REGENERATIVE LIVING IN KIRIBATI

Danielle Nawisielski

Research Question

How can the implementation of regenerative strategies and systems between land and sea benefit Kiribati in terms of health and wellbeing ?

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Regenerative Living in Kiribati

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"I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person (except where explicitly defined in the acknowledgements), nor used artificial intelligence tools or generative artificial intelligence tools (unless it is clearly stated, and referenced, along with the purpose of use), nor material which to a substantial extent has been submitted for the award of any other degree or diploma of a university or other institution of higher learning."

Danielle Nawisielski

Contents

Glossary

Babai: Root crops

Bata: Dwelling house

Inai: woven coconut mat

Maneaba: Village meeting house

Mwenga: Household compound

Te aba: The land and people

Te bui bui: Traditional wall building along the coastline

Te kaainga: The extended family

Te utu: The family

Uma-ni-mane: Men's house

Introduction

As climate change escalates and ocean health declines, small island nations like Kiribati face unique and urgent challenges that threaten their environmental, economic, and social stability. Situated in the central Pacific Ocean, Kiribati comprises 33 atolls and reef islands, where the balance between land and sea is integral to the livelihoods of its inhabitants. This research explored the potential benefits of implementing regenerative strategies and systems that bridge humans and non-humans, particularly focusing on how such approaches can enhance the health and well-being of Kiribati.

The concept of regeneration highlights restoring ecological balance and promoting sustainable practices that enhance biodiversity and resilience. By fostering collaborative relationships between land and sea. This thesis sought to address the pivotal research question: How can the implementation of regenerative strategies and systems between land and sea benefit Kiribati in terms of health and well-being?

In exploring this question, the study analysed existing regenerative practices, assess their applicability in the context of Kiribati, and identify potential pathways for integrating these strategies. This research aimed to provide a comprehensive understanding of how regenerative approaches to ecosystem management can foster resilience and improve the quality of life for humans and non-humans. Ultimately, the findings will contribute to a growing body of knowledge on sustainable development in small island states.

Abstract

This thesis engages architectural methodologies to investigate and address the pressing climate challenges facing Kiribati, a small island nation in the Pacific Ocean.
To effectively explore and respond to the climate crisis in Kiribati, it is imperative to first understand the challenges and issues confronting the nation, as well as the profound impacts these challenges have on both the community and the surrounding environment. Kiribati is particularly vulnerable to climate change, experiencing rising sea levels, increased frequency of extreme weather events, and environmental degradation, all of which threaten the livelihoods, health, and cultural integrity of its inhabitants.
Architecture offers a unique lens through which we can identify opportunities to mitigate and adapt to climate change. By embracing regenerative strategies and systems, architecture can foster a symbiotic relationship between humans and the non-human elements of the environment, including natural ecosystems. This approach seeks to create a harmonious and sustainable living environment that nourishes both people and the ecological systems that they depend on.
The research presented in this thesis is established on the practical application of regenerative systems and strategies tailored to the specific context of Kiribati, which is currently engaging with the adverse effects of climate change. This involves not only identifying and implementing strategies that address immediate challenges but also creating long-term opportunities for resilience and sustainability.
The strategies proposed are designed to be adaptable to both the current environmental conditions and the ongoing changes that climate change is expected to bring. The aim is to enhance the capacity of Kiribati's built environment to withstand and respond to climate impacts. Additionally, this research considers the broader implications of these strategies for mitigating climate change effects throughout Oceania, emphasizing the interconnectedness of environmental issues across the region.
This thesis highlights the critical role that architecture can play in shaping a sustainable future for Kiribati. By integrating regenerative practices into architectural design and urban planning, we can create resilient environments that not only protect but also empower communities to thrive in the face of climate change. The findings of this research aim to contribute to a more comprehensive understanding of how architectural interventions can be a vital part of the solution to the climate crisis in Kiribati.

Positionality Statement

My role in this research is primarily as an external observer. While I am not a part of the culture and lifestyle of the communities in Kiribati, this outsider perspective can be beneficial when approached with openness and a commitment to learning. My objective is to design appropriate and practical solutions suited to their context, considering local knowledge, available materials, and functional needs. It is important to acknowledge and address my own biases and assumptions throughout this process while remaining adaptable to the needs of the community. This project is based in Kiribati and exemplifies the severe impacts of climate change on a developing nation. As someone not from Kiribati, I am committed to being respectful of their culture and to carefully consider the needs of individuals, communities, and the nation as a whole. This research prioritises the perspectives and needs of individuals and communities of Kiribati
Effective communication is a critical consideration in this work. This includes actively listening to and understanding the experiences of the residents of Kiribati, and paying attention to the significant aspects of their daily lives. I have been collaborating with the NUWAO as a research assistant, analysing interviews conducted in South Tarawa, specifically in Nanikaai. This ongoing research addresses the gap in understanding Kiribati's cultural values, beliefs, and community lifestyle, significantly contributing to the growing body of knowledge about the nation. Workshops with residents have aimed to deepen insights into their relationships with nature and their aspirations for the future. Key findings stem from the efforts of NUWAO researchers Maibritt Pedersen Zari, Luke Kiddle, and Sybil Bloomfield, who conducted fieldwork in South Tarawa in 2023 and 2024. The NUWAO research project, which is still ongoing and will be published in the future, aims to develop nature-based solutions (NbS) that aim to support the well-being of communities within Oceania from the effects of Climate change.

Research ethics approval was granted by Te Herenga Waka, Victoria University of Wellington for NUWAO to conduct the work (#00000307000). A Kiribati Government research permit was received in April 2024

Link to NUWAO - https://nuwao.org.nz/

Link to the two fieldwork reports from 2023 & 2024
2023 report - https://drive.google.com/file/d/1AHs27INBqjeLkt1hyLOwmajuhL17RMR2/view

2024 report - https://drive.google.com/file/d/1ZOToq__xlLXuLKrmoASlU1M6htEnvG7S/view

Chapter One

Literature Review
Theoretical Framework
Aims & Objectives
Issues & Challenges

Literature Review

Climate change is one of the most pressing issues of our time, shaping the future of our planet. (U.S. Natl. Res. Counc., 2016, as cited in Dietz et al., 2020) defines climate as encompassing the long-term weather trends, such as temperature, precipitation, and storm occurrences. In contrast, modern climate change involves alterations in these averages over time and heightened fluctuations, leading to a rise in extreme weather events. A critical area of research is the analysis of climate change's ecological and socioeconomic impacts. Understanding the complexities of climate change on a global and community scale is essential for developing effective strategies to mitigate its effects and adapt in ways that positively impact humans and non-humans. Highlighting the vulnerability of certain populations, particularly in developing regions like Kiribati, exacerbating existing inequalities and leading to challenges such as food security, water scarcity, and potential displacement. Rising sea levels pose significant risks to coastal areas, threatening infrastructure and livelihoods while increasing the frequency of flooding and erosion. Additionally, the implications of rising sea levels extend to ecosystems, disrupting habitats and threatening biodiversity as species struggle to adapt to changing environments. However, climate change also presents opportunities for innovation and resilience-building, with research exploring sustainable practices and technological advancements designed to mitigate and adapt to its effects. Ultimately, addressing the social and economic significance of climate change requires an approach that considers the interconnectedness of environmental and human systems.

Climate change on a global scale

As we navigate the complexities of climate change, it is crucial to understand the historical context and the significant impact of human activities on our planet. Earth's climate has fluctuated throughout geological epochs, but the current rapid pace of change has led to the designation of the Anthropocene (Steffen, W. et al. 2018 as cited in Dietz, T., et al.2020). The Anthropocene describes a relatively recent chapter in Earth's history when human actions began to have a major impact on the planet's climate and ecosystems (Steffen, W., et al. 2011). This shift is largely driven by rising global temperatures linked to human activities, especially the release of greenhouse gases like carbon dioxide, methane, nitrous oxide and chlorofluorocarbons. (US Glob. Change Res. Program 2017 as cited in Dietz, T., et al. 2020). The Intergovernmental Panel on Climate Change (IPCC 2018, p. 15 as cited in Dietz, T et al.2020) has the goal of limiting global warming to 1.5°C. To reach this goal there needs to be a rapid change in society in terms of energy, land, urban and key infrastructure and industrial systems. While the phenomenon of climate change itself is not new, Dietz et al. (2020) identifies a lack of contribution to climate research and action, including race, class, gender, Indigenous identity, sexuality, and disability as well as our relationship to non-human species. Vulnerable communities often bear the brunt of climate-related impacts, experiencing heightened exposure to environmental hazards, displacement, and health risks including elevated levels of mental, emotional, and physical stress resulting from exposure to natural disasters (Benevolenza, M. A. and L. DeRigne. 2018). Additionally, marginalized groups frequently have less access to resources and decision-making power in climate adaptation and mitigation efforts (Thomas, D. S. G. and C. Twyman. 2005). Addressing climate change requires an inclusive approach that considers these diverse perspectives, ensuring that all voices, particularly those of marginalized groups, are heard in pursuing equitable solutions.

Climate change and Rising sea level

The warming of ocean waters causes glaciers to expand, a phenomenon known as thermal expansion (McKay, N. P., et al. 2011). During cooler glacial periods, sea levels decrease because the cooling seawater occupies less volume and more precipitation falls as snow, contributing to the expansion of ice sheets and glaciers (Janin, H. and S. A. Mandia 2012). However, the increase in greenhouse gas concentrations over the past century has caused sea levels to rise globally, primarily due to the melting of ice sheets and the thermal expansion of seawater (Warrick, R. and G. Farmer. 1990). This trend is expected to continue, posing a significant threat to low-lying coastal areas in the future (Nicholls, R.J; Cazenave, A. 2010 as cited in Griggs, G. and B. G. Reguero 2021). Hall, J. A., et al. (2019) discuss how using a range of scientifically supported rising sea level scenarios helps decision-makers grasp potential changes in risk at particular locations and supports the creation and assessment of various strategies to manage potential risk. Griggs, G. and B. G. Reguero (2021) explain some of the effects of sea-level rise which

include increased wave action, loss of ecosystems, loss of coastal infrastructure, increased saltwater intrusion, damage to coastal aquifers and displacement of people.

Implications of Rising Sea Levels on coastal areas
The consequences of rising sea levels are extensive having major negative effects in coastal areas. Coastal areas are home to some of the world's largest and most densely populated cities and therefore are partially vulnerable to the effects of rising sea levels (Sahin, O. and S. Mohamed. 2014). Griggs, G. and B. G. Reguero (2021) explain the different effects rising sea levels have on higher-elevation shorelines compared to lower-lying shorelines. Low-lying shorelines are more susceptible to hurricanes, large storm waves and high tides. Higher elevation areas, such as cliffs and coastal mountains, are more vulnerable to coastal erosion from wave attacks during high tides or elevated sea levels, with rising sea levels exacerbating this erosion. Rising sea levels can lead to the displacement of communities, loss of property, and extensive economic damage (McLeman, R. 2018). The economic costs of these impacts are distressing and include not just the immediate damage but also long-term challenges related to rebuilding and adaptation (Hinkel, J., et al. 2014). Hall, J. A., et al. (2019) explain that when making decisions for coastal areas there needs to be a clear set of principles and guidelines that can be based on a set of scenarios that are appropriate, defensible and actionable. As rising sea levels pose significant challenges, there is an urgent need for advanced scenario planning and preparation that incorporates a risk-based response, considering the implications of these environmental changes (Hurlimann, A., et al. 2014). Griggs, G. and B. G Reguero suggest that there are six main concerns for low-lying coasts from rising sea levels including "1. Permanent submergence of land by mean sea levels or mean high tides 2. More frequent or intense extreme flooding 3. Enhanced erosion 4. Loss and change of ecosystems such as wetlands 5. Salinization of soils, grounds and surface water 6. Impeded drainage" (IPCC 2014 as cited in Griggs, G and B. G Reguero 2021). Strategies to combat rising sea levels include reducing greenhouse gas emissions, enhancing coastal defences, and implementing effective adaptation measures. These actions require cooperation at multiple levels —individual, community, national, and international (Hall, J. A., et al. 2019). Griggs, G. and B. G. Reguero (2021) argue that to address climate change for both the present and the future, there must be informed action and a targeted response to address the impact of rising sea levels. Hall, J. A., et al. (2019) suggest that whole scientific insights may guide the best response, it is primarily determined by project planning, goal setting, cost-benefit analysis, engineering design practices and legal considerations, all of which are influenced by the decision-maker's risk tolerance

Implications of rising sea levels on ecosystems
Beyond the immediate threat to human settlements, rising sea levels have significant ecological consequences. Coastal ecosystems, such as mangroves, salt marshes, and coral reefs, are crucial for biodiversity and offer important services such as carbon sequestration, storm protection, and habitat provision (Reise, K. and J. E. E. v. Beusekom. 2008). As sea levels rise, these ecosystems are at risk of being submerged or altered in ways that can disrupt their function and reduce their ability to support a diverse range of species. For instance, coral reefs, which provide essential support to countless marine species, are increasingly threatened by both warming temperatures and the physical impacts of rising seas (Cole, A. J., et al. 2008). Griggs, G. and B. G. Reguero (2021) explain Rising water temperatures and ocean acidification are projected to impact coastal ecosystems, leading to significant consequences for the essential services they provide, such as fisheries, coastal protection and carbon sequestration.

Social and Economic Significance
Griggs, G. and B. G. Reguero (2021) address how rising sea levels could impact tourism and recreation by constantly altering landscapes like beaches and transportation infrastructures. The future appeal of coastal areas for tourism and recreation will also be influenced by changes in air temperature, seasonality, and sea surface temperature. While ocean warming and acidification are likely to have a more direct impact on global fisheries and aquaculture, rising sea levels may exert indirect effects by damaging habitats (Bigford, T. E. 2008). Vulnerable communities, especially in developing countries like Kiribati will experience the greatest impacts. These communities often have fewer resources to adapt to changes and are more likely to experience severe consequences from environmental changes (Vellinga, P. and S. P. Leatherman. 1989). The effects of sea level rise are, therefore, not merely a matter of environmental concern but also one of social justice and equity. Addressing these impacts requires a concerted effort to support affected communities through adaptation strategies, financial assistance, and international cooperation (Woodruff, S., et al. 2018).

Architecture addressing rising sea levels (negative and positive impacts
Architecture significantly influences the impacts of rising sea levels, both positively and negatively. On the positive side, innovative designs and engineering solutions enhance resilience against climate change (Hill, K. 2015). For example, architects in the Netherlands have developed advanced flood management systems and floating structures that can adapt to rising water levels (El-Shihy & José, 2019). Additionally, sustainable practices like green roofs and permeable materials improve urban resilience by managing stormwater and reducing runoff, thereby alleviating pressure on coastal defences (Huber, J. E., et al. 2017).
In contrast, traditional architectural approaches often exacerbate vulnerabilities in coastal areas by ignoring sea level rise risks, leading to the destruction of vital natural barriers such as wetlands and mangroves, which are essential for flood protection (Hirschfeild et al., 2021). Furthermore, conventional coastal protection strategies often rely on engineered solutions like seawalls, which can result in habitat loss (Ashley & Ashley, 2008; Sutton-Grier, Wowk, & Bamford, 2015; Temmerman et al., 2013). A growing recognition of nature-based solutions suggests a potential shift towards more sustainable, habitat-focused strategies (Hobbie & Grimm, 2020). Although architecture holds promise for addressing the challenges of rising sea levels, it must be pursued with an emphasis on environmental considerations and long-term resilience to mitigate adverse effects.

In conclusion, the rising sea levels driven by climate change represent a significant and diverse set of challenges, impacting the safety of coastal communities, the health of global ecosystems, and social stability. Addressing these issues requires a comprehensive and collaborative approach that integrates scientific research, policy-making, and community engagement. As we move forward, it is crucial to recognize the interconnected nature of these challenges and work collectively toward solutions that safeguard our environment and the well-being of future generations. To achieve this, we propose a forward-thinking initiative for the Nanikaai community, crafted specifically to align with the needs and lifestyles of the I-Kiribati people. The aim is to develop versatile spaces that can support the wide range of activities and gatherings essential to community life. By thoroughly understanding traditional customs, social structures, and environmental factors, we can create spaces that are both practical and adaptable to the changing needs of the community. Ultimately, seeking to establish a welcoming environment that nurtures connections, fosters learning, and encourages growth, grounded in the experiences and aspirations of the I-Kiribati. This initiative represents a proactive effort to build resilience and empower the community in the face of climate change.

Theoretical Framework

In this research, I have utilized and adapted two theoretical frameworks to critically analyse and shape my work. Each framework offers a unique set of criteria that will be used to critique this research which will allow for a deeper understanding and more refined interpretation of what this could look like.

The first framework is Te maiu raoi (well-being) created but the Ministry of Social Development and is found in the report “Boutokaan Te Mweeraoi: A Conceptual Framework for Enhancing I-Kiribati Wellbeing’s” (Development, M. o. S. 2015) Been represented as a series of interconnected circles. Each circle depicts the relationship between four key elements. The outermost circle, Marin abara, represents a healthy environment and ecology. The next circle within Marin abara is Te toronibwai, which encompasses self-reliance skills related to subsistence and spiritual connections with nature. Inside Te toronibwai is Te katei, which consists of customary practices that are unique to the I-Kiribati people. This has been developed over generations to create a sense of unity with the environment. Lastly inside Te katei is Te karinerine which represents the demonstration of respect within te utuu (the family), te kaainga (the extended family community), te maneaba (the traditional hall of community governance), and te aba (the land and its people).

The second framework is inspired by the Te Maiu raoi framework and focuses on adapting the four key elements into a set of design criteria. This approach allows the opportunity to explore and identify various aspects of the design and research process, assessing how effectively they incorporate these principles. This framework is organized into 12 categories: Fresh Produce, Waste Management, Community Engagement, Ecosystem Regeneration, Energy Systems, Air Flow, Green Spaces, Habitat Regeneration, Learning Spaces, Water Systems, Sunlight, and Tide/Storm Systems.

By applying these frameworks, I aim to understand and contribute a deeper appreciation of how design can meet functional needs and promote ecological health, cultural identity, and community cohesion. This approach creates more meaningful and impactful outcomes in this research

Theoretical Framework One

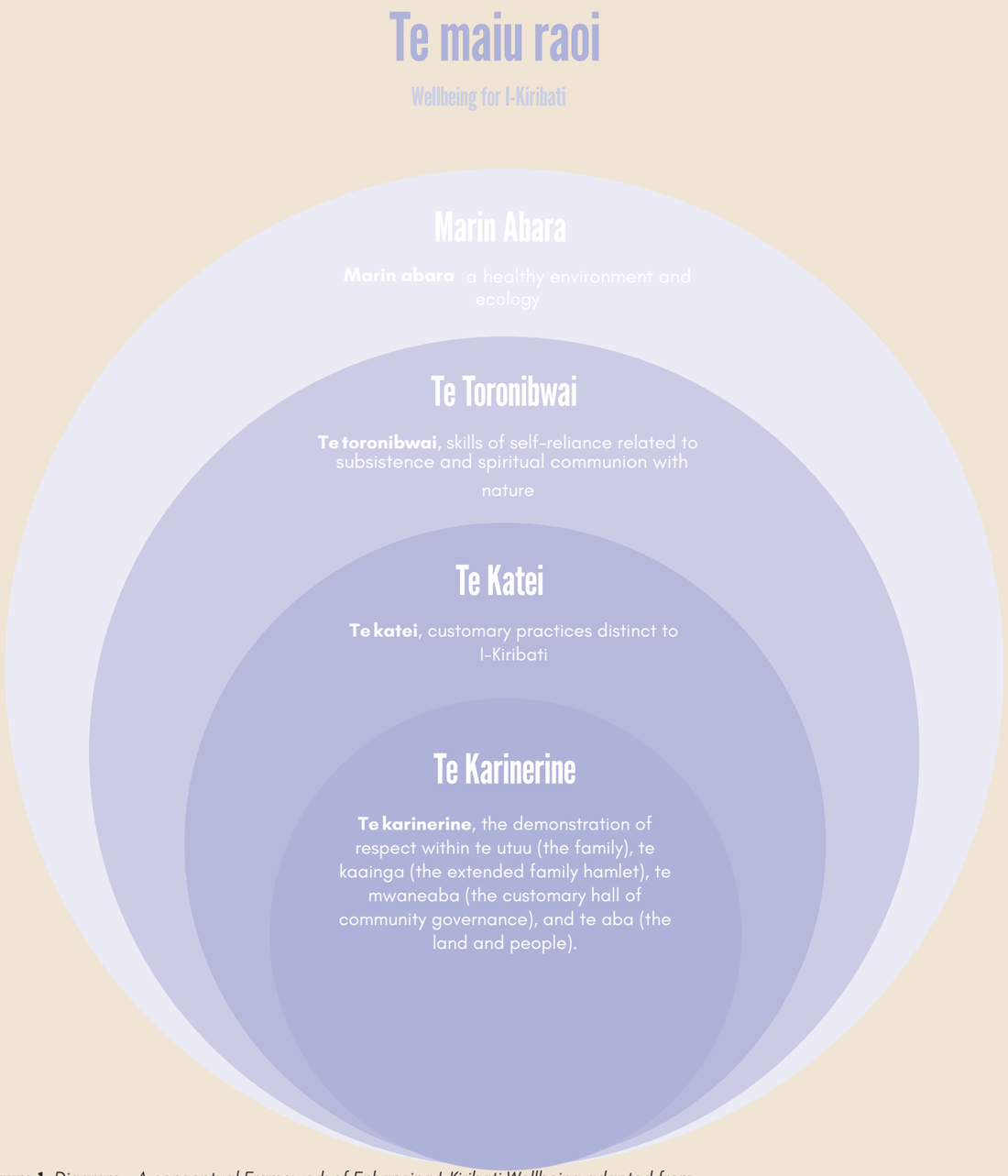


Figure 1. *Diagram - A conceptual Framework of Enhancing I-Kiribati Wellbeing adapted from Development, M. o. S. (2015)*

The Te maiu raoi framework can influence architecture by integrating cultural, ecological, and social dimensions into the design process.

1. Sustainable Design: By prioritizing Marin abara, architects can focus on creating environmentally sustainable buildings that harmonize with local ecosystems, utilizing materials and practices that minimize environmental impact.
2. Community Engagement: Incorporating Te toronibwai encourages designs that foster self-reliance and community resilience. Architects can create spaces that support local resources and practices, promoting a sense of ownership among residents.
3. Cultural Heritage: Through Te katei, architects can weave in customary practices and local traditions, ensuring that designs reflect and honor the cultural identity of the I-Kiribati people. This could manifest in architectural styles, materials, and communal spaces that resonate with local history.
4. Social Cohesion: Emphasizing Te karinerine, designs can enhance family and community interactions. Architectural layouts that facilitate gatherings, such as communal halls (te maneaba), and family-oriented spaces promote respect and unity among inhabitants.

Overall, this framework encourages an architecture that is not only functional but also enriches the community's cultural and ecological wellbeing. Development, M. o. S. (2015)

Theoretical Framework Two

Food security

Food security is essential for the well-being of individuals and communities, ensuring access to sufficient, safe, and nutritious food. It supports health, promotes economic stability, and fosters social cohesion. By safeguarding food supplies, we can reduce hunger and malnutrition, empowering people to thrive and contribute to society. Prioritizing food security also helps protect against the impacts of climate change and global instability.

Community Engagement

Community engagement is essential for building strong, resilient neighborhoods where residents feel connected and empowered. It fosters collaboration, encourages diverse perspectives, and enhances decision-making processes, leading to better outcomes for local initiatives. Active participation helps address community needs and priorities, creating a sense of ownership and responsibility. Ultimately, engaged communities are more likely to thrive, innovate, and support one another.

Ecosystem Regeneration

Ecosystem regeneration is crucial for restoring natural habitats and enhancing biodiversity. It helps revive ecosystems that have been degraded, promoting healthier soil, cleaner water, and improved air quality. By supporting ecosystem regeneration, we can mitigate the impacts of climate change and create resilience against environmental challenges. Ultimately, healthy ecosystems provide essential services that sustain life and support human well-being.

Waste management

Effective waste management is vital for protecting public health and the environment. It helps prevent pollution, reduces landfill overflow, and conserves natural resources through recycling and composting. Proper waste management also promotes sustainability by encouraging responsible consumption and minimizing waste production. Ultimately, it contributes to cleaner communities and a healthier planet for everyone.

Energy systems

Energy systems are vital for powering our daily lives, supporting economic growth, and ensuring the functionality of modern infrastructure. Transitioning to sustainable energy systems reduces reliance on fossil fuels, lowers greenhouse gas emissions, and mitigates climate change. Diversifying energy sources enhances resilience and security, while promoting innovation in technology and efficiency. Ultimately, effective energy systems are essential for a sustainable future and the well-being of communities worldwide.

'The breeze'

Airflow and breezes are crucial for regulating temperatures and maintaining a comfortable climate in both natural and built environments. They help disperse pollutants, improving air quality and promoting healthier living conditions. In ecosystems, breezes aid in pollination and seed dispersal, supporting biodiversity. Additionally, effective airflow enhances ventilation in buildings, reducing energy consumption and improving indoor air quality.

Figure 2. *Icons - Theoretical framework 2*

Green spaces

Green spaces are vital for enhancing urban environments and promoting public health. They provide recreational areas for communities, encouraging physical activity and social interaction. These spaces improve air quality, support biodiversity, and help mitigate urban heat. Additionally, green areas contribute to mental well-being, offering a natural escape that reduces stress and enhances overall quality of life.

Cultural Recognition

Cultural recognition is essential for fostering inclusivity and respect among diverse communities. It validates the identities and experiences of individuals, promoting social cohesion and understanding. By acknowledging and celebrating different cultures, we can combat stereotypes and prejudice, creating a more equitable society. Ultimately, cultural recognition enriches our collective experience and contributes to a more harmonious world.

Water systems

Regenerative water systems are essential for sustaining healthy ecosystems and ensuring clean water supply for communities. They promote natural filtration processes, enhance biodiversity, and restore wetlands, which help mitigate flooding and improve water quality. By implementing regenerative practices, we can conserve water resources, support agri-cultural resilience, and adapt to climate change impacts. Ultimately, these systems contribute to a more sustainable and balanced relationship between human activity and the natural environment.

Tides / Storm systems

Tide and storm systems are crucial for maintaining the health of coastal ecosystems. Tides help regulate marine habitats, supporting diverse species and promoting nutrient cycling. Storm systems can replenish wetlands and estuaries, providing natural barriers against erosion and flooding. Understanding these dynamics is vital for effective coastal management and disaster preparedness, ensuring the resilience of communities against climate change impacts.

Sun

The sun is fundamental to life on Earth, providing the energy necessary for photosynthesis, which sustains plant life and, consequently, the entire food chain. It regulates our climate and weather patterns, influencing ecosystems and habitats. Solar energy is a clean and renewable resource, offering a sustainable alternative to fossil fuels. Additionally, sunlight plays a crucial role in our physical and mental well-being, promoting vitamin D production and enhancing mood

Learning spaces

Learning spaces are crucial for fostering effective education and collaboration. They provide environments that inspire creativity, critical thinking, and active participation among students. Well-designed learning spaces can enhance engagement, accommo-date diverse learning styles, and promote teamwork. By prioritizing these spaces, we can create a more inclusive and stimulating atmo-sphere for personal and academic growth.

Figure 2. *Icons - Theoretical framework 2*

Aims & Objectives

Regenerative relationships for Wellbeing and Health of people and ecosystems

Creating regenerative relationships for wellbeing & health of people & ecosystems in terms of:
-Fresh water
-Access to nourishing affordable food
- Fresh water
-Healthy ecosystems
-Community growth

Healthy realtionship between land and sea

Creating relationships between land and sea
- Tarawa, Kiribati being an atoll the island is mostly water.
-How can we create more land? can we bring land to water?

Architecture for supporting regenerative coral infrastructure

Designing architecture for supporting regenerative coral infrastructure
- Promoting coral growth
-Promoting healthy ecosystems
- Mitigating rising sea levels

Figure 3. *Diagram - Aims & Objectives: Land and sea*

Issues & Challenges

Defining the issue:

Outside View Perspective

From an outside perspective, Kiribati faces significant challenges, with sea level rise emerging as a paramount concern. As one of the most vulnerable nations to climate change, the rising ocean threatens not only the physical landmass but also the livelihoods and cultural heritage of its people. Saltwater intrusion jeopardizes freshwater supplies and agriculture, while frequent flooding disrupts daily life and economic stability. These pressing issues call for urgent international attention and support, highlighting the need for adaptive strategies and sustainable solutions. Prioritizing action against sea level rise is essential for safeguarding Kiribati's future and the resilience of its communities.

Inside View Perspective

From an inside perspective, the people of Kiribati view their challenges through a lens that often contrasts with global narratives about sea level rise. Rather than focusing solely on the threat of disappearing land, many I-Kiribati recognize that land creation through natural processes is altering their landscape. Instead, their primary concerns center on the scarcity of freshwater resources, dwindling agricultural produce, and the degradation of existing habitats. Access to clean water is a pressing issue, affecting health and food security, while changing environmental conditions threaten their traditional livelihoods. For the people of Kiribati, these immediate challenges take precedence, as they navigate a complex reality that often feels overshadowed by external perceptions of their situation.

Chapter Two

Case Studies
Methodologies

Community

Community engagement is a vital process that encourages collaboration between individuals, organizations, and local authorities to address shared challenges and improve overall quality of life, particularly in places like Kiribati, where environmental vulnerabilities are pronounced. In this context, the active participation of community members in decision-making and project implementation is crucial, as it empowers residents and ensures that initiatives are tailored to their unique needs and perspectives, ultimately enhancing the resilience of I-Kiribati communities in the face of climate change.

Case Study 1

Live & Learn: Environmental Education

Figure 4. *Image - Live & Learn: Environmental Education symbols*

Summary of Climate Resilient Islands Case Study: Live and Learn Environmental Education

The Climate Resilient Islands initiative focuses on enhancing rural communities' resilience to climate change through nature-based solutions. The program aims to achieve three main objectives:

1. Improved Ecological Resilience: This involves adopting sustainable land management practices that supports the health of local ecosystems.
2. Enhanced Community Resilience: The initiative supports the development of nature-based livelihoods and improves food security, ensuring communities can sustain themselves in the face of climate impacts.
3. Disaster Preparedness: It provides training and resources to prepare communities for climate-related disasters, thereby increasing their overall resilience.

The program integrates three key capacities—absorptive, adaptive, and transformational—symbolized by the coconut palm, crab, and butterfly, respectively. These capacities help communities navigate the challenges posed by climate change. Communities participating in the program actively identify their priorities and strategies for resilience. Key pathways include:

- Intergenerational Indigenous land management practices.
- Strengthening ecological resilience.
- Restoring and enhancing local food systems.
- Accessing small resilient grants to support community livelihoods.
- Engaging in disaster preparedness training.

Through these key pathways, the Climate Resilient Islands initiative fosters sustainable, resilient communities capable of thriving despite the challenges of climate change.

Case Study 2

Youth Learning Centre, Betio, Kiribati

Figure 5. *Image - Youth learning centre on Kiribati*

The Youth Learning Centre in Betio, Kiribati, is designed as a vibrant space for local youth to learn, connect, and engage in recreational activities. Developed in collaboration with young community members, the centre features flexible learning areas, an office, a café, vegetable gardens, and a performance space.

The design process was established with community involvement, with workshops and interviews conducted with various youth groups to gather feedback. These sessions, primarily held in traditional maneaba (meeting houses), revealed a strong desire among young people to celebrate their Kiribati culture, particularly through traditional architectural styles. This preference contrasted with the views of many local adults, who leaned towards a more modern aesthetic.

The final design is a two-storey structure that creatively interprets the traditional maneaba, topped with a bright yellow roof. Overall, the Youth Learning Centre stands as a testament to the importance of cultural identity and community engagement in creating spaces for youth empowerment.

Tactical Urbanism

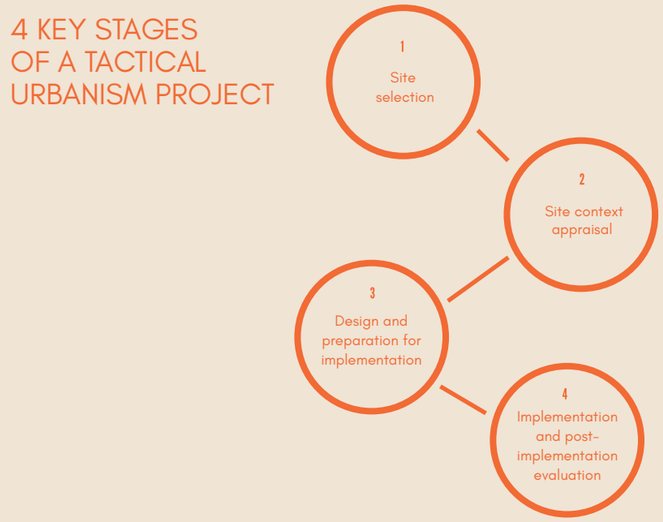


Figure 6. *Diagram - 4 Key Stages of a Tactical Urbanism Project adapted from Mohankumar, V. (2020)*

Tactical urbanism is a citizen-led, adaptable approach to transforming urban spaces, and its principles can be particularly impactful in Kiribati, where communities face unique environmental and infrastructural challenges. By implementing short-term, low-cost strategies tailored to the specific needs of I-Kiribati communities, this method allows residents to quickly address issues related to climate change and urban development. Encouraging collaboration among community members, local businesses, and government agencies promotes public engagement and meaningful feedback, ultimately paving the way for sustainable, long-term improvements that enhance the liveability of public spaces in this vulnerable island nation.

Mohankumar, V. (2020). A Tactical Urbanism Guid-book M. o. H. a. U. A.-G. o. India.

Case Study 3

72 Hour Urban Action

Figure 6. *Image - 72 Hour challenge Stuttgart 2012*

Figure 7. *Image - 72 Hour challenge Stuttgart 2012*

Figure 8. *Image - 72 Hour challenge Stuttgart 2012*

72-Hour Urban Action (72HUA) is an innovative, real-time architectural competition where international teams collaborate to design and build public interventions within a limited urban space in 72 hours. This initiative aims to reshape perspectives on public spaces by quickly addressing local issues and generating alternative ideas through creative solutions in small urban areas that hold significant potential but are often overlooked.

Key features of 72HUA include:

- Flexibility: Projects adapt to the specific functions and characteristics of each site, allowing for quick adjustments.
- Competition: While the event fosters a competitive spirit, the focus is on collaboration and pushing boundaries rather than solely winning.
- Smart Solutions: Diverse teams, including experts and amateurs, collaborate to devise optimal solutions in a short timeframe.
- Local Engagement: A playful preparatory phase involves understanding local circumstances and integrating community members from the outset.
- International Collaboration: Designers from around the globe come together with local residents, fostering cross-cultural exchanges.
- Innovative Design: Participants often hail from art and architecture fields, ensuring that installations are creatively conceived.
- Rapid Construction: Unlike lengthy planning processes, structures are completed and handed over to users within the 72-hour timeframe.
- Community Building: The project strengthens connections among local actors and establishes new points of reference for community interaction.
- Collaborative Impact: A large, collaborative effort enables significant improvements in a neighbourhood within a short period.
- Knowledge Transfer: The initiative encourages the exchange of skills and insights among participants and local inhabitants.
- Immediate Change: 72HUA addresses specific local challenges and initiates processes for improvement.
- Bottom-Up Approach: Input from the community informs structural interventions, guiding local administration on future developments.
- Fun and Passion: The event serves as a creative counterpoint to traditional, slower architectural processes, driven by enthusiasm and love for the project.

Overall, 72-Hour Urban Action is a dynamic platform that harnesses creativity and collaboration to transform urban spaces quickly and meaningfully, creating lasting impacts within communities.

Stuttgart 2012 72 hour challenge - all photos by 72 hour urban action - https://www.flickr.com/photos/72hua/albums/72157631997475073/

Coral Regeneration

Coral regeneration is a vital process for restoring damaged reef ecosystems, and it holds particular significance for Kiribati, where coral reefs are essential for marine biodiversity, coastal protection, and the livelihoods of local communities. Techniques such as coral gardening and Biorock technology can be particularly beneficial in this island nation, as they not only rehabilitate degraded reefs but also enhance their resilience against climate change and ocean acidification. By promoting coral health and diversity, these initiatives support the overall restoration of marine ecosystems in Kiribati, ensuring the sustainability of both the environment and the economies that depend on healthy coral reefs.

Case Study 4

Oceanix City Concept

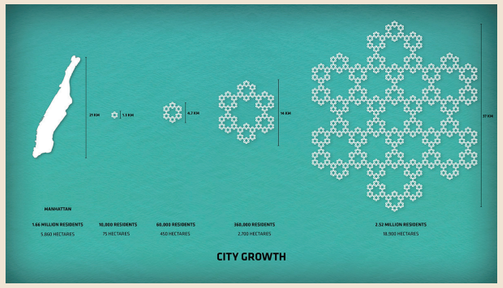


Figure 9. *Image - Oceanix City modular system*

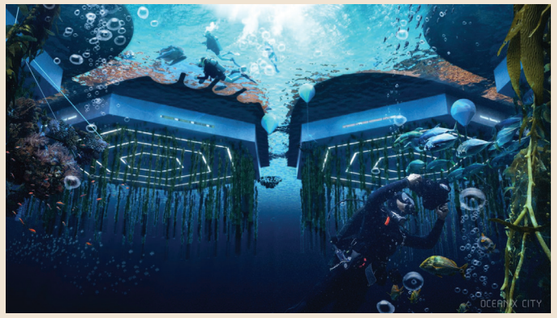


Figure 10. *Image - Oceanix city Biorock floating reefs*

Figure 11. *Image - Oceanix city concept birds eye view*

The Oceanix City concept envisions a sustainable urban habitat consisting of buoyant islands clustered into groups of six, creating self-sufficient villages. Each village can accommodate approximately 1,650 residents, with the potential to scale up to an archipelago designed for 10,000 inhabitants. This innovative approach addresses the urgent challenges posed by climate change and rising sea levels.

Coral reefs, which are critical to marine biodiversity and provide essential ecosystem services, are facing rapid decline due to overfishing, poor water quality, and global climate change. These ecosystems offer food security through small-scale fisheries, economic benefits from commercial fishing and tourism, and protection against coastal erosion. Additionally, coral reefs hold significant cultural importance for island communities.

To support Oceanix City and enhance its environmental sustainability, the concept integrates undersea Biorock floating reefs and promotes the farming of seaweed, oysters, mussels, scallops, and clams. These initiatives not only purify the water for the villages but also contribute to the preservation and restoration of coral reef ecosystems, ensuring the long-term viability of both the urban habitat and its surrounding marine environment.

Vernacular Architecture

Vernacular architecture refers to the traditional and localised building styles that evolve organically in response to the specific cultural, environmental, and social contexts of a community. This type of architecture is characterized by the use of readily available materials and techniques, often passed down through generations, reflecting the unique identity and heritage of the people who create and inhabit these structures. Vernacular buildings are typically designed to meet the practical needs of their users while being sensitive to the local climate, topography, and resources. As a result, they often feature distinctive elements, such as specific roof shapes, wall constructions, and layouts that resonate with the local environment and culture.

Case Study 5

Solomon Islands - Artificial Islands

Figure 12. *Image - Artificial island - Langalanga Lagoon*

The artificial islands of Langalanga and Lau lagoons, constructed by the saltwater people of the Solomon Islands, represent a profound cultural and historical tradition. Over centuries, these coral rock islands were meticulously built to evade frequent head-hunter raids and have become central to the local practice of shell money manufacture, which is used in various cultural transactions like bridewealth and land deals. (Watson, J., et al. (2020)

The Langalanga people have historically created and inhabited these islets in the Langalanga Lagoon on Malaita Island. Their construction process involves creating a large raft of logs, loading it with rocks, and then sinking it with coral to form a permanent landmass. These islands, built to a level above the high tide, are further developed with soil and trees. This labour-intensive process not only showcases their technical skills but also embodies supernatural beliefs. The initial rock placement, often done by a Kastom priest, symbolizes the power of the shark, while rocks from ancestral clan islets are used to transfer ancestral power to new constructions.

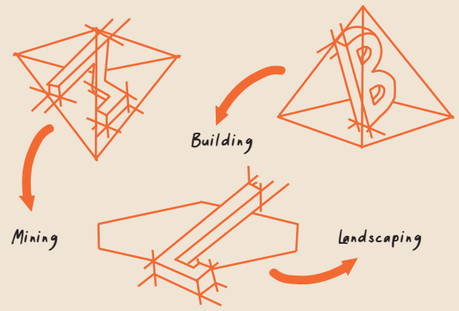
By 1997, the Langalanga population was about 5,000, primarily engaged in subsistence agriculture, fishing, and wage labour, with shell money as a significant cash income source. The artificial islands serve as cultural symbols and represent the Langalanga's relationship with their landscape. This relationship is a direct interaction with the land and sea, providing sustenance and shaping their cultural identity. The landscape thus acts as a dominant symbol, reflecting both the tangible and symbolic connections between the people and their environment. (Guo, P.-Y.) Nawisielski, D. (2024).

Methodologies

This thesis aims to develop and test regenerative systems and strategies within the specific context of Kiribati. The research methodology is structured to include a comprehensive approach that combines theoretical and practical aspects. The literature will inform and define the issues surrounding climate change on both global and community scales. This essential research will provide critical insights into the unique challenges faced by small island nations and will help frame the context for the study.
To strengthen the research context, a series of case studies will be conducted to identify effective practices and lessons learned from previous regenerative initiatives. By analysing examples, the study aims to gather valuable insights that can inform the development of strategies adapted to the specific needs of Kiribati.
Design methodologies will play a crucial role in the project, applying techniques such as collages and architectural drawings, including sections, isometric views, and perspectives, to visualize and communicate design concepts. Additionally, site analysis will be conducted to assess local conditions, resources, and cultural contexts, ensuring that the proposed solutions are both contextually relevant.

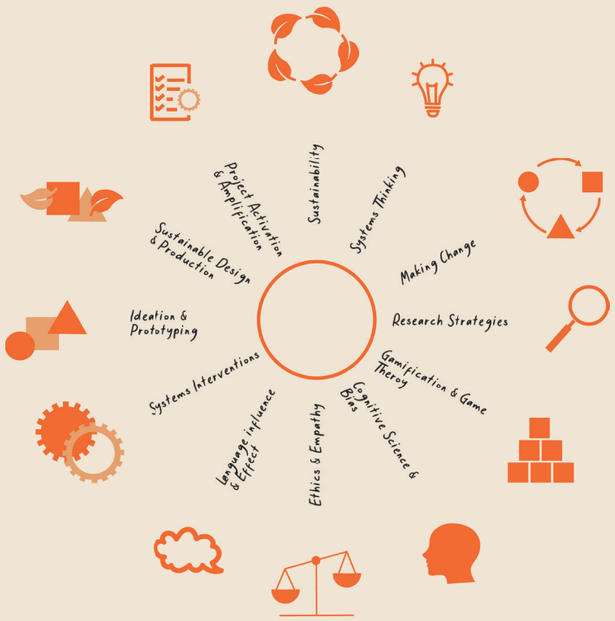
The Disruptive Design Methodology

The Disruptive Design Method (DDM) is a system-based approach that facilitates innovative problem-solving in response to complex environmental and social challenges. The methodology is structured into three interconnected sections: Mining, Landscaping, and Building, which together create a continuous cycle for refining solutions. Each section focuses on different aspects of the design process—Mining involves gathering insights and data, Landscaping explores potential interventions and strategies, and Building focuses on the implementation of solutions. Additionally, DDM comprises twelve specific components that guide practitioners in leveraging both creative and scientific methods to achieve meaningful and actionable outcomes. By fostering a collaborative and iterative approach, the Disruptive Design Method aims to drive transformative change in various contexts.



Three distinct parts of the Disruptive Design Methods

Figure 13. *Diagram - Three distinct parts of the Disruptive Design Methods adapted from Acaroglu, L (n.d.)*



The 12 parts of The Disrupt Design Methodology

Figure 14. *Diagram - The 12 parts of The Disrupt Design Methodology adapted from Acaroglu, L (n.d.)*

Chapter Three

Site Analysis
Programme

Site Analysis

Kiribati

Kiribati is an island country in the central Pacific Ocean, made up of 33 islands, Only 20 of theses are inhabited. Although the land area is small, the islands are scattered widely

Traditionally there are two building types
The maneaba (village meeting house)
Bata (dwelling house)

The forms of the maneaba and bata are simple yet highly complex in cultural meanings.

Water
Fresh water is obtained from wells sumk to the level of the fresh water lens

Marine resources
Ocean reef being very hazardous to navigate by canoe even at high tide, so most fishing was done by rod off the reef edge at low tide

The reef platform, exposed at low tide on both ocean and lagoon sides provide a continuous but minor source of food along its entire length

Tarawa, Kiribati

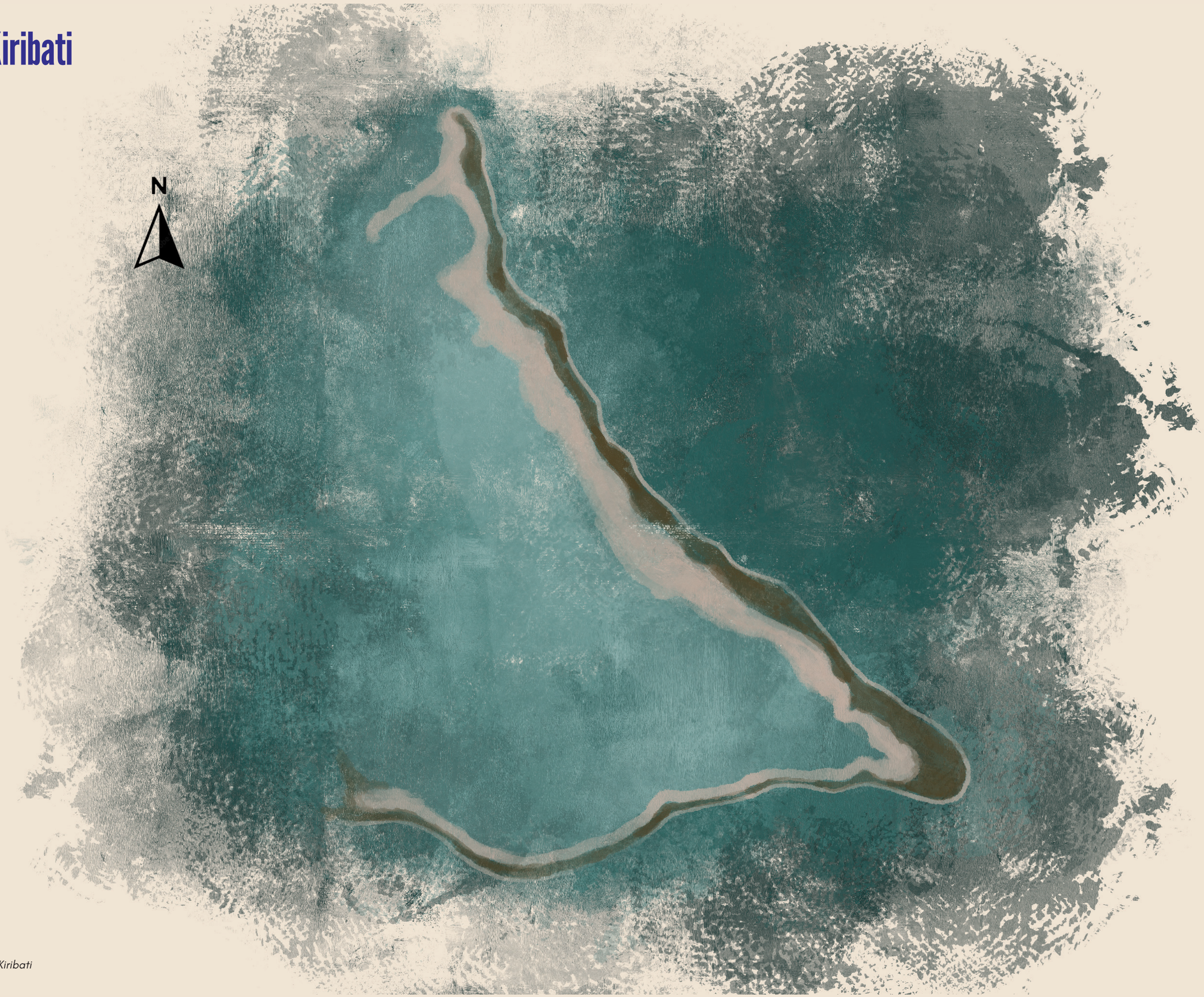


Figure 15. *Map – Tarawa, Kiribati*

Articulation of traditional space in Kiribati

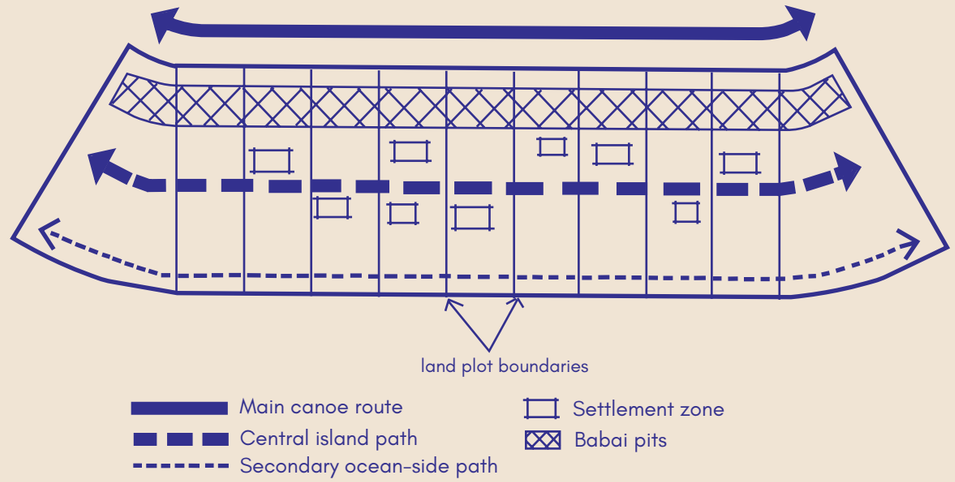


Figure 16. *Diagram - Traditional island pathways adapted from Hockings, J (1989)*

Taking into consideration of layouts of traditional pathways will be important to take into design.

The site is located ocean side of Nanikaai so taking inspiration of the layouts into the system of the design for instance the Baibai pits (root crops) being closest to the laggon side can be reflected by being located closest to land rather than further to sea.

Settlement's zones being central to this path which could create opportunity for placement of structure to be central to the design and having pathways around this.

Spatial composition of the *Mwenga* (household compound)

The *mwenga* as a spatial unit was composed of:
1. Residential structure/s
2. External spaces adjacent to the residential structure/s and used on a daily basis
3. Store houses and other ancillary structures

Each mwenga site customarliy contained
1. One or more cooking hearths and ovens
2. Semi-permanent drying racks for sea-food
3. An open fire place

The mwenga must be seen as almost undiffernetiated spatially, with most areas subject to multiple usage

Most of the spaces are intended for multiple usages for different occasions like eating, socializing and slepping. The spatial layout varied depending on the needs and desires of the residents and the site conditions. These key spaces like cooking and social spaces are generally seen as seperate spaces mkaing sure this is reflected in the design is an important factor when thinking about how Kiribati live, Hockings, J. (1989)

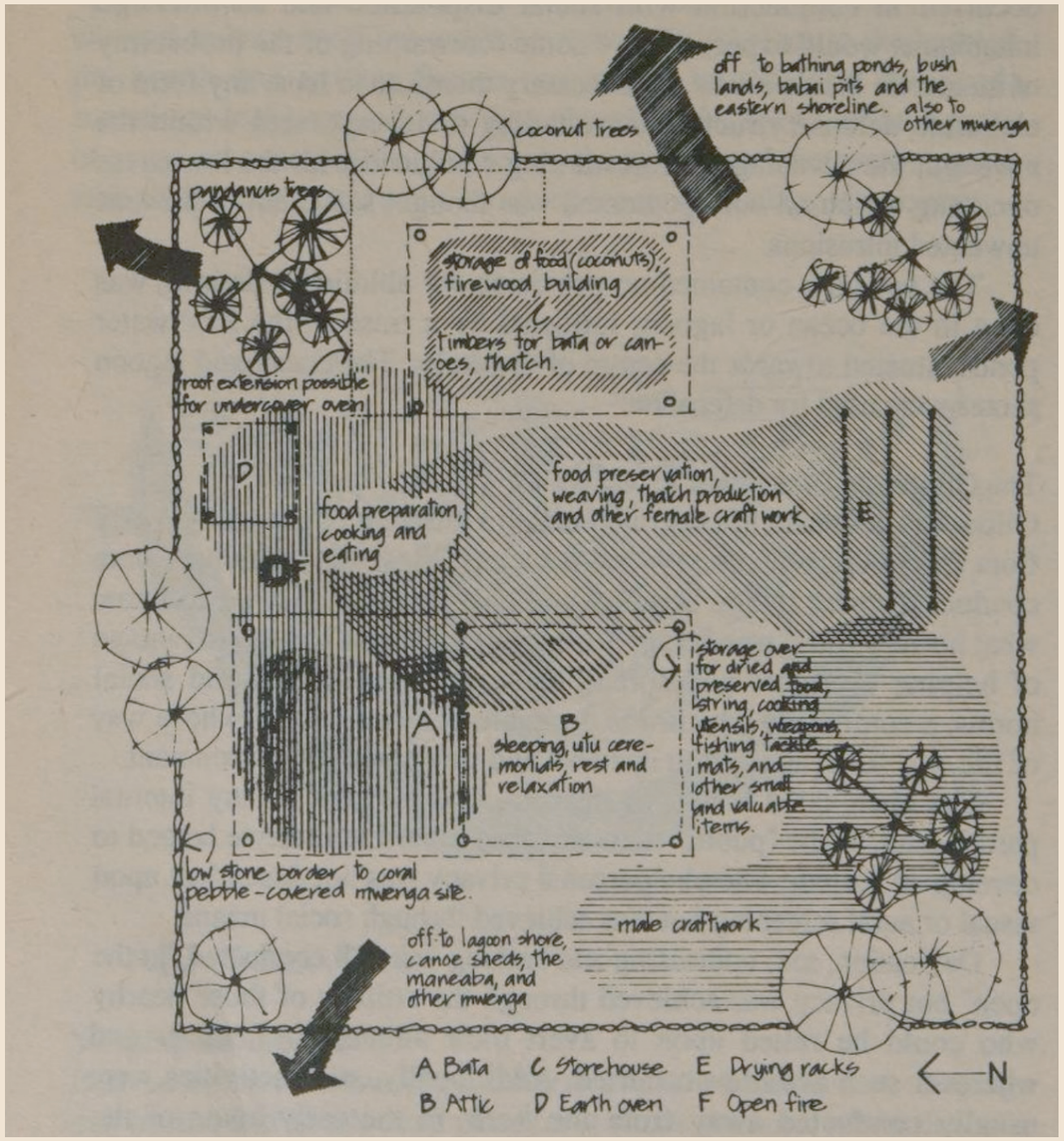


Figure 17. *Image: Dispersal of Activities around the Mwenga*

Structural form of the uma-ni-mane (men's house)

Element	Materials	Size/Proportion
Roofing	Pandanus thatch	-
Roofing structure	Pandanus timber	Pitch number of rafters, jointing details and lashing details matched the maneaba. The maneaba with which the kainga was associated
Post	Pandanus or limestone	Six posts, of the same height as the maneaba
Floor	Coral gravel on earth with coral stone border to same barea as eaves lines, plus a layer of matting	Plan proportions as used for maneaba
Footings	Large beach pebbles	300-500mm square

Hockings, J. (1989)

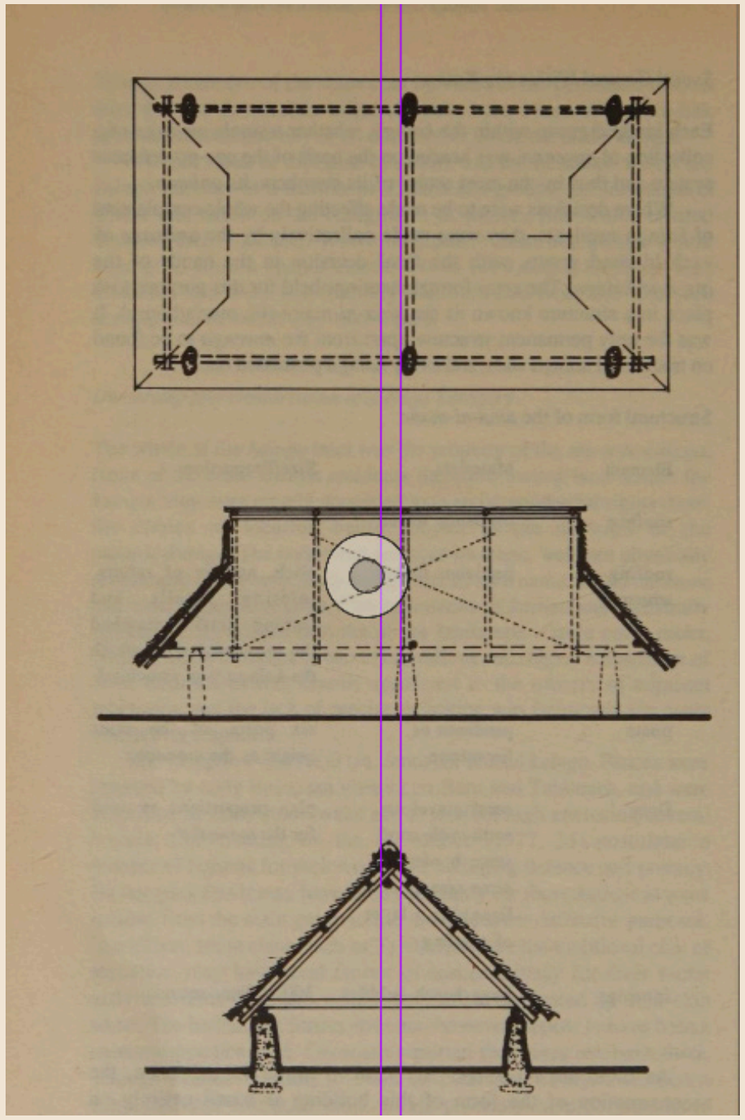


Figure 18. *Image: Construction of the Uma-ni-mane*

Figure 19. *Image: Maneaba*

Maneaba (Village meeting house)

The traditional maneaba is crafted using pandanus and coconut trees, relying on the strength of wooden pins, expertly fitted joints, and coconut husk string called te kora. This string is secured with intricate knots and lashing techniques, as highlighted by Hockings: “the lashings used throughout the maneaba were not arbitrary but meticulously specified for each joint... Many of the knots were highly complex and challenging to tie, and a significant part of the builder’s expertise lies in this knowledge” (Hockings, J., 1989, Whincup - Te Maneaba ni Kiribati).

Constructing the maneaba is a communal effort, with the entire village contributing materials such as string and thatch. This collaboration involves tree cutting, weaving, and physical labor, drawing upon various skills that are integral to Kiribati’s material culture and fostering strong community bonds among those involved.

The structure of the maneaba consists of three main areas: the marae, which surrounds the building and is covered in coral; the atama; and an inner space bordered by small stones, where village members gather. The unimwane have their designated boti, while the central area serves as a space for performances. Each aspect of the maneaba and the process of its construction carries significant spiritual, physical, and symbolic meanings for both individuals and the community.

This building process, marked by celebration and reverence for the master builder’s expertise (te tabunea), creates a sense of individuality within a supportive communal framework. Tvhe methodical construction aims to ensure ‘safety’ in the deliberative practices and decision-making of the maneaba (Hockings, J., 1989). Typically, maneabas are located along the shoreline, facing the lagoon.

Maneaba styles

Maneaba have 9 different styles with different roof pitches

Major subdivision	Subdivision	Ratio L/B
Tabiang	Tabiang	36/28
	Tabontebike	35/29
	Maungatabu	34/30
Maungatabu	Tabiang	40/24
	Tabontebike	39/25
	Maungatabu	38/26
Tabontebike	Tabiang	44/20
	Tabontebike	43/21
	Maungatabu	42/22

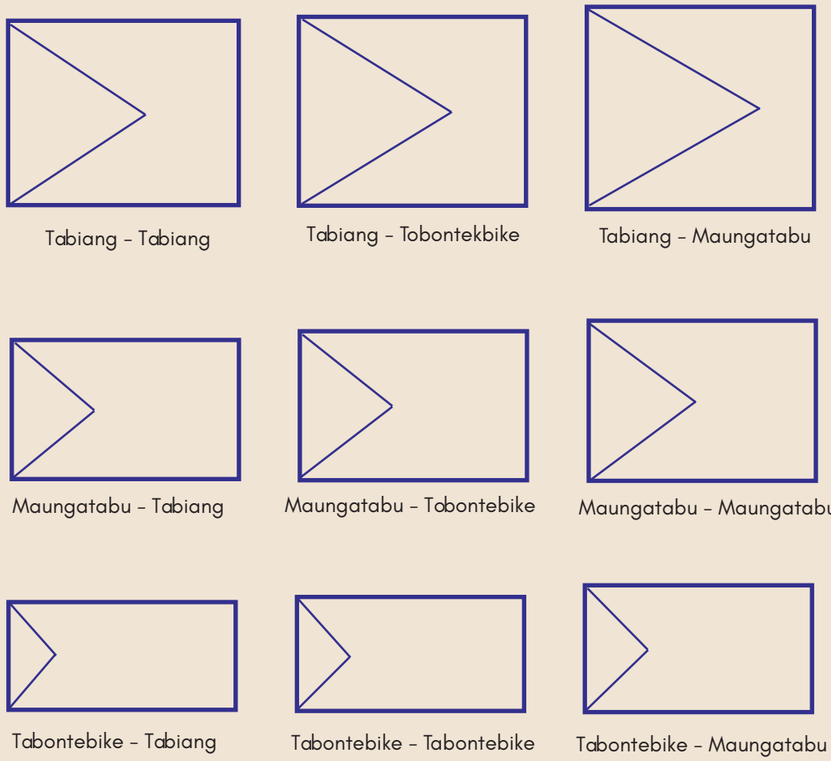


Figure 20 . *Diagram: Maneaba roof styles*

Figure 21 . *Image: Maneaba*

Nanikaai, Tarawa

Figure 22 . *Map: Nanikaai, South Tarawa, Kiribati*

Site: Nanikai Village, Kiribati
Population: 800 people
Main Road distance: 0.82km

- Tarawa is he capital of the republic of Kiribati, in the Central Pacific Ocean
- The atoll is largely known as the site of the Battle of Tarawa during Word War II.
- Kiribati consists of 33 coral islands divided into three island groups. The Gilbert islands (Tarawa is apart of the Gilbert Islands). The Phoenix Islands and the Line Islands.

Key trees/fruit trees common in Kiribati:
- Breadfruit
- Papaya
- Banana Tree
- Coconut
- Pandanus

Figure 23 . *Image: Cleanest beach in Nanikaai*

Nanikaai has one of the cleanest beaches on South Tarawa.
The community's takes pride in maintaining their beach clean-ups due to the protection of the ocean and marine life especially fish, which is their major food source. By maintaining their coastal clean-ups, the practice has now become part of their everyday lives and has changed their behaviour in relation to their waste management.

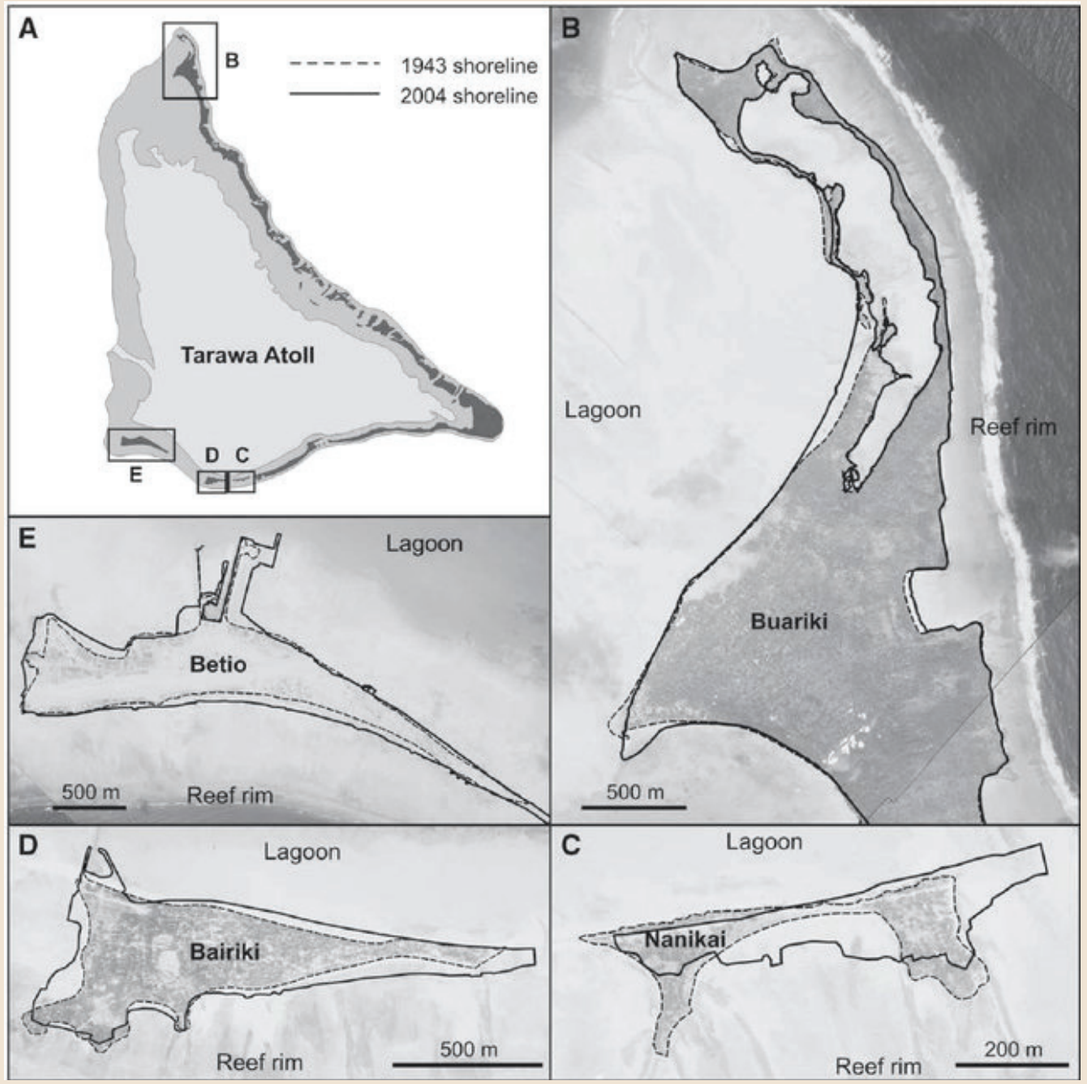


Figure 24 . *Image:* Changes in reef island planform characteristics for selected study islands on T arawa atoll, Kiribati. B) Buariki and E) Betio 1943 - 2004. C) Nanikai and D) Bairiki 1969 - 2004

Land Accretion

Land accretion is the gradual accumulation of soil or sediment in a particular area, is particularly relevant to the context of Kiribati. Interviews conducted by NUWAO have revealed that local communities are witnessing land expanding and growing due to land accretion, challenging the prevailing narrative that rising sea levels are solely responsible for suspected loss of land. Accretion typically occurs when the water flow slows, allowing sediments to settle, a process influenced by factors such as changes in water velocity or human activities like the causeway structures that were built in Tarawa changing the shape of the land due to the way the water now flows around these causeways. The ecological impact of newly formed land can be significant, providing habitats for wildlife and contributing to ecosystem diversity. Furthermore, the creation of new land can affect property rights, as ownership may extend to land that accrues naturally. Human activities, including agriculture and construction, can also accelerate or modify these natural processes. NUWAO (n.d.)

While climate change poses risks through rising sea levels and increased storm activity, the understanding of land accretion is crucial for effective environmental management and urban planning in Kiribati. Recognising the changing nature of the land can help reshape strategies for adaptation and sustainability, emphasizing the importance of local knowledge and perspectives in addressing climate-related challenges.

Atolls

Figure 25 . *Image:* How atolls are formed

Figure 26 . *Image:* Atolls - side view

Figure 27 . *Image:* Atolls - birds eye view

Atolls are ring-shaped coral reefs encircling a lagoon, often formed from volcanic islands. These unique ecosystems are typically located in warm, tropical ocean waters like Kiribati and play a crucial role in the lives of the communities that inhabit them.

Atolls, such as those found in Kiribati, develop from fringing reefs that grow around volcanic islands. Over time, as these islands erode and sink, they leave behind a lagoon encircled by the coral reef. These structures host diverse marine ecosystems, with the coral reefs providing essential habitats that significantly contribute to local biodiversity. While atolls are commonly found in the Pacific and Indian Oceans, Kiribati is home to several notable examples including Tarawa which is the main island on which this project is being placed. However, atolls are particularly vulnerable to climate change, facing threats from rising sea levels and ocean acidification, which endanger their coral systems and overall stability. Many of these atolls are inhabited, with communities relying on fishing and tourism for their livelihoods. Yet, their limited land area and resources pose significant challenges for sustainable living. Additionally, atolls hold profound cultural importance for indigenous communities, with traditions and practices deeply linked to their marine environments (Barnett, J. and W. N. Adgar (2003)

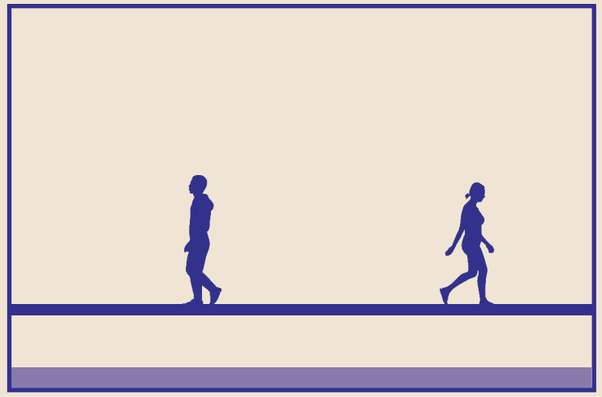
From the NUWAO interviews conducted during the field research trip in 2024, it was identified that atolls are perceived as living entities that are constantly changing. This perspective is vital in understanding the dynamic relationship between the communities of Kiribati and their environment. Recognizing atolls as living forms re-establishes the need for practical solutions that are not only practical within the context of Kiribati but also adaptable to the ongoing changes in these ecosystems.

Programme

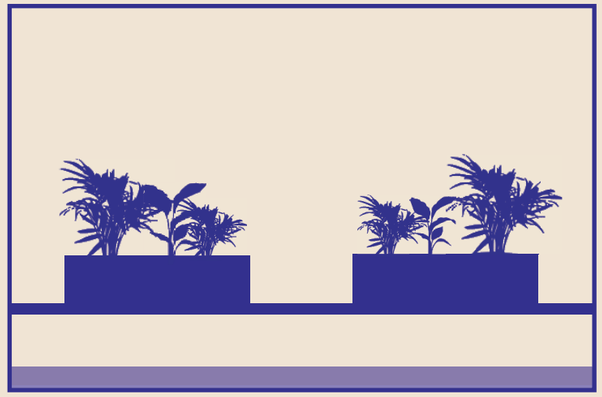
The youth space in Nanikaai, Kiribati, is envisioned as a dynamic and multi-use hub that not only nurtures young people's talents and interests but also deepens their connection to the environment and their cultural heritage. Central to this program is the careful consideration of circulation and accessibility, ensuring that every young person can navigate the space easily and participate in a variety of activities. The incorporation of green spaces and agricultural zones allows youth to engage in sustainable farming practices, promoting a sense of responsibility toward food production and security. Learning to grow their food empowers them with essential skills, while also promoting healthier eating habits within the community. Additionally, the focus on fishing and coral regeneration is crucial, as it educates young people about the importance of marine ecosystems and their role in sustaining local livelihoods. Through hands-on experiences, youth will learn traditional fishing techniques and modern conservation practices, emphasizing the balance between utilizing resources and protecting them for future generations. The innovative design of a double-height wharf accommodates the varying tides, providing a unique platform for educational activities related to coastal studies and climate resilience.

The integration of the breeze and natural ventilation throughout the space enhances comfort and promotes a connection with the outdoors, while solar power and rainwater harvesting systems embody principles of sustainability, encouraging youth to embrace eco-friendly practices in their daily lives. Furthermore, the seamless flow between indoor and outdoor areas fosters collaboration and creativity, allowing for a range of social and educational activities to take place in a flexible environment.

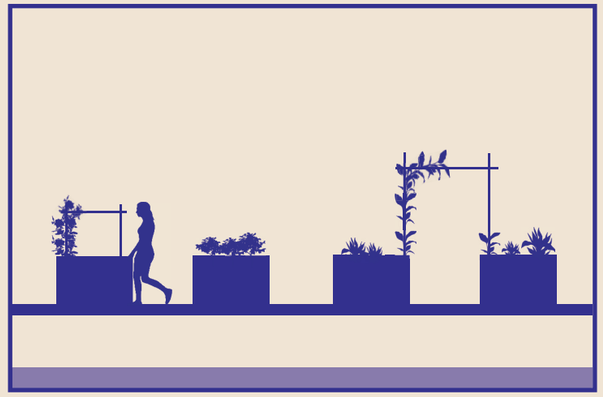
Drawing inspiration from traditional cultural architecture, the design reflects the community's heritage, instilling a sense of pride and identity among young people. This connection to their roots is further enhanced through cooking skills workshops, where youth can transform their agricultural harvests into nutritious meals. These sessions not only promote self-reliance but also cultivate creativity and appreciation for local ingredients, linking culinary traditions with contemporary practices. Ultimately, this programme provides the youth of Nanikaai with invaluable skills that extend beyond the immediate context of their community. By fostering a sense of responsibility for their environment, encouraging sustainable practices, and honouring their cultural identity, the youth space aims to cultivate a resilient generation capable of navigating the challenges of the future while cherishing their rich heritage.



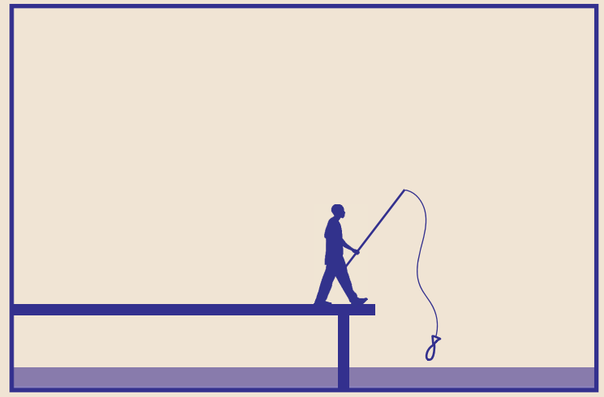
CIRCULATION



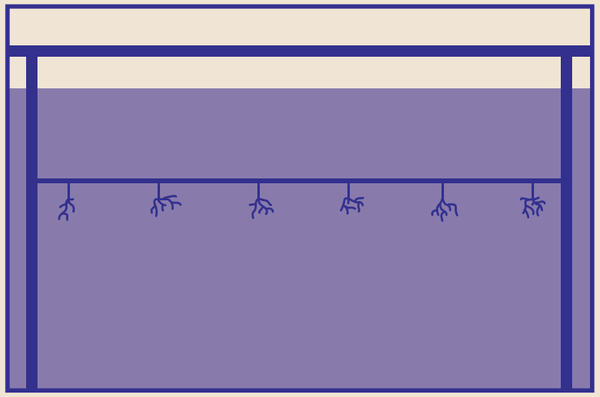
GREEN SPACES



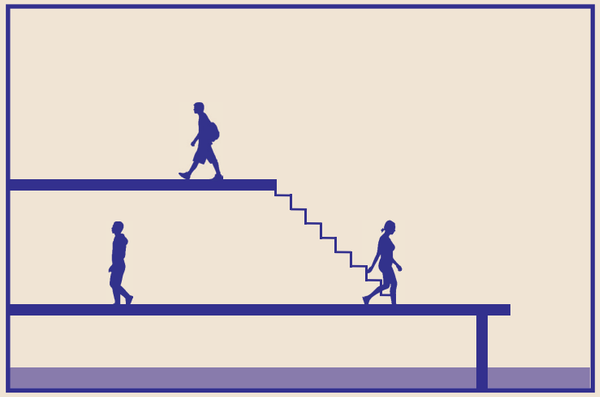
AGRICULTURE



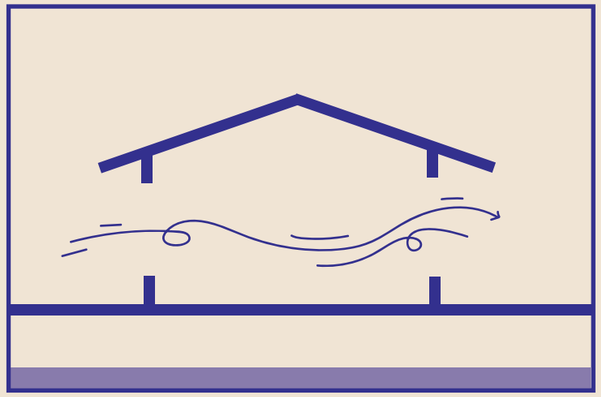
FISHING



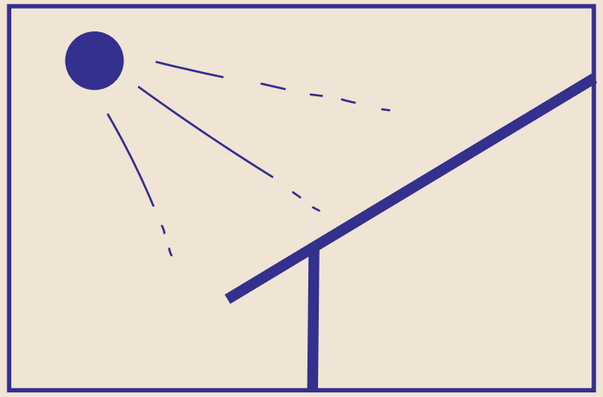
CORAL REGENERATION



DOUBLE HEIGHT

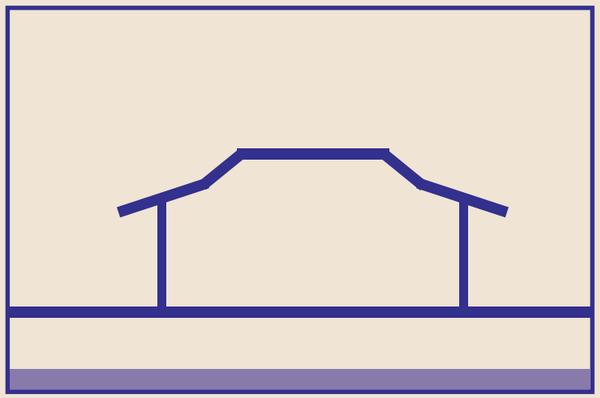


"THE BREEZE"

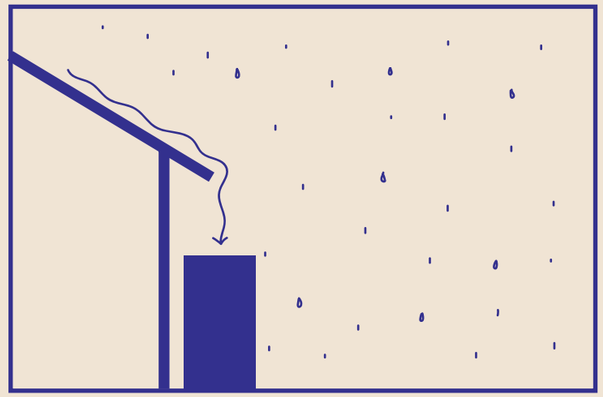


SOLAR POWER

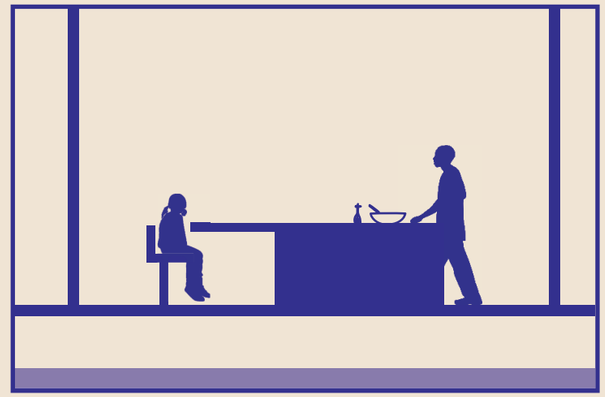
INSIDE & OUTSIDE FLOW



CULTURAL INSPIRATION



RAIN WATER HARVESTING



COOKING SKILLS

Figure 28 . *Diagram: Programme*

Chapter Four

Regenerative Systems:
- Zero Waste Systems
- Water Systems
- Food Systems
- Habitat Regeneration
- Energy Systems
- Materiality

Regenerative Systems

Due to climate change and the potential risk of rising sea levels, the need for regenerative systems has never been more urgent. Regenerative systems prioritize zero-waste practices and renewable resources. By focussing on zero food waste and human waste systems, sustainable food production, efficient water management, habitat regeneration, renewable energy solutions, and the use of sustainable materials, These regenerative strategies are essential for fostering resilience against climate-related impacts and promoting environmental and social well-being.

Zero Waste Systems play a crucial role in minimizing landfill contributions and reducing greenhouse gas emissions. By emphasizing resource efficiency and circularity, these systems not only alleviate pressure on landfills but also create opportunities for local economies, aligning with climate adaptation strategies.

Food Systems must evolve to prioritize sustainable agriculture and local sourcing, reducing the carbon footprint associated with food transportation and promoting biodiversity. Regenerative agricultural practices improve soil health, enhance carbon sequestration, and mitigate the risks associated with food insecurity that are exacerbated by rising sea levels and climate instability.

Water Systems are vital in managing the quality and availability of freshwater resources. Integrated water management strategies help communities adapt to changing precipitation patterns and rising sea levels, ensuring a reliable water supply while protecting ecosystems.

Habitat Regeneration seeks to restore natural ecosystems, enhancing biodiversity and increasing resilience against climate impacts. Healthy ecosystems act as buffers against flooding and coastal erosion, critical concerns in the context of rising sea levels.

Energy Systems based on renewable sources reduce dependence on fossil fuels, significantly cutting greenhouse gas emissions. Transitioning to decentralized energy models empowers communities, enhances energy security, and fosters innovation in climate adaptation measures.
The use of Sustainable Materials in architecture and construction minimizes environmental impact while promoting resource efficiency. By prioritizing materials that are renewable, recyclable, and low in embodied energy, we can create built environments that contribute to climate resilience and reduce vulnerabilities to sea-level rise.
Together, these regenerative systems not only address the challenges posed by climate change but also create a framework for sustainable development. By integrating these practices into our urban and architectural landscapes, we can build resilient communities prepared to face the uncertainties of climate change, ensuring a sustainable future for generations to come.

Zero Waste Systems

Zero Waste Systems play a crucial role in minimizing contributions to landfills and significantly reducing greenhouse gas emissions. Focusing on resource efficiency and promoting circularity minimises the pressure on landfills. A key feature of closed-loop systems is that they produce no waste, following a circular life cycle where materials are repurposed in various ways. They can either be recycled into new products, reverted to their original raw materials, or returned to the environment as biodegradable waste, ensuring that resources are utilized to their fullest potential.

In Kiribati, where waste management and environmental sustainability are critical issues, the implementation of Zero Waste Systems could result in transformative benefits for local communities. Practices such as anaerobic digestion like Home Biogas systems offer a practical solution for households to convert organic waste into clean energy and nutrient-rich fertilizers. This approach not only addresses the pressing challenges of waste disposal and energy scarcity but also empowers residents to engage actively in sustainable practices, thereby enhancing their quality of life. Moreover, composting can play a crucial role in improving soil health and supporting local agriculture, which is vital for food security in this island nation. By enriching the soil with organic matter, composting helps increase agricultural productivity while reducing reliance on chemical fertilizers, which can harm the delicate ecosystems in Kiribati. HomeBlogas (n.d).

Together, these strategies can foster community resilience by promoting sustainable agricultural practices and reducing the ecological footprint of households. Additionally, by creating local markets for biogas and compost, communities can stimulate economic development and reduce dependency on imported goods.

By embracing Zero Waste Systems, Kiribati can not only mitigate the environmental challenges it faces but also cultivate a more sustainable future. This integrated approach will conserve resources, reduce emissions, and empower local economies, ultimately fostering a healthier ecosystem and enhancing the well-being of its people.

Water Systems

Regenerative water systems are essential for effectively managing the availability and quality of freshwater resources, particularly in Kiribati where water availability is limited. One key water system is rainwater harvesting, which involves capturing and storing rainwater for various beneficial uses. This harvested rainwater can be utilized for irrigation in gardens, washing clothes, and flushing toilets, effectively reducing dependence on municipal water supplies. With appropriate treatment and filtration, rainwater can be made safe for drinking, providing a sustainable and cost-effective alternative source of clean water that can significantly enhance community resilience. Campisano, A., et al. (2017)
In addition to rainwater harvesting, greywater systems represent another critical aspect of regenerative water management. Greywater refers to domestic wastewater generated from sources without faecal contamination, such as sinks, showers, baths, washing machines, and dishwashers. By treating and reusing greywater for irrigation or toilet flushing, these systems not only conserve freshwater but also minimize the volume of wastewater entering sewage systems. This practice not only reduces the burden on municipal wastewater treatment facilities but also promotes a circular approach to water use, where water is recycled and reused rather than discarded. Li, F., et al. (2009) Although anaerobic digestion systems eliminate the need for water to flush toilets, rainwater can be collected for other water uses. In this context, using greywater systems may not be as practical. However, in a large-scale project, they could potentially offer more benefits.

Implementing regenerative water systems creates a deeper understanding of the relationship between water, land, and community health. Engaging local communities in water management practices—such as installing rainwater collection systems promotes awareness and education about water conservation and sustainable practices.

Ultimately, regenerative water systems in Kiribati contribute to a more sustainable future by enhancing water security, supporting local ecosystems, and building community resilience in an era of environmental uncertainty. By embracing innovative approaches to water management, communities can adapt to the challenges posed by climate change while ensuring that future generations have access to the clean water they need to thrive.

Food Systems

According to community members and site visits, a range of vegetables are produced in the communities

Traditional tree & fruit crops	Root vegetables	Other vegetables
Coconut	Kumera	Cucumber
Mango	Cassava	Bok choy & Pak choy
Papaya	Taro	Cabbage
Breadfruit	Engish Potato	Spinach
Noni	Pumpkin	Broccoli
Banana		Salandeer
Pandanus	**Other vegetables**	Tomatoes
Dragon fruit	Ginger	Capsisum
Melon	Lemon grass	Beans
Moca	Chilli	Corn
Mbele		Lettuce
		Eggplant
		Chives

Figure 29 . *Table: Vegetables produced*

Food systems must evolve to prioritize sustainable agriculture and local sourcing, significantly reducing the carbon footprint associated with food transportation while promoting biodiversity and enhancing food security.

An initiative addressing food security in vulnerable atoll nations including Kiribati is the Atoll Food Futures (AFF) Program, led by the Live & Learn organization. This project aims to implement climate-smart agriculture technologies specifically designed for atoll communities, which are particularly susceptible to the impacts of climate change. The goal of AFF is to improve food security and reduce reliance on imported foods by empowering local populations to enhance their own agricultural practices. Through this program, Live & Learn emphasizes the significance of harnessing local knowledge and community-based solutions, ensuring that the strategies adopted are culturally relevant and environmentally sustainable.

Among the innovative methods introduced by AFF are raised bed gardens, which optimize growing space and improve soil drainage, making them particularly effective in areas with limited arable land. These gardens elevate crops, which helps to prevent waterlogging and allows for better management of soil quality. Another technique, keyhole gardens, offer an efficient and accessible gardening solution, designed with a circular shape that allows easy access to crops while conserving water through effective irrigation techniques. These gardens are ideal for small spaces and promote efficient resource use, ensuring that even in challenging environments, communities can cultivate their own food.

Raised beds would be the best option in a wharf concept for several reasons. First, they enhance drainage, which is crucial in coastal areas where waterlogged soil can hinder plant growth. Second, raised beds provide better accessibility for maintenance and harvesting, making it easier for individuals of all ages and abilities to engage in gardening activities. Additionally, they can help mitigate the impacts of saltwater intrusion, protecting plants from potential damage. Finally, the use of raised beds can create visually appealing green spaces that enhance the overall aesthetic of the wharf, encouraging community interaction and promoting sustainable practices. Education, L. L. E. (n.d)

	Family scale vision	Community scale vision	Island scale vision
Women	-Growing own food (and therefore) saving money - Have 1 bag of rice for 2 months for security for when cargo boats don't come -Food preservation & planting more food and crops	-Encouraging communities to provide seedlings and local food crops and vegetables - (Being able to) cater for big events and fundraising - Establish a canteen and plant more	- Agriculture must sustain the (whole) island - Have arrangements between businesses and shipping companies to avoid food shortages -Create a stroage house for food preservation for emergencies
Men	-Fishing and toddy (money making) - Save family funds by preserving food -Provide local food crops -Motivate young boys by providing local skills for fishing and cutting toddy -Sustain the traditional way of living	-Planting for food security and fishing - Sharing skills on gardening - Collaborating ideas to sustain culture and improve health to sustain food security	-A design on growing food crops using a quater acre to include fruit, local and root crops and vegetables -Training on gardening that helps to improve behaviour from not eating healthy food to eating a balanced diet
Youth	-Toddy and food preservation - preserve suagr for time of food security and a source of vitamin C	-Train youth to grow food crops, cut toddy and fish	-Training on agriculture production

Figure 30 . *Table: Community perceptions for improved food security - a vision adapted from Live & Learn: Enviromental Education (n.d)*

By integrating these visions at all scales into design, we can create spaces and systems that promote collaboration, education, and sustainable practices, ultimately strengthening food security for future generations.

Although primary considerations are for youth as design is a space for youth Taking into consideration the visions for women and men aswell for adaptability of the design.

Habitat Regeneration

Habitat regeneration is a crucial initiative aimed at restoring natural ecosystems, thereby enhancing biodiversity and increasing resilience against the impacts of climate change. Healthy ecosystems serve as essential barriers against flooding and coastal erosion, which are critical concerns in the context of rising sea levels. One significant aspect of habitat regeneration is coral reef restoration. There are various methods designed to rebuild damaged coral reefs and maintain sustainable ecosystems. An innovative technique used to regenerate coral reefs is Biorock technology, which accelerates coral settlement, growth, healing, survival, and resistance to environmental stresses such as high temperatures, sediment, and pollution. By applying safe, low-voltage electrical currents through seawater, Biorock technology causes dissolved minerals to crystallize on structures, forming a white limestone similar to the natural composition of coral reefs and tropical beaches. This method not only benefits corals but also supports the broader marine ecosystem.

To effectively restore coral reefs, several techniques have emerged. One method is coral gardening, where fragments of broken corals or small buds are collected and nurtured in land-based or underwater nurseries before being planted back onto the reefs. This process is akin to regrowing cuttings or seedlings in a garden, with various attachment methods such as glues or innovative techniques like the Coral clip, which allows corals to attach naturally to the reef without chemical bonding agents. This approach has proven to be faster and more cost-effective than traditional methods, achieving an impressive coral survival rate of 85%. NUWAO (n.d)

Another technique for coral restoration is coral IVF, which takes advantage of annual spawning events by capturing coral eggs and sperm from healthy reefs to rear millions of baby corals in controlled environments. This method not only promotes fertilization but also helps deliver coral larvae to damaged reefs, aiding in the re-establishment of breeding populations. The other technique coral aquaculture involves producing healthy corals in land-based tanks through a systematic process of collecting fragments, fertilizing them, and rearing the larvae in nurseries. Once these corals are settled onto specially designed surfaces, they are monitored for survival and growth, offering valuable insights for future conservation efforts. Hobbs, R. J., et al. (2022)

Overall, habitat regeneration through innovative coral restoration methods not only aims to restore damaged ecosystems but also contributes significantly to the health and resilience of marine environments. By implementing these innovative strategies, we can foster thriving coral reefs that support diverse marine life while simultaneously addressing the pressing challenges posed by climate change. Due to the smaller scale of this project, coral gardening would work best in this instance but on a larger scale, other techniques would also be beneficial and could become something that could be expanded on.

Energy Systems

Solar, Wind, Sea/Waves, Energy from waste systems

Energy systems based on renewable sources are essential for reducing dependence on fossil fuels and significantly cutting greenhouse gas emissions, playing a crucial role in the global fight against climate change.

Solar power, for instance, involves converting sunlight into electricity, either directly through photovoltaic (PV) cells or indirectly via concentrated solar power (CSP) systems. Photovoltaic panels utilize the photovoltaic effect to transform sunlight into usable electricity, making solar energy one of the fastest-growing renewable sources worldwide. As technology advances, solar panels are becoming more efficient and affordable, leading to widespread implementation in residential, commercial, and industrial settings. Additionally, innovations like solar farms and community solar projects allow multiple users to benefit from solar energy, further democratizing access to clean power. Muhammad Badar Hayat, et al. (2018)

Wind power operates similarly but focuses on harnessing the kinetic energy of wind. Wind turbines convert this energy into mechanical or electrical energy, making wind power one of the most widely utilized forms of renewable energy globally, alongside solar and hydroelectric power. Wind farms, both onshore and offshore, have proliferated in recent years, showcasing the potential of wind as a significant contributor to the energy mix. With advancements in turbine technology, including larger and more efficient models, wind energy is becoming increasingly cost-competitive with traditional fossil fuels.Archer, C. L. and M. Z. Jacobson (2005)

In addition to solar and wind, wave energy presents another promising avenue for renewable power generation. Wave energy captures the up-and-down motion of ocean waves, generating electricity through floating turbine platforms or buoys that rise and fall with the swells. This form of energy is particularly beneficial due to the vastness of the oceans, which provide a consistent and abundant source of power. As technologies for wave energy conversion continue to evolve, they offer the potential to contribute significantly to the energy grid, especially in coastal regions. Astariz, S. and G. Iglesias (2015)

Moreover, integrating these renewable energy systems with waste-to-energy technologies can further enhance sustainability. Energy recovery from waste involves converting non-recyclable waste materials into usable heat, electricity, or fuel through various processes, including combustion and anaerobic digestion. By utilizing waste as a resource, communities can reduce landfill contributions while simultaneously generating clean energy.

Collectively, these renewable energy systems not only provide cleaner alternatives but also empower local communities to engage in sustainable practices. By expanding energy options, communities can minimize reliance on traditional energy sources that often contribute to environmental degradation. This approach to energy generation not only addresses the immediate need for clean energy but also lays the groundwork for a more resilient and adaptive energy future, capable of meeting the challenges raised by climate change. As we continue to innovate and invest in these technologies

Materiality

Sustainable Materials in architecture and construction minimizes environmental impact while promoting resource efficiency. By prioritizing materials that are renewable, recyclable, and low in embodied energy, we can create built environments that contribute to climate resilience and reduce vulnerabilities to sea-level rise.

Figure 31 . *Image: The Auckland Council Stormwater Project*

Accoya Wood

Accoya wood is particularly well-suited for use in Kiribati, with challenges such as termite infestations and salt erosion. Accoya wood provides an effective solution to these environmental issues given its unique properties. The wood's resistance to insects, including termites, makes it an ideal choice for construction with the common infestations that termites pose on structures in Kiribati.

Accoya's resilience to saltwater exposure is also crucial for an island nation like Kiribati, where buildings and infrastructure are frequently subjected to harsh marine conditions. With over ten years of testing demonstrating that Accoya withstands saltwater contact better than many other durable woods, it offers peace of mind for those looking to maintain the integrity of their properties against erosion and decay.

Using Accoya wood as the main material, residents of Kiribati can benefit from a resource that improves the aesthetics of spaces but also adds to sustainability efforts, supporting the environment while addressing the challenges posed by their unique location. Accoya wood is a versatile material that can be used for cladding, decking, windows, and doors, allowing for cohesiveness throughout the design.

Some other Key Features include:

- Highly Stable and Durable
- Long Service Life
- Designed for all climates
-Low CO2 emissions
- Sustainably sourced
-Non-Toxic

Accoya (2024).

Figure 32. *Image: New & old wharf structure in Kiribati*

I-Kiribati communities take careful consideration of their skill in making the most of the materials at hand for various uses. They skillfully craft items like baskets, house walls, hats, and a variety of mats including mats for floors, sleeping, and dancing. These are generally made using pandanus and coconut fronds. These everyday objects have been refined over generations. They resonate deeply with the cultural beliefs, social and personal needs, history, resources, and concepts of identity of the I-Kiribati culture.

Chapter Five

Design

Design

When creating a concept for the Nanikaai community, the design must cater specifically to the needs and lifestyles of the I-Kiribati people. The primary objective is to create flexible environments that can adapt to the diverse activities and gatherings that are essential to the community's daily life.

Understanding the I-Kiribati way of life is essential in this process. Traditional practices, social structures, and environmental considerations all play a significant role in shaping the needs of the community. By prioritizing flexibility, we can ensure that spaces are not only functional but also responsive to the evolving needs of the community. Whether for community meetings, cultural celebrations, educational activities, or recreational events, these spaces must accommodate a range of uses.

Incorporating local materials and traditional practices will not only celebrate the cultural heritage of the I-Kiribati people but also ensure that the spaces blend in with their surroundings. Using locally sourced materials will ensure easier maintenance and repairs, making it simpler for community members to replace or fix elements of the design when necessary. This approach encourages sustainable practices, ensuring that the spaces remain functional and accessible for generations to come.

The ultimate goal of this project is to create a space that empowers the Nanikaai community, offering a welcoming space where people can connect, learn and thrive. The design is centred around the lived experiences and aspirations of the I-Kiribati.

Ideation

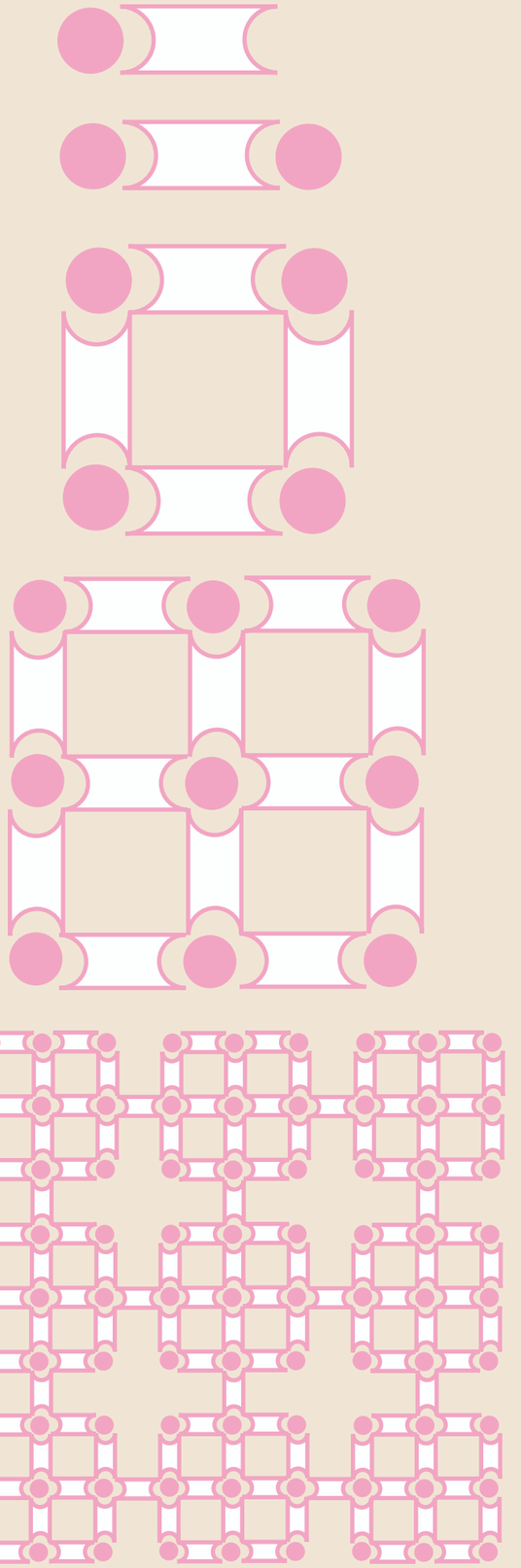
Using card to cut out different geometric shapes and coral shapes to create a contrast between a solid building and the abstract unpredictable nature of coral. and experimenting how these two forms could come together as one.

Figure 33. *Image: Ideation using cut outs of paper*

Outside View

As sea levels continue to rise, the boundaries between land and water blur, presenting challenges and opportunities for our coastal cities. This concept explores the innovative design of floating communities that integrate with the ocean's natural landscape. By reimagining our relationship with water, we can create sustainable habitats that rise and fall with the tides, ensuring safety and resilience against flooding while enhancing marine ecosystems.
In this concept, architecture becomes fluid, adapting to the changing environment and promoting a sense of community in a time of climate uncertainty. These floating communities will feature green spaces, energy-efficient structures, and communal areas that encourage connection among residents. By embracing the water rather than resisting the inevitable, we can design a future where communities thrive above the water, creating a new path towards sustainable living in harmony with nature.

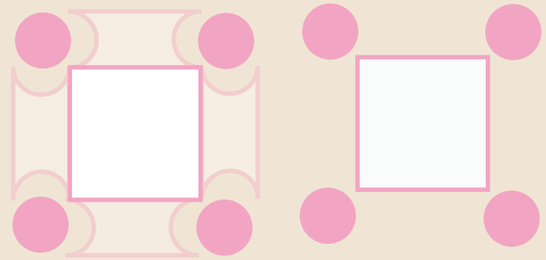
Figure 34. *Image: Floating spaces*



Permanent Bio rock Structures / Anchor points

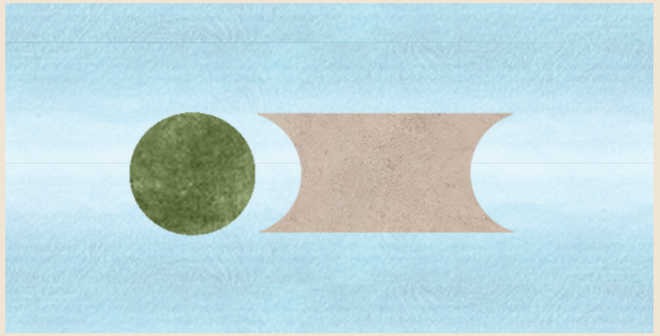
Adaptable floating Buildings

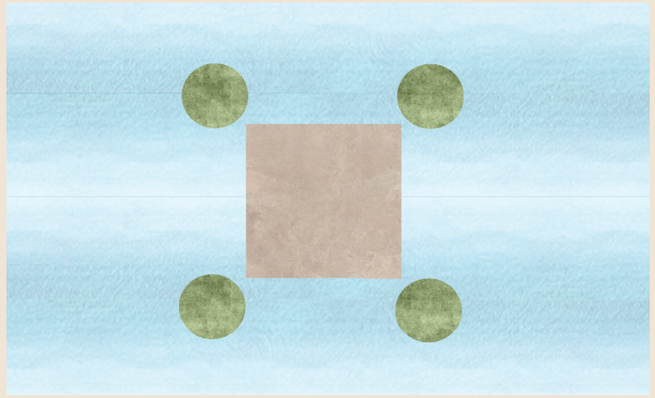
Figure 35. *Diagram: Modular floating community*

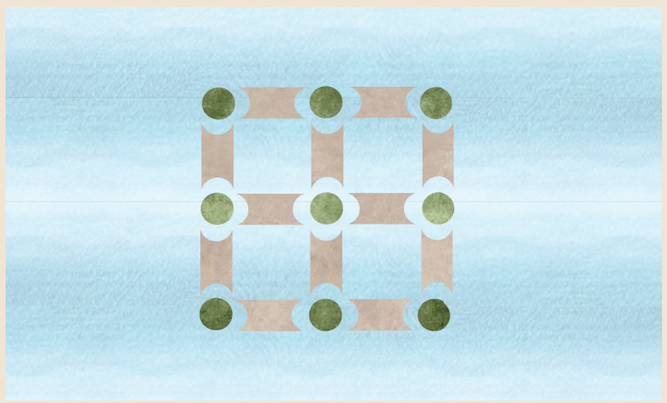


By taking away the smaller buildings and using a square shape that would have been the shape of water in the middle of the hubs to create a larger building for community use or a larger house to accommodate more people or people with potential disability. This way there is something for everyone. This building would take a whole hub system using the 4 Bio rock collumns and attaching to them to anchor.

Figure 36. *Image: plans for floating homes*







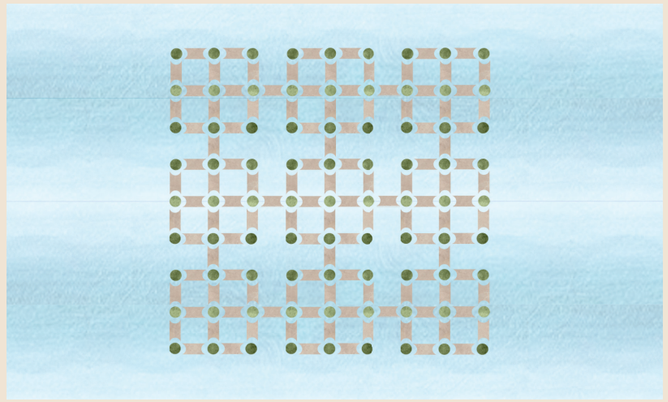


Figure 37. *Diagram: Modular floating community*

Crit 1 Reflection - April

- challenges re look at how to organise these, water and food quite different, not malnourished land but understand fertile soil in use maybe rephrase those,
- good to see the differentiating between challenges would be good to see opportunities of what could be done there but not here
- jump into design steps
- link between your work and Kasia
- work in Nuwao
- thinking about these systems and how they flow between urban system - urban political ecologies.
- use design skills
- add concepts

Inside View Concept

The people of Kiribati offer a unique perspective on the challenges of climate change. Contrary to the narrative of a looming crisis due to rising sea levels many Kiribati people are witnessing g a different reality: land accretion and the gradual expansion of their islands due to this. This viewpoint shifts our focus from reactive measures to proactive solutions that prioritise immediate and pressing concerns. As we design concepts inspired by this inside perspective, the key urgent matters are food security, water management, energy efficiency, habitat regeneration, and zero-waste systems. These elements are critical for the sustainability and resilience of Kiribati's communities. By harnessing local resources and traditional knowledge, we can develop innovative strategies that enhance agricultural practices, improve water access, and promote renewable energy solutions.

Figure 38. *Image: Local Hut structures in Kiribati*

Figure 39. *Collage: Ecological Wharf*

Collage 1

Using a wharf structure and what this could look like with flourishing eco-systems

Figure 40 . *Collage: Regenerative Wharf*

Collage 2

Testing how a wharf system could be inhabited with life specifically children under 18 years of age.

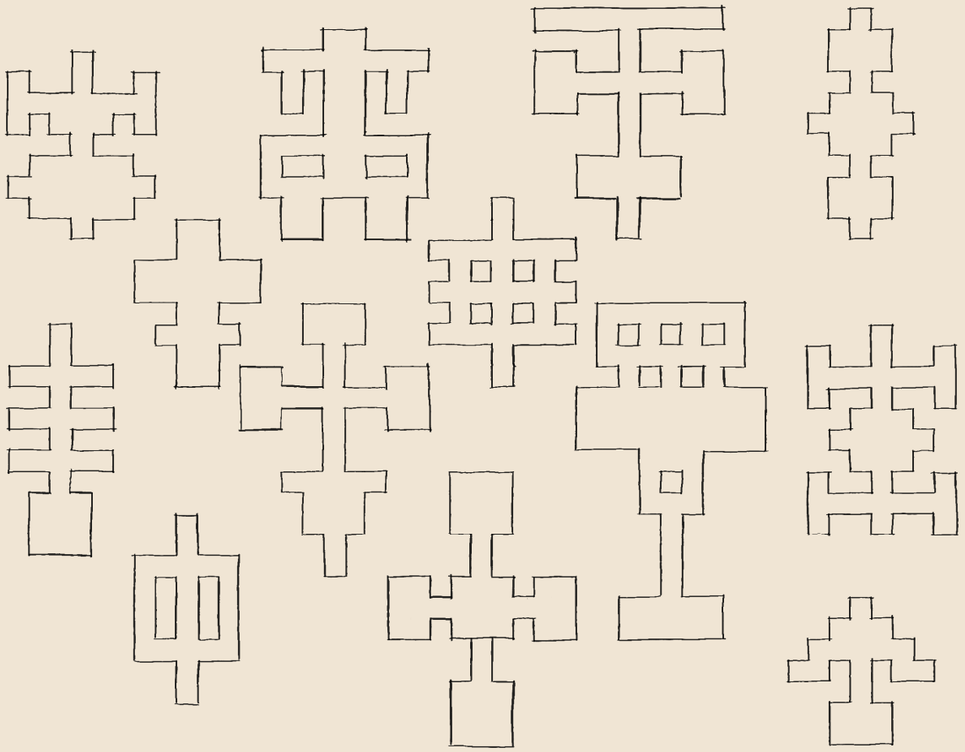


Figure 41 . *Image: 2D Layout drawings*

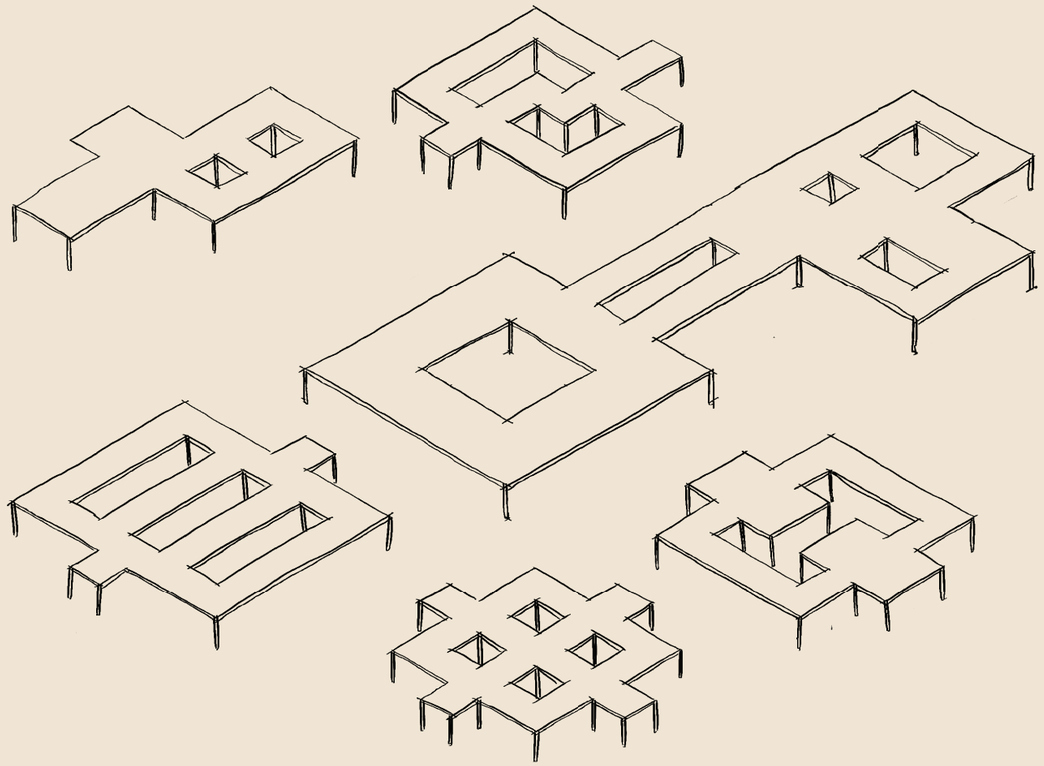


Figure 42 . *Image: 3D Layout drawings*

Layout Drawing

Testing layout pathways for a wharf using lines to create these pathways

Thinking about the traditional pathways and how this could be visualised in a wharf structure

Layout Drawing

Testing how these layouts would look as a wharf structure

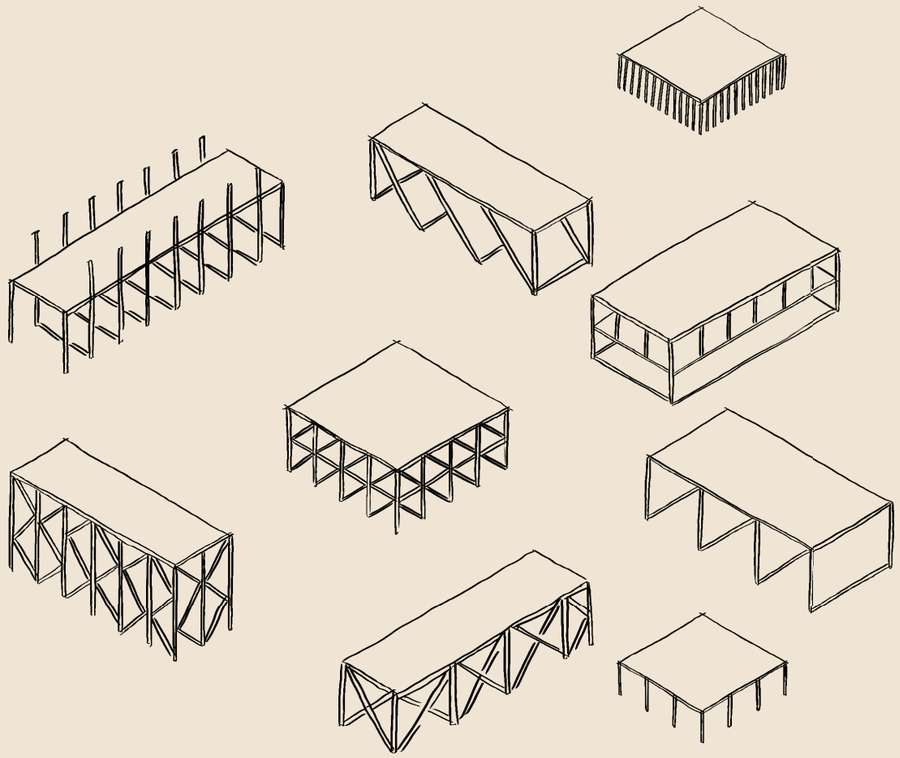


Figure 43 . *Image: Support drawings*

Support Drawing

Testing different ways wharf support foundations could work in a wharf system

Something to think about: How could these systems affect land accretion and change the shape of the land - would this have positive or negative implications

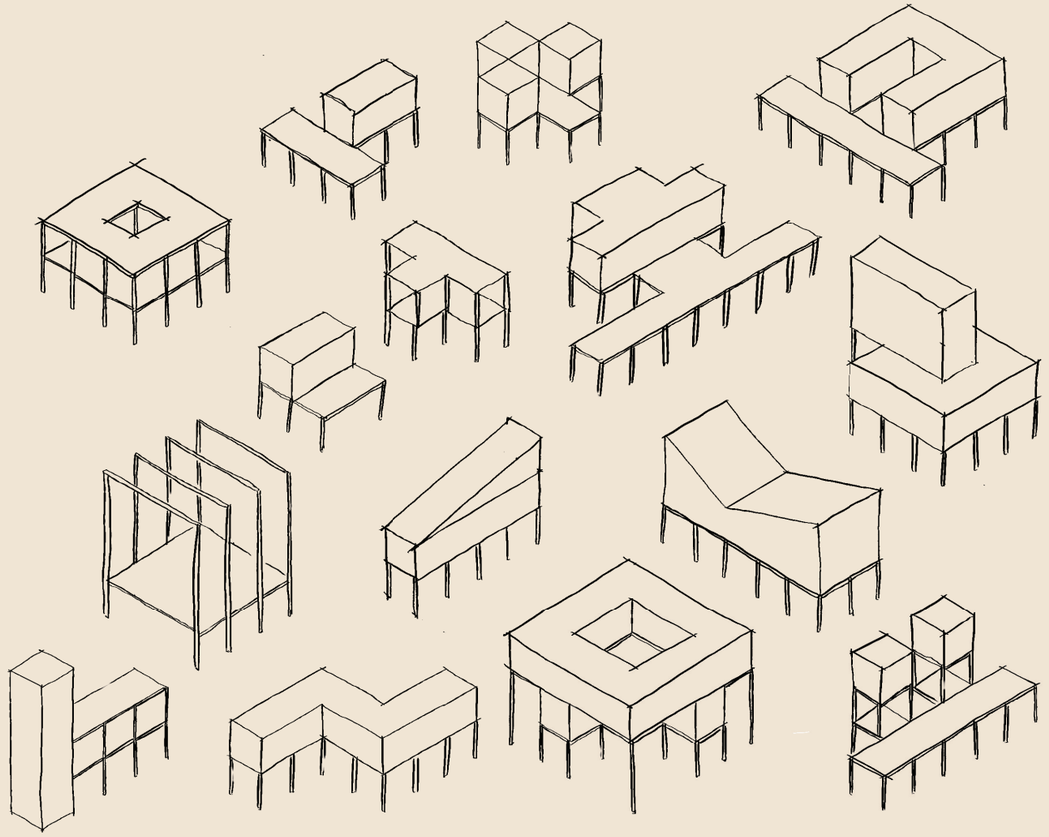


Figure 44 . *Image: Form drawings*

Form drawings

Testing forms ann what a structure could look like on a different wharf pathways

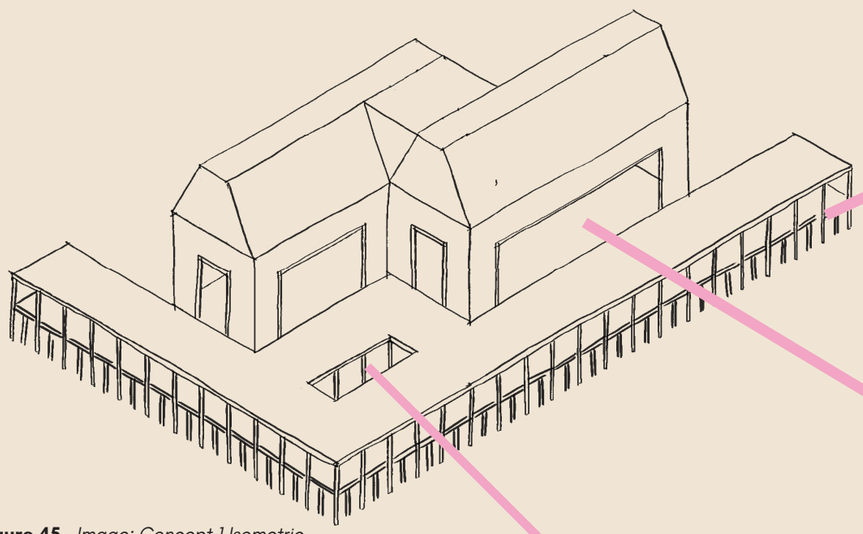


Figure 45 . *Image: Concept 1 Isometric*

Concept 1

Experimenting with the building shape the wharf shape being the same to merge the two into system

Testing idea of double height systems for access to different tides

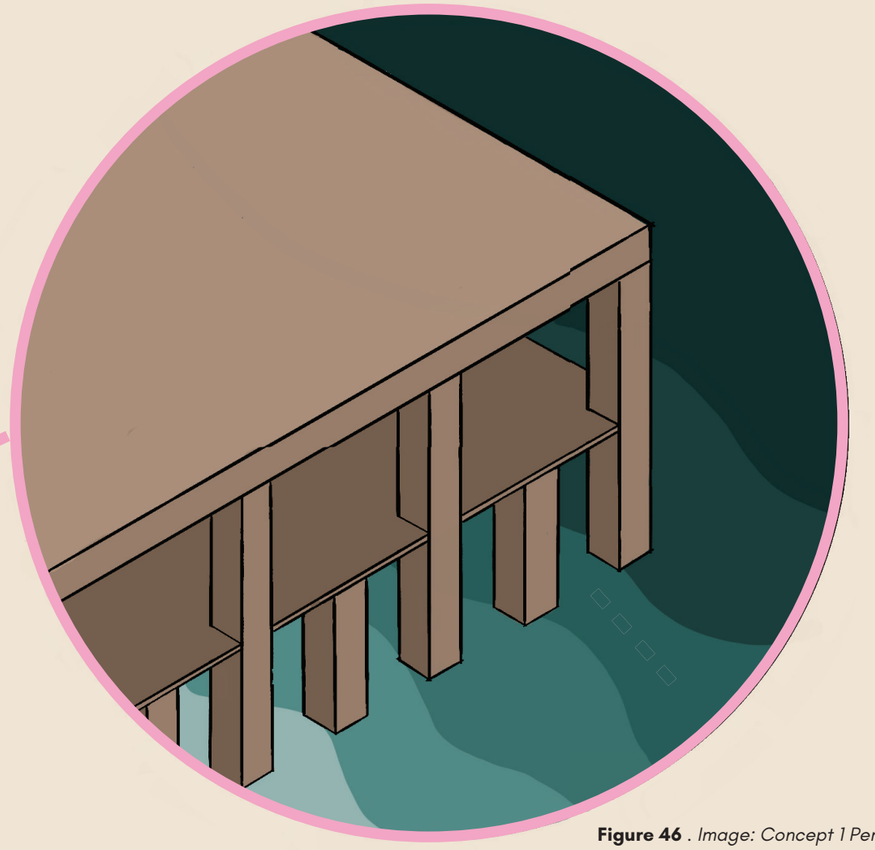


Figure 46 . *Image: Concept 1 Perspective 1*

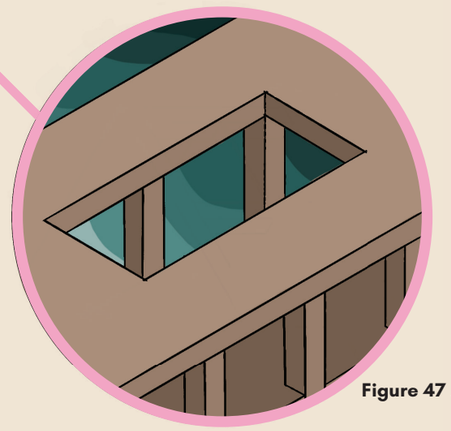


Figure 47 . *Image: Concept 1 Perspective 2*

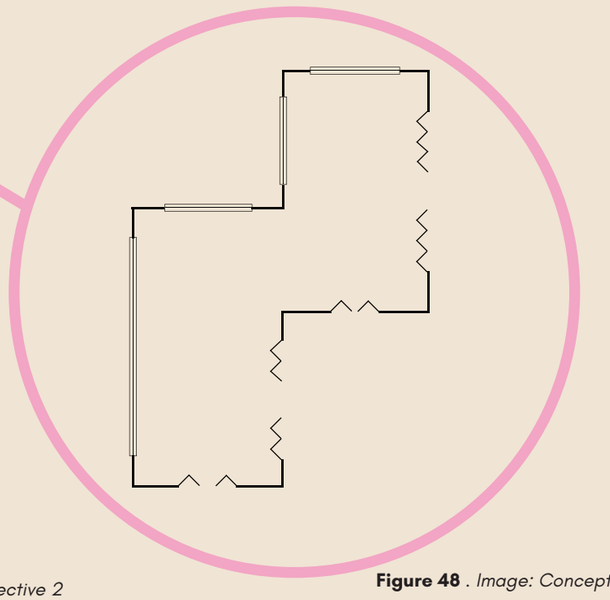


Figure 48 . *Image: Concept 1 Plan*

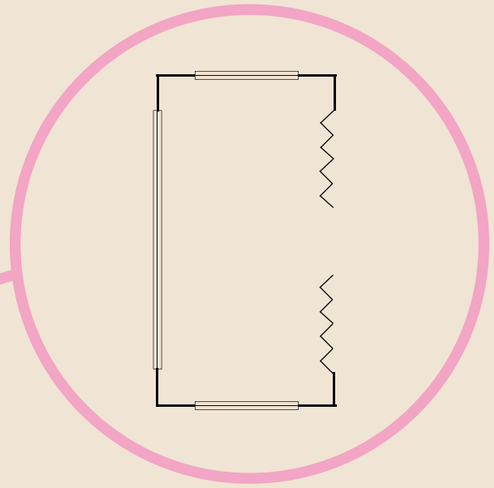


Figure 50 . *Image: Concept 2 Plan*

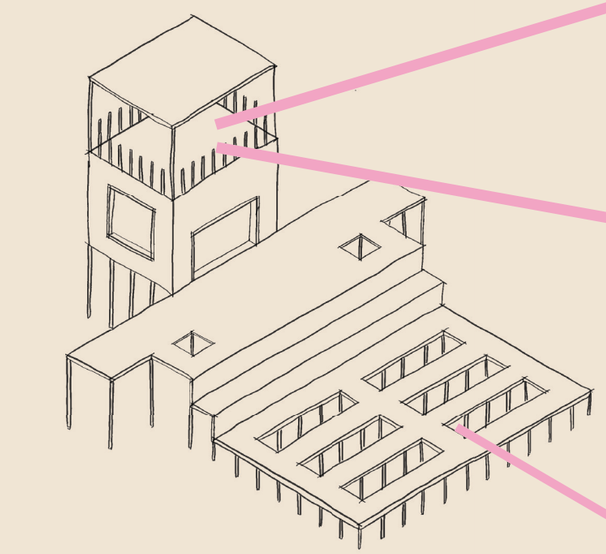


Figure 49 . *Image: Concept 2 Isometric*

Concept 2

Experimenting with double height buildings with one floor closed in and other floor open for “the breeze”

Testing different height wharf for tides and also holes in the wharf for fishing or coral regeneration systems

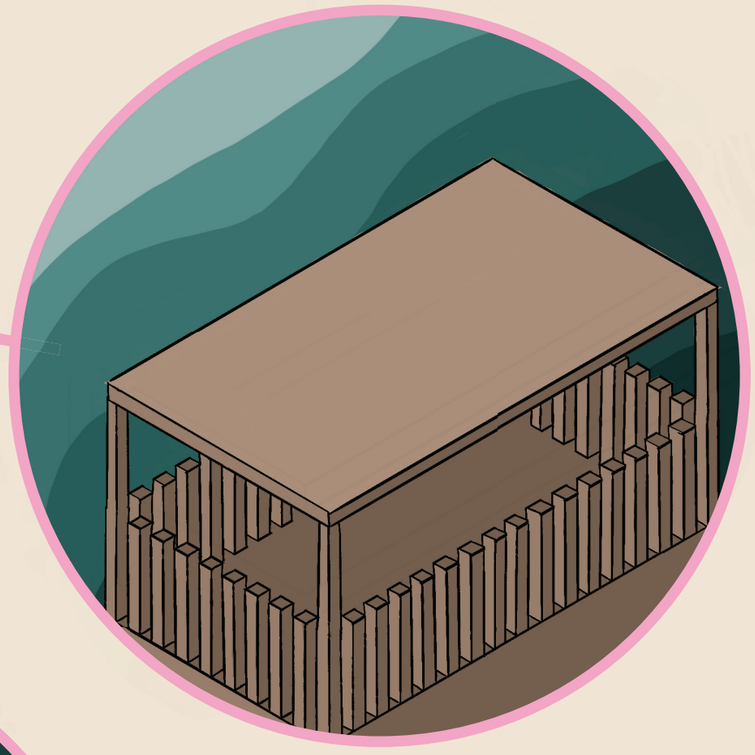


Figure 51 . *Image: Concept 2 Perspective 1*

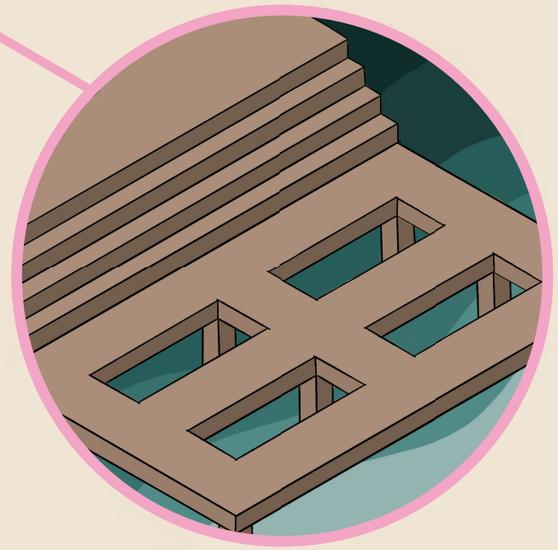


Figure 52 . *Image: Concept 2 Perspective 2*

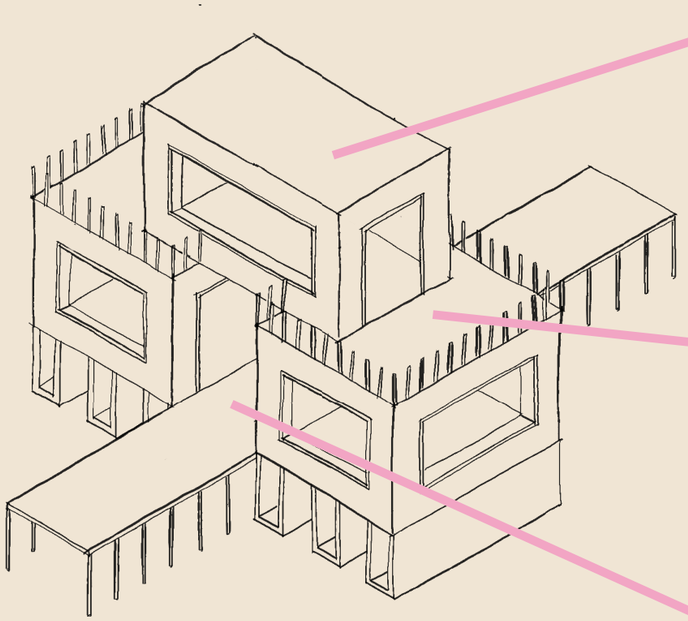


Figure 53 . *Image: Concept 3 Isometric*

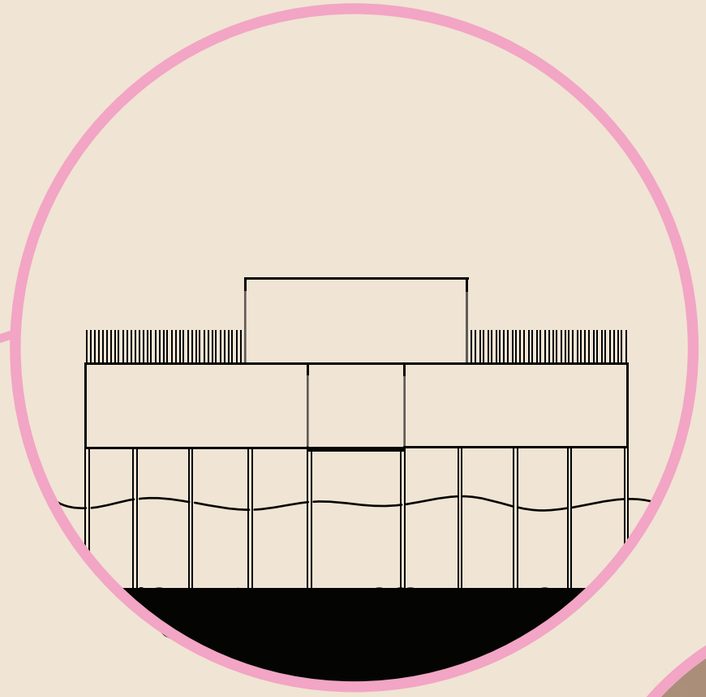


Figure 54 . *Image: Concept 3 Section*

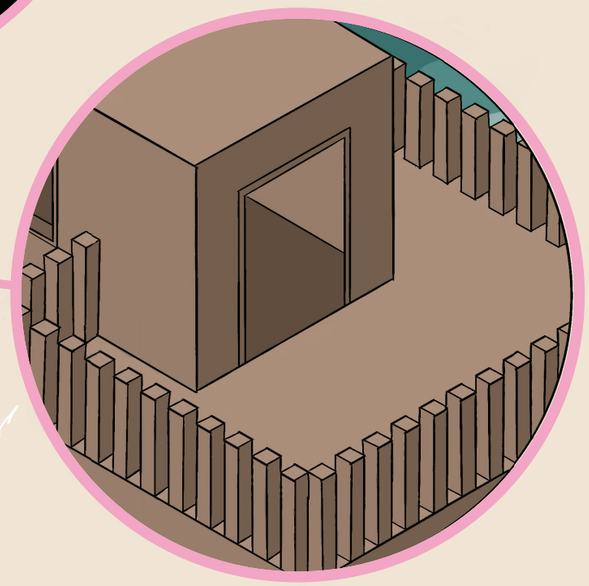


Figure 54 . *Image: Concept 3 Perspective 1*

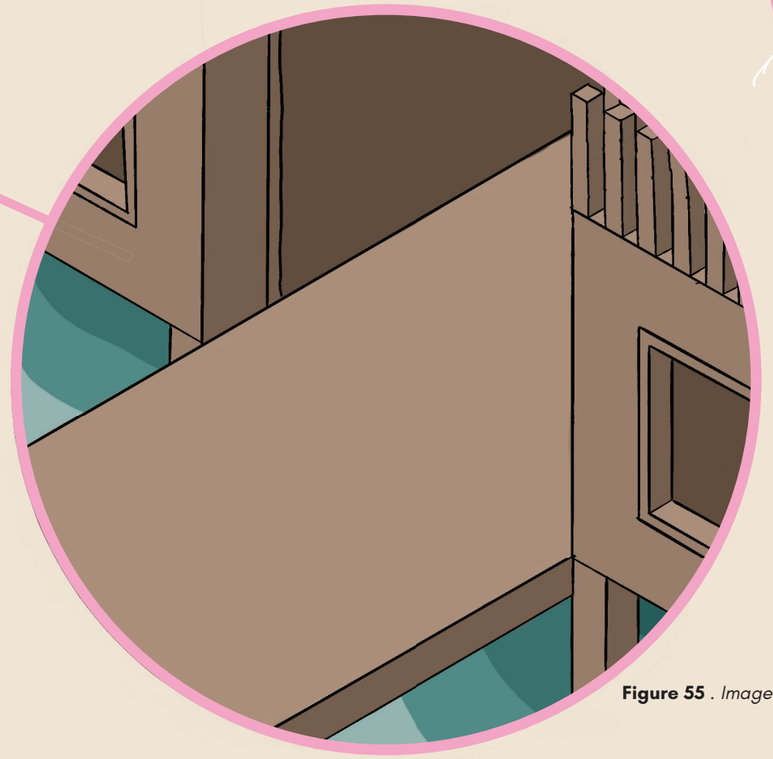


Figure 55 . *Image: Concept 3 Perspective 2*

Concept 3

Testing forms that stack up on each other.
This further explored could become a modular like systems that could be stacked in different scenarios

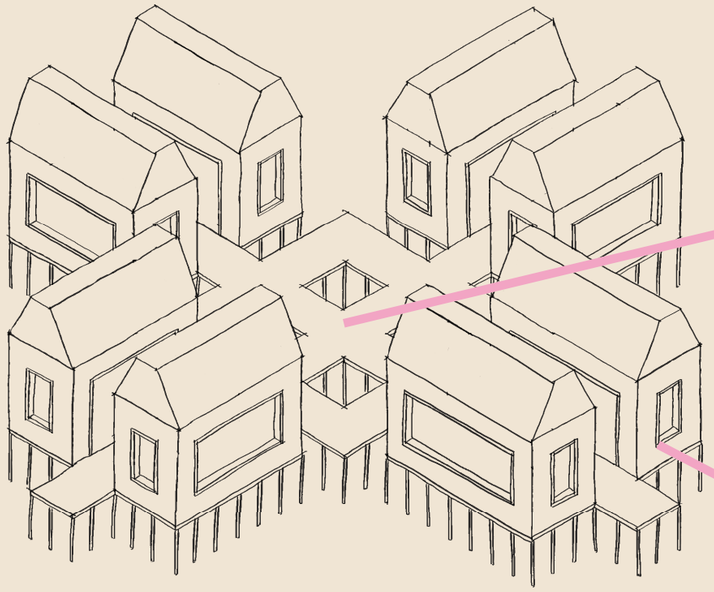


Figure 56 . *Image: Concept 4 Isometric*

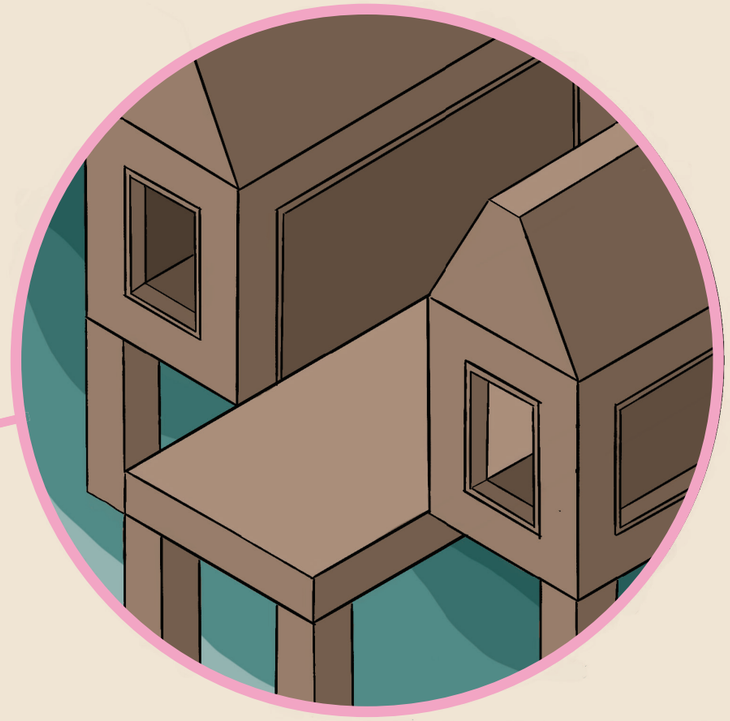


Figure 57 . *Image: Concept 4 Perspective 1*

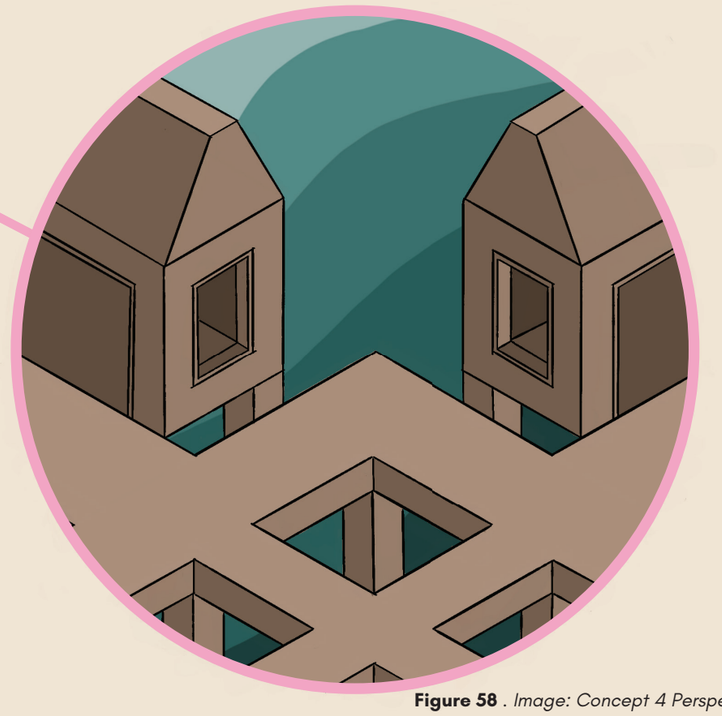


Figure 58 . *Image: Concept 4 Perspective 2*

Concept 4

Testing a hub of buildings together.
This is less ideal as doesn't feel like it would flow as easy and feels very boxed in. Thinking about how the traditional layouts are in site analysis where the progammes flow

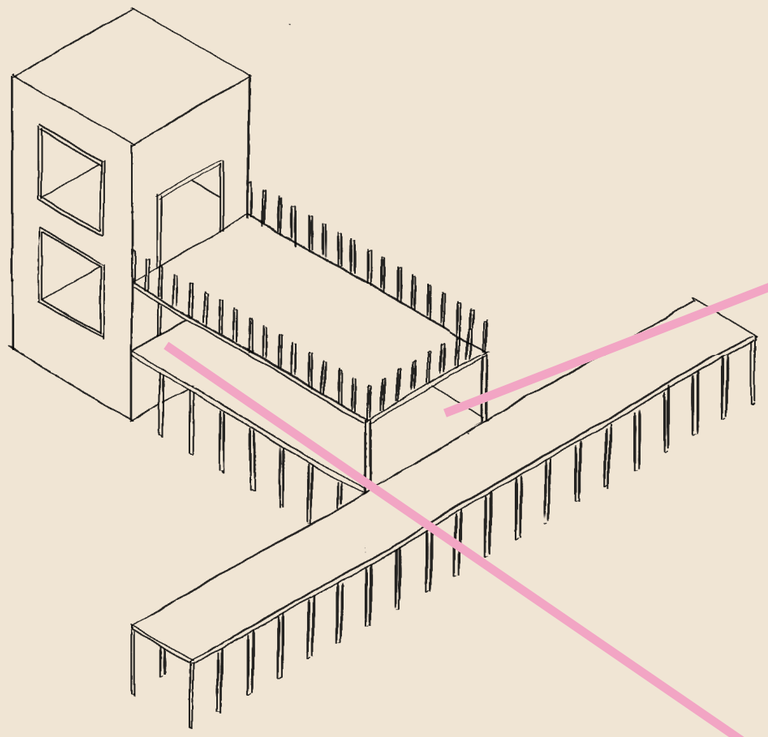


Figure 59 . *Image: Concept 5 Isometric*

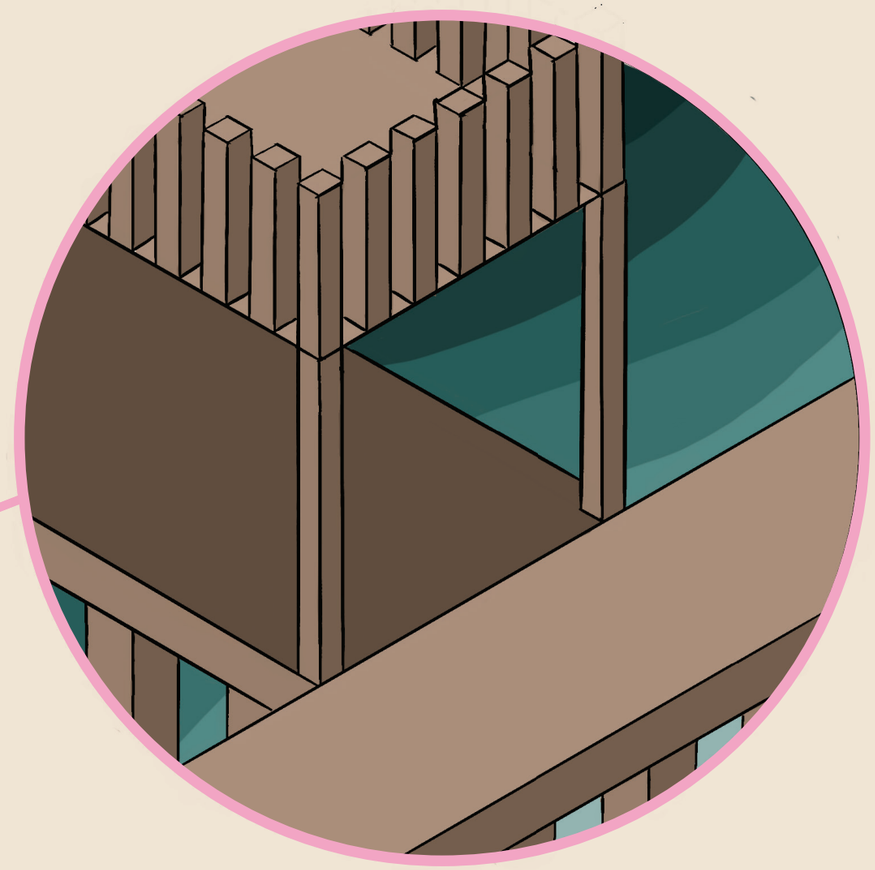


Figure 60 . *Image: Concept 5 Perspective*

Concept 5

Experimenting with double height buildings and wharf systems.

Building structure and shape needs to be considered into more detail.
Feels disconnected

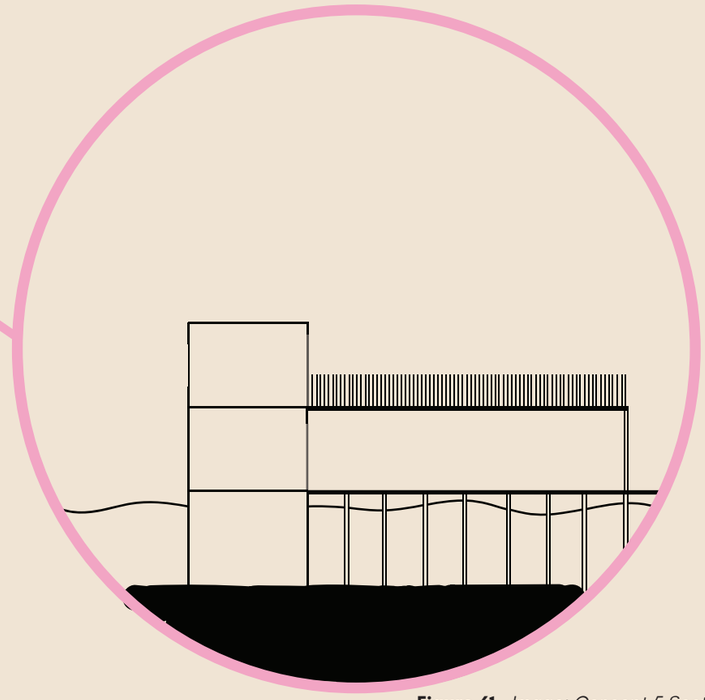


Figure 61 . *Image: Concept 5 Section*

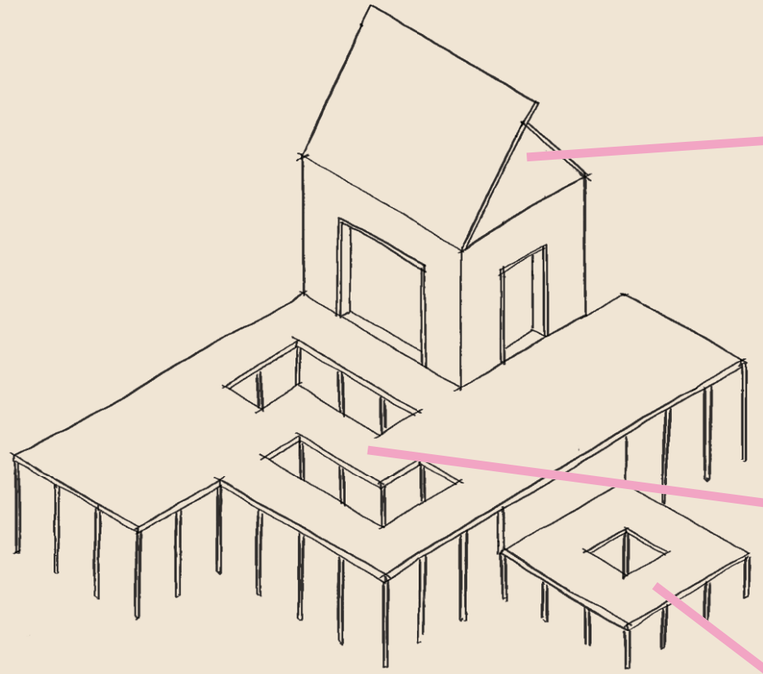


Figure 62 . *Image: Concept 6 Isometric*

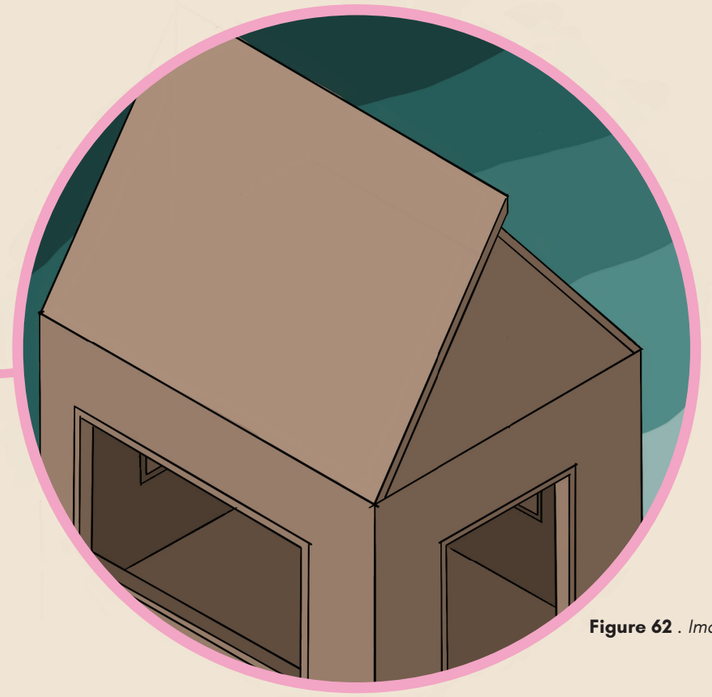


Figure 62 . *Image: Concept 6 Perspective 1*

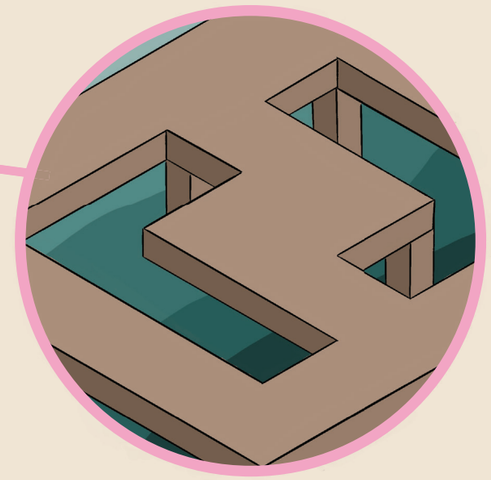


Figure 63 . *Image: Concept 6 Perspective 2*

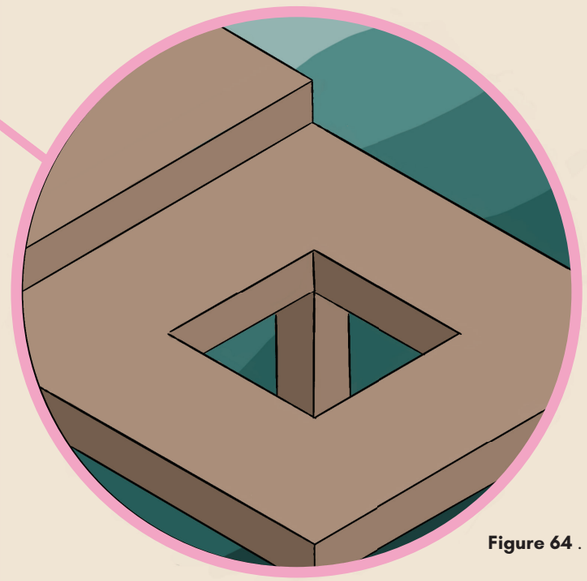


Figure 64 . *Image: Concept 6 Perspective 3*

Concept 6

Using the shape of the pathway to inspire cut out into the wharf connecting to the ocean

Thinking about a roof which is angled similar to the traditional roof structures in Kiribati

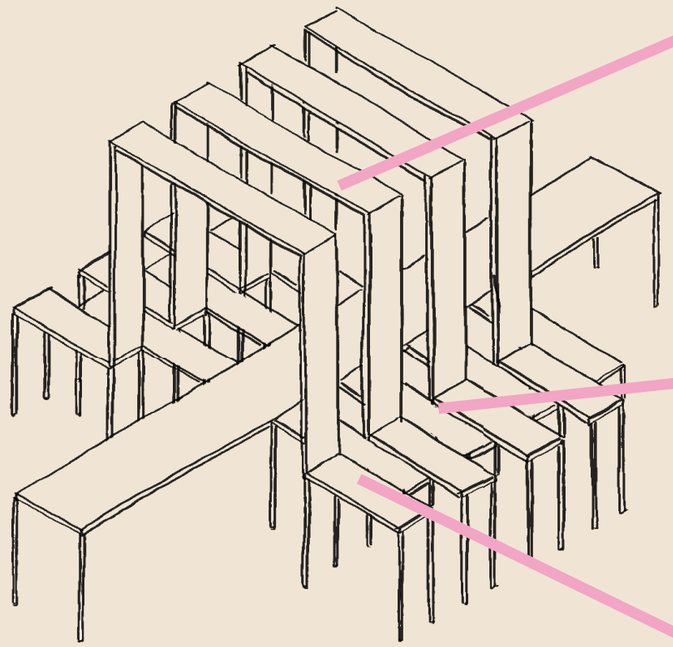


Figure 65 . *Image: Concept 7 Isometric*

Concept 7

Experimenting with layering and offsetting pathways

Also testing joints which mimic the look of the pathway by using a comb joint.

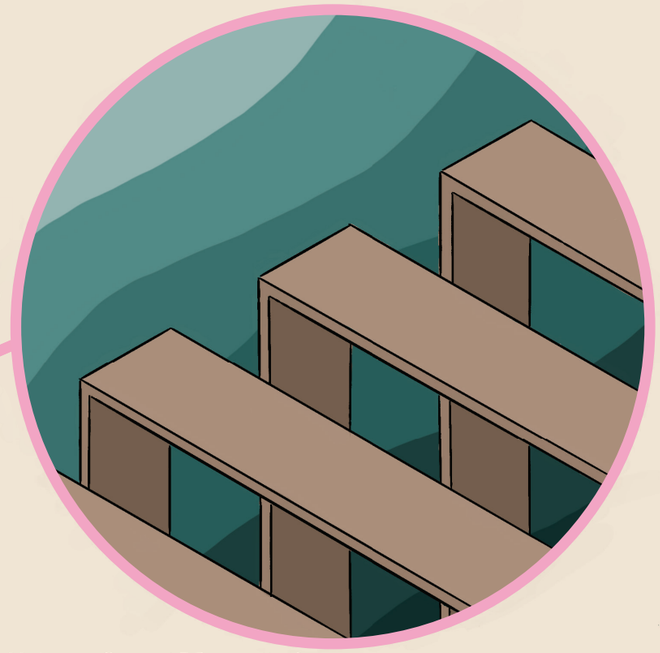


Figure 66. *Image: Concept 7 Perspective 1*

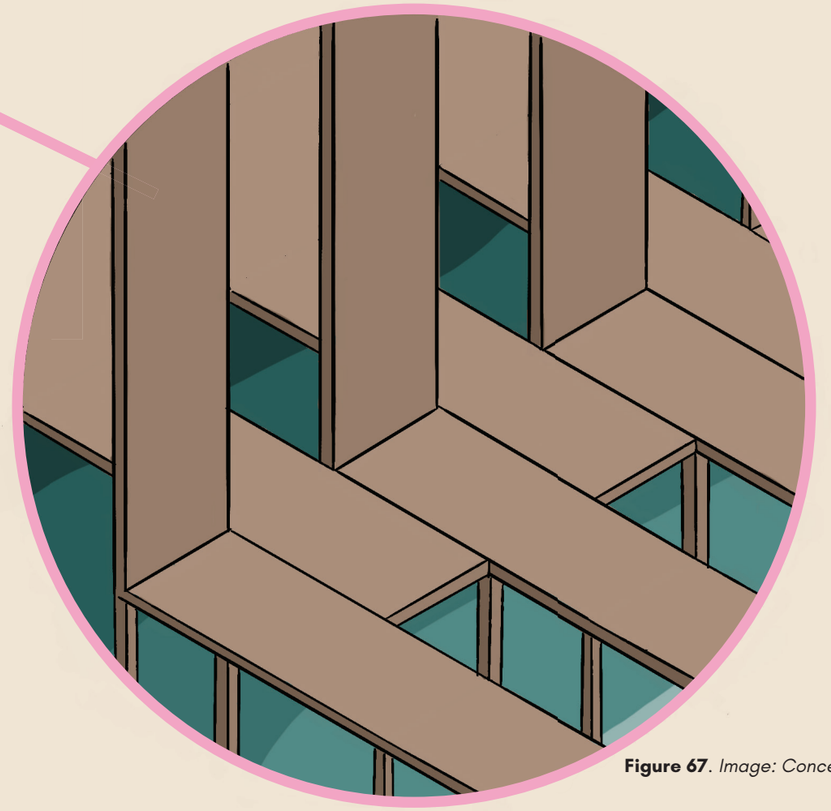


Figure 67. *Image: Concept 7 Perspective 2*

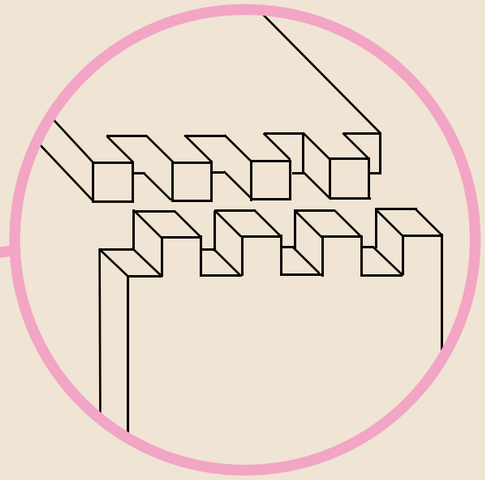


Figure 68. *Image: Concept 7 Detail 1*

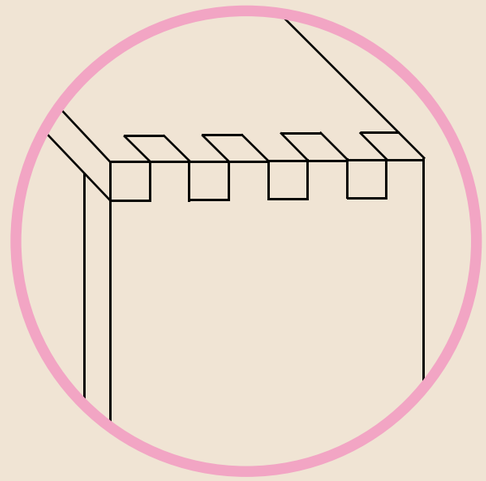


Figure 69. *Image: Concept 7 Detail 2*

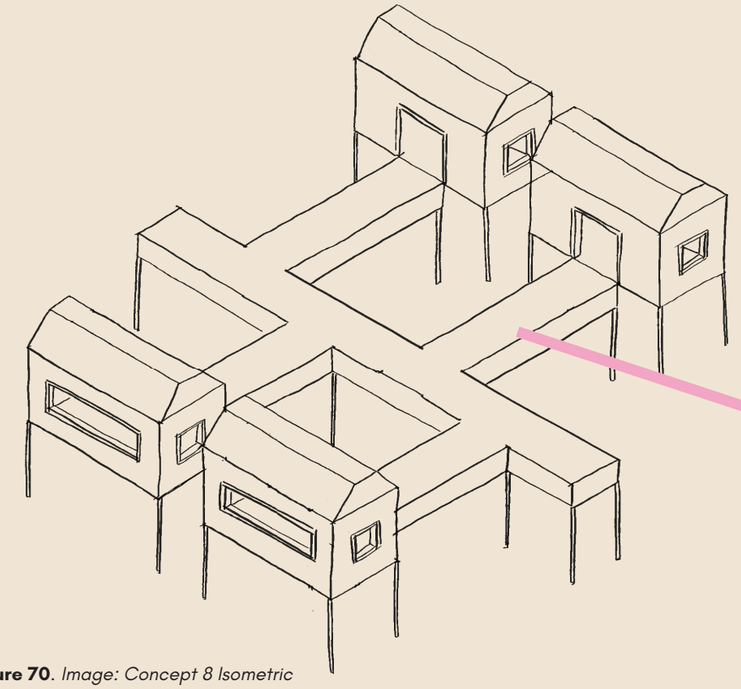


Figure 70. *Image: Concept 8 Isometric*

Concept 8

Offsetting buildings off the side of a main pathway

Main pathway needs to be wider as doesn't feel like a main pathway.

How could the building form look more interesting or mimic the offset of the pathways ?

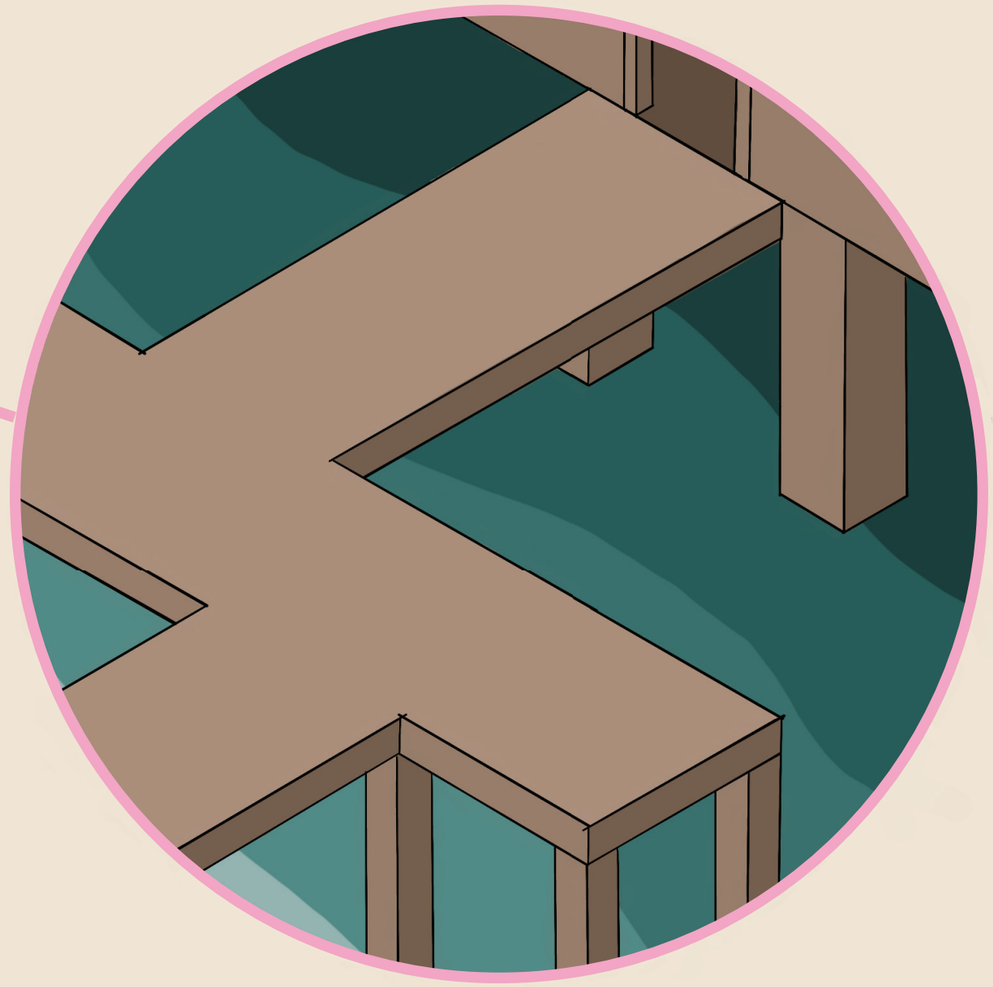


Figure 71. *Image: Concept 8 Perspective*

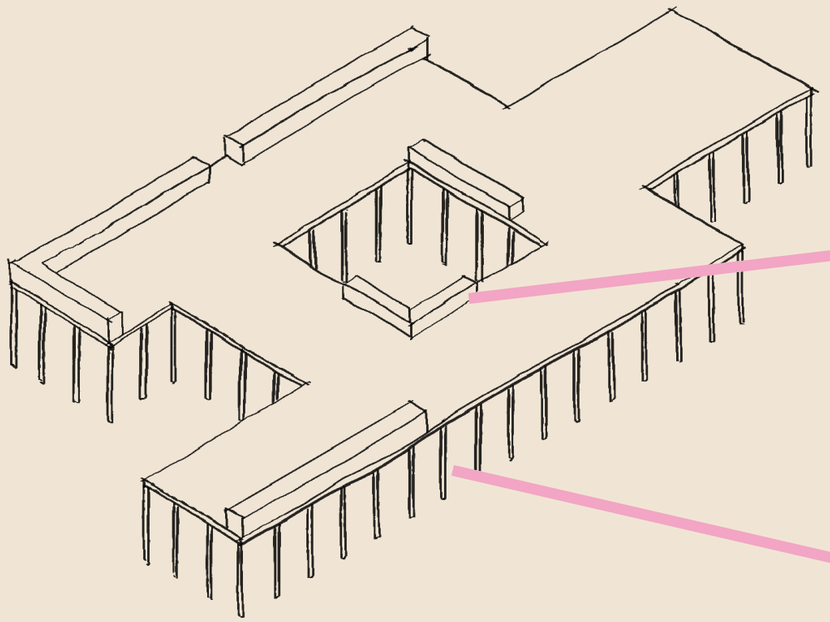


Figure 72. *Image: Concept 9 Isometric*

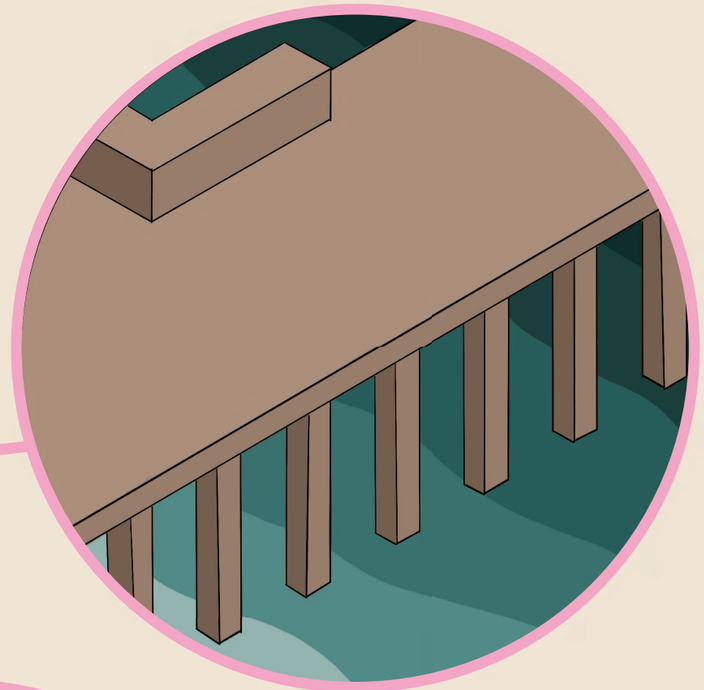


Figure 73. *Image: Concept 9 Perspective 1*

Concept 9

experimenting with adding seating to the wharf and how this could become a part of the wharf pathway

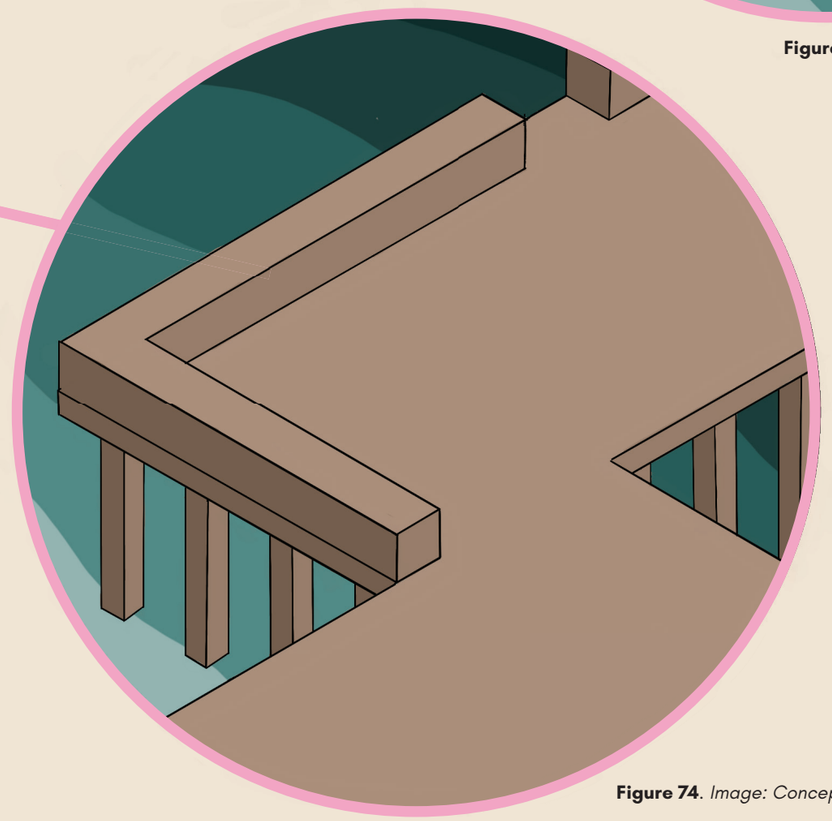


Figure 74. *Image: Concept 9 Perspective 2*

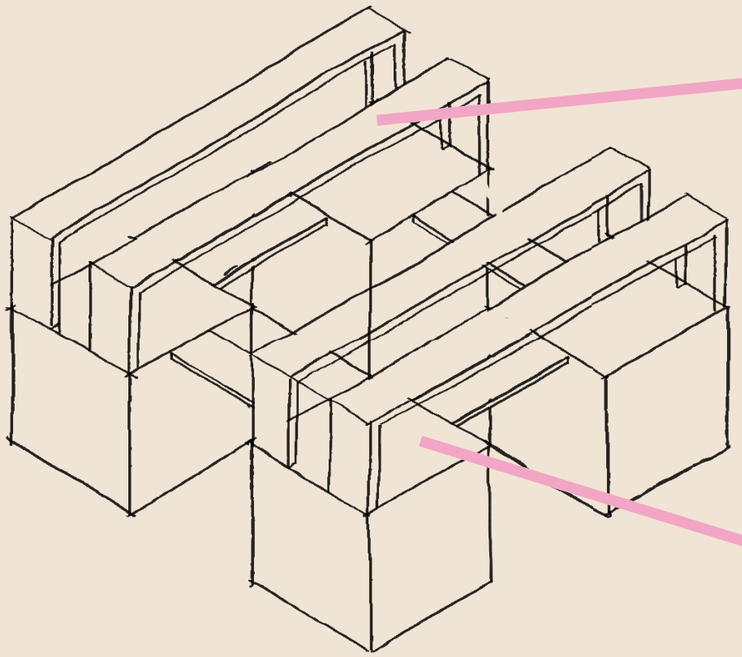


Figure 75. *Image: Concept 10 Isometric*

Concept 10

Testing larger support for the wharf although this may effect the way the water moves and therefore changing the land of the island due to currents and land accretion

Looking at how the wharf could feel like bridges between zones

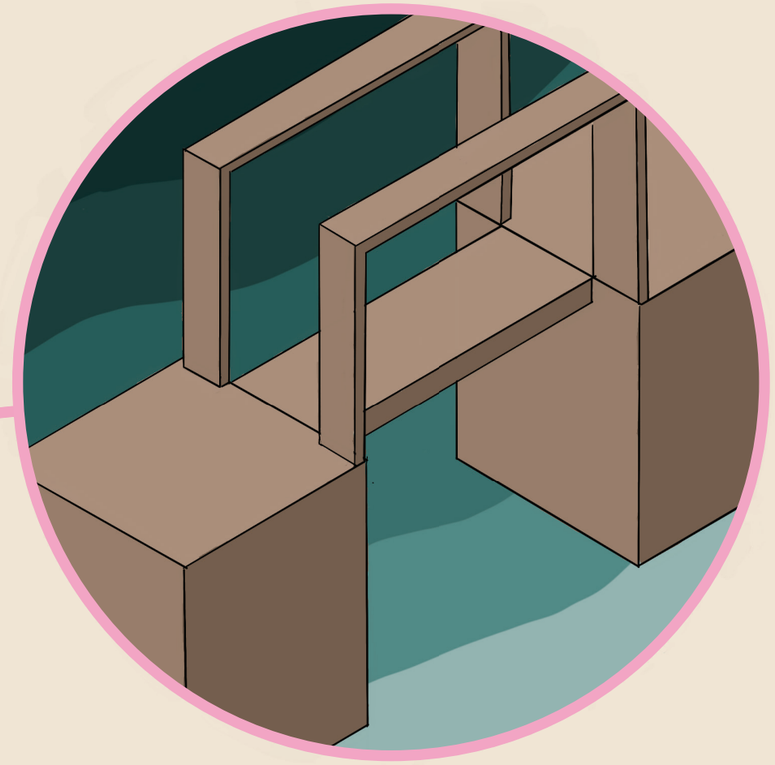


Figure 76. *Image: Concept 10 Perspective 1*

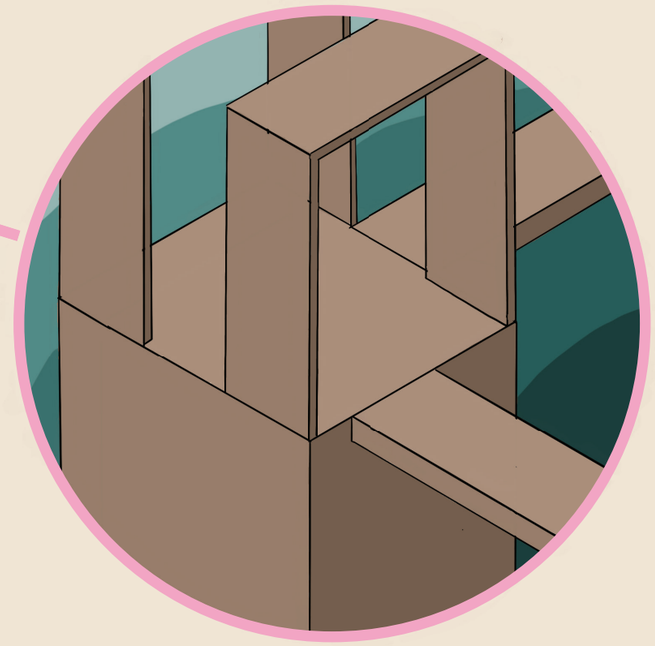


Figure 77. *Image: Concept 10 Perspective 2*

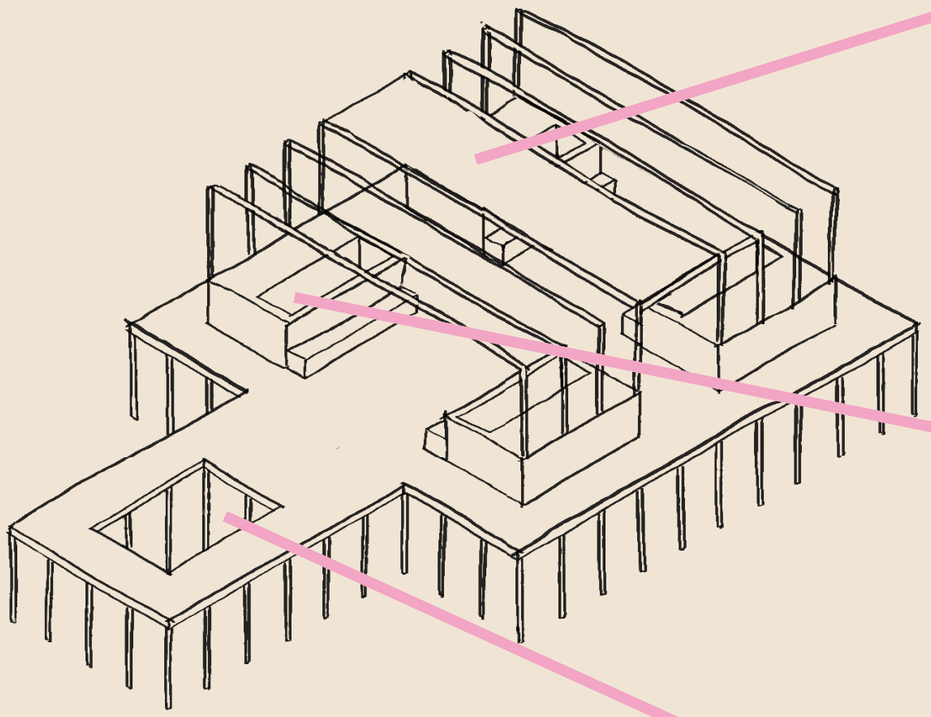


Figure 78. *Image: Concept 11 Isometric*

Concept 11

Looking at incorporating seating and planter boxes to create green zones in social spaces

Playing with shelter ideas to still allow some shelter from the sun

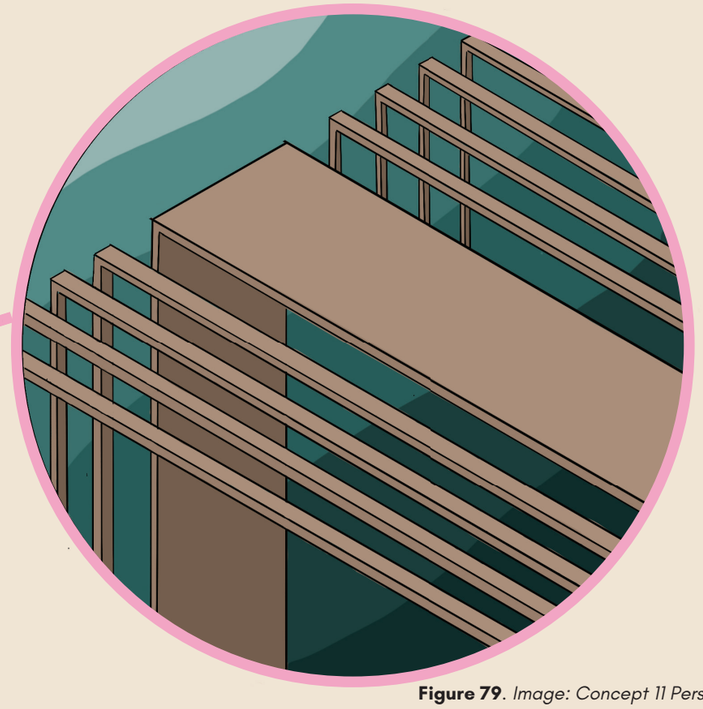


Figure 79. *Image: Concept 11 Perspective 1*

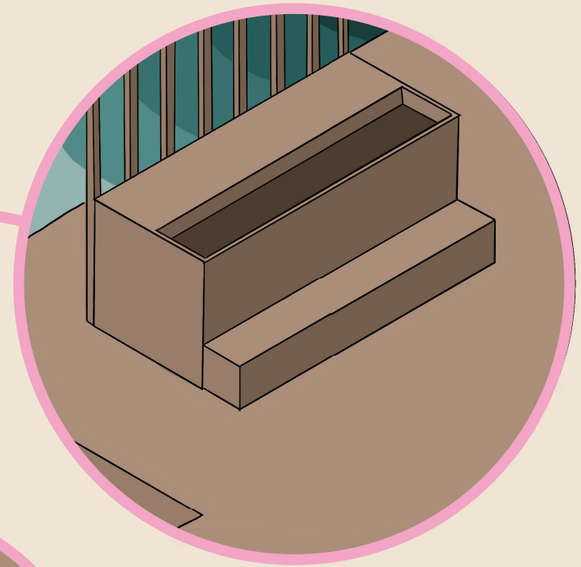


Figure 80. *Image: Concept 11 Perspective 2*

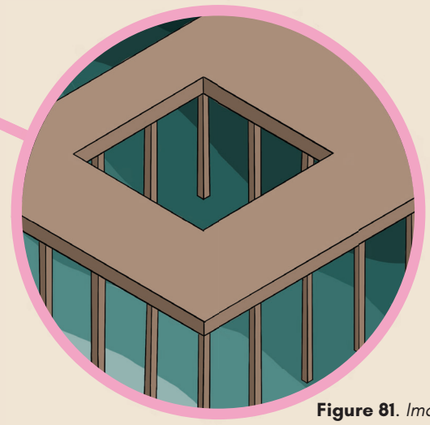


Figure 81. *Image: Concept 11 Perspective 3*

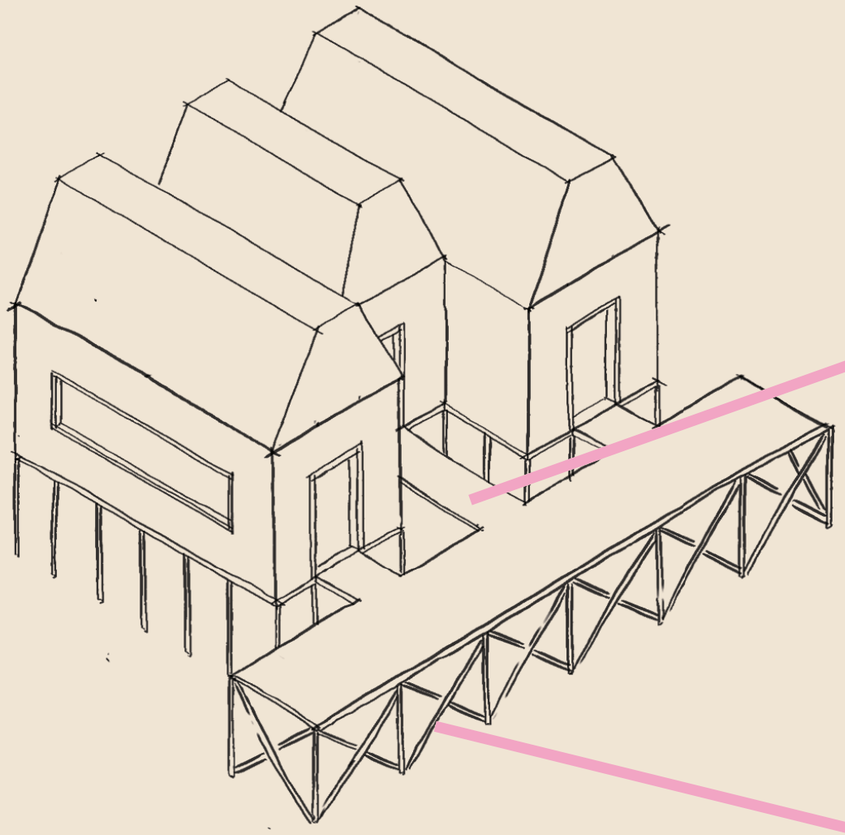


Figure 81. *Image: Concept 12 Isometric*

Concept 12

Testing different shaped support systems

Making the building closer togther
Could this become a larger building rather than three smaller buildings?

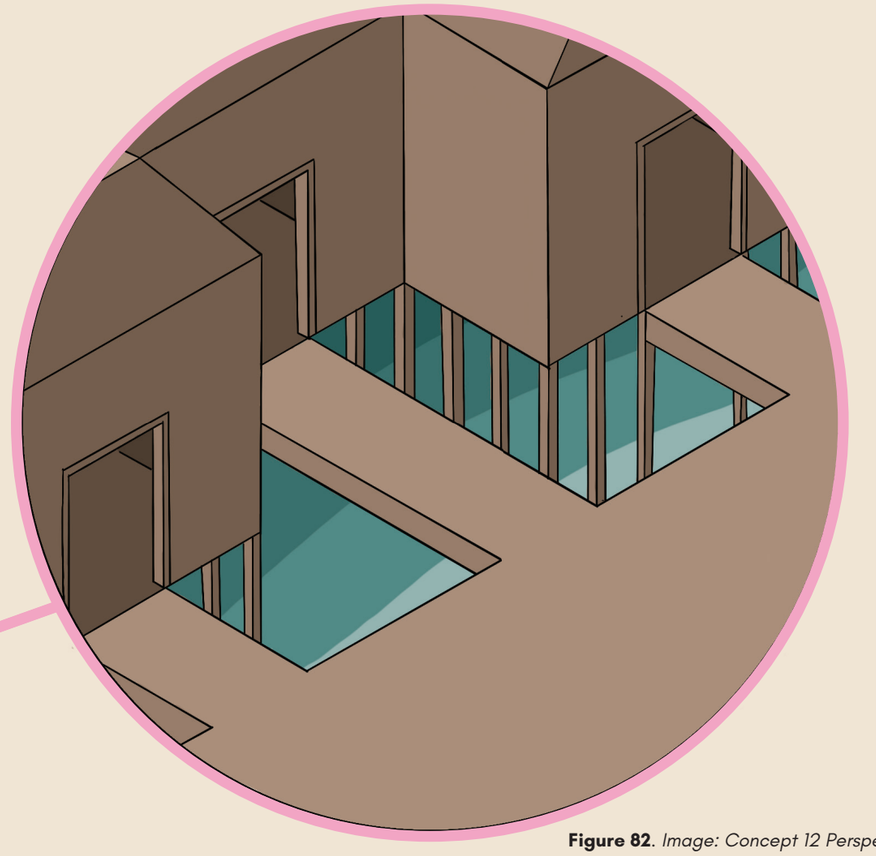


Figure 82. *Image: Concept 12 Perspective 1*

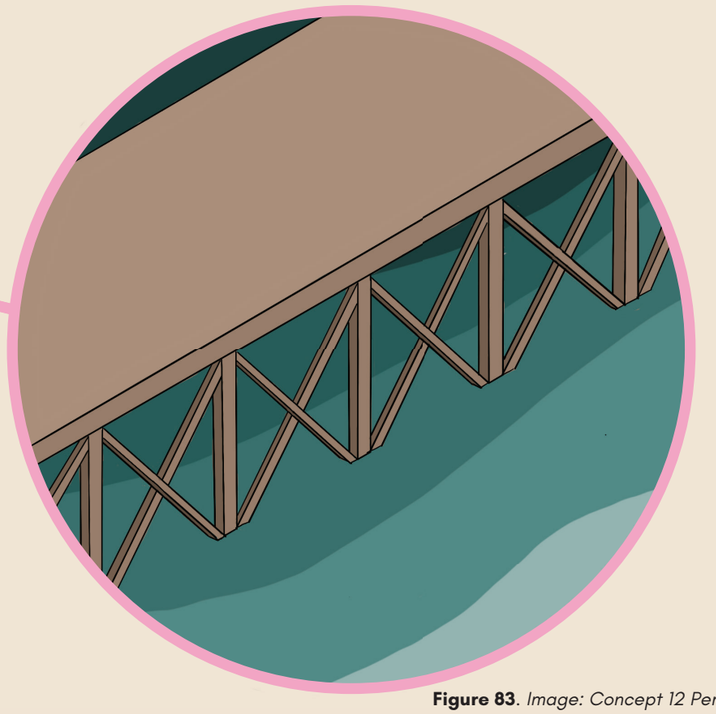


Figure 83. *Image: Concept 12 Perspective 2*

Next steps...

In Nanikaai, many young people face the daunting challenge of disengagement, due to education and employment opportunities. Creating a dedicated space for these youth is not just a necessity; it is an investment in their futures and the well-being of their community. This initiative aims to empower young individuals by equipping them with essential life skills through hands-on experiences in agriculture, fishing, cooking, and coral regeneration.

By engaging in crop cultivation, youth will learn the fundamentals of sustainable farming, fostering a connection to the land while promoting food security for their families and neighbours. Fishing skills will not only provide them with nutritional resources but also instil a sense of stewardship over their local waterways. Cooking workshops will enhance their culinary skills, promoting healthy eating habits and cultural heritage. Additionally, coral regeneration activities will educate them about marine ecosystems, encouraging environmental responsibility and a deeper appreciation for their natural surroundings.

This initiative goes beyond skill-building; it creates a sense of purpose and belonging among the youth. By contributing to their community through sustainable practices, they will gain confidence and agency, shaping their own destinies while positively impacting the future of Nanikaai. In fostering a generation of informed, skilled, and engaged young people, we lay the groundwork for a more resilient and thriving community, ensuring a brighter future for both its residents and the land they live on.

Design Crit

In a recent design feedback session with Naakori Taniera, who has strong connections to Kiribati, valuable insights were gained regarding the design project. Accompanied by a fellow student whose thesis also sited in Kiribati, the discussion provided a rich context for understanding key cultural considerations that could enhance this project.
One of the primary takeaways was the importance of spatial layout, reflecting the common practice in Kiribati of organizing spaces around a central area, with separate zones designated for cooking, sleeping, and other activities. This concept not only influences the architectural design but also extends to how wharf pathways can be visualized and integrated with the overall layout.
This session also emphasized the significance of materiality in the design process. Naakori pointed out that traditional Kiribati architectural techniques and materials that are not often seen, so the potential to incorporate elements of traditional design would be interesting to incorporate. This could take inspiration from the maneaba, the village meeting house, to create a connection to cultural heritage while ensuring that the design resonates with the local community.

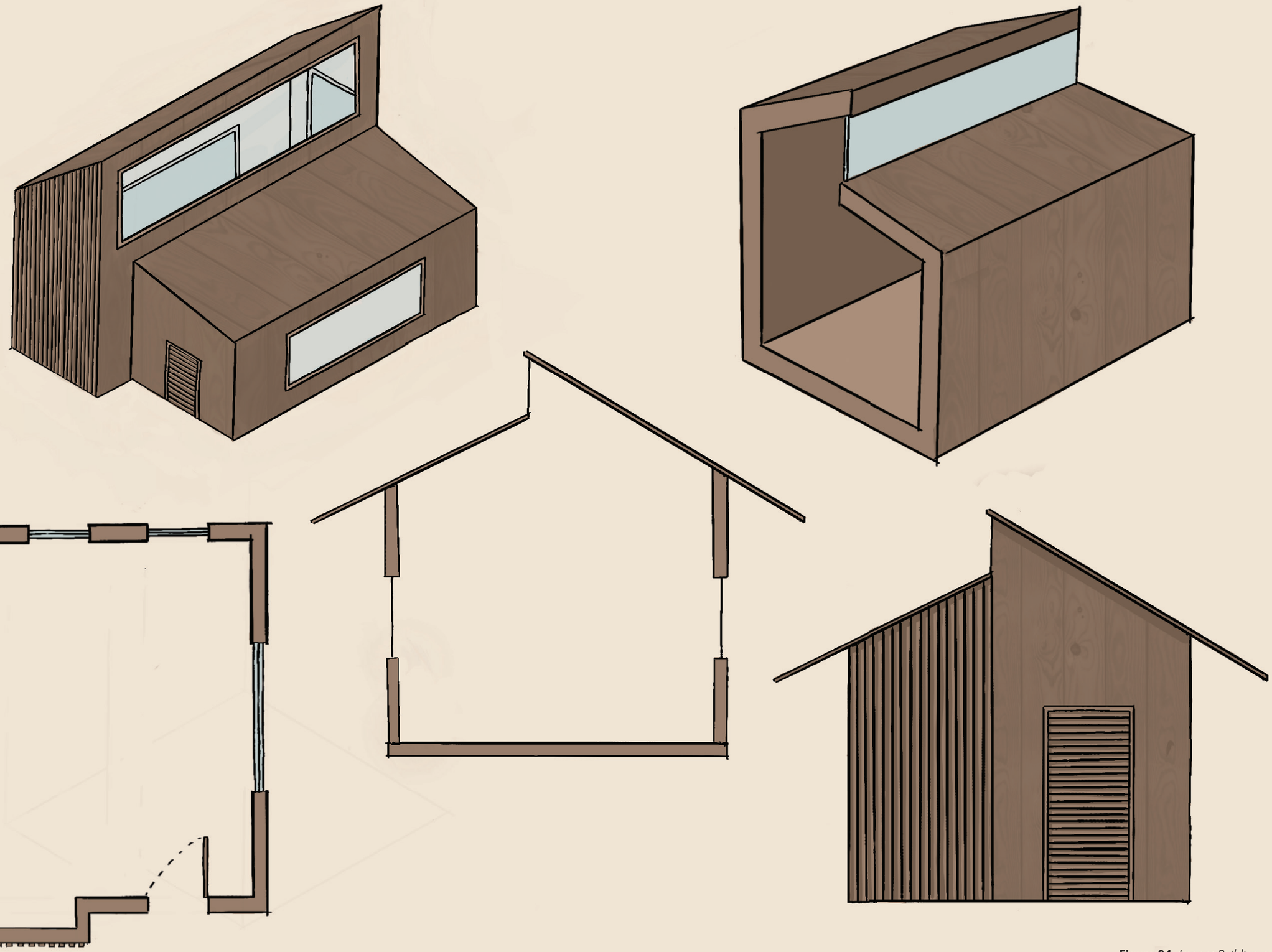


Figure 84. *Image: Building exploration*

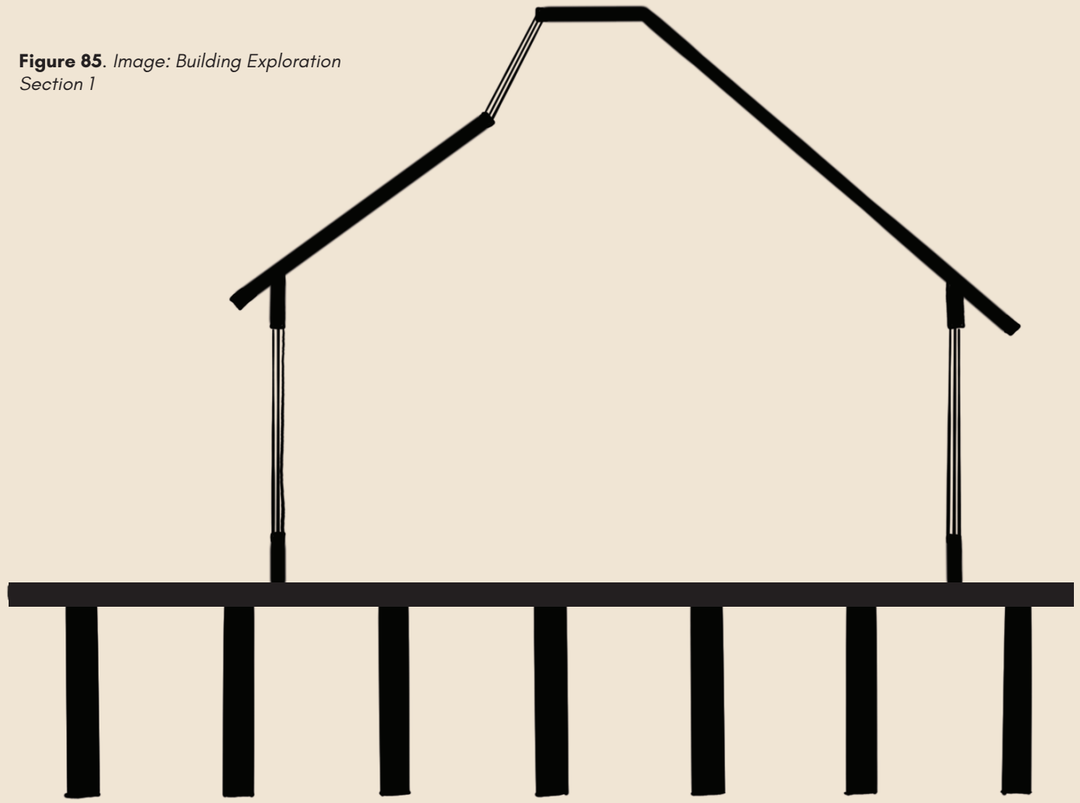


Figure 85. *Image: Building Exploration Section 1*

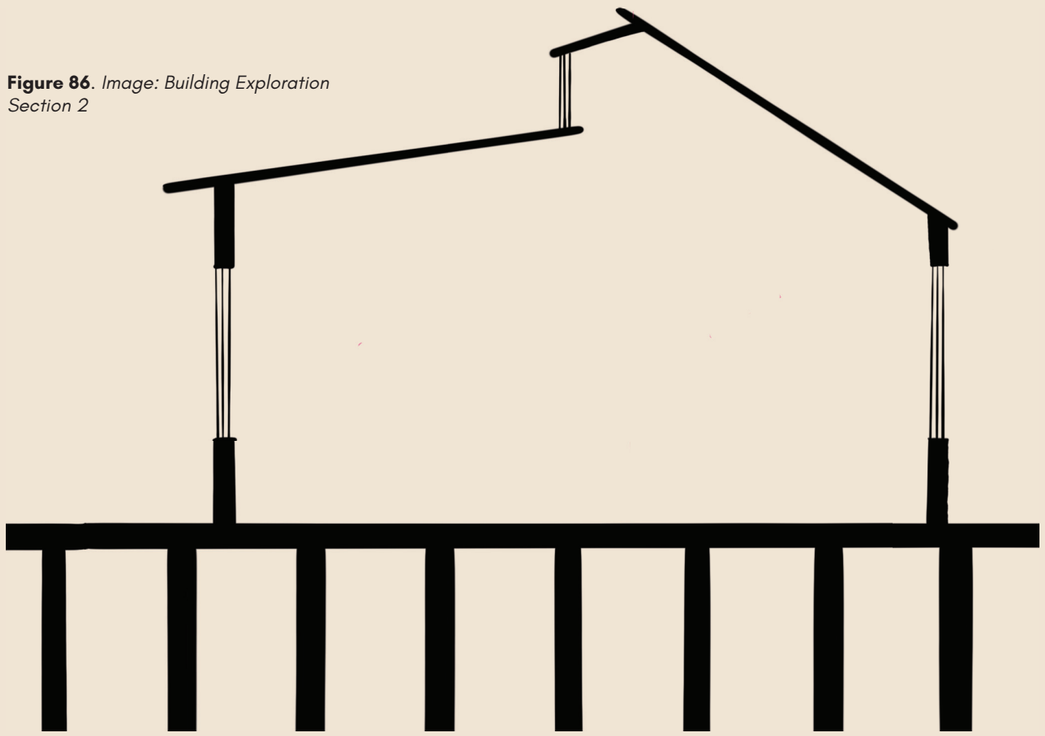


Figure 86. *Image: Building Exploration Section 2*

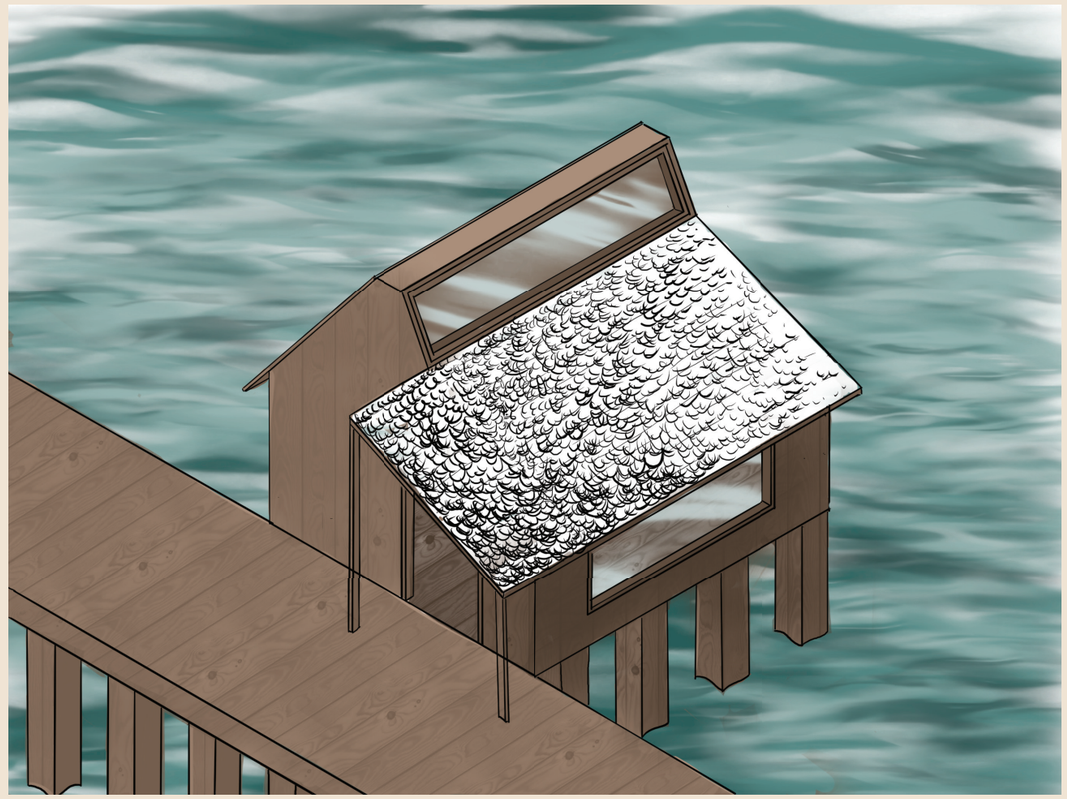


Figure 87. *Image: Building Exploration Perspective*

The traditional Maneaba building serves as an important reference point in the design, particularly in its iconic roofing design. This structure, central to community life, embodies the cultural heritage and shared values of the I-Kiribati people. By drawing on the Maneaba's distinctive roof, we honour the traditions that have been upheld for generations while seamlessly integrating them into modern architectural solutions.

The Maneaba's expansive, thatched roof not only provides essential protection from the elements but also symbolizes unity and collaboration among community members. The design aims to replicate this sense of togetherness, creating communal spaces that create social interaction and cultural exchange.

Incorporating elements of the Maneaba into the design will ensure that the approach remains deeply rooted in Kiribati's identity. This integration of tradition and innovation not only preserves cultural significance but also reinforces a sustainable future, creating spaces that resonate with the community's values and aspirations.

Testing a central space for community. How the space can flow from inside to outside. Using bifold to close of spaces to create flexibility of the space.

Next steps How can this become more central to a wharf structure.

Having access to all sides of the building make it really central to everything.

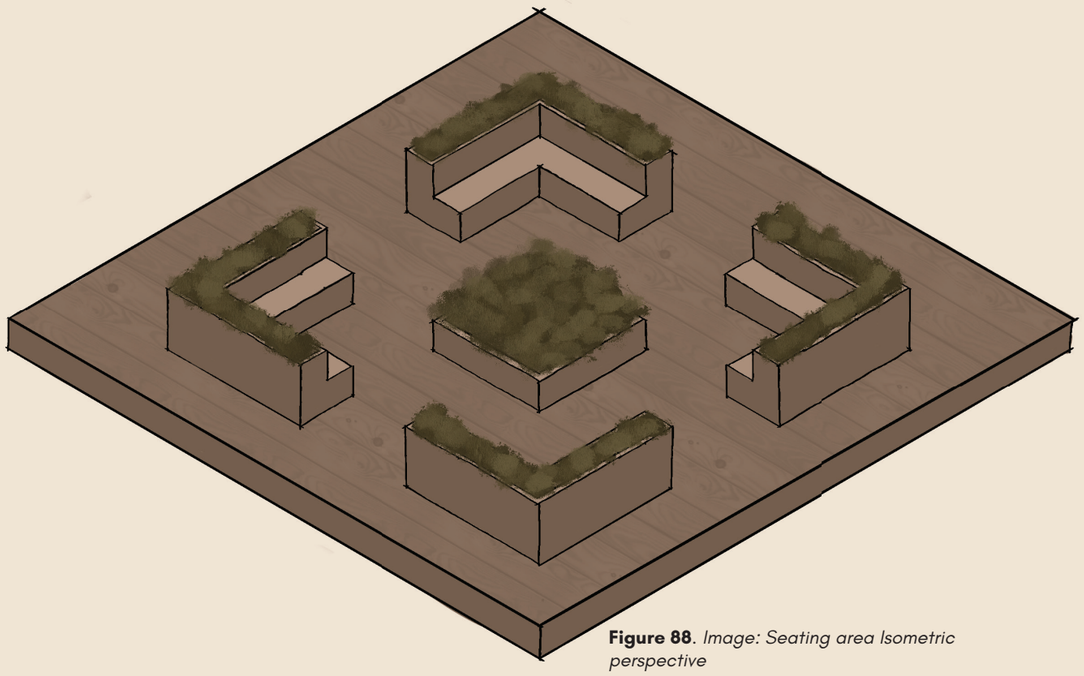


Figure 88. *Image: Seating area Isometric perspective*

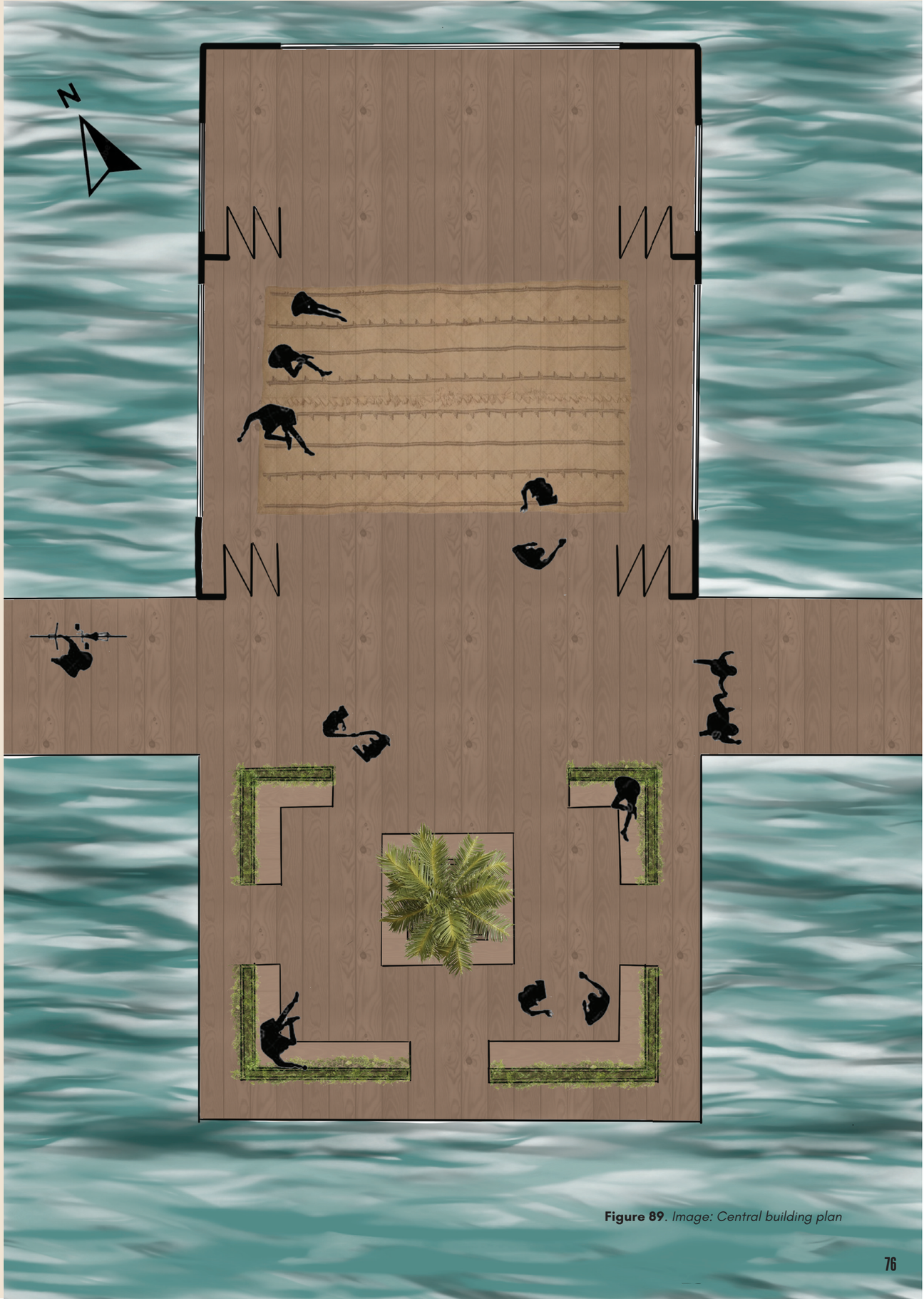


Figure 89. *Image: Central building plan*

Figure 90. *Image: Wharf layout Isometric perspective*

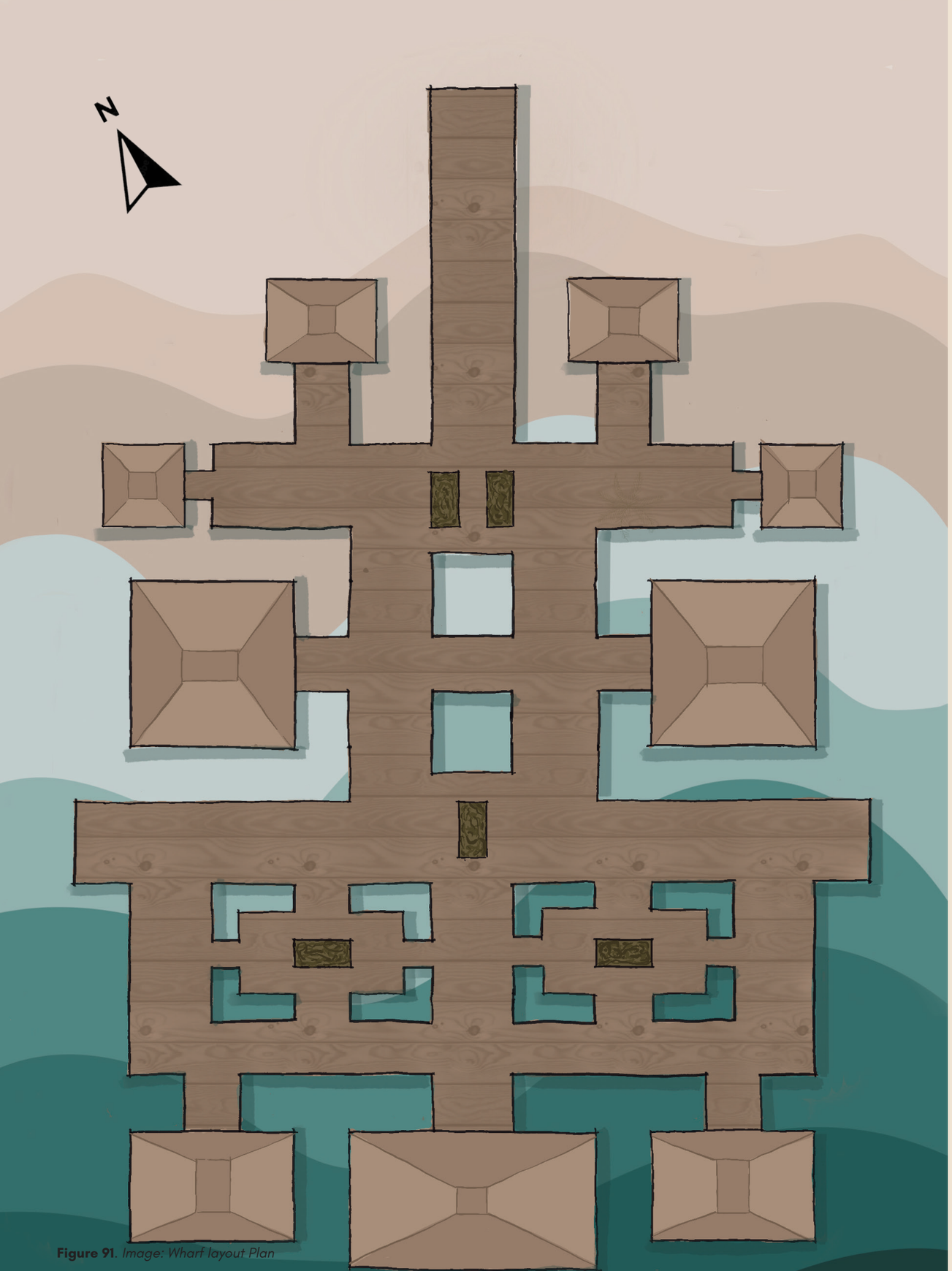


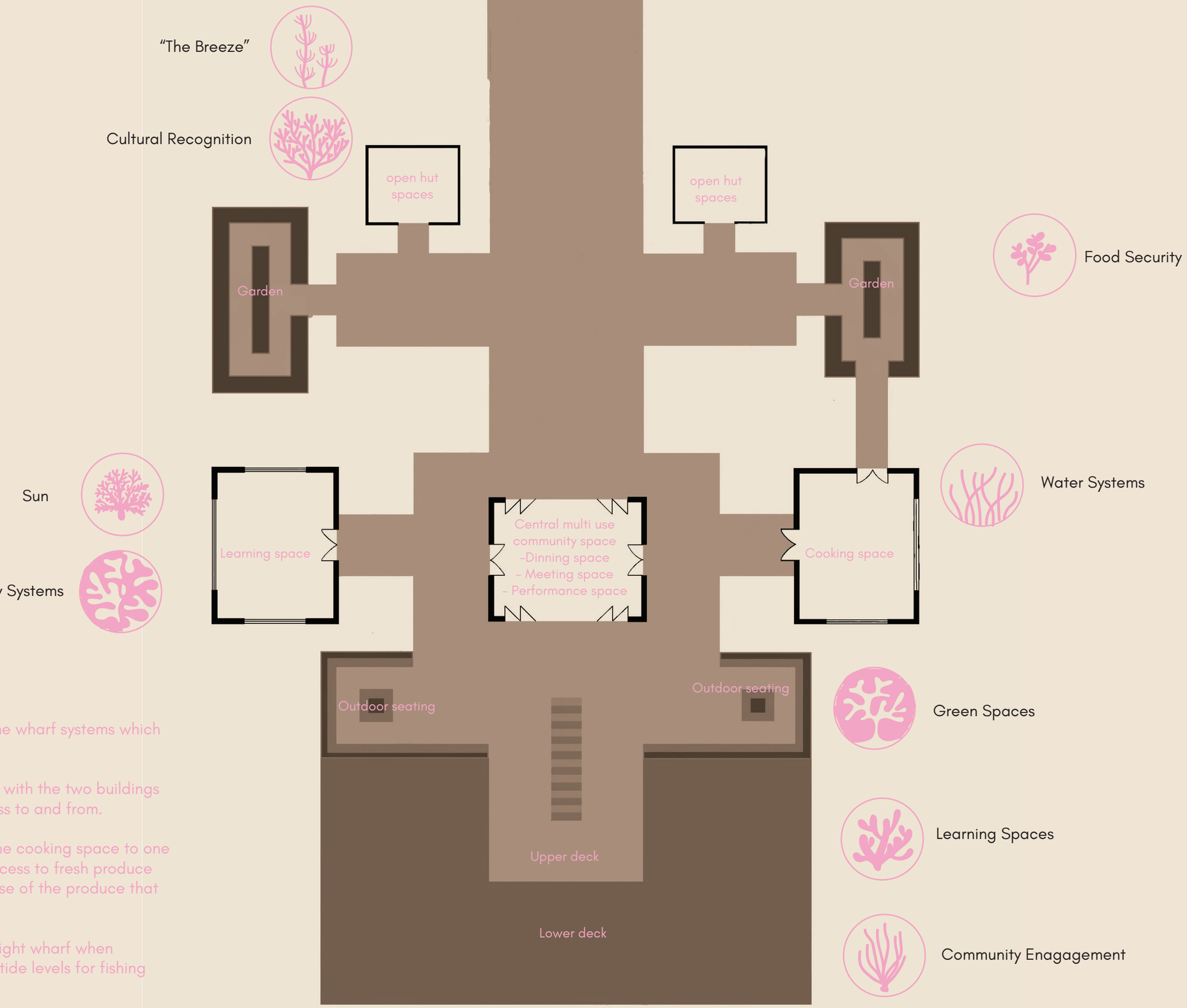
Figure 91. *Image: Wharf layout Plan*

Next steps: Adding a central building which could be placed central to the wharf systems and the buildings off the side of the wharf being the separate spaces, but making sure there still feel like an extension of the space.

Incorporating gardens that are closest to the shore based of the research from site analysis and the traditional root crops being closest to the lagoon shoreline

Also giving each building a programme is important in determining layout and how it fits in the bigger system of the wharf layout.

Figure 92. *Image: Wharf layout Plan revised*



Revised plan:

-Incorporating gardens to the wharf systems which are closest to the shore.

-Creating a central building with the two buildings off to either side. with access to and from.

Also creating access form the cooking space to one of the gardens for easier access to fresh produce hopefully encouraging the use of the produce that has been produced.

Incorporating the double height wharf when thinking about the different tide levels for fishing opportunities

Raised bed garden detail

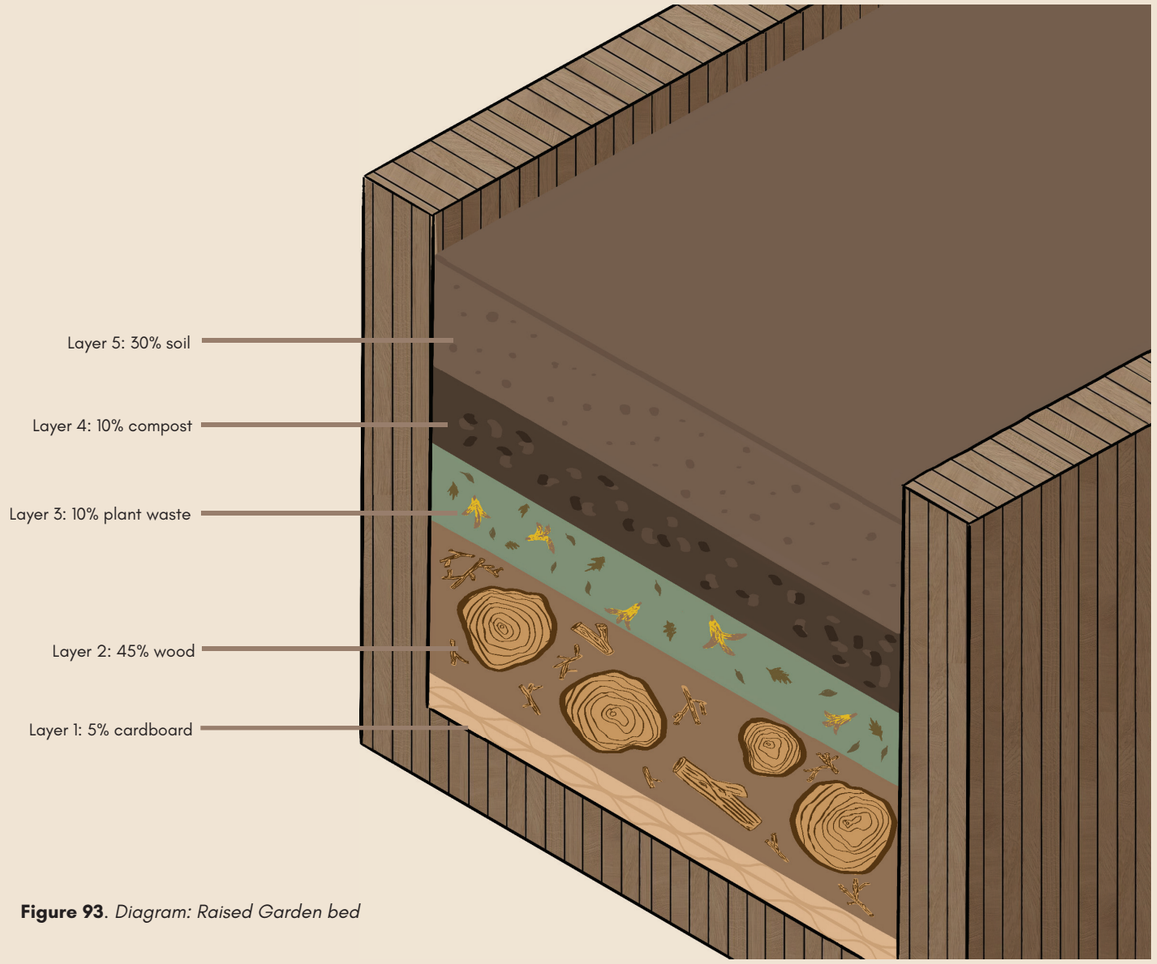
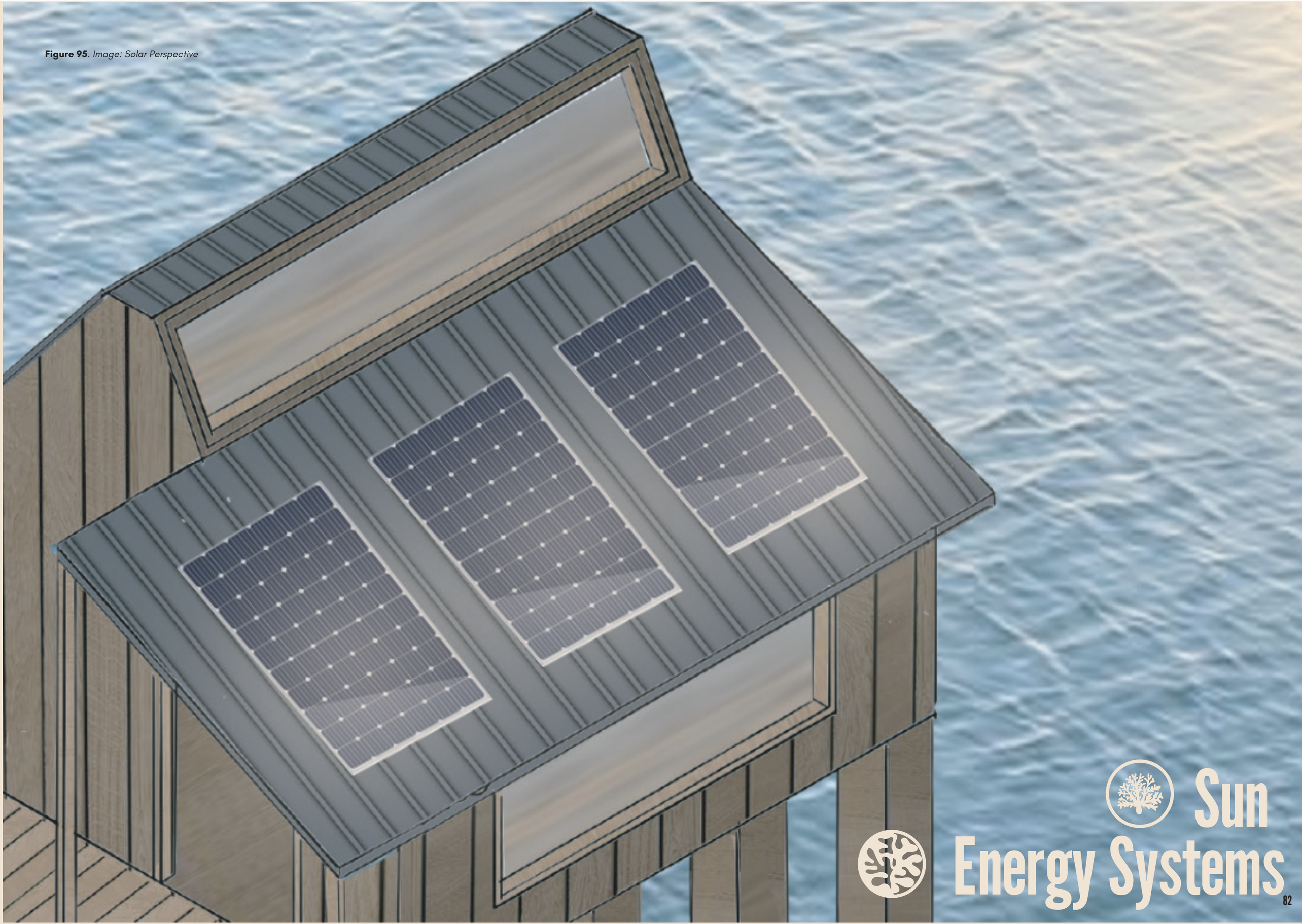


Figure 93. *Diagram: Raised Garden bed*

Figure 94. *Image: Vegetable Garden Perspective*

Food Security

Figure 95. *Image: Solar Perspective*



Sun Energy Systems

“The Breeze”
Cultural Recognition

Figure 96. *Image: Traditional Hut Perspective*

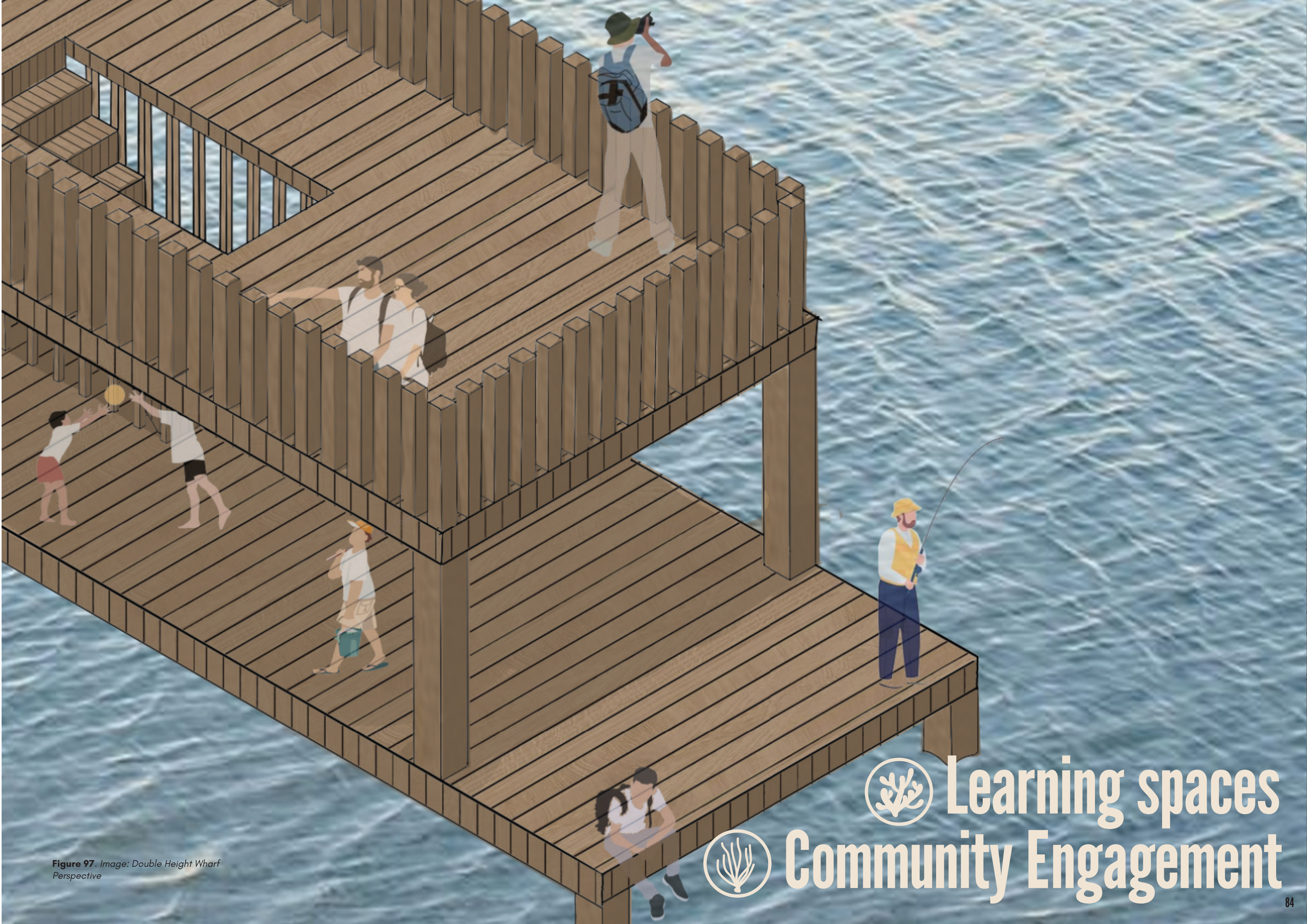
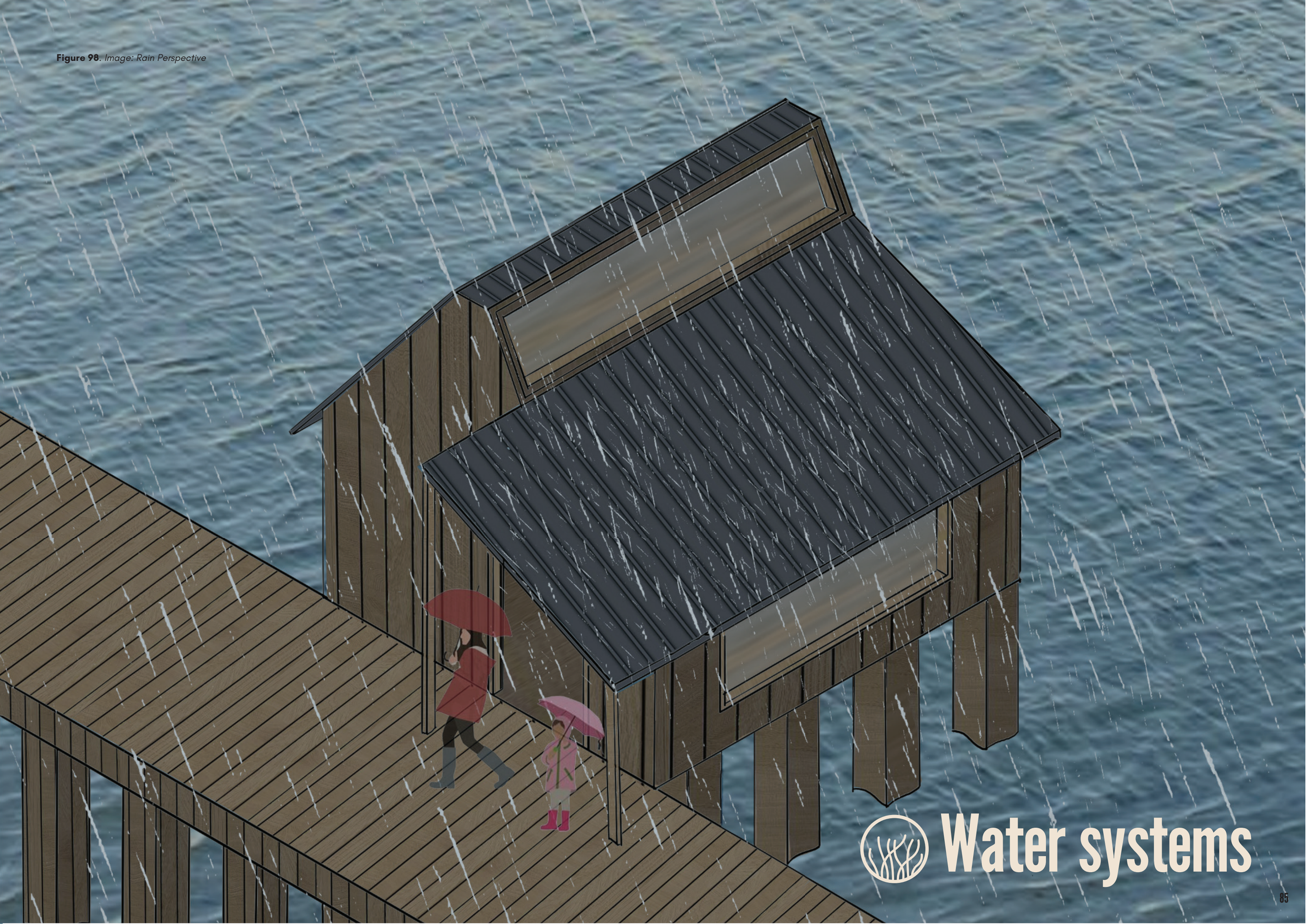


Figure 97. *Image: Double Height Wharf Perspective*

Learning spaces
Community Engagement

Figure 98. *Image: Rain Perspective*



Water systems

Figure 99. *Image: Green spaces Perspective*

Construction details

Wall detail

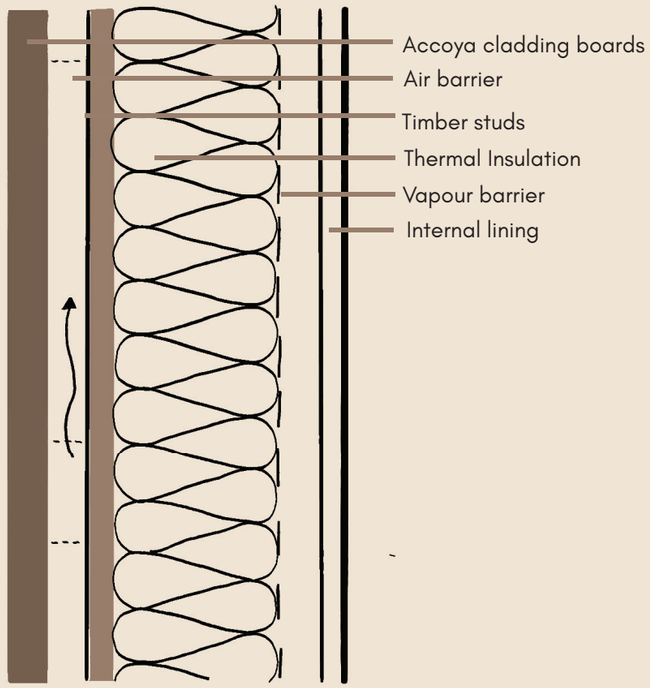


Figure 100. *Diagram: Wall detail*

Wharf Support Detail

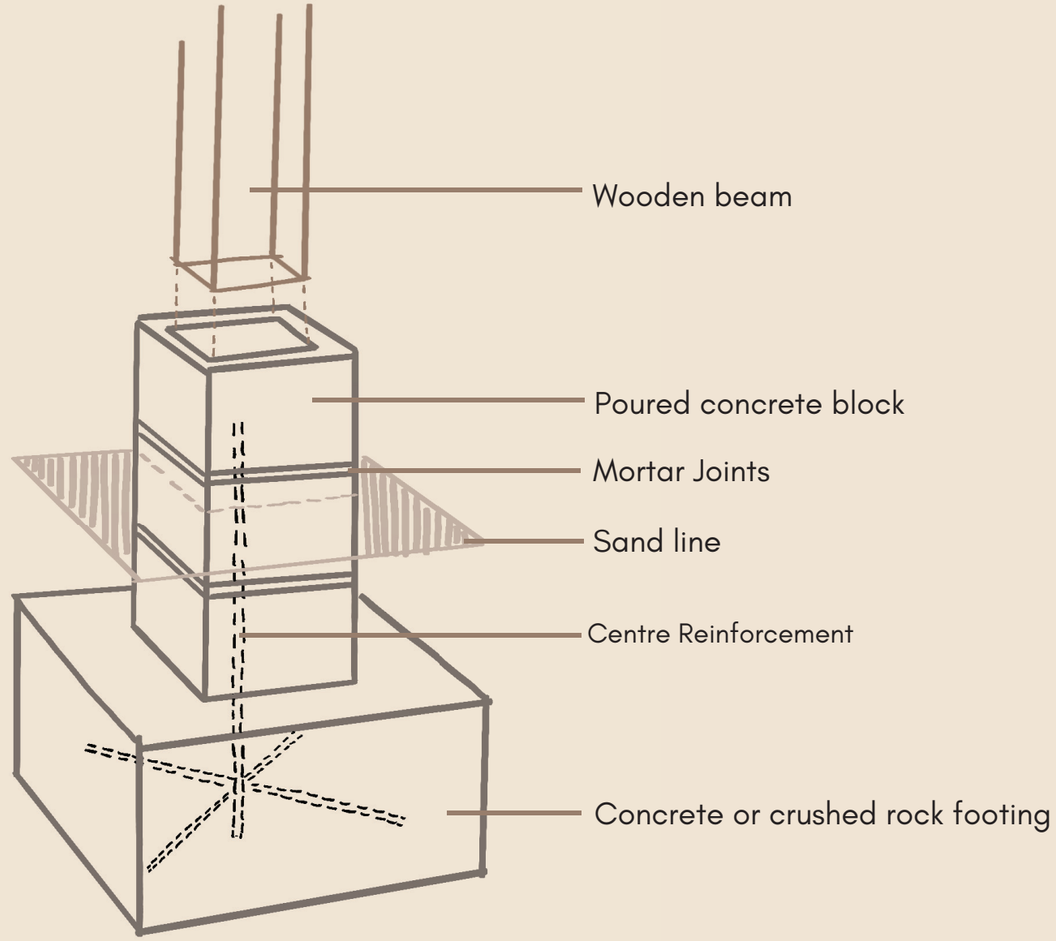


Figure 101. *Diagram: Wharf footing detail*

Due to the unique conditions of an atoll I have made the assumption of using a standard wharf footing for the structure of the wharf although extensive site research into the land below would need to be placed and potentially engineering support to ensure the stability of the structure.

Figure 102. *Image: Bio rock structures*

Figure 103. *Image: Section*

Figure 104. *Image: Plan*

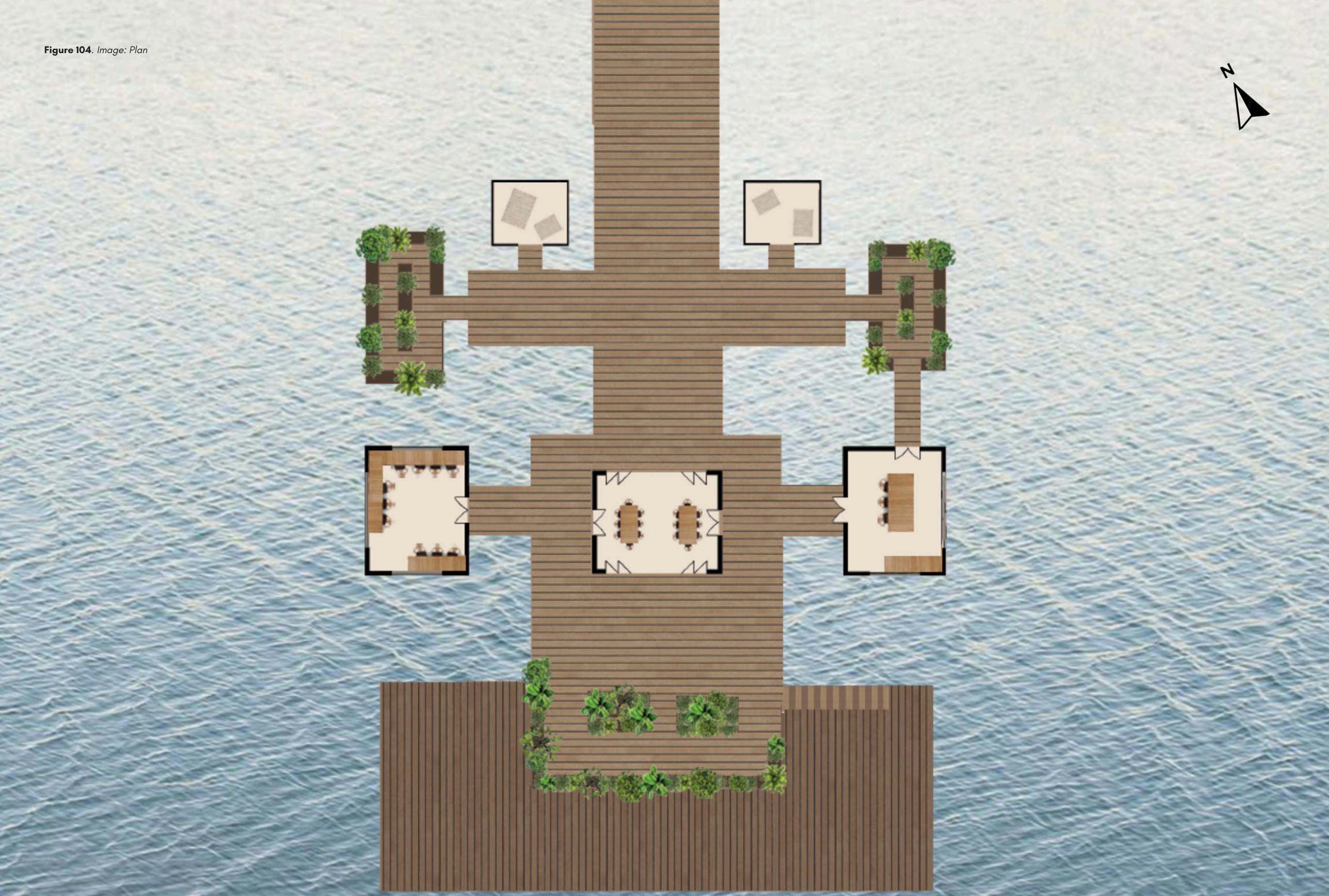


Figure 105. *Image: Perspective*

Chapter Seven

Critical Reflection
Conclusion
Figure List
References

Conclusion

In conclusion, this thesis has explored the potential of implementing regenerative strategies and systems that harmonize the relationship between land and sea in Kiribati, a small island nation grappling with the impacts of climate change and environmental degradation. As highlighted throughout this research, the urgent challenges faced by Kiribati—ranging from rising sea levels and extreme weather events to issues of waste management and limited access to resources—underscore the critical need for innovative and sustainable approaches to ecosystem management.

The investigation has revealed that the integration of regenerative practices offers a pathway to restoring ecological balance while simultaneously enhancing the health and well-being of the Kiribati population. By fostering collaborative relationships between humans and non-humans, Kiribati can optimize its natural resources, ensuring food security and promoting community resilience. This thesis has emphasized the importance of not only understanding existing regenerative practices but also assessing their applicability within the unique socio-cultural and environmental context of Kiribati.

Key issues identified during the research process, such as material access and waste management, are exacerbated by the pressures of climate change. The prevalence of plastic pollution, ineffective waste disposal systems, and inadequate infrastructure not only harm the environment but also pose significant risks to public health. Addressing these challenges requires a comprehensive approach that incorporates community engagement and local knowledge. Engaging with the community is crucial for crafting solutions that are both effective and culturally relevant.

This study has illuminated the critical role of youth in Kiribati's future. Seeking purpose and direction amid the existential threats posed by climate change. By involving youth in regenerative initiatives—whether through education, advocacy, or hands-on participation—Kiribati can encourage a generation that is empowered to take charge of their environment and advocate for sustainable practices. This engagement not only addresses immediate environmental concerns but also instills a sense of hope and initiative that is essential for fostering long-term resilience within communities.

The research process also provided valuable insights into differing perspectives on environmental priorities. While external observers may emphasize the urgency on rising sea levels, local voices highlight the need for culturally rooted practices and community-driven initiatives. The different in priorities illustrates the necessity of an inclusive approach that balances external expertise with local knowledge and aspirations. By integrating these perspectives into frameworks, Kiribati can ensure that its strategies for regeneration are grounded in the realities of its people's lives and needs.

In conclusion, the findings of this thesis add to the expanding knowledge base on sustainable development in small island nations, providing practical recommendations for policymakers, practitioners, and communities. By emphasizing regenerative practices that connect land and sea, Kiribati can pave the way for a healthier, more resilient future for its residents. This approach not only tackles immediate issues but also establishes a foundation for enduring ecological and social stability.

As Kiribati progresses, incorporating regenerative strategies will be crucial for preserving its cultural heritage, protecting natural resources, and enhancing the overall quality of life for its citizens. The insights gained from this research highlight that sustainable development is not just an endpoint but an ongoing journey of adaptation and innovation. By adopting regenerative practices, Kiribati has the potential to set a powerful example in the global fight against climate change, fostering a vibrant community that honours and nurtures its distinctive environment.

Critical Reflection

This thesis which investigates how regenerative strategies and systems between land and sea can benefit Kiribati in terms of health and well-being is a vital contribution to sustainable development for small island nations. By focusing on Kiribati, a nation at the forefront of climate change challenges, this study highlights the urgency of developing strategies that are contextually relevant and culturally sensitive. This research not only emphasizes the potential advantages of regenerative approaches but also uncovers several critical gaps in knowledge that must be addressed for the most effective results.

One of the key contributions of this research is its emphasis on the significant gap in research about Kiribati's cultural values, beliefs, and community lifestyles. Recognising these is essential for effective sustainability initiatives that connect with the community. This work significantly enhances the growing body of knowledge about Kiribati, offering insights into how cultural perspectives shape environmental interactions and community adaptability.

A challenge identified in the research is the lack of local knowledge regarding cultural values and everyday life. This knowledge gap poses a significant problem that affects design decisions about how best to program and layout spaces that will suit the daily lifestyles of those who will use the proposed spaces. Without a clear understanding of local customs, traditions, and social interactions, it will lead to creating spaces that do not align with the community's needs. This disconnect can result in a lack of community engagement and interaction. To address this issue, it is crucial to involve local stakeholders in the design process, ensuring their insights are incorporated into the proposed design. By prioritizing this collaborative approach, designers can create spaces that not only meet functional requirements but also resonate deeply with the cultural identity and everyday experiences of the community, ultimately enhancing the overall impact and usability of the space proposed.

Future steps to enhance collaboration with the broader community in this project involve building relationships with local schools, Government organisations, Non-governmental organizations, and research institutions, which could collaborate more knowledge and provide practical training in regenerative practices. Additionally, these educational initiatives could revitalize traditional practices that have been overshadowed by contemporary methods, thereby enhancing community resilience and environmental care.
Observations from the research show a gap in site analysis research and understanding, Interviews conducted during the NUWAO field trip in 2024 communicated that residents are experiencing a different reality than what is often perceived externally. While rising sea levels are frequently presented as an urgent threat, the people of Kiribati report that their land is expanding due to land accretion. This discrepancy highlights the need for further research to fully understand the impacts of these processes, as well as to validate local experiences against current narratives.
Furthermore, site observations concerning land conditions, mapping, and climate considerations such as wind and tidal conditions are currently lacking, yet they play a crucial role in ensuring that the proposed designs meet both community and environmental needs Understanding these factors is essential for creating solutions that are not only effective but also sustainable in the long term.
Given the limited research available, assumptions have been made based on NUWAO's findings, alongside individual literature reviews and site analyses, to inform this project.
More research is needed, particularly focused on site, to ensure that decisions are made based on facts rather than assumptions. This insight will ultimately enhance the potential for successful and sustainable design solutions in Kiribati. Ongoing research and collaboration with local communities will be vital in addressing the complexities of sustainability in small island nations, allowing for the development of regenerative strategies that can respond effectively to the challenges posed by climate change. By bridging the gap between local and scientific knowledge, this research can contribute to a more detailed understanding of regenerative strategies, encouraging resilience and well-being in Kiribati and similar contexts around the world.

Figure List

Bibliography

Accoya. (2024). Benefits of Accoya https://www.accoya.com/nz/why-accoya/benefits/

Afzal, M. S., Tahir, F., & Al-Ghamdi, S. G. (2022). Recommendations and Strategies to Mitigate Environmental Implications of Artificial Islands Developments in the Gulf. https://www.mdpi.com/2071-1050/14/9/5027

Archer, C. L., & Jacobson, M. Z. (2005). Evaluation of global wind power. Journal of Geophysical Research 110. https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2004JD005462

*Aretaake, R. (2019). Traditional Kiribati beliefs about environmental issues and its impacts on rural and urban communities Disaster Prevention and Management https://www.emerald.com/insight/content/doi/10.1108/DPM-06-2018-0182/full/html?casa_*

Ashley, S. T., & Ashley, W. S. (2017). Flood Fatalities in the United States Journal of Applied Meteorology and Climatology 47, 198-205. https://www.researchgate.net/publication/255278322_Flood_Fatalities_in_the_United_States#fullTextFileContent

Astariz, S., & Iglesias, G. (2015). The economics of wave energy: A review. renewable and Sustainable Energy Reviews, 45. https://www.sciencedirect.com/science/article/abs/pii/S1364032115000714

Babinard, J., Bennett, C. R., Hatziolos, M. E., Faiz, A., & Somali, A. (2014). Sustainably managing natural resources and the need for construction materials in Pacific island countries: The example of South Tarawa, Kiribati Natural Resources Forum https://www.researchgate.net/publication/260283892_Sustainably_managing_natural_resources_and_the_need_for_construction_materials_in_Pacific_island_countries_The_example_of_South_Tarawa_Kiribati

Bacheva, V. (2022). Inhabiting a finite world: Towards a regenerative architecture
Barnett, J., & Adgar, W. N. (2003). Climate Dangers and Atoll Countries. Climatic Change, 61. https://link.springer.com/article/10.1023/B:CLIM.0000004559.08755.88

Benevolenza, M. A., & DeRigne, L. (2018). The impact of climate change and natural disasters on vulnerable populations: A systematic review of literature Journal of Human Behaviour in the Social Environment 29(2). https://www.tandfonline.com/doi/full/10.1080/10911359.2018.1527739?scroll=top&needAccess=true

Bigford, T. E. (2008). Sea-level rise, nearshore fisheries, and the fishing industry Coastal Management, 19(4). https://www.tandfonline.com/doi/abs/10.1080/08920759109362152

Biorock, Mineral Accretion Technology, Seament. https://www.globalcoral.org/biorock-coral-reef-marine-habitat-restoration/

Campisano, A., Butler, D., Ward, S., Burns, M. J., Friedler, E., DeBusk, K., Fisher-Jeffes, L. N., Ghisi, E., Rahman, A., Furumai, H., & Han, M. (2017). Urban rainwater harvesting system: Research, implementation and future perspectives. Water Research 115. https://www.sciencedirect.com/science/article/abs/pii/S0043135417301483

Cauchi, J. P., Correa-Velez, I., & Bambrick, H. (2019). Climate change, food security and health in Kiribati: a narrative review of the literature Global Health Action. https://www.tandfonline.com/doi/full/10.1080/16549716.2019.1603683

Cauchi, J. P., Moncada, S., Bambrick, H., & Correa-Velez, I. (2021). Coping with environmental hazards and shocks in Kiribati: Experiences of climate change by atoll communities in the Equatorial Pacific Environmental Development https://www.sciencedirect.com/science/article/pii/S2211464520300683

Cole, A. J., Pratchett, M. S., & Jones, G. P. (2008). Diversity and functional importance of coral-feeding fishes on tropical coral reefs. Fish and Fisheries 9(3). https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-2979.2008.00290.x

Development, M. o. S. (2015). Boutokaan Te Mweeraoi: A conceptual Framework for Enhancing I-Kiribati Wellbeing
Dietz, T., Shwom, R. L., & Whitley, C. T. (2020). Climate Change and Society Annual Review of Sociology 46. https://www.annualreviews.org/content/journals/10.1146/annurev-soc-121919-054614

Donner, S. D., & Webber, S. (2014). Obstacles to climate change adaptation decisions: a case study of sea-level rise and coastal protection measures in Kiribati Sustainability Science. https://link.springer.com/article/10.1007/s11625-014-0242-z?sa_campaign=email%2Fevent%2FarticleAuthor%2FonlineFirst

Education, L. L. E. (n.d). Atoll Food Futures. https://livelearn.org/atoll-food-futures/

El-Shihy, A. A., & José M, E. (2019). Architectural design concept and guidelines for floating structures for tackling sea level rise impacts on Abu-Qir. Alexandria Engineering Journal 58(2), 507-518. https://www.sciencedirect.com/science/article/pii/S1110016819300328

Griggs, G., & Reguero, B. G. (2021). Coastal Adaptation to Climate Change and Sea-Level Rise. (Adaptation to Coastal Climate Change and Sea-Level Rise). https://www.mdpi.com/2073-4441/13/16/2151

Guo, P.-Y. 'Island Builders': landscape and historicity among the Langalanga, Solomon Islands. https://d1wqtxts1xzle7.cloudfront.net/15820212/Guo_2003_island_builders-libre.pdf?1390864495=&response-content-disposition=inline%3B+filename%3Dlsland_builders_landscape_and_historicit.pdf&Expires=1718674636&Signature=FluBlzh67LPrvcX1BxGzgn~L-0sP6-EzahfsSULu3QHMMK4hiuoPu7t2lO~Pfhz7ubw7PdV8uqQLIncQUYw6AVcMLhSOQrmFJ67vMKnx1K1OpZ3G

Hall, J. A., Weaver, C. P., Obeysekera, J., Crowell, M., Horton, R. M., Kopp, R. E., Marburger, J., Marcy, D. C., Parris, A., Sweet, W. V., Veatch, W. C., & White, K. D. (2019). Rising Sea Levels: Helping Decision-Makers Confront the Inevitable. Coastal Management, 47(2). https://www.tandfonline.com/doi/abs/10.1080/08920753.2019.1551012

Harris, D. L., Rovere, A., Casella, E., Power, H., Canavesio, R., Collin, A., Pomeroy, A., Webster, J. M., & Parravicini, V. (2018). Coral reed structural complexity provides important coastal protection from waves under rising sea levels. Science Advances https://www.science.org/doi/full/10.1126/sciadv.aao4350

Hermann, E. (2017). Climate Change and Worries over Land: Articulation in the Atoll state Kiribati Environmental Transformations and Cultural Responses https://link.springer.com/chapter/10.1057/978-1-137-53349-4_3

Hill, K. (2015). Coastal infrastructure: a typology for the next century of adaptation to sea-level rise. Frontiers in Ecology and the Environment 13(9). https://esajournals.onlinelibrary.wiley.com/doi/full/10.1890/150088

Hinkel, J., Lincke, D., Vafeidis, A. T., Perrette, M., Nicholls, R. J., Tol, R. S. J., Marzeion, B., Fettweis, X., Ionescu, C., & Levermann, A. (2014). Coastal flood damage and adaptation costs under 21st century sea-level rise. Social sciences, 111(9). https://www.pnas.org/doi/abs/10.1073/pnas.1222469111

Hirschfield, D., Hill, K. E., & Plane, E. (2021). Adapting to Sea Level Rise: Insights from a New Evaluation Framework of Physical Design Projects Coastal Management, 49(6), 636-661. https://www.tandfonline.com/doi/full/10.1080/08920753.2021.1967563

Hobbs, R. J., O'Brien, J. K., Bay, L. K., Severati, A., Spindler, R., Henley, E. M., Quigley, K. M., Randall, C. J., Madeleine J. H. van Oppen, Carter, V., Zuchowicz, N., Hagedorn, M., & Daly, J. (2022). A decade of coral biobanking science in Australia – transitioning into applied reef restoration. Marine Conservation and Sustainability 9. https://www.frontiersin.org/journals/marine-science/articles/10.3389/fmars.2022.960470/full

Hockings, J. (1989). Traditional Architecture in the Gilbert Islands: A Cultural Perspective University of Queensland Press.
Hoegh-Guldberg, O. (2011). Coral reef ecosystems and anthropogenic climate change. Regional environmental change https://link.springer.com/article/10.1007/s10113-010-0189-2

HomeBiogas. (n.d). Our Solutions: Bio-Toilet https://www.homebiogas.com/solutions/bio-toilet/

Huber, J. E., Riet, K. V. d., Sandell, J., & Scarpa, L. (2017). Salty Urbanism: Towards an Adaptive Coastal Design Framework to Address Sea Level Rise. The Plan Journal 2(2). https://repository.library.noaa.gov/view/noaa/33071

Hulme, M. (2009). Why we disagree about climate change https://www.mikehulme.org/wp-content/uploads/2009/10/Hulme-Carbon-Yearbook.pdf

Hurlimann, A., Barnett, J., Fincher, R., Osbaldiston, N., Mortreux, C., & Graham, S. (2014). Urban planning and sustainable adaptation to sea-level rise Landscape and Urban Planning 126. https://www.sciencedirect.com/science/article/abs/pii/S0169204613002442

Janin, H., & MAndia, S. A. (2012). Rising Sea Levels - An Introduction to Cause and Impact McFarland & Company. https://books.google.co.nz/books?hl=en&lr=&id=l6RA71uAQu4C&oi=fnd&pg=PP1&dq=rising+sea+levels&ots=lgMlNVTWKF&sig=xN-yAA2rJfeJcDx1imWVw7UDEQ0&redir_esc=y#v=onepage&q=rising%20sea%20levels&f=false

Krier, L. (2009). The Architecture of Community

Li, F., Wichmann, K., & Otterpohl, R. (2009). Review of the technological approaches for grey water treatment and reuses. Science of The Total Environment 407(11). https://www.sciencedirect.com/science/article/abs/pii/S0048969709001594

Live & Learn Environmental Education (2024). https://livelearn.org/about-us/

Mallin, M.-A. F. (2021). From sea-level rise to seabed grabbing: The political economy of climate change in Kiribati Marine Policy https://www.sciencedirect.com/science/article/pii/S0308597X18302434

Mazurek, O. (2020). THERE WILL BE FLOOD: Resilient architecture for sea level rise Chalmers University of Technology, Gothernburg].
McKay, N. P., Overpeck, J. T., & Otto-Bliesner, B. L. (2011). The role of ocean thermal expansion in Last Interglacial sea level rise Geophysical Research Letters, 38(14). https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2011GL048280

McLeman, R. (2018). Migration and displacement risks due to mean sea-level rise. Bulletin of the Atomic Scientists 74(3). https://www.tandfonline.com/doi/abs/10.1080/00963402.2018.1461951

McPhearson, T., Kabisch, N., & Frantzeskaki, N. (2023). Nature-Based Solutions for Cities Edward Elgar Publishing Limited https://www.researchgate.net/publication/373043794_Nature-based_Solutions_for_Cities

Mohankumar, V. (2020). A Tactical Urbanism Guidebook Retrieved from https://www.transformative-mobility.org/wp-content/uploads/2023/03/TrainingMaterial_A_Tactical_Urbanism_Guidebook-5zZpKb.pdf

Mould, O. (2014). Tactical Urbanism: The New Vernacular of the Creative City Geography Compass. https://compass.onlinelibrary.wiley.com/doi/full/10.1111/gec3.12146?casa_token=CVYYVSxQVVUAAAAA%3AnV5D4Z0OQe9_ujHWQC2BghJQMLRQOrBZIYD_V5HPoNa6CTS-8hetqLKBUPJ98aLCeB5dCm2dsSme3HjUKg

Muhammad Badar Hayat, Ali, D., Keitumetse Cathrine Monyake, Lana Alagha, & Ahmed, N. (2018). Solar energy - A look into power generation, challenges, and a solar-powered future. International Journal of Energy Research https://onlinelibrary.wiley.com/doi/abs/10.1002/er.4252
Nawisielski, D. (2024). Artificial Islands: Solomon Islands case study [Unpublished assignment submitted for ARCH810]. Auckland University of Technology.
NUWAO. ((n.d.)). Bio accretion/mineral accretion. https://nuwao.org.nz/bio-accretion-mineral-accretion/

NUWAO. (n.d). Coral reseeding https://nuwao.org.nz/coral-reseeding/

Piggott-McKellar, A. E., McNamara, K. E., & Nunn, P. D. (2020). Who defines "good" climate change adaptation and why it matters: a case study from Abaiang Island, Kiribati Regional Environmental Change https://link.springer.com/article/10.1007/s10113-020-01614-9

Reise, K., & Beusekom, J. E. E. v. (2008). Interactive effects of global and regional change on a coastal ecosystem. Helgoland Marine Research 62. https://link.springer.com/article/10.1007/s10152-007-0102-7

Sahin, O., & Mohamed, S. (2014). Coastal vulnerability to sea-level rise: a spatial-temporal assessment framework Natural Hazards, 70. https://link.springer.com/article/10.1007/s11069-013-0818-4

Seah, C. H. (2023). For Regenerative Urban Ecologies: Strategies and Synergy of Integrated Community Hubs. International Journal on Smart and Sustainable Cities. https://www.worldscientific.com/doi/epdf/10.1142/S2972426023710022

Steffen, W., Grinevald, J., Crutzen, P., & McNeil, J. (2011). The Anthropocene: conceptual and historical perspectives Philosophical Transactions of the Royal Society A, 369(1938). https://royalsocietypublishing.org/doi/abs/10.1098/rsta.2010.0327

Storey, D., & Hunter, S. (2010). Kiribati: an environmental 'perfect storm'. Australian Geographer https://www.tandfonline.com/doi/full/10.1080/00049181003742294

Suttton-Grier, A. E., Wowk, K., & Bamford, H. (2015). Future of our coasts: The potential for natural and hybrid infrastructure to enhance the resilience of our coastal communities, economies and ecosystems Environmental science & Policy 51. https://core.ac.uk/reader/82296180

Tarawa Island. (2024). https://www.kiribatitourism.gov.ki/islands-to-explore/tarawa-island/#:~:text=In%20Kiribati%20mythology%2C%20Tarawa%20was,sky%20as%2C%20'Tarawa'.

Temmerman, S., Meire, P., Bouma, T. J., Herman, P. M. J., Ysebaert, T., & Vriend, H. J. D. (2013). Ecosystem-based coastal defence in the face of global change Nature, 504. https://www.researchgate.net/publication/259200820_Ecosystem-based_coastal_defence_in_the_face_of_global_change

Thomas, D. S. G., & Twyman, C. (2005). Equity and justice in climate change adaptation amongst natural-resource-dependent societies. Global Environmental Change 15(2). https://www.sciencedirect.com/science/article/abs/pii/S0959378004000779

Vellinga, P., & Leatherman, S. P. (1989). Sea level rise, consequences and policies. Climatic Change, 15. https://link.springer.com/article/10.1007/BF00138851

Wang, Y.-N., Peng, J.-R., Bogrireddy, C., Rattan, B., & Tan, M.-X. (2023). Artificial islands in modern development: Construction, applications, and environmental challenges. Marine Georesources & Geotechnology. https://www.tandfonline.com/doi/

Warrick, R., & Farmer, G. (1990). The Greenhouse Effect, Climatic Change and Rising Sea Level: Implications for Development Transactions of the Institute of British Geographers 15(1). https://www.jstor.org/stable/623089?seq=1

Wates, N., & Knevitt, C. (1987). Community Architecture - How people are creating their own environment https://www.taylorfrancis.com/books/mono/10.4324/9781315885957/community-architecture-routledge-revivals-nick-wates-charles-knevitt

Watson, J., Linaraki, D., & Robertson, A. (2020). Lo-Tek: Underwater and Intertidal Nature-based Technologies. https://link.springer.com/chapter/10.1007/978-981-15-8748-1_4

Woodruff, S., BenDor, T. K., & Strong, A. L. (2018). Fighting the inevitable: infrastructure investment and coastal community adaptation to sea level rise System Dynamics Review, 34(1-2). https://onlinelibrary.wiley.com/doi/abs/10.1002/sdr.1597

Zari, M. P., Kiddle, L., Chanse, V., Bloomfield, S., Latai-Niusulu, A., Abbott, M., Blaschke, P., Mihaere, S., Brockie, O., ershadi, S., Grimshaw, M., Platje, A., & Varshney, K. (2024). NUWAO Nature-based Solutions Design Guide for TE Moananui Oceania https://nuwao.org.nz/nbs-guide/

Zari, M. P., MacKinnon, M., Varshney, K., & Bakshi, N. (2022). Regenerative living cities and the urban climate-biodiversity-wellbeing nexus. Nature Climate Change

Appendices

Presentation

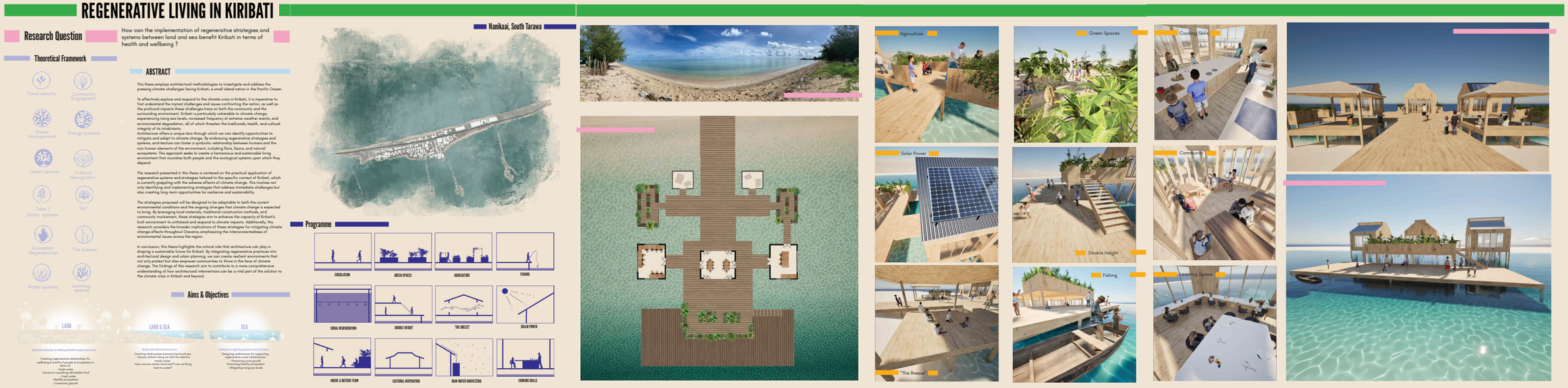


Figure 106. *Final Pin-up presentation*

Figure 107. *Final Pin-up Image: Double Height*

Figure 108. *Final Pin-up Image: Cooking Skills*

Figure 109. *Final Pin-up Image: Community*

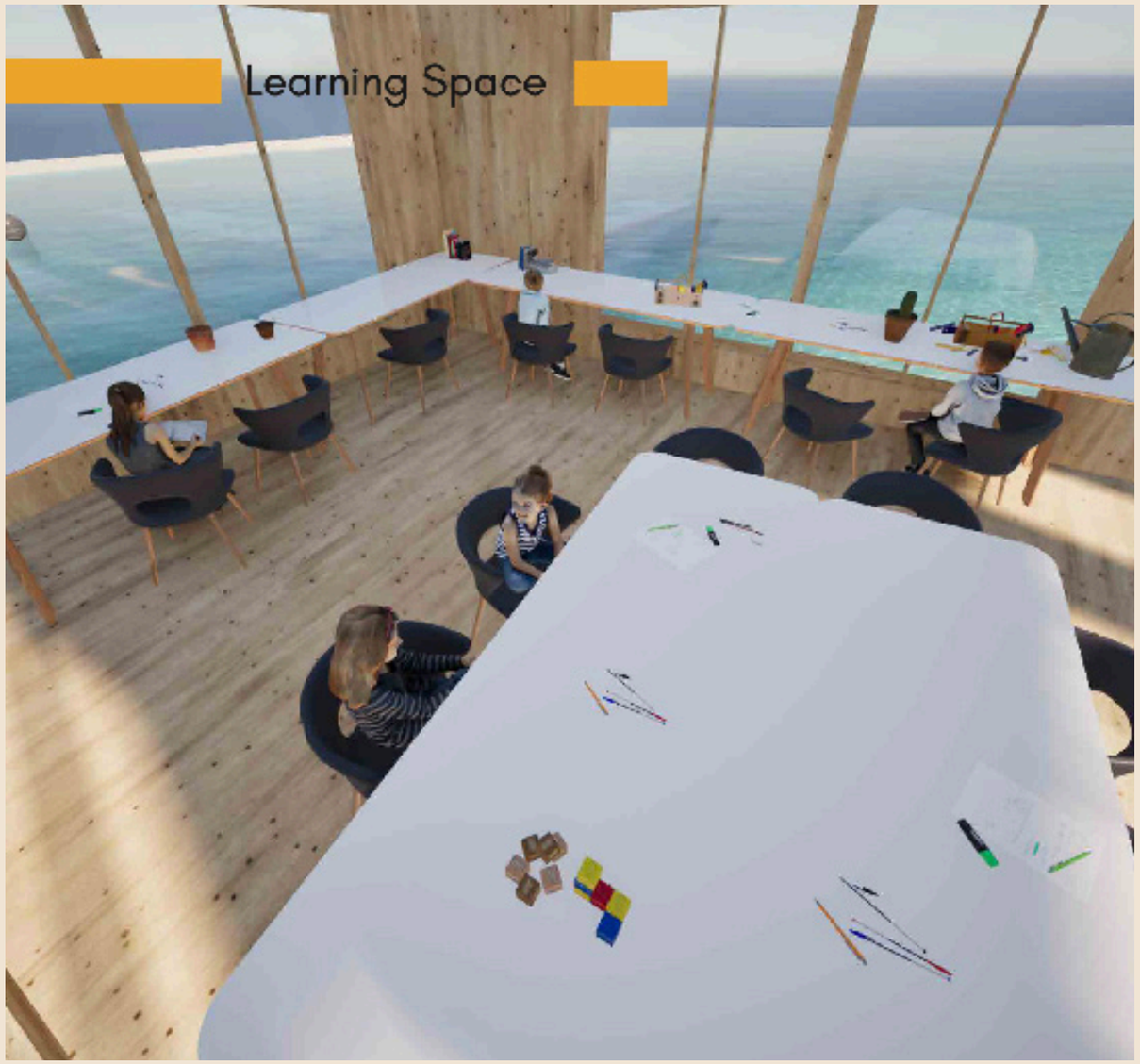


Figure 110. *Final Pin-up Image: Learning Space*

Figure 111. *Final Pin-up Image: Solar Power*

Figure 112. *Final Pin-up Image: "The Breeze"*

Figure 113. *Final Pin-up Image: Fishing*

Figure 114. *Final Pin-up Image: Agriculture*

Figure 115. *Final Pin-up Image: Green Spaces*

Figure 116. *Final Pin-up Image: Front Perspective*

Figure 117. *Final Pin-up Image: Back Perspective*