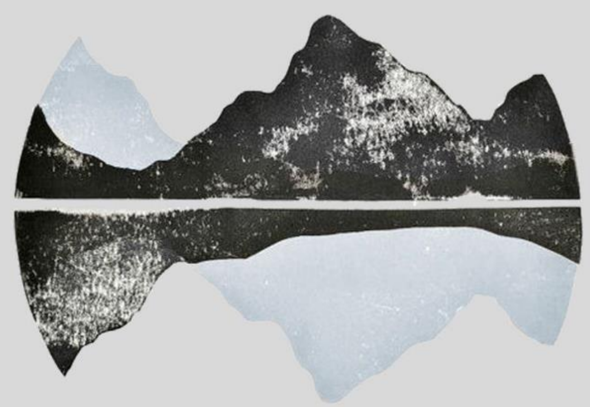


(De)Landing Growth

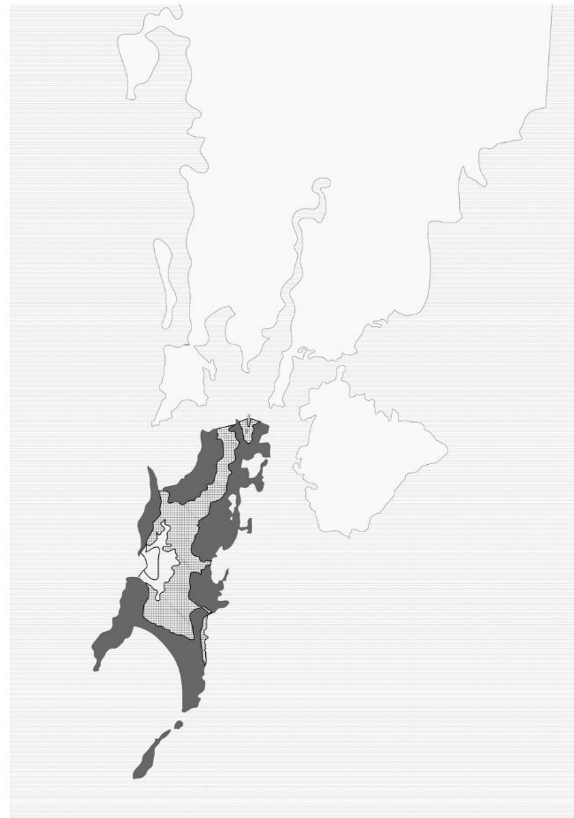
Framing Alternative Perspectives to Evolution In Mumbai

Sanika Charatkar | 5499984 | Transitional Territories 22'-23' | P5 Presentation | 21st June,23

20.96 million

17.53 million

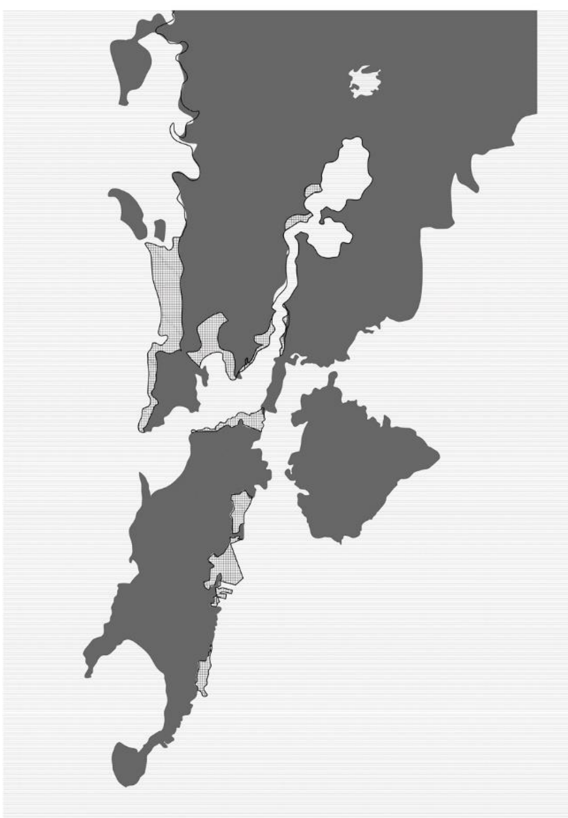
1650



1800

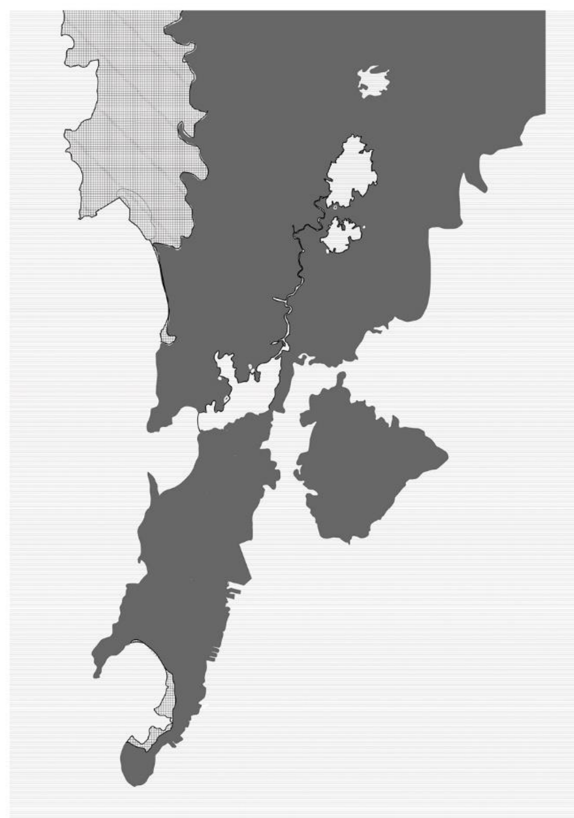
1850

1870



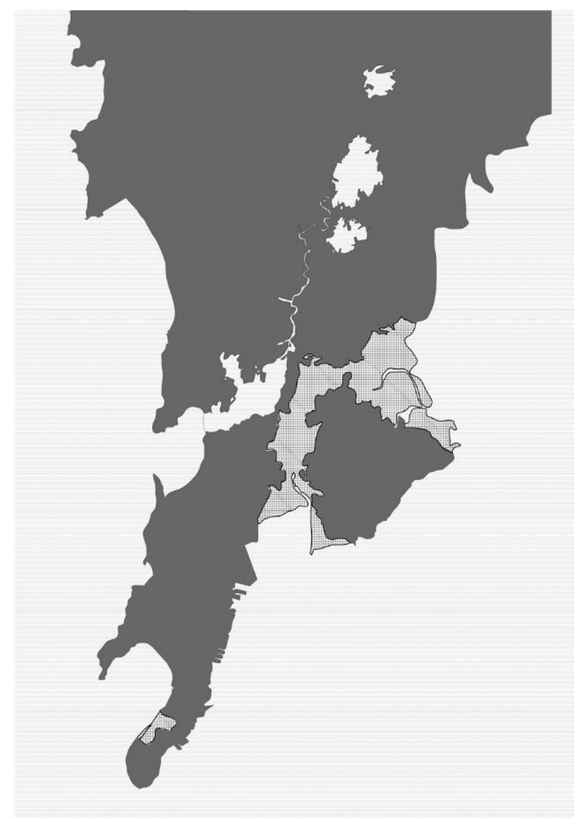
1905

"επτανησία"



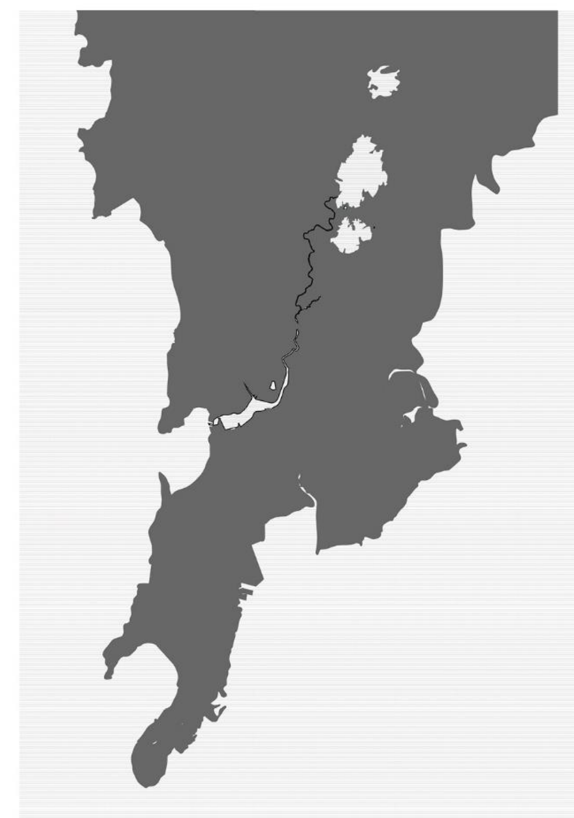
1920

"Bom Baíam"



1950

"Bombay"



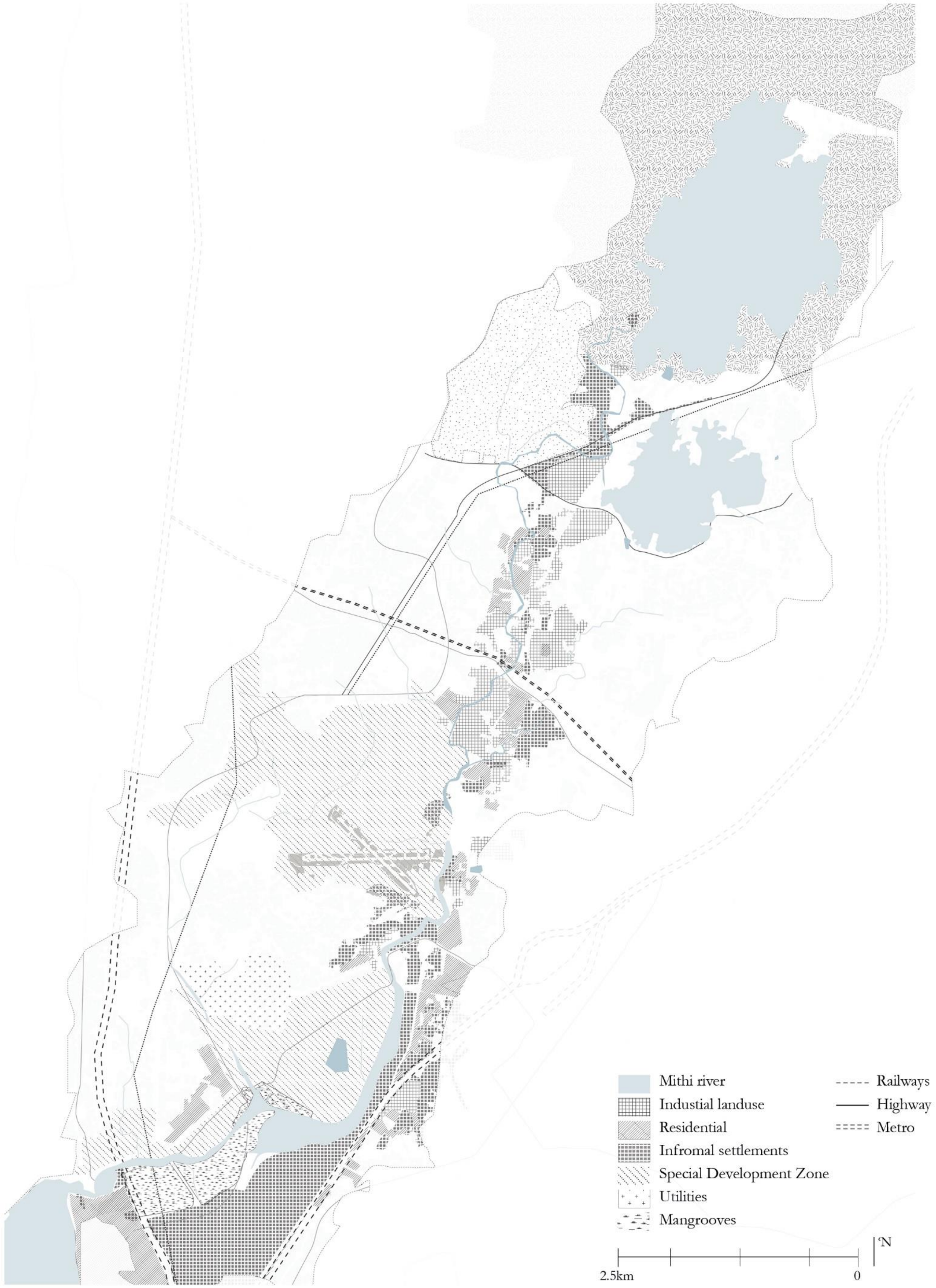
385 sq. km. reclaimed area | 2020

"Mumbai"

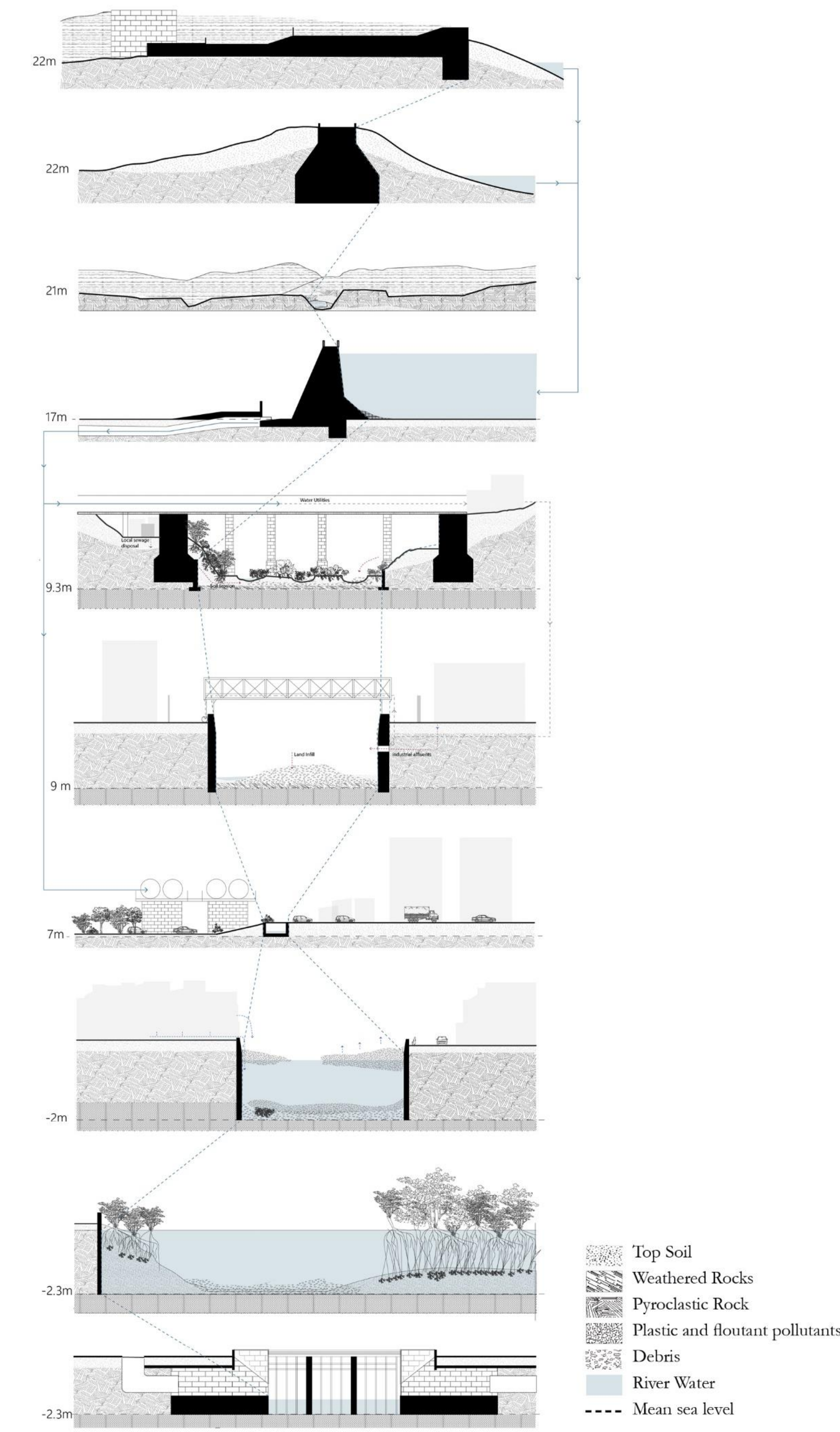
Growth & Development
in the 21st century

Development = Building | expand
intensify
'reclaim'

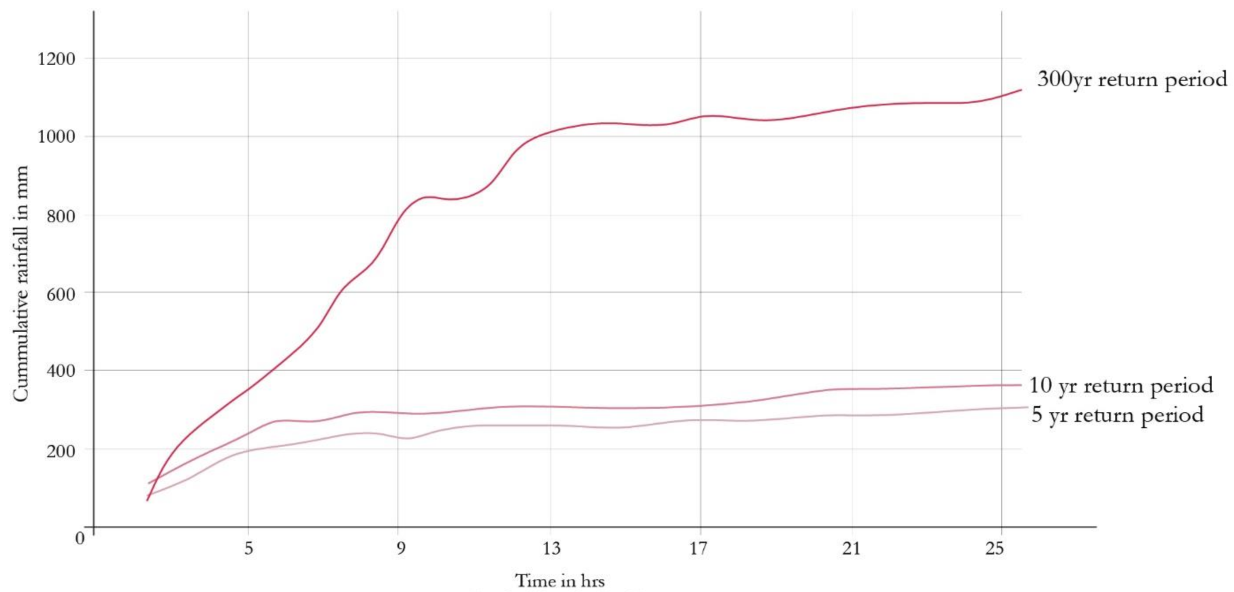
Current Reclaimation for the Coastal Road Project



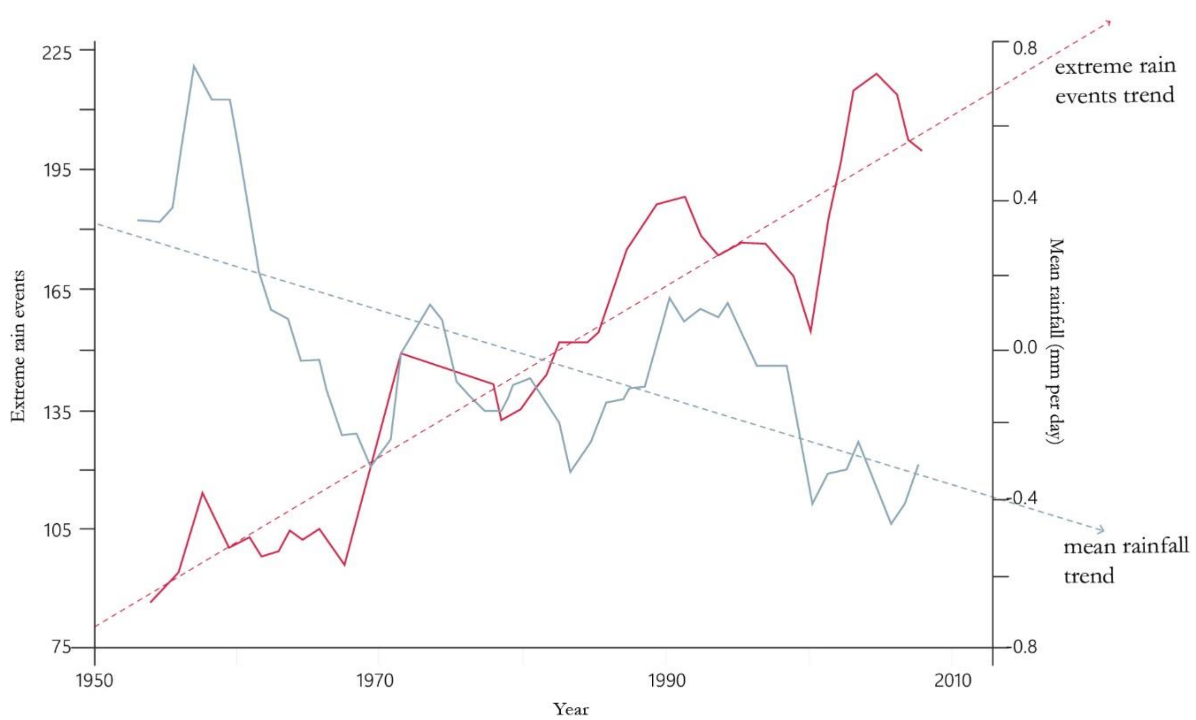
Mithi River basin and its present land use



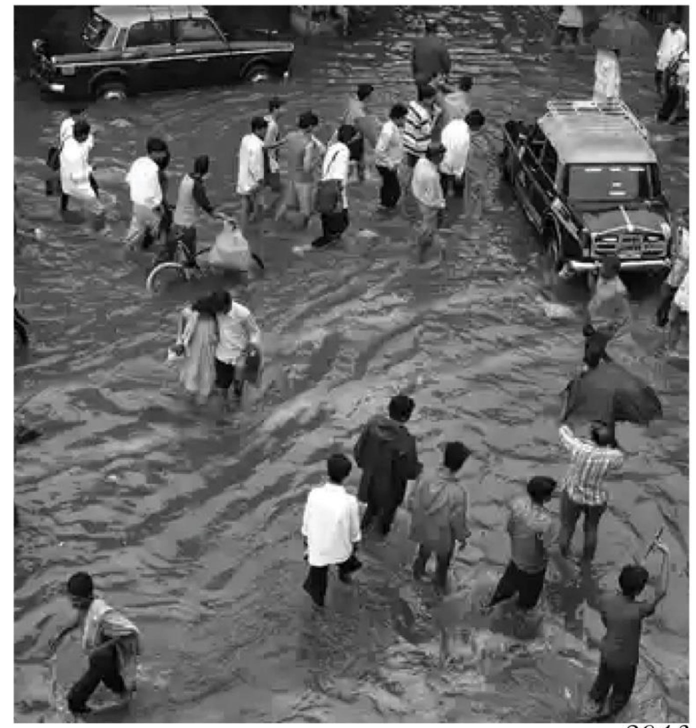
Alterations in the river body



Source: Central Water and Power Research Station



Source: ORS Research Centre

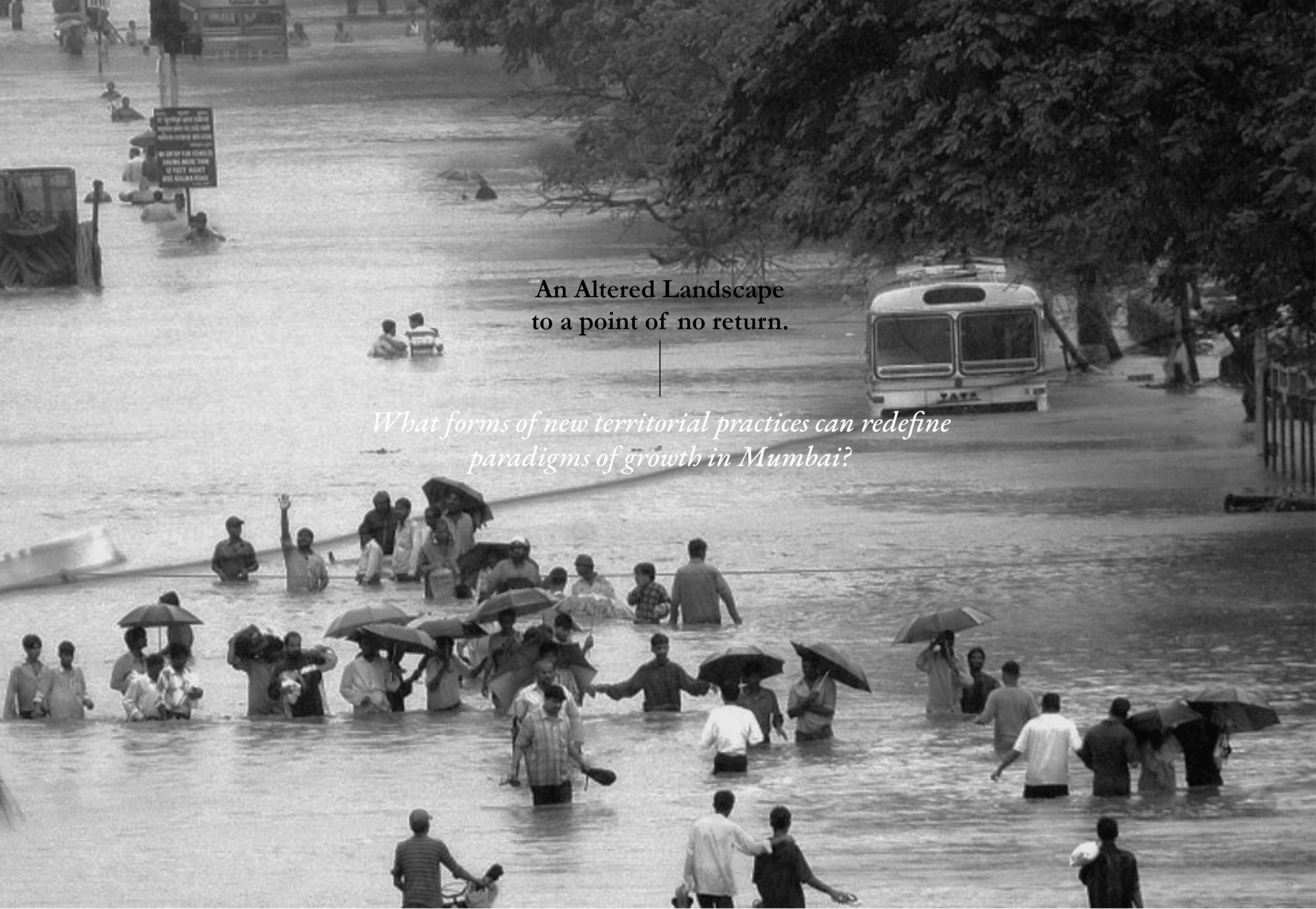


2013

2015

2017

2021



An Altered Landscape to a point of no return.

What forms of new territorial practices can redefine paradigms of growth in Mumbai?

Research Question

What forms of new territorial practices can redefine paradigms of growth in Mumbai? That responds to the necessity to accommodate the growing population and their neo-liberal/globalization ambitions whilst addressing its **externalities** that manifest in the form of a **disrupted hydrological cycle**- causing recurring and intense flooding every monsoon. So as to foster an **evolutionary** and **symbiotic** relationship between its **critical ecosystem cycles** (geological and hydrological) and **habitation patterns** as a means to safeguard the existence of humans and more than humans alike .

Sub-Questions

Contexutalizing

1. Which natural (biotic + abiotic) cycles of the ecosystem are fundamental in shaping the morpho-dynamics of the territory and how do they **manifest spatially in time**?

Research by Design

2. What are the critical **anthropogenic dependencies** and ambitions embedded/positioned in these ecosystem cycles and in which form?

Grounding

3. What are the **thresholds** of the prevalent human appropriation and growth patterns in Mumbai before they are **incongruently positioned** in the territorial ecosystem cycles? How is their impact witnessed in the region across the varying scales of space and time?

Evaluation:

4. What are the **limits of growth** and how can they be directed progressively to influence the morphodynamics of the territorial landscape so as to mitigate the externalities of intensifying anthropogenic functions on the estuarine territory to ensure its **biophysical as well as functional health**?

Landscape hypothesis

Accumulation of Matter + Water *(substrate)*

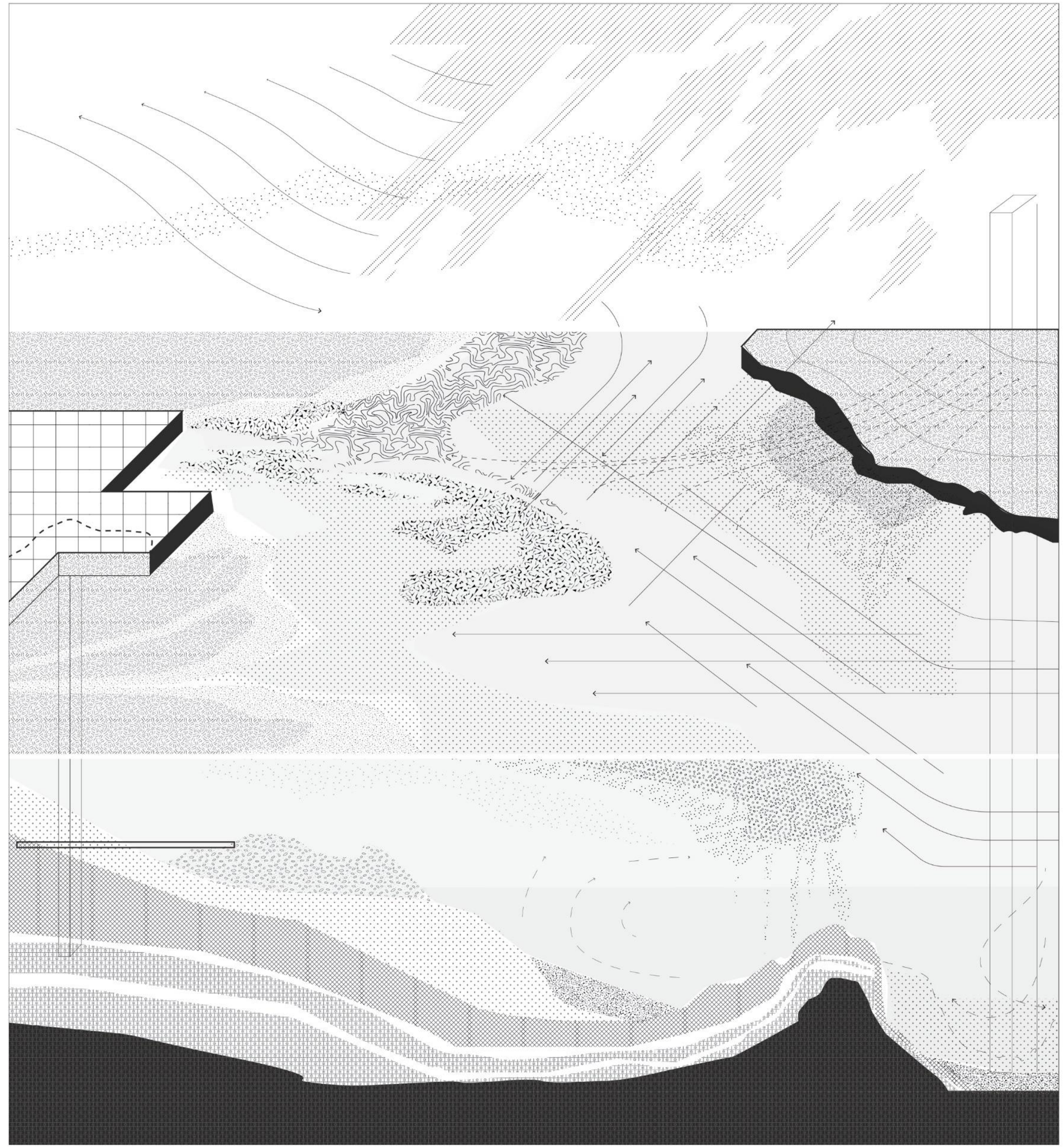
- Heavy precipitation
- Monsoon
- Tidal

↑ insurgent

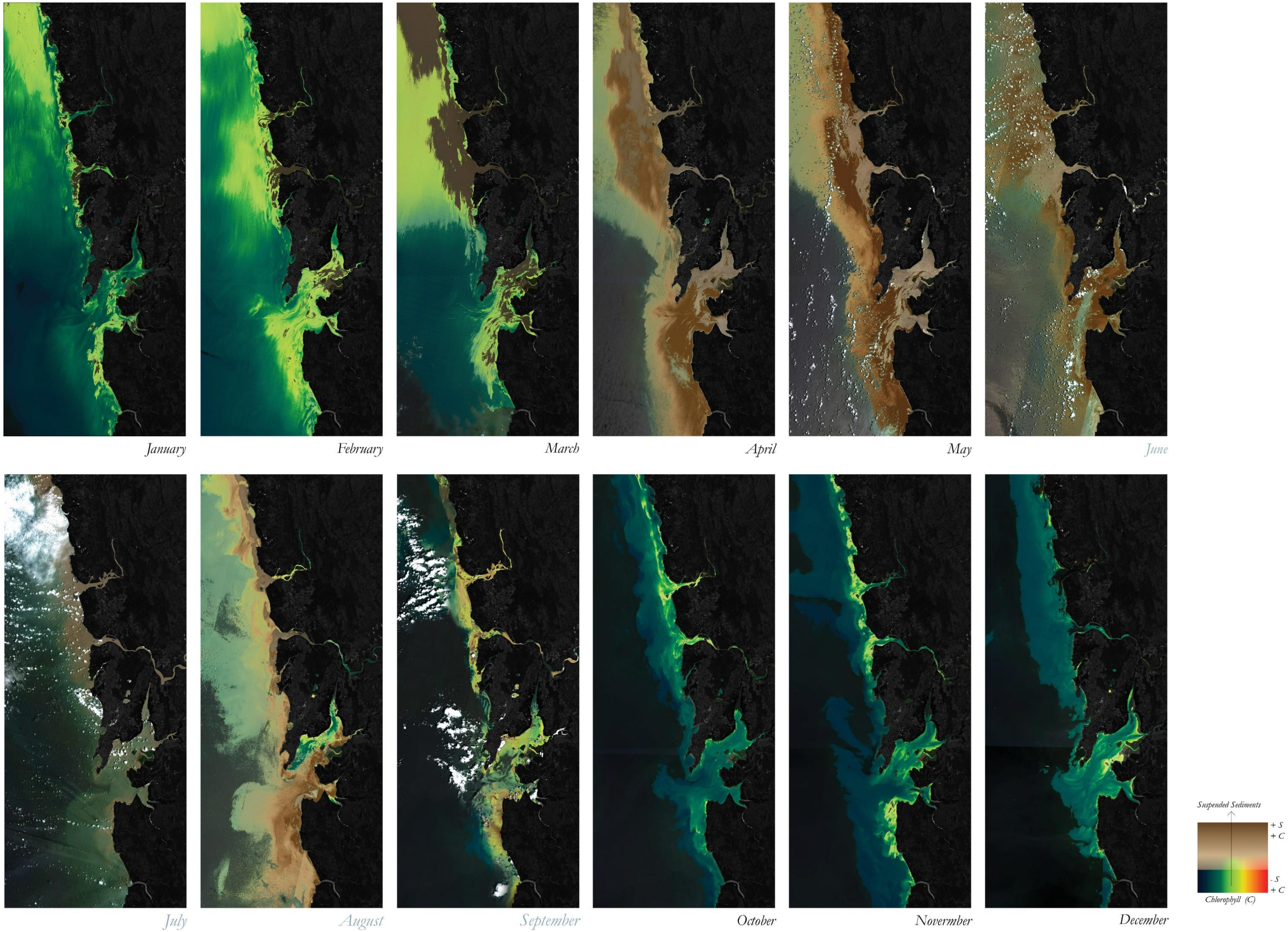
increasing intensity

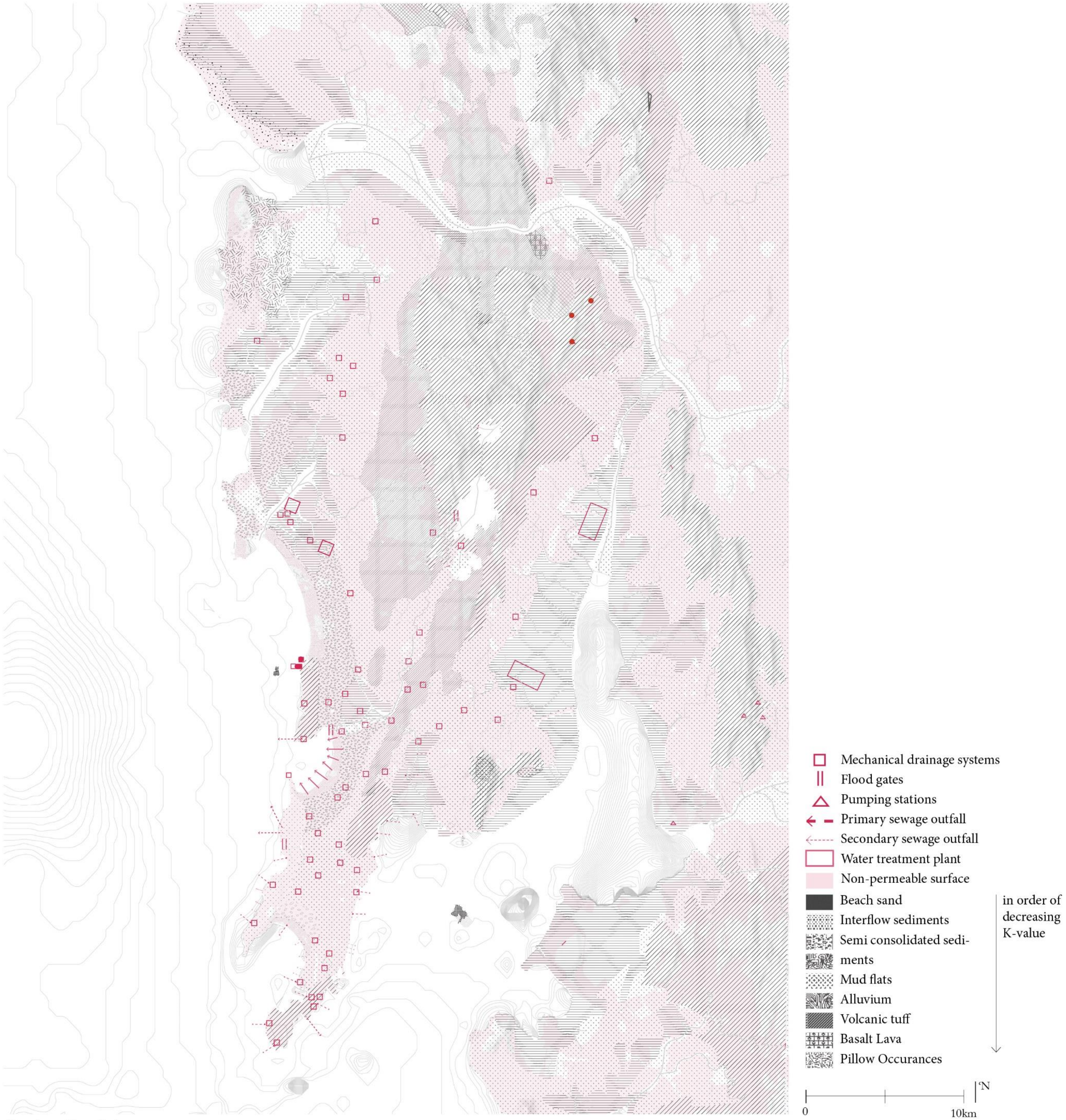
urgent

constants

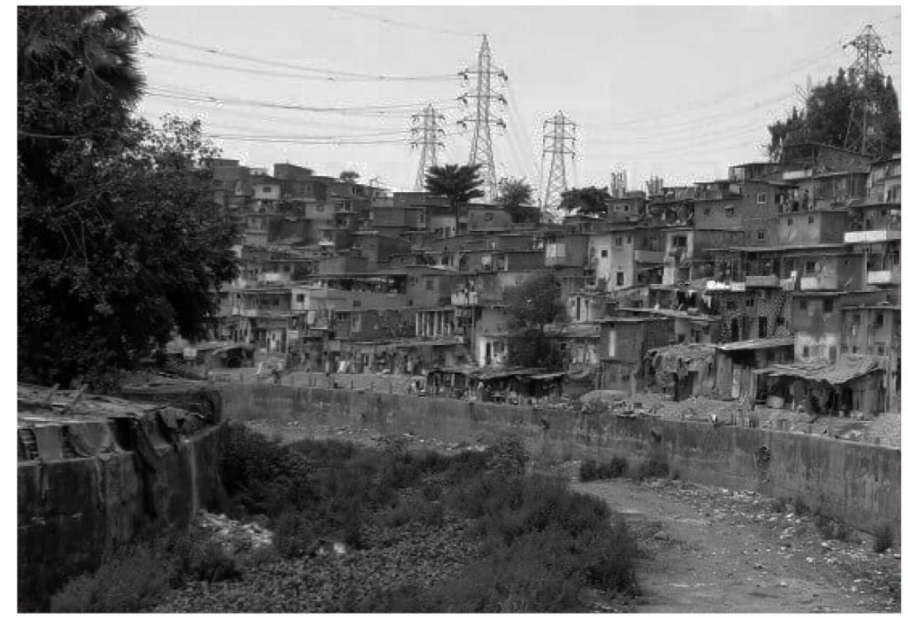


potentials of stratigraphic and antistratigraphic processes


January
February
March
April
May
June
July
August
September
October
Novermber
December
Suspended Sediments
+ S
+ C
- S
+ C
Chlorophyll (C)

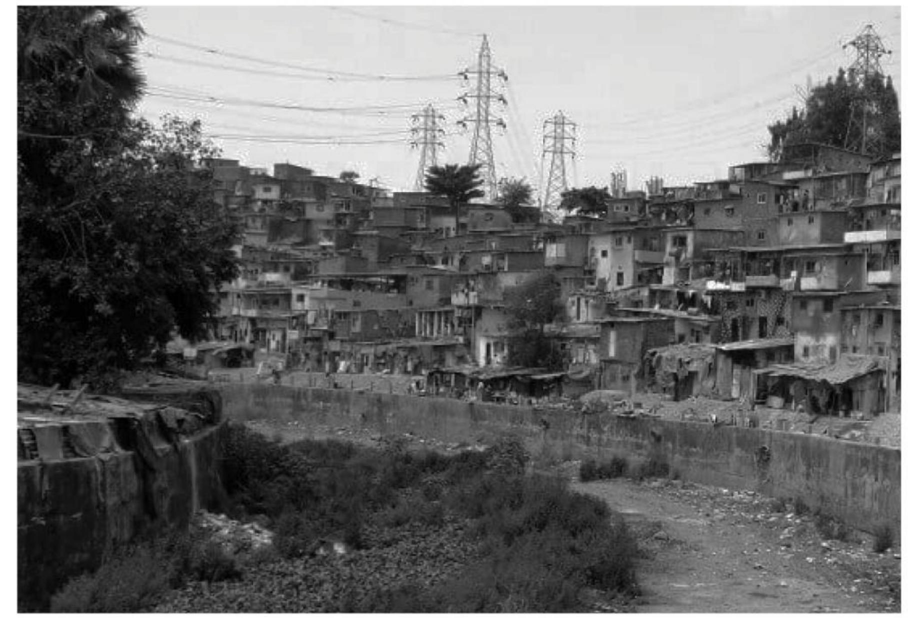


Surface Conditions

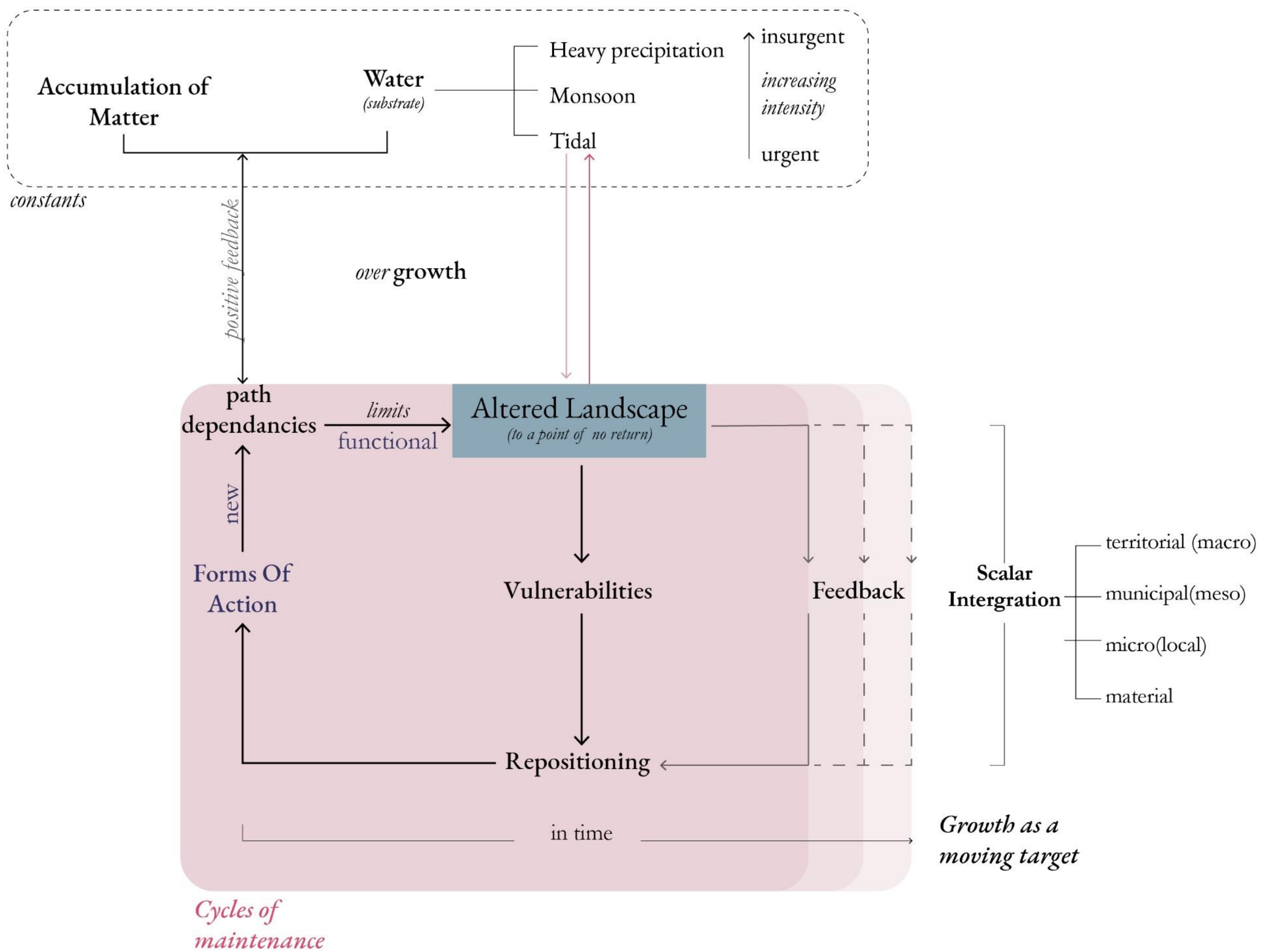




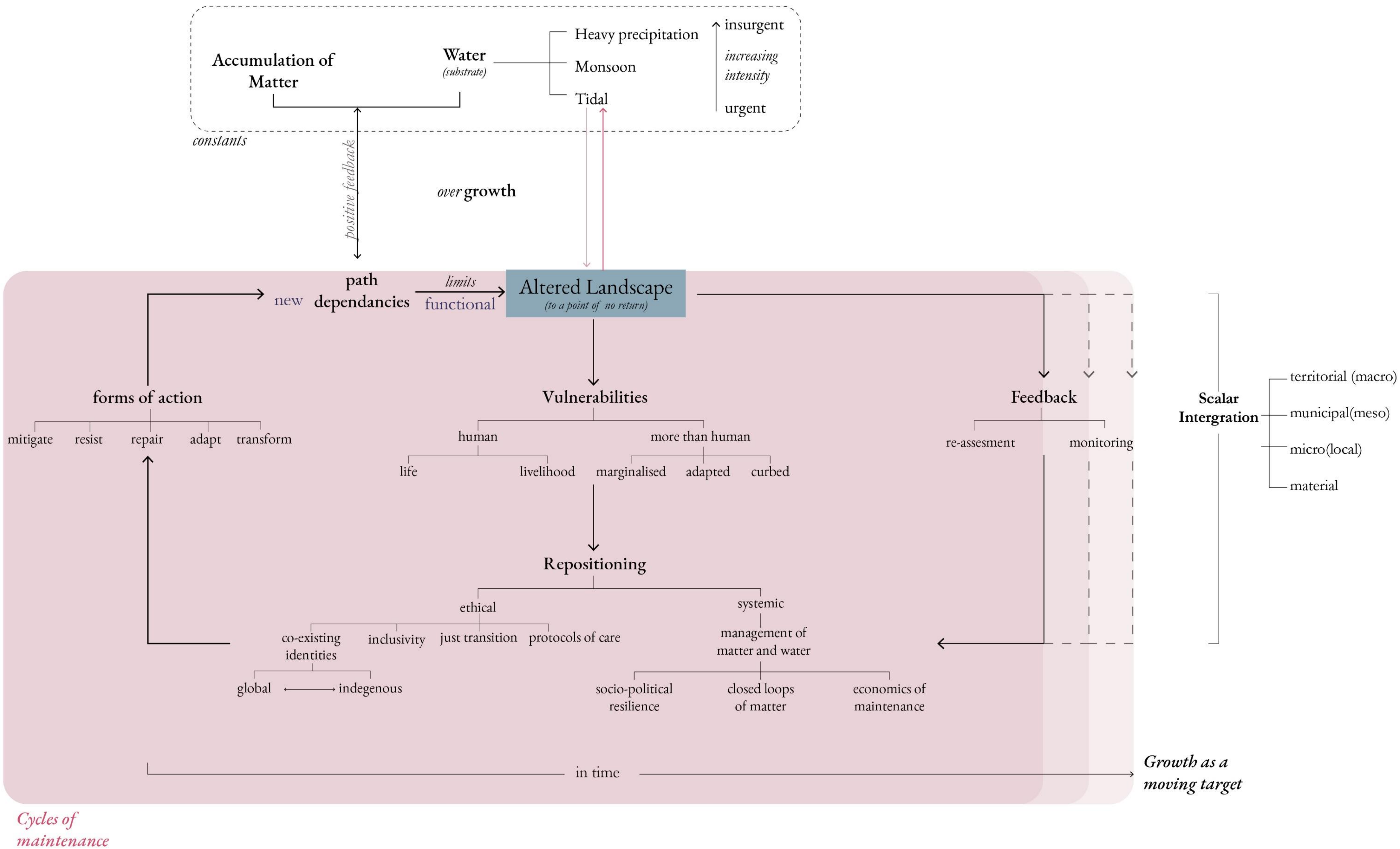

SANY


over growth


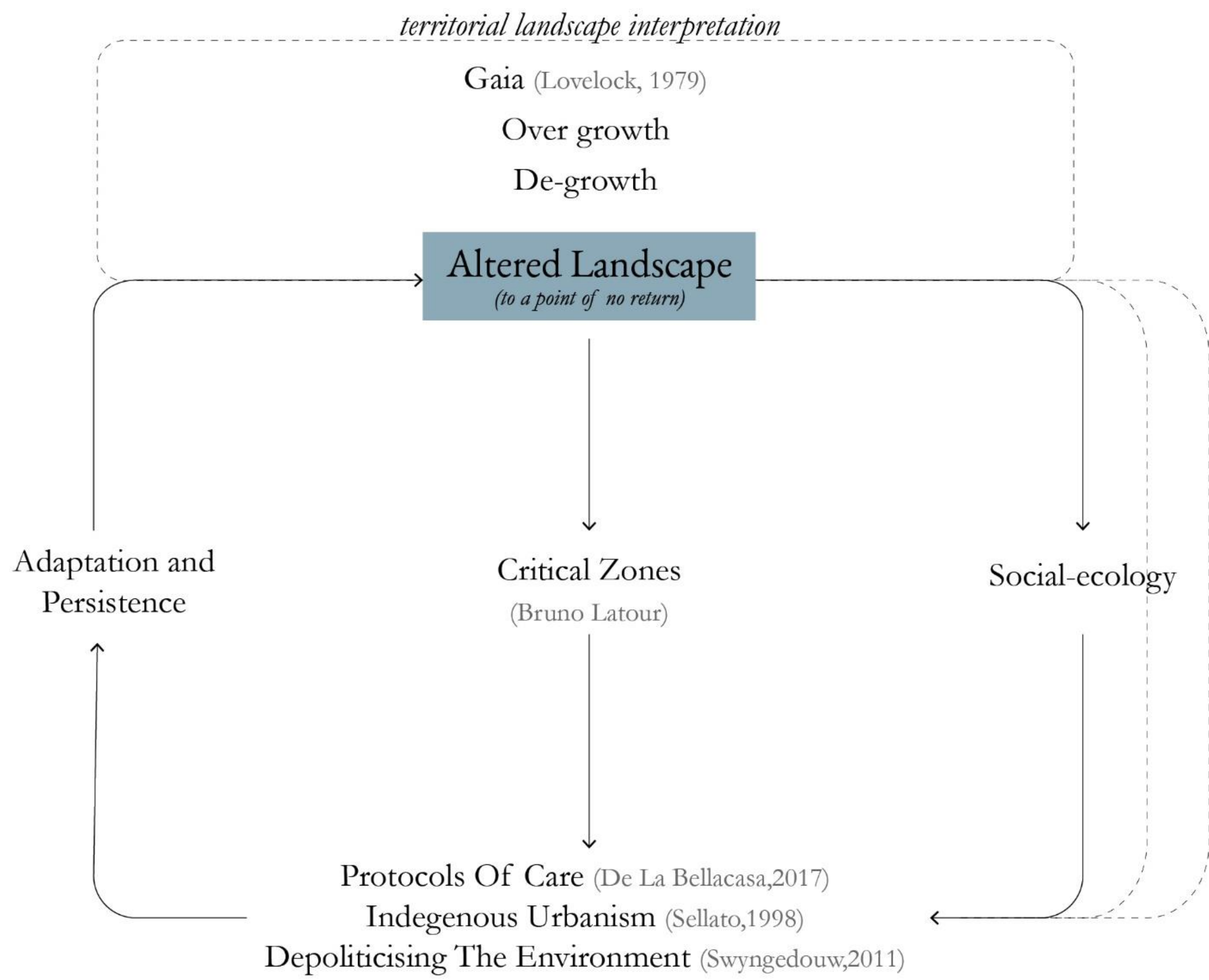

Conceptual Framework



Conceptual Framework

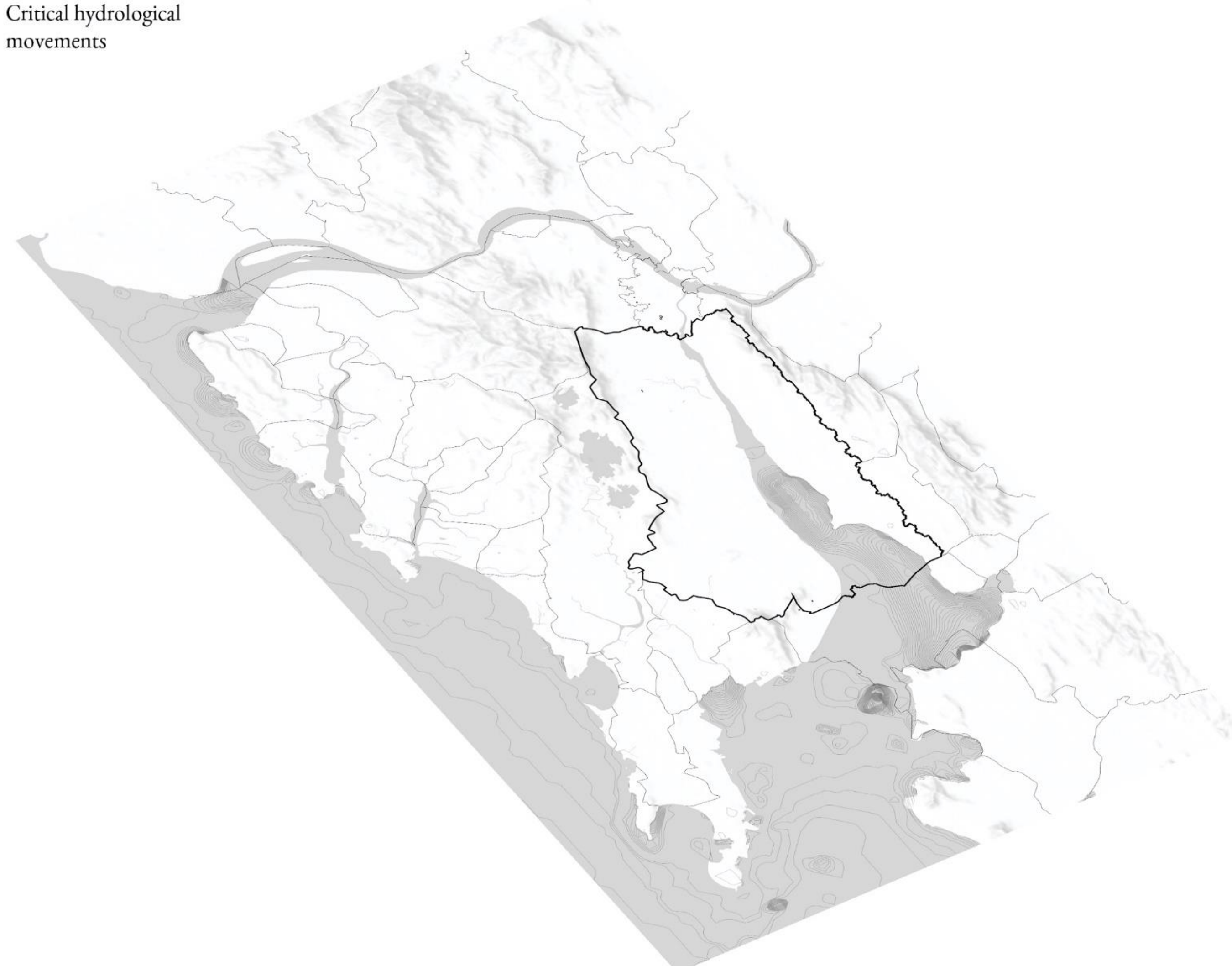


Theoretical Framework



Testing Grounds

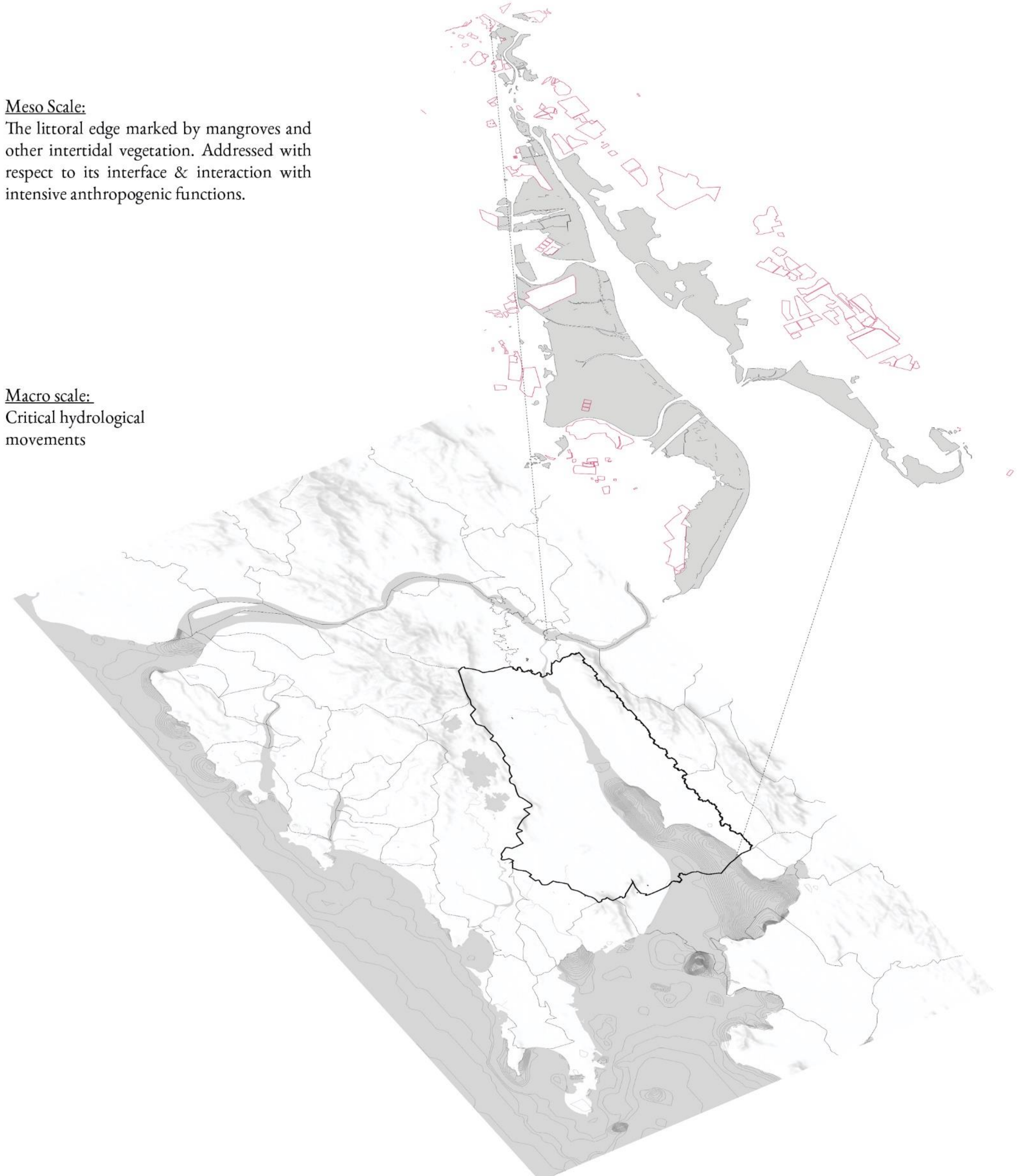
<u>Macro scale:</u>
Critical hydrological movements



Testing Grounds

<u>Meso Scale:</u>
The littoral edge marked by mangroves and other intertidal vegetation. Addressed with respect to its interface & interaction with intensive anthropogenic functions.

<u>Macro scale:</u>
Critical hydrological movements

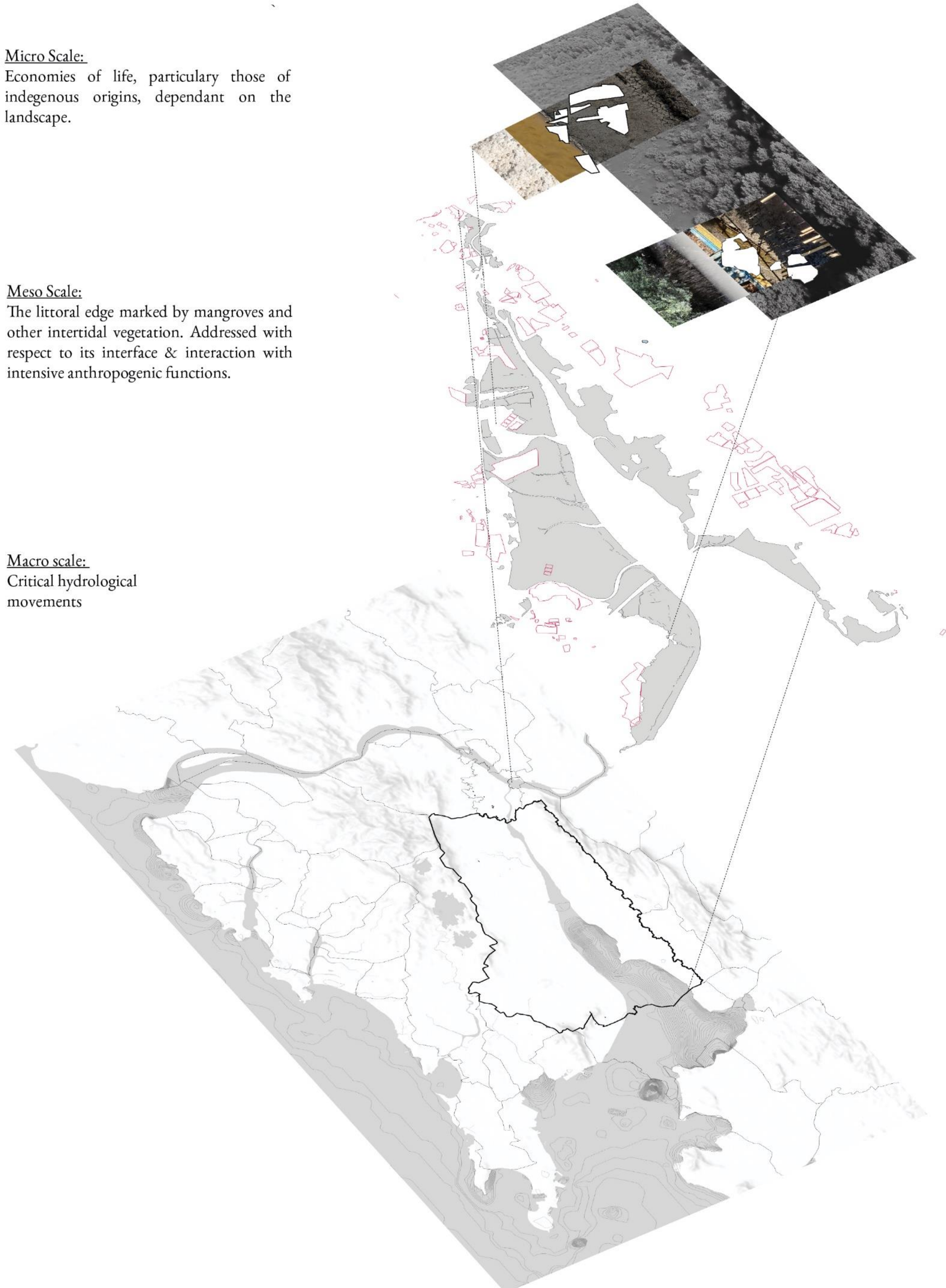


Testing Grounds

Micro Scale:
Economies of life, particulary those of indegenous origins, dependant on the landscape.

Meso Scale:
The littoral edge marked by mangroves and other intertidal vegetation. Addressed with respect to its interface & interaction with intensive anthropogenic functions.

Macro scale:
Critical hydrological movements

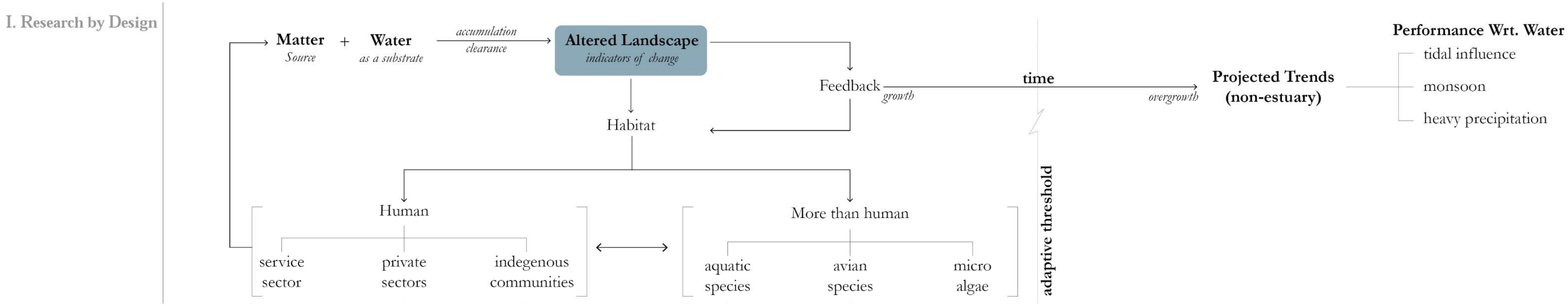


A thriving landscape

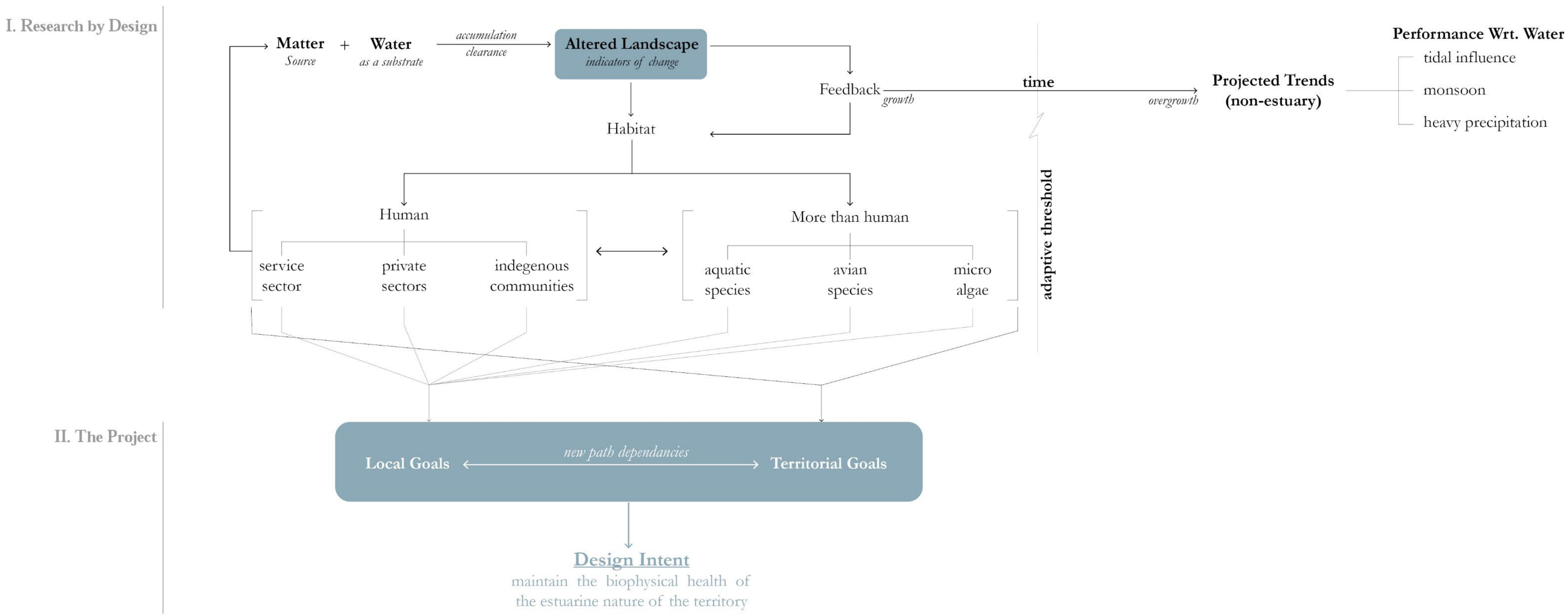
The two directions of time

Archiving indegenity

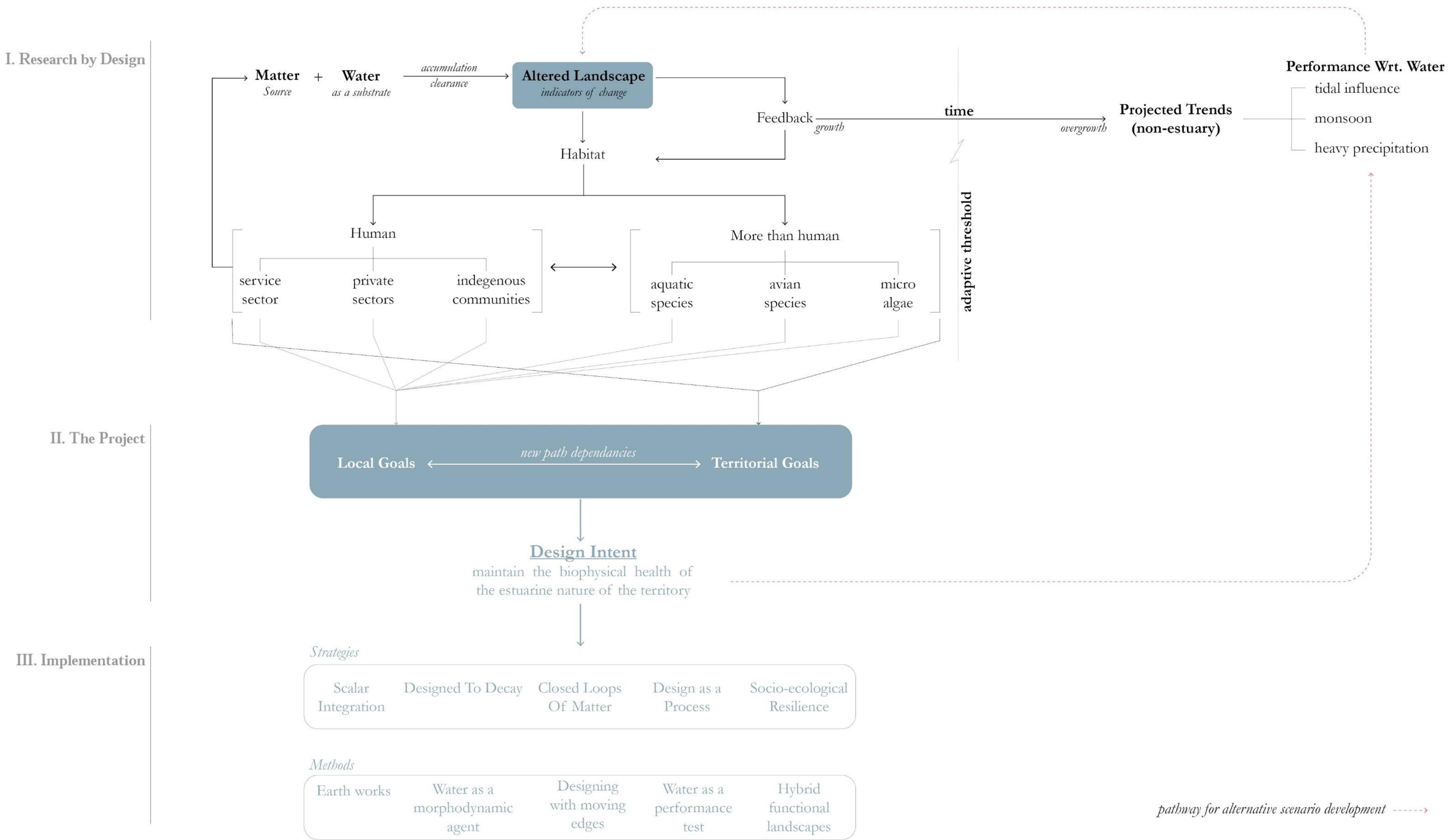
The Approach -*research by design*



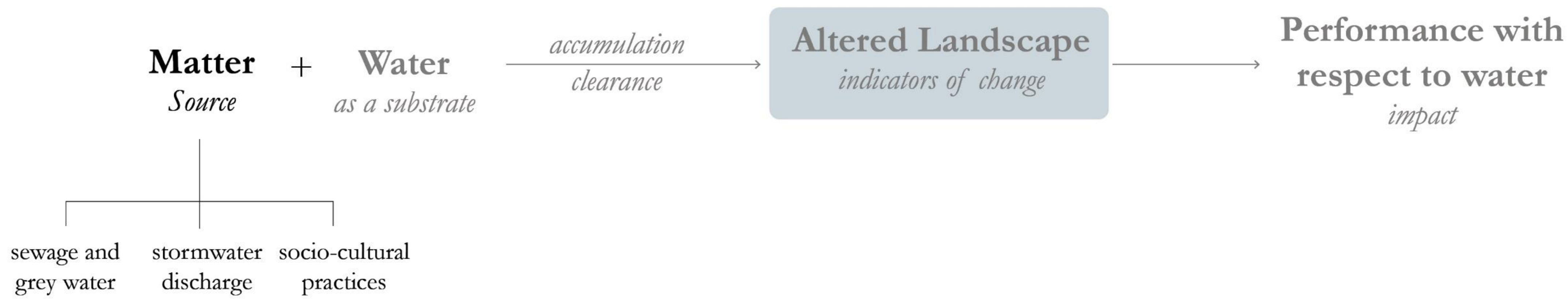
The Approach- *the project*



The Approach- *implementation*




Matter
Source
+
Water
as a substrate
accumulation
clearance
Altered Landscape
indicators of change
Performance with respect to water
impact


Matter
Source
+
Water
as a substrate
accumulation
clearance
Altered Landscape
indicators of change
Performance with respect to water
impact
sewage and grey water
stormwater discharge
socio-cultural practices

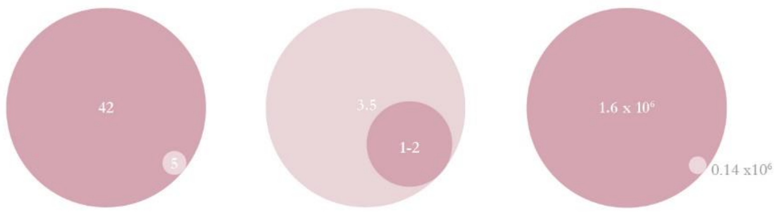
Matter Source

Grey water

Quantity:

1260 million liters of sewage is discharged into the creek per day. With a projected increase by 10% in the next 5 years.

Quality:

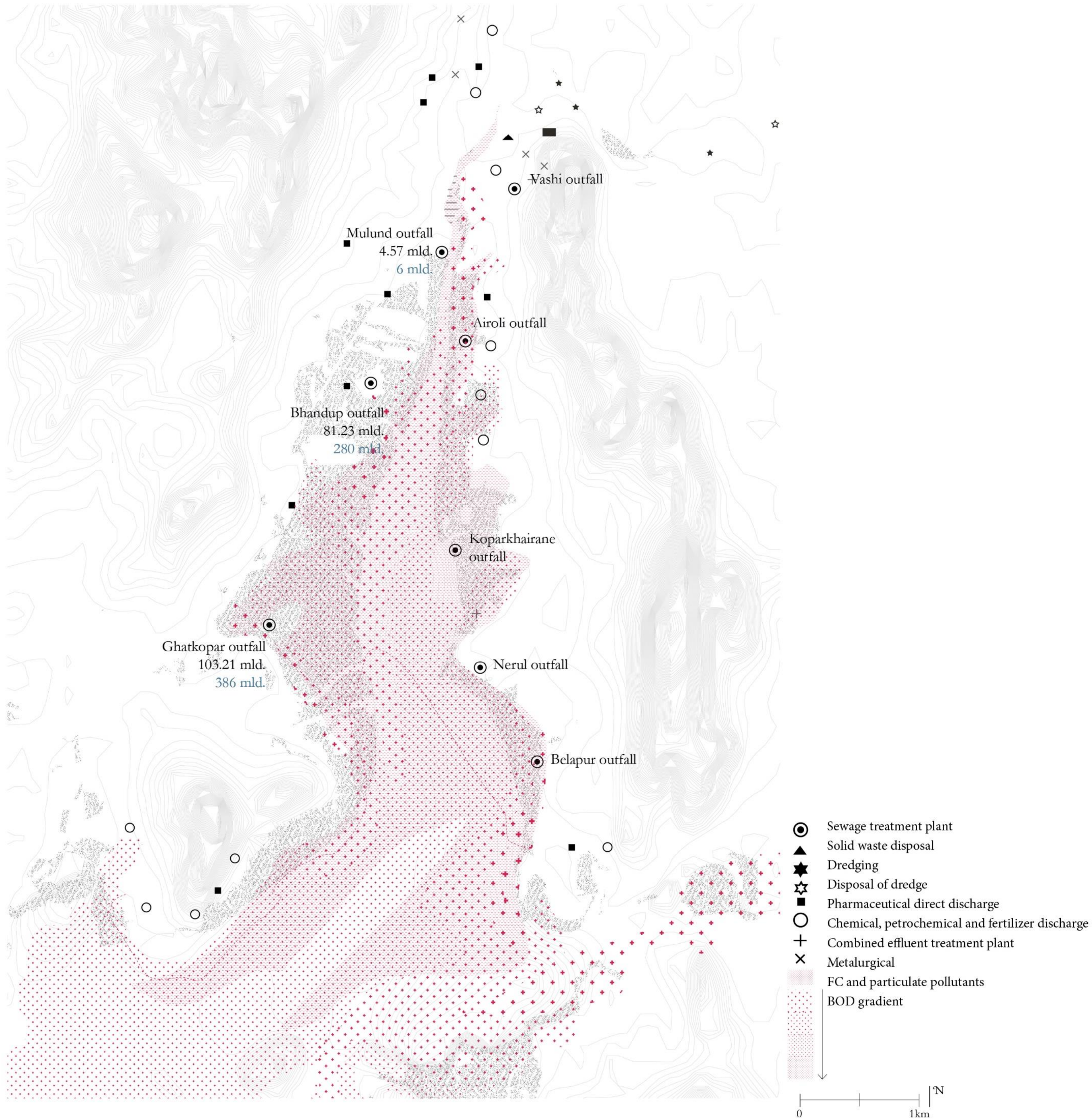


Biological Oxygen Demand (BOD) in mg/l

Dissolved Oxygen (DO) in mg/l

FC and Pollutants (CFU/100ml)

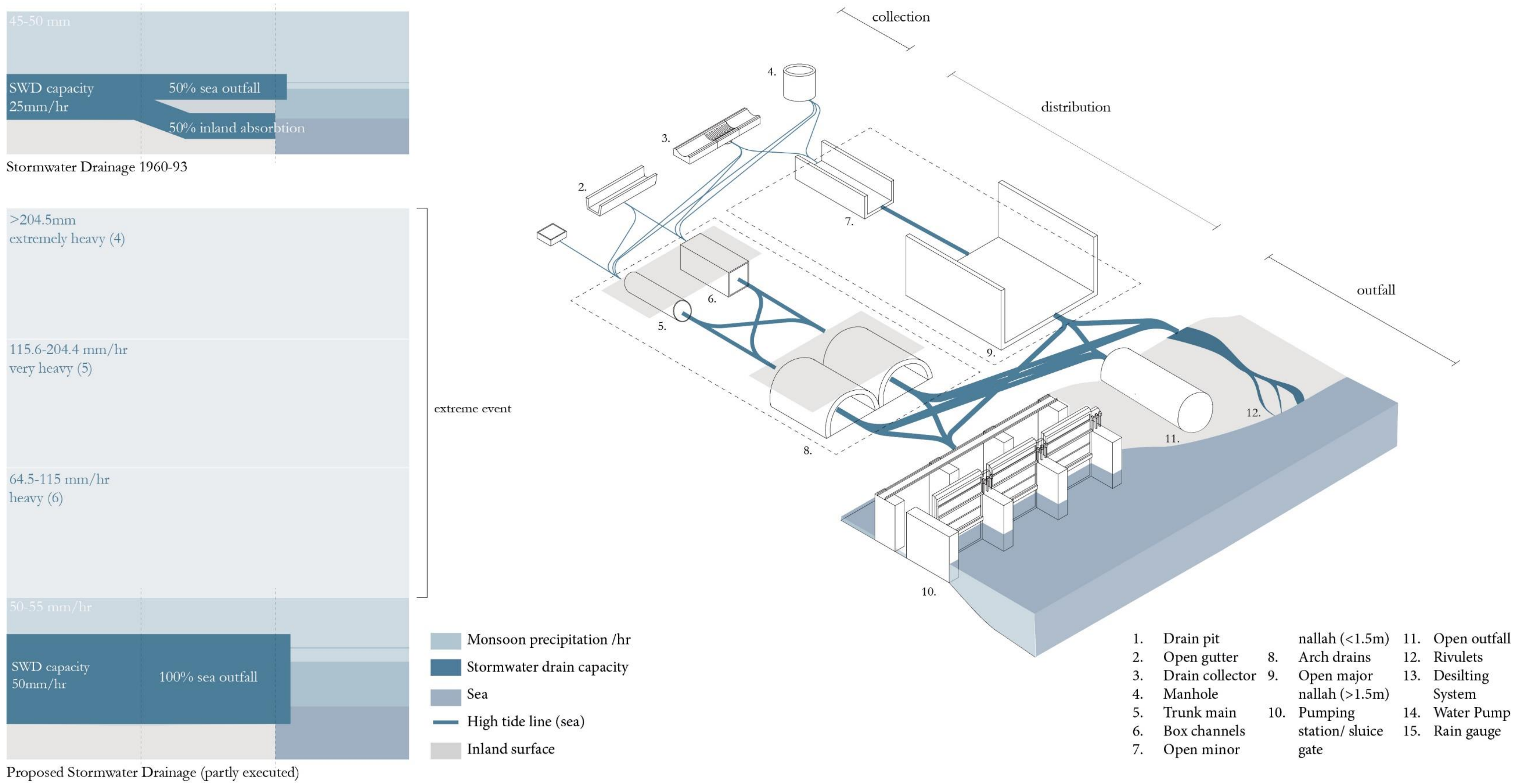
- volumes of matter as a **constant in time**
- **internalise** its management



Matter Source

Stormwater discharge

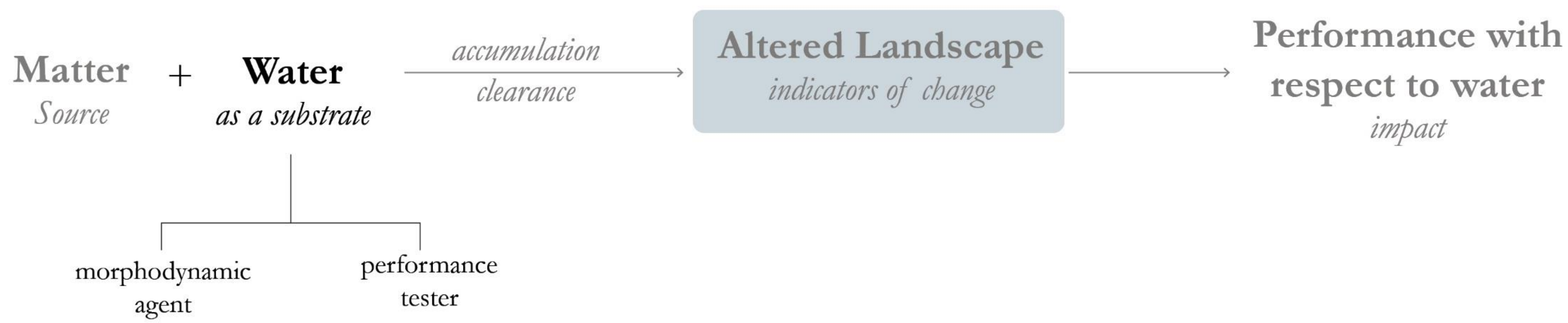
- **Scalar intergration** of storm water management from the Basin level.
- Respond to landscape **materiality**
- **Innate capacity** to mitigate wetness extremities.



Matter Source

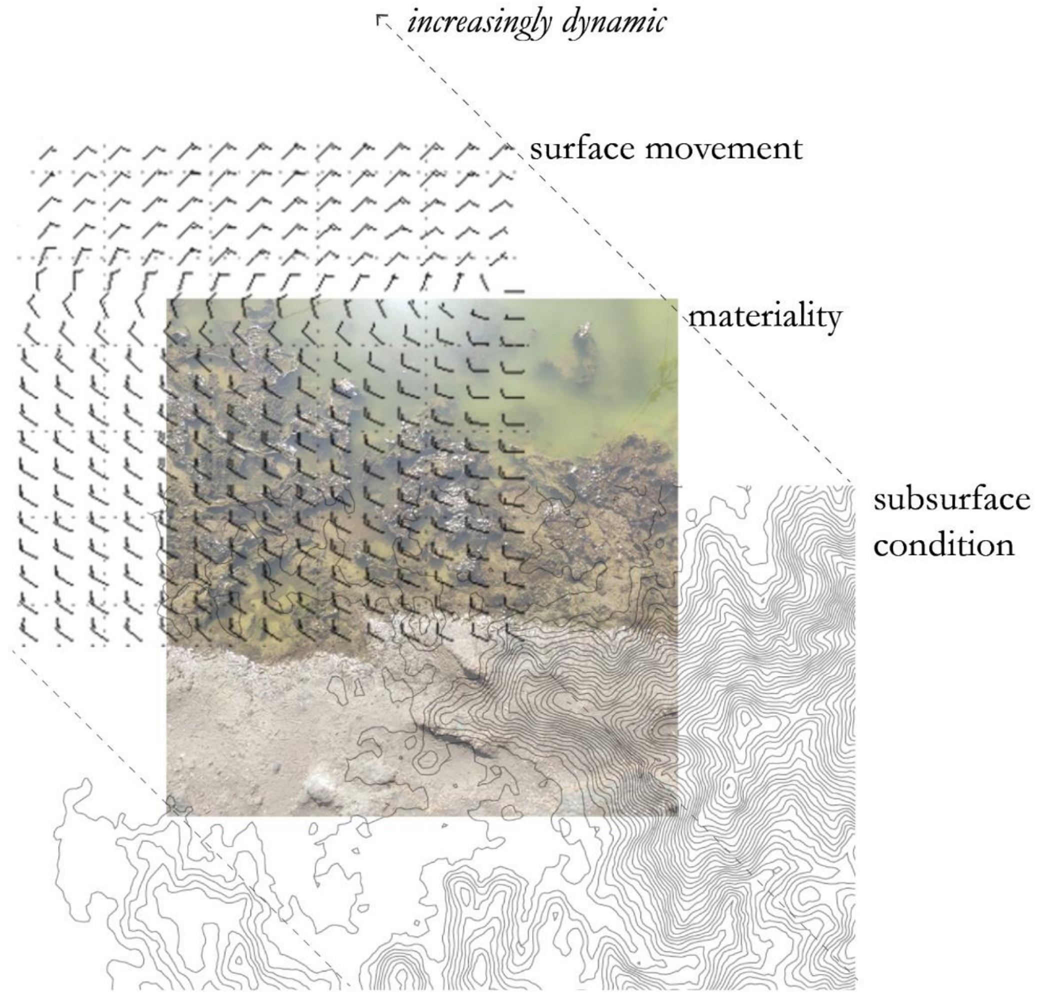
Socio-cultural practices

○ Embedded constants


Matter
Source
+
Water
as a substrate
accumulation
clearance
Altered Landscape
indicators of change
Performance with respect to water
impact
morphodynamic agent
performance tester

Water as a Substrate

A morphodynamic agent



Water as a Substrate

A morphodynamic agent
A performance determinant

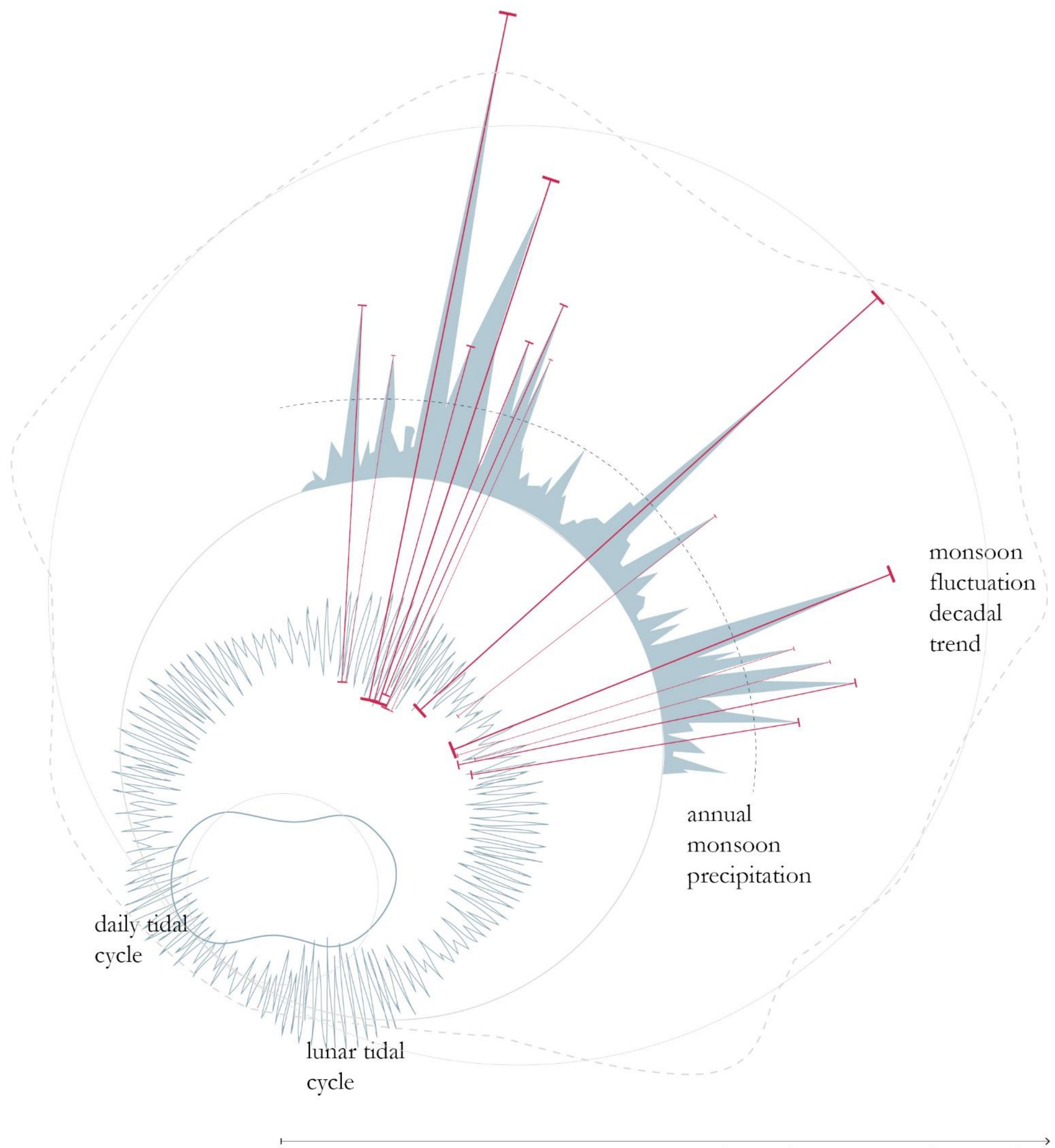
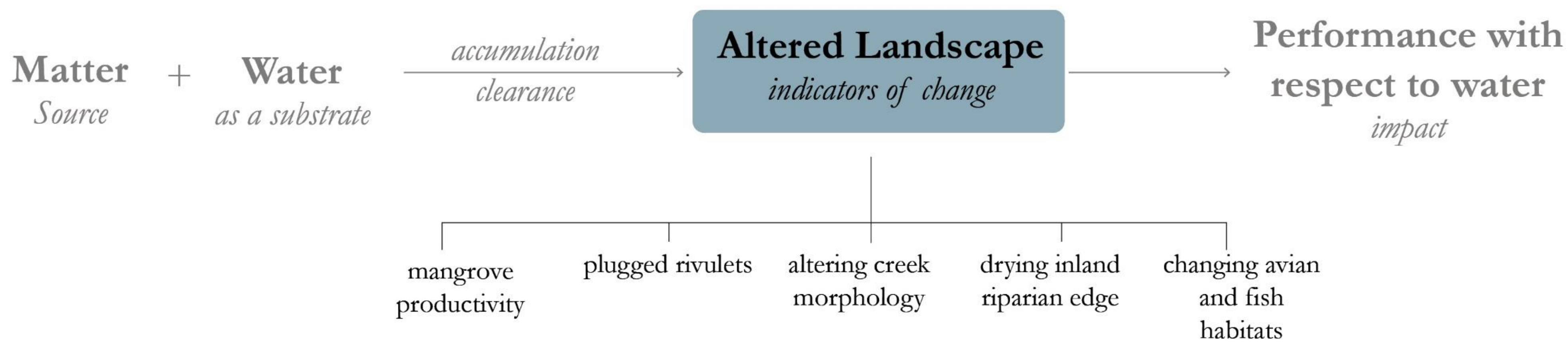


illustration based on:
tides on 3rd june, 2022
lunar tidal cycle 1 june - 3 july 2022
monsoonal data 2022

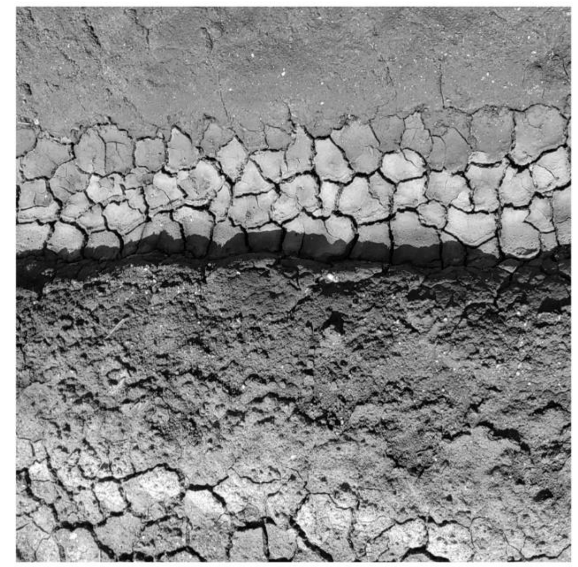

Matter
Source
+
Water
as a substrate
accumulation
clearance
Altered Landscape
indicators of change
Performance with respect to water
impact
mangrove productivity
plugged rivulets
altering creek morphology
drying inland riparian edge
changing avian and fish habitats

Altered Landscape
As indicators of change

1. Mangrove Productivity

2. Plugged Rivulets

3.Altering Creek Morphology

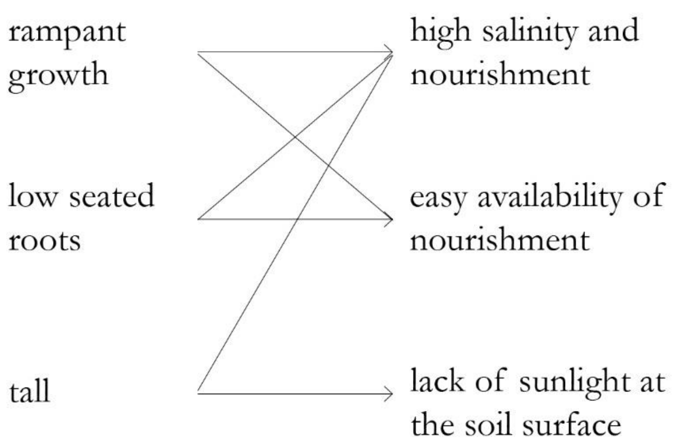


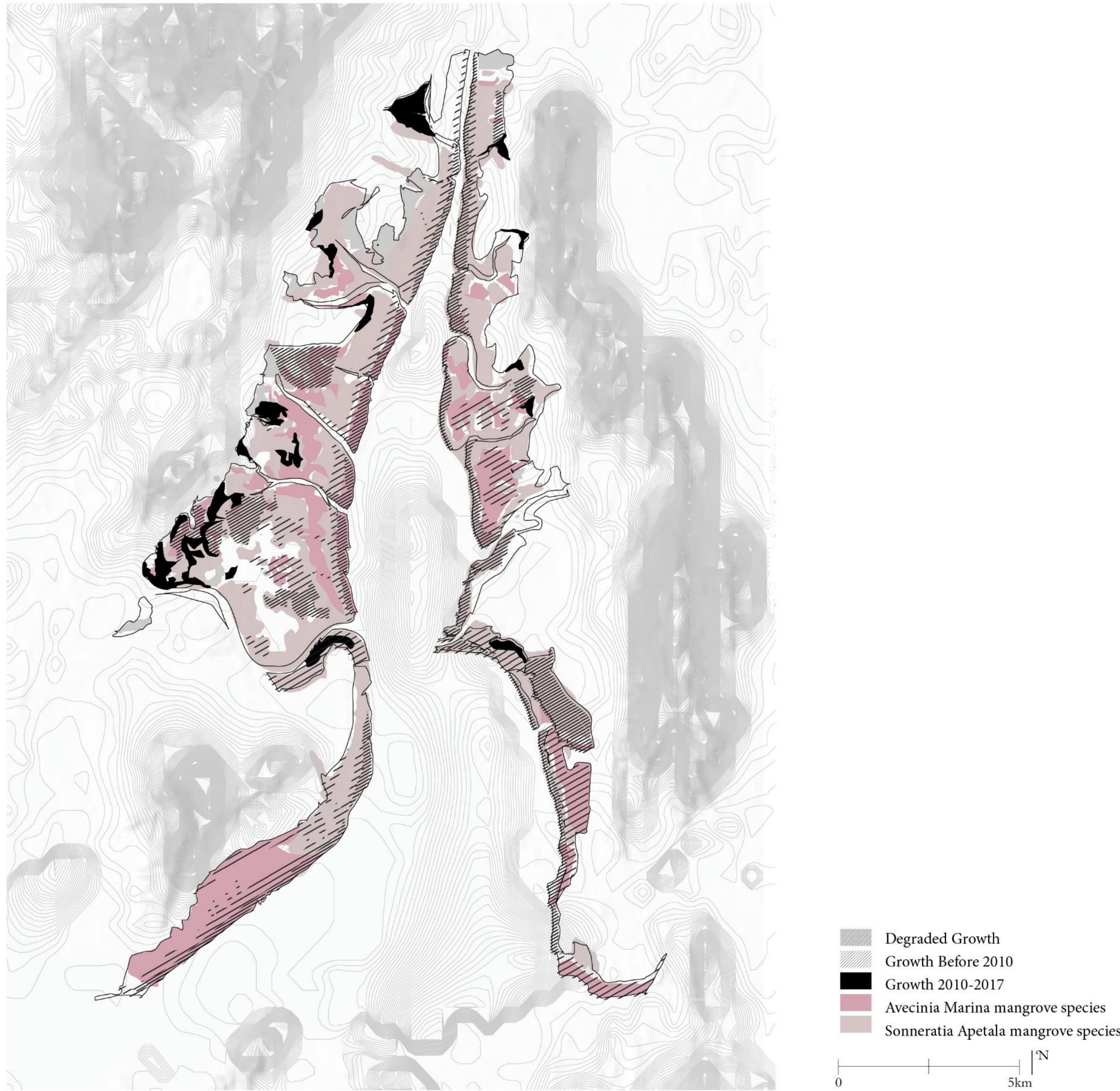
4. Drying Inland Littoral Edge

5. Aquatic & Avian Habitations Patterns

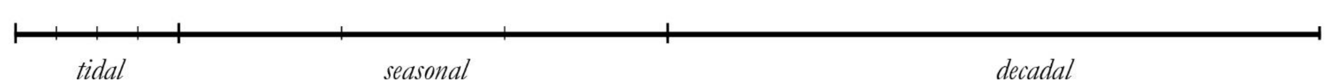
Altered Landscape

Mangrove Overproductivity





Alterations in the mangrove habitat. Data Source: WRI India, LandSat 5 and LandSat 8 (USGS)



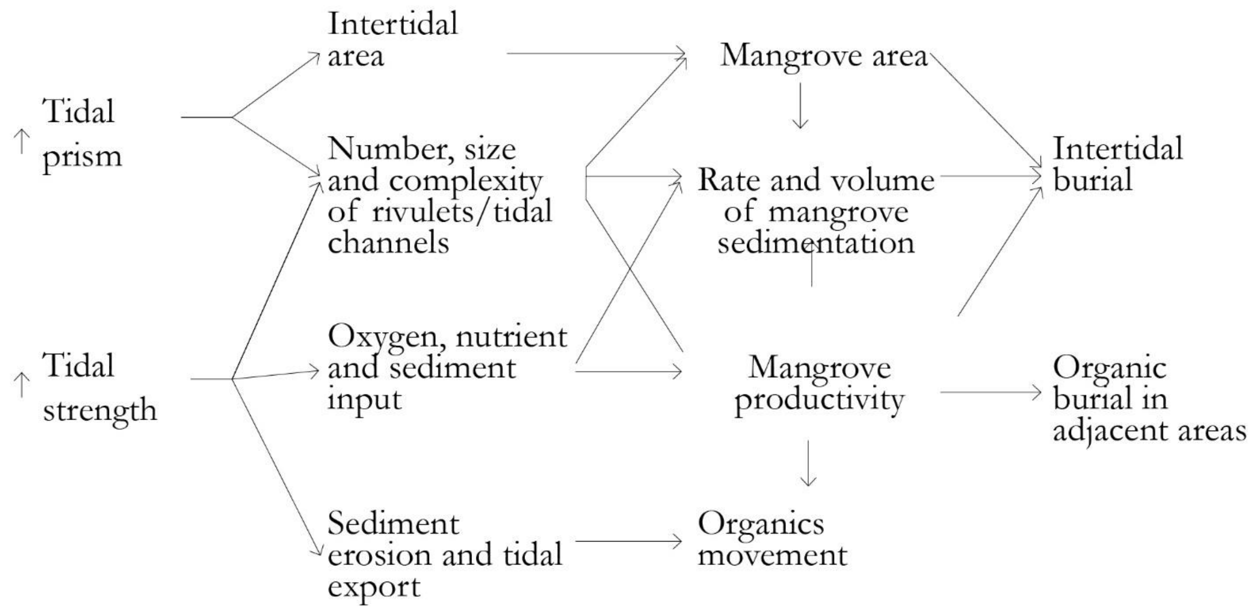
Avecinia Marina- (hardy species but week structure)

Heavy litter and felling during peak monsoons

Trapped litter, propogating new plants

Altered Landscape

Plugged Rivulets



Clogged and vegetated creek streams

Altering Landscape

Changing Creek Morphology

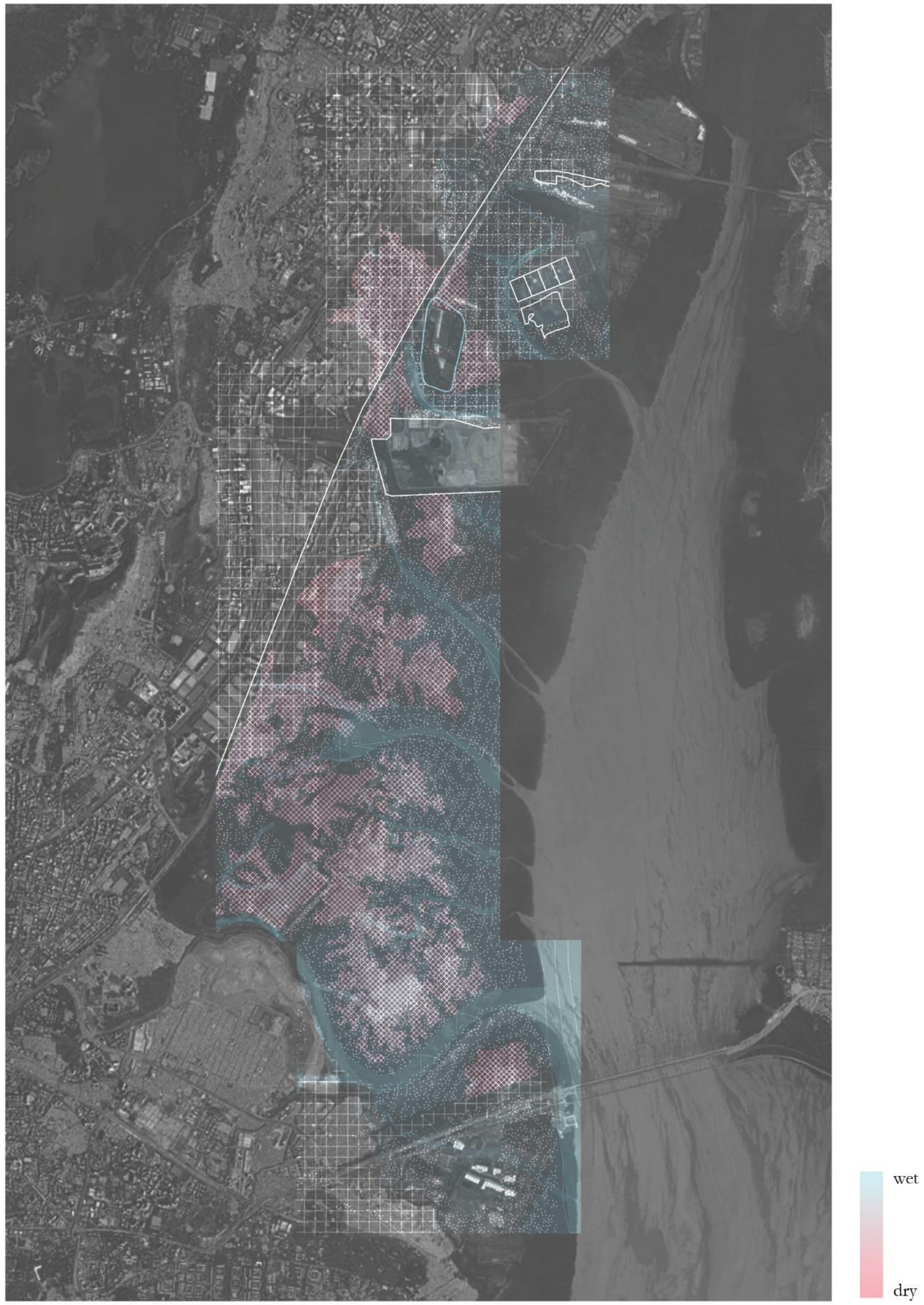
1992-2002

2002-2011

Accreting marshland

tidal *seasonal* *decadal*

Altered Landscape:
Drying Inland Littoral Edge



LandSat Color grading band 1 and 2. To determine actual varation in vegetation as an indication of surface dryness.



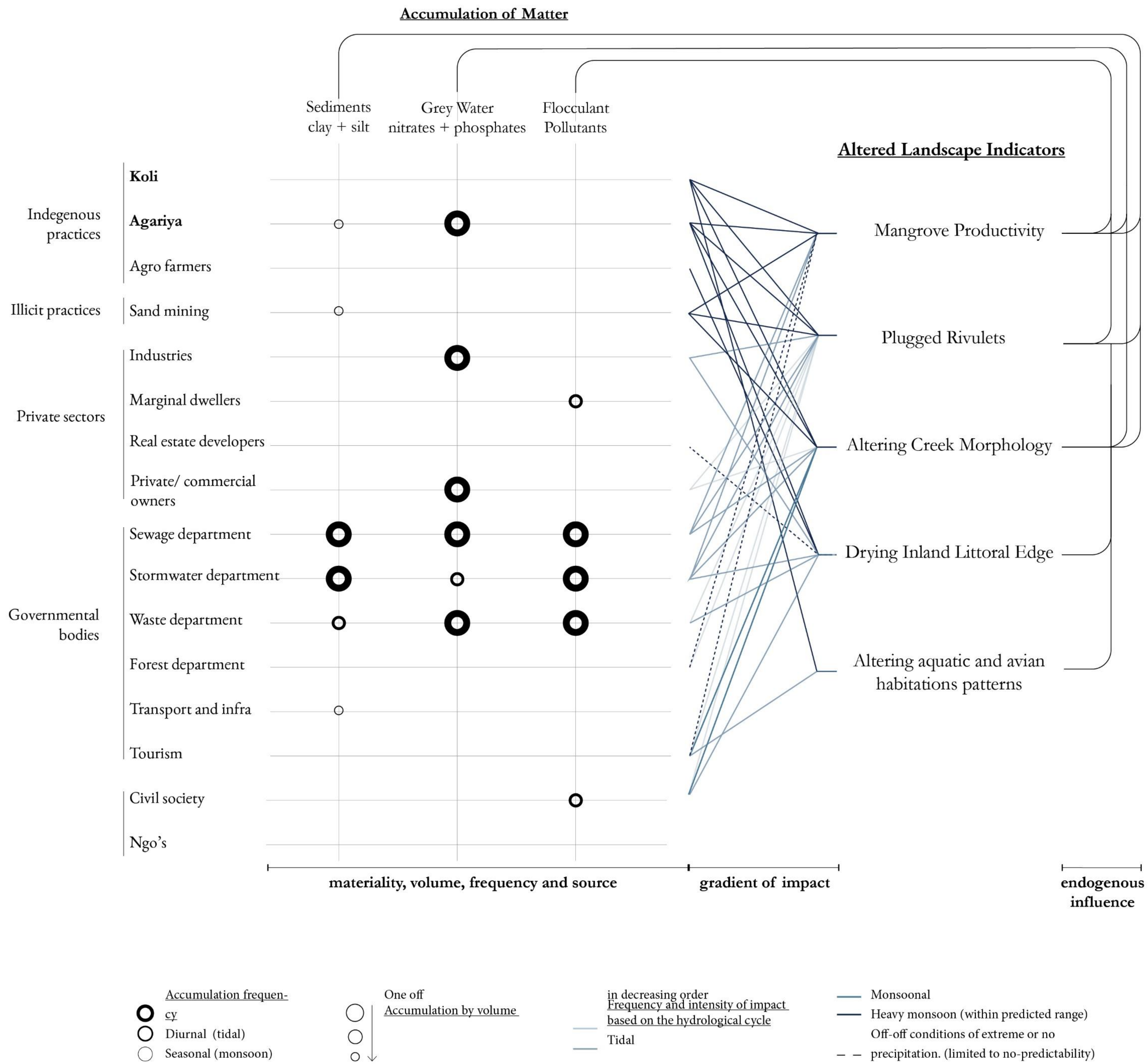
Altering Landscape

Aquatic & Avian Habitations Patterns

Flamingoes and Grey Plovers .Information Source: local fisherman

Mud crab burrow holes. Information Source: local fisherman

Impact

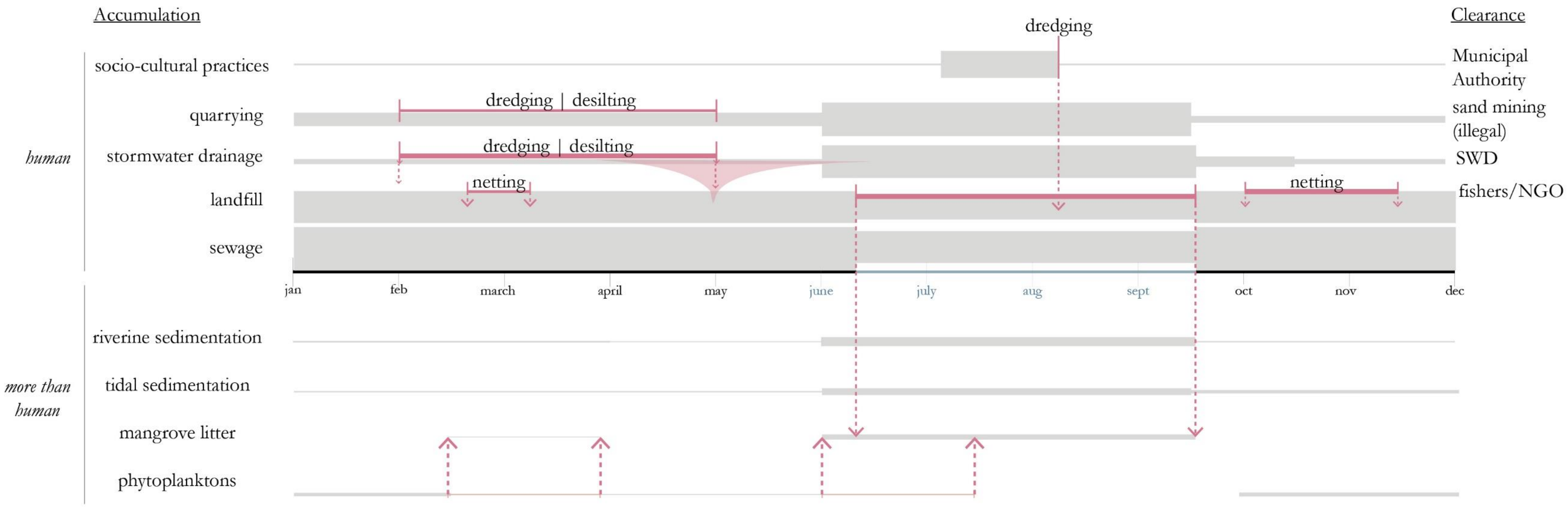


Accumulation of Matter
Sediments clay + silt
Grey Water nitrates + phosphates
Flocculant Pollutants
Altered Landscape Indicators
Indegenous practices
Koli
Agariya
Agro farmers
Illicit practices
Sand mining
Private sectors
Industries
Marginal dwellers
Real estate developers
Private/ commercial owners
Governmental bodies
Sewage department
Stormwater department
Waste department
Forest department
Transport and infra
Tourism
Civil society
Ngo's
Mangrove Productivity
Plugged Rivulets
Altering Creek Morphology
Drying Inland Littoral Edge
Altering aquatic and avian habitations patterns
materiality, volume, frequency and source
gradient of impact
endogenous influence
Accumulation frequency
Diurnal (tidal)
Seasonal (monsoon)
One off
Accumulation by volume
in decreasing order
Frequency and intensity of impact based on the hydrological cycle
Tidal
Monsoonal
Heavy monsoon (within predicted range)
Off-off conditions of extreme or no precipitation. (limited to no-predictability)

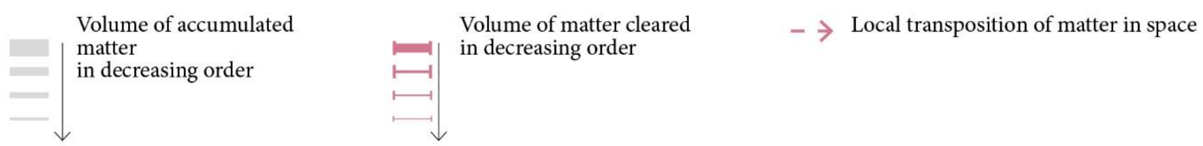
Impact
Koli Community

Impact

Agariya Community



Annual cycles of Clearance (material removal/ transposition)



Where does the matter go ?
Whose matter is it?

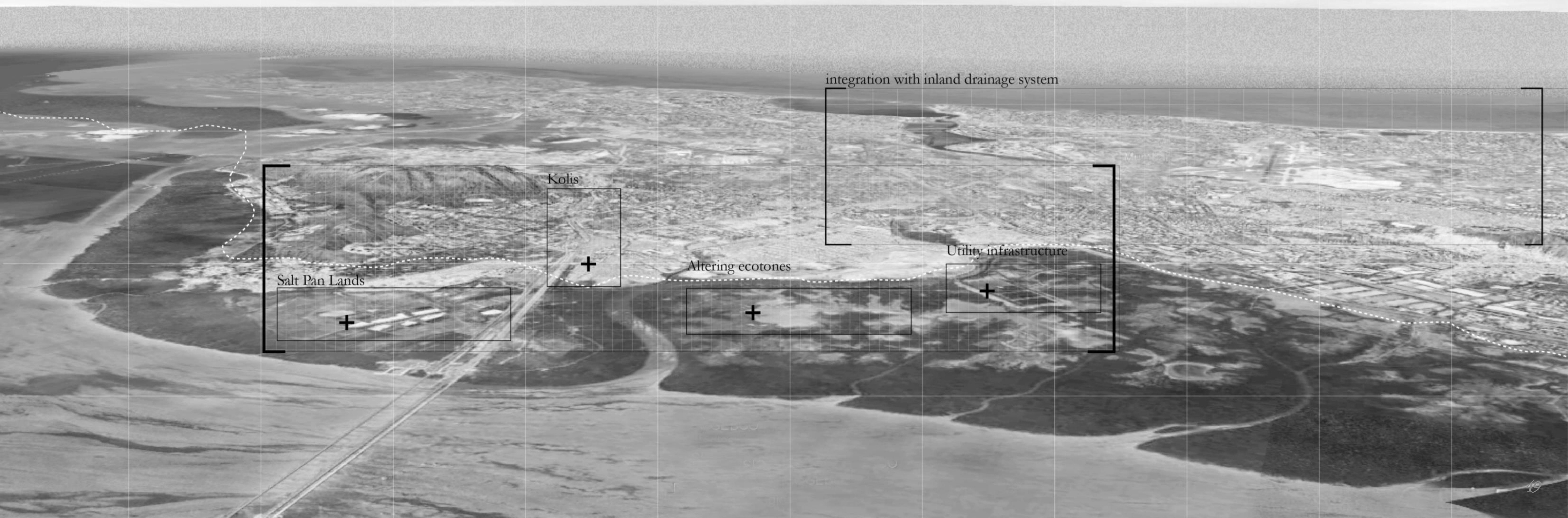
Existing estuary - 2023

A non estuary- 2050

The Project: a landscape intermediary

Acknowledging the discordantly shifting environments, the project thus proposes a landscape of buffer - conducing **new synergies** between the inland territorial practices/dependencies in response to the altering ecology of the estuary. Aimed at achieving a **resilient co-existence** of both human well as more than human occupants of the territory.

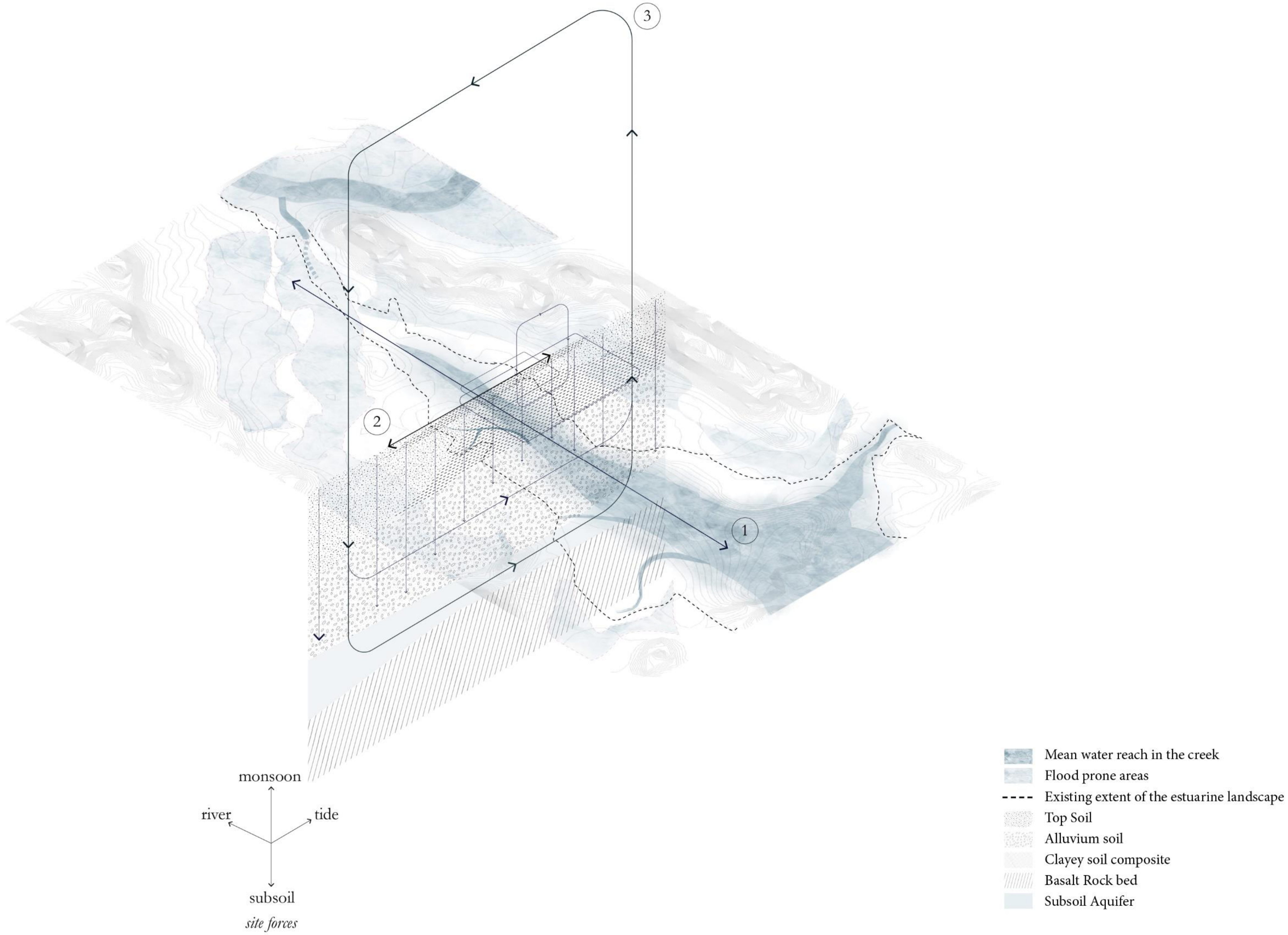
The proposal **breaks down the homogenous identity** of the wetland zone into smaller **local cycles of engagement with the water**. Stipulated by processes of **conscious release and clearance of the accumulated matter**, as a means of **maintaining the socio-ecological integrity** of the region. Such that it **cumulatively recalibrates** the hydrological cycle on a macro scale by harnessing the potential of the surface and subsurface to accommodate the rampant variations of water throughout the year. Thereby making it (the eastern catchment area of the city) resilient to annual flooding caused by heavy precipitation during monsoons.



Territorial Goals

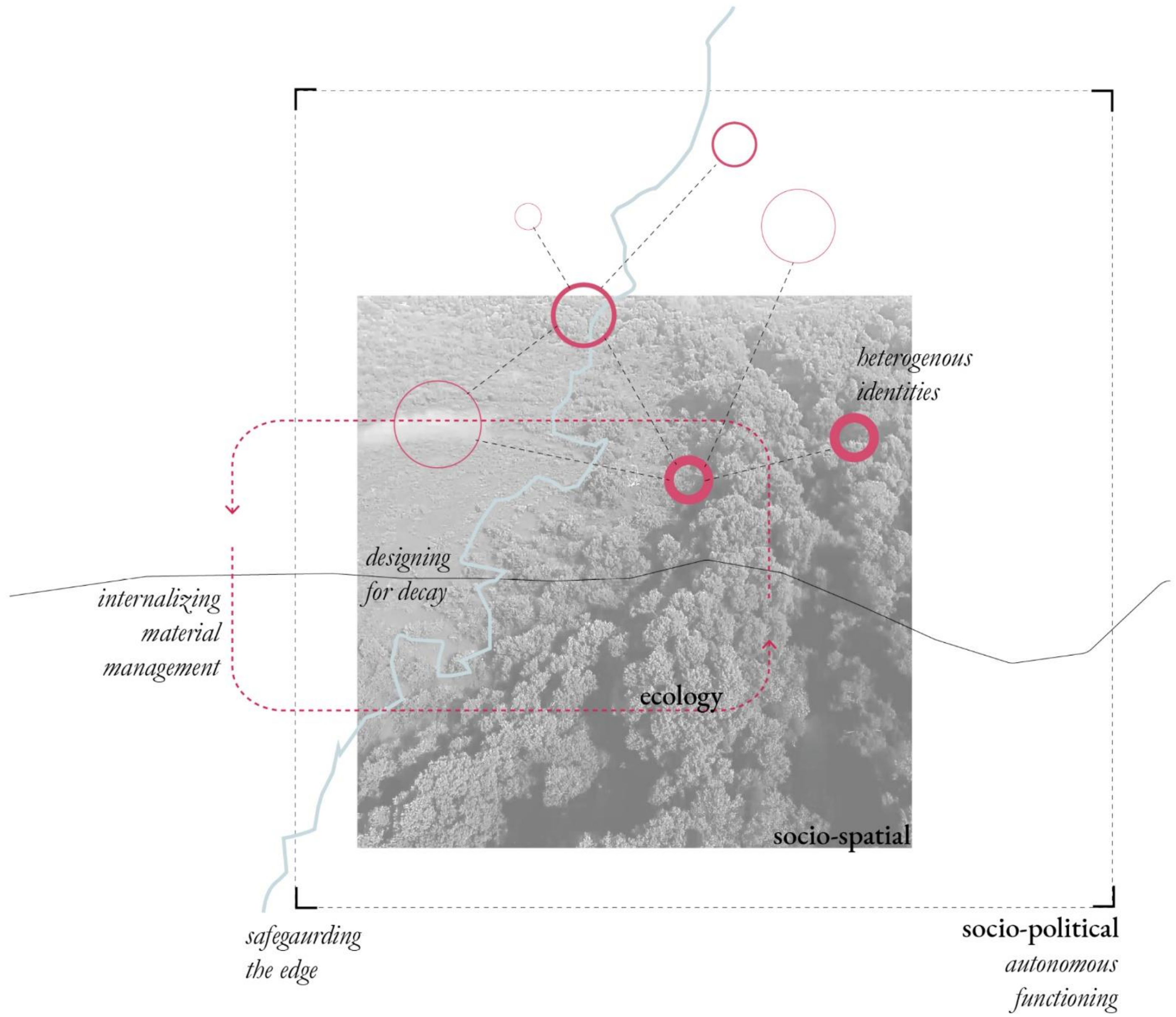
Hydrological reconfiguration

1. Lateral - Increase the influx of freshwater into the creek
2. Horizontal- Expand the influence of tidal waters into the inland reaches of the estuary to maintain its characteristic wetness.
3. Vertically- Harness potentials of the surface and subsurface materiality to capacitate the territory across scales (micro, meso and macro) against fluctuating volumes of water throughout the year.
4. Quality- Consciously ensure an acceptable biochemistry (refer to the quality page in terms of bod as parameter) of the water in the landscape to ensure survival of the estuarine landscape as well as its dependent habitats.



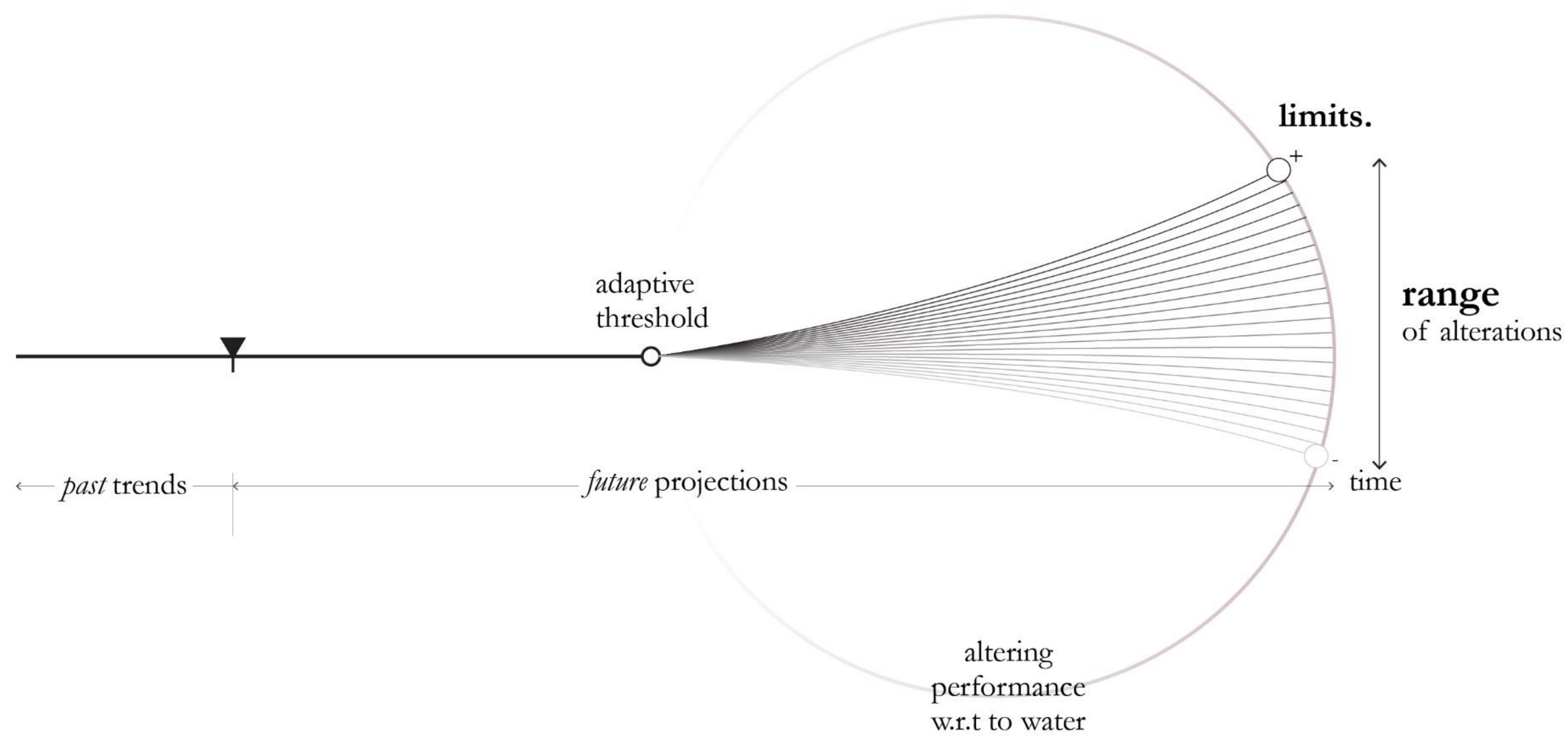
Meso-Micro Goals

1. Internalizing the management of matter (circular matter management)
2. Thriving ecological habitat -revive, secure and create.
3. Safeguarding the edge
4. Bolstering local heterogenous identities and new economies
5. Designing for decay(growth by decay)
6. Autonomous functioning (political resilience)



Designing with time
Approach

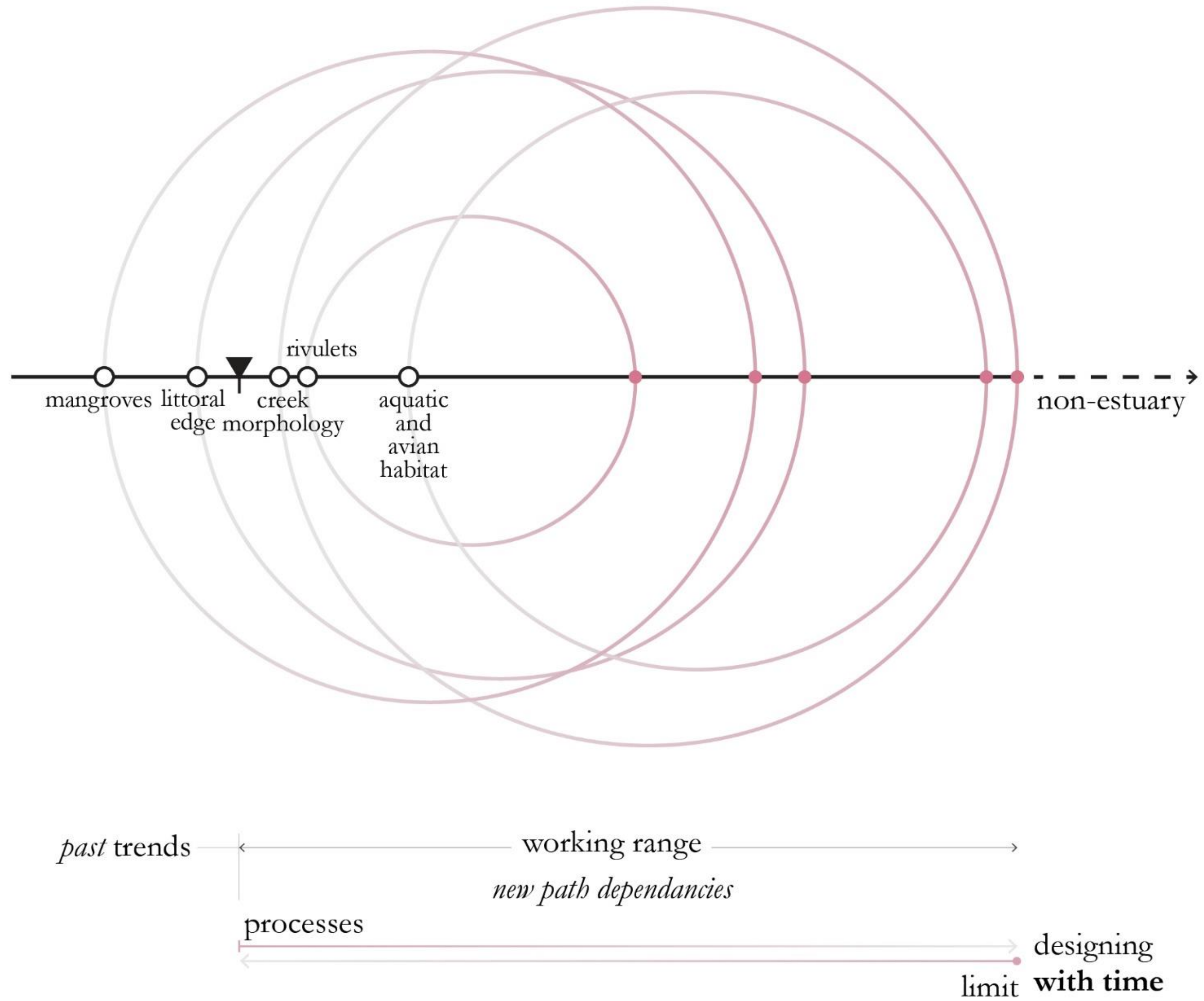
Macro scale of time, observed in the functional cycles of the estuarine ecosystem as a whole.



Designing with time

Approach

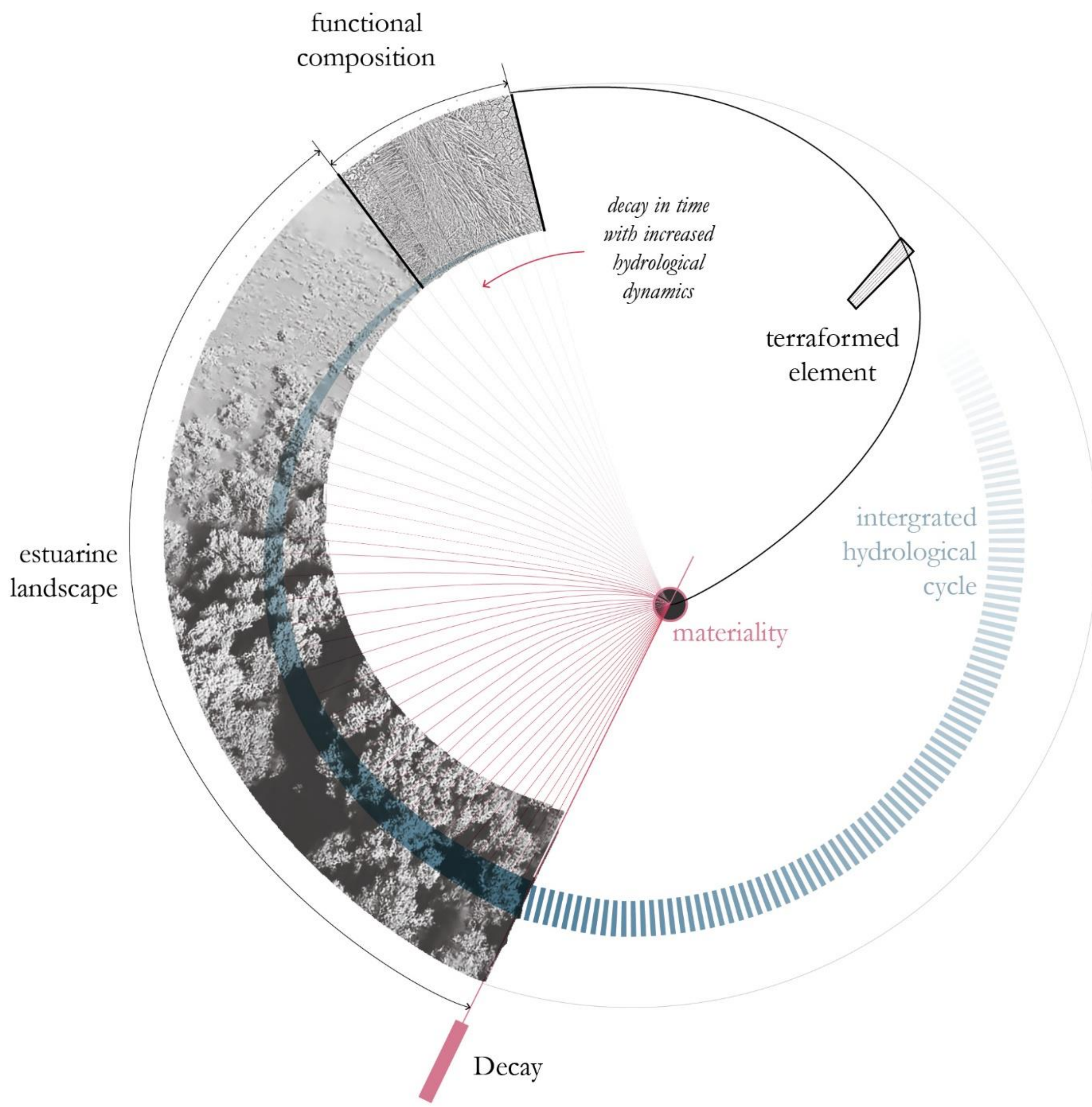
Meso to micro scales of time, observed in the paces of adaptation in individual estuarine elements.



Designing for time

Towards maintenance

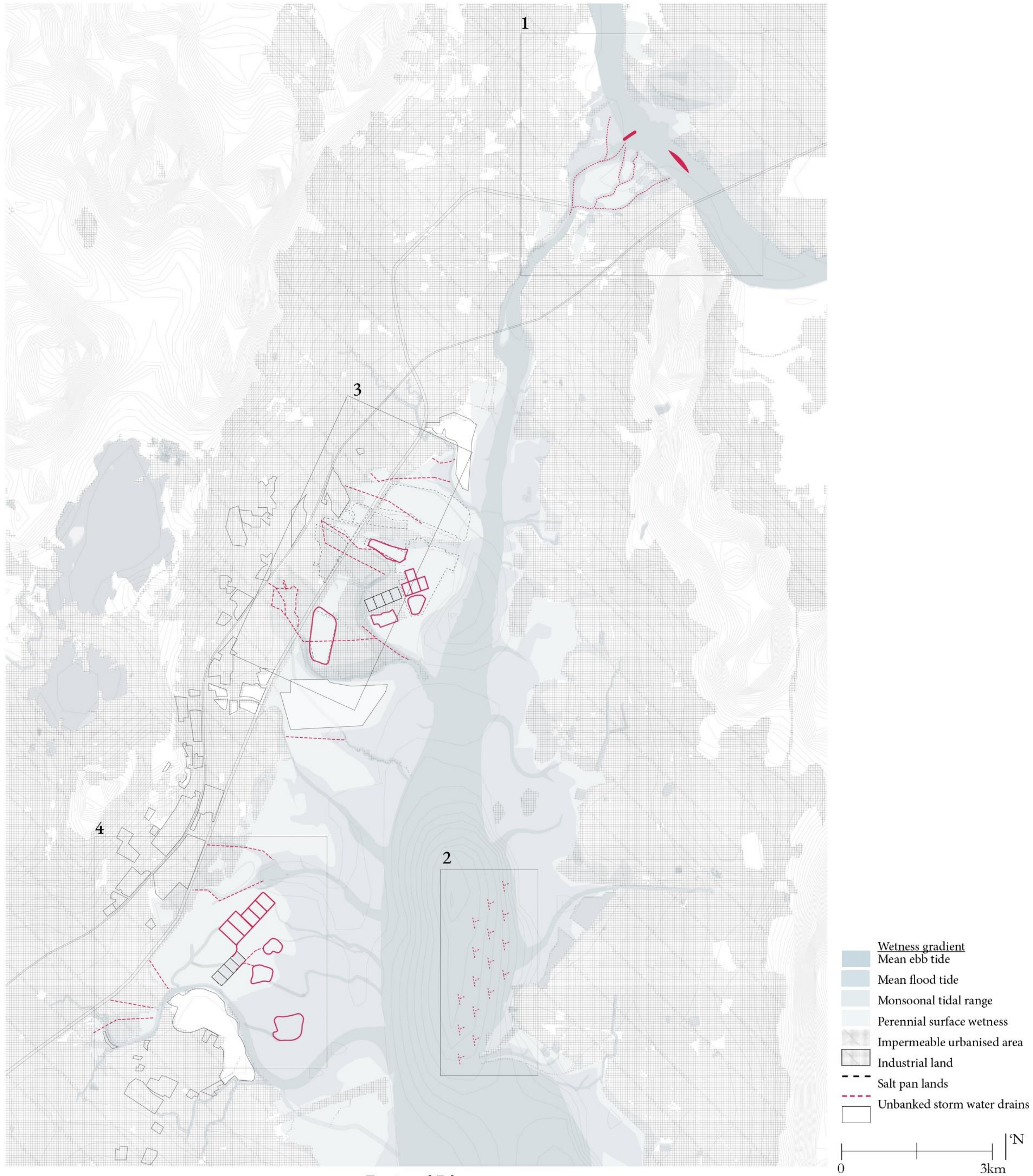
Calibrating landscape elements to function across scales that through their decay restore the hydrological integrity of the territory in time



The Landscape Collage

regional intervention

1. River avulsion
2. Sediment Traps
3. Un-banking the stormwater drains
4. Waste water aquaculture

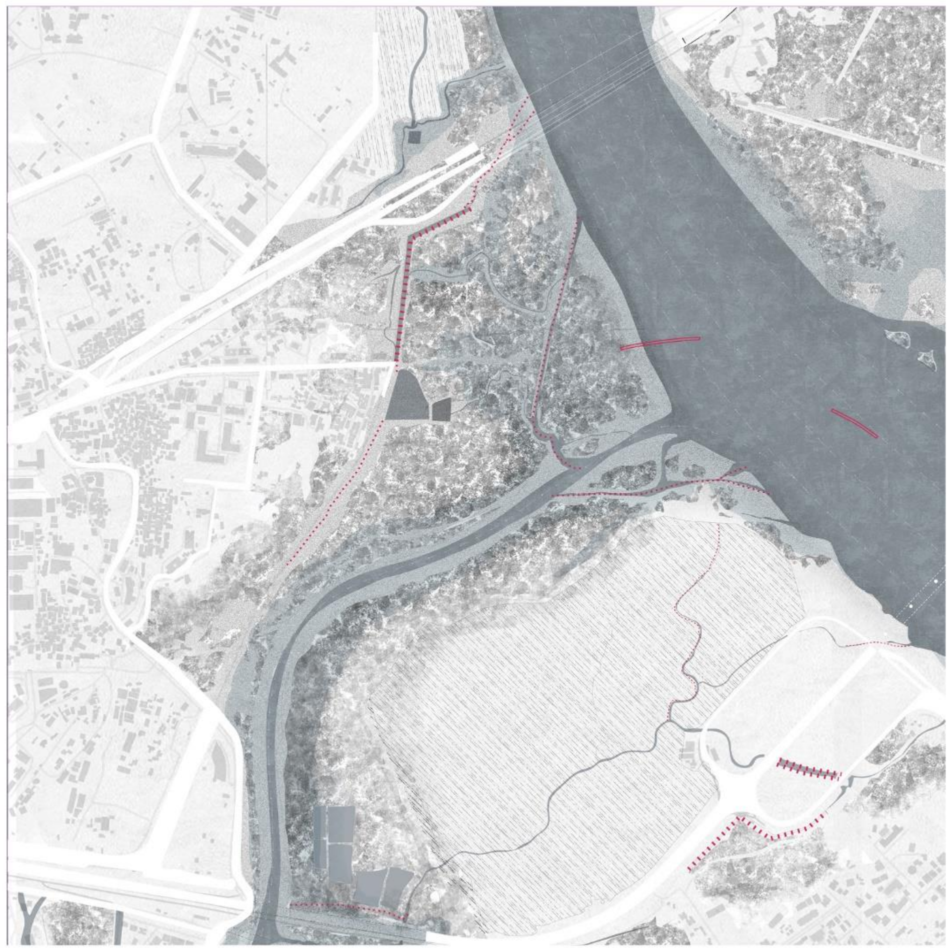


Regional Plan

I. River Avulsion

strategic intervention

Un-Earthing
Re-Earthing



Initiation phase:
Desilting and Introducing barriers

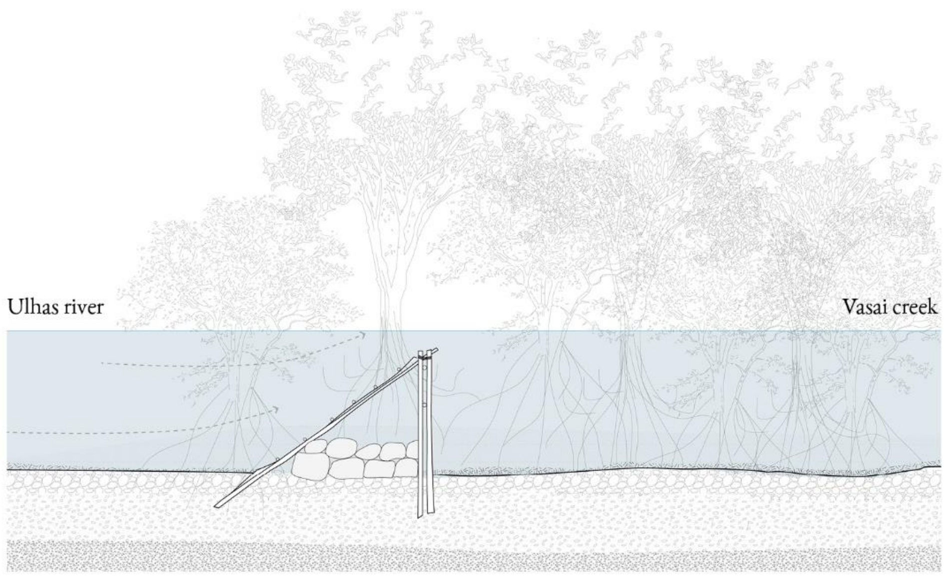
<u>Non-monsoonal clearance rate:</u>
Ulhas River: 2.57days
Upper Creek: nill

2 years
Annual Desilting (pre-monsoon clearance)

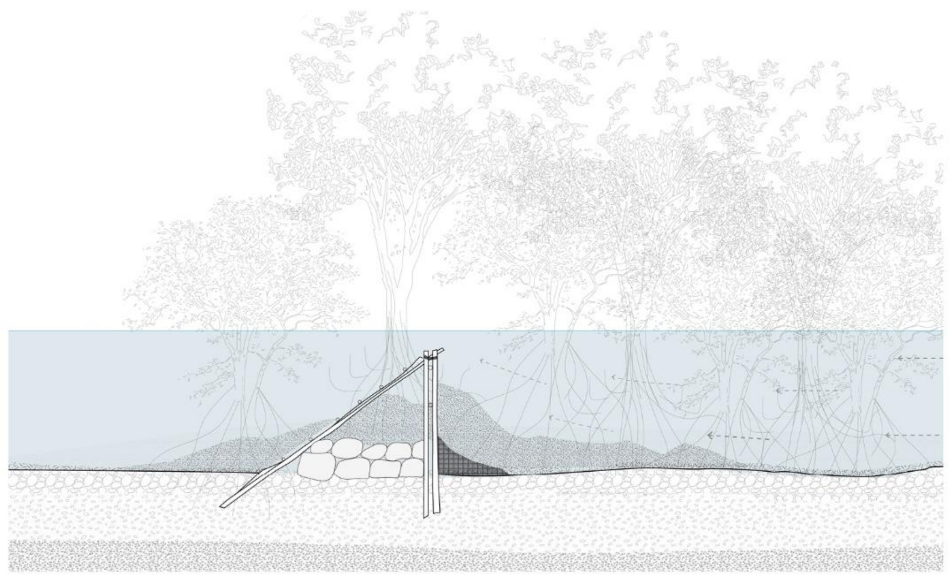
5 years

<u>Non-monsoonal clearance rate:</u>
Ulhas River: 2.57days
Upper Creek: aprox. 4 days

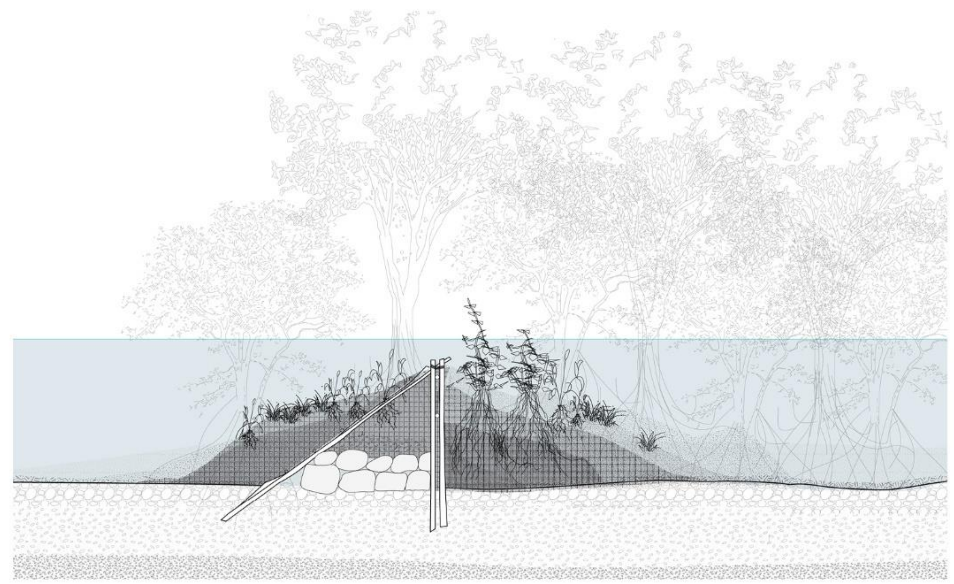
Proposed sediment barrier
Desilting paths
Un-banking drains
Mangrove vegetation
Exposed tidal marshlands
Farmlands
<u>Wetness gradient</u>
Mean ebb tide
Mean flood tide



Initiation phase: Ebb tide. Predominance of riverine deposition



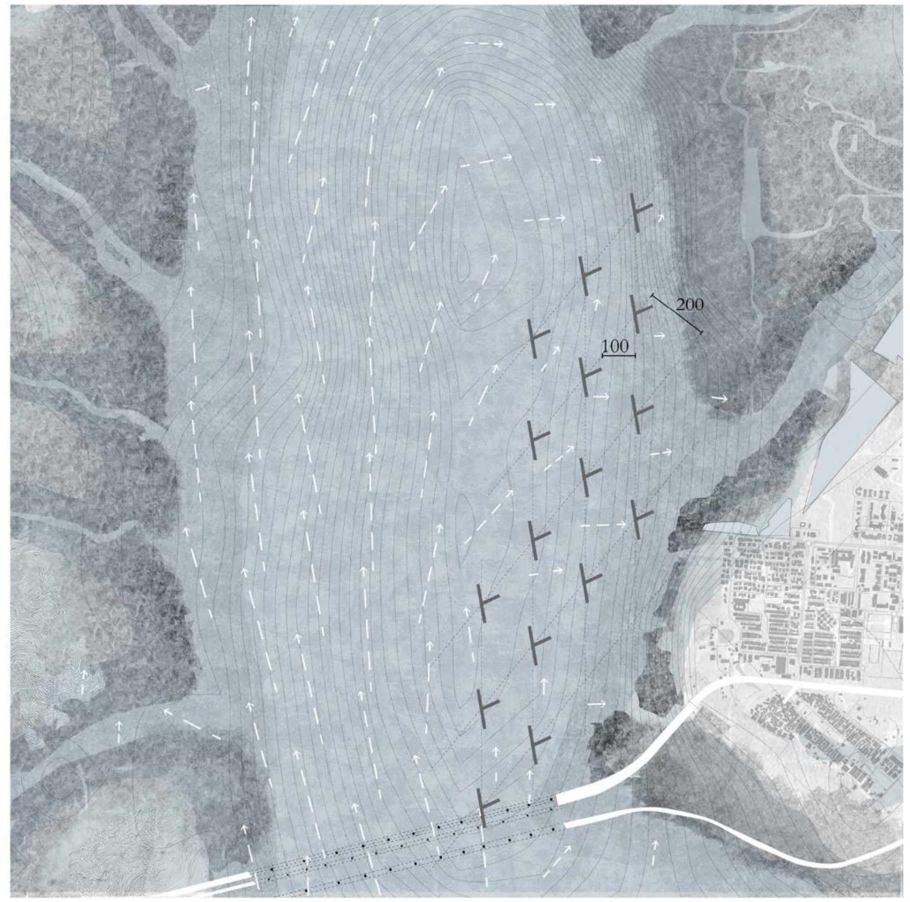
Initiation phase: Flood tide. Predominance of tidal deposition from Vasai



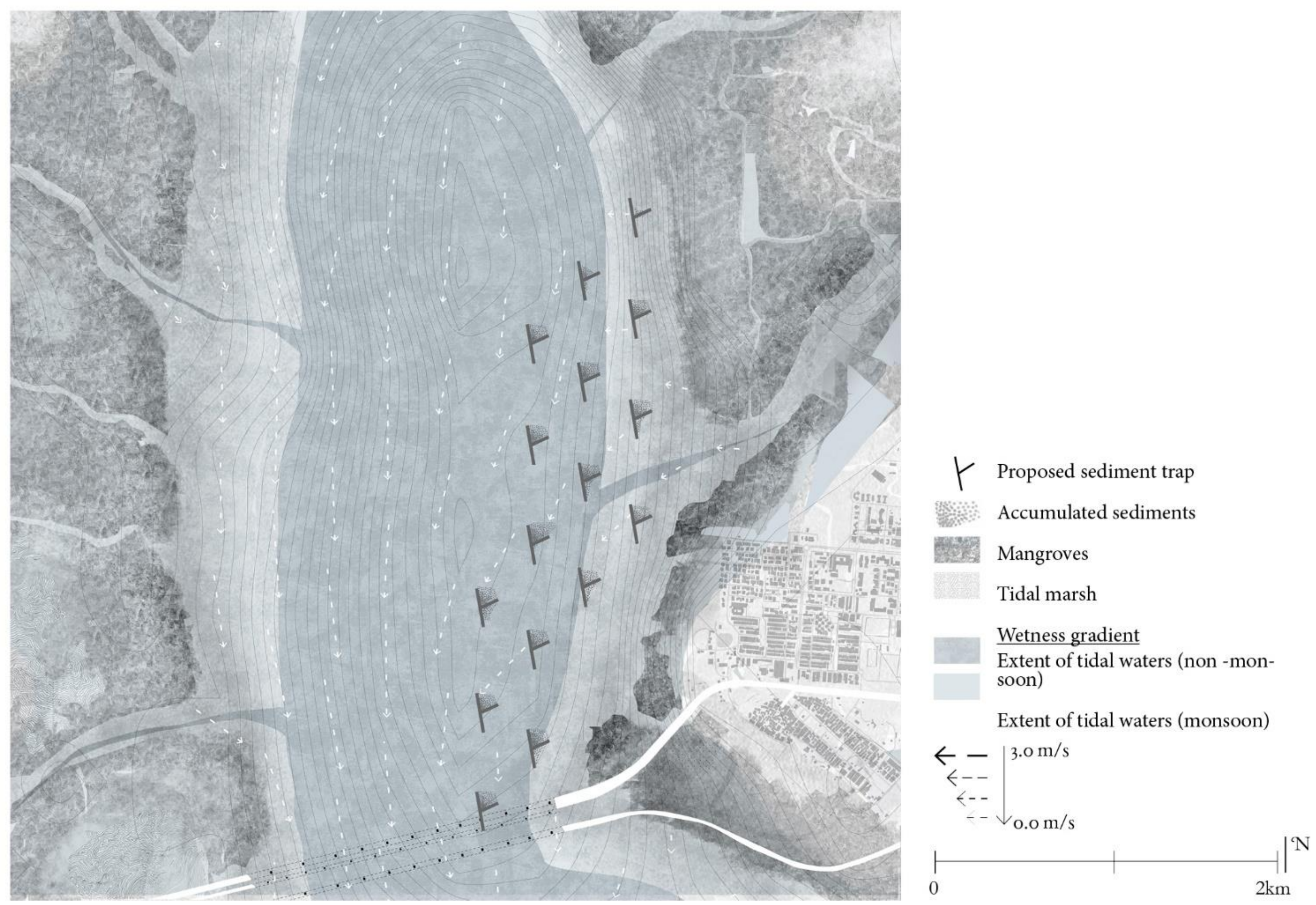
Stabalised tidal bar.

A thriving wetland by 2050 with regions of permanent wetness. New and revived rivulets flowing

II. Sediment Trap
Strategic Intervention



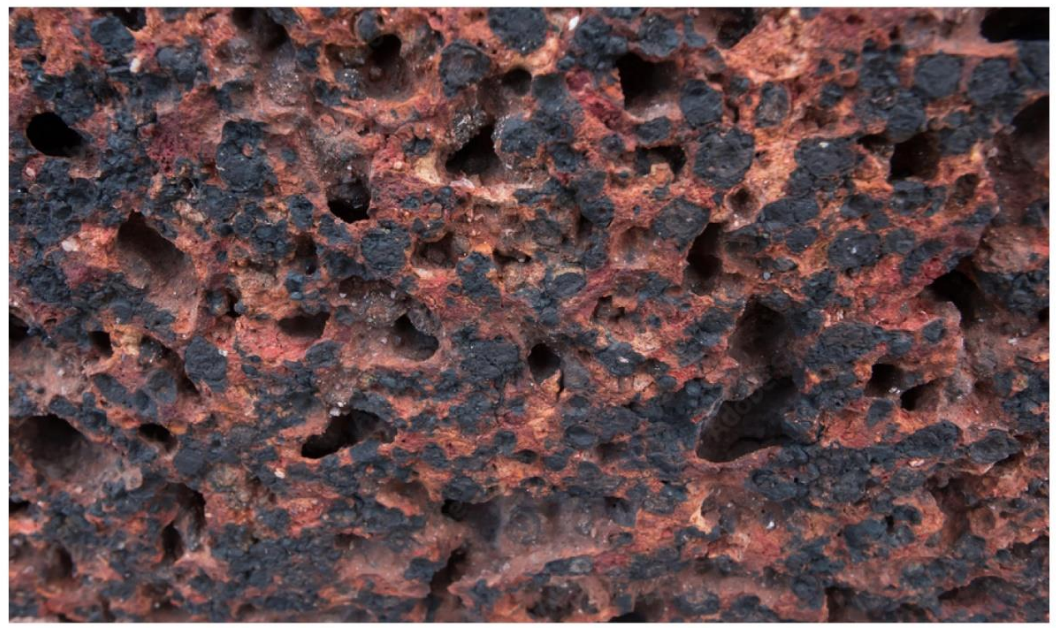
Sediment deposition in flood tide



Sediment trapping in ebb tide

II. Sediment Trap

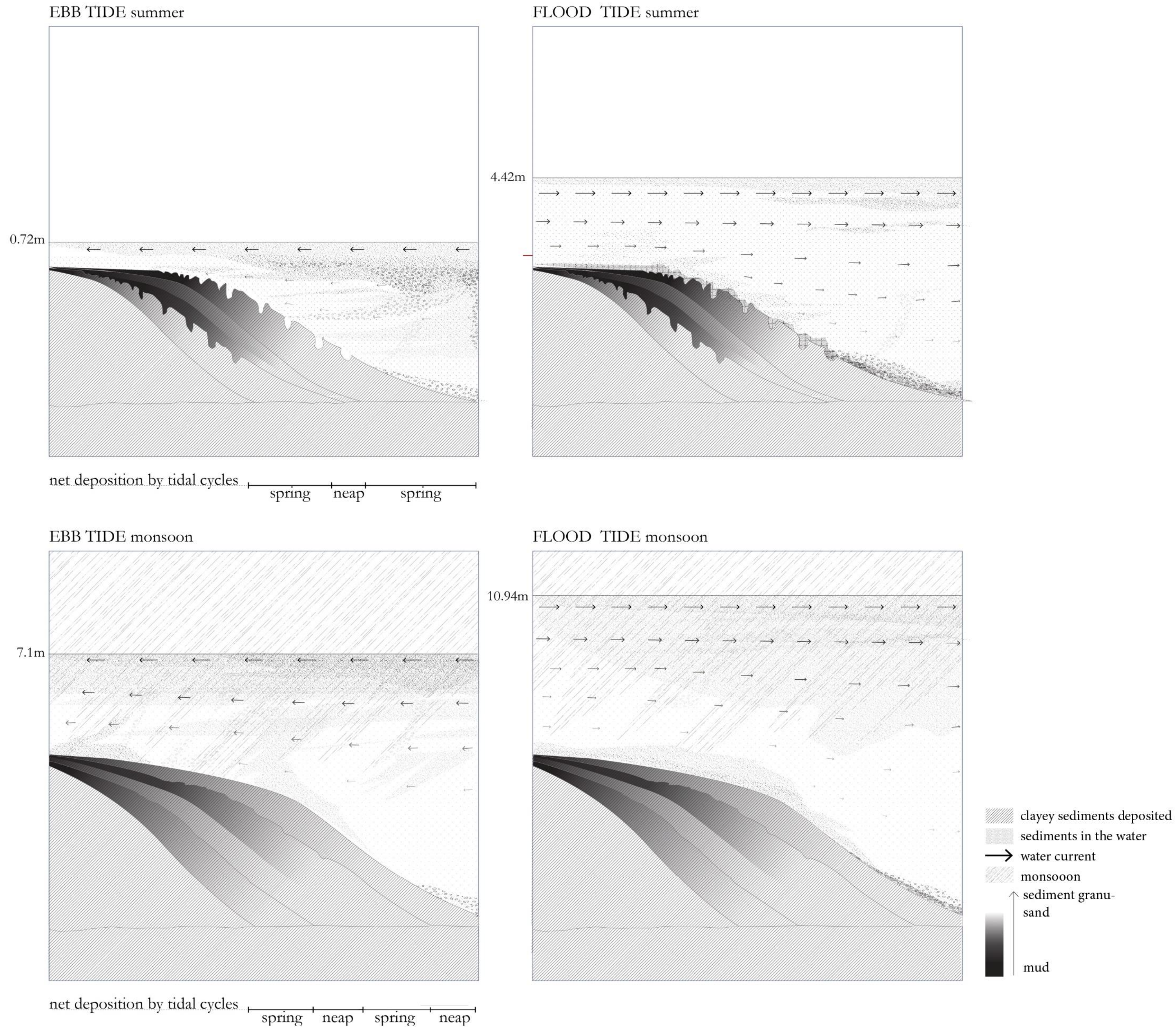
Materiality



- red laterite stone speculated with basalt
- coarse texture
- colloidal properties
- high iron ocxide content

Ii. Sediment Trap

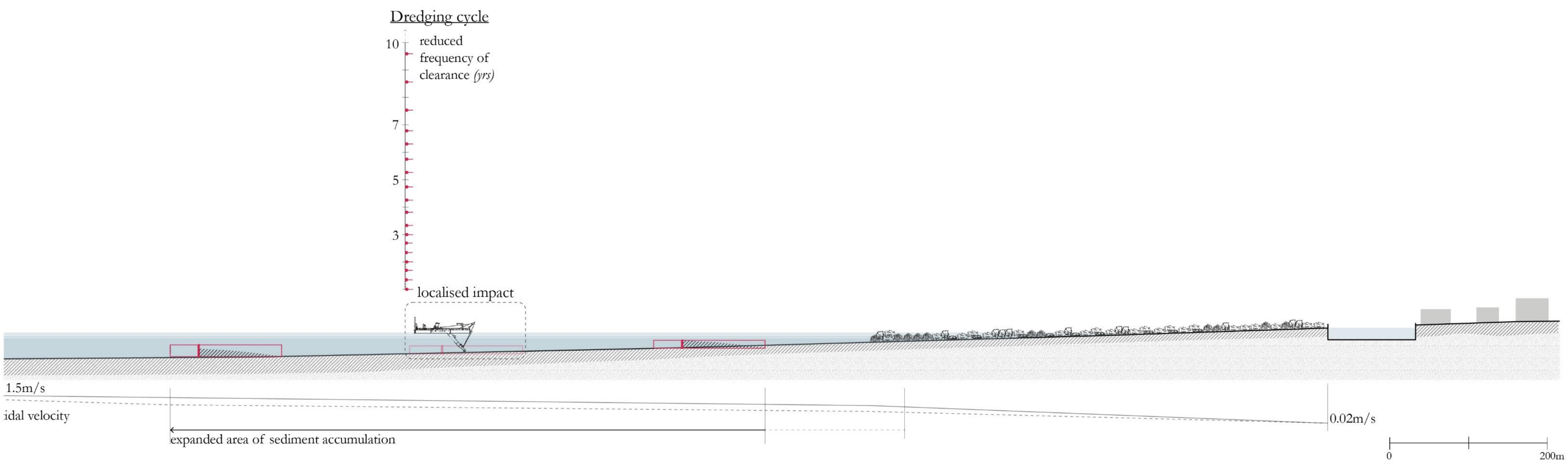
Hydrological Function



Hydrological Performance and shaping of the intervention in Non-monsoon and Monsoon conditions.

II. Sediment Trap

Cycles Of Maintenance

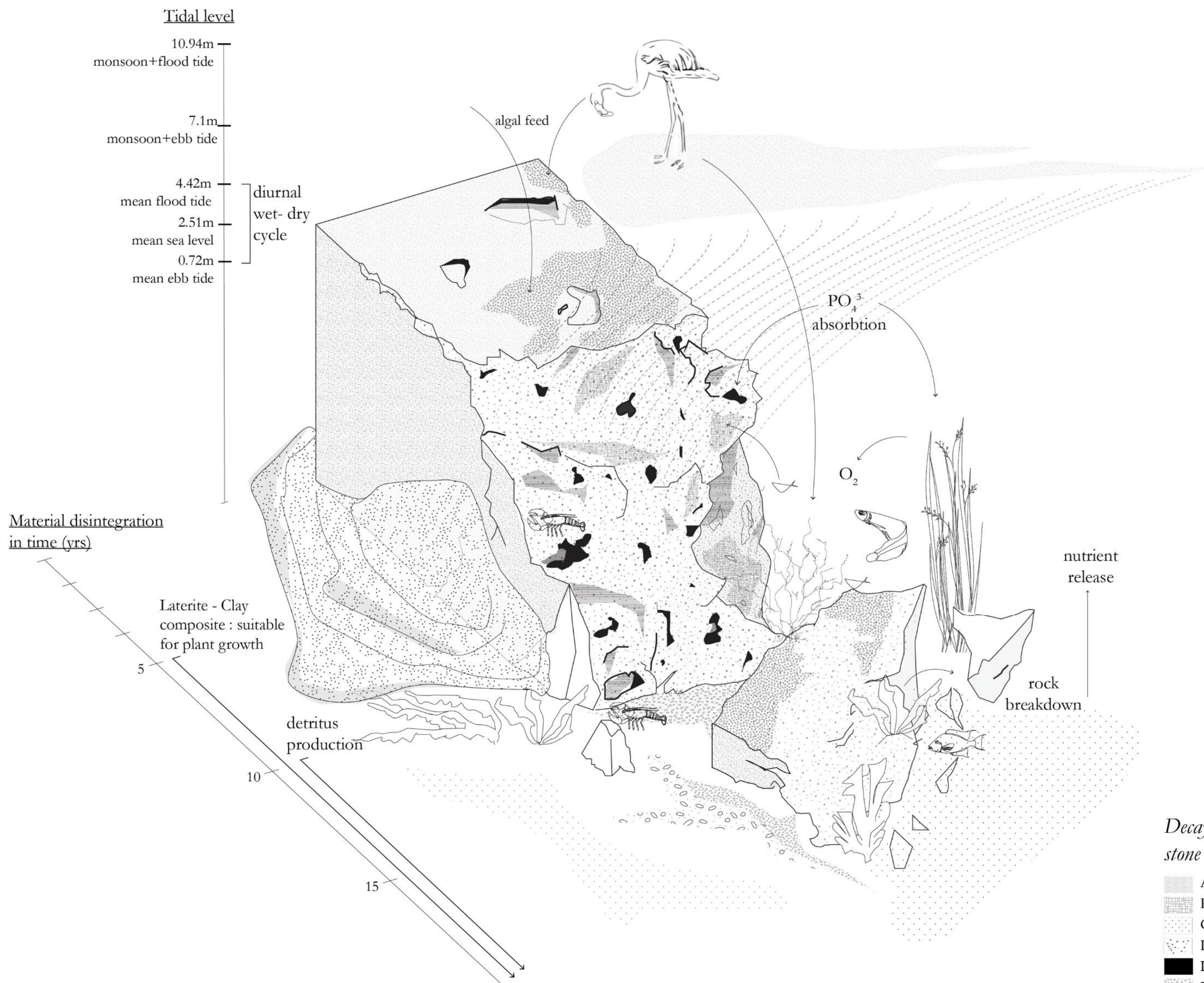


Section through the site

Clayey mud
Sand
Original tidal velocity
Tidal velocity after intervention
Sediment traps

II. Sediment Trap

Designed For Decay

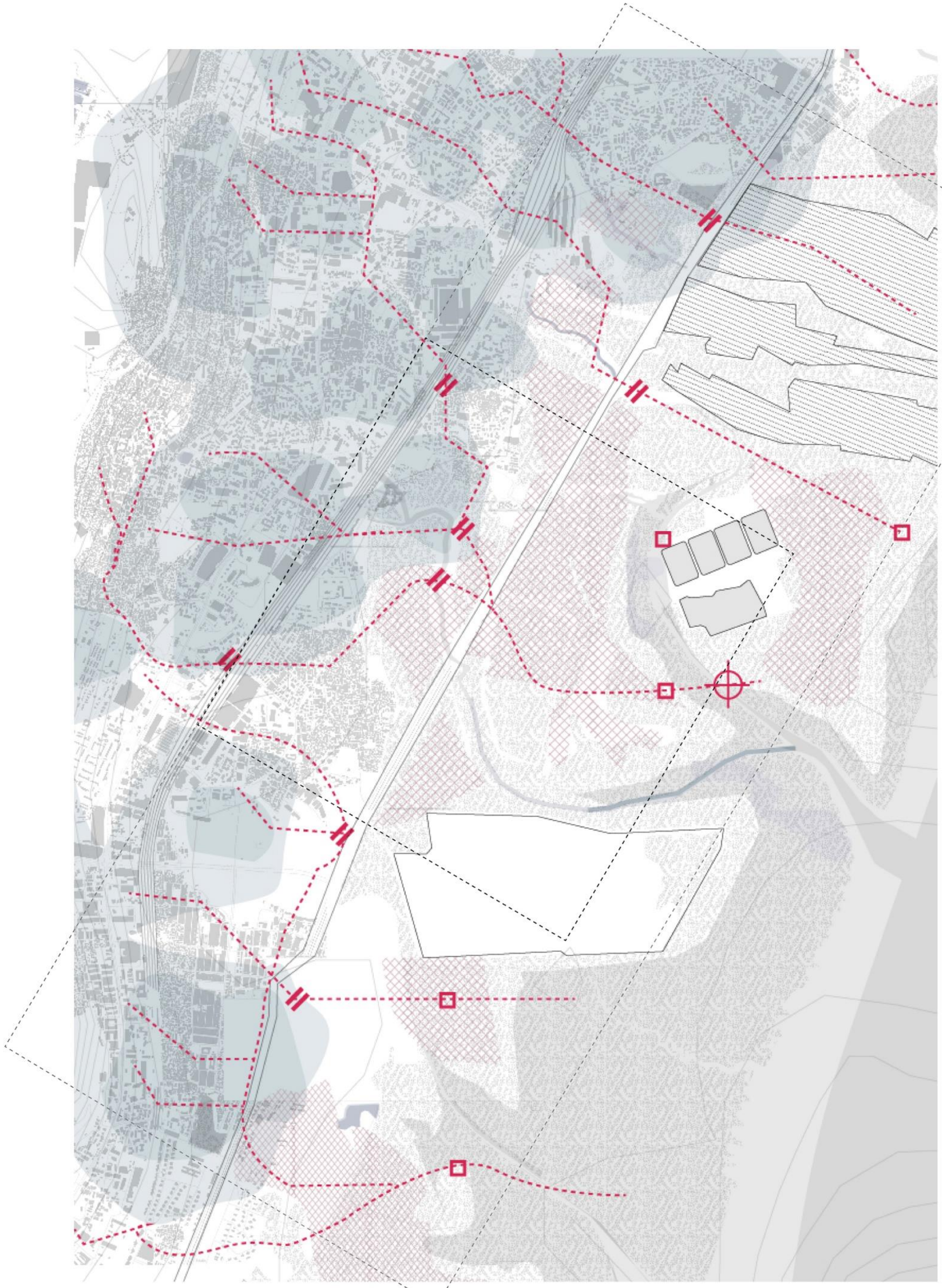


Decay of the intervention made from cheera stone in time and its influence on the sur-

- Accumulated sediments
- Phytoplanktons
- Clay
- Laterite clay composite
- Iron oxide
- Blue green algae

III. Un-banking drains

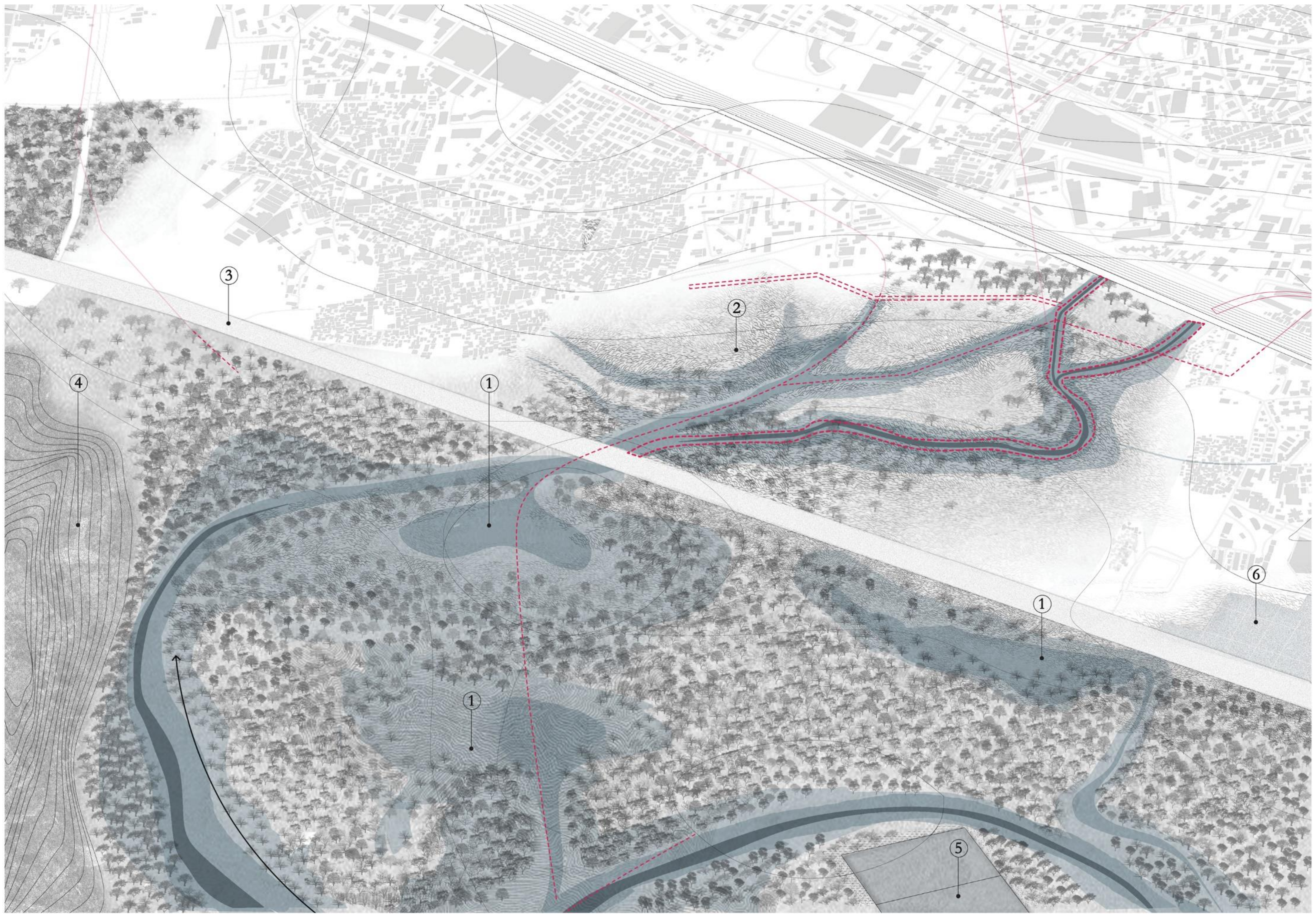
Strategic Intervention



Exemplary site conditions

III. Un-banking drains

Strategic Intervention



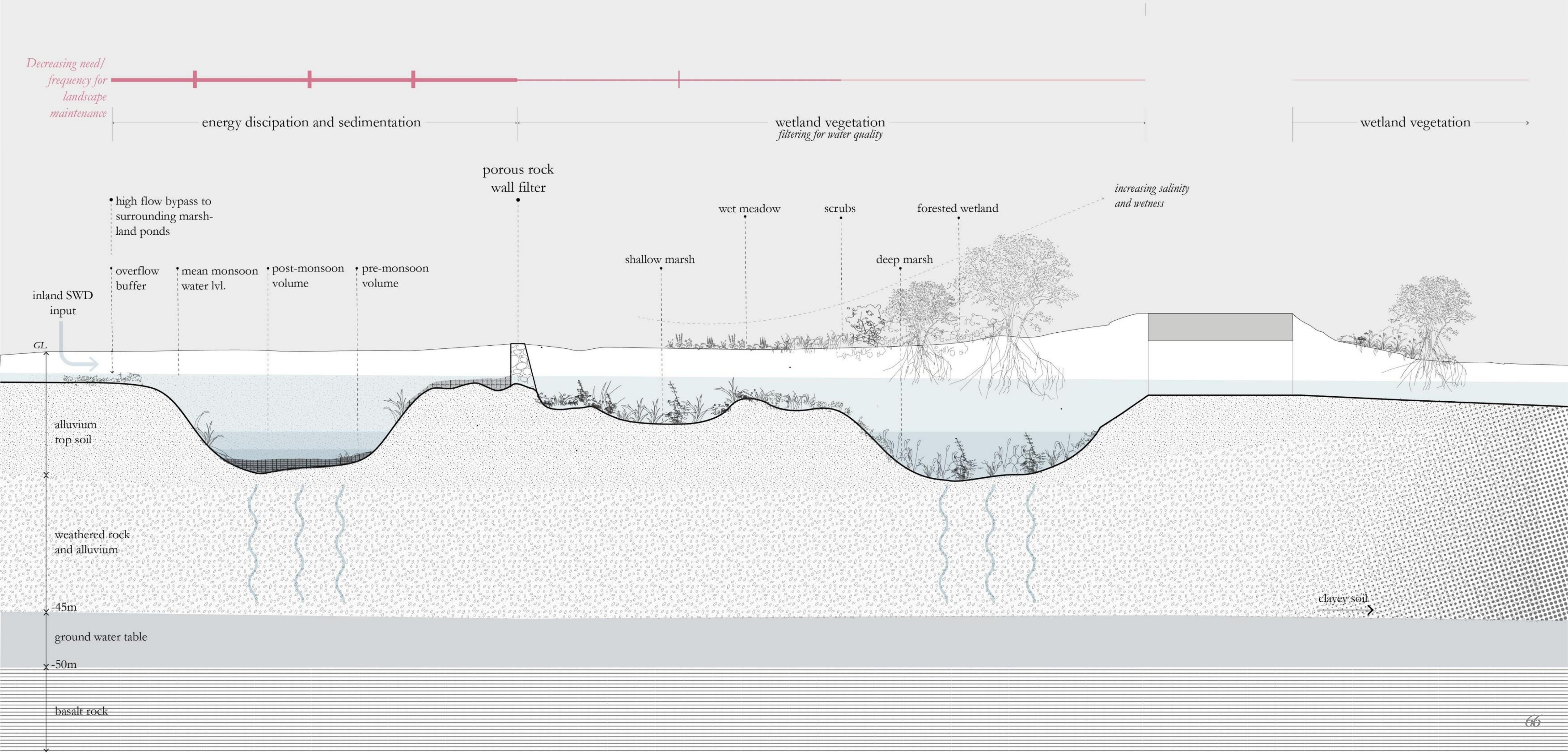
Unbanking drains, to create more room to capacitate excessive volumes of water and its influence on the surrounding landscape.

- Existing open drains unbanked
- Subsurface drains integrated in the system
- Wetland vegetation
- Meadows and scrubs
- Ponding- areas of residual tidal water.

Gradient of wetness

- Extent of tidal waters (flood tide)
- Space for draining average monsoonal volume of water (50-115mm/hr)
- Space for draining extreme volumes of water (>115mm/hr + flood tide)

1. Stormwater holding ponds
2. Growing wetland vegetation
3. Eastern express highway
4. Kanjurmarg landfill
5. Sewage treatment plant
6. Salt farms



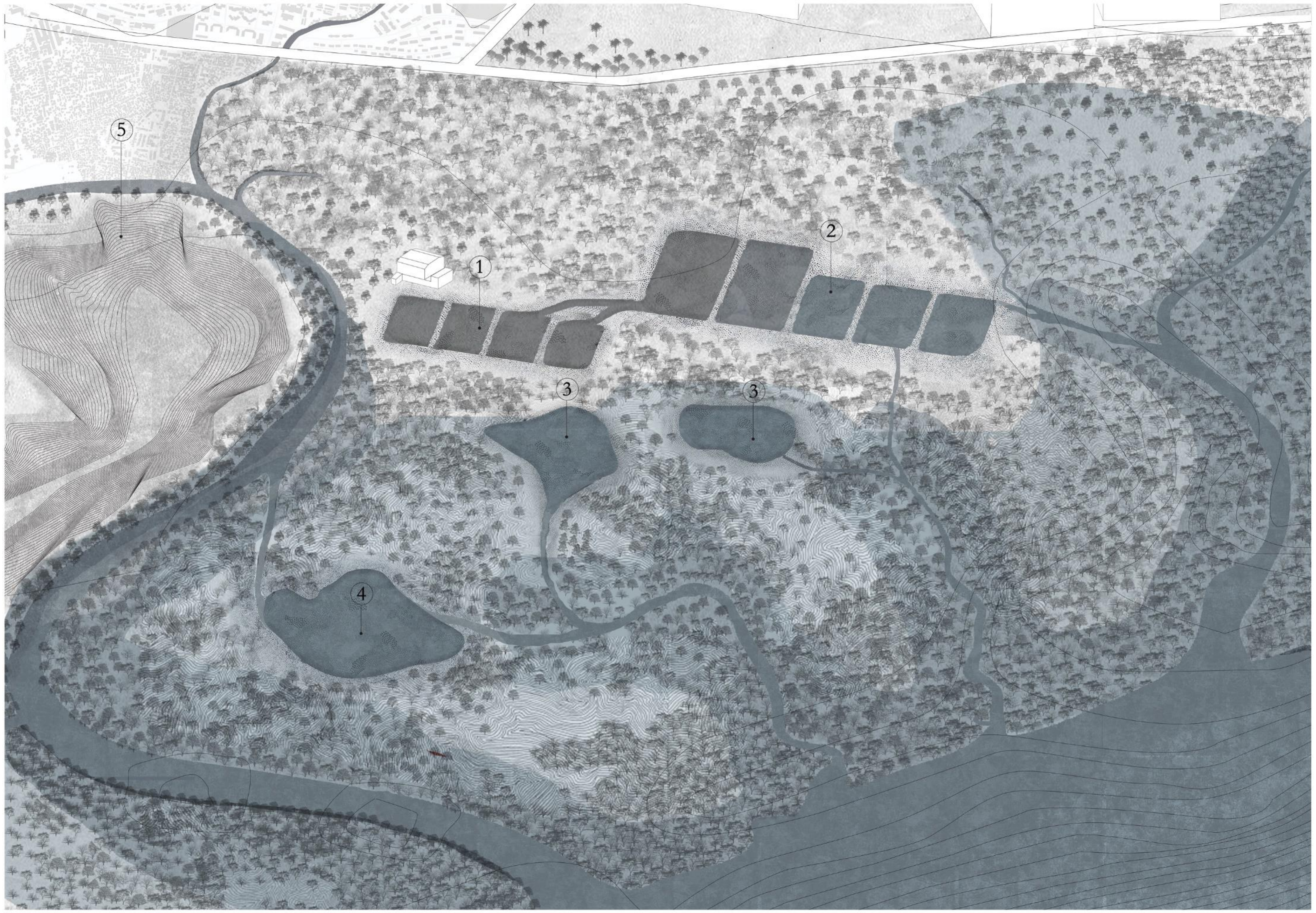
Decreasing need/ frequency for landscape maintenance
energy discipation and sedimentation
wetland vegetation
filtering for water quality
wetland vegetation
porous rock wall filter
high flow bypass to surrounding marsh-land ponds
overflow buffer
mean monsoon water lvl.
post-monsoon volume
pre-monsoon volume
inland SWD input
GL
shallow marsh
wet meadow
scrubs
forested wetland
deep marsh
increasing salinity and wetness
alluvium top soil
weathered rock and alluvium
-45m
ground water table
-50m
basalt rock
clayey soil

Landscape in the summer

Landscape in the monsoon

IV. Wastewater Aquaculture

strategic intervention



Wastewater aquaculture embedded in the wetlands.

0 500m 'N

Ponding- areas of residual tidal waters.

Mangrove vegetation

Gradient of wetness

Mean ebb tide

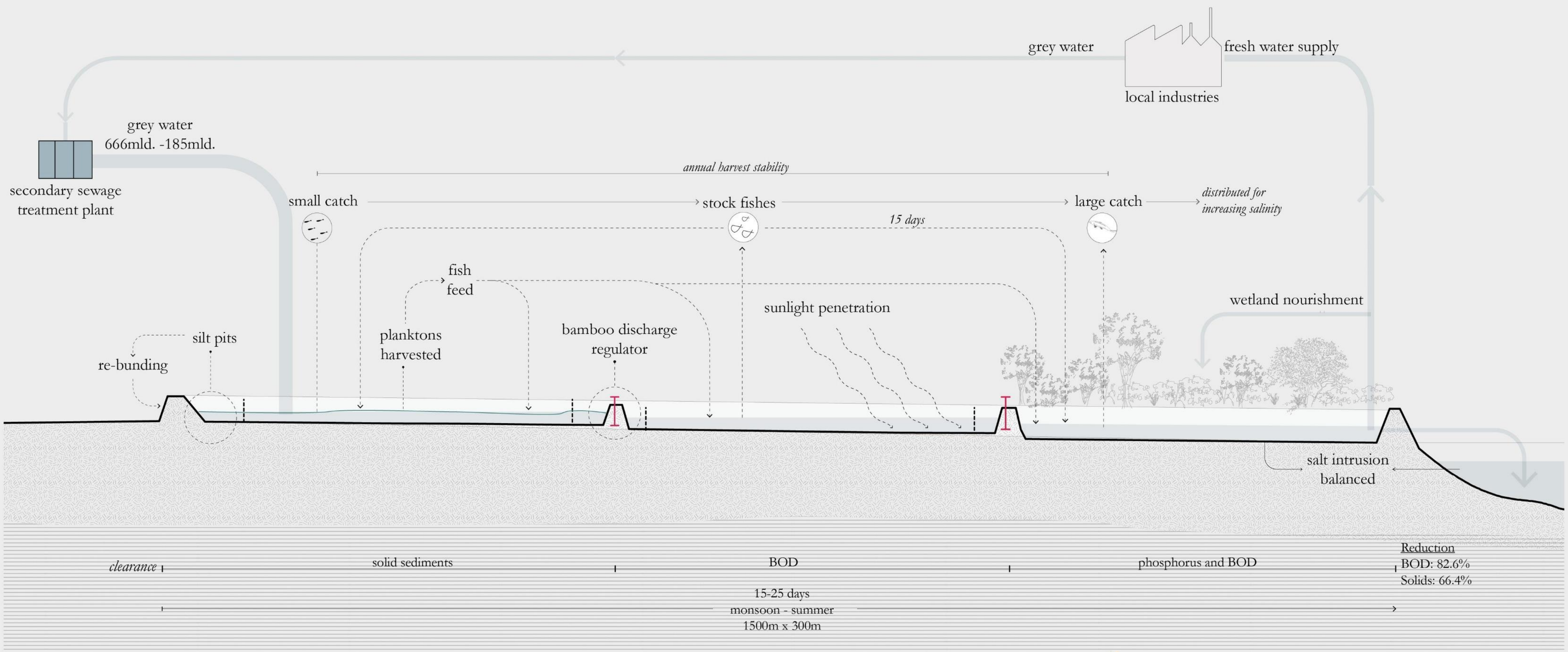
Mean flood tide

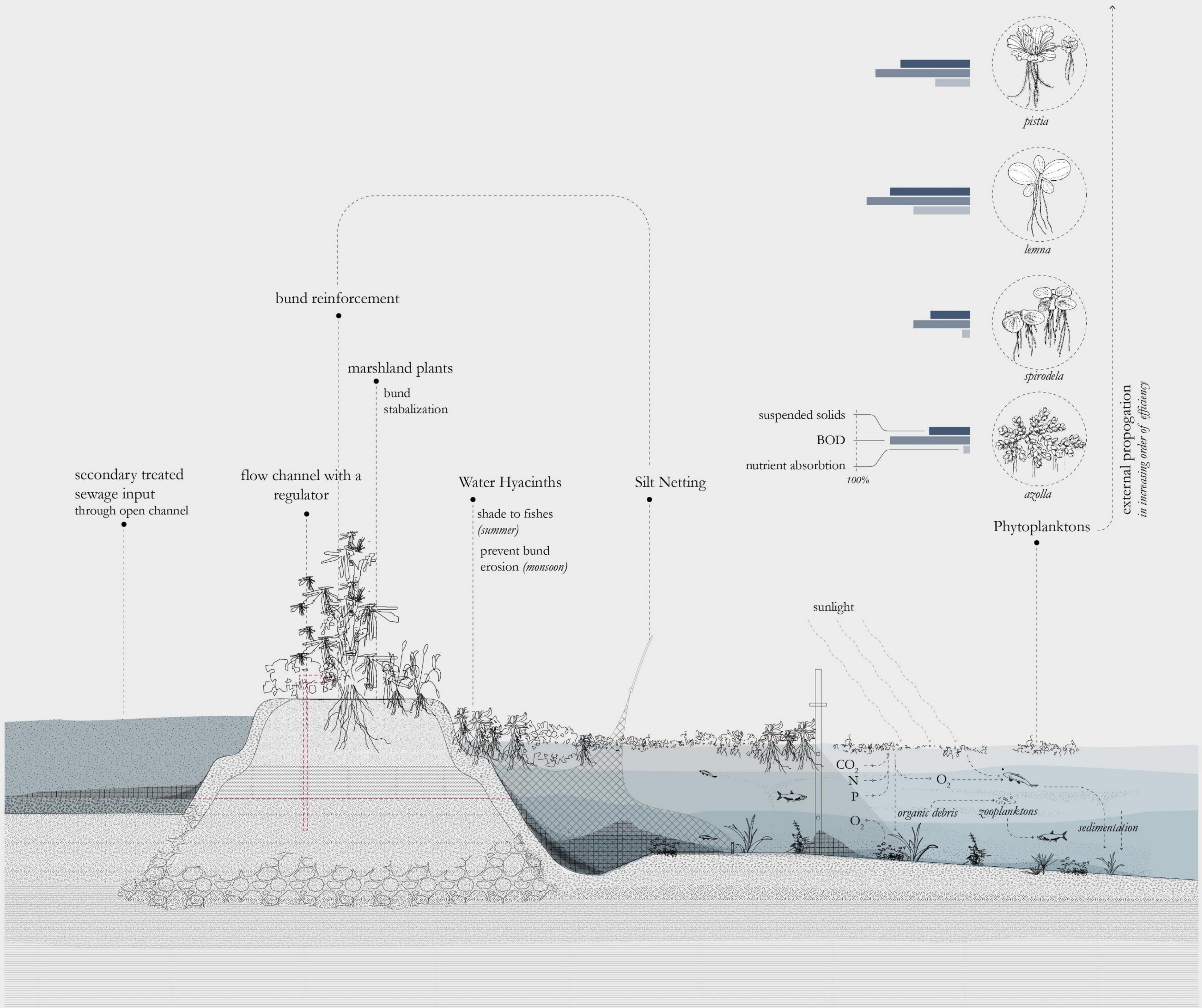
Mean tidal extent in extreme monsoon events

1. Existing sewage treatment ponds (secondary)
2. Waste water aquaculture ponds (fish farms)
3. Higher salinity ponds (crustacean farming)
4. Higher turbidity pond (mussel farming)
5. Deonar Landfill

IV. Wastewater Aquaculture

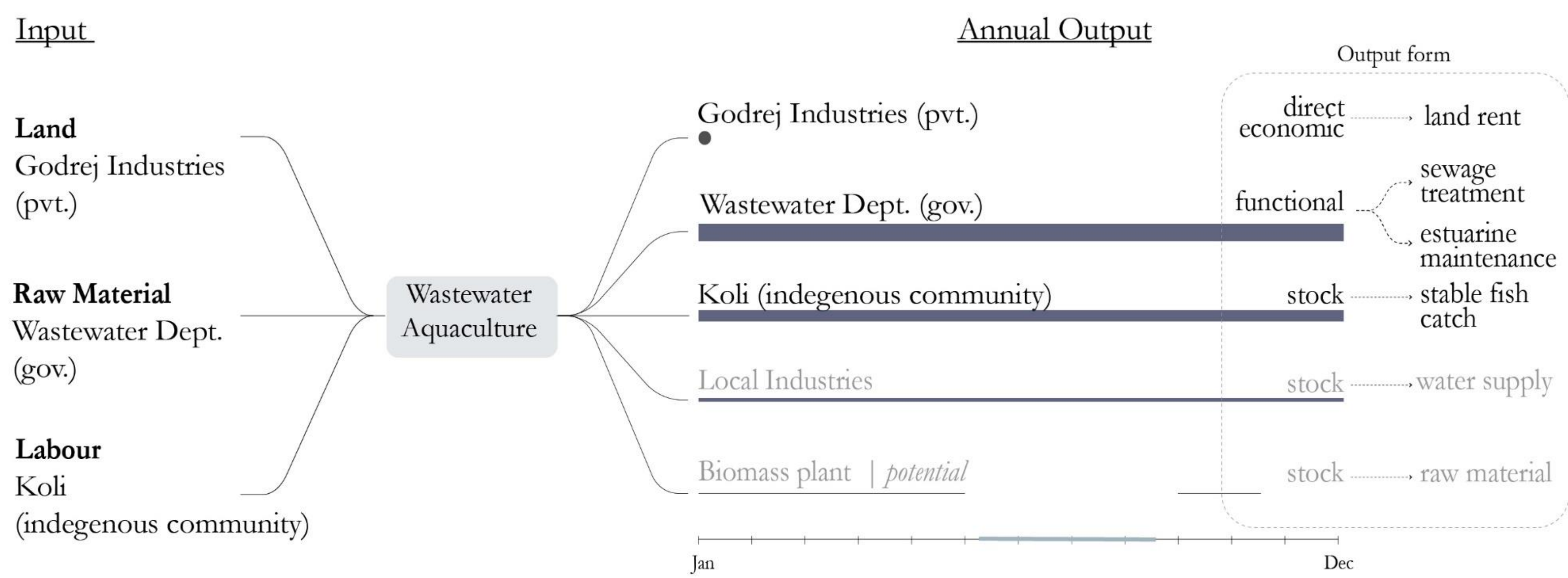
strategic intervention





pistia
lemna
spirodela
azolla
suspended solids
BOD
nutrient absorbtion
100%
external propogation
in increasing order of efficiency
Phytoplanktons
bund reinforcement
marshland plants
bund
stabalization
secondary treated
sewage input
through open channel
flow channel with a
regulator
Water Hyacinths
shade to fishes
(summer)
prevent bund
erosion (monsoon)
Silt Netting
sunlight
CO_2
N
P
O_2
O_2
organic debris
zooplanktons
sedimentation

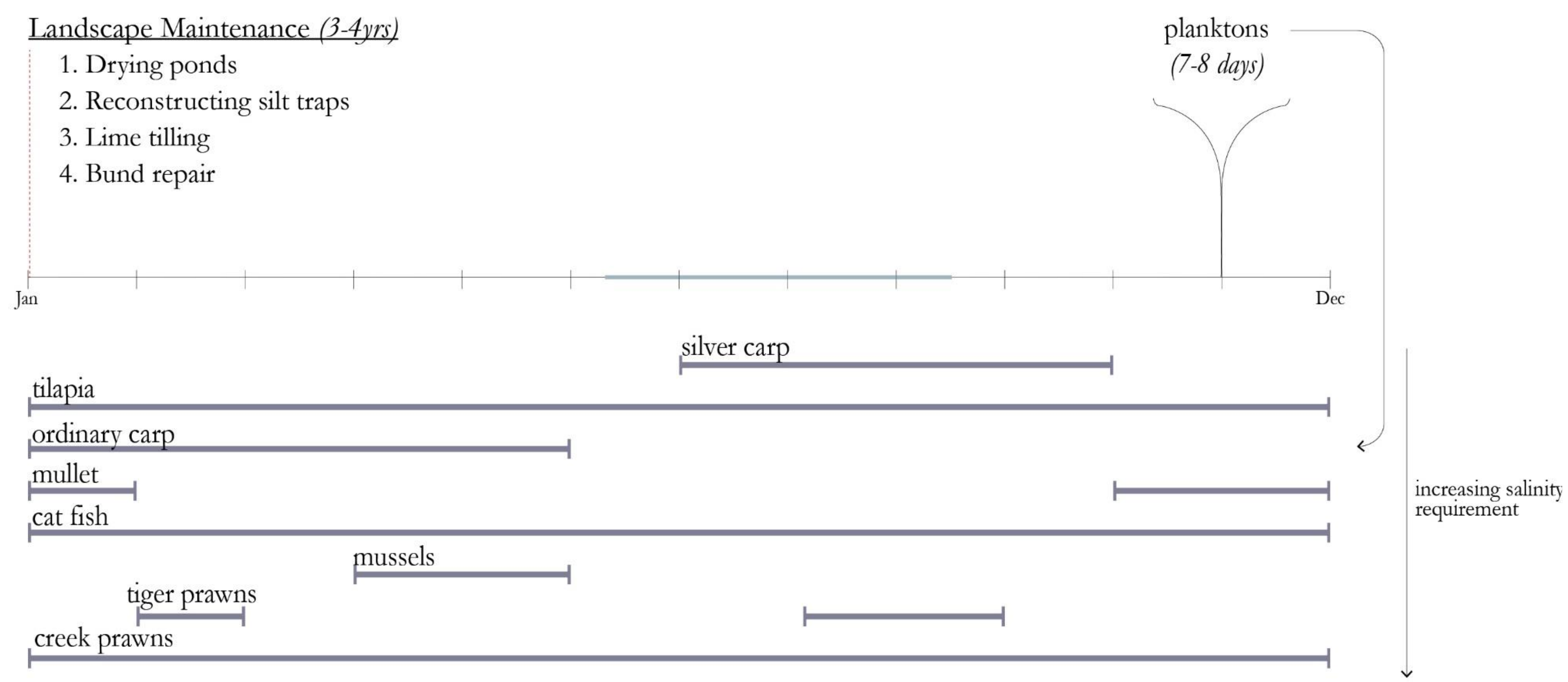
IV. Wastewater Aquaculture
Implementation



Involvement and collaboration between the sectors on site

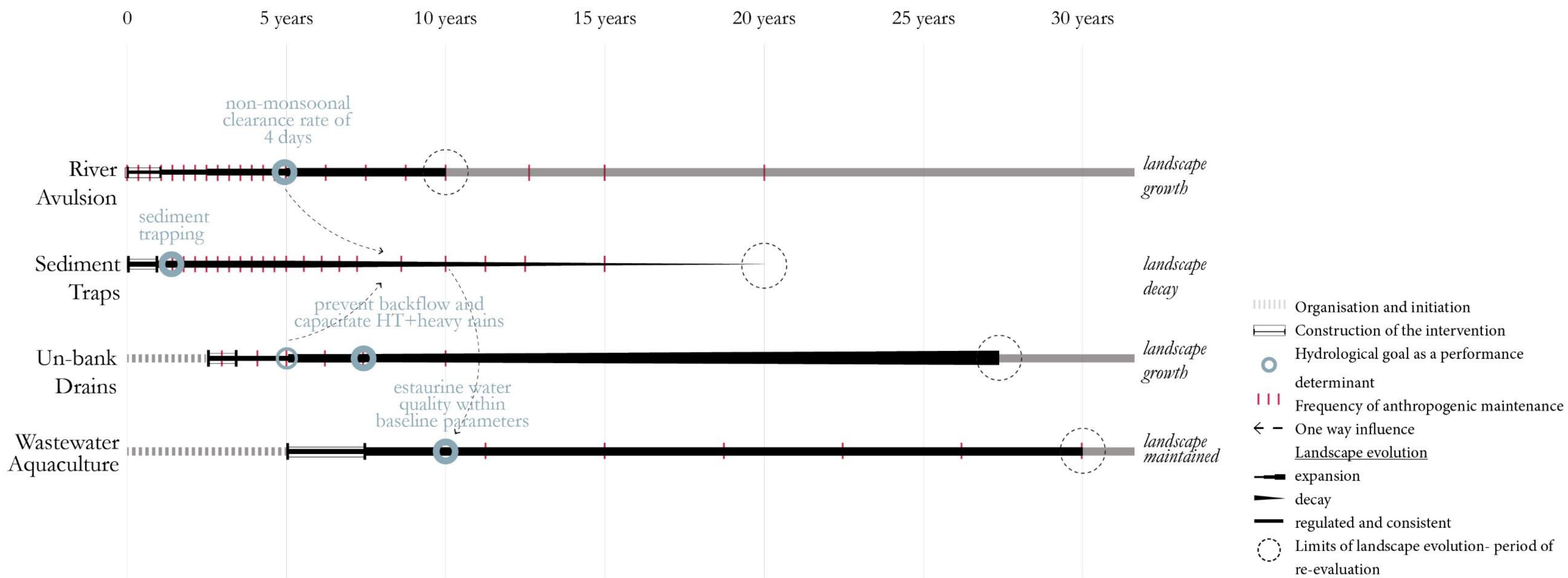
IV. Wastewater Aquaculture

Economic Viability



Functions and periods of landscape maintenance required to be done by the fishing community, thereby having a stable year round scope for fish harvest.

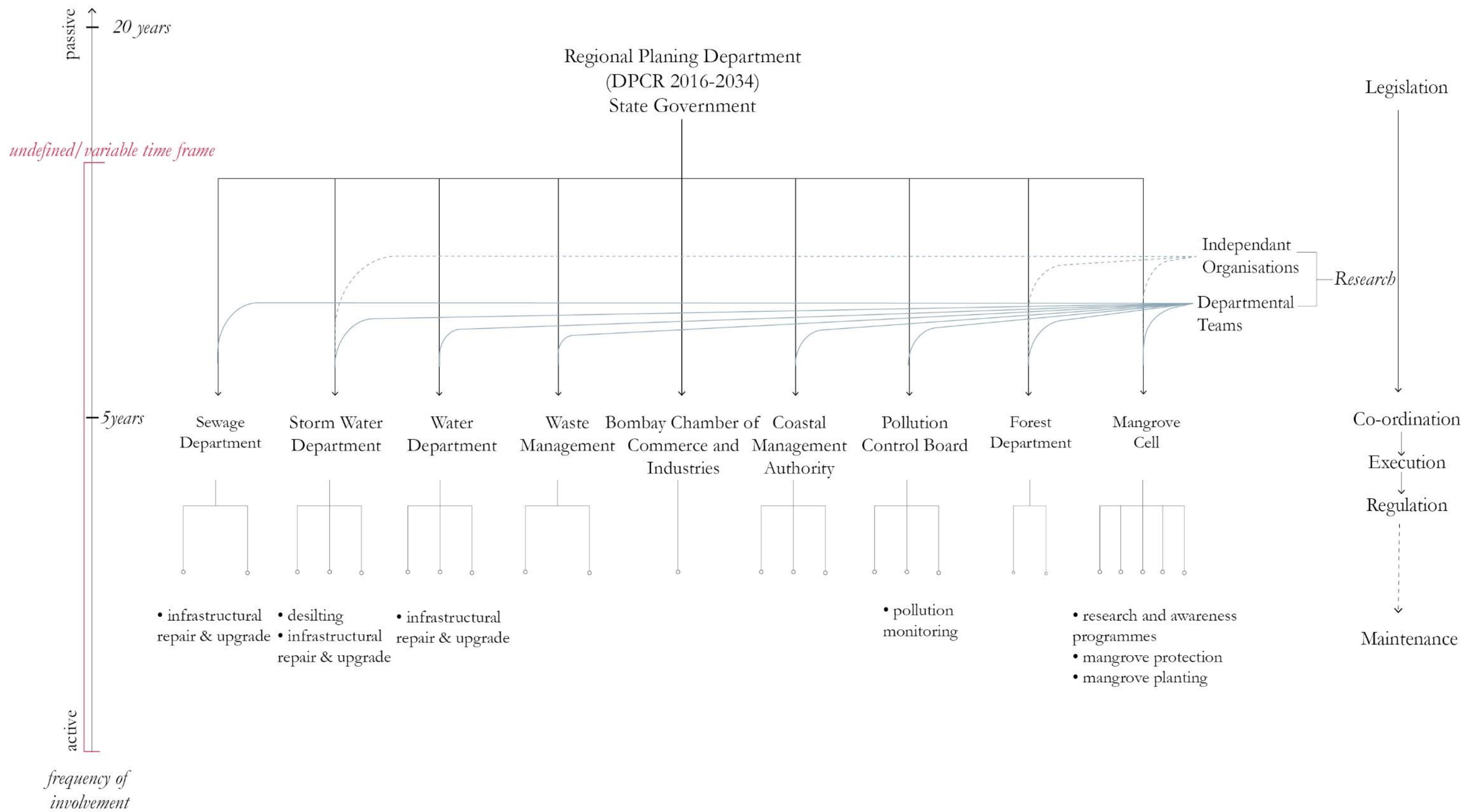
Project Phasing



Acupunctures in time. Phasing the project

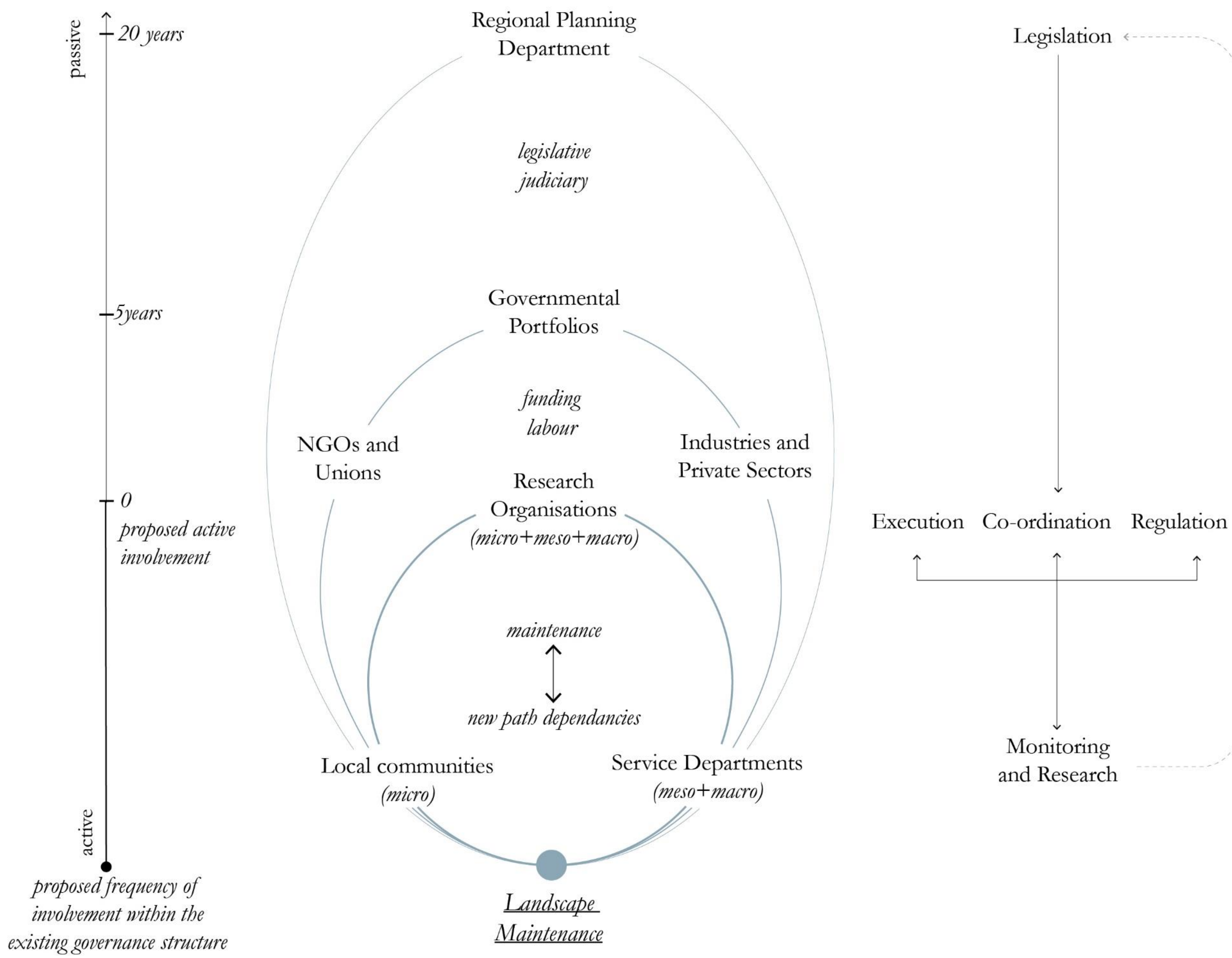
Implementation

Prevalent governance structure for urban development



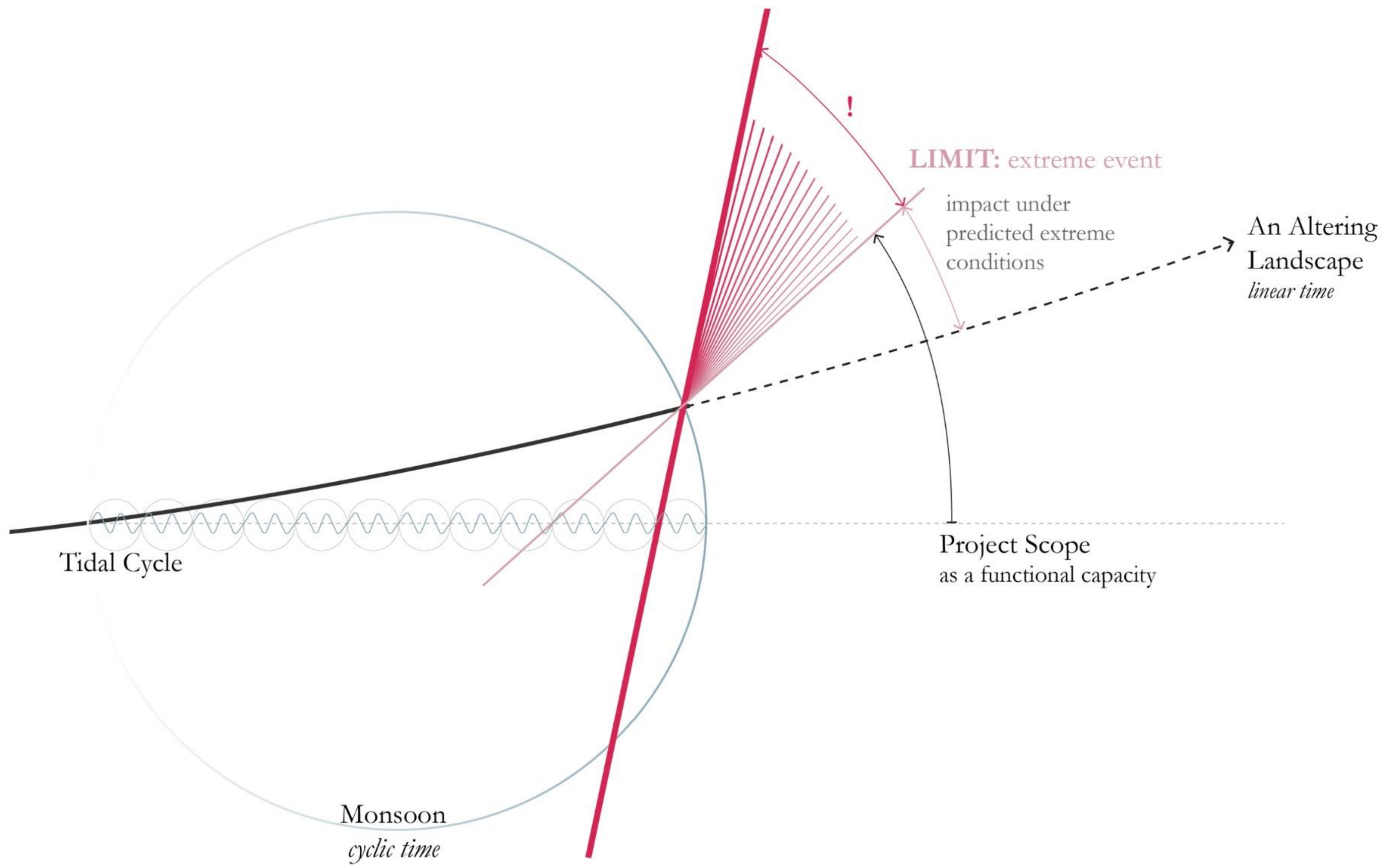
Implementation

Proposed structure for landscape maintenance



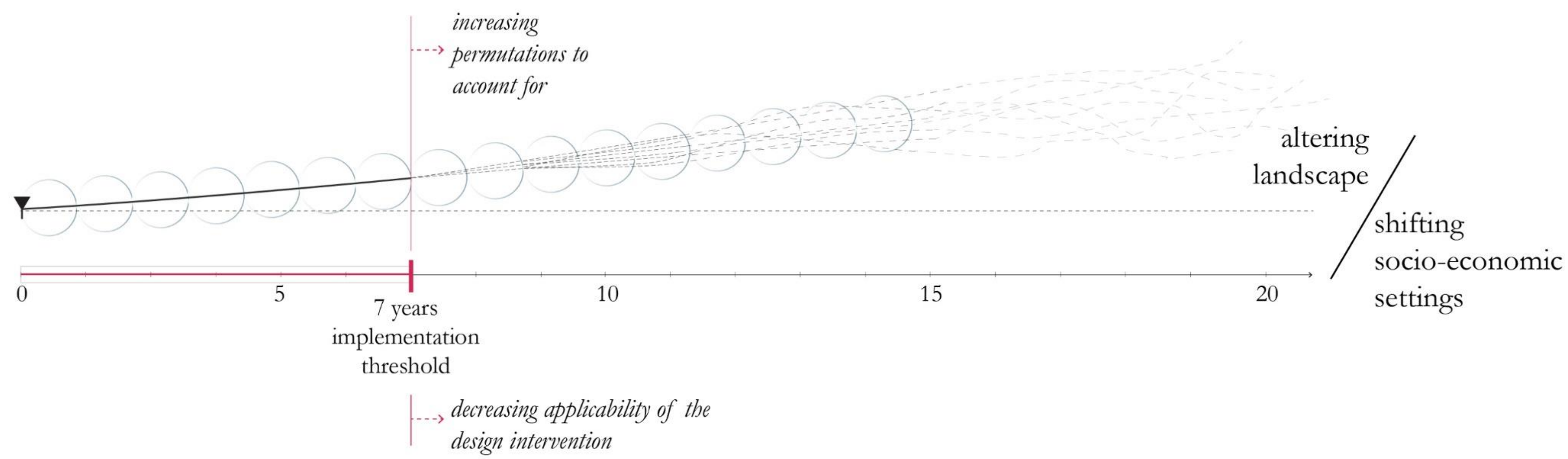
Critique and Limitations

Limited capacity to accommodate extreme or unforseen hydological upheaval beyond the projected scope.



Critique and Limitations

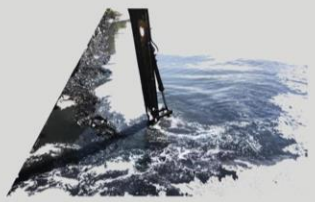
Necessity to initiate within the stipulated timeframe

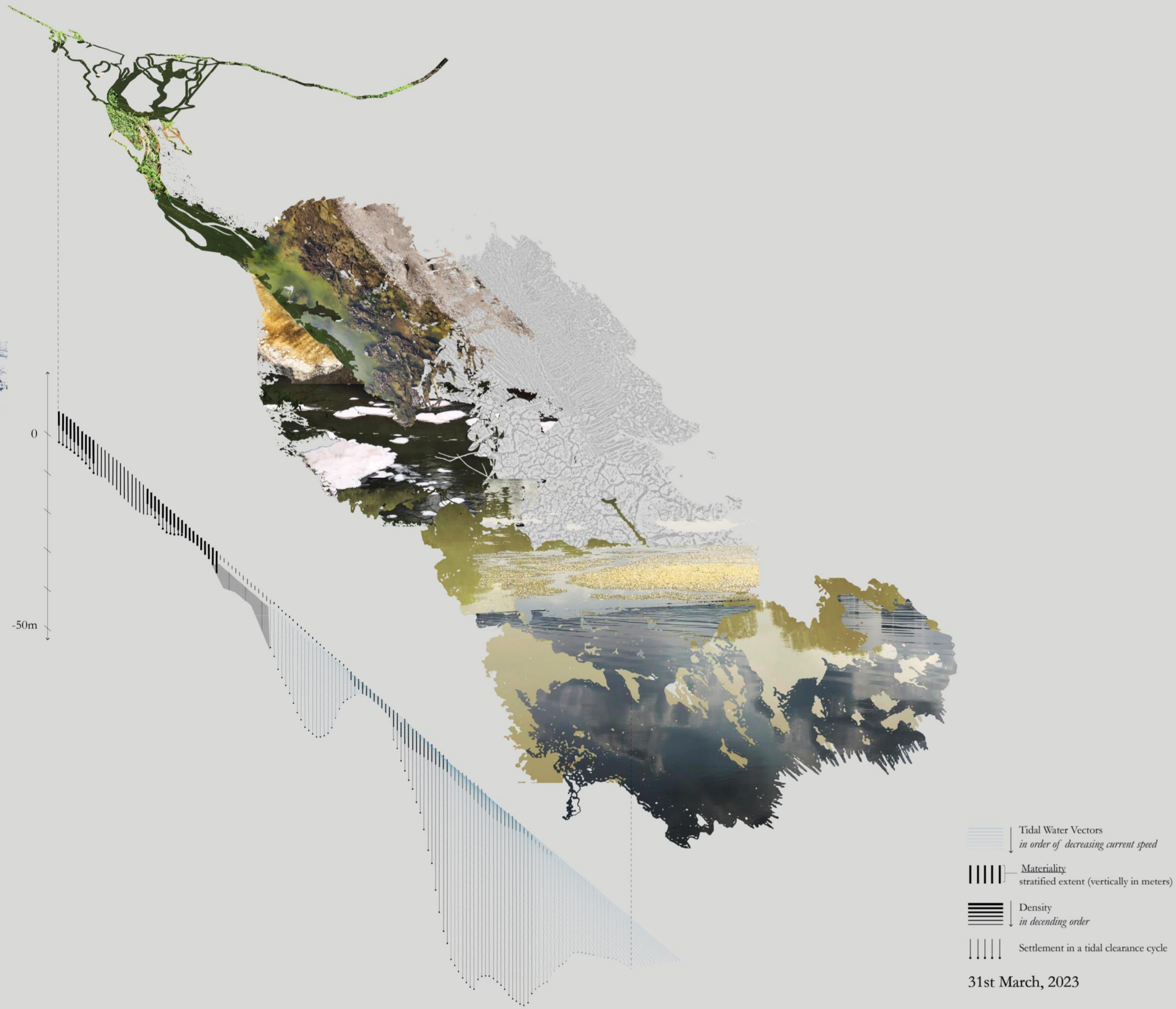


A New Material Reading

A render of the proposed Trans-Harbour link in the Thane Creek. Image Source: ARUP rapid environmental assesment report.

An actual visual of the bridge under construction captured in September, 2022. Showing its material impact on the landscape. Bridge due for completion in November 2023. Image Source : @cbdhage/Twitter





31st March, 2023