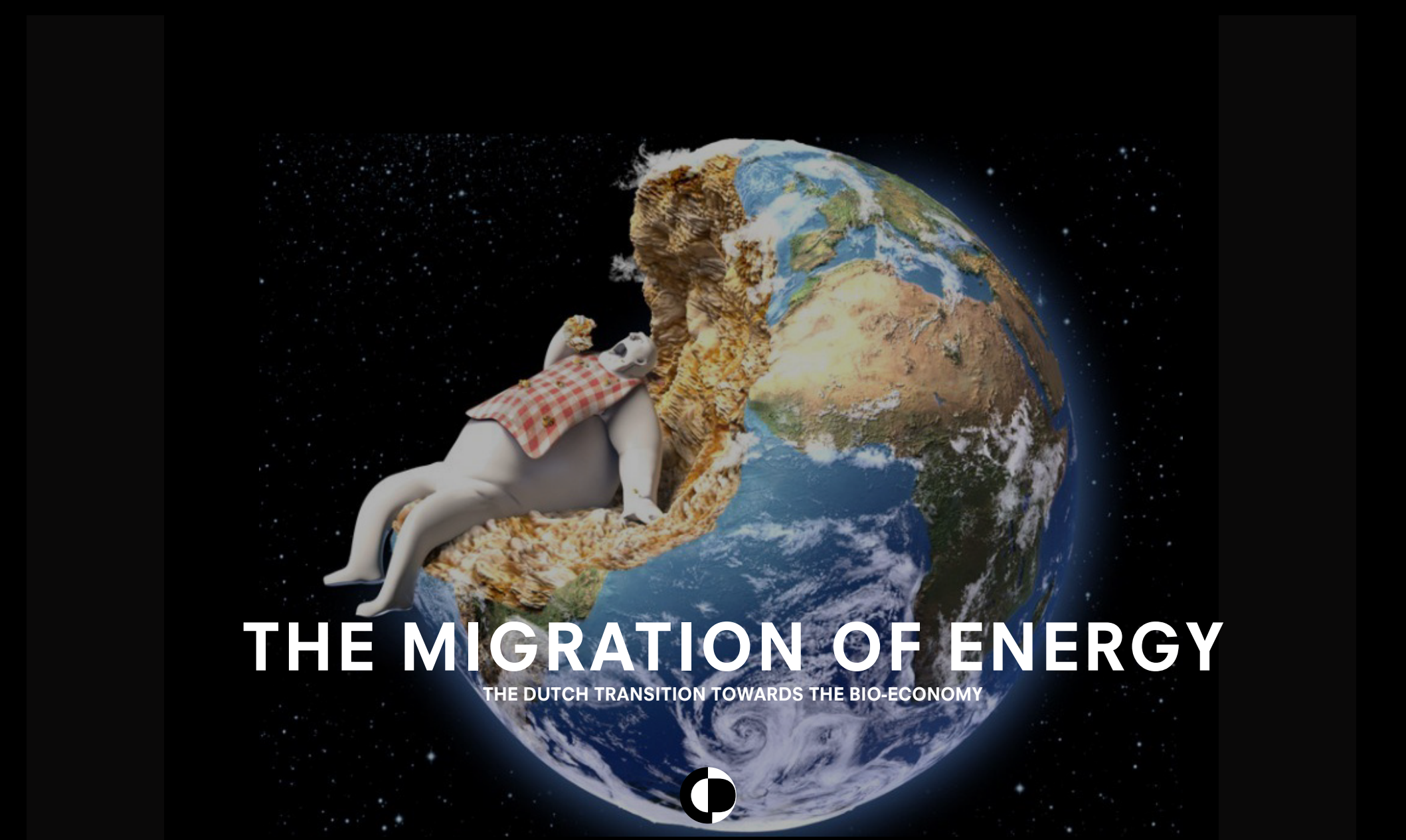


THE MIGRATION OF ENERGY

THE DUTCH TRANSITION TOWARDS THE BIO-ECONOMY

P5 Presentation

12/01/2022

Complex Projects | Victoria Oshinusi | 5048915

Contents

01 Introduction

THE MIGRATION OF ENERGY?

A LINEAR Fossil Carbon Economy

CIRCULAR Bio-Economy

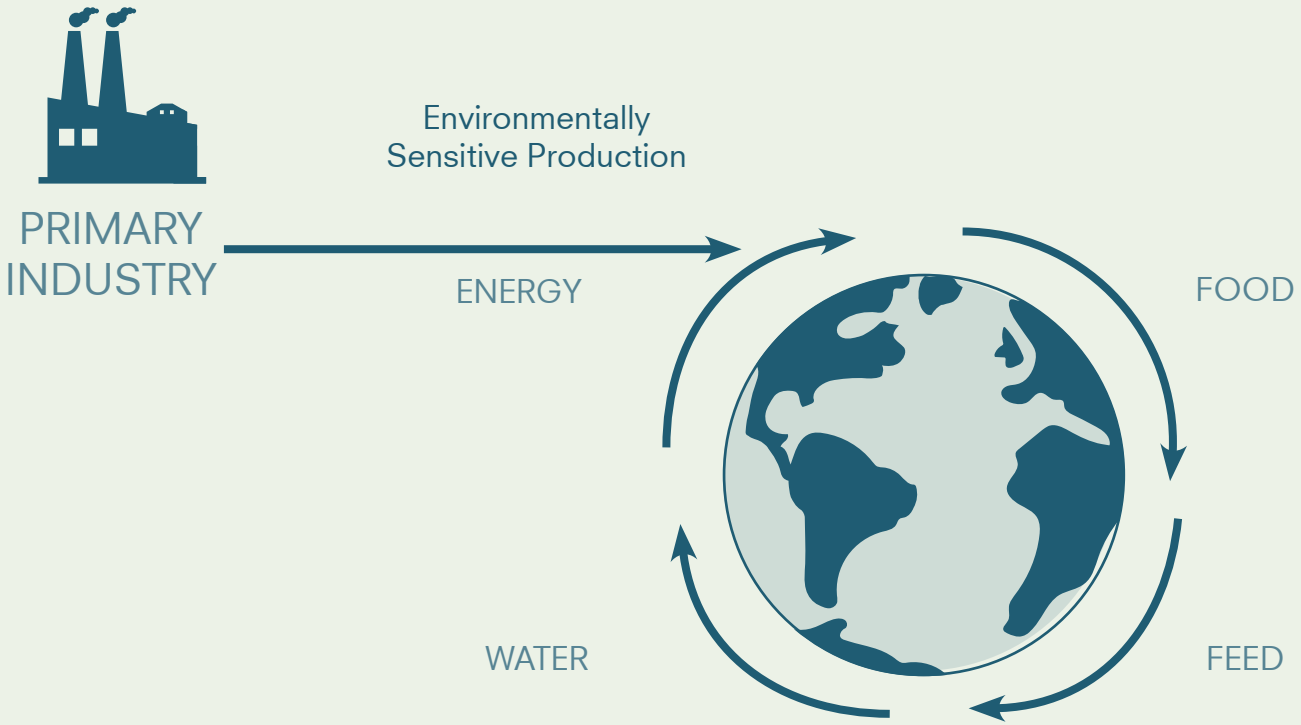
GROWTH

Dependency

BALANCE

Mentality intrinsic to the natural environment

WHAT IS THE BIO-ECONOMY?



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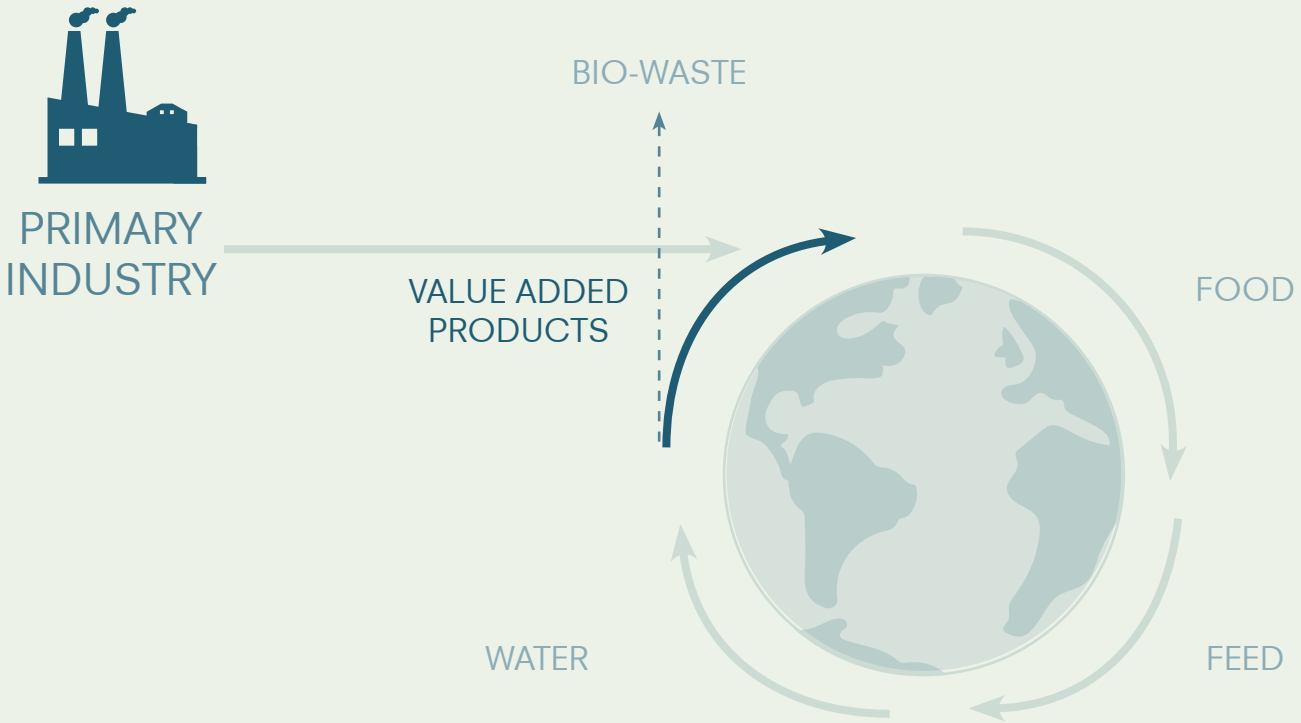

IMPLEMENTATION

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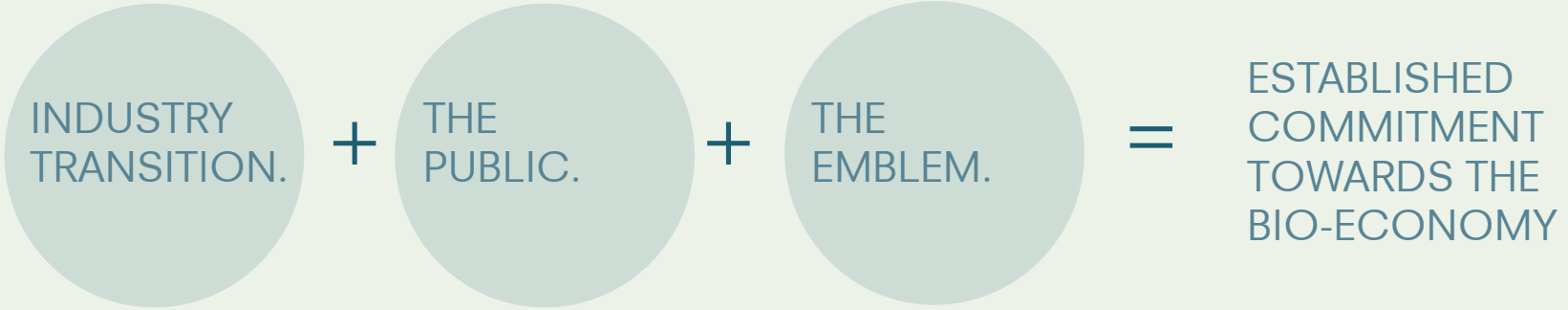

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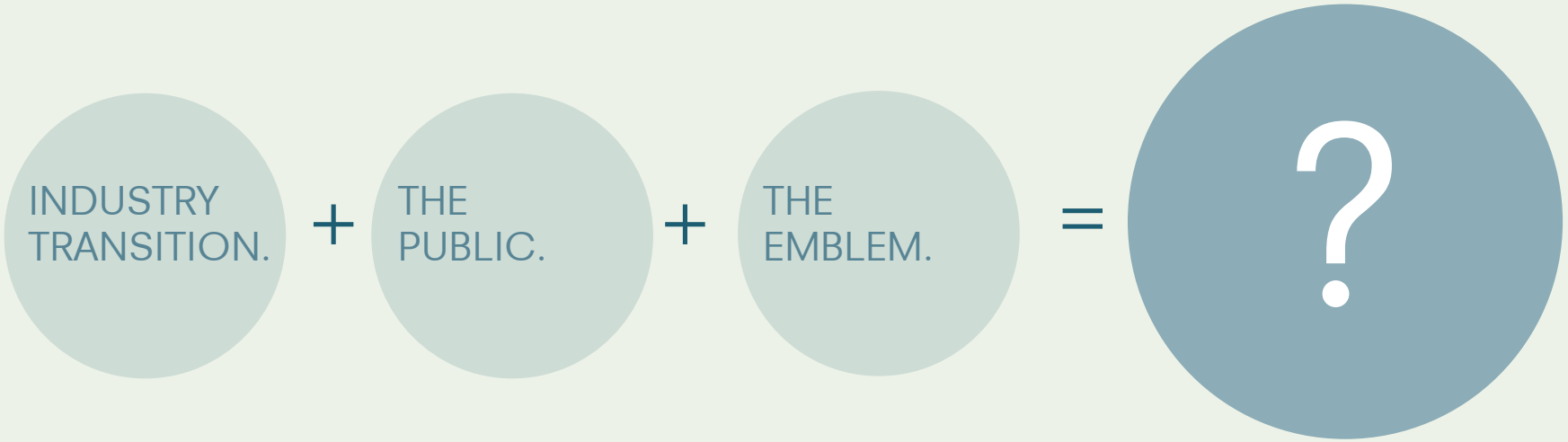


THE PROPOSAL

A CENTRE FOR BIO-BASED RESEARCH AND RECREATION.

Leading Rotterdam and the Netherlands towards a sustainable future

02 Research

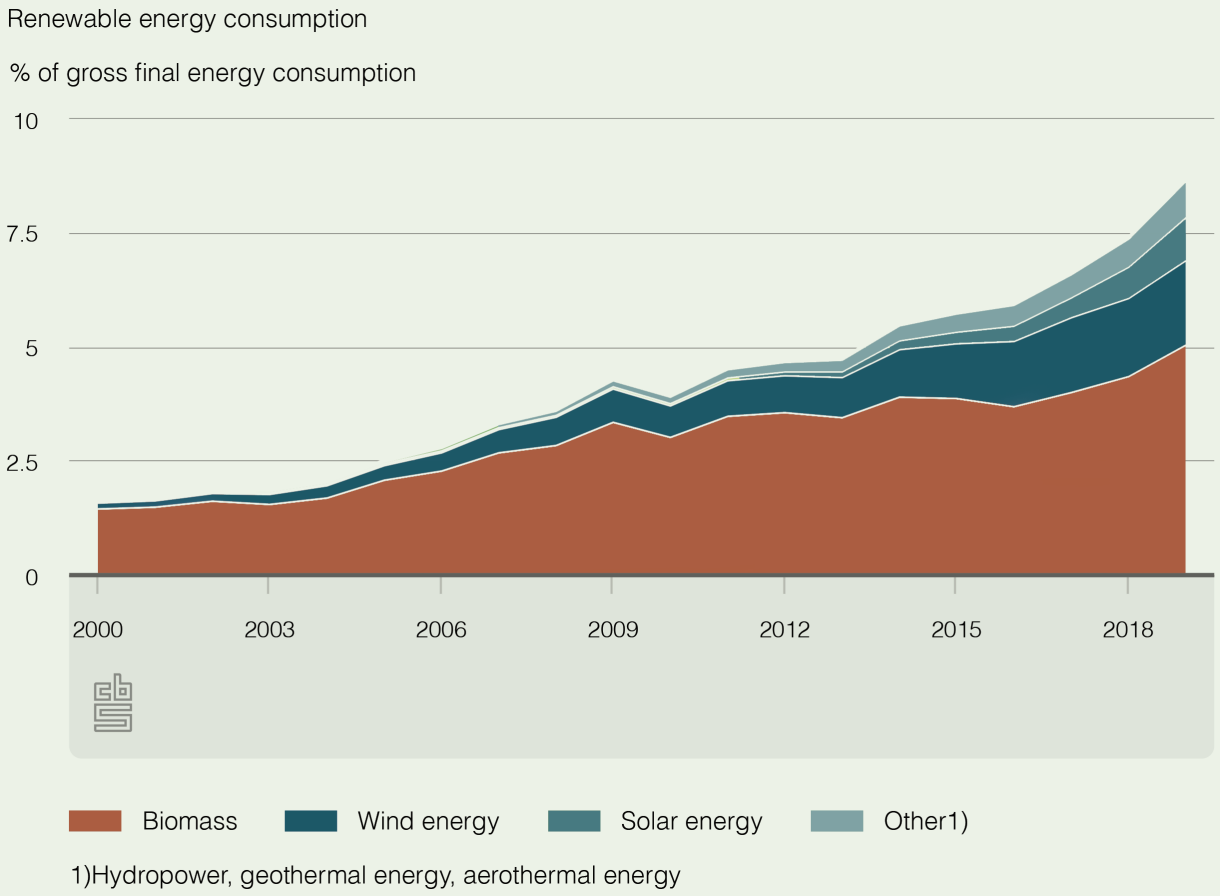
IMPLEMENTATION

INDUSTRY TRANSITION.

THE PUBLIC.

THE EMBLEM.

RENEWABLE ENERGY CONSUMPTION



INDIRECT LAND USE CHANGE

1. ‘Food Vs Fuel’ Food Insecurity
2. mono-cropping causes biodiversity loss
3. Social and political conflict
4. Displacement of carbon sequestering forest
5. More loss of nitrates and phosphorous for fertiliser
6. Water insecurity

STILL RENEWABLE ENERGY?

+113%

Soy

+203%

Palm Oil

+18%

Rapeseed Oil

Bio-diesel from vegetable oils, leads to

80%

higher emissions than the fossil diesel it replaces.

(Transport & Environement , 2016)

CLEANER ALTERNATIVES

LEAST ENERGY DENSE → MOST ENERGY DENSE

1ST GENERATION
Food biomass

Corn

Palm Oil

Rapeseed Oil

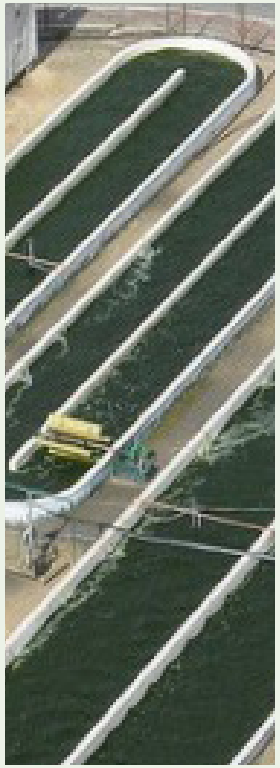
2ND GENERATION
Non-Food biomass

Wood

Straw

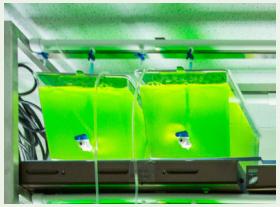
Food Waste

3RD GENERATION
Waste Biomass



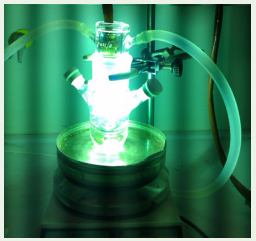
Algae

4TH GENERATION
Advanced Biotechnology



Algae - Hydrogen

Direct Solar light - hydrogen



Solar Fuels

TYPES OF BIO-FUEL

1 → 2 → 3 → 4

1ST GENERATION
Food biomass

Corn

Palm Oil

Rapeseed Oil

2ND GENERATION
Non-Food biomass

Wood

Straw

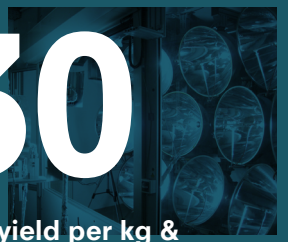
Food Waste

3RD GENERATION
Waste Biomass

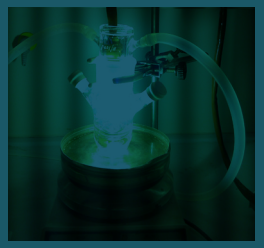
Microalgae

4TH GENERATION
BioTechnology

Algae - Hydrogen



Direct Solar light - hydrogen

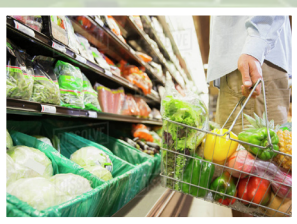


Solar Fuels

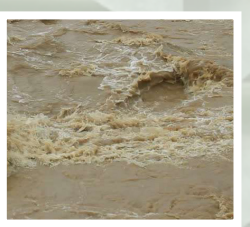
x130

more efficient energy yield per kg & grown anywhere.

THE SOLUTION





1. Doesn't compromise food security
2. Re-forestation
3. Social and political peace
4. Carbon neutral
5. Nitrates and phosphorous sourced from residual streams
6. Waste water is sufficient. More water security

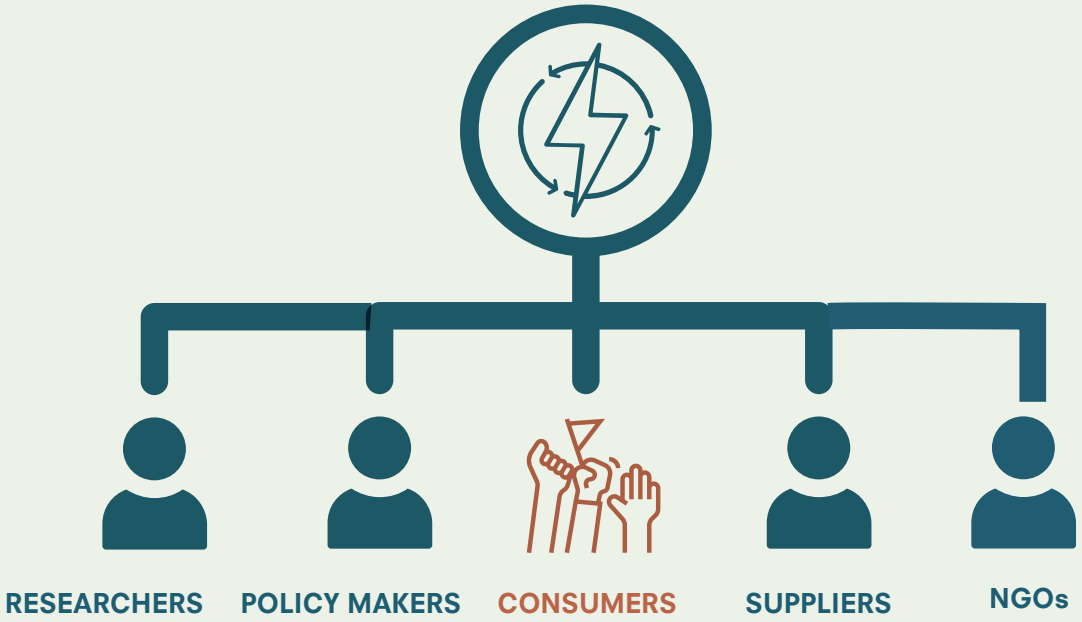
IMPLEMENTATION

THE
TRANSITION.

THE
PUBLIC.

THE
EMBLEM.

PUBLIC/ CONSUMER EDUCATION

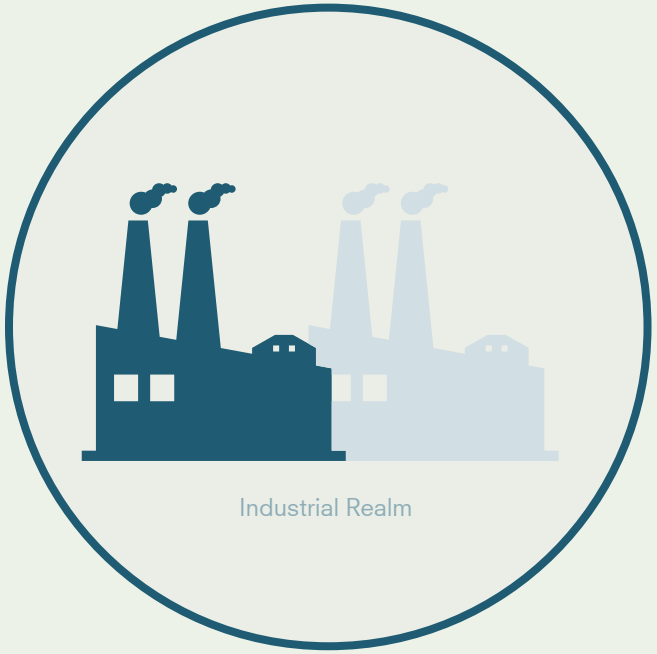


OUT OF SITE. OUT OF MIND.

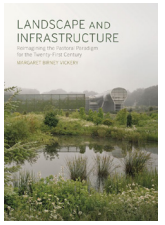
PRODUCTIVE INFRASTRUCTURE - DISASSOCIATED

Public Realm

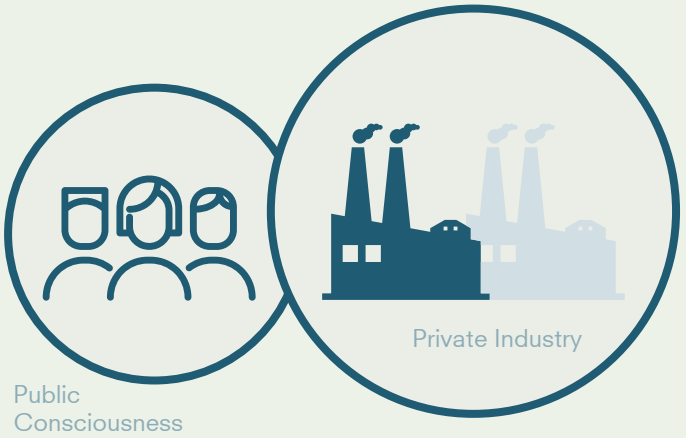
Lost touch of wear food, energy, water come from



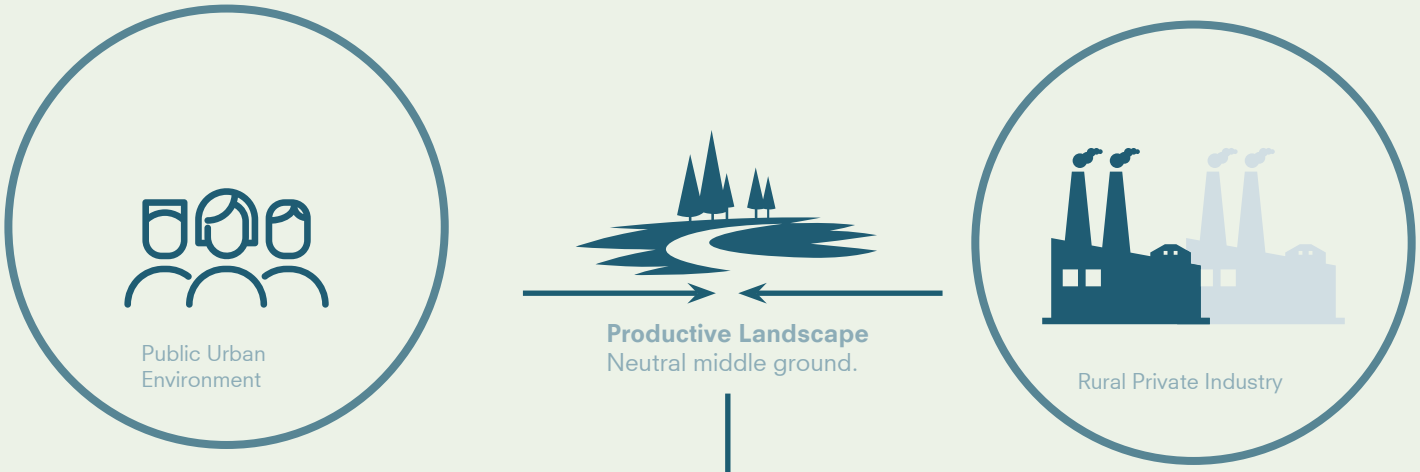
Industrial Realm



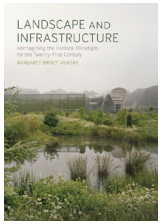
RE-UNIFY



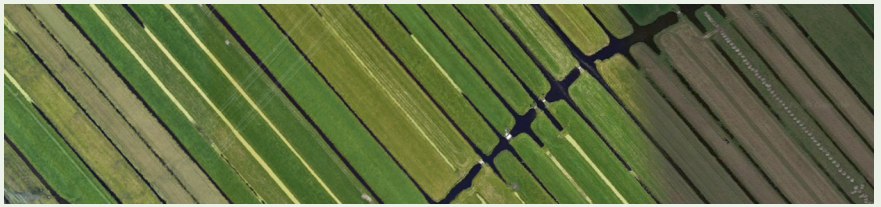
A PRODUCTIVE LANDSCAPE

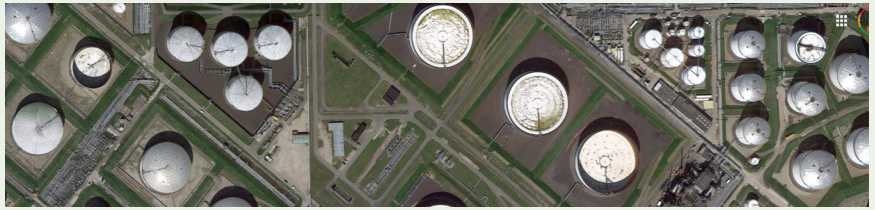


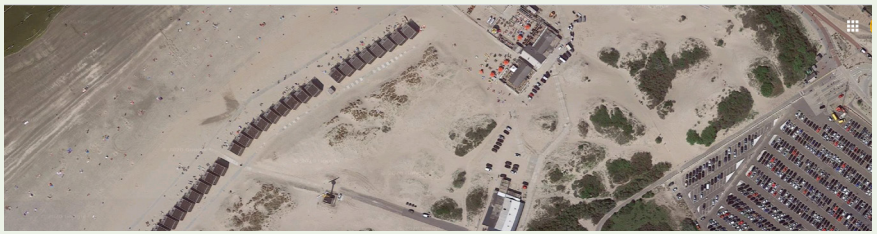
‘Recreational destination & source of regional civic pride”
- Vickery 2019
+ Solving Infrastructural Challenges In A Sustainable Way

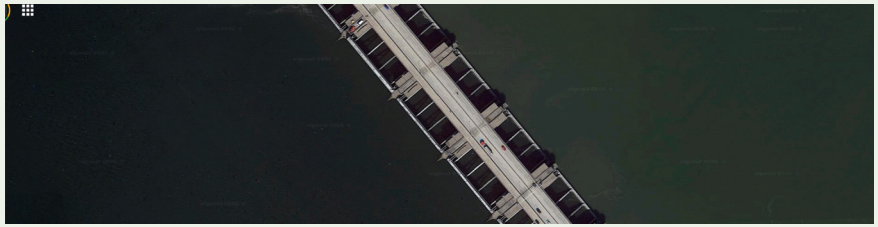


PRODUCTIVE, ENGINEERED LANDSCAPES









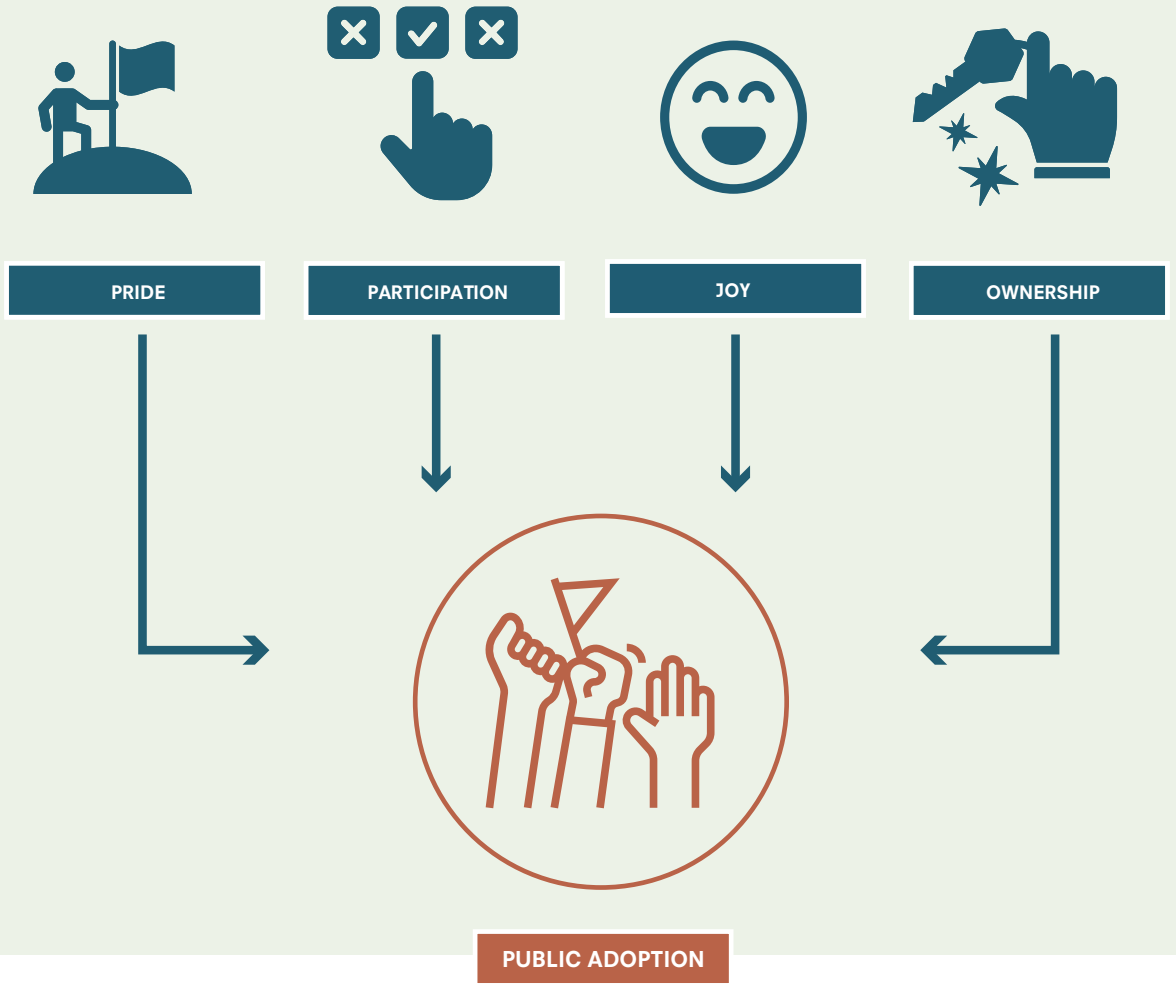
IMPLEMENTATION

THE
TRANSITION.

THE
PUBLIC.

THE
EMBLEM.

THE EMBLEM



THE EMBLEM

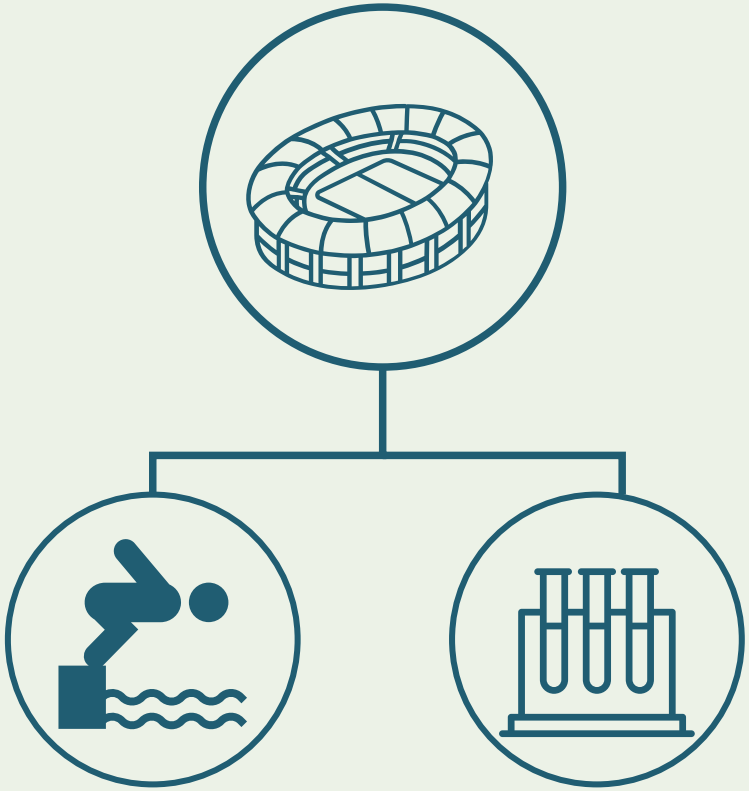
Source : historiebetaaldvoetbal

OPENING DAY, 1937O

PRIDE, PARTICIPATION, OWNERSHIP

How can Rotterdam create an **emblem** for the Dutch bio-economy **transition** that fosters transparent communication between industry, policy and the **public**?

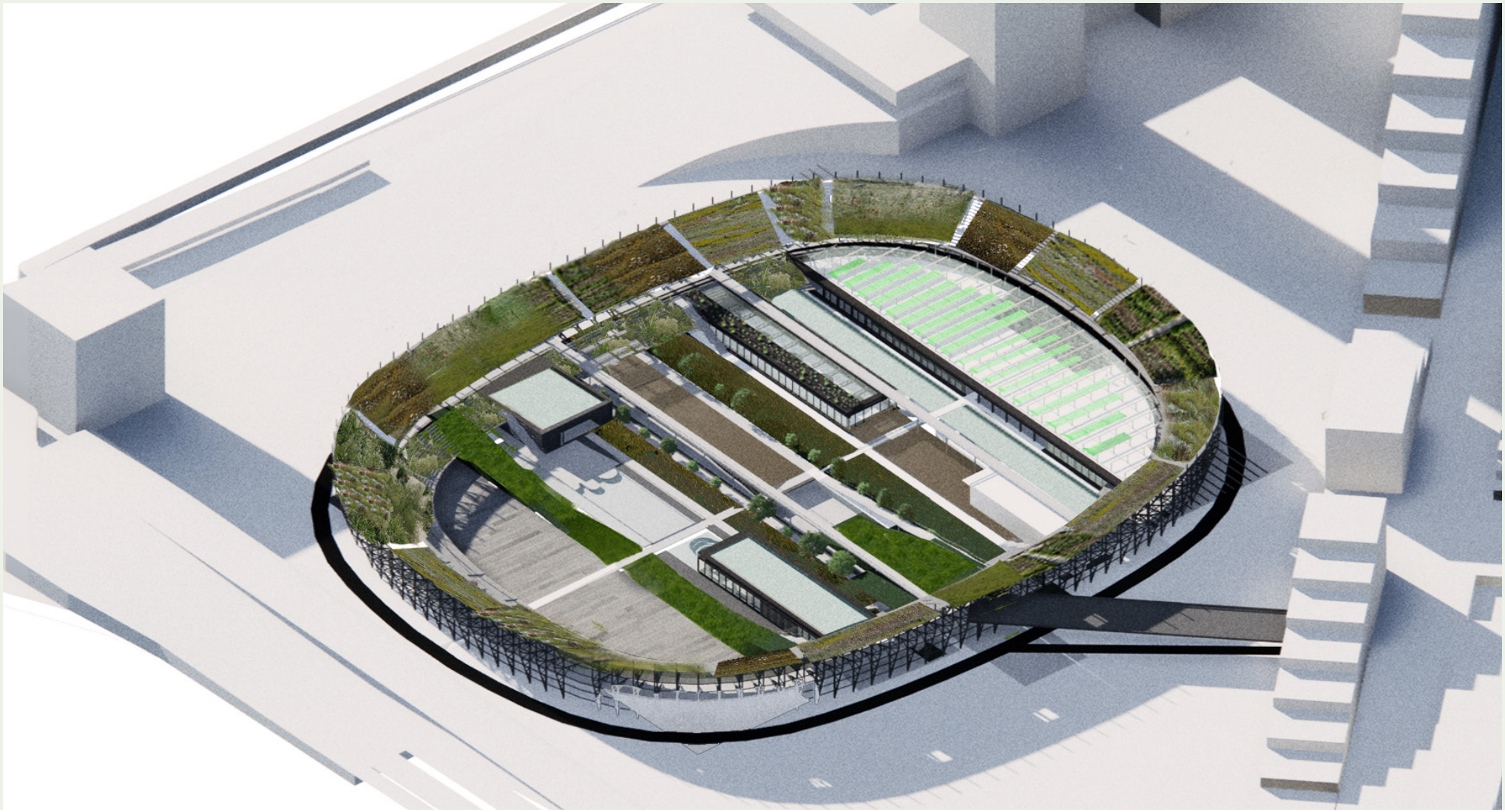
HYBRID CENTER



Urban Scale
Leisure & Education

National Scale
Bio-Tech Research,
Innovation & Pilot Testing

PRODUCTIVE LANDSCAPE

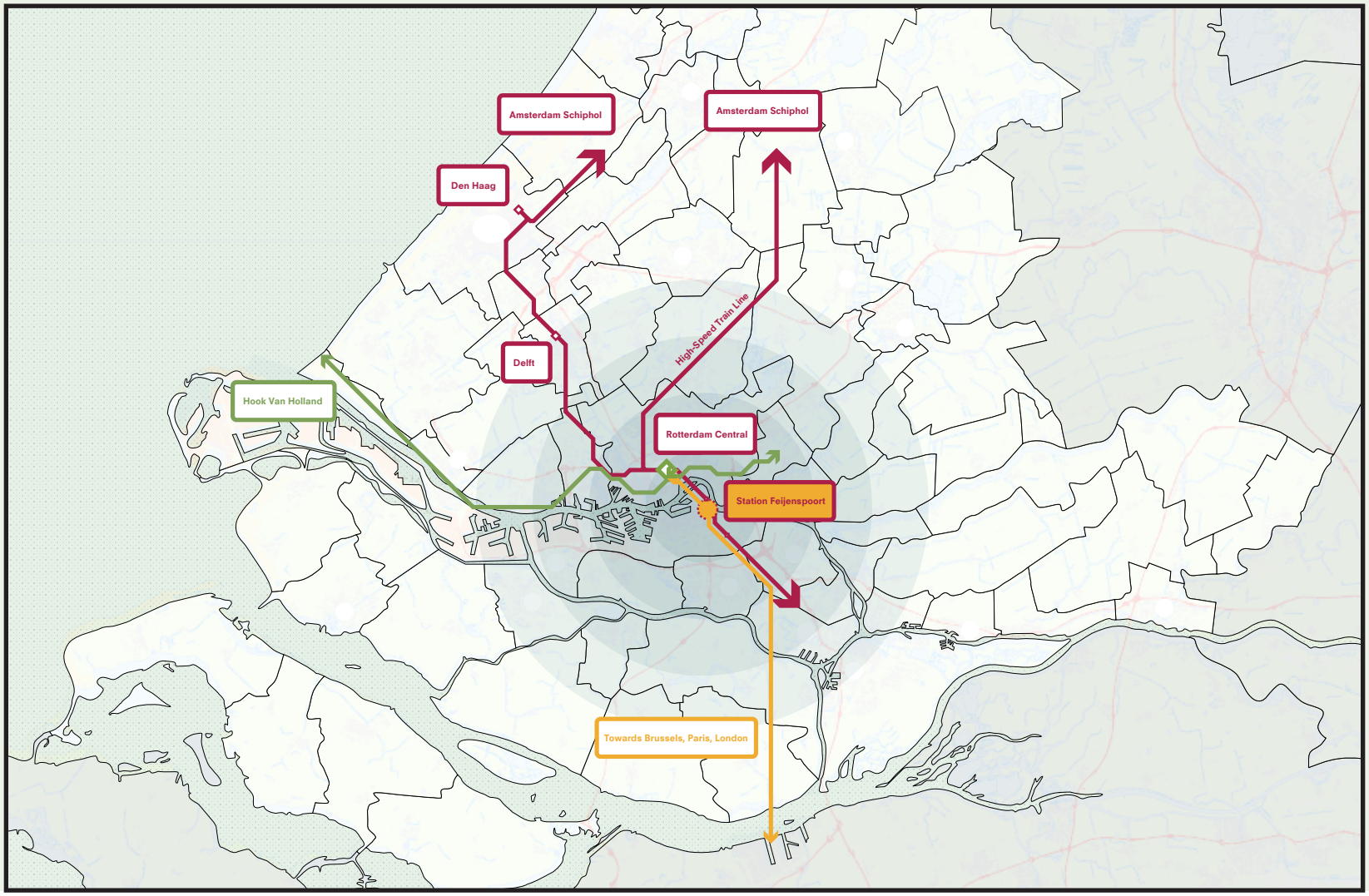


-Enclosed open space.
-Spectator becomes participant.

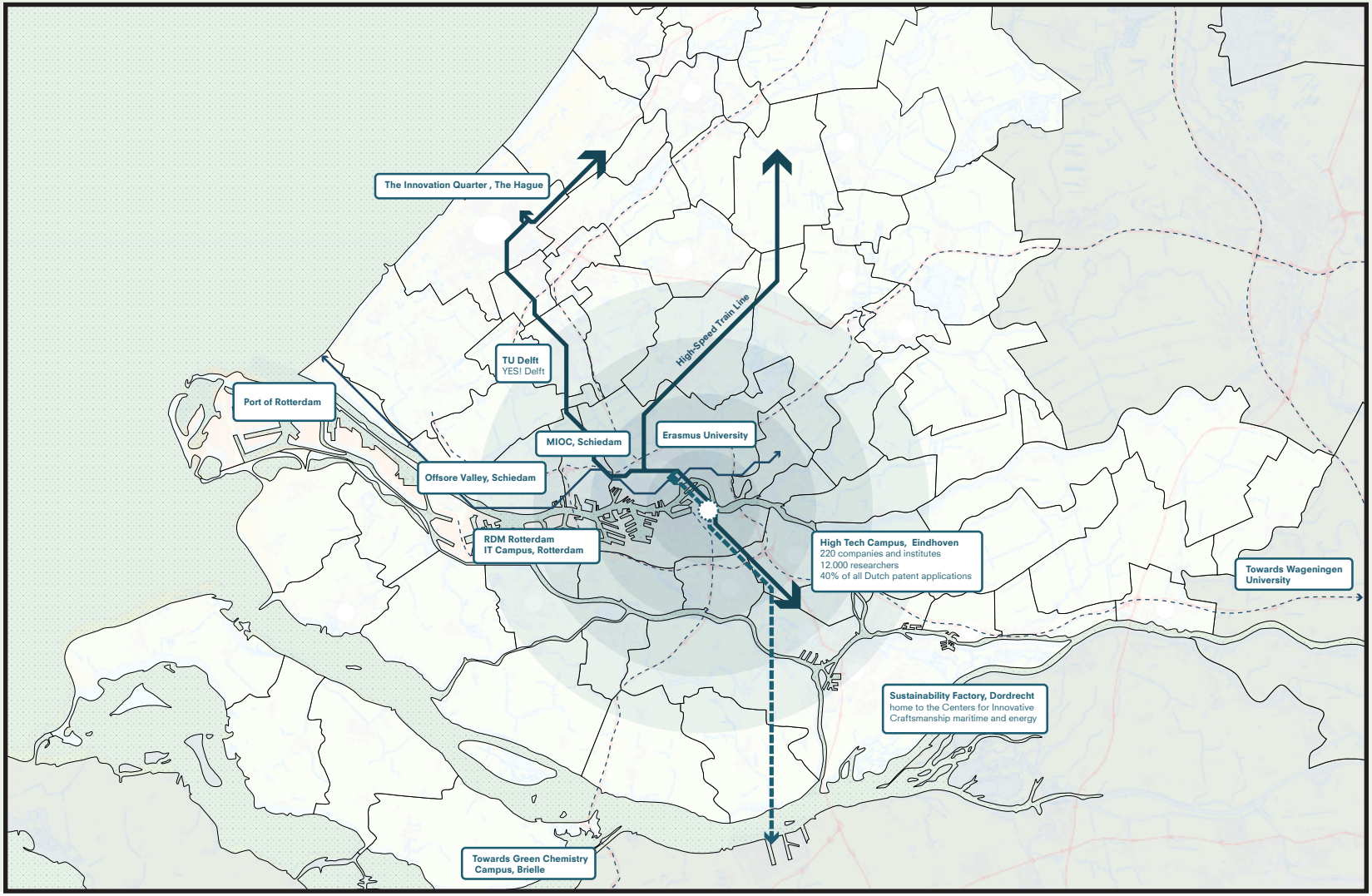
03 Design Brief

FIEJENPOORT

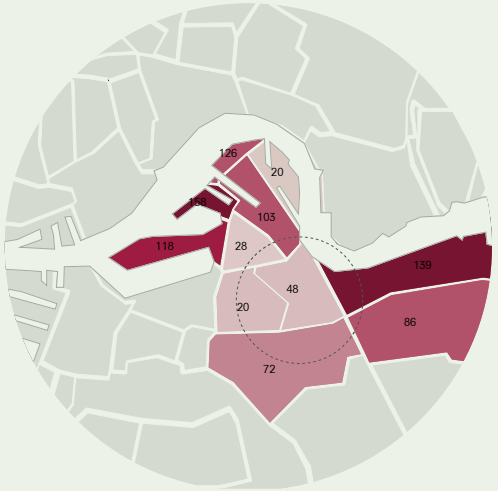
MOBILITY NETWORK



RESEARCH & INNOVATION



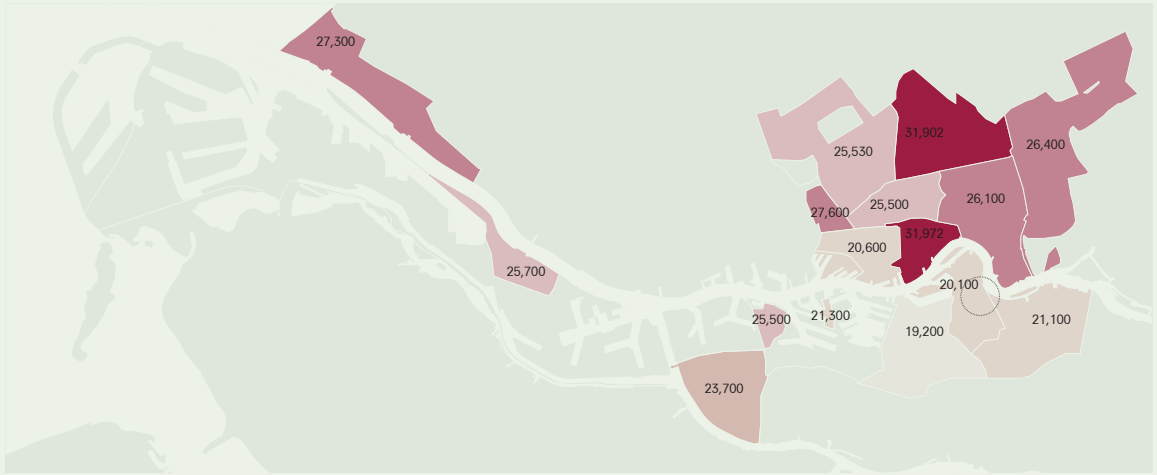
UNHAPPY & UNSAFE

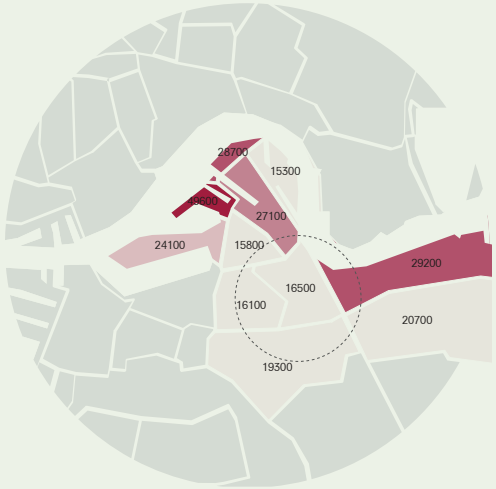


SUBJECTIVE QUALITY OF LIFE JUDGMENT

- > 130 Far Above Rotterdam's Average
- 110 - 129 Above Rotterdam's Average
- 90 - 109 Around Rotterdam's Average
- 70 - 89 Far Below Rotterdam's Average
- <69 Far Below Rotterdam's Average

LOWEST INCOMES IN ROTTERDAM





INCOME LEVELS IN EURO

- > 32,000
- 30,000 - 32,000
- 28,000 - 30,000
- 24,000 - 26,000
- 22,000 - 24,000
- 20,000 - 22,000
- <20,000
- Unknown

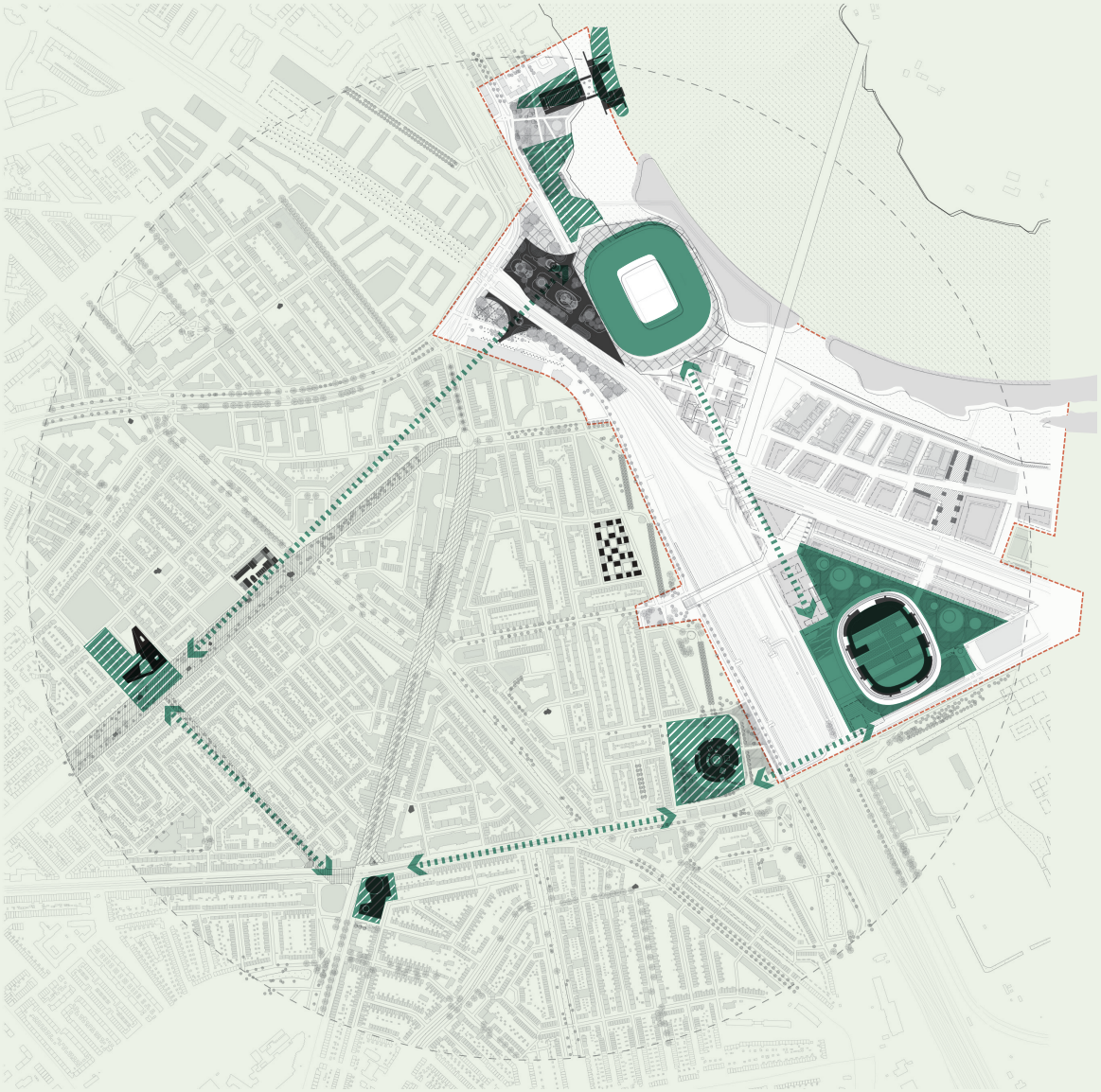
EXISTING CONTEXT

ADOPTED FUTURE DEVELOPMENT

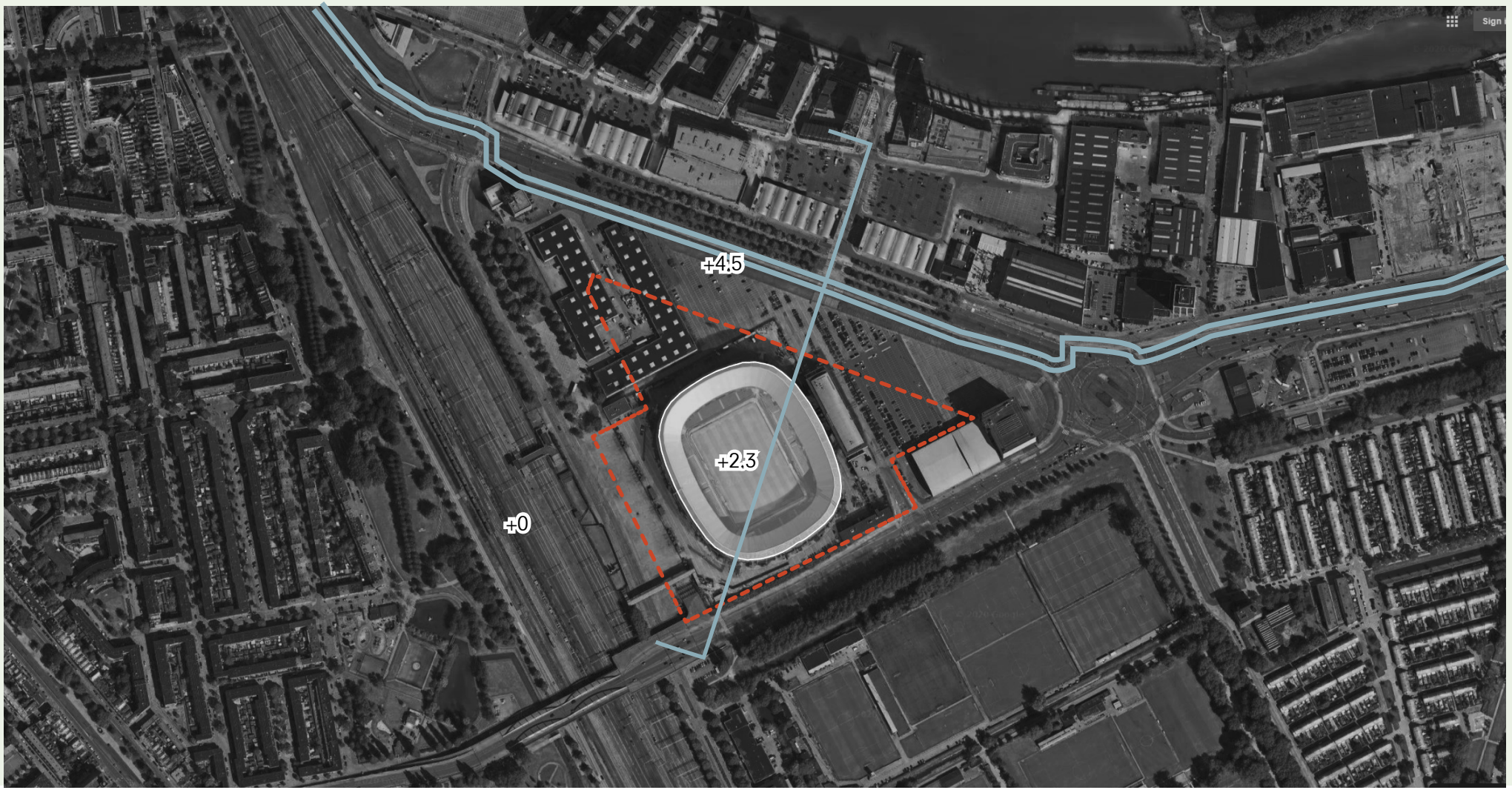
STRENGTHEN GREEN BELT, BIODIVERSITY + ECOLOGICAL AXIS

recreational nodes

CULTURE & LEISURE LANDMARKS



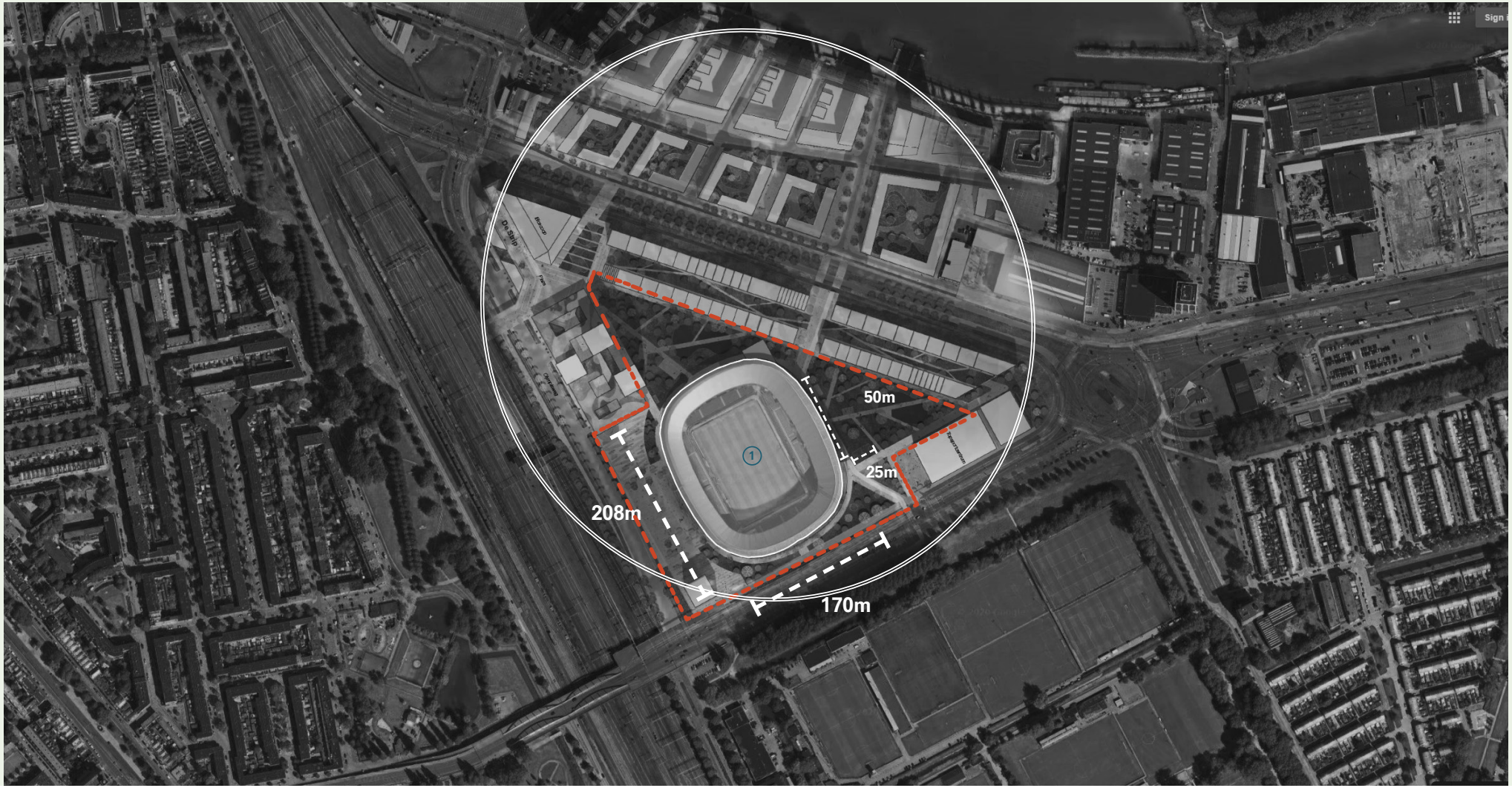
EXISTING SITE



Dike Defence

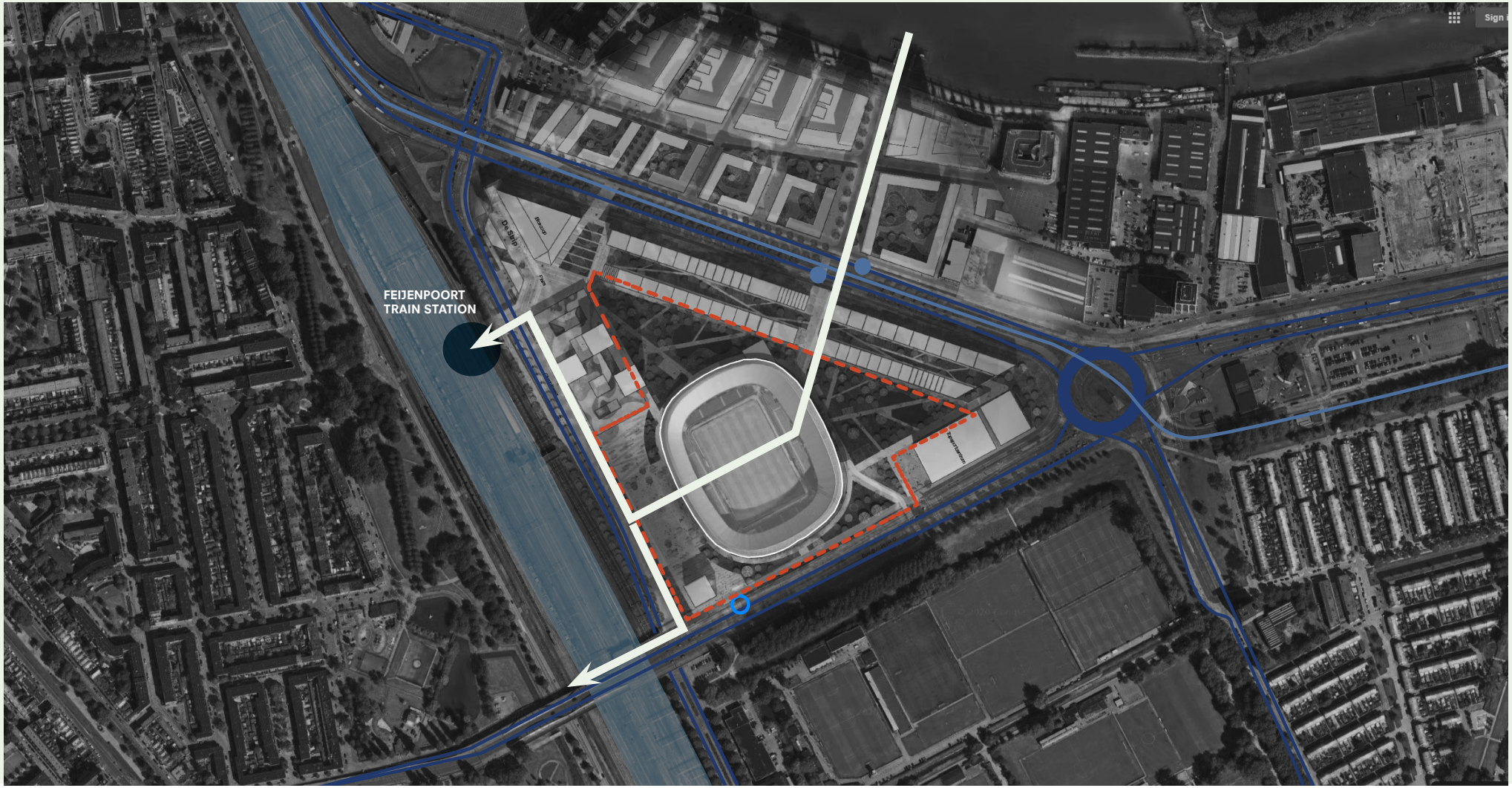
1. Plot Area: 79,000 sqm
2. Stadium Footprint : 31,000 sqm
3. Roof 15,000 sqm
4. Pitch 7140 sqm

OMA MASTERPLAN



1. Plot Area: 79,000 sqm
2. Stadium Footprint : 31,000 sqm
3. Roof 15,000 sqm
4. Pitch 7140 sqm

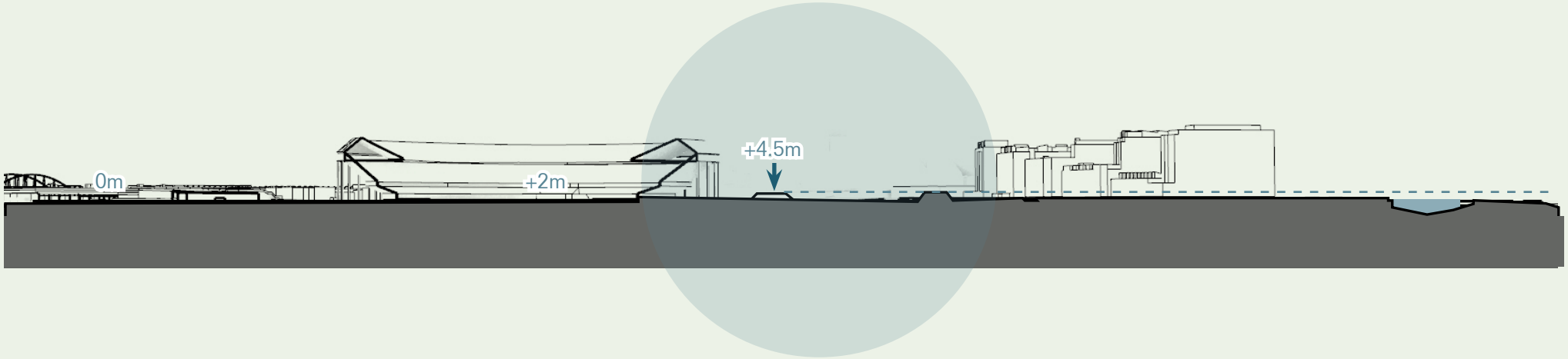
URBAN WALKWAY



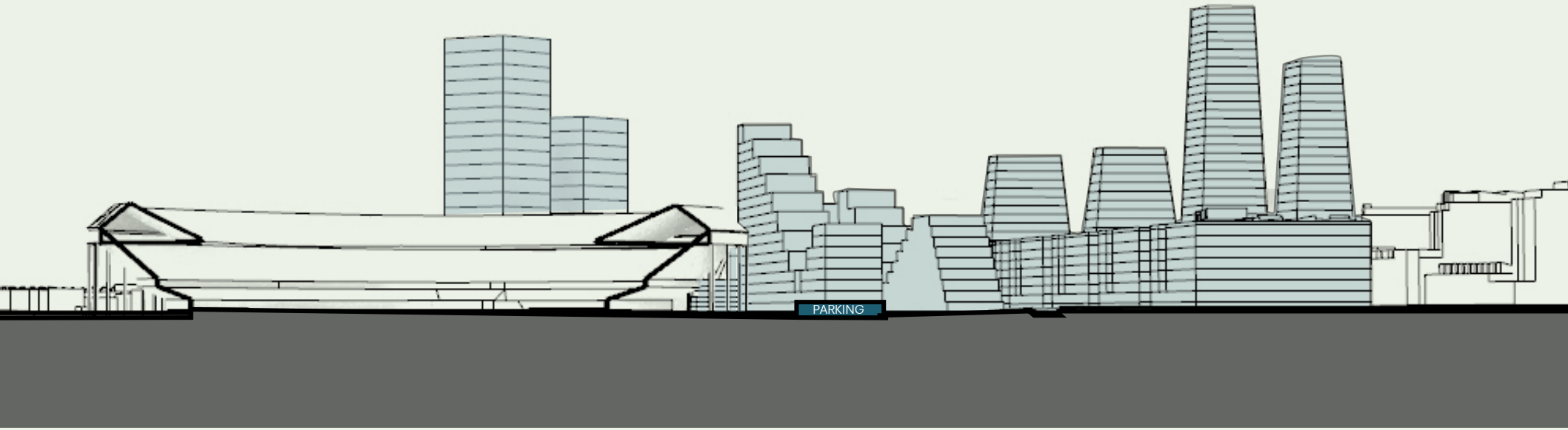
Tram
Car
Bus
Proposed Train Station
Urban Walkway

DIKE DEFENCE

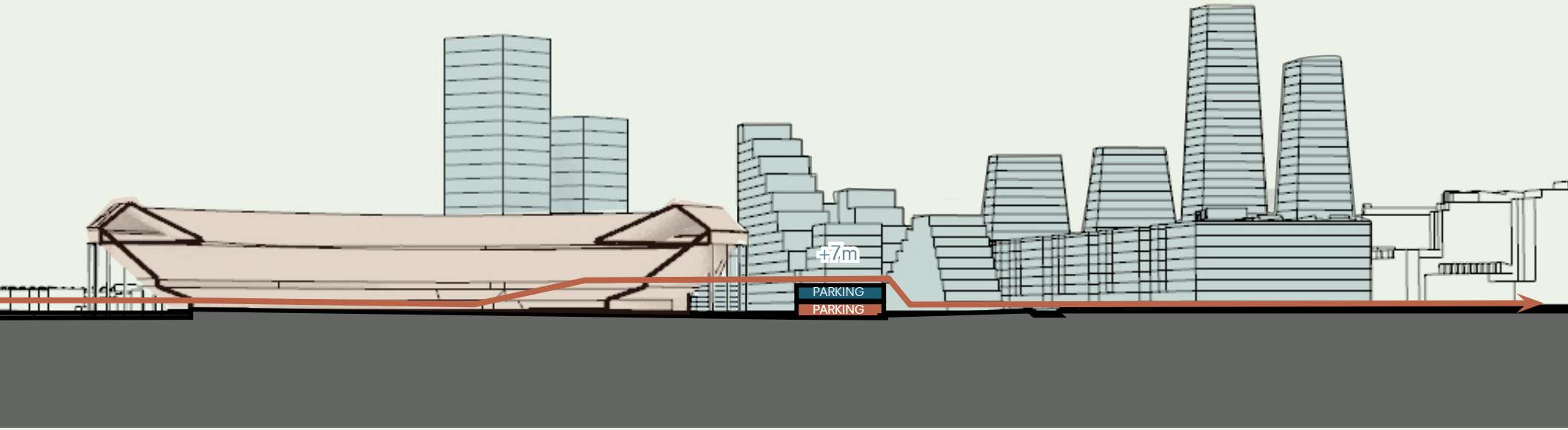
DIKE LEVEL



OMA STRATEGY



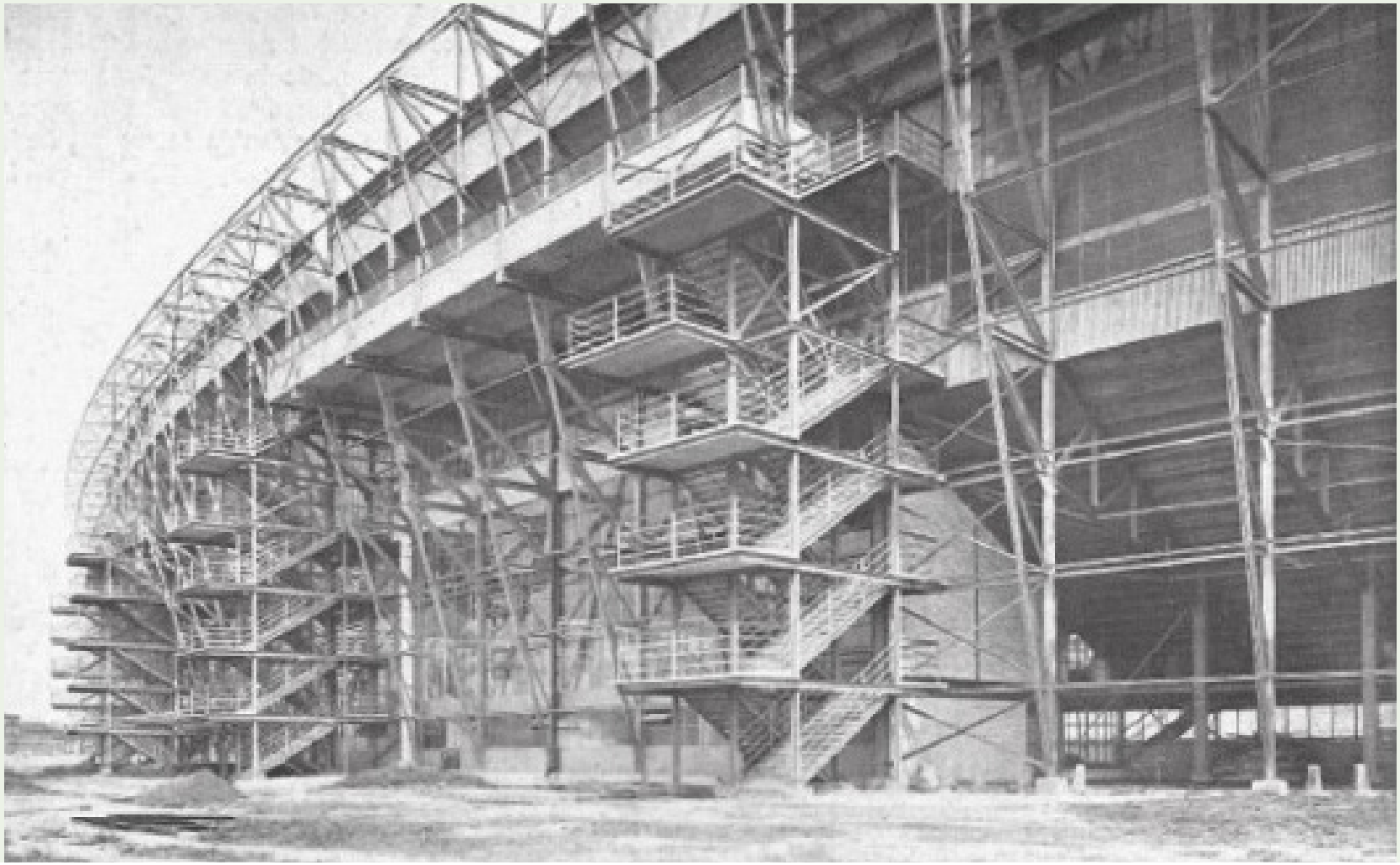
ADDITIONAL PARKING + ACTIVATED ROUTE

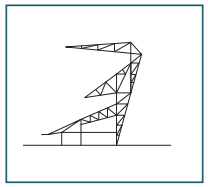


Urban Walkway

04 Design Concepts

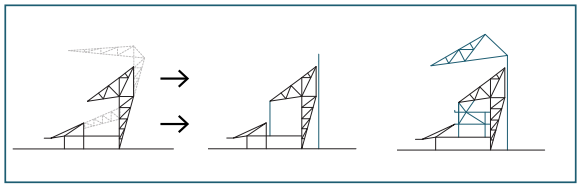
1937





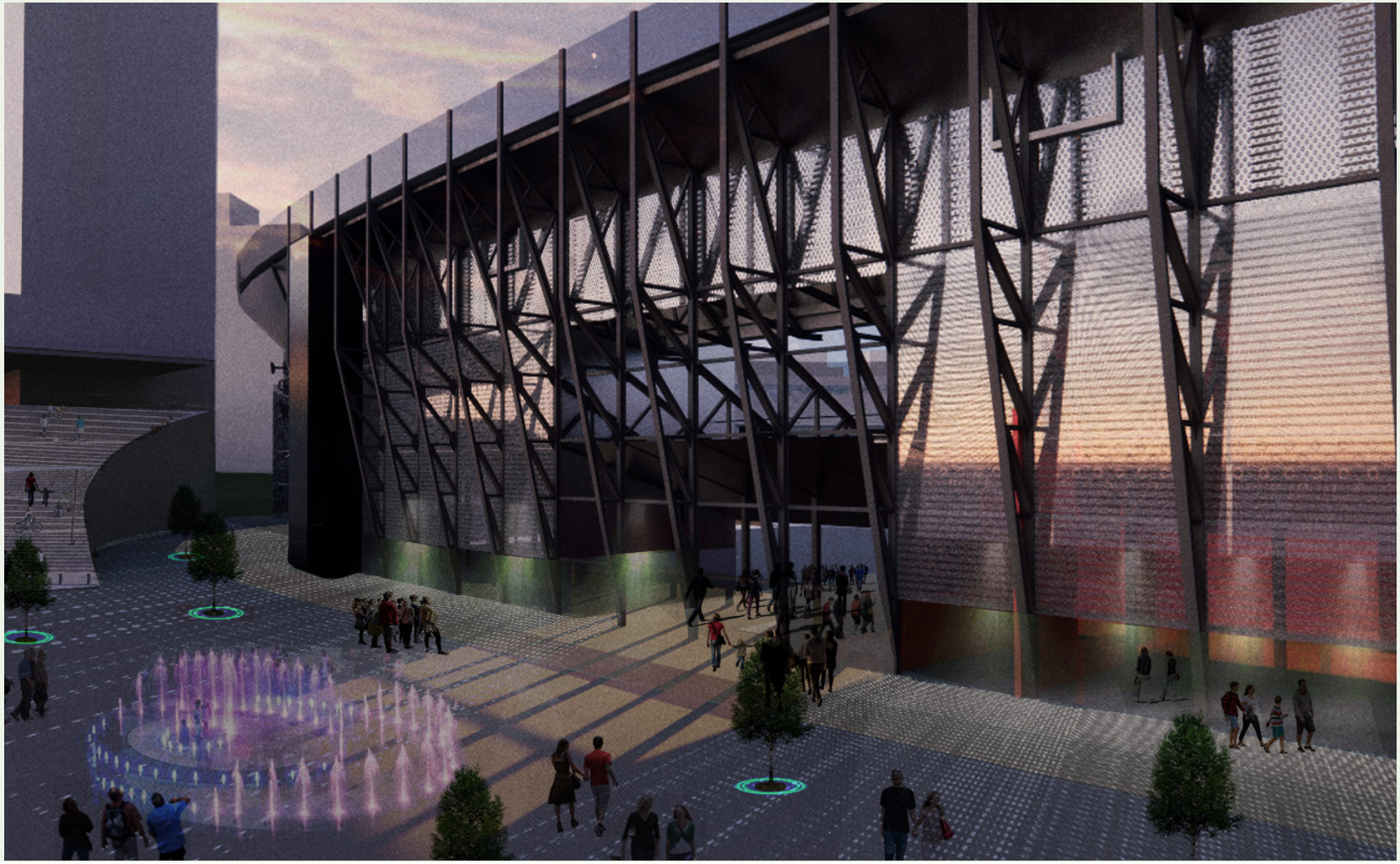
1937

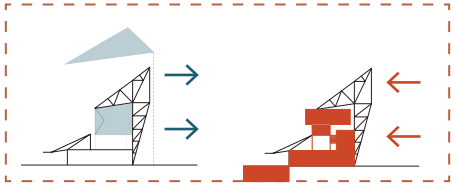
1994



1994

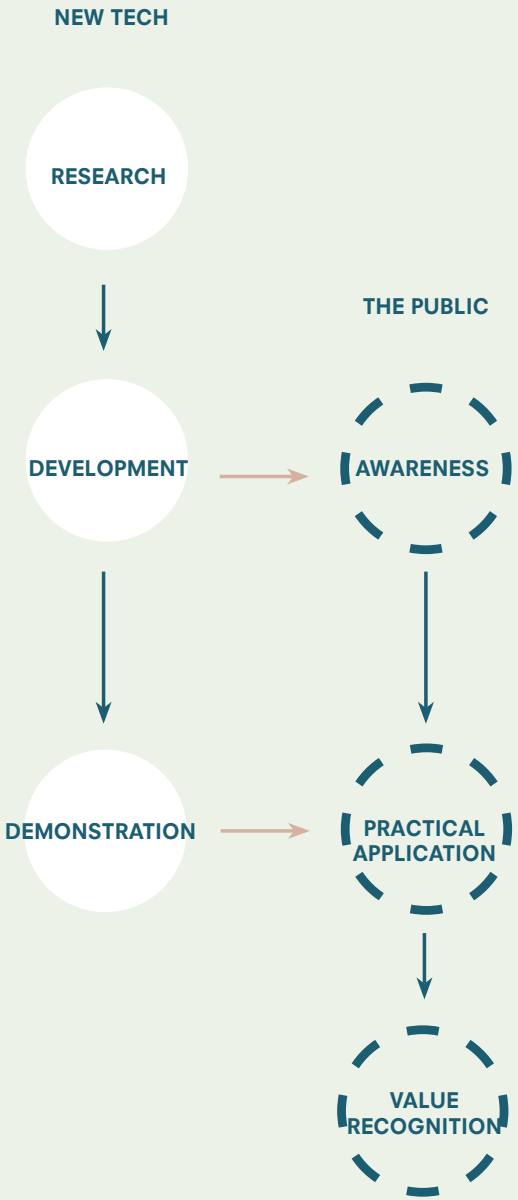
>2022



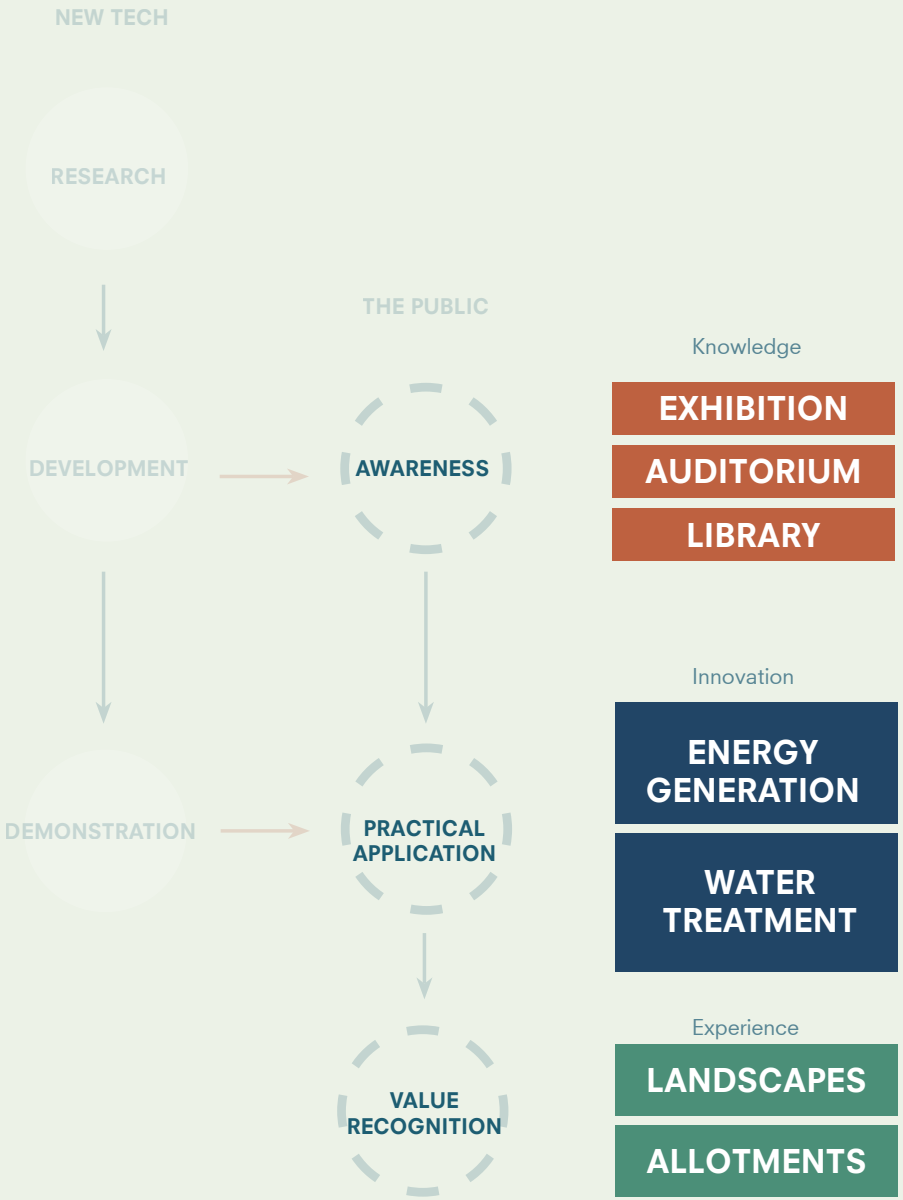


>2022

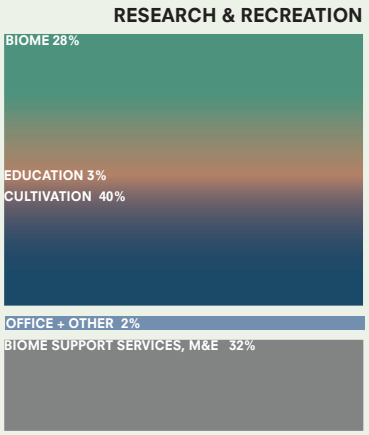
PARALLEL PROCESS

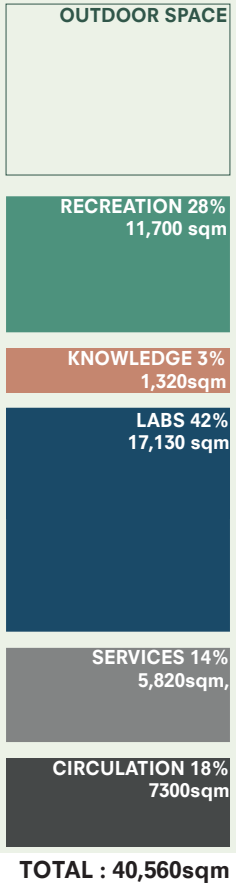


PUBLIC EXPERIENCES



PROGRAMS





TOTAL : 40,560sqm

biosphere 2 :
services + m&E= 3000 = 26%
biomes = 7600m2 = 66%
lab support, offices + boh = 930 = 8%
total = 11530

OUTDOOR SPACE

FOH

Hydrogen Go Karting Track	2415 m2
Courtyard, Main Entrance	5400 m2
Kuip Gardens / Playground	9,000 m2
Go Karting Support	200 m2

BOH 5000 sqm

Service Parking + loading bay
Disabled & Employee parking

RECREATION 11,700 sqm

FOH		m2
Main Foyer	950 m2	min 4
Activity Box Office	130 m2	4
Admin / Information center	213 m2	4
Microbial Energy Exhibition Space	955 m2	4
Biomes		
- Rock Climbing Zone	250 m2	40
- Canopy Walkway	-	-
- Marsh Concept	560 m2	4
-Atmosphere concept room	280 m2	8
Ocean concept (salt water tank)	900 m2	4
River concept (Fresh water tank)	340 m2	4
Gift Shop	160 m2	4
Canteen	900 m2	7
Occasion Dining	500 m2	min 4
Cloakroom	110 m2	4
Kids Play / crèche	510 m2	4
Bar	200 m2	4

BOH

Public WC & Changing	715 m2	4
Kitchen	225 m2	4

KNOWLEDGE 11%

Classroom / Conference Rooms	240 m2	4
Research Reading Room	350 m2	4
Auditorium	600 m2	12
Backstage support + lighting	130 m2	4
wc	30 m2	4

LABS 31%

FOH 16,190 sqm

Algae Cultivation	14,000 m2	8
Waste water treatment	6000 m2	8
Algae water storage tank	100 m2	8
Meeting Rooms	240 m2	4
Office	230 m2	4
Admin	120 m2	4

BOH 904 sqm

Soil Analysis Lab	216 m2	4
Microbiology Lab (Algae Cultivation Research)	216 m2	4
Water Analysis Lab	216 m2	4
Staff Room	200m2	4
Staff WC / Shower	60 m2	4

SERVICES 27%

Water Mechanical Room	1200 m2	8
Algae Mechanical Room	2800 m2	8
ATES mechanical room	510 m2	8
Technical Room	550 m2	8
Data Center	450 m2	8
Co2 Storage	200 m2	8
Storage/ Service	200 m2	8

STAKEHOLDERS

Client:
Bio-Tech Incubators

GREEN CHEMISTRY CAMPUS

YES! DELFT

Researchers

WAGENINGEN UNIVERSITY & RESEARCH

TNO innovation for life

Independent Research Facility

Deltares

Companies

BPF BIOPROCESS PILOT FACILITY

CEIMICI NOVEL

Policy makers

Gemeente Rotterdam

cen

European Committee for Standardization

nen Standard for progress

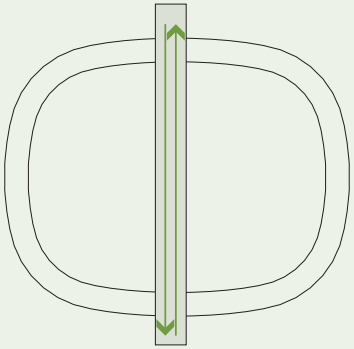
A non profit that brings together different parties to create a product and safety a standard for many sectors including biofuels in the Netherlands

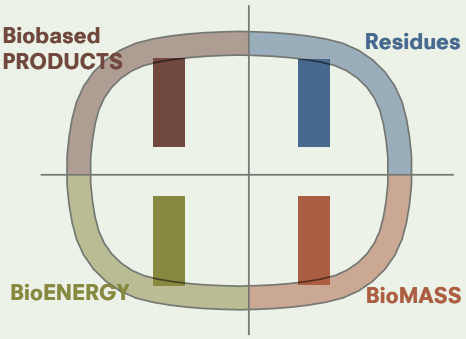
Public

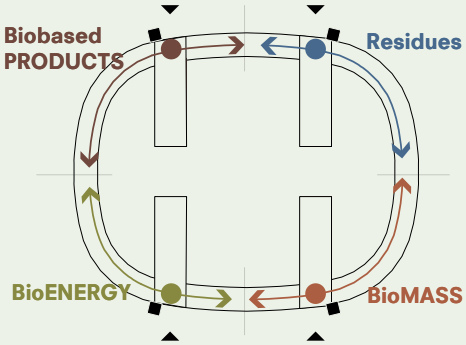
USER PROFILES

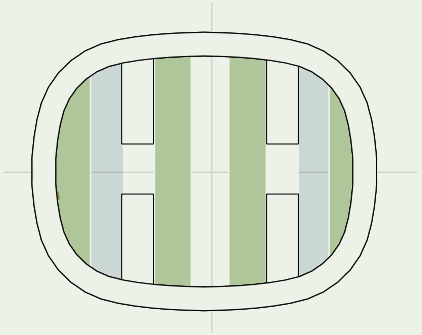
User:	Informed Public	General Public	Researcher	Industry Engineers	Industry Professionals	Service support staff
Aims	Attract the local and national youth to STEM research to education and engagement through outreach + participation + school visits	Increase green space accessibility and use for local deprived neighbourhood.	PHD specialist research into bio-economy	Engineering + Pilot scale testing	Test economic viability + new policy. Test consumer interest + uptake	Area for loading, unloading, crop equipment storage, mechanical rooms, fire escape
Age	10-18	All ages	>18	>25	>25	18+
Key interests :	On school visits	Leisure, public workshops, gardening, exhibition & hands on experience	Biomass, Biofuel, Residual waste steams, Water technologies research + design consumer products	Generate energy, clean water + resilient crops + energy harvesting crops		
Means of accessibility:	By foot / bike/ coach	By foot / bike / public transport	By bike / public transport	By bike / public transport / car	By bike / public transport / car	By delivery & loading trucks / car
User spaces :	Open education, Workshops &Exhibitions Guided tours Auditorium Conference Room, wc, locker rooms, cloak room Material library	Green corridor, Swimming pool, Basketball, outdoor informal exercise, changing, gardening houses	-pre-pilot research labs, computer rooms. Library -staff offices, changing, shower etc -facilities for (conference room / auditorium) cafeteria, staff room, wc Storage	-Offices, meeting rooms, pilot labs, industry workspace, outdoor test site, cafeteria, WC, changing -material library	-Offices, meeting rooms, Public consultation rooms workshop space, admin, cafeteria, WC, changing -material library	wc, office, concierge/ post delivery, loading bay, storage, freight / service lifts / mechanical rooms, HVAC, ATES

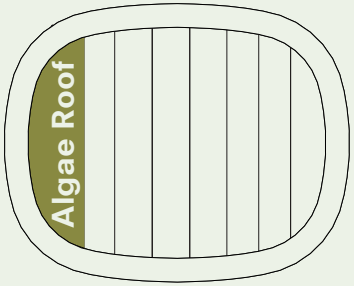
FUNCTIONAL CONCEPTS - INDUSTRY

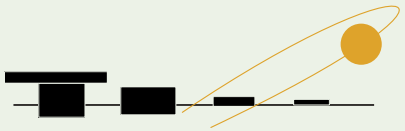




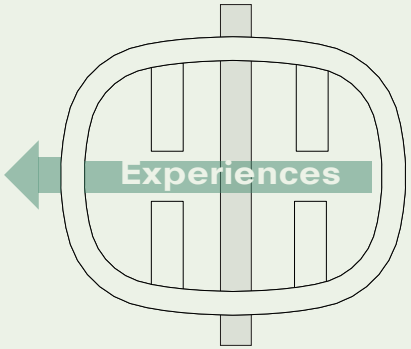


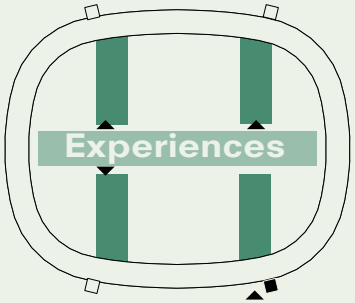


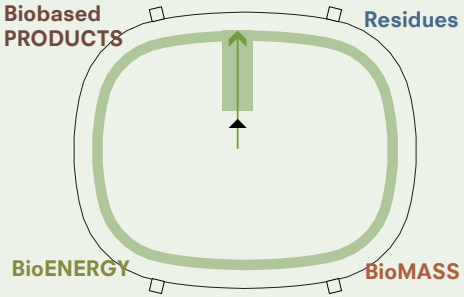


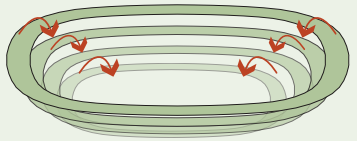


FUNCTIONAL CONCEPTS - PUBLIC & VISITORS



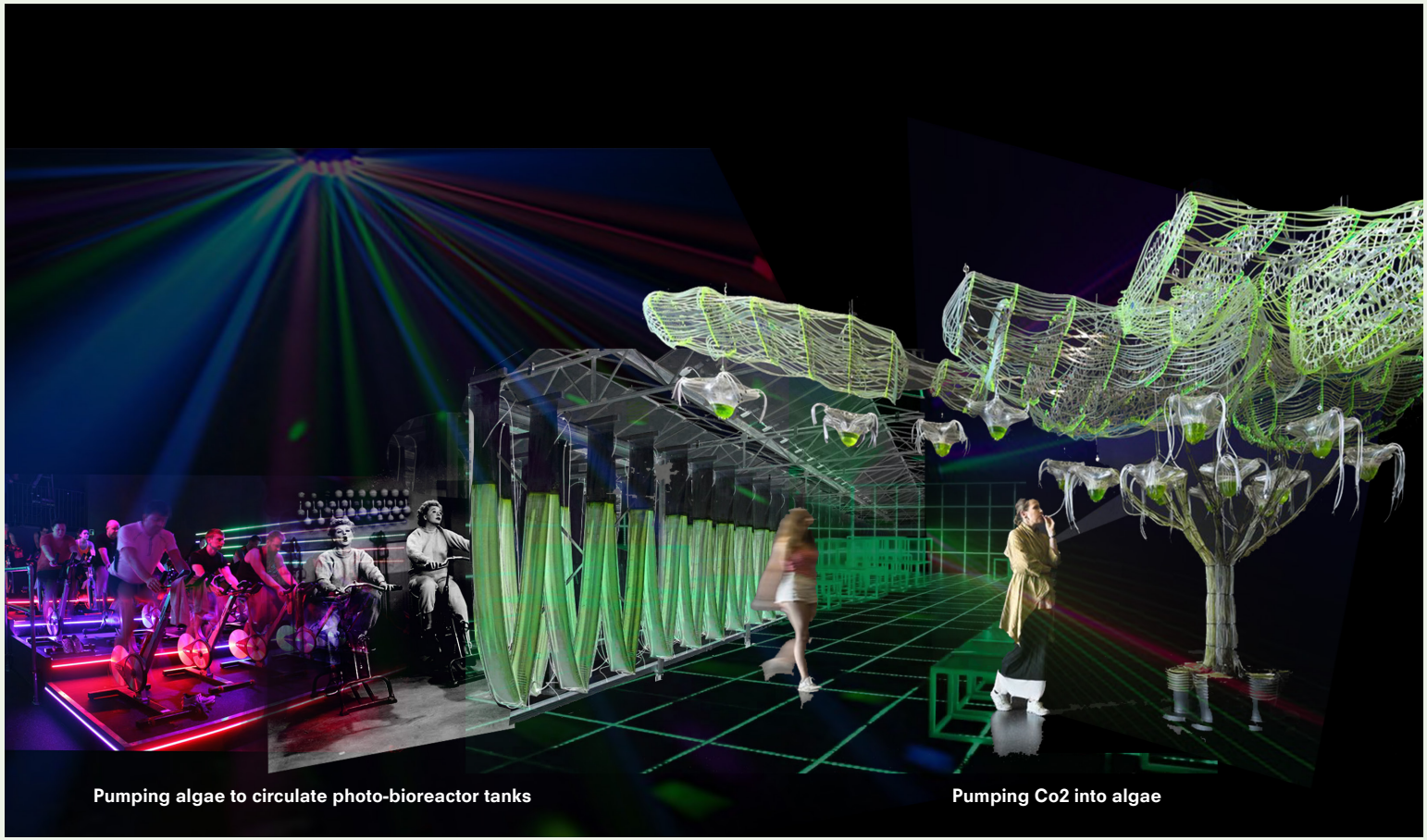






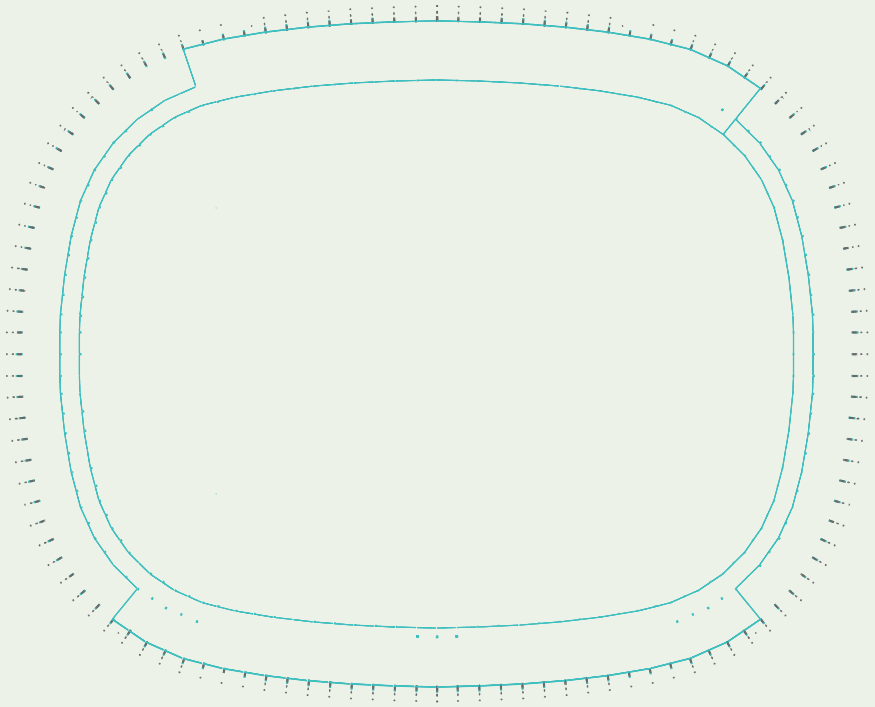
INTERSECTING SPACES | AWARENESS

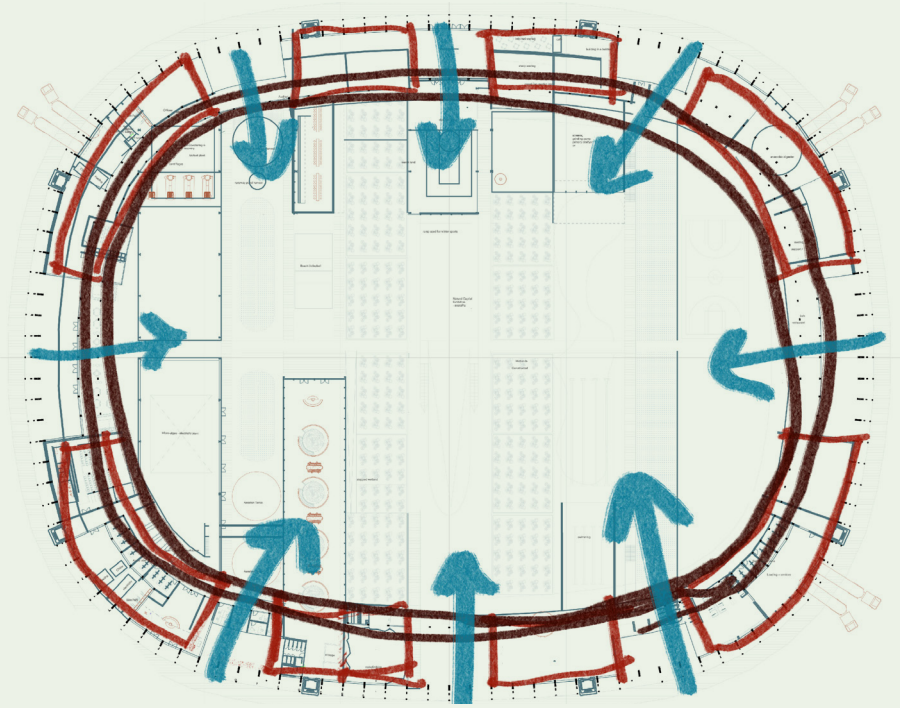
INTERACTIVE EXHIBITION | APPLICATION

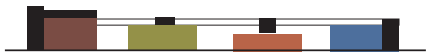


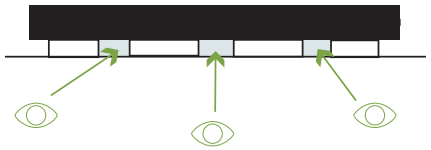
ECOSYSTEM SERVICES | VALUE RECOGNITION

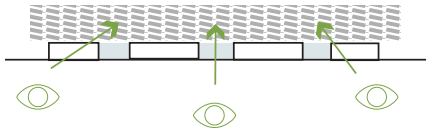
EXISTING STRUCTURE





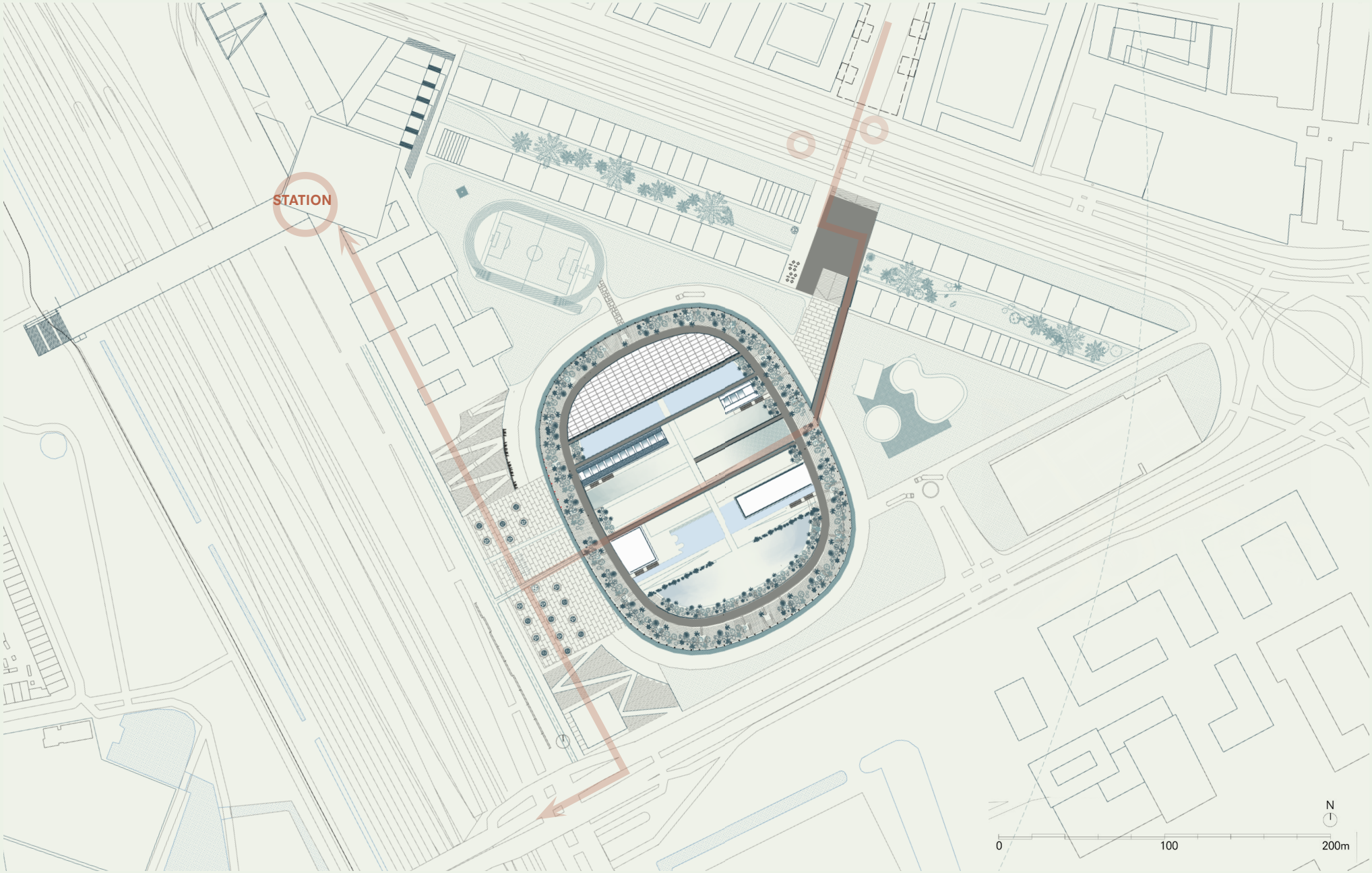




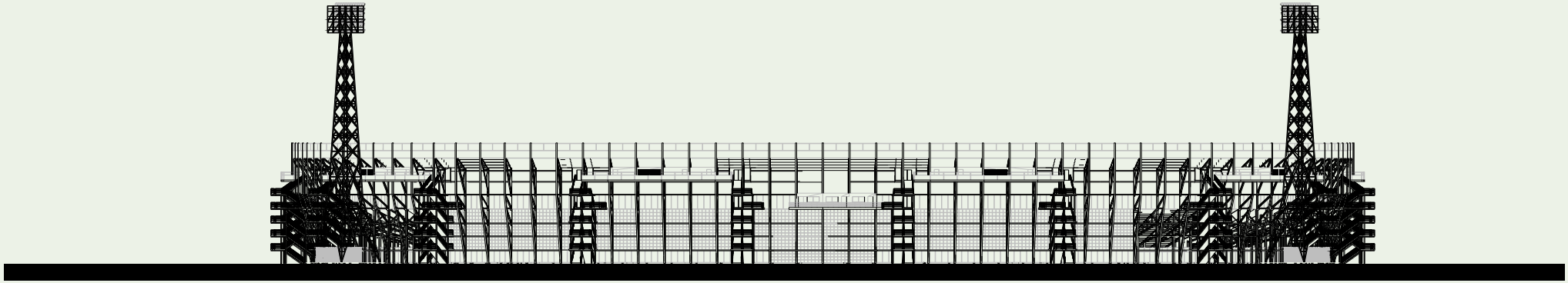


05 Design Implementation

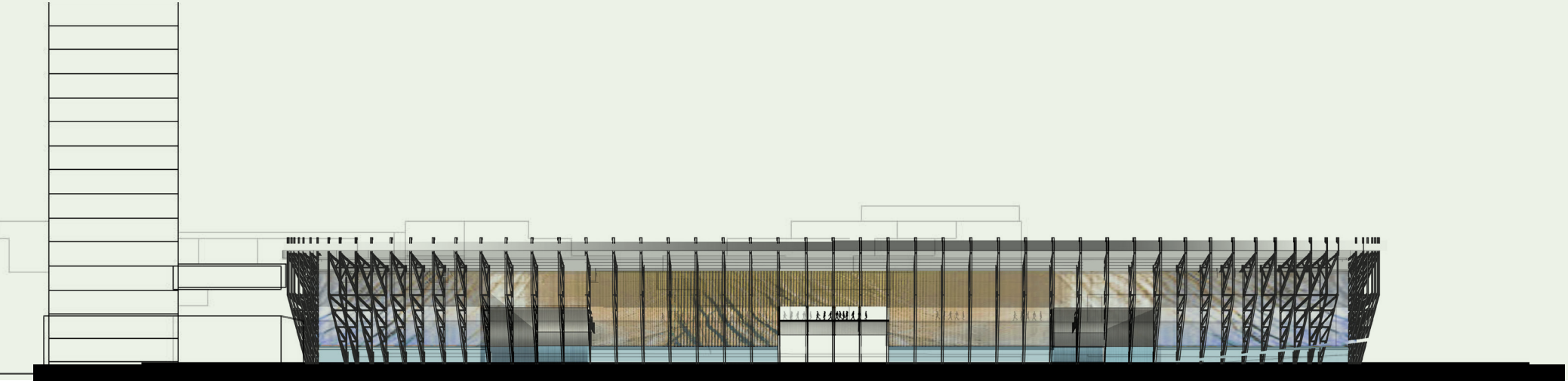
1 :2000 SITE PLAN | URBAN NODE



MAIN ENTRANCE

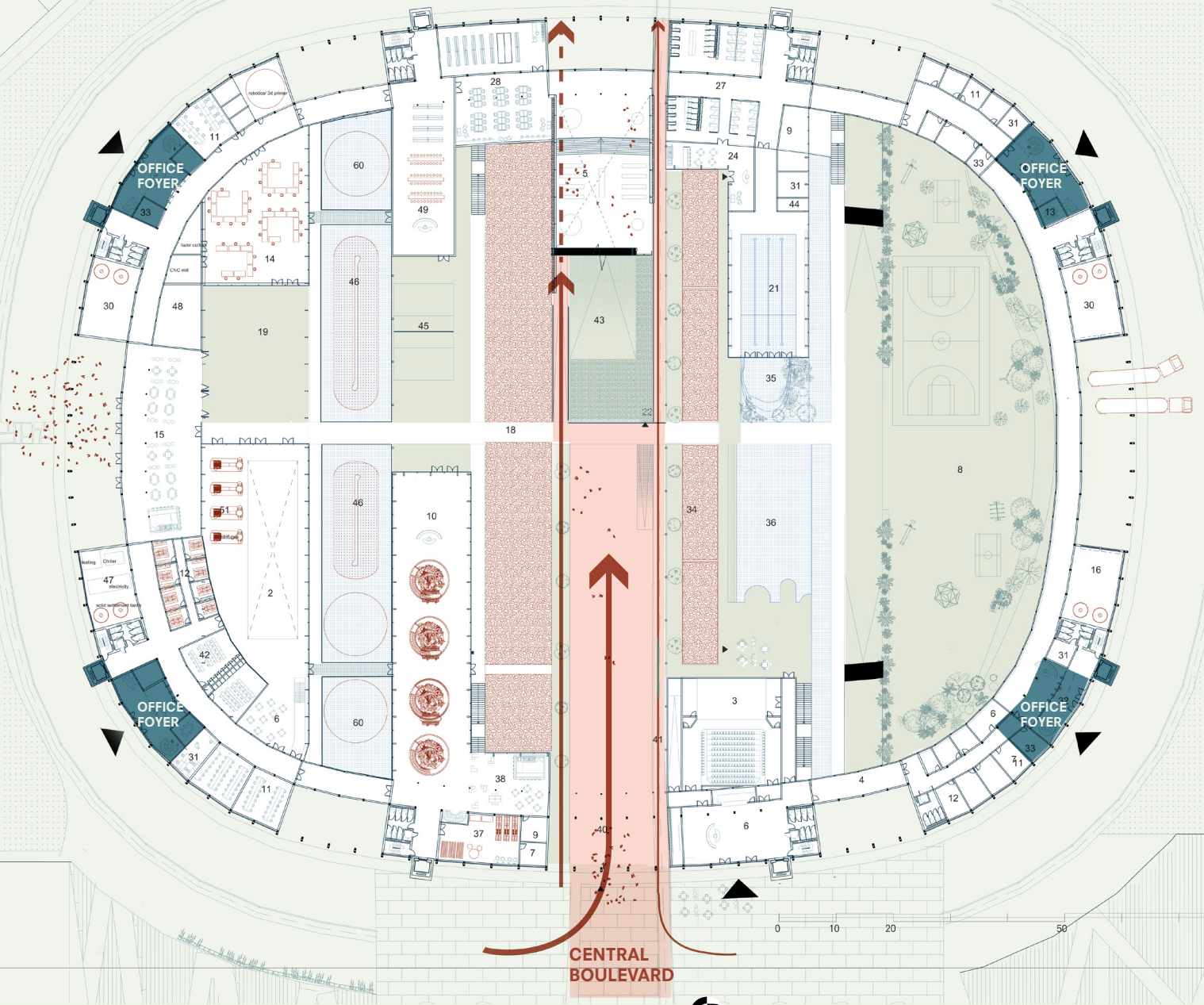


EXISTING



PROPOSED

GROUND FLOOR PLAN 1:200



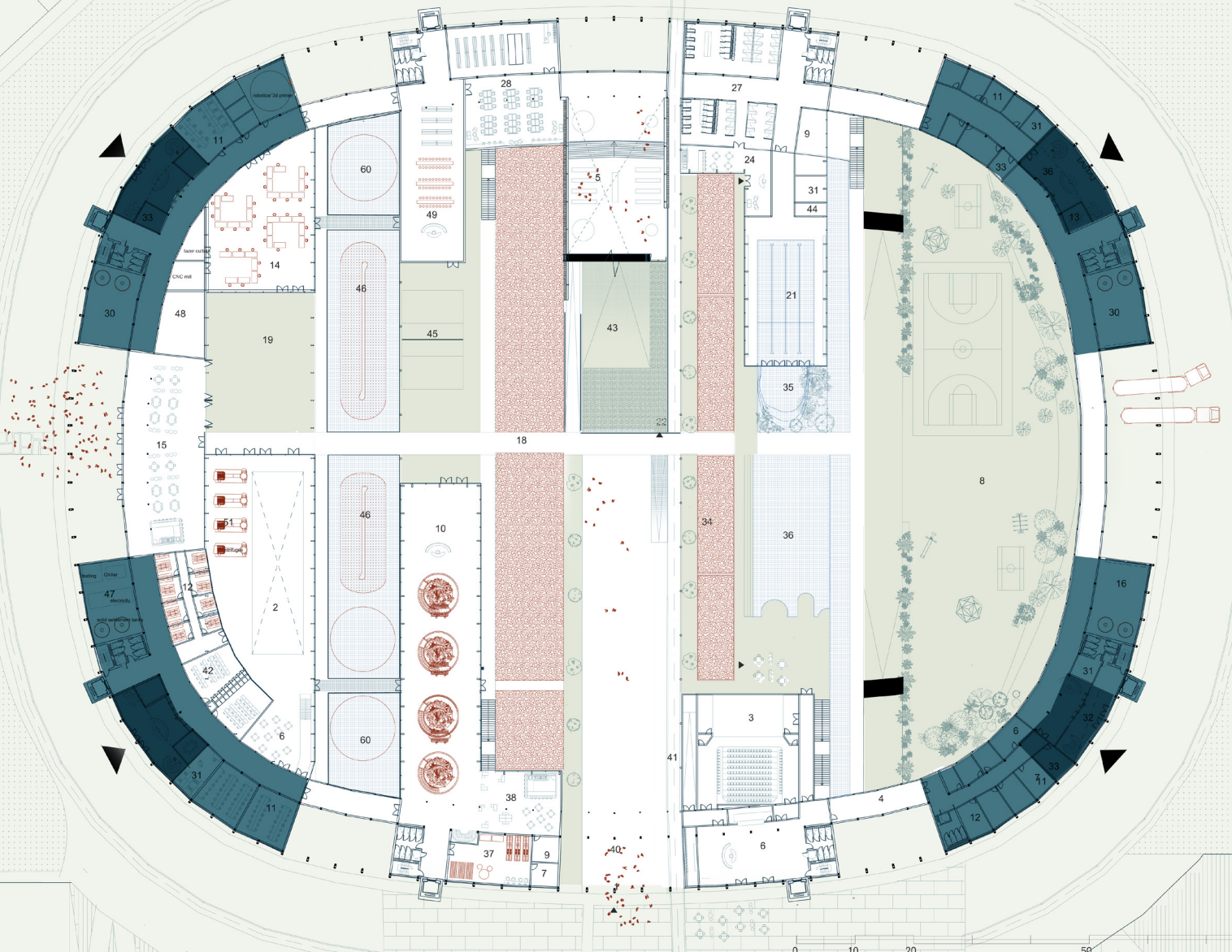
Key

1. Main Entrance
2. Algae Mechanical Hall
3. Auditorium
4. Private Corridor
5. Exhibition
6. Informal Meeting
7. Services & Support
8. Sports & Recreation
9. Storage
10. Aerated lagoons
11. Offices
12. Labs
13. Conference Rooms
14. Workshops
15. Cafeteria
16. Loading Bay
17. Bike Park
18. Liesure Experience Axis
19. Test Floor
20.
21. Indoor swimming
22. Exhibition Entrance
23.
24. Cafe
25. Staff Room
26. Water treatment
27. Changing Rooms
28. Library Archives & Reading Room
29. BOH
30. Waste disposal
31. Admin
32. Agro Staff Entrance
33. Staff Kitchen
34. Constructed Wetlands
35. Outdoor Natural Pool
36. Shallow pool
37. Aquaponics scaled research & Display
38. book/ gift shop
39. Auditorium foyer
40. Pedestrian Boulevard
41. Cycle Path
42. Seminar Room
43. Constructed Landscape
44. Lifeguard
45. Beach Volleyball
46. Raceway Pond/ Cultivation
47. Mechanical Room
48. Commerical Kitchen
49. R&D Hall
50. Harvesting
51. Algae Dewatering & Thickening

CENTRAL BOULEVARD

OFFICE FOYER

GROUND FLOOR PLAN 1:200



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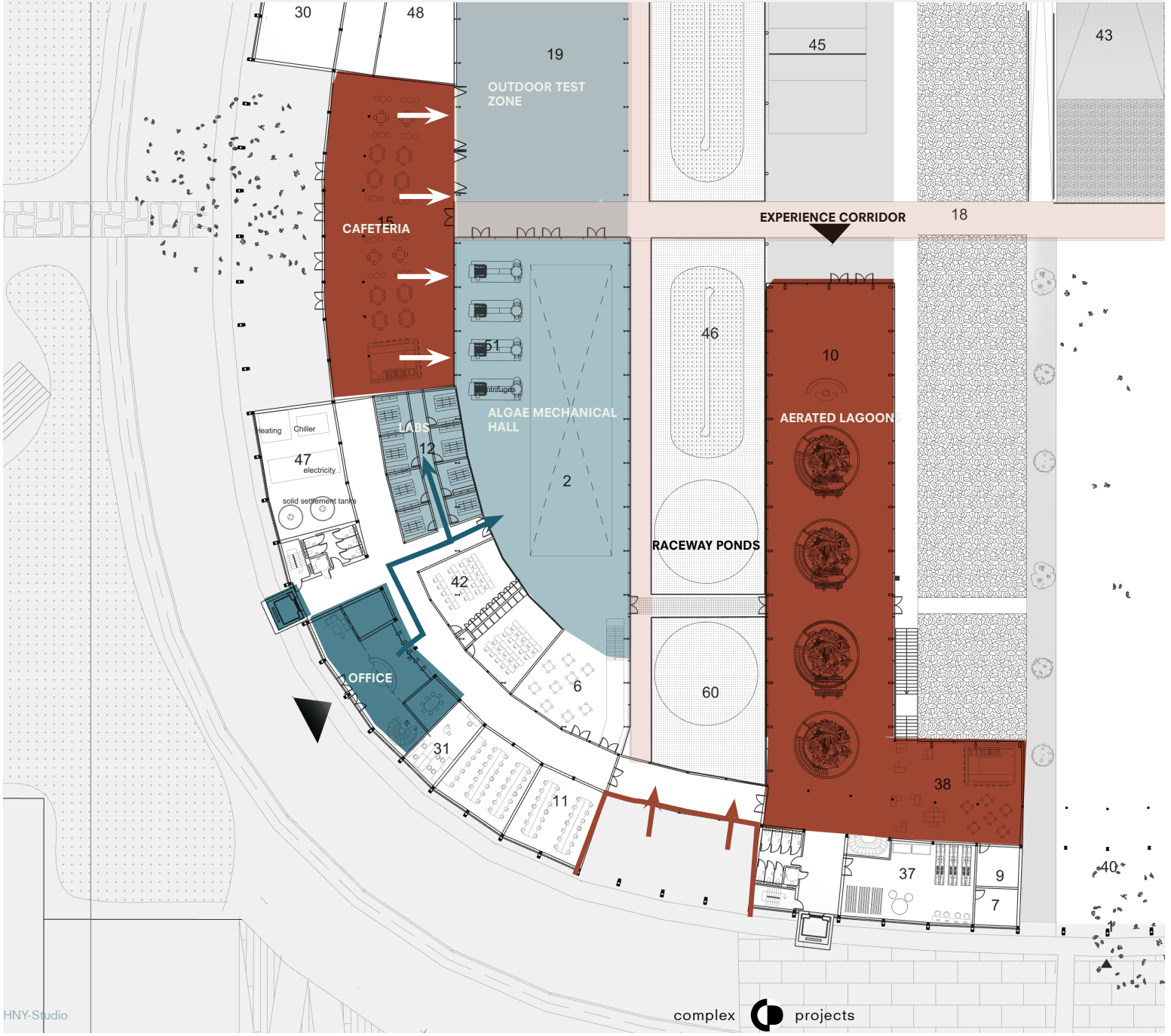
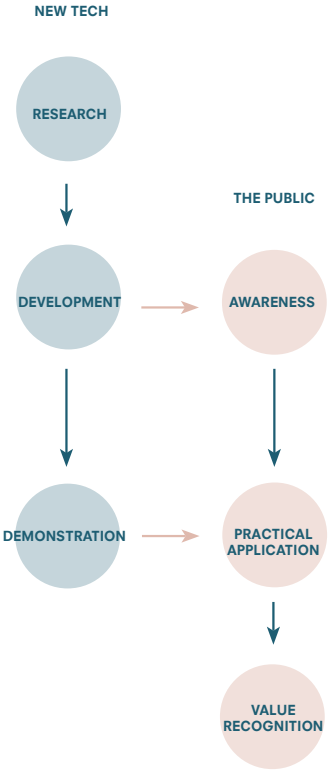
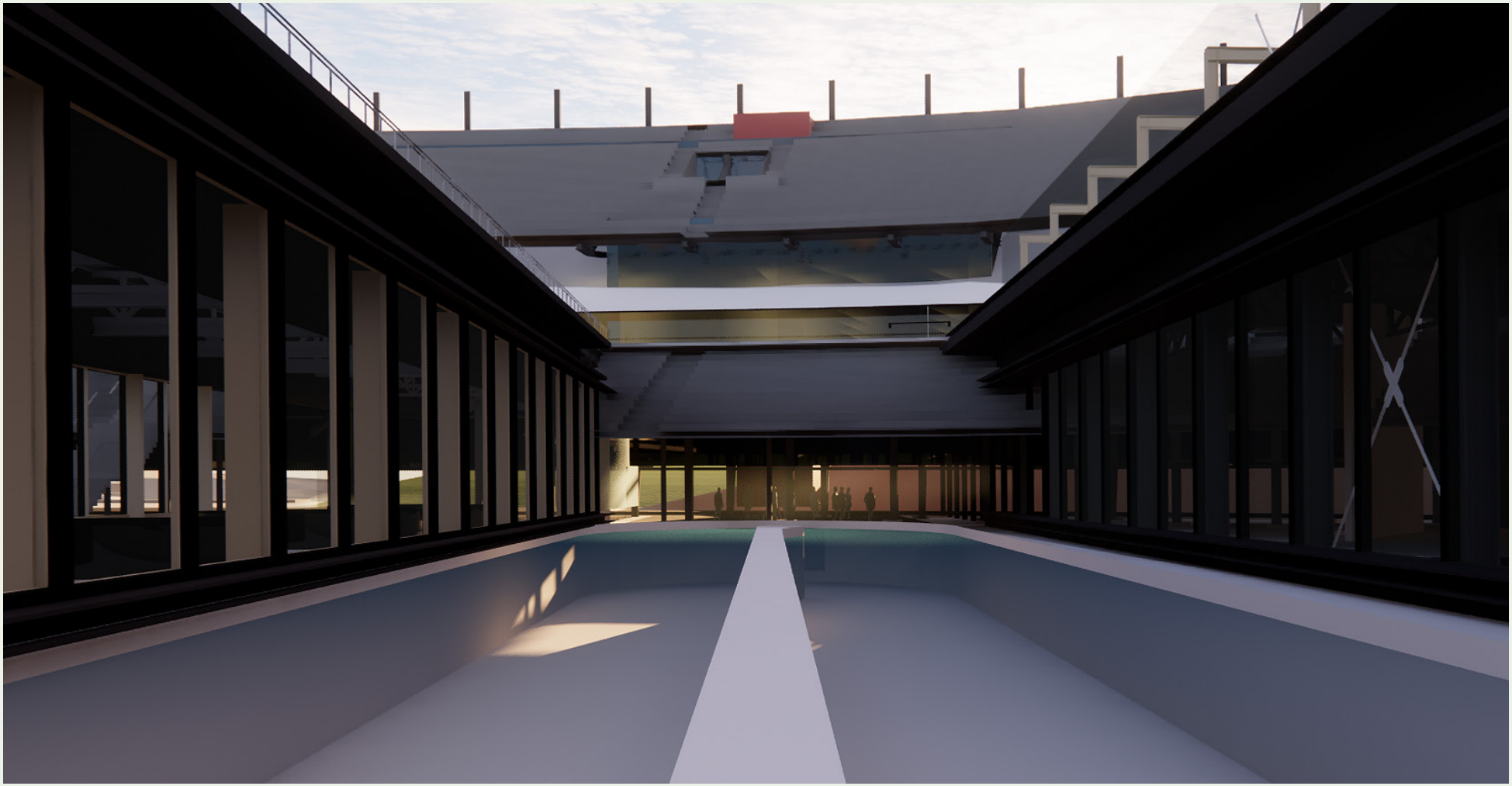
RESEARCH AND DEVELOPMENT



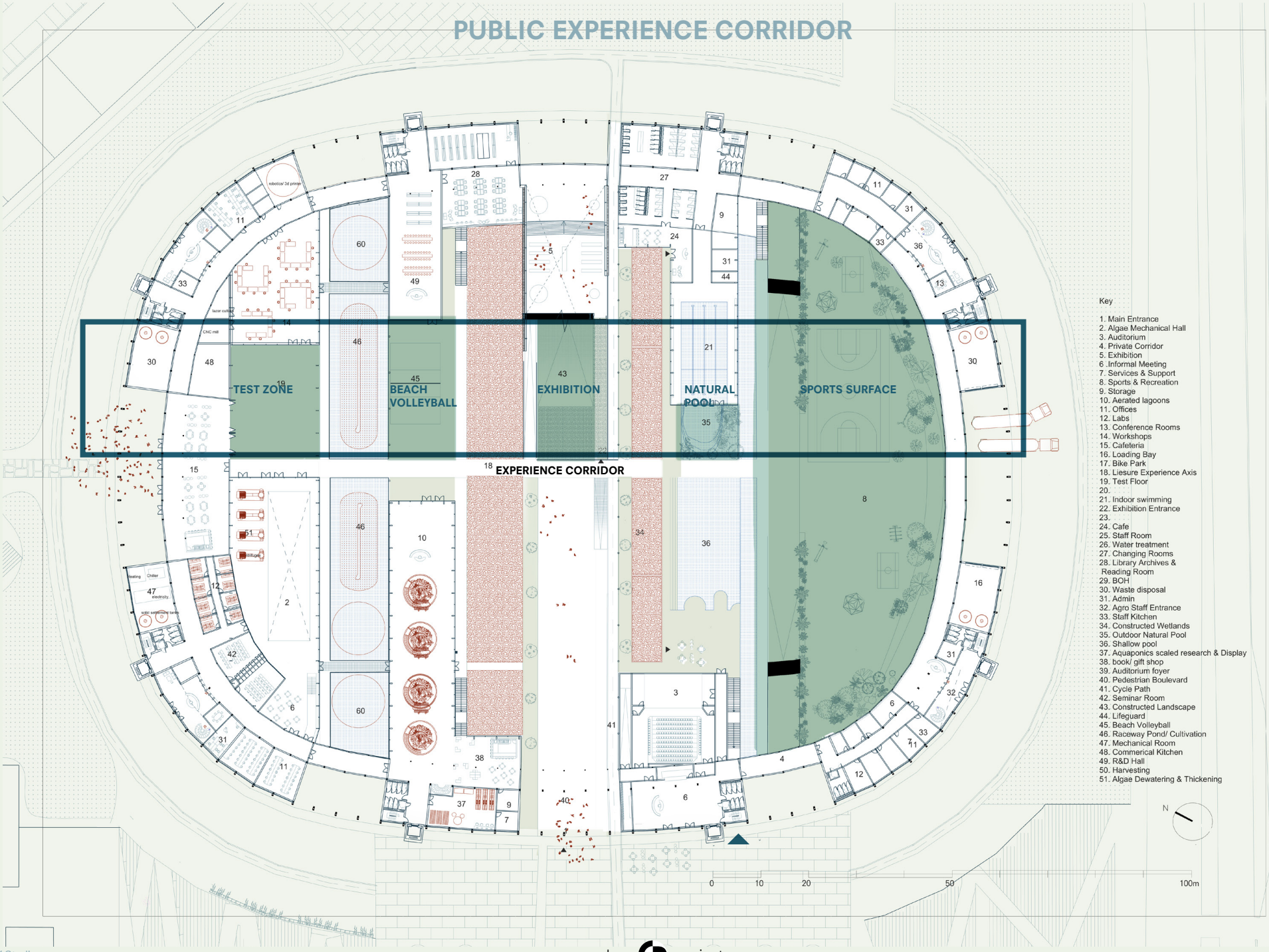


RECESSES



ALGAE MECHANICAL HALL

PUBLIC EXPERIENCE CORRIDOR



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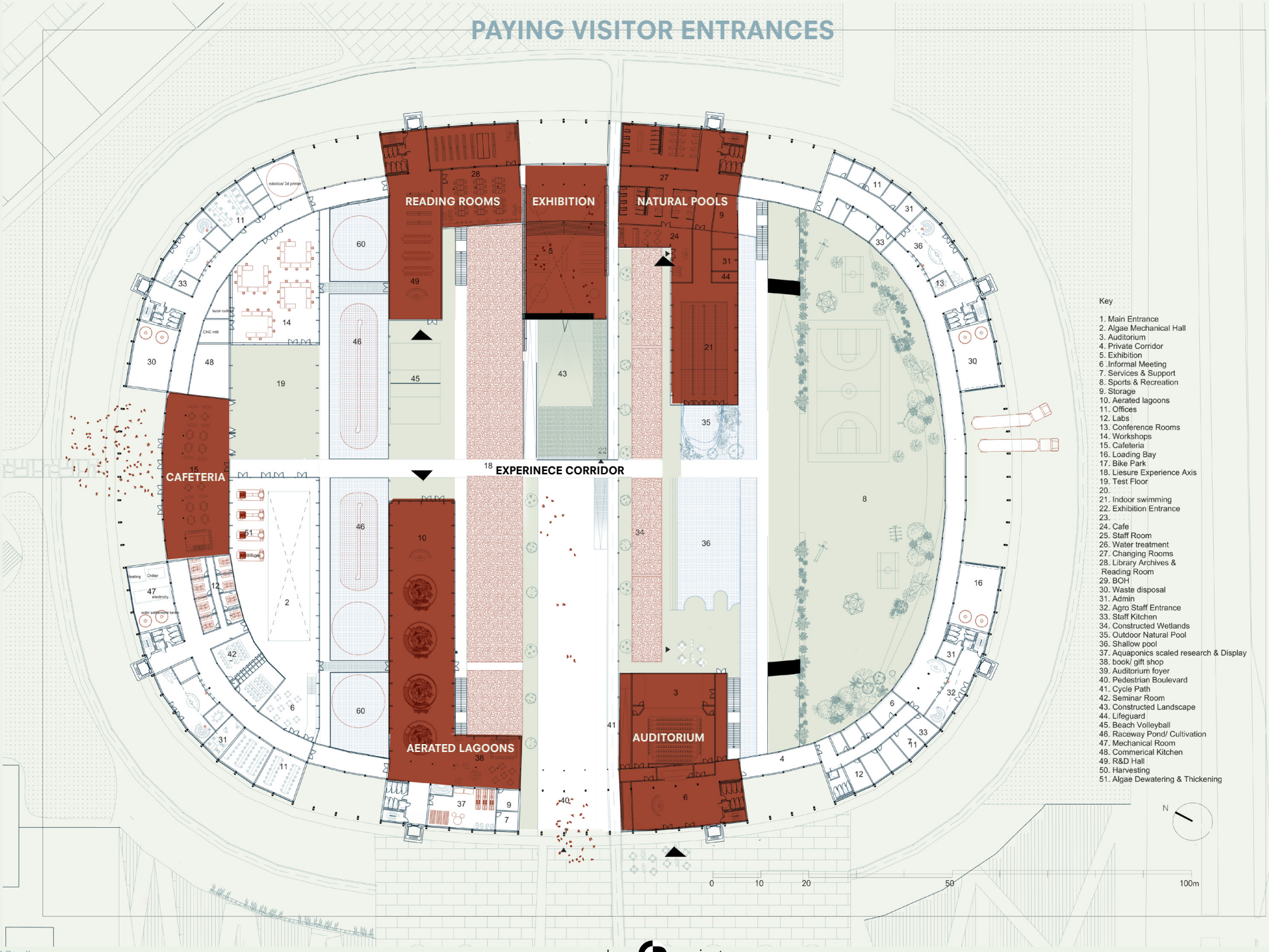
PUBLIC EXPERIENCE CORRIDOR

PAYING VISITOR ENTRANCES



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AUDITORIUM FOYER

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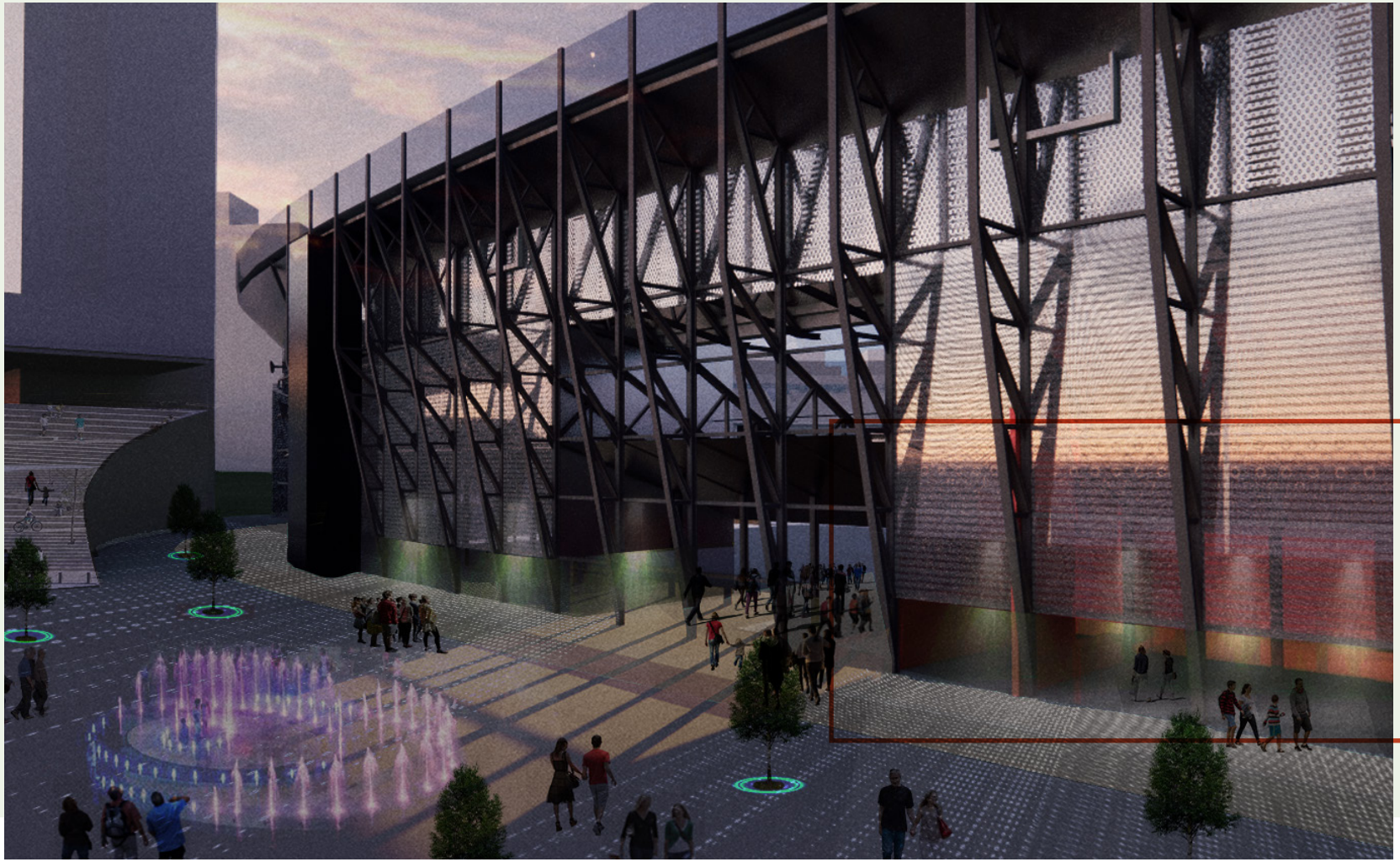
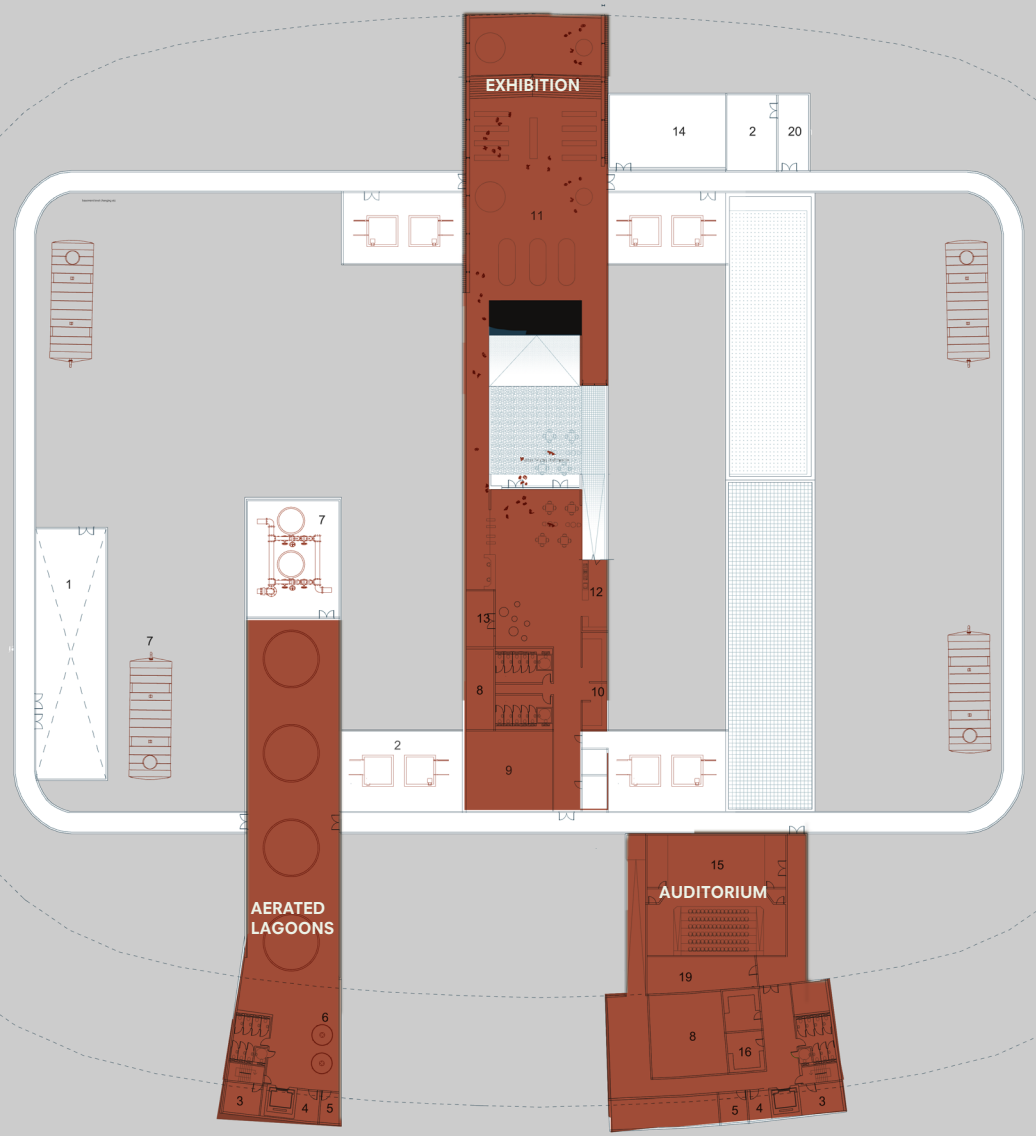


BASEMENT



Key

1. Algae Mechanical Hall
2. Mechanical Room
3. Air Handling Unit
4. Lift Room
5. Electrical Room
6. Solid Settlement Tank
7. Recirculating Sand Filter
8. Storage
9. Offices
10. Locker Room
11. Exhibition
12. Cafe
13. Shop
14. Water Pre-Treatment
15. Auditorium
16. Changing Room
17. Audio-Visual
18. Storm Water Storage
19. Clean Water Storage
20. Pump room
21. Dispersal Fields

N

0 10 20 50 100m

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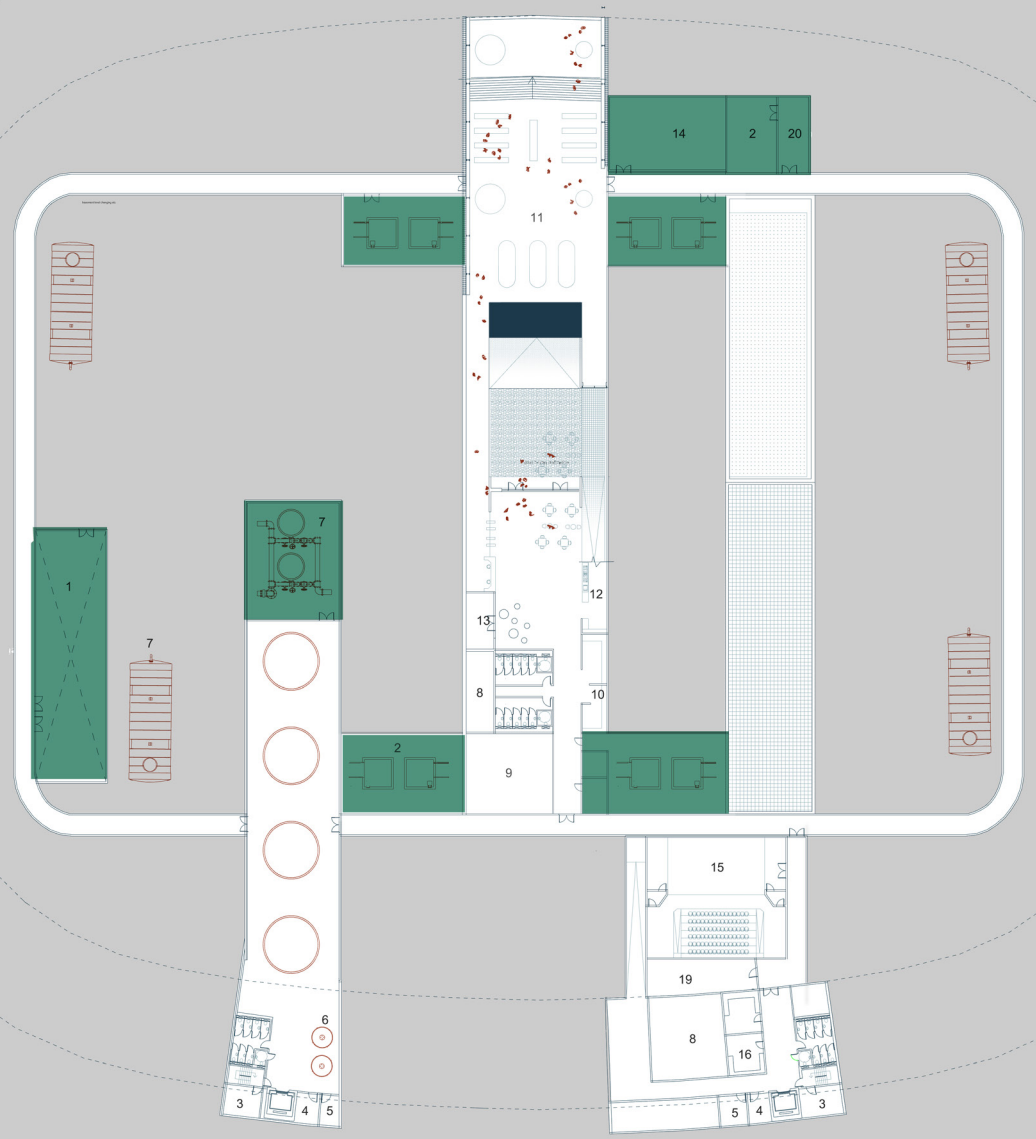

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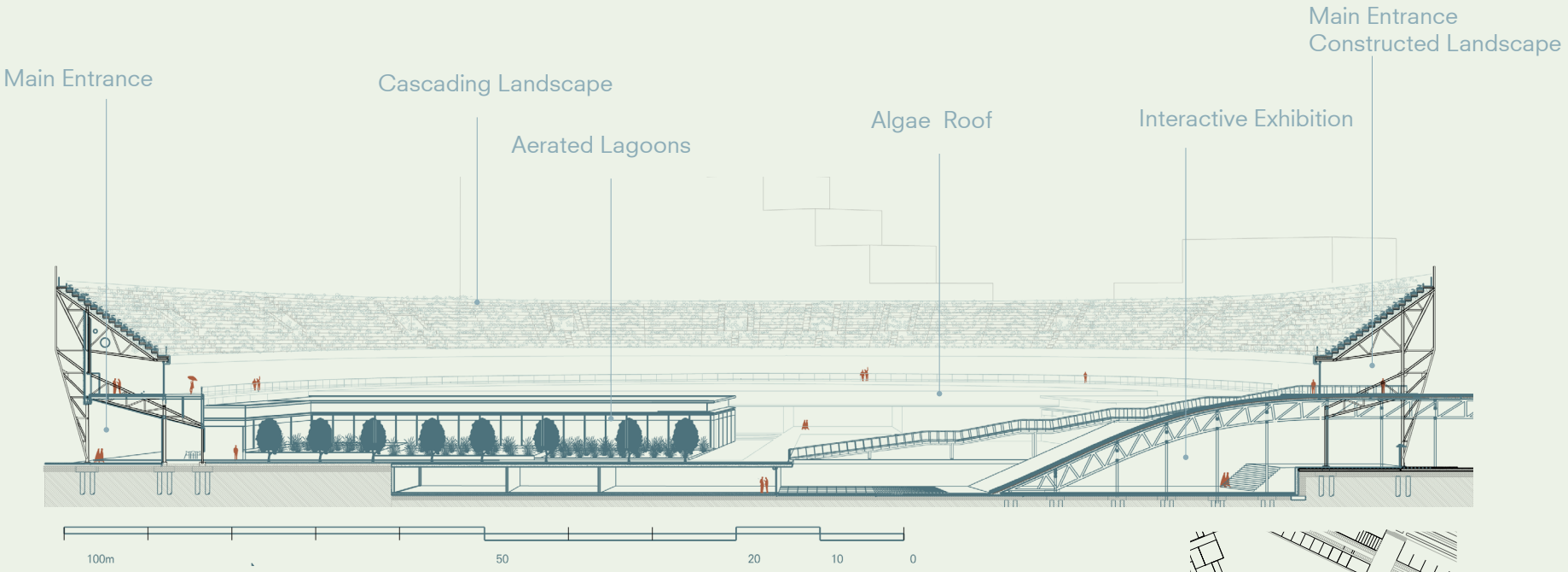
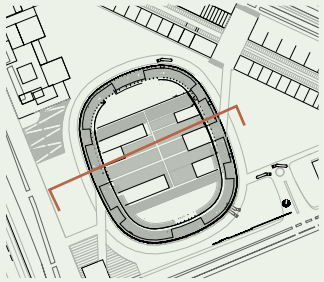
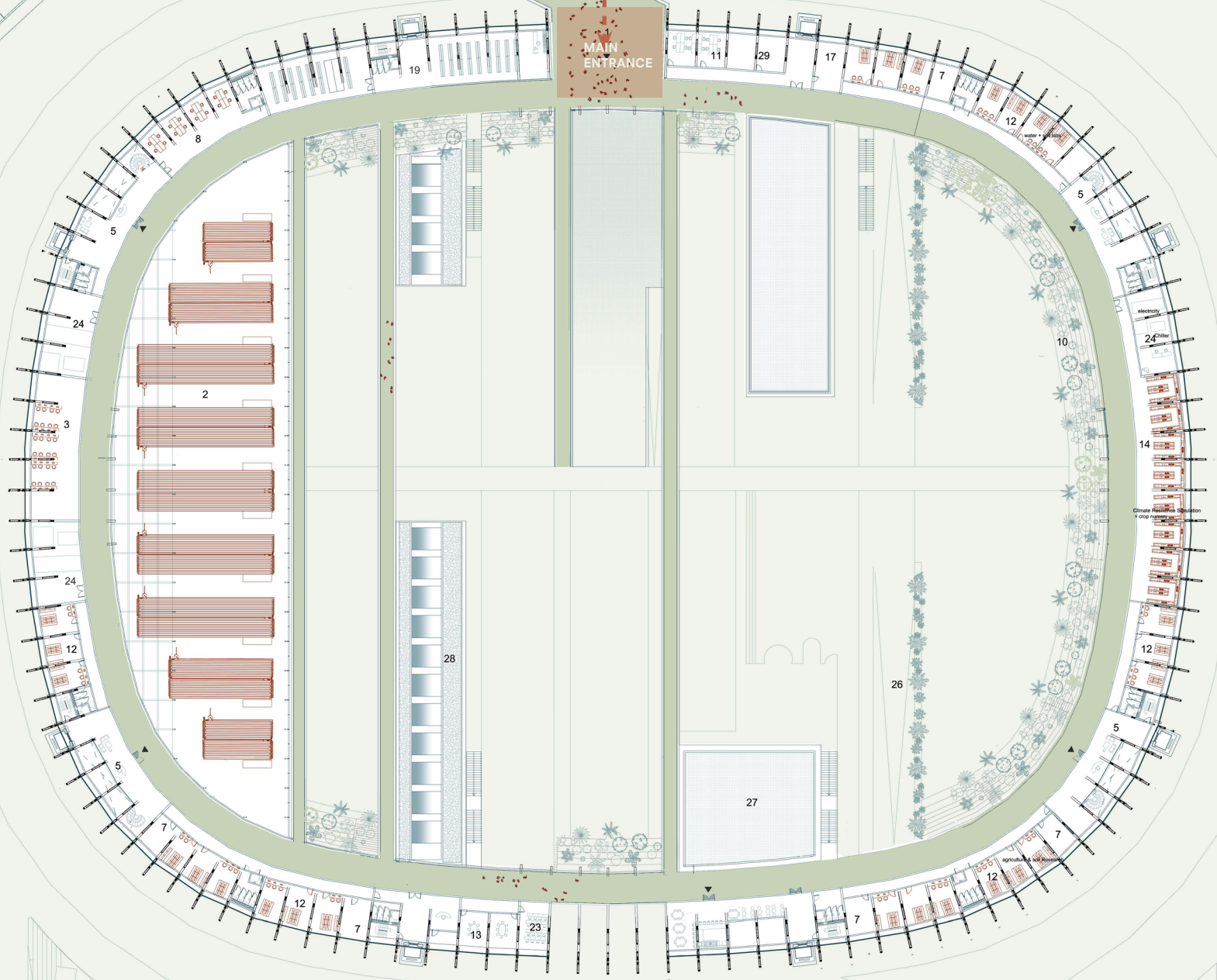
EXHIBITION ENTRANCE

SHORT SECTION





CONNECTED PROGRAMS



Key

1. Main Entrance
2. Algae Photobioreactor Roof
3. Computer Cluster
4. Private Corridor
5. Visitor Lobby
6 .Informal Meeting
7. Services & Support
8. Project Room
9. Storage
10. Intensive Landscape
11. Offices
12. Labs
13. Conference Rooms
14. Workshops
15. Cafeteria
16. Cafe
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19. Library Archives & Reading Room
20. Admin
21. Agro Staff Entrance
22. Staff Kitchen
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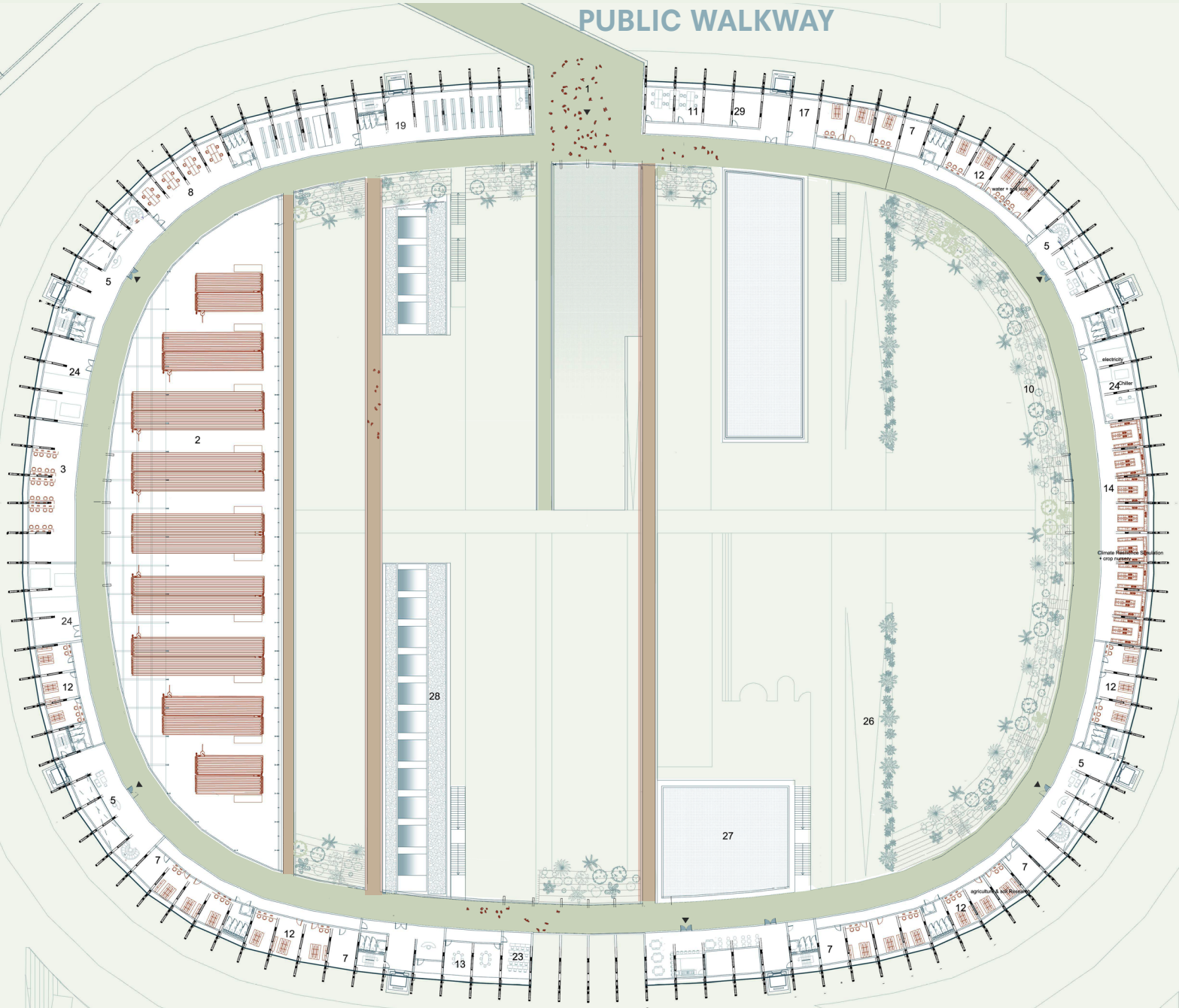
24. Mechanical Room
25. Commerical Kitchen
26. Constructed Landscape
27. Water Storage Roof
28. Extensive Roof

PUBLIC WALKWAY



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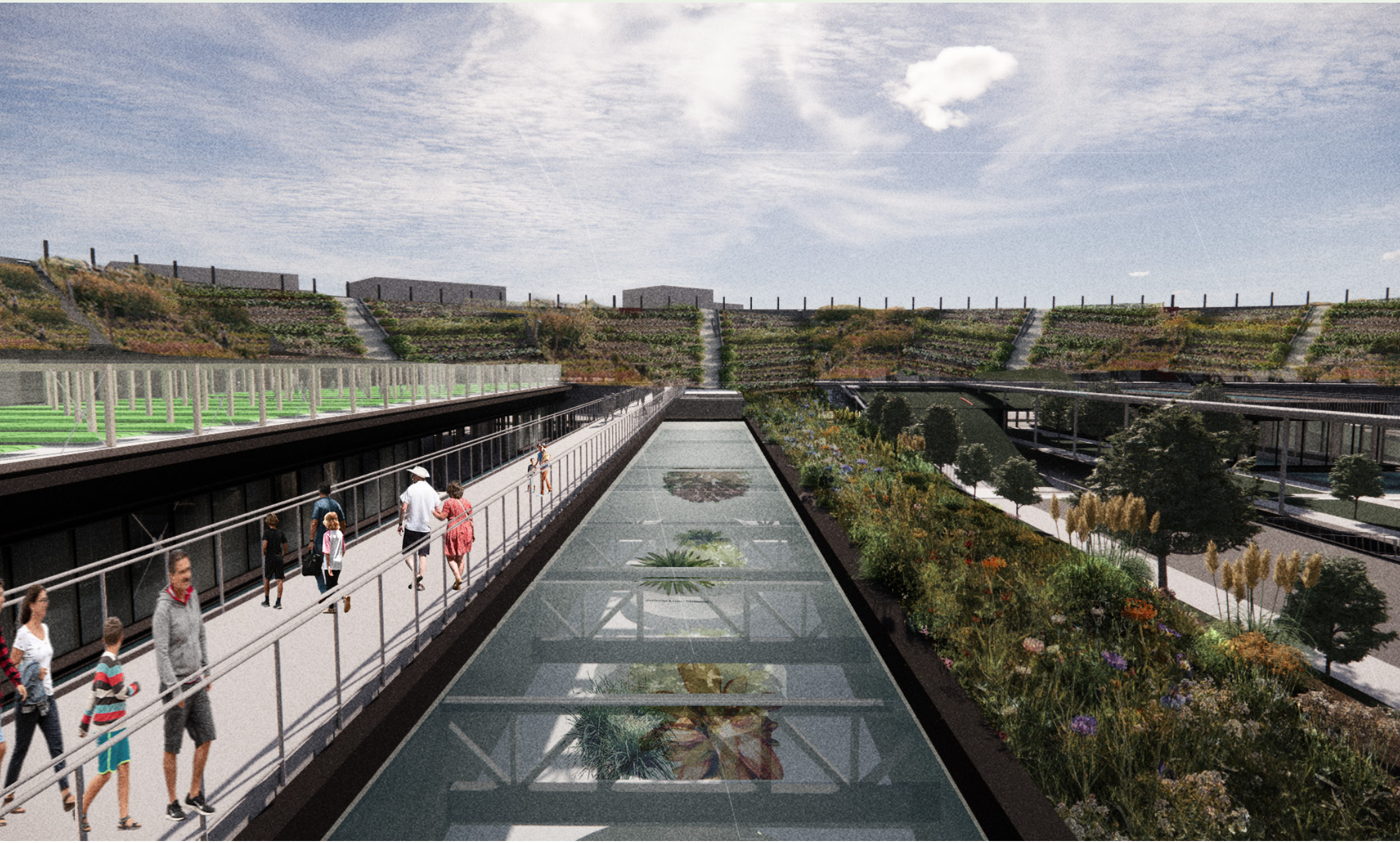
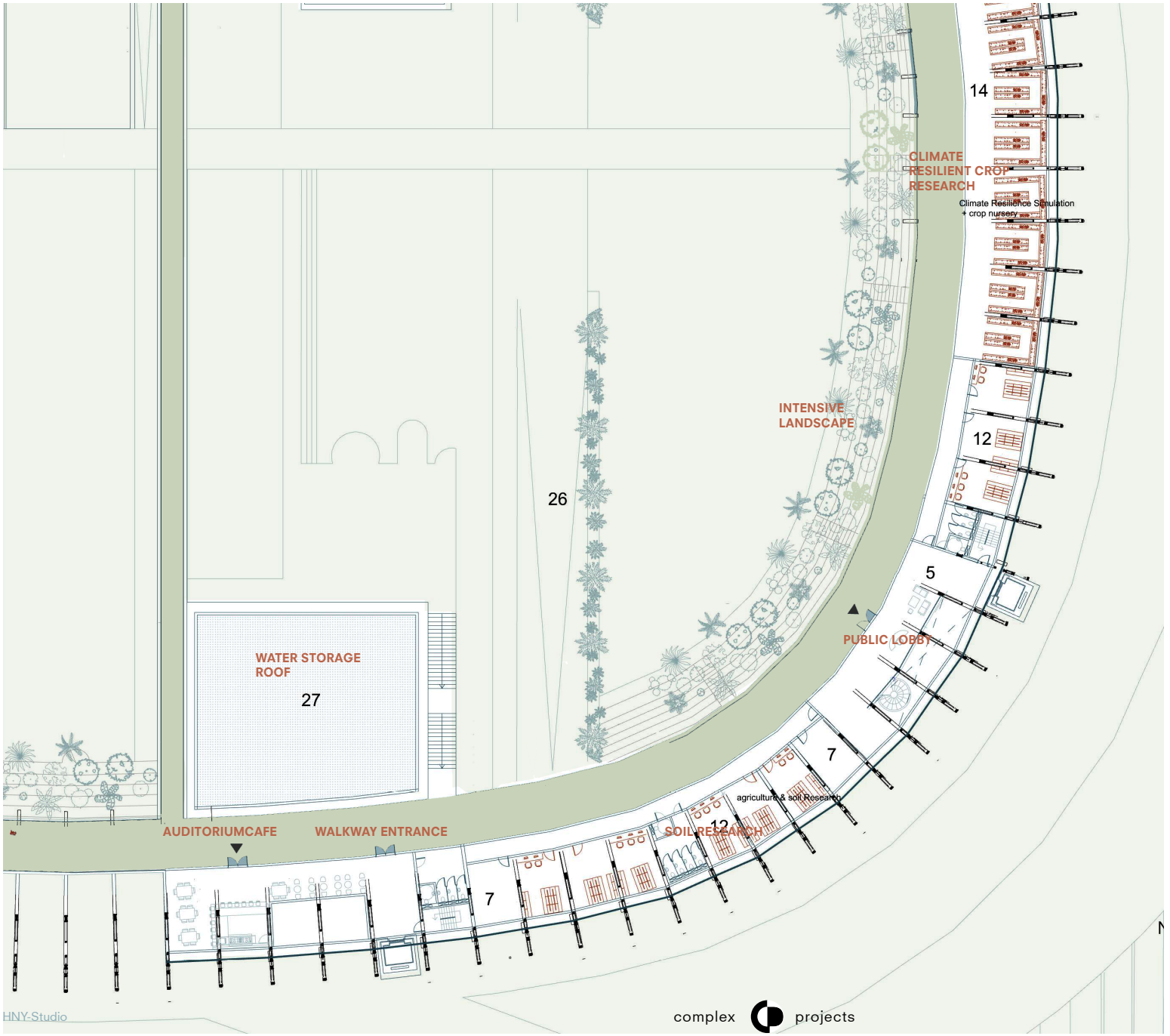
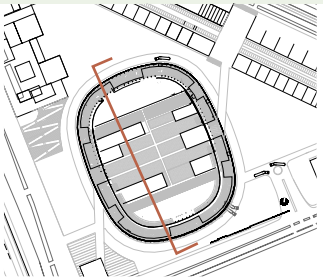


LABS + CROP NURSERIES



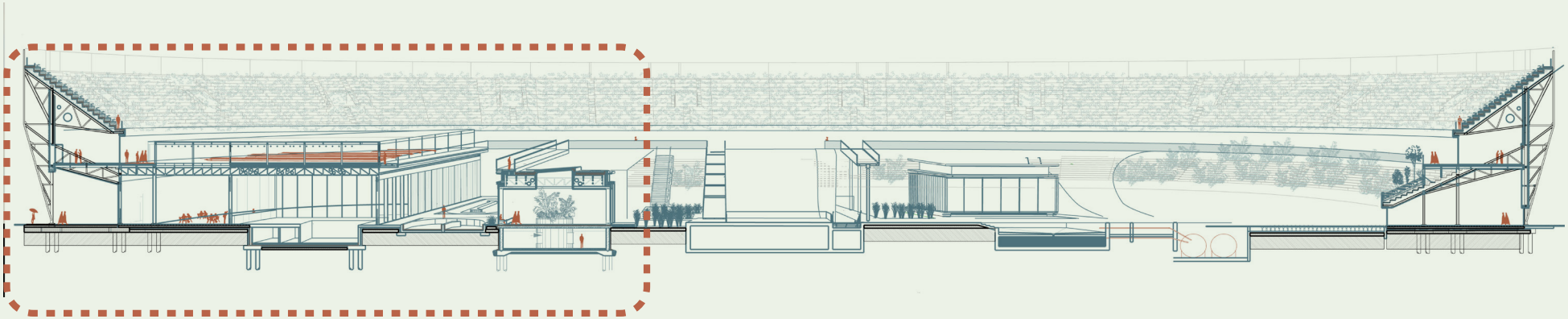
LABS + CROP NURSERIES

PERSPECTIVE SECTION

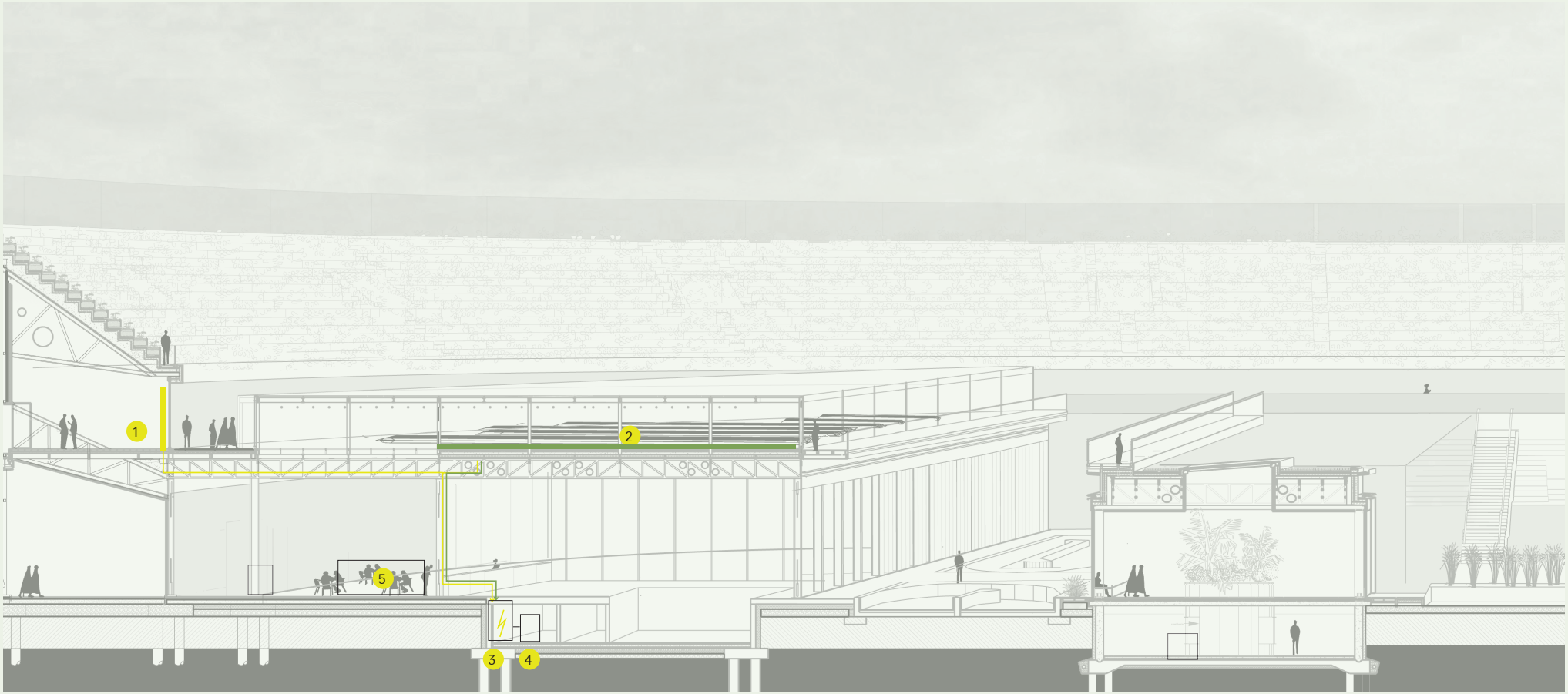


06 Design Development

CLIMATE STRATEGY



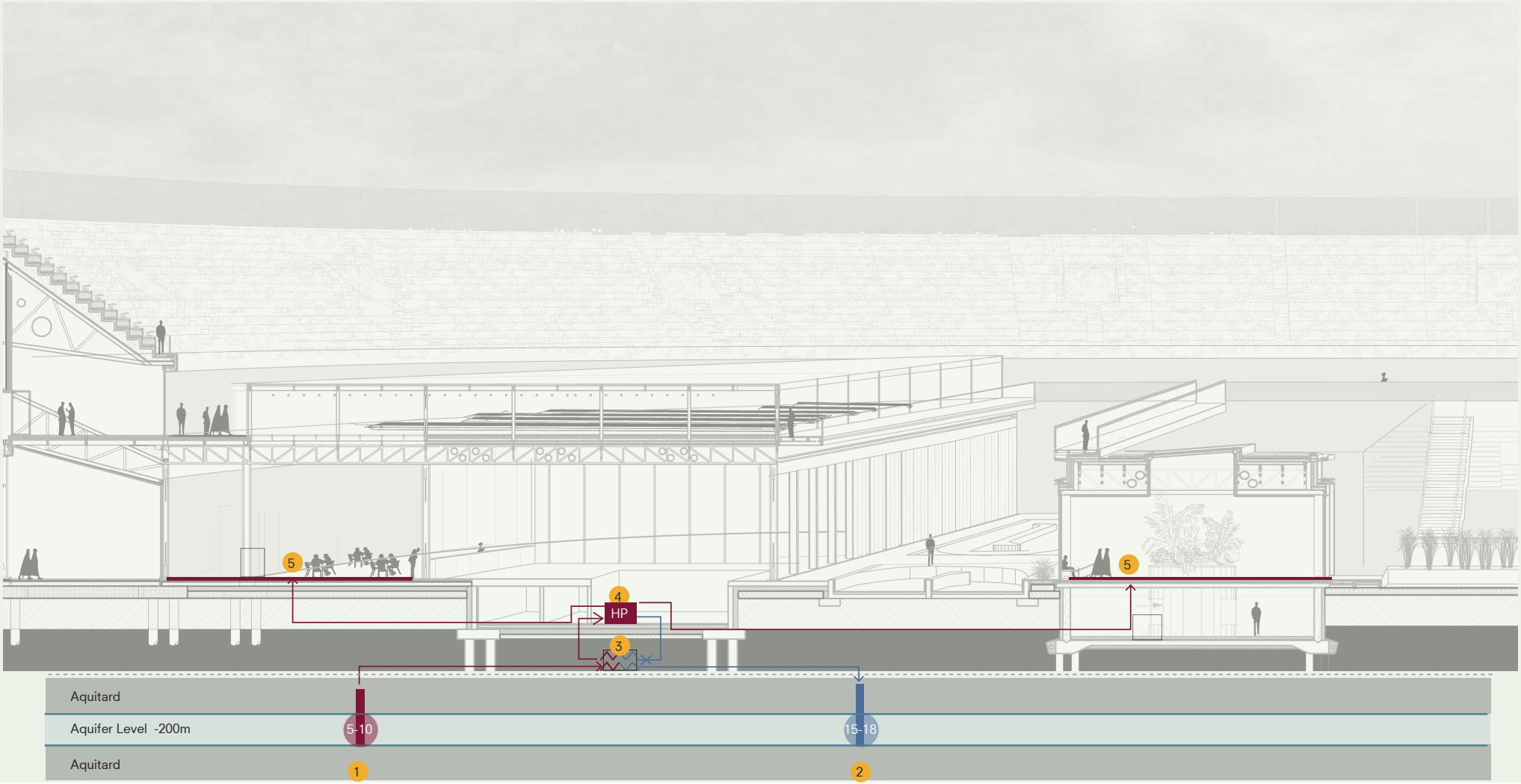
ELECTRICITY



Electricity

1. UV Cells convert UV light to electricity all year round.
2. Algae Photobioreactor
3. Inverter
4. Batteries / storage
5. Chillers

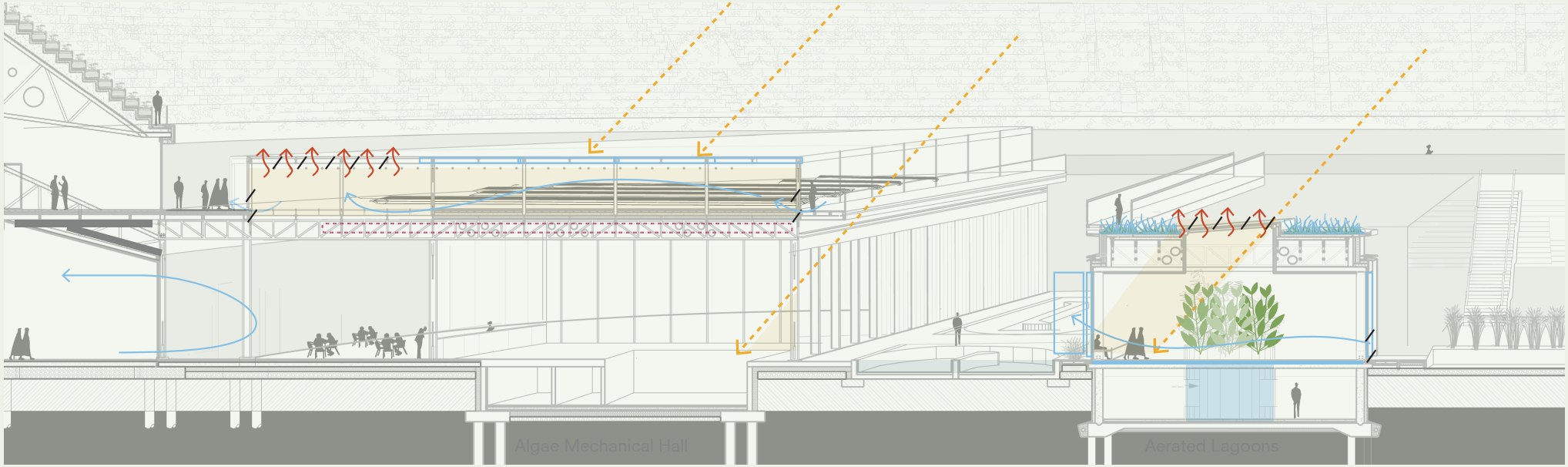
HEATING & COOLING



Heating + Cooling

1. Warm Well
2. Cold Well
3. Heat Exchanger
4. Heat Pump (For Use in Winter)
5. Underfloor heating and cooling

SUMMER



Cooling:

SUMMER DAY

SUMMER NIGHT

Cooling:

Natural Ventilation
Roof Vents + louvred side vents

Vaccum Insulated Glass

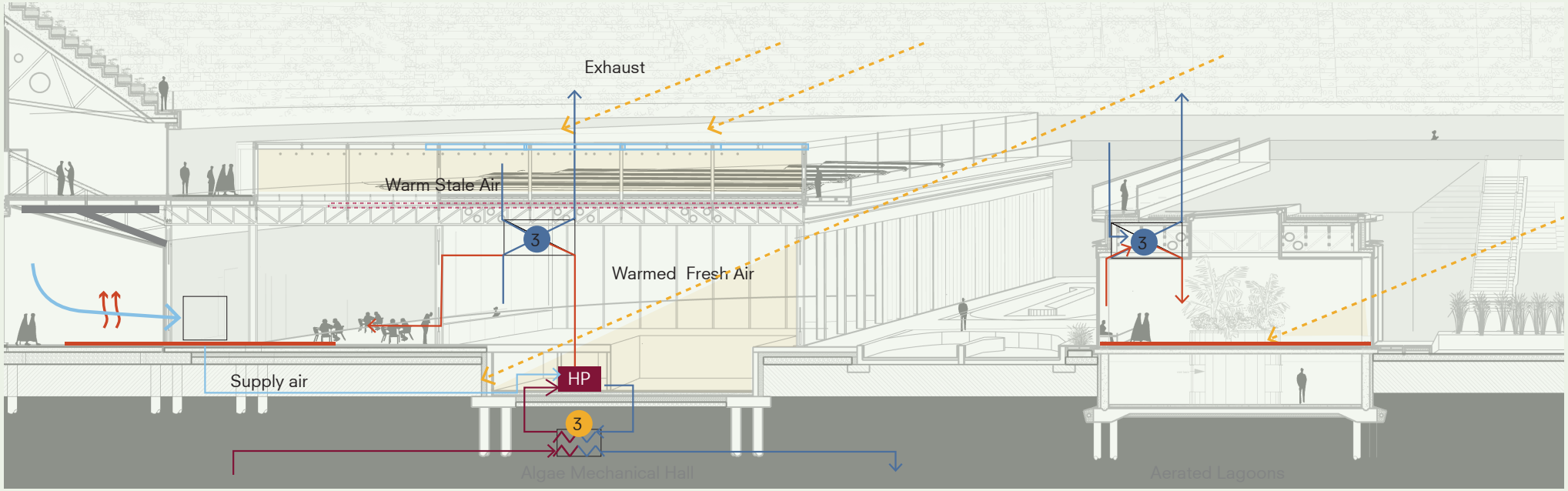
Water + Plants create increase humidity

Plants solar shading

Underfloor Cooling

Concrete Thermal Mass slows thermal gain

WINTER



Heating:

WINTER DAY — Underfloor heating

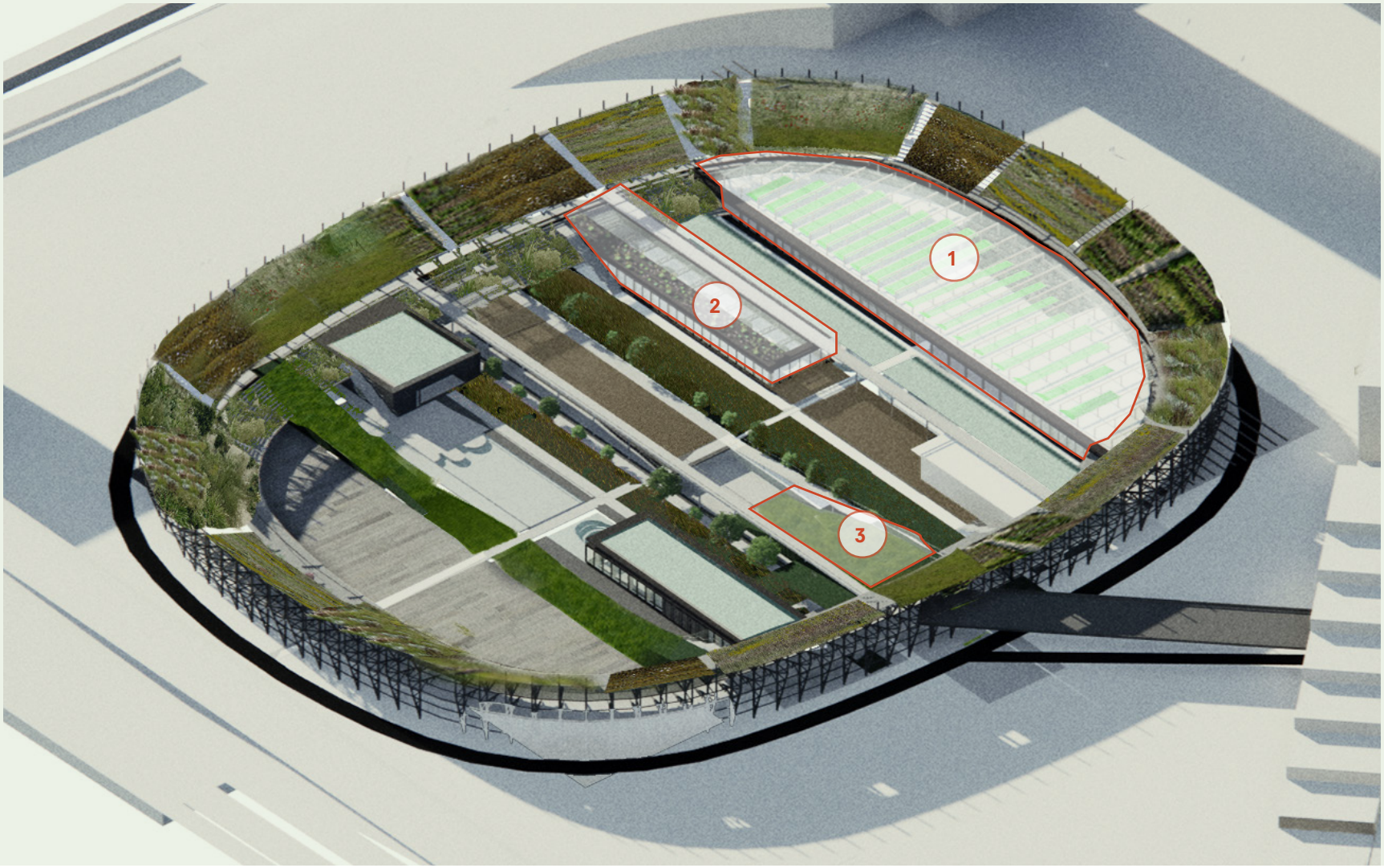
Vaccum Insulated Glass prevents heat loss

3 — Mechanical Ventilation with Heat Recovery Fresh Warm Air in & stale cool air out

Thermal Gain

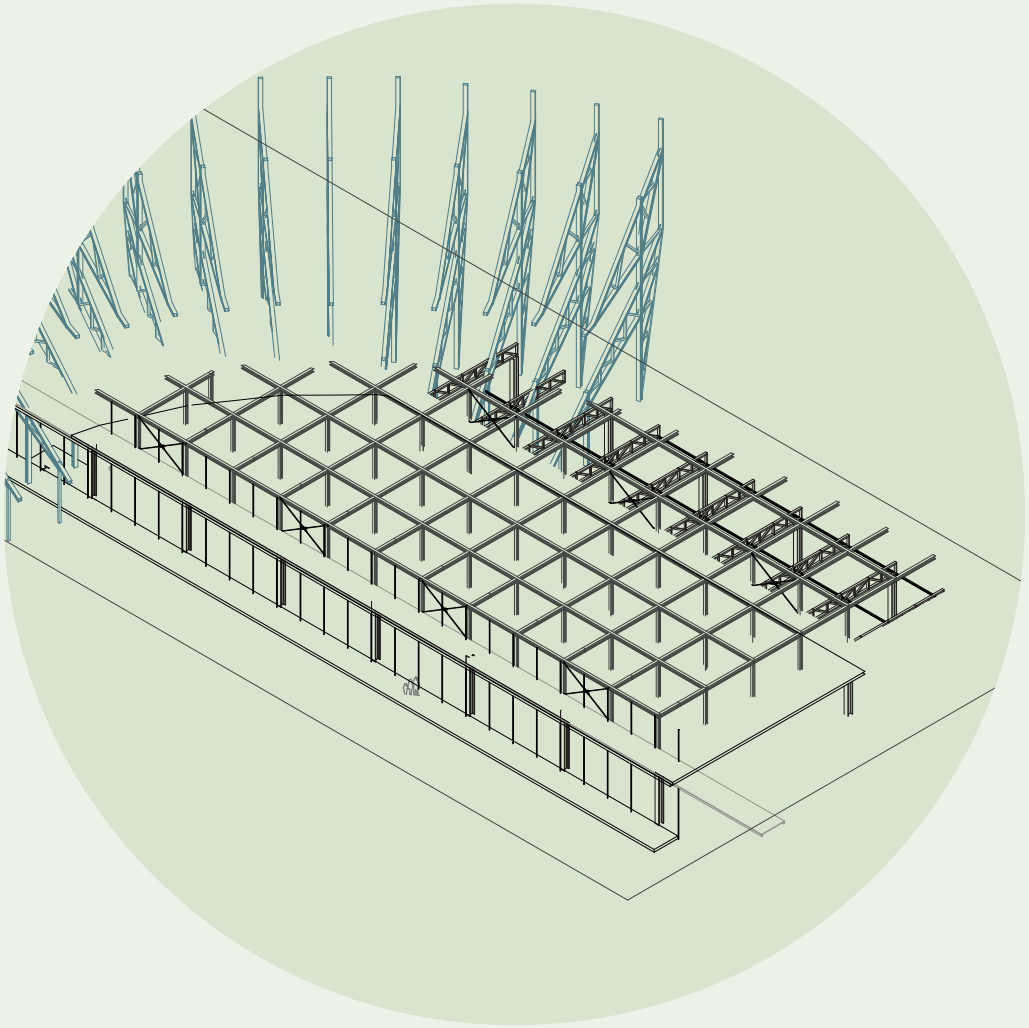
WINTER NIGHT — Concrete Thermal Mass slows thermal gain

3 STRUCTURAL TYPES

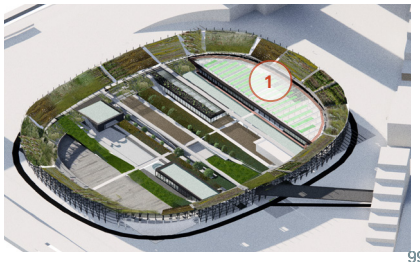


1. The Algae Mechanical Hall
2. The Aerated Lagoons - Water Treatment Facility
3. The Constructed landscape

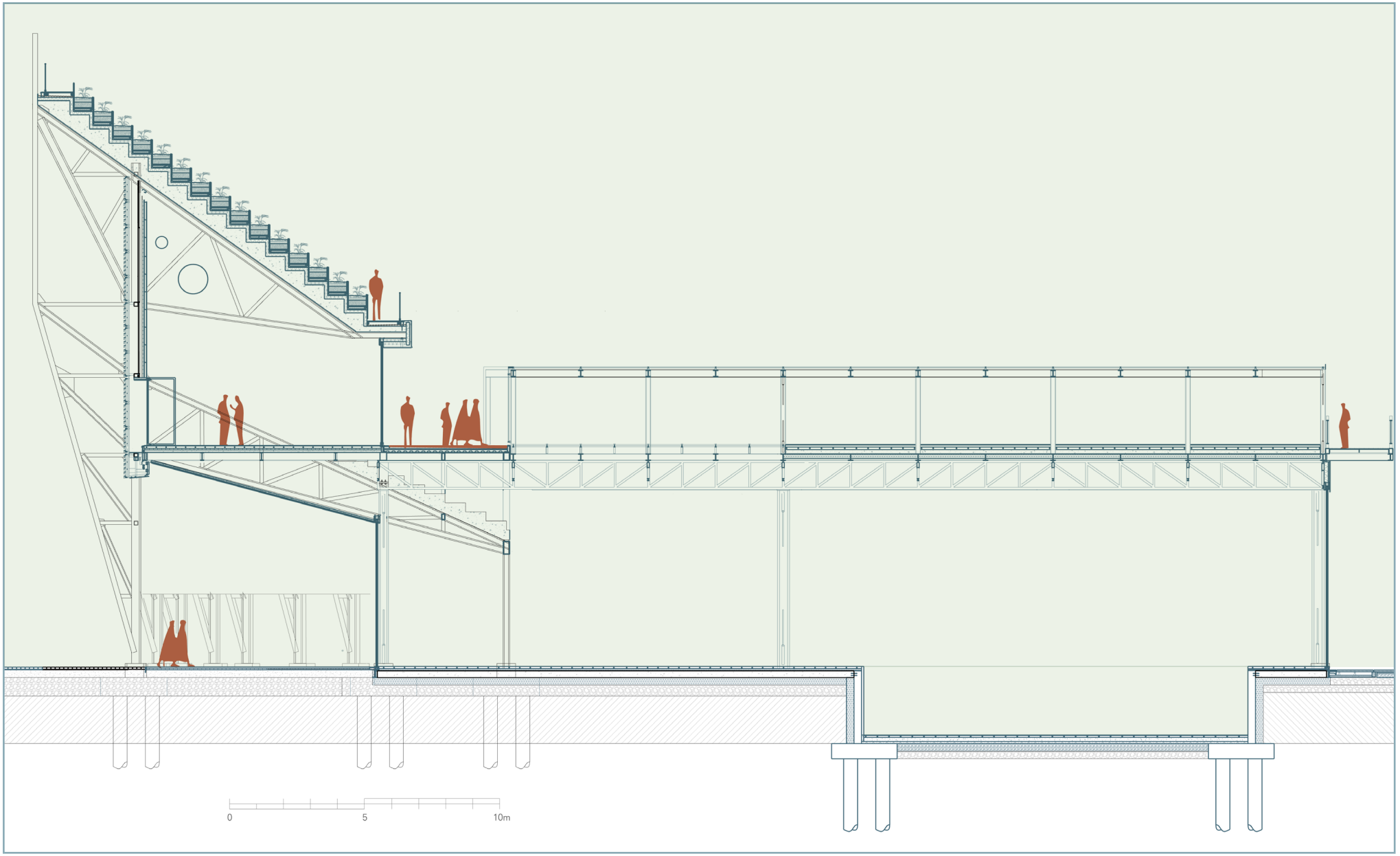
ALGAE MECHANICAL HALL



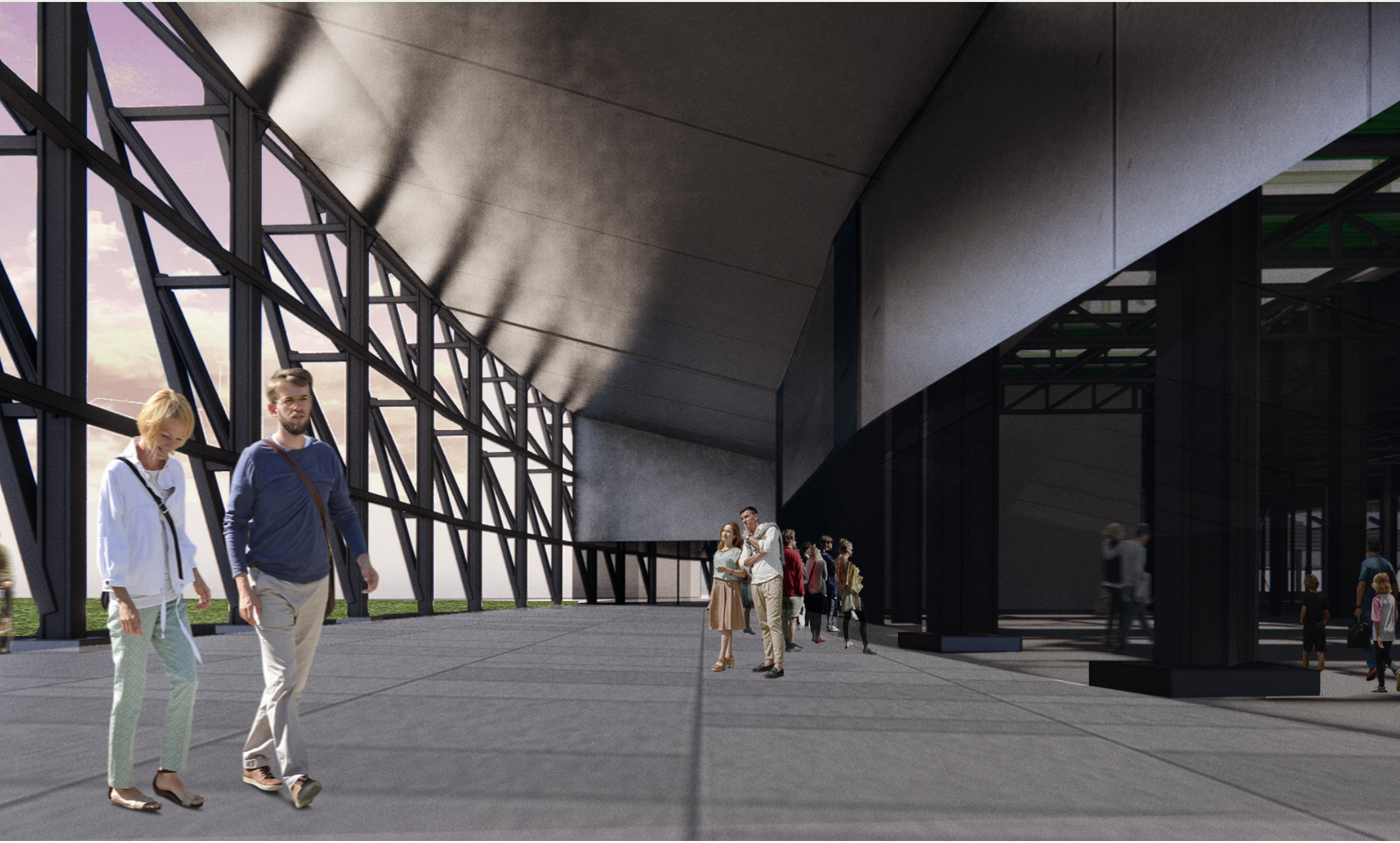
Large Span, Two storey structural steel frame construction.



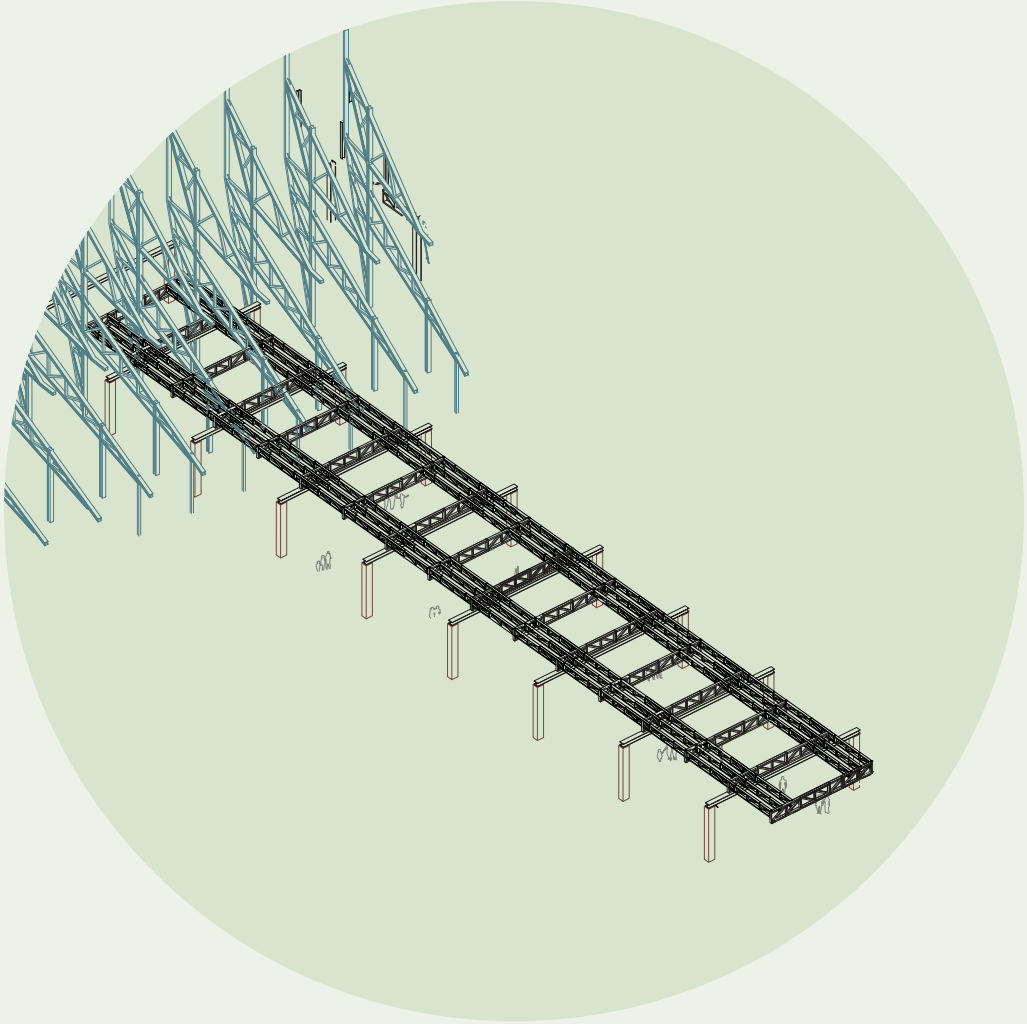
1: 50 ALGAE MECHANICAL HALL



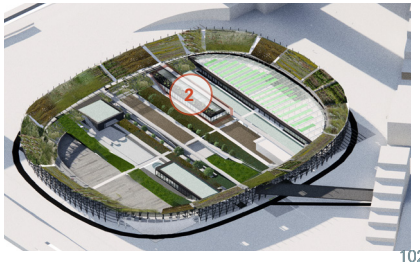
1: 50 ALGAE MECHANICAL HALL



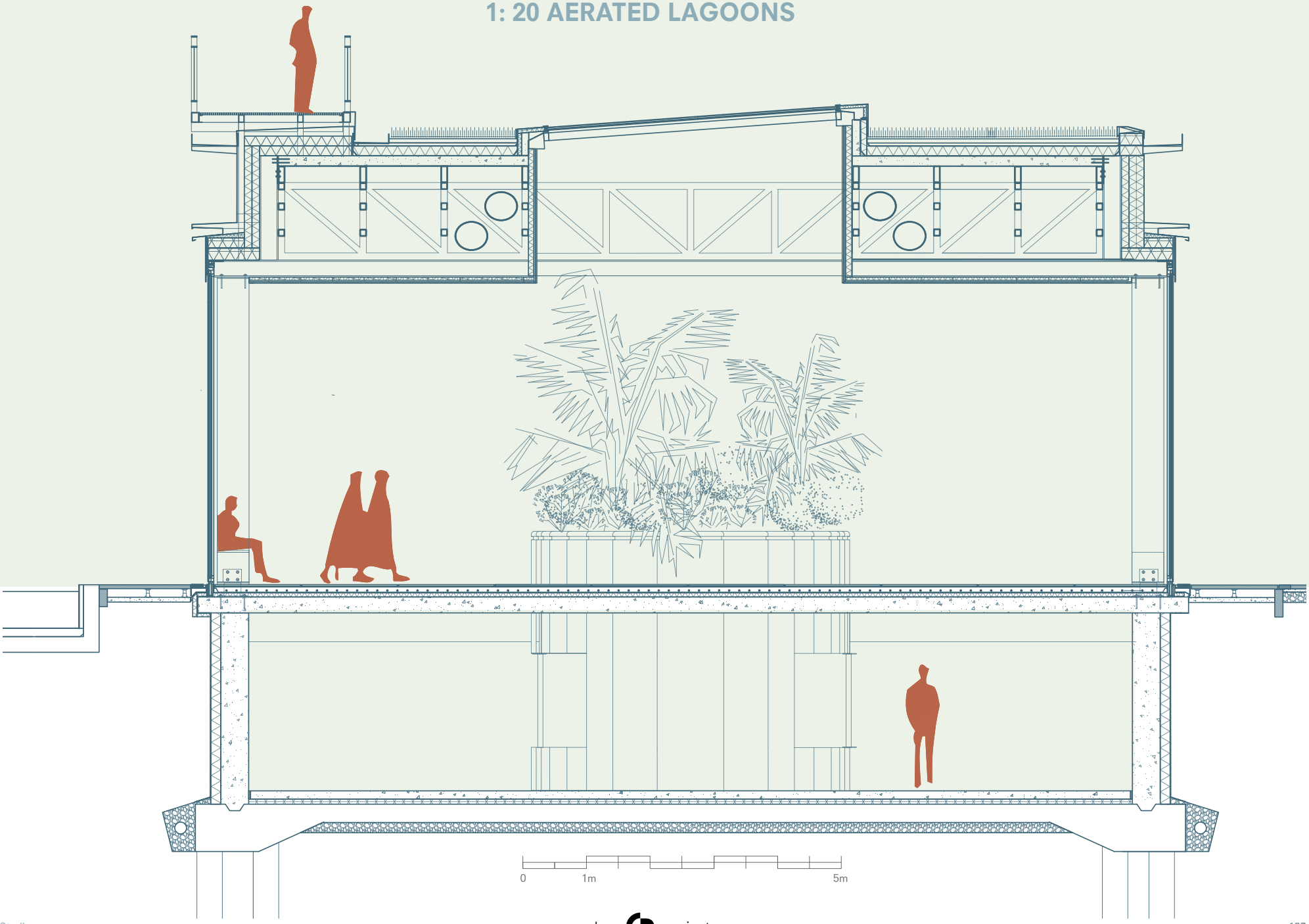
AERATED LAGOONS



Glu-Lam Columns supporting steel struss.

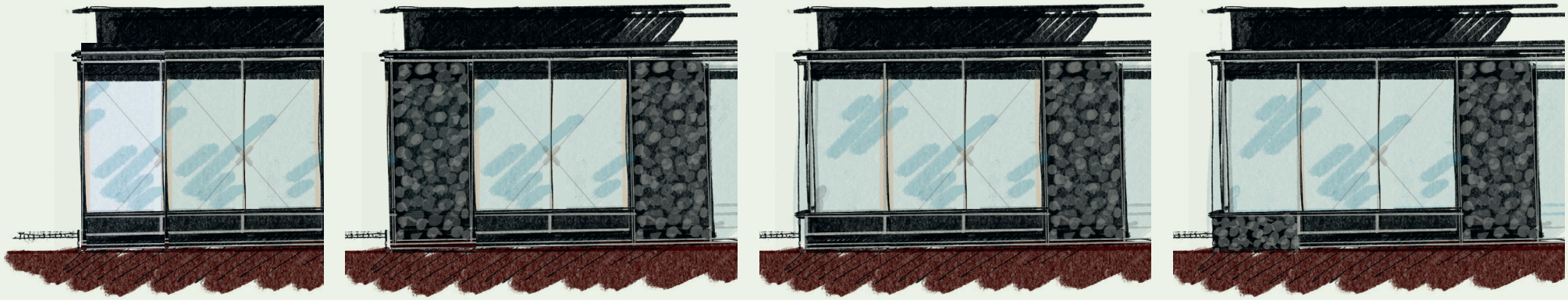


1: 20 AERATED LAGOONS



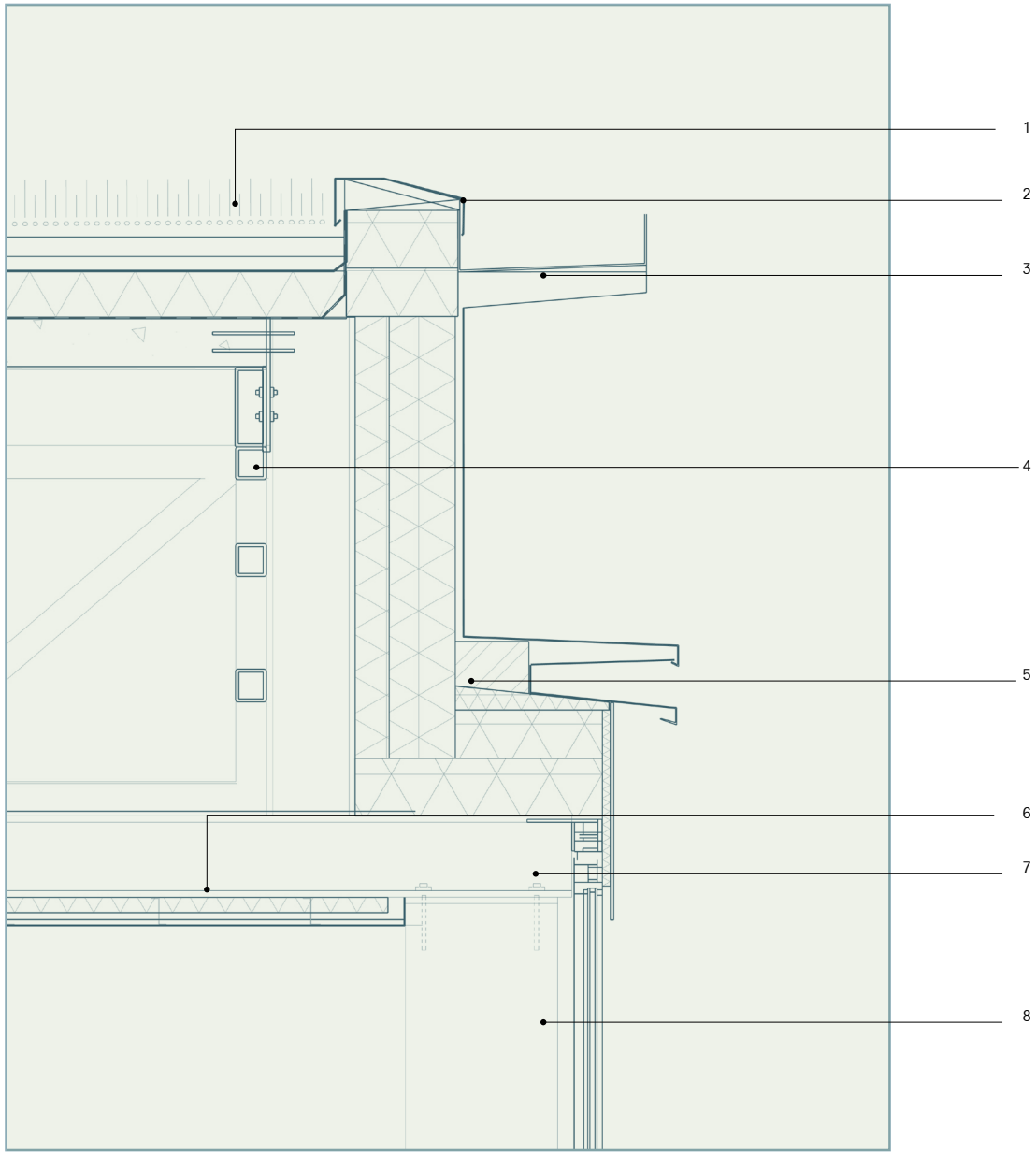
1:50 AERATED LAGOONS FACADE

GABION FACADE VARIATIONS



1:5 Detail

ROOF FRAGMENT



1 **Extensive Green Roof**
Planting
120mm Substrate on filter mat
40mm drainage layer
Waterproof membrane
160mm thermal insulation
Trapezoid profile with concrete topping

2 Aluminium Parapet Capping with plywood support

3 3mm Folded Aluminium Drainage Channel

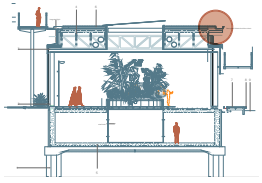
4 Steel Rectangular Beam
1200mm Square Profile Steel Truss

5 Aluminium Cladding
Ventilation Cavity
Thermal Insulation

6 Insulated Suspended Ceiling

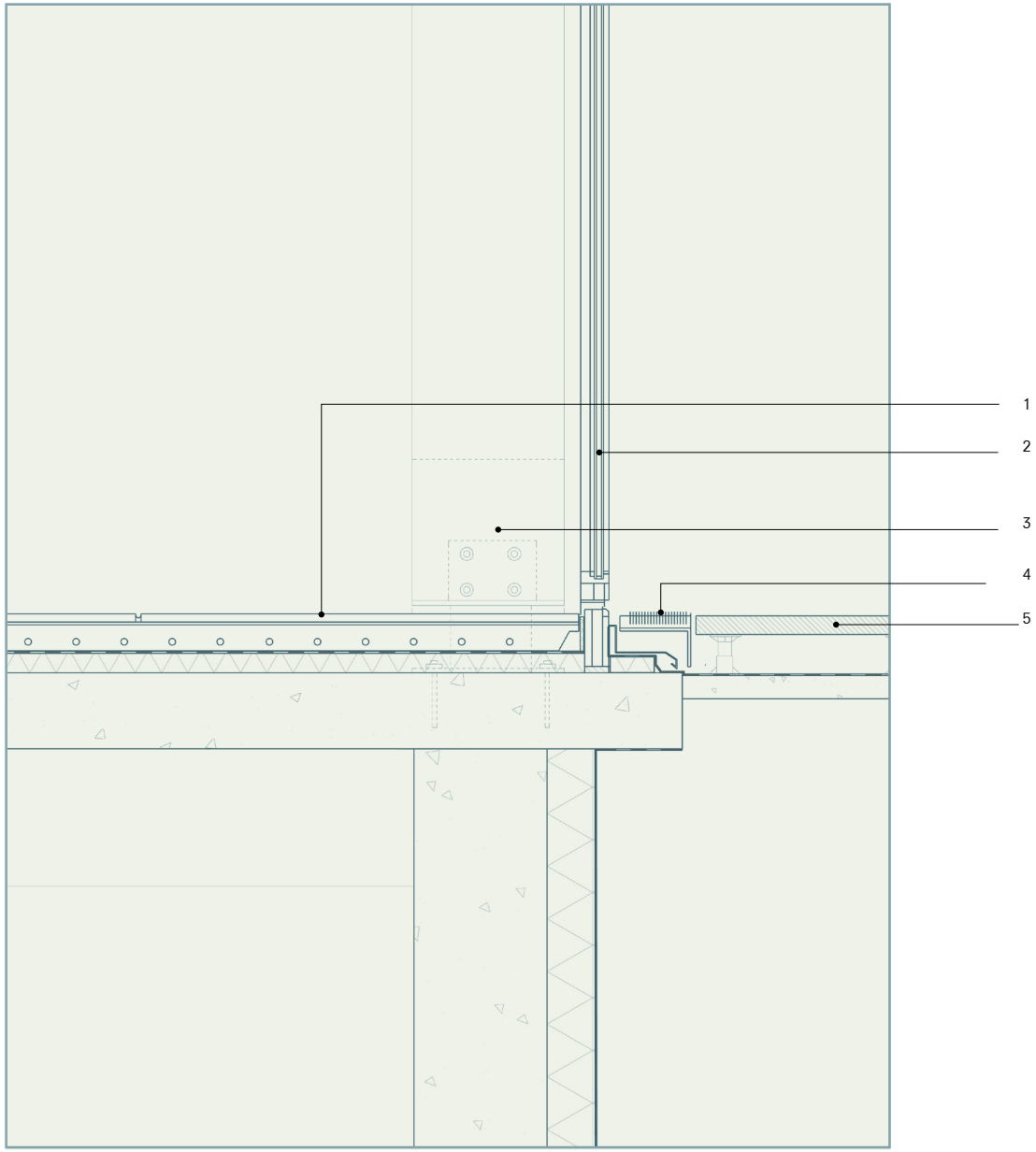
7 Steel I Beam

8 500 x 350mm Glue-lam timber column



1:5 Detail

GROUND CONNECTION



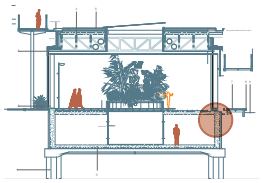
1 **Flooring**
Ceramic Tile
Cement screed with underfloor heating
Vapour Barrier
Rigid Foam thermal Insulation
Precast concrete slab

2 Insulating glazing in aluminium frame

3 500 x 350mm Glue lam timber column with bolted steel baseplate

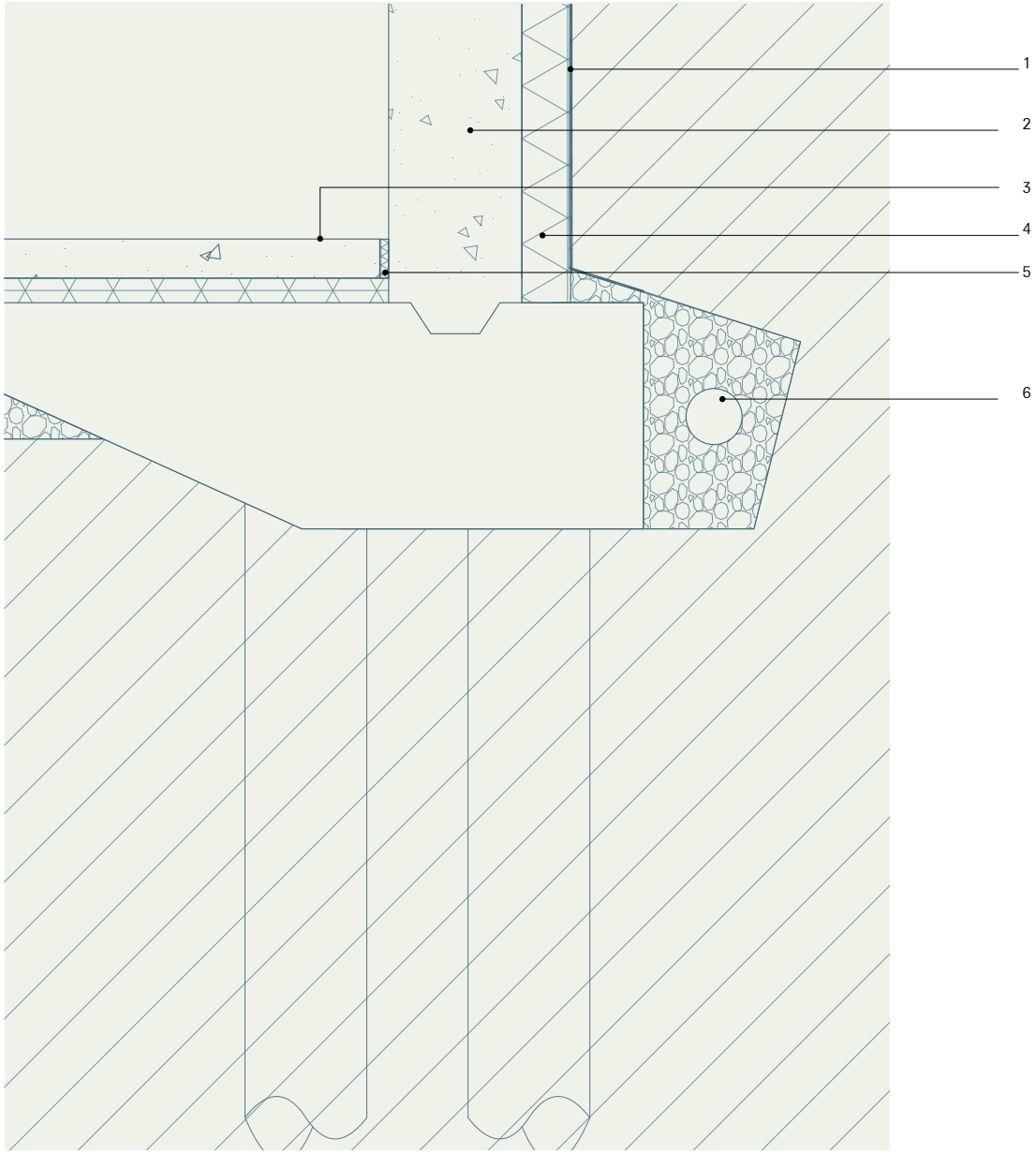
4 Stainless steel grating

5 **Patio**
Pre-fabricated concrete tiles with support pedestals
Waterproof membrane
Levelling mortar



1:5 Detail

BASEMENT FRAGMENT



1 Waterproof membrane

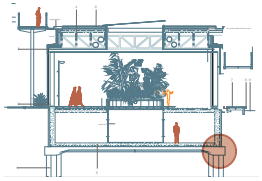
2 Concrete Foundation Wall

3 Concrete slab
Rigid Insulation
Concrete Footing
Granular Fill

4 Rigid Thermal Insulation

5 Rigid Insulation Isolation Joint

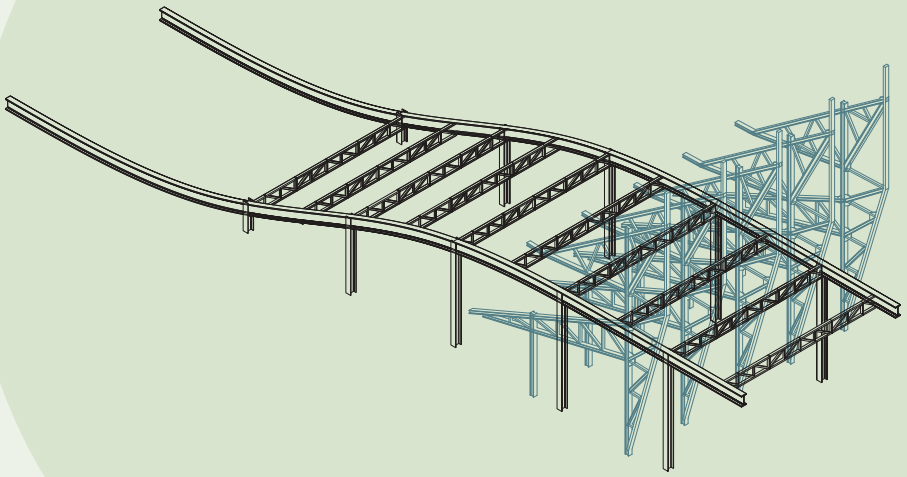
6 Drainpipe in coarse gravel
granular backfill



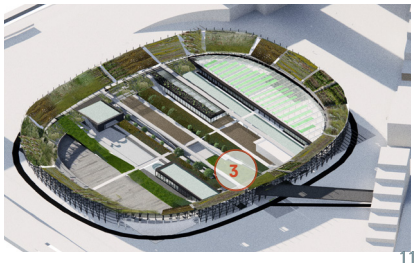
1: 50 AERATED LAGOONS

NATURAL SWIMMING POOL

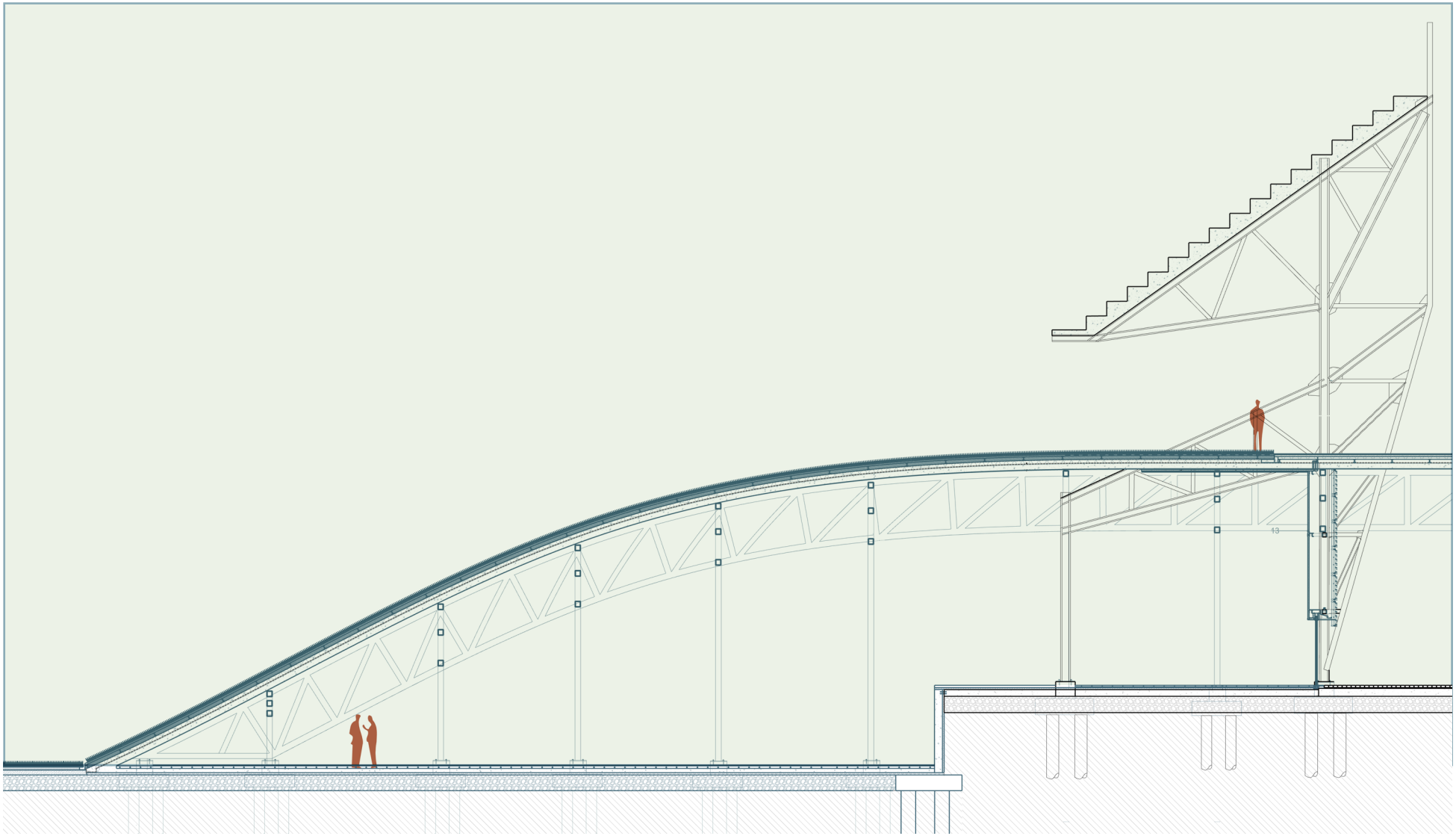
CONSTRUCTED LANDSCAPE



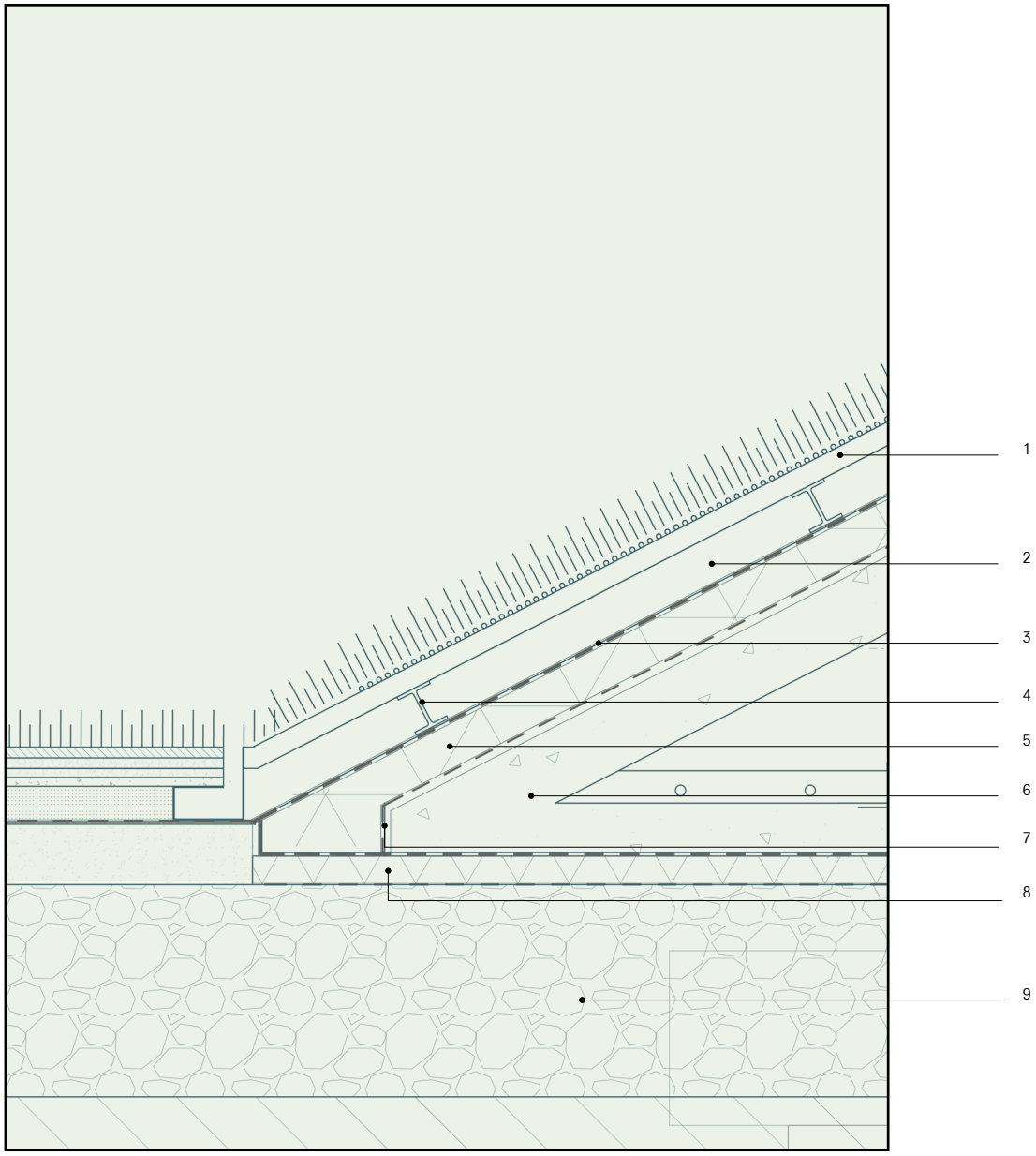
steel struss system.



CONSTRUCTED LANDSCAPE



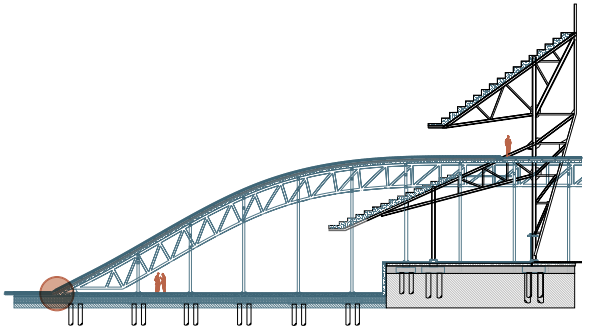
1:5 CONSTRUCTED LANDSCAPE



Extensive Sloping Lawn

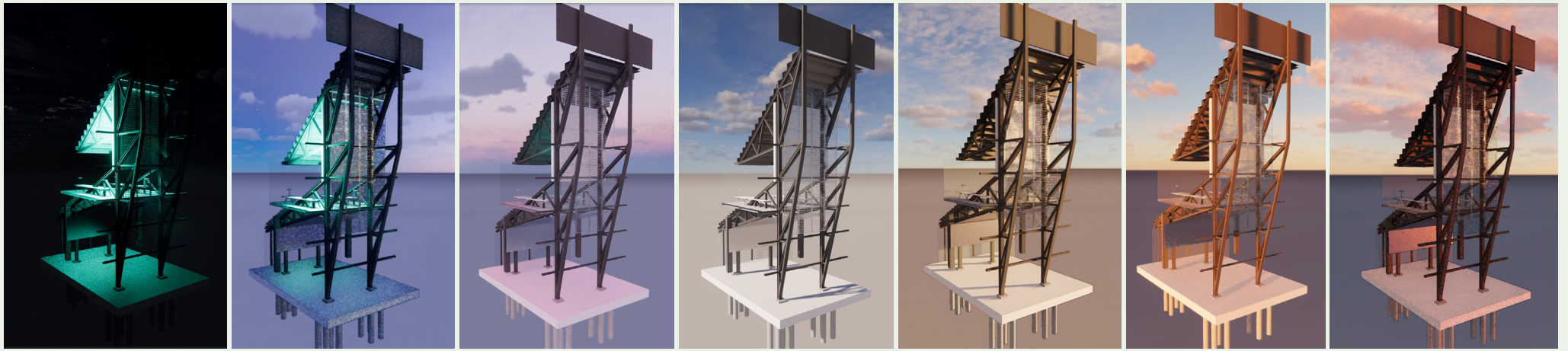
1 Vegetation Mat
2 Extensive Substrate
3 Drainage Mat
4 Anti-Slippage Structure
5 Thermal Insulation
6 Reinforced Concrete
7 Vapour Seal
8 Thermal Rigid Insulation
9 Granular Fill

Extensive grass roof transition to permeable pavers for heavy rainfall management

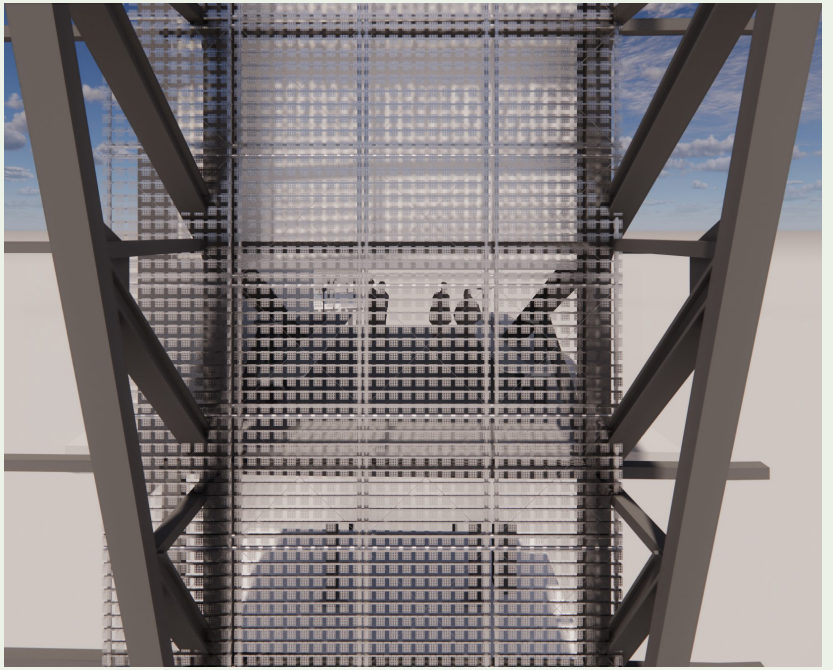


CONSTRUCTED LANDSCAPE

CLADDING CONSTRUCTION

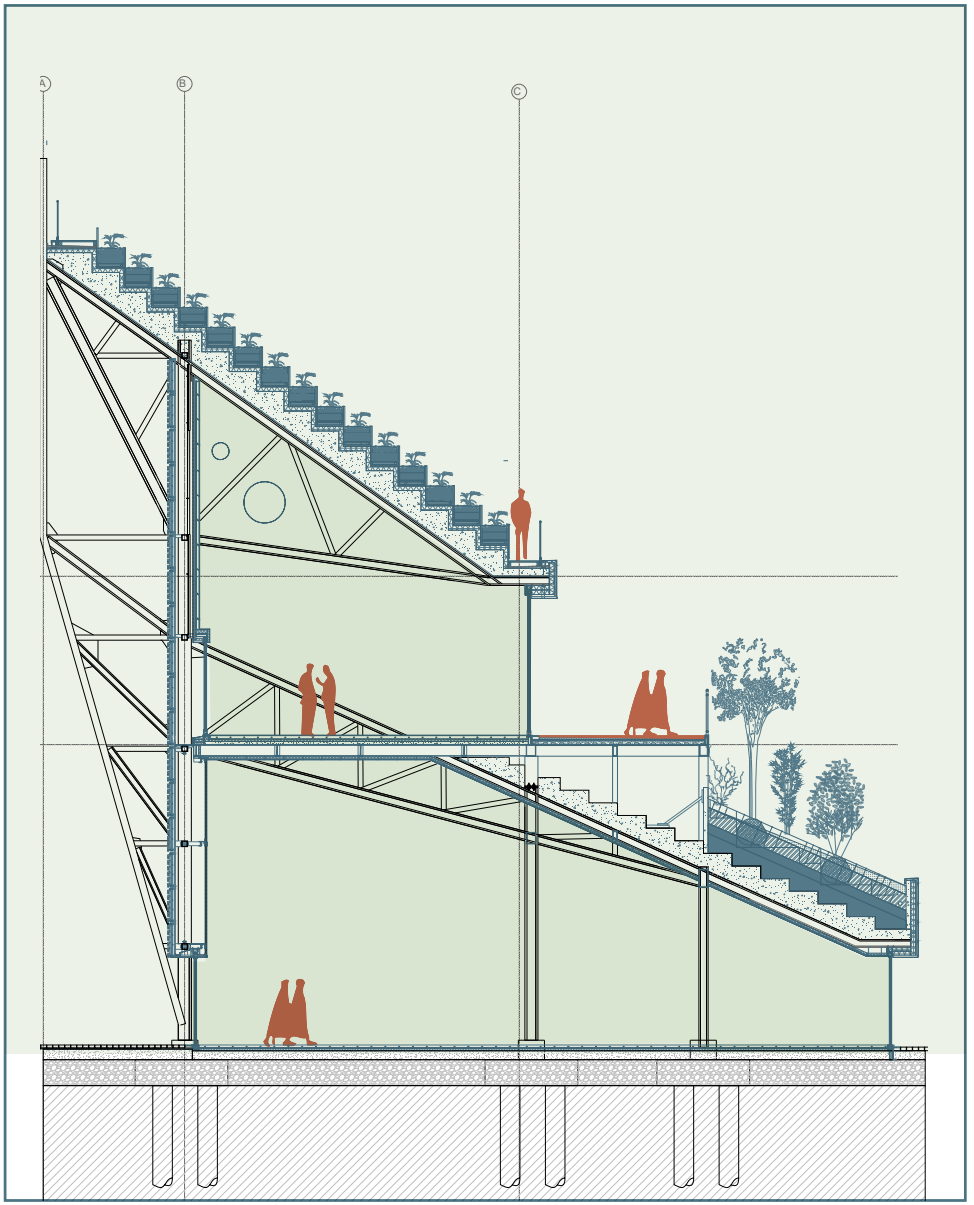


CLADDING CONSTRUCTION

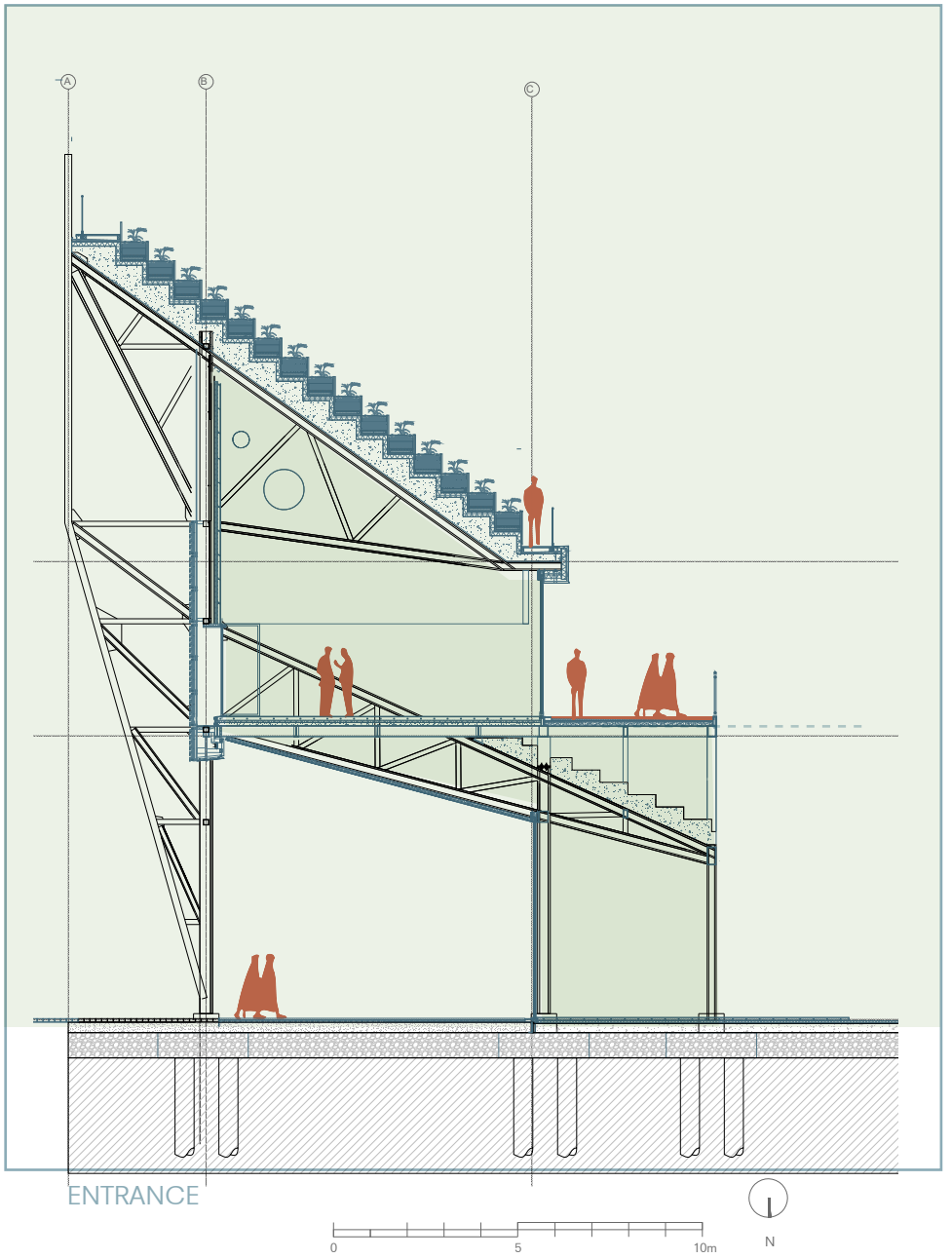


Aluminium panels on frame

1:20 SECTIONS | TYPICAL VS ENTRANCE

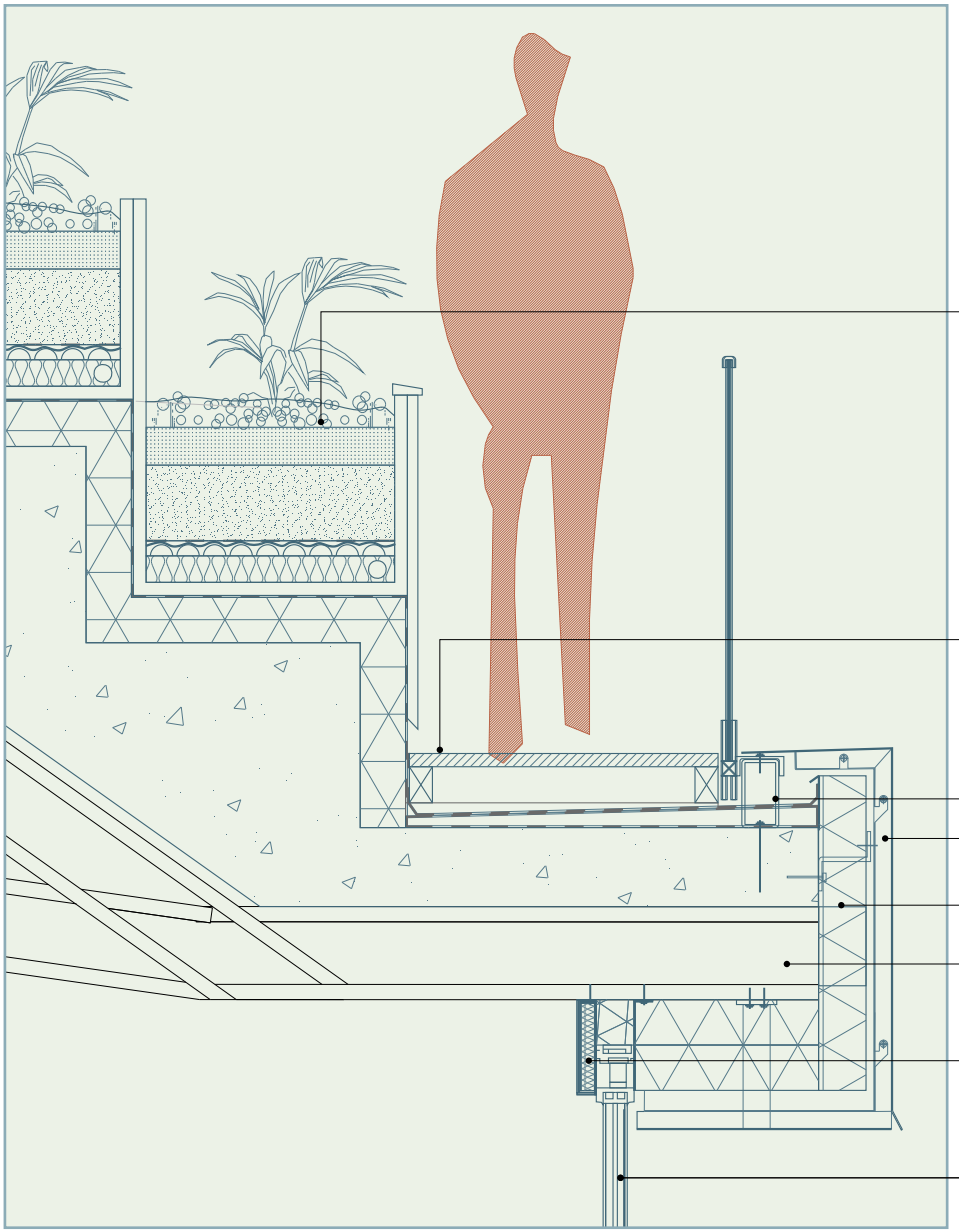


TYPICAL



ENTRANCE

1:5 DETAIL | TRIBUNE ROOF



1 **Intensive allotment**
Planting
100mm mulch
100mm top soil
Mix soil
Filtering layer
40mm drainage area aeration
Mechanical water retention felt
Root proof synthetic membrane
Insulation

2 820mm timber deck

3 Rectangular Hollow Section

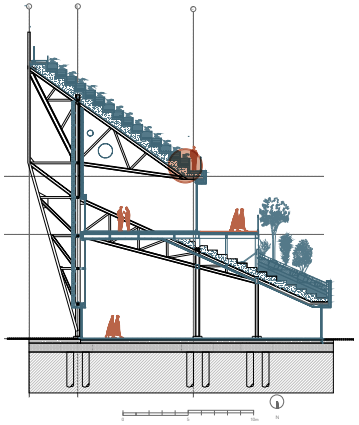
4 Polished Aluminium cladding panel

5 Existing In-Situ concrete steps

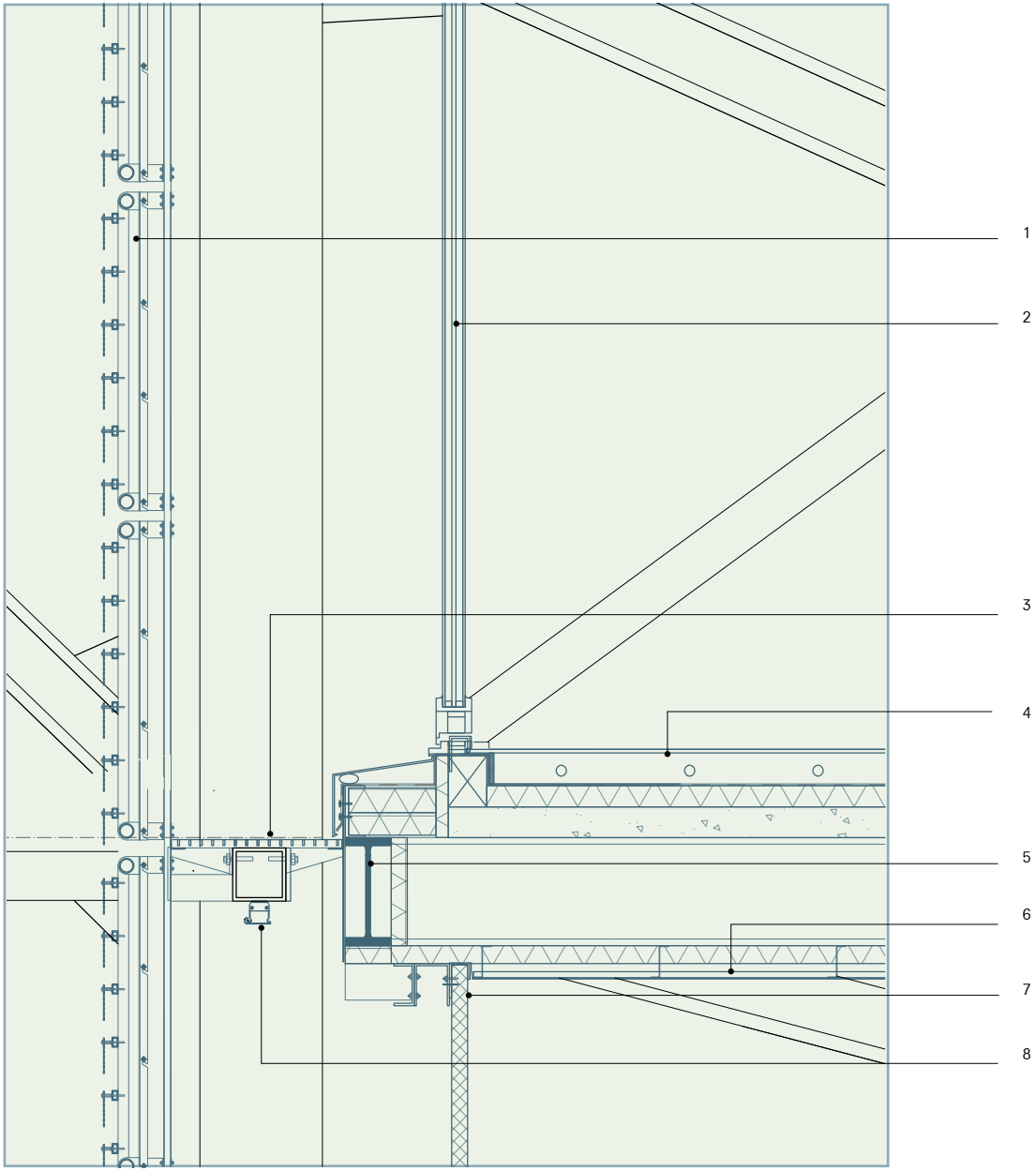
6 Existing steel tribune structure

7 Insulation

8 16mm laminated glass with/ organic, luminescent, UV solar film



FACADE CONNECTION



1 **Cladding**
3mm Perforated Polished Aluminium Plates screwed to 850x850mm circular hollow section frame.

2 Insulating Glazing in Aluminium Profile Frames

3 Floor Grating connected to existing square profile

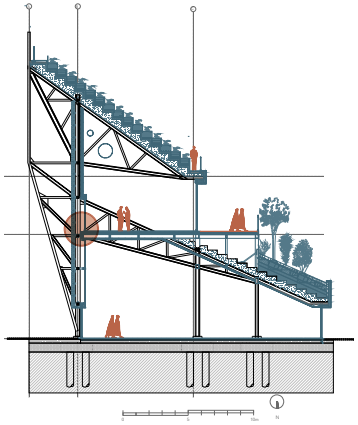
4 Polished Concrete screed with underfloor heating
Vapour Barrier
Rigid Foam thermal Insulation
Composite concrete slab
Steel I Beam

5 Steel I Beam Section

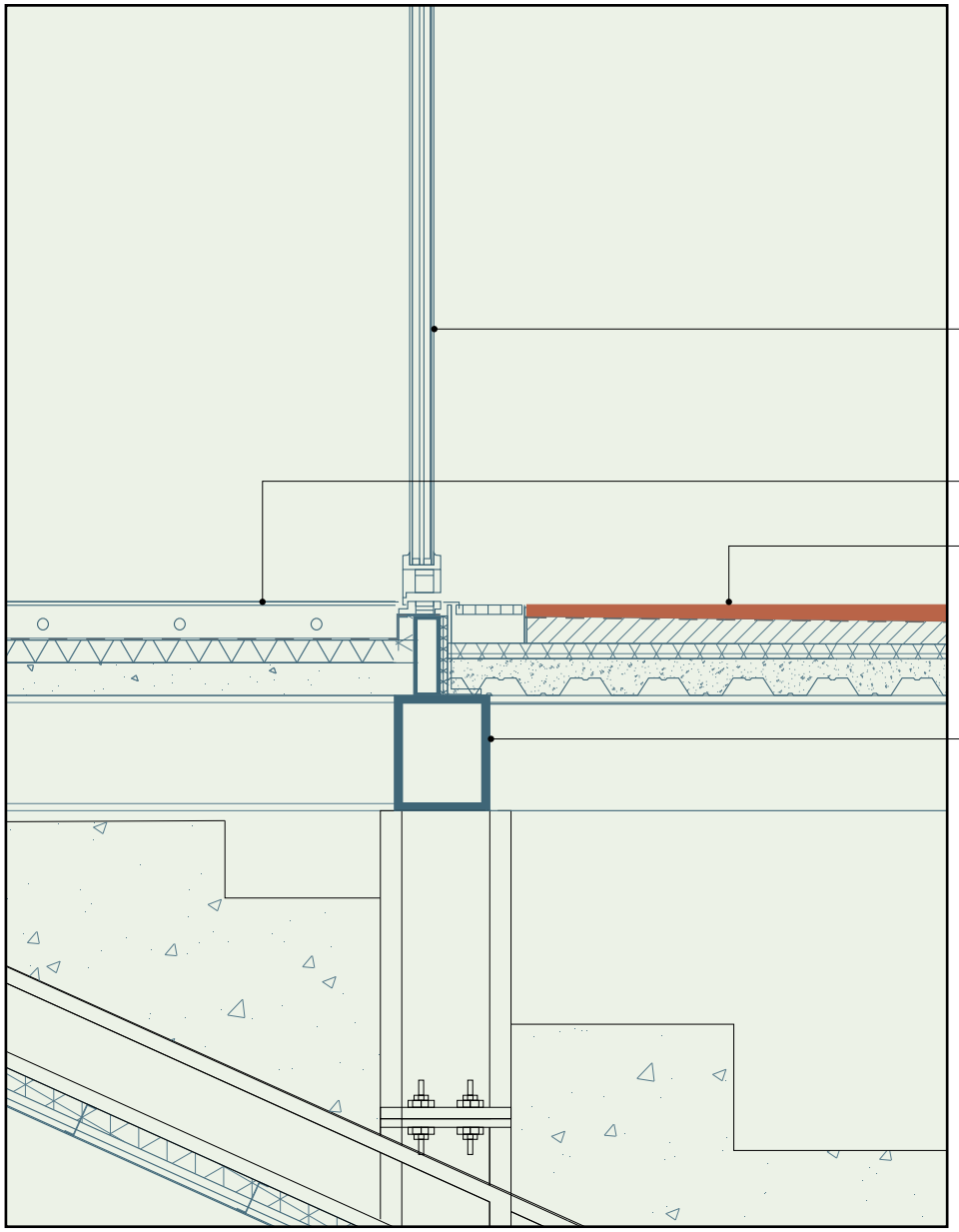
6 Insulated Suspended Ceiling

7 45mm Polycarbonate Translucent facade panel screwed to U Channel

8 LED lighting screwed to existing square profile



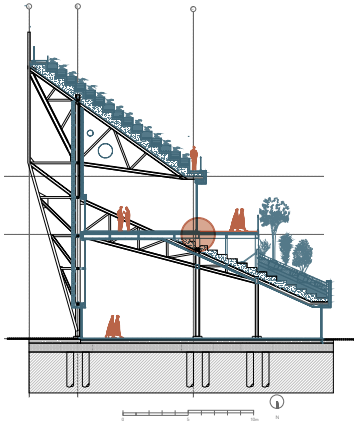
TYPICAL CONNECTION TO WALKWAY



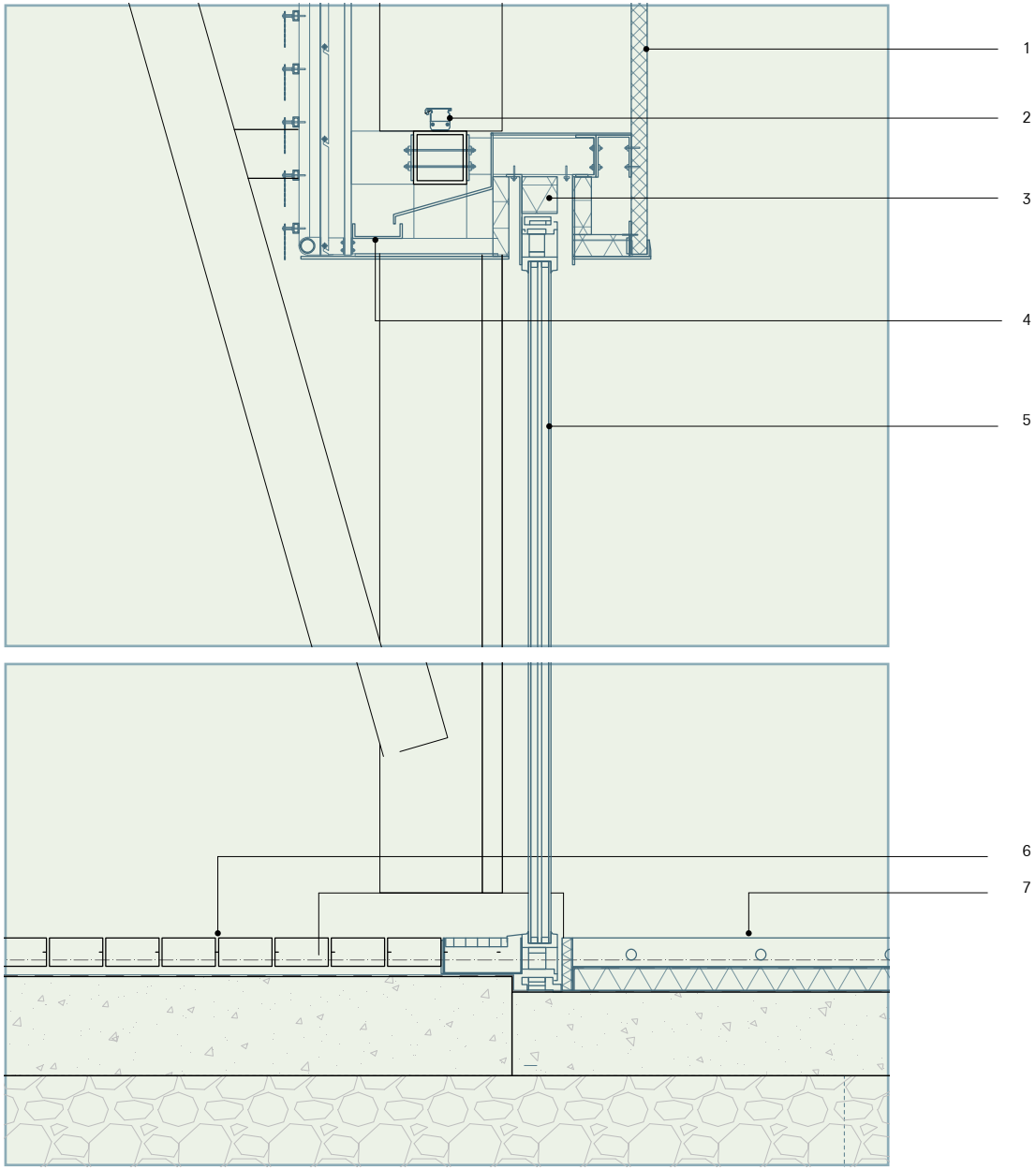
1 16mm laminated glass with/ organic, luminescent, UV solar film

2 Polished Concrete screed with underfloor heating
Vapour Barrier
Rigid Foam thermal Insulation
Composite concrete slab
Steel I Beam

3 **Circular Walkway**
30mm rubber floor covering
40mm cement screed
Waterproof Membrane
20mm sound insulation
100mm composite steel decking



TRANSPARENT GROUND FLOOR



1 45mm Polycarbonate
Translucent facade panel

2 LED lighting screwed to existing
square profile

3 100mm Insulation panel

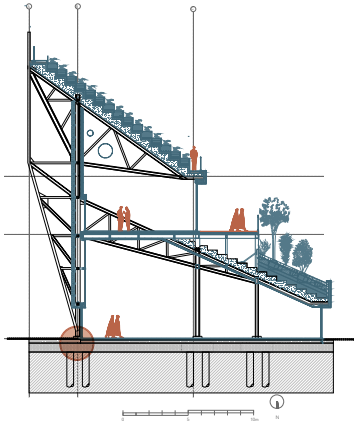
4 Integrated drainage channel

5 Insulating Glazing in Aluminium
Profile Frames

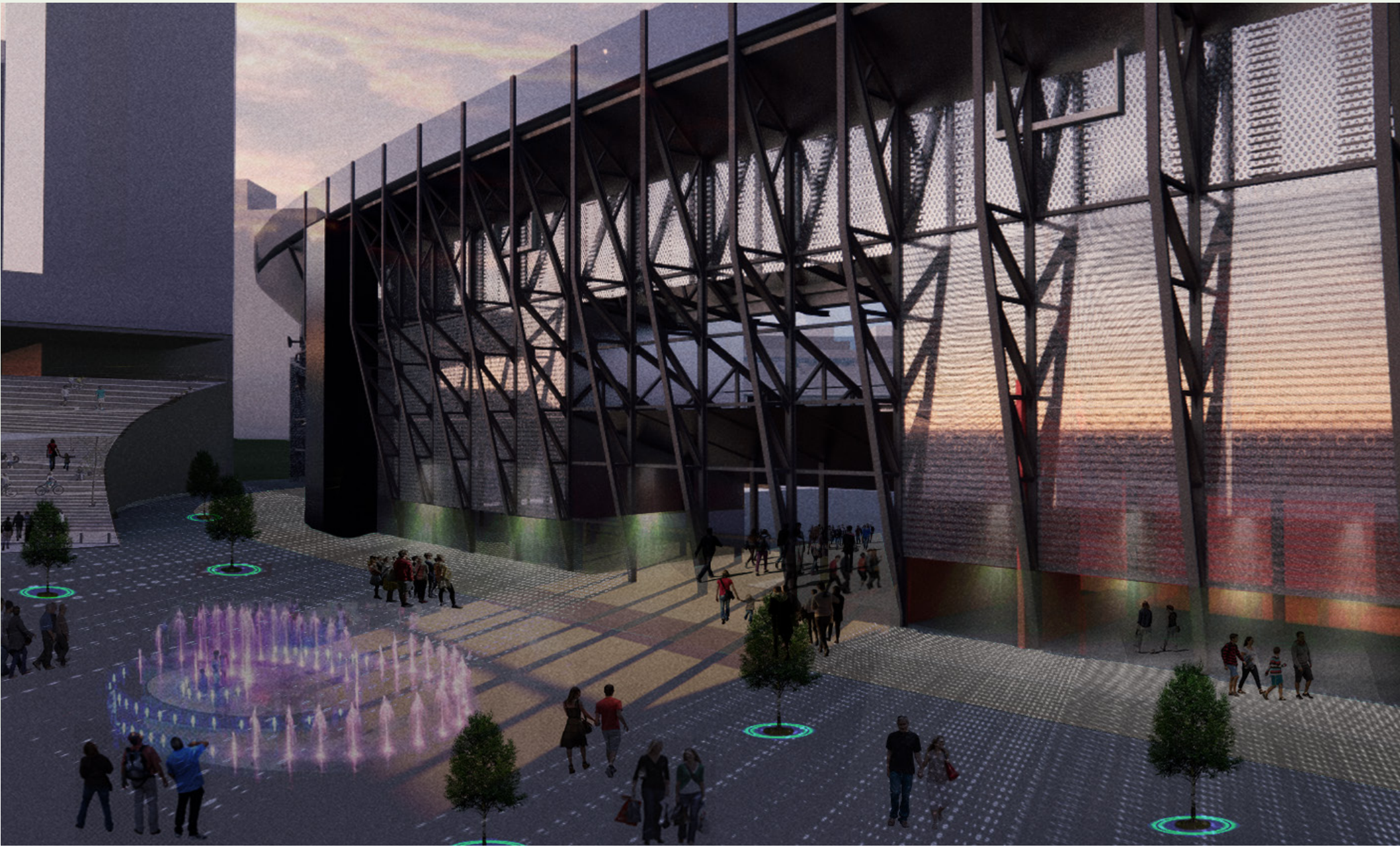
6 **Typical Existing Paving**
80mm Concrete paving
150mm ballast base course
200mm frost protection
Subsoil

6 Existing steel tribune structure

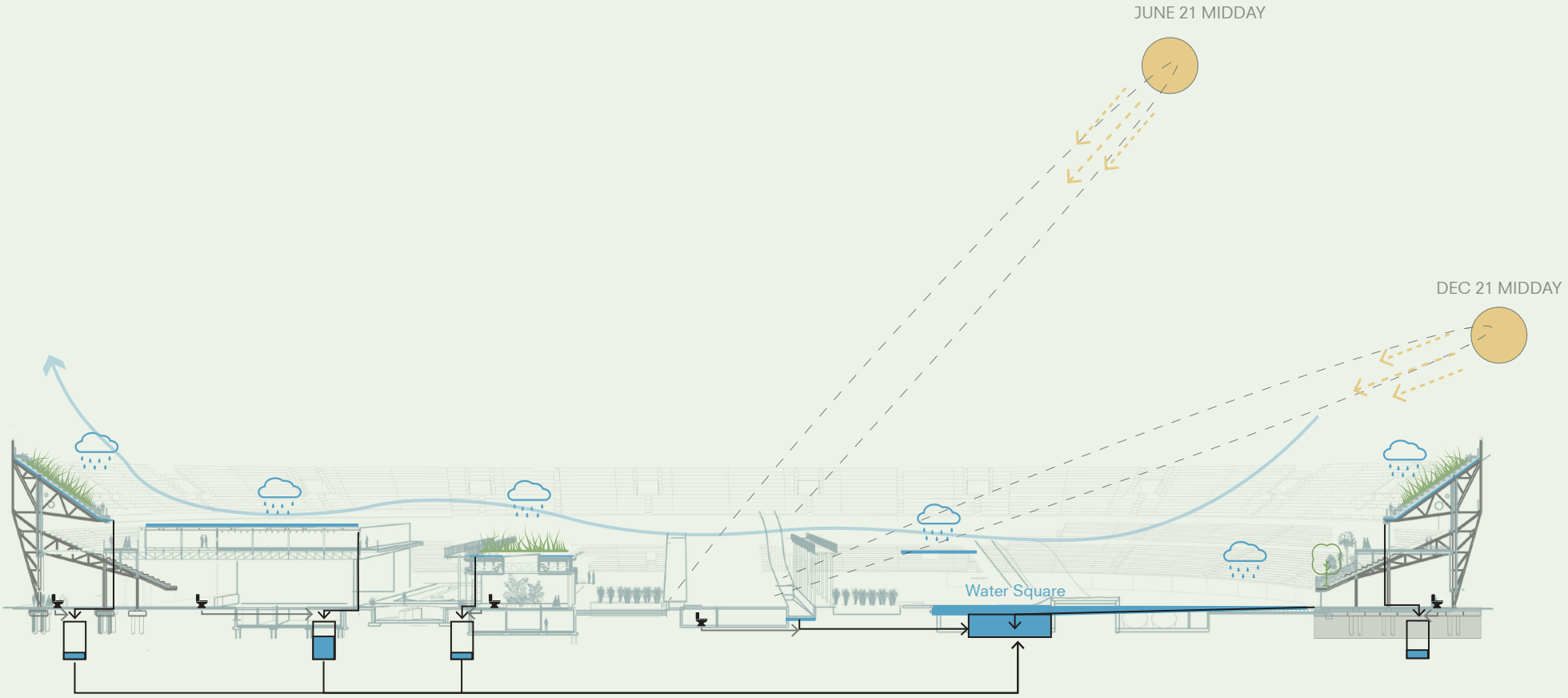
7 **New Flooring**
Polished Concrete screed with
underfloor heating
Vapour Barrier
Rigid Foam thermal Insulation
Existing In-Situ Concrete slab



>2022 CLADDING



WATER MANAGEMENT STRATEGY



Extensive Green Roof
The buildings and constructed landscape use a shallow and deep extensive
green roof strategies with drainage plates to collect rainwater whilst growing small shrubs perinnials and edible crops in allotments.

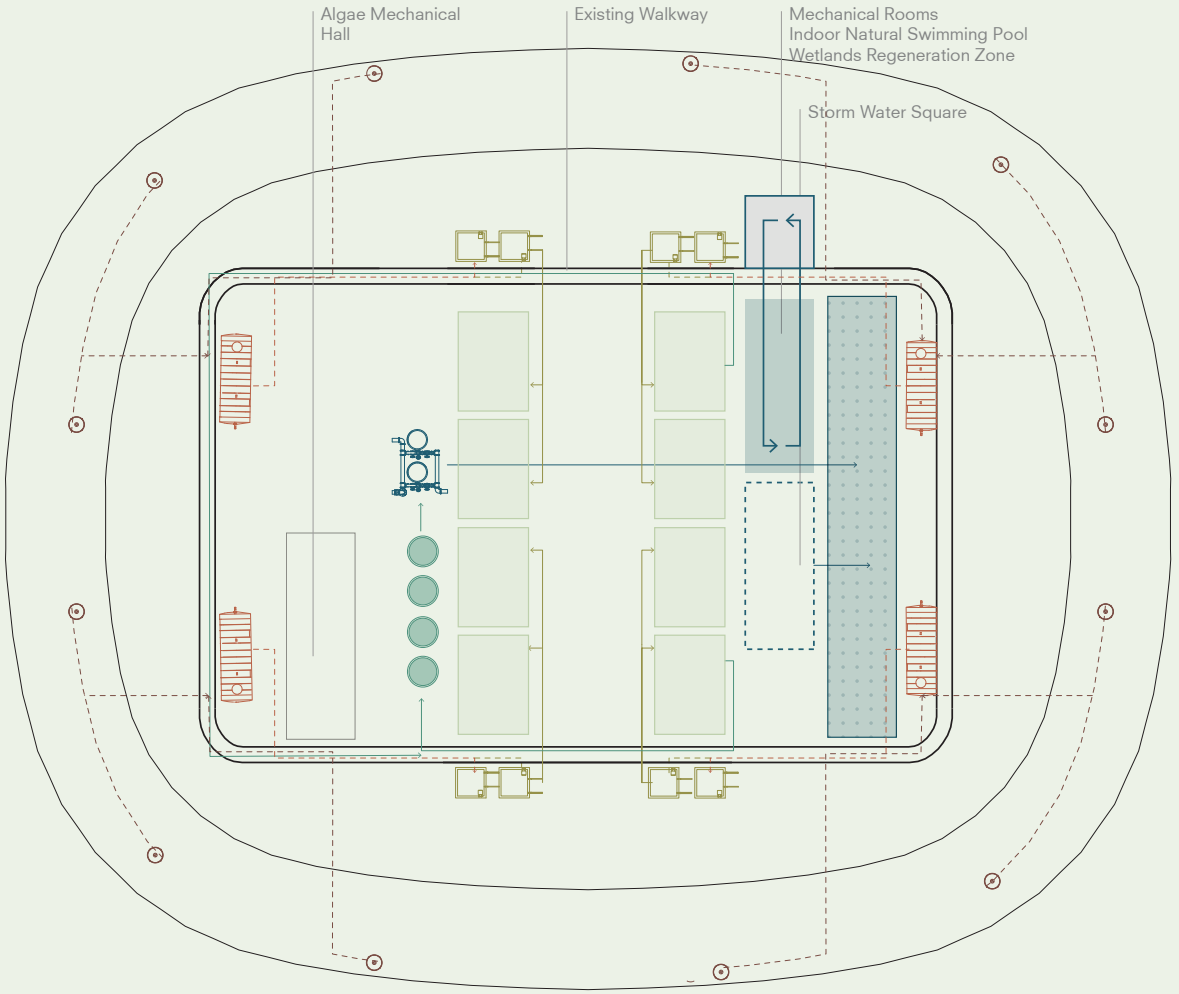
Intensive Landscape
Requires Irrigation but enables larger plants and small trees to grow at visitor level. These contribute to experience, education, cleaner air quality and outdoor comfort.

Rainwater Collection
occurs on all flat roofs and stored below ground to be combined with grey-water for algae and building services. Excess water is stored subsurface for drier summer periods

Water Harveting
Grey Water
Rainwater
Solid Settlement Tank
'Clean' Water Storage

WATER SQUARE

RESILIENT WATER MANAGEMENT



1. Solid Settlement Tanks
Are distributed throughtout the site to first seperate solids into sludge. Nutrients from the sludge is harvested for the algae process.

2. Equalisation Tanks
6,000 Gallon tanks balance out fluctuations in flow during the course of a day.

3. Anoxic Tanks
Here, ammonia, phosphorus, nitrogen, potassium are digested in anaerobic conditions producing small amounts of methane.

4. Constructed Wetlands
Water is evenly distributed among 8, basketball sized, 1m deep wetlands. These are stepped to allow gravity to flow throguh hough the system. Water clarity improved by 75% here and odourous gasses by 90%.

5. Aerated Lagoons
3m deep lagoons grow tropical plants whose roots and nutrients create a suitable climate for a diverse array of micro-organisms to thrive on and feed off.

5. Algae Photobioreactors
At this stage, required water is directed to algae industries whilst the rest continues in the treatment

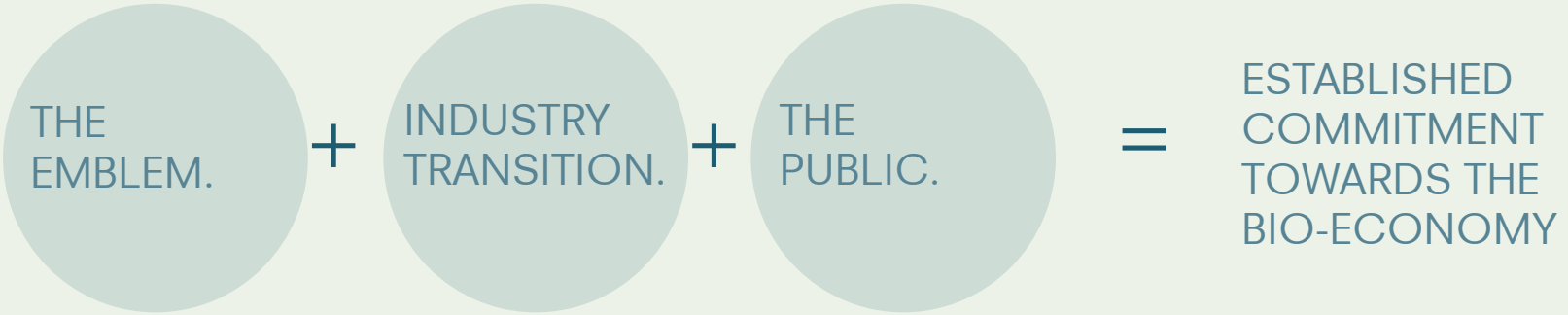
6. Recirculating Sand FIlter
Removes remaining nitrates. Here it is of high enough quality to be discharged

7. 'Clean' Water Storage

07 Conclusion

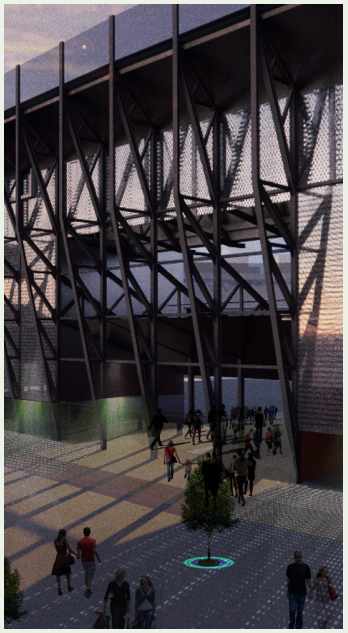
How can Rotterdam create an **emblem** for the Dutch bio-economy **transition** that fosters transparent communication between industry, policy and the **public**?

3 STEP IMPLEMENTATION



THE KUIP CENTRE FOR BIO-BASED RESEARCH AND RECREATION.

Leading Rotterdam and the Netherlands towards a sustainable future



EMBLEM OF COLLECTIVE IDENTITY + NATIONAL PRIDE

+

RESEARCH & PILOT TESTING FOR SMOOTH TRANSITION TOWARDS THE CIRCULAR ECONOMY

+

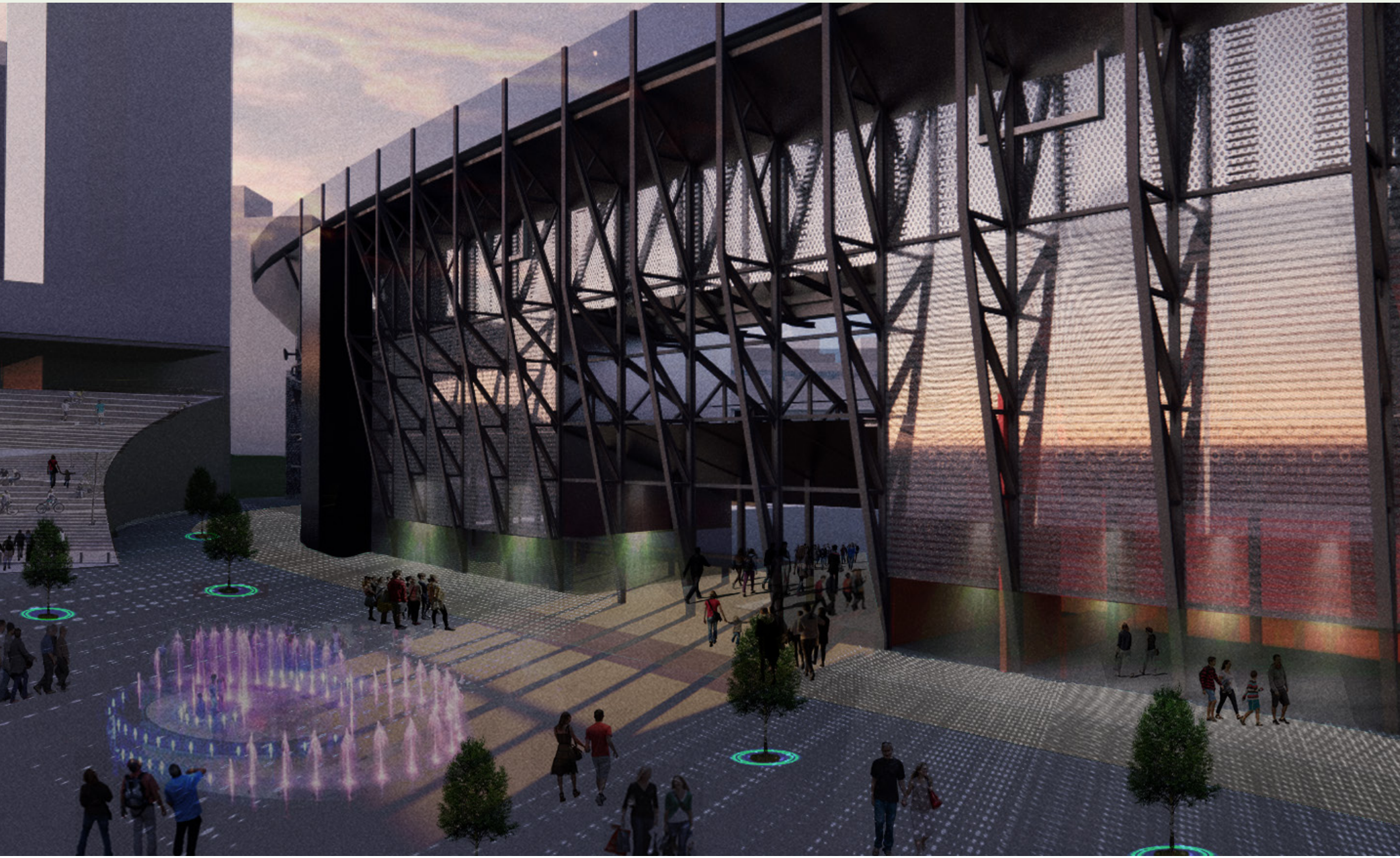
TRANSPARENT COMMUNICATION THROUGH PUBLIC VISIBILITY, EDUCATION + OVERLAPPING SPACE

=

- PRIDE
- PARTICIPATION
- JOY
- OWNERSHIP

The End

>MAIN ENTRANCE



ALGAE MECHANICAL HALL

OFFICE FOYER

ALGAE MECHANICAL HALL

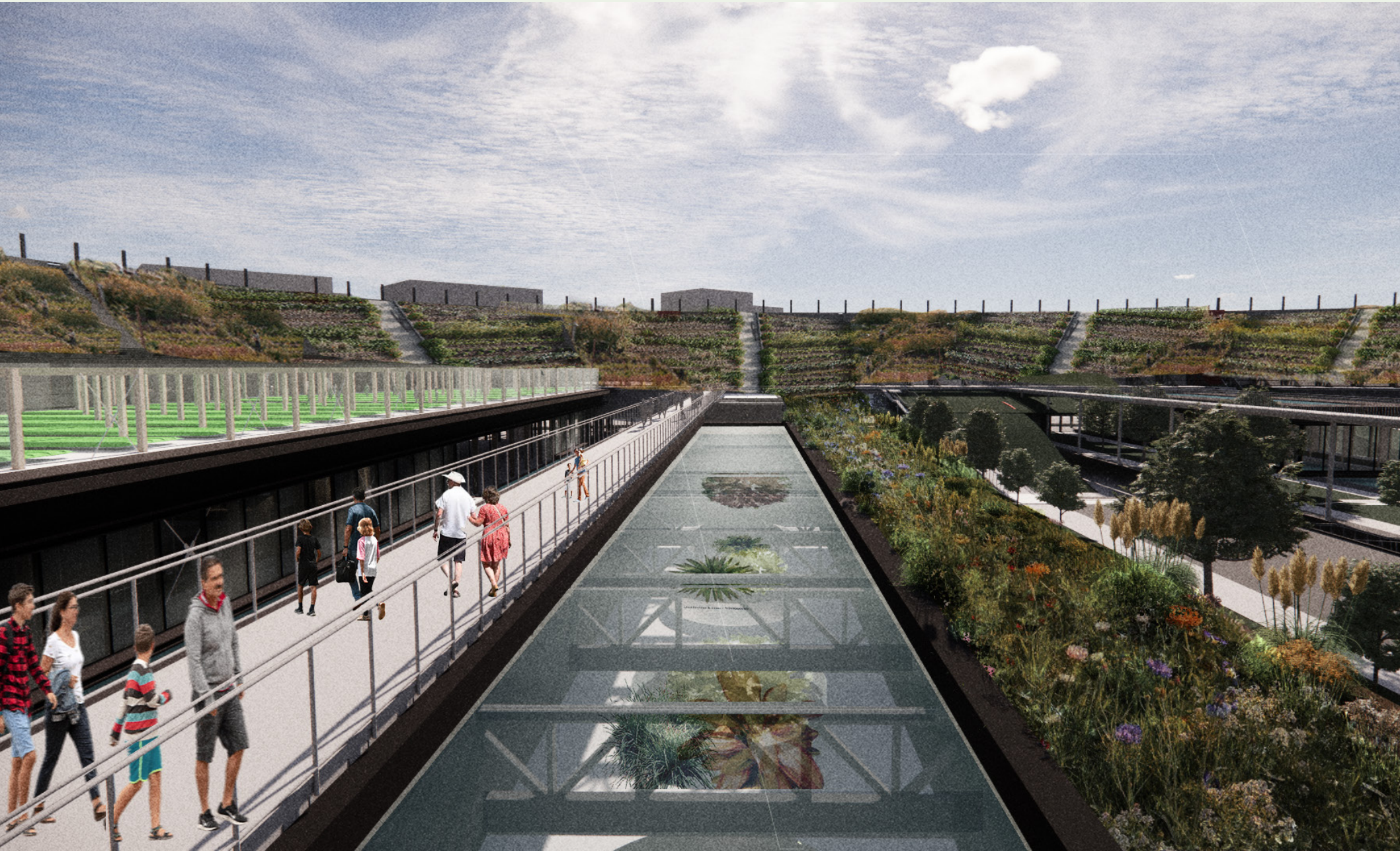
LABS + CROP NURSERIES

AUDITORIUM FOYER

URBAN WALKWAY

EXHIBITON ENTRANCE

PUBLIC WALKWAY



NATURAL SWIMMING POOL

1: 50 AERATED LAGOONS

1:50 AERATED LAGOONS FACADE

PUBLIC EXPERIENCE CORRIDOR