

Adaptive water-management systems



Country /City

University / School

Academic year

Title of the project

Authors

Switzerland / Zurich

ETH Zurich

2021 - 2022

Aqua Leni

Silvan Burkard, Luzia Rohrer



TECHNICAL DOSSIER

Title of the project	Aqua Leni
Authors	Silvan Burkard, Luzia Rohrer
Title of the course	amplitude, climate-change adaptation of water infrastructures
Academic year	2021 - 2022
Teaching Staff	Martina Voser, Coralie Berchtold, Yann Junod, Sofia Prifti
Department / Section / Program of belonging	D-ARCH Department of Architecture / Landscape Architecture / Studio Voser
University / School	ETH Zurich



" Adaptive water-management systems "

The Great Moss region in the Swiss Plateau is struggling with an increasing water shortage in agriculture. At the same time, mudflows occur after short, heavy rainfalls, causing damages to villages, along the streams, at the foot of the Jura mountain range. The „Aqua Leni“ project addresses these two conditions, implementing water and soil as the main design tools. Through a system of retention and storage, rainwater is slowed down from the catchment areas and flows gently until it reaches the fields, where it can be used for irrigation, reducing the extreme amplitude between drought and flooding. Furthermore, the design of a functional water management system chain emphasises the value of water and addresses this force of nature in a new, celebratory, way. The limestone layers of the Jura, the moraine material from the last ice age and the stream debris cones at the foot of the slope form the three basic rock substrates that the streams came across. The nodes, which include protection, retention and storage, are located at the transitions of the geological layers. In-between the nodes, linear systems are developed, allowing the water to reach the fields in controlled quantities and at regular intervals. The interventions are constructed with earth dams, that visibly and experientially highlight the importance of the geological subsoil on the water flow.

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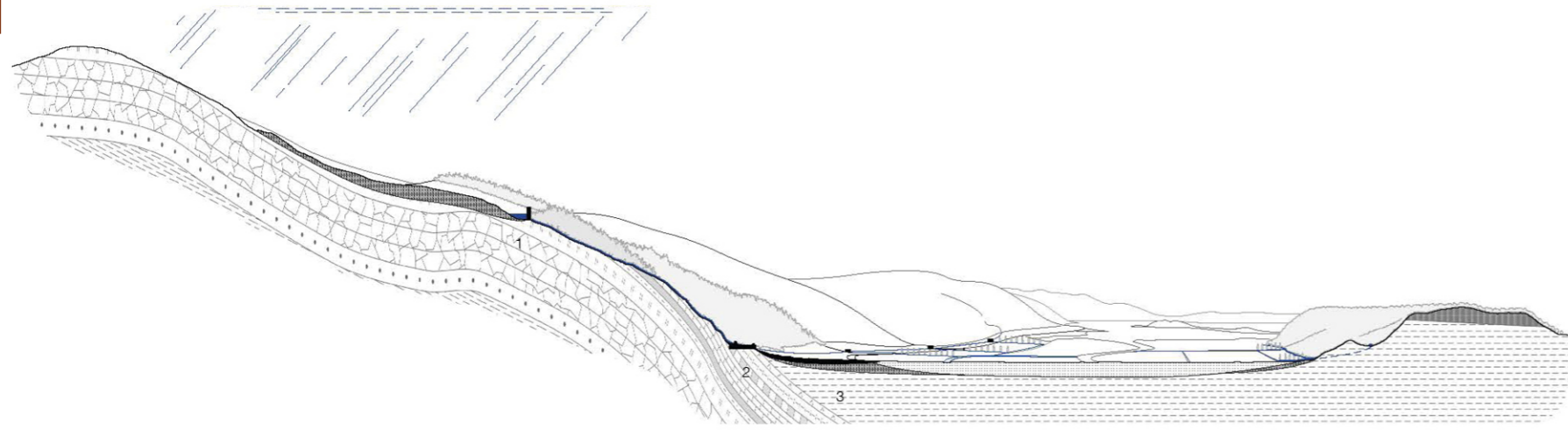
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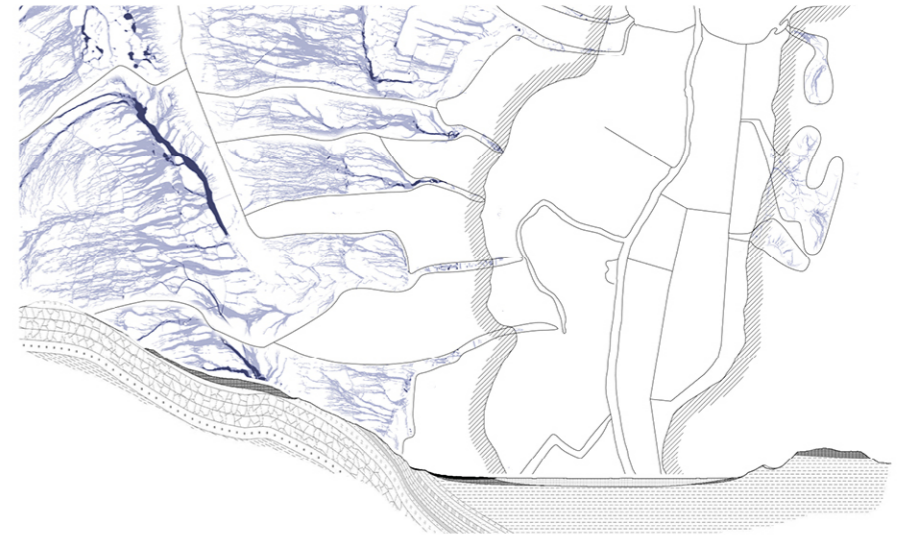
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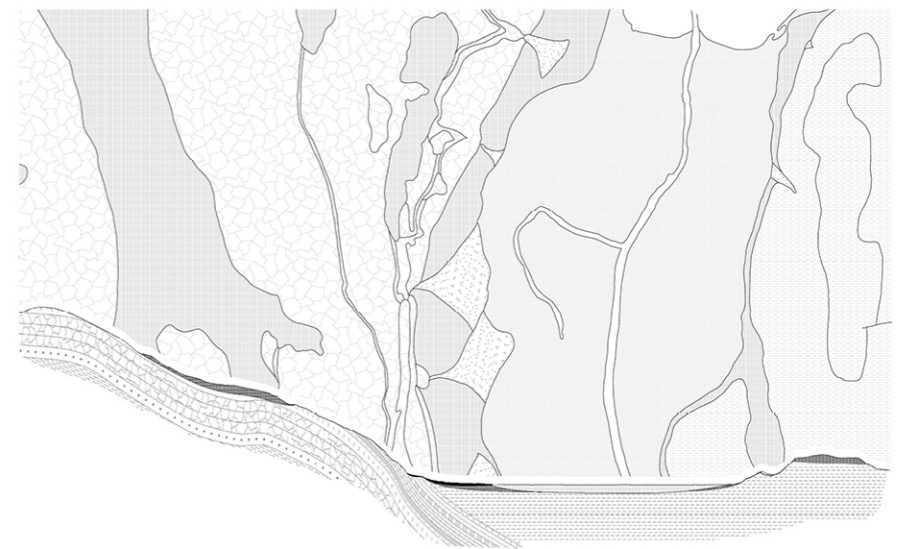
Systemic perspective section across the valley



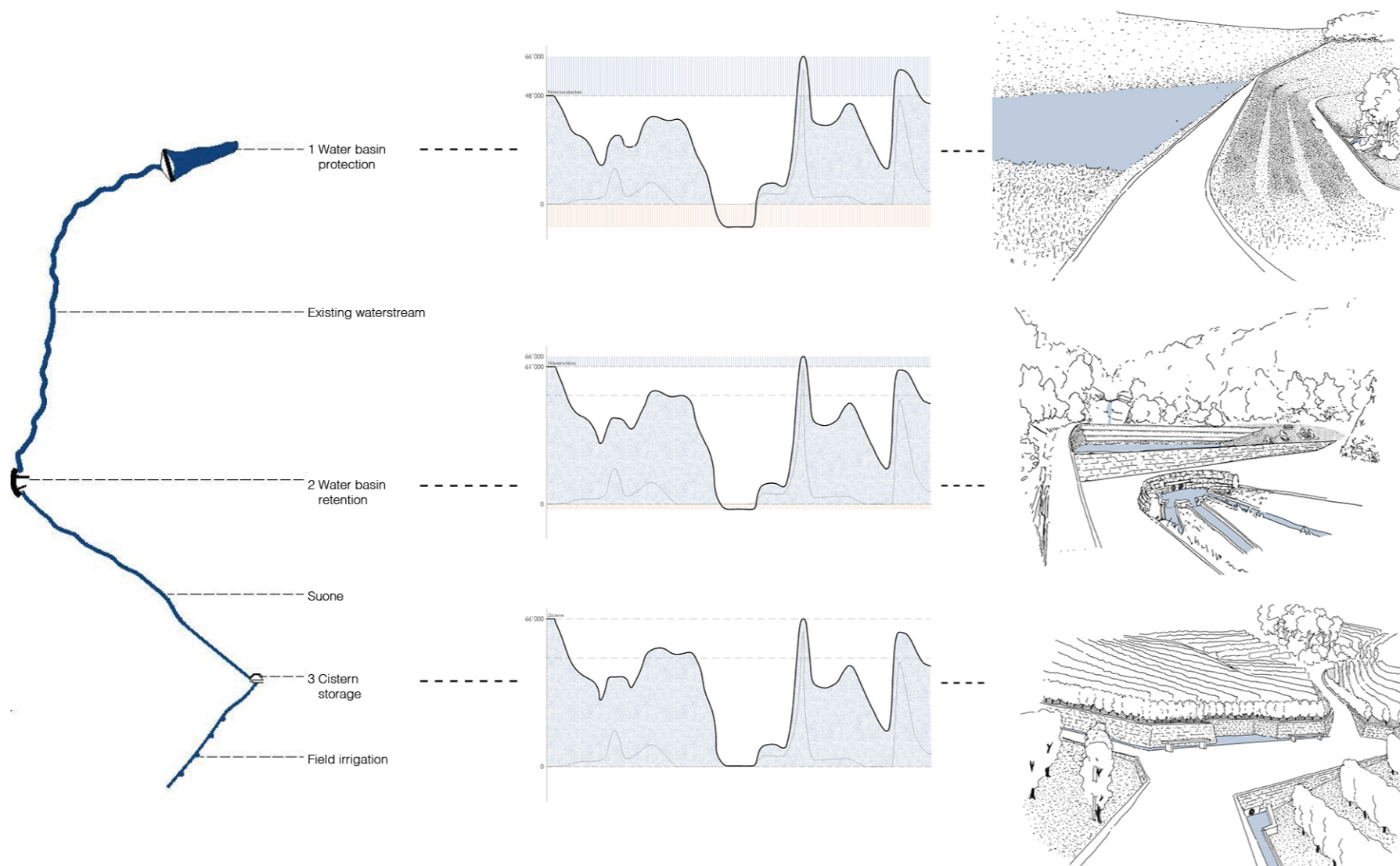
Site observations _ locating different scapes and atmospheres



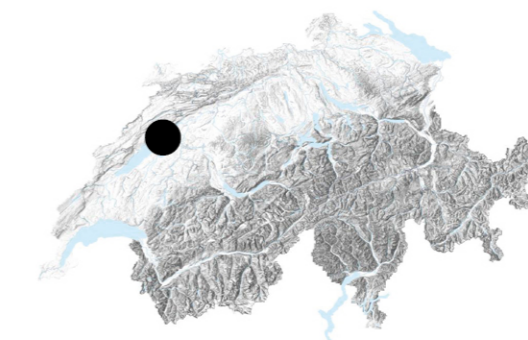
Surface water runoff



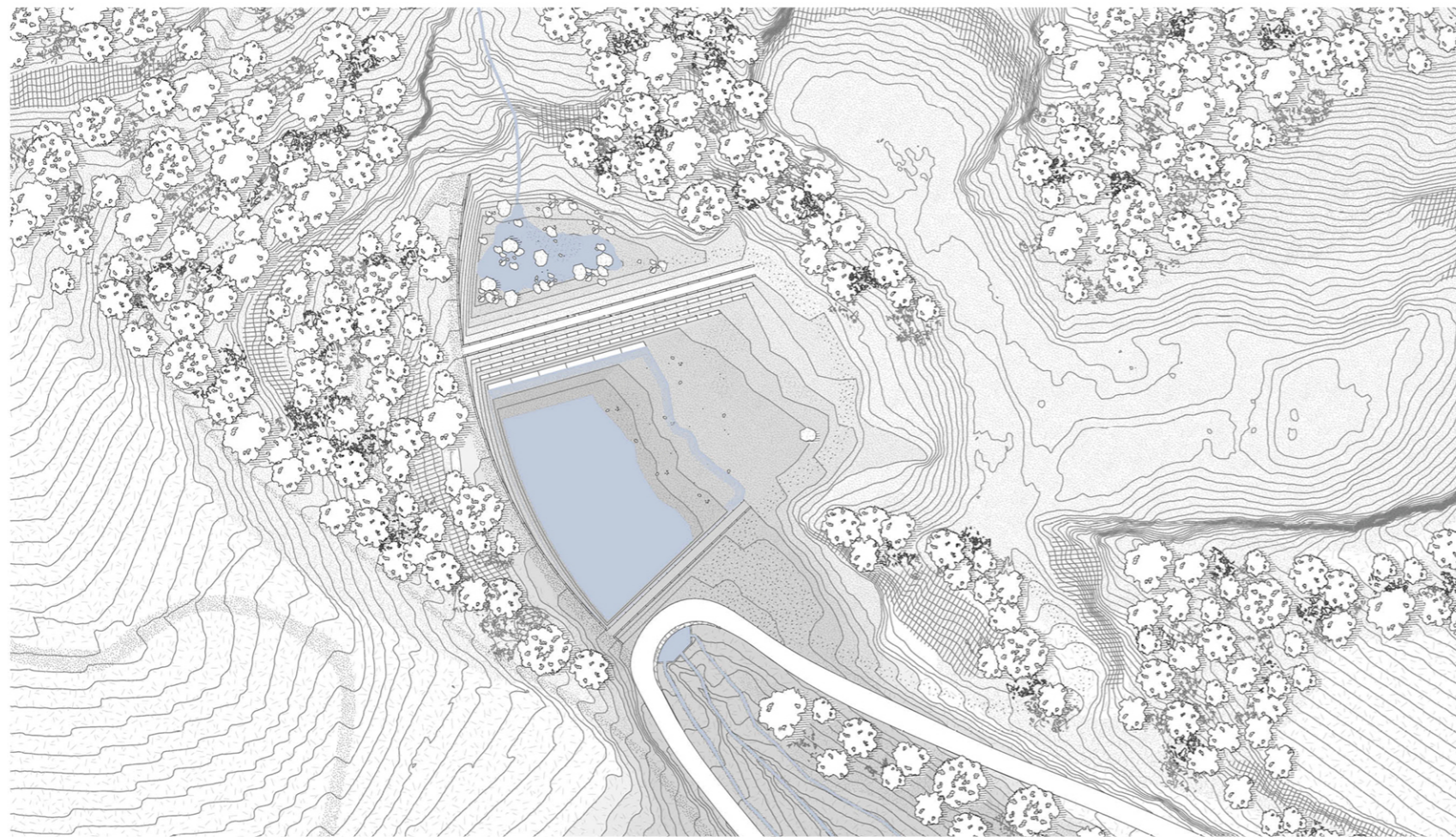
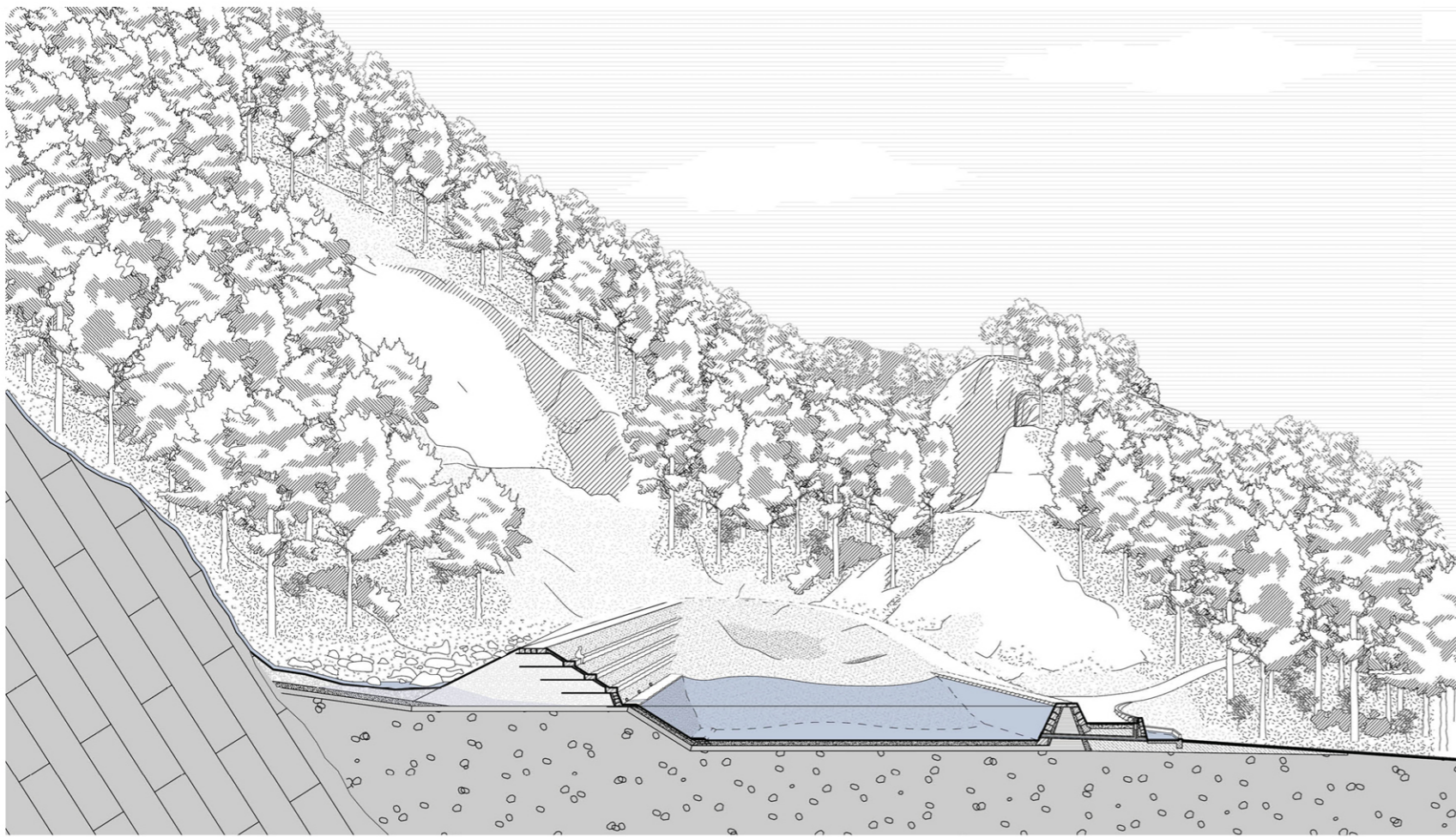
Geology of the valley



The proposed watersystem _ locations, water quantities before and after and spatial qualities



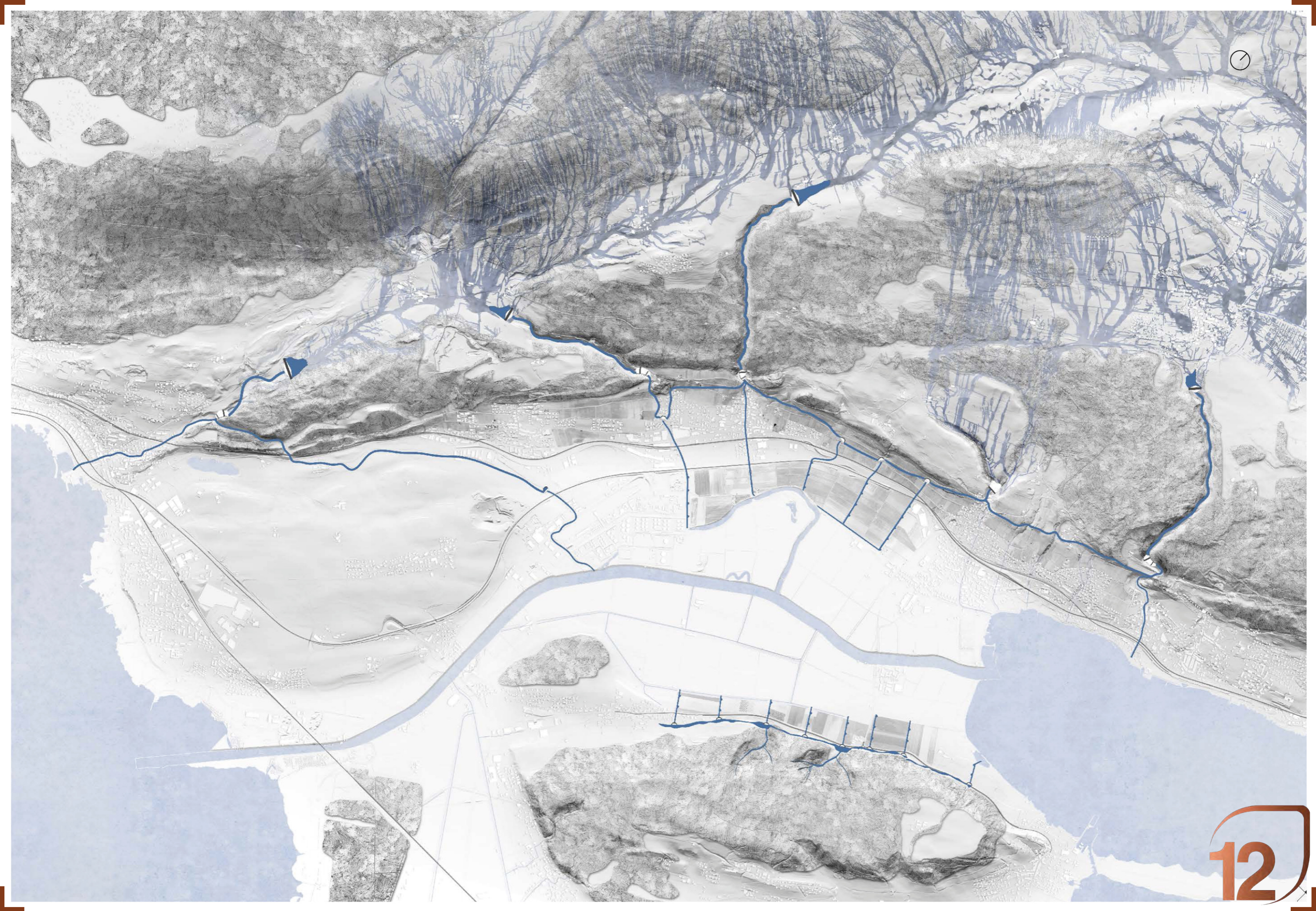
Seeland _ climate-change adaptation of water infrastructures



Plan and perspective section of the water basin _ type 2 retention



The various water elements create different spatial correlations



Designing multi-layered productive landscapes



Country / City
University / School
Academic year
Title of the project
Authors

Switzerland / Zurich
ETH Zurich
2021 - 2022
Zwiegespräche
David Hauser, Andreas Hasler

TECHNICAL DOSSIER

Title of the project	Zwiegespräche
Authors	David Hauser, Andreas Hasler
Title of the course	amplitude, climate-change adaptation of water infrastructures
Academic year	2021 - 2022
Teaching Staff	Martina Voser, Coralie Berchtold, Yann Junod, Sofia Prifti
Department / Section / Program of belonging	D-ARCH Department of Architecture / Landscape Architecture / Studio Voser
University / School	ETH Zurich



" Designing multi-layered productive landscapes "

The outcome of the first Jura water correction, which involved straightening the course of the former meandering Zihl river and lowering the average lake levels, is a predominantly cultivated landscape. This starkly contrasts with the more dynamic wetlands along the silted-up lake shores and the old Zihl arm. In "Zwiegespräche", the corset of the Zihl canal is alternately loosened to enhance its water capacity. This allows a continuous natural expansion of the wetlands throughout the valley, creating diverse habitats for both humans and animals. As a result of the initial plantings, an arm of trees emerges in response to the changed soil conditions. On the cultivated land side, the Zihl is accompanied by a dam, that in conjunction with the revised inland canal infrastructure and pumping stations, enables a more direct control over the water balance and facilitates the cultivation of a wide variety of plants. These two topographical interventions align with the linear transport infrastructures in the valley and oscillate around the existing Zihl canal. Additionally, a wind power plant overlay contributes to the production of renewable energy. Furthermore, the long-term plan involves replacing the existing facilities of the last Swiss oil refinery with a wood processing industry. The exaggeration of the existing spatial qualities, through contradictory, mutually fertilizing interactions, is aiming at an emerging, productive landscape with a new identity.

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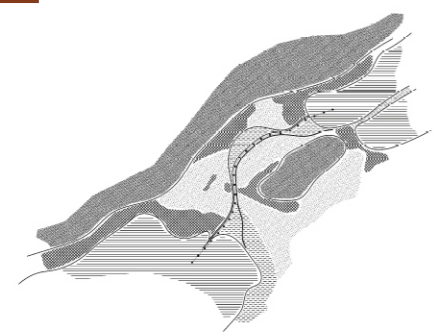
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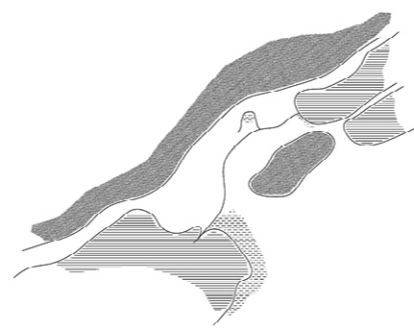
SCHOOL PRIZE



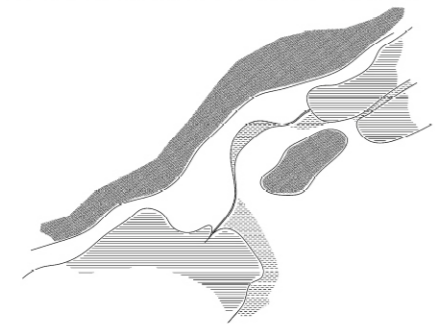
A palimpsest of overlapping functions, uses and seasons



Historical changes of the water streams _ 400 _ 600 _ 1850



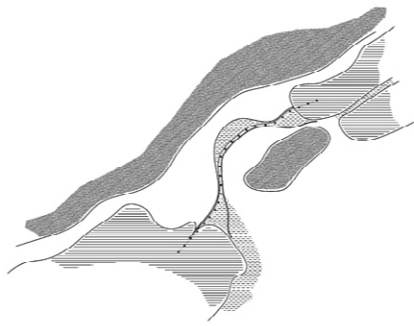
Wetlands _ 2021



Contour _ 2050

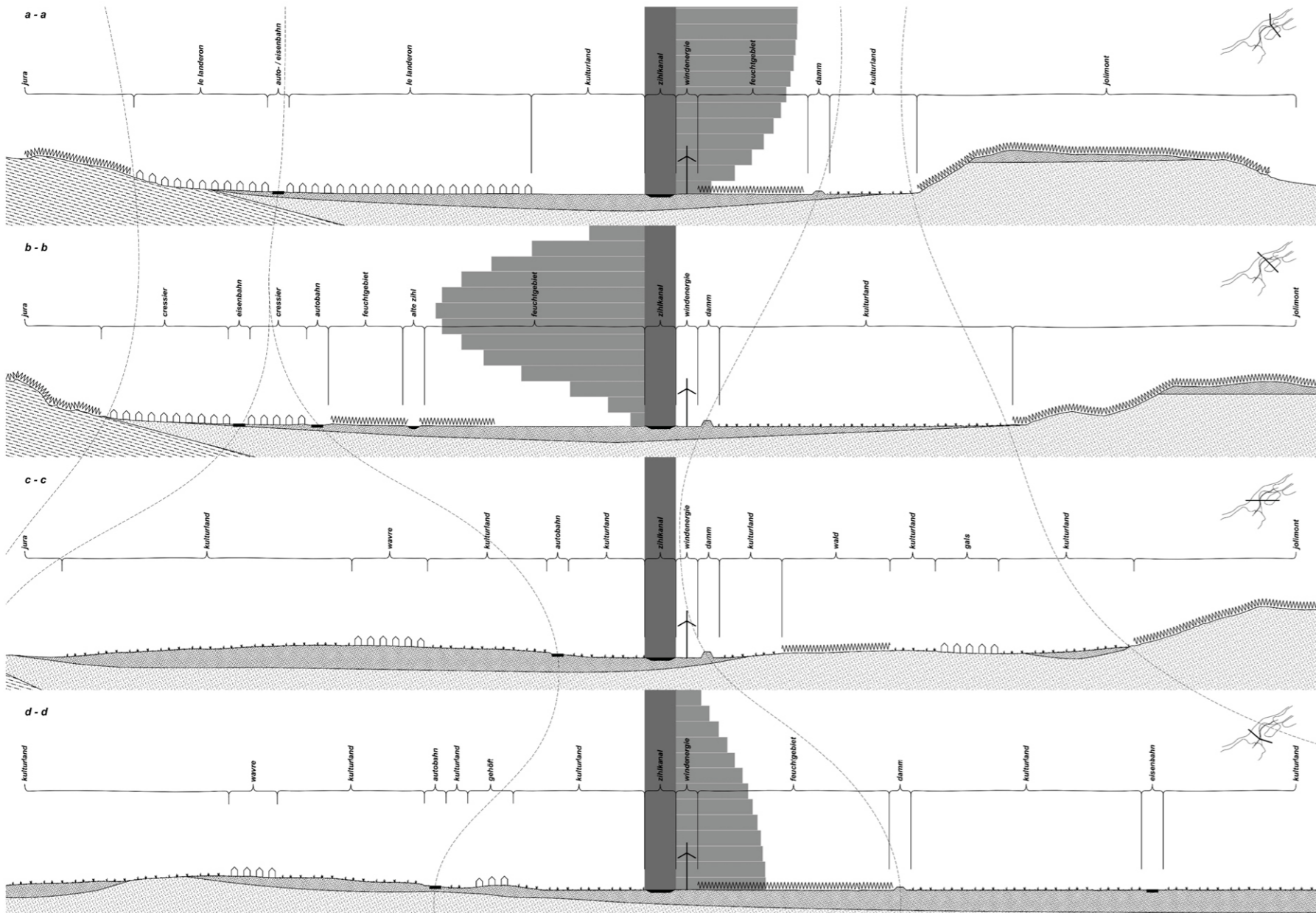


Dam _ 2050



Wind energy _ 2050

Break down of the design elements & principles in layers



Section series along the valley



Tendencies



Constitutions



Potentials



Subjective



Rational

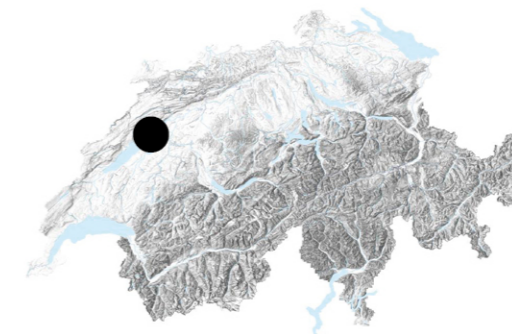


Dynamic

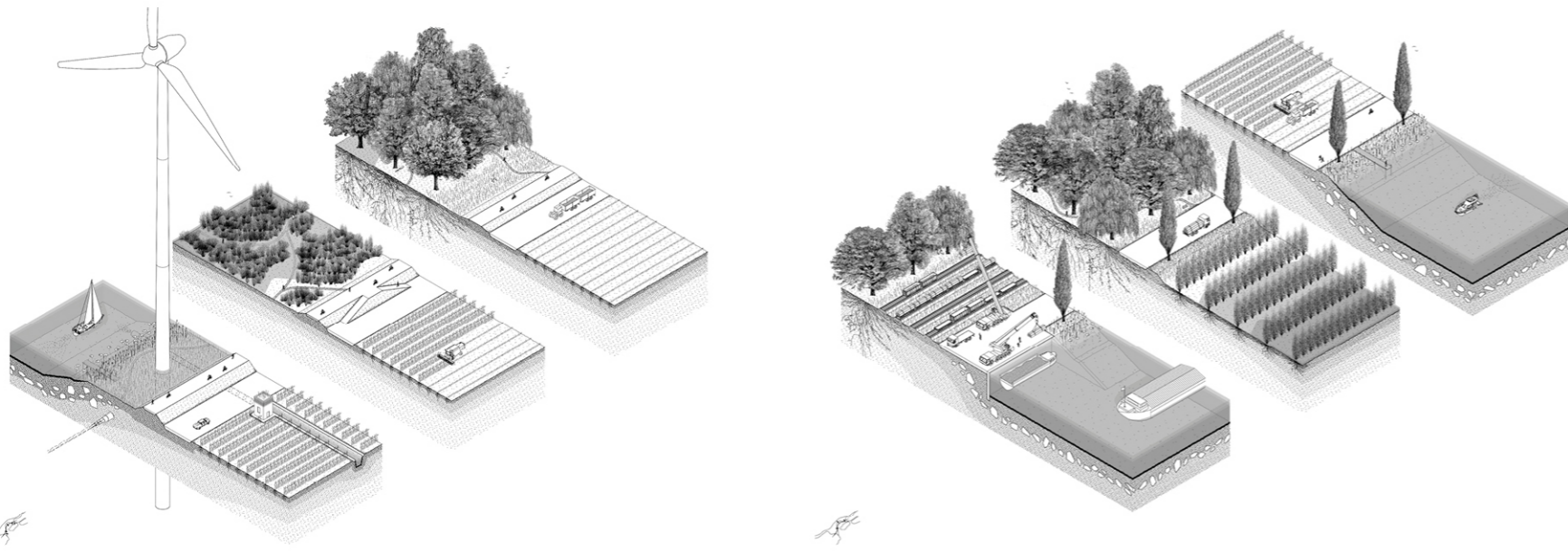
Reading and interpretations of the site



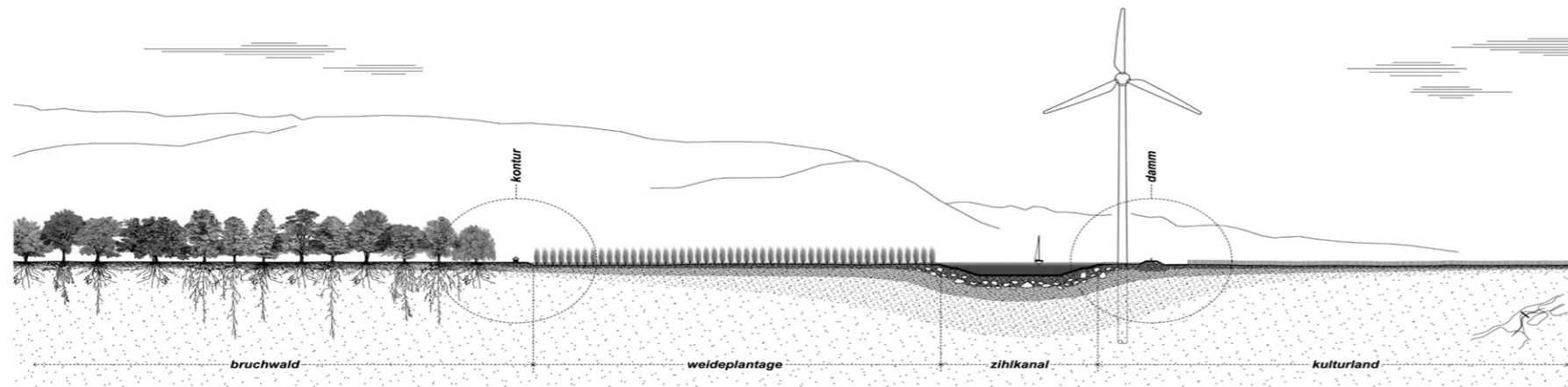
Reaching out for new spatial relations



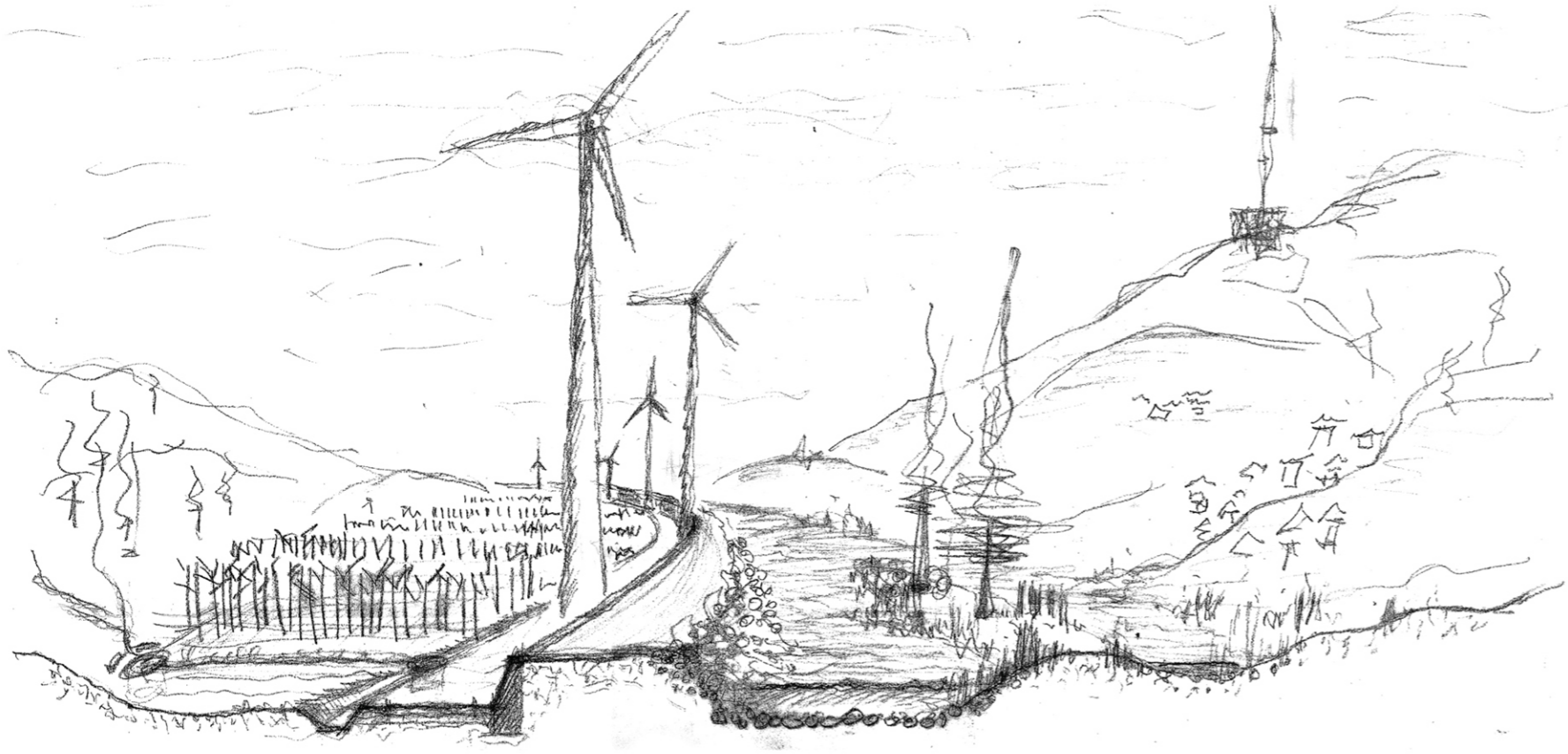
Seeland _ climate-change adaptation of water infrastructures



The two sides of the Zihl channel

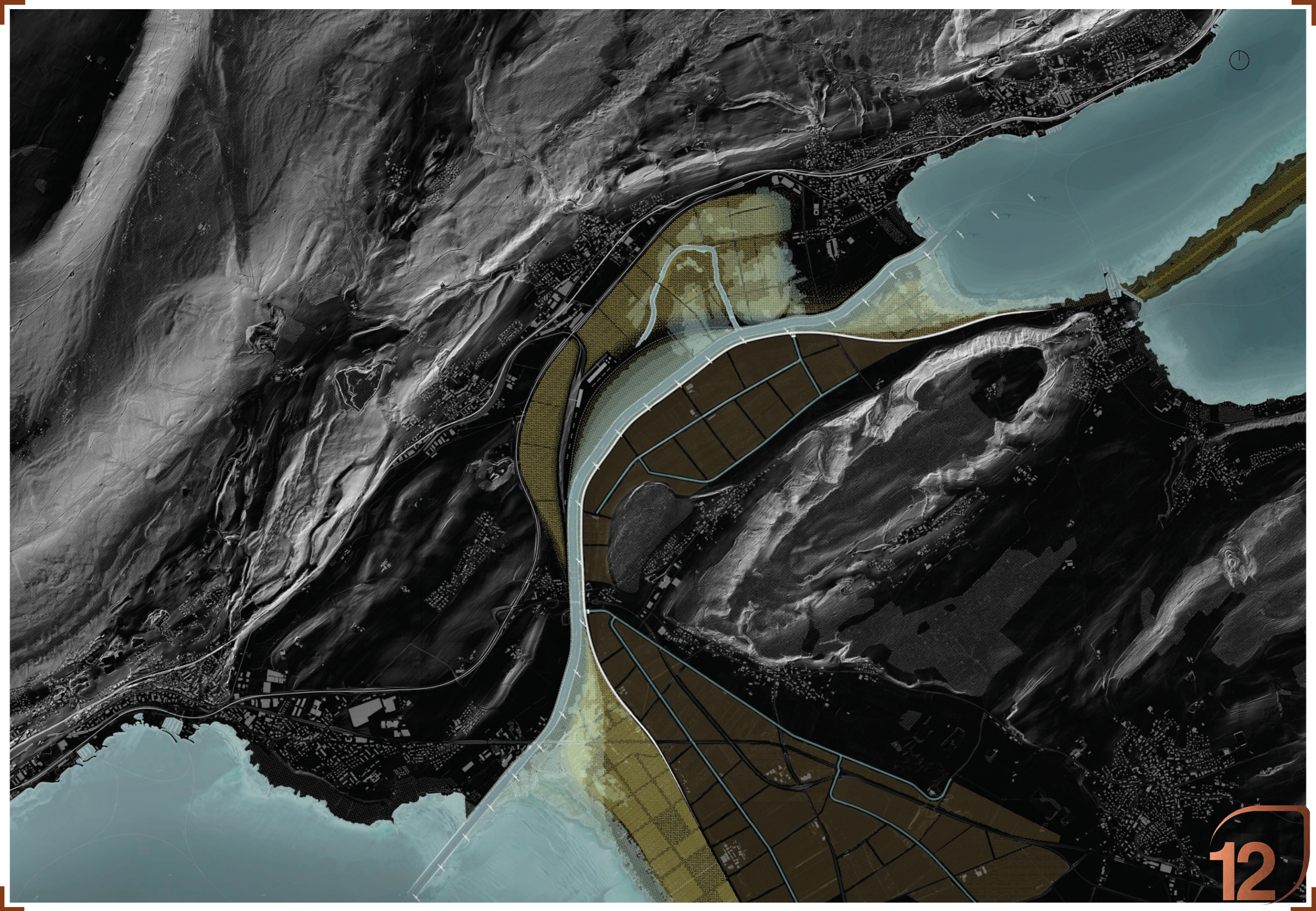


Territorial section _ a sequence of landscapes



Visualising the valley as a productive land





Creating space for melting mountains



Country /City
University / School
Academic year
Title of the project
Authors

Switzerland / Zurich
ETH Zurich
2021 - 2022
Spina Dorsela
Marin Lercher, Florian Rüegg

TECHNICAL DOSSIER

Title of the project	Spina Dorsela
Authors	Marin Lercher, Florian Rüegg
Title of the course	cinétique, climate-change adaptation to natural hazards
Academic year	2021 - 2022
Teaching Staff	Martina Voser, Coralie Berchtold, Yann Junod, Sofia Prifti
Department / Section / Program of belonging	D-ARCH Department of Architecture / Landscape Architecture / Studio Voser
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" Creating space for melting mountains "

The Upper Engadin area is currently facing various challenges. On one hand, natural hazards, intensified by climate change and the thawing of permafrost, such as floods, debris flows and rockfalls. On the other hand, unplanned settlement growth, leading to spaces that are disconnected from their surroundings, and lacking urban qualities. Consequently, due to human settlements and agricultural expansion, the Engadin mountains have been detached from the river basin of the Inn, with negative consequences for both flora and fauna. "Spina Dorsela" aims to address these challenges and transform them into opportunities. The Inn river acquires a new role and becomes the backbone of the valley. Through renaturation, it can absorb large amounts of water during heavy precipitation, while creating habitats of increased ecological value. Additionally, it offers seasonal recreational spaces for residents and visitors. Perpendicular to the Inn river, forested cross ribs create a new structure in the valley that can mitigate natural hazards from the side valleys and connect the mountain to the river. This structuring of the valley provides the infrastructure for a sustainable expansion of the settlements. In the future, there may even be an alpine city that emerges, developing between and in harmony with the opposing forces of the mountain and the river.

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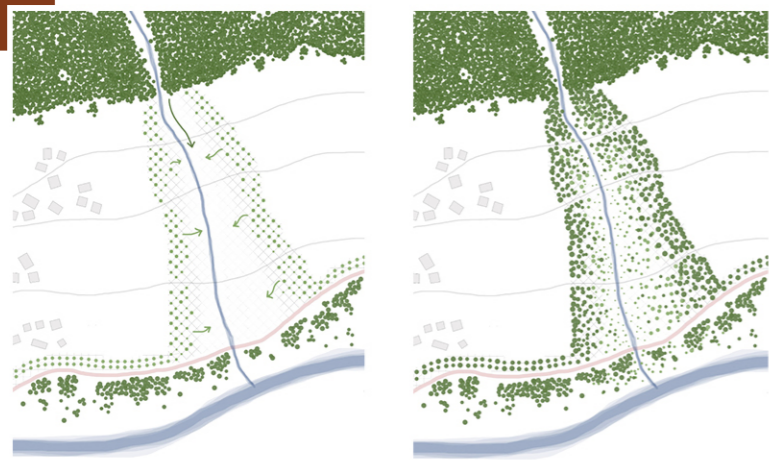
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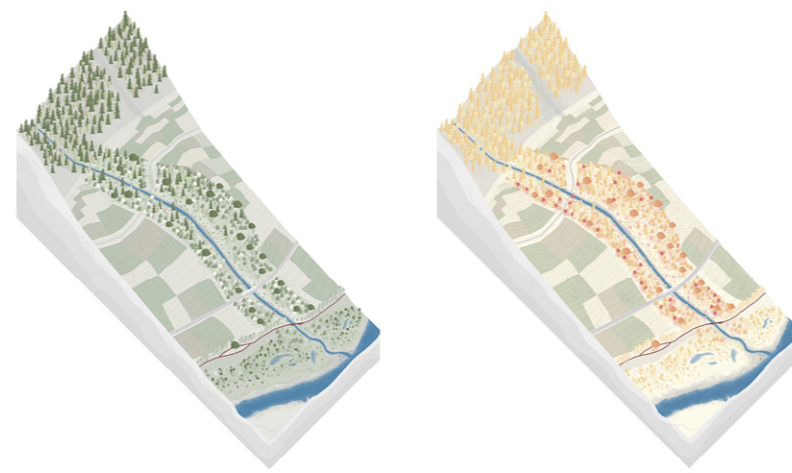
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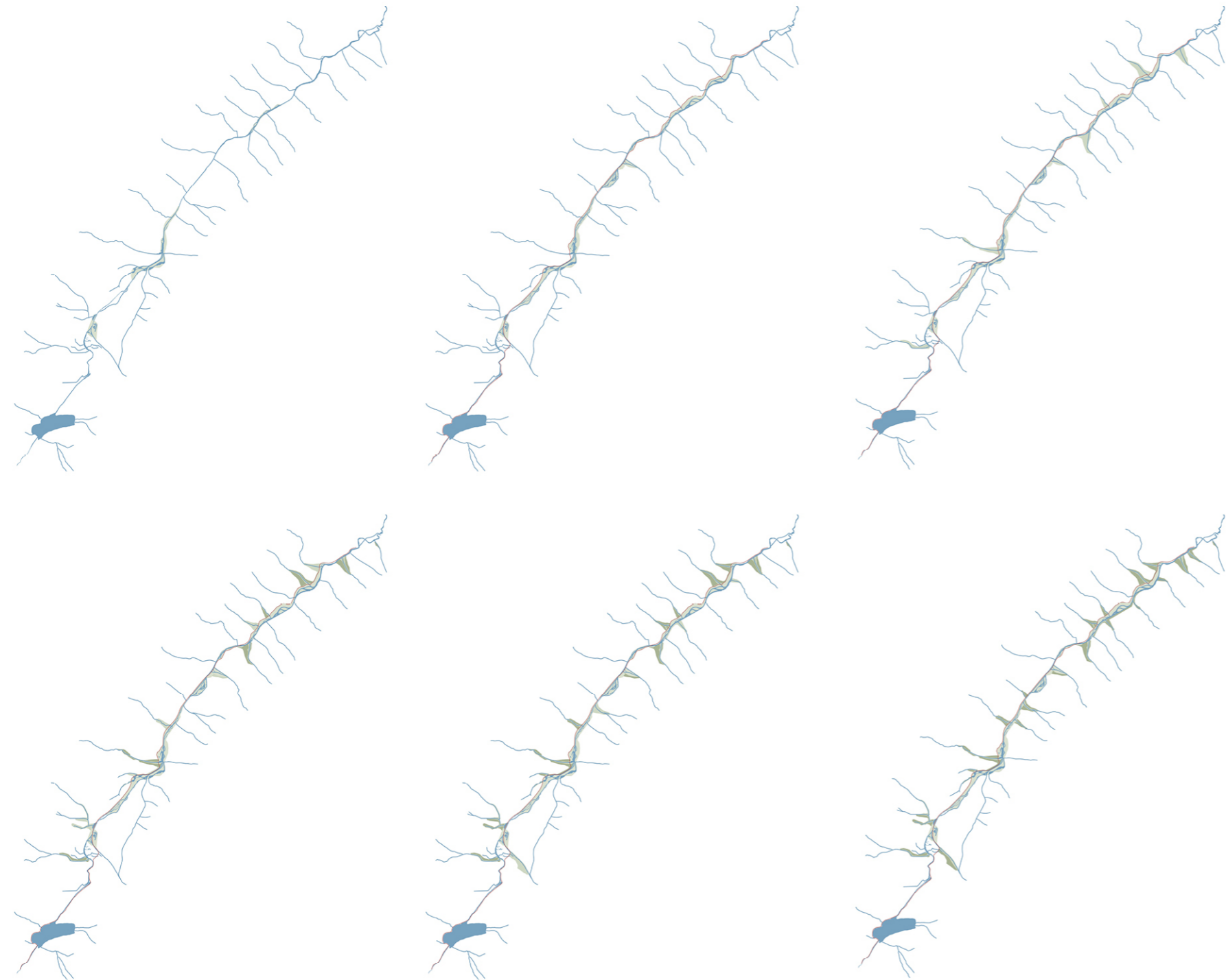
Vegetation strategy _ establishment and evolution



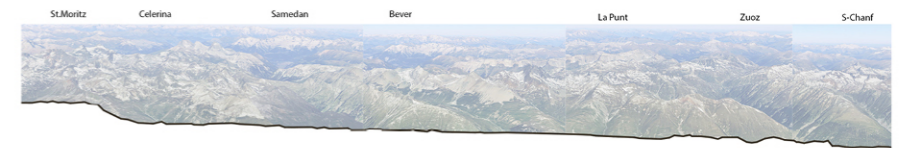
Forested cross ribs _ seasonal changes



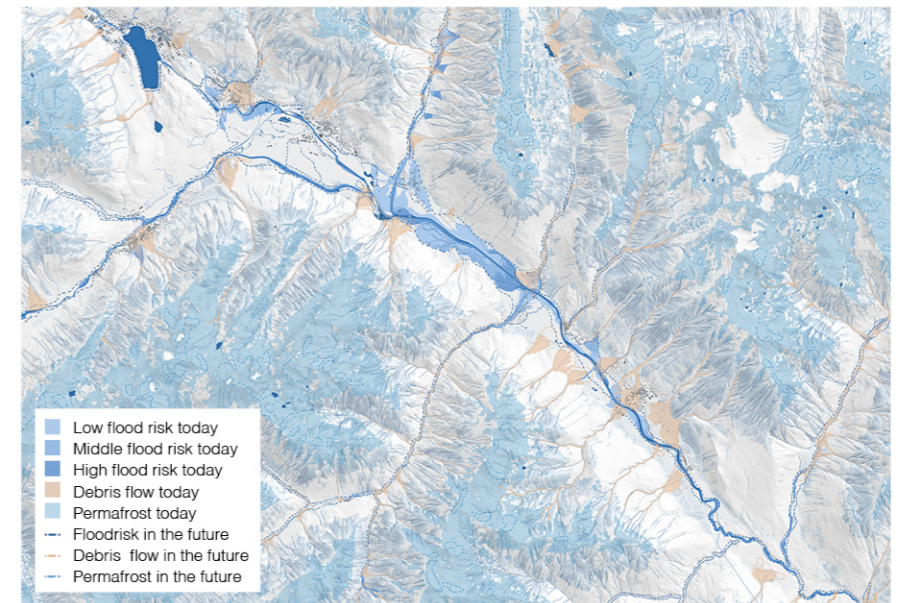
Inn river _ the backbone of the valley



Time evolution of the spina



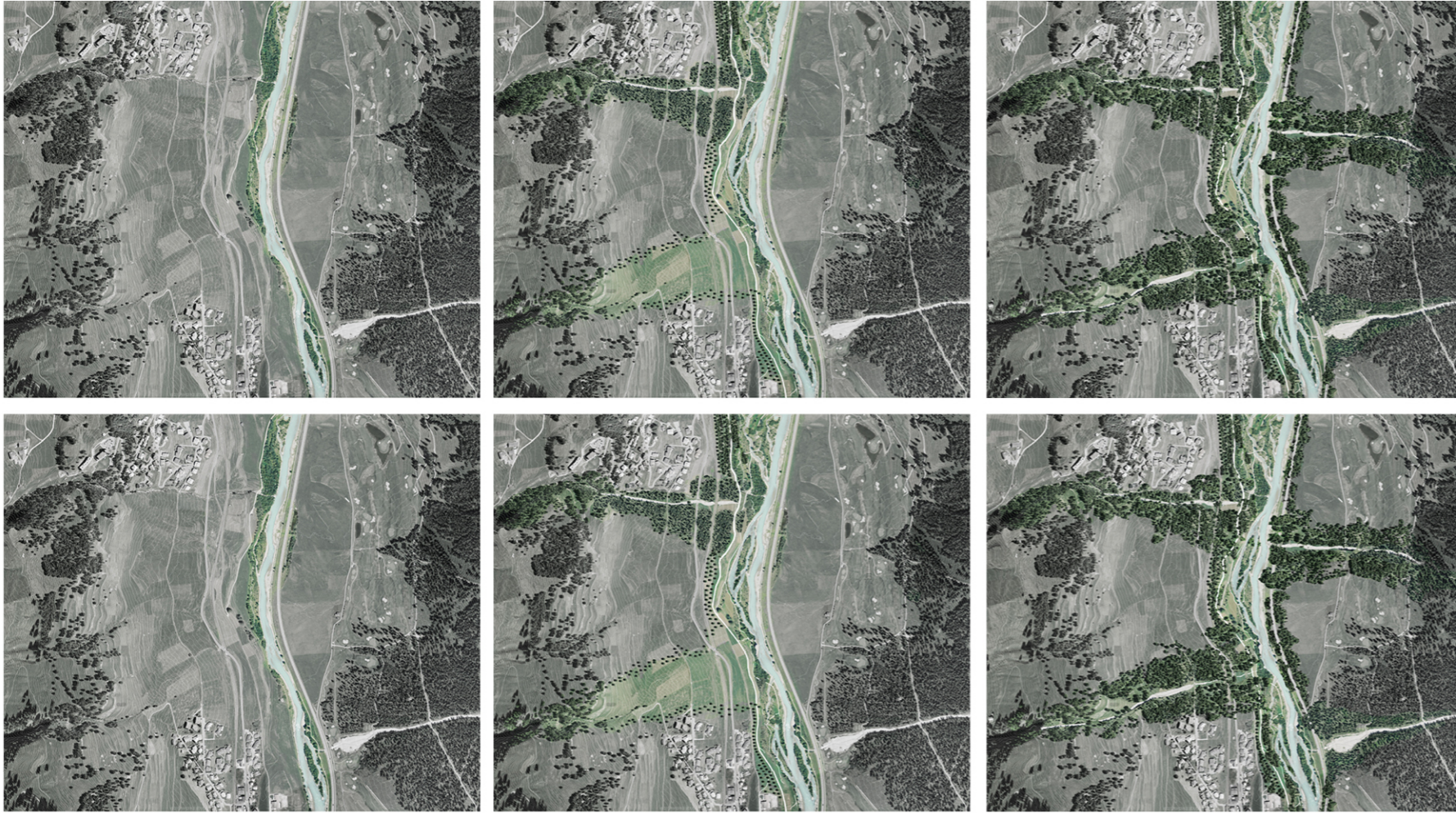
Longitudinal section of the Engadin valley



Analysis map of the natural dangers



Engadin _ climate-change adaptation to natural hazards



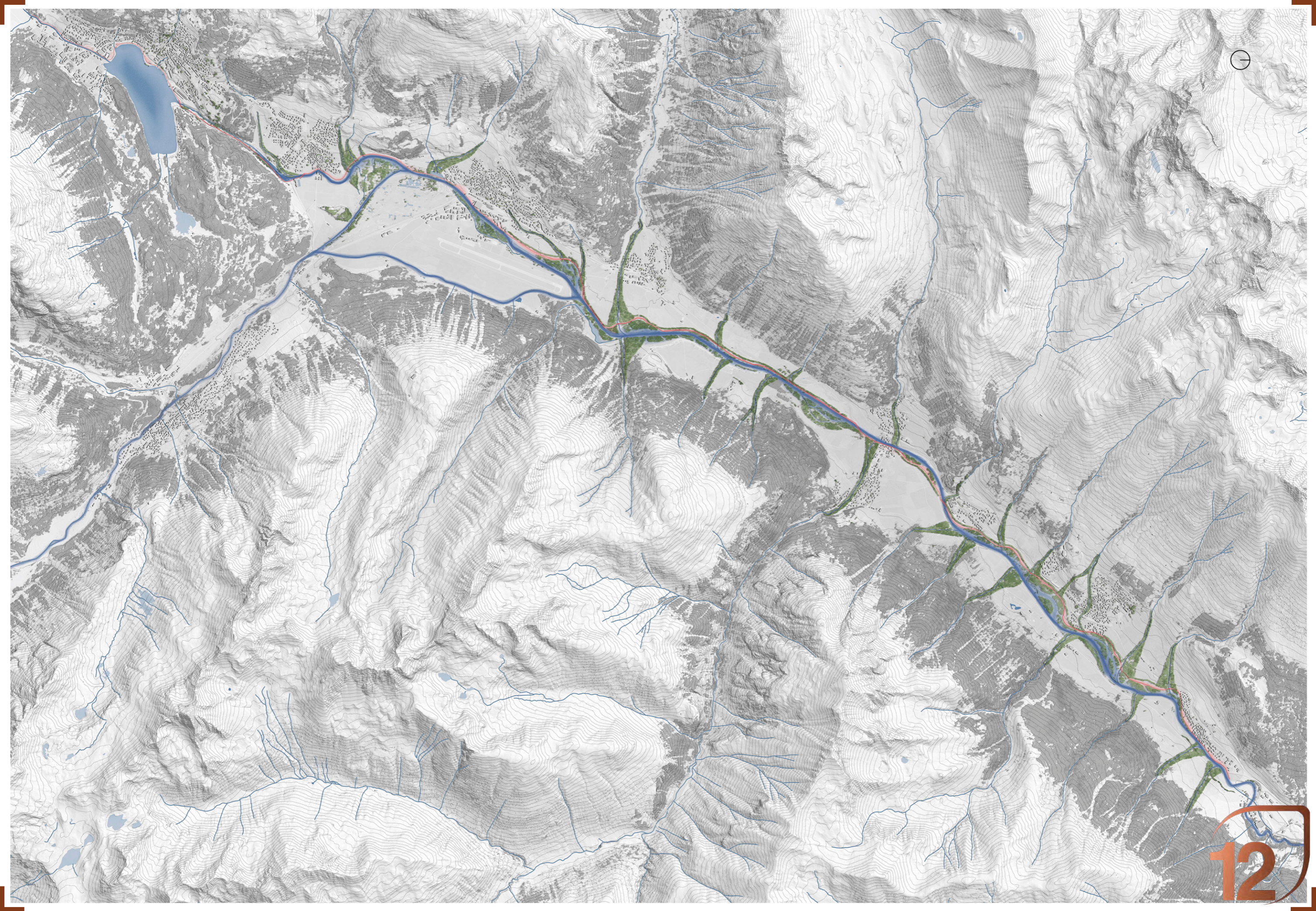
The new interventions establishing ecosystems with time



Adaptive landscapes to seasonal changes



Envisioning the Engadin valley as a climate-change proof region



Between control and „laisser-faire“



Country /City
University / School
Academic year
Title of the project
Authors

Switzerland / Zurich
ETH Zurich
2021 - 2022
Cumin Protectzium
Michael Mohr, Salome Weiss



TECHNICAL DOSSIER

Title of the project	Cumin Protecziun
Authors	Michael Mohr, Salome Weiss
Title of the course	cinétique, climate-change adaptation to natural hazards
Academic year	2021 - 2022
Teaching Staff	Martina Voser, Coralie Berchtold, Yann Junod, Sofia Prifti
Department / Section / Program of belonging	D-ARCH Department of Architecture / Landscape Architecture / Studio Voser
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" Between control and `laisser-faire` "

It has already been proven that in Graubünden, as well as in other alpine regions in Switzerland, there will be, in the future, increased threats to inhabitants and villages from natural forces such as avalanches, debris flows and rockfalls. The permafrost is increasingly thawing due to rising temperatures, unleashing unpredictable and incalculable energies and forces. Taking a closer look at the Engadin valley, numerous protective structures with a significant impact on the landscape can be observed. The current response to such natural events primarily involves purely monofunctional, technical engineering structures. While protective structures are necessary, the question that arises is how can they be designed in a non-monofunctional manner. How can we design along with the danger rather than against it? "Cumin Protecziun" responds to natural hazards in a site-specific way, taking into consideration both the natural and built environment and offering added value to both. Protective structures, constructed with local, natural materials and with minimal impact on the landscape, can be inhabited and utilized by people. Through thoughtful placement and arrangement, these structures can generate a diverse range of landscape forms. Samedan was selected as the location for this pilot project due to its strategic position in the valley, in terms of public transportation and its advantageous sunny slope.

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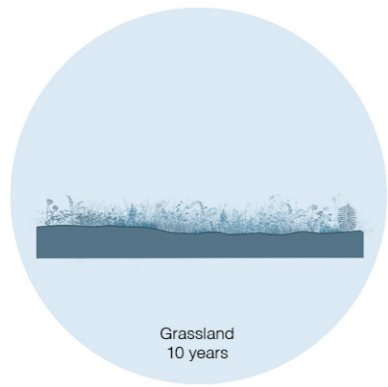
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Grassland
10 years

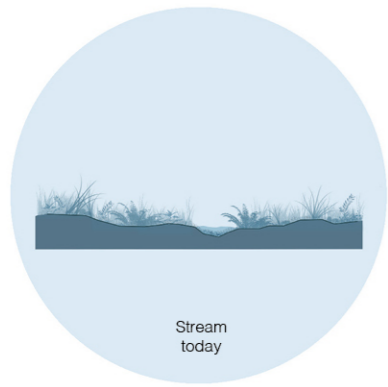


Meadow
10 years

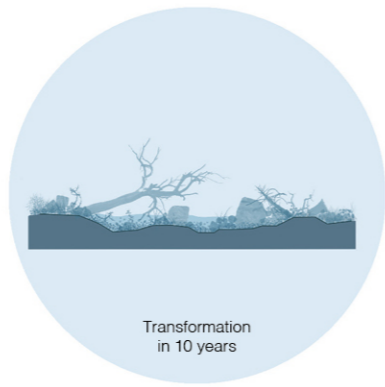


Enduring hedges
10 years

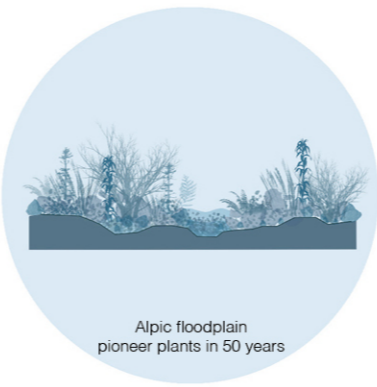
Transformation of the cultivation land



Stream
today



Transformation
in 10 years



Alpic floodplain
pioneer plants in 50 years

Evolution into an alpic floodplain landscape



Existing
today



New
initial planting in 10 years

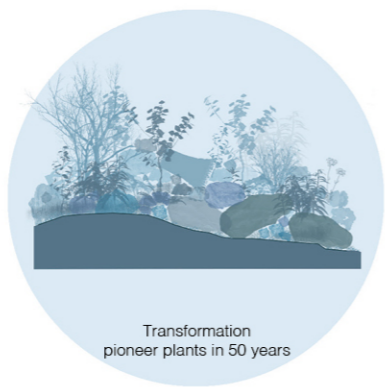


Transformation
in 50 years

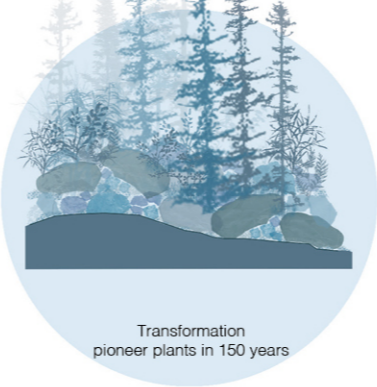
Evolution of the protection forests



In 10 years

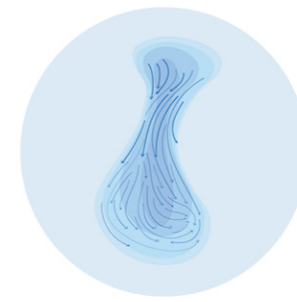


Transformation
pioneer plants in 50 years

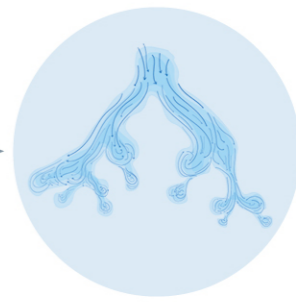


Transformation
pioneer plants in 150 years

Evolution of the deposition areas



Avalanches today
100% force / energy
100% rockslide



Avalanches in the future
Reduction of force / energy
rockslide material distribution



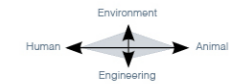
Objective _ steering natural forces



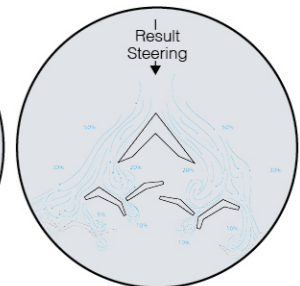
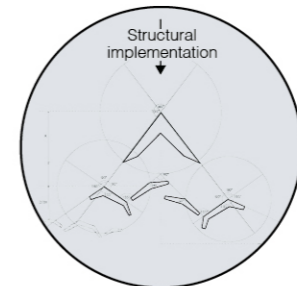
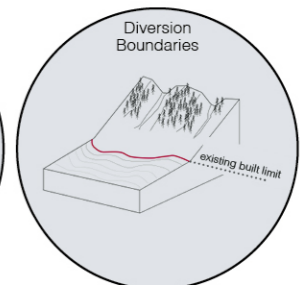
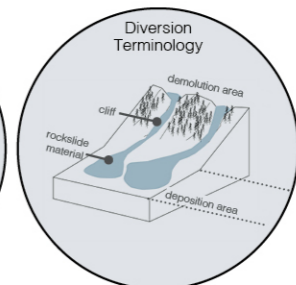
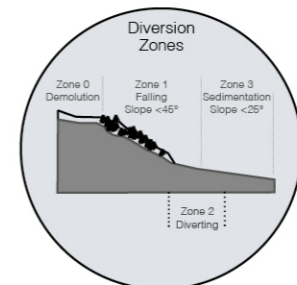
Protective structures today
monofunctional / technical
animals, environment and humans
not considered



Protective structures
in the future
added layers



Objective _ protective structures as added value

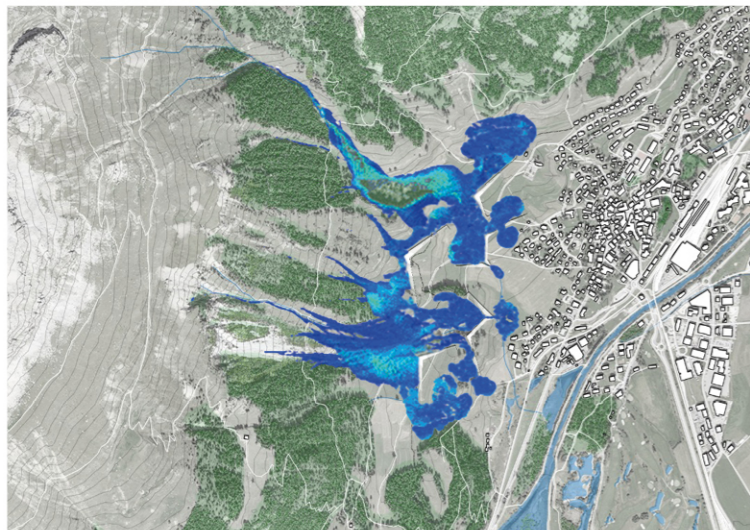
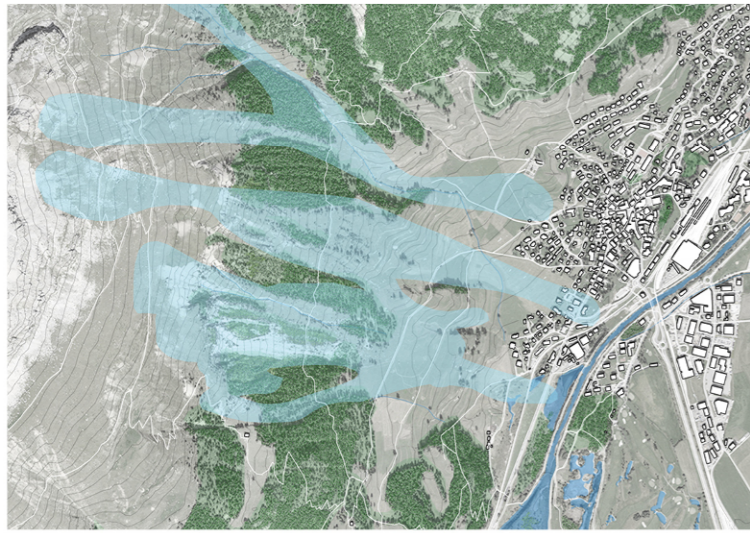


Implementation of the protective structures

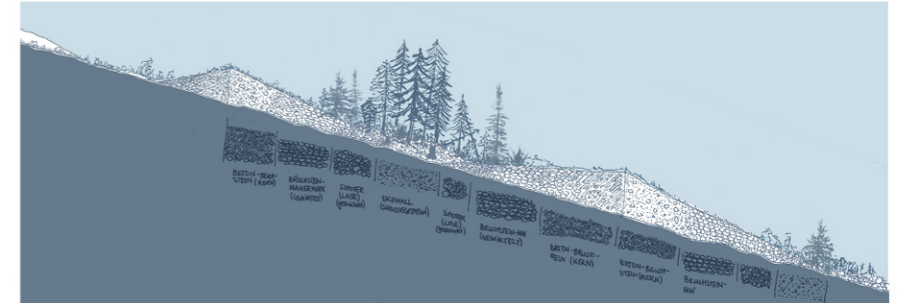
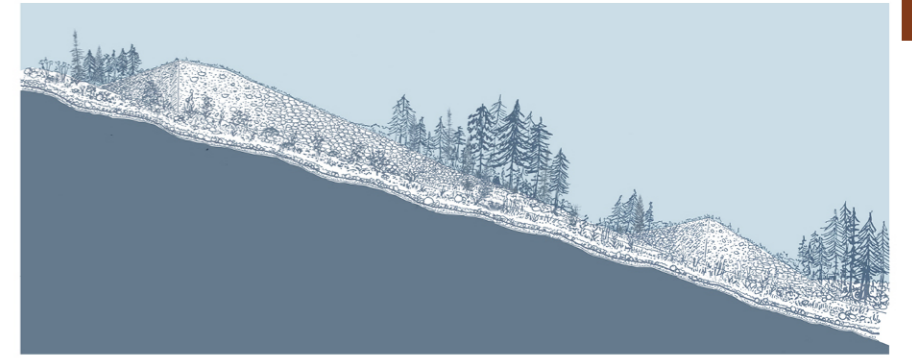


Engadin _ climate-change adaptation to natural hazards

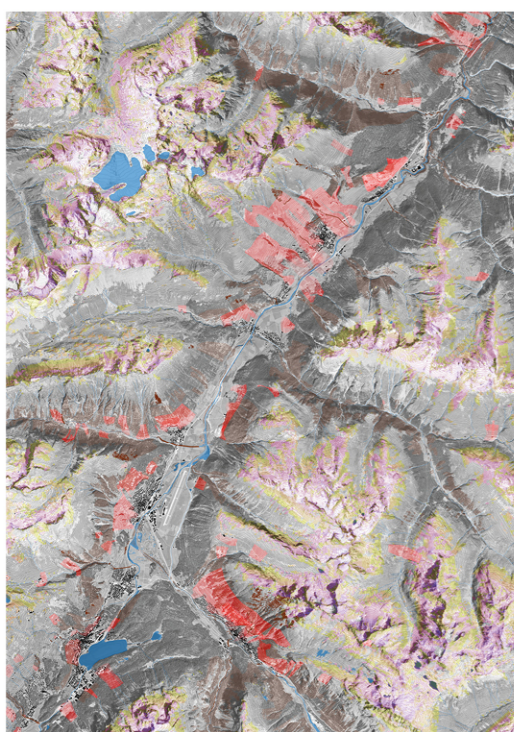
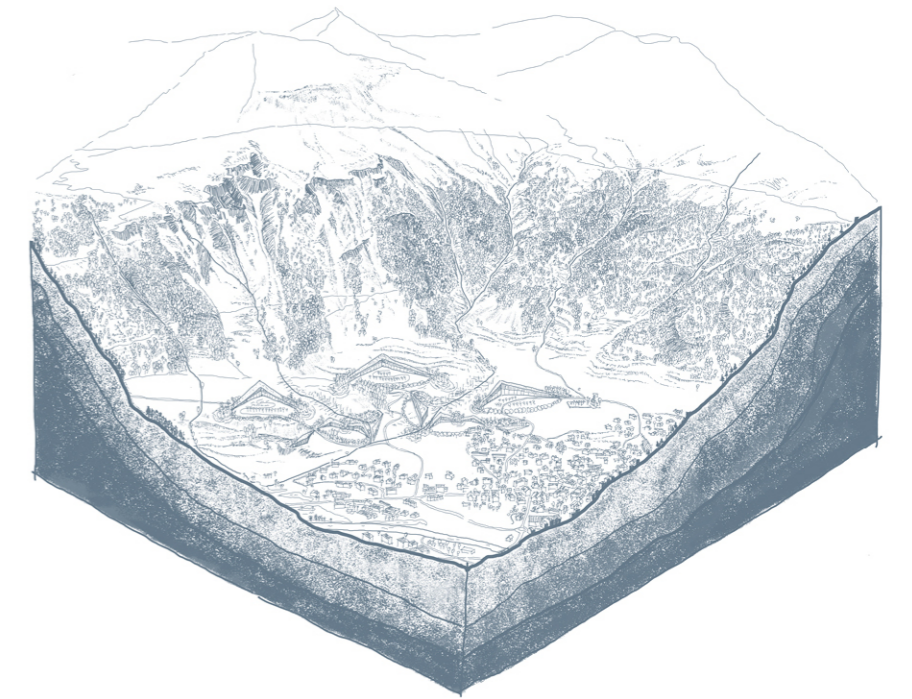




Samedan case _ natural forces reacting to the new protective structures



Materiality of the protective structures and vegetation



Analysis map of the natural danges in the Engadin valley



Guiding forces _ model experimentntation





0 100 200 300 400 500m

Retention basins as a new dynamic water system



Country /City

University / School

Academic year

Title of the project

Authors

Switzerland / Zurich

ETH Zurich

2022 - 2023

AcquaAlpina

Laura Elsener, Arianna Lurati



TECHNICAL DOSSIER

Title of the project	AcquaAlpina
Authors	Laura Elsener, Arianna Lurati
Title of the course	al di là, climate-change adaptation of infrastructural landscape
Academic year	2022 - 2023
Teaching Staff	Martina Voser, Coralie Berchtold, Yann Junod, Sofia Prifti
Department / Section / Program of belonging	D-ARCH Department of Architecture / Landscape Architecture / Studio Voser
University / School	ETH Zurich



" Retention basins as a new dynamic water system "

Climate change is affecting the Gotthard Massif, leading to an increase in heavy rainfall events and raising the risk of natural disasters such as debris flows and floods. Simultaneously, prolonged periods of drought are occurring. These two extremes result into water either flowing too fast, without being absorbed by the soil or a lack of water altogether. Considering these new circumstances, "AcquaAlpina" seeks to address the following question: " How can we shape our landscape - from the mountain peaks to the lowest points of the Airolo valley - so that natural extremes can be reinvented, tackled as potential and reintroduced as beneficial? " By implementing two systems—control and retention—we can alter the water dynamic. In the alpine area, retention basins are strategically designed to regulate the flow of the Vallascia and Dragone creeks, thus preventing debris flows. Within the cultivated landscape above Airolo, rainwater is stored in basins, slowing down runoff and facilitating passive infiltration for irrigation purposes. These water basins also serve as spaces where the presence of water can be celebrated and new spatial opportunities are emerging.

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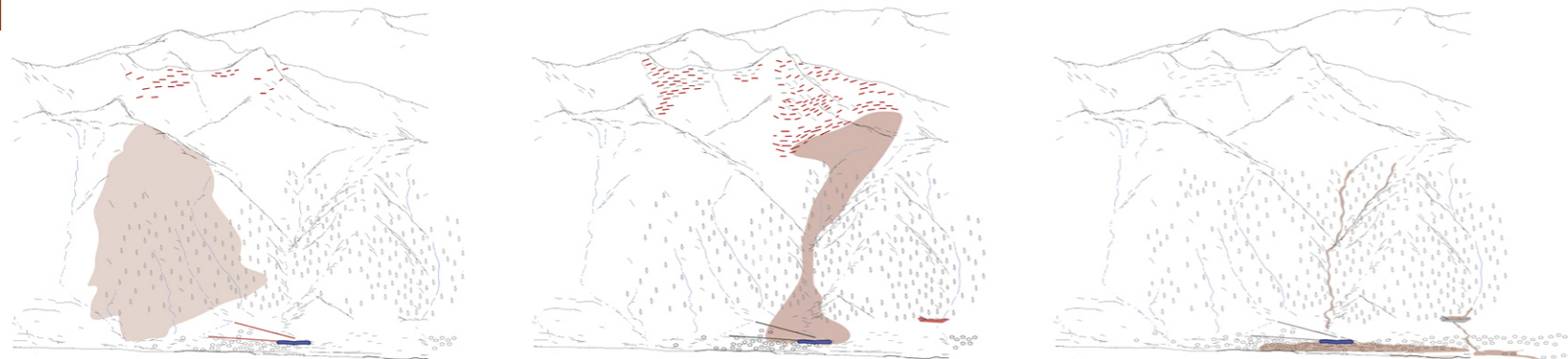
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1898
Rockslide - Sasso Rosso

1951
Avalanche - Grande Valanga

Today / Future

Construction of a protection
stone wall

Construction of the first
snow-protection, steel structures

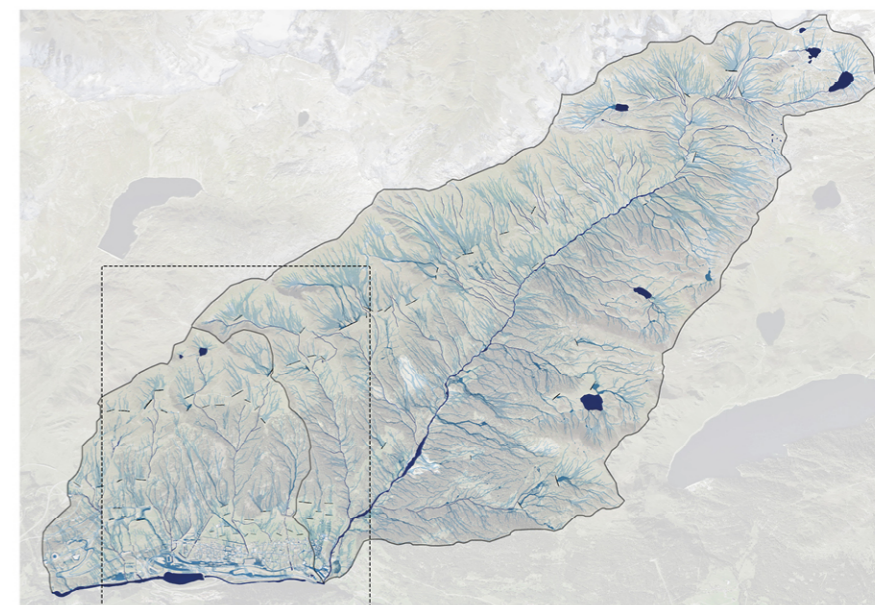
Project AcquAlpina



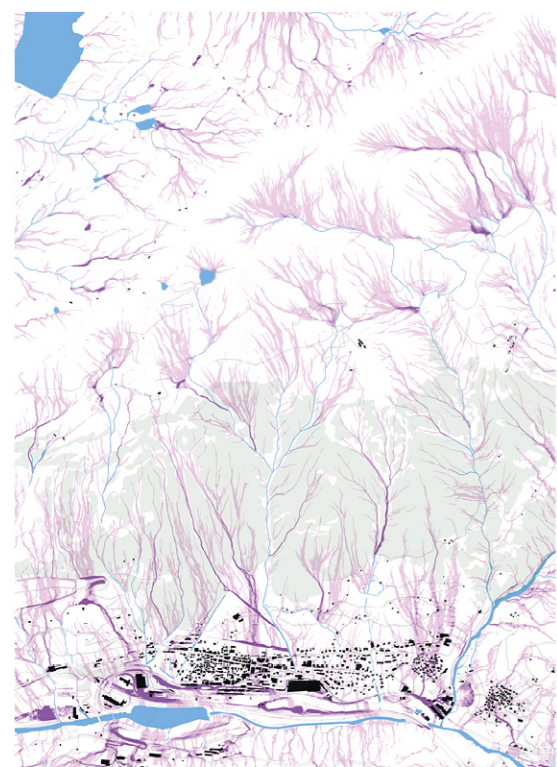
Natural hazards / infrastructural projects timeline



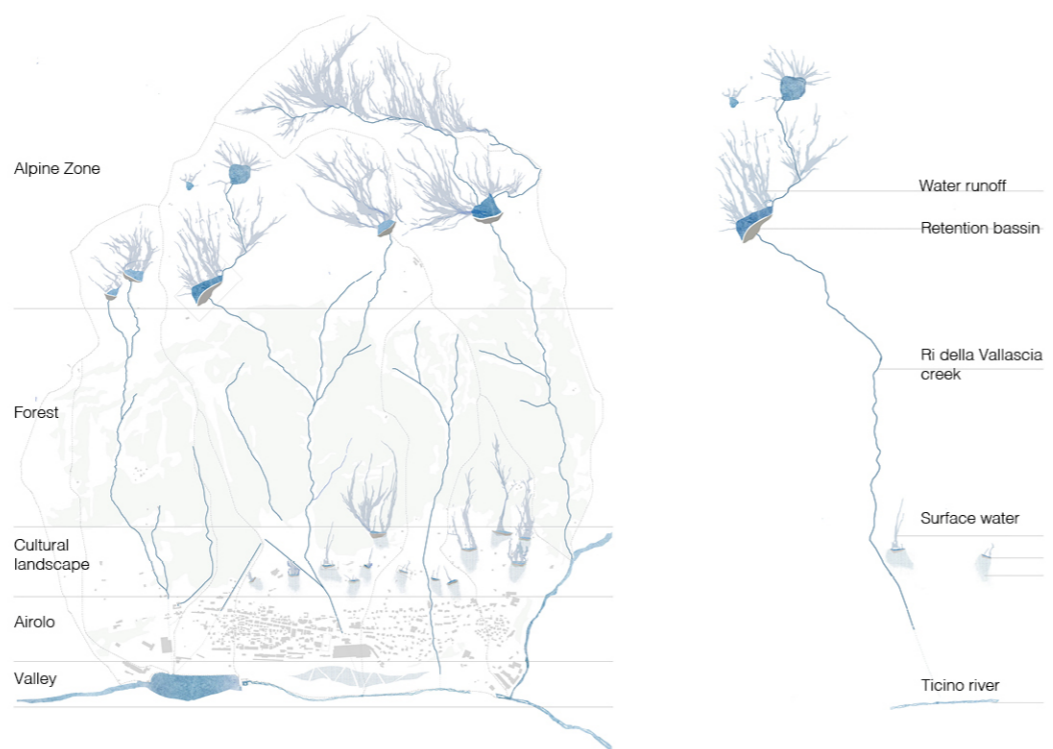
Esprit du lieu



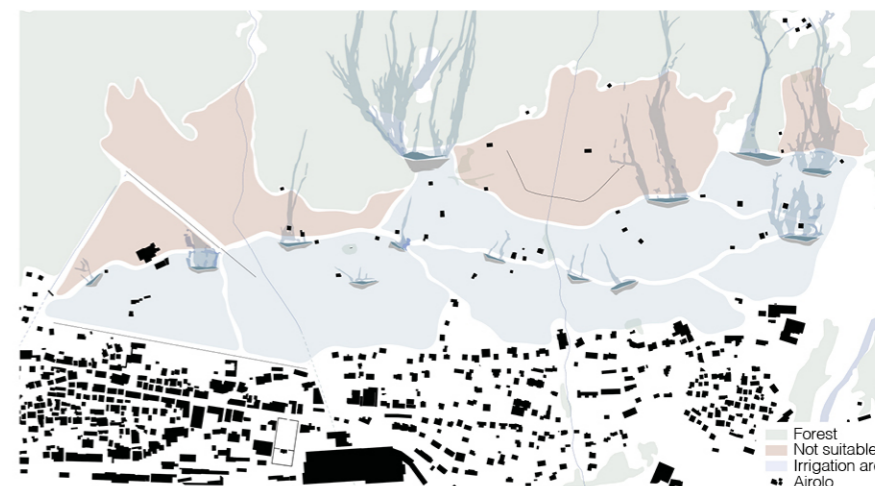
Surface water map _ research on potential locations for water basins



Map of the existing surface water runoff



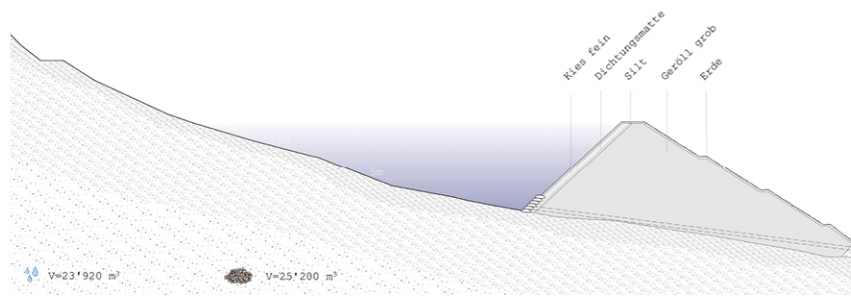
New water system and distribution



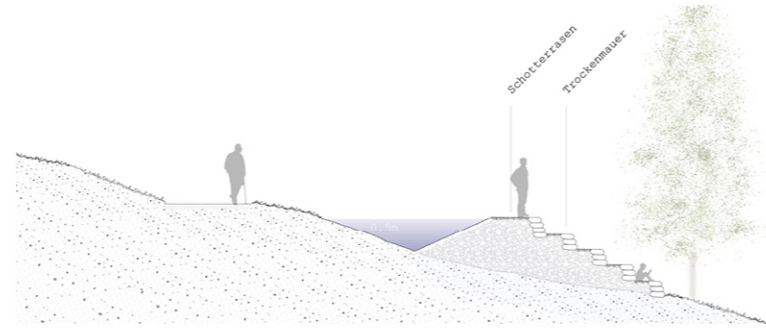
Suitability map



Gotthard Massiv _ climate-change adaptation of infrastructural landscape



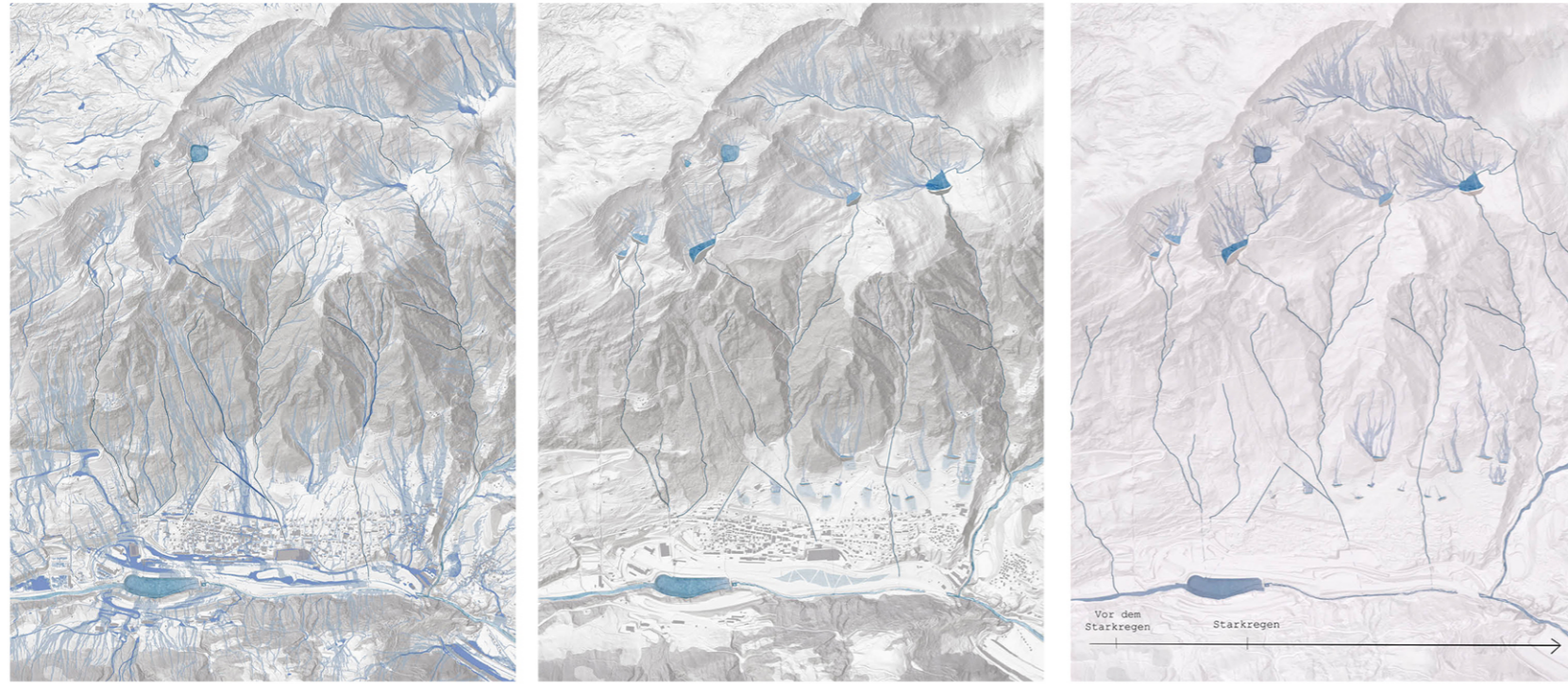
Retention basin in the alpine zone



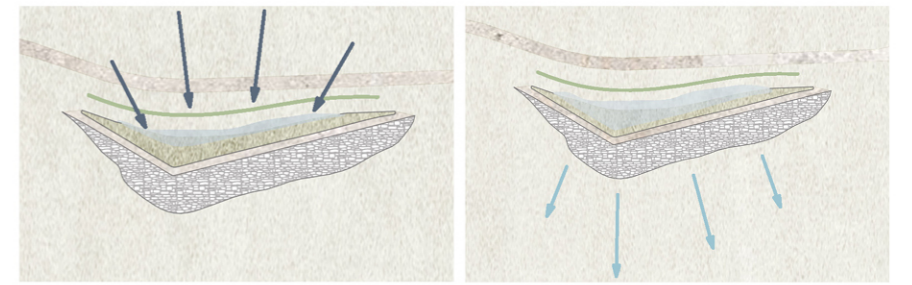
Retention basin above the village of Airolo



The various water basins embedded smoothly in the mountain foot above Airolo



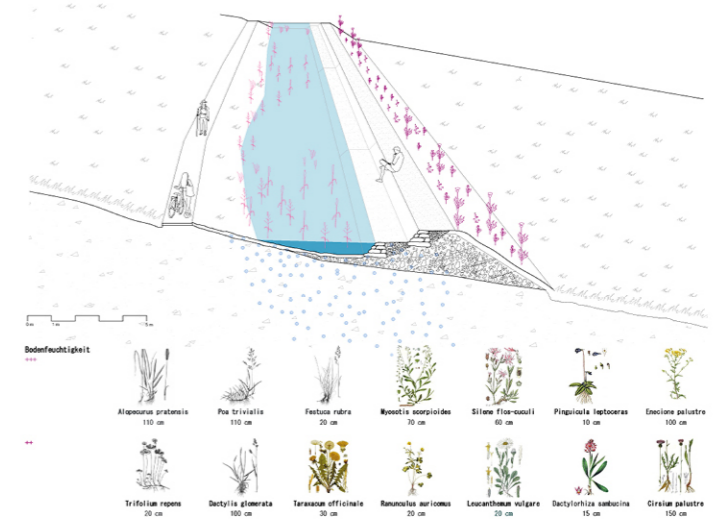
Water dynamics evolution



Water storage, infiltration and distribution



Vision of Airolo _ before and after the intervention



Establishing new natures

