DESIGNING WITH NATURE

Culturally Informed Biophilic Design for Community Wellbeing in New Zealand

Cilla Tomlinson



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Culturally Informed Biophilic Design for Community Wellbeing in New Zealand

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ABSTRACT

This thesis examines how biophilic design and design approaches drawing on Māori concepts can inform the design of a holistic healthcare centre in New Zealand. The research explores how architecture can support human wellbeing and ecological regeneration by creating connections between people, culture and the environment. Grounded in the theoretical foundations of biophilia, environmental psychology and Indigenous Māori worldviews, the study investigates how design can respond to Māori health inequities and broader societal disconnection from nature.

Employing a design-led methodology in which concepts are iteratively developed, tested and reflected upon, the study applies Terrapin Bright Green's 14 Patterns of Biophilic Design, Te Whare Tapa Whā and Te Aranga Māori design principles to a holistic community-focused architectural intervention. The research proposes a framework for integrating biophilic and culturally responsive design approaches through iterative design exploration and critical reflection.

The thesis suggests that integrating natural elements and culturally responsive strategies may support occupant health, contribute to ecological resilience, and enable meaningful engagement with place and culture. These outcomes are presented as evidence-informed design propositions rather than empirically measured results. The thesis offers a framework for biophilic and culturally informed design, providing insights for architects, educators and policymakers seeking to integrate human-centred and place-responsive approaches.



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ATTESTATION OF AUTHORSHIP

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 nor material which has, to a substantial extent, been submitted for the award of any other degree or diploma at a university or other institution of higher learning. The tools Grammarly (Grammarly Inc., 2025) and ChatGPT (OpenAI, 2025) were used solely for grammar and spelling correction in this thesis. No generative AI tools were used for content creation, idea development or analysis.

Signed:



POSITIONALITY STATEMENT

As a Pākehā researcher and designer, I approach this work with humility and an awareness of the limits of my cultural authority. My research engages with te ao Māori to inform more holistic approaches to biophilic and healthcare design, while acknowledging that I do not possess the lived experience or authority of Māori communities. Māori values and ancestral knowledge offer profound insight into the interconnectedness of people, whenua and living systems, and I seek to learn from these perspectives without appropriating or speaking over Indigenous voices.

This thesis is not Kaupapa Māori research, as it is not by Māori. However, it aims to follow the leadership of Māori scholars whose work helps shape culturally informed design. In this context, culturally informed design refers to drawing on established cultural frameworks and knowledge, whereas culturally grounded design emerges through direct engagement with mana whenua and place-specific relationships. This project remains within a culturally informed scope.

Early in the process, I considered consulting with mana whenua but chose not to pursue engagement, given the project's conceptual scope and the risks of extractive practices without a long-term partnership. Instead, I take responsibility for ongoing reflexive and decolonial work within this project. By acknowledging my positionality, I aim to support research that remains respectful and attentive to Māori knowledge sovereignty.

ACKNOWLEDGEMENTS

To my Mum, who has always supported me in my education, encouraged me to pursue my passions and taken a genuine interest in my studies.

To Luke, for standing by my side throughout my entire university journey, always bringing a positive outlook and believing in me.

To my supervisors, Maibritt and Sibyl, for guiding our supervisor group throughout the year and for passionately sharing their wealth of knowledge.



BIOPHILIC DESIGN ORGANIC FORMS NATURAL PATTERNS AND TEXTURES NATURE-BASED SOLUTIONS SENSORY ENGAGEMENT NATURAL LIGHT AND SHADOW BIOMIMICRY LIVING SYSTEMS ECOSYSTEM INTERACTIONS BIODIVERSITY SUPPORT SPATIAL HARMONY DAYLIGHT ACCESS NATURAL VENTILATION INDOOR-OUTDOOR CONNECTION HEALTH & WELLBEING PREVENTATIVE CARE HEALING ENVIRONMENTS HOLISTIC HEALTH MENTAL RESTORATION SOCIAL COHESION PLACE ATTACHMENT COMMUNITY WELLBEING MULTI-SENSORY DESIGN INTERGENERATIONAL CONNECTION RELATIONAL ONTOLOGY ECOLOGY & ENVIRONMENT NATIVE PLANTS LOCAL ECOLOGY NATIVE BIODIVERSITY INTERCONNECTEDNESS HABITAT CONNECTIVITY ECOSYSTEM RESILIENCE NATURAL CYCLES AND RHYTHMS MICROCLIMATES ENVIRONMENTAL STEWARDSHIP HABITAT COMPLEXITY ECOLOGICAL NETWORKS CULTURE & WORLDVIEW MĀTAURANGA MĀORI TE AO MĀORI WORLDVIEW CULTURALLY INFORMED AOTEAROA KAITIAKITANGA (GUARDIANSHIP) WHAKAPAPA (LINEAGE & CONNECTION) TOHU (PLACE MARKERS) MANĀKITANGA (HOSPITALITY) WHĀNAU (FAMILY & COMMUNITY) RELATIONALITY WITH LAND AND PEOPLE

CHAPTER 1: INTRODUCTION

INTRODUCTION

1.0 Background and Context

The future of architecture in New Zealand requires a broader approach than technical innovation alone, one that considers how built environments support human wellbeing, reflect cultural identity, and restore ecological balance. As the nation grapples with compounding crises, including climate change, biodiversity loss, rising mental health challenges and persistent health inequities, there is an increasing recognition that architectural practice must extend beyond clinical efficiency or economic cost-cutting (Yates et al., 2023). Built environments, particularly in the healthcare sector, are increasingly expected to foster the health of both people and the planet (Lopez, 2012). However, much of New Zealand's healthcare infrastructure does not fully align with this vision. The system tends to remain largely reactive, with a stronger focus on treating illness than on prevention, and is influenced by economic pressures that prioritise short-term savings over long-term wellbeing. Consequently, emotional, spiritual and environmental dimensions of health are often overlooked in the design of health facilities (Goodyear-Smith & Ashton, 2019).

In New Zealand, healthcare environments often exhibit a dual disconnection, both cultural and ecological. Culturally, many facilities fail to acknowledge Indigenous health frameworks such as Te Whare Tapa Whā and the relational values embedded in whenua and whakapapa (Goodyear-Smith & Ashton, 2019). Ecologically, many healthcare settings are characterised by sterile environments that are largely devoid of nature, limiting opportunities for meaningful human-nature connection. These limitations not only compromise wellbeing but also represent missed opportunities for healing, connection and place-based restoration (Totaforti, 2018). Biophilic design provides a compelling framework to address this gap, grounded in the understanding that humans possess an innate affinity for nature (Kellert et al., 2008). This thesis examines how integrating culturally informed and ecologically responsive design principles, such as those found in biophilic design and Mātauranga Māori, can transform healthcare environments in New Zealand to better support holistic wellbeing for both people and place.

1.1 The Critical Issue of Nature Disconnection

A pressing concern is the increasing disconnection between people and the natural environment (Beery et al., 2023; Aristizabal et al., 2021). Richardson (2025) reports a decline of over 60% in human connection to nature over the past 220 years, largely driven by urbanisation and environmental degradation. This ecological disconnection - defined as the weakening of human relationships with natural systems (Kellert, 2012; Ryan et al., 2014) is particularly impactful in New Zealand, where diverse natural landscapes are central to cultural and ecological identity (Lindsay-Latimer et al., 2024). A recent survey by the Mental Health Foundation of New Zealand (2018) highlights that the human-nature connection is highly valued, with 95% of respondents reporting an improvement in their wellbeing after spending time in natural environments. Despite this, built environments may offer limited opportunities to experience nature, which can result in interiors that feel more artificial and less connected to the natural world (Aristizabal et al., 2021). Globally, people in developed nations now spend over 90% of their time indoors, highlighting the importance of integrating nature into built environments (Kellert & Heerwagen, 2008). In New Zealand, more than 86% of the population resides in urban areas (Stats NZ, 2023), further limiting encounters with natural settings and their restorative benefits (Browning et al., 2014).

The consequences of ecological disconnection for human health are substantial. Urban residents, compared with rural populations, exhibit poorer lung function and a higher prevalence of major depressive and anxiety disorders (Zijlema et al., 2015). A pilot study further revealed that individuals exposed to highly built environments experienced elevated salivary cortisol and amylase levels - biological markers of stress - compared to those in natural settings (Beil & Hanes, 2013). Meta-analyses indicate that built environments, particularly dense urban areas lacking natural elements, can exacerbate stress, anxiety and depression (Yao et al., 2021). For Māori, these impacts are especially profound, as hauora (health) is grounded in reciprocal and spiritual relationships with whenua, wai and rangi (land, water and sky) (Tassell-Matamua et al., 2020; Lindsay-Latimer et al., 2024). These challenges underscore the need to rethink architectural practice. Biophilic design offers a potential pathway forward: evidence demonstrates that integrating natural light, vegetation, fractal patterns and natural materials can reduce stress, enhance immune function, restore attention and improve mood (Browning et al., 2014). This research explores the possibility that in New Zealand, aligning biophilic strategies with local ecologies and mātauranga Māori could help address ecological disconnection while supporting cultural integrity and holistic wellbeing.

1.2 The Critical Issue of Māori Health Inequities

Achieving holistic wellbeing for Māori requires approaches beyond biophilic design alone. Contemporary healthcare architecture in New Zealand is largely shaped by Western biomedical models that prioritise clinical efficiency but often overlook the emotional, spiritual, familial and cultural dimensions of health essential to Māori wellbeing (Masters-Awa-

tere et al., 2020). Healthcare environments may be experienced as culturally unsafe and exclusionary, lacking the symbolism and spatial qualities that affirm Māori identity and mātauranga Māori (Espiner et al., 2021). Such environments reinforce a system associated with persistent inequities, including higher avoidable mortality, reduced life expectancy and systemic barriers to care for Māori (Ellison-Loschmann & Pearce, 2006; Rumball-Smith et al., 2013; Walsh & Grey, 2019; Ministry of Health, 2024).

These disparities are rooted in colonial structures embedded within the health system, which have persistently failed to uphold the obligations of Te Tiriti o Waitangi (Waitangi Tribunal, 2019; Cormack et al., 2018). Te Tiriti o Waitangi is New Zealand's founding document and provides the basis for the principles of partnership, protection and participation between Māori and the Crown. While frameworks such as Te Whare Tapa Whā and the Te Aranga Māori Design Principles offer holistic, tikanga-based approaches to health and spatial design, their integration into mainstream practice remains limited, leaving environments that continue to reflect dominant Pākehā values rather than Māori worldviews (Wilson et al., 2021). Addressing this gap requires reimagining healthcare architecture as a culturally responsive model of care.

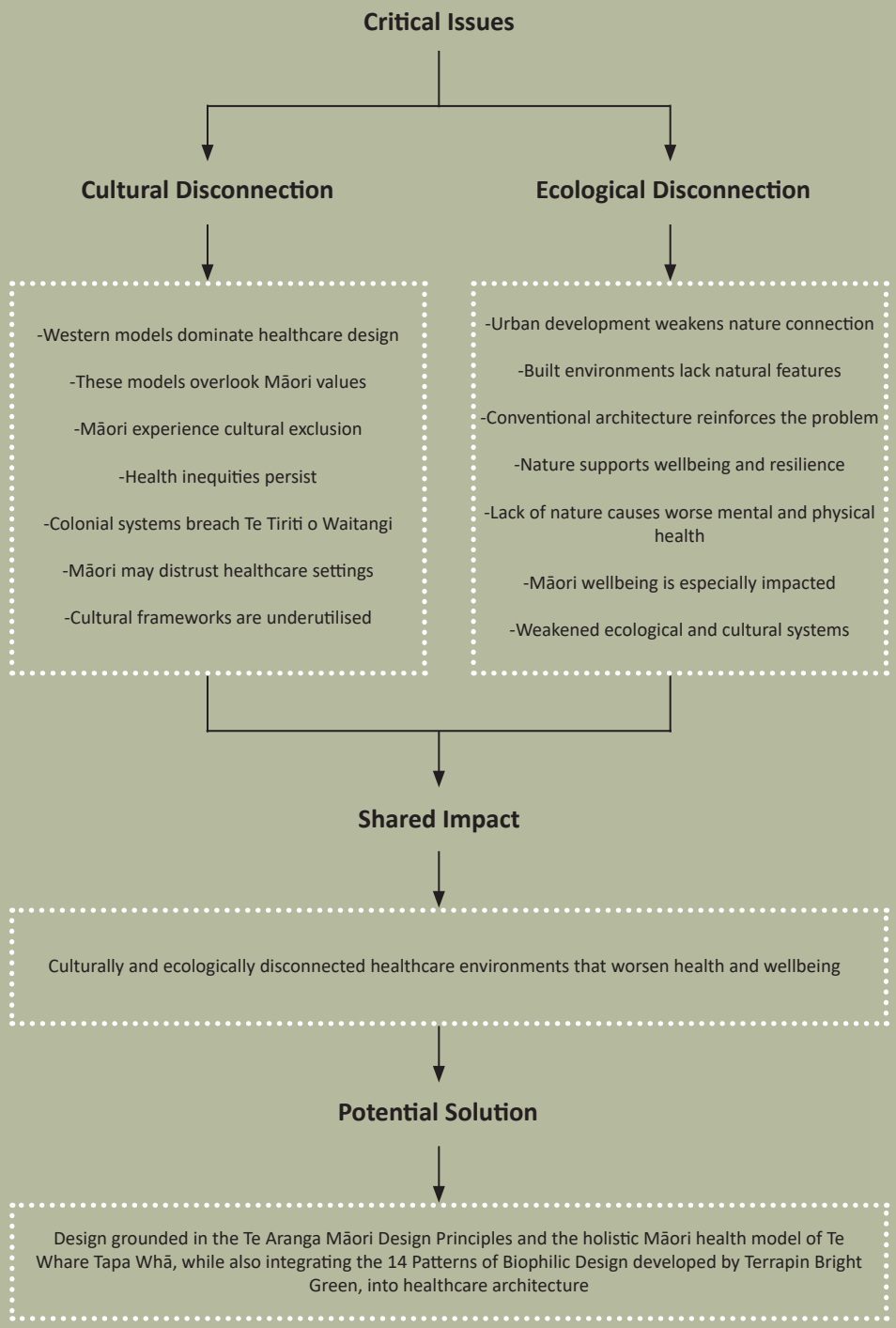


Figure 1. Critical Issues Diagram

1.3 RESEARCH QUESTION:

How can biophilic design and Māori cultural frameworks inform the design of a holistic healthcare centre in Takapuna to enhance community wellbeing?

1.4 AIMS AND OBJECTIVES

Aim

This thesis aims to investigate how culturally informed biophilic design can be applied within the New Zealand context to guide the creation of a community-based healthcare space intended to support holistic health and wellbeing. The research seeks to bridge the disconnection between people, culture and the natural environment by integrating Indigenous design knowledge and biophilic design theory into architectural practice.

Objectives

1. Critically examine the disconnection between contemporary healthcare architecture and holistic wellbeing in New Zealand, with a focus on cultural and ecological dimensions.

2. Explore the theoretical foundations of biophilic design and Indigenous knowledge systems, particularly the Te Aranga Māori Design principles and Te Whare Tapa Whā, in relation to architecture and health.

3. Analyse local precedents and international case studies to identify successful strategies for embedding biophilic and culturally informed principles in community health environments.

4. Investigate the ecological and cultural characteristics of a specific site to test a place-responsive design approach.

5. Apply a design-led research methodology to develop a conceptual architectural proposal for a community-based holistic health centre.

6. Reflect on the challenges, limitations and future opportunities for implementing culturally and ecologically informed biophilic design within New Zealand's healthcare infrastructure.



1.5 SIGNIFICANCE OF THE STUDY

This research is significant because it addresses a gap in knowledge by integrating biophilic design with mātauranga Māori to begin to address environmental and cultural disconnection in the built environment. It has the potential to reshape academic discourse by promoting culturally informed and ecologically literate models of design research. It also supports decolonial methodologies by investigating how Māori frameworks might provide a new lens on biophilic design.

Practically, the research offers strategies to begin to transform healthcare environments into restorative and culturally safe spaces, encouraging design processes that better meet the needs of New Zealand communities.

Societally and culturally, the study explores the ways in which sterile, disconnected healthcare environments - particularly those serving Indigenous and marginalised populations - may be challenged, and considers how design might support relational wellbeing through the affirmation of cultural identity, kaitiakitanga and interconnectedness.

Locally, the research explores ways in which Māori worldviews might be integrated into architecture, potentially contributing to efforts to address the ongoing effects of colonisation and the marginalisation of Māori values in the built environment (Awatere et al., 2008; Walker et al., 2019; Kiddle et al., 2022).

Ultimately, the research begins to lay the groundwork for future empirical studies on the effects of place-based biophilic design on physical, mental, spiritual and social wellbeing.

1.6 SCOPE AND LIMITATIONS

The primary focus is on biophilic design, Māori worldviews and design principles, considered through the concept of a holistic healthcare centre. The project strikes a balance between practical architectural thinking and speculative exploration. Ultimately, the aim is to provoke critical discussion about how architecture can meaningfully integrate ecological and cultural knowledge. While the project draws on Māori concepts and established frameworks, it remains culturally informed rather than culturally grounded, as direct engagement with mana whenua and place-specific knowledge was beyond the scope of this research. Finally, this research accepts that culturally informed biophilic healthcare architecture is not a comprehensive solution for mental or physical health challenges. Rather, it is understood as one supportive intervention among many, recognising that the complexity of these issues requires a broader multidisciplinary approach beyond the scope of architecture alone.

THESIS STRUCTURE

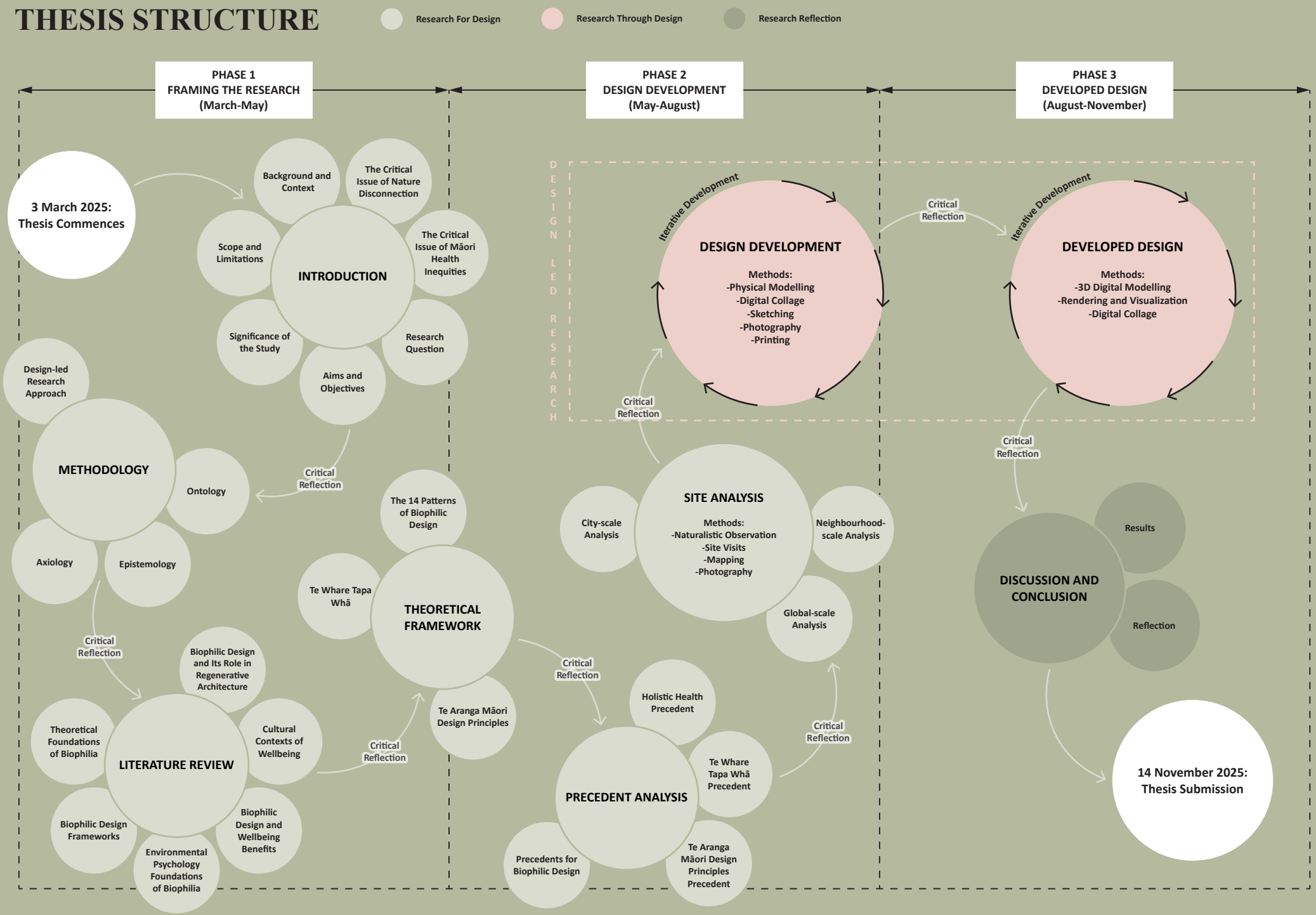


Figure 2. Thesis Organisation

CHAPTER 2: METHODOLOGY

FROM BELIEF TO METHOD

The diagram illustrates the layered philosophical and methodological structure of the design-led inquiry. Each concentric ring builds from ontological assumptions about the built environment as a complex adaptive system, through epistemological and axiological values, to specific design-based methods of enquiry.

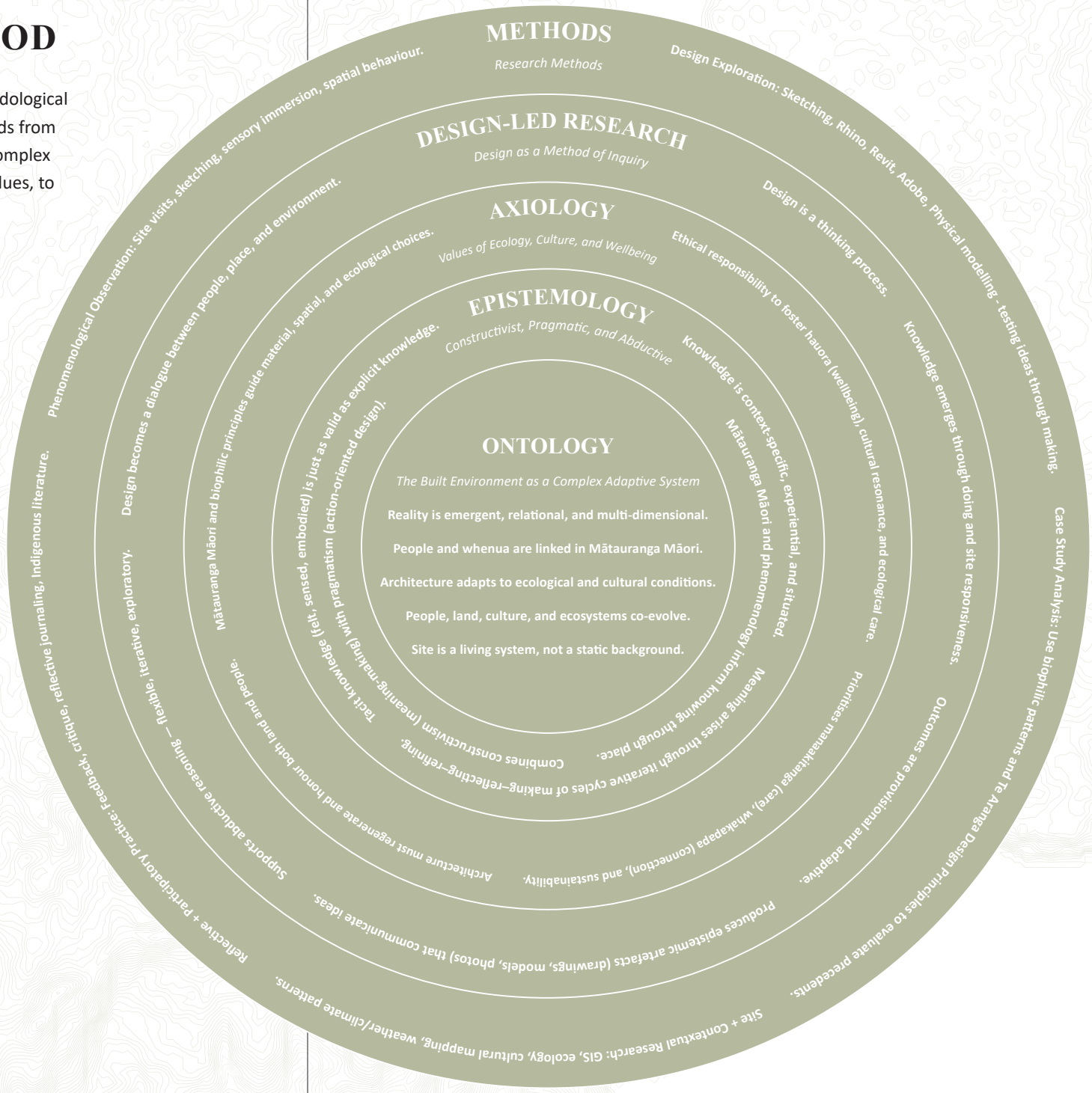


Figure 3. Research Paradigm and Methodology

2.0 Ontology: The Built Environment as a Complex Adaptive System

Ontology in this thesis is grounded in the understanding of the built environment as a complex adaptive system, wherein social, cultural, environmental and spatial elements continuously interact and co-evolve (Holland, 1995; Capra, 1996). This perspective acknowledges that architectural spaces are not fixed objects but dynamic assemblages shaped by both human and non-human agents, including natural ecosystems and cultural practices (DeLanda, 2006; Ingold, 2000). Within the context of biophilic design in New Zealand, ontology encompasses the recognition that the environment, people and cultural values, particularly Māori worldviews, are deeply interconnected and inseparable (Marsden, 2003; Mead, 2003). The thesis assumes that reality is multi-dimensional, where physical materials, ecological processes, and Indigenous knowledge systems coexist and are understood as informing one another in the shaping of places that may foster wellbeing (Durie, 2001; Kellert et al., 2008). This ontological stance enables a holistic examination of architecture as an emergent process rather than a static outcome (Till, 2009). It adapts in response to local conditions, relationships and values.

2.1 Epistemology: Abduction, Tacit Knowledge, and Iteration

This thesis adopts a constructivist and pragmatic epistemological stance, recognising that knowledge of place, wellbeing and design - particularly within biophilic and Indigenous frameworks such as mātauranga Māori - is culturally situated, emergent from lived experience and inextricably linked to the local environment (Lincoln & Guba, 1985; Durie, 2001; Crotty, 1998). Knowledge generation follows an abductive reasoning process, wherein iterative cycles of designing, reflecting, theorising and refining facilitate the emergence of understanding from both tacit, embodied experience and explicit, formalised representations such as annotated drawings, diagrams and models (Lawson, 2004; Polanyi, 1966; Schön, 1983). Tacit knowledge, inherently subjective and context-dependent, is revealed through spatial practice, while iterative processes of observation, modelling and communication translate this implicit understanding into communicable and actionable forms. Epistemic tools such as sketching, iterative modelling and photography support reflective practice and enable the integration of cultural and ecological knowledge into practical architectural interventions (Fraser, 2021; Thomsen & Honour, 2022). This dual constructivist-pragmatic stance thus balances culturally and ecologically grounded meaning-making with context-sensitive, actionable design outcomes.

2.2 Axiology: Values-Driven Design

This research is fundamentally axiological, grounding its inquiry in the values of ecological stewardship, cultural integrity and holistic wellbeing (Hart, 1971). Rather than focusing solely on technical or aesthetic aspects of architectural design, the study prioritises what is considered meaningful and worthwhile within both the natural environment and the cultural landscape of New Zealand. This axiological stance informs the integration of biophilic design principles by emphasising an ethical responsibility to promote wellbeing and nurture a deep connection to place, particularly through the recognition of mātauranga Māori and Indigenous perspectives (Marsden, 2003; Mead, 2003; Kellert et al., 2008).

In practical terms, these values guide spatial and material decisions throughout the design. For example, planting strategies prioritise native vegetation to support biodiversity corridors and sensory engagement - an approach grounded in both Indigenous ecological knowledge (Berkes, 2012) and biophilic urbanism (Beatley, 2011). Interior spaces are arranged to facilitate communal gathering, restoration and connection to the mauri of the land. References to whakapapa and manaakitanga - expressed through the architecture's spatial, material, ecological and social dimensions - foster cultural resonance and enhance wellbeing (Paul, 2016; Temby-Spence, 2024). By centring these values, the research advocates for design approaches that promote regeneration, cultural respect and human flourishing (Paul, 2016; Mang & Reed, 2012; Till, 2009). In this way, axiology shapes not only the research aims but also the evaluation of design success. Outcomes are prioritised that aim to support both community wellbeing and ecological resilience, with success understood not solely through efficiency or novelty, but through the project's capacity to contribute to restoring relationships between people and whenua (Marsden, 2003).

2.3 Design-led Research Approach

This research adopts a design-led research approach, where design is positioned not merely as a product but as a central method of inquiry. Within this framework, design serves as a primary mode for generating knowledge by engaging with complex, situated problems through iterative cycles of making, reflection and theorisation (Fraser, 2021; Downton, 2003). It is particularly well-suited to addressing wicked problems that are context-dependent, open-ended and socially contested, such as the intersections of health, cultural disconnection and ecological degradation in the built environment explored in this research (Rittel & Webber, 1973; Jonas, 2007). Through this approach, design becomes a critical and reflective process. It enables exploration of multiple possibilities, testing of spatial ideas and articulation of embedded values. This research not only draws upon existing theory but also contributes to it through spatial propositions, drawings, models and site-responsive interventions, which serve as epistemic artefacts - tools that generate and communicate knowledge (Bovelet, 2010; Thomsen & Honour, 2022). Anchored in constructivist and pragmatic paradigms, this approach supports both subjective meaning-making and context-specific outcomes, revealing design not just as a method but as a vital dialogue between people, place and meaning.

2.4 Research Process and Methods

This design-led research utilises iterative processes and methods to develop the architectural design. Design thinking is operationalised through sketching, physical modelling and digital modelling to explore spatial concepts informed by biophilic and cultural principles. Local and international precedents are analysed with reference to the 14 Patterns of Biophilic Design (Browning et al., 2014), Te Whare Tapa Whā (Durie, 1985) and the Te Aranga Māori Design Principles (Paul, 2017) to identify strategies that integrate health, culture and ecological responsiveness. The site is examined through GIS mapping, ecological analysis, cultural research and diagramming, facilitating the identification of meaningful spatial values and design opportunities. Design development is supported through critiques and supervisory feedback, documented via annotations, diagrams and reflective writing consistent with Schön's (1983) reflection-in-action. Finally, naturalistic and phenomenological observation, including on-site study and photography, captures both spatial behaviours and embodied experiences, informing architectural strategies that are contextually grounded, human-centred and responsive to the site's unique characteristics.



CHAPTER 3: LITERATURE REVIEW

LITERATURE REVIEW

Introduction

This literature review examines the theoretical foundations, design frameworks and well-being implications of biophilia to inform its integration into architectural practice. It traces the historical, psychological and biological origins of biophilia, including the evolutionary and cognitive mechanisms underpinning human responses to nature, drawing on key concepts from environmental psychology such as Attention Restoration Theory (Kaplan & Kaplan, 1989), Stress Reduction Theory (Ulrich, 1983), the Savanna Hypothesis (Orians, 1980) and Prospect-Refuge Theory (Appleton, 1975). The review also explores biophilic design frameworks for practical implementation, including Kellert's six elements and seventy attributes (Kellert, 2008), Kellert and Calabrese's experience-based model (Kellert & Calabrese, 2015) and Terrapin Bright Green's 14 Patterns (Browning et al., 2014), alongside evidence of physiological, psychological, social and behavioural benefits. Cultural perspectives, particularly Māori health models such as Te Whare Tapa Whā (Durie, 1985), rongoā Māori and Māori conceptualisations of nature are considered to highlight opportunities for culturally informed and regenerative design (Mead, 2003). Collectively, the literature review provides the beginnings of a theoretical, empirical and cultural foundation for integrating biophilic principles into architectural practice in New Zealand.

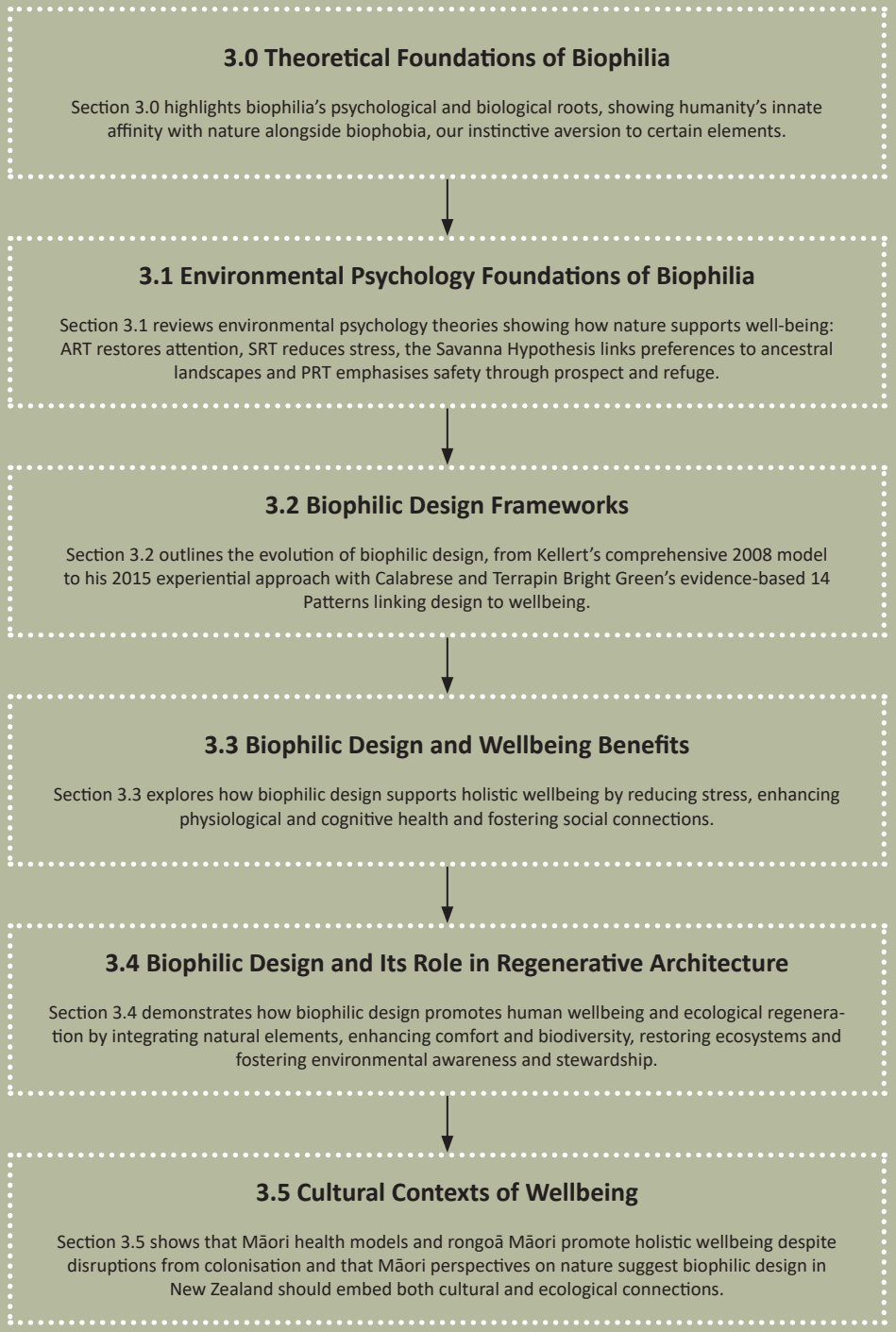


Figure 4. Literature Review Structure

3.0 Theoretical Foundations of Biophilia

Psychological Origins of Biophilia

The concept of biophilia was first formally introduced by psychoanalyst and humanist philosopher Erich Fromm in The Heart of Man (1964) and later elaborated in his subsequent works (Fromm, 1973, 1994). Fromm defined biophilia as "the passionate love of life and of all that is alive," manifesting as the "wish to further growth, whether in a person, a plant, an idea or a social group" (Fromm, 1964, 1973, p. 406) and encompassing "love for humanity and nature" (Fromm, 1994, p. 101). Beyond a simple affection for living things, Fromm framed biophilia as a fundamental moral and psychological orientation, grounded in the human capacity for growth, creativity and relational connection. He contrasted this life-affirming disposition with necrophilia - an attraction to death, destructiveness and control - which emerges when social and environmental conditions fail to support human flourishing (Fromm, 1964, 1973; Gunderson, 2014; Barbiero & Berto, 2021).

Fromm emphasised the ontogenetic and innate nature of biophilia, describing it as a "primary potentiality" intrinsic to human biology (Fromm, 1964, p. 51; 1973, p. 407). However, this potentiality unfolds only under conditions that meet fundamental human needs: security, justice and freedom (Fromm, 1964, p. 52). Physical and mental security - including access to shelter and economic resources - is essential, as deprivation can foster necrophilic tendencies (Gunderson, 2014). Similarly, justice and the ability to act freely within a socially structured context enable the cultivation of biophilic capacities. When these preconditions are met, individuals can develop four active elements of biophilia: care, responsibility, respect and knowledge (Fromm, 1956). While Fromm initially applied these elements primarily to human relationships, care was explicitly extended to nature, highlighting the ethical dimension of human-environment interactions.

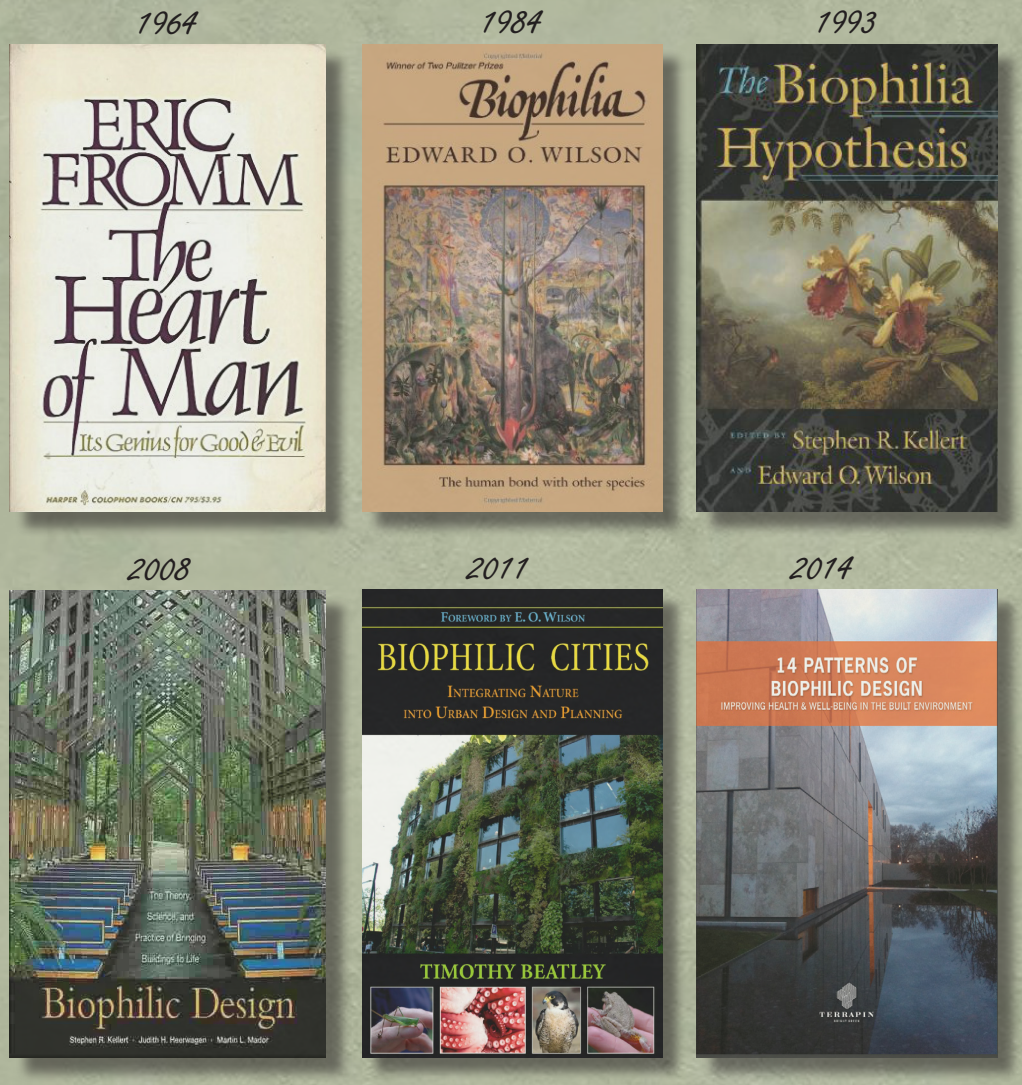
Gunderson (2014) extended Fromm's framework to natural systems, proposing that biophilia in relation to nature involves: (1) active concern for the growth and prosperity of the natural world, (2) the ability to respond to and satisfy the needs of nature, (3) respect for the autonomy and integrity of natural systems and (4) knowledge of nature without seeking to dominate it. Fromm's psychological and ethical framing thus provides a foundation for understanding human connection with the living world, highlighting how environmental and social design can either enable or inhibit biophilic potential. This perspective is particularly relevant in Aotearoa, where standardised healthcare environments often overlook the relational and spiritual dimensions central to Māori wellbeing, potentially suppressing biophilic experiences and contributing to feelings of alienation or lifelessness (Tipene-Leach et al., 2024; Fromm, 1964; Gunderson, 2014; Barbiero & Berto, 2021).

Biological and Evolutionary Basis of Biophilia

Building on Fromm's moral and psychological framing of biophilia as a developmental need for connection (Fromm, 1964), Edward O. Wilson reframed it as a biologically and evolutionarily grounded tendency (Wilson, 1984; Kellert & Wilson, 1993). In Biophilia (1984), Wilson defined this as "the innate tendency to focus on life and lifelike processes." This concept draws on the idea that over evolutionary time, human dependence on natural cues such as water, vegetation providing shelter and animals for survival, safety and sustenance shaped adaptive preferences for particular landscapes and living forms (Orians, 1980; Ulrich, 1984; Kaplan & Kaplan, 1989). These predispositions help explain the positive responses humans have to natural environments, often articulated through the concepts of fascination - the effortless attention elicited by natural stimuli (Kaplan & Kaplan, 1989) - and affiliation - the emotional and evolutionary connection with other living beings (Kellert & Wilson, 1993; Barbiero & Berto, 2021).

Together with Stephen Kellert, Wilson later expanded this view in The Biophilia Hypothesis (1993), arguing that humanity's affinity with nature is biologically rooted yet expressed and shaped through culture, upbringing and experience - a "weak learning rule" that depends on environmental and social context for its realisation (Wilson, 1984). This perspective complements Fromm's developmental framing (Fromm, 1964), as both highlight the interaction between inherent tendencies and the conditions necessary for their expression. In this way, the evolution of biophilia theory traces a continuum from psychological orientation to biological predisposition, highlighting a shared understanding of human identity as inherently connected to the living world - a foundation for re-establishing meaningful human-nature relationships through design.

However, Wilson and Kellert's framing of biophilia has been subject to critical scrutiny. Joye and De Block (2011) argue that the biophilia hypothesis offers limited utility for environmental ethics due to conceptual ambiguity, conflicting interpretations and unclear evolutionary reasoning. They suggest that evolutionary claims may overstate the innate origins of human affinity for life and lifelike processes, neglecting empirical and theoretical perspectives that propose alternative explanations. Although humans derive meaning, enjoyment and health benefits from interactions with nature, these responses cannot be reliably attributed solely to evolved predispositions (Joye & De Block, 2011). This perspective underscores the importance of integrating cultural, social and psychological dimensions alongside biological predispositions when designing environments that promote human wellbeing. It also emphasises the need to consider not only our supposed innate affinity for life but also the complementary aversions that shape human responses to natural environments.



31 **Figure 5.** Influential Texts - Biophilia and Biophilic Design

Biophobia

Human-nature interactions are shaped by both biophilia and its counterpart, biophobia - the instinctive aversion to certain natural elements such as snakes, spiders, darkness or heights (Wilson, 1984; Ulrich, 1993; Kellert, 1993, 1997, 2005; Öhman & Mineka, 2001). Biophobia functions as an adaptive mechanism that protects against potentially threatening stimuli (Öhman & Mineka, 2001). Biophilia and biophobia are intertwined, balancing attraction to life-supporting features with caution towards hazards (Wilson, 1984; Kellert & Wilson, 1993). From an architectural perspective, recognising this interplay is essential: overly dense vegetation, shadowy spaces or dark enclosed corridors can trigger biophobic responses (Patuano, 2020) whereas thoughtfully integrated natural elements can foster engagement, reduce stress and enhance cognitive functioning (Ulrich, 1993; Hartig et al., 2014; Kellert, 2005). Consequently, design decisions must consider both biophilic and biophobic responses to create environments that genuinely support human wellbeing.

Despite growing attention to cultural influences, much of the literature on biophobia remains grounded in Western perspectives and often overlooks the role of Indigenous knowledge in shaping human-nature relationships (Patuano, 2020; Tekin et al., 2025). In Te Ao Māori (the Māori worldview), for instance, rats, insects and reptiles are not inherently feared or viewed as “biophobic,” as Western interpretations might suggest (Stewart, 2023). Instead, they are understood relationally - regarded as kin through whakapapa (genealogy) and connected to atua (gods or spiritual beings) (Stewart, 2023; Woodhouse et al., 2021; Royal, 2007). Kiore (Polynesian rats) hold nutritional, cultural and symbolic significance, appearing in carvings, waiata (songs), haka (ceremonial dances) and whakataukī (proverbs) (Stewart, 2023; Haami, 1993). Ngārara (reptiles and insects), such as tuatara and geckos, may be seen as ill omens in certain contexts, yet they can also act as kaitiaki (guardians), protecting sacred sites and invoking the protection of the gods (Haami, 2007a; Stewart, 2023). The aitanga pepeke (insect world) embodies the Māori concept of whakapapa, linking all living beings to the primordial gods and featuring in cosmological stories such as that of Rātā (Haami, 2007b; Stewart, 2023). These examples show that Māori responses to species often deemed threatening are deeply relational and culturally meaningful, emphasising the importance of understanding human-nature connections through culturally informed perspectives and design.

3.1 Environmental Psychology Foundations of Biophilia

Attention Restoration Theory (ART)

Stephen and Rachel Kaplan's (1989) Attention Restoration Theory (ART) explains how exposure to natural environments restores cognitive resources depleted by sustained mental effort. ART proposes that natural settings replenish directed attention - the focused, effortful form of attention required for complex tasks - by engaging the mind through soft fascination: a gentle, involuntary attention elicited by stimuli such as flowing water, rustling leaves or drifting clouds. Figure 6, Dali Fengyasong Hotel by Jing-Rui Lin (Usual Studio), demonstrates conditions that promote soft fascination through a walkway with water overhead, which reflects and refracts light, creating dynamic patterns that gently engage attention. Unlike urban environments that overwhelm cognitive capacities, natural settings promote effortless engagement supporting recovery from mental fatigue. ART has helped shape biophilic design, particularly in Terrapin Bright Green's framework (Browning et al., 2014) where the pattern of Non-Rhythmic Sensory Stimuli translates ART principles into spatial strategies fostering moments of soft fascination.

However, ART faces critique for conceptual ambiguity and limited empirical validation. Key constructs such as soft fascination remain loosely defined and insufficiently operationalised for experimental testing, and studies have yielded mixed results regarding the mechanisms underlying attention restoration (Joye & Dewitte, 2018; Ohly et al., 2016). Despite these limitations, ART continues to offer valuable insights into how natural environments support cognitive restoration and psychological wellbeing.



Figure 6. Dali Fengyasong Hotel / Jing-Rui Lin (Usual Studio) / 2024

Stress Reduction Theory (SRT)

Stress Reduction Theory (SRT) focuses on affective and physiological responses to natural environments. Developed by Roger Ulrich (1983), SRT proposes that connection with nature, such as viewing trees, water or natural landscapes, can rapidly reduce stress responses including heart rate, blood pressure and muscle tension. From an evolutionary perspective, humans possess an inherent positive response to nature, as such environments historically signified safety and resource availability, aligning with Wilson's biophilia hypothesis (1984). Ulrich's seminal 1984 study demonstrated that hospital patients with window views of trees recovered faster, required less pain medication and experienced fewer complications than patients viewing a brick wall. These findings contributed to the development of the Visual Connection with Nature pattern within Terrapin Bright Green's framework (Browning et al., 2014) and underpin biophilic healthcare design. Figure 7, the Xingcheng Exhibition Gardens by Archermit, exemplifies this principle by providing uninterrupted views over a garden landscape and water feature.

However, SRT has been critiqued for its narrow focus on visual stimuli, overlooking multisensory factors such as sound, scent and temperature (Franco et al., 2017; Gillis & Gatersleben, 2015), and some benefits may reflect the absence of urban stressors rather than inherent restorative properties (Bowler et al., 2010). Moreover, SRT is challenged by evidence that restorative experiences can occur in non-natural settings, such as museums and cultural heritage sites (Wang et al., 2023). This suggests that cultural and symbolic dimensions of place also contribute to human wellbeing, reinforcing the relevance of incorporating Te Aranga Māori design principles alongside biophilic strategies in this research.



Figure 7. Xingcheng Exhibition Garden / Archermit / 2024

The Savanna Hypothesis

Building on evolutionary theory, the Savanna Hypothesis, proposed by Gordon Orians in the 1980s, suggests that humans possess an innate preference for landscapes resembling the African savanna, characterised by open spaces interspersed with scattered trees, water sources and varied topography (Orians & Heerwagen, 1992). This preference is thought to stem from environments in which early hominins evolved, where such landscapes provided essential resources including food, shelter and visibility for spotting predators or prey (Orians & Heerwagen, 1992). Savanna-like settings are proposed to evoke feelings of safety, comfort and aesthetic pleasure because they historically increased chances of survival (Wilson, 1984). In biophilic design, the hypothesis informs the incorporation of open spaces with tree clusters, water features and gentle elevation changes to evoke these deep-seated preferences, fostering environments that feel inviting and secure (Söderlund, 2019; Zhong et al., 2022).
An architectural example of this application is Figure 8, the ShineMaker residential building by CLB Architects, which demonstrates views out to a landscape reflecting Savanna Hypothesis principles, with open spaces interspersed with scattered trees and varied topography.

Despite its prominence, the hypothesis has faced critique: early hominins often inhabited wooded or mosaic environments (Domínguez-Rodrigo, 2014), humans show preferences for diverse landscapes beyond savannas (Kahn, 1997) and definitions of “savanna” vary across studies. Extensions such as the Savanna-IQ Interaction Hypothesis have also been criticised for oversimplifying evolutionary pressures (Dutton, 2013). Collectively, these critiques highlight the need for more nuanced, context-sensitive models of human evolutionary landscape preferences.



Figure 8. ShineMaker / CLB Architects / 2021

Prospect-Refuge Theory

Jay Appleton's Prospect-Refuge Theory (1975) draws on evolutionary reasoning to explain human environmental preferences, proposing that humans are innately drawn to spaces balancing prospect - open areas with clear, unobstructed views - and refuge - sheltered spots offering concealment and safety. This preference reflects ancestral survival needs, where vantage points allowed early humans to detect threats or resources while refuges provided protection from predators and environmental hazards. The interplay of prospect and refuge creates environments that feel safe and comfortable, supporting psychological well-being. Prospect-Refuge Theory has influenced biophilic design, informing the Prospect and Refuge patterns in Terrapin Bright Green's framework (Browning et al., 2014) and guiding the creation of spaces that balance openness and shelter. Figure 9, The Stone Pavilions (DODESIGN), illustrates these principles by combining an elevated vantage point with the protective enclosure of the building's substantial walls. This approach can be seen in seating areas with landscape views partially enclosed by architectural elements.

However, empirical support is inconsistent and methodologically varied. Studies testing PRT differ in design, measurement tools and sample populations, raising concerns about reliability and comparability (Dosen & Ostwald, 2013). Meta-analysis further shows that while evidence generally supports the appeal of prospect, findings for refuge are mixed and vary between natural, urban and interior environments (Dosen & Ostwald, 2016; Dosen, 2016). These limitations highlight the need for context-sensitive research to clarify when and how PRT principles effectively inform design.

Integrating Environmental Psychology Theories

Taken together, these four frameworks illustrate the diverse theoretical foundations of environmental psychology that inform biophilic design. This is reflected in Figure 10, which depicts the underlying theories. While they highlight the restorative, affective and evolutionary dimensions of human-nature relationships (Ulrich, 1983; Kaplan & Kaplan, 1989; Orians & Heerwagen, 1992; Appleton, 1975), each theory also demonstrates conceptual ambiguities and mixed empirical support (Joye & Dewitte, 2018; Ohly et al., 2016; Dosen & Ostwald, 2013, 2016). ART and SRT provide influential but partial accounts of restoration, focusing on cognition and stress, while the Savanna Hypothesis and PRT offer broader evolutionary explanations that risk oversimplification (Dutton, 2013; Kahn, 1997). Despite these limitations, they provide a valuable conceptual foundation for this research, where biophilic design is applied critically to develop spatial strategies that connect people with nature.



Figure 9. The Stone Pavilions / DODESIGN / 2024



Figure 10. Theoretical Origins of Biophilic Design

3.2 Biophilic Design Frameworks

The Emergence of Biophilic Design

While Wilson's Biophilia Hypothesis (1984) established the concept of human's innate affinity for nature, it remained primarily a biological and psychological proposition for over two decades (Wilson, 1984; Kellert & Wilson, 1993; Söderlund, 2019). Its application to architecture and design began with a 2006 gathering convened by Stephen Kellert in Rhode Island, shown in Figure 11 as one of the key milestones in the growth and development of biophilic design. This meeting brought together a diverse group of academics aiming to translate biophilic principles into practical design strategies (Barbiero, 2024; Söderlund, 2019; Söderlund & Newman, 2022). By synthesising insights from environmental psychology, neuroscience and evolutionary biology, Kellert and colleagues developed a structured design framework (Söderlund, 2019; Barbiero, 2024). From this collaboration emerged a set of design principles, culminating in the publication of Biophilic Design: The Theory, Science, and Practice of Bringing Buildings to Life (Kellert et al., 2008; Barbiero, 2024; Söderlund, 2019).

In this text, Kellert and Heerwagen (2008) defined biophilic design as "the expression of the inherent human need to affiliate with nature in the design of the built environment" (p. viii). This marked a deliberate shift: rather than treating nature in cities as incidental or purely aesthetic, it was positioned as a central component of urban and architectural environments (Barbiero, 2024; Söderlund, 2019). This helped formalise biophilic design as a discipline, providing architects, planners and designers with strategies to integrate natural elements, processes and experiences into built environments, from healthcare and educational facilities to workplaces and public spaces (Söderlund & Newman, 2015; Beatley, 2011).

Kellert's Foundational Model: Six Elements and Seventy Attributes

Kellert et al.'s (2008) foundational model of biophilic design is widely recognised as the first comprehensive framework for integrating nature into the built environment (Kellert et al., 2008; Wijesooriya et al., 2023; Patel et al., 2022; Zhong et al., 2022; Söderlund, 2019; Barbiero, 2024). Organised into six elements and seventy-two attributes (shown in Table 1), the framework provides a multidimensional approach to human-nature integration, guiding designers beyond superficial or purely aesthetic applications. Grounded in biology, psychology and evolutionary theory, the model is based on empirical evidence of human wellbeing (Ulrich, 1983; Kaplan & Kaplan, 1989). However, unlike the later Terrapin Bright

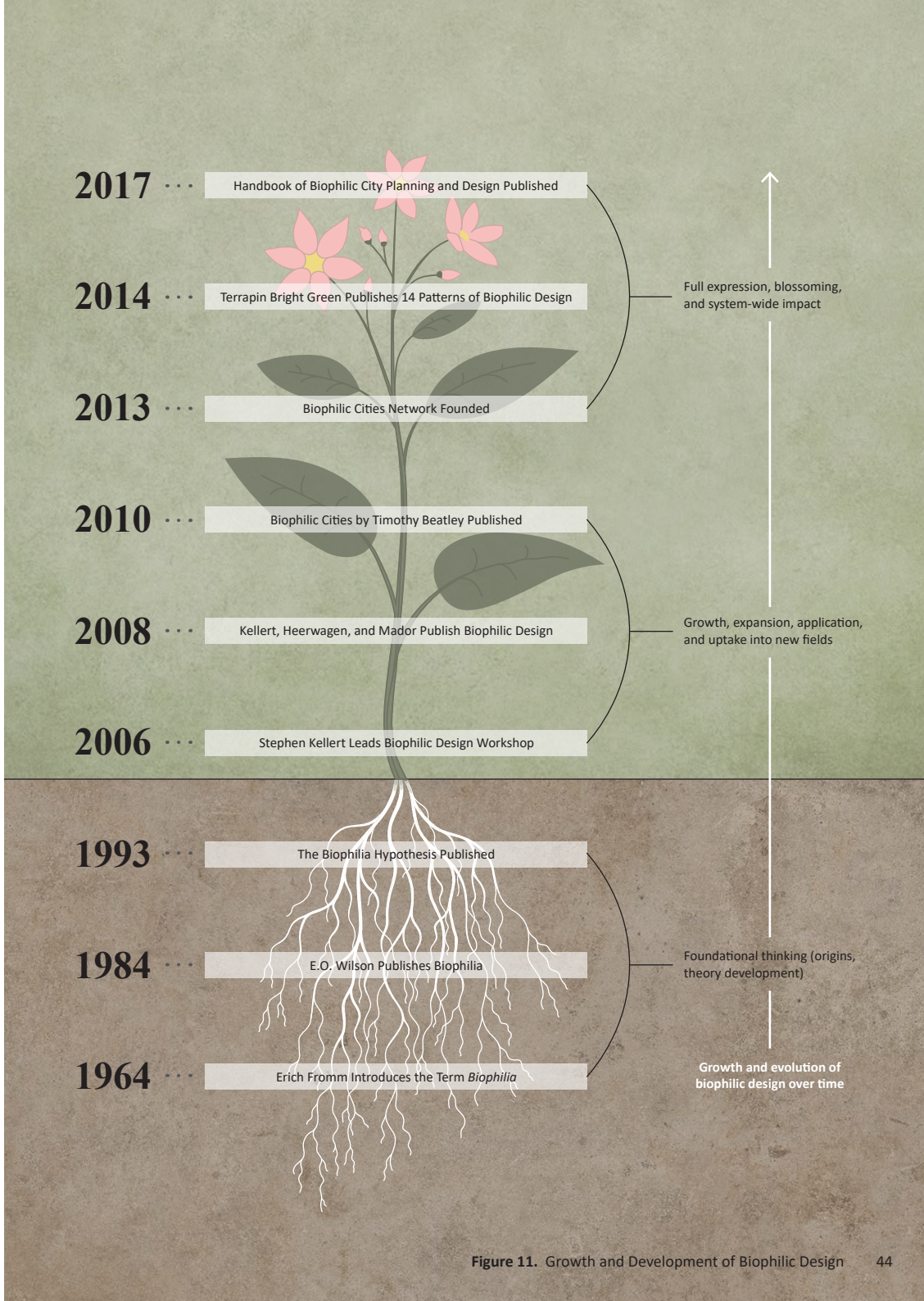


Figure 11. Growth and Development of Biophilic Design

Green 14 Patterns framework, it does not explicitly link each attribute to specific health or wellbeing outcomes (Browning et al., 2014). Attributes emphasising place-based relationships, cultural connections and Indigenous materials enhance cultural relevance, while elements such as natural materials, habitats and ecosystems align with regenerative design principles (Kellert et al., 2008). The 2008 taxonomy thus represents a landmark contribution, providing a foundation for subsequent research and practice (Barbiero, 2024; Söderlund, 2019; Zhong et al., 2022).

Despite its comprehensiveness, the model presents challenges for practical implementation. The extensive set of attributes, combined with overlapping concepts and the absence of a clear hierarchy among elements, can overwhelm designers and complicate prioritisation within specific project contexts (Zhong et al., 2022). Conceptually, although the framework recognises cultural and ecological connections to place, it remains predominantly grounded in a Western cultural perspective and adopts a largely universalist approach, implying that people experience nature in roughly the same way. Additionally, although the 2008 framework is foundational, subsequent research has refined and expanded its application, reflecting advances in empirical evidence supporting biophilic design (Kellert & Calabrese, 2015; Browning et al., 2014). In response to these limitations, Kellert later co-developed a streamlined, experience-based model that emphasises human interaction with nature and is more readily implementable in design practice (Kellert & Calabrese, 2015).

Kellert and Calabrese (2015): Experience-Based Integration

The Practice of Biophilic Design (Kellert & Calabrese, 2015) refines Kellert's earlier framework and represents a pivotal shift towards aligning biophilic theory with practical design application (Patel et al., 2022). Rather than simply cataloguing natural features, this model organises biophilic design into three experiential categories: Direct Experience of Nature, Indirect Experience of Nature and Experience of Space and Place (Kellert & Calabrese, 2015). Within these categories, twenty-four attributes are identified, as shown in Table 2 (Kellert & Calabrese, 2015). Central to this framework is an emphasis on integration, as the authors argue that the effectiveness of biophilic design lies not in the presence of isolated natural features but in their capacity to interact and generate restorative multisensory experiences (Kellert & Calabrese, 2015). As they explain, "multisensory encounters with nature in the built environment can greatly contribute to comfort, satisfaction, enjoyment and cognitive performance" (Kellert & Calabrese, 2015, pp. 10-11). This perspective shifts the focus from the mere inclusion of natural elements to their orchestration into coherent patterns that strengthen human-nature connections across sensory and spatial dimensions.

A key limitation of Kellert (2008) and Kellert and Calabrese (2015) is the lack of a clear definition of "nature." As Zhong et al. (2022) note, "Nature itself is a contested and ambiguous notion" (p. 134), affecting what is considered natural in design (Gaston & Soga, 2020, p. 2). Clear definitions help architects translate human perceptions of nature into practical strategies and allow comparison across studies (Patel et al., 2022). By contrast, Terrapin Bright Green's framework adopts a broad conception, defining nature as "living organisms and non-living components of an ecosystem - inclusive of everything from the sun and moon and seasonal arroyos, to managed forests and urban rain gardens, to Nemo's fish-bowl habitat" (Browning et al., 2014, p. 10). This expansive framing enhances conceptual clarity and offers designers more concrete guidance for embedding nature in architectural practice.

Terrapin Bright Green's 14 Patterns: Evidence-Based Practical Framework

Terrapin Bright Green's 14 Patterns of Biophilic Design provide a structured, evidence-based framework for translating biophilic principles into practical architectural strategies (Browning et al., 2014). The 14 patterns are organised into three overarching categories, as shown in Table 3. Nature in the Space focuses on the direct presence of natural elements such as plants, water and sunlight; Natural Analogues emphasise the use of natural materials, forms and patterns to evoke a sense of nature; and Nature of the Space addresses spatial configurations such as prospect and refuge. A key strength of this framework lies in its empirical grounding: each pattern is supported by studies demonstrating measurable improvements in physiological, psychological and cognitive outcomes, including stress reduction, enhanced mood and increased productivity (Browning et al., 2014; Ryan et al., 2014). This evidence-based approach distinguishes it from earlier biophilic design models, which were primarily conceptual and lacked direct links to measurable human health and wellbeing outcomes.

A key limitation of Terrapin Bright Green's 14 Patterns framework (Browning et al., 2014) is the absence of a pattern explicitly addressing culturally informed biophilic design. By contrast, other frameworks incorporate attributes such as "cultural connection to place" and "Indigenous materials" (Kellert, 2008) or "cultural and ecological attachment to place" (Kellert & Calabrese, 2015). Predominantly shaped by Western scientific paradigms and evidence hierarchies, the 14 Patterns tend to overlook relational, spiritual and genealogical dimensions of human-nature connection that are central to te ao Māori and many other Indigenous knowledge systems (Mead, 2016; Marsden, 2003). This lack of cultural specificity may limit the framework's relevance in contexts requiring engagement with Indigenous worldviews. Adaptation to local cultural contexts can address this gap. In New

Zealand, combining the 14 Patterns with approaches such as the Te Aranga Māori Design Principles (Paul, 2017) and Te Whare Tapa Whā (Durie, 1985) enriches biophilic design to support not only physical wellbeing but also cultural and spiritual flourishing.



TABLE 1 KELLERT'S BIOPHILIC DESIGN FRAMEWORK

In *Biophilic Design: The Theory, Science and Practice of Bringing Buildings to Life*, Kellert, (2008) proposed six biophilic design elements and 70 attributes.

ENVIRONMENTAL FEATURES

- Color
- Water
- Air
- Sunlight
- Plants
- Animals
- Natural materials
- Views and vistas
- Façade greening
- Geology and landscape
- Habitats and ecosystems
- Fire

NATURAL SHAPES AND FORMS

- Botanical motifs
- Tree and columnar supports
- Animal (mainly vertebrate) motifs
- Shells and spirals
- Egg, oval, and tubular forms
- Arches, vaults, domes
- Shapes resisting straight lines and right angles
- Simulation of natural features
- Biomorphy
- Geomorphology
- Biomimicry

NATURAL PATTERNS AND PROCESSES

- Sensory variability
- Information richness
- Age, change, and the patina of time
- Growth and efflorescence
- Central focal point
- Patterned wholes
- Bounded spaces
- Transitional spaces
- Linked series and chains
- Integration of parts to wholes
- Complementary contrasts
- Dynamic balance and tension
- Fractals
- Hierarchically organized ratios and scales

LIGHT AND SPACE

- Natural light
- Filtered and refused light
- Light and shadow
- Reflected light
- Light pools
- Warm light
- Light as shape and form
- Spaciousness
- Spatial variability
- Space as shape and form
- Spatial harmony
- Inside-outside spaces

PLACE-BASED RELATIONSHIPS

- Geographic connection to place
- Historic connection to place
- Ecological connection to place
- Cultural connection to place
- Indigenous materials
- Landscape orientation
- Landscape features that define buildings
- Landscape ecology
- Integration of culture and ecology
- Spirit of place
- Avoiding placelessness

EVOLVED HUMAN-NATURE RELATIONSHIPS

- Prospect and refuge
- Order and complexity
- Curiosity and enticement
- Change and metamorphosis
- Security and protection
- Mastery and control
- Affection and attachment
- Attraction and beauty
- Exploration and discovery
- Information and cognition
- Fear and awe
- Reverence and spirituality

TABLE 2 KELLERT AND CALABRESE'S BIOPHILIC DESIGN FRAMEWORK

In *The Practice of Biophilic Design*, Stephen R. Kellert and Elizabeth F. Calabrese (2015) introduce the Experiences and Attributes of Biophilic Design, organised into three categories and 24 distinct attributes.

DIRECT EXPERIENCE OF NATURE	INDIRECT EXPERIENCE OF NATURE	EXPERIENCE OF SPACE AND PLACE
• Light	• Images of nature	• Prospect and refuge
• Air	• Natural materials	• Organized complexity
• Water	• Natural colors	• Integration of parts to wholes
• Plants	• Simulating natural light and air	• Transitional spaces
• Animals	• Naturalistic shapes and forms	• Mobility and wayfinding
• Weather	• Evoking nature	• Cultural and ecological attachment to place
• Natural landscapes and ecosystems	• Information richness	
• Fire	• Age, change, and the patina of time	
	• Natural geometries	
	• Biomimicry	

TABLE 3 14 PATTERNS OF BIOPHILIC DESIGN BY TERRAPIN BRIGHT GREEN

The 14 *Patterns of Biophilic Design*, developed by Terrapin Bright Green in 2014, is a scientifically grounded framework that bridges biophilia research with practical applications in architecture and urban design (Browning, Ryan, & Clancy, 2014).

NATURE IN THE SPACE

1. Visual Connection with Nature
2. Non-Visual Connection with Nature
3. Non-Rhythmic Sensory Stimuli
4. Thermal and Airflow Variability
5. Presence of Water
6. Dynamic and Diffuse Light
7. Connection with Natural Systems

NATURAL ANALOGUES

8. Biomorphic Forms and Patterns
9. Material Connection with Nature
10. Complexity & Order

NATURE OF THE SPACE

11. Prospect
12. Refuge
13. Mystery
14. Risk/Peril

Table 4 Comparative Analysis of Biophilic Frameworks

ASPECT	KELLERT'S FOUNDATIONAL MODEL (2008)	KELLERT & CALABRESE'S EXPERIENCE-BASED MODEL (2015)	TERRAPIN BRIGHT GREEN'S 14 PATTERNS (2014)
Origin / Authors	Stephen Kellert	Stephen Kellert & Elizabeth Calabrese	Browning, Ryan, & Clancy (Terrapin Bright Green)
Structure	6 Elements with ~70 Attributes	3 Experiential Categories with 24 Attributes	3 Pattern Categories with 14 Patterns
Key Categories	1. Environmental Features 2. Natural Shapes and Forms 3. Natural Patterns and Processes 4. Light and Space 5. Place-Based Relationships 6. Evolved Human-Nature Relationships	1. Direct Experience of Nature 2. Indirect Experience of Nature 3. Experience of Space and Place	1. Nature in the Space 2. Natural Analogues 3. Nature of the Space
Focus / Emphasis	Conceptual breadth; categorising nature's diverse qualities in design	Multisensory human experience and place-based connection	Empirical validation and practical application in design
Purpose	Theoretical foundation for biophilic design	Bridge theory and application through experiential interaction	Provide evidence-based, ready-to-use patterns for practice
Sensory Integration	Includes sensory aspects but primarily visual	Strong emphasis on multisensory engagement (touch, sound, scent, temperature)	Incorporates sensory variation (e.g., airflow, thermal, light) in some patterns
Cultural & Symbolic Dimensions	Includes spirit of place, attachment, symbolic meaning	Deepened focus on place attachment, time, cultural meaning	Limited integration; mainly grounded in empirical science
Ease of Application	Complex and sometimes ambiguous; hard to operationalise	More streamlined and adaptable for practice	Highly accessible and practitioner-friendly
Strengths	- Rich conceptual and theoretical depth - Introduced full lexicon for biophilic design	- Grounded in lived experience - Holistic and adaptable - Multisensory and culturally resonant	- Empirically validated - Easy to implement - Widely adopted in industry
Limitations	- Overwhelming number of attributes - Difficult to prioritise - Ambiguous structure	- Less comprehensive than original taxonomy	- Less focus on cultural and spiritual dimensions - Risk of being applied superficially without deeper contextual layering
Use in Thesis Context	Foundational conceptual base; provides historical and theoretical context	The 'Cultural and Ecological Attachment to Place' attribute will be implemented in the design.	Operational toolkit; forms primary design evaluation framework, adapted to Aotearoa context
Relevance to Indigenous Knowledge	Implicit alignment; requires interpretation for use	Strong potential for integration with mātauranga Māori due to place and sensory focus	Lacks Indigenous grounding; needs supplementary layers (e.g., whakapapa, mauri, kaitiakitanga)
Theoretical Grounding	Evolutionary biology, environmental psychology	Evolutionary theory + phenomenology of experience	Environmental psychology, neuroscience

3.3 Biophilic Design and Wellbeing Benefits

Physiological Benefits

Biophilic design engages the human body at a fundamental level, triggering physiological responses that support overall health. Visual connections with nature, including plants, greenery and daylight, have been shown to reduce heart rate and systolic blood pressure, producing a measurable calming effect on the cardiovascular system (Brown et al., 2013; Xiaoxue & Huang, 2024; van den Berg et al., 2007; Tsunetsugu & Miyazaki, 2005). These effects extend to the autonomic nervous system, with reductions in sympathetic activity and modulation of stress hormones such as cortisol (Ulrich et al., 1991; Xiaoxue & Huang, 2024; Park et al., 2009). Beyond stress regulation, exposure to natural environments has been linked to enhanced immune function, with forest bathing studies demonstrating increased natural killer (NK) cell activity and reductions in inflammatory markers (Li et al., 2007; Li, 2010; Lew & Fleming, 2024). Moreover, exposure to plants and natural environments positively impacts energy metabolism, insulin secretion and hormones such as DHEA and adiponectin. These mechanisms contribute to a reduced risk of obesity, type 2 diabetes, hypertension and coronary heart disease (Bhasin et al., 2013; Astell-Burt et al., 2014; Bodicoat et al., 2014; Lachowycz & Jones, 2011; Thiering et al., 2016; Ohtsuka, 1998; Bjørnerem et al., 2004).

Biophilic design also supports health through multiple sensory and environmental pathways. Indoor plants and natural ventilation improve air quality, thereby supporting respiratory function and reducing physiological stress (Tavera-Ruiz et al., 2025; Talaie & Ponraj, 2024; López Plazas & Sáenz de Tejada, 2024). Exposure to greenery also lowers the prevalence of respiratory diseases and related mortality (Donovan et al., 2013; Maas et al., 2009; Richardson et al., 2010; Villeneuve et al., 2012). Non-visual interactions, such as auditory, olfactory and tactile experiences of nature, further enhance relaxation and physiological regulation (Jo et al., 2019; Kim et al., 2023; Lopes & Falk, 2024; Michels & Hamers, 2023). Natural light also plays a vital role by synchronising circadian rhythms, benefiting sleep quality, mood and overall physiological health (Blume et al., 2019; Burns et al., 2021; Wang et al., 2025; Gubin et al., 2024). Taken together, these findings suggest that biophilic design may provide a holistic and multi-sensory approach to promoting cardiovascular, autonomic, immune, metabolic, respiratory and circadian health, highlighting its potential as a preventive and restorative strategy for human wellbeing in the context of this research.

Psychological and Emotional Benefits

In addition to physiological effects, biophilic design promotes psychological and emotional wellbeing by fostering restorative experiences that reduce stress, enhance mood and improve cognitive functioning (Barton & Pretty, 2010; Raanaas et al., 2012; Paredes-Céspedes et al., 2024). Both direct experiences with nature and indirect exposure through images or videos have been found to produce restorative effects (Hartig et al., 2003; Kahn et al., 2008; Leather et al., 1998; Mostajeran et al., 2021; Grahn & Stigsdotter, 2010). Research suggests humans tend to prefer real natural environments over urban settings because these environments provide greater psychological restoration (Hartig, 1993; Kaplan & Kaplan, 1989; Knopf, 1987; van den Berg et al., 2003). Attention Restoration Theory provides a theoretical framework for these effects (Kaplan & Kaplan, 1989; Hartig et al., 1991). Not all natural environments provide the same level of restorative benefits. Fuller et al. (2007) demonstrate that exposure to biodiverse areas, rather than simply larger green spaces, provides greater mental health benefits. Additionally, access to nature can enhance perceived control over one's environment, which is linked to lower stress levels and higher life satisfaction (Kaplan, 1995; Ulrich, 1984).

Specific environmental qualities further amplify psychological restoration. Elements of complexity and mystery, such as partially obscured views or intricate natural patterns, stimulate fascination and engagement, enhancing pleasure responses (Biederman, 2011; Herzog & Bryce, 2007; Salimpoor et al., 2011; Szolosi et al., 2014). Similarly, experiences of manageable risk, for example walking on overhanging platforms or glass-floored walkways, can elicit positive emotional responses and dopamine-related reward activity (van den Berg & ter Heijne, 2005; Kohno et al., 2013; Wang & Tsien, 2011; Zald et al., 2008). Multisensory stimuli, including water features, thermal variation, natural sounds such as birdsong and scents from flowers, have been shown to reduce stress and enhance psychological restoration (Alvarsson et al., 2010; Pheasant et al., 2010; Liu et al., 2024; Song et al., 2024). Taken together, these findings suggest that it is the richness, dynamism and sensory diversity of natural environments, not merely the view of nature, that enhance the effectiveness of biophilic design in supporting wellbeing. From a holistic perspective, these benefits are as important as physiological effects, emphasising the interconnectedness of mind, body and social health. Building on this, social health represents another critical dimension of holistic wellbeing and biophilic design can play a key role in fostering prosocial behaviours.

Social and Behavioural Benefits

Exposure to nature appears to be associated with prosocial behaviour, reduced antisocial

behaviour and stronger social connections (Arbuthnott, 2023; Zelenski et al., 2015). Longer-term access to nature, such as neighbourhood greenspace, has been linked to stronger social bonds (Arbuthnott, 2023). Nature experiences may also support charitable giving and pro-environmental behaviours, including sustainable resource use and donations to environmental causes (Castelo et al., 2021; Zelenski et al., 2015; Arendt & Matthes, 2016), often mediated by a sense of connectedness to nature (Mayer et al., 2009; Alcock et al., 2020). Short-term exposure can elicit positive emotions for many people, such as joy, awe and gratitude, which are associated with broadened thought-action repertoires and increased helping behaviours, volunteerism and social cohesion (Fredrickson, 1998; Berman et al., 2012; Lyubomirsky et al., 2005). Awe-inspiring natural stimuli and perceptions of beauty have also been linked to experiences of humility and self-transcendence (Keltner & Haidt, 2003; Stellar et al., 2018). In communal and workplace settings, natural elements have been associated with increased social cohesion, collaboration and cognitive performance (Dannenberg et al., 2011; Aristizabal et al., 2021). Overall, biophilic design may support individual wellbeing while also fostering prosocial, socially adaptive and functional outcomes in group contexts.

Limitations of Current Healthcare Studies

While these studies offer valuable insights, additional research is necessary. Most healthcare research focuses on inpatient or acute care, particularly in hospitals. As a result, there is limited understanding of the effectiveness of biophilic interventions within holistic healthcare settings - a primary programmatic focus of this study. Tekin et al. (2025) further reinforce this by highlighting the typological narrowness of most studies on the benefits of biophilic design. Gender differences are also important, as research indicates that women often exhibit stronger psychological responses to plants than men (Kim & Mattson, 2002; Liu, Kim & Mattson, 2003; Shibata & Suzuki, 2002, 2004). Further investigation is required to understand how gender influences responses to different elements of biophilic design. Cultural considerations are equally critical for understanding the impact of biophilia on Indigenous peoples (Tekin, Izmir Tunahan, Disci & Ozer, 2025). Currently, New Zealand lacks case studies examining the health benefits of biophilic design within its cultural context, as shown in Figure 13 of Tekin et al. (2025), which illustrates the geographic focus of existing research. A valuable direction for future research would be to explore how Māori perceive biophilic design through their own worldview and how it could influence Māori health outcomes.

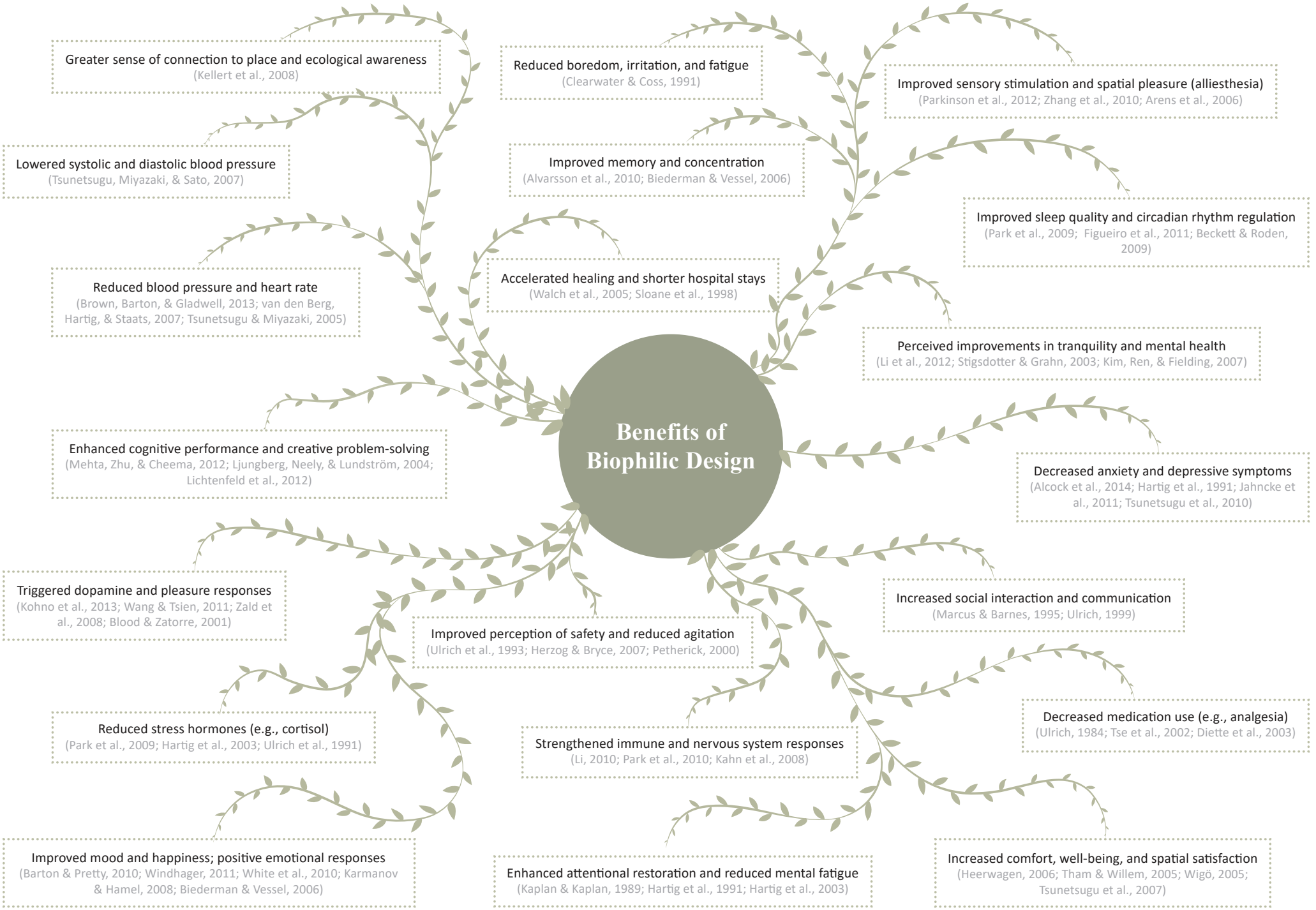


Figure 12. Health and Wellbeing Benefits of Biophilic Design

3.4 Biophilic Design and Its Role in Regenerative Architecture

Contemporary crises, including climate change, biodiversity loss and resource depletion, have intensified the need for regenerative architectural practices (Fahmy et al., 2019; Pedersen Zari, 2012). Buildings contribute significantly to energy consumption and environmental degradation, yet they also have a major impact on human health and wellbeing, highlighting the importance of addressing both ecological and human outcomes (Zhong et al., 2022; Paul et al., 2024). Biophilic design responds to this dual challenge by extending sustainability beyond technical efficiency to include human-centred outcomes (Browning et al., 2014; Söderlund & Newman, 2015; Paul et al., 2024). The deliberate incorporation of natural elements such as daylight, vegetation, water features and natural materials has been associated with supporting human health while enhancing ecological performance (Browning et al., 2014; Söderlund & Newman, 2015; Paul et al., 2024). For instance, green roofs and living walls manage stormwater, reduce urban heat islands, support biodiversity and improve building cooling, energy efficiency and occupant comfort, advancing both regenerative goals and human wellbeing (Vashishta et al., 2024; Mihalakakou et al., 2023). Similarly, natural ventilation and daylighting reduce energy demand while maintaining occupant comfort, creating a system where human wellbeing and ecological regeneration reinforce each other (Zoure & Genovese, 2023; Aboulnaga & Maryam, 2022). In this way, biophilic interventions complement regenerative architecture, promoting buildings that support both ecological systems and human wellbeing.

3.5 Cultural Contexts of Wellbeing

Māori Health Models

Māori health models have developed over the past several decades to articulate holistic approaches to wellbeing. Te Whare Tapa Whā, introduced by Durie (1985), uses the metaphor of a four-walled house, with each wall representing taha tinana (physical), taha wairua (spiritual), taha whānau (family/social) and taha hinengaro (mental/emotional) health (Murray, 2010; Durie, 1985). This model emphasises balance across these domains and forms a foundational framework widely adopted in clinical practice and community health programs (Murray, 2010; Durie, 1985). Pere's Te Wheke (1991) expands the concept of holistic health using the octopus metaphor, where the head represents overall wellbeing and each tentacle corresponds to a specific dimension (Pere, 1991; Love, 2004). This model builds on Te Whare Tapa Whā by incorporating additional dimensions of mauri (life force), mana ake (identity and self-esteem), whanaungatanga (relationships) and taiao (connection to the environment), foregrounding relationality and ecological embeddedness alongside personal wellbeing (Pere, 1991; Love, 2004). Building on these foundations, Durie's Te Pae Mahutonga (1999) frames Māori health within a public health context, using the Southern Cross constellation to represent health promotion goals and emphasising societal determinants of health, Māori leadership and cultural identity (Durie, 1999). Finally, the Meihana Model (Pitama et al., 2007) operationalises holistic Māori health concepts for contemporary clinical practice, integrating individual, whānau, cultural, spiritual and life experience dimensions to facilitate culturally safe assessment and intervention, bridging traditional perspectives with biomedical frameworks.

Overall, Māori health models have progressively expanded in scope and application. Te Whare Tapa Whā provides a foundational, easily communicated framework for understanding holistic wellbeing at the individual and family level. Te Wheke broadens this perspective, highlighting relational, cultural and environmental dimensions, while Te Pae Mahutonga shifts focus toward public health and policy-level determinants. The Meihana Model integrates these principles into clinical practice, emphasising cultural safety and practical application in contemporary health services. Across models, a consistent theme is the centrality of balance and interconnection, whether among personal, familial, spiritual or environmental dimensions, demonstrating the adaptability and enduring relevance of Māori holistic health perspectives (Durie, 1985, 1999; Pere, 1991; Pitama et al., 2007).

Rongoā Māori

Rongoā Māori (RM) is a traditional Māori system of healing that integrates knowledge and practices passed down through generations, often transmitted orally via pepeha (tribal proverbs), karakia (prayers) or waiata (songs) (Wirihana et al., 2020; Mark et al., 2017). These practices are grounded in Māori cultural customs and beliefs, shaping holistic understandings of health and wellbeing. A central facet of RM is the connection to the land, which is viewed both as a site and a source of healing, with reciprocal health between people and the environment. This relationship is highlighted by Mark et al. (2022), whose study shows that land forms a central part of Māori cultural identity and wellbeing. Participants reported that disconnection from traditional lands is associated with poorer physical, mental, emotional and spiritual health. Beyond this connection to land, Durie (1998) identifies five main forms of RM: ritenga (rituals), karakia (prayers), rongoā (herbal remedies), mirimiri (massage) and wai (water therapies). Each element serves a distinct yet interconnected function, collectively forming a system of healing that bridges the spiritual, physical and ecological, with ritenga providing the ceremonial foundation for this integration (Mark et al., 2022).

Ritenga refers to the ceremonial processes that establish the conditions for healing, ensuring that tapu (sacred restrictions) and noa (balance) are maintained (Wirihana et al., 2020). Closely linked are karakia - prayers or incantations that invoke atua (deities) and ancestors for protection, while also strengthening wairua (spiritual essence) to restore balance between the individual, whānau and environment (Brice, 2020). Rongoā encompasses plant-based medicines derived from native flora such as kawakawa, harakeke and mānuka, which are prepared through boiling for oral remedies or steeping into infusions for bathing (Mark et al., 2017). Plants are considered sacred, with genealogical ties to Tāne Mahuta, highlighting the spiritual foundations of healing (Connor, 2021). Complementing this spiritual dimension, mirimiri (massage) addresses the physical and emotional aspects of the body, releasing tension and fostering trust and reciprocity between the healer and patient (Mark & Lyons, 2010; Mark et al., 2017; Wirihana et al., 2020). Finally, wai (water) therapies embody cleansing and life-giving properties, purifying and restoring mauri (life force) beyond the physical domain (Mark et al., 2017; Wirihana et al., 2020). Together, these practices highlight how Māori healing is integrated, weaving spirituality, ecology and kinship into a holistic approach distinct from the biomedical models imposed under a colonial system.

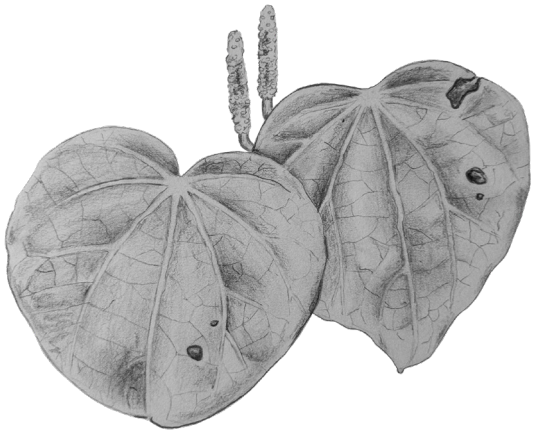
Colonial suppression of traditional healing practices disrupted the intergenerational transmission of knowledge, leading to fragmentation and loss in certain domains (Mark et al., 2017, 2019; Wirihana et al., 2020; Woodard, 2014). A key example is the Tohunga Suppression Act (1907), which targeted tohunga - Māori healers, spiritual experts and knowledge holders (Wirihana et al., 2020). While presented as protecting Māori from “fraudulent” or “superstitious” practitioners, the Act effectively delegitimised Māori cultural practices and imposed Western medicine and Christianity (Mark et al., 2017, 2019). Its impacts were profound: traditional healing and spirituality were criminalised, many tohunga silenced and rongoā knowledge forced underground (Mark et al., 2019). Remaining in force until 1962, the Act suppressed Māori healing for over half a century, entrenching the dominance of Western medicine in New Zealand. Despite this, Rongoā Māori persisted and has adapted to contemporary contexts (Durie, 2001; Tito, 2007). Recent revitalisation efforts have sought to reclaim these traditions within both community-led and integrative health frameworks, though tensions remain regarding the risk of reductionism when embedding Rongoā within biomedical models (Mark et al., 2019). This highlights the need to view Māori healing not merely as a therapeutic practice but as a holistic philosophical system that challenges Western dualisms of mind and body.

MEDICINAL PLANTS OF NEW ZEALAND

Medicinal plants of New Zealand are native species traditionally used by Māori for healing and wellbeing, collectively known as rongoā Māori. These plants have been used to treat physical ailments, promote health and support spiritual and emotional wellbeing (Eason et al., 2024). Integrating these species into designed landscapes provides opportunities for practical engagement with herbal remedies.

Kawakawa

Kawakawa supports pain relief, cardiovascular and digestive health, immune regulation, and skin healing, making it one of the most versatile rongoā plants in New Zealand (Rashidinejad, 2024).



Mānuka

Mānuka promotes wound healing, reduces inflammation, fights infection, protects against oxidative stress, and supports digestive health (Rashidinejad, 2024).



Tītoki

Tītoki supports skin healing, joint relief, digestive health, insect bite relief, and may have antiviral properties (Te Rūnanga o Ngāi Tahu, 2013).



Kūmarahou

Kūmarahou supports lung, liver, and kidney health, protects against infections, aids skin care, and has cleansing and antioxidant properties (Rashidinejad, 2024).



Harakeke

Harakeke supports wound care, skin healing, and digestive health, while also offering antimicrobial protection (Rashidinejad, 2024).



Koromiko

Koromiko supports skin healing, reduces inflammation, protects against oxidative damage, and aids digestion (Rashidinejad, 2024).



Rātā

Rātā aids in infection control, skin care, and throat relief, while also supporting ecological health (Rashidinejad, 2024).



Figure 13. Medicinal Plants Sketches



 Figure 14. Western vs Te Ao Māori Approach to Healthcare

Māori Health Inequities

Māori health cannot be understood without recognising the impacts of colonisation in New Zealand, which suppressed Indigenous knowledge and justified the appropriation of land and resources (Moewaka Barnes & McCreanor, 2019; Pool, 2016; Reid et al., 2019). Although New Zealand introduced a universal, publicly funded healthcare system in 1938, Māori have consistently experienced poorer health outcomes, largely due to the effects of colonisation (Brown & Bryder, 2023). Colonisation operates through ongoing dehumanisation, grounded in racist ideologies of white superiority and false hierarchies of race (Moewaka Barnes & McCreanor, 2019; Reid et al., 2019). Colonial systems redefined norms and values, marginalising Māori as "different" while positioning Pākehā as the standard. These structures redistributed power and resources to benefit colonisers, framing unequal Māori health outcomes as deficiencies within Māori themselves (Reid & Robson, 2000). Health inequities are not inherent to Māori biology or culture, but rather result from social, economic and political structures shaped by colonisation (Reid et al., 2019). Institutional, interpersonal and internalised racism, along with unequal access to the determinants of health, healthcare services and quality of care, contribute to persistent disparities (Wilson et al., 2021), underscoring that racism is a major determinant of health. These inequities are well-documented across the literature and empirical studies.

The Tatau Kahukura: Māori Health Chart Book 2024 (Ministry of Health, 2024) highlights persistent health inequities between Māori and non-Māori populations. Life expectancy at birth remains lower for Māori, with males living 73.4 years and females 77.1 years in 2017–2019, representing modest increases from 2005–2007 but still lagging behind non-Māori (80.9 and 84.4 years respectively). Cardiovascular disease (CVD) continues to disproportionately affect Māori, who experience more than double the mortality rate of non-Māori (RR 2.33) and are nearly twice as likely to be hospitalised for CVD (RR 1.76). Māori females experience particularly high inequities across CVD, stroke and COPD, with mortality and hospitalisation rates up to 4.8 times higher than those of their non-Māori counterparts. Similarly, cancer incidence and mortality are elevated among Māori adults, with lung and liver cancers showing the starkest disparities. Diabetes prevalence among Māori adults is over twice that of non-Māori, contributing to higher rates of renal failure and lower-limb amputations (RR 3.61 and 3.07 respectively). These findings demonstrate the continuing burden of preventable and chronic conditions within Māori populations, reflecting the enduring impacts of colonisation and the shortcomings of a health system that does not adequately serve them. Addressing these health disparities requires not only improvements in healthcare access and delivery but also recognition of Māori cultural values and the deep connections between people and the natural environment, which

shape holistic wellbeing.

Māori vs Western Views on Nature and Implications for Biophilic Design

Māori perspectives on nature are deeply rooted in whakapapa (genealogical connections), mauri (life force), and kaitiakitanga (guardianship), which together emphasise the profound interconnectedness of people, land, waters, and non-human beings (Harmsworth & Awatere, 2013). Whakapapa, often translated as genealogy, denotes the layers of descent that link all living beings to one another and to the origins of the universe (Tassell-Matamua et al., 2021; Hikuroa, 2017). Complementing this, mauri represents the life force present in all living and non-living entities, framing rivers, mountains, forests, and species as living, sacred, and interconnected rather than as mere resources (Marsden, 2003; Harmsworth & Awatere, 2013). Grounded in whakapapa and mauri, kaitiakitanga encompasses the responsibilities and practices of stewardship, whereby humans actively care for and protect the environment, ensuring that the life force and balance of all things are maintained (Paul-Burke & Rameka, 2017; Kawharu, 2000). This is often expressed through customary practices such as rahui - seasonal restrictions that allow species and ecosystems to recover (Maxwell & Penetito, 2007; McCormack, 2011). Māori engagement with the environment is therefore relational rather than utilitarian, with obligations to maintain ecological balance.

Western perspectives on nature are traditionally anthropocentric, framing the natural environment primarily as a set of resources to be used, managed, or controlled for human benefit (Glacken, 1999; Jarwar et al., 2024). This worldview often separates humans from ecological systems, positioning people as external observers or dominant agents rather than integrated participants within the natural world (Klein, 2000). Nature is typically valued in instrumental terms - its worth is measured through economic productivity or aesthetic appeal - rather than being recognized as possessing an intrinsic life force or spiritual significance (Glacken, 1999; Jarwar et al., 2024; Klein, 2000). Environmental management within this framework prioritizes technical expertise and measurable outcomes for sustainability, but can be reductionist, neglecting the complex interdependencies of ecosystems (Randerson, 2015). Moreover, Western environmental ethics often focus on mitigating human impact or conserving resources for future utility, rather than fostering reciprocal relationships or recognizing the inherent sacredness of ecosystems (Himes et al., 2023). Ultimately, by prioritizing human benefit over relational responsibility, this perspective can lead to fragmented and unsustainable engagement with the natural world.

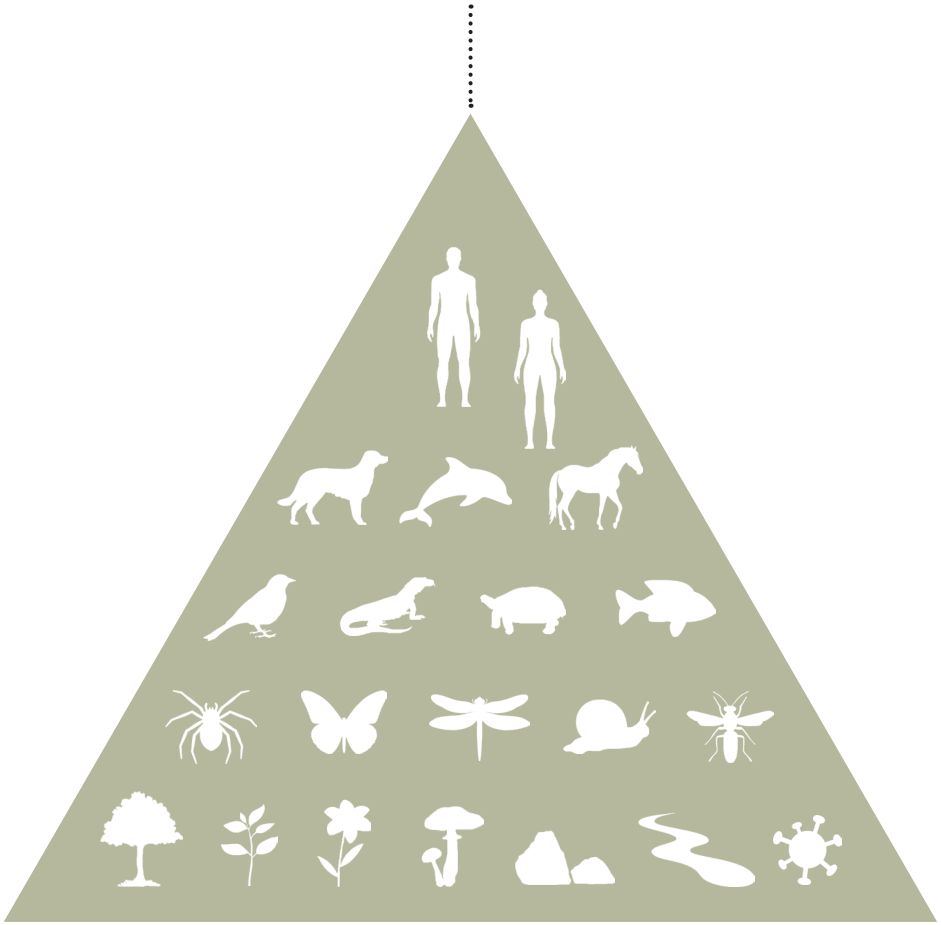
These differences carry profound implications for implementing biophilic design in New Zealand. While biophilic design aims to reconnect people with nature to enhance health and wellbeing (Kellert & Calabrese, 2015), its prevailing applications are often shaped by Western psychological and architectural paradigms (Söderlund, 2019). For Māori however, these bonds with the living world have been sustained across generations and involve maintaining enduring relationships through kaitiakitanga (stewardship), respect for mauri and culturally informed engagement with place (Harmsworth & Awatere, 2013). Incorporating Māori perspectives into biophilic design therefore requires more than the mere addition of natural elements; it calls for a reciprocal, culturally embedded design ethos in which human wellbeing is inseparable from ecological and spiritual health. This approach may foster regenerative outcomes, strengthen cultural identity and ensure that biophilic spaces honour both the living world and Māori cultural systems.

TABLE 5 WESTERN VS MĀORI WORLDVIEWS ON NATURE

Western and Māori worldviews differ significantly in how they relate to nature. Acknowledging these differences is crucial to ensure that biophilic design in New Zealand is both culturally and contextually relevant.

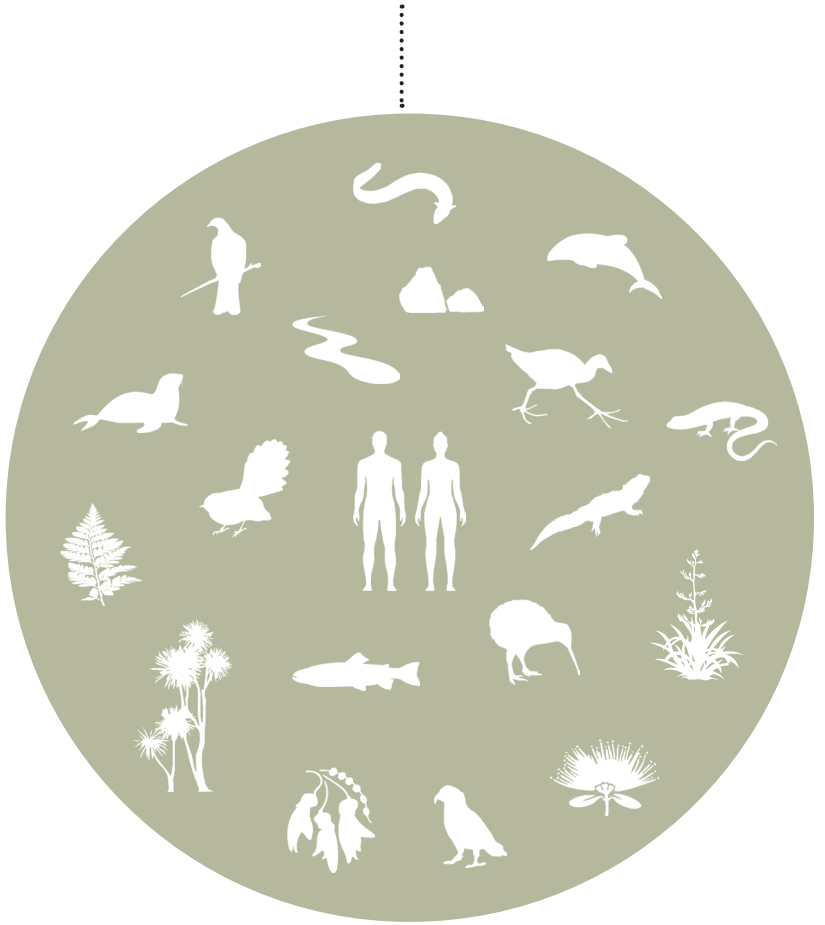
THEME	WESTERN WORLDVIEW	MĀORI WORLDVIEW
Ontological Relationship to Nature	Nature is often viewed as an object or external system, separate from humans, to be studied, managed, or exploited for human benefit.	Nature is genealogically and spiritually connected to people through whakapapa (genealogy); all living and non-living entities share kinship.
Biophilia and Human-Nature Connection	Biophilia is described as an innate human affinity for nature, often understood through evolutionary psychology and applied in design to promote wellbeing (e.g., reduced stress, cognitive restoration).	Connection to nature is embedded in lived experience and cultural practice. Concepts such as mauri (life force) and wairua (spiritual essence) underpin Māori relationships with the environment.
Design and Built Environment	Biophilic design seeks to reintroduce natural elements into urban life through features like natural light, vegetation, and materials - primarily focused on individual wellbeing and performance.	Design must respect tikanga (customs), the mana (authority) of place, and kaitiakitanga (guardianship). Built form is integrated with the land's identity and the stories it holds.
Temporal Worldview and Sustainability	Emphasises progress, innovation, and efficiency, often through linear, short- to mid-term planning models.	Sustainability is intergenerational. Decision-making is rooted in respect for ancestors (tīpuna) and responsibilities to future generations (mokopuna).
Place and Belonging	Place is generally defined by ownership, function, and utility (e.g., land parcels, infrastructure zones).	Place (tūrangawaewae) is a source of identity, meaning, and belonging. It is spiritual, ancestral, and relational.
Epistemology (Knowledge Systems)	Emphasises empirical observation, scientific method, and abstraction from context for universal application.	Embraces relational knowledge, storytelling, observation, and intergenerational wisdom, specific to place and community.

WESTERN VIEW OF NATURE



The Western model sees nature as a hierarchy with humans dominating and exploiting lesser beings (Glacken, 1999; Jarwar et al., 2024).

MĀORI VIEW OF NAURE



Māori often view nature as a living, interconnected system imbued with wairua (spirit), whakapapa (genealogy), and mauri (life force) (Marsden, 2003).

Figure 15. Nature Through Western and Māori Lenses

Conclusion

Literature indicates that biophilia is deeply rooted in historical, psychological, and evolutionary understandings of human-nature interactions, and that these collectively support its intentional integration into architectural design. Environmental psychology theories provide mechanisms for understanding cognitive, emotional and behavioural responses to natural environments, while established design frameworks offer practical guidance for implementation. Empirical evidence demonstrates the physiological, psychological and social benefits of biophilic design, reinforcing its relevance for promoting holistic wellbeing. Māori health models and cultural perspectives underscore the importance of relational, holistic approaches to nature, revealing opportunities for culturally responsive biophilic design that aligns with regenerative architectural principles. By synthesising theoretical, practical and cultural insights, the review establishes a robust foundation for research exploring the integration of biophilic and Māori principles within contemporary architectural practice in New Zealand.

CHAPTER 4:
THEORETICAL FRAMEWORK

THEORETICAL FRAMEWORK

A Healing Framework Rooted in Te Ao Māori and Biophilic Design

Amid growing recognition of the shortcomings of conventional healthcare design, this research responds with an architectural approach that aims to reconnect people with culture, community and nature (Kellert & Calabrese, 2015; Browning et al., 2014; Khairoowala et al., 2025; Cumming et al., 2021; Sheridan et al., 2024; Ramalho et al., 2022). By synthesising Indigenous Māori epistemologies with contemporary evidence-based biophilic design strategies, this framework provides a culturally embedded and interdisciplinary lens through which to reimagine healthcare environments. Central to this framework are the 14 Patterns of Biophilic Design (Browning et al., 2014), Te Whare Tapa Whā (Durie, 1985), and the Te Aranga Māori Design Principles (Paul, 2017), each contributing distinct but complementary insights into how the built environment can foster wellbeing and support meaningful relationships between people, place, and the natural world.

Role and Function of the Theoretical Framework

This integrative framework underpins and directs the research, establishing essential structure and coherence. It provides the conceptual structure through which the research question is explored, the methodology is informed, precedents are critiqued, and design work is generated and interpreted. It acts as a critical bridge between literature-based inquiry and design-led exploration (see Figure 16), translating conceptual insights into spatial, programmatic, and material strategies. At its core, the framework defines the lens through which the research is approached. Rather than relying on a single theoretical paradigm, this study draws on a combination of established design and cultural frameworks.



Figure 16. Theoretical Framework: Bridging Literature and Design

At its heart, this framework is a call to heal –
through nature, through culture, and through design.

4.0 The 14 Patterns of Biophilic Design

The 14 Patterns of Biophilic Design (Browning et al., 2014) have been selected as a primary framework for this research. Rooted in extensive interdisciplinary scholarship, the framework effectively translates complex scientific insights into clear and actionable design strategies that facilitate the integration of nature and its reported health benefits within the built environment - an outcome central to the research aim of fostering holistic well-being. As a natural progression of prior frameworks, it refines and extends their insights by integrating contemporary scientific evidence. Furthermore, its clarity and adaptability across diverse building typologies enhance its applicability in architectural practice. By providing both a rigorous foundation, the 14 Patterns of Biophilic Design offer a robust conceptual lens through which this study is conducted.

However, one limitation of the 14 Patterns is that it primarily conceptualises health benefits through a Western lens, which may overlook the holistic and relational nature of well-being central to the Māori worldview in New Zealand. Therefore, integrating the Māori health framework Te Whare Tapa Whā and Te Aranga Māori Design Principles are essential to provide a contextually relevant and culturally authentic conception of health.

Application of the 14 Patterns of Biophilic Design in this Research

In this research, the 14 Patterns of Biophilic Design (Browning et al., 2014) serve as both an analytical and generative framework that supports the cyclical, iterative nature of design-led research. They inform each stage of the research and creative process by guiding precedent analysis, site interpretation, and design development. Analytically, the patterns are employed in precedent studies to critically evaluate built examples where biophilic strategies have been successfully implemented, providing inspiration for the emerging architectural response. During site analysis, the patterns are used to identify existing biophilic qualities as well as deficiencies in nature integration, thereby grounding the design in its ecological context. Generatively, the framework informs the design response by ensuring alignment with the biophilic patterns. This is achieved through multiple aspects, including spatial configurations, design features, programme development, and material selection. For instance, the pattern Material Connection with Nature supports the specification of locally sourced and natural materials, while Prospect and Refuge shape spatial layouts to evoke a sense of safety, openness, and psychological comfort. Integrating the 14 Patterns throughout the iterative design process supports the translation of conceptual intentions into architectural strategies that are expected to contribute to holistic health outcomes.

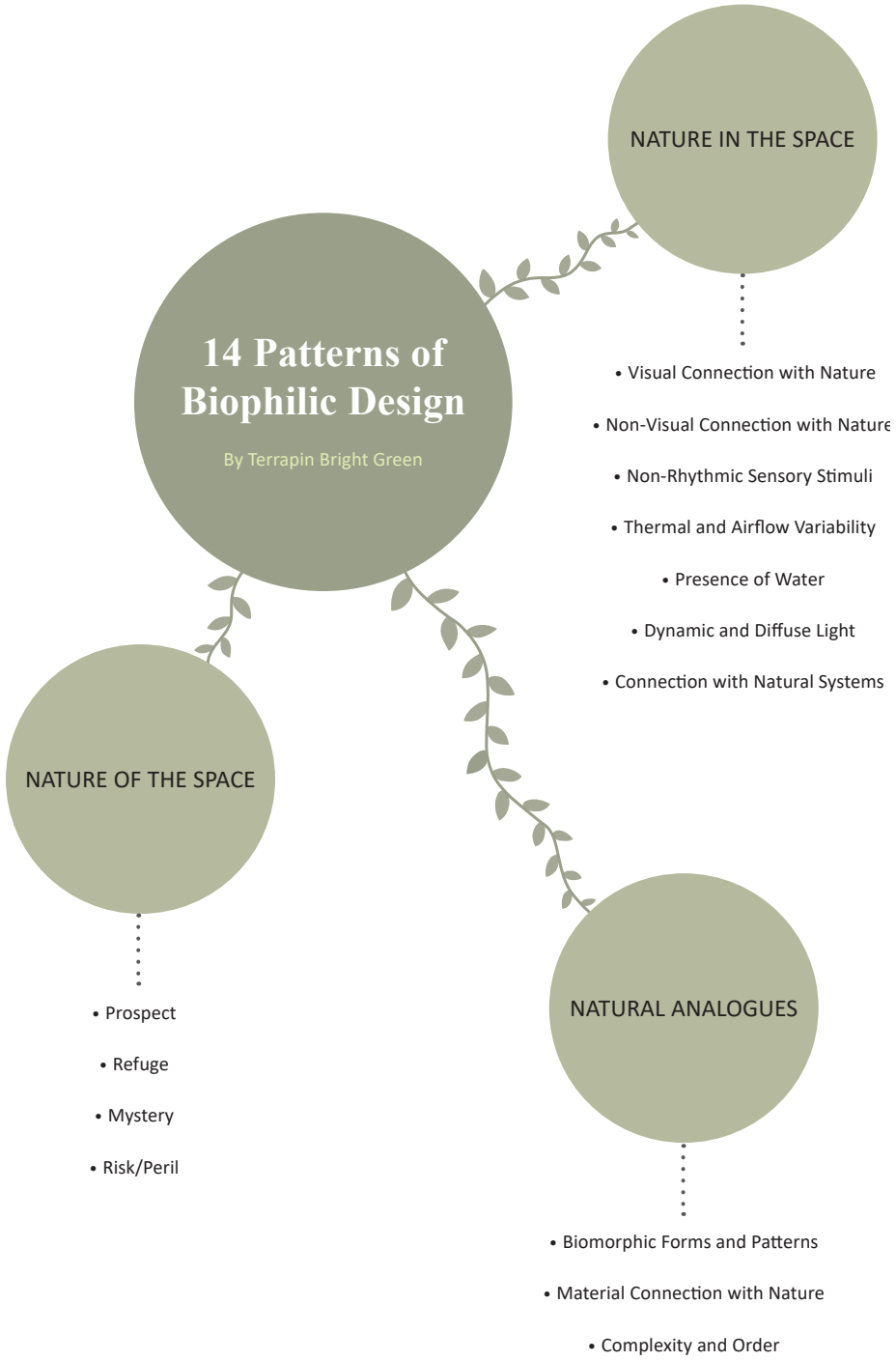


Figure 17. The 14 Patterns of Biophilic Design

4.1 Te Whare Tapa Whā

Te Whare Tapa Whā, developed by Mason Durie in 1985, conceptualises wellbeing as a four-sided house (whare), with each wall representing a fundamental dimension: taha tinana (physical health), taha wairua (spiritual health), taha whānau (family and social health) and taha hinengaro (mental and emotional health), as illustrated in Figure 18 (Durie, 1985). This holistic framework emphasises the interconnectedness and balance of these dimensions, asserting that optimal health is achieved only when all aspects are nurtured collectively. Grounded in Māori epistemologies, it extends beyond Western bio-medical models by incorporating spiritual and relational elements essential to Indigenous conceptions of wellbeing (Durie, 1998).

Te Whare Tapa Whā has been selected as a core theoretical framework for this research because it offers a comprehensive understanding of health, uniquely suited to New Zealand's bicultural context. Unlike dominant biomedical models that often marginalise cultural determinants and sometimes contribute to health inequities for Māori (Brown & Bryder, 2023), this model, grounded in mātauranga Māori, provides an ethical and inclusive approach. While other Māori health models such as Te Wheke (Pere, 1991), the Meihana Model (Pitama et al., 2007) and Te Pae Mahutonga (Durie, 1999) offer valuable insights, its foundational status, widespread recognition in Māori health scholarship and conceptual clarity make it particularly well suited to this research (Wilson et al., 2021).

Application of Te Whare Tapa Whā in this Research

Te Whare Tapa Whā (Durie, 1985) is embedded in this research as a framework that integrates Māori perspectives on health and wellbeing, guiding spatial priorities and interpreting outcomes through a holistic mātauranga Māori lens. It primarily informs the design phase, aiming to support spatial and programmatic strategies that foster holistic wellbeing. Physical health is supported through design elements that promote movement and comfort, including natural ventilation, daylight access, on-site food production, opportunities for physical activity and GP and dental services. Spiritual health is reinforced through spaces for spiritual guidance and architectural connections to wai (water). Social and family health is addressed through inclusive communal areas that encourage whānau and community interaction. Mental and emotional health is fostered through biophilic and sensory design strategies, counselling spaces and features that reduce stress and support psychological wellbeing. Subtle design gestures throughout the site also facilitate the re-connection of mind, body and spirit.



Figure 18. Te Whare Tapa Whā

4.2 Te Aranga Māori Design Principles

Complementing this holistic foundation, the Te Aranga Māori Design Principles comprise seven culturally embedded guidelines developed to embed Māori values and worldview within the design of the built environment in New Zealand (Paul, 2017). Originating from a collaborative kaupapa Māori research project in Auckland, these principles were created by Māori design professionals in response to the New Zealand Urban Design Protocol of 2005 (Paul & Hatton, 2018). The framework - consisting of Mana, Taiao, Tāngata, Mauri Tu, Whakapapa, Mahi Toi and Ahi Kā - offers architects, planners and developers a comprehensive approach to respectfully incorporate Māori cultural narratives, ancestral connections to whenua (land) and principles of environmental stewardship into architectural and urban design. More than a design framework, the Te Aranga Principles embody a living expression of Māori knowledge and values, disrupting conventional architectural paradigms by centring Indigenous perspectives.

Te Aranga Māori Design Principles were selected as a core component of this research's theoretical framework to ensure the design is deeply informed by mātauranga Māori and Indigenous values (Paul, 2017). Unlike the more universally applied 14 Patterns of Biophilic Design (Browning et al., 2014) and the conceptual wellbeing model of Te Whare Tapa Whā (Durie, 1985), Te Aranga uniquely offers a culturally specific, structured and principle-based framework developed by Māori to guide spatial and architectural design. While Te Whare Tapa Whā provides a holistic metaphor for health and the 14 Patterns promote human-nature connections, neither explicitly integrates tikanga, whakapapa, mana whenua or functions as a decolonising tool to assert Indigenous sovereignty in the built environment. Te Aranga fills these critical gaps by centring Indigenous epistemologies and enabling site-specific, culturally responsive design that reconnects people to whenua (Paul, 2017). This makes Te Aranga Māori Design Principles indispensable for creating architecture that is not only biophilic and holistic but also authentically Māori and decolonised.

Application of Te Aranga Māori Design Principles in this Research

Te Aranga Māori Design Principles (Paul, 2017) are employed in this thesis as an evaluative and ethical framework that guides spatial decision-making through a culturally informed values-based lens. For instance, the principle of Taiao guides approaches that seek to protect and enhance the natural environment, such as prioritising native planting and regenerative landscape strategies, with the intention of respecting and nurturing the site's ecology. Complementing this, Mauri Tu guides design decisions that promote environmental health and kaitiakitanga by restoring aquatic and terrestrial ecology and fostering community stewardship. Furthermore, Whakapapa is embedded in the architectural design by celebrating Māori place names and genealogical narratives through naming conventions, wayfinding systems and culturally significant artworks, thereby helping reinforce ancestral connections to the land. As an evaluation tool, the principles provide a set of criteria through which key design decisions can be critically assessed. Architecture that embodies these values can be understood as more culturally informed, aligning with the aim of this research.



Figure 19. Te Aranga Māori Design Principles

Table 6 Comparative Analysis of Key Frameworks

ASPECT	14 PATTERNS OF BIOPHILIC DESIGN	TE WHARE TAPA WHĀ	TE ARANGA MĀORI DESIGN PRINCIPLES
Origin/Discipline	Environmental psychology and biophilic design (Western, evidence-based)	Māori health model rooted in Indigenous epistemology and holistic wellbeing	Māori design framework grounded in Indigenous epistemologies and decolonising methodologies
Core Focus	Human-nature interaction to promote health and wellbeing through nature integration in built environments	Holistic wellbeing encompassing physical, spiritual, social, and mental health dimensions	Embedding Māori values, ancestral connections, and environmental stewardship in design
Theoretical Foundation	Biophilia hypothesis (Wilson), Attention Restoration Theory, Stress Reduction Theory, Place Attachment	Mātauranga Māori; relational and holistic health; interconnectedness of health dimensions	Relational ontology; Indigenous spatial paradigms; Indigenous sovereignty; decolonisation
Framework Structure	14 actionable patterns grouped into Nature in the Space, Natural Analogues, and Nature of the Space	Four interconnected dimensions (walls of the whare): taha tinana, taha wairua, taha whānau, taha hinengaro	Seven design principles: Mana, Taiao, Tāngata, Mauri Tu, Whakapapa, Mahi Toi, Ahi Kā
Application in Architecture	Guides spatial layout, materials, light, water, and sensory elements to align with innate human needs	Informs spatial and programmatic strategies that reflect holistic health dimensions (physical comfort, spirituality, social connection, mental wellbeing)	Provides evaluative and ethical guidelines ensuring designs reflect Māori culture, environment, and values
Cultural Context	Universal but requires cultural informed adaptation when applied locally	Specifically informed by the Māori worldview and cultural values	Deeply embedded in Māori cultural narratives and tikanga, designed for New Zealand context
Strengths	Strong empirical basis; practical and actionable; promotes measurable health benefits	Holistic and relational understanding of health; aligns health with architecture symbolically and practically	Centres Indigenous knowledge; challenges Western paradigms; fosters cultural sovereignty and regenerative design
Weaknesses	Culturally complacent; ecologically generic	Risk of tokenistic application	Lack of technical guidance for application
Considerations	Needs careful cultural adaptation for local Indigenous values and ecological contexts	May be less known outside Māori communities; requires cultural competency to apply authentically	Less familiar to non-Māori practitioners; requires deep cultural engagement and site-specific interpretation
Role in Research Framework	Provides an evidence-based lens and practical toolkit for integrating nature into design	Offers a culturally anchored model of wellbeing to guide holistic design responses	Acts as an ethical and cultural compass ensuring respectful, values-driven design decisions
Contribution to Design Outcome	Enhances health and wellbeing through nature-focused spatial and material strategies	Encourages design that nurtures multiple dimensions of wellbeing in a balanced manner	Ensures design honors Māori values, place, and cultural identity, embedding Indigenous sovereignty in architecture

4.3 Limitations of the Theoretical Framework

Epistemological Scope and Tensions

The ambition to integrate Indigenous and Western knowledge systems reflects a progressive step toward decolonial practice. However, this integrative approach also reveals significant epistemological tensions. The 14 Patterns of Biophilic Design (Browning et al., 2014) are grounded in evolutionary biology and environmental psychology, prioritising empirical observation, human-centred benefits and universalist assumptions about human-nature relationships. In contrast, mātauranga Māori is based on ontologies that are relational, spiritual and genealogical - where land, people and non-human entities are interdependent, possess agency and are embedded within whakapapa (Durie, 1998). Framing these knowledge systems as naturally complementary without fully acknowledging their ontological distinctiveness risks reducing Indigenous knowledge to a symbolic or functional layer within a predominantly Western paradigm. To avoid this, the framework is applied dialogically, with reflexive attention to the ethical implications of synthesis. This includes a commitment to ensuring that Indigenous epistemologies are not subordinated, appropriated or instrumentalised, but instead valued as complete and sovereign knowledge systems in their own right.

Absence of Cultural Grounding

While the 14 Patterns of Biophilic Design are robust in ecological and psychological terms, it does not adequately account for the ways in which cultural identity and heritage shape human-nature relationships. To address this gap, the framework is deliberately extended through the integration of Kellert and Calabrese's (2015) attribute of cultural and ecological attachment to place, which emphasises the need to root architectural design in the culturally and ecologically embedded relationships that shape place-based identity. This attribute serves as a conceptual bridge between biophilic design and Indigenous place-based knowledge. In this research, it is operationalised through the application of Te Whare Tapa Whā and the Te Aranga Māori Design Principles, ensuring that biophilic strategies are not only ecologically responsive but also culturally resonant and contextually grounded. This approach honours the mauri of place, attending not only to land and ecology but also to whakapapa, ancestral narratives and values that sustain wellbeing in Aotearoa.

Cultural Limitations and Ethical Constraints

A significant limitation in implementing the Te Aranga Māori Design Principles (Paul, 2017) within this project is the absence of direct engagement with mana whenua, which was not possible within the context of a masters thesis. This lack of co-design critically undermines the full expression of Mana and Rangatiratanga, which are grounded in recognising and upholding mana whenua authority, leadership and decision-making in the design process. Without genuine partnership, the project risks replicating extractive practices that symbolically incorporate Māori values without enabling Māori agency or tino rangatiratanga. In response to this ethical constraint, mitigation strategies have been employed to respectfully acknowledge mana whenua relationships to place. These include a design that employs te reo Māori place naming and dual-language wayfinding to affirm mana whenua identity and connection. It protects culturally significant features such as maunga, awa and wāhi tapu, applying site-sensitive strategies aligned with kaitiakitanga, including restoration and habitat protection. Ancestral narratives are incorporated where possible, while adaptable spaces are intentionally created to allow for future mana whenua-led cultural input, reflecting a commitment to ongoing collaboration and partnership. While these actions reflect ethical intent, they do not replace genuine partnership, serving instead as provisional acknowledgements of Indigenous authority and highlighting the need for deeper sustained engagement in future work.

Contextual Specificity and Transferability

This framework is intentionally situated within the cultural and ecological context of New Zealand. Its grounding in local Indigenous knowledge enhances its relevance and capacity to support culturally resonant design outcomes. However, this place-specific orientation also limits the framework's direct transferability to other regions or Indigenous contexts. Application in different cultural or ecological settings would require a fundamentally different process - one grounded in local knowledge systems, community leadership and co-design methodologies. Rather than proposing a universally applicable model, this research underscores the importance of methodological pluralism, cultural humility and situated practice. Future work should explore how relational ethics, decolonising methodologies and Indigenous-led design can inform the adaptation of similar frameworks in diverse global contexts without reducing them to generic or tokenistic templates.

Towards an Architecture of Wellbeing, Culture, and Nature

This framework reimagines healthcare architecture in New Zealand through a culturally informed lens, positioning mātauranga Māori, ecological interdependence and holistic wellbeing as foundational rather than supplementary to design. By weaving together Indigenous values with evidence-based biophilic design strategies, the framework functions

not only as a critical interpretive lens but also as a generative foundation for creating environments that are restorative, culturally resonant and future-focused. Crucially, these frameworks are not applied in isolation; instead, this research engages them relationally - foregrounding their epistemological intersections and tensions - to cultivate a structurally integrated, reflexive and non-extractive design methodology. In the future, the framework could be further developed into a set of accessible design principles or evaluative heuristics. These tools would aim to maintain the integrity of the original concepts while enhancing their practical application across diverse design settings.

DESIGN PRINCIPLES

This diagram illustrates the design principles established in the theoretical framework as a cohesive set of principles. These principles will be used in this project to guide the design proposition and to evaluate how successfully the design aligns with culturally informed biophilic design principles.

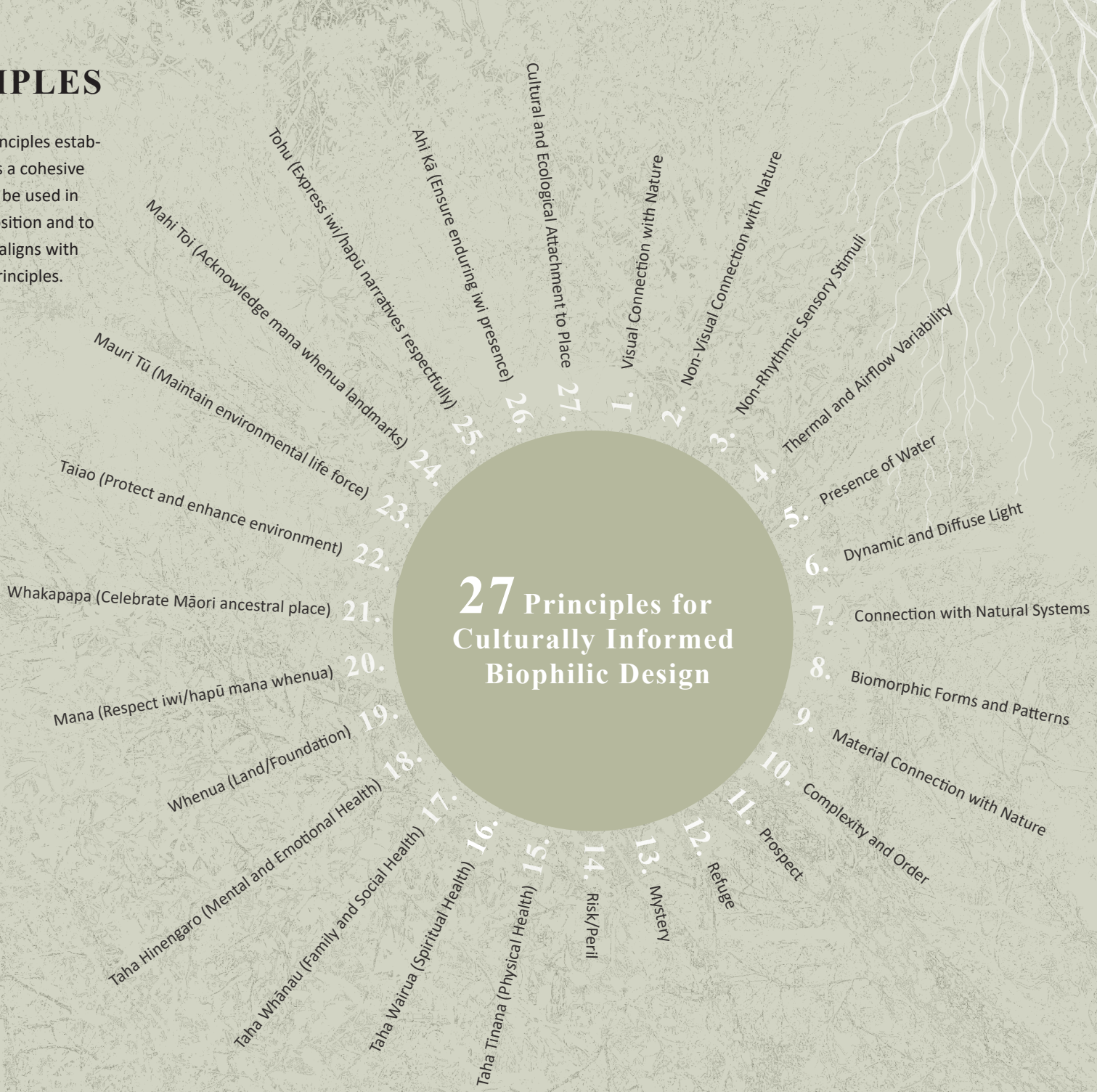


Figure 20. Design Principles

CHAPTER 5: PRECEDENT ANALYSIS

This section examines a range of architectural precedents that demonstrate how the 14 Patterns of Biophilic Design, Te Whare Tapa Whā, and Te Aranga Māori Design Principles can be effectively applied in practice. Together, they establish a foundation for the proposed design by grounding it in proven approaches by leading architecture firms.

5.0 PRECEDENTS FOR BIOPHILIC DESIGN

Precedents were selected for their strong application of the 14 Patterns of Biophilic Design (Browning et al., 2014). By analysing how each precedent implements these patterns, the study identifies effective design strategies. This analysis clarifies how theoretical concepts are translated into built form, supporting the design approach. Ultimately, it ensures the proposed design is informed by established applications of biophilic principles in real-world contexts. One limitation of this analysis is the challenge of identifying certain biophilic design patterns - such as non-rhythmic sensory stimuli and non-visual connection with nature - through visual precedent analysis alone. These patterns rely on multi-sensory experiential qualities that are often only perceivable through direct, in-person engagement with the built environment.



Figure 21. Prøysenhuset /Snøhetta / 2014

Unterwasser Valley Station / Herzog & de Meuron / 2024

Jacques Herzog's Unterwasser Fountain embodies the Connection with Natural Systems pattern of biophilic design by poetically tracing the journey of water through the natural hydrological cycle. His description - where water falls as rain, filters through rock, emerges as a spring and flows into rivers, basins and taps - reflects an awareness of the dynamic processes that sustain life. The fountain's integration of visible water flows and reclaimed materials serves as inspiration for this research, particularly in unveiling the hydrological cycle as an experiential element within the proposed design (Herzog & de Meuron, n.d.).



Figure 22. Unterwasser Valley Station

Grand Canyon Skywalk / Mark Ross Johnson / 2007

The Grand Canyon Skywalk exemplifies biophilic design by immersing visitors in prospect, risk and visual connection with nature. Its cantilevered glass platform extends over a 1,200-metre-deep canyon, creating a visceral sense of suspension and connection to the landscape (Explore the Canyon, n.d.). This deliberate engagement with scale and verticality evokes innate awe, embodying biophilic principles that inspire emotional intensity, sensory engagement and spatial dynamism, providing valuable guidance for cantilevered platforms in the proposed design in this research project.

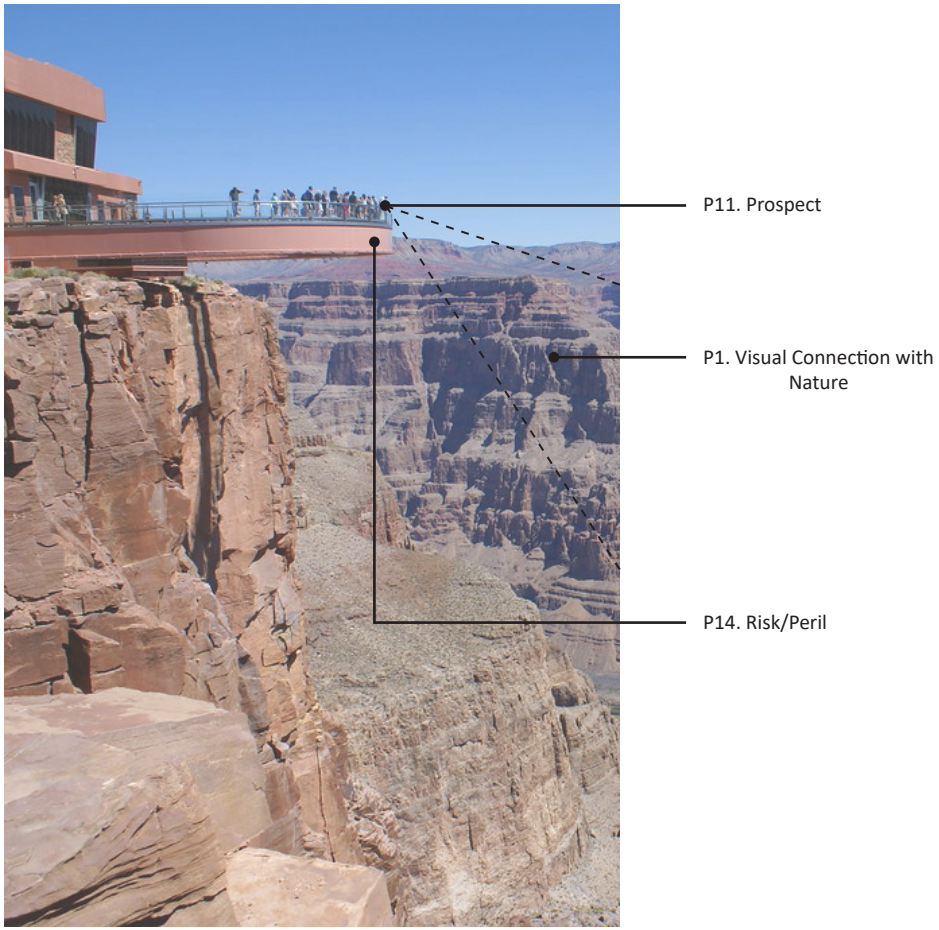


Figure 23. Grand Canyon Skywalk

University of Auckland B201 Building / JASMAX / 2023

The B201 Building exemplifies how biophilic and regenerative design principles can be integrated through adaptive reuse and low-carbon strategies. Its transformation from a derelict structure into a high-performing timber-structured academic space demonstrates how reconnecting people to nature can occur through sustainable material choices, natural daylight and thermal comfort (Jasmax, n.d.-a). For the proposed community-focused design, B201 offers a precedent for incorporating timber elements, passive environmental controls and spatial reuse as strategies to enhance wellbeing while reducing embodied carbon - affirming that biophilic intent can align with long-term ecological responsibility and climate resilience.



 Figure 24. University of Auckland B201 Building

Tōtara Haumaru / JASMAX / 2024

Tōtara Haumaru exemplifies biophilic design by embedding natural elements and cultural meaning into a healthcare setting to support healing and wellbeing. The 450sqm indoor healing garden - New Zealand's first at this scale - brings greenery, filtered daylight and sensory richness into the heart of the building, creating a calm restorative space for patients, whānau and staff. Timber finishes throughout non-clinical spaces, pou carved from a site-specific tōtara tree and bird-inspired wayfinding patterns connect occupants with the natural world and Te Ao Māori, invoking familiarity, meaning and comfort (Jasmax, n.d.-b). This closely aligns with the aims of my project, which similarly seeks to integrate cultural and ecological sensitivity.



Figure 25. Tōtara Haumaru

Coastal House / Fearon Hay / 2022

This project exemplifies biophilic design by seamlessly integrating architecture into the natural contours of the coastal dune, strengthening the relationship between people and place. The partially buried pavilions and sheltered courtyards create comfortable microclimates that support thermal and airflow variability, enabling year-round sensory engagement with nature. Expansive glazed openings maintain uninterrupted visual access to the surrounding landscape, reinforcing a constant connection to the outdoors. A key takeaway from this precedent is its approach to landscape integration: embedding built forms into the terrain and incorporating sheltered outdoor zones work together to foster a sense of immersion and connection to the land (Fearon Hay Architects, n.d.).



Figure 26. Coastal House

Lakehouse Wendelstrand / Snøhetta / 2025

This project exemplifies biophilic design by transforming a former quarry into a vibrant nature-integrated community. It fosters a seamless relationship between built form and landscape through the use of natural materials, abundant daylight and visual access to surrounding greenery. Embedded in bedrock and rising into timber structures, the architecture dissolves boundaries between nature and the built environment. Features such as patterned glazing mimic dappled sunlight through trees, enhancing sensory experience while offering thermal performance (Snøhetta, n.d.-b).

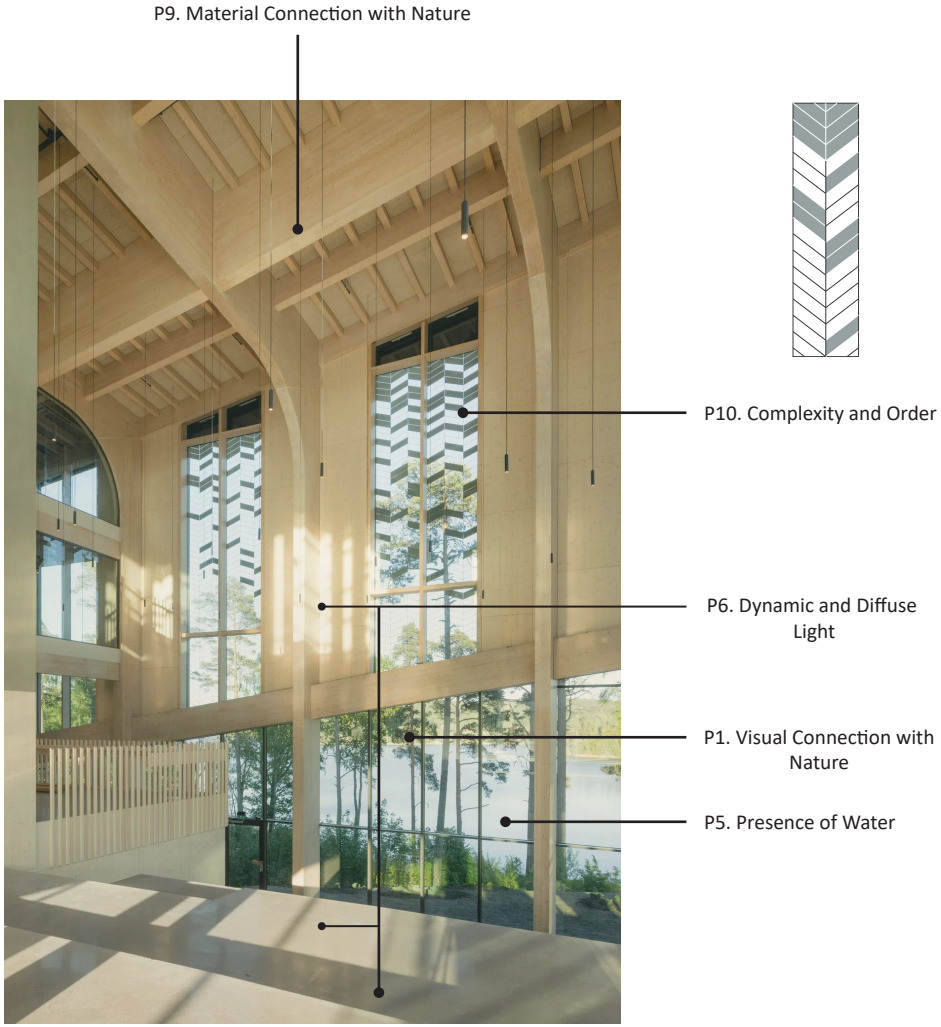


Figure 27. Lakehouse Wendelstrand

The Therme Vals / Peter Zumthor / 1996

Therme Vals by Peter Zumthor embodies biophilic design through its deep integration with the Alpine landscape, use of natural stone and emphasis on sensory experience. The building's materiality, interplay of light and shadow and presence of water foster a strong connection to nature. Its spatial qualities offer refuge, contemplation and restorative immersion, aligning with key biophilic principles that enhance human wellbeing through connection to place and environment (ArchEyes, 2024).

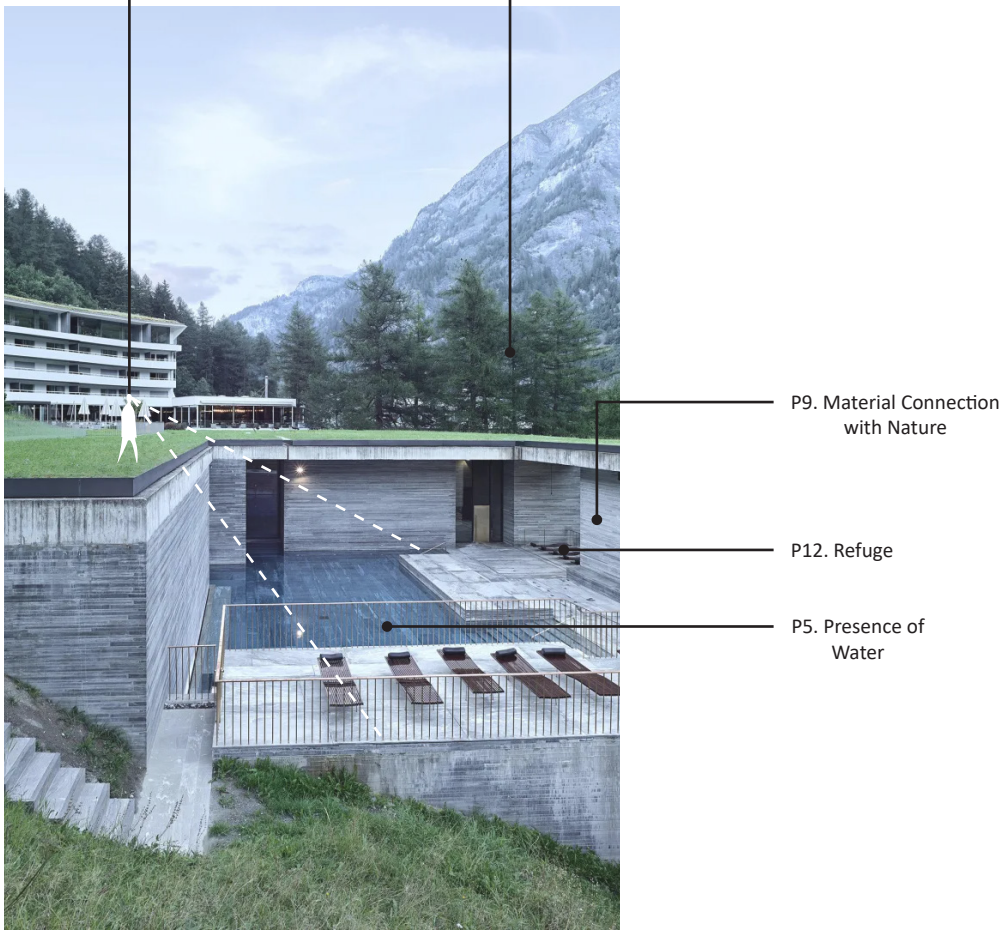


Figure 28. The Therme Vals

Heydar Aliyev Centre / Zaha Hadid Architects / 2012

The Heydar Aliyev Centre serves as a precedent for the application of Biomorphic Forms and Patterns in biophilic design, demonstrating how organic flowing curves can evoke the fluidity and complexity of natural forms such as waves and hills. This approach could inform the design of the proposed healthcare centre by encouraging the use of soft undulating geometries that reflect the surrounding terrain and support a deeper sensory connection to place.

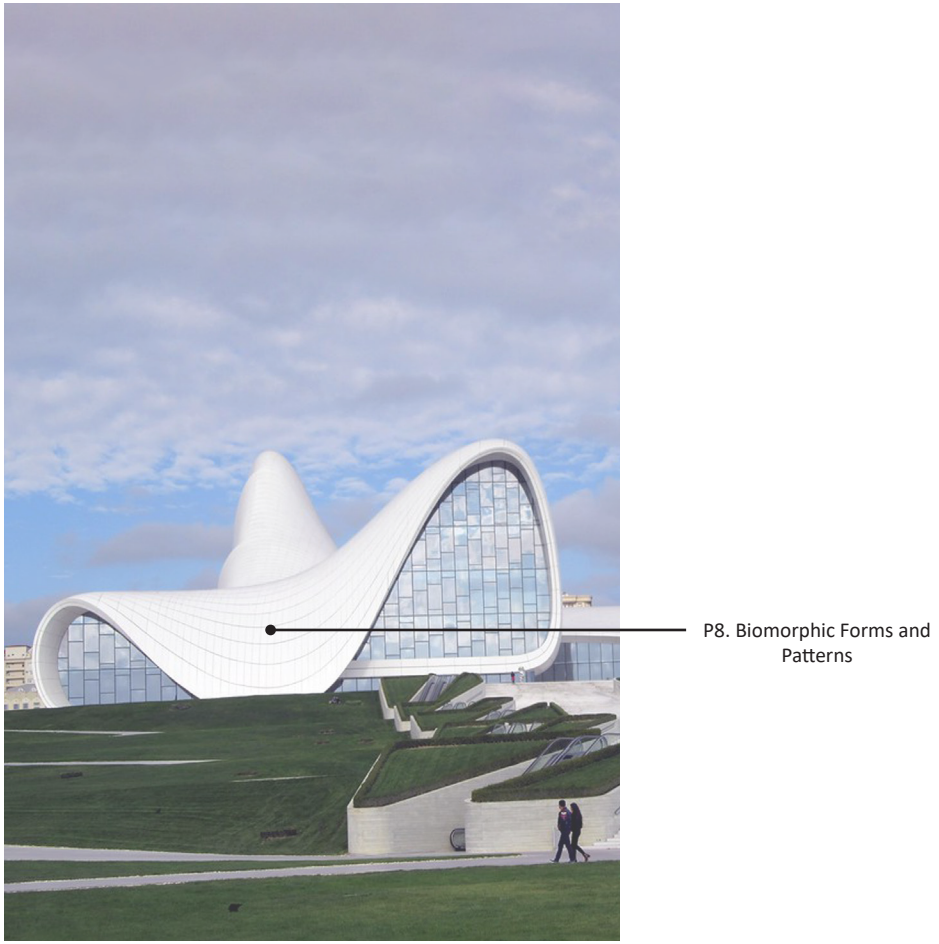


Figure 29. Heydar Aliyev Centre



Figure 30. Lakehouse Wendelstrand

5.1 MAGGIE'S YORKSHIRE

A PRECEDENT FOR HOLISTIC HEALTH

Maggie's Centres, founded by Maggie Keswick Jencks in the mid-1990s, are non-clinical cancer care facilities that provide free community support including counselling, stress reduction, nutrition advice and social connection. Designed by prominent architects, they depart from conventional healthcare aesthetics, offering welcoming homelike spaces that reduce anxiety and promote dignity (Maggie's, n.d.). The 2020 Yorkshire centre by Heatherwick Studio exemplifies these principles with human-scale architecture, natural materials, organic forms and integrated gardens, fostering calmness, emotional comfort and connection to nature (Heatherwick Studio, n.d.). This precedent demonstrates how spatial intimacy, social support, sensory richness and therapeutic aesthetics can help create healing environments.

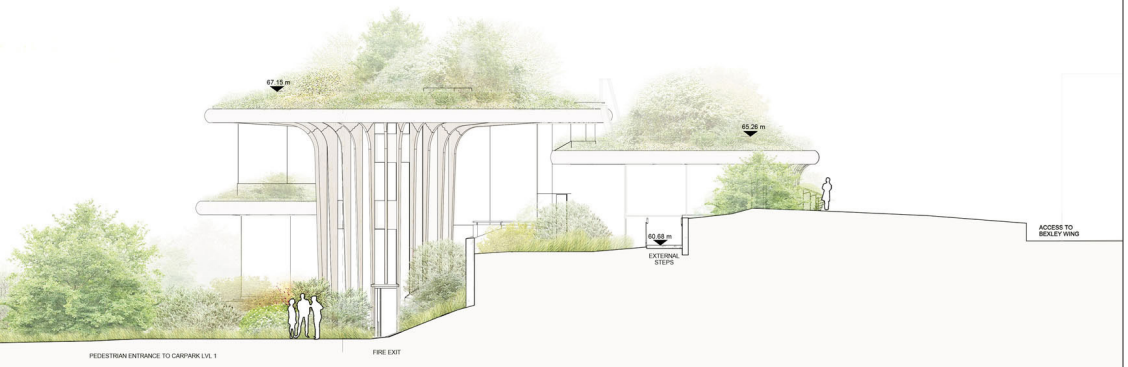






Figure 31. Maggie's Yorkshire

5.2 NGĀ WHARE WAATEA MARAE

A PRECEDENT FOR TE WHARE TAPA WHĀ

The Manukau Urban Māori Authority (MUMA) and Ngā Whare Waatea Marae exemplify a holistic kaupapa Māori model of urban wellbeing aligned with Te Whare Tapa Whā. Their integrated services span health, education, employment and cultural revitalisation - addressing taha tinana through clinics and food security, taha hinengaro through counselling and justice programmes, taha wairua through marae-based tikanga and karakia and taha whānau through early childhood and education initiatives (Durie, 1994; MUMA, n.d.). This precedent informs the design of a holistic healthcare facility that interweaves physical, mental, spiritual and whānau wellbeing. By embedding kaupapa Māori values spatially and programmatically, the design can foster community gathering, spiritual connection and integrated care that reflects the interconnected nature of wellbeing.



Figure 32. Ngā Whare Waatea Marae

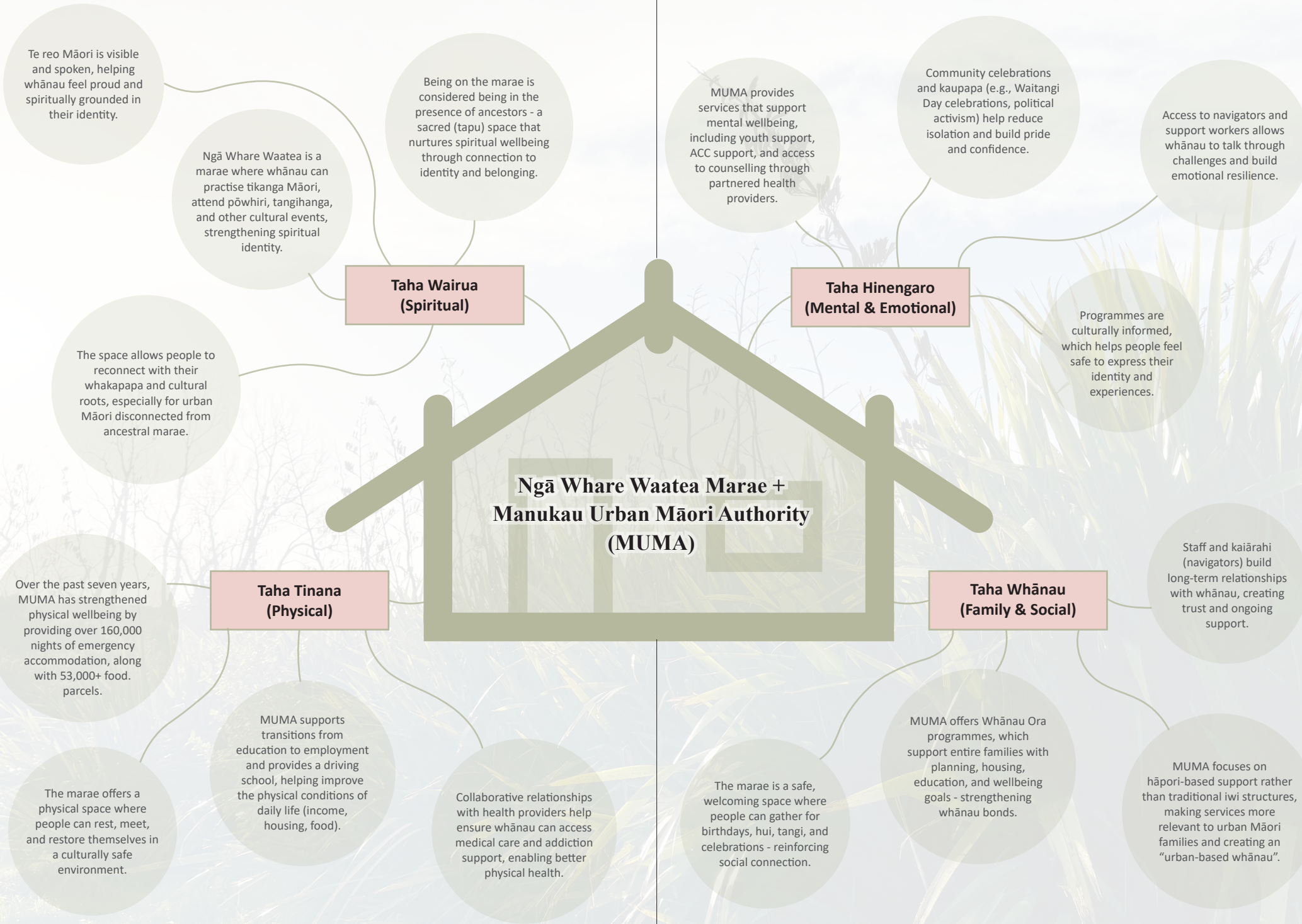


Figure 33. Ngā Whare Waatea Marae and MUMA Alignment with Te Whare Tapa Whā

5.3 ÓPERA DE ARAME

A PRECEDENT FOR QUARRY REVITALIZATION

The Ópera de Arame (Wire Opera House), located in Curitiba, Brazil, is a distinctive opera house and performing arts venue completed in 1992 within a rehabilitated rock quarry. Designed by architect Domingos Bongestabs, the structure features tubular steel and transparent polycarbonate, creating a lightweight open design that integrates seamlessly with its natural surroundings - including forested cliffs, water features and native vegetation (Ópera de Arame, n.d.).

This project exemplifies key principles of biophilic design, especially in the context of quarry remediation. The design embraces the quarry's existing geological and ecological characteristics, working to improve its ecology in a practical and achievable way. By incorporating natural elements such as native vegetation, water features and open-air circulation, the project re-establishes a sensory and psychological connection between people and nature (Ópera de Arame, n.d.). The transformation of a degraded industrial site into a vibrant public space highlights a central tenet of biophilic design: built environments can simultaneously promote human wellbeing and support ecological recovery (Kellert & Calabrese, 2015). In this case, the reintroduction of natural systems not only enhances biodiversity but also creates meaningful opportunities for community engagement within a previously damaged landscape.

This precedent is relevant as it establishes a central goal of reconnecting people with nature in a degraded environment. In this way, quarries present an ideal opportunity to restore nature where it is most needed.

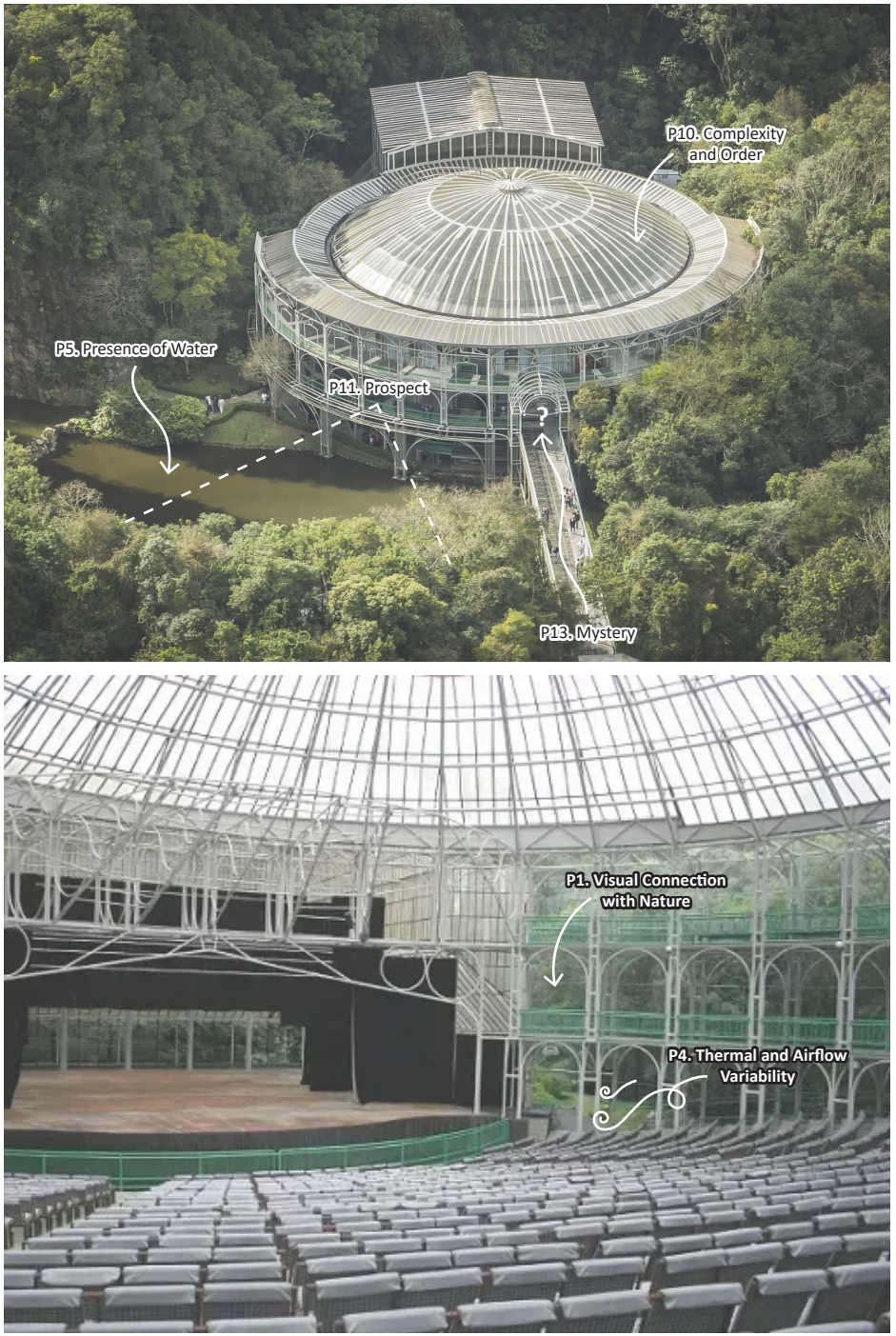


Figure 34. Ópera de Arame

5.4 THE PĀ, UNIVERSITY OF WAIKATO

A PRECEDENT FOR TE ARANGA MĀORI DESIGN PRINCIPLES

Designed by Jasmax and opened in 2023, The Pā at the University of Waikato serves as a bicultural gateway uniting a wharenui (ceremonial meeting house), Vice-Chancellor's Office, student hub and the Faculty of Māori and Indigenous Studies. Located on Karipūkau, once a native forest, the building features timber elements inspired by Māori design and narratives, including some of the longest glulam beams made in Aotearoa. Acting as the university's welcoming front door and cultural heart, The Pā celebrates inclusiveness, connection and bicultural identity (Jasmax, n.d.-c).

Importantly, The Pā exemplifies the Te Aranga design principles. As these principles guide this thesis project, it is valuable to see how they are enacted in a real-life scenario. Below is how the design aligns with each principle:

• **Manaakitanga:** The Pā is designed as a place of welcome and hospitality for students, staff and visitors, promoting inclusiveness and connection - a clear expression of manaakitanga.

• **Whanaungatanga:** Bringing multiple campus functions and communities together under one roof fosters relationships and connection, supporting whanaungatanga.

• **Kaitiakitanga / Taiao:** The project acknowledges the historic environment of Karipūkau's kahikatea and tawa forest and wetlands, using timber thoughtfully to reflect respect for guardianship and the natural environment.

• **Wairuatanga:** The wharenui as the central spiritual space reflects Māori cultural spirituality embedded in the architecture.

• **Rangatiratanga:** The presence of the Vice-Chancellor's Office and the Faculty of Māori and Indigenous Studies under one roof symbolises shared leadership and authority in the space.

• **Ahi Kā:** The Pā serves as a "front door" and academic heart, maintaining an ongoing presence of Māori culture and learning at the university.



Figure 35. The Pā, University of Waikato

PRECEDENT ANALYSIS CRITICAL REFLECTION

The precedents collectively illustrate the potential of integrating ecological, cultural and wellbeing frameworks into architecture. The biophilic design examples reveal the diverse ways these principles can be applied, often embodying qualities that are intuitively perceived as “good design” without occupants and designers consciously recognising their biophilic nature. The Manukau Urban Māori Authority (MUMA) and Ngā Whare Waatea Marae precedents are equally insightful, which demonstrate how community services can be thoughtfully structured to support holistic wellbeing. A limitation of this analysis is the challenge of identifying interventions that fully incorporate all 14 Patterns of Biophilic Design, highlighting the potential difficulty of integrating them comprehensively in this project. Similarly, precedents guided by Te Whare Tapa Whā can be challenging to analyse, as elements such as familial and spiritual health are not always explicit without programmatic information. Furthermore, some case studies offer limited information about the designer’s intentions, meaning that potentially relevant design insights may be overlooked. The next step in this research is site analysis, allowing insights from the precedents to be contextualised within a specific site.

CHAPTER 6: SITE ANALYSIS

This section introduces the site within the broader goal of advancing Auckland as a biophilic city. It explains the selection of the quarry by examining its ecological, cultural, demographic and physical conditions, while highlighting opportunities and constraints for its transformation into a restorative, community-focused environment.

6.0 Biophilic and Cultural Context

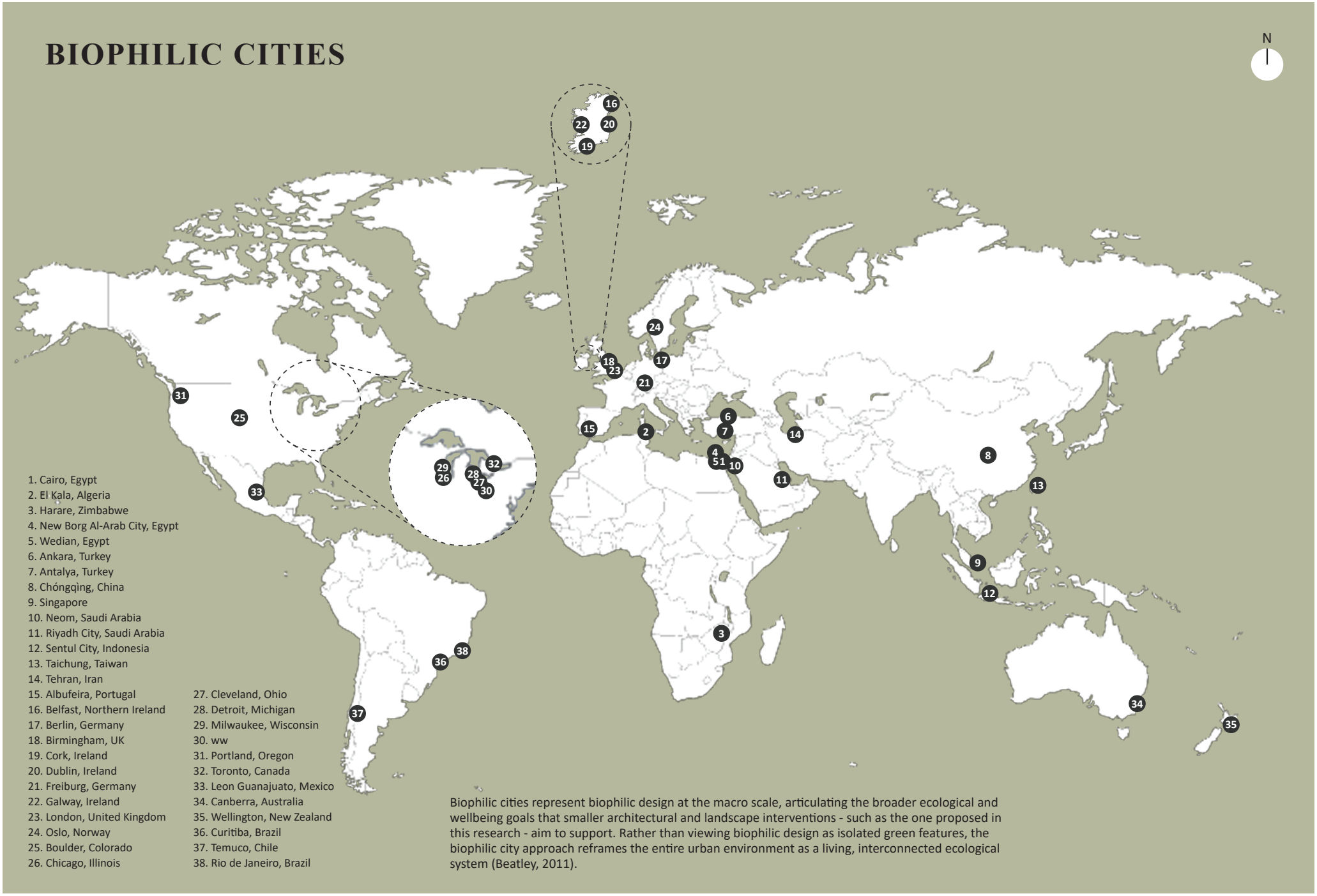


Figure 36. Global Network of Biophilic Cities

TOWARDS A BIOPHILIC AUCKLAND

Auckland has been selected as the area of investigation due to its accessibility for in-person site analysis and its untapped potential to become a biophilic city. As the largest and most urbanised city in New Zealand, Auckland faces challenges in maintaining strong connections to nature (Insch, 2018). In contrast, Wellington - the country's second largest city - has already been recognised as a Biophilic City (Pedersen Zari, 2019). This difference highlights a clear opportunity and need for biophilic interventions within Auckland's urban fabric. Even small-scale biophilic strategies can serve as catalysts for broader ecological and social transformation (Beatley, 2009). Therefore, the intervention proposed in this research seeks to contribute to the broader objectives of establishing a biophilic Auckland.



Figure 37. Geographic Position of Auckland

SITES NEEDING RESTORATION

In regenerative architecture, it is considered best practice to prioritise sites with the greatest ecological degradation. By doing so, architecture avoids imposing on intact natural habitats and further threatening biodiversity (Dumitrescu et al., 2023). Instead, it focuses on areas that require intervention and ecological repair. Degraded sites offer opportunities to reconnect people with nature by transforming damaged or neglected environments into places of restoration. For this reason, potential sites such as car parks and quarries were considered for development. Three main options were identified: Option One: Smales Quarry and Unused Adjacent Land, Option Two: Wilson Parking Northcroft Street, and Option Three: Wilson Parking Elliott Street.

Smales Quarry and the unused adjacent land were ultimately chosen as the most suitable site. Its ecological degradation means development will not displace intact habitats but instead enable restoration. The site's location beside Lake Pūpuke and its proximity to Killarney Park provide opportunities to strengthen biodiversity corridors. Its accessibility to surrounding neighbourhoods, schools, and transport also makes it well positioned to serve as a community hub for collective wellbeing. The quarry's varied terrain offers an ideal foundation for a distinctive architectural intervention that helps revitalise the land.



Figure 38. Potential Sites

EXISTING ECOLOGICAL CONDITIONS

Auckland supports a rich diversity of ecosystems; however, in central areas these ecosystems are often fragmented and degraded. The proposed biophilic intervention is strategically located near an existing ecologically significant area to leverage its natural and therapeutic benefits and enhance ecological connectivity in a part of the city where it is currently lacking. By linking nearby natural zones, the project contributes to progressively closing the gaps within Auckland's fragmented ecological network. Takapuna, with its proximity to key natural features such as Lake Pūpuke and coastal reserves, provides an ideal context to demonstrate how biophilic design can reconnect urban communities with nature.

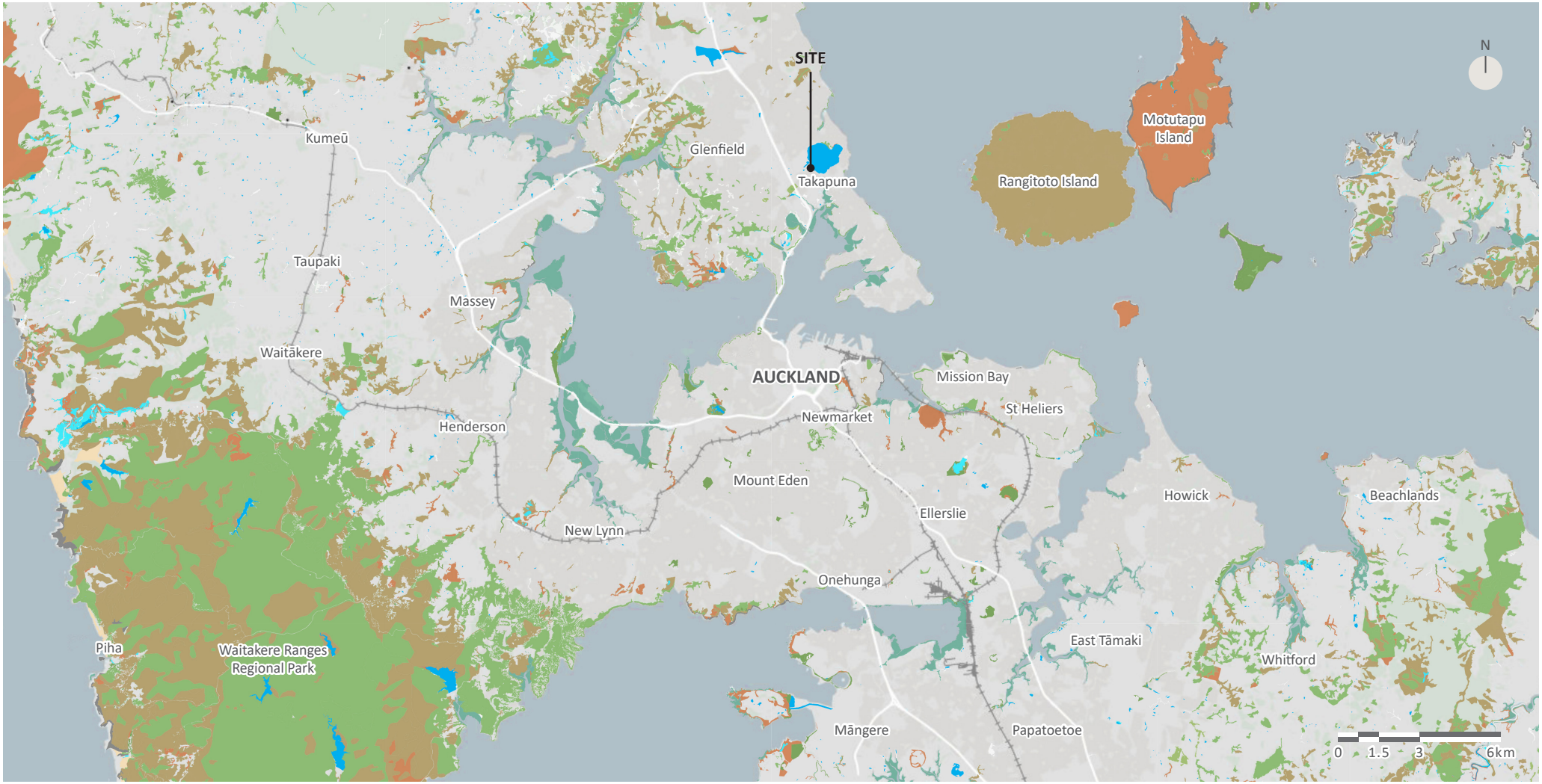


Figure 39. Auckland's Existing Ecosystems

SITE CONNECTION TO NATURAL FEATURES



Figure 40. Relationship Between Site and Natural Features

NATURE IN THE NORTH SHORE

The North Shore of Auckland features diverse natural elements, including volcanic formations like Lake Pūpuke, sandy beaches, intertidal zones, and ecologically significant estuaries and wetlands. These assets provide a foundation for biophilic design to enhance urban-nature connectivity. Access to green and blue spaces is often limited by private development, making the selected site - one of the few undeveloped plots around Lake Pūpuke - particularly valuable for inclusive public access. Nearby areas such as Takapuna Beach and Killarney Park frequently reach capacity, highlighting high demand for spaces connected to nature and opportunities for intentional biophilic interventions.

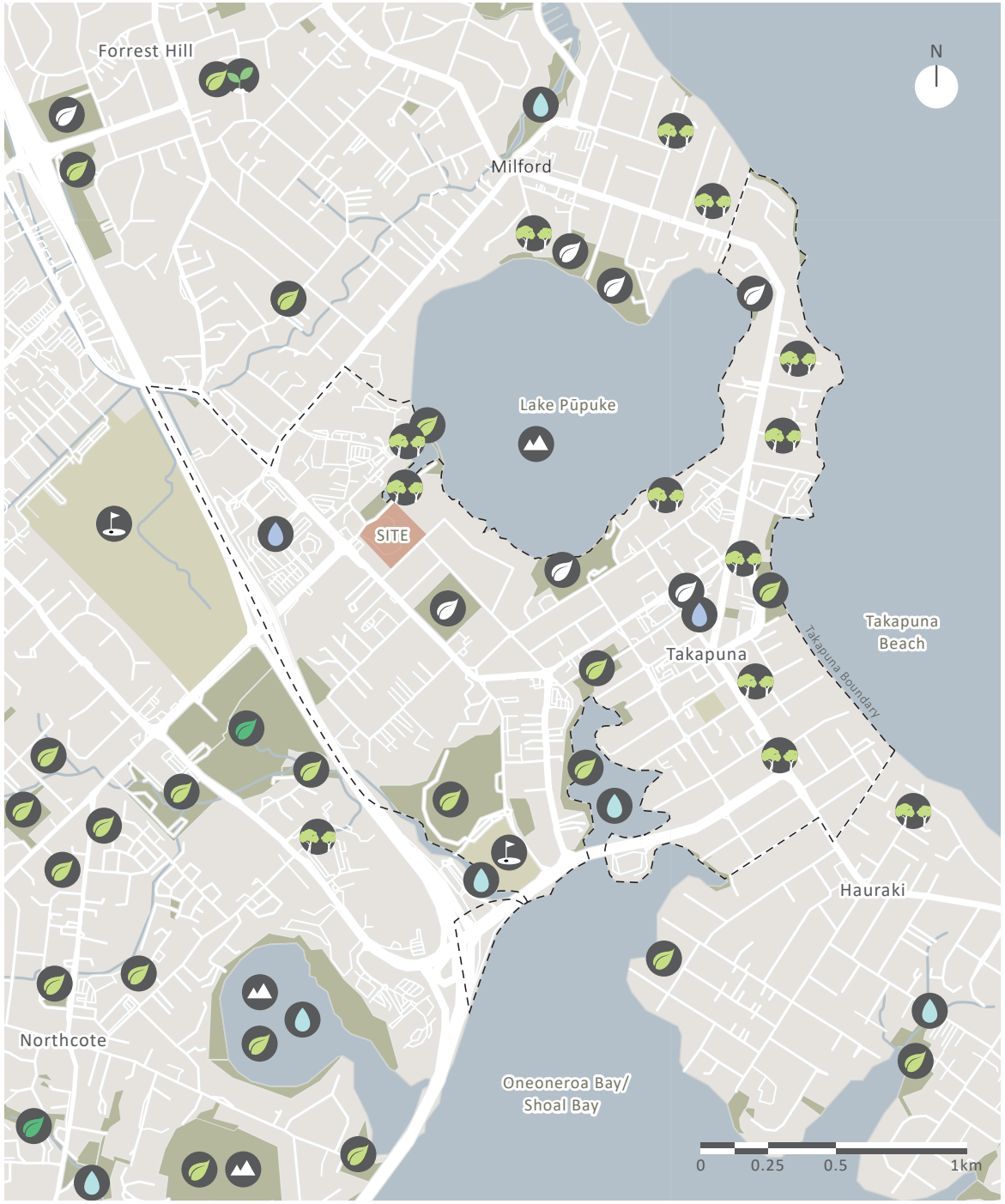


Figure 41. Biophilic Elements in the North Shore

NATURAL ELEMENTS IN TAKAPUNA

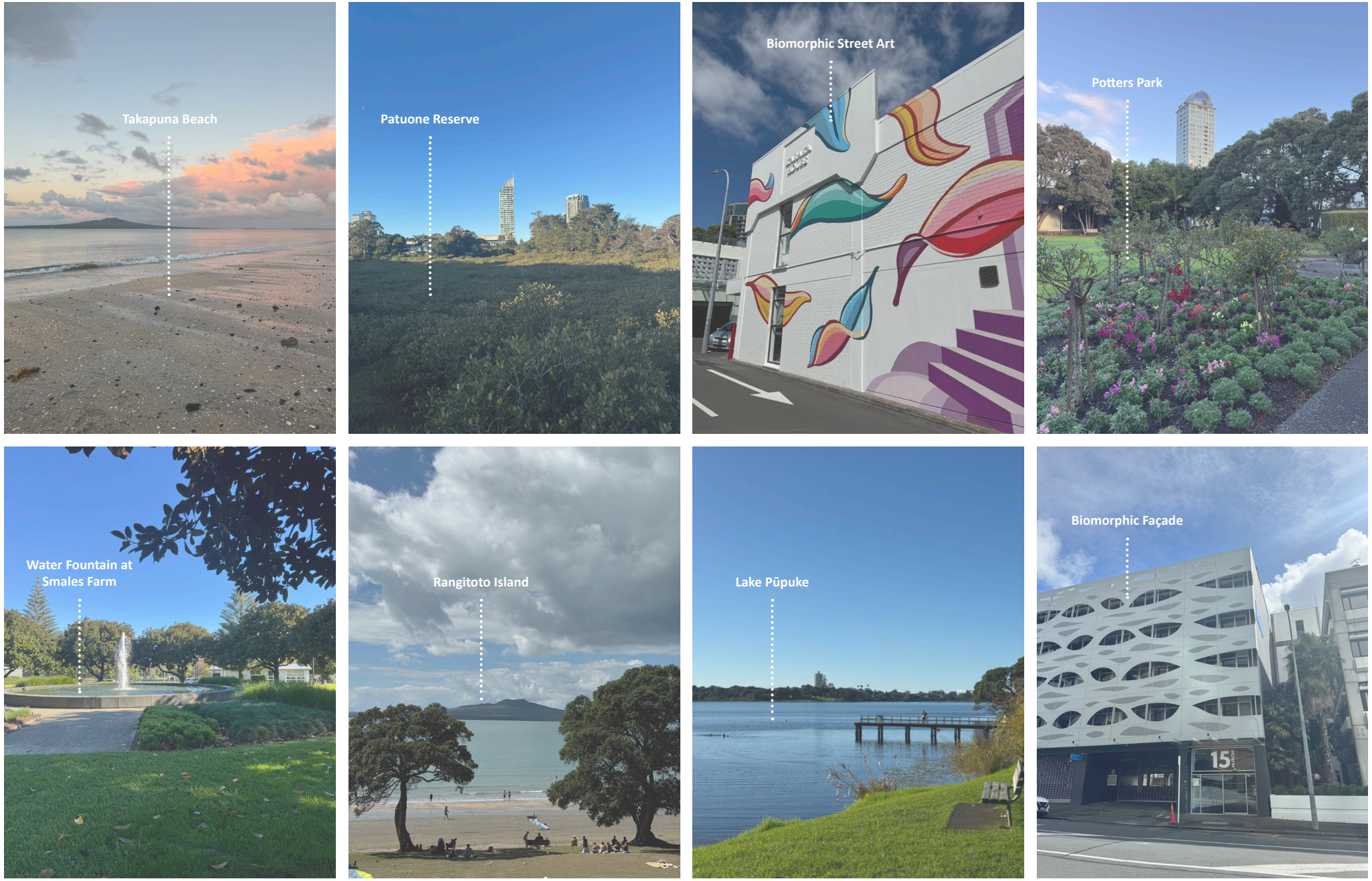
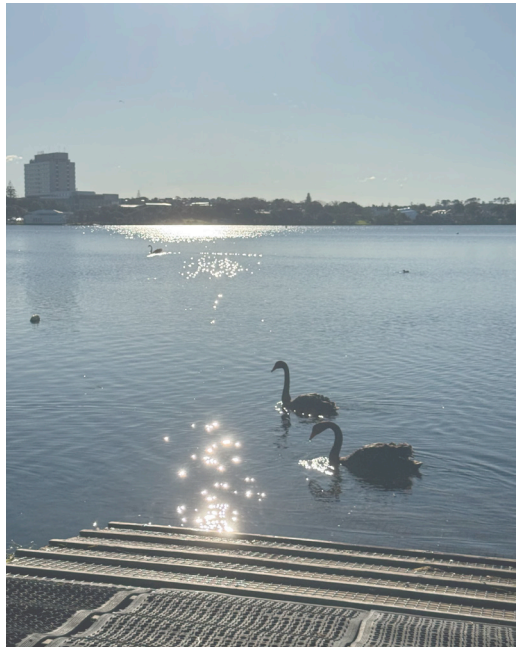


Figure 42. Collage of Takapuna's Natural Features

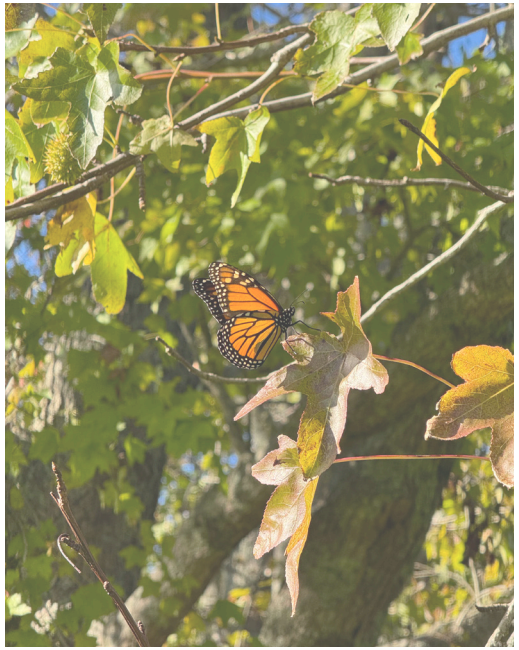
KILLARNEY PARK

Killarney Park is the closest and most significant outdoor public space immersed in nature near the proposed site. Located on the edge of Lake Pūpuke, just a short walking distance from the site, the park offers access to open green space and lake views. As the nearest outdoor community space, it provides an opportunity for the design to create a connection to this area to extend ecological connectivity.

Black Swans in Lake Pūpuke



Monarch Butterfly on Maple Tree



Seagull Resting on the Grass



The PumpHouse Theatre



Lake Pūpuke Wharf



Maple Tree



Figure 43. Killarney Park Collage

CREATING ECOLOGICAL CONNECTIONS

To strengthen the relationship between the site and Killarney Park, this project proposes transforming Lakeview Road into a pedestrian-prioritised shared street. Conceived as a slow, green corridor, the intervention softens the boundary between the built environment and parkland, fostering continuity between urban life and ecological systems. Vehicular access is limited to residents in a one-way, low-speed configuration, reducing traffic and enhancing safety. Beyond functioning as a physical connector, the street acts as a social and ecological threshold, encouraging engagement with nature beyond the site and embodying principles of biophilic design.



Figure 44. Lakeview Road Reimagined

CULTIVATING THE LIVING EDGE

Edges are critical in ecology, serving as transitional zones where ecosystems interact. Known as ecotones, these areas often support higher biodiversity due to the overlap of species from adjacent habitats (Forman & Godron, 1986). In urban settings, rewilding the boundaries between built and natural environments can restore ecological function, enhance habitat connectivity and strengthen ecosystem resilience (Benedict & McMahon, 2006). In this project, street edges are revitalised with native vegetation, focusing on nectar-rich species such as kōwhai (Sophora spp.) and harakeke (Phormium tenax) to attract keystone birds like the tūī, which support pollination and indicate ecosystem health (Payton et al., 2002). This planting enriches the sensory experience for pedestrians and cyclists (Mendes et al., 2024). Permeable pavements and green spaces aid stormwater absorption, reduce surface runoff and support the long-term vitality of plantings (Cai et al., 2024; Zimmermann et al., 2016). Street trees also enhance social and health outcomes for urban residents, with research showing they improve perceived wellbeing more than private gardens (Kardan et al., 2015). The redesigned street forms a connective threshold to Killarney Park, facilitating wildlife movement and human interaction with nature and fostering ecological continuity.

Lake View Road Before



Observations:

-High volume of vehicle parking

-Narrow pedestrian footpaths

-Limited provision of shade

-Absence of public seating

-Minimal pedestrian activity

-Predominantly impervious paving materials

Figure 45. Lakeview Road Current Conditions

Lake View Road After



Figure 46. Lakeview Road Transformed

FROM EXTRACTION TO RESTORATION

This proposal presents an initial vision for regenerating Smales Quarry's landscape, focusing on ecological restoration before architectural intervention. The site is imagined as a living system, where native plantings and a pond restore natural processes, support wildlife and enhance biodiversity. The approach emphasises immersive biophilic experiences - visual and sensory connections to greenery and water (Browning et al., 2014) - while honouring Indigenous knowledge through Te Aranga Māori principles of taiao and kaitiakitanga, fostering stewardship and cultural connection.



Figure 47. Smales Quarry Reimagined, Not To Scale

CULTURAL CONTEXT

The site lies within the rohe (territory) of multiple iwi (tribes) and hapū (sub-tribes), including Ngāti Whātua, Ngāti Whātua Ōrākei, Te Kawerau ā Maki, Ngāti Tamaoho, Te Ākitai Waiohua, Ngāti Maru, Te Patukirikiri, Ngāti Pāoa, Ngāti Tamaterā, Ngāi Tai ki Tāmaki, Ngāti Whanaunga, and Ngāti Te Ata (Te Puni Kōkiri, n.d.). The site does not fall under Land Subject to RFR, Cultural Redress Land, Commercial Redress Land, or Te Kete Rukuruku dedicated land. However, its location opposite a significant section of Land Subject to RFR in the North Shore Hospital area, combined with its close proximity to marae, highlights the site's strategic position within a network of culturally significant land parcels. The proposed development could contribute to this network, enhancing culturally informed design in the North Shore.

KEY

Site

Marae

Land Subject to RFR
Land subject to RFR is Crown-owned land in Tāmaki Makaurau that must first be offered to iwi and hapū before it can be sold or disposed of.

Cultural Redress Land
Cultural redress land is land returned to iwi or hapū through Treaty settlements to restore cultural, spiritual, or historical connections, rather than for economic purposes.

Commercial Redress Land
Commercial redress land is land, cash, or assets provided to iwi or hapū through Treaty settlements to support economic development and financial sustainability.

Te Kete Rukuruku
Te Kete Rukuruku is a programme that records and preserves Māori place names and their associated histories, supporting cultural knowledge and identity.

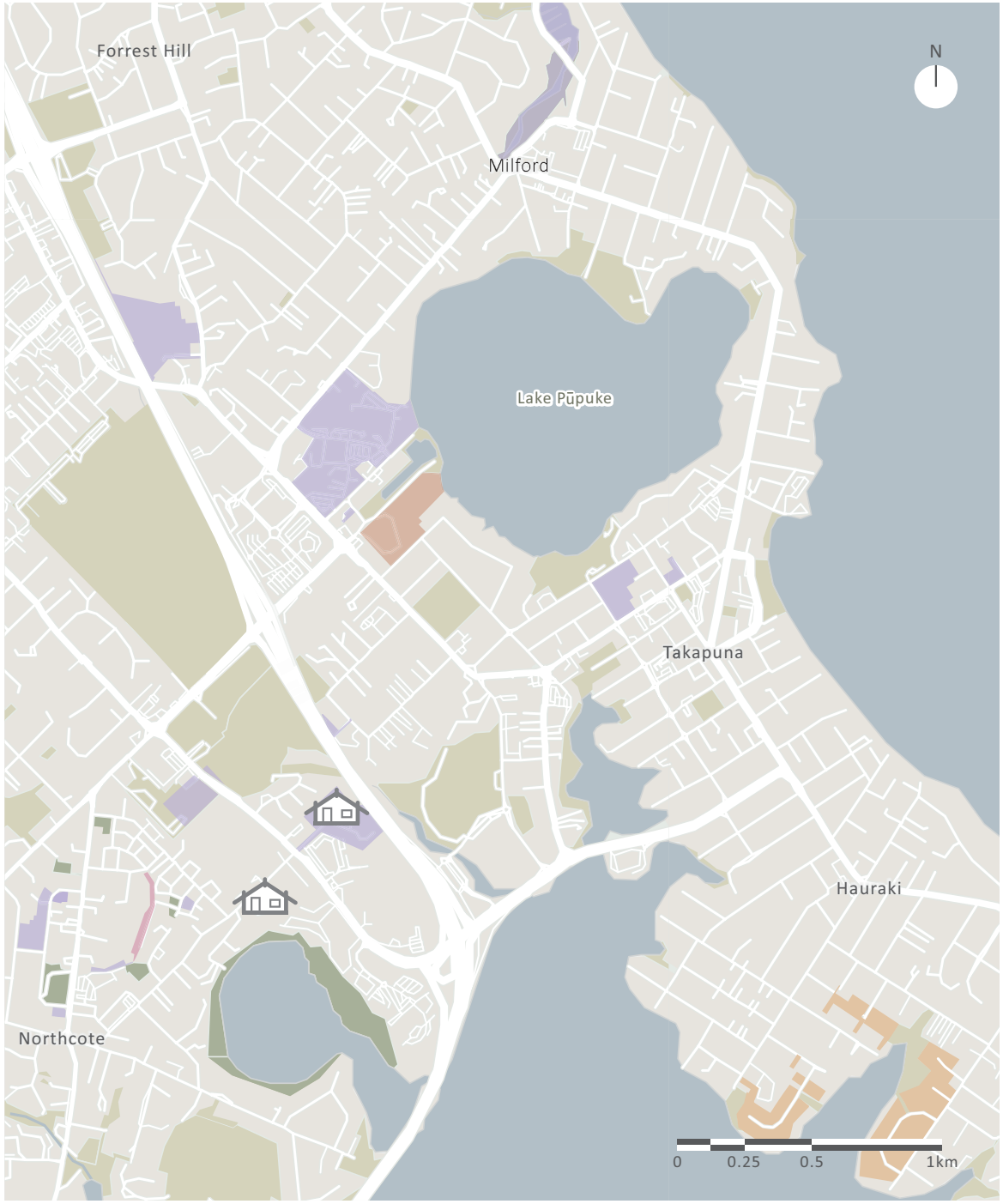


Figure 48 Cultural Context

6.1 Site Context & History

MĀORI NARRATIVES OF THE SITE

It is important to acknowledge the history of the site from its Māori origins rather than beginning the narrative solely at the point of European settlement. Mātauranga Māori offers valuable perspectives on the landscape, including a narrative associated with the formation of Lake Pūpuke, located adjacent to the site.

A narrative from Ngāi Tai ki Tāmaki (Māori iwi of Tāmaki Makaurau / Auckland) describes the origins of Lake Pūpuke and Rangitoto Island. The narrative is associated with the pūrākau (traditional story or narrative) of the tipua (supernatural beings) couple Matakamokamo and Matakerepo, alongside the atua (deities) Mahuika and Mataaho. Following a dispute between the couple over a woven garment, their fire went out and could not be rekindled, leading Matakamokamo to curse Mahuika. In response, Mahuika called upon Mataaho to release volcanic forces. The land at Te Rua Maunga, where the couple lived, collapsed beneath the earth, forming Pūpuke Moana (Lake Pūpuke), while Rangitoto Island rose from the sea as the couple fled. Upon their return, they were again confronted by Mataaho's force and were ultimately turned to stone, their ancestral presence becoming embedded within the surrounding landscape and linked to nearby coastal features (Ngāi Tai ki Tāmaki, n.d.; Nunn, 2019).

Understanding the site through this lens shifts it from being seen as neutral or purely physical to one that is culturally layered and interconnected. Rather than simply a volcanic feature, the narrative presents the site as a living cultural landscape shaped by atua, conflict and transformation, where the land reflects the consequences of these events. This suggests an opportunity for the design to move beyond function and recognise the land as a site of ancestral presence. The transformation of the couple into stone and the formation of the lake through collapse emphasise the significance of the land's existing form, supporting design approaches that minimise intervention and work with, rather than alter, the terrain. This also highlights the importance of engaging with mana whenua in shaping how these narratives are expressed in design. At this stage, the narrative acts as a guiding layer with the potential to shape more culturally responsive and meaningful design outcomes as the project develops.



Figure 49. Lake Pūpuke Today

SITE HISTORY 1959-2025

In 1928, William Henry (Bill) Smale inherited a quarry at Northcote and Taharoto Roads from his father-in-law, Henry Hopper Adams (Smales Farm, n.d.). The quarry, which extracted scoria and basalt, later operated briefly as a concrete recycling facility before closing in the 2010s due to health concerns (Cadacio & Watson, 2010). Subsequent land development initiatives, including the Smales Quarry Reclamation Project, prepared the site for property development (Rebbeck Dunn Watters, 2020), but financial and logistical challenges - such as nearby office projects and the Vodafone building refurbishment - delayed progress (Collins, 2016). As of 2025, the site remains largely undeveloped, overgrown, and underutilised, despite its strategic location, presenting an opportunity for this project.

1959



2001



2006



2008



2017



2025



Figure 50. Site Over Time

DEMOGRAPHICS

Understanding demographic data is essential to ensure the design meets local community needs. Information on age, ethnicity, income, and disability will guide inclusive, accessible, and culturally relevant spaces. Age data supports multi-generational areas, ethnicity informs cultural relevance, and income influences affordability. Grounding the design in these insights ensures it is tailored to the community.

According to census boundaries, the site falls within the Takapuna West area.

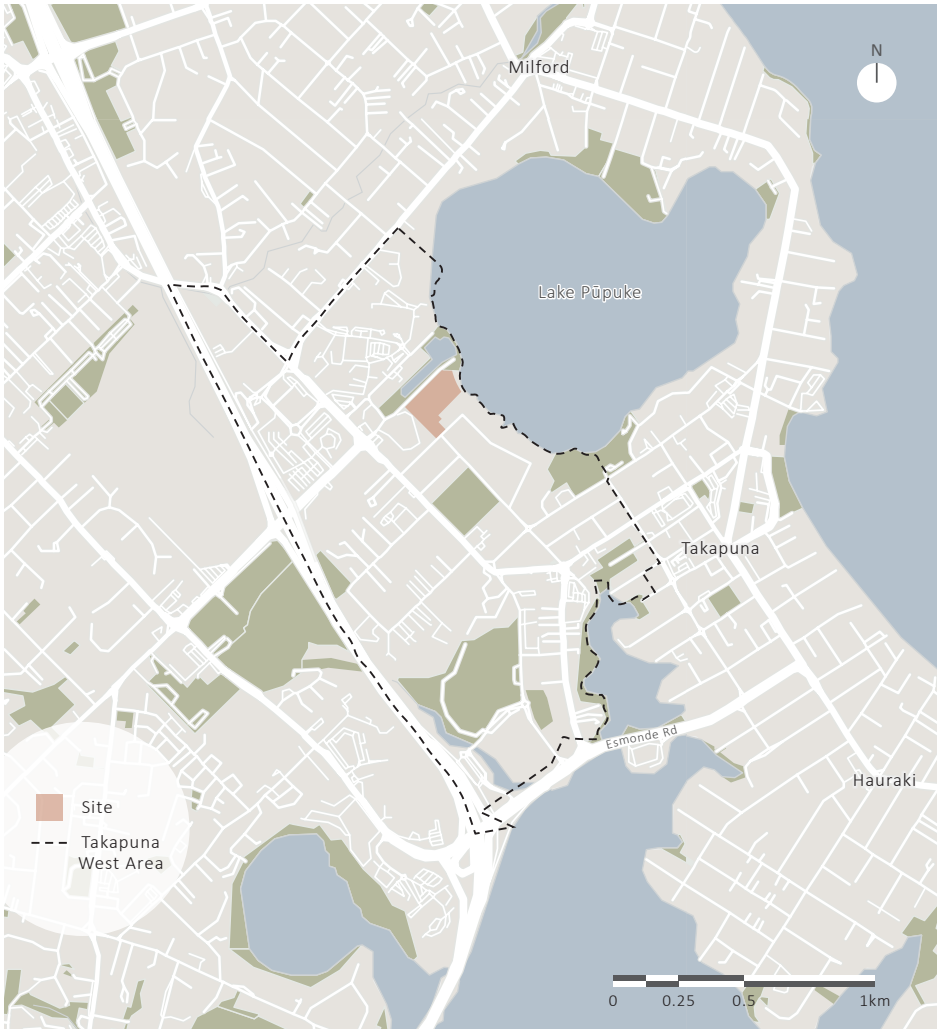


Figure 51. Takapuna West Area

Takapuna West Statistics (2018 Census)

Number of people: 4,509

Median age: 39.2 years

Females: 2,397

Males: 2,109

Number of Maori: 189

Born in New Zealand: 49.7%

Born overseas: 50.4%

Table 7 Ethnic groups for people in Takapuna West and Auckland Region

Category	Takapuna West (%)	Auckland Region (%)
European	63	53.5
Māori	4.2	11.5
Pacific peoples	2.2	15.5
Asian	31.6	28.2
Middle Eastern, Latin American, African	4.4	2.3
Other ethnicity	0.9	1.1

Table 8 Age and Sex of people in Takapuna West

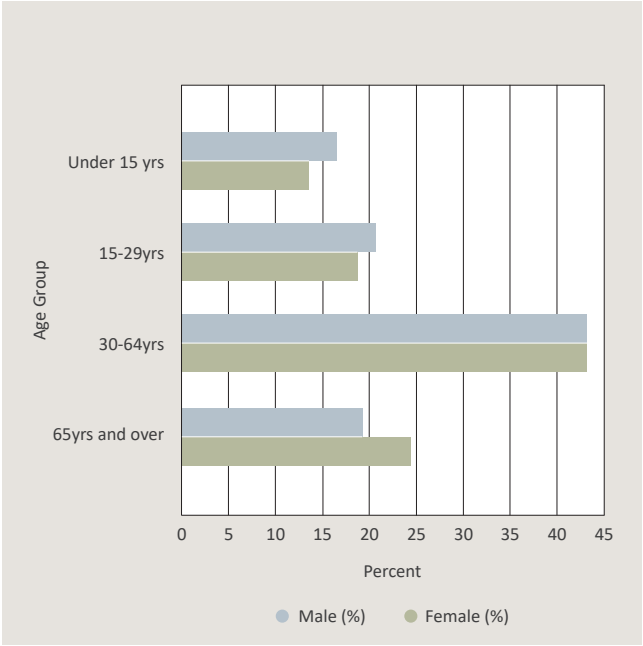


Table 9 Total personal income for people in Takapuna West and Auckland Region



The demographic profile of Takapuna highlights the need for inclusive, community-focused healthcare infrastructure. Over half the population (50.4%) was born overseas, with a significant Asian population (31.6%) alongside Pākehā (68.3%), and smaller proportions of Māori (4.2%) and Pacific peoples (2.6%) (Stats NZ, 2018). While Māori representation locally is limited, healthcare in Tāmaki Makaurau operates across both local and regional scales, with many services accessed beyond the immediate suburb. As such, Māori communities remain relevant users of the proposed facility, particularly where access to culturally responsive health-care environments remains variable.

In this context, Māori health frameworks such as Te Whare Tapa Whā are positioned as holistic models of wellbeing that support Māori users while also benefiting a diverse urban population. This approach aligns with Te Tiriti o Waitangi by embedding bicultural values within a multicultural setting and promoting culturally safe environments. The balanced age distribution (17.2% over 65 and 17.4% under 15) supports the need for an intergenerational facility, while the limited provision of shared public infrastructure reinforces the role of the healthcare centre as a community anchor. Together, these conditions frame the project as an opportunity to foster wellbeing, belonging, and cultural inclusion through architecture.

UNITARY PLAN ZONES +

Surrounding Built Environment

KEY

- Schools
- Churches
- Recreation Centres
- Business - Metropolitan Centre Zone
- Business - Business Park Zone
- Business - Light Industry Zone
- Business - Mixed Use Zone
- Residential - Mixed Housing Suburban Zone
- Residential - Mixed Housing Urban Zone
- Residential - Single House Zone
- Residential - Terrace Housing and Apartment Buildings Zone
- Special Purpose Zone
- Open Space - Sport and Active Recreati on Zone
- Open Space - Conservation Zone
- Open Space - Informal Recreation Zone
- Strategic Transport Corridor Zone

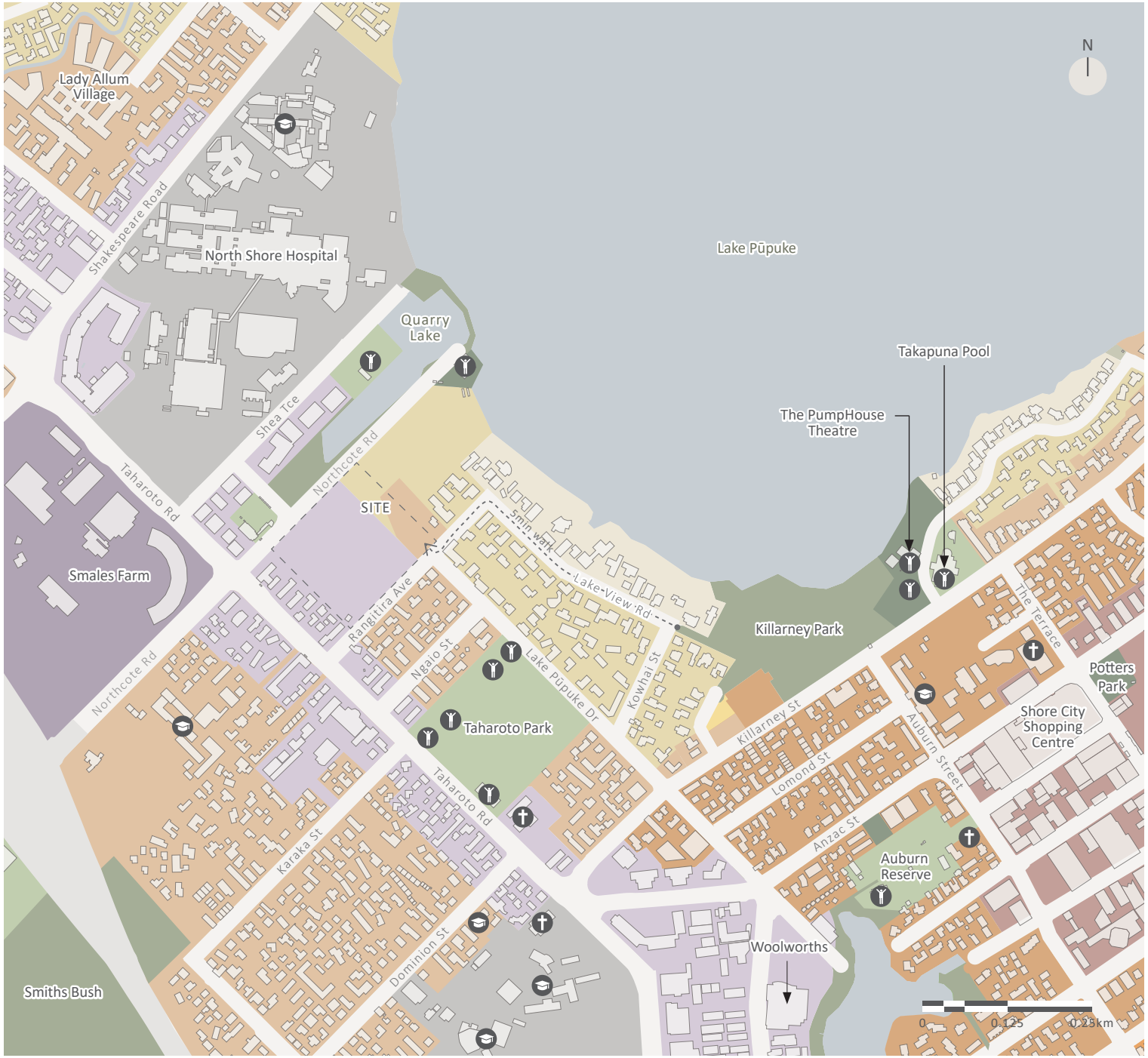


Figure 52. Urban Context

SURROUNDING BUILDINGS

Analysis indicates that the proposed health centre will be situated among other healthcare buildings. This proximity is advantageous, as it suggests that the public is already accustomed to visiting the area for health-related services. Furthermore, the presence of Shore Junction Community Centre opposite the site demonstrates an existing layer of community programming within the locality. By integrating both health and community functions, the programme aligns with the surrounding context while simultaneously diverging from conventional healthcare models to cultivate community engagement within a health-oriented framework.

- Healthcare
- One New Zealand
- Takapuna Normal Intermediate
- Shore Junction Community Centre
- Petrol Stations
- Sports Clubs

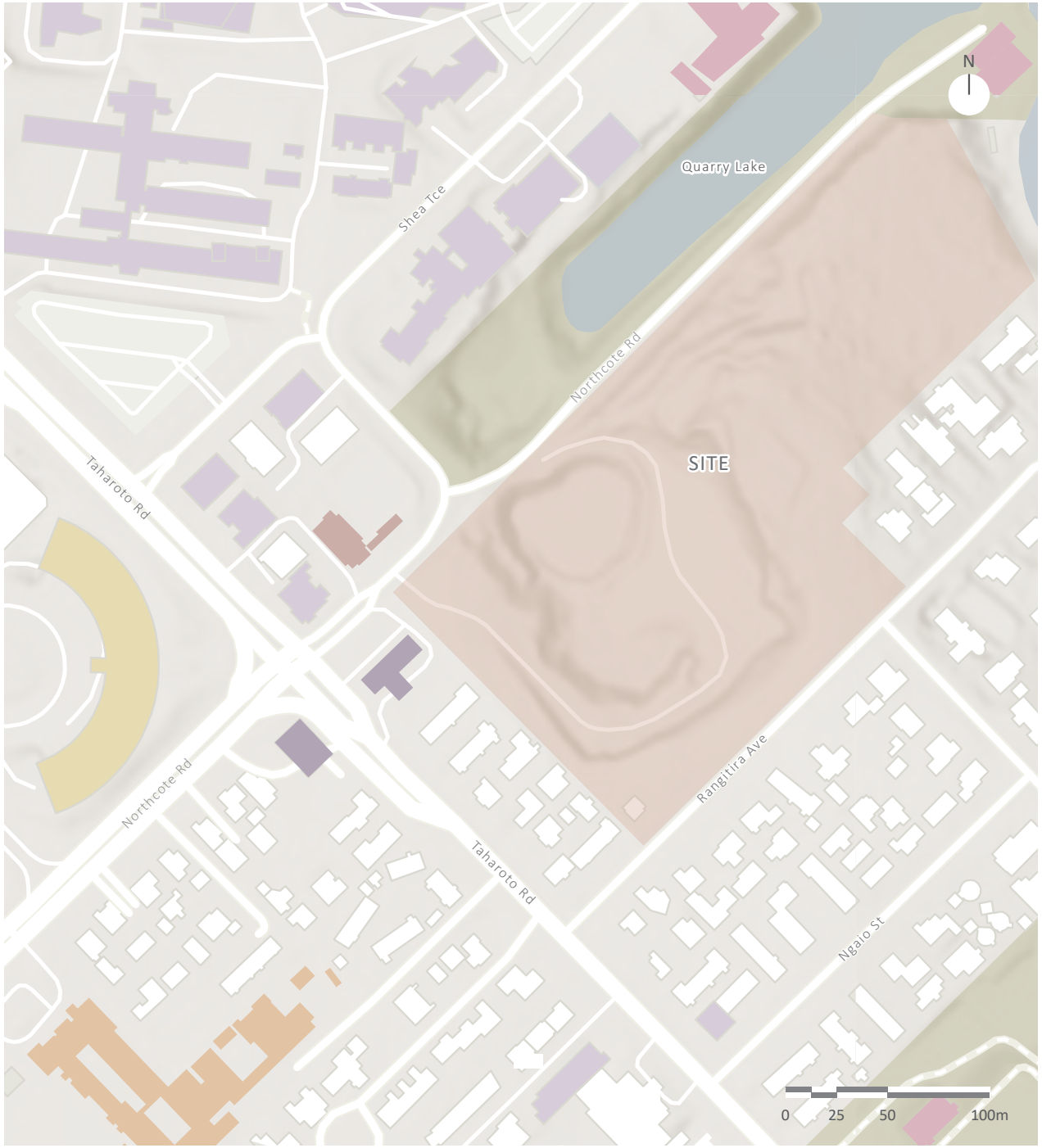


Figure 53. Immediate Built Context

BRIDGING HEALTHCARE & RESIDENTIAL

The site is strategically positioned between North Shore Hospital and an adjacent residential neighbourhood. This location offers the opportunity to establish a transitional space that bridges the institutional realm of healthcare with the familiarity and comfort of home. The project aims to develop a preventative, community-based holistic health centre that promotes wellbeing, belonging, and early intervention, functioning as a gentle threshold between clinical care and everyday living. Rather than maintaining a separation between treatment and daily life, the proposal seeks to embed care within the fabric of the community.

Healthcare

Site

Residential

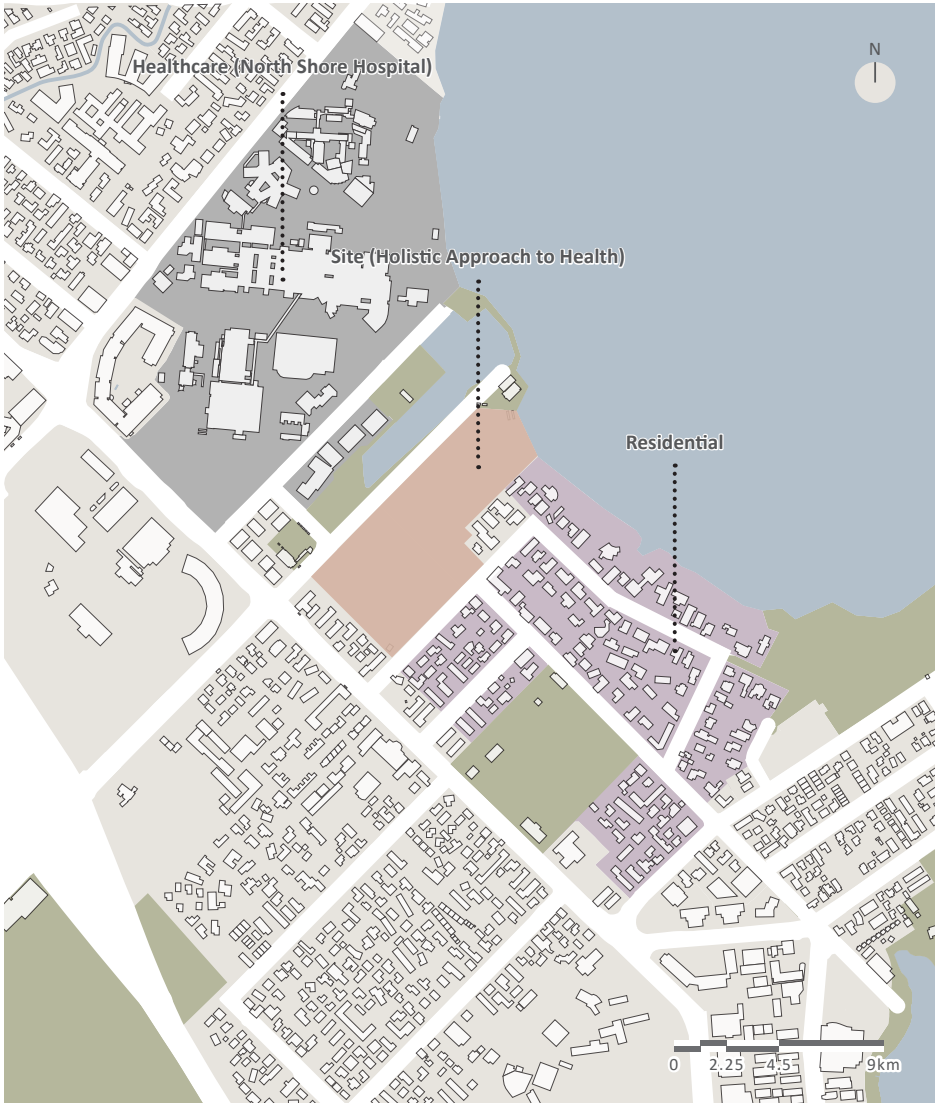


Figure 54. Transitional Spaces of Wellbeing

6.2 Existing Ecological Conditions

CONTOURS

The site's contours strongly influence its design potential and support an environmentally responsive architectural approach. The quarry forms a land depression that rises and tapers toward Lake Pūpuke, creating a sloped terrain ideal for terraced or multi-level structures that step with the land. This approach enables cascading interior volumes, split levels, and outdoor platforms that strengthen the relationship between built and natural environments (Supritha et al., 2023). Within the quarry depression, the irregular contours favour elevated structures that touch lightly on the land, minimising excavation and land modification while aligning with sustainable construction practices (Youssef, 2020).

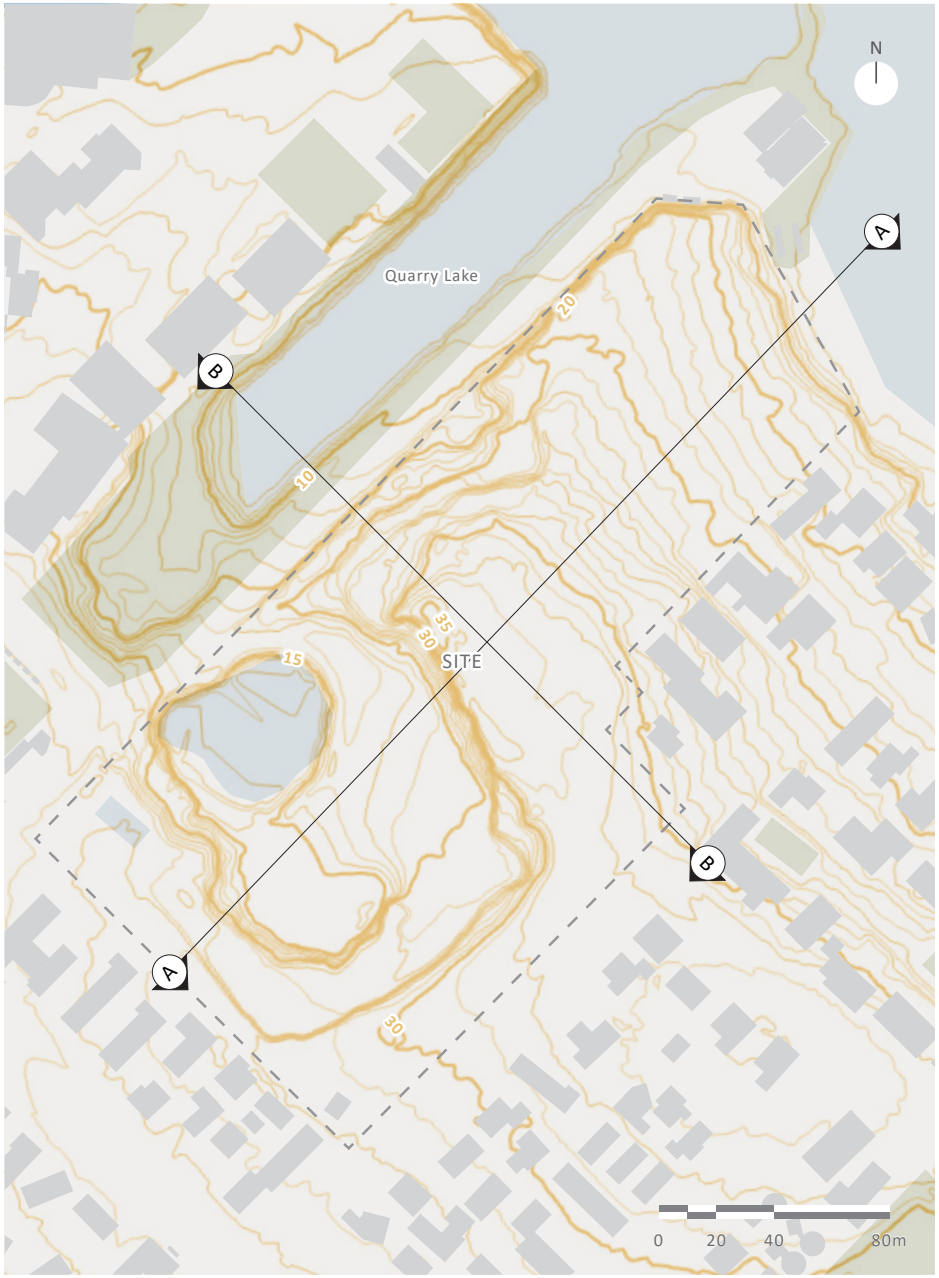


Figure 55. Site Contours

SITE SECTIONS

The longitudinal section reveals a dip where the quarry lies, before the land rises again and then forms a gradual slope descending toward Lake Pūpuke, while the cross-section illustrates a gradient leading down to Quarry Lake.

SECTION A (longitudinal section)

SECTION B (cross section)

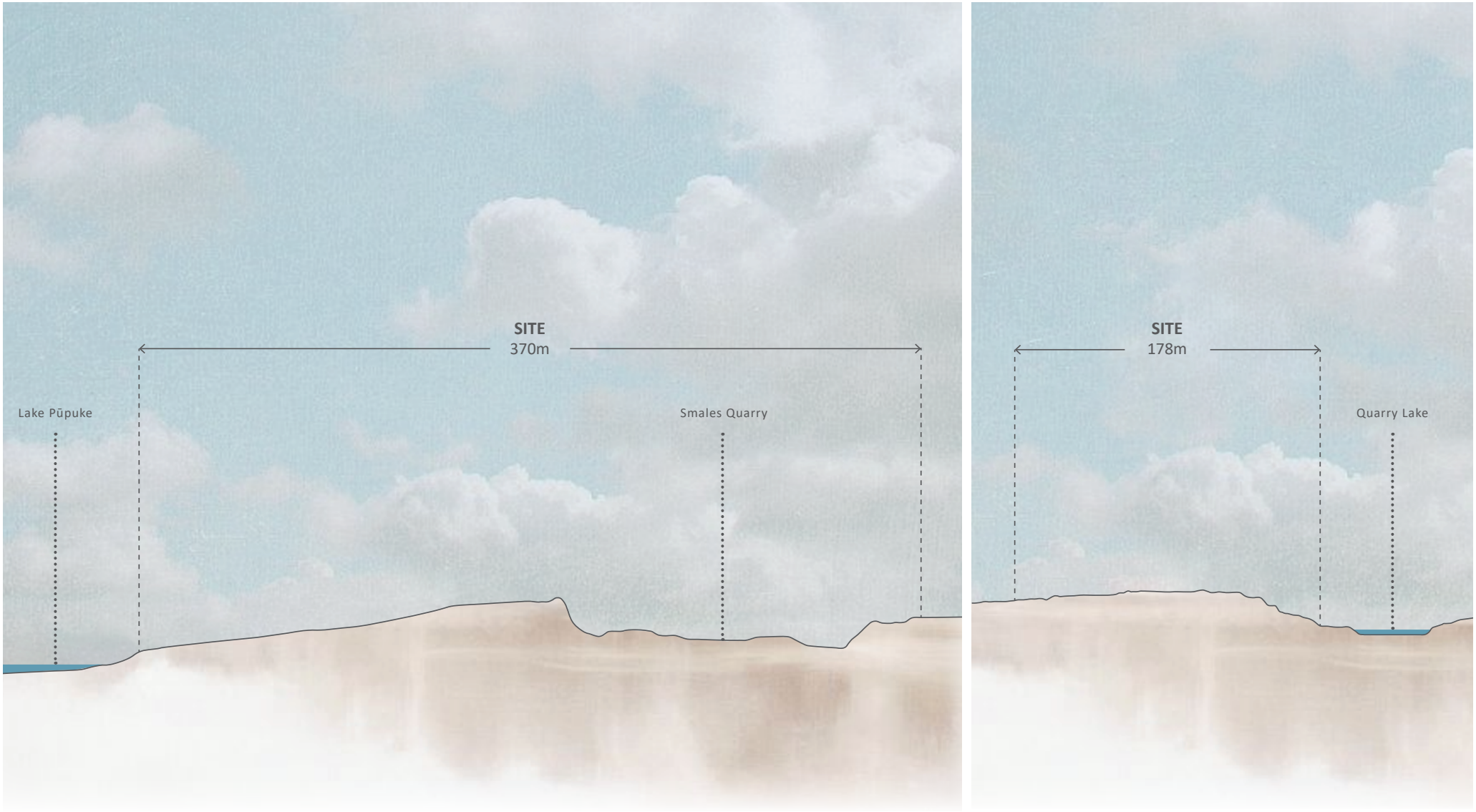


Figure 56. Sections A and B

HYDROLOGY

Hydrological analysis identifies the quarry depression as a flood-prone area, making it unsuitable for built structures to be placed directly within this basin. Filling the depression would require a substantial volume of material from external sources, raising concerns about sustainability. A more environmentally responsive approach would be to work with the existing topography by elevating the architecture, designing around the lowest areas, or repurposing the depression as a permanent pond. Such a feature could contribute to the presence of water - a recognised pattern within Terrapin Bright Green's biophilic design framework. Overland flow paths across the site further shape design considerations, as they channel stormwater during heavy rainfall. These paths should be integrated into the design through measures such as permeable paving, elevated floor levels, flood-resilient landscaping, and green infrastructure like bioswales to manage runoff (Kirkby, 1969; Rotimi et al., 2025). With thoughtful planning, the site's hydrological conditions can be leveraged to support a resilient and sustainable design.

Overland flow paths 100ha and above

Overland flow paths 1ha to 3ha and above

Overland flow paths 4000m2 to 1ha

Overland flow paths 2000m to 4000m2

Stormwater Catchments

Flood plains

Flood prone areas



Figure 57. Site Hydrology

CONSIDERATIONS OF WATER LEVELS

With the potential development of a pond on site comes the risk of fluctuating water levels and possible flooding of nearby architecture. To address this, the design incorporates a stormwater management system that directs excess rainwater through a drainage channel into Quarry Lake, whose greater capacity can safely accommodate overflow during periods of heavy rainfall. Complementary measures - such as permeable paving, riparian planting, and areas of bush - are also integrated to slow runoff and reduce pressure on the system. Together, these strategies help ensure that the building and its surrounding landscape remain resilient to changing water conditions.

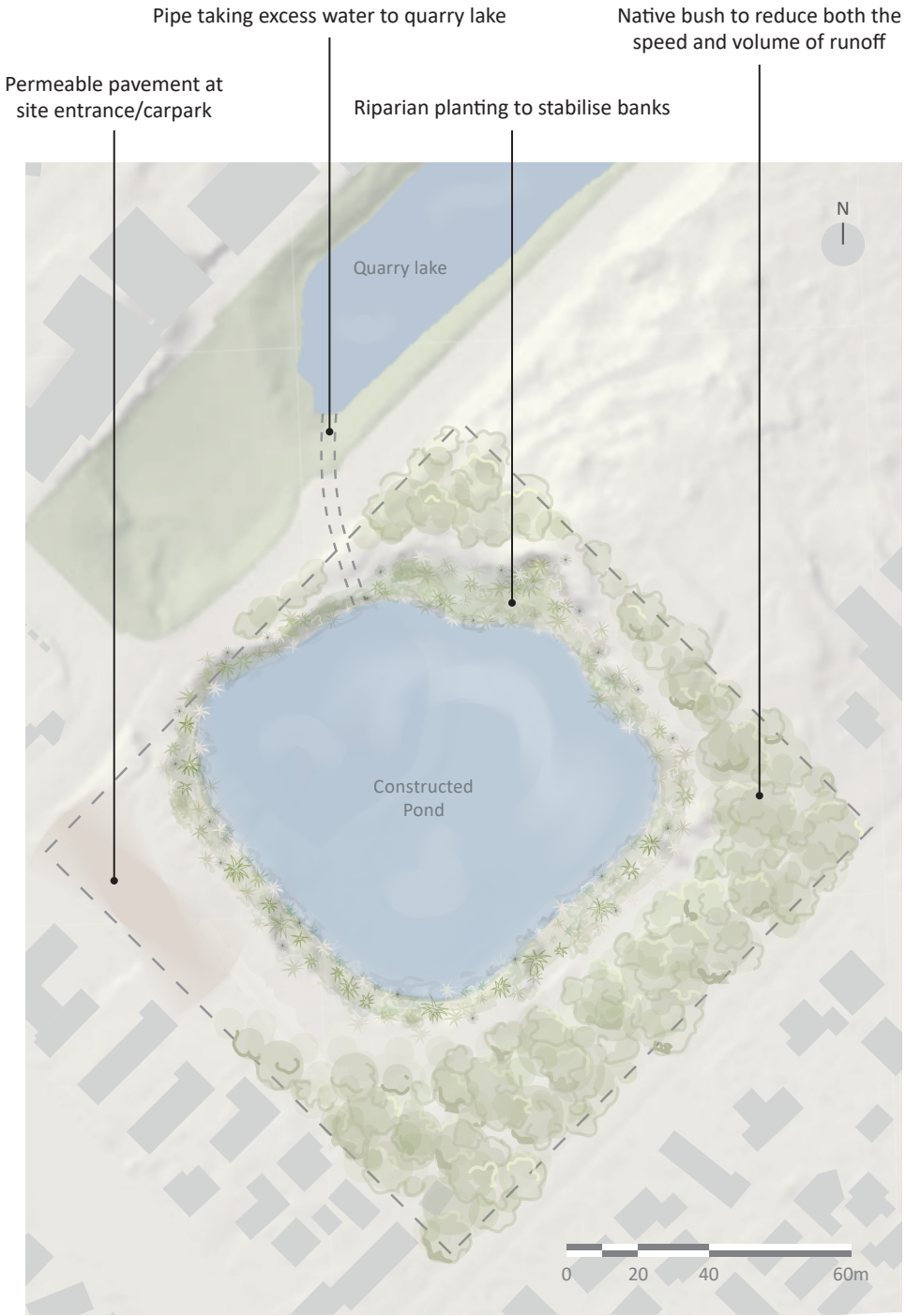


Figure 58. Site Hydrological Management Strategies

SUN PATH

This solar analysis directly informs the project's design strategies, shaping decisions about building orientation, window placement, and shading to optimise occupant comfort and energy performance. By aligning key spaces - such as whānau areas - to the north and northeast, the design maximises winter sunlight for passive heating while controlling summer heat gain, creating naturally lit, thermally comfortable environments. These strategies reduce dependence on artificial lighting and mechanical systems, supporting both environmental sustainability and the wellbeing of occupants. Overall, integrating solar orientation into the design ensures that the project delivers functional, comfortable, and health-promoting spaces aligned with biophilic principles.

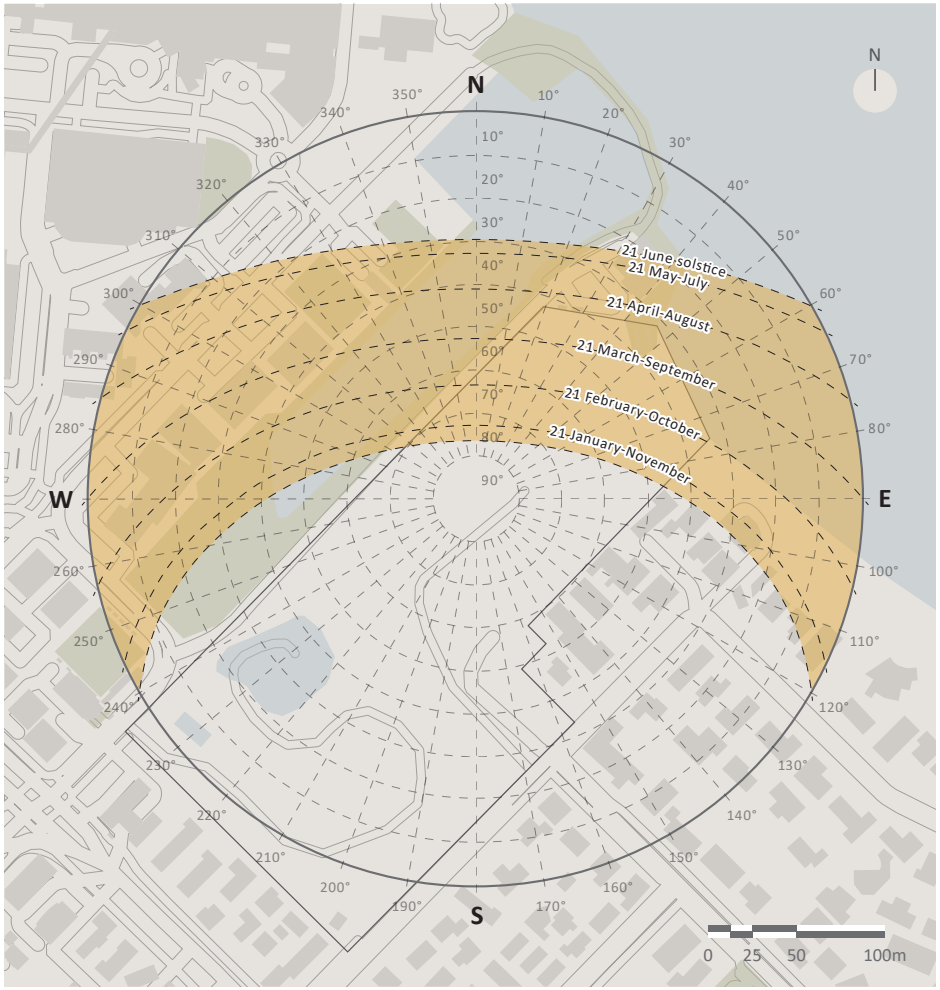


Figure 59. Site Sun Path

6.3 Site Visits & Analysis

SITE VISIT 1:

PERIMETER OBSERVATION & CONTEXTUAL ANALYSIS

The first site visit focused on exploring the site's perimeter and broader context, which forms a critical part of contextual analysis. Understanding how the site connects to its surroundings - ecological systems, circulation routes, cultural markers, and community activities - is essential for situating the intervention within its wider environment. This experiential engagement provided insights into spatial relationships, topography, climate, and sensory qualities that cannot be fully captured through maps or digital models.



Figure 60. Views of Site and Surrounding Context



Figure 61. Collage of Site Perimeter A





Figure 62. Collage of Site Perimeter B

SITE PERIMETER OBSERVATIONS

The site is flanked by pōhutukawa-lined roads, trees that carry both cultural and ecological significance in New Zealand, and is home to pūkeko, indicating an active local ecosystem. Its proximity to Quarry Lake, currently used for informal recreation such as dog walking, remote-controlled sailing, and casual gatherings, demonstrates existing community engagement with the landscape. This presents an opportunity for a new centre to formalise and expand social infrastructure, enhancing the area's role as a community hub while supporting a diverse user base of families, elderly residents, and individuals accessing nearby clinical facilities. The steep site gradient, while limiting visual connections from surrounding streets, offers privacy suitable for contemplative or mental health-supportive spaces. Access is most practical from Rangitira Avenue, as Northcote Road is steeper and less pedestrian-friendly. Furthermore, the site holds potential for regenerative landscape strategies that enhance ecological functions such as pollination and habitat creation, supporting both biodiversity and community wellbeing.



Figure 63. Pukeko Near Quarry Lake

SITE VISIT 2:

ONSITE EXPLORATION

The initial site perimeter analysis offered valuable insights into the surrounding context; however, direct views of the site were significantly limited. This was primarily due to the steep topography and the dense, overgrown vegetation that obscured visibility. As a result, much of the site's internal character, spatial qualities, and microconditions remained inaccessible during the first visit. A follow-up site visit will involve an on-site analysis to gain a more comprehensive understanding of the site's unique attributes, including its terrain, vegetation layers, sensory atmosphere, and accessibility. Multiple site visits are essential, as it is difficult to gain a complete understanding of a place through a single observation. Factors such as time of day, seasonal changes, and varying weather conditions can all influence the perception, mood, and functionality of the site - offering new insights with each return.

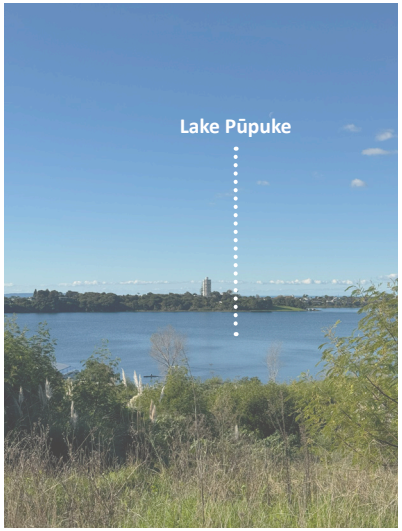


Figure 64. View of Lake Pūpuke From Site

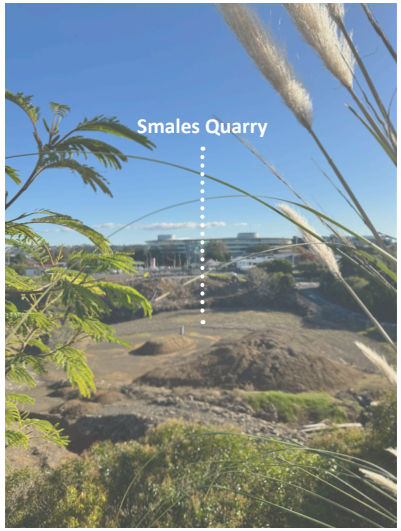


Figure 65. Views of Site Collage A



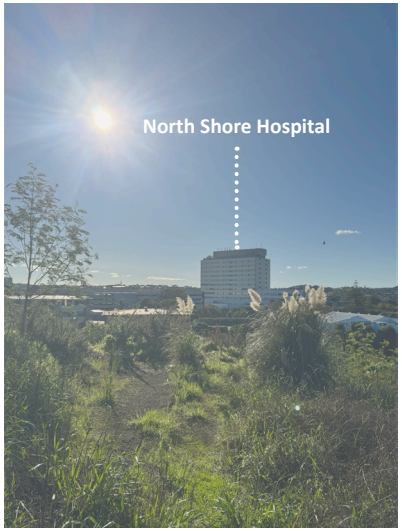


Lake Pūpuke is a key visual connection for the site, offering a natural vista that aligns with biophilic design principles.





Rangitoto is a culturally significant landmark. While it is a more distant view, it remains an important secondary visual connection for the site.





Mature trees on site provides immediate ecological, cultural, and climate benefits while saving time and costs in establishing new vegetation.



Morning Glory is classified as an invasive weed in New Zealand due to its tendency to smother native vegetation, disrupt ecosystems, and outcompete indigenous species.



Pampas grass - not to be confused with toetoe - is an invasive species characterized by upright, fluffy plumes and sharp leaf blades that outcompete native vegetation.



The site contains several established palm trees, some of which may be retained to preserve the site's existing character.



A small copse of macrocarpa is located in the corner of the site, providing shelter for the development.

Figure 66. Views of Site Collage



Figure 67. View of Lake Pūpuke From Site

NARROWING DOWN THE SITE

The site is currently expansive, and the proposed holistic healthcare architecture does not require the full area. This is not considered a limitation, as preserving space for potential future development is important within the context of this project. Doing so enables mana whenua - the local iwi and hapū with authority over the land - to guide how the remaining areas are utilised. Maintaining this flexibility ensures the site can adapt to evolving community needs while respecting cultural, social, and ecological considerations.

The previous on-site analysis revealed that the land closer to Quarry Lake (Section 2) already supports a healthy and thriving plant ecosystem. Since regenerative and biophilic architecture should prioritise areas where ecological conditions are degraded, this portion of the site may not be the most appropriate context for intervention. In contrast, the Smales Quarry area (Section 1) presents a far greater need. As a post-industrial landscape, the quarry is depleted of vegetation, lacks topsoil, and offers poor conditions for natural regeneration - making it an ecological void. This creates an opportunity for architecture to assume a restorative role without displacing existing biodiversity. Within the broader goals of regenerative and biophilic design, Smales Quarry (Section 1) therefore emerges as the more suitable area for meaningful intervention.

Another advantage of focusing on this area is that the entrance would be positioned closer to the main road rather than down a quiet residential street, thereby enhancing public accessibility. Furthermore, its location within a business zone makes it more suitable for accommodating higher traffic volumes and reduces the likelihood of potential concerns from neighbouring residents.



Figure 68. Narrowing Down the Site

STRENGTHS

- Ample space for the development of holistic healthcare facilities
- Absence of existing structures allows for creative design freedom
- Sheltered from prevailing winds
- Minimal noise pollution

WEAKNESSES

- Soil conditions limit planting in certain areas
- Poor soil quality creates erosion-prone zones
- Uneven terrain requires careful planning
- Limited streetfront visibility from main roads
- Potential shading from the northwest cliff

OPPORTUNITIES

- Creation of sections of native bush
- Development of a pond or wetland
- Potential for future expansion
- Creation of recreational spaces
- Ecological restoration and biodiversity enhancement

THREATS

- Structures placed above water must account for water level changes
- Projected climate variability and more intense storm events may alter the site's landscape over time

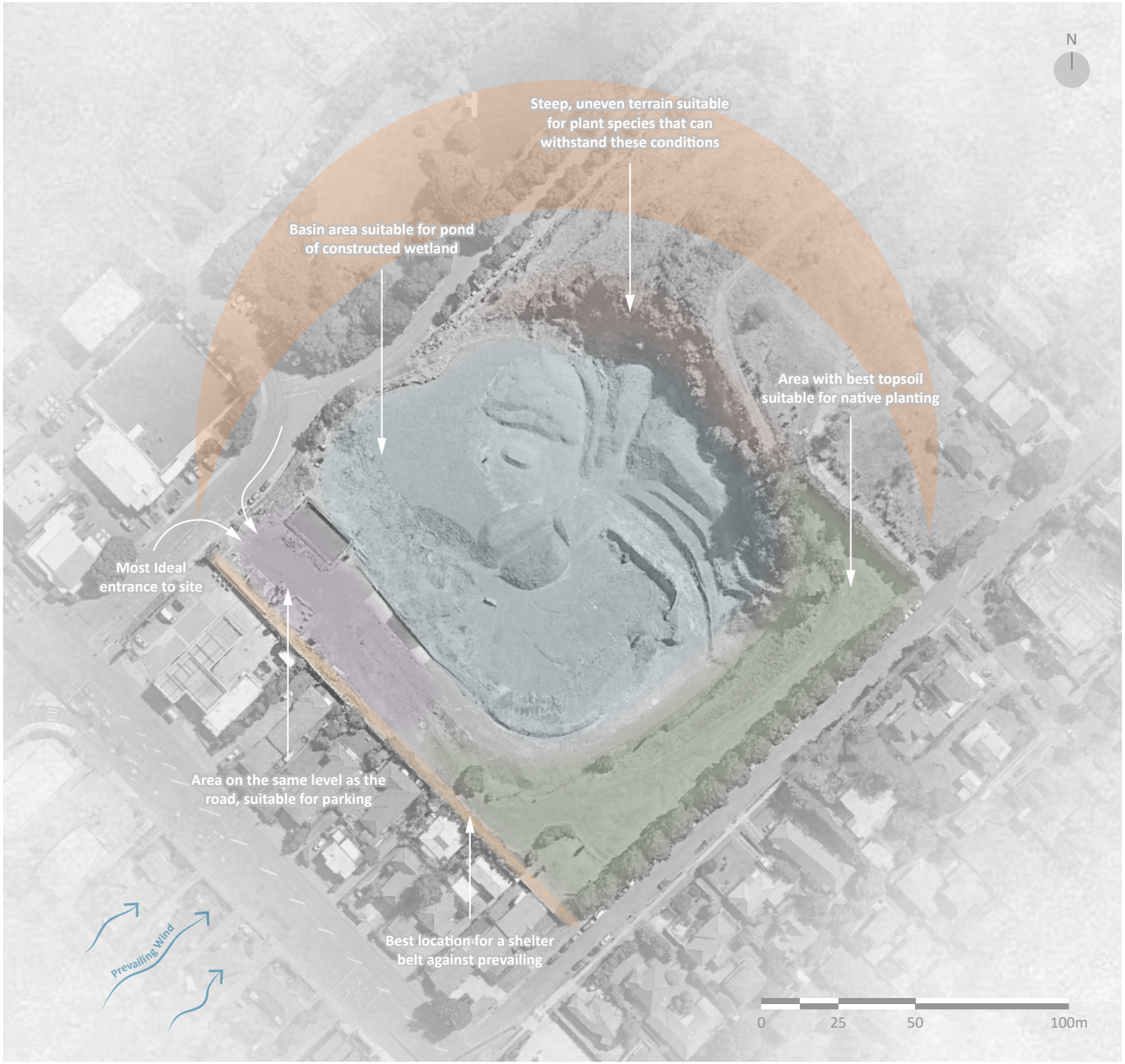


Figure 69. Site SWOT Analysis

6.4 Ecological Design Strategies

Quarries present an ideal opportunity to restore nature where it is most needed...

QUARRY REMEDIATION STRATEGIES

The quarry remediation reimagines a post-industrial site as an ecologically and socially valuable landscape through strategies of ecological restoration, hydrological reconfiguration, and cultural integration, creating a life-supporting environment.

1. Ecological Restoration

- Native planting
- Habitat creation
- Soil remediation
- Erosion control
- Biodiversity corridors



2. Hydrological Systems

- Quarry ponds
- Stormwater management
- Flood mitigation strategies
- Sensory water experience
- Rainwater harvesting and reuse

3. Social Integration

- Walking paths
- Communal gardens
- Outdoor learning spaces
- Spaces for cultural practices
- Community stewardship



Integrated Outcomes

- Biodiversity
- Community wellbeing
- Cultural connection
- Environmental resilience

Figure 70. Quarry Remediation Plan





Figure 71. Smales Quarry

RELEVANT NATURE-BASED SOLUTIONS

From NUWAO Nature-based Solutions Design Guide for Te Moananui Oceania

In addition to conventional quarry remediation strategies, this project adopts nature-based solutions to support long-term ecological regeneration. These approaches are aligned with the Te Aranga Māori Design Principle of Mauri Tu, which emphasises protecting, maintaining, and enhancing environmental health (Paul, 2017). Using the NUWAO Nature-based Solutions Design Guide for Te Moananui Oceania (Pedersen Zari et al., 2024), solutions were selected that are suitable for this project.

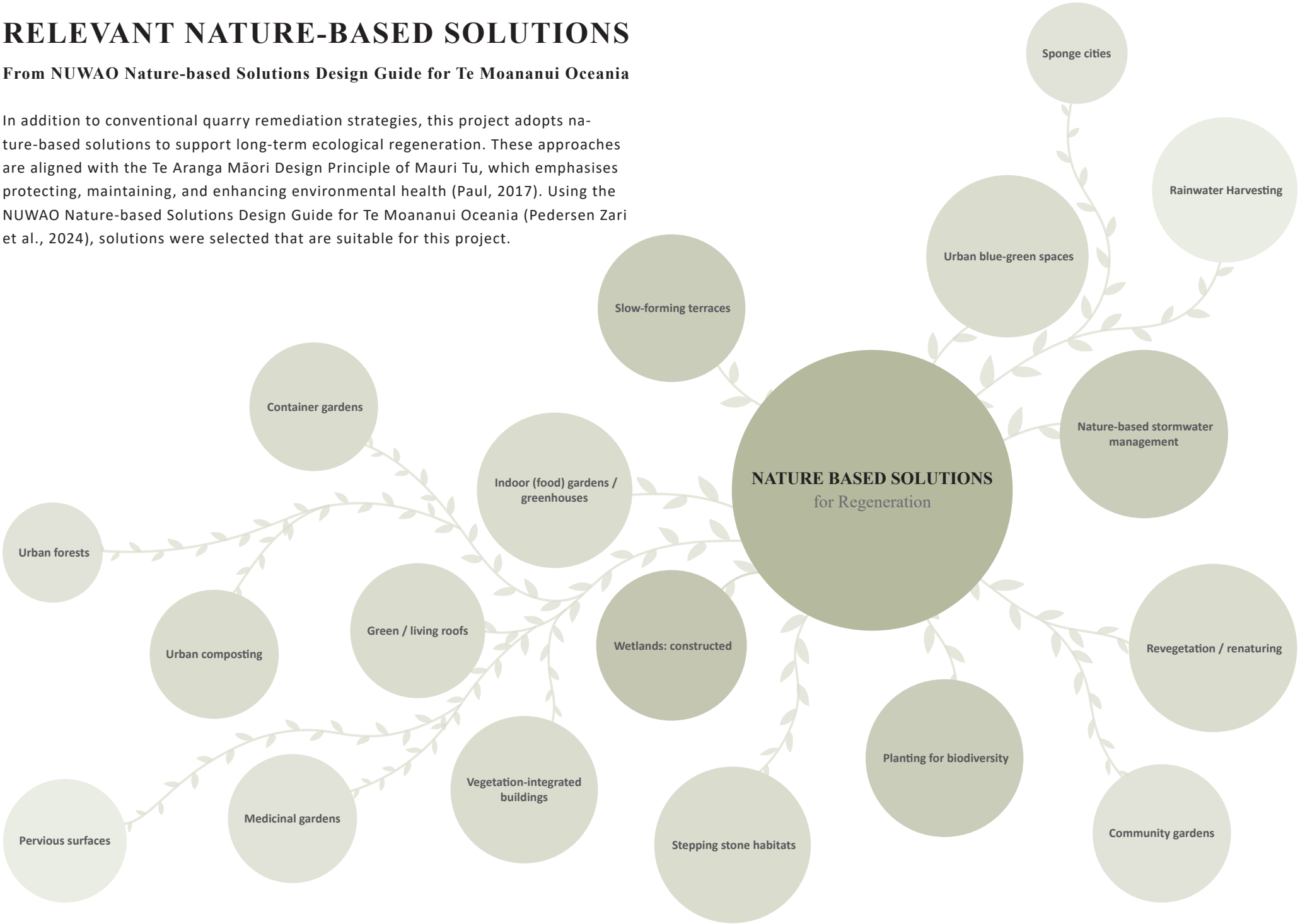
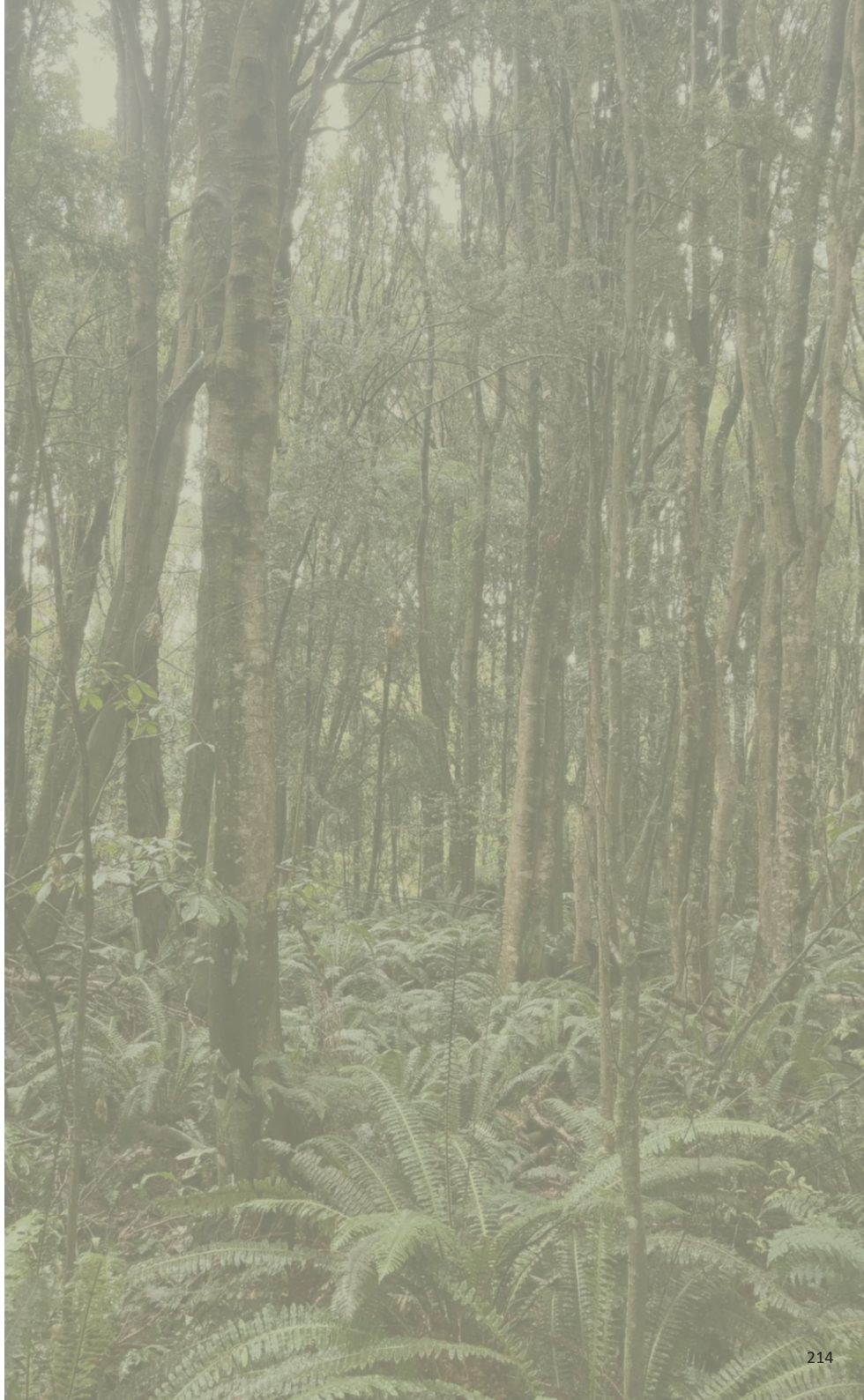
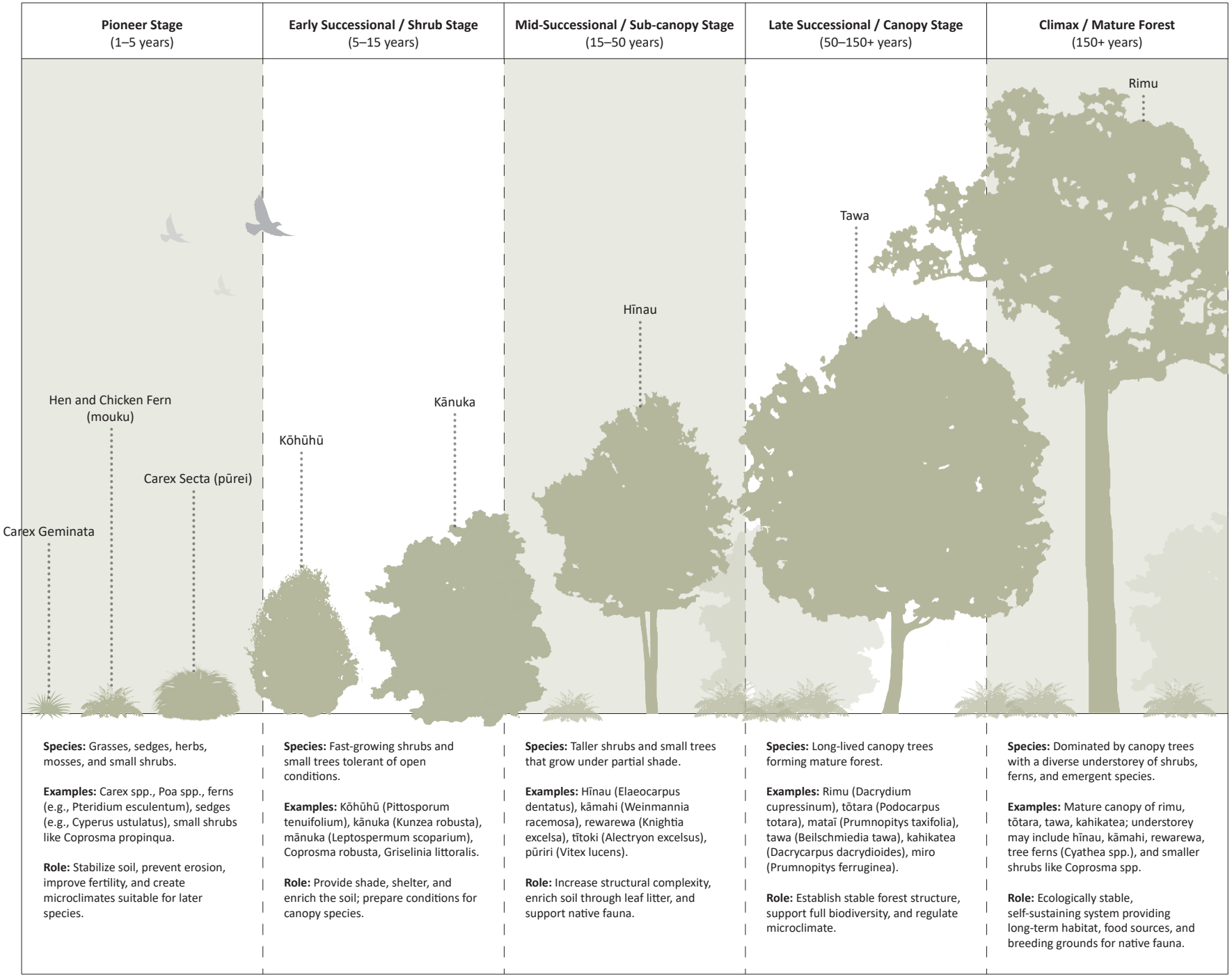


Figure 72. Nature Based Solutions

NATIVE PLANTING/ ECOLOGICAL SUCCESSION

The SWOT analysis highlights opportunities to establish native bush on areas of the site with existing topsoil. In New Zealand, native bush restoration follows principles of ecological succession, creating resilient, self-sustaining ecosystems. Planting typically begins with pioneer species such as grasses, sedges, and low shrubs to stabilise soil and improve microclimates. These are followed by intermediate species like kōhūhū (Pittosporum tenuifolium) and kānuka (Kunzea robusta), which provide shade, shelter, and soil enrichment. Finally, canopy trees including rimu (Dacrydium cupressinum), tōtara (Podocarpus totara), and mataī (Prumnopitys taxifolia) establish the mature forest. Aligning site planting with natural succession accelerates forest development, enhances habitat diversity, and supports native fauna, fostering ecologically robust bush ecosystems (Clout & Hay, 1989; Tāne's Tree Trust, n.d.).





This diagram shows the stages of ecological succession through example species, highlighting that establishing native bush is a long-term process spanning decades and generations. This underlines the importance of protecting existing ecosystems, as the time required to restore them is significant. At the same time, the gradual timeframe of forest development can be seen as a strength for the site, as it allows people to experience and connect with the unfolding of natural systems. This resonates with Pattern 7: Connection with Natural Systems from Terrapin Bright Green's biophilic design framework, which emphasises the human affinity for processes that reveal nature's slow rhythms and cycles (Browning et al., 2014).

Figure 73. Ecological Succession (not to scale)

HABITAT CREATION

Habitat creation involves designing environments that sustain biodiversity by providing shelter, food, and suitable ecological conditions for native species (Gilbert & Anderson, 1998). In this project, this is achieved through planting native bush, creating a pond, and linking biodiverse zones to form a self-sustaining ecological network. Species such as pōhutukawa (Metrosideros excelsa), puriri (Vitex lucens), and kōtukutuku (Rhabdothamnus solandri) provide nectar for birds including tūī, korimako (bellbird), and hihi (stitchbird) (Rasch & Craig, 1988), while larger canopy trees like miro (Prumnopitys ferruginea) and matai (Prumnopitys taxifolia) support long-term forest growth and provide fruit for kererū, aiding seed dispersal (Clout & Hay, 1989). This approach supports taiao, the environmental dimension of wellbeing, and reinforces kaitiakitanga, the Māori principle of guardianship central to the Te Aranga Māori Design Principles (Paul, 2017).

Terrapin Bright Green's biophilic patterns further inform habitat creation, particularly Pattern 1: Visual Connection with Nature, through encounters with diverse flora and fauna; Pattern 2: Non-Visual Connection with Nature, via birdsong and natural scents; and Pattern 6: Connection with Natural Systems, expressed in the rhythms of native fauna (Browning et al., 2014). Collectively, these strategies restore ecological function while enhancing human engagement with natural processes.



Figure 74. Kererū Sitting on a Branch

BIRD-ATTRACTING NATIVE PLANTS

To encourage bird visitation, it is essential to incorporate plant species that offer nutritional resources. The table below summarises key information to guide the selection of species for habitat creation on the site.

Table 10

Bird-friendly plants

Note. Reprinted from "Bird-friendly plants," by Forest & Bird, 2018, https://www.forestandbird.org.nz/resources/native-plants-attract-birds

SCIENTIFIC NAME	COMMON NAME	FOOD PROVIDED
Alectryon excelsus	Tītoki	Fruit and seeds
Alseuosmia macrophylla	Toropapa or karapapa	Nectar, fruit, and seeds
Aristotelia serrata	Makomako (wineberry)	Fruit and seeds
Beilschmiedia tarairi	Taraire	Fruit and seeds
Beilschmiedia tawa	Tawa	Fruit and seeds
Carpodetus serratus	Putaputawētā (marbleleaf)	Fruit and seeds
Coprosma grandifolia	Kanono or raurēkau	Fruit and seeds
Coprosma lucida	Shiny karamū	Fruit and seeds
Coprosma robusta	Karamū	Fruit and seeds
Cordyline australis	Tī kōuka (cabbage tree)	Nectar, fruit, and seeds
Corynocarpus laevigatus	Karaka	Fruit and seeds
Dacrycarpus dacrydioides	Kahikatea (white pine)	Fruit and seeds
Dacrydium cupressinum	Rimu (red pine)	Fruit and seeds
Eleocarpus dentata	Hīnau	Fruit and seeds
Fuchsia excorticata	Kōtukutuku (tree fuschia)	Nectar, fruit, and seeds
Hedycarya aborea	Porokaiwhiri (pigeonwood)	Fruit and seeds
Hoheria populnea	Houhere (lacebark)	Nectar
Knightia excelsa	Rewarewa (New Zealand honeysuckle)	Nectar
Macropiper excelsum	Kawakawa	Fruit and seeds
Melicope ternate	Whārangi	Fruit and seeds
Melicytus ramiflorus	Māhoe (whitey wood)	Fruit and seeds
Metrosideros excelsa	Pōhutukawa	Nectar, fruit, and seeds
Metrosideros fulgens	Akatea (climbing rātā)	Nectar
Metrosideros perforata	Akatea or akatorotoro (white climbing rātā)	Nectar
Metrosideros robusta	Northern rātā	Nectar
Myrsine australis	Māpou	Fruit and seeds
Passiflora tetrandra	Kohia (New Zealand passion flower)	Fruit
Phormium tenax	Harakeke (flax)	Nectar
Pittosporum crassifolium	Karo, kaikaro, or kīhihi	Nectar, fruit, and seeds
Pittosporum eugenoides	Tarata (lemonwood)	Nectar, fruit, and seeds

Pittosporum tenuifolium	Kōhūhū, kohukohu, tawhiwhi	Nectar, fruit, and seeds
Podocarpus totara	Tōtara	Fruit and seeds
Pomamderris kumaraho	Kūmarahou	Nectar
Prumnopitys ferruginea	Miro	Fruit and seeds
Pseudopanax aboreus	Puahou or whauwhaupaku (five finger)	Fruit and seeds
Pseudopanax crassifolius	Horoeka (lancewood)	Fruit and seeds
Pseudopanax lesonii	Houpara	Fruit and seeds
Rhabdothamnus solandri	Taurepo, matata or waiuatua	Nectar
Rhopalostylis sapida	Nīkau	Fruit and seeds
Schefflera digitata	Patē (seven finger)	Fruit and seeds
Solanum aviculare	Poroporo	Fruit and seeds
Sophora micophylla	Kōwhai	Nectar
Vitex lucens	Puriri	Nectar, fruit, and seeds



SITE ANALYSIS CRITICAL REFLECTION

The analysis of Smales Quarry highlights its potential as a site for biophilic and regenerative intervention, revealing both opportunities and constraints that inform design strategy. While post-industrial degradation presents challenges such as poor soil, uneven terrain, and limited visibility, it also allows for ecological restoration without displacing intact habitats. Proximity to Lake Pūpuke, Killarney Park, and surrounding residential and healthcare facilities positions the site as both an ecological and social connector. Cultural considerations within the rohe of multiple iwi and hapū support the integration of Te Aranga principles, ensuring the project is culturally informed. The sun path, topography, and hydrology inform design strategies such as terraced architecture, water features, and green corridors. Despite challenges of isolation and limited street-front visibility, these conditions provide opportunities for privacy and contemplative spaces. Overall, the site offers the potential to transform a degraded landscape into a biodiverse and socially meaningful environment, contributing to the broader vision of a biophilic Auckland.

A limitation of the site analysis process is that the site boundaries could have been defined earlier, which would have enabled a more focused assessment. Closely related to this, greater attention to the site's size and the intended scale of the holistic healthcare centre would have helped ensure that the site dimensions aligned with the proposed intervention. Building on the knowledge gained from this analysis, the next step is to move into the ideation phase to develop design concepts that are inspired by nature and the site's conditions.

CHAPTER 7: DESIGN DEVELOPMENT

During design development, ideas are explored and refined through experimentation with different forms and spatial arrangements. This process generates design directions while helping to identify concepts that best align with the project's objectives, site context and user needs. Through iterative evaluation and refinement, ideas gradually evolve from abstract concepts into more resolved architectural solutions.

7.0 EXPERIMENT 1:
NATURAL PATTERNS & SHAPES

Nature contains a wide array of patterns and shapes that align closely with Pattern 8: Biomorphic Forms & Patterns and Pattern 10: Complexity & Order from Terrapin Bright Green's biophilic design framework (Browning et al., 2014). These natural patterns - such as fish scales, spirals, leaf venation, and fractal geometries - exhibit an underlying order found in living systems, which the human brain intuitively recognises and responds to positively (Browning et al., 2014). In this experiment, different natural patterns and shapes are sourced to inspire architectural design. These patterns may be abstracted and integrated into building components, such as exterior panels, where botanical motifs soften the hard edges of the built form, or applied to window screens and glass etchings to create dappled light effects that mimic the experience of light filtered through a forest canopy.



Figure 75. Gum Tree Leaf Print A





Figure 76. Fern Print



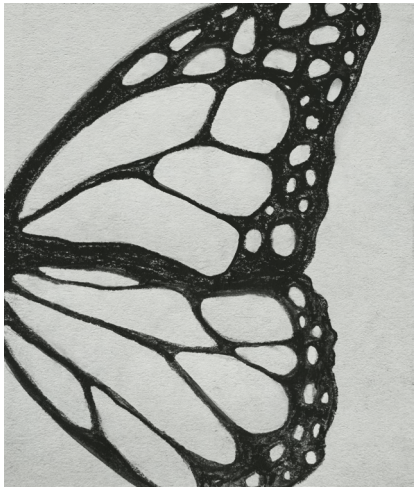
Figure 77. Gum Tree Leaf Print B



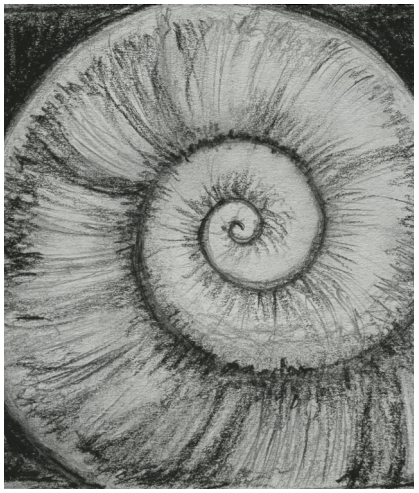


Figure 78. Oak Leaf Print

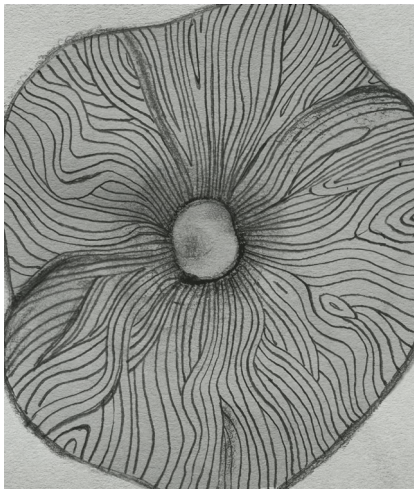
Butterfly Wing



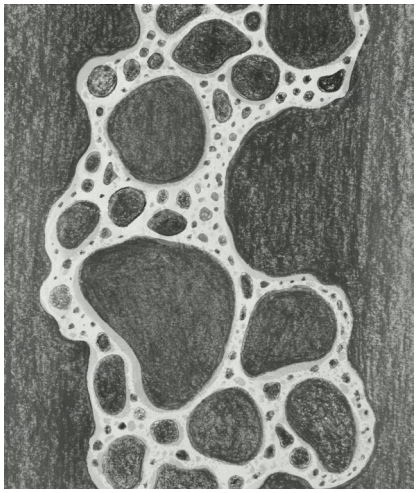
Snail Shell



Mushroom



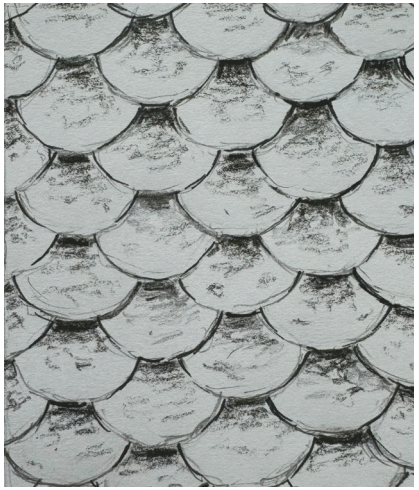
Sea Foam



Wood Grain



Fish Scales



Leaf Veins



Tree Ring



Figure 79. Nature's Patterns Sketches

DESIGNING WITH NATURE'S CIRCLES

Circular forms are widespread in New Zealand's ecosystems, evident in the radial symmetry of limpets and kina, the spiral koru of the silver fern, and the rounded shapes of plants such as karamu, miro, and Raoulia. These forms express ecological intelligence - reducing drag, optimising space, and enhancing resilience (Aldersey-Williams, 2004). Referencing such geometries supports a biomimetic and biophilic architectural approach that aligns with natural logic and promotes psychological well-being by reconnecting people with evolutionary patterns, reflecting Pattern 8, Biomorphic Forms & Patterns, from Terrapin Bright Green's framework (Browning et al., 2014). Grounding design in these circular patterns fosters a design ethos attuned to the beauty and ecology of New Zealand's landscapes.

Figure 80. Blue Mushroom

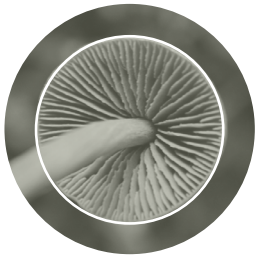


Figure 81. Basket Fungus

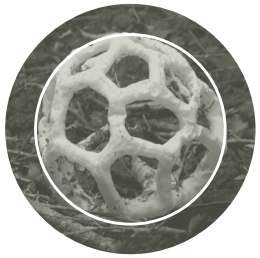


Figure 82. Black Tree Fern



Figure 83. Kina

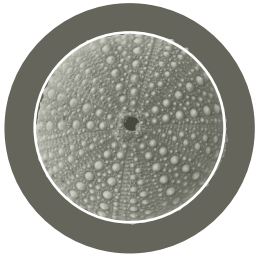


Figure 84. Fantail



Figure 85. Kawakawa



Figure 86. Karamu Berry



Figure 87. Pohuehue

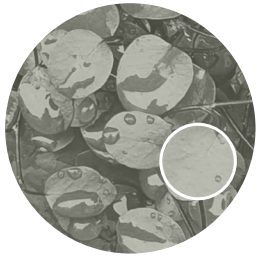


Figure 88. Manuka Flower



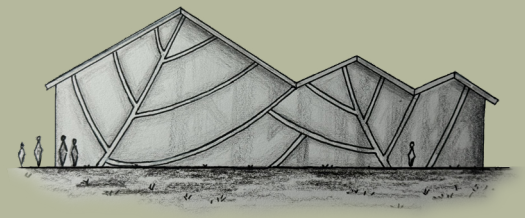


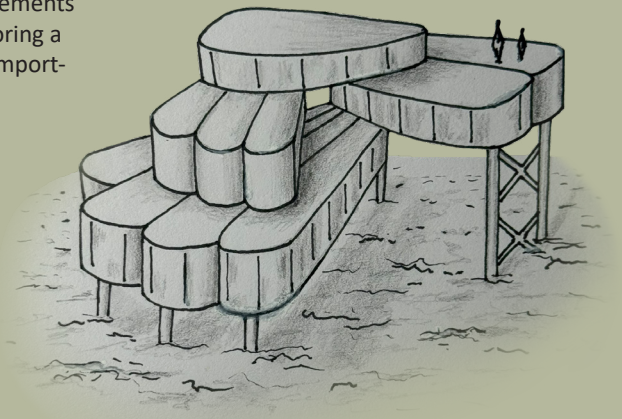


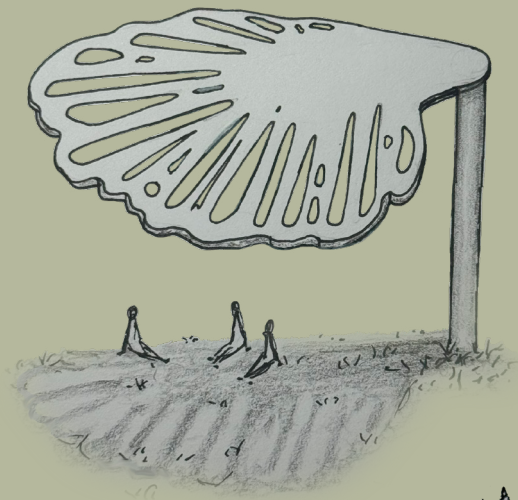
Figure 89. Natural Forms Collage

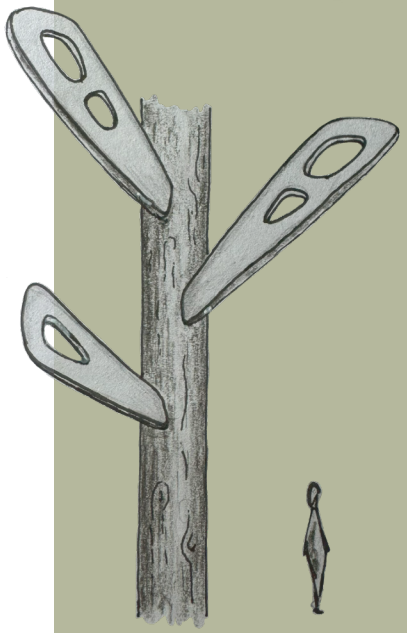
NATURAL PATTERNS & SHAPES
IN ARCHITECTURAL FORM

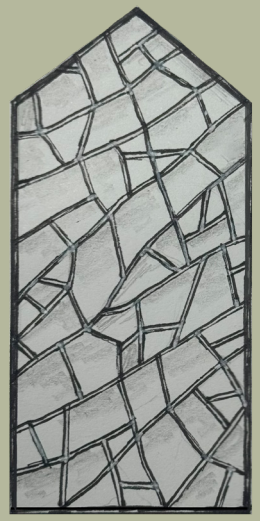
Natural shapes and patterns are reimagined as architectural elements to inspire the design. While not all can be incorporated, exploring a variety of possibilities at this conceptual ideation stage is an important part of the design process.



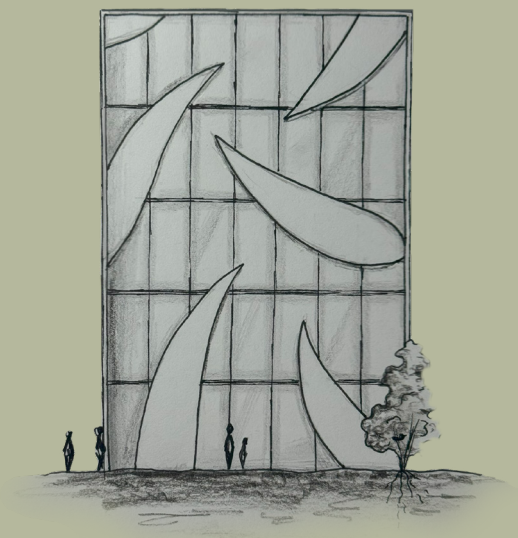












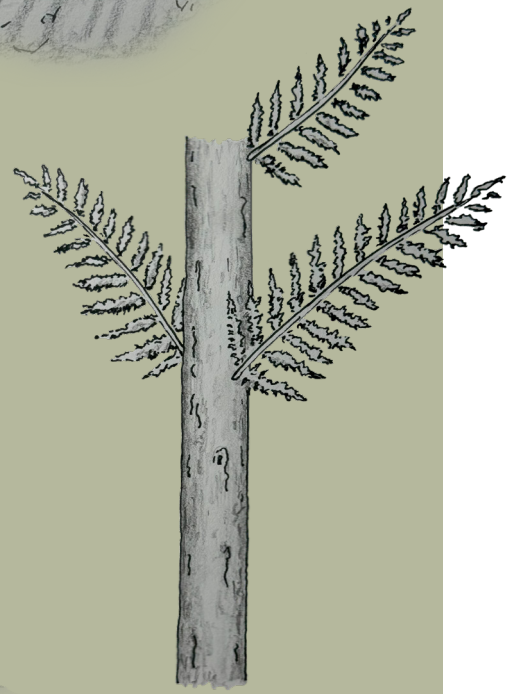


Figure 90. Architectural Forms from Nature

TREE-LIKE COLUMNS

Tree-like columns will be used in the design so that even the structural elements reference nature. A variety of column types, each inspired by different forms of trees, were developed and tested to explore possible options. From these, a final design can be selected that best complements and enhances the overall architectural concept.

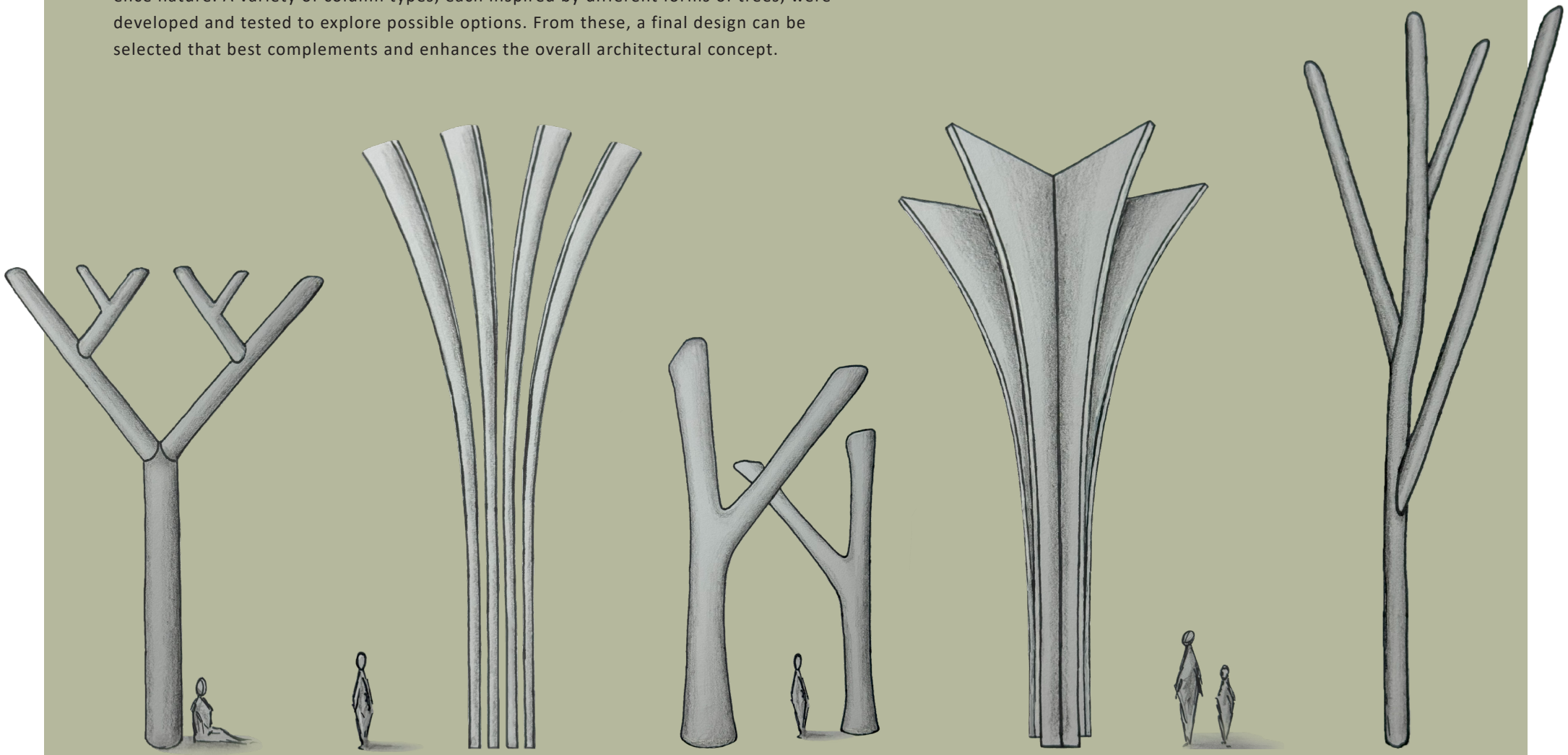


Figure 91. Tree-Like Columns Collage

7.1 EXPERIMENT 2:
GEOLOGICAL ABSTRACTIONS

Experiment 2 explores plaster models that embody terrain-like forms, abstracting and interpreting the site's uneven contours and functioning as tactile tools for exploring spatial form. These models align with biophilic design principles - specifically Pattern 8: Biomorphic Forms & Patterns and Pattern 6: Dynamic & Diffuse Light. Pattern 8 is expressed through the undulating forms of the models, while Pattern 6 is demonstrated by the perforations in the material, which create varying intensities of light and shadow (Browning et al., 2014). This approach offers a pragmatic method for examining the application of the 14 Patterns of Biophilic Design within early-stage conceptual modelling.



Figure 92. Plaster Model

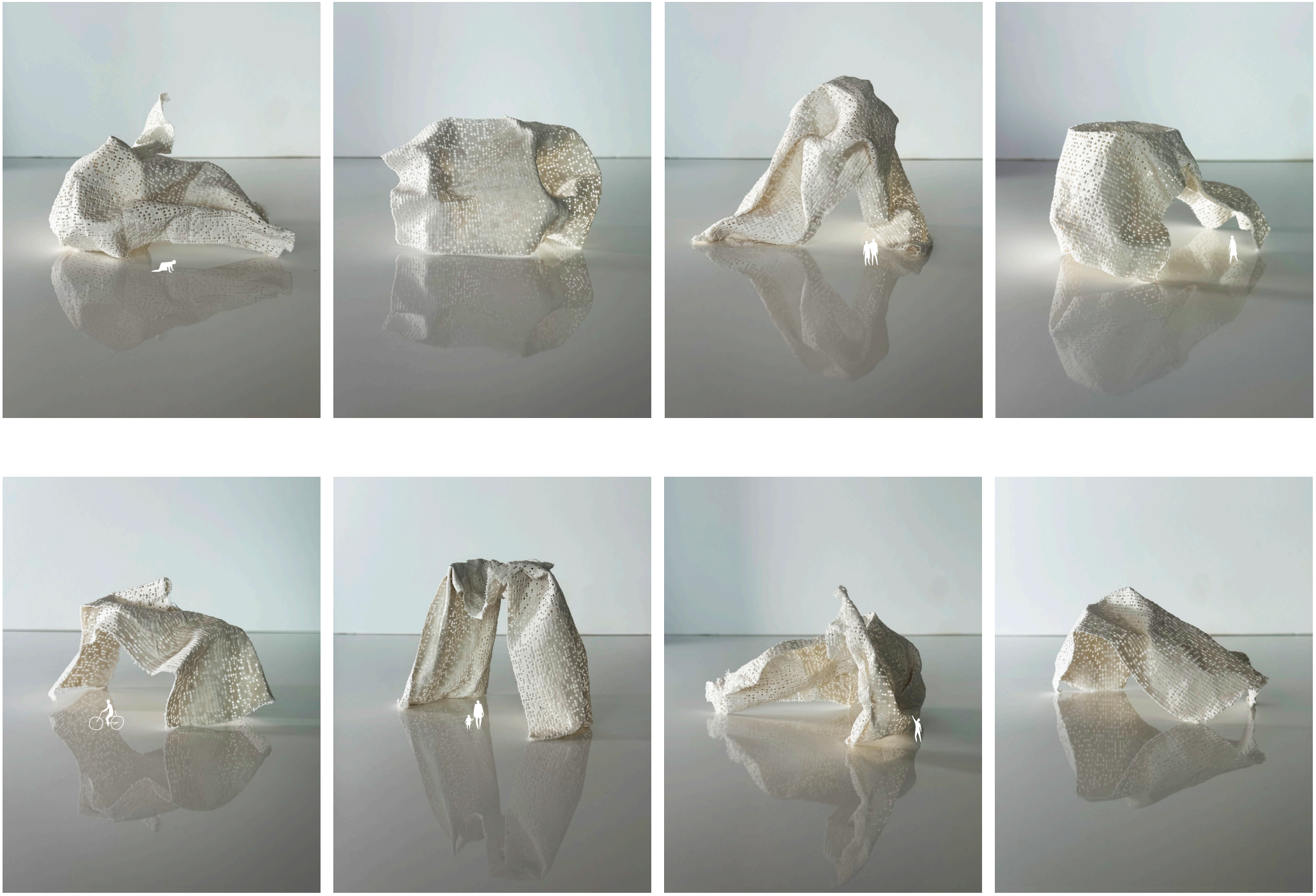


Figure 93. Plaster Model Collage A



Figure 94. Plaster Model Collage B

7.2 EXPERIMENT 3:
BIOMORPHIC FORMS

These models demonstrate biomorphic, flowing forms with smoother, more organic curves compared to the previous experiment, which exhibited steeper, more abrupt changes. The change of material to clay creates a different spatial experience, emphasising continuity and gentle transitions and fostering a calming atmosphere suitable for a holistic health centre. The models explore how such forms could inform the architectural intervention, offering structural and aesthetic strategies for integrating natural, fluid shapes. They function as both experimental tools and conceptual references, identifying forms that embody biomorphic design and reflect Pattern 8: Biomorphic Forms & Patterns from Terrapin Bright Green's framework.



Figure 95. Clay Model



Figure 96. Clay Model Collage A



Figure 97. Clay Model Collage B

7.3 EXPERIMENT 4:
NATURE-BASED MODELS

In this exploration, nature serves both as a theoretical foundation and a tangible resource for model-making. By collecting and working with natural materials such as bark, leaves, sticks, and shells, a series of experimental forms was created to inspire architectural design. These organic forms have the potential to influence both the overall structure of a building and specific spatial elements such as lobbies, outdoor pavilions, and transitional areas.

Drawing directly from natural textures and shapes fosters a more intuitive and authentic biophilic design process. This hands-on engagement supports the core aim of this research: to strengthen the connection between people and the natural environment through architecture. It also reflects Pattern 9: Material Connection with Nature from Terrapin Bright Green's biophilic design framework, reinforcing the alignment between making practice and the theoretical foundation of this research (Browning et al., 2014).

The materials used in this model series are sourced in close proximity to the site, from Killarney Park and Takapuna Beach, signalling a place-based design intervention. This practice resonates with the cultural and ecological attachment to place, as described by Kellert and Calabrese (2015), and highlights the importance of grounding architectural responses in the local context.

Furthermore, the use of biodegradable and compostable materials reflects an environmentally responsible design ethos. Avoiding synthetic materials that contribute to waste and pollution supports a sustainable and ethical process in architectural development.



Figure 98. Nature Model (Leaves and Bark)



Figure 99. Nature Model Collage A



Figure 100. Nature Model Collage B



Figure 101. Nature Model Collage C

CRITICAL REFLECTION

One limitation of the experiments conducted so far is their removal from the site, which reduces contextual grounding. Future experiments would benefit from being more closely tied to the site, allowing the design process to respond directly to its unique spatial conditions. Experiment 4 (nature-based models) was also less iterative compared to earlier experiments, as the materials used were less conducive to generative or exploratory processes, limiting the ability to quickly test multiple variations. In contrast, previous experiments employed more pliable and adaptable materials, which facilitated a higher degree of iteration and experimentation, highlighting the importance of selecting methods and materials that support iterative design processes. Despite these limitations, the physical models have provided a strong foundation for design development, offering valuable insights into the evolution of organic, flowing geometries. The next steps will involve integrating these experiments into the site context and further refining the ideas into a developed design.



Figure 102. Orange Shells



Figure 103. Shells From Takapuna Beach

7.4 EXPERIMENT 5:
INTRODUCING MODELS ON SITE

The models are positioned on site to explore how they integrate with the surrounding environment and respond to its spatial qualities. As part of this process, the site is deliberately modified to simulate future ecological conditions, such as wetlands or a pond. This allows the models to be tested in anticipation of the site's projected transformation, providing insight into how design interventions can adapt to and harmonise with evolving landscapes.



Figure 104. Model On Site A



 Figure 105. Model On Site B



Figure 106. Model On Site C



Figure 107. Model On Site D



Figure 108. Model On Site E



CRITICAL REFLECTION

Placing models on site offered some initial understanding of their potential interactions with the environment, but their limitations quickly became apparent. Many of the forms remained static, relying on simple upward extrusions with little engagement with the site itself. Further development is needed to explore how these forms might work more dynamically with the landscape, moving beyond basic extrusion toward more abstract interpretations rather than literal representations of natural references, such as shells.

Figure 109. Model On Site F

7.5 ESTABLISHING A DESIGN LANGUAGE

An initial design language has been developed to guide a cohesive architectural proposition, ensuring that all elements of the project are both unified and intentional. Drawing from earlier models, key shapes have been extracted to inform the design approach. In this case, the language is characterised by arches, shell forms, circles, and wavy lines, which shape both the visual character and the spatial experience. These forms inform the structural elements, circulation patterns, and decorative motifs, creating a continuous and coherent design narrative throughout the project. At this stage, however, the design language remains broad and will require further refinement and narrowing through ongoing exploration.

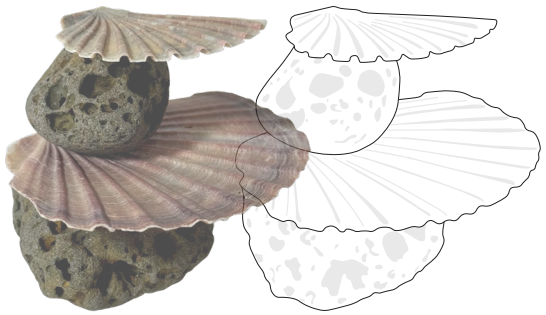
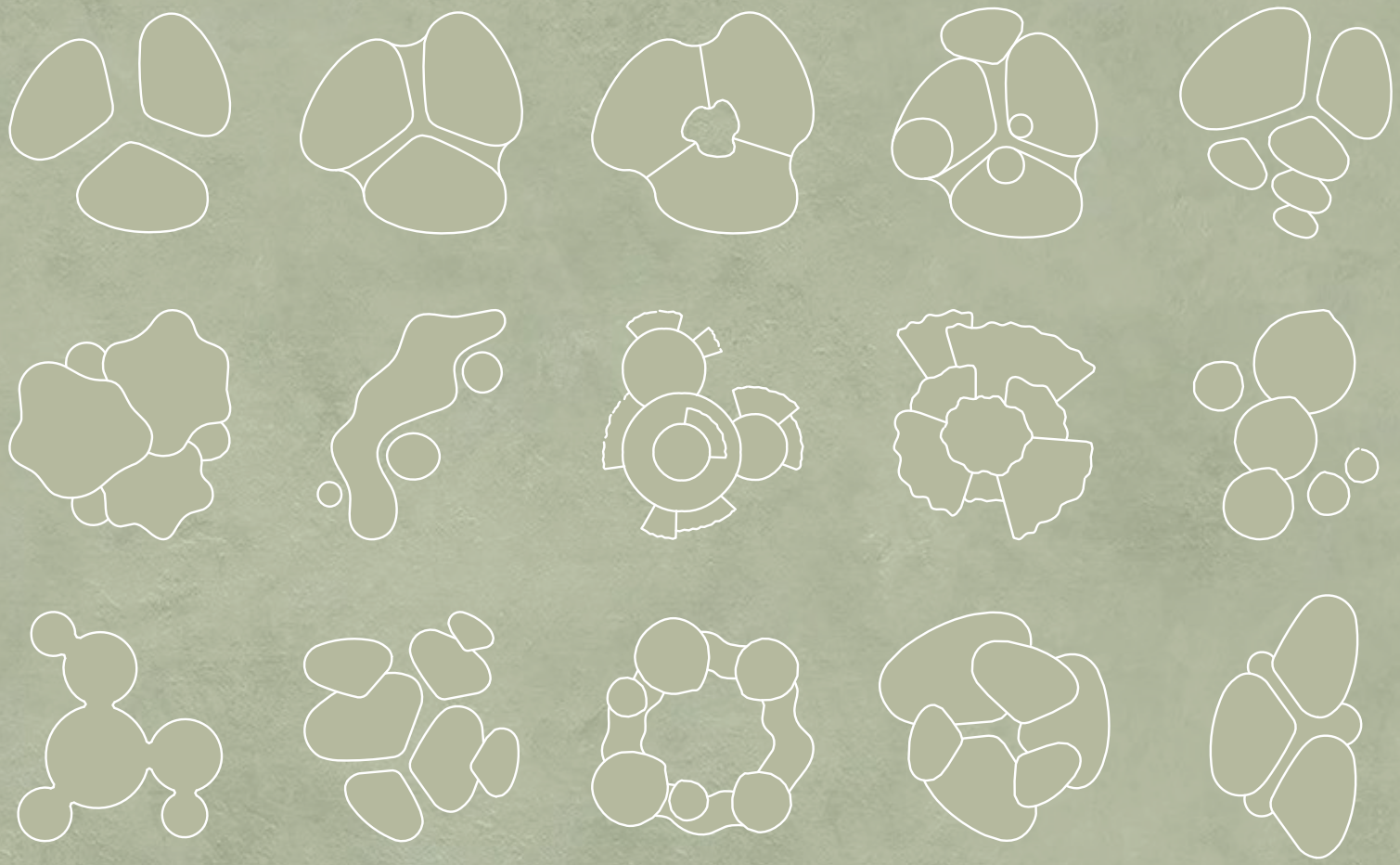


Figure 110. Design Language Collage

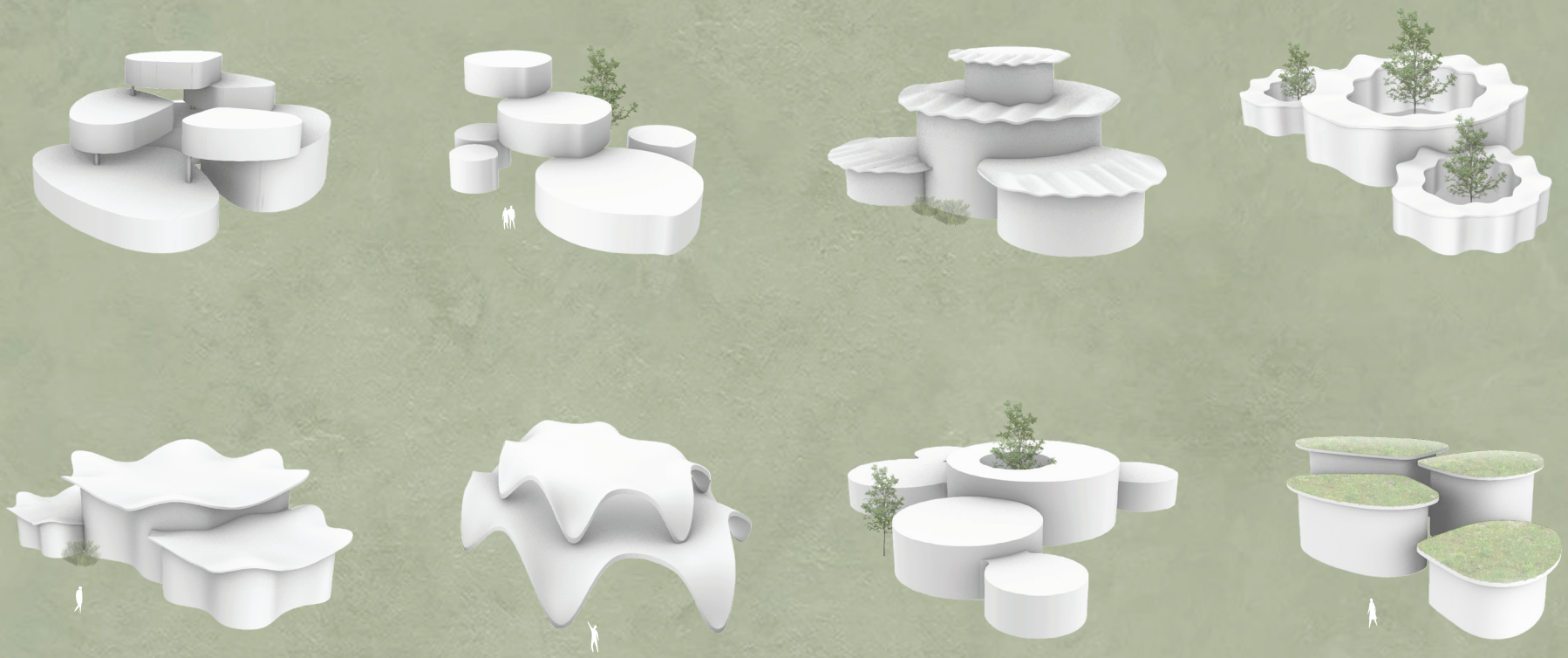
Design Language in Plan



Using the initial design language, a series of plan explorations were developed to generate inspiration for the overall spatial organisation. These variations tested how different shapes could be arranged to guide programme layout and circulation, providing insight into the relationships between spaces and the flow of movement through the design.

Figure 111. Plan Iterations

Design Language in 3D



Exploring basic volumes in three dimensions, guided by the established design language, is an essential step in refining the architectural concept. This process enables ideas to be narrowed down while testing how the building may appear and how its volumes might be organised. Engaging in this stage prior to the final design allows multiple options to be examined in their simplest form, ensuring the final outcome emerges as a deliberate progression built on tested and refined ideas.

Figure 112. 3D Iterations

CRITICAL REFLECTION

This stage of design has been valuable in testing how natural systems, forms, and materials can inform an architectural language grounded in biophilic and place-responsive principles. Through five experiments, the investigation moved beyond theoretical understandings of Terrapin Bright Green's patterns and began materialising them through modelling, abstraction, and site-based interventions. Each experiment revealed both opportunities and limitations that will shape the next stages of development.

Experiment 1 demonstrated the potential of natural shapes, particularly circles, spirals, and fractal geometries, to guide architectural form-making, but also highlighted the risk of superficial application if not embedded within structural and spatial logics. Experiments 2 and 3 extended this inquiry through geological abstractions and clay models, showing how material choice influences both form and atmosphere. However, these explorations often prioritised aesthetics over programme clarity, raising questions about circulation, functionality, and cultural appropriateness.

Experiment 4 marked an important shift by incorporating local natural materials, fostering authentic engagement with site ecology while aligning the process with sustainable practice. Yet, the use of ephemeral materials proved challenging, as they lacked the tactile qualities of earlier models and resulted in more static, less iterative outcomes. Experiment 5 advanced the work by situating models on site and simulating future ecological conditions, testing spatial integration and adaptability, though it also revealed challenges in integrating the building with the site.

Collectively, these experiments established an initial design language of arches, shell forms, circles, and wavy lines. While evocative of natural geometries, this vocabulary remains broad and must be refined into a coherent framework for spatial organisation, structural systems, and cultural narratives. To date, limited attention has been given to programme and practical spatial requirements, which will form the next stage of development. Overall, this stage successfully expanded the conceptual horizon of the project while underscoring the need for discernment: not every natural form is suitable or meaningful in architecture. Moving forward, the design must balance biomorphic inspiration with pragmatic, cultural, and ecological considerations to ensure outcomes that are both resonant and functional.



7.6 Programme

PROGRAMME DEVELOPMENT

At the start of the year, multiple programme directions were considered to guide this project and respond to the site, reflecting the various ways culture and biophilic design can be integrated into different building typologies to enhance community wellbeing. The programme was subsequently developed through an iterative process, ultimately resulting in a holistic healthcare centre.

1. Mental Health Unit

Pros:

• Utilises the mental health benefits of biophilic design

• Responds to the growing demand for mental health services

• Offers potential to integrate mātauranga Māori and whānau-centred models of care (e.g., Te Whare Tapa Whā)

Cons:

• Located near the existing He Puna Waiora Mental Health Unit, risking service duplication

• The site's unstable ground conditions may pose heightened safety risks, particularly for individuals experiencing acute mental distress

• Potential overlap with hospital services might reduce the facility's distinctiveness as a community space

2. Community Centre

Focused on nature-based activities

Pros:

• Has the potential to act as a community anchor, fostering social cohesion

• Supports health and wellbeing through nature engagement (e.g., gardening, outdoor learning, cultural events)

• Can accommodate a wide demographic - intergenerational and inclusive

• Aligns well with climate resilience goals and supports local biodiversity awareness

Cons:

• Risk that the programme may not adequately reflect strong community needs

• May struggle to attract people due to lack of visibility at the street-front level

• Risk that services offered may feel disjointed or lack cohesion without a clear narrative or guiding kaupapa

3. Architecture Campus

Campus that is focused on design that responds to māori culture, regenerative design, and biophilic design

Pros:

• Promotes educational innovation in sustainability, mātauranga Māori, and ecological design

• Could attract research partnerships and interdisciplinary collaboration

• Helps train future professionals in regenerative architecture and planning

• Offers a platform to showcase Indigenous knowledge systems in spatial design

Cons:

• Site is not well-connected to academic institutions or student populations

• May struggle to attract a consistent user base without strong institutional backing

• Programme focus may seem too specialised or niche for broader community engagement

4. Holistic Healthcare Centre

Preventative, holistic healthcare inspired by Māori health principles and nature connection

Pros:

• Addresses all dimensions of health, integrating physical, mental and emotional, spiritual, and social/family wellbeing

• Culturally safe and relevant, incorporating mātauranga Māori and whānau-centred approaches to support Indigenous engagement

• Empowers self-determination by supporting individuals and whānau as active participants in their health journey

• Shifts the focus from illness to wellness through early intervention and lifestyle-based prevention

• Reduces long-term costs by easing pressure on hospitals through prevention

• Strengthens community resilience by serving as a hub for connection and wellbeing

Cons:

• Risk of underuse without ongoing outreach and whanaungatanga

• Due to its divergence from mainstream biomedical models, individuals may experience difficulties in adapting to a new holistic health paradigm

INTENDED USERS

Located in Takapuna, the project primarily serves the local community and surrounding North Shore suburbs, while also accommodating users from across Auckland seeking holistic and culturally responsive health-care. This reflects the area's diverse urban population and the broader regional use of healthcare services.

Within this context, Māori communities are positioned as integral to the conceptual foundation of the design rather than a peripheral user group. Māori health principles, including Te Whare Tapa Whā, inform a holistic approach to wellbeing that supports both Māori and non-Māori users while responding to the need for more culturally informed models of care.

The design prioritises whānau as primary users, supporting multigenerational use and collective wellbeing. This is reinforced through spaces that enable social connection, intergenerational interaction, and shared care. Informal and communal areas also function as "third spaces," extending the role of the centre beyond clinical services to support everyday wellbeing and community life.

TABLE 11 ALIGNING THE PROGRAMME WITH TE WHARE TAPA WHĀ

A core tenet of the theoretical framework is the integration of Te Whare Tapa Whā into the design. This is primarily achieved through the programme, as the services provided have a significant impact on whether all dimensions of health are addressed. Therefore, this table examines various facilities, activities and services that could be offered by the centre to support all dimensions of health and provide inclusive healthcare.

PRINCIPLE	FOCUS	POSSIBLE SPACES / SERVICES	DESIGN / CULTURAL INTEGRATION
Taha Tinana (Physical Health)	Physical well-being, preventative care, and maintenance	General practice/medical consultation rooms, dental clinic, physiotherapy/recovery areas, gyms, exercise studios, community kitchens, gardens, hāngī pits, nutrition counselling spaces, outdoor play/exercise equipment	Rongoā Māori treatments, mirimiri (massage), romiromi, traditional nutrition practices, hāngī cooking, use of native plants for medicine, community hīkoi (walks) promoting fitness and whenua connection
Taha Wairua (Spiritual Health)	Connection to self, ancestors, beliefs, and values	Meditation rooms, quiet reflection spaces, marae-style meeting areas, sacred gardens, spiritual counselling rooms, dedicated areas for pōwhiri and waiata, pools or water features	Incorporation of karakia, waiata, whakapapa carvings and tukutuku, pou or sculpture symbolising atua, spaces oriented to the sun/moon cycles, acknowledgment of maunga, awa, or moana in design
Taha Whānau (Family / Social Health)	Relationships, belonging, and community	Whānau rooms, community meeting rooms, multipurpose halls, play areas, outdoor gathering spaces, shared dining areas, wharekai, intergenerational activity zones	Whānau-centred activities, communal gardens, kapa haka or mau rākau classes, weaving and carving workshops, kaumātua spaces for leadership and guidance, youth mentoring hubs, collaborative cooking and eating traditions
Taha Hinengaro (Mental / Emotional Health)	Emotional and cognitive well-being	Counselling rooms, therapy spaces, mindfulness/quiet zones, creative arts rooms, group therapy areas, healing garden	Therapeutic creative workshops (art, music, dance), storytelling and oral traditions, wānanga on resilience and emotional well-being, whaikōrero (speech-making) or kōrero spaces for sharing narratives
Taha Taiao / Whenua (Environmental / Connection to Land)	Connection to environment, nature, and place	Outdoor gardens, walking paths, green courtyards, rooftop gardens, nature observation areas, food forests, outdoor classrooms, stormwater ponds designed as natural features	Native planting reflecting local ecology, maara kai (food gardens), spaces for gardening with Māori medicinal plants, integration of whakapapa with local maunga/awa/moana, bird habitats, outdoor gathering spaces aligned with seasonal cycles, acknowledgment of atua (e.g., Tāne Mahuta, Tangaroa) through planting and water design

TABLE 12 ALIGNING PROGRAMME WITH TE ARANGA MĀORI DESIGN PRINCIPLES

PRINCIPLE	FOCUS	POSSIBLE SPACES / SERVICES	DESIGN / CULTURAL INTEGRATION
Mana	Recognise and respect iwi and hapū as mana whenua	Entrances, reception, outdoor spaces, gardens, lobby, signage	Display acknowledgements of local iwi/hapū, incorporate iwi motifs in artwork, carvings, or signage; orientation of building respecting local landmarks; include welcoming pōwhiri spaces or cultural protocols in the entrance; flags or symbols representing local iwi identity
Whakapapa	Celebrate Māori names and genealogy	Room names, wayfinding, corridors, hallways, directories	Name rooms and spaces after ancestors, iwi, or historical events; interpretive panels telling stories of lineage; integrate genealogy stories in artwork or murals; digital displays highlighting local iwi history; educational displays about family structures and cultural connections
Taiao	Protect, restore, and enhance the natural environment	Gardens, walking paths, outdoor therapy areas, courtyards, green roofs	Native planting, restoration of degraded areas, water features, biodiversity-friendly landscaping; spaces for therapeutic horticulture; create wildlife habitats; rain gardens and sustainable drainage to protect local ecosystems; integrate natural sounds, light, and textures into interior spaces
Mauri Tu	Protect, maintain, and enhance environmental health	Therapy rooms, outdoor spaces, healing gardens, meditation spaces	Use natural light and ventilation, sustainable and non-toxic materials; integrate flowing circulation and open layouts to promote vitality; spaces for restorative practices like mirimiri; create calming sensory environments that enhance physical and mental well-being
Mahi Toi	Acknowledge significant sites and cultural landmarks	Art spaces, communal areas, cultural workshops, galleries	Incorporate carvings, weaving, murals, and art inspired by significant sites; display locally significant artworks; interactive workshops where community can contribute artwork; rotate exhibits to reflect cultural storytelling and seasonal events; consider sculpture or landmark elements that reference ancestral sites
Tohu	Capture and express iwi/hapū narratives creatively	Storytelling rooms, corridors, interactive displays, digital installations	Use murals, installations, and interpretive signage to communicate local narratives and history creatively; include audio-visual storytelling or augmented reality features; incorporate symbols, patterns, or motifs that reference iwi stories; integrate narrative into wayfinding and room design
Ahi Kā	Ensure iwi/hapū have a living, enduring presence	Marae-style meeting rooms, whānau spaces, cultural hubs, multipurpose halls	Co-design with local iwi/hapū on remaining site lareas; host regular cultural events, workshops, and ceremonies; create dedicated spaces for intergenerational learning; enable flexible spaces for hui, kapa haka, and cultural training; include areas for local crafts and traditional practices to be maintained onsite

PROGRAMME

The programme reflects an integrated approach to health, valuing multiple dimensions and drawing upon both Māori and Western perspectives on wellbeing, acknowledging that each offers unique strengths in health promotion. While this represents a careful balance to avoid over-Western-ising healthcare, there is a clear emphasis on addressing the specific needs of Māori communities while also incorporating broader health initiatives to cater to the wider community. Incorporating both Western and Māori health perspectives enables people to exercise sovereignty over their health journey, providing choice rather than limiting them to Western biomedical services. Additionally, although Western health knowledge is incorporated, the programme remains primarily focused on preventative care - for example, general practice and dental services emphasise prevention rather than treatment alone.

One noticeable aspect of this programme is that it may initially appear disjointed, drawing upon multiple initiatives; however, there is an overarching focus on health. Although some elements may resemble community-centre-type programming, it is important to acknowledge that this perspective may reflect a Western view of health as primarily clinical, whereas Māori understandings of health encompass community, social, and relational dimensions. Thus, even spaces that might seem removed from health, such as community kitchens or art gallery spaces, still promote wellbeing, even if they are not explicitly clinical.

The programme is evaluated on its ability to meet the different dimensions of Te Whare Tapa Whā.

- Taha Tinana (Physical Health)
- Taha Wairua (Spiritual Health)
- Taha Whānau (Family/Social Health)
- Taha Hinengaro (Mental/Emotional Health)
- Taha Taiao (Environmental/Connection to Land)

Public Engagement & Gathering Spaces

- **Marae ātea -** An open space that supports wellbeing through social connection, cultural engagement, and community participation.



- **Atrium space** - central gathering area promoting openness and connection.



- **Multipurpose performance / event space** - A flexible venue for performances, workshops, and community gatherings that foster social connection.



- **Art gallery** - displays works by local Māori artists and creations from onsite art therapy programs, supporting cultural expression and wellbeing.



- **Health foods café** - nutrition-focused meals incorporating traditional kai and healthy options.



Community & Social Wellbeing



• **Community living area** - social interaction, whanaungatanga (relationships), and communal support.



• **Community dining area** - shared meals to encourage healthy eating and social connection.



• **Community kitchen** - nutrition education, food preparation, and engagement with traditional kai.



• **Community vegetable garden** - growing vegetables for nutritious meals.



• **Children's play area** - physical activity, social development, and safe spaces for tamariki (children).

Wellness & Fitness



• **Healing pools (water therapy)** - Hydrotherapy supporting wellbeing, reflecting the life force of wai.



• **Indoor gym** - accessible fitness facilities to support physical and mental health.



• **Sauna** - relaxation and stress relief.



• **Physiotherapy** - rehabilitation and preventative care.



• **Multipurpose hall (Kapa haka practice spaces, Mau rākau)** - Cultural practices fostering holistic wellbeing.



• **Mirimiri (massage / bodywork)** - traditional Māori healing to restore physical and spiritual balance.

Healthcare & Holistic Services



• **Dental services** - preventative oral health care.



• **General practice** - primary healthcare services.



• **Therapy rooms / group therapy rooms** - psychological and emotional support, including culturally-informed approaches.



• **Spiritual counselling rooms** - wairuatanga (spiritual healing), karakia, and guidance.



• **Family-centred social services** - whānau ora support for holistic family wellbeing.



• **Nutrition counselling** - education and guidance incorporating traditional kai and healthy lifestyles.



• **Plant medicine room** - A space for rongoā Māori herbal remedies.

Outdoor & Nature Spaces



• **Outdoor walking trail** - physical activity and connection to nature.



• **Vegetable Garden and Orchard** - food production and relaxation.



• **Nature observation platforms** - passive engagement with flora and fauna, promoting mental and emotional wellbeing.



• **Medicinal garden** - cultivation of native plants used in Rongoā Māori (herbal healing).

Reflection

It is evident that each space supports at least one dimension of health from Te Whare Tapa Whā, demonstrating a programme that successfully addresses all dimensions of wellbeing across different spaces and services. While the programme is extensive and may feel less targeted, the site analysis indicates that ample space is available, allowing for a broader range of spaces and services to be offered to the community.

A note on the marae atea....

One element of the programme that requires careful cultural consideration is the marae ātea. While this project is not a kāpuapā Māori design and does not follow all customary protocols, it draws inspiration from the cultural and symbolic significance of the marae ātea as a space of welcome and communal gathering (Mead, 2003; Royal, 2007). In this context, the space is positioned at the start of the health journey to function as a place for welcoming and gathering visitors, including pōwhiri (Mead, 2003). At the same time, it is acknowledged that this design does not replicate the full role of a traditional marae ātea, which in customary contexts is intrinsically linked to the wharenui, the wider marae complex, and the layers of protocol, ancestry, and spiritual significance embedded within those spaces (Royal, 2007). By referencing the marae ātea, the design seeks to honour Māori cultural concepts while acknowledging the limitations of adapting these practices within a non-traditional context.

PUBLIC VS PRIVATE SPACES

It is important to consider the balance between public and private spaces within the programme to create a layout that avoids clashes and allows for gradual, seamless transitions.

Public ← → **Private**

- Foyer
- Atrium space
- Art gallery
- Health foods café
- Outdoor walking trail
- Nature observation platforms
- Community living area
- Community dining area
- Community kitchen
- Children's play area
- Multipurpose hall (Kapa haka practice spaces, Mau rākau)
- Marae Ātea
- Healing pools (water therapy)
- Sauna
- Medicinal garden
- Nutrition counselling rooms
- Therapy rooms
- Group therapy rooms
- Mirimiri (massage / bodywork)
- Spiritual counselling rooms
- Plant Medicine Room
- Physiotherapy
- Family-centered social service rooms
- General practice
- Dental services

Figure 113. Public vs Private

INITIAL SPATIAL LAYOUTS

Option 1

The initial spatial layout positions the public and cultural spaces (foyer, atrium, art gallery, and health foods café) as the central heart of the building and primary point of circulation. From there, the layout branches into more public spaces, while the second level accommodates the service-based, private healthcare rooms.

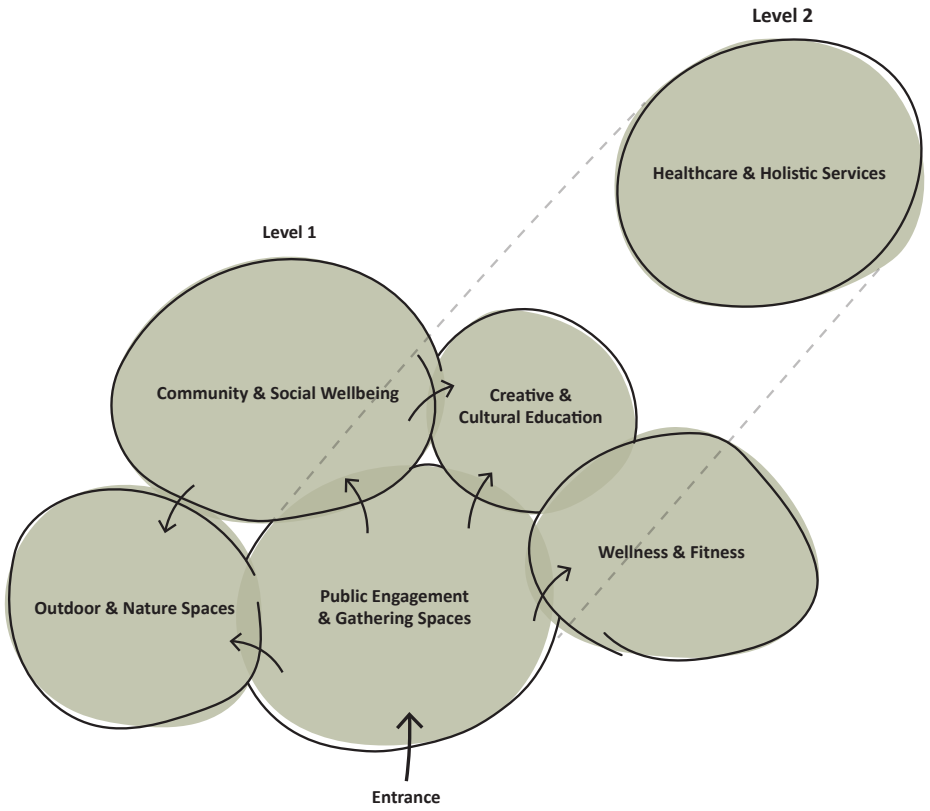
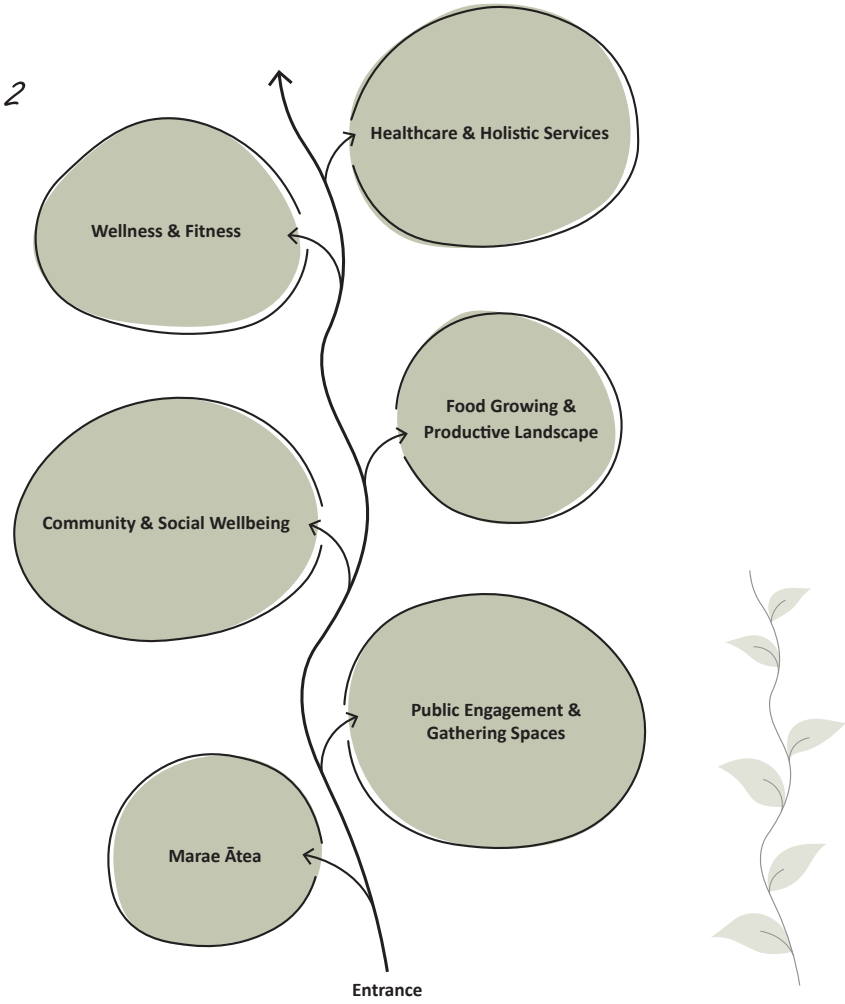


Figure 114. Spatial Layout: Option 1

Option 2



Inspired by the alternating leaves on a stem, this alternative layout creates a circulation that feels more like a journey - fluid and continuous rather than static. It illustrates how each section must be passed through before holistic health can be achieved. This circulation style was chosen to encourage a gradual progression through different spaces, reinforcing the idea that wellbeing is not reached all at once but through interconnected stages. By moving sequentially, users are guided to engage with each aspect of the programme, fostering a more holistic health experience.

Figure 115. Spatial Layout: Option 2

HE HAERENGA HAUORA (A JOURNEY OF HEALTH)

The journey of health begins with collective connection, where whanaungatanga is fostered through spaces designed for gathering and shared experience. Public and cultural areas - such as the marae ātea, atrium, and art gallery - act as welcoming thresholds, bringing whānau and community together. Within community living areas, dining spaces, the vegetable garden, and children's play areas, people can interact, collaborate, and nurture relationships, strengthening social bonds across generations. Together, these environments create a strong foundation for family and social wellbeing, grounded in connection to both people and place.

From this collective grounding, the journey moves into a productive landscape, where food growing becomes an act of care and learning. Orchards and gardens replace formal educational spaces, offering hands-on, place-based knowledge rooted in whenua, seasonal rhythms, and intergenerational exchange. Cultivating, harvesting, and sharing food engage individuals in practices that support personal wellbeing and collective responsibility. This creates a transitional zone between social connection and personal restoration, while reinforcing the link between nourishment, movement, and health.

As the journey continues, personal wellbeing is further nurtured through wellness and fitness spaces that support physical, mental, and sensory restoration. Healing pools, saunas, movement spaces, and mirimiri/romiromi areas provide opportunities for movement and relaxation.

Finally, the journey culminates in holistic care, where healthcare and wellbeing services address the interconnected needs of tinana, hinengaro, wairua, and whānau. From spiritual guidance to general practice, therapy, nutrition support, and whānau ora services, these spaces integrate traditional and contemporary approaches to health. This stage recognises that healthcare must extend beyond physical health, understanding healing as a holistic process that encompasses multiple dimensions of wellbeing.

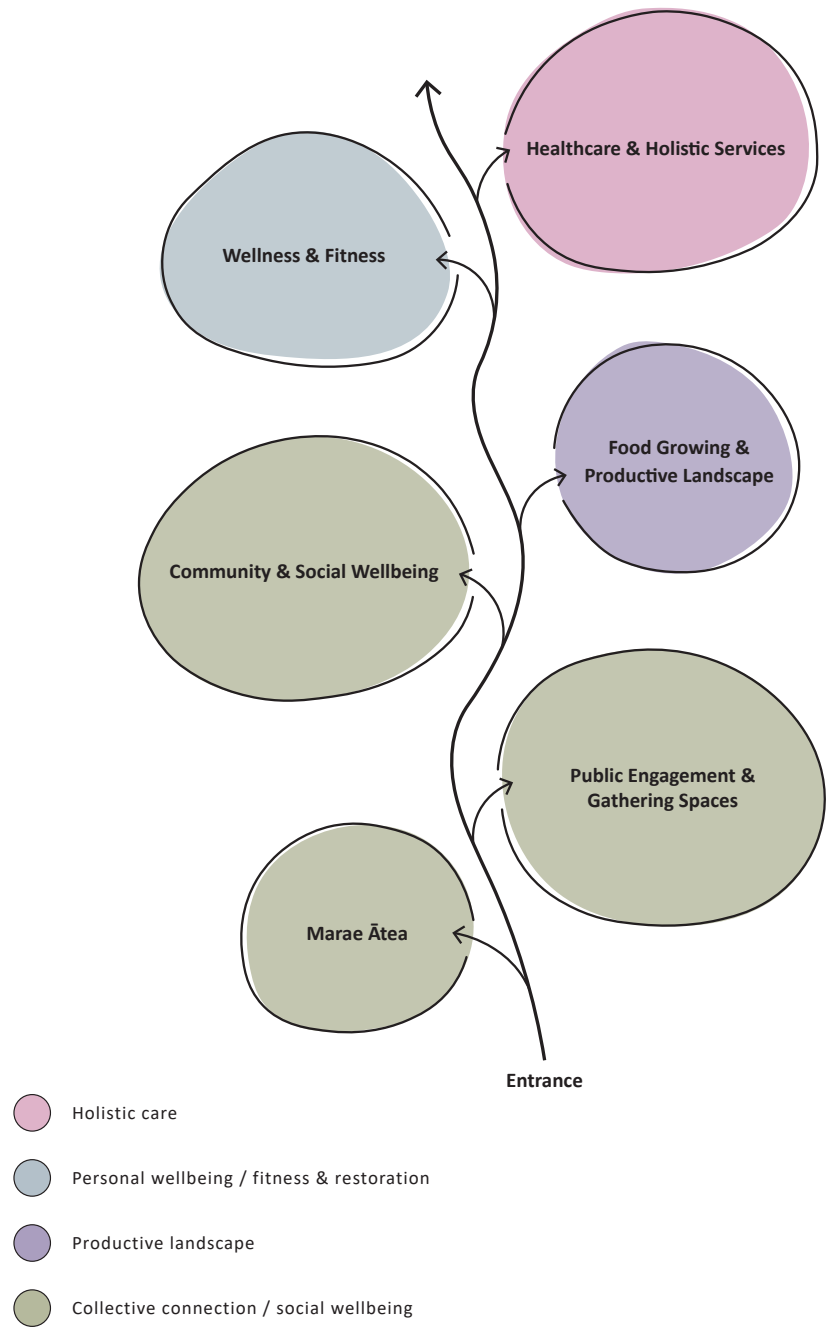
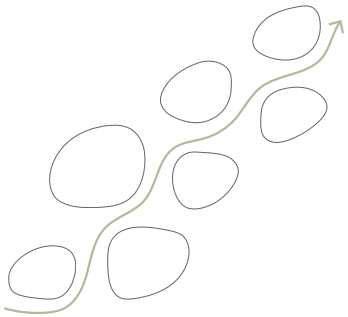


Figure 116. Stages of a Journey of Health

7.7 Establishing the Design Concept

INITIAL PLAN DEVELOPMENT

Building on the chosen circulation layout and insights from the SWOT analysis, a site plan has been developed that integrates both the arrangement of buildings and the overarching landscaping strategy. Earlier on-site experiments revealed that the buildings felt detached from their context, as if they could occupy any location. In contrast, this plan orchestrates the buildings to create a purposeful journey across the site. The building forms and pond layout draw inspiration from shell forms found at Takapuna Beach, explored in previous modelling. Native bush has been planted where the best topsoil remains, while the pond occupies the area most lacking in nutrients for plant growth. This stage of design marks the initial step in formalising the scheme within its landscape context.



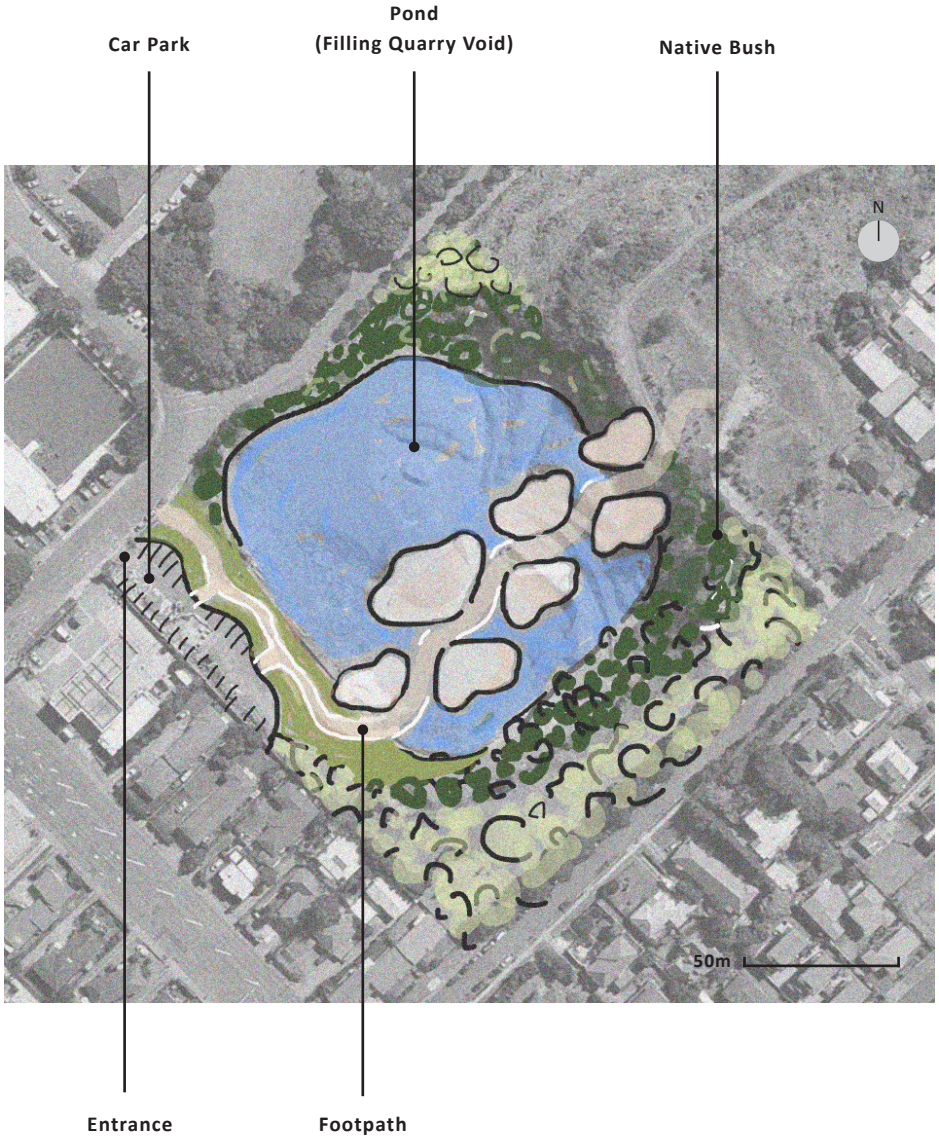


Figure 117. Initial Plan A

A PROBLEM WITH CIRCULATION

One issue that has arisen with the circulation of He Haerenga Hauora (A Journey of Health) is the journey's end point. From a practical perspective, concluding the experience on the far side of the site, distant from the car park, proves inconvenient. To resolve this, the pathway will instead loop back through the native forested area. This adjustment not only enhances practicality but also reshapes the return as a contemplative journey, where the experience flows from the touch of biophilic design in architecture into the healing embrace of the native bush. In this way, the journey does not simply conclude but comes full circle, reinforcing the interconnectedness of built and natural environments in the healing process.



Figure 118. Initial Plan B

INITIAL PERSPECTIVE DEVELOPMENT

Following the testing of multiple ideas in earlier conceptual explorations, this concept emerges as the chosen design direction. The initial perspective investigates how the structure will be arranged on site prior to further formalisation. The volumes are positioned to touch the site lightly, elevated above the ground plane, responding to the site analysis which determined that the land should remain unaltered. In this way, the structures work with the existing terrain rather than relying on additional material to fill depressions and flatten the site. This stage of testing allows an understanding of how the centre engages with its context before further refinement. Ongoing refinement will ensure that the programme fits appropriately within the structure and that the design is fully integrated with the theoretical frameworks of Terrapin Bright Green's 14 Patterns of Biophilic Design, Te Aranga Māori Design Principles, and Te Whare Tapa Whā - which has already strongly influenced the programme.

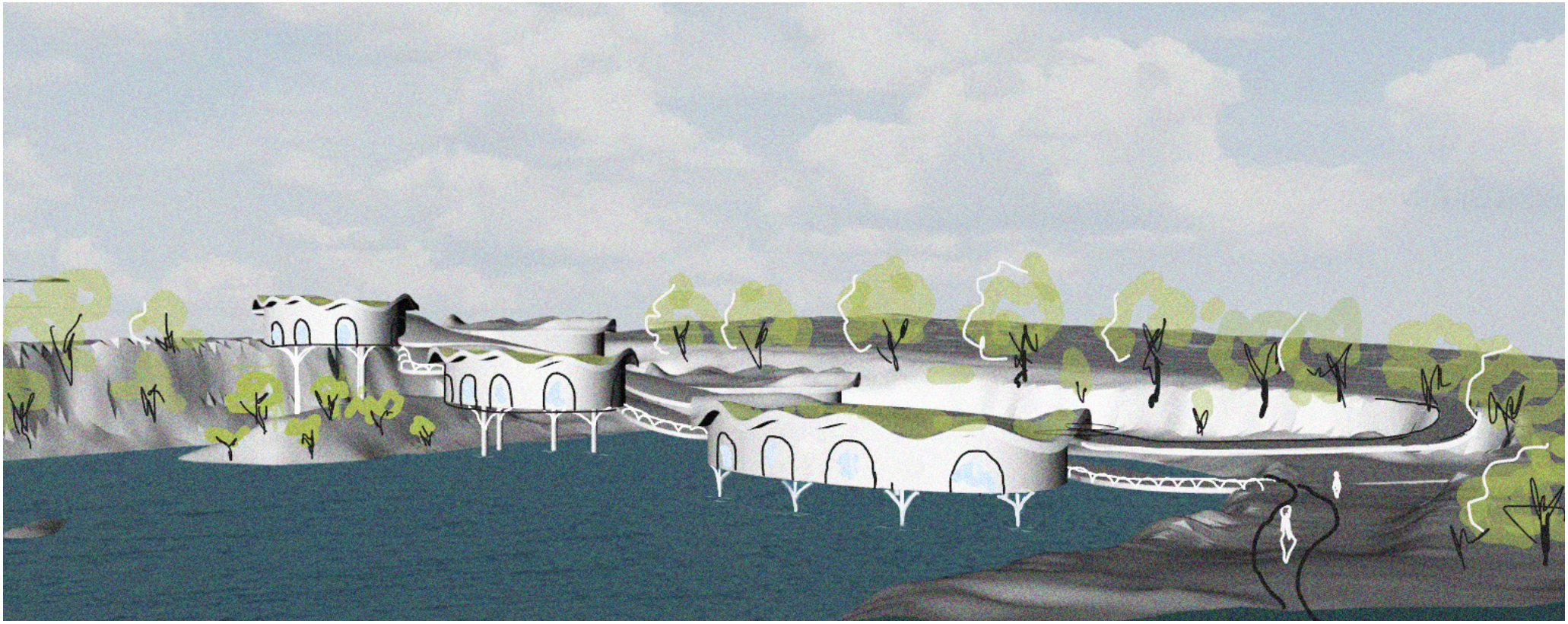


Figure 119. Initial Perspective

APPROACHES TO CURVED PLANS

Curved building envelopes present both opportunities for innovative design and challenges in spatial and structural resolution. There are different approaches to organising spatial layouts within curved building envelopes, each negotiating the relationship between expressive form and functional requirements. These iterations offer different approaches to dividing space within an irregular curved building envelope and provide strategies for guiding spatial layout in the design.

Plans

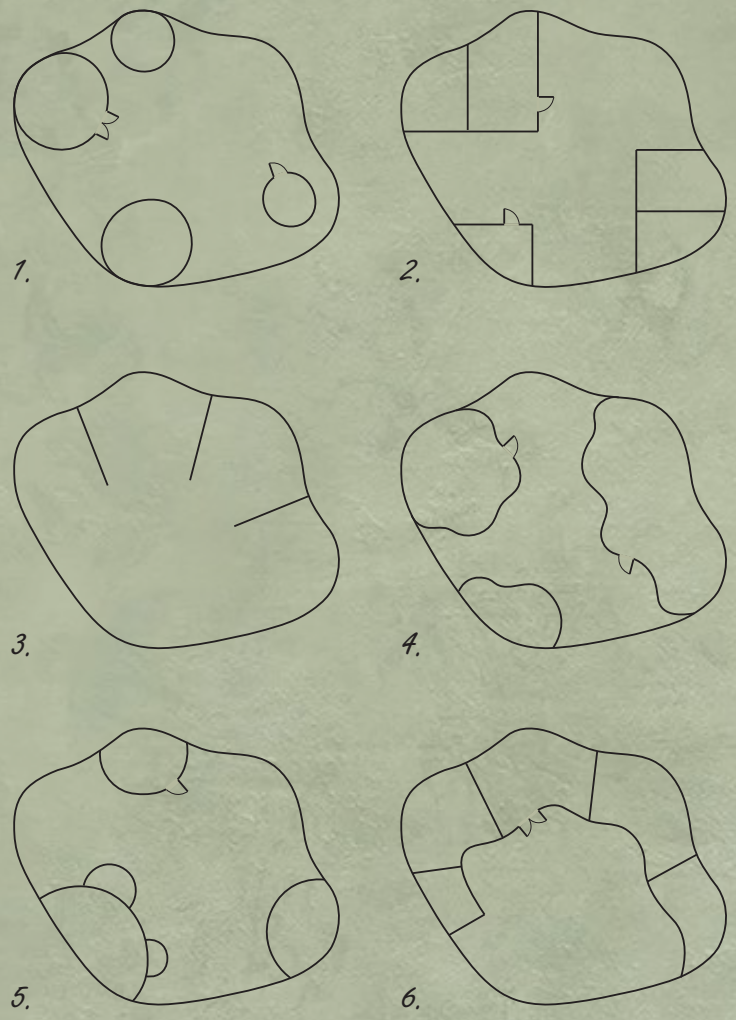


 Figure 120. Exploring Curved Building Envelopes

Perspectives

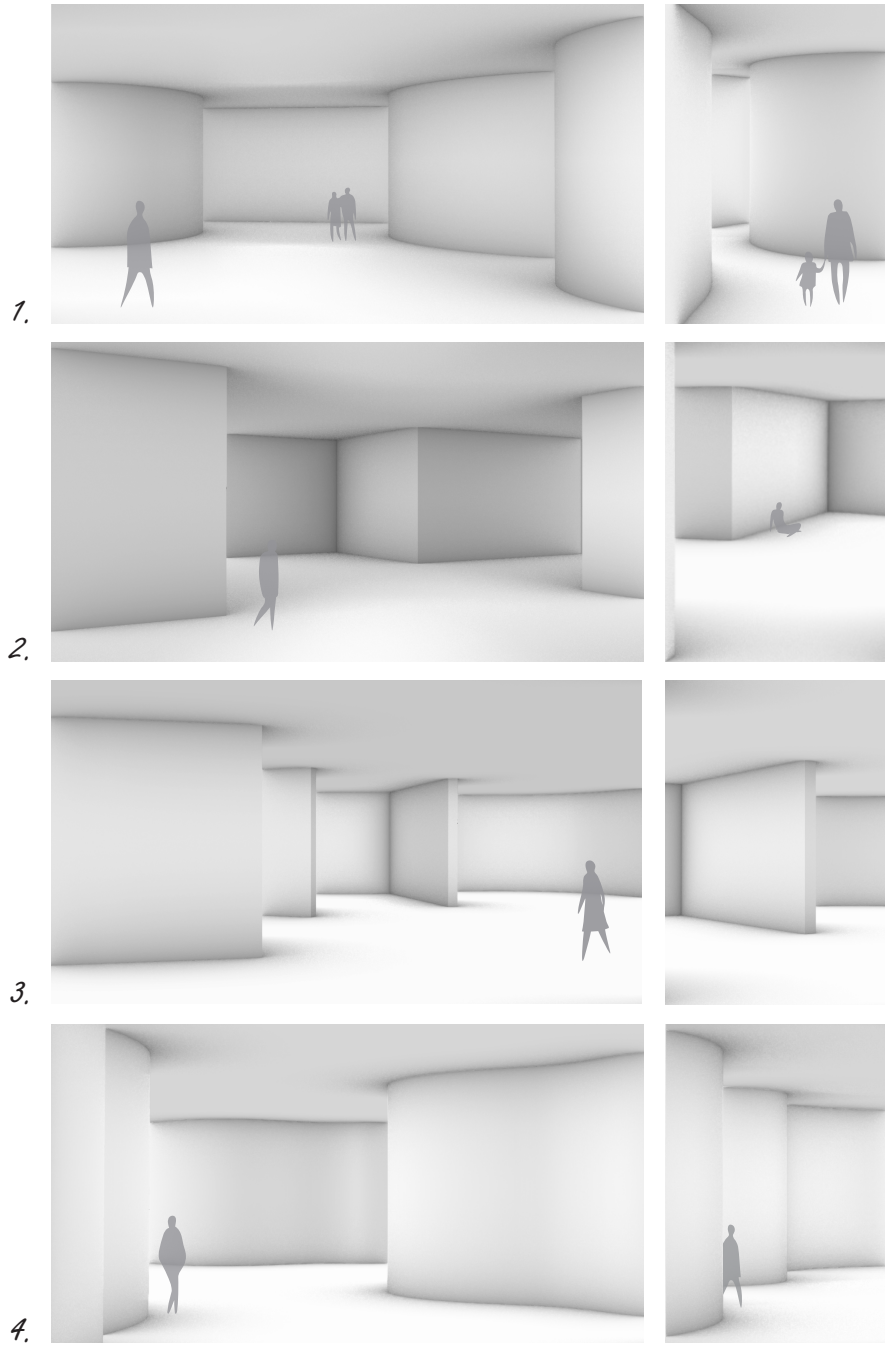
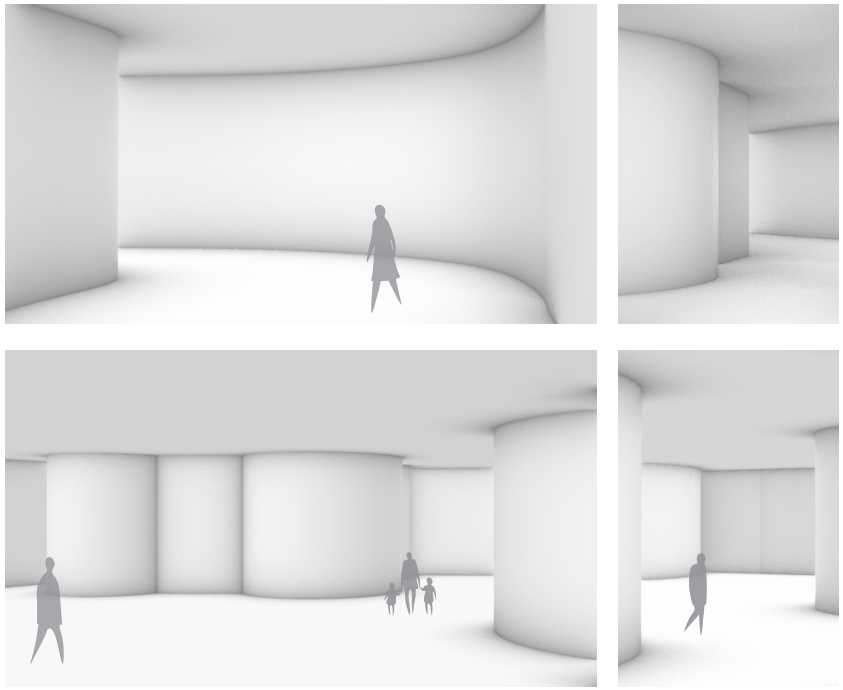


Figure 121. Experiential Qualities of Different Plans Collage A



5.

6.

Plans defined by straight lines (2 and 3) produced a sharper, more rigid spatial character, while the curved plans offered a flowing and continuous experience. In perspective, the curved and circular configurations revealed particularly engaging spatial qualities, which are intended to be incorporated into the final design to enrich user experience.

Figure 122. Experiential Qualities of Different Plans Collage B

DESIGNING WITH CIRCLES

An approach that will be carried through to the final design is the use of circles. Common in nature, they align well with the planned building footprint and create efficient gathering spaces by focusing attention toward the centre - ideal for meeting rooms, performances, or meditation. Their curved geometry softens movement, improves circulation, maximises views, and blends more naturally with the landscape. Symbolically, circles embody unity, inclusiveness, and the cycles of life - qualities well suited to a holistic healthcare centre. Ultimately, they help soften the architecture, moving away from rigid grids toward a more organic, biophilic, and sculptural form.

Circular Spaces Formed by Shells

Shells from Takapuna Beach have been used throughout the design process as a source of inspiration, and they continue to guide the layout of circular spaces in plan.

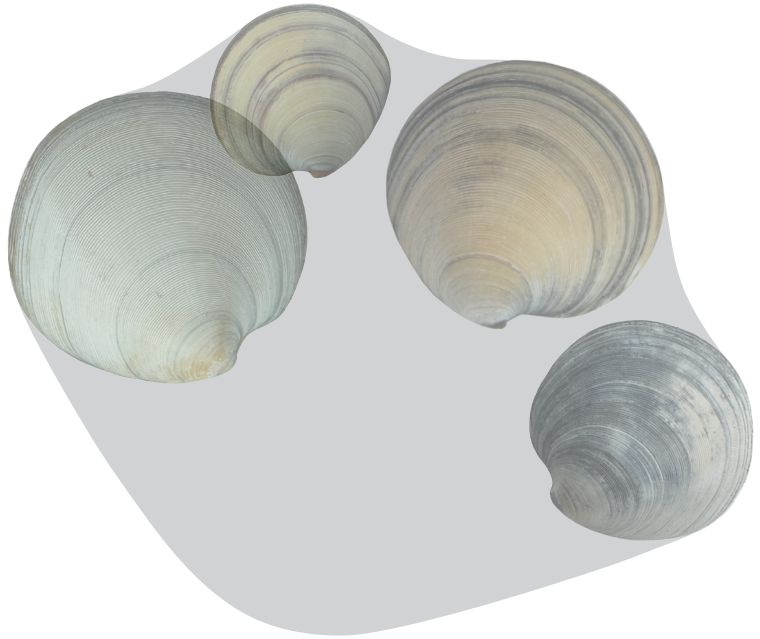
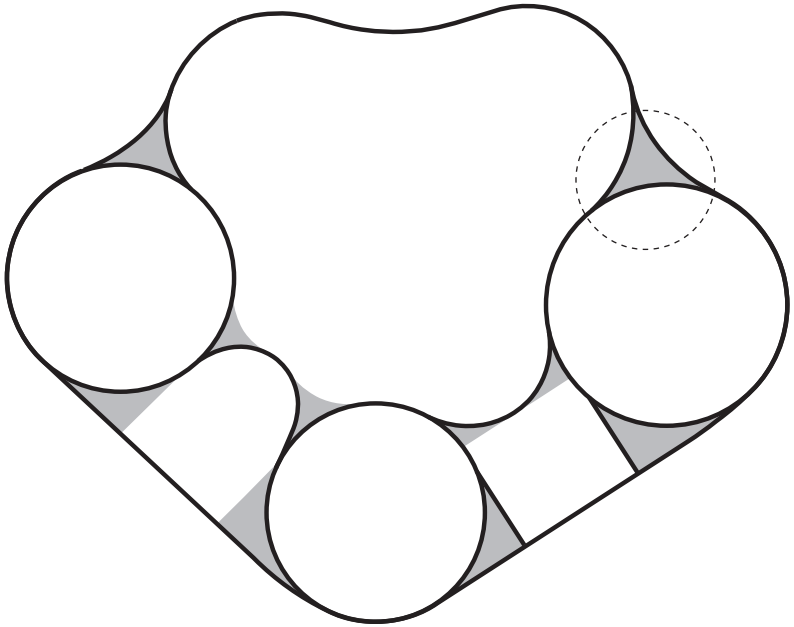


Figure 123. Circular Spaces Formed by Shells

CIRCULAR DESIGN CHALLENGES

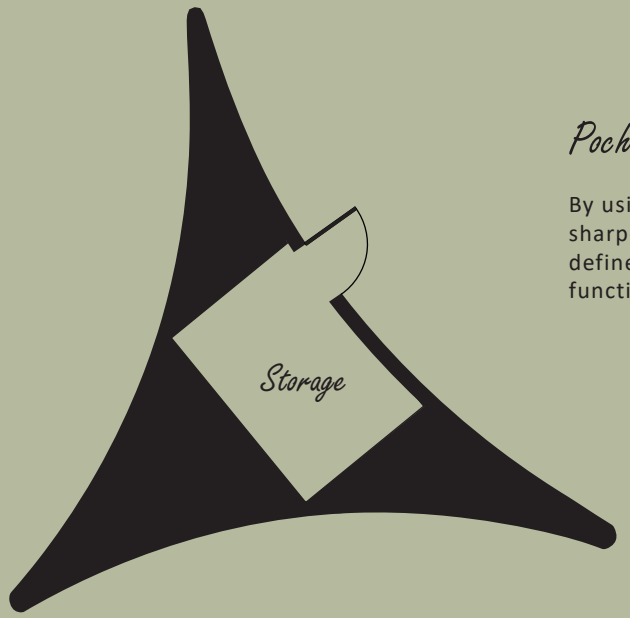
It is acknowledged that working with circles is not the most practical approach structurally or financially; however, this project prioritises holistic health outcomes and the benefits of biophilic and Māori design principles over cost or efficiency. One limitation of circular design is that it often creates rectilinear envelopes with awkward residual spaces. A useful strategy to address this is poché, which in architectural design refers to intentionally thickened wall zones or buffer spaces. By treating leftover triangular or wedge-shaped areas as poché, these irregularities can either be concealed within wall thickness or repurposed for secondary functions such as storage, services, or circulation. Another approach is the introduction of pocket gardens in these residual spaces, which transforms otherwise unusable areas into small green areas - supporting biophilic design. Both strategies turn potential wasted space into functional or experiential design features.



Uninhabitable or inefficiently usable space

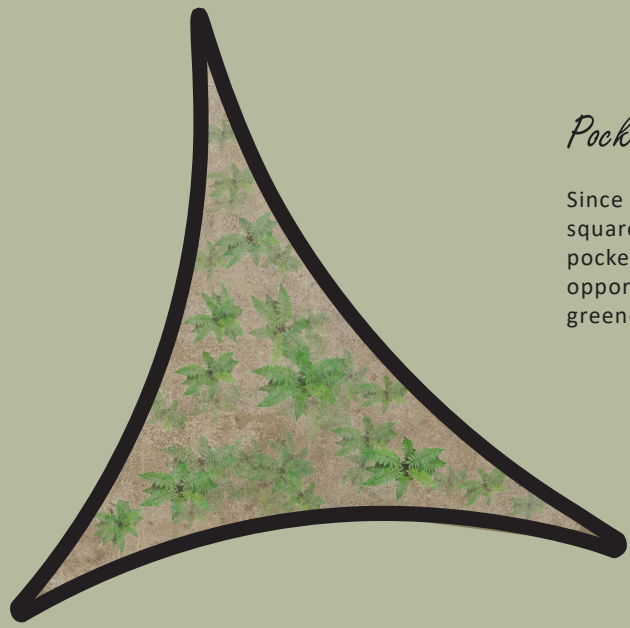
Figure 124. Residual Spaces in Plan Containing Circles

Solutions to uninhabitable or inefficiently usable space



Poché Approach

By using poché, awkward sharp-angled spaces can be re-defined to create areas that are functional.



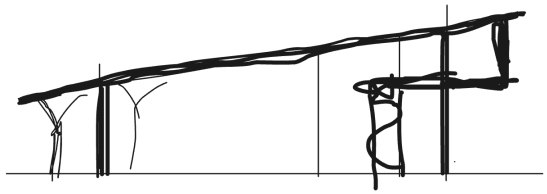
Pocket Garden

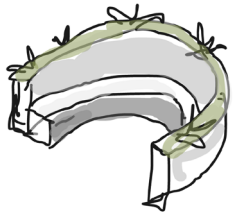
Since nature does not rely on square or regular forms, these pockets of space offer valuable opportunities to introduce greenery.

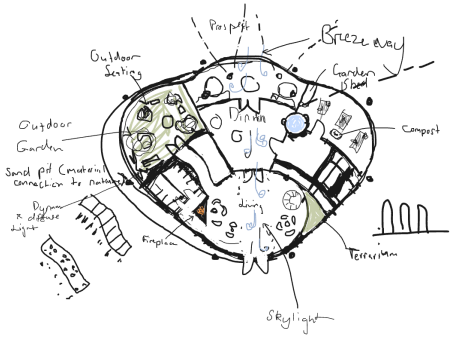
Figure 125. Solutions to Inefficiently Usable Space in Plan

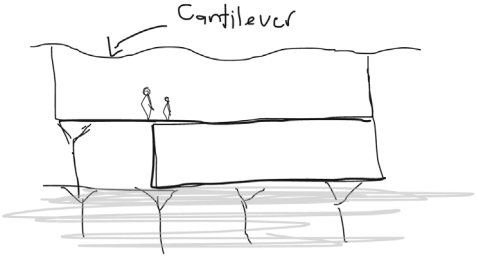
ITERATIVE DESIGN PROCESS

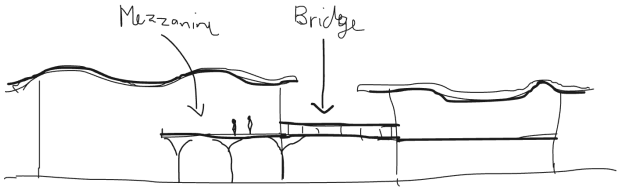
During the design process, rapid digital sketches were used to explore multiple ideas efficiently. Numerous design variations were tested before arriving at the finished design. Neat drawings were sometimes deprioritised due to their time-intensive nature and their tendency to limit experimentation. The final design, therefore, did not emerge fully formed - it evolved through a series of rough, sometimes unpolished iterations that allowed concepts to be explored, tested, and refined before reaching their final expression.













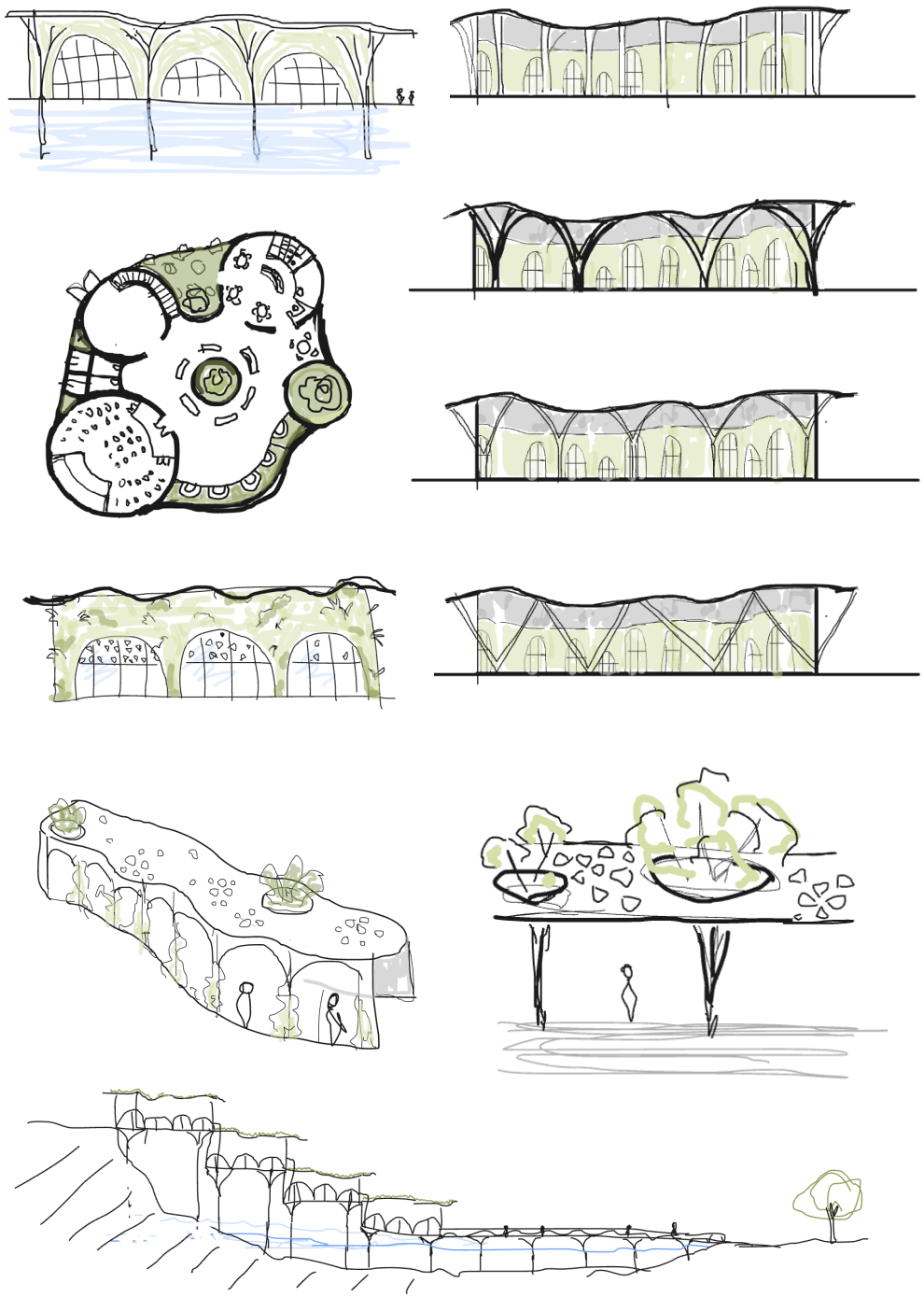


Figure 126. Iterative Design Collage

CHAPTER 8: DEVELOPED DESIGN

The developed design stage signals that the design has been fully resolved, responding to all previous research and design exploration.

It is important to note that references such as “P8” correspond to Terrapin Bright Green’s (2014) 14 Patterns of Biophilic Design, indicating the specific pattern being applied.

8.0 Overall Design



Figure 127. Site Plan, Scale: 1:750 @ A3

TABLE 13 SITE PLAN KEY

The following table provides context for the plan shown in Figure 127. The site plan depicts He Haerenga Hauora (A Journey of Health), guiding visitors across a pond within the quarry's natural depression. Each space along the journey supports holistic wellbeing. The shell-like buildings draw on biomorphic forms (P8) and reference early shell studies from nearby Takapuna Beach, while views to the pond reinforce the presence of water (P5). The final component of the health journey is a bush walk - a deliberate design move that harnesses the restorative qualities of natural environments.

SPACE / FEATURE	DESCRIPTION / ALIGNMENT WITH THEORETICAL FRAMEWORK (The 14 Patterns of Biophilic Design, Te Whare Tapa Whā, and Te Aranga Māori Design Principles)	POTENTIAL BIOPHILIC HEALTH BENEFITS Information in this section is derived from Table 1 in the 14 Patterns of Biophilic Design (Browning et al., 2014).
1. Car Park	The car park features permeable paving, which allows rainwater to infiltrate the ground, reducing runoff and the risk of flooding. This system naturally filters pollutants, supports groundwater recharge, and contributes to regenerative design. This aligns with taiao and mauri tū.	-
2. Footpath	The footpath serves as the main circulation route, supporting physical movement and aligning with the taha tinana (physical wellbeing) dimension of Te Whare Tapa Whā.	-
3. Deciduous Trees	Deciduous trees line the footpath and car park at the site entrance, creating a Connection with Natural Systems (P7). Their seasonal transformation into autumnal hues allows visitors to engage with the rhythms of nature.	**Pattern 7: Connection with Natural Systems** • Enhanced positive health responses; shifted perception of environment
4. Marae Ātea	An area designated for welcoming and ceremonial purposes, where visitors are received and formal greetings (pōwhiri) take place, although it does not carry the same spiritual significance as the marae ātea of a traditional marae.	-
5. Pontoon	Allows access to the pond's water, strengthening the Presence of Water (P5).	**Pattern 5: Presence of Water** • Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure • Improved concentration and memory restoration • Enhanced perception and psychological responsiveness • Observed preferences and positive emotional responses
6. Pond	The pond was designed in response to the quarry's natural dip, creating a habitat for wildlife while serving as a biophilic intervention that enhances both Visual Connection with Nature (P1) and Presence of Water (P5).	**Pattern 1: Visual Connection with Nature** • Lowered blood pressure and heart rate • Improved mental engagement/ attentiveness • Positively impacted attitude and overall happiness **Pattern 5: Presence of Water** • Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure • Improved concentration and memory restoration

		• Enhanced perception and psychological responsiveness • Observed preferences and positive emotional responses
7. Public Engagement & Gathering Spaces	These spaces provide flexible, welcoming environments where people can gather, participate in cultural and creative activities, share nutritious meals, and connect with each other. This aligns with taha whānau (family and social wellbeing) through connection and shared experiences, taha hinengaro (mental and emotional wellbeing) through cultural expression and creativity, and taha tinana (physical wellbeing) through access to healthy food.	-
8. Community & Social Wellbeing Spaces	This suite of spaces is designed to nurture social connection and active participation. Visitors can interact, share meals, engage in food preparation and nutrition education, enjoy play for children, and participate in growing and harvesting produce from the vegetable garden. Together, these areas foster relationships, communal support, and healthy lifestyles, meeting the principles of taha whānau (family and social wellbeing), taha tinana (physical wellbeing), and taha hinengaro (mental and emotional wellbeing).	-
9. Community Orchard	The orchard provides a space for the community to grow and harvest fruit, or simply walk and relax. It nurtures a Connection with Natural Systems through fruit cultivation and seasonal cycles (P7). This supports taha whānau (family and social wellbeing) through shared communal use, taha tinana (physical wellbeing) through active engagement and access to fruit, and taha hinengaro (mental and emotional wellbeing) by providing a calm, restorative environment.	**Pattern 7: Connection with Natural Systems** • Enhanced positive health responses; shifted perception of environment
10. Pool & Wellness Spaces	These spaces feature pools, a mirimiri and romiromi area, a multipurpose exercise zone, and a sauna. They promote holistic health by supporting low-impact exercise, improving strength and flexibility, and facilitating recovery, stress relief, and mindfulness. This aligns with taha tinana (physical wellbeing) and taha hinengaro (mental and emotional wellbeing), and for some users may also support taha wairua (spiritual wellbeing).	-
11. Holistic Healthcare Spaces	This service-focused area of the journey offers a spectrum of care, ranging from general practice and dental services to Rongoā Māori spaces and spiritual counselling. The broad range of services is designed to meet all four dimensions of Te Whare Tapa Whā.	-
12. Native Bushwalk	The final component of the health journey is a walk through native bush, offering a restorative experience that reconnects people with New Zealand's unique ecology. This provides a strong Visual Connection to Nature (P1). It also engages a Non-Visual Connection with Nature (P2), experienced through birdsong (such as tūī, fantail, and kererū), natural airflow, and the sensory qualities of the bush environment.	**Pattern 1: Visual Connection with Nature** • Lowered blood pressure and heart rate • Improved mental engagement/ attentiveness • Positively impacted attitude and overall happiness **Pattern 2: Non-Visual Connection with Nature** • Reduced systolic blood pressure and stress hormones • Positively impacted cognitive performance • Perceived improvements in mental health and tranquillity

13. Native Bush	Establishing native bush is a key design strategy to create wildlife habitat and enhance the ecological condition of the site, aligning with taiao and mauri tū of the Te Aranga Māori Design Principles. It also ensures that the area is embedded within nature, providing a strong Visual Connection with Nature (P1).	**Pattern 1: Visual Connection with Nature** • Lowered blood pressure and heart rate • Improved mental engagement/ attentiveness • Positively impacted attitude and overall happiness



Figure 128. Exterior Perspective 1



Figure 129. Exterior Perspective 2



Figure 130. Exterior Perspective 3

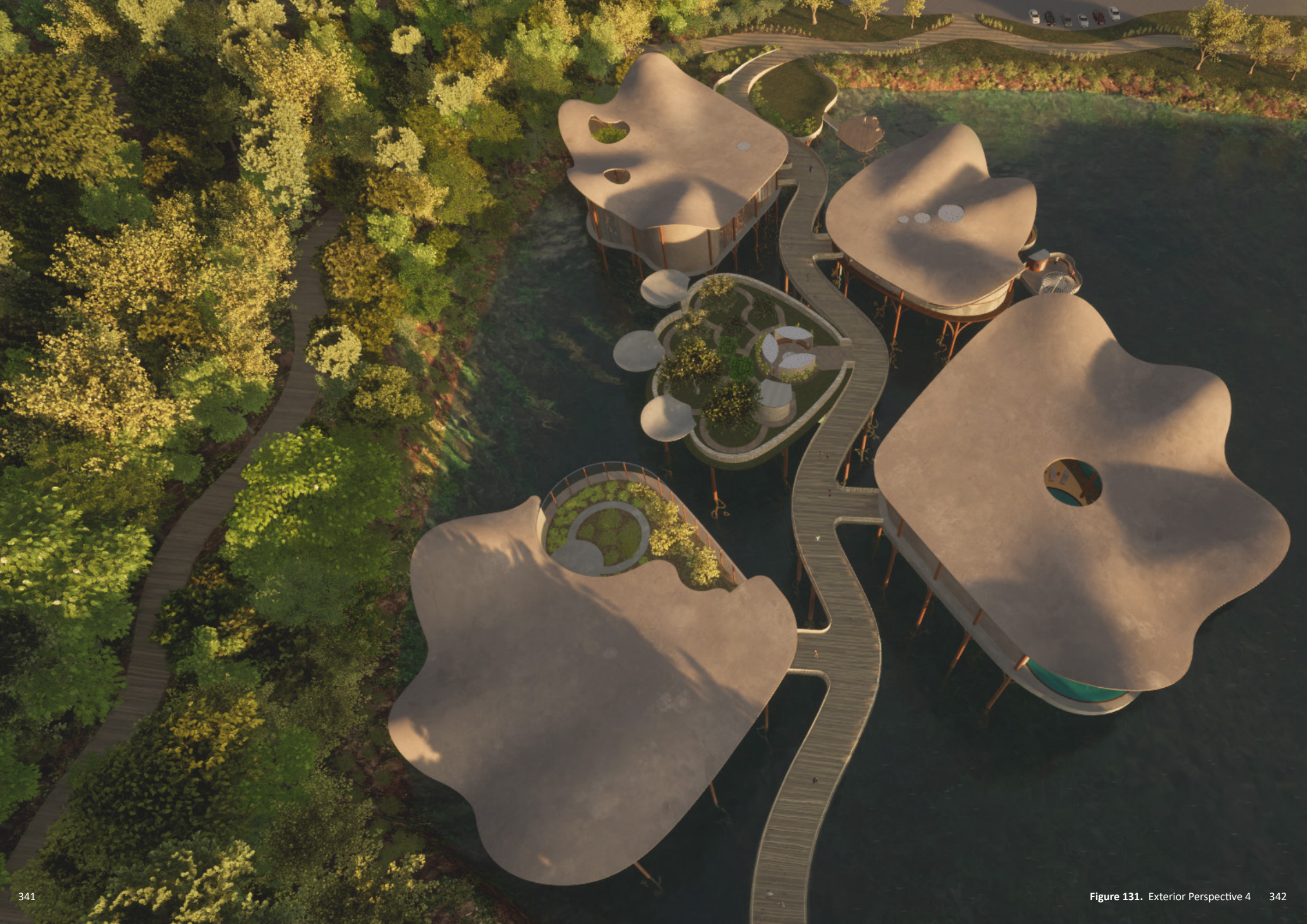


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Figure 131. Exterior Perspective 4 342

8.1 Public Engagement & Gathering Spaces

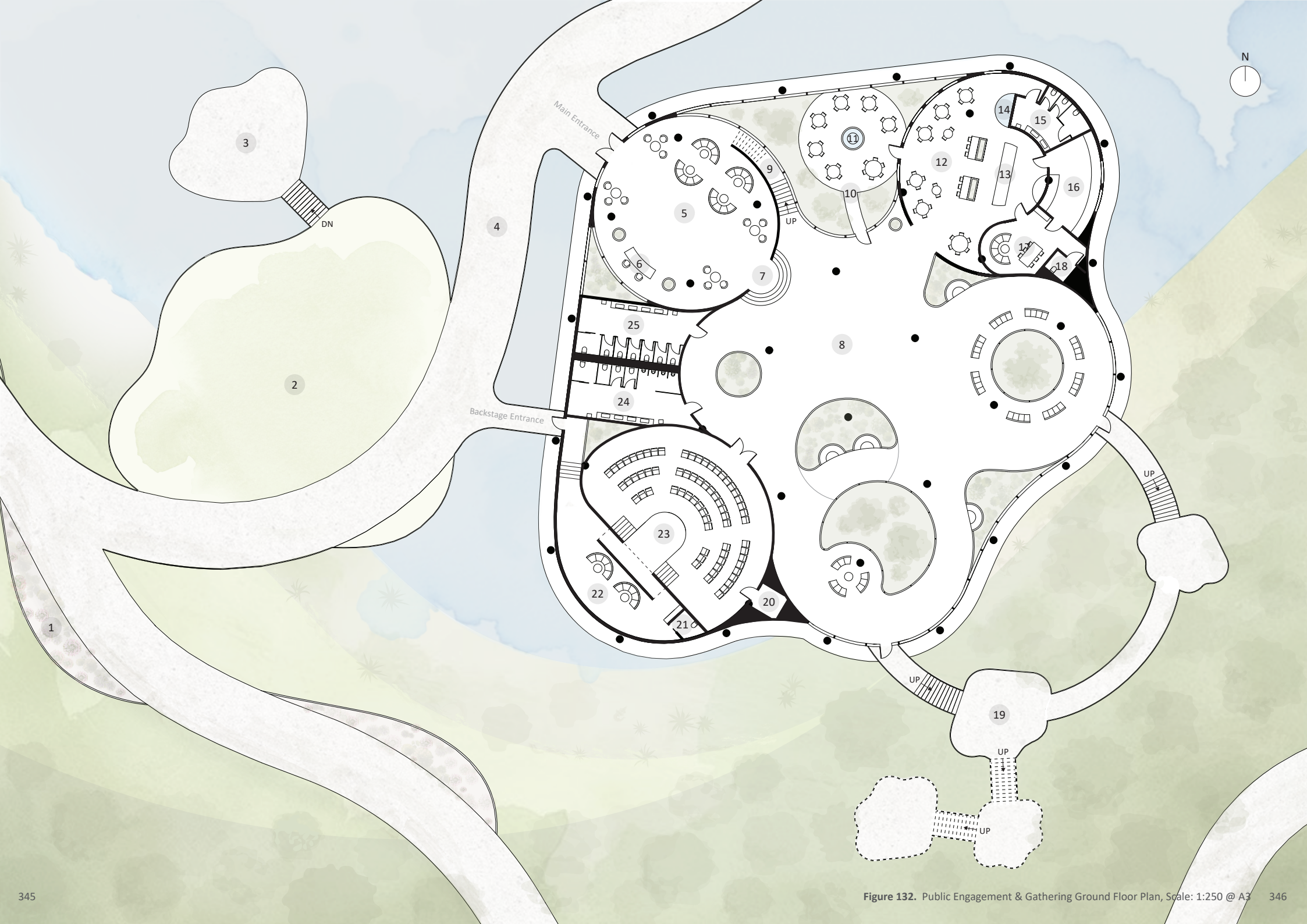

Figure 132. Public Engagement & Gathering Ground Floor Plan, Scale: 1:250 @ A3

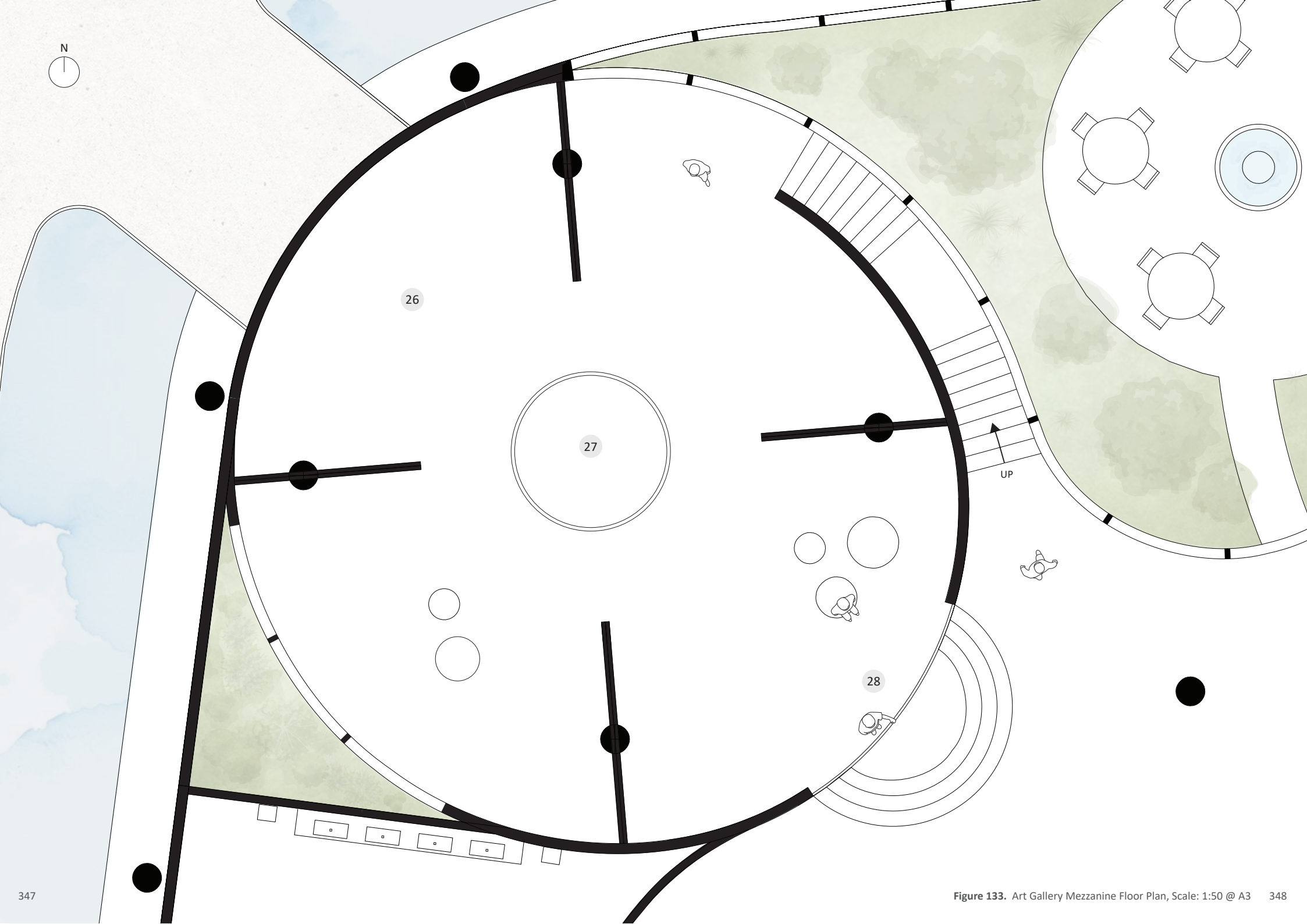

Figure 133. Art Gallery Mezzanine Floor Plan, Scale: 1:50 @ A3

TABLE 14 PUBLIC ENGAGEMENT & GATHERING SPACES KEY

The following table provides context for the plans shown in Figures 132 and 133. The first focus along the health journey is the public engagement and gathering spaces, serving as the initial point of contact that welcomes people into the broader environment of care and community.

SPACE / FEATURE	DESCRIPTION / ALIGNMENT WITH THEORETICAL FRAMEWORK (The 14 Patterns of Biophilic Design, Te Whare Tapa Whā, and Te Aranga Māori Design Principles)	POTENTIAL BIOPHILIC HEALTH BENEFITS Information in this section is derived from Table 1 in the 14 Patterns of Biophilic Design (Browning et al., 2014).
1. Fragrant Flower Beds	Positioned along the circulation route at the start of the health journey, flower beds enhance Non-Visual Connection with Nature (P2) by engaging the olfactory sense through the scent of flowering plants such as lavender and jasmine. These flowers also attract bees, providing a Connection with Natural Systems (P7) through the observation of pollination.	**Pattern 2: Non-Visual Connection with Nature** • Reduced systolic blood pressure and stress hormones • Positively impacted cognitive performance • Perceived improvements in mental health and tranquillity **Pattern 7: Connection with Natural Systems** • Enhanced positive health responses; shifted perception of environment
2. Marae Ātea	The inclusion of a marae ātea aligns with the Te Aranga Māori Design Principles of mana, ahi kā, and whakapapa. It recognises the authority of mana whenua to host and lead activity on the marae ātea, acknowledges whakapapa through ancestral relationships to place, and reflects ahi kā through the ongoing presence, use, and stewardship of mana whenua within their rohe.	-
3. Pontoon	Provides opportunities to see, hear, and touch water, aligning with the Presence of Water pattern (P5). It also supports Non-Rhythmic Sensory Stimuli (P3) when water movement or reflections are unpredictable. This element connects to the holistic health intent, as water is considered healing across many cultures.	**Pattern 3: Non-Rhythmic Sensory Stimuli** • Positively impacted heart rate, systolic blood pressure and sympathetic nervous system activity • Observed and quantified behavioural measures of attention and exploration **Pattern 5: Presence of Water** • Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure • Improved concentration and memory restoration • Enhanced perception and psychological responsiveness • Observed preferences and positive emotional responses
4. Main Circulation Path	The main circulation path provides views of the pond, resonating with the Presence of Water (P5) and Visual Connection with Nature (P1), while its exposure to seasonal and climatic changes reflects Connection with Natural Systems (P7). Its elevation also introduces a sense of Prospect (P11), enhancing spatial awareness and connection with the surrounding environment.	**Pattern 1: Visual Connection with Nature** • Lowered blood pressure and heart rate • Improved mental engagement/ attentiveness • Positively impacted attitude and overall happiness **Pattern 5: Presence of Water** • Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure • Improved concentration and memory restoration • Enhanced perception and psychological responsiveness

		Pattern 7: Connection with Natural Systems • Enhanced positive health responses; Shifted perception of environment **Pattern 11: Prospect** • Reduced stress • Reduced boredom, irritation, fatigue • Improved comfort and perceived safety
5. Lobby	The lobby features a skylight with biomorphic-patterned (P8) apertures, creating Dynamic and Diffuse Light (P6). A pocket garden behind the reception desk provides a Visual Connection with Nature (P1).	**Pattern 1: Visual Connection with Nature** • Lowered blood pressure and heart rate • Improved mental engagement/ attentiveness • Positively impacted attitude and overall happiness **Pattern 6: Dynamic & Diffuse Light** • Positively impacted circadian system functioning • Increased visual comfort **Pattern 8: Biomorphic Forms & Patterns** • Observed view preference
6. Reception Desk	Central point for wayfinding and engagement.	-
7. Point of Prospect Overlooking the Atrium	Provides an elevated viewpoint for surveillance and spatial orientation, aligning with Prospect (P11).	**Pattern 11: Prospect** • Reduced stress • Reduced boredom, irritation, fatigue • Improved comfort and perceived safety
8. Atrium	The atrium offers a Visual Connection with Nature (P1) through views of the exterior native forest, interior courtyards, and pocket gardens. Seating is embedded within these gardens or positioned to maximise greenery views. High ceilings enhance Thermal and Airflow Variability (P4), creating environmental dynamism. Vegetation is arranged to create partially obscured views, fostering Mystery (P13), while integrated seating within partially enclosed planters establishes a semi-Refuge state (P12), supporting comfort and psychological safety. The changing daylight filtered through trees outside the floor-to-ceiling glazing creates dynamic patterns of light and shadow while softening direct sunlight, reinforcing the Dynamic and Diffuse Light (P6).	**Pattern 1: Visual Connection with Nature** • Lowered blood pressure and heart rate • Improved mental engagement/ attentiveness • Positively impacted attitude and overall happiness **Pattern 4: Thermal & Airflow Variability** • Positively impacted comfort, wellbeing and productivity • Positively impacted concentration • Improved perception of temporal and spatial pleasure (alliesthesia) **Pattern 6: Dynamic & Diffuse Light** • Positively impacted circadian system functioning • Increased visual comfort **Pattern 12: Refuge** • Improved concentration, attention and perception of safety **Pattern 13: Mystery** • Induced strong pleasure response

9. Stairs Leading to Art Gallery	Stairs wrap around a garden area to create a Visual Connection with Nature (P1) within a circulation space.	**Pattern 1: Visual Connection with Nature** • Lowered blood pressure and heart rate • Improved mental engagement/ attentiveness • Positively impacted attitude and overall happiness
10. Health Foods Café Garden Seating	Garden seating provides a Visual Connection with Nature (P1).	**Pattern 1: Visual Connection with Nature** • Lowered blood pressure and heart rate • Improved mental engagement/ attentiveness • Positively impacted attitude and overall happiness
11. Water Fountain	Engages Presence of Water (P5) and Non-Rhythmic Sensory Stimuli (P3) / Non-Visual Connection with Nature (P2) through the gentle, unpredictable sound of flowing water, creating a calming and restorative effect.	**Pattern 2: Non-Visual Connection with Nature** • Reduced systolic blood pressure and stress hormones • Positively impacted cognitive performance • Perceived improvements in mental health and tranquillity **Pattern 3: Non-Rhythmic Sensory Stimuli** • Positively impacted heart rate, systolic blood pressure and sympathetic nervous system activity • Observed and quantified behavioural measures of attention and exploration **Pattern 5: Presence of Water** • Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure • Improved concentration and memory restoration • Enhanced perception and psychological responsiveness • Observed preferences and positive emotional responses
12. Health Foods Café	Offers accessible, healthy food options that align with the physical dimension of Te Whare Tapa Whā by addressing the need for convenient yet nutritious meals. The space incorporates timber flooring, establishing a material connection to nature (P9).	**Pattern 9: Material Connection with Nature** • Decreased diastolic blood pressure • Improved creative performance • Improved comfort
13. Point of Sale Counter	-	-
14. Fish Tank	Supports Presence of Water (P5) and evokes Non-Rhythmic Sensory Stimuli (P3) through the unpredictable movement of fish and bubbles.	**Pattern 3: Non-Rhythmic Sensory Stimuli** • Positively impacted heart rate, systolic blood pressure and sympathetic nervous system activity • Observed and quantified behavioural measures of attention and exploration **Pattern 5: Presence of Water** • Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure • Improved concentration and memory restoration • Enhanced perception and psychological responsiveness • Observed preferences and positive emotional responses

15. Customer WC	-	-
16. Kitchen	-	-
17. Staff Room	-	-
18. Staff WC	-	-
19. Elevated Viewing Platforms with Bird Feeders	These platforms offer an immersive Visual Connection with Nature (P1) by being elevated among the trees. It supports Non-Rhythmic Sensory Stimuli (P3) and Non-Visual Connection with Nature (P2) through the sounds of birds and rustling leaves. The elevated height introduces a subtle sense of Risk/Peril (P14), while the layered design fosters Mystery (P13) by revealing new perspectives and experiences. This space also provides a Connection with Natural Systems (P7) by allowing observation of bird behaviours such as feeding and nesting.	**Pattern 1: Visual Connection with Nature** • Lowered blood pressure and heart rate • Improved mental engagement/ attentiveness • Positively impacted attitude and overall happiness **Pattern 2: Non-Visual Connection with Nature** • Reduced systolic blood pressure and stress hormones • Positively impacted cognitive performance • Perceived improvements in mental health and tranquillity **Pattern 3: Non-Rhythmic Sensory Stimuli** • Positively impacted heart rate, systolic blood pressure and sympathetic nervous system activity • Observed and quantified behavioural measures of attention and exploration **Pattern 7: Connection with Natural Systems** • Enhanced positive health responses; shifted perception of environment **Pattern 13: Mystery** • Induced strong pleasure response **Pattern 14: Risk/Peril** • Strong dopamine or pleasure responses
20. Storage	-	-
21. Backstage WC	-	-
22. Backstage	-	-
23. Multipurpose Performance / Event Space	This multipurpose space provides a venue for educational talks, workshops, and community engagement, supporting holistic health education. It aligns with the Te Aranga principles of Ahi Kā, Mahi Toi, and Tohu by sustaining mana whenua presence, enabling ongoing cultural practices and storytelling, and expressing iwi narratives.	-

24. Male Public WC	-	-
25. Female Public WC	-	-
26. Art Gallery	The art gallery aligns with Mahi Toi and Tohu from the Te Aranga Māori Design Principles through the display of works by local Māori artists. The space embodies Mahi Toi through the creative expression of mana whenua identity, culture, and storytelling, and reflects Tohu by capturing and communicating local iwi and hapū narratives in an authentic and meaningful way, ensuring these stories remain visible and celebrated within the built environment.	-
27. Skylight Void	The skylight void allows natural light to penetrate through to the ground floor and creates a sense of Prospect (P11) by offering views down to the lobby below.	**Pattern 11: Prospect** • Reduced stress • Reduced boredom, irritation, fatigue • Improved comfort and perceived safety
28. View of Atrium	The art gallery is located on a mezzanine that overlooks the atrium, creating a sense of Prospect (P11).	**Pattern 11: Prospect** • Reduced stress • Reduced boredom, irritation, fatigue • Improved comfort and perceived safety



The atrium is designed to feel like a seamless extension of the outdoors. It frames views of the native bush beyond, while its interior features raised planters filled with ferns and glass-enclosed trees, complemented by tree-like columns that evoke the experience of a native forest brought indoors. Natural materials, such as stone-clad planter boxes and timber flooring, reinforce a material connection to nature (P9). Light within the atrium is dynamic and diffuse (P6), filtering softly through the interior trees and the glazed mullions, creating a serene interplay of shadow and illumination throughout the space.

Figure 134. Atrium Perspective 1



Figure 135. Atrium Perspective 2



Figure 136. Atrium Perspective 3



Figure 137. Health Foods Café Perspective

8.2 Community & Social Wellbeing Spaces



Figure 138. Community & Social Wellbeing Ground Floor Plan, Scale: 1:150 @ A3

TABLE 15 COMMUNITY & SOCIAL WELLBEING SPACES KEY

The following table provides context for the plan shown in Figure 138. This building is the second checkpoint along the journey, supporting wellbeing through the embodiment of Taha Whānau (family and social wellbeing) from Te Whare Tapa Whā. By creating spaces where people can grow food, cook, share meals, socialise, and play, it promotes healthy lifestyles and collective resilience.

SPACE / FEATURE	DESCRIPTION / ALIGNMENT WITH THEORETICAL FRAMEWORK (The 14 Patterns of Biophilic Design, Te Whare Tapa Whā, and Te Aranga Māori Design Principles)	POTENTIAL BIOPHILIC HEALTH BENEFITS Information in this section is derived from Table 1 in the 14 Patterns of Biophilic Design (Browning et al., 2014).
1. Foyer	The foyer provides a designated space for shoe removal, respecting Māori customs by marking a clean, sacred threshold and honoring tikanga. It also reinforces ahi kā, supporting the enduring presence of iwi/hapū by embedding Māori practices into everyday building use.	-
2. Community Living Area	This area is designed for casual socialisation and relaxation, featuring views of water that reflect its presence (P5) and indoor plantings and green walls that maintain a Visual Connection with Nature (P1). Thermal and Airflow Variability (P4) is achieved through cross-ventilation between the balcony (marked 12) and the foyer (marked 1). A sense of Mystery (P13) is created through partially obscured views toward the dining area and balcony, encouraging exploration and discovery within the space.	**Pattern 1: Visual Connection with Nature** • Lowered blood pressure and heart rate • Improved mental engagement/ attentiveness • Positively impacted attitude and overall happiness **Pattern 4: Thermal & Airflow Variability** • Positively impacted comfort, wellbeing and productivity • Positively impacted concentration • Improved perception of temporal and spatial pleasure (alliesthesia) **Pattern 5: Presence of Water** • Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure • Improved concentration and memory restoration • Enhanced perception and psychological responsiveness • Observed preferences and positive emotional responses **Pattern 13: Mystery** • Induced strong pleasure response
3. Fireplace	The crackling sound of the fireplace connects with Non-Visual Connection with Nature (P2), while the flickering flames and fluctuating warmth provide Non-Rhythmic Sensory Stimuli (P3), offering momentary, unpredictable visual, auditory, and thermal engagement that mimics natural sensory variation, and creating Dynamic and Diffuse Light (P6).	**Pattern 2: Non-Visual Connection with Nature** • Reduced systolic blood pressure and stress hormones • Positively impacted cognitive performance • Perceived improvements in mental health and tranquillity **Pattern 3: Non-Rhythmic Sensory Stimuli** • Positively impacted heart rate, systolic blood pressure and sympathetic nervous system • Observed and quantified behavioural measures of attention and exploration **Pattern 6: Dynamic & Diffuse Light** • Positively impacted circadian system functioning • Increased visual comfort

4. Sandpit	The sandpit, stepping stones, and surrounding grass provide children with a strong Material Connection with Nature (P9), engaging their sense of touch, which corresponds with Non-Visual Connection with Nature (P2).	**Pattern 2: Non-Visual Connection with Nature** • Reduced systolic blood pressure and stress hormones • Positively impacted cognitive performance • Perceived improvements in mental health and tranquillity **Pattern 9: Material Connection with Nature** • Decreased diastolic blood pressure • Improved creative performance
5. Children's Outdoor Play Area	A space for children to engage in outdoor play.	-
6. Splash Zone	A space where children can play in shallow water, fostering a Presence of Water (P5).	**Pattern 5: Presence of Water** • Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure • Improved concentration and memory restoration • Enhanced perception and psychological responsiveness • Observed preferences and positive emotional responses
7. Children's Indoor Play Area	This area supports the health of the community by providing children with a space to play and interact with others.	-
8. Parent's Lounge	This space enables parents and caregivers to comfortably supervise and support children in the play areas, ensuring safety.	-
9. Female WC	-	-
10. Male WC	-	-
11. Water Tank	A water tank is placed near the dining area and kitchen, equipped with taps to provide fresh drinking water. The tank is made of glass, creating a Presence of Water (P5) while also fostering a Connection with Natural Systems (P7) by revealing the rainwater collection process. Unlike typical water tanks, which are usually hidden, this design allows people to see and engage with the water infrastructure that supports the building, helping to promote Mauri Tū and environmental stewardship through a direct connection with water management.	**Pattern 5: Presence of Water** • Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure • Improved concentration and memory restoration • Enhanced perception and psychological responsiveness • Observed preferences and positive emotional responses **Pattern 7: Connection with Natural Systems** • Enhanced positive health responses; shifted perception of environment
12. Community Dining Area	A communal dining space for shared meals that encourages healthy eating and social connection, supporting the physical and whānau dimensions of Te Whare Tapa Whā. Floor-to-ceiling glazing and its elevated position above the water create a sense of Prospect (P11) and reinforce a Presence of Water (P5).	**Pattern 5: Presence of Water** • Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure • Improved concentration and memory restoration • Enhanced perception and psychological responsiveness

		• Observed preferences and positive emotional responses **Pattern 7: Connection with Natural Systems** • Enhanced positive health responses; shifted perception of environment
13. Balcony	The balcony extends over the water, with a strip of transparent glass that creates a sense of risk and peril (P14). It is surrounded by fragrant flowers planted along the edges, creating a non-visual connection with nature (P2) through the olfactory sense.	**Pattern 2: Non-Visual Connection with Nature** • Reduced systolic blood pressure and stress hormones • Positively impacted cognitive performance • Perceived improvements in mental health and tranquillity **Pattern 14: Risk/Peril** • Strong dopamine or pleasure responses
14. Garden Shed	The garden shed provides storage and workspace for gardening tools and activities.	-
15. Water Tank	Collects and stores rainwater for watering plants and garden use.	-
16. Community Vege Garden	The garden provides fresh, healthy produce for the community to use in preparing nutritious meals, supporting physical health. Through engagement with cycles of growth, water, and renewal, users also gain insight into Connection with Natural Systems (P7).	**Pattern 7: Connection with Natural Systems** • Enhanced positive health responses; shifted perception of environment



Figure 139. Dining Area Perspective



Figure 140. Living Area Perspective

8.3 Community Orchard



Figure 141. Community Orchard Plan, Scale: 1:150 @ A3

TABLE 16 COMMUNITY ORCHARD KEY

The following table provides context for the plan shown in Figure 141. The community orchard fosters Connection with Natural Systems (P7) by enabling people to engage directly with fruit production and experience cycles of growth, seasonality, and care. Different compatible fruit tree varieties are planted to enhance cross-pollination, improving fruit set, quality, and overall yield. The orchard also provides a strong gustatory connection to nature through its edible produce. It supports Taha Tinana (physical wellbeing) through nutritious food and outdoor activity, while fostering Taha Whānau (family and social wellbeing) through collective harvesting, shared maintenance, and intergenerational learning. As part of a holistic healthcare environment, the orchard integrates nature, nourishment, and community connection to support wellbeing.

SPACE / FEATURE	DESCRIPTION / ALIGNMENT WITH THEORETICAL FRAMEWORK (The 14 Patterns of Biophilic Design, Te Whare Tapa Whā, and Te Aranga Māori Design Principles)	POTENTIAL BIOPHILIC HEALTH BENEFITS Information in this section is derived from Table 1 in the 14 Patterns of Biophilic Design (Browning et al., 2014).
1. Raspberry Bushes	Variety: Heritage	-
2. Blueberry Bushes	Varieties: Sunshine Blue, Misty and O'Neal	-
3. Water Fountain	Engages Presence of Water (P5) and Non-Rhythmic Sensory Stimuli (P3) / Non-Visual Connection with Nature (P2) through the gentle, unpredictable sound of flowing water, creating a calming and restorative effect.	**Pattern 2: Non-Visual Connection with Nature** • Reduced systolic blood pressure and stress hormones • Positively impacted cognitive performance • Perceived improvements in mental health and tranquillity **Pattern 3: Non-Rhythmic Sensory Stimuli** • Positively impacted heart rate, systolic blood pressure and sympathetic nervous system activity • Observed and quantified behavioural measures of attention and exploration **Pattern 5: Presence of Water** • Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure • Improved concentration and memory restoration • Enhanced perception and psychological responsiveness • Observed preferences and positive emotional responses
4. Overhead Pergola Edge	An overhead pergola with perforated patterns creates dappled light, producing a Dynamic and Diffuse illumination (P6).	**Pattern 6: Dynamic & Diffuse Light** • Positively impacted circadian system functioning • Increased visual comfort
5. Sunflowers	-	-
		Pattern 8: Biomorphic Forms & Patterns • Observed view preference

6. Pathways	The pathway design engages with Biomorphic Forms & Patterns (P8) and Complexity & Order (P10) through fish-scale-shaped paths that form a repeating fractal pattern. It also evokes a sense of Mystery (P13) by suggesting hidden views and inviting people to explore deeper into the orchard.	**Pattern 10: Complexity & Order** • Positively impacted perceptual and physiological stress responses • Observed view preference **Pattern 13: Mystery** • Induced strong pleasure response
7. Mandarin Trees	Varieties: Imperial and Nova	-
8. Feijoa Trees	Varieties: Mammoth and Apollo	-
9. Tool Shed	For orchard maintenance, a tool shed is provided to ensure adequate storage for tools and equipment, including loppers, pruning saws, a lawn mower, a line trimmer, and rakes.	-
10. Stepped Water Channel	The steps within the water channel allow water to flow over them, increasing aeration and circulation, which helps maintain oxygen levels and discourages algae growth. At the same time, the cascading water creates a tranquil sound in the orchard, eliciting a Non-Visual Connection to Nature (P2).	**Pattern 2: Non-Visual Connection with Nature** • Reduced systolic blood pressure and stress hormones • Positively impacted cognitive performance • Perceived improvements in mental health and tranquillity
11. Submersible Water Pump	Utilizing two Pedrollo TOP 2 submersible water pumps to enhance water circulation effectively reduces stagnation and helps prevent algae growth.	-
12. Apple Trees	Varieties: Gala and Braeburn	-
13. Rainwater Collection Fins	Rainwater fins are used to capture rainwater, feeding the orchard's water channel for irrigation. These structures, along with the water channel, help foster a Connection with Natural Systems (P7).	**Pattern 7: Connection with Natural Systems** • Enhanced positive health responses; shifted perception of environment
14. Orange Trees	Variety: Washington Navel	-
15. Irrigation Channel	The irrigation channel supplies water to the orchard trees through underground pipes and sprinklers at their bases.	-



The use of stone and timber in the design strengthens the material connection to nature (P9).

Figure 142. Orchard Perspective

8.4 Pools & Wellness Spaces



Figure 143. Pools & Wellness Ground Floor Plan, Scale: 1:200 @ A3



Figure 144. Pools & Wellness Mezzanine Floor Plan, Scale: 1:200 @ A3

TABLE 17 POOLS & WELLNESS SPACES KEY

The following table provides context for the plans shown in Figures 143 and 144. These spaces support holistic health through the integration of movement, relaxation, and mindfulness. The pool encourages low-impact exercise, activity areas build strength and flexibility, and massage zones support recovery. Together, they create a restorative environment that nurtures physical and mental wellbeing, while also supporting the spiritual dimensions of Te Whare Tapa Whā.

SPACE / FEATURE	DESCRIPTION / ALIGNMENT WITH THEORETICAL FRAMEWORK (The 14 Patterns of Biophilic Design, Te Whare Tapa Whā, and Te Aranga Māori Design Principles)	POTENTIAL BIOPHILIC HEALTH BENEFITS Information in this section is derived from Table 1 in the 14 Patterns of Biophilic Design (Browning et al., 2014).
1. Lobby	-	-
2. Reception Desk	-	-
3. Fragrant Flower Bed	Fragrant flowers create an olfactory connection to nature (P2).	**Pattern 2: Non-Visual Connection with Nature** • Reduced systolic blood pressure and stress hormones • Positively impacted cognitive performance • Perceived improvements in mental health and tranquillity
4. Elevator	-	-
5. Egress Stairs	-	-
6. Biomorphic Furniture	Leaf-inspired furniture reflecting Biomorphic Forms and Patterns (P8).	**Pattern 8: Biomorphic Forms & Patterns** • Observed view preference
7. Pool Deck	-	-
8. Women's Changing Room	-	-
9. Family Changing Room	-	-
10. Men's Changing Room	-	-
11. Mirimiri & Rōmiromi - Waiting Room	The waiting room acts as a calm transitional space, preparing clients mentally and spiritually before their mirimiri or rōmiromi session.	-

12. Mirimiri & Rōmiromi Room	The mirimiri/rōmiromi room is a dedicated space for traditional Māori healing practices, where gentle (mirimiri) or deeper (rōmiromi) bodywork supports the restoration of balance to the body, mind, and spirit. Designed in accordance with the Te Aranga Māori design principle of Ahi Kā, it ensures the enduring presence and recognition of Māori healing knowledge within the holistic health centre.	-
13. Thermal & Airflow Variability	Arched perforations in the walls allow breezes to flow through while still offering shelter, and the surrounding plants further enhance this protective comfort. Along with the varying warmth of the pools and spa, this creates a sense of thermal & airflow variability (P4).	**Pattern 4: Thermal & Airflow Variability** • Positively impacted comfort, wellbeing and productivity • Positively impacted concentration • Improved perception of temporal and spatial pleasure (alliesthesia)
14. Infinity Pool Edge	The infinity edge of the pool introduces a subtle sense of Risk or Peril (P14) by creating the impression of an unbounded drop, while its position at a vantage point provides Prospect (P11), allowing users to look out over the pond below and enhancing the sense of the Presence of Water (P5).	**Pattern 5: Presence of Water** • Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure • Improved concentration and memory restoration • Enhanced perception and psychological responsiveness • Observed preferences and positive emotional responses **Pattern 11: Prospect** • Reduced stress • Reduced boredom, irritation, fatigue • Improved comfort and perceived safety **Pattern 14: Risk/Peril** • Strong dopamine or pleasure responses
15. Seating Alcove	Smaller seating alcoves within the larger pool provide a sense of Refuge (P12), offering privacy and promoting relaxation.	**Pattern 12: Refuge** • Strong dopamine or pleasure responses
16. Saltwater Healing Pools	Saltwater healing pools offer a restorative experience in which natural salt water supports healing and renewal, inviting calm through a deep connection with the ocean's cleansing energy. The pools adopt biomorphic forms reminiscent of sea foam bubbles and tidal pools, expressing Biomorphic Forms and Patterns (P8).	**Pattern 8: Biomorphic Forms & Patterns** • Observed view preference
17. Water Fountain	Fountains establish a vital Non-Visual Connection with Nature (P2) through the gentle, auditory bubbling of water as it cascades into the pool. This ever-changing soundscape also embodies Non-Rhythmic Sensory Stimuli (P3) through its subtle, unpredictable sounds.	**Pattern 2: Non-Visual Connection with Nature** • Reduced systolic blood pressure and stress hormones • Positively impacted cognitive performance • Perceived improvements in mental health and tranquillity **Pattern 3: Non-Rhythmic Sensory Stimuli** • Positively impacted heart rate, systolic blood pressure and sympathetic nervous system activity • Observed and quantified behavioural measures of attention and exploration

18. Poolside Planting	Poolside planting softens the pool edge and creates an immersive Visual Connection to Nature (P1). It introduces fragrance, texture, color, and movement, enriching the sensory experience. Subtle rustling leaves and floral scents enhance the atmosphere, aligning with the Non-Visual Connection with Nature (P2) and Non-Rhythmic Sensory Stimuli (P3) biophilic patterns.	**Pattern 1: Visual Connection with Nature** • Lowered blood pressure and heart rate • Improved mental engagement/ attentiveness • Positively impacted attitude and overall happiness **Pattern 2: Non-Visual Connection with Nature** • Reduced systolic blood pressure and stress hormones • Positively impacted cognitive performance • Perceived improvements in mental health and tranquillity **Pattern 3: Non-Rhythmic Sensory Stimuli** • Positively impacted heart rate, systolic blood pressure and sympathetic nervous system activity • Observed and quantified behavioural measures of attention and exploration
19. Arched Colonnade	The arched colonnade forms a wall of graceful openings within and around the pool, creating a sense of Mystery (P13) through partially obscured views. It also enhances Dynamic and Diffuse Light (P6), as shifting light and shadow through the perforations throughout the day reflect natural rhythms of illumination.	**Pattern 13: Mystery** • Induced strong pleasure response **Pattern 6: Dynamic & Diffuse Light** • Positively impacted circadian system functioning • Increased visual comfort
20. Spa Pool	A secluded spa pool, nestled within lush vegetation (P1), offers a tranquil sense of refuge.	**Pattern 1: Visual Connection with Nature** • Lowered blood pressure and heart rate • Improved mental engagement/ attentiveness • Positively impacted attitude and overall happiness
21. Sauna	A sauna is included in the design for its holistic health benefits. Saunas have been shown to lower the risk of cardiovascular disease and improve vascular function (Laukkanen et al., 2018). Long-term studies link frequent sauna use to reduced all-cause mortality and lower rates of neurocognitive decline (Laukkanen & Laukkanen, 2018). This supports the physical health dimension of Te Whare Tapa Whā.	-
22. Female Changing Room	-	-
23. Male Changing Room	-	-
24. Mezzanine Walkway	The mezzanine walkway provides a point of Prospect over the pools (P11) while also creating a sense of Risk and Peril (P14) due to its elevated nature.	**Pattern 11: Prospect** • Reduced stress • Reduced boredom, irritation, fatigue **Pattern 14: Risk/Peril** • Strong dopamine or pleasure responses

25. Quiet Exercise Space	This multipurpose space accommodates quiet movement activities, such as yoga, supporting the physical dimension of Te Whare Tapa Whā, while also offering a vantage point (P11) over the pond.	**Pattern 11: Prospect** • Reduced stress • Reduced boredom, irritation, fatigue • Improved comfort and perceived safety



Figure 145. Pools Perspective 1



Figure 146. Pools Perspective 2



Figure 147. Pools Perspective 3



Figure 148. Spa Pool Perspective

8.5 Holistic Healthcare Services



Figure 149. Holistic Healthcare Services Ground Floor Plan, Scale: 1:150 @ A3

TABLE 18 HOLISTIC HEALTHCARE SERVICES KEY

The following table provides context for the plan shown in Figure 149. This is the service-based building in the journey, offering a range of services that address all dimensions of health outlined in Te Whare Tapa Whā. While some services, such as dentistry or general practice, may not immediately appear preventative, they play a crucial role in promoting long-term wellbeing through education and guidance. These services are designed to allow more time with clients, enabling practitioners to inform and empower individuals about healthy, preventative lifestyles. More distinctly holistic spaces, such as the Rongoā / Plant Medicine Room, allow individuals to explore the medicinal benefits of native New Zealand plants and connect with traditional healing practices. Together, the services target all dimensions of health: physical, mental, spiritual, and whānau/social wellbeing.

Architecturally, the repetition of curvilinear forms at multiple scales - from the water feature near reception to the flowing contours of the consultation and perimeter walls - establishes visual hierarchy and coherence, expressing Complexity and Order (P10).

SPACE / FEATURE	DESCRIPTION / ALIGNMENT WITH THEORETICAL FRAMEWORK (The 14 Patterns of Biophilic Design, Te Whare Tapa Whā, and Te Aranga Māori Design Principles)	POTENTIAL BIOPHILIC HEALTH BENEFITS Information in this section is derived from Table 1 in the 14 Patterns of Biophilic Design (Browning et al., 2014).
1. Lobby	-	-
2. Reception Desk	-	-
3. Water Feature	The water feature incorporates a water wall flowing into catchments. This creates a Non-Visual Connection with Nature (P2), as the trickling water produces soothing, unpredictable sounds that engage the auditory senses. This evokes Non-Rhythmic Sensory Stimuli (P3), while also reinforcing the Presence of Water (P5) within the space, enhancing both its environmental qualities.	**Pattern 2: Non-Visual Connection with Nature** • Reduced systolic blood pressure and stress hormones • Positively impacted cognitive performance • Perceived improvements in mental health and tranquillity **Pattern 3: Non-Rhythmic Sensory Stimuli** • Positively impacted heart rate, systolic blood pressure and sympathetic nervous system activity • Observed and quantified behavioural measures of attention and exploration **Pattern 5: Presence of Water** • Reduced stress, increased feelings of tranquillity, lower heart rate and blood pressure • Improved concentration and memory restoration • Enhanced perception and psychological responsiveness • Observed preferences and positive emotional responses
4. Waiting Room 1	Waiting Room 1 serves the mental, spiritual, and whānau/social wellbeing wing. It is encircled by a medicinal garden that provides a direct Visual Connection to Nature (P1). The surrounding plantings filter sunlight, producing a dynamic interplay of light and shadow that brings Dynamic and Diffuse Light (P6) to the space.	**Pattern 1: Visual Connection with Nature** • Lowered blood pressure and heart rate • Improved mental engagement/ attentiveness • Positively impacted attitude and overall happiness **Pattern 6: Dynamic & Diffuse Light**

		• Positively impacted circadian system functioning • Increased visual comfort
5. Tree-like Column	The columns follow a shape reminiscent of a tree, reflecting Biomorphic Forms and Patterns (P8). For this reason, the columns are sometimes left visible rather than obscured, as their form is not only functional but also an intentional aesthetic choice.	**Pattern 8: Biomorphic Forms & Patterns** • Observed view preference
6. Waiting Room 2	Waiting room 2 serves the wing focused on physical health services. Providing two waiting rooms improves patient comfort, privacy, and workflow efficiency.	-
7. Biomorphic Screen	The screen features a decorative foliage motif that reflects Biomorphic Patterns (P8).	**Pattern 8: Biomorphic Forms & Patterns** • Observed view preference
8. Female Patient WC	-	-
9. Male Patient WC	-	-
10. Rongoā Garden	This medicinal garden features native plants with traditional healing properties used in Rongoā Māori practices. It incorporates small to medium-sized species such as harakeke (flax), kawakawa, kūmarahou, and koromiko, while larger medicinal trees are located within the adjacent patch of native bush. The garden fosters a Connection with Natural Systems (P7), encouraging awareness of the properties of particular plants and the seasonal timing of harvestable components such as berries or flowers. The consumption of some plants cultivated in the garden also provides a gustatory connection to nature (P2).	**Pattern 2: Non-Visual Connection with Nature** • Reduced systolic blood pressure and stress hormones • Positively impacted cognitive performance • Perceived improvements in mental health and tranquillity **Pattern 7: Connection with Natural Systems** • Enhanced positive health responses; shifted perception of environment
11. Rongoā Preparation Lab	A space where native plants are transformed into traditional remedies and healing products for use within the clinic. This area supports the integration of mātauranga Māori and holistic wellbeing practices, providing facilities for drying, grinding, infusing, and storing plant-based medicines.	-
12. Seating Nook	A semi-enclosed seating nook providing a sense of Refuge (P12).	**Pattern 12: Refuge** • Strong dopamine or pleasure responses
13. Winding Hallway	The winding hallway is designed to create partially obscured views, fostering a sense of Mystery (P13).	**Pattern 13: Mystery** • Induced strong pleasure response
14. Spiritual Councelling Room	The spiritual counselling room provides a calm and private environment for one-on-one	-

	sessions focused on emotional and spiritual wellbeing. It is a space for reflection, prayer, karakia or conversation with a counsellor, kaumātua, or spiritual advisor, supporting the spiritual and emotional dimensions of health.	
15. Rongoā Māori Room	This space is designated for administering herbal remedies to patients, cultivated in the medicinal garden and prepared in the rongoā lab, drawing on the healing properties and traditional practices of Māori. In doing so, it addresses a gap in conventional Western healthcare services, offering an alternative approach to wellbeing.	-
16. Counselling Room	A room used for talk-based support, mental health guidance, and spiritual/emotional support.	-
17. Social Services Room	The social services room provides a private space for clients and their whānau to receive guidance, support, and advocacy related to social, practical, and community needs, including access to resources, case management, and emotional or family support.	-
18. General Practice Room	The general practice (GP) room focuses on prevention and serves as a space for comprehensive, patient-centred consultations that integrate conventional medical care with proactive, lifestyle-based, and culturally responsive approaches to wellbeing.	-
19. Nurse Consultation Room	The nurse consultation room supports preventive and wellness-focused interactions, where nurses provide education, screenings, and support for ongoing health management.	-
20. Nutritionist Consultation Room	The nutritionist consultation room provides a space for personalised dietary assessments, education, and lifestyle guidance, supporting the physical dimension of Te Whare Tapa Whā.	-
21. Physiotherapy Room	The physiotherapy room provides a space for assessment, rehabilitation planning, and one-on-one guidance to support physical wellbeing. It focuses on preventing injury, improving mobility, and promoting long-term musculoskeletal health.	-
22. Dentist Room	The dentist room provides a space for oral health assessments, treatment, and patient education focused on preventing tooth decay and promoting long-term dental wellbeing. It supports holistic, patient-centred care by combining clinical procedures with guidance on oral hygiene, diet, and preventive strategies to maintain healthy teeth and gums.	-
23. Dental Hygienist Room	The dental hygienist room provides a space for preventive oral care, including professional cleanings, plaque and tartar removal, and patient education.	-

24. Clean Utilities Room	A dedicated space for storing, preparing, and managing sterile or clean supplies.	
25. Dirty Utilities Room	This room provides a dedicated space for the safe handling, sorting, and temporary storage of soiled instruments, linens, and clinical waste.	-
26. Staff WC	-	-
27. Staff Kitchen	-	-
28. Staff Room	-	-
29. Point of Prospect	The staff room provides a close visual connection to nature (P2), with a point of prospect (P11) overlooking the native bush outside.	-



Figure 150. Holistic Healthcare Services Reception



Figure 151. Holistic Healthcare Services Hallway

8.6 Native Bush Walk

The final component of the health journey is a bush walk, designed to transition users into direct immersion in nature and harness its restorative qualities.



Figure 152. Native Bushwalk Back to Carpark

CHAPTER 9: DISCUSSION

9.0 Introduction

This chapter critically examines and interprets the design process, decisions, and outcomes, reflecting on how they respond to the research question: How can biophilic design and Māori cultural frameworks inform the design of a holistic healthcare centre in Takapuna to enhance community wellbeing? The discussion considers the theoretical framework, site and precedent analyses, design development, and the proposed holistic healthcare centre.

9.1 Theoretical Framework and Design Approach

A theoretical framework combining the 14 patterns of biophilic design, Te Whare Tapa Whā, and Te Aranga Māori design principles was developed to guide design decisions. This framework brings together evidence-based strategies (biophilic design) and Māori perspectives on health and wellbeing, offering both scientific and cultural lenses for architectural intervention. The design-led investigation explores how this framework may be translated into spatial form, with biophilic and Māori principles referenced throughout the design process.

9.2 Design Process and Site Integration

The design process was informed by precedent and site analyses. Precedent studies provided reference points for biophilic and Māori design strategies, while site analysis - including climate, contours, and hydrology - informed the placement of elevated structures, a pond, and native planting. A SWOT analysis contributed to site planning considerations, ensuring ecological and human wellbeing were addressed. Conceptual modelling informed the evolving aesthetic language, including shell-like footprints, circular rooms, and an undulating roof form. Te Whare Tapa Whā informed programme considerations, supporting a holistic approach to health and care provision beyond traditional clinical models. The spatial narrative of a health journey is used to organise layout and wayfinding strategies.

9.3 Strengths of the Design

• **Contribution to a Biophilic Auckland:** The design proposes how architectural intervention may contribute to a more biophilic Auckland, a city not currently recognised as a biophilic city.

• **Strategic Site Use and Future Flexibility:** Only a portion of the wider site is developed, preserving capacity for future interventions. This approach allows for potential future guidance from mana whenua regarding the use of remaining areas, and suggests adaptability to evolving community needs while maintaining cultural integrity.

• **Environmental Responsiveness:** The site selection avoids ecologically sensitive areas and instead prioritises previously degraded zones, where development may contribute to ecological restoration rather than displacing intact habitats.

• **Ecological Enhancement:** The design proposes the regeneration of a degraded quarry into a more ecologically responsive environment through native planting, permeable paving and a pond. It also explores the potential to strengthen broader green networks via a corridor to Killarney Park, suggesting opportunities for increased ecological connectivity and biodiversity support. These strategies are intended to contribute to both environmental and human wellbeing on site.

• **Strong Design Foundation:** Early research, including precedent and site analysis, informed design development and provided key directions for the project. Precedent studies offered reference points for potential applications of biophilic and Māori design strategies in architectural and programmatic design.

• **Physical Modelling as a Design Strength:** Iterative early modelling established a conceptual foundation, allowing the final design to evolve through organic forms derived from initial studies while maintaining alignment with the biophilic principles outlined in the theoretical framework.

• **Bridging Clinical and Community Contexts:** Located between North Shore Hospital and a residential neighbourhood, the healthcare centre is proposed as a transitional space that bridges clinical care environments and domestic contexts. The design aims to support preventative, community-based holistic health by integrating care into everyday community life.

• **Multi-Generational Spaces:** The programme is designed to accommodate the diverse demographic profile of Takapuna West, proposing family-friendly and multi-generational spaces, including community living areas, an orchard and a vegetable garden.

• **Holistic and Culturally Guided Health Programme:** Guided by Te Whare Tapa Whā, the programme proposes a diverse and preventative-oriented approach to health. It integrates physical, mental, social, and spiritual dimensions while supporting community choice and contributing to wellbeing.

• **Intuitive Wayfinding - He Haerenga Hauora:** A clear, well-structured path links grouped services, guiding users through communal, personal growth, and healing spaces to support an intended sequential journey of wellbeing.

• **Experiential Quality:** Biophilic design creates a rich, engaging spatial proposition by integrating natural elements and processes. Organic forms, double-height spaces, meandering pathways, skylights, water features, tree-like columns, and natural materials combine to suggest a multisensory environment.

• **Theoretical Alignment:** Design decisions consistently reference both biophilic and Māori principles. The final design reflects these frameworks, with the intent behind spaces and features articulated through annotations and design documentation.

• **Unique Architectural Expression:** Departing from traditional rectilinear forms, the design features an elevated structure, an unconventional roof, and non-traditional programme arrangements. These elements are intended to create visual and experiential focal points that may engage the community.

• **Potential Health Outcomes:** Biophilic design strategies aligned with the 14 patterns are understood in the literature to support physical and psychological wellbeing. Culturally informed design, grounded in Te Whare Tapa Whā and Māori principles, responds to Māori health inequities and is intended to support holistic models of health and wellbeing.

9.4 Weaknesses and Challenges

• **Framework Implementation:** While Te Whare Tapa Whā and biophilic strategies were readily integrated, Te Aranga design principles were more challenging to apply without deeper consultation with mana whenua. Certain principles, such as Whakapapa and Tohu, were expressed more abstractly through narratives or signage rather than explicit spatial interventions.

• **Sectional and Vertical Complexity:** Sections could have incorporated more cantilevered or interlocking volumes to explore greater vertical variation beyond mezzanines and double-height atria.

• **Structural Integration:** Structural considerations were secondary within the project's scope; however, greater collaboration with structural engineers could have provided valuable insight into buildability and the refinement of key structural elements. The healing pools, requiring large clear spans to avoid columns within the water, presented particular challenges. The unconventional geometry of the design further emphasised the need for specialist structural input to ensure feasibility.

• **Safety and Accessibility:** Elevated structures and the presence of water introduce additional safety concerns that require further consideration. Greater attention could have been given to accessibility and protection measures, particularly for children and elderly users.

• **Cultural Limitation:** While the project draws on Māori concepts and frameworks, it remains culturally informed rather than culturally grounded. Culturally informed design applies established principles, whereas culturally grounded design emerges through direct engagement with mana whenua and place-specific knowledge. Due to the scope of this research, such engagement was not undertaken, limiting the project's cultural grounding.

9.5 Opportunities for Improvement

• **Māori Engagement and Cultural Responsiveness:** Although direct consultation with Māori communities was not possible within the constraints of this master's thesis, such engagement would be important in a real-world context to support both cultural and ecological responsiveness.

• **Theoretical Framework Alignment:** Closer alignment with the theoretical framework during the conceptual stage could have strengthened the coherence of the design process. Systematic exploration of design responses to each principle may have supported more focused and contextually responsive concepts, particularly in relation to the Te Aranga Māori Design Principles.

• **Conceptual Documentation and Design Development:** More rigorous documentation linking conceptual modelling to final design outcomes could have strengthened the clarity of the design development process.

• **Sectional and Volumetric Exploration:** Enhanced sectional and volumetric strategies could have been explored to introduce greater vertical variation and spatial complexity.

• **Regenerative and Nature-Based Systems:** Further integration of regenerative and nature-based technologies may offer opportunities to improve ecological performance.

• **Structural Collaboration and Feasibility:** Increased coordination with structural engineers would likely support the feasibility of unconventional forms and assist in addressing safety considerations.

• **Ecological Shading and Environmental Balance:** The larger footprint of the built structures increases shading over the pond. While shading can be beneficial for aquatic habitats, further research could explore the balance of light and shade required for optimal ecosystem performance.

While challenges and areas for improvement remain, the project provides insights into how community-focused healthcare spaces can balance clinical, social, and ecological considerations, offering a foundation for future iterations and further research.

CHAPTER 10: CONCLUSION

10.0 Conclusion

This research addresses the question: How can biophilic design and Māori cultural frameworks inform the design of a holistic healthcare centre in Takapuna to enhance community wellbeing? It proposes that culturally informed biophilic design can guide the development of spaces that aim to support health and wellbeing, explored through the design of a proposed holistic healthcare centre.

This thesis suggests that integrating the 14 patterns of biophilic design with Te Whare Tapa Whā and Te Aranga Māori design principles offers a holistic framework that can inform healthcare environments intended to support physical, mental, social, and spiritual wellbeing. Through the incorporation of Māori cultural frameworks alongside evidence-informed biophilic strategies, the project explores how architecture can extend beyond functional healthcare provision to propose restorative and culturally responsive spatial conditions. It further suggests that architecture can be positioned as a mediator between people, culture, and environment, offering spatial strategies that may support wellbeing and encourage meaningful engagement with place.

Rather than presenting outcomes as proven effects, this research draws on existing literature and design thinking to propose that biophilic design may support health and wellbeing by integrating natural systems and processes into the built environment. In the context of the Takapuna healthcare centre, these strategies are used to inform spatial conditions intended to support restoration, reduce stress, and contribute to preventative wellbeing for users. This perspective encourages architects to critically engage with evidence-informed biophilic principles in ways that may support both human and environmental wellbeing, while recognising the interdependent relationship between people and nature.

Beyond biophilic strategies alone, the project suggests that holistic health frameworks provide valuable guidance for healthcare design. Holistic health is understood as extending beyond clinical treatment to include preventative care, emotional wellbeing, social connection, and spiritual balance. Architecture, in this sense, may contribute to environments that support multiple dimensions of wellbeing through spatial and experiential design. This approach challenges conventional biomedical models and encourages broader consideration of how health and wellbeing are understood in New Zealand.

For Māori communities, holistic models such as Te Whare Tapa Whā emphasise the interconnected dimensions of spiritual, physical, mental, and social wellbeing, highlighting limitations in conventional healthcare environments that do not always reflect Māori understandings of health. This research proposes that incorporating Māori frameworks and acknowledging traditional healing practices such as Rongoā Māori within architectural thinking can support more culturally responsive approaches to healthcare design. These strategies can contribute to more inclusive environments that support a wide range of users, while positioning architecture as one contributor within a broader wellbeing ecosystem that integrates culture, nature, and care.

For architectural practice in New Zealand and beyond, this research proposes that culturally responsive biophilic design offers an opportunity to extend existing Western approaches to human-nature relationships. It suggests that engagement with te ao Māori and collaboration with mana whenua can strengthen the cultural and ecological relevance of biophilic strategies. Such approaches can also be applied beyond healthcare settings, including in education, housing, and community infrastructure, where they contribute to wellbeing, cultural continuity, and environmental awareness.

Future research could explore the development of a New Zealand-specific approach to biophilic design grounded in te ao Māori concepts and mātauranga. This could be evaluated over time to better understand its potential effects on user experience, community engagement and ecological performance. Comparative studies across cultural contexts may also help identify best practices for embedding Indigenous knowledge within architectural practice globally. Ultimately, this research suggests that the future of architecture may increasingly involve designing spaces that support the wellbeing of people, communities and the natural environment, while engaging respectfully with diverse cultural knowledge systems, contributing to more holistic and sustainable built environments.

FINAL PRESENTATION LAYOUT

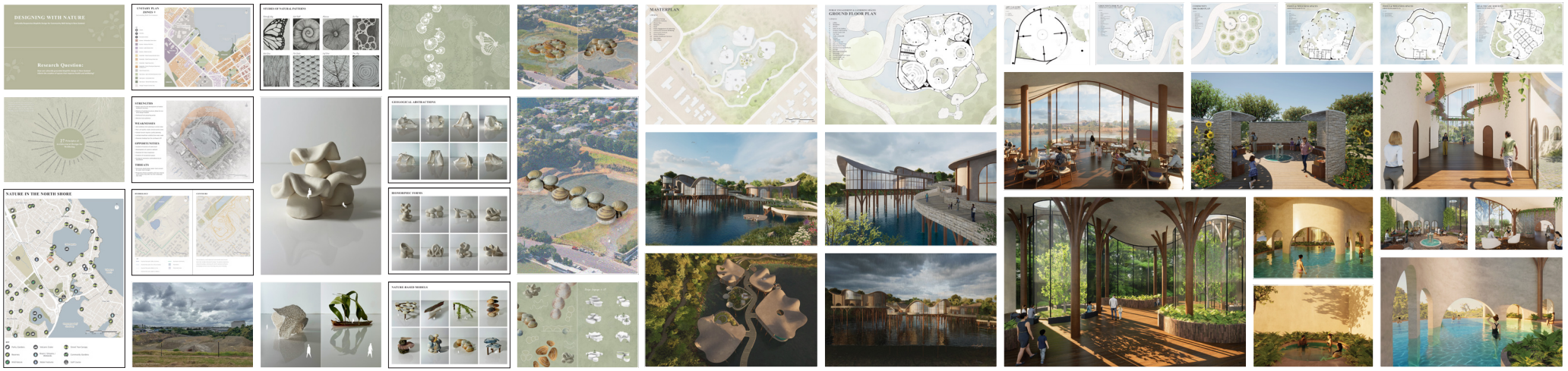

Figure 153. Presentation Layout

REFERENCES

Aboulnaga, M., & Maryam, E. (2022). The role of shading, natural ventilation, daylighting, and comfort in enhancing indoor environmental quality and liveability in the age of COVID-19. In A. Sayigh (Ed.), Achieving building comfort by natural means (pp. [insert page numbers]). Springer. https://doi.org/10.1007/978-3-031-04714-5_8

Alcock, I., White, M. P., Wheeler, B. W., Fleming, L. E., & Depledge, M. H. (2014). Longitudinal effects on mental health of moving to greener and less green urban areas. Environmental Science & Technology, 48(2), 1247–1255. https://doi.org/10.1021/es403688w

Aldersey-Williams, H. (2004). Towards biomimetic architecture. Nature materials, 3(5), 277-279.

Alvarsson, J. J., Wiens, S., & Nilsson, M. E. (2010). Stress recovery during exposure to nature sound and environmental noise. International Journal of Environmental Research and Public Health, 7(3), 1036–1046. https://doi.org/10.3390/ijerph7031036

Appleton, J. (1996). The experience of landscape (Revised ed.). Wiley. (Original work published 1977)

Arens, E., Zhang, H., & Huizenga, C. (2006). Partial- and whole-body thermal sensation and comfort—Part I: Uniform environmental conditions. Journal of Thermal Biology, 31(1–2), 53–59. https://doi.org/10.1016/j.jtherbio.2005.11.028

Aristizabal, S., Byun, K., Porter, P., Clements, N., Campanella, C., Li, L., Mullan, A., Ly, S., Senerat, A., Nenadic, I. Z., Browning, W. D., Loftness, V., & Bauer, B. (2021). Biophilic office design: Exploring the impact of a multisensory approach on human well-being. Journal of Environmental Psychology, 77, 101682. https://doi.org/10.1016/j.jenvp.2021.101682

Arbuthnott, K. D. (2023). Nature exposure and social health: Prosocial behavior, social cohesion, and effect pathways. Journal of Environmental Psychology, 90, 102109. https://doi.org/10.1016/j.jenvp.2023.102109

Astell-Burt, T., Feng, X., & Kolt, G. S. (2014). Greener neighborhoods, slimmer people? Evidence from 246,920 Australians. International Journal of Obesity, 38(1), 156–159. https://doi.org/10.1038/ijo.2013.64

Bajestani, S. A., Serrao-Neumann, S., Hanna, C., & Fu, X. (2024). Dealing with uncertainty in flood risk management and land use planning decisions: Insights from Aotearoa New Zealand. Climate Risk Management, 46, 100666. https://doi.org/10.1016/j.crm.2024.100666

Barbiero, G. (2024). Biophilic design reframed: The theoretical basis for experimental research. Ri-Vista. Research for Landscape Architecture, 21(2), 80–91. https://doi.org/10.36253/rv-15678

Barbiero, G., & Berto, R. (2021). Biophilia as evolutionary adaptation: An onto- and phylogenetic framework for biophilic design. Frontiers in Psychology, 12, 700709. https://doi.org/10.3389/fpsyg.2021.700709

Barlow, C. (1991). Tikanga Whakaaro: Key Concepts in Māori Culture.

Barton, J., & Pretty, J. (2010). What is the best dose of nature and green exercise for improving mental health? A multi-study analysis. Environmental Science & Technology, 44(10), 3947–3955. https://doi.org/10.1021/es903183r

Beatley, T. (2009). Biophilic urbanism: Inviting nature back to our communities and into our lives. William & Mary Environmental Law and Policy Review, 34(1), 209–237.

Beatley, T. (2011). Biophilic cities: Integrating nature into urban design and planning. Island Press.

Beery, T., Olafsson, A. S., Gentin, S., Maurer, M., Stålhammar, S., Albert, C., Bieling, C., Buijs, A., Fagerholm, N., Garcia-Martin, M., Plieninger, T., & Raymond, C. M. (2023). Disconnection from nature: Expanding our understanding of human–nature relations. People and Nature, 5(1), 1–18. https://doi.org/10.1002/pan3.10451

Beil, K., & Hanes, D. (2013). The influence of urban natural and built environments on physiological and psychological measures of stress--a pilot study. International Journal of Environmental Research and Public Health, 10(4), 1250–1267. https://doi.org/10.3390/ijerph10041250

Berkes, F. (2012). Sacred ecology (3rd ed.). Routledge.

Bhasin, M. K., Dusek, J. A., Chang, B. H., Joseph, M. G., Denninger, J. W., Fricchione, G. L., Benson, H., & Libermann, T. A. (2013). Relaxation response induces temporal transcriptome changes in energy metabolism, insulin secretion and inflammatory

pathways. PLoS One, 8(5), e62817. https://doi.org/10.1371/journal.pone.0062817w

Biederman, I., & Vessel, E. A. (2006). Perceptual pleasure and the brain: A novel theory explains why the brain craves information and seeks it through the senses. American Scientist, 94(3), 247–253. http://www.jstor.org/stable/27858773

Blume, C., Garbazza, C., & Spitschan, M. (2019). Effects of light on human circadian rhythms, sleep and mood. Somnologie, 23(3), 147–156. https://doi.org/10.1007/s11818-019-00215-x

Bodicoat, D. H., O'Donovan, G., Dalton, A. M., Gray, L. J., Yates, T., Edwardson, C., Hill, S., Webb, D. R., Khunti, K., Davies, M. J., & Jones, A. P. (2014). The association between neighbourhood greenspace and type 2 diabetes in a large cross-sectional study. BMJ Open, 4(12), e006076. https://doi.org/10.1136/bmjopen-2014-006076

Bovelet, J. (2010). Drawing as epistemic practice in architectural design. FOOTPRINT: Journal of City & Land Use, 4(2), 727. https://doi.org/10.7480/footprint.4.2.727

Bratman, G. N., Hamilton, J. P., & Daily, G. C. (2012). The impacts of nature experience on human cognitive function and mental health. Annals of the New York Academy of Sciences, 1249(1), 118–136. https://doi.org/10.1111/j.1749-6632.2011.06400.x

Brice, L. T. (2020). Indigenous healing in New Zealand: An anthropological analysis of "traditional" and "modern" approaches to well-being.

Brown, D. (2009). Māori architecture: From fale to wharenui and beyond. Raupo.

Brown, D. K., Barton, J. L., & Gladwell, V. F. (2013). Viewing nature scenes positively affects recovery of autonomic function following acute mental stress. Environmental Science & Technology, 47(11), 5562–5569. https://doi.org/10.1021/es400302r

Brown, H., & Bryder, L. (2023). Universal healthcare for all? Māori health inequalities in Aotearoa New Zealand, 1975–2000. Social Science & Medicine, 319, 115315. https://doi.org/10.1016/j.socscimed.2022.115315

Blood, A., & Zatorre, R. J. (2001). Intensely pleasurable responses to music correlate with activity in brain regions. Proceedings from the National Academy of Sciences, 98(20), 11818–11823.

Boehm, J. K., & Kubzansky, L. D. (2012). The heart's content: The association between positive psychological well-being and cardiovascular health. Psychological Bulletin, 138(4), 655–691. https://doi.org/10.1037/a0027448

Beckett, M., & Roden, L. (2009). Mechanisms by which circadian rhythm disruption may lead to cancer. South African Journal of Science, 105, 415–420. https://doi.org/10.4102/sajs.v105i11/12.125

Borrell-Carrió, F., Suchman, A. L., & Epstein, R. M. (2004). The biopsychosocial model 25 years later: Principles, practice, and scientific inquiry. Annals of Family Medicine, 2(6), 576–582. https://doi.org/10.1370/afm.245

Cadacio, J., & Watson, B. (2010, May 11). It's set in concrete. North Shore Times, p. 1. Auckland Libraries. https://natlib.govt.nz/records/44293461?search%5Bi%5D%5Bsubject%5D=Smales+Quarry&search%5Bpath%5D=items

Cai, Q., Lin, J., & Chen, C. (2024). Evaluate the potential of permeable pavement for urban runoff reduction. Water Conservation Science and Engineering, 9, 71. https://doi.org/10.1007/s41101-024-00298-0

Castelo, N., White, K., & Goode, M. R. (2021). Nature promotes self-transcendence and prosocial behavior. Journal of Environmental Psychology, 76, 101639. https://doi.org/10.1016/j.jenvp.2021.101639

Canzonieri, C. M. (2007). Review of Green infrastructure: Linking landscapes and communities by M. E. Benedict & E. T. McMahon. Landscape Ecology, 22(5), 797–798. https://doi.org/10.1007/s10980-006-9045-7

Capra, F. (1996). The web of life: A new scientific understanding of living systems. Anchor Books.

Clearwater, Y. A., & Coss, R. G. (1991). Functional esthetics to enhance wellbeing. In J. Harrison, Y. A. Clearwater, & C. P. McKay (Eds.), From Antarctica to outer space: Life in isolation and confinement (pp. 403–410). Springer-Verlag.

Clout, M. N., & Hay, J. R. (1989). The importance of birds as browsers, pollinators and seed dispersers in New Zealand forests. New Zealand Journal of Ecology, 12, 27–33. http://www.jstor.org/stable/24053245

Collins, S. (2016, October 4). Land values up – and still no houses. NZ Herald. https://www.nzherald.co.nz/nz/land-values-up-and-still-no-houses/7B7EYNFWZ6NQR46DEHZWVN4YCE/

Connor, H. (2021). Ko te Rākau Hei Tohu Mō te Rangahau Me te Tuhi Whakapapa: Tree symbolism as a method for researching and writing genealogy. Genealogy, 5(2), 29. https://doi.org/10.3390/genealogy5020029

Cormack, D., Harris, R., & Paradies, Y. (2018). Racism and health in Aotearoa New Zealand: A systematic review of quantitative studies. New Zealand Medical Journal, 131(1471), 55–68.

Cross, N. (2007). Designerly ways of knowing. Springer.

Crotty, M. (1998). The foundations of social research: Meaning and perspective in the research process. Sage.

Creswell, J. W., & Creswell, J. D. (2017). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). Sage Publications.

Cumming, J., Middleton, L., Silwal, P., & Tenbensel, T. (2021). Integrated care in Aotearoa New Zealand 2008–2020. International Journal of Integrated Care, 21(S2), 14. https://doi.org/10.5334/ijic.5815

Davids, R. (2021). Dynamic landscapes: The reclamation of disused quarries. Studies in the History of Gardens & Designed Landscapes, 41(1), 66–76.

DeLanda, M. (2006). A new philosophy of society: Assemblage theory and social complexity. Continuum.

Diener, E. (2000). Subjective well-being: The science of happiness and a proposal for a national index. American Psychologist, 55(1), 34–43. https://doi.org/10.1037/0003-066X.55.1.34

Dietter, G. B., Lechtzin, N., Haponik, E., Devrotes, A., & Rubin, H. R. (2003). Distraction therapy with nature sights and sounds reduces pain during flexible bronchoscopy: A complementary approach to routine analgesia. Chest, 123(3), 941–948. https://doi.org/10.1378/chest.123.3.941

Donovan, G. H., Butry, D. T., Michael, Y. L., Prestemon, J. P., Liebhold, A. M., Gatziolis, D., & Mao, M. Y. (2013). The relationship between trees and human health: Evidence from the spread of the emerald ash borer. American Journal of Preventive Medicine, 44(2), 139–145. https://doi.org/10.1016/j.amepre.2012.09.066

Dosen, A. (2013). Evidence for prospect-refuge theory: A review of empirical research. Environment and Behavior, 45(2), 123–147. https://doi.org/10.1177/0013916512467249

Dosen, A. S., & Ostwald, M. J. (2013). Methodological characteristics of research testing prospect–refuge theory: A comparative analysis. Architectural Science Review, 56(3), 232–241. https://doi.org/10.1080/00038628.2013.809689

Dosen, A. S., & Ostwald, M. J. (2016). Evidence for prospect-refuge theory: A meta-analysis of the findings of environmental preference research. City, Territory and Architecture, 3(4). https://doi.org/10.1186/s40410-016-0033-1

Dutton, E. (2013). The Savanna-IQ interaction hypothesis: A critical examination of the comprehensive case presented in Kanazawa's The Intelligence Paradox. Intelligence, 41(5), 607–614. https://doi.org/10.1016/j.intell.2013.07.024

Durie, M. (1985). A Māori perspective of health. Social Science & Medicine, 20(5), 483–486. https://doi.org/10.1016/0277-9536(85)90363-6

Durie, M. (1998). Te mana, te kāwanatanga: The politics of Māori self-determination. Oxford University Press.

Durie, M. (1998). Whaiora: Māori health development. Oxford University Press.

Durie, M. (1999). Te Pae Mahutonga: A model for Māori health promotion. Health Promotion Forum of New Zealand Newsletter, 49(2), 2–5. https://www.massey.ac.nz/documents/483/An_Indigenous_model_of_health_promotion.pdf

Durie, M. (2001). Mauriora: The dynamics of Māori health. Oxford University Press.

Dumitrescu, L., Baran, I., Pescaru, R.-A., & Parincu, P.-D. (2023). Regenerative design: General principles and implementation strategies in building design. Bulletin of the Polytechnic Institute of Iași. Construction. Architecture Section, 67(1), 1–21. https://doi.org/10.2478/bipca-2021-0031

Eason, C., McGowan, P. R., Mead, A., Foster, M., Kerridge, D., & Stephens, M. (2024). Giving voice to Ngā Taketake a Tāne: a review of contemporary, traditional and indigenous pharmacopoeias, and implications for Te Tauihu in Aotearoa-New Zealand. Journal of the Royal Society of New Zealand, 55(6), 1400–1417. https://doi.org/10.1080/03036758.2024.2415899

Ellis, P. A., Leake, C. C., & Hammond, M. (2007). Water-based quarry restoration. Quarry Management, 34(2), 21.

Explore the Canyon. (n.d.). Grand Canyon Skywalk. Retrieved July 27, 2025, from https://explorethecanyon.com/grand-canyon-skywalk/

Fahmy, A., Abdou, A., & Ghoneem, M. (2019). Regenerative architecture as a paradigm for enhancing the urban environment. Port-Said Engineering Research Journal, 23(2), 11–19. https://doi.org/10.21608/pserj.2019.49554

Fearon Hay Architects. (n.d.). Coastal House. https://fearonhay.com/coastal-house

Fehnker, L., Pearson, D., & Howland, P. (2022). Informing future land systems using self-reported pathways and barriers to connections to nature: A case study in Auckland, New Zealand. Land, 11(10), 1758. https://doi.org/10.3390/land11101758

Figueiro, M., Brons, J., Plitnick, B., Donlan, B., Leslie, R., & Rea, M. (2010). Measuring circadian light and its impact on adolescents. Lighting Research & Technology, 43(2), 201–215. https://doi.org/10.1177/1477153510382853

Forman, R. T. T., & Godron, M. (1986). Landscape ecology (Illustrated ed.). Wiley.

Franco, L. S., Shanahan, D. F., & Fuller, R. A. (2017). A review of the benefits of nature experiences: More than meets the eye. International Journal of Environmental Research and Public Health, 14(8), 864. https://doi.org/10.3390/ijerph14080864

Fraser, M. (2021). Design research in architecture: An overview (1st ed.). Routledge. https://doi.org/10.4324/9781315258126

Fromm, E. (1964). The heart of man: Its genius for good and evil. Harper & Row.

Fuller, R. A., Irvine, K. N., Devine-Wright, P., Warren, P. H., & Gaston, K. J. (2007). Psychological benefits of greenspace increase with biodiversity. Biology Letters, 3(4), 390–394. https://doi.org/10.1098/rsbl.2007.0149

Gilbert, O. L., & Anderson, P. (1998). Habitat creation and repair (Online ed.). Oxford Academic. https://doi.org/10.1093/oso/9780198549673.001.0001

Gillian, K., & Gatersleben, B. (2015). A review of psychological literature on the health and wellbeing benefits of biophilic design. Buildings, 5(3), 948–963. https://doi.org/10.3390/buildings5030948

Gladwell, V. F., Brown, D. K., Wood, C., Sandercock, G. R., & Barton, J. L. (2013). The great outdoors: How a green exercise environment can benefit all. Extreme Physiology & Medicine, 2(1), 3. https://doi.org/10.1186/2046-7648-2-3

Glacken, C. J. (1999). Reflections on the history of Western attitudes to nature. In A. Buttimer & L. Wallin (Eds.), Nature and identity in cross-cultural perspective (Vol. 48, pp. 3–19). Springer. https://doi.org/10.1007/978-94-017-2392-3_1

Good, J. E. (2000). The restoration and revegetation of degraded land including quarry waste: A review.

Gourlay, S. (2006). 'Towards conceptual clarity for 'tacit knowledge': A review of empirical studies.' Knowledge Management Research & Practice, 4(1), 60–69.

Grinde, B., & Patil, G. G. (2009). Biophilia: Does visual contact with nature impact on health and well-being? International Journal of Environmental Research and Public Health, 6(9), 2332–2343. https://doi.org/10.3390/ijerph6092332

Gubin, D. G., Borisenkov, M. F., Kolomeichuk, S. N., Markov, A. A., Weinert, D., Cornelissen, G., & Stefani, O. (2024). Evaluating circadian light hygiene: Methodology and health implications. Russian Open Medical Journal, 13(4), e0415. https://doi.org/10.15275/rusomj.2024.0415

Gullone, E. (2000). The biophilia hypothesis and life in the 21st century: Increasing mental health or increasing pathology? Journal of Happiness Studies, 1(3), 293–322.

Haami, B. (2007a). Ngārara – Reptiles. In Te Ara – The encyclopedia of New Zealand. https://teara.govt.nz/en/ngarara-reptiles

Haami, B. (2007b). Te aitanga pepeke – The insect world. In Te Ara – The encyclopedia of New Zealand. https://www.teara.govt.nz/en/te-aitanga-pepeke-the-insect-world/page-1

Hartig, T., Mang, M., & Evans, G. W. (1991). Restorative effects of natural environment experiences. Environment and Behavior, 23(1), 3–26. https://doi.org/10.1177/0013916591231001

Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., & Gärling, T. (2003). Tracking restoration in natural and urban field settings. Journal of Environmental Psychology, 23(2), 109–123. https://doi.org/10.1016/S0272-4944(02)00109-3

Hartig, T., & Kahn, P. H. (2016). Living in cities, naturally. Science, 352(6288), 938–940. https://doi.org/10.1126/science.aaf3759

Harmsworth, G. R., & Awatere, S. (2013). Indigenous Māori knowledge and perspectives of ecosystems. In J. R. Dymond (Ed.), Ecosystem services in New Zealand – con-

ditions and trends (pp. 274–286). Manaaki Whenua Press.

Hart, S. L. (1971). Axiology—Theory of values. Philosophy and Phenomenological Research, 32(1), 29–41. https://doi.org/10.2307/2105883

Heatherwick Studio. (n.d.). Maggie's Yorkshire. In Projects. Retrieved July 28, 2025, from https://heatherwick.com/projects/spaces/maggies/

Heerwagen, J. H. (2006, September 19–22). Investing in people: The social benefits of sustainable design. Paper presented at Rethinking Sustainable Construction, Sarasota, FL.

Herzog, T. R., & Bryce, A. G. (2007). Mystery and preference in within-forest settings. Environment and Behavior, 39(6), 779–796.

Herzog & de Meuron. (n.d.). 658 Unterwasser Brunnen. Retrieved July 27, 2025, from https://www.herzogdemeuron.com/projects/658-unterwasser-brunnen/

Hidalgo, M. C., & Hernández, B. (2001). Place attachment: Conceptual and empirical questions. Journal of Environmental Psychology, 21(3), 273–281. https://doi.org/10.1006/jevp.2001.0221

Hildebrand, G. (1999). Origins of architectural pleasure. University of California Press.

Himes, A., Muraca, B., Anderson, C. B., Athayde, S., Beery, T., Cantú-Fernández, M., González-Jiménez, D., Gould, R. K., Hejnowicz, A. P., Kenter, J., Lenzi, D., Murali, R., Pascual, U., Raymond, C., Ring, A., Russo, K., Samakov, A., Stålhammar, S., Thorén, H., & Zent, E. (2023). Why nature matters: A systematic review of intrinsic, instrumental, and relational values. BioScience, 74(1), 25–43. https://doi.org/10.1093/biosci/biad109

Hikuroa, D. (2016). Mātauranga Māori—the ūkaipō of knowledge in New Zealand. Journal of the Royal Society of New Zealand, 47(1), 5–10. https://doi.org/10.1080/03036758.2016.1252407

Holland, J. H. (1995). Hidden order: How adaptation builds complexity. Addison-Wesley.

Insch, A. (2018). Auckland, New Zealand's super city. Cities, 80, 38–44. https://doi.org/10.1016/j.cities.2017.08.019

Ingold, T. (2000). The perception of the environment: Essays on livelihood, dwelling and skill. Routledge.

Jarwar, M., Dumontet, S., & Pasquale, V. (2024). The natural world in Western thought. Challenges, 15, 17. https://doi.org/10.3390/challe15010017

Jasmax. (n.d.-a). University of Auckland B201 Building. https://jasmax.com/projects/university-of-auckland-b201-building

Jasmax. (n.d.-b). Tōtara Haumaru – North Shore Hospital. https://jasmax.com/projects/t%C5%8Dtara-haumaru-north-shore-hospital

Jasmax. (n.d.-c). University of Waikato: The Pā. Jasmax. Retrieved July 29, 2025, from https://jasmax.com/projects/university-of-waikato-the-p%C4%81

Jahncke, H., Hygge, S., Halin, N., Green, A. M., & Dimberg, K. (2011). Open-plan office noise: Cognitive performance and restoration. Journal of Environmental Psychology, 31(4), 373–382. https://doi.org/10.1016/j.jenvp.2011.07.002

Joye, Y., & Dewitte, S. (2018). Nature's broken path to restoration: A critical look at Attention Restoration Theory. Journal of Environmental Psychology, 59, 1–8. https://doi.org/10.1016/j.jenvp.2018.08.006

Kake, B. J. (2015). Pehiāweri Marae papakāinga: A model for community regeneration in Te Tai Tokerau (Master of Architecture (Professional) thesis, Unitec Institute of Technology). Unitec Research Bank. https://www.researchbank.ac.nz/items/4e82651b-e06d-4a98-accb-16fa1d7d202f

Kahn, P. H., Jr. (1997). Developmental psychology and the biophilia hypothesis: Children's affiliation with nature. Developmental Review, 17(1), 1–61. https://doi.org/10.1006/drev.1996.0430

Kahn, P. H., Jr., Friedman, B., Gill, B., Hagman, J., Severson, R. L., Freier, N. G., Feldman, E. N., Carrere, S., & Stolyar, A. (2008). A plasma display window? The shifting baseline problem in a technology-mediated natural world. Journal of Environmental Psychology, 28(2), 192–199. https://doi.org/10.1016/j.jenvp.2007.10.008

Kardan, O., Gozdyra, P., Misic, B., Moola, F., Palmer, L. J., Paus, T., & Berman, M. G. (2015). Neighborhood greenspace and health in a large urban center. Scientific Reports, 5, 11610. https://doi.org/10.1038/srep11610

Kaplan, R. (1995). The restorative benefits of nature: Toward an integrative framework. Journal of Environmental Psychology, 15(3), 169–182. https://doi.org/10.1016/0272-4944(95)90001-2

Kaplan, R., & Kaplan, S. (1989). The experience of nature: A psychological perspective. Cambridge University Press.

Karmanov, D., & Hamel, R. (2008). Assessing the restorative potential of contemporary urban environment(s): Beyond the nature versus urban dichotomy. Landscape and Urban Planning, 86(2), 115–125. https://doi.org/10.1016/j.landurbplan.2008.01.004

Kawharu, M. (2000). Kaitiakitanga: A Māori anthropological perspective of the Māori socio-environmental ethic of resource management. The Journal of the Polynesian Society, 109(4), 349–370. http://www.jstor.org/stable/20706951

Kellert, S. R. (1993). The biological basis for human values of nature. In S. R. Kellert & E. O. Wilson (Eds.), The biophilia hypothesis (pp. 42–69). Island Press.

Kellert, S. R. (1997). Kinship to mastery: Biophilia in human evolution and development. Island Press.

Kellert, S. R. (2005). Building for life: Designing and understanding the human-nature connection. Island Press.

Kellert, S. R. (2008). Dimensions, elements, and attributes of biophilic design. In S. R. Kellert, J. H. Heerwagen, & M. L. Mador (Eds.), Biophilic design: The theory, science, and practice of bringing buildings to life (pp. 3–19).

Kellert, S. R. (2012). Birthright: People and nature in the modern world. Yale University Press.

Kellert, S. R., Heerwagen, J., & Mador, M. (2008). Biophilic design: The theory, science, and practice of bringing buildings to life. Wiley.

Kellert, S. R., & Heerwagen, J. H. (2008). Nature and healing: The science, theory, and promise of biophilic design. In R. Guenther & G. Vittori (Eds.), Sustainable healthcare architecture (pp. 85–89). John Wiley & Sons.

Kellert, S. R., & Wilson, E. O. (Eds.). (1993). The biophilia hypothesis. Island Press.

Kesim, B., & Baturayoğlu Yöney, N. (2021). Architectural travelers: The role of field trips in spatial design education. Periodica Polytechnica Architecture, 52(2), 155–164. https://doi.org/10.3311/PPar.18861

Khairoowala, Z., Aslam, F., Ali, U., Haq, S., & Ansari, M. (2025). Biophilic design and its implications for human health and well-being. African Journal of Biomedical Research, 28(1, Suppl.), Article 6408. https://doi.org/10.53555/AJBR.v28i1S.6408

Kiddle, R., Elkington, B., Ross, M., Mercier, O. R., Thomas, A., Gjerde, M., Smeaton, J., Arona, T., & Mawer, C. (2022). Imagining a decolonized city in and from Aotearoa New Zealand. International Journal of Urban and Regional Research, 46(6), 1138–1157. https://doi.org/10.1111/1468-2427.13132

Kirkby, M. J. (1969). Infiltration, throughflow, and overland flow. In Introduction to fluvial processes (1st ed., p. 13). Routledge. https://doi.org/10.4324/9780429273315

Kim, E., & Mattson, R. H. (2002). Stress recovery effects of viewing red-flowering geraniums. Journal of Therapeutic Horticulture, 13, 4–12.

Kim, J. T., Ren, C. J., Fielding, G. A., Pitti, A., Kasumi, T., Wajda, M., Lebovits, A., & Bekker, A. (2007). Treatment with lavender aromatherapy in the post-anesthesia care unit reduces opioid requirements of morbidly obese patients undergoing laparoscopic adjustable gastric banding. Obesity Surgery, 17(7), 920–925. https://doi.org/10.1007/s11695-007-9170-7

Kim, Y.-J., Choi, S.-W., & Park, S.-A. (2023). Effects of tactile stimulation using an assortment of natural elements on the psychophysiological responses of adults. Horticulturae, 9(12), 1293. https://doi.org/10.3390/horticulturae9121293

Kohno, M., Ghahremani, D. G., Morales, A. M., Robertson, C. L., Ishibashi, K., Morgan, A. T., Mandelkern, M. A., & London, E. D. (2013). Risk-taking behavior: Dopamine D2/D3 receptors, feedback, and frontolimbic activity. Cerebral Cortex, bht218. https://doi.org/10.1093/cercor/bht218

Lacey, C., Huria, T., Beckert, L., Gilles, M., & Pitama, S. (2011, December 16). The Hui Process: A framework to enhance the doctor-patient relationship with Māori. The New Zealand Medical Journal, 124(1347), 72–78.

Lachowycz, K., & Jones, A. P. (2011). Greenspace and obesity: A systematic review of the evidence. Obesity Reviews, 12(5), e183–e189. https://doi.org/10.1111/j.1467-789X.2010.00827.x

Lawson, B. (2004). What designers know (4th ed.). Architectural Press.

Laukkanen, J. A., Kunutsor, S. K., Zaccardi, F., & Laukkanen, T. (2018). Cardiovascular and other health benefits of sauna bathing: A review of the evidence. Mayo Clinic Proceedings, 93(8), 1111–1121. https://doi.org/10.1016/j.mayocp.2018.04.008

Leather, P., Pyrgas, M., Beale, D., & Lawrence, C. (1998). Windows in the workplace: Sunlight, view, and occupational stress. Environment and Behavior, 30(6), 739–762. https://doi.org/10.1177/001391659803000601

Lechner, N. (2014). Heating, cooling, lighting: Sustainable design methods for architects (4th ed.). John Wiley & Sons.

Lederbogen, F., Kirsch, P., Haddad, L., Streit, F., Tost, H., Schuch, P., Wüst, S., Pruessner, J. C., Rietschel, M., Deuschle, M., & Meyer-Lindenberg, A. (2011). City living and urban upbringing affect neural social stress processing in humans. Nature, 474(7352), 498–501. https://doi.org/10.1038/nature10190

Lew, T., & Fleming, K. J. (2024). Phytoncides and immunity from forest to facility: A systematic review and meta-analysis. Pharmacological Research - Natural Products, 4, 100061. https://doi.org/10.1016/j.prenap.2024.100061

Lindsay-Latimer, C., Allport, T., Potaka-Osborne, M., & Wilson, D. (2024). Belonging to the land: Indigenous Māori narratives of home and place. Folk, Knowledge, Place, 1(2), 23–41. https://doi.org/10.24043/001c.125729

Lincoln, Y. S., & Guba, E. G. (1985). Naturalistic inquiry. Sage Publications.

Li, Q. (2010). Effect of forest bathing trips on human immune function. Environmental Health and Preventive Medicine, 15(1), 9–17. https://doi.org/10.1007/s12199-008-0068-3

Li, Q., Kobayashi, M., Inagaki, H., Wakayama, Y., Katsumata, M., Hirata, Y., Li, Y., Hirata, K., Shimizu, T., Nakadai, A., & Kawada, T. (2012). Effect of phytoncides from forest environments on immune function. In Q. Li (Ed.), Forest medicine (pp. 157–167). Nova Science Publishers.

Li, Q., Morimoto, K., Nakadai, A., Inagaki, H., Katsumata, M., Shimizu, T., Hirata, Y., Hirata, K., Suzuki, H., Miyazaki, Y., Kagawa, T., Koyama, Y., Ohira, T., Takayama, N., Krensky, A. M., & Kawada, T. (2007). Forest bathing enhances human natural killer activity and expression of anti-cancer proteins. International Journal of Immunopathology and Pharmacology, 20(2 Suppl 2), 3–8. https://doi.org/10.1177/03946320070200S202

Liu, C., Jing, X., Shi, J., Li, J., Zhang, Y., & Gao, W. (2024). Effects of natural sound on human stress recovery based on EEG techniques. Journal of Environmental Psychology, 97, 102365. https://doi.org/10.1016/j.jenvp.2024.102365

Liu, M., Kim, E., & Mattson, R. H. (2003). Physiological and emotional influences of cut flower arrangement and lavender fragrance on university students. Journal of Therapeutic Horticulture, 14, 18–27.

Ljungberg, J., Neely, G., & Lundström, R. (2004). Cognitive performance and subjective experience during combined exposures to whole-body vibration and noise. International Archives of Occupational and Environmental Health, 77, 217–221.

López Plazas, F., & Sáenz de Tejada, C. (2024). Natural ventilation to improve indoor air quality (IAQ) in existing homes: The development of health-based and context-specific user guidelines. Energy and Buildings, 314, 114248. https://doi.org/10.1016/j.enbuild.2024.114248

Lopes, M. K. S., & Falk, T. H. (2024). Audio-visual-olfactory immersive digital nature exposure for stress and anxiety reduction: A systematic review on systems, outcomes, and challenges. Frontiers in Virtual Reality, 5, 1252539. https://doi.org/10.3389/frvir.2024.1252539

Love, C. (2004). Extensions on Te Wheke (Working Papers No. 6-04). The Open Polytechnic of New Zealand. https://repository.openpolytechnic.ac.nz/handle/110

Maas, J., Verheij, R. A., de Vries, S., Spreeuwenberg, P., Schellevis, F. G., & Groenewegen, P. P. (2009). Morbidity is related to a green living environment. Journal of Epidemiology and Community Health, 63(12), 967–973. https://doi.org/10.1136/jech.2008.079038

Mang, P., & Reed, B. (2012). Designing from place: A regenerative framework and methodology. Building Research & Information, 40(1), 23–38.

Manzo, L. C. (2003). Beyond house and haven: Toward a revisioning of emotional relationships with places. Journal of Environmental Psychology, 23(1), 47–61. https://doi.org/10.1016/S0272-4944(02)00074-9

Mark, G., Boulton, A., Allport, T., Kerridge, D., & Potaka-Osborne, G. (2022). “Ko au te whenua, ko te whenua ko au: I am the land, and the land is me”: Healer/patient views on the role of Rongoā Māori (traditional Māori healing) in healing the land. International Journal of Environmental Research and Public Health, 19(14), 8547.

Mark, G., Boulton, A., & Kerridge, D. (2019). Rongoā Māori is not a complementary and alternative medicine: Rongoā Māori is a way of life. International Journal of Human Rights Education, 3(1), 12.

Mark, G., Chamberlain, K., & Boulton, A. (2017). Acknowledging the Māori cultural values and beliefs embedded in rongoā Māori healing. International Journal of Indigenous Health, 12(1), 75–92.

Mark, G., & Lyons, A. (2010). Māori healers' views on wellbeing: The importance of mind, body, spirit, family and land. Social Science & Medicine, 70, 1756–1764. https://doi.org/10.1016/j.socscimed.2010.02.001

Marsden, M. (2003). The woven universe: Selected writings of Rev. Māori Marsden. Estate of Rev. Māori Marsden.

Marcus, C. C., & Barnes, M. (1995). Gardens in healthcare facilities: Uses, therapeutic benefits, and design recommendations. The Center for Health Design.

Maggie's. (n.d.). Our story. Retrieved July 28, 2025, from https://www.maggies.org/about-us/how-maggies-works/our-story/

McDonough, M. (2006, June 4). Grand Canyon Skywalk [Photograph]. Flickr. https://www.flickr.com/photos/mikemcd/539914172/

Mead, H. M. (2003). Tikanga Māori: Living by Māori values. Huia Publishers.

Mendes, P., Goyette, J.-O., Cottet, M., Cimon-Morin, J., Pellerin, S., & Poulin, M. (2024). The aesthetic value of natural vegetation remnants, city parks and vacant lots: The role of ecosystem features and observer characteristics. Urban Forestry & Urban Greening, 98, Article 128388. https://doi.org/10.1016/j.ufug.2024.128388

Mental Health Foundation of New Zealand. (2018, September 24). Survey shows strong link between time spent in nature and positive mental health. https://mentalhealth.org.nz/news/post/survey-shows-strong-link-between-time-spent-in-nature-and-positive-mental-health

Ministry of Health. (2011). Whānau Ora: Transforming our futures. https://www.health.govt.nz/system/files/2011-10/whanau-ora-transforming-futures-v2.pdf

Ministry of Health. (2024). Tatau Kahukura: Māori health chart book 2024 (4th ed.). Wellington: Ministry of Health.

Mihalakakou, G., Souliotis, M., Papadaki, M., Menounou, P., Dimopoulos, P., Kolokotsa, D., Paravantis, J. A., Tsangrassoulis, A., Panaras, G., Giannakopoulos, E., & Papaefthimiou, S. (2023). Green roofs as a nature-based solution for improving urban sustainability: Progress and perspectives. Renewable and Sustainable Energy Reviews, 180, 113306. https://doi.org/10.1016/j.rser.2023.113306

Mostajeran, F., Krzikawski, J., Steinicke, F., Schultheis, M., & Kiefer, P. (2021). Effects of exposure to immersive videos and photo slideshows of forest and urban environments. Scientific Reports, 11, 3994. https://doi.org/10.1038/s41598-021-83277-y

Murray, L. (2010). Tau ora for our people. In S. Hoani & S. Davis (Eds.), Toroa-te-Nukuroa Volume V: Ako Wānanga (pp. 112–117). https://ndhadeliver.natlib.govt.nz/delivery/DeliveryManagerServlet?dps_pid=IE6427401

Ngāi Tai ki Tāmaki. (n.d.). Matakamokamo and Matakerepo. https://www.ngaitaitamaki.iwi.nz/matakamokamo-and-matakerepo

Nunn, P. D. (2019, June 4). Firepits of the gods: Ancient memories of maar volcanoes. The Conversation. https://theconversation.com/firepits-of-the-gods-ancient-memories-of-maar-volcanoes-116808

Ohly, H., White, M. P., Wheeler, B. W., Bethel, A., Ukoumunne, O. C., Nikolaou, V., & Garside, R. (2016). Attention Restoration Theory: A systematic review of the attention restoration potential of exposure to natural environments. Journal of Toxicology and Environmental Health, Part B, https://doi.org/10.1080/1093740 4.2016.1196155

Öhman, A., & Mineka, S. (2001). Fears, phobias, and preparedness: Toward an evolved module of fear and fear learning. Psychological Review, 108(3), 483–522. https://doi.org/10.1037/0033-295X.108.3.483

Ohtsuka, Y., Yabunaka, N., & Takayama, S. (1998). Shinrin-yoku (forest-air bathing and walking) effectively decreases blood glucose levels in diabetic patients. International Journal of Biometeorology, 41(3), 125–127. https://doi.org/10.1007/s004840050064

Ópera de Arame. (n.d.). Opera Experience. Retrieved July 29, 2025, from https://operadearame.com/

Orians, G. H., & Heerwagen, J. H. (1992). Evolved responses to landscapes. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds.), The adapted mind: Evolutionary psychology and the generation of culture (pp. 555–579). Oxford University Press.

Paredes-Céspedes, D. M., Vélez, N., Parada-López, A., Toloza-Pérez, Y. G., Téllez, E. M., Portilla, C., González, C., Blandón, L., Santacruz, J. C., & Malagón-Rojas, J. (2024). The effects of nature exposure therapies on stress, depression, and anxiety levels: A

systematic review. European Journal of Investigation in Health, Psychology and Education, 14(3), 609–622. https://doi.org/10.3390/ejihpe14030040

Patterson, J. (1998). Respecting nature: A Māori perspective. Worldviews: Global Religions, Culture, and Ecology, 2(1), 69–78. https://doi.org/10.1163/156853598X00064

Paul, J., & Hatton, W. (2018, September). Te Aranga Māori design principles. Building Better Homes, Towns and Cities. https://www.buildingbetter.nz/publication/te-aranga-maori-design-principles/index.html

Paul, A., Hourakhsh, N., Findikgil, M., & Yildirim, S. (2024). Assessing the effectiveness of biophilic design approach in contribution to sustainable architectural goals. Journal Name, 8, 144–169.

Paul, J. (2017). Exploring Te Aranga design principles in Tāmaki (Bachelor's thesis, Unitec Institute of Technology). https://www.buildingbetter.nz/wp-content/uploads/2023/08/Paul_2017_exploring_te_aranga_design_principles.pdf

Paul, J. (2016). Design research: Theory and practice. Routledge.

Payton, I. J., Fenner, M., & Lee, W. G. (2002). Keystone species: The concept and its relevance for conservation management in New Zealand (Science for Conservation No. 203, pp. 5–29). Department of Conservation.

Pedersen Zari, M. (2012). Ecosystem services analysis for the design of regenerative built environments. Building Research & Information, 40(1), 54–64. https://doi.org/10.1080/09613218.2011.628547

Pedersen Zari, M. (2019). Understanding and designing nature experiences in cities: a framework for biophilic urbanism. Cities & Health, 7(2), 201–212. https://doi.org/10.1080/23748834.2019.1695511

Pedersen Zari, M., Kiddle, G. L., Chanse, V., Latai-Niusulu, A., Bloomfield, S., Brockie, O., Grimshaw, M., Platje, A., Varshney, K., Ershadi, S., Mihaere, S., Blaschke, P., & Abbott, M. (2024). NUWAO Nature-based solutions design guide. Auckland: NU WAO.

Pere, R. R., & Nicholson, N. (1991). Te Wheke: A celebration of infinite wisdom. Health Promotion Forum of New Zealand.

Pitama, S., Robertson, P., Cram, F., Gillies, M., Huria, T., & Dallas-Katoa, W. (2007). A proposed hauora Māori clinical guide for psychologists: Using the hui process and Meihana model in clinical assessment and formulation. New Zealand Journal of Psychology, 36(3), 118–127.

Pool, I. (2016). Māori health, colonization and post-colonization: Aotearoa New Zealand, from 1769. Journal of Northern Studies, 10(2), 19–43.

Polanyi, M. (1966). The tacit dimension. Doubleday.

Prach, K., & Walker, L. R. (2011). Four opportunities for studies of ecological succession. Trends in Ecology & Evolution, 26(3), 119–123. https://doi.org/10.1016/j.tree.2010.12.007

Ramalho, R., Groot, S., & Adams, P. (2022). Community mental health care in Aotearoa New Zealand: Past, present, and the road ahead. Consortium Psychiatricum, 3(4), 53–62. https://doi.org/10.17816/CP202

Rameka, L. (2018). A Māori perspective of being and belonging. Contemporary Issues in Early Childhood, 19(4), 367–378. https://doi.org/10.1177/1463949118808099

Rajpar, M. N., Ahmad, S., Zakaria, M., Ahmad, A., Guo, X., Nabi, G., & Wanghe, K. (2022). Artificial wetlands as alternative habitat for a wide range of waterbird species. Ecological Indicators, 138, 108855. https://doi.org/10.1016/j.ecolind.2022.108855

Raanaas, R. K., Patil, G. G., & Hartig, T. (2012). Health benefits of a view of nature through the window: A quasi-experimental study of patients in a residential rehabilitation center. Clinical Rehabilitation, 26(1), 21–32. https://doi.org/10.1177/0269215511412800

Rasch, G., & Craig, J. L. (1988). Partitioning of nectar resources by New Zealand honeyeaters. New Zealand Journal of Zoology, 15(2), 185–190. https://doi.org/10.1080/03014223.1988.10422613

Rashidinejad, A. (2024). Bioactive compounds from New Zealand's native edible plants: Their role in future functional foods. Future Postharvest and Food, 1(4), 435–440. https://doi.org/10.1002/fpf2.12038

Rebbeck Dunn Watters. (2020). Smales Quarry. https://rdw.co.nz/portfolio-item/smales-farm-quarry/

Reid, P., & Robson, B. (2000). Understanding health inequities. Hauora: Māori standards of health IV. A study of the years, 2005, 3–10.

Reid, P., Cormack, D., & Paine, S.-J. (2019). Colonial histories, racism and health - The

experience of Māori and Indigenous peoples. Public Health, 172, 119–124. https://doi.org/10.1016/j.puhe.2019.03.027

Reid, P., Paine, S.-J., Te Ao, B., Willing, E. J., Wyeth, E., Vaithianathan, R., & Loring, B. (2022). Estimating the economic costs of Indigenous health inequities in New Zealand: A retrospective cohort analysis. BMJ Open, 12(10), e065430. https://doi.org/10.1136/bmjopen-2022-065430

Relph, E. (1976). Place and placelessness. Pion.

Richardson, E., Pearce, J., Mitchell, R., Day, P., & Kingham, S. (2010). The association between green space and cause-specific mortality in urban New Zealand: An ecological analysis of green space utility. BMC Public Health, 10, 240. https://doi.org/10.1186/1471-2458-10-240

Richardson, M. (2025). Modelling nature connectedness within environmental systems: Human-nature relationships from 1800 to 2020 and beyond. Earth, 6(3), 82. https://doi.org/10.3390/earth6030082

Rittel, H. W. J., & Webber, M. M. (1973). Dilemmas in a general theory of planning. Policy Sciences, 4(2), 155–169. https://doi.org/10.1007/BF01405730

Royal, T. A. C. (2007). The woven universe: Selected writings of Rev. Māori Marsden. The Estate of Rev. Māori Marsden.

Royal, T. A. C. (2009). Mātauranga Māori: An introduction. MKTA.

Salgueiro, P. A., Prach, K., Branquinho, C., & Mira, A. (2020). Enhancing biodiversity and ecosystem services in quarry restoration – Challenges, strategies, and practice. Restoration Ecology, 28(2), 243–252. https://doi.org/10.1111/rec.13160

Salimpoor, V. N., Benovoy, M., Larcher, K., Dagher, A., & Zatorre, R. J. (2011). Anatomically distinct dopamine release during anticipation and experience of peak emotion to music. Nature Neuroscience, 14(2), 257–262. https://doi.org/10.1038/nn.2726

Scotton, M., & Andreatta, D. (2021). Anti-erosion rehabilitation: Effects of revegetation method and site traits on introduced and native plant cover and richness. Science of The Total Environment, 776, 145915. https://doi.org/10.1016/j.scitotenv.2021.145915

Schön, D. A. (1983). The reflective practitioner: How professionals think in action. Basic Books.

Seamon, D. (2000). A way of seeing people and place: Phenomenology in environment-behavior research. In S. Wapner, J. Demick, T. Yamamoto, & H. Minami (Eds.), Environmental psychology: Directions and perspectives (pp. 157–178). Cambridge University Press.

Seligman, M. E. P. (2008). Positive health. Applied Psychology, 57(s1), 3–18. https://doi.org/10.1111/j.1464-0597.2008.00351.x

Sheridan, N., Jansen, R. M., Harwood, M., Oetzel, J., Tipene-Leach, D., Curtis, E., & Cram, F. (2024). Hauora Māori – Māori health: A right to equal outcomes in primary care. International Journal for Equity in Health, 23, Article 42. https://doi.org/10.1186/s12939-023-02071-6

Shibata, S., & Suzuki, N. (2002). Effects of the foliage plant on task performance and mood. Journal of Environmental Psychology, 22, 265–272.

Shibata, S., & Suzuki, N. (2004). Effects of an indoor plant on creative task performance and mood. Scandinavian Journal of Psychology, 45, 373–381. https://doi.org/10.1111/j.1467-9450.2004.00419.x

Sloane, P. D., Zimmerman, S., Williams, C. S., Reed, P. S., Preisser, J. S., Eckert, J. K., Boustani, M., & Dobbs, D. (2005). Dementia care and quality of life in assisted living and nursing homes. The Gerontologist, 45(Suppl. 1), 133–146. https://doi.org/10.1093/geront/45.suppl_1.133

Smales Farm. (n.d.). 140 years of embracing change and innovation. https://smalesfarm.co.nz/about-the-farm/history/

Snøhetta. (n.d.). Wendelstrand Lakehouse. Snøhetta. Retrieved July 27, 2025, from https://www.snohetta.com/projects/lakehouse-wendelstrand

Soga, M., & Evans, M. J. (2024). Biophobia: What it is, how it works and why it matters. People and Nature, 6(3), 922–931.

Stewart, G. T. (2023). Animals of Aotearoa: Kaupapa Māori Summaries. Anthrozoös, 37(1), 1–17. https://doi.org/10.1080/08927936.2023.2254552

Stigsdotter, U. A., & Grahn, P. (2003). Experiencing a garden: A healing garden for people suffering from burnout diseases. Journal of Therapeutic Horticulture, 14, 38–48.

Söderlund, J. (2019). The emergence of biophilic design (1st ed.). Springer Cham.

https://doi.org/10.1007/978-3-030-29813-5

Söderlund, J., & Newman, P. (2015). Biophilic architecture: A review of the rationale and outcomes. AIMS Environmental Science, 2(4), 950–969. https://doi.org/10.3934/environsci.2015.4.950

Söderlund, J., & Newman, P. (2022). How the biophilic design social movement informs planning, policy and professional practice. Sustainable Earth, 5(1), 4. https://doi.org/10.1186/s42055-022-00051-2

Tāne's Tree Trust. (n.d.). Planting native forest - selecting the right species for the right site. Retrieved from https://docs.tanestrees.org.nz/planting-native-forest-selecting-the-right-species-for-the-right-site/

Talaie, A., & Ponraj, M. (2024). Impact of houseplants on reducing indoor air pollution. Journal of Environmental Treatment Techniques, 12(3), 1–13.

Tassell-Matamua, N., Lindsay, N., Bennett, A., & Masters-Awatere, B. (2020). Māori cultural identity linked to greater regard for nature: Attitudes and (less so) behavior. Ecopsychology, 13(1), 9–18. https://doi.org/10.1089/eco.2020.0027

Te Puni Kōkiri (Ministry of Māori Development). (n.d.). Tāmaki. https://tkm.govt.nz/region/tamaki/

Tekin, B. H., Corcoran, R., & Gutiérrez, R. U. (2022). A systematic review and conceptual framework of biophilic design parameters in clinical environments. HERD, 16(1), 233–250. https://doi.org/10.1177/19375867221118675

Tekin, B. H., Izmir Tunahan, G., Disci, Z. N., & Ozer, H. S. (2025). Biophilic design in the built environment: Trends, gaps and future directions. Buildings, 15(14), 2516. https://doi.org/10.3390/buildings15142516

Temby-Spence, A. (2024). Designing alongside Māori: Theorising experiences of relational, place-based architectural practice in Aotearoa. Asylum, 1, 255–268. https://doi.org/10.34074/aslm.2024107

Te Rūnanga o Ngāi Tahu. (2013, December 11). The good oil on tough old tītoki. Te Rūnanga o Ngāi Tahu. https://ngaitahu.iwi.nz/opportunities-and-resources/publications/te-karaka/good-oil-tough-old-titoki/

Tham, K. W., & Willem, H. C. (2005). Temperature and ventilation effects on performance and neurobehavioral-related symptoms of tropically acclimatized call center operators near thermal neutrality. ASHRAE Transactions, 111(1), 687–698.

Thiering, E., Markevych, I., Brüske, I., Fuertes, E., Kratzsch, J., Sugiri, D., Hoffmann, B., von Berg, A., Bauer, C. P., Koletzko, S., Berdel, D., & Heinrich, J. (2016). Associations of residential long-term air pollution exposures and satellite-derived greenness with insulin resistance in German adolescents. Environmental Health Perspectives, 124(8), 1291–1298. https://doi.org/10.1289/ehp.1509967

Thomsen, B. S., & Honour, H. (2022). Epistemic artefacts in design research: Visual tools for design thinking. In Proceedings of the Design Research Society Conference 2022. https://doi.org/10.21606/drs.2022.175

Till, J. (2009). Architecture depends. MIT Press.

Todini, E. (2025). Understanding and mitigating urban flood risk. Hydrology, 12(6), 146. https://doi.org/10.3390/hydrology12060146

Tosama, M. J. (2023). The biomedical and the relational model of the body, the meaning of illness and quality of care: A comparative analysis. South African Journal of Philosophy, 41(2). Advance online publication. https://doi.org/10.1080/02580136.2022.2059984

Tost, H., Champagne, F. A., & Meyer-Lindenberg, A. (2015). Environmental influence in the brain, human welfare and mental health. Nature Neuroscience, 18(10), 1421–1431. https://doi.org/10.1038/nn.4108

Tuan, Y.-F. (1977). Space and place: The perspective of experience. University of Minnesota Press.

Tuck, E., & McKenzie, M. (2014). Place in research: Theory, methodology, and methods (1st ed.). Routledge. https://doi.org/10.4324/9781315764849

Tse, M. Y. M., Ng, J. K. F., Chung, J. W. Y., & Wong, T. K. S. (2002). The effect of visual stimuli on pain threshold and tolerance. Journal of Clinical Nursing, 11(4), 462–469. https://doi.org/10.1046/j.1365-2702.2002.00608.x

Tsunetsugu, Y., Miyazaki, Y., & Sato, H. (2007). Physiological effects in humans induced by the visual stimulation of room interiors with different wood quantities. Journal of Wood Science, 53(1), 11–16. https://doi.org/10.1007/s10086-006-0812-5

Tsunetsugu, Y., Park, B. J., & Miyazaki, Y. (2010). Trends in research related to “Shinrin-yoku” (taking in the forest atmosphere or forest bathing) in Japan. Environmental Health and Preventive Medicine, 15(1), 27–37. https://doi.org/10.1007/s12199-009-0091-z

Tsunetsugu, Y., Park, B. J., Ishii, H., Hirano, H., Kagawa, T., & Miyazaki, Y. (2013). Physiological and psychological effects of viewing urban forest landscapes assessed by multiple measurements. Landscape and Urban Planning, 113, 90–93. https://doi.org/10.1016/j.landurbplan.2013.01.014

Twohig-Bennett, C., & Jones, A. (2018). The health benefits of the great outdoors: A systematic review and meta-analysis of greenspace exposure and health outcomes. Environmental Research, 166, 628–637. https://doi.org/10.1016/j.envres.2018.06.030

Ulrich, R. S. (1983). Aesthetic and affective response to natural environment. In I. Altman & J. F. Wohlwill (Eds.), Behavior and the natural environment (pp. 85–125). Plenum Press.

Ulrich, R. S. (1984). View through a window may influence recovery from surgery. Science, 224(4647), 420–421. https://doi.org/10.1126/science.6143402

Ulrich, R. S. (1993). Biophilia, biophobia, and natural landscapes. In S. R. Kellert & E. O. Wilson (Eds.), The biophilia hypothesis (pp. 73–137). Island Press.

Ulrich, R. S. (1999). Effects of gardens on health outcomes: Theory and research. In C. C. Cooper Marcus & M. Barnes (Eds.), Healing gardens: Therapeutic benefits and design recommendations (pp. 27–86). Wiley.

Ulrich, R. S., Simons, R., Losito, B. D., Fiorito, E., Miles, M. A., & Zelson, M. (1991). Stress recovery during exposure to natural and urban environments. Journal of Environmental Psychology, 11(3), 201–230.

Van Os, J. (2004). Does the urban environment cause psychosis? The British Journal of Psychiatry, 184(4), 287–288. https://doi.org/10.1192/bjp.184.4.287

van den Berg, A. E., Koole, S. L., & van der Wulp, N. Y. (2003). Environment preference and restoration: (How) are they related? Journal of Environmental Psychology, 23(2), 135–146. https://doi.org/10.1016/S0272-4944(02)00111-1

van den Berg, A. E., & ter Heijne, M. (2005). Fear versus fascination: An exploration of emotional responses to natural threats. Journal of Environmental Psychology, 25(3), 261–272. https://doi.org/10.1016/j.jenvp.2005.08.004

van den Berg, A. E., Hartig, T., & Staats, H. (2007). Preference for nature in urbanized societies: Stress, restoration, and the pursuit of sustainability. Journal of Social Issues, 63(1), 79–96.

Varshney, K., MacKinnon, M., Pedersen Zari, M., Shanahan, D., Woolley, C., Freeman, C., & van Heezik, Y. (2024). Biodiverse residential development: A review of New Zealand policies and strategies for urban biodiversity. Urban Forestry & Urban Greening, 94, 128276. https://doi.org/10.1016/j.ufug.2024.128276

Vashishta, N., Gupta, H., & Bhargava, B. (2024). Green walls, green roofs, and urban city landscapes as nature-based ecological solutions. In Nature-based solutions for resilient urban design. Springer. https://doi.org/10.1007/978-981-97-4028-4_15

Villeneuve, P. J., Jerrett, M., Su, J. G., Burnett, R. T., Chen, H., Wheeler, A. J., & Goldberg, M. S. (2012). A cohort study relating urban green space with mortality in Ontario, Canada. Environmental Research, 115, 51–58. https://doi.org/10.1016/j.envres.2012.03.003

Wang, D. V., & Tsien, J. Z. (2011). Convergent processing of both positive and negative motivational signals by the VTA dopamine neuronal populations. PLoS ONE, 6(2), e17047. https://doi.org/10.1371/journal.pone.0017047

Wang, K., & Taylor, R. B. (2006). Simulated walks through dangerous alleys: Impacts of features and progress on fear. Journal of Environmental Psychology, 26(4), 269–283. https://doi.org/10.1016/j.jenvp.2006.07.006

Wang, S., Xu, Y., Yang, X., Zhang, Y., Yan, P., Jiang, Y., & Wang, K. (2023). Urban cultural heritage is mentally restorative: An experimental study based on multiple psychophysiological measures. Frontiers in Psychology, 14, 1132052. https://doi.org/10.3389/fpsyg.2023.1132052

Wepa, D., & Wilson, D. (2019). Struggling to be involved: An interprofessional approach to examine Māori whānau engagement with healthcare services. Journal of Nursing Research and Practice, 3(3), 1–5. http://dx.doi.org/10.37532/jnrp.2019.3(3).1-5

White, M., Smith, A., Humphryes, K., Pahl, S., Snelling, D., & Depledge, M. (2010). Blue space: The importance of water for preference, affect and restorativeness ratings of natural and built scenes. Journal of Environmental Psychology, 30(4), 482–493.

Whiteford, H. A., Degenhardt, L., Rehm, J., Baxter, A. J., Ferrari, A. J., Erskine, H. E., Charlson, F. J., Norman, R. E., Flaxman, A. D., Johns, N., Burstein, R., Murray, C. J. L., & Vos, T. (2013). Global burden of disease attributable to mental and substance

use disorders: Findings from the Global Burden of Disease Study 2010. The Lancet, 382(9904), 1575–1586. https://doi.org/10.1016/S0140-6736(13)61611-6

Wigö, H. (2005). Technique and human perception of intermittent air velocity variation [Doctoral dissertation, KTH Research School, Centre for Built Environment].

Wijesooriya, N., Brambilla, A., & Markauskaite, L. (2023). Biophilic design frameworks: A review of structure, development techniques and their compatibility with LEED sustainable design criteria. Cleaner Production Letters, 4, 100033. https://doi.org/10.1016/j.clpl.2023.100033

Windhager, S., Atzwanger, K., Bookstein, F. L., & Schaefer, K. (2011). Fish in a mall aquarium—An ethological investigation of biophilia. Landscape and Urban Planning, 99, 23–30.

Wikaire, E. (2020). The past, present and future of traditional Indigenous healing: What was, is, and will be, rongoā Māori (Doctoral dissertation, ResearchSpace@Auckland).

Wilson, D., & Barton, P. (2012). Indigenous hospital experiences: A New Zealand case study. Journal of Clinical Nursing, 21(15–16), 2316–2326.

Wilson, D., Moloney, E., Parr, J. M., Aspinall, C., & Slark, J. (2021). Creating an Indigenous Māori-centred model of relational health: A literature review of Māori models of health. Journal of Clinical Nursing, 30(23–24), 3539–3555. https://doi.org/10.1111/jocn.15859

Wilson, E. O. (1984). Biophilia. Harvard University Press.

Woodard, W. (2014). Politics, psychotherapy, and the 1907 tohunga suppression act. Psychotherapy and Politics International, 12(1), 39–48.

Woodhouse, J., Carr, A., Liebergreen, N., Anderson, L., Beausoleil, N. J., Zobel, G., & King, M. (2021). Conceptualizing Indigenous human–animal relationships in Aotearoa New Zealand: An ethical perspective. Animals, 11(10), 2899. https://doi.org/10.3390/ani11102899

Wou, Z., Jiang, M., Yuan, Y., & Verhoeven, J. (2019). Case studies of ecological restoration and conservation strategies for marshes and peatlands. In Restoration of wetlands and peatlands (pp. [insert page range]). Springer. https://doi.org/10.1007/978-3-030-14861-4_9

Workman, A., Hossain, S. Z., Liamputtong, P., Ojinnaka, A., & Mpofu, E. (2021). Cultural models of health and health care. In Culture, diversity and health in Australia

(1st ed., pp. 16). Routledge.

Wüthrich-Grossenbacher, U. (2024). The need to widen the concept of health and to include the spiritual dimension. International Journal of Public Health, 69, 1606648. https://doi.org/10.3389/ijph.2024.1606648

Yao, W., Chen, F., Wang, S., & Zhang, X. (2021). Impact of exposure to natural and built environments on positive and negative affect: A systematic review and meta-analysis. Frontiers in Public Health, 9, 758457. https://doi.org/10.3389/fpubh.2021.758457

Youssef, M. (2020). Guidelines for sustainable construction methods to build over difficult topographies. BAU Journal - Creative Sustainable Development, 1(2), Article 9. https://doi.org/10.54729/2789-8334.1022

Zald, D. H., Cowan, R. L., Riccardi, P., Baldwin, R. M., Ansari, M. S., Li, R., Shelby, E. S., Smith, C. E., McHugo, M., & Kessler, R. M. (2008). Midbrain dopamine receptor availability is inversely associated with novelty-seeking traits in humans. The Journal of Neuroscience, 28(53), 14372–14378. https://doi.org/10.1523/JNEUROSCI.2423-08.2008

Zhang, H., Arens, E., Huizenga, C., & Han, T. (2010). Thermal sensation and comfort models for non-uniform and transient environments: Part II: Local comfort of individual body parts. Building and Environment, 45(2), 389–398. https://doi.org/10.1016/j.buildenv.2009.06.015

Zhou, W., Schröder, T., & Bekkering, J. (2022). Biophilic design in architecture and its contributions to health, well-being, and sustainability: A critical review. Frontiers of Architectural Research, 11(1), 114–141. https://doi.org/10.1016/j.foar.2021.07.006

Zimmermann, E., Bracalenti, L., Piacentini, R., & Inostroza, L. (2016). Urban flood risk reduction by increasing green areas for adaptation to climate change. Procedia Engineering, 161, 2241–2246. https://doi.org/10.1016/j.proeng.2016.08.822

Zoure, A. N., & Genovese, P. V. (2023). Implementing natural ventilation and daylighting strategies for thermal comfort and energy efficiency in office buildings in Burkina Faso. Energy Reports, 9, 3319–3342. https://doi.org/10.1016/j.egyr.2023.02.017

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Permission to use requested; no response received. Please contact the author for any issues with use.

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Permission to use requested; no response received. Please contact the author for any issues with use.

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Permission to use requested; the author could not be reached. Please contact the author for any concerns regarding use.

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Permission to use accepted.

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APPENDICES

Appendix A: 14 Patterns of Biophilic Design (Browning et al., 2014).

14 PATTERNS OF BIOPHILIC DESIGN

Improving Health and Well-Being in the Built Environment

NATURE IN THE SPACE



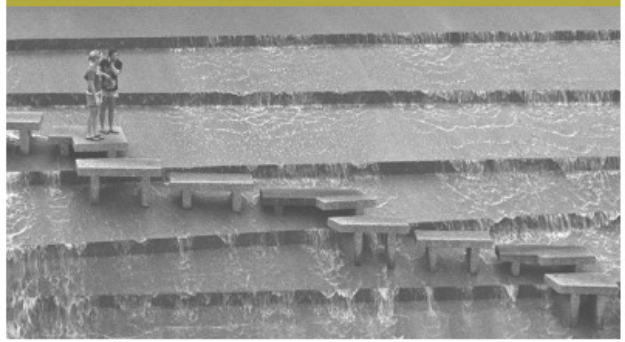
1. **Visual Connection with Nature**
   A view to elements of nature, living systems and natural processes.
2. **Non-Visual Connection with Nature**
   Auditory, haptic, olfactory, or gustatory stimuli that engender a deliberate and positive reference to nature, living systems or natural processes.
3. **Non-Rhythmic Sensory Stimuli**
   Stochastic and ephemeral connections with nature that may be analyzed statistically but may not be predicted precisely.
4. **Thermal & Airflow Variability**
   Subtle changes in air temperature, relative humidity, airflow across the skin, and surface temperatures that mimic natural environments.
5. **Presence of Water**
   A condition that enhances the experience of a place through the seeing, hearing or touching of water.
6. **Dynamic & Diffuse Light**
   Leveraging varying intensities of light and shadow that change over time to create conditions that occur in nature.
7. **Connection with Natural Systems**
   Awareness of natural processes, especially seasonal and temporal changes characteristic of a healthy ecosystem.

NATURAL ANALOGUES



8. **Biomorphic Forms & Patterns**
   Symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature.
9. **Material Connection with Nature**
   Material and elements from nature that, through minimal processing, reflect the local ecology or geology to create a distinct sense of place.
10. **Complexity & Order**
    Rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature.

NATURE OF THE SPACE



11. **Prospect**
    An unimpeded view over a distance for surveillance and planning.
12. **Refuge**
    A place for withdrawal, from environmental conditions or the main flow of activity, in which the individual is protected from behind and overhead.
13. **Mystery**
    The promise of more information achieved through partially obscured views or other sensory devices that entice the individual to travel deeper into the environment.
14. **Risk/Peril**
    An identifiable threat coupled with a reliable safeguard.