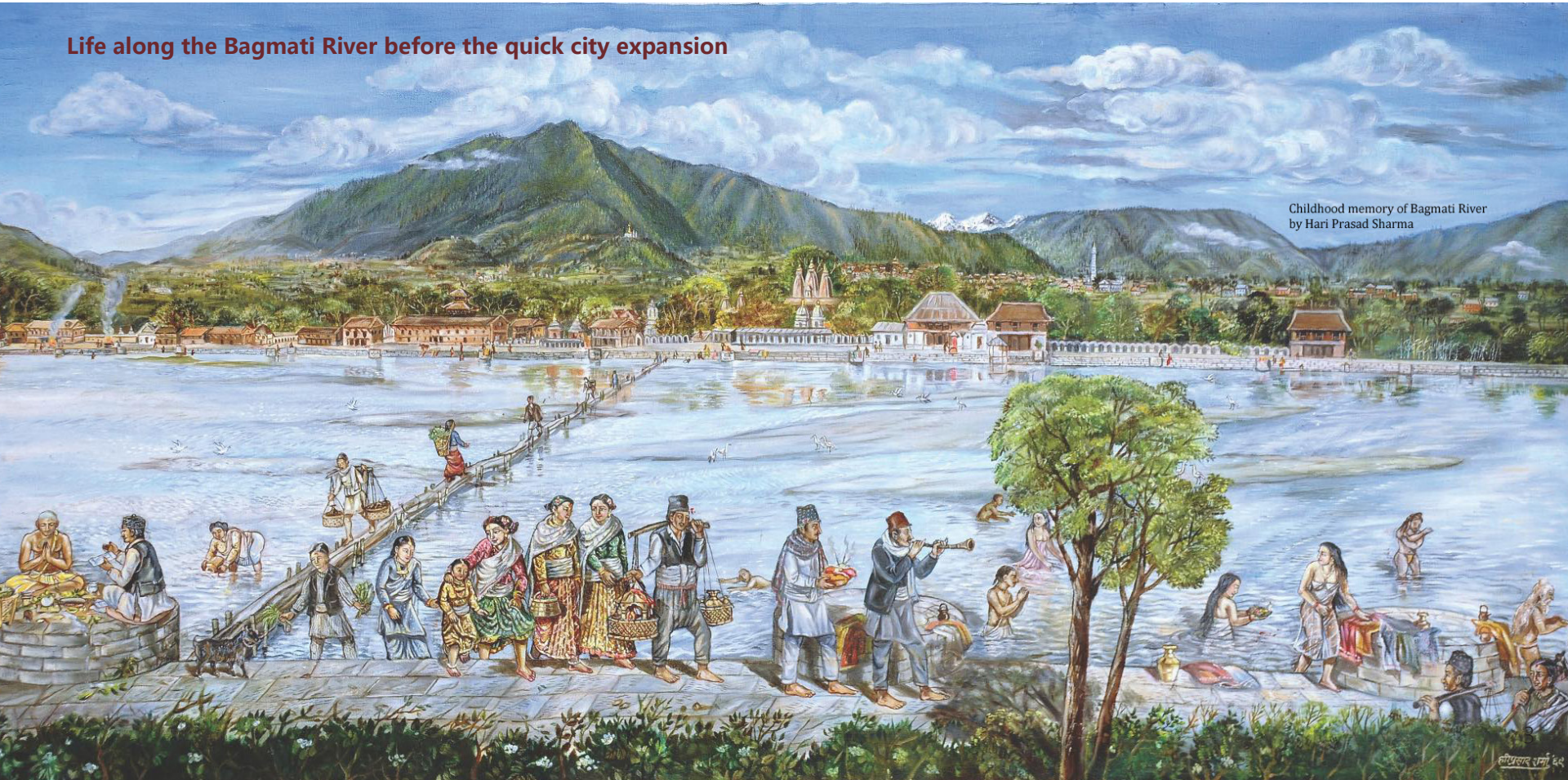
-Water steps-

Reviving the Bagmati River in the Kathmandu Valley, Nepal

P5
Circular water stories
Maozhu Zhang
5531829
21.06.2023

Life along the Bagmati River before the quick city expansion



Childhood memory of Bagmati River
by Hari Prasad Sharma

Life along the Bagmati River after the quick city expansion

Research for design

The change of the connection between people and the Bagmati River

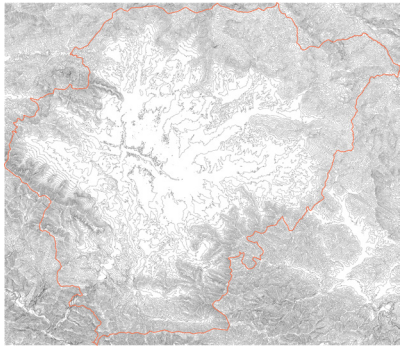
1. Context
2. Challenges
3. Problem statement and Research question
4. Theoretical Framework
5. Intervention Area

Research through design

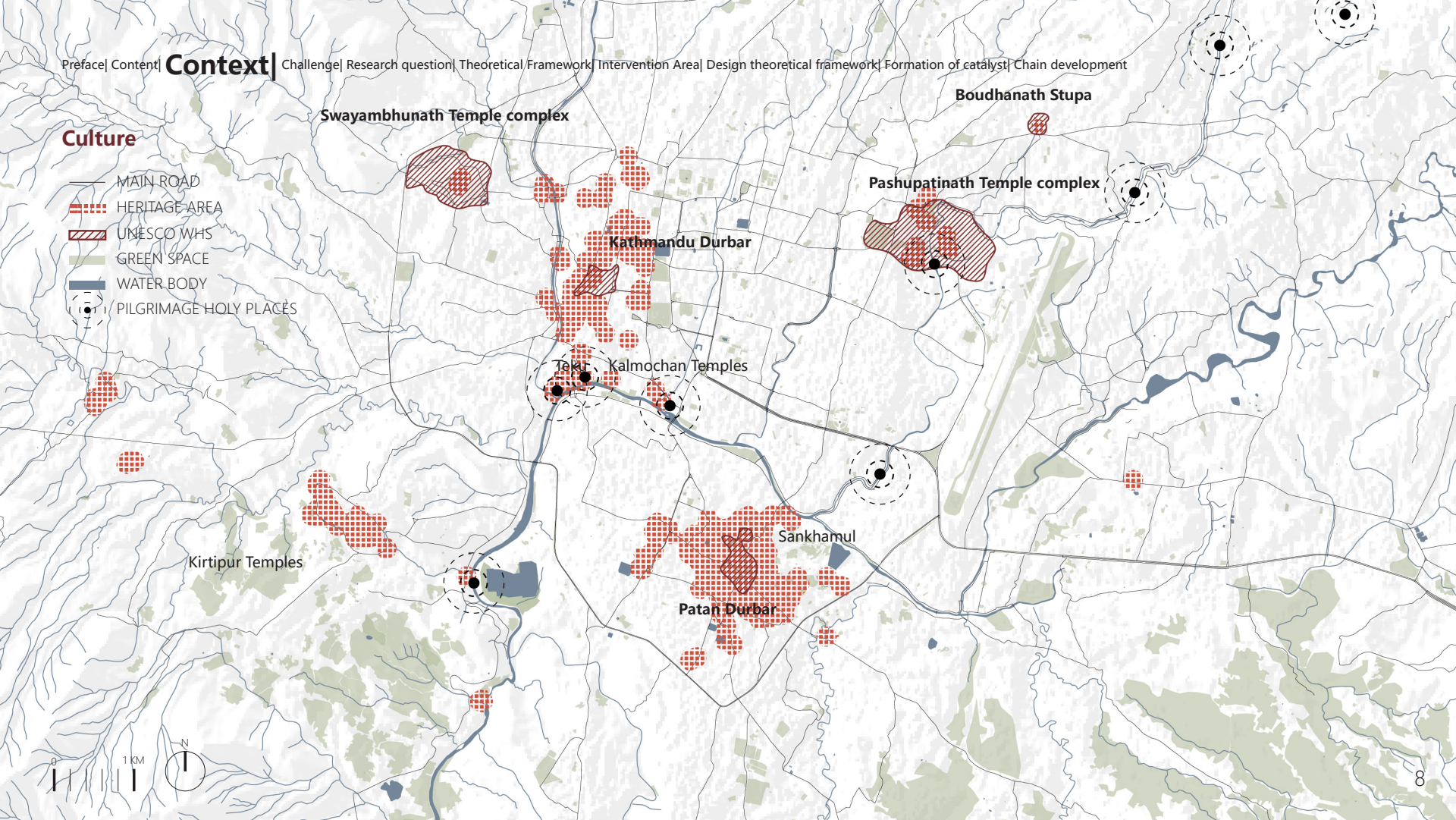
Rebuild a new connection between people and the Bagmati River

6. Design theoritical framework
7. Formation of catalyst
8. Chain development

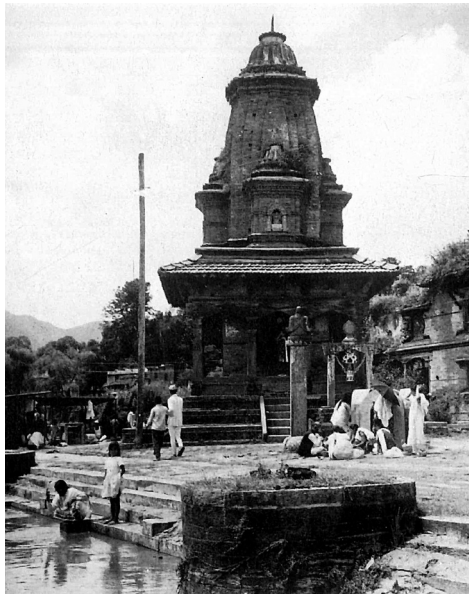
Location

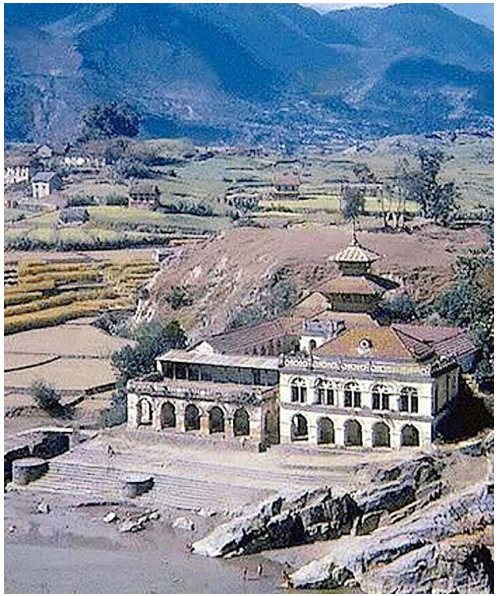


Bagmati River


Culture
MAIN ROAD
HERITAGE AREA
UNESCO WHS
GREEN SPACE
WATER BODY
PILGRIMAGE HOLY PLACES
Swayambhunath Temple complex
Boudhanath Stupa
Pashupatinath Temple complex
Kathmandu Durbar
Tekur
Kalmochan Temples
Sankhamul
Kirtipur Temples
Patan Durbar
0
1 KM
N

Culture





Temple and ghat along Bagmati River

Ghat, refer to the series of steps leading down to the spiritual river

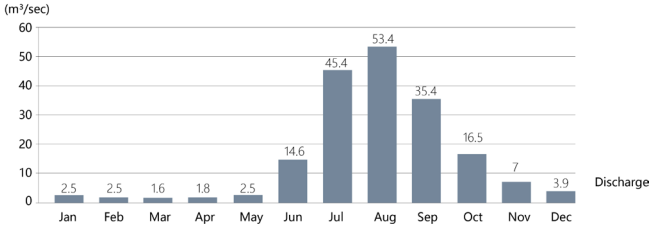
In the past, spiritual connection with Bagmati River

Annual Water Level Change

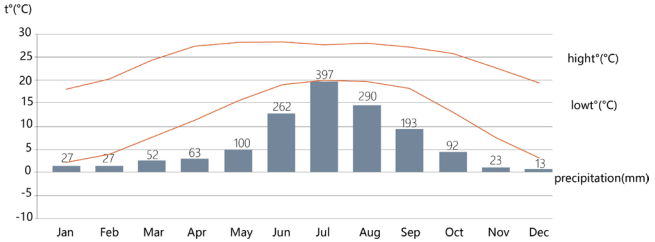
The source of Bagmati is mainly rainfall.
Water level change significantly due to the uneven annual precipitation.
The water level difference is up to 3.5 meters(1.5m-5m)

There are **different activities** on the bank of the river **in different seasons**.

Monsoon



Dry season



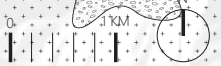
Monsoon-Daily life

Swimming-1926 AD

Swimming-1969 AD

Monsoon-Water recharge for dry season

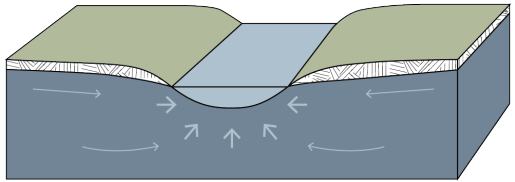
- Lower Terrace or Slope Wash Deposit(Micaceous sand, gravel)
- Patan Formation(Fine sand, silt)
- Thimi Formation(Fine sand, coarse sand)
- Gokarna Formation(Fine sand, silt)
- Alluvial Fan or Debris Flow Deposit (Gravel, sand)
- Tokha Formation ((Clay, sand and gravel)
- Rocky Area



Monsoon-Water recharge for dry season

Monsoon

Dry season



Open green space-1950

Traditional water retention pond -1960

Recharge

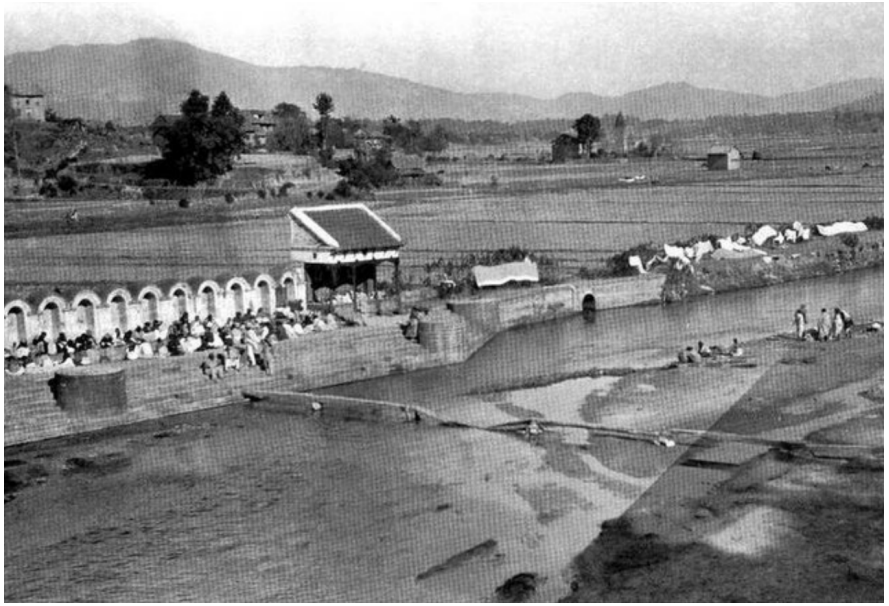
Dry season-Daily life

Grain drying and clothes washing-1971

Cowherding-1968

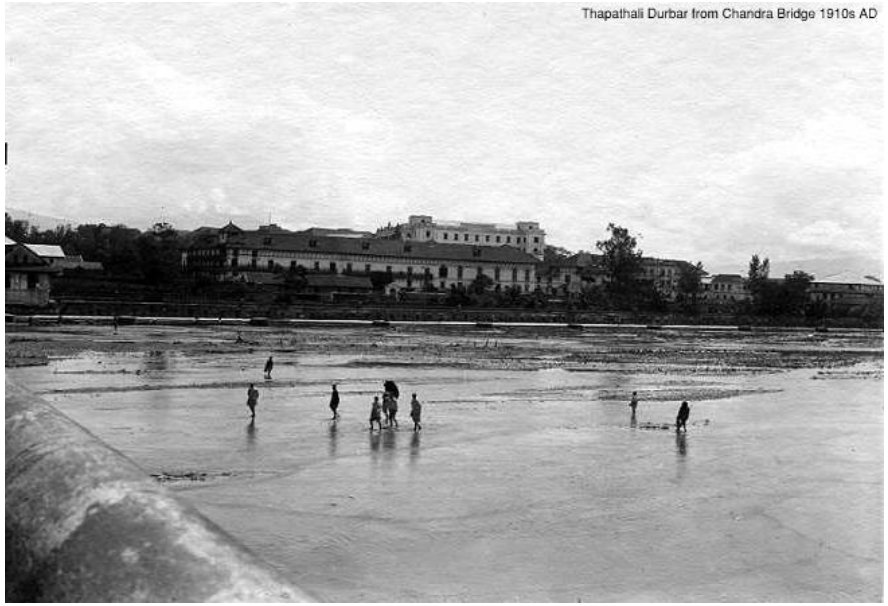
Dry season-Daily life

Gathering-1950s

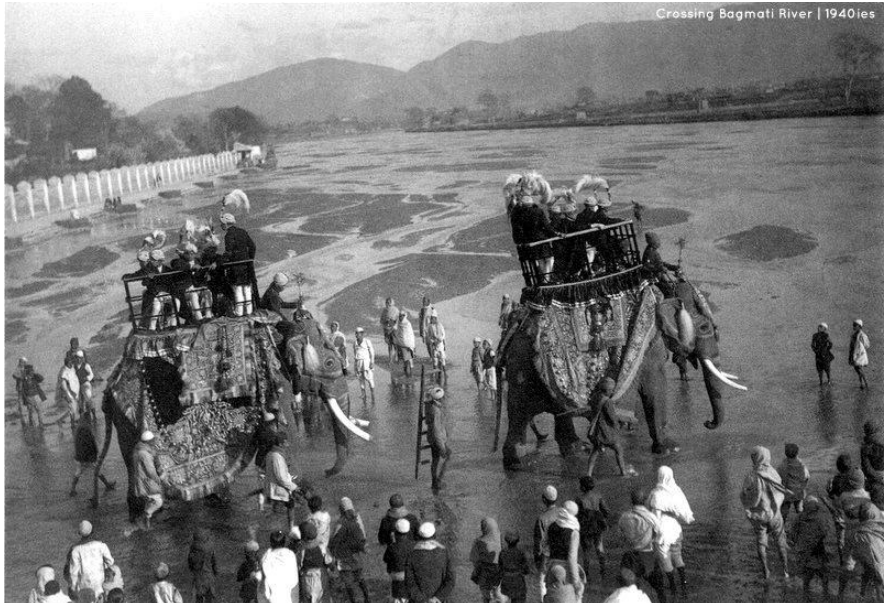


Gathering-1940AD

Dry season-Daily life



Transportation-1940s



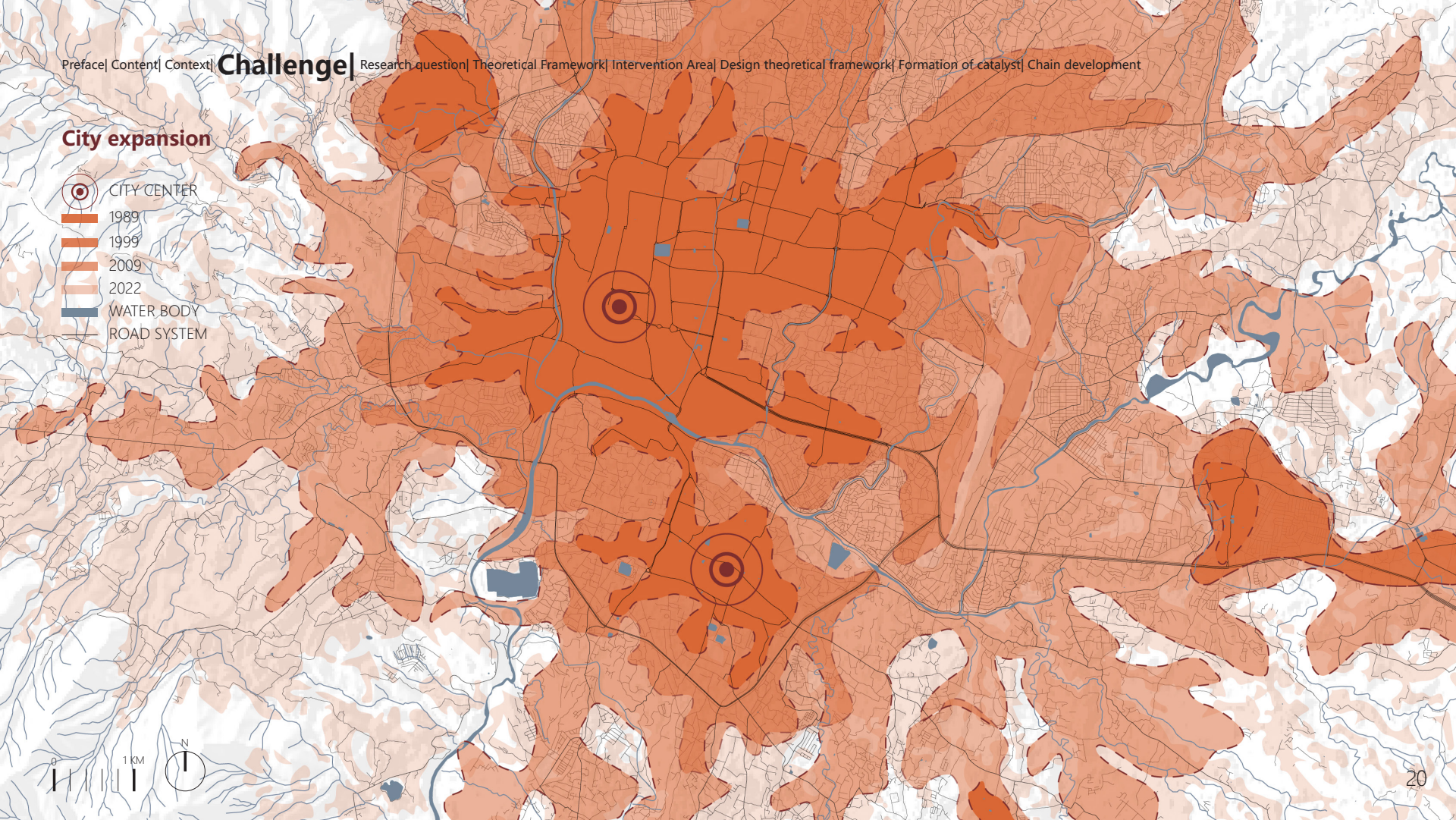
Transportation- 1918AD

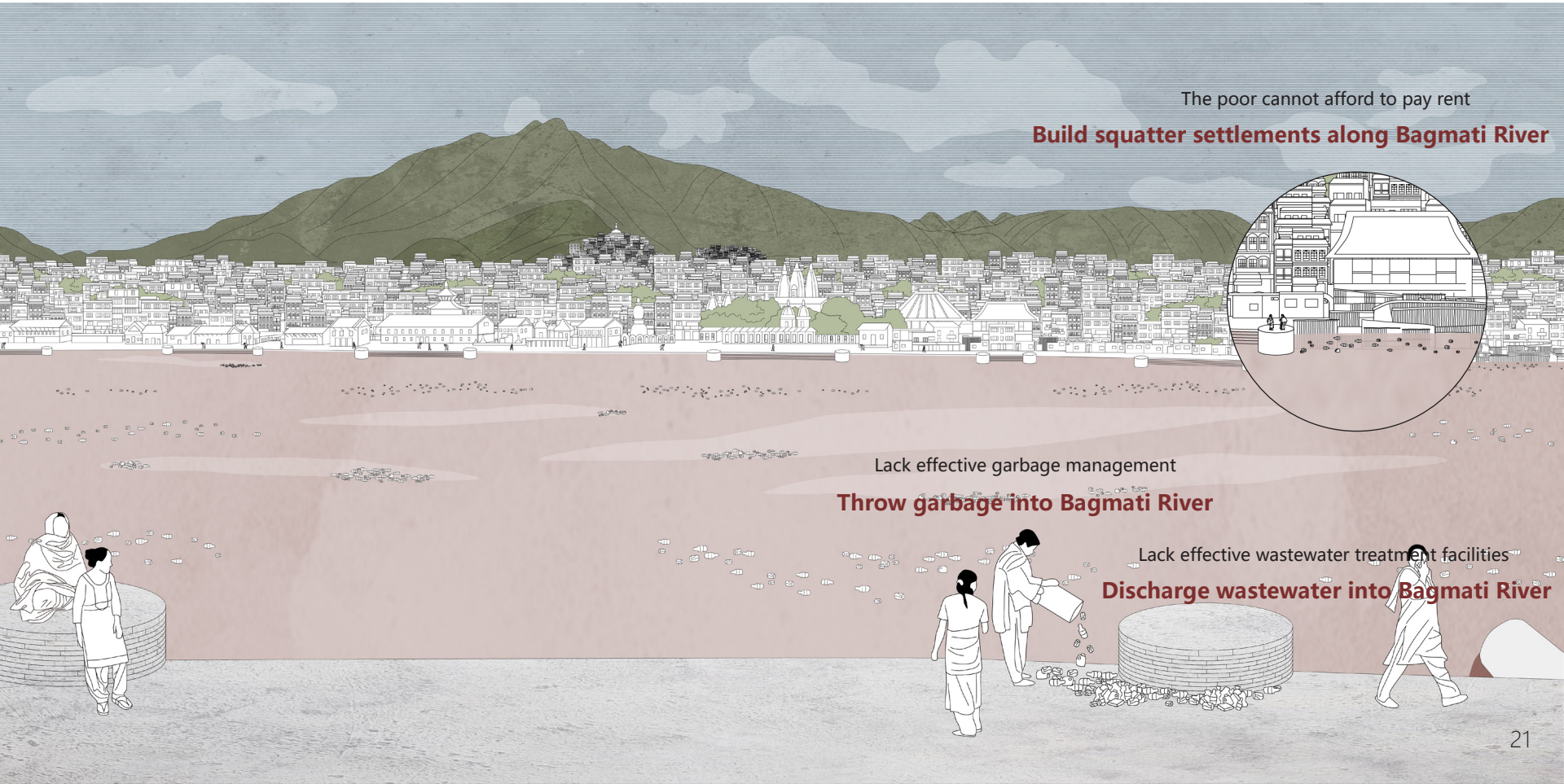
Dry season-Religious life

Devotees take bath-1960s

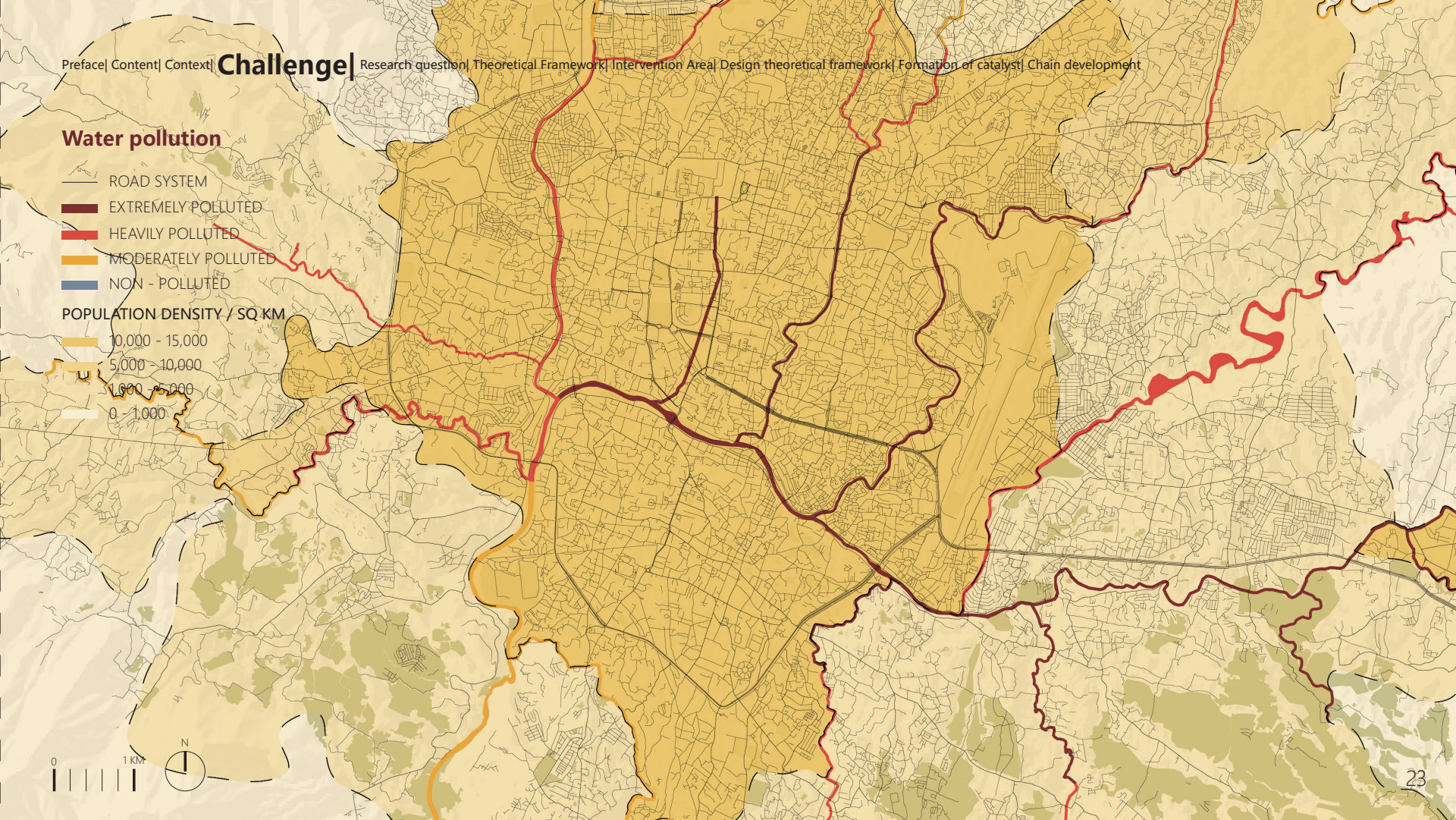
Shiva Ratri-1968

Childhood memory of Bagmati River
by Hari Prasad Sharma


City expansion
CITY CENTER
1989
1999
2009
2022
WATER BODY
ROAD SYSTEM
0
1 KM
N

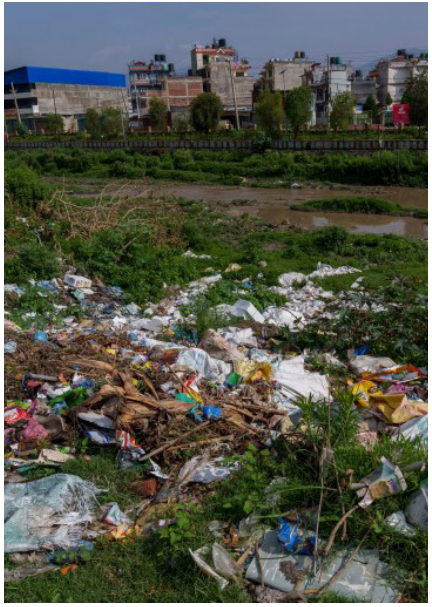

The poor cannot afford to pay rent
Build squatter settlements along Bagmati River
Lack effective garbage management
Throw garbage into Bagmati River
Lack effective wastewater treatment facilities
Discharge wastewater into Bagmati River

Now, lose connection with Bagmati River

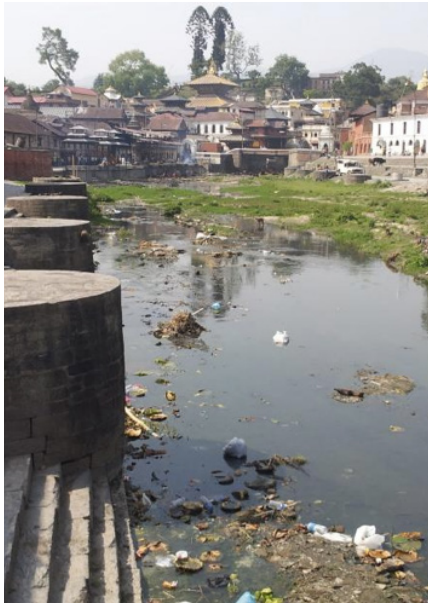

Water pollution
ROAD SYSTEM
EXTREMELY POLLUTED
HEAVILY POLLUTED
MODERATELY POLLUTED
NON - POLLUTED
POPULATION DENSITY / SQ KM
10,000 - 15,000
5,000 - 10,000
1,000 - 5,000
0 - 1,000
0
1 KM
N

Solid waste

In the river



Riverbank



Near religious site

Squatter settlements make pollution worse

Riverside Littering

Outside Drainage

Monsoon Flooding

0 1 KM N

CITY CENTER
ROAD SYSTEM
RIVERSIDE SQUATTER SETTLEMENT
NON-RIVERSIDE SQUATTER SETTLEMENT
MOST DENSELY POPULATION AREA
WATER BODY
MONSOON FLOODING

Religious rituals make pollution worse

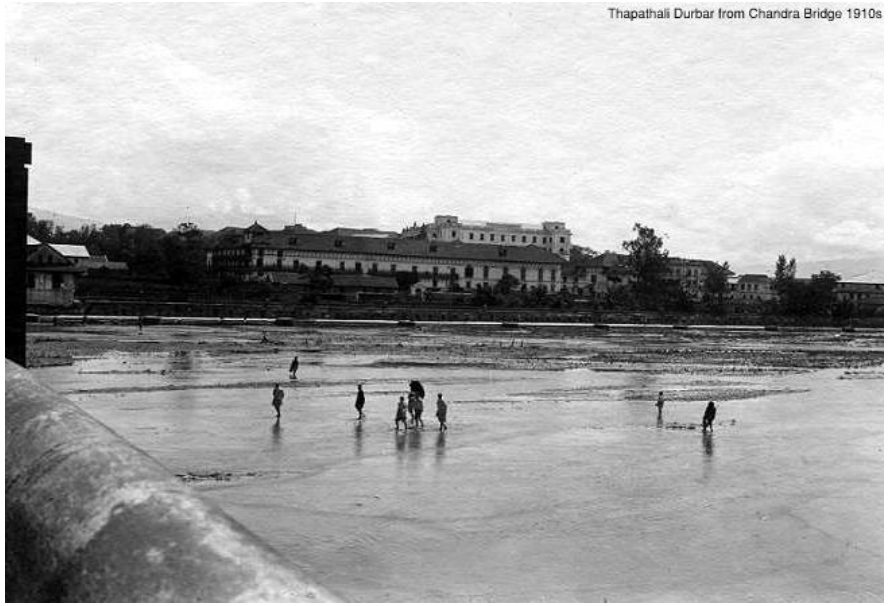
Worship at the Pashupatinath Temple complex

During Bala Chaturdashi Festival

The Bagmati River no longer supports their daily life, even their religious life

Loss of Connection

Thapathali(Patan) from Thapathali bridge



People used walk through Bagmati-1918

Now, Bagmati is chocked with Sewage and trash which is no longer safe for people to get close-2023

Loss of Connection

River bank of Thapathali(Patan) in rainy season

Swimming during monsoon-1926

Water of Bagmati is too dirty for swimming inside-2021

Loss of Connection

Sankhamul Ghat

A pleasant gathering space-1920

Home to scavenging animals and birds-2016

The government made efforts to revive Bagmati River, but did not get the expected results

Existing solutions of Water Pollution

- ROAD SYSTEM
- MAIN SEWER INTERCEPTOR
- POLLUTED WATER BODY
- WWTP
- PROPOSED WWTP
- CATCHMENT AREA OF WWTP
- CATCHMENT AREA OF DHOBIGHAT (NOT MEET DEMAND)
- CATCHMENT AREA OF KODKU (NOT MEET DEMAND)
- GREEN SPACE

Gokarna
Pop 2020: 12447
Pop 2030: 23363

Guheshwori
Pop 2020: 169704
Pop 2030: 348415

Dhobighat
Pop 2020: 1592540
Pop 2030: 2944277

Kodku
Pop 2020: 437606
Pop 2030: 871769

Sallaghari
Pop 2020: 91434
Pop 2030: 123640

0 1 KM

N

Existing solutions of solid waste in the river

"Not that there has not been any efforts, there have been several cleaning campaigns, but there are more people dirtying it. People are the problem."

Bagmati River Clean-up Mega Campaign

Difficulty of the relocation of Squatters

Main contradiction:

From squatters
1. Cannot afford rent of new residence
2. No job opportunity
3. Insufficient public facilities

From the neighbors of the relocation site
Very resistant to squatters moving to the neighborhood

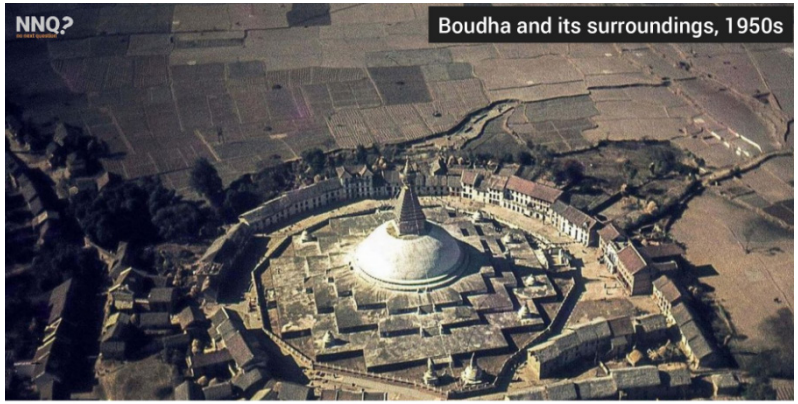
From government
For environmental reasons, the squatters should leave

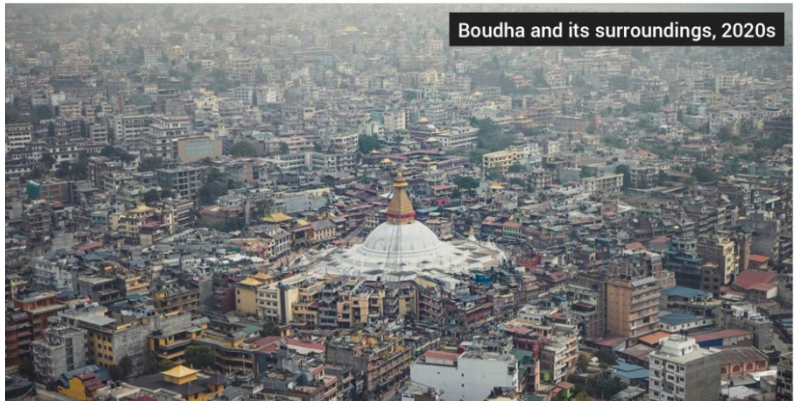
Squatters

Government

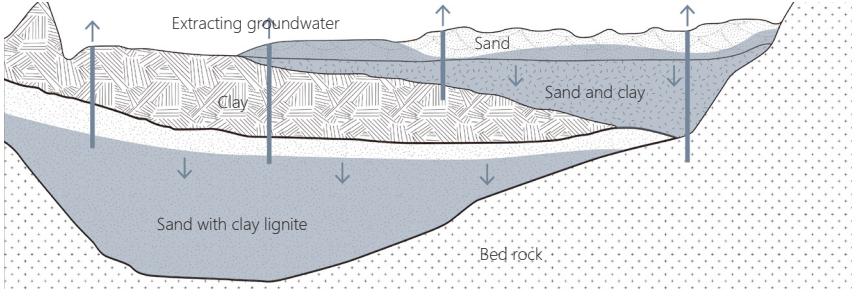
Residents

Declining groundwater level makes cleaning more difficult

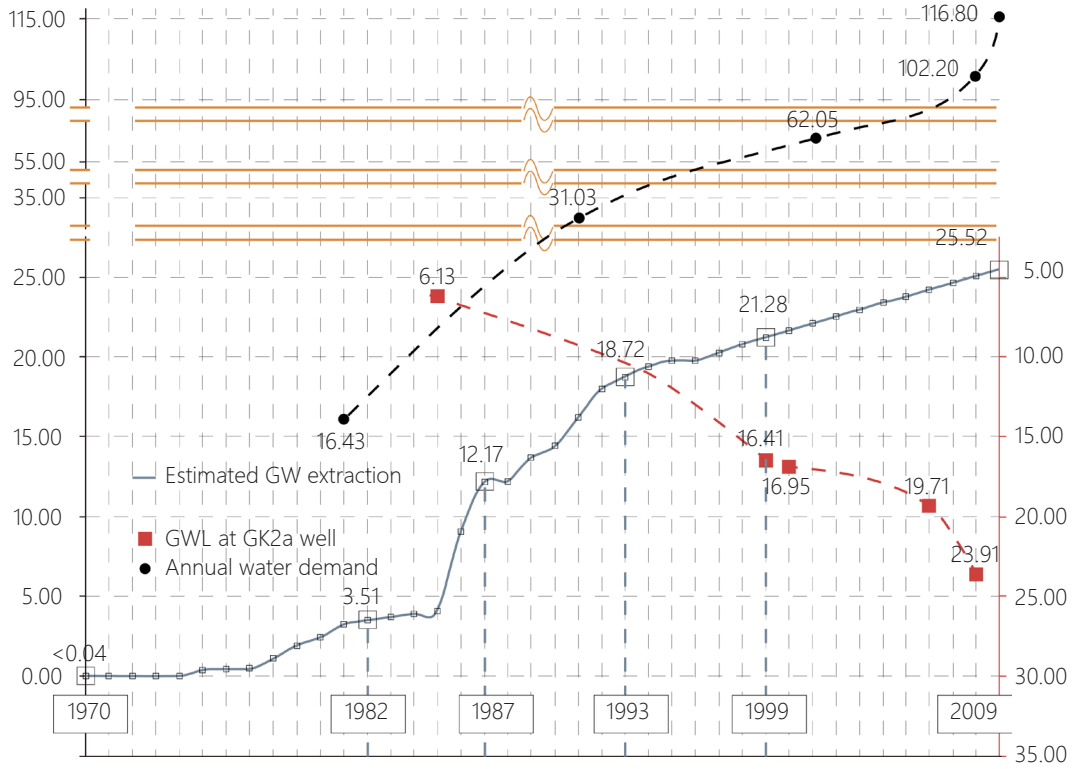


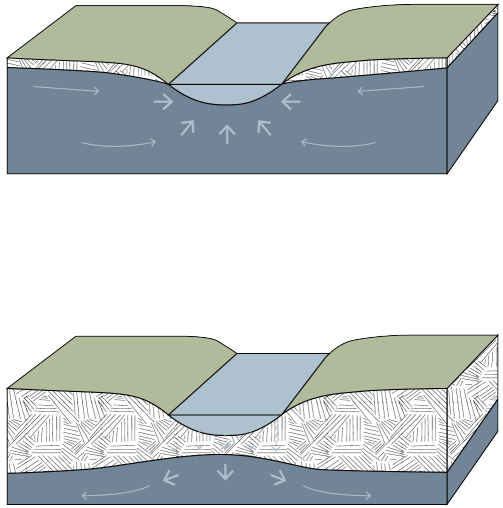


Groundwater abstraction is much greater than groundwater recharge.



Declining groundwater level makes cleaning more difficult

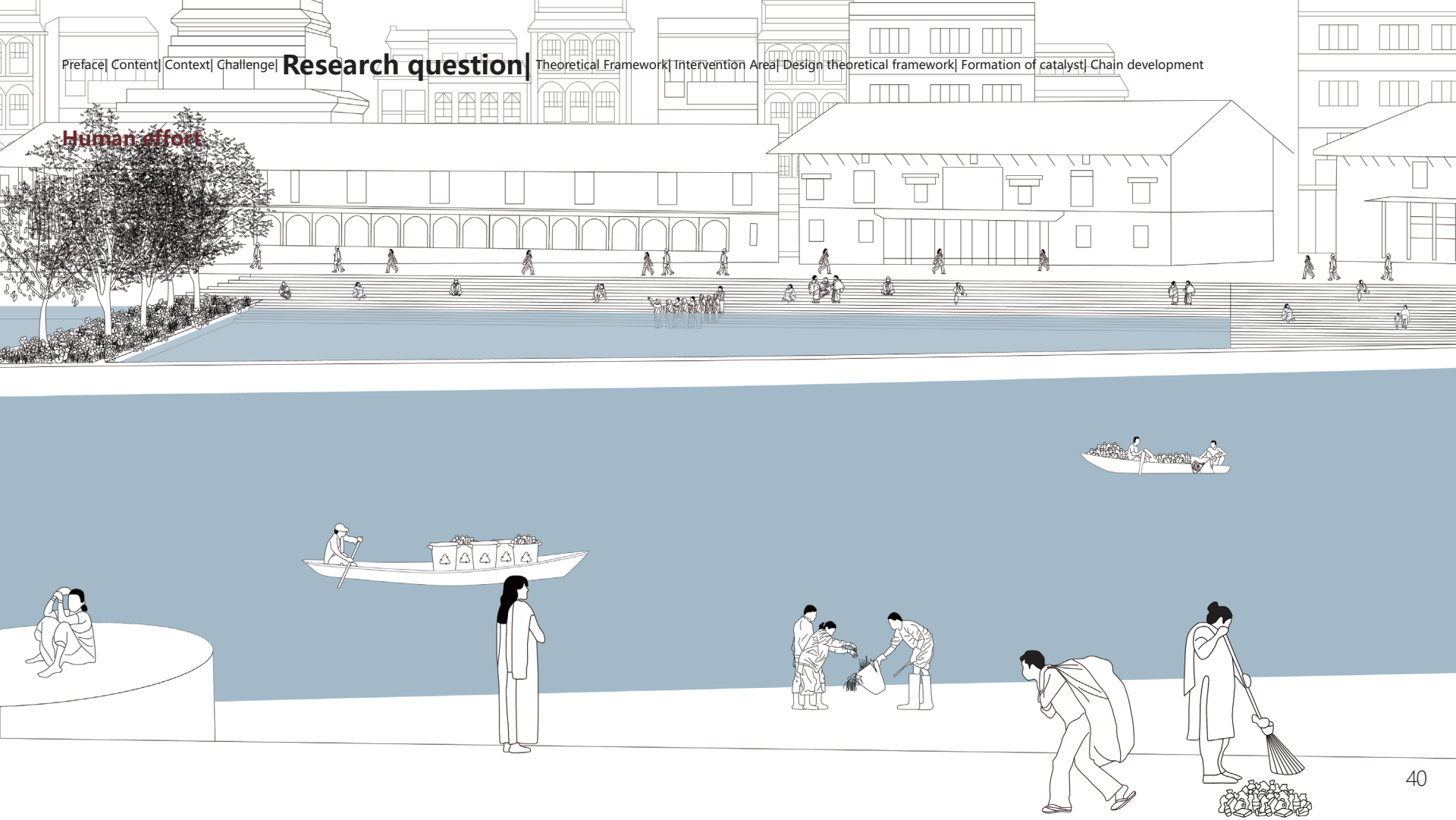




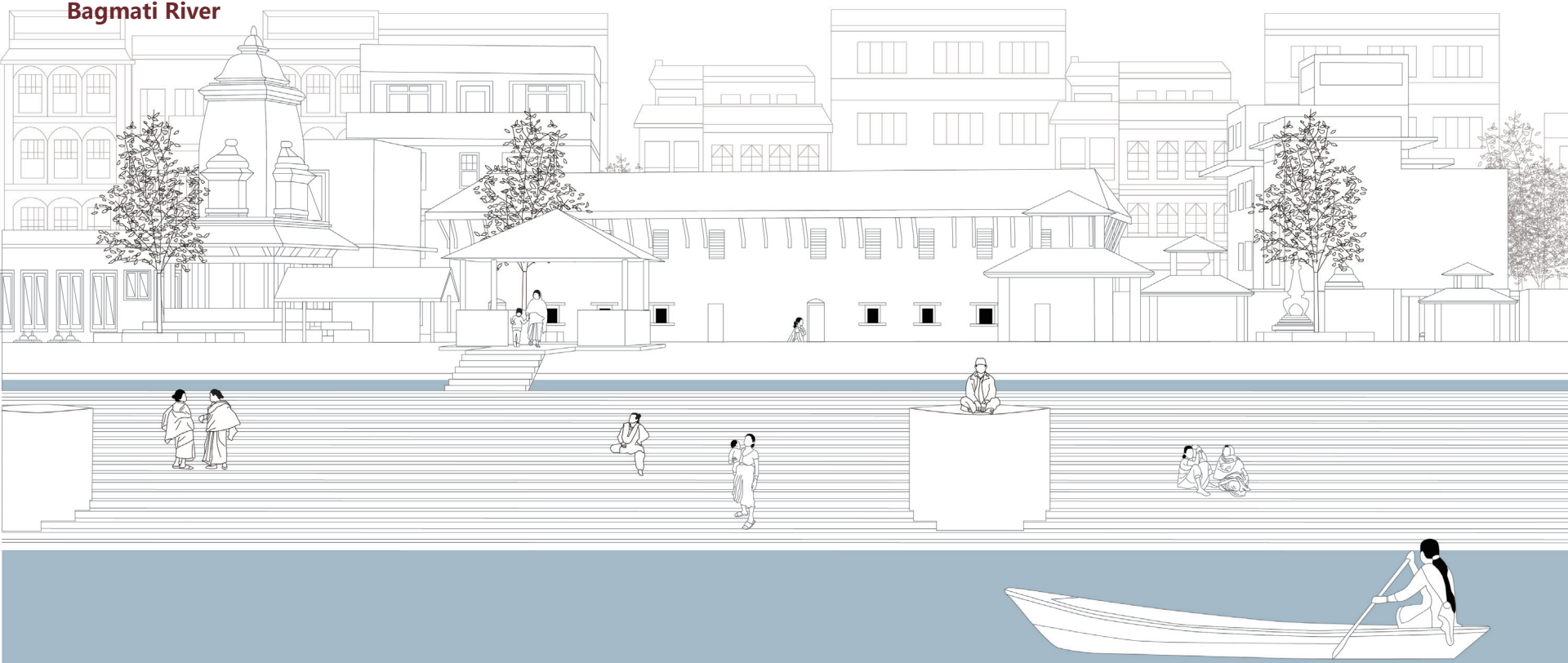
What can be the role of **landscape architecture** in this context?

Can an **integrated and comprehensive** landscape architectonic (spatial) design of the **Bagmati River** reconnect people to the river and enhance the **living quality** in the Kathmandu Valley?

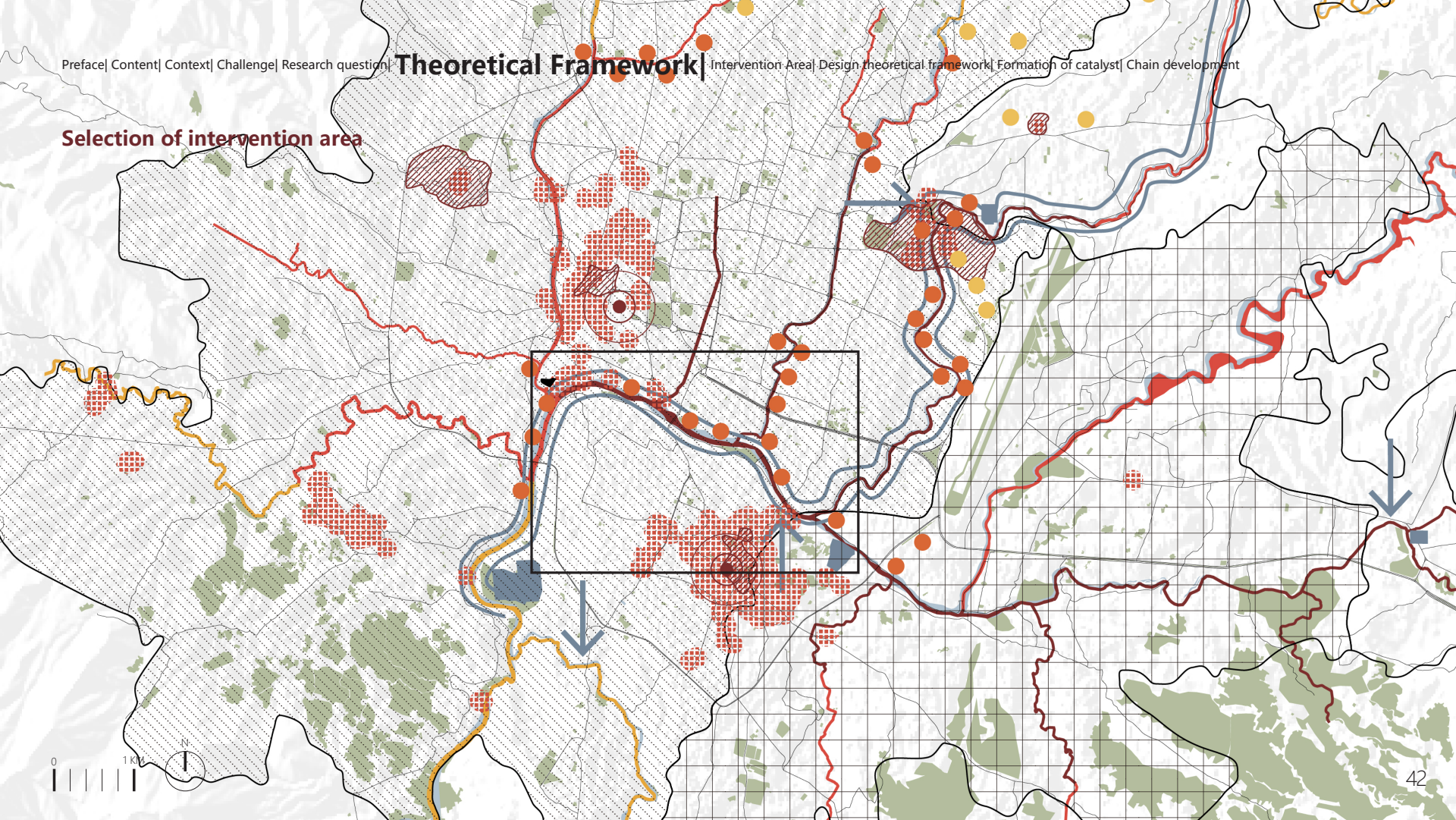
Rebuild a new connection


Human effort

Bagmati River

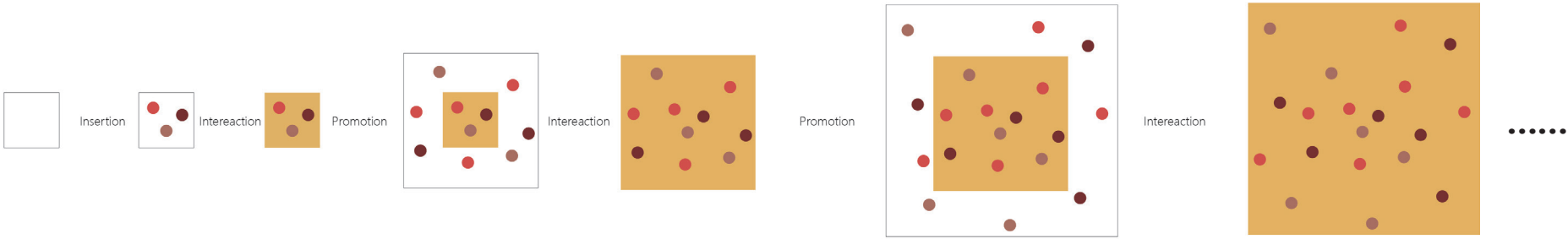


Selection of intervention area



How Urban Catalyst works

Chain development



Intervention Area | Catalyst points | Urban Catalyst | Larger area | Strong destinantion area | Larger area | Impact on the city

STAGE 1
The formation of Urban Catalyst

STAGE 2
Inspire and guide follow-up projects

STAGE 3
Continuity of the impact

Overview

Religious monuments

Teku Temple Area

Thaphatali Temple Area

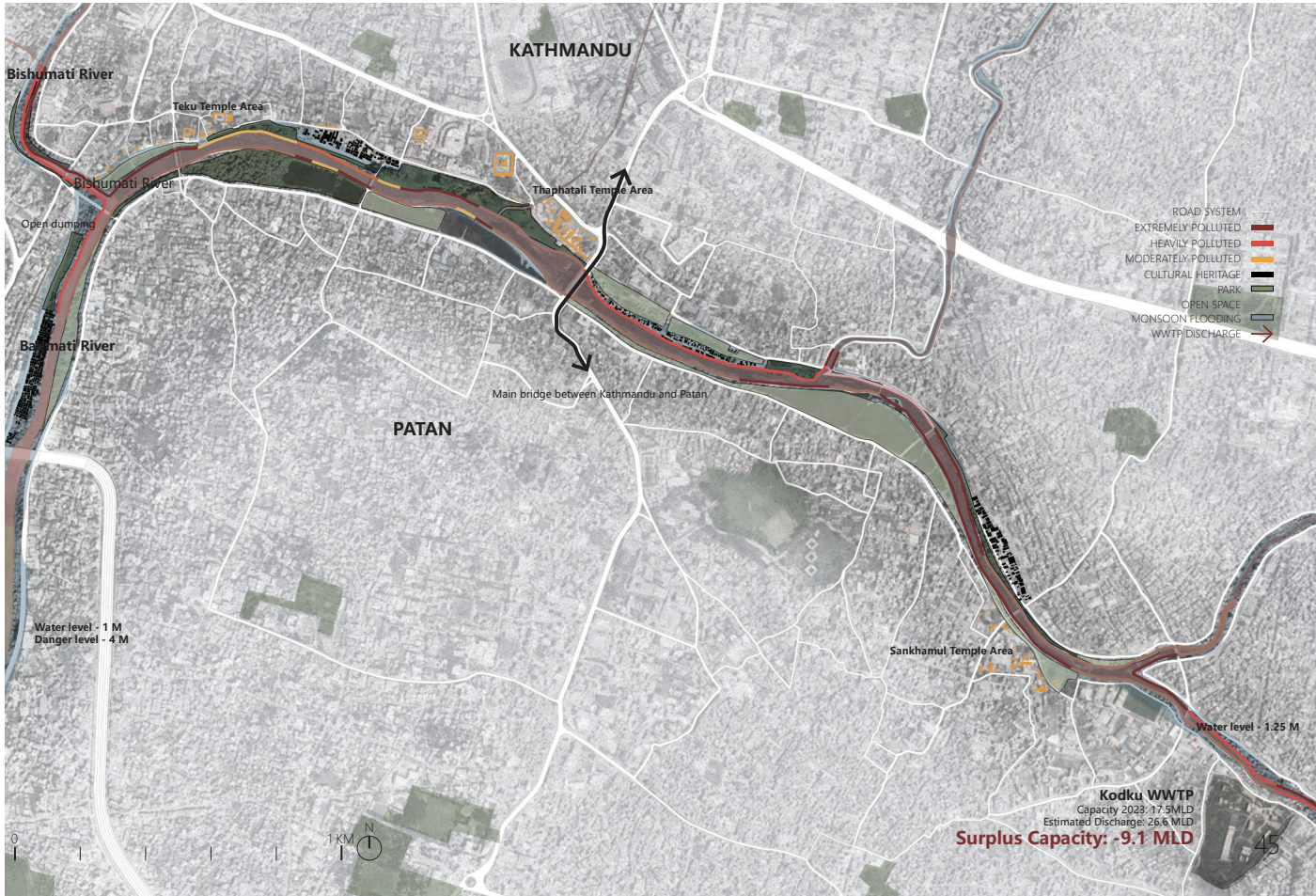
Sattal at Purohit Ghat

Sankhamul Squatter Settlement

Overview

Kodku WWTP

Wastewater is discharged directly into Bagmati River



Overview

Transfer station

Poor garbage management

Overview

squatter settlement

Aggravating pollution

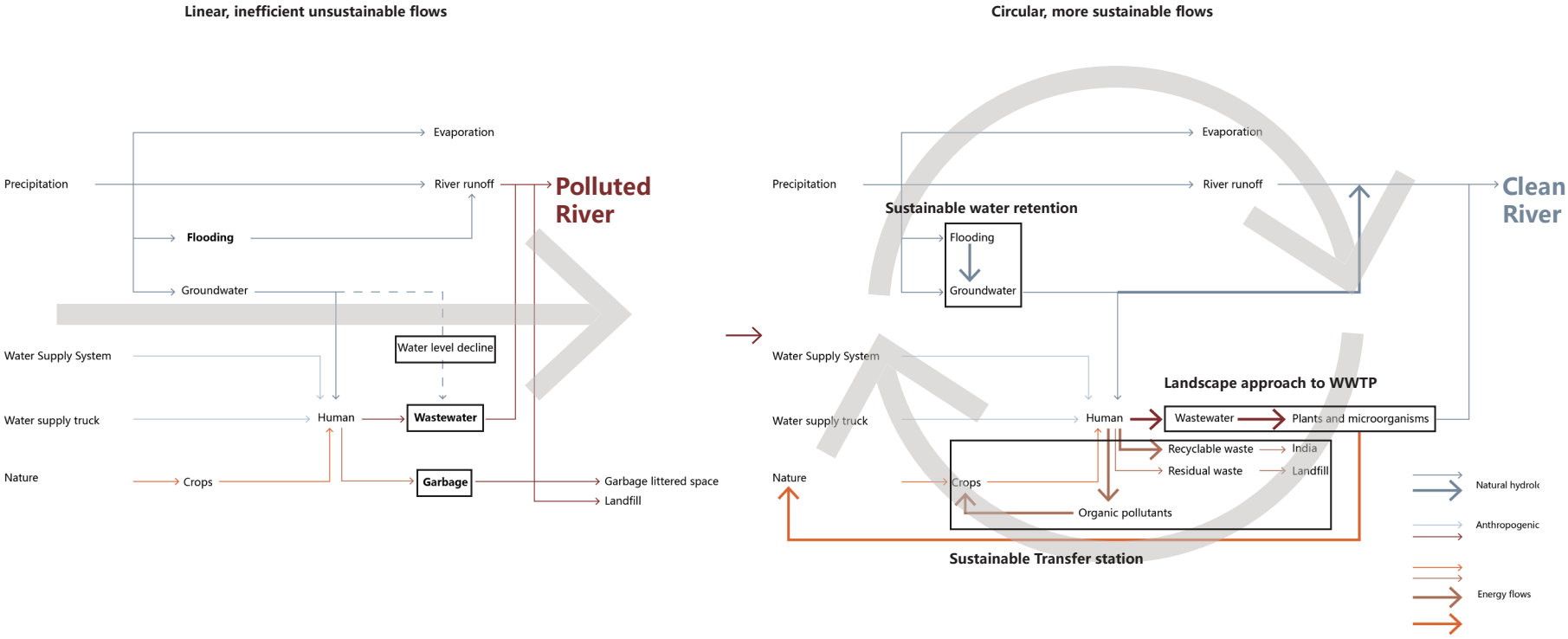
Balkhu Squatter Settlement

Bansighat Squatter Settlement

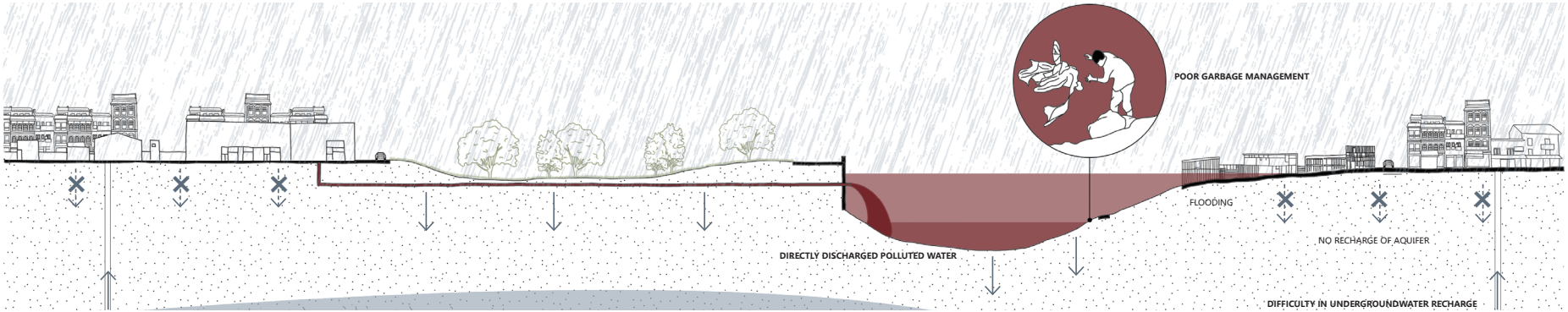
Thapatali Squatter Settlement

Sankhamul Squatter Settlement

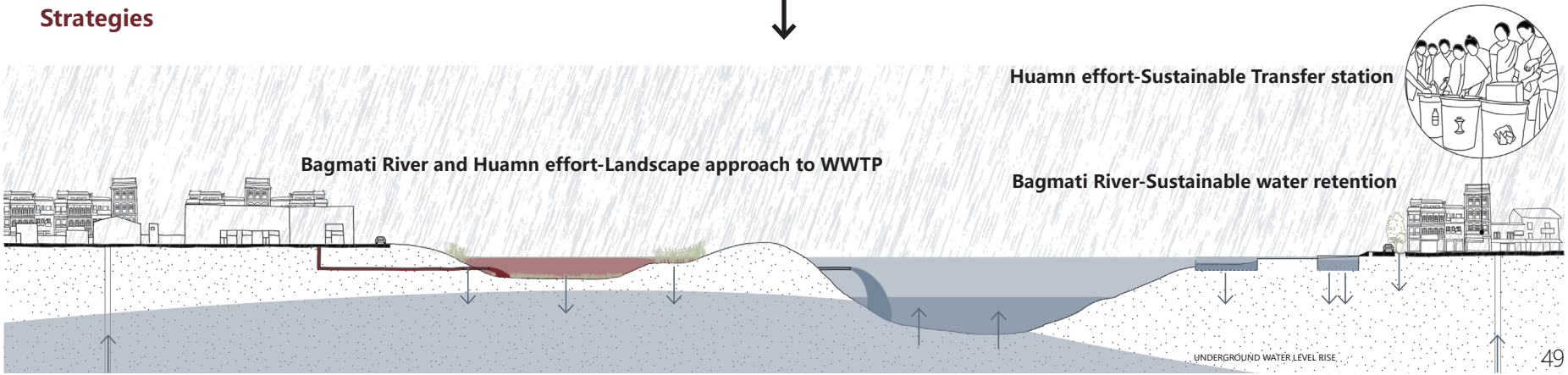
Urban Metabolism

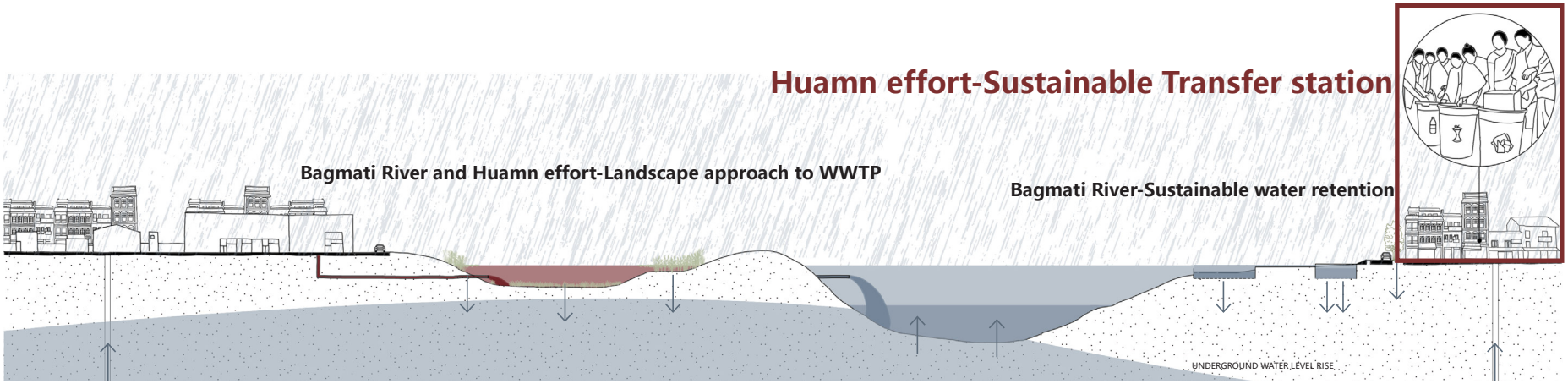


Problems

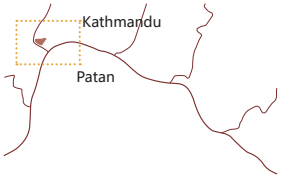


Strategies




Huamn effort-Sustainable Transfer station
Bagmati River and Huamn effort-Landscape approach to WWTP
Bagmati River-Sustainable water retention
UNDERGROUND WATER LEVEL RISE

Transfer station

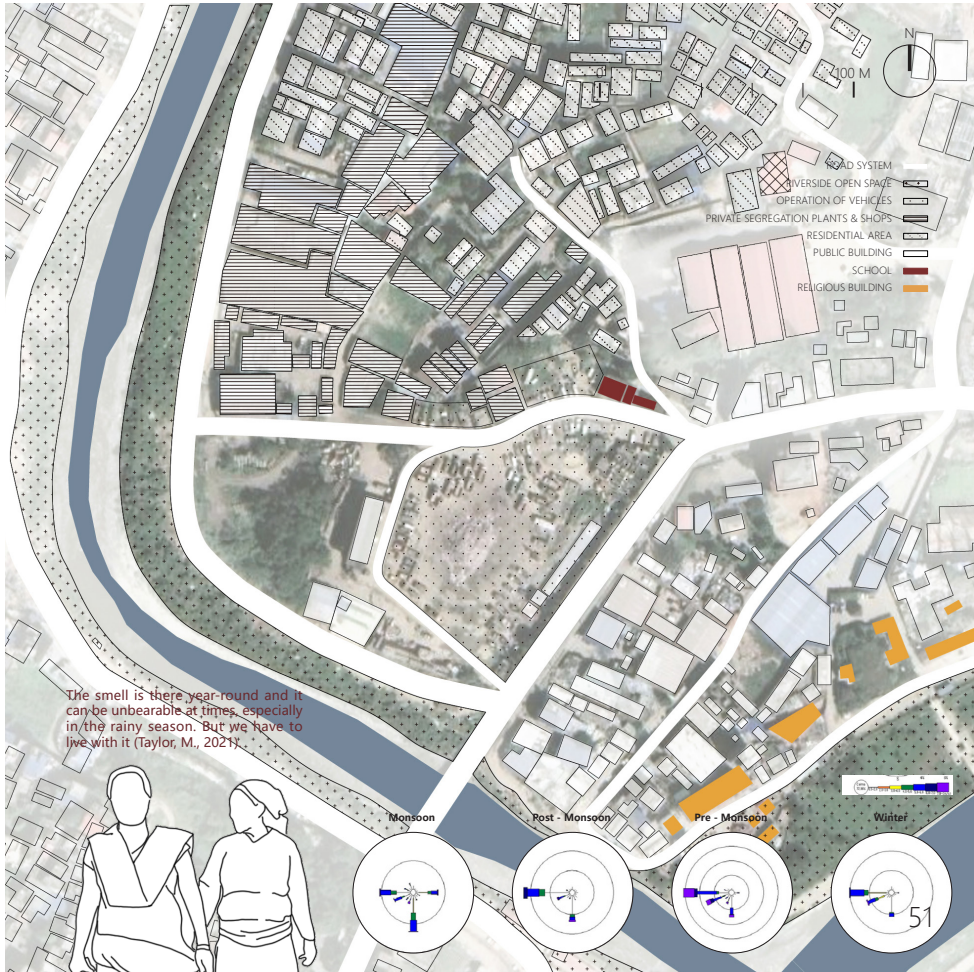


PROBLEM OF THE EXISTING WORK FLOW IN TEKU T/S

1. Teku T/S allows access only to garbage collected by truck. **Garbage from** the dense and **narrow city roads cannot be collected**.

2. Since Teku T/S has a **limited capacity** - 100 tons per day - and the Kathmandu Valley generates 1,200 tons per day, it can only collect waste within a **limited service area**.

3. **Manpower is lack** due to the caste. Most Nepalis believe that managing garbage cannot be honourable work.



Sustainable transfer station

Main strategies based on problem

1. Limited capacity cause limited service area → **Improve capacity through garbage segregation**.

2. Garbage from the dense and narrow city roads cannot be collected → **More ways to collect garbage to transfer station**.

3. Manpower is lack due to the caste → **Involving squatters in the waste management process**.

Sustainable transfer station

1. Limited capacity cause limited service area → **Improve capacity through garbage segregation**.

2. Garbage from the dense and narrow city roads cannot be collected → **More ways to collect garbage to transfer station**.

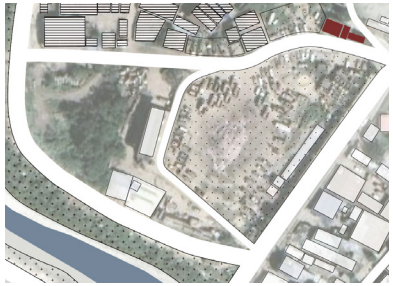
Sustainable transfer station

1. Limited capacity cause limited service area → **Improve capacity through garbage segregation**.

1. Compression area
2. Composting area
3. Store to sell fertilizer
4. Farmland that can use organic waste fertilizer for food production and provided garbage reuse education
5. Storage area for recyclable waste
6. Storage area for residual waste during monsoon.

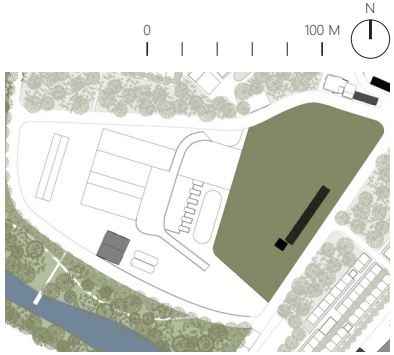
Traffic flow

- Organic waste truck
- Non-organic waste truck
- Compressed waste truck
- Recyclable waste
- Residual waste in monsoon season



Existing situation

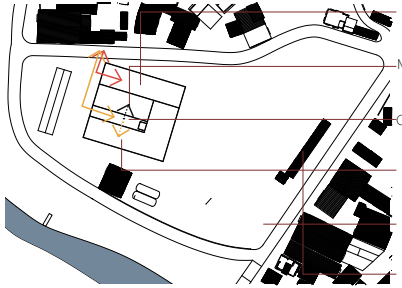
2. Garbage from the dense and narrow city roads cannot be collected → **More ways to collect garbage to transfer station**.



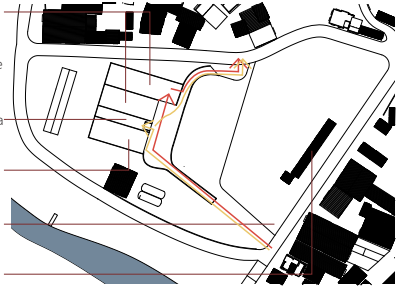
Master plan of sustainable transfer station

1. smaller vehicles such as tricycles and trolleys-more workers
2.boat-more workers
3.private cars-residents
4. people who walk in-residents

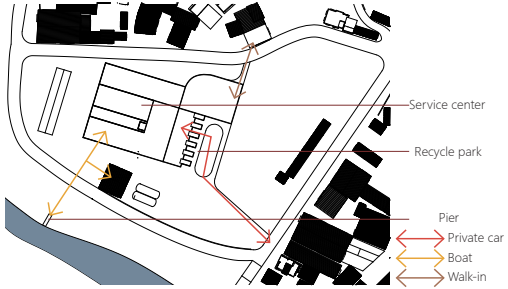
More functional area:
1. recycle park for private cars
2.service center for workers and people who walk in.



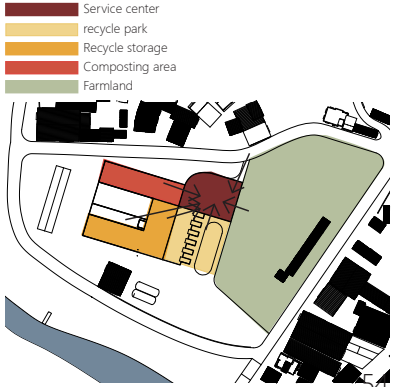
0 Floor



1 Floor



Traffic flows for different types of waste collection

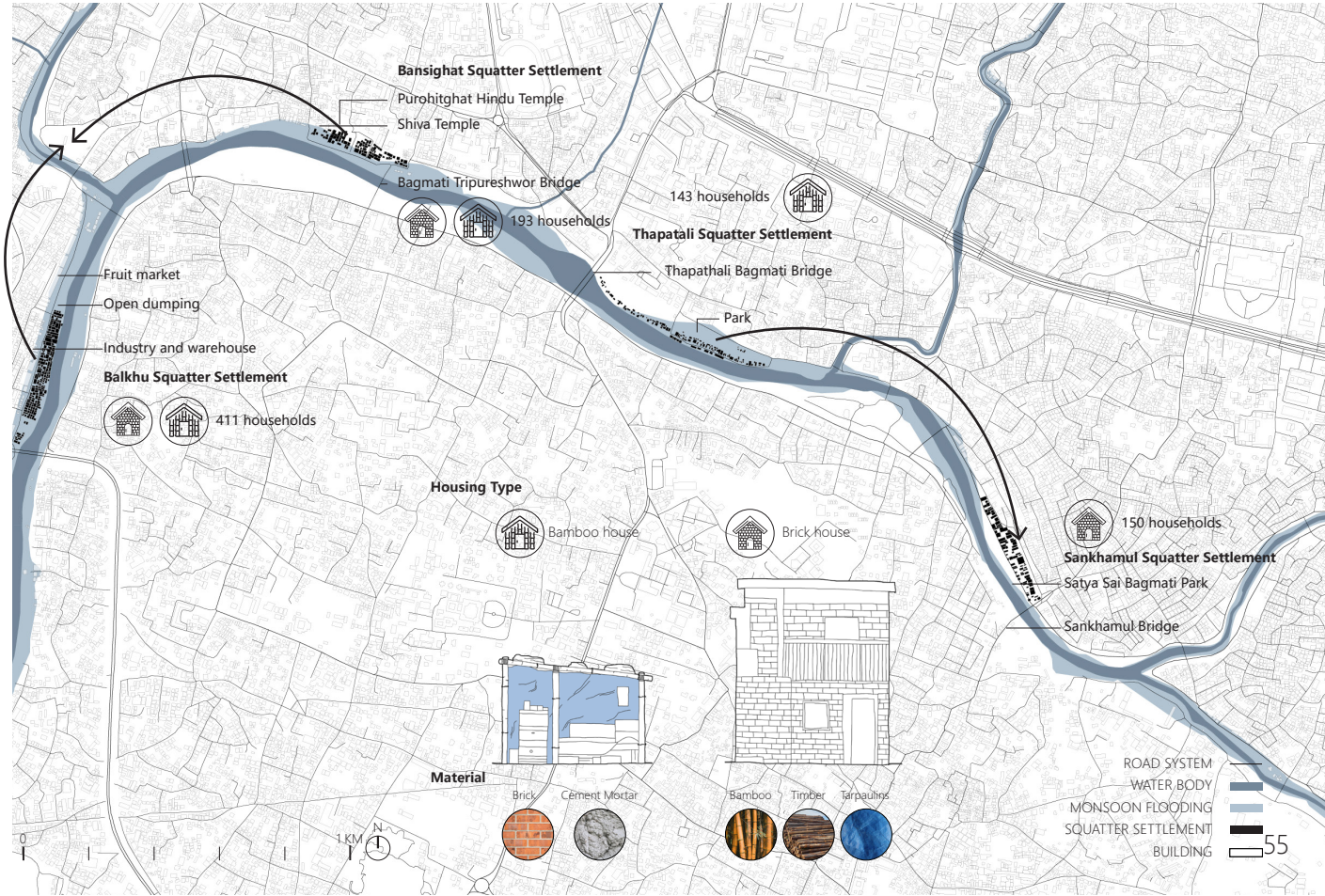


Relation map

Sustainable transfer station

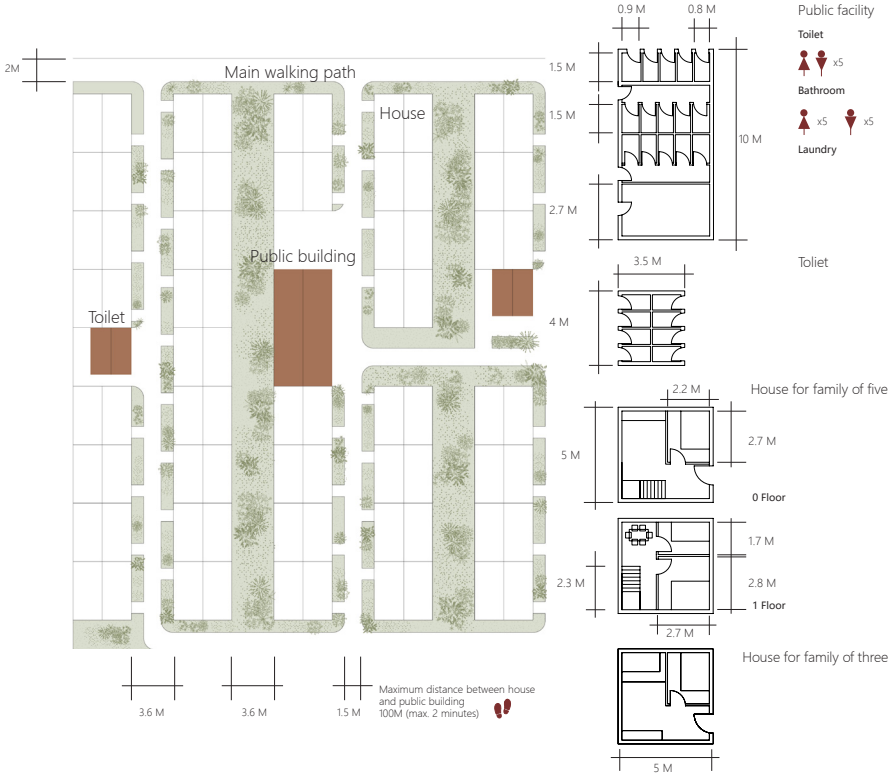
3. Manpower is lack due to the caste → **Involving squatters in the waste management process**.

Relocated the squatters along river bank and provide them with residential area and garbage management jobs (350 new job opportunities).

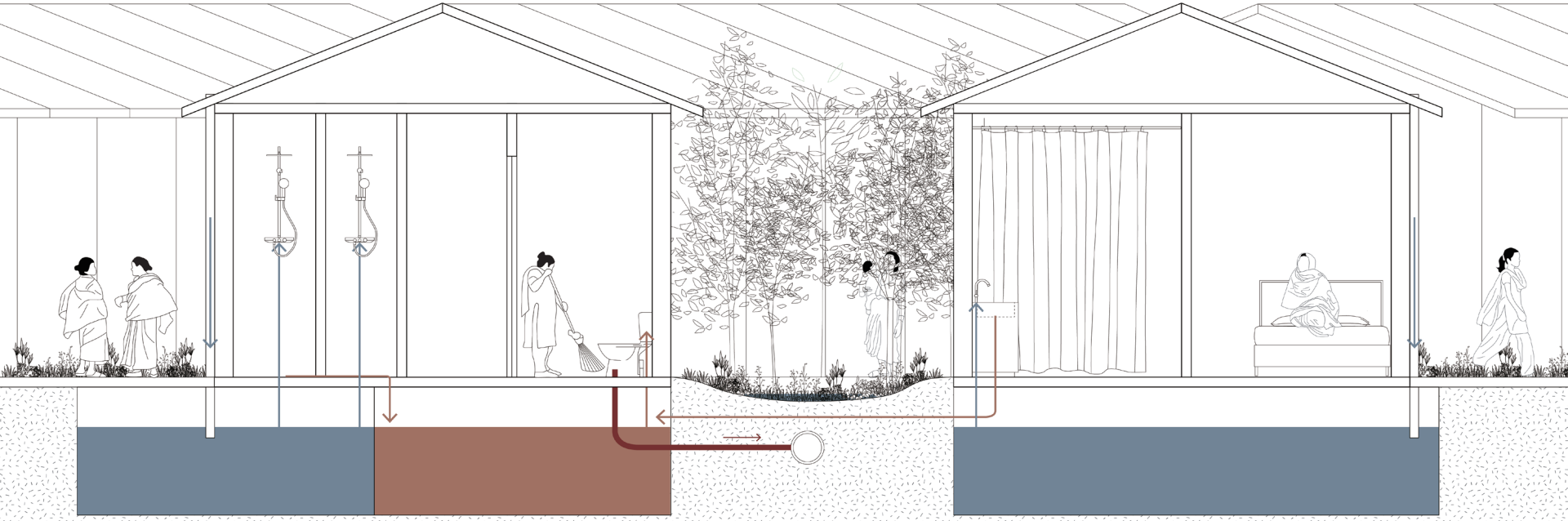


Sustainable transfer station

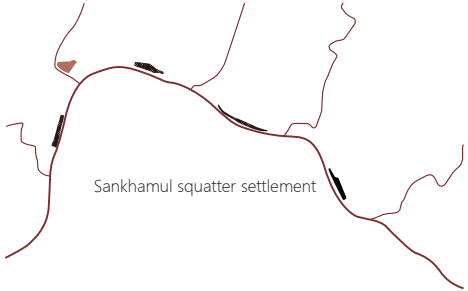
Unit for 35-45 families



Sustainable transfer station



Sustainable transfer station



Provide houses for 320 families

Total:900 squatter families

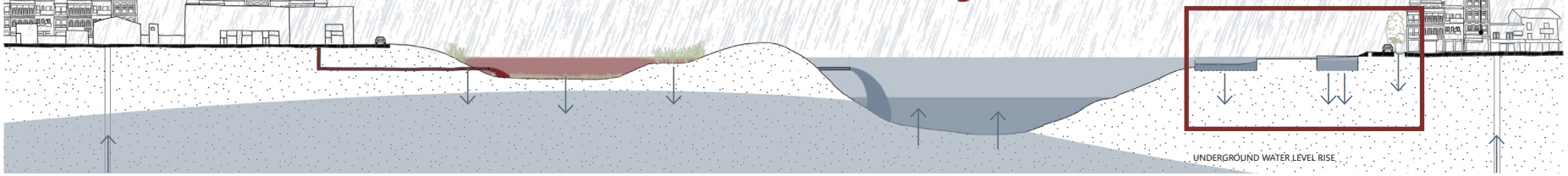
Government apartment (already built):300 families

Sankhamul: 320 families

Huamn effort-Sustainable Transfer station

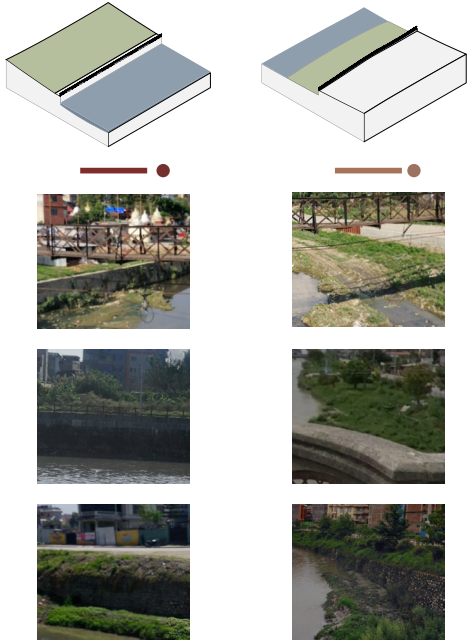
Bagmati River and Huamn effort-Landscape approach to WWTP

Bagmati River-Sustainable water retention



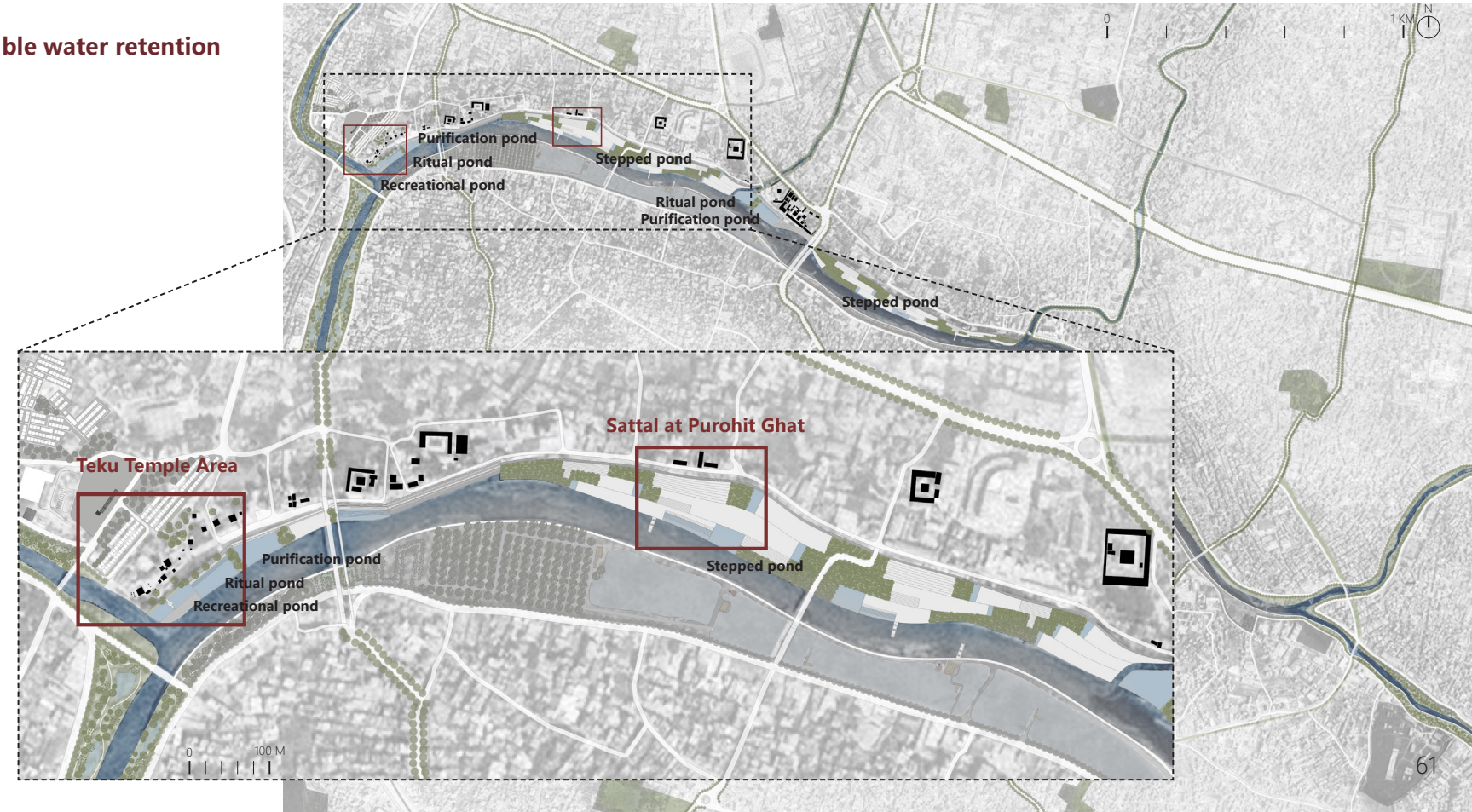
River bank typology

Hard Riverbank



Soft Riverbank

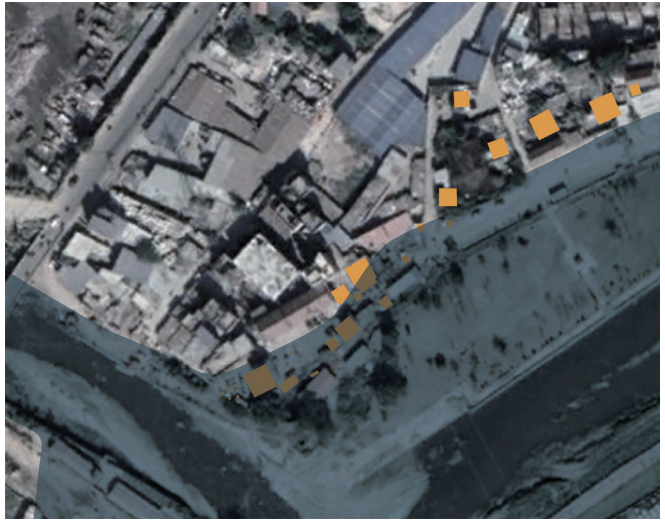
Sustainable water retention



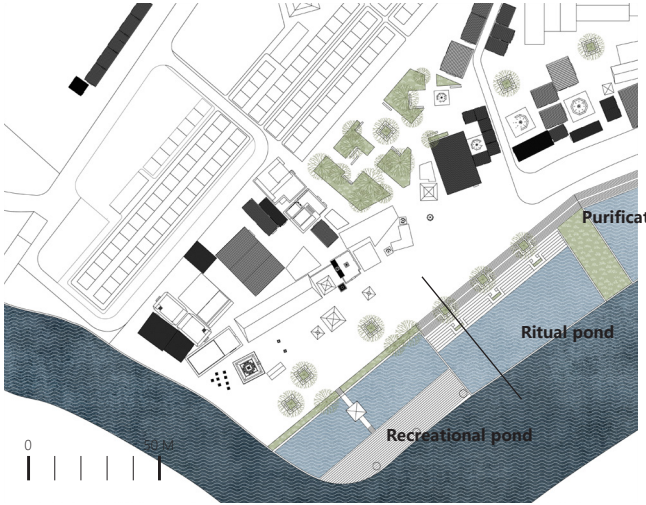
Sustainable water retention-Teku Temple Area

1993

Now



Sustainable water retention-Teku Temple Area

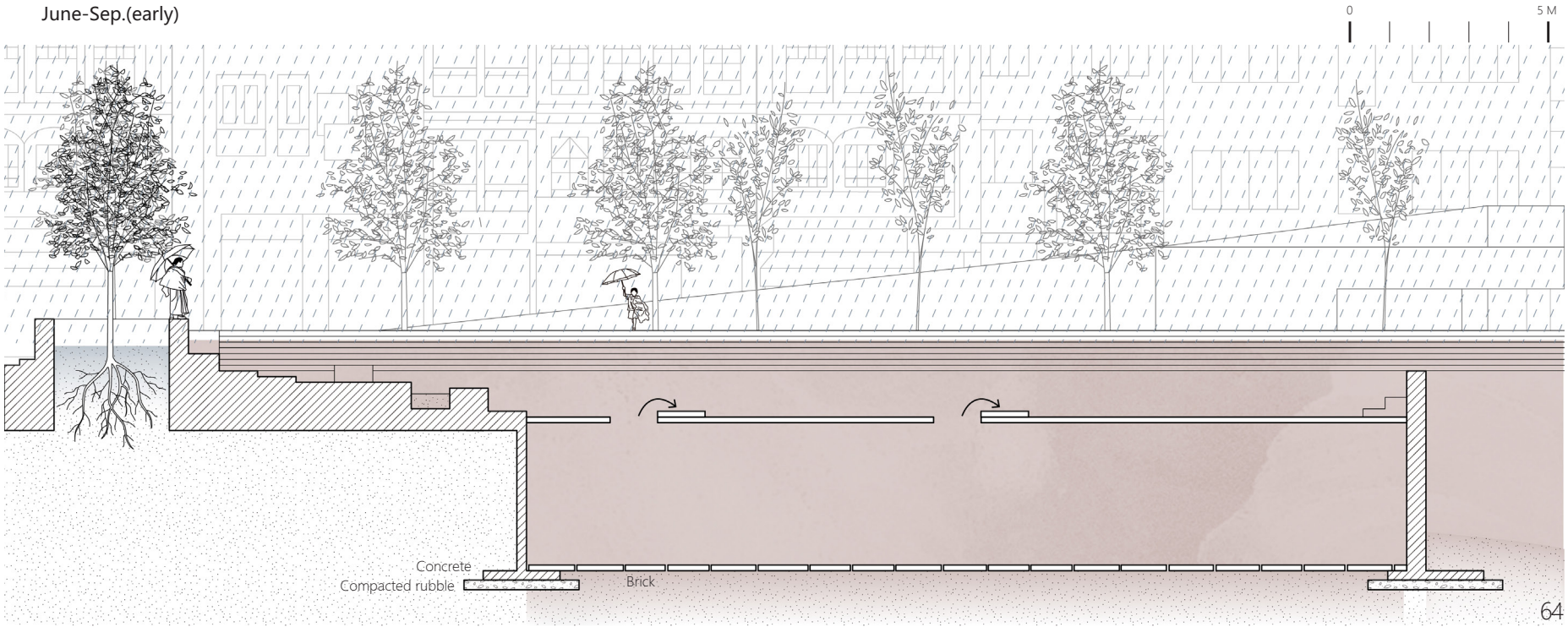


Reference
Traditional pond

Sustainable water retention-Teku Temple Area

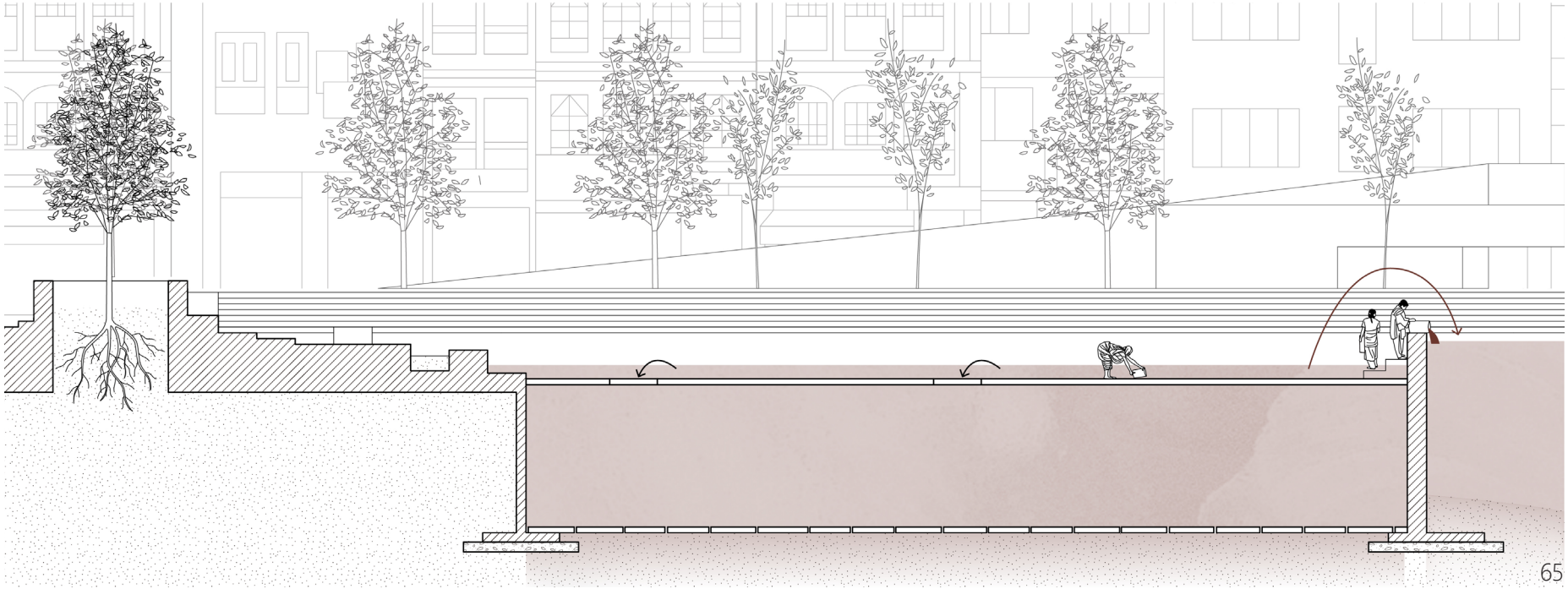
Ritual pond

June-Sep.(early)



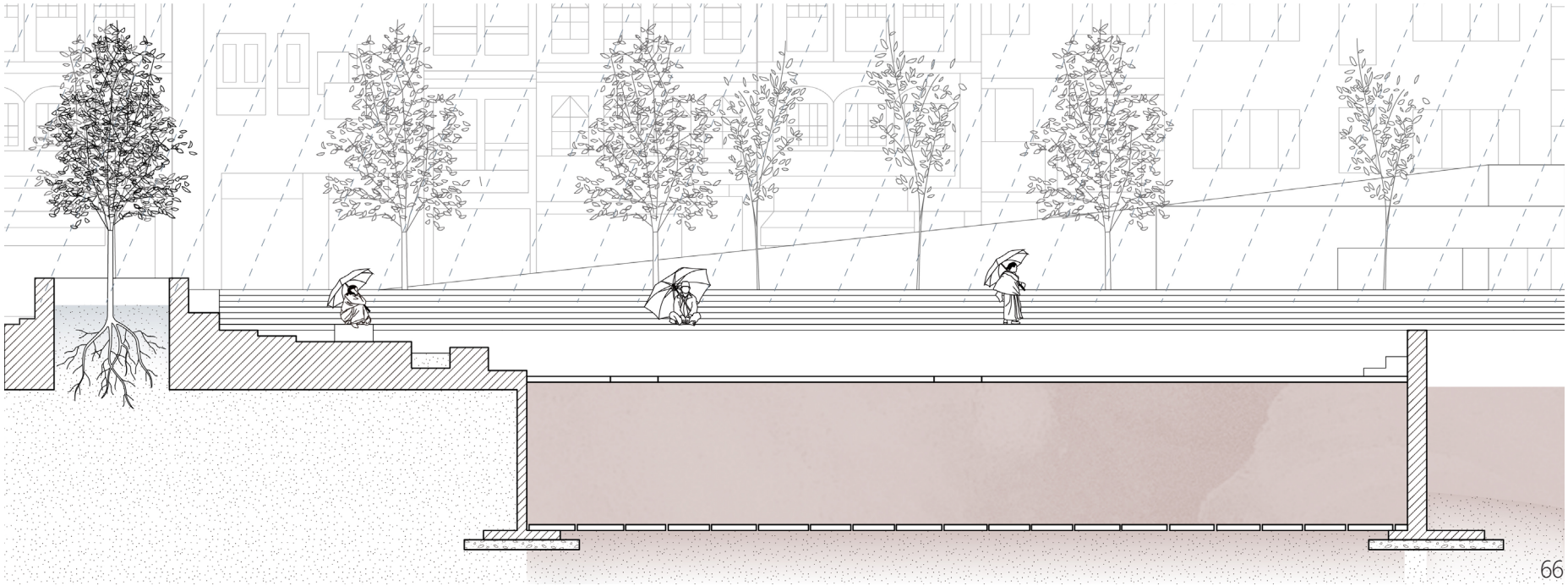
Sustainable water retention-Teku Temple Area

Sep.(late)



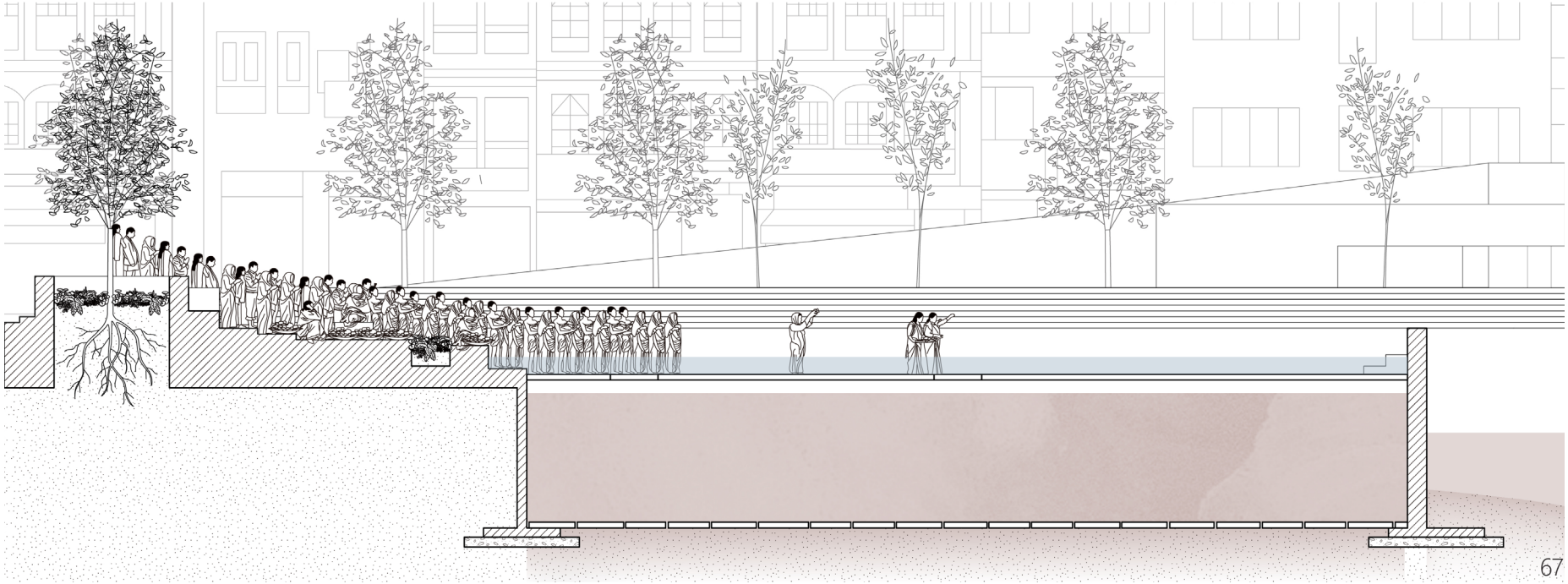
Sustainable water retention-Teku Temple Area

Sep.(late)-Oct.



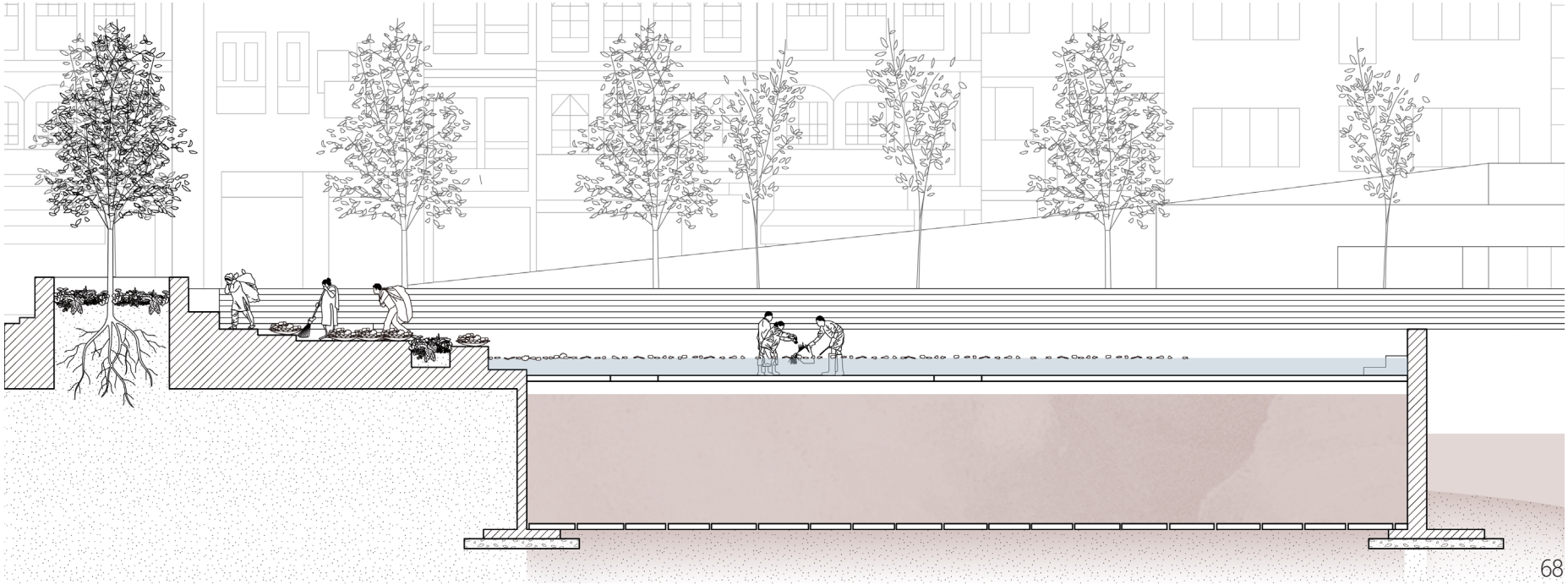
Sustainable water retention-Teku Temple Area

Nov.-Chhath festival



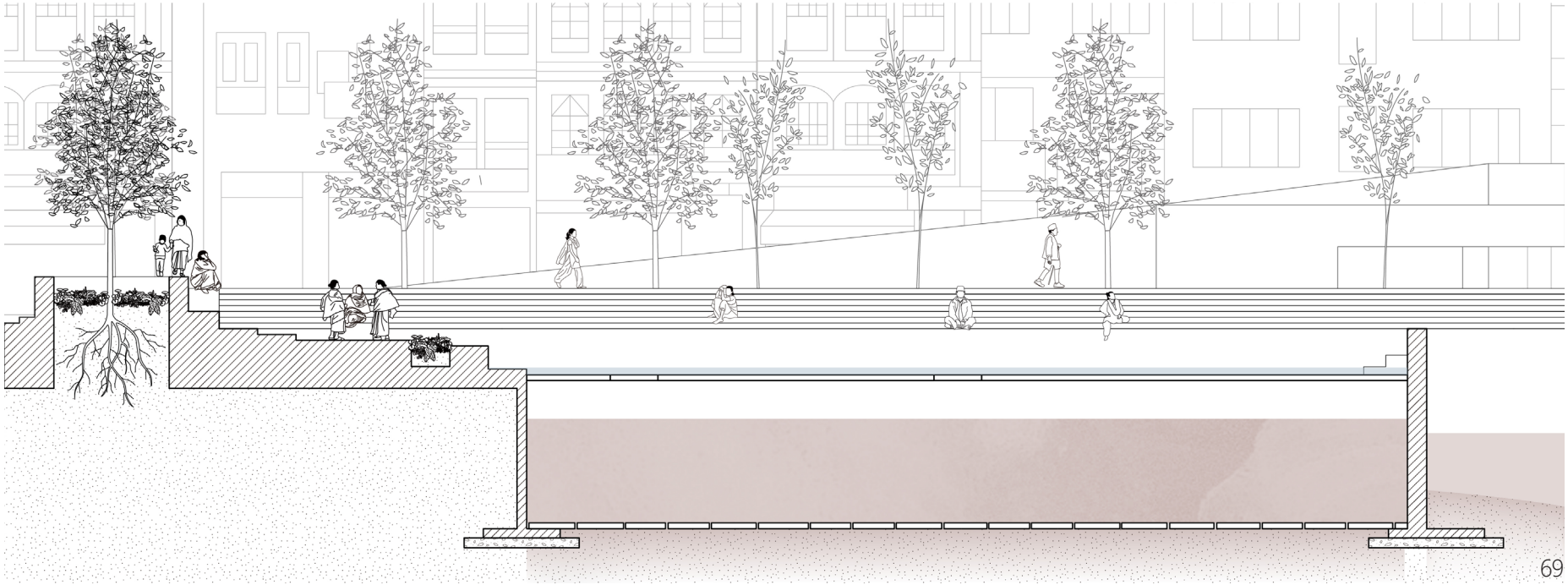
Sustainable water retention-Teku Temple Area

Nov.-Chhath festival

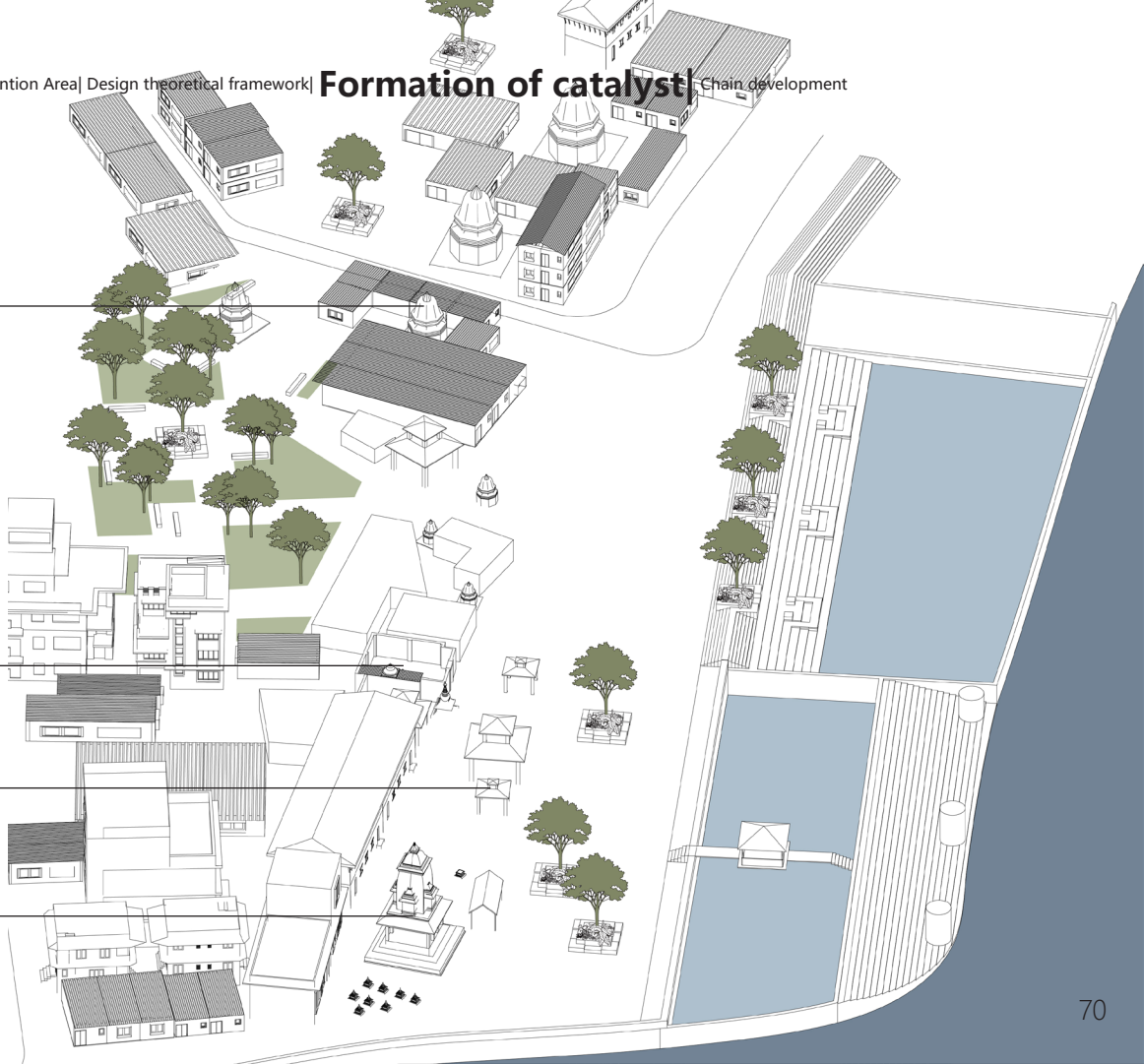


Sustainable water retention-Teku Temple Area

Dec.-Aug.

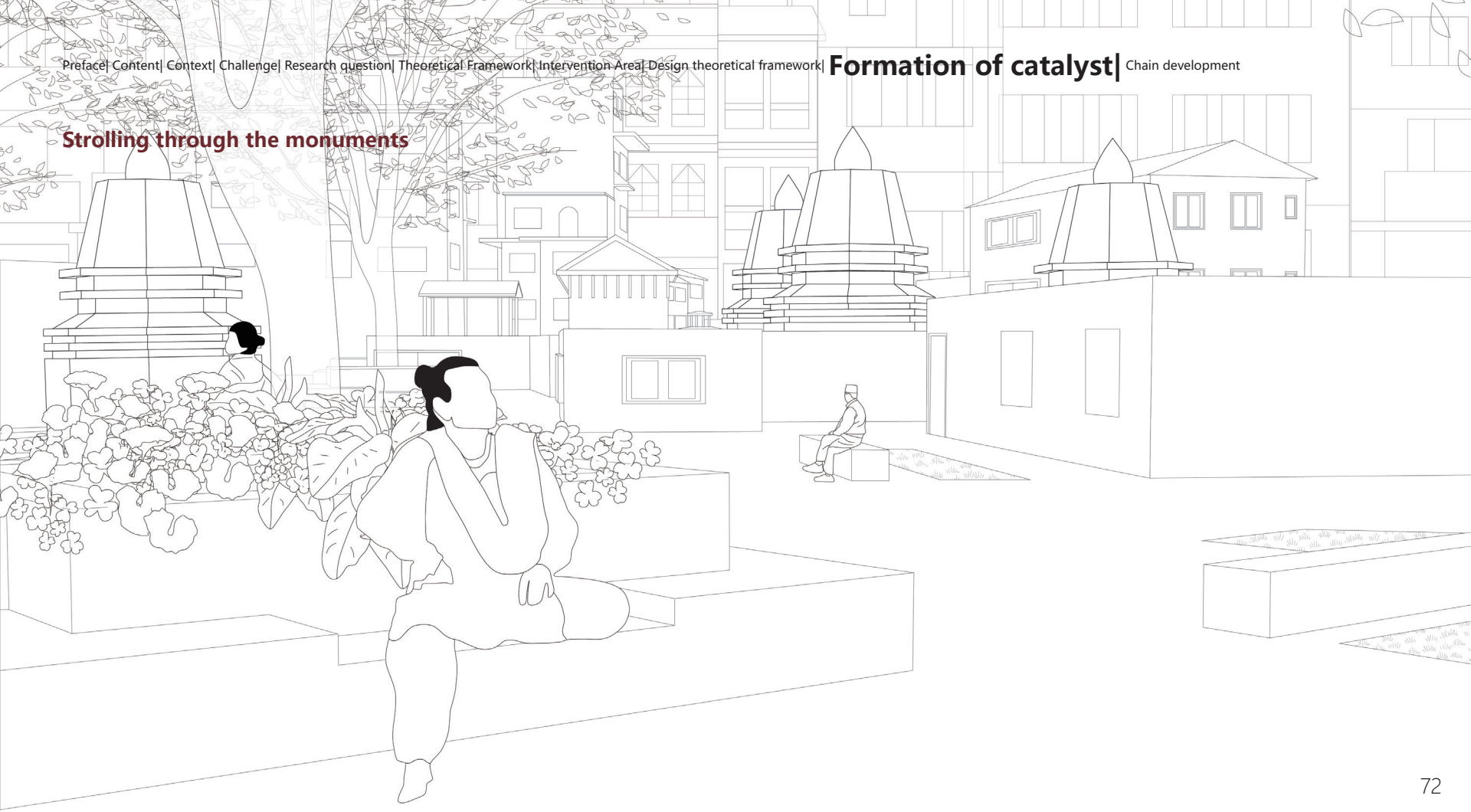


Sustainable water retention-Teku Temple Area

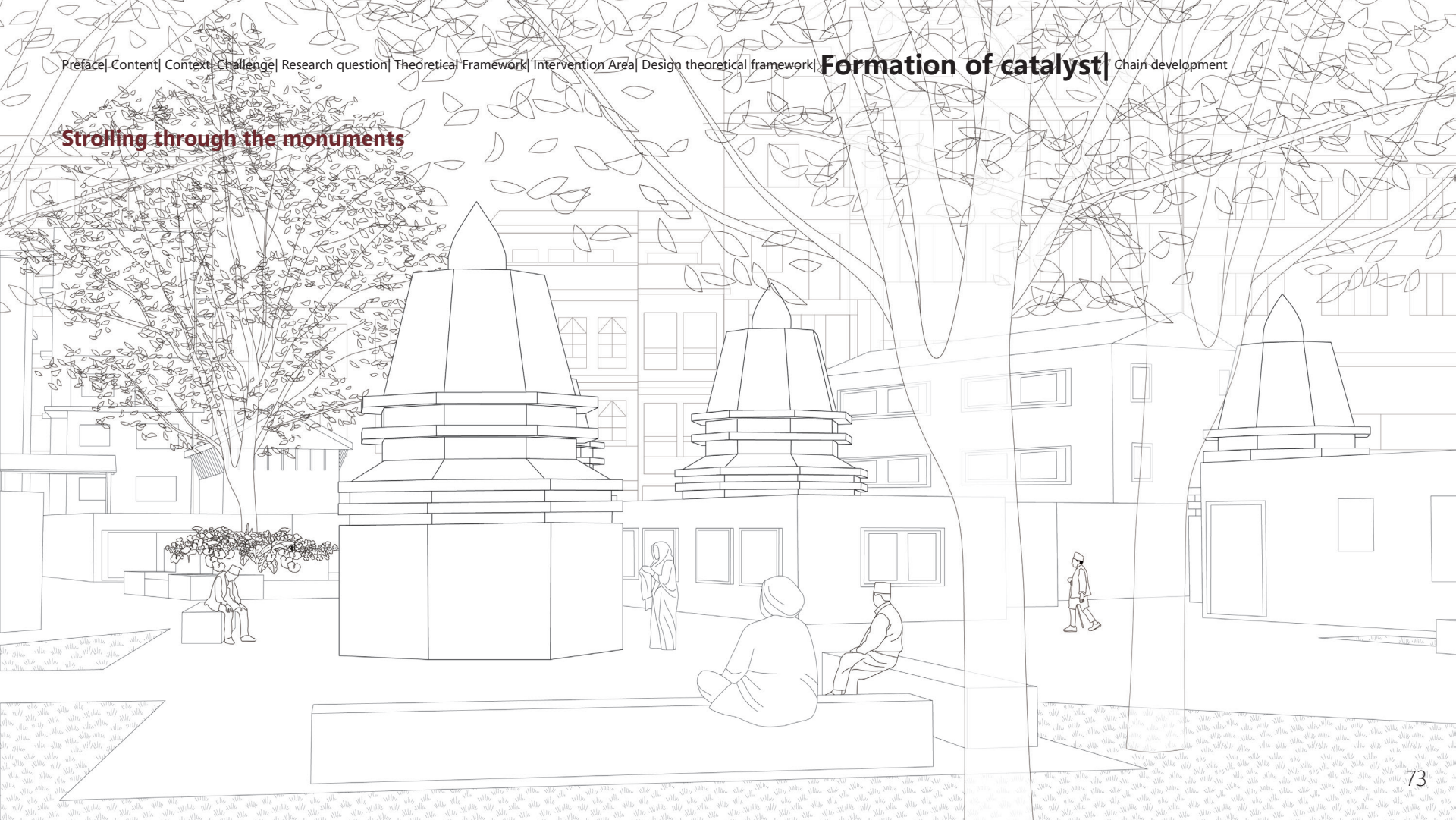


Strolling through the monuments

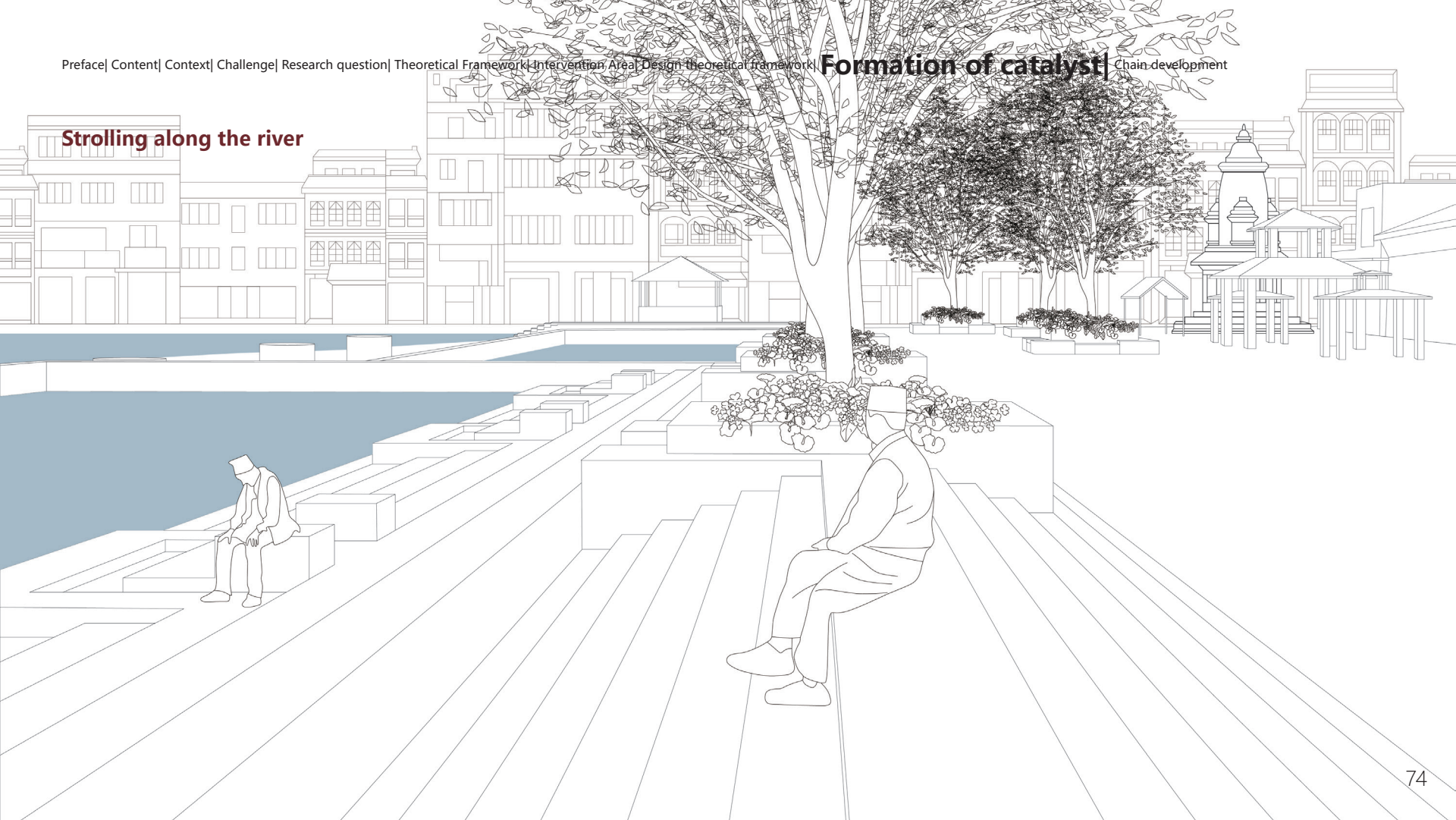
Strolling through the monuments



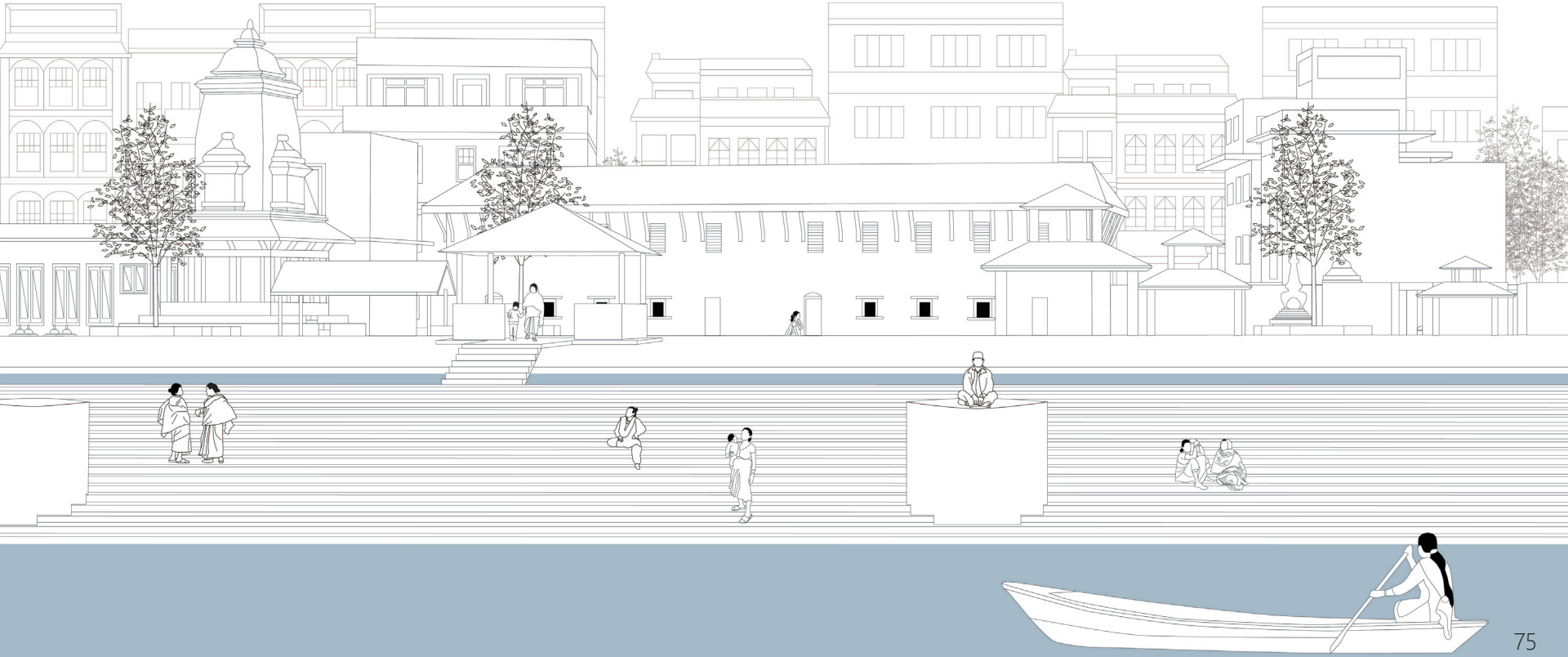
Strolling through the monuments



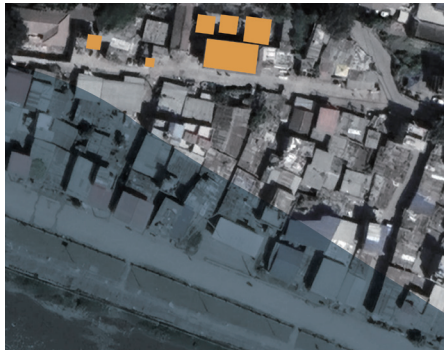
Strolling along the river



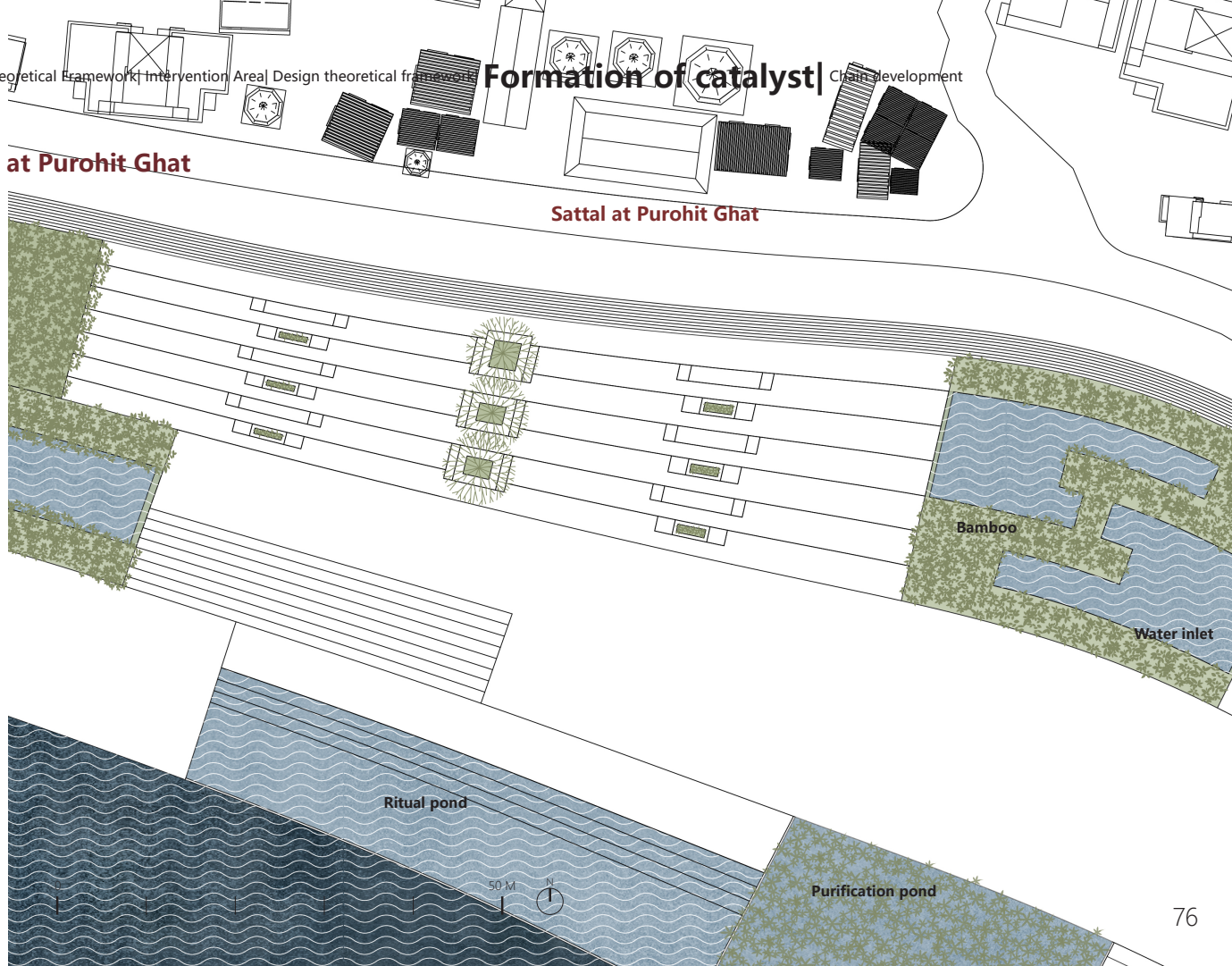
Sustainable water retention-Teku Temple Area



Sustainable water retention-Sattal at Purohit Ghat



Reference
Ghat



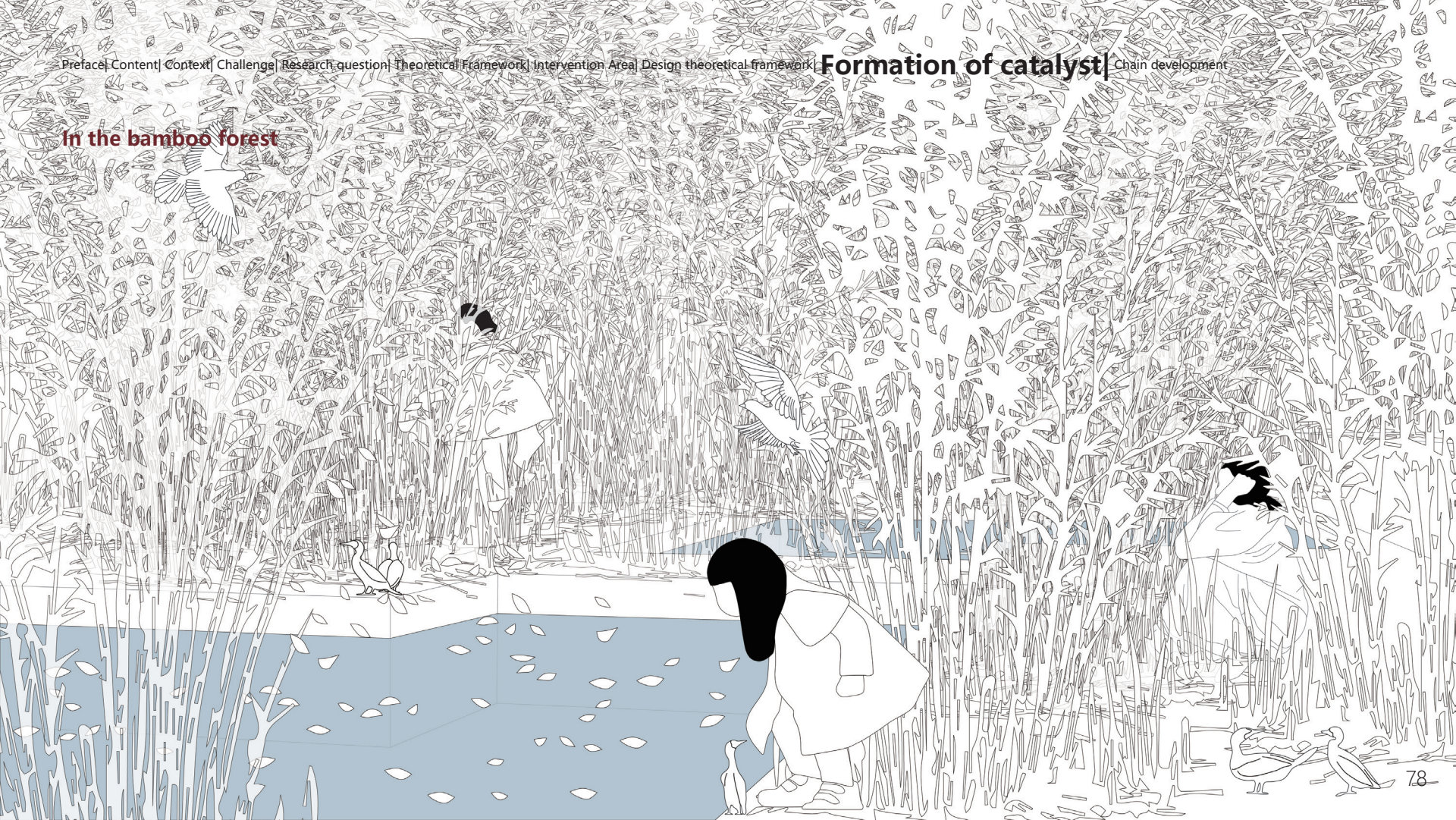
Sustainable water retention-Sattal at Purohit Ghat

1983

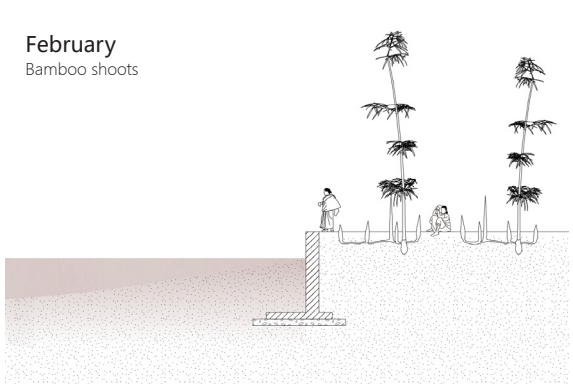
Now

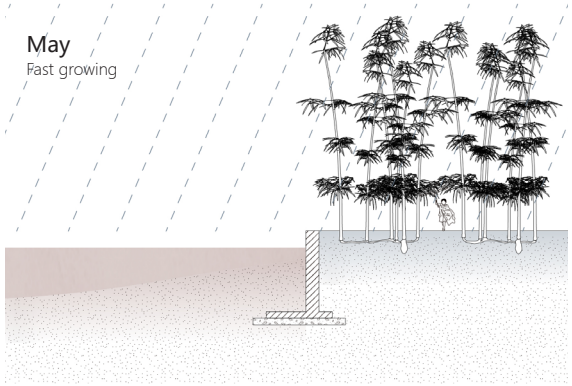
Time: 12PM, 01/01/2023

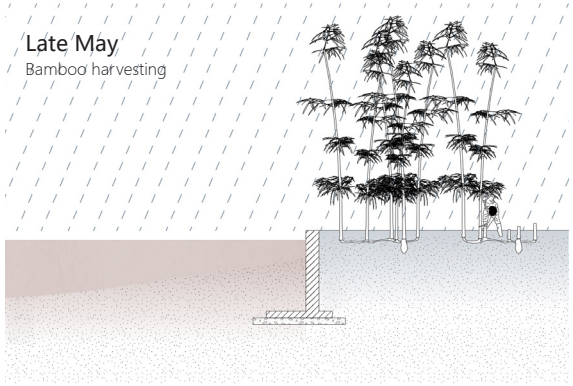
In the bamboo forest

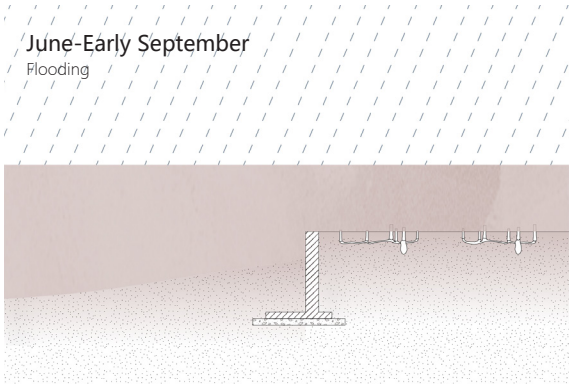


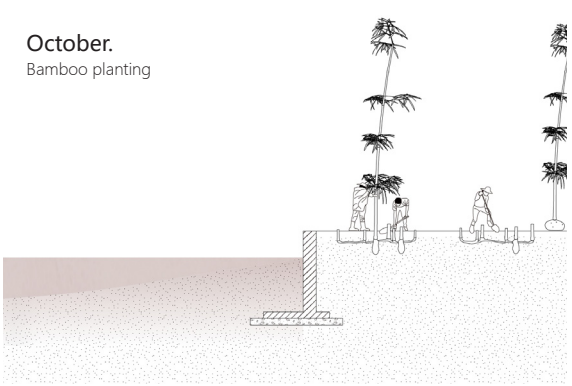
Sustainable water retention-Sattal at Purohit Ghat

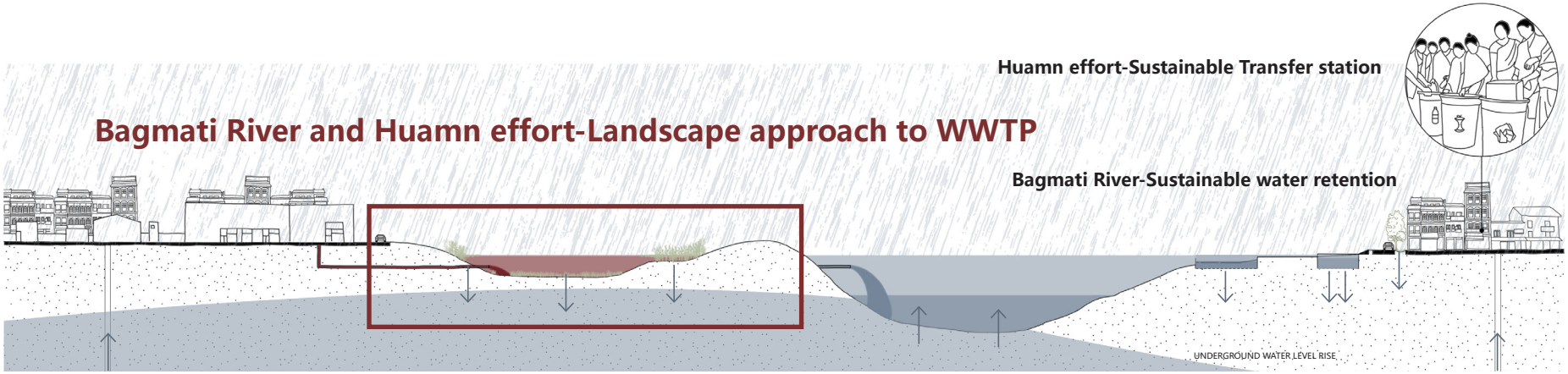




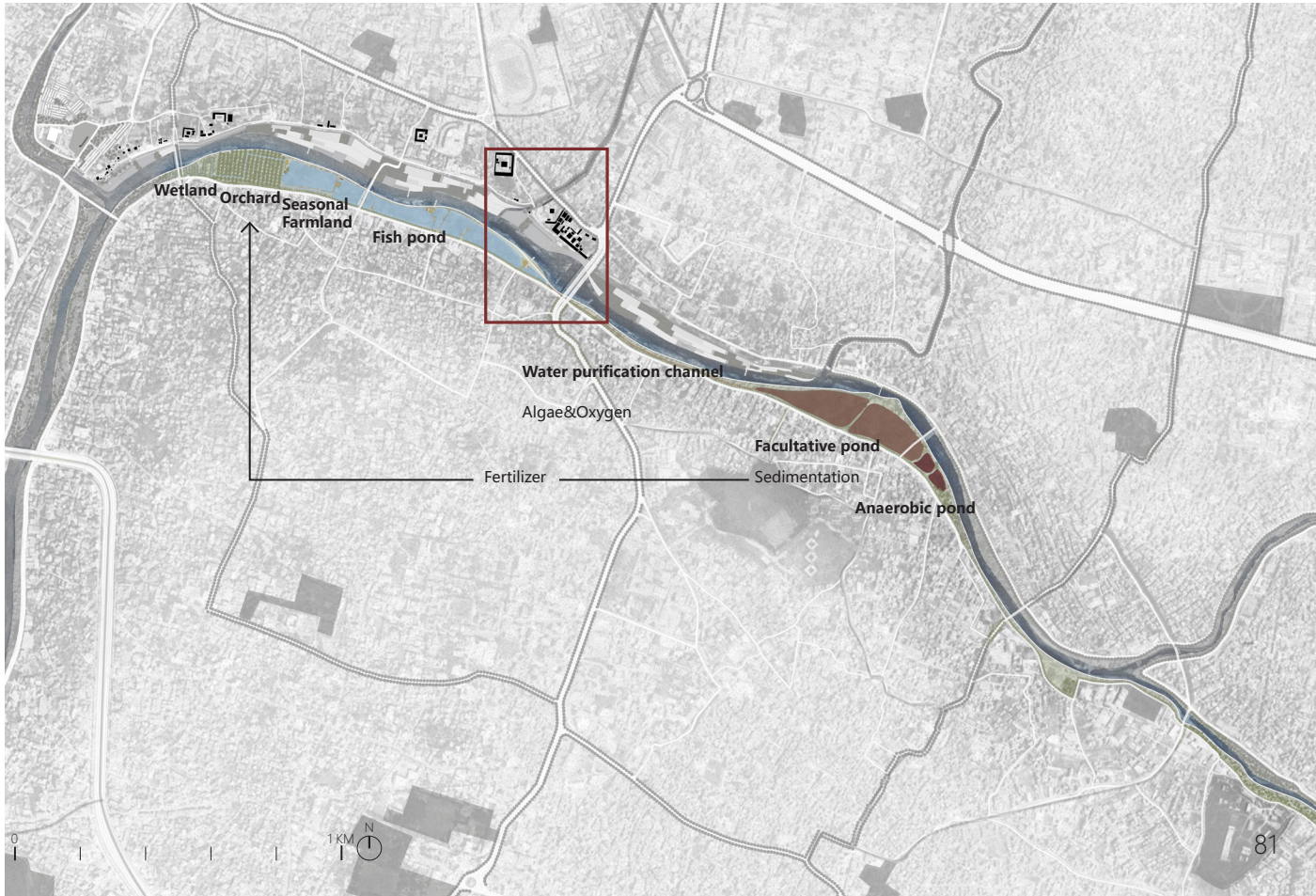




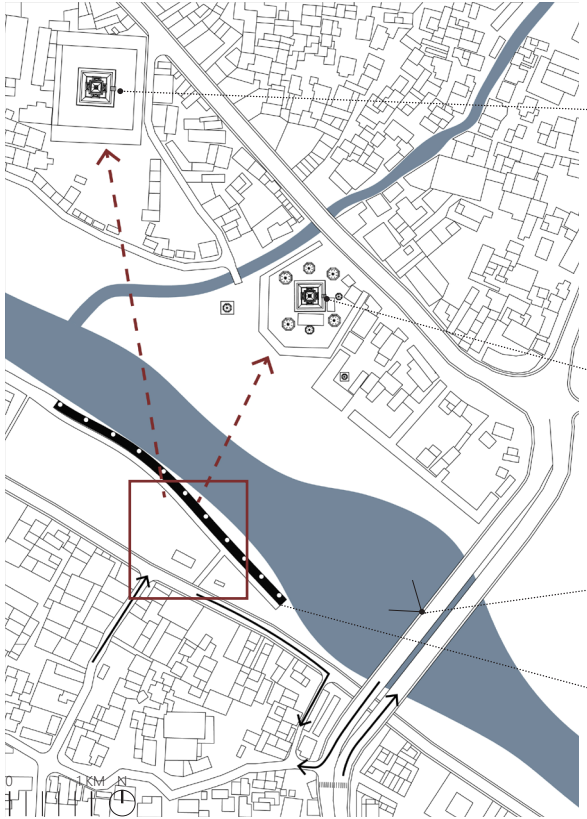



Huamn effort-Sustainable Transfer station
Bagmati River and Huamn effort-Landscape approach to WWTP
Bagmati River-Sustainable water retention
UNDERGROUND WATER LEVEL RISE

Landscape approach to WWTP



Landscape approach to WWTP-Fish pond design



Tripureshwor Mahadev Mandir

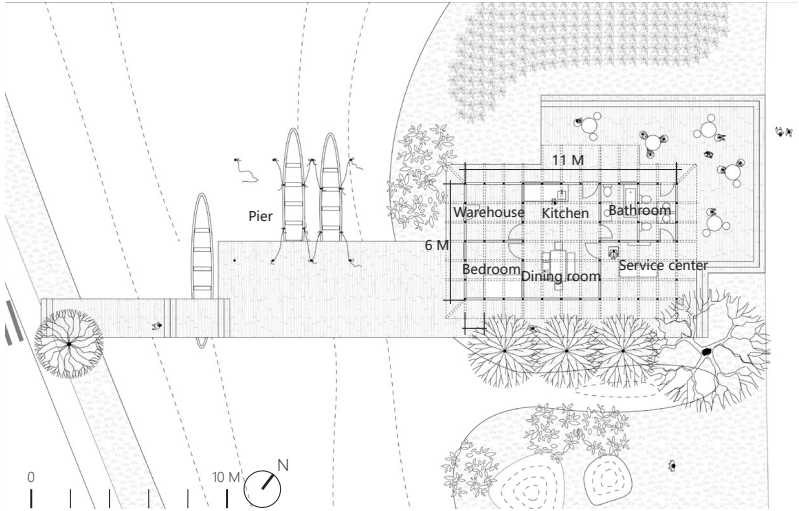
Kalmochan Mahadev Temple

Ghat

View from Thapathali Bagmati Bridge

Landscape approach to WWTP-Fish pond design

1.Workplace for fishermen
2.Destination for tourists to take a break
3.Creat connection between people and Bagmati
4.Create more connections between the two sides of the river
5.Wastewater purification education



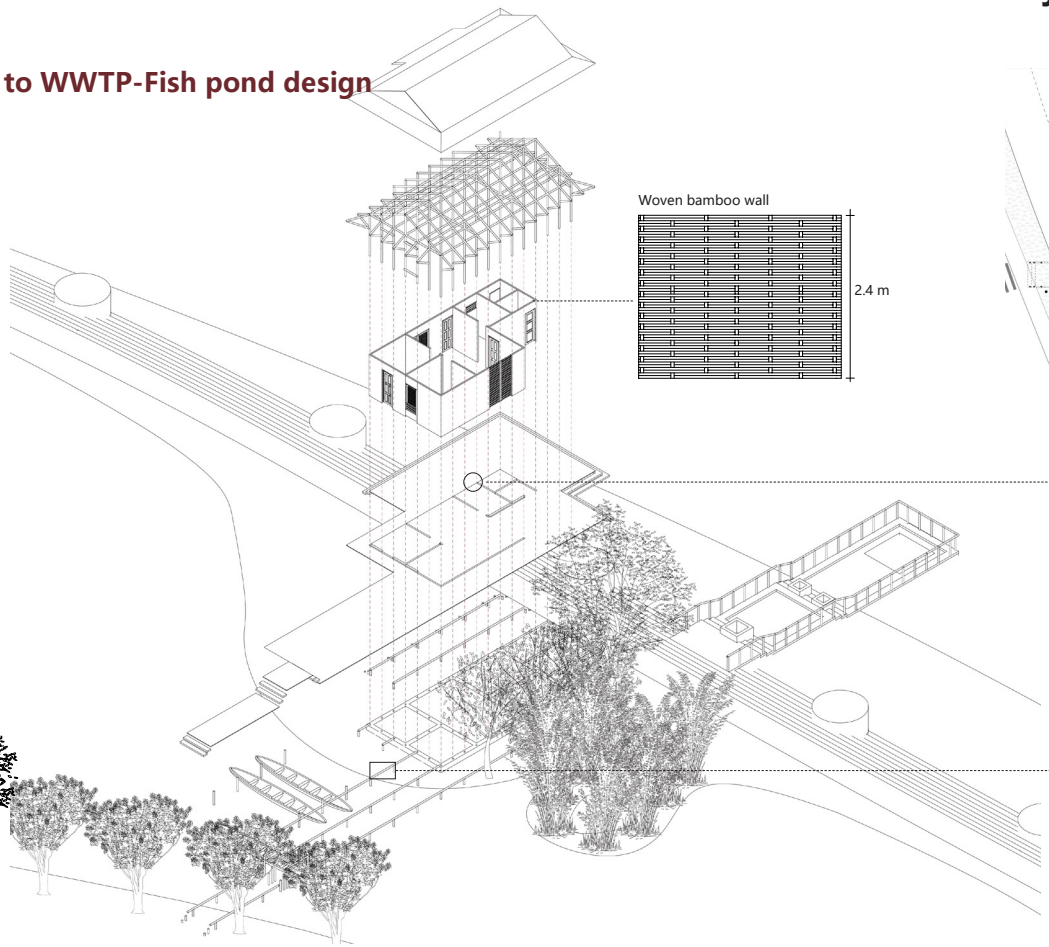
Landscape approach to WWTP-Fish pond design

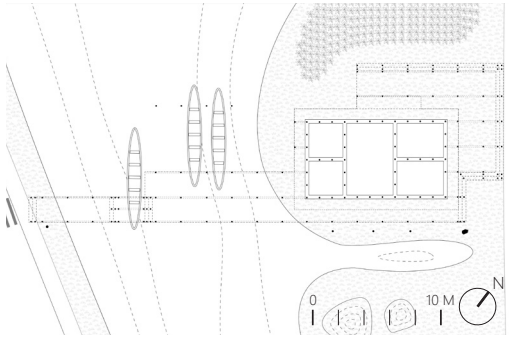
June-August
Crepe Myrtle
Lagerstroemia indica L.

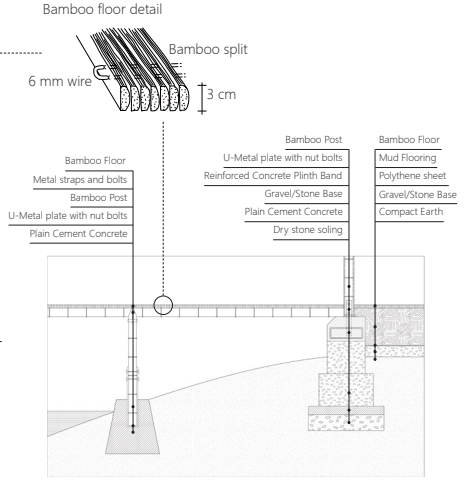
Bead Tree
Elaeocarpus angustifolius Bl.

Bamboo
Bambusa vulgaris

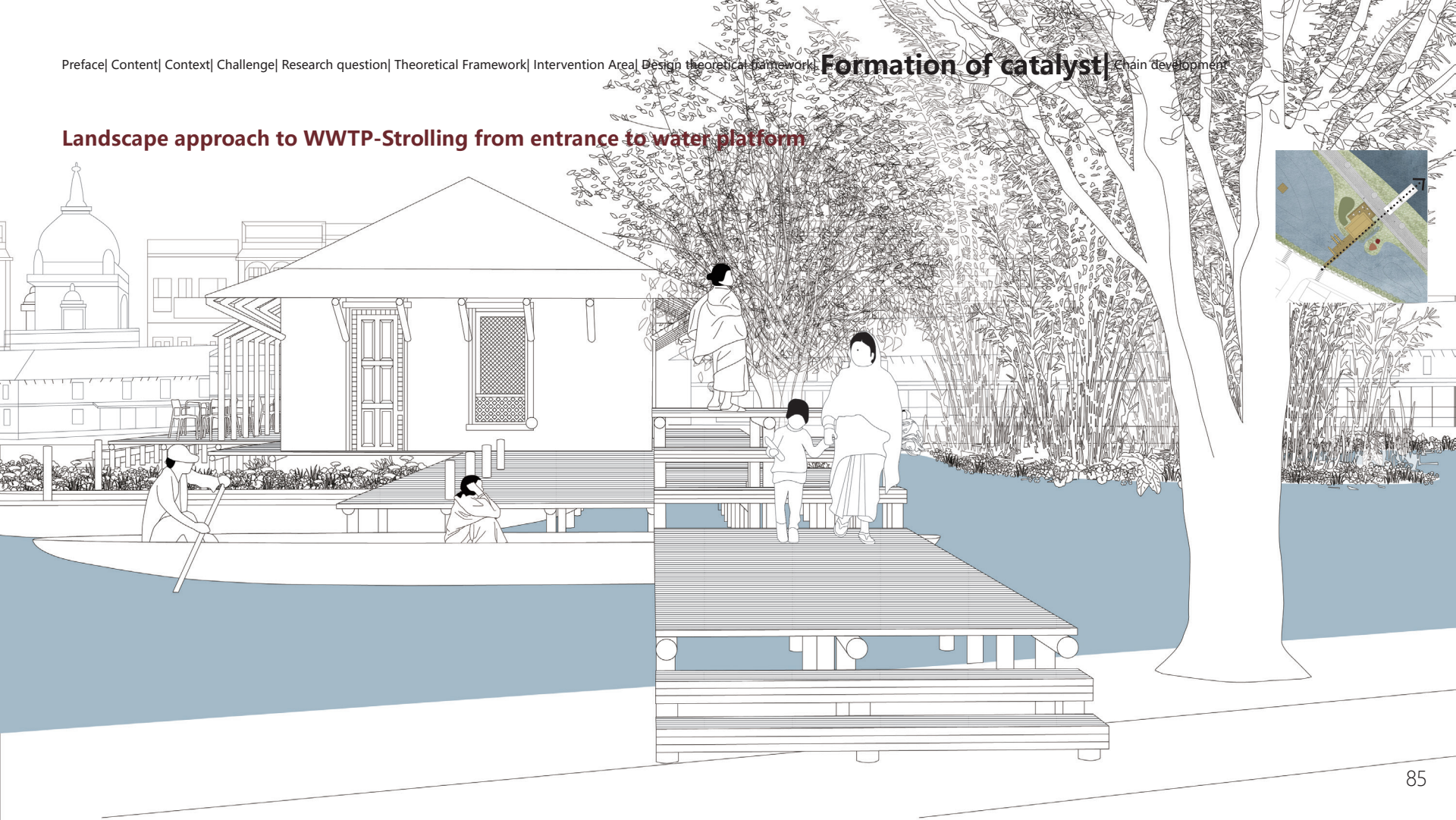
March-April
Coraltree
Erythrina stricta Roxb.

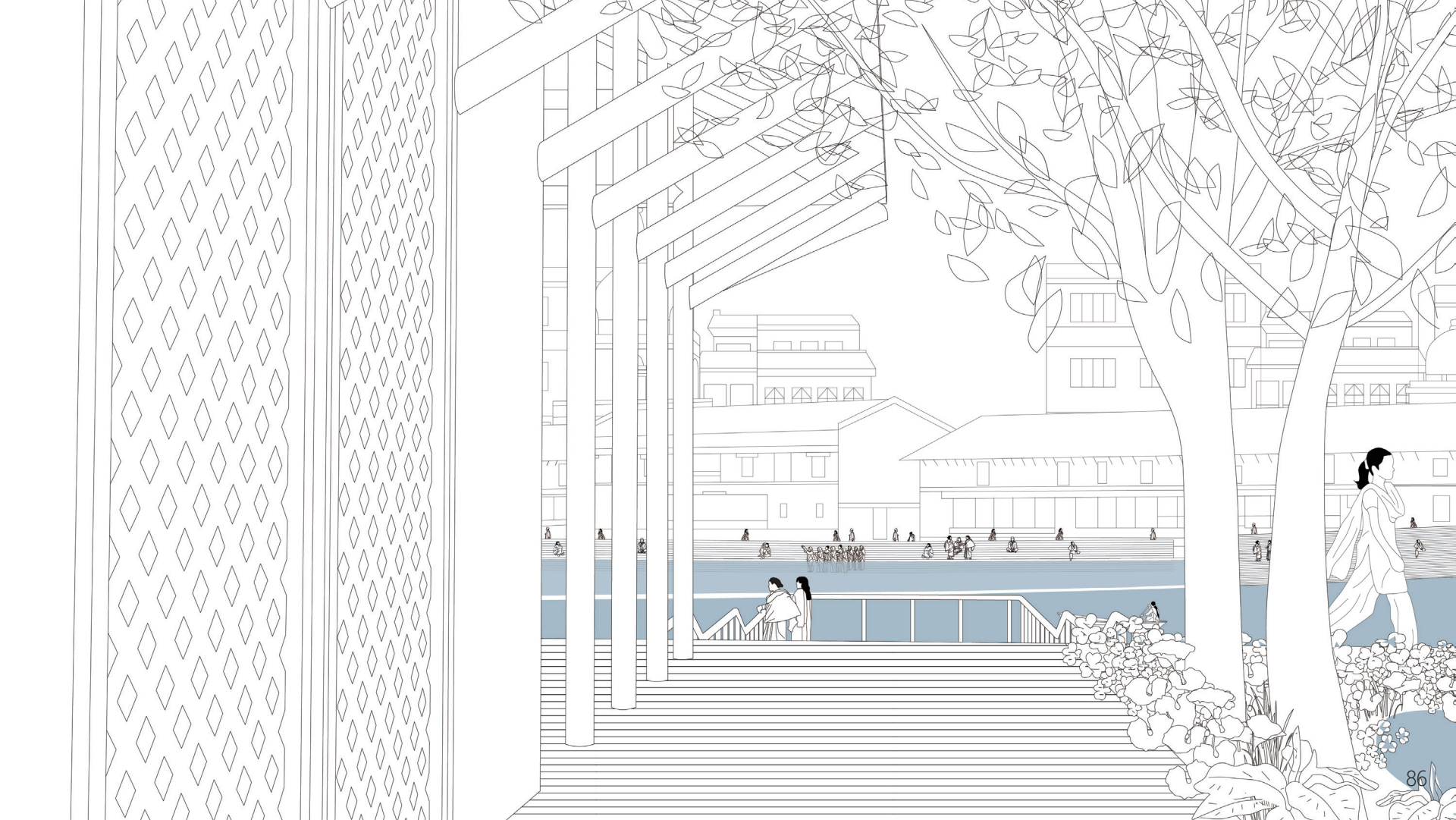




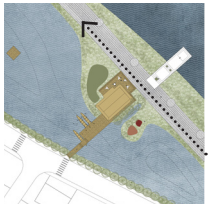


Landscape approach to WWTP-Strolling from entrance to water platform

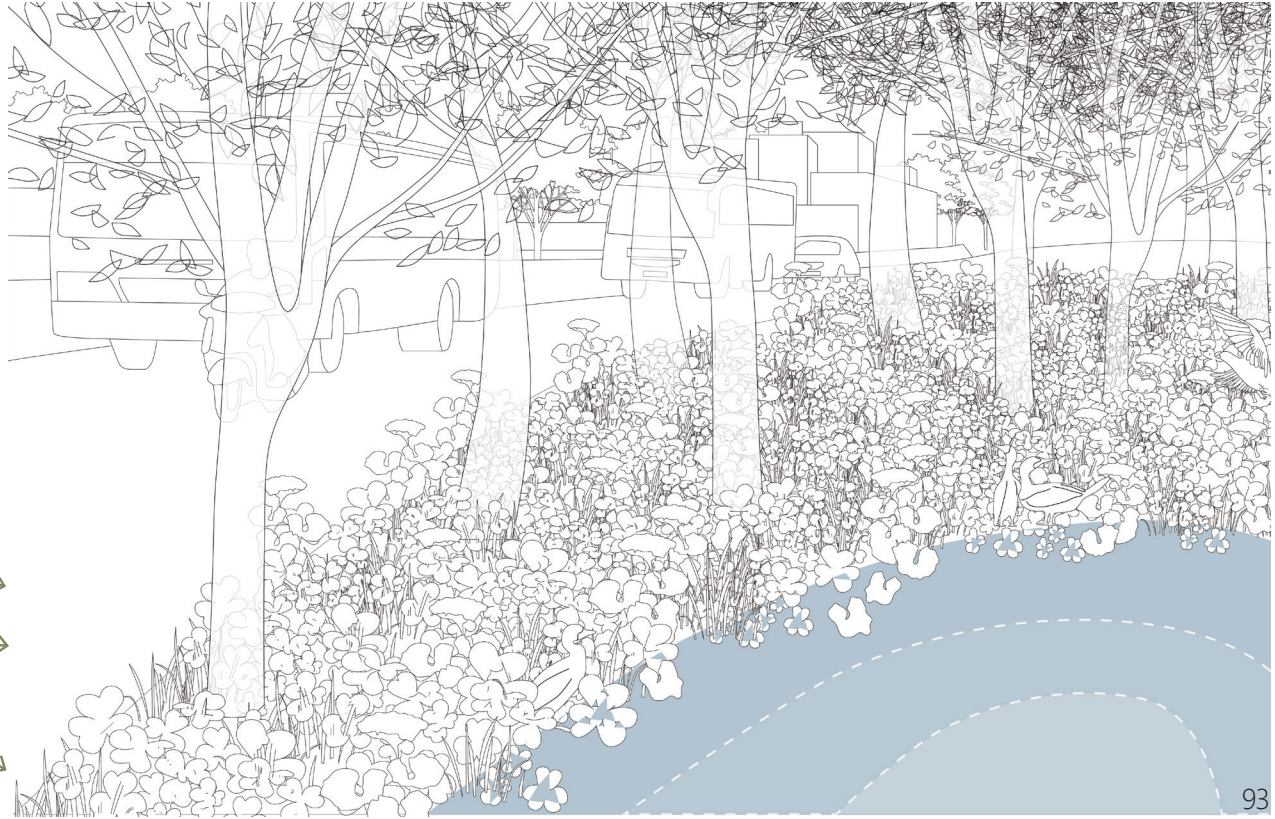




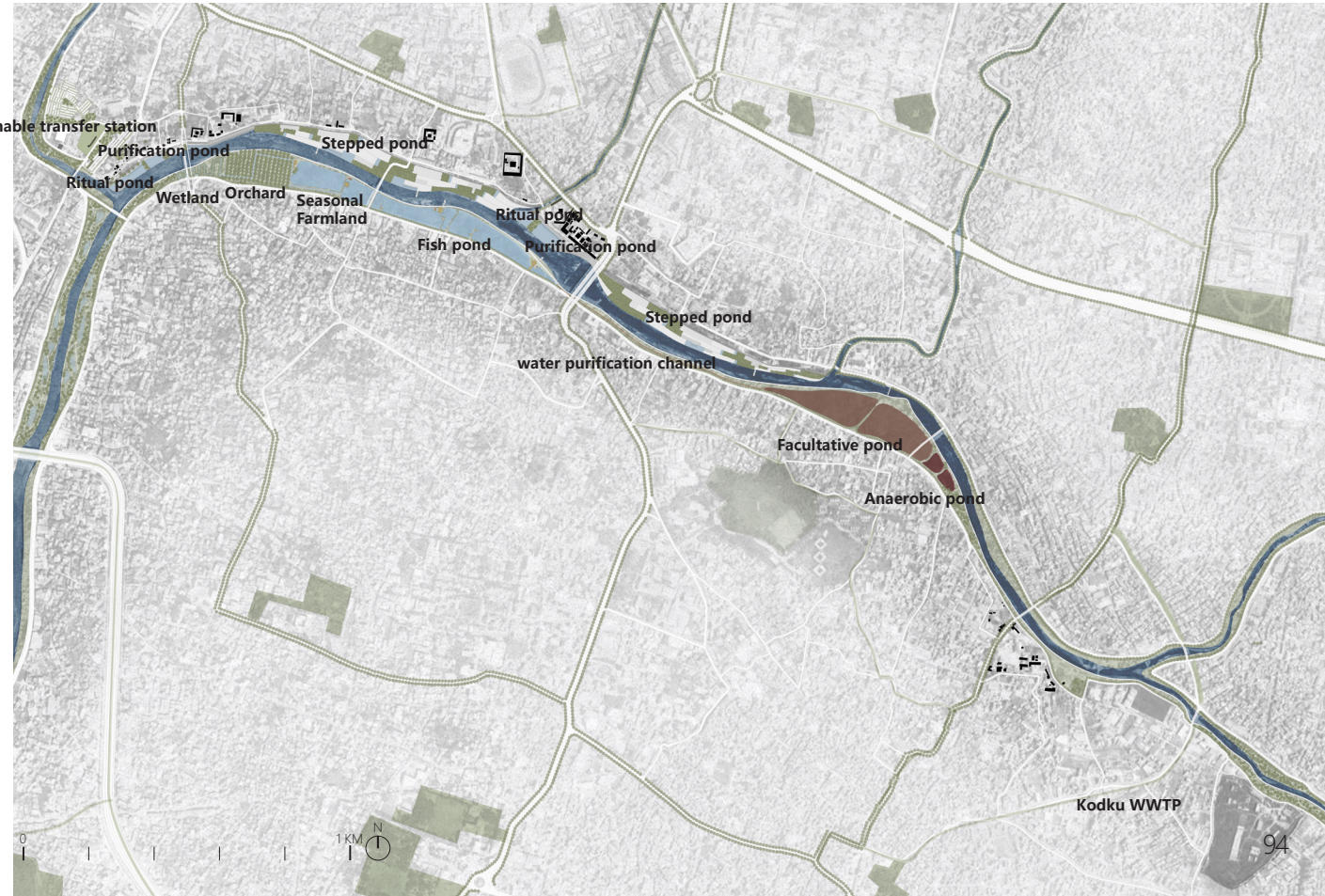
Landscape approach to WWTP-Strolling along the river



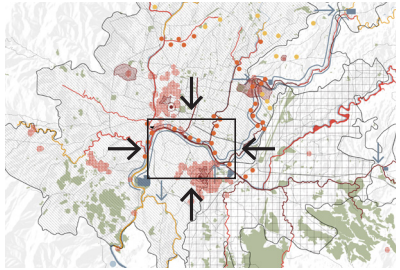
Green network

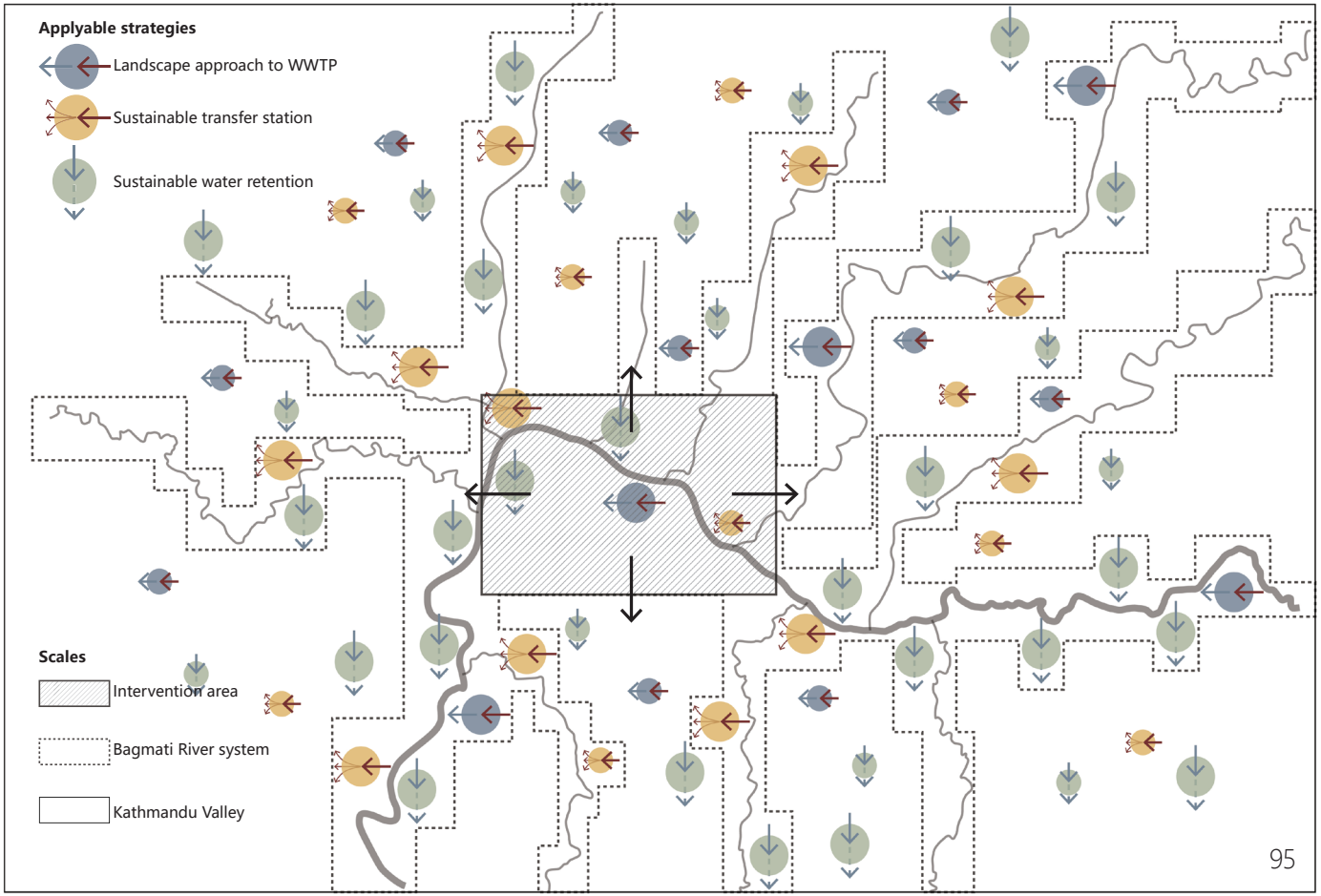


Master plan


Sustainable transfer station
Purification pond
Ritual pond
Wetland
Orchard
Seasonal Farmland
Stepped pond
Fish pond
Ritual pond
Purification pond
Stepped pond
water purification channel
Facultative pond
Anaerobic pond
Kodku WWTP
0
1 KM
N

 Chain development





Can an **integrated and comprehensive** landscape architectonic (spatial) design of the **Bagmati River** reconnect people to the river and enhance the **living quality** in the Kathmandu Valley?


To worship the god Pashupatinath, every day worshippers must take water from the river. But due to heavy pollution, we are not doing that now.
I feel very bad that in the past the water was very clean and (we) could drink (from it). Now even the fish can' t survive, I even feel very guilty that I am also one of the polluters of the Bagmati river.
The river is a public place, nobody complains, everyone can throw it and no one is bothered about it. So that became a very easy spot.
If I throw it in the river, it goes somewhere, not my problem now. I' m clean, I don' t care.
The river is too close. Water has started to enter our huts.
When I first came to live here, the water was black and the smell was bad. The smell would not go away, it would be there all day and all night. When the smell got very bad, we would pinch our noses (and get on with our daily lives).


People
People making effort to make Bagmati River better
Bagmati River
Bagmati River supports the daily and religious life of people

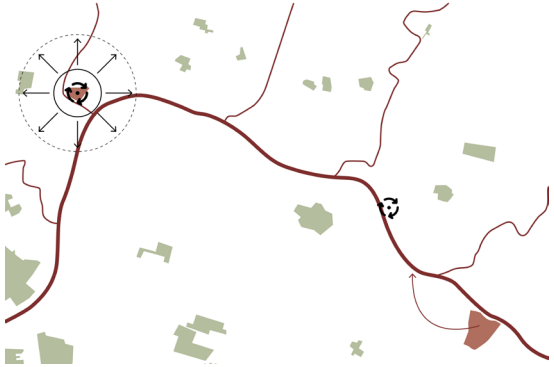

THANK YOU FOR YOUR ATTENTION

Appendix

Process

Stage1-Reduce the source of pollution

Sustainable transfer station



HUMAN EFFORT

Residents Squatters Government

Landscape approach to WWTP

HUMAN EFFORT AND BAGMATI RIVER

Residents Squatters Government

Stage2-Cleaning up already existing pollutants

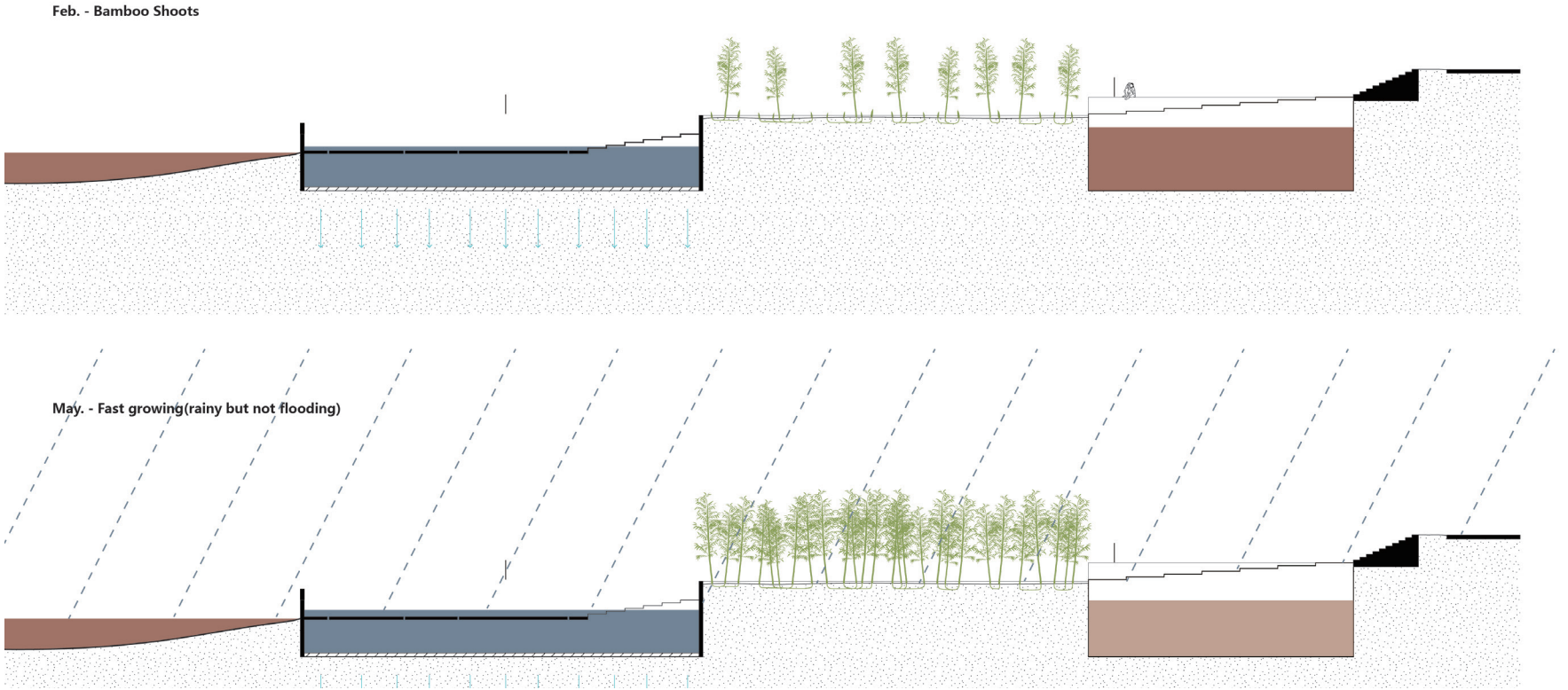
Sustainable water retention

BAGMATI RIVER

Government

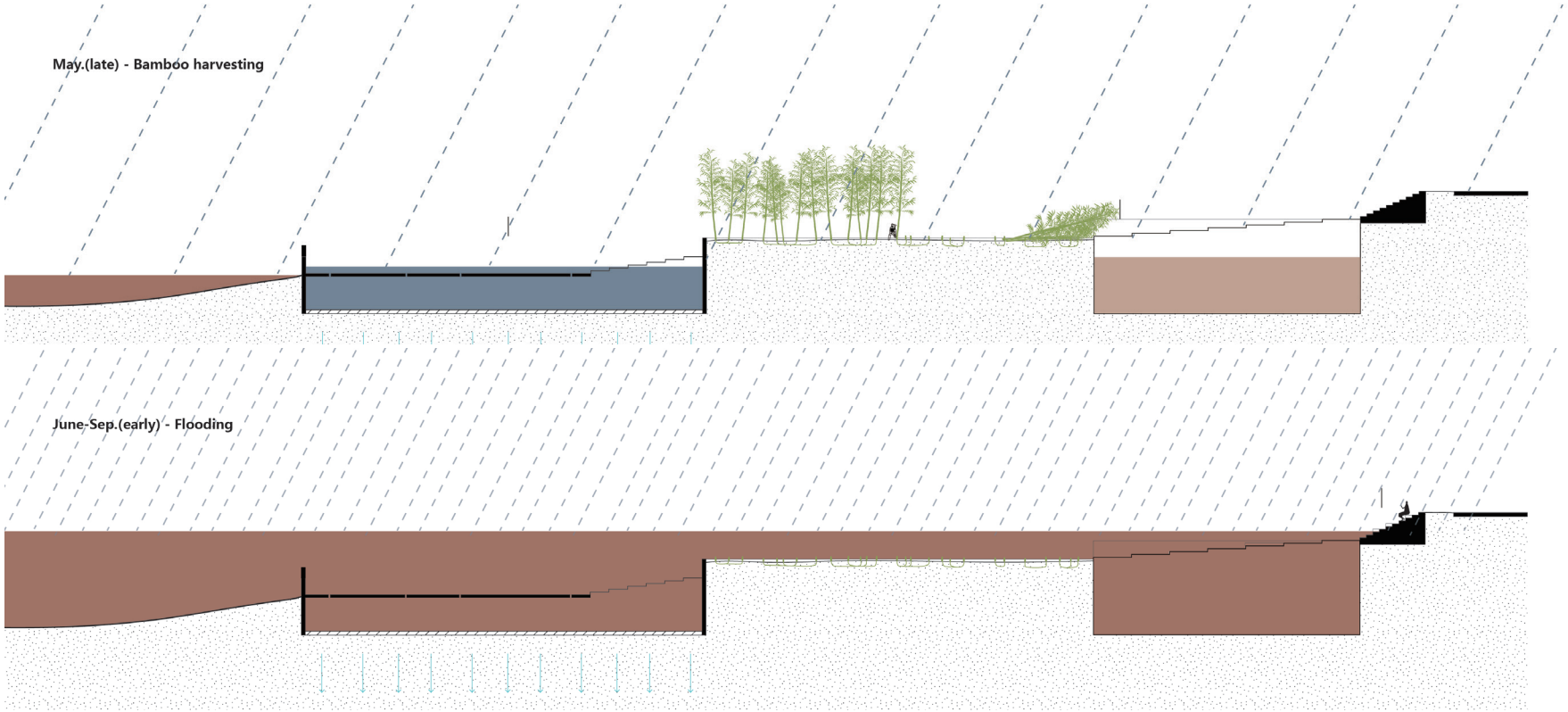
Appendix

Sattal at Purohit Ghat



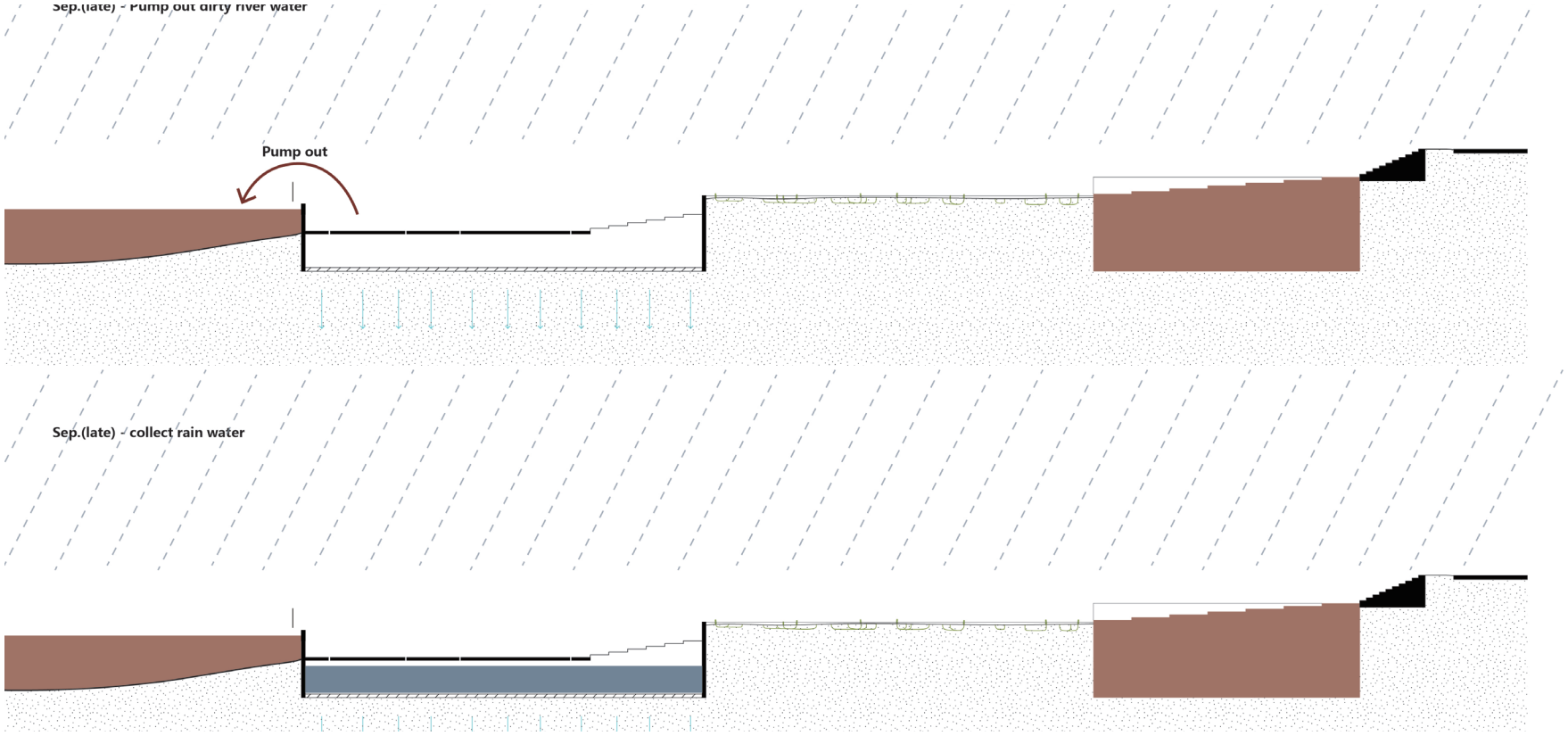
Appendix

Sattal at Purohit Ghat



Appendix

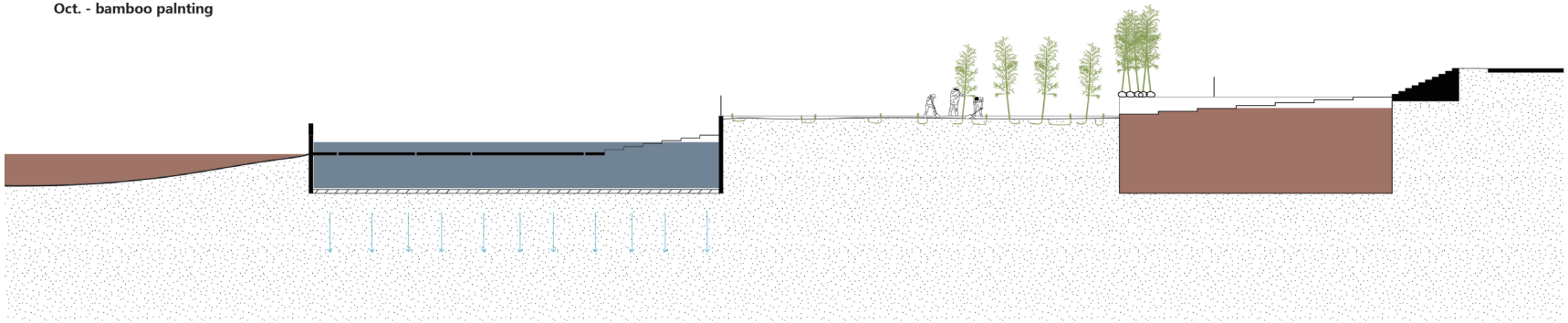
Sattal at Purohit Ghat



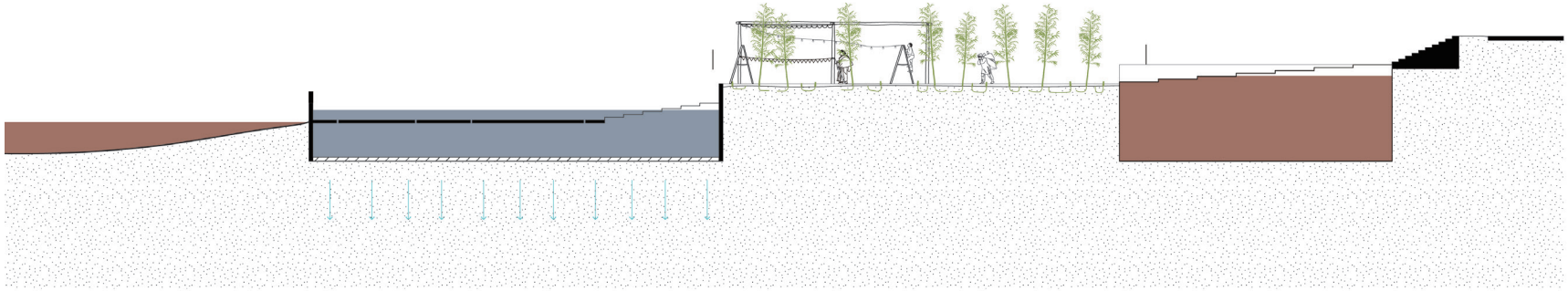
Appendix

Sattal at Purohit Ghat

Oct. - bamboo palnting

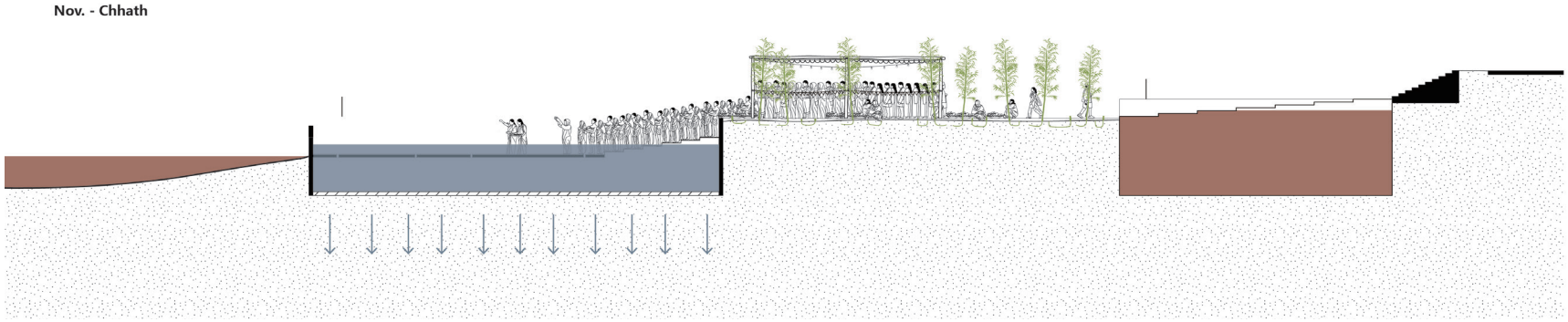


Nov. - Chhath (prepare)



Appendix

Sattal at Purohit Ghat



Appendix

Caculation of transfer station

Kathmandu-346 tons of garbage per day, Patan-around 44 tons

Total capacity: 390 tons of garbage per day (273 tons are organic-composting; 100 tons are recyclable- sale for money; 27 tons are residual- compress and send to landfill)

Size of functional areas:

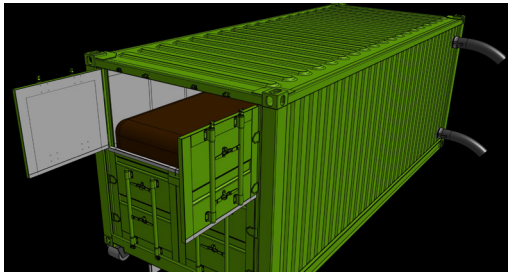
Capacity of Small garbage compactor-80 tons per day: space for one compactor is enough

Daily capacity of organic waste-273 tons per day: 70 IM-CCS are required(5 per day and for 2 weeks), covering around 1200 square meters

Recyclable waste-1320 square meters

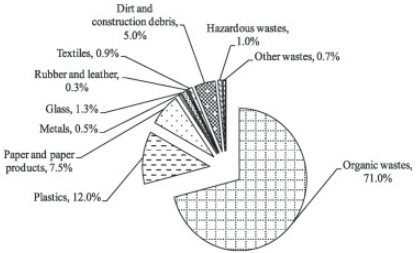
Residual waste-410 square meters

Intermodal Containerized Compost System (IM-CCS)



Capacity	56 tons/day
Composting cycle	2 weeks (14days)
Production	25 tons
Size	2.5m*6m
Prize	$ 25,000- $ 35,000

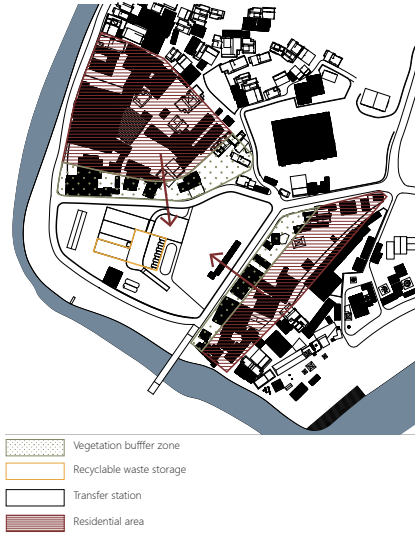
GARBAGE COMPOSITION



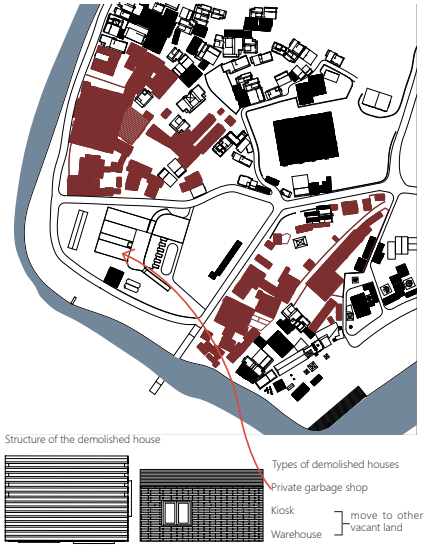
Appendix

Application of unit

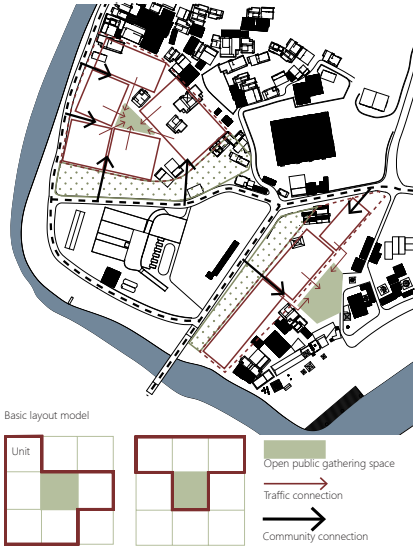
Site selection - connection with transfer station



Existing situation



Units layout - community and traffic connection



Structure