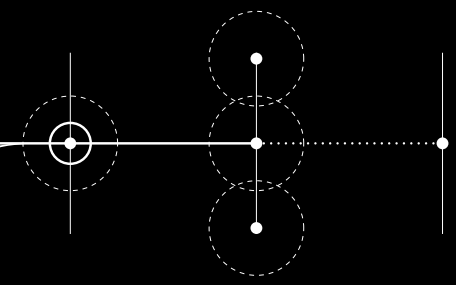
ACTIVATION

Building Technology Report



Equilibrating dualities

The coalescence of man, machine and territory.

Building technology Report

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Architecture, Urbanism and Building Sciences
North Sea: Landscapes of Coexistence
Transitional Territories Studio 2019-2020

Index

Abstract

The following booklet is part of a series of three, together collecting and forming the storyline of the project 'Equilibrating dualities'. All under close eye of the Transitional Territories 2019-20' graduation studio.

The activation booklet attempts to visualise both the flow and the machine aspect of the project, both elements vital for the creation and integration of the project in its surroundings. The machine itself is analysed and exposes through different methods, ranging from technical layout, structure, climate schemes, façade and technical detailing.

The collection of individual elements are together needed to allow for the full integration onto site and its related specificities of which the project desires. All together the machine is not only analysed to introduce an energy transition, it also exposes the 'minimal' requirements needed for this energy transition to thereby cause a moment of reflection. All in all the project proposes a multi scalar approach as an act of structural justice.

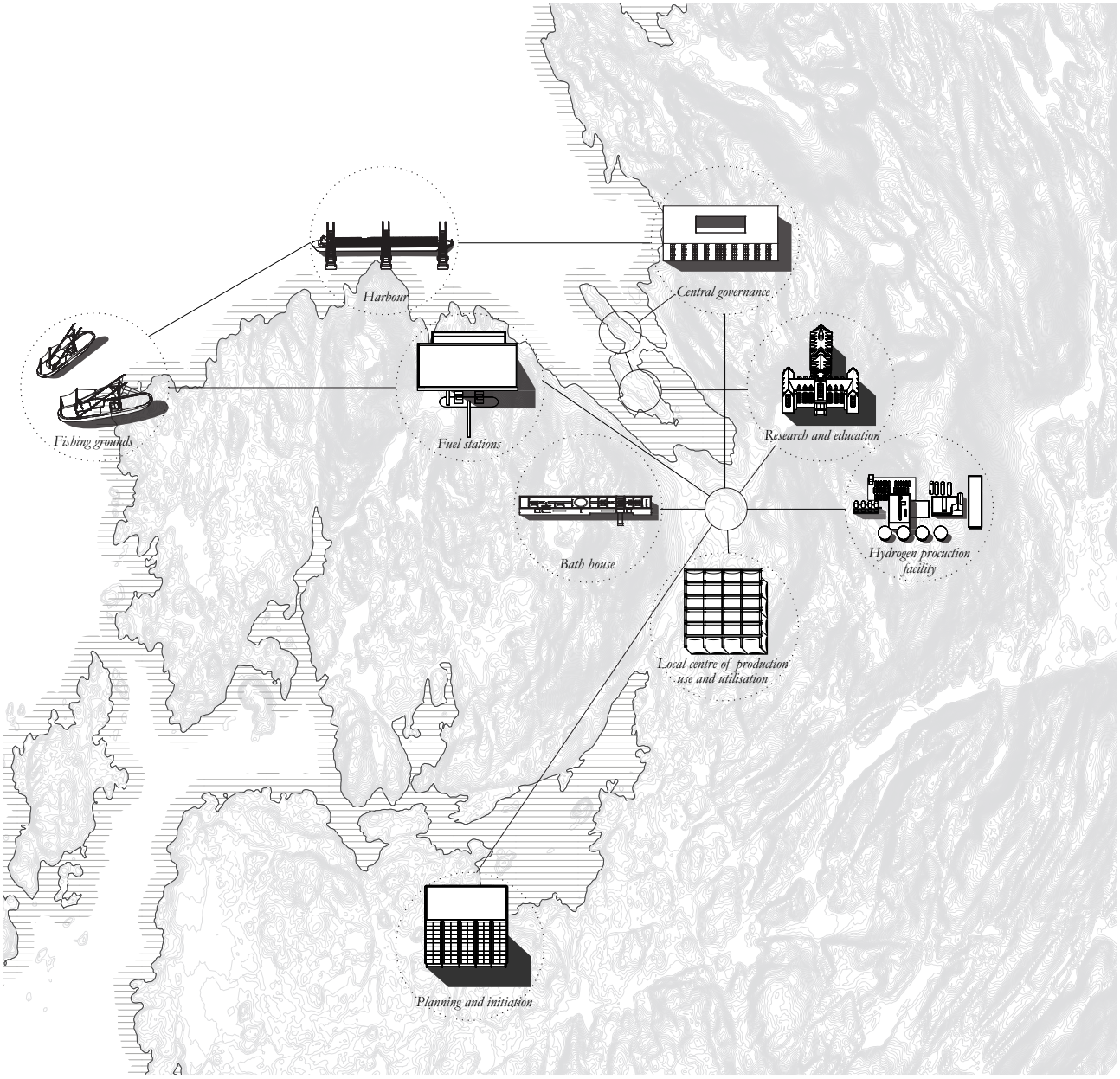
Key words: imposing industries, structural injustice, dual existence, energy transition, integrated justice

I. Flows

Integrated energy proposal

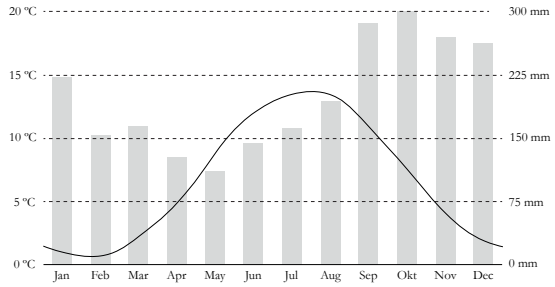
The project proposes a new type of industry entailing a series of interventions linked to a multi scalar energy transition in terms of production and utilisation by means of direct linkage between man, machine and territory. The proposition consists of three main elements: a hydrogen production facility, a fuelling station and a bath house. Each individual element plays a critical role in the integration and coalescence of production, flows and territory to create an integrated and sustainable energy transition. The hydrogen production facility as the manifestation of integrated production and service to the city by means of both product and waste. The fuelling station as the long term solution and the possibility of reterritorialization of fjordic waters by local fishermen. And lastly the bath house as a social proposition of full process exposure, tangibility and integration. These elements make various appearances ranging from: the uncovering of present-day systems to the management of site specificities, use and enhancement of cultural aspects and the utilisation of clean energy and waste. Furthermore, a moment of reflection on the self and the structural injustice imposed by the governmental machines which we currently heavily rely on. Together acting as a statement of minimal intervention to maximise territorial use and therefore the activation of structural justice by means of integration. Together the elements create a link through the city integrating all aspects ranging from existing flows to experimental research.

The focus on within this booklet 'Activation' lays on the last element, the bath house.


Harbour
Central governance
Fishing grounds
Fuel stations
Research and education
Bath house
Hydrogen procuction facility
Local centre of production use and utilisation
Planning and initiation

Flows: Utilisation of Bergen's unique climate and topography

The project proposes a utilisation and exposure of flows related to the sites territorial specificities. These flows of water and hydrogen originate from two sides of the mountain. The flow of water in the form of streams resulting from the cities year-round high level of precipitation and the flow of hydrogen directly linked to the cities industrial area. The project coalesces both the flows, the cities division and its visitors to integrate and expose the energy transition. Additionally, the continuous flows of water are used to generate electricity by means of small hydroelectric power stations on strategic positions through the landscape.


20 °C
15 °C
10 °C
5 °C
0 °C
300 mm
225 mm
150 mm
75 mm
0 mm
Jan
Feb
Mar
Apr
May
Jun
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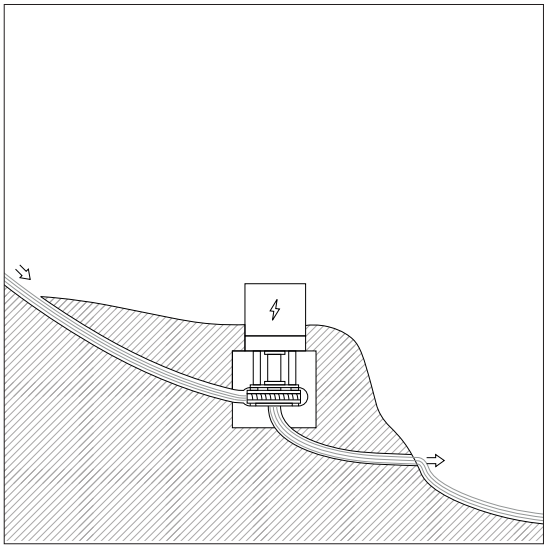
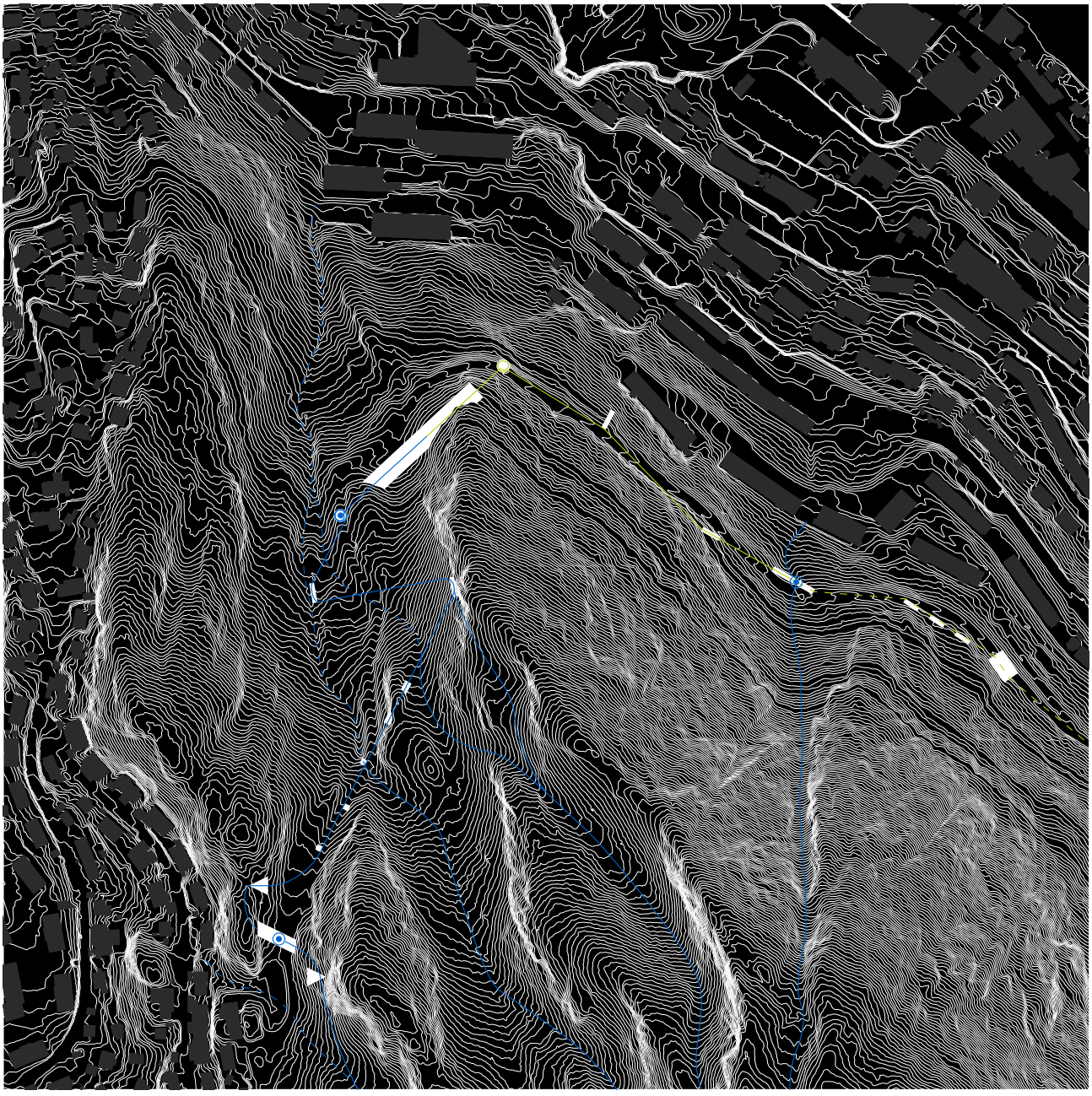
Dec

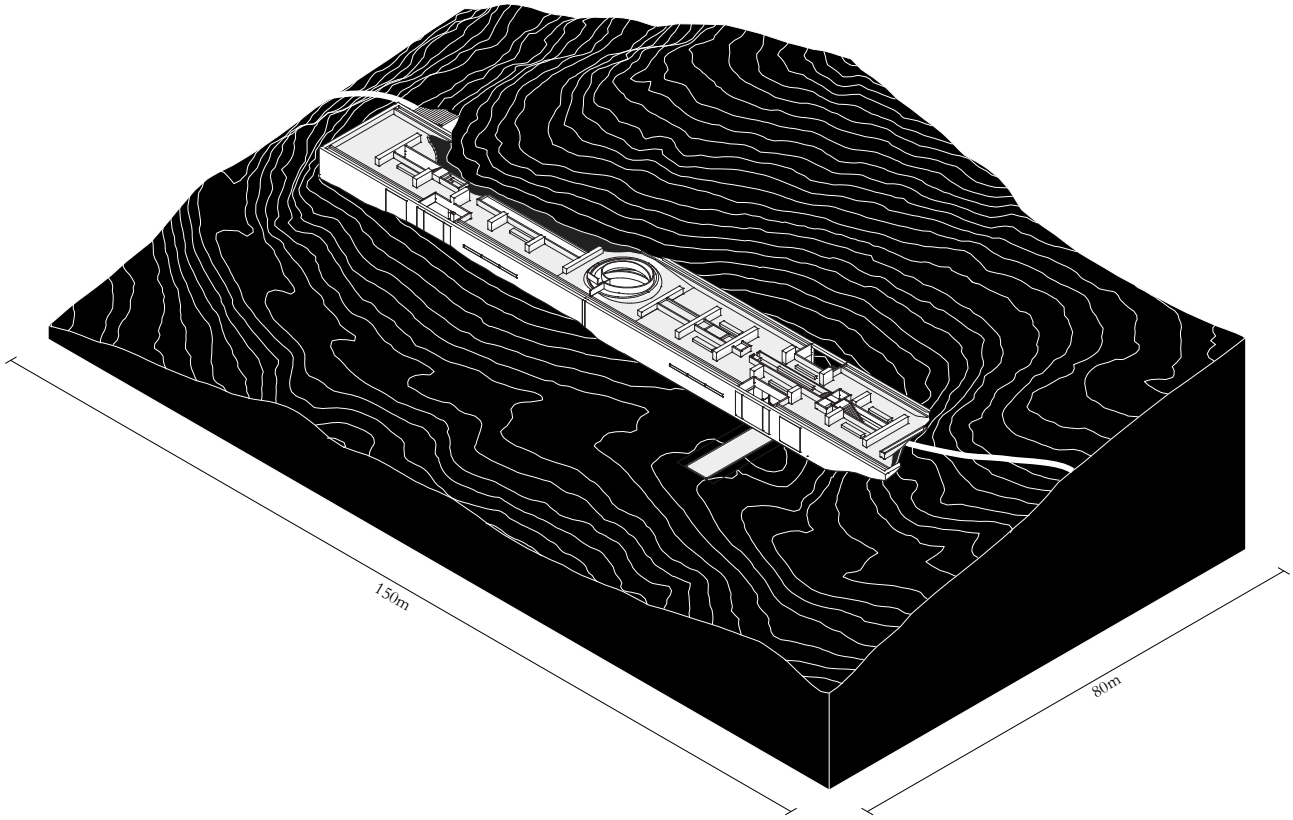


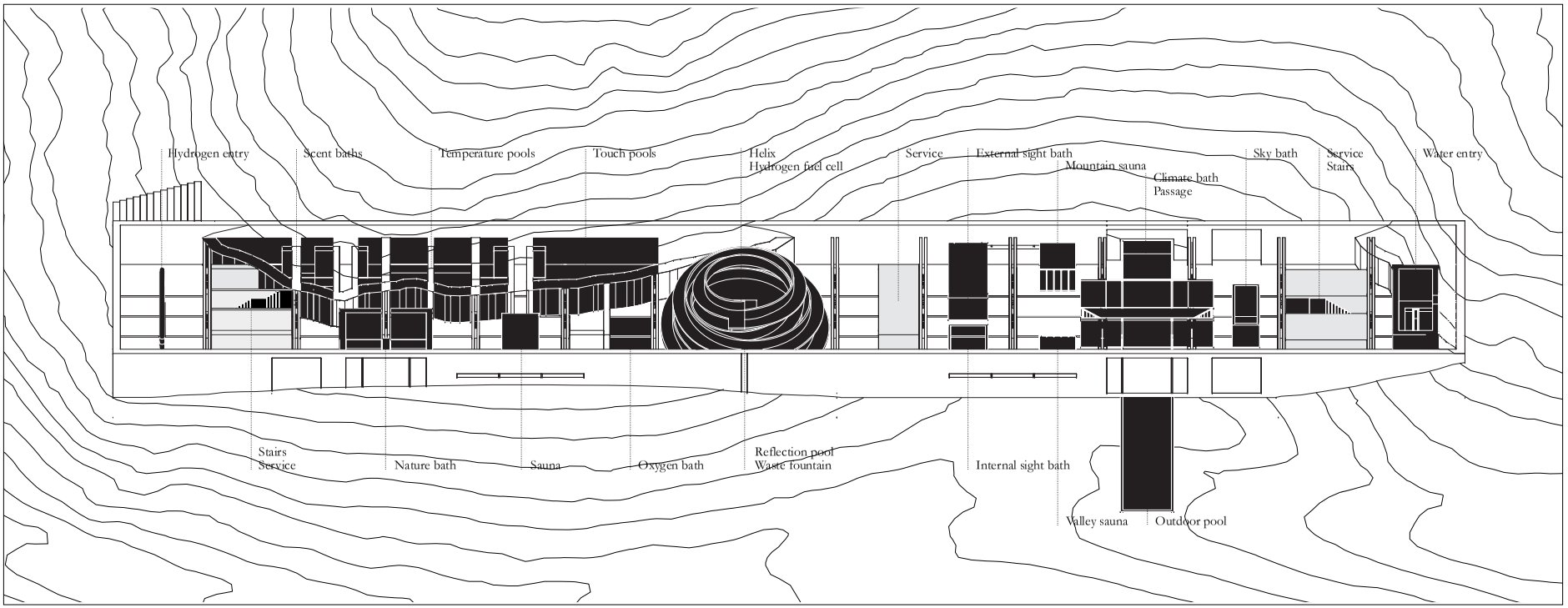


II. Bath house

Disruptive integration

The main element of the bath house expresses the combination of flows by means of its positioning in the landscape. The building itself forced through the mountain on one side to eventually bridge a gap and rest on a hill. The expression of forcing and resting embodied within one element relates to the manmade of the hydrogen and the flowing of the existing streams of water.

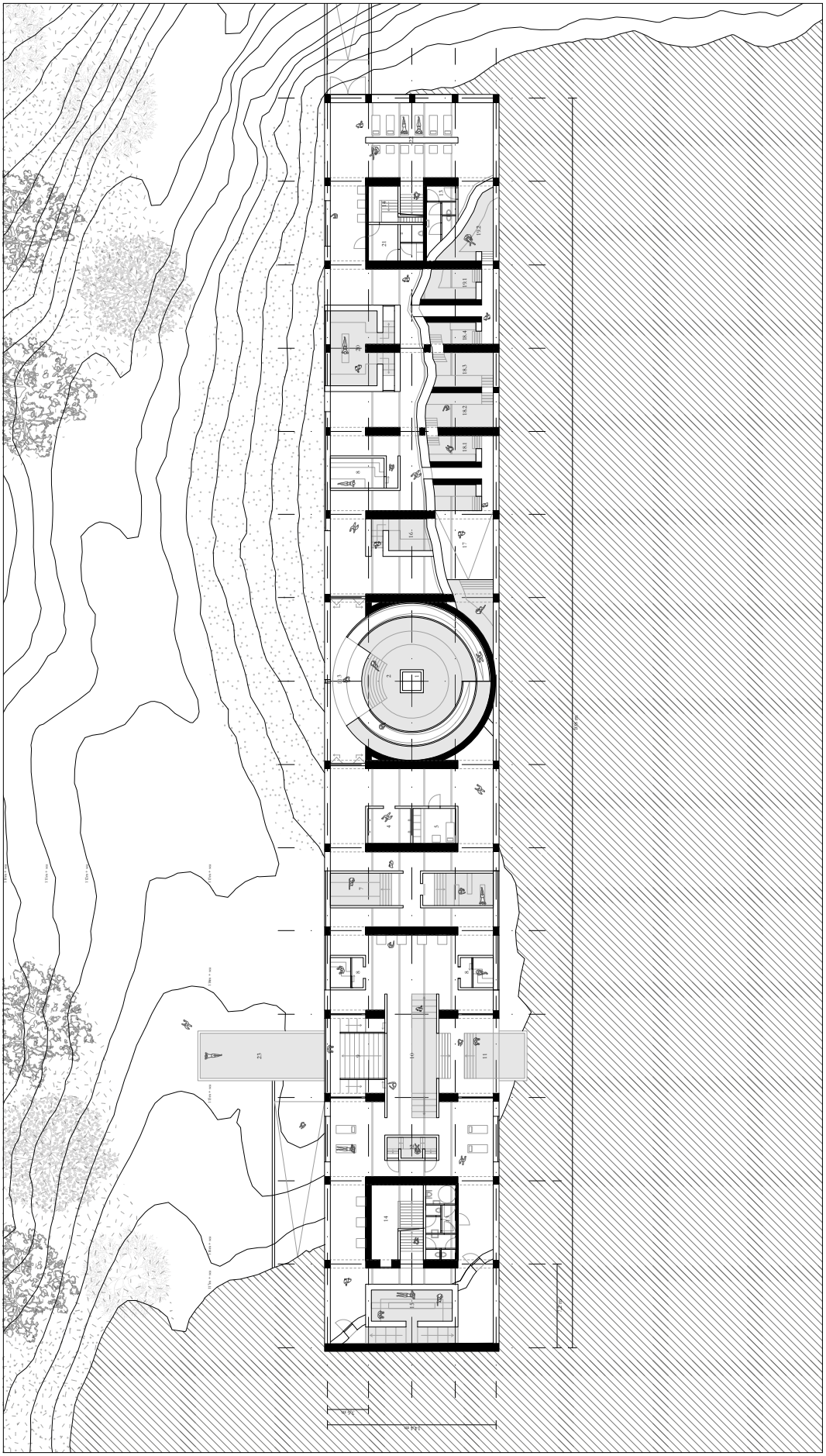

150m
80m

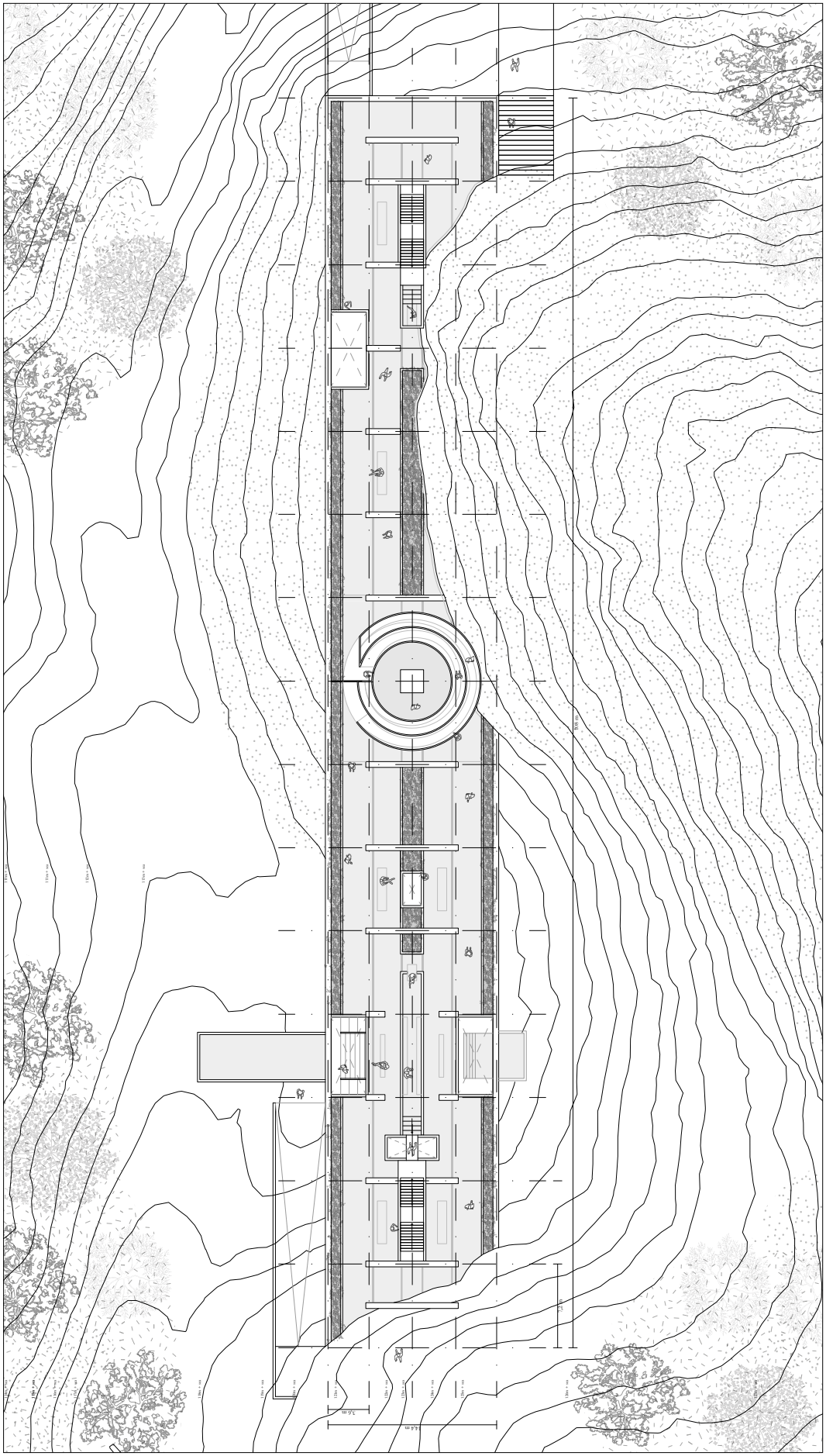

Hydrogen entry
Scent baths
Temperature pools
Touch pools
Helix
Hydrogen fuel cell
Service
External sight bath
Mountain sauna
Climate bath
Passage
Sky bath
Service
Stairs
Water entry
Stairs
Service
Nature bath
Sauna
Oxygen bath
Reflection pool
Waste fountain
Internal sight bath
Valley sauna
Outdoor pool

10m

Legend bathing floor

1.	Aktiver	Fuel cell
2.	Refleksjon	Reflection pool 34°C
3.	Utfall	Clean waste fountain
4.	Dusjer	Showers
5.	Førstehjelp	First aid
6.	Syn	External sight bath 32°C
7.	Syn	Internal sight bath 32°C
8.	Balansere	Sauna steam or dry
9.	Forbindelse	Connection to management layer and outdoors
10.	Passage	Passage
11.	Klima	Climate Bath 30°C
12.	Himmel	Skybath temperature resulting from precipitation
13.	Toaletter	Toilets
14.	Service	Service space
15.	Lyd	Sound bath-water entry temperature resulting from water flow
16.	Oksygen	Oxygen bath 36°C
17.	Ta på	Touch bath 38°C
18.	Prosess	Temperature bath
18.1	Varm	Warm 32°C
18.2	Brann	Fire 42°C
18.3	Kald	Cold 26°C
18.4	Is	Ice 14°C
19.	Smak	Taste bath
19.1	Hav	Salt mineral
19.2	Stein	Rock mineral
20.	Duft	Seasonal scent bath temperature dependant on seasons
21.	Attendants	Bath attendants
22.	Hydrogenlagring	Hydrogen storage and entry
23.	Utendørs	Pool - outdoor area


N
10m



N

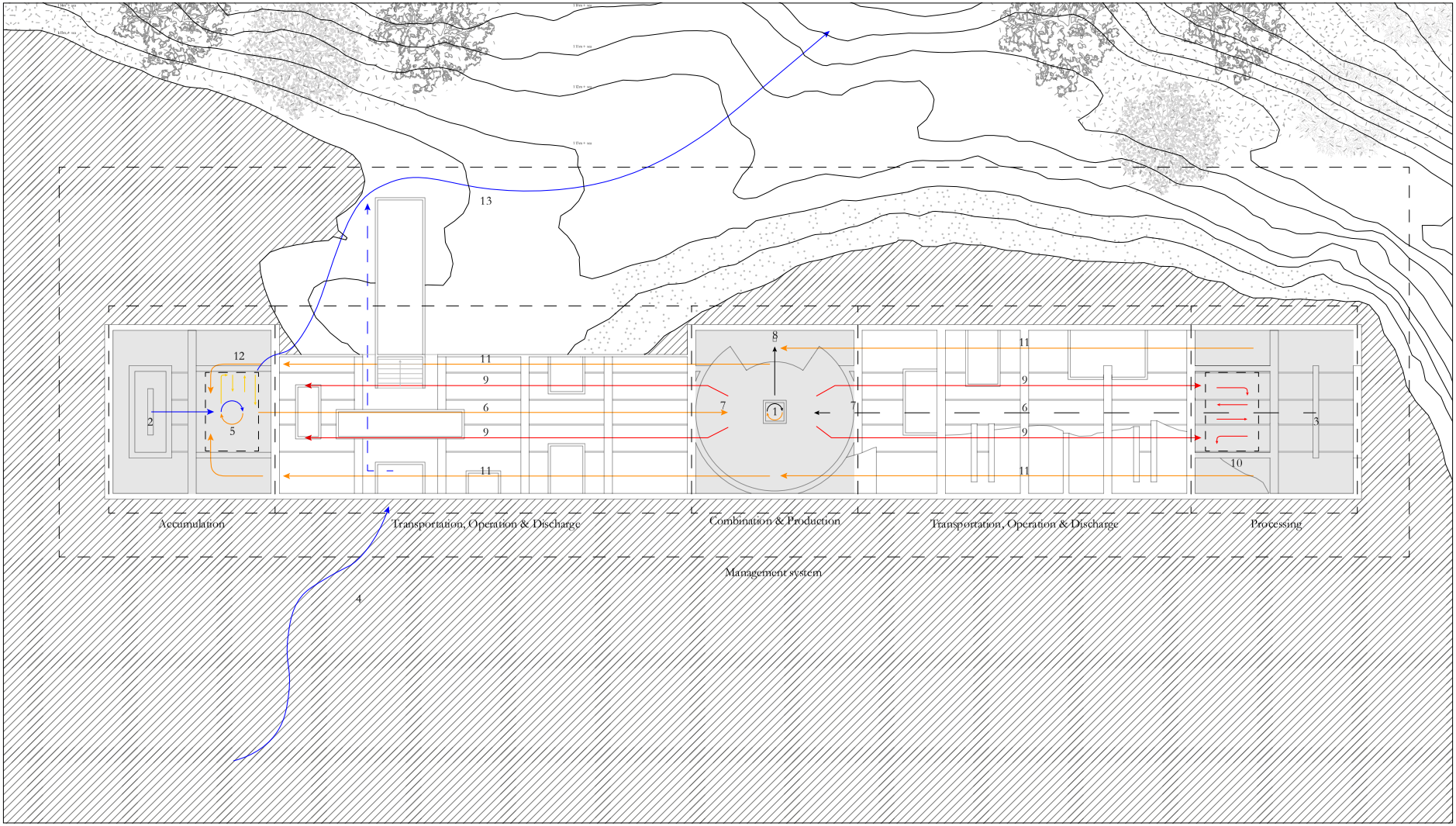
10m

Flow management

The placement of baths and rooms in and around the building directly result from the management of flows directed by the machine. The machine utilises the flows in eight different steps. accumulation, exchange, transportation, combination, production, processing, operation and discharge. The elements and baths relating to the operations of the machine are more enclosed and inward directed spaces, while the operation and transportation spaces are opened to its surroundings. This sequence experienced by the visitor exposes either the process, the results or constant variables which the machine, people and the surroundings are faced with. Additionally, the water running down the mountain not captured in the system hits the side of the building, in term filling a bath directly related to the amount of precipitation. At the end of the cycle the waste water is returned to its original heading; towards the sea.

Legend management floor

1. Fuel cell
2. Water entry
3. Hydrogen entry
4. Precipitation
5. Wastewater heat exchange
6. Flow transportation
7. Entry activator
8. ‘ Waste’ Consumption
9. Operation
10. Treatment
11. Discharge
12. Sanitation
13. ‘ Waste’ water


13
12
11
9
6
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11
2
5
8
1
7
7
11
9
6
9
11
3
10
Accumulation
Transportation, Operation & Discharge
Combination & Production
Transportation, Operation & Discharge
Processing
Management system
4

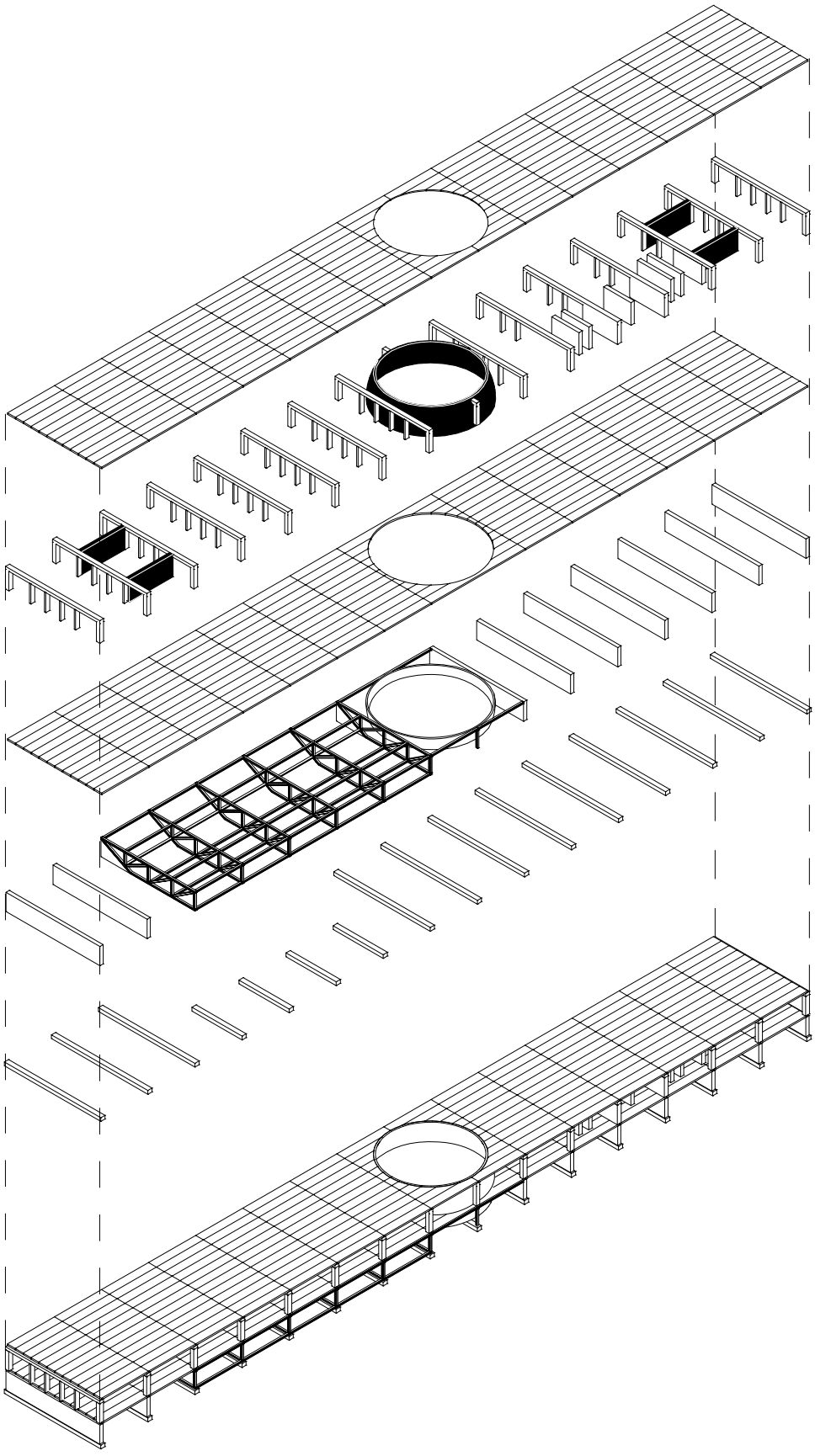
10m N

III. Structure

Structure

The structure of the building plays its role in the expression of its appearance. The building itself can be seen as two elements joined by a central machine and reflection space. The side which is forced through the mountain plays with this intimacy by appearing as hard and enclosed, in a way symbolising the mountain. The other side of the building which 'bridges the gap' symbolises its position in relation to the mountain while the structure fully exposes the dependency on the similar mountain. These dual relations expressed and exposed throughout the building are a trigger to the visitor and their perspective on the energy transition.

The structure itself features concrete and steel elements placed specifically in relation to the mountain. The steel shows the dependency on the mountain and its openness to the machine while the concrete symbolises our current dependency on imposing industries which even this bath house is dependant on.



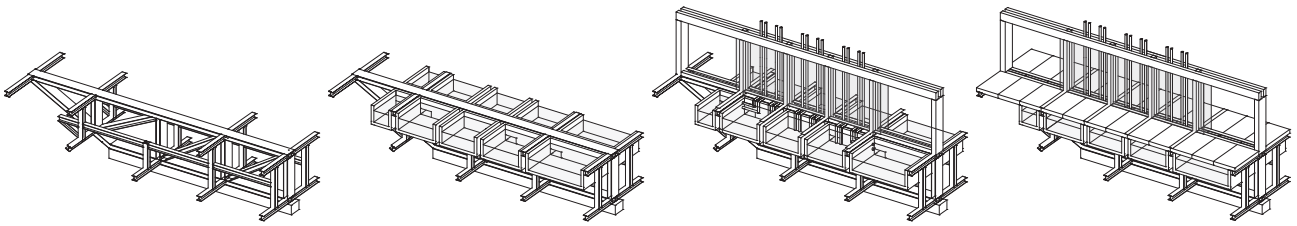
Strucutral walls - flow connection/exposure

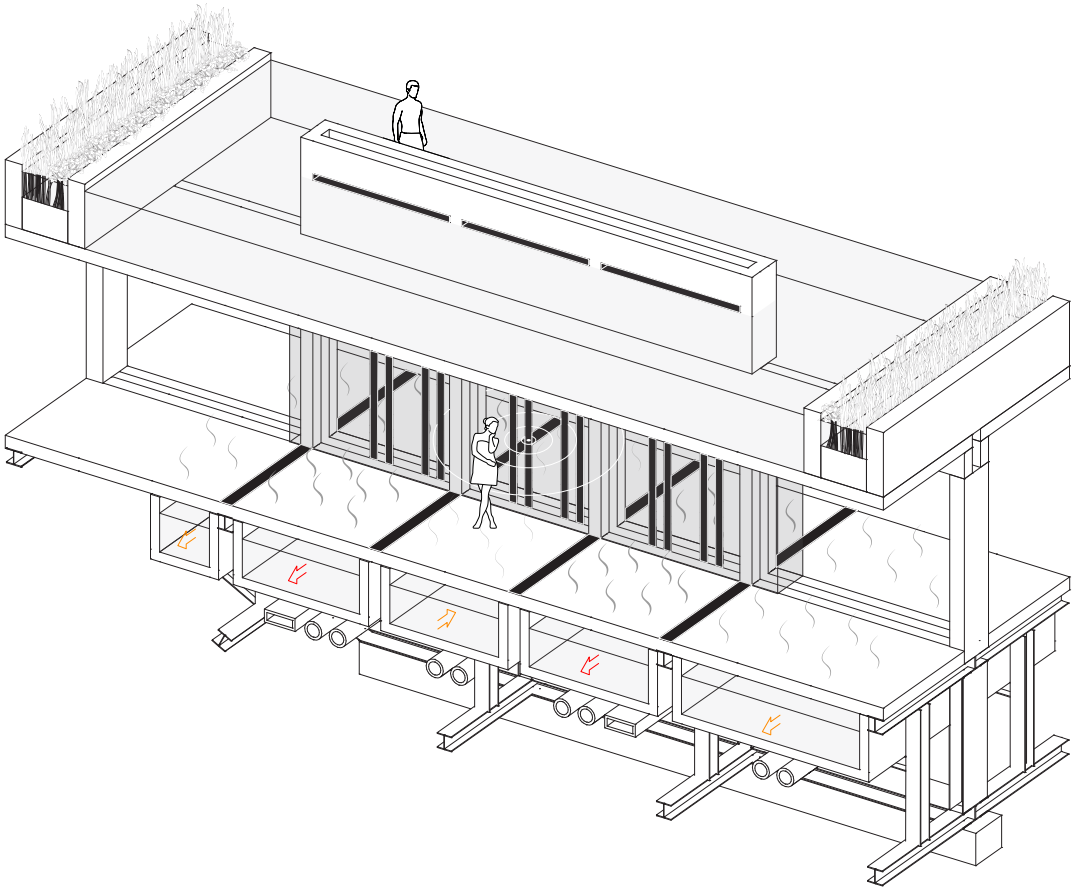
The composition of different elements used throughout the building play their role in the exposure of flows. The structural walls and floors provide the visitor with a sensory experience of the flow management within the building. Beneath the floor the water is managed in different sequences. Central is the entry of fresh water which has undergone a heat exchange process with the waste water. Adjacent to this water basin are the basins containing heated water coming from the fuel cell. The water basins at the edge of the building contain the used which will be either re-used after sanitation or discharged. The sequencing of the water basins allows each pool to have access to the fresh, heated and used water basins for quick access and discharge. Additionally, the placement of the water basins with different temperatures against the floor provides the visitors bare feet a sensation the water underneath, which is made recognisable by glass strips (black in image) attached to the floor and ceiling. Different baths and saunas receive their water and steam from these similar walls and strips along the floor and ceiling.

Through the translucent resin cast the clear drainage and supply pipes are visible when up close. This exposes the vertical water transportation to the visitor when seeing water and bubbles being transported through the pipes. Additionally, the sound of water going through the pipe enhances the sensory experience of flow management.

The split in the construction continuing through the roof allows for daylight to enter the building and illuminates the resin block. The ambient lighting coming from the structure walls literally highlights them to attract attention of the visitors. Knowing the geographical positioning of Bergen in winter time the days are short therefore, LED's mounted underneath the resin block reverse the effect when dark.

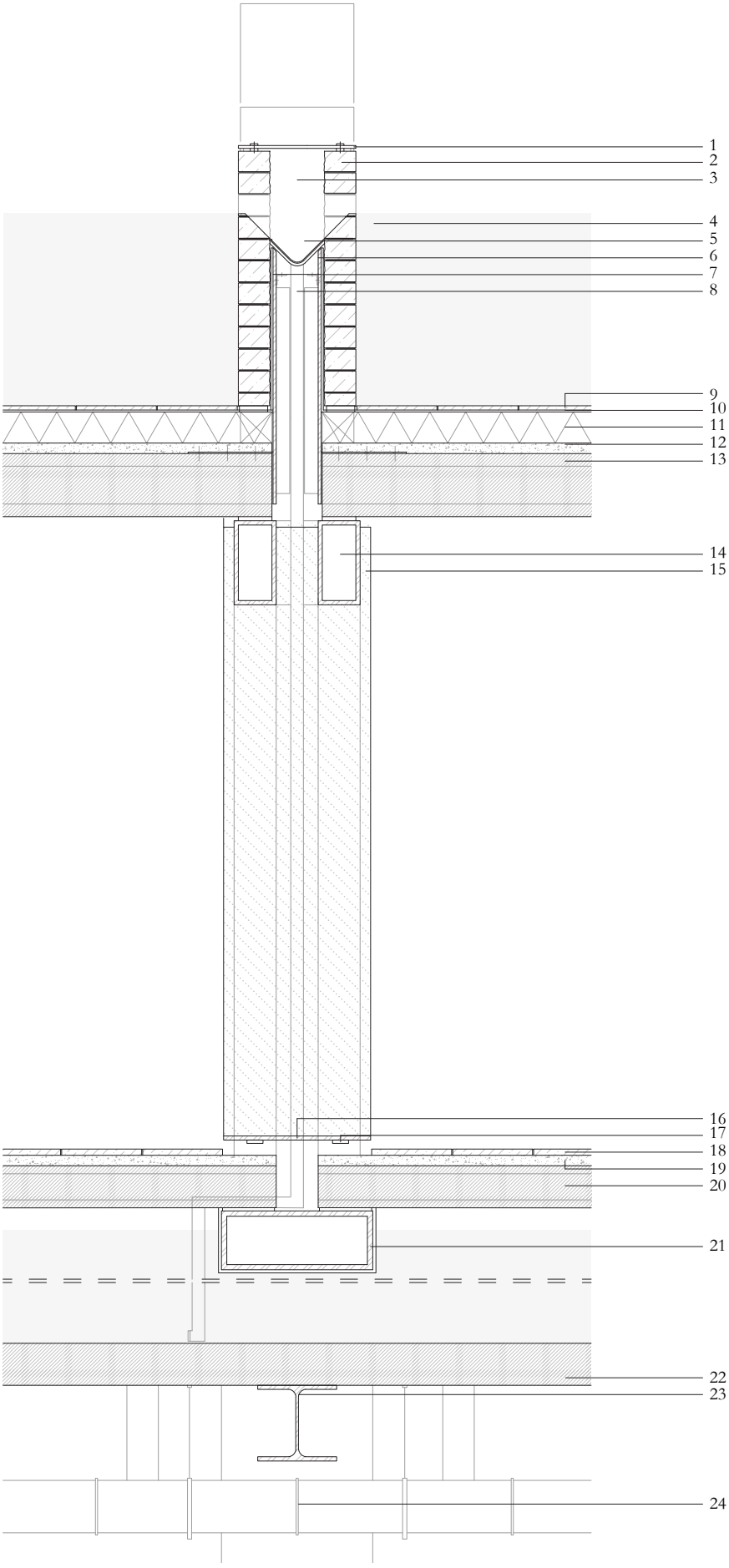
The rooftop of the building Exposes the entry and exit of fresh water by means of slots in the natural stone and water fountains.





Structural wall
Scale 1:20 (1:30 on page)

1. Glass plate
2. Glued natural stone
3. Air cavity
4. Heated water
5. Water drain funnel
6. Pool liner
7. Steel fortification bolted to flooring
8. Transparent drainage pipe
9. Natural stone slabs
10. pool liner
11. Foamglass insulation 150mm
12. Screed
13. Hollow core slab floor 300mm
14. Vierendeel truss
15. Resin cast
16. Steel fortification plate
17. LED light
18. Natural stone slabs
19. Screed
20. Hollow core slab floor 200mm
21. Steel truss with protective coating
22. Water basin
23. HEA 260
24. Pipes (ventilation, supply, drainage)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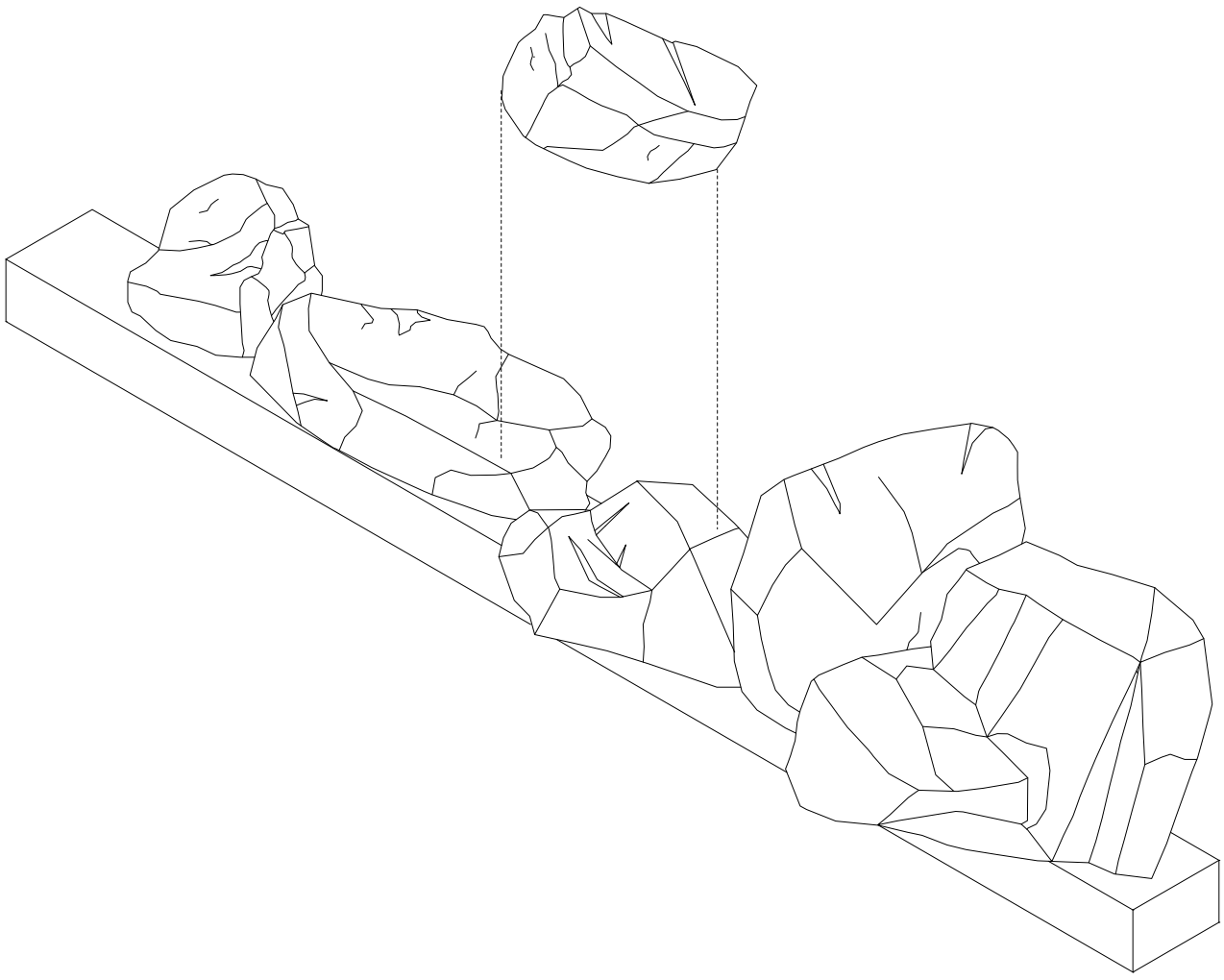
21
22
23
24

Stone wall

The building features one part buried underneath the mountain, to expose this relation to the visitor the mountain has been brought down into the building following its contour. The wall is constructed using rocks from the building site which have been excavated to make place for the building. These rocks are then stacked without the use of mortar to form a solid and rough wall.



IV. Climate

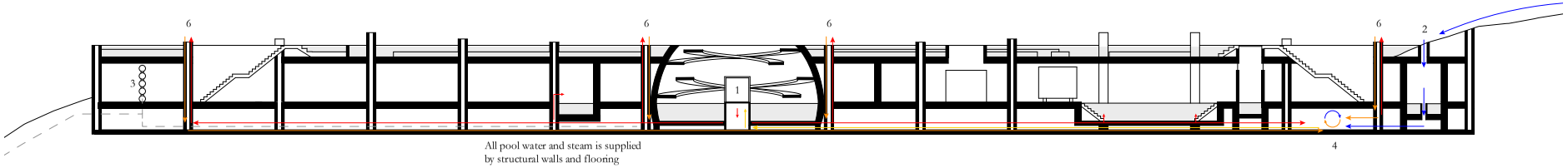
Climate utilisation

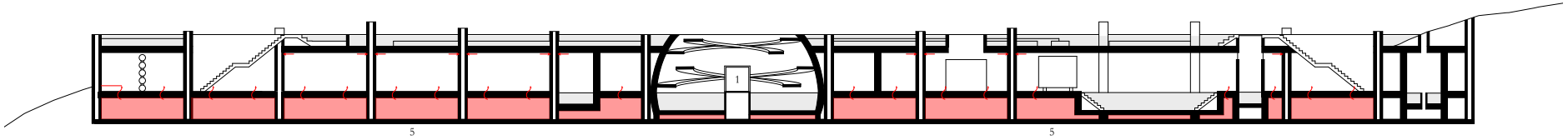
Bergen has in comparison to Norway a mild and oceanic climate, meaning that the temperature varies from 0 to 15 degrees around the year. Additionally, Bergen is known for its large amounts of yearly precipitation around 3 times that of Amsterdam. To fully integrate the project in its site the constant rain is an important factor to take in consideration. Therefore the project sets to maximally utilise this constant supply of water through different methods, the creation of hydrogen, providing the water for the baths and for the generation of energy. Secondly, the project sets to expose all these elements to the visitor either inside the bath house or along the path.

Climate schemes: water heating - space heating

1. Fuel cell
2. Entry water
3. Entry hydrogen
4. Wastewater heat exchange
5. Water basins
6. Roof water supply and discharge
7. Helopyte filters
8. Aerobic water sanitation
9. Ventilation unit
10. Used air heat exchange
11. Fresh air intake
12. Used air blowout
13. Energy backup system

Fresh water
Heated water
Used water
Fresh air
Heated air
Used air
Sanitized water
Oxygen supply

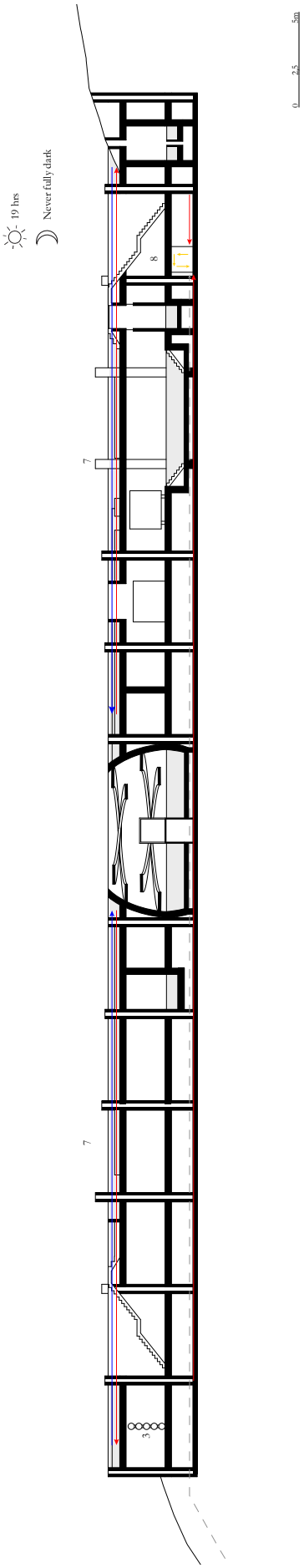

6
6
6
6
2
3
1
4
All pool water and steam is supplied
by structural walls and flooring
0
2,5
5m

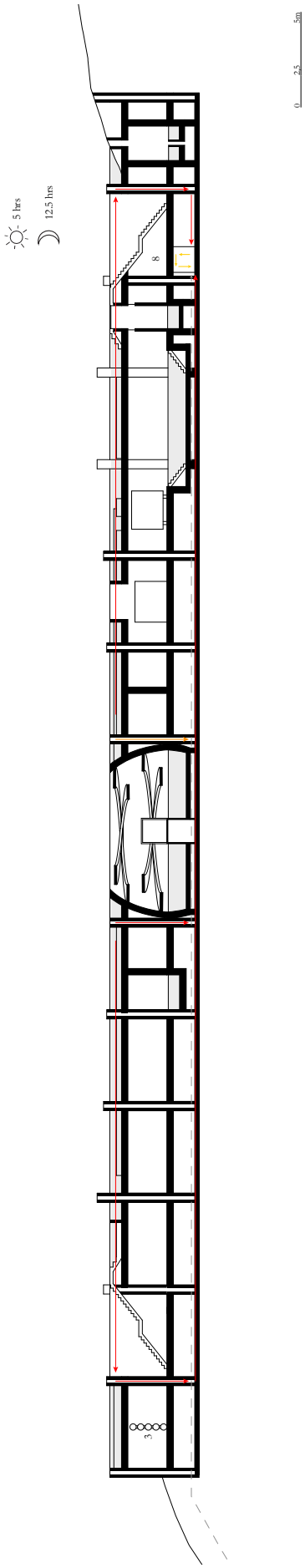

1
5
5
0
2,5
5m

Climate schemes: water sanitation summer - winter

1. Fuel cell
2. Entry water
3. Entry hydrogen
4. Wastewater heat exchange
5. Water basins
6. Roof water supply and discharge
7. Helopyte filters
8. Aerobic water sanitation
9. Ventilation unit
10. Used air heat exchange
11. Fresh air intake
12. Used air blowout
13. Energy backup system

Fresh water
Heated water
Used water
Fresh air
Heated air
Used air
Sanitized water
Oxygen supply

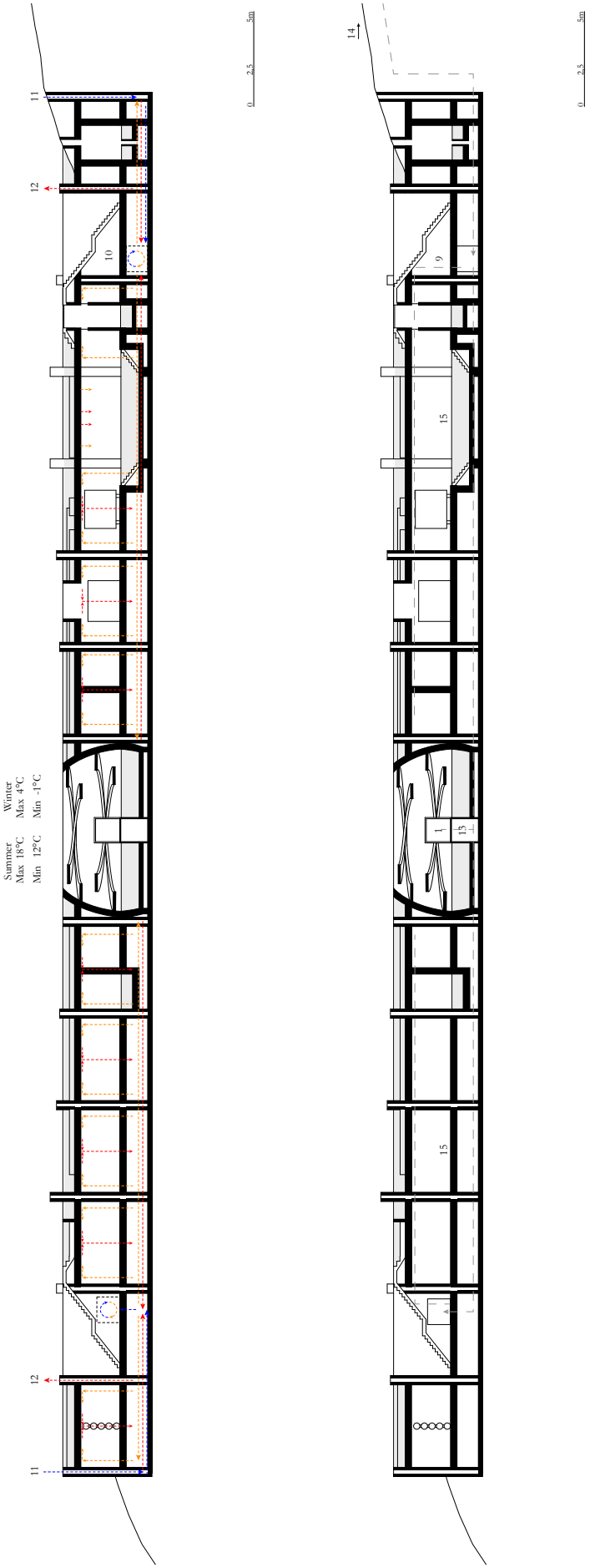

19 hrs
Never fully dark
0
2.5
5m
8
7
7
3


5 hrs
12.5 hrs
0
2.5
5m
8
3

Climate schemes: ventilation - energy

1. Fuel cell
2. Entry water
3. Entry hydrogen
4. Wastewater heat exchange
5. Water basins
6. Roof water supply and discharge
7. Helopyte filters
8. Aerobic water sanitation
9. Ventilation unit
10. Used air heat exchange
11. Fresh air intake
12. Used air blowout
13. Energy backup system

Fresh water
Heated water
Used water
Fresh air
Heated air
Used air
Sanitized water
Oxygen supply


Summer
Max 18°C
Min 12°C
Winter
Max 4°C
Min -1°C
11
12
10
12
11
0
2.5
5m
14
9
15
15
1
13
0
2.5
5m

V. Façade

Materiality

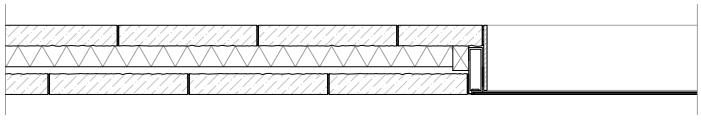
The bath house is formed using different materials representing either exposure or closure. The most appearing material is natural stone similar to that occurring on site, yet slightly darker. The darker tone of the stones sets to resemble the wet appearance of the existing natural stone. This wet look allows the building to fully integrate when it is raining and the flow management process is in full action, yet when there is no rain and the mountain is dry the building stands out. The difference between integration and disruption of the building symbolise its dependency of the water flows occurring because the climate the building is exposed to.

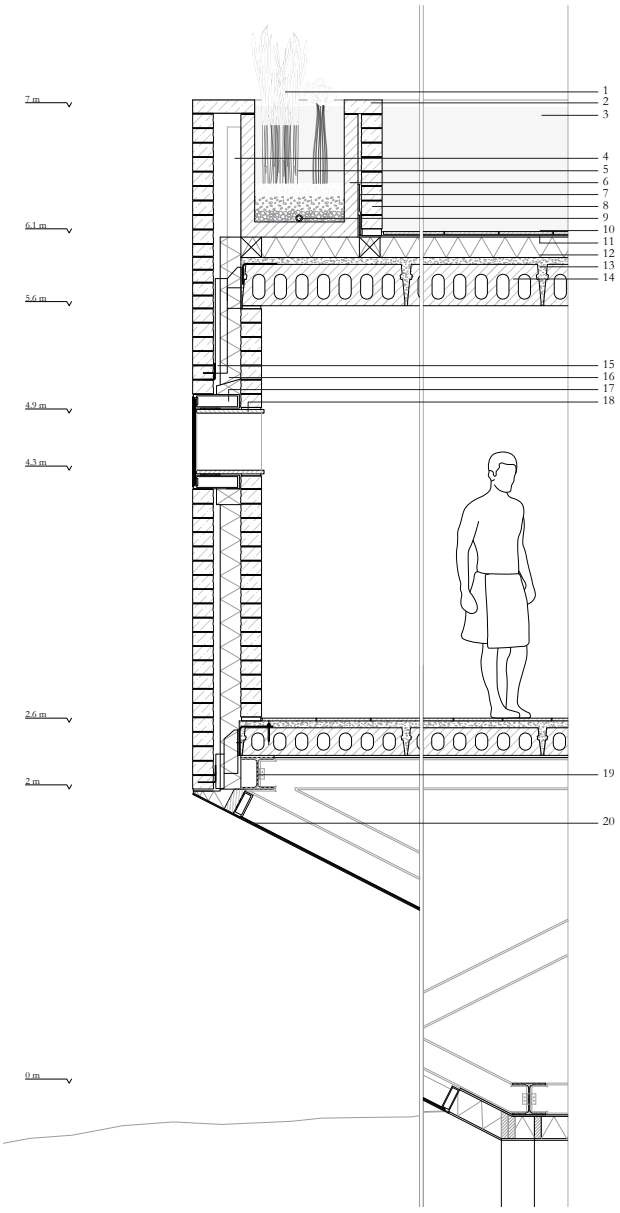
Besides the use of natural stone transparent materials such as glass and resin are common in the project. The use of transparent or semi transparent materials allows for the exposure of machine elements which in normal conditions disrupt the peaceful and calm environment of a bath house.

Facade daylight

Scale 1:20 (out of scale)

1. Helopyte filter
2. Natural stone wall cover
3. Heated water
4. Steel fortification bolted to flooring
5. Sediment layers
6. Concrete planter
7. Pool liner
8. Glued natural stone
9. Drainage pipe
10. Natural stone slabs
11. Insulation 150mm
12. Vapor seal
13. Screed
14. Hollow core slab floor
15. Steel stone carrier
16. Insulation 150mm
17. Window frame
18. Windowsill
19. Steel truss
20. Layered glass




7 m
6.1 m
5.6 m
4.2 m
4.3 m
2.6 m
2 m
0 m
1
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4
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6
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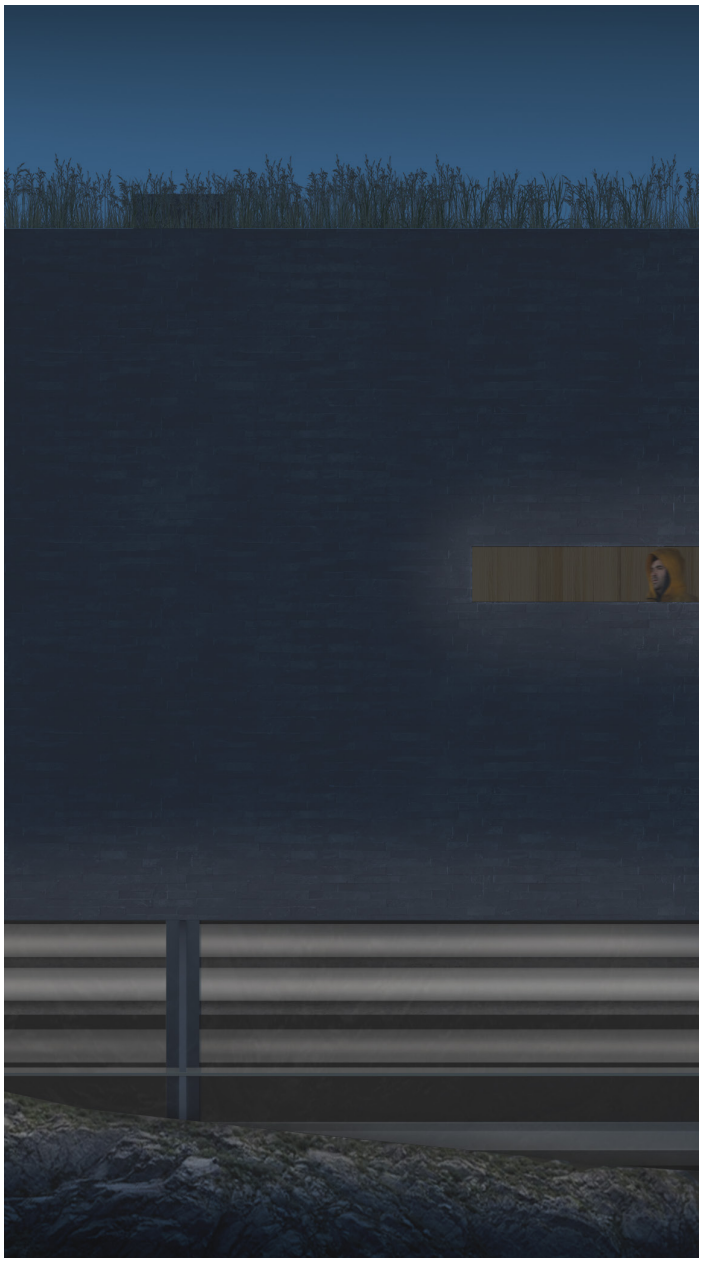
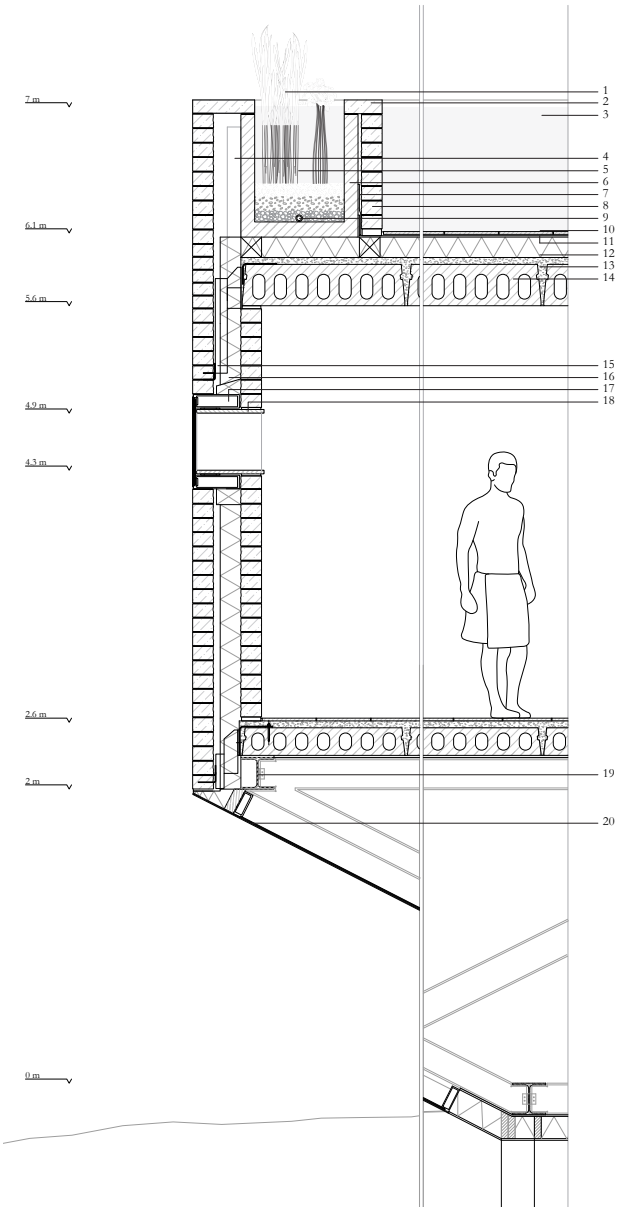
19
20

Facade nighttime
Scale 1:20 (out of scale)

1. Helopyte filter
2. Natural stone wall cover
3. Heated water
4. Steel fortification bolted to flooring
5. Sediment layers
6. Concrete planter
7. Pool liner
8. Glued natural stone
9. Drainage pipe
10. Natural stone slabs
11. Insulation 150mm
12. Vapor seal
13. Screed
14. Hollow core slab floor
15. Steel stone carrier
16. Insulation 150mm
17. Window frame
18. Windowsill
19. Steel truss
20. Layered glass




7 m
6.1 m
5.6 m
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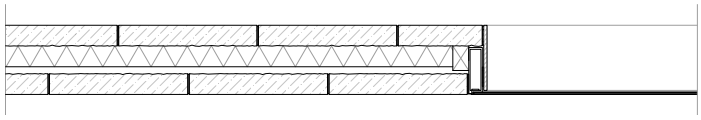
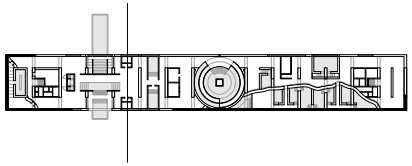
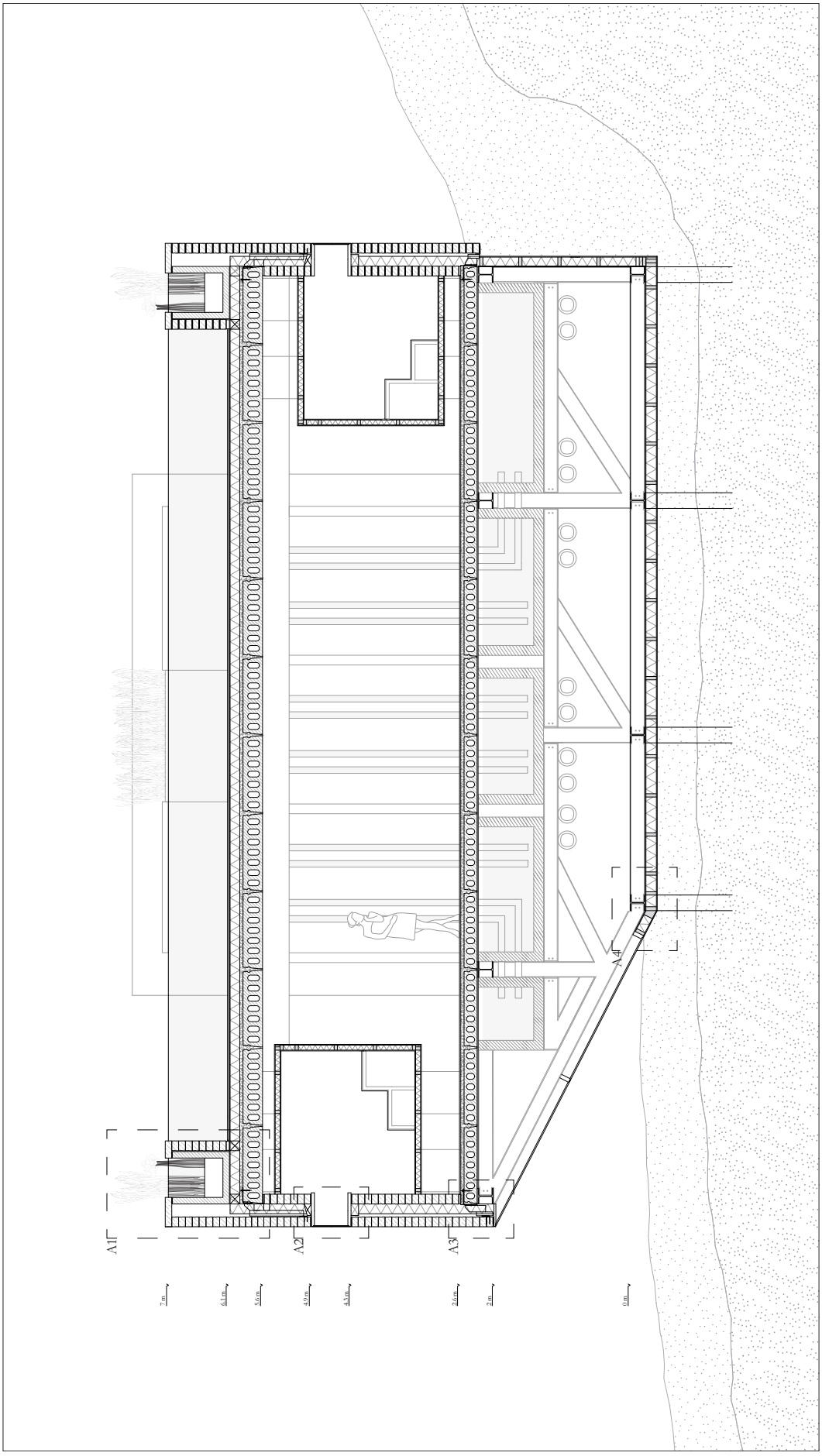


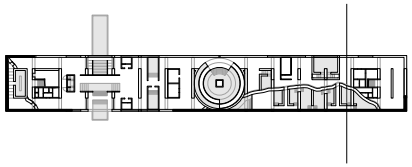
VI. Details



Section 1 - 'Sauna's'

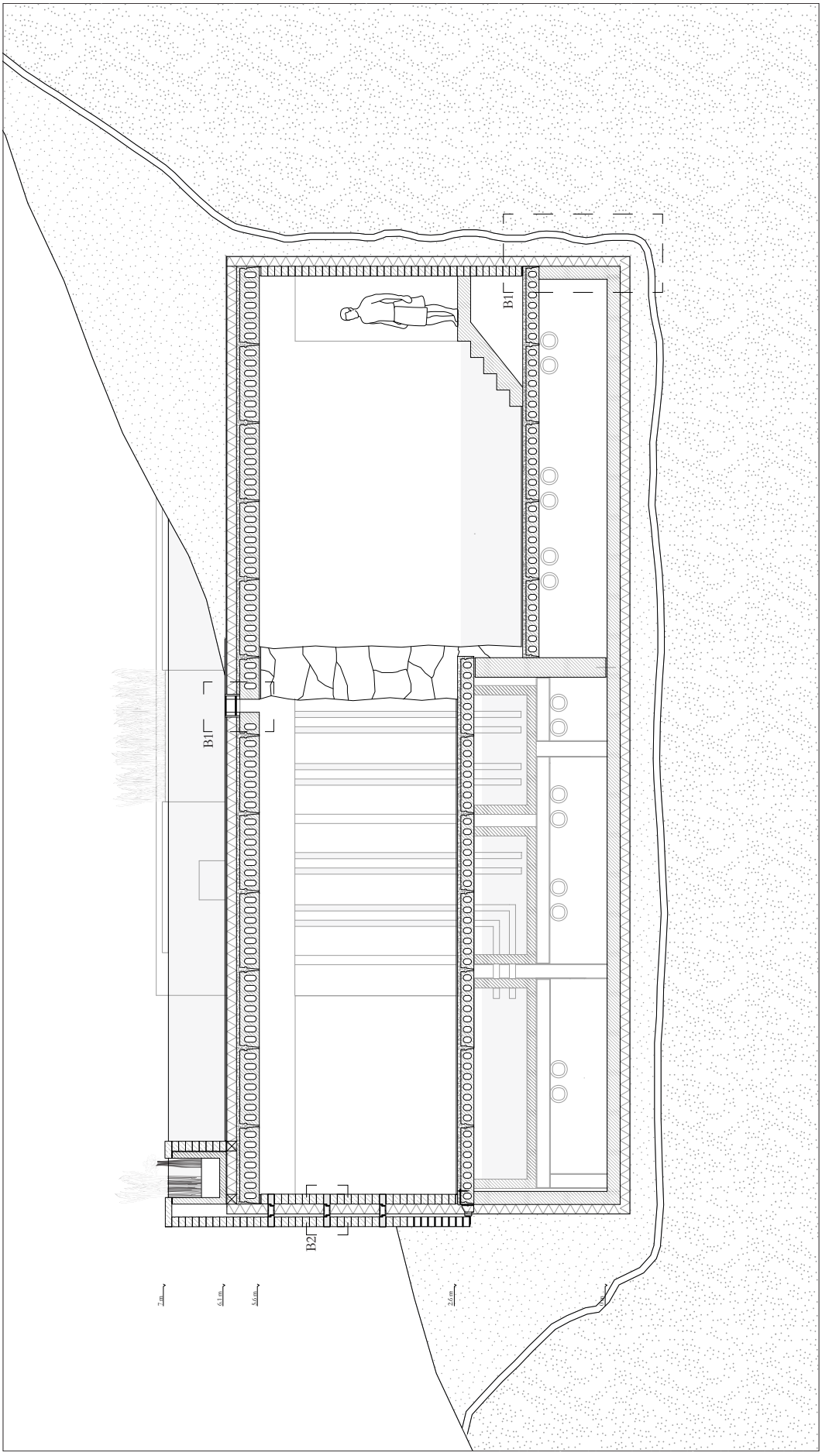
A1. Roof detail
A2. Window detail
A3. Overhang detail
A4. Foundation detail

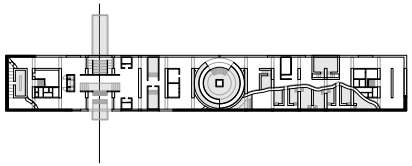

A1
A2
A3
A4
7m
6.4m
5.6m
4.9m
4.5m
2.6m
2m
1m
2m



Section 2 - 'Mountain'

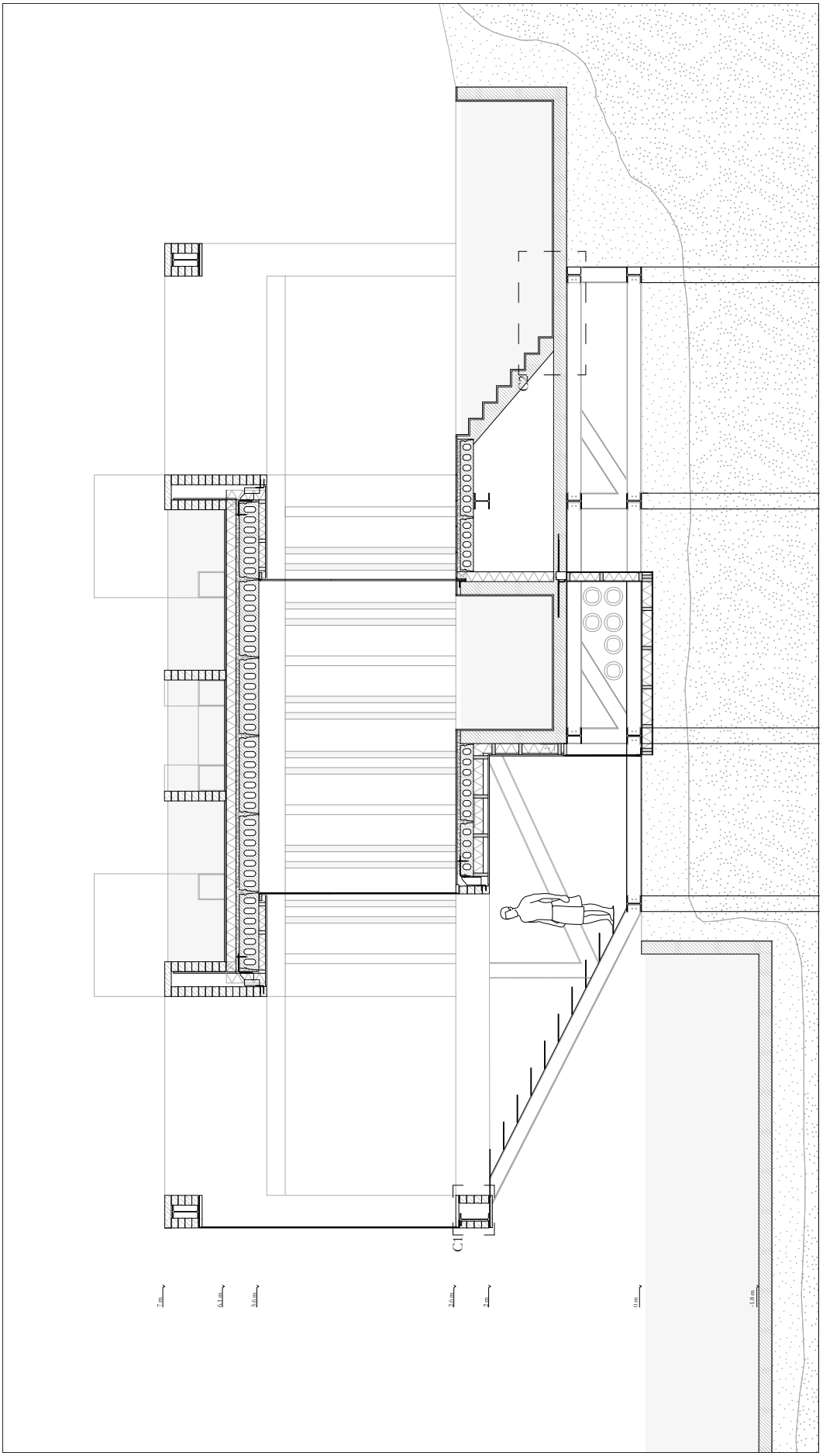
B1. Pool window detail
B2. Glass brick detail
B3. Connection rock building

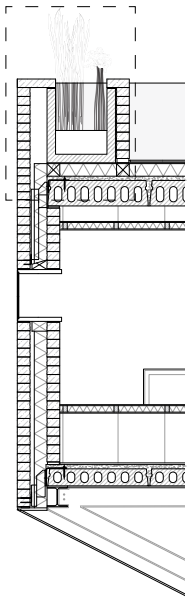

B1
B1
B2
2m



Section 3 - 'Passage'

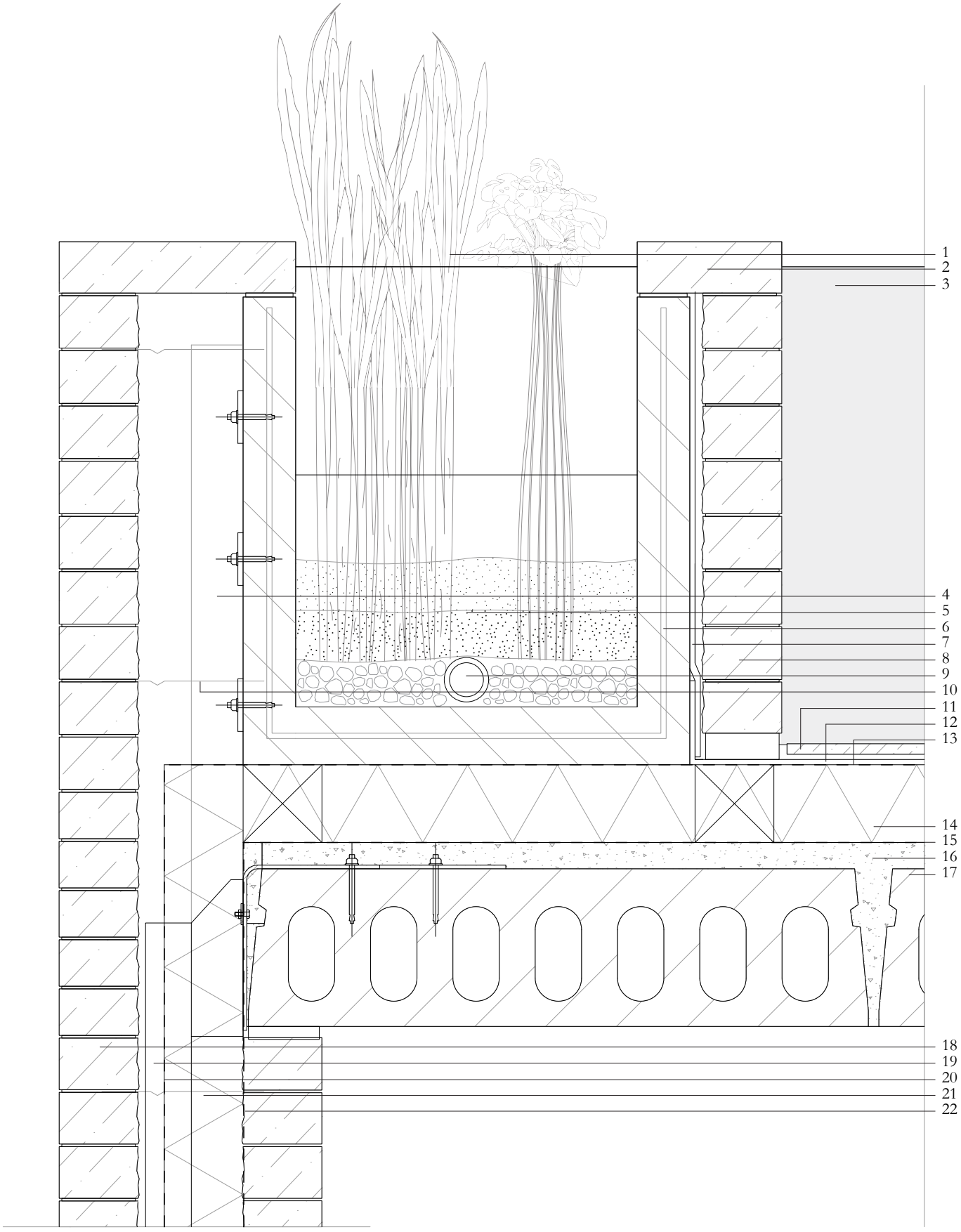
C1. Lookout and stairs detail
C2. Stairs to pool detail


C11
7m
6.4m
5.6m
2.6m
2m
0m
-1.8m
2m



Detail A1
Scale 1:10

1. Helopyte filter
2. Natural stone wall cover
3. Heated water
4. Steel fortification bolted to flooring
5. Sediment layers
6. Concrete planter
7. Pool liner
8. Glued natural stone
9. Drainage pipe
10. Fortification natural stone
11. Natural stone slabs
12. Pool liner
13. Secondary waterproof layer
14. Foamglass insulation 150mm
15. Vapor seal
16. Screed
17. Hollow core slab floor 300mm
18. Glued natural stone
19. Natural stone carrier
20. Waterproof layer
21. Insulation 150mm
22. Vapor seal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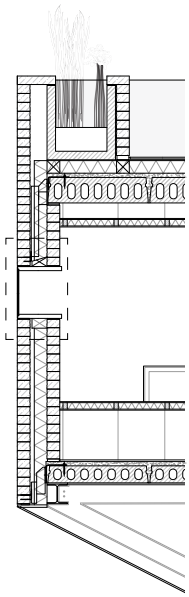
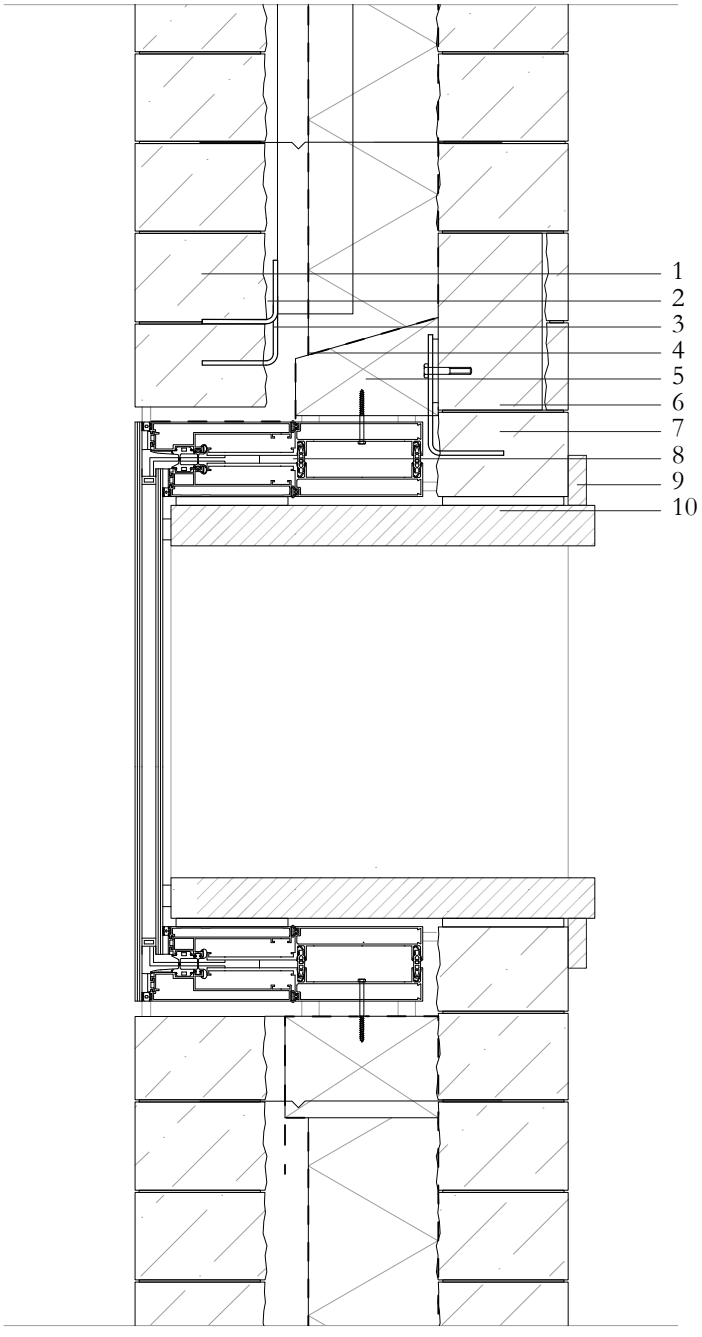


Detail A2
Scale 1:10

1. Glued natural stone
2. Air cavity
3. Natural stone carrier
4. Vapor seal
5. Screwable insulation
6. Lintel
7. Glued natural stone
8. Window frame
9. Wooden finishing
10. Wooden windowsill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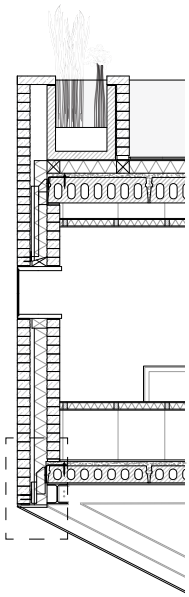
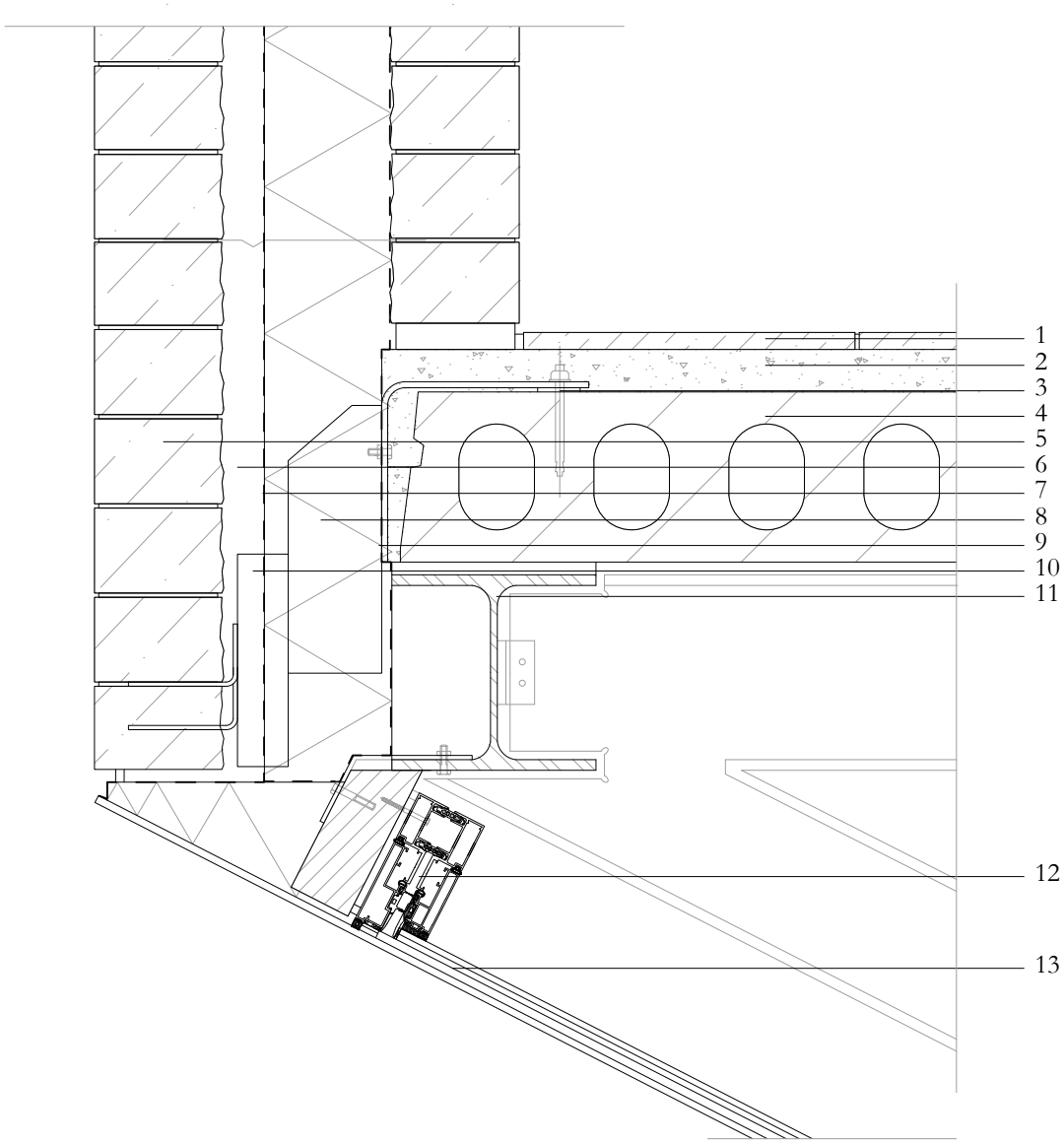


Detail A3
Scale 1:10

1. Natural stone slabs
2. Screed
3. Floor bolts
4. Hollow core slab floor 200mm
5. Glued natural stone
6. Air cavity
7. Waterproof layer
8. Insulation 150mm
9. Vapor seal
10. Steel stone carrier
11. Steel truss
12. Window frame
13. Layered glass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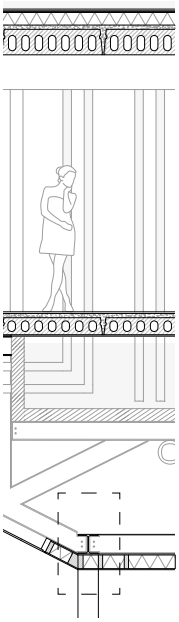
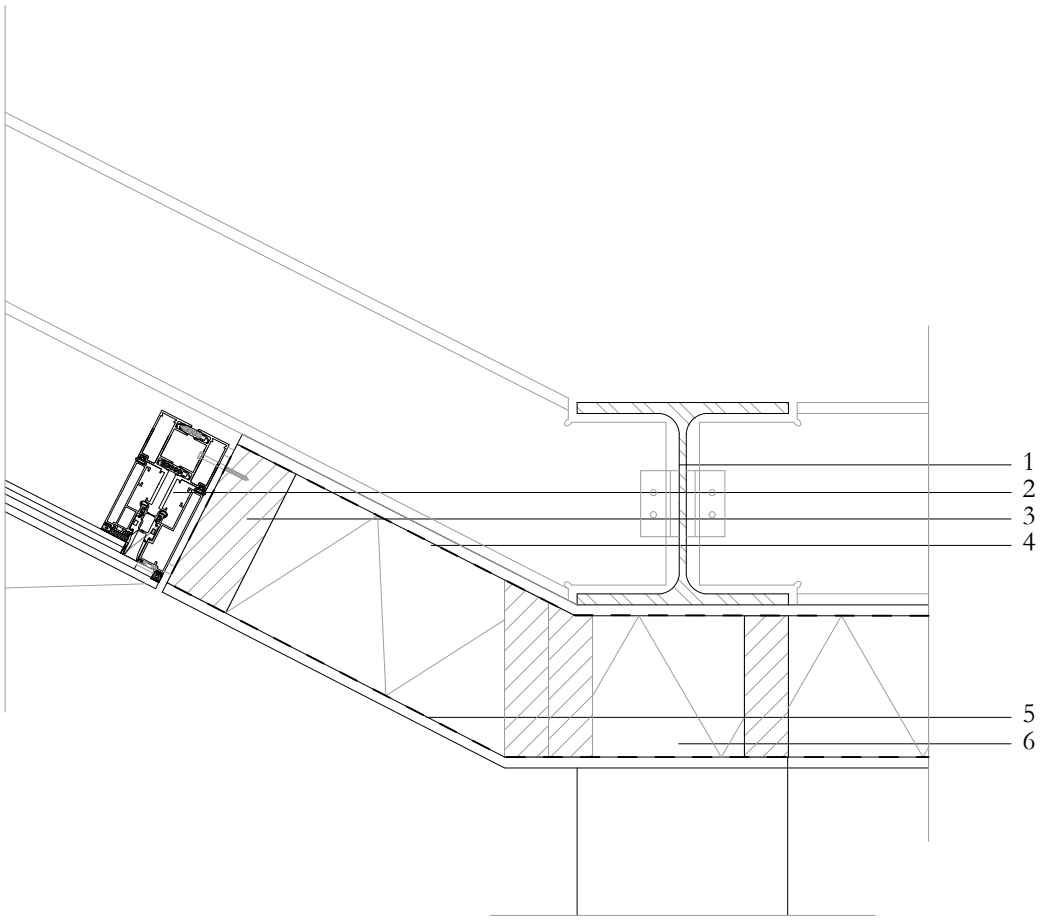


Detail A4
Scale 1:10

1. Steel truss
2. Window frame
3. Insulated timber frame 150mm
4. Vapor seal
5. Waterproof layer
6. Chemical anchor thermally interrupted from construction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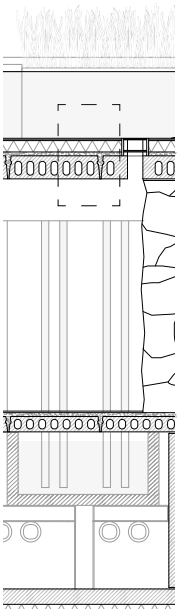
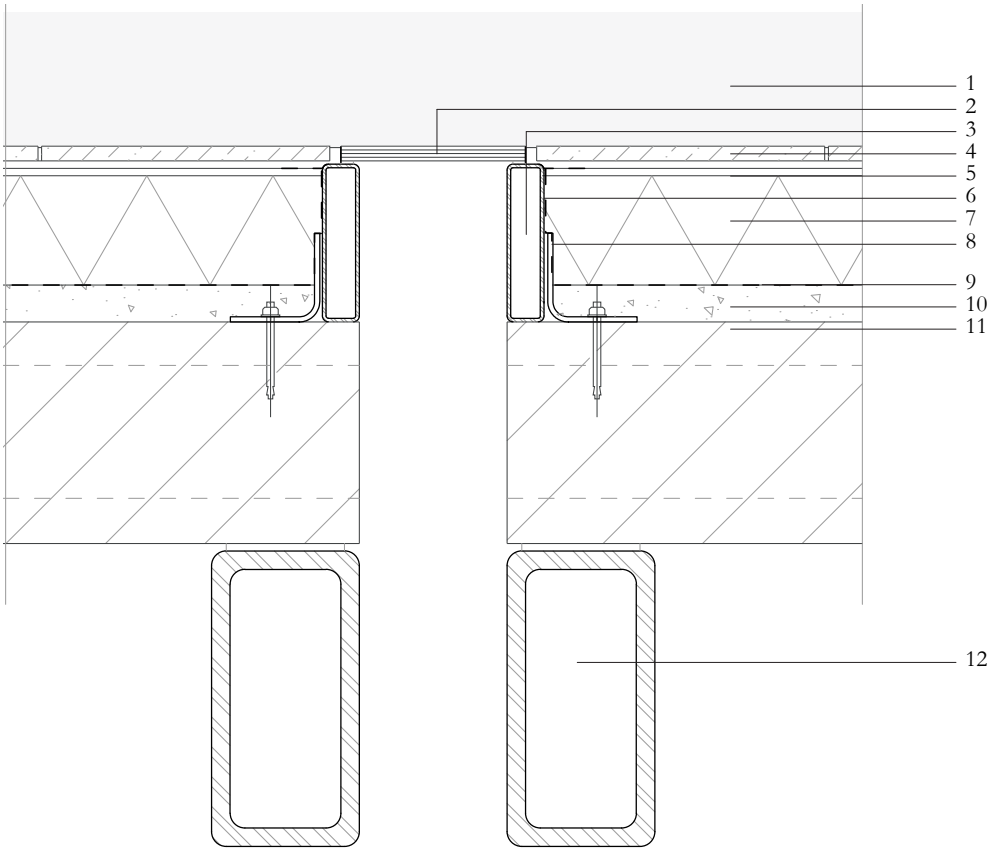


Detail B1
Scale 1:10

1. Heated water
2. Layered glass
3. Steel framework
4. Natural stone slabs
5. Pool liner
6. Waterproof layer
7. Foamglass insulation 150mm
8. Steel fortification
9. Vapor seal
10. Screed
11. Hollow core slab floor 300mm
12. Vierendeel truss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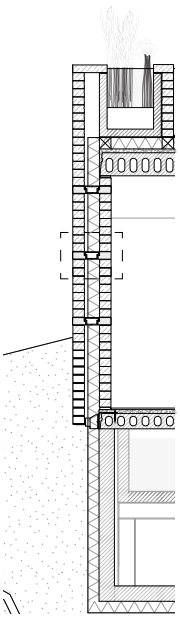
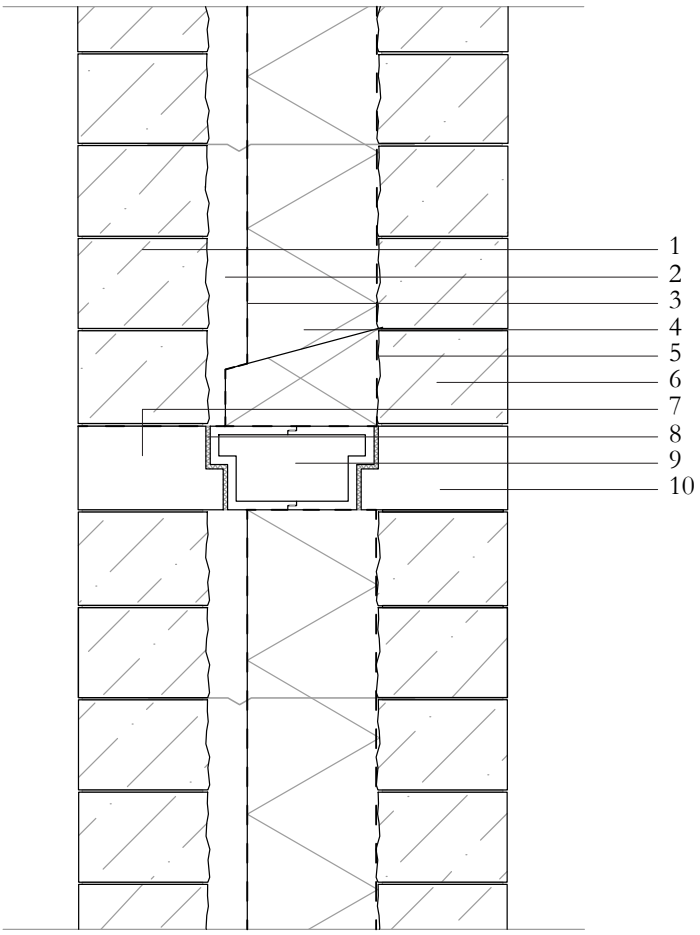


Detail B2
Scale 1:10

1. Glued natural stone
2. Air cavity
3. Waterproof layer
4. Insulation 150mm
5. Vapor seal
6. Glued natural stone
7. Solid glass brick
8. Transparent insulation
9. Hollow glass brick glued in factory
10. Solid glass brick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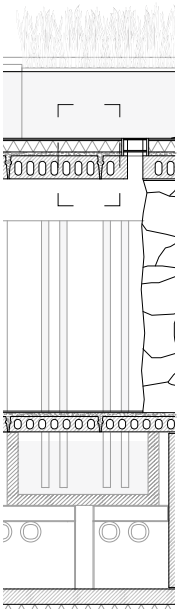
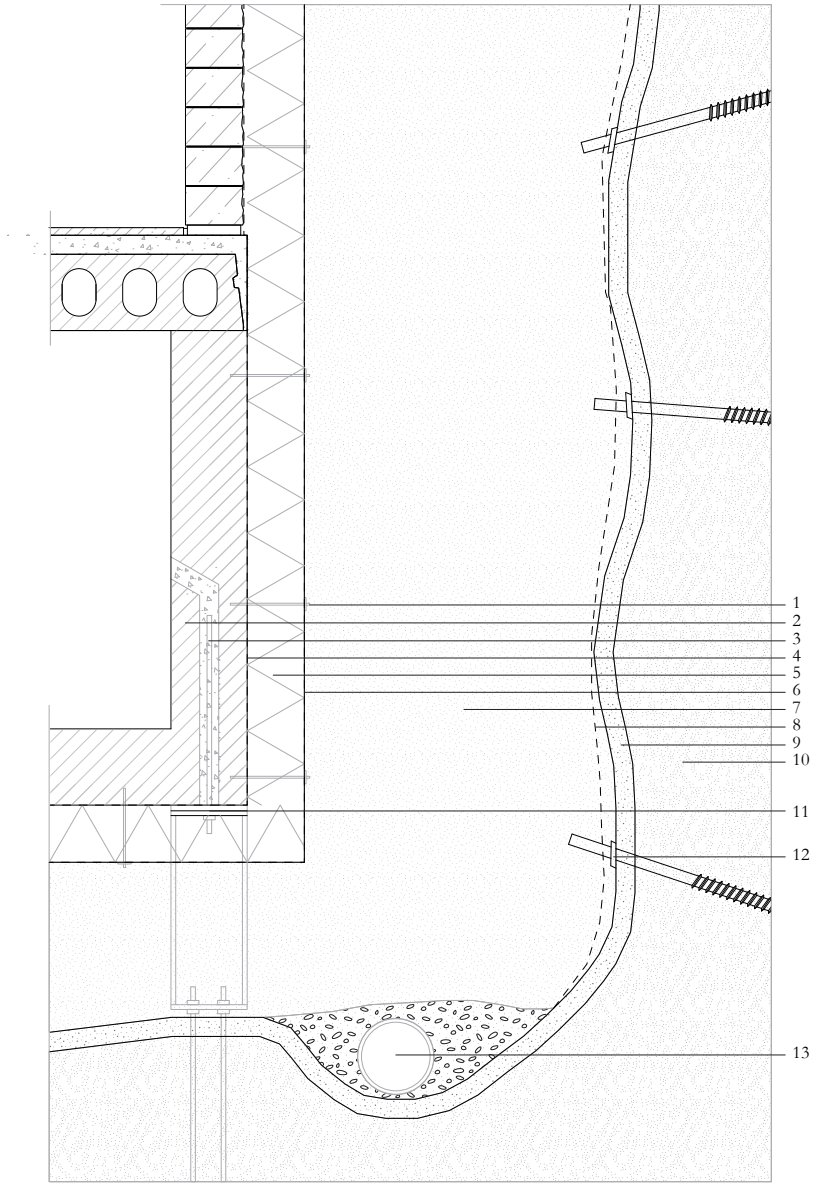


Detail B3
Scale 1:10

1. Insulation anchor
2. Concrete element
3. Anchoring rod filled with concrete
4. Vapor seal
5. Insulation 150mm
6. Waterproof layer
7. Sand
8. Steel netting
9. Sprayed concrete
10. Rock
11. Foundation termally interrupted
12. Chemical anchor
13. Drainage pipe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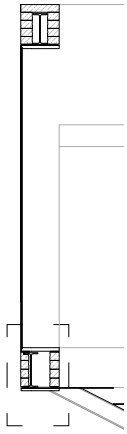
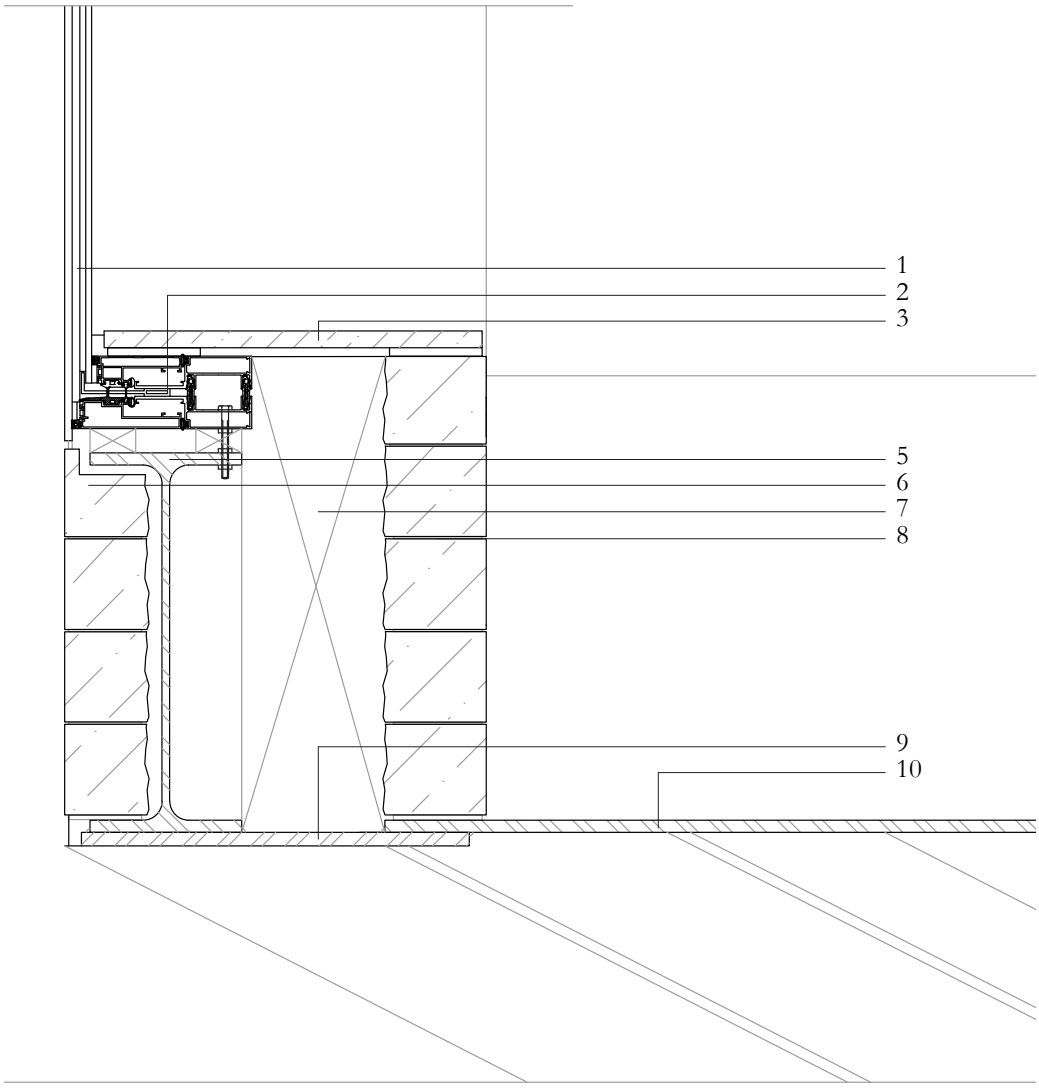


Detail C1
Scale 1:10

1. Layered glass
2. Window frame
3. Natural stone wall cover
5. IPE 450
6. Glued natural stone
7. Fortification for wall cover
8. Glued natural stone
9. Steel plate
10. Steel stairs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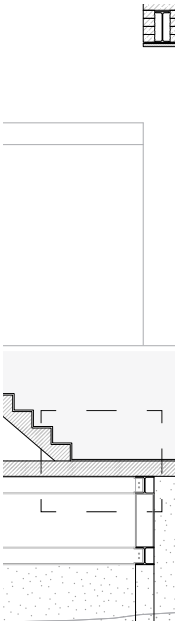
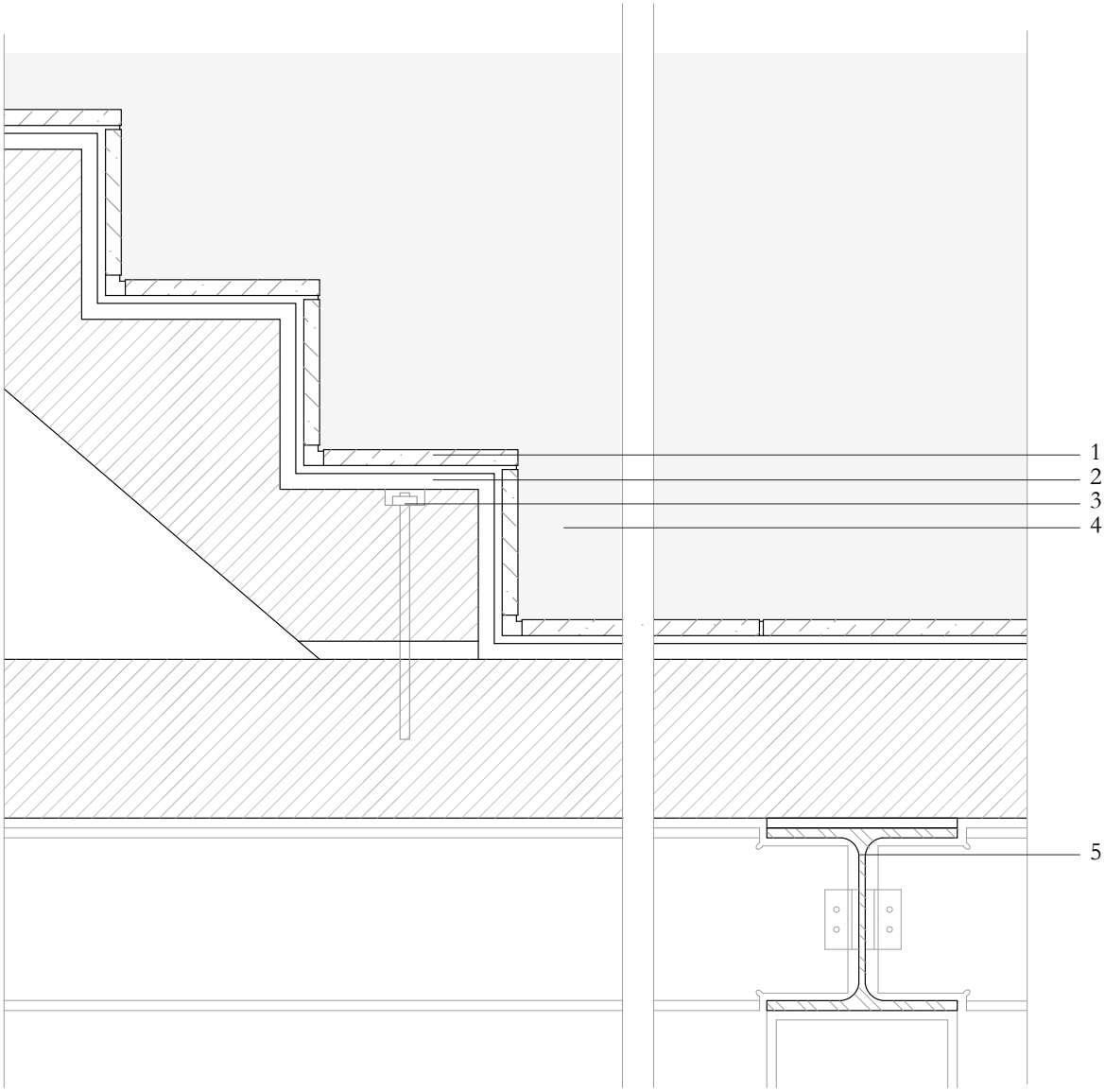


Detail C2
Scale 1:10

1.Natural stone slabs
2. Pool liner
3. Bolt connection
4. Heated water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VII. Conclusion

Post-activation

The analysis and technical development of the flows and the machine utilising the flows exposes the different elements of which the project consists. Its main goal to initialise an energy transition and to expose this are recurring through all elements used in the project. The different technical elements either directly serve the machine by means of guiding the flows, others are used to expose the management of the similar flows. The projects goal can be exposed through two scales.

Firstly, the scale of the bath house and the machine to the two flows which they are exposed to. The building sets to take action by means of form and territorial positioning. The difference between the two flows and two parts of the city are the base for the formation of the integrated disruption piercing the mountain. The proposes a coalescence of climatic and industrial flows embedded within the cultural and traditional act of bathing within the landscape. The combination of elements allow for the exposure of flow management and offer a moment of reflection on ones own position within the energy transition.

Secondly, the larger territorial scale by means of the creation of a new type of industry unlike current imposing industries. It's main goal is set to allow for an integrated experience of processes which are required to reach a finalised product, in this case energy production and utilisation. The opening of the unknown, or formerly enclosed, within territorial specificities known to a site of existence allows for a new perspective on the both the urban and industrial division of cities and our related perception. Our countries, politicians, researchers and hopefully everyone else currently has climate change on their minds and it will inevitably lead to actions, hopefully sooner than later. Yet, if these actions are imposed as we know from previous industrial developments they will lead to multi scalar structural injustice. The project seeks to integrate all aspects for all elements related to or in contact with it's industrial and infrastructural elements. The full integration of all elements provides a beneficial position and in term structural justice. Therefore, the project and all it entails can be reflected upon as a test or trial how these territorial specificities can be integrated. With the final goal of the coalescence of man, machine and territory.