

GRADUATION STUDIO
METROPOLITAN ECOLOGY OF PLACES

VIENNA WATER CITY

TRANSITIONING TOWARDS CLIMATE RESILIENCY





*"WE MUST BECOME THE STEWARDS OF
THE BIOSPHERE. TO DO THIS, WE MUST
DESIGN WITH NATURE."*

Ian McHarg (1969, p.5)

[Fig. 1]: Roots taking their path shaped by urban environment

1

THE PROBLEM

PROBLEM FIELD

PROBLEM STATEMENT

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METHODOLOGY

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METHODOLOGY

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ANALYSIS

THE GREEN SYSTEM

THE BLUE SYSTEM

THE SOCIAL SYSTEM

4

DESIGN

DESIGN FRAMEWORK

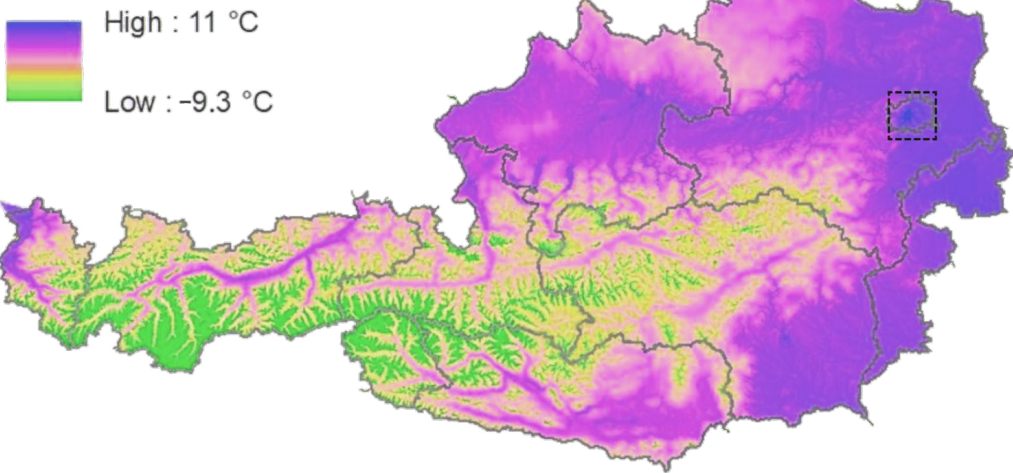
DESIGN EXPLORATION

DESIGN PRINCIPLES



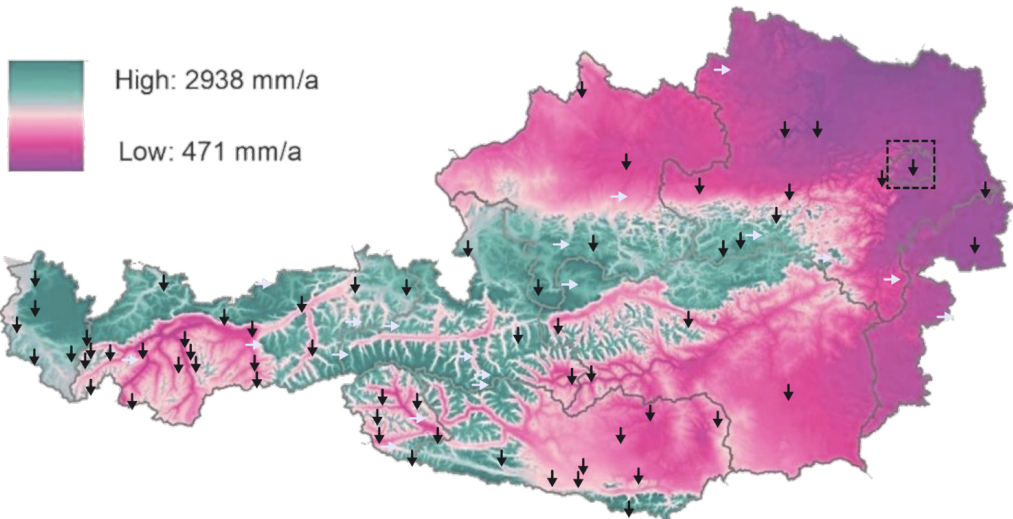
CLIMATE CHANGE IN THE SPATIAL CONTEXT OF AUSTRIA

MEAN TEMPERATURE PER YEAR

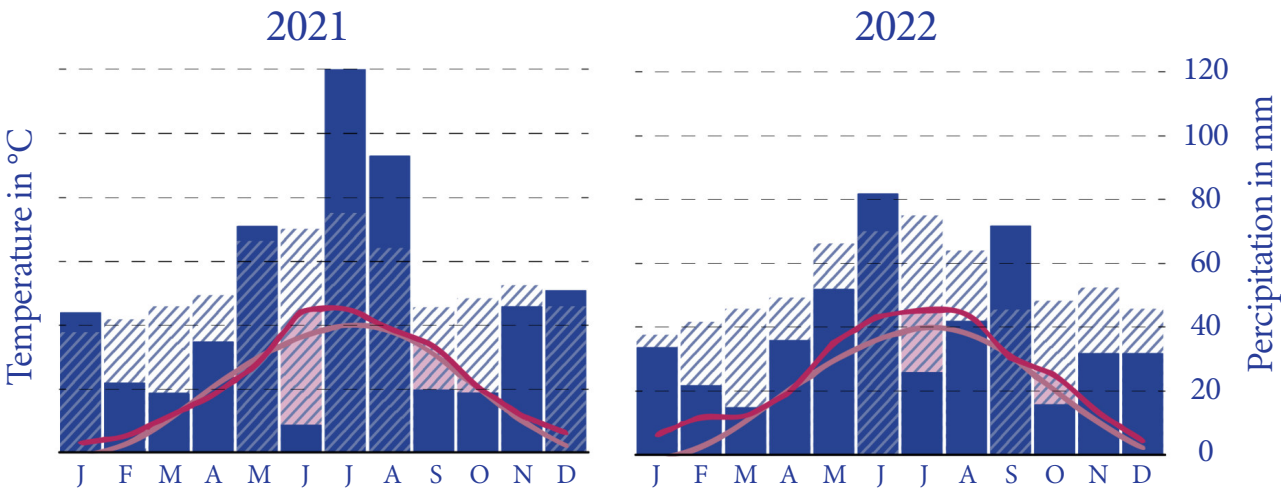


[Fig. 2]: Mean temperature per year with climatic zones
Source: Olefs et al., 2019

PRECIPITATION (WATER & SNOW)



[Fig. 3]: Mean precipitation per year with seasonal snow cover duration trends (1961-2019)
Source: Olefs et al., 2019



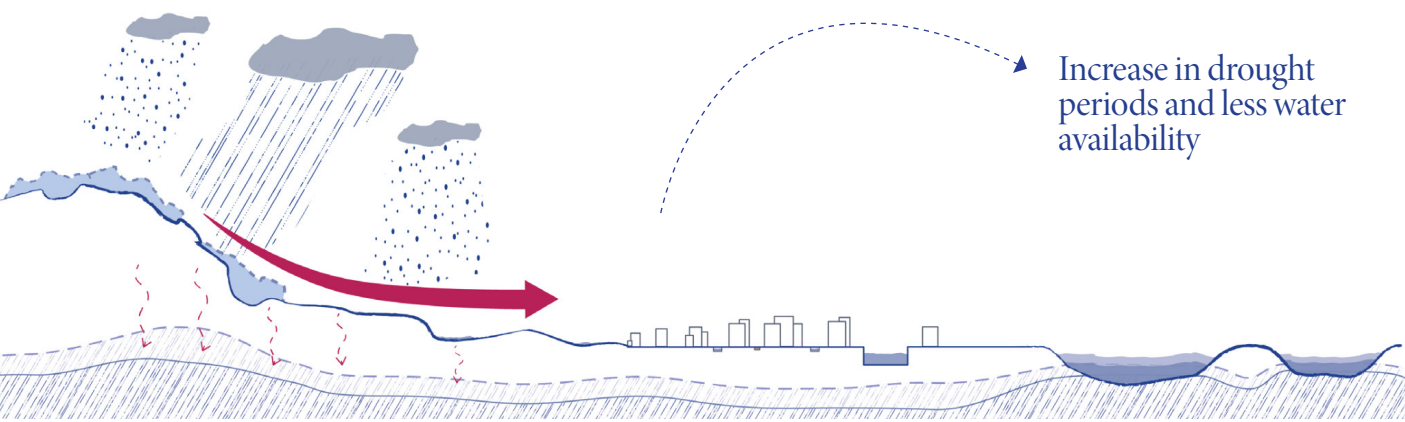
[Fig. 4]: Gausen-Walter diagram showing monthly temperature in relation with percipitation , each year compared with average values (1933-2000)

Source: Stadt Wien 2022:



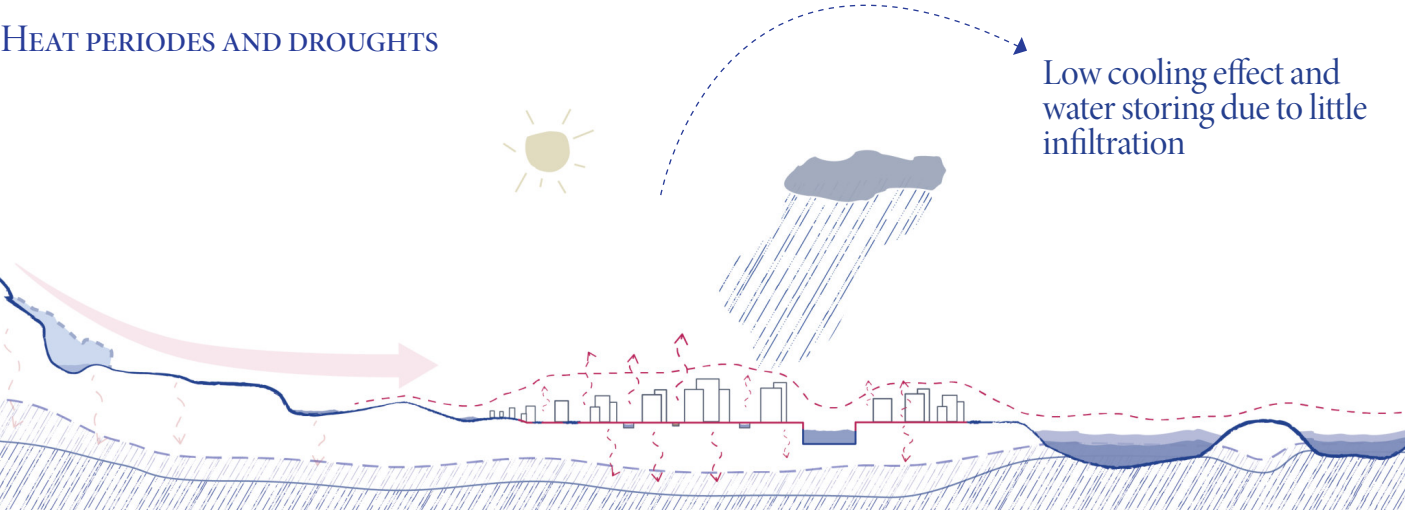
VIENNAS VULNERABILITY TO CLIMATE CHANGE

CHANGES IN PERTICIPATION AND WATER CAPTURING CAPACITY



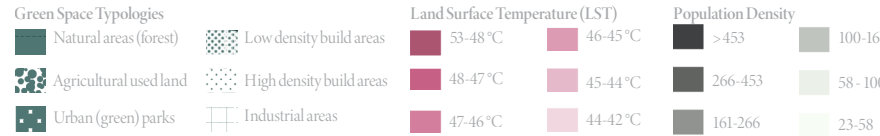
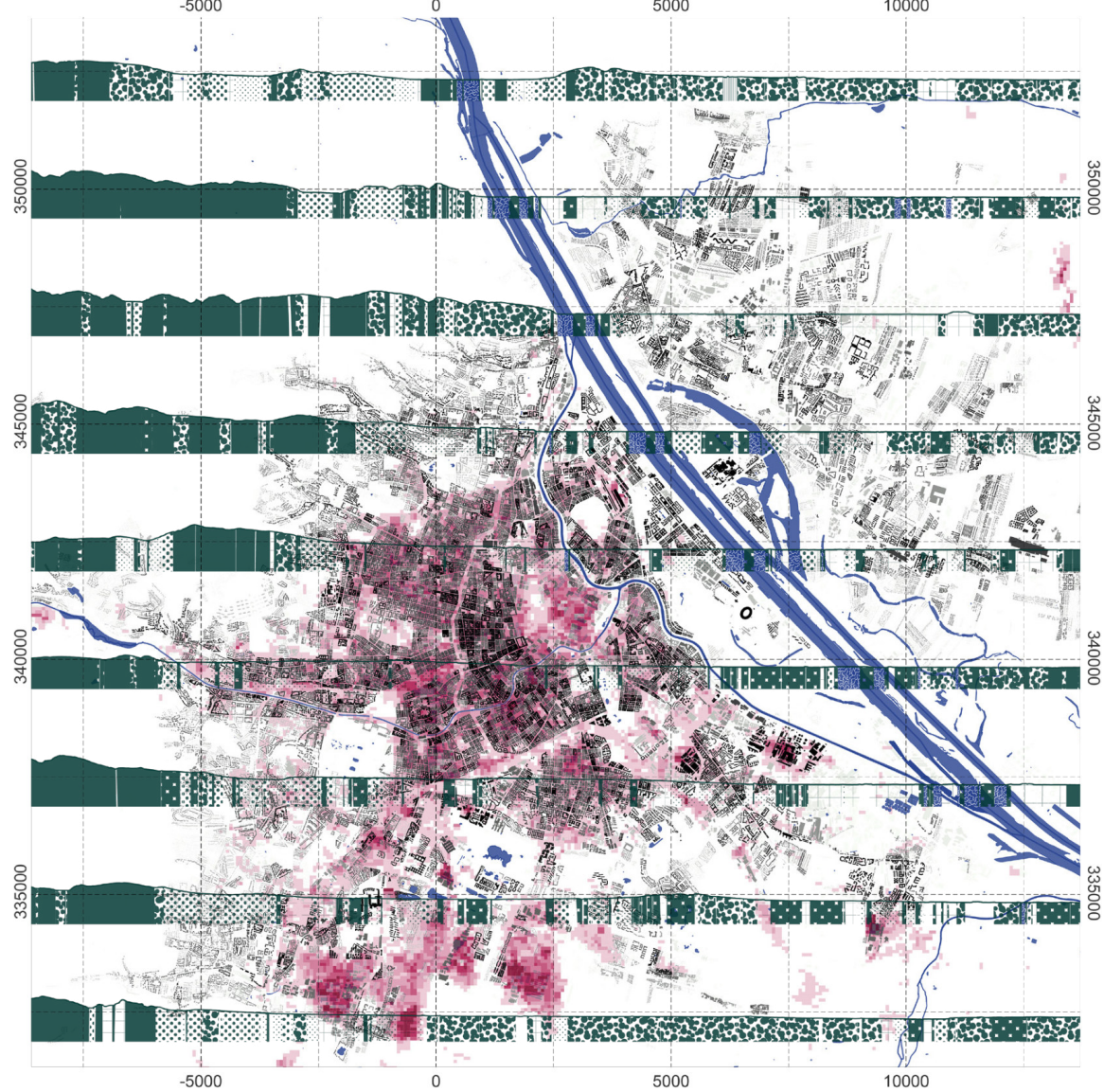
[Fig. 5]: Increase in water shortage and run-off extremes

HEAT PERIODES AND DROUGHTS



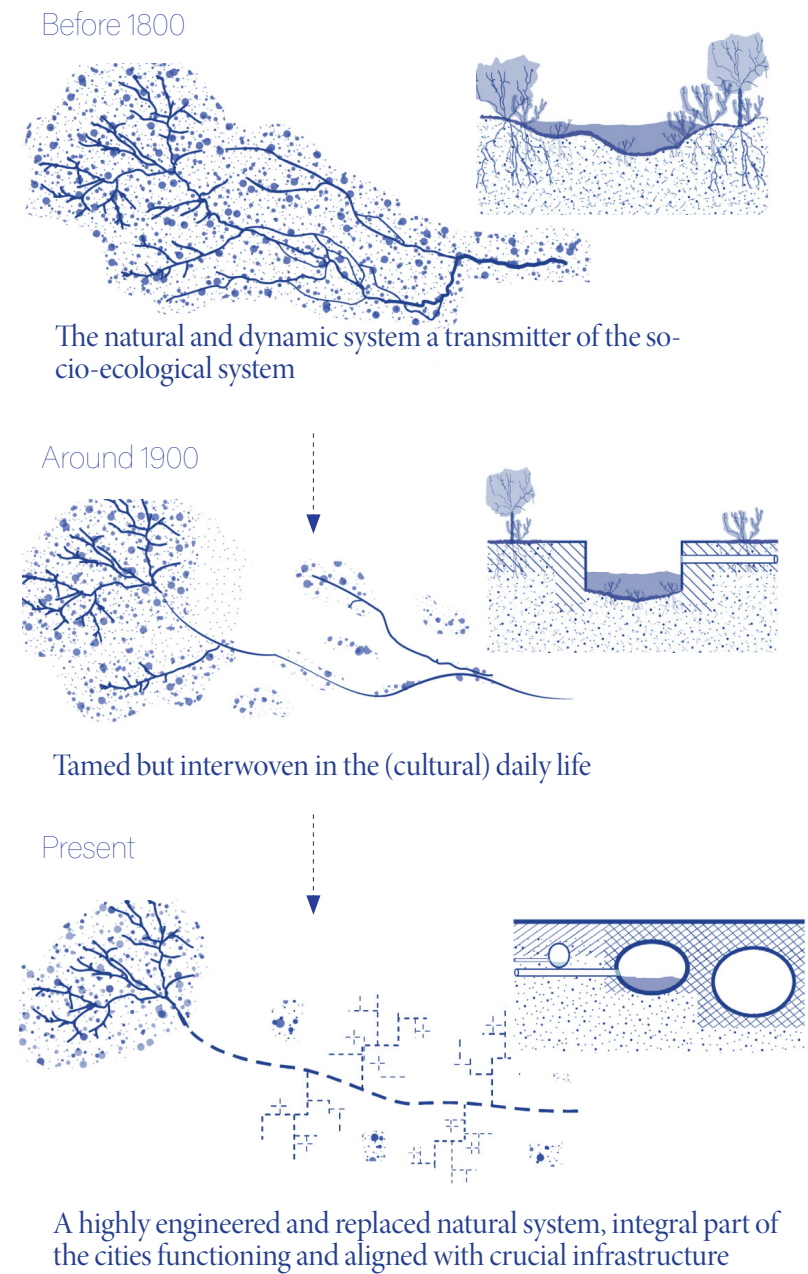
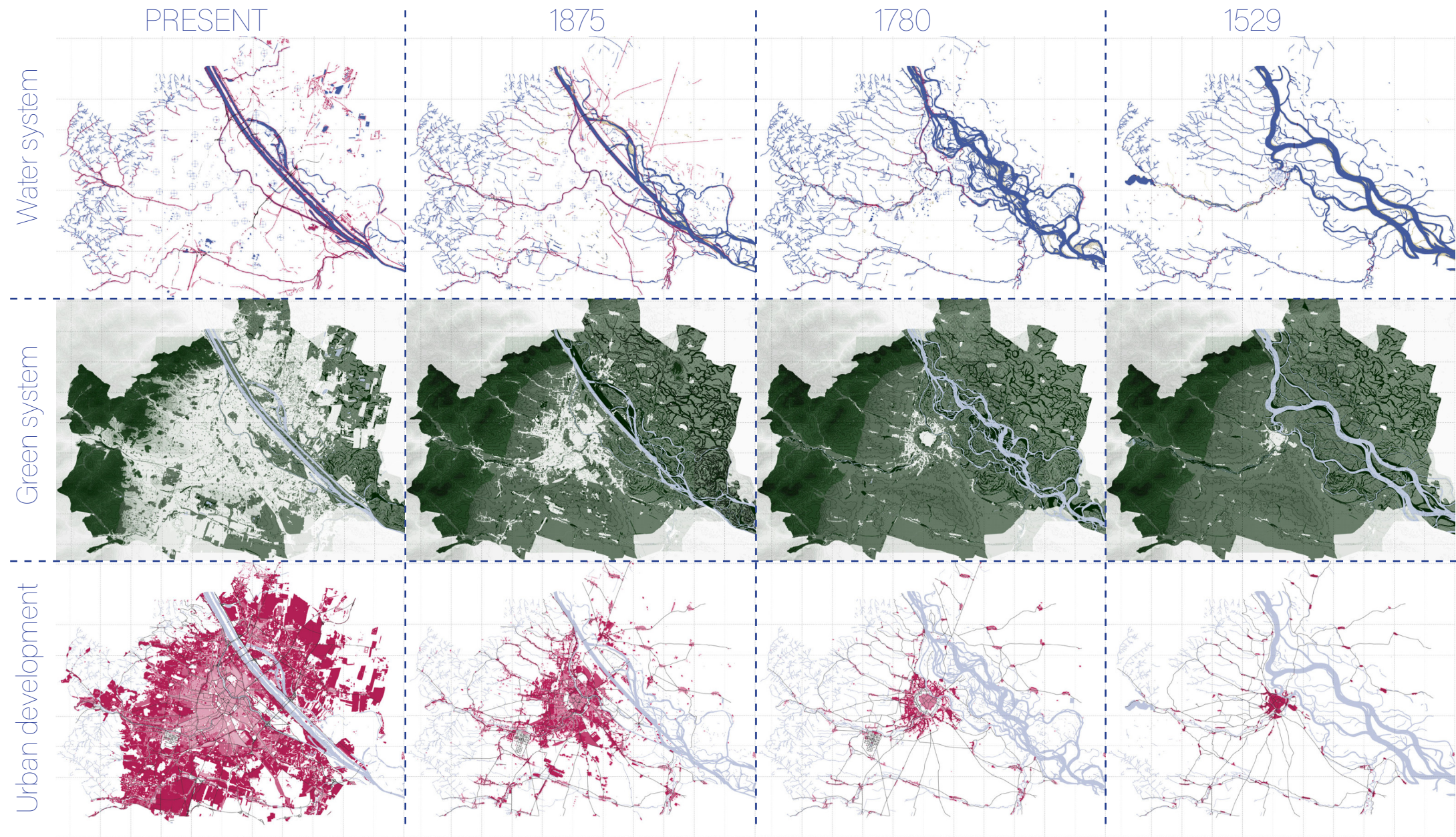
[Fig. 6]: High sealing and little infiltration

IMPACT OF DENSITY ON FRAGMENTATION AND DISTRIBUTION OF GREEN-BLUE SPACES



[Fig.7]: LST, population density and green space typologies
Source: EEA 2018, NASA 2023, Stadt Wien 2023, Geofabrik 2023

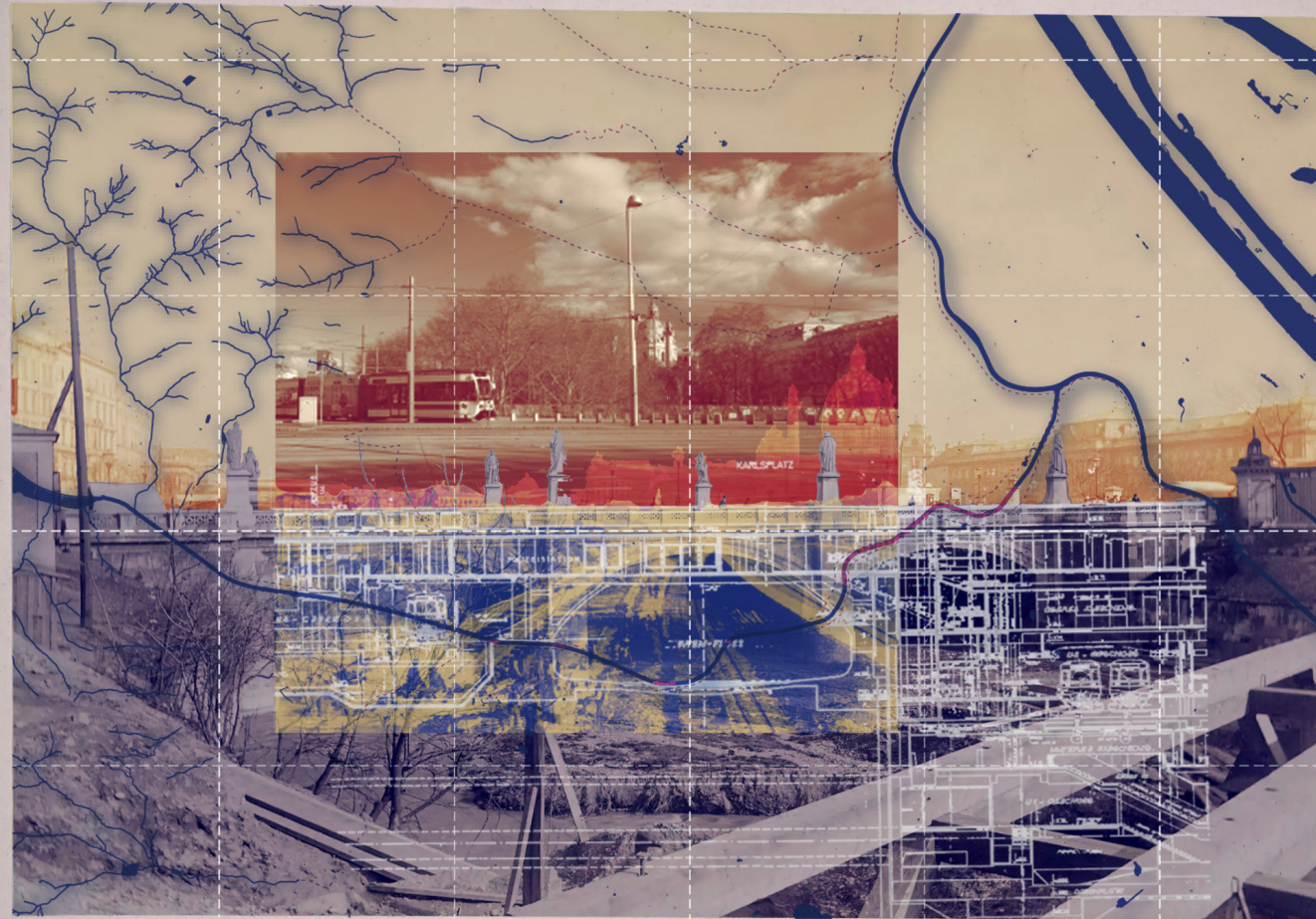
FRAGMENTATION OF VIENNAS GREEN-BLUE SYSTEM



[Fig.8]: Historical development of water, green & urban system
Source: Hohensinner et al. 2012-2023,

GEMEINDE WIEN.

WIENFLUSS-REGULIRUNG.



Fotogr. v. R. Lechner, Wien

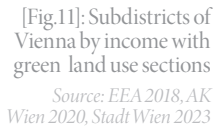
aufgen. am 26. März 1897.

ELISABETHBRÜCKE.

8

Environmental qualities in proximity mainly for people with higher income

PROBLEM



PROBLEM STATEMENT

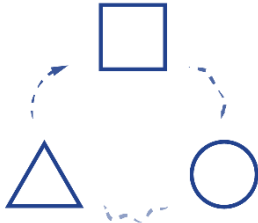


SEALED SURFACES & HARD EDGES



UNEVEN DISTRIBUTED ECOSYSTEM

Replaced green-blue system,
especially in social-economic
vulnerable areas



LIMITS RESILIENCE, ADAPTABILITY
& TRANSFORMATION POTENTIAL

RESEARCH QUESTION, FRAMEWORK & METHODOLOGY

RESEARCH QUESTION

HOW CAN A JUST CLIMATE RESILIENT TRANSITION IN VIENNA BE FOSTERED BY REIMAGINING THE GREEN-BLUE SYSTEM?

RQ1 CONCEPTUAL FRAME:

CLIMATE RESILIENCE TRANSITION

How are spaces and systems that influence a climate resilient transition identified?

JUST TRANSITION

What are methods to ensure an environmentally just transition of the green-blue system with benefits for all actors?

RQ2 ANALYSIS:

ACCESS POINTS WITHIN SOCIO-ECOLOGICAL SYSTEM

How can the landscape and urban morphology disciplines help to unfold and design the green-blue system as part of the socio-ecological system towards urban climate resiliency?

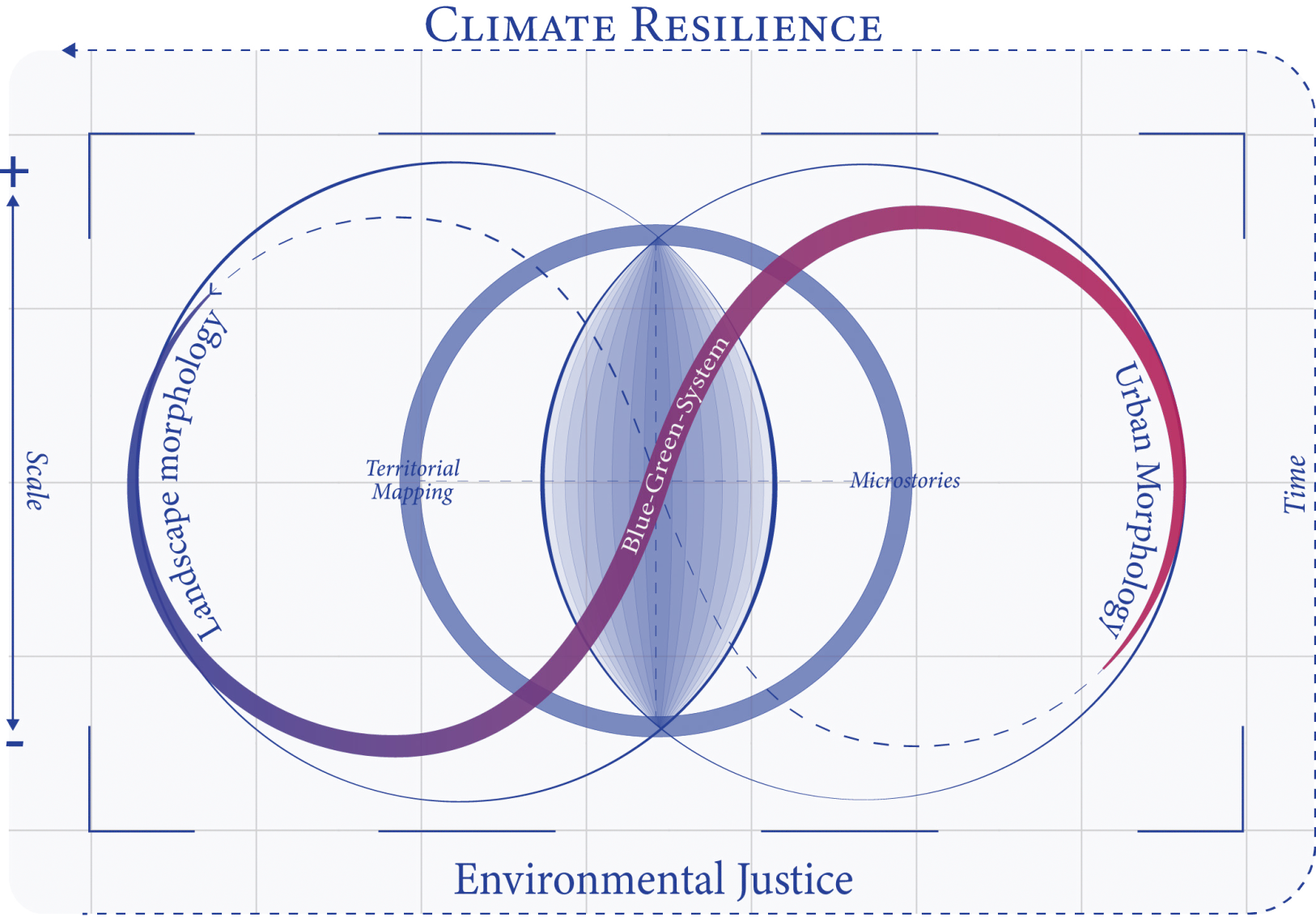
- What is and was the role of the green-blue system of Vienna and how do other systems interrelate?
- What are constraining factors in Vienna due to engineered resilience and vulnerability, in light of a just climate resilient transition?

RQ4: DESIGN

REIMAGINATING THE GREEN-BLUE SYSTEM

How can the green-blue system be reimagined in Vienna for a climate resilient system?

Research by Design



[Fig. 11]: Conceptual Framework

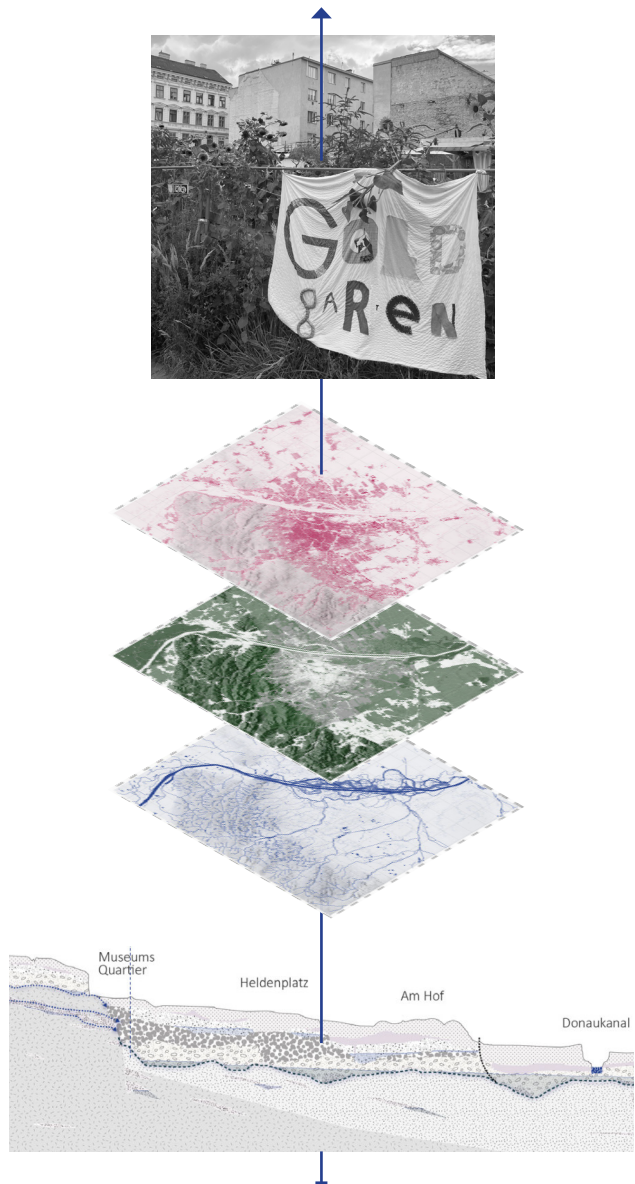
A topographic map of Vienna, Austria, in shades of blue. The map shows the city's layout, including the Danube River (Donau) flowing through it, and the surrounding hills and valleys. The text is overlaid on the map.

UNFOLDING THE SOCIO-ECOLOGICAL SYSTEM OF VIENNA

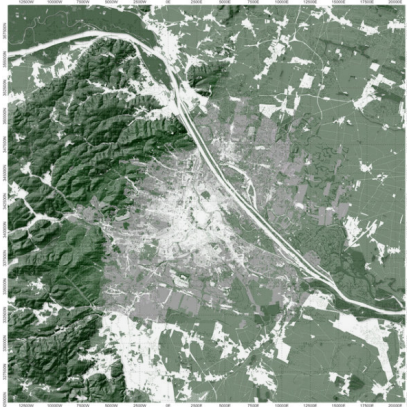
THE GREEN SYSTEM

THE WATER SYSTEM

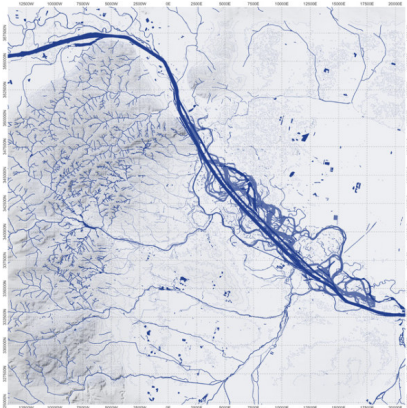
THE SOCIAL SYSTEM



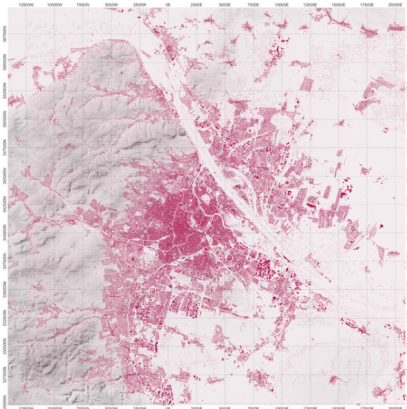
[Fig. 12]: Different layers of the socio-ecological system under investigation



THE GREEN SYSTEM

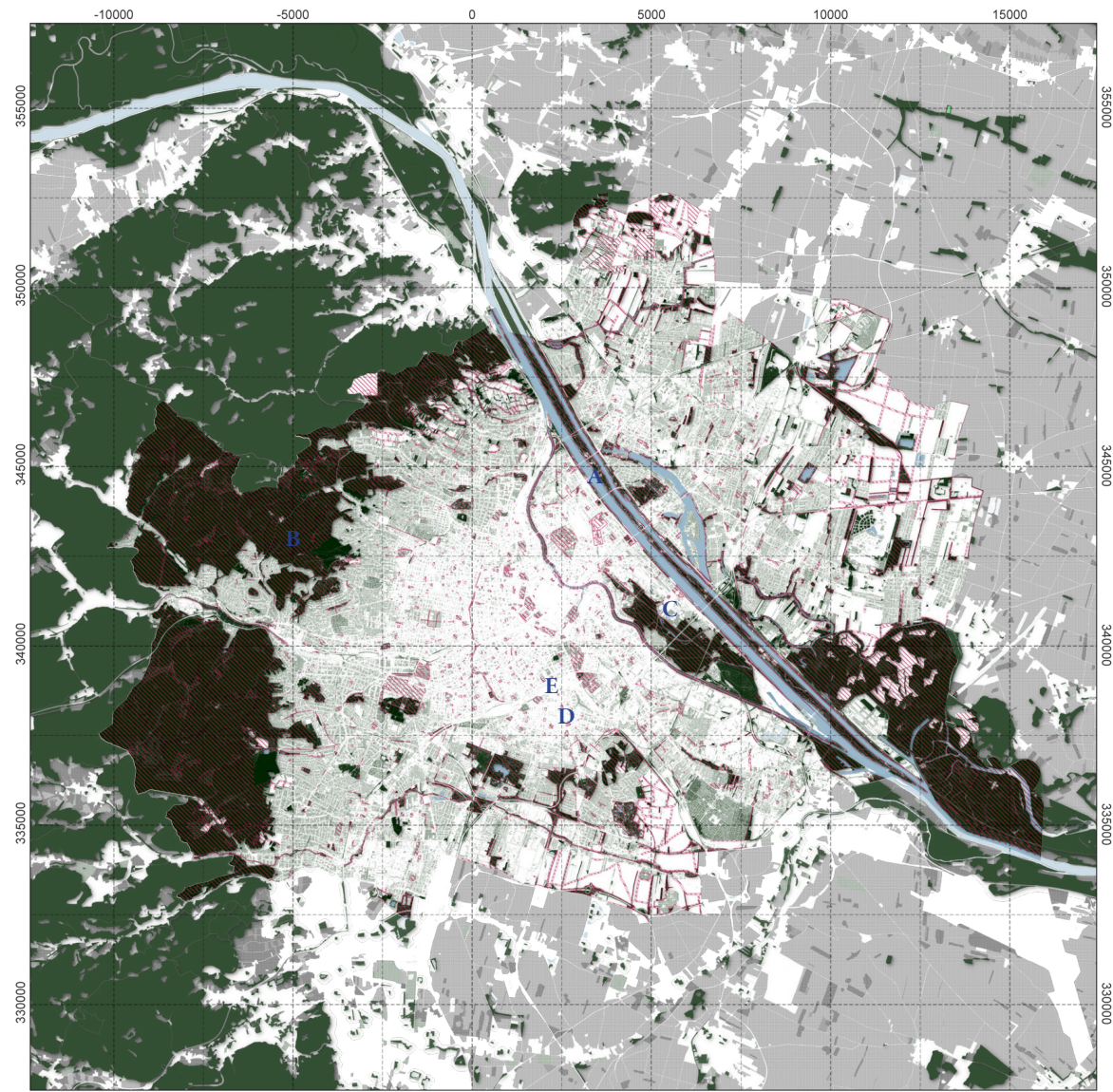


THE BLUE SYSTEM



THE SOCIAL SYSTEM

GREEN SYSTEM: CONCENTRATED AND DISPERSED PROVISION OF SERVICES



[Fig.13]: Green space types and their usage with public accessibility

Source: Stadt Wien 2023

A| DANUBE ISLANDS

B| VIENNA WOODS

C| PRATER

D| KEPLER PARK

E| SONNWEINDPLATZ

B| VIENNA WOODS

D| KEPLER PARK

Everything is fine here, I dont miss anything. I just openend my kiosk here.

We need more communal spaces, since Covid I have the feeling that a sense of community got lost!

When I go to a Park, then in a different district.

More space/ infrastructure for sport and activities would be great!

The heat is a problem, before I go out with my toddler, I checked the shadowy & cooler roots.

ACTORS



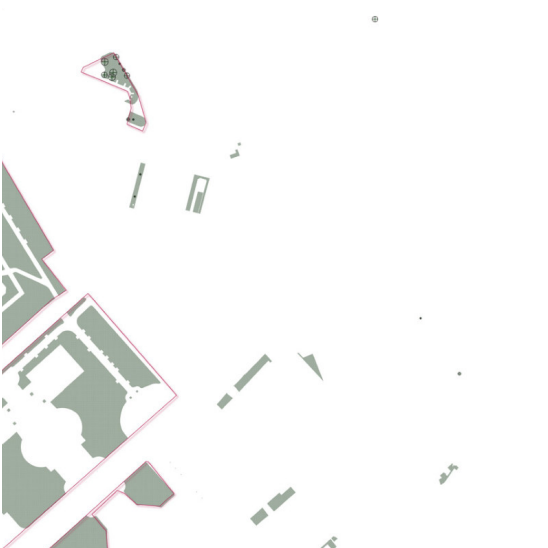
ACTORS



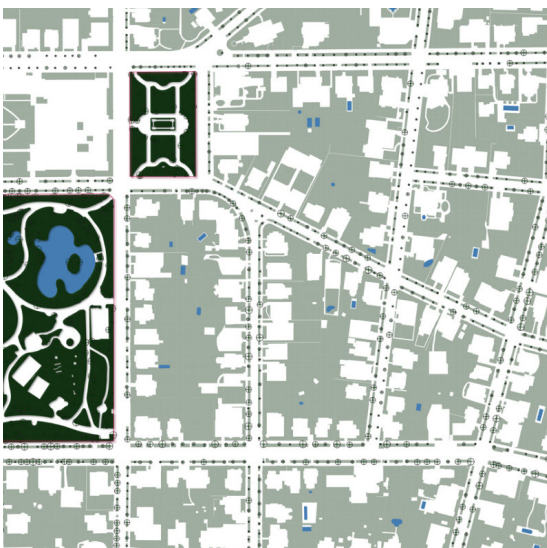
[Fig.15]: Collage of Ecosystem Wienerwald

UNEVEN DISTRIBUTION OF ECOSYSTEM SERVICES

HISTORICAL CITY CORE



TOWNHOUSES AND MULTI-HOUSEHOLD DWELLING



POST-WAR MODERN URBAN DEVELOPMENT



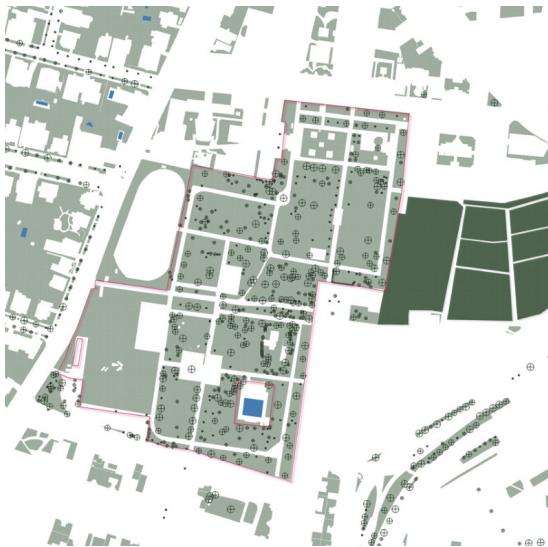
URBAN BLOCK (GRÜNDERZEIT)



SINGLE-HOUSEHOLD DWELLING

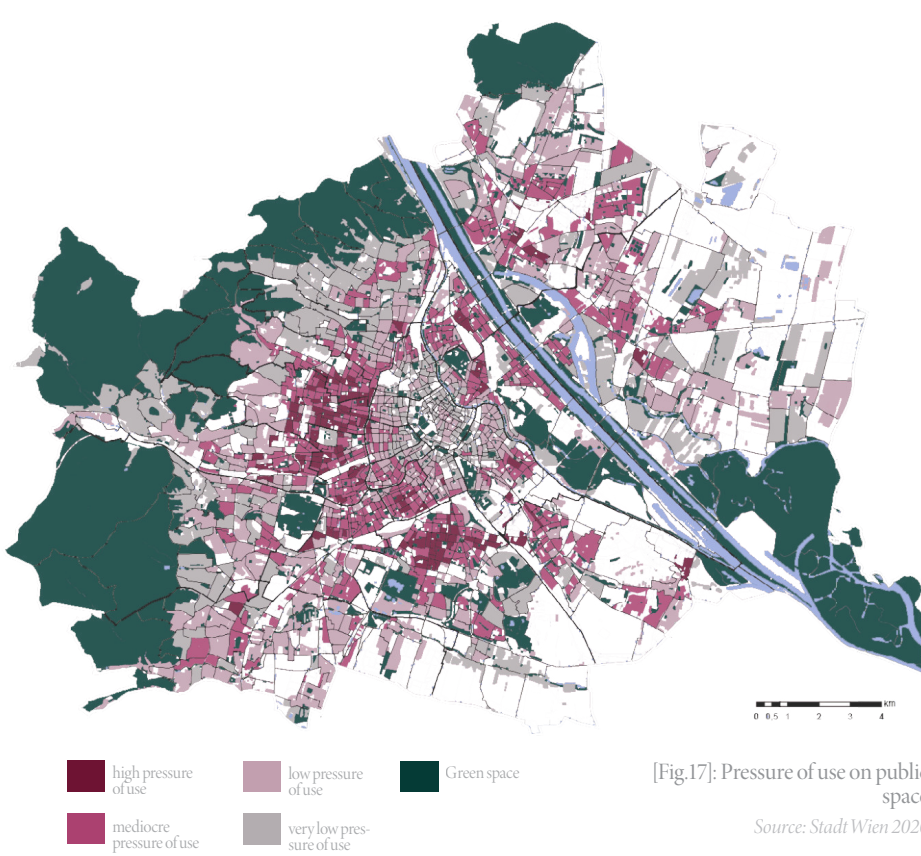


PUBLIC & SPECIAL TYPOLOGIES



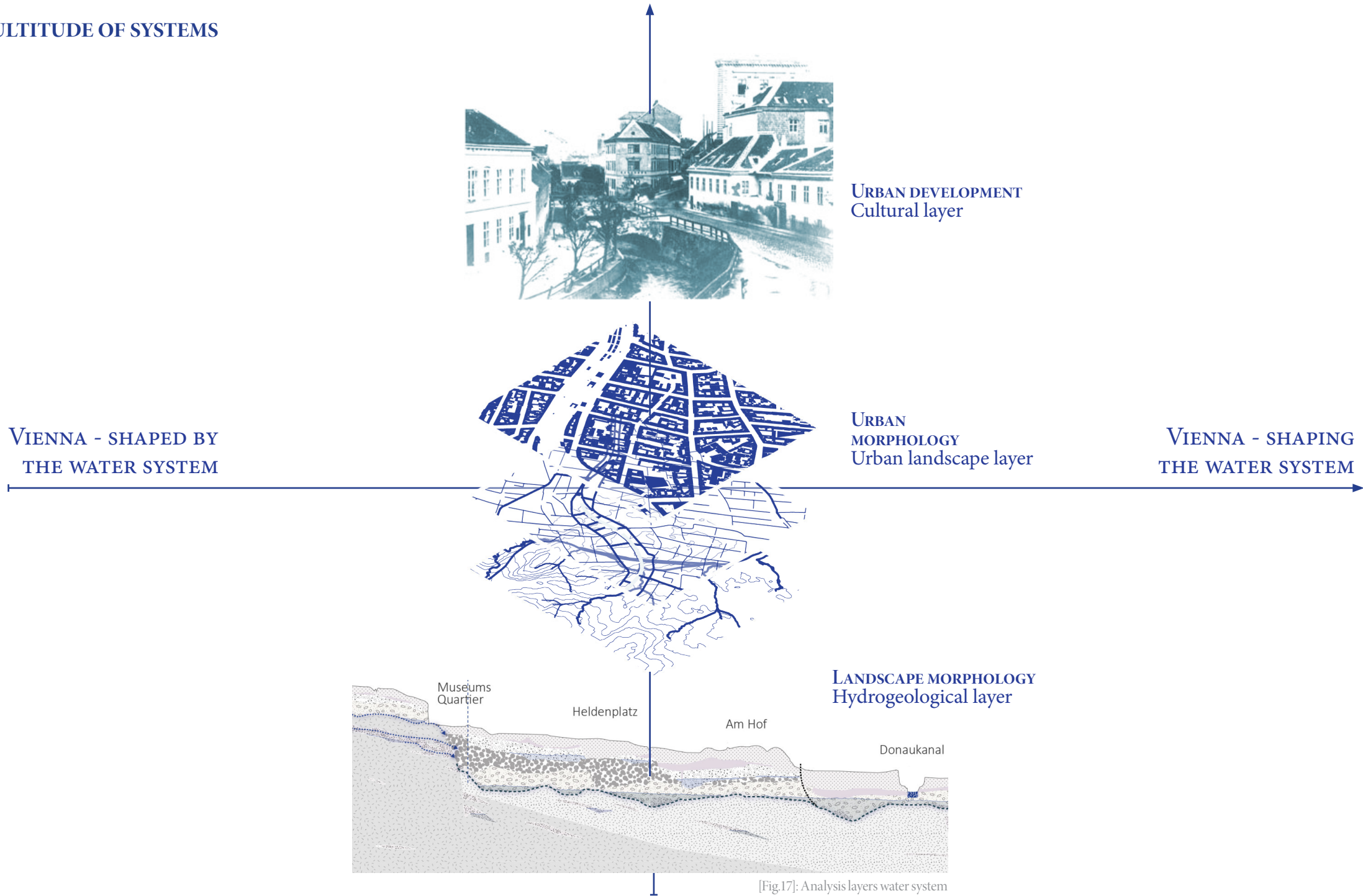
[Fig.16]: Green stamp in urban fabric and its public accessibility
Source: Stadt Wien 2023

PRESSURE OF USE ON PUBLIC SPACE



[Fig.17]: Pressure of use on public space
Source: Stadt Wien 2020

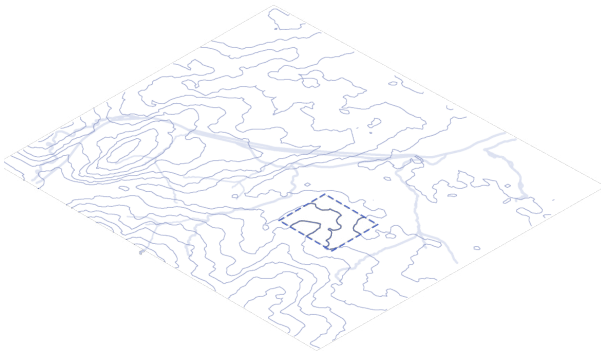
THE WATER SYSTEM: A MULTITUDE OF SYSTEMS



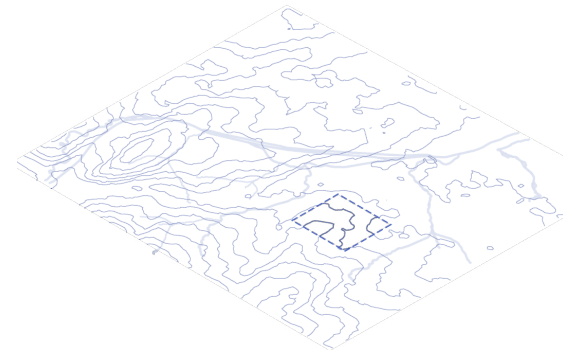
[Fig.17]: Analysis layers water system

THE HYDROGEOLOGICAL SYSTEM

DISCONNECTED AND CONTINUOUS GW

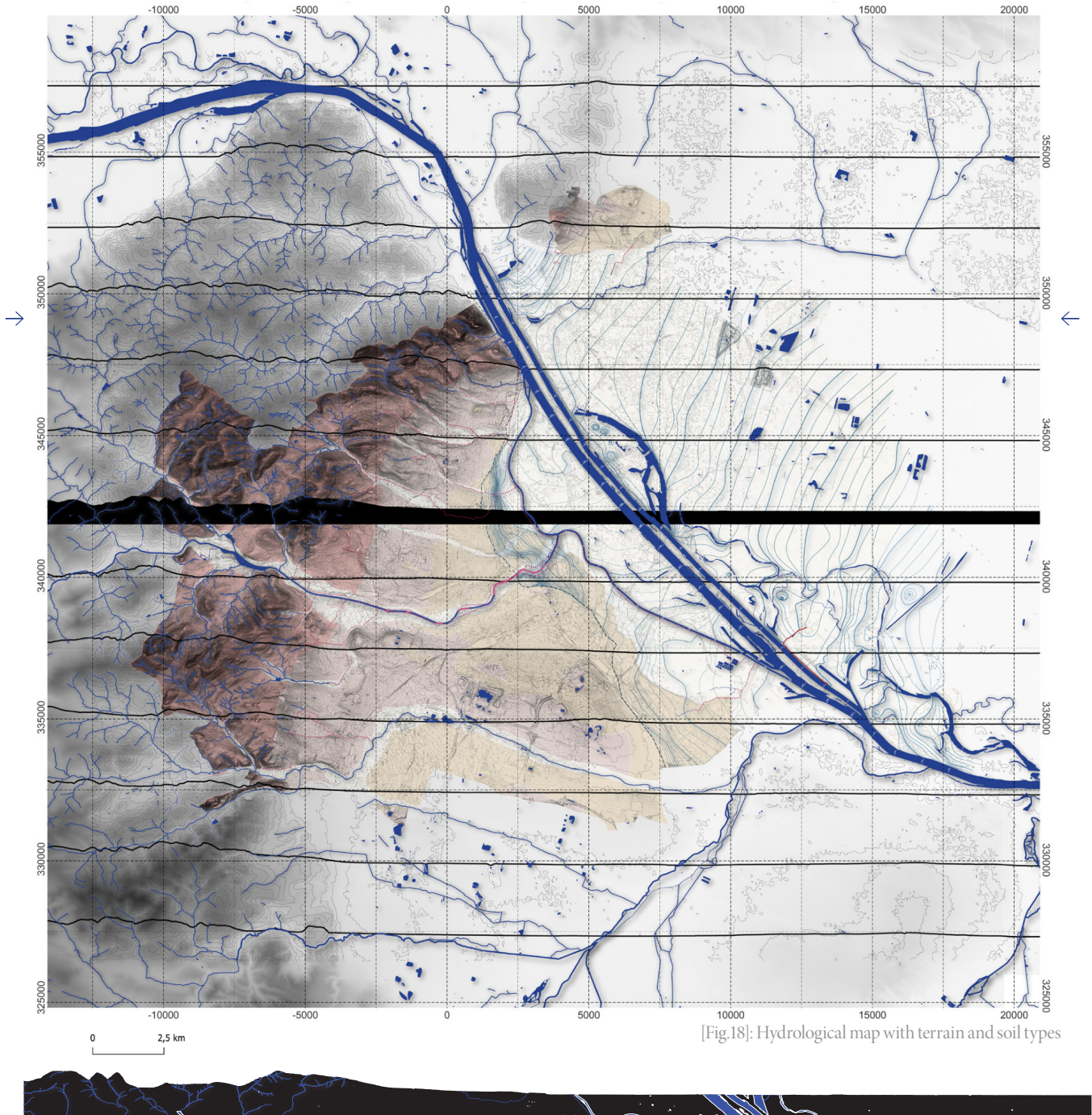


DISCONNECTED AND DISCONTINUOUS GW



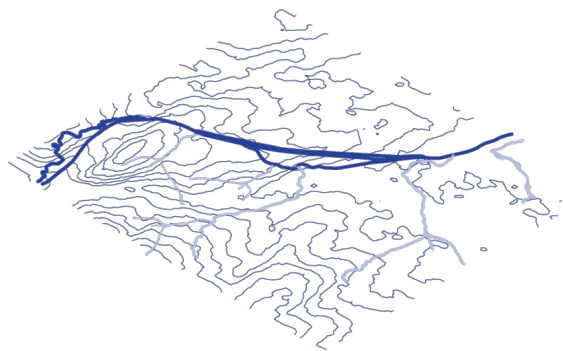
Legend

- Catchment area
- Viennes main waterbodies with Danube (canal) & Wienkanal
- Natural and floating streams
- Covered/ channeled streams
- Groundwater conditions (hights and movement)
- Border groundwater flow accompa-nying the Danube
- Terrain section (x2)
- Alpine bedrock
- Miocene unconsolidated rocks of Vienna Basin
- Pleistocene terrace gravels of Danube & streams
- Recent gravels in valley floor & Wienerwald streams

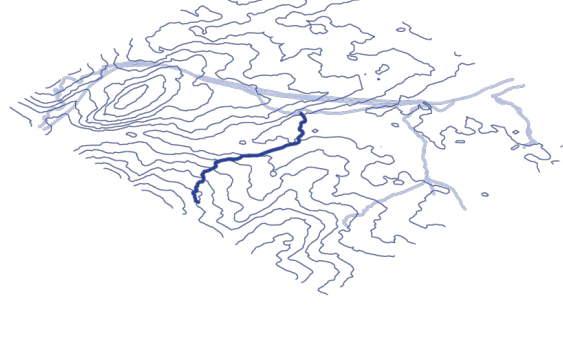


[Fig.18]: Hydrological map with terrain and soil types

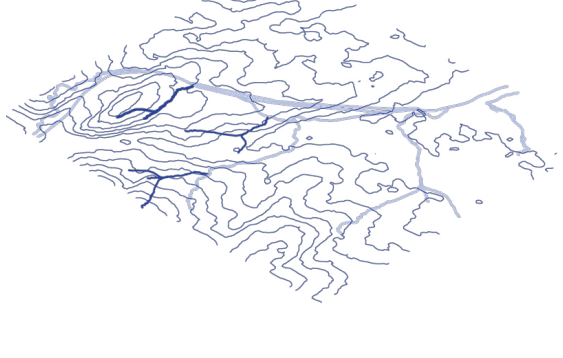
DANUBE & DANUBE CANAL



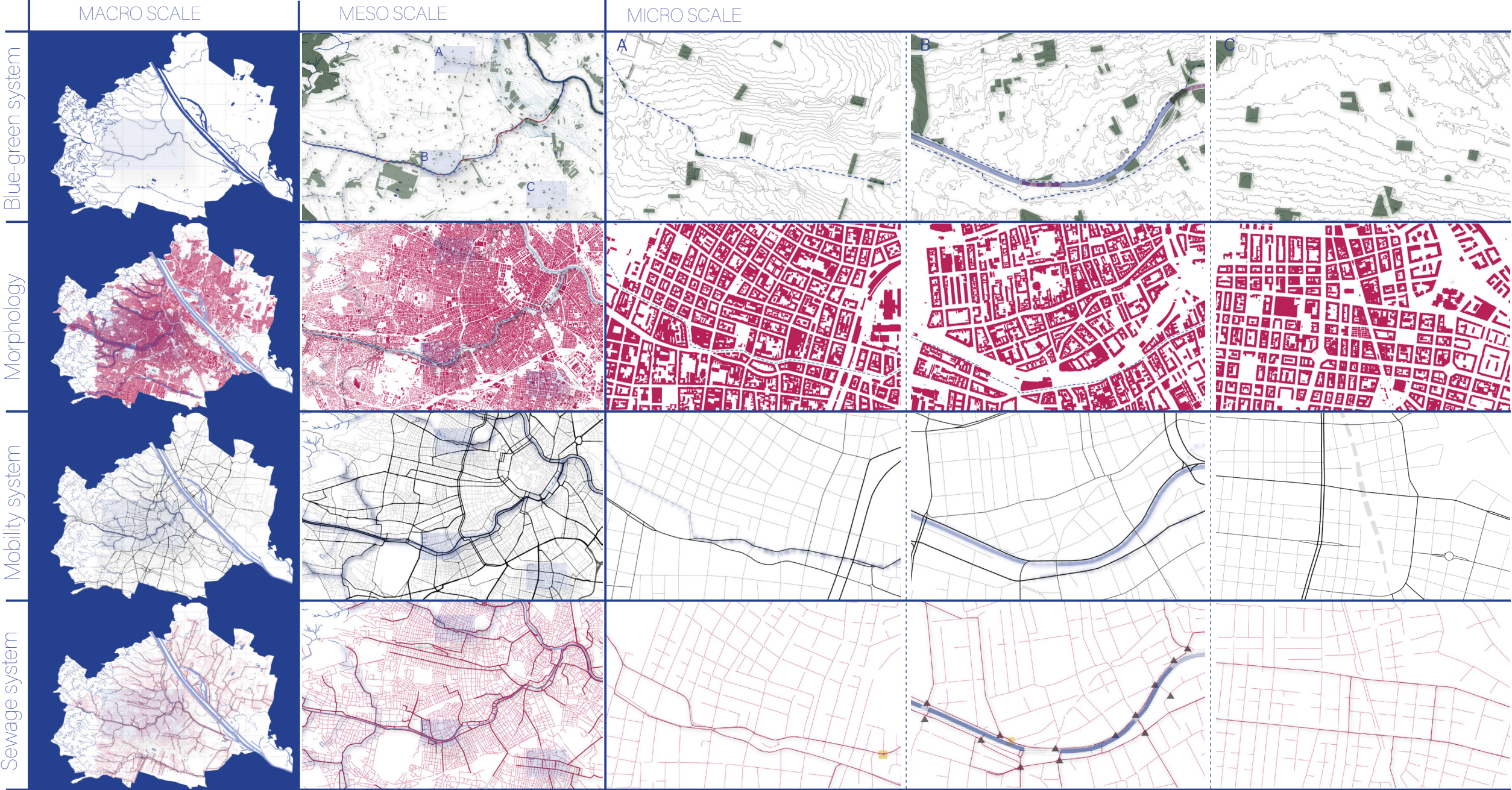
VIENNA CANAL



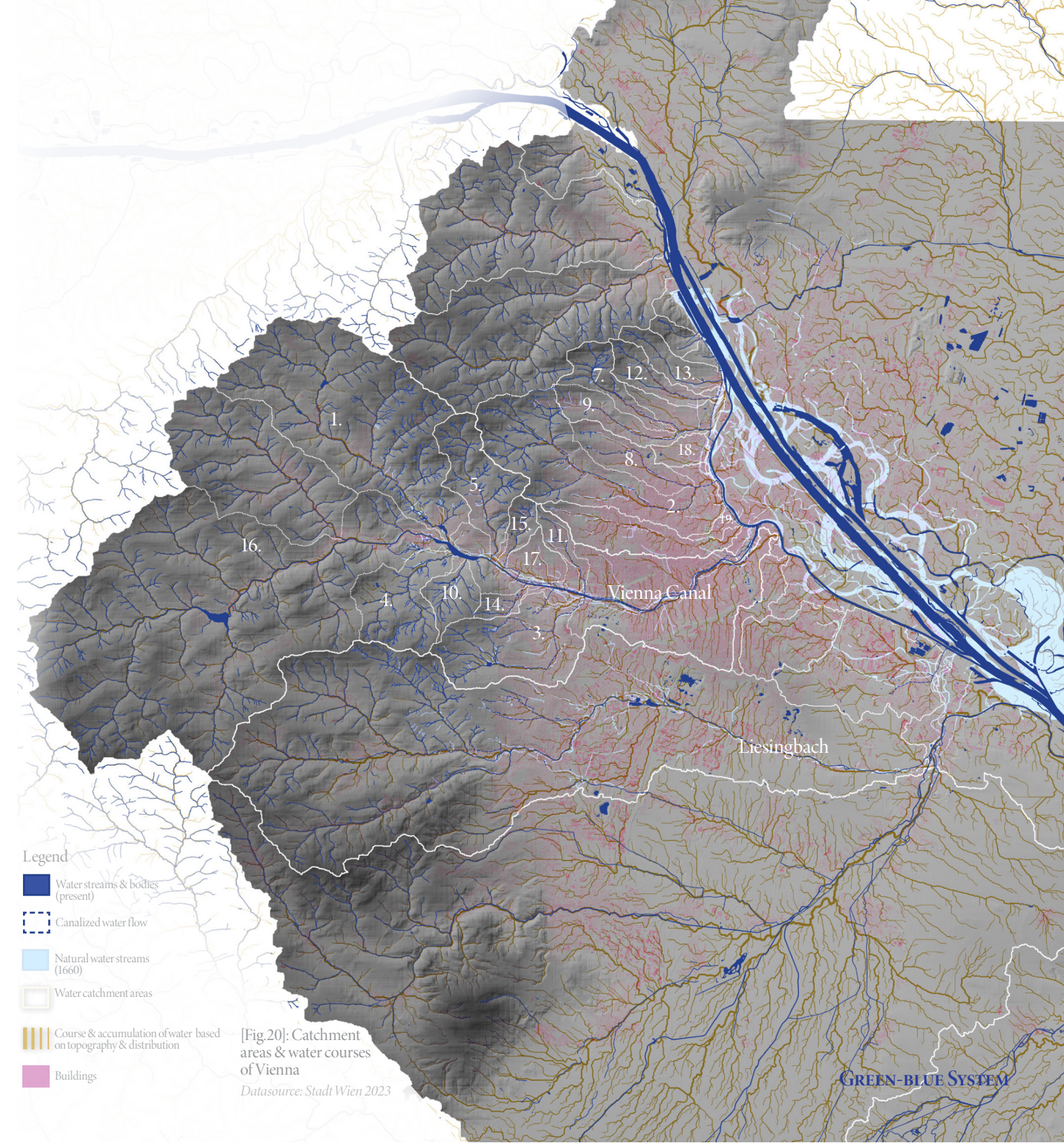
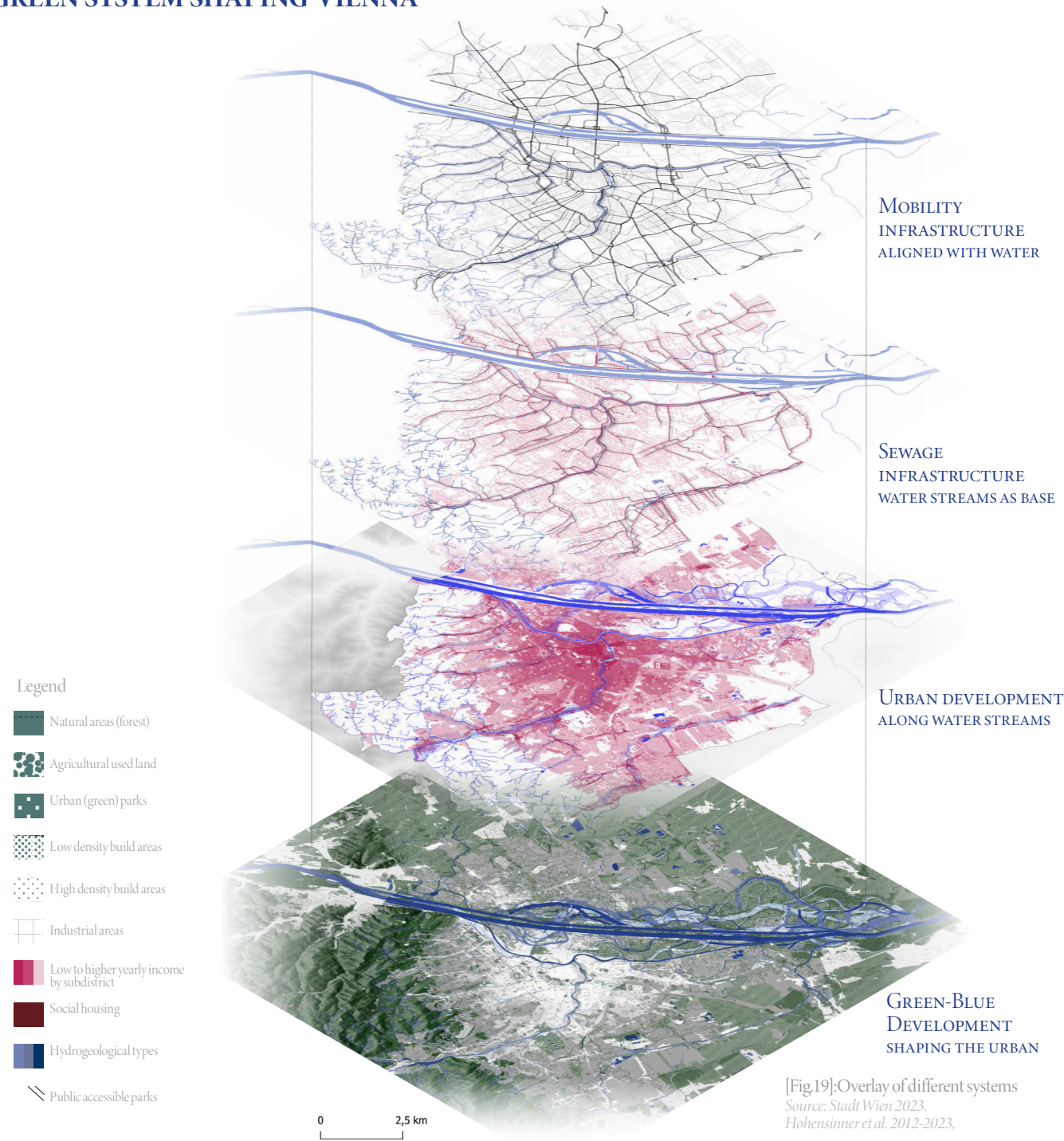
STREAMS



INTERWOVEN IN THE URBAN SYSTEM



[Fig.19]:Blue-green system in comparison with the urban systems, like street infrastructure, sewage infrastructure and urban morphology
Source: Stadt Wien 2023



CONCLUSION

CHALLENGE (PRESENT)

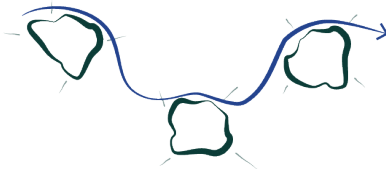
Exchange of natural processes & surfaces through artificial and engineered processes.



Linear water utilization on the cost of the natural water & eco-system.



Dispersed and fragmented green spaces & prioritizing of car-friendly public spaces.



POTENTIAL(FUTURE)

Transition towards natural & blue-green systems to benefit from ecosystem resilience & services.



Drainage by the means of streams to benefit from ecosystem values, utilizing Vienna's unique landscape & urban morphology.



Connecting green spaces & habitats as green corridors through rainwater drainage & redistribution of car infrastructure.

People are mentally and physically disconnected from the ecosystem and its benefits.

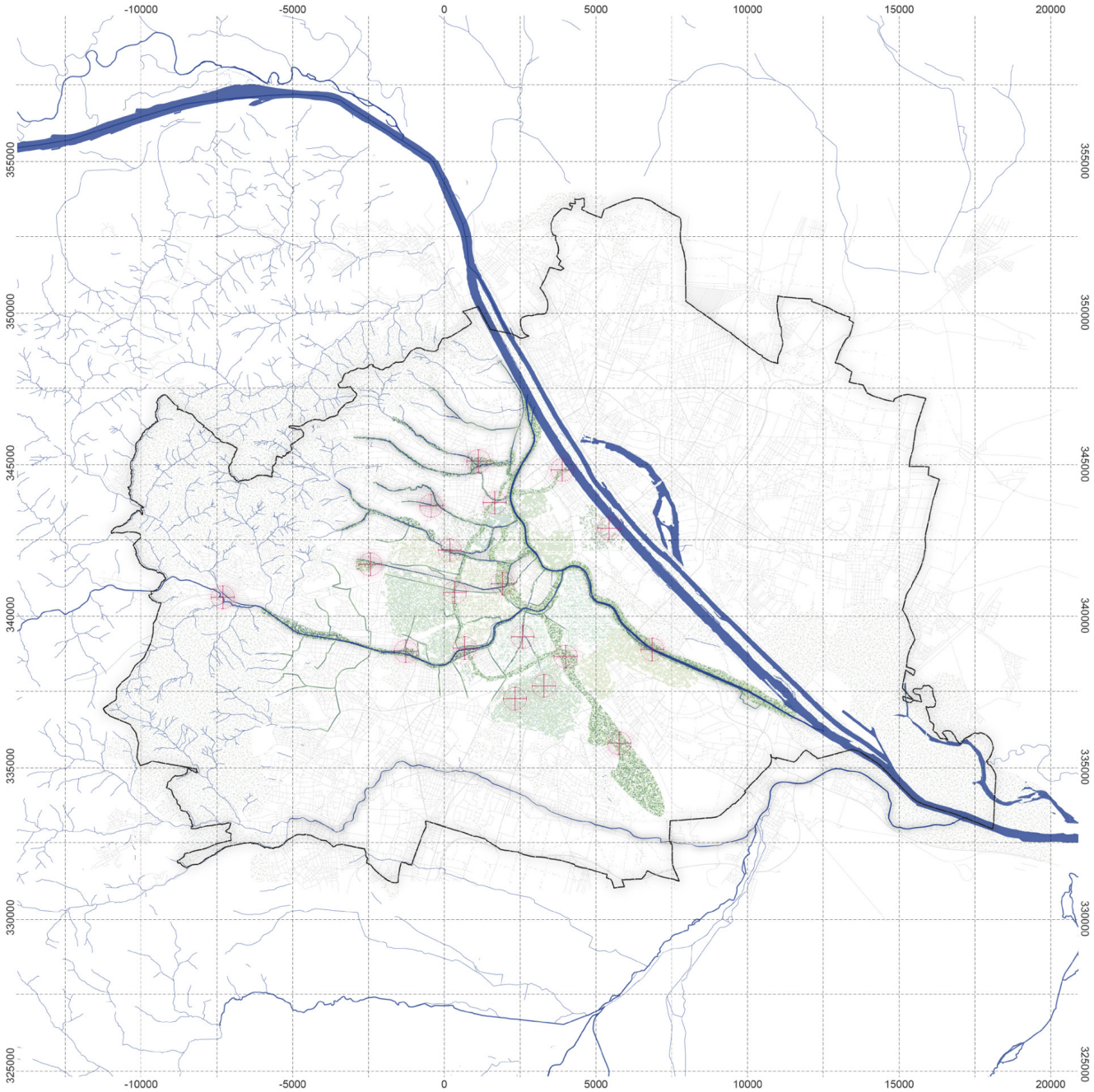
Aligning ecosystem & social benefits/ flows enables to enhance living conditions & reestablish valuing of ecosystems.

Limited spaces for social interaction, experimentation and stewardship within ecosystem

Fostering the ecosystem as communal infrastructure for co-creation allows activation of public spaces & communal activities.

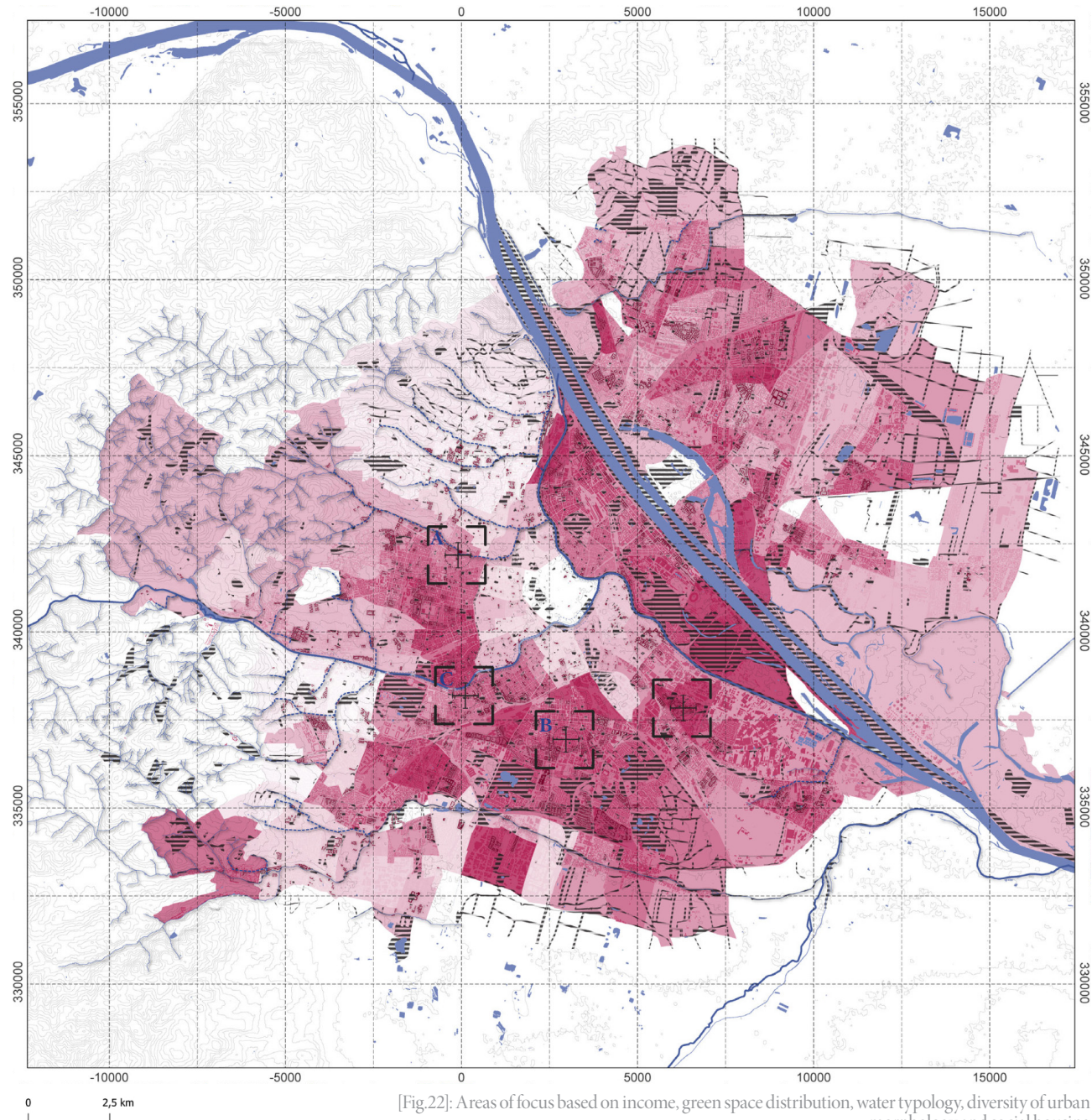
Legend

- Integrating green/ ecosystem values, fostering robust ecosystems.
- Blue-green corridors connecting & creating green spaces, utilizing streams & water runoff.
- Social amenities & communal spaces integrated into & complementing blue-green infrastructure.



[Fig.21]: Conclusive map showing potential transformation

DESIGNING FOR AN ENVIRONMENTAL JUST TRANSITION



[Fig.22]: Areas of focus based on income, green space distribution, water typology, diversity of urban morphology and social housing
Source: AK Wien 2018, Stadt Wien 2023

- Low to higher yearly income by subdistrict
- Social housing
- Hydrogeological types
- Public accessible parks

A | HERNHALS - JÖRGERSTRASSE

Hydro-geological type:

- stream
- terraced ground
- no GW connection

Urban typology:

- Mainly gründerzeit block, spacious block, special public type

Social housing:

- little

Income:

- low-medium mixed

B | FAVORITEN - FAVORITENSTRASSE

Hydro-geological type:

- dry and disconnected

Urban typology:

- Mainly gründerzeit block, modern post war development, spacious block

Social housing:

- high

Income:

- Very low

C | SECHSHAUS

Hydro-geological type:

- Vienna canal

Urban typology:

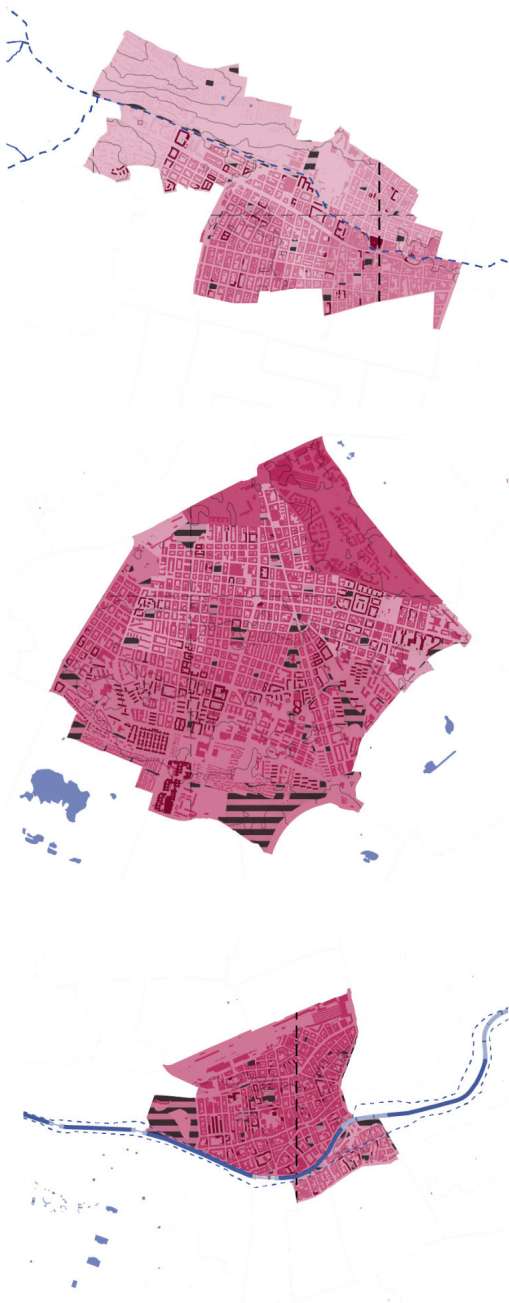
- Mainly gründerzeit block, modern post war development

Social housing:

- available

Income:

- Very low-medium



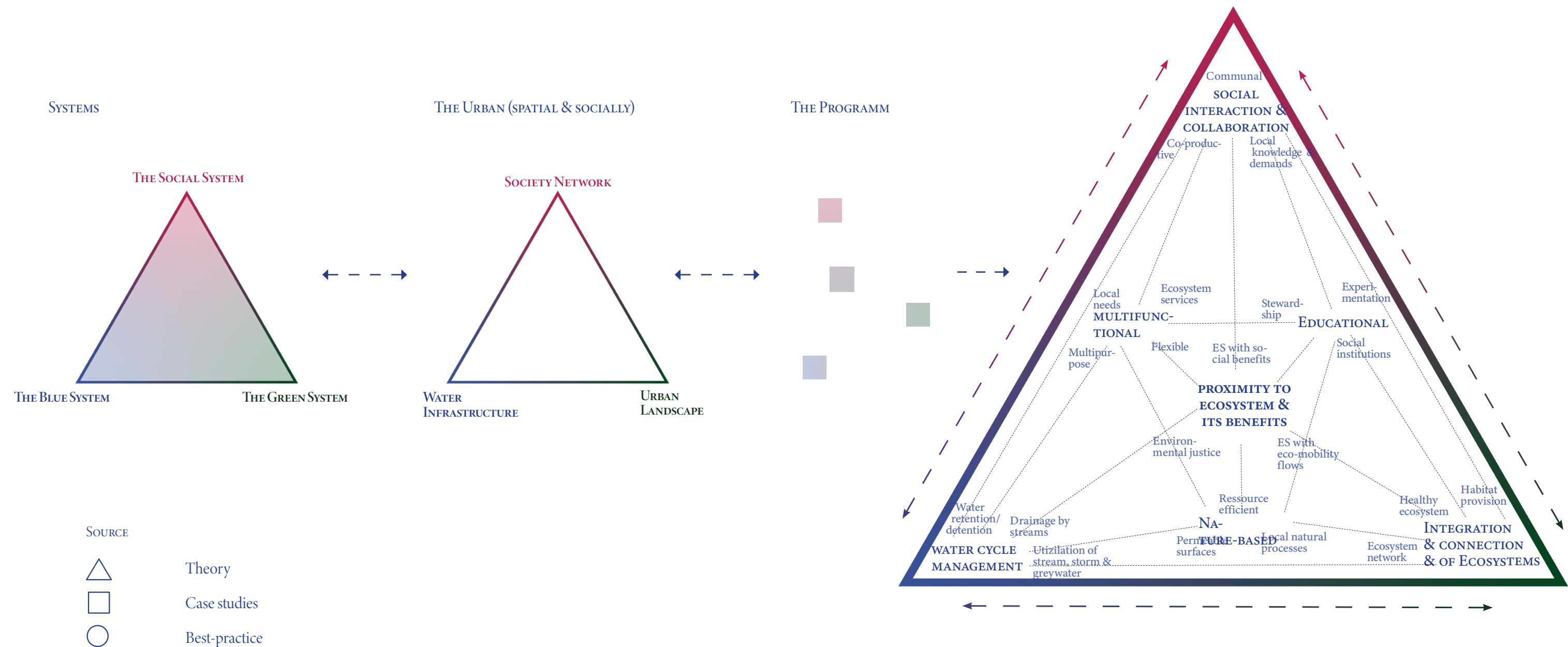
The background of the slide is a topographic map with a blue color scheme. The map shows intricate contour lines and some larger, lighter blue areas that represent water bodies. The overall tone is a deep, muted blue.

DESIGN FRAMEWORK & EXPLORATION

DESIGN FRAMEWORK

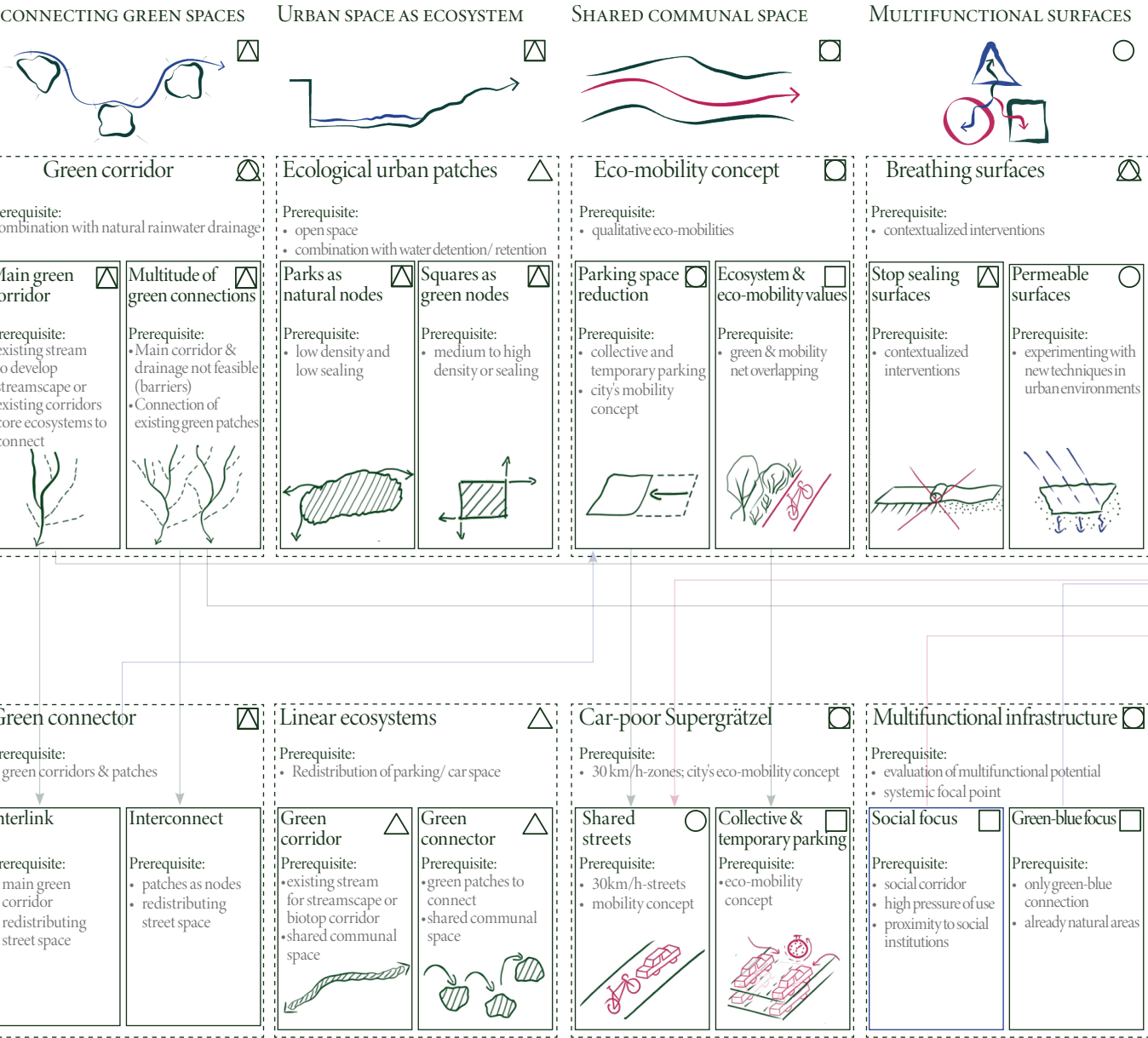
DESIGN EXPLORATION

DESIGN PRINCIPLES

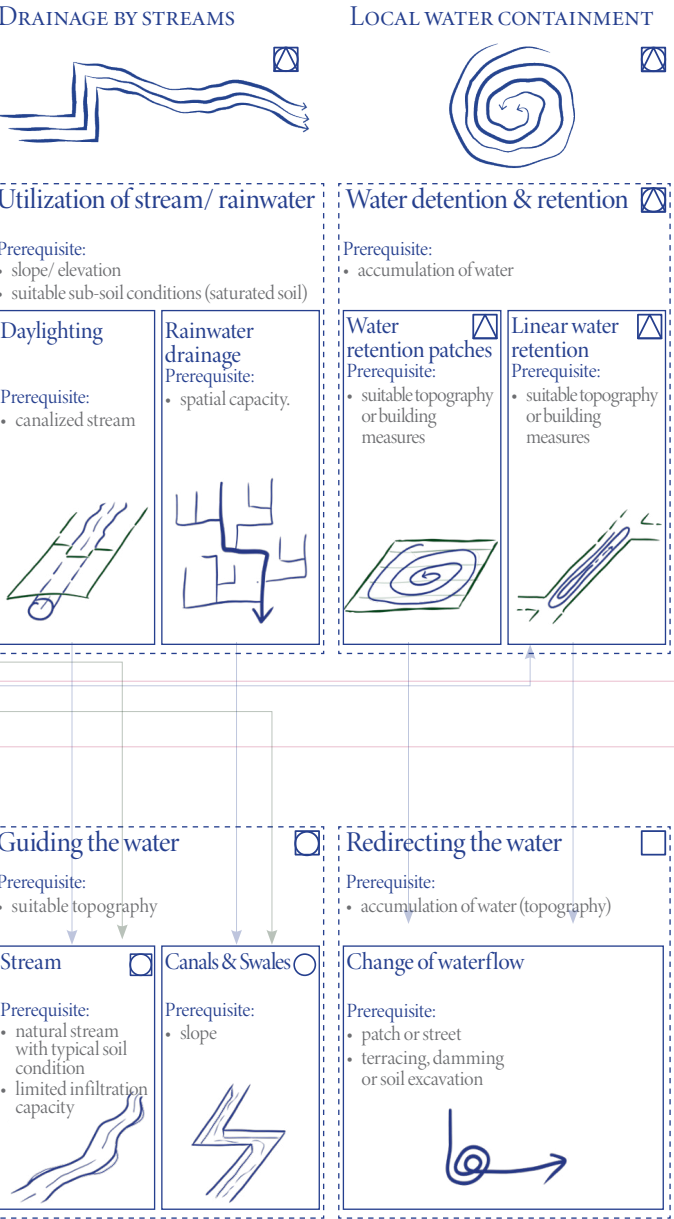


MAIN DESIGN PRINCIPLES

INTEGRATION AND CONNECTION OF ECOSYSTEMS



NATURAL WATER CYCLE MANAGEMENT



Guiding the water

Prerequisite:
• suitable topography

Stream

Prerequisite:
• natural stream with typical soil condition
• limited infiltration capacity



Canals & Swales

Prerequisite:
• slope



Redirecting the water

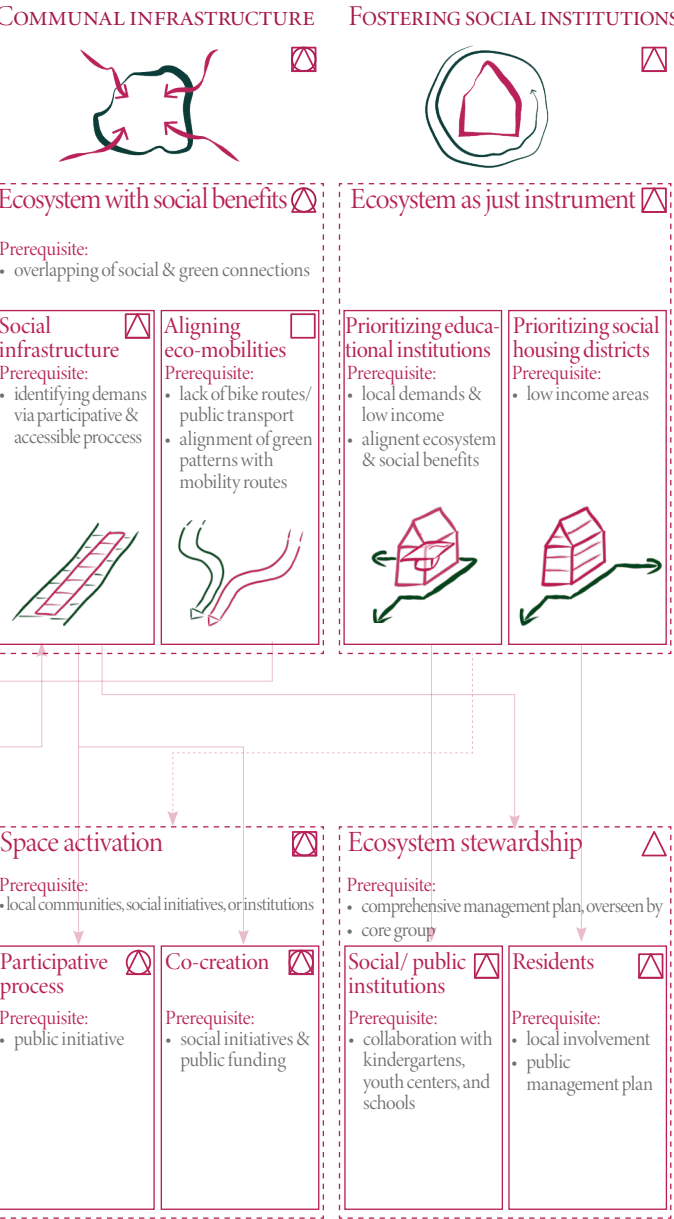
Prerequisite:
• accumulation of water (topography)

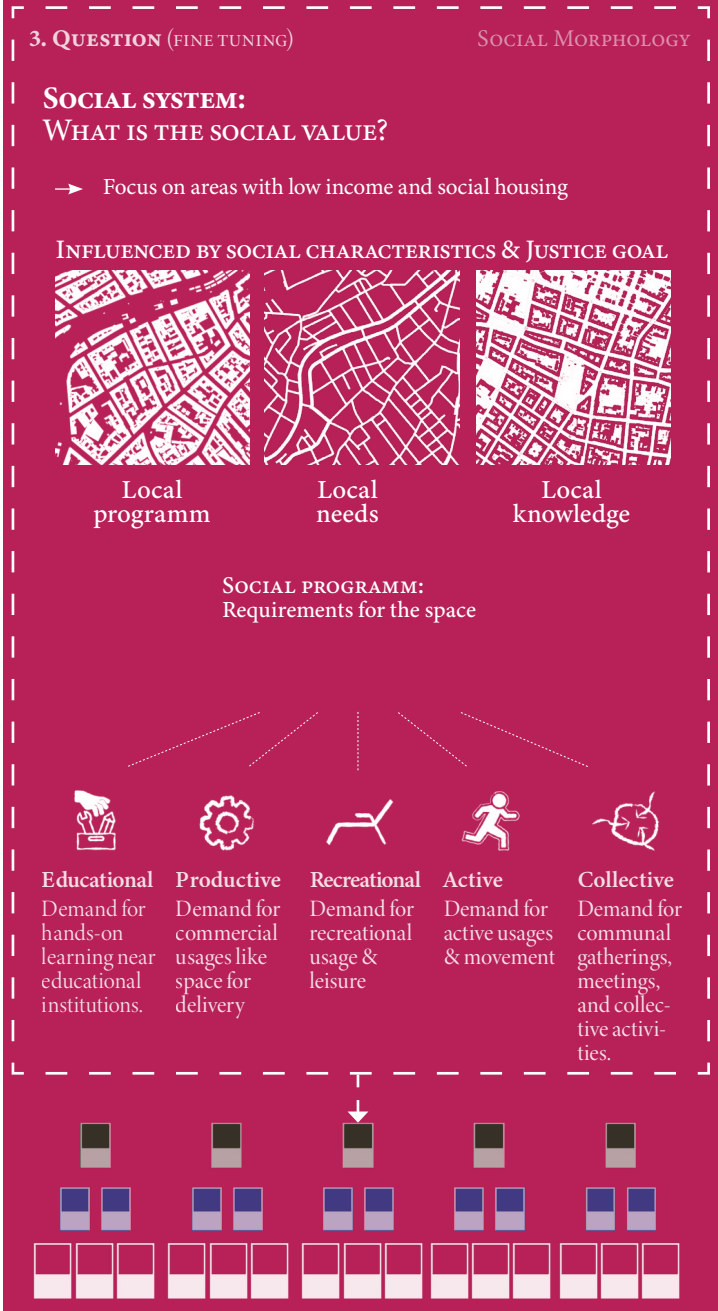
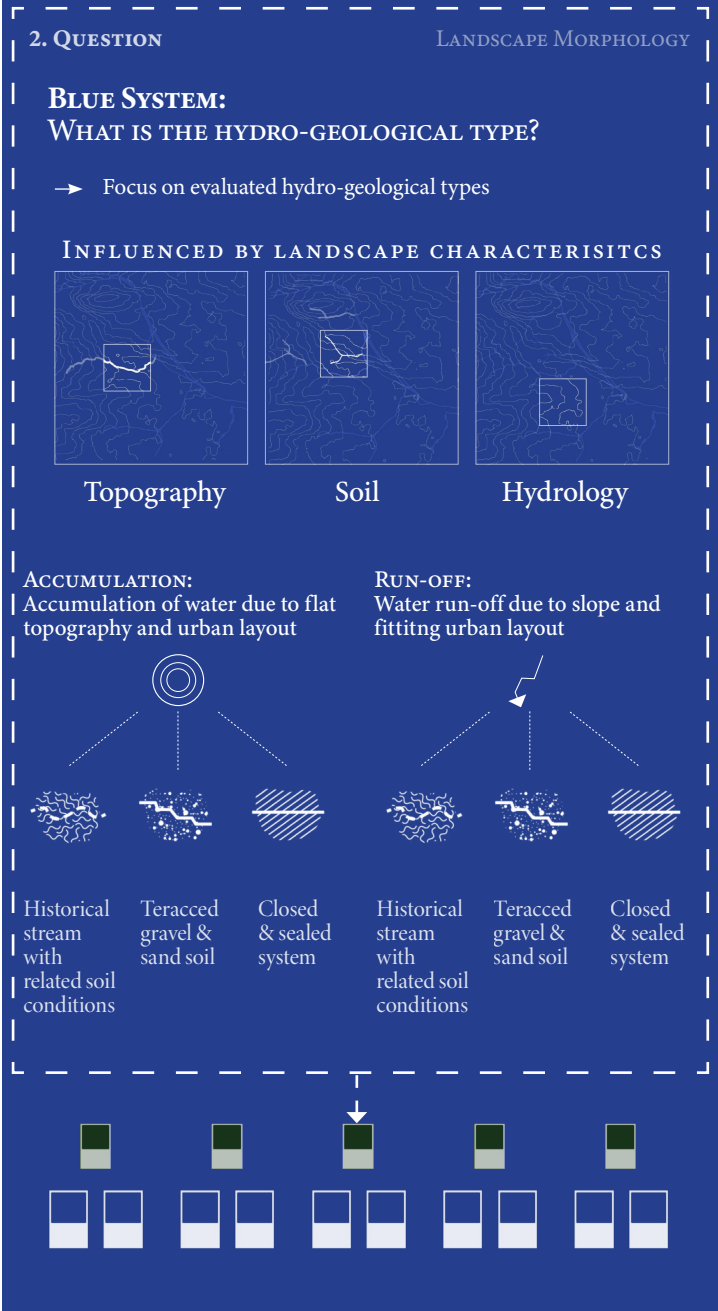
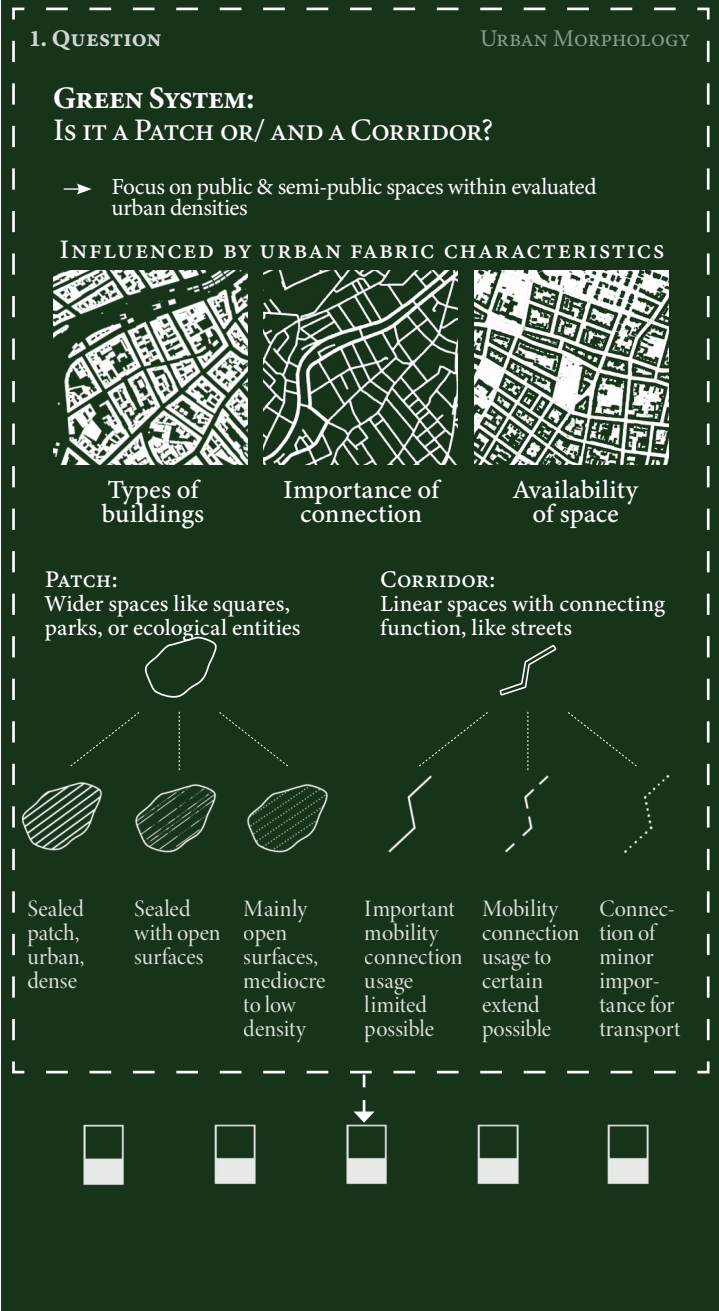
Change of waterflow

Prerequisite:
• patch or street
• terracing, damming or soil excavation



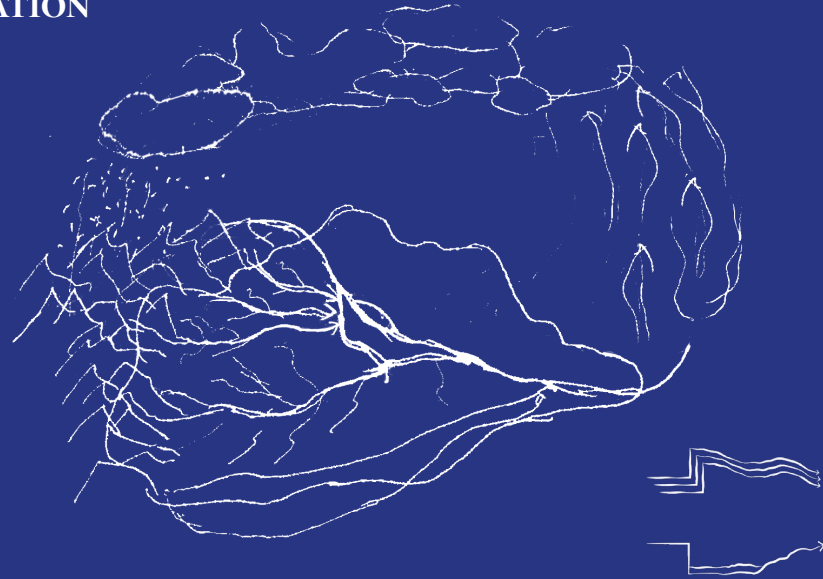
ECOSYSTEM AS COMMUNAL INFRASTRUCTURE



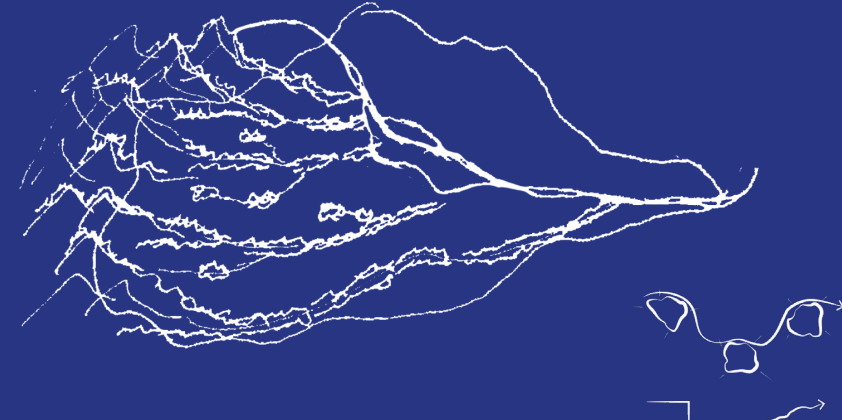


DESIGN EXPLORATION

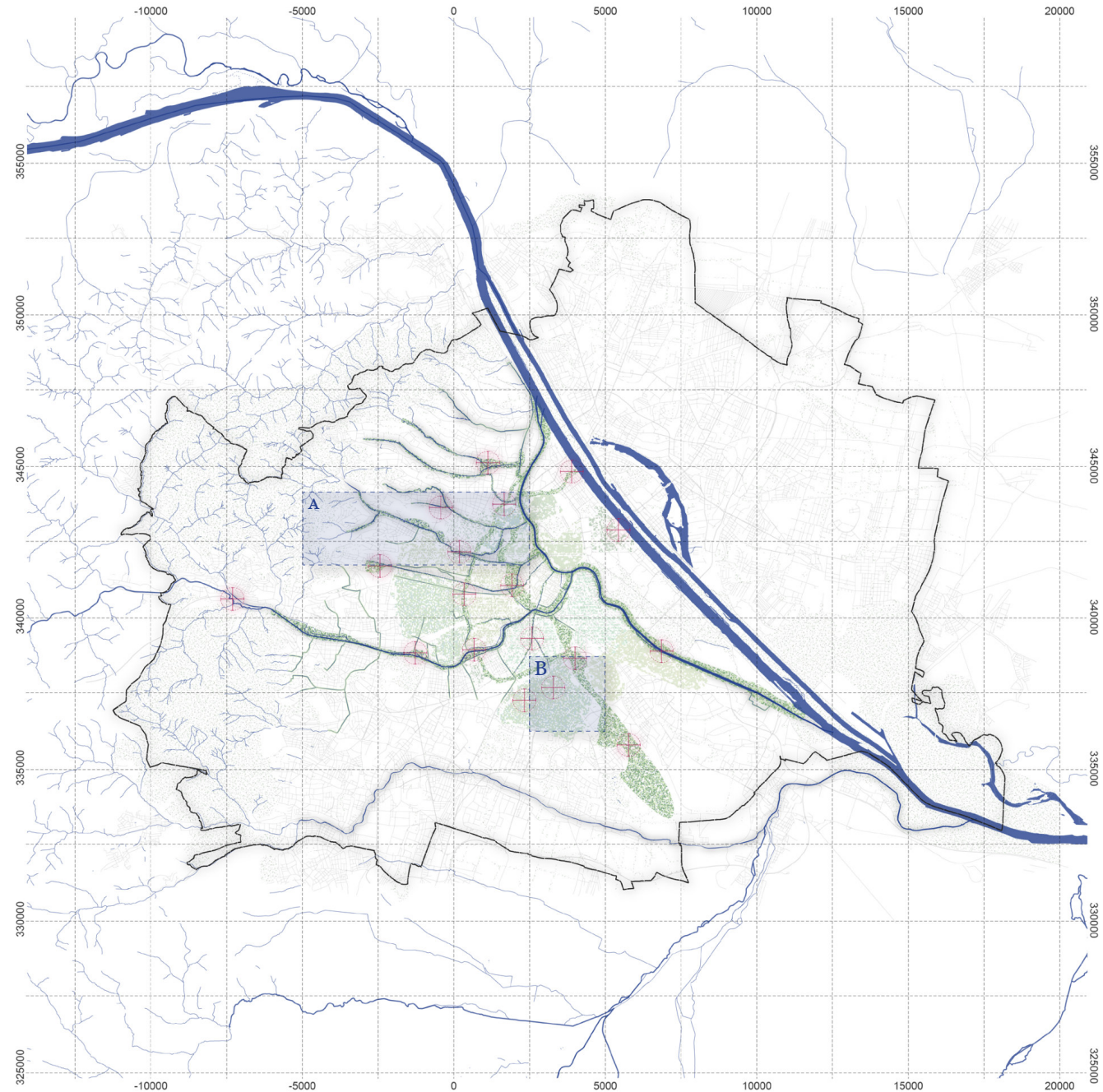
NATURAL
WATER CYCLE
MANAGEMENT



INTEGRATION AND
CONNECTION OF
ECOSYSTEMS



ECOSYSTEM
AS COMMUNAL
INFRASTRUCTURE



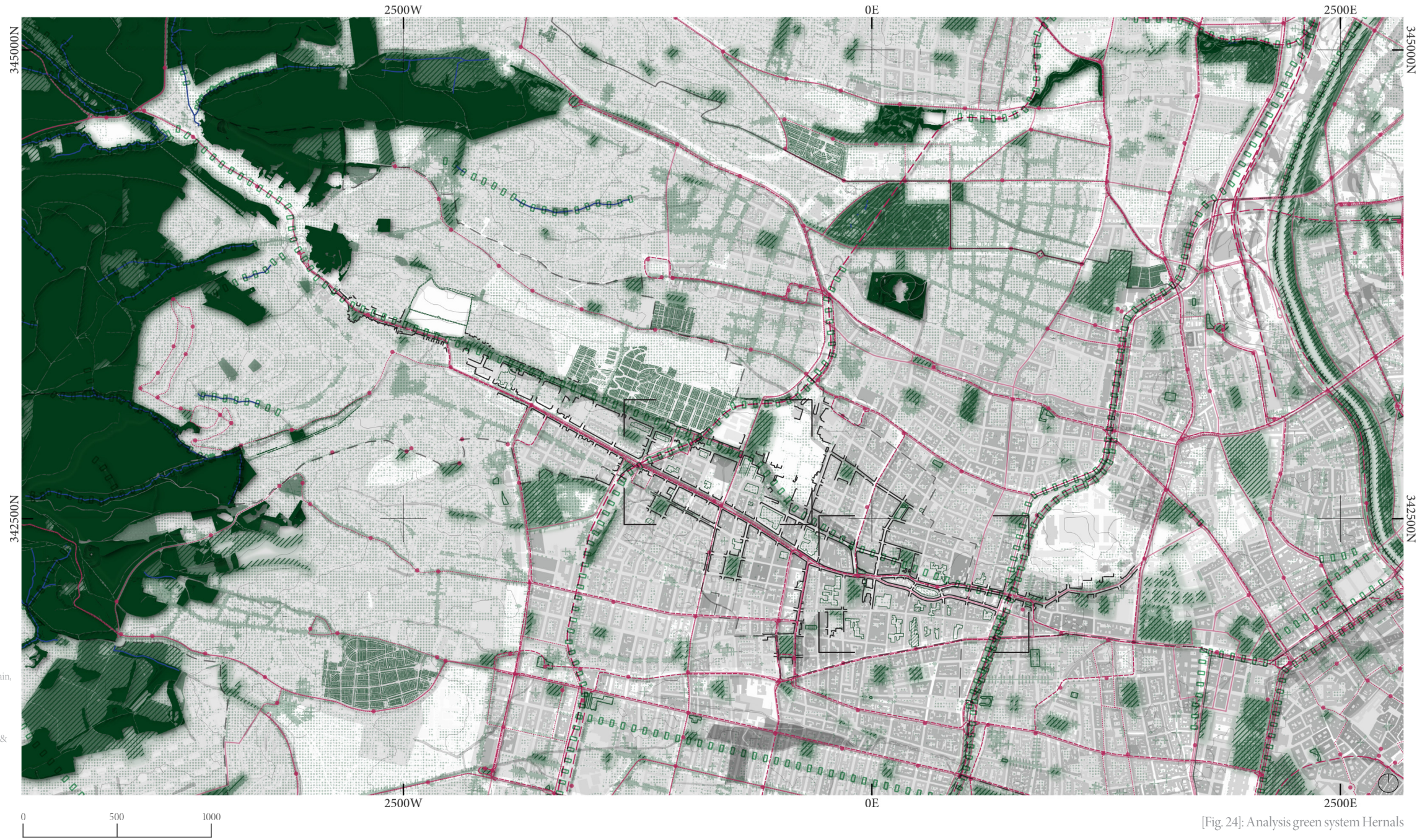
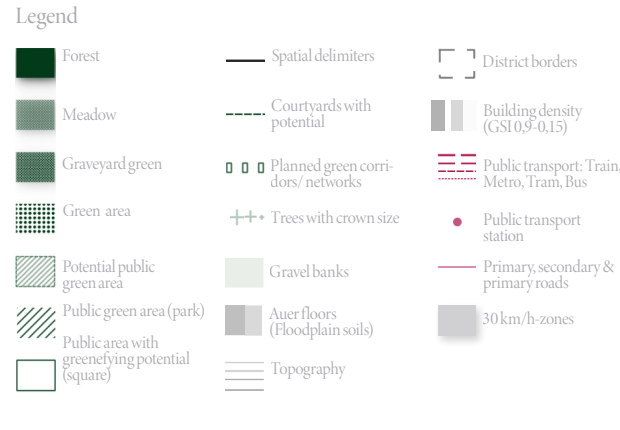
A | HERNALS

B | FAVORITEN

DESIGN EXPLORATION



[Fig 23]: Documentation of Hernalers reveals both its spatial attributes and deficiencies, as part of my field trip in Vienna.

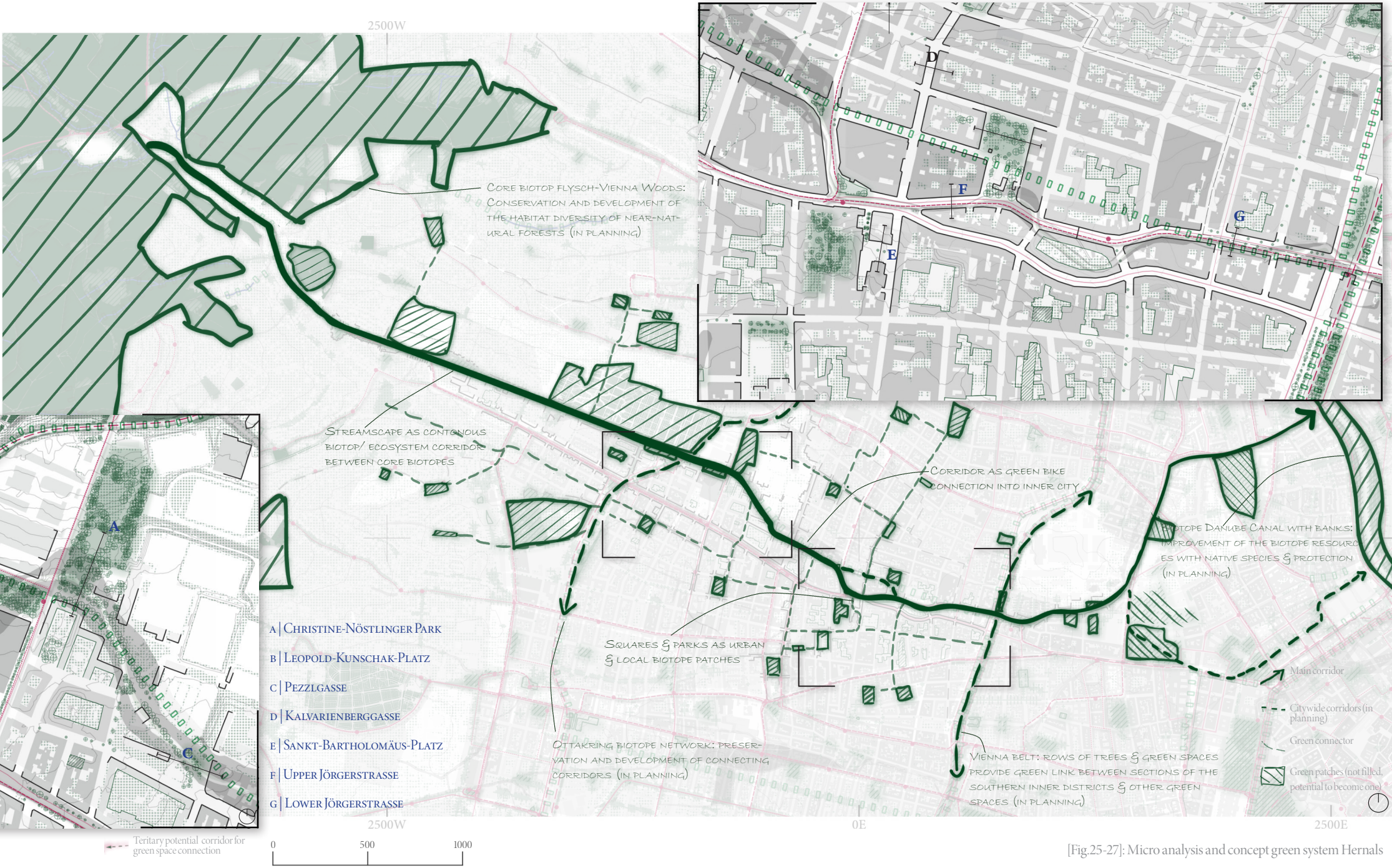
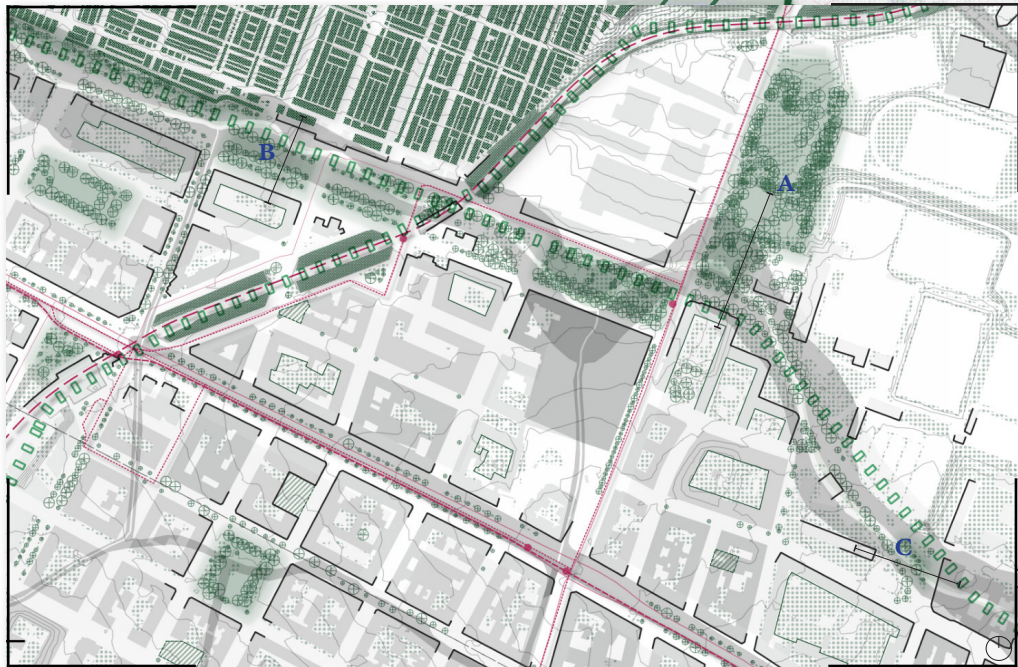
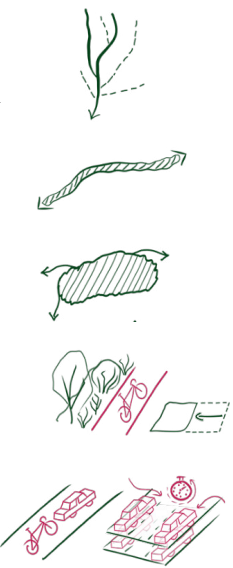


[Fig. 24]: Analysis green system Hernal's

HERNALS - THE GREEN SYSTEM

PRINCIPLES

- Streamscape as main green corridor in ecosystem network
- Green corridor connecting core ecosystem patches
- Ecosystem patches as nodes in a network connected towards main corridor
- Fostering eco-mobilities with ecosystem benefits & reducing parking space
- Car-poor supergrätzl with shared streets & temporary/collective parking



DESIGN EXPLORATION

[Fig.25-27]: Micro analysis and concept green system Hernals

HERNALS - THE BLUE SYSTEM

ANALYSIS

- Legend
- Vienna canal/ streams

- - -

Canalized streams

↘

Run-off floating direction

▣

Run-off floating patches

■

Topography

⋯

Catchment areas

⋯

Catchment areas

▨

Course & accumulation of water based on topography & distribution

■

Historic course of stream (1630)

■

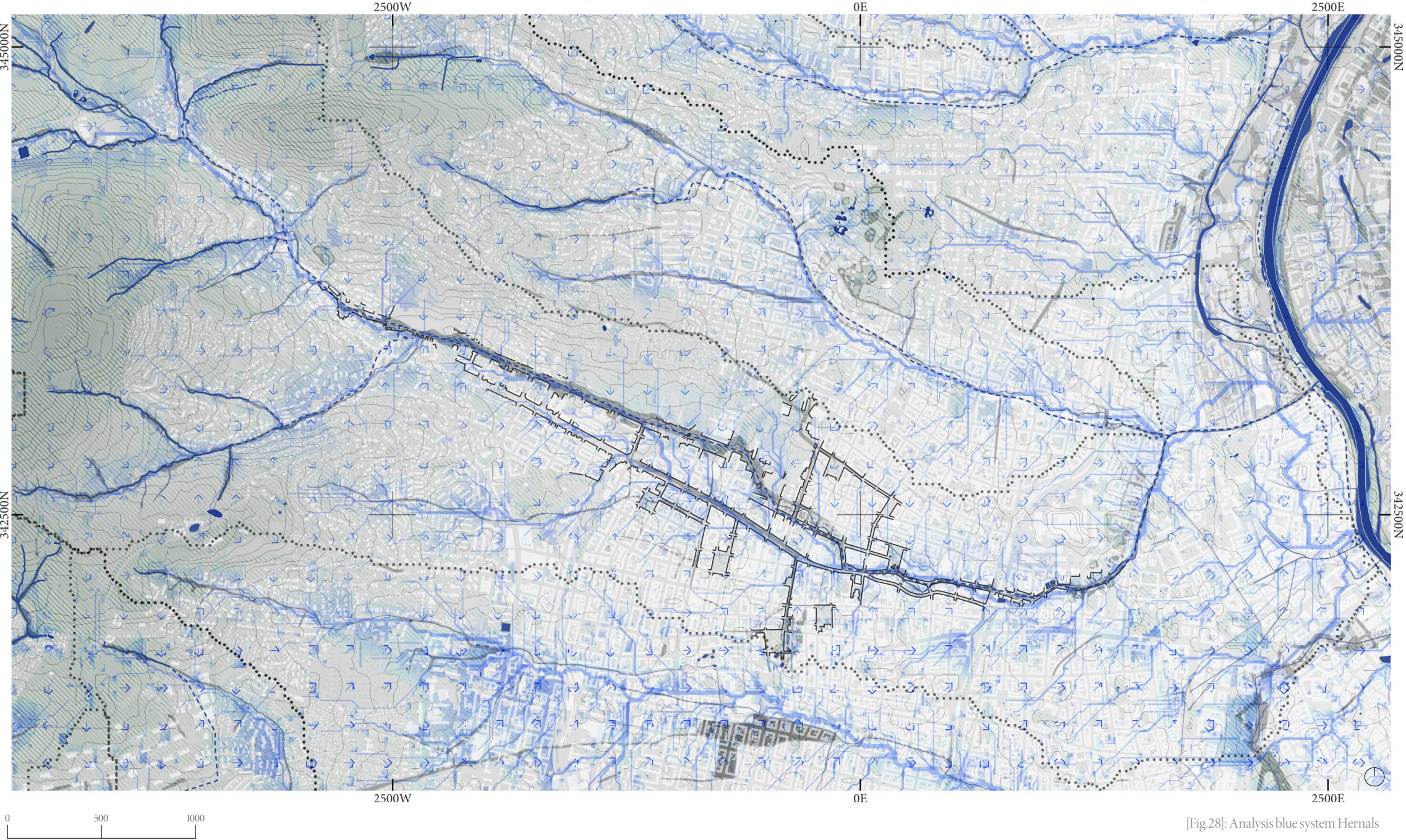
Gravel banks

■

Auer floors (Floodplain soils)

▨

Green areas



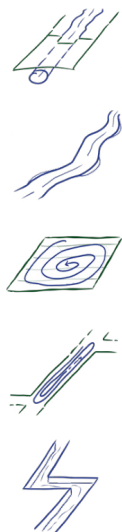
DESIGN EXPLORATION

[Fig.28]: Analysis blue system Hernal's

HERNALS - THE BLUE SYSTEM

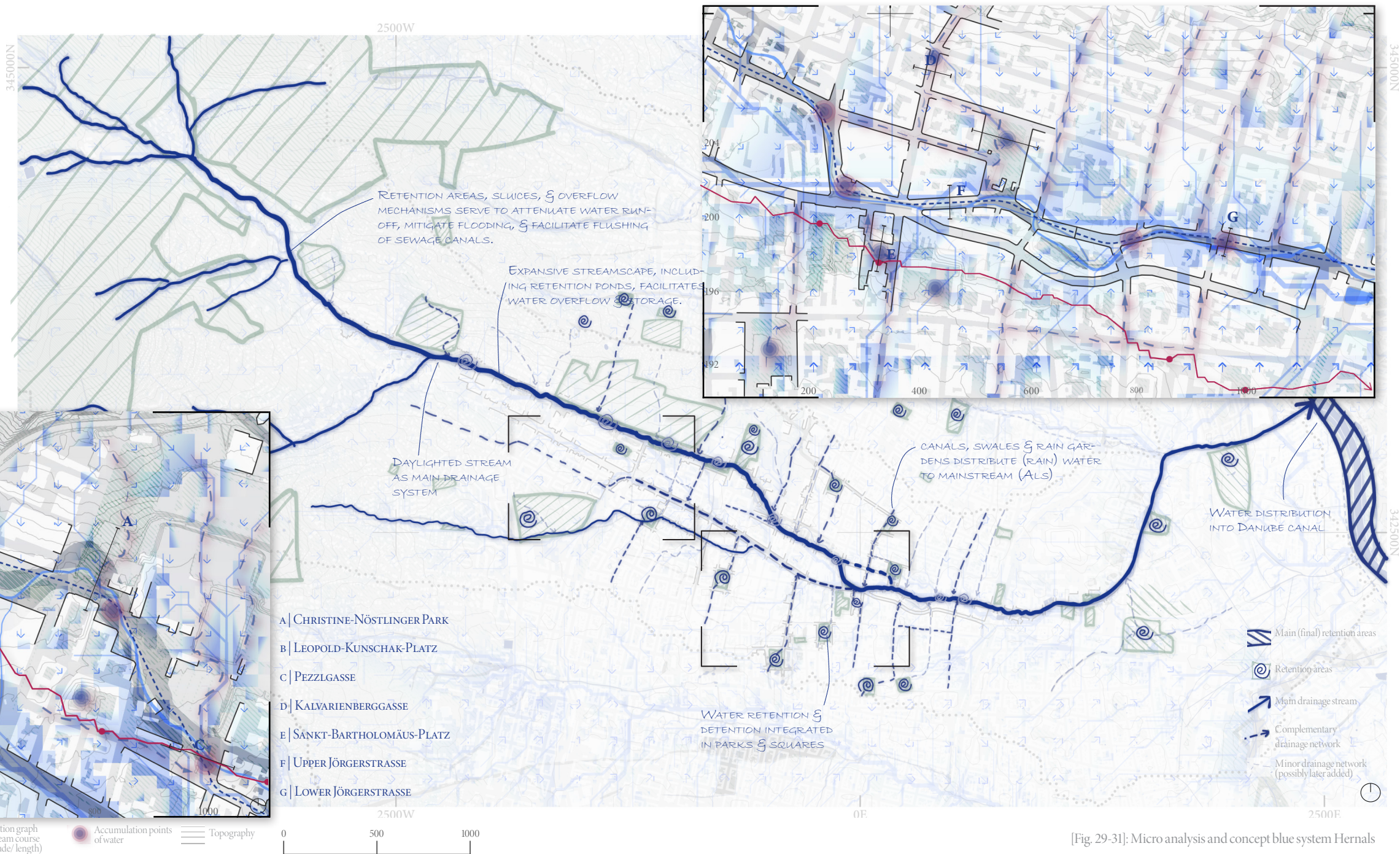
PRINCIPLES

- Utilization of rain & stream water via daylighting of stream
- Streamscape to guide and drain stream/ rainwater with distributing canals
- Patches (squares & parks) are used to store and infiltrate water
- Streets as water storage/ infiltration areas, when topography allows accumulation of water
- Canals, swales & rain gardens distribute (rain) water to stream



- A | CHRISTINE-NÖSTLINGER PARK
- B | LEOPOLD-KUNSCHAK-PLATZ
- C | PEZZLGASSE
- D | KALVARIENBERGGASSE
- E | SANKT-BARTHOLOMÄUS-PLATZ
- F | UPPER JÖRGERSTRASSE
- G | LOWER JÖRGERSTRASSE

Possible water flow connections
Elevation graph of stream course (altitude/length)
Accumulation points of water
Topography

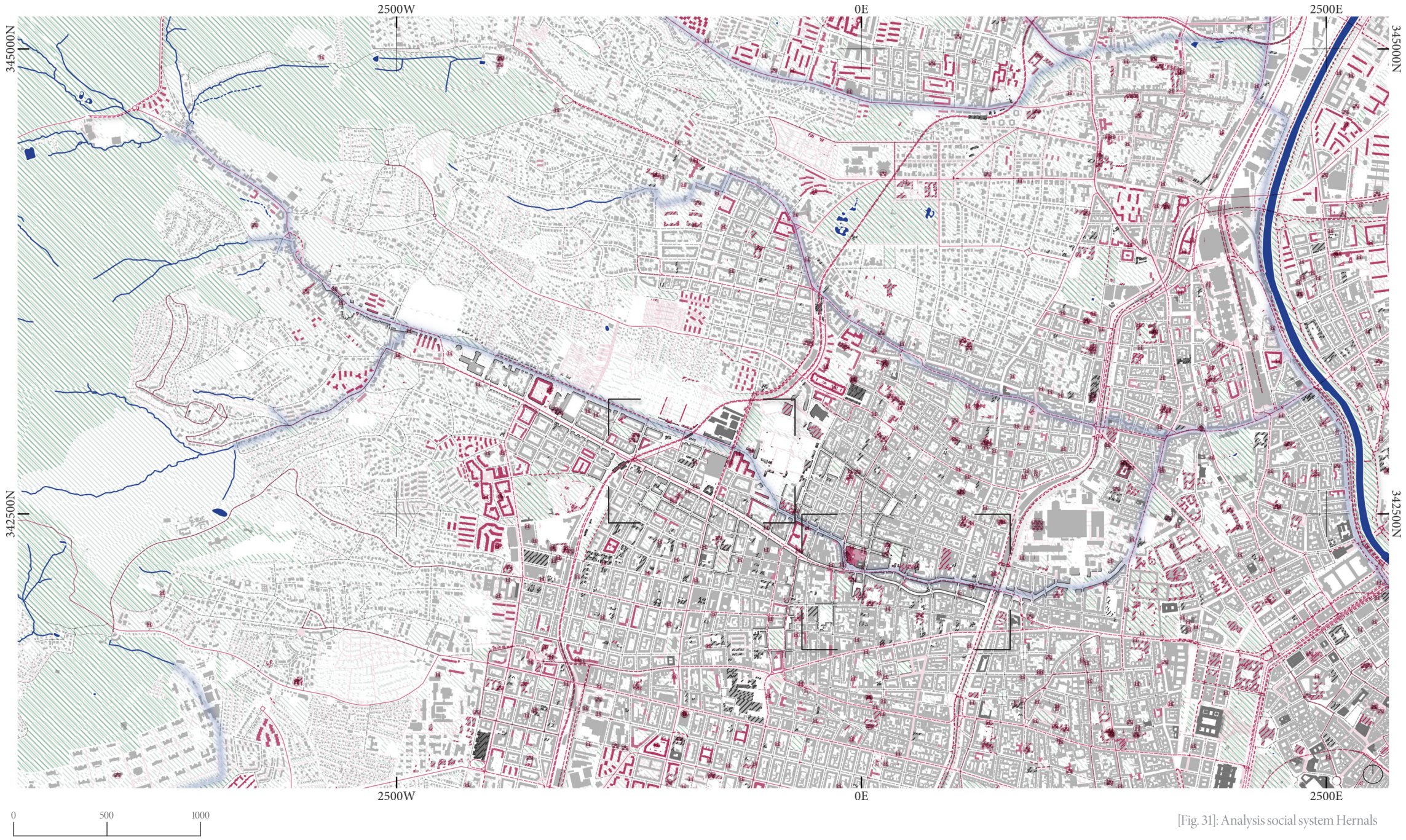


- Main (final) retention areas
- Retention areas
- Main drainage stream
- Complementary drainage network
- Minor drainage network (possibly later added)

DESIGN EXPLORATION

[Fig. 29-31]: Micro analysis and concept blue system Hernalserbach

- Legend (macro)
- | | | |
|--|--|--|
|  Social housing (high to low amount of flats) |  Public/ private transport facilities |  Train/ Metro |
|  Public social facilities |  Public park/ square |  Tram |
|  Commercial facilities with public functions |  Green areas |  Bus |
|  Public/ private administration | | |

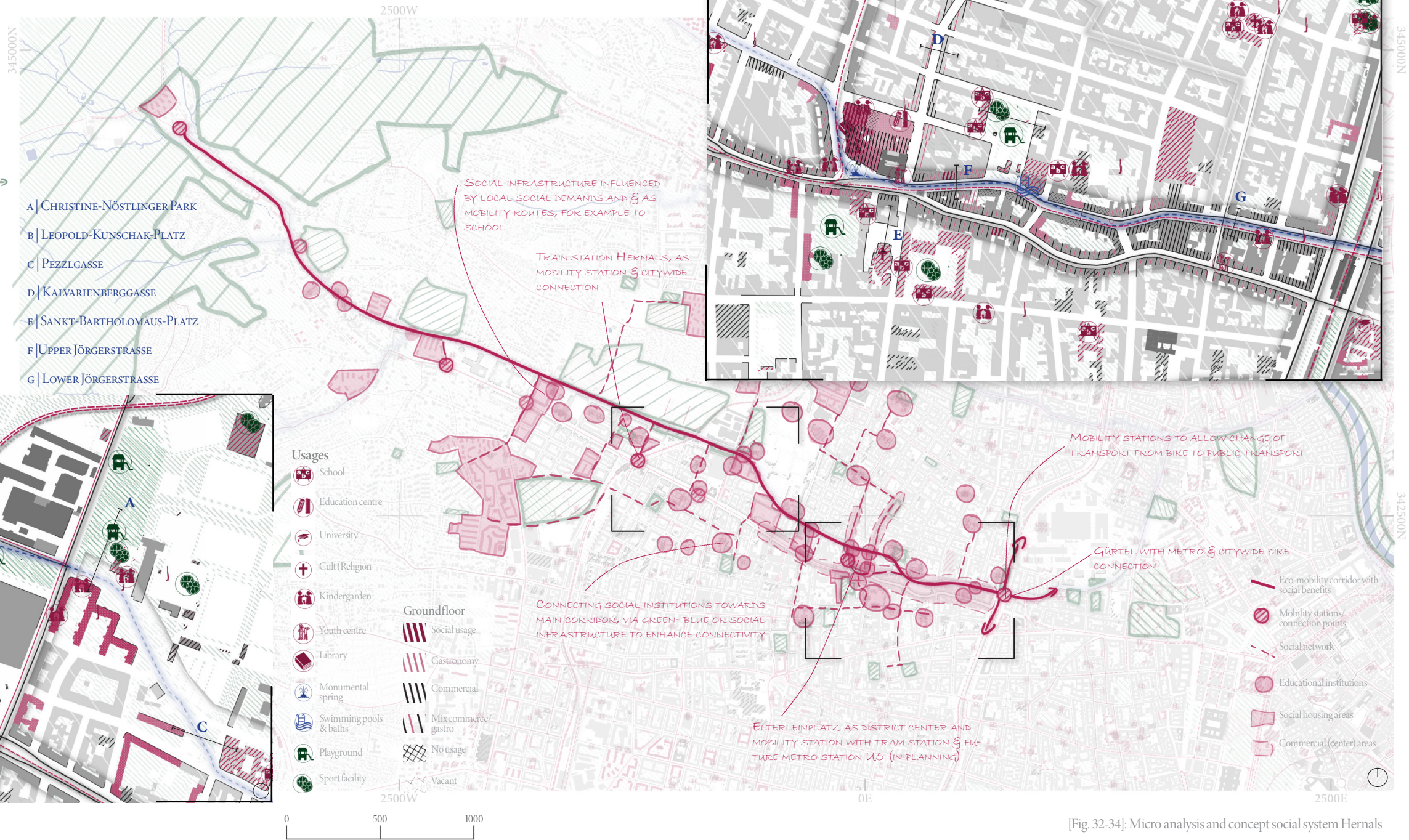
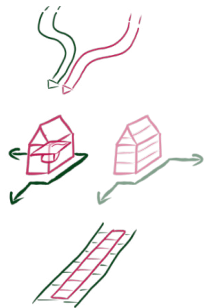


[Fig. 31]: Analysis social system Hernals

HERNHALS - THE SOCIAL SYSTEM

PRINCIPLES

- Aligning eco-mobility routes with ecosystem benefits
- Prioritization & connection of educational facilities
- Ecosystem as social infrastructure
- Fostering ecosystem stewardship



[Fig. 32-34]: Micro analysis and concept social system Hernhals

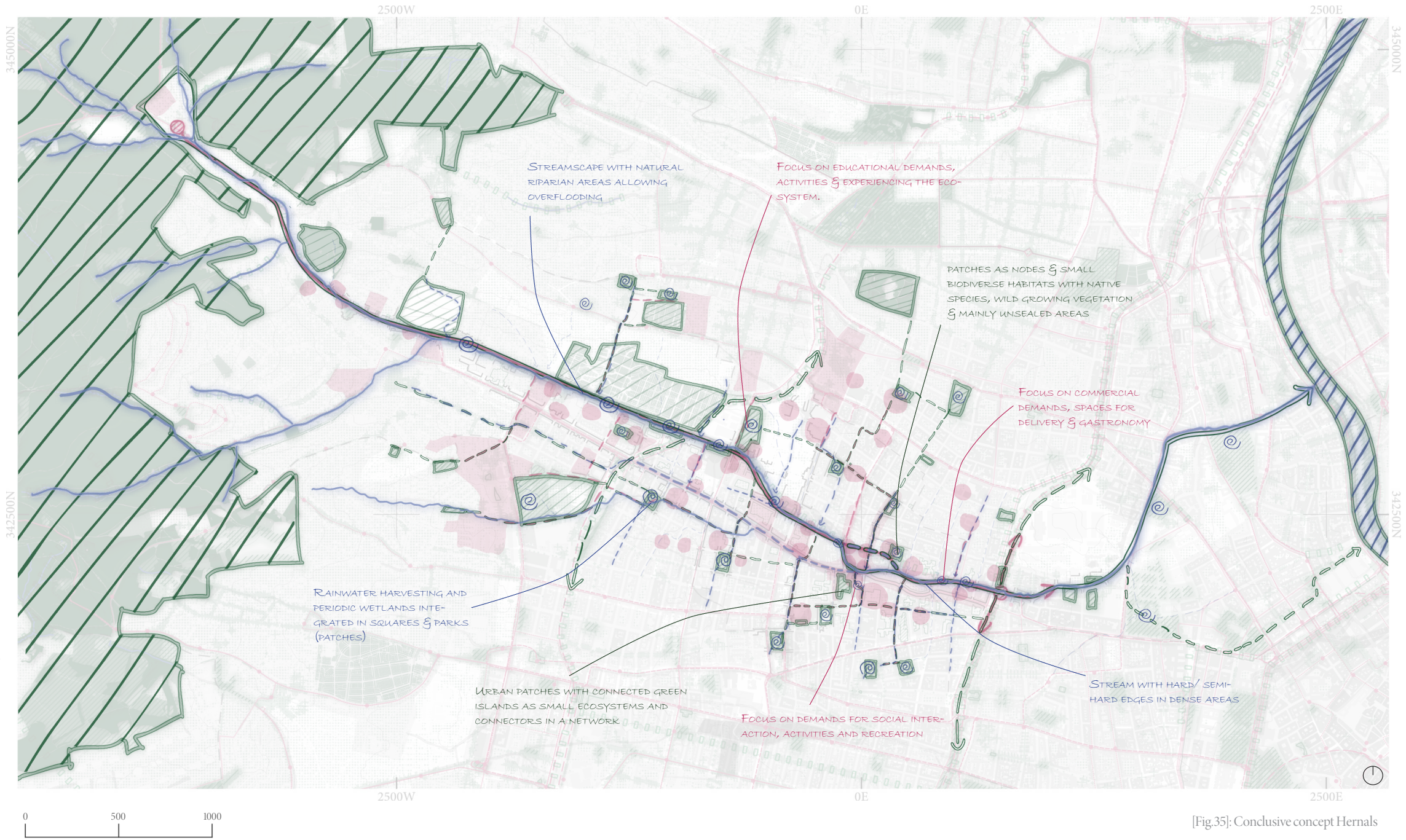
GREEN-BLUE-SOCIAL CORRIDOR FOR HERNALS

SYSTEMIC FOCUS



Legend

- Green corridor
- Planned ecosystem corridors
- Green connector
- Fostering/preserving ecosystem benefits
- Main drainage stream
- Complementary drainage network
- Retention/detention areas
- Drainage network of swales/canals
- Mobility corridor with social benefits
- Mobility stations/connection points
- Social benefits focus
- Educational/active focus
- Recreational/communal focus
- Productive & gastro focus



DESIGN EXPLORATION

[Fig.35]: Conclusive concept Hernal's

LAYERED DESIGN EXPLORATION VIA SECTIONS

THE PRESENT

LAYERED ANALYSIS & SYSTEMATIZATION

PRESENT SECTION & IMPRESSIONS

THE GREEN SYSTEM

Displaying finalized & ideal transition of urban landscape towards ecosystem integrated and climate resilient environment in street scale.


THE BLUE SYSTEM

Displaying water system related principles and its value and character in transitioned urban landscape. Showcasing potential state within rain intense periods.

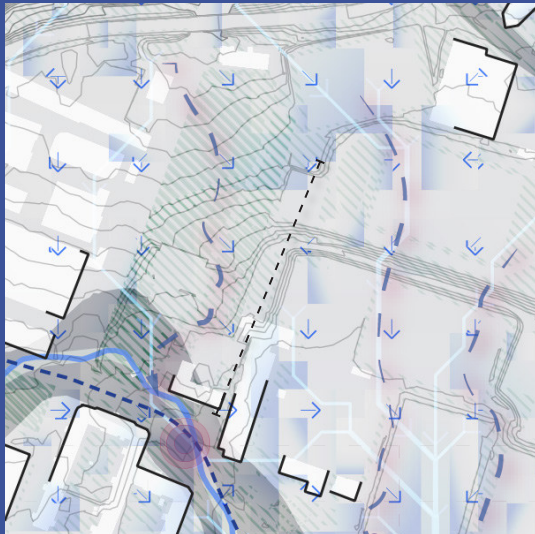
THE SOCIAL SYSTEM

Displaying social system related principles and social benefits and character in transitioned urban landscape. Showcasing potential usages.

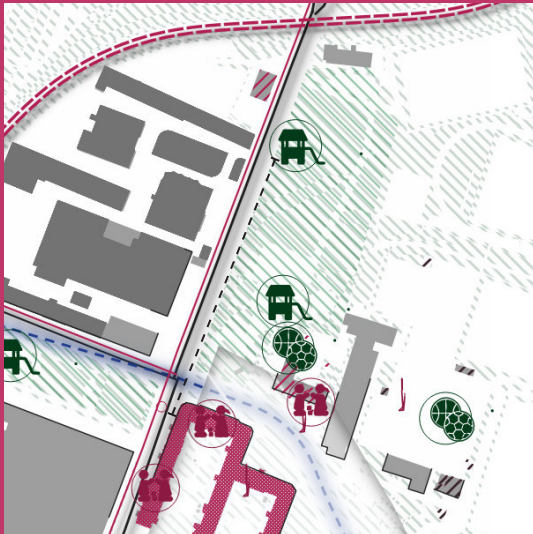




- spacious green park (patch)
- no important mobility connection
- potential & planned important green connection (corridor)

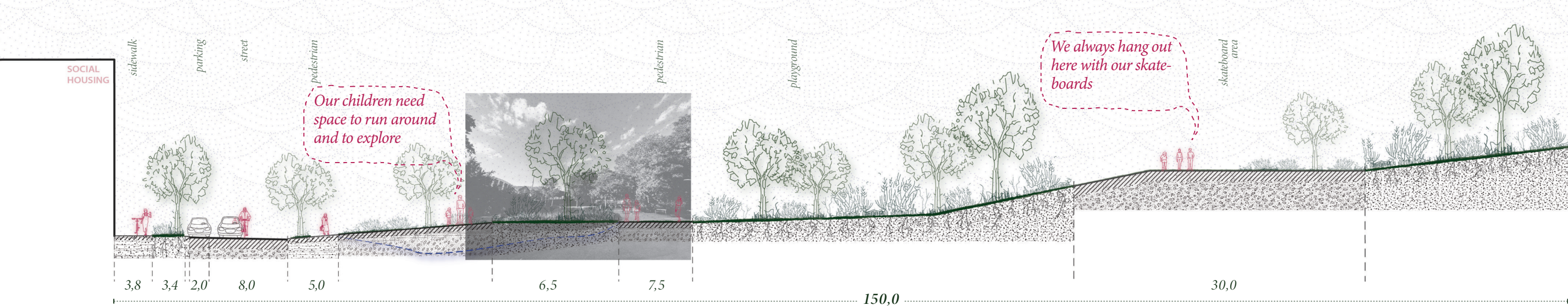


- terraced slope
- historical stream bed
- natural water run-off
- accumulation of water



- kindergarden (3)
- playground
- sport area
- social housing

DESIGN EXPLORATION



SYSTEMIC FOCUS



TIMEFRAME



Shared communal space

Shared space & parking space reduction

Reduce space for individual transport & private usage of green areas

Breathing surfaces

Stop sealing surface!

Construction stop of paved/ sealed surfaces & reducing paved areas where possible

Green corridor

Natural stream landscape as green corridor

Space for waterstream landscape with green shores as green corridor to foster biodiversity

Ecological patches

Terraced mounted basins

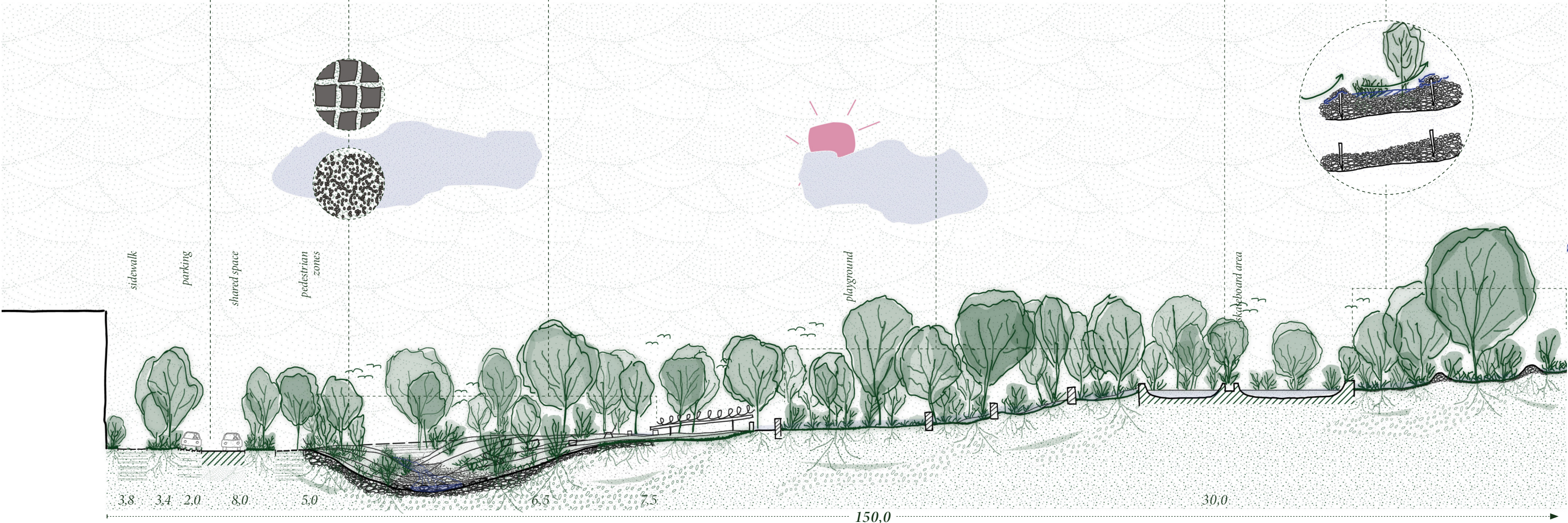
(Vegetated) gabions or stone barriers used for terracing slope to fixate basins/ erosion (swales)

Multifunctional infrastructure

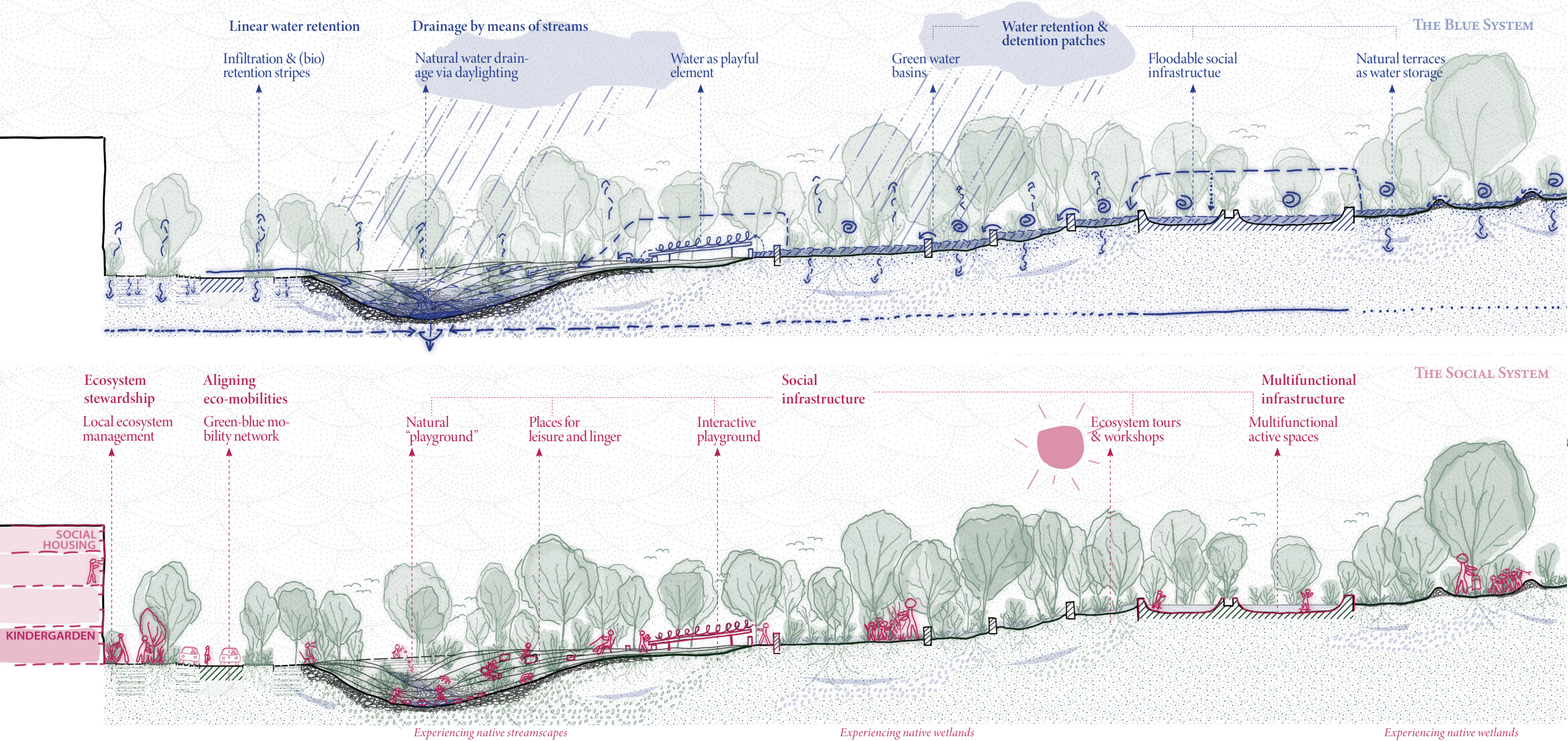
Terraced living slopes

Terraces through relocation of local soil and stones to form basins (nature-based long term approach).

THE GREEN SYSTEM



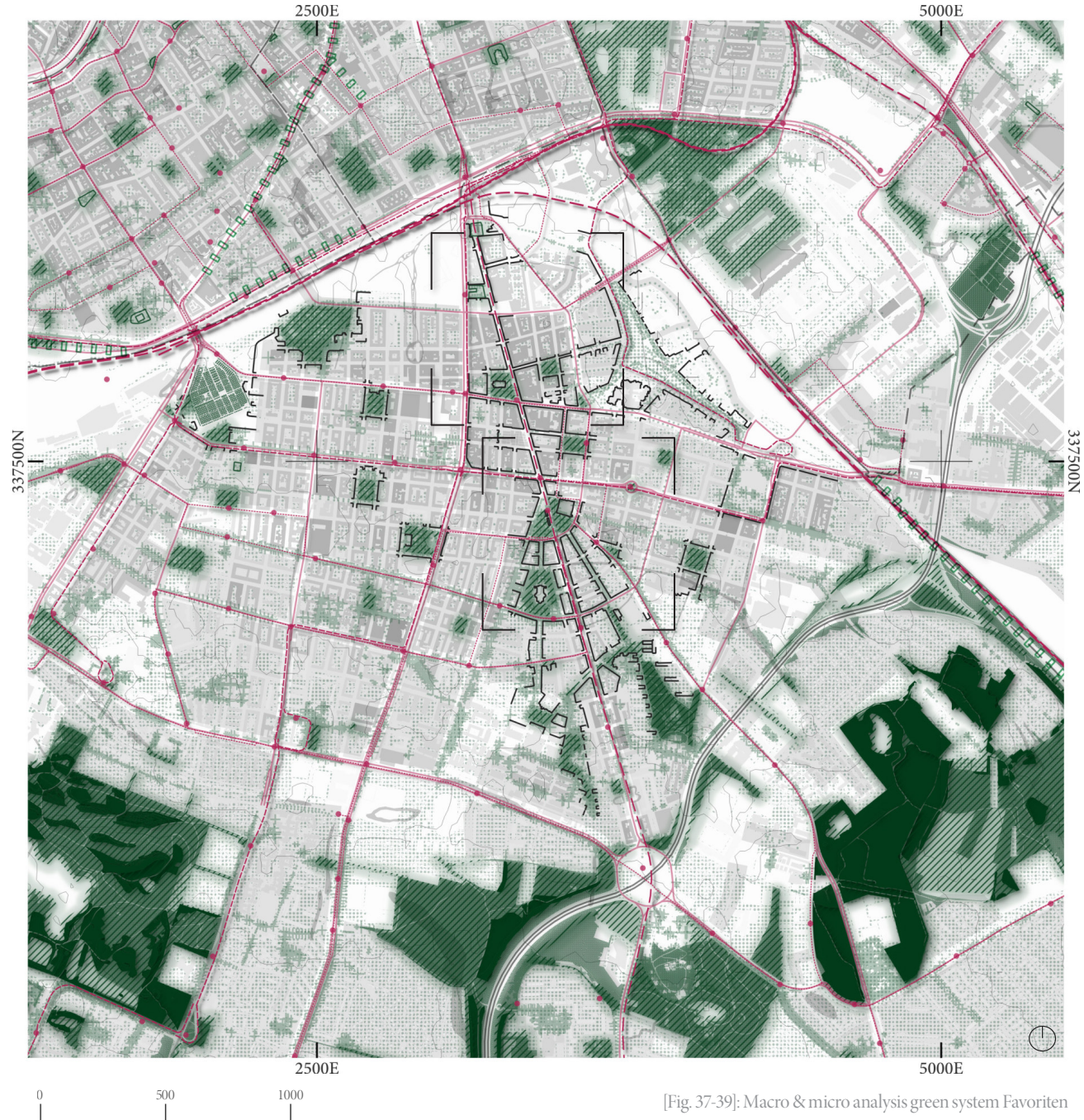
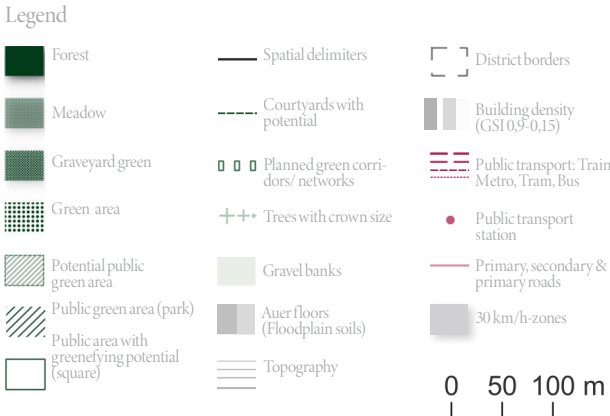
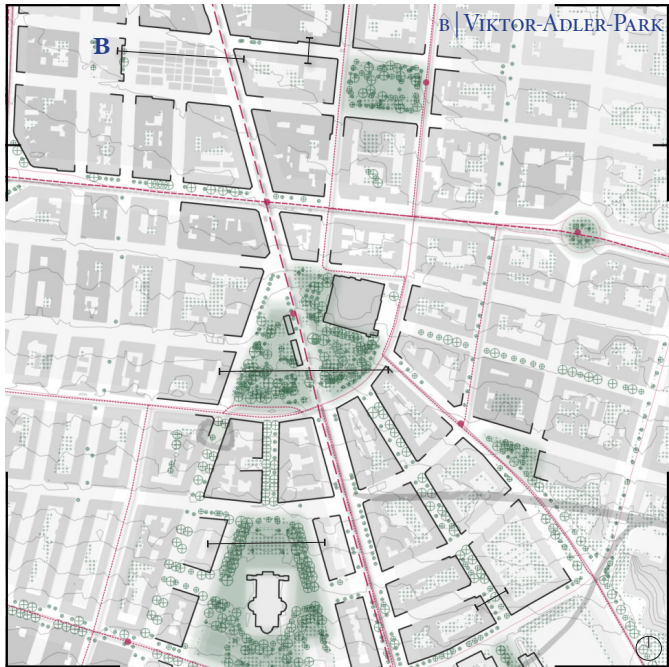
DESIGN EXPLORATION





[Fig 36]: Collage of Favoriten reveals spatial attributes and deficiencies, as part of my field trip in Vienna.

FAVORITEN - THE GREEN SYSTEM



[Fig. 37-39]: Macro & micro analysis green system Favoriten

FAVORITEN - THE GREEN SYSTEM

PRINCIPLES

- Multitude of green routes to ensure ecosystem connectivity



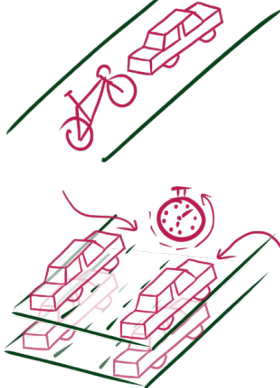
- Eco-mobility concept to reduce public space captured by cars



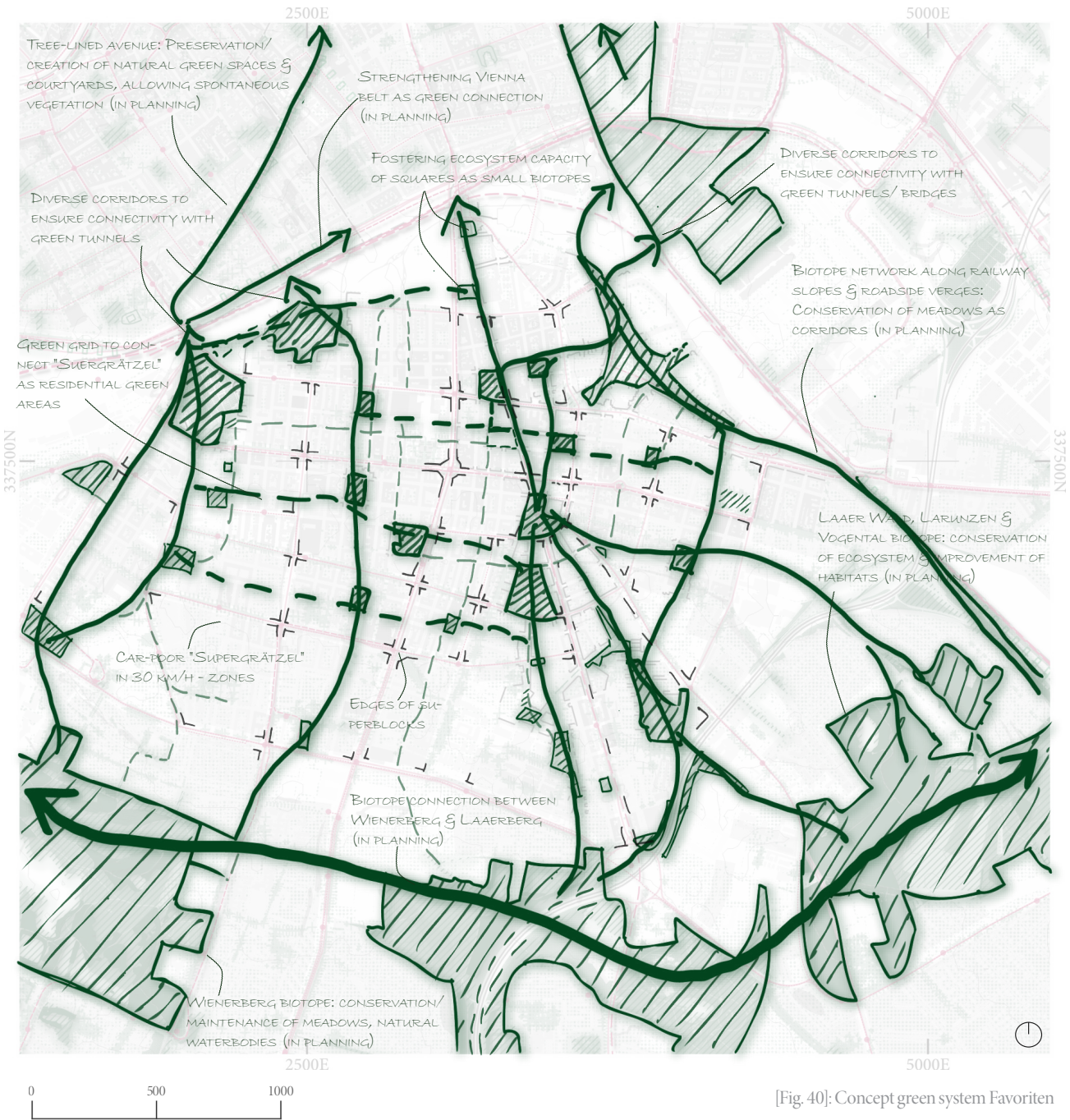
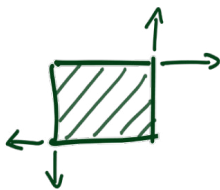
- Green connectors connecting green patches & "Supergrätzl" through green grid



- Car-poor supergrätzl with shared streets & temporary/ collective parking

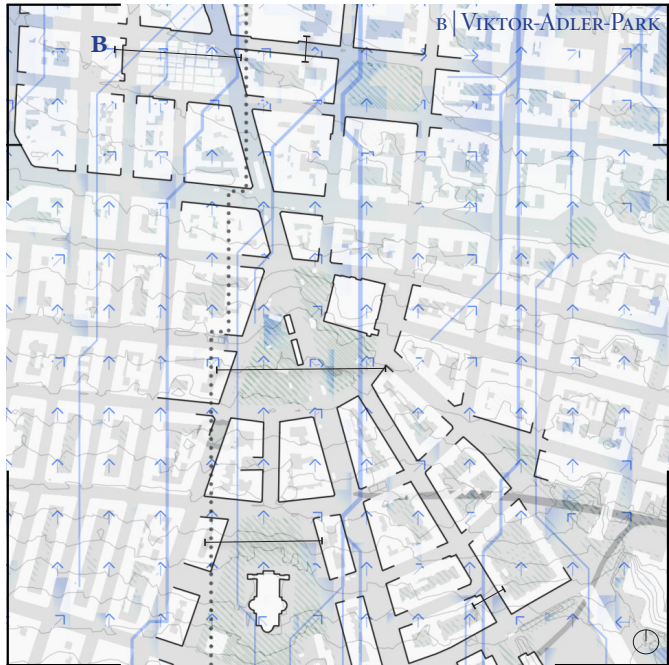
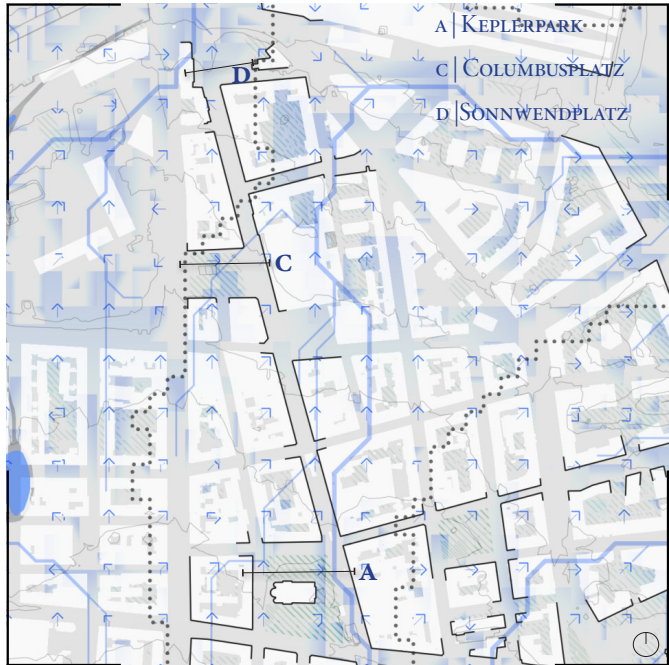


- Ecosystem patches as nodes in a network

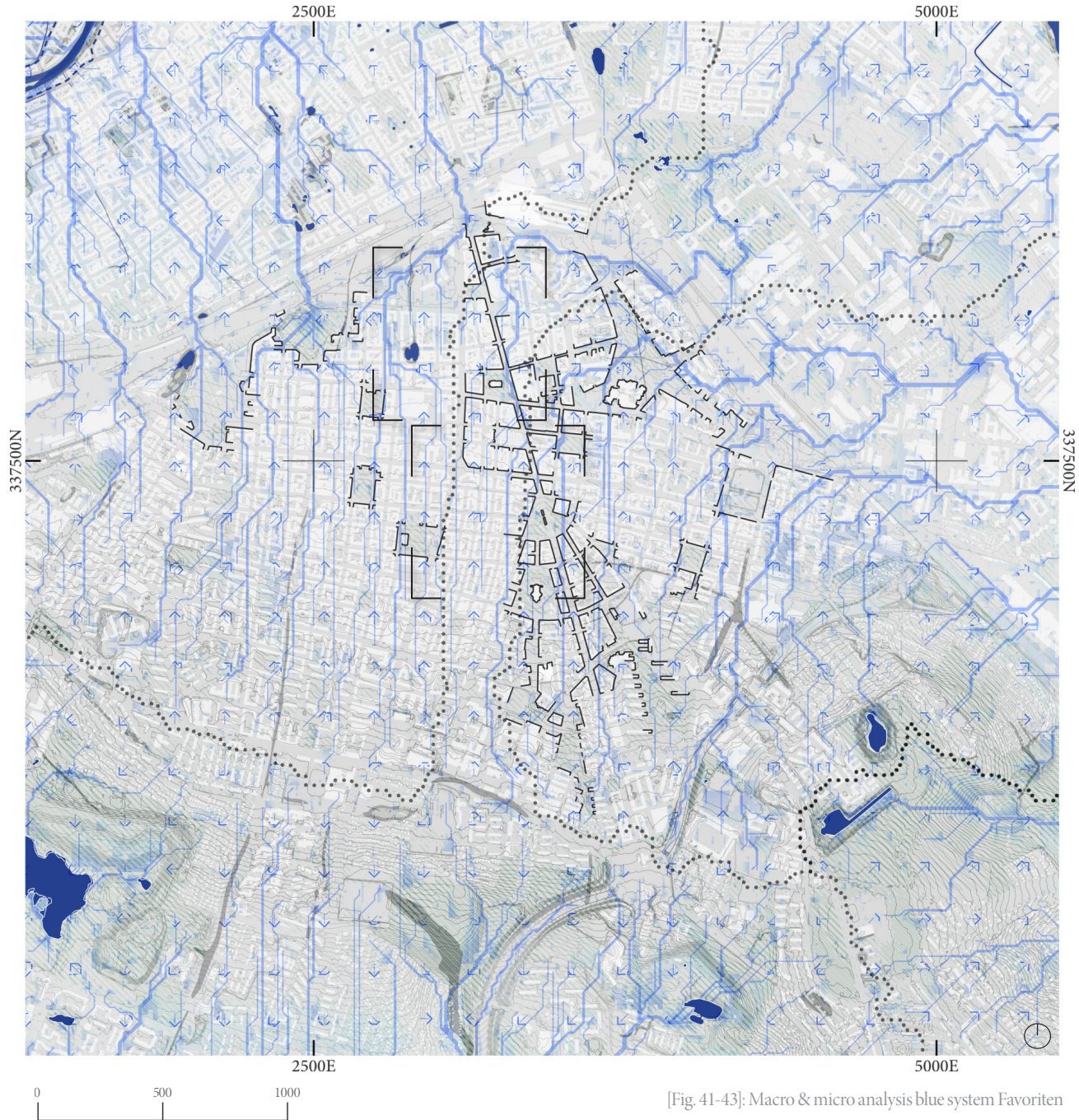


[Fig. 40]: Concept green system Favoriten

FAVORITEN - THE BLUE SYSTEM



- Legend
- Vienna canal/ streams
 - Run-off floating direction
 - Run-off floating patches
 - Topography
 - Catchment areas
 - Course & accumulation of water based on topography & distribution
 - Historic course of stream (1630)
 - Gravel banks
 - Auer floors (Floodplain soils)
 - Green areas

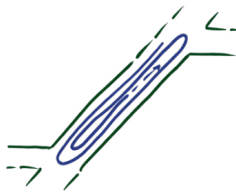
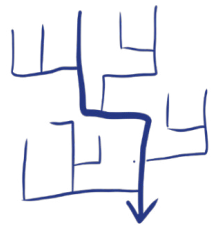


[Fig. 41-43]: Macro & micro analysis blue system Favoriten

FAVORITEN - THE BLUE SYSTEM

PRINCIPLES

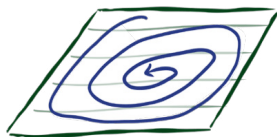
- Superficial rainwater drainage by guiding the water through the public space with canals, swales, etc.
- Water storage in Supergrätzel streets, when topography allows accumulation of water



- Canals & swales as means of guiding water, with hard edges in dense area & open sole to allow water to infiltrate where possible
- Use of accumulation (in patches or corridors) to change direction of natural water flow

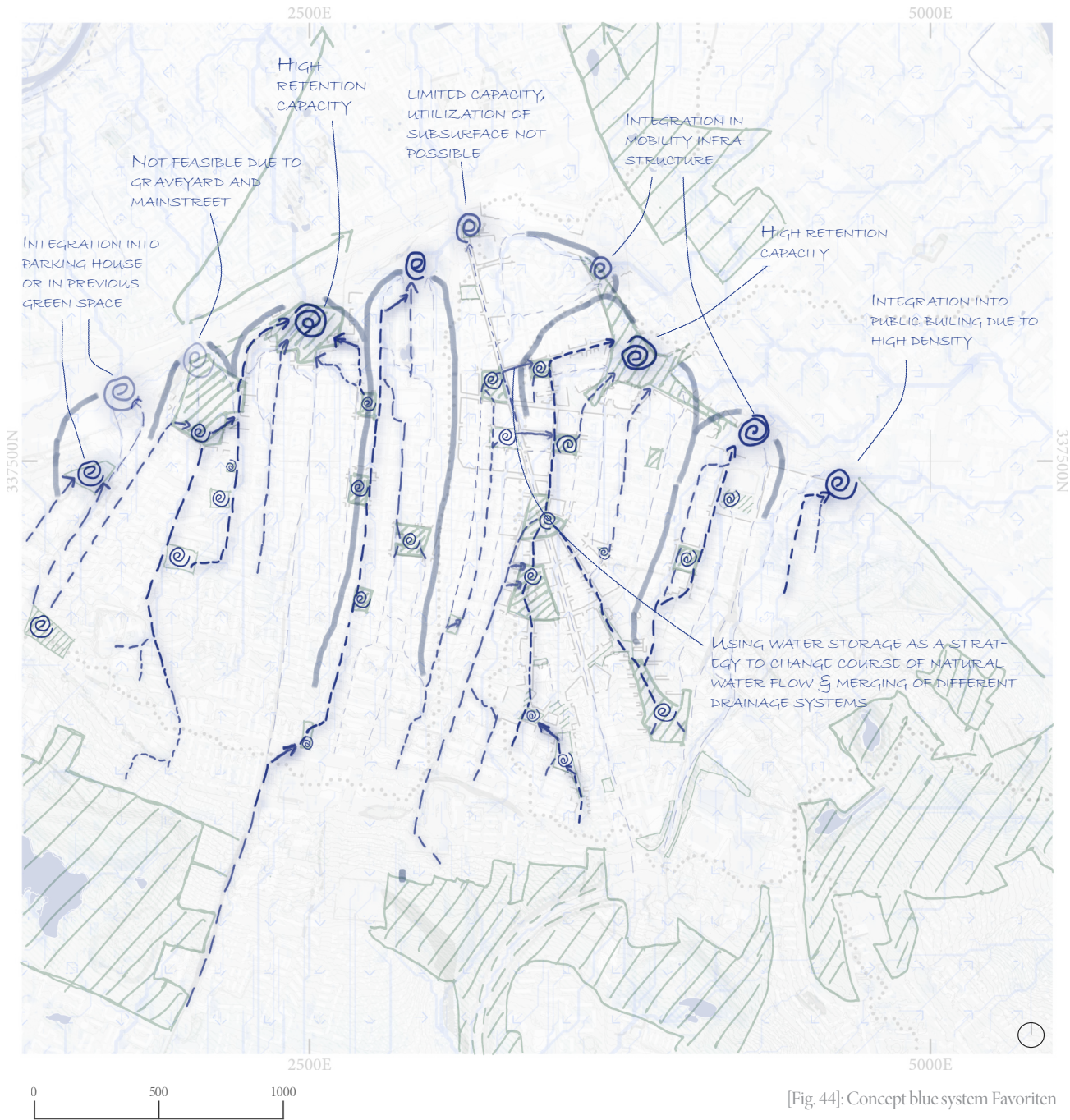


- Parks/ squares (patches) as water accumulation points, to store & retain water in between



Legend

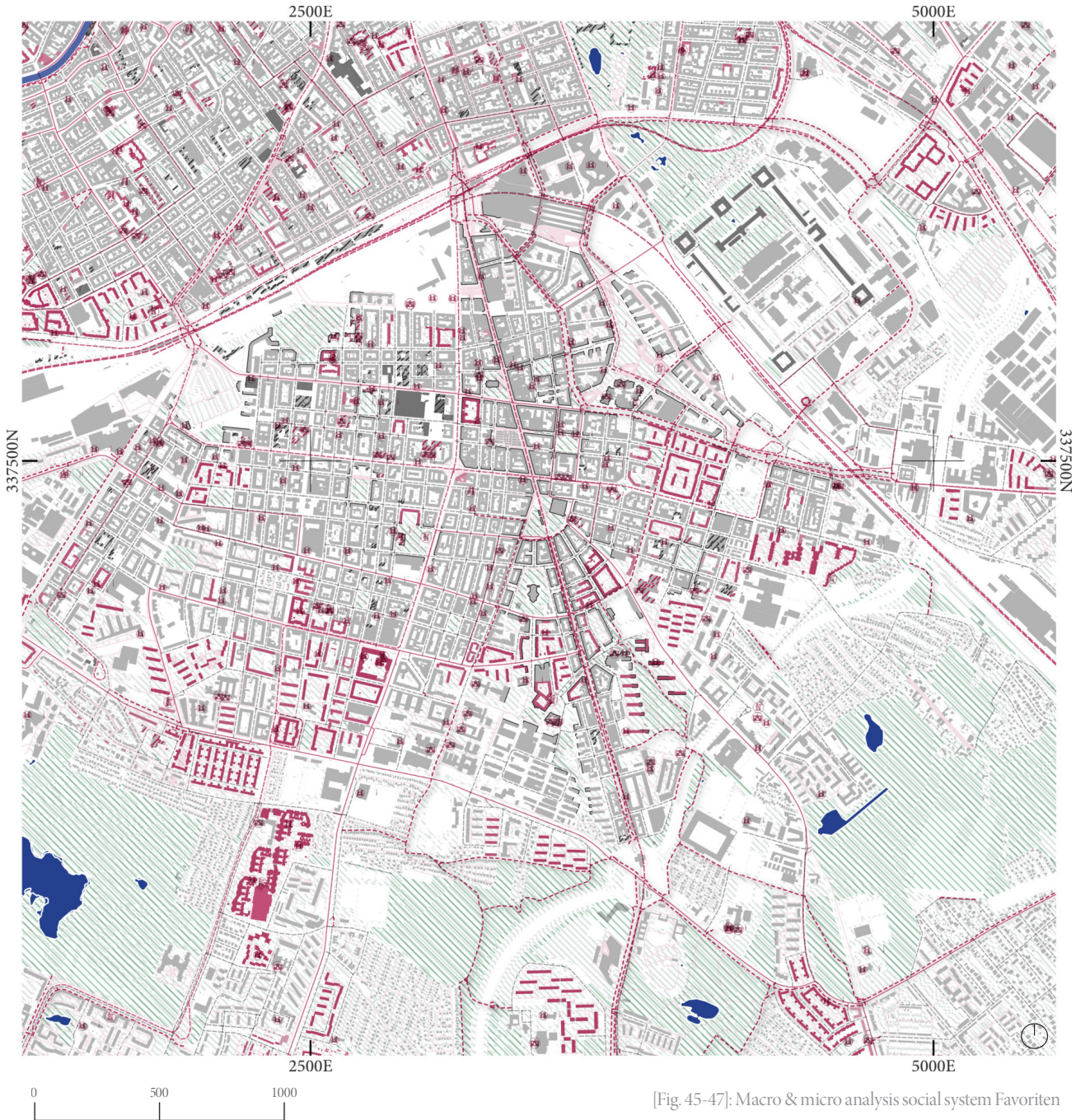
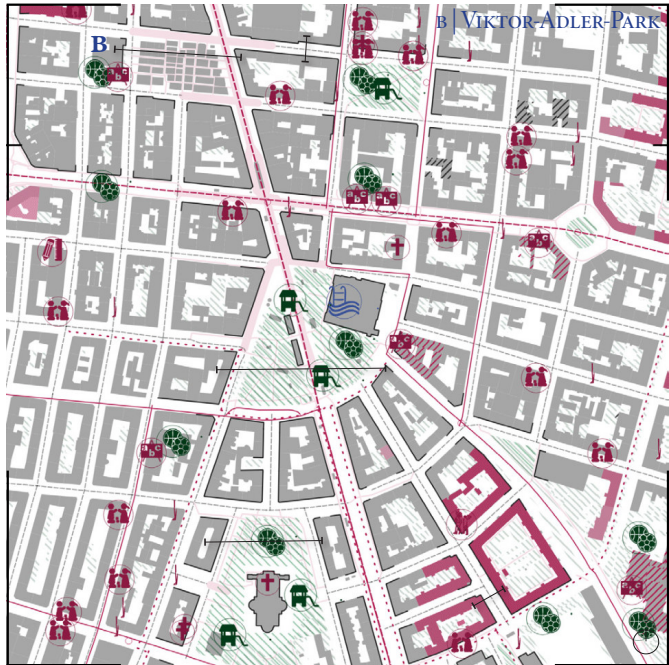
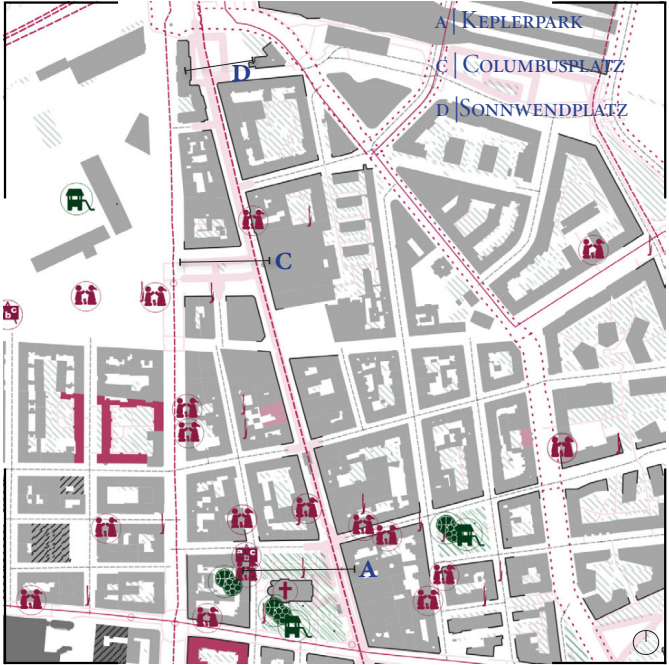
- ⊙ Main (final) retention areas
- ⊙ Retention areas
- Main drainage network
- Minor drainage network (possibly later added)
- Storage for change of flow direction



DESIGN EXPLORATION

[Fig. 44]: Concept blue system Favoriten

FAVORITEN - THE SOCIAL SYSTEM

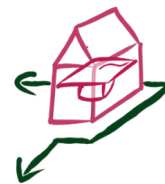


[Fig. 45-47]: Macro & micro analysis social system Favoriten

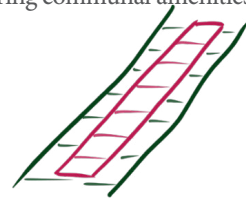
FAVORITEN - THE SOCIAL SYSTEM

PRINCIPLES

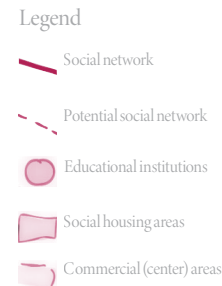
- Aligning ecosystem benefits with social benefits as social infrastructure
- Ecosystem as just instrument through prioritizing & connecting educational institutions



- Reallocating public space to function as both ecosystem and social infrastructure, connecting and offering communal amenities.
- Ecosystem as just instrument through prioritizing & connecting social housing neighbourhoods and upgrading living conditions



- Ecosystem maintenance & stewardship through local residents & social/ public institutions



[Fig. 48]: Concept social system Favoriten

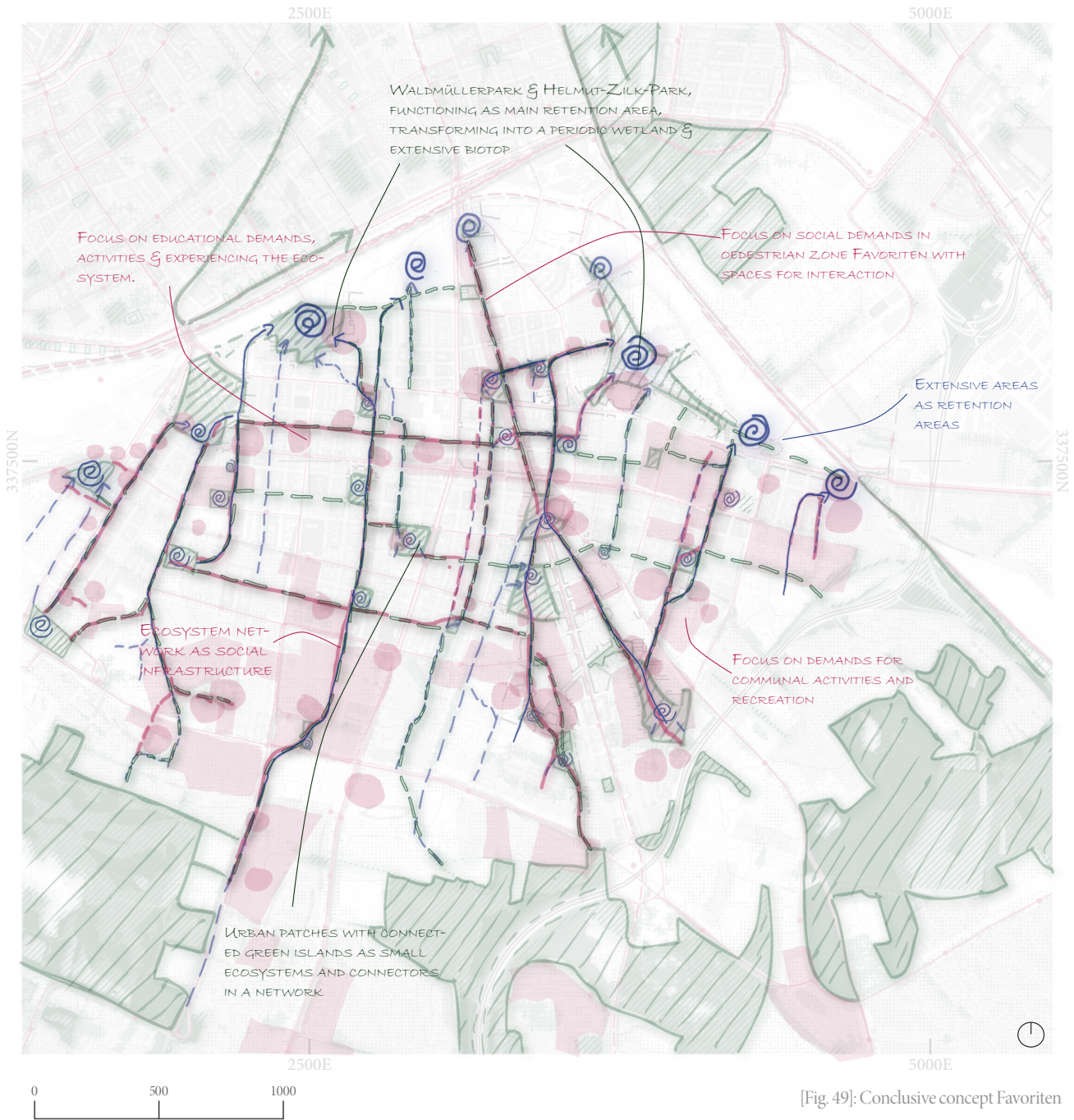
GREEN-BLUE-SOCIAL GRID FOR FAVORITEN

SYSTEMIC FOCUS

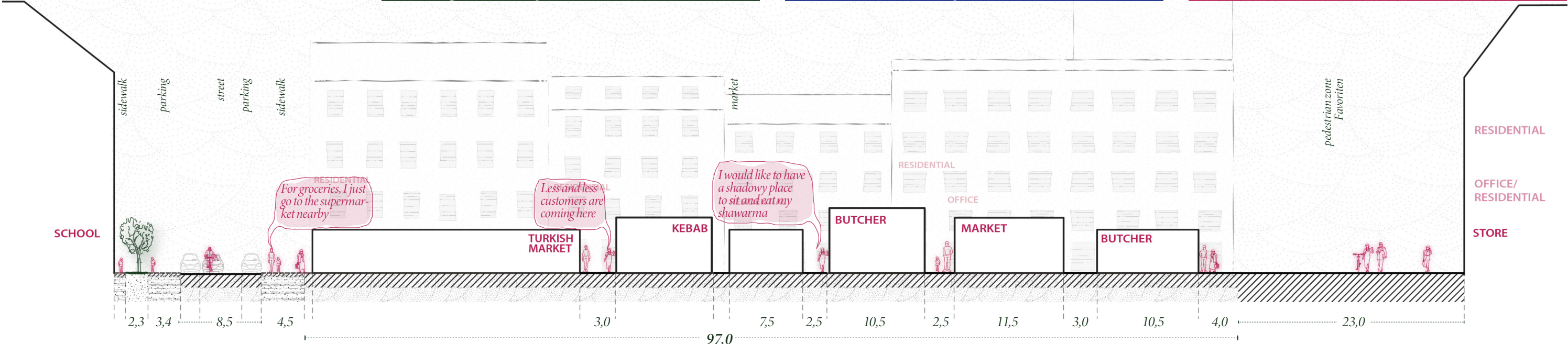
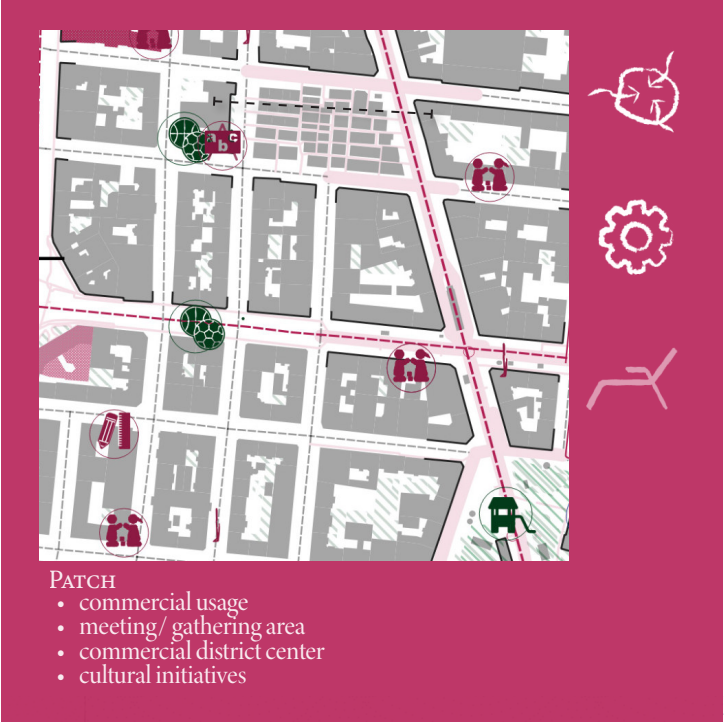
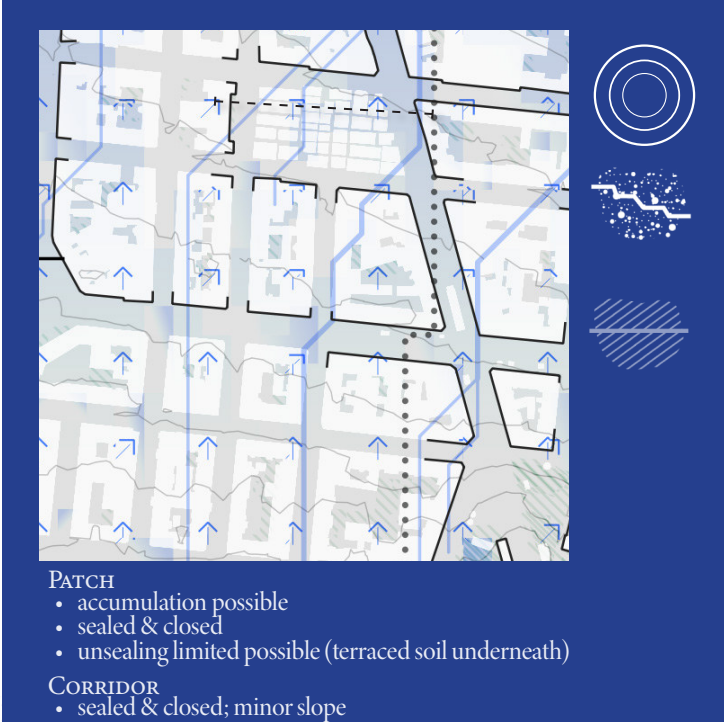


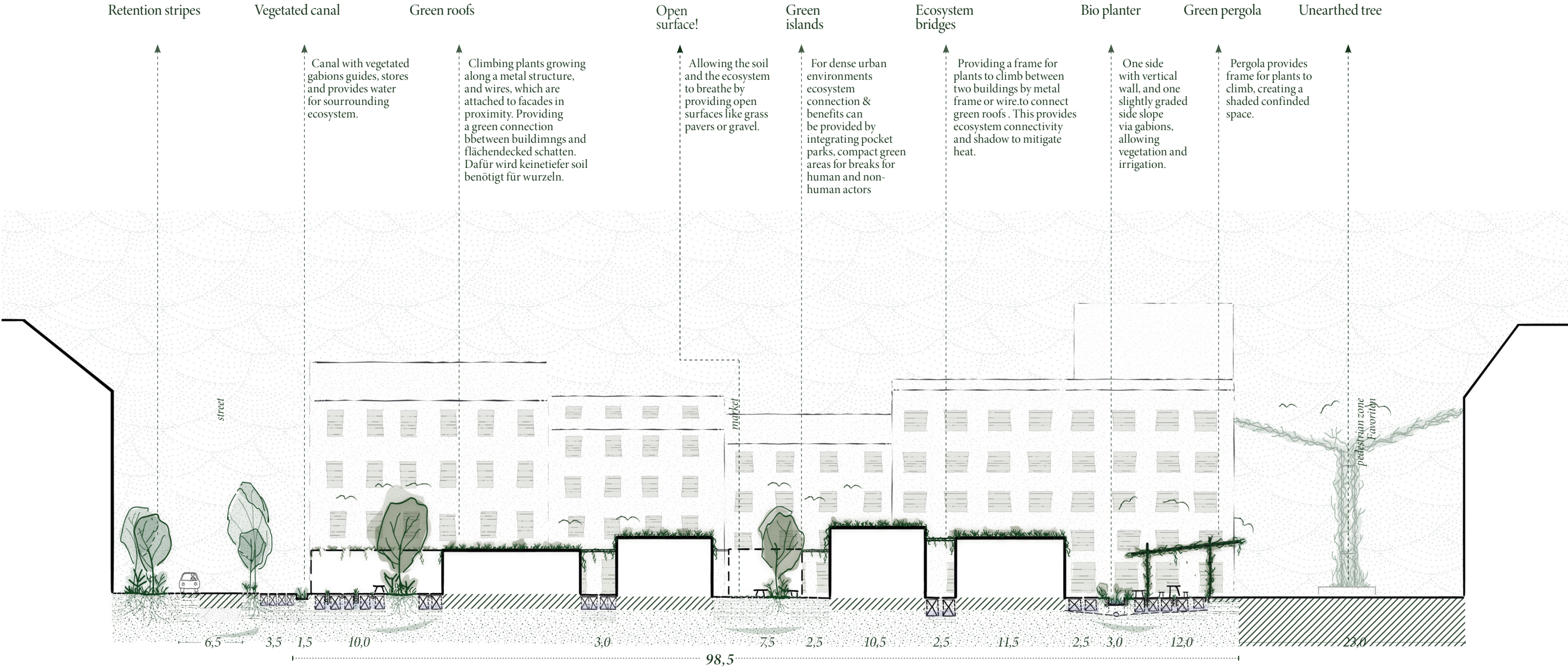
Legend

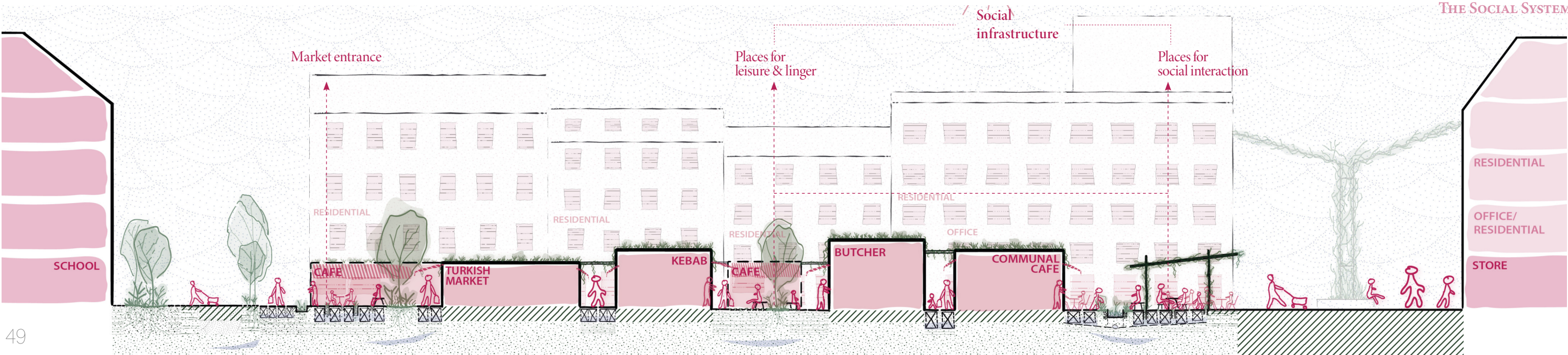
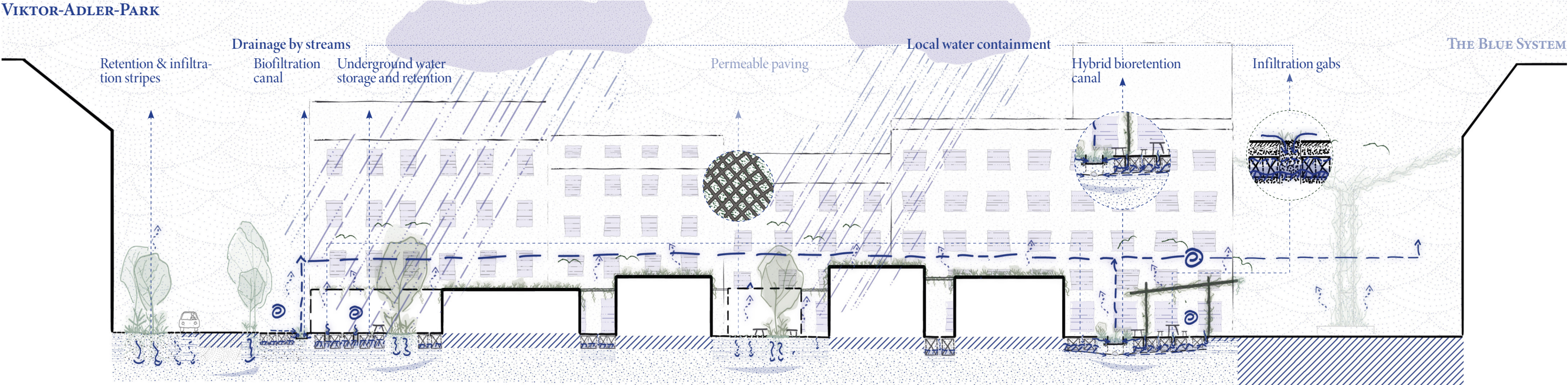
Green corridor	Main drainage	Mobility corridor with social benefits
Ecosystem connection	Complementary drainage network	Social benefits focus
Green connector (islands, less continuous)	Retention/detention areas	Educational/active focus
Fostering/preserving ecosystem benefits	Drainage network of swales/canals	Recreational/communal focus
		Productive & gastro focus



[Fig. 49]: Conclusive concept Favoriten







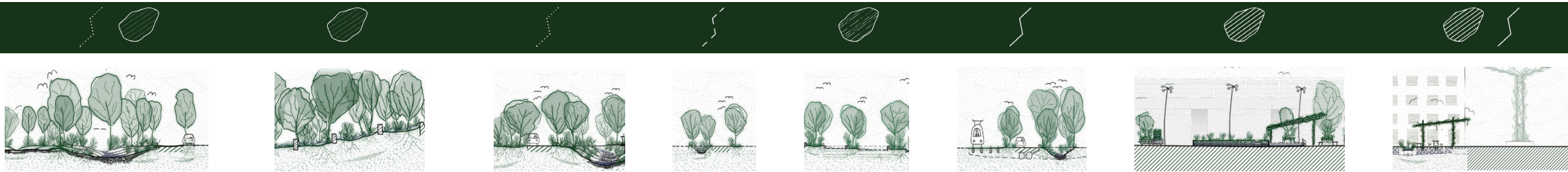
DESIGN PRINCIPLES AS ELEMENTS OF A CLIMATE-RESILIENT VIENNA

1. QUESTION

URBAN
MORPHOLOGY

GREEN SYSTEM:
IS IT A PATCH OR/
AND A CORRIDOR?

→ Focus on public &
semi-public spaces within
evaluated urban densities

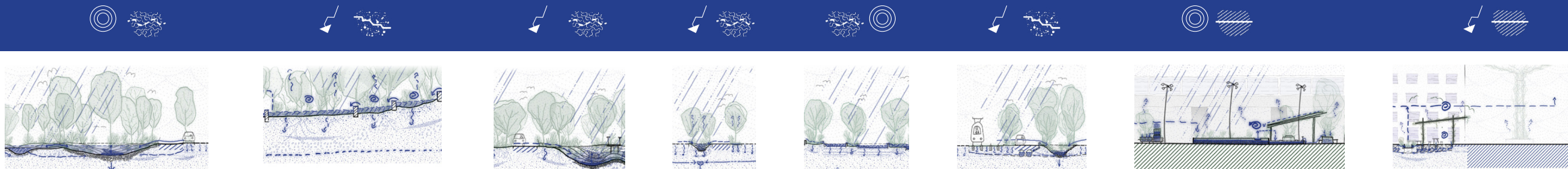


2. QUESTION

LANDSCAPE
MORPHOLOGY

BLUE SYSTEM:
WHAT IS THE HYDRO-
MORPHOLOGICAL TYPE?

→ Focus on topography &
landscape history



3. QUESTION (FINE TUNING)

SOCIAL
MORPHOLOGY

SOCIAL SYSTEM:
WHAT IS THE SOCIAL
VALUE?

→ Focus on areas with
low income and social
housing



DESIGN ELEMENTS



[Fig. 50]: Collage of a transitioned & climate resilient Vienna



[Fig. 51]: Collage of a transitioned & climate resilient Vienna

CONCLUSION & REFLECTION

The background of the slide is a topographic map with a blue color scheme. The map features a dense network of contour lines and a complex river system. A prominent river flows from the upper left towards the lower right. In the lower right quadrant, there is a large, irregularly shaped area that appears to be a lake or a reservoir, surrounded by a darker blue region. The overall texture of the map is intricate, with many small details visible in the contour lines and water bodies.

HOW CAN A JUST CLIMATE RESILIENT TRANSITION IN VIENNA BE FOSTERED BY REIMAGINING THE GREEN-BLUE SYSTEM?

RQ1 CONCEPTUAL FRAME:

CLIMATE RESILIENCE TRANSITION

How are spaces and systems that influence a climate resilient transition identified?

JUST TRANSITION

What are methods to ensure an enviromen-
tally just transition of the green-blue system
with benefits for all actors?

RQ2 ANALYSIS:

ACCESS POINTS WITHIN SOCIO-ECOLOGICAL SYSTEM

How can the landscape and urban morphol-
ogy disciplines help to unfold and design the
green-blue system as part of the socio-ecologi-
cal system towards urban climate resiliency?

- What is and was the role of the green-blue
system of Vienna and how do other systems
interrelate?
- What are constraining factors in Vienna due
to engineered resilience and vulnerability, in
light of a just climate resilient transition?

RQ4: DESIGN

REIMAGINATING THE GREEN-BLUE SYSTEM

How can the green-blue system be reima-
gined in Vienna for a climate resilient system?

Fostering a just and climate-resilient transition in Vienna relies on reimagining the green-blue system:

- through a systemic and integrated approach.
- harmonizing ecosystem and societal benefits.
- making societal & individual benefits comprehensible to the public.
- a metropolitan perspective.
- a collaborative green-blue framework that encourages bottom-up actions & prioritizes local knowledge.
- considering interrelations between urban and landscape elements.
- customizing interventions based on location-specific demands.

Future

- Planning for different outcomes and adaptable interventions, considering different scenarios.
- addressing different actors and distributing tailored roles & tasks

A topographic map of a region, likely in the Pacific Northwest, showing intricate contour lines and several large water bodies. The map is rendered in shades of blue and white, with the text 'THANK YOU!' overlaid in white. The water bodies include a large one in the bottom right, a smaller one in the middle right, and several others scattered throughout the landscape.

THANK YOU!

