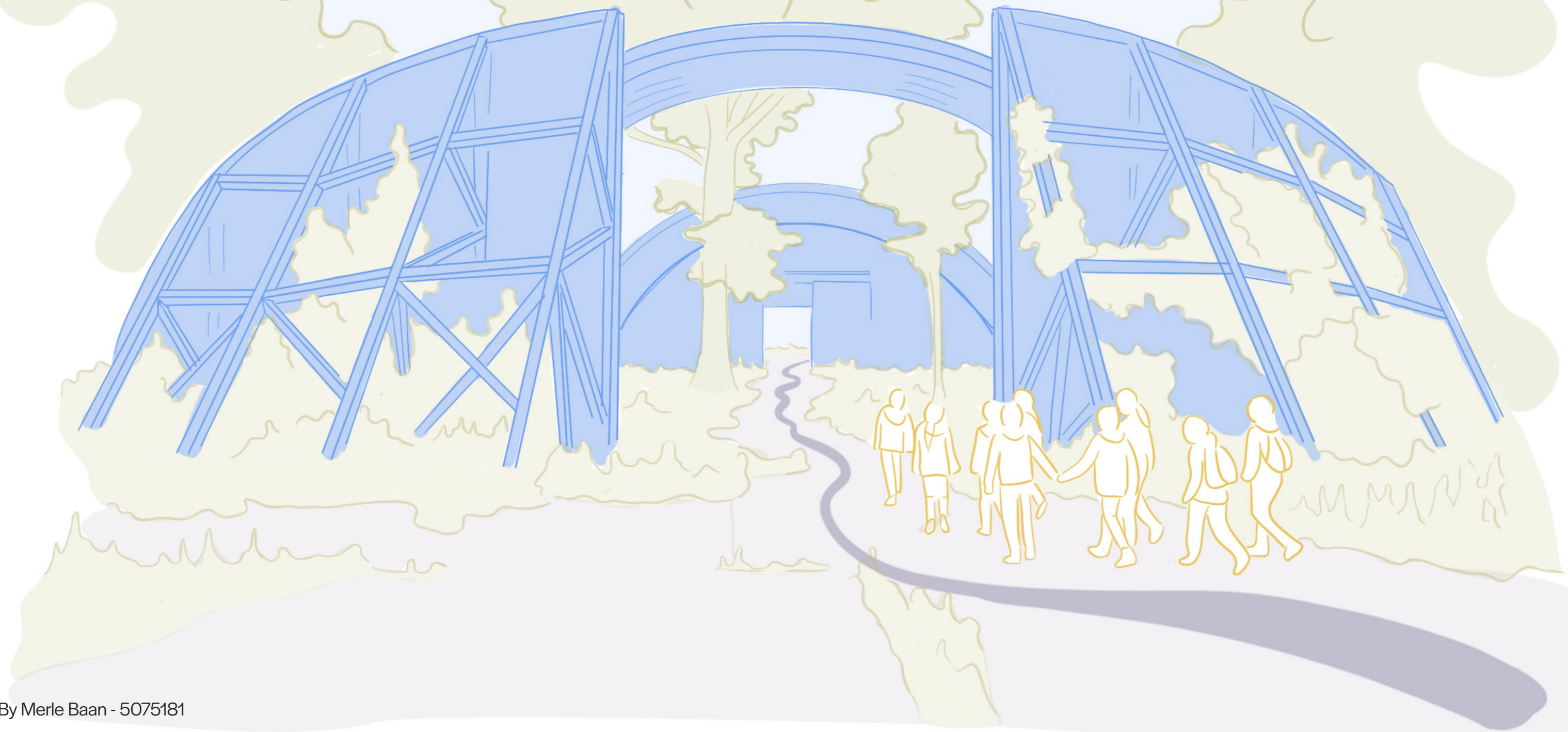


Heritage Reimagined as a Landscape

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Studio: AR4AH120 Adaptive Reuse of Heritage Graduation Studio (2025/26 Q2)

Graduation Report

PREFACE

This graduation report is written for the 'Reuse of Heritage' Graduation Studio of the Faculty of Architecture and the Built Environment of TU Delft. The primary focus of the studio is the Cold War period. At present, the Cold War is scarcely valued within the national heritage register of the Netherlands. A task emerges to assess the value of this heritage and to explore how it can be engaged with in the future landscape. After visiting various Cold War heritage sites, the NATO air shelters at the Airbase Soesterberg formed the primary inspiration for the research topic of this report; Heritage Reimagined as Landscapes. Situated in a natural park, these remnants of the Cold War create a unique dialogue between natural and cultural values.

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note. AI was used solely for grammatical purposes, not for the generation of information

TABLE OF CONTENT

O. INTRODUCTION	5
Problem Statement	6
Scope	7
Objective and Research Questions	9
I. APPROACH	10
Method	11
Theoretical Framework	12
II. RESULTS	15
Values of Nature and Culture	16
Design Approach	18
Building Construction	23
Program of Requirements	29
III. CONCLUSION AND DISCUSSION	35
Conclusion	36
Reflection	41
References	42
APPENDIX	43
A - Planning	44
B - Elaboration of Chapter II.1 - Values of Nature and Culture	45
C - Extensive version of Chapter II.2 -Design Approach	46
D - Extensive version of Chapter II.3 - Building Construction	57
E - Extensive version of Chapter II.4 - Program of Requirements	68
F - Timelayers of the ASA	76
G - Moving Materials at the ASA	78
H - Current Habitats at the ASA	79
I - Ecological Permeable Fences	80
J - Educational Programs and Activities	81

ABSTRACT

The reciprocal relationship between people (culture) and nature (ecology and environmental processes) grows in disbalance. The trend of urbanisation puts culture in a dominating position over nature. Additionally, people lose the connection to nature and their own biological rhythms through fast and digitalised environments. In the field of heritage architecture, we see that traditional practices prioritise the value of culture. The value of nature is often overlooked. Both have value to exist in a landscape. It is relevant to understand how to regenerate the reciprocal relationship between people and nature in heritage architecture.

This research aims to explore reimagining heritage architecture as a landscape. A space where culture, ecology, and environmental processes balance. It will explore this through an architectural intervention for a nature school at the Air Shelter Area at Airbase Soesterberg. The central question in this research is; *How can adaptive reuse of heritage, reimagined as a landscape, transform the Air Shelter Area of Airbase Soesterberg into a nature school that restores a reciprocal relationship between culture, ecology, and environmental value?*

To answer this question the research will use literature studies, case studies and a design-driven reflection. Literature and case studies provide relevant available knowledge to explore design scenarios within the contextual framework of the Air Shelter Area of Airbase Soesterberg. The research concludes with a design proposal for a nature school at the Air Shelter Area. The design reimagines the heritage as a landscape where future generations learn to slow down and experience environmental, biological and cultural processes. A landscape where nature is not suppressed by a human-centric philosophy but flourishes equally with culture.

Reading guide

This report consists of four parts. Part one introduces the problem, scope and objective. Part two outlines the methodology and theoretical framework. Part three elaborates on the results of the sub-questions by applying insights of literature and case studies to the contextual framework. Extensive versions of the chapters of part three are included in the appendix. Part four forms a conclusion to the central question by synthesising the results of the sub-questions into a design proposal for a nature school at Airbase Soesterberg, which balances a reciprocal relationship between culture, ecology, and environment. The discussion positions the design proposal within the broader field of heritage architecture. A final reflection reviews the research process.

I. INTRODUCTION

Problem Statement, Relevance, Scope, Objective, Motivation and Research Questions

1. Problem Statement

The reciprocal relationship between people (culture) and nature (ecology and environmental processes) grows in disbalance. As urbanisation puts pressure on ecological spaces future generations are becoming increasingly disconnected from nature. Within this problem two statements emerge.

Firstly, nature is dominated by people. Once, a landscape was a shared and balanced space of environmental processes, ecology, and culture. The wastelands functioned as communal ground, where natural processes, vegetation, animals, and people coexisted. Over time, cultivation and urbanisation put culture in a dominating position over nature (Cortesi, 2020; figure 1). In the last 50 years, wildlife numbers in the world have fallen by 73% (WWF, 2024). In the Netherlands, the biodiversity decreased in quality and quantity to approximately 15 percent of the original situation due to cultivation and urbanisation (Atlas Leefomgeving, n.d.). Buildings and borders are fixed, expanding and rarely making space for nature, as nature does for culture. Nature is reduced from a co-actor to a managed actor in a landscape.

Secondly, people are becoming increasingly separated from nature. In the past, the life of people was structured by natural and biological rhythms. Today's urbanised, overstimulating, fast-paced environment disrupts these rhythms and challenges people's well-being. Problematic internet- and smartphone-use is negatively linked to subjective mental well-being (Cai et al., 2023; van Rooij et al., 2018). People are continuously triggered by digital cues, and their behaviour correlates with neurological disturbances in the brain's executive control and rewarding systems (León Méndez et al., 2024). People become more susceptible to distraction, less capable of sustained attention or experiencing boredom (Subramanian, 2018), have less self-control, and favour short-term rewards and quick dopamine hits. Life has become quicker. The fast digital environments pull people away from balanced ecological rhythms and disturb foundational skills, creating a cultural distance from nature.

Combining these two statements, the culture–nature imbalance threatens both nature and a healthy human development.

Landuse legend

- Agricultural grassland
- Corn
- Arable/horticulture
- Greenhouses
- Orchards
- Flower bulbs
- Forest & natural land
- Water
- Urban area
- Infrastructure
- Rural buildings
- Other land use
- Tree nurseries
- Fruit nurseries



Figure 1. Landuse of the Netherlands 2024, showing cultivated and urban areas versus natural land. Source: CLO (2025).

Relevance in the Field of Heritage Architecture

This culture-nature imbalance also shows within the field of heritage architecture. Recent studies like 'Curated Decay' (DeSilvey, 2017) and 'Ecologies of Architecture' (Radman, 2021) reveal this tendency. These studies highlight that within the practice of architecture and heritage the value of nature as co-actor is overlooked. People tend to perceive architecture as immortal, something that should not recede or decay into nature. There exists a cultural tendency to separate culture from the ecological and environmental systems that sustain them. In architecture the value of culture (heritage) is often prioritised above the value of nature (ecology and environmental processes). The question arises; why are entities, which cannot articulate themselves, not let to express themselves in a landscape? It is relevant to illustrate how architectural heritage, through negotiating between nature and culture, can shape landscapes that balance ecological and natural processes, while sustaining culture for future generations.

The design assignment is to examine how architectural heritage can interact with natural processes rather than resist them, and how cultural and natural values can be negotiated within a shared landscape. This research tests this through a design assignment of a nature school at the Air Shelter Area of Airbase Soesterberg. The recent entry of the Cold War period into the field of heritage has left approaches to this heritage uncertain, making it a relevant testing ground for investigating new heritage approaches and theories. Additionally, the Cold War air shelters are situated within a nature park, forming a context in which cultural and natural values directly intersect.

2. Scope

The contextual framework of this research is defined by the site and program. This research focuses on the Air Shelter Area at Airbase Soesterberg to propose a nature school for pre-school and primary school children.

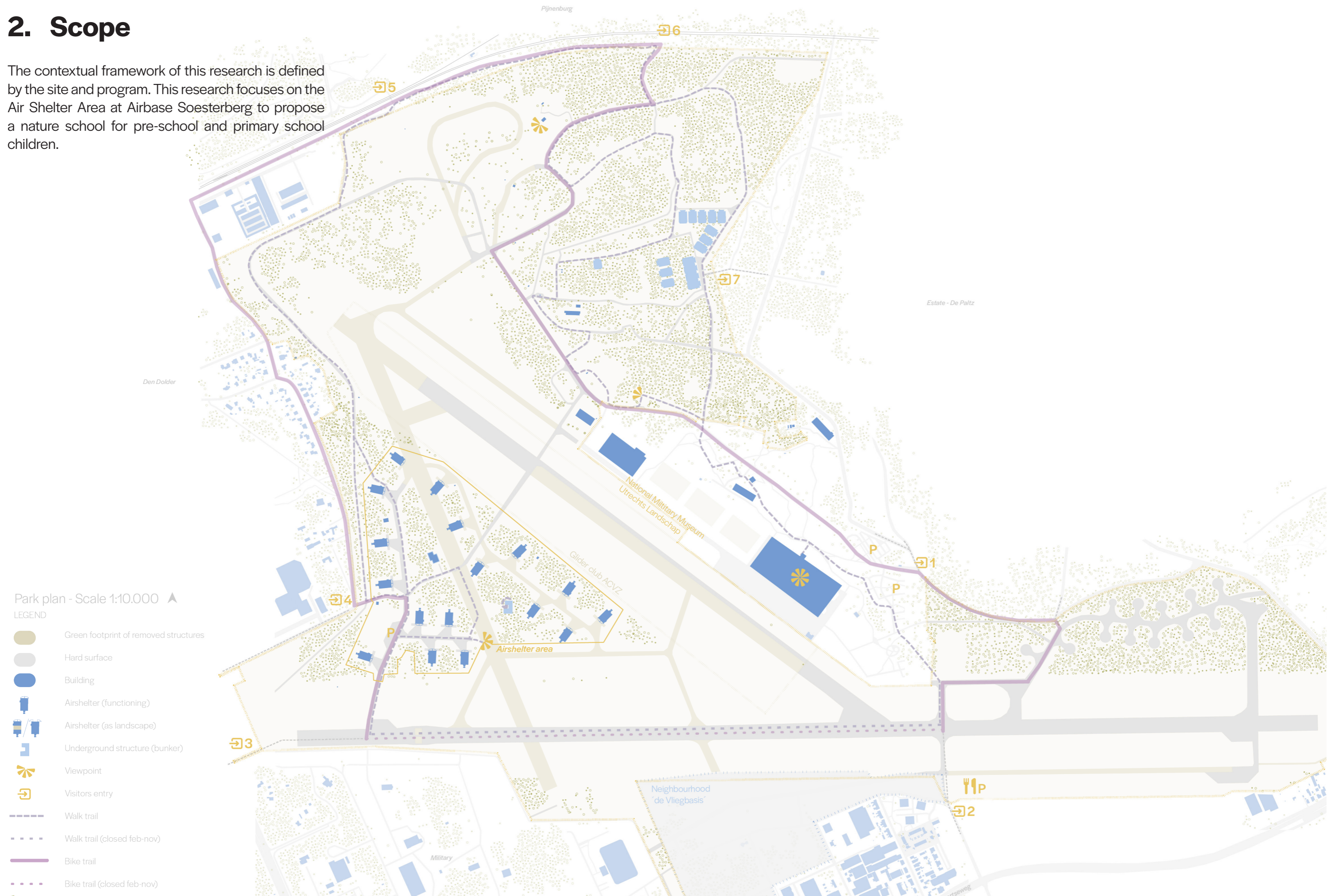




Figure 3. Air Shelter Area Soesterberg Airbase, nature reclaiming space. Source: Own work.

Heritage: Air Shelter Area of Airbase Soesterberg

This research reimagines the shelters at the Air Shelter Area (ASA) of Airbase Soesterberg as landscapes. The site's layered environmental, ecological and cultural values provide a study ground for designing with a balance and coexistence of the three actors of a landscape: culture, ecology and environmental processes (Theoretical framework, pp. 12-13).

The culture-nature balance of the site transitioned over time. Prior to the 1900s, the landscape was characterised as a large wildland on a moraine between Amersfoort and Zeist. The heathland functioned as common land for sheep grazing, travel between villages and temporary military purposes. In 1908, two car dealers transformed the area into a 'vliegerheide' (aviator heath). Here, planes landed directly on the sandy plain. In 1913, the Dutch military

established an aviation department at the site, which made the site inaccessible to the public. During World War II, the Germans transformed the sandy plain into a terrain with concrete landing strips. During the Cold War, NATO transformed a green open field into a camouflaging forest with fixed hardened concrete shelters to protect their airplanes, the Air Shelter Area was established. Currently, the site is owned by Utrechts Landschap and has been transformed into a public park, where nature reclaims space (figure 3).

In short, the flexible, natural collective wilderness gradually transformed into a cultivated, private landscape where nature was regulated and structures became more fixed. Nowadays, the site has reopened to the public, offering the chance to experience nature and Cold War heritage.



Figure 4. Preschooler of nature school observing nature with binoculars. Source: I Uhr och Skur (n.d).

New Cultural Actor: The Nature School

A landscape is dynamic and ever-changing, continuously shaped by the passage of time and the interactions of its three actors. This research positions itself as a cultural actor, capable of influencing ecological and environmental processes, but unable to react in these positions.

This research proposes a 'Nature School' as future cultural act to create balance with the ecology and environmental processes at the site. This school educates pre-school and primary school students through the principle of 'Outdoor Landscape Education' (Theoretical framework, p. 12).

Why focus on child education? Neuroscience has taught us that early childhood is the most important time for building strong foundations for life. 'Our early

experiences shape our brain architecture, which provides the foundation for all future learning, behavior, and health.' (CDC, n.d.) Between the ages of three and five, the brain has the most synapse connections (Bianchi et al., 2023). This early childhood most affects the foundation of brain connections that form later in life, negatively or positively (CDC, n.d.). It is during this period that life experiences influence cognitive, emotional, and social development (Farrell, 2014). Therefore, it is essential to create a positive environment during early childhood. By proposing a program for this age group, the research addresses future generational growth and development.

3. Objective and Research Questions

This research aims to re-establish the relationship between people and nature by enabling ecological and environmental processes to coexist with cultural practices, through reimagining heritage buildings as landscapes. The motivation is to create a space in which future generations can learn to slow down and become aware of natural and cultural systems. This is explored through the proposal of a nature school in the Air Shelter Area. Therefore, the central question of this research is:

How can adaptive reuse of heritage, reimagined as a landscape, transform the Air Shelter Area of Airbase Soesterberg into a nature school that restores a reciprocal relationship between culture, ecology, and environmental value?

The sub questions are:

1. How do values of nature and culture coexist in the Air Shelter Area?

2. How can (landscape) architectural design approaches, existing within the field of adaptive reuse, support the balance of nature and culture values at the Air Shelter Area?

3. How can the building construction of newly built architecture convey the concept of architecture as a landscape at the Air Shelter Area?

4. How do spatial characteristics and program approaches encourage children's learning and engagement with the landscape of the Air Shelter Area?



Figure 5. Interplay of shadows (environment), moss (ecology) on skin of the airshelter (culture) at park Soesterberg Airbase. Source: Own work.

II. APPROACH

Method and Theoretical Framework

1. Method

The method of this research is a combination of literature studies, case studies and design-driven reflection (figure 6). The planning for this research can be found in appendix A.

Literature studies and case studies gather theoretical and practical information, which are used to create scenarios within the theme 'Heritage Reimagined as Landscapes'. These scenarios are then examined through the contextual framework of a Nature School at the Air Shelter Area, and visualised in sketches. This reflection results in separate strategies for the site. The specific method for each sub-question is as follows:

To answer the question, 'How do values of nature and culture coexist in the Air Shelter Area?', the following method will be used: First, research will be conducted on different value assessment techniques. These techniques will then be compared and combined to develop a comprehensive value assessment method that integrates both natural and cultural values. The assessment is filled in using information from the site analysis. The conclusion is a value assessment that showcases what and how values of nature and culture coexist at the air shelter area. A reflection relates the value assessment to the values identified by the site's owner, Utrechts Landschap. This identifies differences in perspective and creates a position for alternative or complementary strategies.

To answer the question, 'How can (landscape) architectural design approaches, existing within the field of adaptive reuse, support the balance of nature and culture values at the Air Shelter Area?', the following method will be used: Literature studies and case studies of existing design approaches within the field of heritage and landscape architecture will be used to define scenarios. These scenarios are evaluated by implementing them on the site. This results in one or more site strategies per scenario. Through reflection, these strategies are compared and related to each other and the existing approach of Utrechts Landschap. With this, a conclusion is drawn for a design approach that balances cultural and natural values.

To answer the question, 'How can the materiality and structural design of newly built architecture convey the concept of architecture as a landscape at the Air Shelter Area?', the following method is used: The characteristics of a landscape are linked to existing building construction principles. These principles will be applied to the contextual framework to find a fitting building construction for new additions.

To answer the question, 'How do spatial characteristics and program approaches encourage children's learning and engagement with the landscape at the Air Shelter Area?', the following method is used: Case studies of (nature) schools are analysed to identify spatial characteristics and program approaches that encourage learning and engagement with its landscape. These spatial solutions are analysed by applying them to the contextual framework. The findings are then summarised into a program of requirements with an abstract zoning plan of a nature school.

The conclusion provides an answer to the central question; 'How can adaptive reuse of heritage, reimagined as a landscape, transform the Air Shelter Area of Airbase Soesterberg into a nature school that restores a reciprocal relationship between culture, ecology, and environmental value?', through a design proposal that integrates the results from the sub-questions.

The discussion reflects on the broader implications of the research for the field of heritage architecture, providing insights into how reciprocity of culture and nature can be incorporated into the adaptive reuse of heritage.

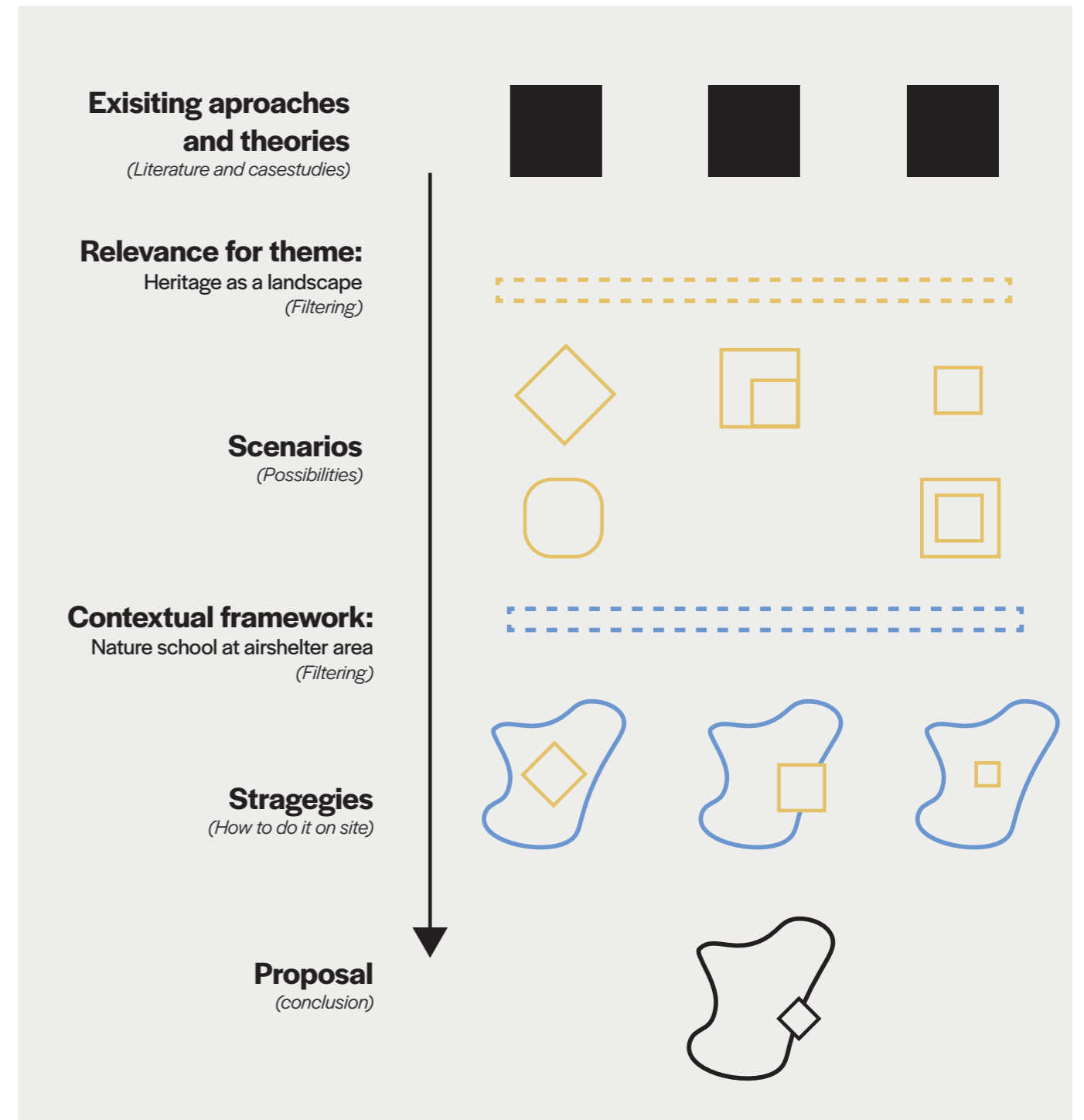


Figure 6. Overview of the general research method. Source: Own work

2. Theoretical Framework

This theoretical framework sets the principles guiding this research. It situates this research in existing relevant theories and knowledge.

A Philosophy of Buildings Reimagined as Landscapes

“Landscapes are hybrid natural and cultural entities, dynamic and everchanging, but rarely applied to individual parts like boundaries and buildings.”
(DeSilvey, 2017)

Theory

In the Western world, heritage buildings are traditionally perceived as unmortal objects. A structure that is prevented from change in form, boundaries, materiality and meaning. The thought of entropy, decay or loss generates discomfort in people. It gives us an urge to take care of a structure, through actions like restoration and preservation. Yet, if every object is treated as non-changing heritage, future generations will inherit an abundance of preserved objects, potentially making its cultural value indifferent. It is important to consider what aspects of heritage make it valuable and the approach this evokes. As Riegl (1903) noted, when the intentional commemorative value of an object is given priority, care and repair seem appropriate. An object for which age is the primary value should be perceived as a ‘natural organism’, undergoing natural processes of decay and change. This suggests that not all structures benefit from preservation and restoration; some may gain more value through interaction with natural processes.

Where ecosystems tell a natural and cultural story, structures tell a social and biological one. As Tilmann suggested, we should view a building as a landscape. This perspective opens up the design strategy of controlled decay and growth, in which the balance between ongoing processes and planned use is negotiated between the three actors of a landscape: environmental processes, ecology and culture (figure 7).

How to use

In this research we reimagine heritage structures as a landscape. With a landscape being defined as ever-changing, the use, boundaries and interpretation of heritage become dynamic. Users become the three actors of a landscape; environmental processes (wind, water, sun, earth), ecology (plants and animals), and culture (people) (figure 7). The users are coexisting, abandoning, moving, and creating ‘pockets of habitats’. Boundaries can collapse and create space for social and natural transformation. Heritage will be in between identities and open for future change.

Outdoor ‘Landscape’ Education

“It’s about helping people learn about themselves, how they relate to other people and the environment”
(Wattchow & Brown, 2011)

Theory

Access to nature is important for children’s wellbeing (Kahn & Kellert, 2002). Being in nature is proven to have health benefits, such as feeling less stress, anxiety, aggressiveness and being able to focus better (Kaplan, 1995). A study (de Vries, Verheij, & Smeets, 2015) even showed that children playing in green areas reduced their need for ADHD-medication. Because of these benefits, more nature schools or forest schools are formed around the world.

Nature-based outdoor education focuses on nature-specific outdoor learning (excluding built environments) to achieve academic outcomes (Mann et al., 2022). In addition to nature-based education, several sub-modes exist within the broader field of Outdoor Environmental Education (OEE), such as place-based, place-responsive, land-based, adventure education, field trips or field-studies (Mannion et al., 2025). Place-based education does include the built environment and focuses besides the natural also on the social, cultural, economic, political context of their local environment (Lloyd, Truong & Gray, 2018).

How to use

With the objective to restore a reciprocal relationship between nature and culture, OEE should find a balance between the two. Therefore, the educational program for the contextual framework combines place- and nature-based education. This research defines this mode as ‘Outdoor Landscape Education’ (OLE), as a landscape forms a balance between environment, ecology and culture. It is an education mode where children actively learn from culture, ecology and environmental processes by exploring the outdoors.

One Framework

The philosophy of buildings reimagined as landscapes and Outdoor Landscape Education both highlight a system in which nature and culture coexist. Collectively, these perspectives support a framework in which children actively explore and learn from the landscape, forming understanding of both heritage and the natural environment.

2. Theoretical Framework



Figure 7. Definition (and colour coding) of a landscape and its three actors. Source: Own work.

2. Theoretical Framework

Abbreviations and Acronyms

<i>ASA</i>	Air Shelter Area
<i>DfD</i>	Design for Disassembly
<i>Ecologies</i>	Ecological building envelopes, defined by Technical University München
<i>HA</i>	Heritage Architecture
<i>LA</i>	Landscape Architecture
<i>Landscape</i>	An everchanging entity influenced by three actors; environmental processes, ecology and culture (the influence of people)
<i>Moving Materials</i>	Environmental processes, as sun, rain and wind, defined by Sambucchi
<i>OLE</i>	Outdoor Landscape Education
<i>OEE</i>	Outdoor Environmental Education
<i>UL</i>	Utrechts Landschap; organisation that owns and manages park Airbase Soesterberg, including the Air Shelter Area

III. RESULTS

Research and Design Reflection

1. Values of Nature and Culture

This chapter addresses the following question: *How do values of nature and culture coexist in the Air Shelter Area?*

In order to identify the natural and cultural values at the Air Shelter Area, this chapter introduces a new comprehensive value assessment.

Value Assessment for Landscapes

One method of value assessment is ‘The Value Assessment Matrix’ of Kuipers & de Jonge (2017) (figure 8). This matrix relates the building layers identified by Brand (1995) to the heritage values defined by Riegl (1996). In the theme of ‘Heritage reimagined as a Landscape’, Riegl’s values do not include the natural values embedded within cultural heritage. The Australian Natural Heritage Charter (Australian, Heritage Commission, 2002), the Burra Charter (Australia ICOMOS, 2013) and the Outstanding Universal Values of UNESCO (2017) acknowledge the existence of heritage that is natural and cultural (figure 9). This coexistence is seen in indigenous heritage, where a high reciprocal relationship with nature is found. However, the natural and cultural heritage values are assessed separately. This limits an understanding of heritage as an interrelated landscape or ecosystem.

Azzopardi et al. (2023) proposed an ecosystem-based framework, an assessment method where natural and cultural heritage are interrelated. Their ‘Life Framework of Values and Heritage’ conceptualises heritage values through four ways that describe how humans engage with nature: ‘living from’ (economy and wellbeing), ‘living in’ (identity and sense of place), ‘living with’ (existence and stewardship), and ‘living as’ (reciprocity).

The value assessment applied in this research combines ‘The Value Assessment Matrix’ and ‘The Life Framework’. Together, these methods form a value assessment that interprets layers of heritage as part of an ecosystem or landscape.

Values at the ASA

The value assessment of the Air Shelter Area (figure 10) illustrates that the highest values are in the layers of surroundings, site, system, and spirit of place. This indicates that the significance of the area lies primarily in its relationship with the landscape and its atmosphere, rather than in architectural features alone.

Educational, historical, nostalgic, and existence values stand out most clearly. Educational value is expressed through the site’s ability to experience military history and ecological processes. Historical and nostalgic values are visible through traces of past military use, which contribute to a strong sense of memory and identity. Existence value shows in the ecological richness of the area, where the air shelters now function as new habitats. Together, these values create a spirit of place, defined by the coexistence of cultural memory and natural succession.

To position this research, the value assessment is related to the values of Utrechts Landschap in appendix B (p. 45).

BRAND +	RIEGL +	AGE value	HISTORICAL value	INTENTIONAL COMMEMORATIVE value	NON INTENDED COMMEMORATIVE value	USE value	NEW-NESS value	(relative) ART value	RARITY value [+]	OTHER relevant values [+]
SURROUNDINGS / SETTING [+]										
SITE										
SKIN (exterior)										
STRUCTURE										
SPACE PLAN										
SURFACES (interior) [+]										
SERVICES										
STUFF										
SPIRIT of PLACE [+]										

Figure 8. Value assesment that combines Brand’s and Riegl’s theories. Source: Kuipers & de Jonge (2017)

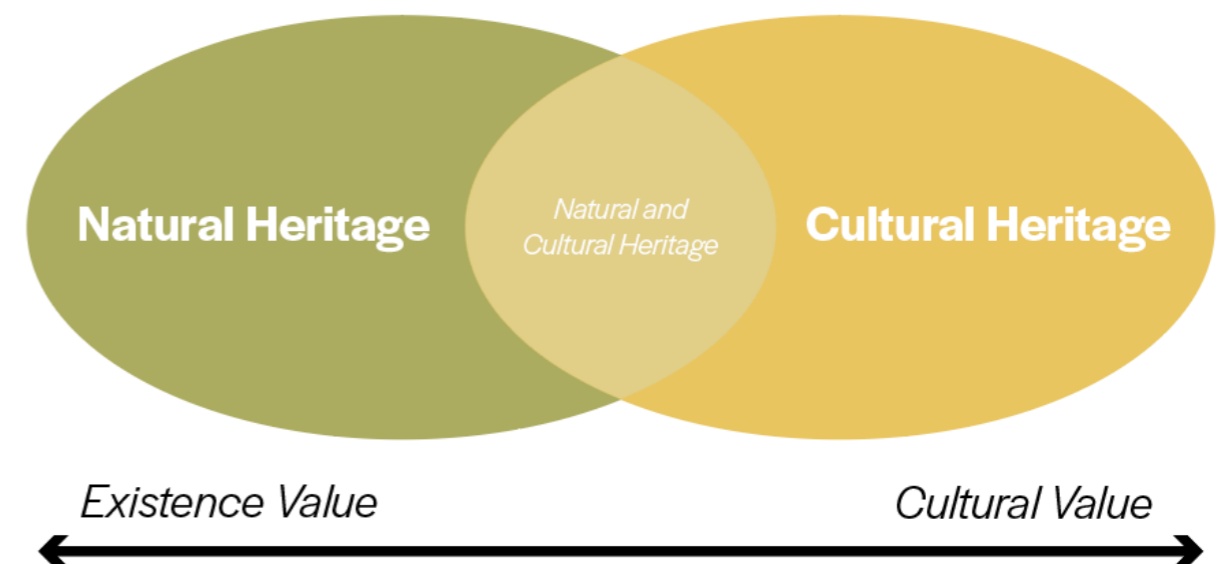


Figure 9. Overlap in natural and cultural heritage. Source: Australian Heritage Commission (2002) (edited)

1. Values of Nature and Culture

	'Life from'				'Life in'					'Life with'		'Life as'	
	Economic	Health	Scientific	Education	Age	Historic	Aesthetic	Commemorative	Nostalgic	Existence	Biocultural diversity	Spiritual	Symbolic
Surroundings <i>Utrecht, Soesterberg Airbase</i>	Animal and plants get basic needs from surroundings Public park and Tourism	Park with space for biking, walking, running, exercise and slow down	Biology and biodiversity studies	Learn about history in nature, culture and environment and biodiversity	- Relief of moraine and plain landscape - Layers of human interventions (landingstrip)	Napoleon Stratetical point much military activity Vliegerheide	Scenic nature relief and depth. Openness vs. enclosure - sight lines	Museum and memorial statue is commemorative	Limited acces Sound of overflying airplane Peak inside - Open Vliegerdagen	Utechts Landschap protects the green space in the provence	High biodiversity - ecology routes to Natura 2000		Using nature as camouflage technique
Site <i>Air shelter area</i>	Advertisement Utrechts landschap	Much vegetation results in clean air and relaxation	Numbers of animal species tracking trough	Learn about cold war history and biodiversity	Big mature trees Footprint 'German landingstrip' and other paths	NATO and WO2 activity	Contrasting nature and concrete scene		American military NATO activity Mysterious	Originally heather, the planted forest creates more habitat diversity and shelter	Along concrete strips more calcium rich species		Reciprocity of culture and nature
System <i>Air shelters</i>	Head quarters and storage Utrechts Landschap Rentable event or work space		NATO air shelter placement system Generation 3 shelter	Learn about cold war history and reciprocity with nature (nature camouflage plan)		NATO activity	Randomness in orientation			Random orientation create different habitat circumstances	Diversity in placement and orientation of aishelters		
Structure <i>Wondr building</i>	High carrying capacity				Water traces on the steel plates	Wondr structure from chicago	Rythmic arch structure		Construction process, quick assembling of the shelters	Environmental processes of steel weathering			
Space plan <i>Floorplan</i>	Open flexible space				Worn painted guidelines		Emptyness		Teamwork Organised Loud noises Air flow	Exhaust vault creates habitat for mosses			
Skin <i>Concrete</i>						Hardened shelter as reminder from conflict in Egypt	Shadow of trees on the concrete			Weathering of concrete and moss growth			
Service <i>Ventilation, mechanics, etc.</i>	Operational systems, like door mechanism and electricity				Weathering stains old electrical system for opening door		Scene of story of use		Ventilation noise Teamwork: Hoisting the airplane inside Opening process of the door	Empty ducts spaces for nests and animal species			
Stuff <i>(removed)</i>									Spitfire- airplane in middle Tools behind the Yellow painted line-marking				
Spirit of Place <i>Stories and atmosphere</i>	Tourism and investors attractor	Sense of identity and perspective development		Learn about the old stories and memories		Americans under dutch command	Contrast of former activity and current abandonment		Orderness Teamwork Respect Discipline	Cultural identity			



Figure 10. Value assessment, combining the 'Life Framework of Values and Heritage' and the building layers of the ASA. Source: Own work.

2. Design Approach

This chapter addresses the following question: *How can (landscape) architectural design approaches, existing within the field of adaptive reuse, support the balance of natural and cultural values at the Air Shelter Area?*

In reimagining heritage as landscape, the chapter considers approaches from both landscape architecture (LA) and heritage architecture (HA) (figure 11-14). These approaches are then applied within the contextual framework.

An extensive version of this chapter is provided in appendix C (pp.46-56). This version provides a more detailed explanation of the case studies and its implementation on the ASA, alongside an additional evaluation of the current approaches at the airbase.

2.1. LA - Articulation Approach



Figure 11. Drentsche Aa. Source: <https://strootman.net/>

2.2. LA - Fragmentation Approach



Figure 12. Deltawerk by RAAAF. Source: <https://www.raaaf.nl/>

2.3. HA - Analogue Approach



Figure 13. City Hall Den Helder by Office Winhov. Source: <https://www.winhov.nl/>

2.4. HA - Missing Approach

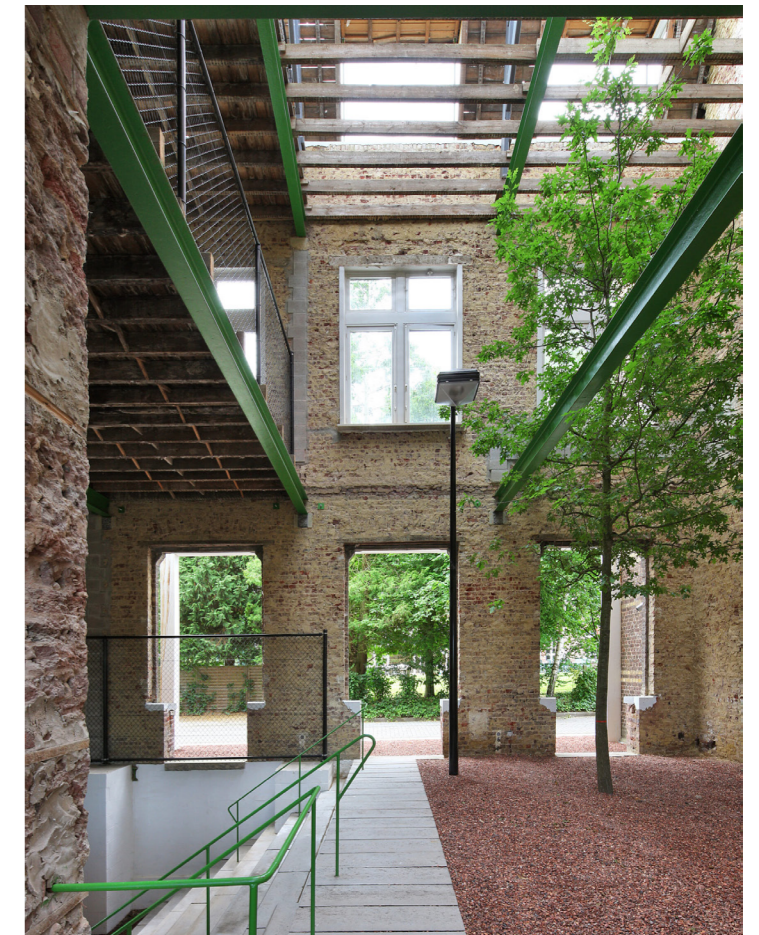


Figure 14. Caritas by De Vylder Vinck Tailieu. Source: <https://architectenjddiv.com/>

2.1. LA - Articulation Approach

Landscape architecture is about creating continuity. The articulation approach is about making the landscape and its time layers more readable for the visitor, through clusters (figure 15), clearing overgrown areas, restoring view lines and creating viewpoints (figure 16).

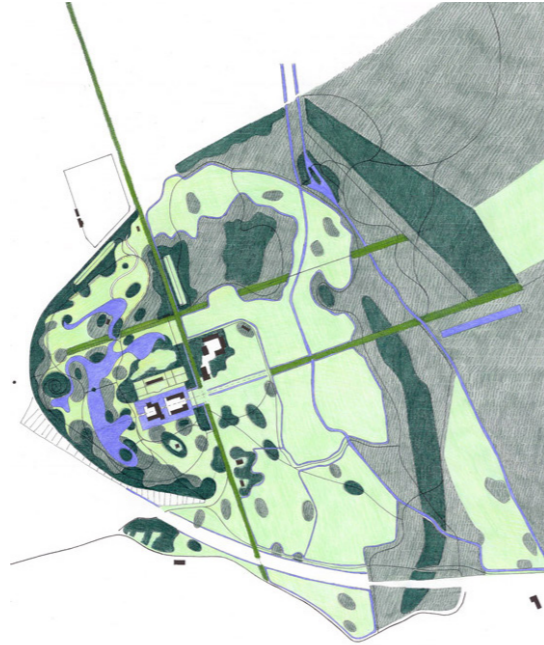


Figure 15. Twickel Estate by Micheal van Gessel. Source: <http://www.michaelvangessel.com/>

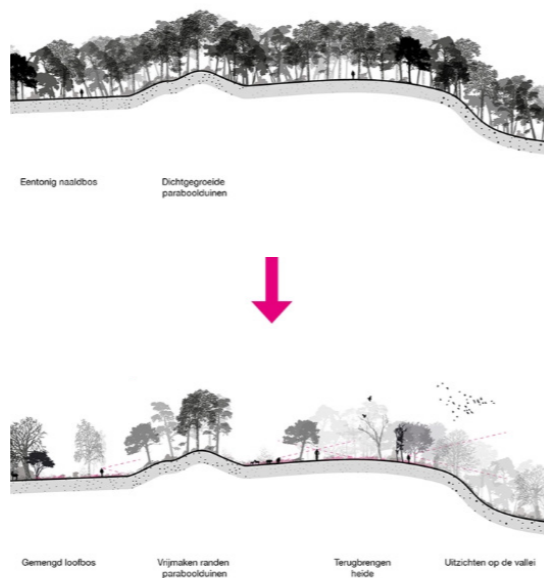


Figure 16. Kempense Heuvelrug by Strootman Landschap Architecten. Source: <https://strootman.net/>

Articulation at the ASA

In addition to the layers of the Cold War period and the German period, which are currently emphasised by Utrechts Landschap (Bakker, 2011), an earlier agrarian layer was present. Sandy tracks crossed the former heathland of the ASA (appendix F, p. 48). Reintroducing this layer could reveal a reciprocity of culture and nature at the ASA.

The pattern of desire tracks could be translated into a system that opens up the air shelters (figure 17). This system connects the area in the form of sightlines and/or pathways. The Cold War and German pathways are not used for routing, but interpreted as natural ground. In this way, the Cold War and German patterns articulate a sense of secrecy (chapter 1), while simultaneously reconnecting the area with its surroundings.

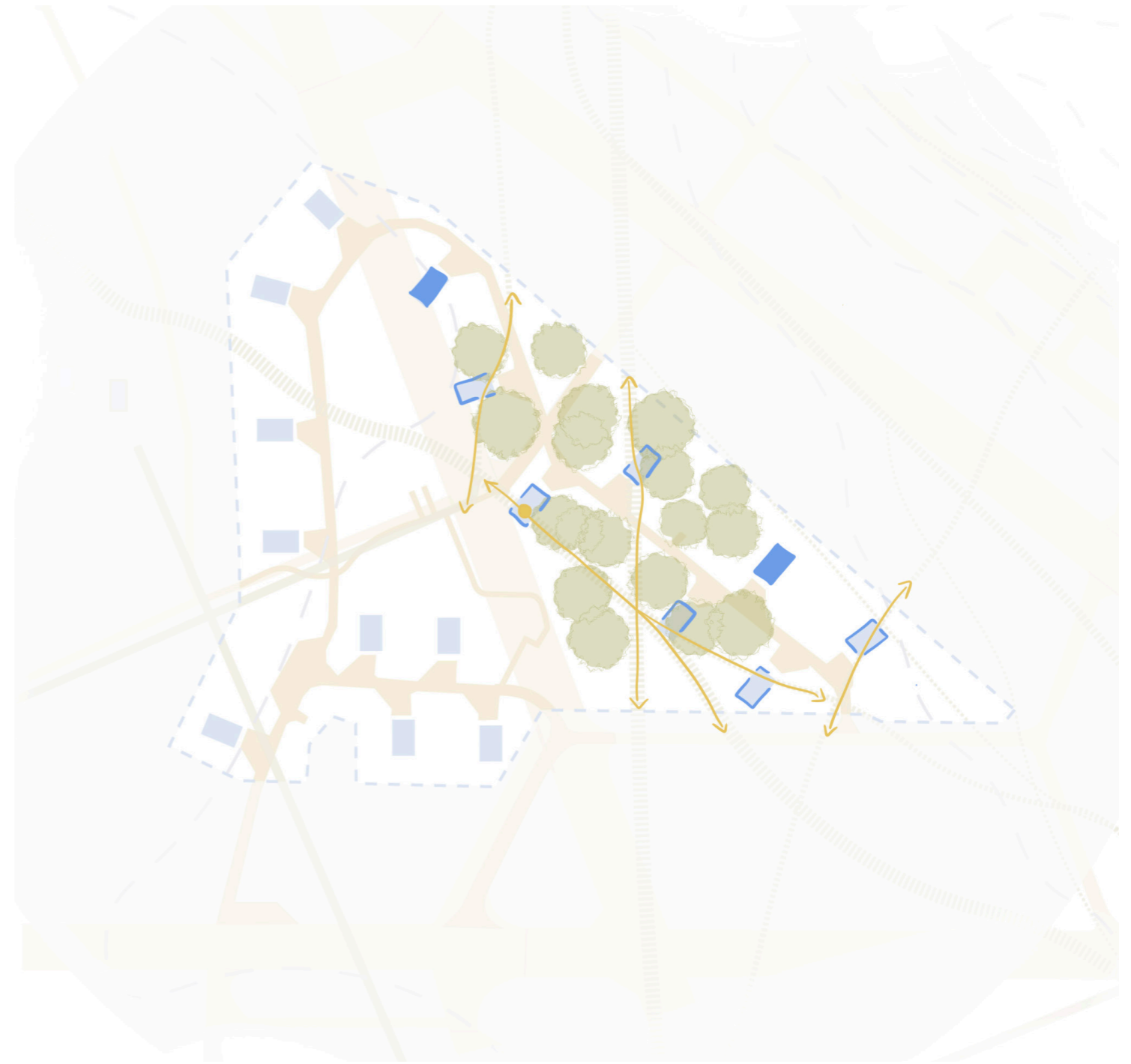


Figure 17. Historical trails as system for opening up the shelters to reconnect to surroundings and history. Source: Own work.

2.2. LA - Fragmentation Approach

The fragmentation approach aims to create curiosity, thereby strengthening the meaning of an object and its relationships (figure 18). According to Burström (as cited in Desilvey, 2017, p. 187), the absence of a complete original fascinates and invites interpretation. Fragmentation can be applied not only within the layers of a building, but also to its context (figure 19).



Figure 18. 'Hardcore Heritage' at 'Deltawerk' (left) and 'Bunker 599' (right), by RAAAF. Source: <https://www.raaaf.nl/>



Figure 19. 'Radical Contextualism' at Prinses Beatrixsluis, Object Trouvés by B+B and H+N+S. Source: <https://bplusb.nl/>

Fragmentation at the ASA

The fragmentation tools are removal, excavation, destruction, displacement and alteration of buildings or sites (Rietveld&Rietveld, 2017). At the ASA, fragmentation could be achieved by removing and displacing the skin, the arches (figure 20). This generates questions about the original shape, materiality and functionality of the building.

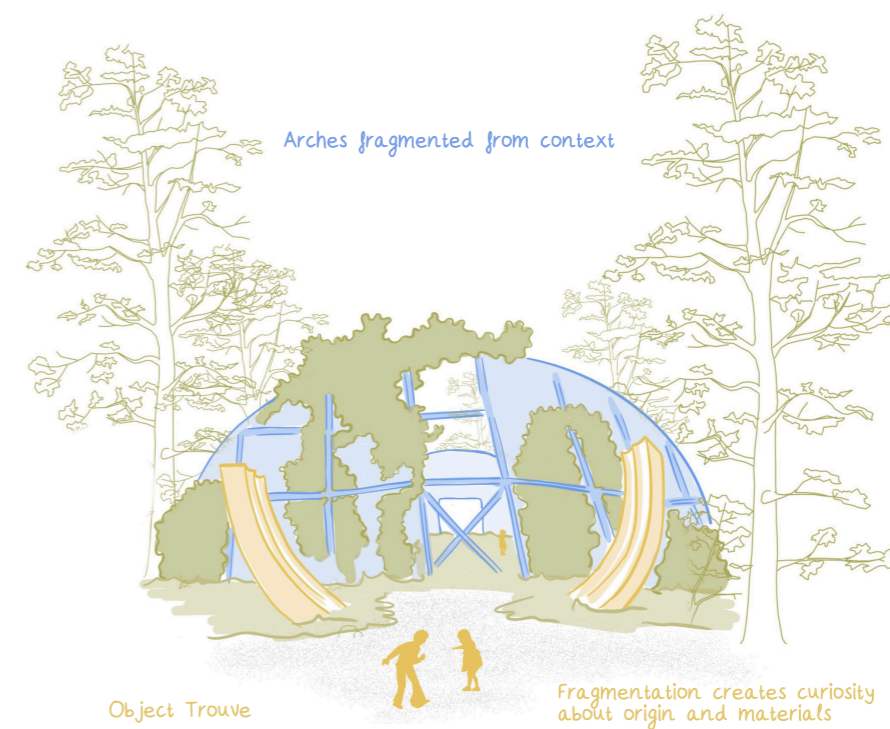
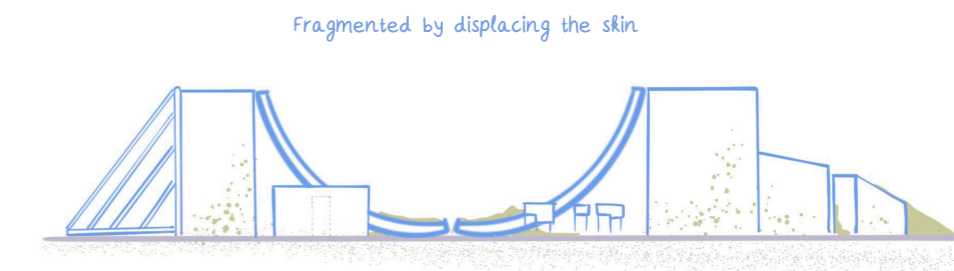
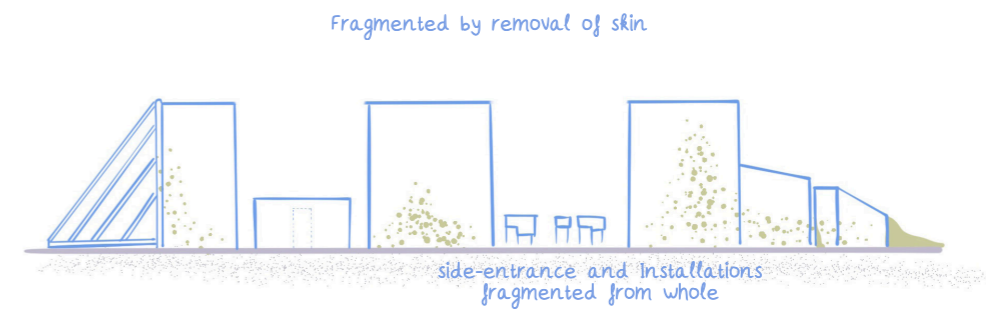


Figure 20. Sketches of fragmentation interventions at an air shelter. Source: Own work..

2.3. HA - Analogue Approach

The aim of the analogue approach (Office Winhov, 2024) is to continue the story of heritage through new interpretation of the existing; identity, connection to the new context, building catalogue, type and material palette (figure 21).



Figure 21. Selection of images of City Hall Den Helder, from left to right; original building, uncovering identity, reconstruction with catalogue and pallet, and interior as palimpsest. Source: Office Winhov (2024)

An Analogue at the ASA

Following the principles of the analogue approach the identity, catalogue and material palette of the ASA were analysed (appendix C). A possible design outcome is a shelter with subtracted arches and a new infill of demountable and elevated spaces (figure 22). The resulting space is protective, efficient and flexible for both people and nature. The new structure resembles the temporary cultural use of airplanes and migrating tents.

A continued story, to be continued...

- + Add layers for nature and people
- Subtract layers for nature and people

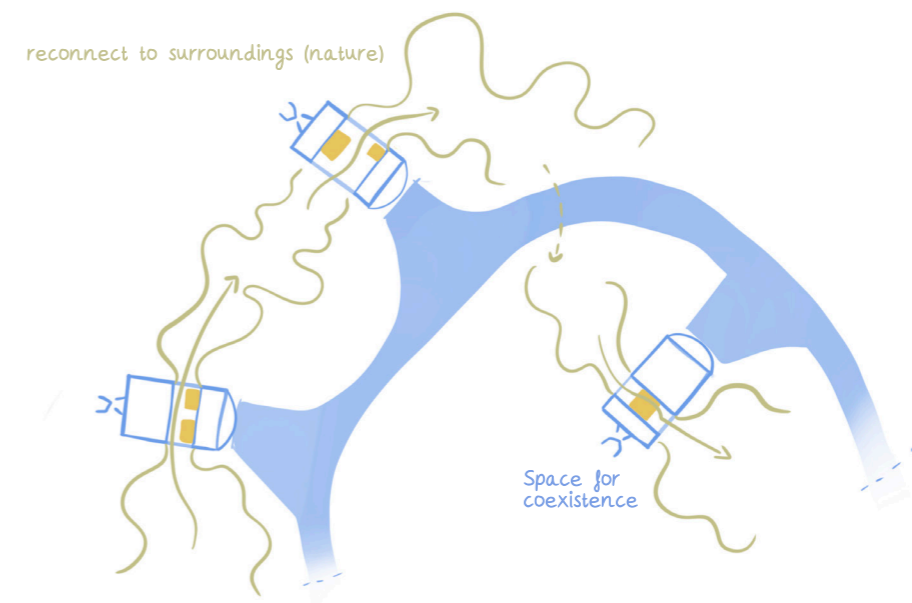
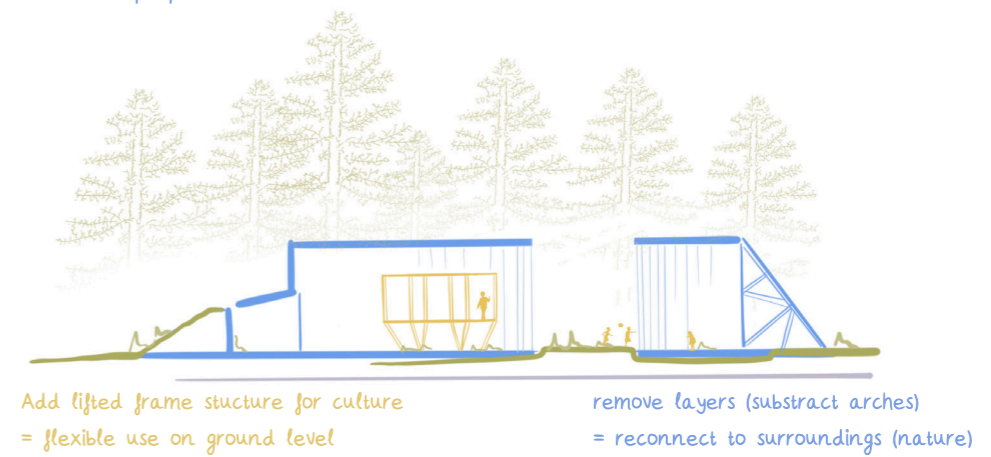


Figure 22. Sketches of the analogue approach at the Air Shelter Area. Source: Own work.

2.4. HA - Missing Approach

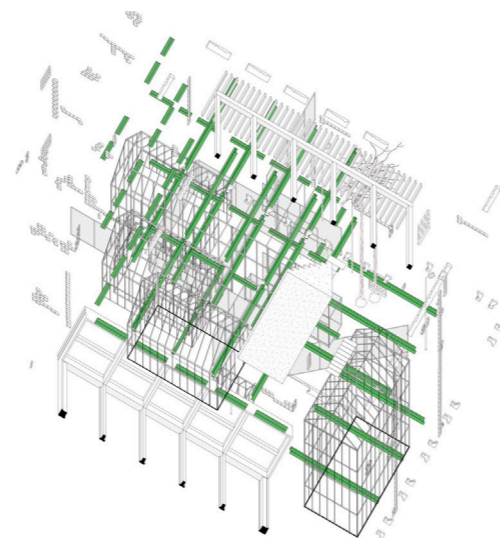
The missing approach looks for, and allows the existence of mistakes in the redesigning of heritage (Columbia GSAPP, 2018). For instance, irregularities in plan orientation (figure 23), form, space transitions (figure 24), materiality, facade openings, levels, routing etc. As with the fragmentation approach (Chapter 2.2.), 'mistakes' create confusion and encouraging users to discover heritage architecture.



Figure 23. Woning CG, reorientation. Source: <https://architectenjdviv.com/>



Figure 24. Pc Caritas, confusion of inside and outside space. Source: <https://architectenjdviv.com/>



Making Mistakes at ASA

The reorientation and inside-or-outside method at the ASA encourages the discovery of environmental processes, ecology and culture (figure 25). Reorientation method creates awareness and curiosity in the form, orientation and placement of the shelters. Openings in the roof and gravel inside create confusion as to whether the space should be considered inside or outside.

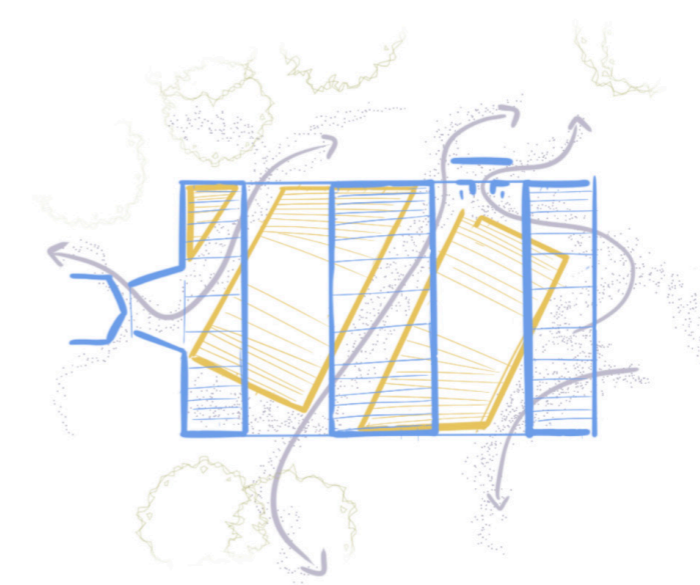
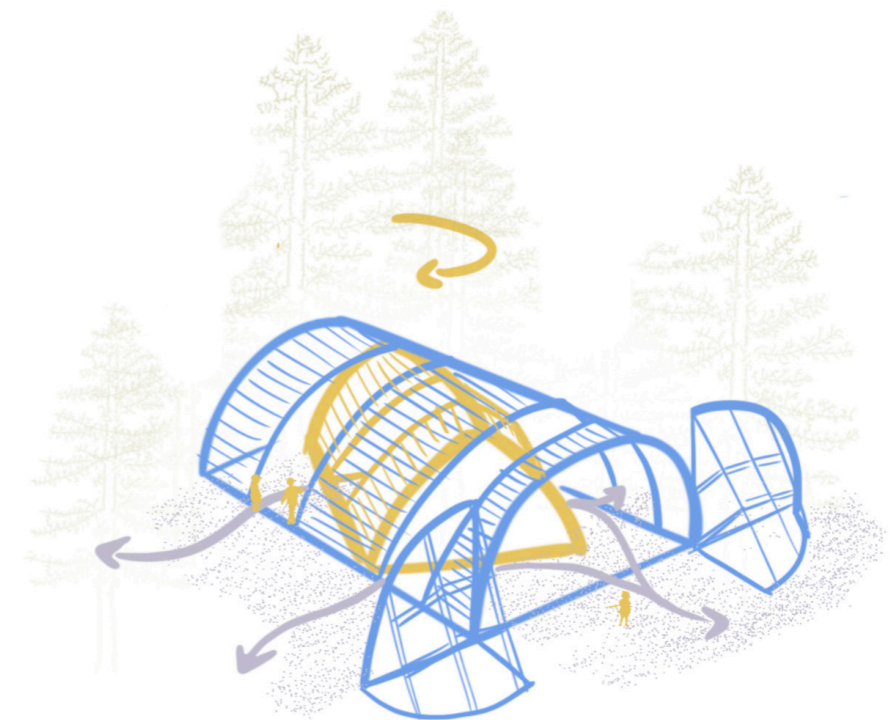


Figure 25. Sketches of the Missing Approach at the Air Shelter Area. Souce: Own work.

3. Building Construction

This chapter addresses the following question: *How can the materiality and structural design of newly built architecture convey the concept of architecture as a landscape in the air shelter area?*

The definition of a landscape (p. 13) led to the identification of five building construction strategies that convey architecture as a landscape (figure 26-30) Together, these strategies inform the construction of new architecture as a landscape at the ASA.

An extensive version of this chapter is provided in appendix D (pp.57-75), presenting a more detailed explanation of the case studies and the implementations on the ASA.

3.1. Moving Materials

Environmental processes



Figure 26. Miyajima Misen observatory by Sambuichi. Source: Sambuichi (2015)

3.2. Ecolope

Ecology



Figure 27. NEST by NAMO. <https://namoarchitecture.nl/project/vreemde-vogels/>

3.3. Ecosystem

Self-sustaining



Figure 28. Outside Woodlands Nursery & Forest School. Source: Feilden Clegg Bradley Studios.

3.4. Bioregional Materials

Materiality



Figure 29. LOT 8 by BC architects. Source: <https://bcarchitects.org/>

3.5. Design for Change

Flexible Building Components



Figure 30. Fuji Kindergarten by Tezuka Architects. Source: <https://regenerativedesign.world/fuji-kindergarten/>

3.1. Moving Materials

'Environmental processes' are an actor of a landscape (p.13). If architecture is reimagined as a dynamic landscape rather than as a static object, it must engage with forces of the environment such as sun, wind and water. These 'moving materials' have a velocity, direction and density which can be affected by architecture's non-moving materials (glass, stone, wood and steel) (Hushimoto, 2011; figure 31).

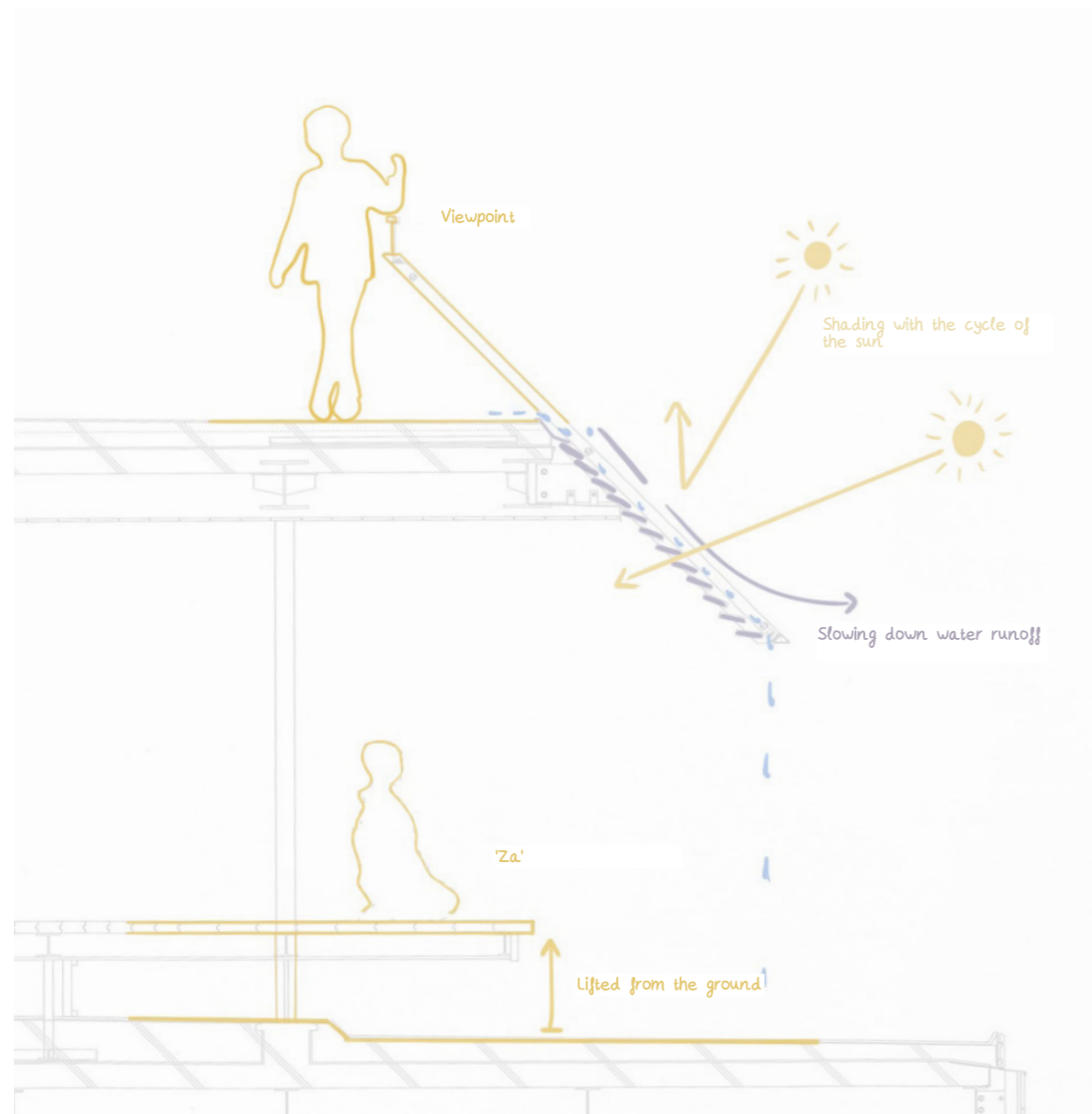


Figure 31. Detailed section form the Miyajima Misen Observatory. Souce: Sambuichi, 2015, annotations added by the author.

Designing with Moving Materials at the ASA

The section drawings in figure 32 demonstrate how the design of the shelters could interact with environmental forces. They illustrate how the shelter could filter light, guide wind and manage rainwater. The shelter becomes a responsive landscape.



Figure 32. Sketches of designing with moving materials in an air shelter . Souce: Own work.

3.2. Ecolope

The second actor of a landscape is 'Ecology' (p. 13). This implies that architecture should be a multi-species living space. The building envelope could be transformed into an 'ecolope' that benefits four types of inhabitants; humans, plants, animals, and microbiota (Weisser et al., 2023; figure 33). From this perspective, ecology can be integrated into Brand's (1995) building layers. The structure, skin, and site should not only serve human needs but also allow plants to grow, provide nesting spaces for animals, and support insects and microorganisms.

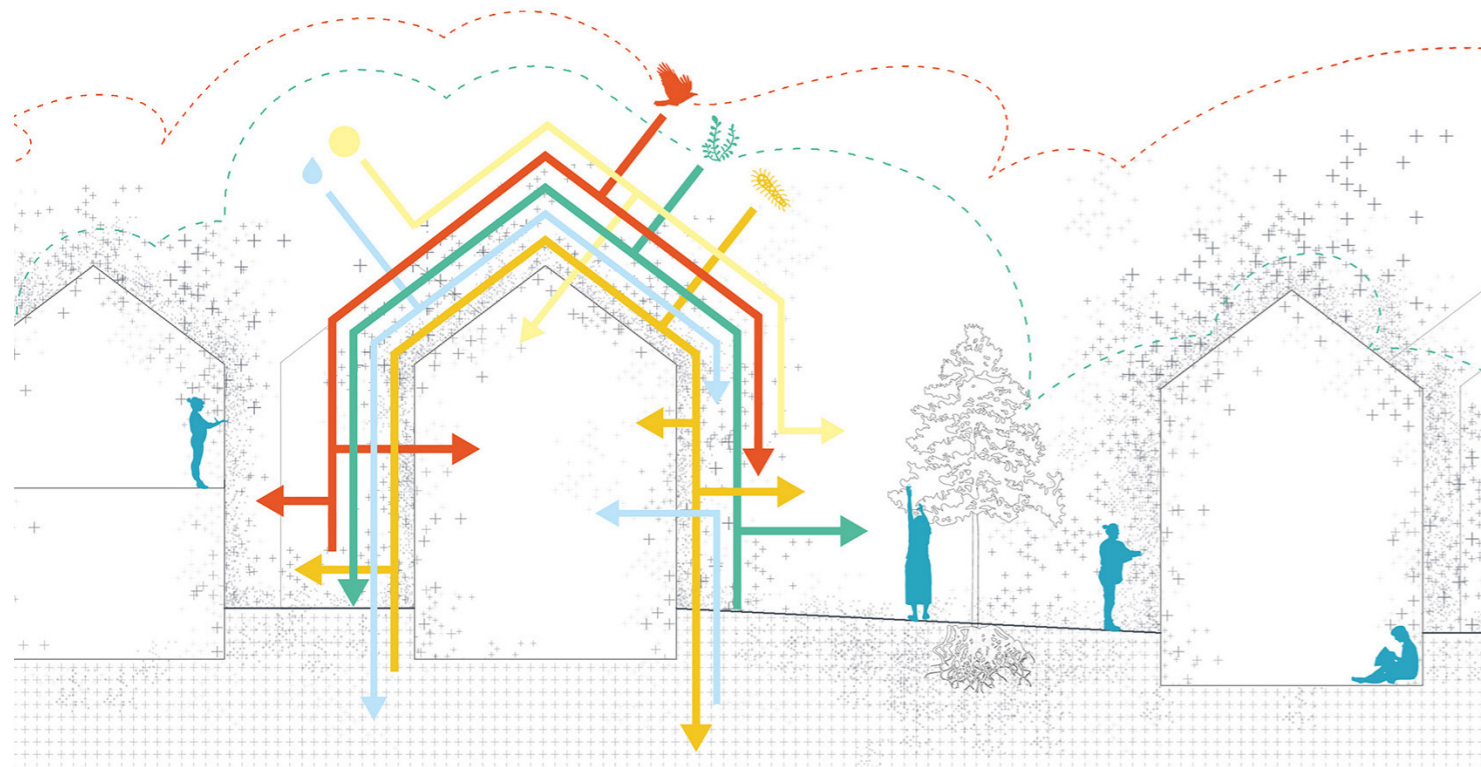
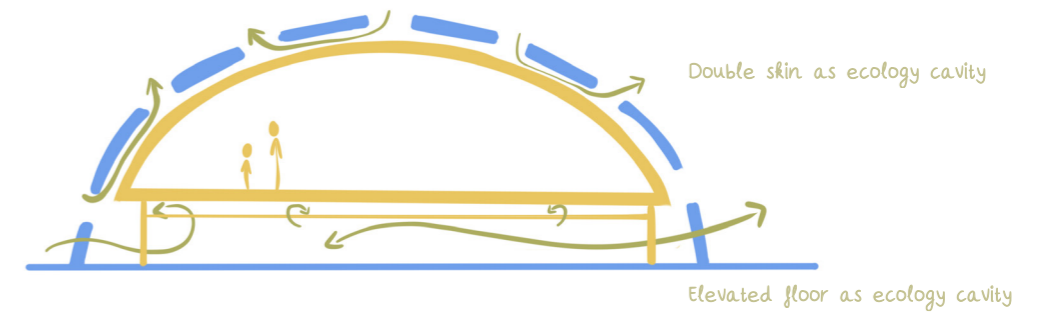


Figure 33. The ecolope, a conventional building envelope transformed into a dynamic living space for animals, plants and microbiota. Source: Weisser et al., 2023.

Ecolope at the ASA

Creating an ecolope is about thinking of corridors and habitats for ecology. Creating ecology corridors involves considering the routing and migration possibilities of species. This can be achieved by elevating the architecture from the ground (figure 34). Habitats can be created at the building envelope by designing intentional cavities. For the shelters, cavities can be created, by using the concrete and corrugated steel as double skin (figure 34). This adds an ecology-inclusive layer to the shelter's envelope.

Heritage as Ecolope



Roof cavities

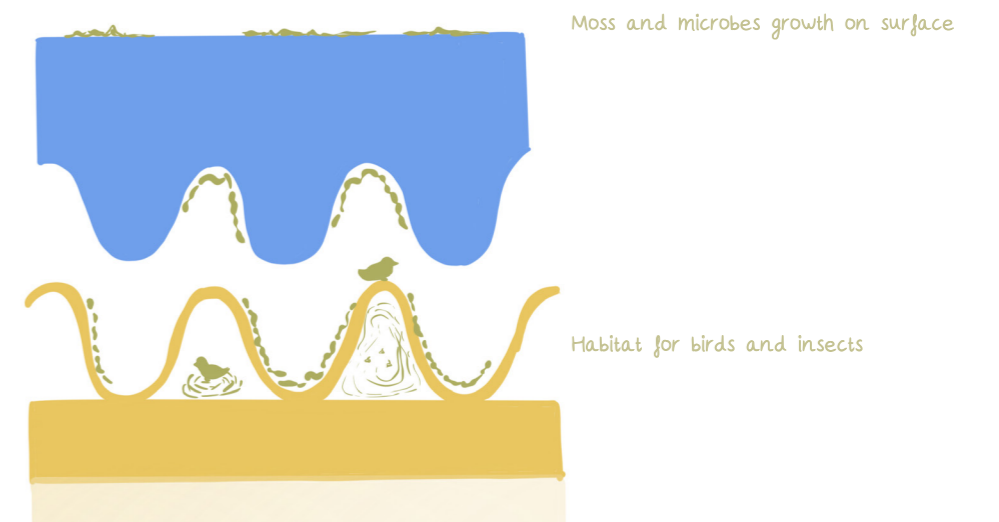


Figure 34. Ecolope of an Air Shelter. Source: Own work.

3.3. Ecosystem

Landscapes are part of an ecosystem. A natural ecosystem is self-sustaining. If a building is reimagined as a landscape, it should be off-the-grid and self-sufficient. This involves the integration of passive solar and thermal energy strategies (Figure 35). To achieve a fully off-the-grid, closed-loop building, the cycles of food, water, energy and waste must be completed. With such strategies the building turns into a self-sustaining ecosystem.

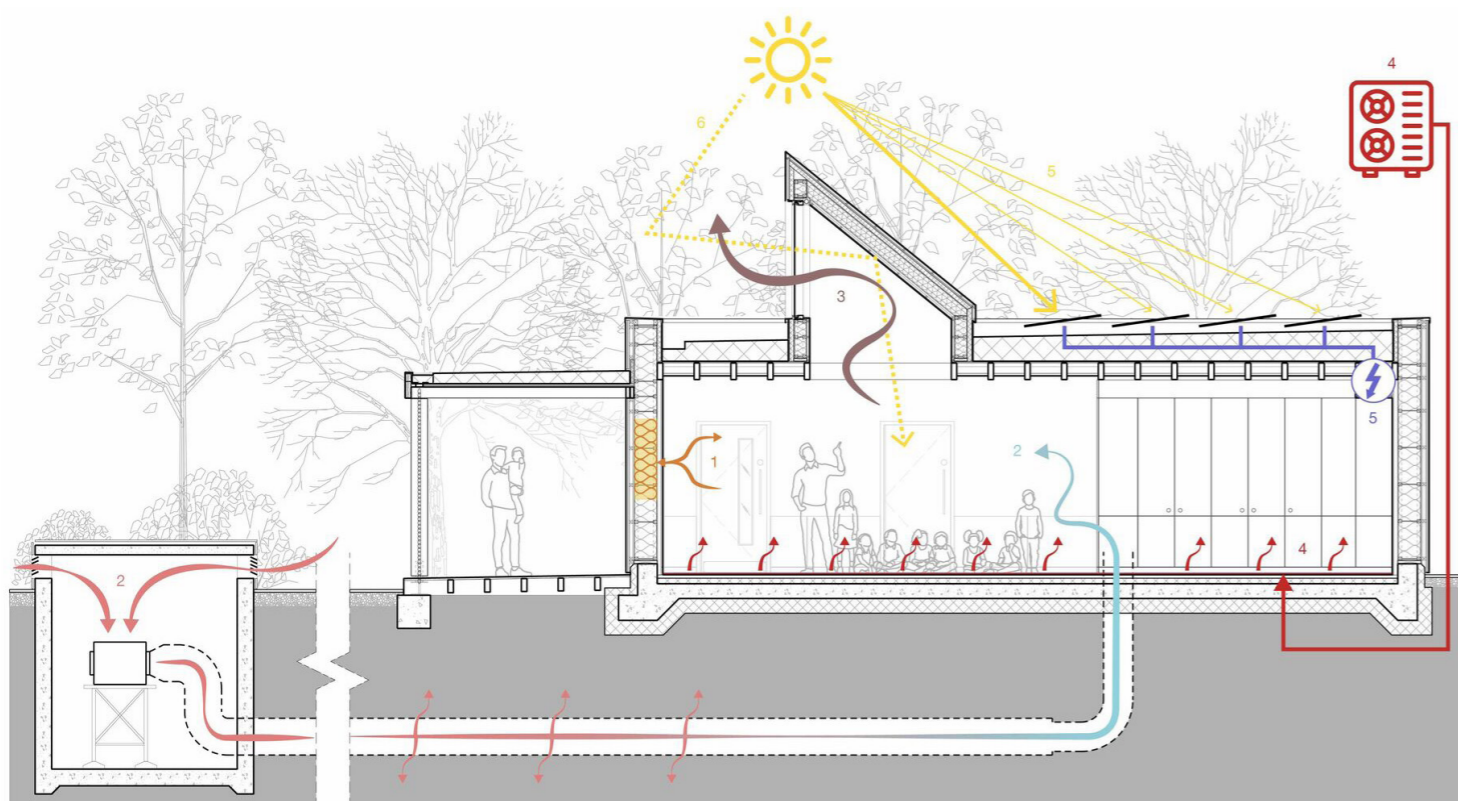


Figure 35. Climate section Woodlands Nursery & Forest School. Source: Feilden Clegg Bradley Studios.

Ecosystem at the ASA

A strategy to create a self-sustaining ecosystem at the ASA is illustrated in figure 36. For solar efficiency, a new roof shape and patio are formed. Rainwater is collected, filtered, and stored for daily use and irrigating the garden. Ventilation is achieved through earth tube inlets, which precondition incoming air. Stale air exits through roof outlets.

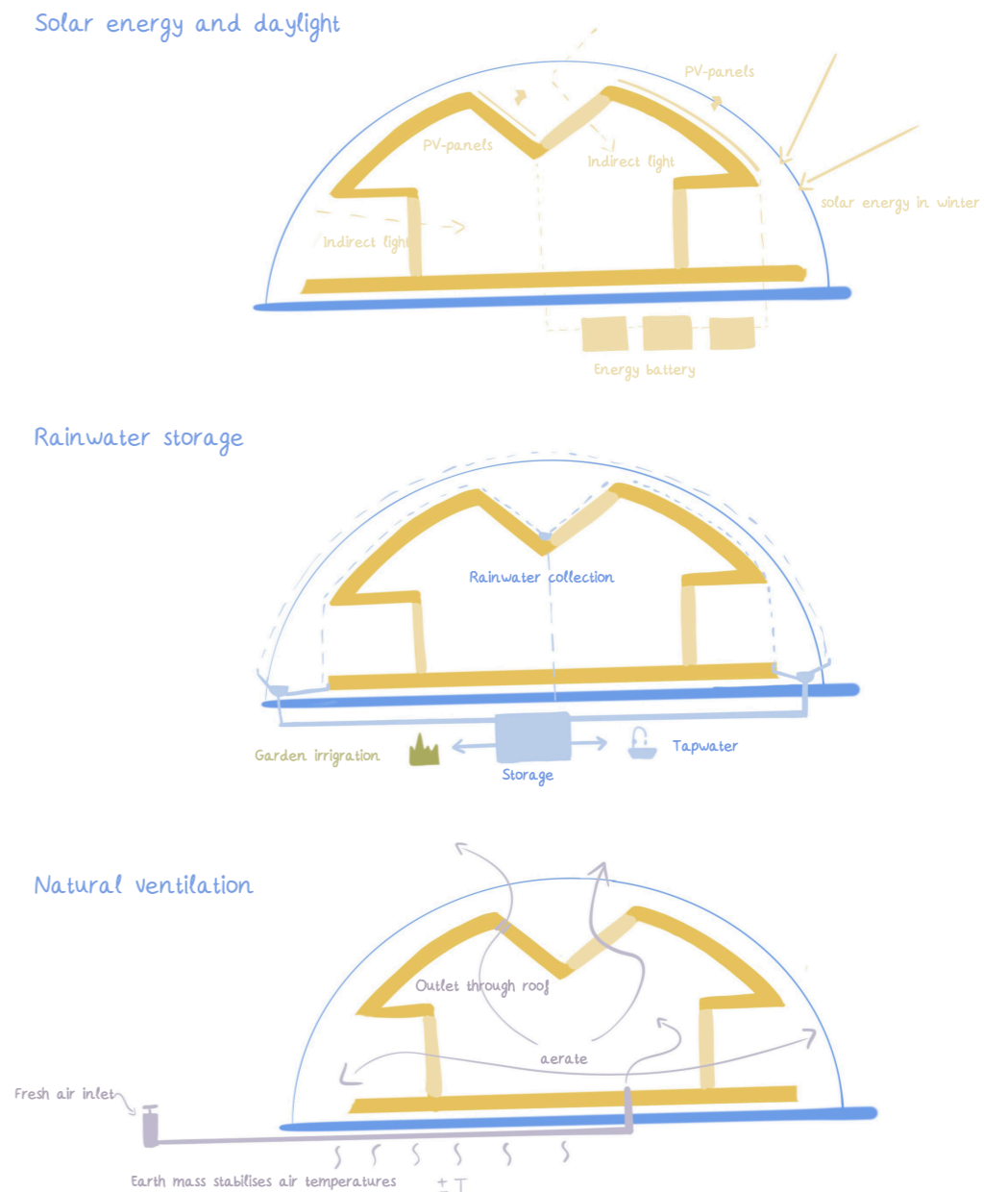


Figure 36. A strategy to turn an air shelter into an ecosystem. Source: Own work.

3.4. Bioregional Materials

If heritage architecture is meant to act as a landscape, its added materiality should connect to the natural and cultural environment. Bioregional materials link a building to the region's geology, ecology, and cultural craftsmanship. Additionally, regenerative materials support natural cycles and reduce environmental impact. By sourcing materials locally (figure 37), building on-site and collaborating with local craftspeople (figure 38), architecture can act as a continuous part of the landscape.

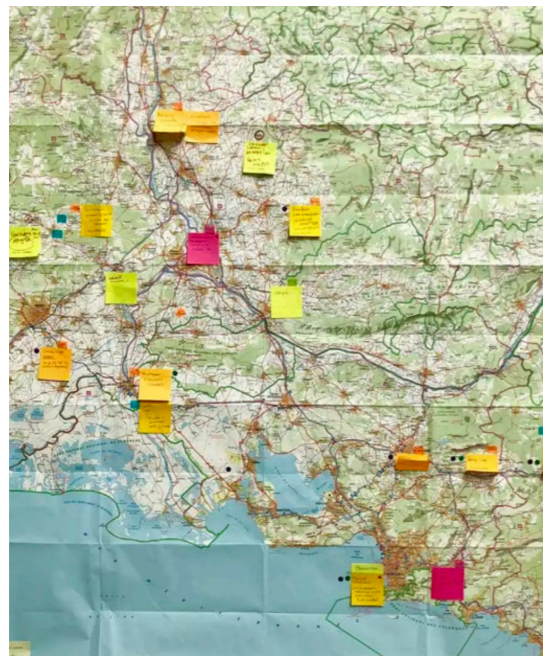
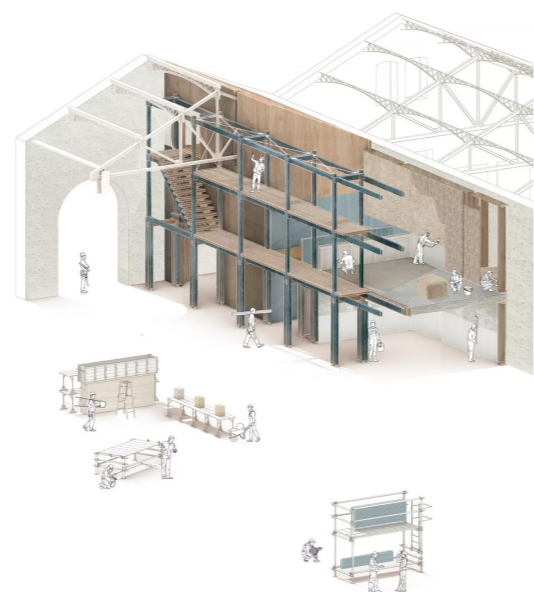
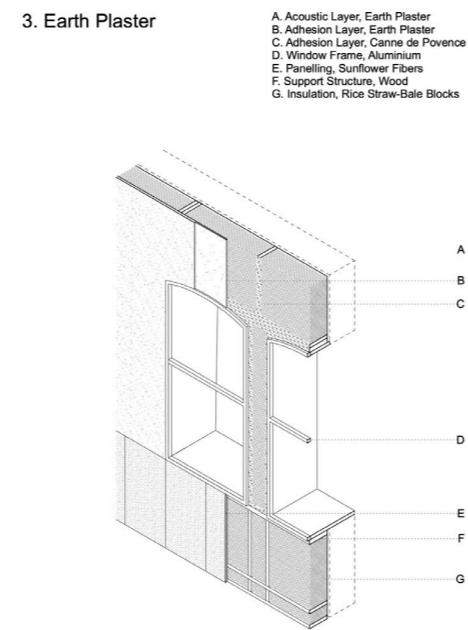


Figure 37. Mapping and detailing local resources of LOT 8, by bc architects. Source: <https://bcarchitects.org/>



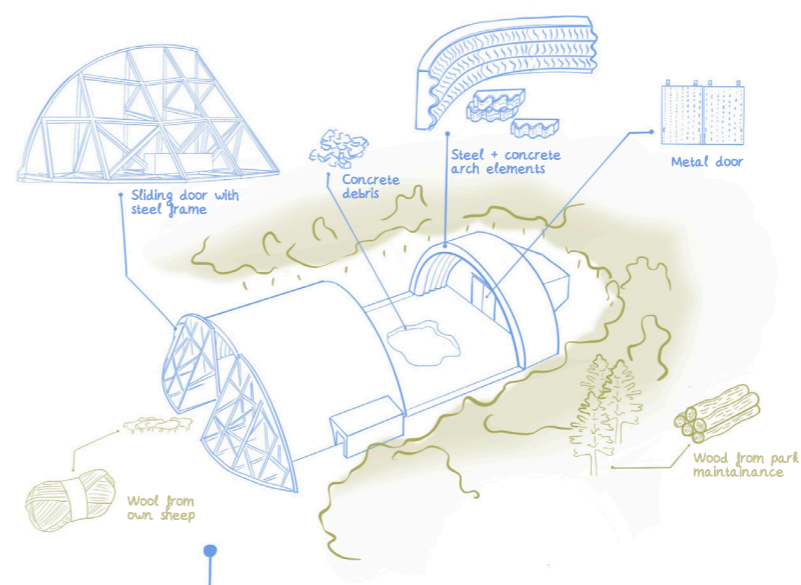
Figure 38. Local crafts, experimenting and building proces of LOT 8, by bc architects. Source: <https://bcarchitects.org/>



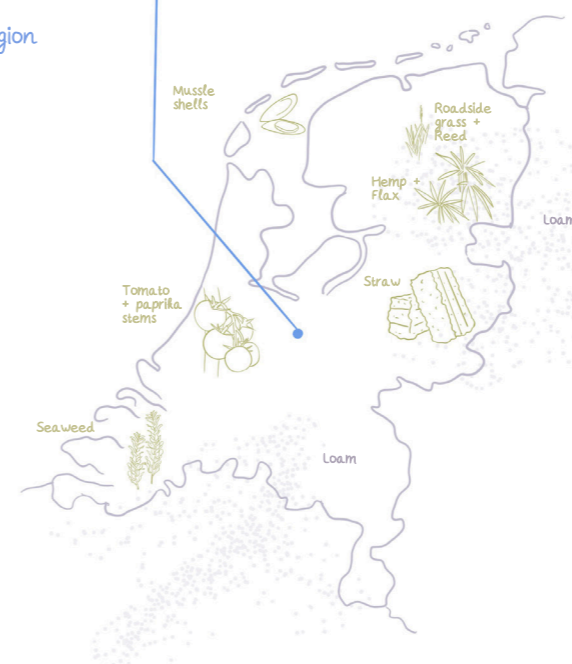
Bioregional Materials at the ASA

Considering the building as a landscape, its building layers could also be defined as 'bioregional materials'. Therefore, the ASA's resources include not only wool from the sheep and wood from the park maintenance, but also the concrete slabs and steel doors of the shelters (figure 39). Additionally, taking an analogue approach (chapter 2), regenerative materials that relate to the ASA's immediate bioregion should be selected, such as flax, straw and loam.

Resources on site



Resources in bioregion



Building materials

- Steel beams
- Upcycled Bricks
- Wood beams
- Wood plants
- Wood facade elements
- Wool insulation
- Wool acoustic panels
- Hempcrete
- Straw insulation
- Loam plaster
- Biolaminate (grass, shells horticulture waste)
- Softboard (seaweed)

Figure 39. Bioregional and regenerative materials at or in the surroundings of the airshelter area. Source: Own work.

3.5. Design for Change

Landscapes change dynamically over time and through seasonal cycles. For new architecture, this implies the need for flexible and adaptable building components. In 'Building for Change' (2022) it is described that reuse exists in four scales; materiality (Design for Disassembly, figures 41&42), building (programmatic flexibility, figure 40), site (capacity for different use) and time (future use).



Figure 40. Fuji Kindergarten by Tezuka Architects.
Source: <https://blueprint.ozpropertygroup.com.au/fuji-kindergarten-tokyo-japan/>

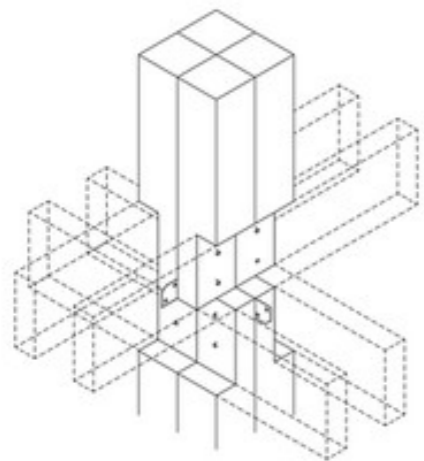
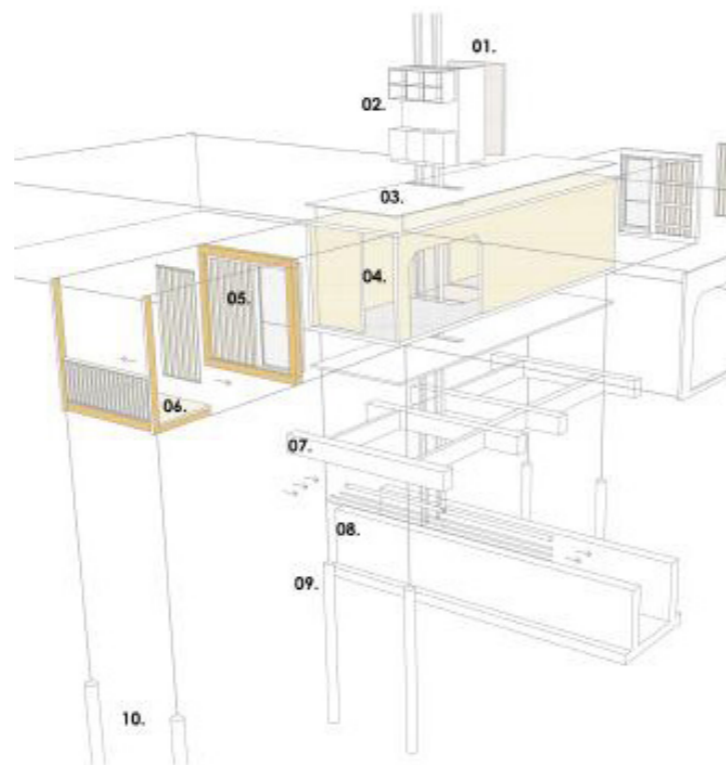


Figure 41. Dry joints methods by Kengo Kuma.
Source: <https://www.archdaily.com/934591/details-of-wooden-structures-in-kengo-kumas-work>



- | | |
|--|---------------------------------|
| 01. Module salle de bain préfabriqué | 06. Coursive préfabriqué |
| 02. Module cuisine mobile | 07. Grille de répartition |
| 03. Isolant acoustique et couche coupe-feu | 08. Galerie technique |
| 04. Module préfabriqué | 09. Pieux de fondation module |
| 05. Façade module préfabriqué | 10. Pieux de fondation coursive |

Figure 42. DfD at Rigot collective dwelling centre, by acau.
Source: <https://www.acau.ch/projets/amig-rigot>

Design for Change at the ASA

A flexible plan for the shelter can be designed using a systematic grid, dry joints and flexible boundaries (figure 43). These strategies together enables the building to adapt to changes in future, seasonal and day-night use.

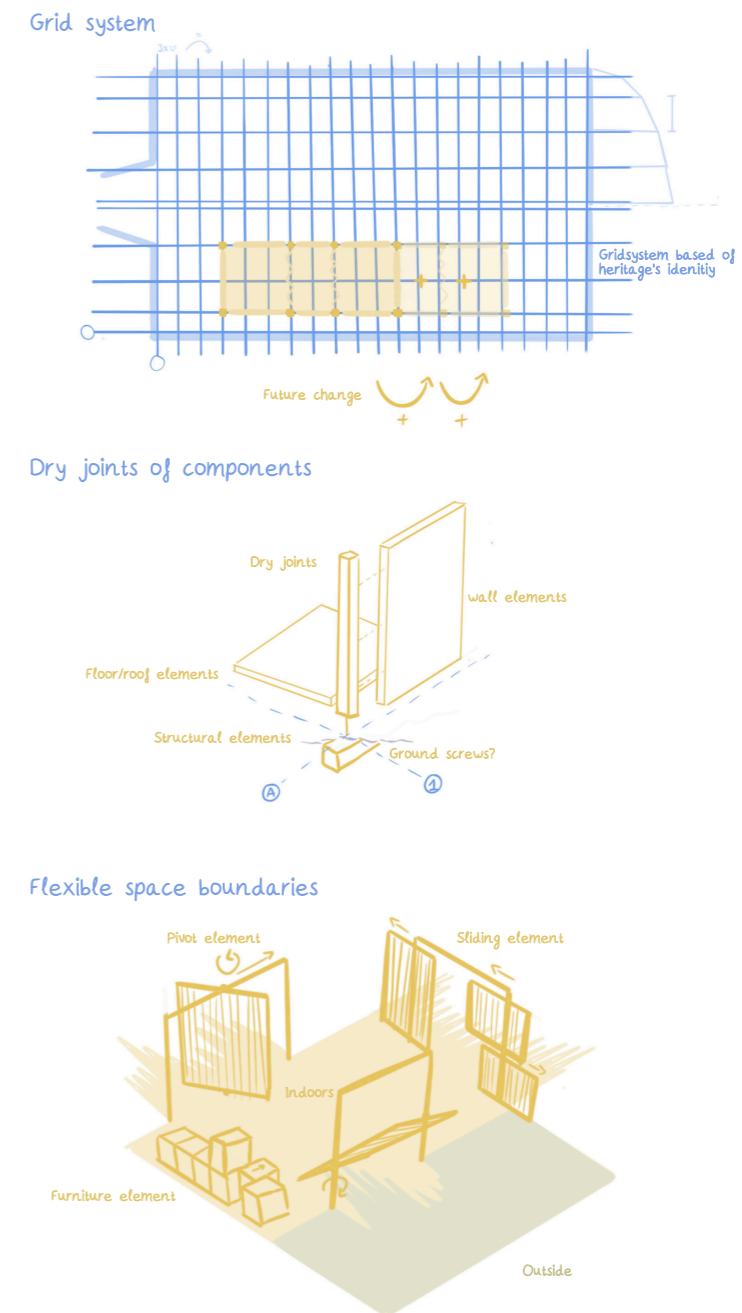


Figure 43. Strategies for design for change at the ASA. Source: Own work.

4. Program of Requirements

This chapter addresses the following question: *How do spatial characteristics and program approaches encourage children's learning and engagement with nature at the air shelter area?*

The spatial characteristics are analysed using three principles found in cases of educational architecture (figure 44-46). Together with an analysis of the programs of nature school organizations (figure 47) a program of requirements and zoning plan is formed for the ASA.

An extensive version of this chapter is provided in appendix E (pp.68-75), presenting a more detailed explanation of the case studies and the implementations at the ASA.

4.1. Exploration of Spaces



Figure 44. School of Architecture by Doshi.
Source: <https://arquitecturaviva.com/>

4.2. Learning with Nature



Figure 45. Gjai kindergarten by Henning Larsen.
Source: <https://henninglarsen.com/>

4.3. Connectivity of Community



Figure 46. House of elementary education by LP architektur.
Source: <https://www.lparchitektur.at/>

4.4. Program and Zoning Plan

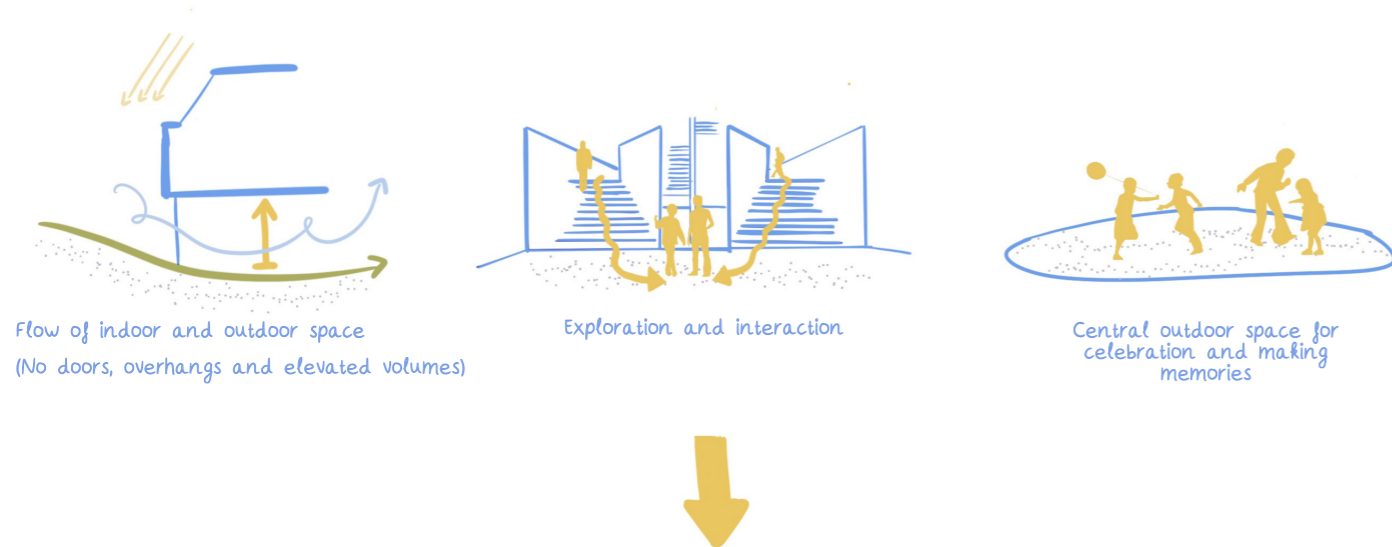


Figure 47. Collage of education programs analysed for the program requirements. Source: Own work.

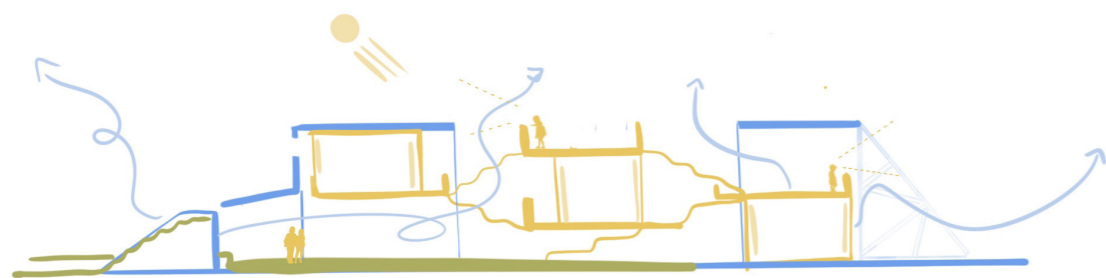
4.1. Exploration of Spaces

In order to make students more aware participants of space, the routing between spaces need to be exploratory. Exploratory routing supports coincidental interaction between community and landscape. (UofTDaniels, 2018). This can be seen in 'School of Architecture', analysed and applied to the ASA in figures 48 and 49. Doshi called it education without doors. He talked about the flow of spaces rather than rooms.

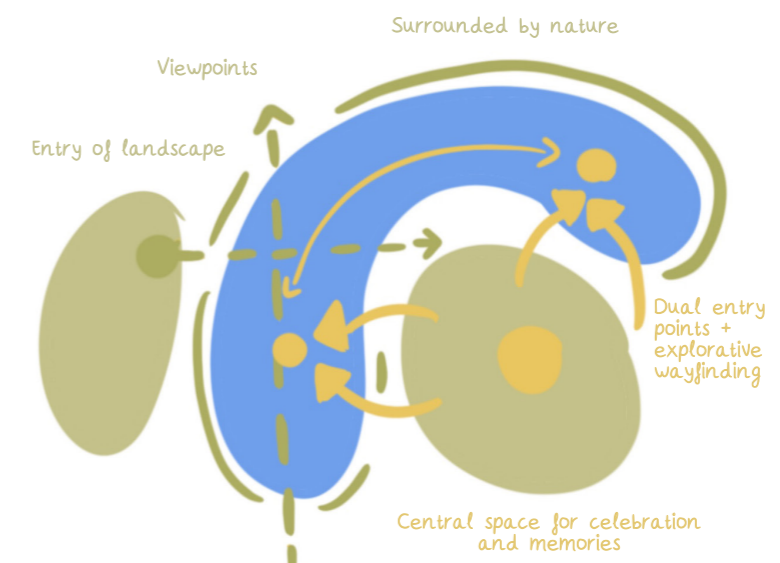
Key spatial characteristics



Air Shelter



Abstract spatial plan



Air Shelter Area

- Using same entryway
 - stretched out central space, large distance
- Using distinct entryways
 - + compact central space
 - + explorative entry options
- Creating new entryways
 - needs alteration of the shelter
 - + explorative entry options

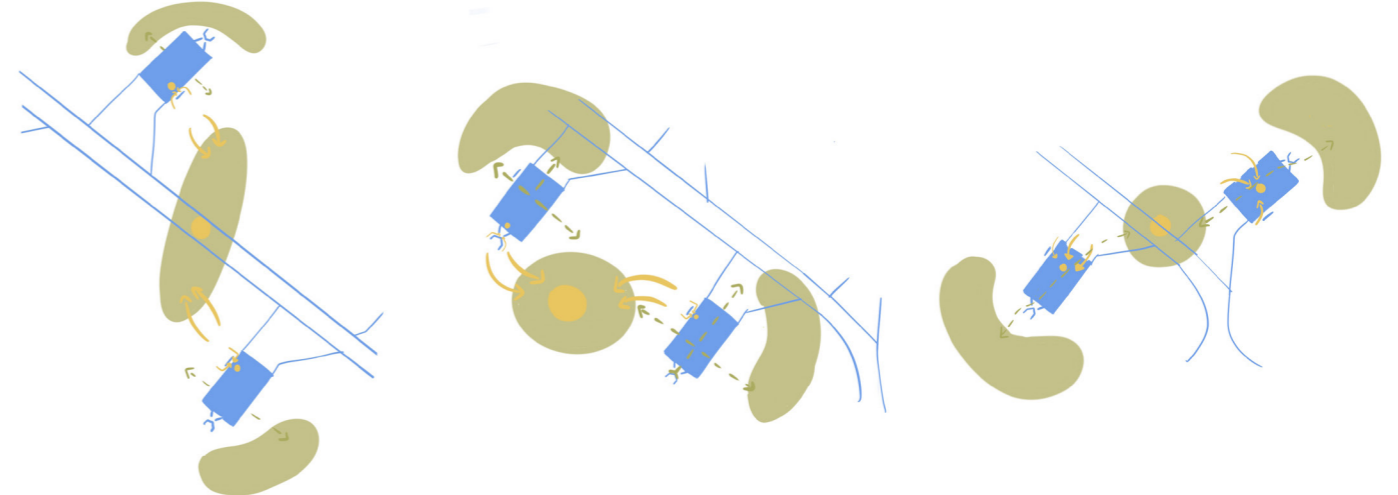


Figure 48. Key spatial characteristics of School of Architecture by Doshi and implemented on a shelter. Source: Own work.

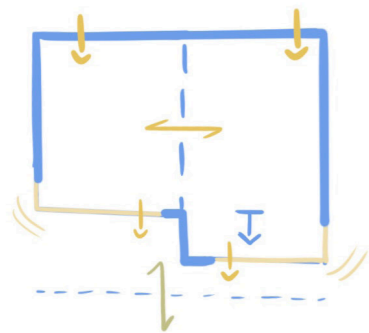
Figure 49. Spatial plan of School of Architecture by Doshi implemented on the ASA. Source: Own work.

4.2. Learning with Nature

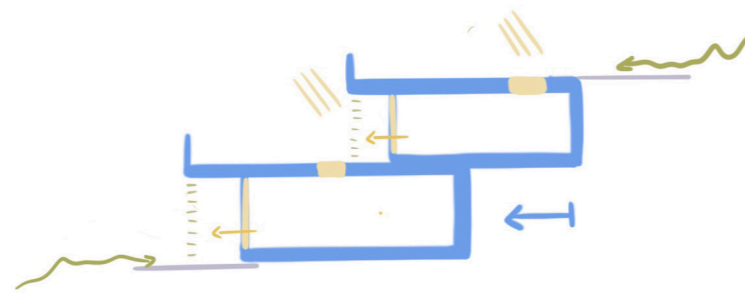
Spatial characteristics from the Qjai Kindergarten (Henning Larsen, n.d.; figure 50) and Woodlands Day Nursery and Forest School (FCBStudios, n.d.; figure 51) inform how in- and outdoor spaces could be closely connected and support Outdoor Landscape Education (OLE) at the ASA. The indoors connect to the outdoors through skylights, room-wide windows, covered outdoor spaces next to the indoor spaces, and changing rooms with toilets that are directly accesible from the playground.

Qjai Kindergarten

Key spatial characteristics



Joinable classrooms + cornered windows



Covered outdoor area + skylights

Air Shelter

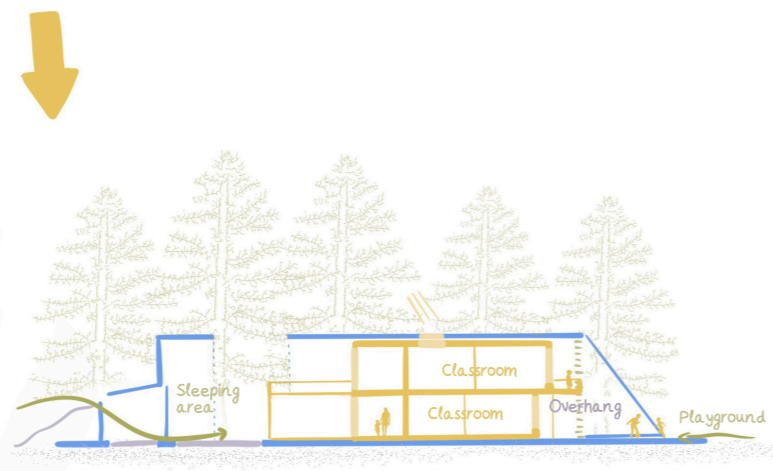
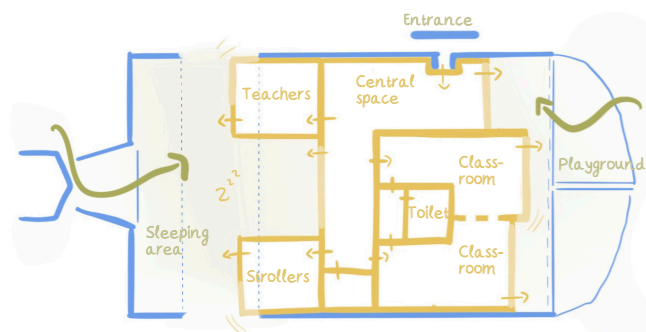
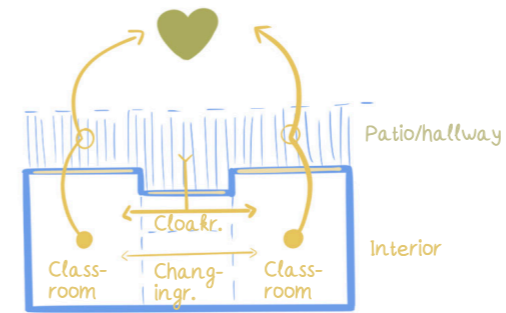


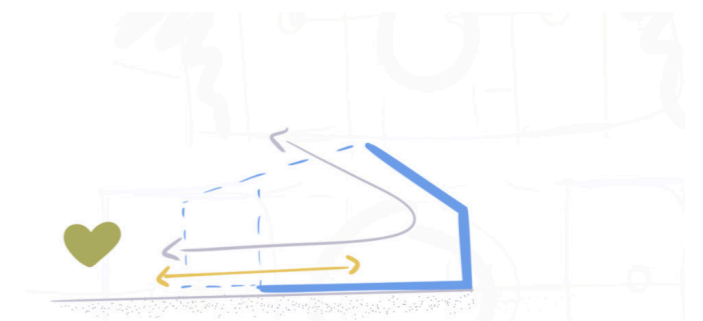
Figure 50. Spatial analysis of Qjai kindergarten and implementation at ASA. Source: Own work.

Woodlands Day Nursery and Forest School

Key spatial characteristics



Joined outdoor entrance and changing room



Transparency toward nature

Air Shelter Area

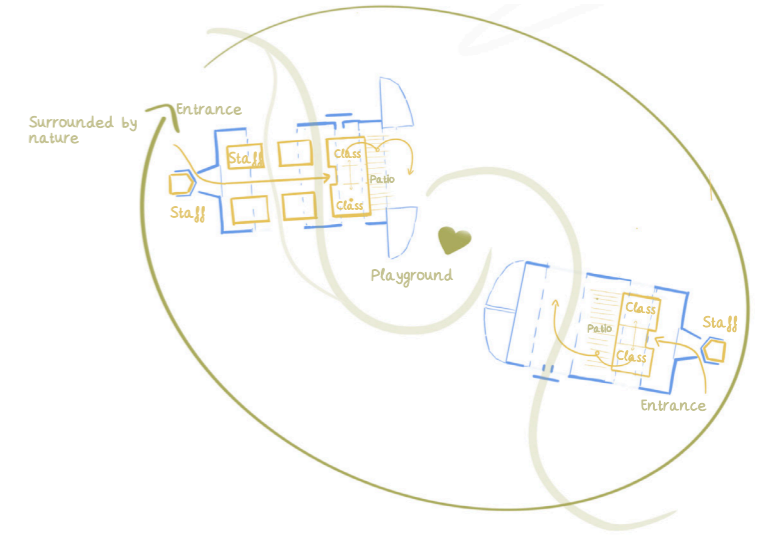
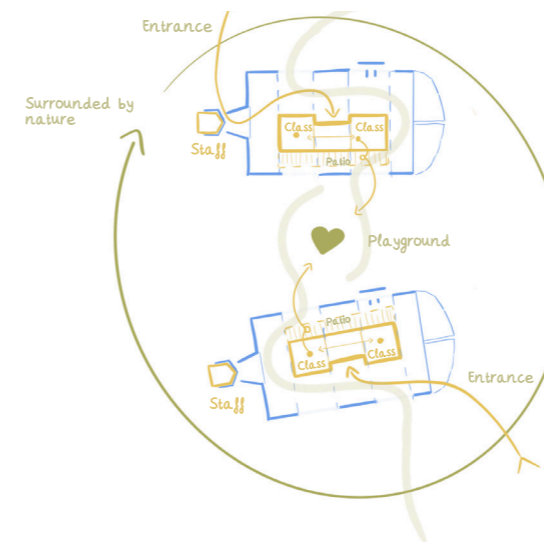


Figure 51. Spatial analysis of Qjai kindergarten's spatial characteristics and its implementation on ASA. Source: Own work.

4.3. Connectivity of Community

Besides feeling connected to nature, students should also feel connected to each other. House of Elementry (Pintos, 2023), reveals how a sense of connectivity in a community can be designed through transparent interior walls, room-crossing sightlines, double-height spaces, and mezzanines, which create visual horizontal and vertical connections. These characteristics are applied on a shelter in figure 52.

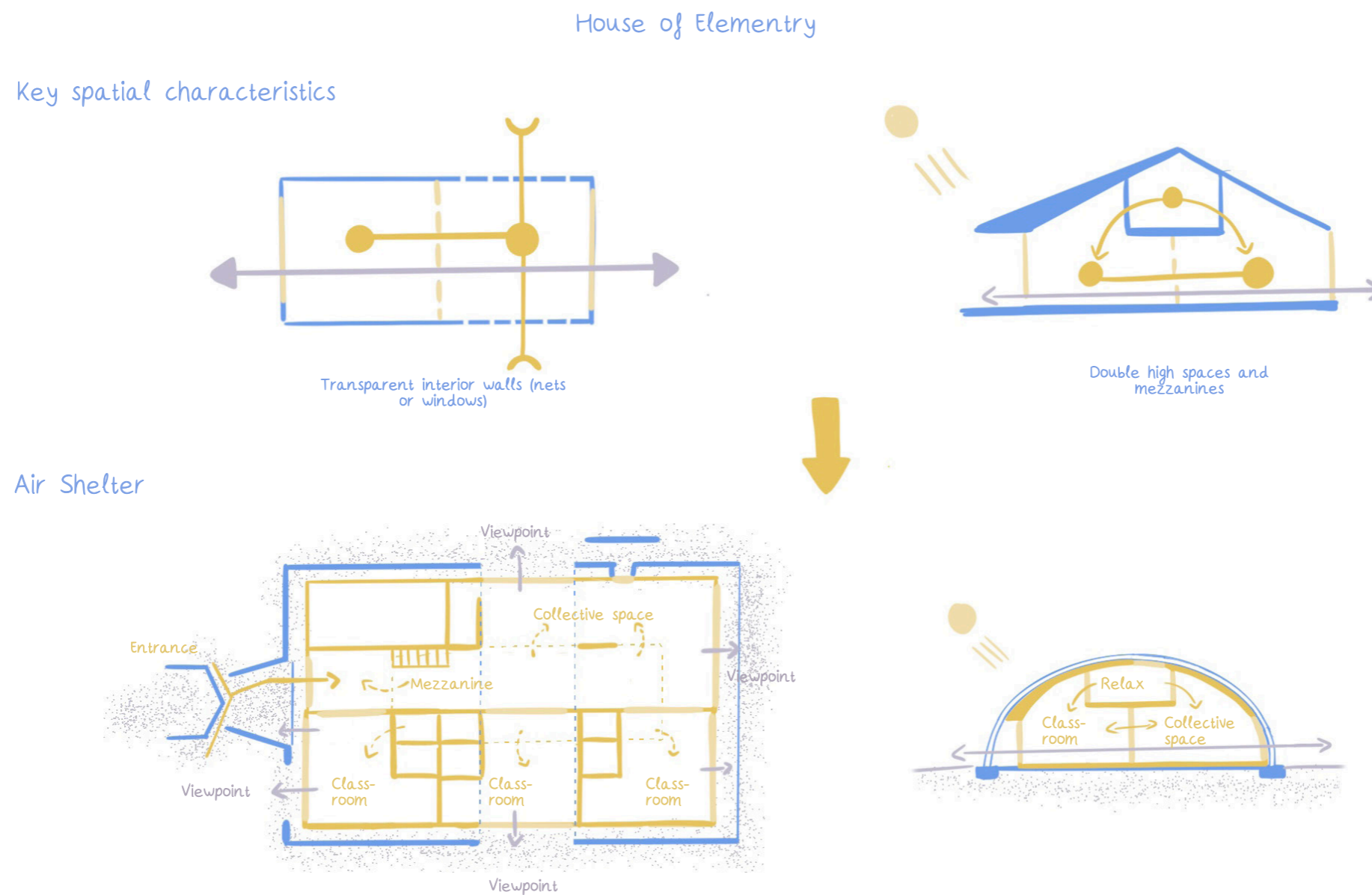


Figure 52. Spatial analysis of House of Elementry's spatial characteristics and its implementation on ASA. Source: Own work.

4.4. Program and Zoning Plan

In order to create a program of requirements nature-based educational programs were analysed (appendix J). These requirements, along with the analyses from the previous paragraphs and chapter form a program of requirements for a nature school at the ASA (table 1 & figure 53).

TABLE 1 - program of requirements of a nature school

Space requirement	notes	area (m2)*	total (m2)
Atmosphere and climate			-
Nature inclusive	<i>intergrate moving materials, ecolope, bioregional materials, Design for Change principles (ch 3)</i>	-	
Learning from nature	<i>outdoor lessons, covered outdoor areas, window seating, calm, bioregional materials</i>	-	
Exploring and Wonder	<i>level differences, routing options, viewpoints, peak holes, nooks</i>	-	
Connectivity of Community	<i>central common space, transparent internal walls and windows towards common space / hallway</i>	-	
Safety	<i>safe circulation routes and clear sightlines for supervision (indoor & outdoor)</i>	-	
Ecosystem	<i>self sustaining system; passive energy and closed loop food, energy, water and waste flows</i>		
Classrooms			754
Shared with age groups	<i>7 classrooms; 0 / 1-2 / 3-4 / 5-6 / 7-8 / 9-10 / 11-12 (20 pupils per class)</i>	65 (x7)	
Interconnective classrooms with shared facilities	<i>classroom clusters have removable wall and share cloakroom, changing space, toilets</i>	-	
Cloakroom	<i>can be included in the connected hallway/central space</i>	8 (x4)	
Changing room	<i>with direct access to toilet, boot storage and outdoors</i>	15 (x4)	
Toilets	<i>4 per cluster</i>	15 (x4)	
Storage	<i>1 per classroom, can be integrated in furniture</i>	6 (x7)	
Direct outdoor access through an external learning space	<i>overhang/roofed space</i>	15 (x7)	
Common functions	<i>functions can be combined</i>		500
Kitchen and lunchroom	<i>central space</i>	120	
Podium and celebration space	<i>central space</i>	120	
Indoor exercise space		90	
Lab/Workshop (hands-on skills)	<i>with direct outdoor access</i>	90	
Library and reading nooks	<i>quiet area separate from classroom</i>	30	
Relax space	<i>indoor chill area outside classroom</i>	30	
Sleeping and stroller space		20	
Outdoor learning			1545
Outdoor classroom	<i>with gathering circle of tree trunks</i>	130	
Toilets	<i>direct access from outdoors</i>	15	
Playground	<i>with natural play elements</i>	1000	
Sleeping/Quiet area		100	
Garden with outdoor kitchen	<i>eatable garden where children can help grow plants and make food</i>	200	
Outdoor storage		40	
Bicycle parking		60	

(table continues on next page)

*The estimated square metres are retrieved by comparing space plans of Gaji kindergarten (ch 4.2.), Woodlands Nursery & Forest School (ch 4.2.) and House of Elementary Education (ch 4.3).

Space requirement	notes	area (m2)	total
Management and staff			193
Reception and office	at entrance	25	
Workroom	shared workspace for staff	20	
Toilet	2 toilets	8	
Cloakroom		8	
Changing room		12	
Laundry space		5	
Lunchroom with pantry	direct outdoor acces	35	
Relax/quiet space		20	
Technical space		30	
General Storage		30	
Total Net Area	Indoor and outdoors		2992

*The estimated square metres are retrieved by comparing space plans of Gaji kindergarten (ch 4.2.), Woodlands Nursery & Forest School (ch 4.2.) and House of Elementry Education (ch 4.3).

*Circulation area's of entry and hallways are not included, as this can be combined with the common functions and outdoor space.

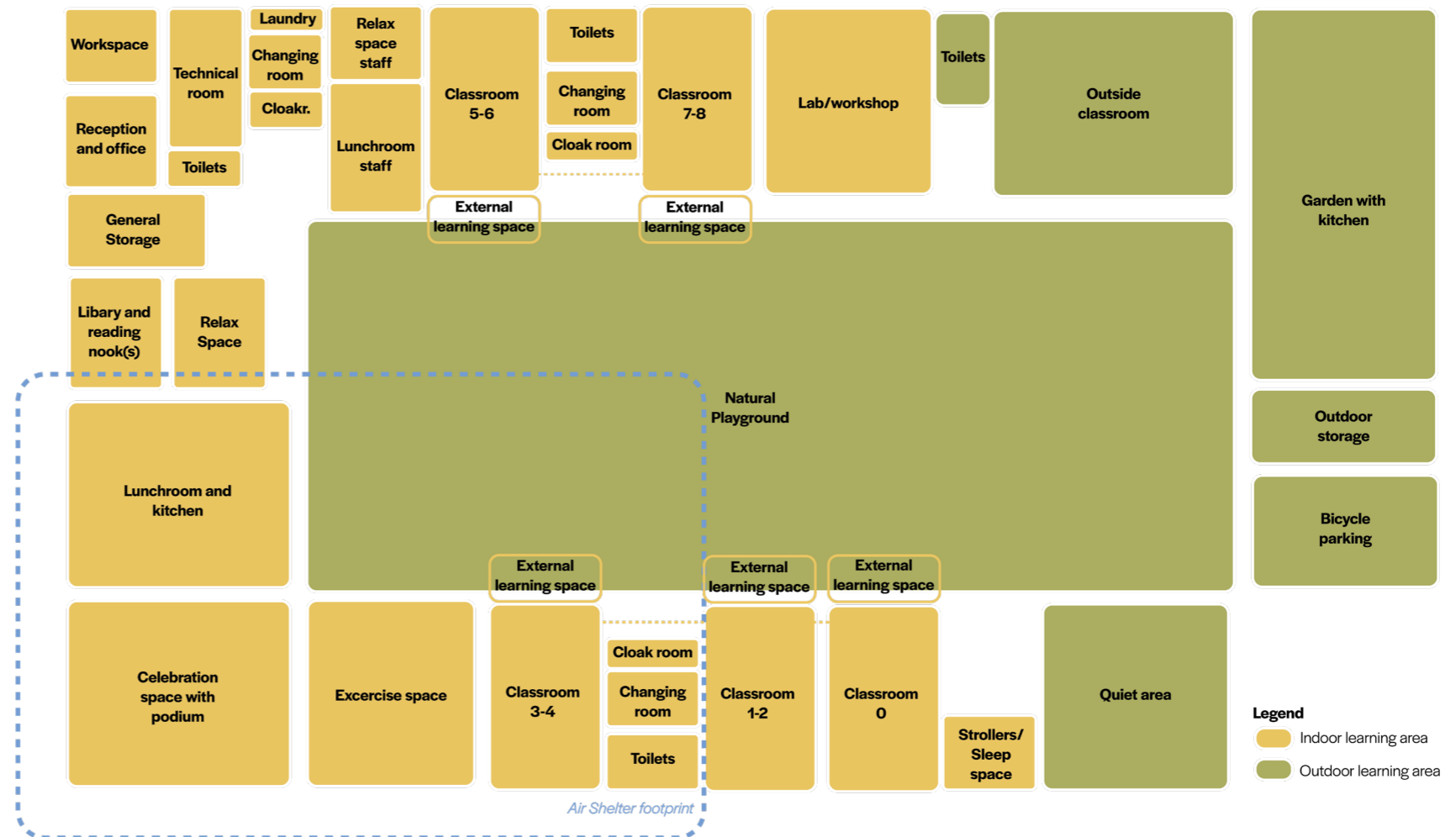


Figure 53. Proportional visualisation of table 1. Source: Own work.

IV. CONCLUSION AND DISCUSSION

Conclusion, Implications, Recommendations, Reflection

1. Conclusion

This chapter concludes the central question: **How can adaptive reuse of heritage, reimagined as a landscape, transform the Air Shelter Area of Airbase Soesterberg into a nature school that restores a reciprocal relationship between culture, ecology, and environmental value?**

Starting with assessing the cultural and natural values of heritage. *How do values of nature and culture coexist in the Air Shelter Area?*

Designing heritage as a landscape requires a new value assessment, one that relates people to nature. With this the values of the 'landscape' can be found. At the ASA, the coexistence of natural and cultural values can be found in educational, historical, nostalgic, and existence values within the building layers of surroundings, site, system, and spirit of place.

In order to balance the coexistence of natural and cultural values a fitting design approach needs to be found. *How can design approaches, existing within the field of adaptive reuse, support the balance of nature and culture values at the Air Shelter Area?*

Firstly, the building should articulate time layers of its place and surroundings. For the ASA this could mean using the historical desire tracks as system of routing and viewlines (figure 54). Secondly, the building should be opened up to reconnect with natural processes. The shelters could be opened up with the pattern of the desire-tracks. The articulation of timelayers and reconnection can be done through the building's catalogue. For the shelter this could mean making openings by removing lanes of arches in the same way they were placed, as set of three.

Additionally, to encourage people to discover and learn about the landscape, promoting curiosity and interpretation could be an effective approach. This can be achieved through fragmentation or intentional mistakes. The air shelter could be fragmented by removing the lanes of arches. Inside the arched shell, the confusion of what could be considered outside could be enlarged by using a outside material (such as gravel) as flooring.



Figure 54. Masterplan proposal of Airbase Soesterberg. Source: Own work.

1. Conclusion

After setting a design approach, the building construction conveys the concept of heritage as a landscape. *How can the materiality and structural design of newly built architecture convey the concept of architecture as a landscape at the Air Shelter Area?*

Firstly, consider designing with moving materials to make use of passive energy and raise awareness of environmental processes. For the shelter this could mean inviting water, sun and wind inside the arched shell. New volumes can direct these moving materials through its massing, roof shapes and overhangs. Elevated platforms, full-length windows and skylights invite people to observe the moving materials (figure 55 and 56).

Secondly, think of the building's envelope to be an ecological place; an ecolope. Intentionally design cavities that function as ecological corridors and habitats. For the shelter this could translate into using the shell and corrugated steel as an additional skin; lifting the structure to allow free movement at ground level; integrating insect hotels into the columns; and creating ventilated facades (figure 55).

Thirdly, research the biocultural region to connect materiality and structural design with the surroundings. For the ASA, the biomaterials include wool, wood, straw, grass, and flax. The cultural materials can be sourced by reusing the shelter's building layers, such as concrete slabs, steel panels and steel frames. These biocultural materials could be reused or repurposed as objects, finishes, thermal insulation, acoustic insulation, and flooring (figure 55).

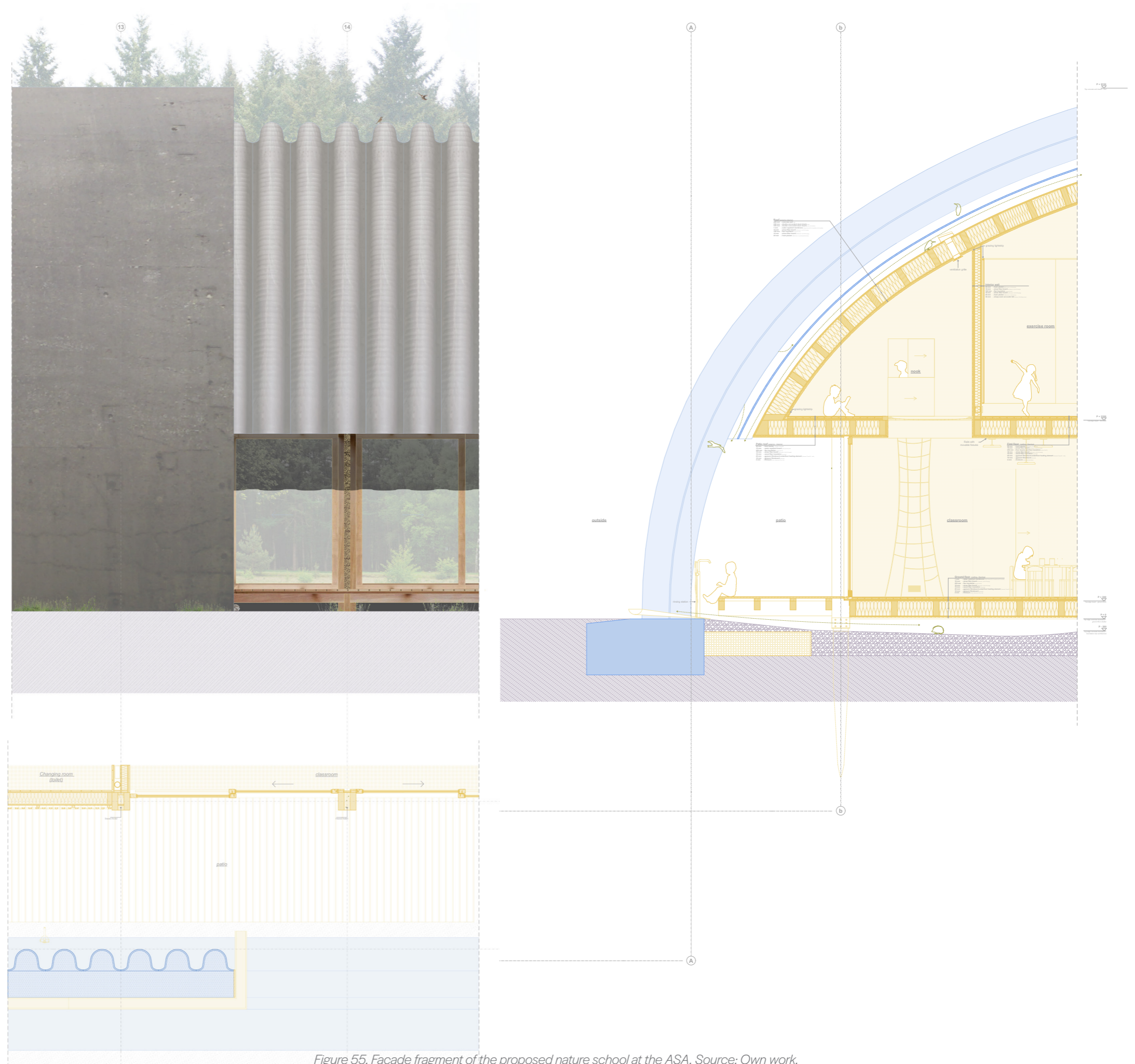


Figure 55. Facade fragment of the proposed nature school at the ASA. Source: Own work.

1. Conclusion

Fourthly, to resemble a landscape's ecosystem the design should be self-sufficient. A garden can provide food. Compost toilets limit water-use and produce compost for the garden. Rainwater is stored and used for cooking, cleaning, washing hands and watering the garden. Solar panels connected to a battery provide electricity all year round (figure 56).

Lastly, to translate the definition of landscape being an everchanging entity, the construction should be 'Designed for Change'. This means allowing future material and programmatic transformations, expansions, contractions, and repurposing through designing flexible or dismantlable building components. For the air shelter, this could translate in creating a box-in-box-principle, where a dismantlable, self-bearing, self-climatized volume is placed inside the concrete shell on a grid system (figure 56). For program flexibility the plan should have flexible walls (sliding or folding walls) between spaces (indoor-indoor and indoor-outdoor) (figure 55). In this way the building's interior could become exterior and smaller spaces could join into larger spaces.

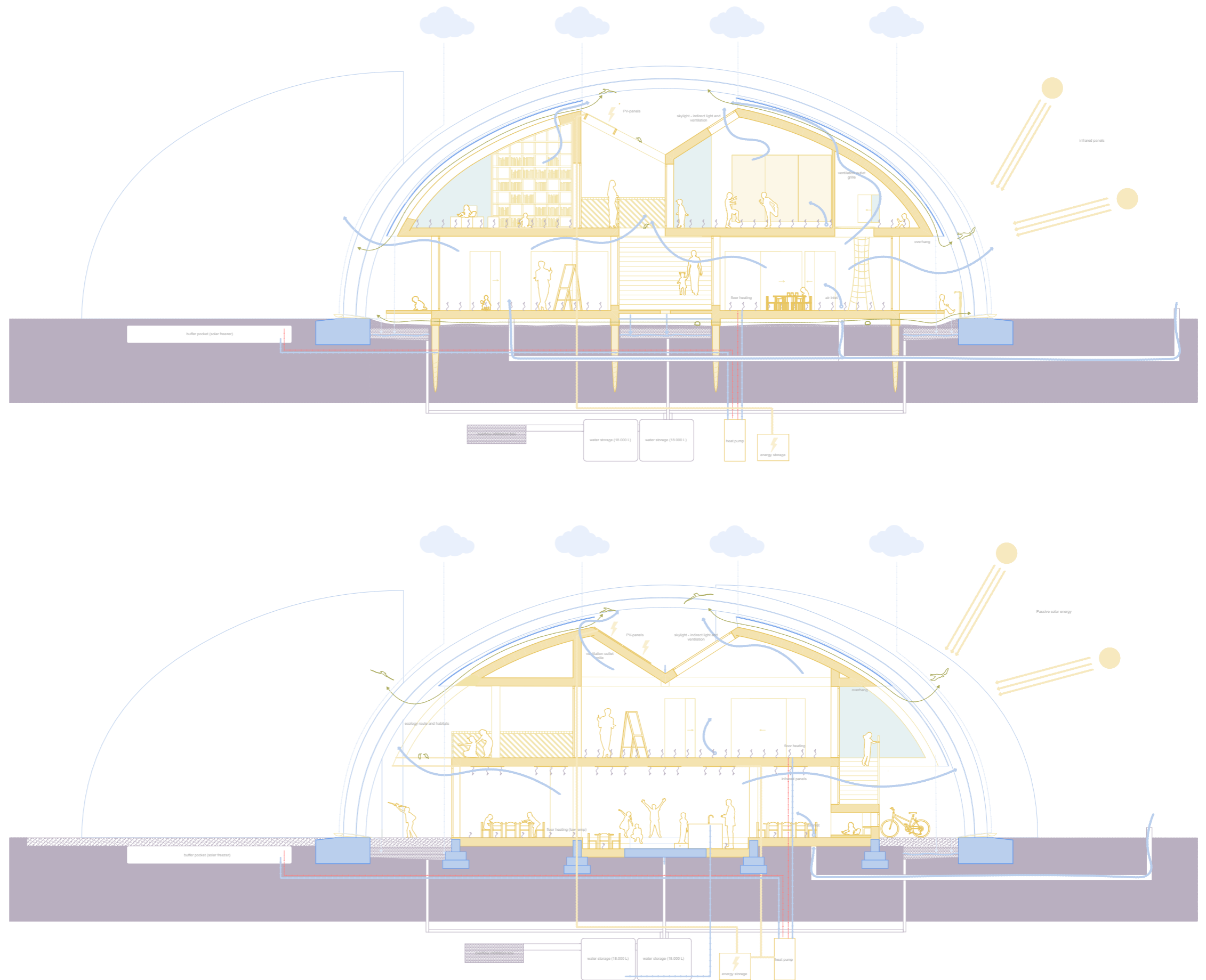


Figure 56. Climate section of the proposed nature school, located in two shelters of the ASA. Source: Own work.

1. Conclusion

After finding the coexistence of values, design approaches and building construction methods for buildings reimagined as a landscape, we can zoom in on the spatial and program requirements of a nature school. *How do spatial characteristics and program approaches encourage children's learning and engagement with the landscape at the Air Shelter Area?*

Firstly, the spatial characteristics that encourage engagement with a landscape can be found in three principles; exploration of spaces, learning with nature, and connectivity of community. Exploration of spaces involves an exploratory flow through spaces with multiple entry points and various routing options. At the ASA, the three original access points of the shelter could be reused in designing explorative routing (figure 57). Learning with nature involves creating an indoor-outdoor experience. At the ASA, this could be achieved through wall-to-wall sliding windows, skylights, peek views and outdoor 'hallways' (figure 57). Connectivity of community is about transparency of spaces. Increasing connectivity across spaces can be achieved by using transparent internal walls or by placing windows across from each other (figure 57). Creating mezzanines and double-height spaces increases vertical connectivity (figure 56).

Secondly, the program to encourage engagement and learning with a landscape differs from a that of a 'regular' preschool. Due to outdoor education, there must be changing rooms close to each classroom. Additionally, toilets need to be directly accessible from outside. Each classroom is positioned adjacent to a covered outdoor area, to extend the learning environment and connect to the outdoors (figure 57).



Figure 57. Floor and site plan, including a section, of the proposed nature school at Shelter 620 (left) and Shelter 622 (right) of the ASA. Source: Own work.

1. Conclusion

In conclusion, reimagining heritage as a landscape enables the Air Shelter Area of Airbase Soesterberg to become a nature school where cultural heritage and ecological systems are no longer separate but interdependent. By articulating the landscape's time layers, integrating natural processes, creating exploratory spaces, and designing for flexibility and self-sufficiency, the project restores a reciprocal relationship between culture, ecology and environmental processes. In this way, the air shelter adapts from a static relic into a dynamic, ever-changing landscape that supports education and environmental awareness, while respecting values of both nature and culture.

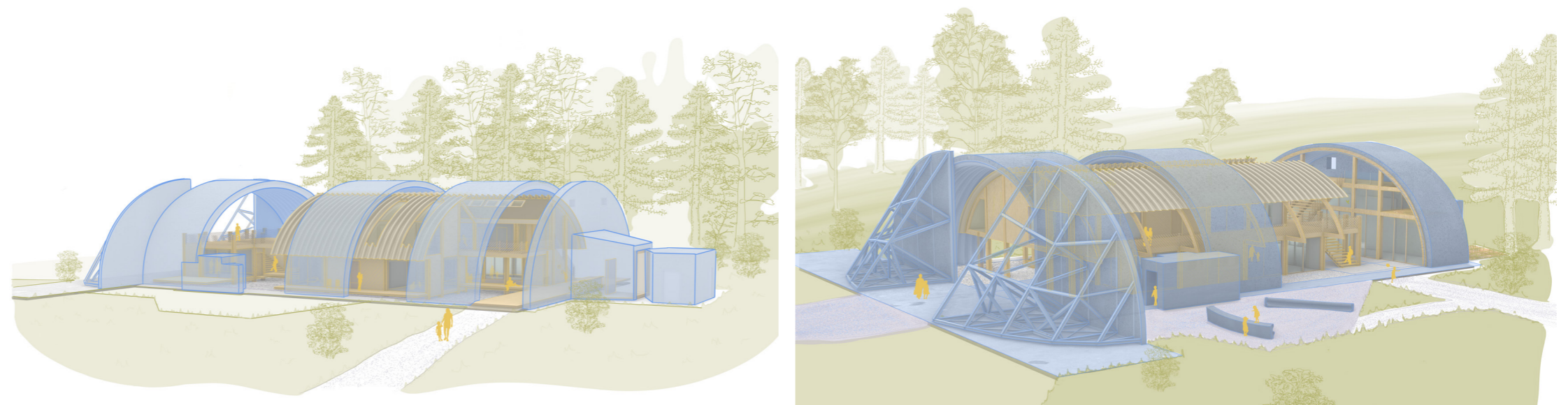


Figure 58. Bird's eye view of Shelter 620 (left) and Shelter 622 (right). Source: Own work.



Figure 57. Image of the outside learning environment of Shelter 620 at the ASA. Source: Own work.

2. Reflection

This research demonstrated how heritage architecture can be understood as a dynamic, shared cultural-natural space. By reimagining the air shelters of the ASA as a landscape, the research explored how adaptive reuse can become negotiation tool between the actors of a landscape. Heritage that does not resist change, but gains meaning through negotiating a balance of culture and nature.

In a broader sense, within the field of (heritage) architecture, this research contributes to discussions on how heritage and architecture is and should be preserved. It challenges traditional preservation approaches by questioning the human-centred nature of the built environment and proposing a more landscape-based perspective in which space is shared with ecological processes rather than dominated by them. Furthermore, it contributes to the understanding that landscape and architecture are not separate disciplines, but interdependent and continuously shape one another (figure 58). Additionally, the research proposes a more integrated value assessment method, combining environmental, ecological, and cultural values of building layers.

In broader sense, within the field of education and societal growth, this research contributes to discussions on how learning environments can become more connected to the outdoors and encourage exploration. It questions the current design of school systems in the Netherlands and their increasing disconnection from natural rhythms, suggesting that outdoor-indoor spatial design plays a role in restoring this relationship.

A few aspects could be further developed. Methodologically, the research is limited by a number of case studies analysed. A broader set of scenarios (case studies), including those that do not support a 'landscape' approach, would allow for more critical comparisons and a more grounded design proposal. Additionally, the scenario's are often explored with only one design strategy for the contextual framework of a nature school at the ASA. Expanding this to include multiple alternative strategies per scenario would strengthen the understanding of the design possibilities. Furthermore, developing a second contextual framework would create a broader design

toolset for heritage adaptation in general. Finally, the research would benefit from more empirical research, such as interviews and visits to nature schools, to connect theory to educational practices.

Overall, this research illustrates a possible approach to reimagining heritage architecture as a landscape. It suggests a direction for future work, suggesting that similar strategies could be developed and applied in other contextual frameworks.



Figure 59. Moss growing on the concrete shell of the rear of an air shelter at ASA. Source: Own work.

References

- Atlas Leefomgeving. (n.d.). *Nature*. Retrieved December 10, 2025, from <https://www.atlasleefomgeving.nl/en/node/911>
- Australia ICOMOS. (2013). *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance*. Australia ICOMOS.
- Australian Heritage Commission. (2002). *Australian Natural Heritage Charter: Standards and principles for the conservation of places of natural heritage significance* (2nd ed.). Australian Heritage Commission.
- Azzopardi, E., Kenter, J. O., Young, J., Leakey, C., O'Connor, S., Martino, S., Flannery, W., Sousa, L. P., Mylona, D., Frangoudes, K., Béguier, I., Pafi, M., da Silva, A. R., Ainscough, J., Koutrakis, M., da Silva, M. F., & Pita, C. (2023). *What are heritage values? Integrating natural and cultural heritage into environmental valuation. People and Nature, 5*(2), 368–383. <https://doi.org/10.1002/pan3.10386>
- Bakker, C. (2011). *Inrichtings- en beheerplan voormalige Vliegbasis Soesterberg: Maatregelen voor natuur, cultuurhistorie en recreatie*. Het Utrechts Landschap.
- Bianchi, S., Stimpson, C. D., Duka, T., Larsen, M. D., Janssen, W. G. M., Collins, Z., Bauernfeind, A. L., Schapiro, S. J., Baze, W. B., McArthur, M. J., Hopkins, W. D., Wildman, D. E., Lipovich, L., Kuzawa, C. W., Jacobs, B., Hof, P. R., & Sherwood, C. C. (2013). *Synaptogenesis and development of pyramidal neuron dendritic morphology in the chimpanzee neocortex resembles humans. Proceedings of the National Academy of Sciences of the United States of America, 110*(Suppl. 2), 10395–10401. <https://doi.org/10.1073/pnas.1301224110>
- Brand, S. (1995). *How Buildings learn. What happens after they're built*. Penguin Books.
- Center on the Developing Child [CDC] (n.d.). *Brain architecture*. Harvard University. <https://developingchild.harvard.edu/key-concept/brain-architecture/>
- Cai, Z., Mao, P., Wang, Z., Wang, D., He, J., & Fan, X. (2023). *Associations between problematic internet use and mental health outcomes of students: A meta-analytic review. Adolescent Research Review, 8*(1), 45–62. <https://doi.org/10.1007/s40894-022-00201-9>
- Columbia GSAPP. (2018, October 17). Architecten De Vylder Vinck Taillieu [Video]. YouTube. <https://www.youtube.com/watch?v=ZQfhBOSecNo>
- Cortesi, I. (2020). *The becoming of the landscape*. In F. Rossi (Ed.), *Transitional Landscapes* (pp. 15–37). Quodlibet.
- DeSilvey, C. (2017). *Curated Decay: Heritage Beyond Saving*. University of Minnesota Press.
- De Vliegbasis. (n.d.). *De Vliegbasis*. <https://wonenopdevliegbasis.nl/>
- De Vries, S., Verheij, R., & Smeets, H. (2015). *Groen en gebruik ADHD-medicatie door kinderen: De relatie tussen de hoeveelheid groen in de woonomgeving en de prevalentie van AD(H)D-medicatiegebruik bij 5- tot 12-jarigen* (Alterra-rapport 2672). Alterra Wageningen UR. <https://edepot.wur.nl/362891>
- Farrell, J. M., Reiss, N., and Shaw, I. A. (2014). *The Schema Therapy Clinician's Guide: A Complete Resource for Building and Delivering Individual, Group and Integrated Schema Mode Treatment Programs*. Hoboken, NJ: John Wiley & Sons. doi: 10.1002/9781118510018
- Feilden Clegg Bradley Studios. (n.d.). *University of Staffordshire Woodlands Nursery*. <https://fcbstudios.com/projects/university-of-staffordshire-woodlands-nursery>
- Gilad, U., Pronkhorst, A., & Wingender, J. P. (Eds.). (2024). *Architecture repurposed: Office Winhov*. nai010 publishers. ISBN 978-94-6208-871-9.
- H+N+S (n.d.). *Nationaal Militair Museum*. <https://hnsland.nl/projecten/nationaal-militair-museum/>
- Henning Larsen. (n.d.). *Gjai Kindergarten*. <https://henninglarsen.com/projects/gjai-kindergarten>
- Hushimoto, J. (Ed.). (2011). *JA 81: Hiroshi Sambuichi*. Shinkenchiku-sha. ISBN 978-4-7869-0230-7.
- I Ur och Skur. (n.d.). *I Ur och Skur friluftsfamjandet*. <https://iurochskur.friluftsfamjandet.se/>
- IVN Natuureducatie. (n.d.). *IVN*. <https://www.ivn.nl/>
- Kaplan, S. (1995). The restorative benefits of nature: Toward an integrative framework. *Journal of Environmental Psychology, 15*(3), 169–182. [https://doi.org/10.1016/0272-4944\(95\)00012-2](https://doi.org/10.1016/0272-4944(95)00012-2)
- Kahn, P. H., Jr., & Kellert, S. R. (Eds.). (2002). *Children and nature: Psychological, sociocultural, and evolutionary investigations*. MIT Press.
- Kuipers, M., & de Jonge, W. (2017). *Designing from heritage: Strategies for conservation and conversion*. Delft University of Technology. <https://doi.org/10.7480/isbn.9789461868022>
- Lang, R. (Ed.), Klanten, R., Flanagan, R. & Servert, A. (Eds.). (2022). *Building for Change: The Architecture of Creative Reuse* (1st ed.). Gestalten. ISBN 9783967040449.
- Leefmilieu Brussel. (n.d.). *Omhein zonder de fauna buiten te sluiten*. Renature.brussels. <https://renature.brussels.nl/acties/faunastad/omheinen-zonder-de-fauna-buiten-te-sluiten>
- León Méndez, M., Padrón, I., Fumero, A., & Marrero, R. J. (2024). *Effects of internet and smartphone addiction on cognitive control in adolescents and young adults: A systematic review of fMRI studies. Neuroscience & Biobehavioral Reviews, 159*, 105572. <https://doi.org/10.1016/j.neubiorev.2024.105572>
- Lloyd, A., Truong, S., & Gray, T. (2018). *Place-based outdoor learning: More than a drag and drop approach. Journal of Outdoor and Environmental Education, 21*(1), 45–60. <https://doi.org/10.1007/s42322-017-0002-5>
- Mann, J., Gray, T., Truong, S., Brymer, E., Passy, R., Ho, S., Sahlberg, P., et al. (2022). *Getting out of the classroom and into nature: A systematic review of nature-specific outdoor learning on school children's learning and development. Frontiers in Public Health, 10*, 877058. <https://doi.org/10.3389/fpubh.2022.877058>
- Mannion, G., Ramjan, C., McNicol, S., Sowerby, M., & Lambert, P. (2025). Outdoor environmental education: Turning back to the environment at a time of climate and nature emergency. *Environmental Education Research, 31*(9), 1916–1938. <https://doi.org/10.1080/13504622.2025.2538030>
- Nationaal Militair Museum. (n.d.). *Educatie*. <https://www.nmm.nl/nl/bezoek/scholen/>
- Pintos, P. (2023, May 19). *House of Elementary Education / LP architectur*. ArchDaily. <https://www.archdaily.com/1001095/house-of-elementary-education-lp-architectur>
- Radman, A. (2021). *Ecologies of Architecture: Essays on Territorialisation*. Edinburgh University Press.
- Riegl, A. (1996). *The modern cult of monuments: Its character and its origin* (K. W. Forster & D. Ghirardo, Trans.). In N. Stanley Price, M. K. Talley Jr., & A. Melucco Vaccaro (Eds.), *Historical and philosophical issues in the conservation of cultural heritage* (pp. 69–83). Getty Conservation Institute.
- Rietveld, E., & Rietveld, R. (2017). *Hardcore Heritage: Imagination for Preservation. Frontiers in Psychology, 8*, Article 1995. <https://doi.org/10.3389/fpsyg.2017.01995>
- Sambuichi, H. (2015). *Sambuichi and the Inland Sea*. TOTO.
- Subramanian, K. R. (2025). *Myth and Mystery of Shrinking Attention Span*. International Journal of Trend in Research and Development, 5(3). *Myth-and-Mystery-of-Shrinking-Attention-Span.pdf*
- UNESCO (2017). *Operational guidelines for the implementation of the World Heritage Convention*. UNESCO World Heritage Centre. <https://whc.unesco.org/en/guidelines/>
- UofTDaniels. (2018, May 17). Pritzker Architecture Prize laureate lecture: “Paths uncharted” with Balkrishna Doshi [Video]. YouTube. <https://www.youtube.com/watch?v=DIQoB90D3lg>
- Van Rooij, A. J., Ferguson, C. J., vandeMheen, D., & Schoenmakers, T. M. (2017). *Time to abandon Internet addiction? Predicting problematic internet, game, and social media use from psychosocial well being and application use. Clinical Neuropsychiatry, 14*(1), 113–121.
- Vesters, P. (2018). *Vliegbasis Soesterberg: Oord van onthouding en verborgen wereldgeschiedenis*. Vitruvius: Onafhankelijk vaktijdschrift voor archeologie, cultuurlandschap, monumentenzorg, 44, 8–11.
- Weisser, W. W., Hensel, M., Barath, S., Culshaw, V., Grobman, Y. J., Hauck, T. E., Joschinski, J., Ludwig, F., Mimet, A., Perini, K., Roccotiello, E., Schloter, M., Schwartz, A., Hensel, D. S., & Vogler, V. (2023). *Creating ecologically sound buildings by integrating ecology, architecture and computational design. People and Nature, 5*(1), 4–20. <https://doi.org/10.1002/pan3.10411>
- WWF. (2024). *Living Planet Report 2024: A System in Peril*. <https://wwflpr.awsassets.panda.org/downloads/2024-living-planet-report-a-system-in-peril.pdf>

V. APPENDIX

References, Data Management Checklist, Acknowledgements

A. Planning

'Heritage Reimagined as Landscapes'

Nov '25 - Jun '26

Graduation studio theme introduction (Site visits, lectures and group analysis)
Cold War Heritage in the Netherlands

Problem statement
Disbalance of reciprocal relationship of people and nature

Selected location and program (scope)
Nature School at Air Shelter Area Soesterberg Airbase

Central question:
How can adaptive reuse of heritage, reimagined as a landscape, transform the air shelter area of Airbase Soesterberg into a nature school that restores a reciprocal relationship between culture, ecology, and environmental value?

Theoretical framework
Heritage and education reimagined as a landscape

Research question 1:
How do values of nature and culture coexist in the air shelter area?

Research question 2:
How can design approaches, existing within the field of adaptive reuse, support the balance of nature and culture values?

Research question 3:
How can the materiality and structural design of newly built architecture convey the concept of architecture as a landscape?

Research question 4:
How do spatial characteristics and program approaches encourage children's learning and engagement with nature?

A1 Results:
Problem statement
Design brief
Objectives
Method
Starting points

A2 Results:
Conclusions to subquestions
Concept design

A3 Results:
Technical design
Final design
Reflection

A4 Results:
Improved storytelling
Graduation

Starting points
literature selection
Analyse literature
Create value assesment where nature and culture coexist
Conclusion: Filled in value matrix of the site that relates culture and nature
Position: Relate to values of Utrechts Landschap

Starting points
Cases + literature selection
Analyse cases + literature extract design approaches in heritage and landscape architecture
Explore each approach (scenario) through quick sketch in contextual framework (strategie)
Conclusion: Compare strategies and combine into one strategie for the site, visualized in sketch
Position: Relate to strategie of Utrechts Landschap

Starting points
Cases + literature selection
Analyse cases + literature extract building construction method
Explore each building construction method (scenario) through quick sketch in contextual framework (strategie)
Conclusion: Compare strategies and combine to one strategie for the site, visualized in sketch

Starting points
Cases + literature selection
Analyse spatial characteristics in cases + literature extract spatial design tools
Explore the spatial design tools (scenario) through quick sketch in contextual framework (strategie)
Conclusion: Compare strategies and find the spatial design tools fitted for the site, visualized in sketch

Analyse program of cases + literature make abstract zoningplans
Explore each zoningplan (scenario) through quick sketch in contextual framework (strategie)
Conclusion: Compare strategies and combine into one abstract zoningplan (strategie) for the site

Design proces
interim conclusion on central question
Concept design

Elaborated design proces
Detailing of strategie
Detailing of construction and materiality (facade and structure)
Detailing of floorplans and sections

Final design
Final conclusion on central question
Discussion on contribution to the field of heritage architecture
Reflection on research-design proces

Feedback from A2 Presentation
Feedback from A3 Presentation
Elaborate on storytelling and presentation techniques

Graduation

9 Weeks

9 Weeks

9 Weeks

2 Weeks

kick-off 22 jan

Legend

- Input retrieved outside research proces
- Input retrieved within research proces

B. Elaboration of Chapter II.1 – Values of Nature and Culture

Cultural and Natural Values of UL

By outlining the current interpretation of values at the site, the underlit values are identified.

The values of the ASA are currently perceived through the vision of the site's owner, Utrechts Landschap. The organisation's main objective is maintaining and creating space for nature and heritage in the province of Utrecht. For the airbase, Vesters (2018) explains that for cultural value the focus is the atmosphere of historic secrecy, tension and mystery, the 'spirit of place'. The natural value focus is the biodiversity of the surroundings and site (Bakker, 2011; figuur B.1).

These priorities are supported by the Value Matrix (figure 10). However, a focus on interrelational values of culture and nature is limited. Existence and symbolic value are not elaborated upon by Utrechts Landschap. These overlooked values will be incorporated into the analyses presented in the following chapters.

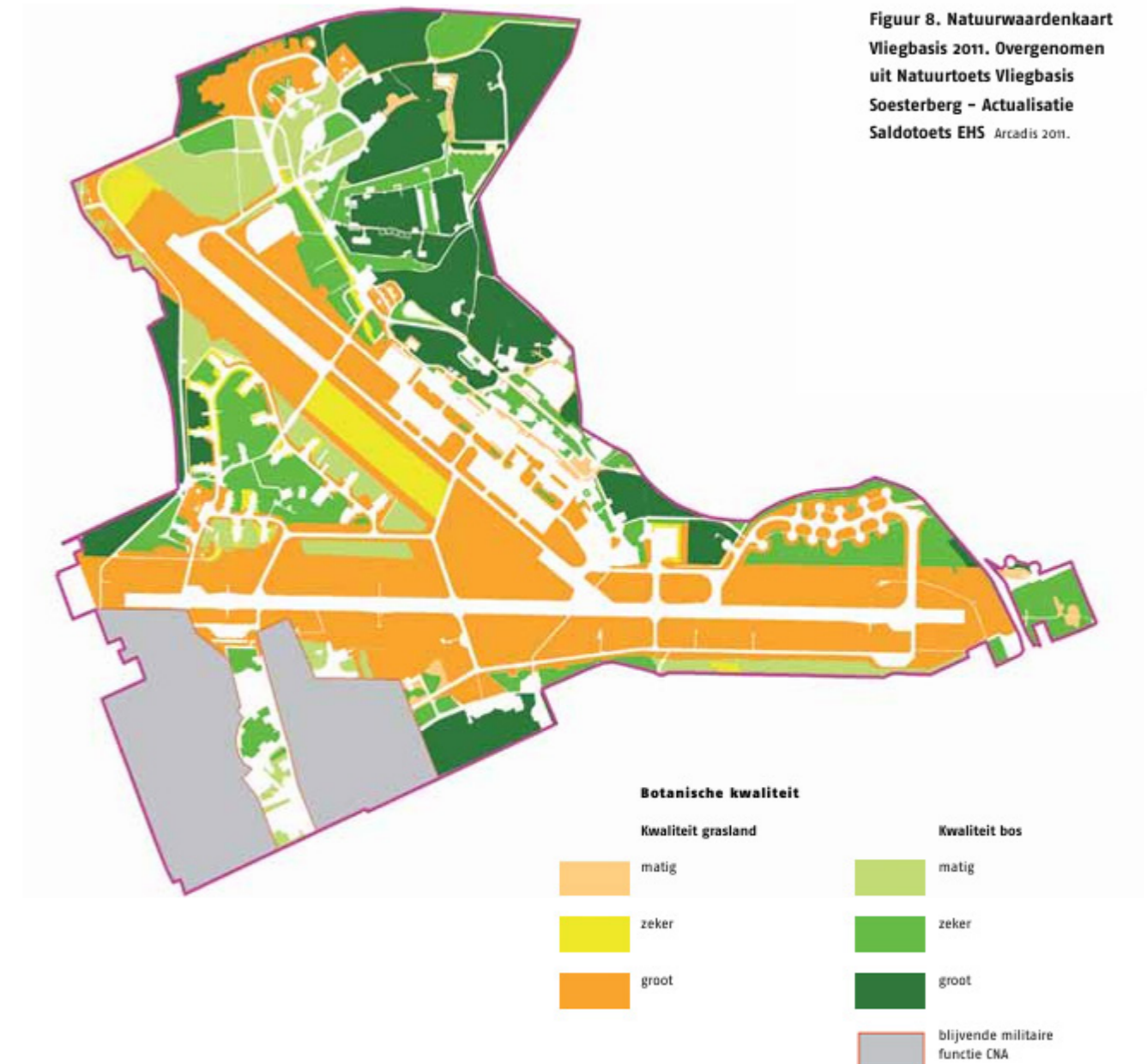


Figure B.1. Natural value map extracted from Management plan of Airbase Soesterberg. Source: Bakker (2011)

C. Extensive version of Chapter II.2 - Design Approach

This chapter addresses the following question: *How can (landscape) architectural design approaches, existing within the field of adaptive reuse, support the balance of natural and cultural values at the Air Shelter Area?*

In reimagining heritage as landscape, the chapter considers approaches from both landscape architecture (LA) and heritage architecture (HA). It examines the 'articulation approach' and the 'fragmentation approach', alongside the 'analogue approach' and the 'missing approach'. First, these approaches are explained, and then they are applied within the contextual framework. Together, these strategies, when compared with the current strategies at the airbase, inform how design approaches could negotiate the relationship between natural and cultural values in the Air Shelter Area (ASA).

2.1. LA - Articulation Approach



Figure C.1. Drentsche Aa. Source: <https://strootman.net/>

2.2. LA - Fragmentation



Figure C.2. Deltawerk by RAAAF. Source: <https://www.raaaf.nl/>

2.3. HA - Analogue Approach



Figure C.3. City Hall Den Helder by Office Winhov. Source: <https://www.winhov.nl/>

2.4. HA - Missing Approach



Figure C.4. Caritas by De Vylder Vinck Tailieu. Source: <https://architectenjdviv.com/>

2.5. Current Approaches

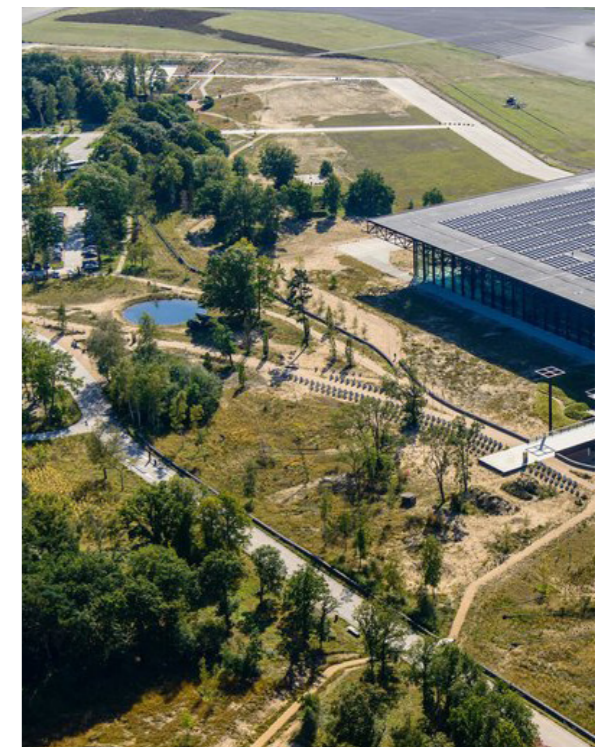


Figure C.5. Landscape and Museum of Airbase Soesterberg by H+N+S. Source: <https://hnsland.nl/>

C. Extensive version of Chapter II.2 - Design Approach

2.1. LA - Articulation Approach

Landscape architecture is not about ego, but about creating continuity. The articulation approach is about making the landscape and its time layers more readable for the visitor.

Michael van Gessel articulates by looking backwards from the most recent development into how much past layers can be brought back. The focus is not on individual accents, but on clusters. These clusters make the stories of the time layers clear and readable. This approach can be seen in his design for the Twickel Estate (figure C.6).

Strootman continued van Gessel's work at the estate. He reconnected the park to its surroundings. He believes that a park belongs to a larger landscape. A park is not an island. It should benefit its surroundings. He articulated time layers by clearing overgrown areas, restoring view lines and creating viewpoints (figure C.7). By clearing overgrown areas the monotonous landscape transforms into a biodiverse landscape.

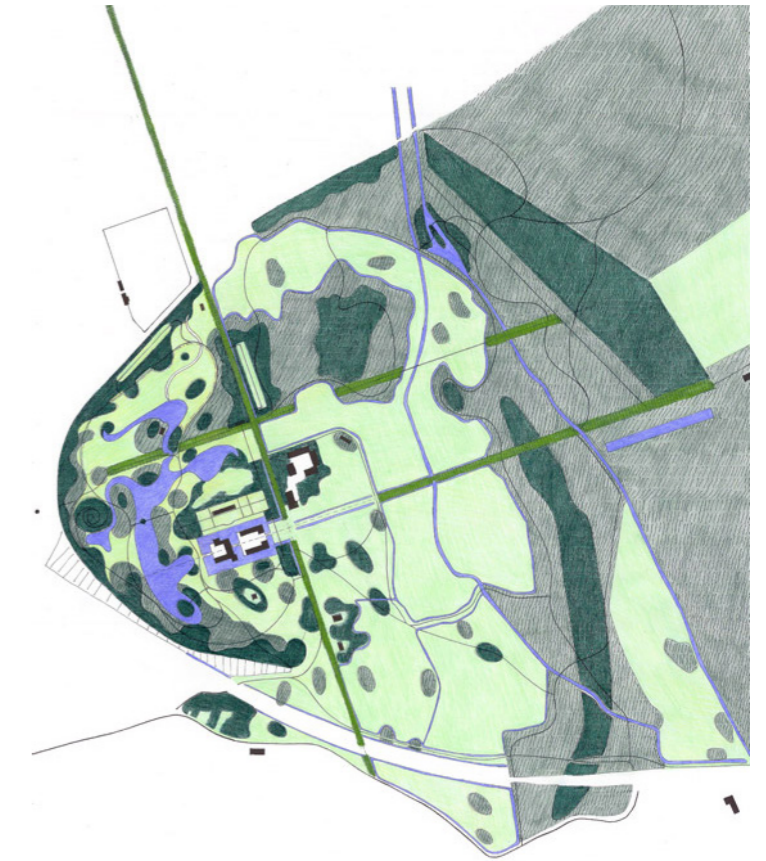


Figure C.6. Twickel Estate by Micheal van Gessel. Source: <http://www.michaelvangessel.com/>

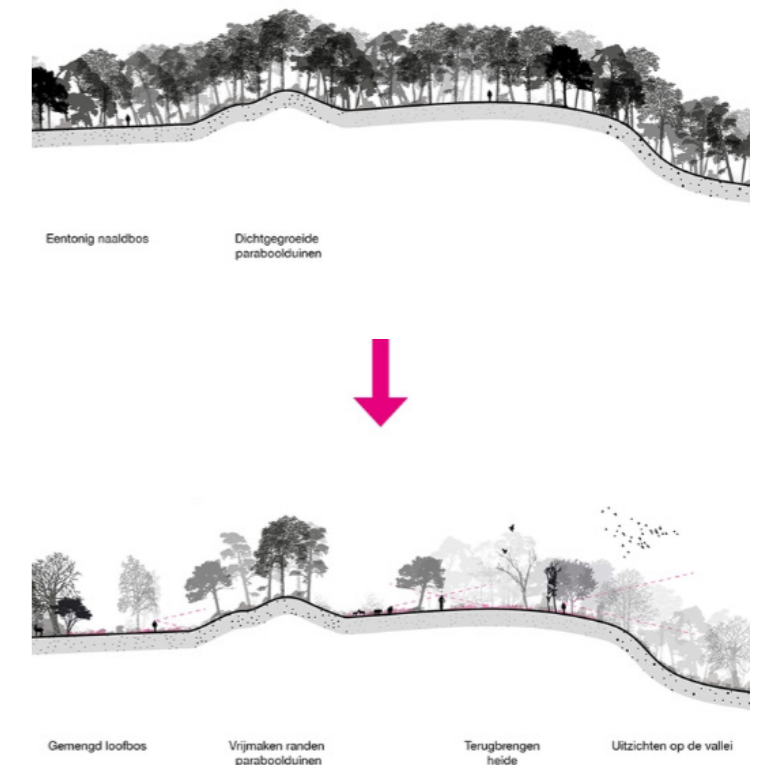


Figure C.7. Kempense Heuvelrug by Strootman Landschap Architecten. Source: <https://strootman.net/>

C. Extensive version of Chapter II.2 - Design Approach

Articulation at the ASA

Applying the articulation approach to the ASA, means analysing its timelayers (Appendix F). In addition to the Cold War period and the German period, which are currently emphasised by Utrechts Landschap (Bakker, 2011), an earlier agrarian period was present (figure C.8). Sandy tracks crossed the former heathland in the air shelter area. These tracks and shortcuts (desire paths) developed organically in response to the geomorphology and surrounding settlements. Reintroducing this layer back, could reveal a reciprocity of culture and nature at the ASA.

The articulation approach is also about reconnecting with and benefiting the surrounding area. Following the Strootman's workflow, the shelters can be interpreted as a monotonous and overgrown area (figure C.9). By opening up the shelters and creating lookout points, the area has the potential to become more connected and biodiverse.

Legend

- High lines (Geomorfology)
- Agrarian period (1850's)
- ▨ Desire tracks (1850's)
- German period (1940-1945)
- Cold War period (1980)
- Airshelters
- - - Airshelter Area

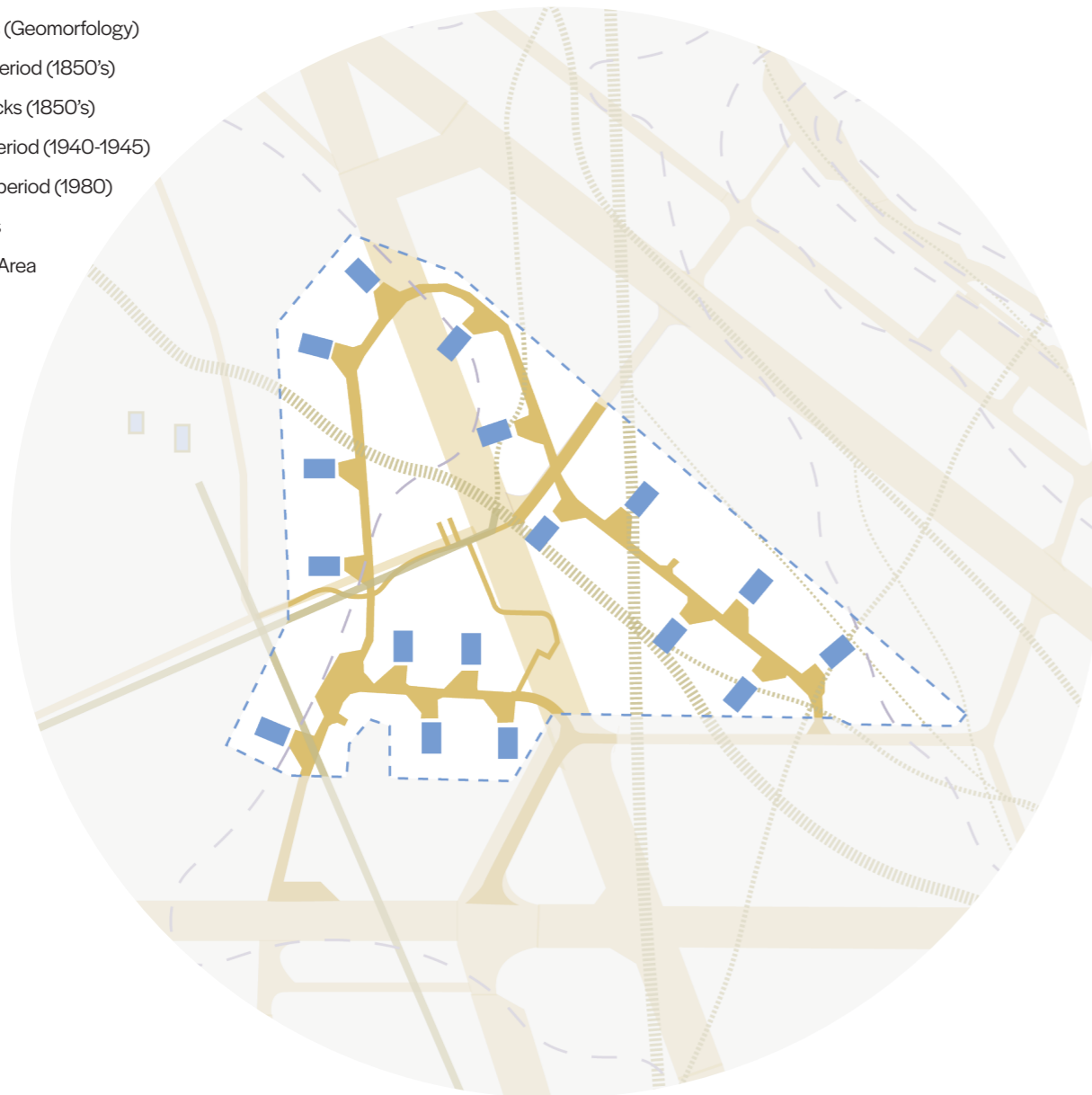


Figure C.8. Timelayers at the ASA. Source: Own work

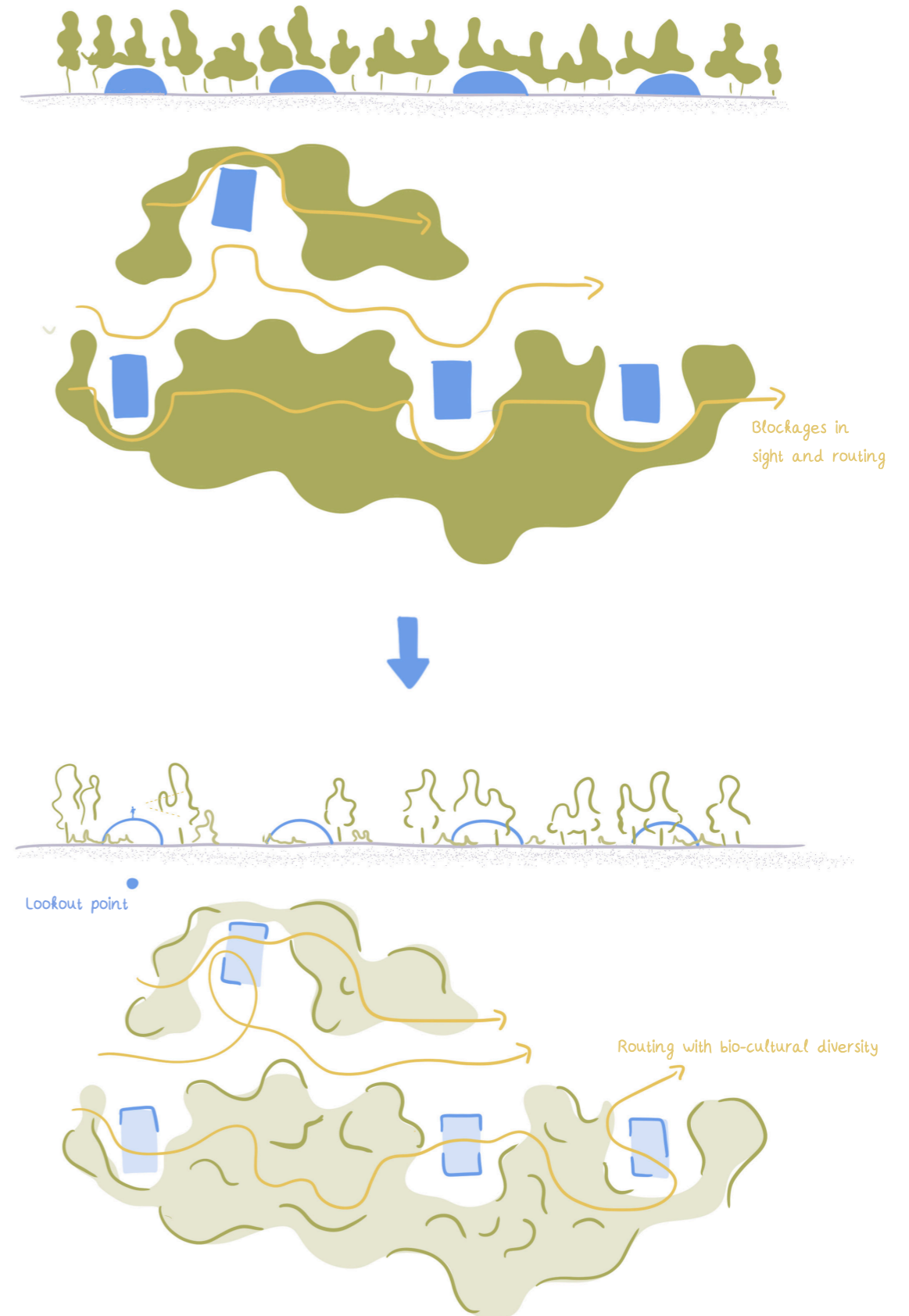


Figure C.9. Creating viewlines and connection at the air shelter area. Source: Own work

C. Extensive version of Chapter II.2 - Design Approach

Articulation at the ASA

Figure C.10 summarises figures C.8 and C.9. The pattern of desire tracks are translated into a system that opens up the air shelters. This system connects the area in the form of sightlines and/or pathways. The Cold War and German pathways are not used for routing, but interpreted as natural ground. In this way, the Cold War and German patterns articulate a sense of secrecy (chapter 1), while simultaneously reconnecting the area with its surroundings.

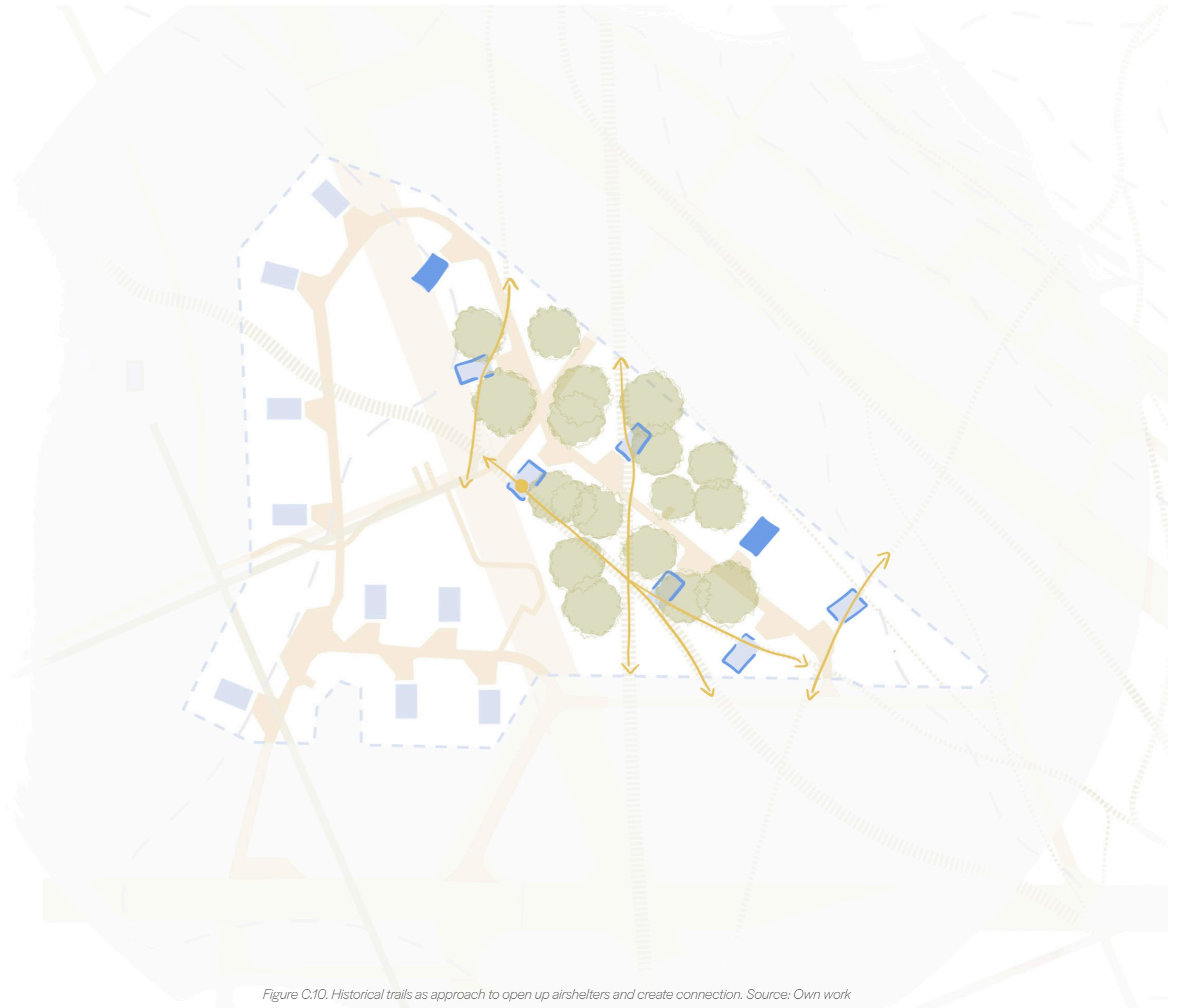


Figure C.10. Historical trails as approach to open up airshelters and create connection. Source: Own work

C. Extensive version of Chapter II.2 - Design Approach

2.2. LA - Fragmentation approach

The fragmentation approach aims to create curiosity, thereby strengthening the meaning of an object and its relationships. According to Burström (as cited in Desilvey, 2017, p. 187), the absence of a complete original fascinates and invites interpretation. Therefore, fragmentation is not per se accidental, but can be used intentionally.

'Hardcore Heritage' by RAAAF (figure C.11) is an example of how intentional fragmentation of building layers "affords people the possibility to discover material and immaterial qualities of their environment that would otherwise remain unnoticed." (Rietveld&Rietveld, 2017)

Fragmentation can be applied not only within the layers of a building, but also to its context. An example can be seen in 'Radical Contextualism' by B+B (figure C.12). While preserving the linear cluster of the Hollandse Waterlinie (UNESCO), bunkers were excavated, reoriented and displacement, thereby adding new meaning and appreciation to the heritage site.



Figure C.11. 'Hardcore Heritage' at 'Deltawerk' (left) and 'Bunker 599' (right), by RAAAF. Source: <https://www.raaaf.nl/>

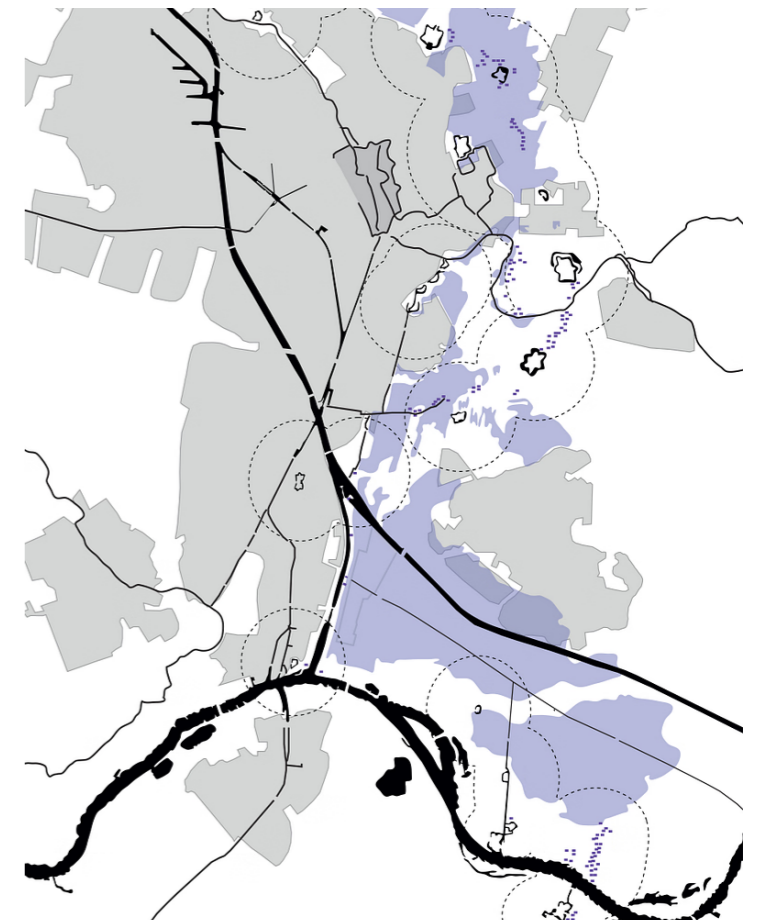
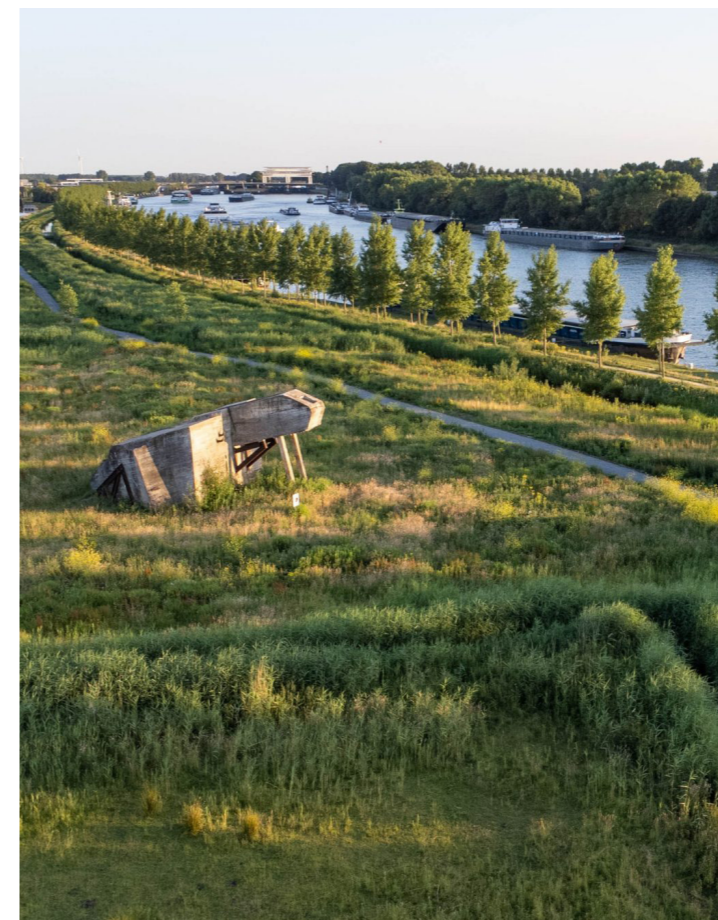


Figure C.12. 'Radical Contextualism' at Prinses Beatrixluis, Object Trouvés by B+B and H+N+S. Source: <https://bplusb.nl/>

C. Extensive version of Chapter II.2 - Design Approach

Fragmentation at the ASA

The fragmentation tools are removal, excavation, destruction, displacement and alteration of buildings or sites. At the ASA, fragmentation could be achieved by removing and displacing the skin, the arches (figure C.13). This generates questions about the original shape, materiality and functionality of the building.

Aligning with the chapter 1 and the articulation approach (figure C.10), the object (shelter) acts as a part of a system (ASA). Therefore, the fragmentation should be approached area-wide in order to generate curiosity about the whole.

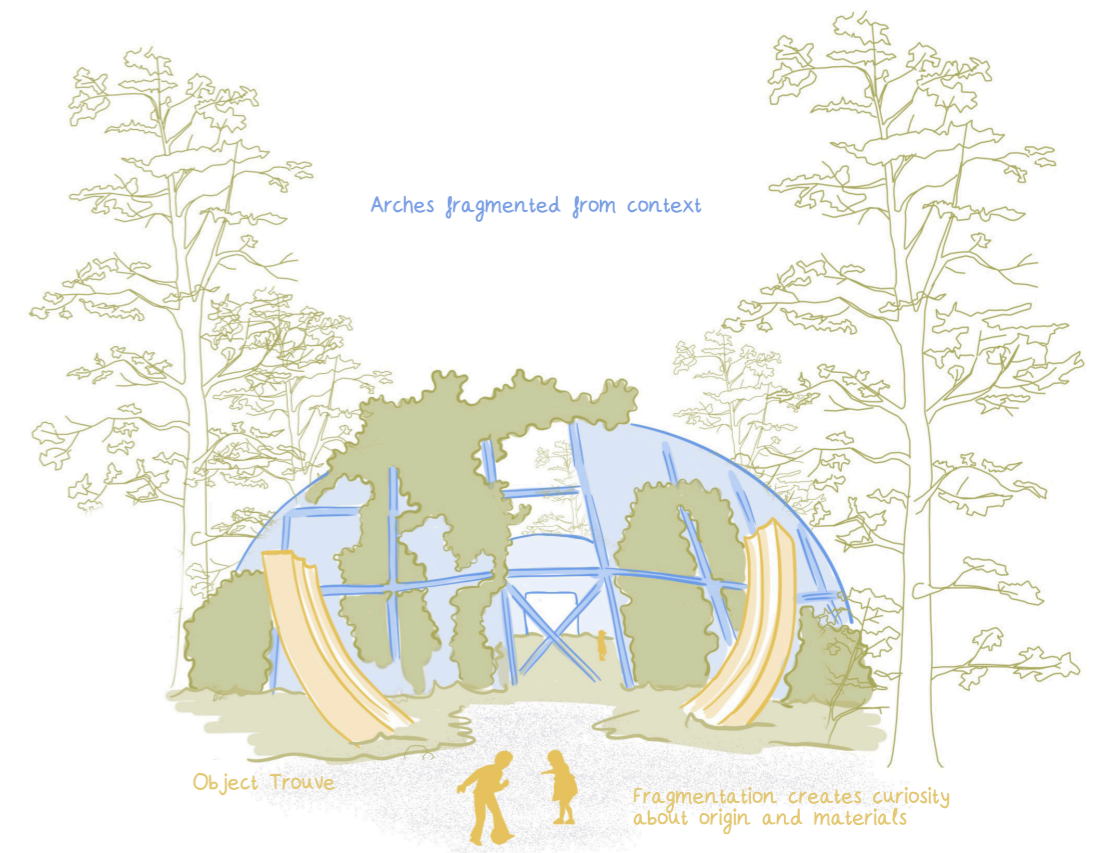
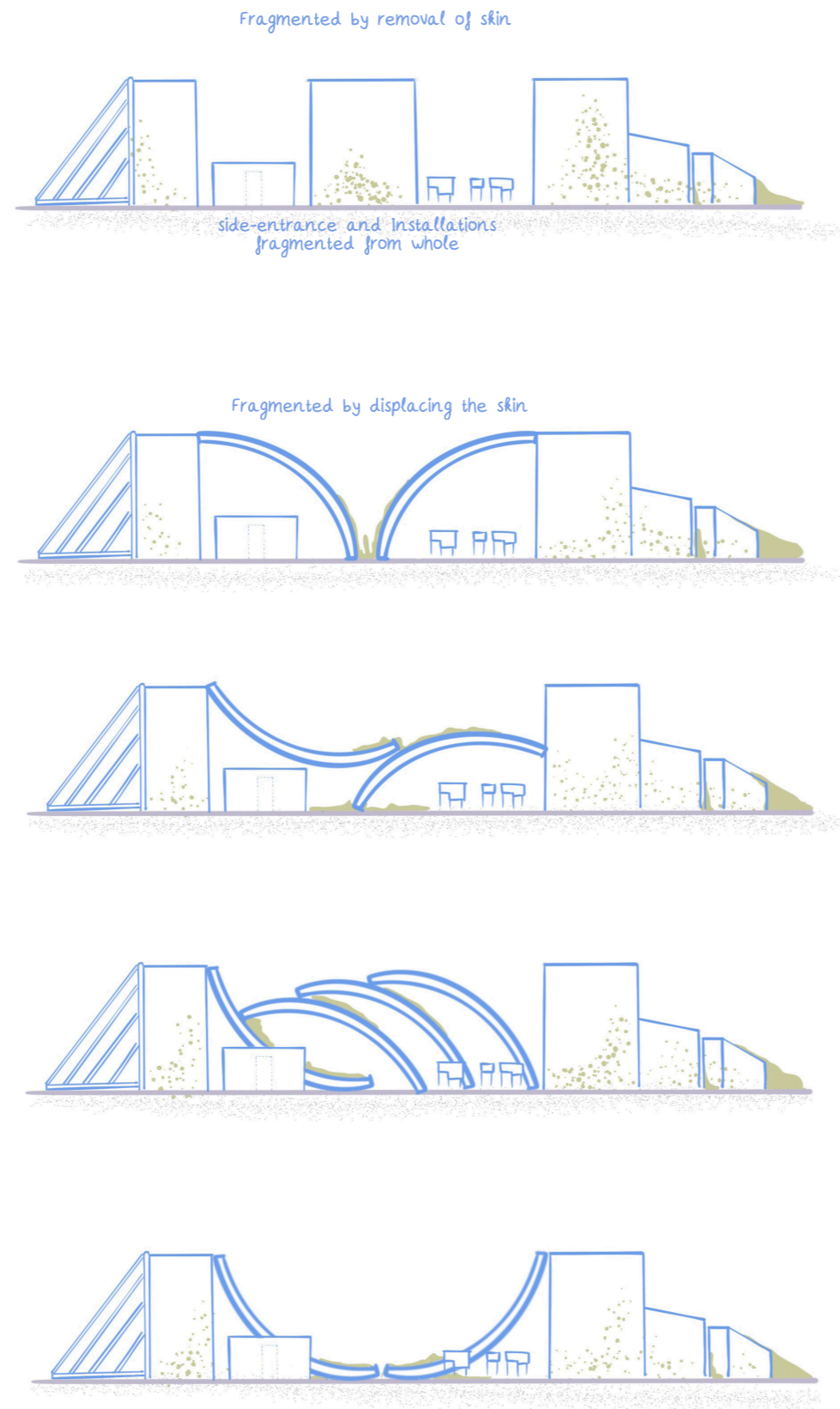


Figure C.13. Sketches of fragmentation interventions at an air shelter. Source: Own work..

C. Extensive version of Chapter II.2 - Design Approach

2.3. HA - Analogue Approach

The aim of the analogue approach is to continue the story of heritage through new interpretation of the existing. The principles of this approach are explained in the book "Architecture Repurposed" by Office Winhov (2024):

1. *Find the identity of the building. Through removing layers you can uncover the essence.*
2. *Reconnect to the surroundings and changed context of the heritage. By reuse of elements, you can intensify the connection.*
3. *Reconstruct through a building catalogue, by copying existing solutions and elements.*
4. *Reprogramming and additions use the building type (spatial, program, construction) as base.*
5. *New layers resonate with the old ones like a palimpsest and palette of materials, by using repetition and finding chemistry between materials.*

A project that illustrates these principles and resembles a shelter is City Hall Den Helder (figure C.14). Like the shelters, its 'identity' is the concrete structure and its 'type' is an open plan. After this analysis, the building was stripped to its concrete shell and the brick infill was replaced with a new layer that aligns with the rhythm in the catalogue and palette of historic colours.

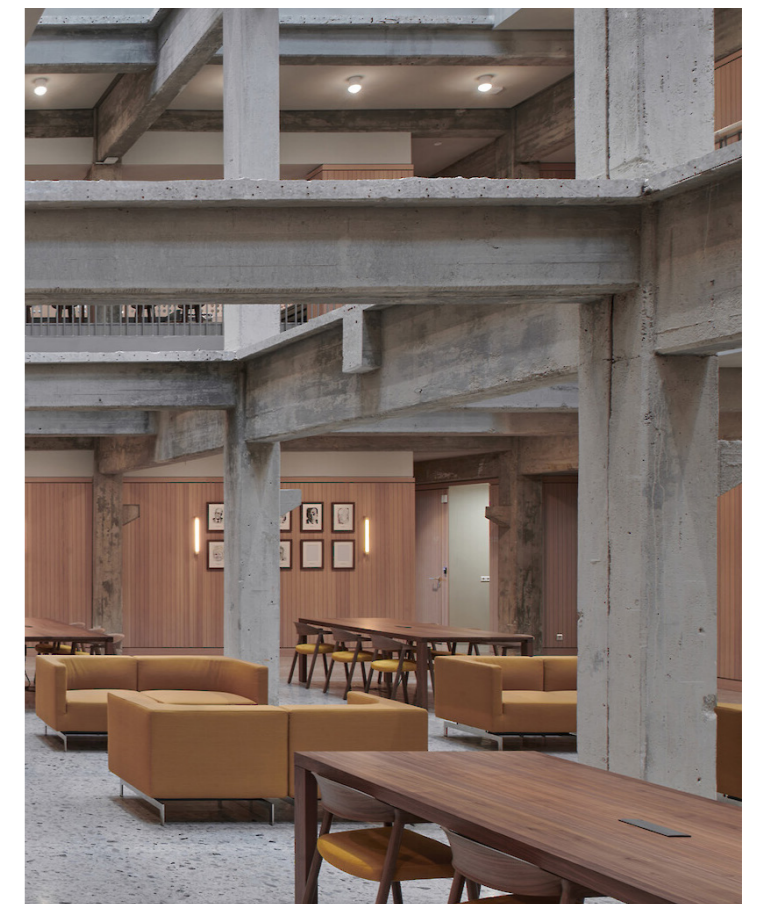
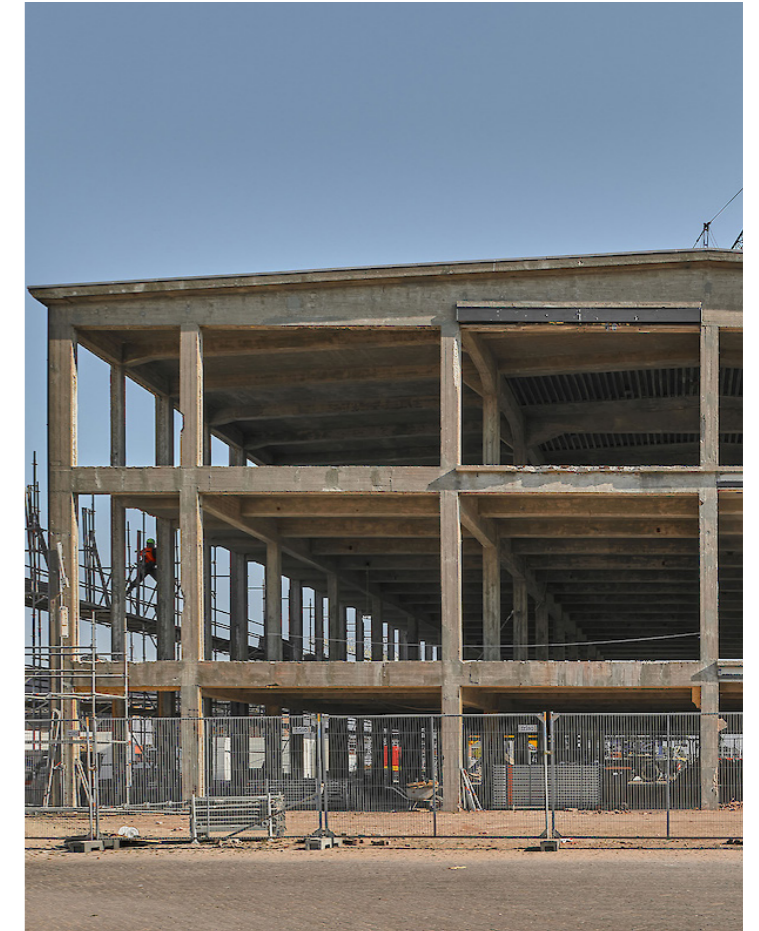


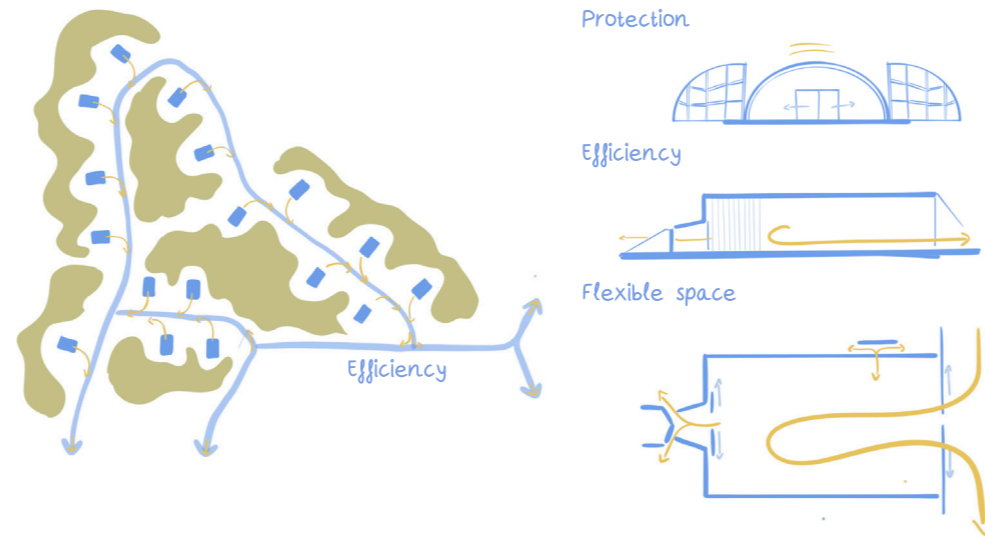
Figure C.14. Selection of images of City Hall Den Helder, from left to right; original building, uncovering identity, reconstruction with catalogue and pallet, and interior as palimpsest. Source: Office Winhov (2024)

C. Extensive version of Chapter II.2 - Design Approach

An Analogue at the ASA

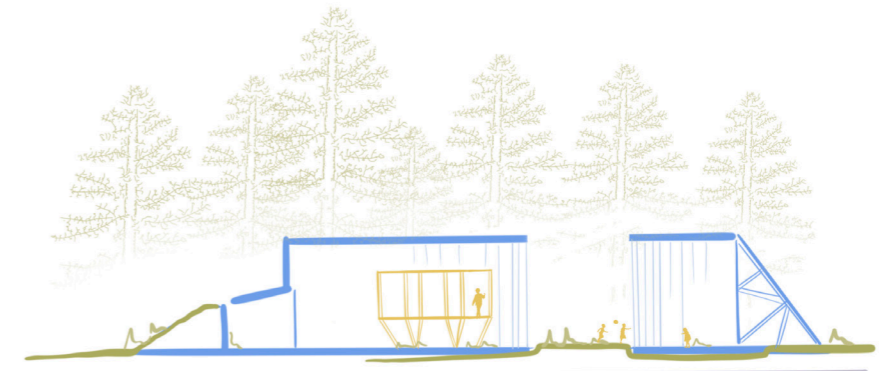
Following the principles of the analogue approach the identity, catalogue and material palette of the ASA are analysed. With this analysis and the theme of heritage as a landscape, one possible design outcome is a shelter with subtracted arches and a new infill of demountable and elevated spaces (figure C.15). The arches are subtracted through the same language as they were constructed. The resulting space is protective, efficient and flexible for both people and nature. The new structure resembles the temporary cultural use of airplanes and migrating tents. This design demonstrates how the analogue approach can be used to tell the cultural and natural story of the ASA.

Identity

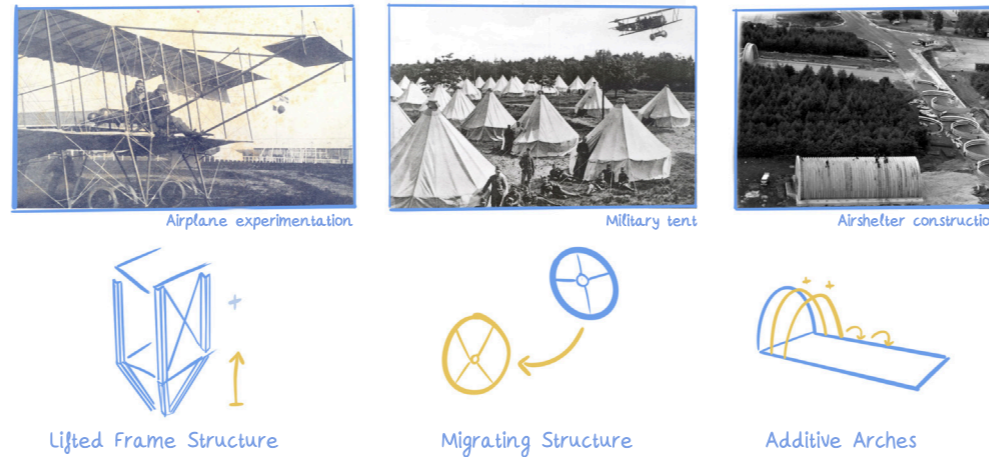


A continued story, to be continued...

- + Add layers for nature and people
- Subtract layers for nature and people



Catalogue



Material Palette

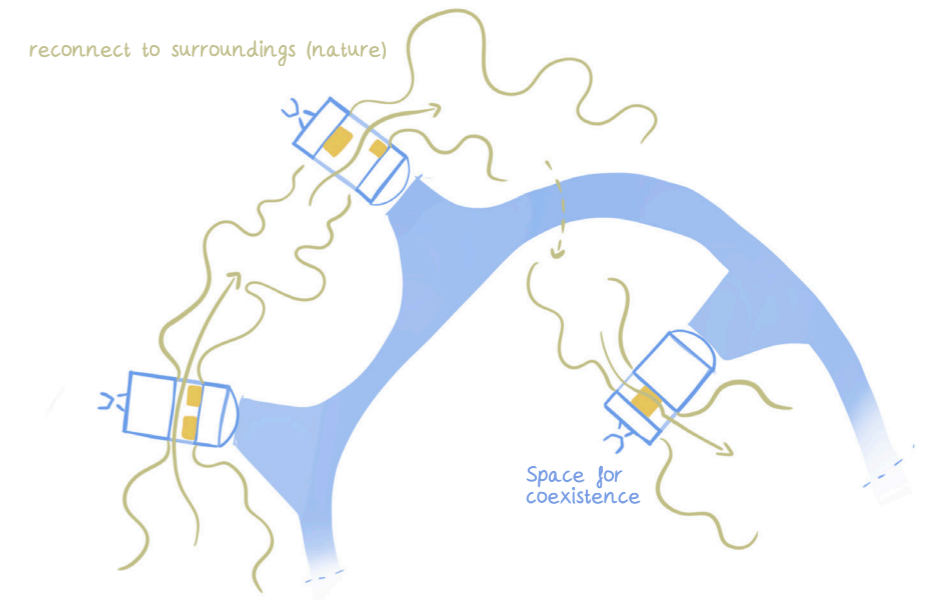


Figure C.15. Sketches of the analogue approach at the Air Shelter Area. Source: Own work.

C. Extensive version of Chapter II.2 - Design Approach

2.4. HA - Missing Approach

The approach applied by Jo Tallieu Architecten is within this research defined as the 'missing approach'. This approach looks for, and allows the existence of mistakes in the redesigning of heritage (Columbia GSAPP, 2018). For instance irregularities can occur in plan orientation (figure C.16), form, space transitions (figure C.17), materiality, facade openings, levels, routing etc.

As with the fragmentation approach, 'mistakes' create confusion and wonder. This is regarded as a way of encouraging users to discover heritage architecture. This new experience is mostly created through removal rather than addition.

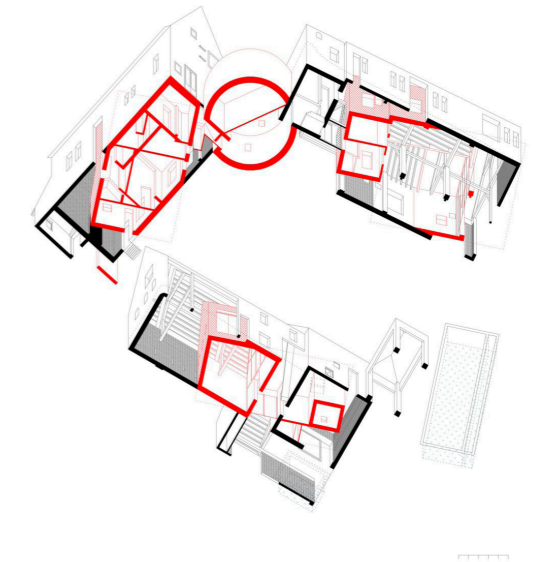


Figure C.16. Woning CG, reorientation. Source: <https://architectenjdviv.com/>

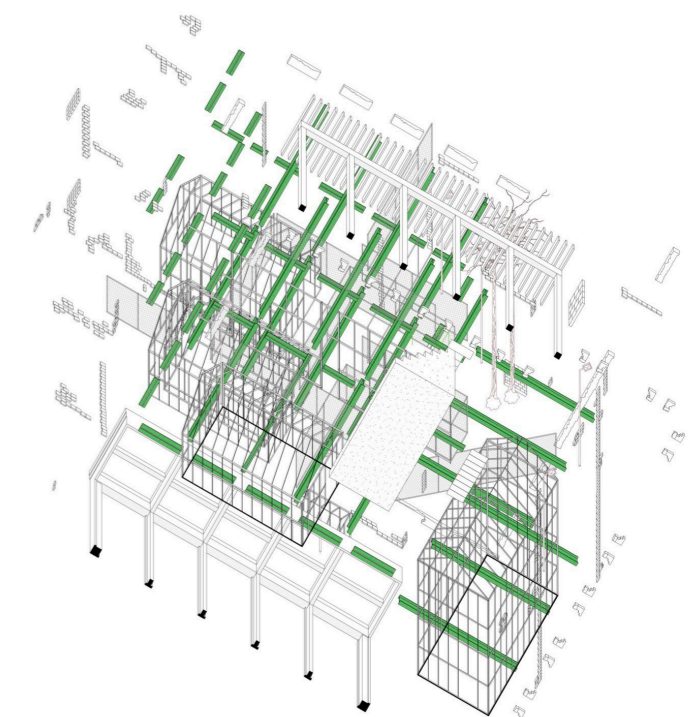


Figure C.17. Pc Caritas, confusion of inside and outside space. Source: <https://architectenjdviv.com/>

C. Extensive version of Chapter II.2 - Design Approach

Making Mistakes at ASA

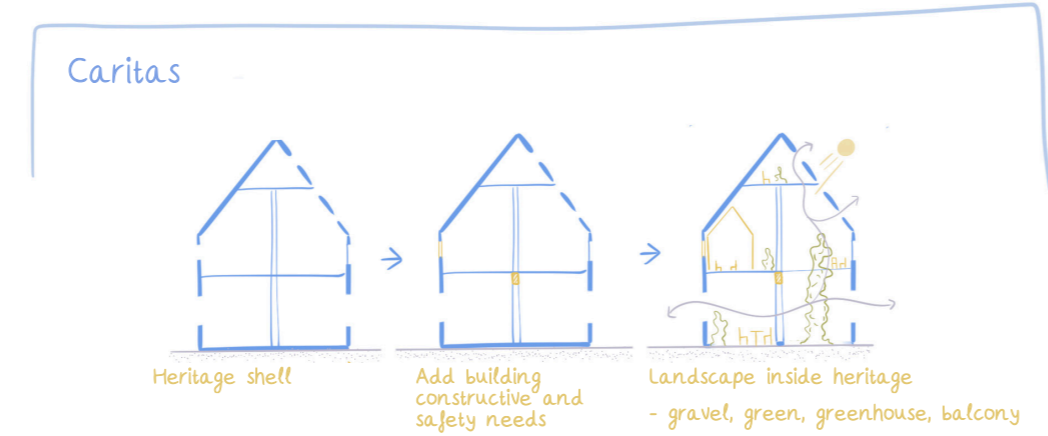
Making mistakes at the ASA could be expressed through the inside-or-outside and reorientation method (figure C.18).

The inside-or-outside method creates awareness of the theme, heritage as a landscape. Heritage is perceived as a shell. Openings in the roof, missing floors, removed windows, gravel inside and greenhouses create confusion as to whether the space should be considered inside or outside.

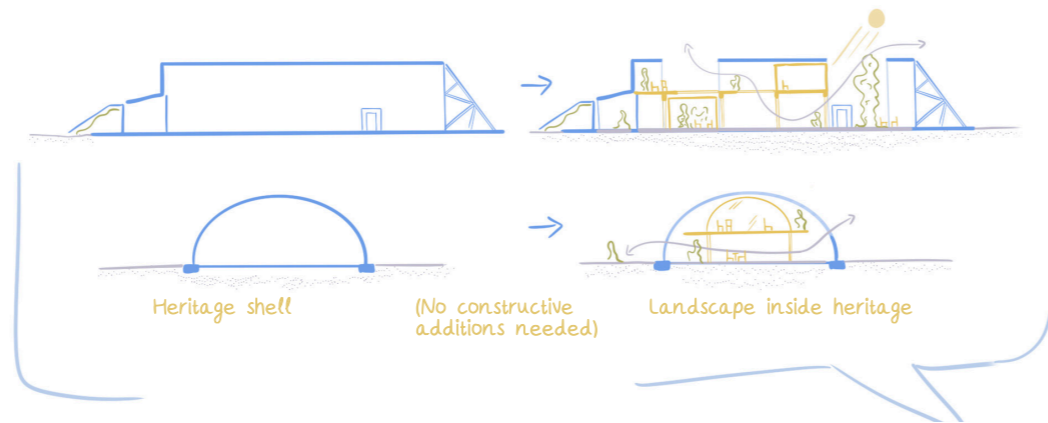
The reorientation method creates awareness and curiosity in the form, orientation and placement of the shelters.

Together, these methods encourage the discovery of environmental processes, ecology and culture.

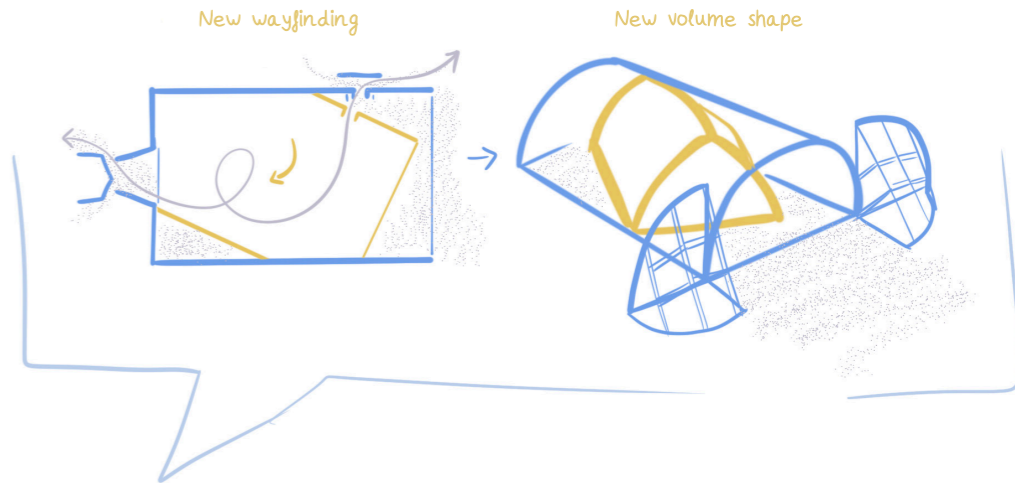
Is this inside or outside?



Airshelter



Reorientation



Combine..

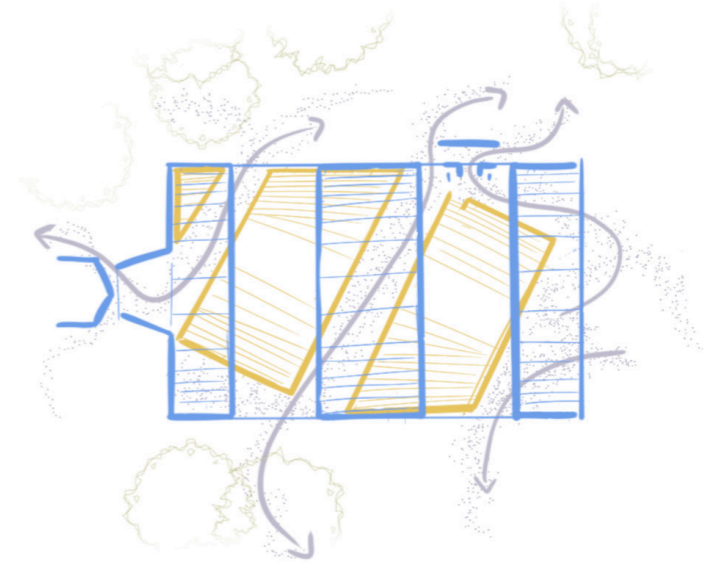


Figure C.18. Sketches of the Missing Approach at the Air Shelter Area. Source: Own work.

C. Extensive version of Chapter II.2 - Design Approach

2.5. Positioning Current Approaches At the Airbase

In finding a fitting design approach for the ASA, it is important to consider the approaches of the organisations that exist at the airbase; the National Military Museum (NMM), De Vliegbasis, and Utrechts Landschap.

The NMM's landscape, designed by H+N+S+ (n.d.), functions as decor for the museum, narrating the site's military history (figure C.19). Similar to the articulation approach, military timelayers have been made visible again within the landscape. German bombings are revealed through waterponds and the gabions refer to medieval military hiding tactics. The museum's architecture was inspired by the identity and catalogue of the hangars.

De Vliegbasis (n.d.) is a neighbourhood under development at the airbase (figure C.20). Residents will collaborate to protect the site's nature and its biodiversity. Like the articulation approach, their approach involves creating clusters of atmospheres. Each cluster has its own architectural typography adapted to the landscape's layers, making the atmosphere and stories of the site readable.

The natural park is owned by Utrechts Landschap. Their general approach (Bakker, 2011) is also similar to the articulation approach. Cultural objects are maintained in clusters and patterns of timelayers are readable. By removing hard surfaces and exotic species biodiversity is enhanced. To improve connectivity, they created viewpoints and pathways. At the ASA, the current approach is 'conservation by non-intervention'. Slow decay and inaccessibility are intended to preserve the historic atmosphere of secrecy.

Overall, the articulation approach is most evident across the airbase in the form of clusters and readable timelayers. However, articulation of older cultural timelayers from before the aviation activity are not well represented. Secondly, the fragmentation approach is evident in the removal of hard surfaces; despite the disappearance of the material, the shapes remain recognisable. However, the hardened shelters remain untouched. The 'conservation by non-intervention' approach for the shelters contradicts

the approach taken to create more habitats and enhance biodiversity. Opening the air shelter through fragmentation supports nature connectivity and development, while enhancing cultural value through wonder. Thirdly, the analogue approach is used in the architecture of the museum and the new houses. This is approach could be continued in the additions made at the ASA, adding that the 'continued story' should both respect cultural and natural values. Lastly, the missing approach is currently not applied. Introducing this approach at the ASA presents an opportunity to deepen the awareness and experience of the theme of this research: heritage reimagined as a landscape.



Figure C.19. NMM at Airbase Soesterberg by H+N+S. Source: <https://hnsland.nl/>



Figure C.20. Plan of De Vliegbasis at Airbase Soesterberg. Source: <https://wonenopdevliegbasis.nl/>

D. Extensive version of Chapter II.3 - Building Construction

This chapter addresses the following question: *How can the materiality and structural design of newly built architecture convey the concept of architecture as a landscape in the air shelter area?*

The definition of a landscape (p. 13) led to the identification of five building construction strategies that convey architecture as a landscape: Moving Materials (figure D.1), Ecolope (figure D.2), Ecosystem (figure D.3), Bioregional Materials (figure D.4), and Design for Change (figure D.5). Together, these strategies inform the construction of new architecture as a landscape at the ASA.

3.1. Moving Materials

Environmental processes



Figure D.1. Miyajima Misen observatory by Sambuichi.
Source: Sambuichi (2015)

3.2. Ecolope

Ecology



Figure D.2. NEST by NAMO.
<https://namoarchitecture.nl/project/vreemde-vogels/>

3.3. Ecosystem

Self-sustaining



Figure D.3. Outside Woodlands Nursery & Forest School. Source: Feilden Clegg Bradley Studios.

3.4. Bioregional Materials

Materiality



Figure D.4. LOT 8 by BC architects.
Source: <https://bcarchitects.org/>

3.5. Design for Change

Flexible building components



Figure D.5. Fuji Kindergarten by Tezuka Architects.
Source: <https://regenerativedesign.world/fuji-kindergarten/>

D. Extensive version of Chapter II.3 - Building Construction

3.1. Moving Materials

'Environmental processes' is an actor of a landscape (p.13). If architecture is reimagined as a dynamic landscape rather than as a static object, it must engage with these forces of the environment.

Sambuichi is a Japanese architect who expresses the environmental processes through architecture. He reads a site with the cycle of seasons and 'moving materials': sun, wind and water. These 'moving materials' have a speed, direction and density which can be affected by architecture's non-moving materials (glass, stone, wood and steel). (Hushimoto, 2011)

The Miyajima Misen Observatory (Sambuichi, 2015) showcases this principle well. The angled louvres (figure D.6) soften the sunlight and slow down the runoff of rainwater and the speed of the wind. In order to make people aware of the moving materials, they are invited to sit still ('za') (figure D.7).

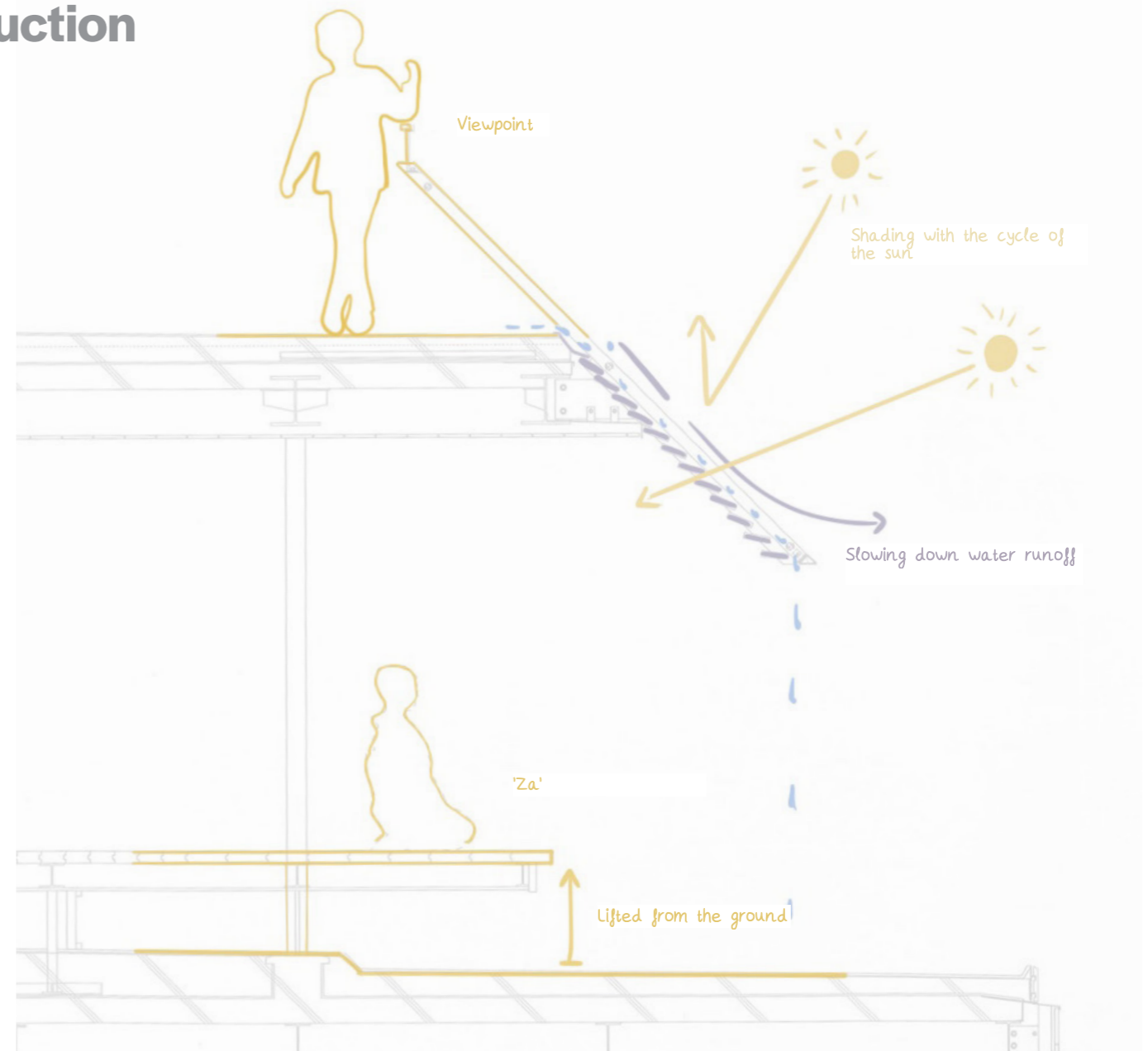


Figure D.6. Detailed section from the Miyajima Misen Observatory. Source: Sambuichi, 2015, annotations added by the author.



Figure D.7. Inside view from the Miyajima Misen Observatory. Source: Sambuichi, 2015

D. Extensive version of Chapter II.3 - Building Construction

Designing with moving materials at the ASA

An analysis of moving materials at ASA (Appendix G) is summarised in figure D.8, marking a potential location for the nature school. The section drawings demonstrate how the design of these shelters could interact with environmental forces. They show how the air shelter could filter light, guide wind and manage rainwater. The shelter is no longer a closed object, but becomes a responsive landscape.

Potential location



Moving materials in a section

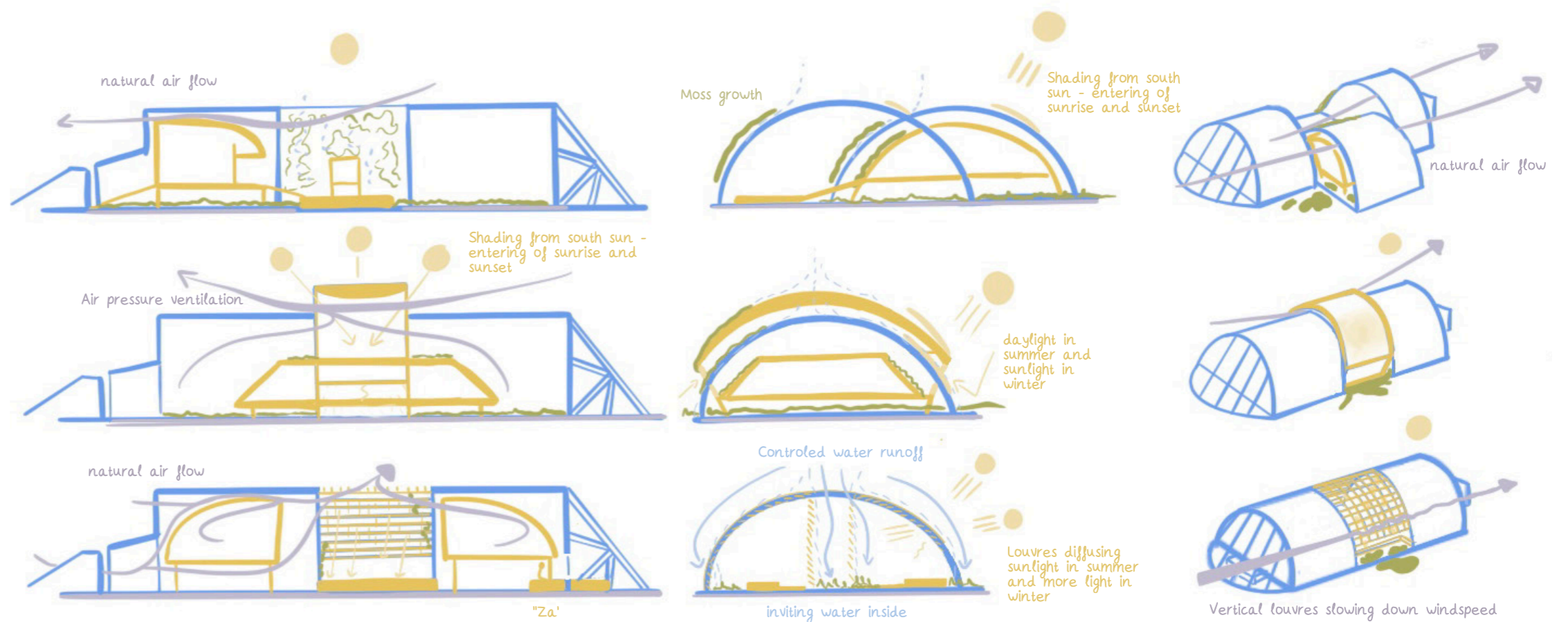


Figure D.8. Sketches of designing with moving materials in an air shelter. Source: Own work.

D. Extensive version of Chapter II.3 - Building Construction

3.2. Ecolope

The second actor of a landscape is 'Ecology' (p. 13). This implies that architecture should be a multi-species living space. ECOLOPES is a research project of the Technical University of Munchen that focuses on how the building envelope can be transformed into an 'ecolope' that benefits four types of inhabitants; humans, plants, animals, and microbiota (Weisser et al., 2023; figure D.9). As stated in the project, "The ecolope designed by this multi-species approach will restore the beneficial human-nature relationships..."

From this perspective, ecology can be integrated into Brand's (1995) building layers. The structure, skin, and site should not only serve human needs but also allow plants to grow, provide nesting spaces for animals, and support insects and microorganisms.

One project that demonstrates this building approach is 'Buitenverblijf NEST' (figure D.10). The building's facade is made up of three layered parts that extend outwards, creating space for built-in nesting boxes. Behind the cladding, animals such as birds and bats find shelter. In addition, the steel frame and the beams under the raised floor provide places for nests. The lifted volume makes the ground floor accessible for all four inhabitants. The architecture acts as an ecological corridor and habitat.

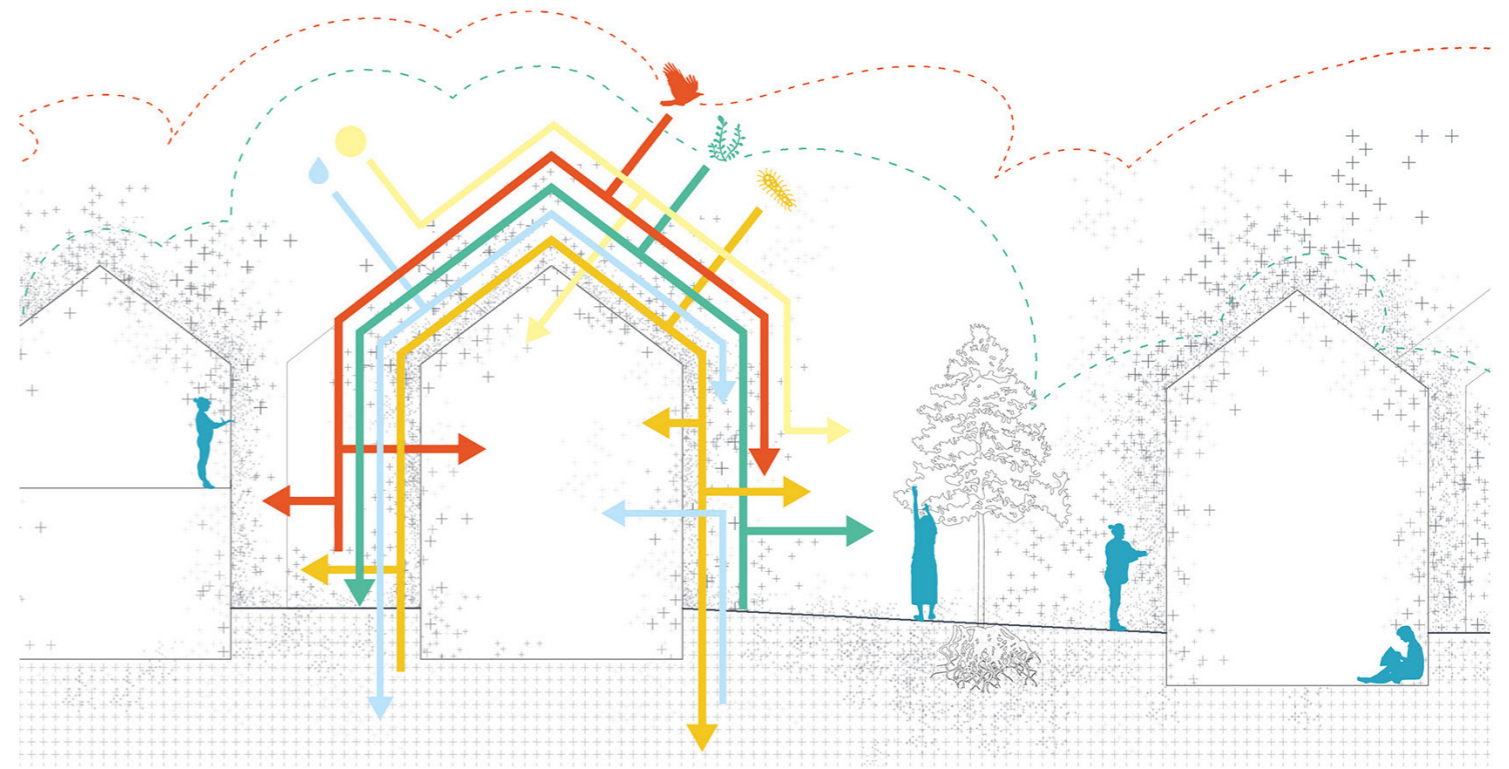


Figure D.9. The ecolope, a conventional building envelope transformed into a dynamic living space for animals, plants and microbiota. Source: Weisser et al., 2023.



Figure D.10. NEST by NAMO. Source: <https://namoarchitecture.nl/project/vreemde-vogels/>

D. Extensive version of Chapter II.3 - Building Construction

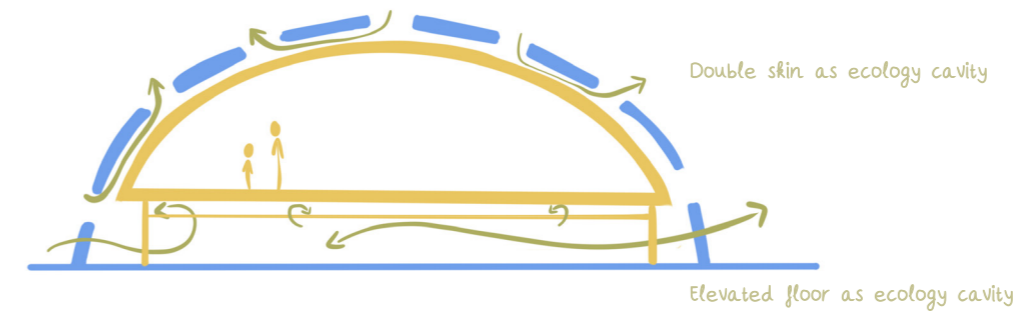
Ecolope at the ASA

Creating an ecolope is about thinking of corridors and habitats for ecology (See Appendix G for an analysis on the ecological habitats at ASA).

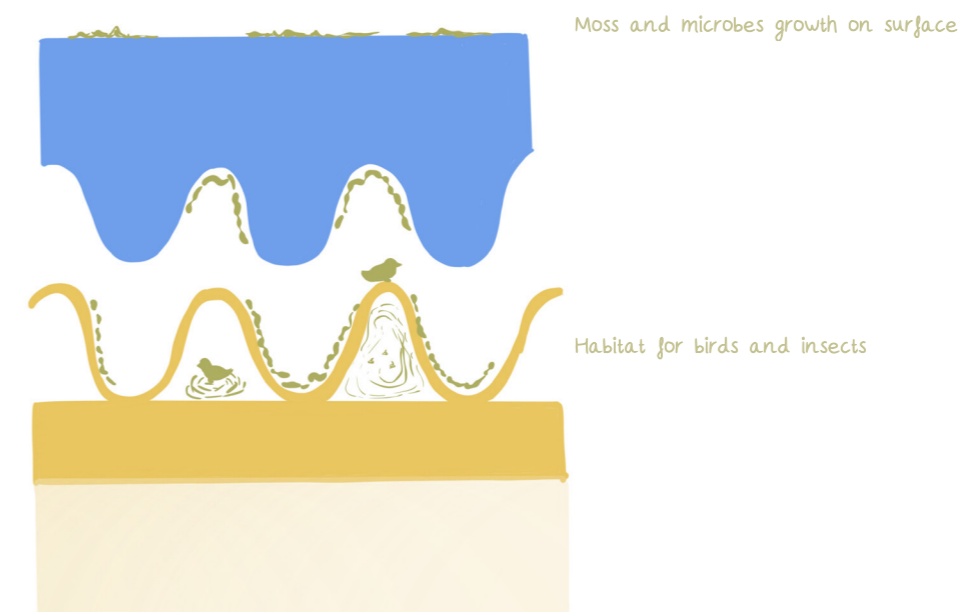
Creating ecology corridors involves considering the routing and migration possibilities of species. This can be achieved by elevating the architecture from the ground (figure D.11). Additionally, playground barriers should be designed to allow animals to pass through (Appendix I).

Habitats can be created at the building envelope by integrating prefabricated nesting elements, such as bat and bird bricks. Another approach is to directly integrate ecology spaces in the building construction by designing intentional cavities. This scenario is explored at the ASA to evaluate how the building construction itself can contribute to habitat creation. Figure D.11, illustrates an elevated structure that uses the concrete as double skin to add an ecology-inclusive building layer within the envelope. Animals, plants and microbes can inhabit the envelope without compromising the indoor comfort for people.

Heritage as Ecolope



Roof cavities



Facade cavities

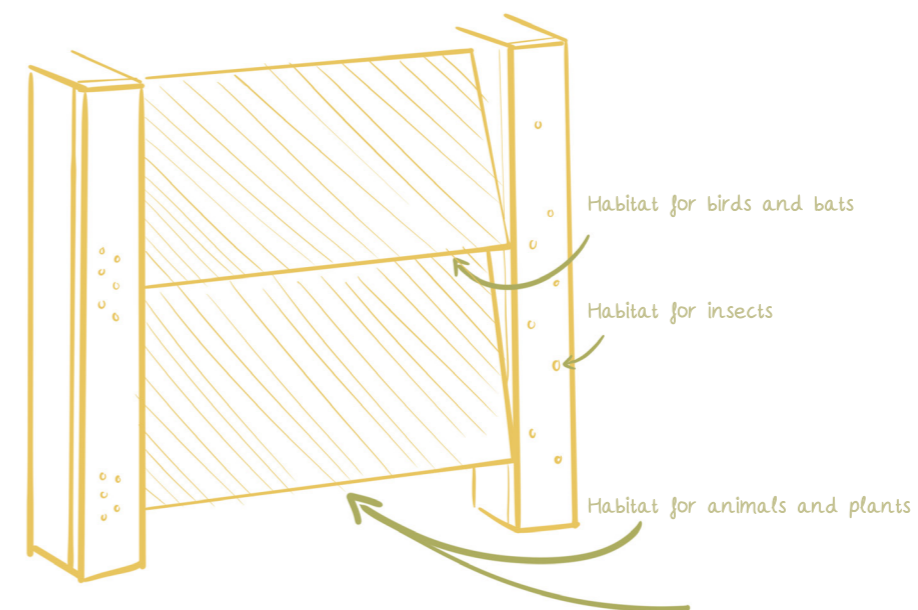


Figure D.11. Ecolope of an Air Shelter. Source: Own work.

D. Extensive version of Chapter II.3 - Building Construction

3.3. Ecosystem

Landscapes are part of an ecosystem. A natural ecosystem is self-sustaining. If a building is reimagined as a landscape, it should be off-the-grid and self-sufficient.

Woodlands Nursery and Forest School (n.d.; figures D.12 & D.13) illustrates strategies for a net-zero building. The patio makes spaces gain from passive solar energy in winter. The building envelope is highly insulated and airtight. Electricity is generated through solar panels. Use of electricity for lighting is limited through the use of indirect light from skylights. A (air source) heat pump system supplies heat to zoned underfloor heating. Earth tube ventilation provides stable air temperatures in winter and summer. The stale air leaves through leaves through skylights.

To achieve a fully off-the-grid, closed-loop building, the cycles of food, water, energy and waste must be completed. This can be achieved by growing food, integrating rainwater harvesting and storage, adding battery systems for year-round energy resilience and incorporating composting toilets to recycle nutrients. With these strategies the building turns into a self-sustaining ecosystem.

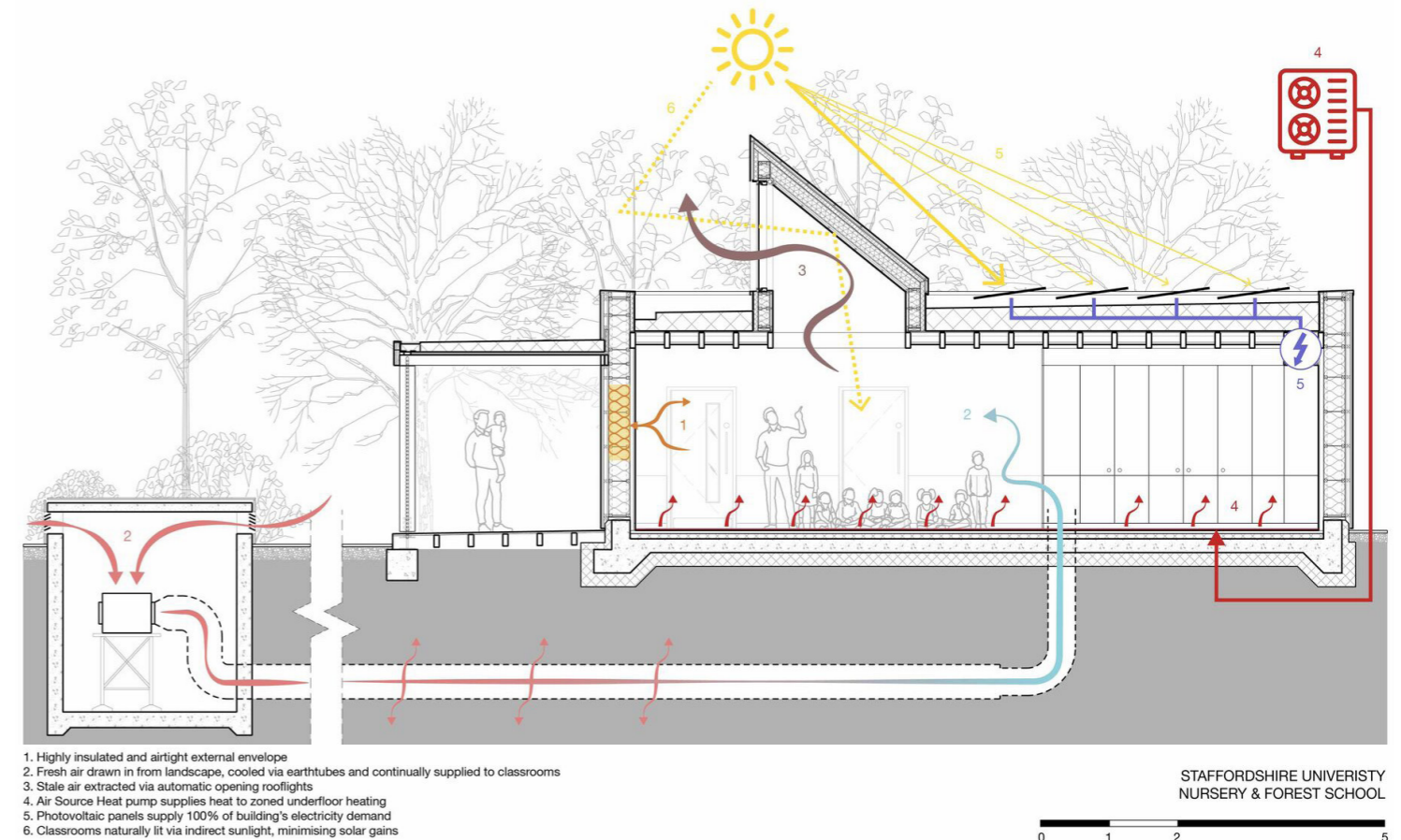


Figure D.12. Climate section Woodlands Nursery & Forest School. Source: Feilden Clegg Bradley Studios.



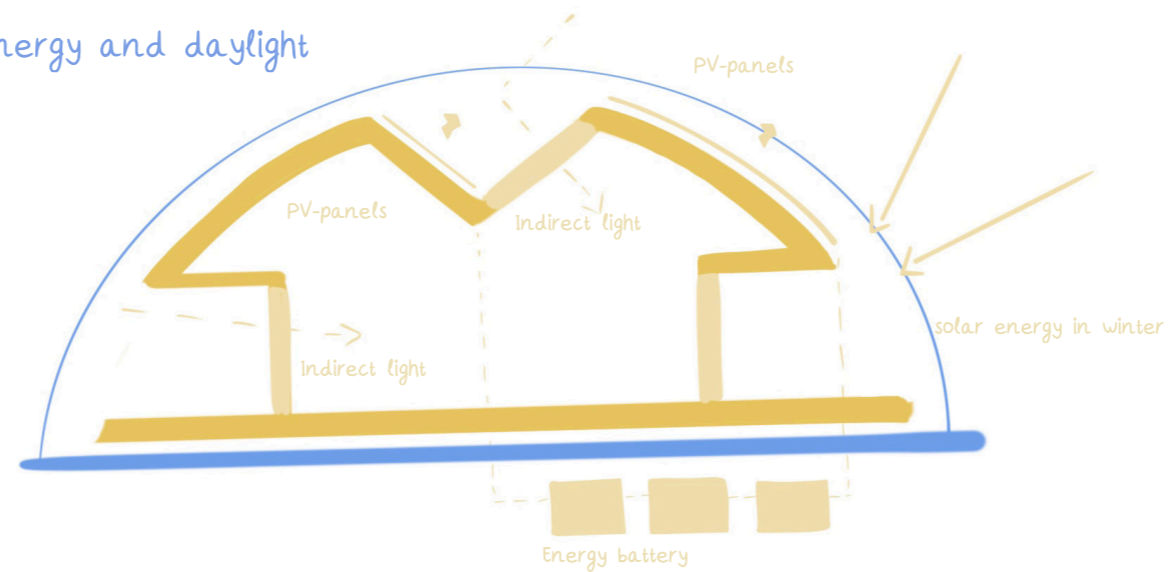
Figure D.13. Outside Woodlands Nursery & Forest School. Source: Feilden Clegg Bradley Studios.

D. Extensive version of Chapter II.3 - Building Construction

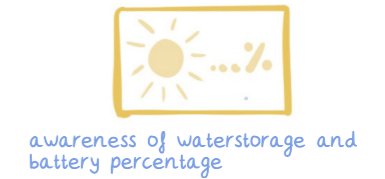
Ecosystem at the ASA

A strategy to create a self-sustaining ecosystem at the ASA is illustrated in figure D.14. By subtracting volume from the building, a roof shape and patio are formed for solar efficiency. The school makes use of indirect light and passive solar energy. Photovoltaic (PV) panels generate electricity, which is stored in batteries for year-round use. Smart meters display real-time energy consumption and storage levels, raising children's awareness of the school's energy and water usage. Rainwater is collected, filtered, and stored for daily use and for irrigating the garden. Children can also access and interact with the water system directly via an interactive water pump. Ventilation is achieved through earth tube inlets, which precondition incoming air. Stale air exits through roof outlets. A composting system can be installed to manage organic waste, producing nutrient-rich compost and water for the garden.

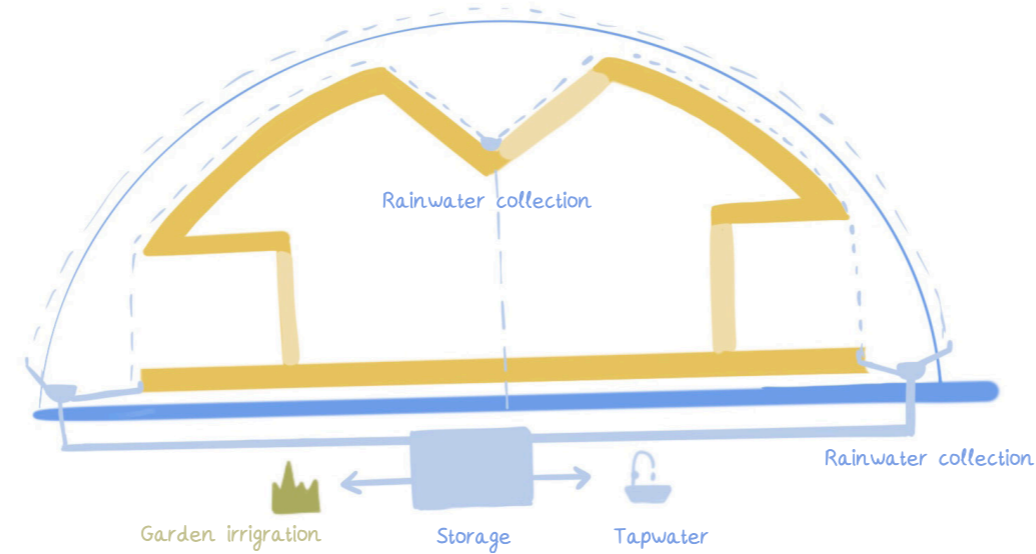
Solar energy and daylight



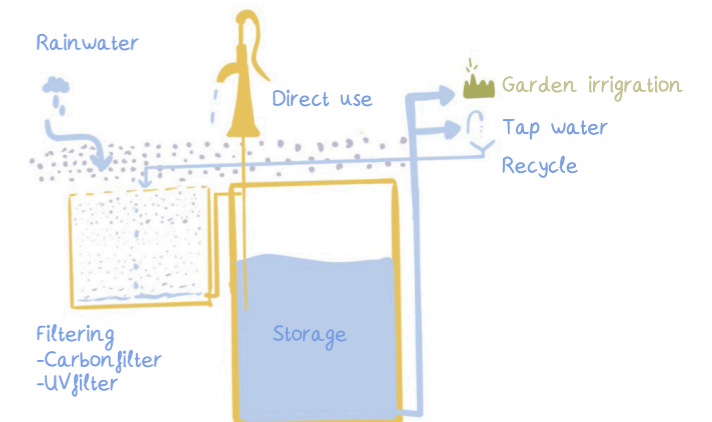
Smart meters



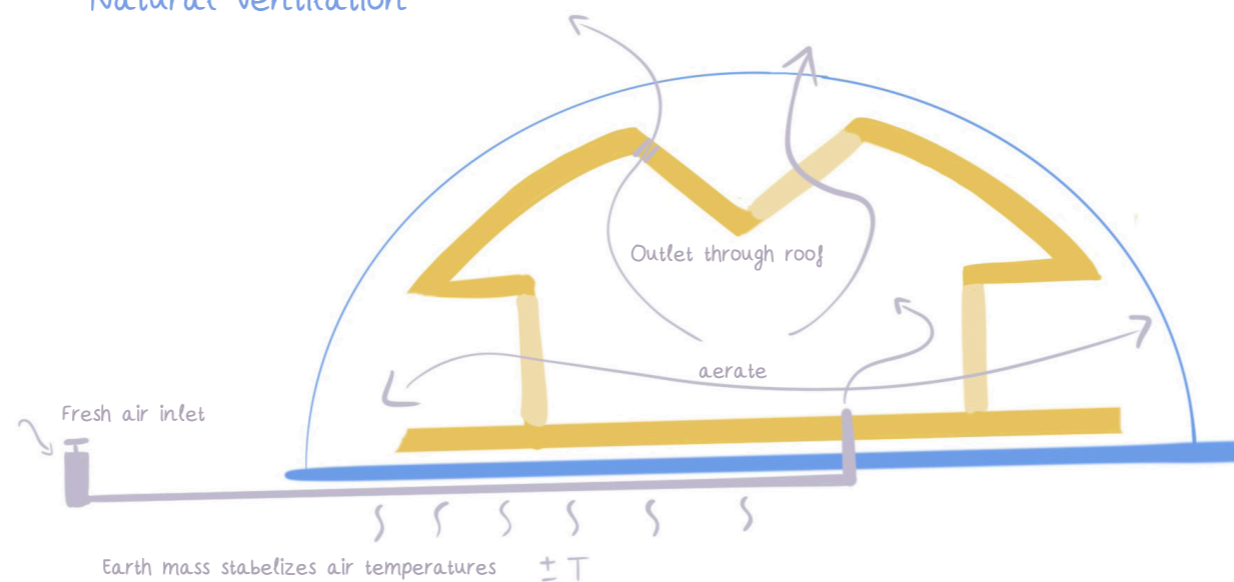
Rainwater storage



Water recycling



Natural ventilation



Composting toilet

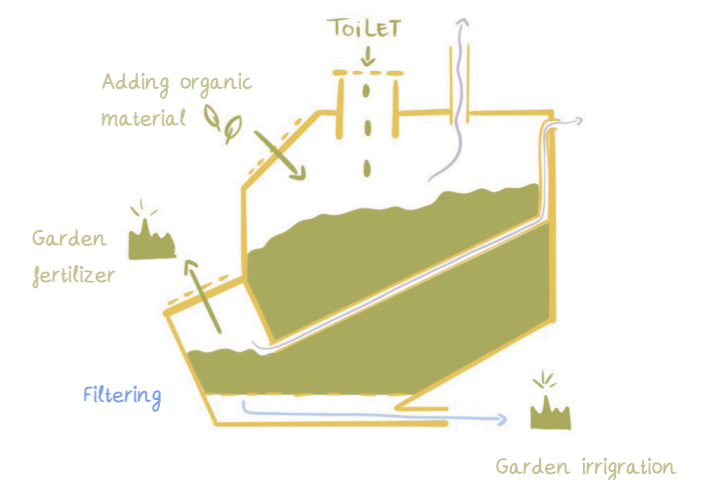


Figure D.14. A strategy to turn an air shelter into an ecosystem. Source: Own work.

D. Extensive version of Chapter II.3 - Building Construction

3.4. Bioregional Materials

If heritage architecture is meant to act as a landscape, its added materiality should connect to the natural and cultural environment.

Bioregional materials link a building to the region's geology, ecology, and cultural craftsmanship. Additionally, regenerative materials support natural cycles and reduce environmental impact. BC Architects creates bioregional architecture by sourcing materials locally (figure D.15), building on-site and collaborating with local craftspeople (figure D.16). By choosing this materials strategy, architecture can act as a continuous part of the landscape.

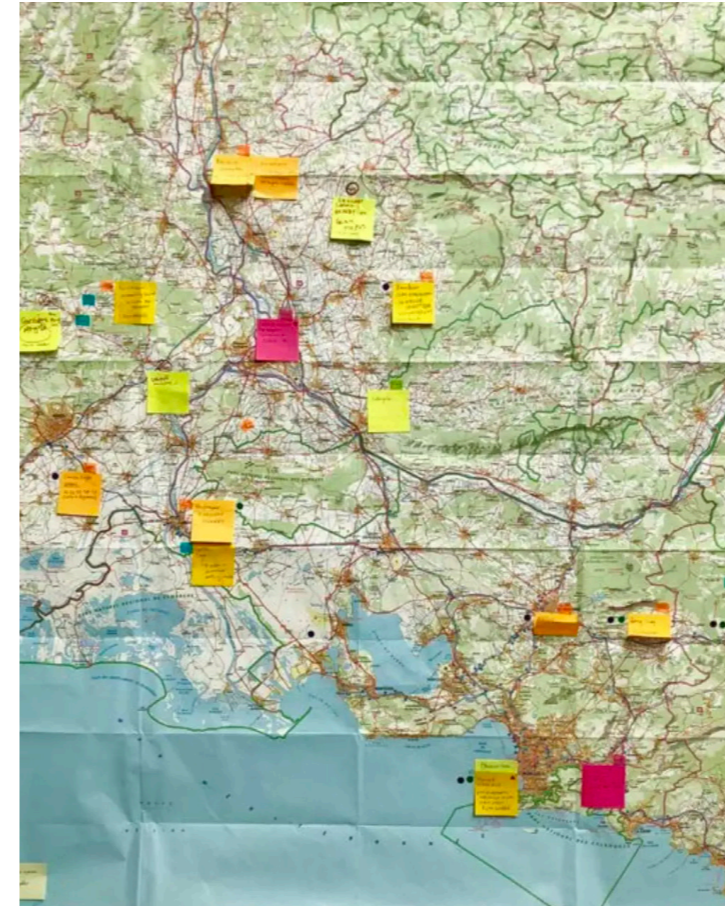


Figure D.15. Mapping and detailing local resources of LOT 8, by bc architects. Source: <https://bcarchitects.org/>

3. Earth Plaster

- A. Acoustic Layer, Earth Plaster
- B. Adhesion Layer, Earth Plaster
- C. Adhesion Layer, Canne de Provence
- D. Window Frame, Aluminium
- E. Panelling, Sunflower Fibers
- F. Support Structure, Wood
- G. Insulation, Rice Straw-Bale Blocks

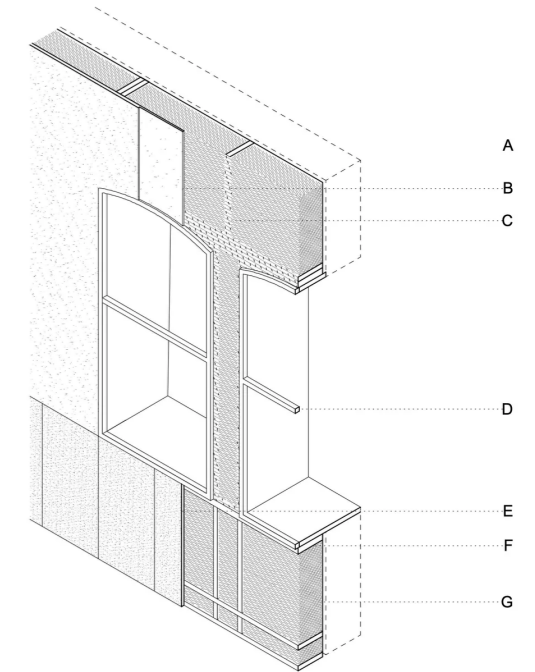
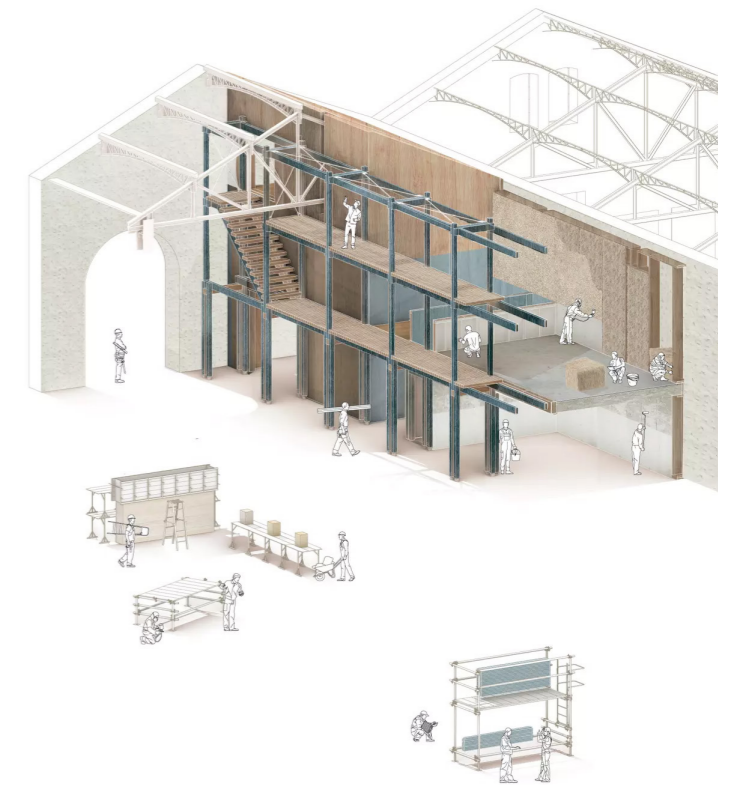


Figure D.16. Local crafts, experimenting and building proces of LOT 8, by bc architects. Source: <https://bcarchitects.org/>



D. Extensive version of Chapter II.3 - Building Construction

Resources on site

Bioregional Materials at the ASA

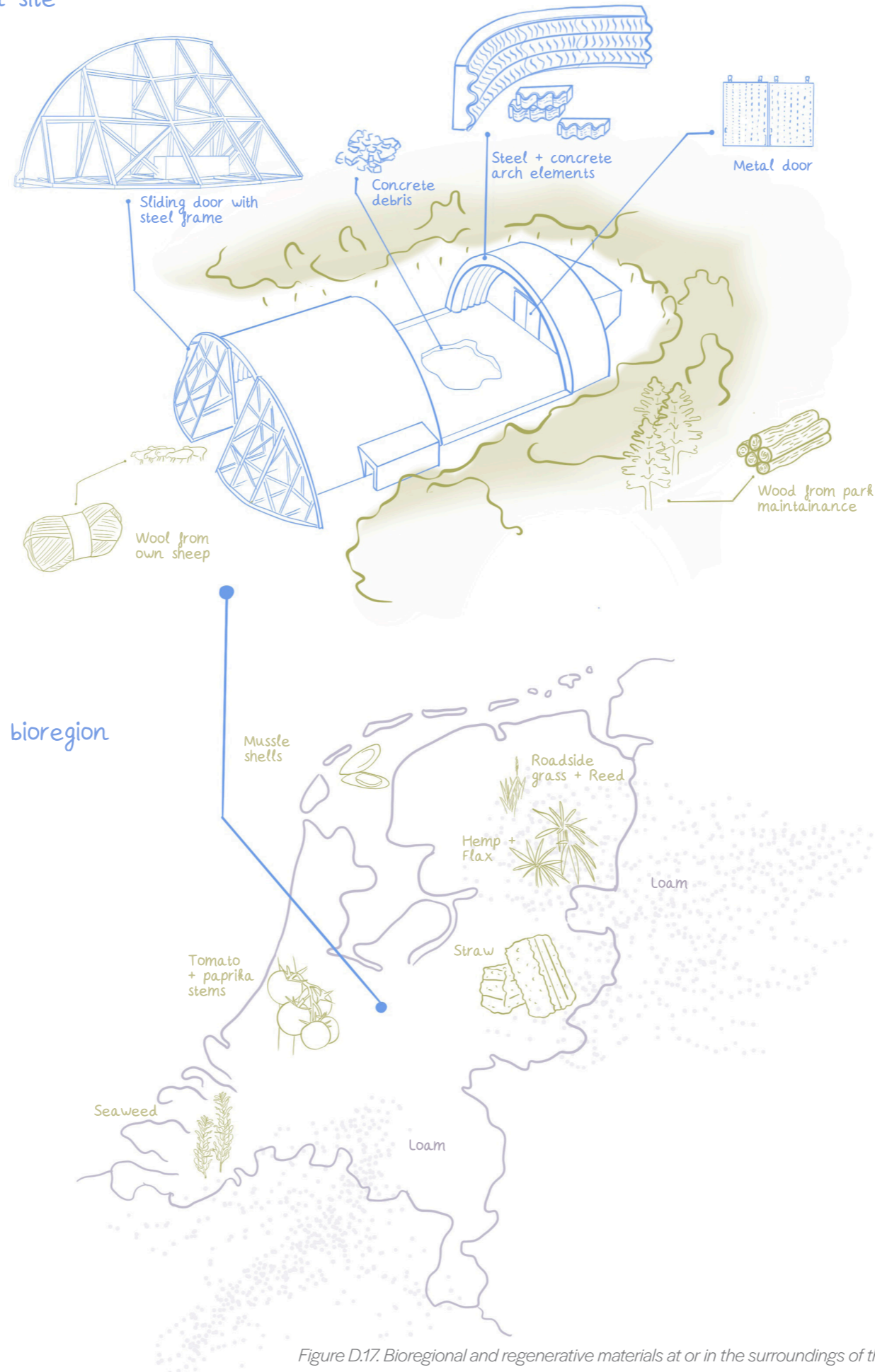
Working with bioregional materials starts with mapping these materials at the ASA (figure D.17).

Considering the building as a landscape, its building layers could also be defined as 'bioregional materials'. Therefore, the ASA's resources include not only wool from the sheep and wood from the park maintenance, but also the concrete slabs and steel doors of the shelters.

Within the Netherlands, a range of regenerative materials can be found (figure D.17). Taking an analogue approach, materials that relate directly to the air shelter's immediate bioregion should be selected, such as flax, straw and loam, rather than materials from other contexts, such as seaweed or mussel shells.

At the ASA, bioregional materials can be applied across the building's layers: interior, structure, insulation and skin. The design would not only reduce environmental impact, but also strengthen the connection between the actors of a landscape.

Resources in bioregion



Building materials

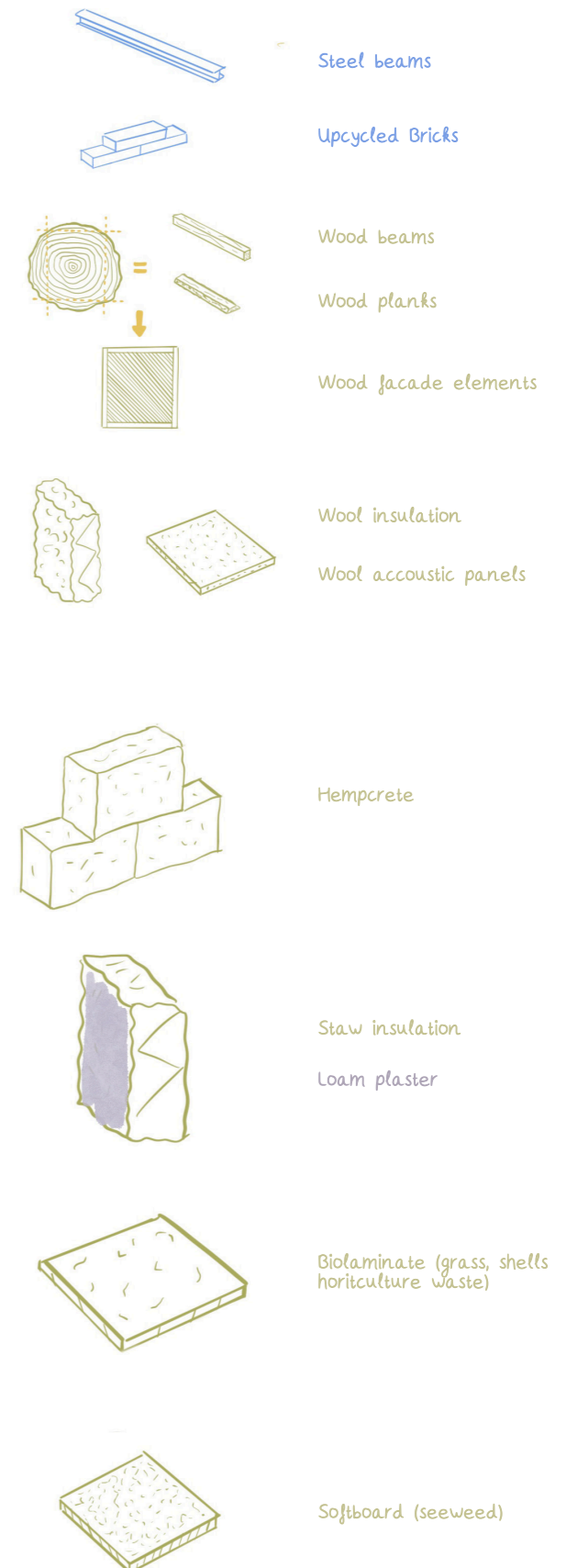


Figure D.17. Bioregional and regenerative materials at or in the surroundings of the airshelter area. Source: Own work.

D. Extensive version of Chapter II.3 - Building Construction

3.5. Design for Change

Landscapes change dynamically over time and through seasonal cycles. For new architecture, this implies the need for flexible and adaptable building components.

In 'Building for Change' (2022) it is described that reuse exists in four scales; materiality (disassembly of components), building (programmatic flexibility), site (capacity for different use) and time (future use). As the site is already being designed for change through proposing a nature school at a former military site, this paragraph focuses on the scales of time, the building and materiality.

The scale of time involves considering the future, in terms of evolving programmes and the lifecycle of materials. Designing for time means enabling transformations, expansions, contractions and repurposing.

The scale of the building is about creating seasonal and future programmatic flexibility. This translates into an open and strategically organised floorplan. Therefore, the architecture should integrate flexible furniture and movable partition walls (interior/exterior) facilitate cultural and natural program changes (figure 48). In this way the building's interior could become exterior and smaller spaces could join into larger ones.

At the scale of materiality, future changes are enabled through Design for Disassembly [DfD]; dismantlement of material components. Material connections should be designed with dry joints, such as interlocking or mechanical joints (figure 49). Instead of dismantling singular components the building could also consist of larger prefabricated modules that can be removed, relocated, or replaced (figure 50).

Not all scales need to be addressed when designing for change. The reuse scales can work independently or collaboratively (Ruth Lang et al., 2022).

A. Changing Boundaries

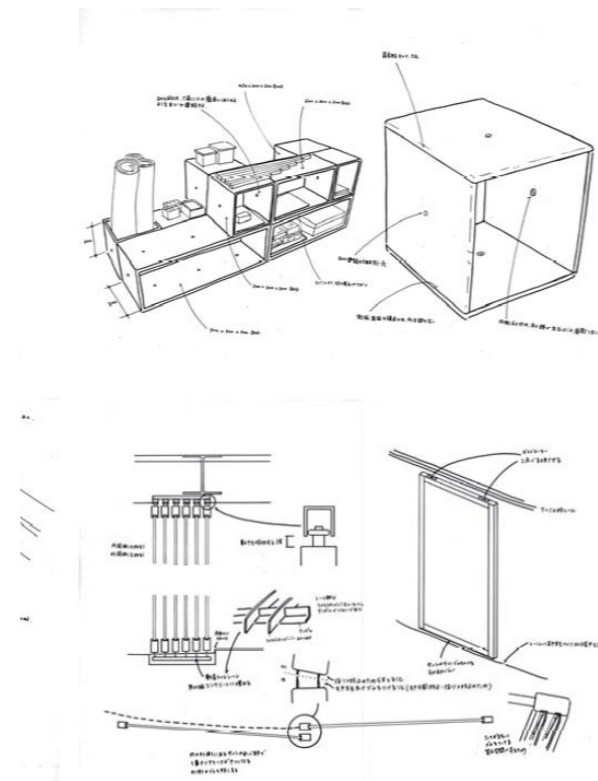
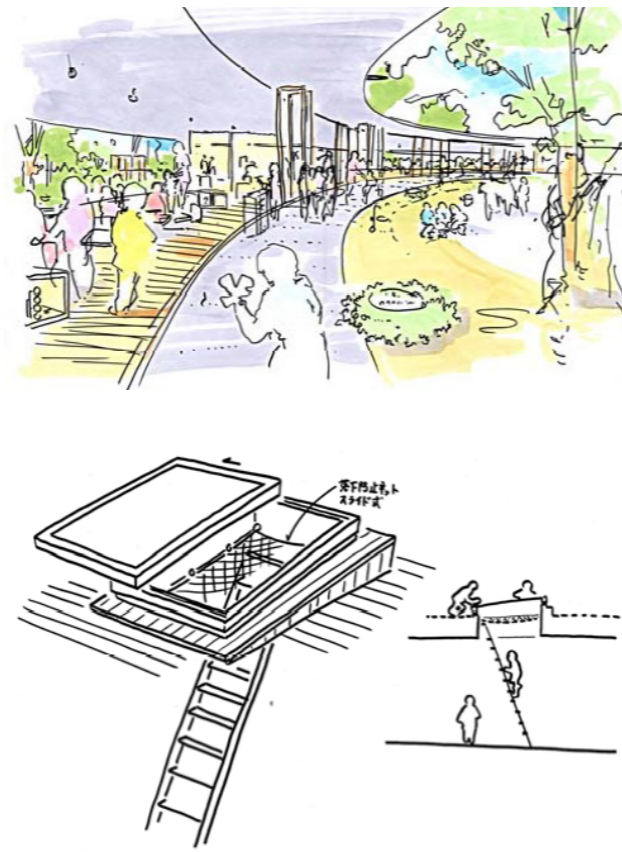


Figure 48. Fuji Kindergarten by Tezuka Architects.
Source: <https://blueprint.ozpropertygroup.com.au/fuji-kindergarten-tokyo-japan/>

B. Dry Joints

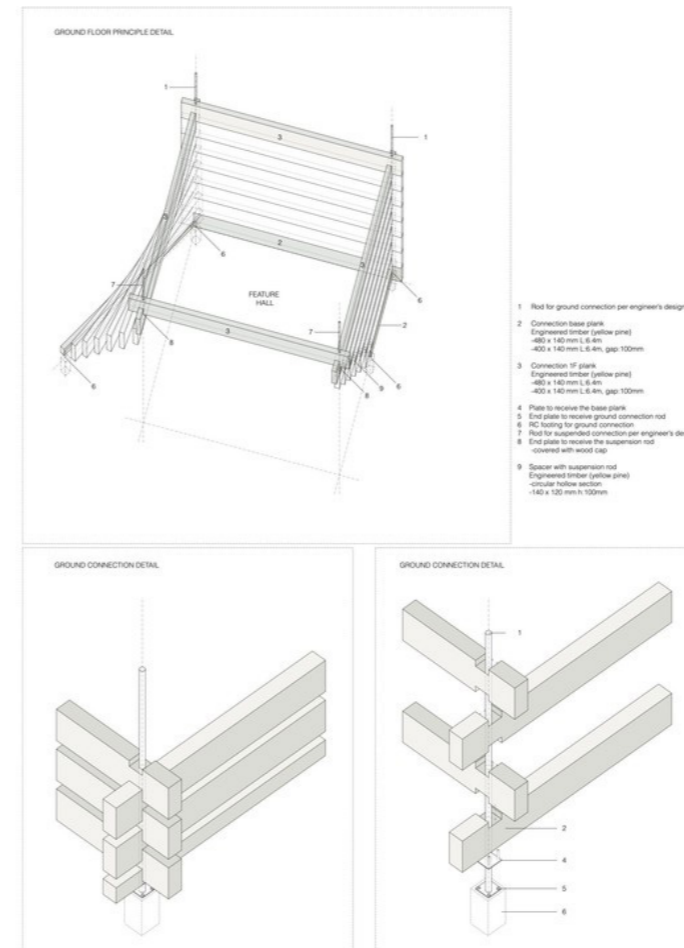
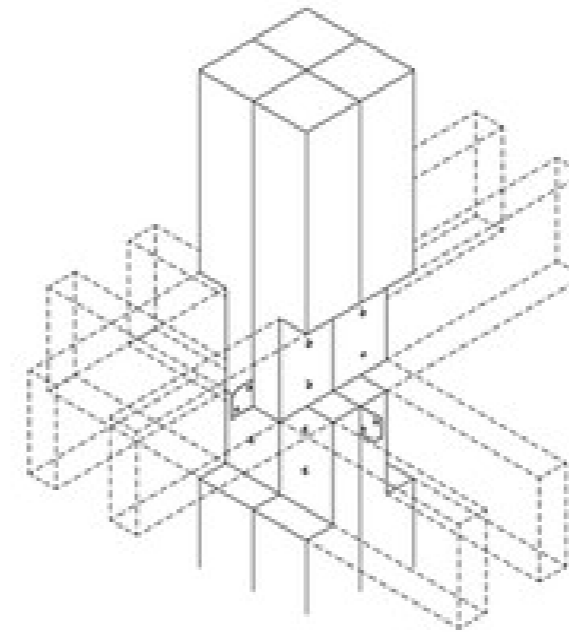
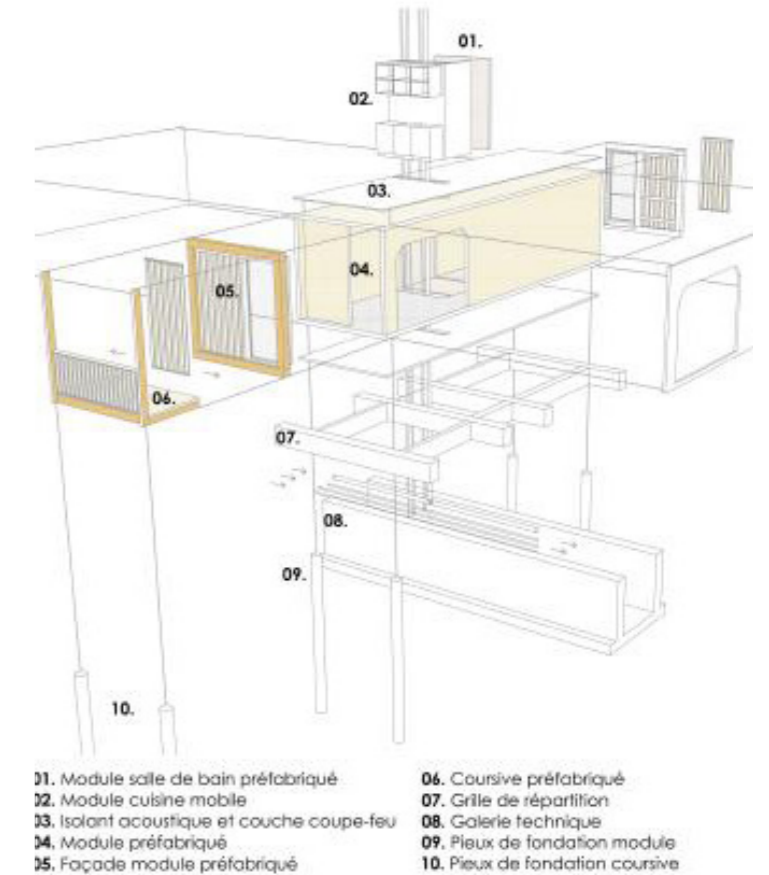


Figure 49. Dry joints methods by Kengo Kuma.
Source: <https://www.archdaily.com/934591/details-of-wooden-structures-in-kengo-kumas-work>

C. Modules and Prefab



- 01. Module salle de bain préfabriqué
- 02. Module cuisine mobile
- 03. Isolant acoustique et couche coupe-feu
- 04. Module préfabriqué
- 05. Façade module préfabriqué
- 06. Course préfabriqué
- 07. Grille de répartition
- 08. Galerie technique
- 09. Pieux de fondation module
- 10. Pieux de fondation course

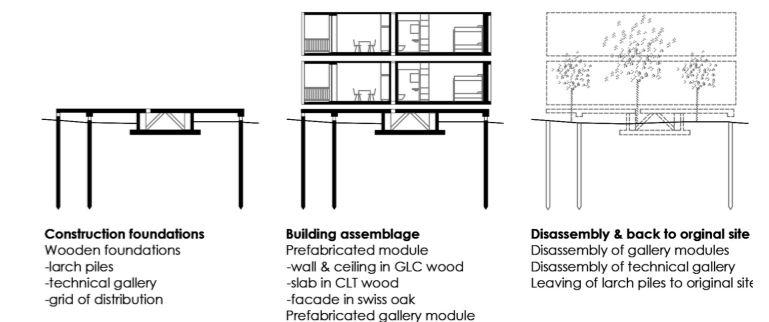


Figure 50. DfD at Rigot collective dwelling centre, by acau.
Source: <https://www.acau.ch/projets/amig-rigot>

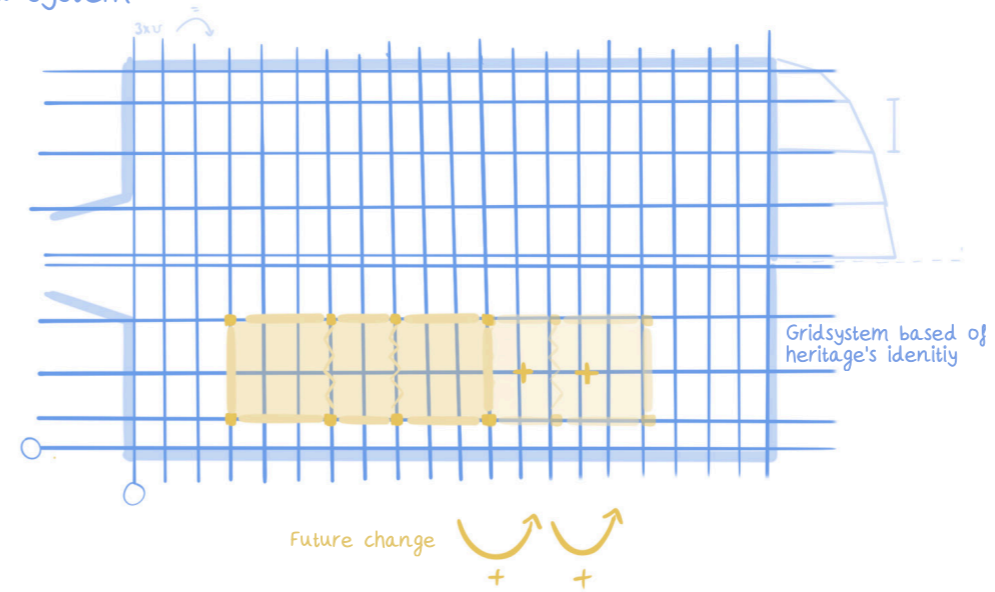
D. Extensive version of Chapter II.3 - Building Construction

Design for Change at the ASA

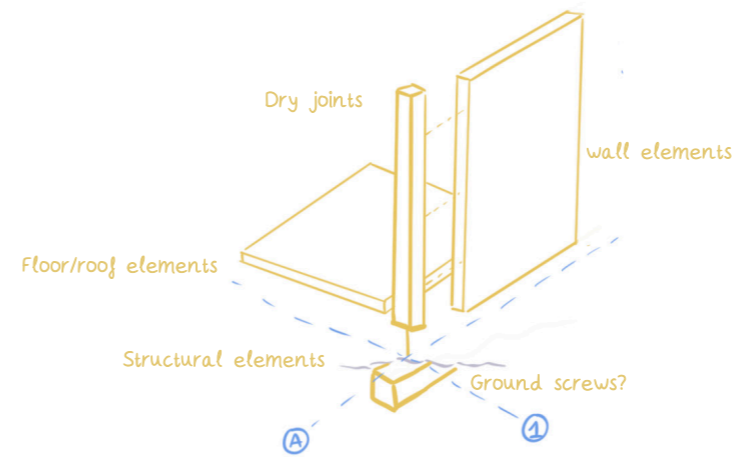
A flexible plan for the air shelter can be designed using a systematic grid, dry joints and flexible boundaries (figure 48). A systematic grid enables spaces to be expanded or reduced for future changes in the natural-cultural program. The components should use dry connections, so elements could be removed, replaced or repurposed. To adapt the construction to different uses during the day or across seasons, the spatial boundaries can be altered by sliding, pivoting, or using furniture elements. In this way, the user is able to define indoor, indoor-outdoor and outdoor zones.

Together, the building can adapt to changes in future, seasonal and day-night use.

Grid system



Dry joints of components



Flexible space boundaries

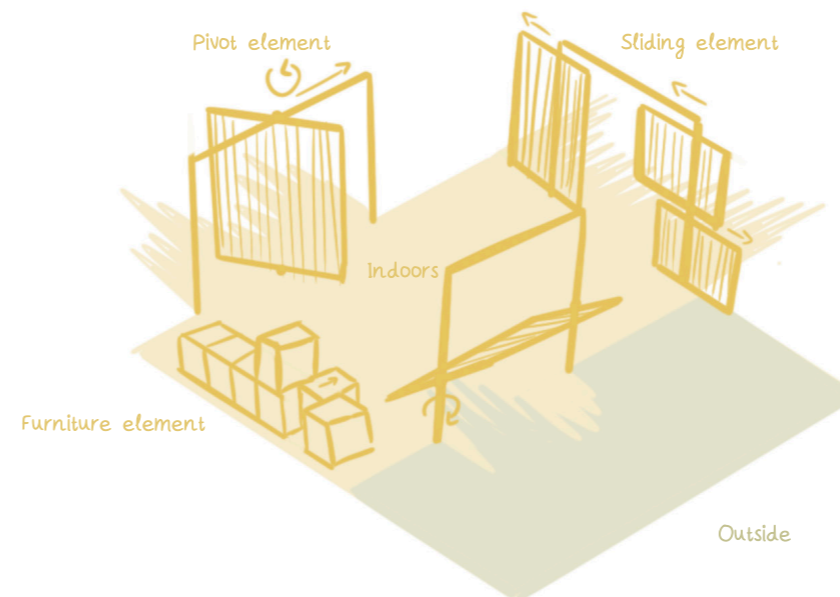


Figure 48. Strategies for design for change at the ASA. Source: Own work.

E. Extensive version of Chapter II.4 - Program of Requirements

This chapter addresses the following question: *How do spatial characteristics and program approaches encourage children's learning and engagement with nature at the air shelter area?*

The spatial characteristics are analysed using the principles of Exploration of Spaces (figure E.1), Learning with Nature (figure E.2) and Connectivity of Community (figure E.3), as found in cases of educational architecture. Together with an analysis of the programs of nature school organizations (figure E.4.) a coherent program of requirements and zoning plan is formed for the ASA.

4.1. Exploration of Spaces



Figure E.1. School of Architecture by Doshi.
Source: <https://arquitecturaviva.com/>

4.2. Learning with Nature



Figure E.2. Gjai kindergarten by Henning Larsen.
Source: <https://henninglarsen.com/>

4.3. Connectivity of Community



Figure E.3. House of elementary education by LP architekt.
Source: <https://www.lparchitektur.at/>

4.4. Program and Zoning Plan



Figure E.4. Collage of education programs analysed for the program requirements. Source: Own work

E. Extensive version of Chapter II.4 - Program of Requirements

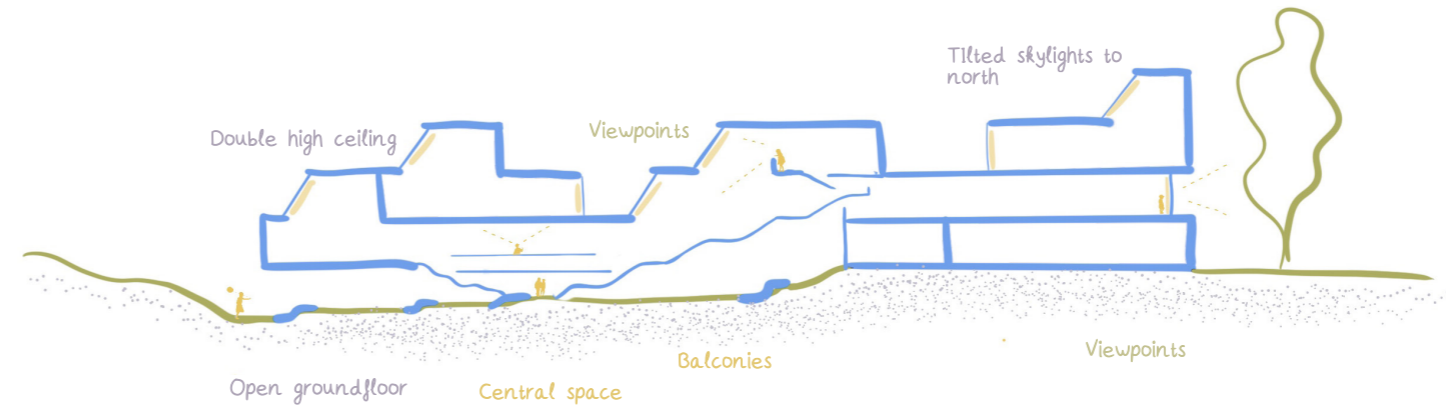
4.1. Exploration of Spaces

Doshi was an architect who connected modern brutalism with local culture, traditions, resources, and nature. He made architectural links between environmental processes, nature and cultural traditions.

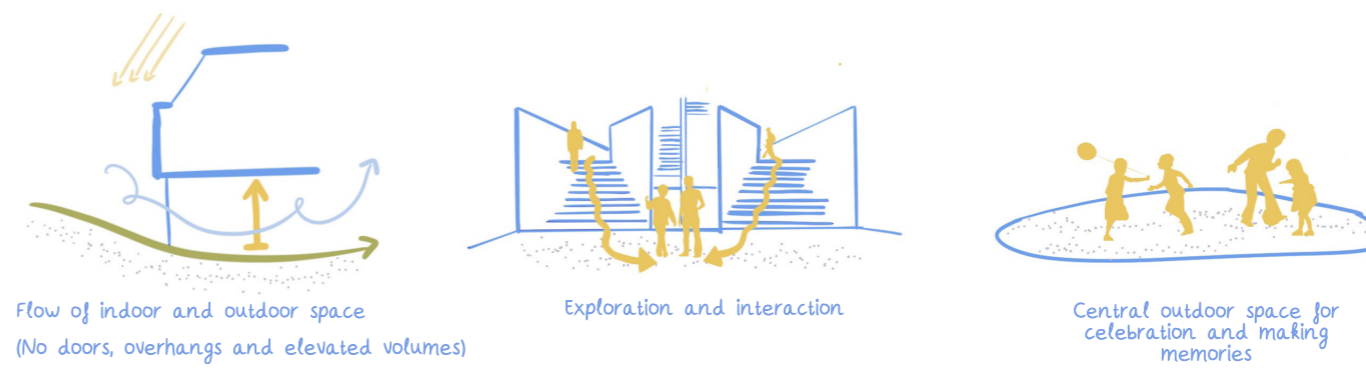
This reciprocity can be seen in 'School of Architecture', analysed in figures E.5 and E.6. Doshi called it education without doors. Students are always in the presence of the landscape because culture shares a space plan with nature. Doshi talks about the flow of spaces rather than rooms. In order to make students more aware participants of this flow of spaces, the routing between spaces need to be exploratory. Explorative routing supports coincidental interaction between community and landscape. (UofTDaniels, 2018)

Applying these spatial characteristics to a shelter at the ASA could result in a fragmented shelter with elevated volumes (figure E.5). This would enable a flow of space on the ground level. Having multiple routing options towards one space enhances coincidental interaction. Balconies support exploration and interaction in the vertical space. Also, multiple shelters together create a flow of space and could be used for space planning (figure E.6). The green space between the shelters could serve as a central space for play and celebration. The choice of which shelters to use for a nature school in the ASA is essential in creating compact, exploratory plans.

School of Architecture



Key spatial characteristics



Air Shelter

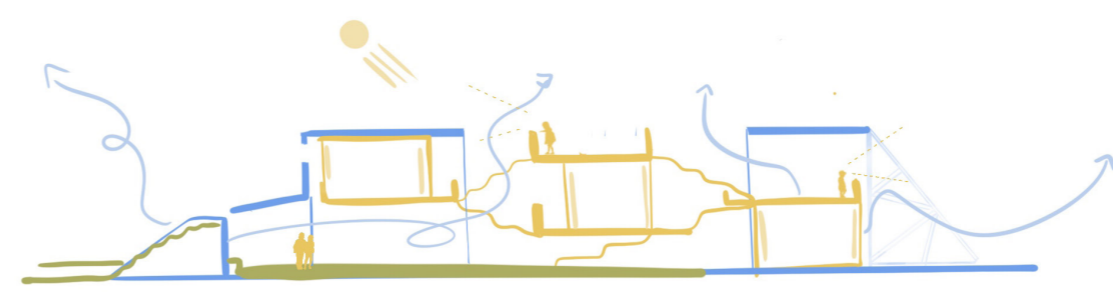
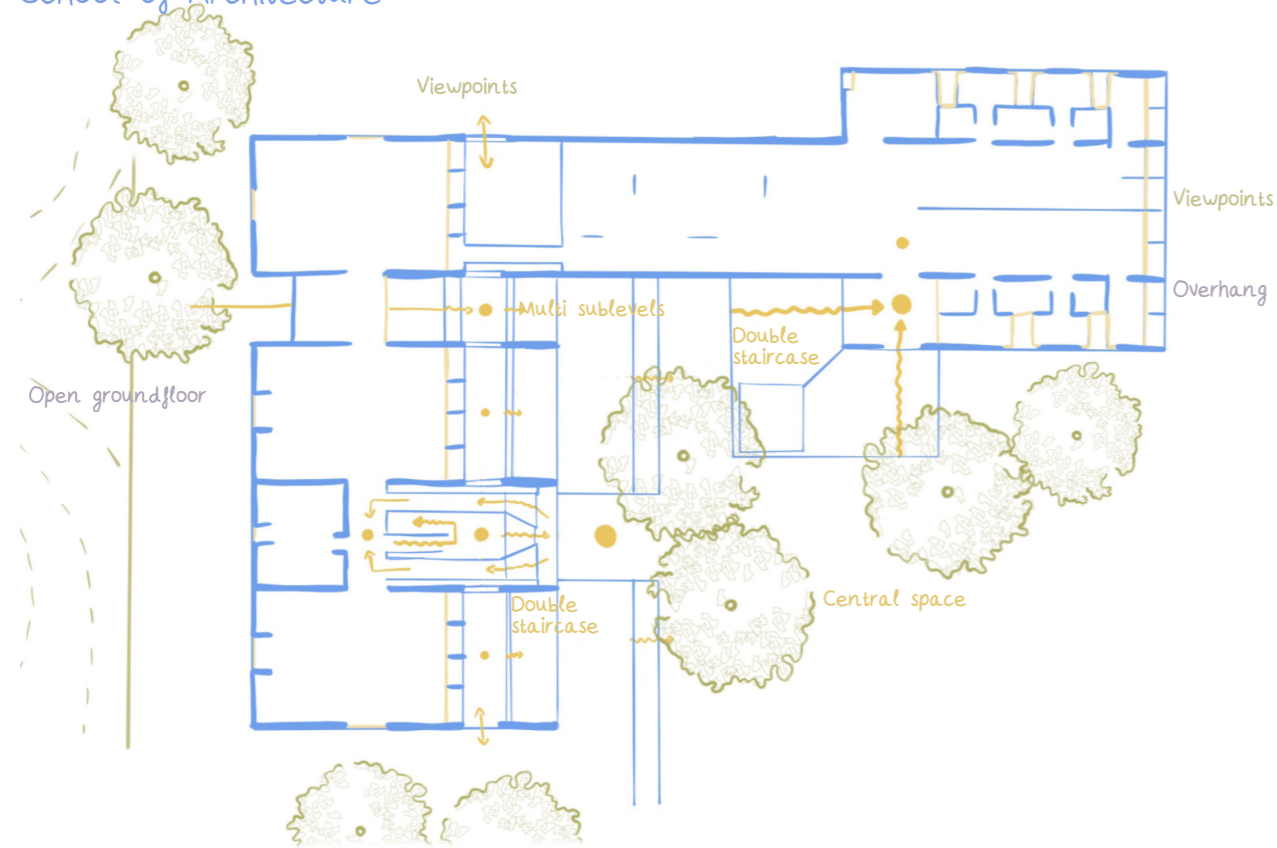


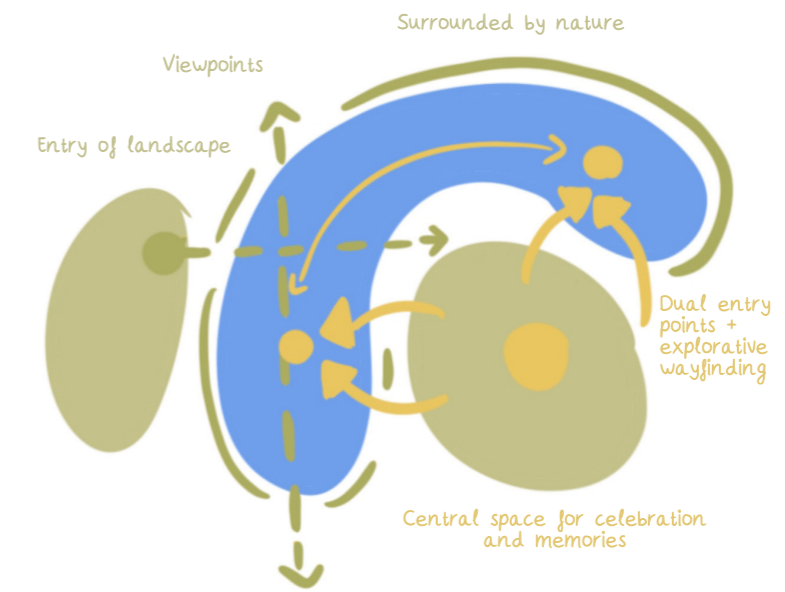
Figure E.5. Spatial analysis of School of Architecture by Doshi and application at a shelter. Source: Own work.

E. Extensive version of Chapter II.4 - Program of Requirements

School of Architecture



abstract spatial plan

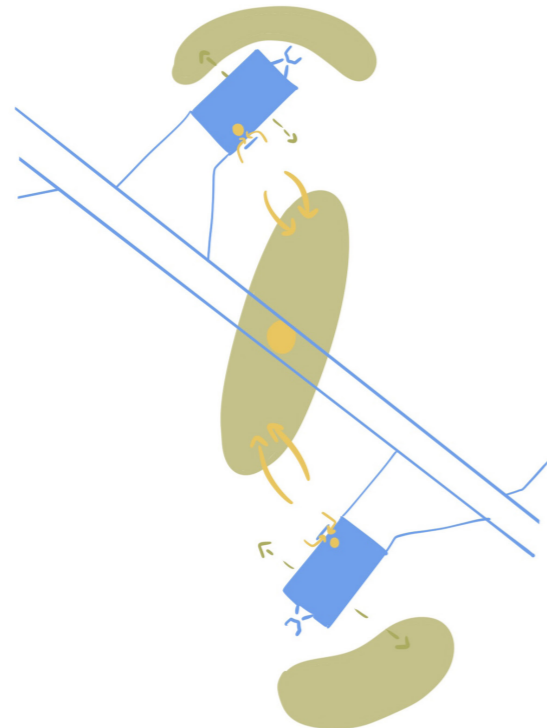


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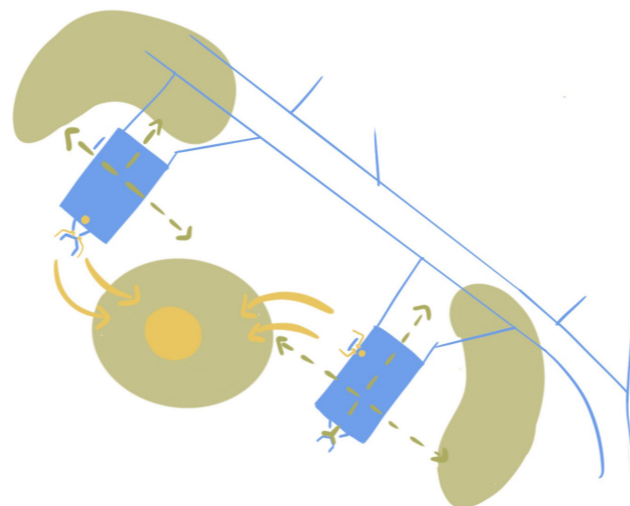


Air Shelter Area

Using same entryway
- stretched out central space, large distance



Using distinct entryways
+ compact central space
+ explorative entry options



Creating new entryways

- needs alteration of the shelter
+ explorative entry options

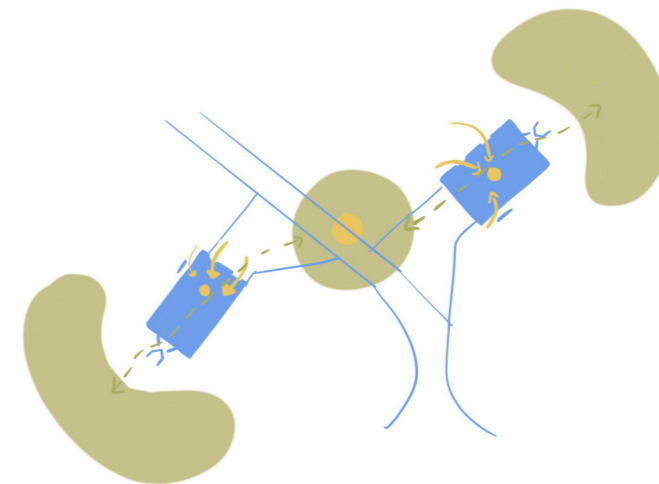


Figure E.6. Spatial analysis of School of Architecture by Doshi and ASA in plan. Source: Own work.

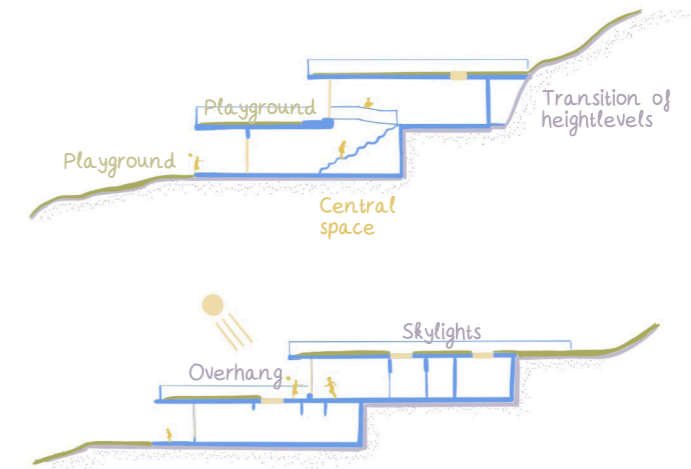
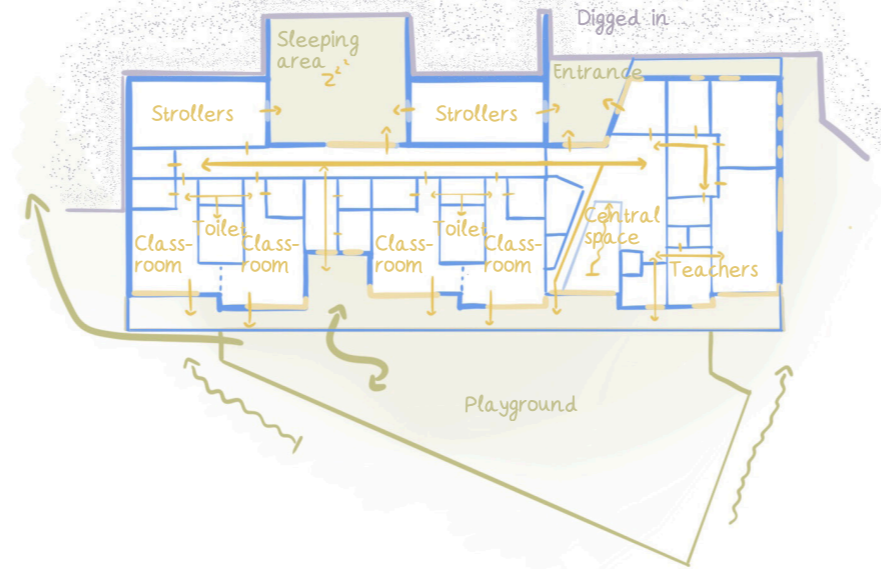
E. Extensive version of Chapter II.4 - Program of Requirements

4.2. Learning with Nature

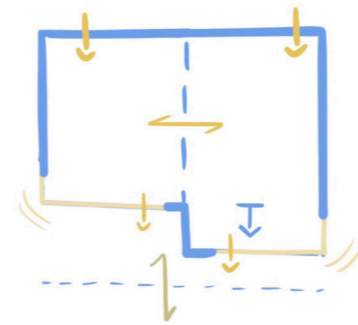
The Qjai Kindergarten (Henning Larsen, n.d.) is designed as a natural entity rooted in the landscape (figure E.7). The building relates to the height differences of the site. The indoors connect to the outdoors through skylights and room-wide cornered windows. Covered outdoor spaces next to the indoor spaces provide shelter and extend the learning and play area, regardless of the weather. Children are not restricted access to nature, but are taught to respect it.

Applying these spatial characteristics to a shelter could result in the classrooms being arranged in a way that the outer shell functions as a covered outdoor space, while the rear side is interpreted as hillside, creating a quieter area for teachers and sleeping.

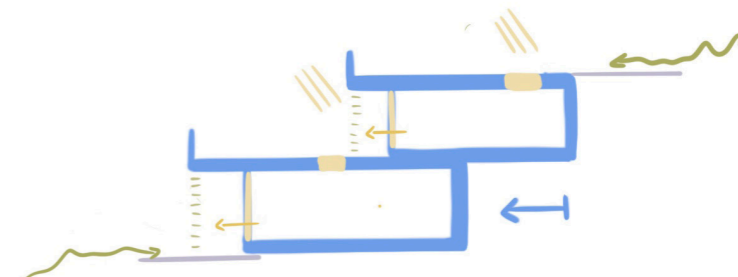
Qjai Kindergarten



Key spatial characteristics



Joinable classrooms + cornered windows



Covered outdoor area + skylights

Air Shelter

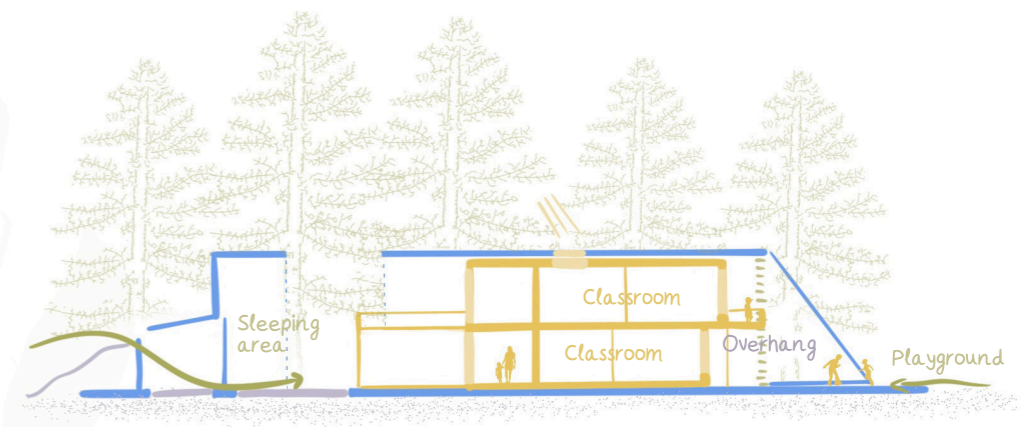
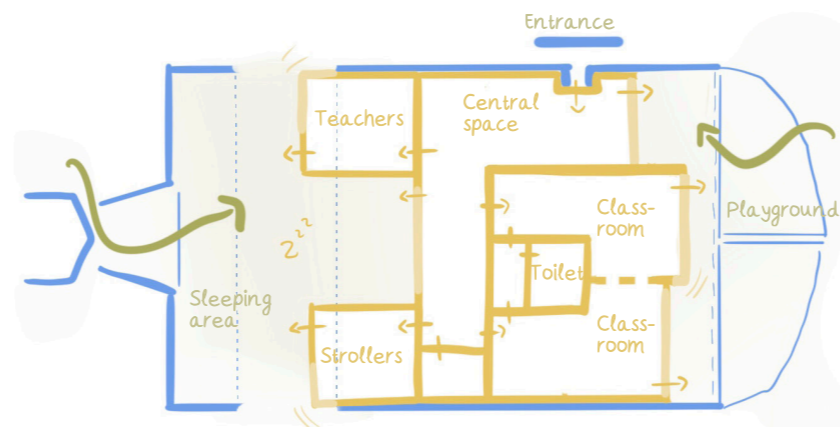


Figure E.7. Spatial analysis of Qjai kindergarten and implementation at ASA. Source: Own work.

E. Extensive version of Chapter II.4 - Program of Requirements

Another case illustrating the principle of learning with nature is Woodlands Day Nursery and Forest School, designed by FCBStudios (n.d.;p.34). Figure E.8 illustrates how the two wings form a sheltering courtyard towards the neighbouring nature reserve and away from adjacent roads. As with the Qai kindergarten, room-wide windows connect the classrooms to the outdoors and the learning space can be expanded with a covered outdoor space. A key difference is the covered outdoor hallway leading towards the classroom entrances, along with the addition of changing rooms between classrooms.

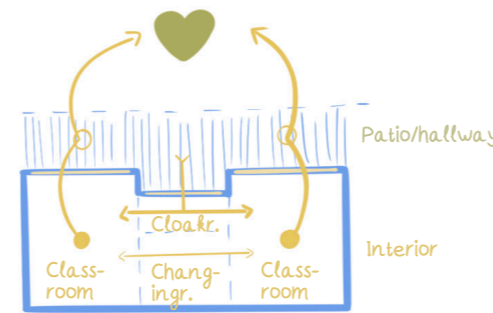
Applying these characteristics to the ASA (figure E.8) suggests interpreting two shelters as the two wings. In this case, the shelters define an enclosed space, the playground. With nature surrounding the site, the entrance, (semi-)covered by the concrete arches, can be positioned on the side opposite the patio of the classroom. This arrangement allows the changing rooms and toilets to connect directly to the playground, improving the floor plan's efficiency. The staff rooms would then be situated along the entrance side.

Overall, Qjai and Woodlands demonstrate how learning from nature informs spatial characteristics and organisation, creating environments where indoor and outdoor spaces are closely connected and which could support Outdoor Landscape Education (OLE).

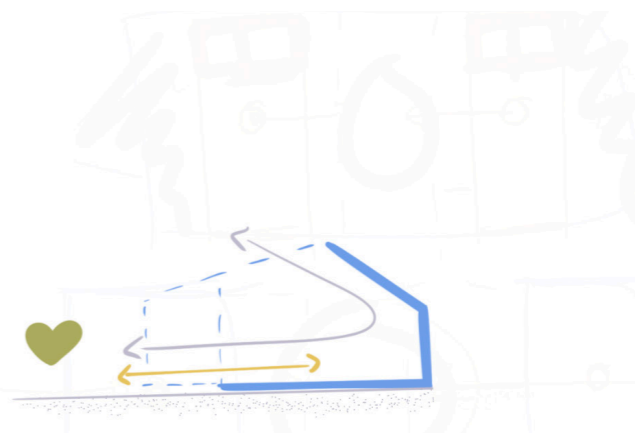
Woodlands Day Nursery and Forest School



Key spatial characteristics



Joined outdoor entrance and changing room



Transparency toward nature

ASA

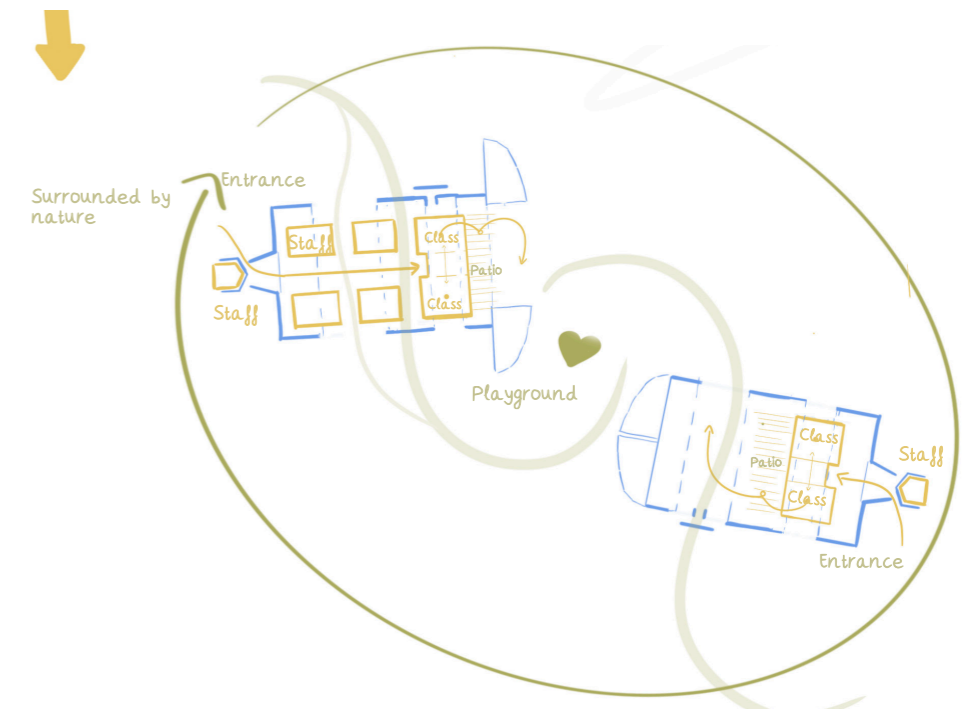
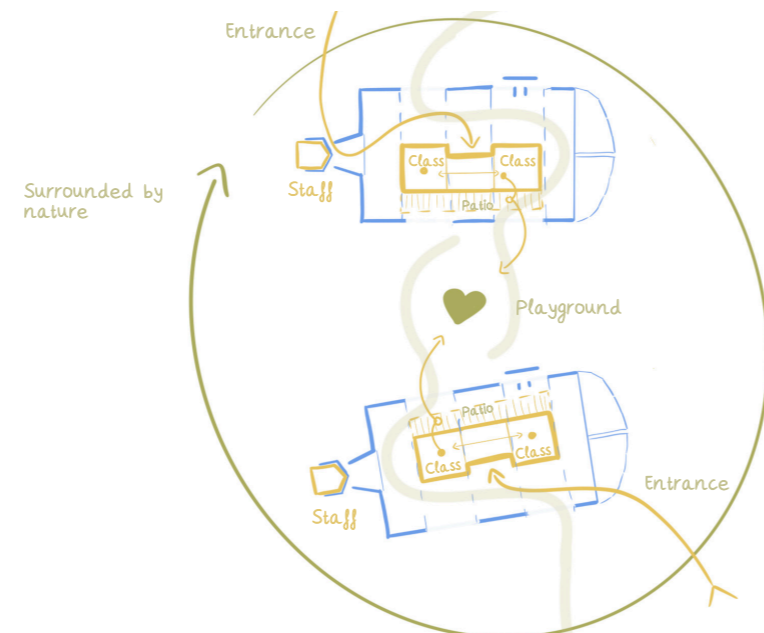


Figure E.8. Spatial analysis of Qjai kindergarten's spatial characteristics and its implementation on ASA. Source: Own work.

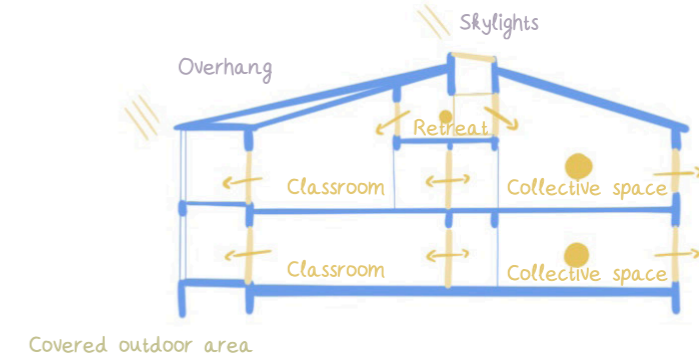
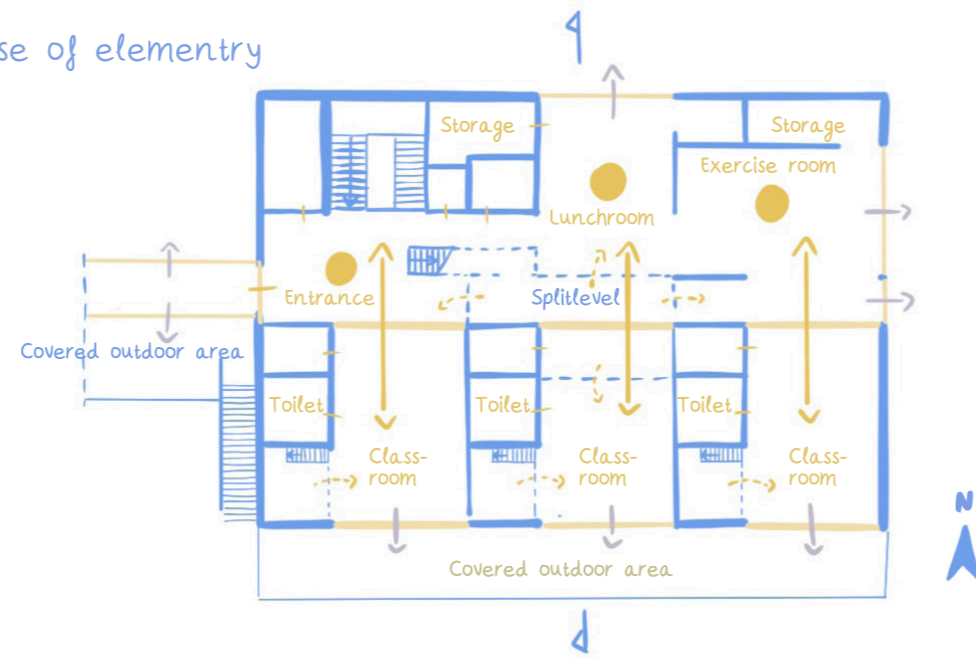
E. Extensive version of Chapter II.4 - Program of Requirements

4.3. Connectivity of Community

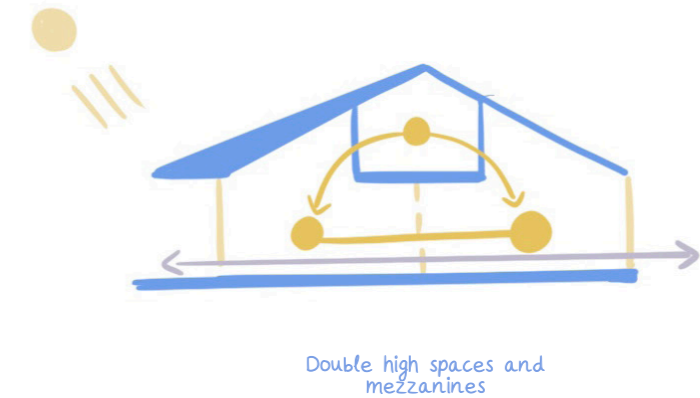
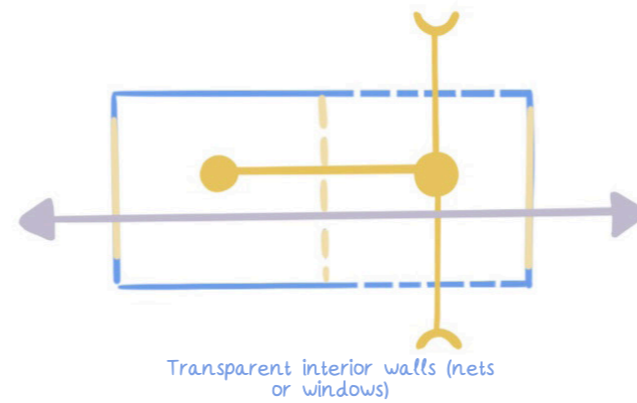
House of Elementry, designed by LP architektur (Pintos, 2023), demonstrates how a sense of connectivity in a community can be designed through transparent interior walls, room-crossing sightlines, double-height spaces, and mezzanines, which create visual horizontal and vertical connections.

These characteristics are applied on a shelter in figure E.9. Sightlines cross in- and outdoor spaces. A mezzanine creates connectivity between classrooms and communal spaces. However, this scenario currently defines the shelter primarily as a cultural space. This floor plan could incorporate more natural spaces, creating a landscape experience (Chapter E.4.1).

House of elementry



Key spatial characteristics



Air Shelter

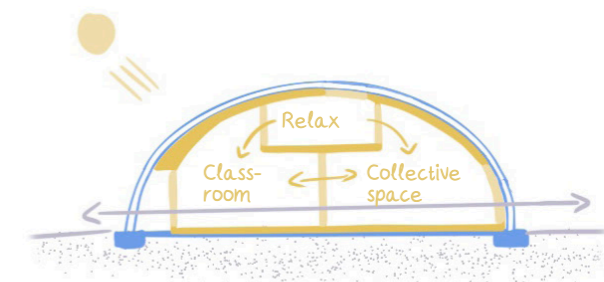
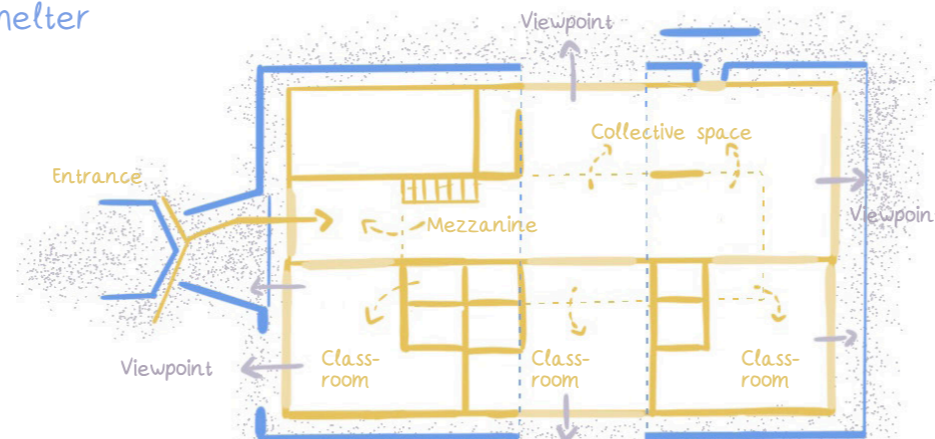


Figure E.9. Spatial analysis of House of Elementry's spatial characteristics and its implementation on ASA. Source: Own work.

E. Extensive version of Chapter II.4 - Program of Requirements

4.4. Program and Zoning Plan

In order to create a program of requirements, it is important to become familiar with daily activities of nature schools. Therefore, the nature-based educational programs of I were analysed (appendix J). The main difference compared to 'regular' schools is the need for changing rooms and rinsing stations, due to more explorative outdoor activities. These requirements, along with the analyses from the previous paragraphs and chapter form a program of requirements for a nature school at the ASA (Table 1). Figure E.10 illustrates the proportional area of the spaces defined in table 1.

TABLE 1 - program of requirements of a nature school

Space requirement	notes	area (m2)*	total (m2)
Atmosphere and climate			-
Nature inclusive	<i>intergrate moving materials, ecolope, bioregional materials, Design for Change principles (ch 3)</i>	-	
Learning from nature	<i>outdoor lessons, covered outdoor areas, window seating, calm, bioregional materials</i>	-	
Exploring and Wonder	<i>level differences, routing options, viewpoints, peak holes, nooks</i>	-	
Connectivity of Community	<i>central common space, transparent internal walls and windows towards common space / hallway</i>	-	
Safety	<i>safe circulation routes and clear sightlines for supervision (indoor & outdoor)</i>	-	
Ecosystem	<i>self sustaining system; passive energy and closed loop food, energy, water and waste flows</i>		
Classrooms			754
Shared with age groups	<i>7 classrooms; 0 / 1-2 / 3-4 / 5-6 / 7-8 / 9-10 / 11-12 (20 pupils per class)</i>	65 (x7)	
Interconnective classrooms with shared facilities	<i>classroom clusters have removable wall and share cloakroom, changing space, toilets</i>	-	
Cloakroom	<i>can be included in the connected hallway/central space</i>	8 (x4)	
Changing room	<i>with direct access to toilet, boot storage and outdoors</i>	15 (x4)	
Toilets	<i>4 per cluster</i>	15 (x4)	
Storage	<i>1 per classroom, can be integrated in furniture</i>	6 (x7)	
Direct outdoor access through an external learning space	<i>overhang/roofed space</i>	15 (x7)	
Common functions	<i>functions can be combined</i>		500
Kitchen and lunchroom	<i>central space</i>	120	
Podium and celebration space	<i>central space</i>	120	
Indoor exercise space		90	
Lab/Workshop (hands-on skills)	<i>with direct outdoor access</i>	90	
Libary and reading nooks	<i>quiet area seperate from classroom</i>	30	
Relax space	<i>indoor chill area outside classroom</i>	30	
Sleeping and stroller space		20	
Outdoor learning			1545
Outdoor classroom	<i>with gathering circle of tree trunks</i>	130	
Toilets	<i>direct access from outdoors</i>	15	
Playground	<i>with natural play elements</i>	1000	
Sleeping/Quiet area		100	
Garden with outdoor kitchen	<i>eatable garden where childeren can help grow plants and make food</i>	200	
Outdoor storage		40	
Bicycle parking		60	

(table continues on next page)

*The estimated square metres are retrieved by comparing space plans of Gaji kindergarten (ch 4.2), Woodlands Nursery & Forest School (ch 4.2) and House of Elementry Education (ch 4.3).

E. Extensive version of Chapter II.4 - Program of Requirements

Space requirement	notes	area (m2)	total
Management and staff			193
Reception and office	at entrance	25	
Workroom	shared workspace for staff	20	
Toilet	2 toilets	8	
Cloakroom		8	
Changing room		12	
Laundry space		5	
Lunchroom with pantry	direct outdoor acces	35	
Relax/quiet space		20	
Technical space		30	
General Storage		30	
Total Net Area	Indoor and outdoors		2992

*The estimated square metres are retrieved by comparing space plans of Gaji kindergarten (ch 4.2.), Woodlands Nursery & Forest School (ch 4.2.) and House of Elementry Education (ch 4.3).

*Circulation area's of entry and hallways are not included, as this can be combined with the common functions and outdoor space.

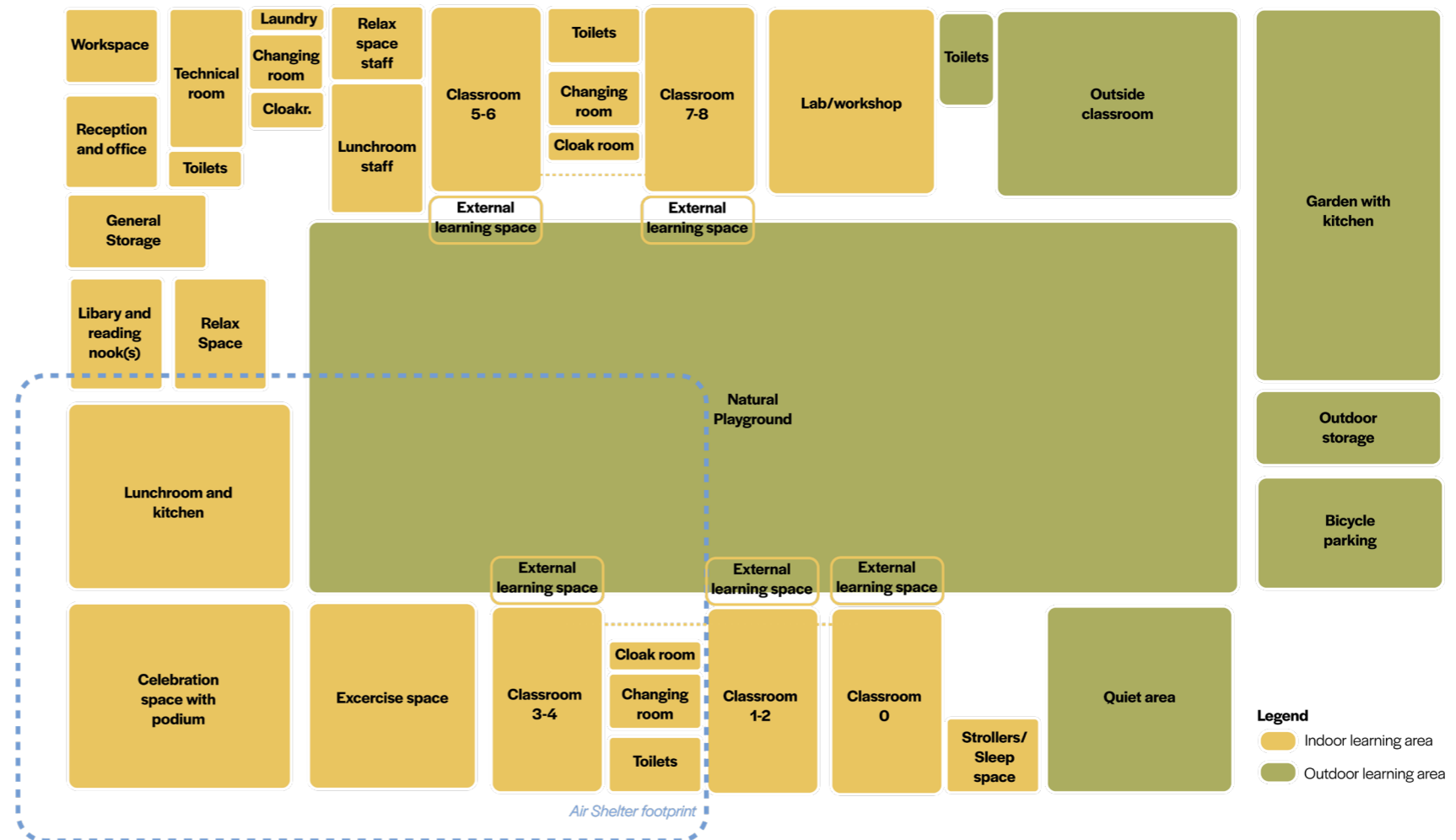


Figure E.10. Proportional visualisation of table 1. Source: Own work.

F. Timelayers of the ASA

In the middle ages, before the aviation period, the ASA was a heatherland with desire tracks connecting villages. The activity of the area is mapped in figure F.1. Paths were naturally formed around the moraine, by knights, merchants, villagers and farmers.

Figures F.2-F.5 illustrate how the path structures changed over time.

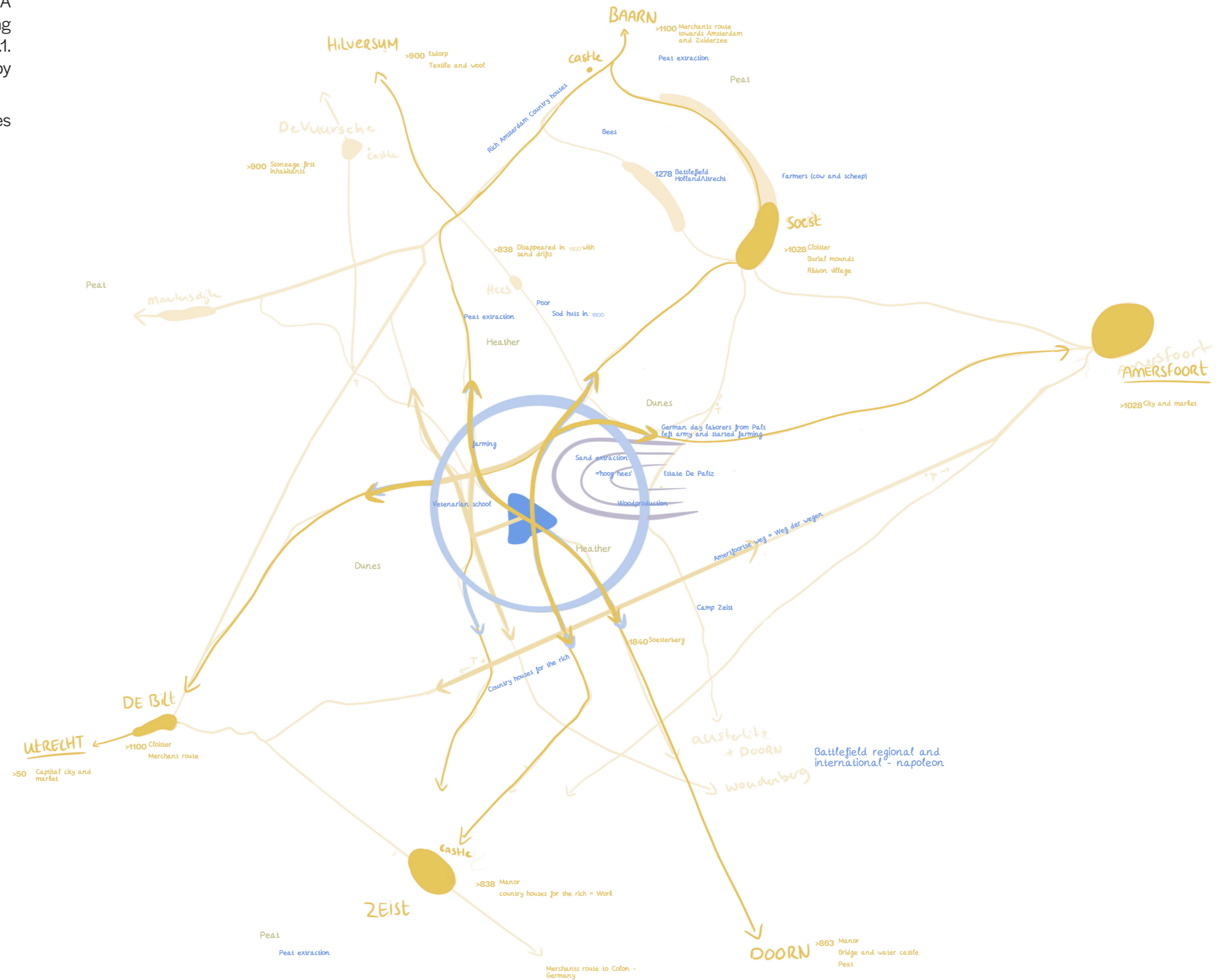


Figure F.1. Proportional visualisation of table 1. Source: Own work.

F. Timelayers of the ASA



Figure F.2. Geomorphical layer of the ASA. Source: Own work.



Figure F.3. The ASA in 1850, heatherland and desire tracks. Source: Own work.

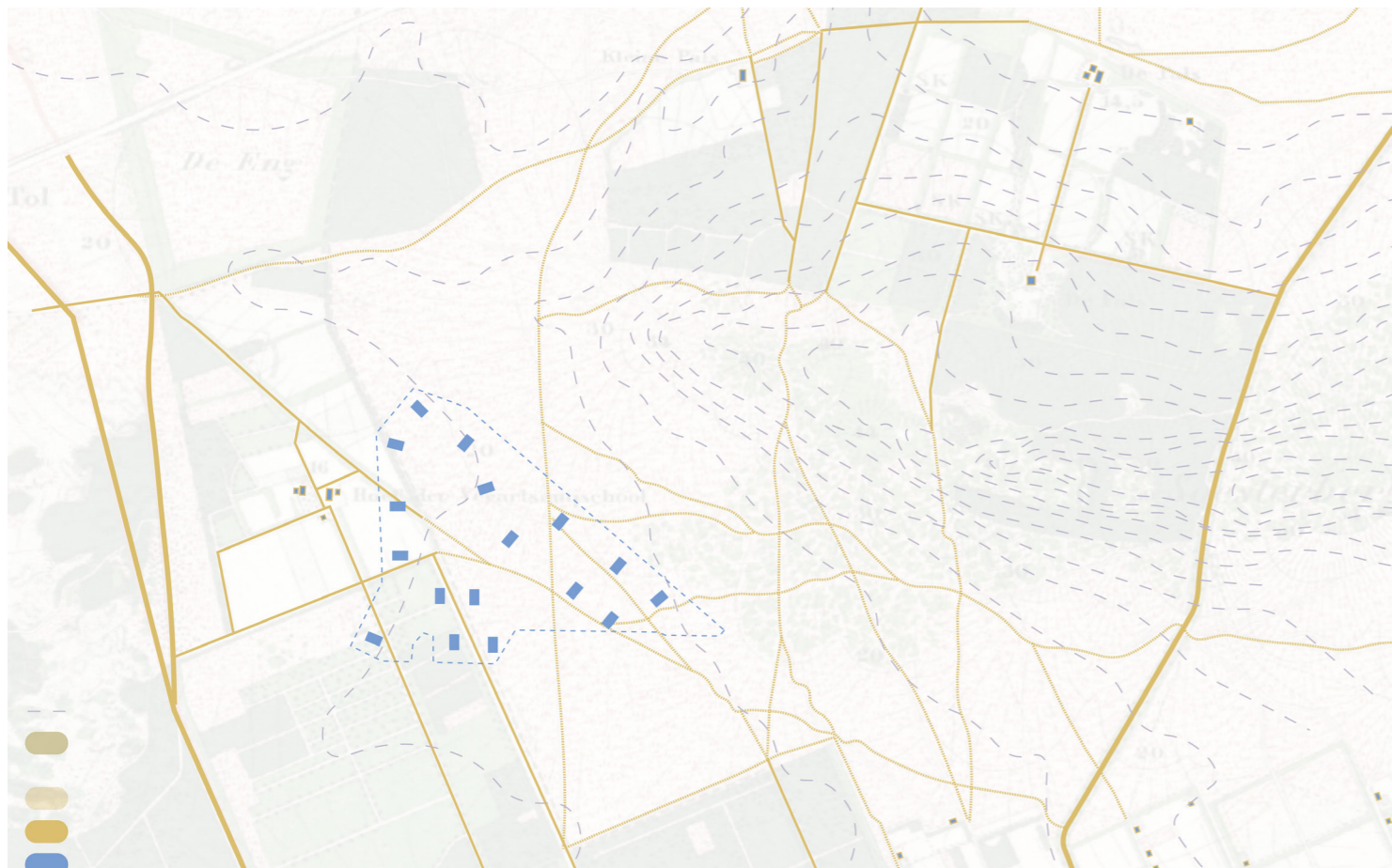


Figure F.4. The ASA in 1875, Paltz estate. Source: Own work.

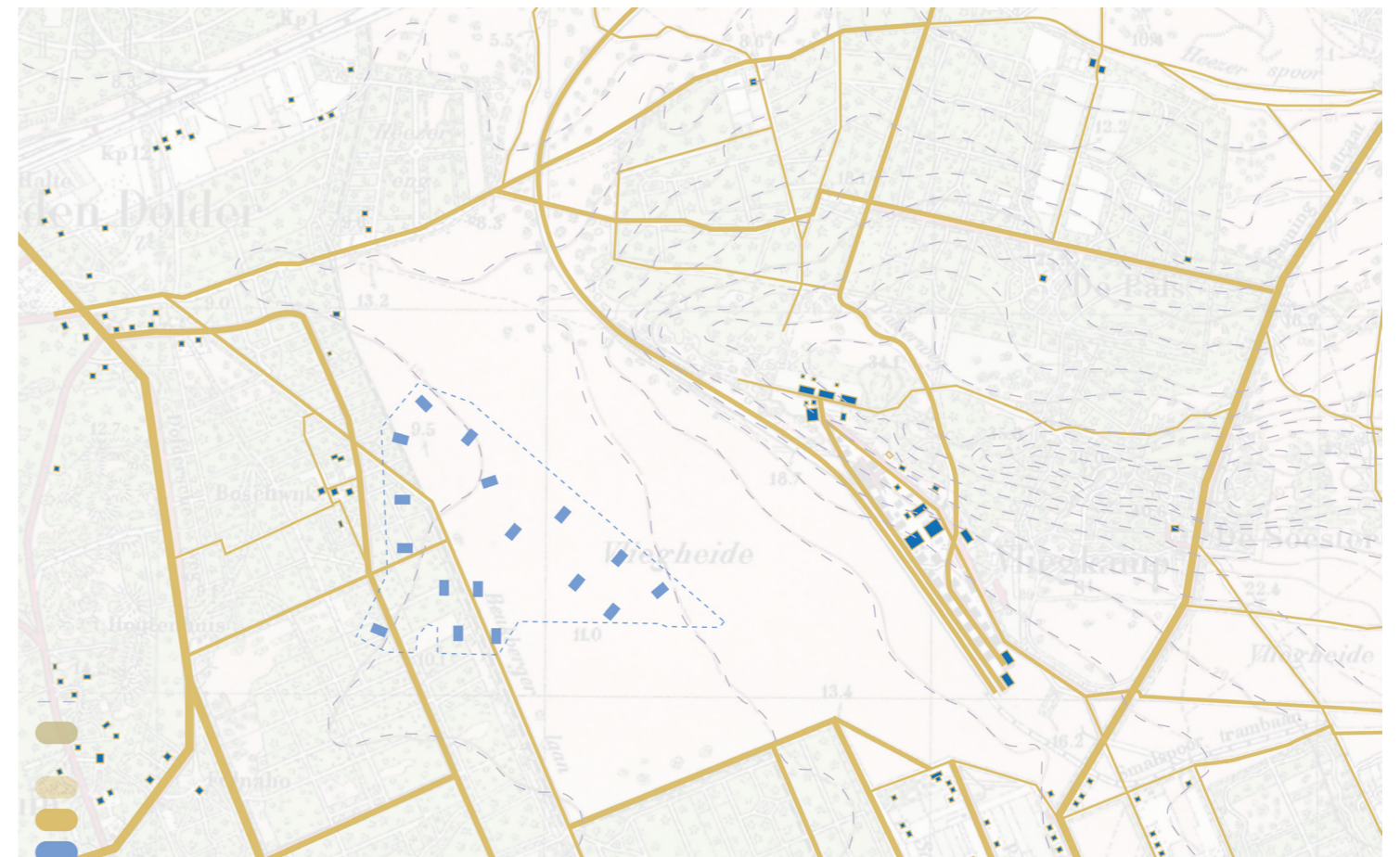


Figure F.5. The ASA in 1930, Dutch military base. Source: Own work.

G. Moving Materials at the ASA

Figure G.1 illustrates an abstract analysis of the speed, direction and density of the moving elements at the Air Shelter Area;

The wind is strongest during the winter and arrives generally from the south-west. The many trees slow down the wind in the area. The wind flows with the pattern of airways.

The average rainfall from Dec-May is slightly higher than in the western part of the Netherlands. This is due to the rising of air over higher ground (from 0 to +11 NAP) and the moraine (+33 NAP), which increases pressure. From June-Novembre, the average rainfall is higher in the west of the Netherlands, because of greater temperature differences between the warmer sea and the air.

The sunlight is diffused by the trees, so not every shelter receives direct sunlight. As the angle of the sun changes with the seasons, the quality of light shifts throughout the year. In autumn and spring, interesting shadows from the trees appear on the concrete shell. In winter, when the sun is at a lower angle and the trees have shed their leaves, sunlight can reach the concrete shell more fully.

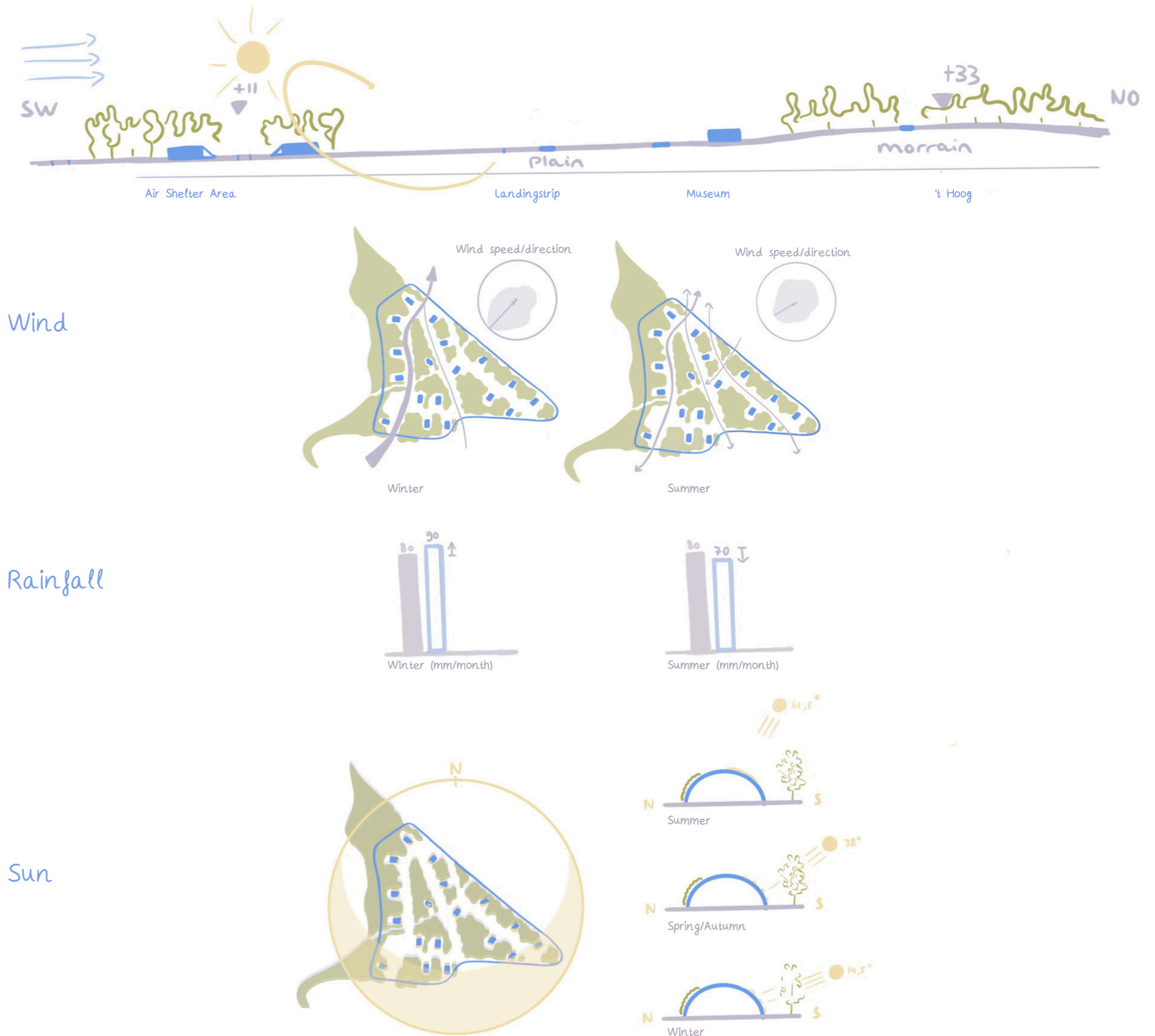


Figure G.1. Analysing sketches of moving materials at the Air Shelter Area. Souce: Own work.

H. Current Habitats at the ASA

The managing plan of park Airbase Soesterberg shows the distribution map of vulnerable species (Bakker, 2011), by overlaying these maps we can suggest a potential location for a new program in the ASA (figure H.1). At this location, existing habitats are probably least affected. This location aligns with the location from appendix G.

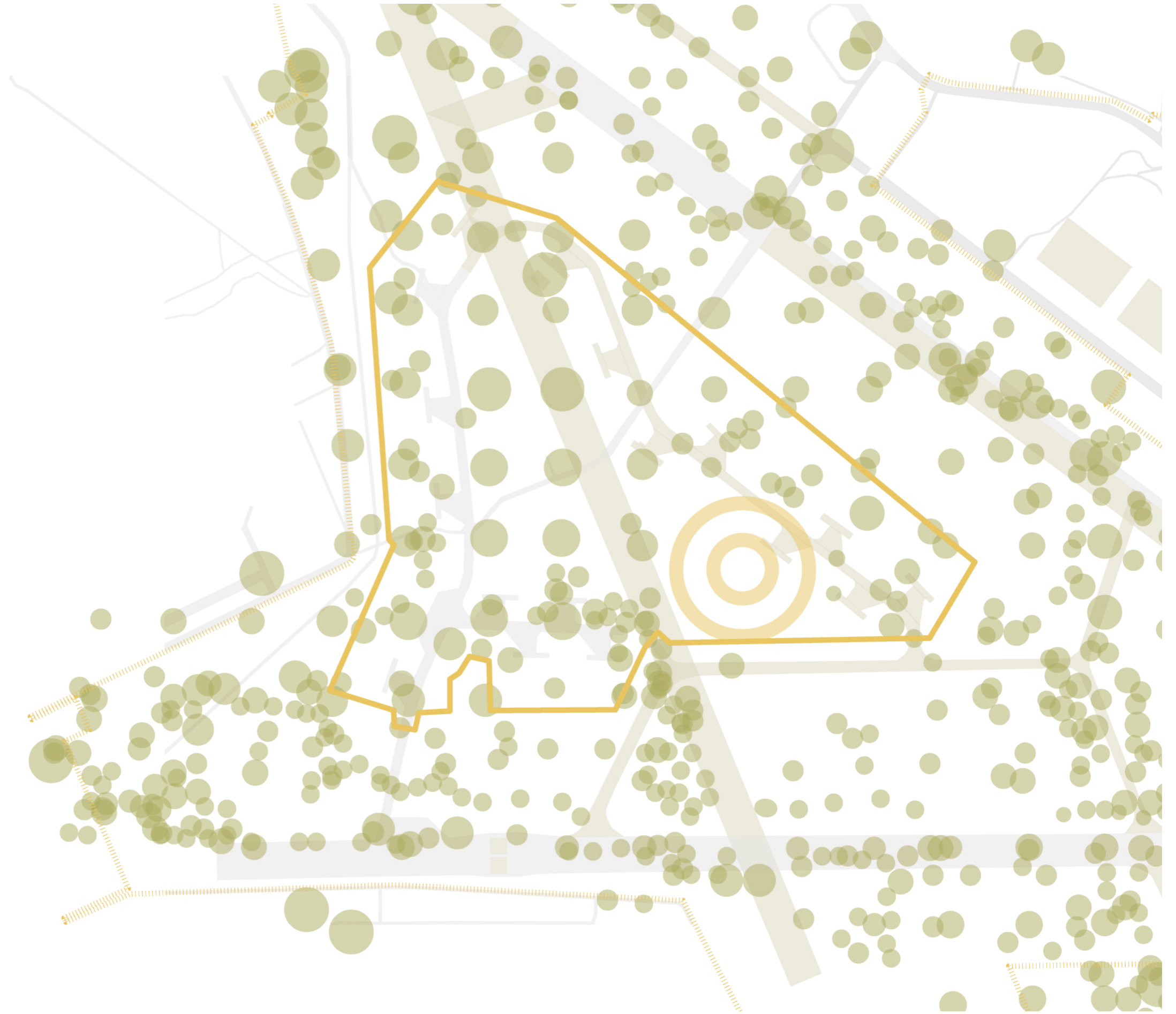


Figure H.1. Distribution of rare-species at the ASA. Source: Own work.

I. Ecological Permeable Fences

A school requires barriers for the safety of children. However, this barrier should not exclude ecology from entering the premises. An initiative by Leefmilieu Brussels (n.d) demonstrates how fencing can be designed with ecological permeability, allowing wildlife to move through and around enclosed areas without compromising safety. A few characteristics of ecological permeable fences are:

1. Use natural barriers as (willow fascine) hedges. This also creates shelter and nesting (figure I.1).
2. Wooden fences include openings of at least 10–15 cm² every 15 meters, or at least one passage for fences shorter than 15 meters (figure I.2).
3. No use of wire mesh.

This approach shows how boundaries can support both protection and biodiversity.



Figure I.1 Willow Fascine Hedge. Source: Leefmilieu Brussels, n.d.

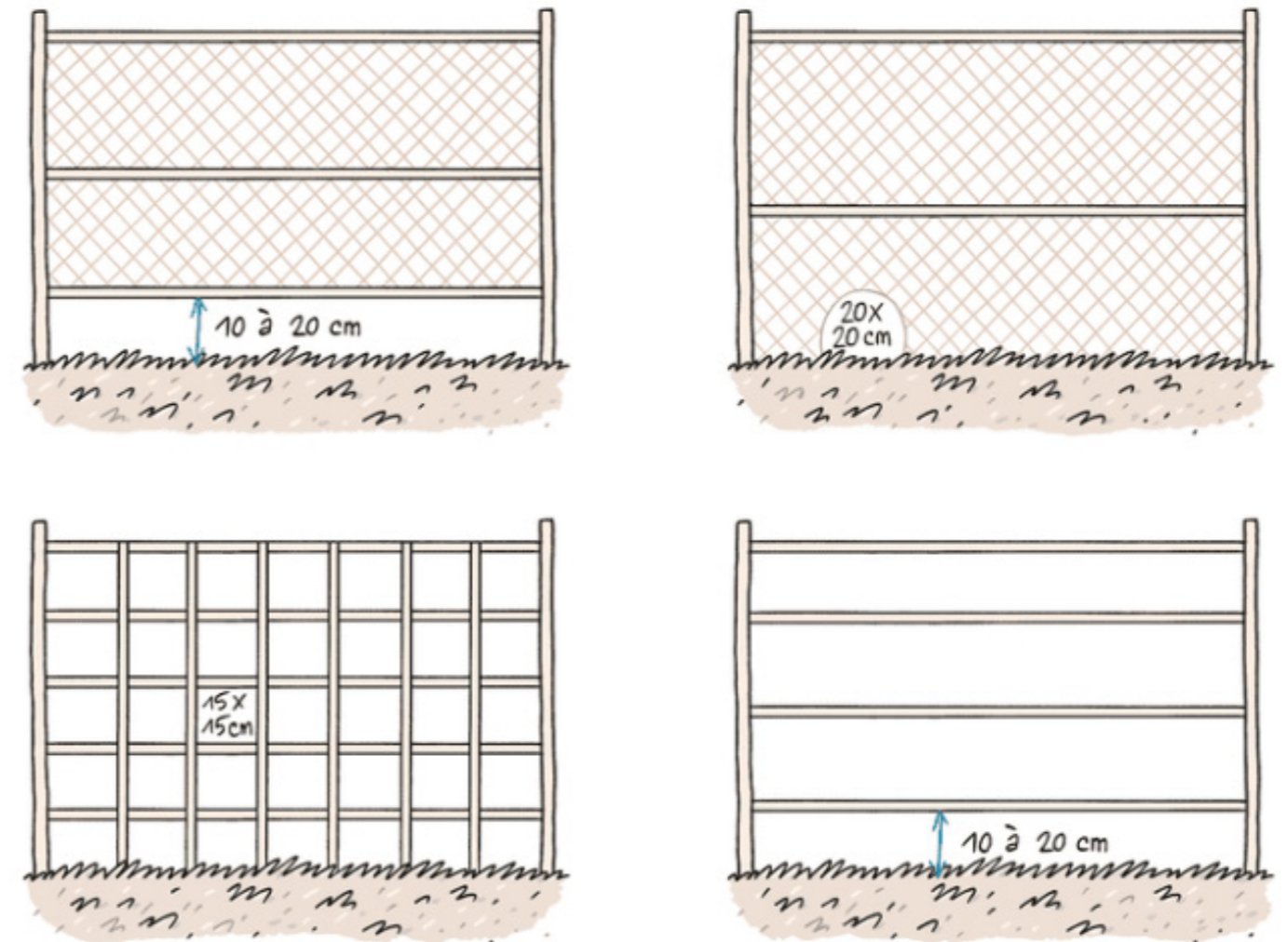


Figure I.2. Examples of fences that are permeable for ecology Source: Leefmilieu Brussels, n.d.

J. Educational Programs and Activities

Programs of Nature Schools Organisations



I Ur Och Skur (n.d.) is a Swedish elementary school collective for outdoor pedagogy. Their activities and requirements are:

- Outside cooking with local or self-produced food.
- Gardening
- Outside classroom
- Exploring the forest
- Nature memory
- Outside painting
- Making art with materials from outside
- Food brings the community together



IVN (n.d.) is a Dutch nature education organisation for all ages. Their activities and requirements are:

- Maths with sticks
- Mud day (rinsing station and changing space)
- Outside drawing lesson
- Measuring area's, wind speed
- Making compost
- How do clouds, trees form
- Compass Routes
- Building huts
- Autumn Memory
- Gardening

Education Programs at or around the Site



The National Military Museum (n.d.) has a cultural education program. Their activities and requirements are:

- Bootcamp with obstacle run
- Changing room in tents
- Building katapults
- Escape game



The local nature educational programs are 'Heuvelrugwijs' from Nationaal Park Utrechtse Heuvelrug and 'Natuurwijs' from Staatsbosbeheer. Their activities and requirements are:

- Closed shoes, rain cloths
- Biking
- Walk with a forester through the forest, dunes and, heatherland