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HEALING THROUGH ARCHITECTURE: A HUMAN-CENTERED DESIGN FOCUSED ON BIOPHILIA AND THE CONNECTION TO NATURE

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HEALING THROUGH ARCHITECTURE: A HUMAN-CENTERED DESIGN FOCUSED ON
BIOPHILIA AND THE CONNECTION TO NATURE

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ABSTRACT

At different points in our lives, we may find ourselves in a healthcare setting—supporting a loved one, undergoing treatment, or working within the healthcare profession. A thoughtfully designed space positively influences mental, emotional, and physical health, creating a conducive atmosphere for recovery. This positive impact extends to healthcare professionals, reducing burnout while enhancing staff satisfaction and productivity. By embracing a holistic approach, healing environments acknowledge the interconnectedness of physical and psychological well-being. The significance of establishing healing environments lies in their potential to positively shape the health and experiences of individuals, healthcare professionals, and communities alike.

Aligned with these principles, this thesis undertakes the design of an outpatient mental health clinic in Fargo, North Dakota. The clinic adopts a patient and staff-centered design approach, fostering an environment that prioritizes healing and support. Through the integration of biophilic design principles, nature is invited into the healing journey, enhancing the therapeutic atmosphere and promoting a sense of overall well-being.

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1. INTRODUCTION

Healthcare institutions excel in diagnosing and treating illnesses, but they often overlook the psychological, emotional, and social needs of their occupants. Hospital design principles still follow the late modern era of the 1950s and 1960s and pay limited attention to patients, families, and staff's emotional, psychological, and social needs (Abdelaal & Soebarto, 2019). The healthcare field is consistently evolving and adapting to changes regarding medical trends and new technologies, yet the facilities remain stagnant.

Society in the United States is witnessing a transformative shift in its approach to health and emphasizing preventive care and overall well-being, rather than solely concentrating on diagnosis and medical treatment (Mazuch, 2017). This shift presents an opportunity for designers to challenge existing norms and initiate a new path in healthcare design. By implementing a holistic approach to healthcare facilities, that pays consideration to the natural environment, allowing patients to be active in their recovery and creating a restorative healing environment.

This thesis explores strategies to enhance the human experience in healthcare environments within the United States. With a primary emphasis on the built environment's impact on both patients and staff, highlighting the significant benefits of integrating biophilic design principles. Challenging healthcare facilities to become more than their conventional role as treatment spaces and evolve into sanctuaries for healing and well-being.

1.1. Problem Statement

In the past, healthcare design has prioritized function over experience. Traditional healthcare design, focused on treatment efficiency and medical requirements, often overlooks the well-being of patients, staff, and visitors. This oversight can lead to environments that contribute to stress, reduced satisfaction, and hindered recovery. The occupational challenges faced by

healthcare professionals, including stress and burnout, are further compounded by poorly designed environments. As perspectives on healthcare shift towards patient-centered care and a more comprehensive consideration of individual well-being, there is a growing recognition of the need to reevaluate and transform healthcare spaces. Identifying and addressing these challenges provides an opportunity for positive transformation, emphasizing the integration of human-centered and biophilic design principles to create environments that are supportive, nurturing, and conducive to the overall well-being of all users.

1.2. Research Questions

The main research questions posed include:

1. How can effective integration of human-centered design principles, in healthcare facilities, enhance the overall well-being and satisfaction of the individuals occupying the space?
2. How does the built environment, in a healthcare setting, influence patients' healing process, staff productivity, and the overall well-being and happiness of all users?
3. What specific ways does the incorporation of biophilic design principles contribute to the well-being and satisfaction of staff, patients, and visitors?

1.3. Proposed Outcomes

The goal of this thesis is to improve the healing environment for patients, treating the whole person not just their illness. The intended outcome of this research is to promote the integration of human-centered design principles within healthcare facilities, emphasizing the priority on the well-being of the occupants. Ultimately, designing an environment that fosters a

holistic approach, focusing on the overall person and not just their illness. Creating a space that allows patients to be active in their recovery, within a natural and restorative environment. All while implementing, informed, biophilic design principles, analyzing the health benefits they bring, and implementing them with thought.

The outcomes of this thesis will then be translated into a comprehensive design focused on the psychological, emotional, and social needs of the individuals occupying these spaces. Influencing design decisions to emphasize the role the built environment plays in meeting the needs of the occupants, along with the inclusion of biophilic design principles. Improving the experience for both staff and patients, while adhering to the requirements of a healthcare facility. Designing an environment that improves the experience for patients, visitors, and staff while increasing their overall well-being, productivity, and happiness.

1.4. Objective

1.4.1. Aim

The aim of this thesis is to comprehensively explore and understand the key elements that shape healing environments within healthcare spaces. It focuses on three pivotal aspects: human-centered design, the impact of the built environment, and the integration of biophilic design principles. The overarching goal is to investigate how these elements contribute to the creation of healing spaces that prioritize the diverse needs of users. By examining the influence of thoughtful design decisions on the well-being of patients and staff, the thesis seeks to shift the paradigm from a disease-centric approach to one that recognizes the holistic health of individuals. Ultimately, the aim is to contribute valuable insights that inform future healthcare designs, fostering positive experiences, improving treatment outcomes, and promoting the overall well-being of occupants within healthcare facilities.

1.4.2. Significance

At different points in our lives, we may find ourselves in a healthcare setting—supporting a loved one, undergoing treatment, or working within the healthcare profession. Establishing healing environments in such settings is crucial for patient well-being and improved treatment outcomes. A thoughtfully designed space positively influences mental, emotional, and physical health, creating a conducive atmosphere for recovery. This positive impact extends to healthcare professionals, reducing burnout while enhancing staff satisfaction and productivity. By embracing a holistic approach, healing environments acknowledge the interconnectedness of physical and psychological well-being. Investing in these environments not only fosters positive experiences but also leads to long-term cost savings through shorter hospital stays and increased efficiency. The significance of establishing healing environments lies in their potential to positively shape the health and experiences of individuals, healthcare professionals, and communities alike.

2. BACKGROUND

2.1. Literature Review

In the exploration of healing spaces, this literature review centers on elements that play a crucial role in shaping healing environments: human-centered design, the built environment, and the incorporation of biophilic design principles. The review begins by examining the influence of human-centered design, emphasizing creating healthcare spaces that prioritize the needs and experiences of both patients and staff. Then, this review delves into how the built environment influences the well-being of all users within healthcare facilities and thoughtful design decisions that highlight the connection between physical surroundings and the holistic health of individuals. Finally, extending to the integration of biophilic design principles and investigates how these biophilic elements contribute to the well-being and satisfaction of all occupants. By interweaving these three aspects—human-centered design, the built environment, and biophilic principles—the literature review aspires to offer a comprehensive understanding of their contribution to healing spaces that cater to the diverse needs of users.

2.1.1. The Human’s Point of View

In the Victorian period, upper-class society used to be prescribed by doctors to go to their country home, for a change of air, soak up the sun, and take a walk when they were ill (Din et al., 2023, p.2). The appreciation of this therapeutic value decreased from the 1950s to the 1990s (Din et al., 2023, p.2) and not until 40 years later in the 1990s did society witness a movement towards patient-centered approaches in the healthcare industry (Din et al., 2023) (Totaforti, 2018, pg.8).

There has been a strong belief for an organizational change in healthcare that considers the needs of humans in their entirety and not just concerning the treatment of the disease in a

therapeutic sense (Totaforti, 2018, pg. 7). Totaforti states, *“The humanization of healthcare spaces entails adherence to a holistic approach that considers people, spaces, and activities not only as individual components of a system but rather as elements in relation to each other”* (Totaforti, 2018, pg.7). However, the design of modern hospitals is still geared towards defining spaces in which the main design goal is creating environments that ensure the proper operation of clinical and surgical procedures (Totaforti, 2018, p.5). *“A hospital is not just a place of therapeutic knowledge, research, and technological innovation, but also a place where professionals and human relationships are activated”* (Totaforti, 2018, p. 7).

According to Totaforti, the humanization of hospitals is, “a therapeutic practice that leads to looking at the patient taking fully into account the person's integrity, encouraging his or her participatory and active role in the therapeutic path and the social structure of the hospital” (Totaforti, 2018, p.6). This practice involves designing interventions that are aimed at redefining the environment regarding how it is experienced by patients and visitors, regarding both the organizational and therapeutic aspects of a hospital (Totaforti, 2018, p.6). Humanizing spaces within hospital design, through the reconnection with nature, offers therapeutic support that can positively impact the psychological and physical well-being of the occupants (Totaforti, 2018, p. 5). “Interventions of humanization have introduced the value of beauty and the recovery of relationships between humans and nature in the architecture of the hospital.” Beauty in this statement, means, “allowing the individual, as a temporary guest of the hospital, to accept the use of space-time rules that regulate and be in an emotional condition that facilitates recovery and care” (Totaforti, 2018 pg.5).

Stress factors for occupants include, but are not limited to, inability to control the surroundings, lack of privacy, unfamiliar and often disturbing sounds and smells, and artificial

light (Totaforti, 2018 pg.5). If hospitals can create a welcoming, understanding, visually appealing, and relaxing environment it promotes *“the development of a greater sense of trust and activates positive feedback to the information and the stimulations coming from outside”* (Totaforti, 2018 pg.5) Only recently has design started considering the patients physical, social, and psychological needs. Designing for the patient’s point of view. By enhancing and promoting interventions that enhance their physical, sensory, and psychological comfort. This also includes improving wayfinding systems and increasing the clarity of the meanings communicated by design (Totaforti, 2018, pg.5). Humanizing spaces in a hospital's design, specifically with the reconnection with nature, offers therapeutic support to the occupants that can impact their psychological and physical well-being, improve the patient's ability to recover (Totaforti, 2018, p.5). These spaces need to be designed for not only those healing but also for the resilient staff who are caring for them every day.

Not only do these spaces need to be designed for patients, but also give regard to the staff that work countless hours in these hospitals and clinics. (Bosch et al., 2023) defines work stress as, *“the harmful physical and emotional responses that happen when the requirements of a job do not match the capabilities, resources, or needs of a worker”* (Bosch et al., 2023, p. 262). If this stress is not maintained it may result in burnout, which leads to lower productivity, lower quality of care, higher risk of medical errors, higher rates of absenteeism, and eventually turnover (Bosch et al., 2023). Studies done by both (Bosch et al., 2023) (Grailey et al., 2021) a group of staff in an emergency department and a group of staff from a critical care unit expressed their feelings of being overworked, their lack of control, and the daily stressors involved in this fast-paced environment. According to (Bosch et al., 2023, p. 262) *“ burnout among emergency physicians jumped from 43% in 2020 to 60% in 2021.”*

Evidence demonstrating the support that the physical environment has on the well-being of healthcare workers, (Bosch et al., 2023) it is imperative to not only for patient needs but staff needs as well. Noise, not having adequate privacy, no access to natural light, and no natural elements have been associated with stress, mood, and perceived pressure and strain in different healthcare settings (Bosch et al., 2023) (Totaforti, 2018 pg.5). In addition, healing gardens help nurses to feel more productive and less fatigued, benefiting the healthcare facility, as fatigue may lead to poor judgment (Din et al., 2023).

2.1.2. The Role of the Built Environment

The hospital highlights advancements in scientific and medical knowledge and is considered a privileged place of research. However, hospitals also highlight the change in relationships between humans, the built environment, and nature (Totaforti, 2018 pg.4). Ulrich argued that the physical environment of healthcare facilities can have a profound effect on emotional and psychological states, which in turn can impact their physical health (Jung et al., 2023). Physical environments have a fundamental and pivotal impact on successful patient treatment, recovery, and ultimate outcomes (Mazuch, 2017)

There has been extensive research showing the connection between the environment and the increase in the effectiveness of treatment, however, there is little attention that is paid to the design quality of the hospital (Totaforti, 2018). Edward Wilson stated that the most significant positive effects of biophilia could be seen in healthcare applications to ameliorate emotional and physical health (Mazuch, 2017). Healthcare facilities contain a high rate of critical and stress factors for patients, their families, and healthcare professionals (Totaforti, 2018 pg.4). On top of that (Jung et al., 2023) states that “*long-term exposure to the built environment can have*

negative effects on physical and psychological health, leading to increased anxiety, depression, stress, and chronic illness” (Jung et al., 2023, p.1).

Contemporary hospitals have evolved from the initial division into pavilions, into the present-day single-block buildings (Totaforti, 2018 pg.4). Hospital architecture has undergone major changes, linked to the role of the hospital in contemporary society. Recovery values are no longer just quantitative and functional but focus on a vision that combines new technological discoveries, treatment, and care protocol and influences design choices. Transitioning from function to experience (Totaforti, 2018 pg.4). Implementing strategic space design enhances the efficiency levels of an organization and contributes to economic benefits, as the staff’s well-being increases it reduces health-related costs (Totaforti, 2018, p.7).

Nature has been given an insignificant role in the built environment that is marginal and irrelevant to the health and happiness of individuals (Totaforti, 2018, p.1). As growing efforts towards “sustainable design” come about, i.e., USGBC, WELL, LEED, and the Living Building Challenge, focusing on urban sustainability and the building's ecological footprint (Totaforti, 2018, pg.3). Sustainable design, however, fails to reduce the separation between humans and nature by *“improving the contact with process related to the natural environment and building accordingly to an approach that is culturally and ecologically geared towards human health and wellbeing”* (Totaforti, 2018, p.2). Sustainable design is missing a key element, biophilic design principles. Sustainability should include both low environmental impact design with biophilic principles, ultimately creating a restorative environmental design, aimed at reconstructing the relationship between humans and nature within the built environment (Totaforti, 2018, p.3).

2.1.3. Biophilic Design

“Biophilic design was born from the growing awareness that the mind and the human body develop within a sensorially rich world that is fundamental to people’s health and intellectual, emotional, and spiritual wellbeing” (Totaforti, 2018)

According to Beatley, Jung, Totaforti, and Olmsted, Erich Fromm (what he is) coined the term biophilia in the 1960s. Through this term, Erich Fromm describes the innate attraction humans have to nature and how humans tend to be attracted to things that are alive and vital. The same authors go on to discuss how biophilia was then popularized by Edward Wilson (what he is) around the 1980s, proposing the biophilic hypothesis and describing the “love of life and living systems” humans have. Wilson defines biophilia as *“the innately emotional affiliation of human beings to other living organisms. Innate means hereditary and hence part of ultimate human nature.”* (Beatley et al., 2018). Wilson’s *“biophilia hypothesis holds that we are innately drawn to and prefer elements of nature that are associated with our evolutionary success and survival”* (Beatley et al., 2018). This innate connection humans have with nature leads humans to have a positive association with an environment that contains natural elements (all).

Biophilic design is an approach that seeks to connect people with nature through the incorporation of natural materials, forms, colors, and patterns within the built environment (Jung et al., 2023). Biophilic design principles can be broken down into direct and indirect experiences of nature within the building. By incorporating both indirect and direct the humans’ connection to the natural environment and promotes well-being (Jung et al., 2023, p.3). Direct experiences of biophilic design refer to the physical contact humans can have with nature through the built environment. These direct experiences include natural elements and patterns and have a profound impact on our physical and mental well-being along with cognitive development (Jung

et al., 2023, p.3). Indirect experience, however, integrates natural elements and patterns into the design of the built environments. Indirect experiences have a variety of ways (list a few) to be implemented and allow occupants to experience nature indirectly, having positive effects on their mental well-being (Jung et al., 2023, p.3).

14 patterns of biophilic design are organized into three categories. These categories consist of nature in the space, natural analogs, and the nature of the space. Overall these categories break down, define, and outline each principle allowing for a comprehensive incorporation into a design that is supportive of the health and well-being of individuals (Olmsted, 2014, p.9) (Totaforti, 2018).

	Principle	Definition	Application	Healing benefits
Nature in the space		addresses the direct, physical and ephemeral presence of nature in a space or place. The strongest nature in the Space experiences are achieved through the creation of meaningful, direct connections with these natural elements, particularly through diversity, movement and multi-sensory interactions (Olmsted, 2014)		
	Visual connection to nature	a view to elements of nature, living systems and natural processes (Olmsted, 2014)	Outside views and vistas, domes, arches, vaults, terraced gardens, landscape elements (Abdelaal & Soebarto, 2019)	Stress Reduction: lowered blood pressure and heart rate (Olmsted, 2014) Cognitive performance: improved mental engagement/ attentiveness (Olmsted, 2014) Emotion, mood & performance: positively impacted attitude and overall happiness (Olmsted, 2014)
	Nonvisual connection to nature	Auditory, haptic, olfactory, or gustatory stimuli that engender a deliberate and positive reference to nature, living systems or natural processes (Olmsted, 2014)	Sensory variability, transitional spaces, fire, gardening, pet therapy, haptic activities, birdsong, jogging spaces (Abdelaal & Soebarto, 2019)	Stress Reduction: reduced systolic blood pressure and stress hormones (Olmsted, 2014) Cognitive performance: positively impacted on cognitive performance (Olmsted, 2014) Emotion, mood & preference: perceived improvements in mental health and tranquility (Olmsted, 2014)
	Non rhythmic sensory stimuli	Stochastic and ephemeral connections with nature that may be analyzed statistically but may not be predicted precisely (Olmsted, 2014).	Age, change, patina and time, botanical motifs & simulation of natural features, natural light and shadows, biomimicry (Abdelaal & Soebarto, 2019)	Stress Reduction: positively impacted on heart rate, systolic blood pressure and sympathetic nervous system activity (Olmsted, 2014). Cognitive performance: observed and quantified behavioral measures of attention and exploration (Olmsted, 2014).
	Thermal and air flow	Subtle changes in air temperature, relative humidity, airflow across the skin, and surface temperatures that mimic natural environments (Olmsted, 2014).	Wind breeze, wind turbines, cooling wells, courtyard size variation, wind catchers, overnight cooling (Abdelaal & Soebarto, 2019)	Stress Reduction: positively impacted comfort, well-being and productivity (Olmsted, 2014). Cognitive performance: positively impacted concentration (Olmsted, 2014). Emotion, mood & preference: improved perception of temporal and spatial pleasure (alliesthesia) (Olmsted, 2014).
	Presence of water	A condition that enhances the experience of a place through seeing, hearing or touching water (Olmsted, 2014).	Water features, fountains, waterfalls, ponds, aquariums (Abdelaal & Soebarto, 2019)	Stress Reduction: reduced stress, increased feelings of tranquility, lower heart rate and blood pressure (Olmsted, 2014) Cognitive performance: improved concentration and memory restoration, enhanced perception and psychological responsiveness (Olmsted, 2014) Emotion, mood & preference:
	Dynamic and diffuse light	Leverages varying intensities of light and shadow that change over time to create conditions that occur in nature (Olmsted, 2014).	Bounded spaces, central focal points, warm light (Abdelaal & Soebarto, 2019)	Stress Reduction: positively impacted circadian system functioning, increased visual comfort (Olmsted, 2014)
	Connection with natural systems	Awareness of natural processes, especially seasonal and temporal changes characteristic of a healthy ecosystem (Olmsted, 2014).	Multisensory contact habitats and ecosystem & information richness, plants, animals and living organisms (Abdelaal & Soebarto, 2019)	Emotion, mood & preference: enhanced positive health responses; shifted perception of environment (Olmsted, 2014)

Table 1. Biophilic Design Principles, Nature in the Space

		Principle	Definition	Application	Healing benefits
<i>Nature of the space</i>			Addresses spatial configurations in nature. The strongest nature of the space experiences are achieved through the creation of deliberate and engaging spatial configurations commingled with patterns of nature in the space and natural analogues		
	Prospect		An unimpeded view over a distance, for surveillance and planning.	Courtyards, terraces, galleries and cells overlooking open space (Abdelaal & Soebarto, 2019)	Stress Reduction: Reduced stress Cognitive performance: reduced boredom, irritation, and fatigue Emotion, mood & preference: improved comfort and perceived safety.
	Refuge		A place for withdrawal from environmental conditions or the main flow of activity, in which the individual is protected from behind and overhead.		Cognitive performance: improved concentration, attention and perception of safety
	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.	Sensory variability, transitional spaces, reflected light (Abdelaal & Soebarto, 2019)	Emotion, mood & preference: induced strong pleasure response
	Risk and peril		An identifiable threat coupled with a reliable safeguard.	Bridges, gateways, overhanging elements, double height space, overlooking galleries (Abdelaal & Soebarto, 2019)	Emotion, mood & preference: resulted in strong dopamine or pleasure responses

Table 2. Biophilic Design Principles, Nature of the Space

		Principle	Definition	Application	Healing benefits
<i>Natural Analogs</i>			Addresses organic, non-living and indirect evocations of nature. The strongest natural Analogue experiences are achieved by providing information richness in an organized and sometimes evolving manner.		
	Biomorphic forms and patterns		Symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature.	Incorporating a cosmic context using fractal, dynamic symmetry and Penrose patterns, spatial harmony by using golden mean and Fibonacci series generative patterns (Abdelaal & Soebarto, 2019)	Emotion, mood & preference: observed view preference
	Material connection with nature		materials and elements from nature that, through minimal processing, reflect the local ecology or geology and create a distinct sense of place.	Geology and landscape, light pools, geomorphology, woodwork, and stonework (Abdelaal & Soebarto, 2019)	Cognitive performance: decreased diastolic blood pressure. improved creative performance Emotion, mood & preference: Improved comfort
	Complexity and order		Rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature.	Patterned wholes, trees and column supports, arches, dynamic balance, fractals, hierarchically organized scales, biomorphic, natural materials, botanical motifs (Abdelaal & Soebarto, 2019)	Stress Reduction: positively impacted perceptual and physiological stress responses Emotion, mood & preference: observed view preference

Table 3. Biophilic Design Principles, Natural Analogues

2.2. Project Type

Healthcare architecture encompasses a diverse range of designs tailored to meet the specific care needs of patients, embracing various typologies such as acute care hospitals, outpatient clinics, primary care facilities, specialized care units, long-term care establishments, mental health facilities, pediatric and senior care centers, urgent care facilities, health and wellness hubs, and more. This project places a strategic emphasis on integrative care, seamlessly combining different care elements on a smaller scale. It recognizes the impact the built environment has on patient experience and well-being and the integration of biophilic design principles to create healing environments that extend beyond medical treatment.

2.3. Project Issues

The primary challenge for this project type is navigating the strict healthcare code in the United States. The current emphasis on infection control, privacy, and security is crucial yet often overlooks occupant comfort and emotional well-being. Recognizing a shift in healthcare design towards a holistic approach that encourages both mental and physical health and acknowledges the role the built environment plays; this project seeks to navigate these challenges. Creating healing spaces that go beyond treating the disease and aim to enhance their overall experience while still adhering to code requirements. A prime example of this shift is the Northwest Kidney Center in Seattle, Washington. Highlighting the contribution biophilic design principles have on the overall well-being of users along with the experience in the space. This clinic demonstrates the successful implementation of these principles while adhering to strict code requirements. Focused on patients undergoing dialysis treatments, the clinic strategically incorporated views of courtyards filled with vegetation and wildlife, creating a form of distraction therapy (*Rainier Beach Clinic – Mahlum, n.d.*).

3. METHODOLOGY

3.1. Approach

The primary aim of this study is to achieve a holistic healing environment within hospitals and clinics through the incorporation of biophilic design principles. This approach involves the qualitative analysis of various healthcare facilities that have successfully implemented such environments, with a focus on understanding the initial project goals, the effective integration of biophilic design principles, and the realization of a healing environment that supports the overall well-being of occupants.

3.1.1. Data Collection

To achieve the study's goals, a qualitative data analysis approach was adopted. The selection criteria for hospitals and clinics included those that had successfully implemented a holistic healing environment with an emphasis on biophilic design principles. Parameters such as square footage, bed numbers, and specialty were intentionally excluded during the selection process to ensure a focus on the principles of biophilic design. The data collection process involved an in-depth analysis of precedent studies, architectural documentation, and user feedback.

3.1.2. Analysis

The study employed thematic analysis to identify recurring themes in the implementation of biophilic design principles across diverse healthcare settings. This method aimed to reveal patterns contributing to the creation of healing environments. Additionally, a comparative analysis examined similarities and differences among selected facilities, providing insight into strategies and contextual factors influencing biophilic design effectiveness. The objective was to draw comparisons to inform best practices and identify potential challenges in integrating

biophilic elements, contributing to a comprehensive understanding of diverse strategies in healthcare environments.

3.1.3. Limitations

The study acknowledges limitations, including the exclusive focus on qualitative analysis and the potential for subjective interpretations. Furthermore, the effectiveness of biophilic design may be influenced by contextual factors unique to each healthcare facility.

3.1.4. Conclusion

This methodology approach provides a comprehensive framework for understanding how biophilic design principles contribute to the creation of a holistic healing environment in hospitals and clinics. Through a qualitative analysis of precedent studies, the study aims to uncover insights into best practices, challenges, and opportunities associated with the integration of biophilic design principles in healthcare settings.

3.2. Project Location (larger scale)

3.2.1. Fargo, North Dakota

Located on the eastern border of North Dakota and Minnesota, sits the city of Fargo. Established in 1871 with the arrival of the Northern Pacific Railroad, the town grew rapidly with the addition of a railway bridge over the Red River connecting North Dakota and Minnesota.



Figure 1. Bird's Eye View of Fargo, North Dakota (Fargo History, n.d.).

By 1876, Fargo's population had increased to 600, and this number surged to 8,000 in 1892 (Fargo History, n.d.). Fast forward to July 1st, 2022, the estimated population reached 131,444 (*U.S. Census Bureau QuickFacts*, n.d.). A breakdown of the Population in Fargo is as follows:

1. 6.4% under 5 years of age, 20.1% under 18 years of age, and 12.6% 65 and older (*U.S. Census Bureau QuickFacts*, n.d.)
2. 49.7% females (*U.S. Census Bureau QuickFacts*, n.d.)
3. 82.5% of the population is white and 8% African American (*U.S. Census Bureau QuickFacts*, n.d.)
4. 7.1% of the population under 65 is living with a disability (*U.S. Census Bureau QuickFacts*, n.d.)

3.2.2. History of Healthcare in Fargo

On April 17th, 1900, the sisters of St. Joseph of Carondelet opened the St. John's Hospital on the residence of Bishop John Shanley. This hospital could provide for twenty-five patients, cared for by six sisters and local doctors. By November of 1904, St. Johns had expanded significantly, opening a new hospital with eighty-seven beds next to Island Park. In 1906, the institution further established itself by introducing a training school and residence for nurses, situated conveniently across the street (*St. John's Hospital | Fargo History, n.d.*).



Figure 2. St. John's Hospital Fargo, North Dakota (*St. John's Hospital | Fargo History, n.d.*).

In 1986 St. John's merged with St. Ansgar Hospital in Moorhead, Minnesota. Also run by the sisters, these two hospitals became Heartland Medical Center. Again, in 1994, Heartland Medical Center merged with Dakota Hospital and became the Dakota Heartland Hospital in 1994. Finally, in 1997, St. John's underwent its final change, going from a traditional med-surg hospital to a psychiatric facility. It was during this period that Prairie St. Johns was established, offering 110 inpatient beds and providing inpatient treatment, day treatment, residential treatment, and intensive outpatient services for children, adolescents, and adults. In 2019, plans

were initiated for a new psychiatric hospital on the existing site, with 132 beds offering essential mental health care to Fargo and the surrounding communities. After 123 years of dedicated service, the hospital closed its doors in January 2023, marking the end of an era. Plans for its demolition are underway, pending the removal of asbestos.

3.2.3. Climate

Fargo, North Dakota, experiences distinct seasons marked by significant temperature variations. The warm and beautiful summers make incorporating biophilic design principles an obvious choice. However, the challenge lies with the frigid and snowy winters and the obstacles it poses to implementing these principles. Instead of letting the weather become a hindrance, the focus should shift towards innovative design strategies. This could include the incorporation of winter gardens and coniferous trees that maintain a connection to nature throughout the winter. Despite the harsh winters, there is an opportunity to create an inviting and sustainable environment that positively impacts users. This thesis can contribute to an understanding of how to design spaces that thrive year-round, by understanding the climate and utilizing that knowledge throughout the design process.

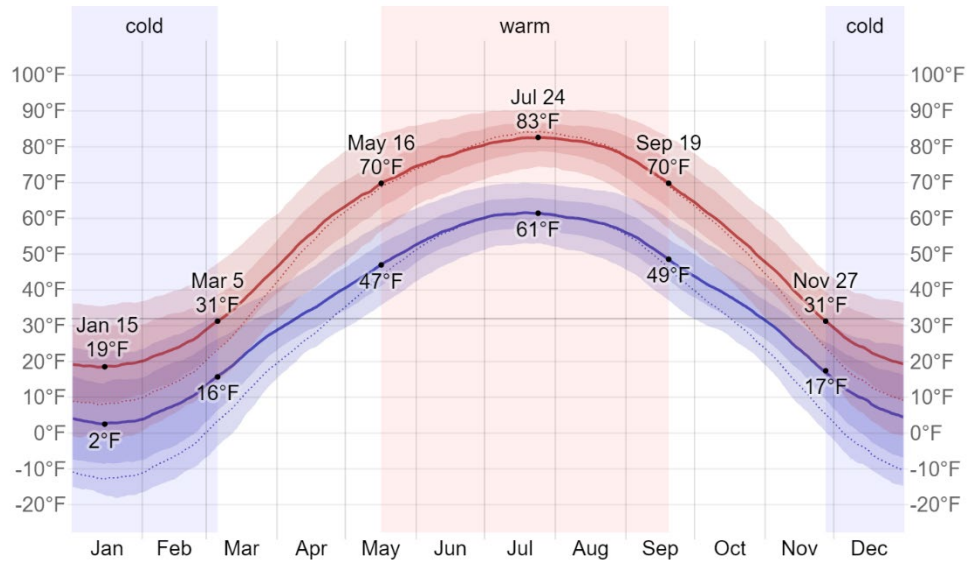


Figure 3. Average High and Low Temperature in Fargo (*Fargo Climate, Weather By Month, Average Temperature (North Dakota, United States) - Weather Spark, n.d.*)

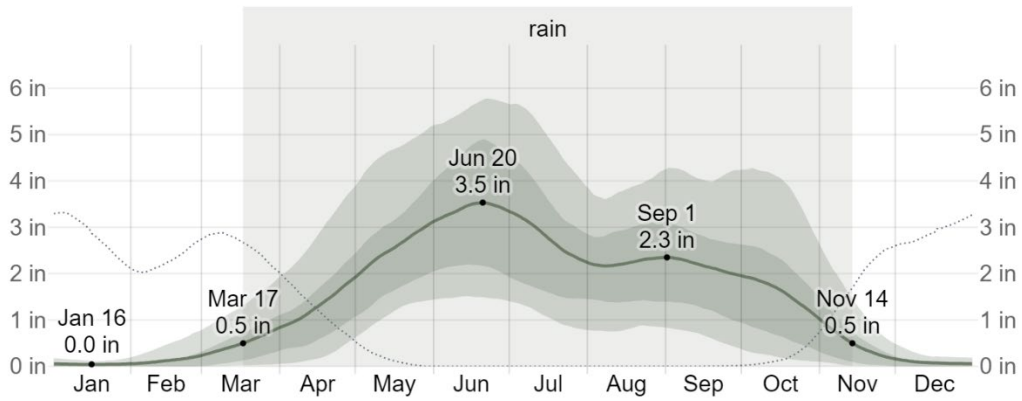


Figure 4. Average Monthly Rainfall in Fargo (*Fargo Climate, Weather By Month, Average Temperature (North Dakota, United States) - Weather Spark, n.d.*)

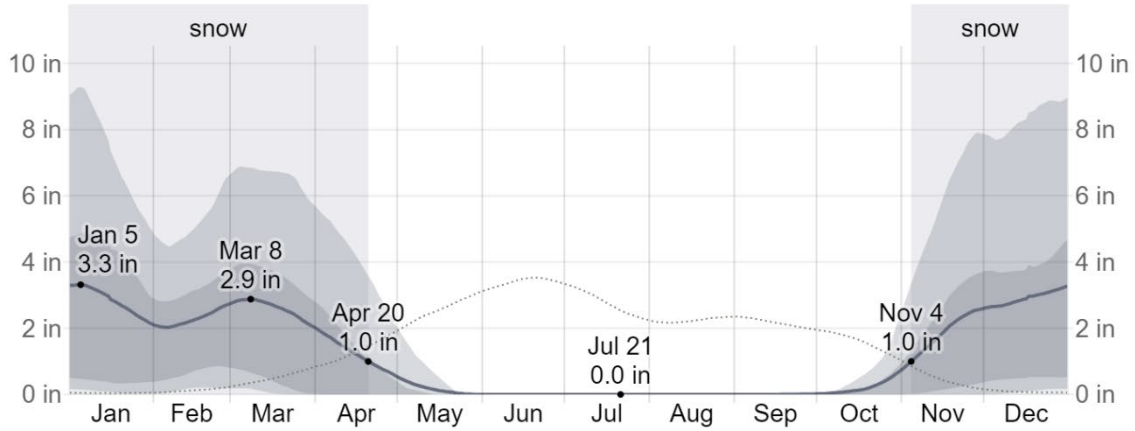


Figure 5. Average Monthly Snowfall in Fargo (*Fargo Climate, Weather By Month, Average Temperature (North Dakota, United States) - Weather Spark, n.d.*)

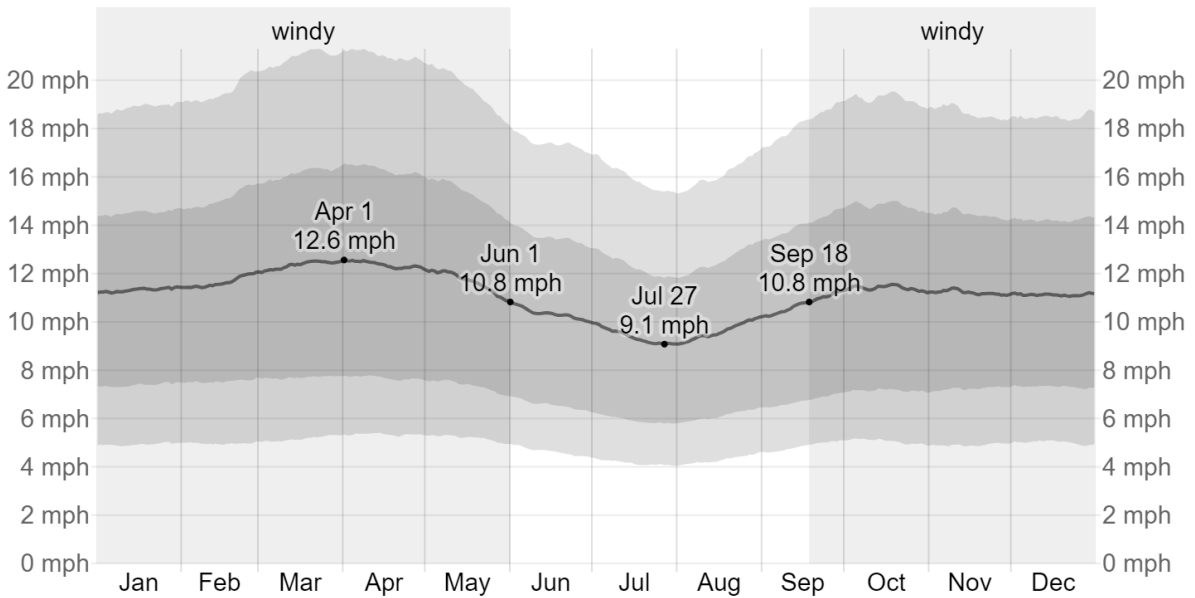


Figure 6. Average Wind Speed in Fargo (*Fargo Climate, Weather By Month, Average Temperature (North Dakota, United States) - Weather Spark, n.d.*)

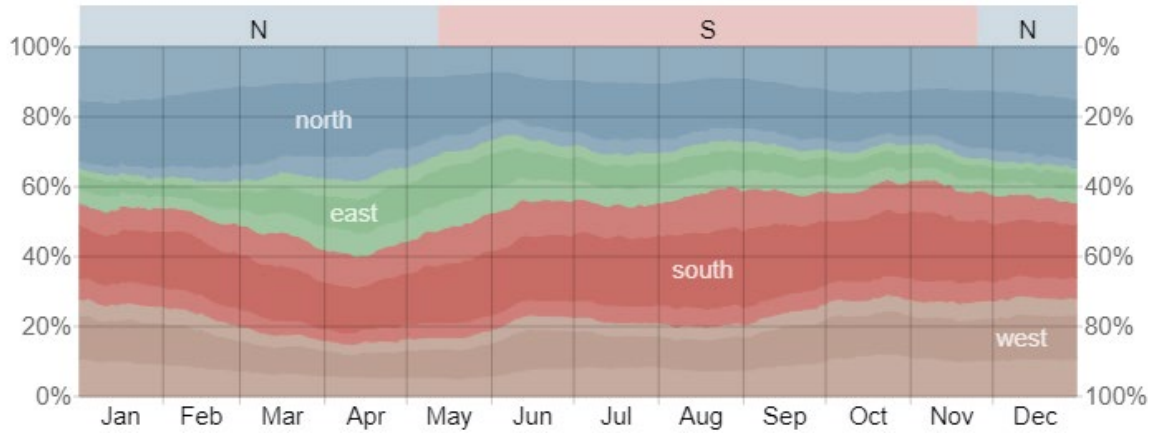


Figure 7. Wind Direction in Fargo (*Fargo Climate, Weather By Month, Average Temperature (North Dakota, United States) - Weather Spark, n.d.*)

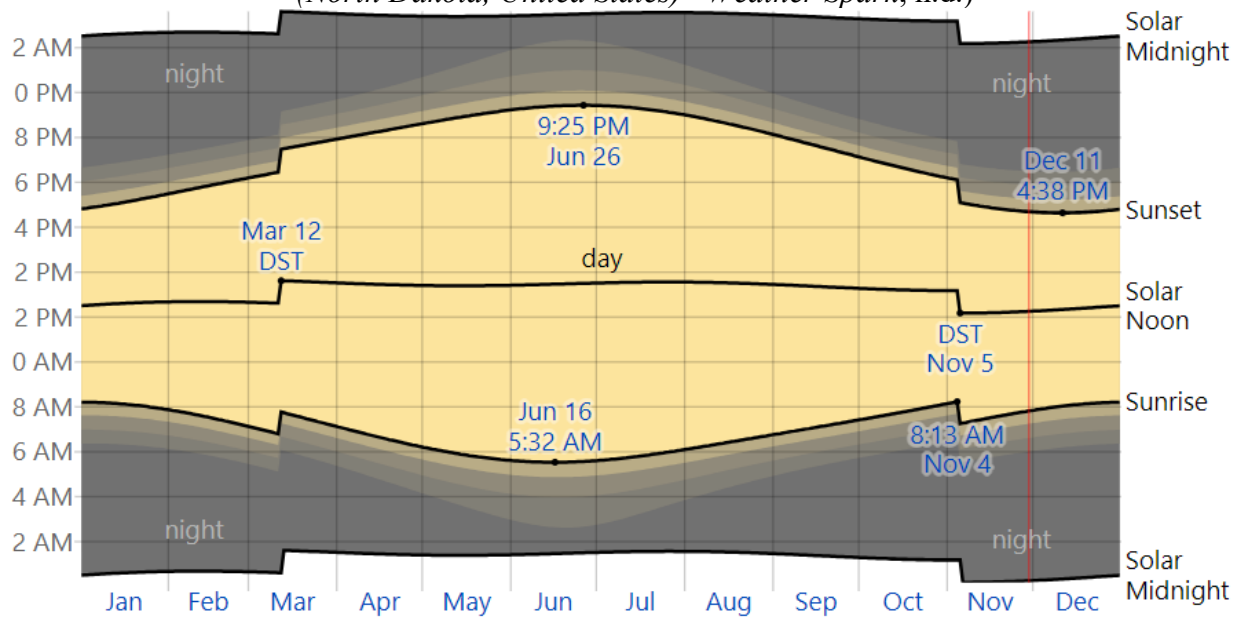


Figure 8. Sunrise and Sunset in Fargo (*Fargo Climate, Weather By Month, Average Temperature (North Dakota, United States) - Weather Spark, n.d.*)

3.3. Specific Site

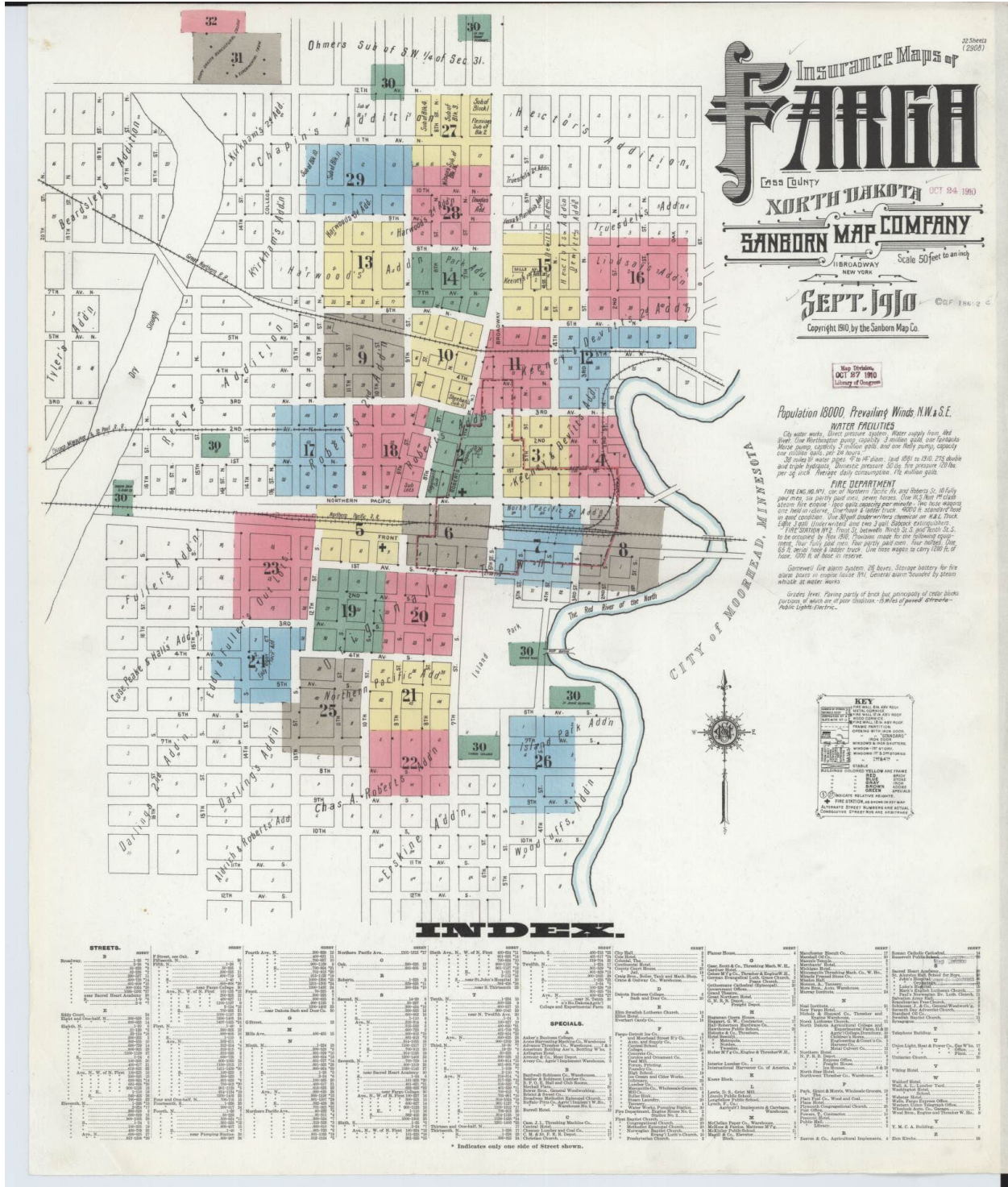


Figure 9. 1910 Sanborn Fire Insurance Map from Fargo, Cass County, North Dakota (*Sanborn Fire Insurance Map from Fargo, Cass County, North Dakota., n.d.*)

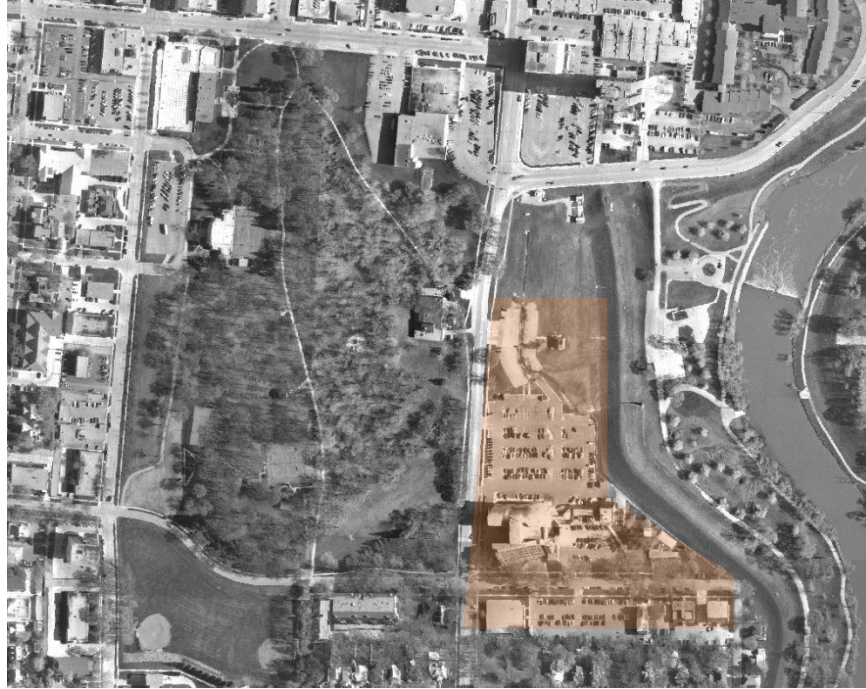


Figure10. Map of Proposed Site in Fargo, North Dakota 1995 (from, City of Fargo GIS)



Figure 11. Map of Proposed Site in Fargo, North Dakota 2021 (from, City of Fargo GIS)

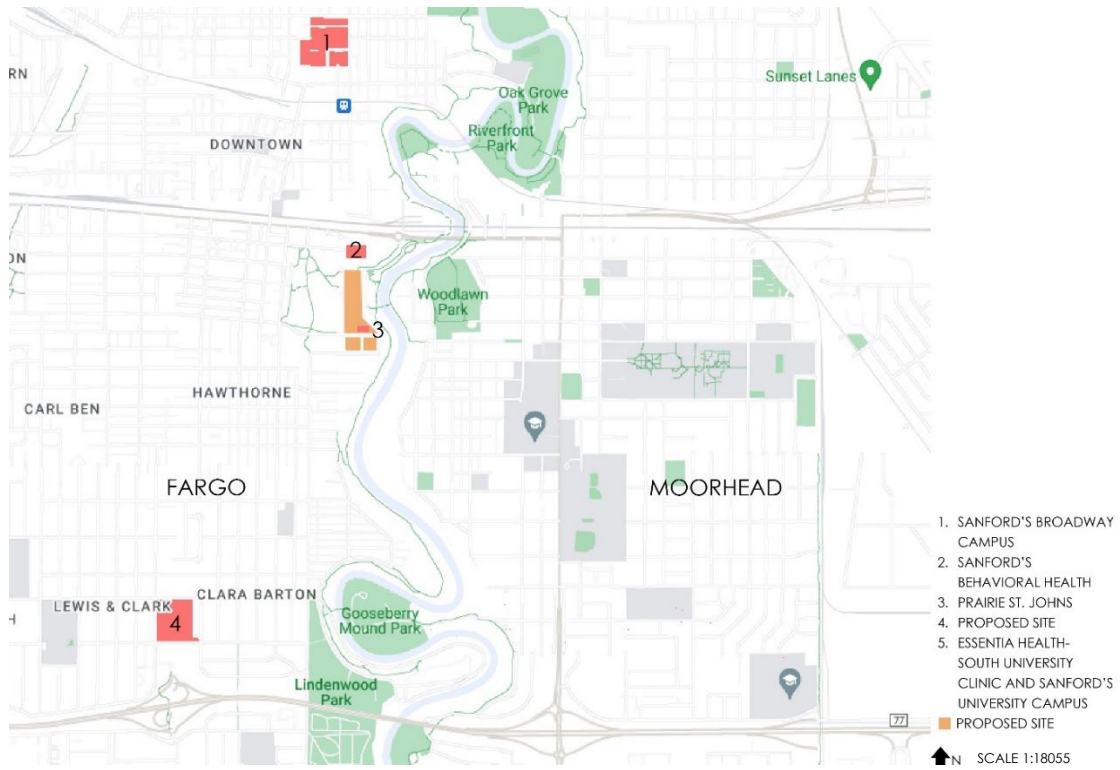


Figure 4. Hospitals Near Proposed Site (modeled from, City of Fargo GIS)

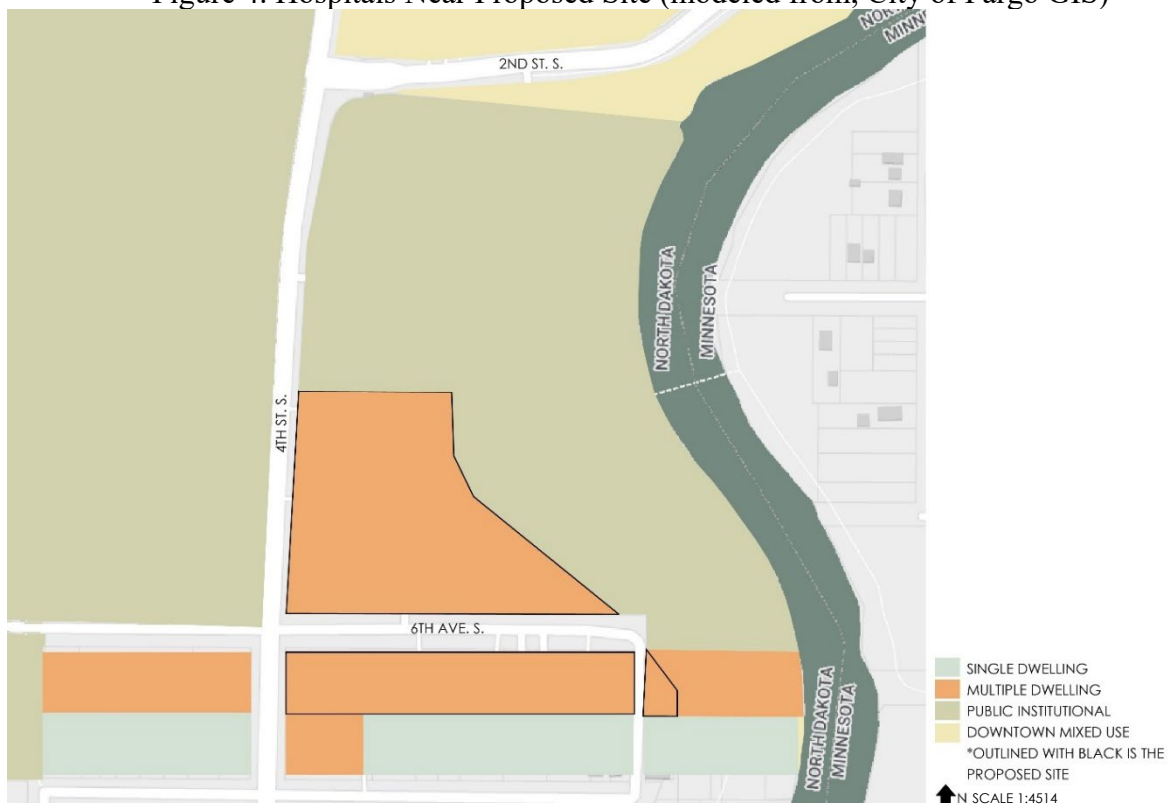


Figure 13. Site Zoning (modeled from, City of Fargo GIS)

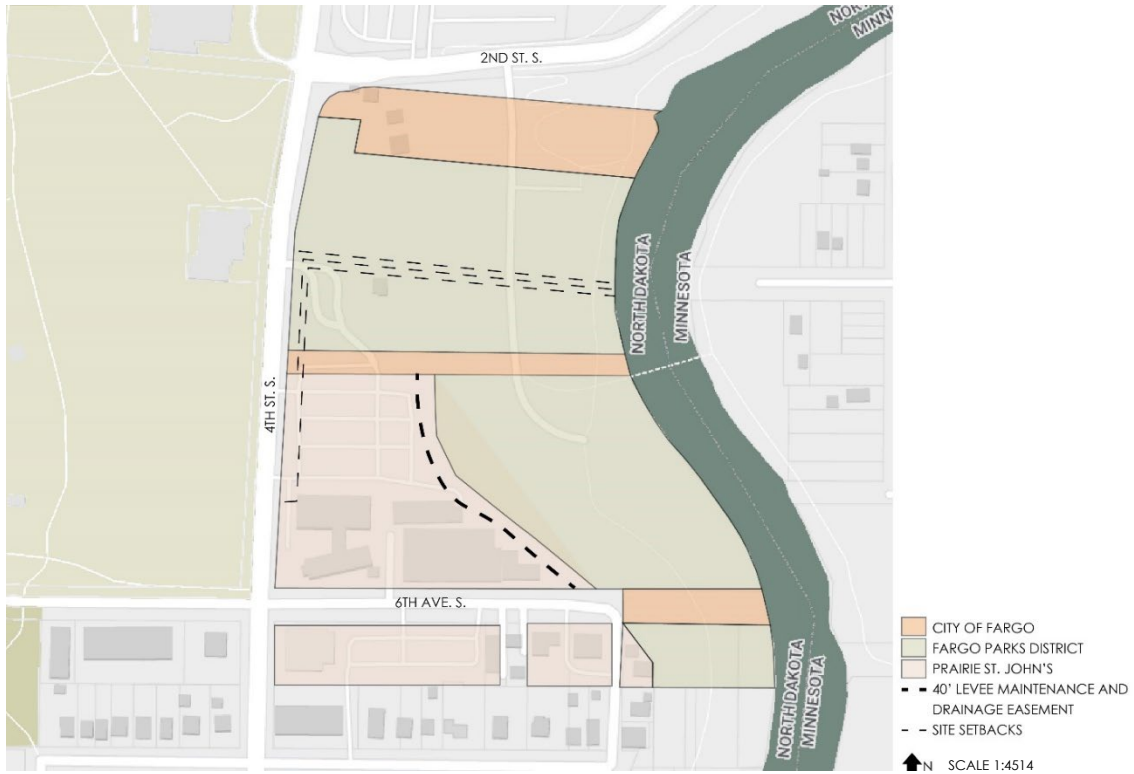


Figure 54. Site Property Lines and Ownership (modeled from, City of Fargo GIS)

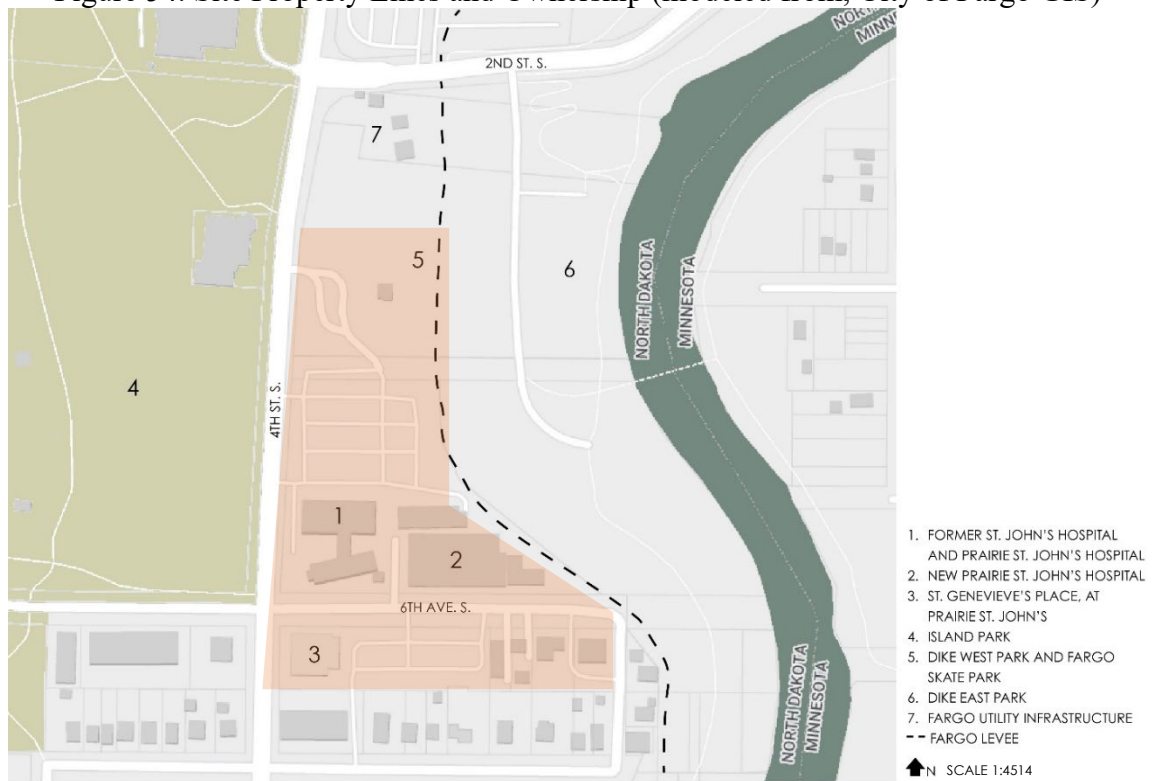


Figure 65. Surrounding Context on Site (modeled from, City of Fargo GIS)

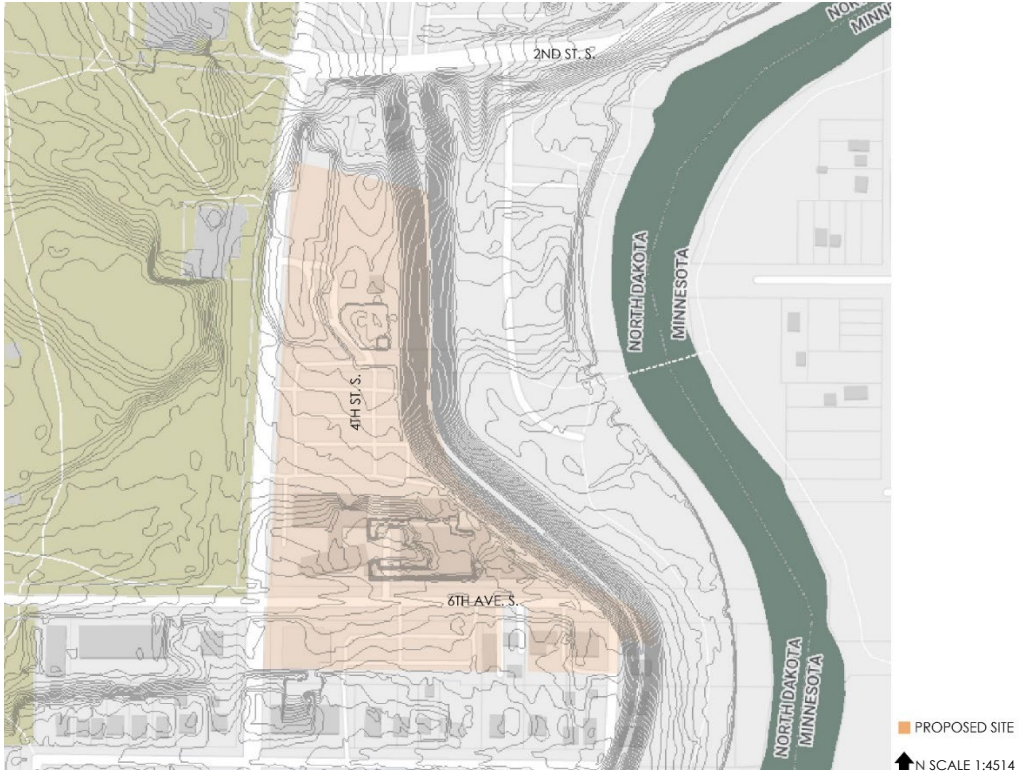


Figure 76. Site Topography (modeled from, City of Fargo GIS)

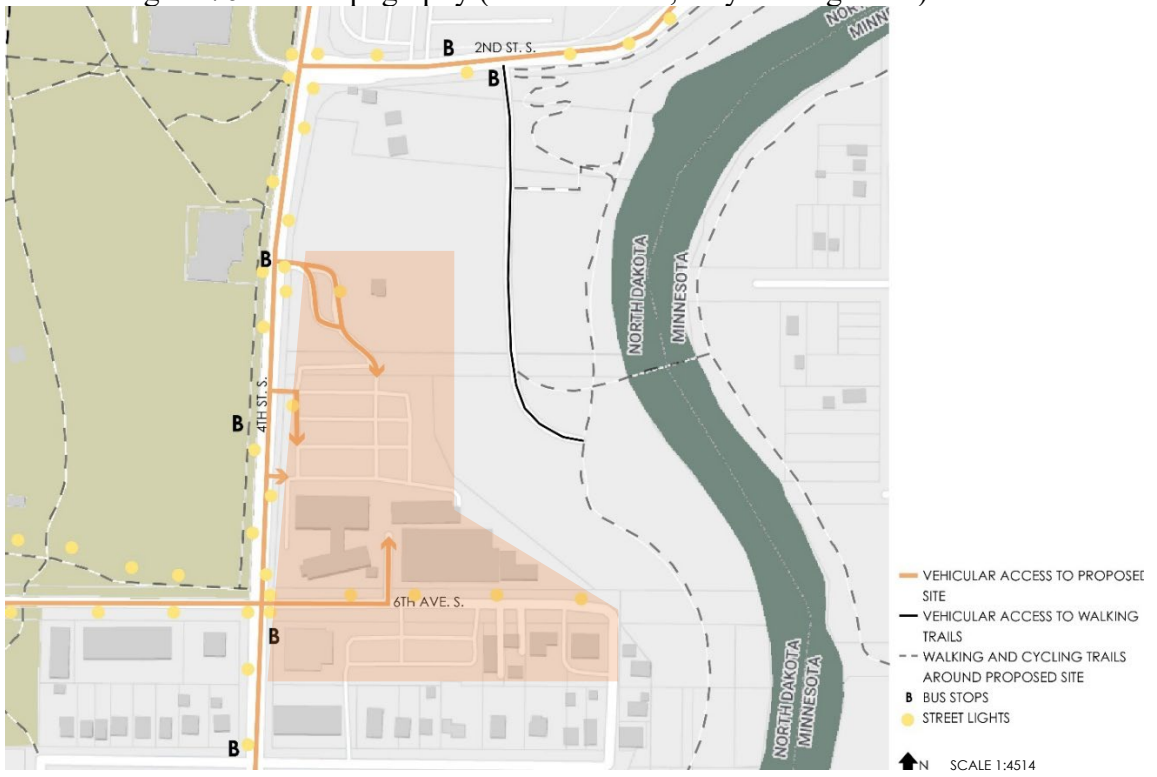


Figure 87. Site Circulation (modeled from, City of Fargo GIS)

WINDS *REFERENCE WIND CHART FOR DIRECTION PER MONTH

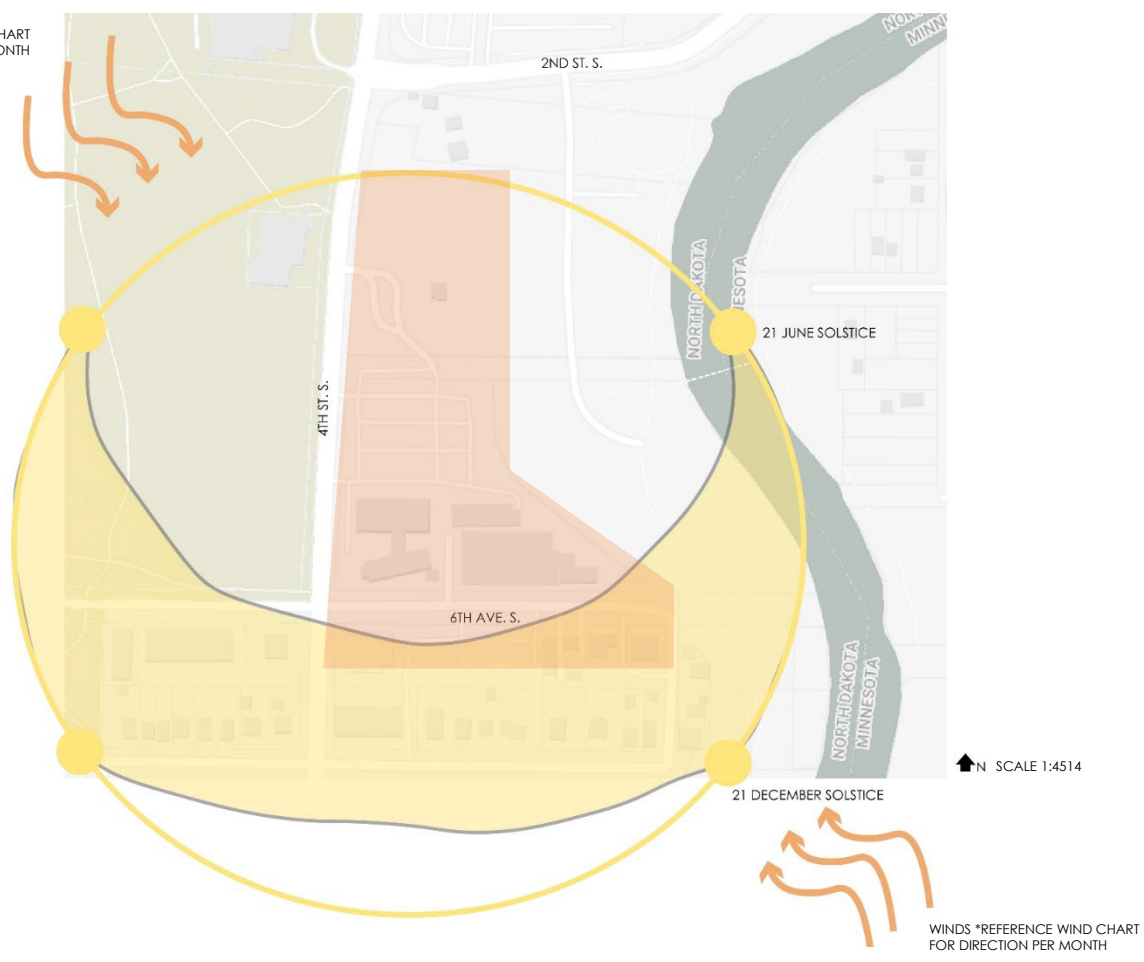


Figure 18. Sun and Wind Patterns on Proposed Site (modeled from, City of Fargo GIS)

3.3.1. Vegetation in Fargo, North Dakota

Shrubs	Small Trees	Medium and Tall Trees	Conifers
Almond, Russian	Apple, Common	Ash, Black	Arborvitae, American
Buffaloberry, Silver	Apricot, Manchurian	Ash, Green	Arborvitae, Siberian
Caragana (Siberian Peashrub)	Chokecherry, Amur	Ash, Manchurian	Douglas-Fir, Rocky Mountain
Cherry, Mongolian	Crabapple, Flowering	Aspen, Quaking	Fir, White (Concolor)
Cherry, Nanking	Crabapple, Siberian	Birch, Paper	Juniper, Rocky Mountain
Currant, Golden (Clove)	Hawthorn, Arnold	Boxelder	Larch, Siberian
Dogwood, Redosier	Ironwood (American Hop-hornbeam)	Buckeye, Ohio	Pine, Jack
Euonymus, Winterberry	Lilac, Japanese Tree	Buckeye, Ohio	Pine, Limber
Forsythia, Meadowlark	Maple, Amur	Elm, American	Pine, Lodgepole
Honeysuckle, Amur	Maple, Tatarian	Elm, Japanese	Pine, Mugo
Honeysuckle, Freedom	Mountain-ash, European	Elm, Siberian	Pine, Ponderosa
Indigo, False	Pear, Ussurian (Harbin)	Hackberry, Common	Pine, Scotch
Juneberry (Saskatoon Serviceberry)	Russian-olive	Honeylocust, Common	Red-cedar, Eastern
Lilac, Common		Linden, American (Basswood)	Spruce, Black Hills
Lilac, Late		Linden, Littleleaf	Spruce, Colorado (Blue)
Plum, American		Maple, Silver	
Potentilla (Shrubby Cinquefoil)		Oak, Bur	
Rose, Hansen Hedge		Oak, Mongolian	
Sandcherry, Western		Poplar, Hybrid	
Sea-buckthorn		Poplar, White	
Silverberry		Walnut, Black	
Spirea, Vanhoutte		Willow, Golden	
Sumac, Fragrant		Willow, Laurel	
Sumac, Skunkbush (Lemonade)		Willow, Redstem	
Sumac, Smooth		Willow, White	
Sumac, Staghorn			
Viburnum, Arrowwood			
Viburnum, Nannyberry			
Willow, Sandbar			

Table 4. Vegetation in Fargo, North Dakota modeled from, (N.D. Tree Handbook, n.d.)

Fargo selects specific tree species for its street landscaping, including Elm, Princeton American Elm, New Horizon Elm, American Elm, Accolade Pear, Prairie Gem Crabapple, Thunderchild Crabapple, Spring Snow Linden, Redmond Coffeetree, Kentucky Ironwood Hackberry Bark Maple, Green Mountain Sugar Honey Locust. (*The City of Fargo - Street Tree Photo Gallery*, n.d.)

3.3.2. Soils in Fargo, North Dakota

Soils in Fargo are characterized by highly saturated and slowly permeable soils formed in clayey lacustrine sediments with a calcareous composition. These soils are predominantly found on glacial lake plains, floodplains, and gently sloping side slopes of streams within glacial lake plains, featuring slopes ranging from 0 to 2 percent. (*Official Series Description - FARGO Series*, n.d.) In areas where the Sherack and Brenna formations are not confined, their elevated plasticity contributes to the instability of slopes. The Red River channel and numerous tributaries cut through the Sherack/Brenna contact, exacerbating mass wasting issues due to the inherent weakness of both formations. (*Geology Under Fargo, North Dakota*, n.d.)

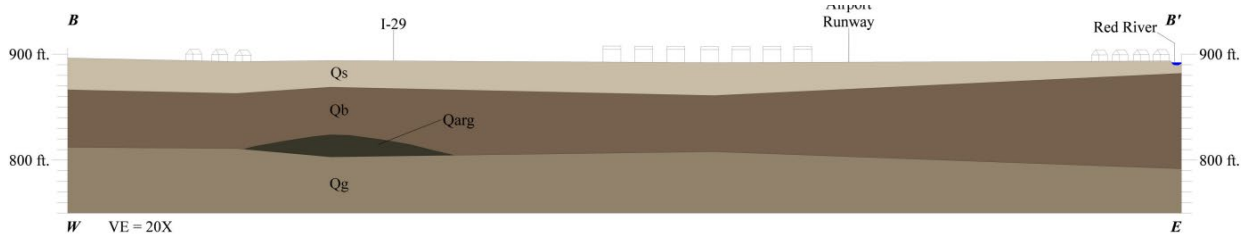


Figure 19. Cross Section of Fargo North Quadrangle, North Dakota (*Geology of the Fargo North Quadrangle*, n.d.)

1. Qs Sherack formation - thinly laminated silt, clay, and silt clay.

Deposited as offshore sediments of Glacial Lake Agassiz. Commonly more than 25 feet thick (*Geology of the Fargo North Quadrangle*, n.d.).

2. Qb Brenna Formation - slightly laminated to unbedded clay, silt clay, soft to very stiff. Deposited as offshore sediments of Glacial Lake Agassiz. Commonly more than 40 feet thick (*Geology of the Fargo North Quadrangle, n.d.*).
3. Qg Glacial Sediment - silty pebble loam (*Geology of the Fargo North Quadrangle, n.d.*).

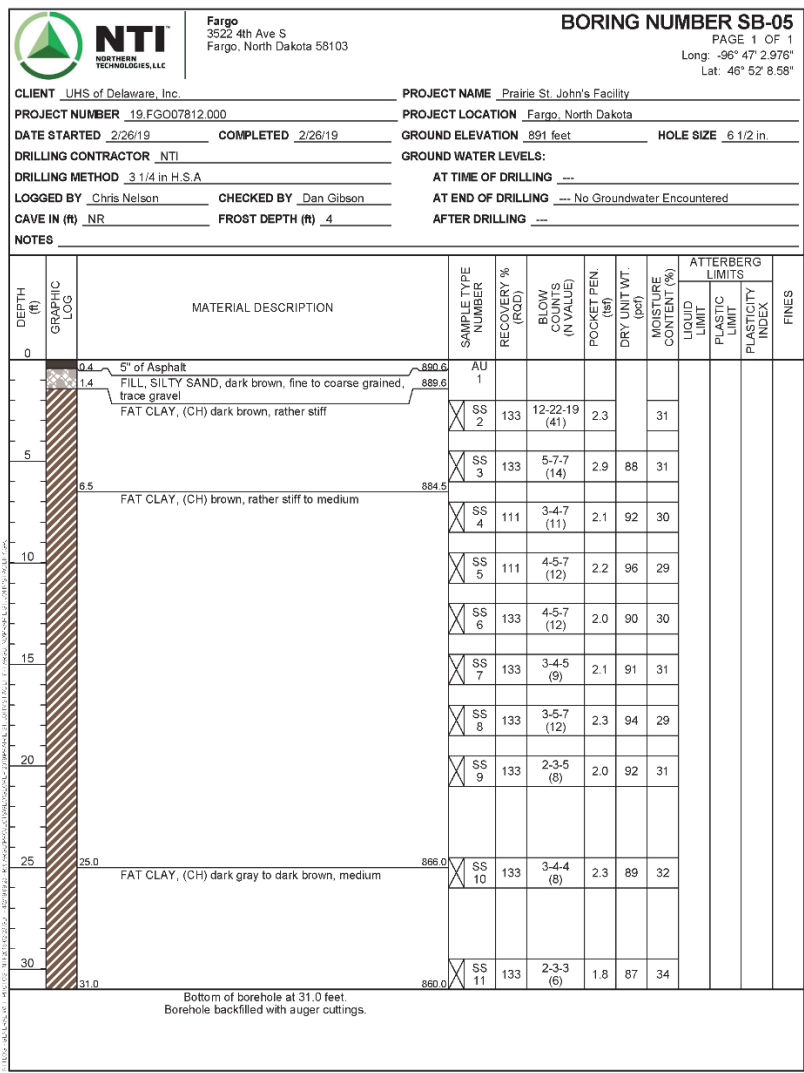


Figure 90. Boring Analysis on Prairie St. Johns site Fargo, North Dakota 2019 (from Northern Technologies, LLC)

3.4. Precedent Studies

Embarking on an exploration of healthcare environments that prioritize holistic well-being, this thesis dives into seven case studies that exemplify innovative and impactful design principles. Each case study caters to a different specialty, bed count, and square footage, yet all uphold the guiding principles of an environment that supports patients' emotional, psychological, and physical health. Each case study delves into the fundamental design principles implemented to create a healing environment, detailing the strategies used and their impact on users.

Project	Location	Climate	Specialty	Architect	Year Completed	Number of Beds/ Patients	Square Footage	Levels
Maggie's Yorkshire	Leeds, United Kingdom	Average 36-70 degrees Fahrenheit	Practical and Psychological Cancer Support	Heatherwick Studio	2019	250 visits a week	5,000 square feet	3
Maggie's Oldham	Oldham, United Kingdom	Average 34-64 degrees Fahrenheit	Practical and Psychological Cancer Support	dRmm	2015	400 visits a week	2,800 square feet	1
Ostra Hospital Emergency Psychiatry Ward	Göteborg, Sweden	Average 28-72 degrees Fahrenheit	Psychiatry Ward	White Arkitekter	2009	120 patients	194,000 square feet	4 - only 2 ward levels
Cambridge Children's Hospital	Cambridge, United Kingdom	Average 35-74 degrees Fahrenheit	Mental and Physical Health for ages 0-19	White Arkitekter	Planning approved March 2022	187 beds	373,507 square feet	6
Velindre Cancer Center	Cardiff, Wales, United Kingdom	Average 39-71 degrees Fahrenheit	Cancer Center	White Arkitekter	Construction start 2024, expected completion 2026	Not Available	387,000 square feet	3
Waldkliniken Eisenberg Hospital	Eisenberg, Germany	Average 28-75 degrees Fahrenheit	Orthopedic Post-Operation	Matteo Thun	2020	246 patients	177,064 square feet	6
Rainier Beach Clinic, North West Kidney Center	Seattle, Washington	Average 39-72 degrees Fahrenheit	Kidney Dialysis Center	Mahlum	2019	100 patients	12,085 square feet	1

Table 5. Chart comparing general information about case studies.

Principle	Visual connection to nature	Thermal and air flow	Dynamic and diffuse light	Connection with natural systems	Material connection with nature	Prospect	Refuge
Maggie's Yorkshire	Yes	No	Yes	Yes	Yes	Yes	Yes
Maggie's Oldham	Yes	No	Yes	Yes	Yes	Yes	No
Ostra Hospital Emergency Psychiatry Ward	Yes	Yes	Yes	No	Yes	Yes	Yes
Cambridge Children's Hospital	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Velindre Cancer Center	Yes	No	Yes	Yes	Yes	Yes	No
Waldkliniken Eisenberg Hospital	Yes	Yes	Yes	Yes	Yes	Yes	No
Rainier Beach Clinic, North West Kidney Center	Yes	No	Yes	Yes	Yes	Yes	Yes

Table 6. Chart comparing biophilic design principles within the case studies.

3.4.1. How Maggie's Cancer Care Support Centers Came to Be

Maggie was a writer, gardener, and designer, living life to the fullest surrounded by her husband and children. In 1988, Maggie's life was forever changed with her diagnosis of breast cancer. After treatments and being placed in remission, the cancer returned just five years later, and was given only months to live. Maggie had nowhere to go that could offer her the emotional support she so desperately needed during this time and witnessed how hard this news was for her, her husband, and her kids. With Maggie's background in design, her husband's knowledge as a landscape designer, and her nurse, they sought to create a space that could provide the support a hospital cannot for those going through a cancer diagnosis.

In 1996, the grand opening of Maggie's Edinburgh marked the beginning of design focused on providing emotional, social, and psychological support to a hospital campus. Each center seamlessly blends natural light, warm materials, and nature fostering a friendly, inviting,

and soothing atmosphere for the users. Maggie's helps those who come in find the hope, determination, and resources they need to navigate life with their cancer diagnosis. Always placed on a hospital campus, usually specializing in oncology, these centers have been initiated in response to hospitals expressing their need for Maggie's. Since 1996, there have been twenty-nine centers created, with most in the United Kingdom and Scotland, one in Barcelona, Hong Kong, and Tokyo. There are currently six centers in development, including Norway, the Netherlands, and the rest in England.

Maggie's Yorkshire and Oldham were further analyzed providing insight into their core objectives, implementation strategies, and the impact on individuals affected by cancer. Emphasizing the integration of natural materials and the infusion of nature into the space, these centers exemplify the creation of a healing environment.

3.4.1.1. Maggie's Yorkshire

Site Analysis and Design Concepts



Figure 101. Yorkshire, United Kingdom, modeled from Google Maps

Catering to the healthcare needs of Yorkshire is the St. James University Hospital, a renowned facility delivering high-quality care to the region. With over one hundred specialties, cancer holds a prominent position among the five medical focus areas. Globally acknowledged as a leader in cancer research and innovation, the Leeds Cancer Center spans 10 floors and offers the world's finest treatments for cancer patients (*Our Services*, n.d.).



Figure 112. St. James University Hospital, Leeds, United Kingdom, modeled from Google Maps

Enriching the campus and distinguishing St. James University Hospital from the competition, is the addition of Maggie's Yorkshire (blue, on the site plan). Built in 2019 by Heatherwick Studio, this 5,000-square-foot center is located diagonally from the Leeds Cancer Center (yellow, on the site plan) and occupies one of the last green spaces left on campus. Dedicated to preserving this green space, Heatherwick Studio sought to incorporate an abundance of vegetation, drawing inspiration from the surrounding landscape. Maggie's Yorkshire takes the form of three planters, varying in size, each containing private spaces at their base and linked together with public spaces (*Maggie's Leeds Centre / Heatherwick Studio*, 2021).

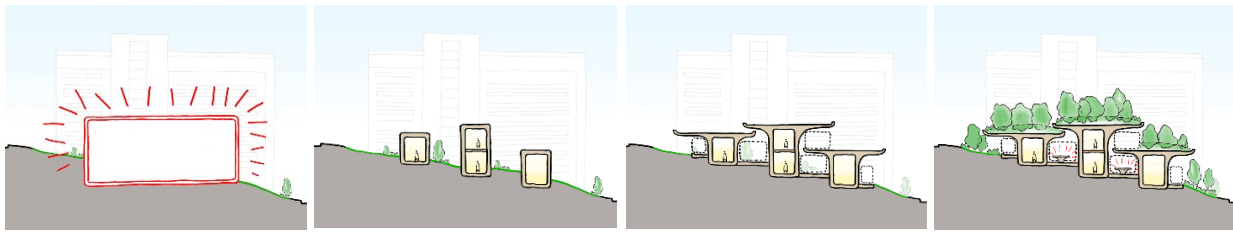


Figure 123. Heatherwick Studio (2019). Building Form Progression [drawing]. Leeds, United Kingdom. <https://www.heatherwick.com/projects/buildings/maggies/>
Implementation

Maggie’s Yorkshire is constructed with a prefabricated, sustainably sourced spruce timber system. With careful consideration of the building’s form and orientation, the building is naturally ventilated using porous materials, like lime plaster, to maintain the internal humidity of the facility. This center only utilized natural and sustainable materials, creating an environment unlike the typical clinical environment. Maggie’s Yorkshire implemented soft and natural lighting to aid in creating a warm, welcoming, and cozy (*Maggie’s Leeds Centre / Heatherwick Studio, 2021*).



Figure 134 . (left) and figure 145. (right) Hufton + Crow (2019). Interior Spaces [picture]. Leeds, United Kingdom. <https://www.heatherwick.com/projects/buildings/maggies/>



Figure 156. Heatherwick Studio (2019). Site Section [drawing]. Leeds, United Kingdom.
<https://www.heatherwick.com/projects/buildings/maggies/>

This center offers a variety of spaces that encourage social interactions as well as quiet and reflective time. Including a variety of counseling rooms, a library, an exercise room, a plethora of group and social spaces, and a kitchen at the heart (*Maggie's Leeds Centre / Heatherwick Studio, 2021*).

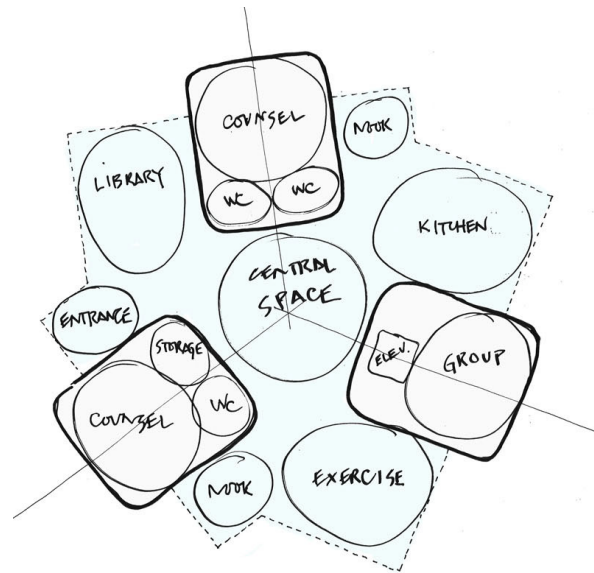


Figure 167. Heatherwick Studio (2019). Bubble Diagram [drawing]. Leeds, United Kingdom.
<https://www.heatherwick.com/projects/buildings/maggies/>



Figure 28. Heatherwick Studio (2019). Floor Plan [drawing]. Leeds, United Kingdom.
<https://www.heatherwick.com/projects/buildings/maggies/>

Inspired by the Yorkshire woodlands, the rooftop garden stands out among the campus. Featuring native English species of plants and evergreens a layered landscape is created through all seasons. This center also has an active garden, encouraging visitors to care for over 23,000 bulbs and the 17,000 plants on the site (*Maggie's Leeds Centre / Heatherwick Studio, 2021*).



Figure 29. Hufton + Crow (2019). Exterior [picture]. Leeds, United Kingdom.
<https://www.heatherwick.com/projects/buildings/maggies/>



Figure 170. (left) and figure 181. (right) showcases the before and after of the site. Hufton + Crow (2019). Site before and after [picture]. Leeds, United Kingdom.
<https://www.archdaily.com/941540/maggies-leeds-centre-heatherwick-studio>

Impact and Conclusion

The greatest impact this center has is on those receiving cancer and their loved ones. Having around 1,000 visits a month (Post, n.d.), Maggie's Yorkshire has a variety of professionals on-site from cancer support specialists to psychologists. This center also offers sessions and workshops on managing stress, fatigue, money, and many more. They offer support groups for families, friends, and those who have lost a loved one to their fight. The greatest way

to understand the impact Maggie's Yorkshire has on those in the community is by reading their own stories about their time at Maggie's.

Testimonies

In the story of Jane and Tim, Maggie's Yorkshire played a crucial role in supporting them through Tim's halted cancer treatments due to the Coronavirus. Despite positive progress with chemotherapy, the pandemic abruptly stopped his treatments, causing stress and disappointment. Seeking solace, they turned to Maggie's, where their close connection with a clinical psychologist eased their anxieties. As Tim's health declined, virtual communication became their only link, and without chemotherapy, he passed away just four weeks after being given over six months to live. Following Tim's death, Maggie continued to provide vital support for Jane, offering counseling and a welcoming space for her to decompress. Despite the challenges, Jane attests to the comforting atmosphere at Maggie's, expressing gratitude for the friendly faces and solace found during her visits (Stories, n.d.).

3.4.1.2. Maggie's Oldham

Site Analysis and Design Concepts



Figure 192. Oldham, United Kingdom, modeled from Google Maps



Figure 203. Royal Oldham Hospital, Oldham, United Kingdom, modeled from Google Maps

Designed by dRmm and completed in 2017, Maggie's Oldham seamlessly integrates nature into the built environment, emphasizing the therapeutic qualities of wood. Located just 38.3 miles from Maggie's Yorkshire, Maggie's Oldham is more intimate in scale with 2,800 square feet (*Maggie's Oldham / dRMM, 2017*).

Implementation

Supported by columns, this wooden structure hovers above the garden. With the incorporation of a void through the center of the building, an open space for the garden below to grow is formed. This void seamlessly blends the external natural elements with the internal spaces, bringing the essence of nature into the center (*Maggie's Oldham / dRMM, 2017*).

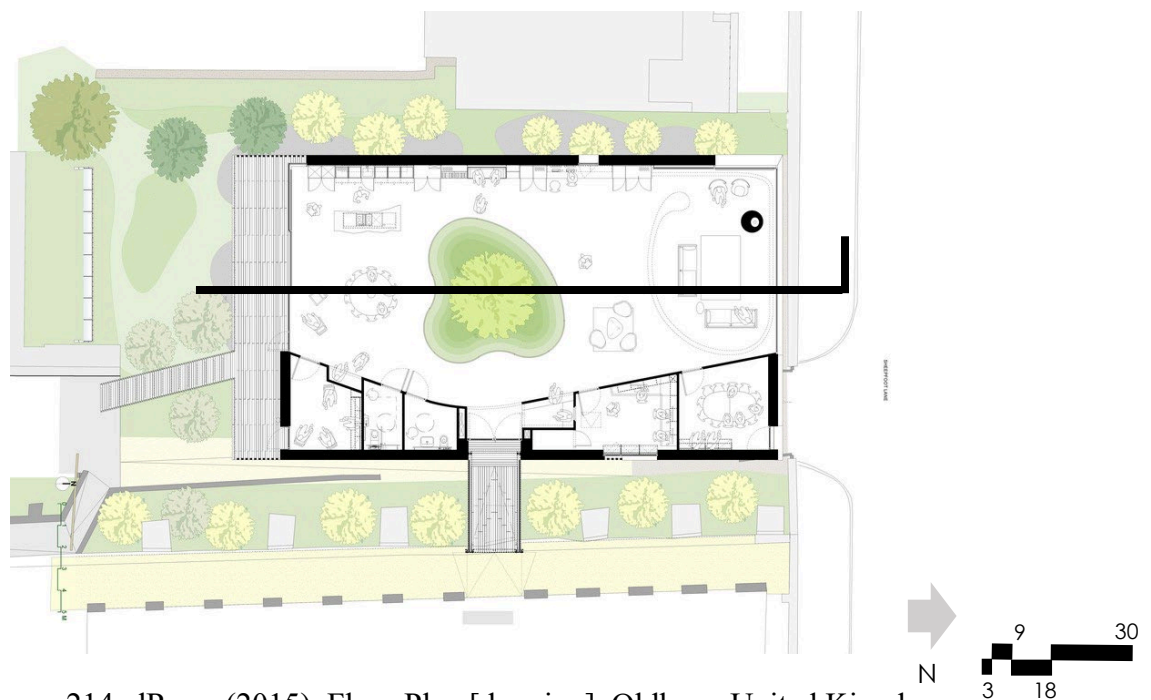


Figure 214. dRmm (2015). Floor Plan [drawing]. Oldham, United Kingdom.
<https://www.archdaily.com/874795/maggies-oldham-drmm>



Figure 225. dRmm (2015). Section Cut [drawing]. Oldham, United Kingdom.
<https://www.archdaily.com/874795/maggies-oldham-drmm>



Figure 236. (left) Tony Barwel (2015). Garden [picture]. Oldham, United Kingdom.
<https://www.archdaily.com/874795/maggies-oldham-drmm> and figure 24. (right) dRmm (2015).
 Garden [picture]. Oldham, United Kingdom. <https://drmmstudio.com/project/maggies-oldham/>



Figure 37. dRmm (2015). Exterior [picture]. Oldham, United Kingdom.
<https://drmmstudio.com/project/maggies-oldham/>

Maggie's Oldham stands as one of the pioneering structures constructed with tulip cross-laminated timber, a sustainable material that showcases the innate beauty of wood while establishing a warm and welcoming environment. In a commitment to sustainability, leftover wood from the fabrication process was utilized for the ceilings, ensuring no waste. Going beyond the norms of hospital architecture, Maggie's Oldham incorporated wood wherever possible. This includes floors, ceilings, cabinets, furniture, door handles, window frames, wherever possible as those receiving chemotherapy tend to gain a sensitivity to cold. Throughout the center wood fiber insulation was used, ensuring a breathable and healthy atmosphere (*Maggie's Oldham / dRMM, 2017*).



Figure 38 (left). Alex de Rijke (2015). Interior [picture]. Oldham, United Kingdom. <https://www.archdaily.com/874795/maggies-oldham-drm> and figure 39. (right) Jasmin Sohi (2015). Interior[picture]. Oldham, United Kingdom. <https://drmmstudio.com/project/maggies-oldham/> and figure 25.

Impact and Conclusion

Maggie's Oldham warmly welcomes approximately 400 weekly visits, ensuring a comforting environment that extends well beyond emotional support (*Maggie's Oldham*, 2018). The deliberate use of wood throughout the center is not merely aesthetic; it serves a practical purpose for individuals undergoing chemotherapy, undergoing chemotherapy can feel pain from objects that are cold to the touch further demonstrating the thought and research that went into the space. Additionally, the center boasts a greenhouse that offers fresh produce to visitors, providing access to nutritious snacks during their visits.



Figure 40. (right) dRmm (2015). Green House [picture]. Oldham, United Kingdom. <https://drmmstudio.com/project/maggies-oldham/> and figure 41. (left) dRmm (2015). Vegetable [picture]. Oldham, United Kingdom. <https://drmmstudio.com/project/maggies-oldham/> and figure 26.

Testimony

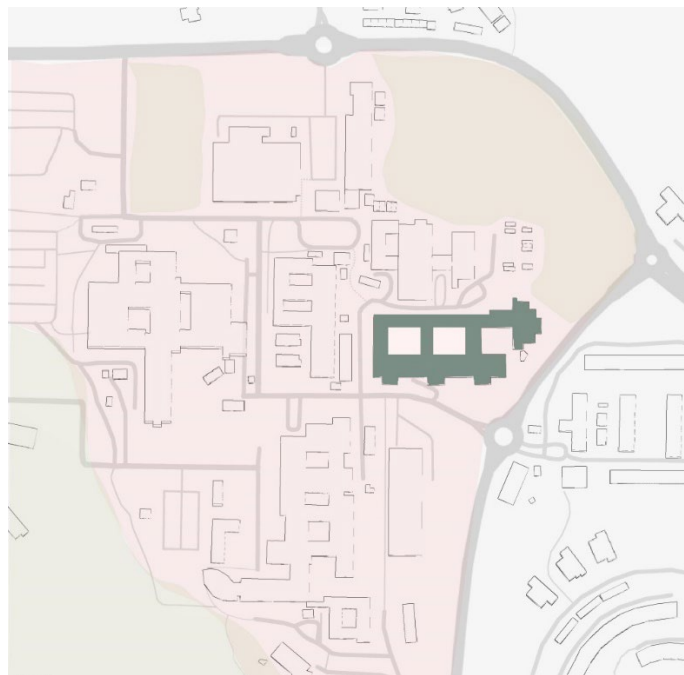
The greatest testament to the impact of Maggie's is through testimonies from the users. Carole, a visitor to Maggie's Oldham, shares a compelling narrative of how the center provided her with hope during a challenging period. Facing the loss of her job, health, and confidence, Carole felt adrift after treatment. However, her experience at Maggie's Oldham transformed her outlook. Accessing various services, Carole received assistance with benefits, alleviating her financial concerns, and consulted with a psychologist who helped her understand the normalcy of her emotions during such a traumatic time. Reflecting on her journey, Carole expresses immense gratitude, stating, 'I feel I owe Maggie's so much for helping me to find ways to cope and move forward. Maggie's is my haven of calm, a place I can go to relax, where I feel like people genuinely care.'

3.4.2. Ostra Hospital Emergency Psychiatry Ward

Site Analysis and Design Concept



Figure 42. Gothenburg, Sweden, modeled from Google Maps



↑ N SCALE 1: 200

Figure 43. Östra Sjukhuset - Sahlgrenska University Hospital, Gothenburg, Sweden, modeled from Google Maps

Providing psychiatric care to the region is the Östra Sjukhuset - Sahlgrenska University Hospital. Originally situated in Lillhagen, the psychiatric hospital was relocated closer to the city in 2009. This move aimed to reduce the stigma and foster a sense of inclusion for patients seeking help for their mental health. With approximately 194,000 square feet, this hospital can accommodate 120 patients. The foundational design principles outlined by the clients lay the groundwork for redefining the possibilities of psychiatric architecture and shaping the goals of the psychiatry ward at Östra Hospital (“Östra Hospital Acute Psychiatry Ward,” n.d.).

1. Design the exterior to harmonize with the natural environment and seamlessly integrate with the existing hospital building (Ågatan, n.d.).
2. Thoughtfully designed on a small scale, featuring 2 or 3 stories, taking into consideration the views from patient rooms (Ågatan, n.d.).
3. Individual rooms for patients provide seclusion, balanced with various opportunities for social interaction (Ågatan, n.d.).
4. Integrated care and treatment within the unit while maintaining security requirements (Ågatan, n.d.).
5. Distinct separation of emergency care and planned care areas for optimal functionality (Ågatan, n.d.).
6. Implementation of color and design choices that actively contribute to the healing process (Ågatan, n.d.).

Implementation

Seeking to create a free and open environment, each ward surrounds an interior courtyard while each ward has a lightwell that is directly accessible from the wards to patients whenever they desire, without the need for staff to escort them. allowing patients to escape the ward, their illness, and seek fresh air and freedom.



Figure 44. Christer Hallgren (2009). Light Court [picture]. Gothenburg, Sweden.
<https://whitearkitekter.com/project/ostra-hospital-emergency-psychiatry-ward/> and Figure 45
Christer Hallgren (2009). Courtyard [picture]. Gothenburg, Sweden.
<https://whitearkitekter.com/project/ostra-hospital-emergency-psychiatry-ward/>
Lightwell within each ward and courtyard the wards surround

To achieve the fifth objective, the separation of emergency care from planned care, the psychiatric hospital is organized as follows: the first level encompasses the entrance hall, county administrative court, and emergency reception. Moving up to the second level, there is an additional emergency reception, ambulance entrance, archives, and changing rooms. Lastly, levels three and four are dedicated to patient wards and support (Ågatan, n.d.).



Figure 46. White Arkitekter (2009). First Floor Plan [drawing]. Gothenburg, Sweden.
<https://whitearkitekter.com/project/ostra-hospital-emergency-psychiatry-ward/> and Figure 47.
 White Arkitekter (2009). Second Level Plan [drawing]. Gothenburg, Sweden.
<https://whitearkitekter.com/project/ostra-hospital-emergency-psychiatry-ward/>



Figure 48. White Arkitekter (2009). Third and fourth level plans [drawing]. Gothenburg, Sweden. <https://whitearkitekter.com/project/ostra-hospital-emergency-psychiatry-ward/>

Ward
scale 1:400



Figure 49. White Arkitekter (2009). Ward Plan [drawing]. Gothenburg, Sweden.
<https://whitearkitekter.com/project/ostra-hospital-emergency-psychiatry-ward/>

In pursuit of the sixth objective, the design relied on natural materials, colors, and lighting. The addition of plants along with vibrant colors, both on the exterior and interior, contribute to creating a distinctive environment that avoids the institutional feel. Utilizing wood as the main interior material, a warm and inviting atmosphere is attained while maintaining a connection to nature. Additionally, in fulfilling the sixth objective, biophilic design principles were integrated. Emphasizing visual connection to nature, dynamic and diffused lights, complexity and order, and refuge. To achieve a strong visual connection to nature, the design ensured consistent access for patients to views of natural elements, living systems, and natural processes. Central courtyards and light wells within the hospital not only establish this visual

connection to nature but also provide natural lighting to the building's core. The integration of numerous windows along the exterior contributes to soft lighting fostering an environment that truly feels like home. The principle of complexity and order is reflected in the floor plan with three repeated, connected, and mirrored L-shape departments. The implementation of order between each module allows for easy navigation of the hospital for staff, patients, and visitors. Each ward maintains this principle with a cluster of patient rooms moving patients from private to semi-private and then public spaces, creating a diverse environment while maintaining security requirements. Finally, refuge was established through a diverse range of seating options, offering a sense of security to users. This principle holds significant importance in psychiatric hospitals, as it provides safety and security to patients who feel there is a threat, even if it is rooted in their minds (Ågatan, n.d.).



Figure 50 Christer Hallgren (2009). Exterior [picture]. Gothenburg, Sweden.
<https://whitearkitekter.com/project/ostra-hospital-emergency-psychiatry-ward/> and figure 51.
Christer Hallgren (2009). Sun Room [picture]. Gothenburg, Sweden.
<https://whitearkitekter.com/project/ostra-hospital-emergency-psychiatry-ward/>

Impact and Conclusion

Before the establishment of the psychiatric hospital on the Ostra campus, individuals in need of mental health treatment had to go to Lillhagen, situated just outside of town. Lillhagen's atmosphere was anything but welcoming—it was cold, intimidating, and unfamiliar. The wards were crowded with approximately 40 patients and there was a lack of communal spaces.

Creating a counterproductive care environment (Ågatan, n.d.). From Lillhagen to Ostra, a study was conducted in 2005, before the relocation to the new hospital in 2007, highlighting the profound impact of the built environment on psychiatric care. Through numerous patient and staff interviews, a positive disparity between Ostra and Lillhagen emerged. The findings revealed lower instances of compulsory medications and restraints at Ostra, indicating a notably calmer department with fewer incidents of aggression. The documented improvements underscore the crucial role that thoughtful design principles can play in shaping a therapeutic and supportive setting within a psychiatric facility (Ostra-Psychiatry-Case-Study.Pdf, n.d.).

Comparison of Average Quarterly Findings
2005 (Pre-move) and 2007 (Post-move)

Table 1. Compulsory Injections		
	2005	2007
Patients	23	17
Occurrences	47	30

"The number of compulsory medications and restraints of patients has fallen greatly"

Table 2. Subject to Restraints		
	2005	2007
Patients	14	16
Occurrences	63	35

"The atmosphere in the department has been calmer and patients have had fewer outbursts of aggression"

Table 3. Sicklisting		
	2005	2007
Staff	9%	6%
Occurrences	NA	NA

Source: Architecture as Medicine.

Figure 52. Comparison of Average Quarterly Findings (Ostra-Psychiatry-Case-Study.Pdf, n.d.).

3.4.3. Cambridge Children's Hospital

Site Analysis and Design Concept



Figure 53. Cambridge, United Kingdom, modeled from Google Maps



↑
N SCALE 1: 200

Figure 54. Cambridge Biomedical Campus, Cambridge, United Kingdom, modeled from Google Maps

Located two miles south of Cambridge is the Cambridge Biomedical Campus. This campus provides world-class biomedical research, patient care, and education all on a single site. Despite all this campus has to offer, it currently lacks a hospital dedicated to individuals ages zero to nineteen. To address this gap and provide care to all age groups, the campus has set forth plans for a 373,507-square-foot children's hospital with projection construction to start in 2024 ("Cambridge Children's Hospital," n.d.). The Goals set forth for this children's hospital are:

1. Develop a joint model of care integrating both physical and mental health ("Cambridge Children's Hospital," n.d.)
2. include research for prevention and early diagnosis of diseases ("Cambridge Children's Hospital," n.d.)
3. a holistic approach that focuses on the whole child and not solely on their illness ("Cambridge Children's Hospital," n.d.)

Designed in collaboration with young people, families, and healthcare professionals, the Cambridge Children's Hospital is paving the way for integrated care. White Arkitekter, along with their partners, dedicated a substantial amount of time to understanding how children interact, learn, and play. This hospital will accommodate 54,000 square feet of research space, seven operating theaters, and 187 hospital beds contributing to the overall mission of the campus ("Cambridge Children's Hospital," n.d.).

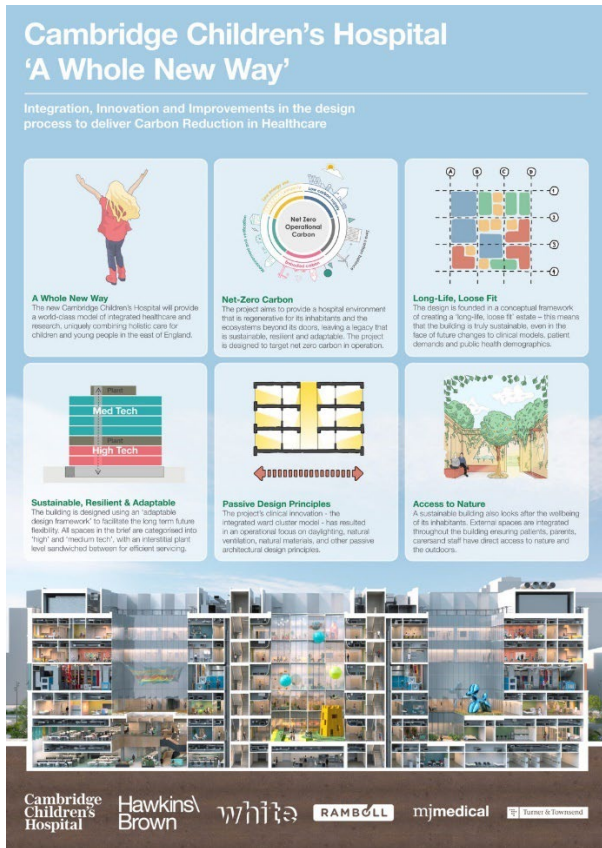


Figure 55. (left) and figure 56. (right) Hawkins\ Brown (2022). Planning Documents [diagram]. Cambridge, United Kingdom. <https://www.hawkinsbrown.com/news/cambridge-childrens-hospital-is-highly-commended-at-european-healthcare-design-2022/>

Implementation

To seamlessly integrate both physical and mental health services, each department is strategically organized to share resources. In doing this, the overall operational efficiency is improved, and collaboration between departments is encouraged. This organizational structure promotes knowledge exchange among clinicians and nurtures empathy between patients. By children seeing other children with different conditions to their own, it promotes empathy and can improve their recovery time. In reducing physical and operational barriers between staff, researchers, and families, the design creates an environment where collaboration and interaction

are encouraged. Creating shared spaces for individuals of diverse roles and backgrounds fosters collaboration, knowledge sharing, and a deeper understanding of patient needs, cultivating a well-informed environment (“Cambridge Children’s Hospital,” n.d.).



Figure 57. Hawkins\ Brown (2022). Exterior [render]. Cambridge, United Kingdom.
<https://whitearkitekter.com/project/cambridge-childrens-hospital/>

To elevate the clinical environment fresh air, natural daylight, and nature were considered through the design of the building and its form and orientation. The approach involved integrating three voids within the building mass, allowing natural light and air to penetrate the deepest parts of the hospital. With attentive detail to the form and orientation of the building of the building, natural shading is provided. To seamlessly integrate nature into the hospital, natural materials, colors, and finishes were used. The incorporation of these materials fosters a warm

and calming environment, promoting overall well-being (“Cambridge Children’s Hospital,” n.d.).



Figure 58. Hawkins\ Brown (2022). Exterior [render]. Cambridge, United Kingdom.
<https://whitearkitekter.com/project/cambridge-childrens-hospital/>



Figure 59. (left) Hawkins\ Brown (2022). Group Room [render]. Cambridge, United Kingdom.
<https://whitearkitekter.com/project/cambridge-childrens-hospital/> and figure 60. (Right) Hawkins\ Brown (2022). Patient Room [render]. Cambridge, United Kingdom.
<https://whitearkitekter.com/project/cambridge-childrens-hospital/>

The architectural plan thoughtfully incorporates a variety of spaces for play and nature, including winter gardens, indoor and outdoor courtyards, and terraces. Each of these spaces is meticulously designed to offer diverse areas for relaxation and play, ensuring there is something

for everyone to explore and enjoy. Filled with a variety of trees and plant species, each courtyard not only enhances aesthetic appeal but also creates a natural habitat for birds and bugs (“Cambridge Children’s Hospital,” n.d.).



Figure 61. Hawkins\ Brown (2022). Courtyard [render]. Cambridge, United Kingdom.
<https://whitearkitekter.com/project/cambridge-childrens-hospital/>

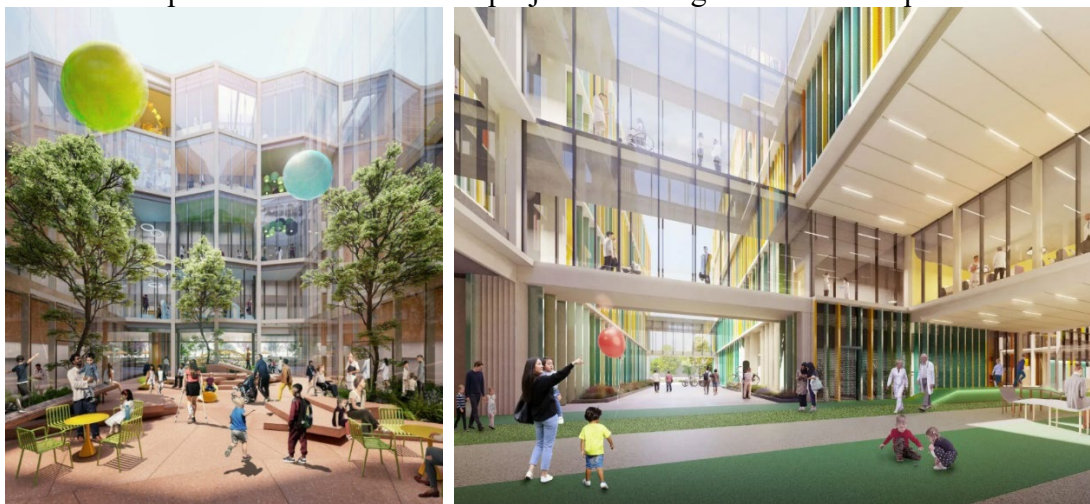


Figure 62. (left) Hawkins\ Brown (2022). Courtyard [render]. Cambridge, United Kingdom.
<https://whitearkitekter.com/project/cambridge-childrens-hospital/> and figure 63. (right) Hawkins\ Brown (2022). Internal Courtyard [render]. Cambridge, United Kingdom.
<https://whitearkitekter.com/project/cambridge-childrens-hospital/>

Impact and Conclusion

Combining treatment for both mental and physical health in a single hospital alleviates stress on both the children and families. This innovative healthcare model acknowledges the impact placing both all types of care can have on children, through the promotion of empathy and fostering a sense of inclusion. The focus on integrated care is a crucial step forward, as it has not been explored enough in the current healthcare facilities. In a region lacking a dedicated children's hospital, this initiative in East England will address crucial healthcare gaps, emphasizing the hospital's transformative impact on the region's healthcare. Cambridge Children's Hospital guides the exploration of this thesis, with the integration of mental and physical care into a hospital. Emphasizing the importance of designing for the occupants, to enhance and improve the healing environment while catering to the diverse healthcare needs of the city.

3.4.4. Velindre Cancer Centre: Wales, UK

Site Analysis and Design Concept



Figure 64. Cardiff, Wales, United Kingdom, modeled from Google Maps



N SCALE 1: 200

Figure 65. Proposed Site for Velindre Cancer Center, Cardiff, England, modeled from Google Maps

Proposed just two miles north of the existing Velindre Cancer Center, the facility is immersed in nature. With approximately 387,500 square feet, this center will provide specialist cancer services to Southeast Wales in the United Kingdom. Velindre Cancer Center is designed by White Arkitekter and is set for construction to start in 2024 and is expected to be completed in 2026 (“Velindre Cancer Centre, Wales,” n.d.). The key design goals for this hospital include:

1. Creating an environment that supports mental and physical well-being (“Velindre Cancer Centre, Wales,” n.d.)
2. Reduce the whole life carbon impact, while improving health outcomes (“Velindre Cancer Centre, Wales,” n.d.)
3. Contribute and foster a stress-relieving and harmonious environment (“Velindre Cancer Centre, Wales,” n.d.)



Figure 66. Vivid Vision (2022). Exterior [render]. Cardiff, Wales, United Kingdom.
<https://whitearkitekter.com/project/velindre-cancer-centre-in-wales-uk/>

Implementation

Seeking to become the most sustainable hospital in the United Kingdom, the Velindre Cancer Center incorporates a high-performance envelope, a passive design approach, energy-efficient services from low-carbon technologies, and on-site generation. To achieve the high sustainability goals set forth, locally sourced and natural materials with low carbon footprints were prioritized. This hospital implemented low-carbon, and bio-based materials in the interior of the hospital like lime and clay plasters, which are breathable and anti-fungal finishes that create a natural and calming environment for the users. This center also implemented a hybrid structural system with mass timber in public areas, allowing for less steel to be used throughout the structure of the building. With the internal spaces structured around a standard grid, this allows for flexibility and reconfiguration in the future without any structural alterations (“Velindre Cancer Centre, Wales,” n.d.).



Figure 67. (left) Vivid Vision (2022). Interior [render]. Cardiff, Wales, United Kingdom. <https://whitearkitekter.com/project/velindre-cancer-centre-in-wales-uk/> and figure 68. (right) Vivid Vision (2022). Interior [render]. Cardiff, Wales, United Kingdom. <https://whitearkitekter.com/project/velindre-cancer-centre-in-wales-uk/>

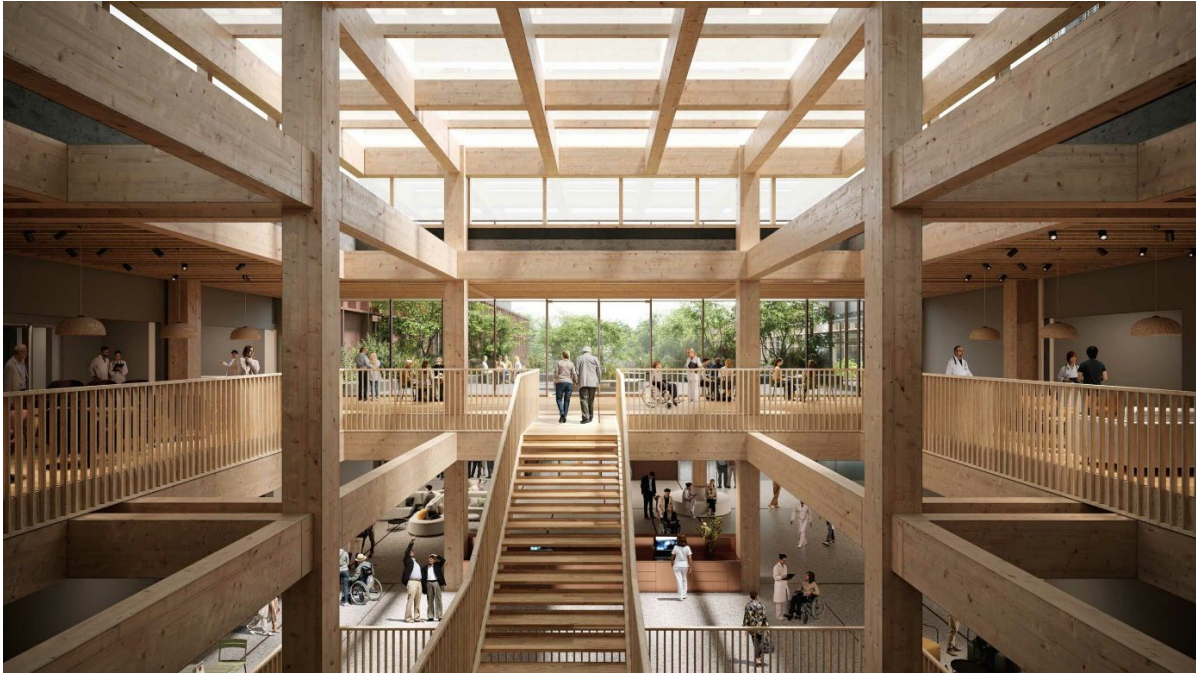


Figure 69. Vivid Vision (2022). Interior [render]. Cardiff, Wales, United Kingdom.
<https://whitearkitekter.com/project/velindre-cancer-centre-in-wales-uk/>



Figure 70. Vivid Vision (2022). Interior [render]. Cardiff, Wales, United Kingdom.
<https://whitearkitekter.com/project/velindre-cancer-centre-in-wales-uk/>

Gently integrated into the Welsh landscape, Velindre Cancer Center is designed with minimal impact on the site. Emphasizing the significance of nature and promoting healthy habits in daily life, the project includes plans for an orchard, community garden, and kitchen, and an informal playground with various walking, cycling, and relaxation areas that promote play and movement (“Velindre Cancer Centre, Wales,” n.d.).



Figure 71. (left) Vivid Vision (2022). Exterior Path [render]. Cardiff, Wales, United Kingdom. <https://whitearkitekter.com/project/velindre-cancer-centre-in-wales-uk/> and figure 72. (right) Vivid Vision (2022). Exterior Path [render]. Cardiff, Wales, United Kingdom. <https://whitearkitekter.com/project/velindre-cancer-centre-in-wales-uk/>

Impact and Conclusion

Though still in the construction phase, the Velindre Cancer Center provides valuable insights into an environment that prioritizes the mental and physical well-being of its occupants—a central focus of this thesis. Similar to Maggie’s Yorkshire, this center adopts a hybrid structural system, minimizing steel production and incorporating the warmth of wood into the more public spaces. The use of wood in interior spaces stands out as a recurring theme across case studies, underscoring its positive impact in healing spaces. The hospital seamlessly integrates into the site, incorporating key exterior elements such as a garden, walking trails, and cycling paths. Demonstrating the impact hospitals have, encouraging patients, to actively connect

with nature, escape the hospital environment, and experience the healing benefits the outdoors have to offer.

3.4.5. Waldkliniken Eisenberg Hospital: Eisenberg, Germany

Site Analysis and Design Concept

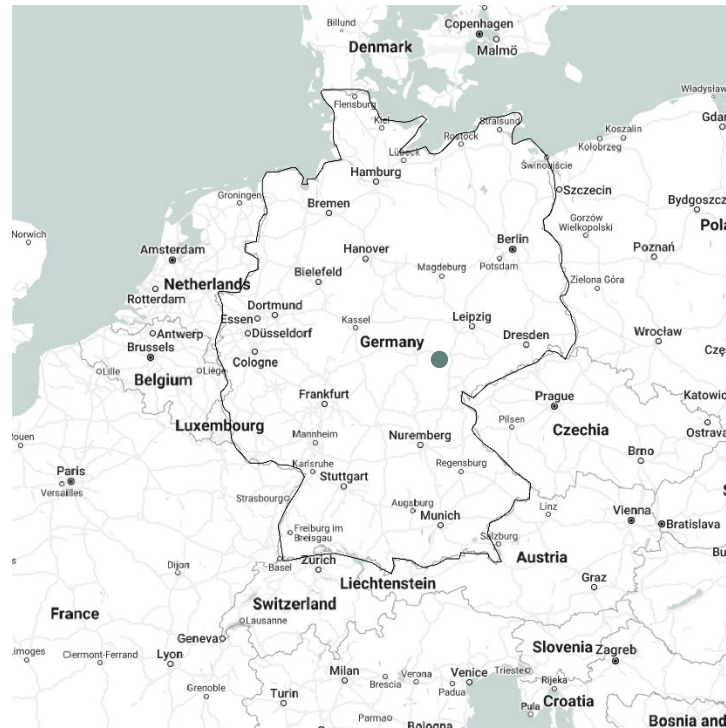


Figure 73. Waldkliniken Eisenberg Hospital, Eisenberg, Germany, modeled from Google Maps



Figure 74. Waldkliniken Eisenberg Hospital, Eisenberg, Germany, modeled from Google Maps

Located on the outskirts of the city is the Waldkliniken Eisenberg Hospital. Completed in 2020, Waldkliniken Eisenberg is the largest Orthopedic Center in Germany. With 6 levels and 177,064 square feet, this center can accommodate 246 orthopedic patients post-operation. With 128 double patient rooms, 11 in the children's ward, and 7 individual rooms (*A hospital like no other | Waldkliniken Eisenberg | Waldkliniken Eisenberg, n.d.*). The goals of this hospital include:

1. positively influence the relationship between physical space and human well-being (*A hospital like no other | Waldkliniken Eisenberg | Waldkliniken Eisenberg, n.d.*)
2. combine the aesthetics of hospitality projects with those of the healthcare sector. Creating an environment most comparable to a hotel

and treating the patient as a guest. (*A hospital like no other* | *Waldkliniken Eisenberg* | *Waldkliniken Eisenberg*, n.d.)

3. incorporates healing architecture that actively supports patients in their recovery and places the focus on both physical and mental well-being (*A hospital like no other* | *Waldkliniken Eisenberg* | *Waldkliniken Eisenberg*, n.d.)

Implementation



Figure 75. Gionata Xerra (2022). Exterior [picture]. Eisenberg, Germany. <https://www.matteothun.com/project/347/interior-waldkliniken-eisenberg>

As a symbolic representation of Saale-Holzland County, Matteo Thun incorporated locally sourced wood into the exterior facade, seamlessly blending the hospital with the lush surrounding forest. With the circular form of the hospital, all patients are allowed a view out into the surrounding forest, creating a transparent connection between the exterior and interior

environment. With a void through the center of the circle, the core of the building gains access to daylight and fresh while providing a variety of outdoor seating areas for patients and staff members (*Waldkliniken Eisenberg* | *Matteo Thun & Partners*, n.d.).



Figure 76. Gionata Xerra (2022). Birds eye [picture]. Eisenberg, Germany.
<https://www.matteothun.com/project/347/interior-waldkliniken-eisenberg>

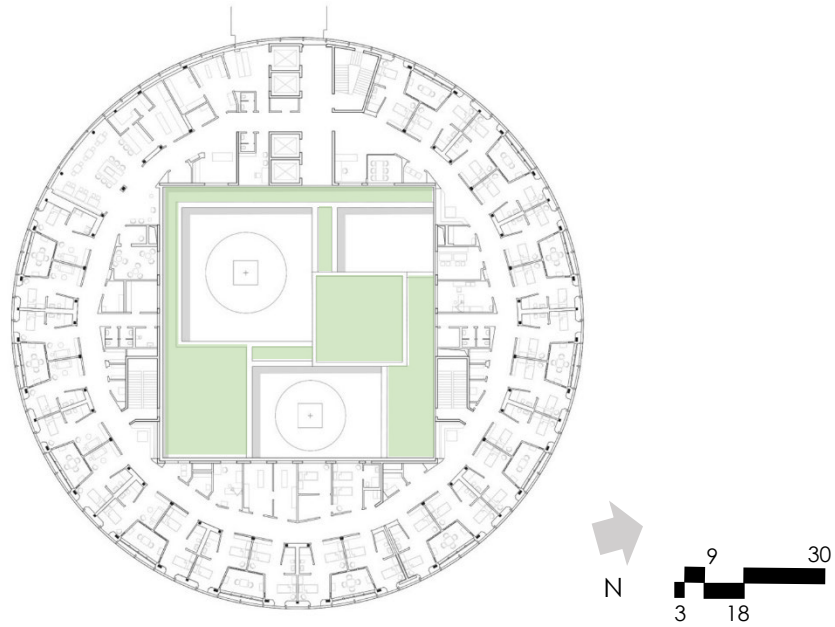


Figure 77. Matteo Thun (2022). Floor Plan [drawing]. Eisenberg, Germany.
<https://www.matteothun.com/project/347/interior-waldkliniken-eisenberg>

Waldkliniken Eisenberg utilized z-shape patient rooms, which accommodate two patients and are connected via a winter garden. The configuration of the patient room allows for increased privacy, improved workflow, and enhanced patient experience (*Waldkliniken Eisenberg* | *Matteo Thun & Partners*, n.d.).



Figure 78. Gionata Xerra (2022). Patient Room Floor Plan [render]. Eisenberg, Germany.
<https://www.matteothun.com/project/347/interior-waldkliniken-eisenberg>



Figure 79. Gionata Xerra (2022). Winter Garden [picture]. Eisenberg, Germany.
<https://www.matteothun.com/project/347/interior-waldkliniken-eisenberg> and Figure 80. Gionata Xerra (2022). Double Patient Room [picture]. Eisenberg, Germany.
<https://www.matteothun.com/project/347/interior-waldkliniken-eisenberg>

Throughout the interior of the hospital, high-quality, natural materials were utilized. Drawing inspiration from the rich color palette found in flora and fauna, a blend of blues, greens, and browns, along with the warmth of wood brings the surrounding Thuringian Forest into the facility. Waldkliniken Eisenberg also prioritized the impacts artificial light and daylight have on patients during recovery, incorporating both elements into the design (*Waldkliniken Eisenberg* | *Matteo Thun & Partners*, n.d.).



Figure 81. Gionata Xerra (2022). Elevator Waiting [picture]. Eisenberg, Germany. <https://www.matteothun.com/project/347/interior-waldkliniken-eisenberg> and figure 82. Gionata Xerra (2022). Single Patient Room [picture]. Eisenberg, Germany. <https://www.matteothun.com/project/347/interior-waldkliniken-eisenberg>

Setting out Waldkliniken Eisenberg from competing hospitals is their four distinct restaurants. Offering fresh and healthy products, each restaurant varies. The lobby features a welcoming bar with snacks and drinks, while the pizza place provides views of the inner courtyard and is filled with natural daylight. The kitchen emphasizes locally sourced ingredients for a fresh and health-conscious menu, and the bistro elevates the dining experience with fine cuisine. This emphasis on a healthy diet during recovery not only sets a new standard for hospital food but also demonstrates Waldkliniken Eisenberg's commitment to patient well-being (*Waldkliniken Eisenberg | Matteo Thun & Partners, n.d.*).



Figure 83. (left) Gionata Xerra (2022). Restaurant [picture]. Eisenberg, Germany. <https://www.matteothun.com/project/347/interior-waldkliniken-eisenberg> and figure 84. (right) Gionata Xerra (2022). Restaurant [picture]. Eisenberg, Germany. <https://www.matteothun.com/project/347/interior-waldkliniken-eisenberg>

Impact and Conclusion

Waldkliniken Eisenberg has transformed healthcare interiors by introducing high-quality, hotel-like finishes, creating a homely atmosphere. Utilizing a circular form, all patient rooms offer views of the surrounding forest. This design would not be as effective if it was not for the void through the central mass, allowing natural light to reach all spaces in the hospital. Enhancing the spatial efficiency of the hospital, the integration of z-shaped patient rooms, each connected to a winter garden, contributes to the overall effectiveness of the design. The inclusion and execution of winter gardens are significant for this thesis, addressing the challenges posed by harsh winters in Fargo, North Dakota. This solution ensures patients have continued access to nature through all seasons while protecting them from the cold.

3.4.6. Rainier Beach Clinic, Northwest Kidney Center: Seattle, Washington

Site Analysis and Design Concept

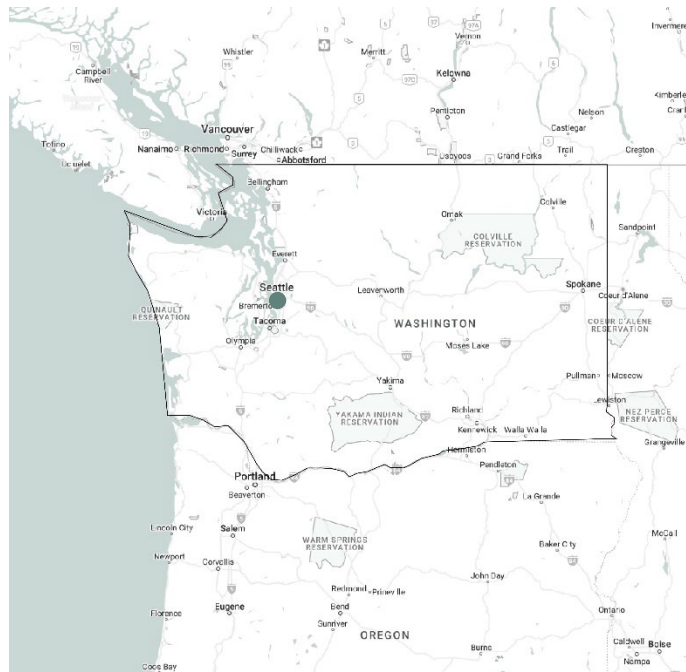


Figure 85. Northwest Kidney Centers, Seattle, Washington, modeled from Google Maps

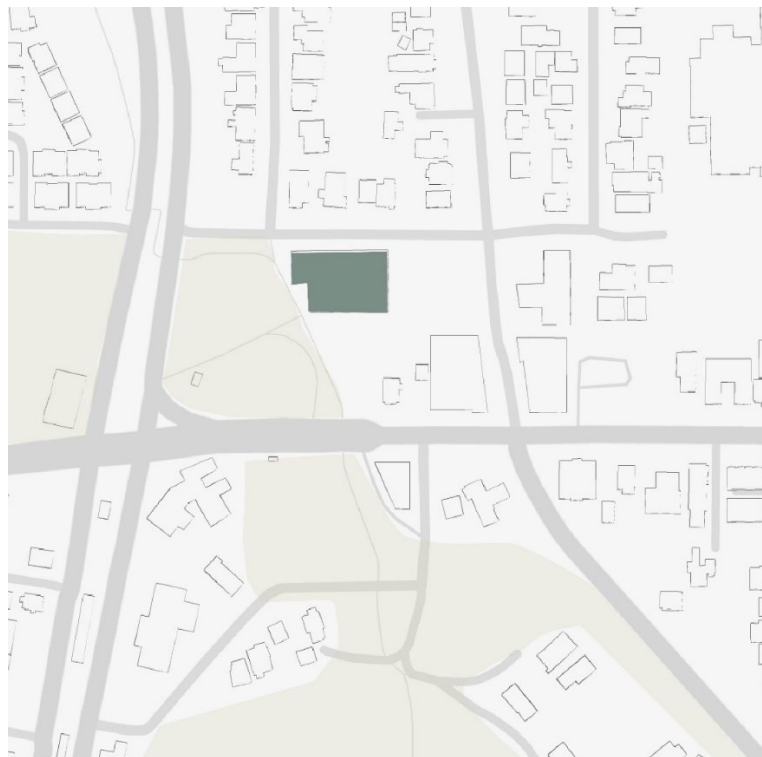


Figure 86. Northwest Kidney Centers, Seattle, Washington, modeled from Google Maps

Located in the Rainier Beach neighborhood, Northwest Kidney Centers provides dialysis treatments to the surrounding communities. Completed in 2019 by Mahlum Architects, this 12,085-square-foot kidney center brings dialysis treatments to those battling chronic kidney disease in South Seattle. Patients spend a significant amount of their time in the clinic as this disease requires dialysis at least three times a week for four hours at a time. Knowing the amount of time each patient and their families spend at the clinic, Northwest Kidney Centers challenged the design team to create a patient-centered design focusing on both the patient and staff's well-being. Mahlum centered this design around nature emphasizing the healing benefits it can offer to those undergoing treatments. Set on a former automotive salvage yard, a brownfield, the incorporation of nature was not only a design choice but also imperative for the environmental restoration of the location (*Rainier Beach Clinic – Mahlum*, n.d.).

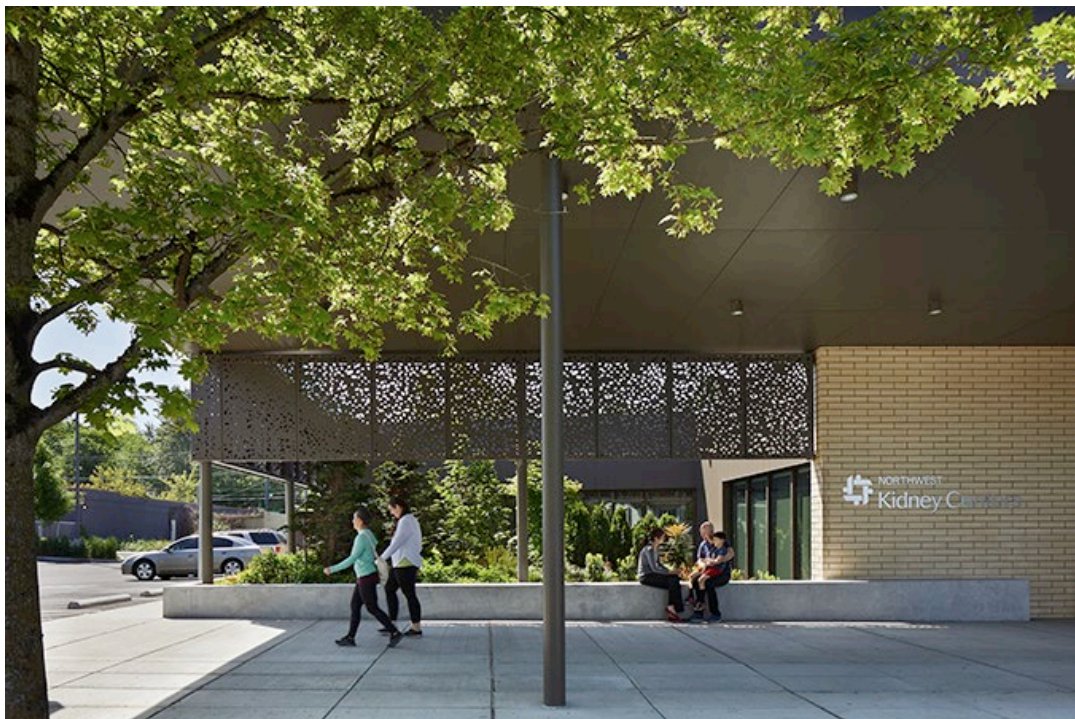


Figure 87. Benjamin Benschneider (2018). Exterior Featuring a Courtyard [picture]. Seattle, Washington. <https://www.mahlum.com/projects/rainier-beach-clinic/>
Implementation

This dialysis center provides 18 dialysis stations, 3 home training rooms, conference, and patient education rooms, and staff support space. Mahlum maintained the strict requirements for patient-care team ratio and sightlines while rethinking the traditional model of a dialysis center. This design decreased the area covered by staff, maximizing visibility, and increasing individual attention to patients, overall improving workflow (*Rainier Beach Clinic – Mahlum, n.d.*).

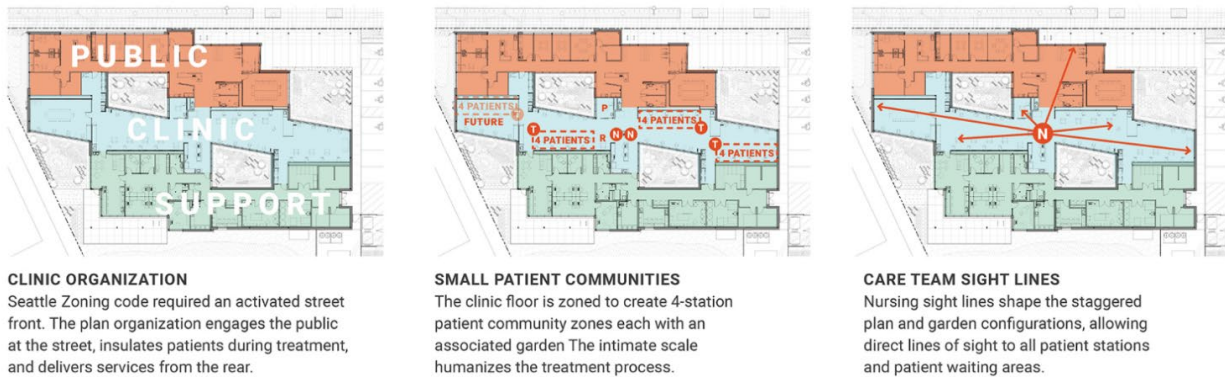


Figure 88. Mahlum (2018). Floor Plan [diagram]. Seattle, Washington.
<https://www.mahlum.com/projects/rainier-beach-clinic/>

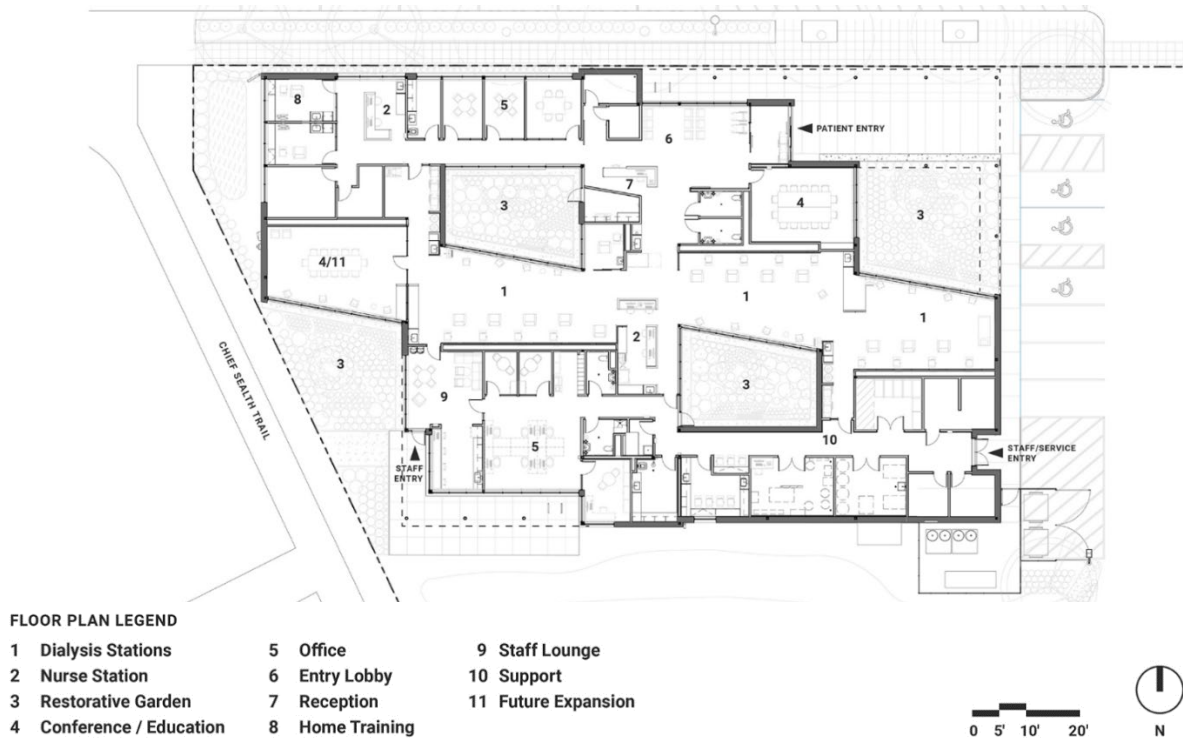


Figure 89. Mahlum (2018). Floor Plan [diagram]. Seattle, Washington.
<https://www.mahlum.com/projects/rainier-beach-clinic/>

Three interior courtyards penetrate the form of the building, allowing for natural light and views of nature to flood the interior. The dialysis stations are arranged in fours, instilling a sense of community and support through treatment. Each set of stations opens to an internal courtyard, filled with an abundance of plants and trees creating a lush habitat for birds and pollinators encouraging distraction therapy for patients (*Rainier Beach Clinic – Mahlum, n.d.*).



Figure 90. (left) Benjamin Benschneider (2018). Courtyard at Dialysis Station [picture]. Seattle, Washington. <https://www.mahlum.com/projects/rainier-beach-clinic/> and Figure 91. (right) Benjamin Benschneider (2018). Courtyard at Dialysis Station [picture]. Seattle, Washington. <https://www.mahlum.com/projects/rainier-beach-clinic/>



Figure 92. Benjamin Benschneider (2018). Courtyard at Dialysis Station [picture]. Seattle, Washington. <https://www.mahlum.com/projects/rainier-beach-clinic/>

Mahlum implemented biophilic design principles within the clinic, drawing inspiration from Terrapin Bright Green’s “14 Patterns of Biophilic Design.” Gaining a greater understanding

of each biophilic design principle and a guide to the implementation of these principles in the clinic. Incorporating 10 of the 14 principles, this design instills a strong connection to nature within the users, while promoting healing and an immersive environment for those receiving dialysis. Using natural, warm material palettes throughout, helps lower heart rates while creating a welcoming and non-institutional feel. The consideration of daylighting models and life cycle assessments in material selection further emphasizes the commitment to sustainable and patient-centric design (*Rainier Beach Clinic – Mahlum, n.d.*) (*Rainier Beach Clinic - AIA, n.d.*).

BIOPHILIC DESIGN: FOCUSING ON THE PATIENT

To best leverage research into the healing qualities of nature, the design team utilized Terrapin Bright Green's "14 Patterns of Biophilic Design" as a biophilic design strategy resource. Utilizing ten of the 14 strategies created an immersive and rich environment that brings nature indoors, offers natural analogues, and has spatial properties aligning with nature. The remaining four patterns were determined incompatible with the demands of a dialysis environment.



VISUAL CONNECTION WITH NATURE
A view to elements of nature, living systems and natural processes.



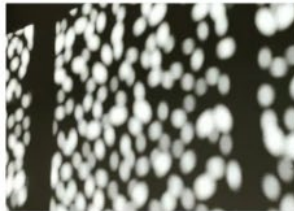
NON-RHYTHMIC SENSORY STIMULI
Stochastic and ephemeral connections with nature that may be analyzed statistically but may not be predicted precisely.



DYNAMIC & DIFFUSE LIGHT
Leveraging varying intensities of light and shadow that change over time to create conditions that occur in nature.



CONNECTION WITH NATURAL SYSTEMS
Awareness of natural processes, especially seasonal and temporal changes characteristic of a healthy ecosystem.



BIOMORPHIC FORMS & PATTERNS
Symbolic references to contoured, patterned, textured or numerical arrangements that persist in nature.



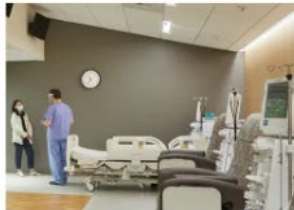
MATERIAL CONNECTION WITH NATURE
Material and elements from nature that, through minimal processing, reflect the local ecology or geology to create a distinct sense of place.



COMPLEXITY & ORDER
Rich sensory information that adheres to a spatial hierarchy similar to those encountered in nature.



PROSPECT
An unimpeded view over a distance for surveillance and planning.



REFUGE
A place for withdrawal, from environmental conditions or the main flow of activity, in which the individual is protected from behind and overhead.



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.

Figure 93. Mahlum (2018). Biophilic Design Principles [chart]. Seattle, Washington.
<https://www.aia.org/showcases/6388164-rainier-beach-clinic>

Impact and Conclusion

Northwest Kidney Centers redefines the model of dialysis centers, highlighting the impact a patient-centered approach has on the health and well-being of the patients. Providing views of courtyards, flooded with nature, the clinic instills a serene and peaceful atmosphere. While offering distraction therapy to patients, which has been shown to reduce pain and discomfort. Creating a unique environment to entertain patients as they receive dialysis, with equal healing benefits. This dialysis center highlights the impact on the physical environment, inspiring a shift towards clinics that prioritize comfort and well-being. In an era dominated by technology, this center stands out for its commitment to creating a meaningful connection between patients and nature, elevating the healthcare experience. In a post-occupation survey completed by Mahlum Architects, one respondent stated, “Stress and tension are reduced compared to (other clinics). There is a lighter feel here. Patients refer to the location as peaceful” (*Rainier Beach Clinic – Mahlum, n.d.*). Also in their post-occupancy surveys, they confirmed the positive impact the gardens have had on the occupants by creating a calmer environment than the other dialysis facilities (*Rainier Beach Clinic – Mahlum, n.d.*).

3.5. Detailed Space Program

The programming for this project came from an understanding of the patients and staff that will be occupying the clinic along with state requirements for a partial hospitalization program. The core wings include community spaces, an administrative wing, a recovery maintenance wing, and four treatment pods.

PATIENTS

- Children, adolescence, and adults seeking treatment for mental health and substance use who are not an immediate threat to themselves or others.

STAFF

- Psychiatrist
- Psychologist
- Therapist
- Counselors
- Pharmacist
- Case Managers
- Occupational Therapist
- Administrative Personnel

Figure 94. Patients and Staff

PROGRAM SPECIFICATIONS	
THERAPIES	PATIENT SCHEDULE
○ Group	
○ Individual	
○ Family	
ACTIVITIES	
○ Movement	
○ Cooking	
○ Art	
○ Music	
EDUCATION	
○ Psycho-Education	
○ Medication Management	
○ Life skills building	
8:10	Check-In
8:30	Process Group
9:00	Daily Goal Setting
10:00	Activity
11:00	Individual Therapy
12:00	Lunch
1:00	Activity
1:30	Education
2:30	Group Therapy
3:30	End of Day

Figure 95. Program Specifications

PROGRAMMING

ID	Space Name	W	x	L	SQFT	QTY	NSF
Public Spaces							
	Waiting	12	x	10	120	2	240
	Patient Check-In	3	x	5	15	2	30
	Reception	10	x	10	100	2	200
	Check-in/ Work room	7	x	12	84	2	168
	Intake/ Assessment Office	12	x	10	120	2	240
	Testing	12	x	10	120	2	240
	Kitchen	15	x	16	240	1	240
	Activity/ Multi-Purpose Rooms	15	x	16	240	1	240
	Wellness Studio	15	x	16	240	1	240
	Toilet	9	x	7	63	4	252
Patient Spaces - Four Treatment Pods							
	Lounges	15	x	16	240	3	720
	Break area/ Kitchen	15	x	16	240	1	240
	Group Therapy Rooms	15	x	16	240	2	480
	Activity/ Multi-Purpose Rooms	15	x	16	240	1	240
	Kitchen	15	x	16	240	1	240
	Music Room	12	x	14	168	1	168
	Consult Rooms	12	x	10	120	2	240
	Quiet Rooms	9	x	7	63	2	126
	Mothers Room	9	x	7	63	1	63
	Patient Toilet	9	x	7	63	2	126
Private Spaces - Staff							
	Private Offices	10	x	10	100	10	1000
	Shared Office	12	x	12	144	6	864
	Collaborative Work Space/ Flex	10	x	12	120	6	720
	Relaxation/Reset Room	9	x	7	63	6	378
	Staff Toilet	9	x	7	63	6	378
	Mothers Room	9	x	7	63	2	126
	Breakroom	12	x	12	144	2	288
Recovery Maintenance							
	Private Offices	10	x	10	100	10	1000
	Collaborative Work Space/ Flex	10	x	12	120	2	240
	Exam Rooms	12	x	10	120	3	360
	Pharmacy	40	x	40	1600	1	1600
Building Services							
	IT	8	x	10	80	1	80
	Electrical	8	x	4	32	1	32
	Mechanical	15	x	15	225	1	225
	Janitor	6	x	6	36		36
	Storage	8	x	12	96	4	384
NET SQUARE FOOTAGE (NSF)							12444
Circulation/Structure (35%)							4355
GROSS SQUARE FEET (DGSF)							16799

Figure 96. Programming

4. RESULTS AND DISCUSSIONS

4.1. Final Project Description

Located in Fargo, North Dakota, MindWell Outpatient Mental Health and Substance Use Clinic is strategically positioned between Island Park and the Red River. While the city's initial development linked Island Park directly to the river, urban expansion over time replaced this connection with surface parking lots. Despite this, the area still offers an abundance of amenities, including walking paths, bike paths, tennis courts, the Island Park pool, basketball courts, and a skate park, providing ample opportunities for client engagement with the surrounding environment. In addition, this site was chosen for its proximity to both Inpatient and Outpatient Care facilities at Prairie St. Johns and Sanford Health. This location facilitates seamless transitions for patients moving from inpatient to outpatient care, enhancing the continuum of mental health services available within the community.

By extending its walking trails and vegetation throughout the site, the outpatient clinic aims to seamlessly blend with Island Park, as it once did. Trees and vegetation are strategically placed throughout the site to enhance the visual connection with nature for the occupants of the building. Additionally, a walking path was placed around the building strengthening patients' engagement with nature and providing a closer option to the clinic.

To effectively implement a patient and staff-centered design, it was imperative to understand the type of outpatient care the clinic will provide, the requirements for the different levels of care, the programming required, the patients and staff that will occupy the space, and most importantly the emotions the patient and staff go through daily. MindWell Healing Center offers three levels of outpatient care for mental health and substance use treatment to clients who are not at immediate risk to themselves or others. This outpatient clinic serves as an alternative to

inpatient care or as a transition from inpatient care back into the community. Structured programming is offered based on a clinical assessment and the client's needs. Programming is offered for children, adolescents, and adults 5 days per week. Staff that will be offered at the clinic include but are not limited to: psychiatrist, psychologist, therapist, counselors, pharmacist, case managers, occupational therapist, and administrative personnel.

The programs will offer a variety of therapies, activities, and educational classes to patients, including therapies (group, individual, and family), activities (movement, cooking, art, and music), and education (Psychoeducation, Medication Management, Life Skills Building, and educational accommodations for clients still attending school).

By understanding the levels of care, the patients and staff occupying the space, and the required programming, a foundation for the treatment pods was formed. The treatment pod layout was designed to promote patient comfort and privacy while facilitating staff collaboration and efficiency. As patients, family, friends, and community members enter the clinic, they are greeted by the receptionist. The process for patients checking in and navigating the clinic is outlined, emphasizing the importance of a supportive and welcoming environment for individuals seeking treatment.

The first level entails the reception and waiting areas, community spaces, recovery maintenance, and administration. Specific areas and functions on this level are detailed, including the incorporation of community spaces to reduce the stigma surrounding mental health treatment.

Moving up to level 2, patient spaces along with dedicated staff space for the staff in each treatment pod are situated. Each pod is separated by age and treatment type to provide

specialized care. The layout and function of patient and staff spaces are outlined to ensure efficiency and comfort.

The clinic's design incorporates biophilic principles to promote well-being and connection to nature. Key aspects of biophilic design, including visual connection to nature, thermal and airflow considerations, material connection to nature, and areas of refuge, are integrated throughout the clinic to enhance the therapeutic environment.

4.2. Project Objectives

The project aims to prioritize the physical, social, and psychological needs of occupants, ensuring patients and staff play a central role in the planning process. It seeks to integrate nature into the healing process by employing site selection and biophilic design principles, fostering a therapeutic environment that supports well-being and enhances treatment outcomes. Ultimately, the objective is to create an optimal healing environment that encourages active engagement in the healing journey for patients, while also improving satisfaction levels for both patients and staff.

4.3. Project Design and Documentation

4.3.1. Surrounding Context, Site Plan, and Exterior Renders

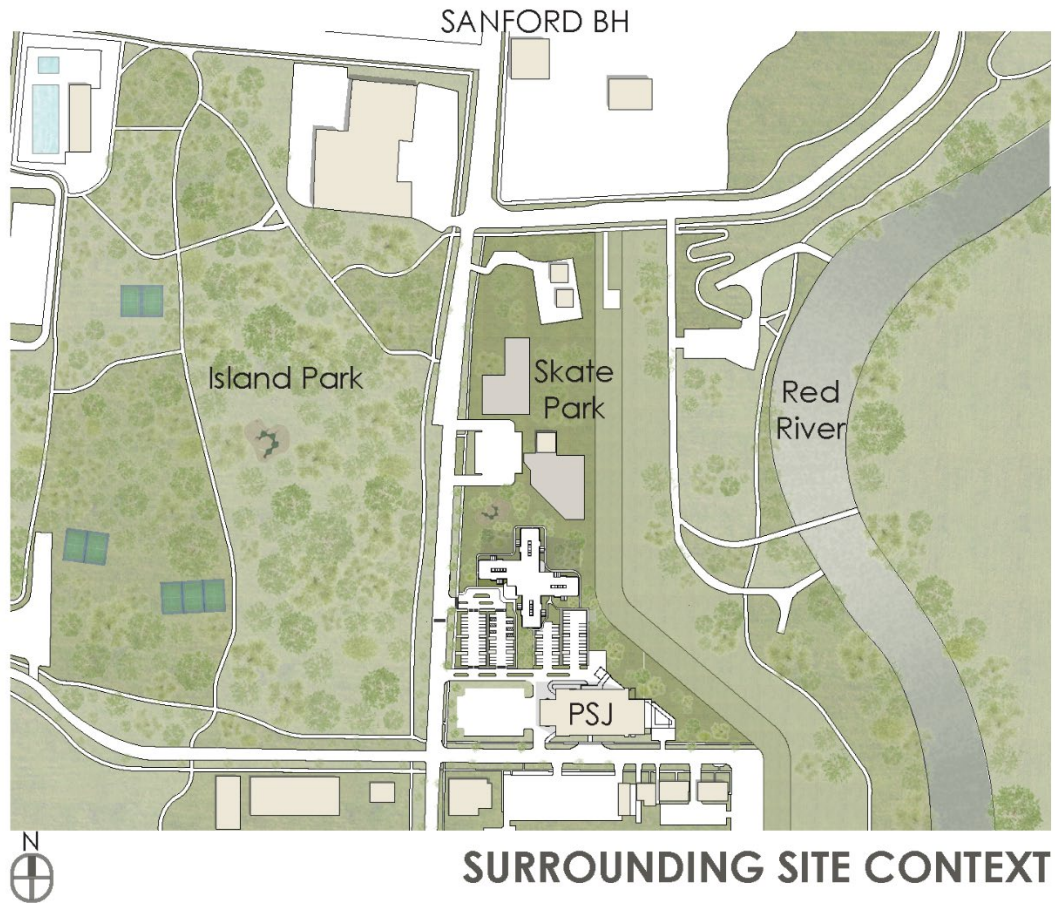


Figure 97. Surrounding Site Context

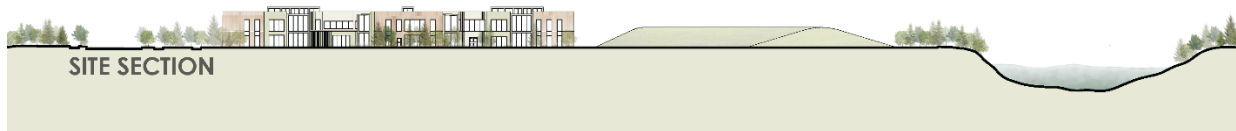


Figure 98. Site Section

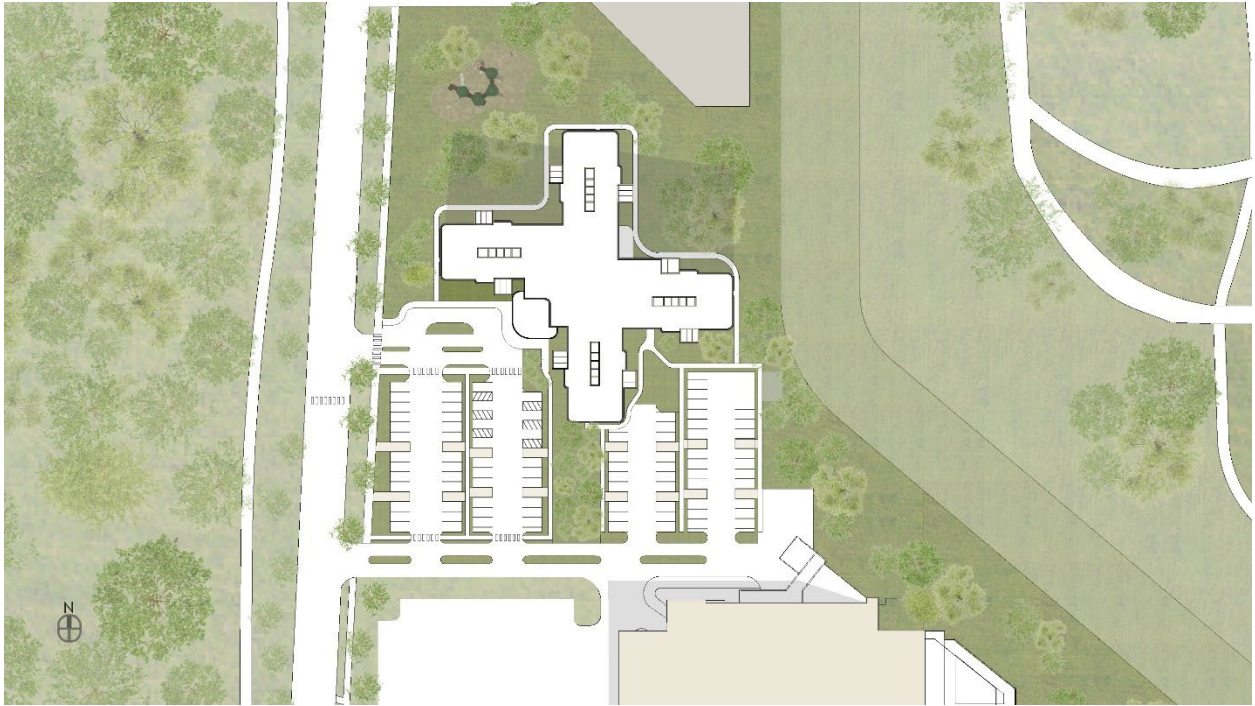


Figure 99. Enlarged Site Plan



Figure 100. Exterior Perspective Walking South Toward the Building Entrance



Figure 101. Exterior Perspective Walking Towards Main Entrance



Figure 102. Exterior Perspective of Walking Trail Around the Perimeter of the Clinic

Level One

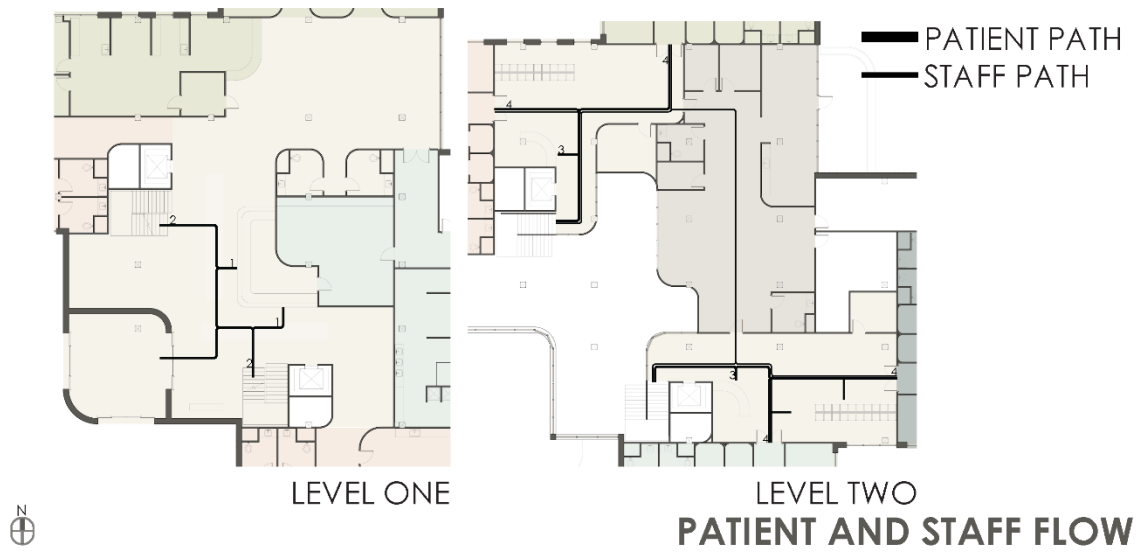


Figure 103. Patient and Staff Flow Plan



Figure 104. Interior Perspective of the Clinic Reception and Waiting Area

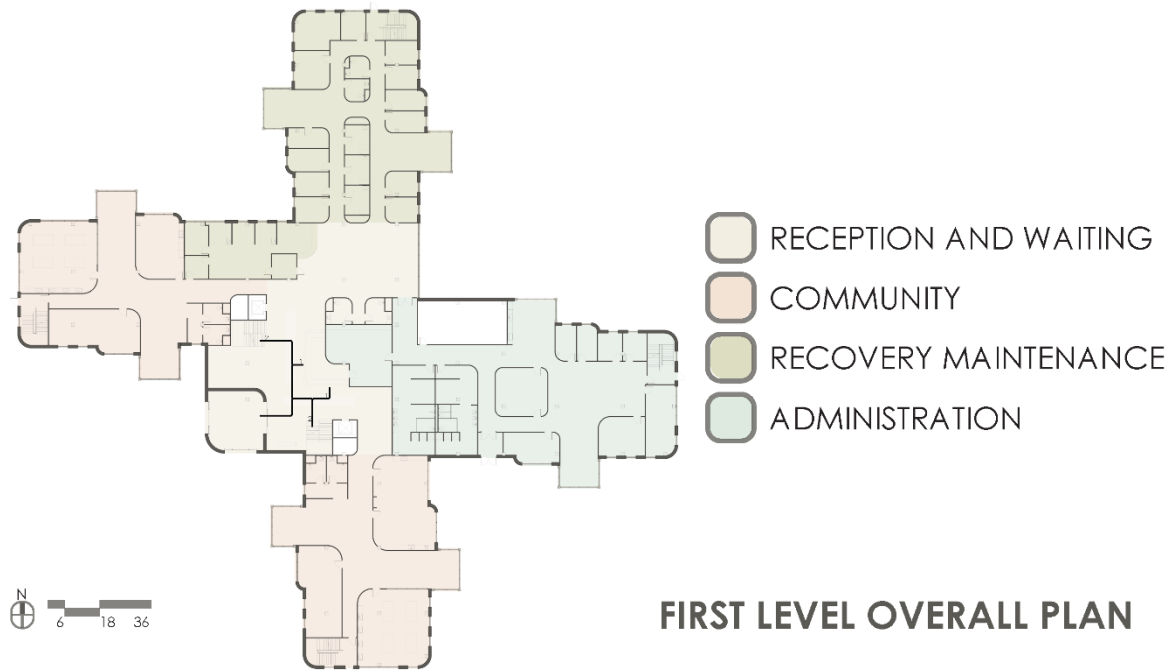


Figure 105. First Level Overall Plan

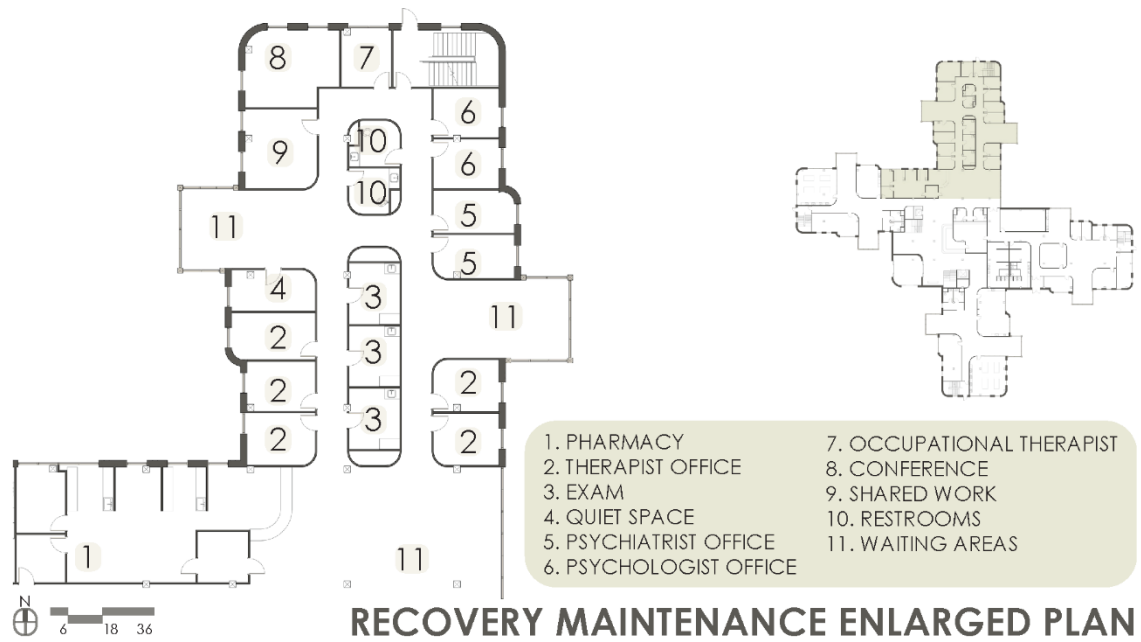


Figure 106. Recovery Maintenance Enlarged Plan



Figure 107. Community Space Enlarged Plan



Figure 108. Community Kitchen Interior Perspective



Figure 109. Community Wellness Studio Interior Perspective

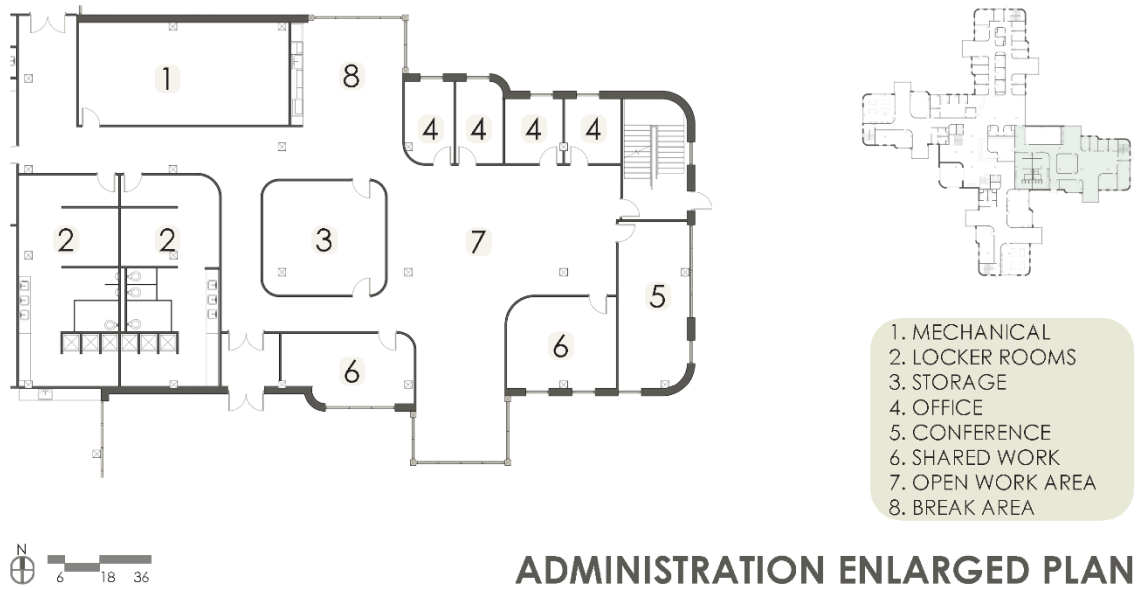


Figure 110. Administration Enlarged Plan

Level Two

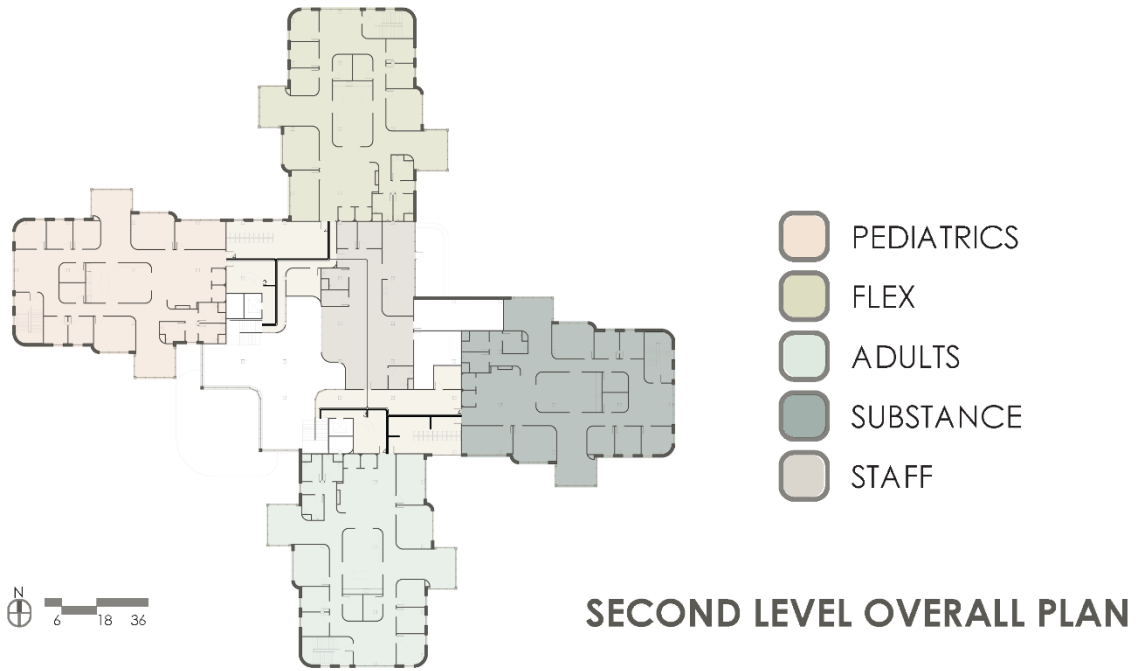


Figure 111. Second Level Overall Plan

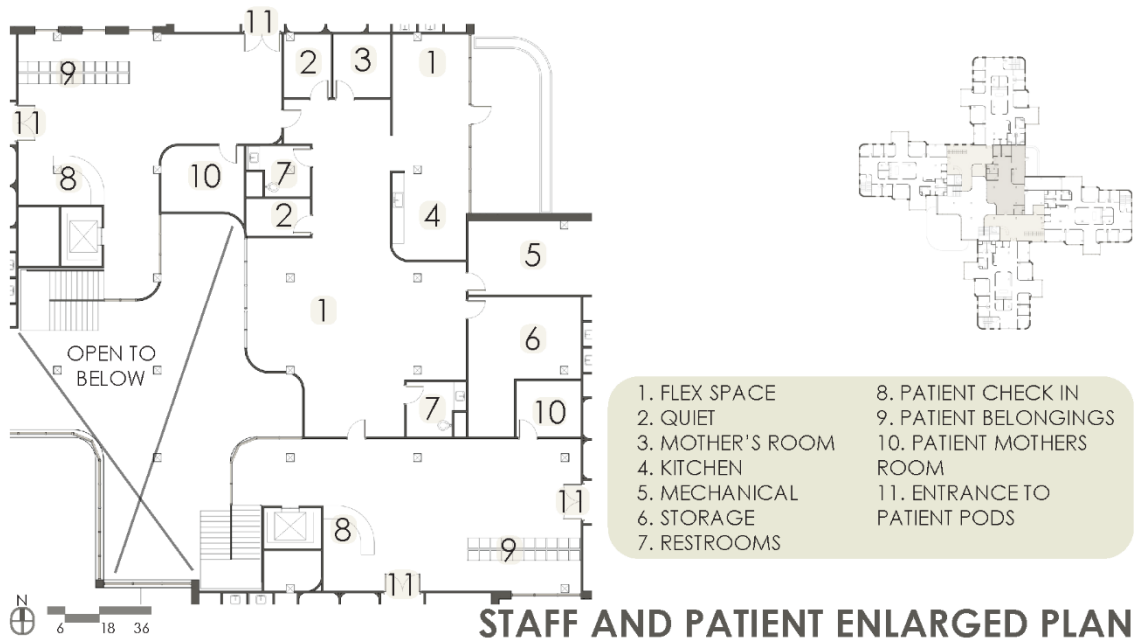


Figure 112. Staff and Patient Enlarged Plan

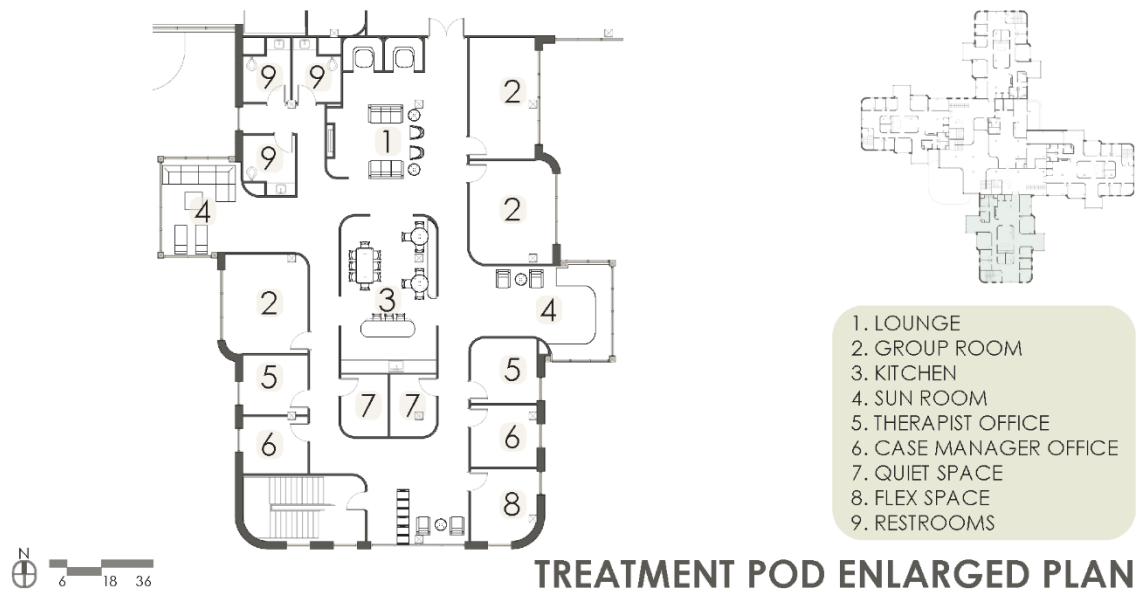


Figure 113. Treatment Pod Enlarged Plan



Figure 114. Patient Lounge Interior Perspective



Figure 115. Patient Kitchen Interior Perspective

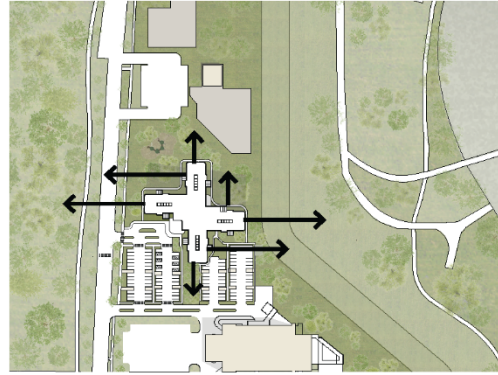


Figure 116. Patient Sun Room Interior Perspective

4.3.2. Implementation of Biophilic Design Principles

VISUAL CONNECTION TO NATURE

Benefits: Lowered blood pressure and heart rate. Along with improving mental engagement and attitude and overall happiness.



(Browning et al., 2014)

Figure 117. Visual Connection to Nature

THERMAL AND AIR FLOW

Benefits: Positively impacted heart rate, systolic blood pressure, and sympathetic nervous system activity. Also positively impacted concentration and improved perception of temporal and spatial pleasure.

(Browning et al., 2014)

Figure 118. Thermal and Air Flow

MATERIAL CONNECTION WITH NATURE

Benefits: Decreased diastolic blood pressure, improved creative performance, and improved comfort.



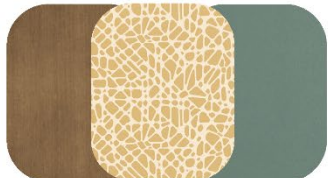
Wall Finishes



Floor Finishes



Furniture Finishes



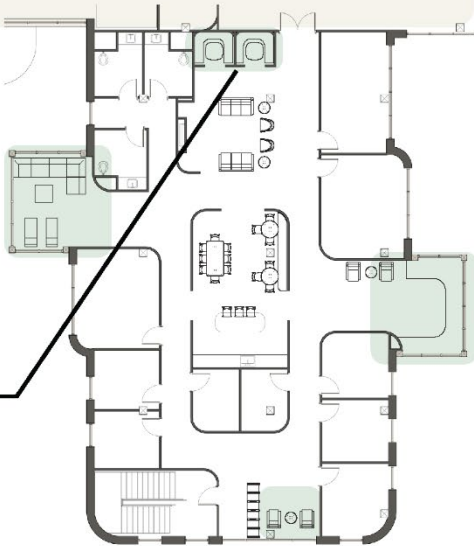
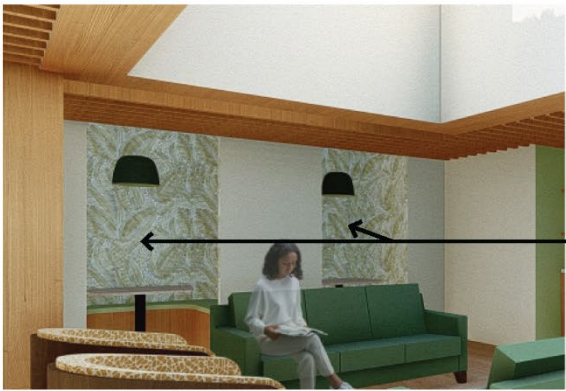
Furniture Finishes

(Browning et al., 2014)

Figure 119. Material Connection with Nature

REFUGE

Benefits: Improved concentration, attention, and perception of safety



(Browning et al., 2014)

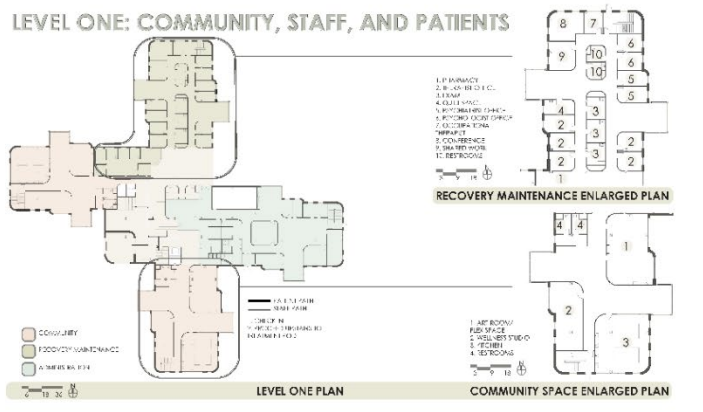
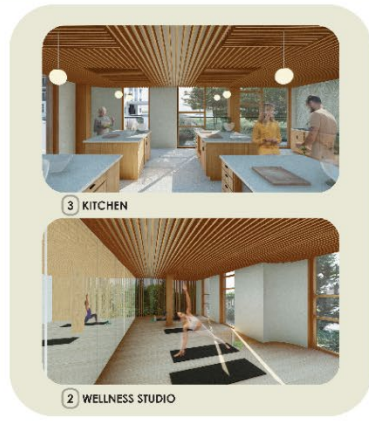
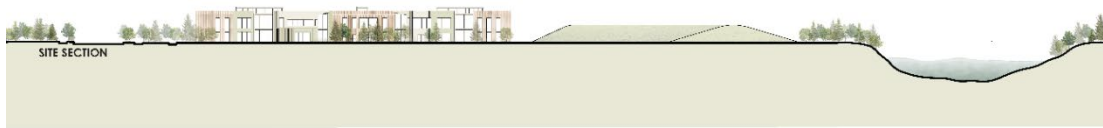
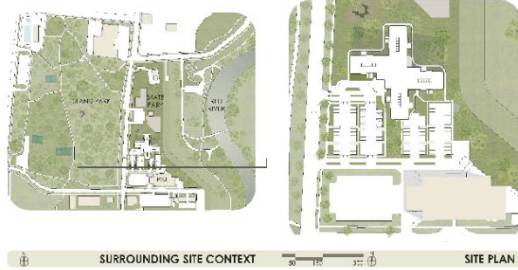
Figure 120. Refuge



MINDWELL HEALING CENTER

AN OUTPATIENT MENTAL HEALTH AND SUBSTANCE USE CLINIC

Located in Fargo, North Dakota, Mindwell Outpatient Mental and Substance Use Clinic sits between Island Park and the Red River. Offering an abundance of ways for patients to engage with the surrounding nature and community, this site has access to walking paths in Island Park and is next to the river, tennis courts, the island park pool, basketball courts, and the state park. South of the clinic is Parkview St. Johns, an inpatient behavioral health hospital, allowing for seamless transitions between inpatient and outpatient care. The site location is the heart of the project, strengthening objectives two and three by providing patients, staff, and the community with a holistic healing environment and ensuring a continuum of mental health and substance use treatment.



PROJECT OBJECTIVES

1. Implement a patient and staff-centered design
2. Incorporate nature into the healing process
3. Provide an optimal healing environment that allows patients to actively engage in their healing journey

OUTPATIENT MENTAL & SUBSTANCE TREATMENT

Mindwell Healing Center offers outpatient levels of care for mental health and substance use disorders. Structured programming is offered based on clinical assessment and client needs. Programming is offered 3 days per week. The following three levels of care are offered:

1. Partial Hospitalization Program (20 hours a week)
2. Intensive Outpatient Program (9 hours a week)
3. Recovery Maintenance, which supports individuals in sustaining progress post-program completion.

PROGRAM SPECIFICATIONS

THERAPIES	<ul style="list-style-type: none"> Group Individual Family
ACTIVITIES	<ul style="list-style-type: none"> Exercise Cooking Art Music
EDUCATION	<ul style="list-style-type: none"> Psycho-Education Medication Management Life skills building

PATIENT SCHEDULE
8:30 Check-in
8:30 Process Group
9:00 Daily Goal Setting
10:00 Activity
11:00 Individual Therapy
12:00 Lunch
1:00 Activity
1:30 Education
2:30 Group Therapy
3:30 End of Day

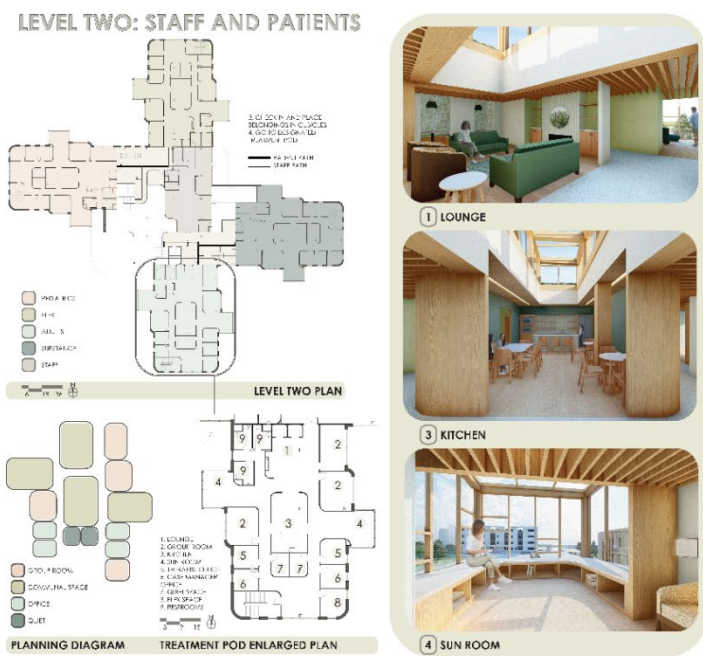


Figure 121. Final Presentation Board

4.4. Conclusion

In conclusion, future research could explore more ways to integrate nature into the building, such as using vegetation-containing products and materials. Additionally, a post-occupancy study could provide valuable insights into the project's effectiveness and areas for improvement.

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