

Hybrid Hydro- Habitat

Maayan Daniel



I. Problem Statement

II. Hypothesis

III . Research Question

IV. Factual/Technological Research

V. Spatial/Architectural Research

VI. Project Proposal

VII. Conclusion

Content

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VI. Project Proposal

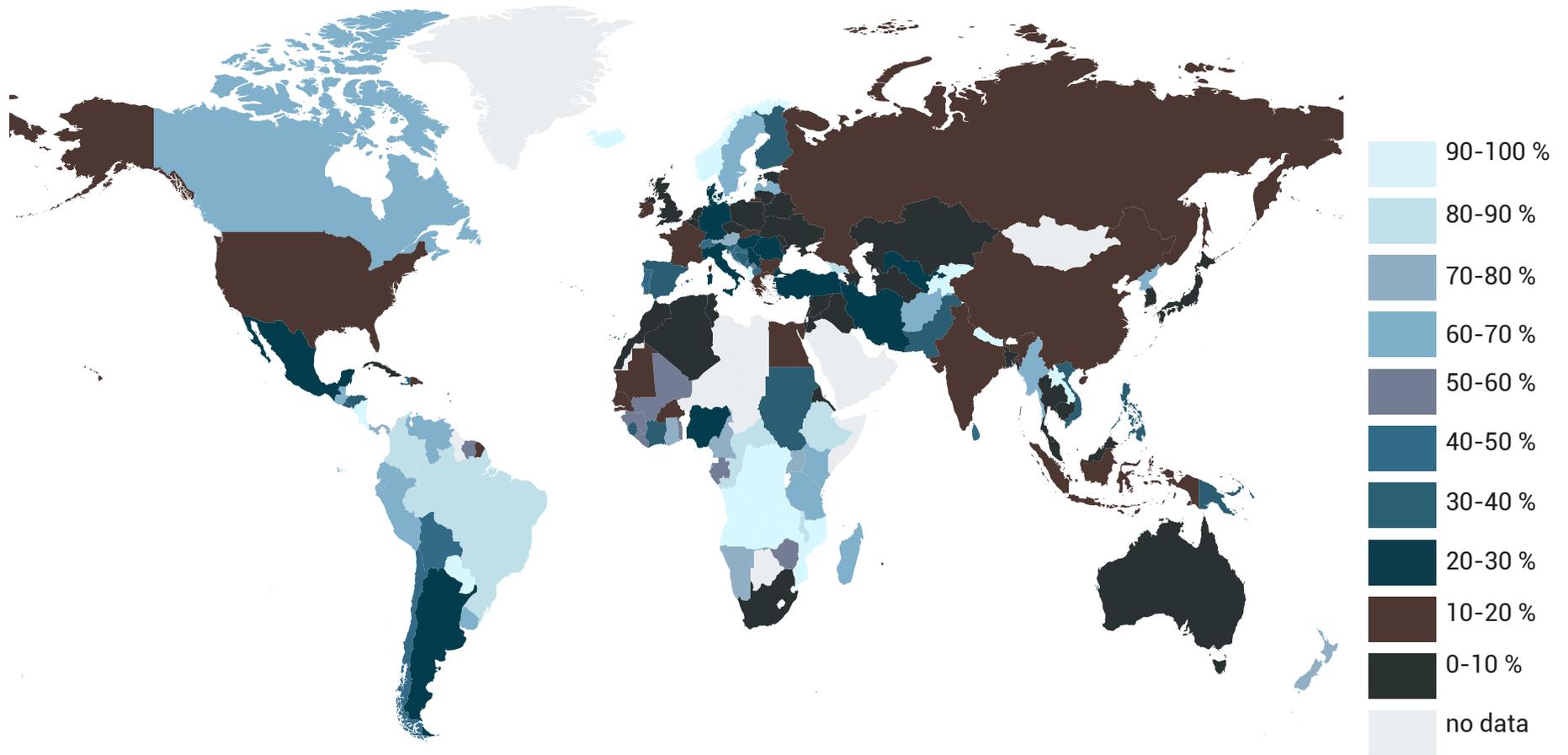
VII. Conclusion

Content

Energy Perspective

Problem Statement

Percentage of energy production from renewable resources

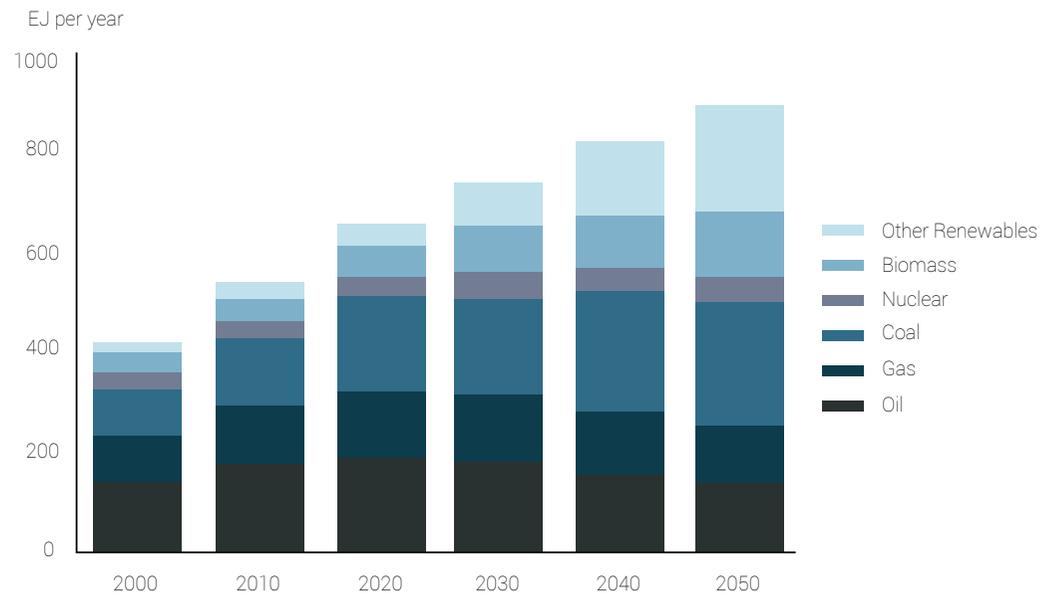


Source: EIA - International Energy Statistics

Energy Perspective

Energy consumption by energysource (2000 - 2050)

"Eventually, locally developed alternative supplies -- biofuels, wind, and thermal solar -- also contribute on a much greater scale than before (Shell, 2008)."



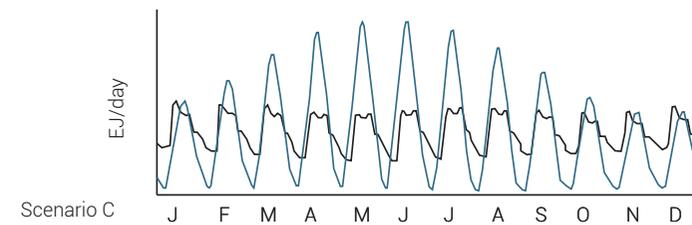
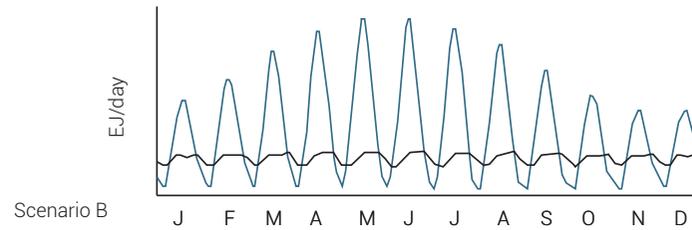
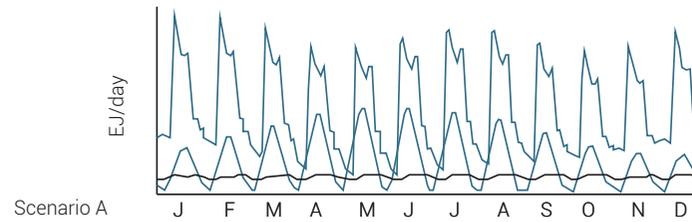
Source: Shell, 2008

Energy Perspective

Intermittency Graph

2050

— Wind and Solar Energy Supply
— Energy Demand



Source: F.M. Mulder (2014)

Energy Perspective

Storage amount for 2030 and 2050

Table I. Summary of energy storage demands in demand scenarios I, II, and III, based on the model described and GEA prognosis for average renewable energy generation in 2030 and 2050.

Demand Scenario	Short term storage demand 10^{-2} EJ/day		Long term, seasonal, storage demand, EJ	
	2030	2050	2030	2050
I	2-8	5-9	16.5	108
II	2-9	3-20	10.7	27.5
III	1.5-8	1-14	10.8	29.2

Source: F.M. Mulder, 2014

Energy Perspective

Urbanisation Perspective

Problem Statement

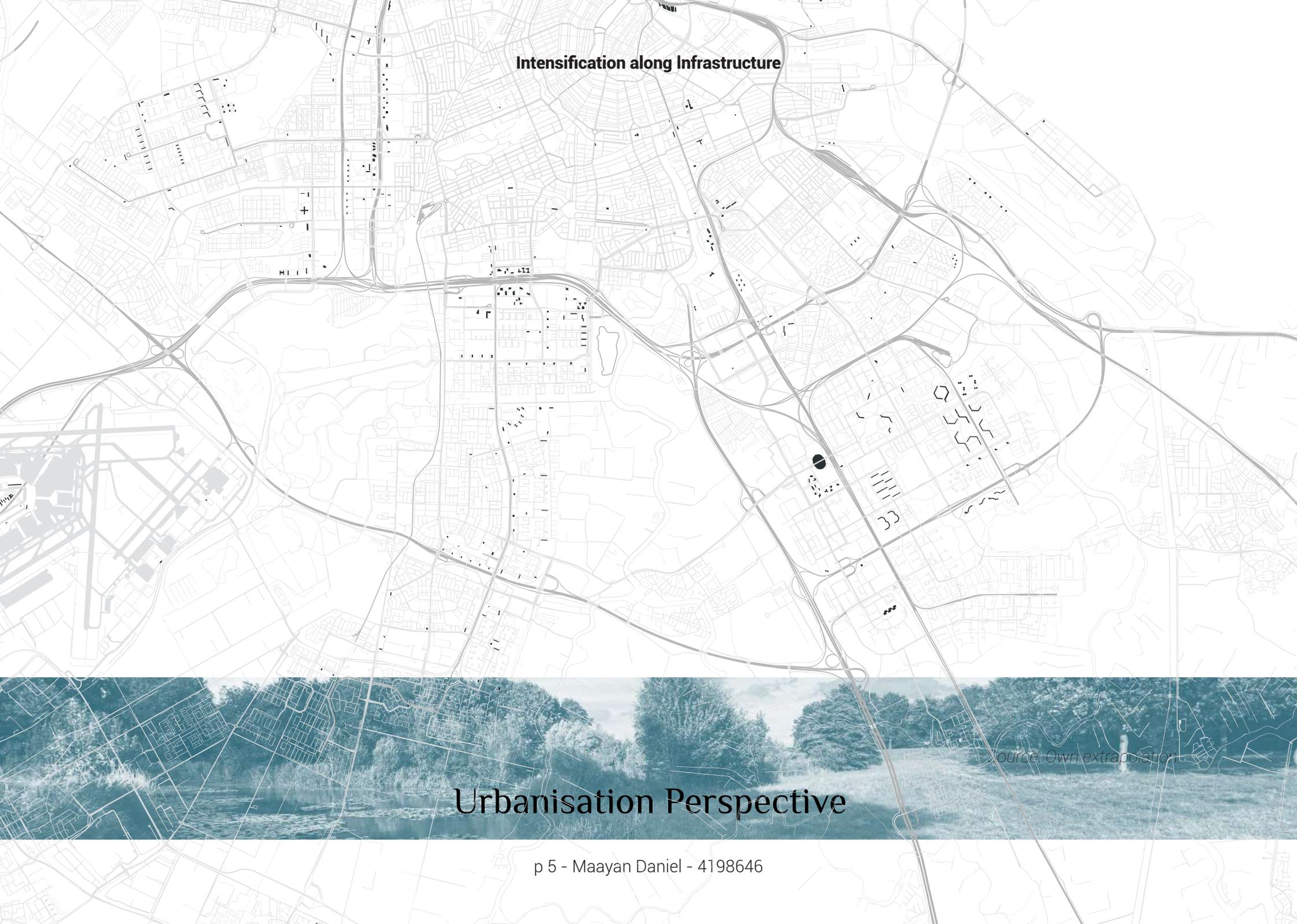


Urbanisation GE Scenario

Source: VU University of Amsterdam, 2012



Urbanisation Perspective



Intensification along Infrastructure

Source: Own extrapolation

Urbanisation Perspective



Intensification along Infrastructure

Source: Own Extrapolation



Urbanisation Perspective

Environmental Perspective

Problem Statement

Current Availability of Salt Groundwater, 2018

Depth underneath groundlevel
1000 mg/L Chloride-limit

- 0 - 5 m.
- 5 - 10 m.
- 10 - 25 m.
- 25 - 50 m.
- 50 - 100 m.
- >100 m. BGS



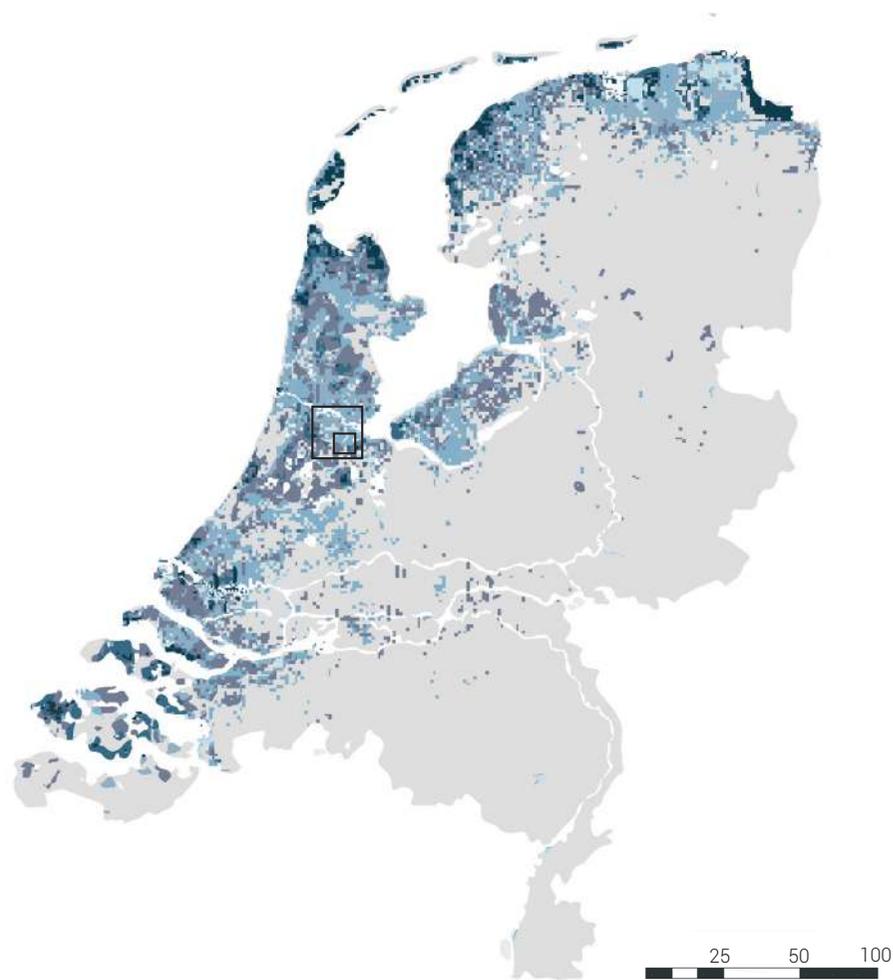
Source: Deltares (2018)

Environmental Perspective

Freshening/Salinization 2050

Difference in mg Cl/litre

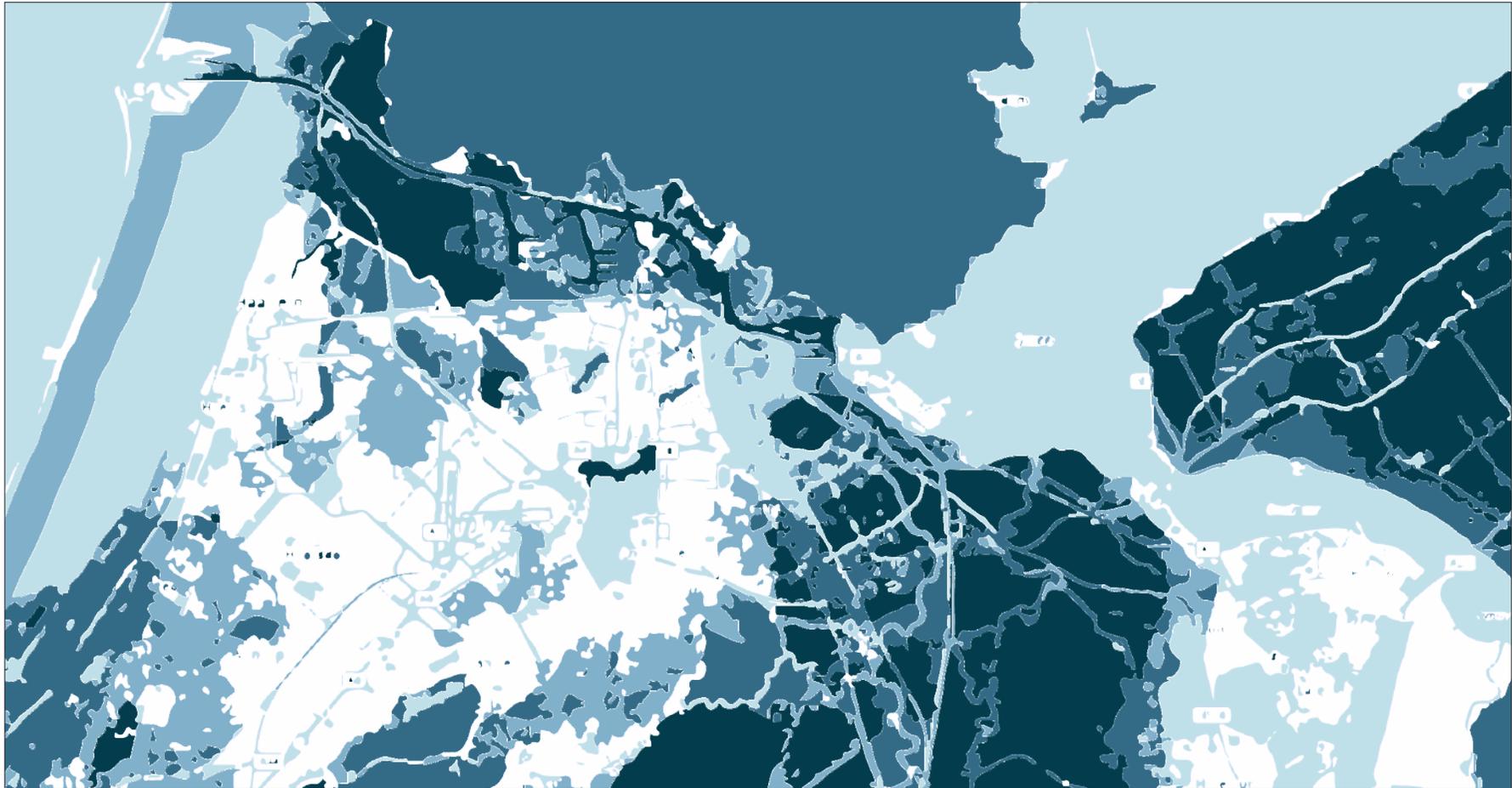
- Strong Salinization (> 3000)
- Salinization (1000 - 3000)
- Light salinization (100 - 1000)
- No change expected (0)
- Light freshening (-1000 - -100)
- Freshening (-1000 - -3000)
- Strong Freshening (>-3000)



Source: Deltares (2009/2010)

Environmental Perspective

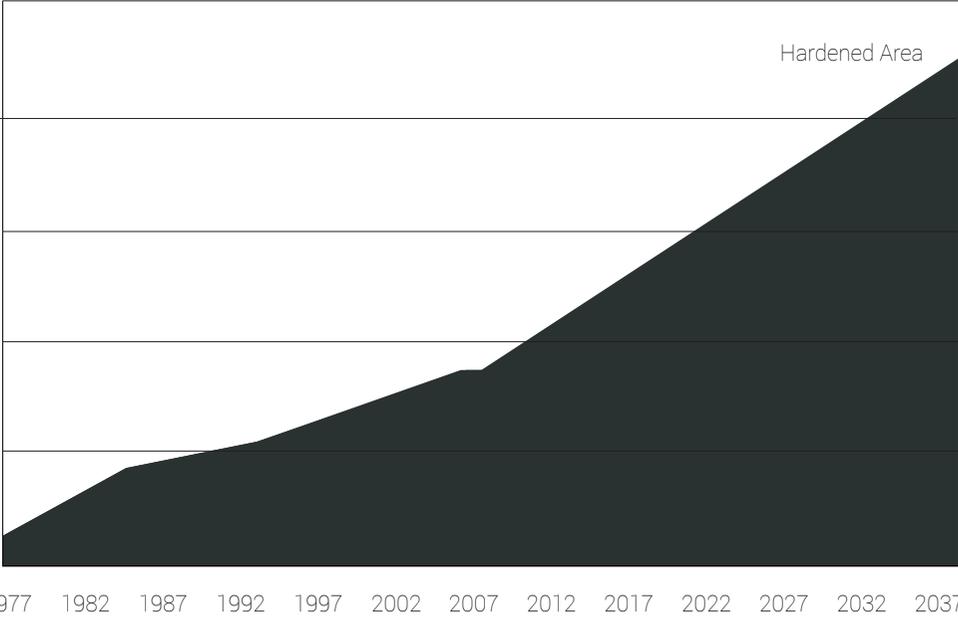
Floodrisk Amsterdam and Surroundings



Source: kaart.edugis.nl, n.d.

Environmental Perspective

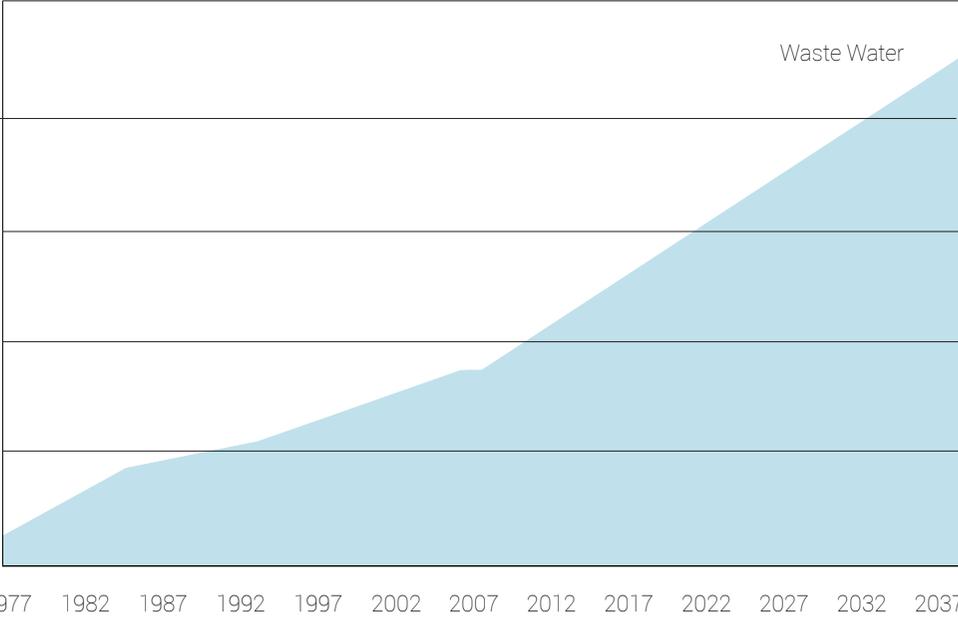
Hardened area, the Netherlands (1977 - 2040)



Environmental Perspective

Source: Own Extrapolation

Waste water, the Netherlands (1977 -2040)



Source: Own Extrapolation

Environmental Perspective

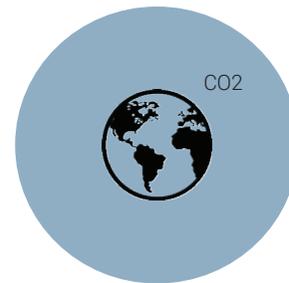
“Some of the major hydrological effects of urbanization are: (1) increased water demand, often exceeding the available natural resources; (2) increased wastewater, burdening rivers and lakes and endangering the ecology; (3) increased peak flow; (4) reduced infiltration and (5) reduced groundwater recharge, increased use of groundwater, and diminishing base flow of streams (Mukherjee, 2016).”



Environmental Perspective

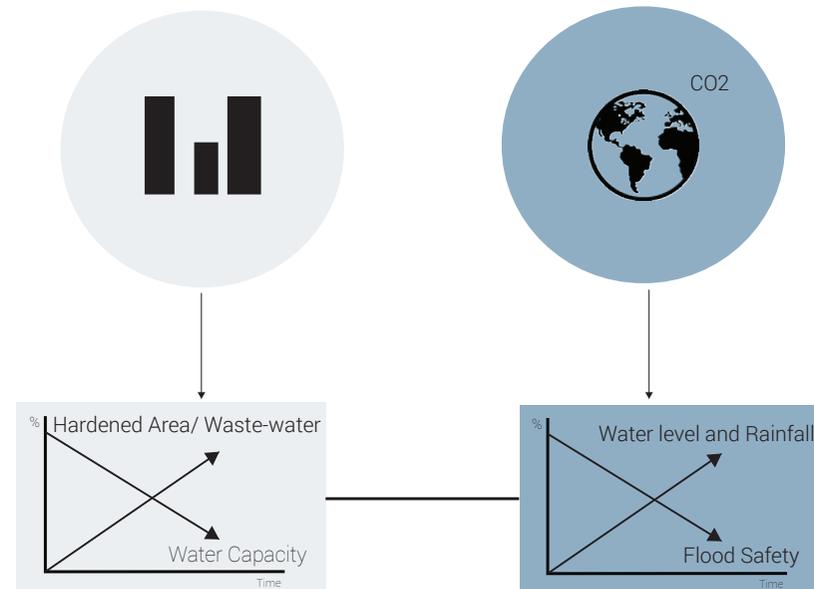
Summarised

Problem Statement



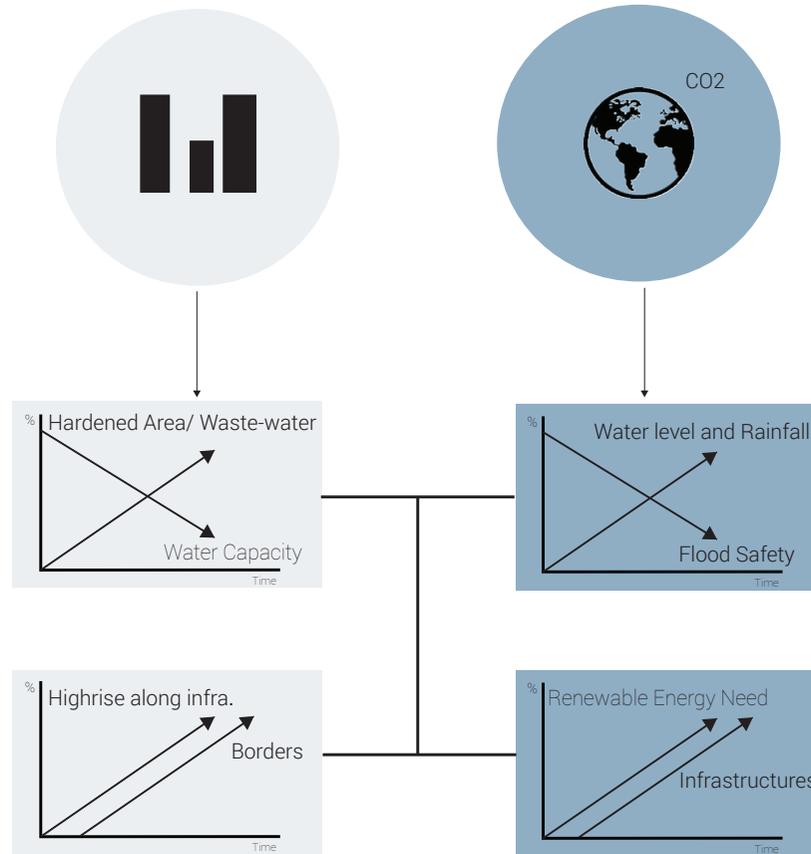
Source: Own Extrapolation

Problem Statement



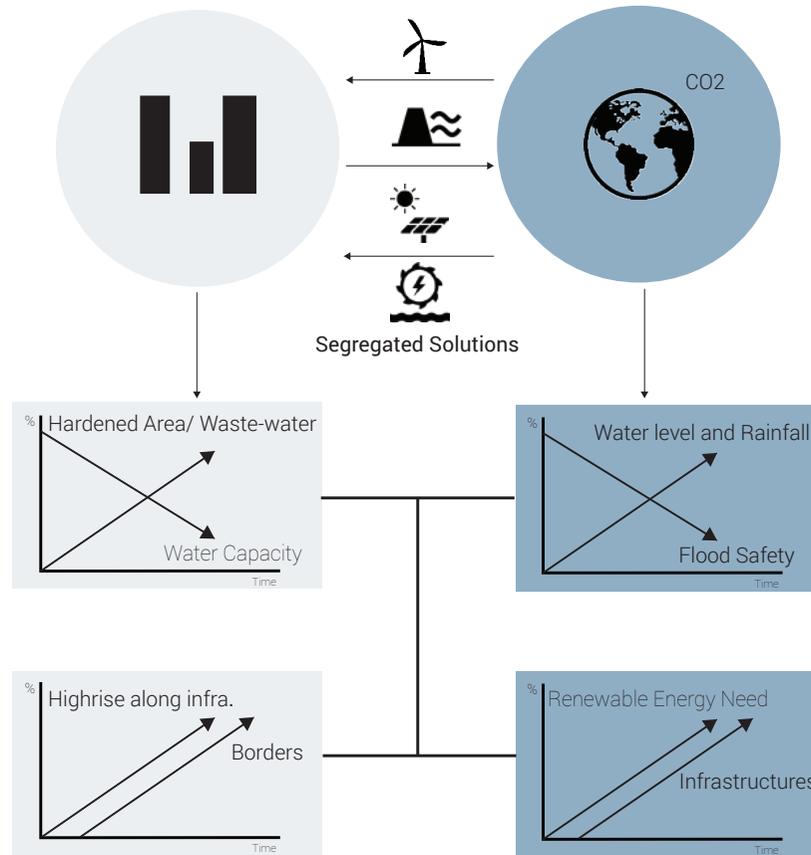
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Problem Statement



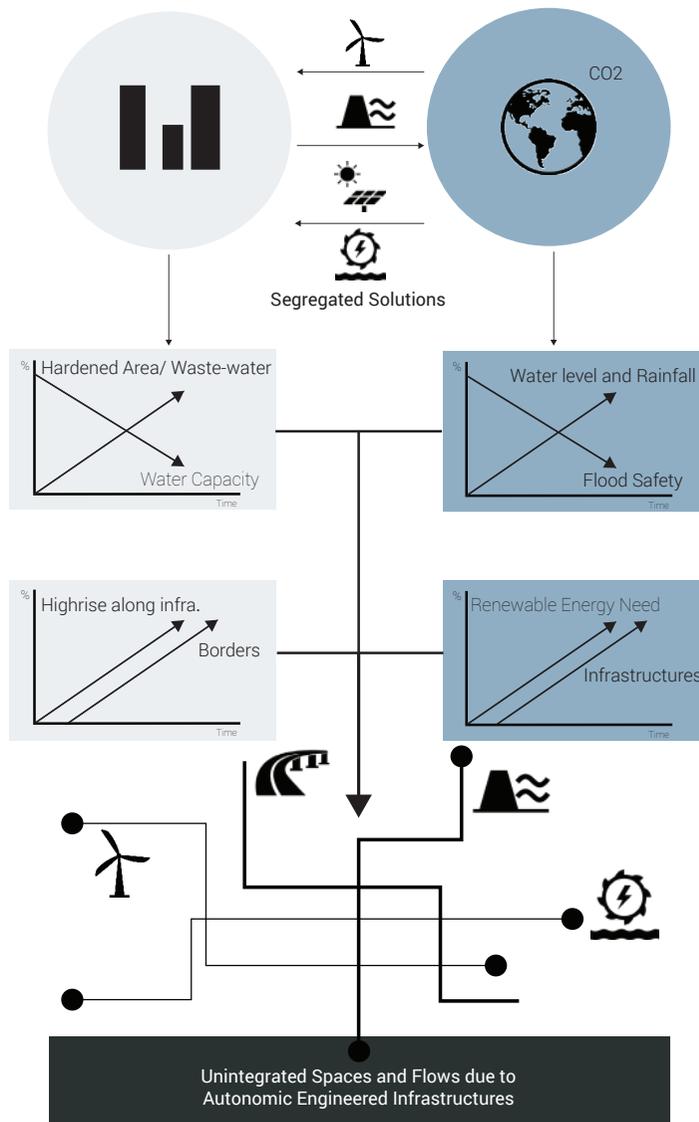
Source: Own Extrapolation

Problem Statement



Source: Own Extrapolation

Problem Statement



Source: Own Extrapolation

Problem Statement

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III. Research Question

IV. Factual/Technological Research

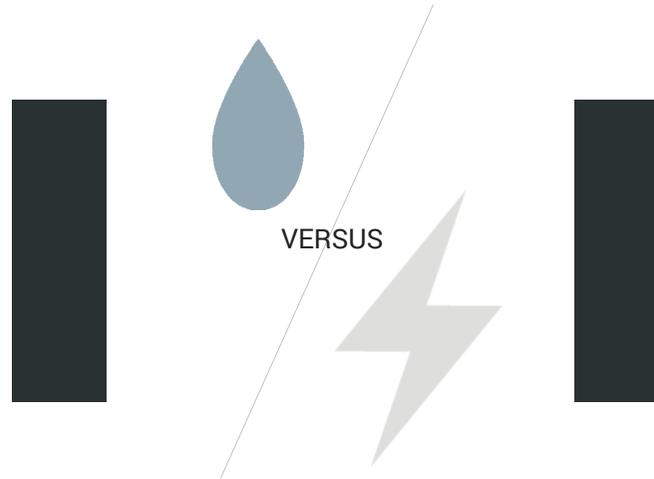
V. Spatial/Architectural Research

VI. Project Proposal

VII. Conclusion

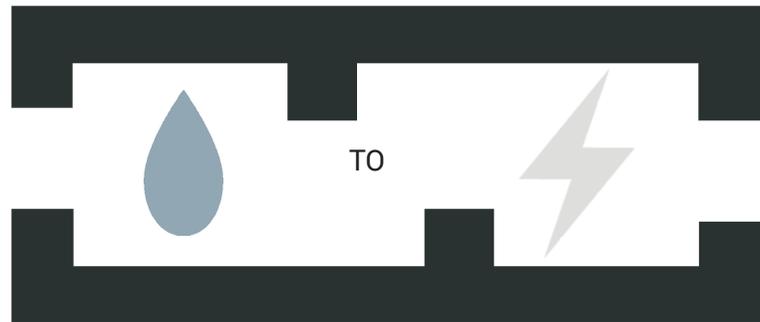
Content

from; **Reproducing & Losing**



Hypothesis

to; Capture & Store Integratively



Hypothesis

“Bundling energy and water services can contribute to a future of reduced operating costs and safer, healthier buildings (Isaacson, Gudell, Miller, Wiese, Wilson. & Center of Neighbourhood Technology, 2014)” .



Hypothesis

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How can integrative water storage contribute to an architectural energy system?



Research Question

I. Problem Statement

II. Hypothesis

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VII. Conclusion

1. Why is the current system un-integral?

The Integral Approach

Waterstructure 1570



Source: *Topotijdreis.nl*, n.d.

The Historic Integral Approach

Waterstructure 1630



Source: topotijdreis.nl, n.d.

The Historic Integral Approach

Steem engines



Source: Shell

The Historic Integral Approach

Waterstructure 1855



Source: topotijdreis.nl, n.d.

The Historic Integral Approach

The Dam



Lost Integral Approach

Waterstructure 1877



Source: topotijdreis.nl, n.d.

The Historic Integral Approach

Sewage System



Lost Integral Approach

Waterstructure Now



Source: topotijdreis.nl, n.d.

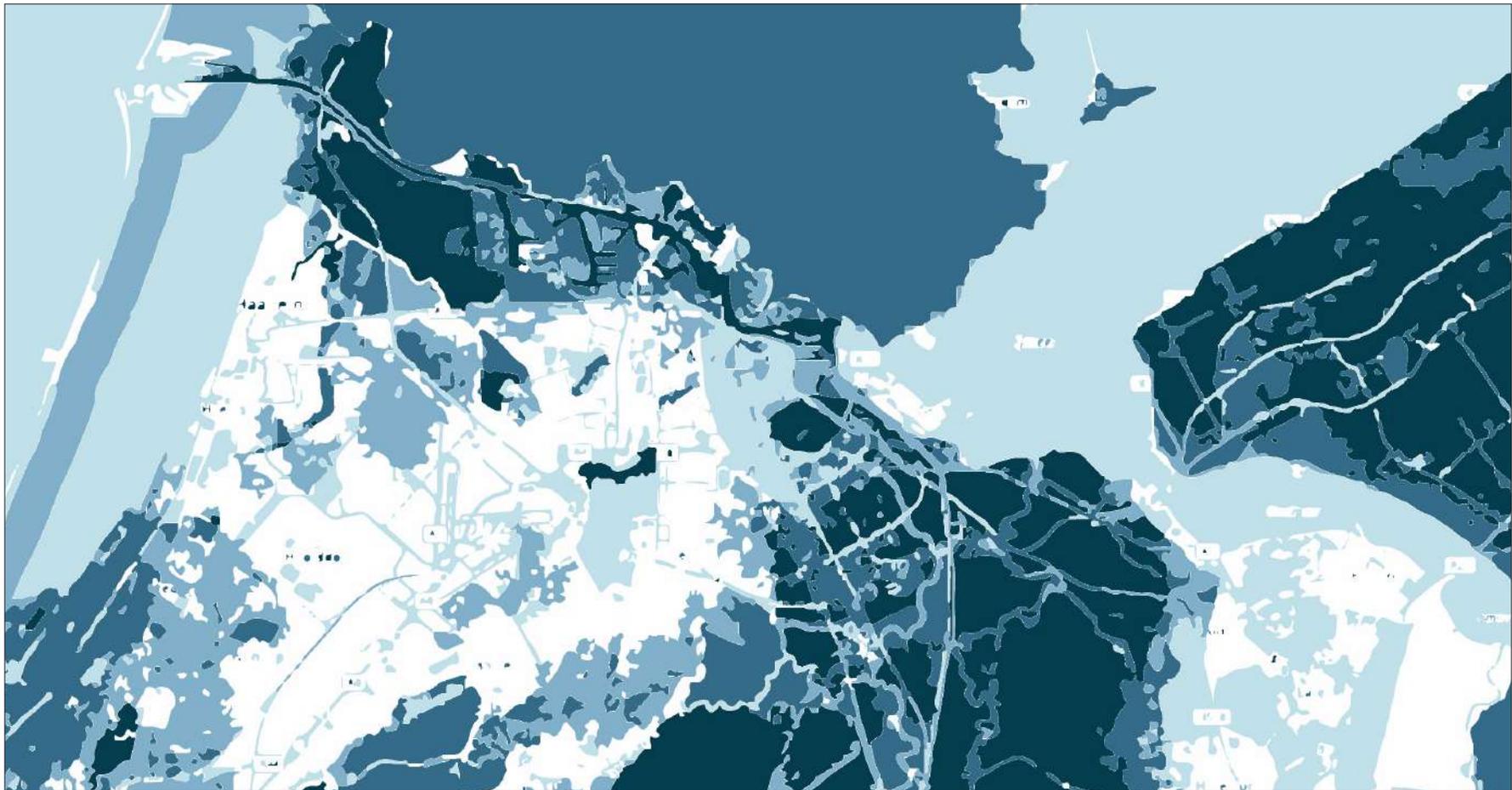
The Historic Integral Approach

“The refinement of technology in the last decades of the twentieth century makes it possible not only to maintain that which is threatened, but also to **take in an increasingly vulnerable place in the game between water and land** (Hooimeijer, 2011) .”



Lost Integral Approach

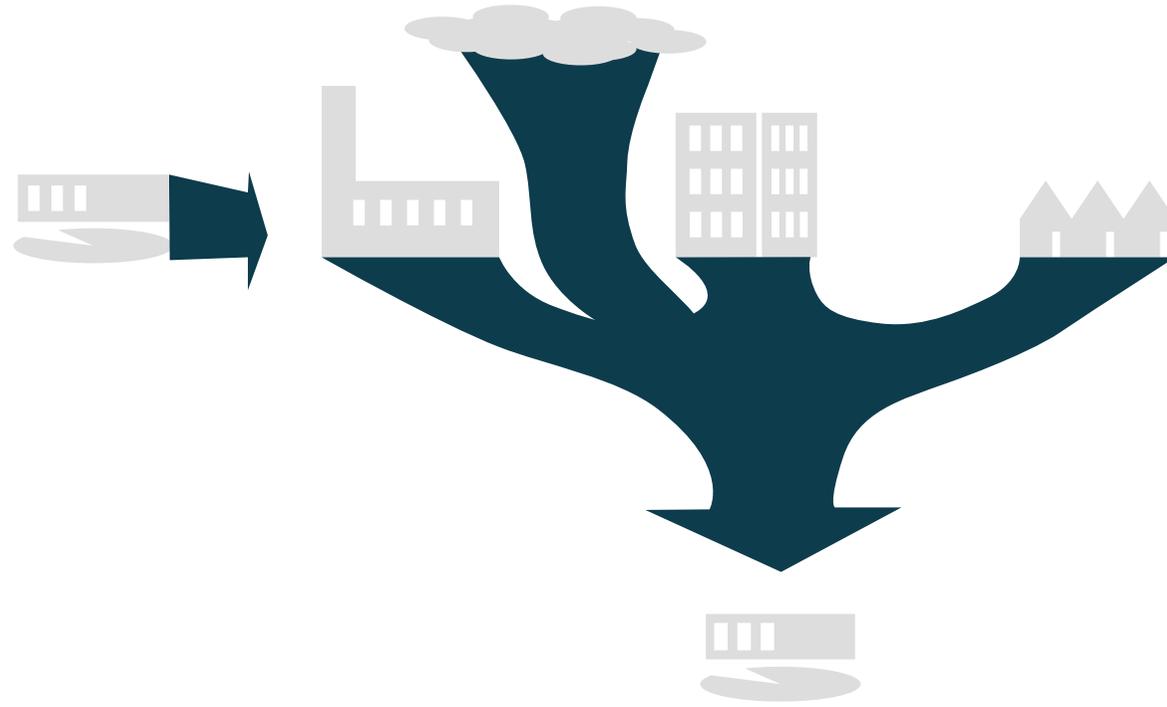
Floodrisk Amsterdam and Surroundings



Source: kaart.edugis.nl, n.d.

Lost integral Approach

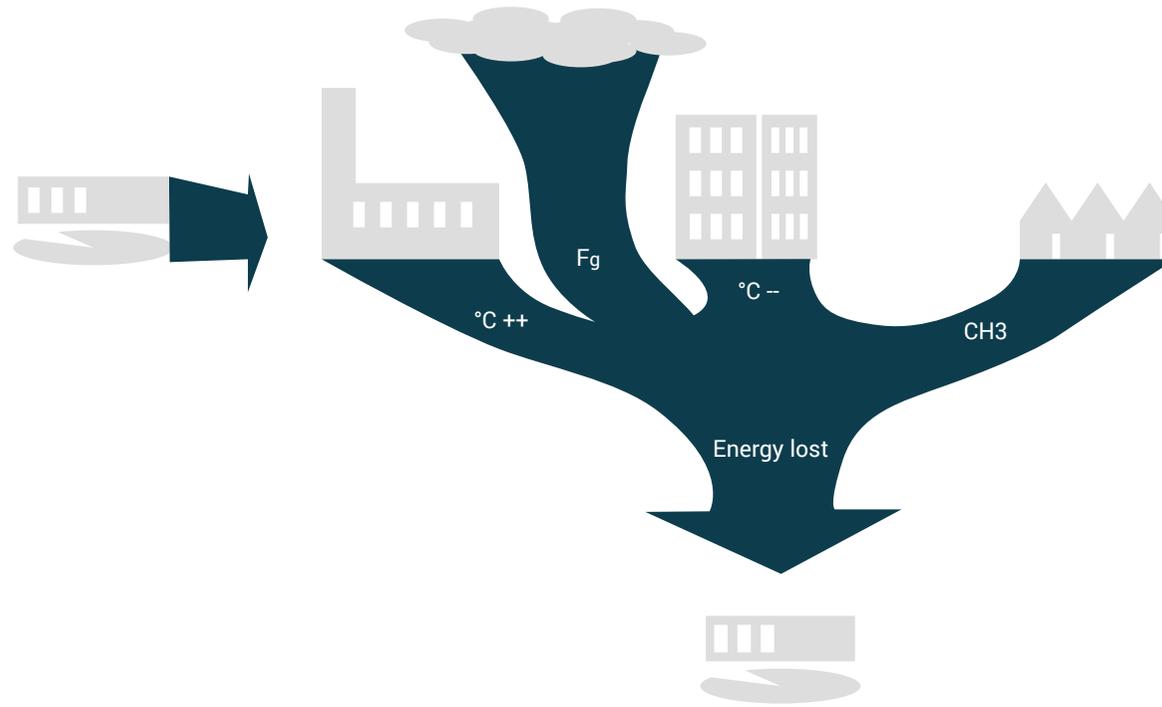
Water Flow and Waste Water Overload



Source: Personal Abstraction from multiple Sources

Current Situation

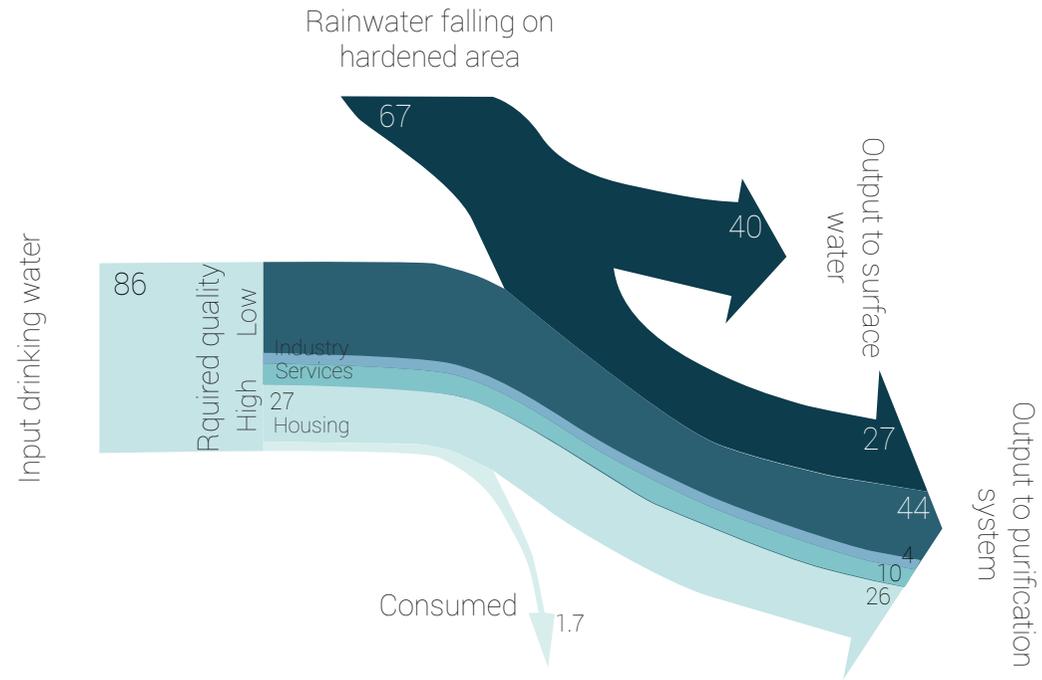
Water Flow and its Lost Embodied Energy



Source: Personal Abstraction from multiple sources

Current Situation

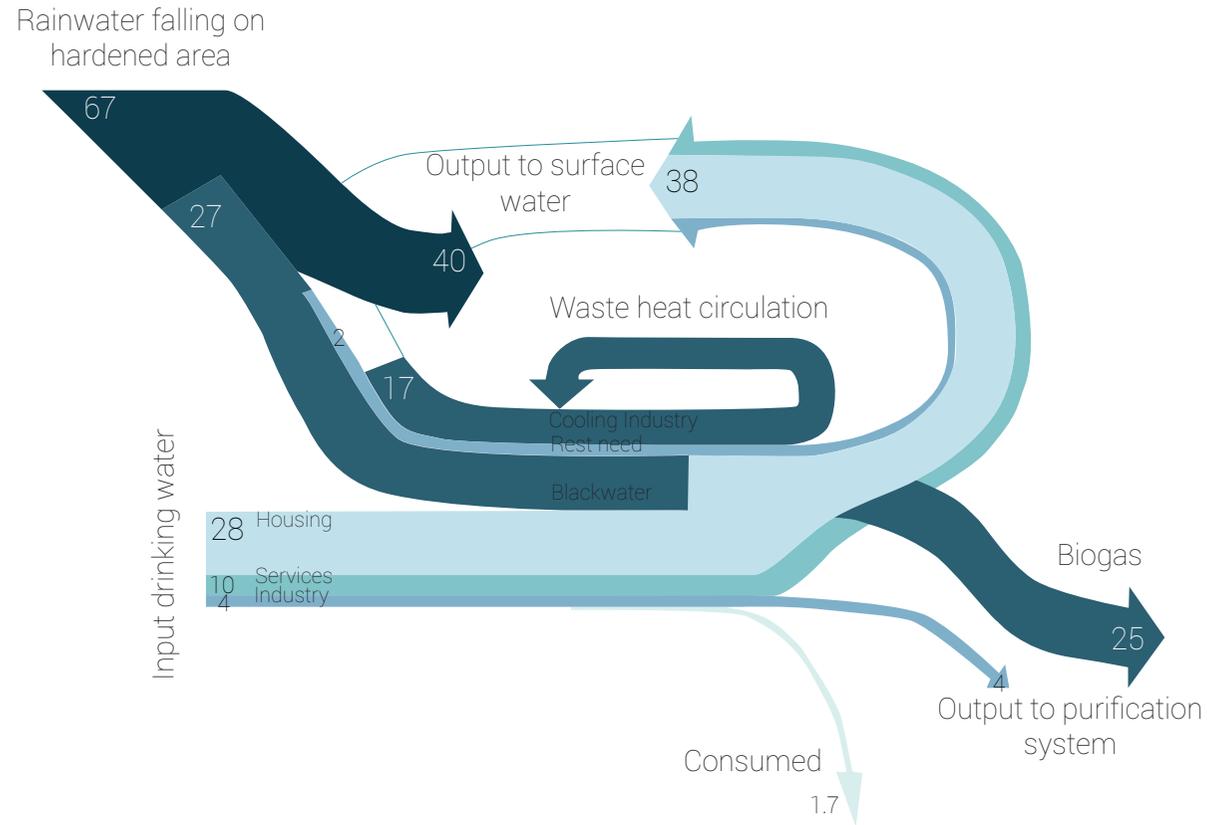
Current Water Flow Amsterdam



Source: Personal Compilation and Calculations

Current Situation

Maximised Solutions



Source: Shell, 2008

Maximised Situation

The Location

Site-Choice

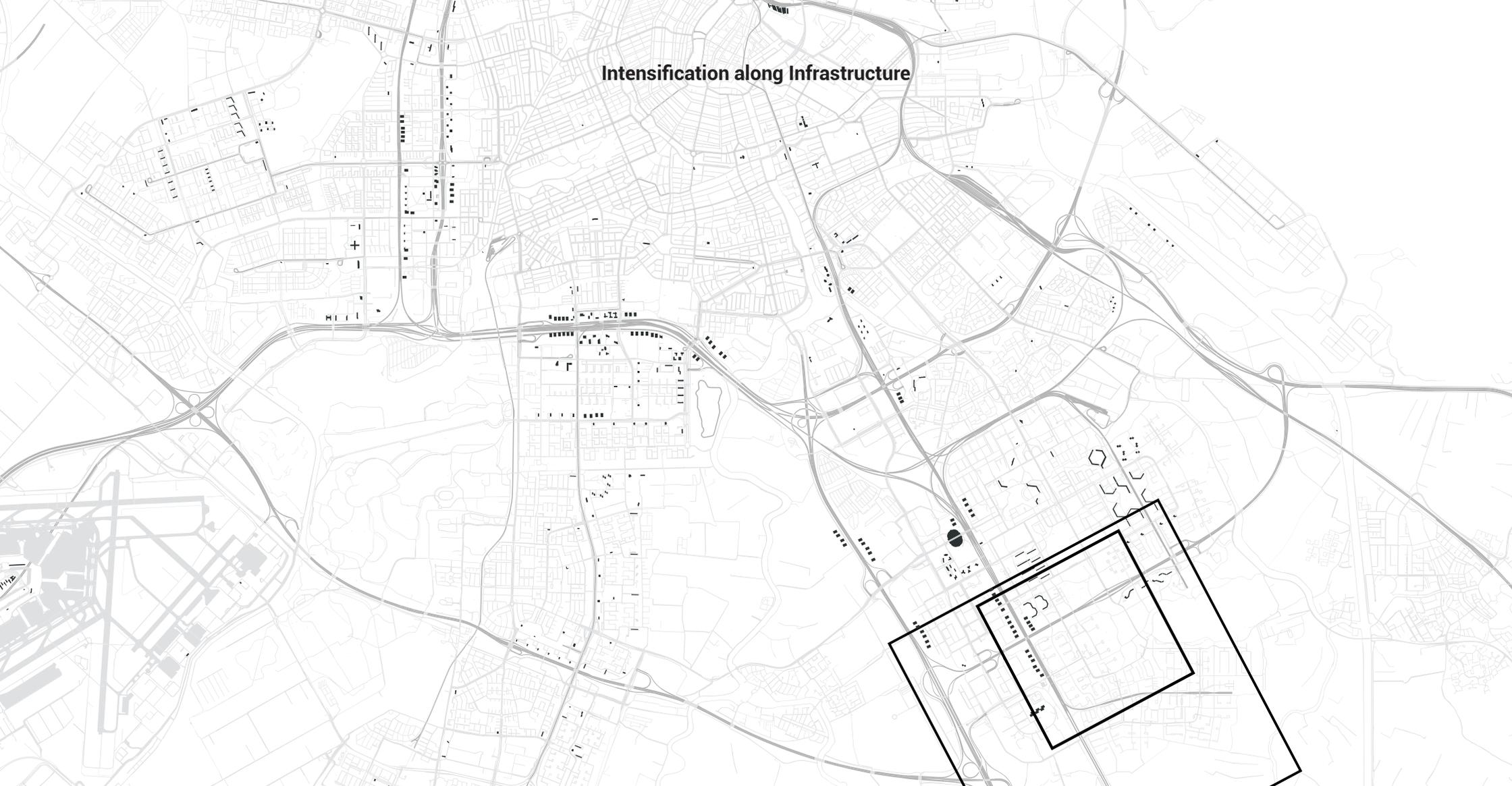
Studio Research

Floodrisk Amsterdam and Surroundings



Location

Intensification along Infrastructure



Location

Source: Own Extrapolation

Intensification along Infrastructure & Floodrisk



Source: Own Extrapolation

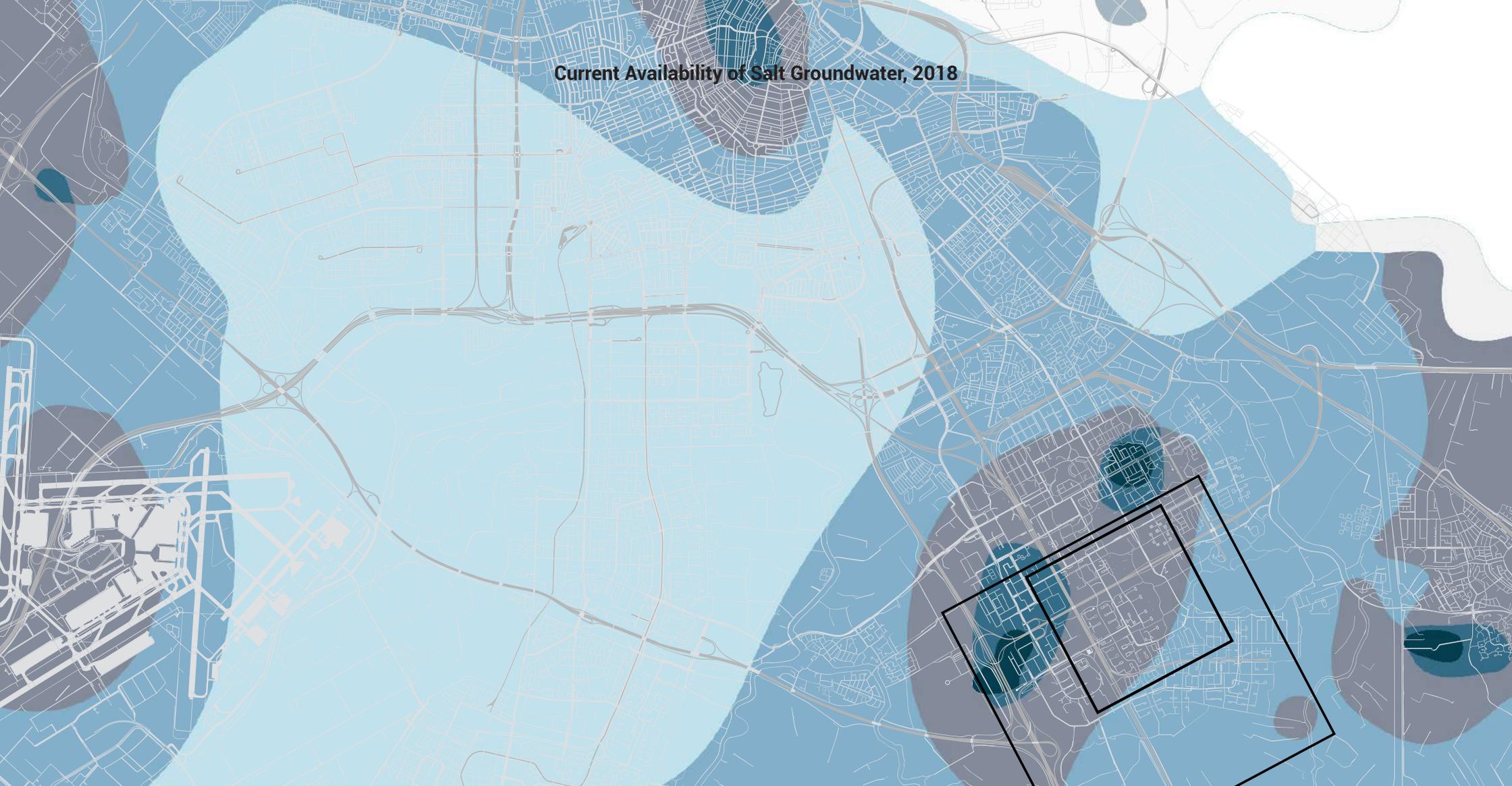
Location

The Location

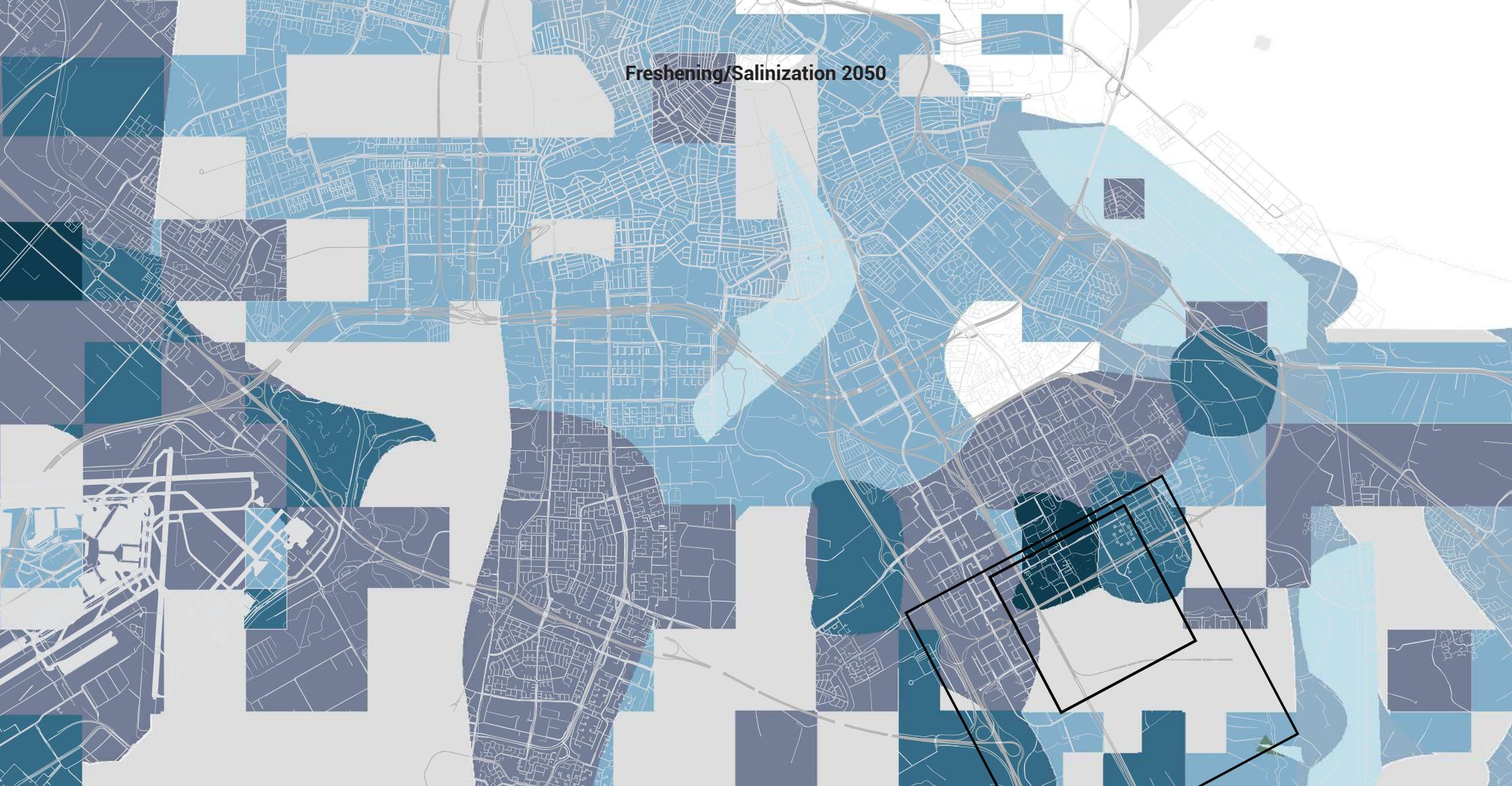
Factual Research

Studio Research

Current Availability of Salt Groundwater, 2018



Location

A map showing various colored regions (shades of blue, purple, and grey) overlaid on a street grid. A black rectangular box highlights a specific area in the lower right quadrant of the map.

Freshening/Salinization 2050

A photograph of a natural landscape featuring a body of water, trees, and a grassy field under a cloudy sky.

Location



Intensification along Infrastructure

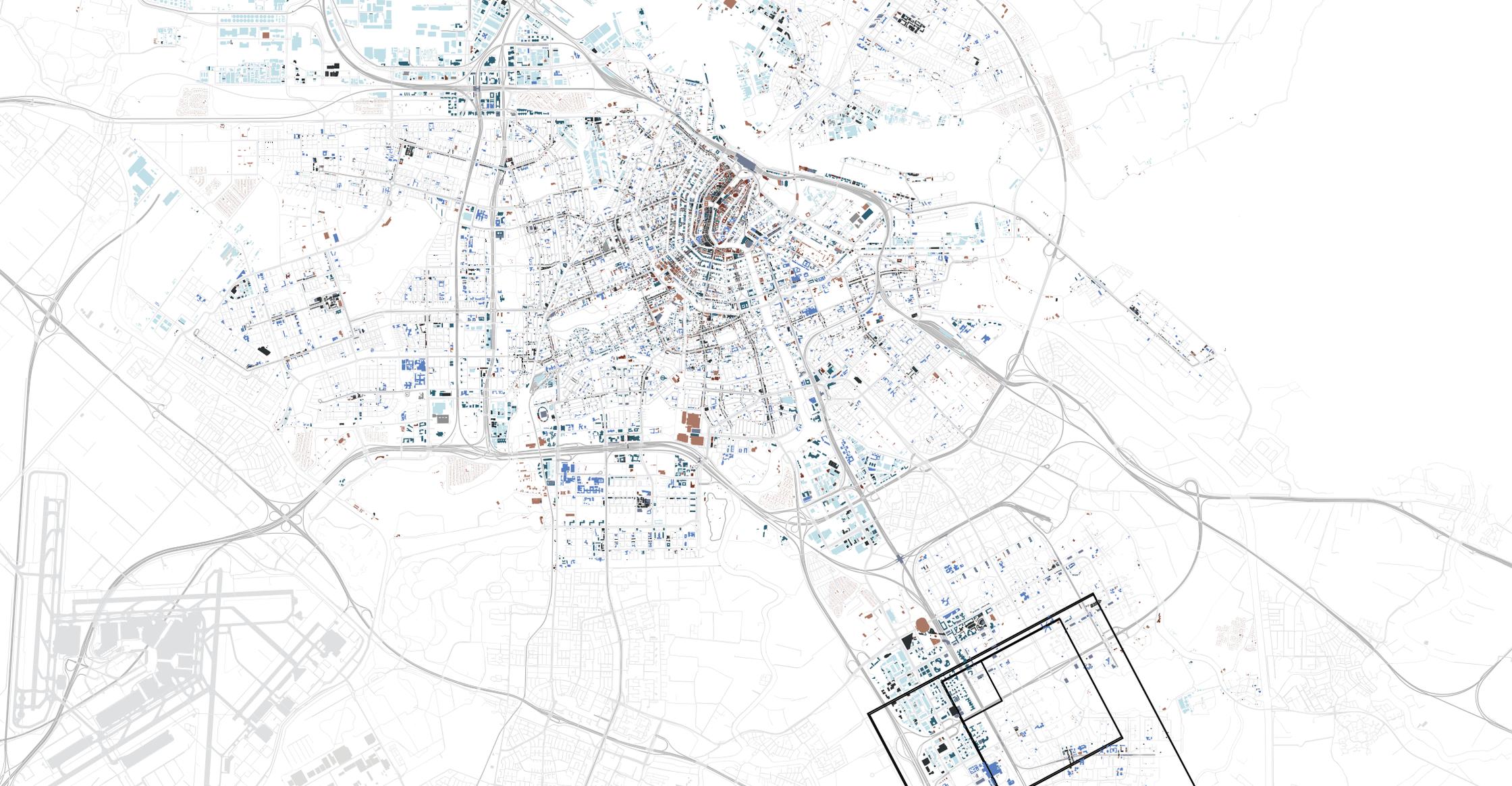


Location

The Location

Further Analyses

Studio Research



Source: Own Creation

Functions



Functions

Housing Bijlmer



The Location

Offices Bullewijk Station



The Location





Culture

Office

Living

Industry

Health

Functions



Building-heights



Water Structure



Water Structure

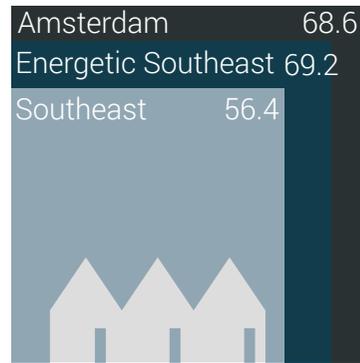
Railway Border



The Location

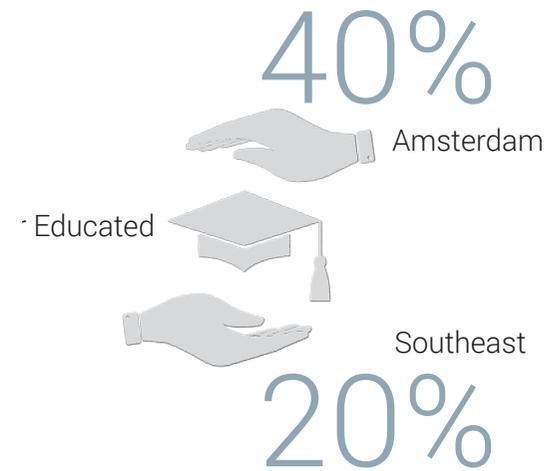
Housing and Offices Amsterdam South East

5000 new dwellings in Amstel III



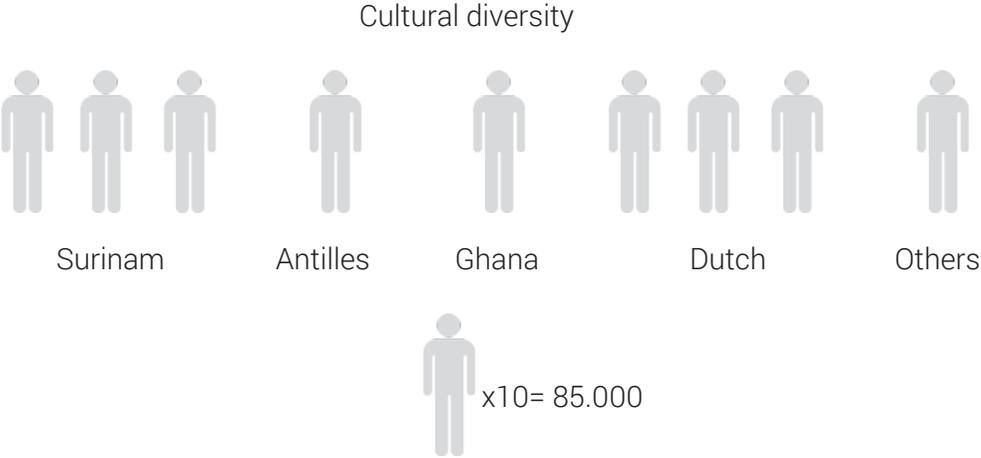
Social Demographics

Inhabitants of Amsterdam South East



Social Demographics

Cultural diversity in Amsterdam South East



Social Demographics

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Typology Study

Natural (Water) References



Natural References



Curvy Flows



Natural References



Circular Holes in Caves



Natural References



Typology Study

Dutch Cultural (Water) References

Orthogonal Ditch Structures



Cultural References



Canal Structures

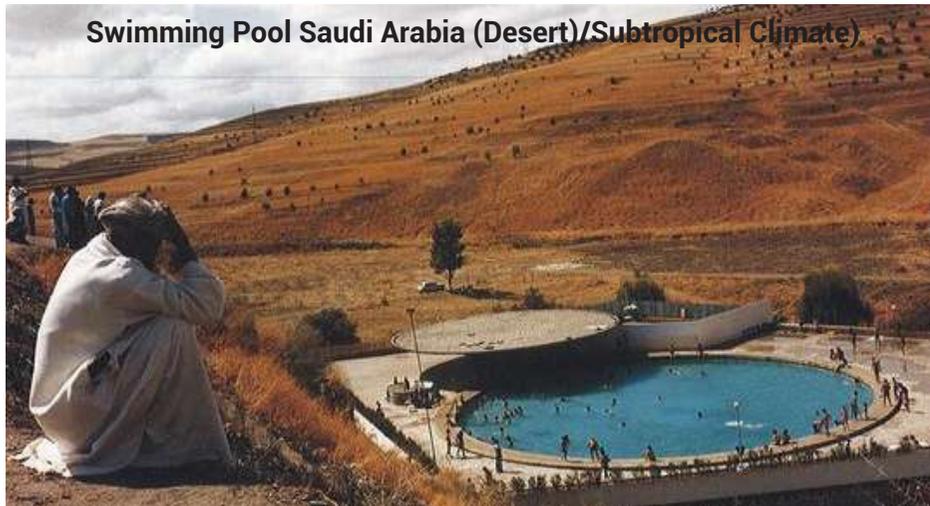
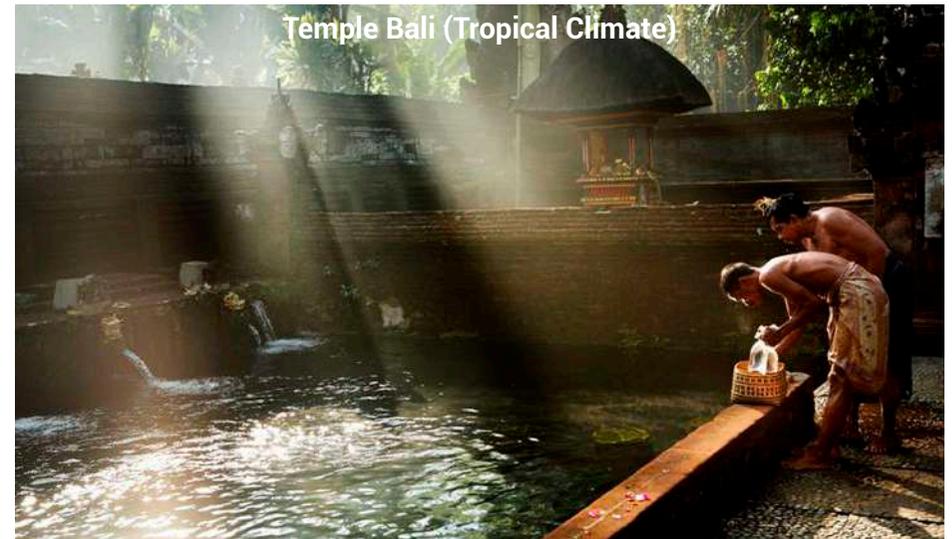


Cultural References



Typology Study

Foreign Cultural (Water) References



Typology Study

Architectural (Water) References



Architectural References



Architectural References



Architectural References



Architectural References

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Content

How can integrative water storage contribute to an architectural energy system?

Conceptual Framework

Concept City-Scale

Conceptual Framework

Proposed State of Spatial Configuration



Concept City-Scale

Current State of Spatial Configuration



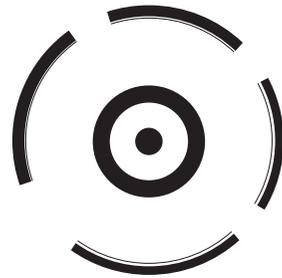
Concept City-Scale

Current State of Spatial Configuration



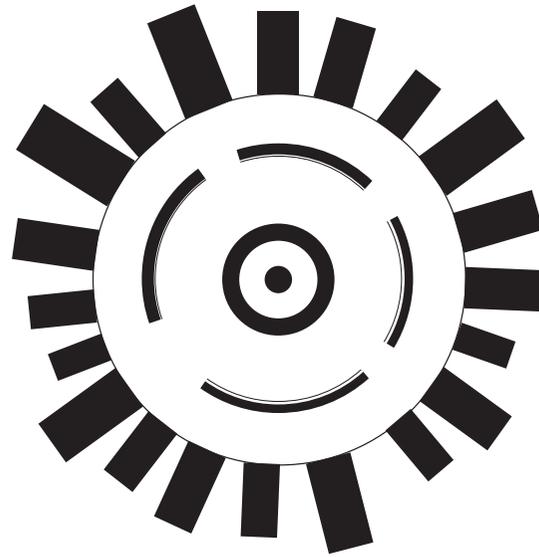
Concept City-Scale

Current State of Spatial Configuration



Concept City-Scale

Current State of Spatial Configuration



Concept City-Scale

Current State of Spatial Configuration



Concept City-Scale

Current State of Spatial Configuration



Concept City-Scale

Proposed State of Spatial Configuration



Concept City-Scale

Proposed State of Spatial Configuration



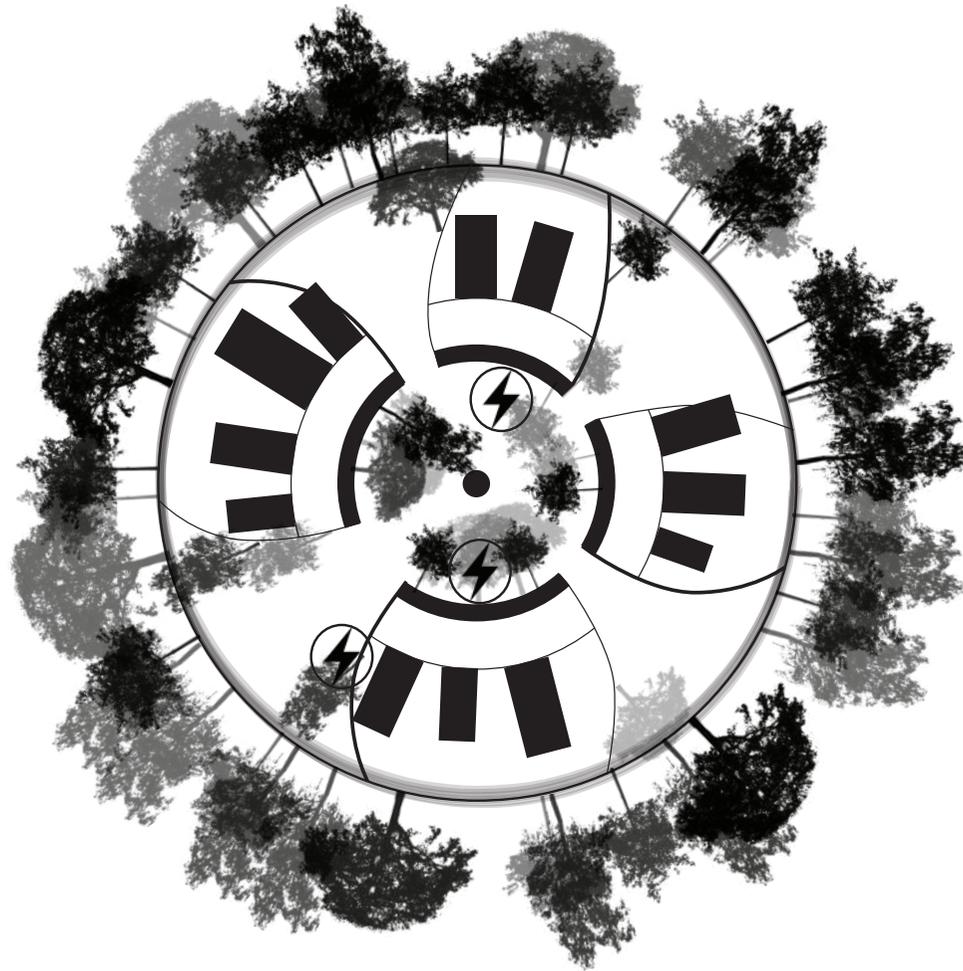
Concept City-Scale

Proposed State of Spatial Configuration



Concept City-Scale

Proposed State of Spatial Configuration



Concept City-Scale

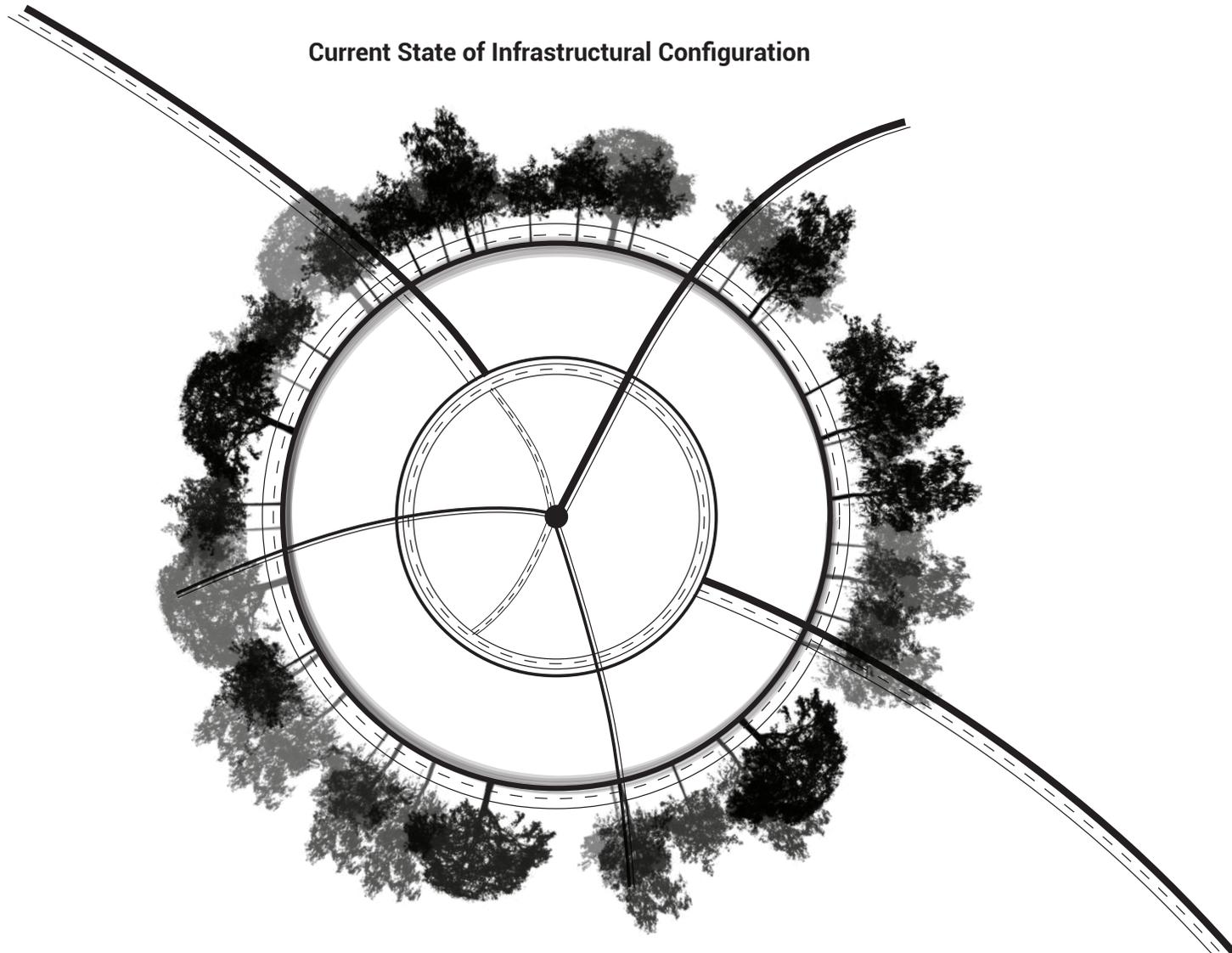
Proposed State of Spatial Configuration



Concept City-Scale



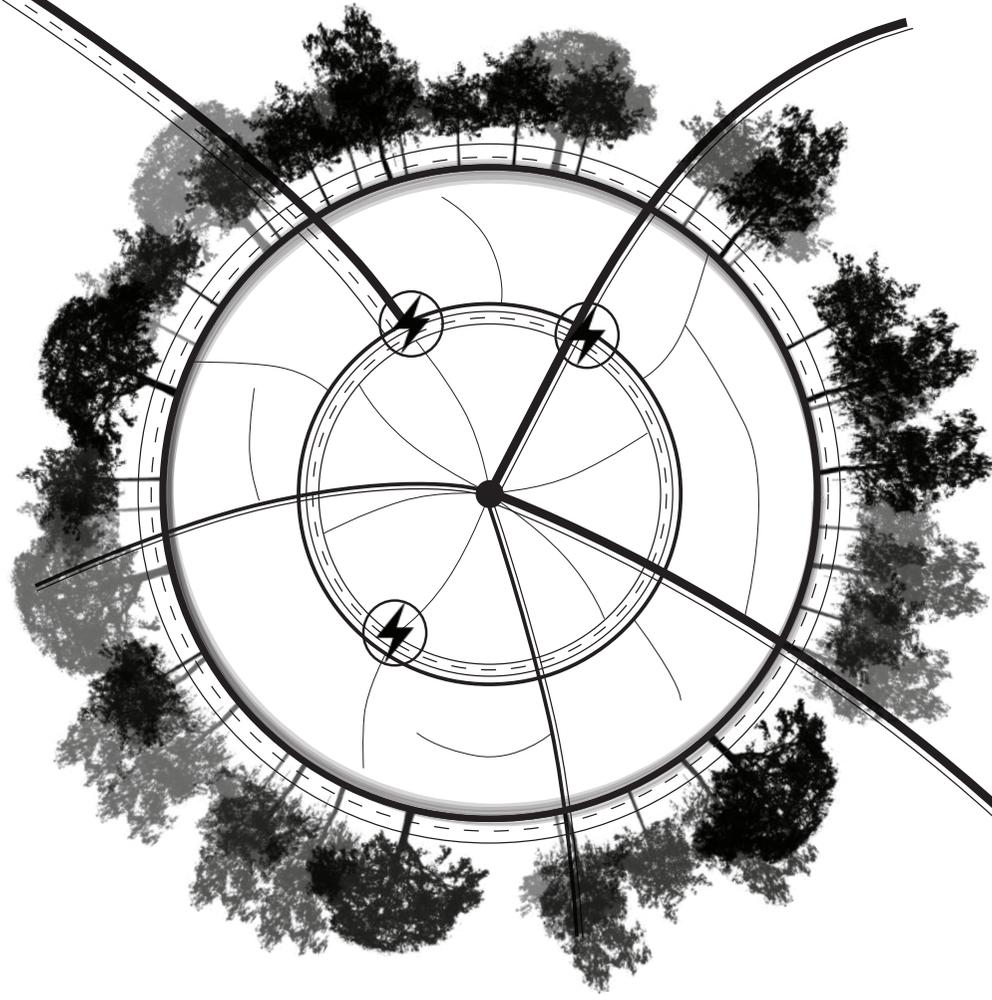
Current State of Infrastructural Configuration



Concept City-Scale

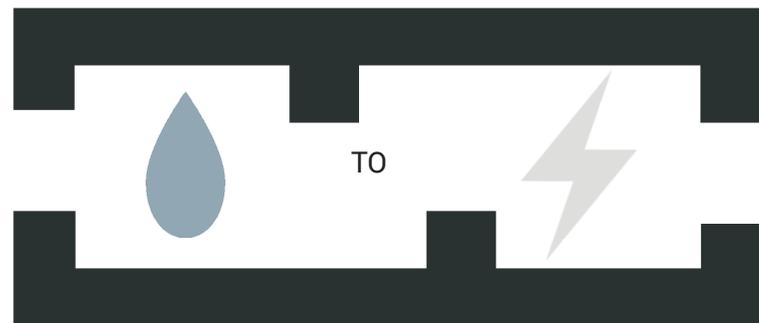


Future State of Infrastructural Configuration



Concept City-Scale

The Water Bat-



Concept Building Scale



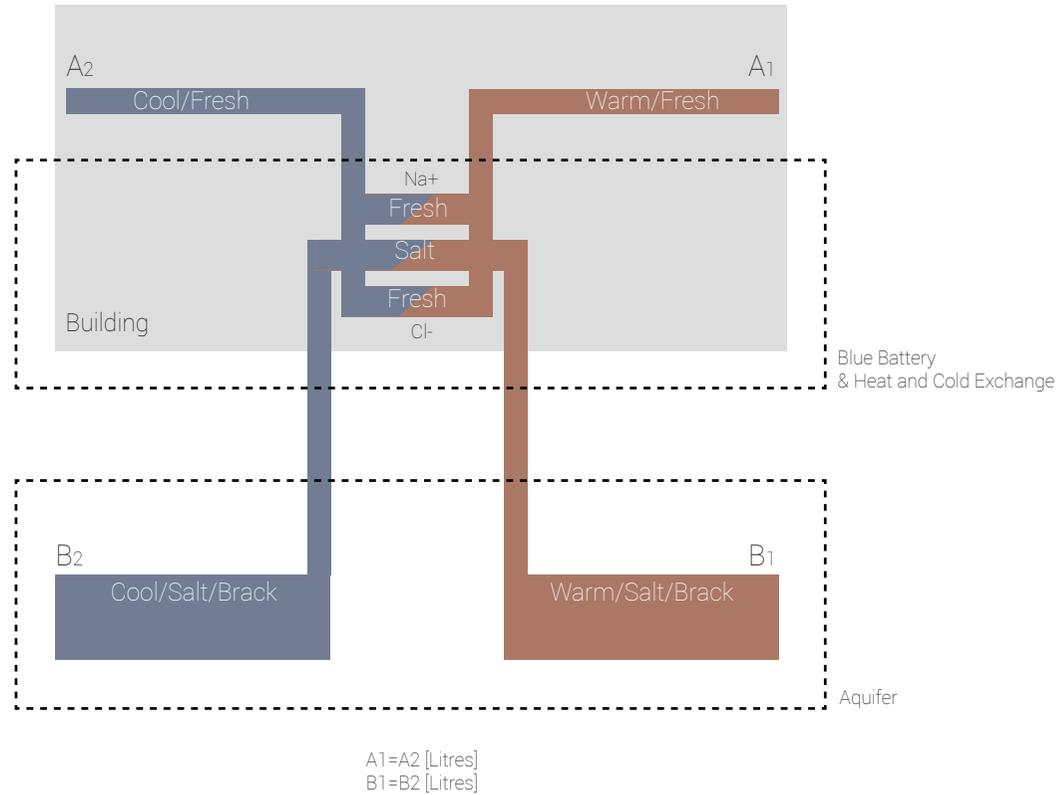
Concept Technical Level

Conceptual Framework

Blue Battery

Charging: Fresh water becomes positive or negative loaded and Salt water becomes Brack

Discharging: Brack water becomes Salt by using the electricity to regenerate the salt from the Na+ and Cl- ions.



Technical Level

Gravitational Force Battery

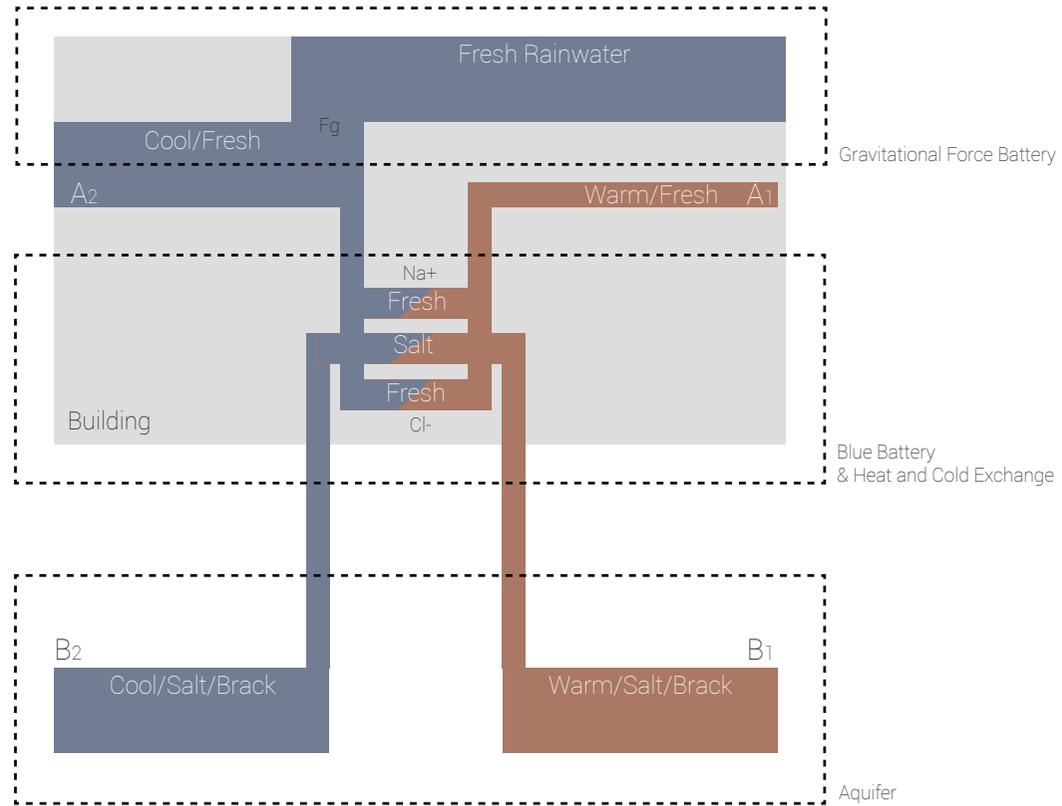
Charging: Water is pumped upwards
Discharging: Energy of water falling down is transferred into electricity.

Section of Water/Energy Exchange principal 2

Blue Battery

Charging: Fresh water becomes positive or negative loaded and Salt water becomes Brack

Discharging: Brack water becomes Salt by using the electricity to regenerate the salt from the Na+ and Cl- ions. (?)



Technical Level

50 percent of Amsterdam will be provided with short-term storage with falling water and when provided at the site with salt-water-batteries every buildings energy demand will be covered on long-term energy storage. Hence this building provides long term energy storage for it's surroundings.



Technical Level

Masterplan

The Design Proposal

Current Situation



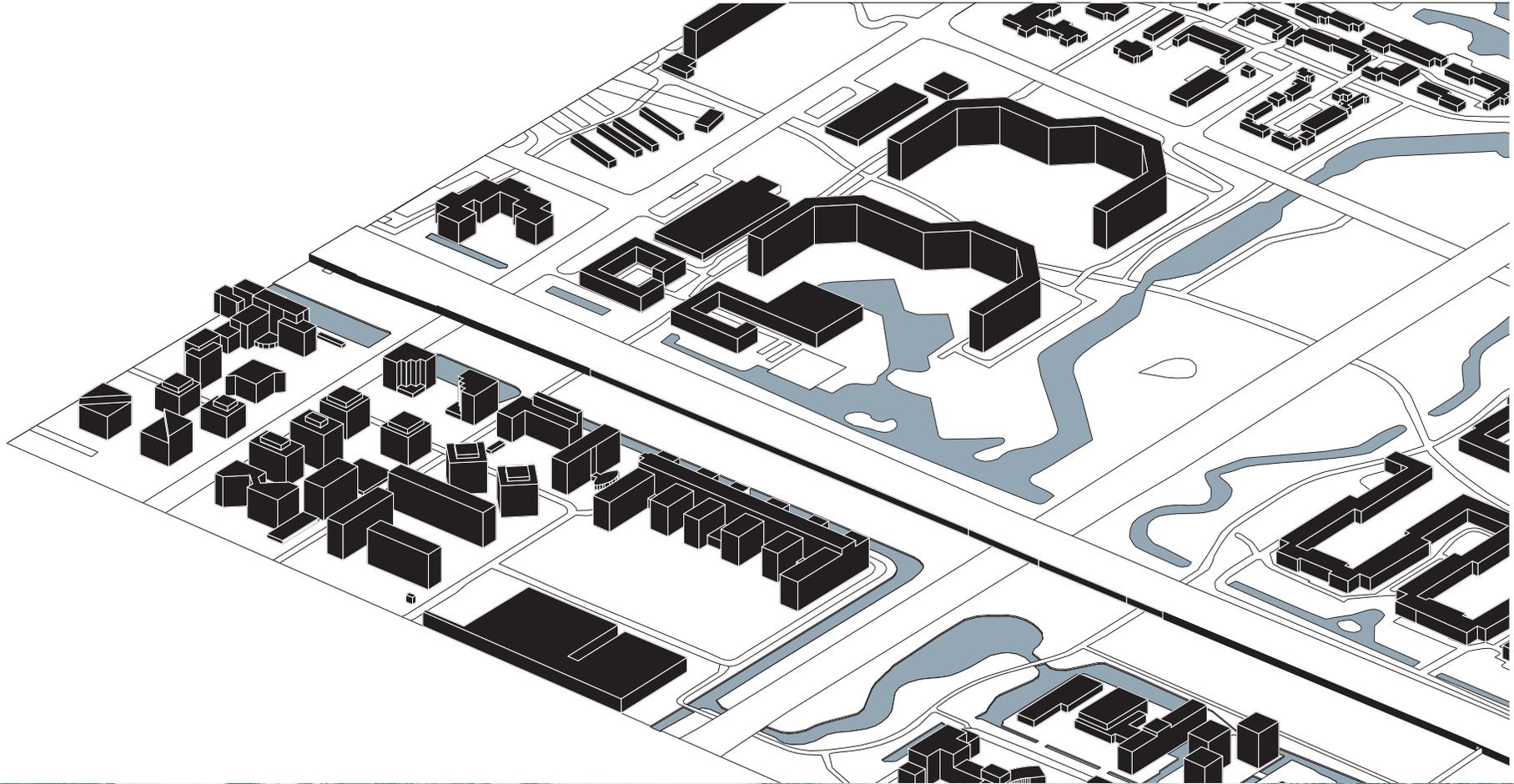
Urban Scale

Future Proposal



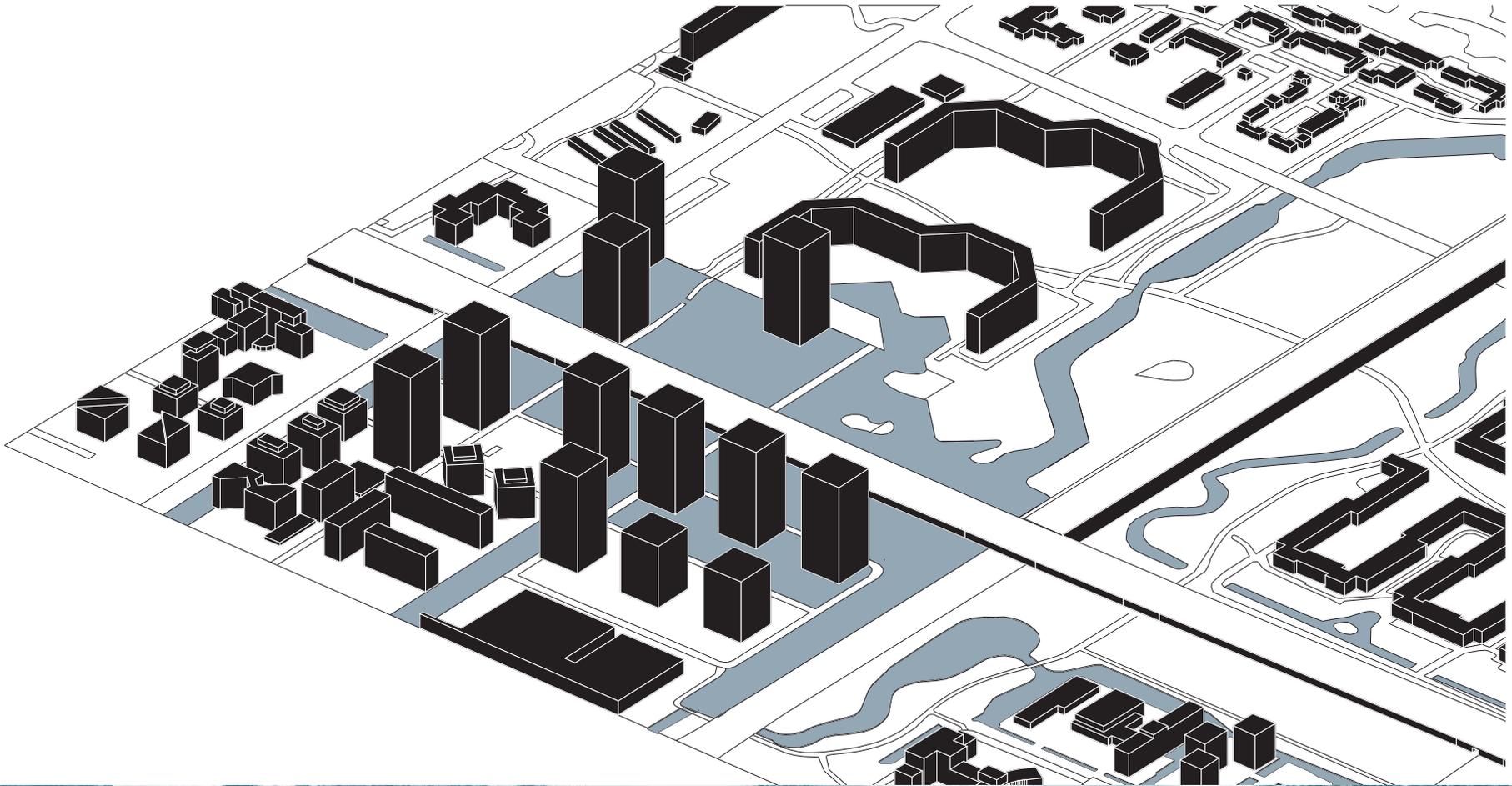
Urban Scale

Current Situation



Urban Scale

Future Scenario



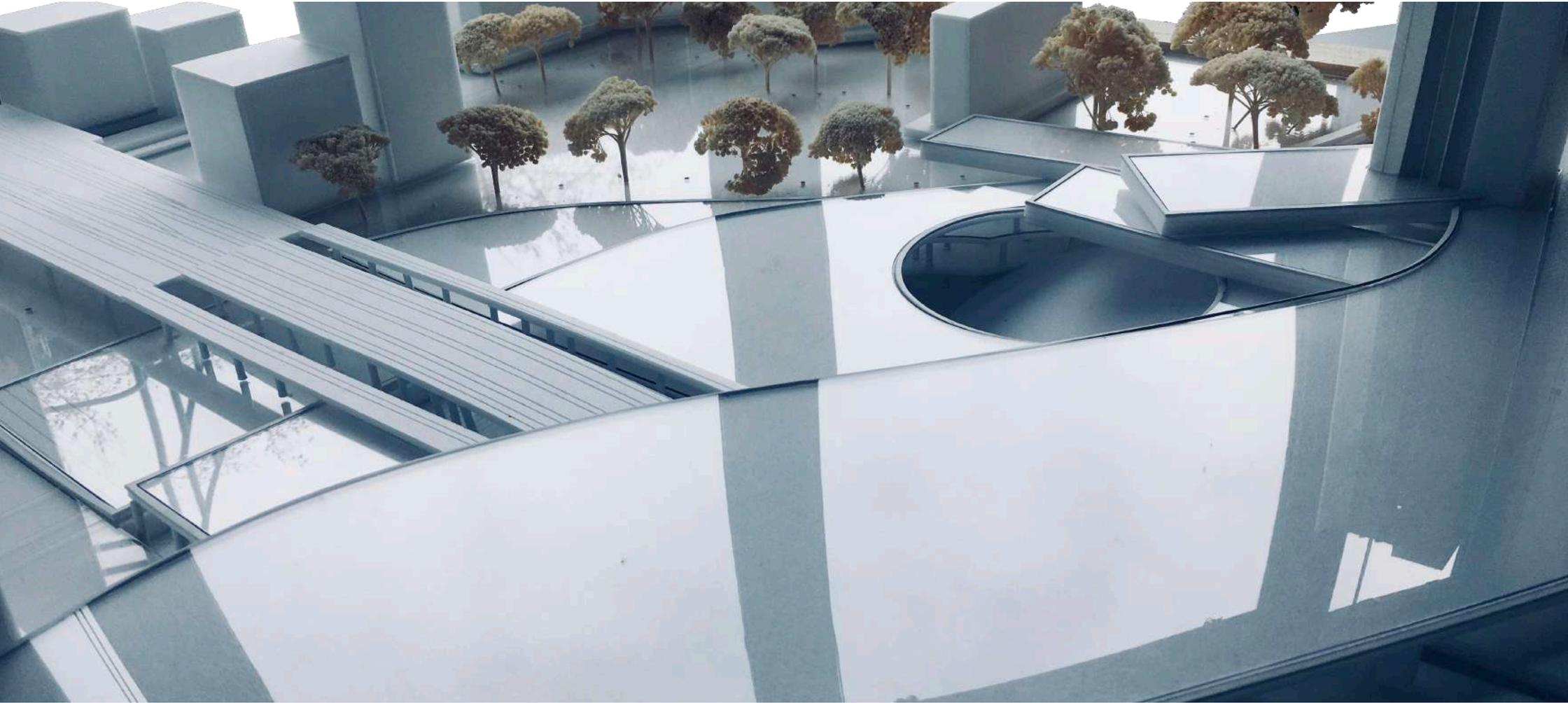
Urban Scale

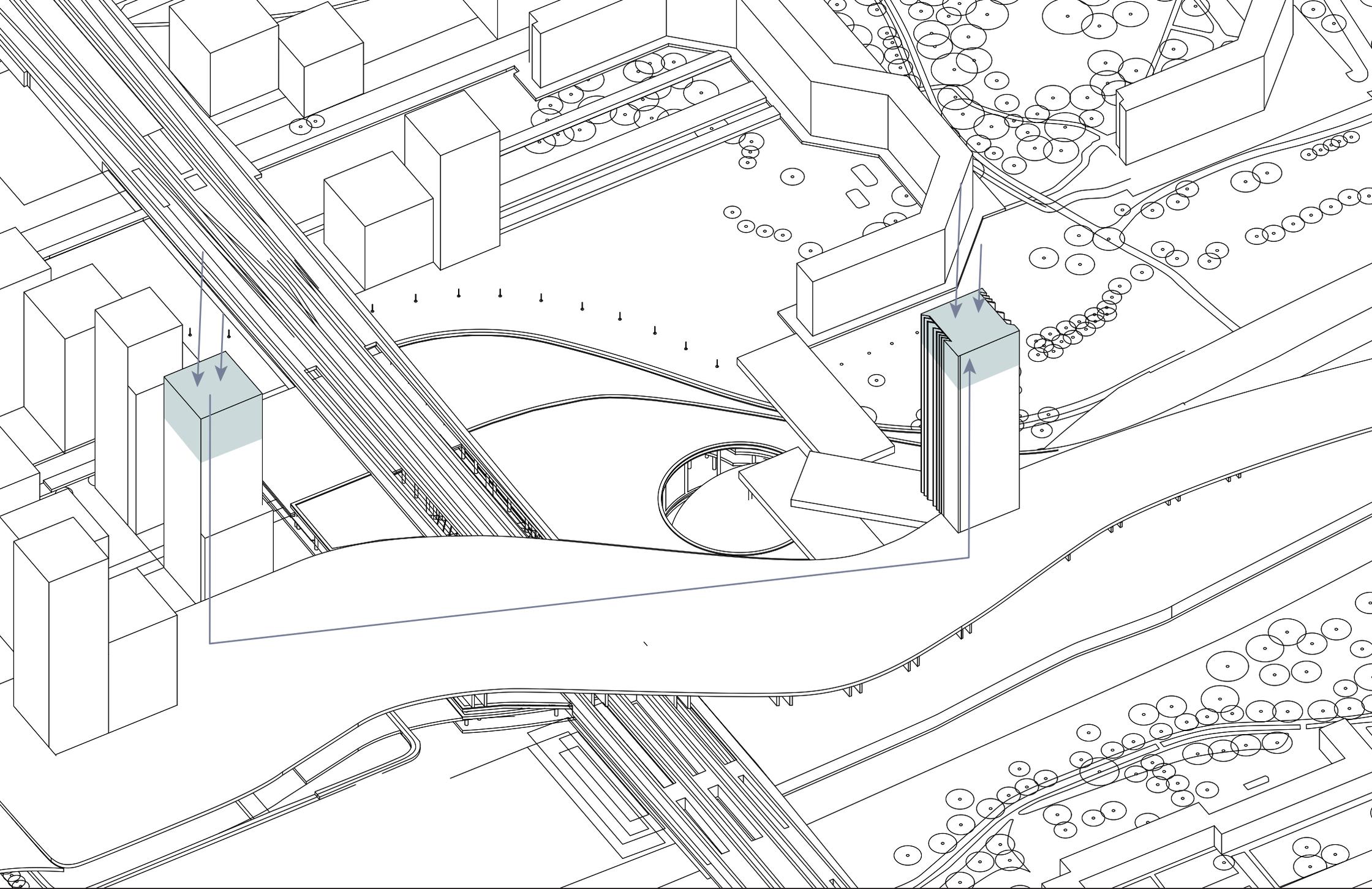
Future Proposal

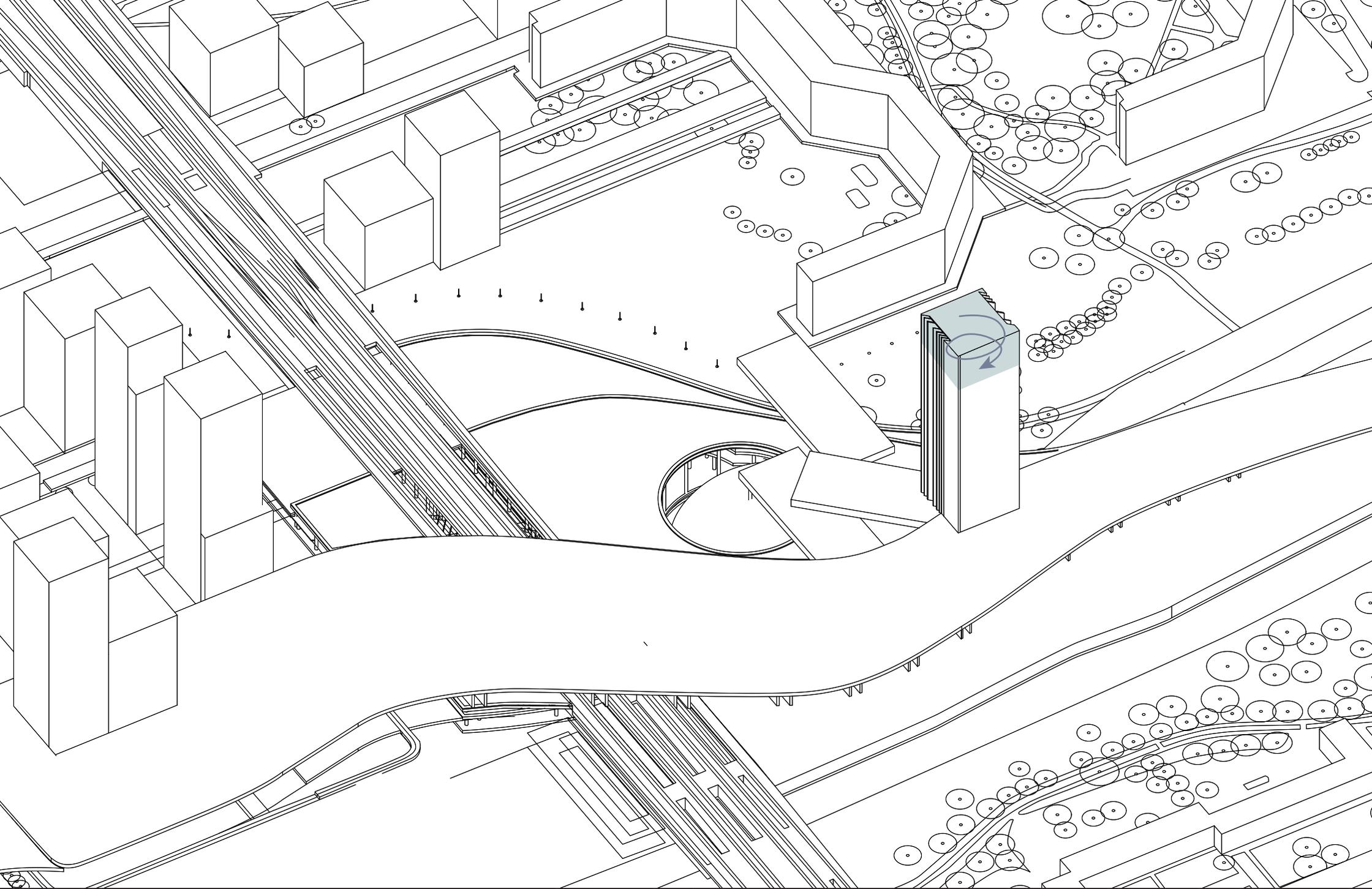


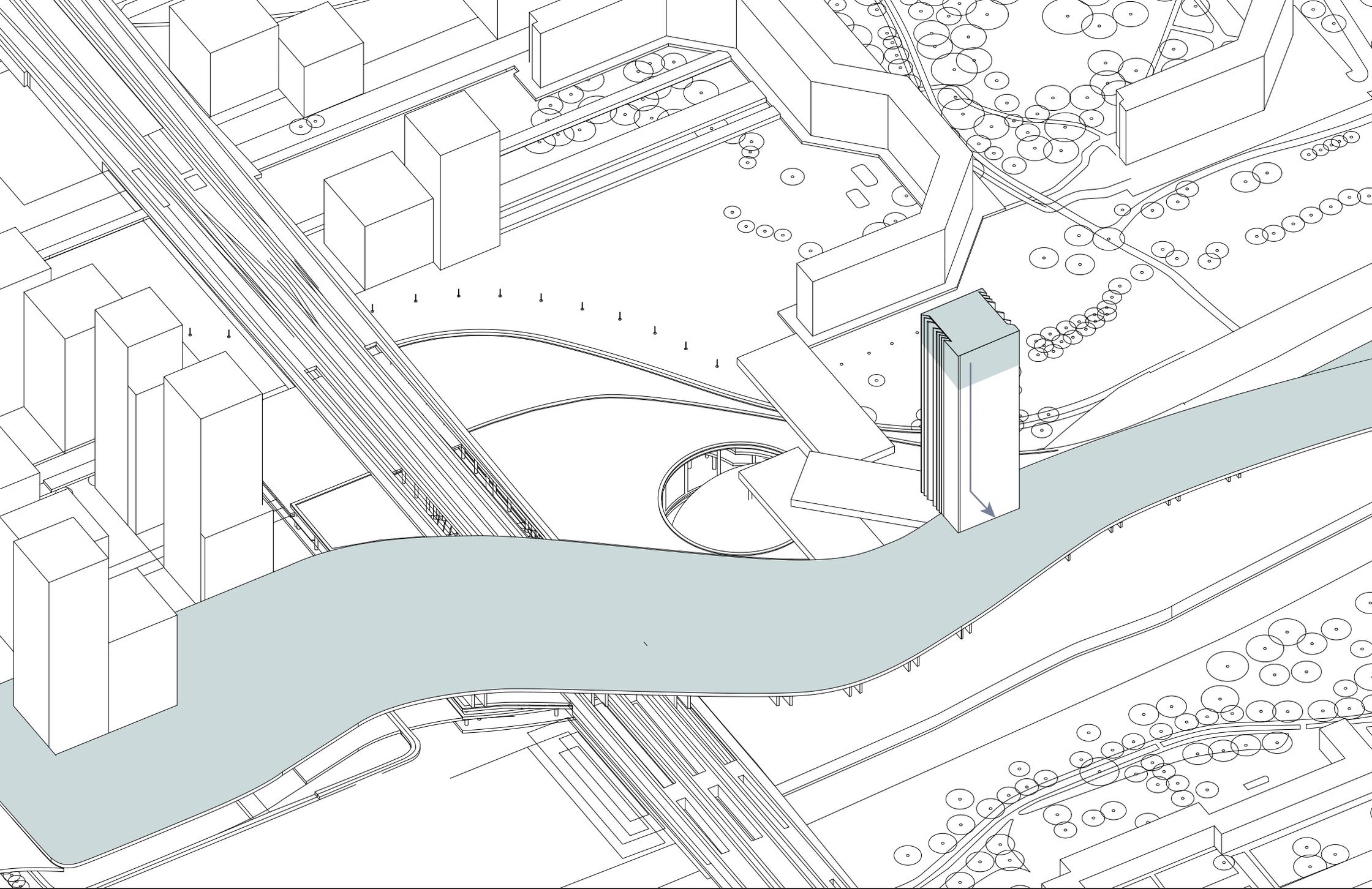
The Watercascade-Routing

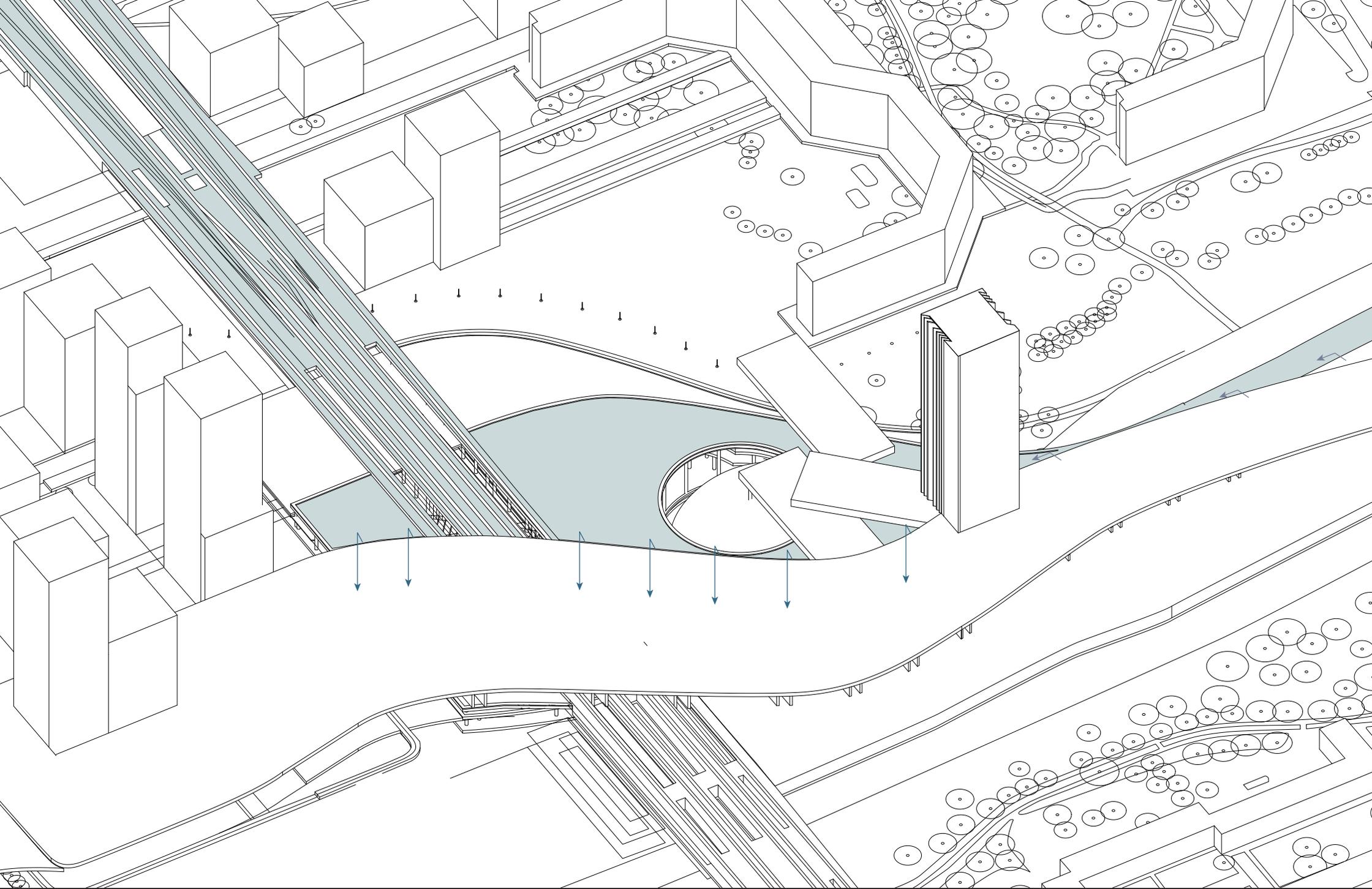
The Design Proposal

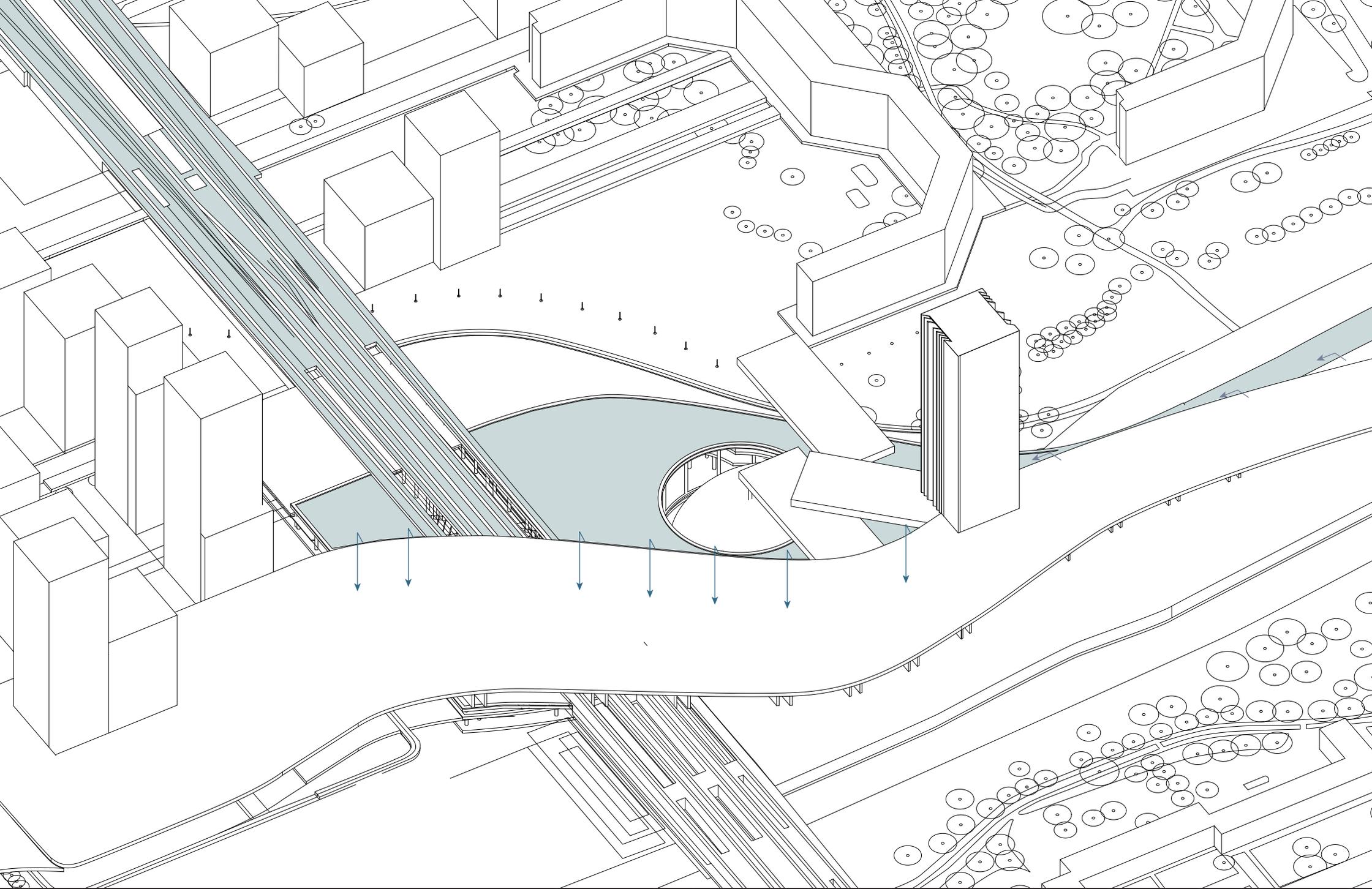


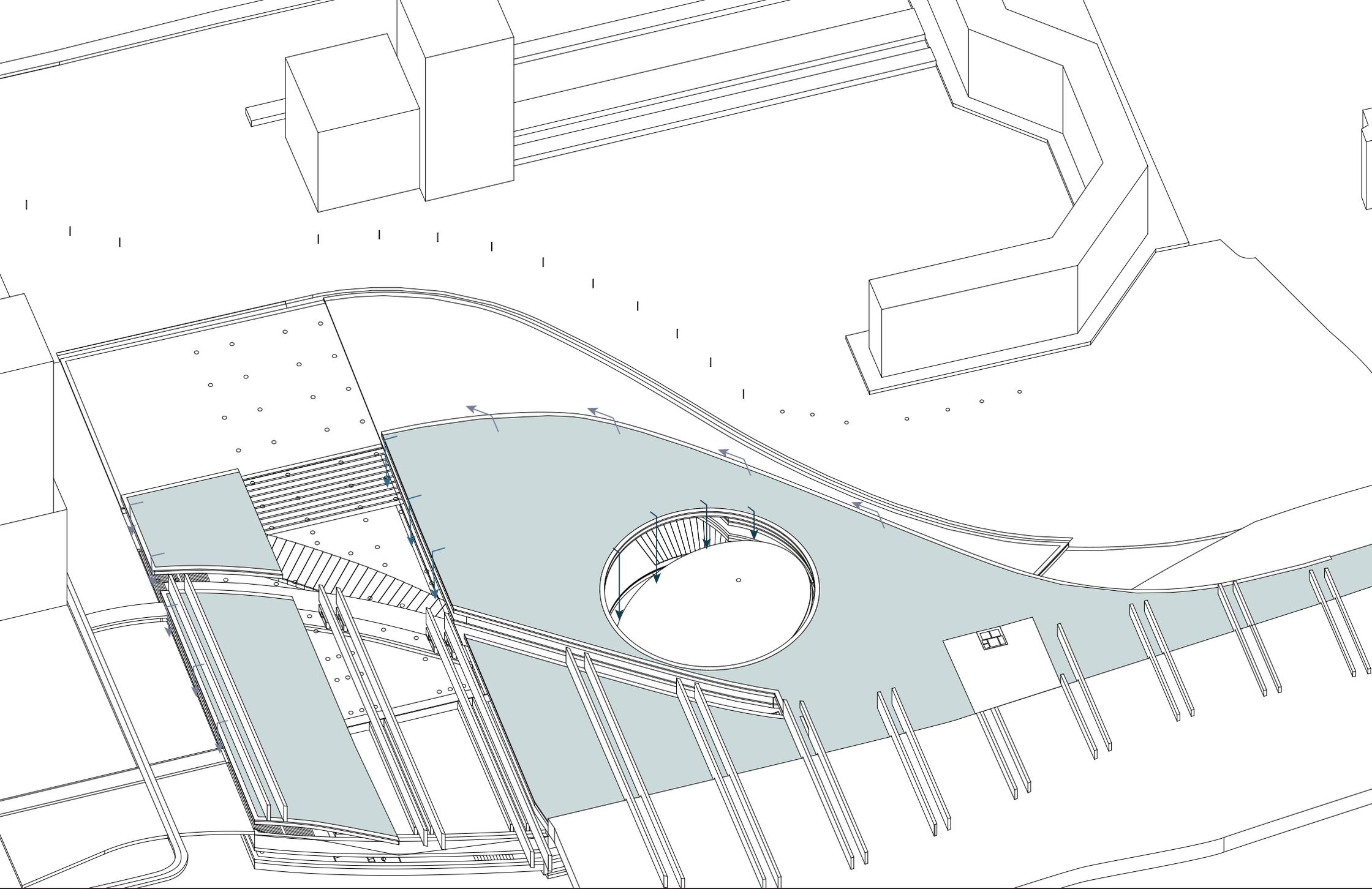


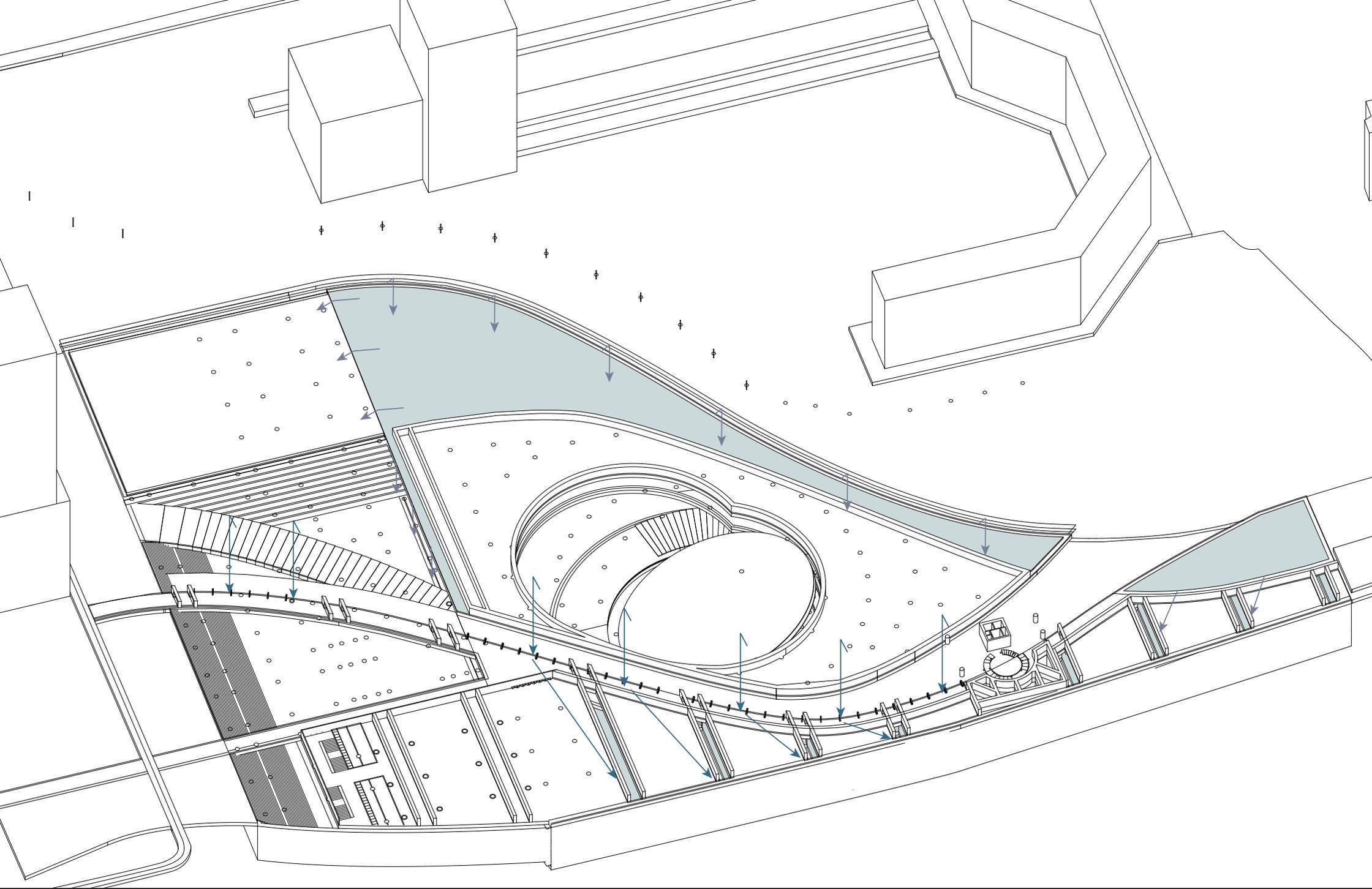


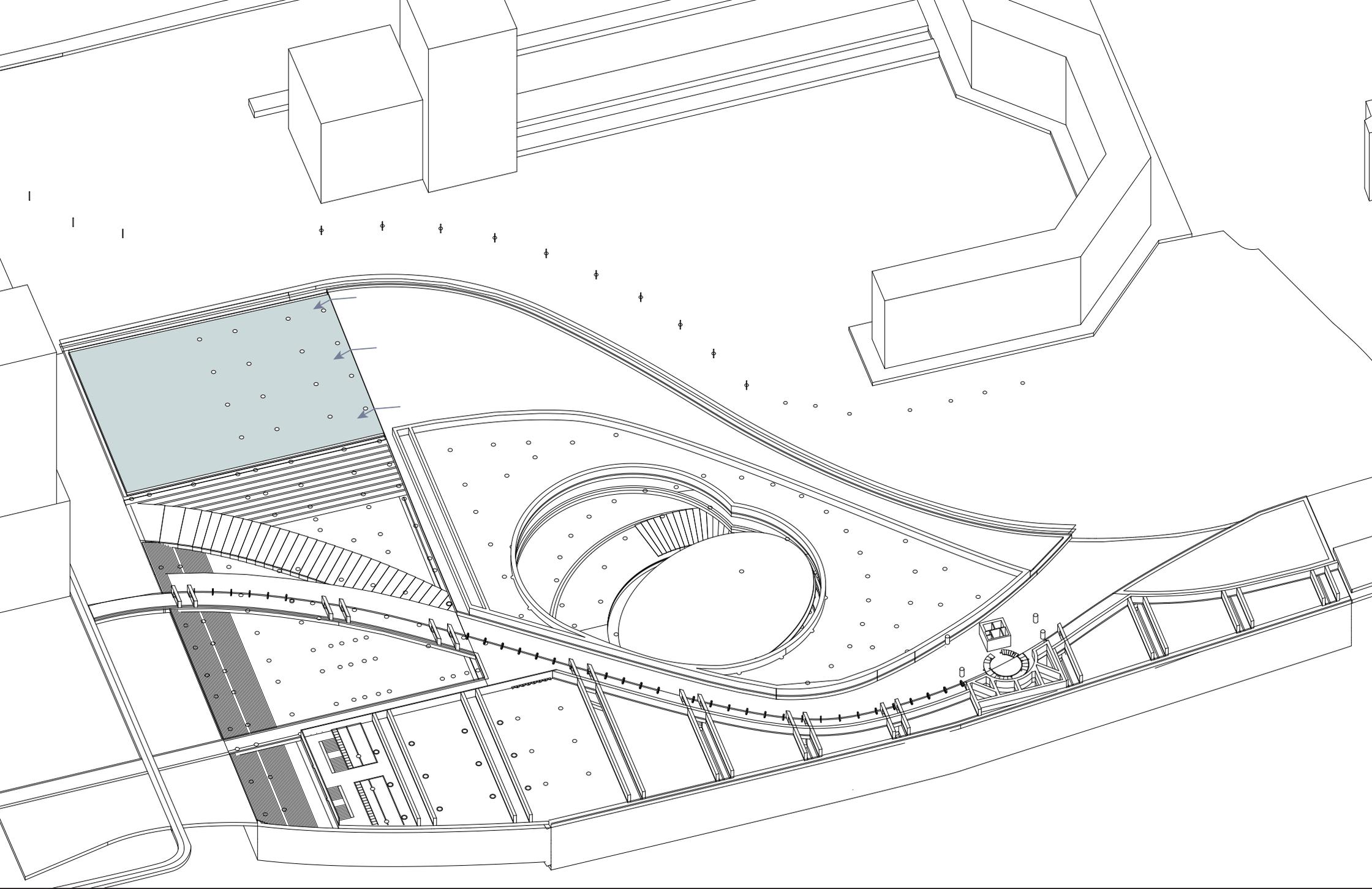


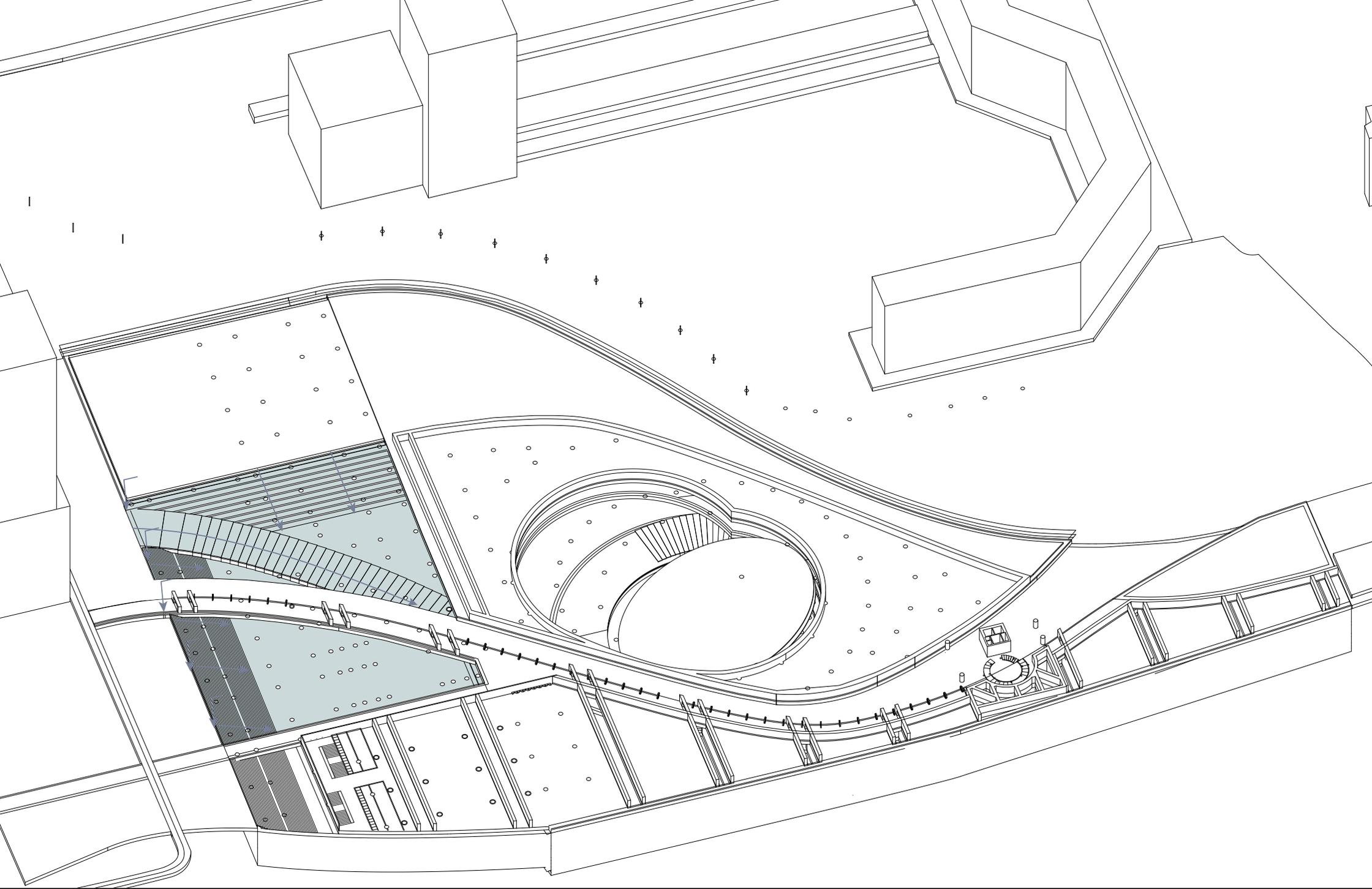


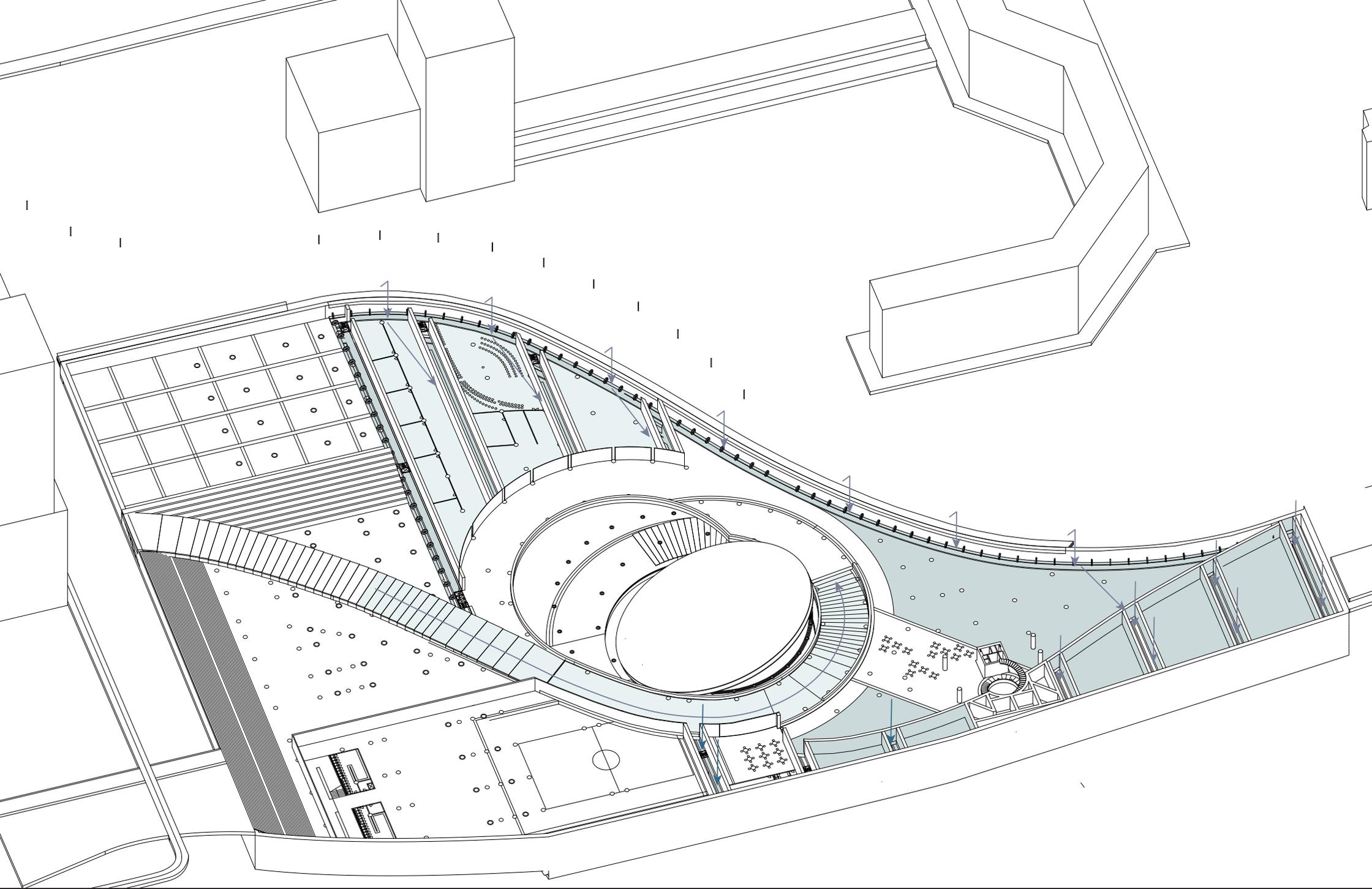


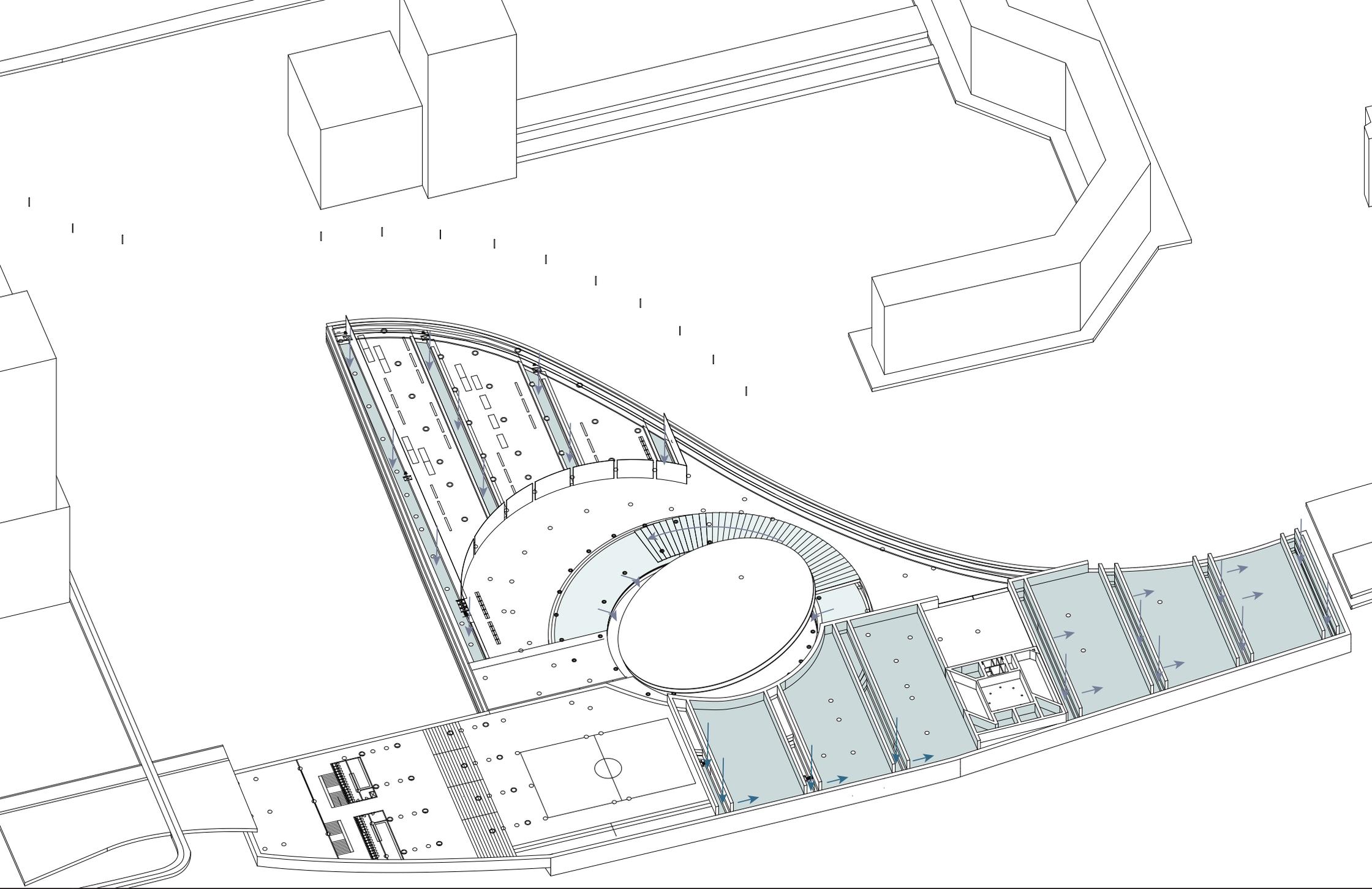


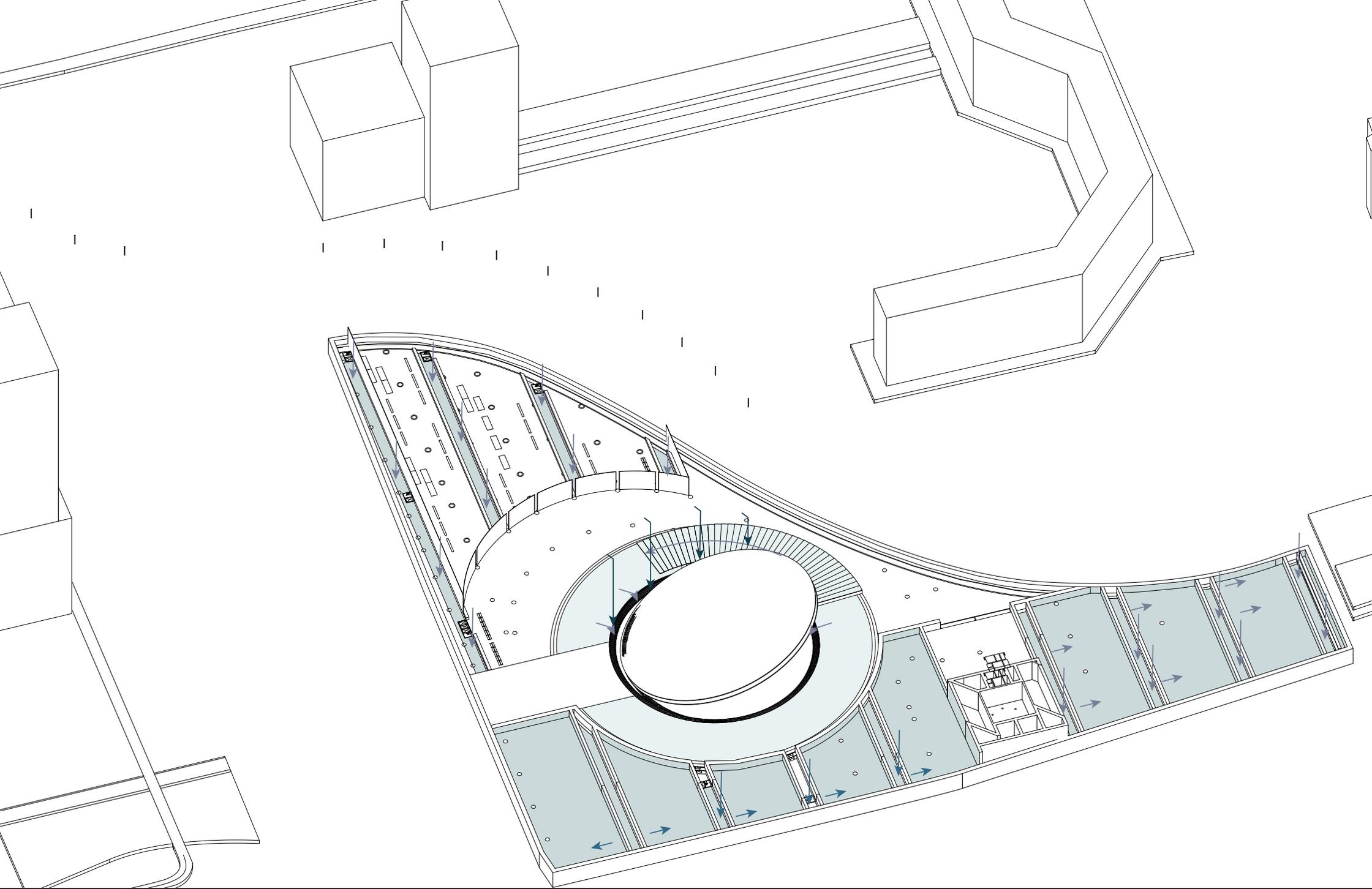


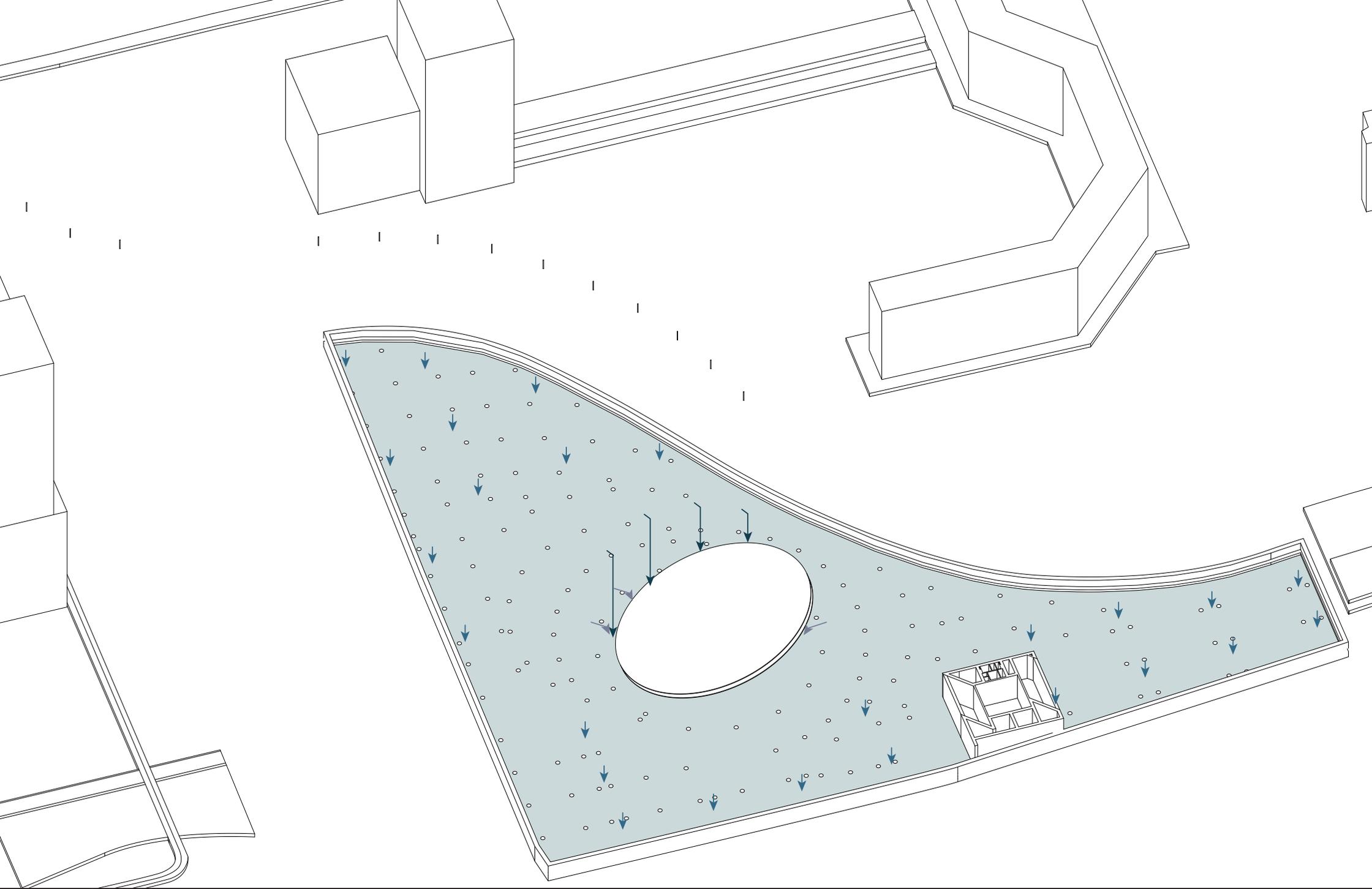


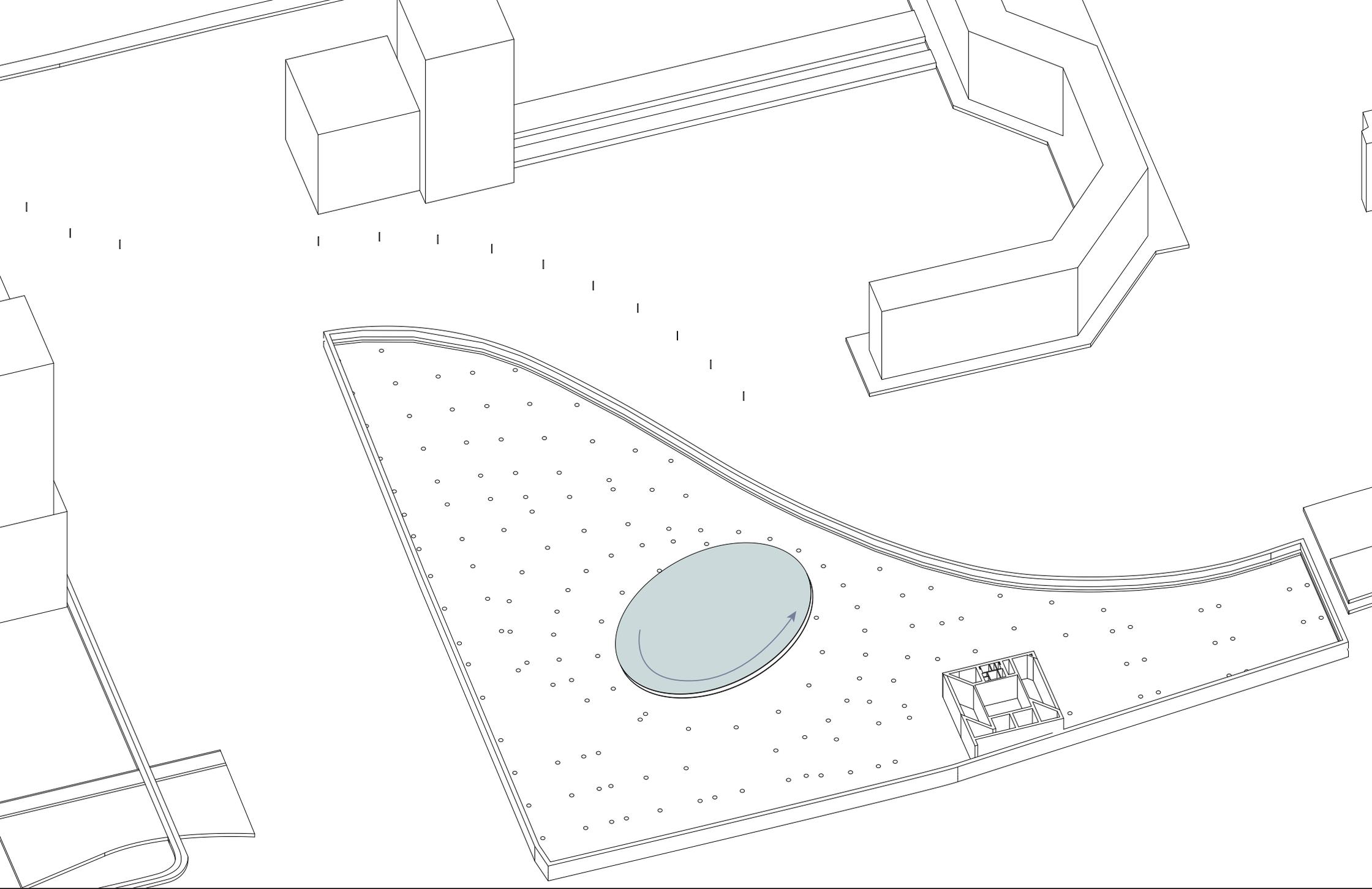


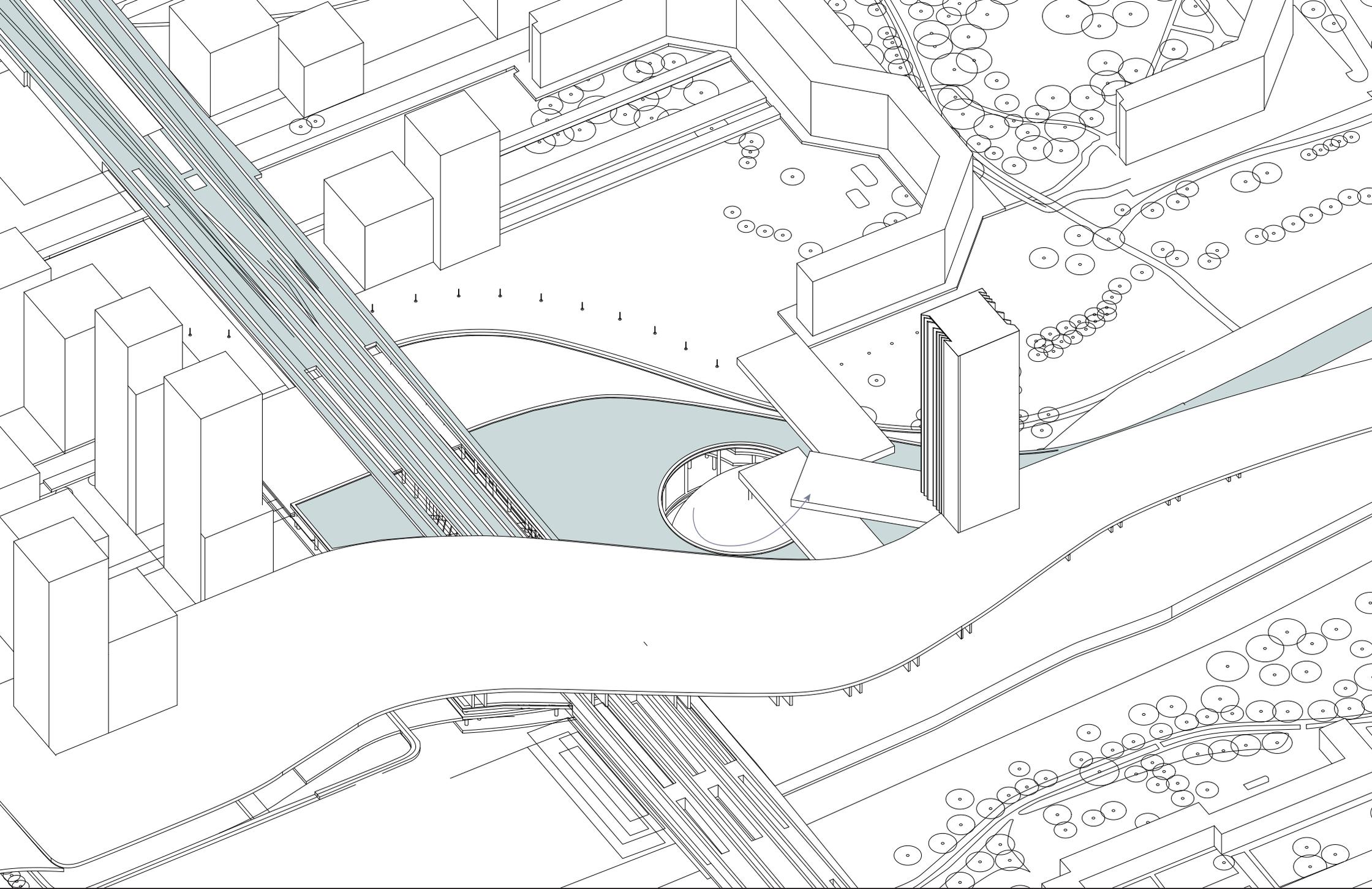


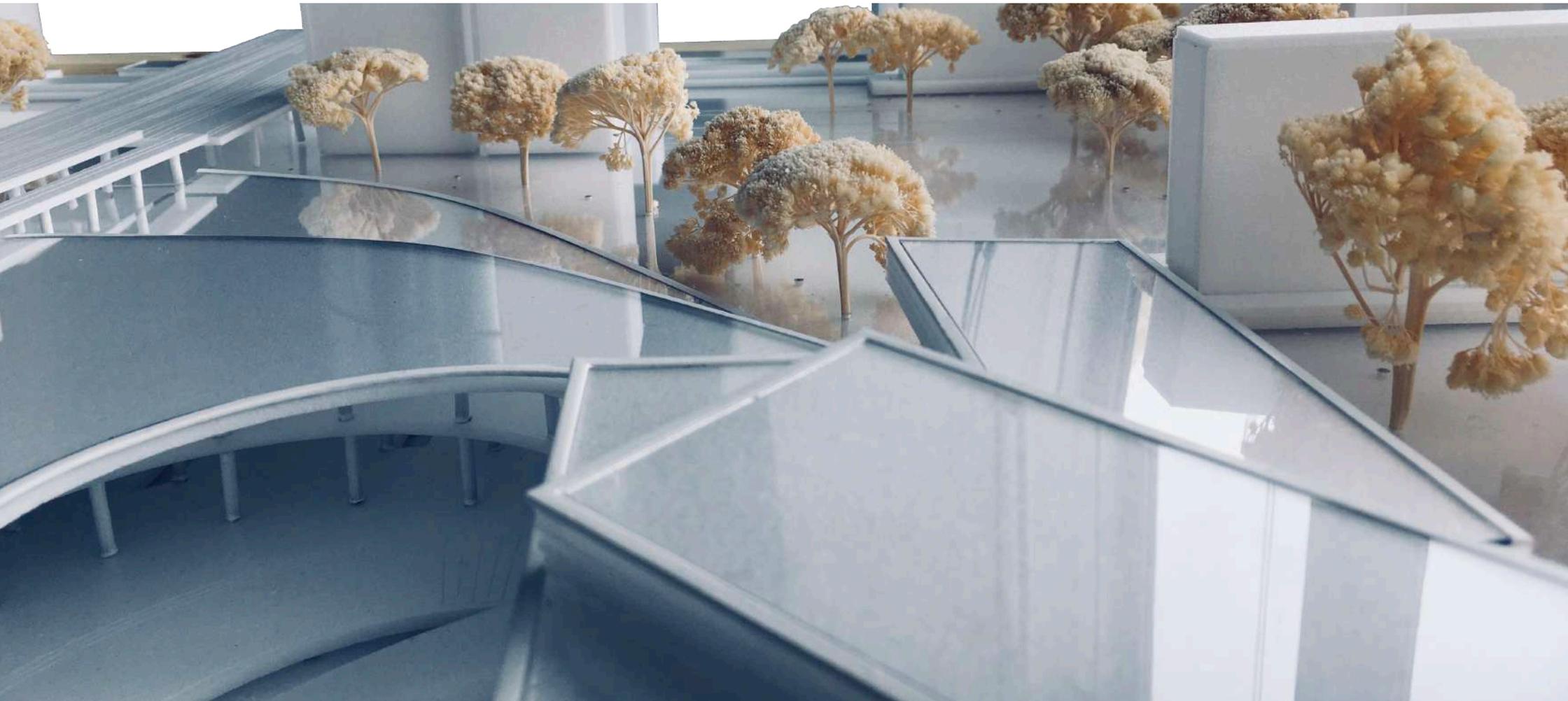








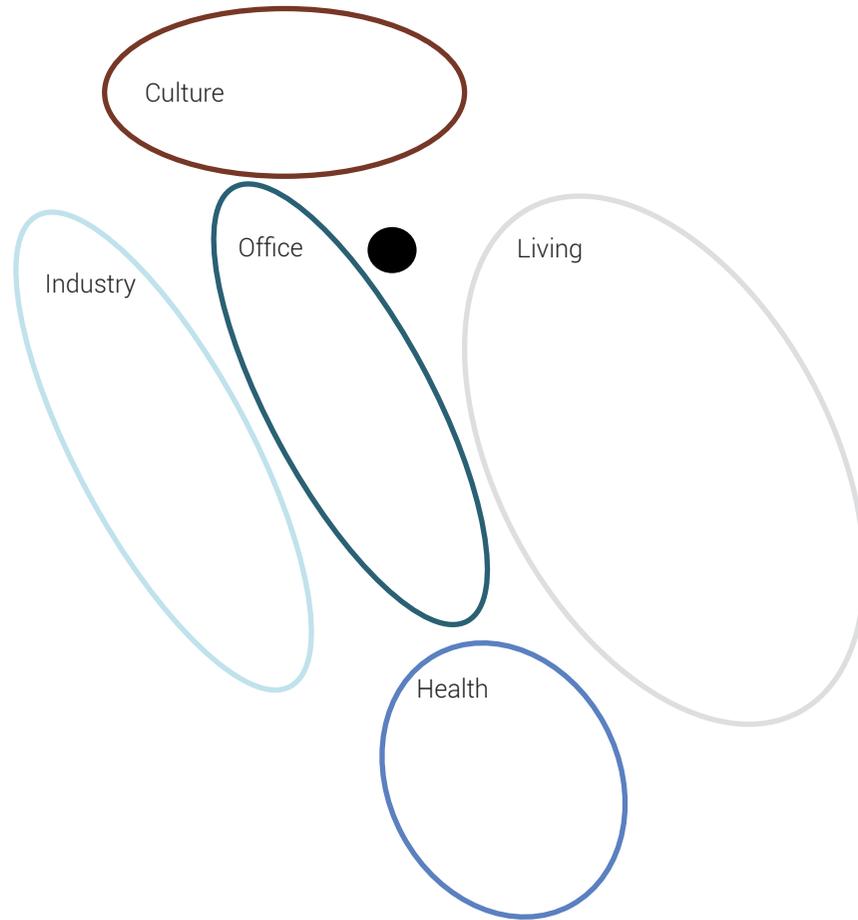




Program

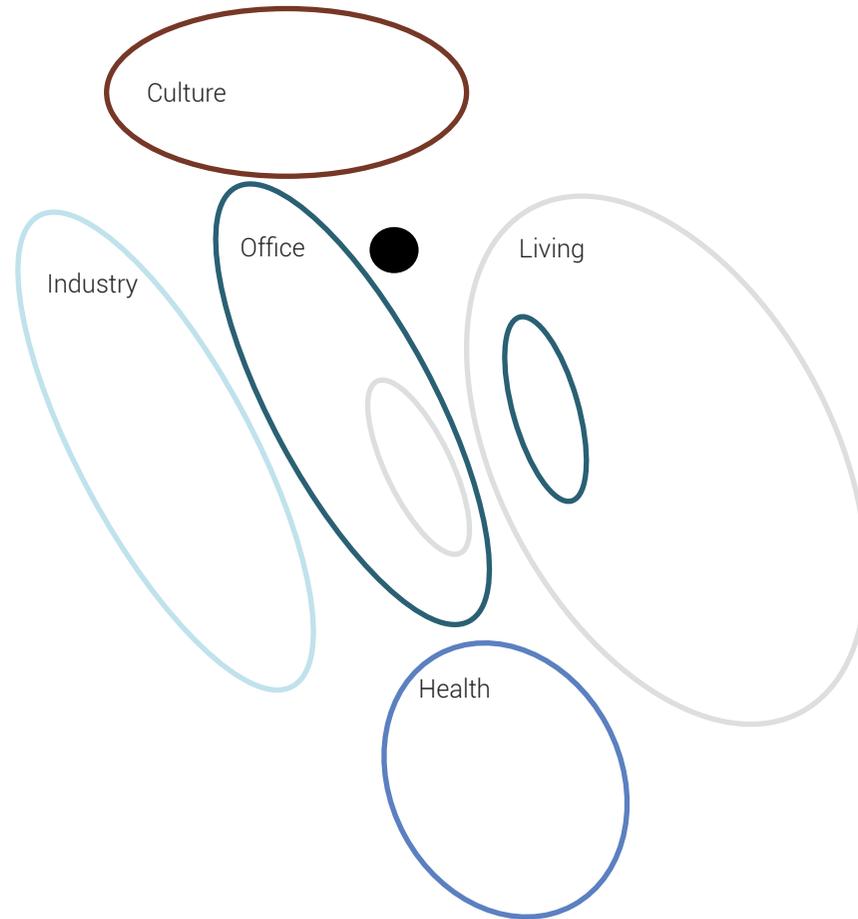
The Design Proposal

Current Clusters



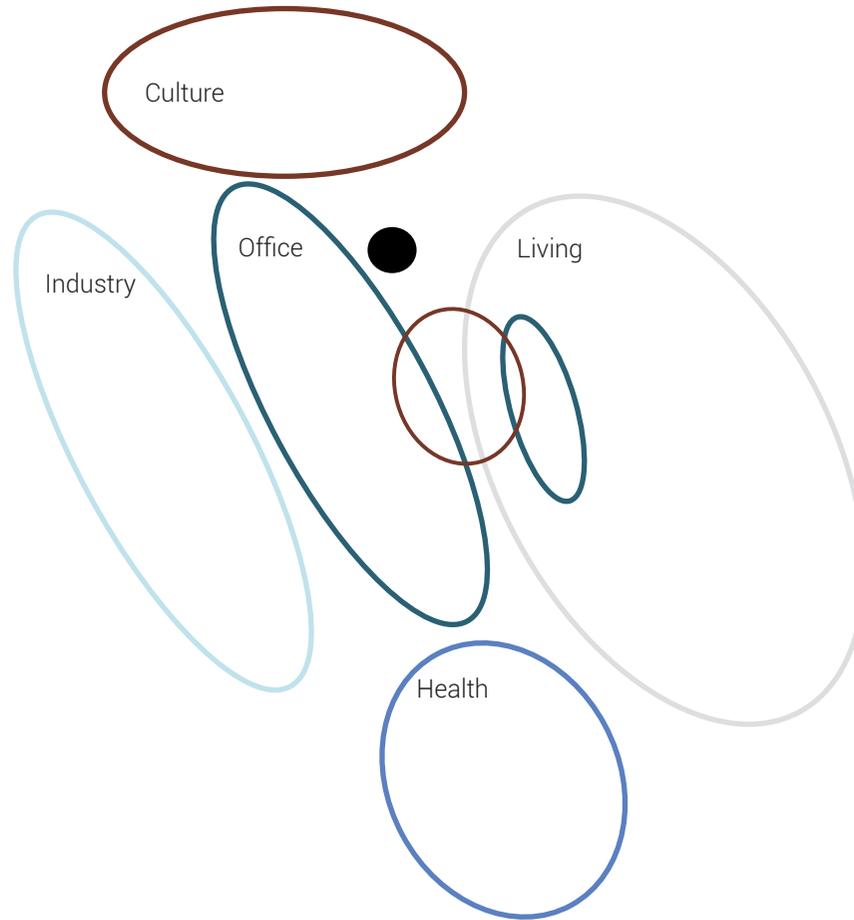
Concept Programme

Proposed Intermingling



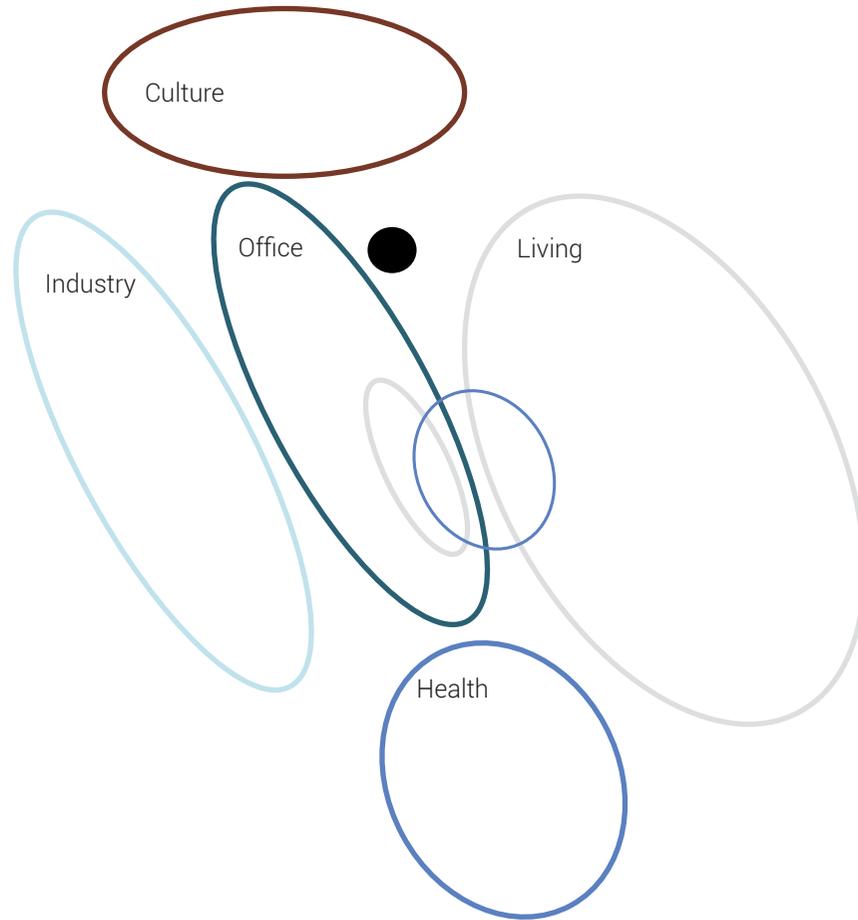
Concept Programme

Drawing Dwellers to Culture Bufferzone



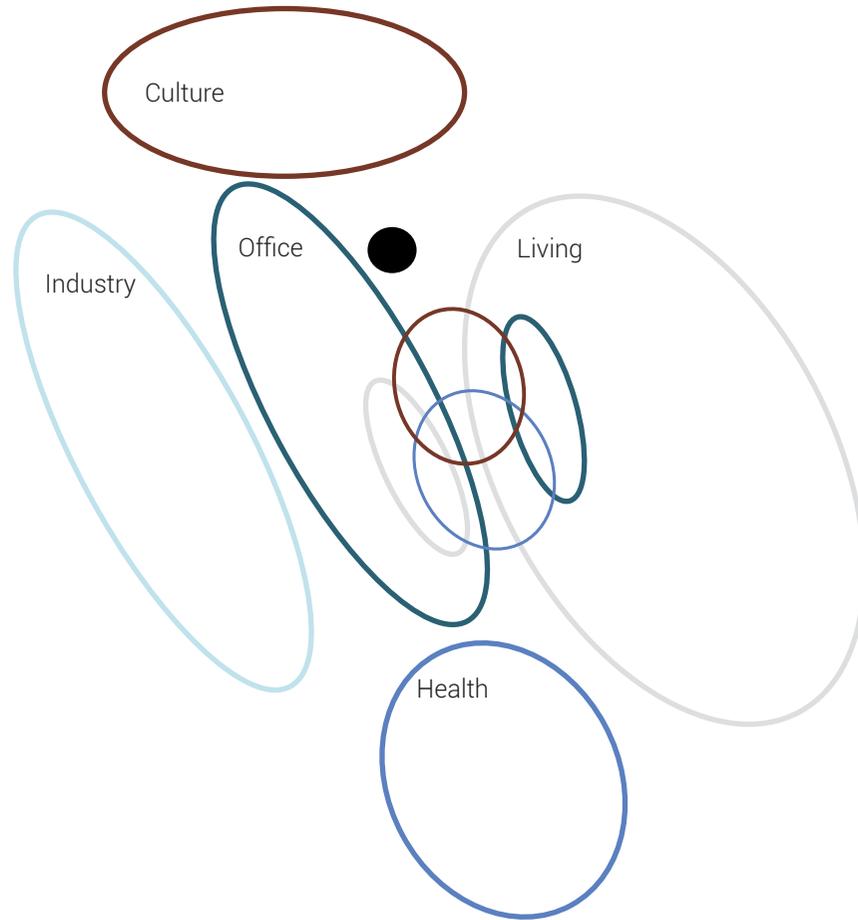
Concept Programme

Drawing Office people to Health and Research Bufferzone



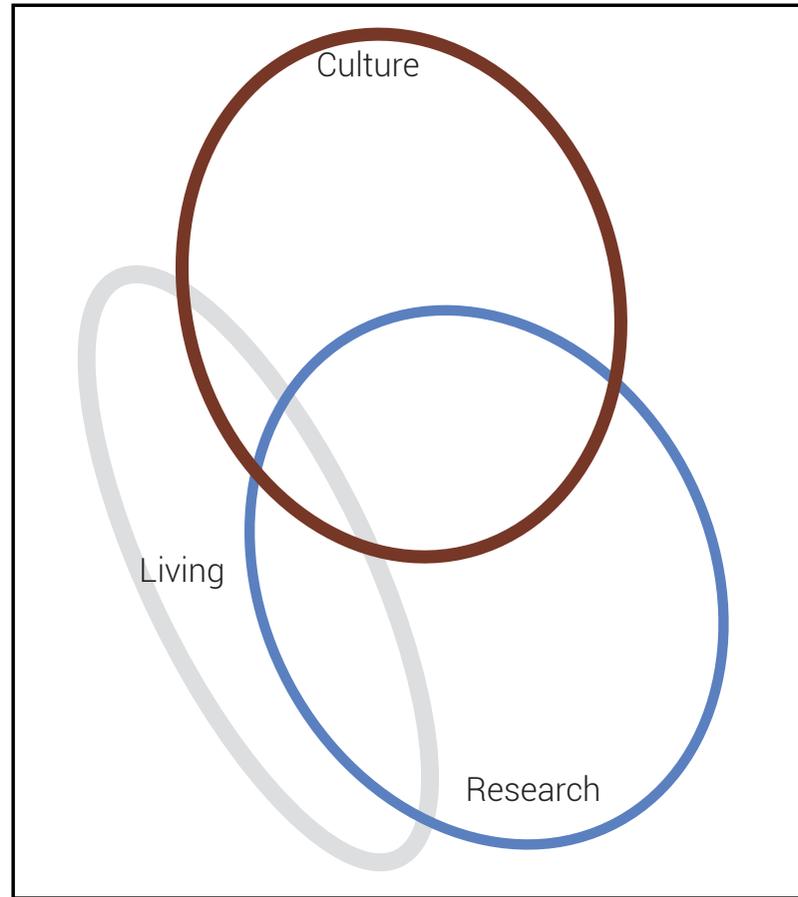
Concept Programme

Proposed Intermingling



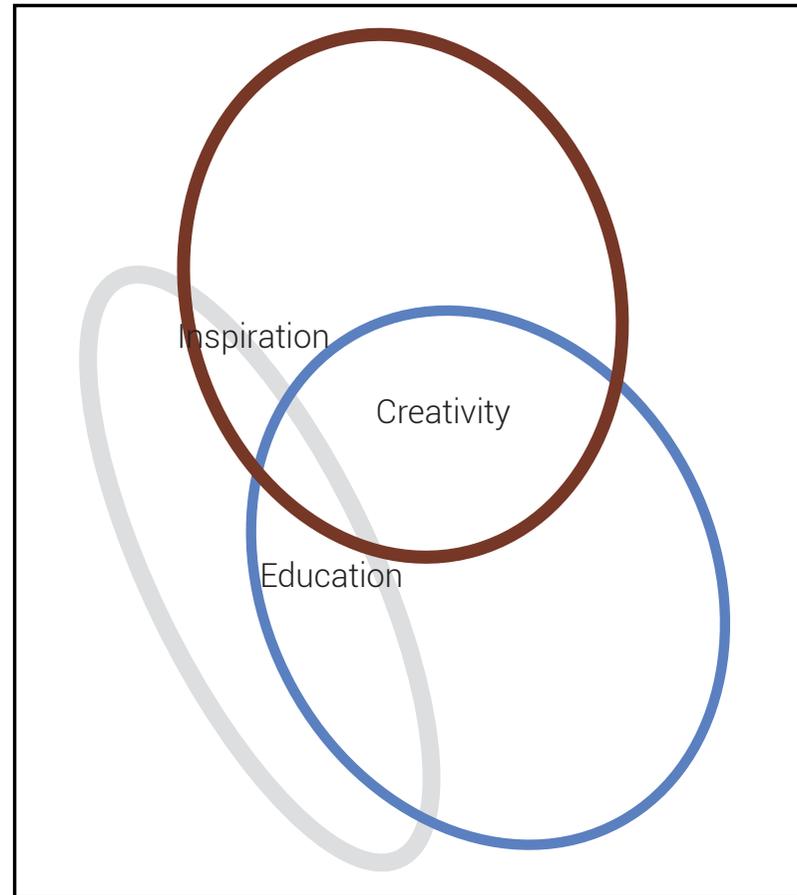
Concept Programme

Culture, Research and Dwelling

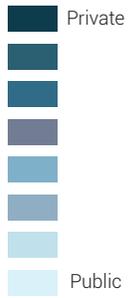


Concept Programme

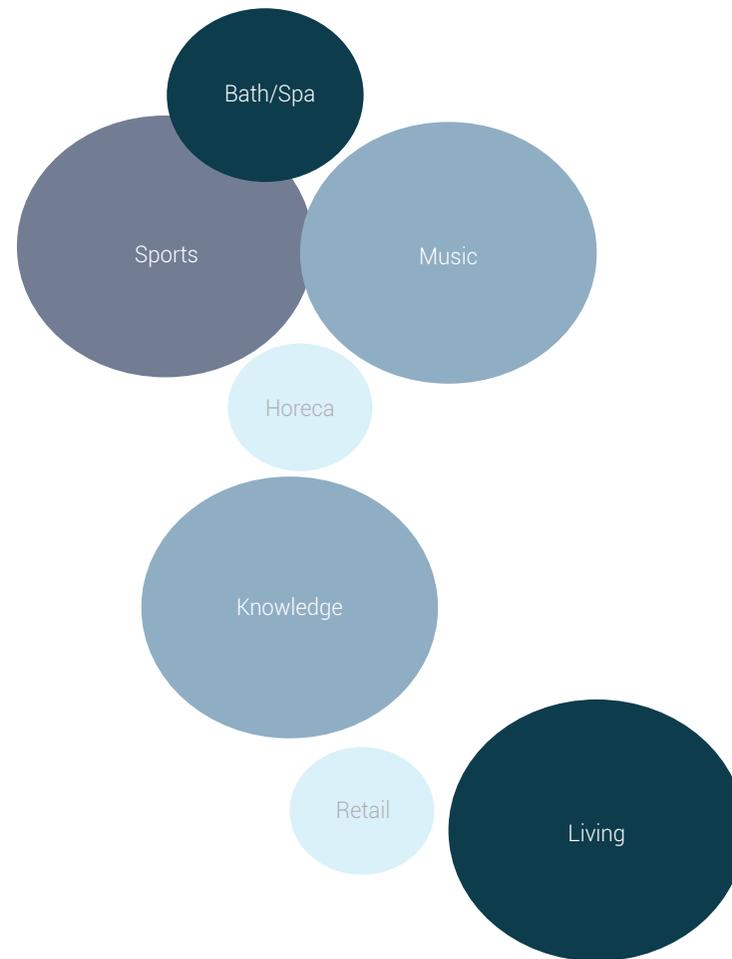
Inspiration, Education & Creativity



Concept Programme

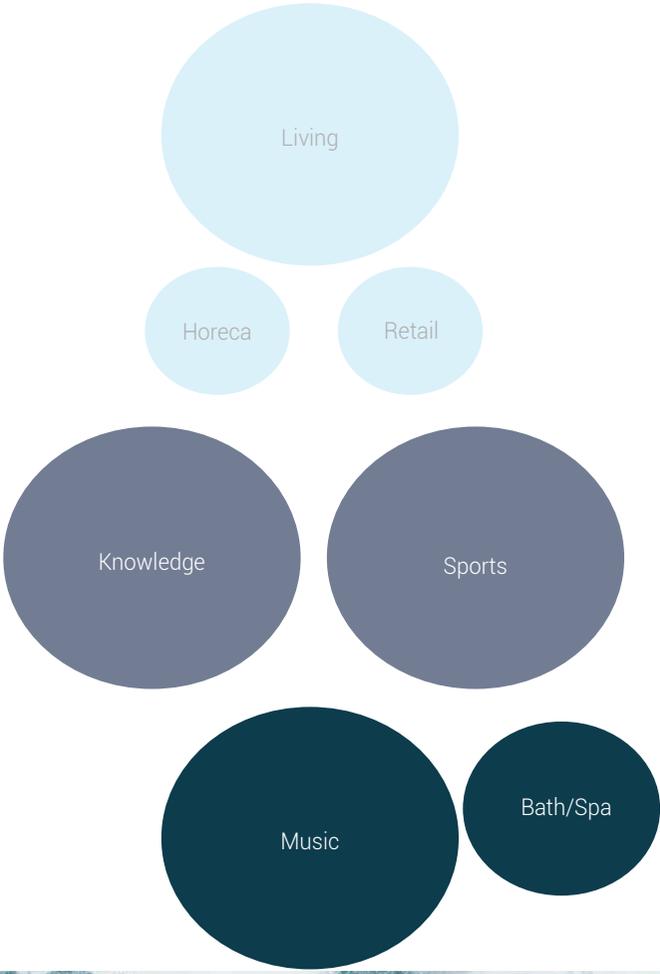
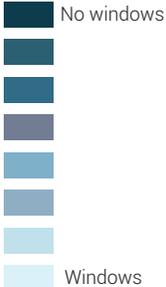


relationship diagram
private vs public distribution



Concept Programme

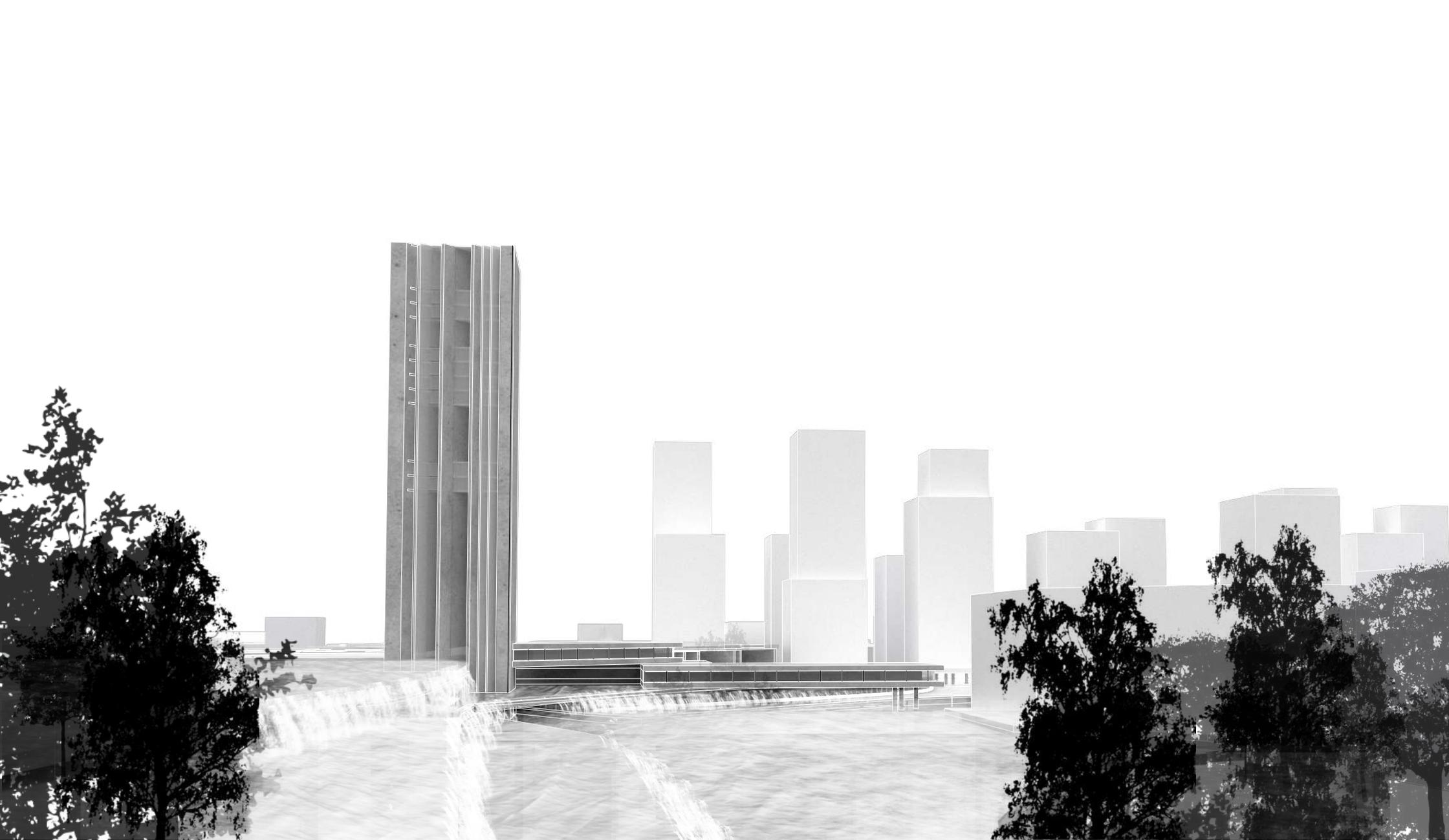
relationship diagram
window openings vs no window openings



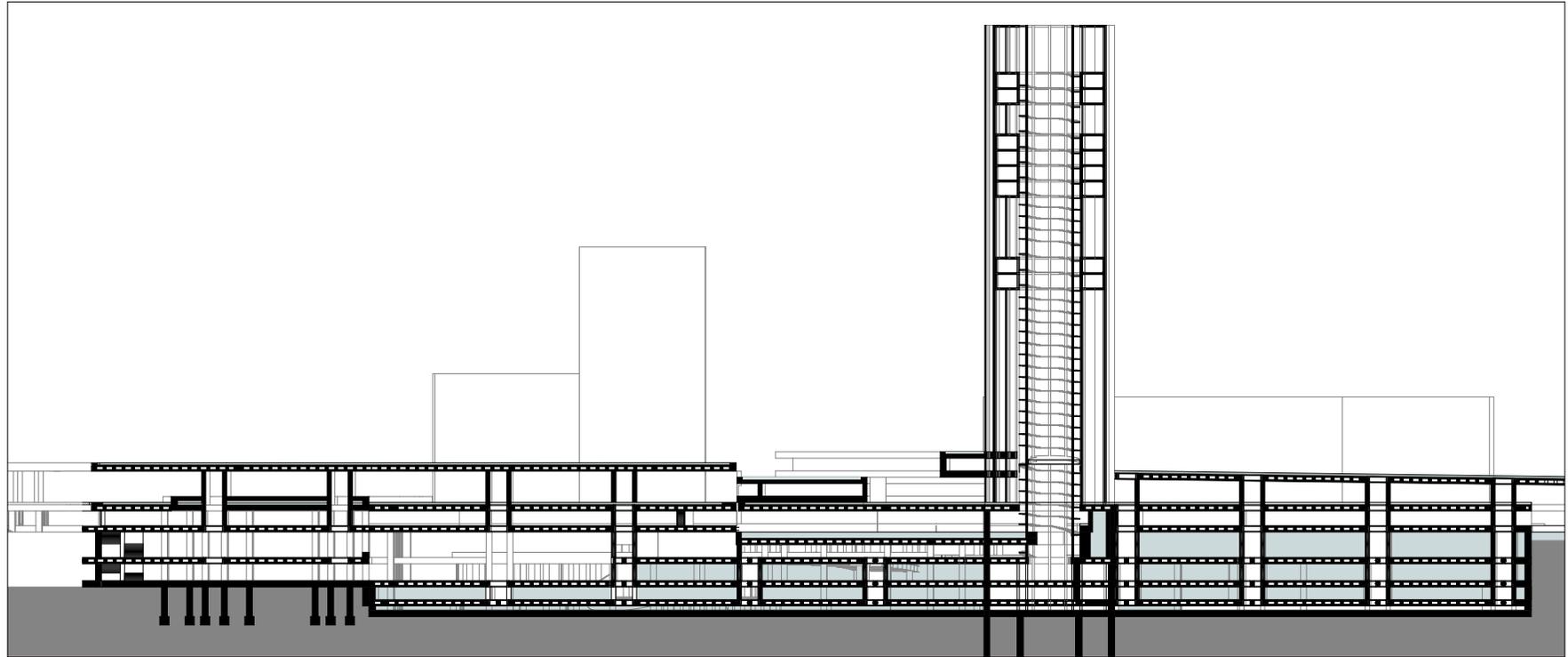
Concept Programme

Plans & Routing

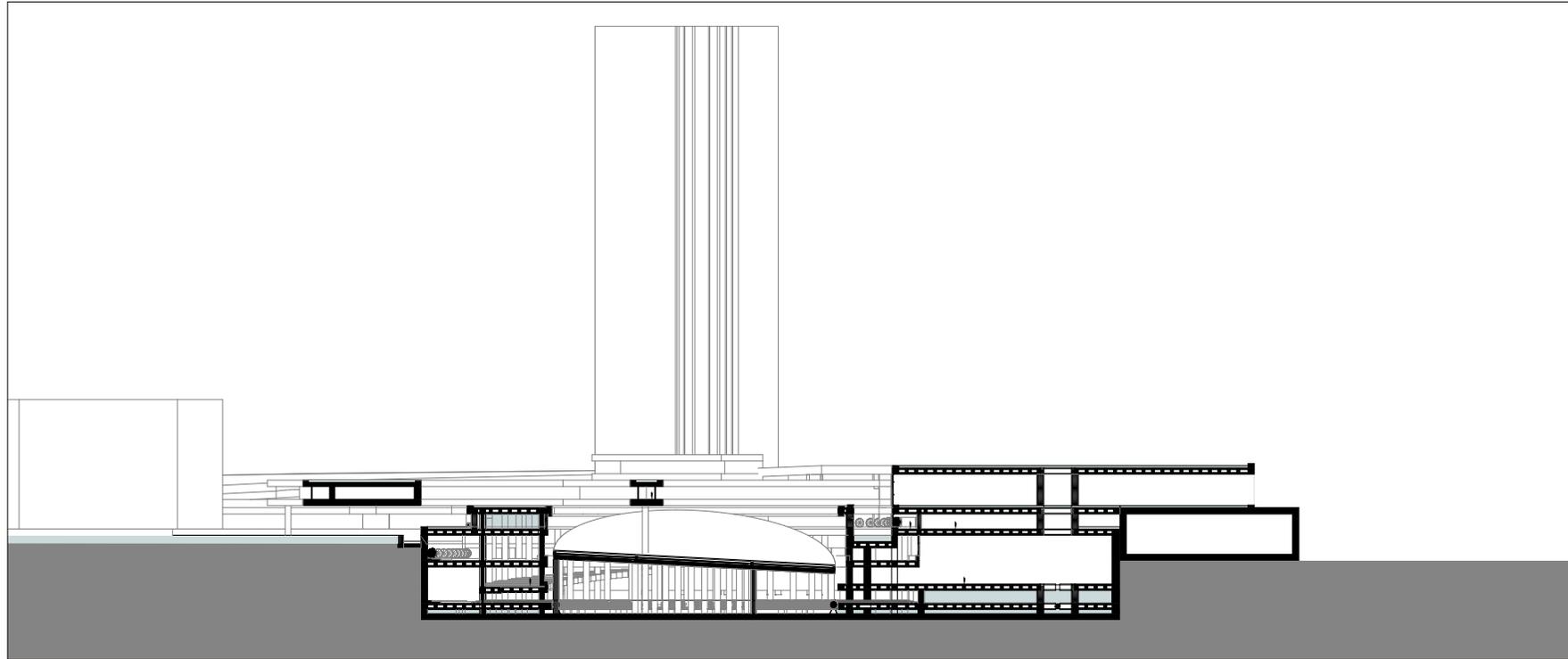
Plan



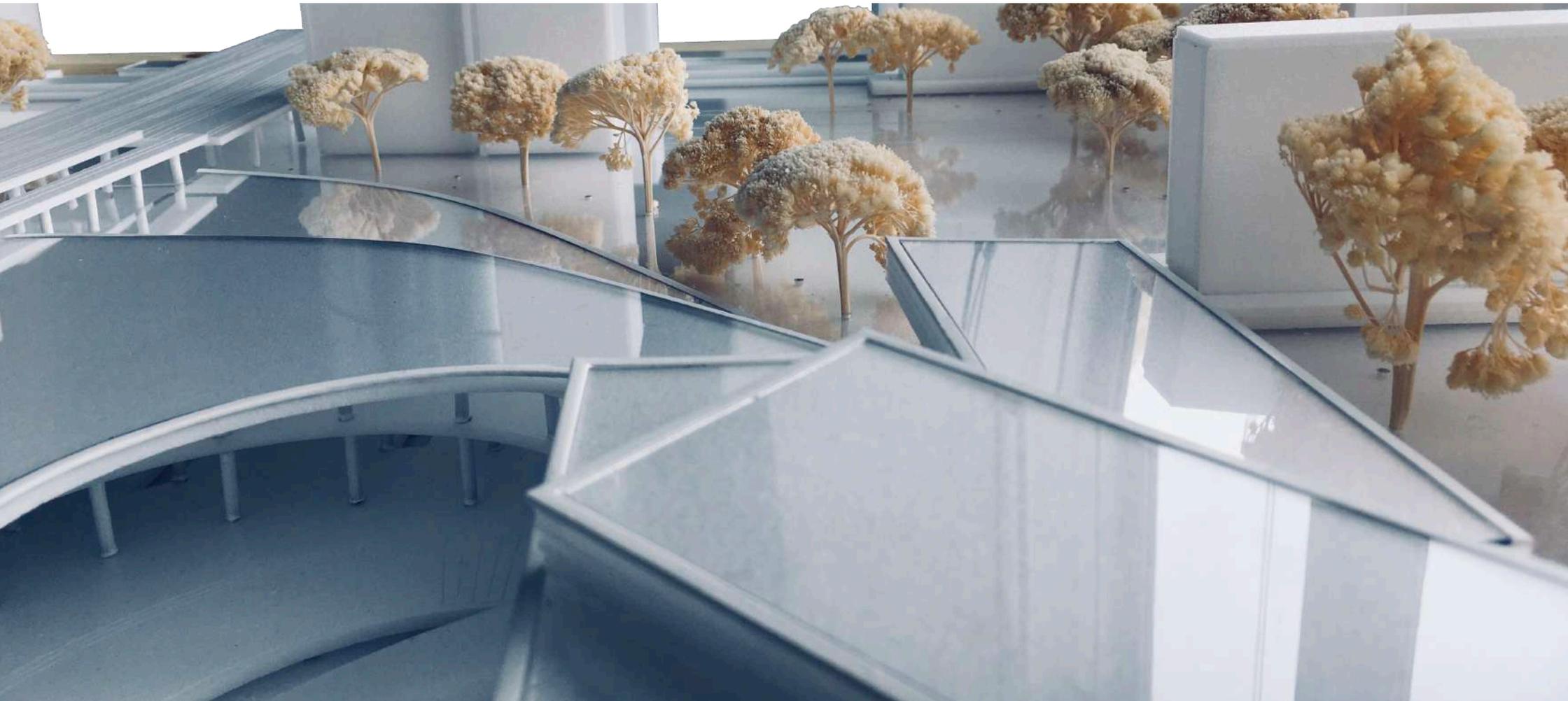




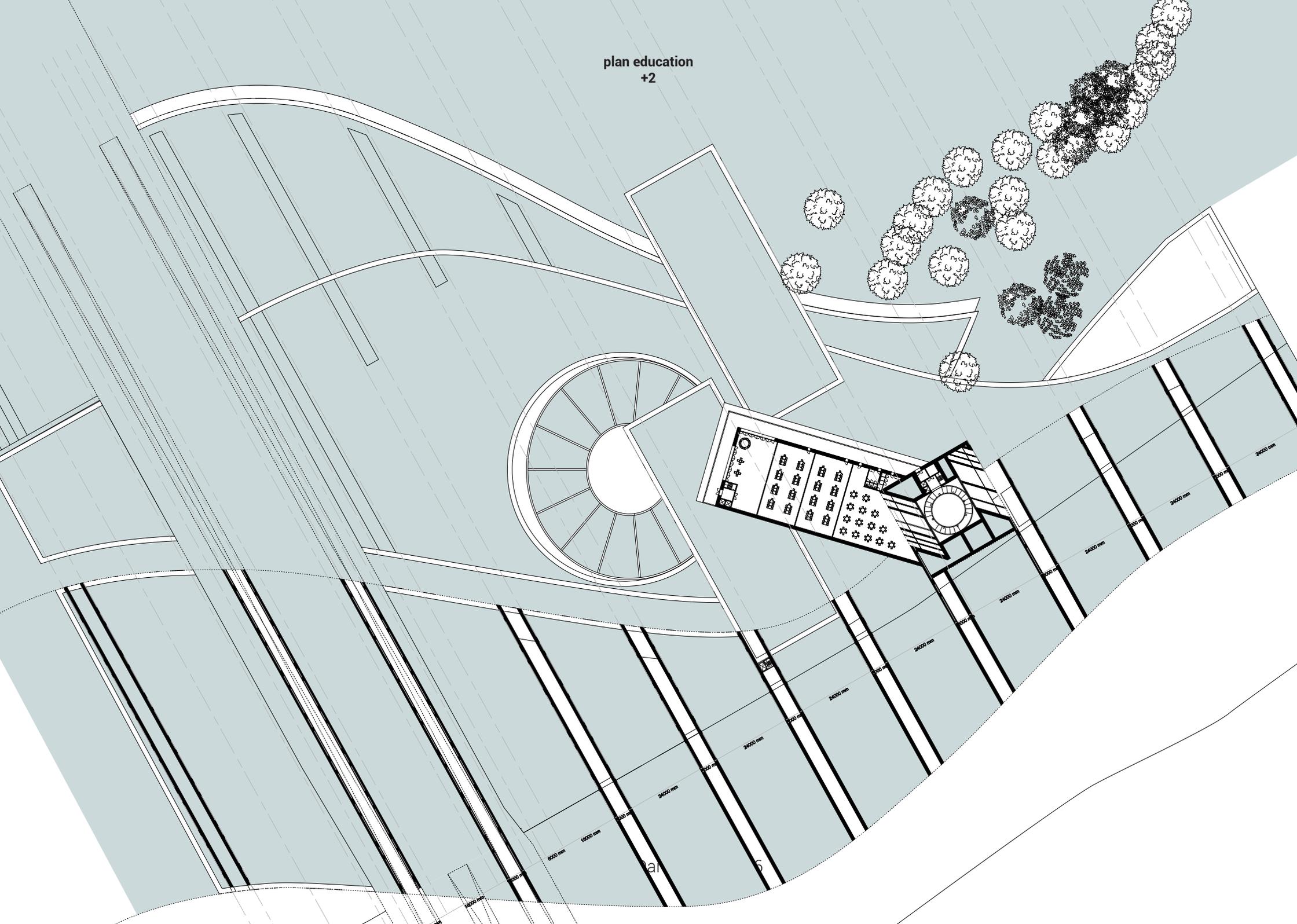
Plan



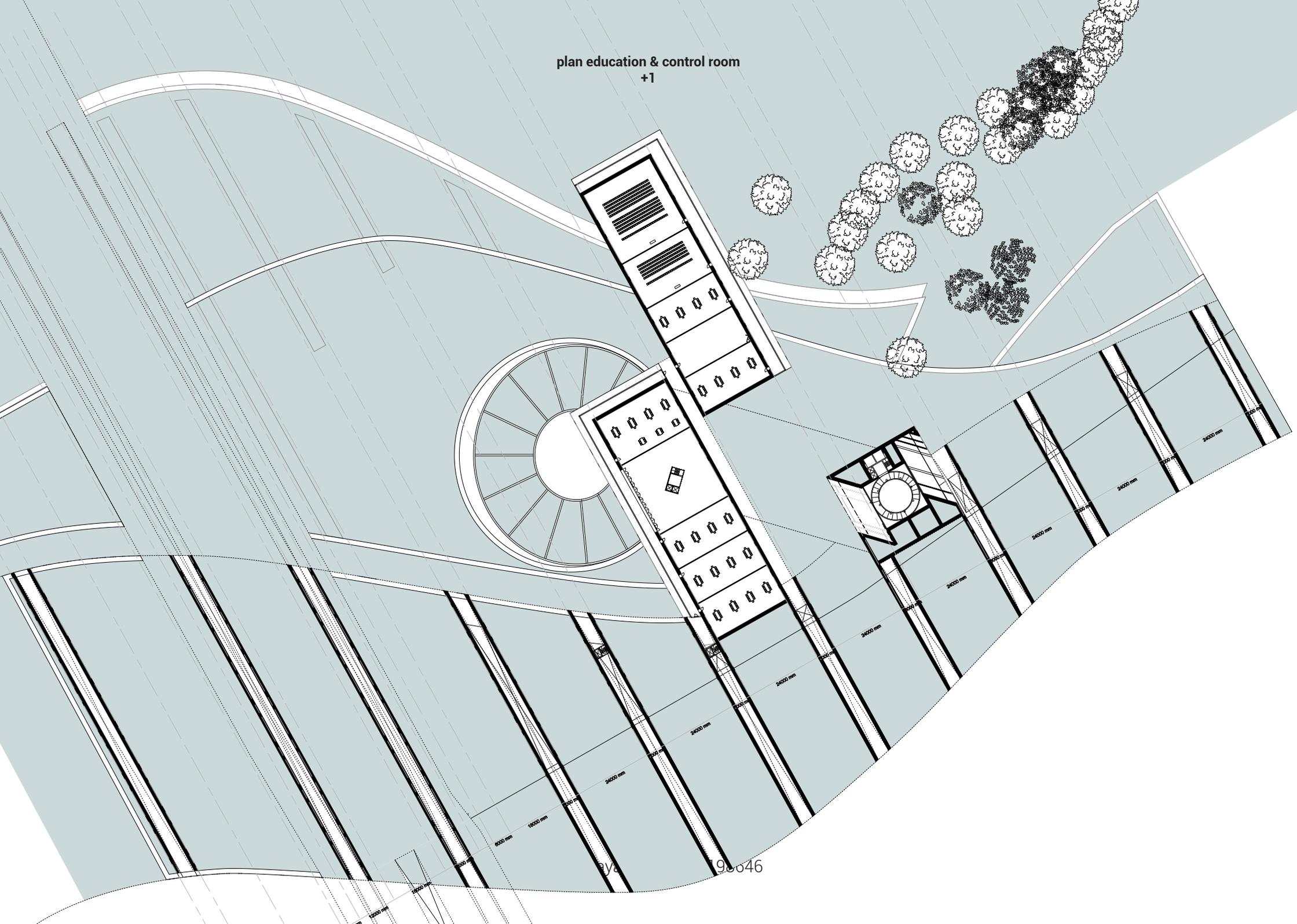
Plan

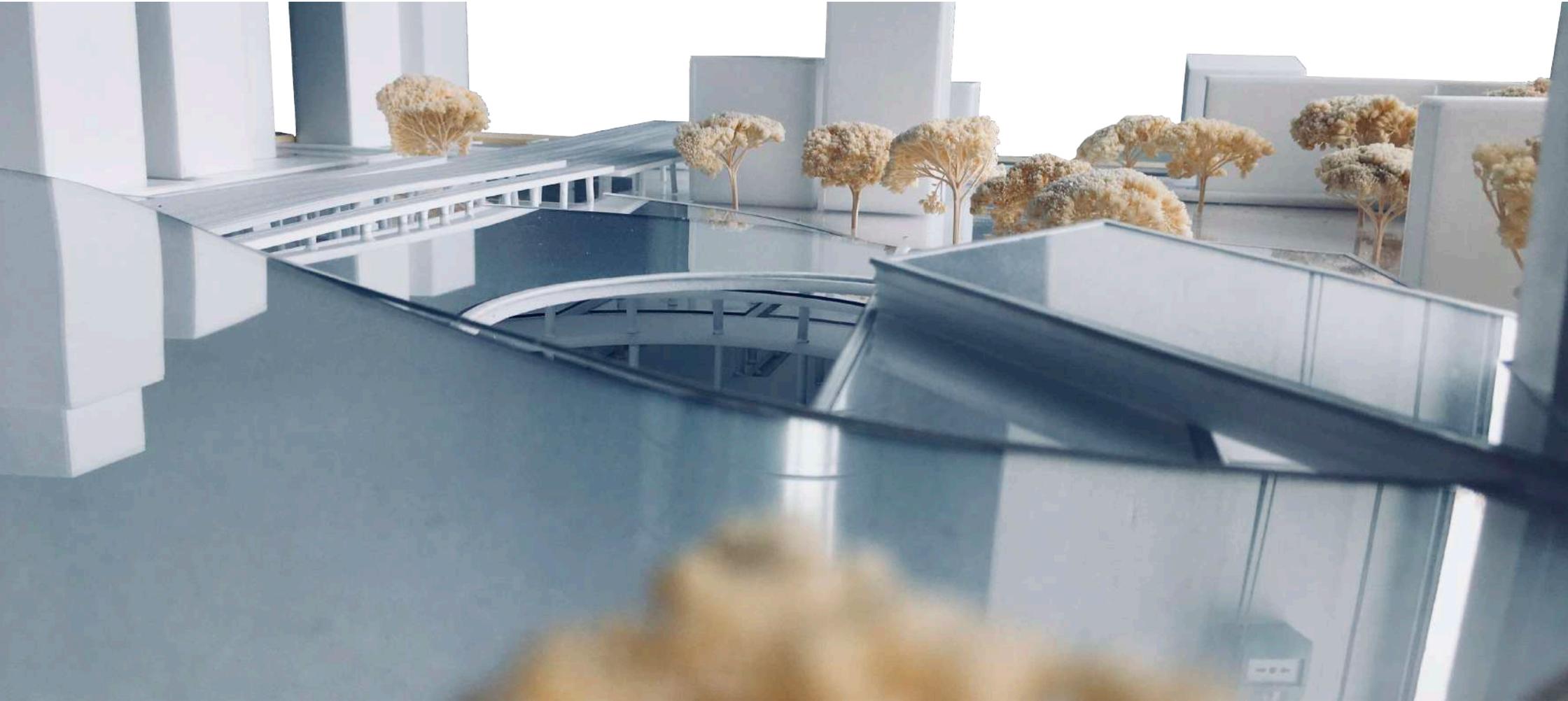


plan education
+2

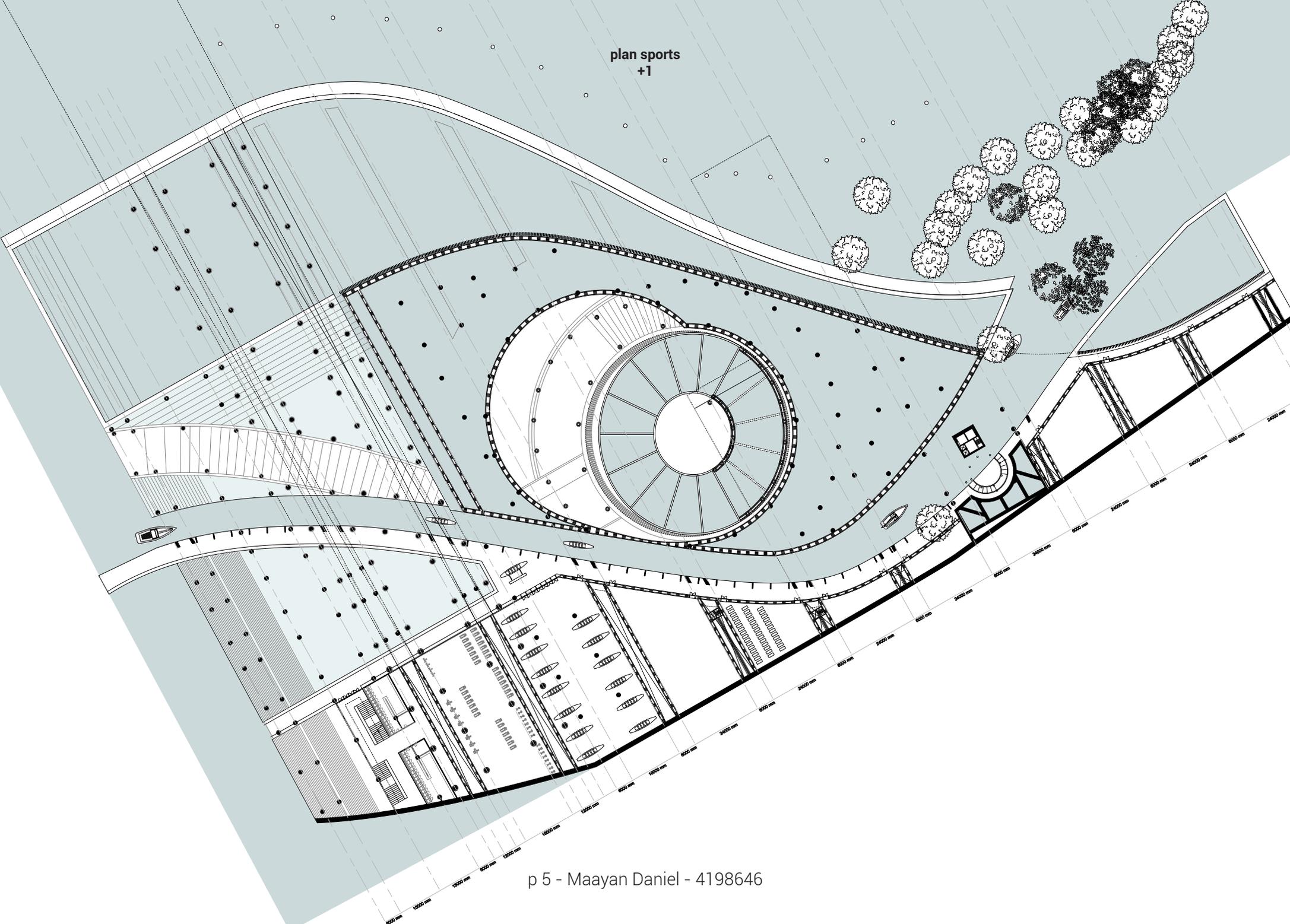


plan education & control room
+1



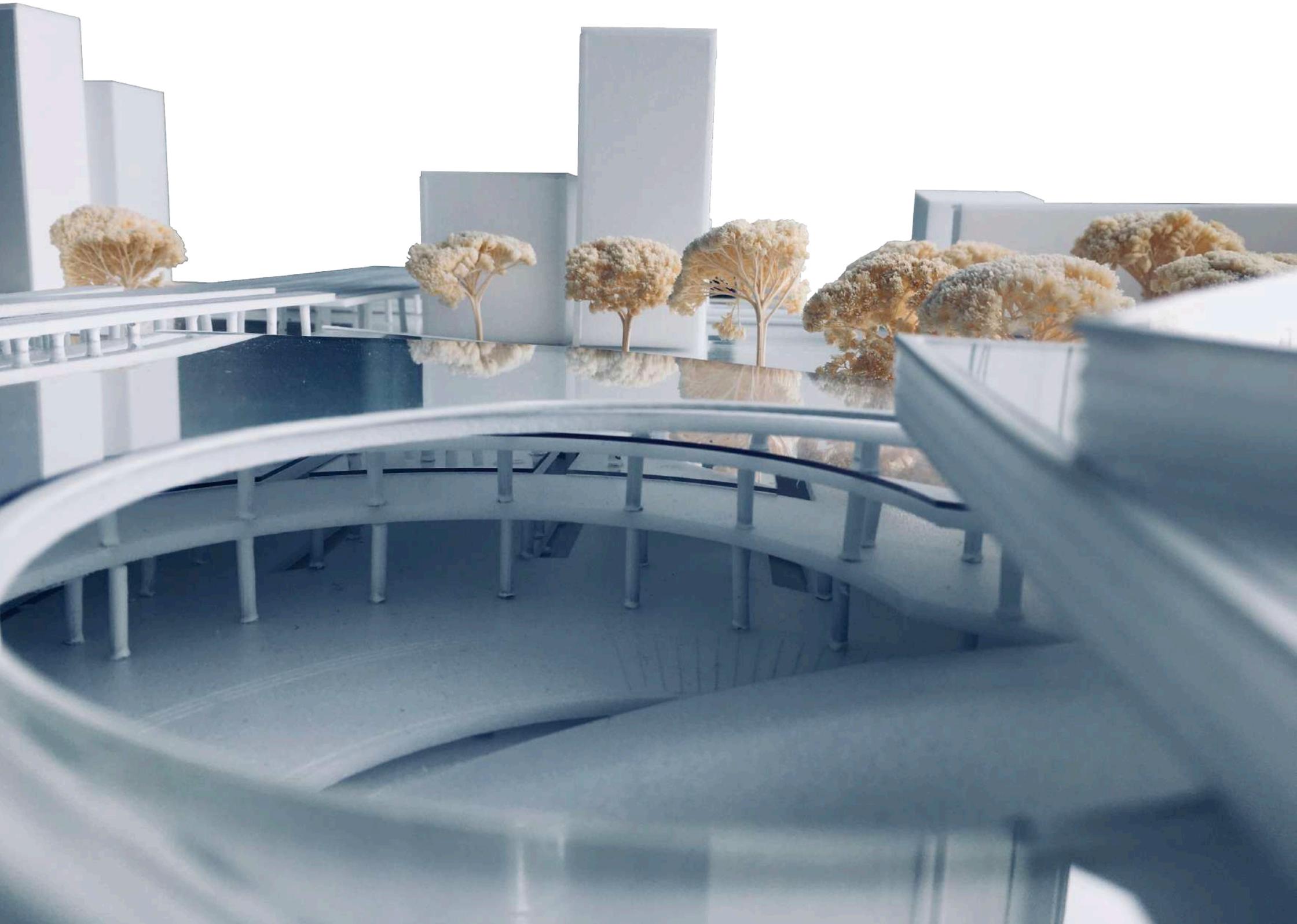


plan sports
+1

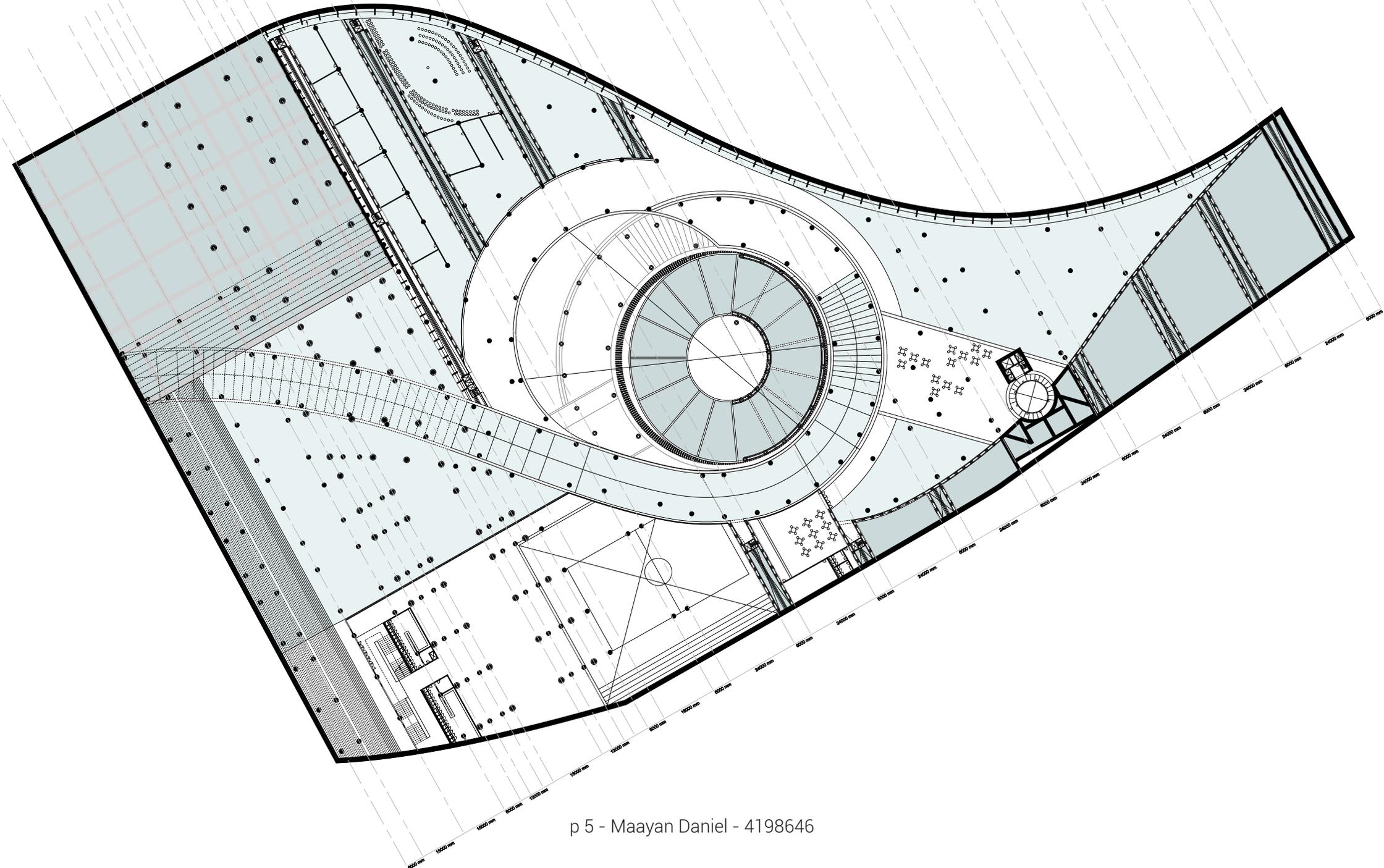


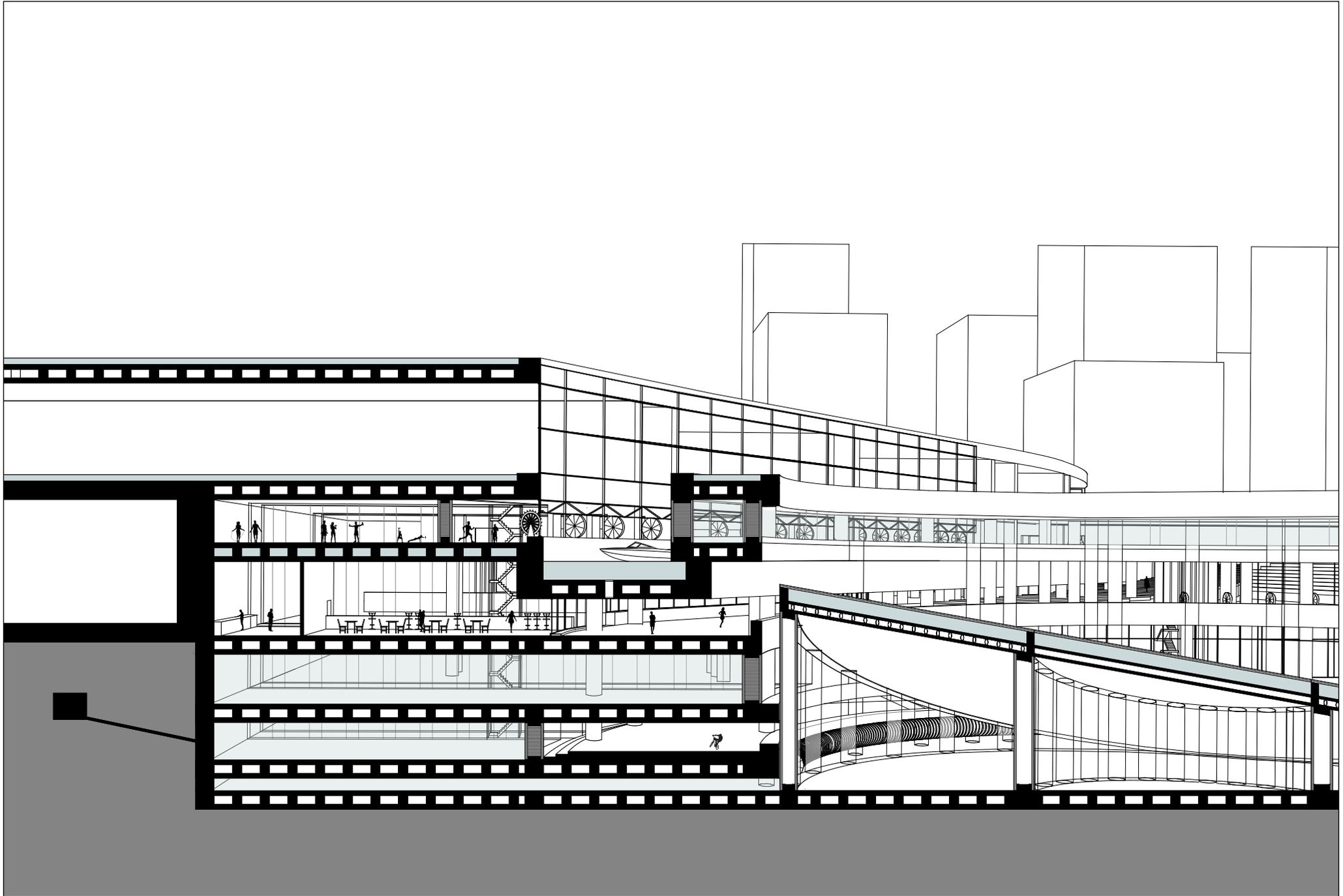






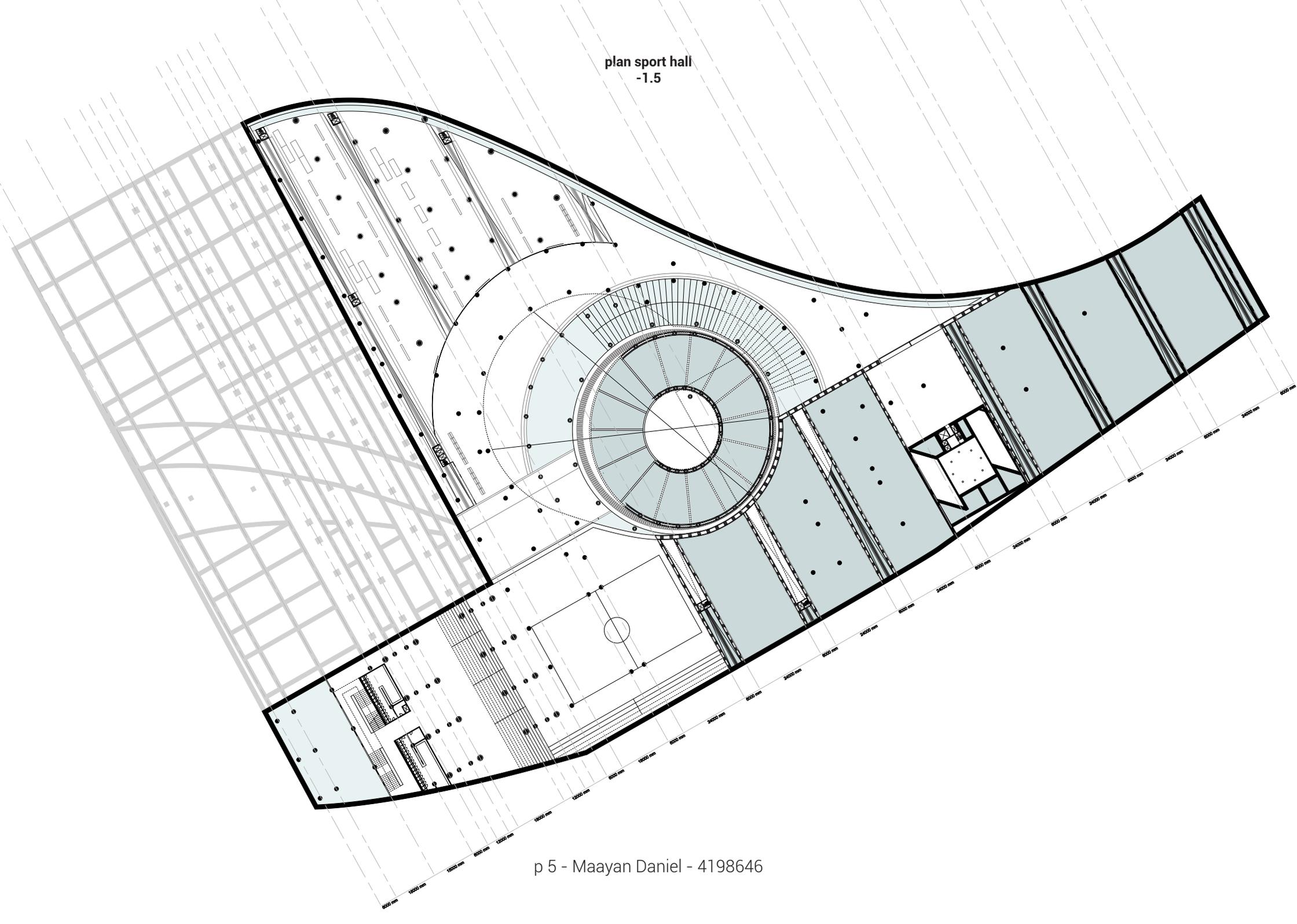
plan dance and music
-1



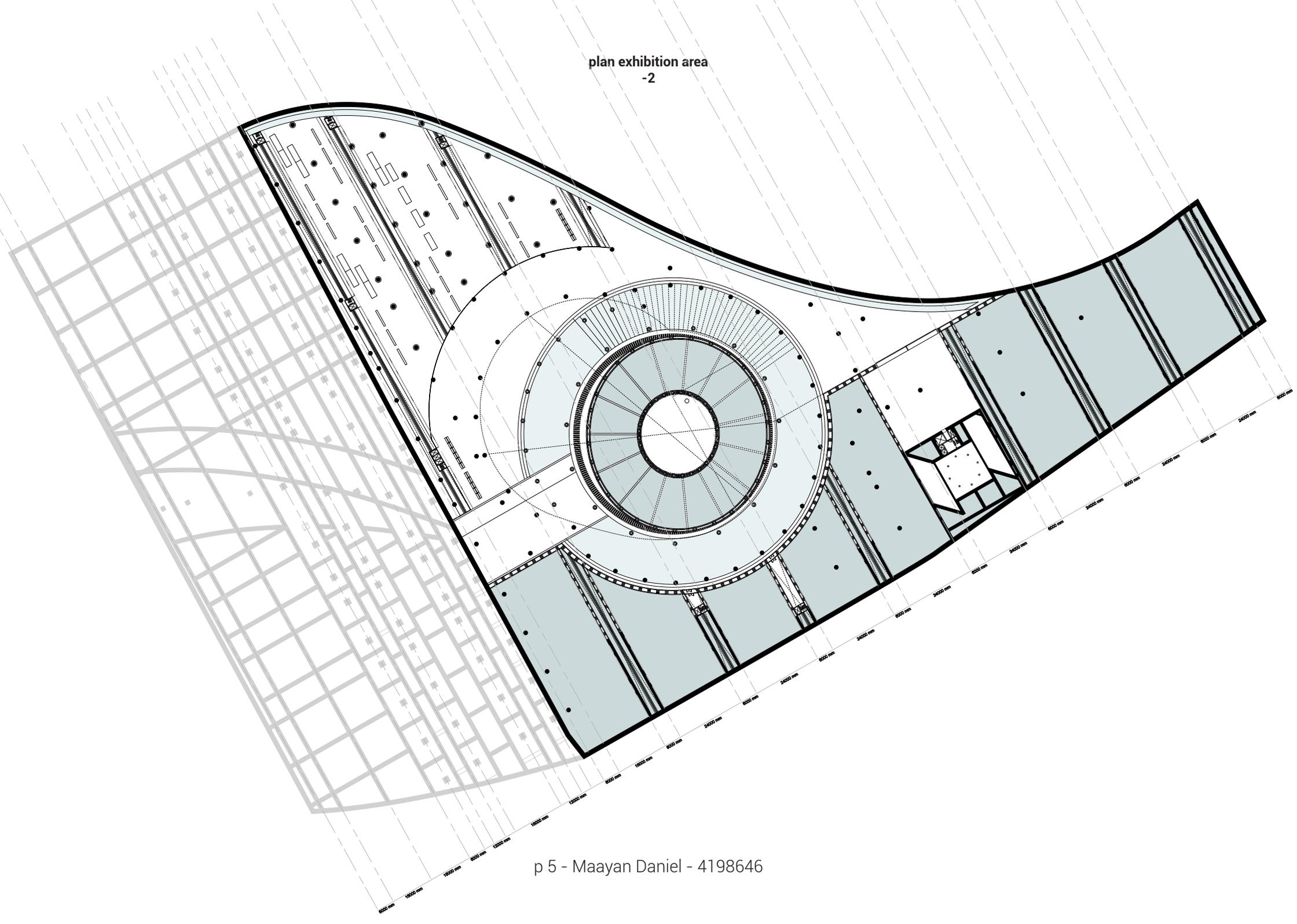


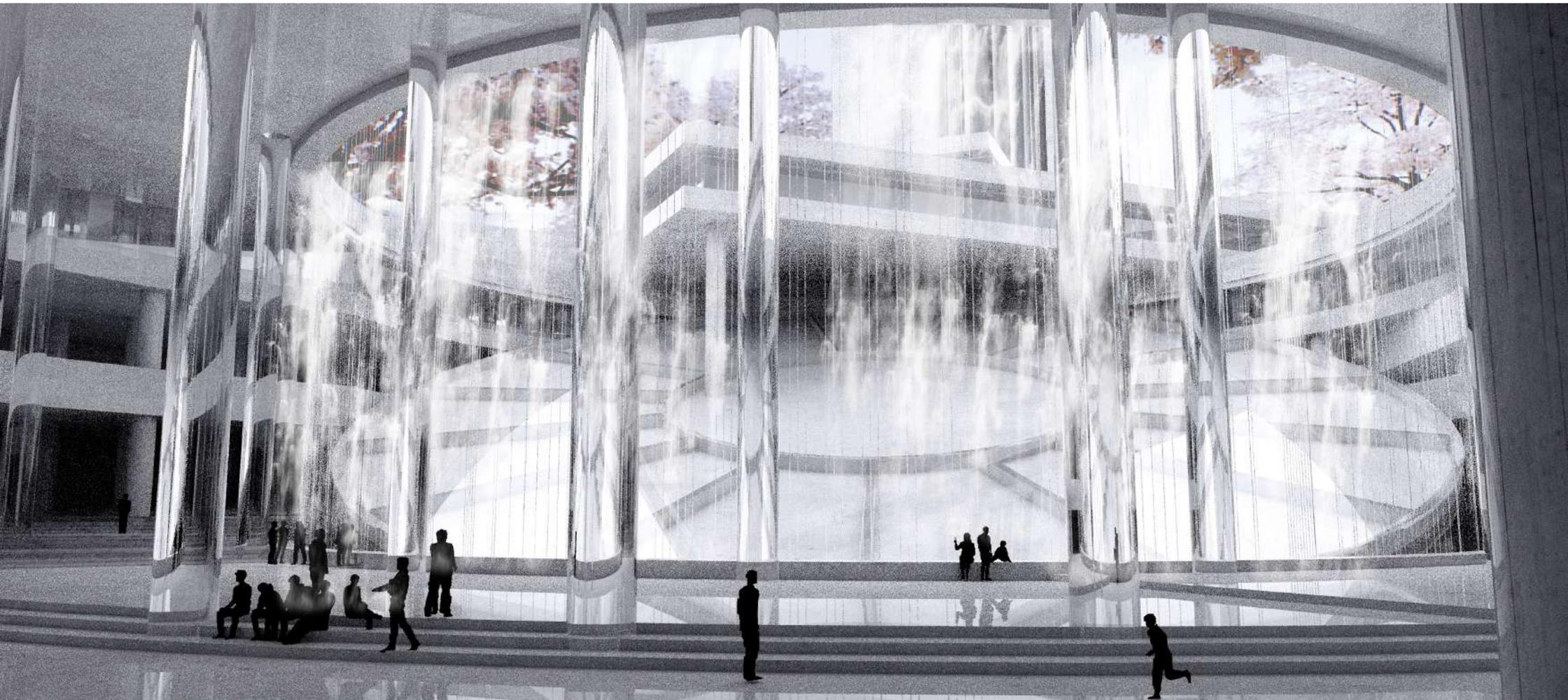


plan sport hall
-1.5



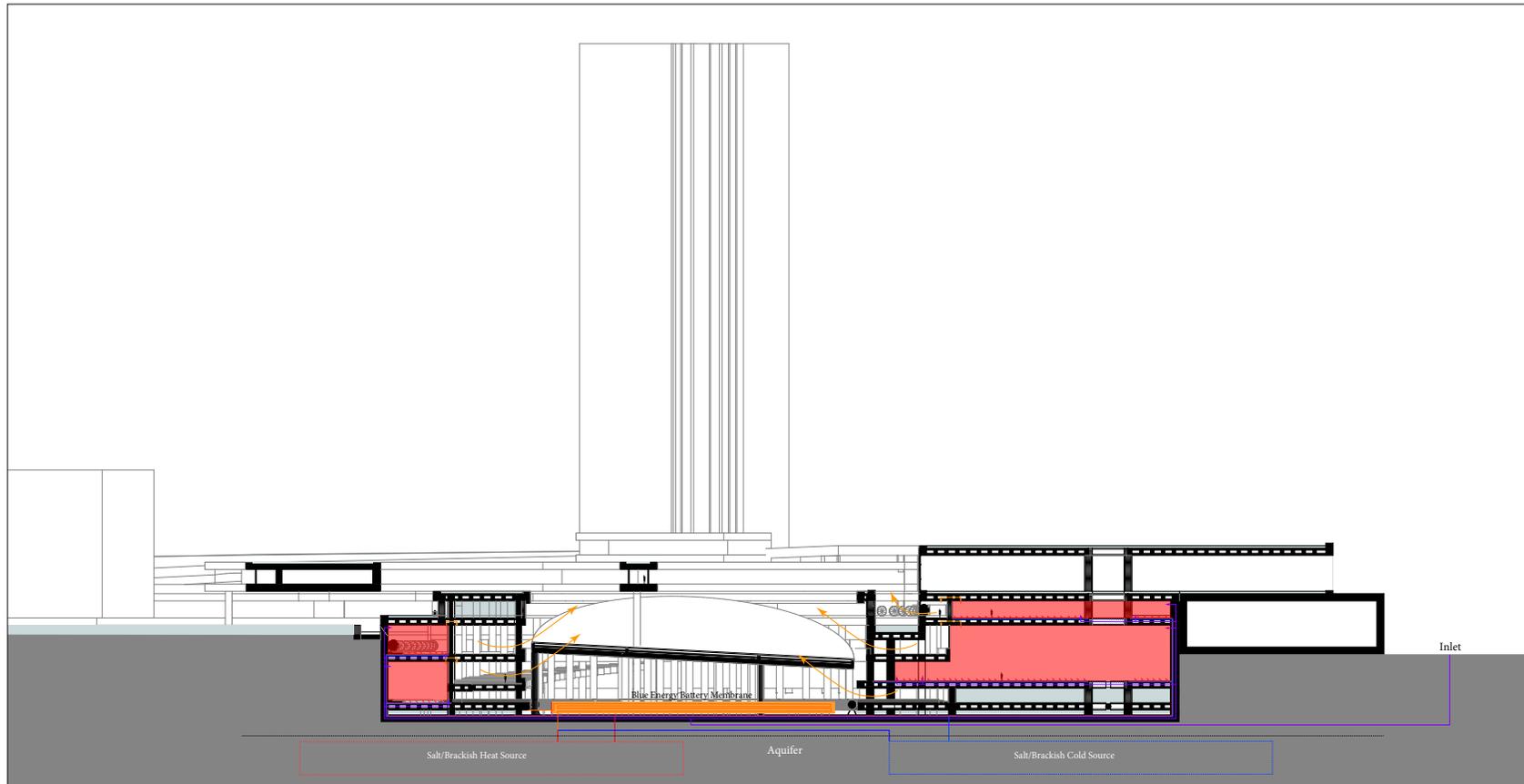
plan exhibition area
-2





Climate

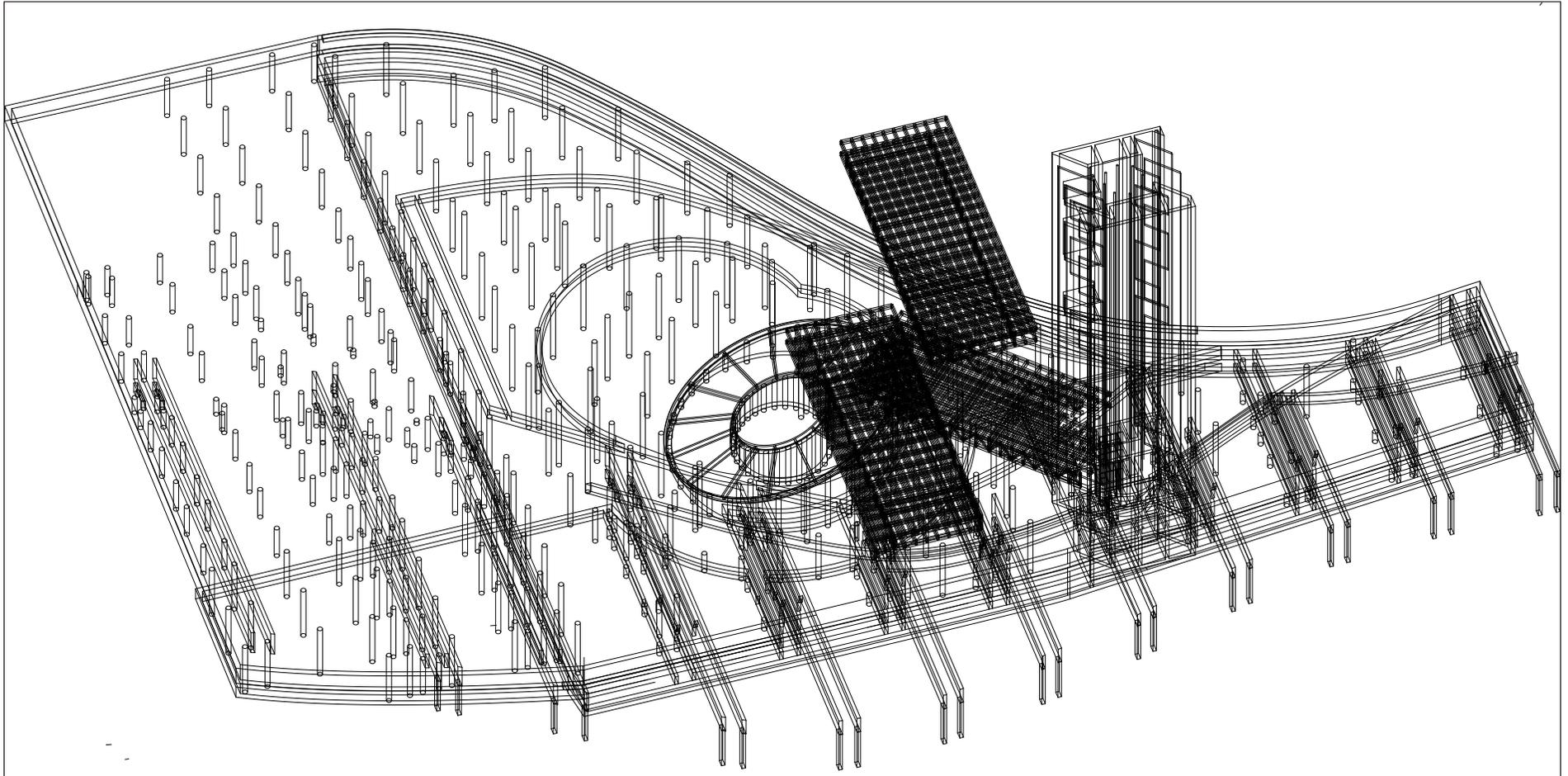
Construction



Climate Design

Load-bearing Structure

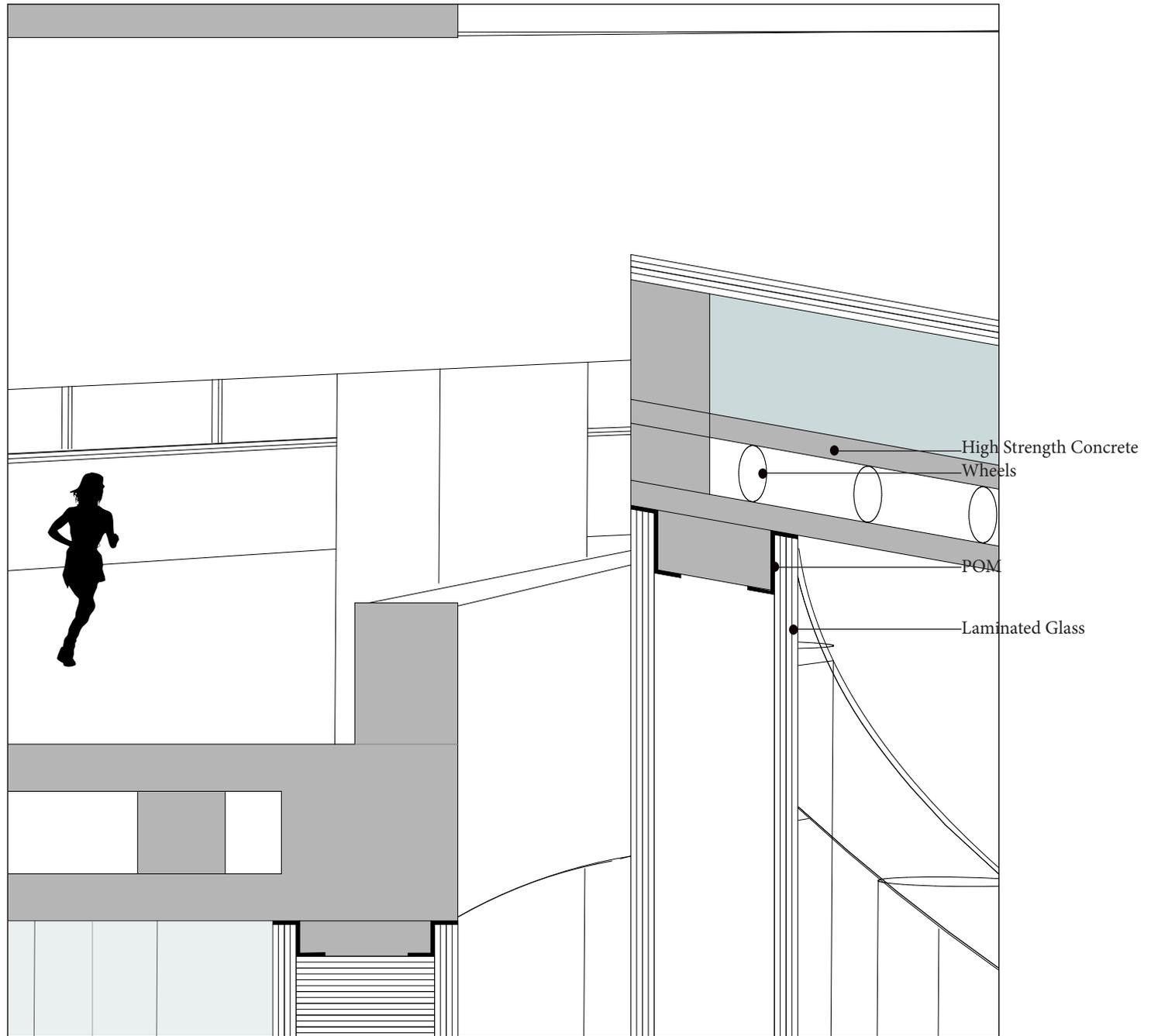
Construction

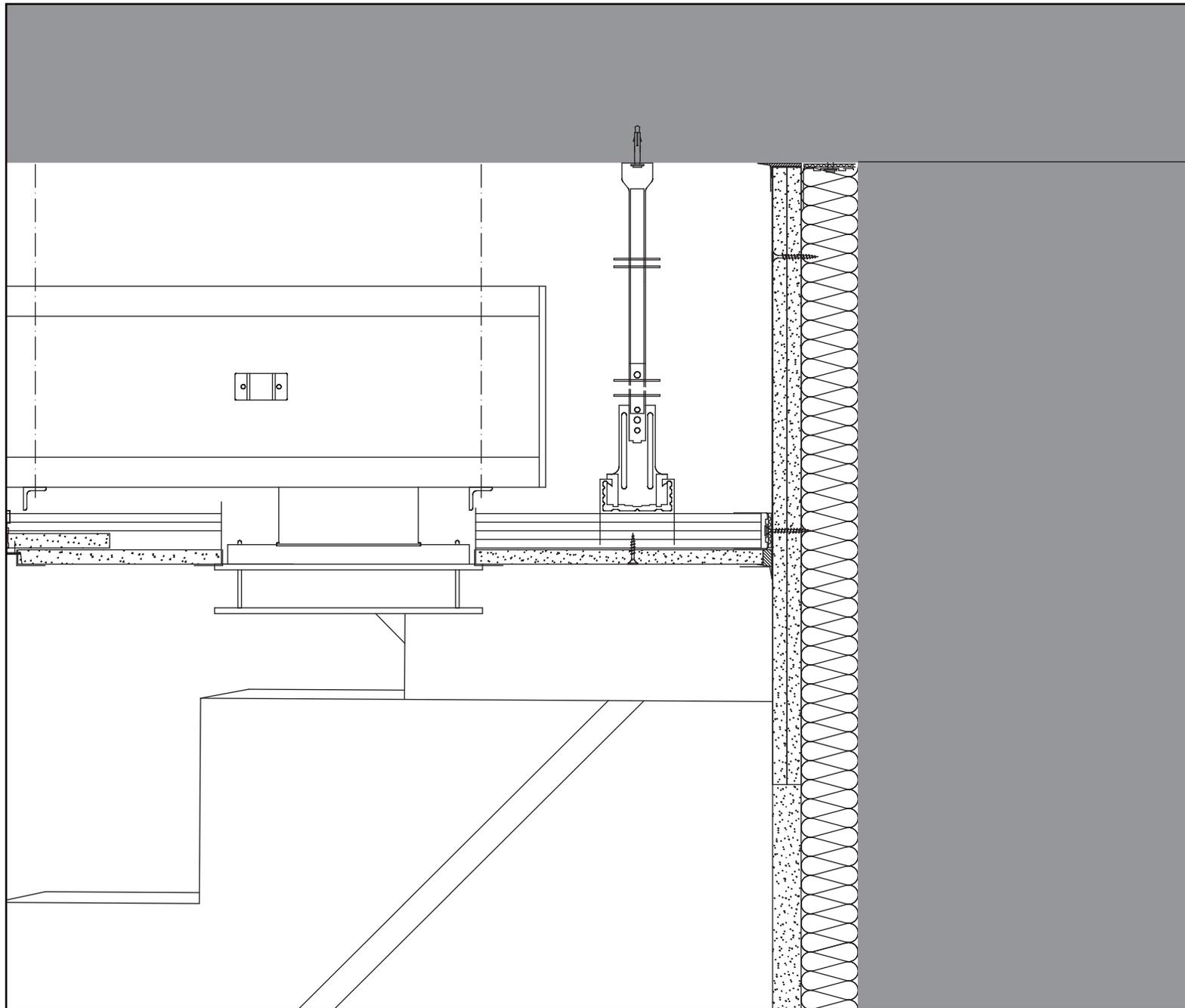


Structural Design

Details

Construction





I. Problem Statement

II. Hypothesis

III. Research Question

IV. Factual/Technological Research

V. Spatial/Architectural Research

VI. Project Proposal

VII. Conclusion

Content

Conclusions

Material variation due to direct climatic factors (sunlight, rain and humidity)

Ecological Consequences

Attraction

Construction Method - Investment Energy System



Thank You!
Maayan Daniel