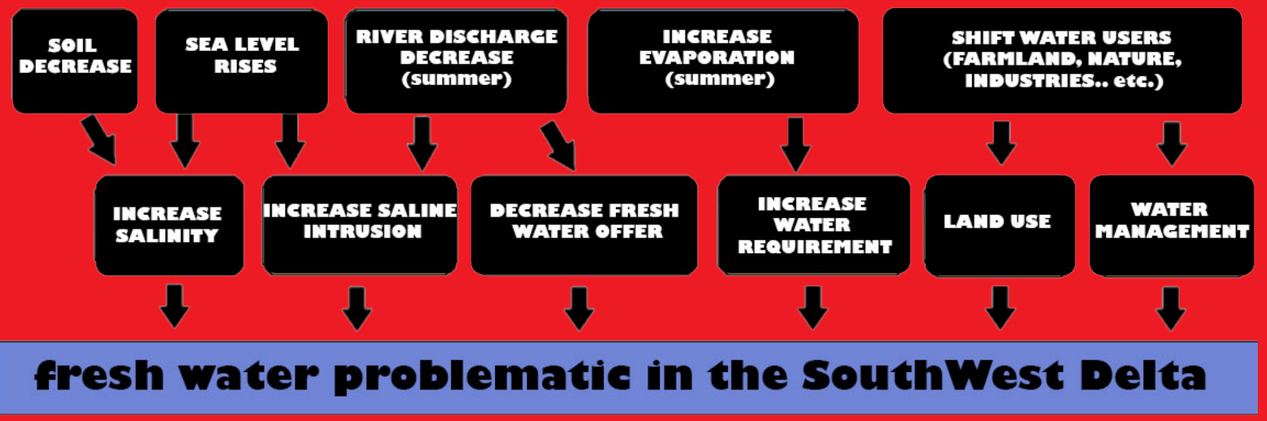
1953: A deadly flood hit The Netherlands killing more than 1,800 people[Source: Wolman, 2008]

Oosterscheldekering, the largest of 13 Delta Works dams and barriers
[Source: Anonymous, 2011]

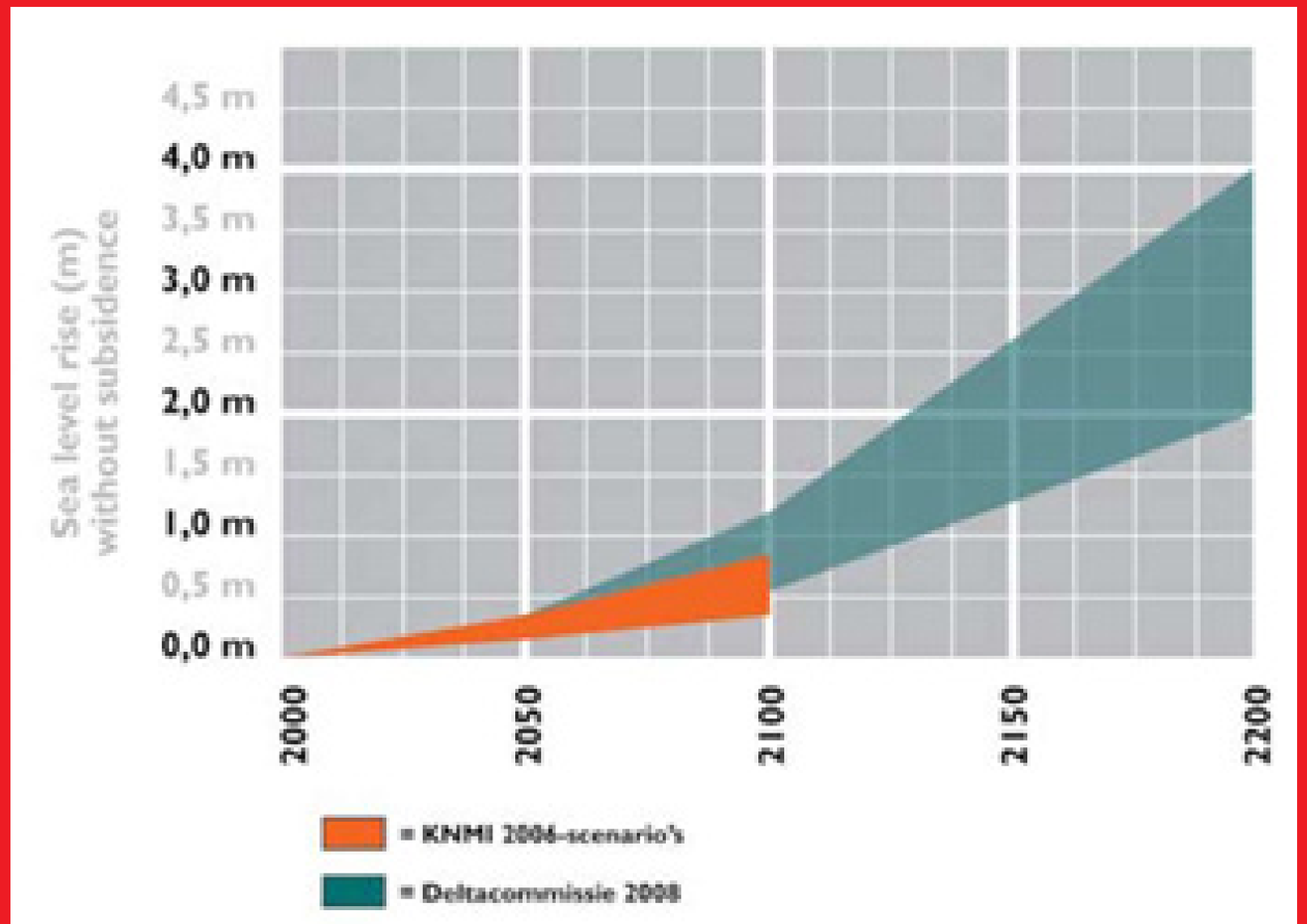


[Source: KNMI, 2011]

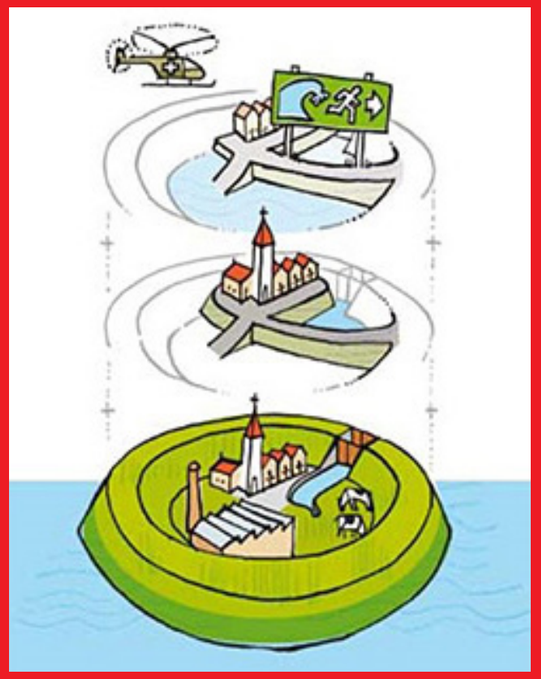
1.7 HISTORY DUTCH DELTA



[Source: L.C.P.M. Stuyt, 2006]



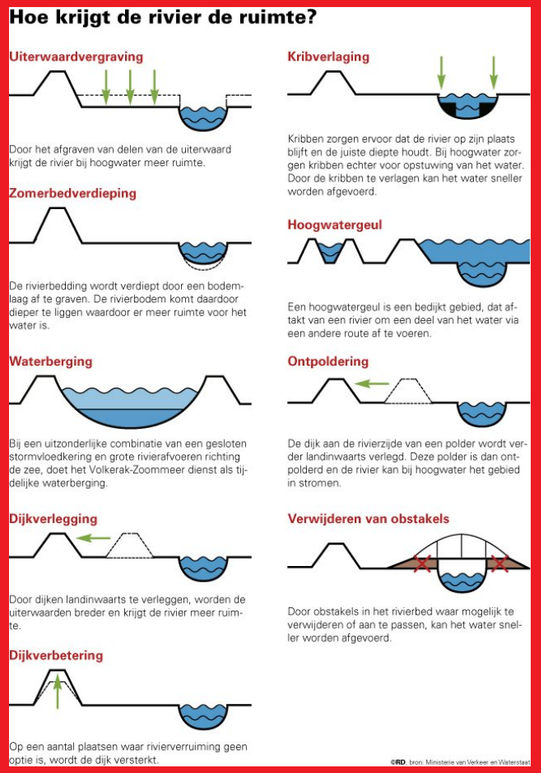
[Source: Deltacommissie, 2008]



Prevention

Sustainable Environmental Design

Improvement Disaster Management



[Source: Nationaal Waterplan, 2009-2015]

2.1 PROBLEM STATEMENT

FLOOD IMPACTS IN DUTCH DELTA

- Sea level rise (4.0 m, within 200 years!)
- Heavy rainfall (Peak of 14 days, more than 50mm rainfall)
- Rising temperatures (Last century the temperature around the globe rise with 0,7 Celcius degrees- Netherlands was 1,0 Celcius)
- Increased risk of flooding and ground settlement
- Less frequent Storm events, but more intense
- Heavier winter floods, rising river water levels

[Source: Blauw Alg ook in Dorplein, 2008]
[Source: PBL, 2005]

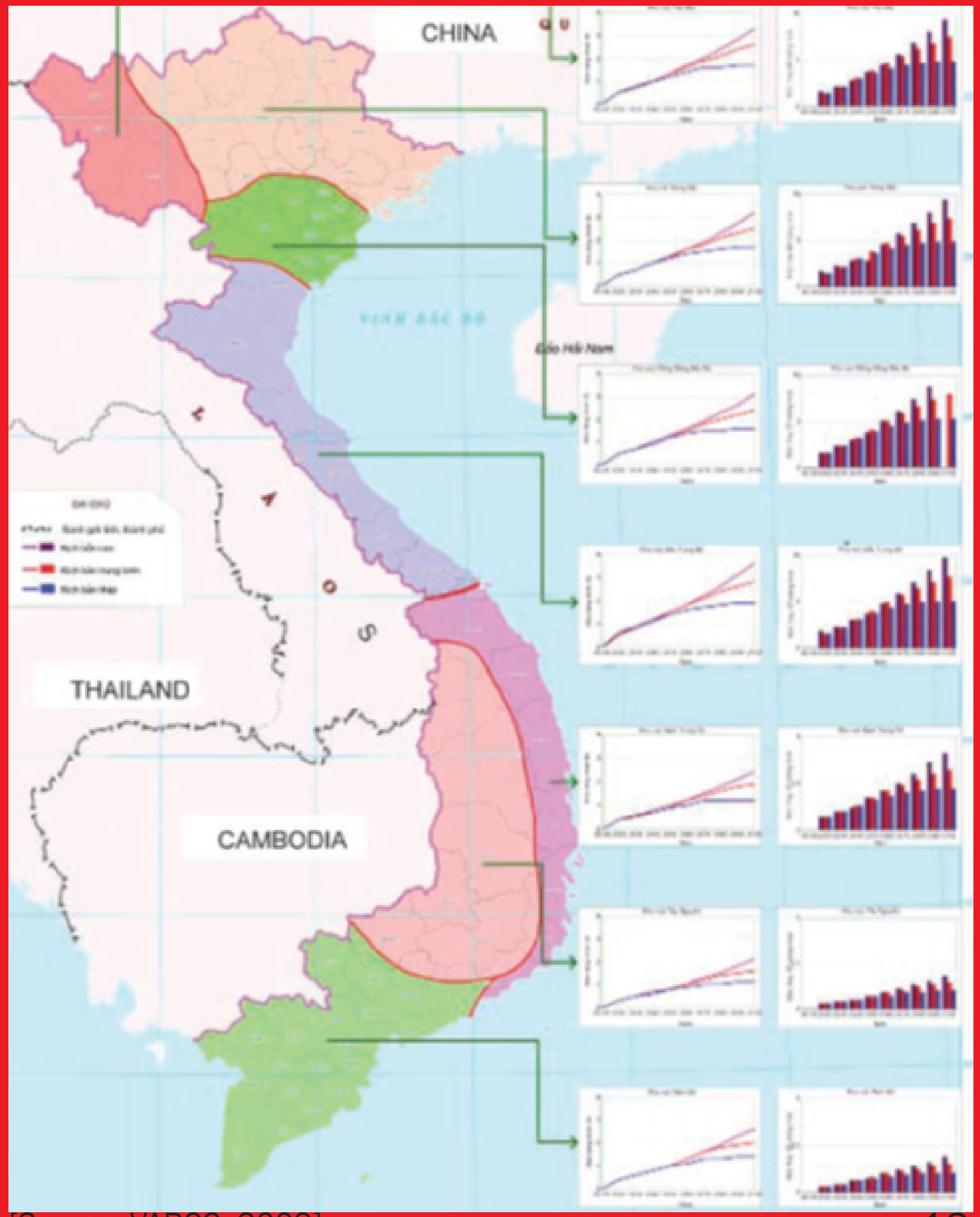

Let op! Blauwalg
Contact met water
vermijden

2.2 PROBLEM STATEMENT

FLOOD IMPACTS VIETNAM DELTA

- Sea level rise
- Heavy rainfall
- Increased risk flooding and coastal erosion
- More heavy tropical storms
- Salt water intrusion
- Problems with fresh water supply
- Forest vanishes into the water due typhoons and tropical storms
- Risk of deseases as a consequence of floods and rising temperatures

[Source: VARCC, 2009]



[Source: VARCC, 2009]

[Source: Vietnam News, 2023]

2.3 COMPARISON TWO DELTAS

OPPORTUNITY FOR TRANSFERABILITY

Both locations are located in Delta Worlds, which are thus land- and sea locked or divided by rivers. Accordingly, similarities between the two problem statements are present.

DIFFERENCES

- The Vietnam Delta is in the top 4 of most climate- sensitive locations around the world, while the Dutch Delta is considered as a safe Delta. (Delta Alliance, 2010).

- Therefore, the global climate changes causes more serious effects in Vietnam (UNEP, 2009).

- The higher temperatures causes more probles with droughts in comparison with the Dutch situation.

- Pollution are dangerous for the human health sector, with high risk of the spread of several diseases (VARCC, 2009).

3.1 TWO FINAL PRODUCTS

CLIMATE RESILIENT HOUSING SOLUTION TOOLBOX

ARCHITECTURAL DESIGN

[Drawings: H.H. Nguyen, 2013]

3.2 SUSTAINABILITY

PEOPLE

Human health
Flooding disaster
Spread of diseases by water

PLANET

Environment and the water safety, quality and quantity before, during and after flooding disaster

PROFIT

Economic development and water infrastructure
Healthy and Safe environment
Business opportunities can be created with Architectural and Urban design?

4.1 RESEARCH QUESTIONS

What are the effects on living conditions due to climate change in the Dutch Delta and the Vietnam Del-

What are the climate- resilient strategies concerning housing in the Dutch Delta and the Vietnam Delta?

How can the knowledge for climate- resilient strategies be transferred to a generic strategic Solution Toolbox and Architectural Design?

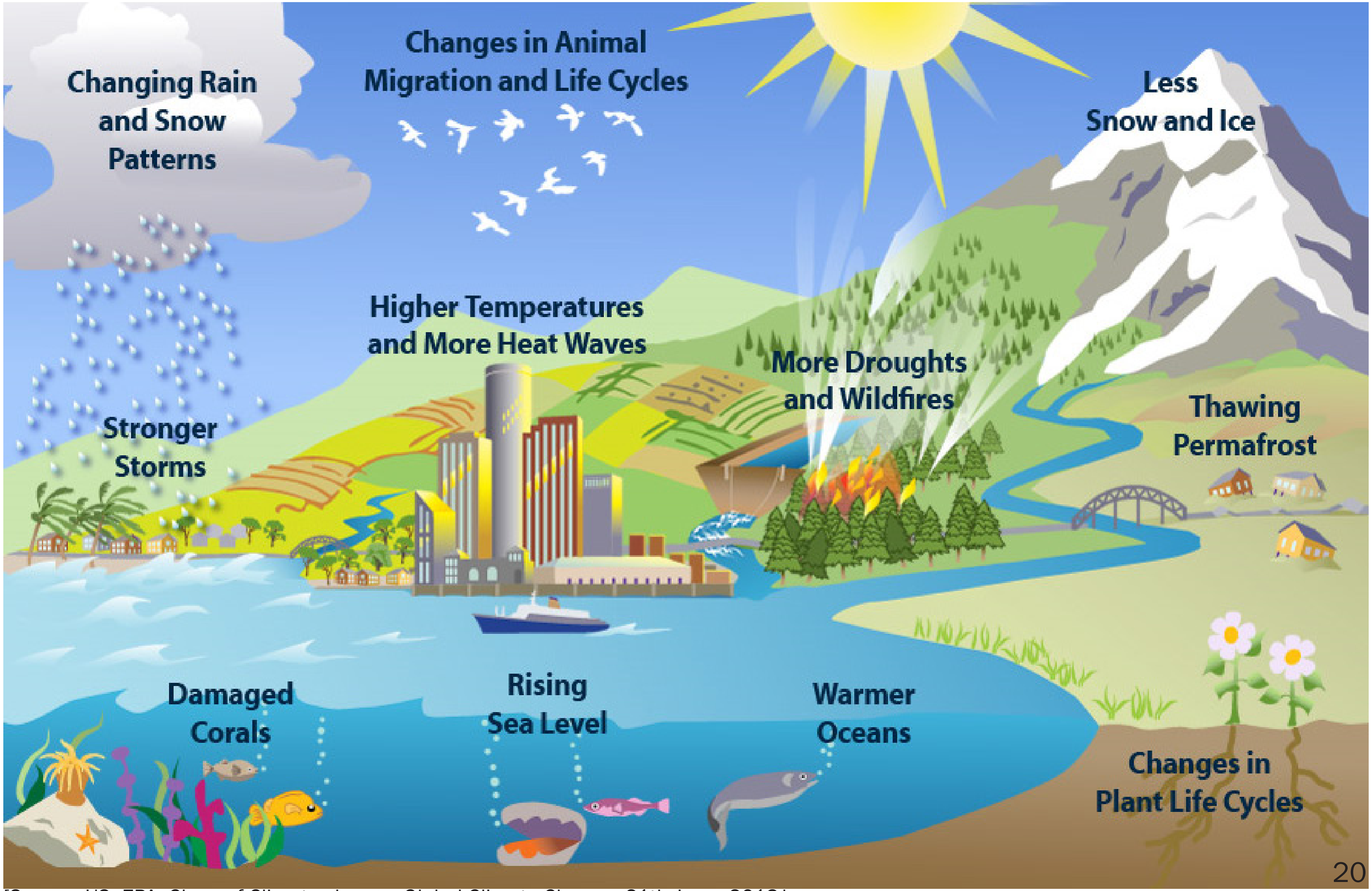
4.2 DEFINITIONS

LIVING CONDITIONS
Concerns the relationship between a subject an organism, a person or a community and the environment in the Delta area. From the individual's appreciation of his or her environment to the degree to which the living environment meets the presumes conditions for actual liveability (van Dorst, 2009).

CLIMATE- RESILIENCE
Respond to disturbances due climate change, by resisting damage of flooding and recovering quickly. (UNEP, 2009)

WATER SAFETY, QUALITY & QUANTITY
Securing against flooding, quality and quantity of ground water and fresh water measured by the amount of pollutants (KNMI, 2008).

5.1 PROJECT RELEVANCE



[Source: US- EPA- Clues of Climate change- Global Climate Change, 21th June, 2013|

5.2 PROJECT RELEVANCE

INNOVATION CLIMATE- RESILIENT HOUSING

This research project will be of added value in the search of solutions to situations where the consequences of climate changes occur earlier and more intense, as it does in Vietnam.

"Sea Level rises 60% faster, than predicted by Intergovernmental Panel on Climate Change "

[Source: Kraaijvanger, 2012]

CONTRIBUTION TO GLOBAL SOCIETAL ISSUE

The contribution of this research is the structure of this design and strategy, which aims to be applicable on a global scale for Delta Worlds in other countries and gains the knowledge of interchangeability of climate-proof solutions, thinking in extremes.

The strategy combines Delta knowledge from two different, but yet comparable Delta worlds. The urge for new approaches and looking for solutions beyond is yet the merging of interest, since climate change is a global issue which needs to be addressed.

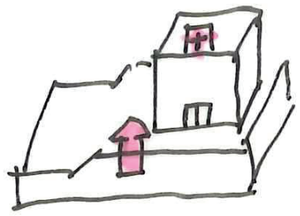
[Source: van Hal, 2009]

6.1 SOLUTION TOOLBOX

NL DELTA

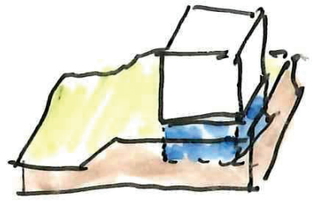
V1

V2

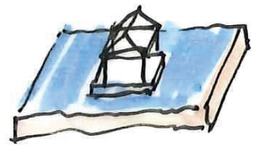


Damage Prevention

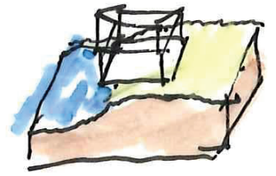
Emergency measures



Storage Reinwaterbasement

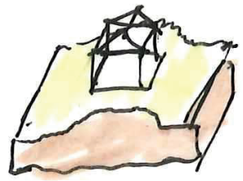


floating buildings

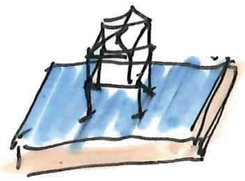


Waterfront house

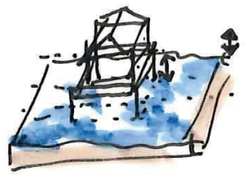
Preparedness



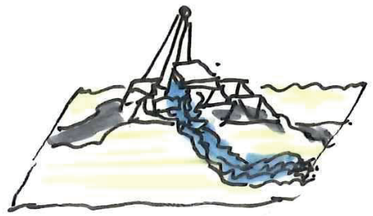
Terp dwellings



Building on pillars

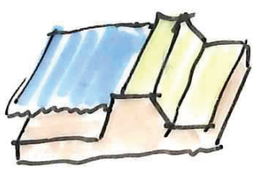


Amphibic dwellings

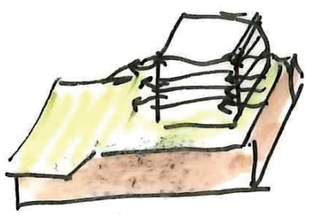


Remedial measures

Ventilating high application

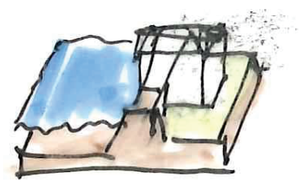


Non-viable ground



Electricity facilities first floor

Staircases



Multifunctional dike

Water safety Water quality Water quantity

[Drawings: H.H. Nguyen, 2013]

	STRATEGIES & MEASURES	WATER SAFETT	WATER QUALITY	WATER QUANTITY
DUTCH DELTA	Multi- layer safety	■		■
	Damage prevention	■	■	
	Preparedness	■		
	Flood robust design			■
	Fresh water storage		■	
	Choice of building materials		■	
	Generators			■
	Wet proof building			■
	Floating buildings	■		
	Floating Facilities	■		
	Amphibic dwellings	■		
	Building as insurance		■	
	Staircases			■
	Building on stilts	■		
	Build Dry proof		■	
	Ventilating high application	■		
	Drywall attached horizontally	■		
	Weighted foundation structures			■
	Water robust emergency communication			■
	Water robust electricity network			■
	Elevated highways and flight paths	■		■
	Small hills	■		
	Difference floor level street-level	■	■	
	Cellular temporary dams	■		
V1	Standing temporary dams	■		■
	Floating platforms	■		
	Ground level increases			■
	Retaining wall	■		
	Partitioning on a small scale		■	
V2	Inflatable temporary dams	■		
	Temporary energy supply			■
	Flood Robust water supply		■	

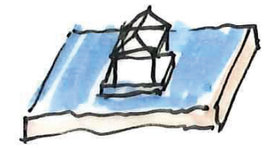
[Source: Wouter Egas 2010; Tijd voor waterveiligheid, 2011]

6.2 HOUSING SOLUTION TOOLBOX

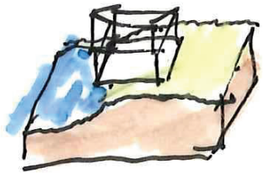
NL DELTA

V1

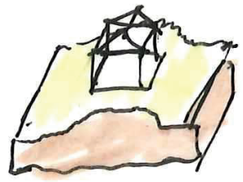
V2



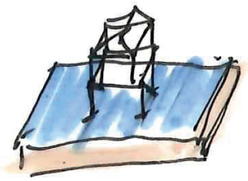
floating buildings



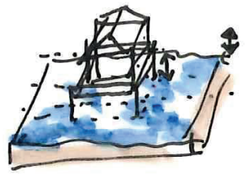
Waterfront house



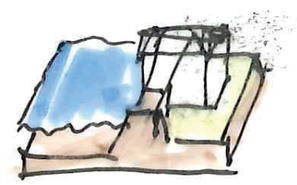
Terp dwellings



Building on pillars



Amphibic dwellings



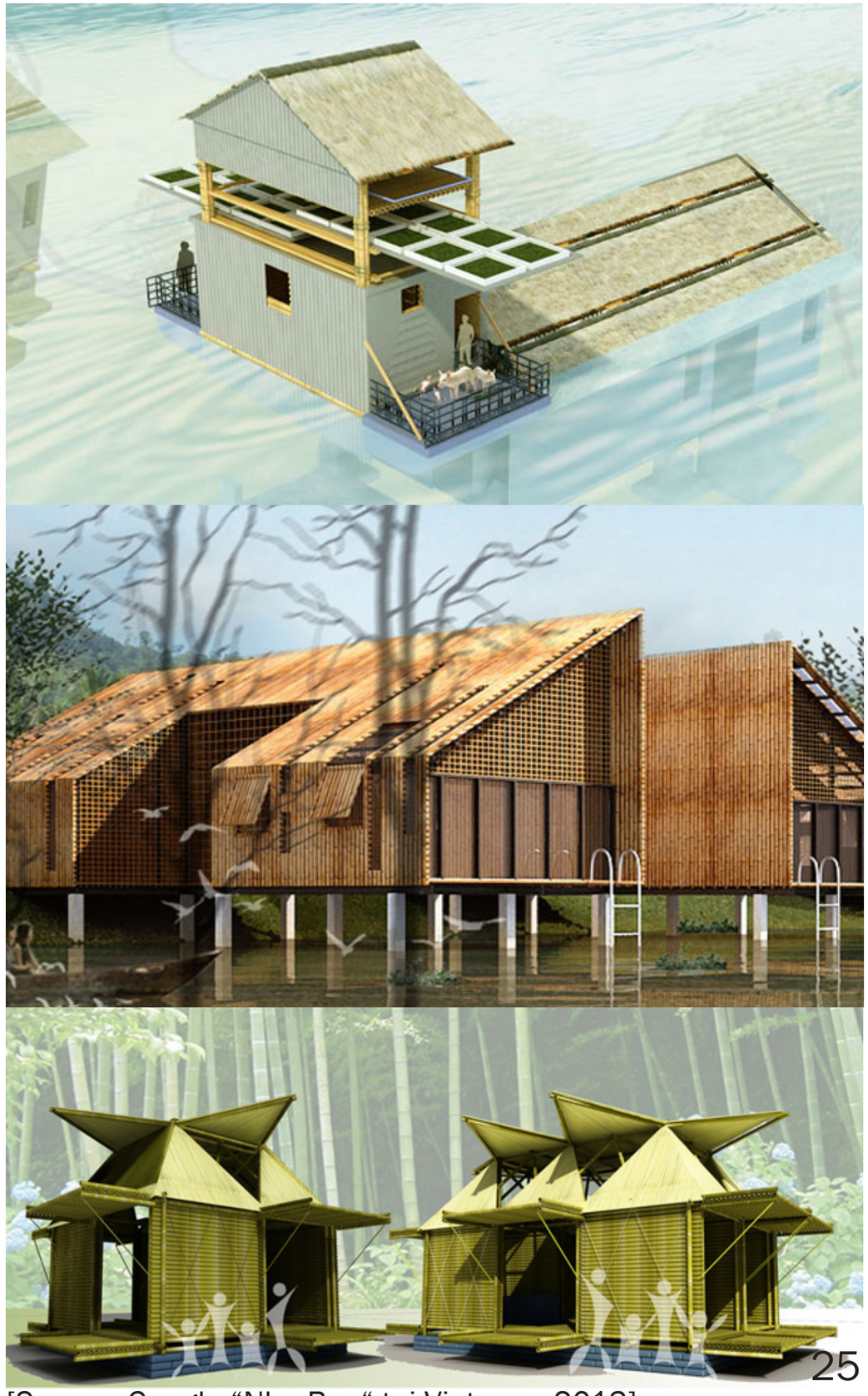
Multifunctional dike

Water safety Water quality Water quantity

[Drawings: H.H. Nguyen, 2013]

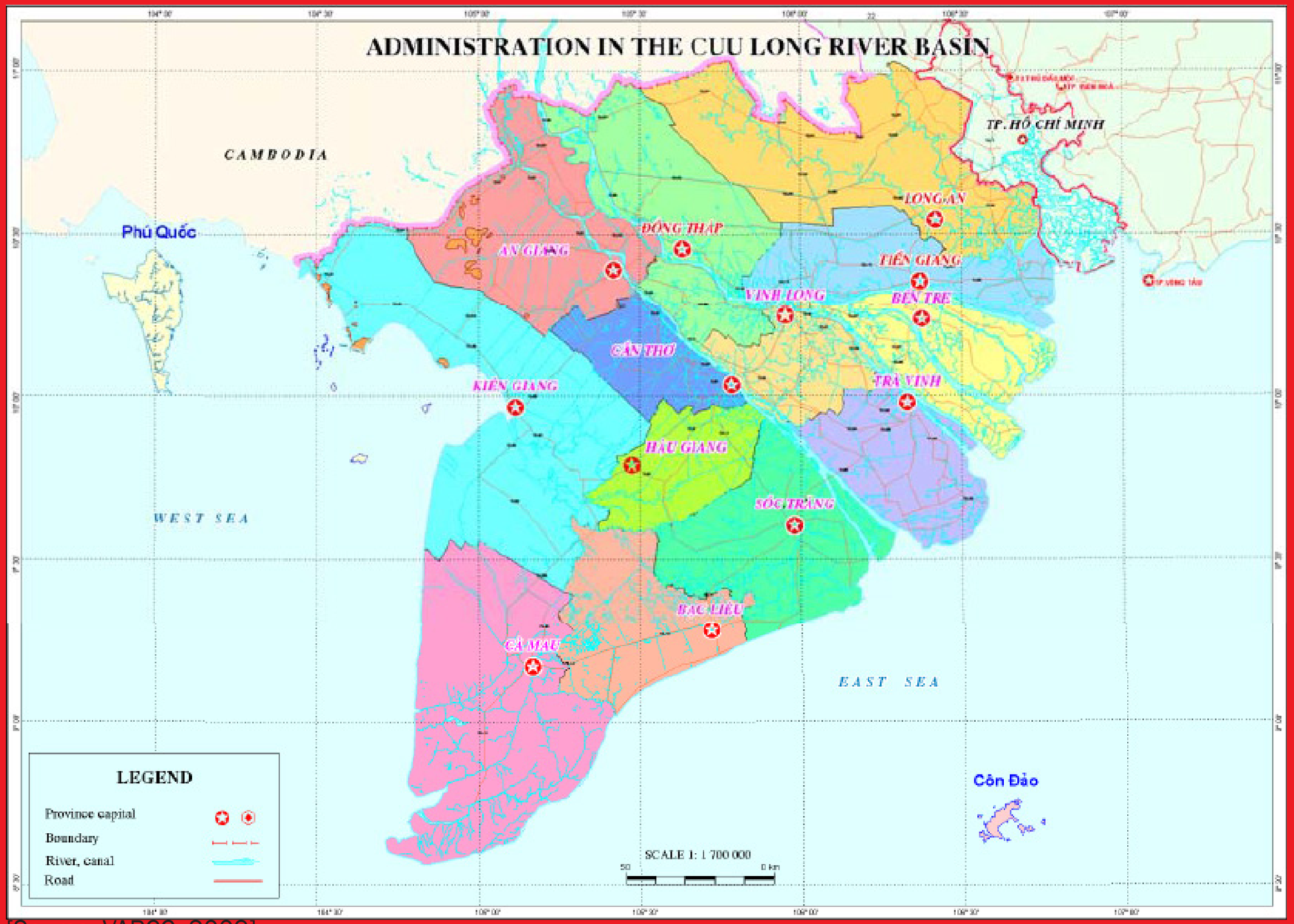
HOUSING TYPOLOGIES		URBAN FARMING	FRESH WATER	ENERGY SUPPLY	CONSTRUCTION	POLLUTION
DUTCH DELTA	Floating buildings	■				
	Amphibic dwellings					■
	Building on stilts			■		■
	Multifunctional dike	■	■			■
V1						
V2						

[Source: Waterwonen in Nederland, 2009]



[Source: Google “Nha Bao“ tai Vietnam, 2013]

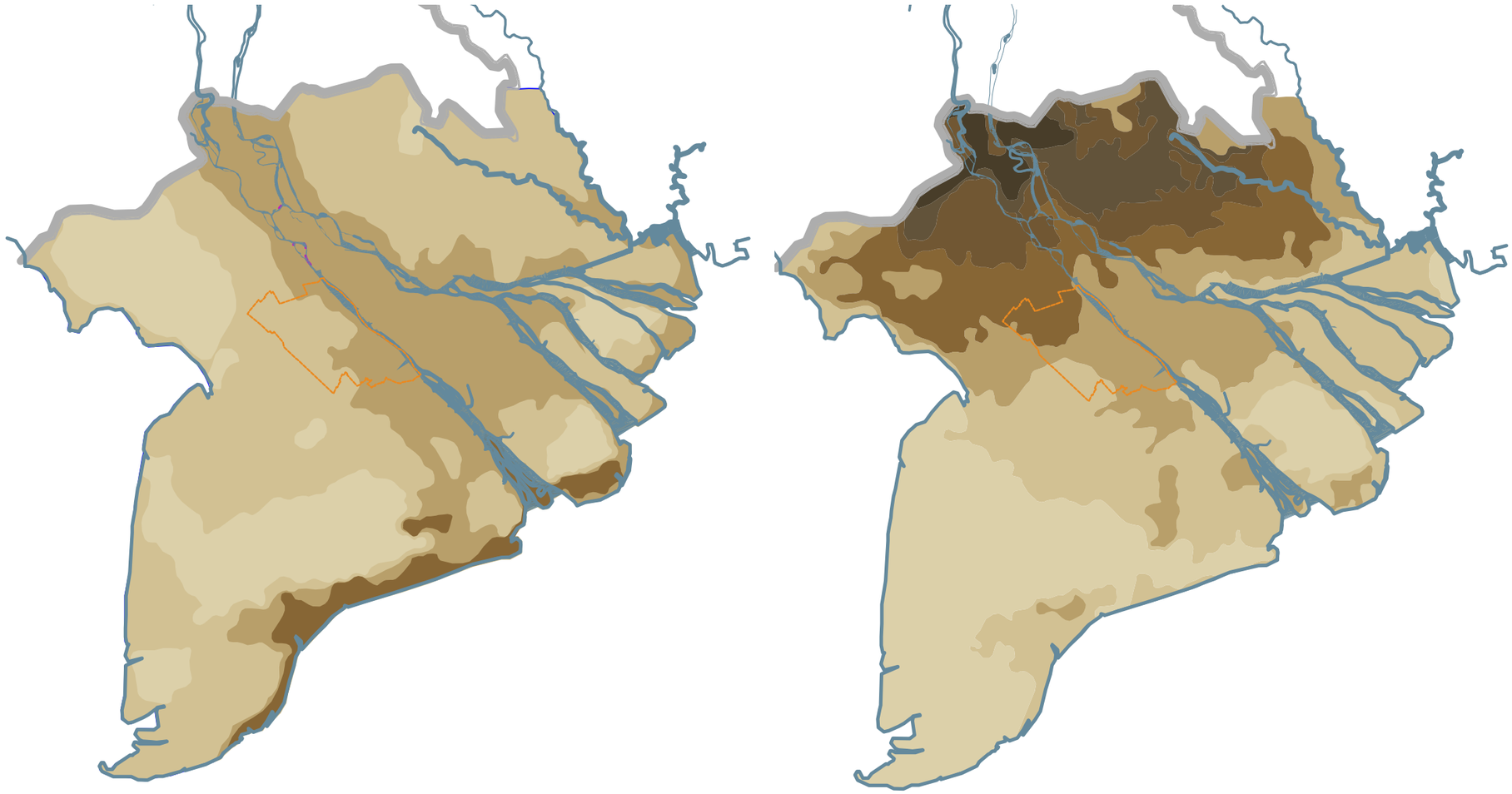
7.1 LOCATION TOOLBOX TESTING



[Source: VARCC, 2009]

CAN THO

7.2 FLOOD MAPS MEKONG DELTA



[Source: International Center of Environmental Management, 2009]

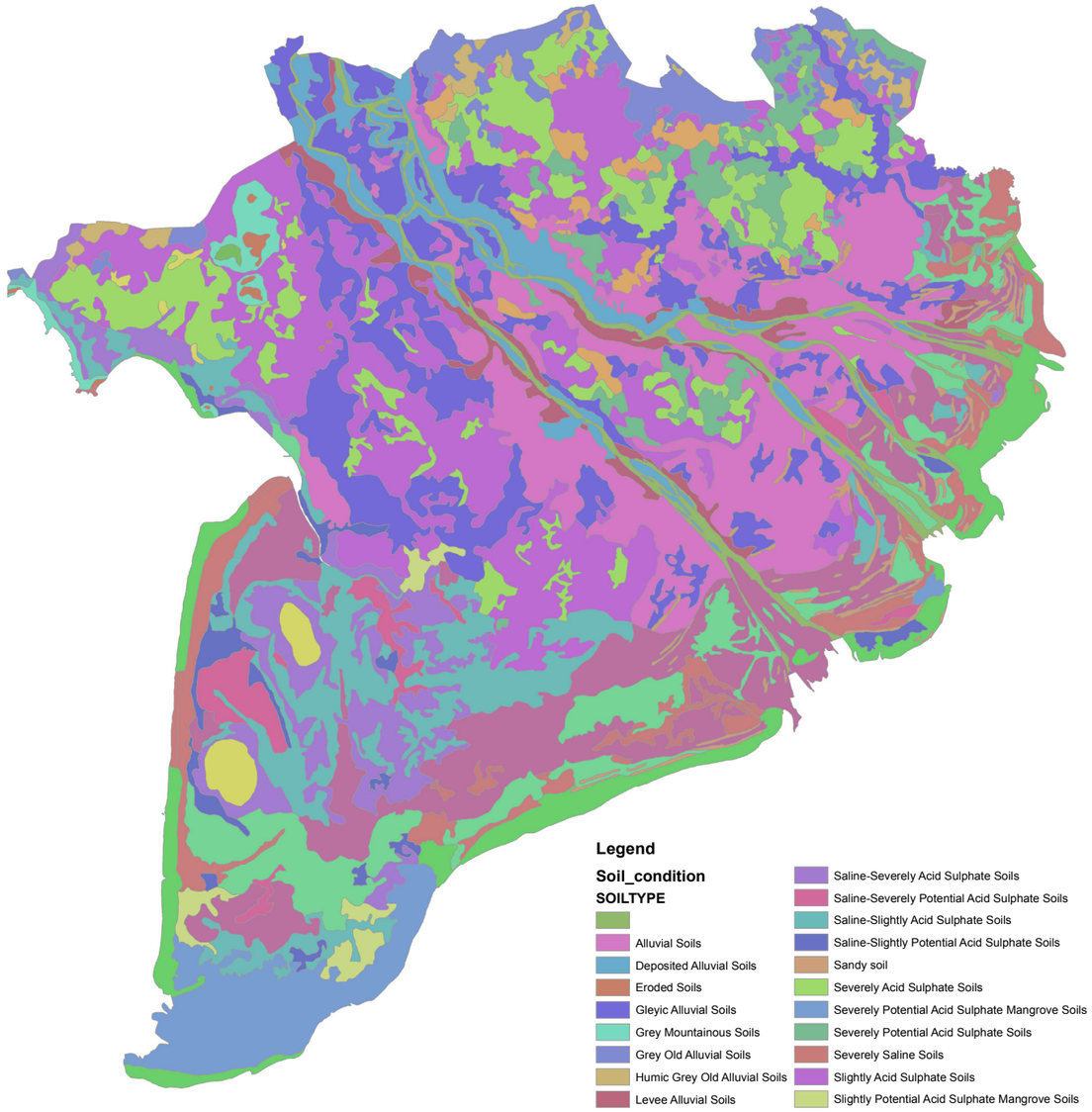
7.3 FLOOD MAP CAN THO AREA

[Source: Can Tho, Reading the poems of the river, 2009]

7.4 SOIL MAP

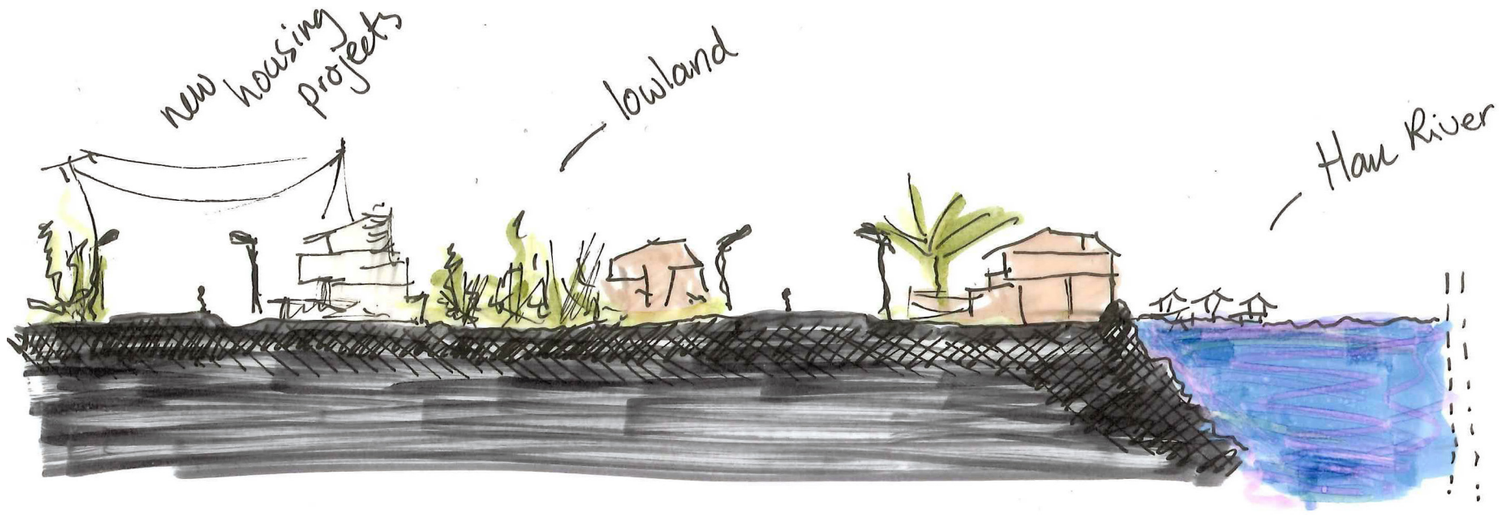
2 Km

[Source: “Can Tho“ Googlemaps, 2th of July2013|

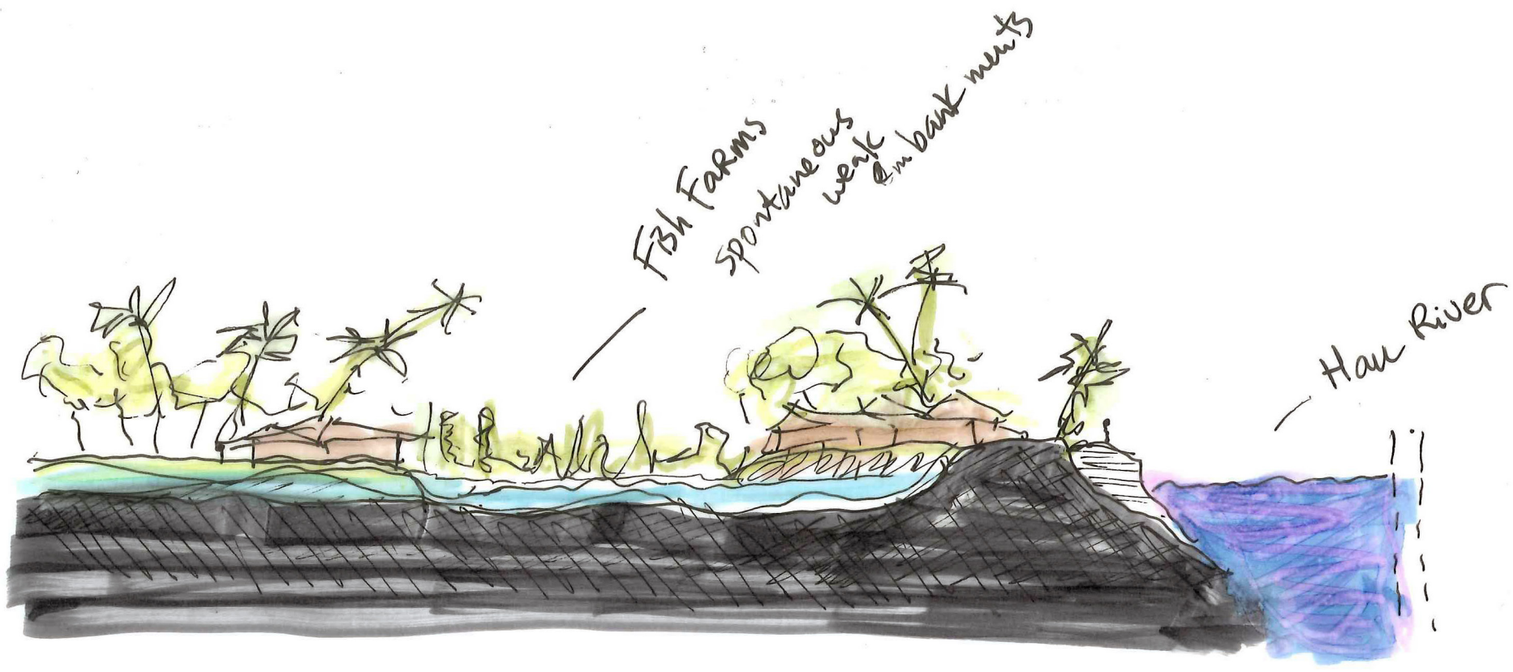


[Source: PhD. Ir.D. P. Quang, 2013|

7.5 SKETCH SECTIONS



AA'



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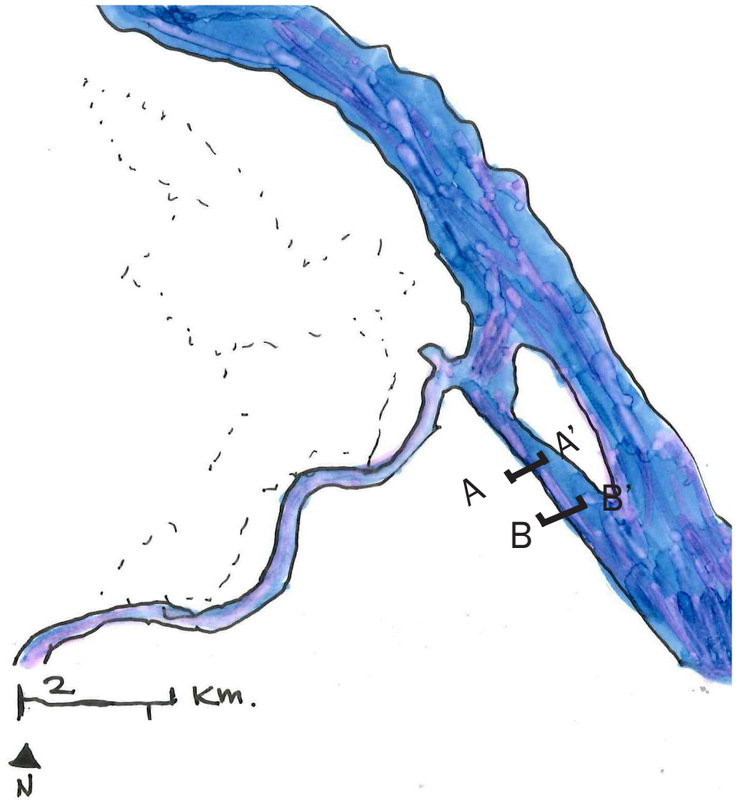


[Drawings: H.H. Nguyen, 2013]

7.6 OTHER MAPPING PLANS

ANALYSE PLANNING

- Soil map design location (1:500)
- Ground water map design location (1:500)
- Sections design locations (1:200)
- Concepts water drainage system (1:200)
- Pollutants concept map location (1:500)
- Water streams map design location (1:500)
- Infrastructure maps (1:500)

8.1 THEORETICAL FRAMEWORK

DEFINITIONS

Normative: “What should be”
Substantive: “What if”, “Why”

Urban design is normative trained to imagine and execute schemes for the future. Research is usually associated with substantial information and with the understanding of specific phenomena.

[Source: Lang 1987, Moudon 1988|

METHODS

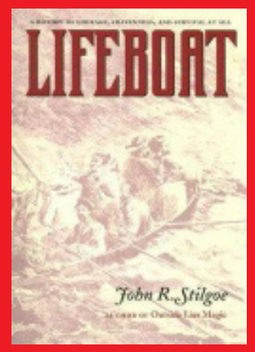
Urban history studies
Picturesque studies
Image studies
Environment- behavior studies
Place studies
Material culture studies
Typology- morphology studies
Space morphology studies
Nature ecology studies

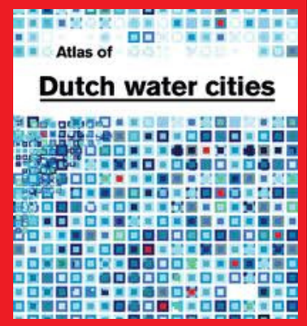
[Source: A.V. Moudon, 2003|

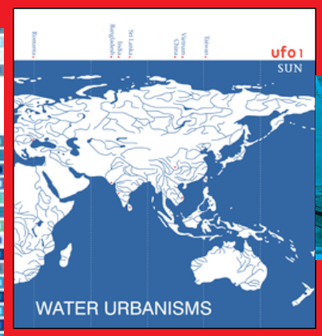
TOOLS

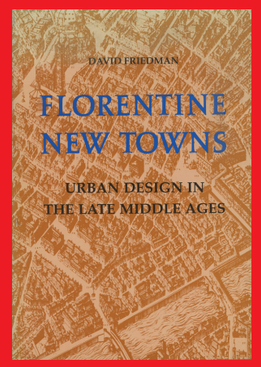
Official data research
Literature research
Site observations
Mapping

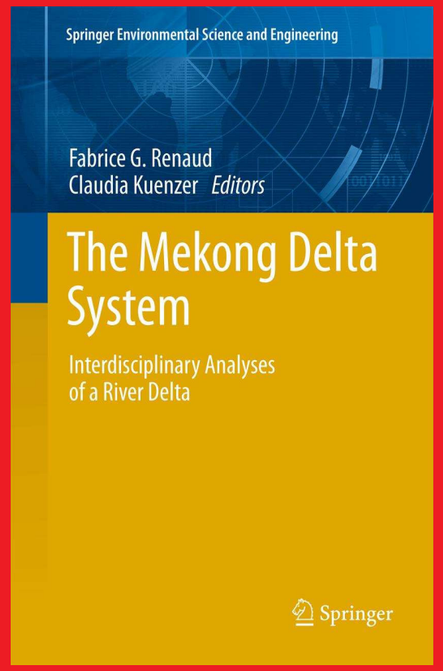
LITERATURE REVIEUWS

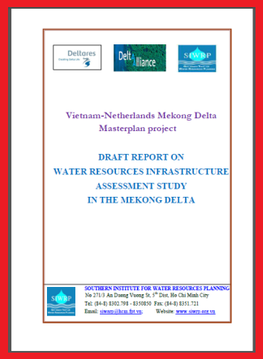


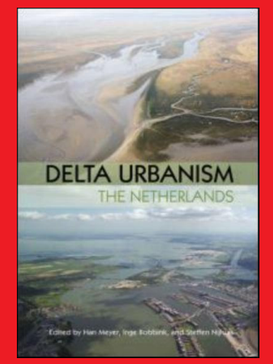


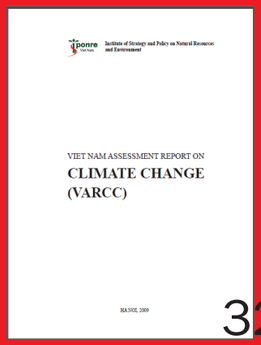




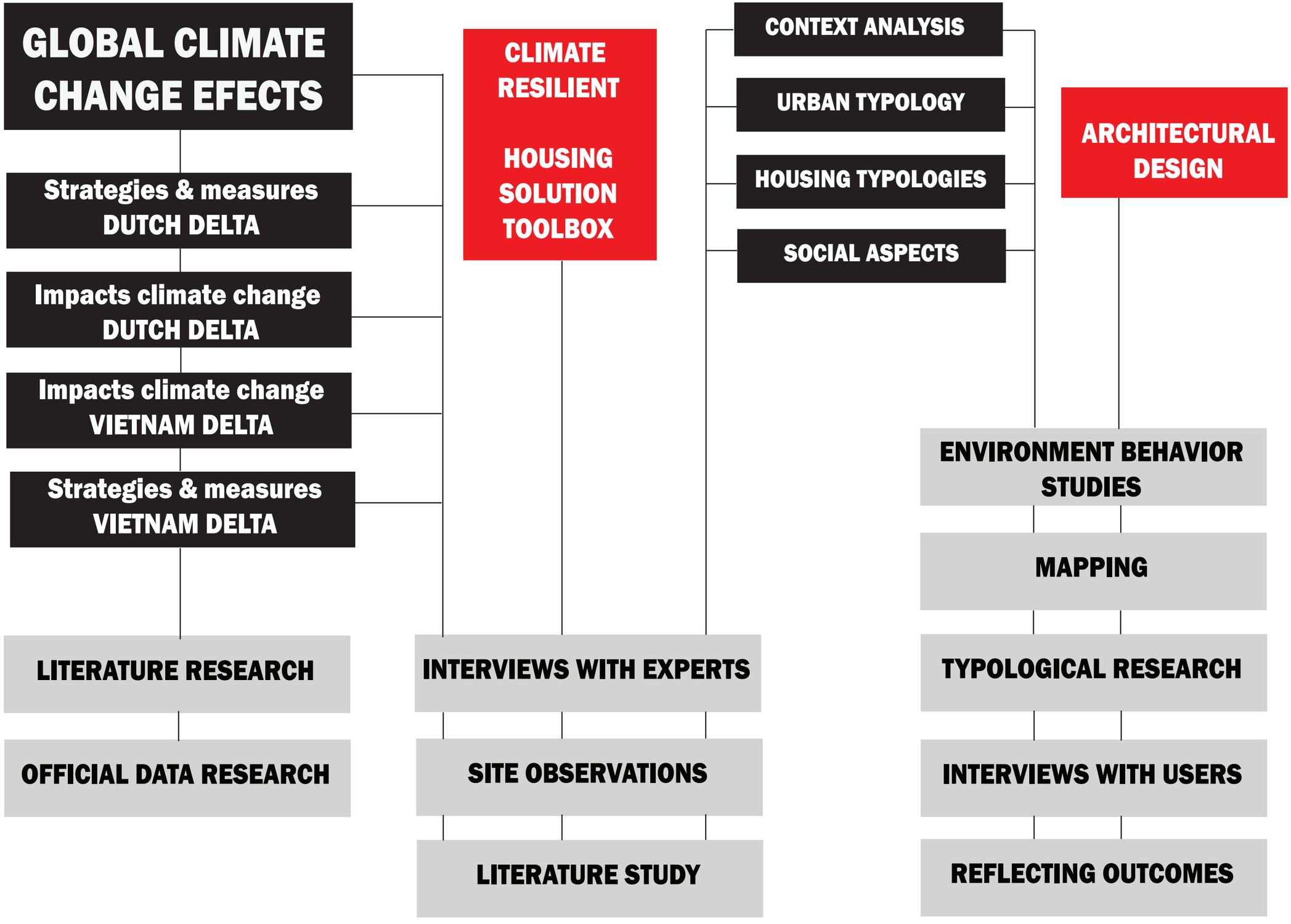






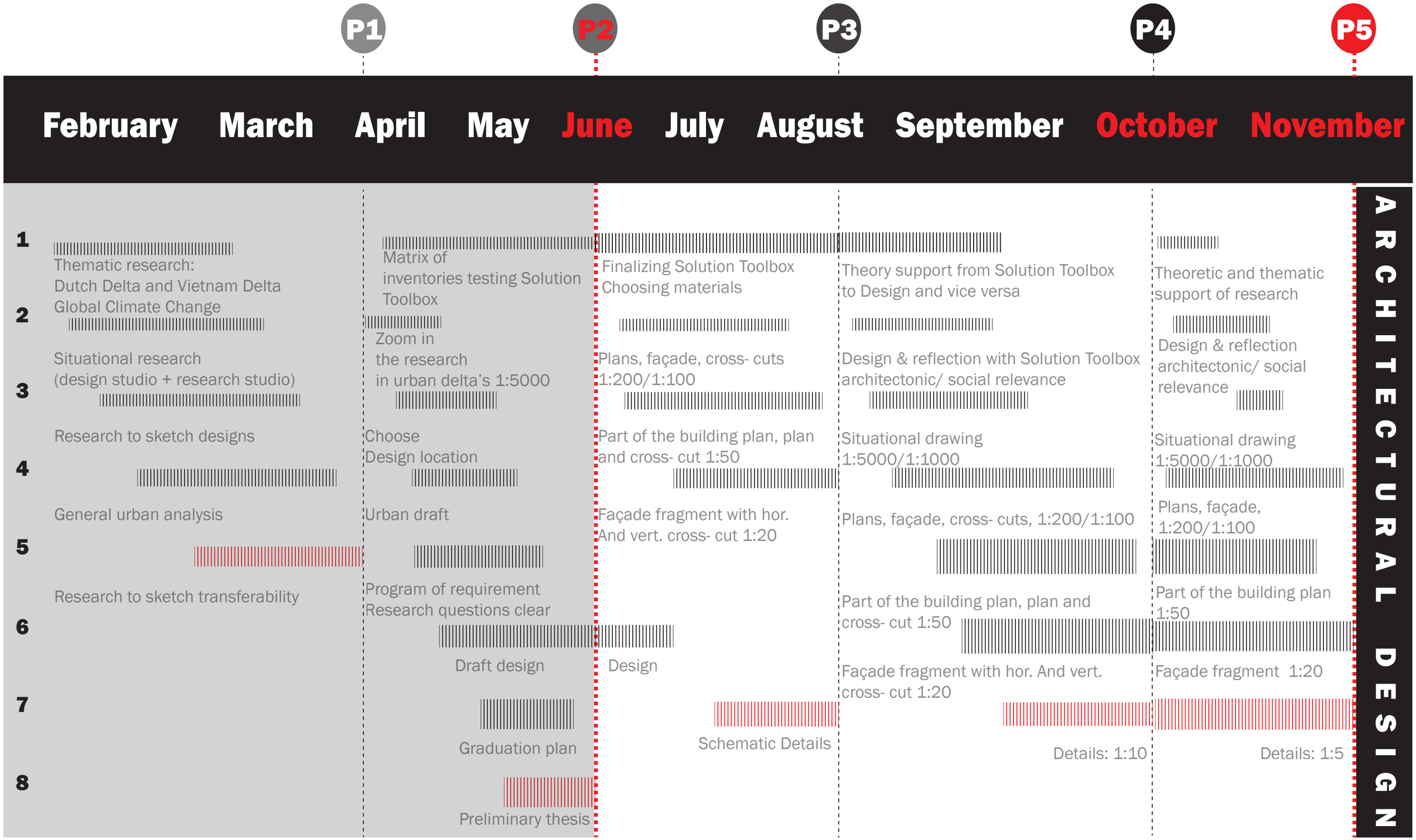


8.2 THEORETICAL FRAMEWORK



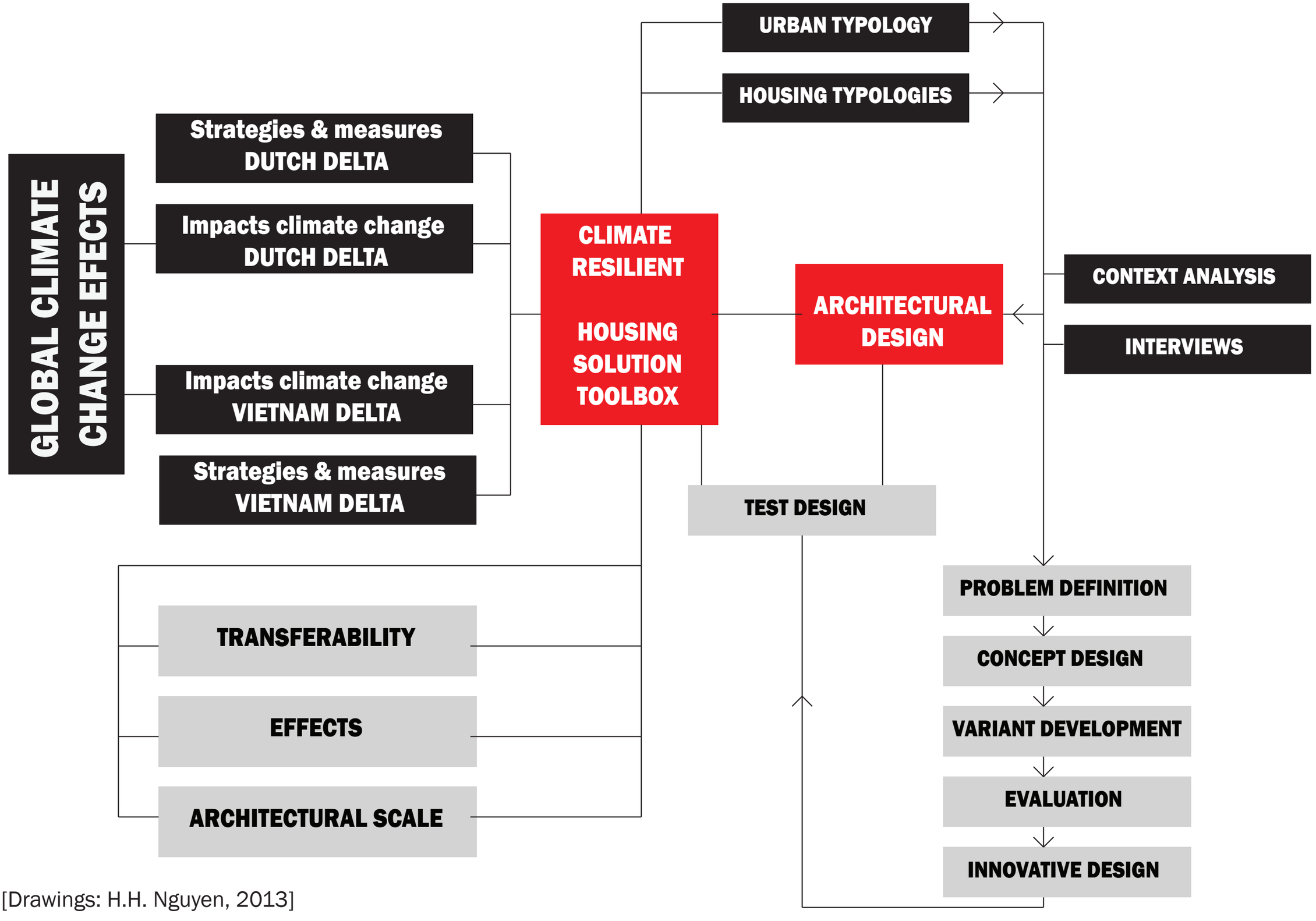
[Drawings: H.H. Nguyen, 2013]

9.1 GRADUATION TIMEPLANNING



[Drawings: H.H. Nguyen, 2013]

9.2 APPROACH & PHASING



[Drawings: H.H. Nguyen, 2013]

10. NEXT STEPS

Serious Gaming possibility?
Contactperson: Jeroen Warmerdam (Tygron),
11th of July, 2013

Contact and plan interviews with
Experts and municipalities Rotterdam, Dordrecht, Can Tho

Contact and plan interviews with
Experts in Vietnam (Mekong Delta)

Collecting more maps and additive data
Continue designing and assessing the Toolbox

Visiting "*Nationaal Water, Wonen & Ruimte congres* " in Rotterdam,
17th of September, 2013

TO BE CONTINUED.

Thank you for your attention!

GRADUATION PROJECT 2013

Delft University of Technology, The Netherlands
Master of Architecture, Urbanism and Building Sciences
Discipline: Master track of Architecture
Studio DELTA INTERVENTIONS
4th of July, 2013
NGUYEN, HONG HANH