STOREHOUSE OF THE EARTH

To Document the Fast-Changing Environment

by

Namjoo Kim

Bachelor of Architecture
Korea University, 2012

SUBMITTED TO THE DEPARTMENT OF ARCHITECTURE IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARCHITECTURE AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY
FEBRUARY 2016

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Namjoo Kim

Submitted to the Department of Architecture
on January 14, 2016 in partial fulfillment of the
requirements for the Degree of
Master of Architecture

ABSTRACT

In the book Silent Spring, Rachel Carson argues that humans are one species that could modify its surroundings so drastically as to cause damage to the Earth. Currently, as a consequence of accumulated modification, the rapidity of environmental change accelerates and causes hazards all over the world. Though the earth is always changing, the current speed of change is unprecedented and problematic.

The site of this thesis, the Rhone glacier and surrounding area, shows the drsatic speed of change. The Rhone glacier, 11,500 years old, is one of the oldest glaciers in the Alps. However, scientists estimate that this glacier, along with 94% others in the Alps, will disappear in 100 years due to climate warming. When the environment changes slowly flora and fauna can adapt to the change. However, species that are vulnerable to small changes become extinct.

Numerous disciplines document the alarming changes taking place including art, science, photography, and film. Each uses unconventional methods to document the rapidly-changing world. I call this new type of documentation culture the "culture of capture." Its preconditions are [1] a shared concern about the extinction of species and the loss of the landscape and [2] the use of new technology to document every detail of change.

This thesis argues that architecture is a unique medium that can both document the changing environment as well as have a positive impact on the physical form. I propose two architectural interventions: a 'glacier blanket' and a 'mountain hat' to delay change and to archive the physical remnants of the melting glacier and nival plants. The future scenario of the site, which consists of four aspects, Glacier retreat, Bio-Diversity, Tourism, and Infrastructure, is complicated and constantly varying. The architectural documentation will also be an intricate system that adapts its function and form.

Thesis Supervisor: J. Meejin Yoon
Title: Head, Department of Architecture
Professor of Architecture

ACKNOWLEDGMENTS

This thesis would have been impossible without supports from my committee members, friends, and my family.

Meejin, thank you for your excellent guidance, caring and sharp criticism throughout the whole process. I have felt truly happy to have had the chance to work with you during my thesis time.

Miho, thank you for being with me during my time at MIT from Surabaya studio and giving me positive and brilliant feedback always.

Rania, thank you for your trust and sincere support from the begging of this journey. Without your trust, this thesis wouldn't be the same.

Caitlin, thank you for your insight and acute comments on both design and structure that have helped me to complete the thesis.

Dr. Michael Zemp and Daia in Switzerland, thank you for accepting my request to visit you and introducing me to new perspectives.

Youngjin, Byongjun, thank you for providing me your excellent drawing and model making skills during the last days. **Joohui, Jayong and Soyeon**, thank you for giving valuable time for the final push.

Lee Kyoung, Chaewon, and Dan, thank you for making every day in the studio and sending me your positive energy.

Mom and Dad, thank you for being my best friends, my biggest fans, and my role models.

God, everything was possible only because of you.

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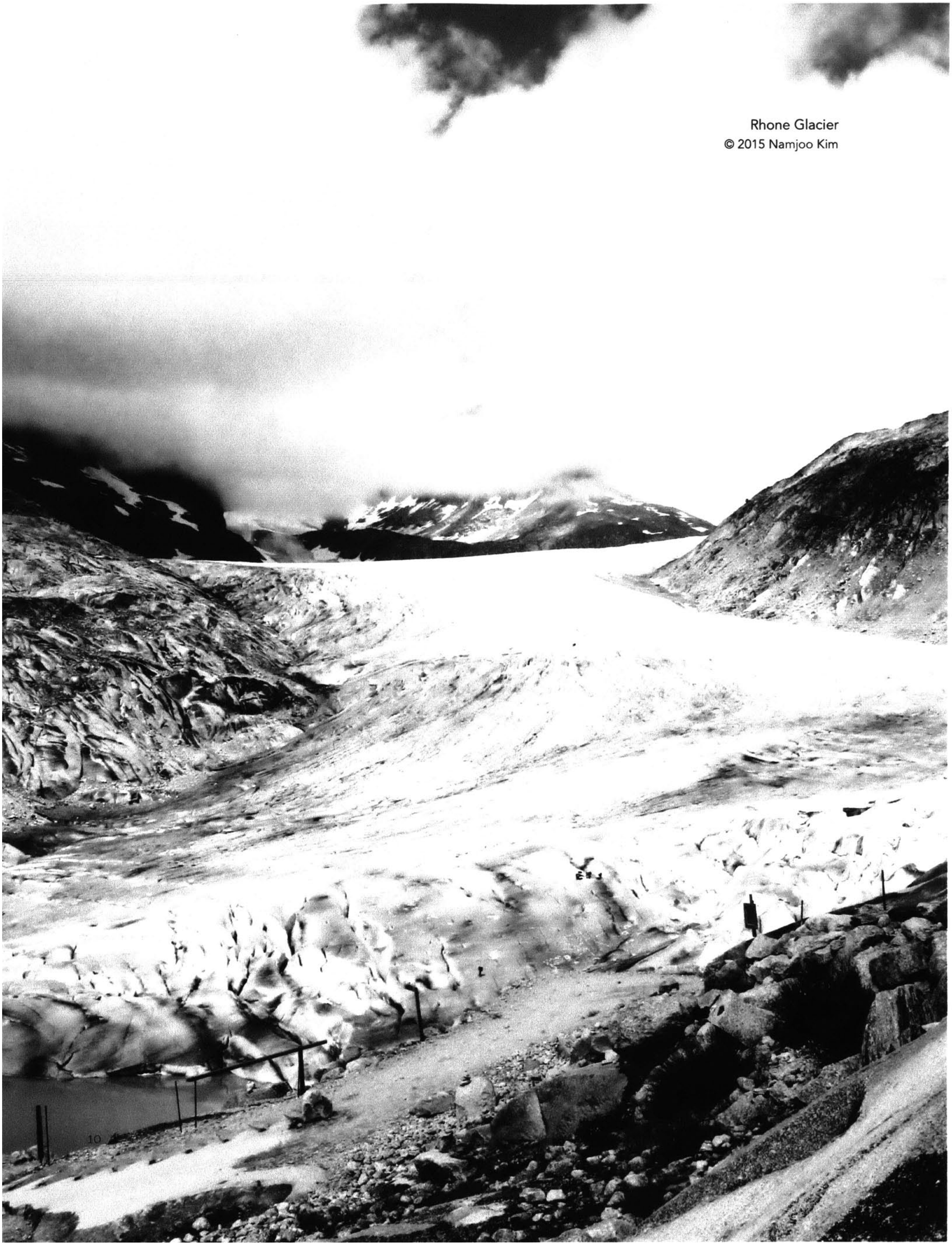
The history of life on earth has been a history of interaction between living things and their surroundings. To a large extent, the physical form and the habits of the earth's vegetation and its animal life have been molded by the environment. Considering the whole span of earthly time, the opposite effect, in which life actually modifies its surroundings, has been relatively slight. Only within the moment of time represented by the present century has one species-man- acquired significant power to alter the nature of his world.

Rachel Carson, Silent Spring



Rhone Glacier
© 2015 Namjoo Kim

1

INTRODUCTION

Storehouse of the Earth, an architectural Documentation

Introduction

STOREHOUSE OF THE EARTH

In the book Silent Spring, Rachel Carson argues that humans are one species that could modify its surroundings so drastically as to cause damage to the Earth. Currently, as a consequence of accumulated modification, the rapidity of environmental change has accelerated and has caused hazards all over the world. Though the earth is always changing, the current speed of change is unprecedented and problematic.

The site of this thesis, the Rhone glacier and surrounding area, shows the drastic speed of change. The Rhone glacier, 11,500 years old, is one of the oldest glaciers in the Alps. However, scientists estimate that this glacier, along with 94% others in the Alps, will disappear in 100 years due to climate warming.[1] When the environment changes slowly flora and fauna can adapt to the change. However, when the speed of change is rapid like today, species that are vulnerable to small changes become extinct.

Numerous disciplines document the alarming changes taking place including art, science, photography, and film. Each uses unconventional methods to document the rapidly-changing world such as replicating, scaling, capturing etc. I call this new type of documentation culture the "culture of capture." Its preconditions are [1] a shared concern about the extinction of species and the loss of the landscape and [2] the use of new technology to document every detail of change.

This thesis argues that architecture is a unique medium that can both document the changing environment as well as have a positive impact on the physical form. I propose two architectural interventions: a 'glacier blanket' and 'mountain hat' to delay change and to archive the physical remnants of the melting glacier and endangered nival plants.

The **future scenario** in which this thesis is projected consist of four categories, Glacier retreat, Bio-Diversity, Tourism, and Infrastructure. I have extracted the future scenario that I use in this thesis from different disciplines such as climatology, glaciology, geology, biology, economy and policy. Each of this discipline has its own scenarios, which stands alone. I drew from these multiple scenarios to make one combined scenario where architecture can intervene in.

Glacier

The Switzerland glacier is melting every year, with 18% of the ice having disappeared in the last 20 years. Thus, there are a series of efforts to slow down this environmental change. For example, the oldest part of the Alps is covered by a giant white cloth, which reflects the sunlight in order to diminish the melting. The Andermatt ski-lift company had covered 2,500 square meters using polyester and polypropylene fabric, which was produced by nonwoven manufacturer in Switzerland.

Bio Diversity

The future scenario for bio diversity predicts the migration of alpine plants and trees will invade the upper elevation zone and disintegrate the nival plant habitat above 2800m, which is called summit trap phenomena. The high mountain plants are venerable to the environment change so they are used as a sensitive bio indicator of mountatin area. The upward shift of treelines and alpine plants are already witnessed and in the future, the nival plant such as Saxifraga exarata and S. oppositifolia eventually become extinct.[2]

Tourism + Infra Structure

The future environmental change also affect human economy including tourism and infra structure. Every year, around 120 million tourists visit the Alps: The area of ski resort area exceed 3,400 km2 and the network of hiking route in the Switzerland Alps is more than 60,000 km. As the glacier and permafrost melt, more proglacial lakes will be created and the natural hazards such as landslides, avalanches and floods threaten the villages in this region.

The **architectural documentation** here is an intricate system, which is composed of many elements that are related to four categories in the future scenario. The form and function of this architectural documentation will change to adapt to the environmental change. This thesis propose an occupiable documentation; therefore, in this thesis, architecture is both a medium to document and a space to archive. Finally, this thesis will propose a new relationship between architecture and the environment by becoming a storehouse of the earth.

1 Wallinga and S.W. Van de Wal, "Sensitivity of Rhonegletscher, Switzerland, to Climate Change: Experiments with a One-Dimensional Flowline Model.", 390

2 Gottfried et al., "A Fine-Scaled Predictive Model for Changes in Species Distribution Patterns of High Mountain Plants Induced by Climate Warming.", 250

Rhone Glacier from Gletsch

2

NEW METHOD OF DOCUMENTATION

Background Research: Documentation in the Fast-Changing Environment

New Method of Documentation

2.1 CULTURE OF CAPTURE

Numerous disciplines document the alarming changes taking place including art, science, photography, and film. Each uses unconventional methods to document the rapidly-changing world such as replicating, scaling, capturing etc. I call this new type of documentation culture the "culture of capture." Its preconditions are

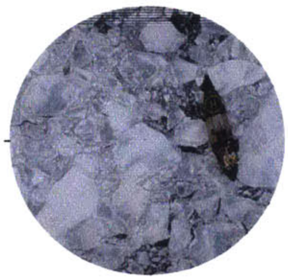
[1] A shared concern about the extinction of species and the loss of the landscape

[2] The use of new technology to document every detail of change.

As the capacity of the storage medium becomes almost unlimited and 3d scanning technology has a capability to scan the exact form of landscapes or buildings, people can store every detail of the world in digital form. This enables artists, researchers, and film directors to record and archive the precise replication of the endangered environment, especially landscapes, and this become a new type of documentation culture. For example, 'Cyark', which is an international Non-Profit Organization, is working on creating 3D digital models of the world's cultural heritage sites in order to ensure that the next generation can share the same knowledge with us regardless of the condition of the physical sites. Another example is "Frozen Relics" project that scanned the arctic floes and recreated them in a gallery space so that people could observe the secret of the arctic landscape.

CATALOGUE

Replicating / Scaling



Frozen Relic: Arctic Works
Scanlab
© Nick Cobbing/Greenpeace

Italian Limes
Folder and collaborators

The Sigirino landscape Project
LVML, at ETH

Digital Mapping

Field Expedition: Mongolia
National Geographic

Ascii-Art Mapping
J. M. Adovasio

Freezing

The Frozen Ark
The Frozen Ark

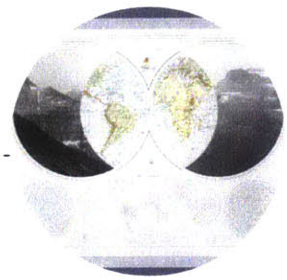
•------- Dissection diagram is attached

I categorize documentation projects under the culture of capture according to the method they use. There are seven categories: Replicating, Scaling, Digital Mapping, Collage, Capturing, Freezing, and Abstracting. Especially, replicating and scaling are very interesting methods to document the landscapes, since they can replicate the original form precisely and display it in various sizes.

This thesis argue that architecture can borrow these methods from other media to communicate with the public and evoke a powerful memory of landscapes. This thesis also wants to demonstrate that architecture has a capability to document the outside world by itself instead of being a container of other media. This is a very interesting argument because historically, architecture has been a repository of maps, art, and documents but not an active medium to document the world. The next chapter will discuss the history of architecture as a repository.

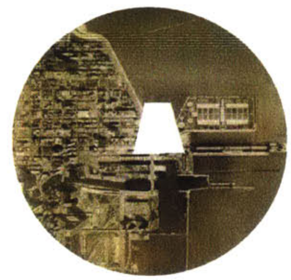
CATALOGUE

Collage



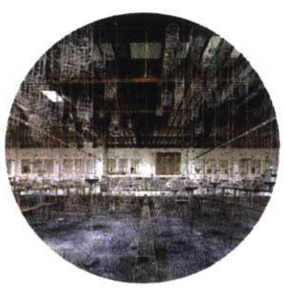
The Victory Atlas
Elena Damiani

Traces of Nature in Japanese Suburbs
Yukiko Suto



Early Map Works
Sol LeWitt

Capturing

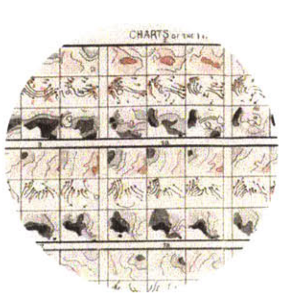


Heterotopia, the Tragic Fall
Vincent J.Stoker

the Landsat Program
NASA

The Ethics of Dust
Jorge Otero-Pailos

Abstraction



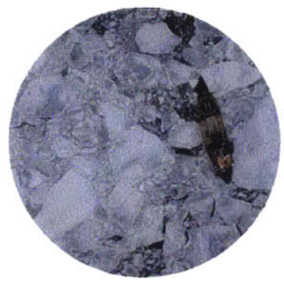
Meteorographica
Francis Galton

The Map as an Artistic Territory
Eduard Imhof

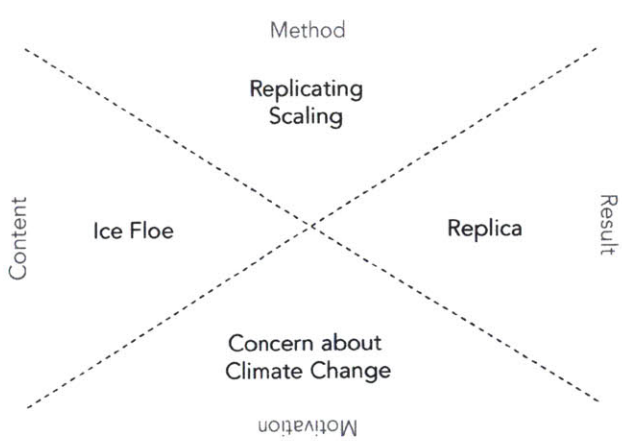
Mnemosyne Atlas
Aby Warburg

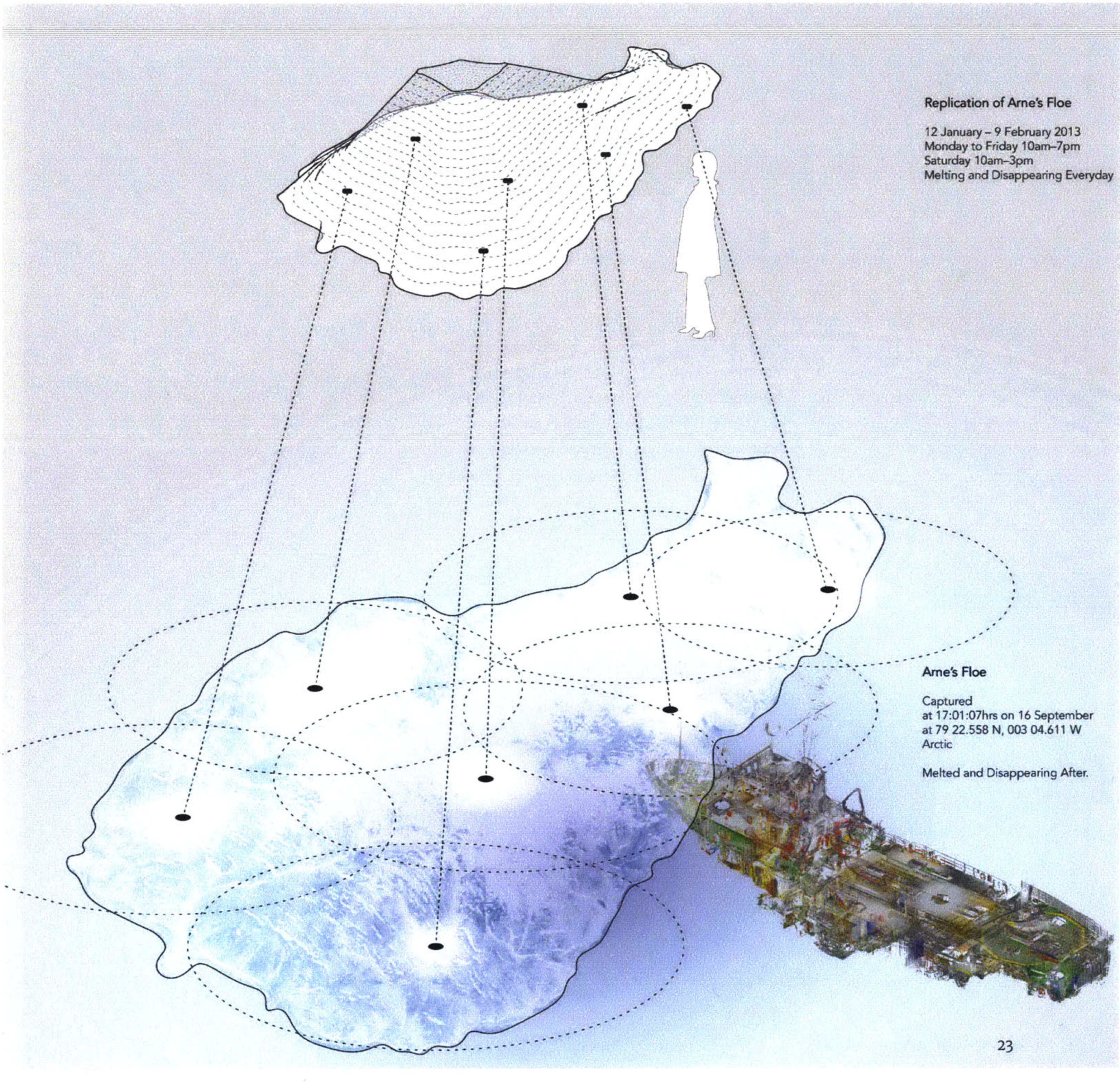
Dissection Diagram 01

Replicating / Scaling



Project Name	Frozen Relic: Arctic Works
People	Scanlab
Method	Scanning /Replicating / Scaling
Contents	Ice Floe, Landscape
Motivation	The Melting Glaciers Display
Discrepancy	Very Low
Year	2014
Type	Digitnal Document

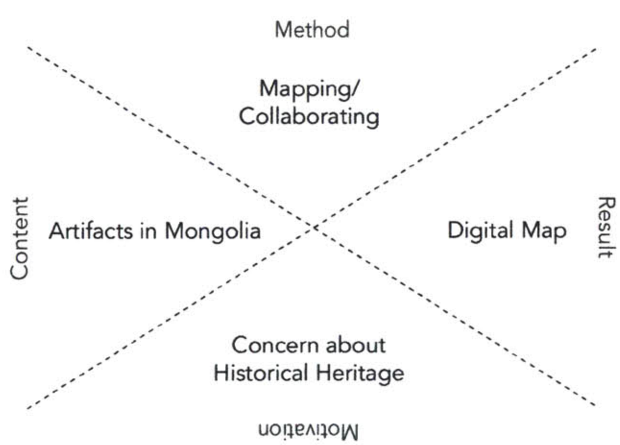


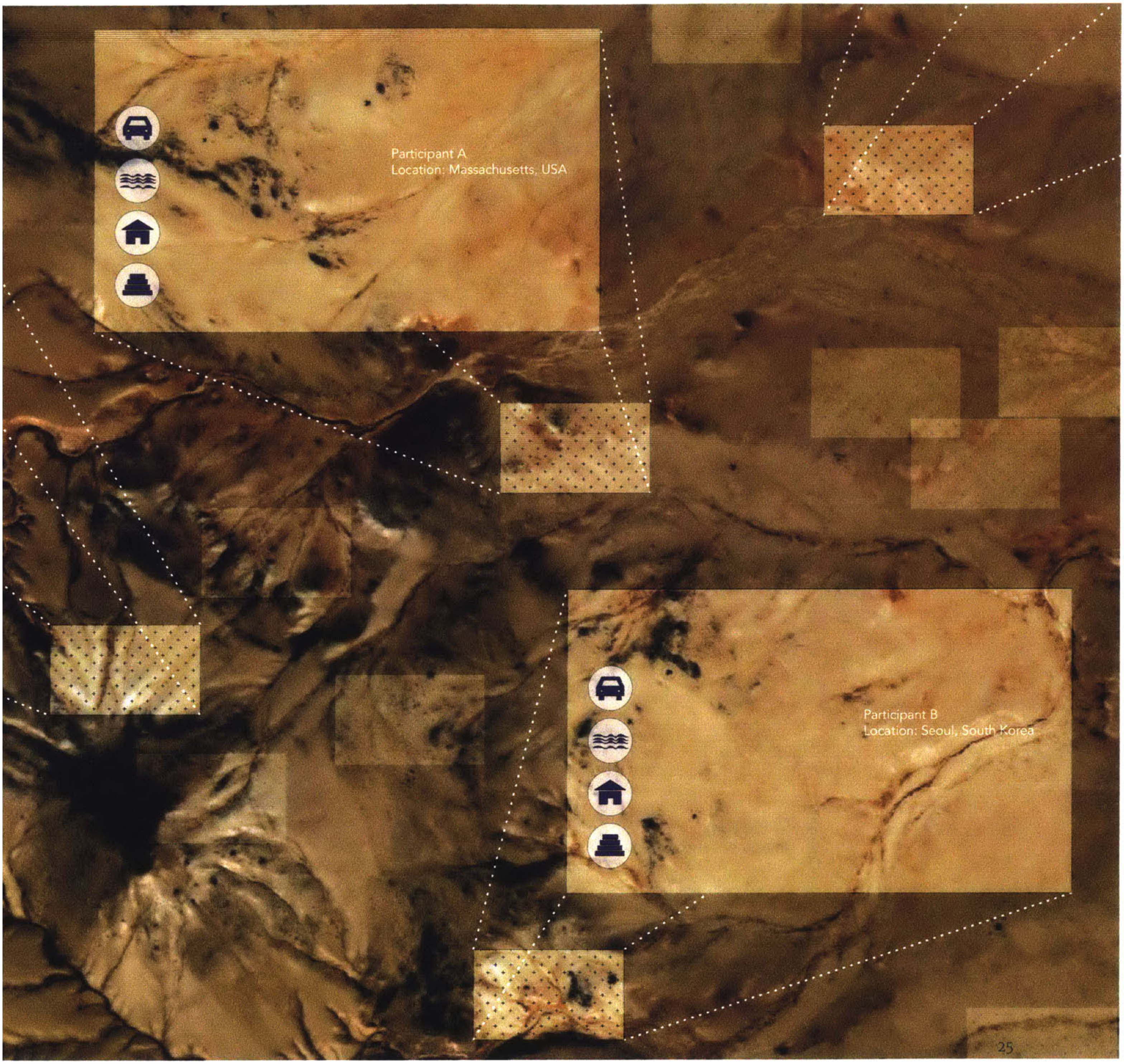

Replication of Arne's Floe
12 January – 9 February 2013
Monday to Friday 10am–7pm
Saturday 10am–3pm
Melting and Disappearing Everyday
Arne's Floe
Captured
at 17:01:07hrs on 16 September
at 79 22.558 N, 003 04.611 W
Arctic
Melted and Disappearing After.

Dissection Diagram 02

Digital Mapping

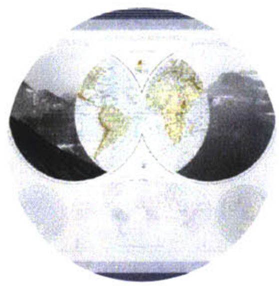
Project Name	Field Expedition: Mongolia
People	National Geographic
Method	Mapping / Collaborating
Contents	Mongolia Landscape
Motivation	Find Ancient Relics
Discrepancy	Getting Lower, Ongoing
Year	Ongoing
Type	Collaboration Work



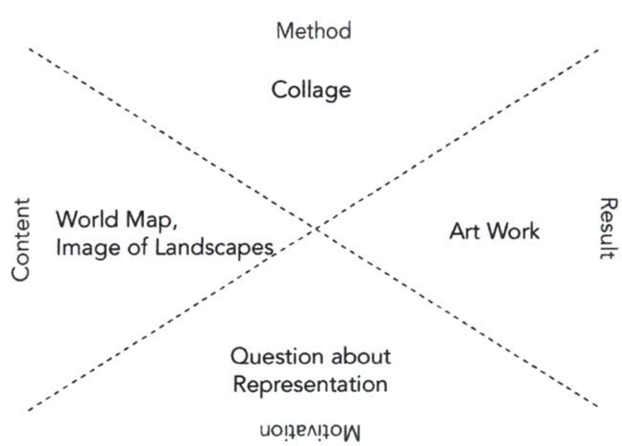

Participant A
Location: Massachusetts, USA
Participant B
Location: Seoul, South Korea

Dissection Diagram 03

Collage



Project Name	The Victory Atlas
People	Elena Damiani
Method	Collage
Contents	Map, Images Of Landscapes
Motivation	Question about the Meaning of Representation
Discrepancy	High, Subjective
Year	2012
Type	Collage



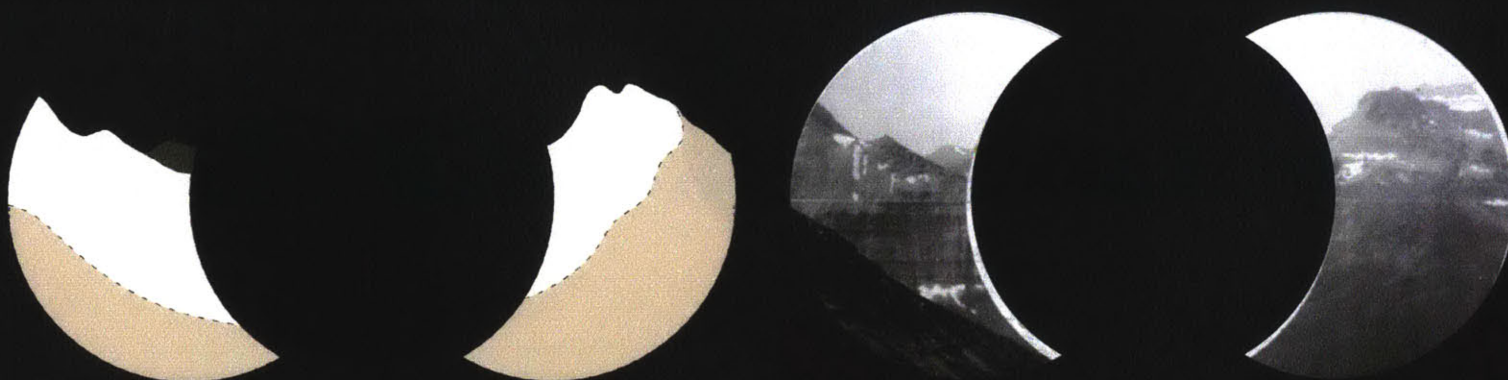
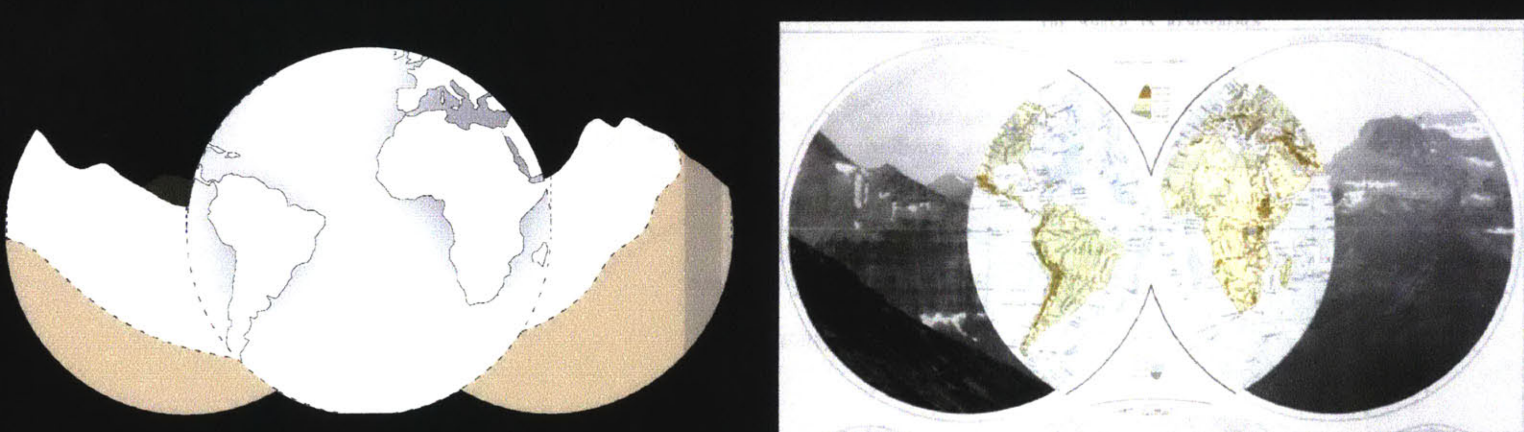


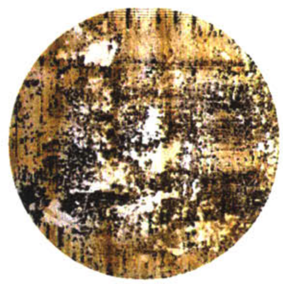
Image of Landscape : Background

Veiled Sections of Map

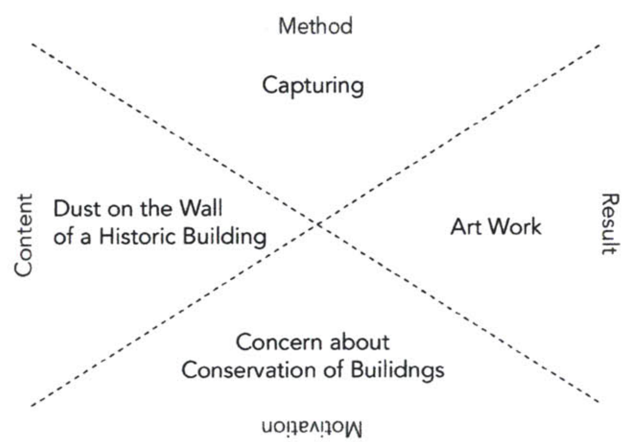


Dissection Diagram 04

Capturing



Project Name	The Ethics Of Dust
People	Jorge Otero-pailos
Method	Capturing (Dust)
Contents	Dust
Motivation	Pollution Display
Discrepancy	Medium
Year	2009
Type	Art Work



Doge's Palace built in 1340
Dirty Wall
Latex Sheet
Latex Sheet with Dust
© 2015 Matthew P. Wright Photography

New Method of Documentation

2.2 ARCHITECTURE TO DOCUMENT

Historically, architecture has provided a space to display the drawings and paintings about landscapes. Cave painting was the earliest example, in which animals and natural environment was stored inside a built form. For example, the Cave of Altamira in Spain, which is believed to have been created between 16,400 and 14,000 years ago, contains detailed figures of animals. The map gallery in Vatican Museum which was built in the 16th century is another example that Italy's geography was documented as the new cartographic techniques were developed. It curated 40 maps of regions or cities in Italy during that period. These historical precedents are repository architecture where other media was stored.

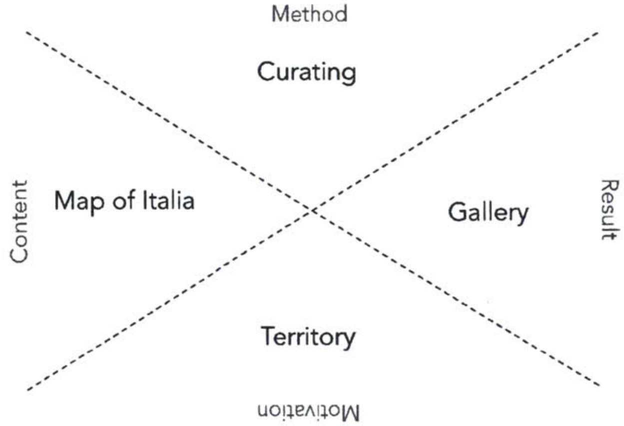
However, this thesis imagines a new architectural typology, the architectural documentation, which is both a medium to document and a space to archive.

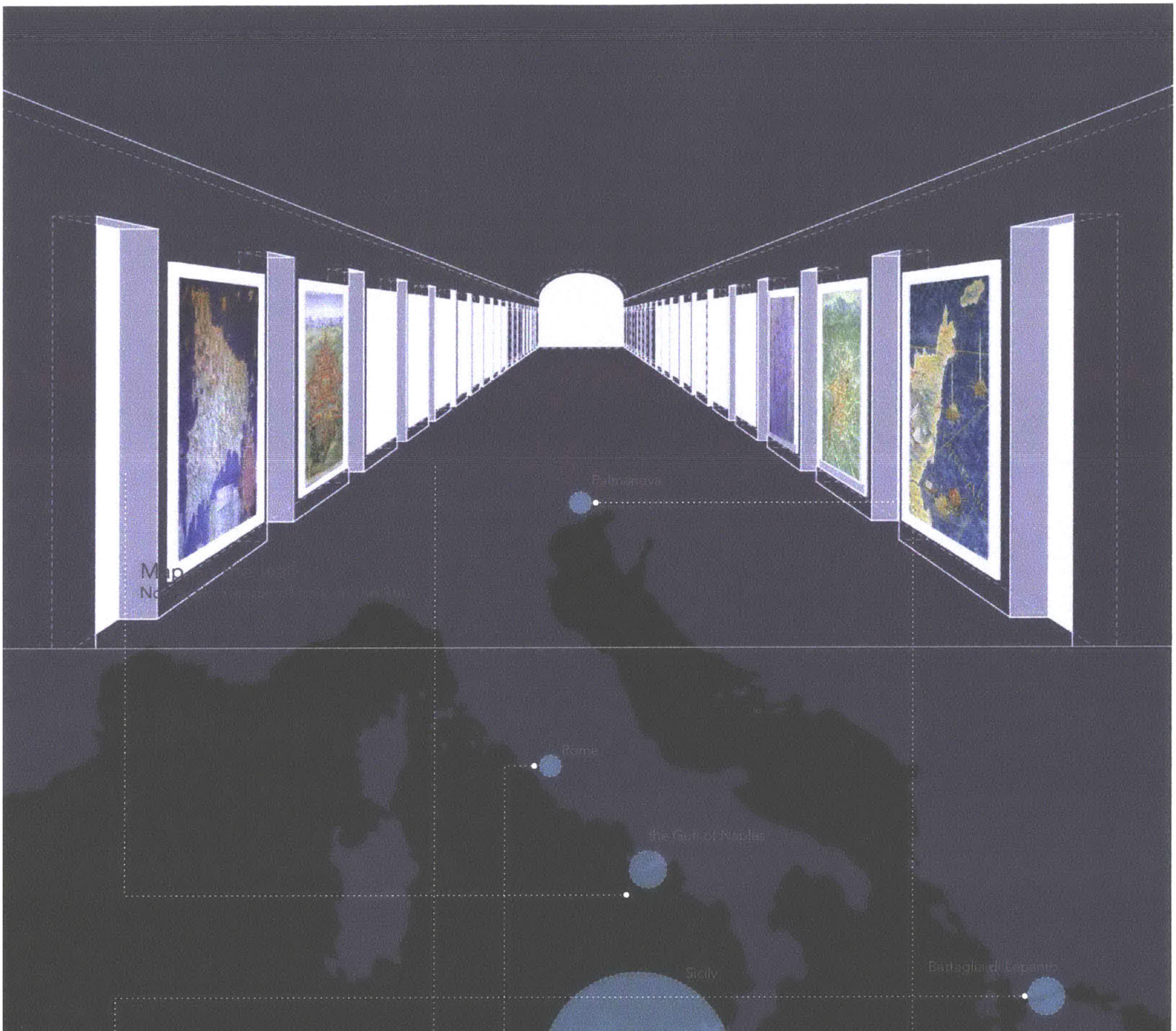
Gallery of the Maps in the Vatican Museum
©https://vaticanpatronscalifornia.org

Galleria Delle Carte Geografiche, Vatican Palace

The Gallery of Maps, 120 Meter Long
Ignazio Danti, 1578 -1580

Perspective Diabram from Franco Cosimo Panini Publisher





Palmanova
Rome
the Gulf of Naples
Sicily
Battaglia di Lepanto

Ice Grotto
© 2015 Namjoo Kim

3

RETREAT OF GLACIERS IN THE ALPS

Background Research: the Switzerland Alps, a rapidly-changing landscape

Retreat of Glaciers in the Alps

3.1 WHY THE ALPS?

An urgent crisis in the 21st century, climate change causes great damage to landscapes, particularly glaciers, which reacts to even small temperature increases. Glaciers have been melting all over the world since the end of the Little Ice Age (around 1850), especially from the late 20th century glaciers have begun retreating rapidly.

The site of this thesis, the Rhone glacier, 11,500 years old, which is one of the oldest glaciers in the Alps shows the drastic speed of change. Scientists estimate that this glacier, along with 94% others in the Alps, will disappear in 100 years due to climate warming.[1]

The melting or retreat of glaciers poses several problems. The glaciers in the Alps are tourist attractions, a natural water source and a buffer against natural hazards.

1 Wallinga and S.W. Van de Wal, "Sensitivity of Rhonegletscher, Switzerland, to Climate Change: Experiments with a One-Dimensional Flowline Model.", 390

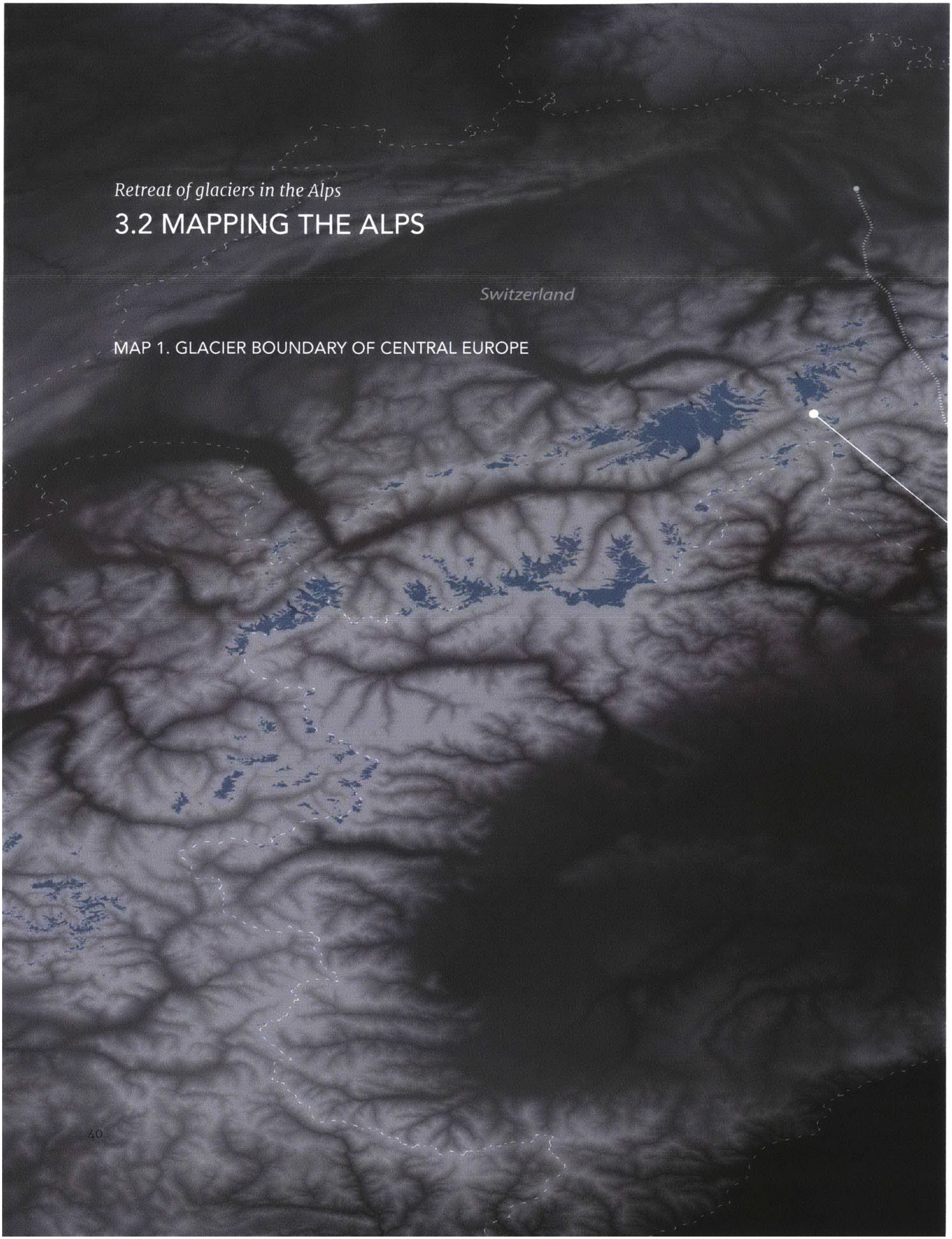
Rhone glacier and Gletsch
© 2015 Namjoo Kim

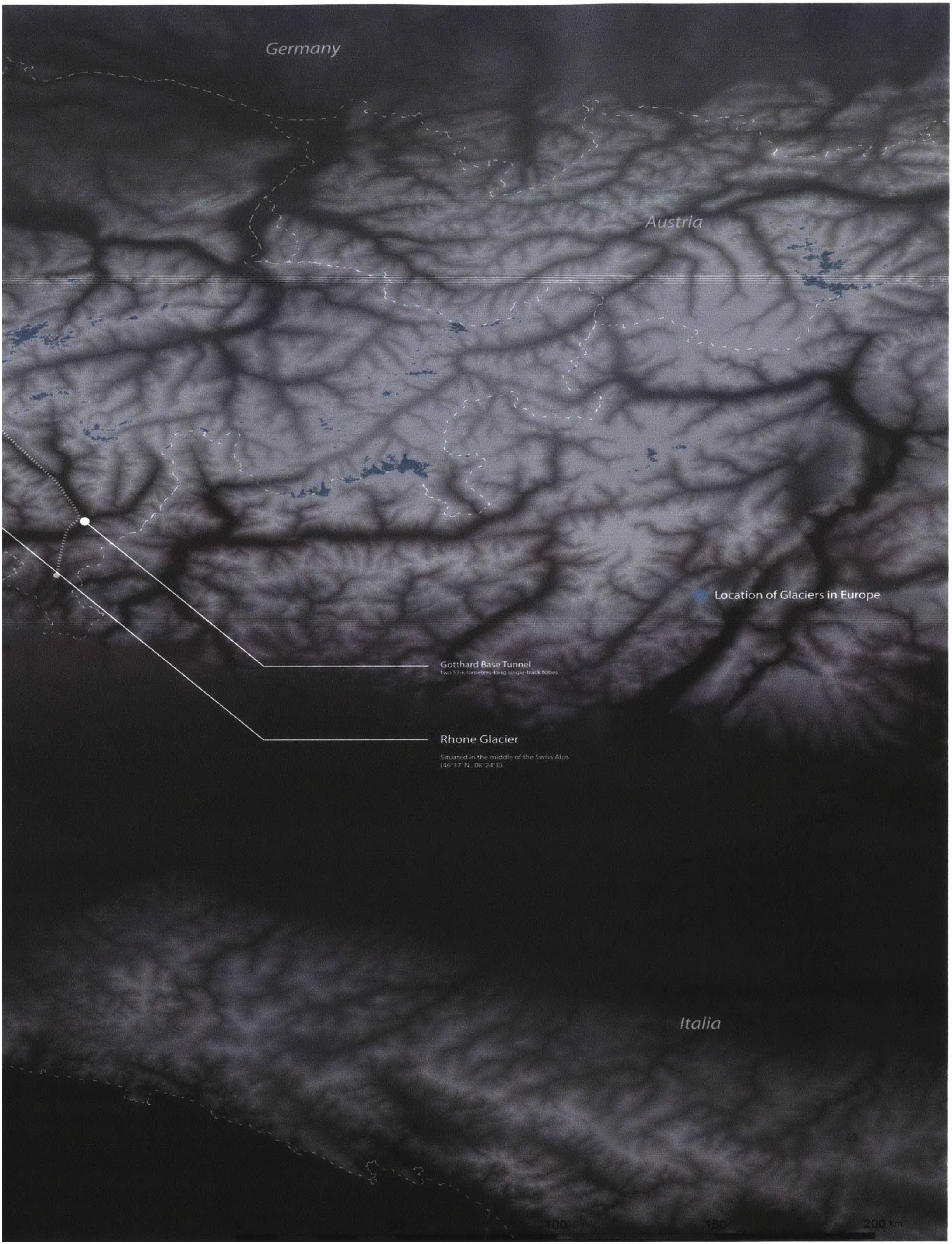
Rhone glacier and Glacier lake
© 2015 Namjoo Kim

Retreat of glaciers in the Alps

3.2 MAPPING THE ALPS

MAP 1. GLACIER BOUNDARY OF CENTRAL EUROPE





Germany
Austria
Location of Glaciers in Europe
Gotthard Base Tunnel
two 57-kilometres-long single-track tubes
Rhone Glacier
Situated in the middle of the Swiss Alps
(46°37' N., 08°24' E).
Italia
0
50
100
150
200 km

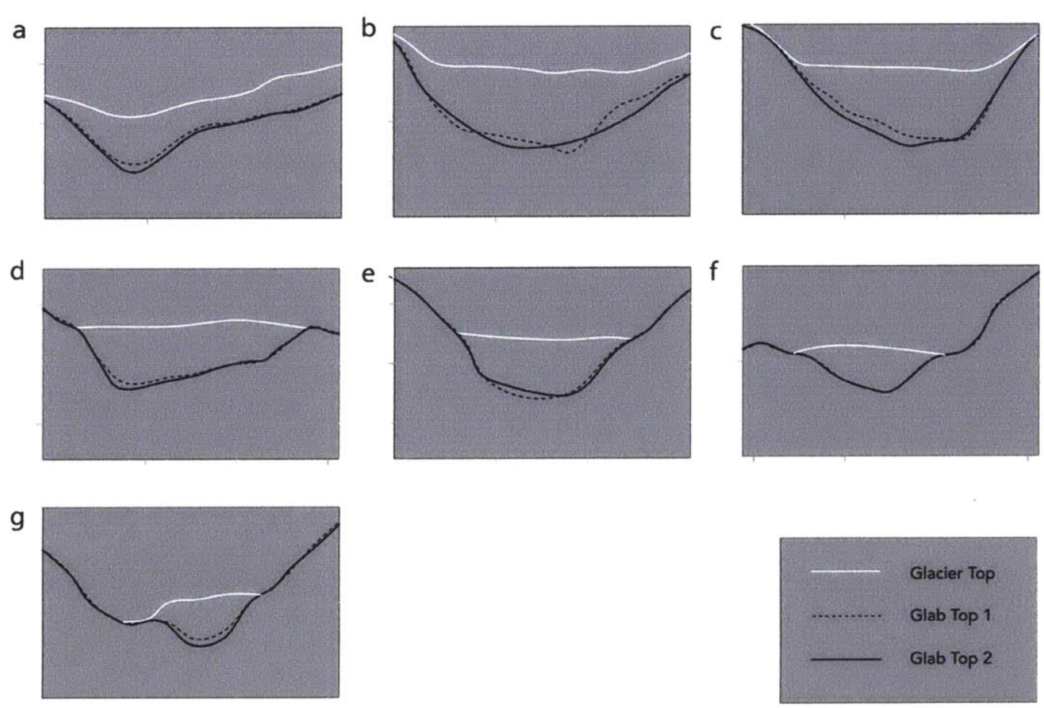
MAP 2. RHONE GLACIER ICE THICKNESS AND BED ROCK SECTION

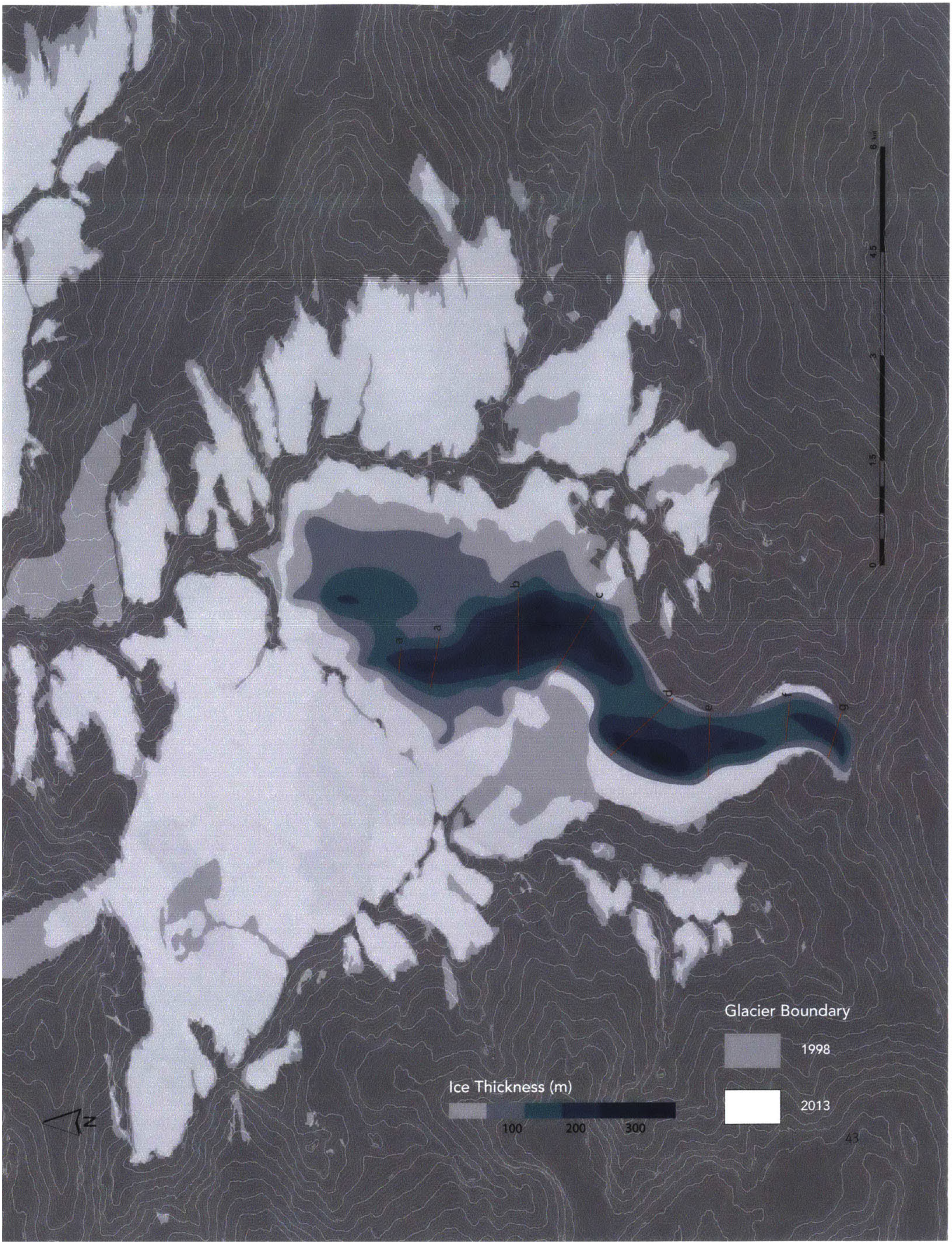
The overdeepening(dark blue in the map) is potential sites for pro-glacial lakes, which is also related to the natural hazards.[1]

Rhone Glacier
1900 (hand-colored postcard)

Rhone Glacier
2004

Calculated Ice-Thickness Distribution

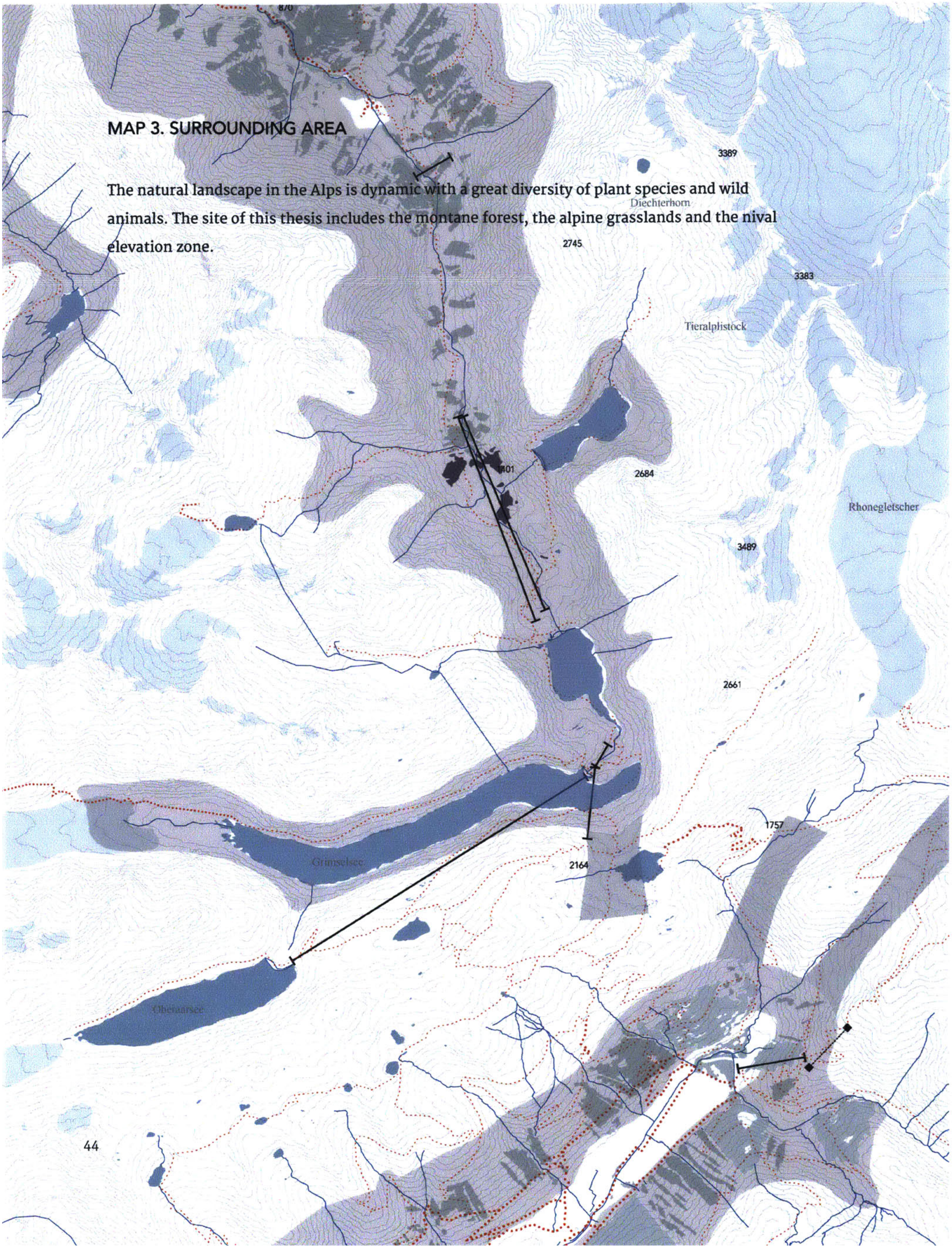


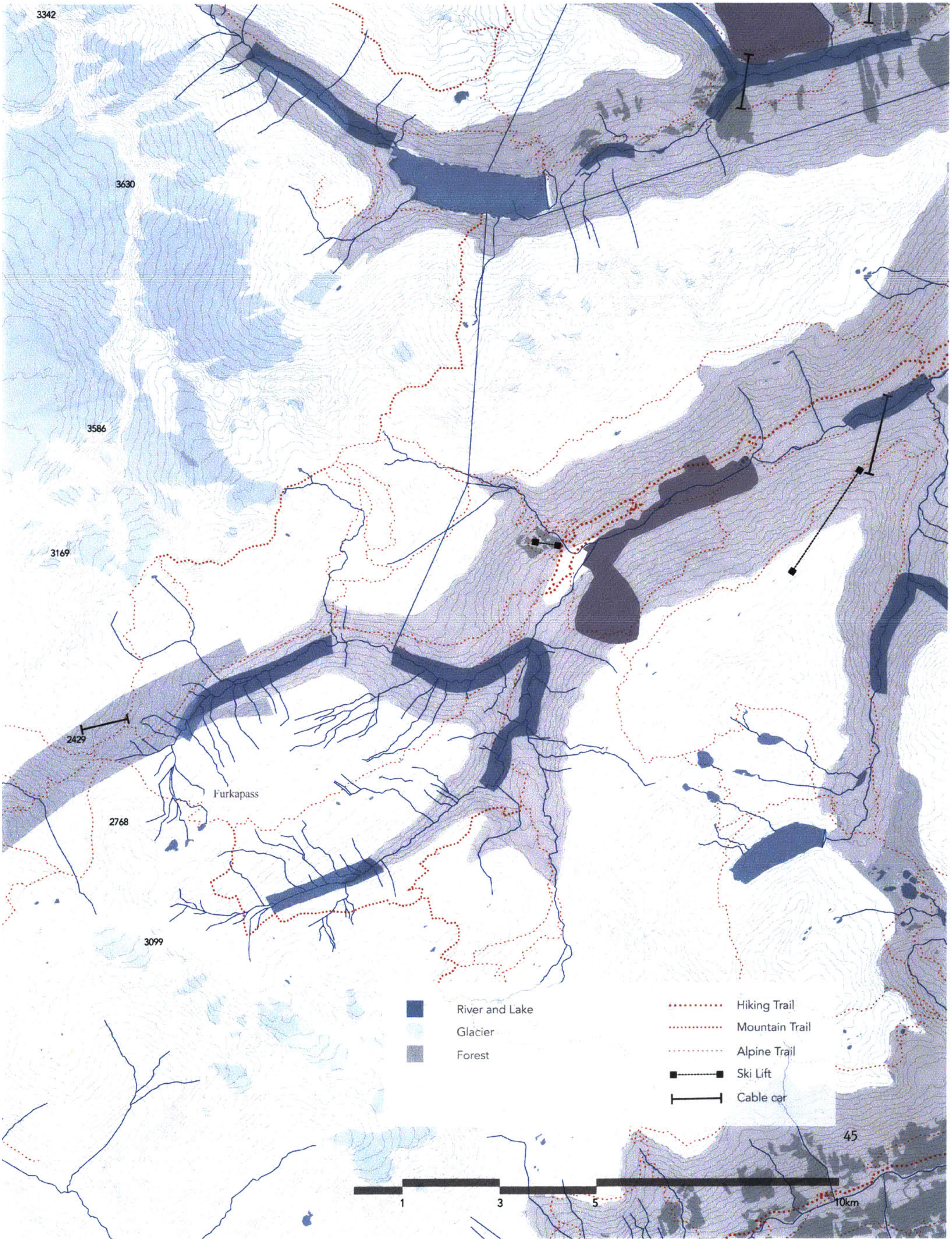


0
1.5
3
4.5
6 km
a
a
b
c
d
e
f
g
N
Ice Thickness (m)
100
200
300
Glacier Boundary
1998
2013

MAP 3. SURROUNDING AREA

The natural landscape in the Alps is dynamic with a great diversity of plant species and wild animals. The site of this thesis includes the montane forest, the alpine grasslands and the nival elevation zone.




3342
3630
3586
3169
2429
Furkapass
2768
3099
River and Lake
Glacier
Forest
Hiking Trail
Mountain Trail
Alpine Trail
Ski Lift
Cable car
1
3
5
10km

The oldest part of the Alps is covered by a giant white cloth, which reflects the sunlight in order to diminish the melting.

© EPA

NOTE

1 Linsbauer, Paul, and Haeberli, "Modeling Glacier Thickness Distribution and Bed Topography over Entire Mountain Ranges with GlabTop." 1

MAP 1

Data adapted from

1. Farr, T. G., and M. Kobrick, 2000, Shuttle Radar Topography Mission produces a wealth of data. Eos Trans. AGU, 81:583-583.
2. GLIMS and NSIDC (2005, updated 2015): Global Land Ice Measurements from Space glacier database. Compiled and made available by the international GLIMS community and the National Snow and Ice Data Center, Boulder CO, U.S.A.

Reproduced by Namjoo Kim

MAP 2

Data adapted from

A. Linsbauer, F. Paul, and W. Haeberli, "Modeling Glacier Thickness Distribution and Bed Topography over Entire Mountain Ranges with GlabTop: Application of a Fast and Robust Approach," Journal of Geophysical Research: Earth Surface 117, no. F3 (September 1, 2012): F03007, doi:10.1029/2011JF002313.

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MAP 3

Data adapted from

http://www.bafu.admin.ch/umwelt/12877/index.html?lang=en

Reproduced by Namjoo Kim

View from the Hiking Route

4

FUTURE SCENARIO

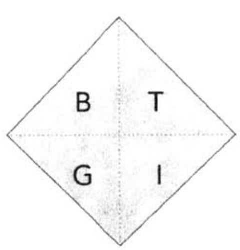
Research on the Four Categories of the Future Scenario

Future Scenario

4.1 FOUR LENSES TO SEE THE FUTURE

The future scenario of this thesis is based on IPCC A1B scenario, which is a moderate version compared to other scenarios (figure 1), because many GCM(Global Climate Model) and RCM(Regional Climate Model) of Europe use A1B scenario to estimate the climate changes in the future. Figure 2 shows the projected global annual mean surface air temperature change under the A1B scenario.

The future scenario in which this thesis is projected consist of four categories, **Glacier retreat, Bio-Diversity, Tourism, and Infrastructure**. I have extracted this four different lenses from different disciplines such as climatology, glaciology, geology, biology, economy and policy. Each of this discipline has its own scenarios, which stands alone. I drew from these multiple scenarios to make one combined scenario where architecture can intervene in.



B : Bio Diversity
G : Glacier
T : Tourism
I : Infra Structure

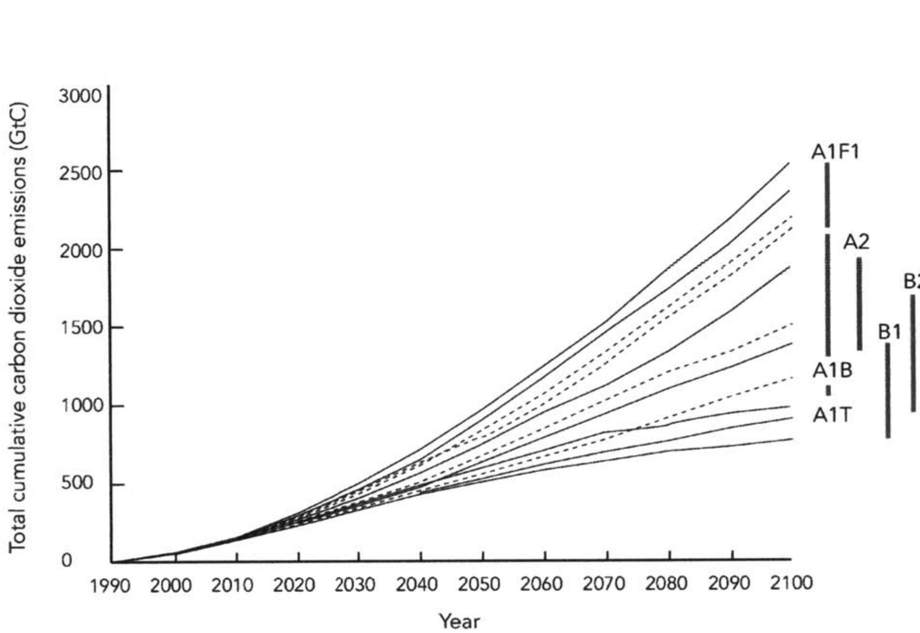


Figure1. Total cumulative carbon dioxide emissions

Figure 1, Data adapted from Nebojsa Nakicenovic and Rob Swart, "Emissions Scenarios" (IPCC, 2000), http://www.ipcc.ch/ipccreports/sres/emission/index.php?idp=0. Reproduced by Namjoo Kim

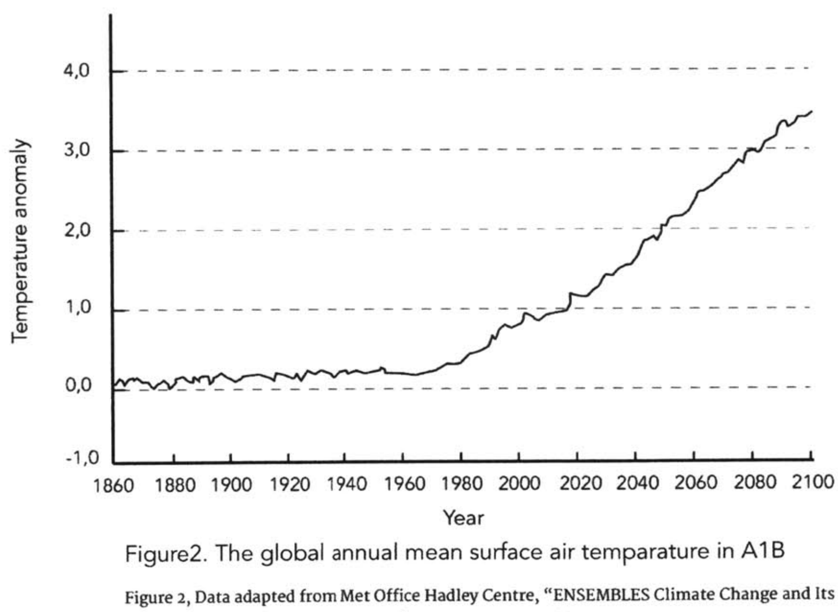


Figure2. The global annual mean surface air temparature in A1B

Figure 2, Data adapted from Met Office Hadley Centre, "ENSEMBLES Climate Change and Its Impacts at Seasonal, Decadal and Centennial Timescales," 2009, www.ensembles-eu.org.
Reproduced by Namjoo Kim

LENSE 1. GLACIER RETREAT

The Switzerland glacier is melting every year, with 18% of the ice having disappeared in the last 20 years.[1] Rhoneglacier, which is the site of this thesis, will also vanish in 100 years. Thus, there are a series of efforts to slow down this environmental change. For example, the oldest part of the Alps is covered by a giant white cloth, which reflects the sunlight in order to diminish the melting. The Andermatt ski-lift company had covered 2,500 square meters using polyester and polypropylene fabric, which was produced by nonwoven manufacturer in Switzerland. However, it is difficult to prevent the melting process of the Alps glaciers.

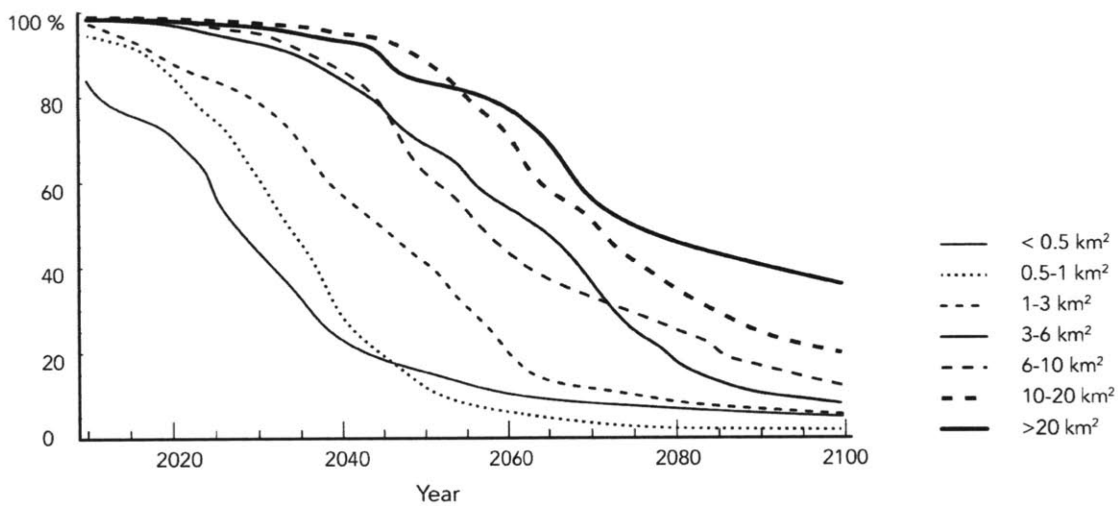


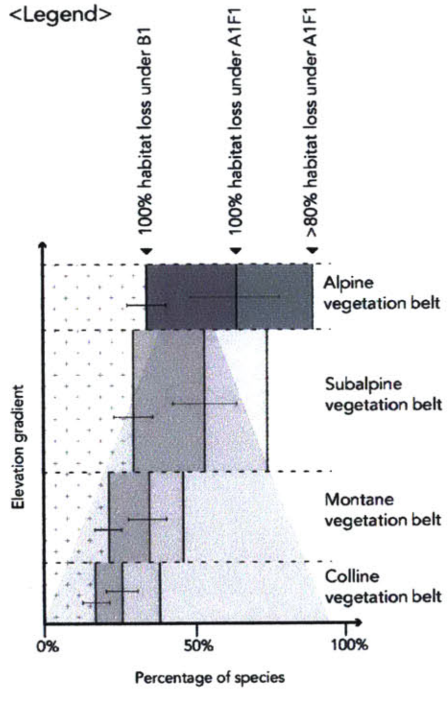
Figure3. Calculated Future Change in Glacier Area

Data adapted from Matthias Huss, "Present and Future Contribution of Glacier Storage Change to Runoff from Macroscale Drainage Basins in Europe," Water Resources Research 47, no. 7 (July 1, 2011): W07511, doi:10.1029/2010WR010299. Reproduced by Namjoo Kim

LENSE 2. BIO DIVERSITY

The future scenario for bio diversity estimates the migration of alpine plants and the upward shift of treeline, which will invade the upper elevation zone and disintegrate the nival plant habitat above 2800m.[2] This is called summit trap phenomena. The upward shift of treelines and alpine plants are already witnessed and in the future, the nival plant such as Saxifraga exarata and S. oppositifolia eventually become extinct.[3] The high mountain plants are used as a sensitive bio indicator of mountain area because they are venerable to the environment change.

<Legend>



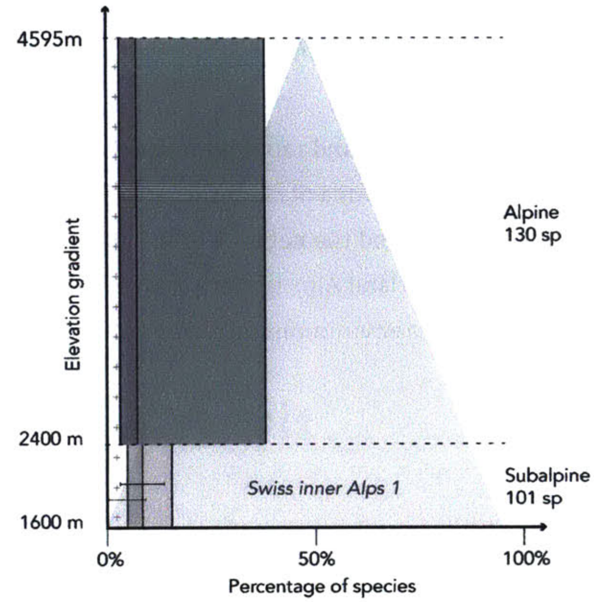


Figure4. Bio Diversity in Switzerland Alps 1

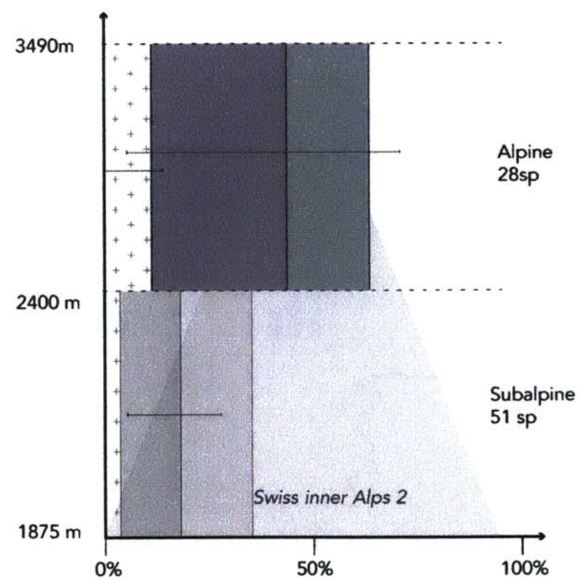


Figure5. Bio Diversity in Switzerland Alps 2

Data adapted from Robin Engler et al., "21st Century Climate Change Threatens Mountain Flora Unequally across Europe," Global Change Biology 17, no. 7 (July 1, 2011): 2330–41, doi:10.1111/j.1365-2486.2010.02393.x. Reproduced by Namjoo Kim

LENSE 3.TOURISM

Every year, around 120 million tourists visit the Alps: The area of ski resort area exceed 3,400 km2 and the network of hiking route in the Switzerland Alps is more than 60,000 km. The future environmental change also affect human economy including tourism and infra structure. Since the snowline is also shift-ing and the landscapes are changing, the ski industry and other tourism industries need to adapt to the future change in order to survive.

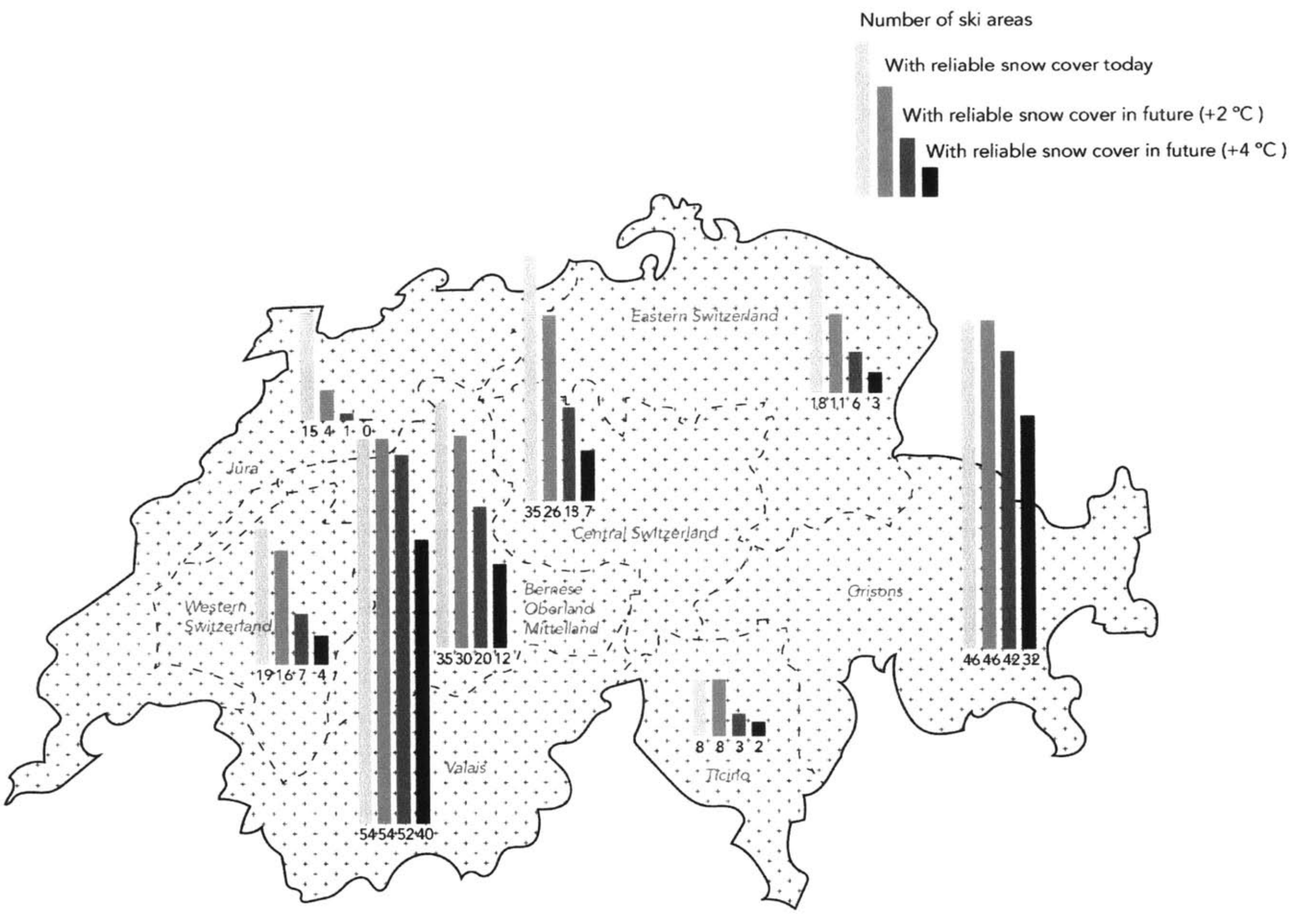


Figure6. Projected changes of the number of ski resorts

Data adapted from Hans Elsasser and Paul Messerli, "The Vulnerability of the Snow Indus-try in the Swiss Alps," Mountain Research and Development 21, no. 4 (November 1, 2001): 335–39, doi:10.1659/0276-4741(2001)021[0335:TVOTSI]2.0.CO;2.Reproduced by Namjoo Kim

LENSE 4. INFRA STRUCTURE

The glaciers in the Alps is a water tower in Europe. For example, in Switzerland's Rhone Valley, melting glaciers have supplied fresh water to crop fields for hundreds of years. As the glacier mass balance decrease, the need for building more water reservoir will increase in the near future to maintain the ground water.

Also, as the glacier and permafrost melt, more proglacial lakes will be created and the natural hazards such as landslides, avalanches and floods threaten the villages in this region. The infra structure to prevent the natural hazards will become more essential in this region.

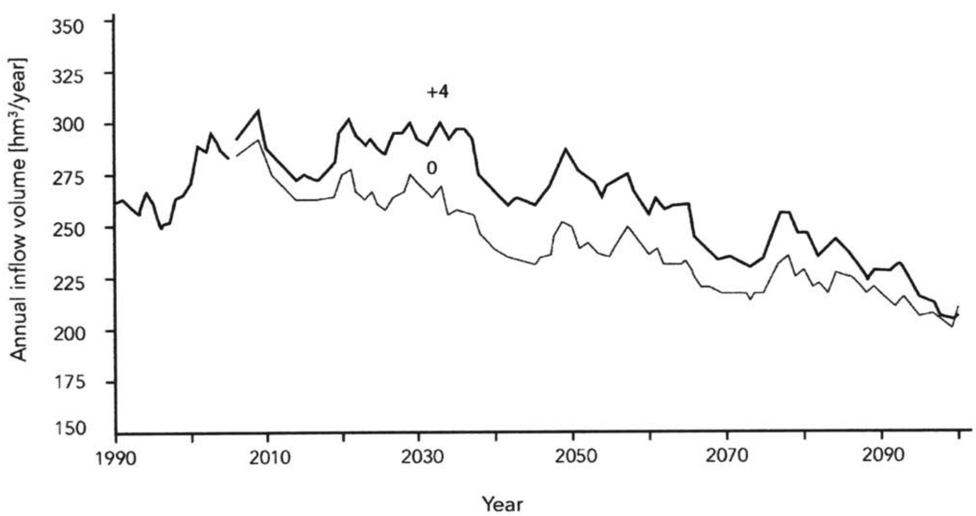


Figure7. Annual flow volumes in the Mauvoisin dam (averaged over five years) in accordance with different climate scenarios

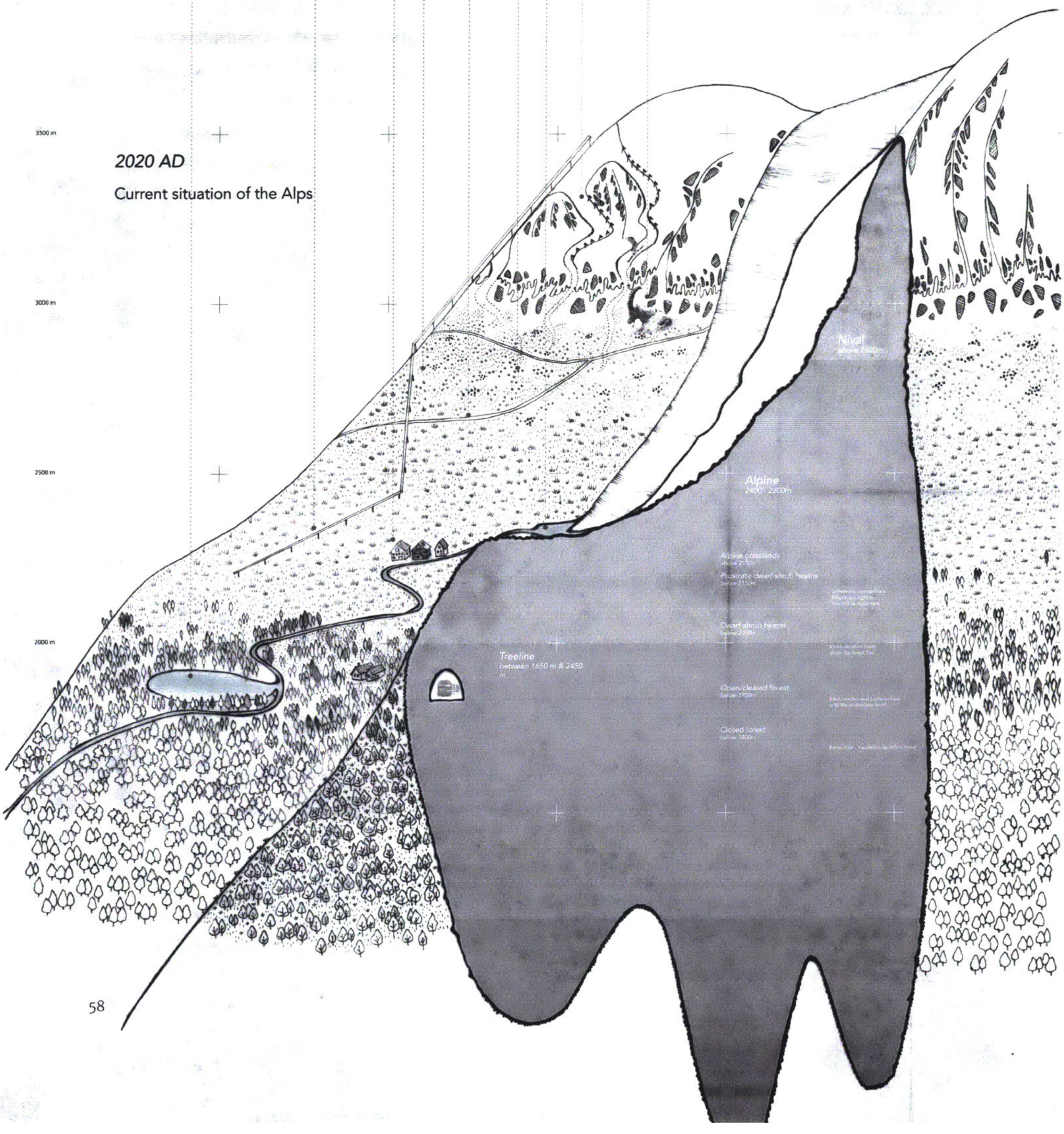
Data adapted from Wilfried Haeberli, et al., "Gletscherschwund Und Neue Seen in Den Schweizer Alpen," Wasser Energie Luft 104 (2012), http://infoscience.epfl.ch/record/178376/files/2012-846_Haeberli_Schleiss_Linsbauer_K%C3%BCnzler_B%C3%BCtler_Gletscherschwund_und_neue_Seen_in_de_Schweizer_Alpen.pdf. Reproduced by Namjoo Kim

Future Scenario

4.2 ELEMENTS IN THE FUTURE SCENARIO

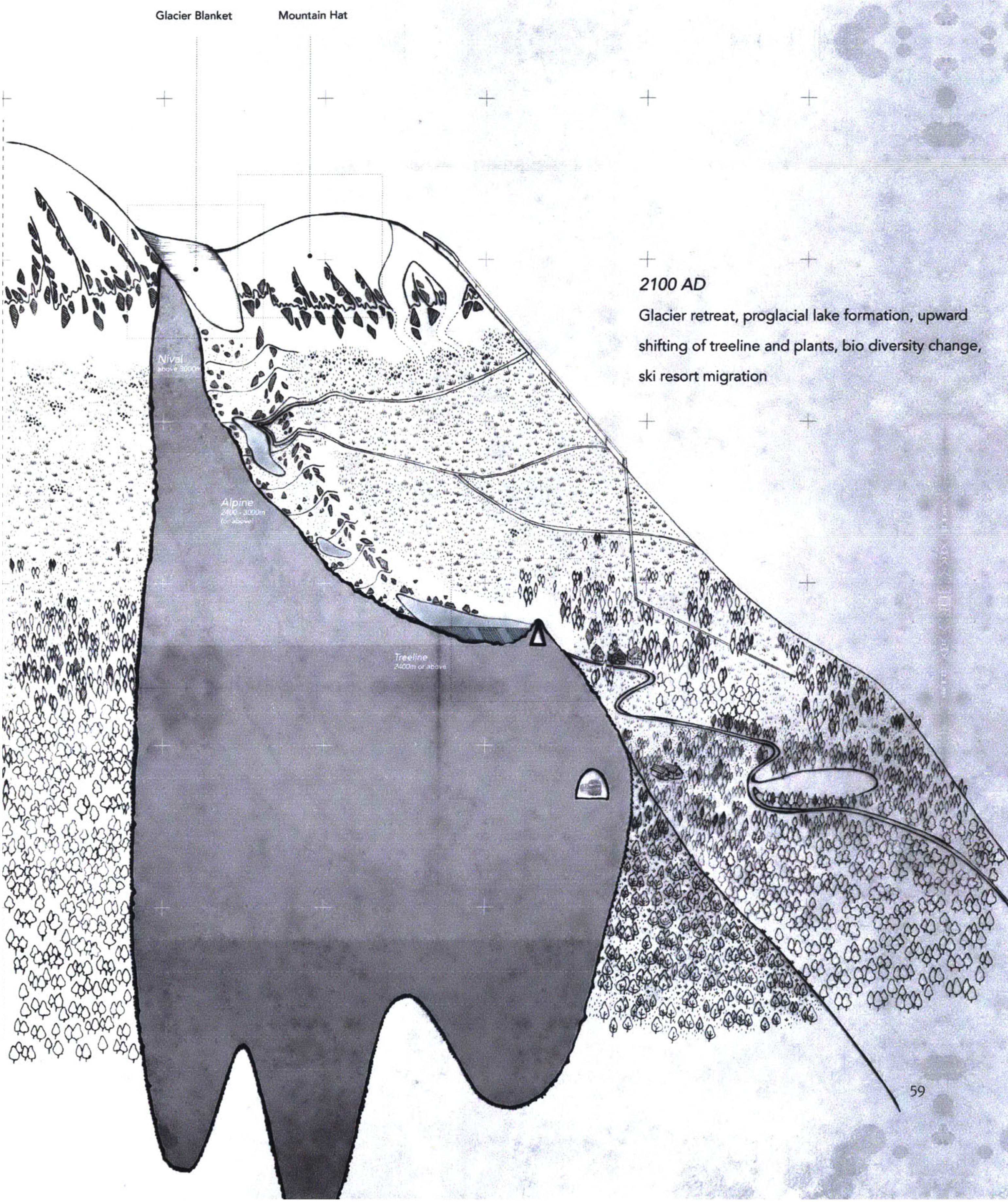
2020 AD

Current situation of the Alps

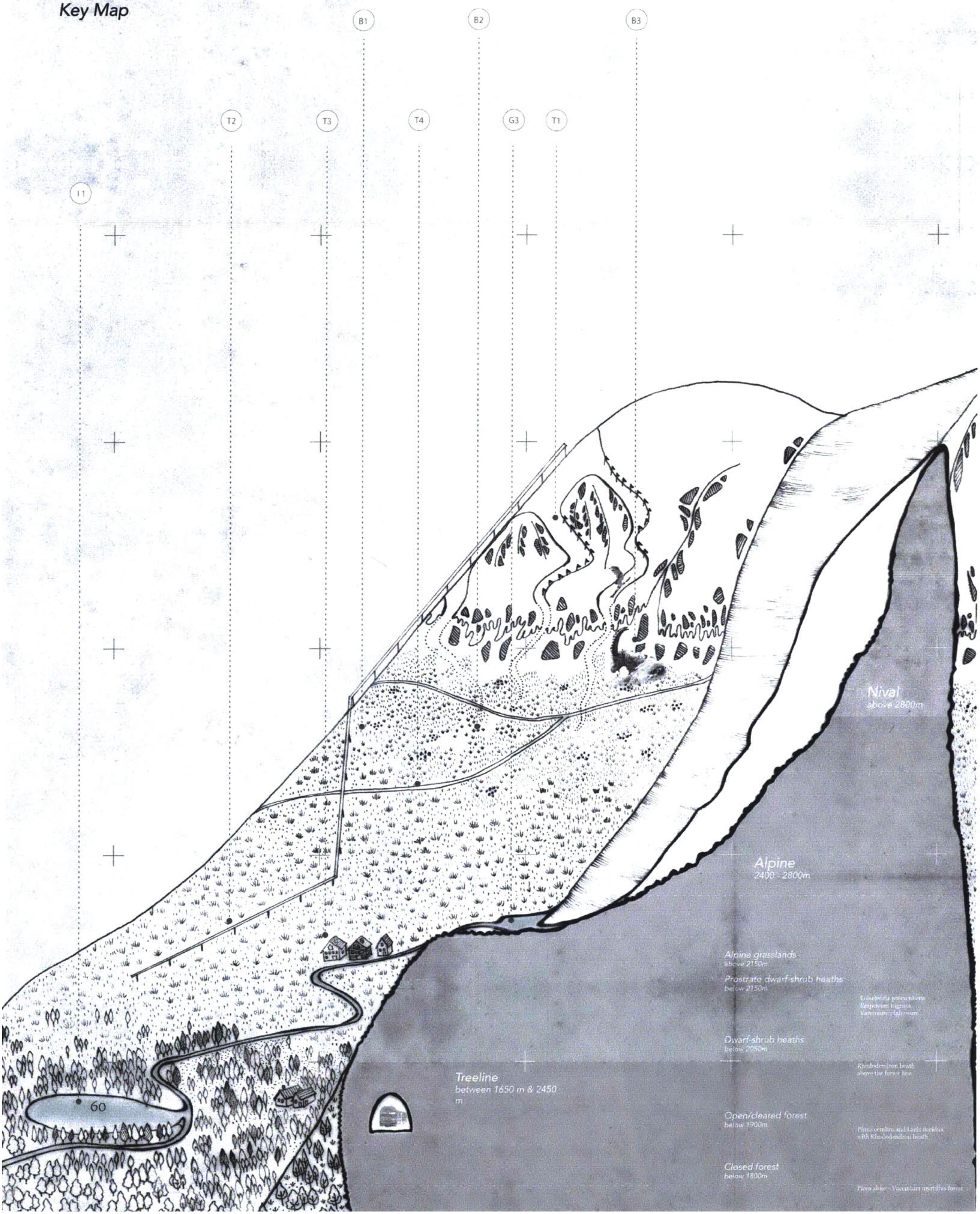


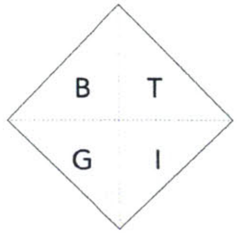
2100 AD

Glacier retreat, proglacial lake formation, upward shifting of treeline and plants, bio diversity change, ski resort migration

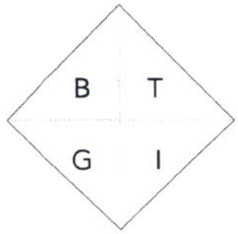


Key Map

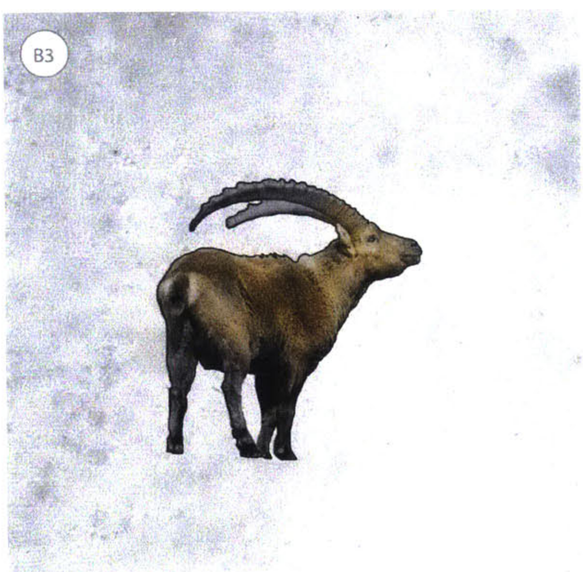

B1
B2
B3
T2
T3
T4
G3
T1
I1
Nival
above 2800m
Alpine
2400 - 2800m
Alpine grasslands
above 2150m
Prostrate dwarf-shrub heaths
below 2150m
Dwarf-shrub heaths
below 2050m
Rhododendron heath
above the forest line
Treeline
between 1650 m & 2450 m
Open/cleared forest
below 1900m
Closed forest
below 1800m
Picea abies - Vaccinium myrtillus forest
60



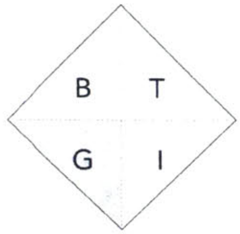
B : Bio Diversity
G : Glacier
T : Tourism
I : Infra Structure



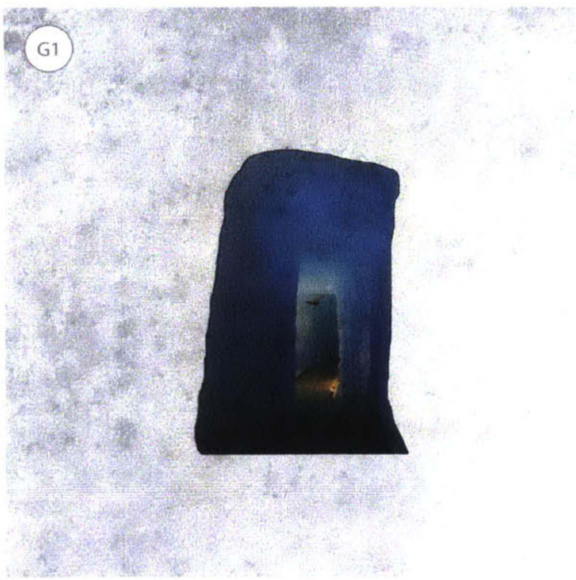
B : Bio Diversity
G : Glacier
T : Tourism
I : Infra Structure

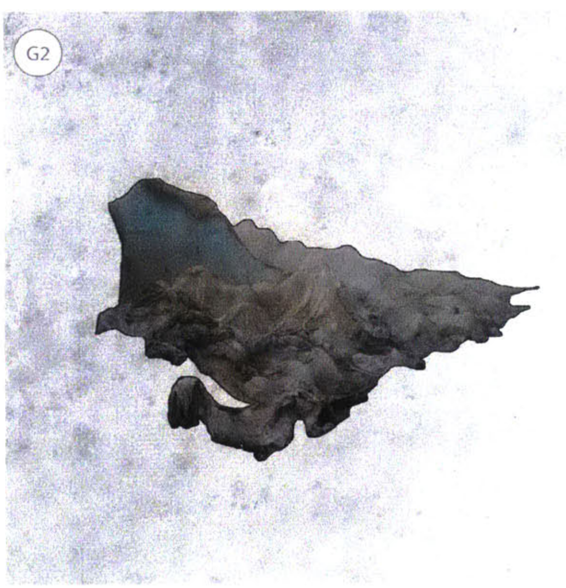


1 Glacier buttercup
2 Poa alpinahinteregeralm
3 Ibex

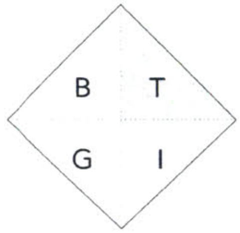


B : Bio Diversity
G : Glacier
T : Tourism
I : Infra Structure

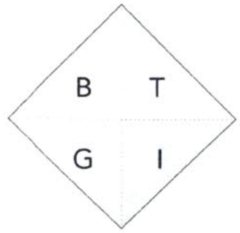




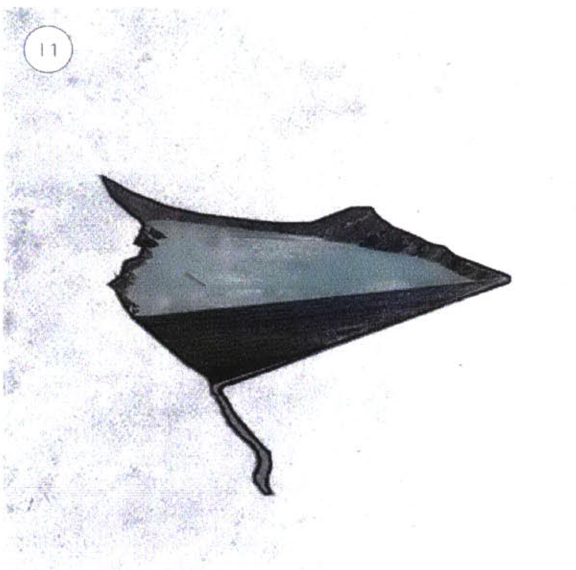
1 Ice grotto
2 Protection clothes
3 Proglacial lake

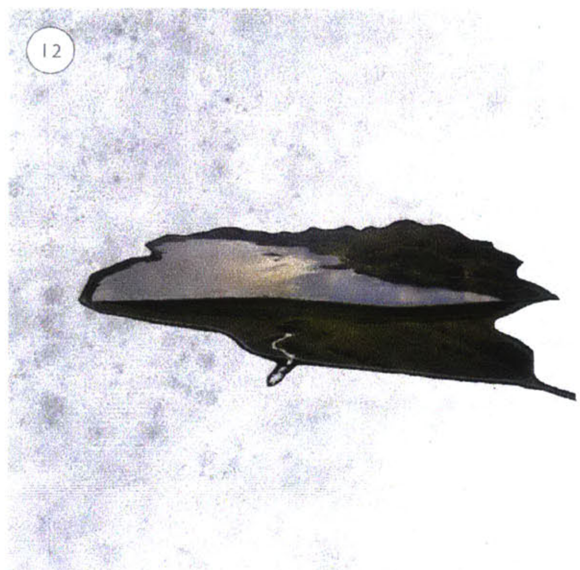


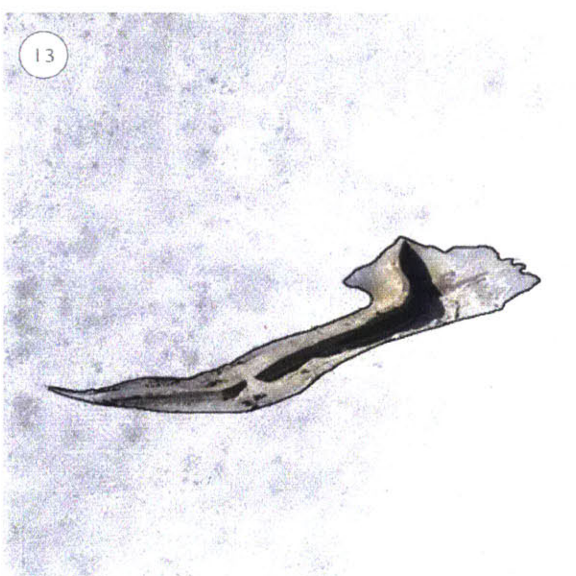
B : Bio Diversity
G : Glacier
T : Tourism
I : Infra Structure



B : Bio Diversity
G : Glacier
T : Tourism
I : Infra Structure







1 Dam

2 Earth dam

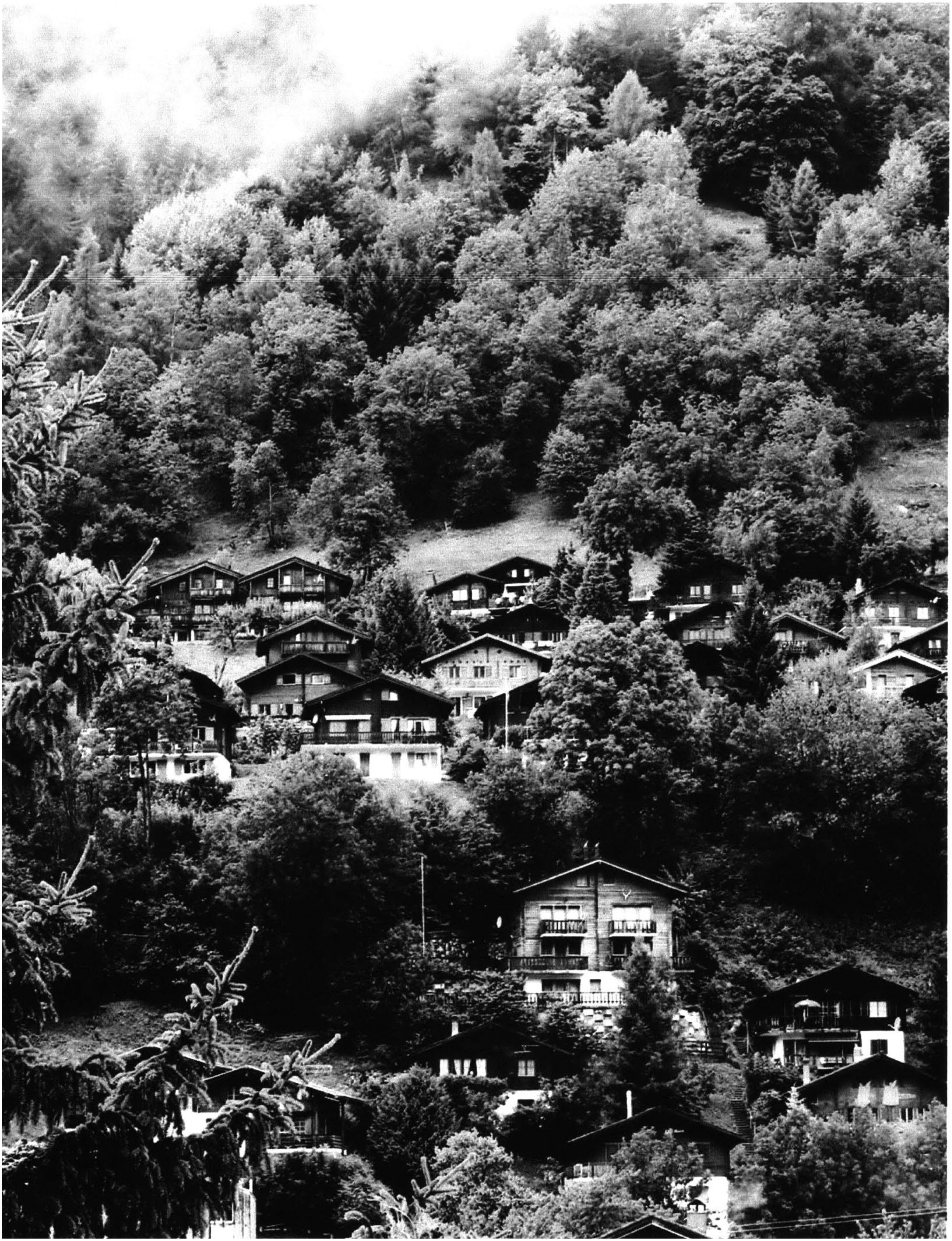
3 Avalanch protection barrier

NOTE

1 Linsbauer, Paul, and Haeberli, "Modeling Glacier Thickness Distribution and Bed Topography over Entire Mountain Ranges with GlabTop." 1

2 Nicoletta Cannone, "Unexpected Impacts of Climate Change on Alpine Vegetation." 362

3 Gottfried et al., "A Fine-Scaled Predictive Model for Changes in Species Distribution Patterns of High Mountain Plants Induced by Climate Warming.", 250



5

ARCHITECTURAL DOCUMENTATION

Two Architectural Intervention, Glacier Blanket and Mountain Hat

Architectural Documentation

5.1 GLACIER BLANKET & MOUNTAIN HAT

This thesis argues that architecture is a unique medium that can both document the changing environment as well as have a positive impact on the physical form. I propose two architectural interventions: a 'glacier blanket' and 'mountain hat' to delay change and to archive the physical remnants of the melting glacier and endangered nival plants.

Glacier Blanket

As mentioned in the previous chapter, there has been attempts to diminish the glacier retreat by covering the glacier with a giant polyester and polypropylene fabric. "Glacier Blanket" aims to go beyond the mere protection and actually function as a tool to document the changing landscape.

The entire size of the glacier blanket is 4.8 km by 8 km to cover 2/3 of the Rhone glacier, under the permanent snowline. The function and form of the glacier blanket will change to cope with the environmental change.
The glacier blanket will 1. Delay the melting process of the Rhone glacier by reflecting sunlight 2. Collect the physical and chemical

remnants of the glacier such as rock and mineral dusts. 3. Become a permanent archive of those remnants. Also, some tension structure, which has maintained the fabric, will be converted to the pedestrian bridges when the underneath glacier melts.

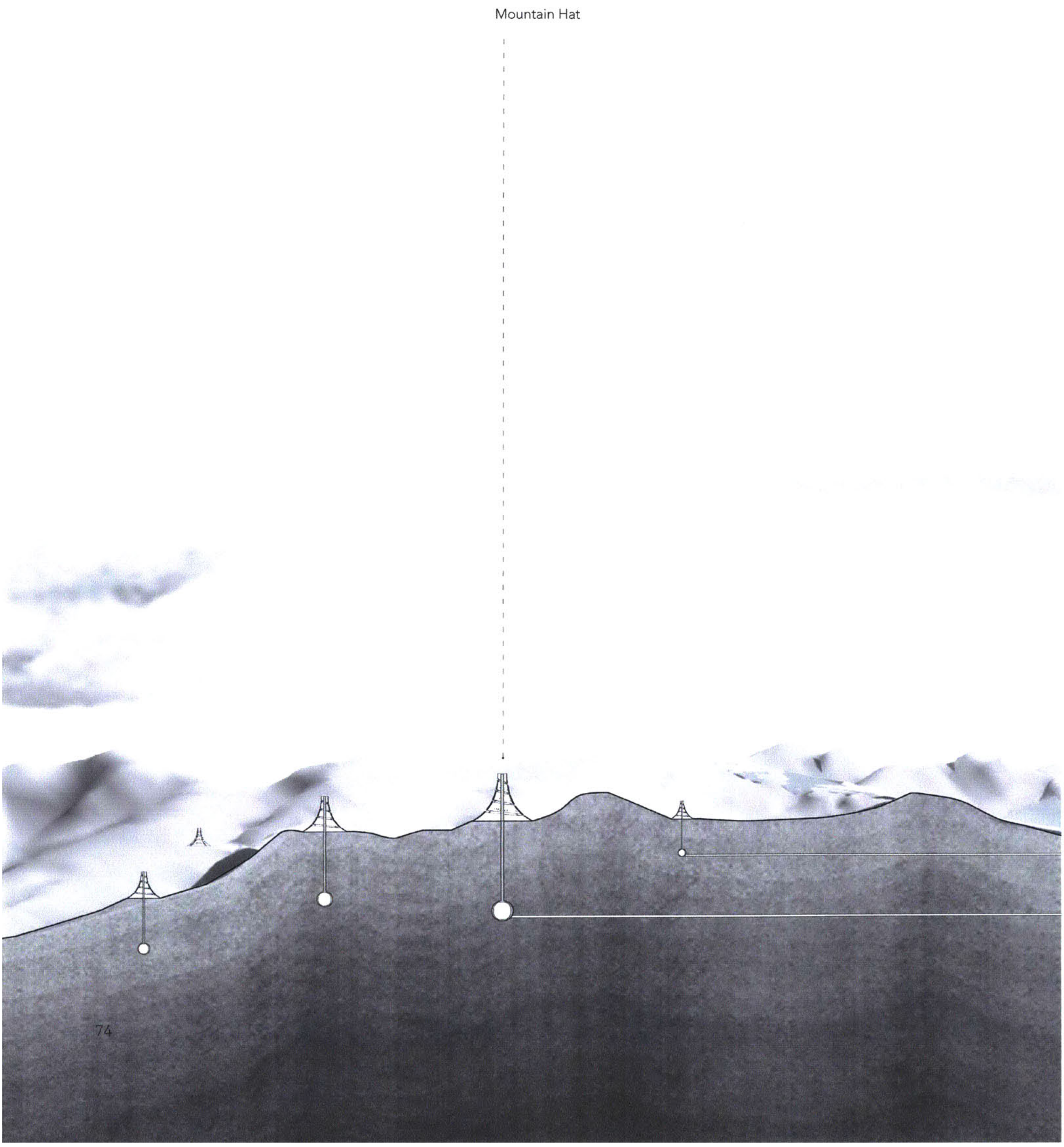
The mineral dusts from the melting glacier provide long-term records of the Earth and by archiving them in the architectural device, this valuable historical records can survive. In the glacier blanket, there are three different structure system: tension structures, which support the fabric, air structures, which provide indoor spaces for researchers and tourists, and flexible structures, which will become archives. The flexible part will sink when the glacier melts to collect gravels and mineral dusts from the melting glacier. Eventually, this archive will sit on the bed rock after the glacier disappear. The process and shape of the archive is similar to the moraine formation; therefore, I call the final stage of the archive "artificial moraines"

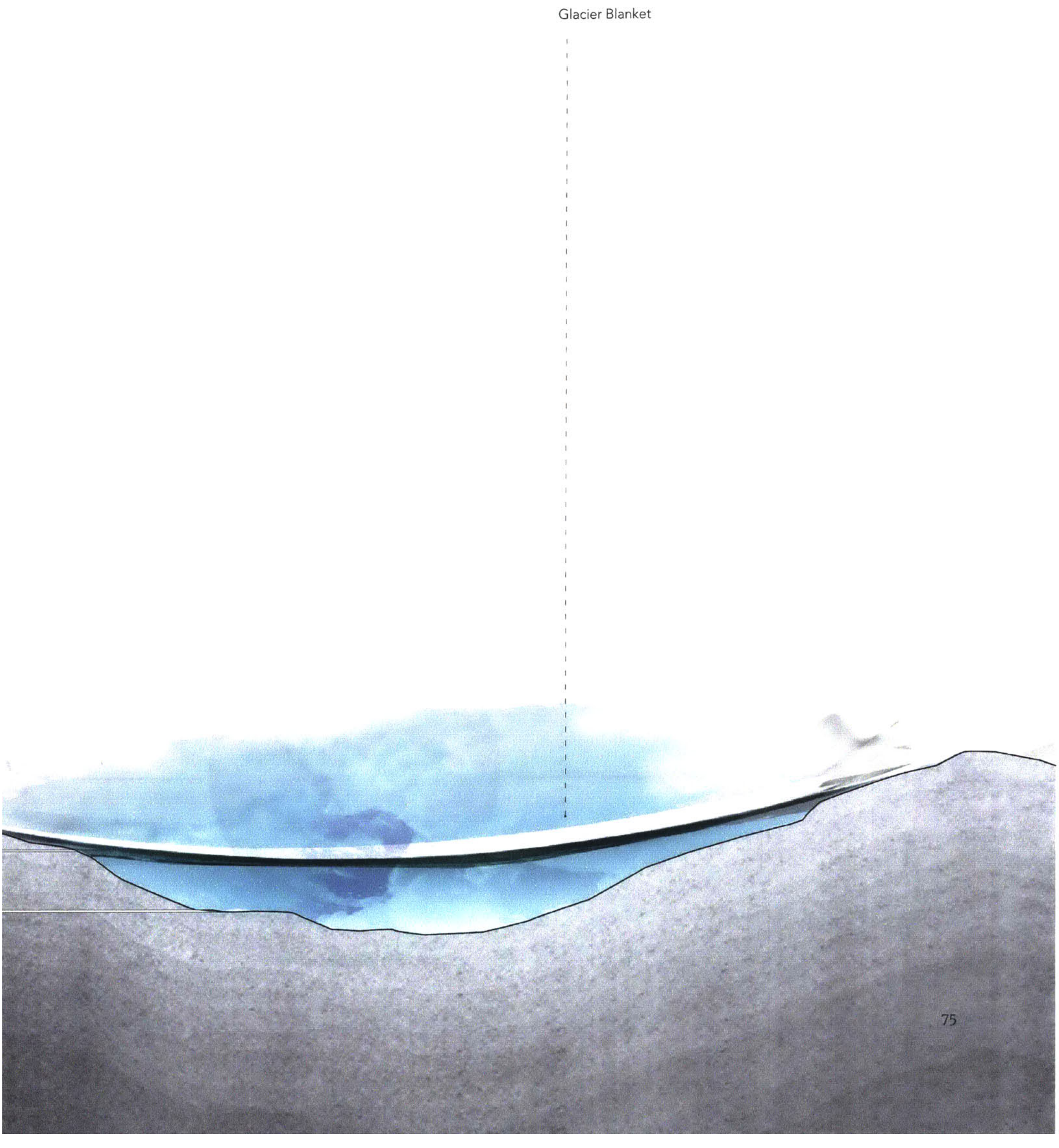
Mountain Hat

Nival plants in the Alps are in danger as alpine plants are migrating to the upper elevation zone. I propose this mountain hat, which will become a new habitat for the nival plants. The mountain hat consists of three parts: a surface, which is a nival plant habitat, a space, which provides huts for tourists, and an underground archive, which will archive the seed.

Mountain hat as well as glacier blanket aim to decelerate the speed of environmental change in order to gain time to document important natural elements.

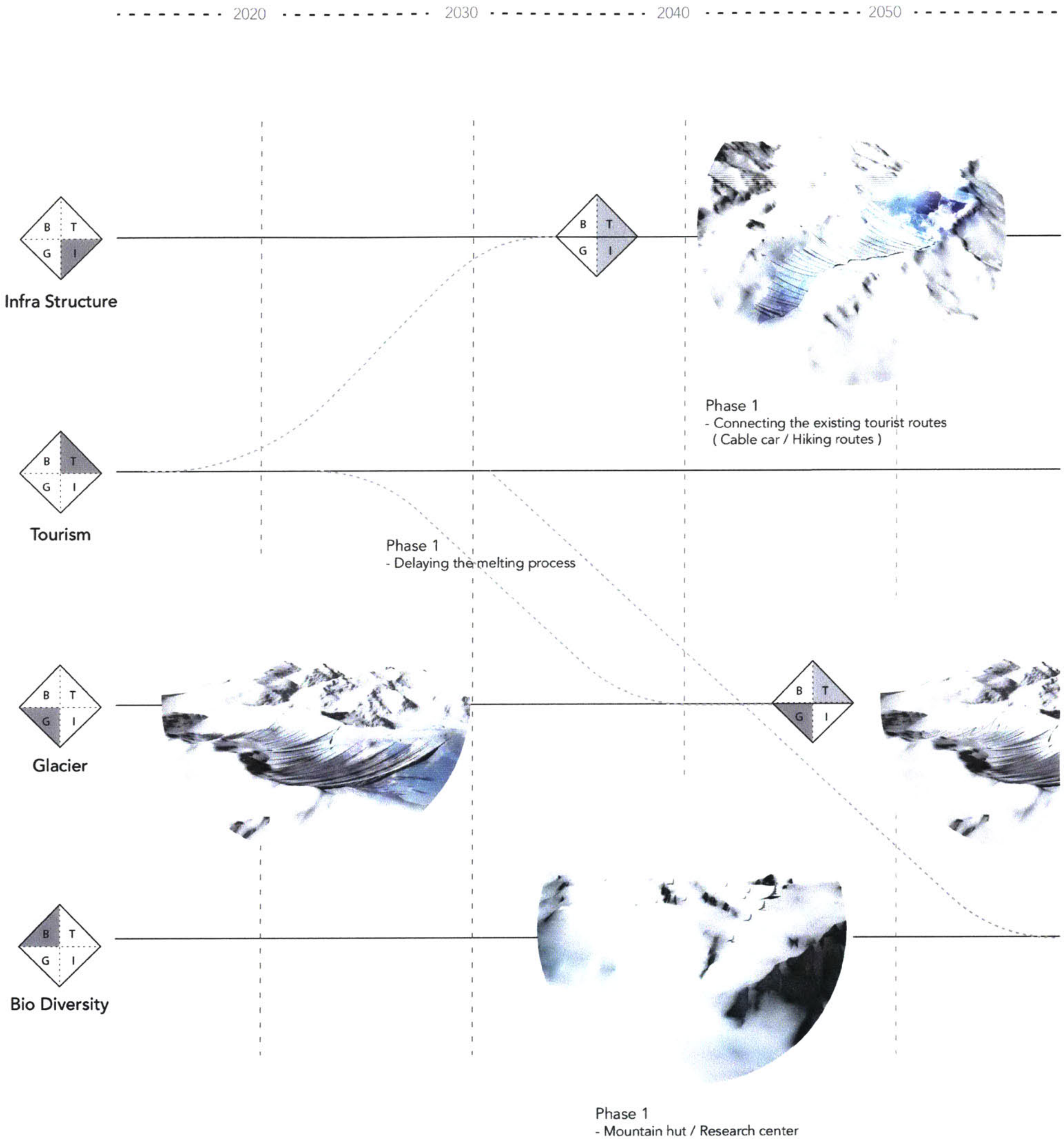

Diechterhorn
Tieralplistock
Long Section
Grimselsee


Mountain Hat

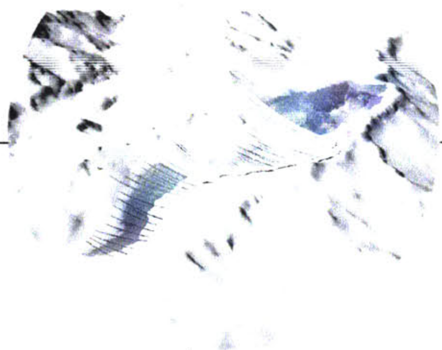

Glacier Blanket

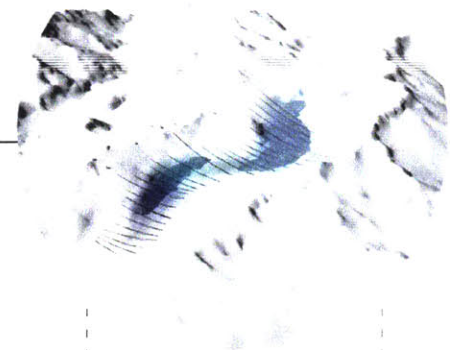
NEW FUTURE SCENARIO

with Glacier Blanket & Mountain Hat



2060 - - - 2070 - - - 2080 - - - 2090 - - - 2100



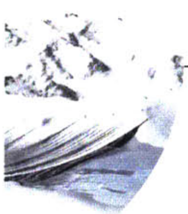


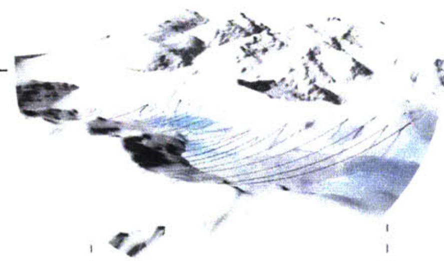
Phase 2
- Preventing natural hazards such as the rockfall and flooding

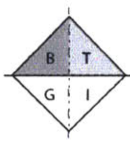
Phase 3
-Proglacial lakes become water reservoir

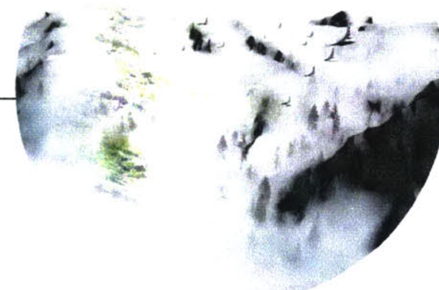
Phase 2
- Archiving the physical and chemical remnants
- Providing indoor spaces to researchers and tourists

Phase 3
- Becoming artificial moraines and tension bridges



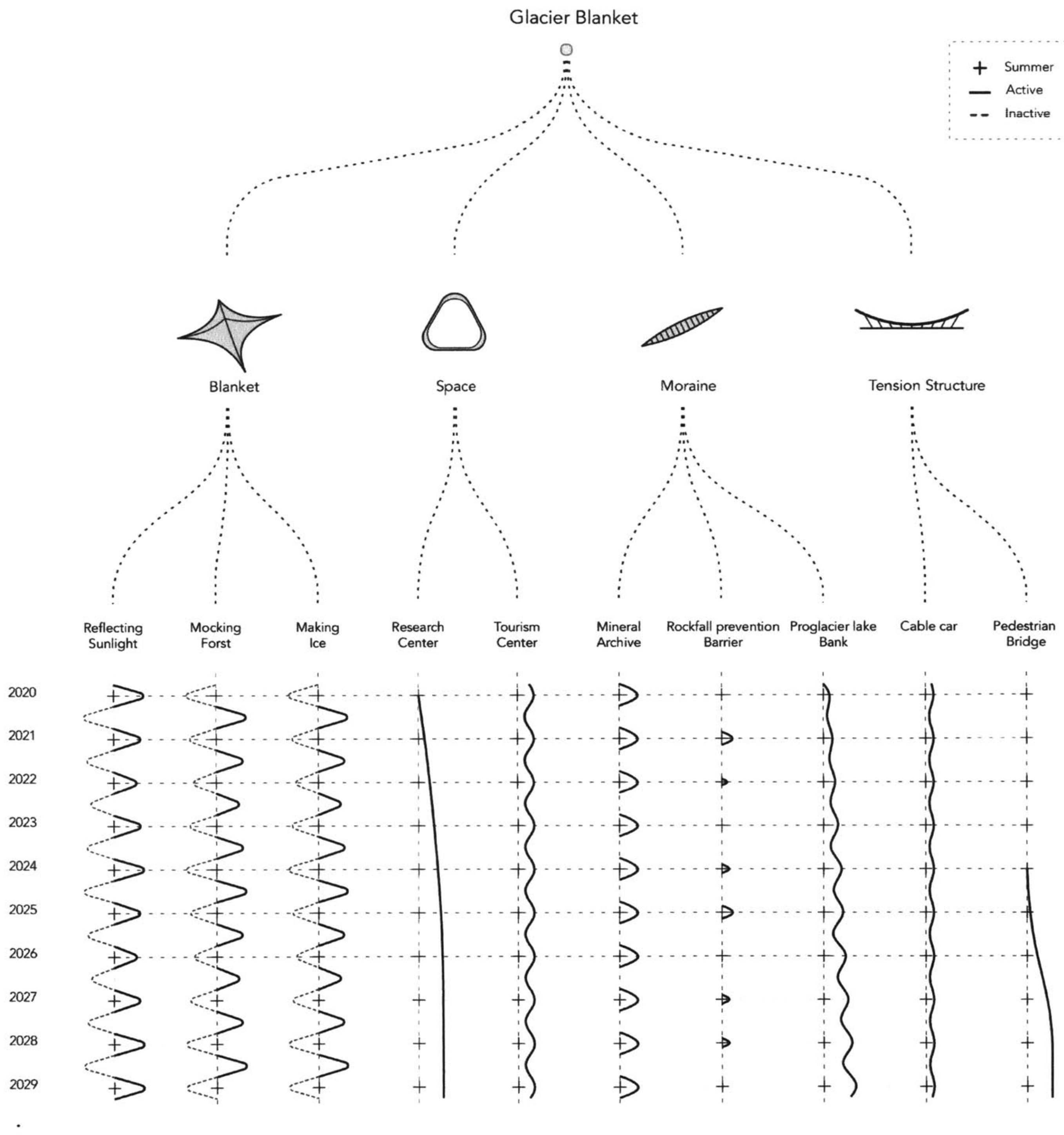


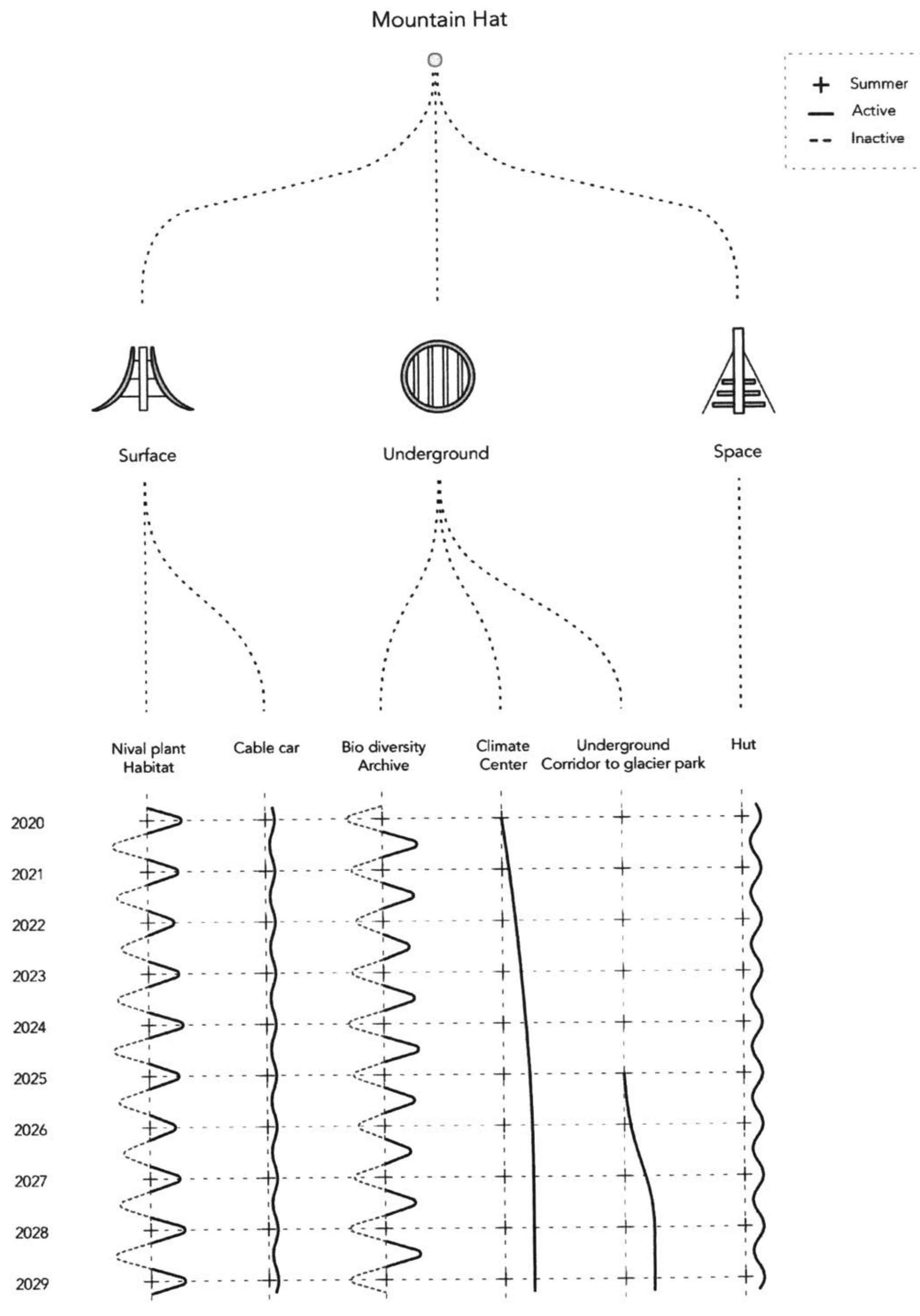


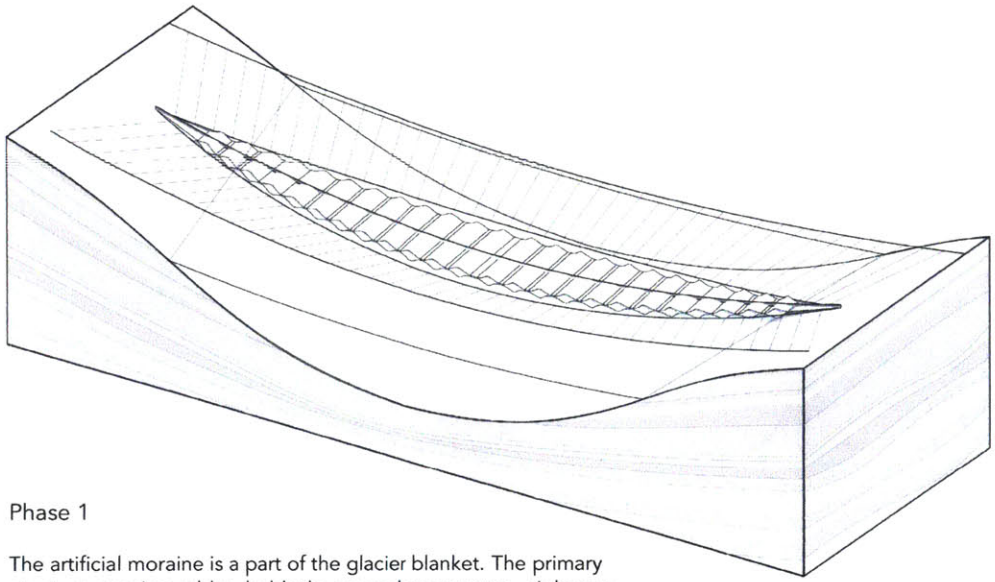


Phase 2
- Archiving the nival plant seed

Phase 3
- Archives become seed banks

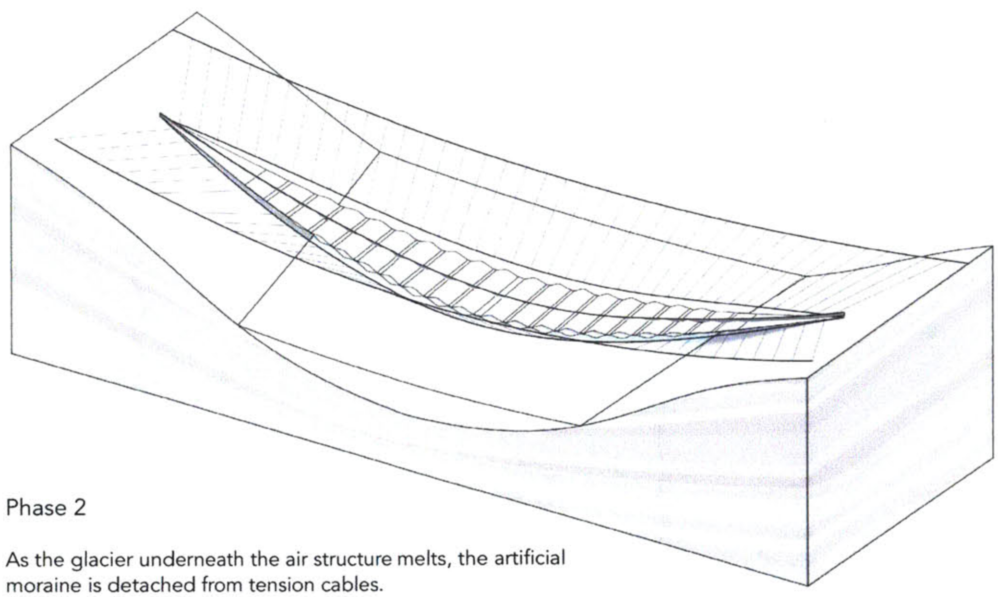

Glacier Blanket
Summer
Active
Inactive
Blanket
Space
Moraine
Tension Structure
Reflecting Sunlight
Mocking Forst
Making Ice
Research Center
Tourism Center
Mineral Archive
Rockfall prevention Barrier
Proglacier lake Bank
Cable car
Pedestrian Bridge
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029


Mountain Hat
Summer
Active
Inactive
Surface
Underground
Space
Nival plant Habitat
Cable car
Bio diversity Archive
Climate Center
Underground Corridor to glacier park
Hut
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029



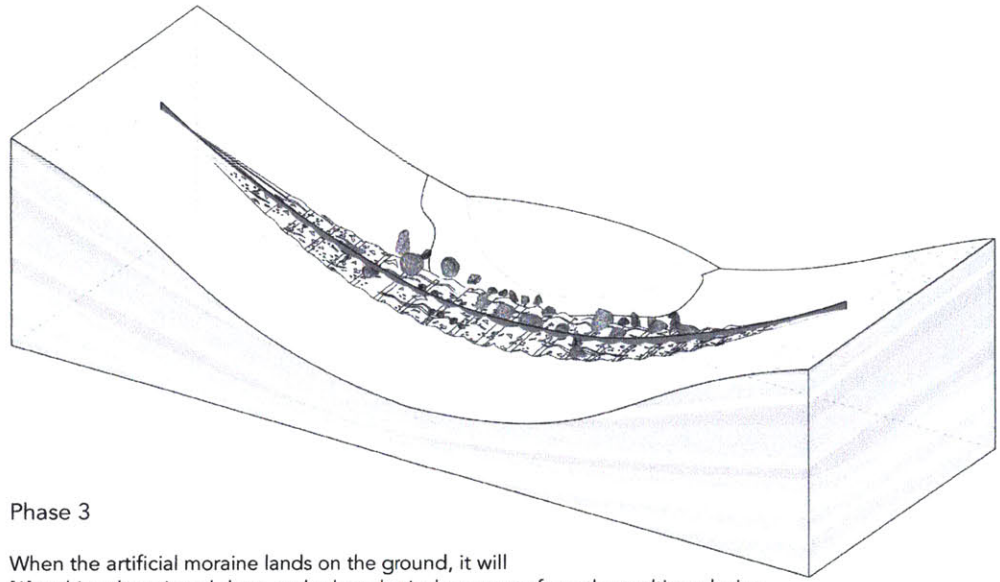
Phase 1

The artificial moraine is a part of the glacier blanket. The primary structure, tension cables, holds the secondary structure, air beams.



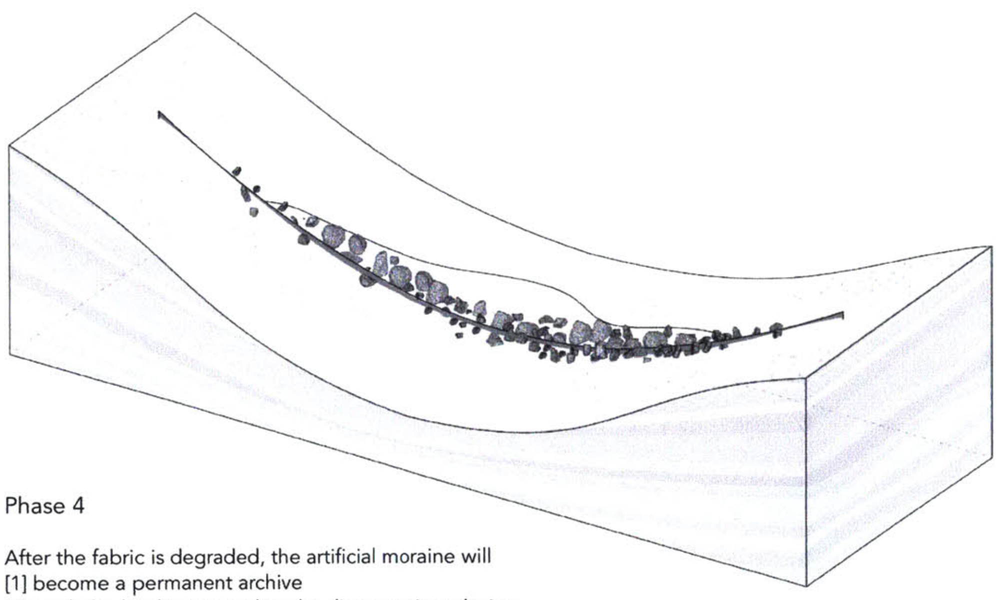
Phase 2

As the glacier underneath the air structure melts, the artificial moraine is detached from tension cables.



Phase 3

When the artificial moraine lands on the ground, it will
[1] archive the mineral dusts and other physical remnants from the melting glacier
[2] become a protective barrier against natural hazards.

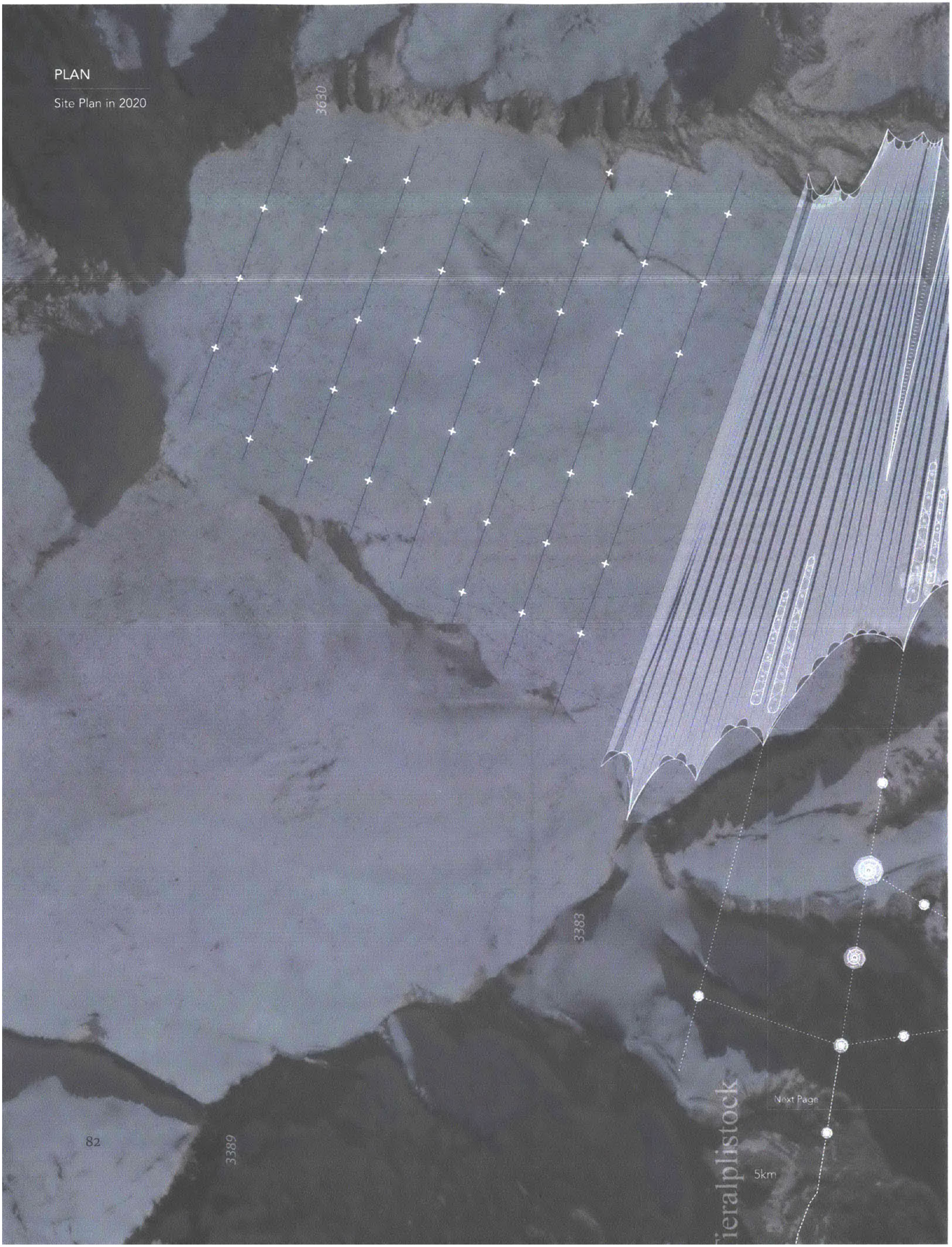


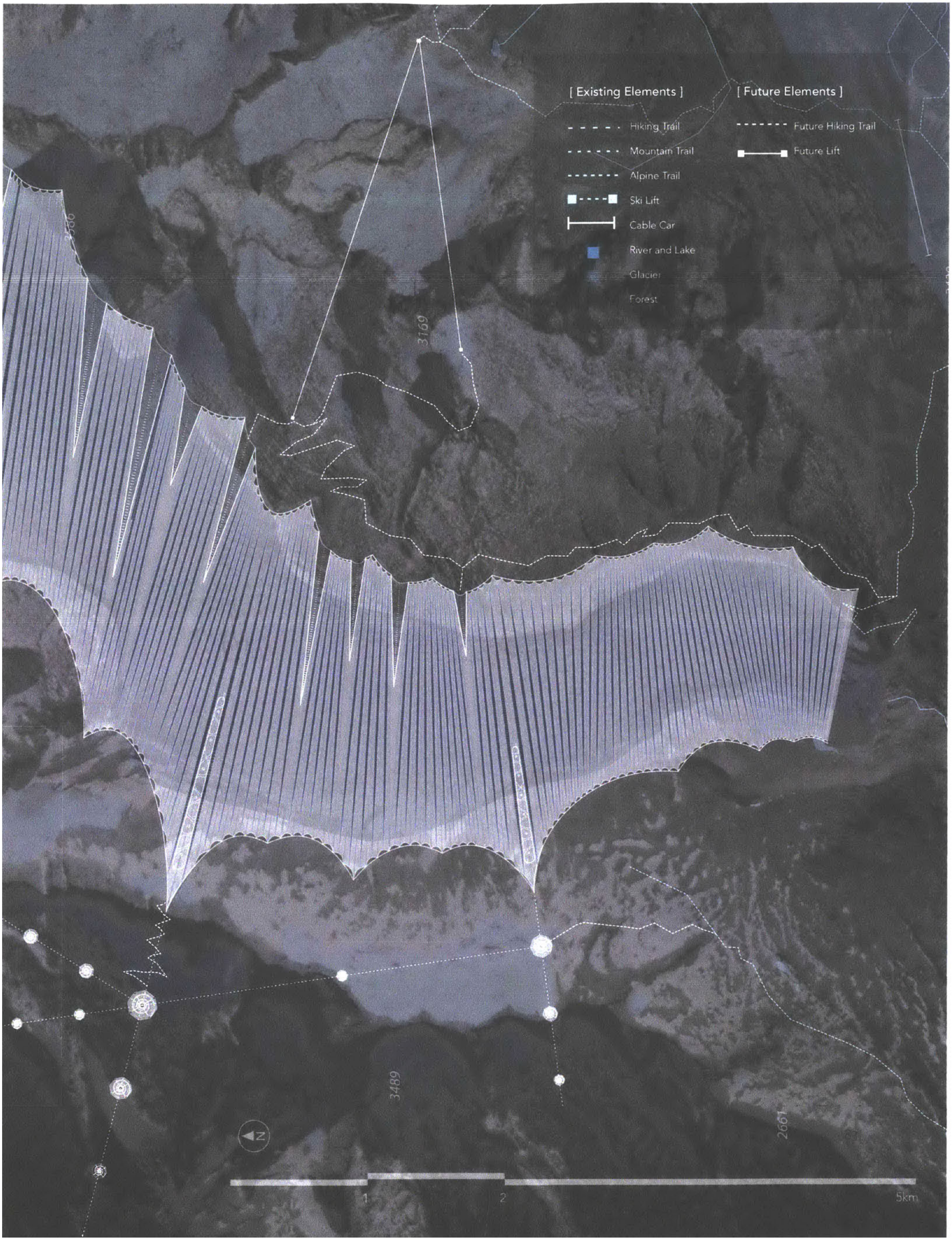
Phase 4

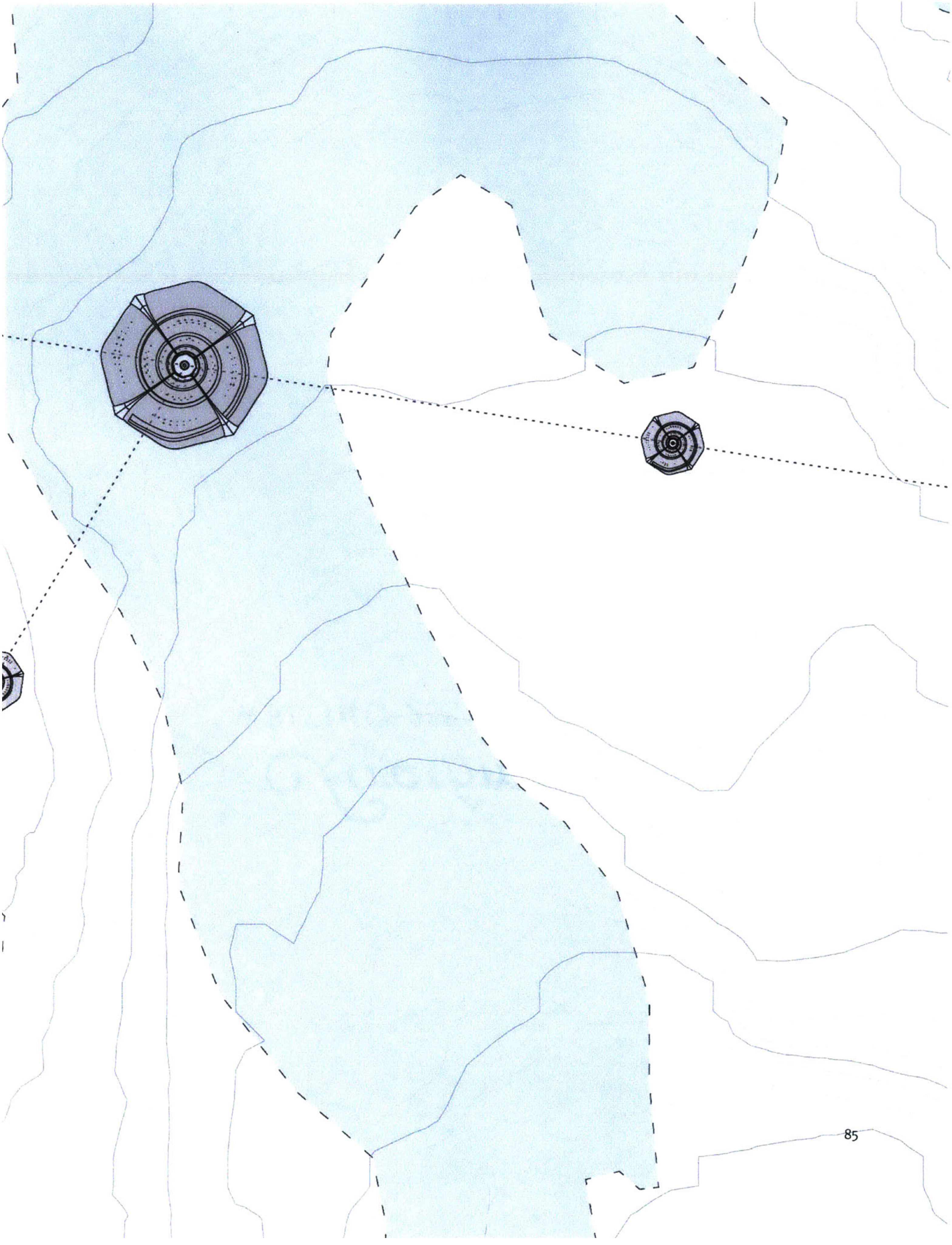
After the fabric is degraded, the artificial moraine will
[1] become a permanent archive
[2] mark the land to remember the disappearing glacier.

PLAN

Site Plan in 2020

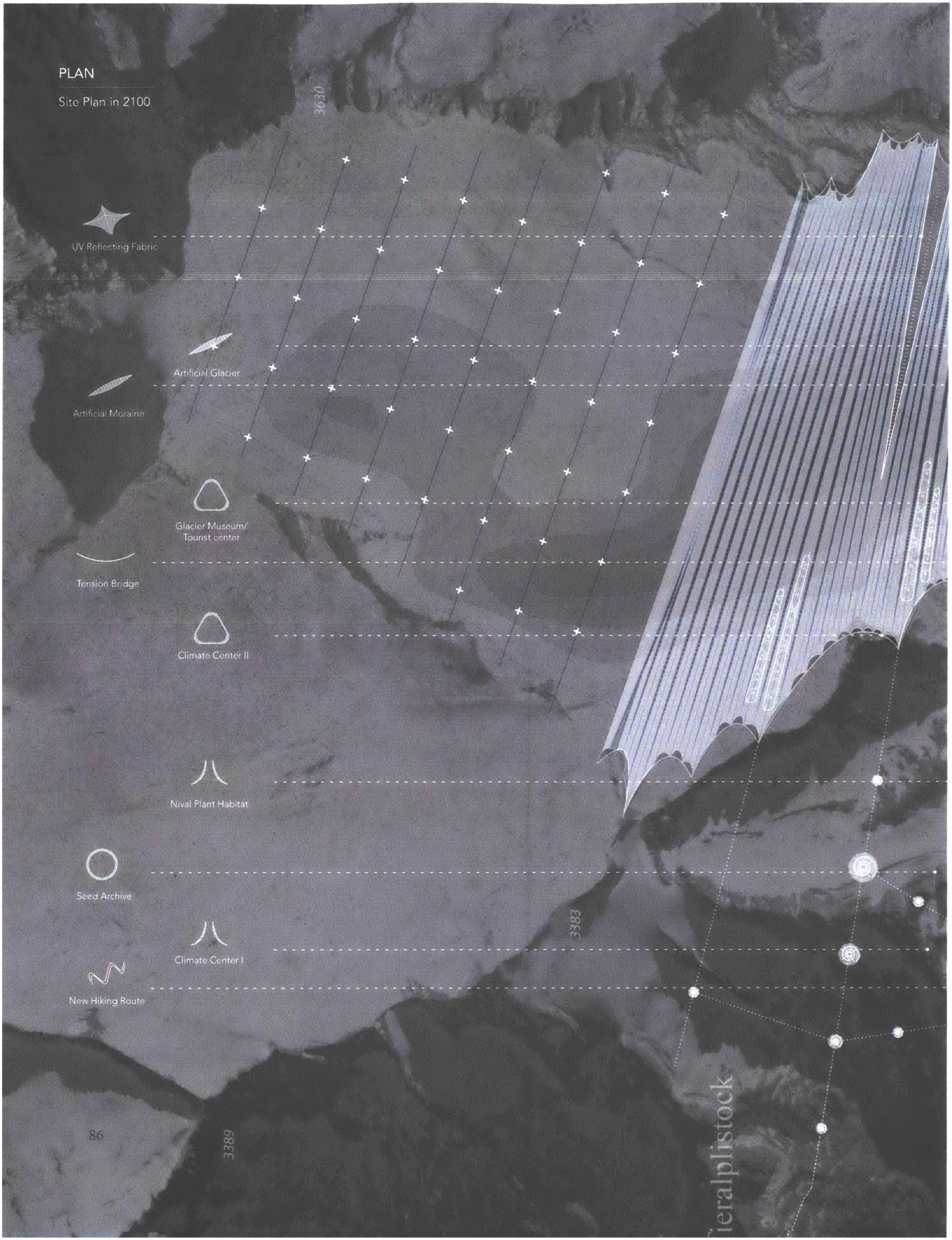


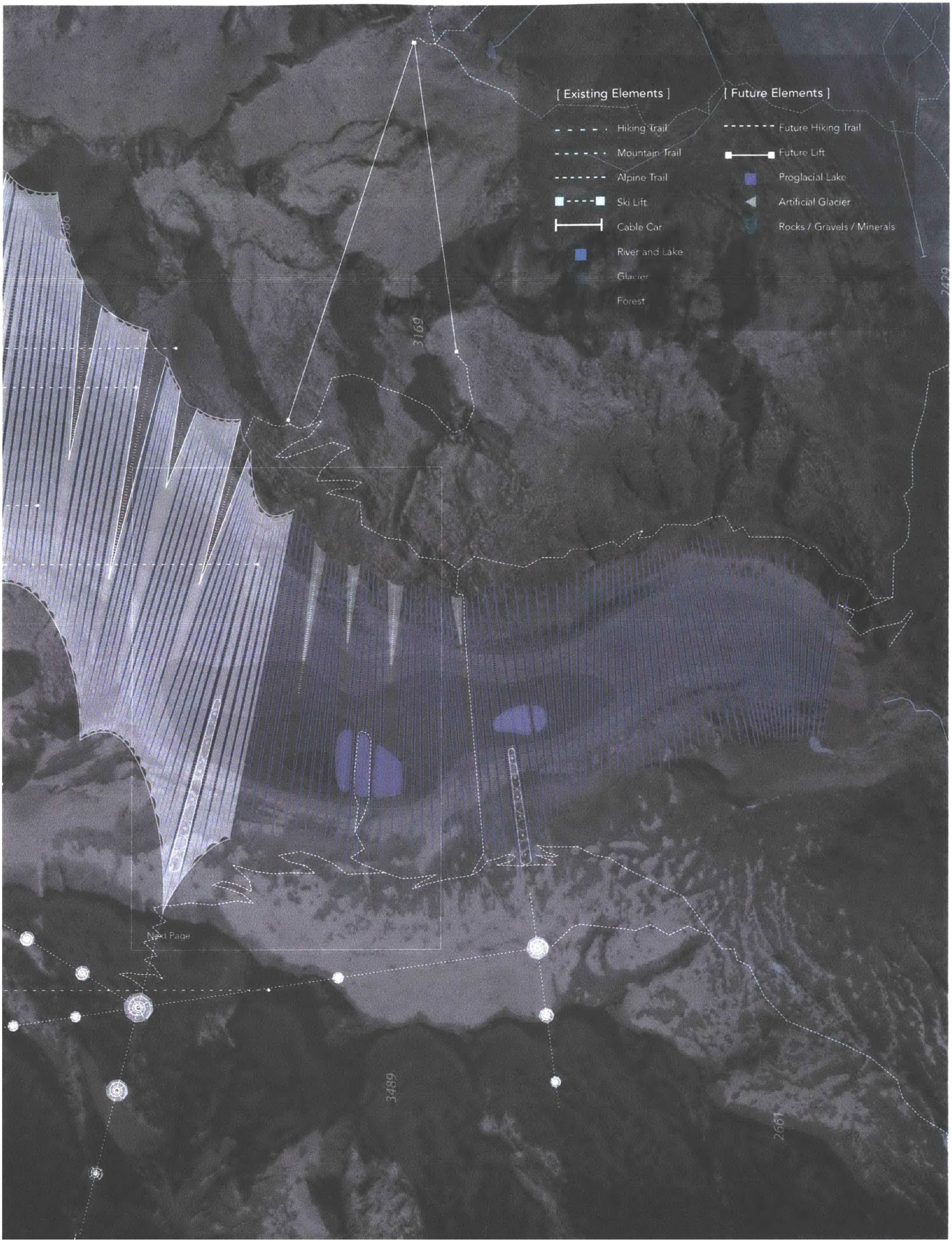

[Existing Elements]
Hiking Trail
Mountain Trail
Alpine Trail
Ski Lift
Cable Car
River and Lake
Glacier
Forest
[Future Elements]
Future Hiking Trail
Future Lift
3169
3489
2661
N
1
2
5km



PLAN

Site Plan in 2100

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Hiking Trail
Mountain Trail
Alpine Trail
Ski Lift
Cable Car
River and Lake
Glacier
Forest
[Future Elements]
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Future Lift
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Artificial Glacier
Rocks / Gravels / Minerals
3169
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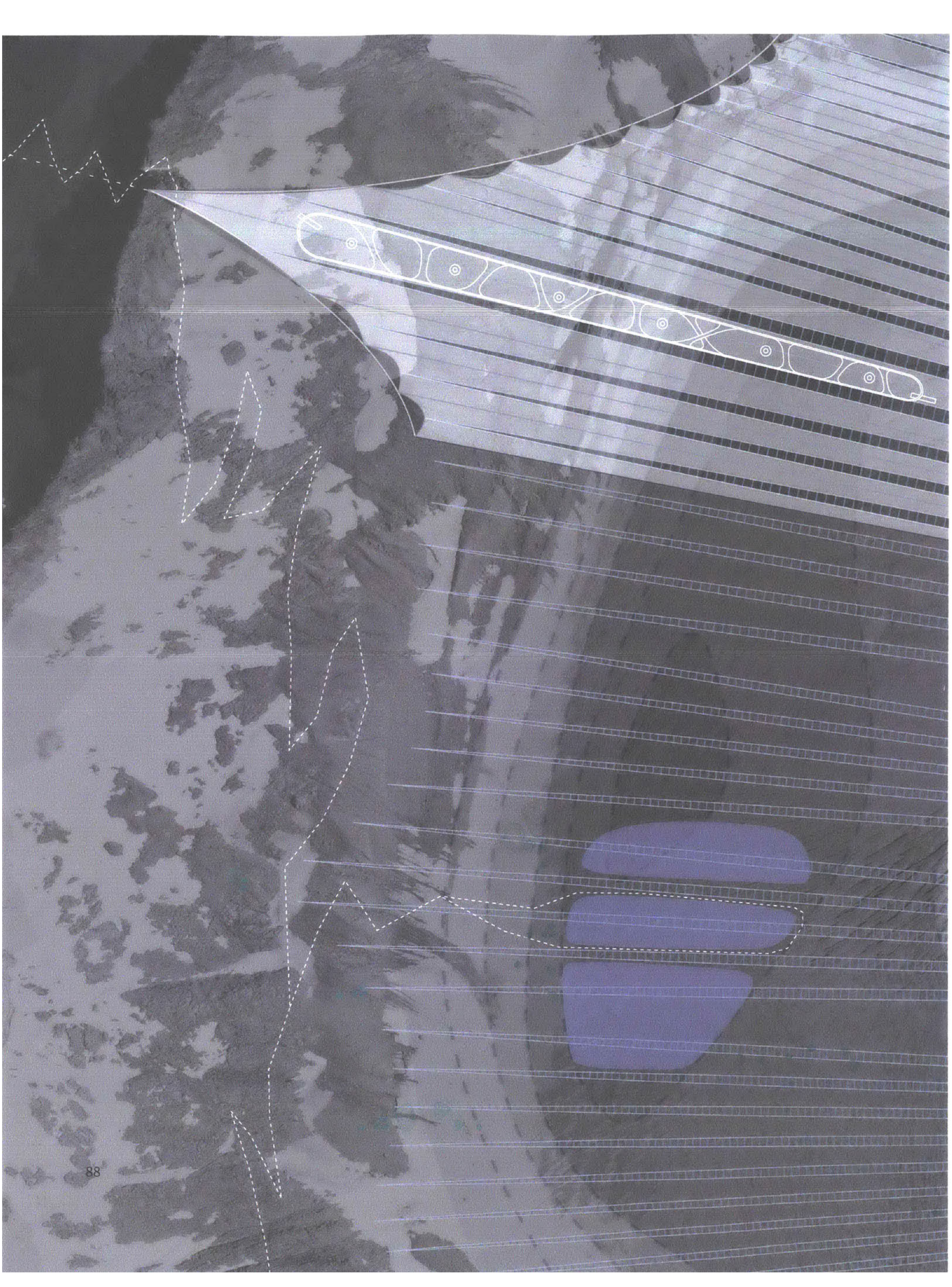
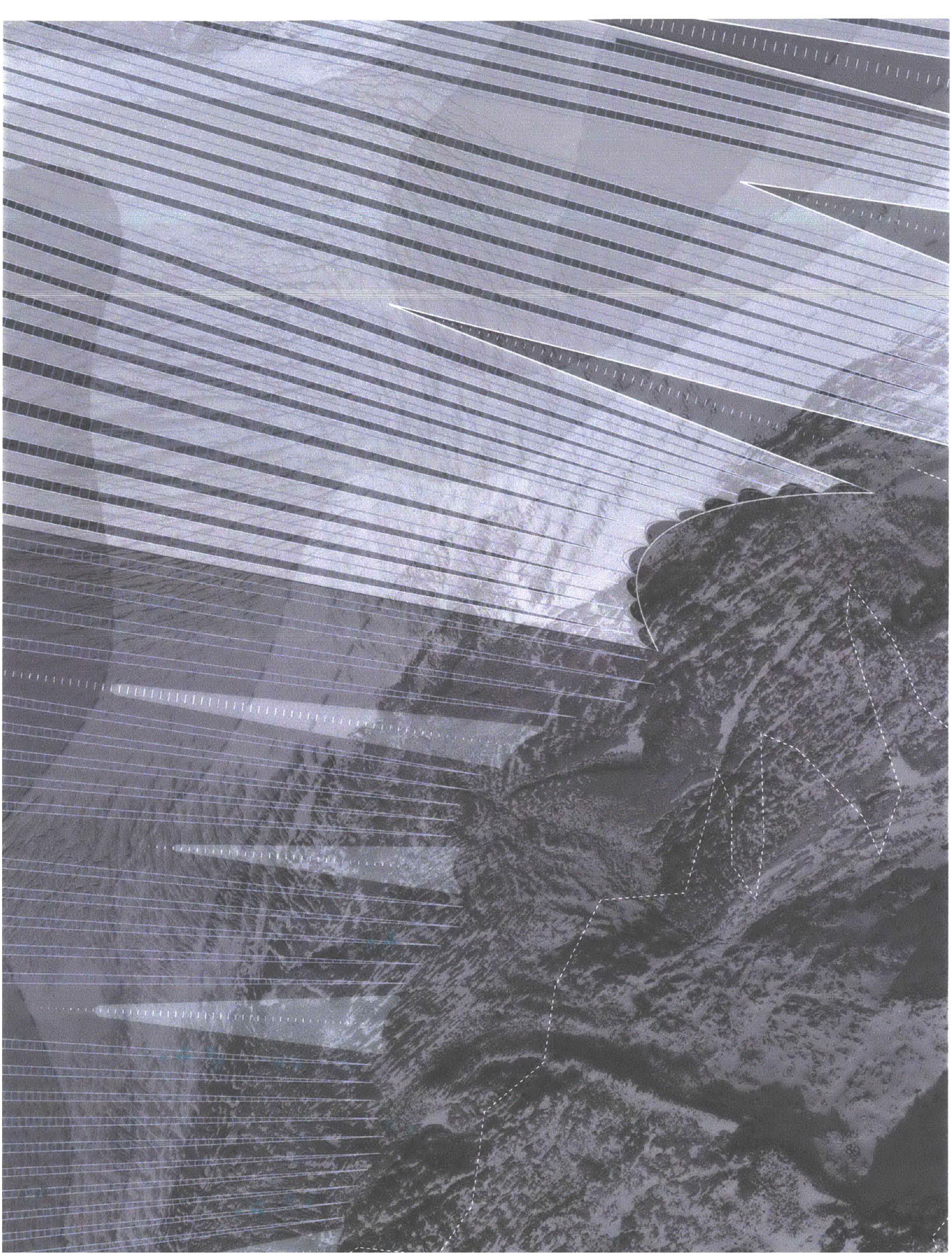
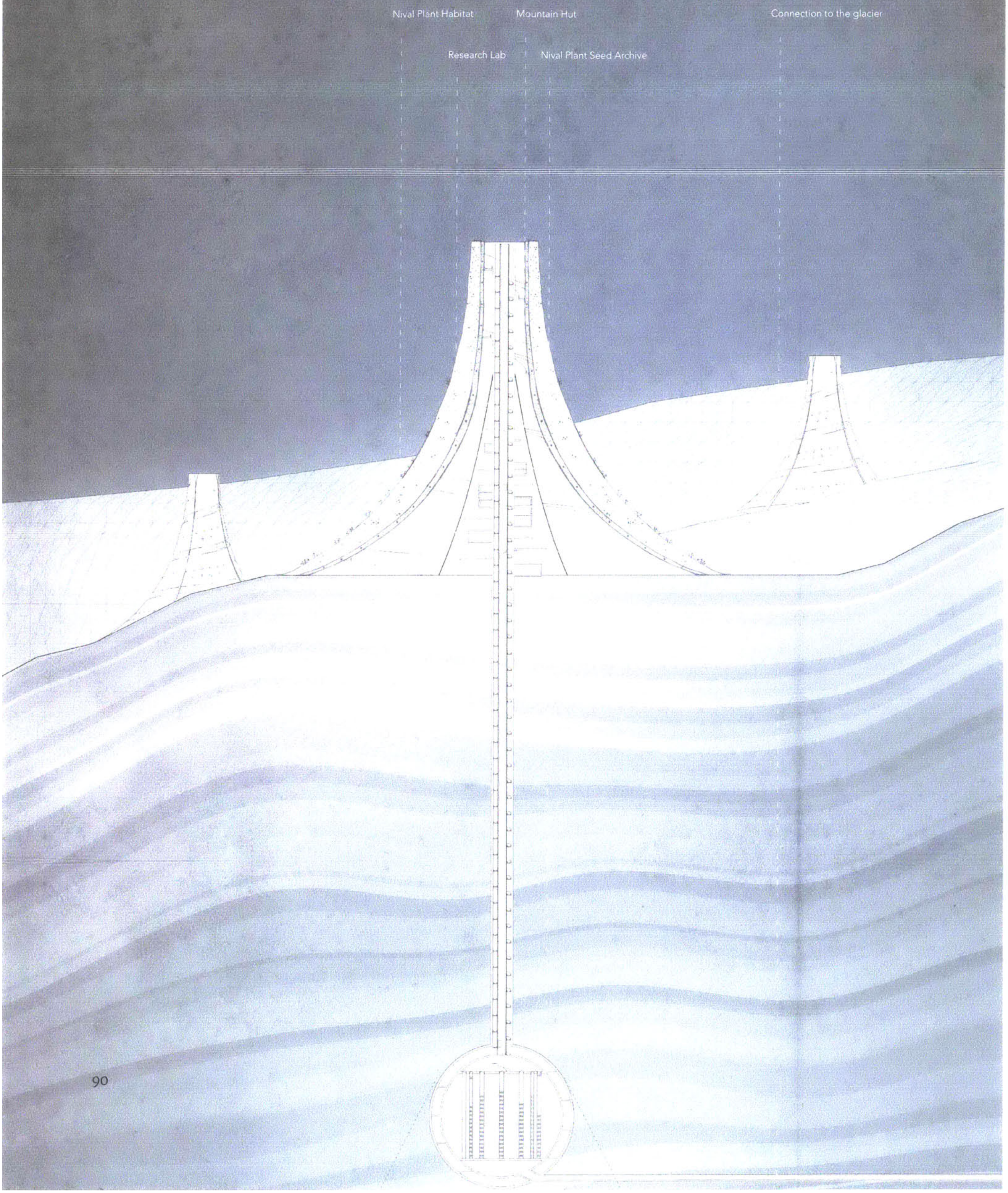


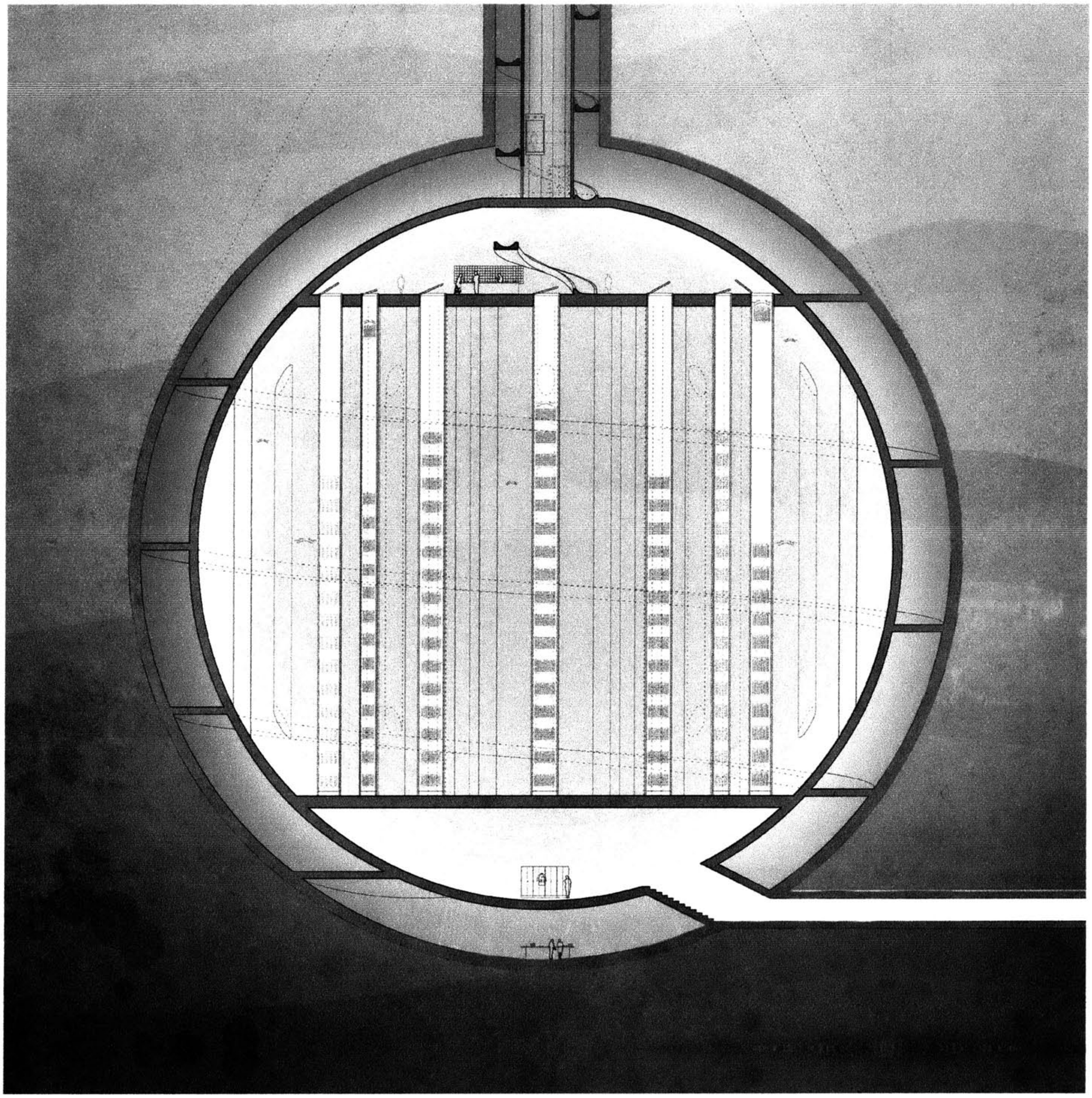


SECTION

Mountain Hat

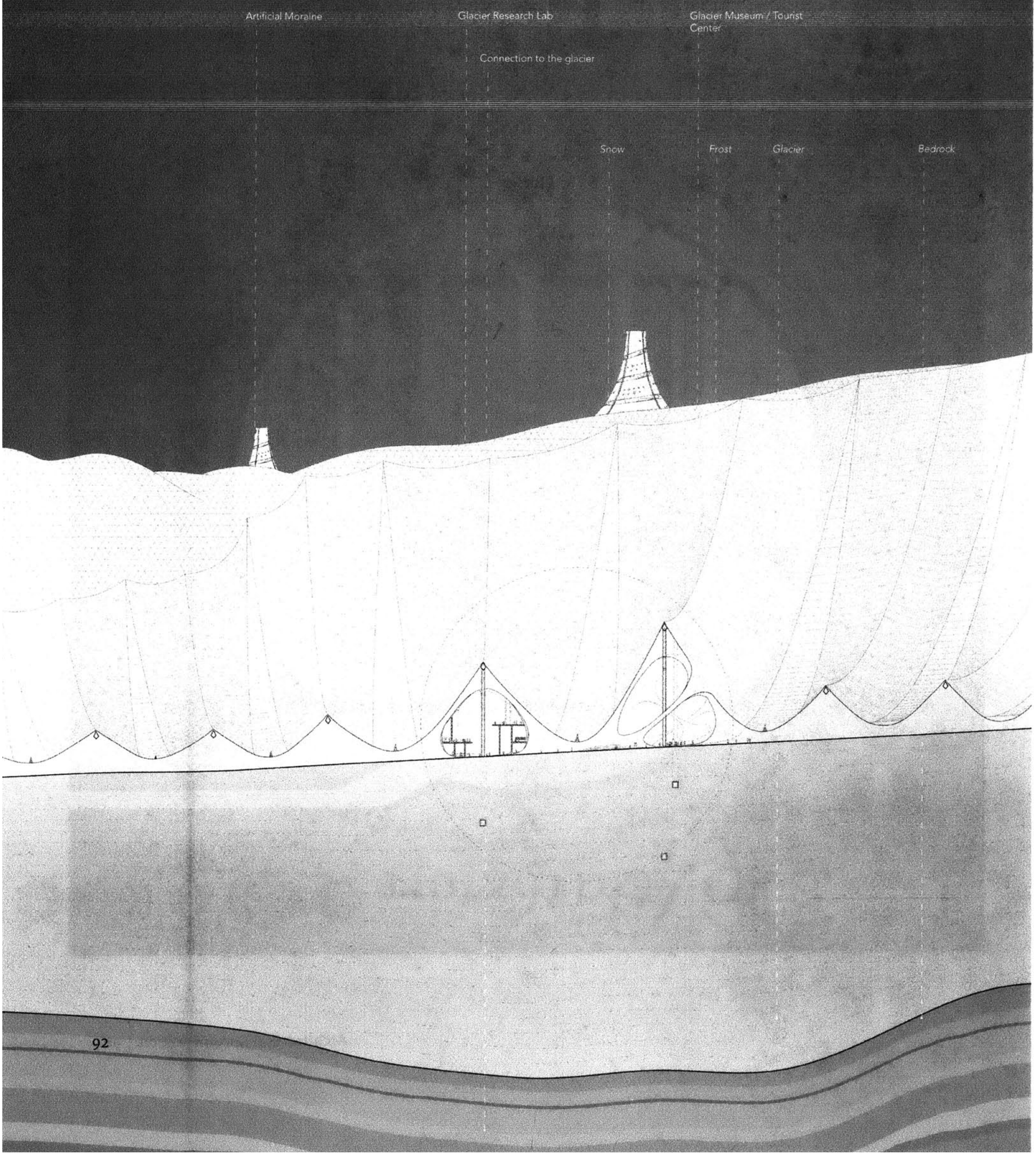


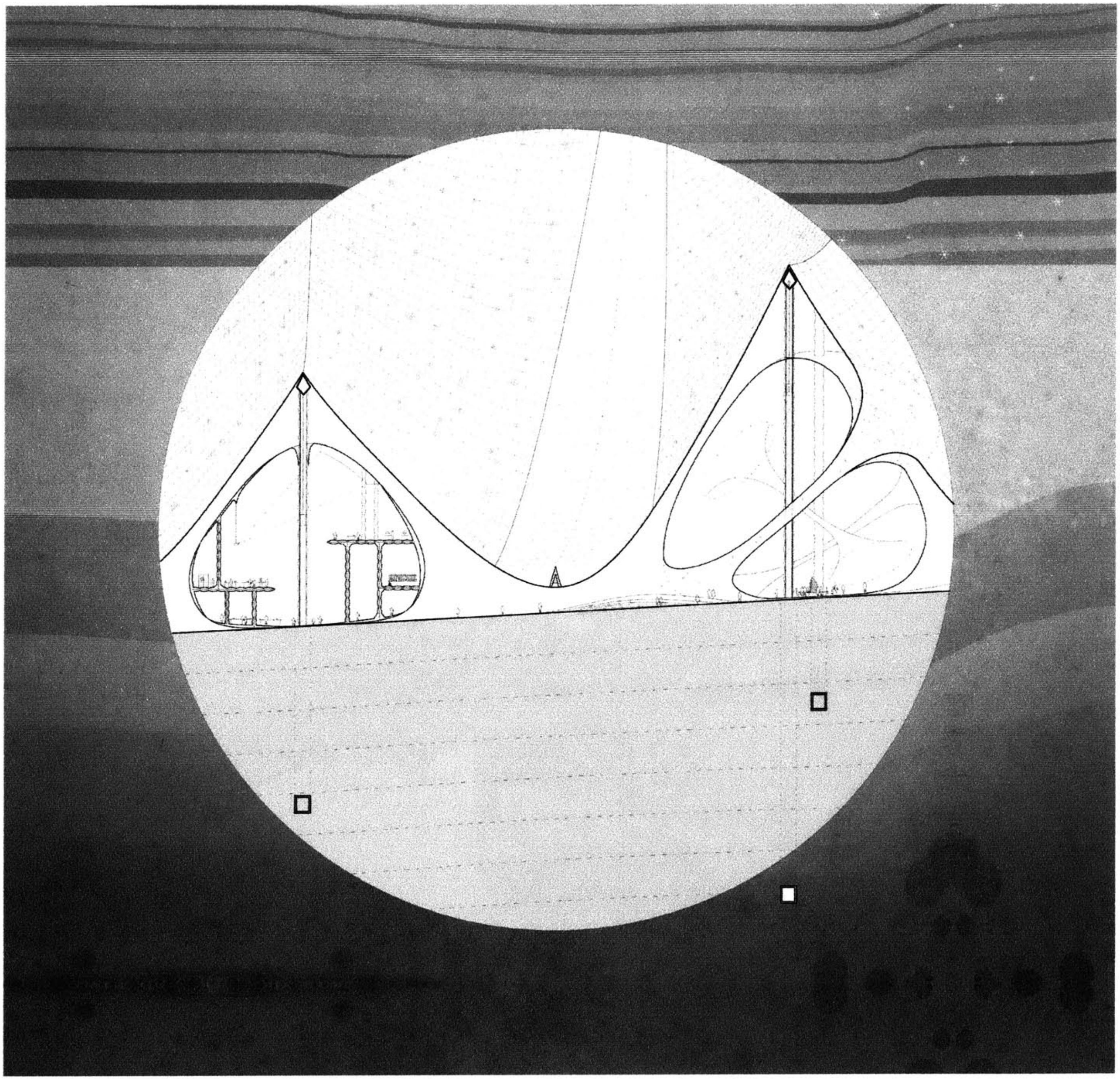
Underground Seed Bank of Mountain Hat



SECTION

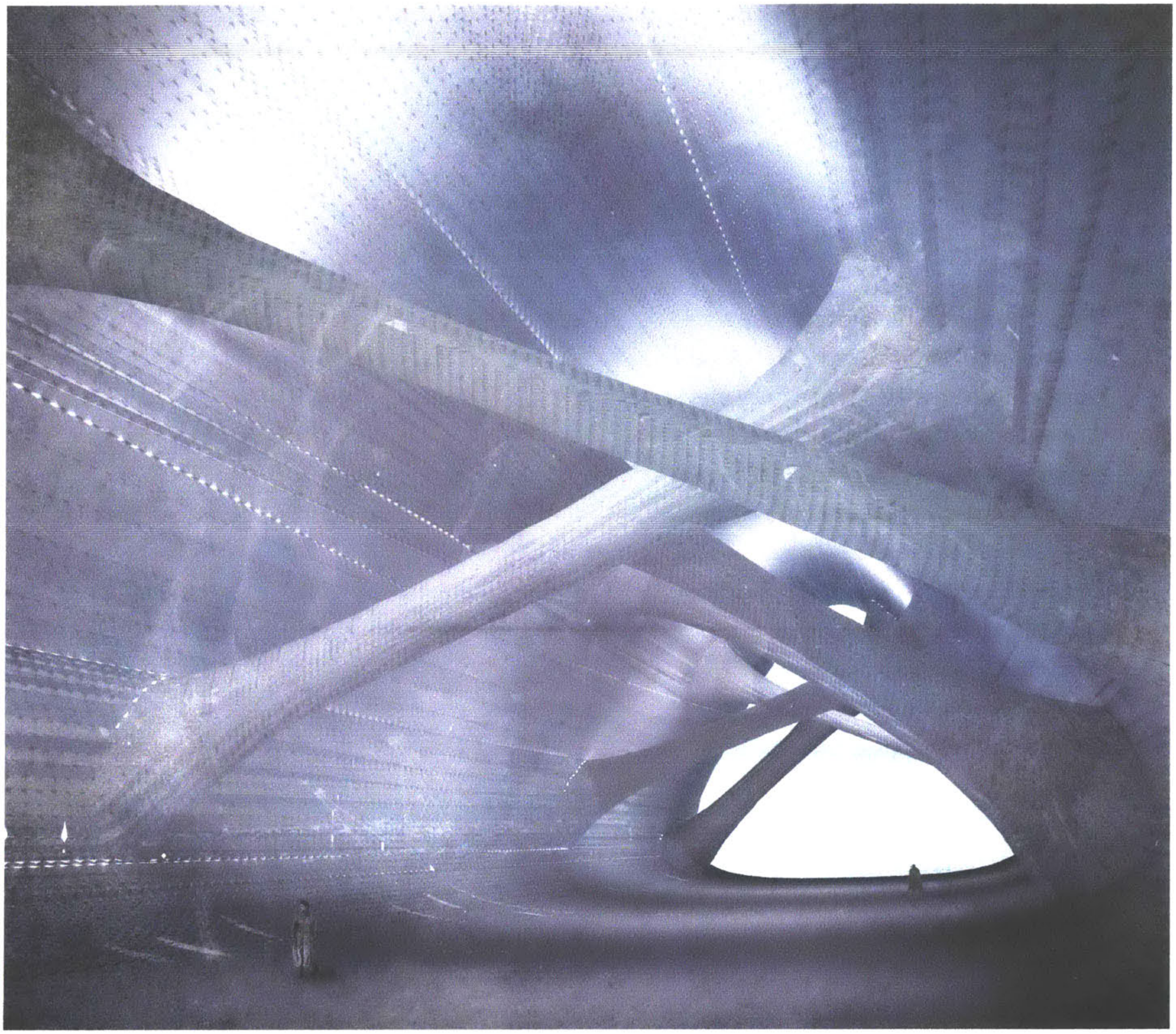
Glacier Blanket





PERSPECTIVE

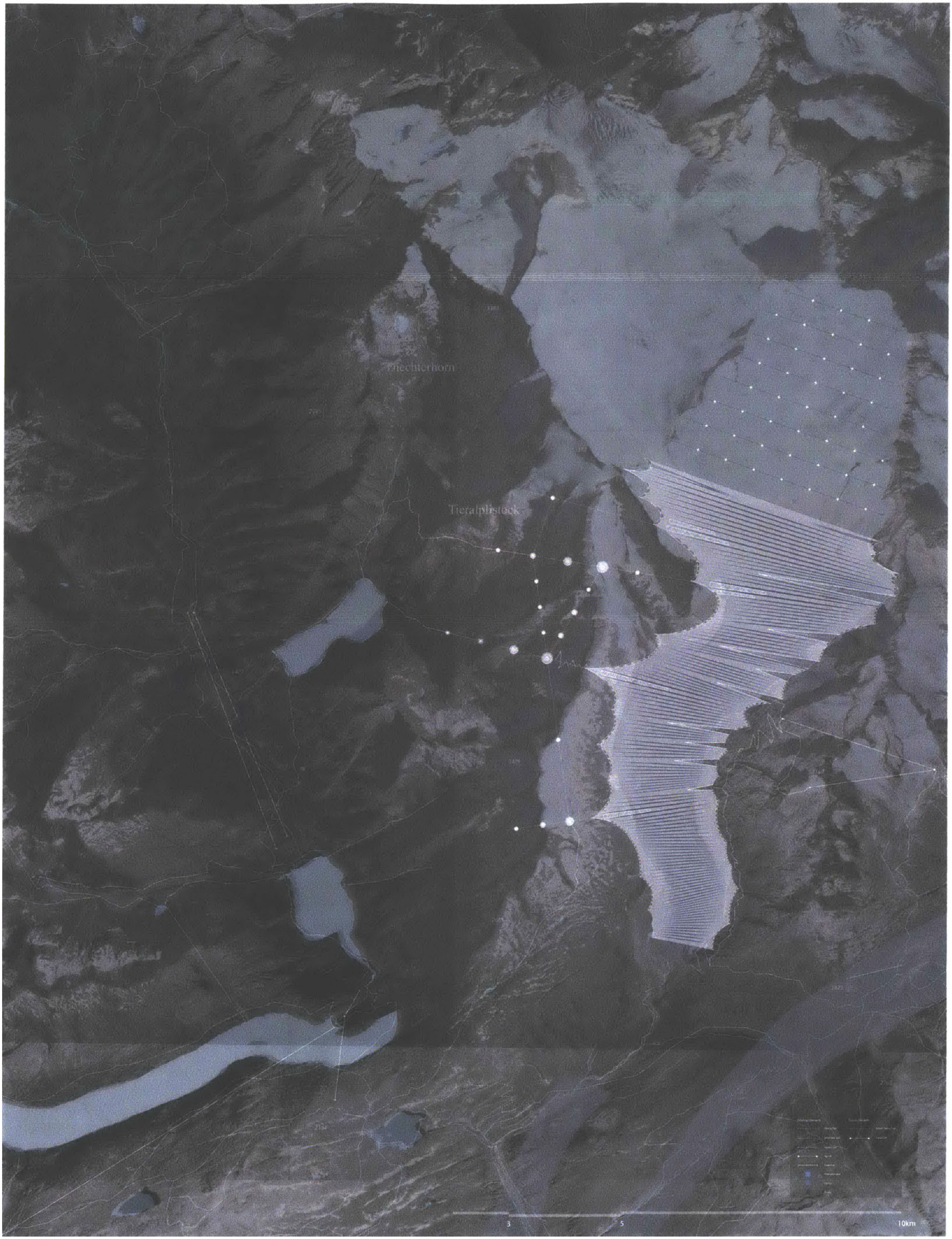
Mountain Hat



Architectural Documentation

5.2 STOREHOUSE OF THE EARTH

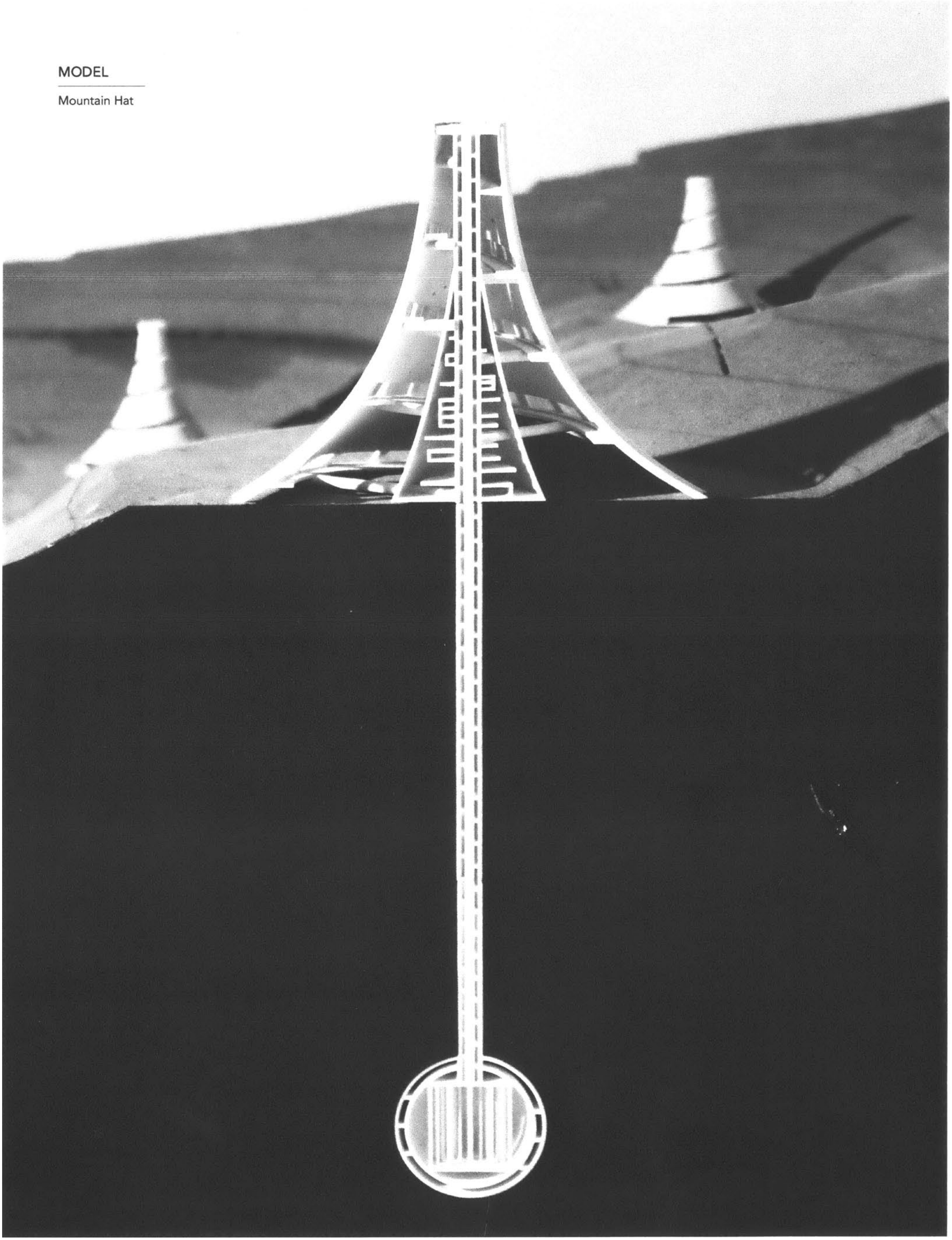
The architectural documentation here is an intricate system, which is composed of many elements that are related to four categories in the future scenario. The form and function of this architectural documentation will change to adapt to the environmental change. This thesis propose an occupiable documentation; therefore, in this thesis, architecture is both a medium to document and a space to archive. Finally, this thesis will propose a new relationship between architecture and the environment by becoming a **storehouse of the earth**.

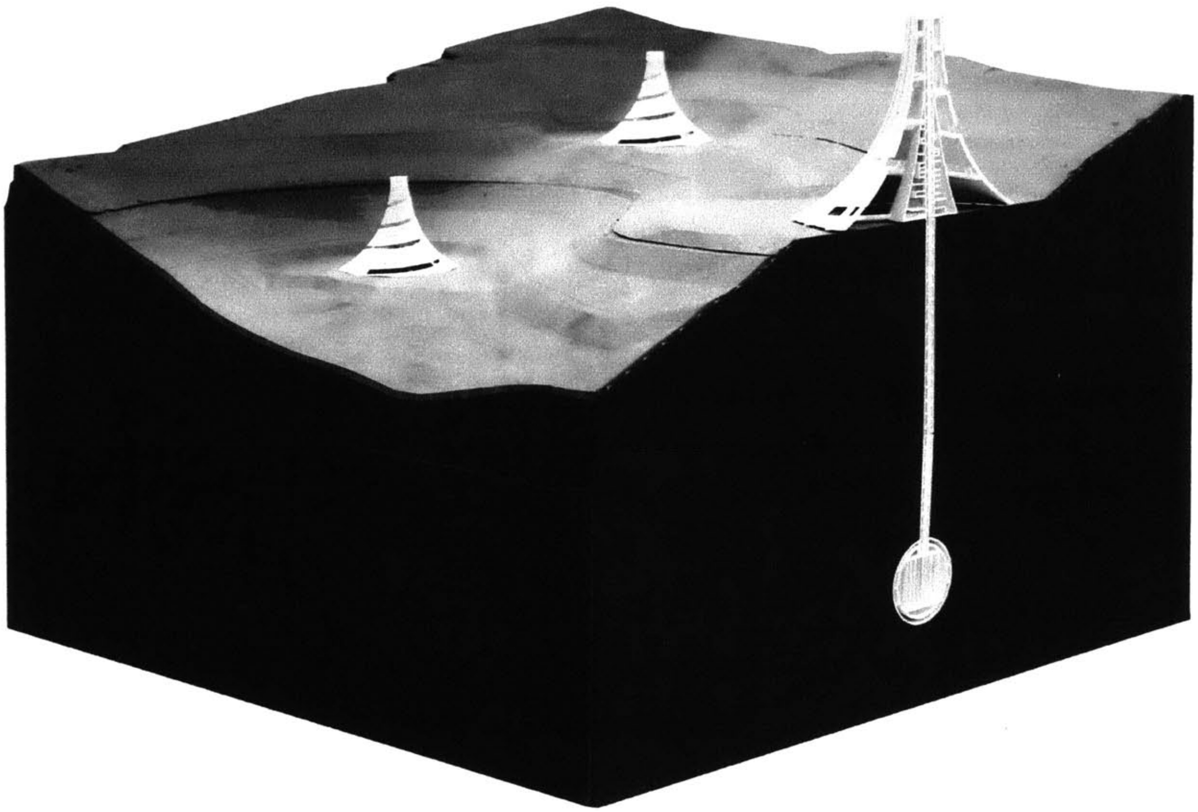


Tieralplistock
3
5
10km

MODEL

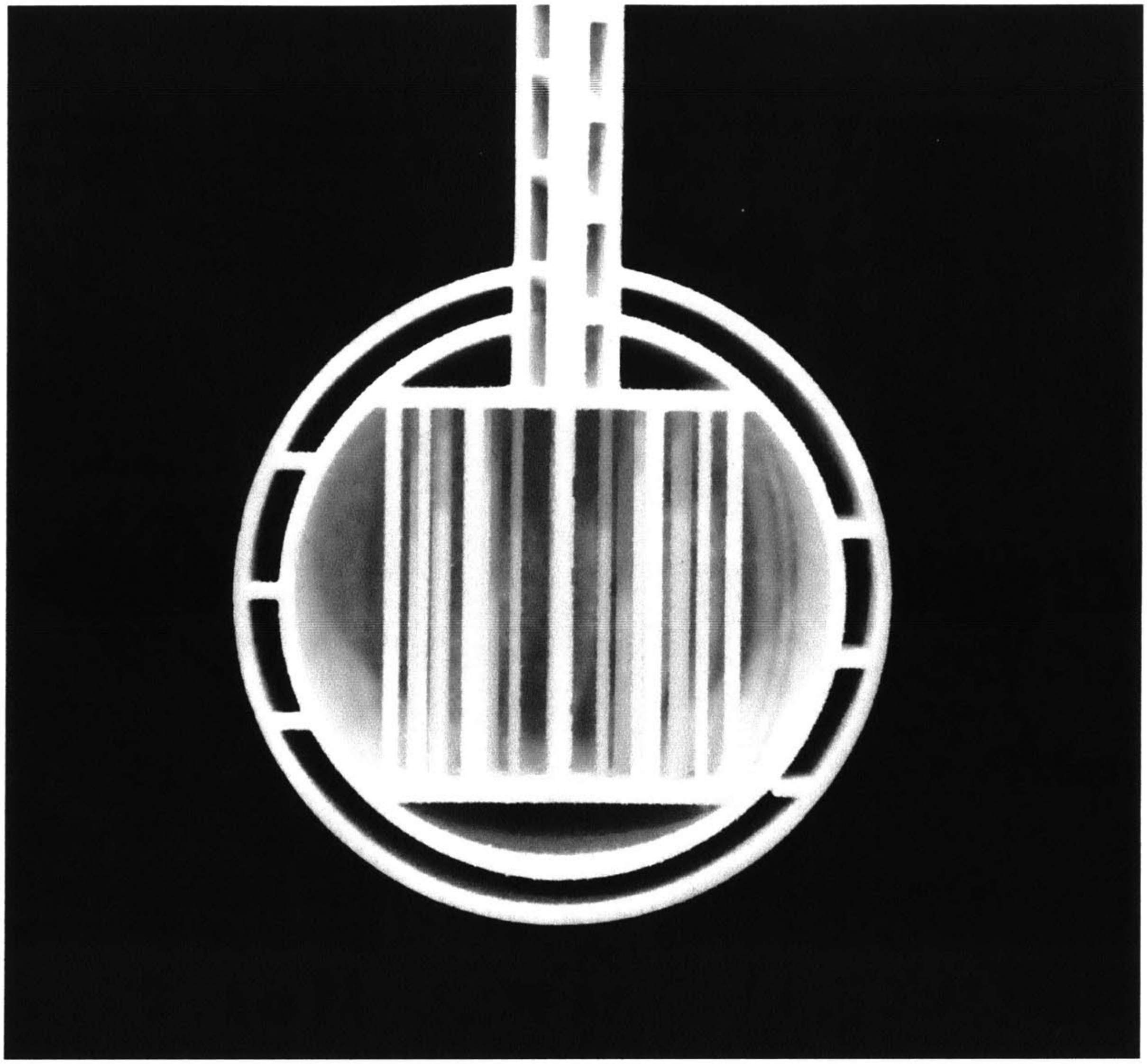
Mountain Hat





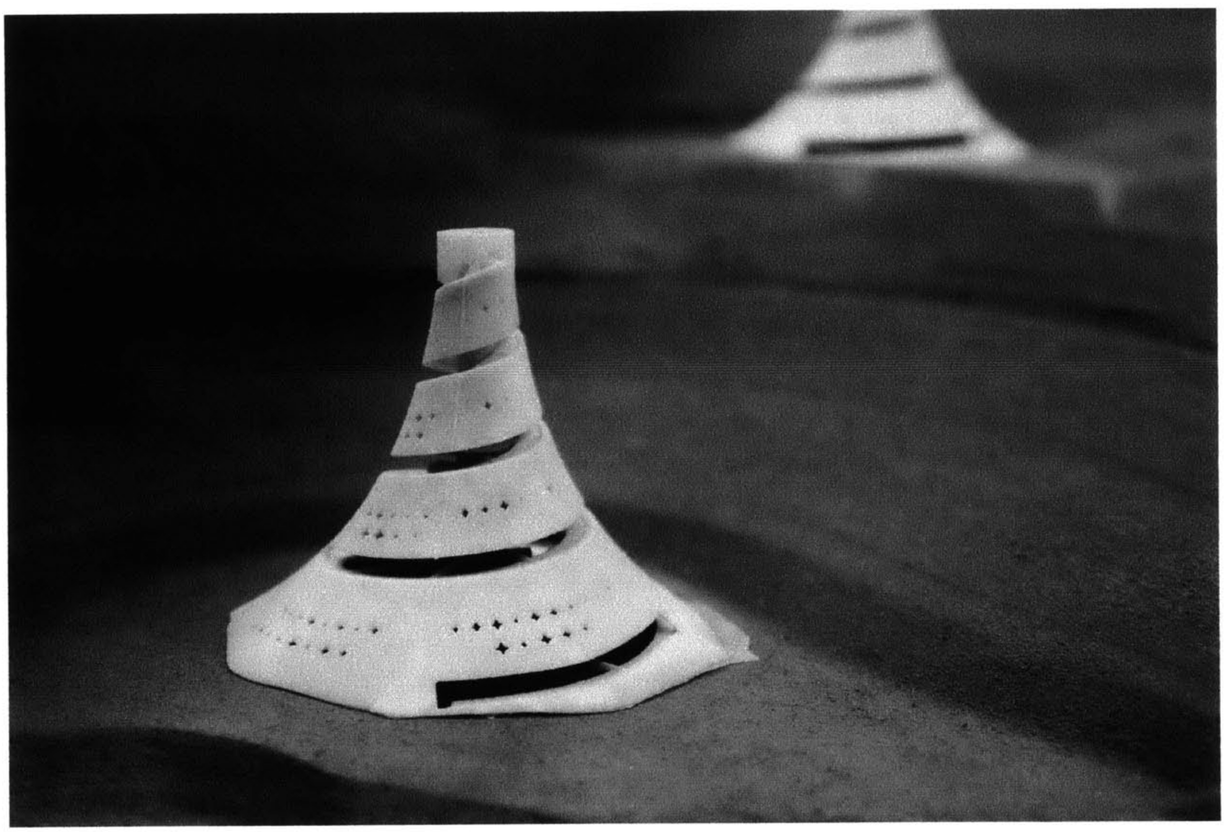
Mountain Hat with Site Model

30 x 30 x 25 inch
Wood, 3d Printing



Mountain Hat with Site Model

30 x 30 x 25 inch
Wood, 3d Printing

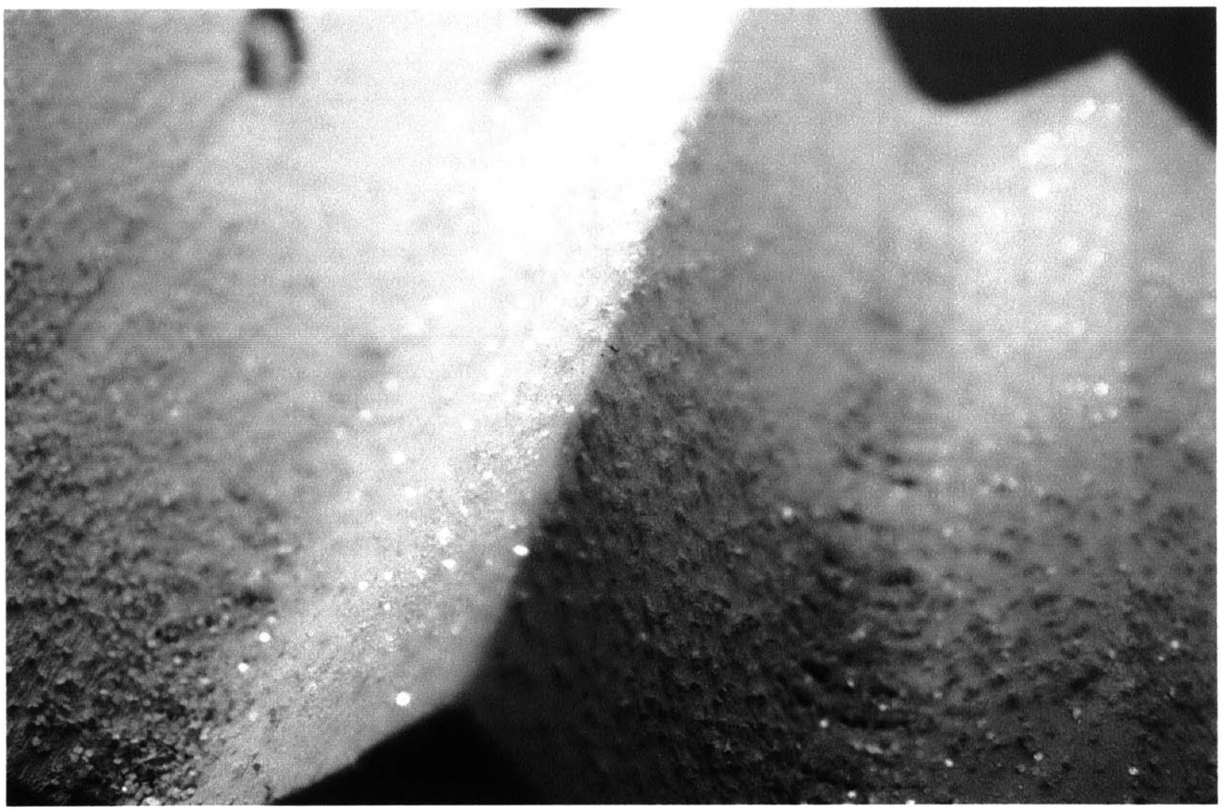


Mountain Hat with Site Model

30 x 30 x 25 inch
Wood, 3d Printing

Glacier Blanket with Site Model

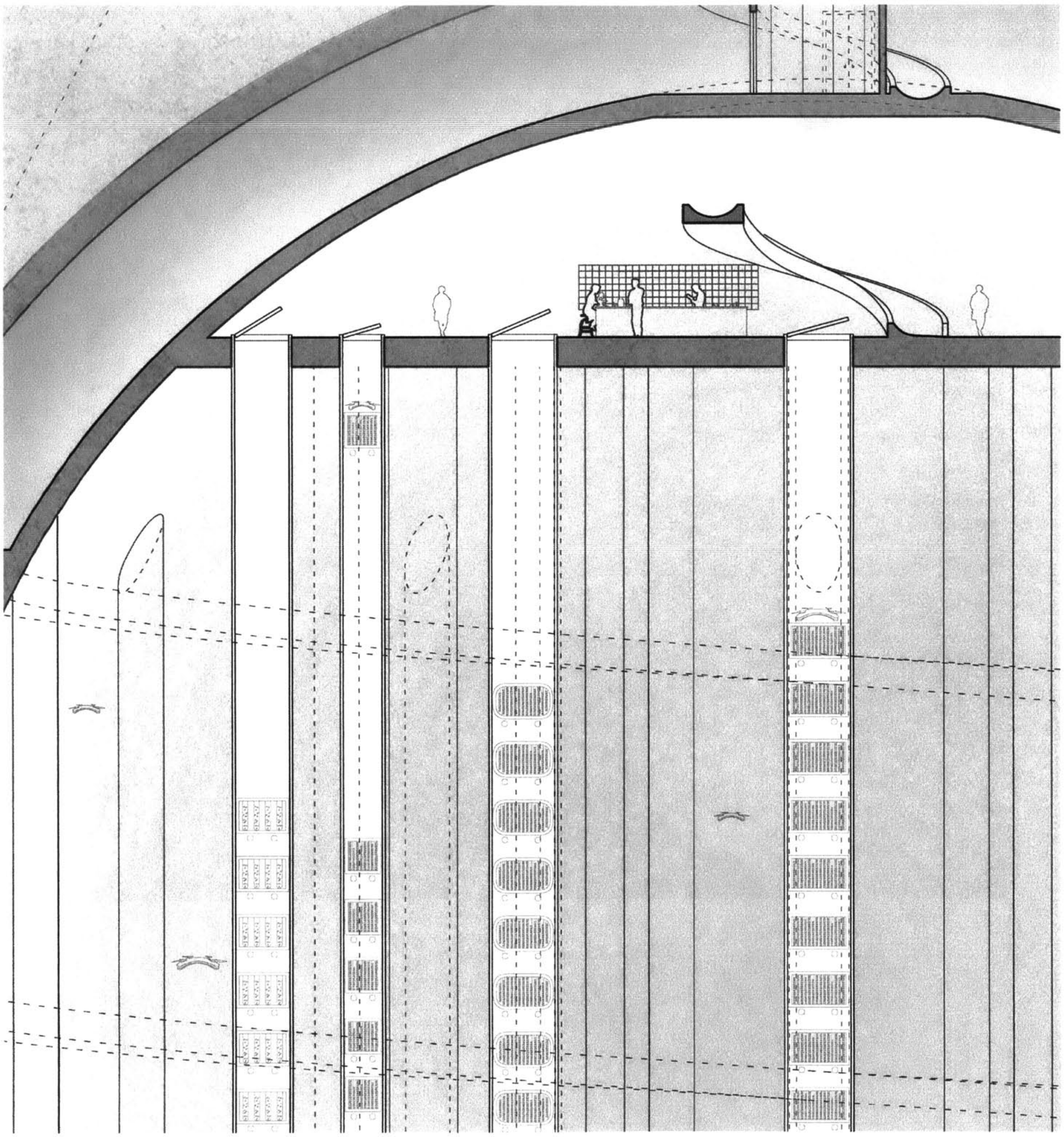
8 x 28 x 12 inch
Wood, 3d Printing, Resin

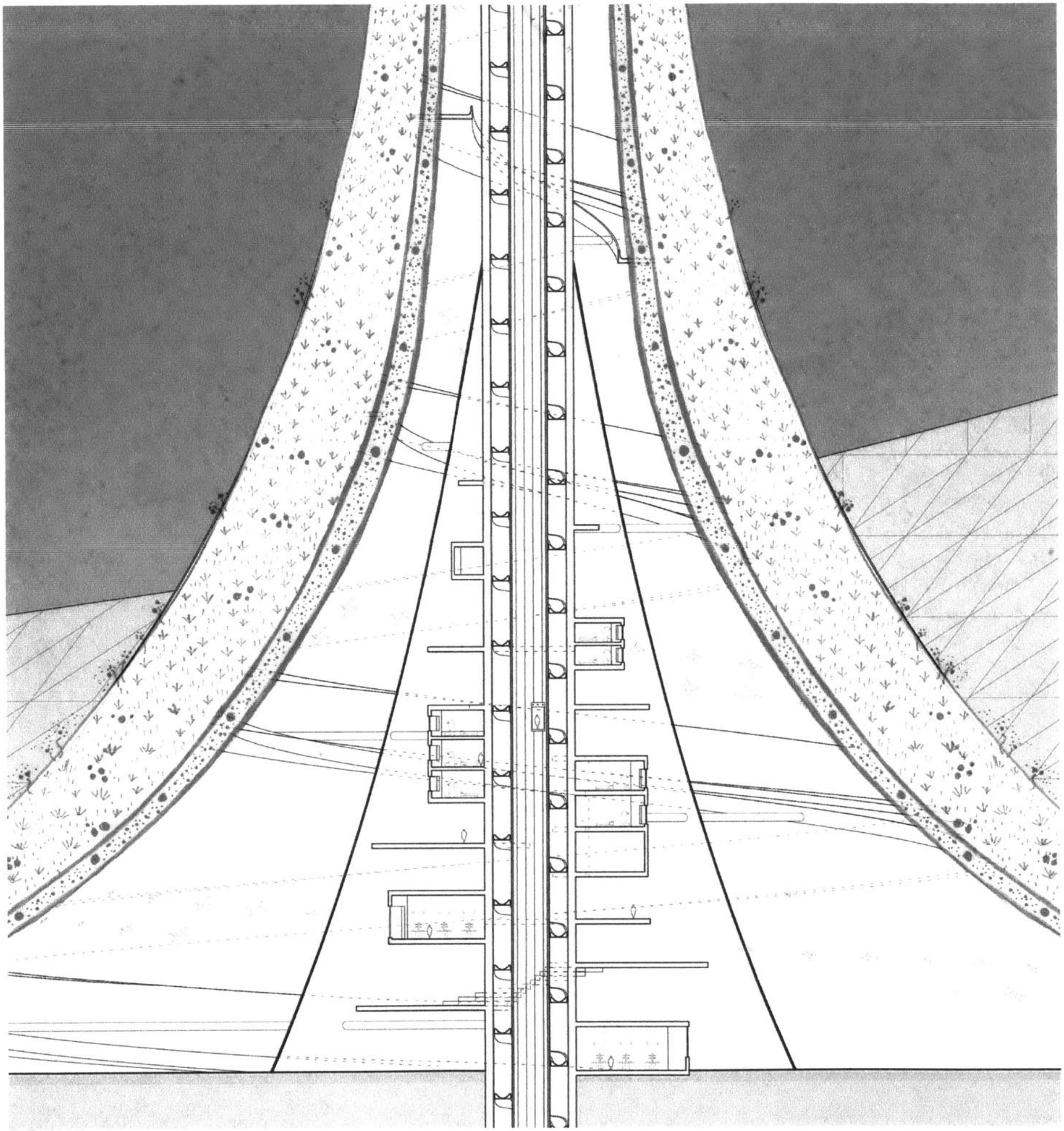


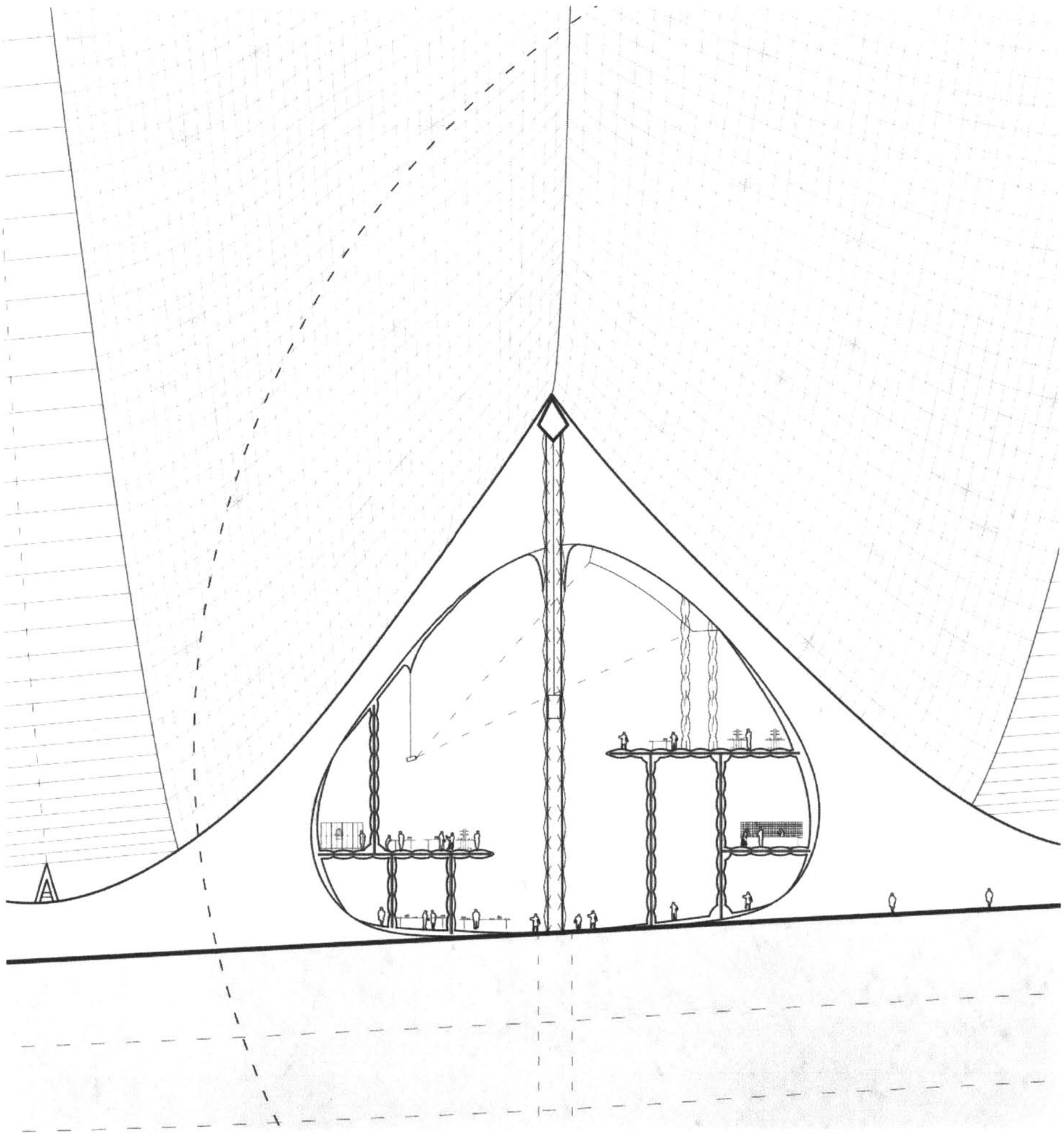
Glacier Blanket with Site Model

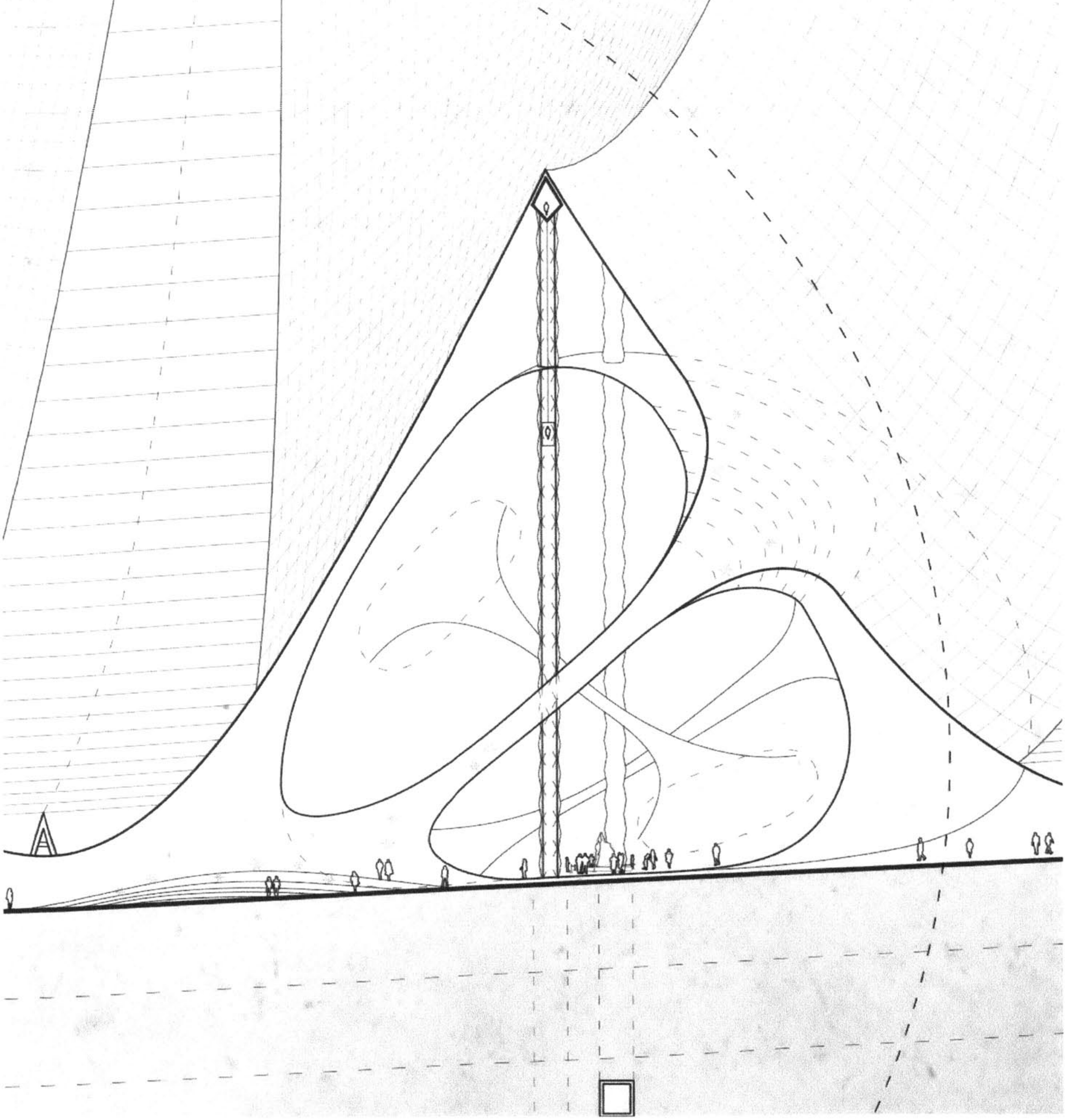
8 x 28 x 12 inch
Wood, 3d Printing, Resin

Underground Seed Bank









View from the Hiking Route

6

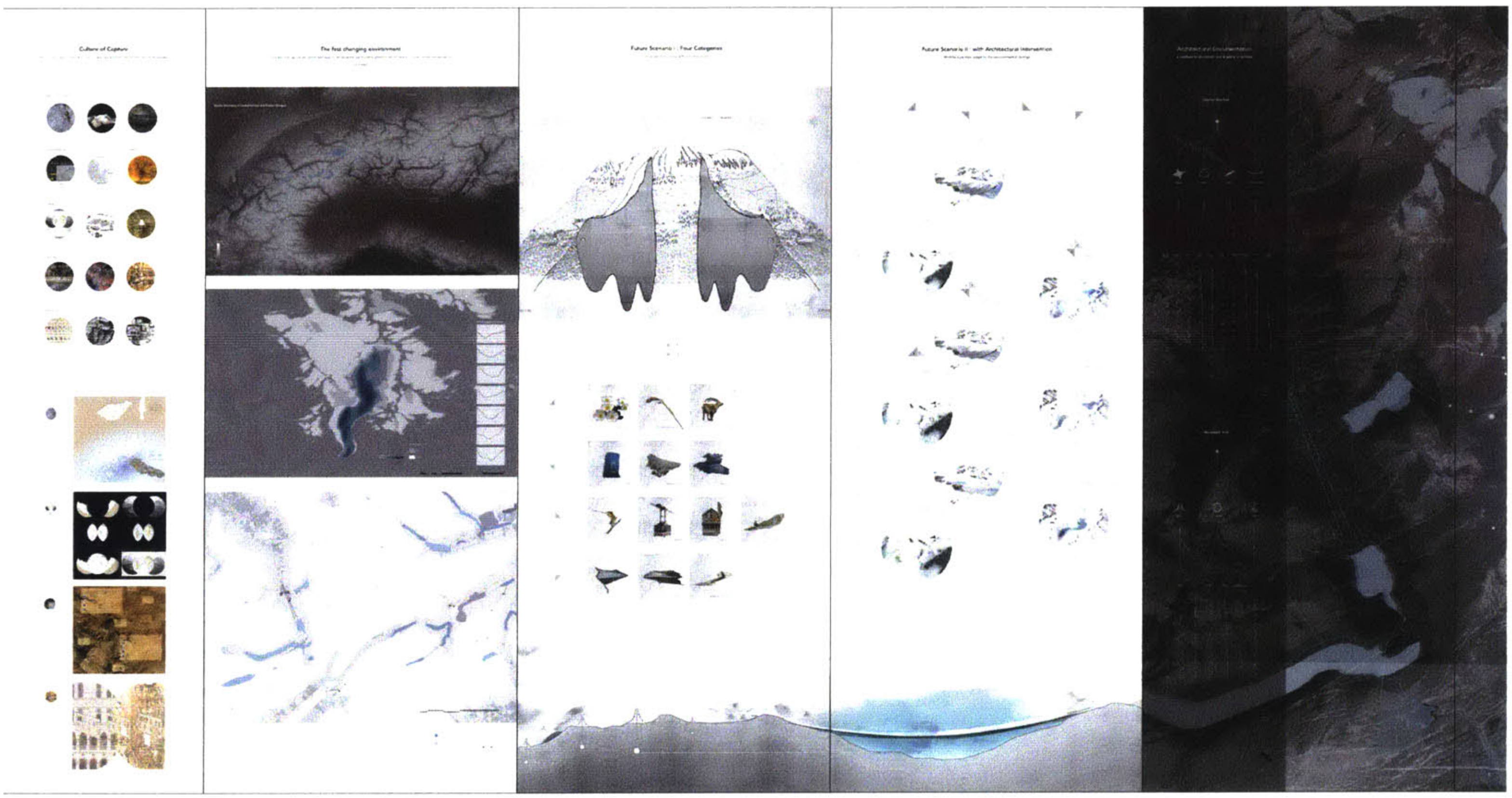
APPENDIX

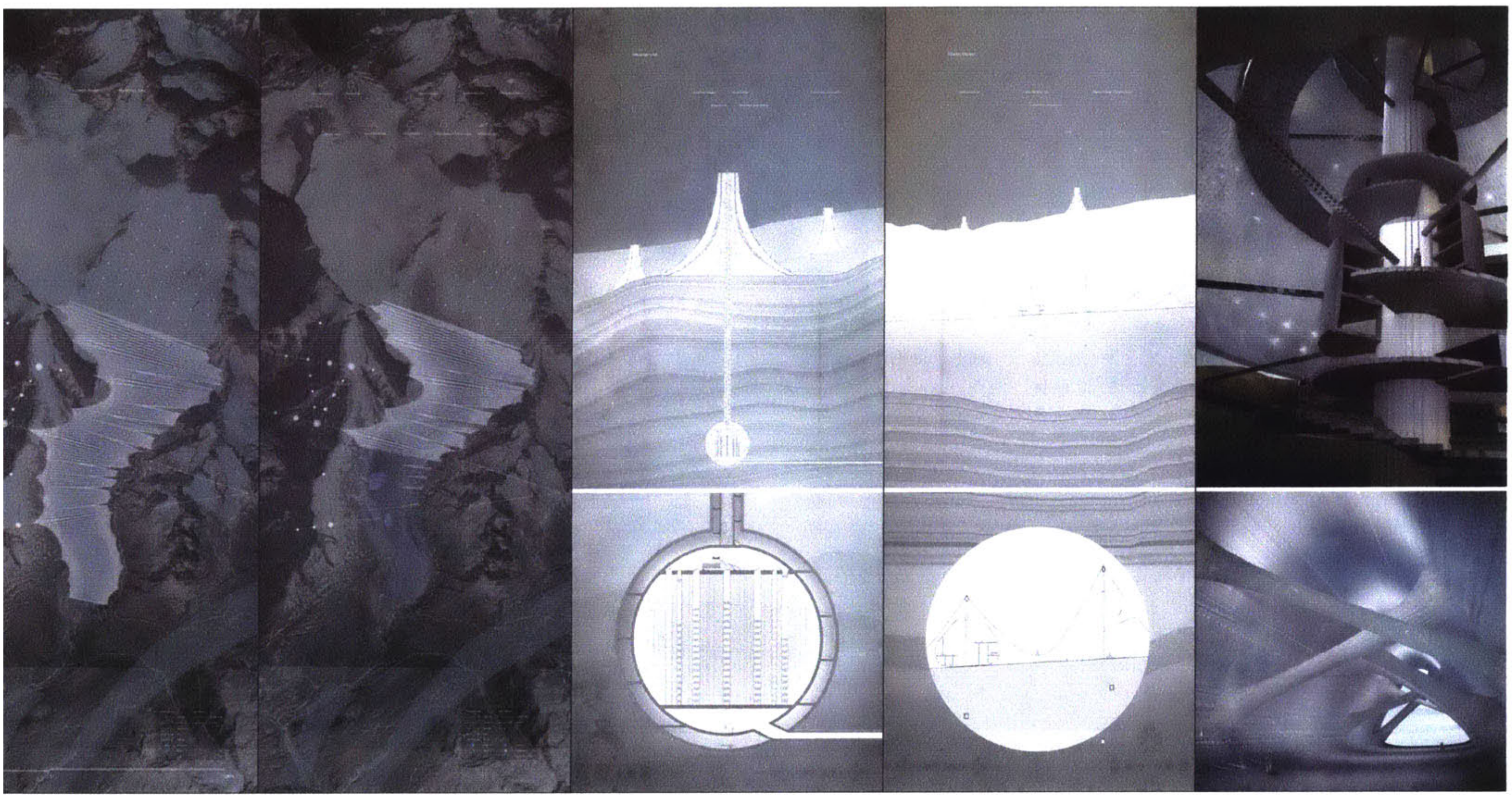
Appendix

THESIS FINAL REVIEW

Media Lab

December 17th, 2015





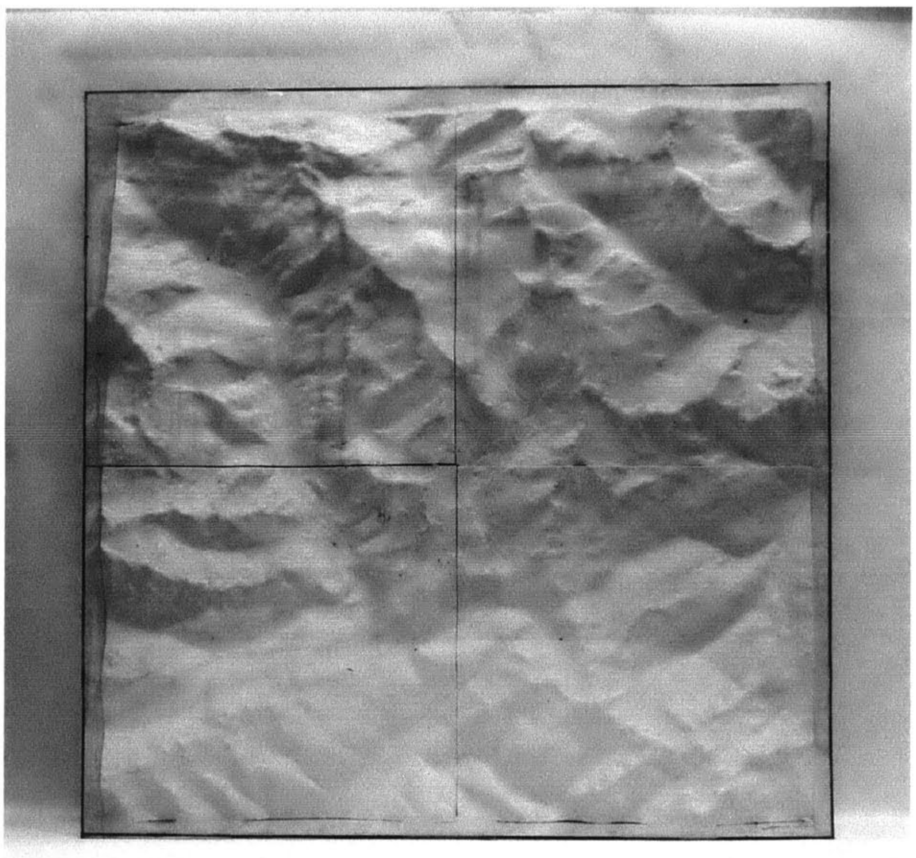
Final Presentation

Media Lab
December 17th, 2015

Final Presentation

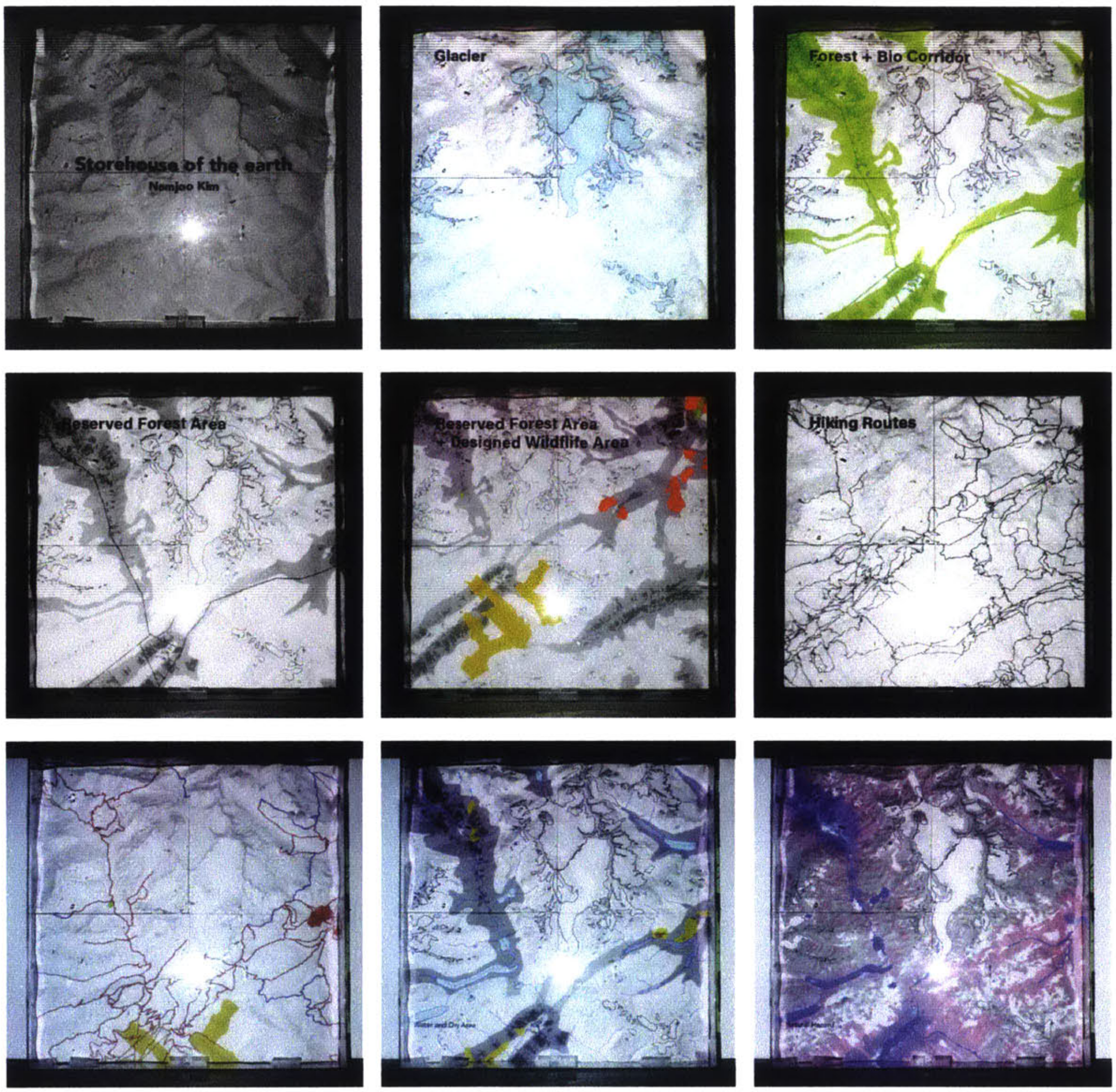
Media Lab
December 17th, 2015

PROJECTION MODEL



Site Model

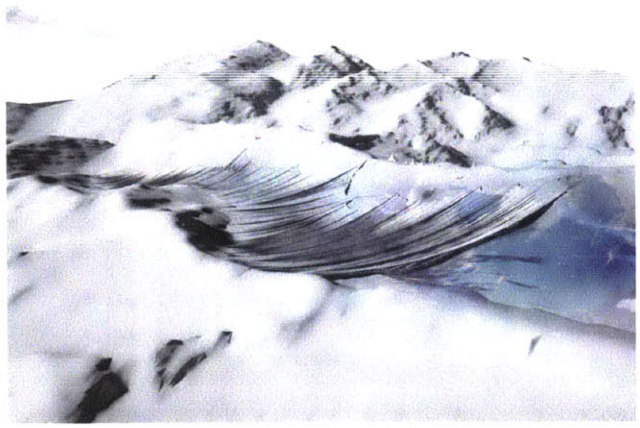
8 x 8 x 4 inch
1: 60,000

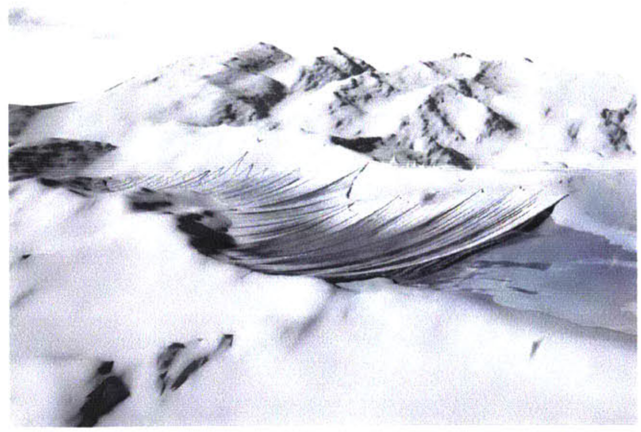


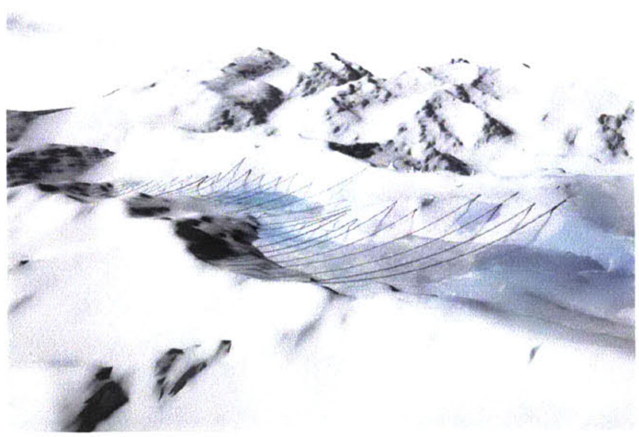
Projection on the Site Model

Mid Review
Final Review

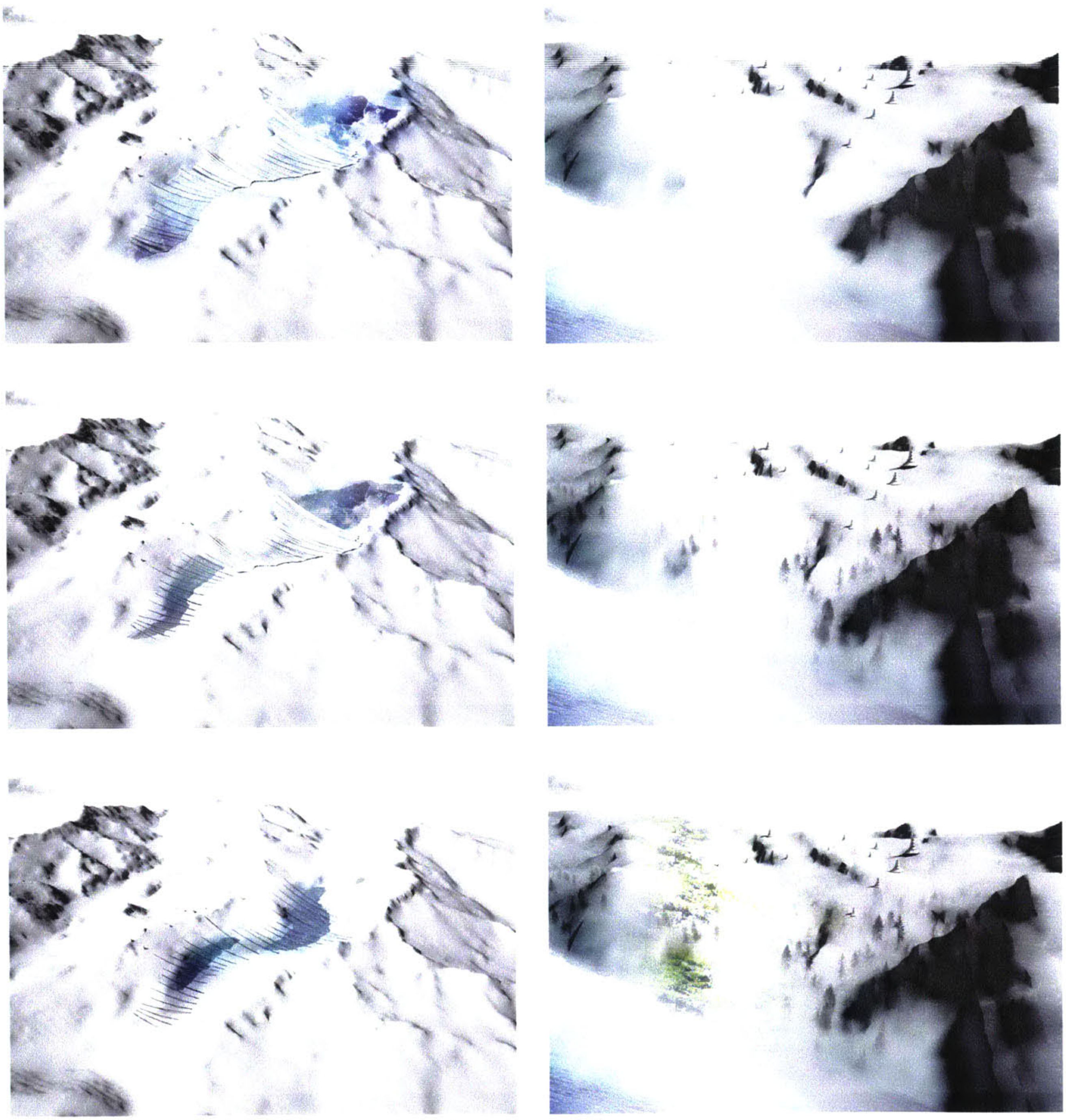
Appendix
IMAGE ARCHIVE







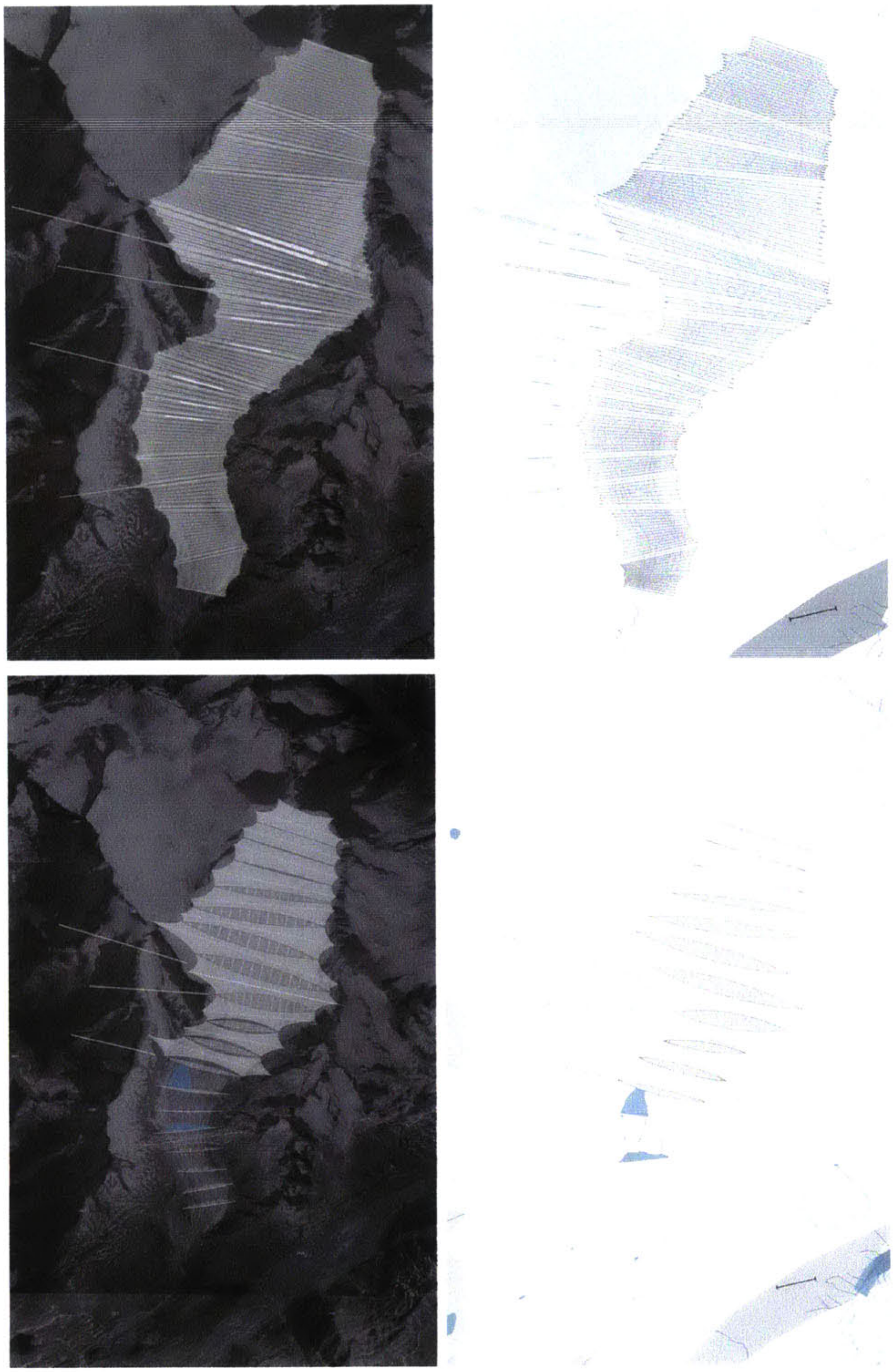
Rendering Images in the Future Scenario



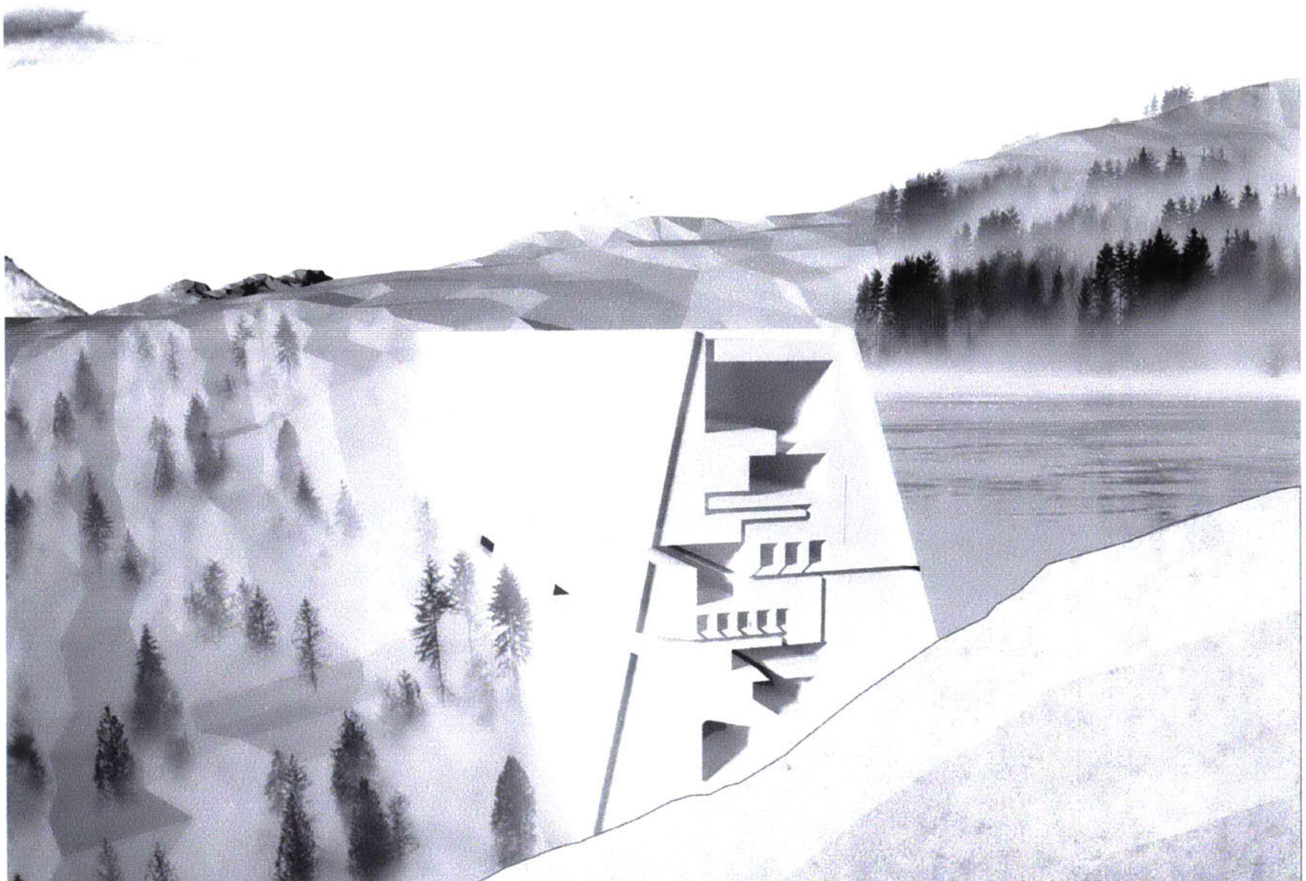
Rendering Images in the Future Scenario

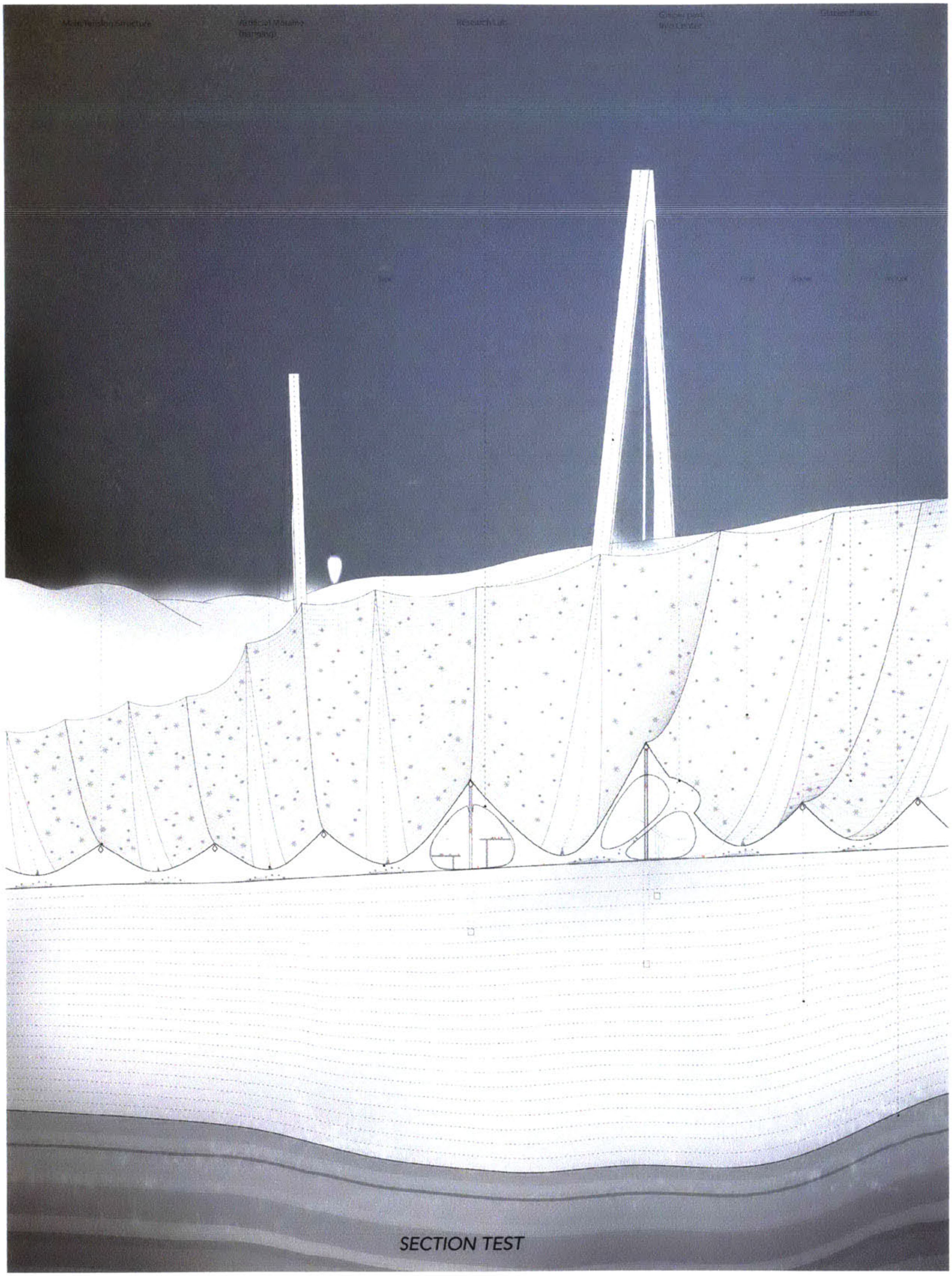
Appendix

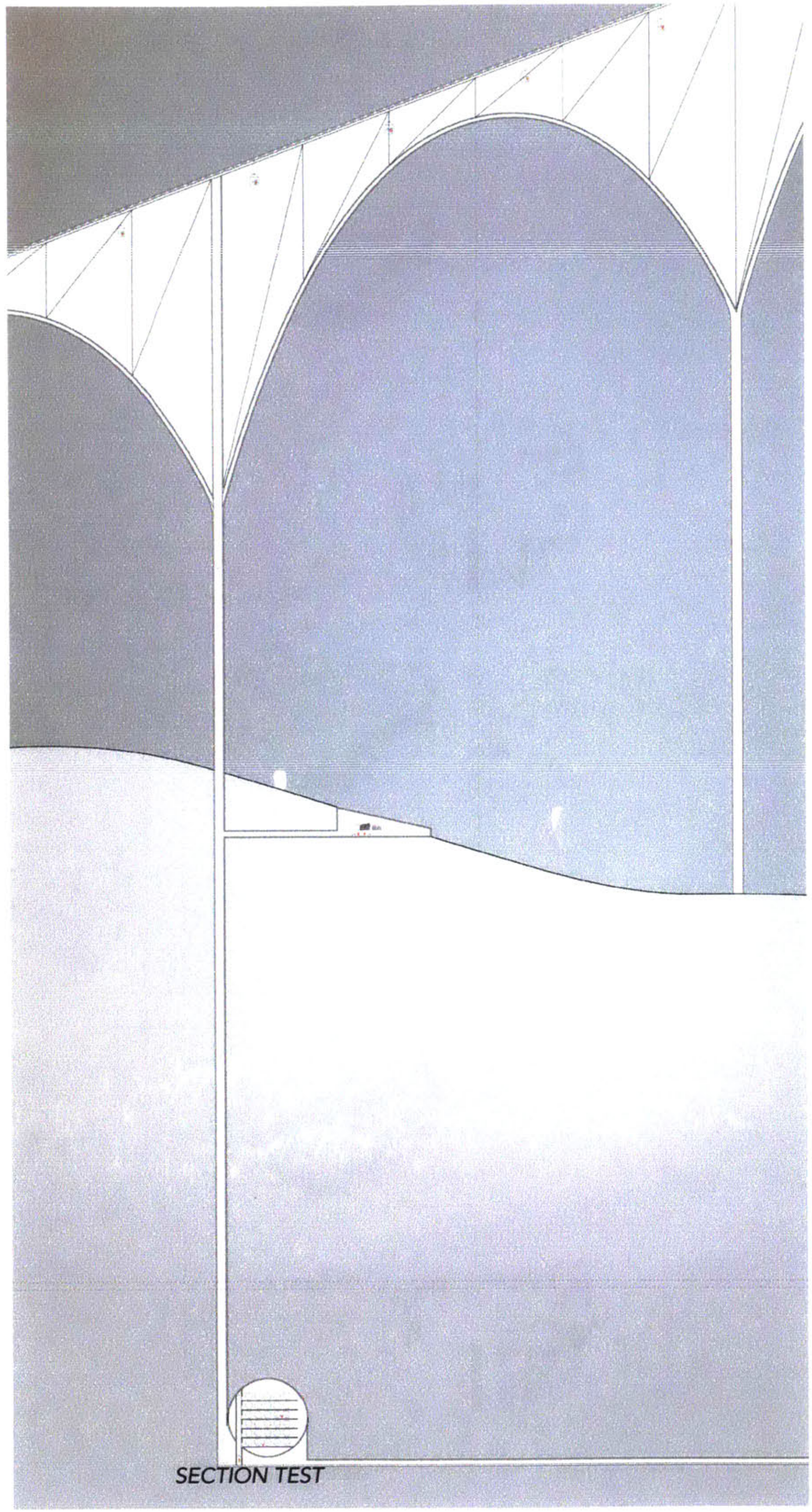
DESIGN PROCESS



PLAN TEST




SECTION TEST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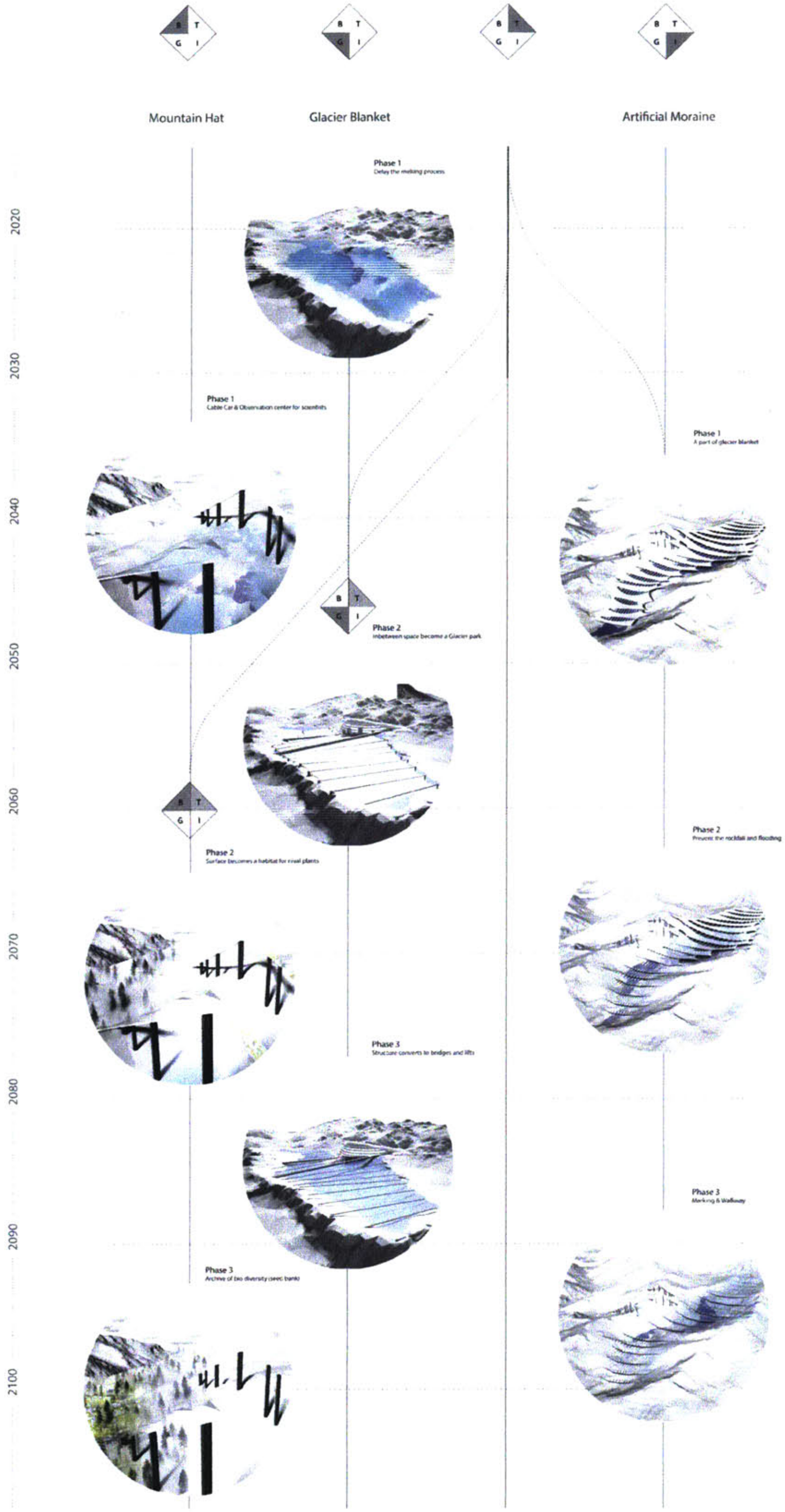
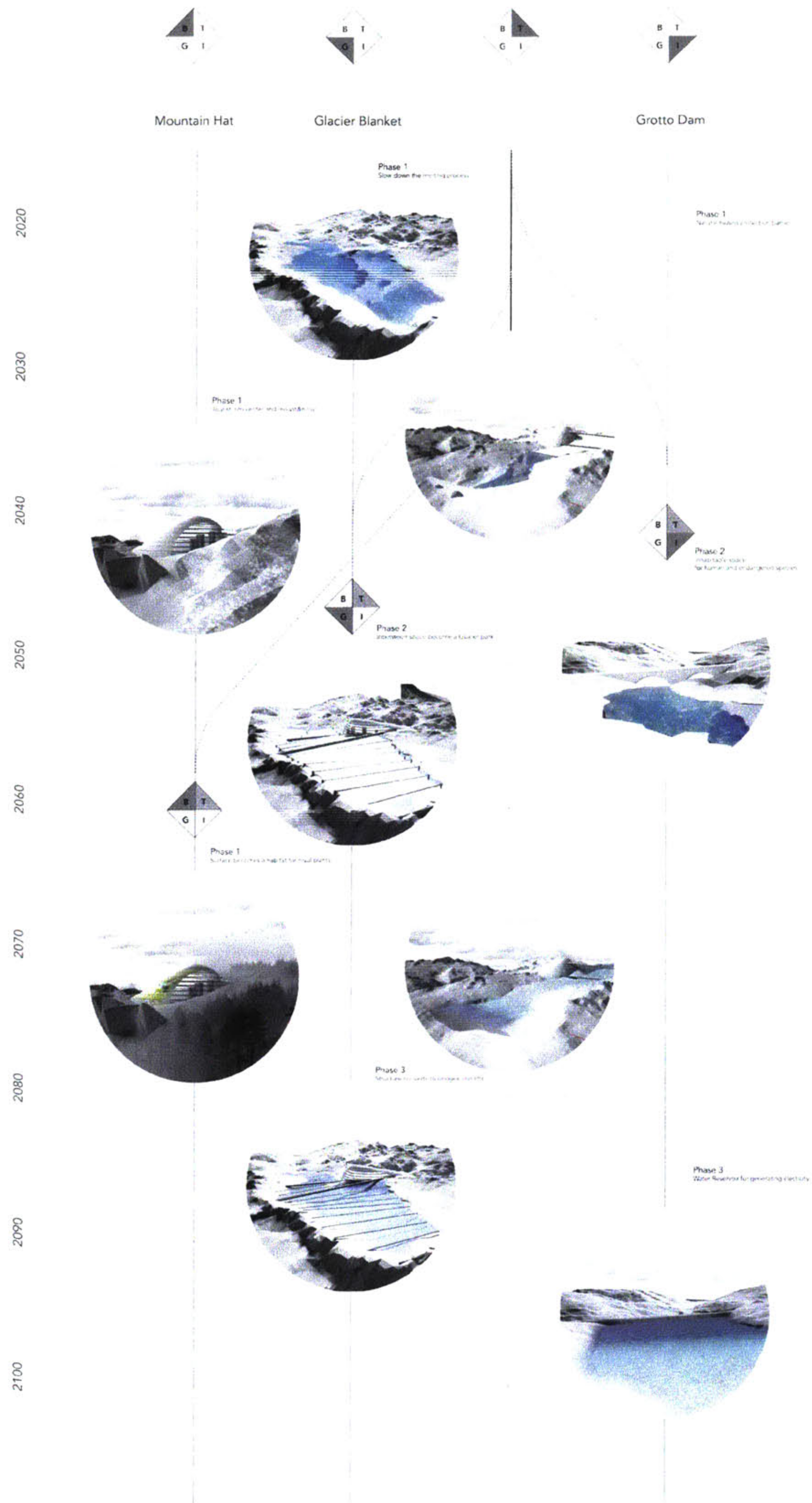


SCENARIO TEST

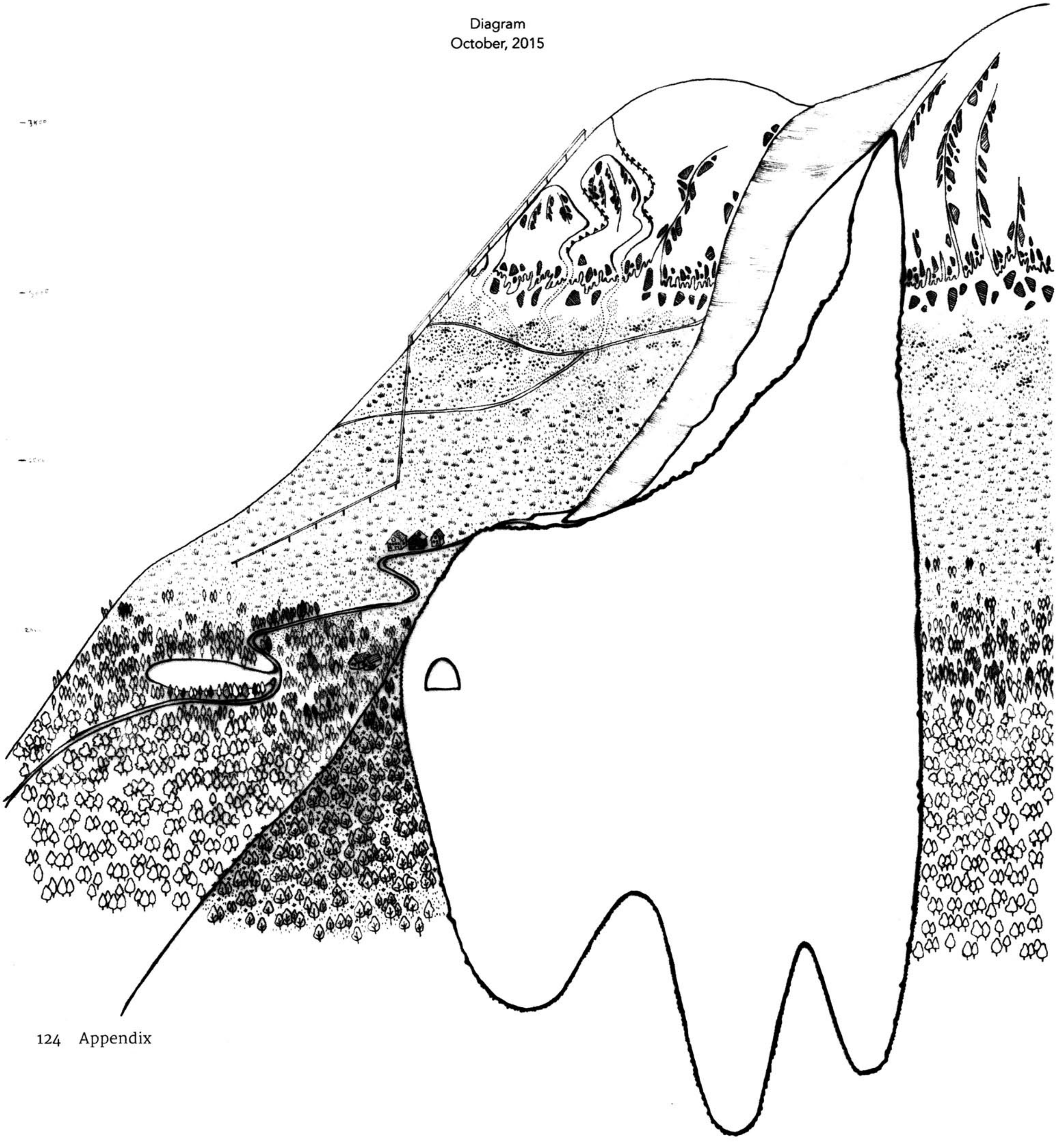


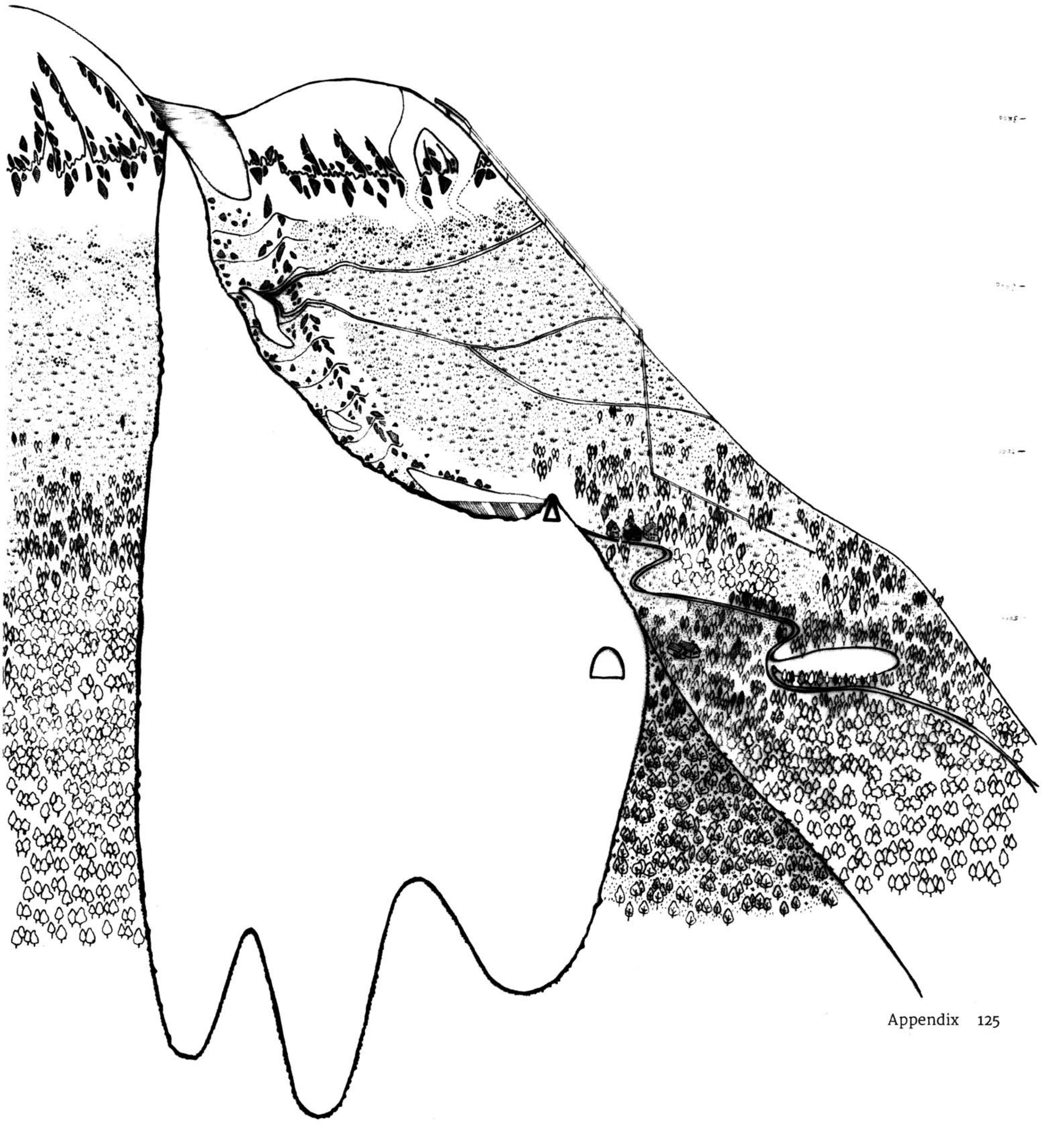
SCENARIO TEST

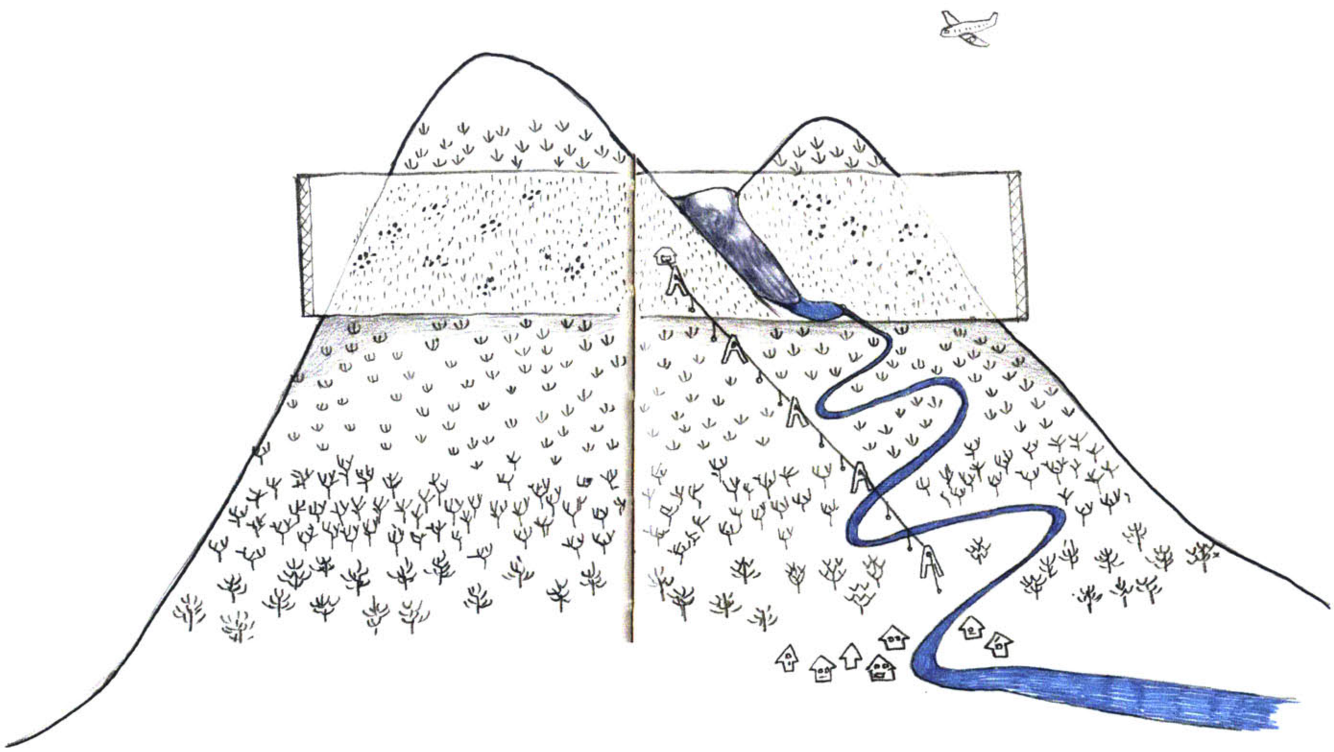
DRAWING

Present and Future

Diagram
October, 2015

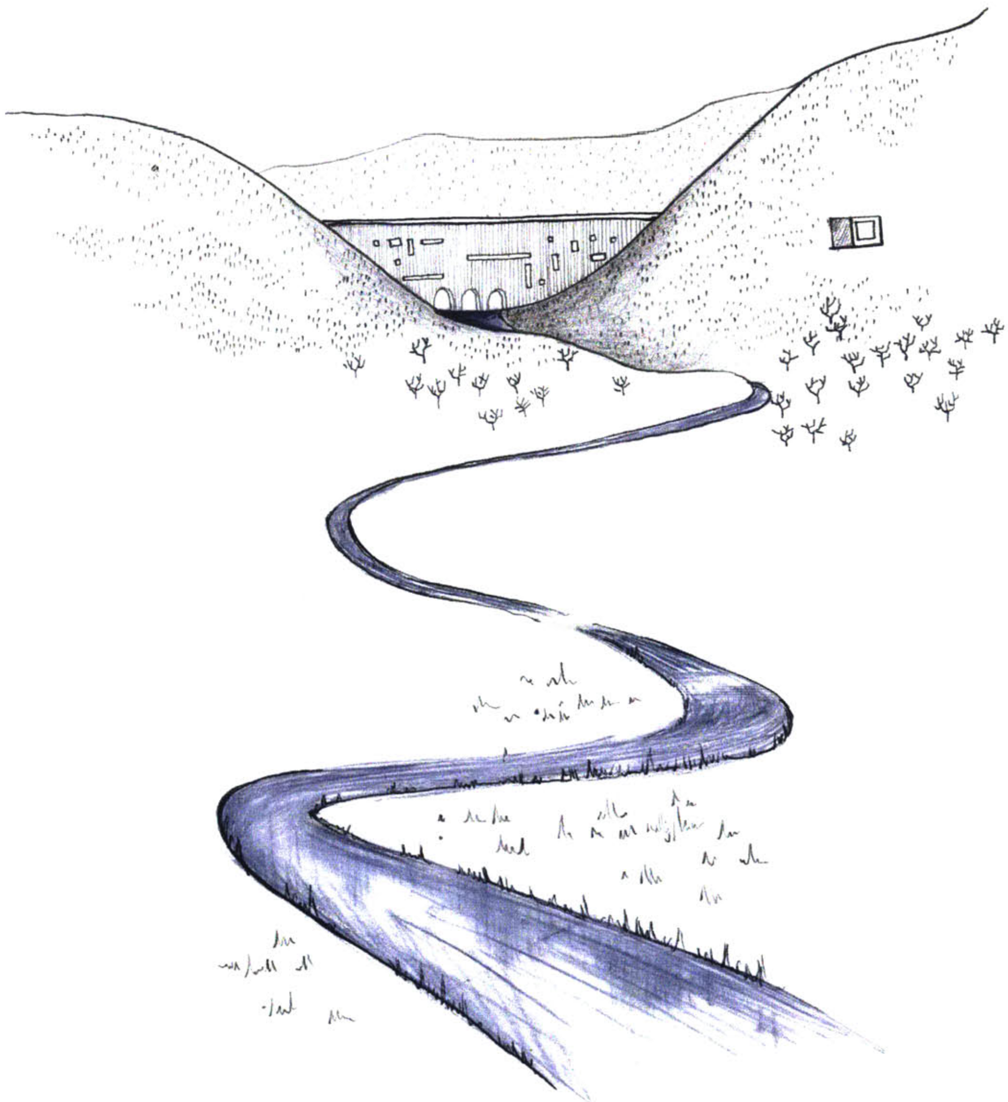






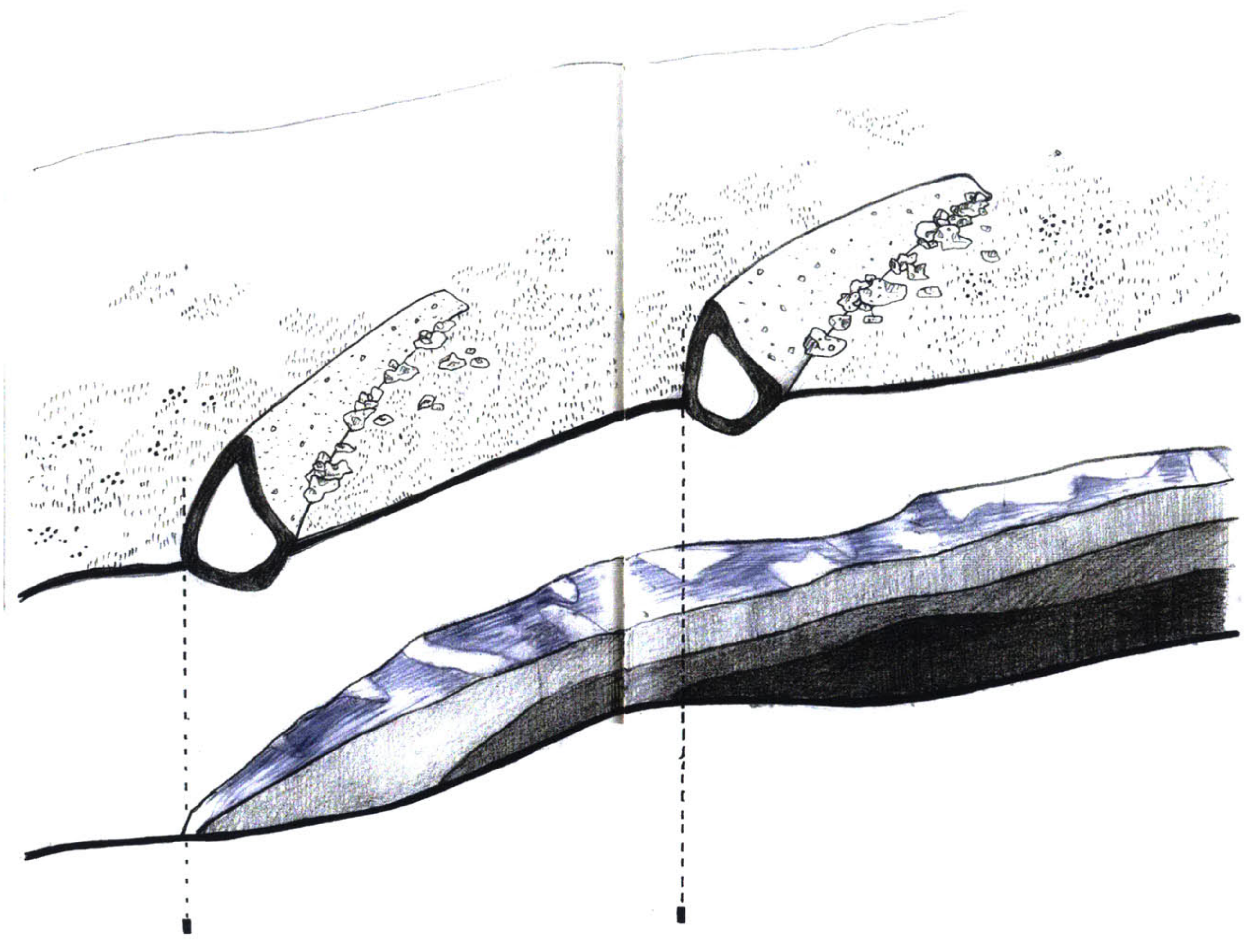
Radical Architect

Idea Sketch
September, 2015



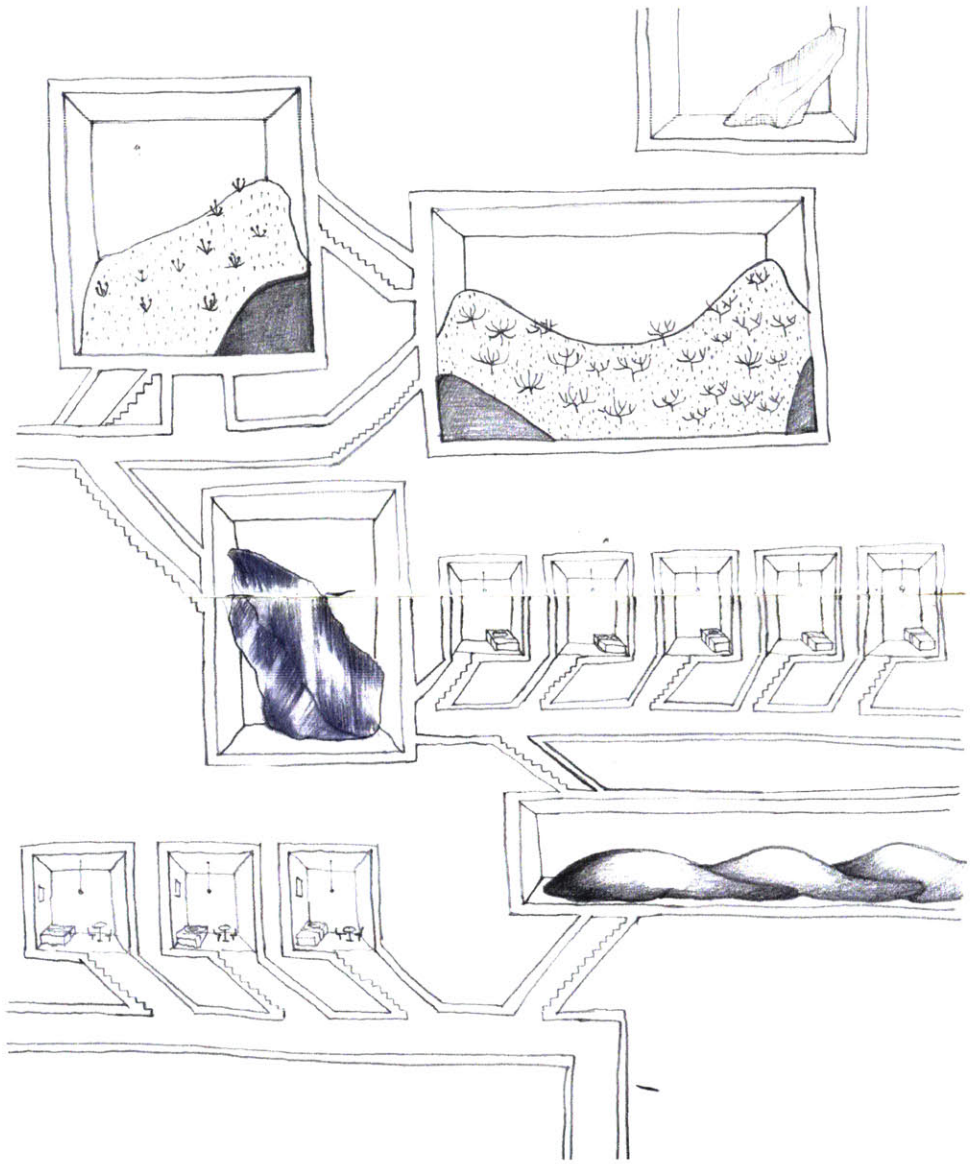
Conservative Government

Idea Sketch
September, 2015



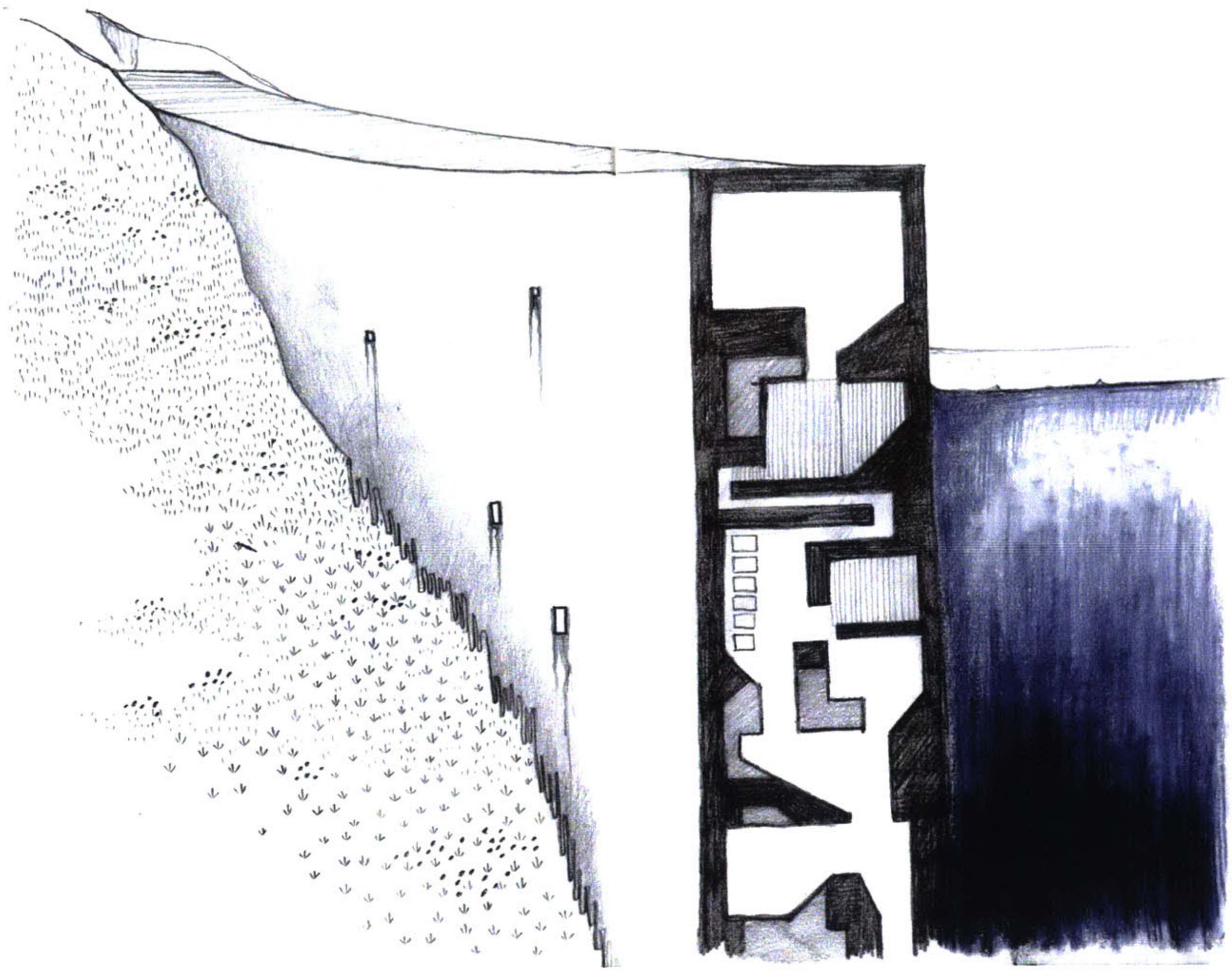
Marking the Land

Idea Sketch
September, 2015



Hotel

Idea Sketch
September, 2015

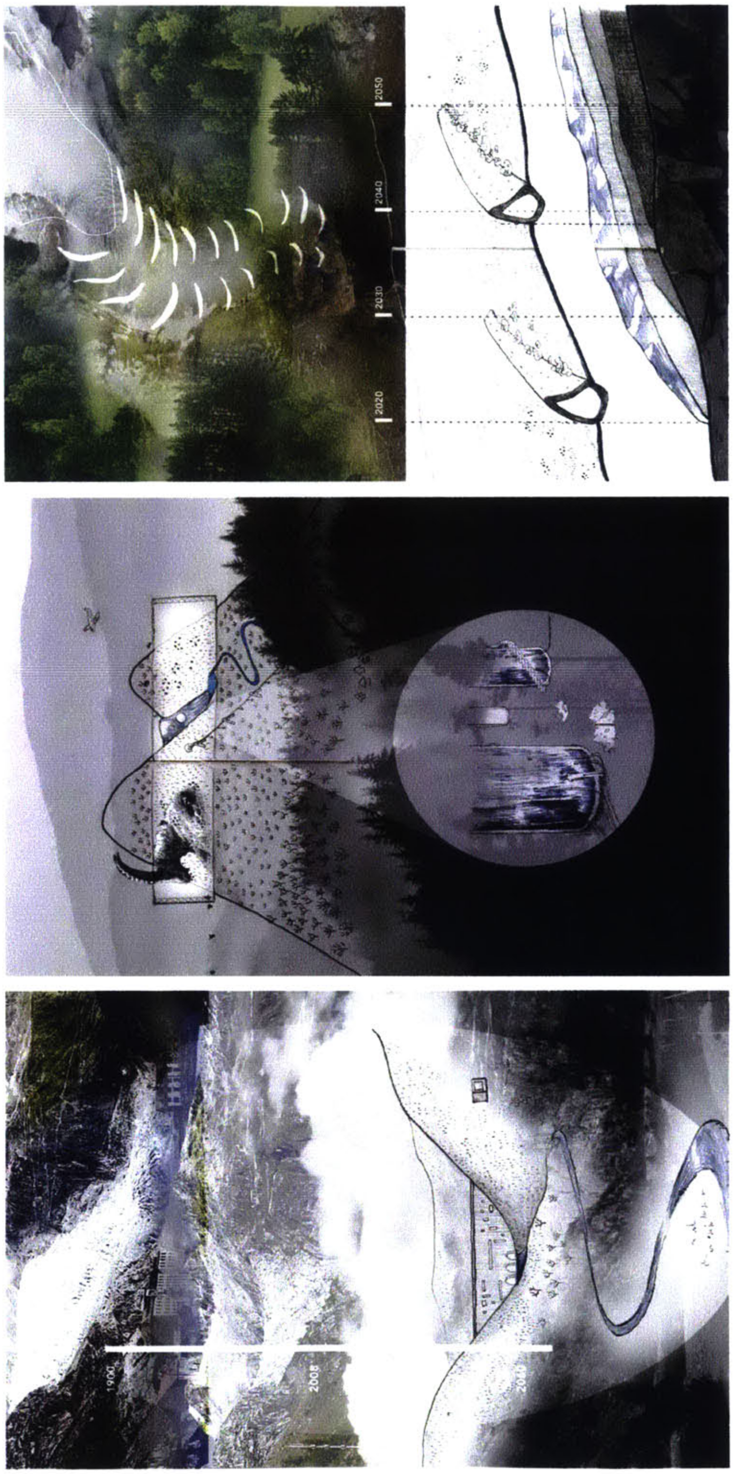


Dam Hotel

Idea Sketch
October, 2015

Appendix

COLLAGE

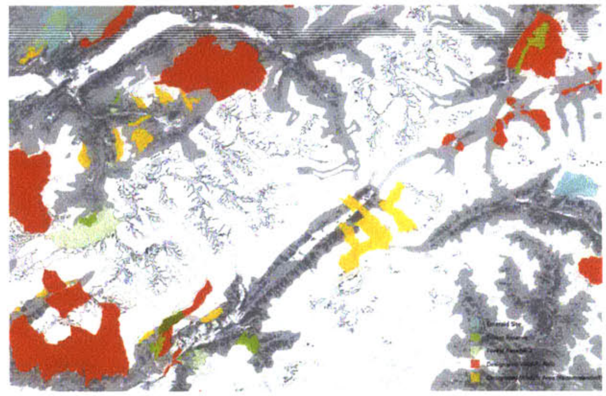


Appendix

SITE ANALYSIS

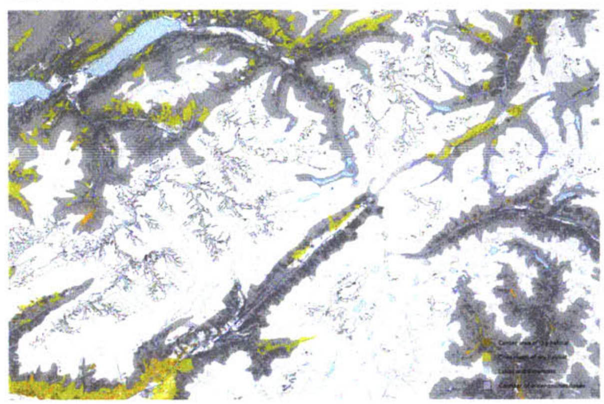
01_Glacier Boundary

01_Reserved Forest Area + Designated wildlife area

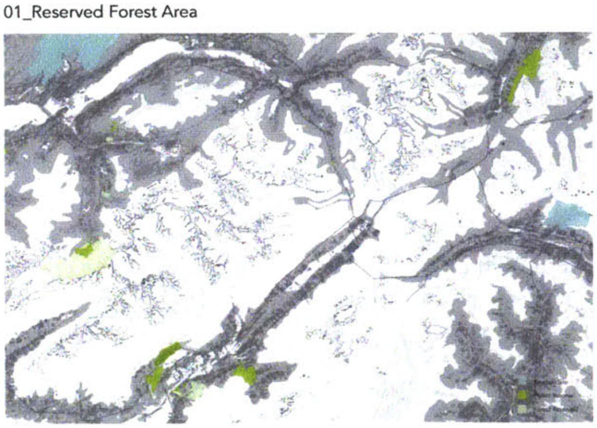


01_Forest + Bio Corridor

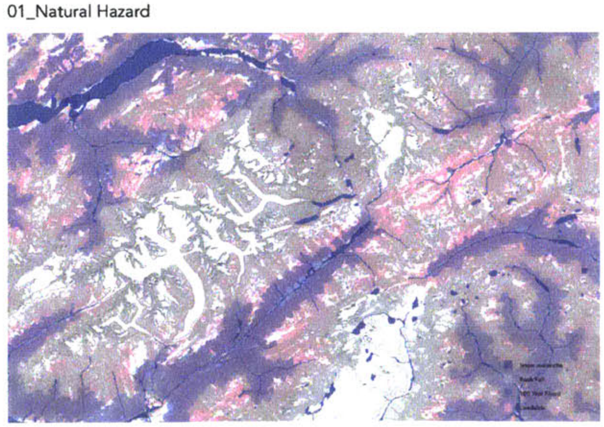
01_Water and Dry Area



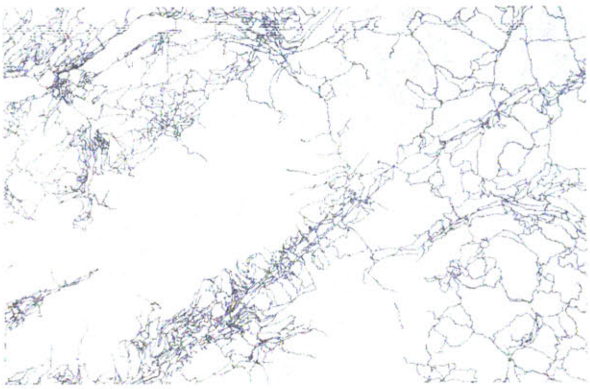
01_Reserved Forest Area



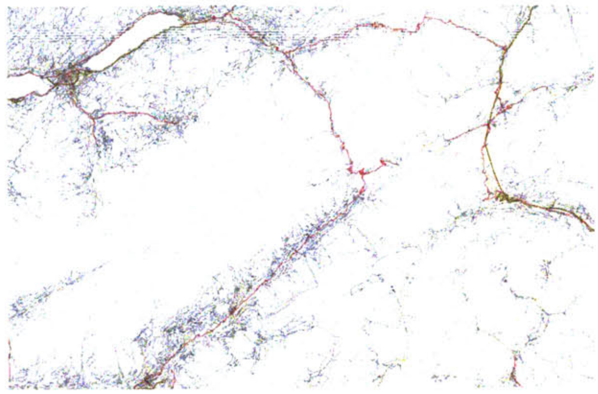
01_Natural Hazard



02_Hiking Route

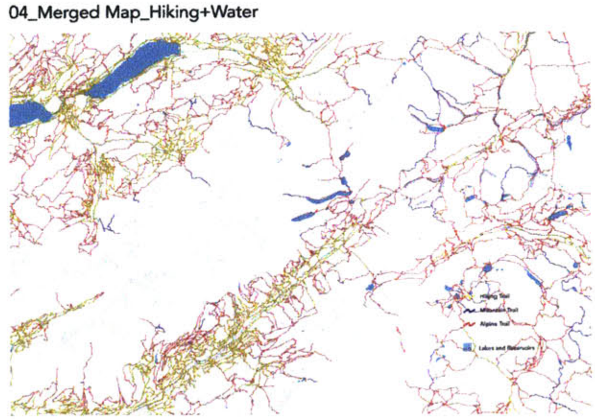


03_Road



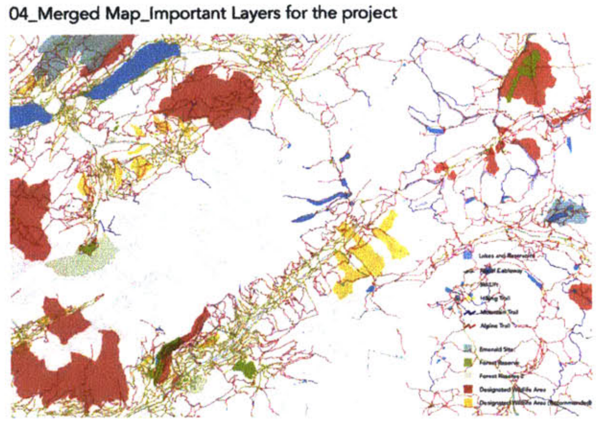
02_Lift

04_Merged Map_Hiking+Water



03_Public Transportation

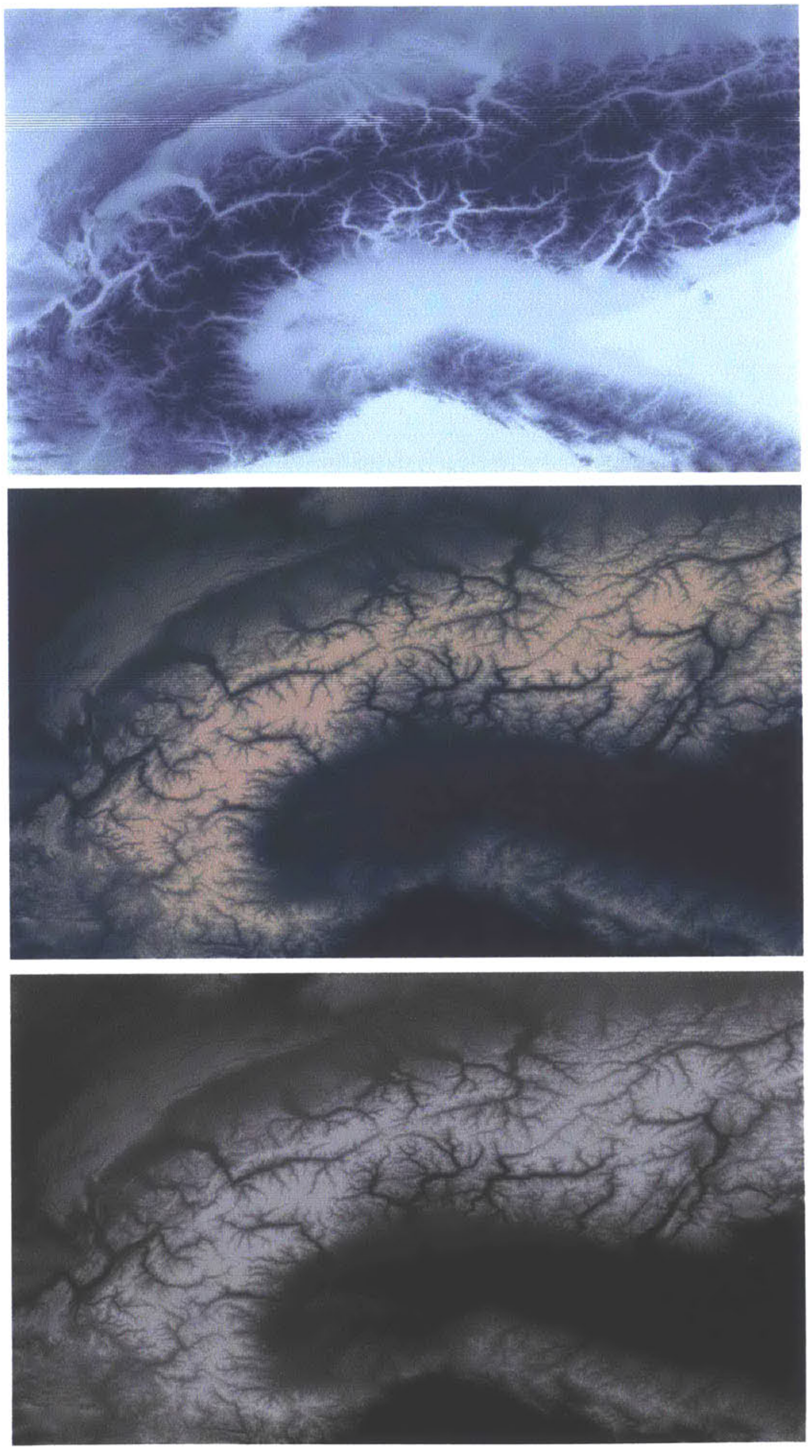
04_Merged Map_Important Layers for the project



Data adapted from swisstopo reproduced by Namjoo Kim

Appendix

MAP COLOR TEST



Appendix

THESIS PREPARATION

Spring semester, 2015

Appendix

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