RESILIENT GROUND

A Proposal for Re-Establishing Relationship Between People, Land and Water
in Saigon/Ho-Chi-Minh City Amidst Urbanization and Flooding

by
Thanh Tran

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis including any required final revisions as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

ABSTRACT

The urban fabric of Saigon (also known as Ho Chi Minh City, HCMC) is an intense and complex layering of planning and development. It has provoked my curiosity for a long time because of its pragmatic, informal, and unpredictable development. This pragmatism has allowed people to become active participants in the process of creating a unique urban form of alleyway housing. Also known as *'hẻm'* in the Vietnamese language, the alleyway is not only a space for traffic but also an inclusive space for different uses throughout the day. It encourages social and economic diversity for families and businesses that embody many characteristics of the city. More than eighty-five percent of Saigon/HCMC's population lives in alleyway neighbourhoods, yet the alleyways have not been well documented.

Moreover, climate change, massive population increase and urbanization in low-lying regions within the last few decades have caused ever-increasing flash floods in overlooked alleyway neighbourhoods of Saigon/HCMC. Immense engineering projects introduced by the government to mitigate flooding have not improved the situation, while responses by local authorities, such as elevating streets and alleyways, are disrupting the spatial, social, commercial, and cultural relationships of alleyway neighbourhoods. Residents are left with little choice but to sell their homes or raise the ground floors of their houses, inevitably partaking in the unjust competition for higher ground.

This thesis aims to build a better understanding of Saigon/HCMC's urbanism and alleyway typology and explores how architectural and urban design can be implemented at the local level to promote resilience and adaptation. The thesis will examine the alleyway typology in detail and how contemporary issues, such as flooding, are challenging it. The goal of this thesis is to question the current flood control paradigm adopted by local authorities. It will then present a concept of living with flooding,

which includes different ways of creating flood-adaptive spaces in flood-prone alleyway neighbourhoods. To better adapt to flooding, residents need to understand the nature and process of flooding, accepting it as an inevitable part of urban life in a megacity rather than a hazard to be eliminated. With dense alleyway neighbourhoods making up most of Saigon/HCMC's fabric, urban flooding needs to be addressed directly from here with the collective participation of local residents. In this way, Saigonese alleyways will become a testing ground for an emerging flood adaptation paradigm that promotes a resilient urban landscape.

TÓM LƯỢT

Cơ cấu đô thị của Sài Gòn (còn được gọi là Thành phố Hồ Chí Minh) là một quá trình quy hoạch và phát triển phức tạp dẫn đến sự hình thành một mạng lưới hẻm dày đặc. Con hẻm đã khơi gợi sự tò mò của tôi trong một thời gian dài vì sự phát triển thực dụng, không chính thức và không thể đoán trước được. Sự thực dụng này đã cho phép người dân trở thành những người tham gia tích cực vào quá trình kiến tạo ra loại hình không gian hẻm. Hẻm không chỉ là không gian dành cho giao thông mà còn là không gian tổng hợp được dùng vào các mục đích khác nhau trong ngày. Nó khuyến khích sự đa dạng về kinh tế và xã hội cho các gia đình và doanh nghiệp nhỏ. Hơn tám mươi lăm phần trăm dân số Sài Gòn/TPHCM sống trong các khu hẻm, nhưng loại hình không gian đô thị này chưa được nghiên cứu đầy đủ .

Hơn nữa, biến đổi khí hậu, sự gia tăng dân số ồ ạt và quá trình đô thị hóa ở các vùng trũng thấp trong vài thập kỷ gần đây đã gây ra tình trạng ngập đô thị ngày càng gia tăng, đặc biệt trong các khu dân cư hẻm của Sài Gòn/TPHCM. Các dự án kỹ thuật khổng lồ do chính phủ đưa ra nhằm giảm thiểu tình trạng ngập đã không cải thiện được tình hình, trong khi các biện pháp ứng phó của chính quyền địa phương, chẳng hạn như nâng cao đường và hẻm, đang phá vỡ các mối quan hệ về không gian, xã hội, thương mại và văn hóa của các khu dân cư trong hẻm. Người dân không còn lựa chọn nào khác ngoài việc bán nhà hoặc nâng nền. Điều này không những không giải quyết triệt để tình trạng ngập, mà còn gây ra các bất công trong xã hội.

Nghiên cứu này nhằm mục đích xây dựng sự hiểu biết tốt hơn về mô hình hẻm của Sài Gòn/TPHCM và khám phá cách thiết kế kiến trúc và đô thị ở cấp địa phương để thúc đẩy khả năng phục hồi và thích ứng với ngập. Luận án này sẽ nghiên cứu chi tiết mô hình đường hẻm và những đường đại đối với mô hình hẻm. Mục tiêu của luận án này là thách thức tư duy "chống ngập" hiện đang được áp dụng bởi chính quyền địa

phương. Tiếp đó, nghiên cứu sẽ đưa ra một khái niệm chung sống với ngập, bao gồm các cách khác nhau để tạo ra các không gian thích ứng với ngập trong các khu dân cư hẻm. Để thích ứng tốt hơn với ngập đô thị, người dân cần hiểu bản chất và quá trình ngập, chấp nhận nó như một phần tất yếu của cuộc sống đô thị chứ không phải là một mối nguy hiểm cần loại bỏ. Với mật độ dân cư ngõ hẻm dày đặc chiếm phần lớn diện tích của Sài Gòn/TPHCM, tình trạng ngập đô thị cần được giải quyết trực tiếp từ đây với sự tham gia tập thể của người dân địa phương. Bằng cách này, các con hẻm ở Sài Gòn/TPHCM sẽ trở thành nơi thử nghiệm cho tư duy "thích ứng với ngập."

ACKNOWLEDEGMENTS

This research was born from a desire to learn and understand more about alleyways and flooding in my native Saigon. Throughout the development of this thesis, I have received a tremendous amount of support from mentors, family members, and friends from many corners of the world. My pursuit of knowledge was made possible by you.

I would like to express my gratitude to Adrian Blackwell, my supervisor, for challenging my thoughts with your constructive criticism and questions. It was fate that you granted me permission to be absent from studio classes at the beginning of my 3A term so that I was able to travel to the Mekong Delta in 2018. My experiences from this trip have been very valuable to my thesis and my life.

I would like to convey my deepest appreciation to Dr. Elizabeth C. English, my supervisor, for your consistent support and patience throughout the years. Without your mentorship, I would not be the person I am today. I have learnt so much from you and your Buoyant Foundation Project.

I am very thankful to have had the opportunity to attend the University of Waterloo's School of Architecture. The education I received there was a life-changing experience and an important stepping stone between different chapters of my life.

Many thanks to the Arch 693 Writing Group: Mariah Palantzas, Stephanie Young, and Sarah Miri, for reading some of the most important sections of my thesis and giving me your invaluable feedback.

I must also thank my amazing friends, Jeremy Chui and Dhisana D'Sa, who have supported me for many years, especially during difficult times.

Special thanks to Julie Marie Elliott for your encouragement, support and accompaniment on this journey.

TRI ÂN

Xin gởi lời tri ân đến ba và mẹ đã nuôi dạy con nên người. Ba và mẹ đã cho con thứ quý báu nhất trong cuộc đời này là sự tự do đi tìm tri thức và ánh sáng. Những dòng này dù ba và mẹ chắc không bao giờ thấy được, nhưng xin ghi lại trên trang sách này để con mãi ghi nhớ sự hy sinh của của ba và mẹ.

Cảm ơn hai bác Vân và Bảo đã yêu thương con như một đứa cháu trong nhà. Trong nhiều năm qua hai bác đã giúp đỡ con và gia đình rất nhiều. Hai bác sẵn sàng cho đi mà không cần nhận lại, và sự rộng lượng này con xin mãi ghi nhớ.

Cảm ơn các bạn Khánh Hà, Ngọc Anh, Nam Phương, và Ngọc Phương đã an ủi động viên mình trong những lúc khó khăn nhất. Những lời động viên và an ủi này đã giúp mình có thêm nhiều động lực để hoàn tất luận án này.

DEDICATION

This thesis is dedicated to the people in flooded alleyway neighbourhoods of Saigon/Ho Chi Minh City who have struggled to live in this ever-changing city.

Luận án này xin đặc biệt gởi đến những người Sài Gòn sống trong các khu hẻm ngập, những người đã và đang phải vật lộn để sống trong một thành phố luôn thay đổi này.

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PREFACE

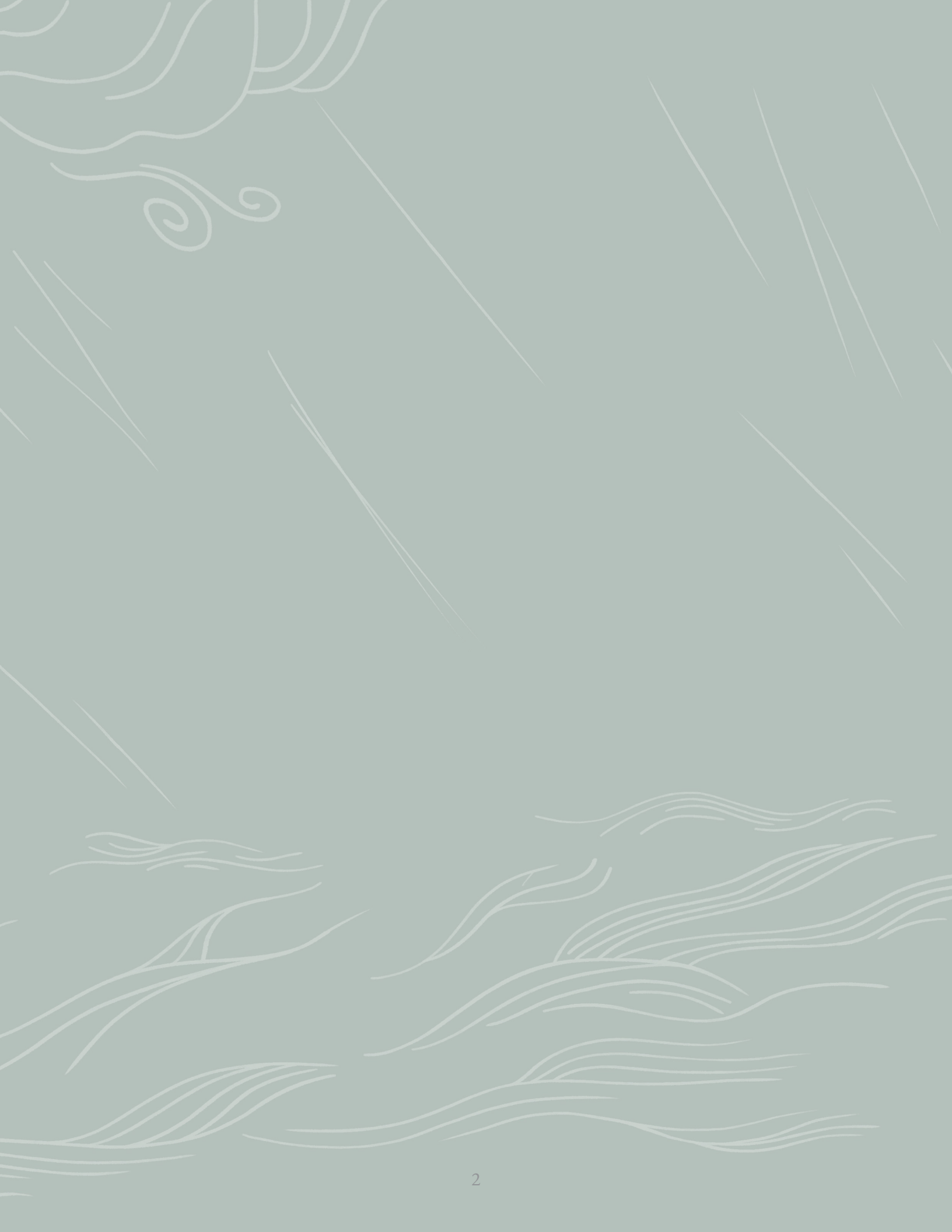
Everyone should have a particular place to call home, I suppose. I have been to a few places and called them home. Yet, the one and only one place that I can really call home is a small alleyway house at the very edge of Saigon (also known as Ho Chi Minh City, HCMC), Vietnam. It was the place where I spent most of my teenage years. It was a shelter for me and a place that shaped a part of what I am today. In the summers of 2016 and 2018, I went back to visit my home after studying architecture in Canada for many years. Although the house itself had not changed much, what surprised me was how often it was flooded during each rainfall. The house had sunken significantly because the alleyway kept getting elevated now and then. Most wealthier households in the neighbourhood did not have any problem with this because they could elevate their ground floors easily. Others did not have the necessary resources and had to live in their sunken houses that got flooded quickly during heavy rainfalls. Upon realizing that local residents are struggling to adapt to this phenomenon, I started to pay more attention to flooding in the city and decided to focus on how it affects alleyway neighbourhoods.

My research began as a study of the relationships between alleyways, people and flooding. I valued the alleyways because they can be seen as cradles that nurture and shape local residents' identities and memories. They are so rich in their characteristics and can be seen anywhere in the city. Yet, they have been taken for granted by people, myself included. My curiosity about the alleyway evolved from my past ignorance of something that seems superficially ordinary yet at the same time so extraordinary and complex. I aspired to build a better understanding of the alleyway, which I had known so much of but also very little. However, it came to me as a surprise that there has not been much research done to study Saigonese alleyways. Subsequently, flooding in alleyway neighbourhoods has also been poorly documented.

As someone who has spent half of his life growing up in Vietnam, and the other half studying in Canada, I was interested in formulating a concept in which modern design ideas and vernacular wisdom can be used in conjunction to address urban flooding. I also wanted to investigate how the trajectory of contemporary urban development can be directed to address urban flooding. With uncertainties from rapid urbanization and impacts of climate change, there must be a shift from flood control paradigm to flood adaptation paradigm in Saigon/Ho Chi Minh City. This shift was my thesis's core argument that presents a concept of living with urban flooding made possible by altering the built environment to address rainwater and urban ecology. Local residents also need to change their perception and attitude to better understand and adapt to ever-increasing flash floods to achieve this goal.

And lastly, I wanted to add a brief note about the name of the city. After the Fall of Saigon in 1975, it was renamed. However, Saigon was a historical name, and many people still call it Saigon. For this thesis, I will refer to the city as Saigon for any events prior to 1975. And from 1975 onward, I will refer to the city as Saigon/Ho Chi Minh City (or Saigon/HCMC).

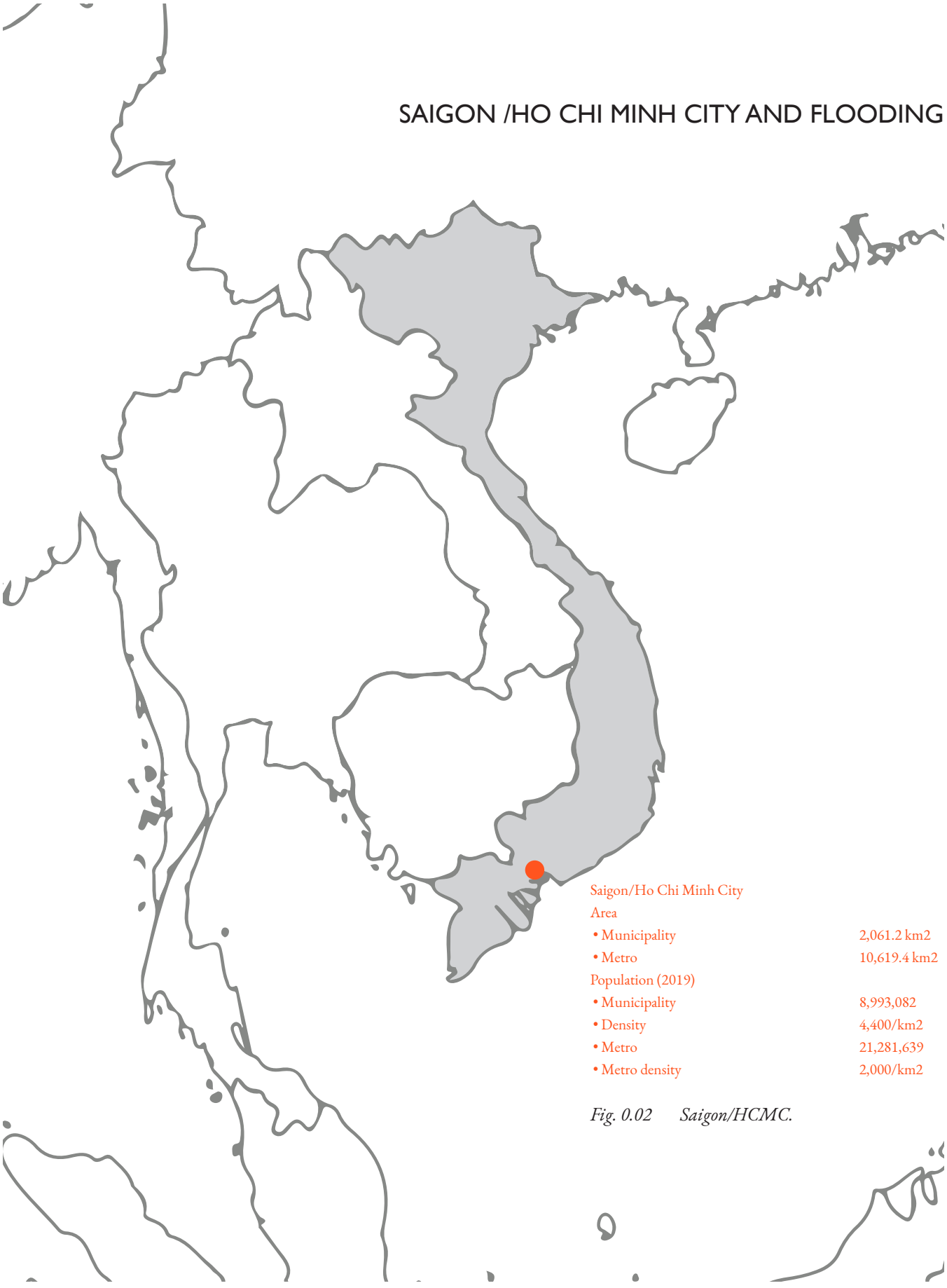
INTRODUCTION



In 2012, Tiffany Chung, a Vietnamese American artist, created a beautiful artwork titled "one giant great flood 2050." However, it depicts a bleak future of Saigon/HCMC when most of the city and its surrounding region are affected by a major flood event. The image on the following page shows a reproduced version of this map by engraving it on plywood (fig. 0.01). This depiction of Saigonese flooding is rather evocative. The event is fictional, yet it is still a possible scenario in the near future if the city does not quickly address this ecological challenge. This chapter is going to introduce Saigon/HCMC and the flooding that happens every year.

Fig. 0.01 The great flood of 2050. The dark brown areas show water bodies. The medium brown patches show flooded areas.

SAIGON /HO CHI MINH CITY AND FLOODING



Saigon/Ho Chi Minh City

Area	
• Municipality	2,061.2 km2
• Metro	10,619.4 km2
Population (2019)	
• Municipality	8,993,082
• Density	4,400/km2
• Metro	21,281,639
• Metro density	2,000/km2

Fig. 0.02 Saigon/HCMC.

Located in the south-eastern region of Vietnam, Saigon/HCMC has a tropical climate that divides the year into two distinct seasons (fig. 0.02). The dry season typically lasts from December to April, and the rainy season typically lasts from May to November. June and September are the rainiest months, with an average rainfall of 300mm. This climatic characteristic creates ecological challenges for this fast-growing city. Flooding has always been an aspect of urban life and was documented in photographs dated back to the 1950s and 60s (fig. 0.03-0.06). From conversations with my friends and family members who have been longtime residents of the city, flooding indeed occurred in the past after heavy rainfall, but it was not severe and damaging. Flooding was definitely not considered a disaster because people were able to cope with the light impacts.

However, Saigon/HCMC has experienced more and more flash floods in recent years. Multiple factors contributing to the intensity of floods include the lowered city's elevation due to groundwater extraction, heavier rainfall cycles from tropical storms, large extents of impermeable paved surfaces, overburdened infrastructure, and the reduction of wetlands.[1] Severe flooding also occurs when heavy rainfalls coincide with daily tides peaking from 5 pm to 7 pm. The water level can range from one's ankle to one's knee and disrupts traffic, commercial activities, and social interactions in alleyway neighbourhoods (fig. 0.07-0.11). Rainwater can be trapped in alleyway neighbourhoods and houses for hours before it can be drained away. Although this disruption only lasts for several hours at most, it can cause significant damages to properties and effects on people's health and livelihoods (fig. 0.12-0.14).

Flooding has been reported in local news every year, yet its extent and impacts have not been thoroughly studied and published. With a lack of official flood data, local residents have not had a complete picture of how flooding affects the city and other people's lives. Furthermore, there has not been any official agency that can provide instructions for flood management and adaptation. Without any official guidance from the government, people have not been able to find appropriate solutions and get insurance coverage for flood damage costs.

Fig. 0.03 Cycle rickshaws in a flooded street, circa 1960s.

Fig. 0.04 Vehicles moving through a flooded street, circa 1960s.

Fig. 0.05 A mildly flooded street in Saigon, circa 1960s.

Fig. 0.06 A flooded busy street, circa 1960s.

1 Ho, "Climate change and urban flooding in Ho Chi Minh City," 194-199.

Fig. 0.07 Flooded street in Saigon/HCMC in August, 2020.

For this thesis, I mainly focus on pluvial flooding caused by large impervious surfaces. The other type of flood is fluvial flood (or riverine flood). It occurs when the water level in a river, lake or stream rises and overflows onto the surrounding land. On the other hand, a pluvial flood occurs when an extreme rainfall event creates a flood independent of an overflowing water body. A common misconception about the flood is that you must be located near a body of water to be at risk. Yet pluvial flooding can happen in any location, urban or rural, even in areas with no water bodies in the vicinity.[2] Fluvial flooding is also an issue in Saigon/HCMC; however, it is not urgent as pluvial flooding. As a matter of fact, many flooded neighbourhoods are situated on higher ground, far away from any bodies of water.

Since the beginning of my research, it has been challenging to find flood data to map the extent of flooding, especially in alleyway neighbourhoods. First of all, most recent studies only emphasized flooding related to sea level rising and used simulated models to predict flooding. Although it is helpful to have these studies to know the effects of flooding in the future, they did not collect factual data from past floods and look at flooding at a human scale in the immediate present. Secondly, Saigon/HCMC's flooding has been a phenomenon limited to one single field of hydraulic and civil engineering. Despite the correlation between flooding and urbanization that will be discussed in later chapters, Vietnamese urbanists or architects have not done extensive research on this topic. Thus, very few studies have examined how the built environment should function in response to flooding.

To provide an overview and better understand urban flooding in Saigon/HCMC, I set out to create a comprehensive flood map to serve as a foundation for this thesis. During this research, I came across many flood maps and realized that they were incomplete because a few places where I had experienced floods in the past were not included. Thus, I wanted to create a comprehensive flood map to the best of my ability before proposing any design interventions. I gathered data from various sources (such as research papers, reports, news articles, and GIS datasets) and used overlay analysis to combine and compare them.

Fig. 0.08 People going through a flooded alleyway, 2017.

Fig. 0.09 A flooded alleyway shortly after a rainfall, 2020.

Fig. 0.10 People are waiting for water to recede inside their flooded home, 2020.

Fig. 0.11 A business owner observing his flooded alleyway, 2017.

2 "Three Common Types of Flood Explained." Zurich.com. Accessed December 17, 2021. https://www.zurich.com/en/knowledge/topics/flood-and-water-damage/three-common-types-of-flood.

Fig. 0.12 This GIS map is an intersection of the official flood map and population statistic. It shows that at least 4,942,262 people (67%) affected by flooding. Different shades of green show different densities.

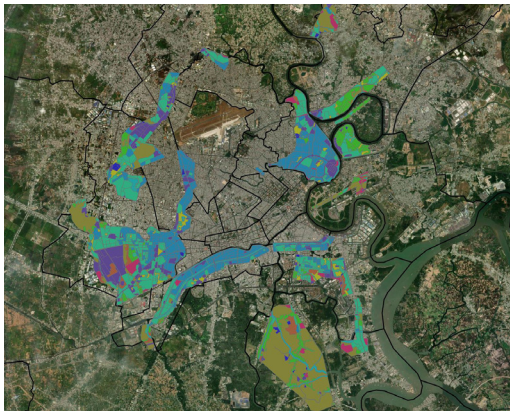


Fig. 0.13 This GIS map is an interestion of the official flood map and land use map. It confirmed that most of the flooded areas were residential (blue and green).

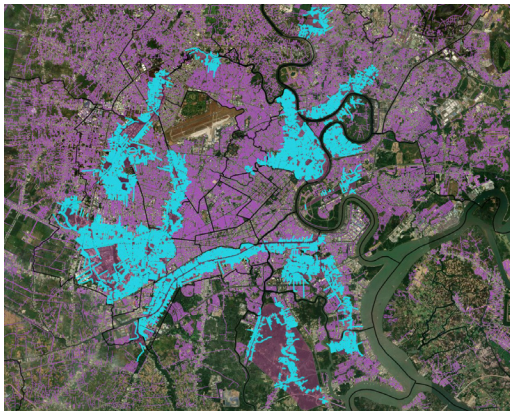
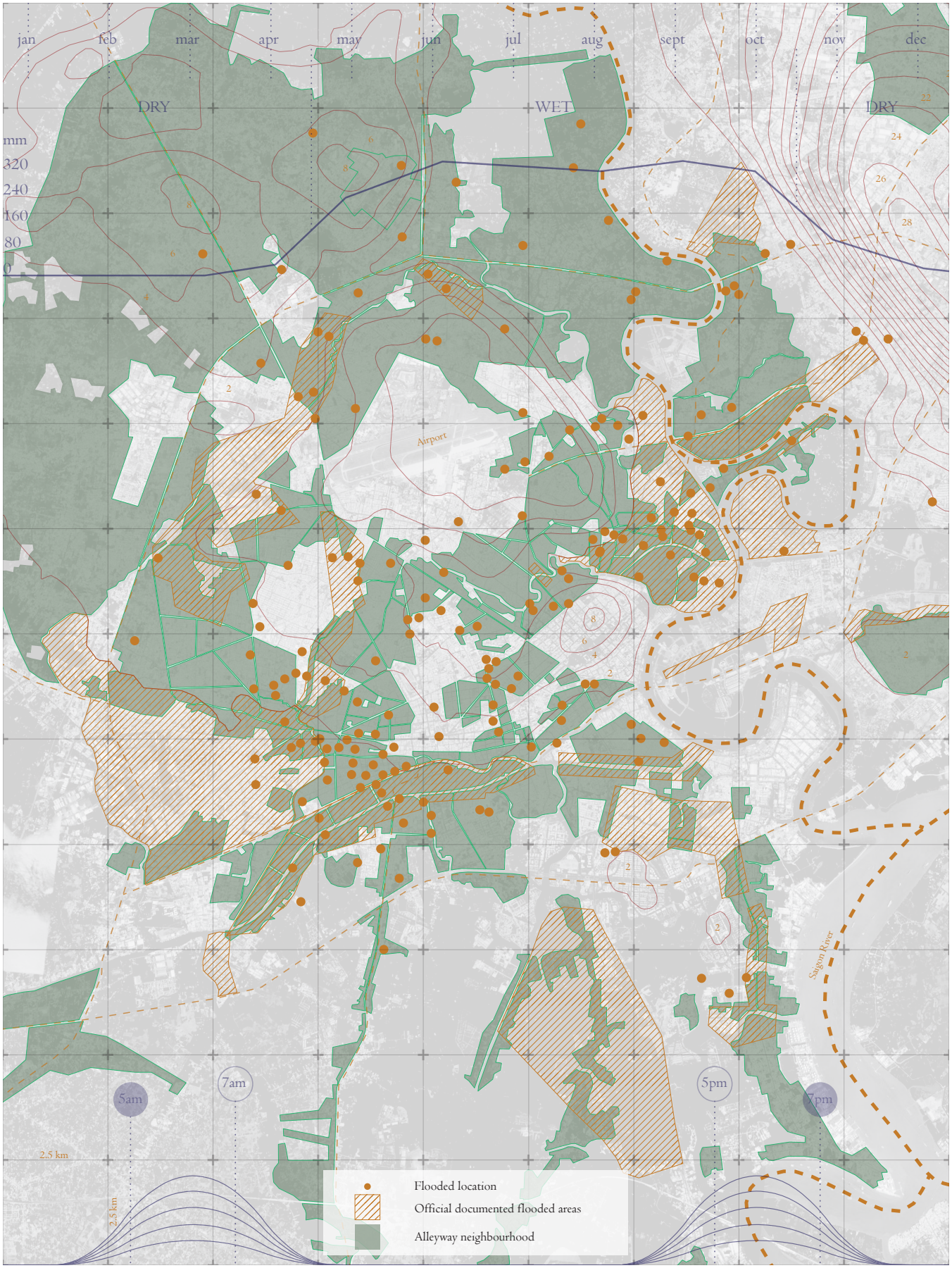


Fig. 0.14 9755 streets resulted in a total of at least 1295 km of infrastructure that needs improvement.

The result is a combined flood map that reveals other flooded locations that have gone unnoticed in recent years (fig. 0.15). It has two core arguments: (1) flooding is happening in more places than previously documented, and (2) alleyway neighbourhoods are the most affected by flooding. This combined flood map once again proved that the official flood map was outdated and did not cover all flooded areas in the city. It revealed other flooded locations that have not been officially documented and published by the government. The lack of factual flood data is alarming because the current flood management system may not address flooding in these areas. As flooding is being exacerbated by urbanization and climate change, it is not surprising if future floods will render any current flood management projects useless.

Fig. 0.15 (Next page) Combined Flood Map with official flood map shown in diagonal hatch, documented flooded points shown in orange dots, and alleyway neighbourhoods shown in solid hatch. At the top, the precipitation chart is overlayed. At the bottom, daily tide chart is overlayed.


jan
feb
mar
apr
may
jun
jul
aug
sept
oct
nov
dec
DRY
WET
DRY
mm
320
240
160
80
0
Airport
Saigon River
5am
7am
5pm
7pm
2.5 km
2.5 km
Flooded location
Official documented flooded areas
Alleyway neighbourhood

METHODOLOGY

Fig. 0.16 The ground floor of this house is almost submerged and retains rainwater, 2014.

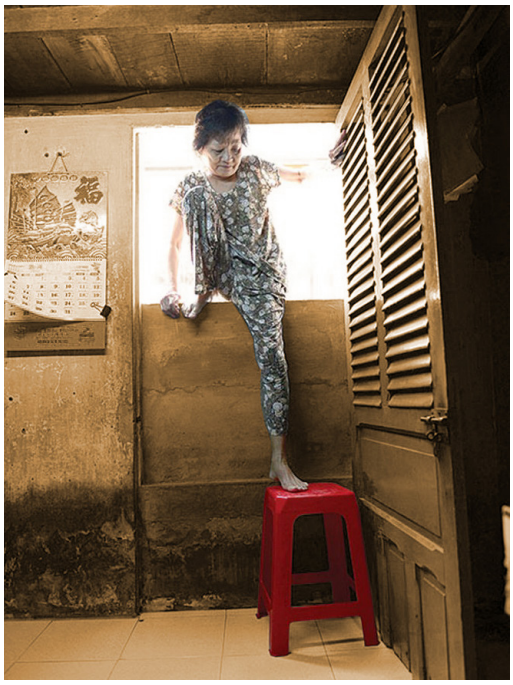


Fig. 0.17 A woman trying to go through her narrow door way, 2014.

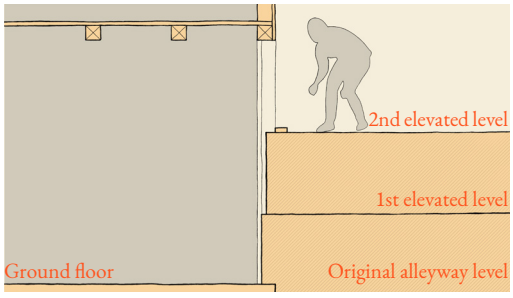


Fig. 0.18 Analytical section showing how the house was affected by its elevated alleyway.

In September 2020, I came across a photo in which a local resident had to use a stool to get out of her house (fig. 0.16-0.18). Her ground floor was much lower compared to the street level, and her doorway was reduced to a small opening. This bizarre situation happened because elevating streets and alleyways have been a common practice to deal with flooding. Upon seeing this injustice, I began my research with an interest in flood-prone alleyway houses in Saigon/Ho Chi Minh City.

Because of the ongoing pandemic from early 2020, I was not able to carry out fieldwork to interview more people in flood-prone alleyway neighbourhoods as planned. My research relied on different methods, including literature review, observation, conversations with families and friends, and experiment through design. Among them, anecdotes from conversations and my past experiences were the most valuable source of information since they were first-hand experiences. I was able to use this source of information to aid my design process and back up my proposal.

My past experiences can be divided into three periods: before 2010, 2018 and 2020-2021 (fig. 0.21). Firstly, I was fortunate to spend most of my youth in Saigon/HCMC before 2010. This portion of my life allowed me to experience living in alleyway neighbourhoods. I lived in many different alleyway neighbourhoods and saw their values and characteristics which were documented and analyzed in Chapter I. Secondly, 2018 was an important year of my life in which I travelled to the Mekong Delta twice to work on a few amphibious houses designed by the Buoyant Foundation Project team. I had the opportunity to observe how people live and build to adapt to the Mekong Delta's seasonal flooding. These trips have had a profound impact on the theoretical framework that will be discussed in Chapter III. Last but not least, the 2020-2021period was also important as I encountered Kuei-Hsien Liao's theory on the flood adaptation paradigm (fig. 0.22), which was summarized and discussed in Chapter 3. I also found Marie Gibert-Flutre's research on the Saigonese alleyway, which has been a valuable resource to my thesis.

From the beginning of this research, I wanted to start with a very basic built environment- the house. My own home in Saigon/HCMC has been flooded easily every rainy season (fig. 0.19-0.20). Thus, my overall approach to flooding was from the perspective of a person who had been affected by it. However, I looked at Saigon/HCMC's flooding like a natural occurrence rather than a disaster. I was also interested in developing different methods to show people how to retrofit their houses and neighbourhoods to accommodate rainwater. Instead of trying to "reinvent the wheel," I looked at various flood management projects from all over the world and applied their principles while considering local factors such as urban context, building typology and local construction.

Fig. 0.19 Flooded side yard of my house. Saigon/ HCMC, 2018.

Fig. 0.20 Flooded front yard of my house. Saigon/HCMC, 2018.

1991

Life in the alleyways
Saigon, Vietnam

2010

Trips to the Mekong Delta
An-Giang Province &
2018 *Long-An Province, Vietnam*

Research begins

2020

Sources for history
Ben Kiernan
Nghia M. Vo

M1 *Preliminary Mapping*
Literature Review
Matters of Concern

Sources for alleyway typology
Marie Gibert-Flutre

M2 *Critical Analysis*
Documentation of the urban expansion, alleyway & flooding

Sources for flood adaptation
Kuei-Hsien Liao

M3 *Experiments*

M4 *Flood-adaptive urban spaces*

2021

Research completion

Fig. 0.21 *Thesis timeline.*

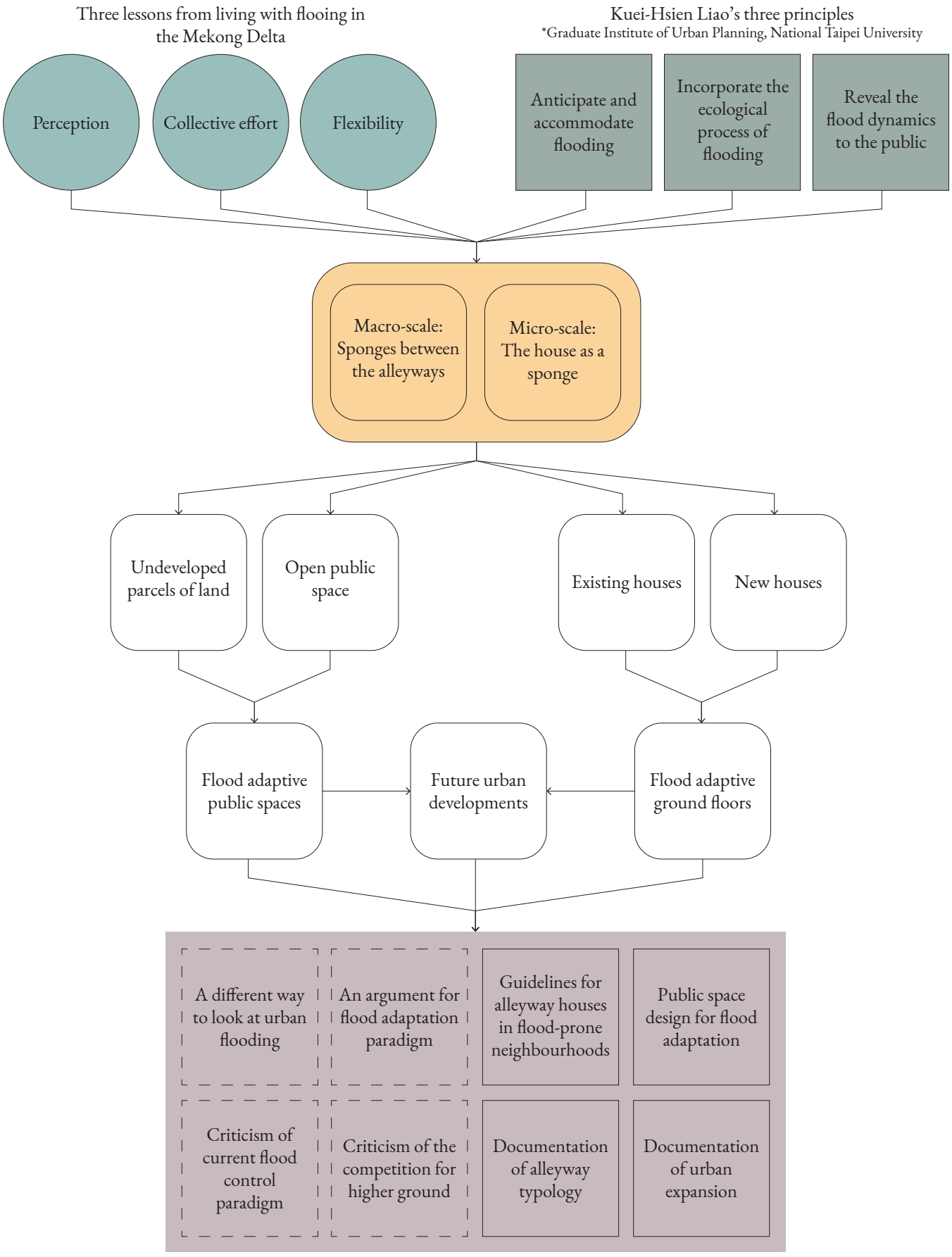
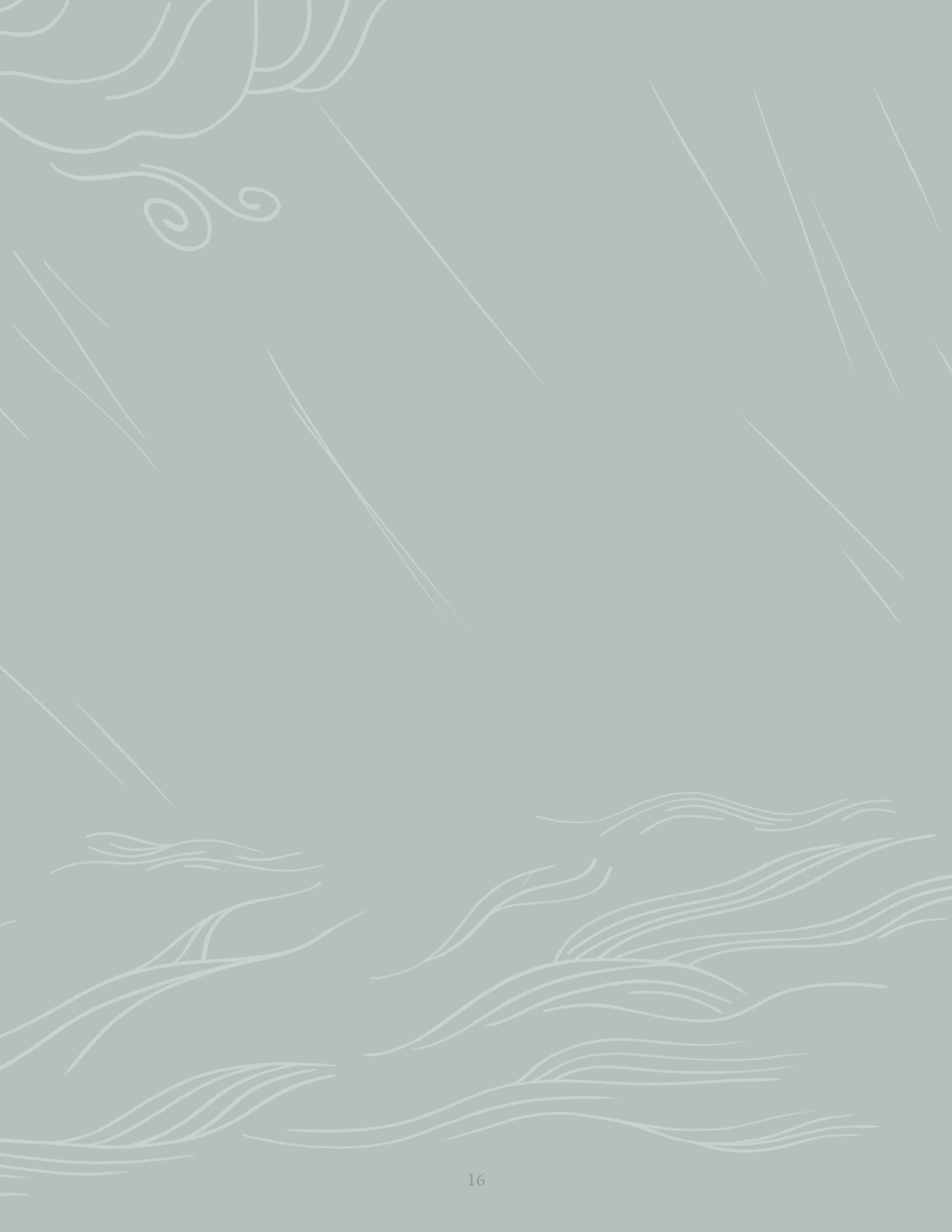


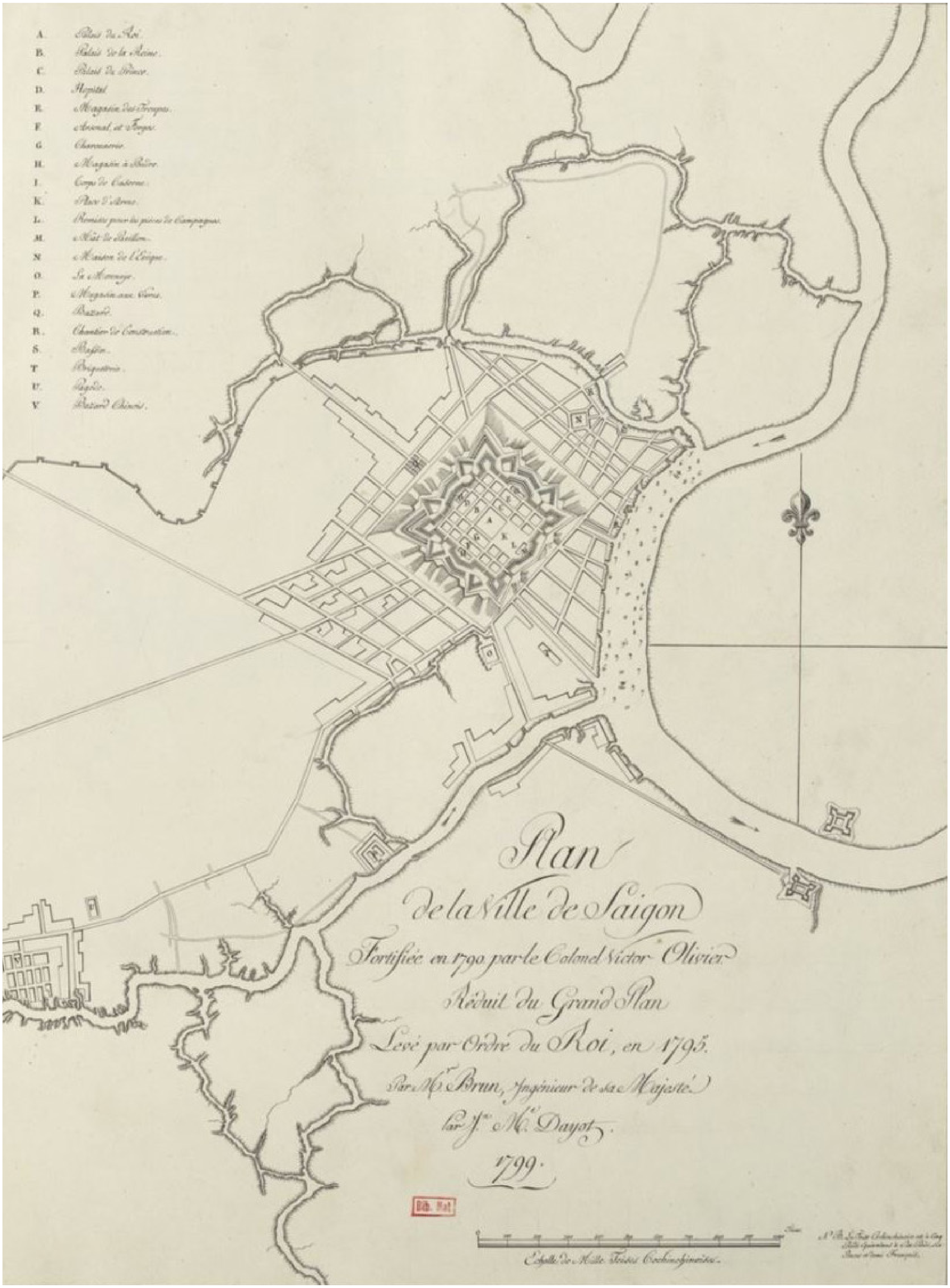
Fig. 0.22 Methodology and summary.

URBAN EXPANSION, ALLEYWAY TYPOLOGY AND URBAN CIVILITY



Urban flooding needs to be studied as a complex issue of climate change, informal building culture, weak infrastructure, rapid urbanization, and historical circumstances. In this chapter, I will focus on the expansion of Saigon/Ho Chi Minh City and its lack of urban plans. For the last 150 years, the city has grown under three administrations: French Indochina (1862-1954), Republic of Vietnam (1954-1975), and Social Republic of Vietnam (1975-present day). As the urban expansion goes through these three consecutive periods, it has left long-lasting impacts on the city, including the formation of alleyways and urban flooding. Additionally, I will analyze the alleyway typology and discuss its importance to Saigonese culture. It has a dominant presence in the city, yet at the same time has not been very well documented. Finally at the end of this chapter, I will also discuss "urban civility"- an ideology that emerged in the 1980s as the ruling Communist Party of Vietnam compromised and embraced an open market economy. This ideology is relatively new to Vietnam, yet it has challenged the alleyways in many ways.

Fig. 1.01 (Next page) Map of Gia-Định Citadel, made in 1790 by Colonel Victor Olivier. According to the large map drawn by the royal engineer Brun in 1795 by order of the king, now redrawn by J.M. Dayot, 1799. The citadel was located on a strategic high ground adjacent to Saigon River. This citadel would be replaced by Saigon.


A. Palais du Roi.
B. Palais de la Reine.
C. Palais du Prince.
D. Hopital
E. Magasin des Troupes.
F. Arsenal et Forges.
H. Magasin à Poudre.
K. Place d'Armes.
L. Remises pour les pièces de Campagne.
N. Maison de l'Evêque.
P. Magasin aux Vivres.
R. Chantier de Construction.
S. Bassin.
T. Briqueterie.
U. Pagode.
V. Bazard Chinois.
Plan de la Ville de Saigon
Fortifiée en 1790 par le Colonel Victor Olivier
Réduit du Grand Plan
Levé par Ordre du Roi, en 1795.
Par Mr. Brun, Ingénieur de sa Majesté
Par Jn. Mie. Dayot.
1799.
Echelle de Mille Toises Cochinchinoises.

150 YEARS OF URBAN EXPANSION

Saigon and the South have been and remain a different entity and region than the rest of the country since the early days of 1600 when Nguyễn Hoàng began establishing his southern "kingdom." Being an outpost away from the direct control of the court, a melting pot of various nationalities, an economic powerhouse with a frontier mentality, Saigon and the South have always followed the beat of their own drum. Saigon has come a long way: from a village in the forest, she has become a large, cosmopolitan city—the largest in Vietnam, bypassing the former capital cities: Hà Nội and Huế. She has undergone tremendous change and passed through many hands: the Khmers, the Chinese, the Nguyễn, the Tây Sơn, the French, the Japanese, the British, the Ngôs, the Americans, and the communists.

*- Nghia M. Vo**

- From 1860 to 1923, Saigon grew from 6,000 to 100,000 due to improved hygiene and medicine but also to the dynamism of colonization.
- From 1921 to 1946, its population grew to 500,000 at a modest rate of 1.7 percent, because of World War I and the 1930 depression. From 1946 to 1954, it grew to 1.7 million people and remained a haven of peace during war time.
- From 1954 to 1974, it grew from 1.7 to 4 million due to the rapid influx of people from the countryside seeking refuge from the war.
- From 1989 to present day, the population has grown to reach 8.9 millions (as of 2011) thanks to economic and land reforms.

Fig. 1.02 Four phases of Saigon/HCMC's population growth.

* Vo, *Saigon: A history*, 259.

Once known as the Pearl of the Orient, Saigon (also known as Ho Chi Minh City from 1975) has been Vietnam's largest city since the 1900s. After the colonization of Vietnam in the 19th century, the French demolished the Nguyễn Dynasty's citadel of Gia-Định and created Saigon in its place (fig. 1.03 & 1.04). As a colonial city, French Saigon was planned to house only administrative headquarters and 500,000 inhabitants. This original French city only covered an area of what would become District One, Three and Five (fig. 1.03 & 1.07). The city has relentlessly expanded to have more than 12 districts that house more than 10 million people as of 2020. In planning and building this contemporary French city, administrative headquarters were located on the higher grounds. They expelled local populations to the lower areas along the main rivers and canals that connect to other regions via the waterways (fig. 1.04).[1] This historical circumstance created a precedent for how in the future, many residential areas would be developed in lower land along rivers and canals and practically obstructed rainwater flow to the larger water bodies.

Vietnam ceased to be a French colony and gained its independence in 1954. However, it was divided into two states with two different ideologies. Saigon, as the capital of the Republic of Vietnam (South Vietnam), then received one million Catholic people who fled to the south because they were afraid of religious persecution by communist North Vietnam (fig. 1.09). Additionally, from the 1960s to 1970s, at least another million people moved to Saigon from rural areas to avoid the war.[2] At this point, the city already had a population that was larger than what was planned for (fig 1.06 & 1.08). Several prominent architects of the Republic of Vietnam (South Vietnam) proposed plans for Saigon's ongoing rapid expansion. One of them was the 'Conurbation of Sài Gòn - Chợ Lớn" proposed by architect Ngô Viết Thụ (who won the Grand Prix de Rome in 1955).[3] However, these plans were not realized as the Vietnam War escalated and

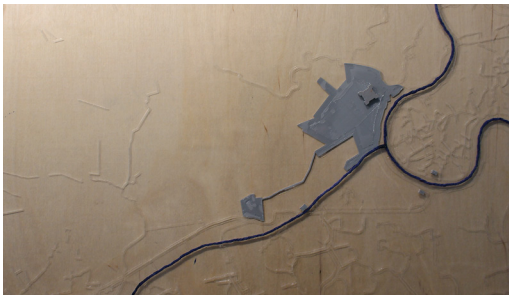


Fig. 1.03 The extent of French colonial Saigon in relative to the Saigon River (north east) and Kenh-Doi Canal (south west). The previous citadel of Gia-Định is shown in relief.

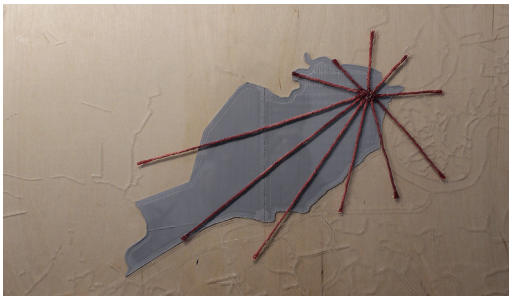


Fig. 1.04 Displacement of local population shown in red lines. The grey patch shows the extent of future Saigon during the Republic of Vietnam.

Fig. 1.05 Saigon in 1881.

Fig. 1.06 Saigon in 1955.

1 Gibert, "Flood-prone Alleyways Neighbourhoods of Ho Chi Minh City," 3.

2 Nguyen et al., "Saigon-Ho Chi Minh City," 17.

3 Pham, *Poetic Significance*, 11.

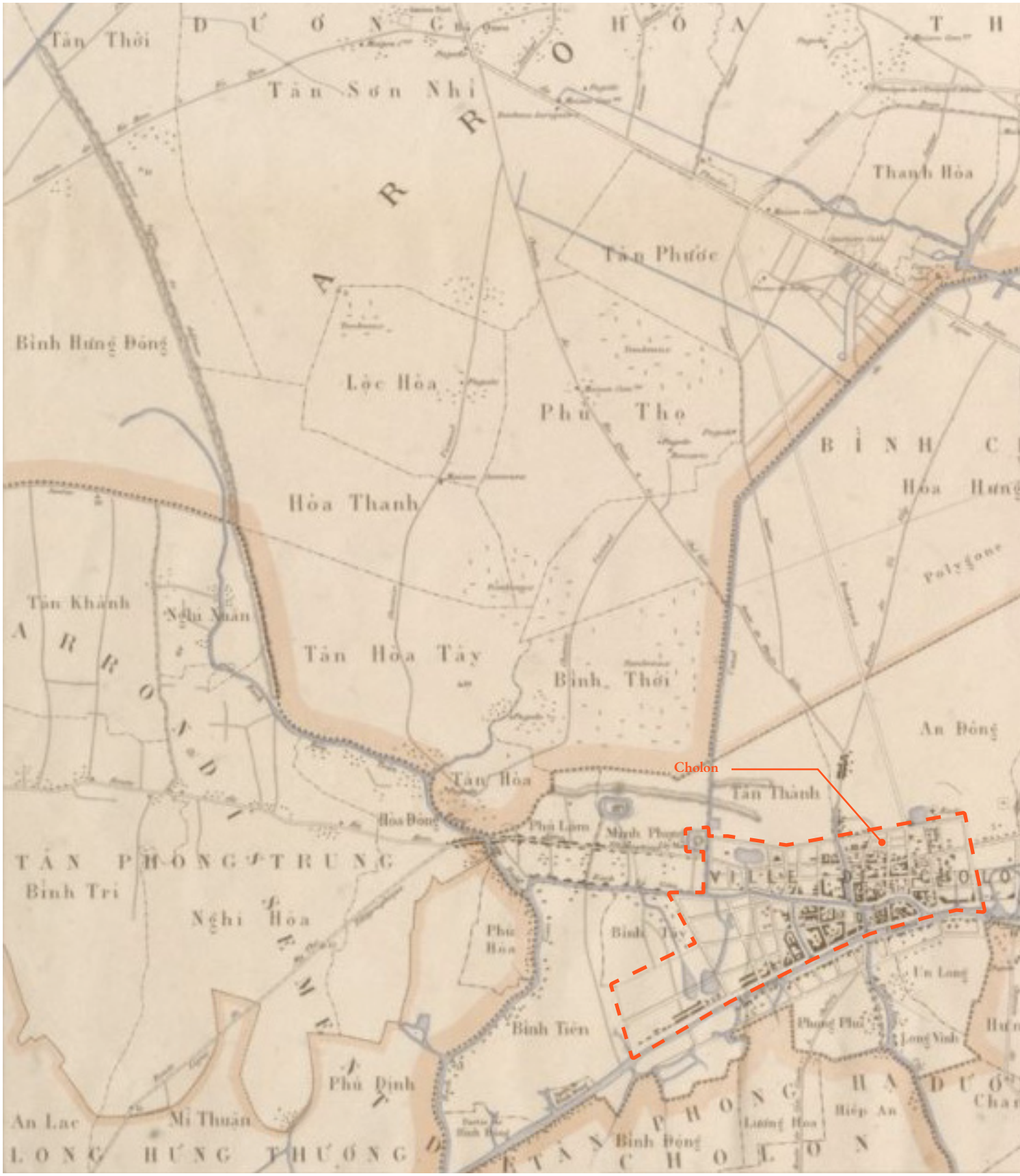
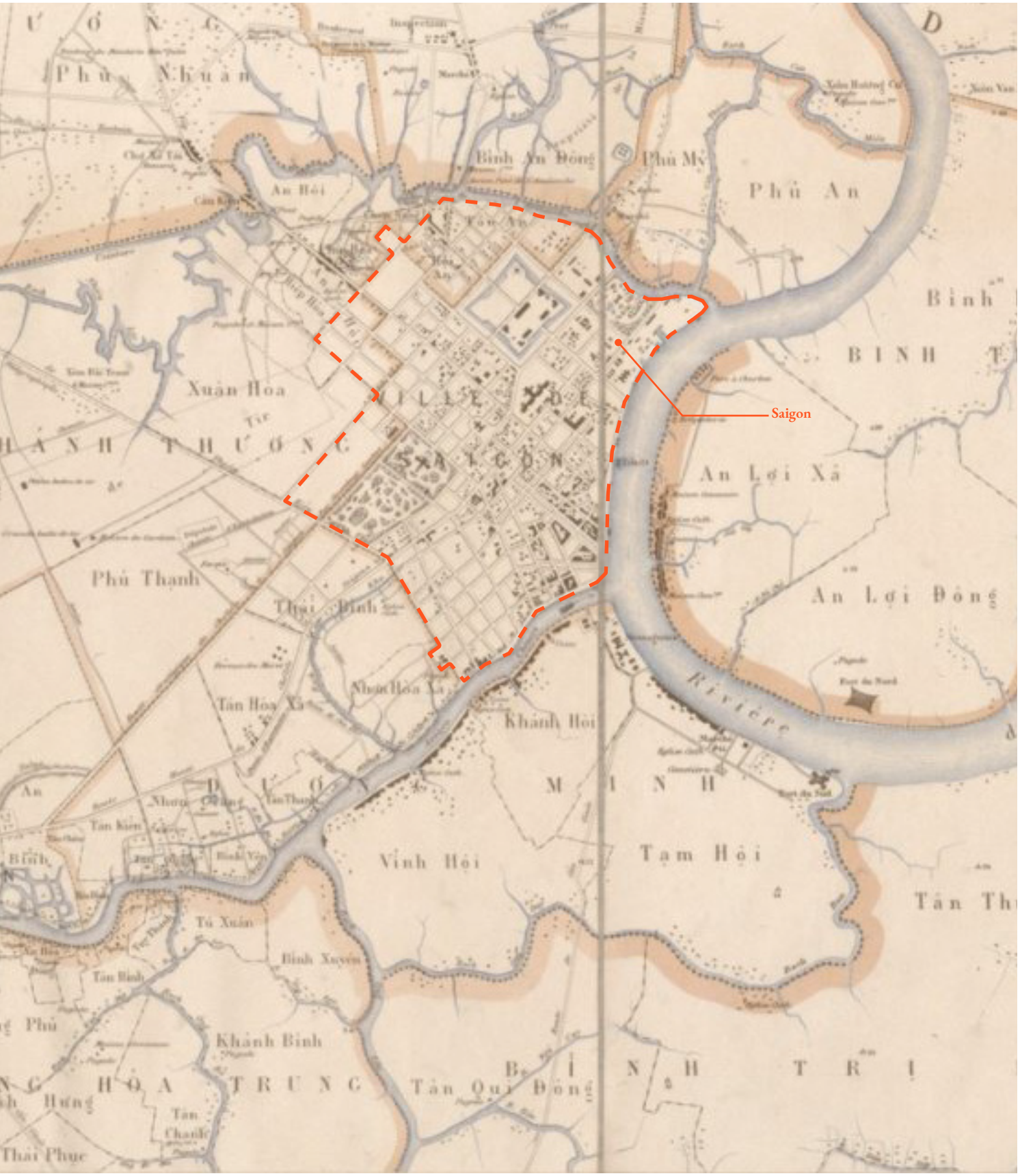


Fig. 1.07 French colonial Saigon (north east) and Cholon (south west) in 1882. These two municipalities would be eventually merged to create a larger Saigon. The citadel of Gia-Định was still visible and surrounded by a newly planned axes and buildings blocks. However, the citadel would be soon demolished as this type of fortress proved to be ineffective in contemporary wars.


Saigon
Phú Nhuận
Bình Thạnh
Phú Mỹ
Phú An
An Lợi Xã
An Lợi Đông
Xuân Hoa
Phú Thạnh
Thái Bình
Tân Hòa Xã
Khánh Hội
Vĩnh Hội
Tam Hội
Tân Quy Đông
Khánh Bình
Thái Phục
River

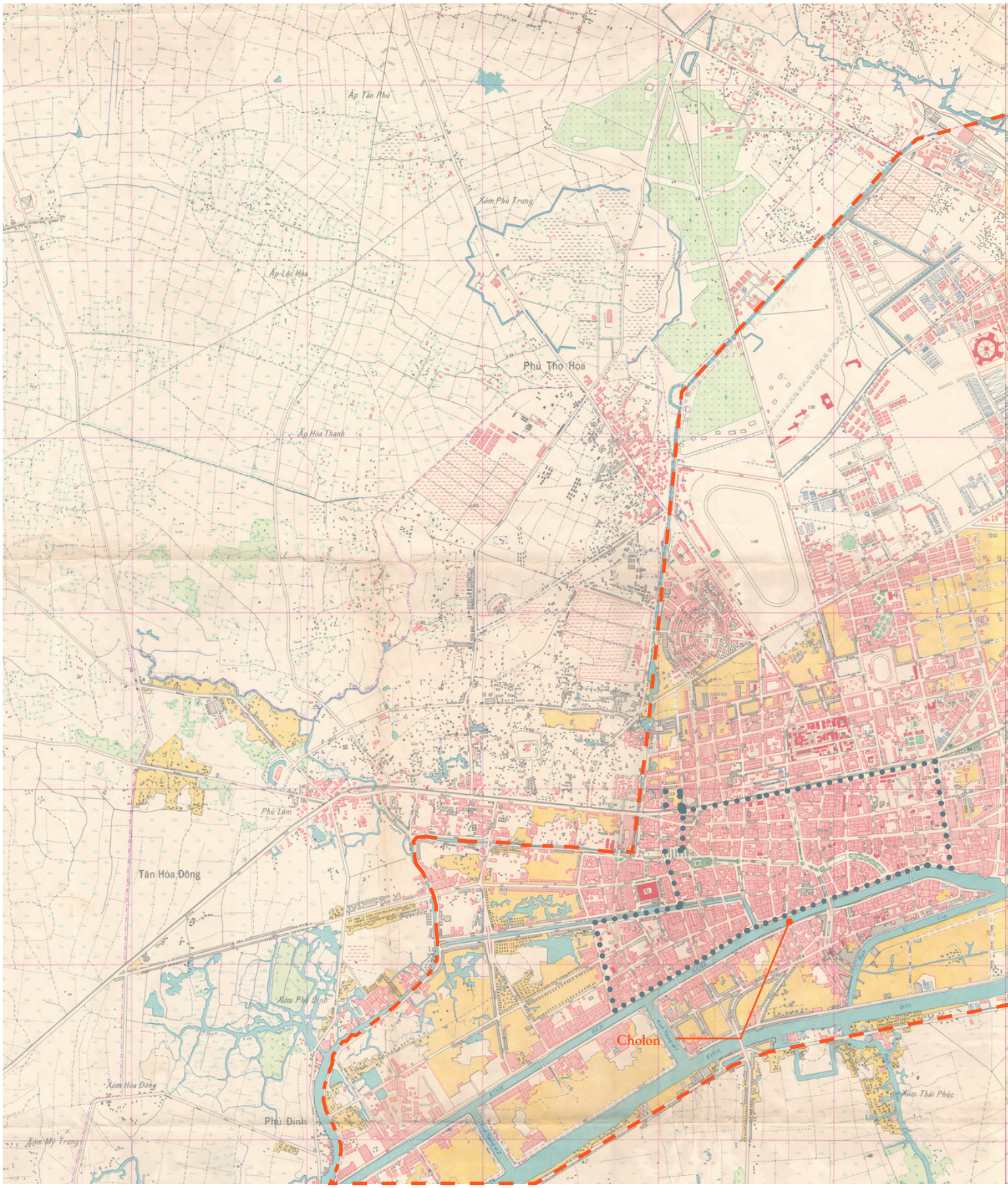
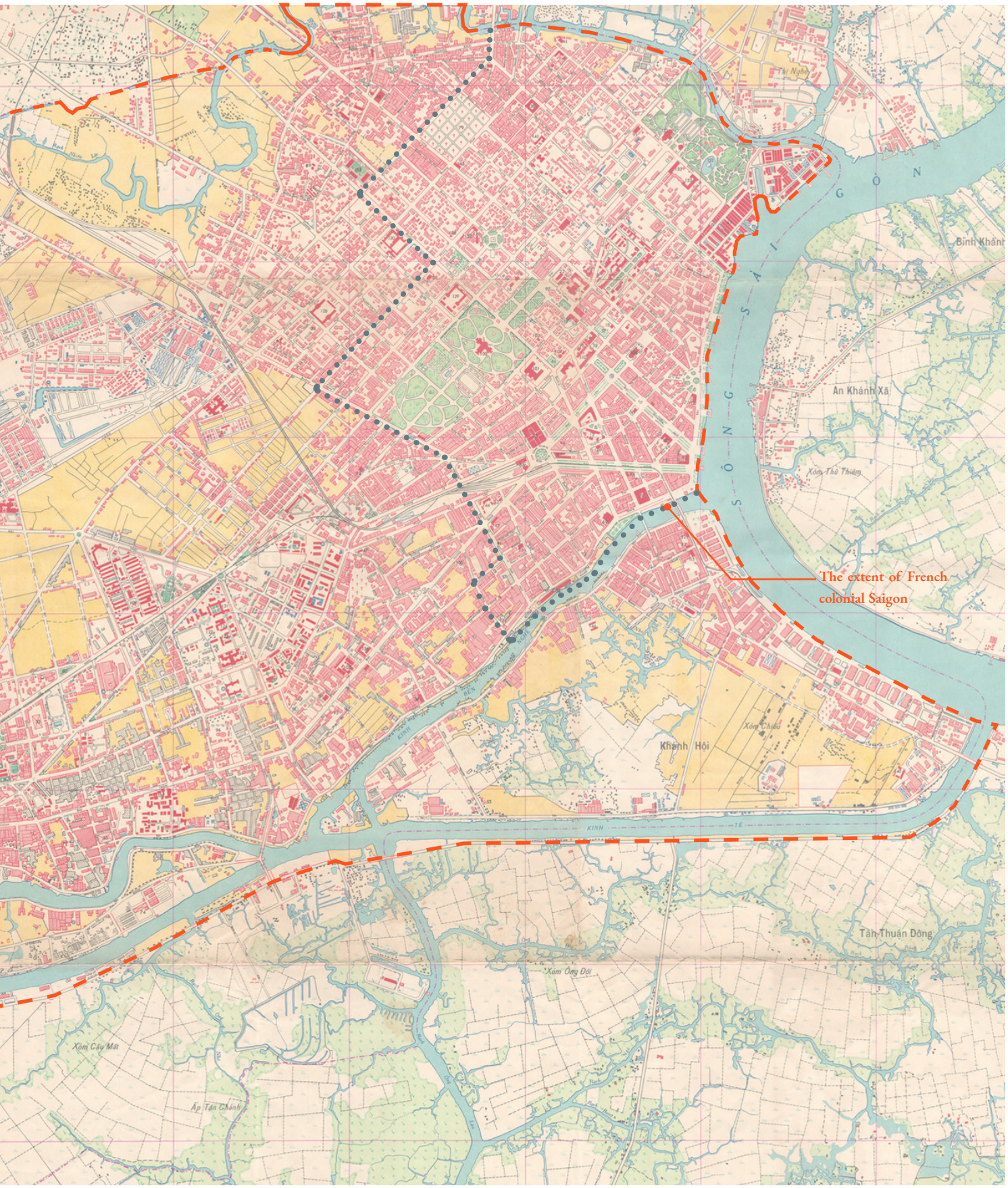


Fig. 1.08 Saigon in 1953 (Republic of Vietnam) shown in red dashed lines. The previous French colonial Saigon and Cholon are showned in blue dotted lines.


The extent of French colonial Saigon
SÔNG SÀI GÒN
Bình Khánh
An Khánh Xã
Xóm Thủ Thiêm
Khánh Hội
Xóm Chiếu
KINH TẾ
Tân Thuận Đông
Xóm Ông Đội
Xóm Cầu Mát
Ấp Tân Chánh

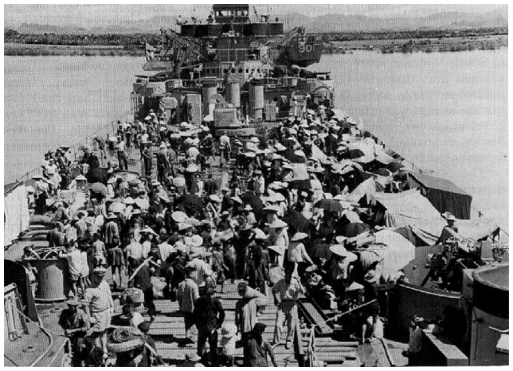


Fig. 1.09 Vietnamese refugees board U.S Navy LST at Haiphong during Operation Passage to Freedom. 1954.

finally concluded when Saigon fell to communist forces in April 1975.[4]

After the official unification of Vietnam (now Social Republic of Vietnam) in 1976, the city had its name changed to Ho Chi Minh City (HCMC), and it continued to be the largest city. However, due to new deurbanization and collectivization policies,[5] Saigon/HCMC did not expand much in the following years of unification. Additionally, there was an exodus of South Vietnamese people who did not want to be ruled by the new communist regime. With waves of people leaving the city, its population change decreased drastically from the 1970s to the 1980s.[6] By the late 1980s, when the Soviet Union was at the brink of collapse, the Communist Party of Vietnam (CPV) tried to avoid the same fate by implementing a radical reform to solve its problematic economic system.[7] With this reform, the CPV embraced capitalism and Vietnam officially transformed into a socialist state with an open market economy. As an economic vanguard, Saigon/HCMC again started to grow to attract foreign investments. It demanded more resources and has expanded toward the Mekong Delta as a gateway to food sources, cheap labour, and naval routes. Inevitably this southern expansion has taken over more low-lying areas for both informal and formal residential developments (fig. 1.10 & 1.12).

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4 Nguyen et al., "Saigon-Ho Chi Minh City," 17.

5 Kiernan, *Viet Nam: A history from earliest times to the present*, 454-455.

6 "Ho Chi Minh City, Vietnam Metro Area Population 1950-2021," MacroTrends.

7 From conversations with my parents, I have known that this total-subsidy economy had spread to South Vietnam after the Fall of Saigon in 1975 and totally ruined the country's economy. It was the time when it did not matter how much one person worked, and everyone would receive the same wage. Pathetically people could not buy what they wanted most of the time. They would instead receive food stamps, clothes stamps and equipment stamps, etc. People would have to line up at stores to hand in their stamps and receive what was distributed throughout the city or province. The next day, people would wear the same set of new clothes or shoes. Clothes were made from crude fabric and shoes sometimes were made from old car tires. Incomprehensibly, people even had to take farming tools even though they lived in the cities. Workers started to slack off at factories and supervisors were bribed to do false reports. International trades were limited and the communist party believed that the country could be self-sufficient. And that was how the economy went down.

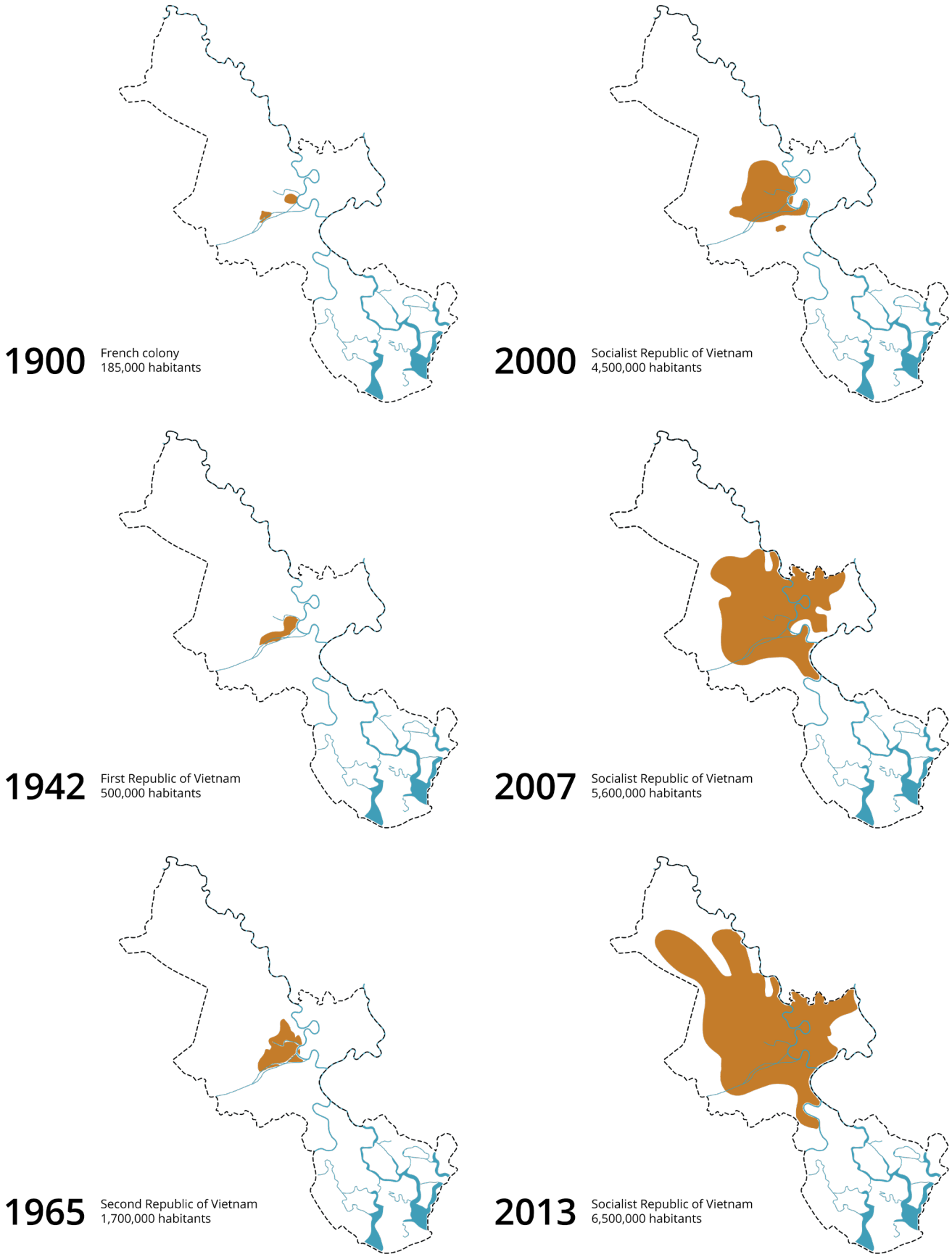


Fig. 1.10 The extent of Saigon/HCMC (in orange) from 1900 to 2013 .

Moreover, Saigon/HCMC is a city that primarily grows horizontally. As it expanded, its fabric has continued to stretch and cover more ground. Many migrants who came to the city were from rural areas. They preferred the openness of low-rise buildings and to stay connected with their neighbours. These low-rise buildings are common in Saigon/HCMC and typically have only two to four stories.

The most current plan for Saigon/HCMC's expansion until 2025 still heavily focuses on the southern and southeastern developments (fig. 1.11).[8] This focus means that more low-lying regions will be consumed for future developments and worsen the impacts of flooding. Furthermore, it has remained unclear how this plan will address urban flooding. Without any flood management incorporated into urban planning, the authorities still approach flooding independently with technically oriented solutions such as building dikes, flood gates and pumps.[9] With these costly projects that aim to barricade or displace water, one can stop wondering when they will become obsolete as sea-level rise and urbanization intensify the flooding year after year.

8 Huynh, "The misuse of urban planning in Ho Chi Minh City," 14.

9 Gibert, "Flood-prone Alleyways Neighbourhoods of Ho Chi Minh City," 1.

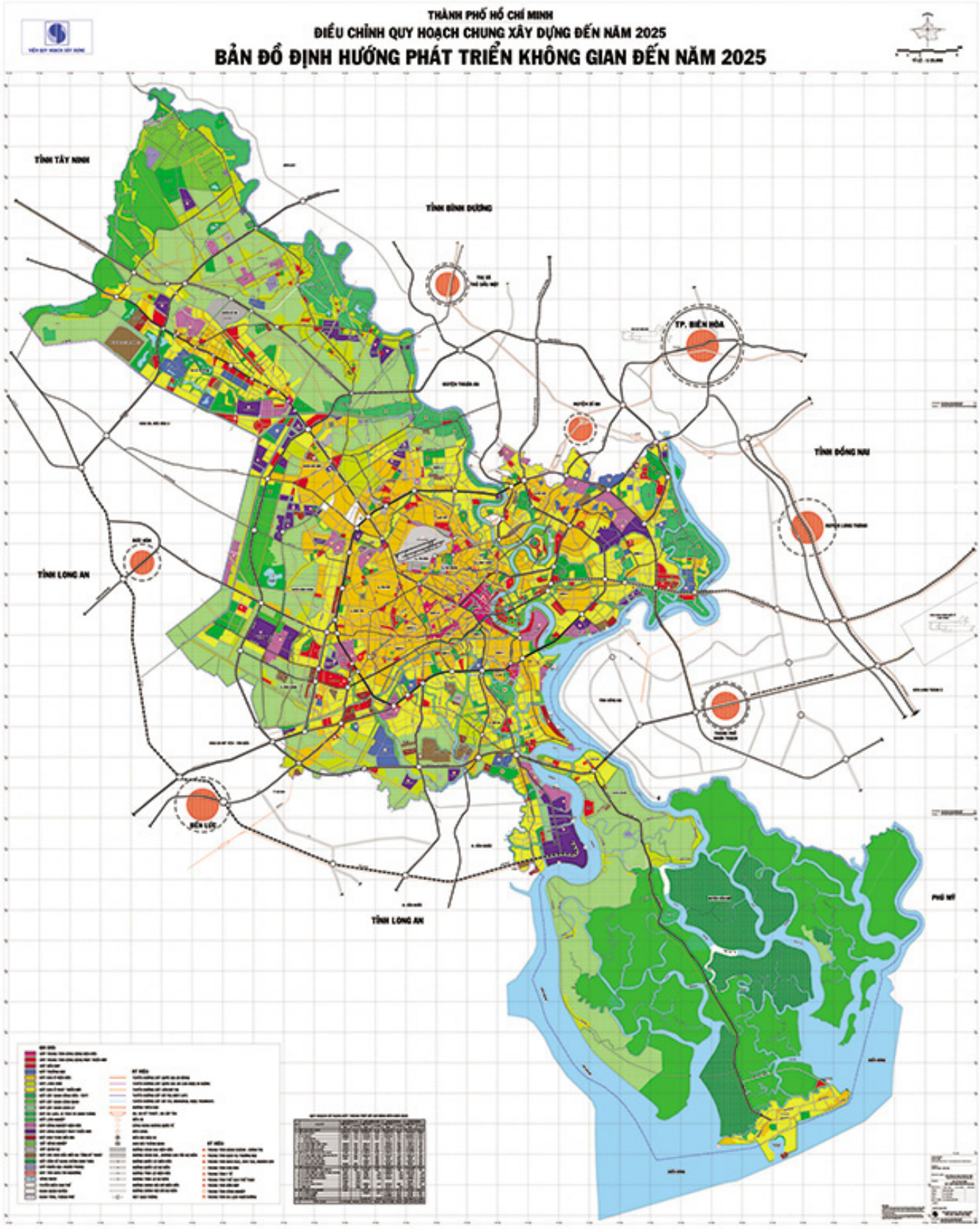


Fig. 1.11 Saigon/HCMC's development plan until 2025. This plan does not have any indication of how the city will address flooding in its planning.

Fig. 1.12 Present-day Saigon (now renamed Ho Chi Minh City). The extent of Saigon in 1950s-1960s is shown in red dotted lines.


The extent of Saigon
during the Republic of
Vietnam (South Vietnam)

ALLEYWAY TYPOLOGY

Hẻm dẫu vắng nhưng tình người đâu vắng
Giúp đỡ nhau chan chứa bao tình thương
Một mai kia, ta rời con hẻm vắng
Dù đổi thay nhưng vẫn nhớ hẻm xưa.

Although the alleyway maybe empty, it is filled with kindness
People helping each other with love
Tomorrow, we will leave the alley
Growing but still remembering the old alleyway.

*— Hoa Khuyết**

Fig. 1.13 Dense alleyway neighbourhoods in the foreground with high-rise buildings in the background.

* "Thơ - Con Hẻm," Gác nhỏ cho người yêu Sách.

If I compare the urban fabric of Saigon/HCMC with a leaf, then the intertwined veins would represent a dense network of alleyways (fig. 1.13). More than 85% of Saigon/HCMC's population live in these alleyway neighbourhoods that stretch across the entire city.[10] This typology results from an unforeseen development since "the very dense network of alleyways was born mainly out of pragmatism during uncertain times in Vietnam's history. The creation of alleyways was a natural process of densification and followed a spontaneous and linear logic."[11] The French colonial Saigon was planned with only main boulevards and large blocks, and covered areas which later became Districts 1, 3 and 5 of contemporary Saigon/HCMC (fig. 1.07). People needed to densify these blocks, so they informally created alleyways off the main boulevards and built their houses tightly on both sides.[12] From the 1950s to 1960s, under the Republic of Vietnam's Rehabilitation Plan, neighbourhoods were being redeveloped, and middle-class people relocated to newly planned neighbourhoods with houses of reinforced concrete frame and masonry enclosures rather than 'nhà lá' (thatch house) (fig. 1.14). The new kind of residential architecture appeared in unplanned neighbourhoods that organically grew aside and behind principal street axes. The unplanned neighbourhoods created a unique morphology of urban inhabitation with small alleyways of random paths sneaking in between buildings.[13] In the past, motorbikes were the most common type of vehicle, so alleyways were created wide enough to accommodate only 2 or 3 lanes of motorbikes without any sidewalk (fig. 1.15-1.16). Because of alleyways' narrow widths, pedestrians and vehicles usually share the same space. Moreover, the narrow widths of alleyways help to keep them shaded for most of the time to deal with the hot and humid climate of Saigon/HCMC (fig. 1.16).

In the Vietnamese language, the alleyway is known as '*hẻm*.' This word was traditionally used to describe a narrow valley with flanking hills and mountains. For example, the noun '*hẻm-núi*' is a combination of '*hẻm*' (narrow) and '*núi*' (mountain) that means mountain pass. Later on, it was adopted

Fig. 1.14 A typical thatch house (nhà lá) during the 1960s-1970s (Republic of Vietnam).

Fig. 1.15 A typical alleyway. 2018.

Fig. 1.16 A narrow alleyway. 2018.

10 Gibert and Phạm, "Understanding the Vietnamese urban fabric from the inside," 32.

11 Ibid, 32

12 Ibid, 32-33.

13 Pham, *Poetic Significance*, 16.

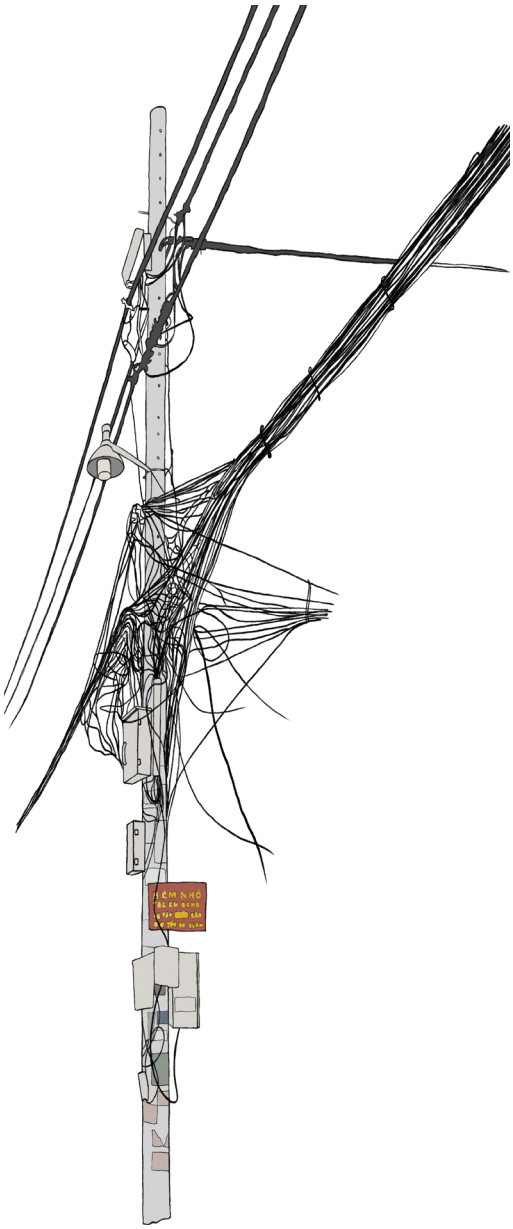


Fig. 1.17 A pole with tangles cables and wires.

to describe a type of narrow street in cities.[14] Using the word '*hẻm*' to call a type of street is rather suggestive, which makes it interesting. The word evolved from naming what is in nature to what Vietnamese people create in their cities. Furthermore, the Vietnamese language provides a categorization of the world characterized using classifiers for nouns, according to whether they are living things ('*con*') or inanimate objects ('*cái*'). Interestingly, the common noun for 'alleyway' is '*con-hẻm*' and not '*cái-hẻm*.'[15] Although the alleyway is a man-made entity in its essence, the word 'con' has made it natural and organic. It is not a coincidence when the alleyway is called 'con-hẻm' because of different types of things flowing through it every day. Local alleyways have been considered a living thing because of their richness, a space imbued with lifeforce and vitality (fig. 1.18-1.27 & 1.28).[16] Each alleyway is an organic being that is constantly changing and growing depending on activities occurring at certain times of the day and year. Furthermore, alleyway neighbourhoods are different from one to another and have their own unique characteristics depending on their ages and locations. An alleyway neighbourhood is a place where each community's identity can be accumulated, preserved, and promoted.[17]

The alleyways are often seen as complicated networks because there was a lack of regulations and zoning bylaws. The closer it is to the main street, the more rectilinear and wider it is, and vice versa. An alleyway may start with a 4-meter width and end up with a 1-meter width when it meanders deep into a neighbourhood. There are alleyways connecting different main streets, but there are also others with dead-ends. In alleyway neighbourhoods, infrastructures are also rudimentary because they are not carefully planned ahead by the local government. Only water and sewage pipes are located underground. Power lines and cables are carried by utilities poles, sometimes in a messy manner (fig. 17). These physical characteristics of an alleyway will dictate the values of plots and houses. For example, an alleyway that can provide a potential for businesses and proximity to main streets are some of the most important factors. Within the alleyway typology, tube house is a common housing

14 Petrotimes, Báo điện tử. "Từ Nguyên Của HẺM & NGÕ."

15 Gibert and Phạm, "Understanding the Vietnamese urban fabric from the inside," 33.

16 Gibert, "Blurring the boundaries," 10.

17 Ly, "Hẻm phố Sài Gòn - trăn trở và hy vọng."

Fig. 1.18 *The alleyway can also be a public space. People usually sit in the alleyway and have breakfast in the morning. In the evening, people gather and occupy the alleyway to socialize.*

Fig. 1.19 *A vendor selling breakfast and coffee.*

Fig. 1.20 A sugarcane juice vendor. Sugarcane juice is a popular drink in Saigon/HCMC.

Fig. 1.21 A wandering vendor. This type of mobile vendor is popular as they can reach different alleyway neighbourhoods.

typology (fig. 1.29). The noun '*nhà-ống*' is a combination of '*nhà*' (house) and '*ống*' (tube). This type of house has a depth longer than its width, and the form is just simply an extrusion of a rectangle. They usually have concrete frames, infill brick walls and corrugated steel roofs. These houses typically range from one storey to three storeys and are built side by side. They are usually built by homeowners and local builders without any standards and are not heavily regulated. Essentially, each house is only presented by its front elevation, explaining why the houses are very inconsistent and different from each other since it is the only way homeowners can express their tastes and aesthetics. Furthermore, open spaces of these houses are often limited to front yards and balconies because of the way houses are tightly packed to form a row of houses. However, this housing typology has started to lose its front yard because people tend to maximize indoor space as a means to increase the building footprint. Additionally, balconies are illegally built beyond the property lines to gain some space due to the lack of setbacks in alleyway neighbourhoods. Consequently, natural lighting and ventilation have been limited to front windows, skylights, and lightwells.

One of the benefits that the alleyway typology provides is the public spaces. Local residents occupy alleyways early in the morning or late in the evening for social gatherings (fig. 1.18-1.19). People usually place some benches in front of their houses, and they can become places for socializing. It can also be a playground for children and a space for older adults to jog around early in the morning (fig. 1.26). The alleyway is an intimate space, so it creates all kinds of relationships between households. Neighbours could squabble over trivial matters, with the whole neighbourhood overhearing. On the other hand, people may form strong bonds over the years and help each other out during hard times. The alleyway does have not only residential buildings but also other religious spaces. There may be small shrines and temples for local gods scattered around the neighbourhood (fig. 1.25). During religious events throughout the year, people temporarily occupy their alleyways and burn votive objects to gods or their ancestors (fig. 1.24-1.25). The alleyway could also be occupied temporarily by households for weddings, funerals, religious celebrations and feasts.[18] These events need space for large gatherings, and it is quite easy for a household to occupy an

18 Ly, "Hẻm phố Sài Gòn - trăn trở và hy vọng."

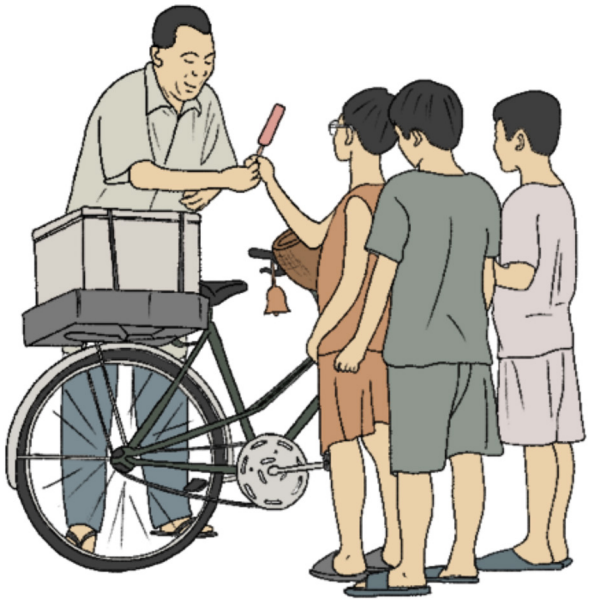


Fig. 1.22 A street vendor selling ice pops to children.

Fig. 1.23 A street vendor selling noodles.

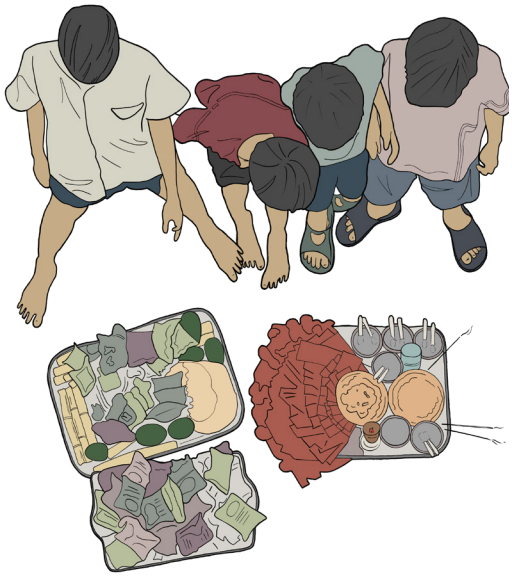


Fig. 1.24 Kids waiting to take "offerings to the ghosts" in the first half of July of the Lunar Calendar.

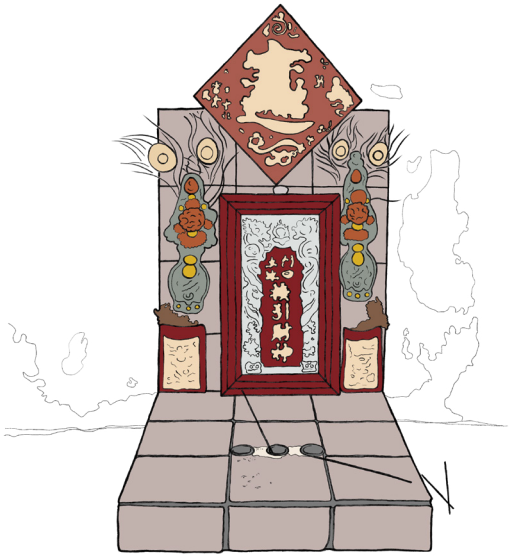


Fig. 1.25 The alleyway can act as a religious space. It is common to see an altar dedicated to local gods in front of each house.

area of the alleyway in front of their houses. All they need to do is negotiate with their neighbours, and most of the time, it is not a problem. Moreover, the alleyway provides great opportunities for commercial activities because of its high density (fig. 1.19-1.23). Networks of alleyways become destinations for wandering vendors, especially those who sell food and household items. Residents can also open a small shop on the ground floor of their houses and open directly to the network of alleyways. This type of house is called a shophouse which is a subcategory of the tube house.[19] These shops can be very small and informal such as restaurants, convenience stores, barbershops, etc. Thanks to these opportunities, an alleyway neighbourhood can become quite vibrant and create a sense of belonging. This type of house may also explain why Vietnamese people are unwilling to live in high-rise apartments with strict regulations because it is very hard for them to connect with their neighbours and do business at home. A large alleyway neighbourhood with many shophouses can possibly form a small market, and it can become a quite busy neighbourhood.

With all of these characteristics, the alleyway presents itself as a unique urban form. Density and diversity are the two key aspects that define Saigonese alleyways. Their richness has also created this particular living and working experience that one cannot find in other Vietnamese cities. Each alleyway is also different from one to another and thus contributes to shaping the identity of residents who live in it. Going back to the poem at the beginning, one can say that the alleyway is where people would want to retreat to because of the nostalgia it created. For me, what makes living in alleyway neighbourhoods attractive is their ability to capture a little bit of everything Saigon/HCMC can offer. The alleyway's main function is allowing traffic, yet it is used as a multi-functional space. The blurred public and private spaces of an alleyway allow people to live together as a community and further strengthen relationships between neighbours.

19 Tran et al., "Typology of Houses and Ventilation Characteristics," 4-5.

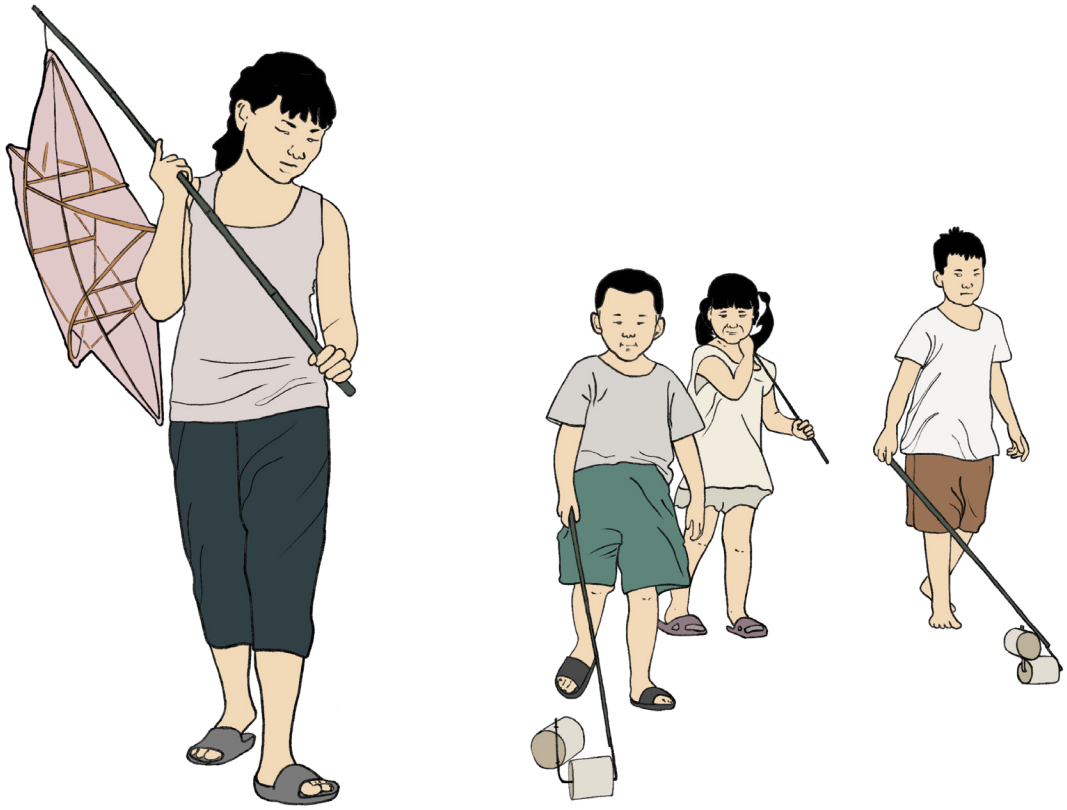
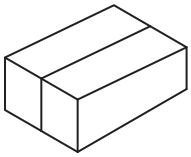


Fig. 1.26 *Children playing in the alleyway with homemade lanterns and toys during Mid Autumn festival day.*

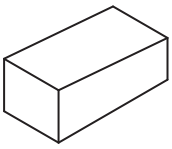
Fig. 1.27 *An alleyways is not only for human beings...*

Fig. 1.28 *Diagram showing different types of activities in an alleyway at different times of the day.*



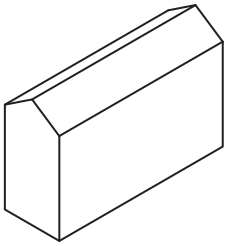
RENTAL HOUSE

- Organization without any external spaces.
- Concrete and brick construction
- Metal roof.
- Only one ground level.



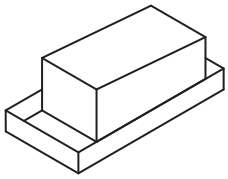
SINGLE STOREY HOUSE WITHOUT FRONT YARD

- Organization without any external spaces.
- Concrete and brick construction
- Metal roof.
- Only one ground level.



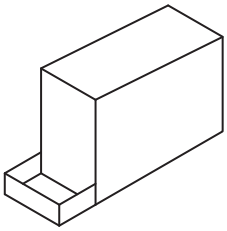
TUBE HOUSE WITHOUT FRONT YARD

- Organization without external space.
- Concrete, brick construction.
- Concrete brick-flat roof or metal roof.
- Multi-story.



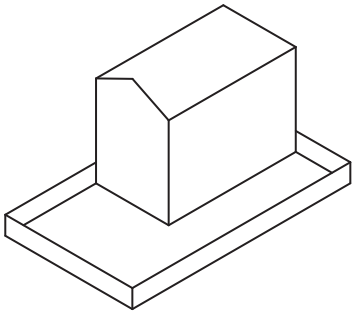
SINGLE STOREY HOUSE WITH FRONT YARD

- Organization without any external spaces.
- Concrete and brick construction
- Metal roof.
- Only one ground level.



TUBE HOUSE WITH FRONT YARD

- Organization with external space or based on a corridor including an outdoor area.
- Concrete, brick construction.
- Concrete brick-flat roof or metal roof
- Multi-story.



ISOLATED HOUSE WITH SURROUNDING YARD

- Organization with external space or based on a corridor including an outdoor area.
- Concrete, brick construction.
- Concrete brick-flat roof or metal roof
- Multi-story.

Fig. 1.29 Differnt types of tubehouses in an alleyway neighbourhood.

URBAN CIVILITY

[...] beautification can be transformed into modes of control precisely because they appear not to be top-down, because their meanings are highly fluid, and because they are coded as "positive" and resonate deeply with people at different stations in social life. They work because people believe in them. Ideas of urban beauty are neither simply top-down impositions nor unambiguously counterhegemonic; even if they reproduce visions of state simplification associated with elite assertions of power, they can signal hopes, desires, pleasures, and even alternative sets of values [...]

*— Erik Harms**

Fig. 1.30 Demolished alleyway houses in Thủ Thiêm Peninsula. This is an example of the tension between the alleyway and contemporary landscape of Saigon/HCMC.

* Harms, "Beauty as control in the new Saigon," 737.

In 1986, the Vietnamese government carried out a reform to radically change its state controlled and centrally planned economy to a market-oriented economic system. The reform (commonly known as '*Đổi-Mới*' in Vietnamese) was intended to modernize Vietnam rapidly.[20] Its goal is to lift post-war US sanctions and trade with other countries. It also brought people out of poverty and created a lot more salaried workers for offices and factories. This social advancement also required the government to invent a new way to govern the ever-increasing number of middle-class people. "Urban civility" was formulated for this purpose and implemented, especially in large cities. As the largest city, Saigon/HCMC was the best candidate for this new ideology to showcase Vietnam's progression to "modernity."[21] Through propaganda campaigns, guidelines and norms were put in place to govern the emerging middle-class people. People were encouraged to act in a "civilized lifestyle" ('*nếp sống văn minh*' or '*nếp sống văn hóa*') so that their neighbourhood can be designated as a "civilized neighbourhood" ('*khu phố văn minh*' or '*khu phố văn hóa*') (fig. 1.31-1.33). "Neighbourhood representative" ('*tổ trưởng tổ dân phố*') often persuades or even pressures households to oblige to norms and standards so that their neighbourhood will be rewarded with a certificate from the government. This process of creating a "modern and civilized city" changed all aspects of urban life and subsequently undermined the core values and characteristics of the alleyways.

Despite being a common typology, the alleyways are often nameless and given only numbers. They are under-documented and barely visible on any official maps. Because their spontaneity and informality contradict the aspiration for "urban civility," the alleyways have been overlooked by researchers and held in low regard by local authorities. Without being studied properly for its role and true values, the alleyway typology is constantly at risk and facing a "breaking point" amidst globalization and metropolisation.[22]

Fig. 1.31 Example 1 of urban civility propaganda at the entrance to an alleyway neighbourhood.

Fig. 1.32 Example 2 of urban civility propaganda at the entrance to an alleyway neighbourhood.

Fig. 1.33 Example 3 of urban civility propaganda at the entrance to an alleyway neighbourhood.

20 Harms, *Luxury and rubble*, 4.

21 Ibid, 9.

22 Gibert-Flutre, " Between 'network' and 'territory', 33.

Fig. 1.34 A house with high walls and an ornamented gate.

Fig. 1.35 A house with high walls surrounding its front yard and an ornamented gate.

Fig. 1.36 Commercial activities in an alleyway.

The new "urban civility" tends to diminish the alleyway's values and characteristics. In fact, "urban civility" especially dictates what people should and should not do in the public realm. As a result, it has drawn a clear line between public and private spaces in alleyway neighbourhoods. "Urban civility" has made people hesitant about using their alleyway as an extension of their houses and threatened its liminal characteristic. It has also prompted a *withdrawal from the alleyay* and reduced its functions to only circulation space.[23] An example of this withdrawal is the introduction of gates and tall fences that separate houses from their alleyways (fig. 1.34-1.35). However, they are not just a boundary between public and private spaces but also give the emerging middle-class residents a sense of being secured and their wealth protected. In some instances, they are proportionately built and overly ornamented to become the 'face' of a house. Thus, fences and gates have become a symbolic tool to show off the newly acquired social status and wealth.

This concept of "urban civility" has also affected local businesses and commercial production. In old alleyway neighbourhoods, people used to work together to make small products (such as incense, jam, etc.), and they needed to use alleyways as their workspaces. However, local authorities have sought to control the commercial activities in alleyway neighbourhoods.[24] Slowly over time, small producers have ceased to exist because it is not viable for them to limit their activities within each household. Additionally, "urban civility" also affects street vendors who rely on their mobility to reach different neighbourhoods. They are mostly rural migrants and have been further marginalized by this concept of a "civilized city." Last but not least, as more people are becoming salaried workers, local businesses and shops have slowly disappeared because of the lack of patronage. Shophouse (as introduced in Chapter I) is the key element that makes a living in Saigon/HCMC affordable (fig. 1.36-1.38). However, they are slowly disapprearing from alleyway neighbourhoods.

Urban civility also promotes "beauty" as a tool to control and radically transform alleyways. This process often initiates an "alleyway-widening scheme" ('*quy hoach mở rộng hẻm*') so that

23 *Withdrawal from the alleyay*: This is a term I use to describe how people have stopped using the alleyway as a public space.

24 Gibert-Flutre, " Between 'network' and 'territory', 46.

they can serve as secondary roads to reduce traffic jams in main arteries. Balconies and projections are also cut back to allow more motorbikes and even cars. Over time, many alleyways have lost their intimate quality and ceased to function as an accessible public space. Widened alleyways also mean fewer shaded spaces between the houses makes it uncomfortable to occupy them during the day.

"Urban civility" has become an effective tool because it has given local residents an aspiration for "modernity" and "civilizations." It has also become a mode of "soft governance" as it has given local residents a set of basic principles that they generally accept.[25] "Urban civility" has directed ways of life and spatial practices of inhabitants, together with coercive policies and regulations in exchange for a modern city, at least in its appearance.[26] This new ideology is seemingly conceived to govern and gentrify the emerging middle-class people, but at the same time, it has presented the alleyway typology as an obstacle in the road to "modernity." In the name of a "modern and civilized city," the alleyways have been slowly stripped of their territorial function and reduced to transit roads.[27] This ideological rhetoric has created a tension between how the city has been developed and what it is striving to be. During this transformation, the alleyway typology has been considered a relic of the past and has not been properly studied. "Urban civility" has contributed to hindering the process of understanding Saigonese alleyways, and thus, it has made flooding in alleyways unknown.

Fig. 1.37 A shophouse that sells snacks and household items.

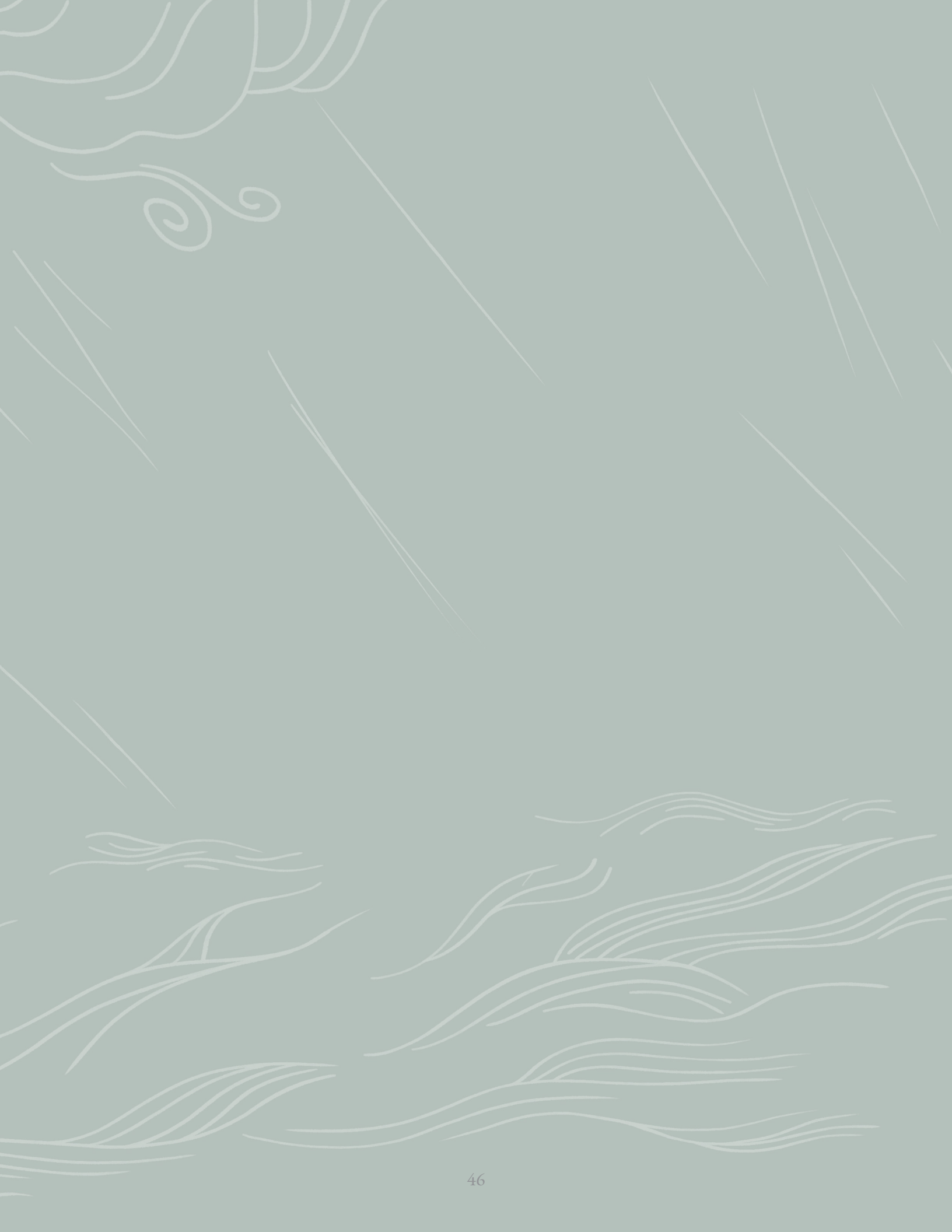
Fig. 1.38 A shophouse that sells shampoo bottles and ice.

25 Gibert and Segard, "Urban planning in Vietnam," 9.

26 Ibid, 10.

27 Gibert-Flutre, " Between 'network' and 'territory', 49.

COMPETITION FOR HIGHER GROUND



In this chapter, I will analyze the competition for higher ground in which people keep elevating the ground floors of their houses in response to flooding in alleyway neighbourhoods. Although this quick fix is occasionally effective, it has created social injustice when water finds its way to lower houses. Meanwhile, the urban ecology is heavily damaged when the city has expanded at an astonishing rate. The authorities have favoured a flood control paradigm that often results in costly infrastructure projects. These actions from residents and authorities have not addressed the real question of why flooding is happening.

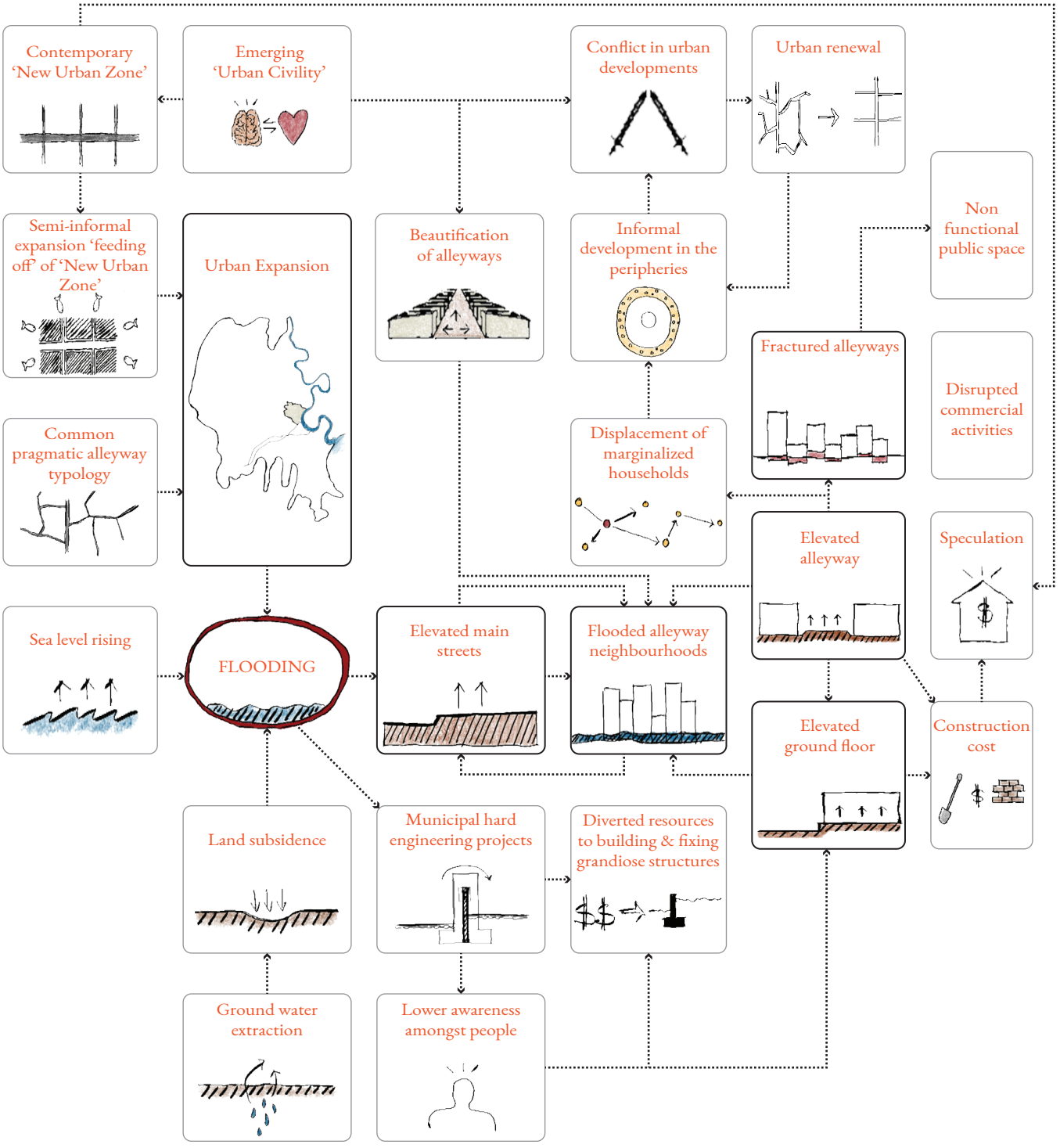


Fig. 2.01 *Flood control paradigm and the competition for higher ground.*

FROM DEGRADING ECOLOGY TO CONTROLLING NATURE

"Urban civility" in Saigon/HCMC also shares some essences with the Vietnamese people's pride in conquering the southern territories. From the 11th to 19th centuries, different Vietnamese dynasties expanded southward by different means, such as war and diplomacy. This expansion saw the extinction of the Champa kingdom (2nd-18th century), and part of the Khmer empire (9th-15th century) with their native population assimilated to Vietnamese culture. As colonizers, the Vietnamese people saw themselves as liberators and had an obligation to march south and bring civilization to the "wastelands," which would become the central and southern parts of modern-day Vietnam. This was taught and praised in history classes, at least when I was a young high school student. Together with "urban civility," this pride is extremely problematic because it pays little respect to the existing ecological systems. Wetlands, for example, have previously been considered "wastelands" and consistently turned into urbanized areas, even though they can serve an important role in rainwater management.

Phú-Mỹ-Hưng New Urban Zone is a perfect example of how a vast area of wetlands was turned into a substantial part of Saigon/HCMC. New Urban Zone (NUZ) arose as a concept of how Vietnamese cities should be transformed to reflect this idea of "civility" and "beauty". In 1993, Phú-Mỹ-Hưng NUZ was planned by Taiwanese developers and promptly approved by the authorities of Saigon/HCMC. Phú-Mỹ-Hưng was the first NUZ, and it set a new standard for urban spaces and life. Its built forms are heavily regulated, and there is tight control over its spaces and people.[1] The NUZ represents a new orderly city in contrast to the seeming chaos of alleyways. It has been promoted by the government as a formula for the modernization of Vietnamese cities and regaining control over urban developments.[2] The story of Phú-Mỹ-Hưng NUZ also shares some similarities with the history of Saigon and the Mekong Delta, which were considered "wastelands" and then colonized by the northern Vietnamese dynasties. Thus, how Phú-Mỹ-Hưng NUZ emerged from the

1 Douglass and Huang, "Globalizing the city in Southeast Asia," 1-2.

2 Tran, "From Socialist Modernism to Market Modernism? ," 249-250.

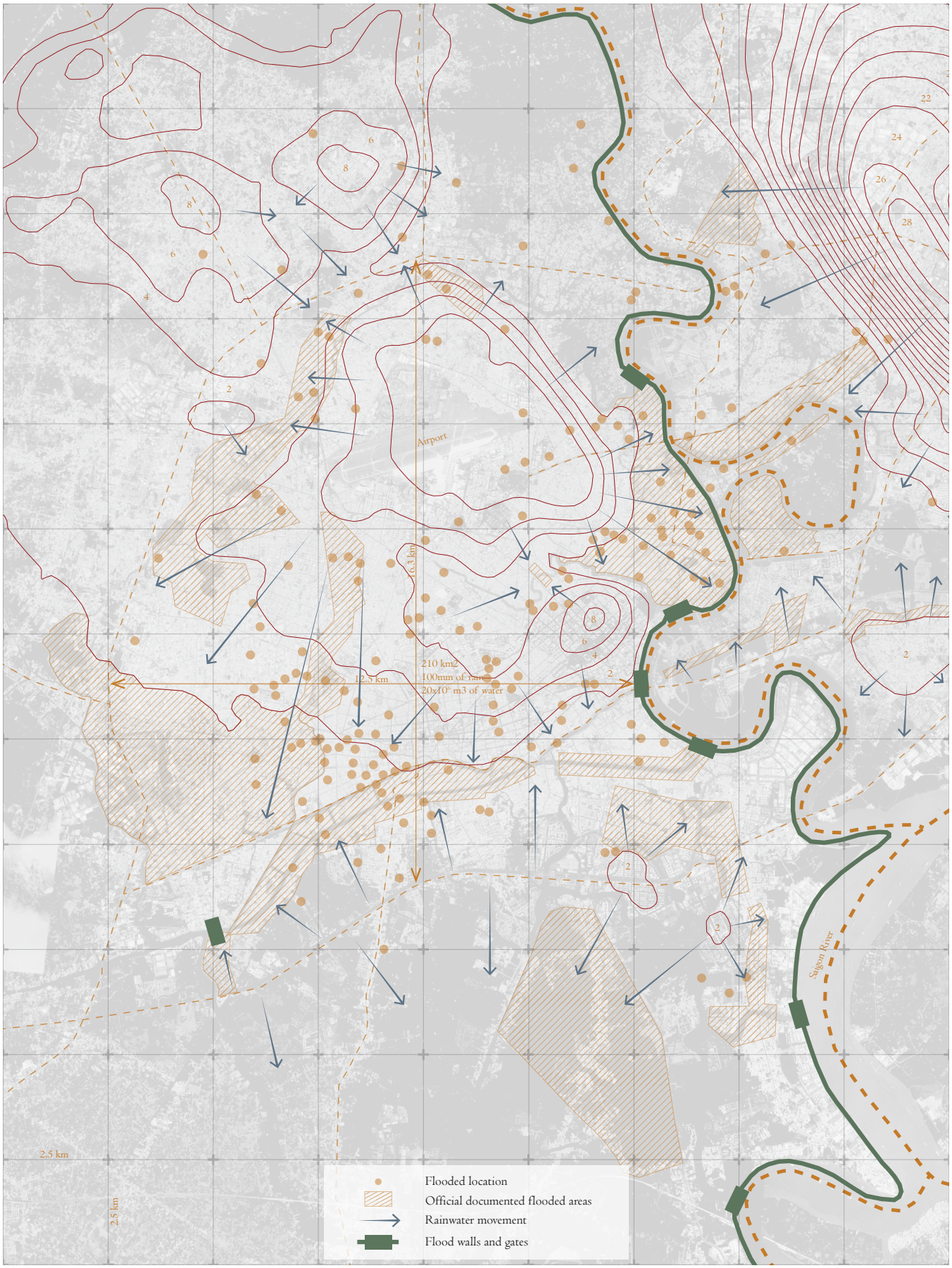


Fig. 2.02 Flooding and water movement.

wetlands gave many Vietnamese people the aspiration of a new and better urban life. However, it set a precedent for how the city would be developed with very little concern for its urban ecology.

The growth of Saigon/HCMC has undoubtedly created profound impacts on the urban ecology and intensified flooding. The urban expansion has accelerated soil sealing and groundwater extraction at an alarming rate. In some areas, the ground is sinking at an astonishing speed of 15 mm/year and creating a risk of heavy flooding.[3] Most importantly, permeability is the real issue when the city has too much impermeable surface. Saigon/HCMC's green space per person ratio is also very low, with only 3-9 m^2/person, while the world standard is 20-25 m^2/person.[4] Although this number typically contributes to illustrate living standards in a city, it can also be interpreted to show how permeable the city is. The population growth has asked for increased supply of housing, and people tend to favour interior space over green space. Over the last two decades, more than 50,000 ha of water bodies, wetlands and permeable areas have been taken over for urban development[5] (fig. 2.03). Rainwater should be absorbed into the ground to replenish aquifers. Yet, in reality, it is forced to be discharged by storm sewers. Outdated infrastructure and rapid expansion have rendered the city incapable of draining an enormous amount of rainwater during the rainiest months.

As flooding is becoming more severe and frequent, Saigon/HCMC's authorities address it by manifesting the mindset of conquering the "wasteland" and attempting to control the regional ecology. They are trying to complete an enormous infrastructural project aiming to control both tidal change and rainwater. This ambitious project is costing the city more than 460 million USD and consists of 12 sluice gates and almost 170 km of dikes and seawalls (fig. 2.04-2.07).[6] With interest and inflation, this project costs the city more than 1% of its GDP. While it is possible to differentiate the water level of inner canals and Saigon River with the combination of sluice gates and dikes,

3 Nguyen, "The main causes of land subsidence in Ho Chi Minh City," 339.

4 Han et al., "Understanding Satellite Image-Based Green Space Distribution," 5.

5 Ho et al., "Integrated Urban Flood Risk Management approach to adapt with uncertainties," 4.

6 Ibid, 3.

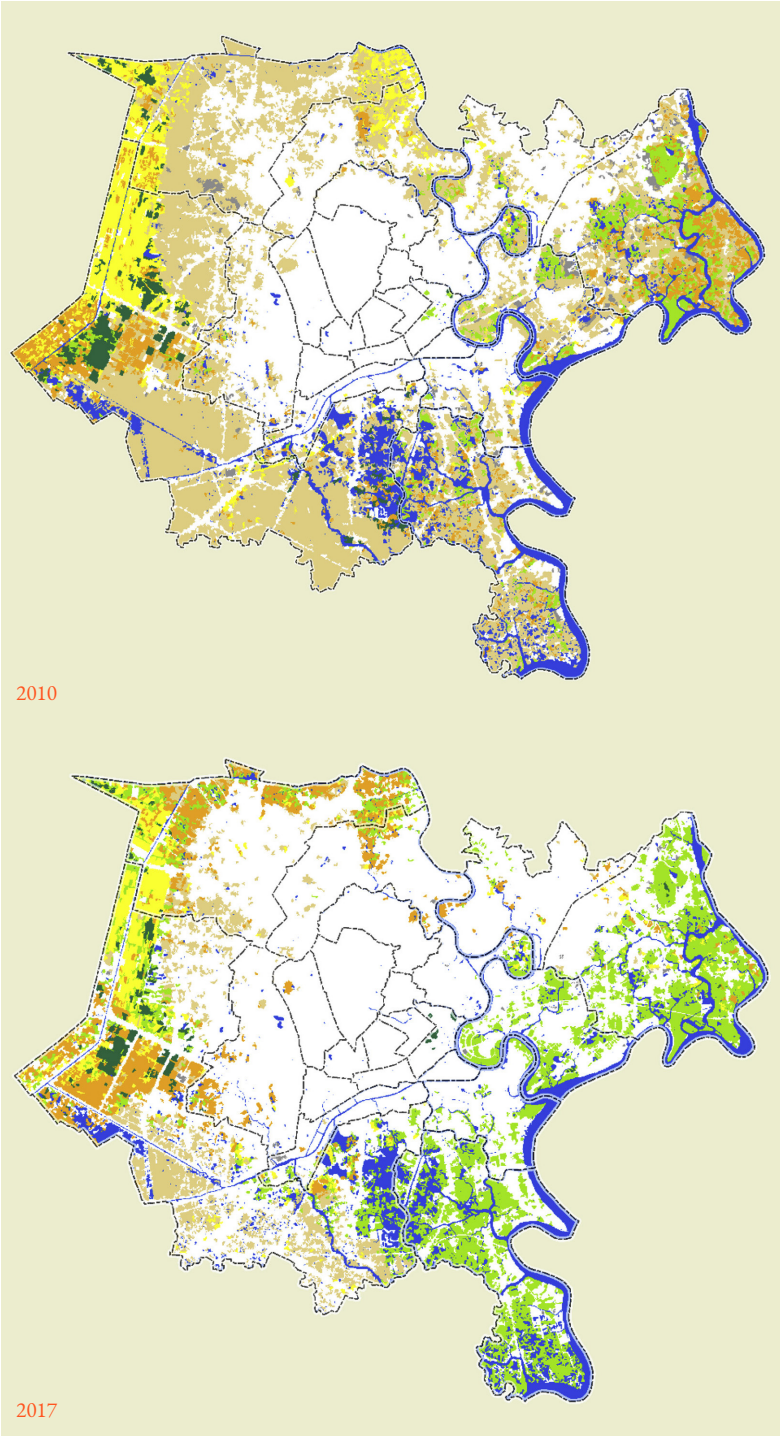


Fig. 2.03 Land coverage change from 2010-2017 showing a signification reduction of vegetated areas and water bodies.

Fig. 2.04 Phu-Xuan flood gate (1 of the 12 flood gates). 2020.

Fig. 2.05 Phu-Dinh flood gate (1 of the 12 flood gates). 2020.

it is unclear how a large amount of rainwater over a central area of 200 km^2 can be collected and pumped into the Saigon River. If water is not swiftly removed, the flooding could cause electric blackouts, rendering local pump stations useless. Suppose heavy tropical rainfalls and high tides coincide. In that case, the damages will be catastrophic as water will be trapped for a longer time.[7]

It is problematic when the government assumes that the complex flooding issue can be predicted, modelled, and solved by large engineering projects. These projects attempt to solve megacities' flooding without looking at why flooding happens in the first place. Being similar to Jakarta's flood management, the project is designed by Dutch engineers and experts. In my opinion, these large engineering projects are a new way of influencing developing countries as they always rely on the expertise of Dutch engineers and external funding from world organizations such as the IMF and World Bank. In other words, this is neo-colonization by flood control infrastructure. This project's effectiveness has yet to be proven. Meanwhile, it weakens the economy and social developments such as health care, adequate housing, and safe communities.

Planners support hard-engineering projects, such as dikes and seawalls, because they attract more funding and support from the central government.[8] Saigon/HCMC favours this kind of approach because the so-called solution to flooding is being constructed at the borders without any interference to new developments, which are one of the city's primary sources of income. Furthermore, Saigon/HCMC's revised 2025 master plan for urban development focuses more on financial benefits than environmental problems.[9] The city's envisaging of these hard-engineering projects will not help local people understand the flood dynamic because everything is being done at the city's most distant borders. Without local communities' involvement, it will lower their awareness of the most pressing issues such as rapid urbanization, groundwater extraction, sea level rising and intense weather conditions due to climate change.[10]

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7 Takagi et al., "Effectiveness and limitation of coastal dikes in Jakarta," 1.

8 Gravert and Wiechmann, "Climate change adaptation governance in the Ho Chi Minh City region," 32.

9 Webster et al., "Urban adaptation to climate change," 6.

10 Takagi et al., "Effectiveness and limitation of coastal dikes in Jakarta," 12.

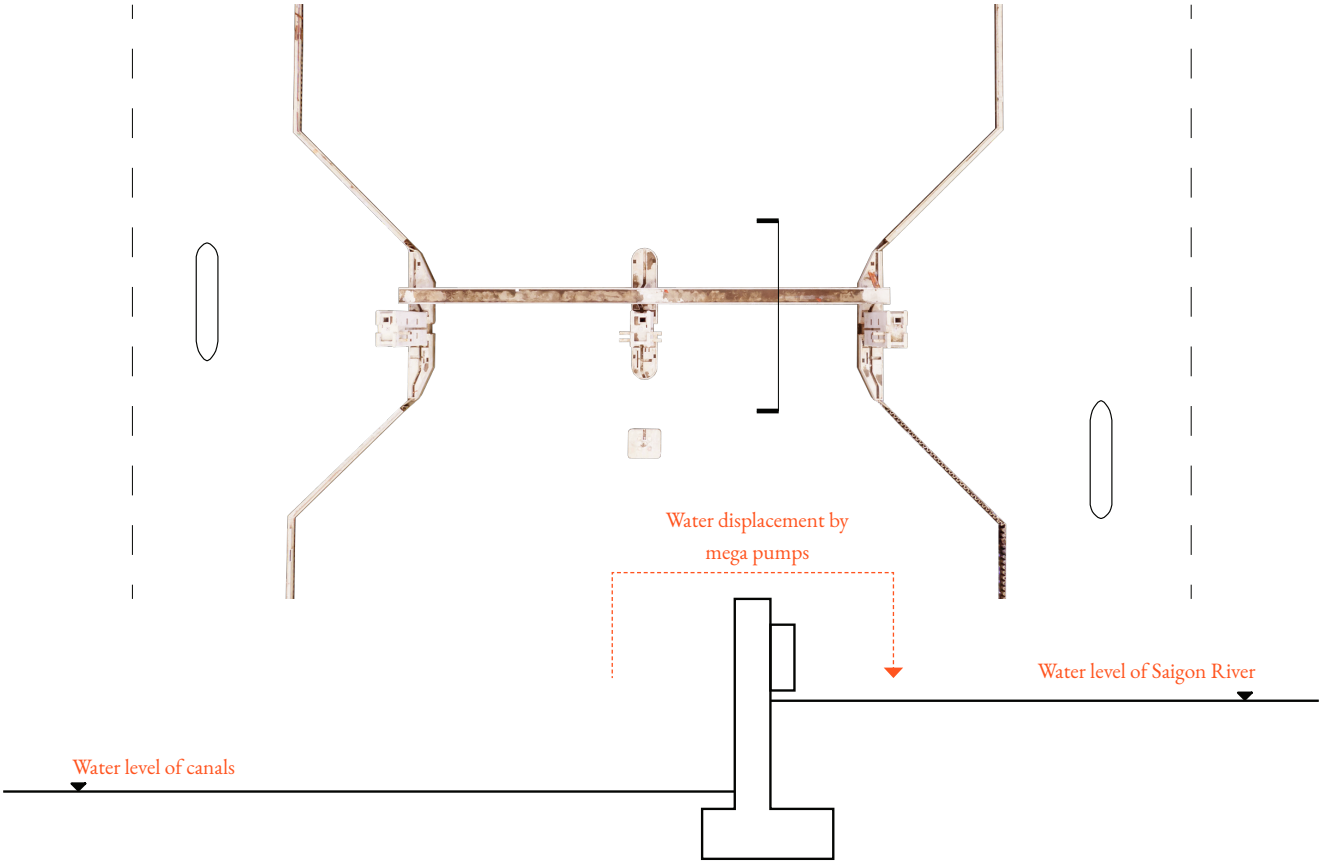


Fig. 2.06 Plan and section of a typical flood gate.

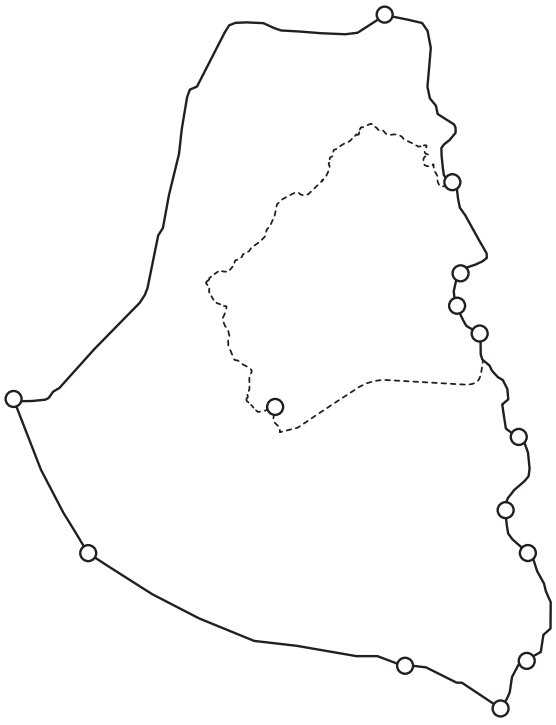


Fig. 2.07 Diagram showing how new flood walls (solid line) will be constructed to surround the city (dashed line). The circles show locations of flood gates used to regulate the water level.

ELEVATED GROUND FLOORS: FROM URBAN FLOODING TO SOCIO-SPATIAL INEQUALITIES

Fig. 2.08 A house that was raised significantly above ground.

"Dù biết là khác người nhưng tôi quyết nâng nền lên 2 m so với mặt hẻm. Thà làm một lần còn hơn mỗi lần ngập là đập ra nâng lại"

*"Although I know that it is odd, I decided to elevate the ground floor 2 meters above the alley. It's better to do once rather than being flooded again." **

Fig. 2.09 A house that has a very low ceiling due to elevated ground floor.

"Tiền không có mà nếu có đi nữa thì cũng không nâng được, sắp đụng trần rồi!"

*"We don't have the money, even if we do, we can't keep elevating the floor, our heads are about to hit the ceiling!" **

* H. Q., & S. T. (2009). "Ngap den dau nang den do."

In my hypothesis, Saigon/HCMC's flooding has directly been related to urban growth and has only become a serious issue since the 1990s. The Vietnam War ended in 1975 with the capitulation of the Republic of Vietnam (South Vietnam). Subsequently, the city's population did not change from 1975 to 1988 due to people fleeing the new communist regime. This regime also enforced new deurbanization policies that relocated people to remote areas for collective farming.[11] Thus, the city's growth basically came to a halt. An inactive urban growth also means that soil sealing and impermeable surfaces could not possibly extend. However, the city changed radically from 1989 thanks to reform policies and a free market economy.[12] Saigon/HCMC has significantly expanded to accommodate newcomers from rural areas who come to seek jobs. Its population has grown from 2.9 million in 1989 to 8.9 million in 2021, with a consistent rate of 3%.[13] This rapid expansion has taken more and more lands for development resulting in the extensive practice of soil sealing to maximize spaces for human activities.

Moreover, there is a lack of data and reports of flooding in the 1990s to early 2000s. To the best of my recollection, flooding usually happened in the streets because houses were typically higher than the street level and separated by 3-step thresholds. During heavy rainfalls, flooded streets usually disabled hundreds of thousands of motorbikes because of their vulnerable engines. Elevating streets was a temporary solution to flooding and traffic jams. However, for the last few decades, this so-called "solution" has become an official initiative and has been done at every governmental level (e.g. district, ward, neighbourhood) (fig. 2.08-2.19).[14] The city's authorities do not hesitate to use flooding as an argument for radical urban renewal projects in frequently flooded neighbourhoods. The elevation of streets plays well into the process of "beautifying" the urban space and maintains

Fig. 2.10 The height of this manhole indicates where the elevated alleyway's new level will be.

Fig. 2.11 Ongoing construction of elevated alleyway.

Fig. 2.12 An alleyway is being elevated by local builders.

11 Kiernan, *Viet Nam: A history from earliest times to the present*, 454-455.

12 Tran, "From Socialist Modernism to Market Modernism?," 249.

13 "Ho Chi Minh City, Vietnam Metro Area Population 1950-2021." MacroTrends.

14 Gibert, "Flood-prone Alleyways Neighbourhoods of Ho Chi Minh City," 1.

Fig. 2.13 *Retaining brick walls being built to respond to the elevation of a street.*

Fig. 2.14 *Retaining brick walls being built to respond to the elevation of a street.*

Fig. 2.15 Interior view of a house that is lower than street level.

Fig. 2.16 A woman trying to get to the street level using a chair.

Fig. 2.17 This house was abandoned, because the owner was no longer able to cope with the elevated street.

Fig. 2.18 A house with downsized doorway due to its elevated alleyway. The sign says "Nhà Bán" that means "House For Sale".

Fig. 2.19 A house was rendered lower in comparison to its elevated alleyway.

the city's overall fabric without any substantial investment and liability from the local government. People often do not get a chance to voice their concerns regarding the elevation of streets and alleyways.[15] This initiative has been a makeshift way to manage the complexity and dynamic of urban flooding. It has also caused many serious issues to alleyway neighbourhoods and people's livelihoods.

Floodwater flows from higher streets to alleyways and eventually makes its way into the lower alleyway houses. The alleyways, as a common space, were then elevated first so as not to be flooded (fig. 2.10-2.12). This quick-fix affected alleyway houses because they became the lowest places. For example, the alleyway in front of my own home in Bình-Chánh District gets elevated 200 to 300mm every 5 to 7 years. The house was built about half a meter higher than the alleyway, but after 20 years, it is now more than 1 meter lower than the alleyway. When it rains heavily, water will seep through the floor and flood the house. Meanwhile, there is a lack of official instructions and guidelines on how houses should be built or retrofitted in response to flooding. As a result, homeowners are forced to elevate the ground floors of their houses every couple of years, inevitably to partake in the unjust competition for higher ground (fig. 2.22-2.25). The competition for higher ground also worsens living conditions in alleyway tubehouses. Existing roofs and upper levels are typically maintained to limit construction activities and lower costs. However, a lower ceiling will make the ground floor hotter and suffocating, especially in the summer (fig. 2.09). The difference between an alleyway and a house also creates an accessibility issue for older adults (fig. 2.24-2.25).

Moreover, the elevation of alleyways is usually organized at the local level, and each household is required to contribute financially. As a matter of fact, they will not be allowed to connect to the adjusted infrastructures if they do not contribute. Households will also spend a lot of money to elevate their ground floors. This situation creates a financial burden for marginalized families in the neighbourhood because land speculation and inflation increase construction fees every year. People will have to borrow money from their local authorities, their neighbours,

15 Gibert, "Flood-prone Alleyways Neighbourhoods of Ho Chi Minh City," 8.

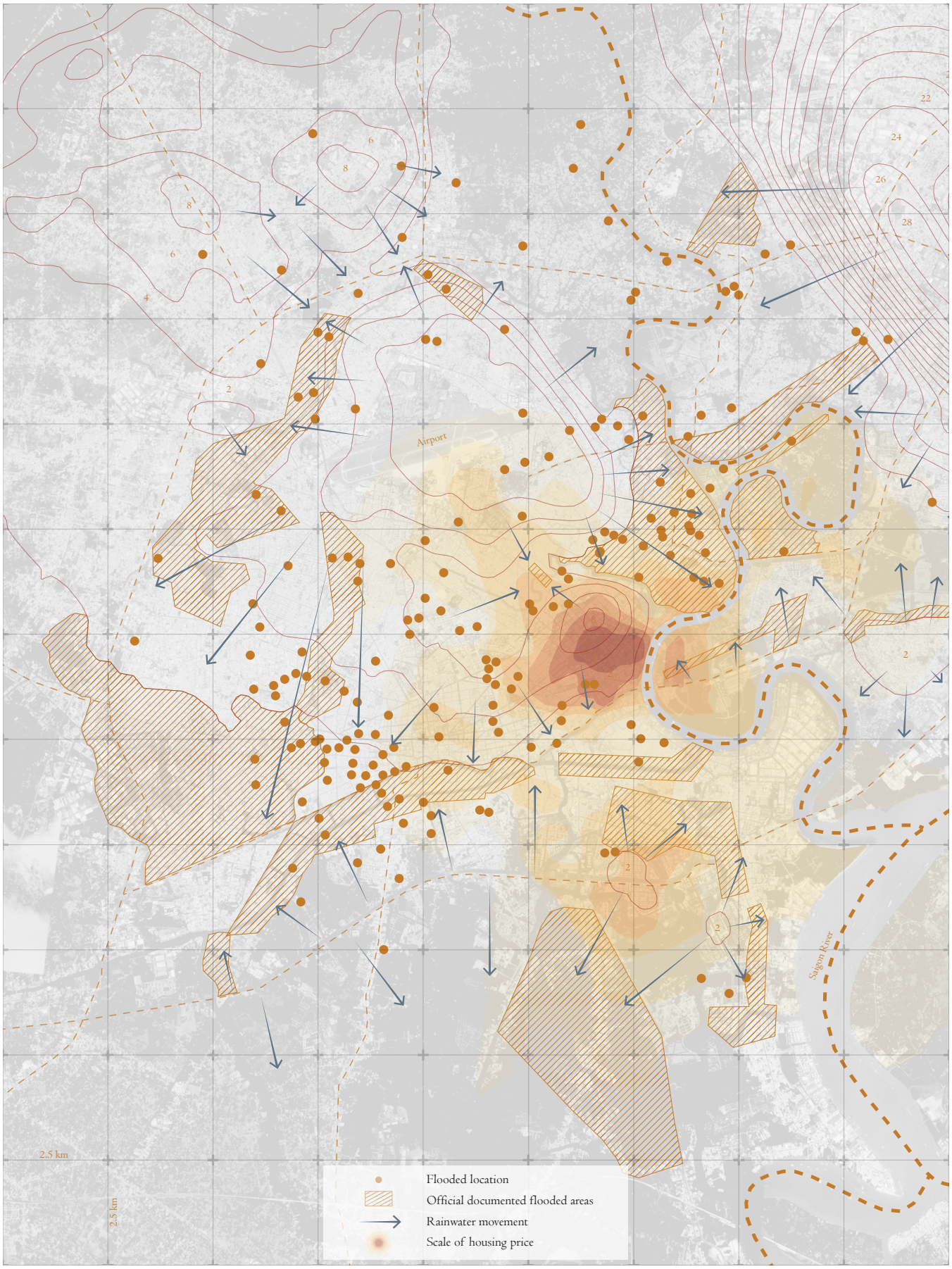


Fig. 2.20 Flooding and housing price.

Fig. 2.21 An alleyway with different levels of ground floors.

or even loan sharks[16]. When an underprivileged household can no longer afford to renovate their house, they have to sell it and move to the peripheries for access to affordable housing.[17] These peripheral districts lack zoning bylaws and are made of informal developments that will likely go through the urban renewal process, which will again displace residents. Meanwhile, their previously owned land will be speculated and drive the housing market. The construction fees will go up accordingly and create another burden for those who wish to alter their houses in the future. By and large, Saigon/HCMC's flooding has created a situation in which incoherent solutions have fragmented the grounds, continuously displaced local people, and contributed to shaping the local housing market (fig. 2.20).

People have been elevating their houses' ground floors for the last 20 years to live with the flood and deal with the elevated alleyways. The competition for the higher ground has also disrupted social and commercial activities. Many households have businesses on their ground floors and rely on local patronage. People directly live at the back of the house or on the upper floors. However, this live-work model is threatened, and people's livelihoods are affected. The fragmented ground plane

16 Gibert, "Flood-prone Alleyways Neighbourhoods of Ho Chi Minh City," 8.

17 Ibid, 7-8.

Fig. 2.22 Elevation showing the result of the competition for high ground. Ground floor levels are all inconsistent with many houses below the alleyway level.

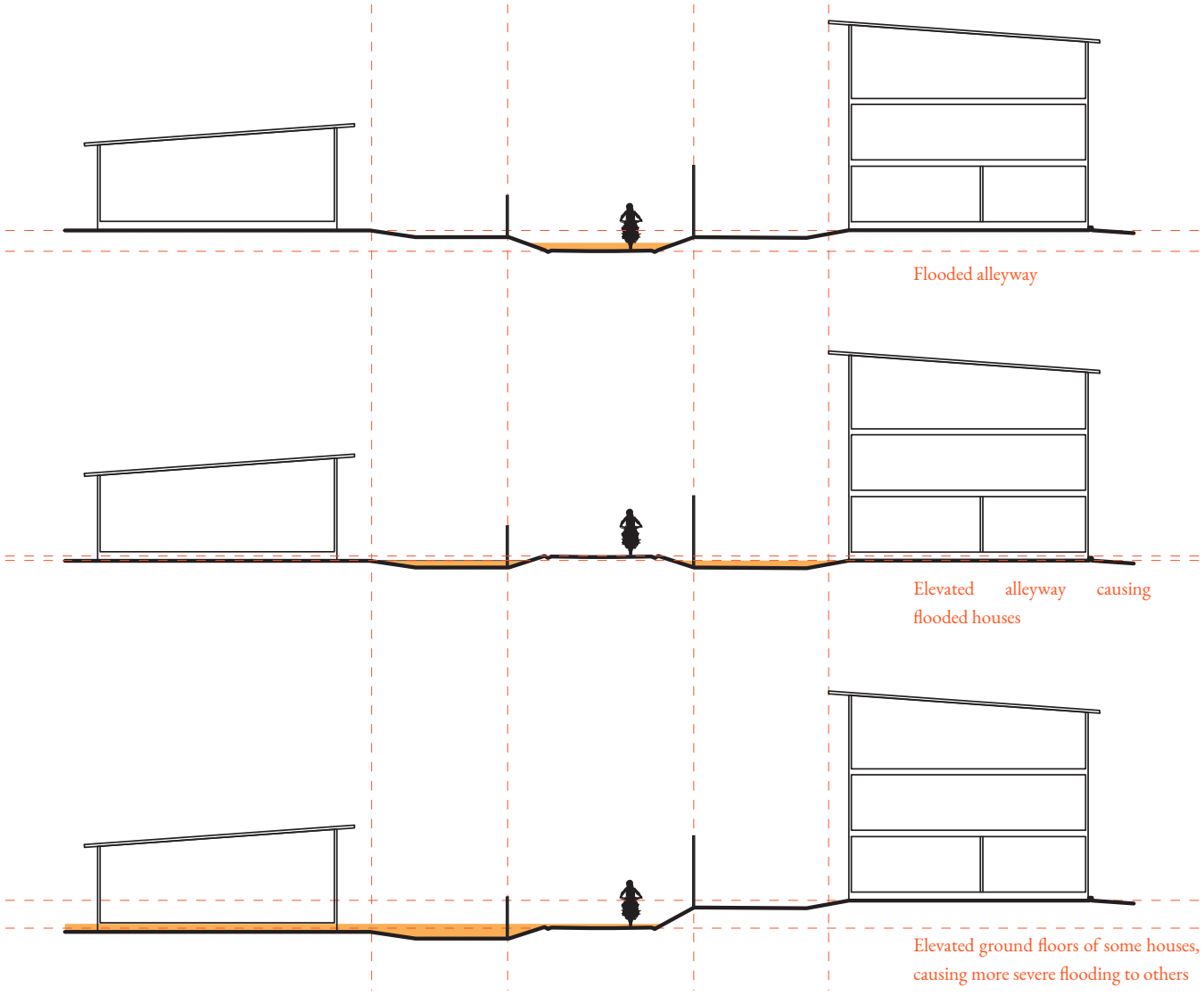


Fig. 2.23 Section showing the competition for higher ground.

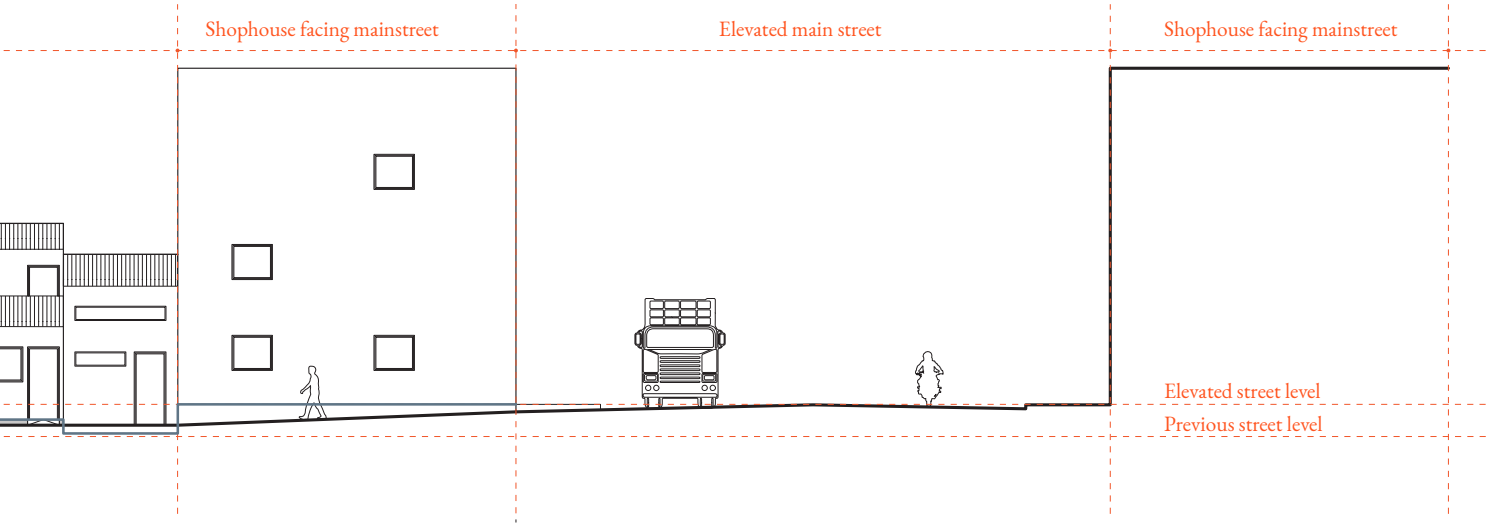


Fig. 2.24 Sectional perspective showing existing conditions of alleyway houses during a heavy rainfall causing flooding.

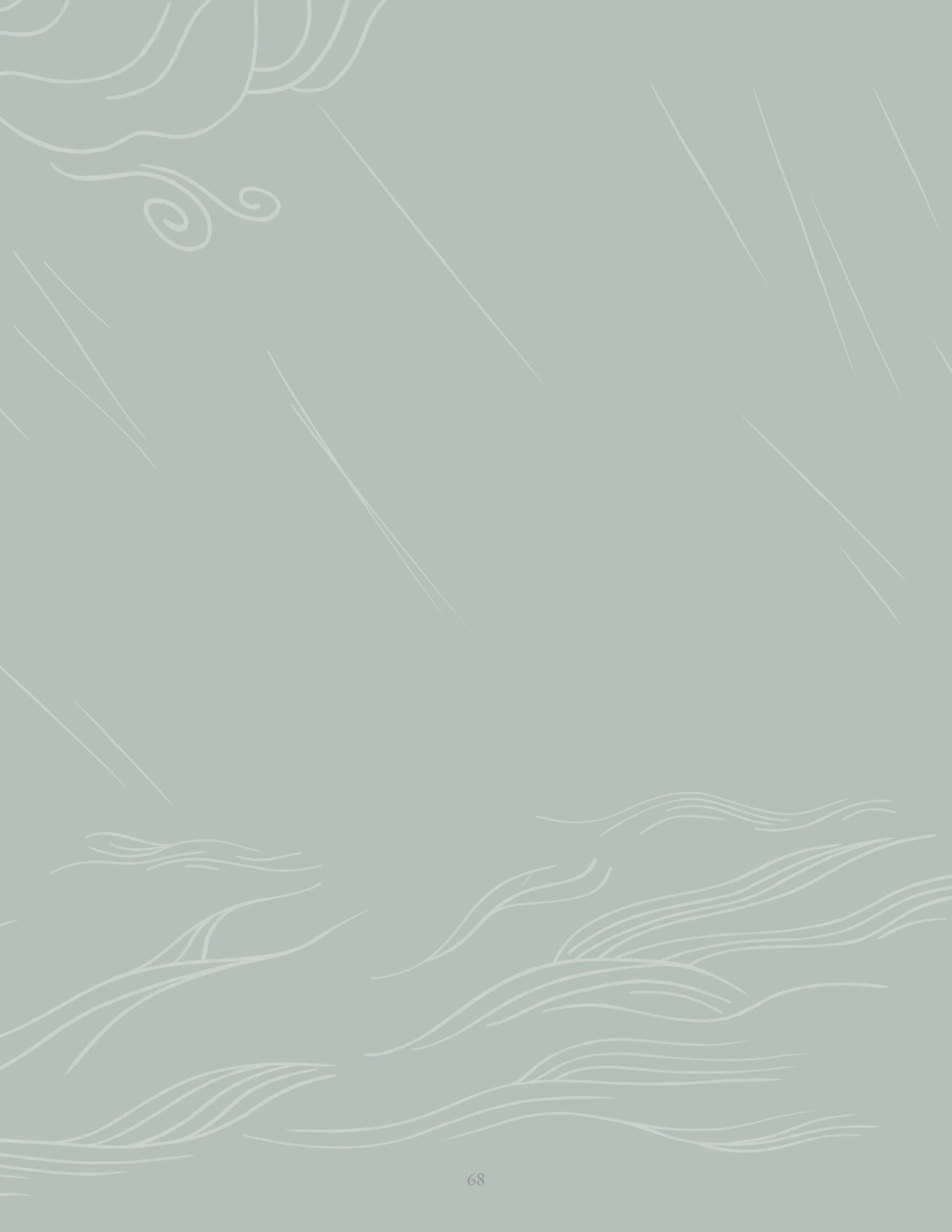

Resident trying remove floodwater
Damaged furniture
Stranded mobile vendor
Overburdened storm drain
Flooded alleyway
Water leaking through
Flooded floor
New floor level
Previous alleyway level
Previous floor level

disconnects the commercial space of a house from its alleyway and limits commercial opportunities. Mobile vendors also face difficulties in advertising their products and communicate with potential buyers.

Furthermore, the elevated ground floors and their protruded ramps limit the use of the alleyway as a social space. People may find it challenging to converse with their neighbours because of the fractured ground (fig. 2.21-2.24). Even with the ever-changing ground floors, the flooding situation has not improved and threatens the sense of community and belonging. The elevation of alleyways and ground floors has been the only choice for each household, yet it is ineffective to deal with flooding in the long term. Saigon/HCMC's flooding is more than just an environmental issue since it has certainly become an indicator of socio-spatial inequalities. The competition for higher ground needs to be abolished to bring forth environmental and social justice to people, especially marginalized ones in alleyway neighbourhoods (fig. 2.25).

Fig. 2.25 *One-point perspective showing how people temporarily adapt to flooding.*

RESILIENCE



In this chapter, I will present the core argument of my thesis that people need to embrace flooding for it to be a nuisance event instead of a disastrous one. Firstly, the chapter will start with my analysis of the Vietnamese worldview of water and flooding and how they have been acknowledged as one dominant aspect in Vietnamese culture. Secondly, I will share some of my experiences in the Mekong Delta, where people have lived with seasonal flooding for many generations. They have developed their own wisdom of how to live with flooding and even take advantage of the flooded landscape to support their livelihoods. Finally, I will end this chapter with a contemporary theory on the flood adaptation paradigm and draw some examples of flood adaptation projects from different countries.

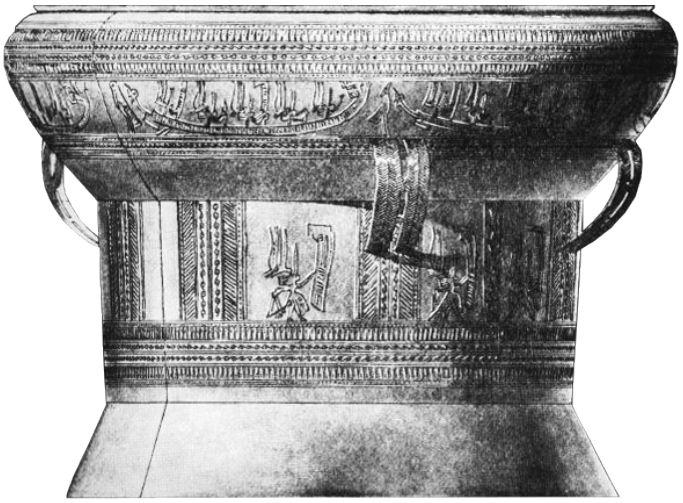


Fig. 3.01 Sông-Đà bronze drum. It is part of a series of bronze drums representing the Đông-Sơn Culture (700 BCE - 100 CE) of the ancient Vietnamese culture. The drum is one of the earliest artifacts that show the aquatic culture of Vietnam. The drum is decorated with boats and scenes of daily life and agricultural activities. This particular drum was stolen by a French colonial official and transported to France for display in 1889. It is now on display at Guimet Museum.

"WATER, WATER EVERYWHERE"- A VIETNAMESE WORLDVIEW

If nations, states, and sea levels rise and fall, some elements of the regional ecology and climate have proved enduring influences on cultural life in Việt-Nam. The country has long possessed an aquatic culture.

*— Ben Kiernan**

Fig. 3.02 The battle between Sơn-Tinh (Mountain God, right) and Thủy-Tinh (Water God, left).

* Kiernan, *Viet Nam: A history from earliest times to the present*, 7.

In the Vietnamese language, we call our homeland *'đất-nước'* or just *'nước,'* which can be translated respectively to 'land-water' and 'water.' From the early days of our nation, water had already become something important and inseparable from the land. Huỳnh-Sanh-Thông, a contemporary Vietnamese scholar, described the Vietnamese worldview itself as "water, water everywhere."[1] In the Vietnamese subconscious, water remains ordinary and excessive in its nature. Land and water have also been portrayed significantly in music, literature and folktales dated back to ancient times (fig. 3.03-3.05). Water has been particularly described as both nurturing and dangerous elements depending on how people view and approach it. My favourite was the famous myth of Sơn-Tinh versus Thủy-Tinh (Mountain God versus Water God) (fig. 3.02). In this story, the 18th King of the ancient Hồng-Bàng Dynasty sought a suitable husband for his beloved daughter. Amongst many suitors, there were Sơn-Tinh and Thủy-Tinh who were both extraordinary, talented and worthy. It was difficult for the King to select the best candidate so he challenged them with a final task. His daughter would be married to the first to arrive the next morning with a set of legendary animals, including a nine-tusk elephant, a nine-spur cockerel, and a nine-mane horse. Sơn-Tinh returned first with the animals. He married the princess and took her back to his mountain. Thủy-Tinh arrived shortly afterward and became enraged at his loss. A battle soon broke out between the two Gods. Thủy-Tinh used his powers to create heavy rain, which caused flooding. Eventually, he was defeated because Sơn-Tinh was able to raise his mountains higher and continuously conquered the flood. This myth was one of many stories that Vietnamese people invented to explain the relationship and tension between their land and water. I would argue that the King favoured Sơn-

1 Kiernan, *Viet Nam: A history from earliest times to the present*, 8.

Tinh as he requested only land animals. If water were perceived differently by the Vietnamese people, then Thủy-Tinh would not have been an antagonist. In this case, the competition would have been resolved in a peaceful manner, and there would not have been any battle or flooding.

In the story of Sơn-Tinh versus Thủy-Tinh, water was conquered by raised land and mountain. In the present-day Saigon/HCMC, people are still carrying out a similar action and suppressing water by raising streets, alleyways and ground floors. The abundance of (rain)water has been made an antagonist in the process of creating urban civility. If people can take one step back and think about the possibility of perceiving flooding differently, there can be an answer to socio-spatial inequalities and damages caused by flooding. When flooding remains simply an urban hazard in people's minds, they will continue to elevate their alleyways and houses without understanding the nature of it. This popular notion should be challenged because flooding only turns into a disaster if people do not accept it and prepare for it. Furthermore, the city is located in a delta region west of the Saigon River, where it empties into the sea. The land is relatively flat and interrupted by small rivers, creeks and canals. Land and water have always been intertwined in this region. Similar to the previously mentioned worldview of the early Vietnamese people, water sometimes becomes a dominant element in this region. Thus, the city must be reconfigured so that land and water work together and people live in harmony with them. Water and flooding should not be removed from urban life and made unknown because people will become ignorant of their city's geographical characteristics. Finally, water and flooding need to be understood as natural forces that cannot be stopped or opposed; thus, there must be a shift in current flood management actions.

Fig. 3.03 Motif on a bronze drum showing ancient Vietnamese people and their boats with mostly marine creatures. 600 BCE.

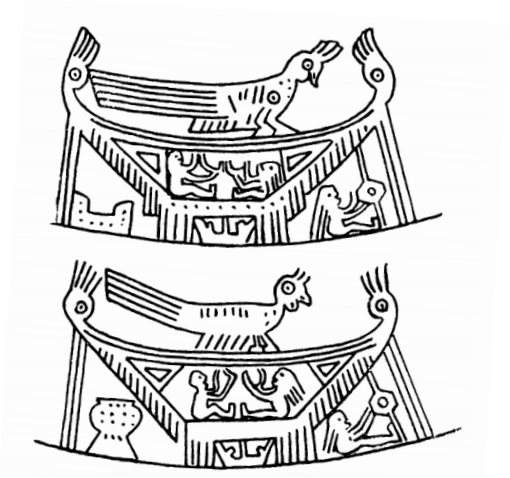


Fig. 3.04 Motif on a bronze drum showing elevated houses. They were lifted above ground to avoid dangerous animals and floods. 600 BCE.

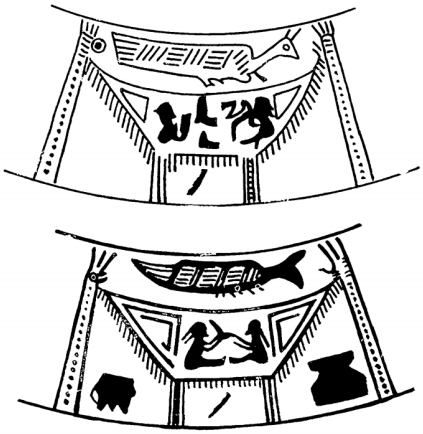


Fig. 3.05 Motif on a bronze drum showing elevated houses. The space below is used as storage space for tools. 600 BCE.

WISDOM FROM THE MEKONG DELTA

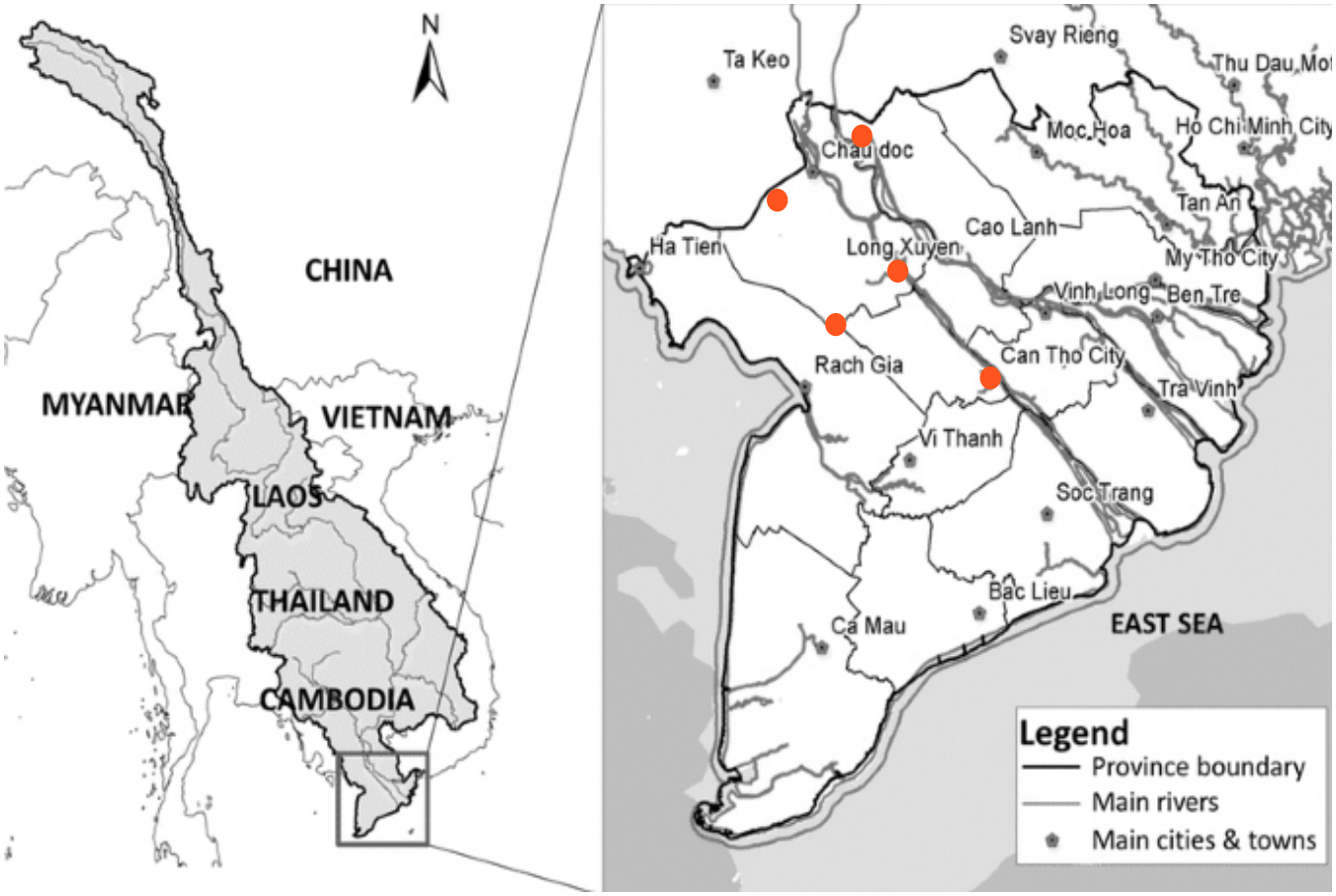


Fig. 3.06 *Map of the Mekong Delta with places where I visited in 2018 (orange dots).*

In the first half of 2018, I made two trips back to Vietnam and visited the An-Giang Province and Long-An Province of the Mekong Delta (fig. 3.06). This southern region is well known for its wet-rice agriculture (fig. 3.07) and annual flood season from August to November. I had an opportunity to observe the relationship between the locals, land, and water. This relationship very much aligned with the previously mentioned Vietnamese worldview. The Mekong Delta has so many bodies of water "that they resemble a net over the land," and "water is like a system of blood vessels for the land."[2] Travelling in this region often involves going over bridges or taking ferries. During the flood season, water is even more abundant and fills the landscape all the way to its horizon. However, flood season (locally called '*mùa nước nổi*'- floating water season) is not considered a disaster but rather something expected and welcomed. In the Mekong Delta, people live in harmony with it and "nine people out of ten are good swimmers and know something about piloting boats."[3] Furthermore, vernacular architecture and flexible lifestyle allow people to live contentedly even though the surrounding landscape can change drastically throughout the year. If there are any lessons to be learned about flood resilience, this region is where we can find them.

Fig. 3.07 A typical rice paddy in the Mekong Delta. 2018.

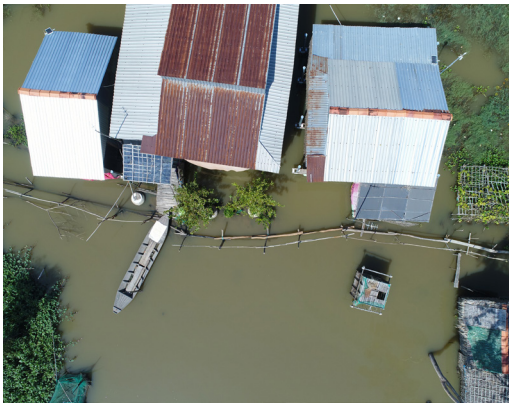


Fig. 3.08 Houses during the flood season in Long-An Province. 2018.

When the landscape is flooded (fig. 3.08 & 3.11), life does not come to a halt here, but it continues in a different way. People will switch from farming to fishing because of the abundant fish resources. They have developed different ways to preserve their fish so they will have enough food for many months. People have also cultivated a species of deepwater rice (or floating rice) that can reach several meters in height to stay above the floodwater. This rice serves as an intermediate crop before people can fully return to regular farming. Additionally, rainwater is collected throughout the flood season and stored away in large containers. When the water recedes, they return to regular farming as floodwater makes the soil fertile by depositing new materials and removes wastes. Hence, the lives here continuously shift back and forth to work

2 Kiernan, *Viet Nam: A history from earliest times to the present*, 9.

3 Ibid.

Fig. 3.09 A typical stilt house in An-Giang province during dry season. 2018.

Fig. 3.10 A typical stilt house in An-Giang province during dry season. 2018.

Fig. 3.11 Flooded landscape in Long-An Province. 2018.

with the land. In the Mekong Delta, people acknowledge the land and flood dynamics. When the water rises, they quickly work together as a community and adapt to the new situation. They build their houses differently and carry out their daily tasks differently. People accept their surrounding conditions and adapt by building their houses with lightweight construction and putting them on wood or stone posts (fig. 3.09-3.10). They can easily lift their houses and elevate them in response to higher flood levels. The house is not intended to be water-tight and will not be severely damaged if flooded. Furthermore, people use water-resistant materials, such as locally harvested melaleuca wood, to build the structures. This allows them to repair only minor water damages and improve their houses after each flood season. Since houses are situated well above the ground, areas below houses are shaded and quite comfortable for people to occupy and store their tools and boats (fig. 3.09). Most importantly, people will empty this space and not obstruct the flow of water under their houses in the flood season. Moreover, people do not let floodwater keep them isolated. They collectively build monkey bridges to connect one house to another and use small boats to reach distant places (fig. 3.08).

When people began to settle in the Mekong Delta and did not have the necessary knowledge to thrive, flooding was not kind to them. This can be seen in the movie *The Buffalo Boy (2004)* by Vietnamese-American director Nguyễn Võ Nghiêm Minh, which portrayed a bleak and challenging flooded landscape (fig. 3.12). However, the people I met in 2018 were the most resilient people that I had ever encountered. They have embraced the flood season for many generations, and by doing so, they have developed their own wisdom of living in this oscillating environment. Their vernacular wisdom of how to live with flooding is simply remarkable.

Although Saigon/HCMC's flooding and people's lifestyle are quite different from the Mekong Delta's. The idea of living with flooding can be very inspirational for people in flood-prone alleyway neighbourhoods. Because of differences between the two places, it is important to identify what can and cannot be learnt from the rural population and made relevant to the urban population.

Firstly, certain things are intrinsically tied to the rural settings. Practices such as building on stilts to allow passage of water are simply not feasible in alleyway neighbourhoods because of their high density. Building with light wood frame and replaceable building materials (such as thatch wall and roof) is also inapplicable because it will create stigmas of being poor as Saigon/HCMC's people prefer building with concrete and masonry. Furthermore, people in the Mekong Delta switch to a different way of living in the flood season, and it is mainly water-based. Floodwater is a matter of life and death to people there. On the other hand, flooding is not a matter of life and death to Saigon/HCMC's people. Unlike people in the Mekong Delta, they do not rely on resources (such as fish) harvested directly from the floodwater to support their livelihood.

The Mekong Delta's living with flooding cannot be applied directly to the urban environments in Saigon/HCMC. However, the trips to the Mekong Delta were an eye-opening experience and taught me many things. Amongst them, there are three main lessons I have learned from living with floods in the Mekong Delta that can be taught to people of Saigon/HCMC: (1) perception of flooding as a positive experience, (2) collective effort to overcome an environmental challenge, and (3) flexible lifestyle. Although Saigon/HCMC's flooding is quite different from the Mekong Delta's, these lessons can be applied to inspire how people live and face their environmental challenges.

Fig. 3.12 Flooded landscape of the Mekong Delta portrayed in The Buffalo Boy (2004).

THREE PRINCIPLES OF FLOOD ADAPTATION

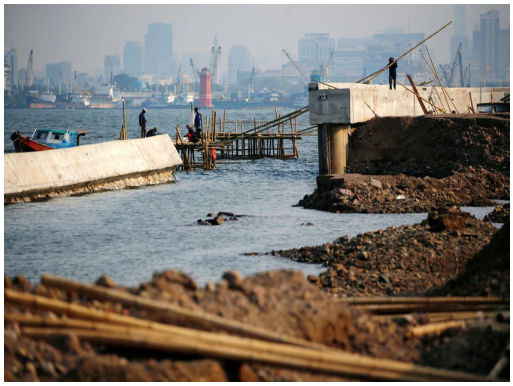


Fig. 3.13 Jakarta crumbled sea wall. 2014.

Fig. 3.14 Jakarta's Waduk Pluit Pump House. 2014.

Recently, I have discovered a theory developed by Kuei-Hsien Liao, an urban researcher from the Graduate Institute of Urban Planning, National Taipei University. Liao suggests that flood-prone cities should move away from the flood control paradigm, which has many limitations amidst climate change and urbanization. In her theory, she advocates for the flood adaptation paradigm and resilient cities. These cities should be designed to accommodate flooding in certain areas. Living with urban floods will also be made possible through a learning-and-doing process in which people will adapt and develop their own knowledge. Liao argues that cities should be adaptive to flooding rather than spending resources to control it. Her three principles for flood-prone cities are: (1) anticipate and accommodate flooding, (2) incorporate the ecological process of flooding, and (3) reveal the flood dynamics to the public.[4]

The flood control paradigm has been adopted in many flood-prone places such as Jakarta and Saigon/HCMC. The essence of this paradigm is keeping water out of the city. In the flood control paradigm, dikes, flood gates and pumps are designed to cope with forecasted conditions and models. Each of these elements can fail if future conditions surpass design criteria resulting in worsened flooding scenarios. For example, sections of Jakarta's sea walls have started to crumble because of land subsidence and strong waves (fig. 3.13).[5] During the 2014 flooding in Jakarta, pump houses, such as Waduk Pluit Pump House (fig. 3.14), were rendered useless because of electricity shutoff resulting in prolonged flooding.[6] In opposition to this, Liao argued that flood-prone cities should anticipate and accommodate flooding. Urban spaces should be designed to be flooded and able to absorb moderate damages. To achieve this, flood management should be decentralized to avoid a chain of failures if a certain element fails to operate.

4 Liao et al., "Urban Design Principles for Flood Resilience," 1.

5 "Crumbling Seawall Heightens Worries over Flood Threat to Indonesian Capital," Reuters.

6 Sedlar, "Inundated infrastructure," 36.

Moreover, flooding is a natural process in which floodwater removes waste, makes the soil fertile, and sustains other lifeforms. In some cases, flooding is vital to the land and its people, such as the Mekong Delta and its people. In fact, some regions need to be flooded as part of the ecological system. When human settlements take over the land and do not acknowledge local conditions, flooding will become inevitable. Therefore, flood-prone cities should restore the ecosystem of rivers and wetlands and integrate them into their existing urban fabrics. Qunli Stormwater Wetland Park in Harbin, China, is an example of this. The project was designed by Turenscape to revitalize a wetland that had been damaged by urbanization in the surrounding area (fig. 3.15). The park has a perimeter piping system to collect stormwater in the vicinity and direct it to the wetland located in its centre.[7] In addition to its ecological importance, the park also offers amenities, such as pavilions, watchtowers, running trails, to the locals (fig. 3.16).

Fig. 3.15 Qunli Stormwater Wetland Park. 2010, Harbin, China.

Fig. 3.16 Qunli Stormwater Wetland Park with the urban context. 2010, Harbin, China.

Finally, flooding will not be a disaster as long as people know how to react and avoid severe damages. Liao emphasized that experience and knowledge would play an essential role in flood adaptation. If city people are not well equipped with knowledge of how to live with floods, then floods—a natural process—will become disasters.[8] Hard infrastructure is essentially human beings' attempt to control nature, and it will not allow them to develop experience and knowledge of how to be resilient. This is one of many limitations that hard-engineered infrastructure has. If the hard infrastructure fails, damages will be sudden and catastrophic. People will also suffer greater consequences because they are ill-prepared for flooding scenarios. Therefore, flood dynamics should be revealed to the public and incorporated into urban design.[9] Bishan-Ang Mo Kio Park in Singapore and Benthemplein Water Square in Rotterdam are two examples of water-sensitive urban design. In the Bishan-

7 Gaete, "Qunli Stormwater Wetland Park / Turenscape," ArchDaily.

8 Kuang and Liao. "Learning from Floods," 2.

9 Liao et al., "Urban Design Principles for Flood Resilience," 7-9.

Fig. 3.17 Bishan-Ang Mo Kio Park. 2012, Singapore.

Fig. 3.18 People interacting with water at Bishan-Ang Mo Kio Park. 2012, Singapore.

Ang Mo Kio Park project designed by Ramboll Studio Dreiseitl, the previous concrete drainage channel was removed and replaced by a winding river and wetland (fig. 3.17). This project not only enhances the city's capacity to manage stormwater and flooding but also provides new recreational spaces for local communities (fig. 3.18). Another example, Benthemplein Water Square—designed by De Urbanisten—is located in a dense urban neighbourhood that has many impermeable surfaces. Most of the time, the park is in a dry condition and functions as a recreational space (fig. 3.19). During rainfall, it turns into a retention pool to collect rainwater from nearby buildings and streets (fig. 3.20).

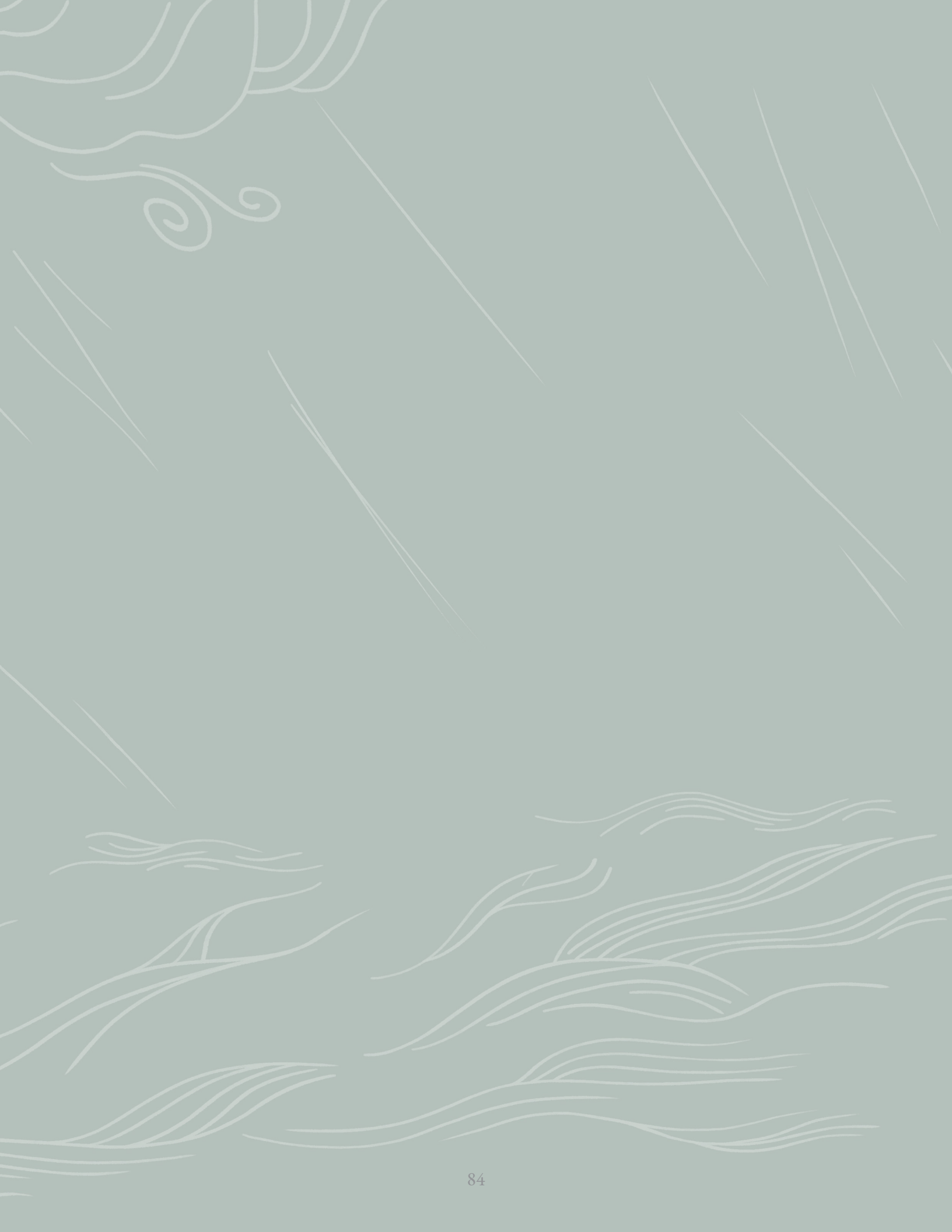
In Saigon/HCMC, hard-engineered infrastructure projects, such as 'the-10,000-billions-VND-flood-resistance project,' (fig. 3.21) have steered people's attention away from the most urgent problems, such as urbanization, soil sealing, land subsidence, and climate change. Kuei-Hsien Liao's three principles open a new possibility for flood adaptation in Saigon/HCMC. However, these three principles were not tailored for the alleyway typology. They still need to provide enough details on how the flood adaptation paradigm can be applied to informal settlements such as alleyways. This is when lessons from the Mekong Delta can complement contemporary theory. These lessons are what I saw and learnt from the vernacular wisdom perfected by many Vietnamese generations, and they can be transcribed in layman language. Their informality made it easier to introduce the idea of flood adaptation to everyday life in alleyway neighbourhoods because living with flooding in the Mekong Delta has been well-known to people in Saigon/HCMC. By introducing the lessons from the Mekong Delta first, I wanted to use vernacular wisdom to explain contemporary theory because they share the same foundational idea about adapting to something rather than resisting it. The three principles of flood adaptation can be radical for Saigon/HCMC, yet it will be a powerful way to reimagine the city's future flood management. For flood-prone alleyway neighbourhoods, I deeply believe they need a radical solution to the unjust competition for higher ground.

Fig. 3.19 Water Square Benthemplein in normal condition. 2013, Rotterdam, The Netherlands.

Fig. 3.20 Water Square Benthemplein retaining rainwater. 2013, Rotterdam, The Netherlands.

Fig. 3.21 Cay-Kho flood gate (1 of the 12 flood gates). 2021.

LIVING WITH FLOODING IN ALLEYWAY NEIGHBOURHOODS



The competition for a higher ground has not solved the problem yet had many other implications. Modern design ideas and frameworks should be implemented to create resilient communities that do not support this competition. Considering how the local Vietnamese people of Saigon/HCMC are active and enthusiastic in creating urban forms, their energy and resources should be invested in locally built resilient projects that directly address the lack of green infrastructure and the excess of impermeable surfaces. The majority of Saigon/HCMC's fabric is the alleyway typology; thus, it is appropriate to think about how adaptation strategies can be manifested at this scale and how the city can be changed to allow this possibility. As an ambiguous and hybrid space, the alleyway can be appropriated and moulded to fit different changing modes of urban lifestyle and design concepts to promote flood adaptation and resilience.

Using three lessons from the Mekong Delta and three principles by Kuei-Hsien Liao as a foundation, my thesis proposes a flood adaptation strategy for alleyway neighbourhoods at two scales. They are (1) macro-scale interventions to accommodate flooding between the alleyway neighbourhoods and (2) micro-scale interventions to manage flooding between the alleyway and the house. In contrast to the general notion of flooding to be handled by the authorities, the proposed strategy requires the proactive participation of local residents. In other words, the proposed strategy is a decentralized approach that manages flooding starting from the finest grains of Saigon/HCMC's fabric- the alleyway houses. Informal building culture in alleyway neighbourhoods also allows creative alteration of existing houses and appropriation of unused lands and public spaces for small-scale flood adaptation infrastructures.

From this chapter onwards, I am going to redefine 'urban flooding' in flood-prone alleyway neighbourhoods. With macro and micro-interventions, there will be areas that are designed to be temporarily flooded and integrated with existing alleyway neighbourhoods. ***'Urban flooding'*** *will not be disastrous because it will only be so when people are ill-prepared. In my proposal,* ***'flooding'*** *will be welcomed and integrated into alleyway neighbourhoods' new architecture and landscape. Living with flooding will be an alternative way of managing rainwater in alleyway neighbourhoods. In doing so, people will be able to gain the necessary knowledge of how to be resilient and minimize flood damages to their lives and houses.*

SITE INFORMATION – WARD 15, DISTRICT 8

Fig. 4.01 The project's location in Ward 15, District 8.

To synthesize the proposed flood adaptation strategy at two scales, I will apply it to a neighbourhood in Ward 15 of District 8 as a hypothetical pilot project (fig. 4.01-4.02). The rationale for choosing this neighbourhood includes: (1) being in a flood-prone area, (2) being topographically isolated, (3) much of the existing fabric is alleyway typology, and (4) there are undeveloped parcels of land (privately owned or public).

Generally, Saigon/HCMC's accumulated precipitation can reach 300mm in September. When it rains, the intensity is about 0.8-1.5mm/min.[1] From my personal experience, heavy rainfall can last up to 2 hours, creating 96-180mm of rainwater. Additionally, local sources have also used the average single-day precipitation of 100mm to gauge the magnitude of heavy rainfall.[2] This amount is one-third of September rain fallen on one single day. September precipitation usually peaks at 300mm with 20 rainy days. In my proposed flood adaptation strategy at two scales, the objective is to accommodate the total amount of rainwater falling on an area on a single day. Thus, the site will be transformed to manage 180mm of rainwater without being utterly dependent on the city's existing infrastructure. Rainwater will be collected and stored in different ways before being absorbed into the soil or gradually discharged by local infrastructure.

After analyzing the existing fabric of the chosen site, density and yard area stood out as two crucial attributes that determine how much rainwater can potentially be managed at the local level (Table 1 and fig. 4.03). Suppose an existing alleyway neighbourhood has an aggregated yard area of 15% that can be transformed to flood storage to accommodate rainwater. In that case, it will be possible to contain and manage 70% of total rainwater at this level. The remaining 30% of total rainwater will be directed to and managed by flood-adaptive public space (fig. 4.04-4.05). The larger the yard area a neighbourhood has, the more potential there is to collect rainwater locally. The denser a neighbourhood, the more water needs to be directed to dedicated flood storage (flood-adaptive public space).

1 Sustainable groundwater management in Asian cities: A final report of research on sustainable water management policy, 72.

2 "People Struggle with Year's Heaviest Rain-Caused Inundation in Ho Chi Minh City." Tuoi Tre News.

Fig. 4.02 Enlarged site plan showing density of the sites and available area (green) for flood-adaptive public space.

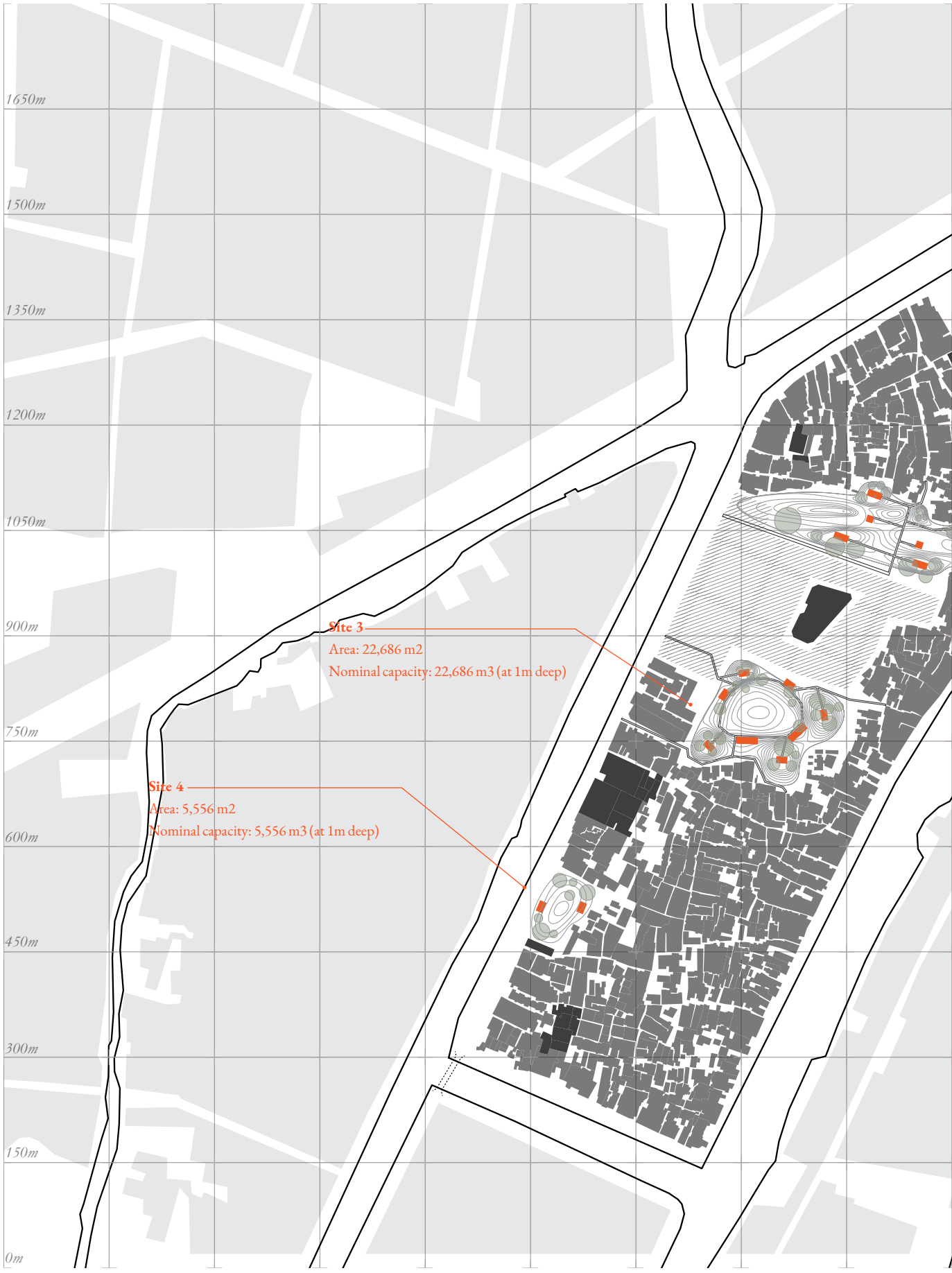
Table 1: Rainwater and flood storage breakdown		
Total area:	741,362 m2	100%
Developed area:	637,571 m2	86%
Undeveloped area:	103,791 m2	14%
Accumulated Rainwater:	133,445 m3	2 hours of rain at maximum intensity
Density 1 (hypothetical): Roof coverage at 65% Yard area at 15% Rainwater harvest at a minimum level Existing infrastructure at 20% capacity	70% of rainwater can be managed at a micro-scale (flood storage + rainwater collection) 30% of rainwater can be managed at a macro-scale (50% of undeveloped areas needs to be flood-adaptive public space at 0.75m deep)	
Density 2 (fig. 4.03): Roof coverage at 70% Yard area at 10% Rainwater harvest at a minimum level Existing infrastructure at 15% capacity	55% of rainwater can be managed at a micro-scale (flood storage + rainwater collection) 45% of rainwater can be managed at a macro-scale (65% of Undeveloped area needs to be flood-adaptive public space at 1.00m deep)	
Density 3 (hypothetical): Roof coverage at 85% Yard area at 5% Rainwater harvest at a minimum level Existing infrastructure at 10% capacity	33% of rainwater can be managed at a micro-scale (flood storage + rainwater collection) 67% of rainwater can be managed at a macro-scale (75% of Undeveloped area needs to be flood-adaptive public space at 1.25m deep)	

Fig. 4.03 A sample size represents Density 1 in Table 1.

Methodology

This site is under-documented, just like other alleyway neighbourhoods in Saigon/HCMC. With the pandemic preventing me from carrying out a field study, Google Earth is the only resource available. Thus, I developed a methodology to analyze satellite images in order to have a better understanding of the site. I applied a 25mx25m grid that seemed to work well with the available resolution of satellite images. Then I analyzed smaller swaths of alleyway neighbourhoods and quantified them by measuring the area of roofs, alleyways, and yards in Rhino6. I also counted vegetated areas and used them as an indicator for front yards. Using the method of taking an average, I could calculate how much a 25mx25m cell contains. By visually comparing other area to a sample cell, I could mathematically determine the percentage of roof, alleyway, and yard. As a result, I could break down the areas of different elements of the site.

Fig. 4.04 Density analysis of the site.


1650m
1500m
1350m
1200m
1050m
900m
750m
600m
450m
300m
150m
0m
Site 3
Area: 22,686 m2
Nominal capacity: 22,686 m3 (at 1m deep)
Site 4
Area: 5,556 m2
Nominal capacity: 5,556 m3 (at 1m deep)

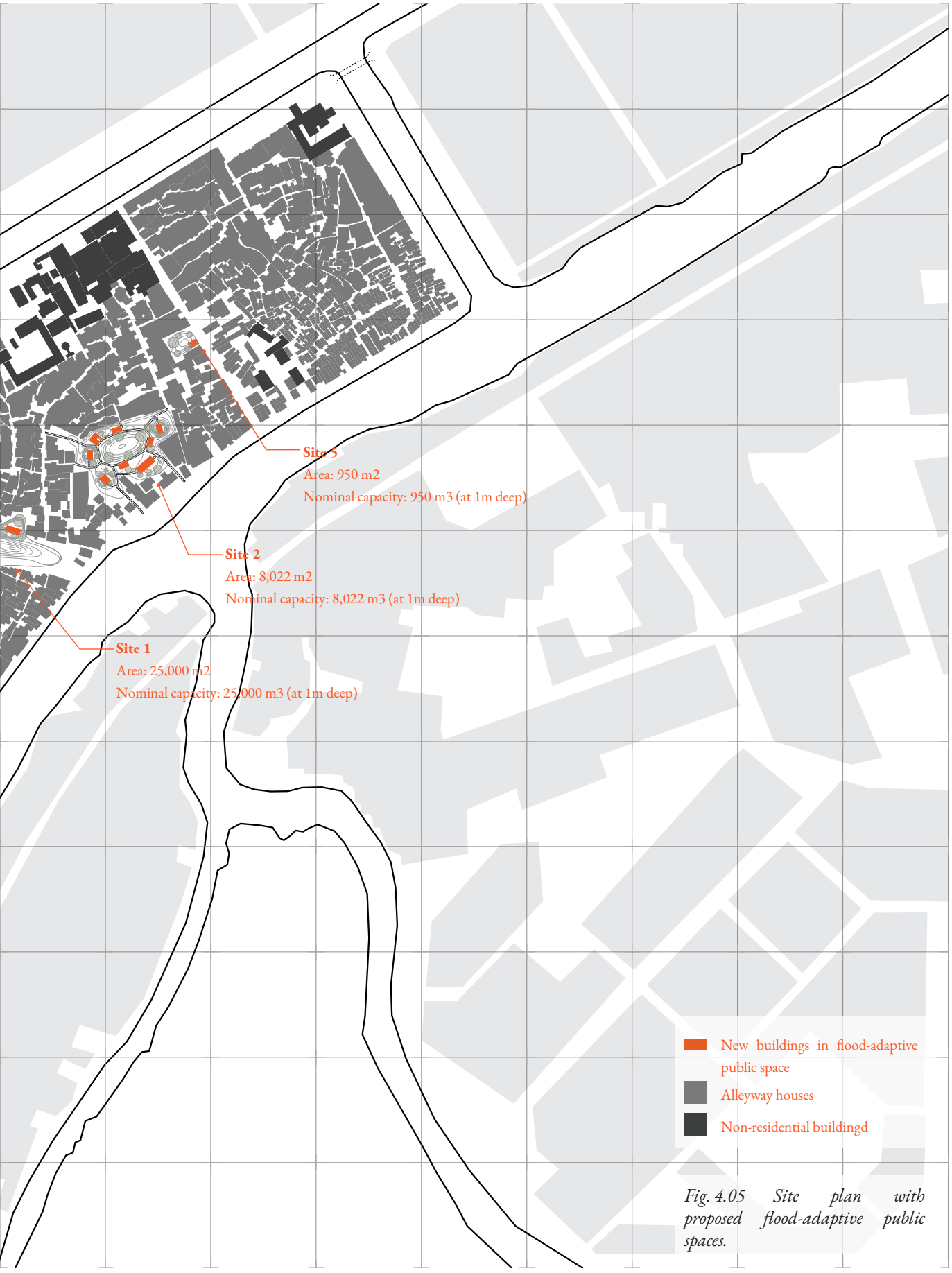
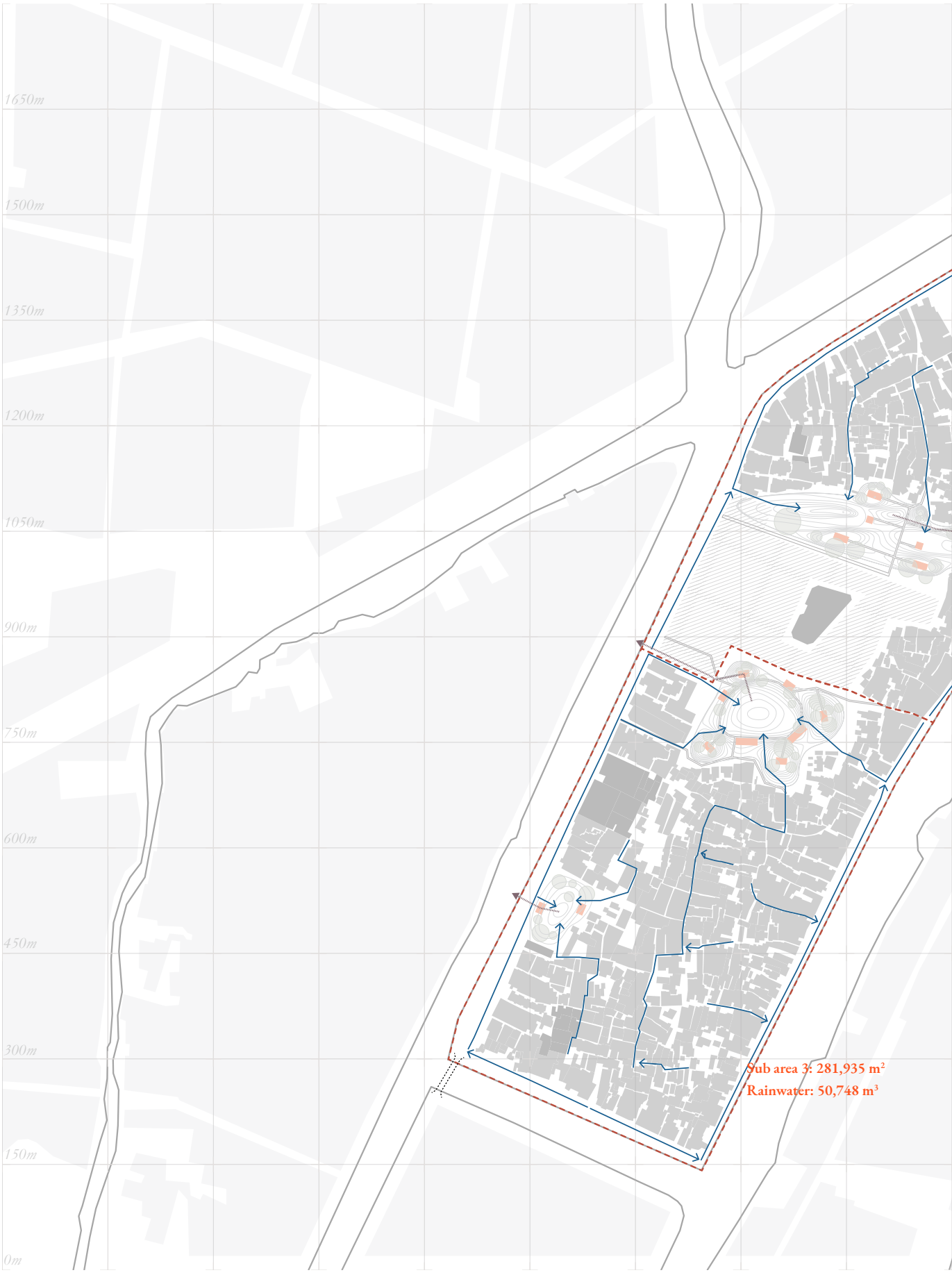


Fig. 4.05 Site plan with proposed flood-adaptive public spaces.


1650m
1500m
1350m
1200m
1050m
900m
750m
600m
450m
300m
150m
0m
Sub area 3: 281,935 m²
Rainwater: 50,748 m³

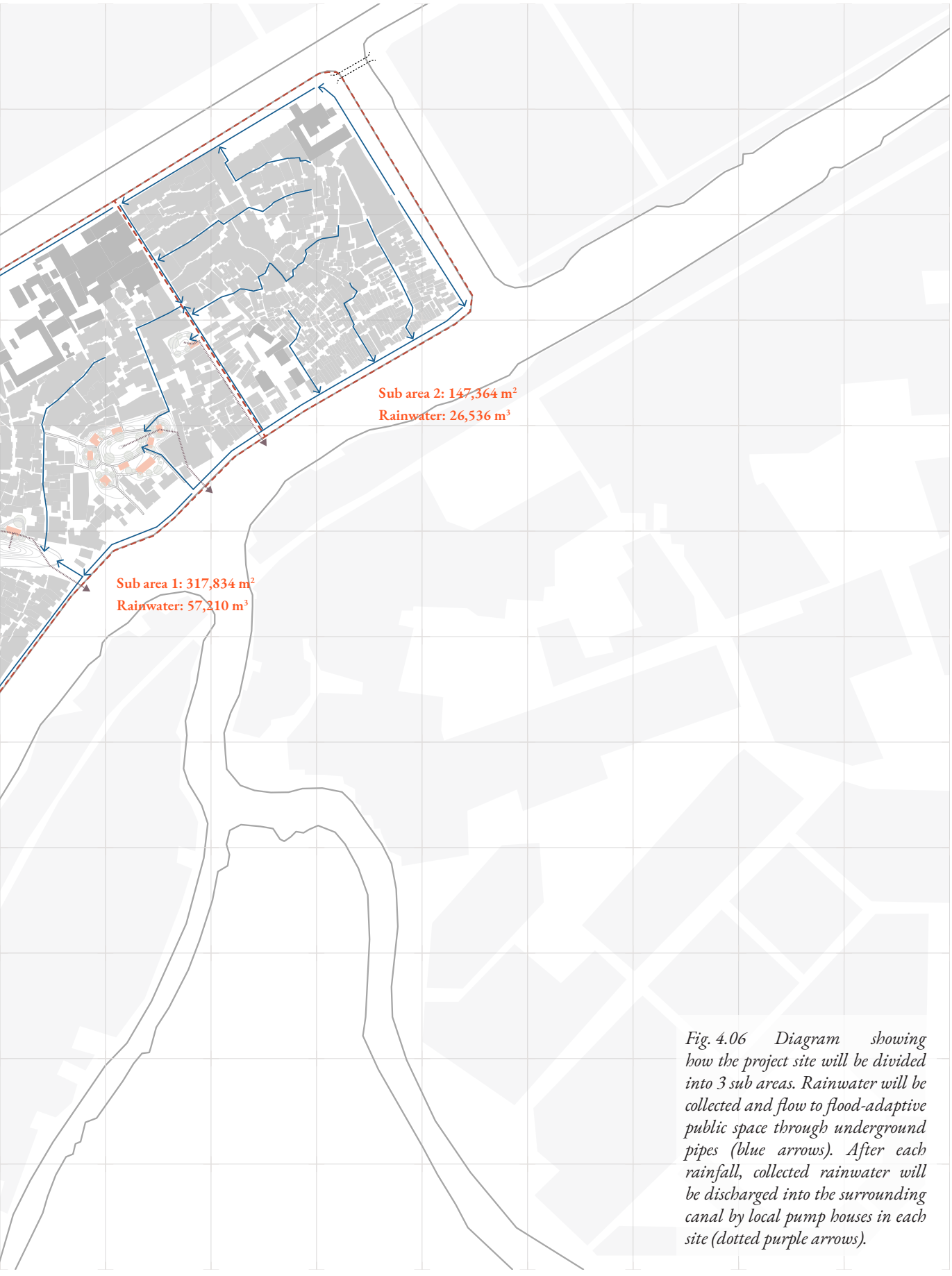


Fig. 4.06 Diagram showing how the project site will be divided into 3 sub areas. Rainwater will be collected and flow to flood-adaptive public space through underground pipes (blue arrows). After each rainfall, collected rainwater will be discharged into the surrounding canal by local pump houses in each site (dotted purple arrows).

MICRO-SCALE: THE HOUSE AS A SPONGE

Chuồn chuồn bay thấp thì mưa, bay cao thì nắng, bay vừa thì râm.

Dragonflies fly at low level, it is rainy; dragonflies fly at high level, it is sunny; dragonflies fly at medium level, it is cloudy.

— Vietnamese proverb.

Fig. 4.07 The micro-scale interventions introduce a concept in which each house is modified to act as a "sponge" to retain and release rainwater when it is flooded. In this image, front yards act as a flood-adaptive space.

The micro-scale interventions introduce a concept in which each house is modified to act as a "sponge" to retain and release rainwater when it is flooded (fig. 4.06-4.08). In contrast to the unjust competition for higher ground, the micro-scale interventions propose a flexible ground plane that anticipates and accommodates flood water. This proposed solution will allow the flood dynamic to be incorporated into the urban morphology of alleyway typology. In a typical alleyway house, only a small area of the ground floor will be dry floodproofed, and the remaining area will be wet floodproofed to accommodate flexible programs. For example, the wet floodproofed area will be a buffer zone and serve as a motorbike parking space and storage. If the house has a front yard, it will be altered to reduce impermeable surfaces so they can act as flood storage and soakaway (fig. 4.09-4.20). Otherwise, flood storage, such as plastic barrels and underground tanks, is implemented to retain rainwater and release it slowly to the existing storm sewer.

Most of the funding for this concept will come from the homeowner along with a small contribution from the local government. Instead of an elevated ground floor, a flexible ground floor will contribute to a larger effort to create a resilient alleyway neighbourhood (fig. 4.06 & 4.08). Additionally, the localized interventions to the ground floors will mean more responsibility from the homeowners and less dependence on the government's flood control infrastructure. The concept will allow houses to remain relatively close to the alleyway level without obtrusive ramps. As a result, the ground floors will become more welcoming and accessible. The concept of micro-scale interventions not only mitigates flooding but also mends the relationship between houses and alleyways. Without extreme elevation of houses, the alleyway can reconnect to them and resumes being a semi-public space.

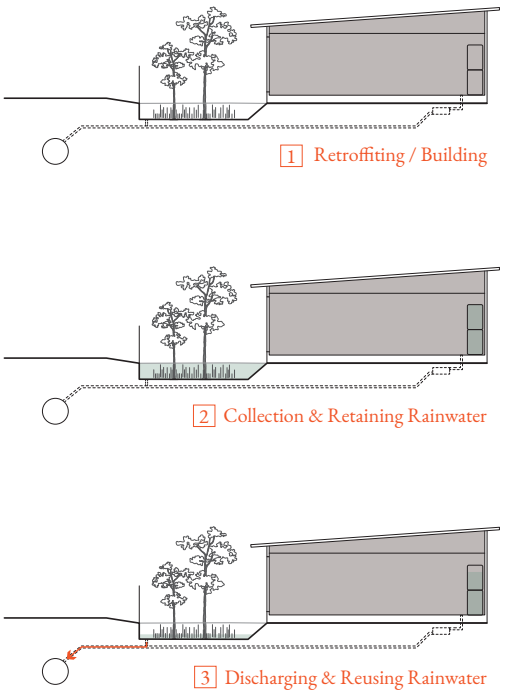


Fig. 4.08 *Three stages of a flood-adaptive house.*

Moreover, previously mentioned interventions can be articulated and applied to future houses in flood-prone alleyway neighbourhoods. These new houses can be more responsible to the community and contribute very much to the flood adaptation strategy. An extreme elevation of ground floors can be avoided if they are designed to be fully flood-adaptive and accommodate flexible programs. The new ground floor should be specifically designed to be flexible and adaptive to dry and wet conditions (fig. 4.21-4.28). It will have different levels for multiple flood elevations depending on the intensity of rainfall. On the ground floor, each type of space will be located based on how susceptible it is to water damage. For example, a living room with furniture that can be easily tucked away will be more flood-adaptive than a kitchen with built-in counters. Other rooms with valuable furniture and belongings can be on upper floors to avoid any possible damages (e.g. during unexpected midnight rainfalls). Furthermore, new houses can also have roofs designed to collect rainwater instead of shedding it to the surroundings (fig. 4.23). Rainwater then can be directed to integrated storage and reused during the dry season. In addition to integrated water storage, these new houses can have yards that will be open and vegetated with a selection of plants to absorb excess rainwater.

Fig. 4.09 Flood-adaptive front yards acting as rainwater storage during a rainfall. Rainwater will be temporarily stored and then slowly discharged when it stops raining.

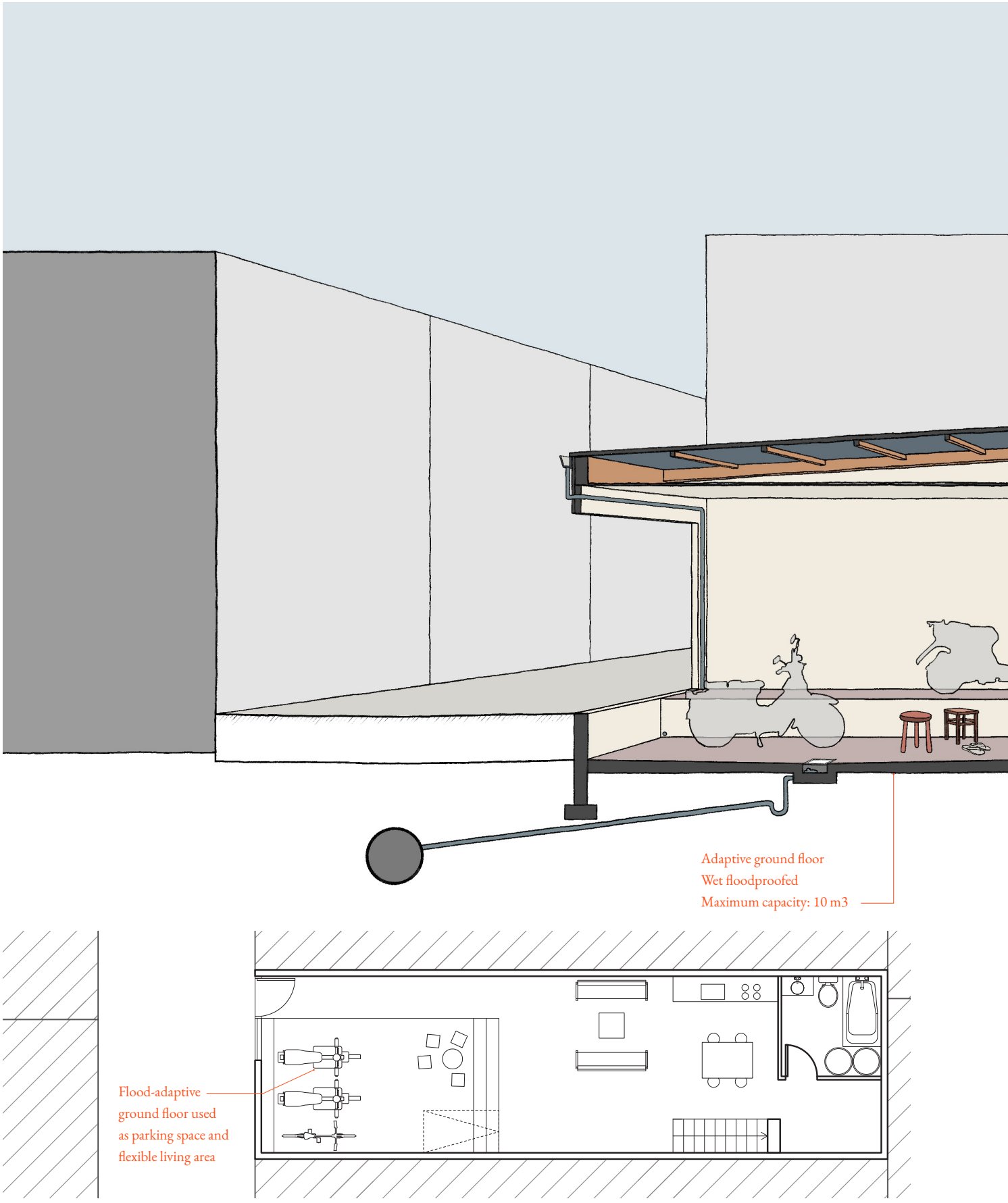


Fig. 4.10 *Plan of retrofitted alleyway house without front yard in dry condition.*

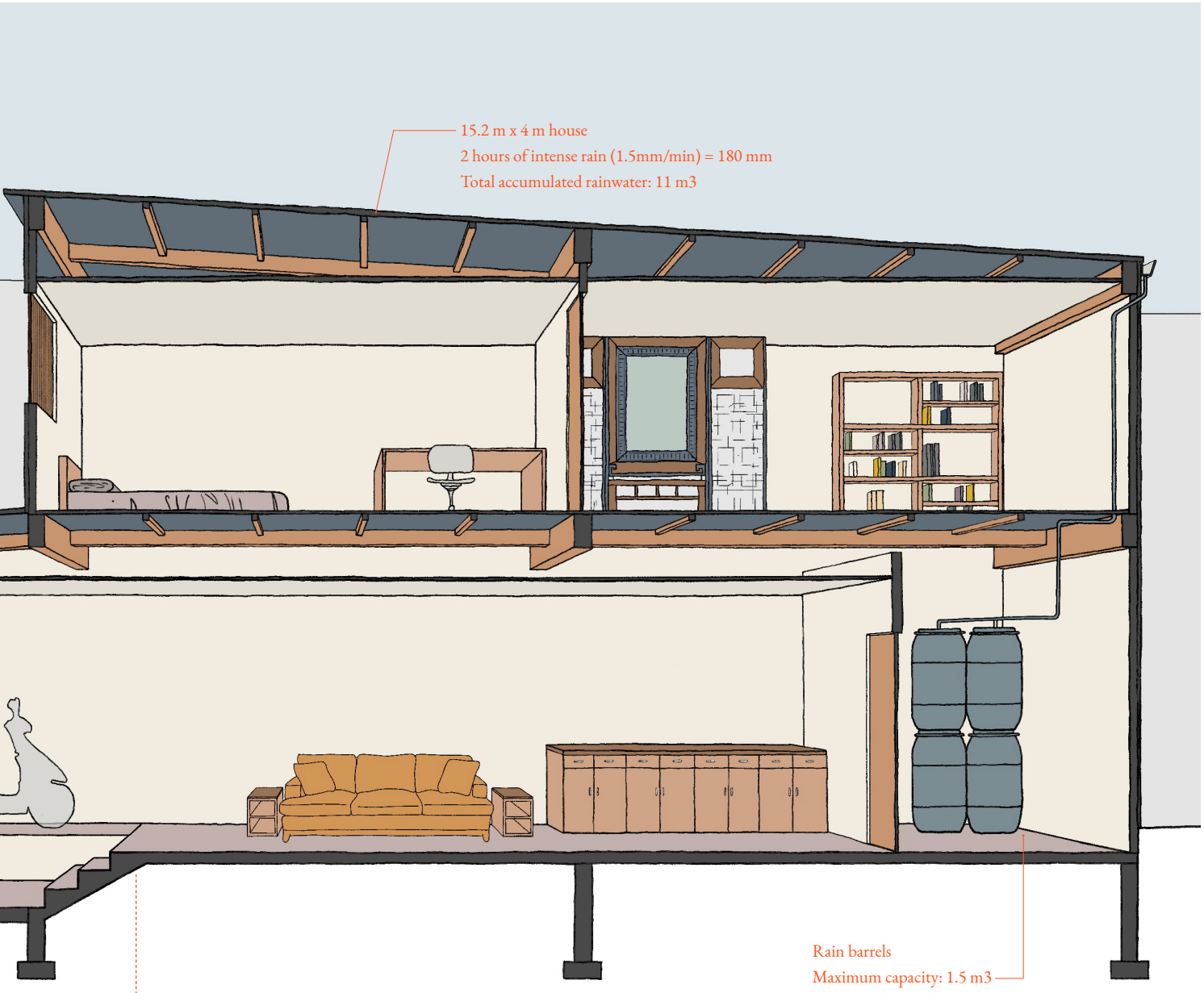


Fig. 4.11 Section of retrofitted alleyway house without front yard in dry condition.

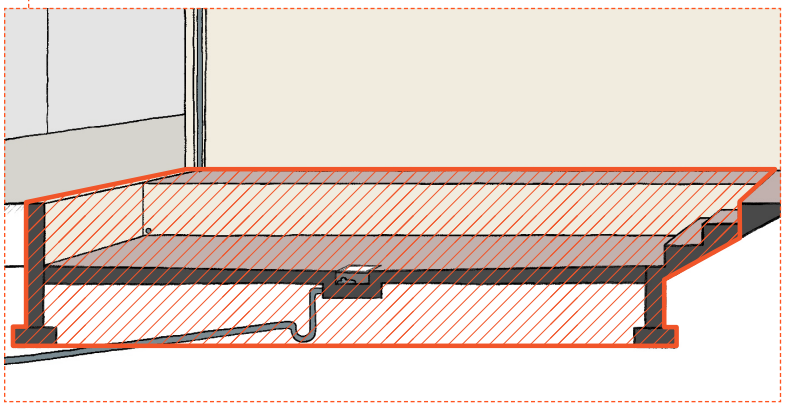
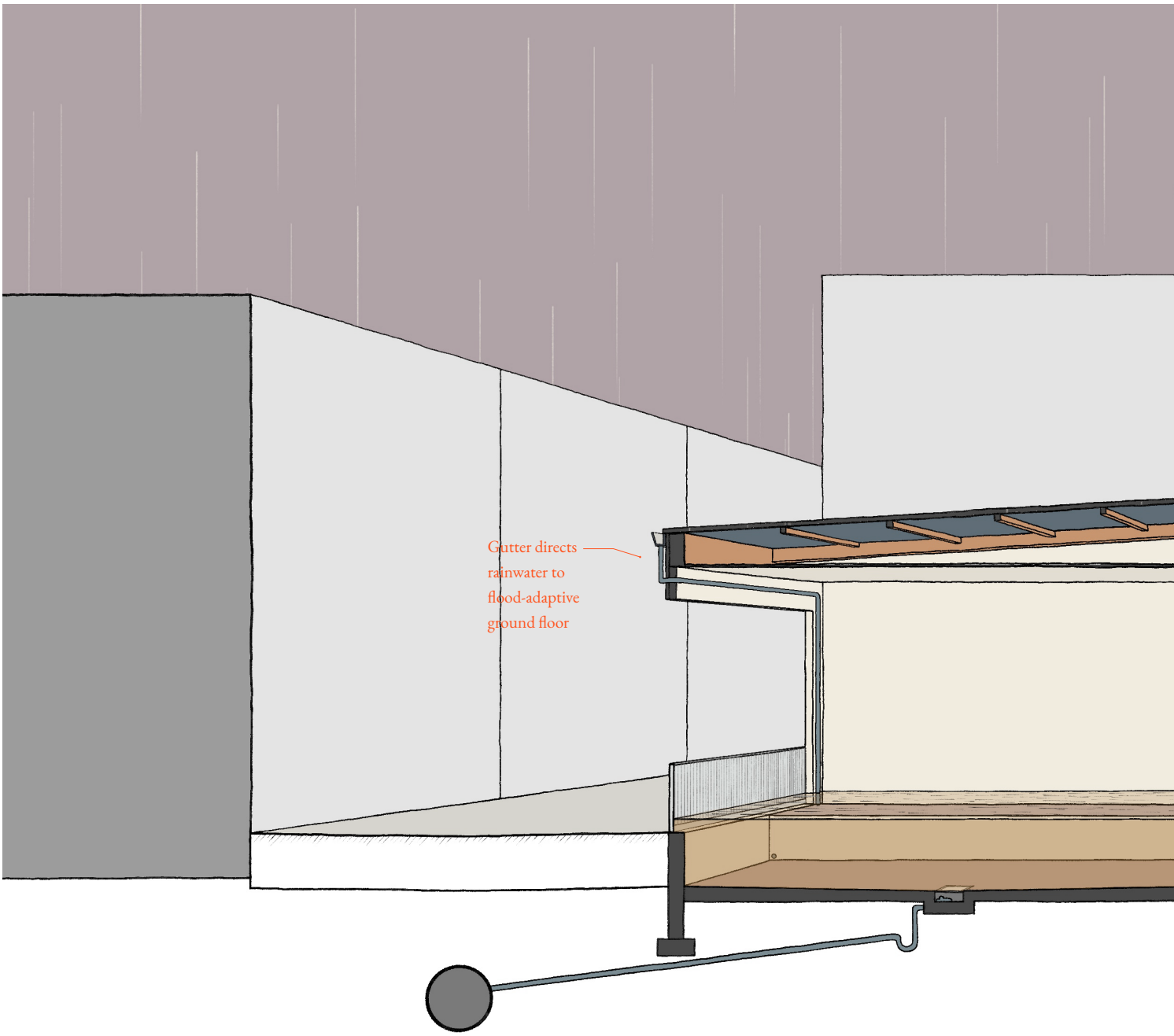


Fig. 4.12 Extent of retrofitted ground floor.



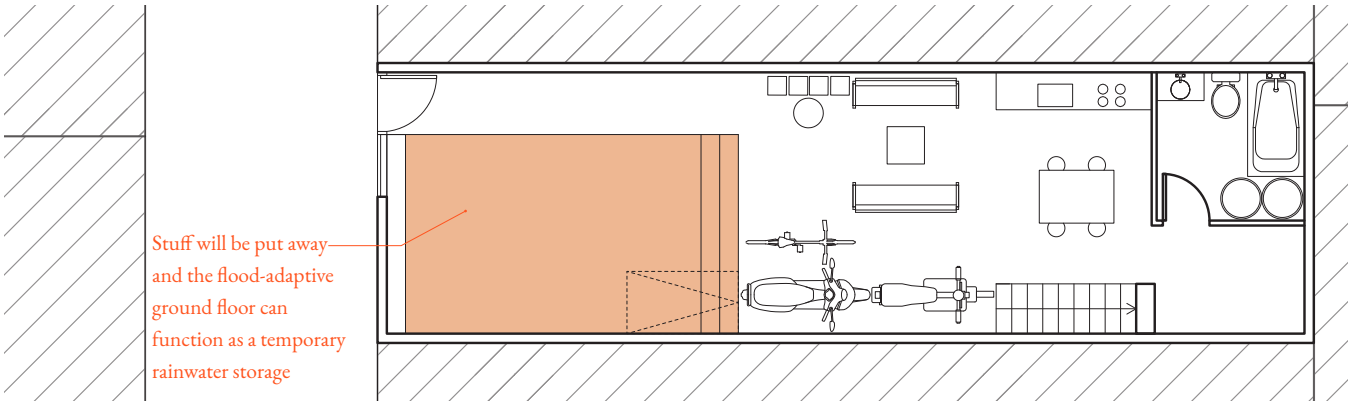


Fig. 4.13 Plan of retrofitted alleyway house without front yard in flood condition.

Temporary flood gate can be deployed in the beginning to prevent overflow when there are not many flood-adaptive houses. As more houses become flood-adaptive, this will be unnecessary.

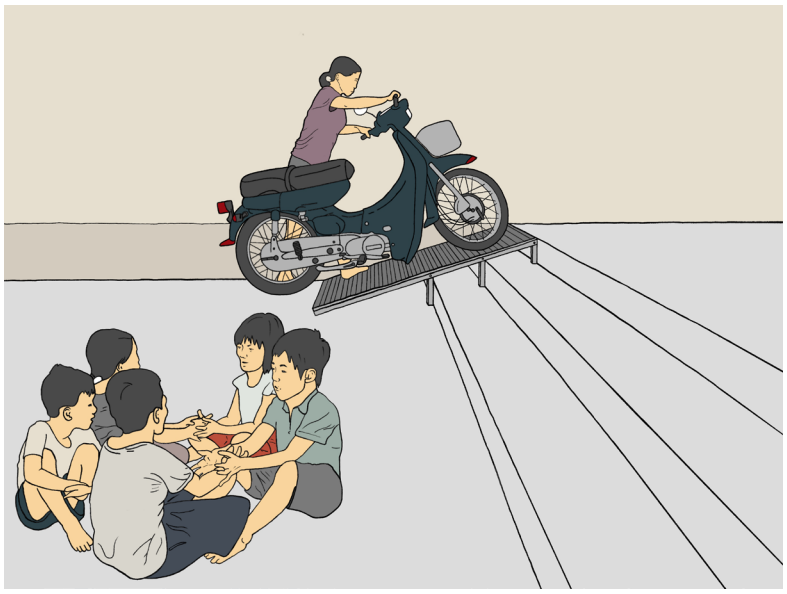


Fig. 4.14 Section of retrofitted alleyway house without front yard in flood condition.

Fig. 4.15 The flood-adaptive ground floor will be emptied prior to each rainfall to accommodate rainwater.

Volume of rainwater

Require	11 m3
Capacity	
Flood-adaptive ground flood:	10 m3
Rain barrel:	1.5 m3
Total:	11.5 m3

Fig. 4.16 *Section of retrofitted alleyway house with front yard in dry condition.*

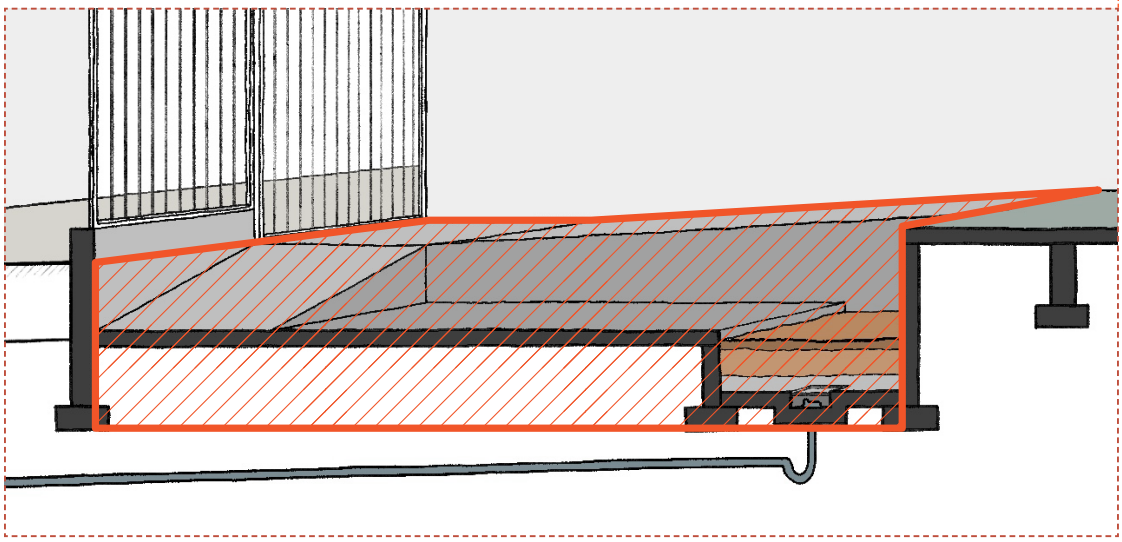
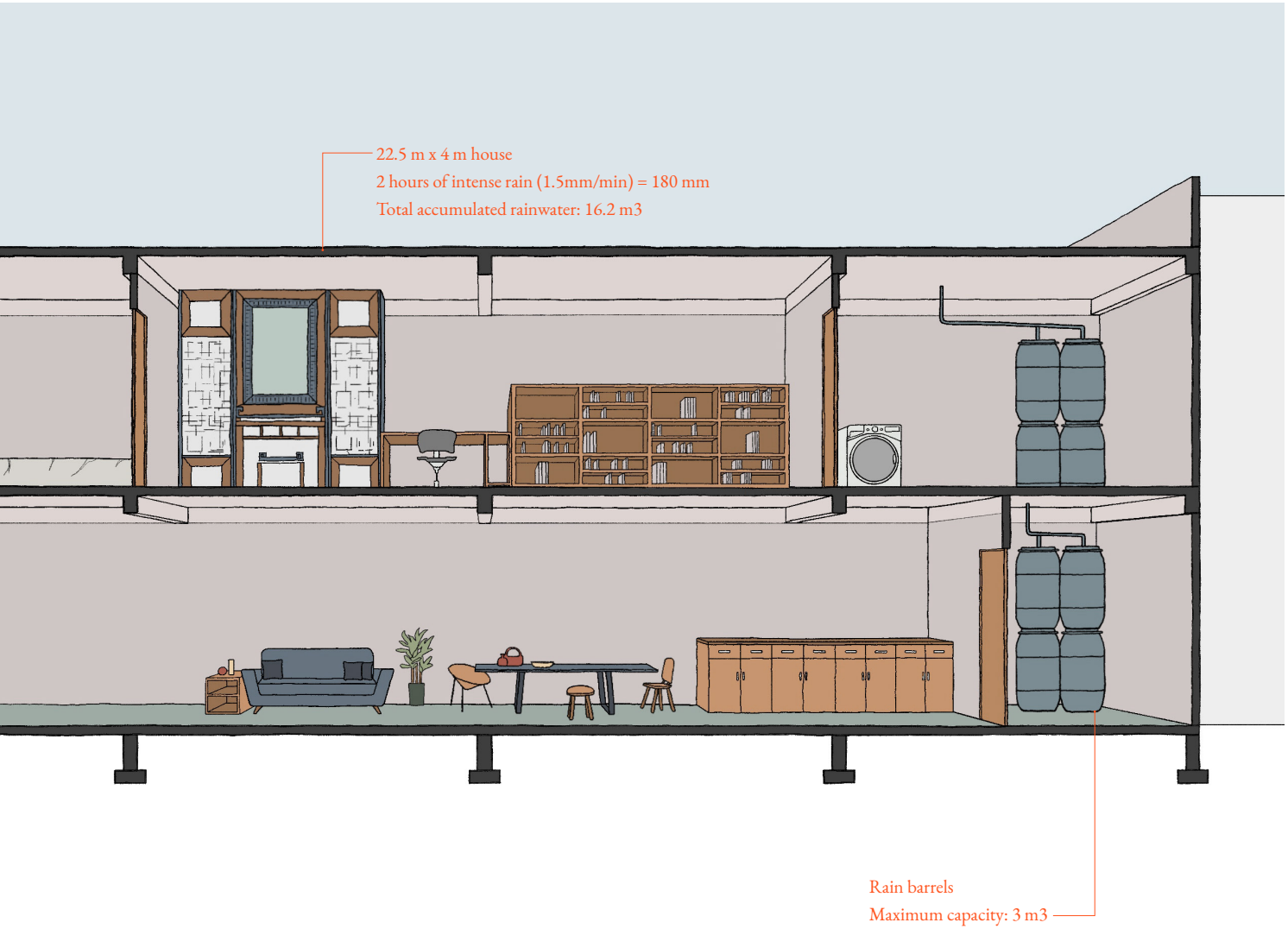


Fig. 4.17 *Extent of retrofitted ground floor.*



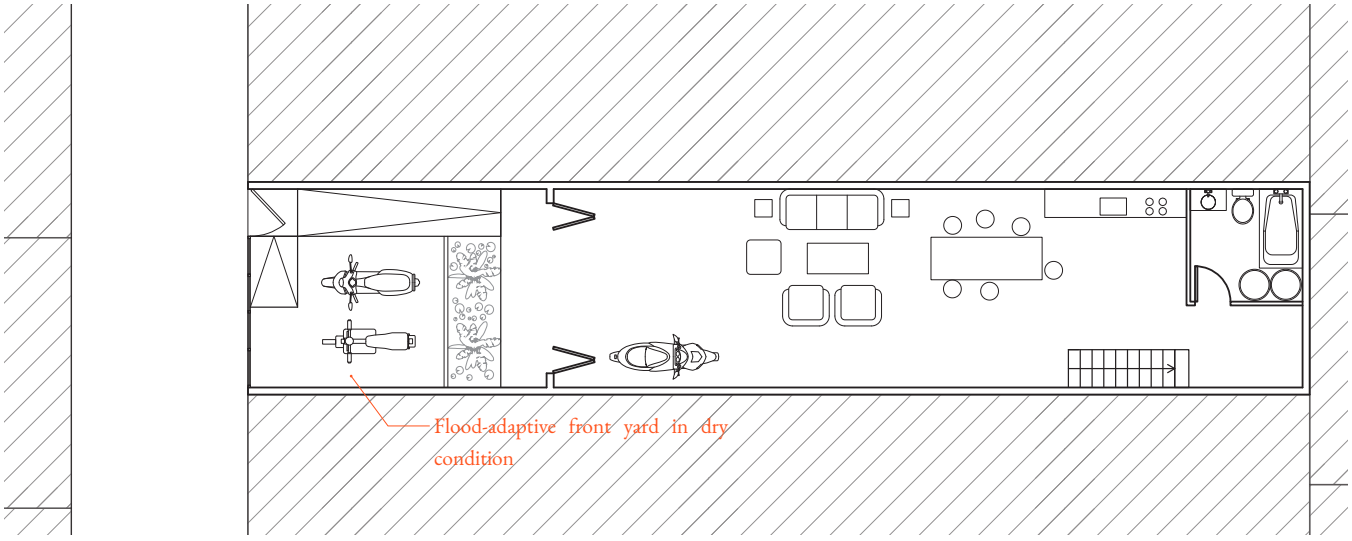


Fig. 4.18 Plan of retrofitted alleyway house with front yard in dry condition.

Fig. 4.19 *Section of retrofitted alleyway house with front yard in flood condition.*

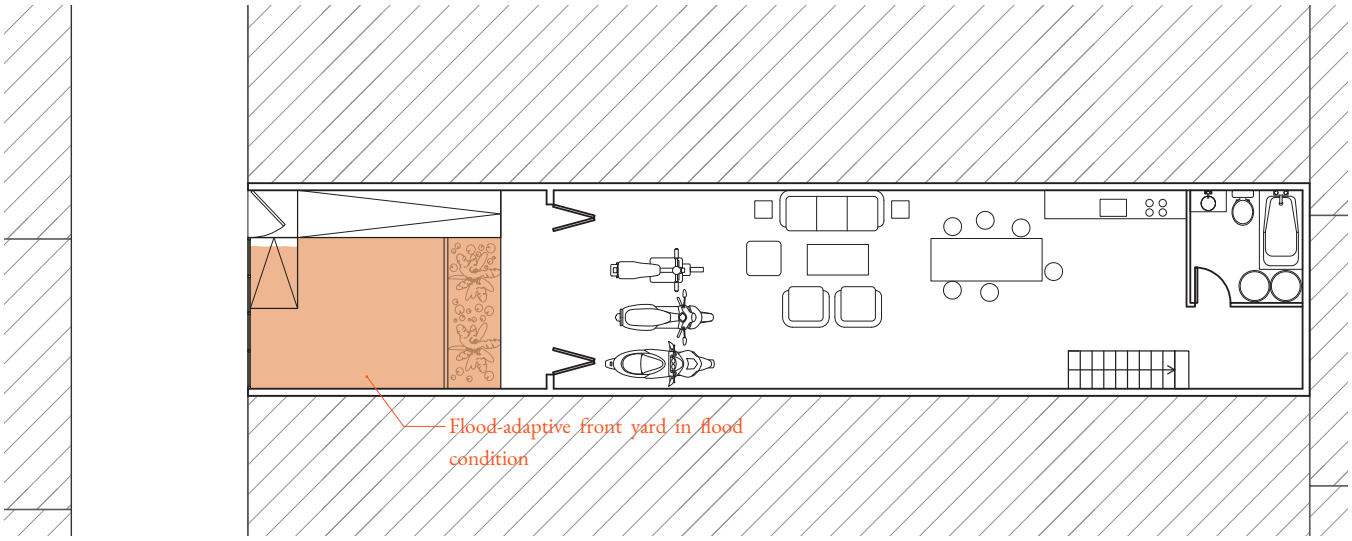


Fig. 4.20 *Plan of retrofitted alleyway house with front yard in flood condition.*

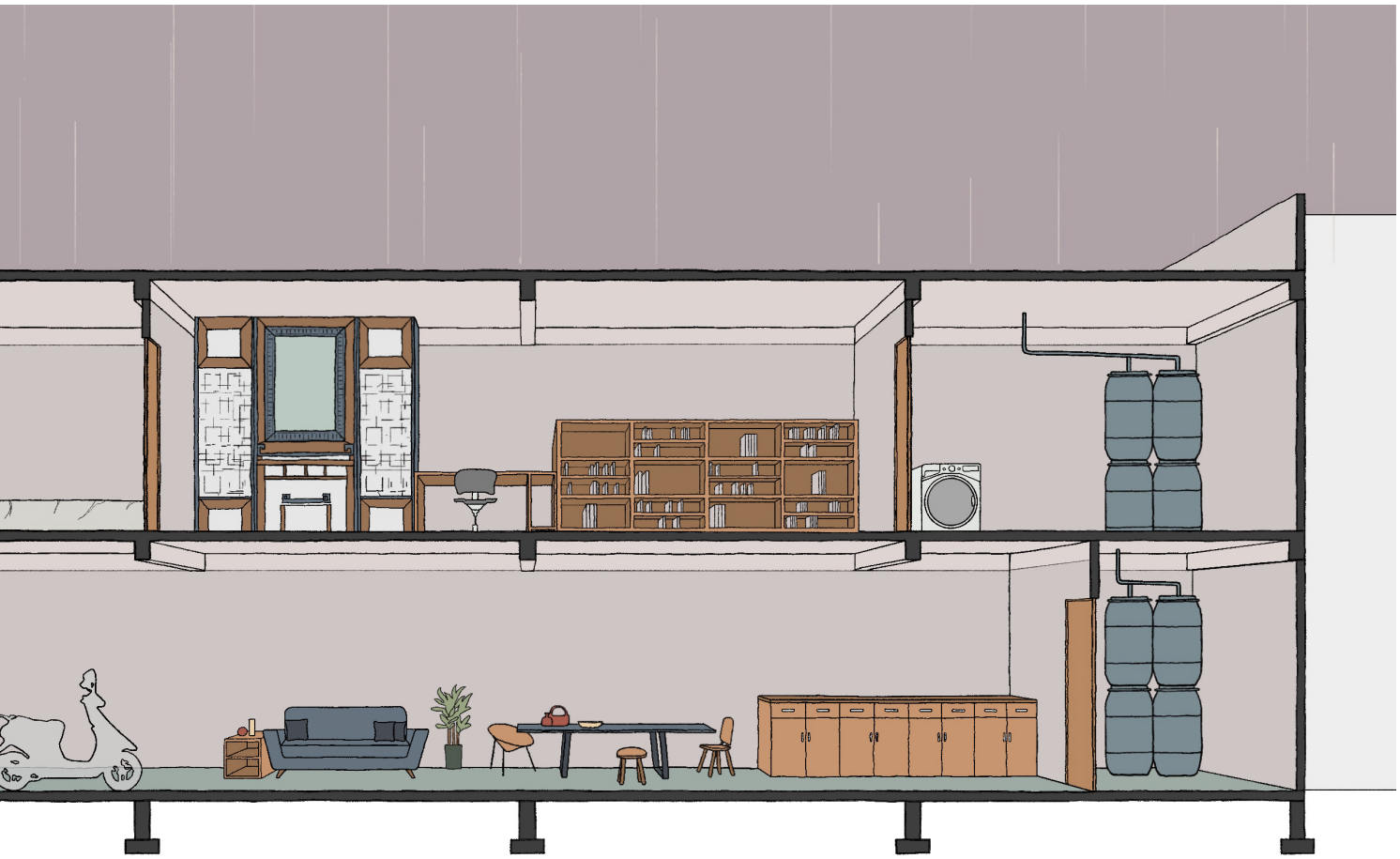


Fig. 4.21 Flood-adaptive ground floor will accommodate rainwater when needed. The homeowners can quickly clean the floor and use it normally after rainwater is fully discharged.

Volume of rainwater

Require	16.2 m3
Capacity	
Flood-adaptive front yard:	13.7 m3
Rain barrel:	3 m3
Total:	16.7 m3

Fig. 4.22 Section of a new flood-adaptive alleyway house that is designed to accommodate a substantial amount of rainwater with flood-adaptive front yard and rainwater storage.

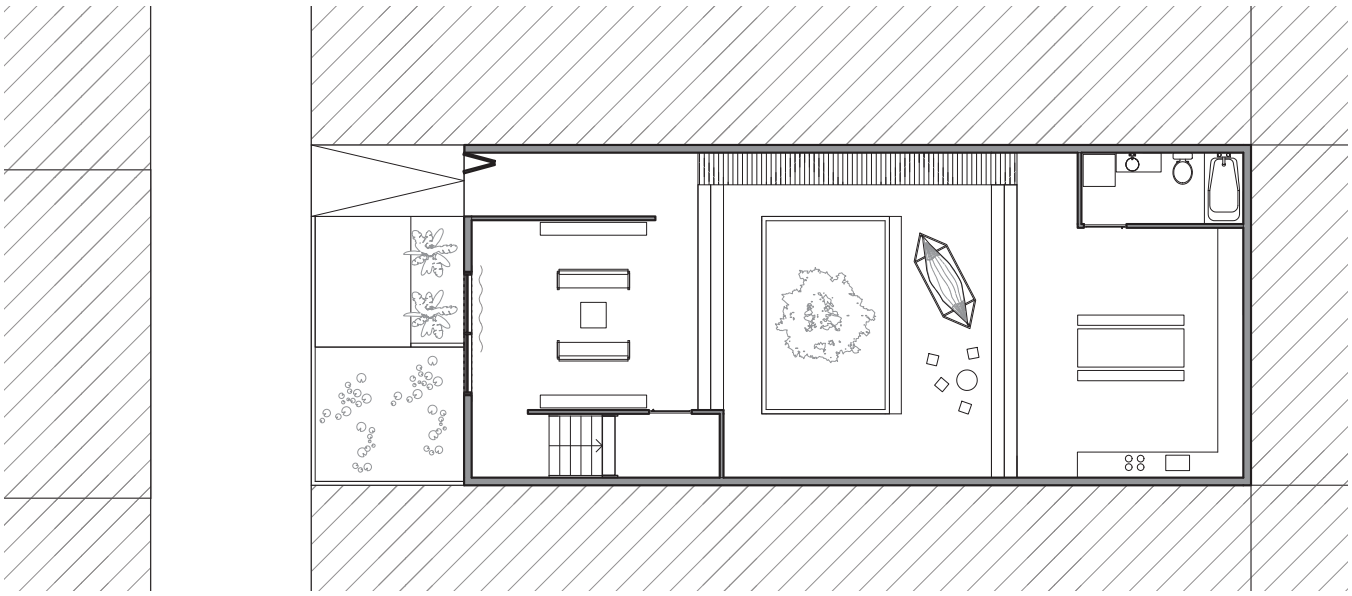


Fig. 4.23 Plan of a new flood-adaptive alleyway house in dry condition.


23 m x 5 m house
2 hours of intense rain (1.5mm/min) = 180 mm
Total accumulated rainwater: 20.7 m3
Adaptive ground floor
Wet floodproofed
Maximum capacity: 12.5 m3
Temporary rainwater storage
Maximum capacity: 6 m3

Fig. 4.24 Section of a new flood-adaptive alleyway house in flood condition

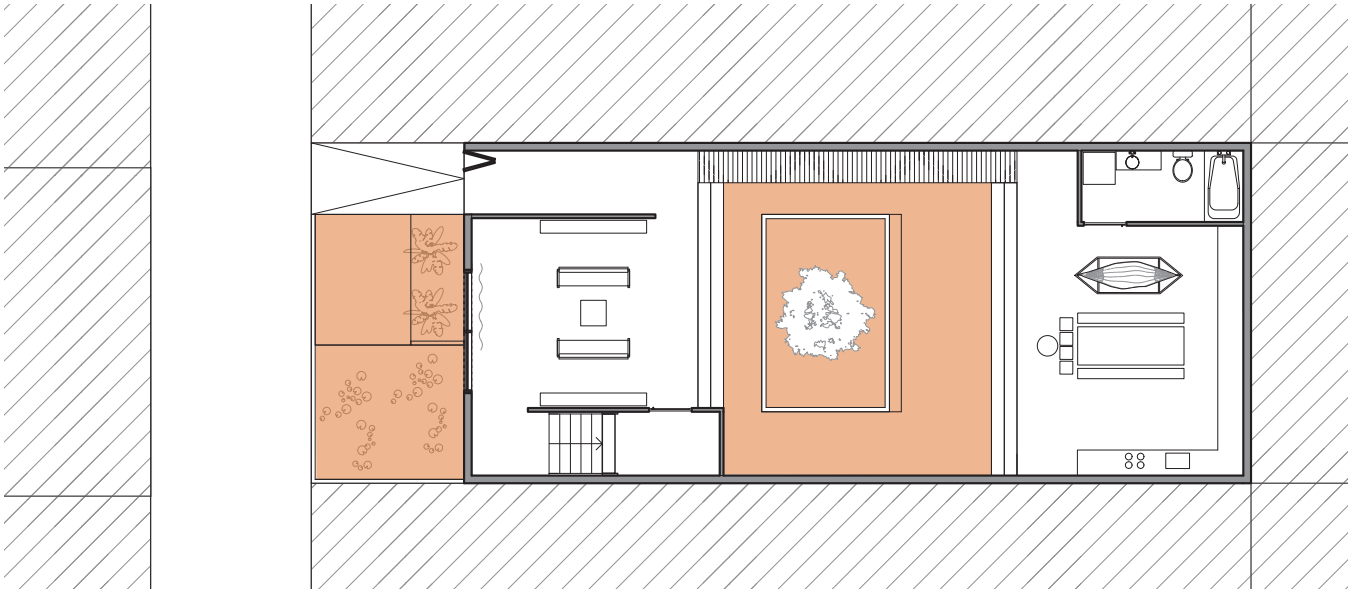


Fig. 4.25 Plan of a new flood-adaptive alleyway house in flood condition.

Fig. 4.26 Children playing with water in flood-adaptive space.

Volume of rainwater

Require	20.7 m3
Capacity	
Flood-adaptive ground flood:	12.5 m3
Flood-adaptive front yard:	10 m3
Temporary rainwater storage:	6 m3
Total:	28.5 m3

Flood-adaptive alleyway neighbourhood

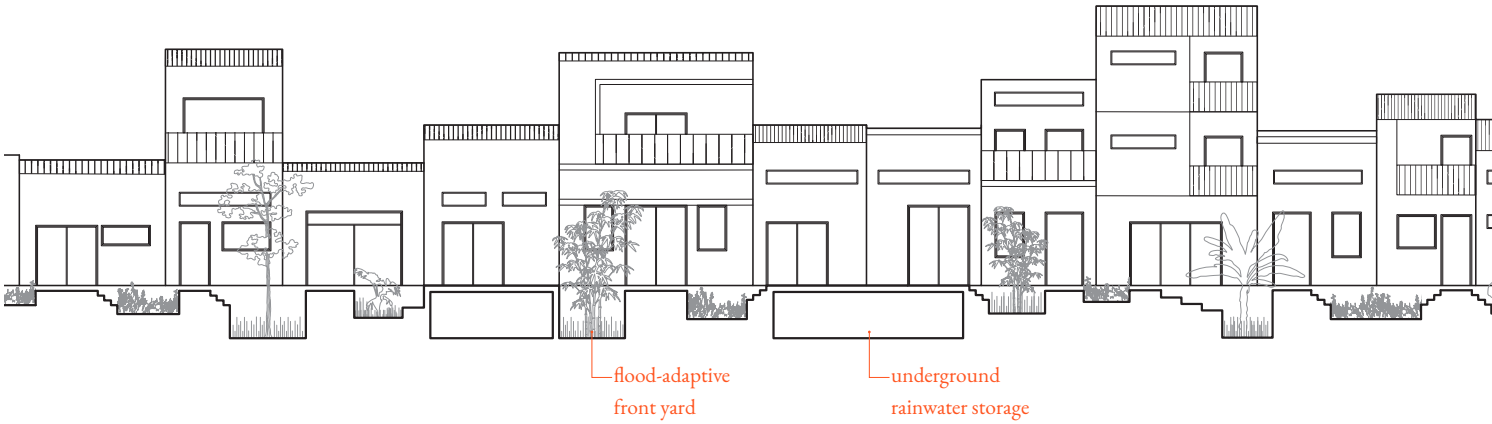


Fig. 4.27 *Section/Elevation drawing with adaptive ground flood in normal condition.*

Fig. 4.28 *Section/Elevation drawing with adaptive ground floor during a rainfall.*

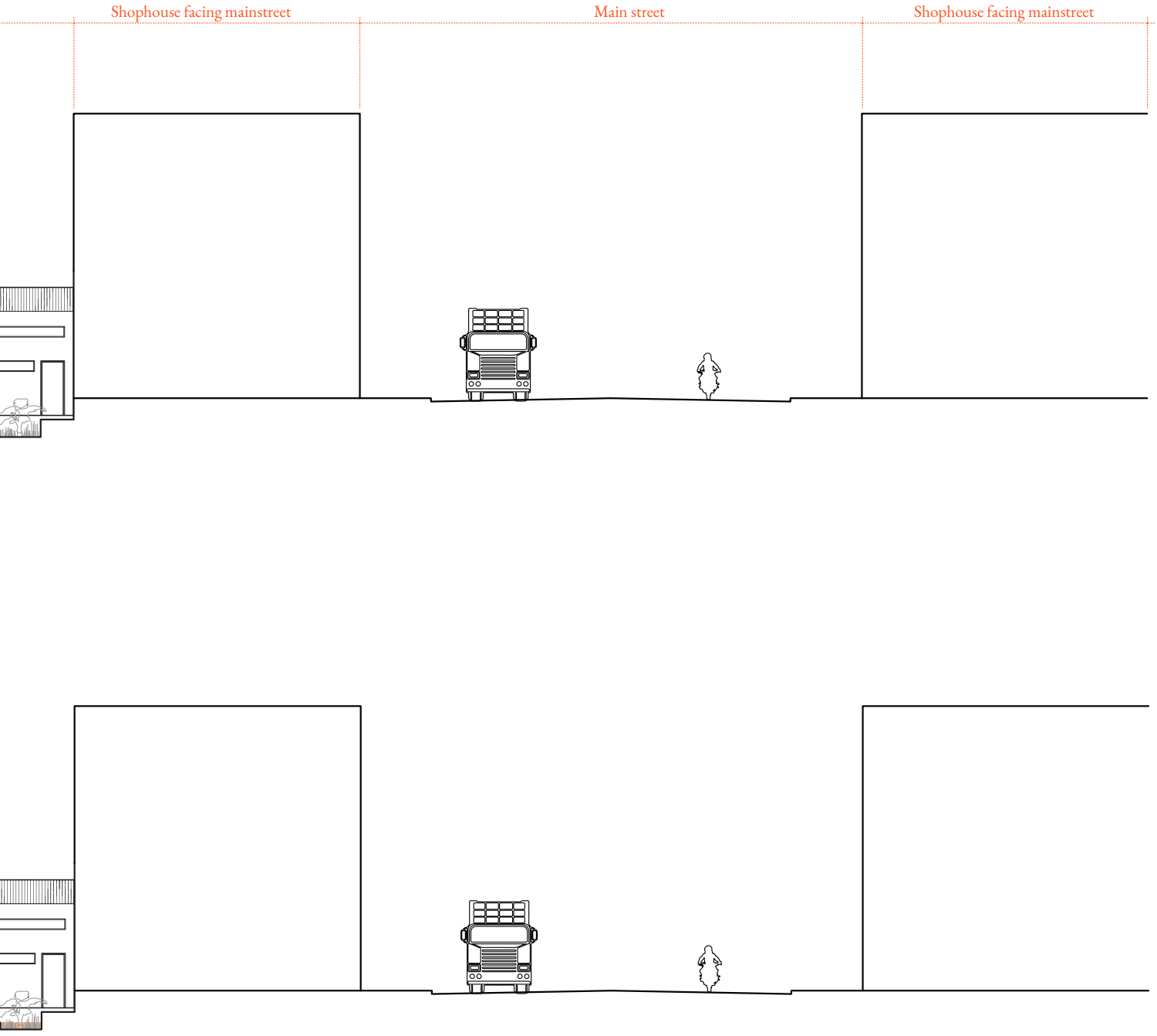

Shophouse facing mainstreet
Main street
Shophouse facing mainstreet

Fig. 4.29 Sectional perspective of houses that have flood-adaptive front yards shortly after a rainfall

Flood-adaptive front yard as temporary rainwater storage. Rainwater will be discharged slowly after each rainfall to relieve existing infrastructure.

MACRO-SCALE: SPONGES BETWEEN THE ALLEYWAYS

Bà con xa không bằng láng giềng gần.

A neighbour is better than a far-away relative.

– Vietnamese proverb.

Fig. 4.30 Isometric of Site 2 flood-adaptive public space. This site has a total area of 8,022 m2 and an effective capacity of 8,565 m3.

The macro-scale interventions engage unused parcels of land between alleyway neighbourhoods and transform them into flood-adaptive public spaces (fig. 4.29, 4.30 & 4.51). Although alleyway neighbourhoods represent a very dense fabric, there are still empty parcels that have been undeveloped or considered unsuitable for residential use (fig. 4.04-4.05). The proposed flood-adaptive public space will allow communal or commercial activities during the dry season. During rainfall, it can be repurposed and act as a swale to address an excess amount of rainwater in the vicinity (fig. 4.37-4.40, 4.43-4.46, 4.52-4.55 & 4.60-4.63). Part of this space will also be vegetated with local plants and perform as a soakaway to reduce the stress on the already outdated infrastructure. In contrast to the government's grandiose project at the urban fringes, the flood-adaptive public spaces in alleyway neighbourhoods can show residents how rainwater will be managed locally. Thus, it can provide some basic knowledge of stormwater management and cultivate more public appreciation and engagement. Finally, this space will act as an extension to the alleyway as a public space and strengthen the relationships between households (fig. 4.41-4.42, 4.47-4.50, 4.56-4.59 & 4.66-4.67).

The funding for this flood-adaptive public space will come directly from the local government of each district or ward to initiate the project. Local households will also contribute a small amount. In fact, the elevation of alleyways has been funded in a similar fashion. Furthermore, monetary contributions and volunteer work provide each household with a sense of ownership over the space and encourage them to use it. For example, part of this public space can be a commercial zone and rented out in rotation to foster local small businesses (fig. 4.41-4.42 & 4.47-4.48). With this program, people will be responsible for the area and carry out regular maintenance. The democratic program to fund and operate this space will guarantee its vitality and longevity. It will also allow the future morphology of such a space to meet the new demands of each neighbourhood. With macro-scale interventions as a guideline, each flood-adaptive public space will adapt and change to manifest each alleyway neighbourhood's identity.

Fig. 4.31 Site plan of flood-adaptive public space (Site 2). This site includes a series of new buildings to support the social and commercial functions of alleyway neighbourhoods. Some of these buildings (such as community hall, pavilion, marketplace) can be flooded without being damaged. At the same time, other buildings (such as washroom, pump station, exercise space) are located on earth moulds to remain fully functional.


Section B
RESILIENT GROUND
+1
0.5
0
1
2
3
Pump Station
0
Pavilion
0
-0.5
0.5
0
Marketplace
Main Street
Canal
-3
+1.5
5m
10m
25m

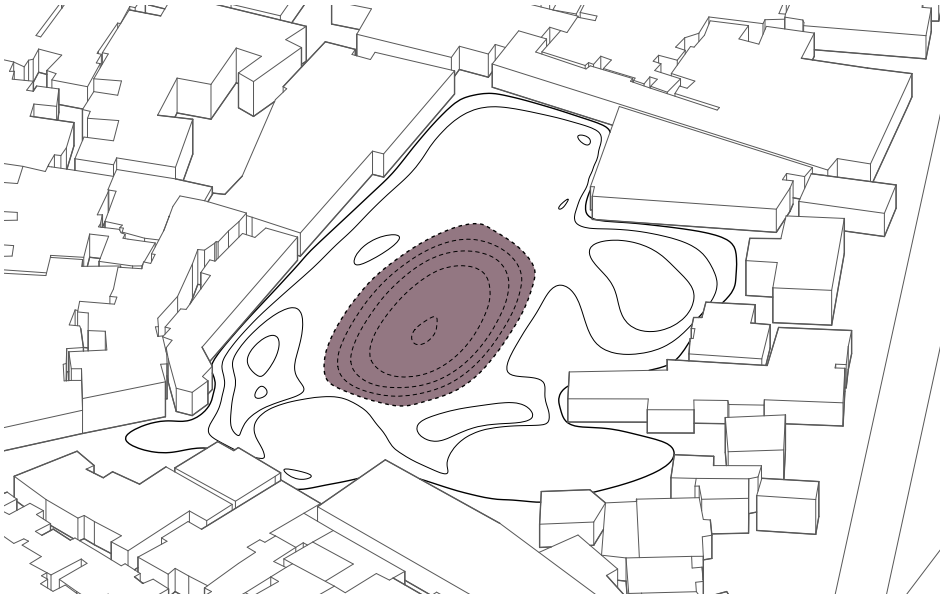


Fig. 4.32 The central area will be excavated to be the main flood storage. Total excavated soil thas a volume of 2,190 m³.

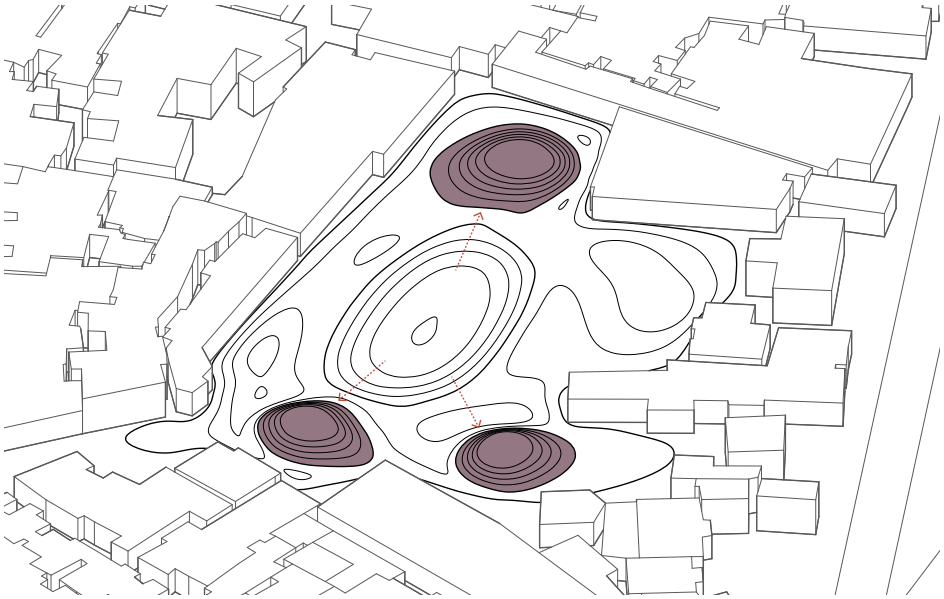


Fig. 4.33 Excavated soil will be used to build up earth mounds that have a total volume of 2252 m³.

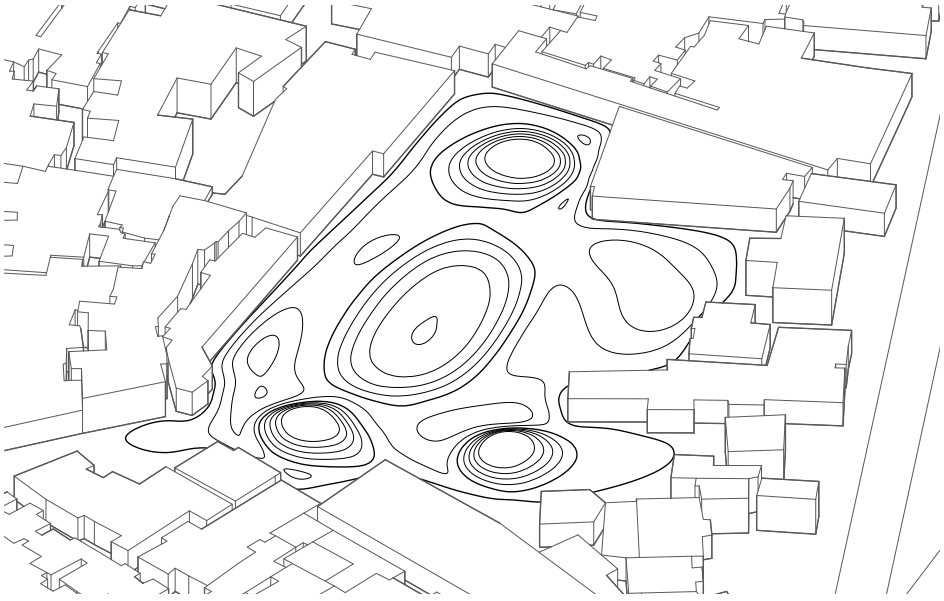


Fig. 4.34 Site 2's topography.

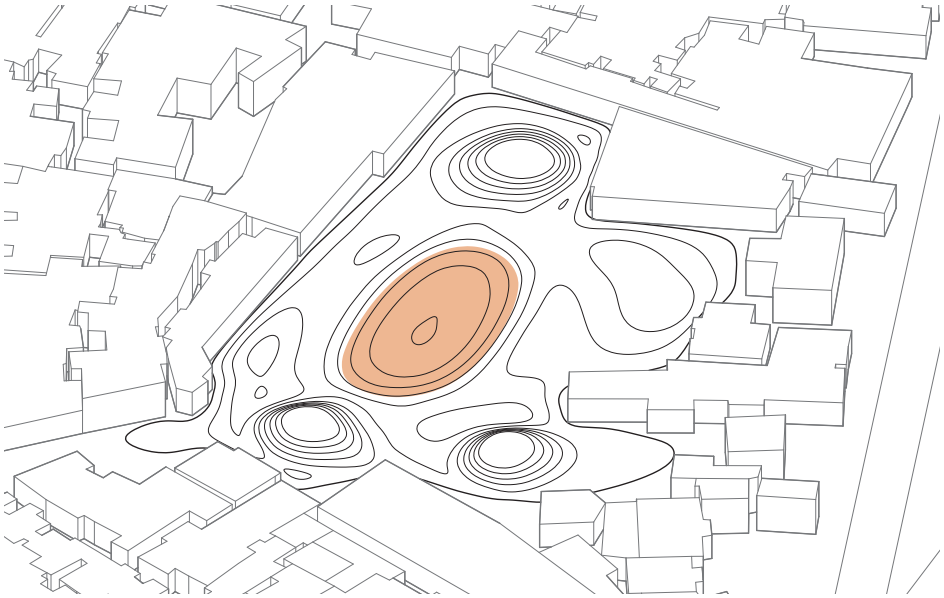


Fig. 4.35 Flood level 1: 1100 m³ of rainwater- 14% of total rainwater that the flood-adaptive public space is supposed to take.

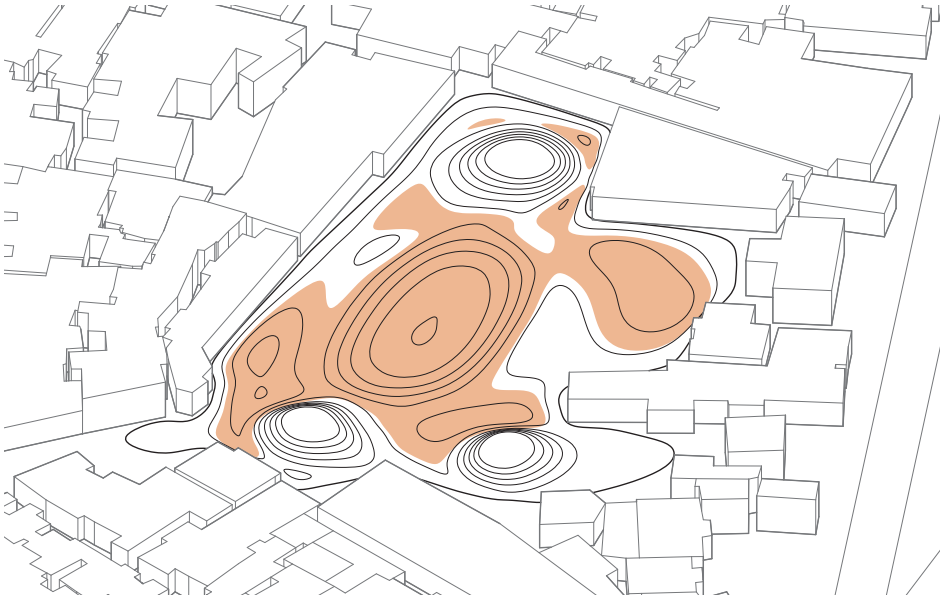


Fig. 4.36 Flood level 2: 3810 m³ of rainwater- 48% of total rainwater that the flood-adaptive public space is supposed to take.

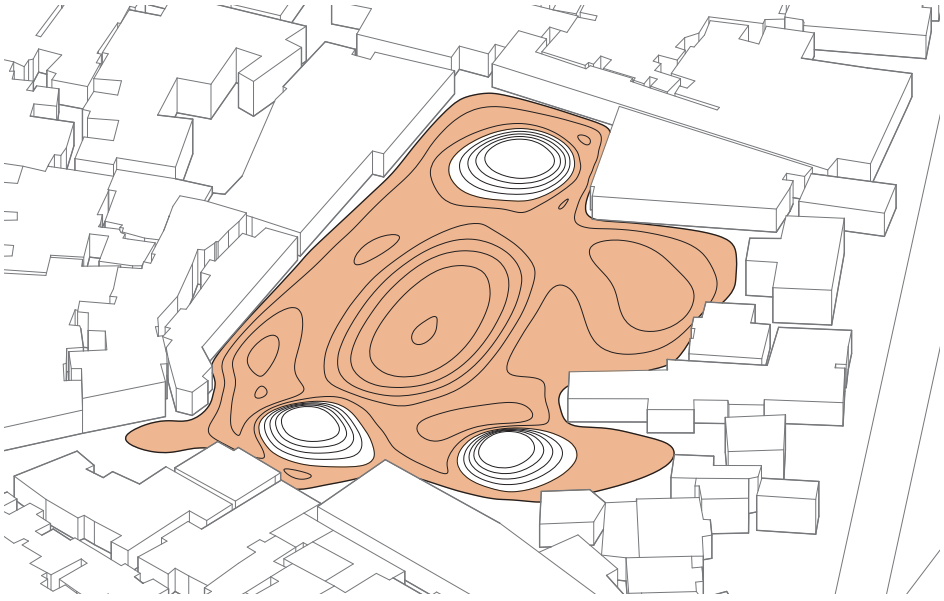


Fig. 4.37 Flood level 3: 8565 m³ of rainwater- 108% of total rainwater that the flood-adaptive public space is supposed to take.

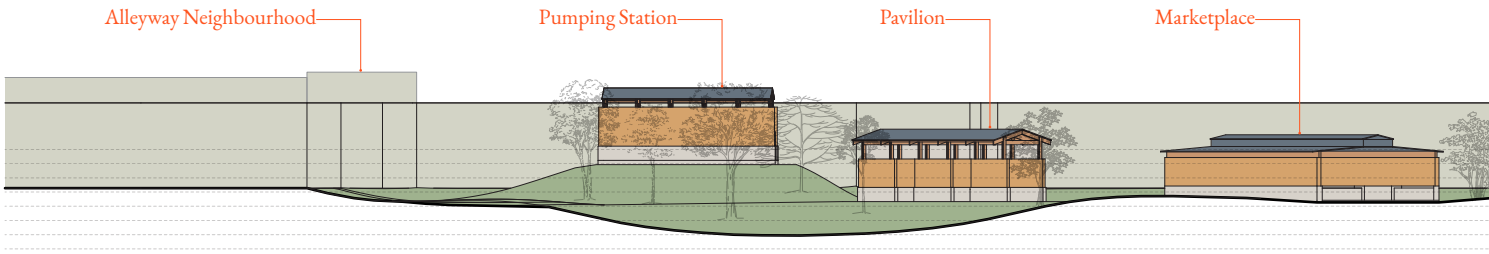


Fig. 4.38 *Section A: Dry condition.*

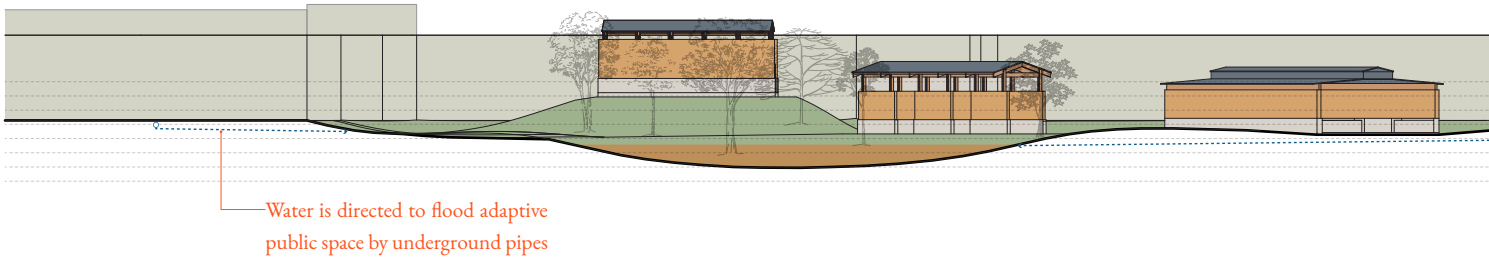


Fig. 4.39 *Section A: Flood condition level 1.*

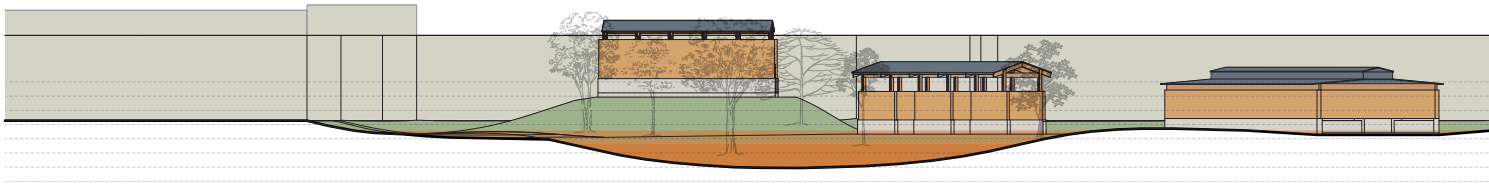


Fig. 4.40 *Section A: Flood condition level 2.*

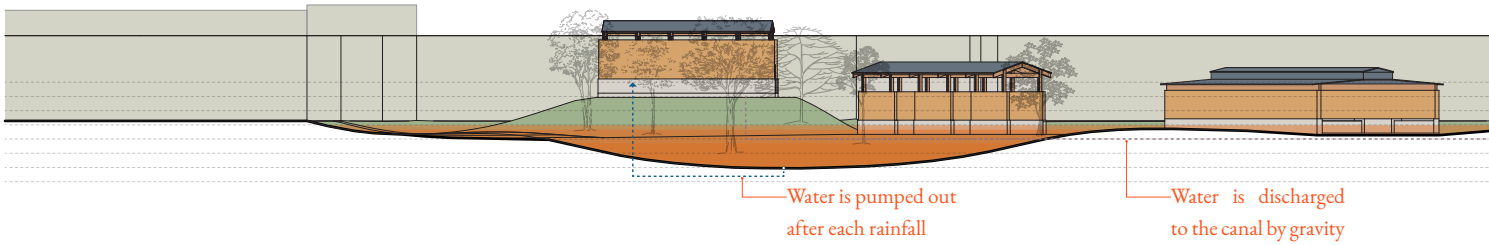
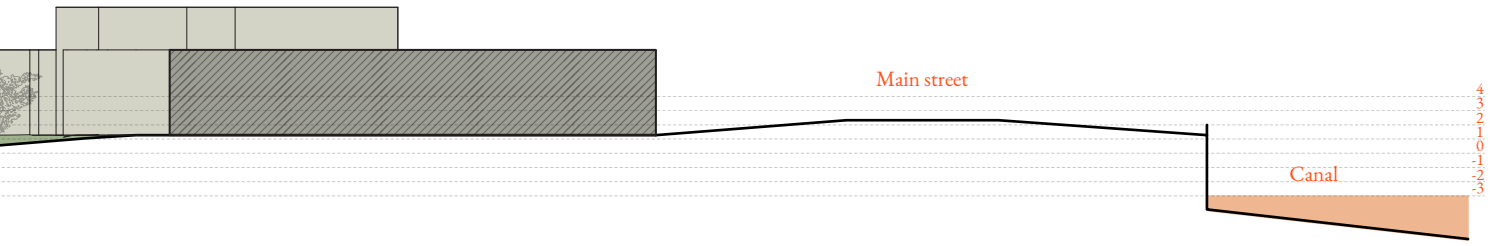
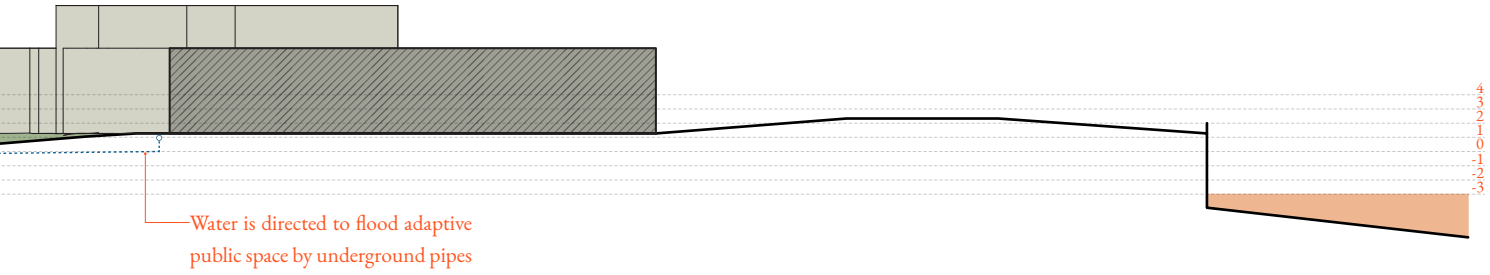
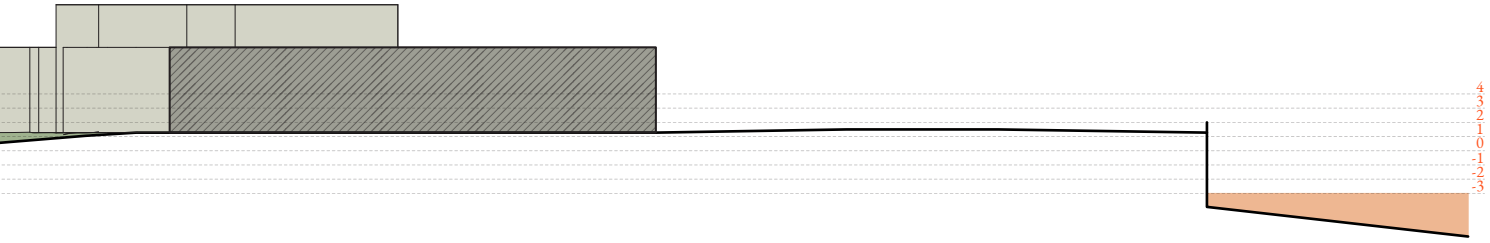


Fig. 4.41 *Section A: Flood condition level 3.*


Main street
Canal
4
3
2
1
0
-1
-2
-3


Water is directed to flood adaptive
public space by underground pipes
4
3
2
1
0
-1
-2
-3


4
3
2
1
0
-1
-2
-3

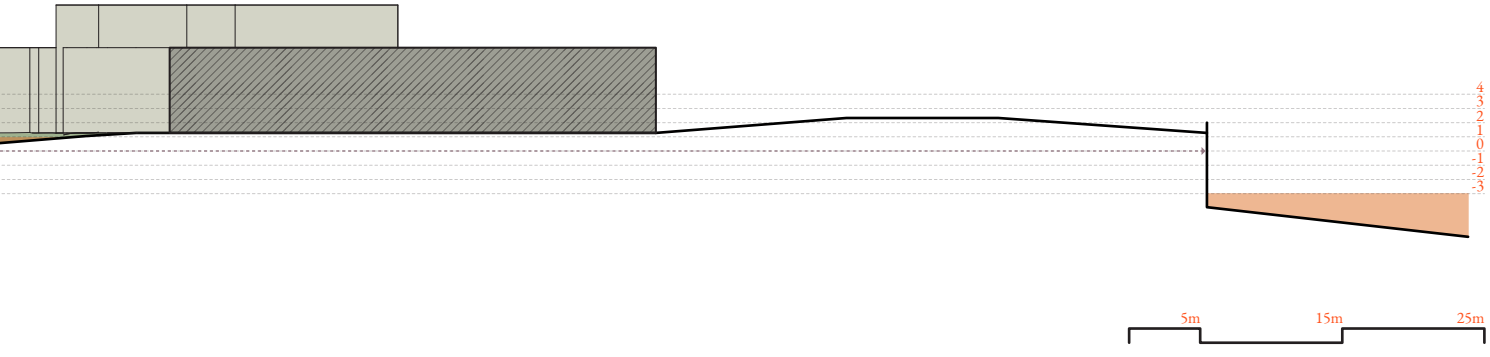
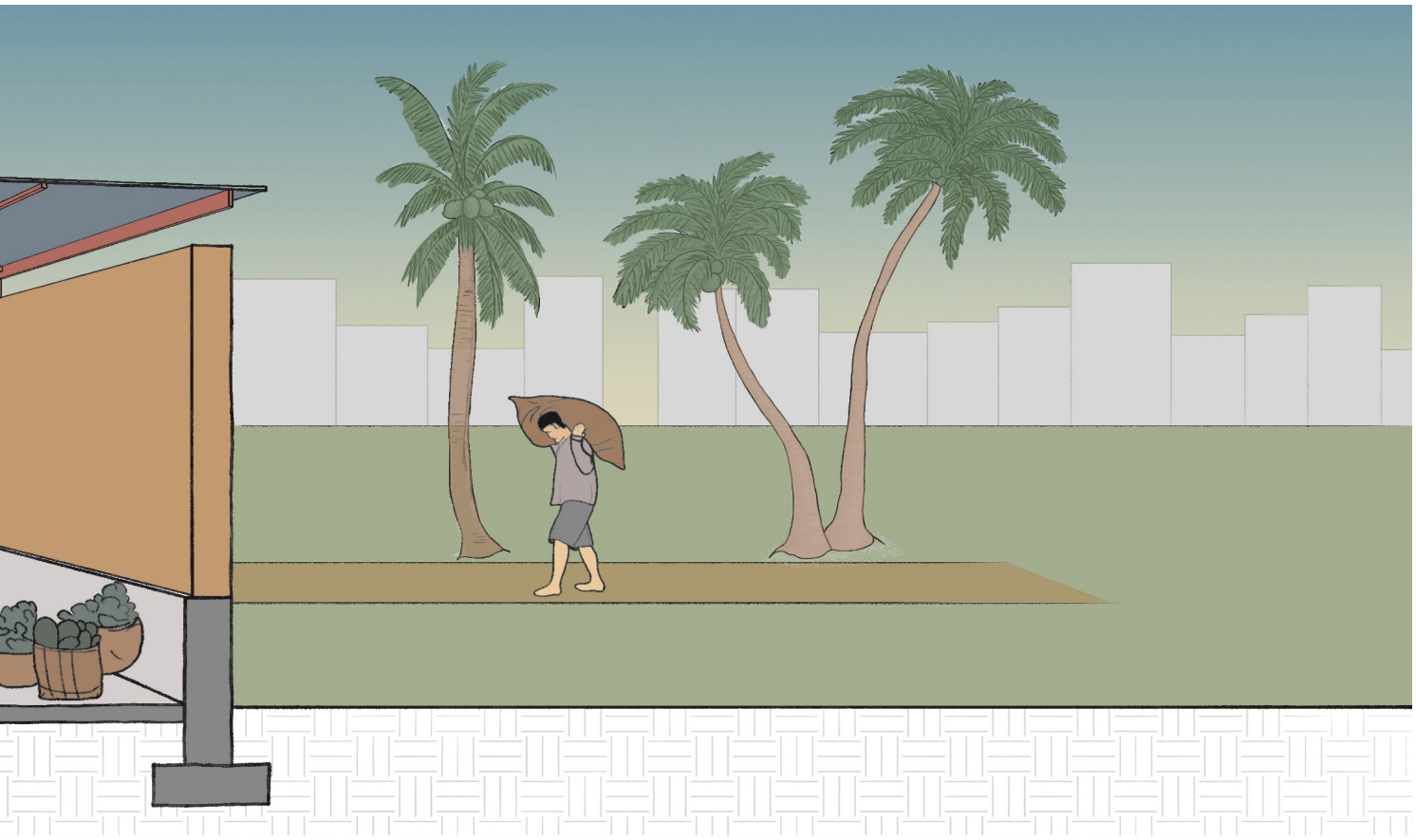
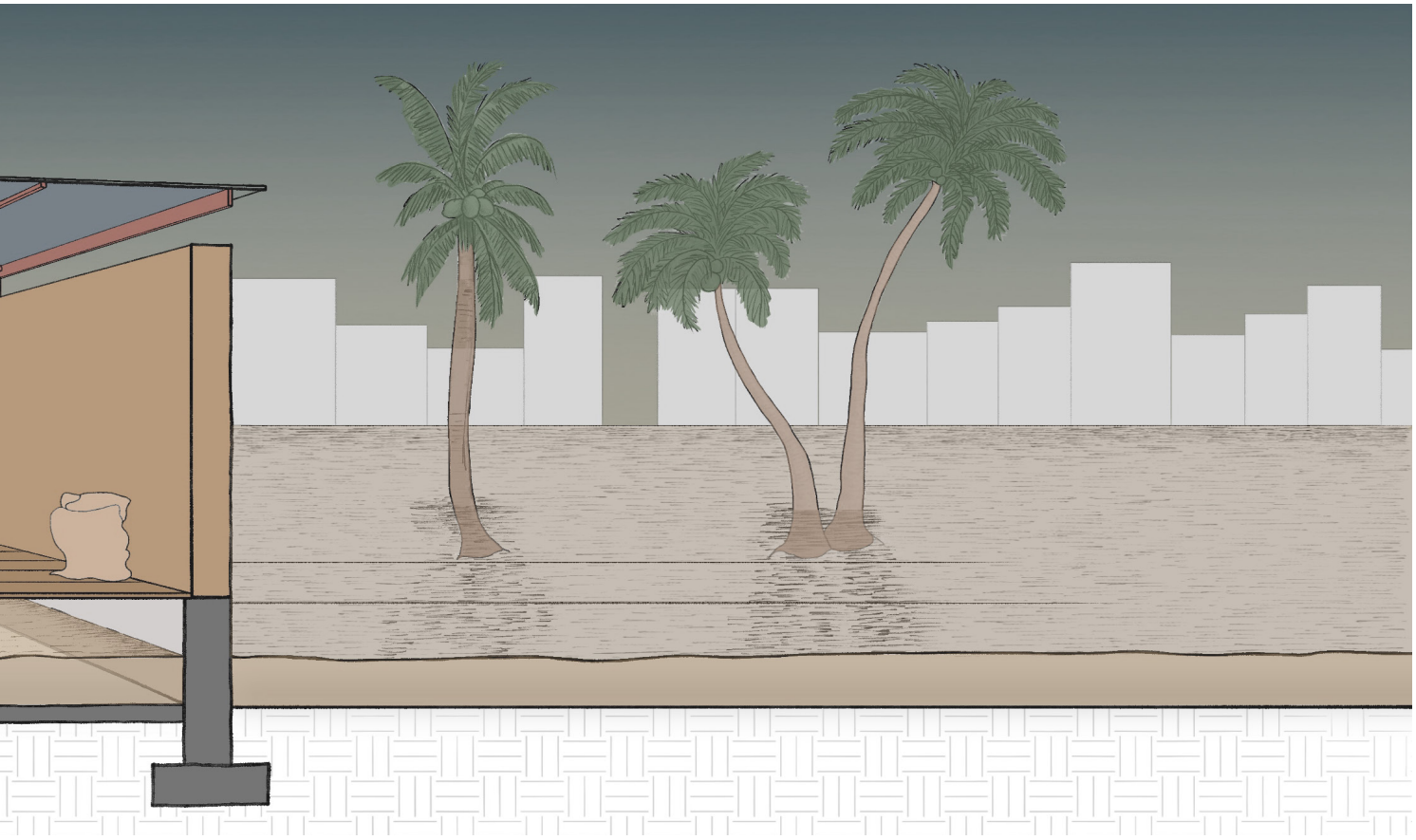

4
3
2
1
0
-1
-2
-3
5m
15m
25m

Fig. 4.42 Flood-adaptive marketplace in dry condition.

Fig. 4.43 Flood-adaptive marketplace in flood condition.





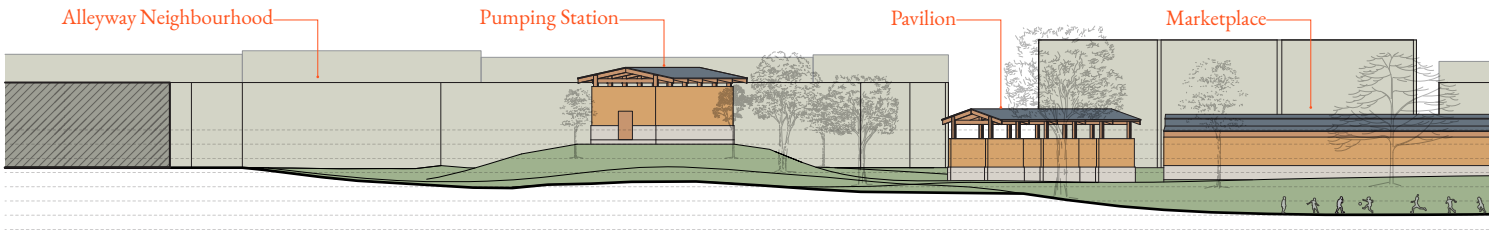


Fig. 4.44 *Section B: Dry condition.*

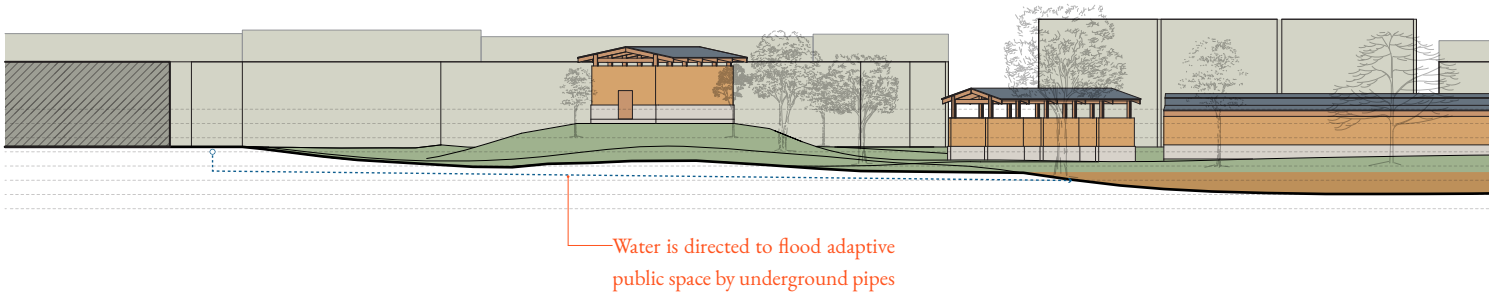


Fig. 4.45 *Section B: Flood condition level 1.*

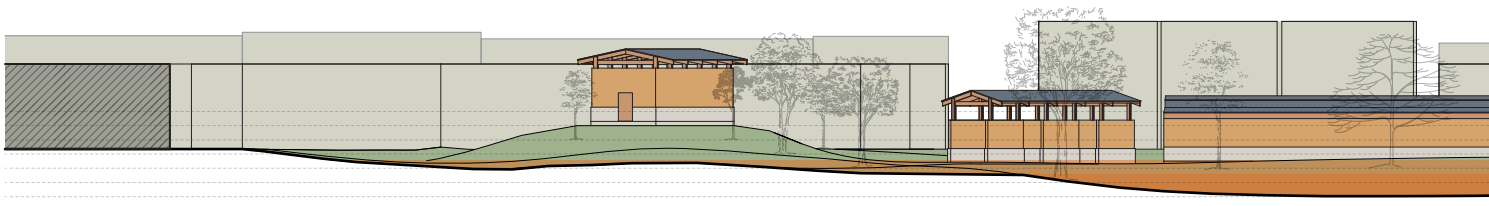


Fig. 4.46 *Section B: Flood condition level 2.*

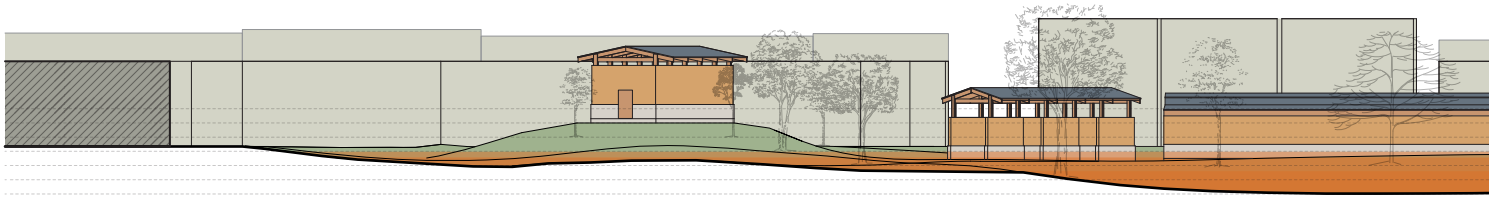
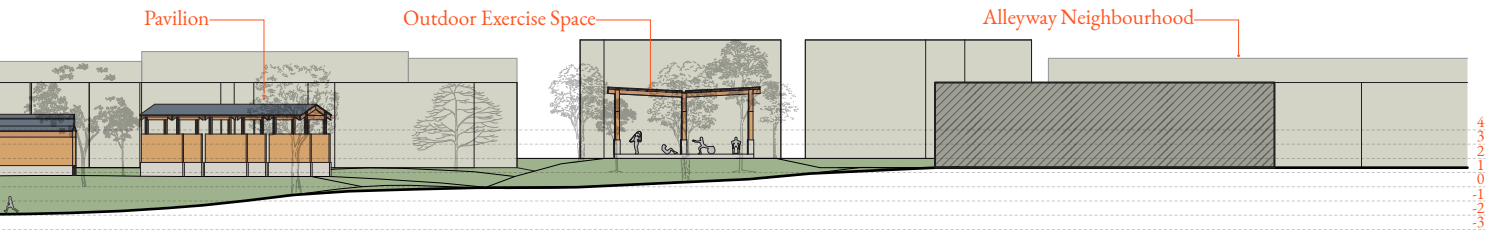
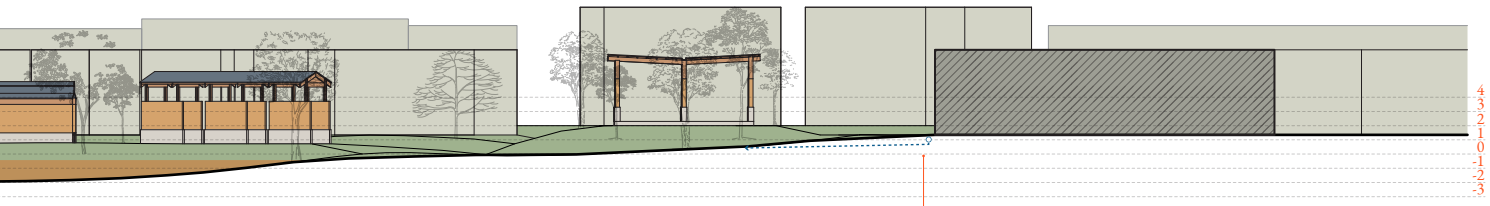
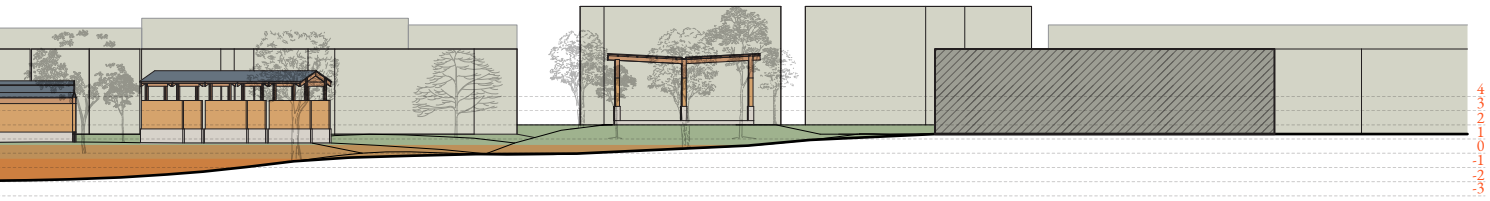
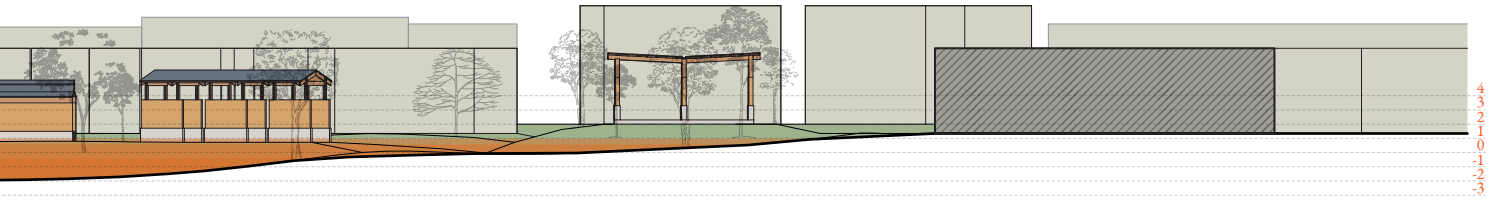


Fig. 4.47 *Section B: Flood condition level 3.*


Pavilion
Outdoor Exercise Space
Alleyway Neighbourhood
4
3
2
1
0
-1
-2
-3

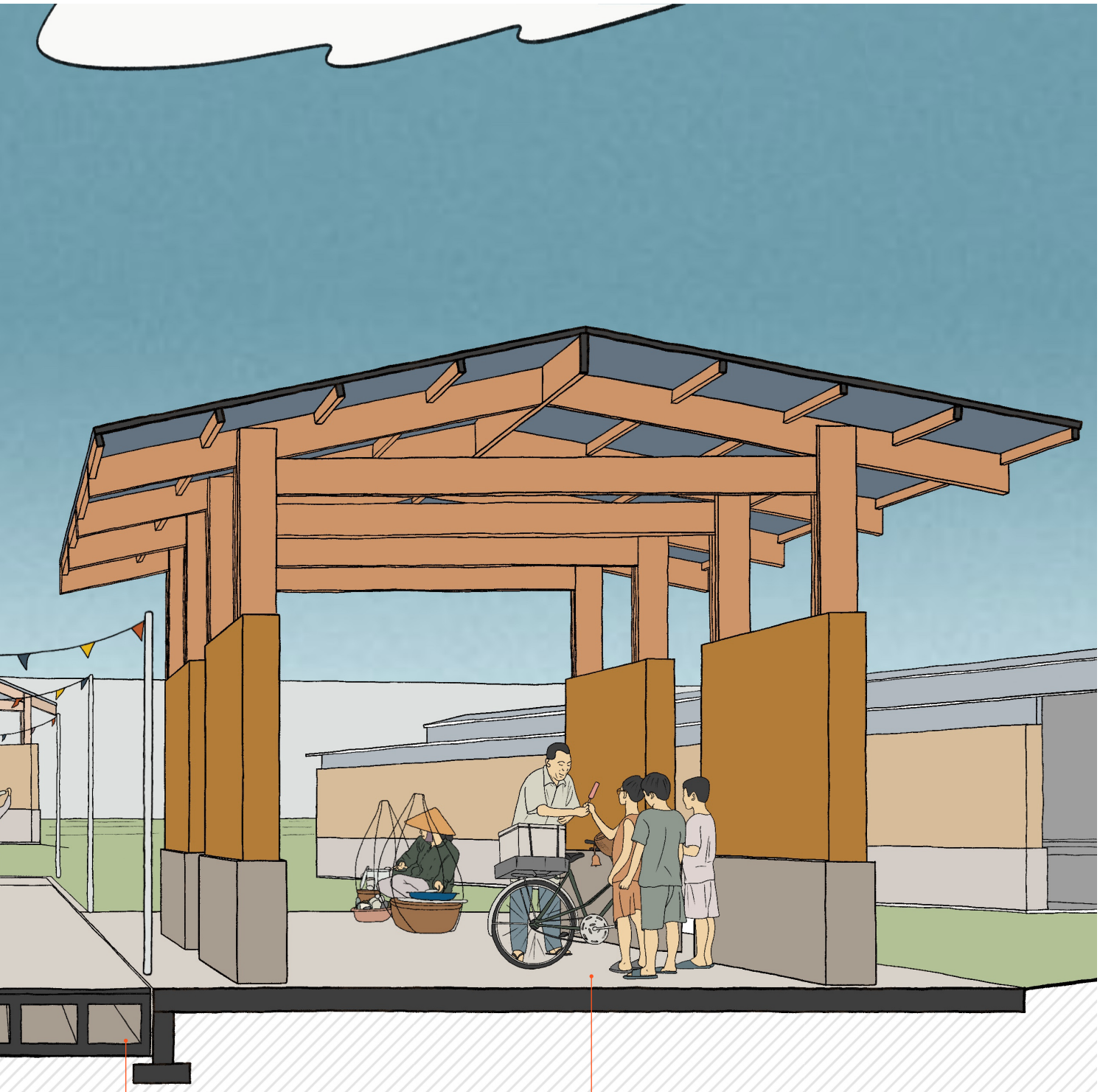

4
3
2
1
0
-1
-2
-3
Water is directed to flood adaptive
public space by underground pipes


4
3
2
1
0
-1
-2
-3


4
3
2
1
0
-1
-2
-3


5m
15m
25m

Fig. 4.48 Section of amphibious walkway in flood apdative public space in dry condition. (in Site 2 and 3)



Amphibious walkway resting on the ground during dry season

Pavilion

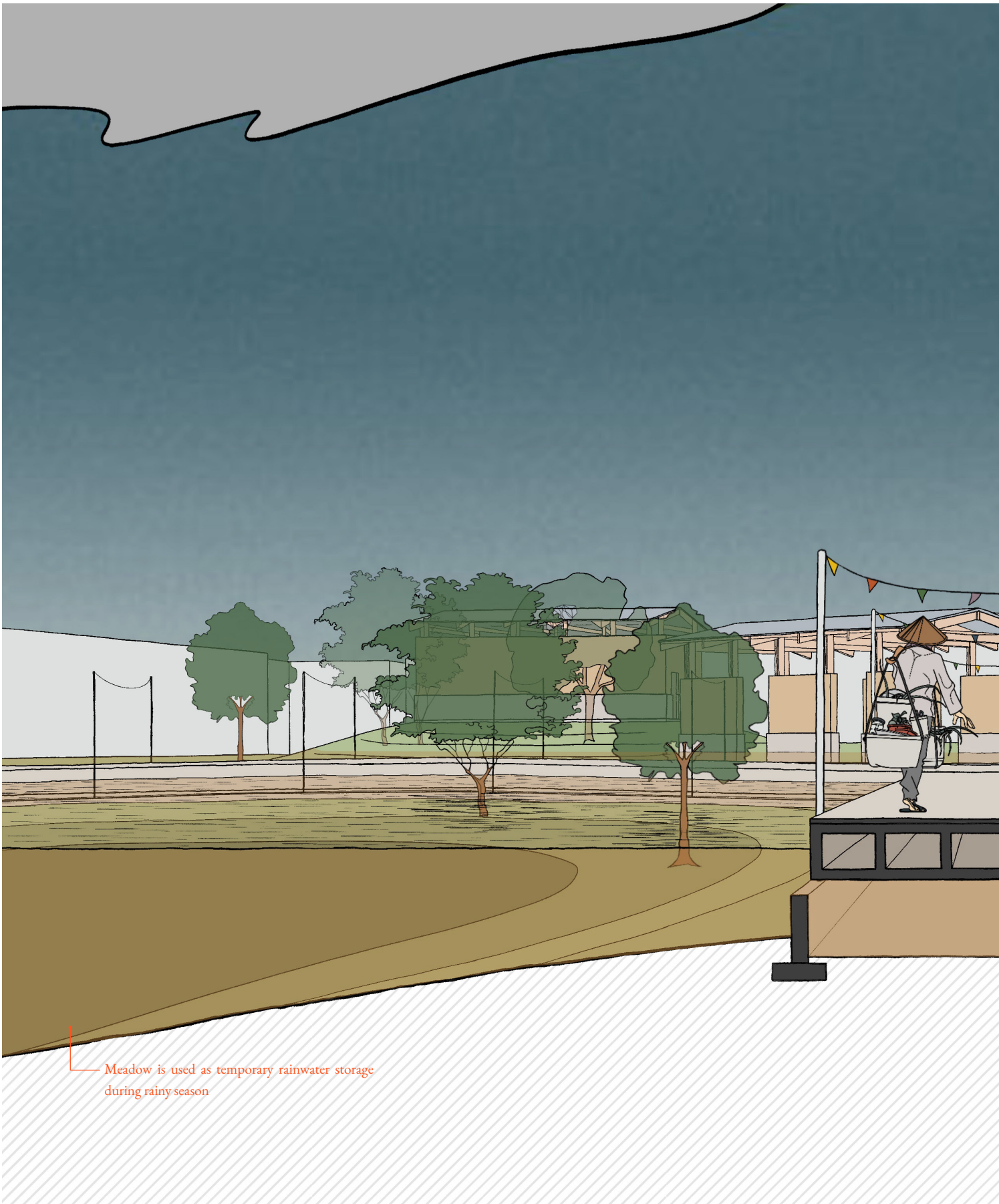
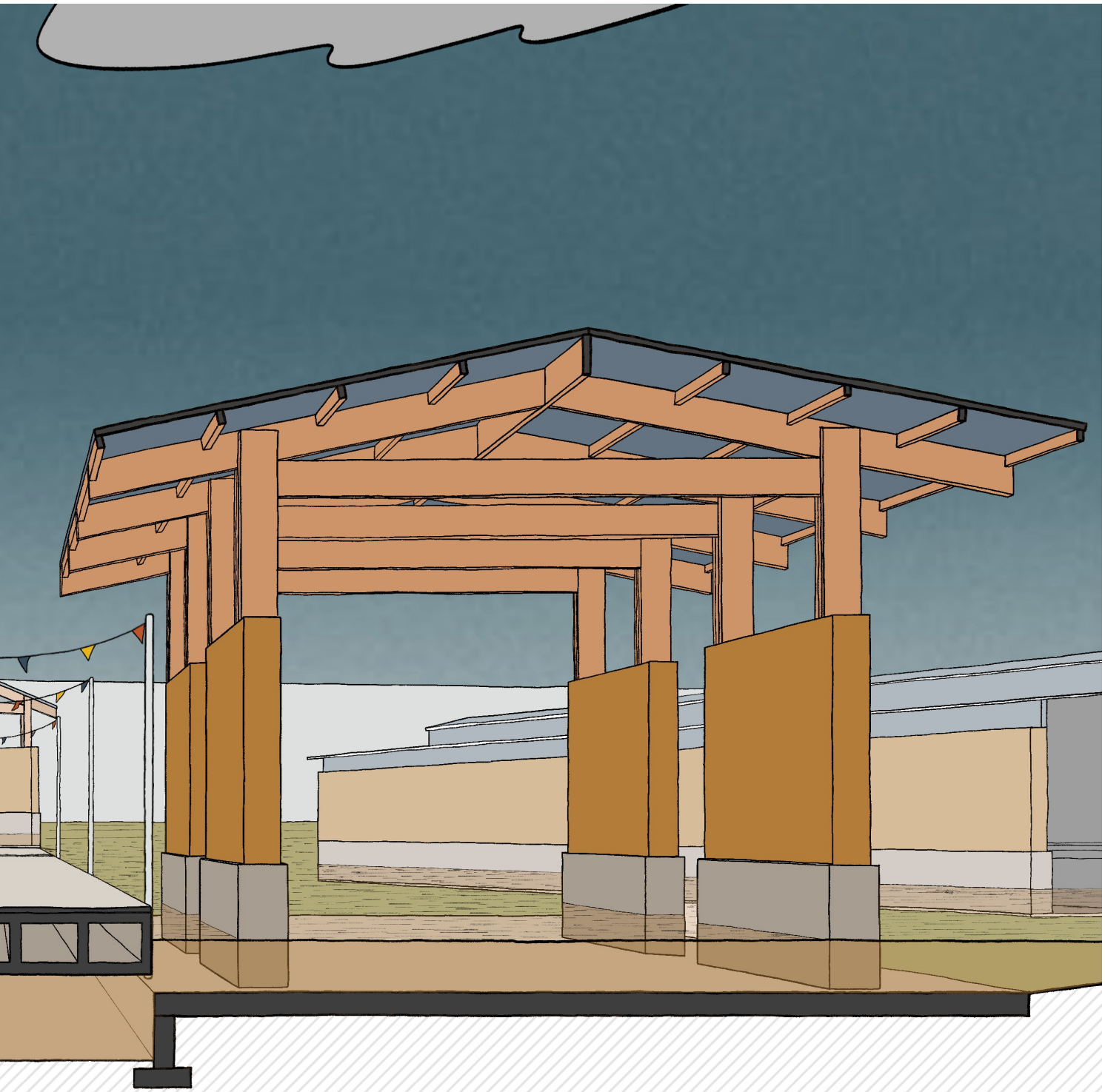


Fig. 4.49 Section of amphibious walkway in flood apdative public space in flood condition. (in Site 2 and 3)



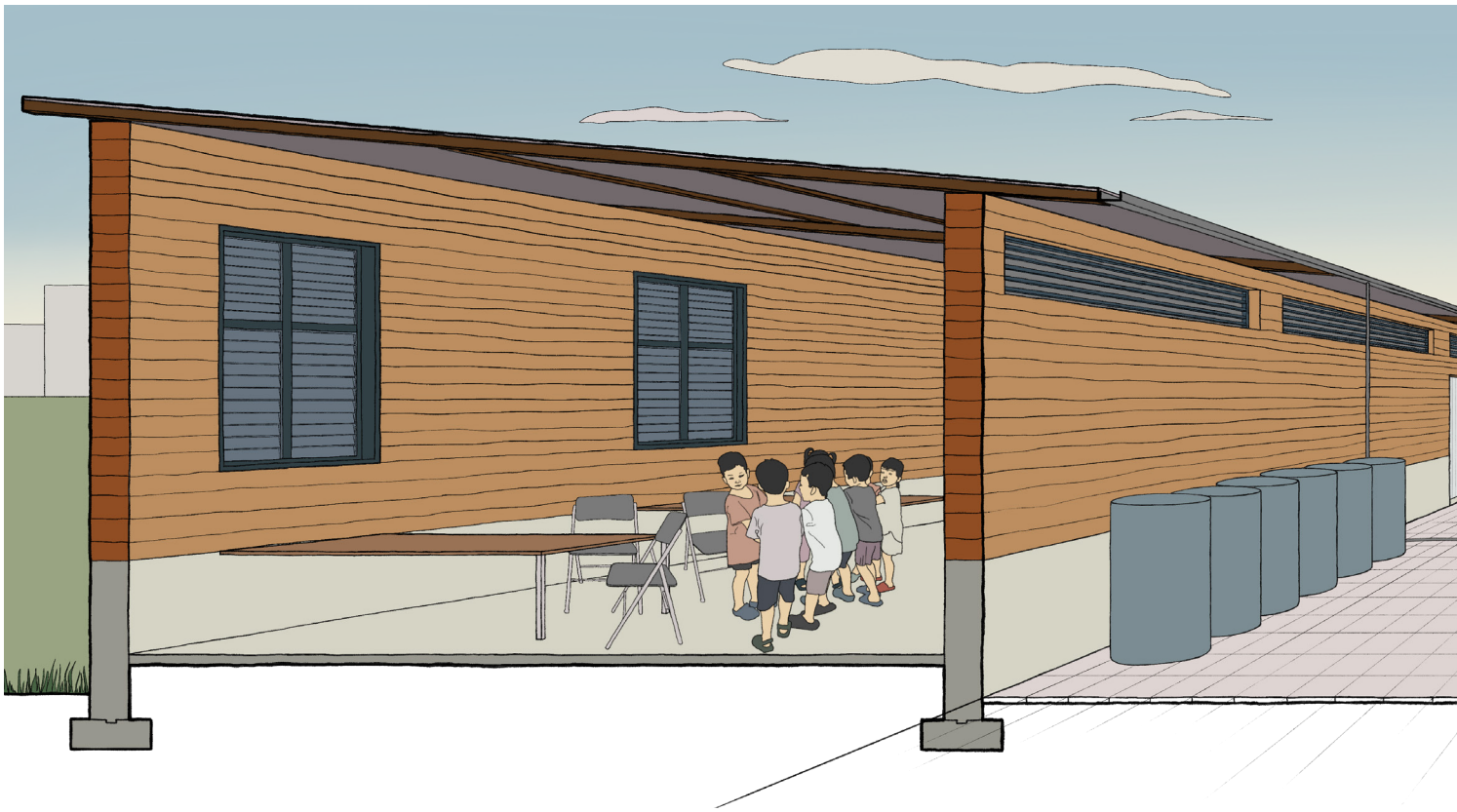


Fig. 4.50 Normal conditions of flood-adaptive community hall and garden. (in Site 2 and 3)

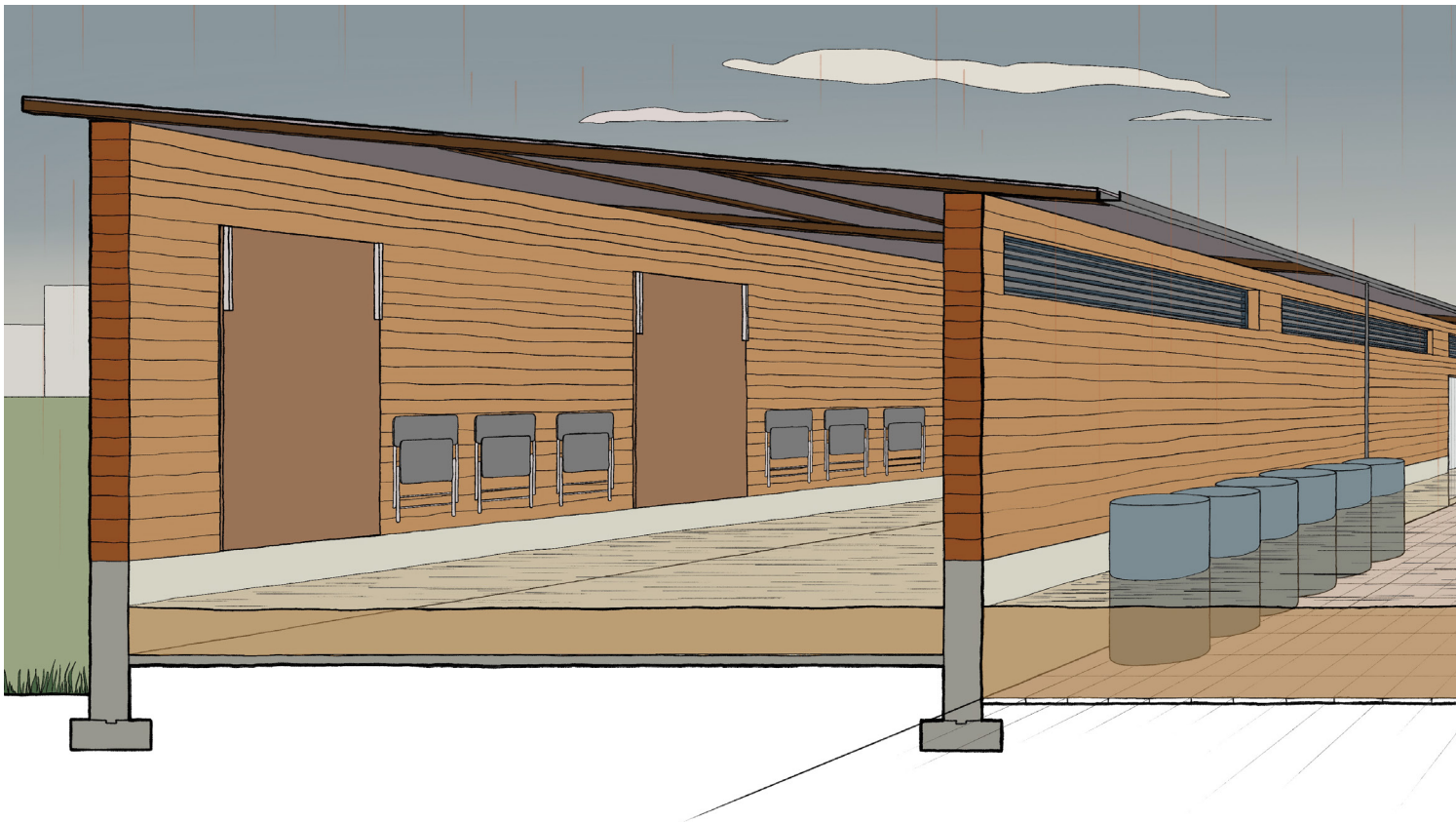
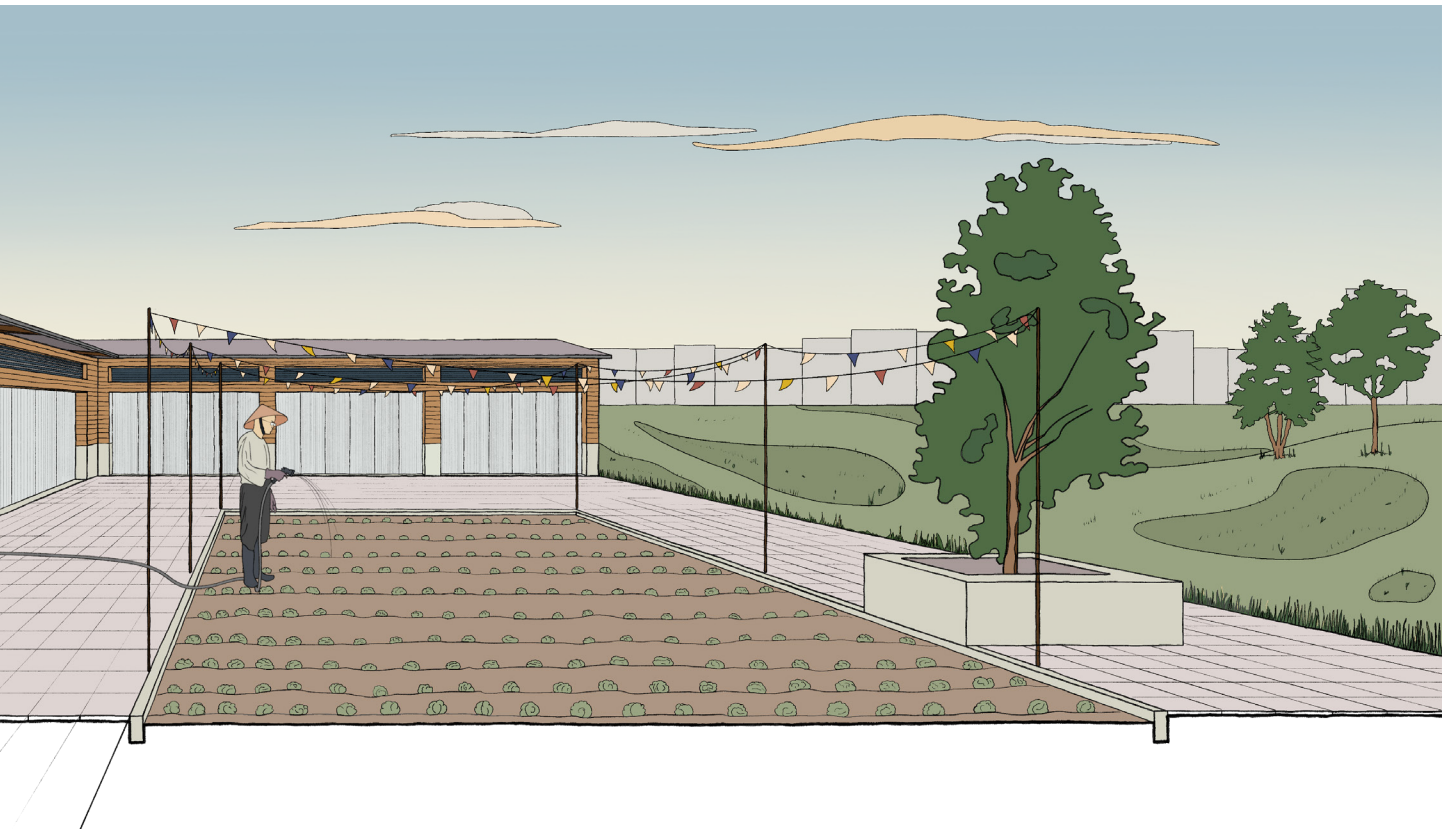


Fig. 4.51 Flood conditions of flood-adaptive community hall and garden. (in Site 2 and 3)



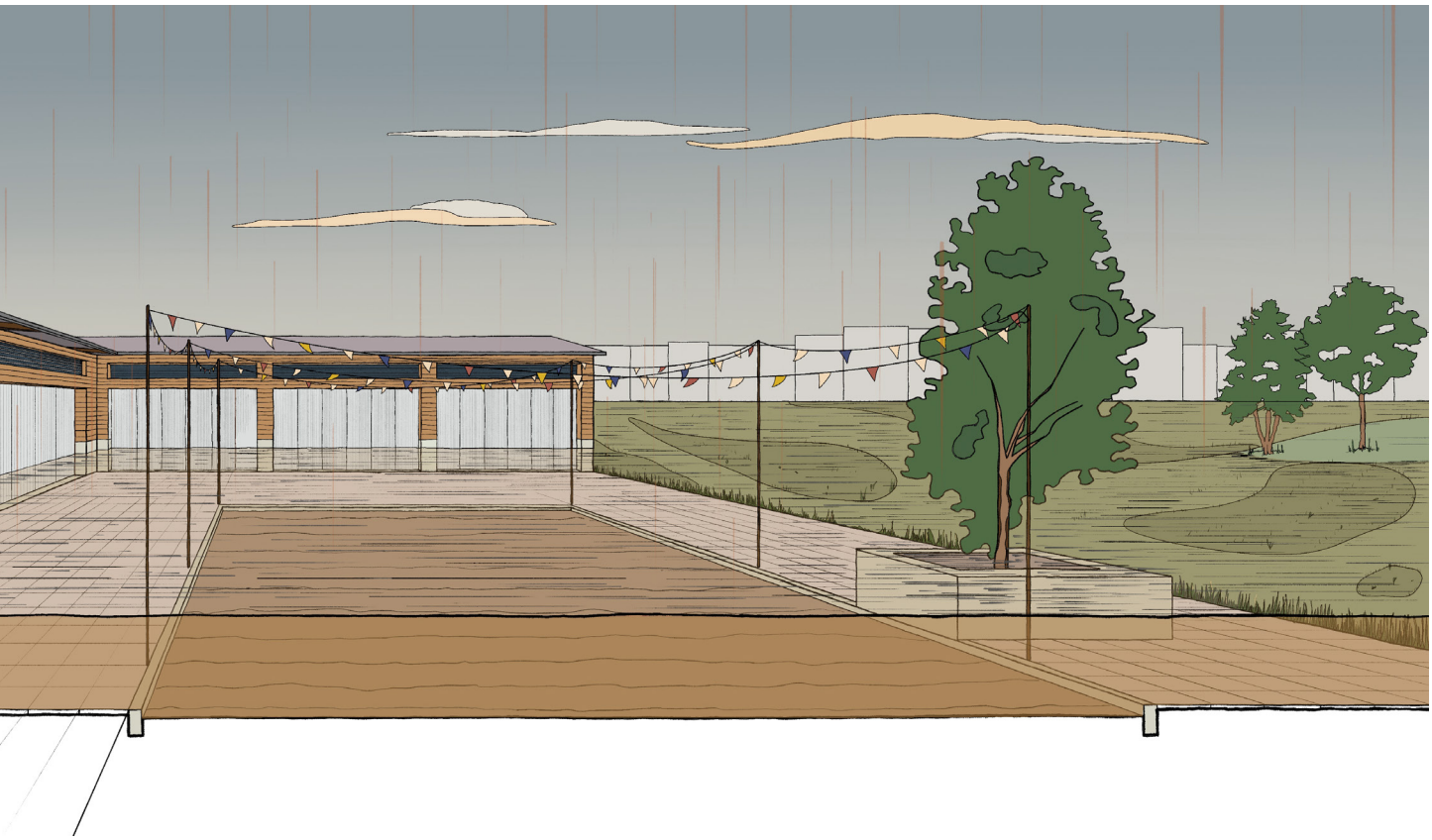


Fig. 4.52 Site plan of flood-adaptive public space (Site 1). This site has an area of 25,000 m2 and an effective capacity of 25,135 m3. Site 1 has similar buildings compared to Site 2. However, its walkways are elevated to connect two different alleyway neighbourhoods (north and south). Site 1 also has two wetland areas that can retain rainwater and function as soakaways.


Section D
Public Washroom
Meadow (main flood storage)
Pump Station
Pavilion
Wetland / Soakaway
Elevated walkway
Community Hall
Main Street
Canal
10m
20m
30m

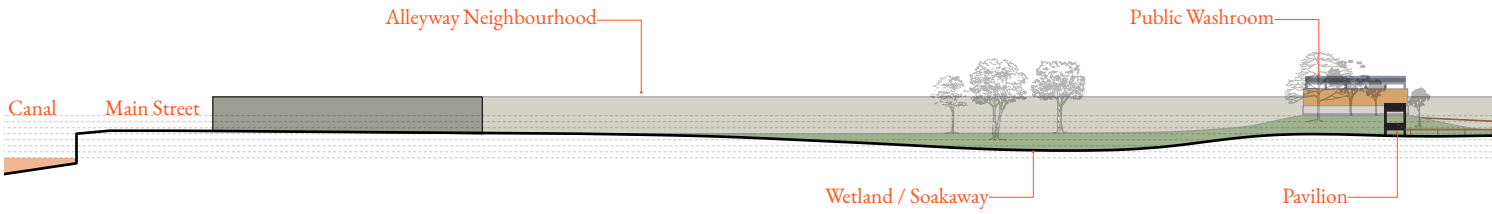


Fig. 4.53 Section C: Dry condition.

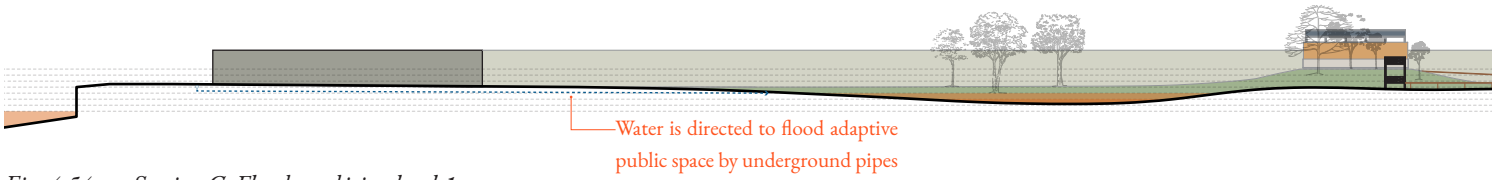


Fig. 4.54 Section C: Flood condition level 1.

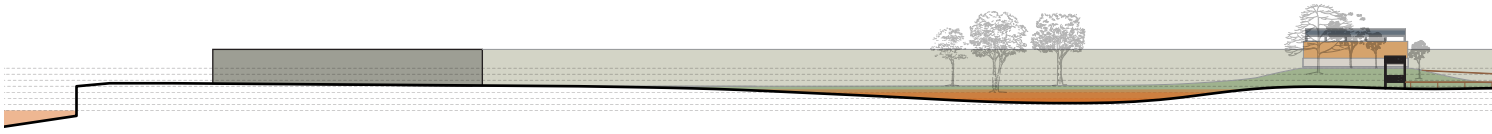


Fig. 4.55 Section C: Flood condition level 2.

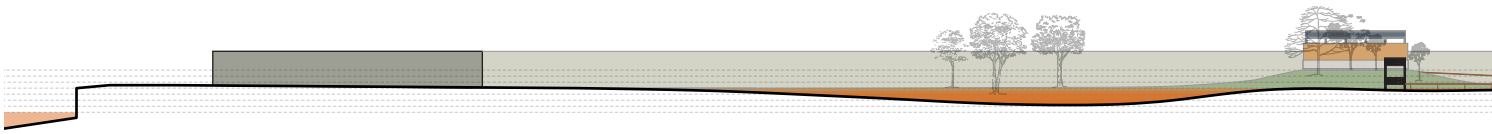


Fig. 4.56 Section C: Flood condition level 2.

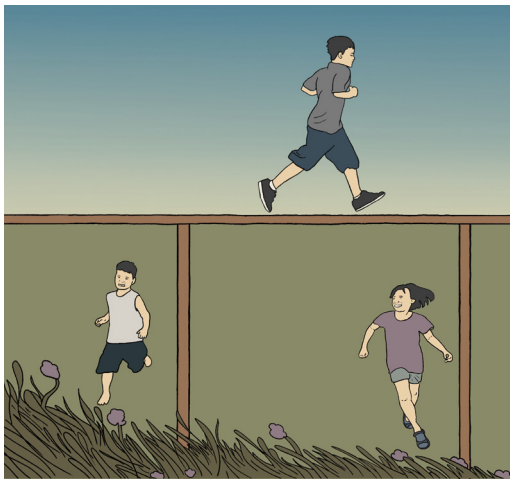


Fig. 4.57 Elevated walkway in dry condition.

Fig. 4.58 Walkway connecting to building on the hill (dry condition).

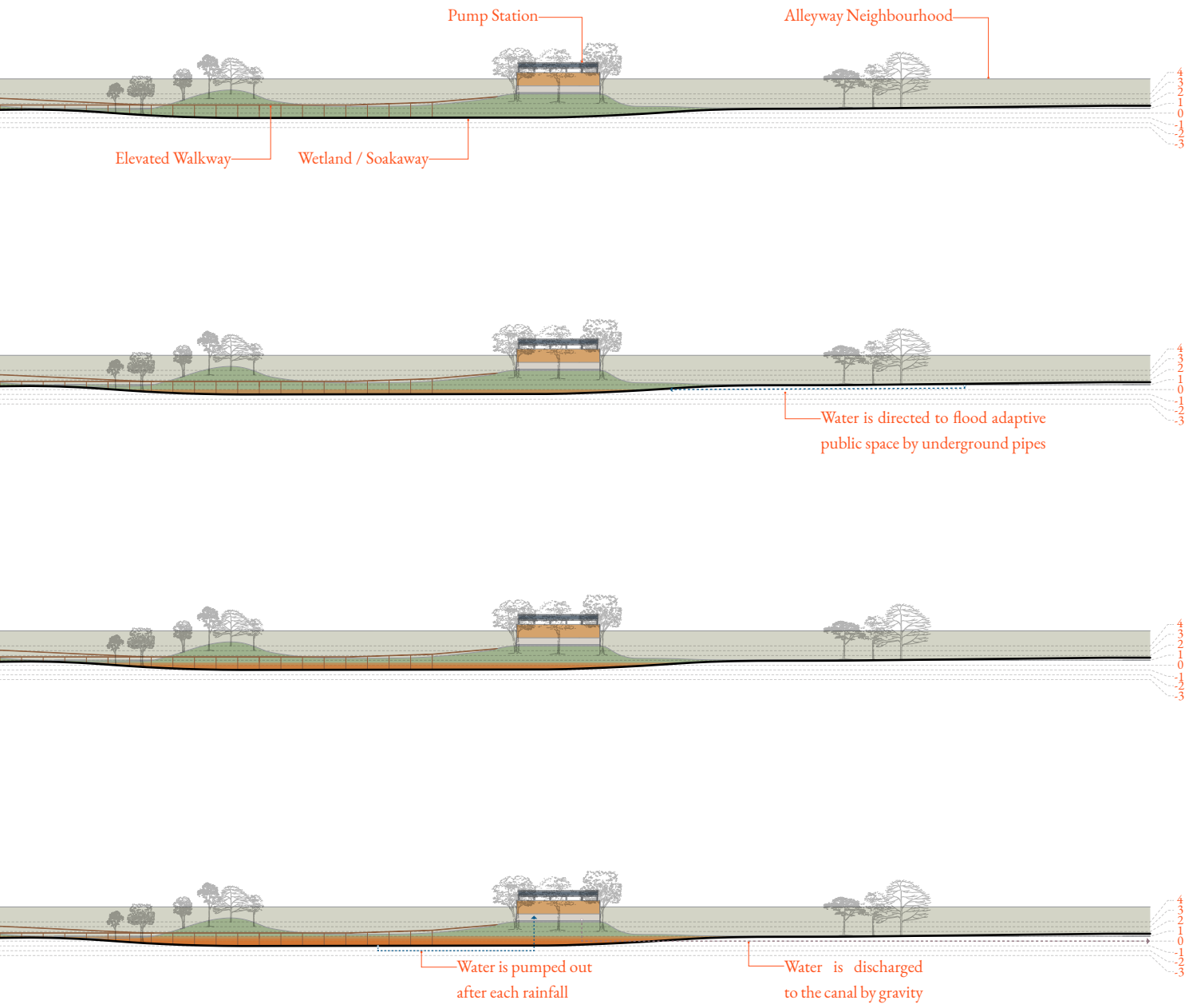


Fig. 4.59 Walkway connecting to building on the hill (flood condition).

Fig. 4.60 Elevated walkway in flood condition.

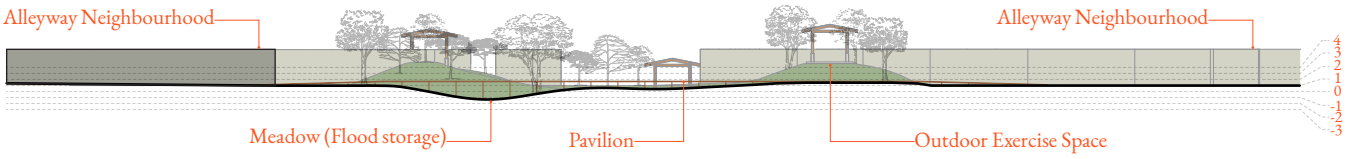


Fig. 4.61 Section D: Dry condition.

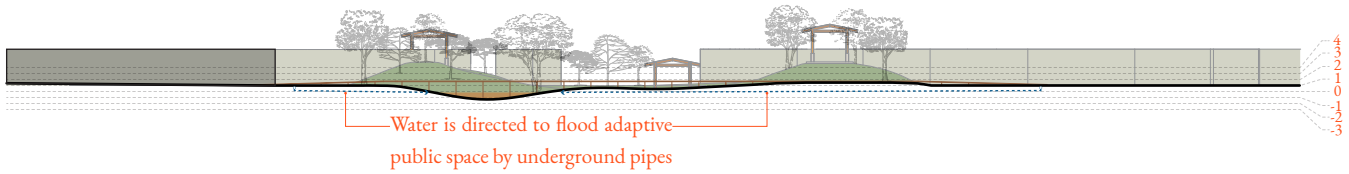


Fig. 4.62 Section D: Flood condition level 1.

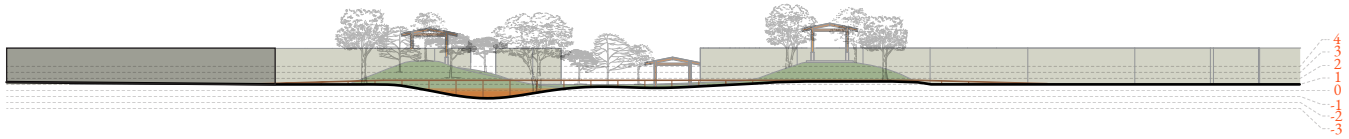


Fig. 4.63 Section D: Flood condition level 2.

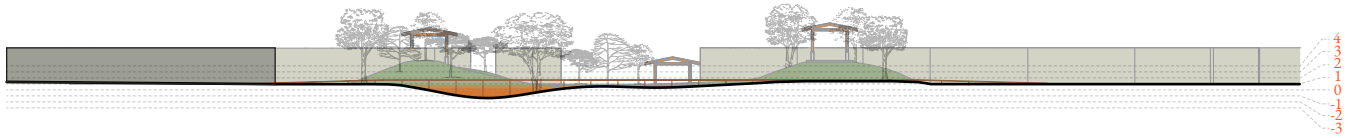


Fig. 4.64 Section D: Flood condition level 3.

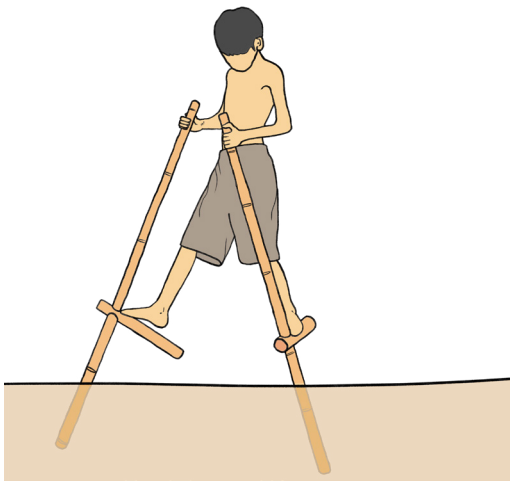


Fig. 4.65 Children in flood adatpive public space.

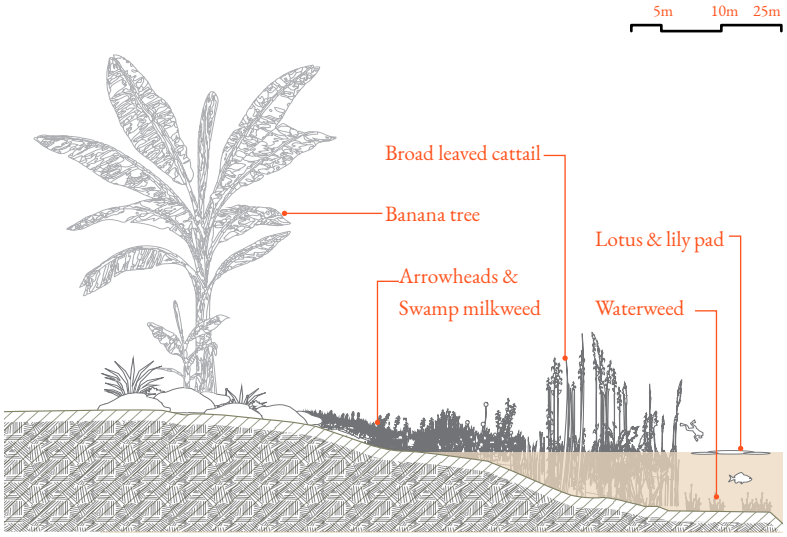


Fig. 4.66 Landscape details of soakaway area in flood-adaptive public space

Fig. 4.67 *Elevated walkway connecting to different building in Site 1's flood-adaptive public space (dry condition).*

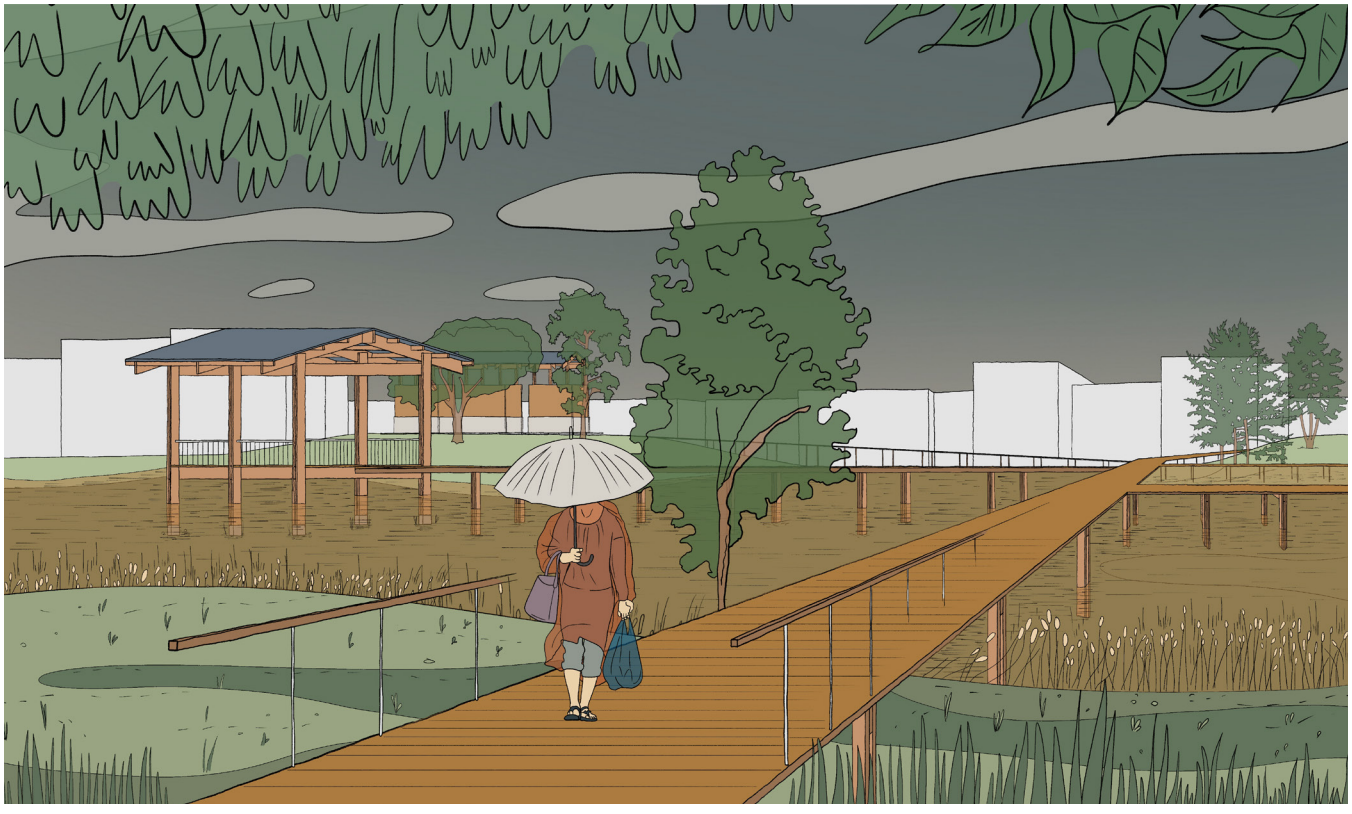


Fig. 4.68 *Elevated walkway connecting to different building in Site 1's flood-adaptive public space (flood condition).*

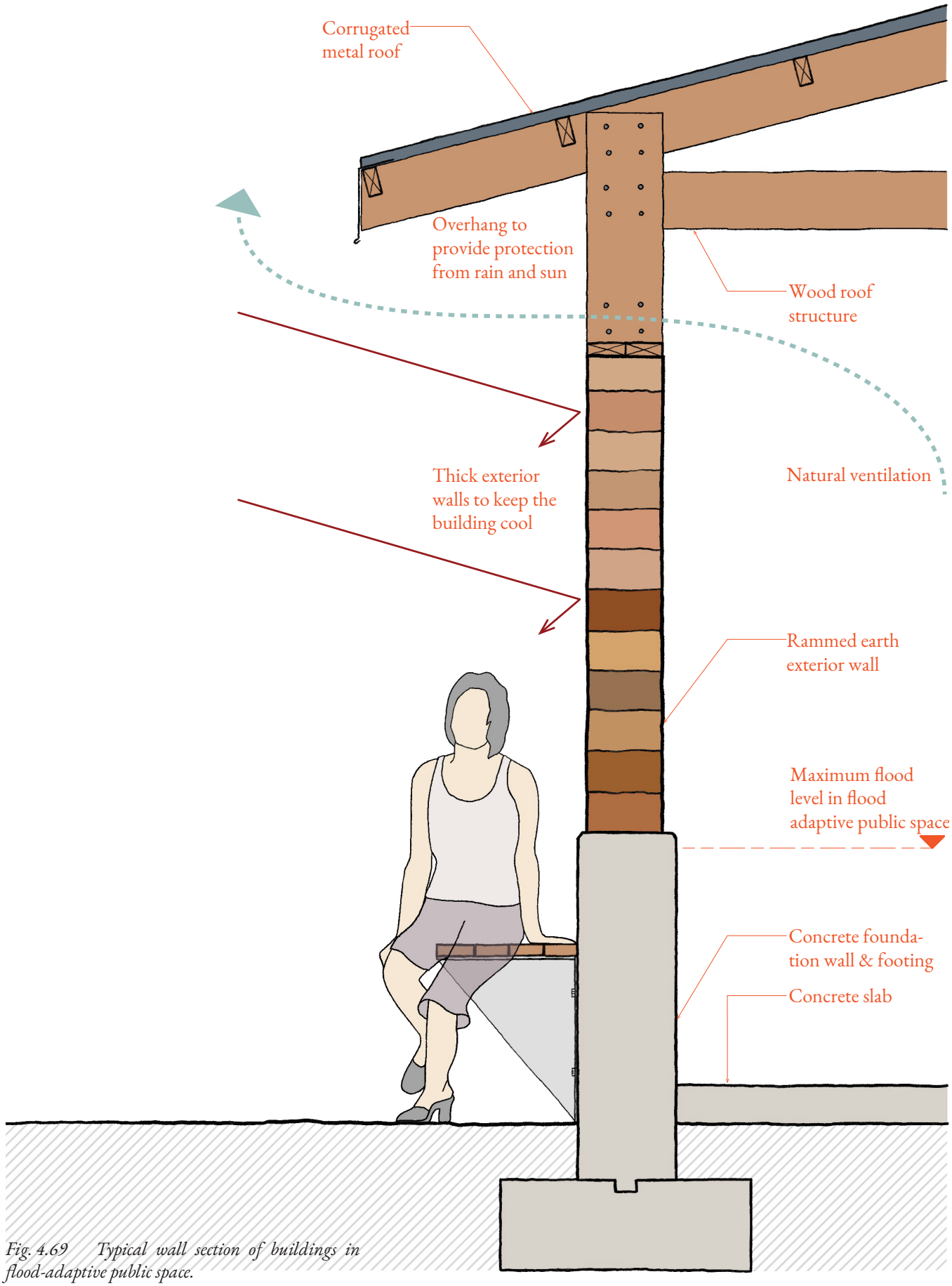


Fig. 4.69 Typical wall section of buildings in flood-adaptive public space.

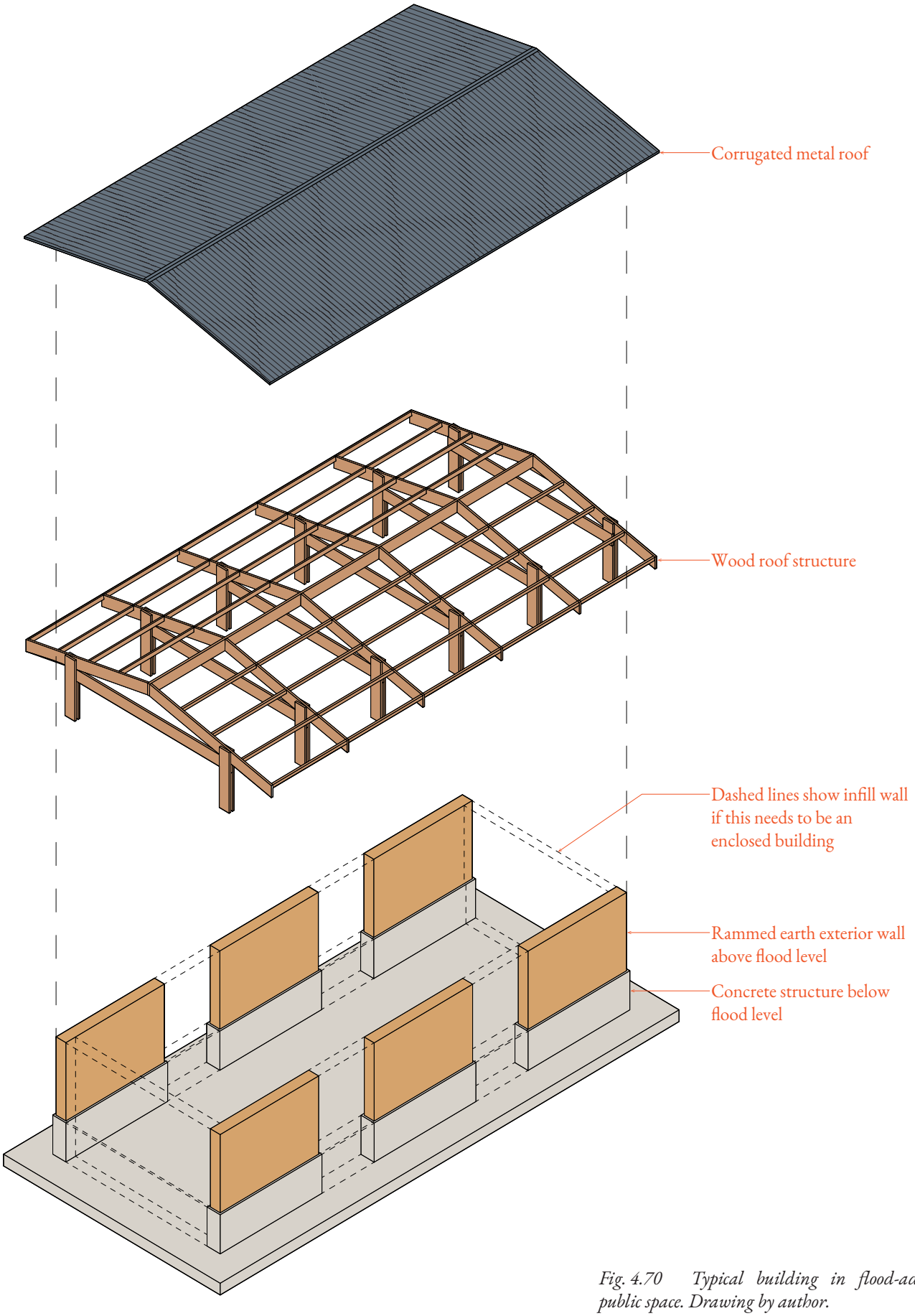


Fig. 4.70 Typical building in flood-adaptive public space. Drawing by author.

FRAMEWORK

To implement the concept of living with flooding in alleyway neighbourhoods, I propose a framework that combines macro and micro-interventions. This framework will allow people to coordinate and collaborate to improve their flood-prone alleyway neighbourhood. For this hypothetical pilot project, I am proposing a five-year plan in which the selected alleyway neighbourhood can be transformed to be flood-adaptive (fig. 4.70). This framework has a short timeline; however, it can make an impact if appropriately executed. Within the framework, there will be *voluntary and obligatory components* to ensure that every household can choose different pathways and work toward a goal.

The Kibera Public Space Project (KPSP) is an example of this type of project in which many stakeholders were involved. Since 2006, this project has allowed the government, NGOs, and locals to work on multiple public space projects. Together they have improved public spaces, communities' wellness, and the environment.[3] Learning from KPSP, the framework of living with flooding can take advantage of the existing administrative system to mobilize local support and resources (fig. 4.71-4.72). Specifically, "neighbourhood representative" (*'tổ trưởng tổ dân phố'*) should be the best candidate who can communicate ideas between local authorities and residents (fig. 4.73). This person is typically an appointed liaison and manages a "residential nest" (*'tổ dân phố'*) of about 50-100 households.[4] By tapping into the existing administrative system, there will be an opportunity to gain local residents' trust and their full participation.

For the first two years, the framework will provide alternatives for rainwater management so that people are not pressured to elevate their alleyways and ground floors. First of all, the *obligatory component* will mandate how much rainwater each household will need to retain so that it will be less dependent

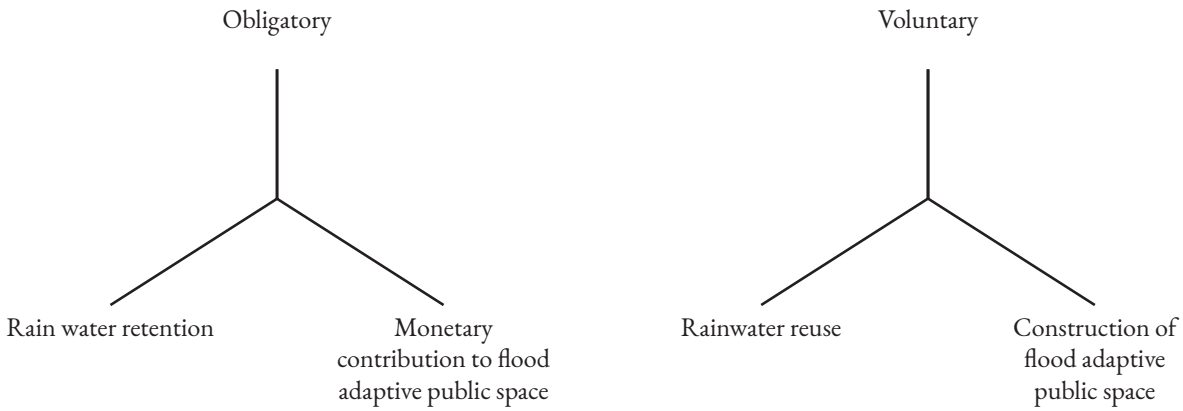
3 "The Kibera Public Space Project." kdi.

4 Gibert and Phạm, "Understanding the Vietnamese urban fabric from the inside," 32.

on existing infrastructure. They can choose to implement flood-adaptive ground floor and/or rain barrels depending on the house's footprint. Each household will also need to retain a certain amount of rainwater for a period of time. People can also implement flood gates to ensure each flood-adaptive house can function independently. Each household will only be in charge of retaining rainwater fallen on its lot. This requirement will ensure that the capacity of the existing infrastructure will stay adequate for a longer time. It can also be based on how well the existing infrastructure can handle rainwater. Outdated infrastructure will mean each household will retain rainwater slightly longer before it can be completely drained. Moreover, it is common in alleyway neighbourhoods to see houses having maximum roof coverage and shedding rainwater directly to surrounding areas. Thus, the v*oluntary component* should discourage impermeable paving. Permeable paving, natural soil and planting should also be used to create a more water-sensitive and greener neighbourhood. Additionally, households can apply for funding from the government to help them kickstart the process early. Less wealthy households will likely not have enough resources to completely retrofit their houses and apply all ideas from micro-scale interventions. However, they can still contribute by being responsible and collecting rainwater. Last but not least, preparation for the construction of flood-adaptive public space will likely occur during the first two years. Potential sites need to be appropriated, and landowners will be compensated fairly. Funding for the flood-adaptive public space will also need to be allocated.

For the next two years, the flood-adaptive public space will be constructed to retain a greater amount of rainwater and provide public amenities to the neighbourhood. Public buildings in this space are designed specifically to be flood-adaptive so they can serve as an example for new construction in flood-prone

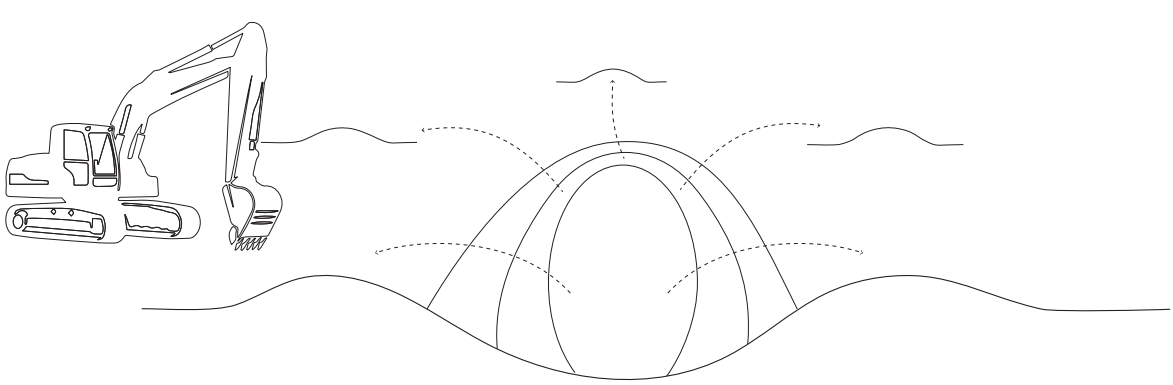
ESTABLISHING FRAMEWORK



FIR

Retrof

THIRD YEAR AND FOURTH YEAR

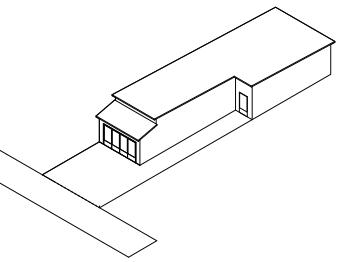


Terraforming

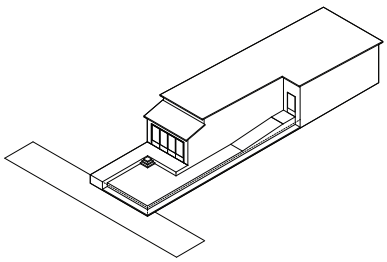
Building const

Fig. 4.71 5-year plan.

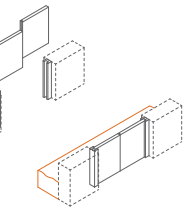
ST YEAR AND SECOND YEAR



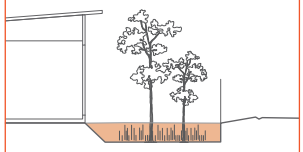
Existing



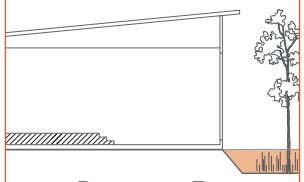
Retrofitted



emporary flood barrier

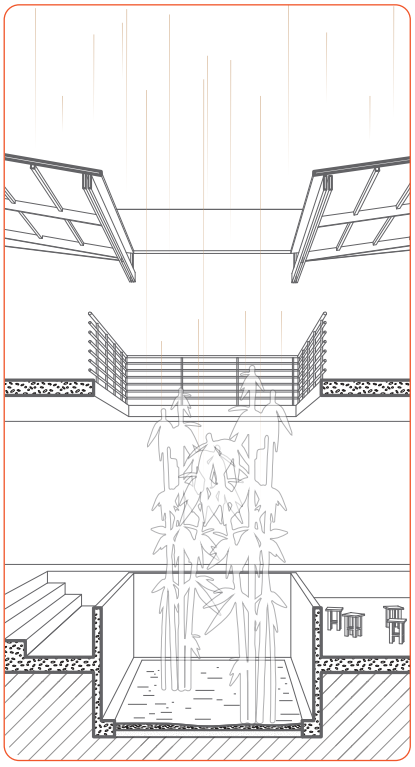


Permanent Wet floodproofed



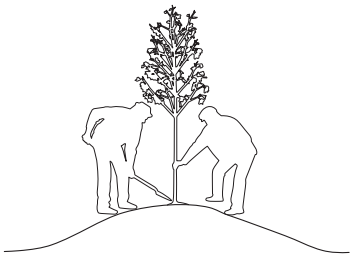
Permanent Dry floodproofed

fiting Existing Houses

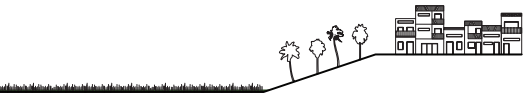


New Houses

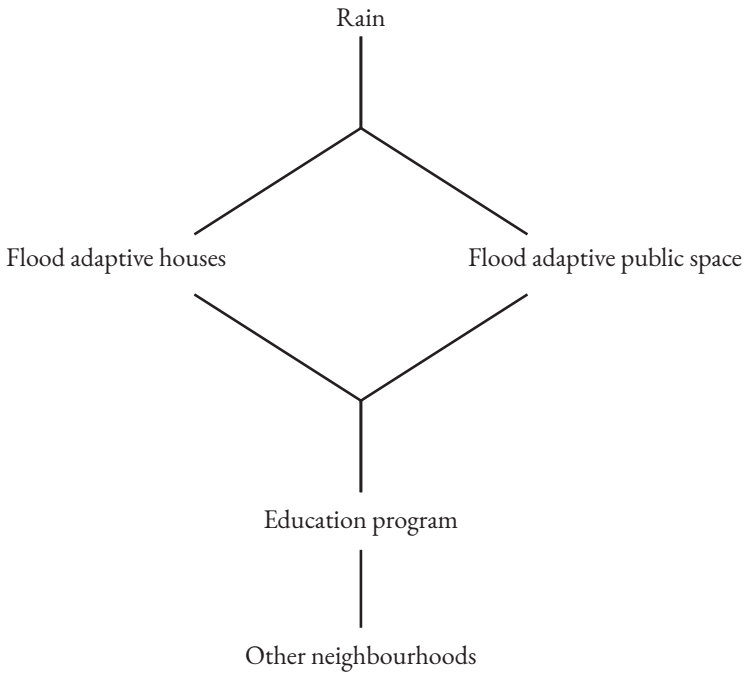
truction



Planting



FIFTH YEAR



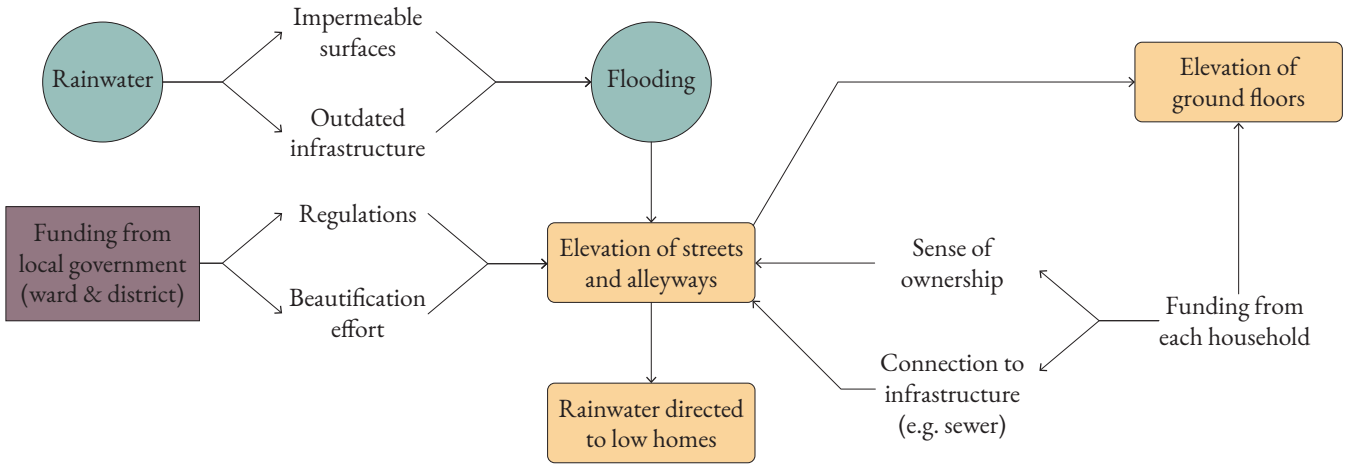


Fig. 4.72 Existing flood management and infrastructure in alleyway neighbourhood.

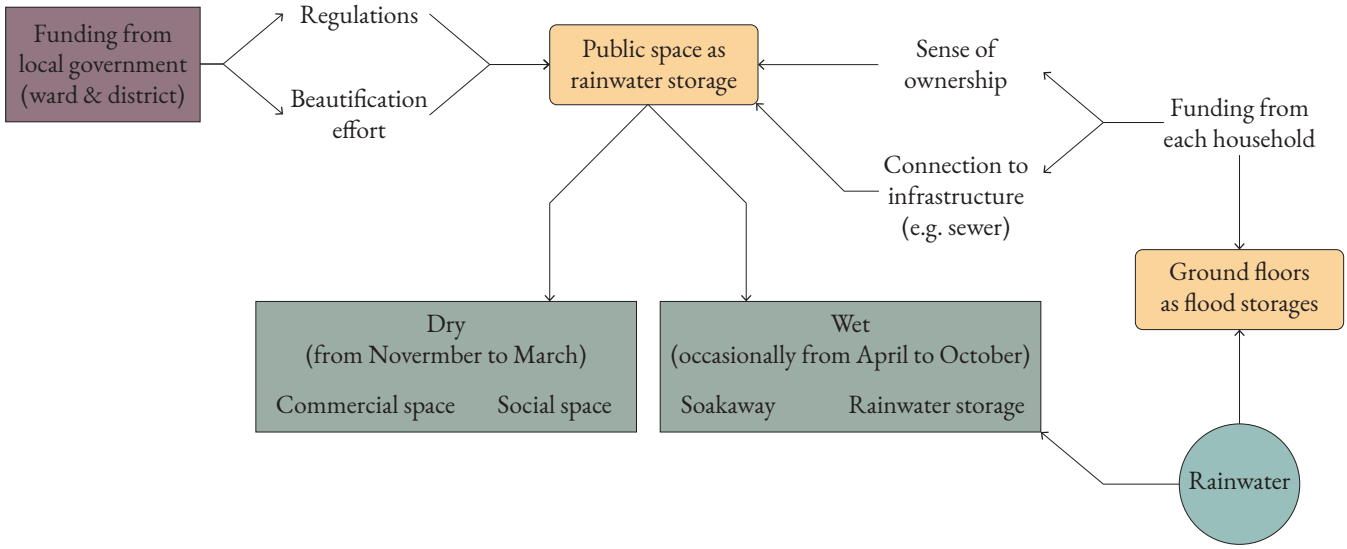


Fig. 4.73 Proposed framework for flood adaptation and social infrastructure.

areas. Educational programs can also be established to provide local residents with knowledge about living and building with flooding. Additionally, existing alleyways will also be adjusted to direct rainwater to flood-adaptive public space by a combination of slopes and underground pipes. For the last year of this five-year plan, most rainwater will be directed to flood-adaptive public space during the regular rainy season. When the whole concept is implemented, flood-adaptive houses, public space, and existing infrastructure will be able to withstand extreme rainfall caused by a combination of the rainy season, typhoons, and daily tides.

Finally, the two *voluntary and obligatory components* will lay out what can be done individually and communally (fig. 4.73). This collaborative approach is the lesson from the Mekong Delta, where people need to work together to overcome the ecological challenge they are facing. The effectiveness of the whole project will be a result of collective efforts from each household. When everyone participates actively in rainwater management, they will develop their own wisdom of how to be resilient. This wisdom can be manifested and turned into a greater campaign to provide general knowledge about living with flooding and building for flood adaptation. As previously mentioned in Chapter III, it took Vietnamese people many generations to develop their own wisdom of living with seasonal flooding in the Mekong Delta. However, in this digital age, when information can be compiled and communicated quickly, perhaps it will not take more than one generation to create a wisdom of living with *'urban flooding.'* Only then, urban flooding will cease to be disastrous to the people of Saigon/HCMC, and they will be able to live contentedly in each rainy season.

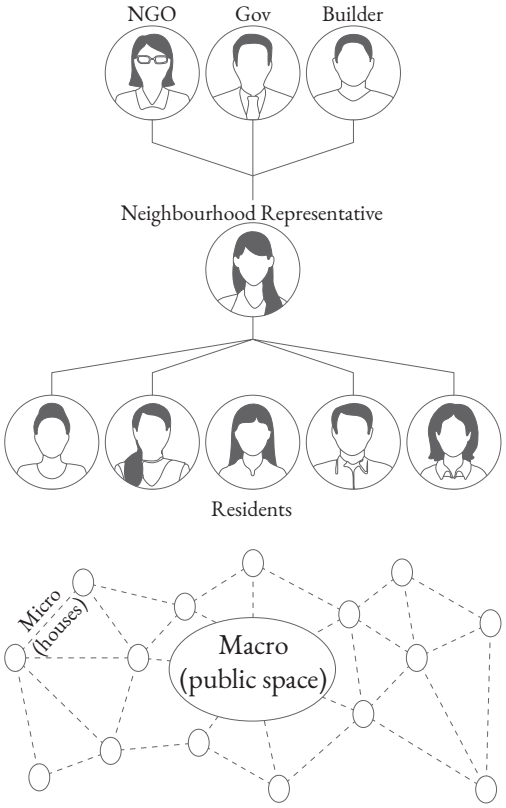
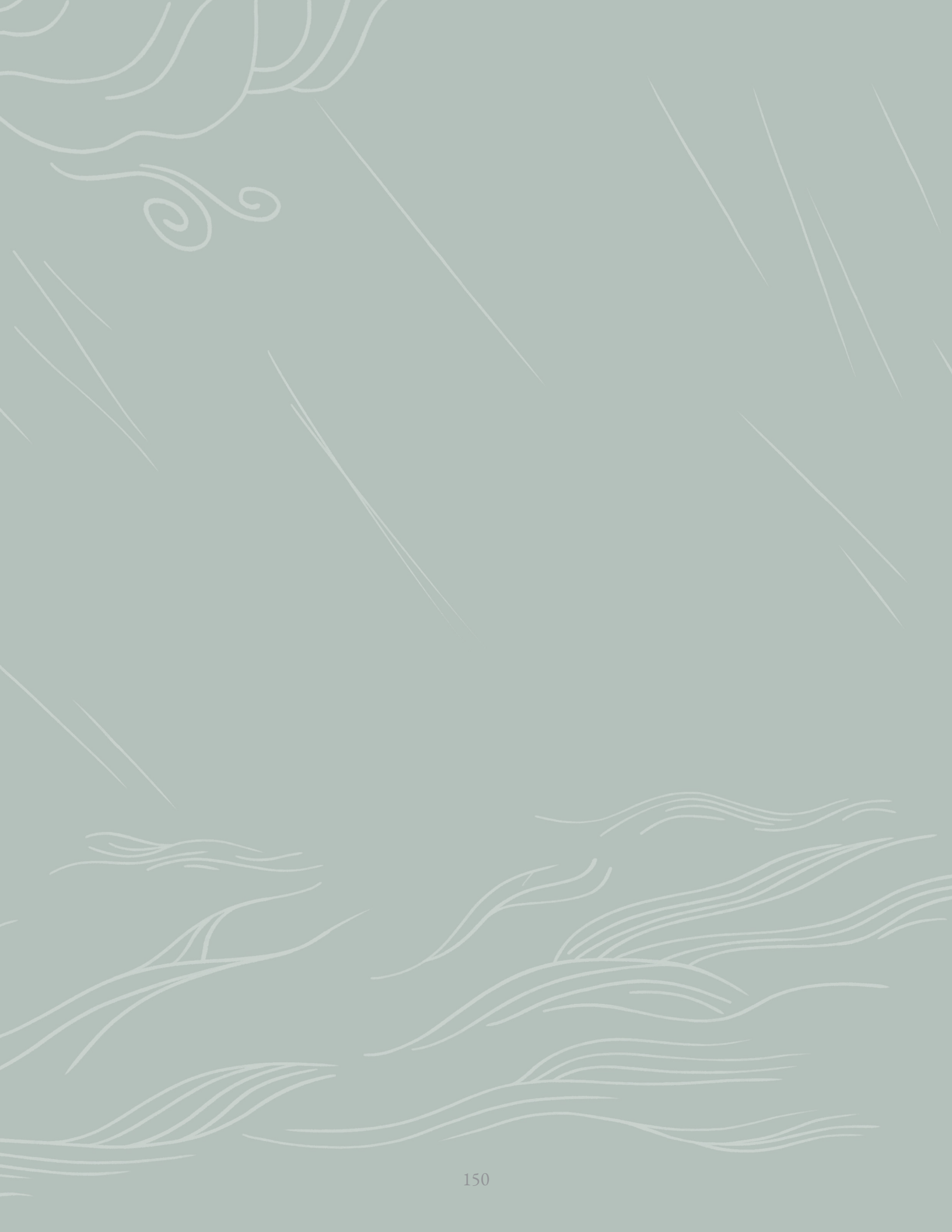


Fig. 4.74 Proposed organization for flood adaptation and social infrastructure.

BACK TO THE CITY



SCALE-UP PROGRAM

From the previous chapter, I developed a framework that entails *voluntary and obligatory components*. These will show local residents what they should do and must do in order to develop a resilient neighbourhood. In Saigon/HCMC, urban flooding needs to be a matter of concern for every individual. Rainwater management should be done at all levels, even at the scale of a small house. However, it is necessary to scale up this concept to create a resilient city that can minimize and absorb the impacts of flooding. These voluntary and obligatory components can be further developed into important documents such guidelines and bylaws. The new guidelines for building flood-prone alleyway neighbourhoods will cancel any makeshift solutions and show people how to implement meaningful and effective rainwater management strategies. Meanwhile, new bylaws can establish standards and distribute a shared responsibility to each building.

In Chapter III and IV, I introduced the concept of embracing and living with flooding in alleyway neighbourhoods and demonstrated how a small alleyway neighbourhood could be transformed to be flood-adaptive within five years. Furthermore, I developed the micro-scale and macro-scale interventions for local construction practices so they can be replicated, adjusted and applied to other flood-prone alleyway neighbourhoods. Principles of living with flooding in alleyway neighbourhoods can be made into official guidelines and published. This kind of document has been done in other countries, such as *New York City Planning's Retrofitting Buildings for Flood Risk*.[1] For Saigon/HCMC, the guide can show people how to retrofit and build their houses in flood-prone neighbourhoods. By applying the principles of living with flooding, people can become proactive and participate in rainwater management. People will manage and collect rainwater not only to reduce flood risks but also to have an opportunity to minimize the need for additional clean

1 "Retrofitting Buildings for Flood Risk," Retrofitting Buildings for Flood Risk - DCP.

water. Most importantly, appropriate guidelines and bylaws will allow local residents to address impermeability which has been one of the most serious causes of urban flooding.

Moreover, Saigon/HCMC needs new zoning bylaws to address excessive rainwater. I have previously argued that rainwater needs to be managed locally because of its sheer amount in the rainy season. The city needs to mandate that a certain amount of rainwater must be accommodated on site. Rainwater management needs to be decentralized, and it should be a shared responsibility between authorities and local residents. New zoning bylaws can introduce different categories such as setback, permeable/impermeable area ratio, a requirement for water retention per building type. These requirements will ensure that rainwater will not flow directly at once to the already outdated infrastructure. Additionally, there has been evidence that existing large projects have intensified flooding in their vicinity.[2] Zoning bylaws will need to require new projects, especially large ones, to demonstrate how they can address flood risks by substantial investment in rainwater management.

Furthermore, existing open public spaces can potentially be retrofitted to become flood-adaptive. Their substantial areas will make a big difference because they can collect a significant amount of rainwater and relieve existing infrastructure in the vicinity (fig. 5.01). New public spaces (such as parks) can also be designed to include programs that address flooding. Their design can be based on the concept illustrated in Chapter IV. Flood-adaptive public spaces will not be a wasteful endeavour for Saigon/HCMC if they are thoughtfully programmed so people can consistently use them. With heavy rainfalls from June to September, flood-adaptive public space can still be used for other purposes for the rest of the year.

2 CNA Insider, "Asia's Sinking Cities: Ho Chi Minh City,"

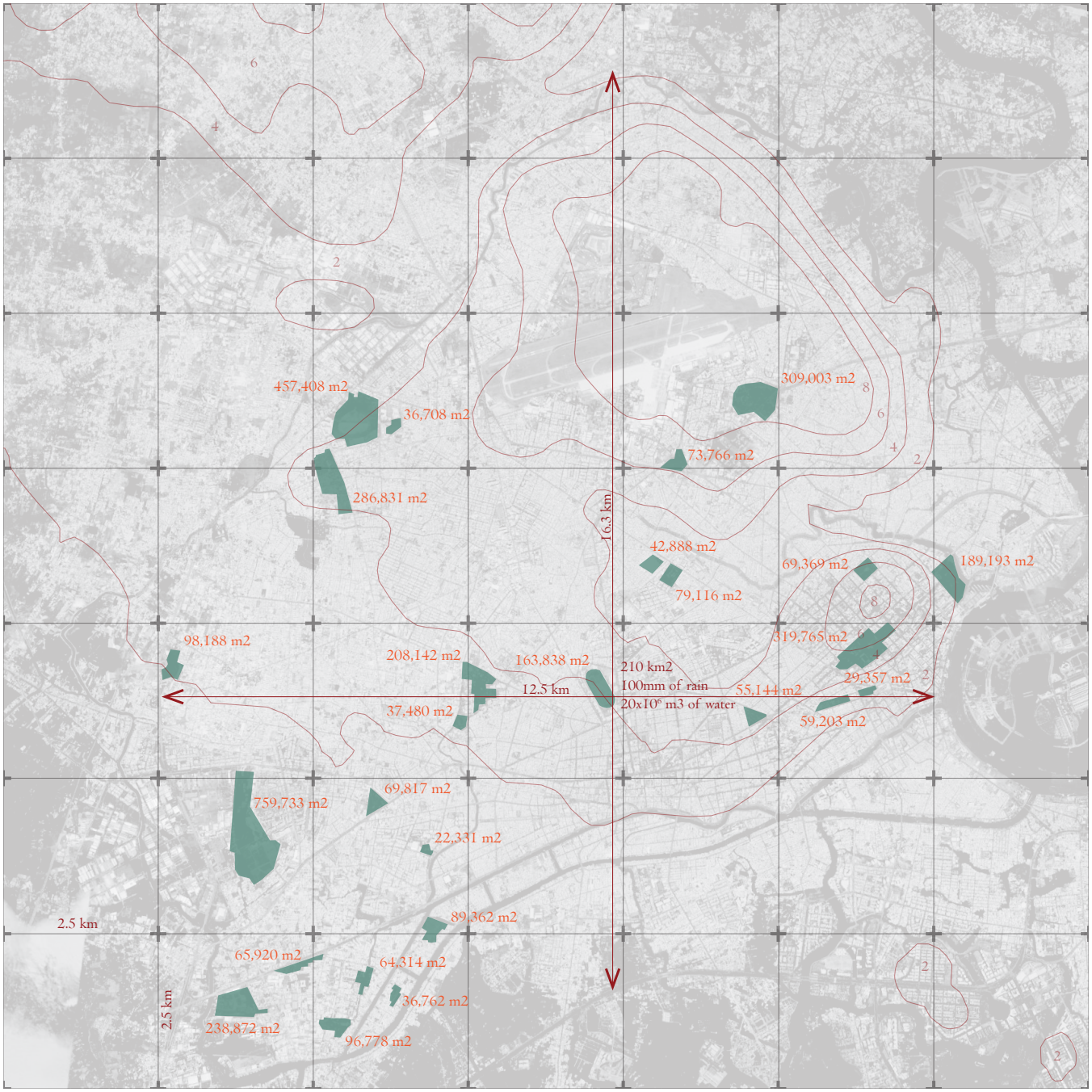


Fig. 5.01 Possible sites for flood adaptive public space. If all of them can be transformed into flood adaptive public space with 1m deep rain storages, then 15% of rainwater will be accomodated.

Moreover, Saigon/HCMC should function and expand in response to its ecological challenge. In chapter I, I discussed urban growth in the past and how it has contributed to urban flooding. Thus, it is obvious that Saigon/HCMC should have a strategic plan for urban growth in the future. The city should expand to higher ground in northern and northwestern areas. Additionally, urban expansion to southern and southwestern areas should be limited by zoning bylaws. Any development in these low-lying areas will need to be flood-adaptive in order to reduce the risk of flood damages.

Heavy rains in the summer have been an ecological feature of this region. And for the next one hundred or even one thousand years, there will be heavy rains in the summer. The local government is currently trying to manipulate the consequences of Saigon/HCMC's rapid urbanization by going with the flood control paradigm. In the end, nature will prevail regardless of how people are trying to control it. So why should people even try to control something that is far greater than their existence? The best lesson I have learnt from living with flooding in the Mekong Delta is that people should learn how to live with the land and appreciate what it has to offer. In chapters III and IV, I envision a Saigon/HCMC where people will again recognize the worldview of past generations and can live in harmony with their land and (rain)water. The goal of this proposal is to turn Saigon/HCMC into a resilient and flood-adaptive city. To achieve this goal, all built environments should be designed and retrofitted to be adaptive flood spaces. It is now the time for the government of Saigon/HCMC to implement meaningful guidelines and bylaws to show its residents how to address rainwater before it has the chance to become harmful. When Saigon/HCMC can accomplish this goal, the flood control paradigm will become obsolete.

DISCOURSE IN FLOOD MANAGEMENT

Fig. 5.02 Jakarta's bird-shaped seawall designed by a Dutch firm. This flood management project will take 30 to 40 years to complete.

Urban flooding is not a phenomenon that only occurs in Saigon/HCMC. Other megacities, such as Jakarta and Dar es Salaam, have also struggled with urban flooding in recent decades. These megacities share similar issues that contribute to flooding, such as population, urbanization, and land subsidence. In the case of Jakarta, a massive bird-shaped seawall was proposed to guard the flood-prone city against waves and storm surges (fig. 5.02).[3] Its effectiveness has yet to be proven; however, recent studies indicate its negative ecological impacts and displacement of the local population.[4] The project does not address land subsidence which has been the leading cause of severe flooding in Jakarta. In fact, it has been favoured because it presents "a symbol of the future of the city and the country, a symbol of modernization and progress for Jakarta."[5] The similarity between Jakarta and Saigon/HCMC is apparent. The governments have adopted flood control projects and glorified them as the city's saviour in both places.

Even though flood risks can have many impacts on all urban dwellers, marginalized households face the greatest challenges. The flood control paradigm does not necessarily address residents' needs or support their livelihoods because it only aims at controlling future floods. Residents often employ ad hoc solutions that may lead to a risk of maladaptation.[6] Thus, there has been a significant gap between this urban population and the government's flood control paradigm. The flood adaptation paradigm can fill this gap because it will allow local residents to choose what will work for them and learn from the process. It is also beneficial because of its low-cost approach that will allow more households to participate in flood management and hazard reduction management. Since the concept of living

3 Kemal Jufri, "$40bn to save Jakarta: the story of the Great Garuda," The Guardian.

4 Wade, "Hyper-planning Jakarta," 159.

5 Ibid.

6 Baker, *Climate change, disaster risk, and the urban poor*, 55.

with flooding is a decentralized approach, it will not be hindered by local constraints such as politics and lack of resources. Local residents can still organize themselves to create localized flood adaptive approaches without relying too much on their local governments. It allows local residents to take the matter into their own hands and develop specific solutions while contributing to the greater effort.

Suppose the concept of living with flooding can become a discourse in flood management in Saigon/HCMC. In that case, it will serve as an example for an alternative approach in other flood-prone megacities such as Jakarta and Dar es Salaam. This concept can be a complementary strategy to reduce post-flood damages if a city is already going with a flood control paradigm. If it is too difficult to completely abandon the flood control paradigm, then flood adaptation will be even more appropriate because it can be organized at local levels such as neighbourhoods. Small pilot projects can happen simultaneously anywhere in the city, like what has been demonstrated in Chapter IV. Over time, these projects will cultivate residents' appreciation and change how they adapt to flooding or any environmental challenges in the future.

CONCLUSION

The discussion of this research began with a brief history of 150 years of urban expansion in Saigon/HCMC and explained how the alleyway typology came into existence. In Saigon/HCMC, alleyways have been tissues of the urban fabric. Despite being a common typology, the alleyway (typology) has been under-documented and vulnerable to contemporary issues such as urbanization and flooding. By identifying the strengths and weaknesses of Saigonese alleyways, I want to contribute to building a better understanding of urban production in Saigon/HCMC. Other variations of the alleyway can also be found in other countries such as Japan, Korea, Thailand and China. Although the alleyways are different in each country, they are all facing similar challenges. They are regarded as urban relics and not seriously considered in contemporary urban planning. The alleyways are in danger of fading away, eroding and being erased from the contemporary urban landscape filled with highrises.[1]

In Saigon/HCMC, urban flooding is one of the most serious issues threatening many alleyway neighbourhoods. The dramatic shifts of the ground have severely damaged the relationship between houses and their alleyways. My research has analyzed flooding in alleyway neighbourhoods and showed how it is affecting local residents' livelihoods. The competition for higher ground has not addressed excessive rainwater in any meaningful way. In fact, it is draining people's resources and exacerbating socio-spatial inequalities. Throughout this research, I have also projected a critical view over the single-minded flood control paradigm favoured by the local government. Saigon/HCMC's flood control project has carried a hefty price tag and given local residents false hopes with delay after delay.[2] It is time for the people of Saigon/HCMC to find alternative approaches to address urban flooding.

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1 Gibert-Flutre and Imai, *Asian Alleyways*, 15-32.

2 Quân, "Dự Án Ngăn Triều 10.000 Tỉ Đồng Hoàn Thành 90% Vẫn Nằm Chờ Về Đích," Báo Lao Động.

In *The Future of Asian Alleyways*, Heide Imai and Marie Gibert-Flutre describe the alleyway as a "liminal space which is in itself ambiguous, hybrid and thus easily re-appropriated and moulded to fit different changing modes of urban lifestyles and design concepts."[3] In this regard, the Saigonese alleyway is not an exception, especially because of its self-production logic. In Saigon/HCMC, local residents have been active participants in the urban production and constantly alter their use of the alleyway. My proposal of living with flooding in alleyway neighbourhoods has taken advantage of these ambiguous and hybrid characteristics. It is a discourse of both living with flooding in the Mekong Delta and Liao's principles of flood adaptation paradigm. In other words, the alleyway can be a place where vernacular wisdom works harmoniously with contemporary theory to solve a problem.

The alleyway is suitable for a radical approach to address flooding by being ambiguous and open. This is the reason why Liao's principles for flood adaptation are appropriate in flood-prone alleyway neighbourhoods. The alleyway is a space of flux and constantly changing to allow different modes of living. Thus, it could be changed to implement the flood adaptation paradigm. As much as the alleyway is changing in the time of globalization and metropolisation, there has always been a strong nostalgia for its previous values and characteristics. Some of them are not different from what I saw in rural places of the Mekong Delta, especially about collectivity and strong relationships between households. These qualities are very much needed for the idea of living with flooding because flooding can not be mitigated only by a single household.

3 Gibert-Flutre and Imai, *Asian Alleyways*, 211.

The model of living with flooding can be integrated into urban production, starting with the alleyway neighbourhoods. I have introduced a set of guidelines for retrofitting existing houses and constructing new houses in flood-prone alleyway neighbourhoods. These guidelines will emphasize the transformation of the ground floors for flood adaptation and how they connect to the alleyway. I have also proposed strategies for flood-adaptive public space design that utilize existing community space and undeveloped parcels of land between alleyway neighbourhoods. With these interventions in place, rainwater will be managed immediately at the local scale. Households and communities will also be more responsible and proactive in flood management. When alleyway neighbourhoods become flood-adaptive, they can inspire how Saigon/HCMC will develop in the future. In contrast to the flood control paradigm, a flood adaptation paradigm in Saigon/HCMC will go beyond managing floods and ensure that the city will quickly recover if there is extreme rainfall. There is a possible scenario in which the city's large public spaces, such as parks, can be transformed to anticipate flooding. This is also an opportunity to increase soft infrastructure in the city with more vegetated areas and permeable surfaces. The result will be a flood-tolerant Saigon/HCMC with multi-functional public spaces and less upkeep cost for its flood control infrastructure. Most importantly, the research will promote a positive relationship between people and water in Saigon/HCMC. Water will not be a hazard during rainy seasons but rather a resource to nurture the land and its people.

Lastly, this research will foster a better understanding of flooding in megacities. Specifically, it is important to understand how flooding affects informal settlements. They usually lack adequate infrastructure and support from the government. People who live in informal settlements are also exposed to more risks because they do not have the necessary resources, rights and political power.[4] However, it is worth exploring different frameworks that tap into their strengths, such as self-organization and community cohesion, to create resilient communities in the face of climate change and social and environmental injustice.

4 Baker, *Climate change, disaster risk, and the urban poor: cities building resilience for a changing world*, 7-9.

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GLOSSARY

ABBREVIATIONS

CPV: Communist Party of Vietnam

HCMC: Ho Chi Minh City

NUZ: New Urban Zone

IMF: International Monetary Fund

DEFINITIONS

Flash flood: intense and high volume of water caused by heavy rain falling within a short amount of time within the vicinity or on nearby elevated terrain.

Fluvial flood: (or riverine flood) occurs when the water level in a river, lake or stream rises and overflows onto the surrounding land. On the other hand, Pluvial flood occurs when an extreme rainfall event creates a flood independent of an overflowing water body.[1]

Dry floodproof: a type of floodproofing that will make an area capable of resisting penetration of floodwater. Building components, such as walls and floors, will be impermeable to the passage of floodwater.[2]

Metropolisation: is defined as the process through which institutionally, functionally, and spatially fragmented urbanized regions become integrated as coherent metropolitan systems.[3]

Pluvial flood: occurs when an extreme rainfall event creates a flood independent of an overflowing water body.[4]

Wet floodproof: a type of floodproofing that will permit parts of the structure to be flooded and recover. The technique will equalize hydrostatic pressures on structures and rely on the use of flood damage-resistant materials.[5]

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