The Phenomenal Chinook:
Experientially Bridging Architecture and Nature Through Wind Design in Lethbridge, Alberta

by

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Dalhousie University is located in Mi'kmaq'i,
the ancestral and unceded territory of the Mi'kmaq.
We are all Treaty people.

Contents

Abstract

In the Western world, we continue to perceive nature as separate from ourselves and the built environment, perpetuating the extinction of experience that distances environmental harm from the human domain. This thesis explores how designing sensitively with intense climates in built environments ignorant of these climates can confront this perception. Lethbridge, Alberta, is selected for its ignorance of the intense chinook wind, a climatic phenomenon neglected through a ‘brute force’ mentality towards materials, transportation, and building form, posing challenges to health and pedestrian connectivity. A bioclimatic approach is deployed, augmented by perceptual concepts of weathering, walking, and bracketing, to design a wellness centre and pedestrian walkway through the Lethbridge Viaduct that connects the city, wind, and river valley. Bridging architecture and the chinook technically and perceptively reveals the capability of sensitive climate design to cultivate nature experiences that can develop greater and more meaningful relationships to and care for nature.

Acknowledgements

We are all treaty people. I would like acknowledge the traditional indigenous territory in which this project is contextualized: Treaty 7 territory—the traditional and ancestral territory of the Blackfoot Confederacy: Kainai, Piikani and Siksika as well as the Tsuu T'ina Nation, Stoney Nako-da First Nation and Métis Nation of Alberta, Region 3. We respect the histories, languages, and cultures of First Nations, Metis, Inuit, and all First Peoples of Canada, whose presence continues to enrich our communities, educational contexts, and academic pursuits.

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Chapter 1: Introduction

As more people continue to move towards living in urban areas, there is an increasing imperative to design natural spaces as reprieve from the human made environment (Soga and Gaston 2016, 96). Rather than focusing on designing distinct and separate ‘natural’ spaces, this thesis argues for the potential of creating nature experiences through architecture by designing and sensitively connecting with climate both technically and perceptually. This approach is particularly important in places with climatic extremes because not only are these extremes often the essence of place but also tend to aggravate an opposition to architectural environments that are insensitive to them. One such example of this, and therefore where this thesis is positioned, is in Lethbridge, Alberta, where local winds are marvelously ferocious.

> The wind is a sea in Lethbridge, and usually by noon the tide rises and the city begins to flood . . . and for the first time I comprehend why the city climbed up out of the deep, protective Old Man River Valley and, despite its indenture to coal, built itself large on the unbounded and treeless prairie lying open to the distant mountains: it wanted the full blessing of the wind. (James and Wiebe 2002, 105–106)

Therefore, this thesis explores the wind, how to design with it as a natural force to create more sustainable built environments, and to connect us more intimately with nature. To do so, we follow Ian McHarg’s approach, considering nature a multi-dimensional process that acts on the physical world, plants, animals and also humans, positioning climate as a form of nature (McHarg 1971, 7).

This perspective challenges the western perception of nature as a separate entity from humans and our built environments. Although varying throughout western history

from personified deities, to commodified reprieve from our own built environments, nature has foundationally remained in binary opposition to ‘us.’ This perception at its core is a sustainability issue. When we live in built environments that are something other than the natural world, we have less ways to access, emotionally engage with, and experience nature. This lack of connection results in what’s called the ‘extinction of experience,’ described as a dissociation which leads to a loss of affinity and motivation to care for nature (Soga and Gaston 2016, 96). As people lose reverence for nature, their ability to act in environmentally meaningful ways diminishes, resulting in the perpetuated complacent environmental harm that we are facing today.

The expression of nature through the built environment is perhaps most evident in its response to local climate. Architecture can abruptly ignore the presence of a local climate, what I have termed ‘brute force,’ which tells us that our buildings are not part of their natural environment. This mentality is unfortunately generally accepted in the way our built environments are erected today. This thesis fundamentally challenges brute force through a new design method of relating and connecting to climate based on bioclimatic design. In juxtaposition to brute force designing, bioclimatic design celebrates the unique character of a natural climate by designing with it to both increase thermal and experiential comfort in and around buildings while exploiting its potential for renewable energy.

Prairie cities continue to extensively use the brute force pen to draw abrupt lines between the built and natural world. This line is particularly evident in Lethbridge, Alberta, a city located in the heart of the windiest region in Canada with minimal response to the wind. Here I spent many years

Damaged wind speed sign one hour outside of Lethbridge after a chinook gust of clocked at 181 km/hr. (Houck 2018)

‘experiencing’ the southwestern warm winds that would frequent hurricane-tier velocities. This climatic phenomenon called the ‘chinook’ is the result of cooped up dry mountain air releasing down the eastern slopes of the Rockies and out into the plains (Quaile 2001, 143). Living day to day in Lethbridge meant frequent confrontations with this wind. Its awesome power and grace that has shaped the stunning coulee landscapes, continues to tear through the ignorant city. The chinook beats upon the hard, flat walls of prairie facades, relentlessly tugging at windows and doors. Occasionally, a dislodged roof that hurricane ties could no longer keep down makes the news (Dhaliwal 2021). Plastic sidings and asphalt shingles can often be found strewn about the grasslands, plucked off suburban homes. Outdoor activities are scarce, hardly a moment for leisurely cycling; forget badminton. Walking outside means hair tied back or under a hat, a windbreaker, a rapid gate tilted toward the southwest. The only refuge can be found severed off from the outside in vehicles and buildings that try their hardest to endure the awesome chinook. The friction between the built environment and the wind is palpable at every scale, from material to building to urban.

Lethbridge today is expanding, but is bisected by a vast mile wide river valley, carved by the wind, and is crossed only by a majestic train bridge and two highways. For pedestrians, there is only one walkway, wind exposed and attached to the highway. West Lethbridge is rapidly growing with a large student and elderly population yet features mostly low-density single-family sprawl and strip malls. Due to the geographical separation from the core of the city and the low-density development ignorant of the wind, west side residents, and in particular, pedestrians, experience the wind as a confrontational force that isolates them from the rest of the city and each other. An architectural intervention is therefore positioned on the west side centred on wellness, designed to positively reframe the relationship to the wind by prioritizing pedestrians and creating mental and physical healing spaces that use the wind. This intervention, or wellness centre, is built into the valley edge near the Lethbridge Viaduct Train Bridge also anchoring west side downhill cycling subculture through a bicycle shop and

The Lethbridge Viaduct train bridge spanning the Old Man River Valley looking toward the south end of town. (Malefant 2021a)

gathering space. The second part of the intervention is a pedestrian walkway adapted into the train bridge. The bridge is chosen not only for its existing structure, but as a poetic icon symbolizing the intersection between humans and nature, worthy of contemplation. The walkway ties into the wellness centre and bicycle shop, connecting the east and west sides of the city for pedestrians while creating moments of sublime experience of the wind.

The project applies a bioclimatic approach that negotiates the wind through three tactics. These tactics are adapted to the wind, however, in principle, are translatable to other types of extreme climates like very rainy, hot, or cold ones. The first strategy is building form design to deflect wind away from habitable spaces, the second is building material choice to reduce the wind's intensity by using materials that flex with in the wind, and the third is building technologies to harvest wind for ventilation and energy. Expanding this approach beyond simply bioclimatic however, is a perceptual framework used augment and enhance the positive emotional experience of a climate by engaging with the users in a multi-sensory way. Three perceptual theories are deployed. First, weathering of regional materials is used to visually and haptically show the climate process. Second, walking as an innately experiential act is used to direct space for fast and slow rhythms, encouraging exploration in and out of the climate. And third, bracketing, isolating phenomena to focus on certain senses, is used to intensify particular climatic experiences. Together, this methodology forms a robust framework for designing with climate that is both technically and perceptively responsive.

Therefore, this thesis argues that a windy wellness centre and pedestrian adaptation of the Lethbridge Viaduct,

designed with this bioclimatic-sensory framework, can address city connectivity while reframing the wind as a positive, supportive, natural process, integral to the well-being of ourselves and our built environments. Through a project that exemplifies connecting with an intense climatic actor such as the chinook wind, this thesis intends to reveal how thoughtful consideration of the climate both technically and perceptively can create a new type of architecture that can confront the extinction of experience upheld by the brute force anti-climatic environments many of us live in today. After all, “Can we not create, from a beautiful natural landscape, an environment inhabited by man in which natural beauty is retained”? (McHarg 1971, 80)

Chapter 2: Nature, Architecture, Wind

Human-Nature Separation

Raymond Williams identifies Nature as, “the inherent force which directs either the world or human beings or both; (Williams 1983, 219). Similarly, Ian McHarg framed nature through a simple preposition: “beyond it being the physical material world, [we perceive] nature as a process, responsive to laws, and representing values and opportunities for human use” (McHarg 1971, 7). Nature is fluid and transformative, a viewpoint that challenges the accepted perception of the natural world is merely a snapshot of the intersecting processes and forces. Through this lens, McHarg brings a sensibility to design that incorporates ecosystemic processes such as the interactions of plants and animals, climatic forces (including winds, tides, precipitation etc.), into architectural planning.

This viewpoint considers how the process of nature intersects architecture over longer periods of time.

> McHarg’s vision . . . was that by living with rather than against the more powerful forces and flows of the natural world, humanity would gain a biocentric sense of place; and this, in the deepest sense, would replace the Brahmanic theologies and capital culture of consumption he held responsible for the environmental crises of the 1960’s. (Steiner, Weller, and M’Closkey 2019, 2)

In this thesis, nature is a process that permeates both the human ‘built’ environment and natural ‘given’ environment, rather than the typical Western sensibilities that identify nature as static and opposite to culture, humans, and their edifices. This disassociation is termed by Robert M. Pyle as the ‘extinction of experience,’ wherein the human experience

is either physically or perceptively segregated from nature. This division further facilitates neglect or apathy towards the natural world based on the ‘extinction’ of empathic experience, ostensibly creating a perceptive barrier towards environmental protection, sustainability, and preservation Ashcroft-Johnson, Mattingly, and Papaioannou state:

> When we view ourselves as completely separate from nature, we build barriers and create divisions seen nowhere in the natural realm. We divide ourselves from nature, isolated from the elements . . . . Streets and buildings are hard delineations; these physical barriers further separate humanity from nature and create boundaries that would not otherwise exist. (Ashcraft-Johnson, Mattingly, and Papaioannou 2017, 33)

This challenge presented in the built environment must be addressed with empathetic and deliberate design. Philip Jodidio has described architecture and nature as dialectical, particularly evident through relationship between architecture and climate. I propose that bioclimatic architecture can facilitate a synthesis between the built environment and the natural world. Bioclimatic design, that is, design with climate, can challenge the ‘extinction of experience’ and incorporate the processes of nature as climate into the built environment. This is especially impactful in built environments where, what I term ‘brute force’ architecture, stands in stark opposition to the natural world and further informs divisive sentiments between man and nature.

Our Western Perception of Nature

The Western world holds a culturally dominant perception that people and urban spaces are separate from nature and separate from it as a process (Ashcraft-Johnson, Mattingly, and Papaioannou 2017, 32). This perception is not surprising, as modern human neuroprocesses have evolutionarily developed to categorize phenomena into binary opposites:

life-death, east-west, good-bad, hot-cold, land-water, and so on (Tuan 1990, 16; Venturi, Brown, and Izenour 1972, 77). This is the default mindset when viewing nature as well; we perceive ourselves as ‘us’ and all of nature as ‘them’” (Ashcraft-Johnson, Mattingly, and Papaioannou 2017, 33). This mode of thinking creates hard boundaries where often our realities are composed of gradients and spectrums. The attempt to blur this binary division presents a significant challenge. However, by redefining nature as a ‘process,’ which intersects and parallel’s human development, we

The problematic binary perceptive divide between our built world and what we would consider ‘nature’ within the typical Western attitude. Illustration in collaboration with Tanner Fletcher. Left: (Fletcher 2016); right: (Zeller n.d.)

can confront both the physiological tendencies and the perceptive separation of the ‘human world’ and the ‘natural world’ in western culture.

In his work, *Nature*, Peter Coates describes Western attitudes towards nature in terms of “Homocentric and ‘anthropocentric,’ thinking (i.e., the separation of people and culture from nature, and culture’s elevation above nature)” (Coates 1998, 3). He first “defines the ‘Western World’ as Western Europe and North America” (Coates 1998, 2), choosing to only glancingly touch on indigenous peoples and the peoples of Eastern continents. When speaking of these groups he holds the opinion that their cultural sentiments parallel the dominant Western approach but are limited by geography, technology, and population.

Coates then begins his examination of Western philosophy in ancient Greece “Since ancient Greek thought provides the bedrock for the Western intellectual experience,” (Coates 1998, 23). For the ancient Greeks, nature was perceived in a number of different ways but regardless of ideas of the interconnectedness or interdependence of the natural world, “All the great Greek and Roman thinkers endorsed the righteousness of human control” (Coates 1998, 27). From a theological standpoint, although, “Greek deities were overwhelmingly nature based” (Coates 1998, 30) this relationship was categorized by dominion. Greek deities used their powers over nature to advance their own anthropocentric interests and there is little sense of nature as anything more than a means and even, “The vast majority of Greek (and Roman) trees and animals enjoyed no divine association so could be chopped down or killed with impunity” (Coates 1998, 31).

Of course, some Greek thinkers opposed religious convention, but it was only the Greek Stoics who first postured that living in harmony with nature, rather than dominion of it, was a core tenant of living virtuously. This sensibility, termed ‘natural theology’ by Coates, was dismissed by the impending Judeo-Christian religions but can be cited as a foundation from modern eco-centric and phenomenological thought.

Judeo-Christian religious views became dominant in the twelfth century CE and informed Western world view for centuries following. According to McHarg,

> The great western religions born of monotheism have been the major source of our moral attitudes… the biblical creation story of the first chapter of genesis, the source of the most generally accepted description of man’s role and powers, not only fails to correspond to reality as we observe it, but in its insistence upon dominion and subjugation of nature, encourages the most exploitative and destructive instincts in man rather than those that are deferential and creative. (McHarg 1971, 26)

This dominance of Judeo-Christian philosophy continued to be militantly enforced until the modernist era, where, “Early twentieth-Century existentialist philosophy, by attributing supreme freedom and autonomy to the individual, posited the widest distance between people and nature” (Coates, 2013, 7). Based on this extreme individualism, industrial humanity and the consumerist society exercised the exploitation of the natural environment without restraint. Coates references Northrop Frye who identifies the emergence of “Canadianness,’ in the 1860s as a polar reaction to the subsistence living and natural exploitation that characterized the Americas (Coates 1998, 108). This shift, however, did not facilitate a convergence of the man/nature dichotomy, but instead ‘fetishized’ pristine nature as the fulfillment of, “the white middle class’s ‘elitist’ quest for

a ‘wilderness experience’” (Coates 1998, 157); in essence a continuation of the sensibilities of the romantics whose, “sensibilities are most strikingly displayed in the perception of the countryside as a cure for urban ills” (Coates 1998, 34).

Even modern ecological approaches are organized on the principle that nature is a separate entity acted upon (even for sake of preservation) by humans. Post 1945, conservation, preservation and environmentalism articulated viewpoints on nature that only pertained to its value to humans. However, Coates argues for the biocentric viewpoint which values nature as having, “intrinsic non-resource value—even rights—simply because they exist” (Coates 1998, 14).

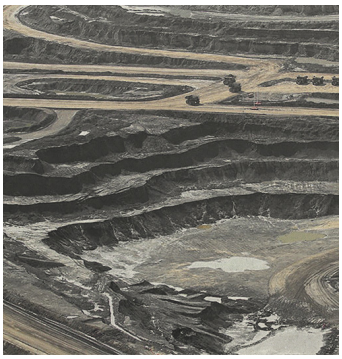
While tracing the long and complex history of nature in western perspectives helps us better understand the ingrained sensibilities we encounter today, Coates also offers a resolution. The inherent separation between man and nature can be addressed in two ways; realization of the intrinsic value of nature and viewing nature as a process. Even in the early-modernist erosion of the church, the emerging, “heliocentrism did not threaten human power over nature on earth. The scientific revolution, those who prefer a historical approach that stresses continuities [did]” (Coates 1998, 68–70). Coates notes the positive shift in modern ecology from, “the study of a singular, static, repetitive and universalistic system to one that is multiple, temporal, and complex” (Coates 1998, 188).

A Sustainability Issue

Precedent theses have explored the effects of the perceived separation of humans from nature in a number of ways, including; connecting to nature for spiritual nourishment and

place making (Hauser 2021); connection to wilderness to combat nature deficit disorder (Jolivet 2018); and connecting to nature for improvement in mental health (Prodor 2012). Building off these precedents, the perception of humans as separate from nature can be expressed as a sustainability issue as it relates to the ‘extinction of experience.’

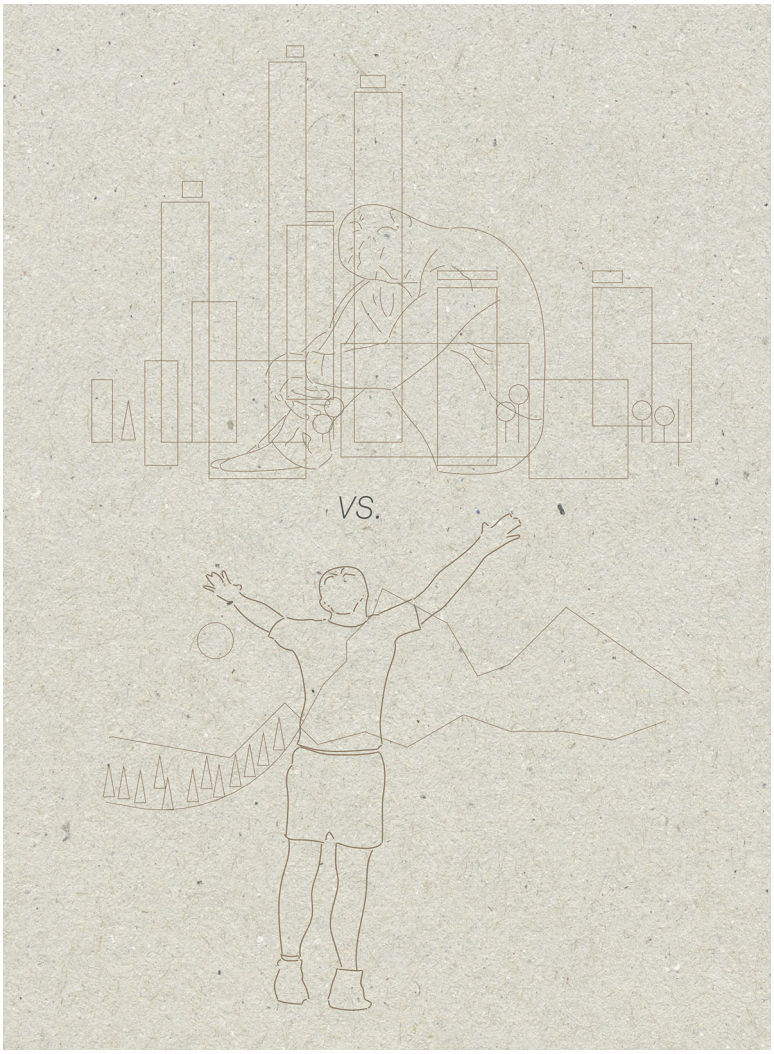
This distance can manifest in environmentally harmful ways, not necessarily out of intentional malice, but through environmental negligence (Ashcraft-Johnson, Mattingly, and Papaioannou 2017, 32). Ian McHarg condemns this divisive perception, exclaiming that it “encourages the most exploitative and destructive instincts in [humans] rather than those that are deferential and creative” (McHarg 1971, 26). For example, in northern Alberta, we have transformed landscapes into ones unrecognizable from their natural states in order to extract fossil fuels that we so often complacently disregard because their transformation occurred out of our sight.



Oil Sands in Northern Alberta strip mining. Some of the most environmentally destructive operations happen in Alberta. (Johnson 2012)

According to Pyle, “is not just about losing the personal benefits of the natural high. It also implies a cycle of disaffection that can have disastrous consequences” (Pyle 1993). Some of those consequences include “deteriorating public health and well-being, reduced emotional affinity toward nature, and a decline in pro-environmental attitudes and behavior” (Soga and Gaston 2016, 95). Pyle argues that personal affinity towards nature precipitates responsible behaviour (Pyle 2003, 206). That affinity can be achieved through meaningful engagement with natural forces, floras, and faunas, while the way we consume and waste material, drive big trucks and SUV’s, and build sprawl that displaces habitat, exacerbates our estrangement from nature (Pyle 2003, 207–10). Soga and Gaston, quoting

Miller, Balmford, and Cowling write that “the extinction of experience has increasingly been viewed . . . as one of the fundamental obstacles to reversing global environmental degradation” (Soga and Gaston 2016, 96). As Soga and Gaston note “Arguably, the root driver of the loss of human-nature interactions is the decline in opportunities to directly experience nature” (Soga and Gaston 2016, 96), creating an entry point for an architectural solution that introduces nature into the built environment.

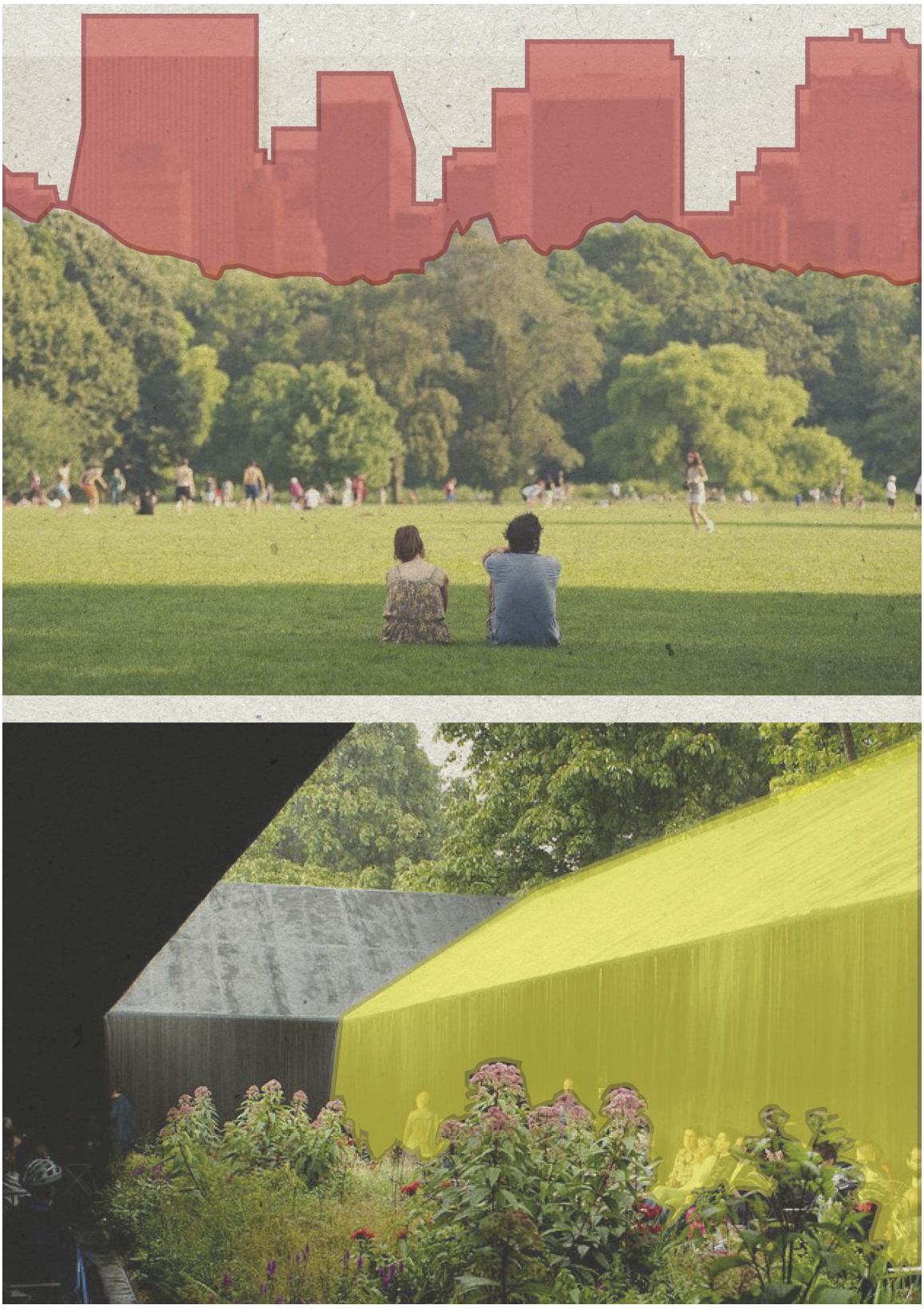


The negative effects of the ‘extinction of experience’ due to a built environment that feels nothing like nature. Illustration in collaboration with Tanner Fletcher.

The Architecture-Nature Dialectic

Architecture conveys perceptions of nature. In his work *Architecture: Nature*, Philip Jodidio frames architecture as the intersection between ‘culture’ and ‘nature’ through different examples of innate material origin and form as response to natural qualities of space and materials. He analyzes a breadth of architectural work from the Barcelona Pavilion to Swiss Alpine Bunkers to illustrate how, “architecture stands between nature and humans, and also expresses the tangible meeting point of climate and technology” (Portoghesi 2000, as cited in Demers and Potvin 2017, 326). Then, how we design our buildings has the ability to either bring nature to us or divide us from it. As Philip Ursprung states, “The Assumption that nature and architecture are able to live together in peaceful symbiosis—but ultimately are, nonetheless, two separate spheres—forms the basis for most projects that consider themselves to be ecological architecture” (Ursprung 2009, 19). In order to resolve this separation, the built environment can more actively engage with natural features, primarily landforms, materials, and most importantly, climate.

“[T]o my mind, the weather is an inseparable part of nature” (Horn 2007, 187). With climate being one of the most prevalent natural forces that architecture has been developed to accommodate (Manzano-Agugliaro et al. 2015, 738), the relationship between architecture and nature is particularly evident in the way that architecture responds to its regional climate (Pressman 1995, 49). For example, as the seasons change, architectural spaces experience different lighting qualities; temperatures fluctuate and affect spatial uses from inside to outside; rain and winds erode or patina materials; and snow-loads inform the shape of

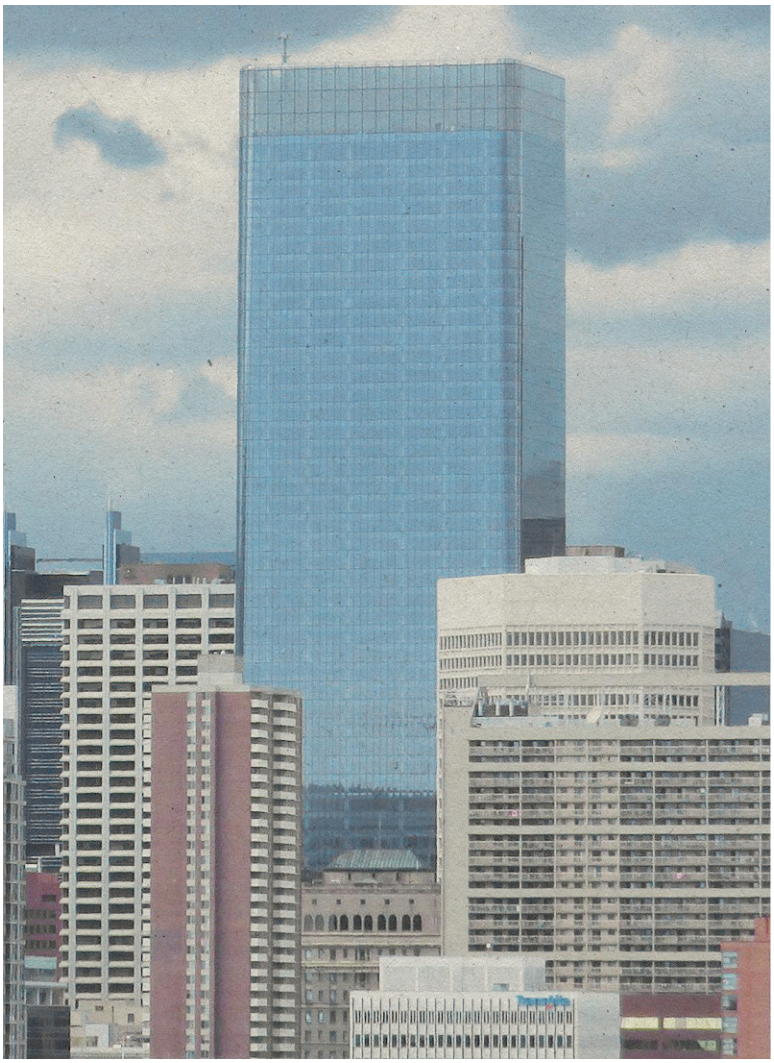


Cityscape in stark contrast to a parkscape further separating built and natural vs. Peter Zumthor's 2011 Serpentine Pavilion bringing climate in as a nature experience. Illustration in collaboration with Tanner Fletcher. Top: (Frenzy Tours 2015); bottom: (Kijek 2011)

roofs and canopies. Unfortunately, architecture is generally considered an opponent of climate, enforcing the perceived separation of our built environment from nature which perpetuates the extinction of experience.

Much Canadian architecture today is designed with a ‘brute force’ mentality regarding climate. ‘Brute force’ architecture is indifferent to the natural world, and made habitable only by continually expending energy and resources until it can endure a local climate regardless of its formal and material composition (Manzano-Agugliaro et al. 2015, 738). This is particularly evident in prairie designs that face extreme temperature variations, due to intense winds. An example of brute force design can be seen in the Brookfield Place tower in Calgary, Alberta. Note that there is no variation in facade relating to cardinal direction and the most shaded side is glazed identically to the most sunned side. The predominantly south-western wind hammers towers like these, shaking glass panels and creating wind tunnels at grade. In keeping with ‘brute force’ design, these towers are only made habitable by consuming copious amounts of energy. This can be seen in the structural design that requires excessive material consumption to counteract sheer forces from wind and the excessive energy consumption required to condition the building in winter and summer. Both of which express little or no relation to the unique prairie climate.

Bioclimatic design poses an opposite approach to that of ‘brute force’ design, by aligning with the regional environment. Bioclimatic design, a term coined by Olgyay in his 1976 work, is explained by E. Vazquez, et al. As a design theory that looks to the unique latent climatic opportunities of a particular place, allowing the architecture to adapt and shape to the climate, much like a natural landscape. It is a



Arney Fender Katsalidis; Dialog, Brookfield Place in downtown Calgary, Alberta, exemplifying brute force design. This glass tower does not reflect the unique character of the southern Prairie climate and could exist literally anywhere. (Malcolm 2017)

A bioclimatic dwelling in Tenerife by Ruiz Larrea y Asociados. Notice how it conveys and integrates with nature through form and material. (Ruiz Larrea y Asociados 2000)

“design [that] considers the natural terrain features (climate, fauna, flora, topography, among others), as variables for the development of design solutions, providing a balance between natural environment and built environment by selecting solutions from renewable energy sources (Energy efficiency), raw materials, and building systems with low environmental impact” (Vazquez et al. 2014, 6). The ‘Bioclimatic Dwelling’ in Tenerife by Ruiz Larrea y Asociados, demonstrates how unifying architecture and climate can create a palpable relation to nature through a building. The architectural form is a direct response to the wind; with the air entering into and ventilating the space, materials originating from the local site with lots of local planting providing further protection from the elements. This marriage of the natural and built environment through climate integration forms the strategic basis for bringing nature as a process into the built environment, thereby combatting the ‘extinction of experience’. It is ‘brute force’ design that this thesis is challenging as I argue it is the most significant force that upholds the perceived separation between humans and nature while causing the massive carbon footprints of our contemporary architecture today. Therefore, addressing brute force design is perhaps nowhere more applicable than in prairie cities for how little they respond to the extreme climatic phenomenon of the wind.

On Prairie Wind

In their work on Climate as an architectural instrument, Mareike Krautheim et al. argue that through designing with climate, architecture can not only protect us from the climate but also bring us back to it, a sentiment aligned with thesis and challenging the extinction of experience (Krautheim et al. 2014, 7). Although many climatic extremes

exist, wind in particular becomes the focus of this thesis. Wind deviates from other climatological factors due to its fast changing and unpredictable dynamism, making it particularly difficult to understand and work with, while also making it a most interesting phenomenon (Krautheim et al. 2014, 12). No where is the wind a more prevalent shifting and exciting natural process than in southern Alberta, where the *chinook*, a type of foehn wind, extensively carves hills, erodes valleys, flattens trees, directs plant growth, and shapes habitats. The chinook also affects our cities, and in turn, as it is such a sensory experience, it affects our health and wellness, social behaviours, how we gather, and how we connect with each other in urban space. In this sense

Wind behavior study of four typical forms found in the Lethbridge landscape: the coulee, the trestle, a building corner, and a building wall.

of influencing both humans in the made world and the form, plants, and animals in the given world, we can consider the chinook the natural essence of the prairies, the Genius Loci. The wind's behavior is ephemeral and hard to perceive. A study was conducted to understand how the wind behaves around four typical forms in southern Albertan towns, to gain insight into its fluid properties. In both natural and built forms, the wind is concentrated in certain areas and diffuse in others. Balance in these differentials seems to be the key to harmony with wind design. Designing architecture with this process of nature can then be the mode to integrate nature into the built environment, challenging the extinction of experience, an occurrence not frequented in prairie cities today.

The Chinook

In the simplest of terms, "wind is the movement of atmospheric gasses caused by differences in atmospheric pressure" (Krautheim et al. 2014, 40). In southern Alberta, pressure differentials generate southwestern wind speeds that can sometimes frequent hurricane tier gusts. This

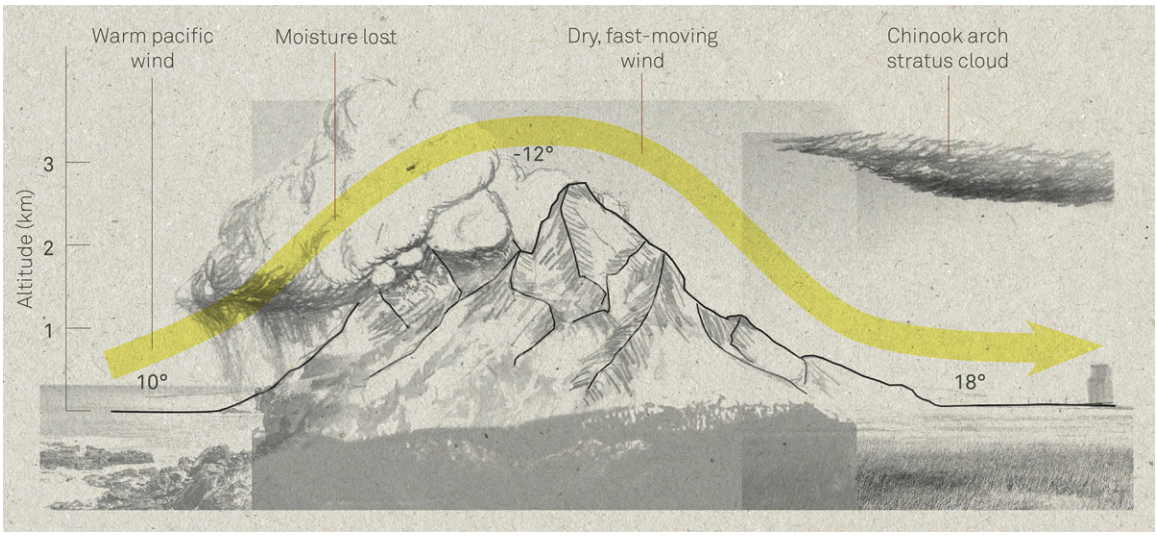


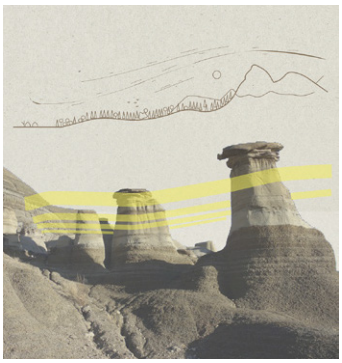
Diagram of the chinook indicating it's origin west of the Rocky Mountains. (Data from Quaile 2001, 144)

climatic phenomenon called the chinook is the result of humid air from the coastal west being pushed towards the Rocky Mountains. This damp air sheds its moisture on the windward west face of the mountains through a process called adiabatic cooling. As the air passes over the peaks of the Rockies, the air remains cool and dry. When it reaches the leeward east face of the mountains, this dry air descends, increasing in velocity and temperature as it expands out into the prairie. This compressional warming can raise the temperature of a chinook by tens of degrees Celsius, drastically changing local weather characteristics present in the prairies prior to its arrival (Quaile 2001, 143–145). The chinook, which is a type of Foehn wind, is therefore the single most influential climatological natural process responsible for shaping both the natural and cultural environments of the southwestern Canadian prairies.

Influence on the Landscape

The chinook profoundly influences the topographic features of the prairies. These warm, dry winds not only sculpt and

Aerial image of the coulees along the bends of the Old Man River Valley. Notice their prominent orientation in the southwest direction of the wind. (Google Maps 2022)



Hoodoos carved by the wind near Drumheller Alberta. (McNaughton 2017)

shape the landscape through aggressive soil erosion, but also direct the flows and accumulation of precipitation which in turn further erode and shape geological features. One example is presented in a nature guide by the Lethbridge Naturalists' Society, where they propose that the Old Man River's short tributary valleys called coulees, one of the most geologically striking natural features in southern Alberta, is in large part resultant from the chinook winds.

> [T]he average orientation of the coulees is approximately N70°E, existing mainly in the southern Alberta chinook belt. This relationship strongly suggests that the orientation of the features has somehow been determined by the direction of the strongest winds in the region. (Lethbridge Naturalists' Society 2011, 6)

Another snapshot of the wind as a natural process are the hoodoos near Drumheller, Alberta. These expressive sandstone megaliths are the product of years upon years of erosion from the wind, carving out the geological characters that have inspired indigenous beliefs and continue to attract sight seers and geological researchers today.

In addition to the land forms, what grows and lives on the landscape is largely due to the chinook wind. Since plants are so finely attuned to their climatic environments, they act as great indicators of the prominent natural forces of a landscape (Lethbridge Naturalists' Society 2011, 8). Grasses dominate the rolling hills of the prairies speckled by small dry shrubs such as milk-vetches, butte marigold, yellow umbrella plant, and others (although much prairie has been now sterilized by monocrop agriculture). Due to the ferocity of the chinook wind, anything larger and less capable of flexing in the wind would surely be uprooted. Many of these grasses and plants rely strongly on wind, incorporating it into their life cycle. For example, grassy crops like maize and wheat reproduce by wind pollination

(Krautheim et al. 2014, 48). Even more striking is the clear species divide between the north and south faces of coulee slopes due to the wind:

> [T]wo overriding factors determining the distribution of plant growth are slope direction and wind, especially the south-westerly chinook winds. It stands to reason that south-facing slopes are warmer, and therefore drier than north-facing slopes. Wind directions during the growing season are predominantly from the west-southwest, so slopes facing that way desiccate most, and those facing toward the north-east hold their moisture longest. (Bain 2014, 11)

The moisture content of the north slopes that also offer wind protection host species such as yarrow, prairie crocus, death camas, and prairie smoke. Towards the coulee and river valleys, the shelter, sediments, and ground moisture facilitate larger bushes and some trees to grow such as cottonwoods, dogwoods and poplars (Lethbridge Naturalists' Society 2011, 9). Also influential in these flora growth patterns is the atmospheric qualities the chinook precipitates.

Chinook is an indigenous word, roughly translating to 'snow-eater' (Quaile 2001, 144). This term is likely derived from the chinook's ability to clear away snowfall and freezing winter temperatures very quickly. Because the windy air is so dry

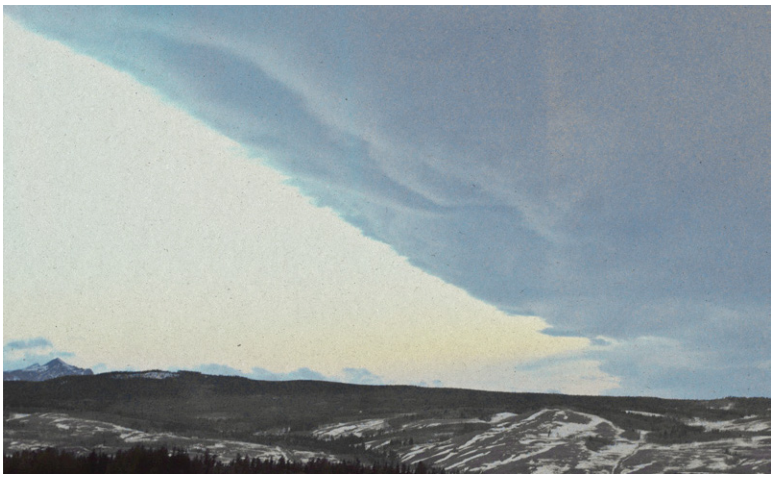


Photo of a chinook arch over the Albertan Foothills taken on January 26, 2011. (Borno 2011)

and warm, snowfall from low pressure systems can often be erased in a single day due to the sublimating effect a chinook has on the snow (Quaile 2001, 144). This makes for a fickle environment during the winter, facilitating habitation of multiple species that could not otherwise endure long dead winters. Another atmospheric effect that the chinook manifests is called the ‘chinook Arch.’ This is a stratus cloud sheet formation caused by the air in the prairies being forced upward by the chinook, cooling, and then condensing. This orographic lift may create the appearance of ominous weather, but a chinook arch is often harmless. Rather, it creates a unique visual character of the sky, exclaiming the approach of a chinook. Beyond its profound influence on shaping the landscape, the chinook also greatly affects our personal emotions and health, how we socialize, and our culture as a whole.

Influence on Southern Albertans

> Man in his daily life constantly responds to buildings, landscapes, trees and other elements of the non-human universe as much as he does to social experience. The openness of vast plains or seashores makes the body and mind different from what they would have become in the subdued light of forest clearings or mountain valleys. (Konya 1980, 7)

Wind, and in particular, the chinook, is a highly sensory experience, influencing our physical and emotional well-being. It is ephemeral and conceptualized through our physical engagement with it, having a direct effect on thermal comfort and experienced most directly through our largest sensory organ: the skin (Krautheim et al. 2014, 28). Through these sensory experiences, we construct emotional responses to the wind since sensing and emotion are so closely related (Rodaway 1994, 5). Since we cannot directly see wind, and instead feel it, integrating wind with

architecture provides a great opportunity to reconnect us to nature, because “sight is associated with western ego-consciousness and with the separation of humans from the rest of the world where the other senses unite us with the world around us” (Pallasmaa 2005, 25). Therefore, when wind is considered in architectural and urban design, negative emotional experiences can be mitigated such as anxiety from wind damage of materials, frustration from walking against the cold wind, or irritation from loud, startling, rushing or whistling noises on exterior facades. Aside from the chinook influencing our emotional well-being, the rapid temperature swings and pressure changes it induces tends to exacerbate existing health conditions (Pressman 1995, 51). Examples include joint pain associated with conditions such as arthritis, increased allergic responses resulting in dry and itchy eyes, sinuses, and skin (Manzano-Agugliaro et al. 2015, 741). In multiple cases, researchers today are exploring the link between migraine onset and chinook winds (Cooke, Rose, and Becker 2000, 302).

Aside from our well-being, wind also shapes our social and cultural behaviours. The wind is of great importance to many cultures around the world, often deified as an omnipresent yet invisible divine force, operating as mythical metaphor for life or breath (Krautheim et al. 2014, 58). There are even multiple indigenous cultural myths of the origin of the chinook form, indicating how wind and climate can form the basis for beliefs and the behaviors that follow. Although myths of wind are distant from southern Albertan culture today, the chinook still plays a key role in directing much of our social behavior. Certain sports and activities are not a possibility such as badminton, while kite flying is a common recreational activity seen in cities like Lethbridge. Outdoor

social spaces tend to be found on introverted and sheltered patios, rather than socialization occurring in public corridors where winds tend to be ferocious. And the southern Albertan winds also affect how people dress, from hair tied back or braided, to tightly woven jackets and thin, shell-like layers.

All to say, the chinook winds have a profound influence on both the well-being and behaviors of people living in windy southern Albertan cities. Through both shaping us and the natural landscapes that we inhabit, the omnipresent natural force that is the chinook wind could be considered the essence of the prairies, what Norberg-Schulz has referred to as the Genius Loci, or the character or atmosphere of a place. In discussing Genius loci, Vecco Identifies it as “a signifier of a process that is happening and cannot intentionally be created” and is a temporal function, changing over a day, or with the seasons, much like the chinook wind (Vecco 2020, 225–226).

In this chapter, we have reframed nature as a process that is perceptively captured in the physical matter around us, transforming over time and importantly, is a connecting

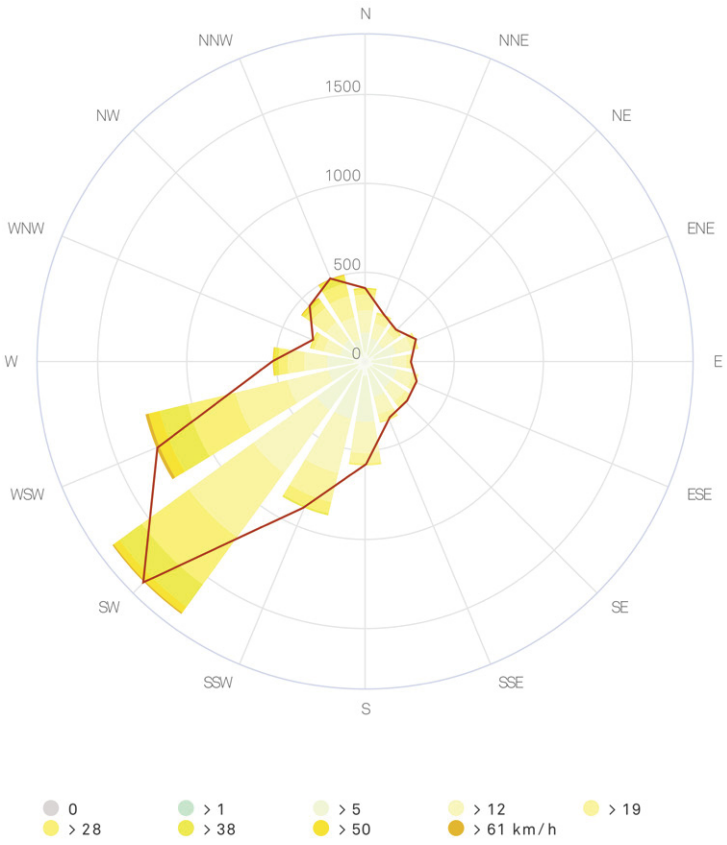
Collection of examples of wind shaping both human and natural character. Illustration in collaboration with Tanner Fletcher.

force to either be harmonized with or struggled against. In McHarg's words "let us abandon the simplicity of separation and give unity its due" (McHarg 1971, 5). This concept does not pervade our western world today. Instead, we encounter a divisive perception between us and nature as separate artifacts that manifests in our built environment. This division is a product of the cultural lineage fostered in west thought revolving around an ever present need to conquer, harness, and control nature rather than harmonize with it. The ignorance of nature as a continual process encompassing us and our built environments is perceptively drawing a line between us and nature today. Experiencing our built world as not nature increases our alienation from it, resulting in environmental apathy termed the extinction of experience, which at its root, is a sustainability issue. Because the "concepts of nature and architecture are not separate but instead, inseparably interlinked" (Ursprung 2009, 13), architecture situates in the role of addressing our relationship to nature. Rather than the typical approach of creating more green or natural spaces, which arguably separates the built and natural environments even further, this thesis aims to combat the extinction of experience by bringing nature as a process, into architecture by designing with climate through a bioclimatic approach since climate is one of the most significant natural formative processes. Of these processes, wind is explored due to its dynamic and unpredictable nature. No where is the wind more prevalent than in the southwestern prairies of southern Alberta where the chinook winds blow. These fast moving, warm and dry winds, sculpt the landscape through erosion and movement of moisture and precipitation. They influence the growth of plants and affect the clouds and weather patterns. Because

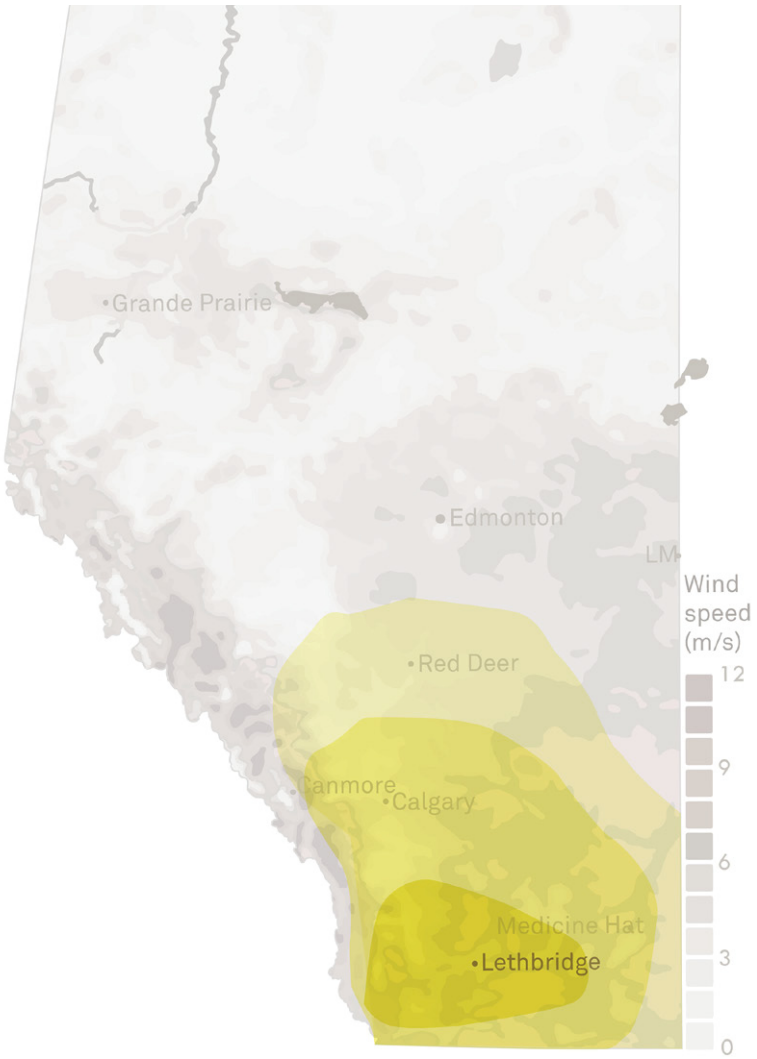
the chinook, and wind in general, is such a sensory experience, it also affects our mental health, our moods, and our behaviors, directing what types of activities we can do outside, what we wear, and how we gather, being the essence of the prairies, the Genius Loci. In the following chapter, we look at Lethbridge, Alberta: a city in the heart of chinook country for its particular lack of design with the wind and how an architectural response to the chinook could begin to catalyze a countering of the extinction of experience.

Chapter 3: Wind in Lethbridge

To learn of the evolution of physical and biological processes is an indispensable step towards the knowledge one needs before making changes to the land (McHarg 1971, 96). The chinook wind is the essential natural process of the prairies, the genius loci. Lethbridge, Alberta, provides the optimal urban context in which to position a project that challenges the 'extinction of experience' through harmonious climate design since its climatic force to be designed with is so clear. It is a powerful wind primarily from two directions. Lethbridge, a growing city of over 100,000 people, is located directly in the heart of chinook country and problematically neglects the influence of the wind. Lethbridge residents are subjected to the 'extinction of experience' where the wind



Wind rose for Lethbridge Alberta. Notice the intensity of wind from primarily two directions. (Metablue n.d.)



Map of Southern Alberta indicating chinook frequency. (Pierre cb 2006)

is an oppressive and divisive force of nature; the remedy of which is to design with it.

There are three main ways in which we experience the climate through the built environment: how materials react to a climate; transport systems, i.e., how we move through a climate in our built environment; and how building forms and shapes are situated in relation to the climate. These three mediums of building materials, movement, and situation, form the framework for the histories and processes of Lethbridge that have led to stark division of the built and natural windy

environment today. The city's geological and local material contrast against its current material palette failing to work with the characteristics of the wind; its transportation networks are car-centric, isolating motorist and segregating them; and the city's architectural forms follow popular and economic trends rather than strategies that are responsive to the wind. The 'brute force' mentality, present in these built responses to the wind, present sustainability issues such as material waste, carbon emissions from vehicle dependency, and building energy consumption. 'Brute force' design also reinforces the perceptive issue that Lethbridge is not a part of the surrounding nature but in conflict with it. An architectural intervention that observes these three factors and aligns with bioclimatic design addresses sustainability issues and divisive perceptions.

The proposed development will be situated on the west side of the Lethbridge Viaduct train bridge and includes a pedestrian viaduct that is integrated into the existing bridge structure. This location is chosen for its consolidation of natural features such as the exposure to the wind and relationship to the river valley, as well as cultural features such as the need for community space on the west side of Lethbridge and physical and metaphorical 'bridging' the two sides of the city.

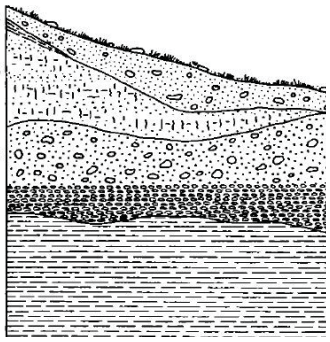
Materiality Ignores the Wind

Lethbridge is situated on the Old Man River Valley and coulees. These landscapes are composed of stereotomic materials that have been shaped and/or exposed by climate and wind. Tectonic materials like timber are available, however, in naturally smaller sized members more suited for cladding and facades than structural applications. Despite

this, these natural materials have not been integrated in the immediate built environment. Contemporary architectural materials do not respond to the intensity of the chinook. As a result, chinook winds often result in damage and accelerated wear, requiring continual replacement. Not only does this reinforce the perception of the wind as a negative force, but the damage produces waste and, as materials are often being shipped in from far away, increases the carbon footprint of the structure. Rather than engaging the wind through materiality, planned weathering, and patinas, these building materials juxtapose the natural materials surrounding the city.

Material History

The easterly flowing, Old Man River that bisects the city of Lethbridge, carved much of the coulee valleys throughout southern Alberta. 12–15,000 years ago, marked the last glacial activity in the region whereby the ice sheets inhabited the river valley and forcibly back-flowed the Old Man River, creating the undulating pattern of meanders seen today (Lethbridge Naturalists' Society 2011, 6). With the ice receded and the landscape returning to a semi-arid climate, the exposed valley faces revealed a profile of geological history. A red and blue shale and sandstone bedrock lays the foundation for the prairies and valleys. Bedrock outcrops along steep slopes of the Old Man River Valley were sometimes mined for shale—as a by-product of coal mining. "Overlying the bedrock there is a . . . layer of sand, gravel and small boulders, which was carried by rivers over shallow ice from the eroding Rocky Mountains" (Johnston and Otter 1985, 13). These layers have traditionally been mined for sands and aggregates. The sheet above this till



Geological section near Lethbridge, AB. Cretaceous shale overlaid by:
1. 10–15 feet of quartzite gravel;
2. 25–30 feet of pre-Wisconsin till of Keewatin ice sheet;
3. 0–50 feet of loess and wind-blown sands overlaid by laminate silt;
4. 3–13 feet of Wisconsin till of Keewatin ice sheet.

(Alden 1932)

is formed of a heavy, compressed clay. These wet clays, a foundational material of southern Alberta, have been used in the production of brick and ceramic. The gravel floor of the receded Old Man River also provided a seemingly endless reserve of gravel. Finally, the post-glacial landforms, coupled with wind erosion of the exposed soils, revealed dramatic coal seams that later led to the settlement of the area.

During the advent of Lethbridge, many of the natural stereotomic materials, such as brick and stone, were often used as the foundation of euro-centric designs. Tectonic construction materials, however, tended to be prolifically shipped into the city. Aside from a slim selection of poplars and cottonwoods that only grew in the river valley, and the spindly brush on the north faces of coulees, there was a relative shortage of tectonic construction materials. Lumber had to come from Montana; prices in Lethbridge were about $16–16.50 per 1000 feet. With inflation being about $350–400.00 today (Johnston and Otter 1985, 13). This lumber was also subject to deformation from rapid drying when exposed to the hot, dry chinooks of Lethbridge. As the city established, the materiality of its architectural exteriors expressed global trends that did not consider regional environments. A prime example is the Beaux Arts style of the post office which is comprised of glass, iron, and a classical-emulating stone façade. Increasing access to standardized construction materials drove the material palette of the city rather than regional characteristics.

Lethbridge City Hall indicating contemporary material palette. (Karst 2021)

Material in the City Today

Today, materials such as concrete, asphalt, and a myriad of plastic composites are utilized through standardized building practices. As they do not account for the regional

climate, these materials neglect the impact of the chinook. Vinyl siding and asphalt shingles often get plucked off houses and strewn into the coulees. These materials require continual replacement which produces substantial waste in both the materials themselves and the impact of transport and manufacturing. David Pearson states, “To extract, process, manufacture, and transport the materials needed for building and living uses enormous energy” (Pearson 1994, 71–72). Even landscaping, supposedly part of the natural environment, is usually maladapted with the regional climate. For example, non-native trees can become hazards in the ferocious winds as they frequently snap and cause

Collection of examples contrasting the natural materials of the river valley with the human made materials of the city.

damage. Because the built environment of Lethbridge is composed mostly of materials with a high carbon footprint, large quantities of energy are frivolously expended.

Through this incompatibility, these materials uphold the perceptive issue that our built environments are separate from nature. This artificial quality of the materials currently used in Lethbridge is, in part, due to their oversight of the wind and its affects. Materials seem lifeless, flimsy, or feeble against the dynamic force the wind which presents as ephemeral, invisible, and transitory. This clashing of materiality and climate is therefore disorienting and dissociative. Pallasmaa argues that materials such as mirrored glass, have no responsiveness to local environments and are devoid of sensory experience beyond the eye. These types of materials make buildings difficult to understand or relate to, "enforcing the alienating feelings of buildings today" (Pallasmaa 2005, 31). The disconnection between materials and the wind in Lethbridge creates spaces that feel dislocated from the natural environmental spaces in which they are contextualized (Soga and Gaston 2016, 96). Additionally, there is psychological stress caused by the wind; when the wind tears off materials off a house or breaks the branches off a tree, the homeowner or occupant is bound to anxiety, anger, or fear. The association of a negative psychological experience with windy days reinforces a mental opposition toward the wind and the natural environment by extension. In this way, non-responsive materiality in the built environment amplifies the 'extinction of experience.'

Transportation Ignores the Wind

European settlement and car culture transformed Lethbridge into a community dependent on the automobile. As

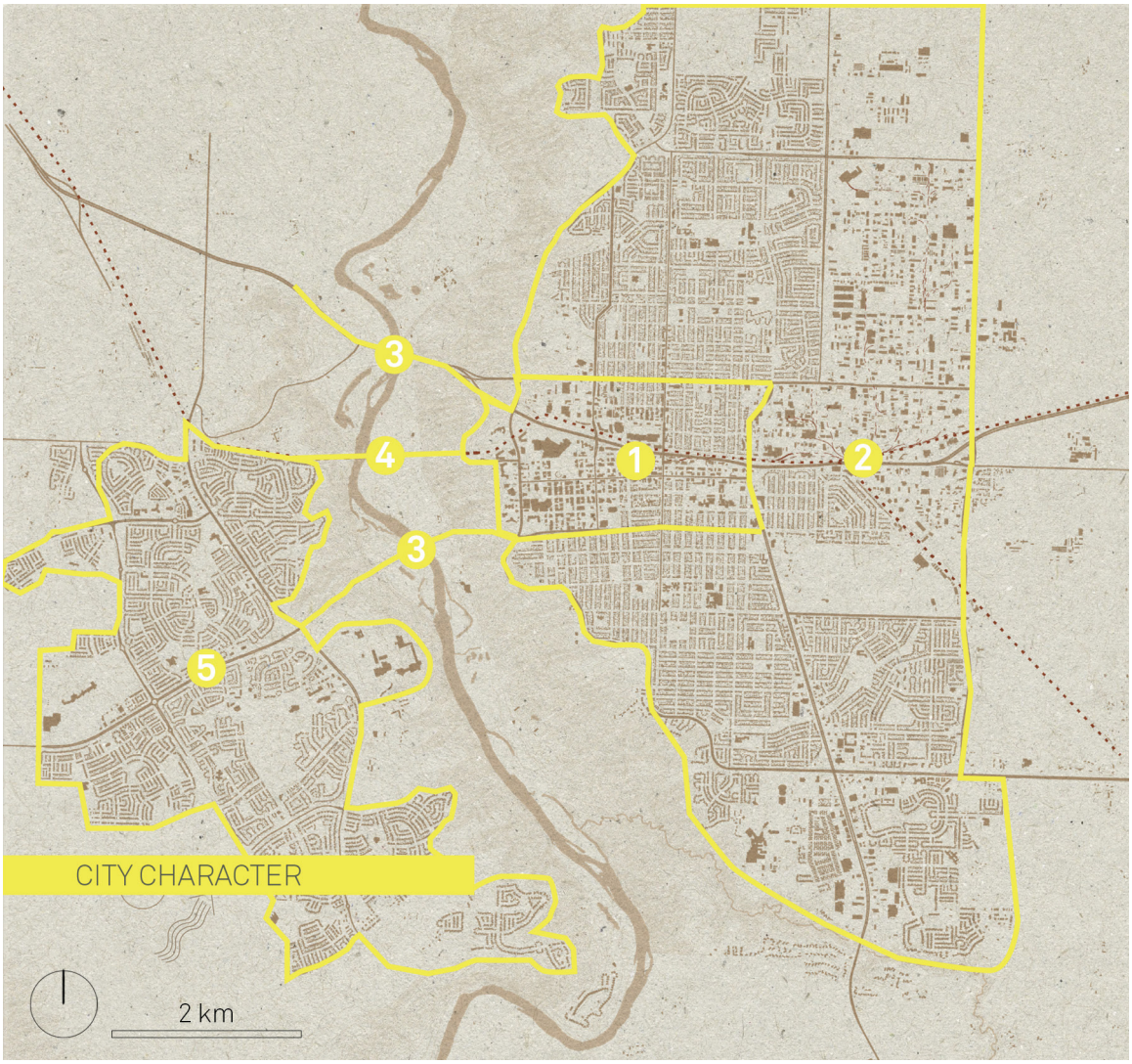
infrastructure developed around the car, the city sprawled west across the river, creating a large bisection between the east and west sides. Despite increasing awareness of the benefits of pedestrian travel, the city today continues to expand, primarily through extensive suburban development, particularly notable on the west side of the river valley. The combination of urban sprawl, little sheltered area, a single, highly exposed pedestrian bridge across the river valley, and frequent, high velocity chinook winds makes pedestrian modes of transport like walking and cycling unfeasible. This lack of pedestrian-oriented infrastructure makes owning a motor vehicle a necessity, contributing to traffic congestion and increased collective emissions. Additionally, pedestrian modes of transport are highly experiential. This dependency on sensory deprivation tanks, called cars, perceptively separates users even further from the wind, from natural processes, of which we and our urban spaces are much a part (Wunderlich 2008, 125).

Transportation History

Prior to colonialization, the prairies and river valleys were a landscape of walking. The indigenous peoples of the area that is now Lethbridge had subsisted off the natural resources of the area through a nomadic lifestyle since the early-prehistoric era. Closely preceding the arrival of colonizers, the landscape was inhabited by various indigenous groups such as the Kainai, Piikani and Siksika as well as the Tsuu T'ina and Stoney Nako-da First Nations who, "were perfectly adapted to this vast, open landscape . . . they were nomads who roamed the plains in summer and sheltered in the river valleys in winter" (Johnston and Otter 1985, 24). There was no agriculture in the region because, "although the land on which Lethbridge was founded is

fertile, the scarcity of rain and the presence of desiccating winds permitted only the growth of hardy grasses . . . [that] . . . flourished and fed large numbers of animals" (Johnston and Otter 1985, 61). Therefore, the nomadic peoples made best use of the mildness of the climate, largely due to the chinook winds, to facilitate a hunter-gatherer subsistence living that thrived even in the dead of winter.

Upon the arrival of colonizers, agrarian practices, and mining operations fragmented the nomadic networks. When abundant coal in the area attracted substantial settlement in



Map of Lethbridge indicating areas of the city separated by character. (Data from City of Lethbridge 2019)

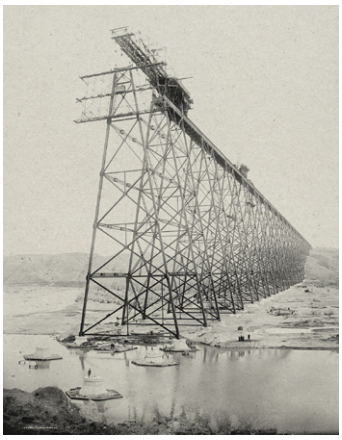
View of the city of Lethbridge, 1911. (Esplanade Arts and Heritage Centre n.d.)

Older residential suburb in north Lethbridge. (Google Maps 2019)

Whoop Up Drive in the spring time. Photo taken by Sam Borsato. (Borsato 2021)

The Lethbridge Viaduct. (Malefant 2021b)

Suburban sprawl on the west side. (Colliers International 2021)



Lethbridge Viaduct under construction at tower 24. (United States Library of Congress's Prints and Photographs n.d.)

1885, Lethbridge was founded by the North Western Coal and Navigation Company Ltd. It had then, for its own benefit, surveyed the land and laid out wide, straight streets (a prairie custom) based off a European grid structure (Johnston, Dogterom, and Ellis 1997, 15). This cold and functional layout offered no wind protection or amenities. Without civic government, there were "no sidewalks, no street lighting, no water or sewage facilities, and no protection against fire." In addition to being filthy and filled with detritus, the climate and soil conditions led to streets and public spaces being, "dusty when dry and quagmires when wet" (Johnston, Dogterom, and Ellis 1997, 9).

Lethbridge was legally incorporated as a city in 1906 and the business owners who established the settlement readily became members of the new municipal government. A development boom in the city characterized early Lethbridge and the city lobbied for significant investment projects. One such investment was the re-routing of the Canadian Pacific Rail to cross the mile long river valley in Lethbridge. In 1907, the CPR consolidated it's twenty river and valley crossings throughout southern Alberta (at the time comprised of rickety wood trestle bridges that were in disrepair only seven years after completion due to poor responsiveness to climate) to the Lethbridge Viaduct, or High-Level Bridge. Completed in 1909 (Ruttan 2018), this steel, thirty-three tower mega-bridge replaced the old wandering southern route, providing a more direct connection from Lethbridge to Fort Macleod. Ironically, the High-Level Bridge is one of the most responsive structures to the wind today. Additionally, it remains the longest and tallest of its kind in the world, being over 1.6 km long and 96 m tall. During the original planning, there was much demand for a 'driveway' to be coupled

Postcard of fifth street south, Lethbridge, Alberta. (Peel Postcard Library c. 1940)

with the rail bridge which would facilitate horse, cart, and pedestrian crossing as an alternative to plunging into the valley and crossing the river on a ferry. Although originally considered, “hopes for the traffic bridge, slim from the start, finally faded all together.” Valley crossing remained arduous until the late 20th century when Highway 3 and Whoop-up Drive were constructed (Johnston 2008, 11).

Automobiles were exciting advancement at the turn of the 20th century. While purchased rarely at first, and by only the affluent commodities owners, they were well accommodated by the wide, flat downtown streets. By 1907 there were only six automobiles, but nonetheless there was a garage, a budding manufacturer, and an automobile club founded that same year (Johnston and Otter 1985, 74). “[B]y 1955 the car had become a social phenomenon” and “as the supply of American cars became more plentiful . . . Lethbridgians became totally dependent upon their autos, driving to the corner store for a package of cigarettes or, on weekends, hundreds of miles” (Johnston and Otter 1985, 160). This dependence on vehicles characterized the next several decades of development as Lethbridge expanded exponentially.

Up until 1958, private investors had mostly free reign on development, growing the city based on individual interest rather than following a development plan. The greatest proponent of this expansion was the unused land reserves available on the south side of the river. Lethbridge finally established an accountable board for city planning and development in the 1950s, but there were few concrete results until as late as 1958. The city plan, still based in the commercially focused mindset of Lethbridge’s origin, focused on three distinct principals:

I. “Recognition of the downtown area as the commercial core of the city. Consequently, the various plans promoted increased accessibility to the downtown area by roadway;”

II. “Incorporate the river valley into the urban fabric by using its recreational potential and by preserving its natural characteristics;”

III. “Balance city development by expanding west of the river so that downtown and river valley became centrally located and easily accessible” (Johnston and Otter 1985, 176).

All three of these principals made citizens heavily reliant on vehicles for transport and accessibility. Specifically, the west side of the Old Man River was sparsely settled and difficult to access. Even with the Highway 3 bridge built in 1947, it was not until the University of Lethbridge was built in 1971 and Whoop up Drive being built in 1975 that development on the west side exploded (Province of Alberta 2019).

The population of the west Lethbridge now exceeds that of the north and south with 40,000+ residents (Therien 2021). To keep pace with the expansion, city planning allowed developers full liberty; the “expansion west of the Old Man River was a ‘planner’s dream,’ an unprecedented opportunity to lay out residential districts, unencumbered by previously built structures” (Johnston and Otter 1985, 208). Because of this, west Lethbridge is distinctly different from the grid-like south and north. Developers opted for a curvilinear suburban structure whereby arterial roads encircle residential blocks which in turn group single-family dwellings in winding streets that are packed with crescents and cul-de-sacs (Johnston and Otter 1985, 208).

Transportation in the City Today

Lethbridge has been car-centric and commercial oriented nearly since its founding. Planning that has neglected the wind has in turn, neglected those who wish to travel on foot or bicycle. This is especially evident in the disconnection of the highly residential west Lethbridge from the city centre in south Lethbridge. The west side is characterized by developer sprawl and is divided from the rest of the city by the vast and windy river valley. There remains only a single east/west pedestrian bridge within the city, grafted onto Whoop-up Drive, and fully exposed to the wind. Since “wind acceleration in urban environments considerably affects pedestrian dynamic and thermal comfort” (Demers and Potvin 2017, 330), Lethbridge today is not easily traversable on foot based on this east/ west divide and the car-oriented sprawl with the lack of wind sheltered walkable area. At “walkscore.com,” a website that rates the ‘walkability’ of cities, Lethbridge scores very low and is described as a car-dependent city with minimal bike infrastructure. David Sim references Jan Gehl’s stance that human beings are biologically designed for walking when he notes that ‘walkability’ should be about the ease and comfort of walking (Sim 2019, 105). This lack of ‘walkability’ in Lethbridge is isolating, unsustainable, and further divides the built environment from the processes of nature.

Because “The pace of walking allows for a rich sensory experience, promoting social interactions as well as connections to the surrounding environment” (Sim 2019, 105), this lack of walking, reduces exposure and opportunity to directly engage with the wind in meaningful ways. A pedestrian in Lethbridge is confronted by the violence of the wind in exposed public spaces where wind was not

accounted for in design. In this context, the wind becomes overwhelming and frustrating: negative emotional responses that designate the wind as an opponent, wishing it out of existence. So instead they drive, “site seeing behind the tinted windows of a coach [which] severs man from nature” (Tuan 1990, 96).

Building Situation Ignores the Wind

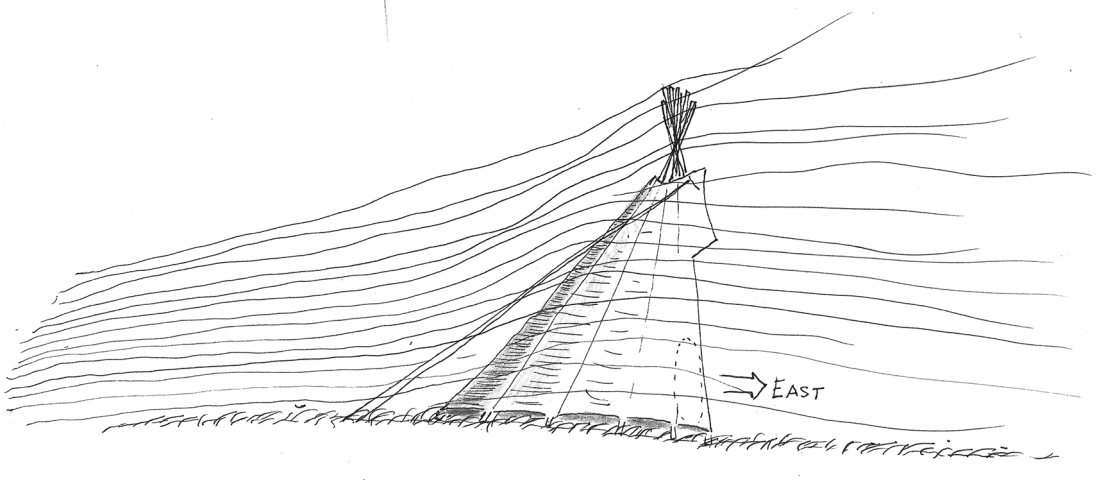
> [Humanity], it seems, has forgotten how to design with nature and tends to ignore the climate while [it] has become preoccupied with forms currently fashionable. The modern building—office or dwelling—looks much the same the world over because, among other things, it has been designed largely to keep natural phenomena outside, to separate conditions inside from the outdoors as much as possible, relying on mechanical devices and systems to do much of the work. (Konya 1980, 7)

The adept indigenous cultures of the prairies cultivated mobile structures, tipis, that linked to the climate and the nomadic life that the climate precipitated. Built to accommodate the flow of the wind, these lightweight, moveable structures incorporated regional materials and bioclimatic design. Upon the arrival of settlers in Lethbridge, buildings became permanently affixed to the ground, with forms driven by governmental regulations and design trends from other locations and climates. Upon the advent of modernism, Lethbridge architecture further rejected the chinook, by creating introverted designs such as Arthur Erickson’s University Hall. The situation, contemporary building form, orientation, and operation of postmodern architecture in Lethbridge continue to disregard the wind. This is especially evident modern design could use the chinook as a tool for thermal comfort, energy efficiency, and meaningful connection to the natural environment. This disregard epitomizes the ‘brute force’ mentality, relying on a copious amounts of energy to make a building succeed in

a climate that it is ill-adapted to. As Lethbridge architecture discounts the wind from its scope of design, the buildings become less and less cohesive to their surroundings, isolating their users, making for hostile and uninhabitable exterior spaces within the urban environment, and ultimately drawing a perceptive ‘line’ between the given and the built environment.

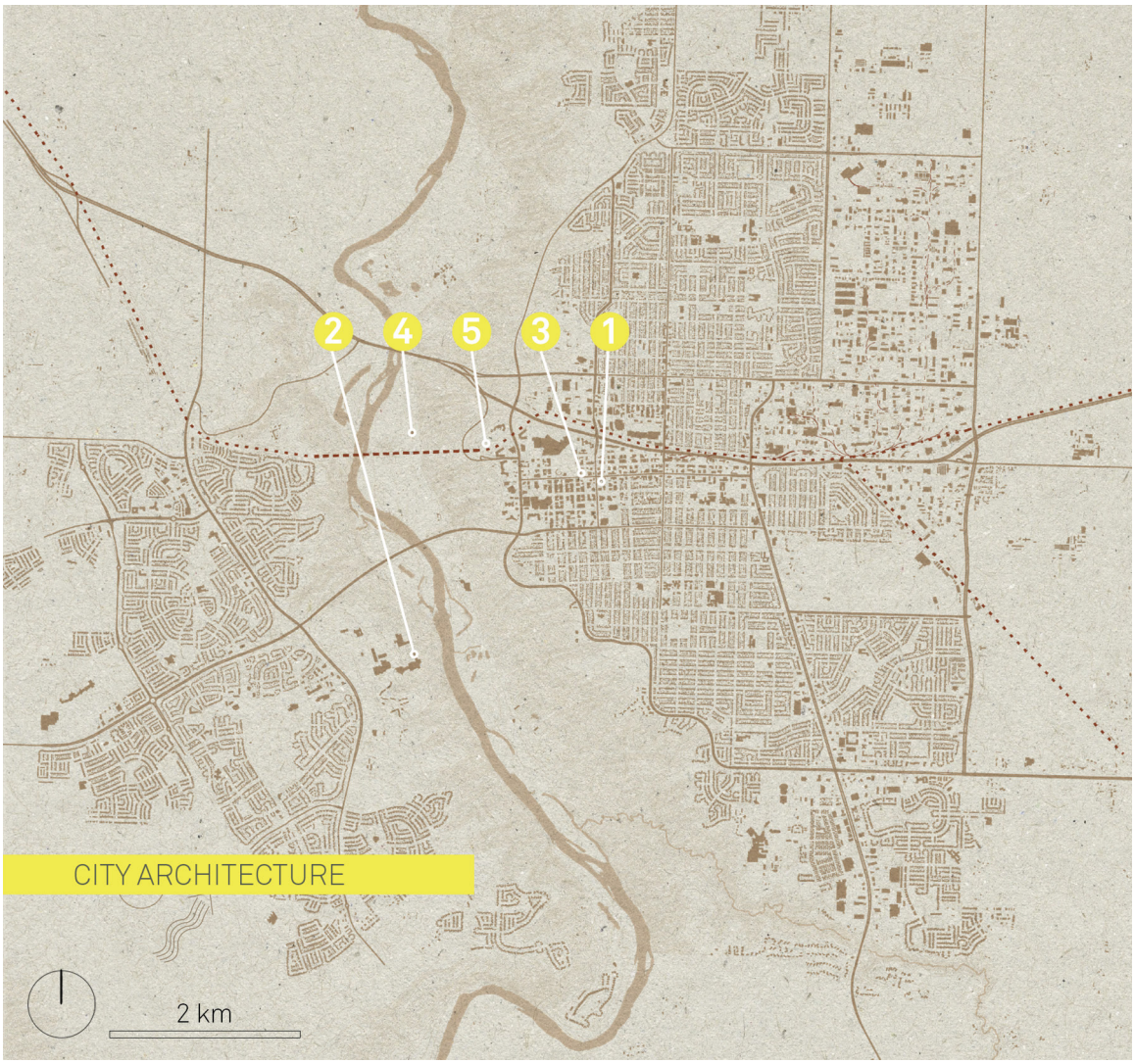
Building History

On of the earliest structures in the Lethbridge region was the Tipi, a conical tent structure, that had to be responsive to the chinook winds and regional landscapes. Tipi designs varied greatly over time and throughout cultures, however, the southern plains tipis had a few unique characteristics that made them so successfully adaptive to the prairie winds (Holley 2007, 26–28). Like many tipis, the entrance tended to face east. This was culturally significant, but also functional as the prominent wind direction was west and southwest. Additionally, the structure of these tipis slanted more drastically in the direction of the wind’s origin. This deflected some of the force of the wind while also creating negative pressure on the leeward side of the structure



Sketch of the wind acting on a slanted Tipi used throughout the prairies.

which helped draw smoke and air out the top of the Tipi (Holley 2007, 30). Finally, many tipis sites were frequently revisited to make use of the previously gathered stones, used to pin down the edges of the hide or canvas fabric of the tent. This practice, that provided both a thermal comfort and structural response to the driving chinook winds, utilized found materials and enabled the structures to remain light and portable. In modern day, rock circles are found throughout southern Alberta and are known as Tipi rings. The Tipi structure continues to be one of the only designs that successfully celebrates the unique climate of



Map of Lethbridge indicating a survey of buildings from settlement to postmodern. (Data from City of Lethbridge 2019)

Lethbridge post office. (Bencito the Traveller 2012)

University of Lethbridge. (O2 Planning + Design n.d.)

The Casa, downtown Lethbridge.

Helen Schuler Nature Centre.

102 Scenic Drive Condominiums. (102 Scenic Drive Lethbridge 2021)

the prairies through architectural form, striking a harmony in given and built environment.

The early sentiment of southern Albertan settlers was not too different from that of the indigenous communities. Settlers saw the chinook wind “mild an exhilarating climate” that made for a habitable landscape, making winters mild and summers cool (McCaig 1900). However, this sensibility did not translate into the architectural designs of early Lethbridge. Instead, most early buildings during the economic boom were driven by economic constraints and standardized plans. The construction of buildings was highly regulated by the conglomerate of landowners. When new builders were seeking loans from the bank, they were based on a cost structure that used predetermined building designs as the rubric to issue mortgage loans (Johnston and Otter 1985, 82). The city of Lethbridge culminated its development boom with the completion of the post office building, then called the J.D. Higin-Botham Building in the Beaux-Arts style. This building was a testament to the short-term prosperity and was modelled after the Neo-Gothic style of the newly constructed parliament buildings of the dominion of Canada. The Lethbridge post office was “expensively faced with stone cut from quarries at Tyndal, Manitoba. . . . It was a fitting symbol of the prosperity and optimism which had dominated the previous 15 years” (Johnston and Otter 1985, 97). Following the depression years and World War II (when development was stagnant), Lethbridge began to reemerge as a rapidly developing community. “By the mid-1950s, the basic outlines of modern Lethbridge were apparent . . . its inhabitants still aware of their natural environment and the vagaries of its climate. . . . Traffic moved smoothly through its tree-lined streets; its

parks provided a cool oasis on a dry and windswept plain" (Johnston and Otter 1985, 175). However, this awareness seemed to deteriorate by the globalizing forces of in later modernism.

Although typical international modernist styles that were arising in Lethbridge, along with many North American Postwar cities, the completion of the University in 1971, saw the advent of a new type of modern architecture. The University of Lethbridge that took inspiration from the landscape. Inspired by the Lethbridge Viaduct, the architect Arthur Erickson designed, "buildings to be low so that they would fit in with the long, sweeping lines of the prairies" (Johnston and Otter 1985, 98). He had designed the University so that housing, lectures, and research was all conducted within the same unified structure, protecting and facilitating the University's inhabitants from the elements as they went about their routines. Even in his designs for auxiliary buildings, Erickson joined them "by covered walkways for protection from the wind" (Johnston and Otter 1985, 98). Conversely, his design also included outdoor gathering spaces such as the 'breezeway' below

Photo of the Lethbridge University Hall by Arthur Erickson looking northwest after 1971 completion. (University of Lethbridge 1974)

Photo of wind socks for the *Breeze* installation by Scott Rogers. (Rogers 2007b)

the university hall structure which, due to the ferociousness of the chinook, is unusable for large portions of the year. An art installation by Scott Rogers titled *Histories, Realities, Prospects: The Erickson Building,* a public walking exhibition on the campus, encouraged a wander through the building and at the interfaces of the architecture and landscape. *Breeze* was part of this installation, comprised of three wind socks positioned just east of the breezeway to visually express how the presence of the chinook. Erickson originally intended it to be an interstitial space that students could gather and socialize, unaware that through the building orientation it would become more of a 'galeway' (Rogers 2007a).

In the last 10 years, Lethbridge has acquired many higher profile public architectural projects designed by well-recognized architectural firms. Although a sensibility towards local climate and sustainability is now trending, many of these projects continue to controvert the awesome winds of southern Alberta through clumsy, ill-considered strategies. A great first example would be the Casa Arts Centre in downtown Lethbridge. This building, although a valuable contribution to the community culture, neglects the habitability of outdoor space around the building. Nor does it try to even recognize wind in its indoor environment in a perceptive or metaphorical way. The siting of this three-storey cube is centred on a vast open parking lot to its west and hosts an equally massive plaza located on the southeast side of the building to protect it from the wind. However, the form of the building hardly creates shelter and instead, due to massive wind pressure differentials created from the wide flat windward faces, volatile vortices and eddies make the plaza hardly habitable.

The Helen Schuler Nature Centre is another recent postmodern project located in the river bottom. This small, renovated structure hosts multiple sustainable strategies compared to the Casa. Again, little consideration or representation is made about its relationship with the wind. Yet, strategies such as rainwater collection are celebrated, despite Lethbridge's climate being semi-arid. Lastly, a new development, a private condominium project, is to be situated along the east bank of the Lethbridge Viaduct train bridge. This three-phase building, currently under construction, is framed around a courtyard, shutting itself out from the natural environment entirely. Although its relatively low profile helps with wind mitigation, being that it is a four-storey building at the edge of the east coulees, it will no doubt be aggravated by the chinook.

Buildings in the City Today

The ideologies of "Sweeping away, shutting out, and controlling nature's imperfect abundance are implicit features of modern design, ones rarely if ever questioned," which form the foundation of postmodern architectural design in Lethbridge (McDonough and Braungart 2002, 86). The situating of buildings continues to ignore the wind as a prominent force and process of the prairie landscapes; the wind not only informs the functionality of the built environment but physically forms the landscapes in which the built environment is contextualized. The indigenous tipi, as a climate sensitive design, did not translate into Lethbridge's built environment. Instead, based on the origins of commercial enterprise and globalizing trends, colonial 'brute force' box buildings tend to remain the status quo. Even though they are insufficient and incompatible with the wind through their form and situation. This formal

ignorance precipitates a sustainability issue. Because the Albertan energy grid remains dirty and buildings of this type of negligent design consume much more energy than ones that would harmonize with the wind, emissions and energy consumption are needlessly high. Responsive, bioclimatic design would substantially reduce the energy needs for heating, cooling and structure and thereby reduce the carbon footprint.

When buildings don't situate properly with the essential forces and character of nature, in this case the wind, they "exist in a 'nowhere'; they are not related to the landscape and not to a coherent, urban whole, but live their abstract life in a kind of mathematical technological space which hardly distinguishes between up and down" (Norberg-Schulz 1980, 190). This disconnect between structure and environment insulates users which diminishes opportunities to experience the natural environment in the built environment.

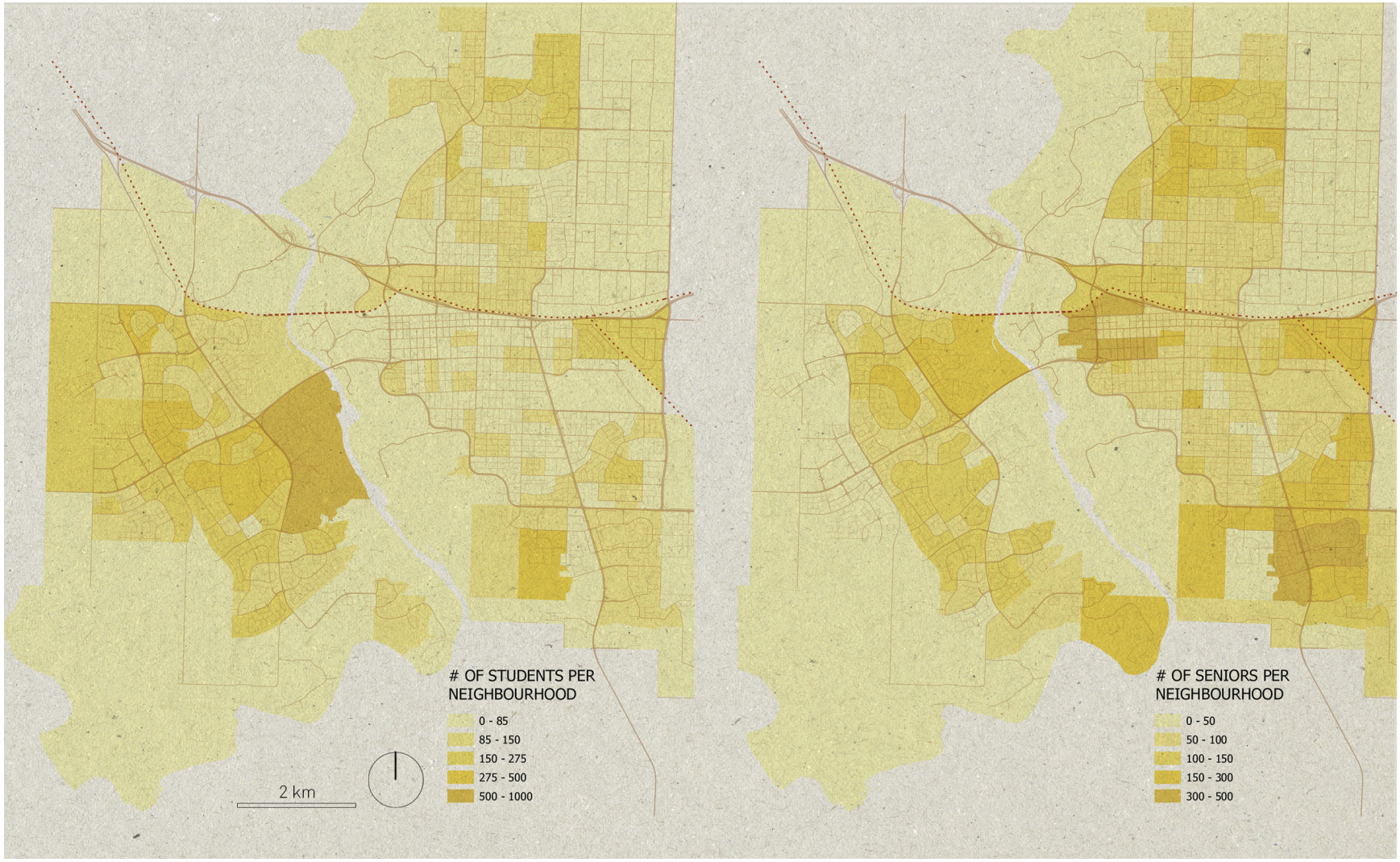
Locating a Site

Lethbridge has disconnected from the chinook in multiple ways. The materiality of the built environment does not integrate with the wind which results in frequent damage and disrepair. A lack of consideration for the wind in transportation networks makes walking or cycling nearly impossible and certainly uncomfortable. Additionally, the city's architectural forms are based on standards and trends rather than responding to regional characteristics to the detriment of the user experience. Each one of these issues contributes to the division between the chinook wind and the inhabitants of Lethbridge, supporting the perception that the built environment is separate from the natural environment. Therefore, Lethbridge is an optimal location

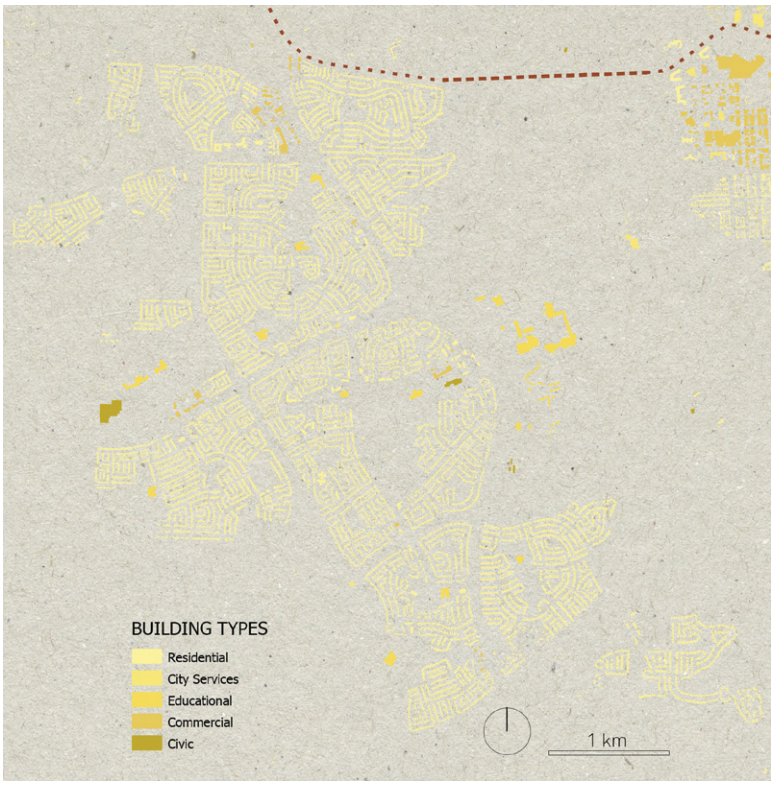
for an architectural intervention which challenges this perception upheld by brute force design through connecting with the wind. By integrating the wind as a process that will continually form and shape the design, much like part of the landscape, architecture can blur the perceived divide. The intervention is two-part: the first, a health and wellness centre combined with a cycling hub nested into the west coulees bank of the river valley; and second, a pedestrian walkway adaptation of the Lethbridge Viaduct connecting east and west, designed to re-frame the wind as a positive natural phenomenon. The building site is located on the west side at the bridge for three primary reasons. Firstly, it represents a central location between existing and proposed city development. Secondly it appeals to the west side demographic that is confined and isolated by sprawl. Lastly, it fosters the enhancement of the latent downhill cycling subculture in the area. The pedestrian bridge, built within the existing structure of the train bridge, addresses the issue of west-to-east connectivity, providing a profound opportunity to engage and experience the wind while celebrating the dialog between the train bridge and the valley.

West Lethbridge Intervention

West Lethbridge experienced most of its development in large sections starting in the 1980's. This rapid development, created vast sprawling, car-centric suburbs and strip malls (Johnston and Otter 1985, 208) resulting in long and wind-exposed distances between single family homes and chain stores, with minimal public social space. Even parks and sport fields are sparsely treed and offer little sheltered community space. With the university campus located on the west side of the city, the student population is mainly concentrated in west Lethbridge. In addition, much of the



Map of Lethbridge indicating both student and senior population by neighbourhood. Note the largest concentration of students on the west side and seniors bookending the train bridge. (Data from City of Lethbridge 2019)

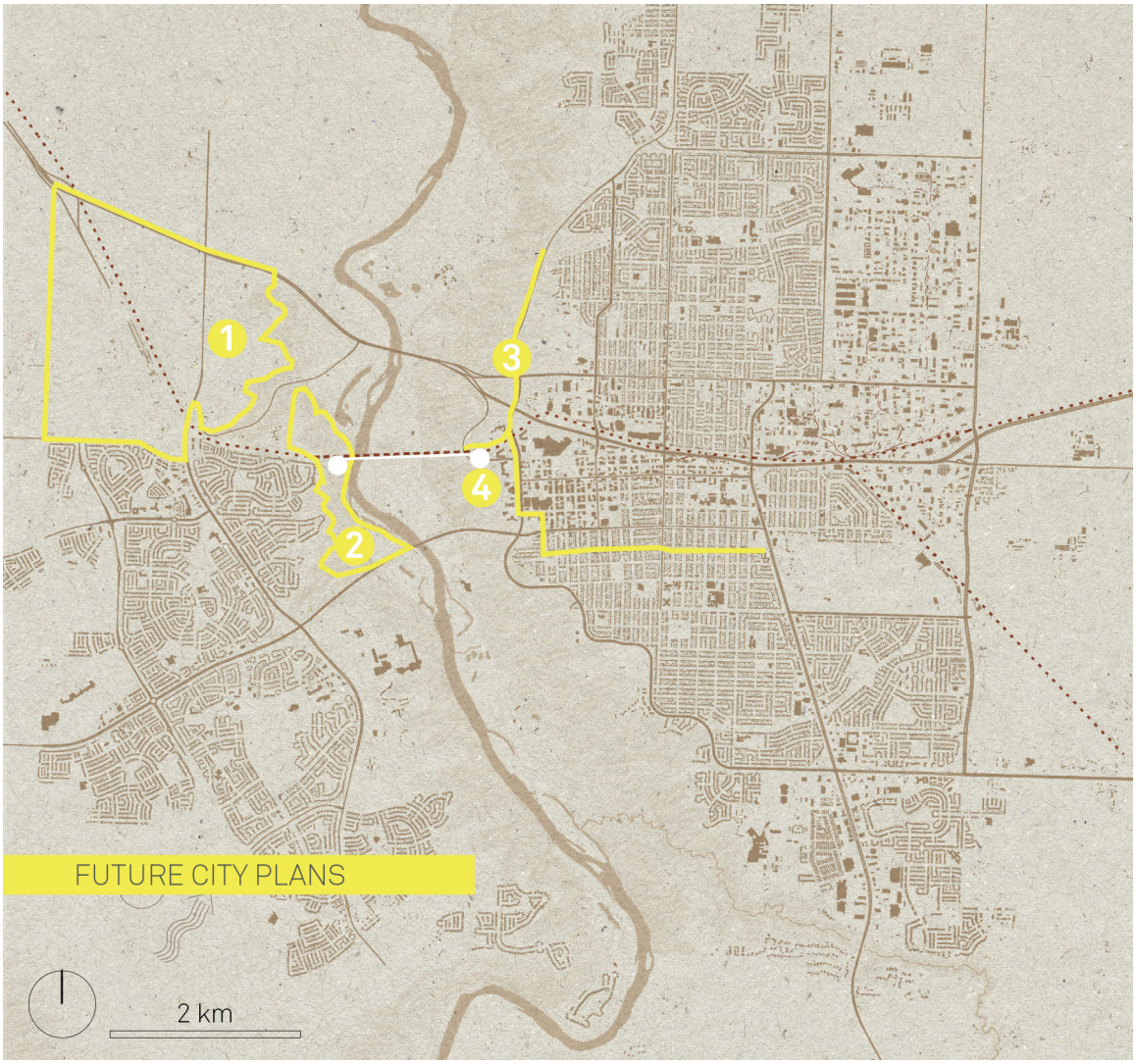


Map of the west side showing building type. Note how it is mostly comprised of residential, schools, and commercial. (Data from City of Lethbridge 2019)

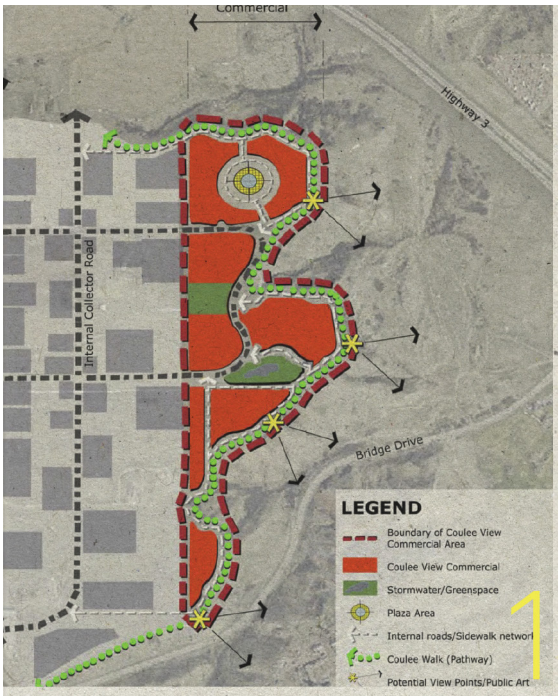
elderly population is positioned on either side of the bridge in seniors housing communities that face the valley. Both populations likely have reduced mobility based on factors such as economic status. Therefore, establishing a public hub that fosters community, wellness, and ‘walkability’ would be most beneficial for residents of the west side.

Examination of the city’s development plan can help determine where to position the project. In 2013, the city of Lethbridge published an Area Structure Plan for the land north of the developed west side. This area is identified as the West Lethbridge Employment Centre (WLEC) and is planned to host mostly industrial and commercial space for west side residents. However, the city is also planning to incorporate pedestrian-oriented retail and walkways

along the west coulee, north of the train bridge (City of Lethbridge Planning & Development Services 2013, 40–41). The intervention should be centralized relative to the west side residents and the proposed employment centre development, placing the site near in line with the train bridge. The coulee edge, as a site, is valuable as it creates a unique opportunity for expansive views into the scenic river valley and has unobstructed access to the wind. The site could also connect to a future north-south walkway along the coulees, tying into the proposed walkable retail area of the WLEC.



Map of Lethbridge indicating the proposed developments currently happening in the city. (Data from City of Lethbridge 2019)



Map and conceptual cross section from the WLEC area structure plan. (City of Lethbridge Planning & Development Services 2013, 41)

West Lethbridge downhill cycling trail sign.

New pedestrian infrastructure crossing the highway north/ south.

Seniors' housing at the edge of the east coulees.

The west coulees, just south of the Lethbridge Viaduct, host a significant informal downhill cycling subculture; an intricate network of forged trails lead east toward the river. In their work, Urban Magnets, Bruce Haden, Mark Holland, and Bruce Irvine describe such subcultures as “lodestones” which are essentially untapped potentials for a project that could cultivate a strong social magnet by providing space for that subculture to flourish (Haden, Holland and Irvine 2020, 83). Therefore, an intervention that facilitates gathering, wellness, and cycling would be optimally situated on the west coulee slopes just south of the Lethbridge Viaduct. We will refer to this intervention as a wellness centre, which I have titled “The West Lethbridge Windy Wellness Centre.”

The vision for this wellness centre would be an extension of the public health system, operating as an alternative natural remedy to mental health issues such as anxiety and seasonal depression. Much like other medical facilities, the wellness centre could receive referrals from general practitioners from both public and institutional facilities like the university. Additionally, the centre could see routine visitors that use the fitness centre, have a prescription to the aero-baths, enjoy visiting the cafe, or frequent the downhill trails and need bike tune-ups or rentals. The intention of the wellness centre would be to combine demographics of all ages while merging informal program with formal and natural approaches to mental and physical health.

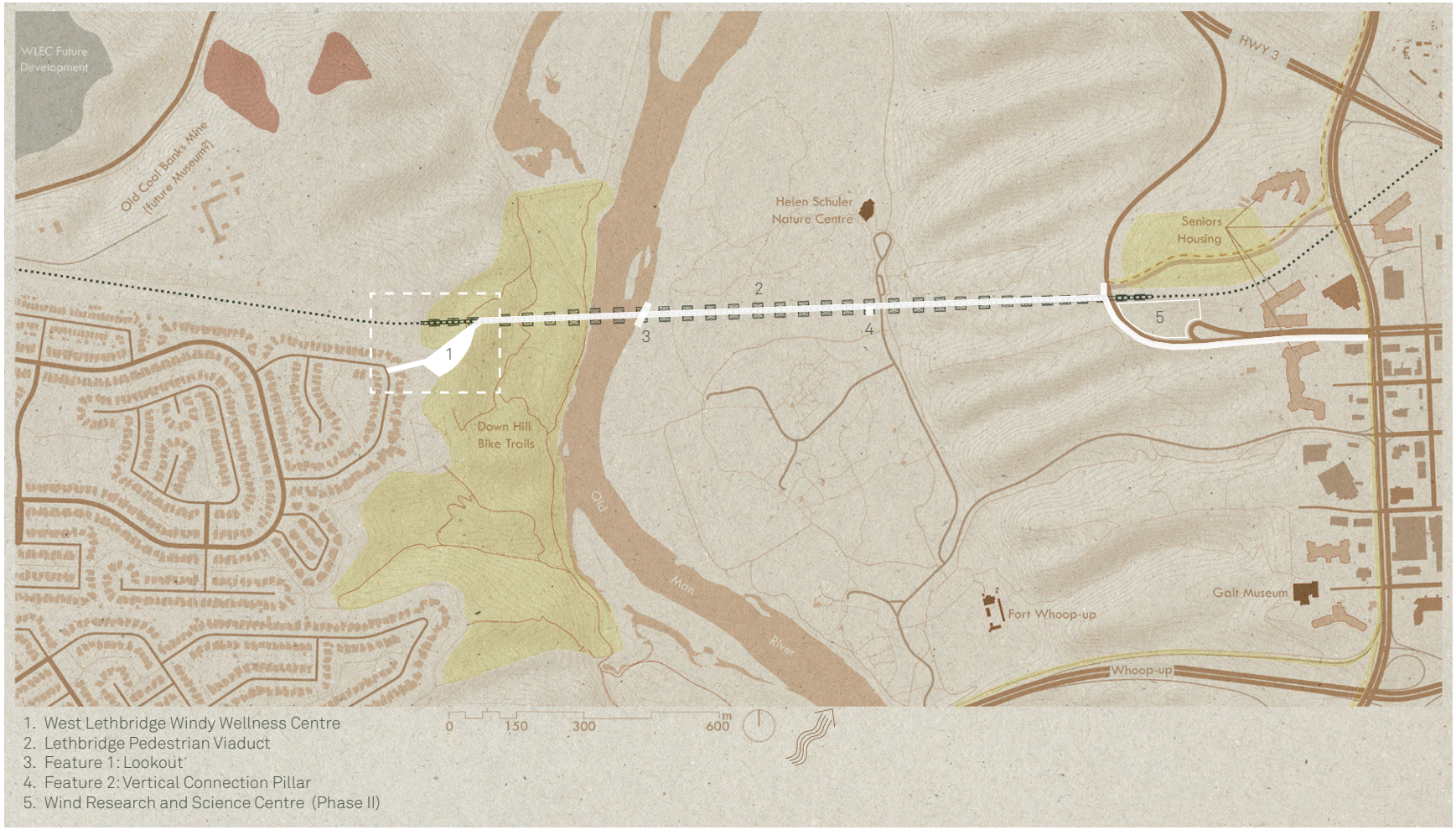
However, there still remains the significant issue of west-to-east connectivity across the river valley. A project on the west coulee alone would not produce enough of a dialogue between the natural and built environment to sufficiently challenge the ‘extinction of experience,’ nor address the

city disconnection for residents. The site being located just south of the train bridge provides a unique opportunity.

Lethbridge Pedestrian Viaduct

The Lethbridge Viaduct is an engineering marvel, cutting through the expansive river valley, creating a contemplative visual metaphor between conceptualizations of humans and nature. As abruptly different in appearance as the bridge is compared to its natural setting, the Lethbridge Viaduct is ironically one of the most wind sensitive structures in the city today. The porosity of the trestle structure ensured that the wind loads would be minimal (Johnston 2008, 11). Regardless of its marvel, “Lethbridge citizens [remain] notoriously blasé about the engineering marvel in their midst” (Johnston 2008, 38), possibly due to a lack of opportunity to engage with it. Aside from the valley road under it, there is no infrastructure that facilitates its exploration.

The Lethbridge Viaduct is perfectly positioned, physically and perceptively, for a pedestrian walkway that ties the west side and the downtown together. Currently, the river valley is a ‘border vacuum,’ what Jacobs describes as an edge of a city created by terrain, industry, or other hard separations that disconnect neighbourhoods from each other by limiting pedestrian flow (Jacobs 1961, 257–258). The train bridge, running perpendicular to the massive valley, creates an opportunity to traverse this vacuum. It presents, what Tabb and Deviren describe as a ‘between-place context’ “capable of supporting a new kind of sustainable architecture, one that had systemic fabric-oriented qualities” (Tabb and Deviren 2014, 131). A pedestrian bridge, integrated with the existing structure and sheltered from the wind, could encourage west and east circulation. Having this pedestrian



Site map indicating the location of the wellness centre site on the west side, the pedestrian adaptation of the train bridge, and a potential phase II site on the east bank of the coulees with the extended path connecting into downtown. (Data from City of Lethbridge 2019)

infrastructure would reduce traffic and emissions while creating a phenomenal opportunity to experience the wind, view the valley, and get some exercise. With the planned residential development on the east side of the bridge, the city is designing a new roadway and bicycle path that connects the city north and south. This west-east pedestrian bridge would be able to engage with that new network, further enhancing the pedestrian connectivity, creating a draw from the west side to downtown Lethbridge.

Both the pedestrian bridge and the wellness centre could enter a symbiotic relationship, creating a strong anchor on the west side while providing the means to cross the coulee to it from the east. This increased fluidity would make for healthier circulation of the city residents, reducing the demand for another vehicle bridge, while bringing more spending activity to the west side. Economically, this project could be fostered through stakeholders in Alberta Health Services who are working to increase mental and physical health facilities throughout the province. The city could also advocate for tourism funding as the experience of the bridge would be one unlike any other in the otherwise planar prairies. The aero-baths would be a unique and rejuvenating experience not just for helping with mental or physical health, but also for the general public wanting to relax and warm up during the cold snaps of winter, perhaps with the opportunity of ancillary short term residencies being developed near by for visitors.

In this chapter, we have identified three ways in which we experience climate, and in particular, the wind, in the built environment: through materials, how we move through the built environment, and the shape and form of architecture. It is evident that, when tracing the material history, Lethbridge’s

material palette is non-regional and non-responsive to the chinook wind. The resulting damage and waste, in turn, foster negative, dissociative emotions that reinforce a separation between ‘us’ and ‘nature.’ When looking at transportation history, from early colonial settlement until today, Lethbridge’s growth was driven by commercial enterprise and centred around the automobile. Lethbridge continues to create a dependency on vehicles, increasing emissions, while eliminating sensorial modes of movement like walking and cycling that encourage a connection with the natural environment (Wunderlich 2008, 125). When examining Lethbridge’s settlement architectural history, building projects tended towards design trends, economic considerations, and dominant convention rather than what the climate demanded. The result is a built environment that requires excessive energy to operate year-round and a harsh delineation between the city and chinook. An intervention is proposed to counter these issues through designing with the wind; a wellness centre and cycling hub positioned on the west coulees just south of the train bridge is ideal. A pedestrian bridge through the existing structure of the train bridge is also proposed. This pedestrian viaduct is chosen for its opportunity to connect the west side to downtown, utilizing north-south running infrastructure currently proposed, and to provide phenomenal experiences of the wind, river valley, and the train bridge itself. In the next chapter we will discuss the methodology for this design based off bioclimatic approaches to the wind, augmented by three experiential theories for engaging with wind.

Chapter 4: Design Framework

> Wind is a powerful force that should be harnessed and harvested to maximize its potential positive contribution to the built environment . . . instead of creating an environmental barrier behind which we can cocoon ourselves within an artificial internal climate. (Battle McCarthy Consulting Engineers 1999, 8)

The main objective of this thesis is to exemplify how designing with climate can produce nature experiences through architecture, countering the brute force mentality in the built environment that perpetuates the extinction of experience. Bioclimatic design is a robust alternative approach to building construction that energetically engages with local climate, integrating architecture into its natural context. It is concerned with improving thermal comfort in and around buildings while reducing energy consumption and is used as a framework to direct the design of this project. Three main bioclimatic strategies are extracted from research that are deployable in intense climatic environments: building form, building material, and building technology. In relation to the chinook wind, these strategies translate to deflecting the wind, flexing with the wind, and harvesting the wind.

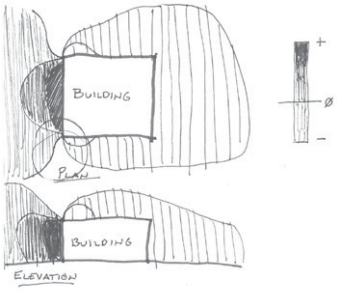
Since the extinction of experience is a perceptive issue, beyond using a bioclimatic framework, we will also deploy perceptive theories that combine with the bioclimatic approach in order to express nature experiences through climate. A theory informing design is applied for each way in which we have discussed climate interacting with the city: material - weathering, transportation - walking rhythms, and building situation - bracketing. By combining the technical solutions of bioclimatic design with perceptively engaging strategies, a robust design framework will be developed to direct designing with wind revealed in the following chapter.

A Bioclimatic Approach

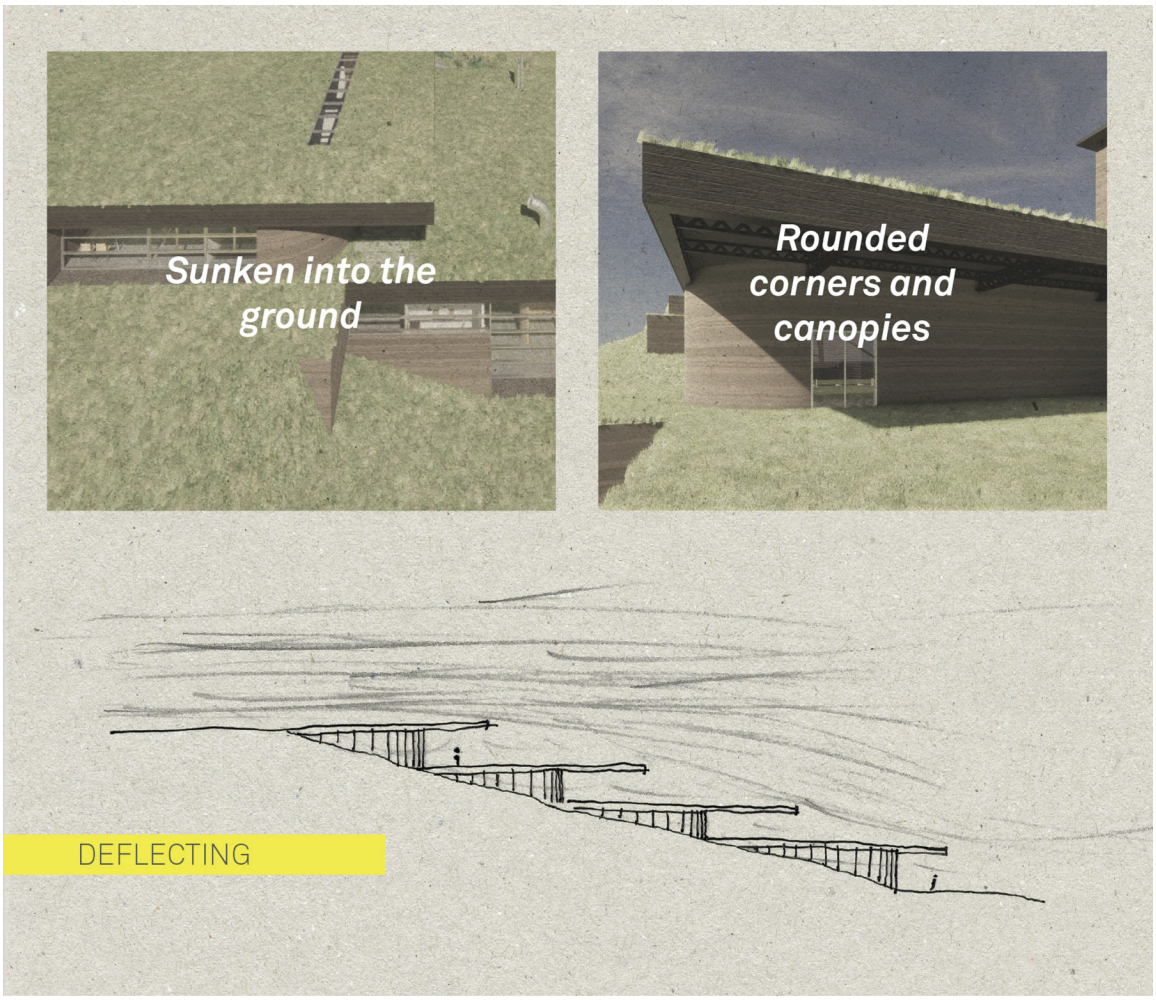
Aligning with the wellness programming of this project, bioclimatic design is primarily concerned with creating thermally comfortable and inhabitable spaces in energy efficient ways by exploiting the latent opportunities of a local climate. This focus on thermal comfort is the priority of bioclimatic strategies considering typical heating and cooling systems are the largest energy consumers in buildings (Manzano-Agugliaro et al. 2015, 737). However, in addition to using the climate as a tool to increase comfort and well-being, its systemic integration with architecture can begin to shift the perceptions of intense climates, in our case the chinook winds, from an antagonistic force of nature to a productive and celebrated part of the built environment, generative of our architecture.

Leonardo da Vinci's Study of water, representing behaviour of flow. (Da Vinci c. 1513)

Bioclimatic design strategies range vastly, "based on a reflexive focus on the climate and environment," and although include responses to wind, they tend to prioritize passive and active solar strategies (Manzano-Agugliaro et al. 2015, 737). These strategies, often rooted in vernacular traditions, have been extensively reviewed and cataloged by Manzano-Agugliaro et al. (Manzano-Agugliaro et al. 2015, 744–45) which form the basis for our bioclimatic approach. Because Lethbridge's temperature fluctuates from +30 to -30 degrees Celsius throughout the year, both solar and aero strategies are used to provide heating for the winter, and cooling for the summer. However, as we are focusing on integrating the chinook wind in the architecture, three main wind strategies adapted Manzano-Agugliaro et al.'s work are emphasized that inform the architectural character and operation of the building. The three are as follows:



Diagrammatic sketch of pressure differentials around a building caused by wind.

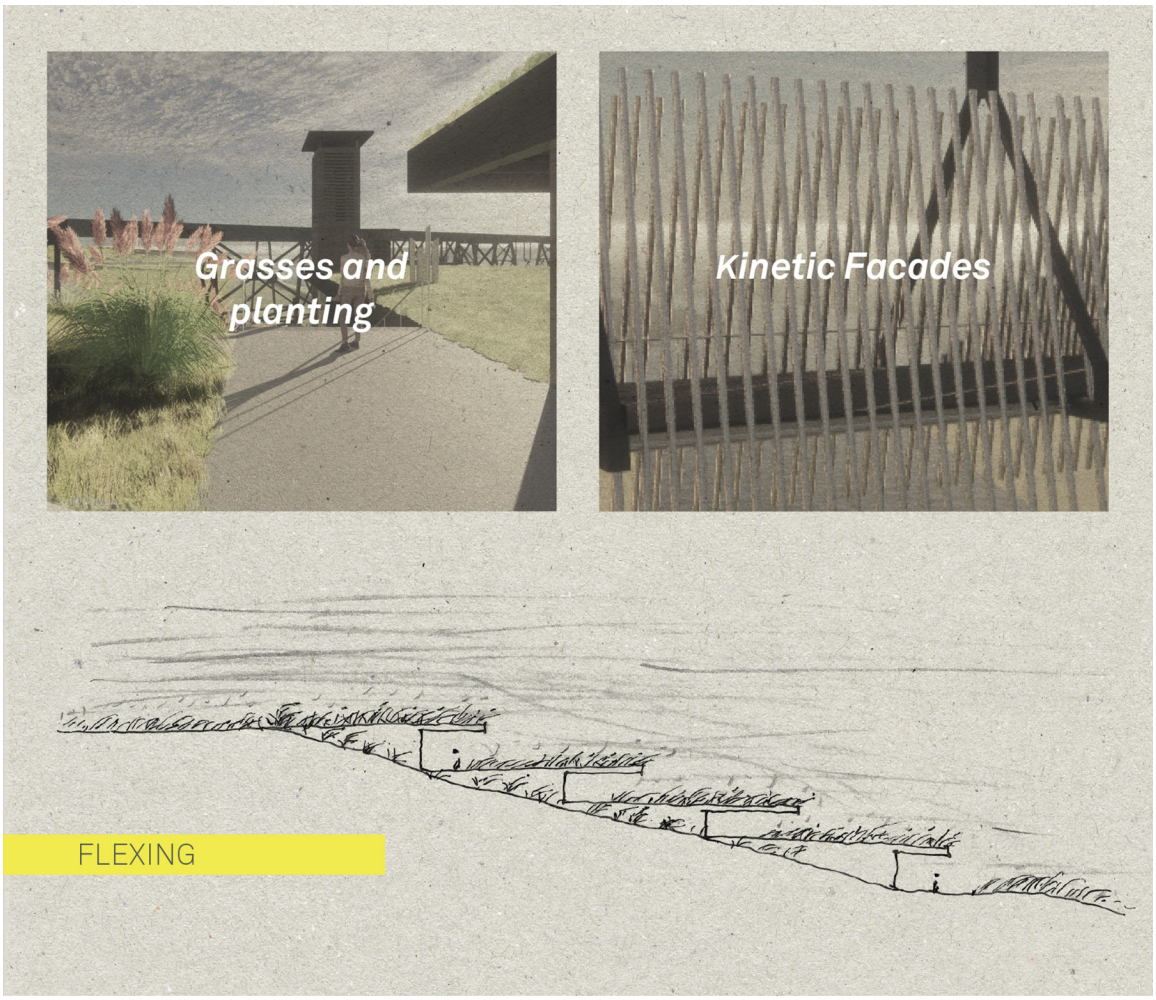


Building form diagram of wind deflecting using methods like sinking the building into the landscape and providing rounded corners and canopies to prevent air pressure differentials.

The first method is bioclimatic building form. The form is the most intuitive way to respond to climate both through the shape of the architecture but also the situation of the building in relation to the prevalent climatic direction. The form can direct the primary forces of an intense climate, whether that's wind, rain, snow, cold, or heat, so that those forces are reduced in intensity at habitable areas. Examples include large roofs for rain, steep roofs for snow, narrow shaded walkways in hot climates, and so on. For wind, the building form is primarily used to prevent strong prevailing winds from disrupting habitable areas. I have termed this method 'deflecting.' "In general, the size, form

and arrangement of buildings determine the degree of influence on wind flow behaviour" (Krautheim et al. 2014, 71). Therefore, deflecting is our first response to designing with the wind. Like a wind deflector on a car, a deflecting strategy moves air flows away from the habitable spaces that normally would be affected by the wind. Deflecting neutralizes turbulent winds around a building by minimizing opportunities for air pressure differentials, preventing vortexes and other phenomena that frequently disrupt habitable spaces around traditional buildings. This strategy orients the architecture in the direction of the prevalent wind and sinks the building into the landscape to allow wind to easily pass over it. Since pressure differentials occur most drastically at sharp corners, Rounded corners soften this contrast (Krautheim et al. 2014, 104), while large overhangs encourage continual air flow over outdoor space. Deflecting can visually and spatially tie the form of an architectural project to its site and environment.

The second method is bioclimatic materials. Selecting the materials comes second because the materials used not only respond to the climate, but also to the building form that is responding to climate. The materials used should be considered for their thermal properties, their sustainability, and the responsiveness to the wind. In intense climates, there are many materials that are incompatible with those climates such as the asphalt shingles mentioned in relation to Lethbridge's wind. Properly selected materials can help mitigate damage from an intense climate or can aid in reducing the intensity of the climate at the building, preventing the damage of more vulnerable materials. We see this through the use of tin or slate roofs in snowy climates, stereotomic and earthen materials in dry and

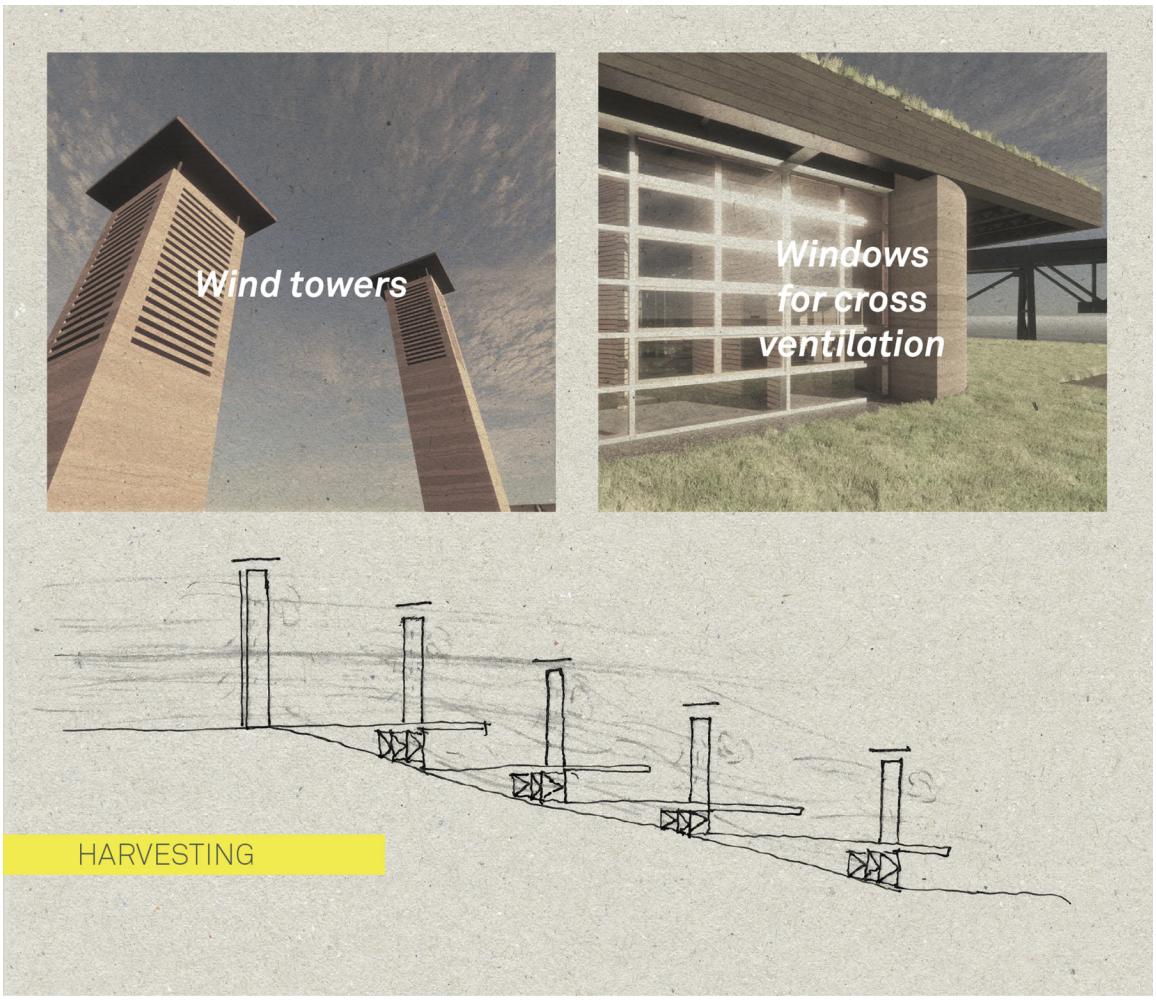


Building material diagram of wind flexing using methods like planting tall grasses and bushes around the building or using kinetic facades that dance in the wind.

hot climates, and so on. When selecting materials for the chinook wind, the primary focus is mitigating its intensity around the exterior of the building and therefore we have selected a material strategy I call ’flexing.’ This strategy has also been referred to as materialization, flexing disperses wind forces around a building by converting the energy in the wind into kinetic energy through moving materials and components. The density of components that flex with the wind, what we can call porosity, influences the effectiveness of wind mitigation (Krautheim et al. 2014, 94). Seen frequently in vernacular climatic strategies, different forms of planting and landscaping have provided shelter from

the wind by flexing with including green roofs. However, dynamic architectural facades that move in the wind are becoming increasingly popular. This strategy uses tall, native grasses planted on the roof canopies and beside the building along walking paths to mitigate wind turbulence. A kinetic façade of parallel, counter balanced, swaying bars is deployed to protect the large, exposed pedestrian walkway of the project that decreases in porosity at areas intended for more habitation. Flex alone will not make a windy space completely thermally comfortable but when combined with deflecting, together can be highly successful in creating habitable, pleasant, wind controlled outdoor environments.

The third strategy is bioclimatic technologies. As mentioned, many climate sensitive and passive technologies used in bioclimatic approaches originate from vernacular traditions. These technologies can be deployed to relate the interior and exterior of the architecture through connecting the functions of the building to the functions of the climate it is nested within. This approach to technological use reframes the climate as a resource to work with rather than as an obstacle to overcome. In many intense climatic environments, this vernacular is present as a source of knowledge to draw from, but that is not the case in Lethbridge. Most of the architecture in Lethbridge shuts out the wind, expending much energy to create separate microclimates inside away from the wind. I have termed the approach to wind technologies ‘harvesting.’ “A major proportion of the energy consumed by buildings is the result of air-conditioning and therefore natural ventilation must be seen as a principal environmental building issue” (Battle McCarthy Consulting Engineers 1999, 9). Making use of the chinook, harvesting strategies ingest the wind into the architecture, using the wind to condition the interior spaces



Building technology diagram of wind harvesting using methods like wind towers and operable windows for cross ventilation.

of an architectural project. In doing so, they can provide further wind mitigation of exterior spaces by removing some of the wind force from around the exterior of the building. This strategy uses wind towers, adapted from traditional Iranian design to capture, and distribute conditioned wind into the building (Manzano-Agugliaro et al. 2015, 746), and casement fenestrations, opening into the prominent wind direction across from the towers, to provide cross ventilation during warm months (Manzano-Agugliaro et al. 2015, 743). Harvesting as a strategy is great for creating a strong experiential connection of interior and exterior while greatly reducing energy demands of conditioning machinery.

Together, these three wind management methods sculpt the architectural response to the climate. However, considering the holistic nature of a bioclimatic approach, we must additionally touch briefly on four solar strategies adapted for this thesis from Manzano-Agugliaro et al.'s catalogue.

Active solar heating: this strategy uses a fluid ran through heating panels to transfer thermal energy into the building (Manzano-Agugliaro et al. 2015, 740). It will be coupled with wind harvesting to condition the air used in the building.

Solar protection: this strategy uses architectural and organic elements to protect the building from extra heat gains in the summer. In the case of this project, the planted roof and nearby vegetation which takes the energy out of the wind, also protects the architectural spaces from the hot summer sun while additionally enhancing evaporative cooling.

Humidification: with planting on the roof and on the windward side of the wind towers, transpiration of the plants due to the sun's radiation humidifies the ambient air that is harvested by the building.

Thermal mass cooling: using a thermally massive wall such as rammed earth but having it minimally exposed during the summer allows the wall to draw warm temperatures out of the ambient air.

When combining deflecting, flexing, and harvesting with these solar bioclimatic principles, we can define an architecture that expresses the local climate of Lethbridge, allowing for a sophisticated control of thermal comfort and reduced energy consumption in and around the building that is so clearly absent in many urban and architectural spaces throughout Lethbridge. Although this approach moves our perception of

the built environment towards nature, since we are dealing with the extinction of experience as a sustainability issue to address, we must enhance our bioclimatic approach with a perceptive framework that brings the wind even more immediately to our senses in positive and exciting ways.

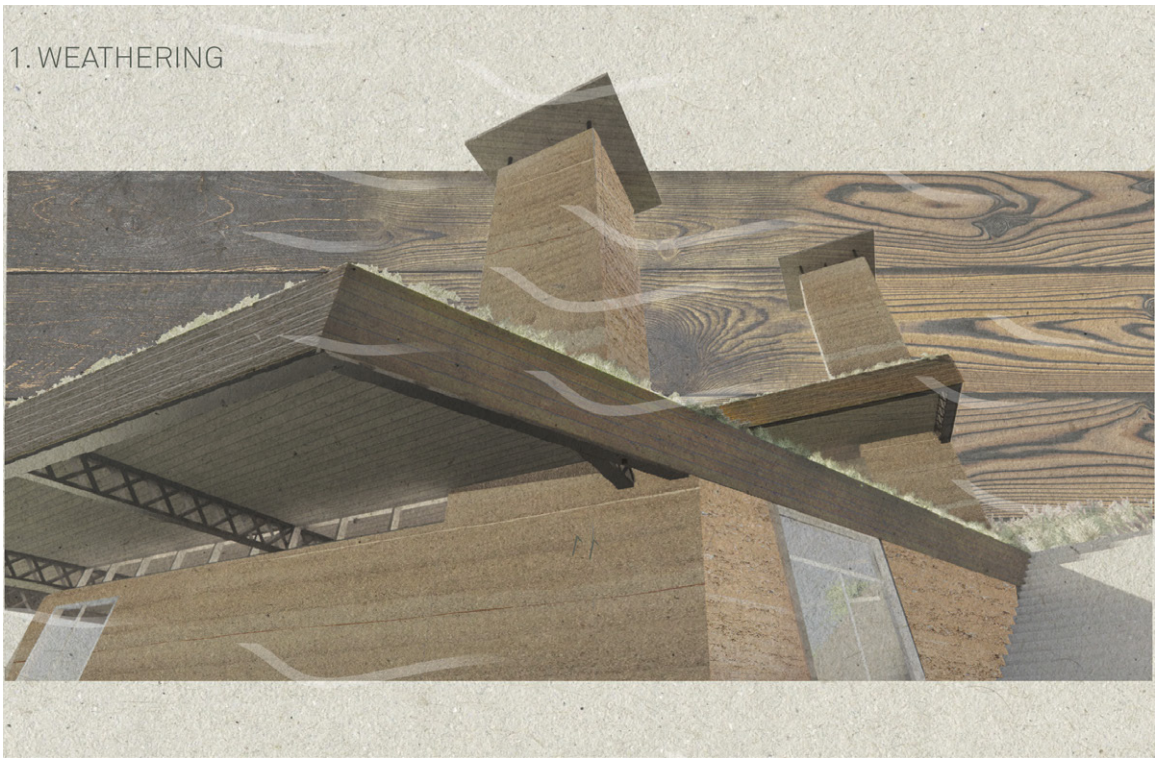
Perceptual Framework

Bioclimatic design forms the basis of the framework for designing with intense climates; however, augmenting our bioclimatic thinking, a perceptual framework is proposed that aims to address each way that we experience the climate in the built environment: through materials, how we move, and how our built environment situates in relation to the climate. By designing with materials that anticipate weathering from the climate, the project can convey both the force and process of the wind as nature, while adding the touch of the environment on the building, much like the surrounding landscape. By designing for multiple paces or rhythms of pedestrian circulation, the project can provide a greater range of opportunity to experience the climate in pleasant ways. And by isolating or bracketing the climate in certain spaces, a more concentrated sensorial experience can be made, influencing a stronger emotional connection to the climatic environment. Together, these strategies form a framework that defines some of the more unique experiences of the wind through the architectural intervention.

Charred and wind scoured log found on a hike near Lethbridge, Alberta. This material formed the inspiration for selecting torrefied cladding.

On Weathering

“Time does not pass in architecture, it accumulates” (Leatherbarrow 2009, 82). Weathering is an inevitable part of the climate and something that should be designed for and celebrated. Whether its intense rain, snow, or sun, when a buildings erosion is planned for and expressed,



Collage of the building indicating the both the torrefied wood cladding and the rammed earth and how the wind exposed sides will weather more acutely than the protected areas.

a profound connection to place and to the climate can be formed. In our example, designing with regional materials that are activated by the wind can subvert the typical conflict between climate and architecture while materializing the wind through visual and haptic experience. Following Mohsen Mostafi and David Leatherbarrow's work on weathering, the aim is to design in a way that the wind, as a natural process, changes materials over time, expressing its process through architectural form. The authors argue that rather than imitating natural forms, often resulting in cheap replicas that still feel unnatural, architecture should account for the forces of nature and allow material to naturally change with those forces (Willis 1994,127). Weathering in particular "is not only a problem to be solved . . . but is an inevitable occurrence to be recognized and made use of" providing the subjective experience of the natural world over time (Willis 1994, 126). Weathering is capable of blurring

the line between climate and architecture because it “adds the finish of the environment” on buildings (Mostafavi and Leatherbarrow 1993, 16). Demers and Potvin equate the importance of the role of this environmental finish and how it shapes nature, to the role of an architect designing a building, stating “Erosion is ever present in the environment, carving nature, as an architect would design a space” (Demers and Potvin 2017, 330).

Pallasmaa furthers this concept by defining one of architecture’s roles as “domesticating limitless time and space and placing it in the finite lived world for us as humans to experience, relate to, and ultimately understand,” putting the emphasis on natural materials as they “weather and express time, age, and speak to vernacular history” (Pallasmaa 2005, 31–32). Therefore, to incorporate the wind as a process, as a metric change over time, natural materials will be chosen to celebrate erosion, patina, and material change, in a way that does not compromise the integrity of the architecture, but instead adds to it.

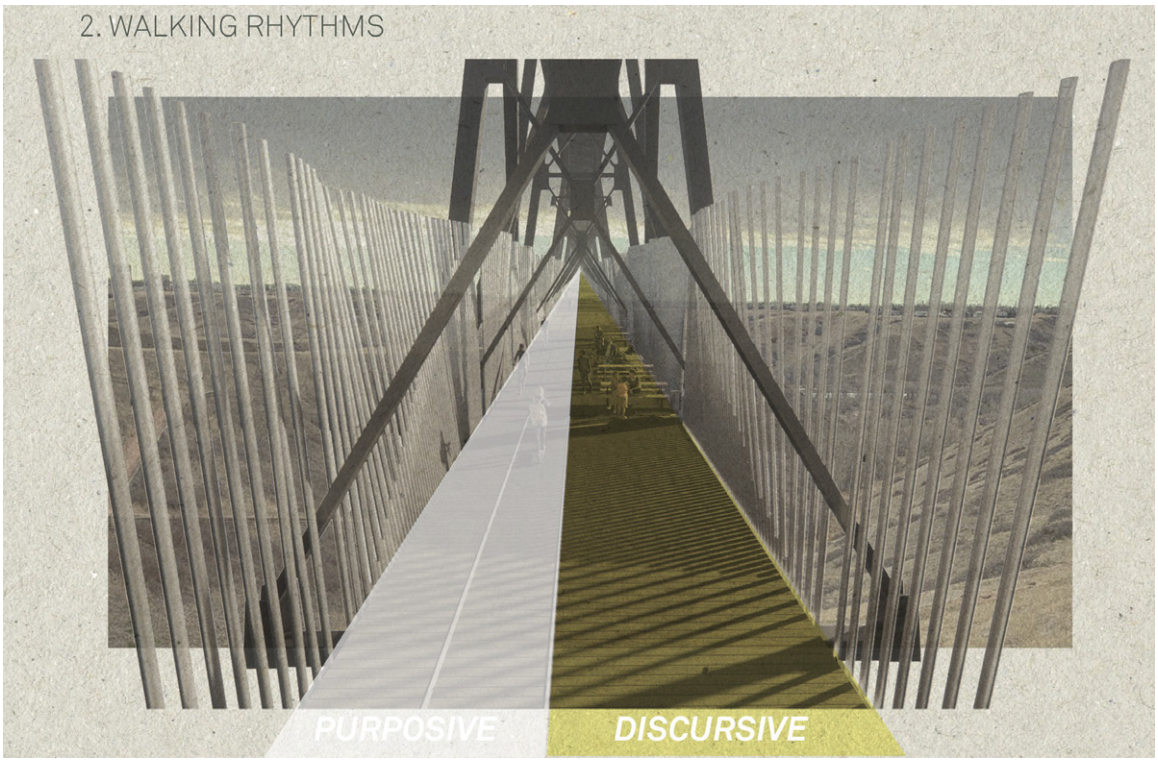
Although use of some contemporary materials are inevitable such as glass, two natural and weatherable materials are emphasized in this work: rammed earth, and torrefied wood. Not only is Lethbridge suitable for rammed earth construction as a semi-arid climate, but also hosts clay deposits throughout the coulees from which many brick buildings have originated. Rammed earth has the unique potential to express the wind through erosion over time, unlike many other stereotomic materials because the erosive character of the material can be tuned based on clay-cement mixture ratios, allowing for flexibility in erosive properties. Torrefied wood, a durable treatment of wood using heat, will be used as the primary exterior cladding for its resistance to moisture

and expansion. Since the exterior is charred, exposure to the wind will erode softer charred growth rings in the wood, expressing greater wood grain texture and character over time. Both Rammed earth and torrefied wood can physically manifest the wind as part of the architectural character through weathering with it, further ensconcing the wind as part of the built environment.

On Walking Rhythms

As discussed, how we move through the built environment influences how we experience and relate to the climate. When intense climates are not designed for in architecture and urban environments, movement outside of vehicles tends to be very uncomfortable and undesirable. By designing for multiple rhythms of walking and cycling through an intense climate, the opportunity is created to reframe that climate as a positive or enjoyable character of the natural environment. Travel by vehicle in Lethbridge has been written into the DNA of the city plan since its formation and unfortunately, vehicles are particularly successful at separating us from the natural environment. Following Filipa M. Wunderlich, designing spaces that facilitate a multitude of slower, non-vehicle modes of transportation like walking and cycling affords a much greater opportunity for people to connect with both urban space and the natural environment it intersects (Wunderlich 2008, 137). Emphasizing walking, she states that:

> Walking is not simply a means to traverse urban space but also a way of becoming acquainted and a form of intervention in urban space. Depending on how it is performed, walking may inspire and influence creative responses to places. In this sense, walking is a way of discovering, creating and or transforming the city. It can be an aesthetic and creative practice as much as a critical and spatial one. (Wunderlich 2008, 136)



Collage of the pedestrian bridge indicating the divide between purposive and discursive walking routes along the walkway.

Wunderlich argues for “using design to accommodate or stimulate slower or varying walking paces and rhythm [to] enrich the experience of place whilst promoting spatial encounters and creative and critical engagement with spaces” (Wunderlich 2008, 137).

Two of which rhythms we will incorporate, the first being purposive. This is a task driven rhythm is about going from one place to another. It is performed in a rather anxious mode in which arrival at a destination is the objective (Wunderlich 2008, 131). Examples include going to and from school, work, a show, and so on. Direct, fast paced circulation space is provided along the bridge along with cycling and scooter rental to accommodate this type of direct to-and-from movement.

The second is discursive. This is a slower, participatory rhythm, “during which we half consciously explore the

landscape while sensorially experiencing it passing by. In this way, our familiarity with the environment is deepened" (Wunderlich 2008, 132). This rhythm can have no destination and is a practice itself, for instance, a leisurely stroll with a friend, walking a dog, or cycling for site seeing. Slower paths and spaces for pausing along the pedestrian bridge and around the building are provided such as a lookout. Additionally, a bathing facility offers a great opportunity for this type of exploratory wandering. Designing for both purposive and discursive rhythms create more opportunity for experiencing the wind and the city together, connecting us with nature through designed space.

On Bracketing

As mentioned, a third way we experience climate in the built environment is through the situation and form of the architecture throughout the city. Although our bioclimatic approach directs the formal composition of the architecture, particular spaces can be situated to create opportunities to experience climate in a positive and awe-inspiring way. These are spaces that can intensify, isolate, and exaggerate the climate so that it can be experienced as beautiful or sublime rather than a nuisance, which seems to be the case in many intense climatic environments. Additionally, if the climate is attuned to one sense in particular, the opportunity for a greater connection with the climate presents itself as our senses are connected to our emotional responses and memory. Following a lineage of thought in phenomenology, this perceptive strategy of isolating a sensual experience through design is what I am referring to as 'bracketing.' The concept of bracketing, has been used by contemporary architects interested in exploring architectural works not solely concentrated on optics, but other senses such as

Collage of the wind meditation room, one of many sensory experiences of the wind throughout the project. Note the chimes that are resonating from the wind centred in the dark room.

touch, hearing, and olfactory (Pallasmaa 2005). Since the visual perception is often a secondary experience of the wind and is so heavily critiqued by phenomenological architects like Pallasmaa, and smelling/ tasting the wind would be a challenging experience to present, isolated experiences of touching the wind and hearing the wind are designed for.

To touch the wind, we can use architectural forms and devices, oriented into the prominent chinook direction, to capture and concentrate its force. To this end, an aero-therapy centre is proposed as part of the wellness centre. Aero-therapy is a term I use (similar to hydro-therapy but using air) to describe using wind in therapeutic ways by capturing it and concentrating it in a haptic experience. This could look like using a venturi in a wind exposed direction to capture and concentrate wind, increasing its velocity so that it can be used in a massage jet system, what I call Aero-jets.

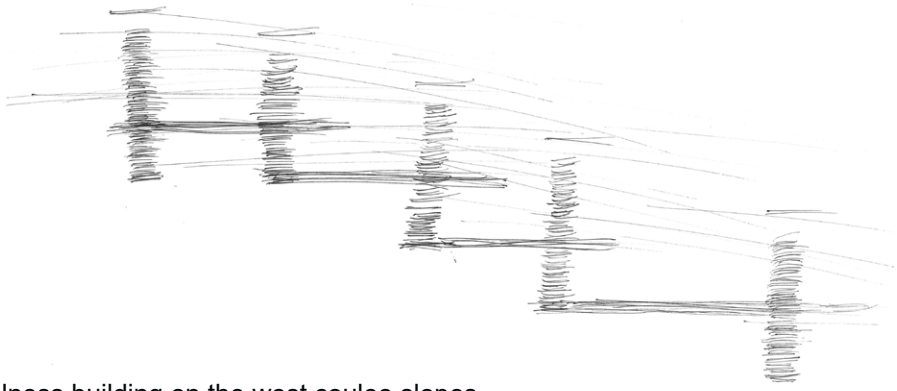
Additionally, wind can be brought into the building and used in a heat and cool bathing cycle by either conditioning the wind or leaving it in its intensity.

To hear the wind, we can use a similar tactic to concentrating wind through venturis. However, instead of increasing wind velocity, the air could pass though flute like forms that resonate at certain frequencies based on wind speeds, transforming the wind into sounds. This is a strategy used in the wellness centre in a meditation room. This room would be a low light space, isolating the senses with the wind flutes penetrating the ceiling. The space would resonate at different frequencies, providing a sound to focus on while meditating. These moments of wind as sensory experience would concentrate our attention and presence, bringing a mindfulness to the environment so essential to the Lethbridge landscape. If subverted into therapeutic experiences, this bracketing strategy could help shift our perception of the wind toward it as a positive, healing force.

In this chapter, we have laid out two intersecting frameworks for designing architecture that harmonizes with climate both technically and perceptively. The first is a bioclimatic framework, intended to integrate climate and architecture to produce a thermally comfortable and enjoyable experience in and around the architectural spaces while reducing the energy requirements to do so. Three main concepts are extracted from bioclimatic literature: building form, material use, and technology. These three concepts can be adapted to any number of intense climates, however, since we are designing with the wind in particular, this bioclimatic framework treats the intense wind in three main ways. It deflects the wind through formal composition and site orientation, minimizing opportunities for pressure

differentials around the building. It uses materials and facades that flex and move with the wind, reducing the wind's intensity around the building while visually conveying it. And it harvests the wind, taking the chinook inside the building through bioclimatic technologies like wind towers and windows for ventilation and thermal comfort, blurring the line between inside and outside. The second framework takes perceptual theories about experiencing architecture and develops materials and spaces that emphasize the climate through their design. This perceptive framework uses the theory of weathering to select natural materials that change with the climatic forces, gaining texture and aggregating time while acutely expressing the climate's natural beauty and force, in our case, the chinook wind. It uses a theory of pedestrian rhythms to define spaces that accommodate direct purposive circulation and playful, strolling, discursive circulation, allowing more opportunity to experience the climate and architecture together in ways that do not frame the intense climate as a nuisance. And lastly, it uses the theory of bracketing to create spaces that emphasize and isolate the experience of the intense climate, making it more impactful, beautiful and memorable. Combined, both frameworks provide the parameters for an architectural project capable of blurring the line between architecture and climate, worthy of challenging the extinction of experience. In the next chapter, we will show how this design methodology, although exportable to other intense climates, is tested in the extreme climate of the chinook winds through the architecture of the west Lethbridge windy wellness centre and the pedestrian viaduct.

Chapter 5: Design

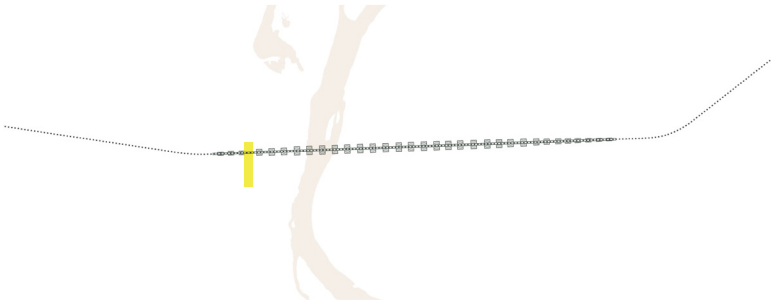


Parti of wellness building on the west coulee slopes.

“When the presence of architecture transforms a place with a new intensity, the discovery of a new relationship with nature is possible” (Ando and Abraham 1996, 461). This design aims to do so, creating a symbiotic relationship between architecture and the chinook to perceptively and experientially integrate nature into our built environment as a process, rather than an artifact separate from it.

The design is described in two parts. Since the extinction of experience can drastically affect individuals’ health and wellness, along with the temperature and pressure swings of a chinook, a four-level wellness centre and social hub is built into the west side coulees. Second, to enhance west-east connectivity and to create opportunities for sublime experiences of wind, a pedestrian viaduct is built into the existing Lethbridge Viaduct. For each part, design decisions are framed using the bioclimatic and perceptual strategies and theories previously discussed. Through blurring the line between prairie wind and prairie architecture, nature can operate on architecture, bringing its presence to the built environment, to us.

Part I: The West Lethbridge Windy Wellness Centre

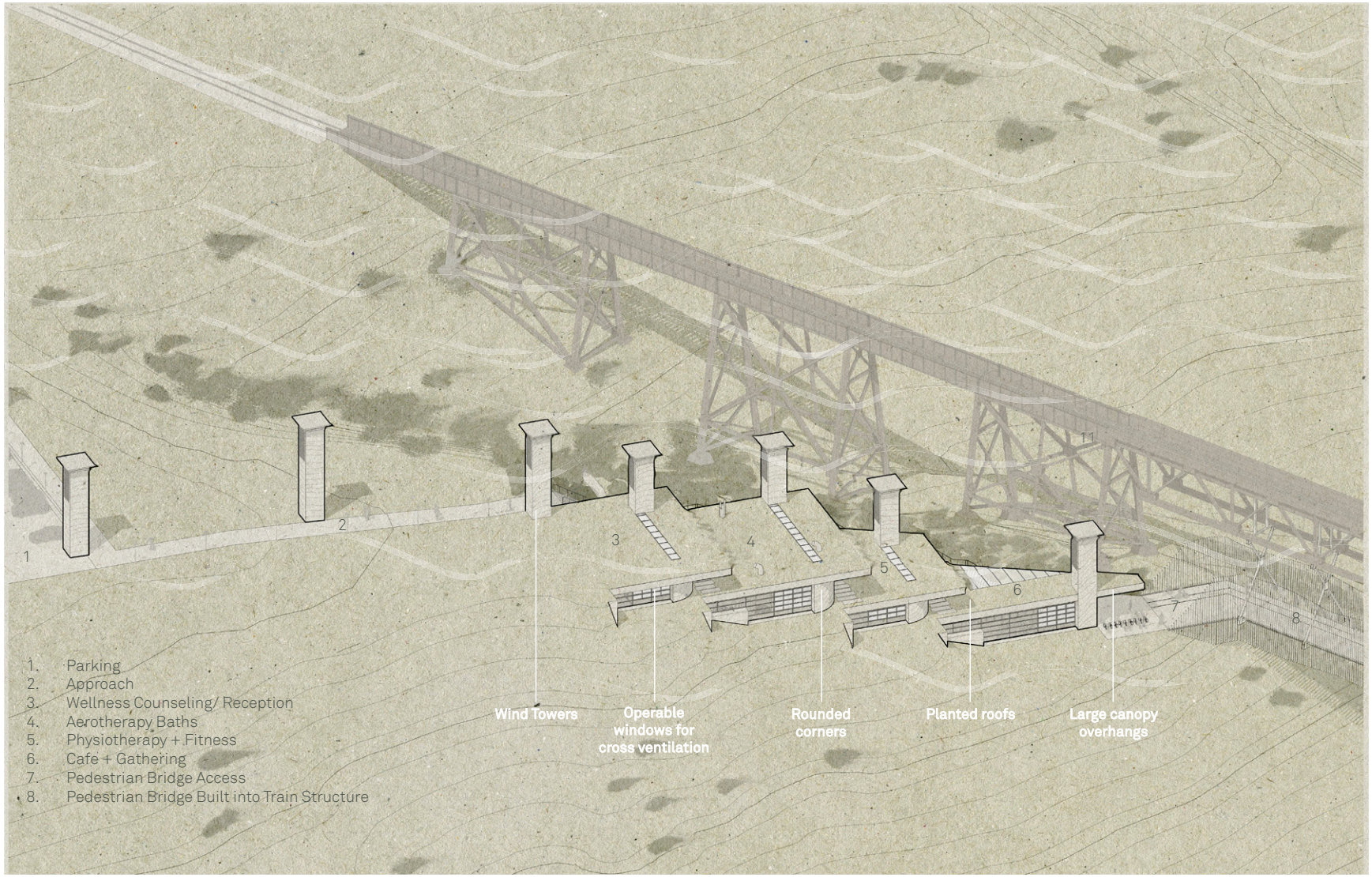


Key map indicating the west side site.

The project site is accessed from the nearby residential neighbourhood *Heritage Heights*. This neighbourhood is one of the largest residential areas on the west side with only few amenities nearby. Many families, students, and elderly reside in this neighbourhood, providing a healthy mix of demographic and economic status. In addition, many of the cyclists that visit the west side coulees live in this area. Therefore, access off its main road is provided through one of the many are many alleys and paths that break the line of houses to the coulee edge. Vehicle access is provided for visitors from farther away that are referred to the wellness centre, as well as employees, while the main demographic targeted are locals traveling on foot. Thus, a large and demarcated pathway traces the edge of the parking lot provided which protects pedestrians from the southwest wind by deflecting it over a rammed earth wall. Since the building is hardly visible from the residential area, rammed earth wind towers dot the path from the neighbourhood toward the building, expressively tracing the approach while creating remarkable visual contrast to the flat landscape. These structures serve to power the lighting along the path and throughout the parking lot while aggregating the wind's process on them through weathering their clay composition.

West side site plan for wellness centre and bicycle hub accessed from the residential street to the west.

An exterior view from the west side approaching the wellness centre past the rammed earth wind towers.

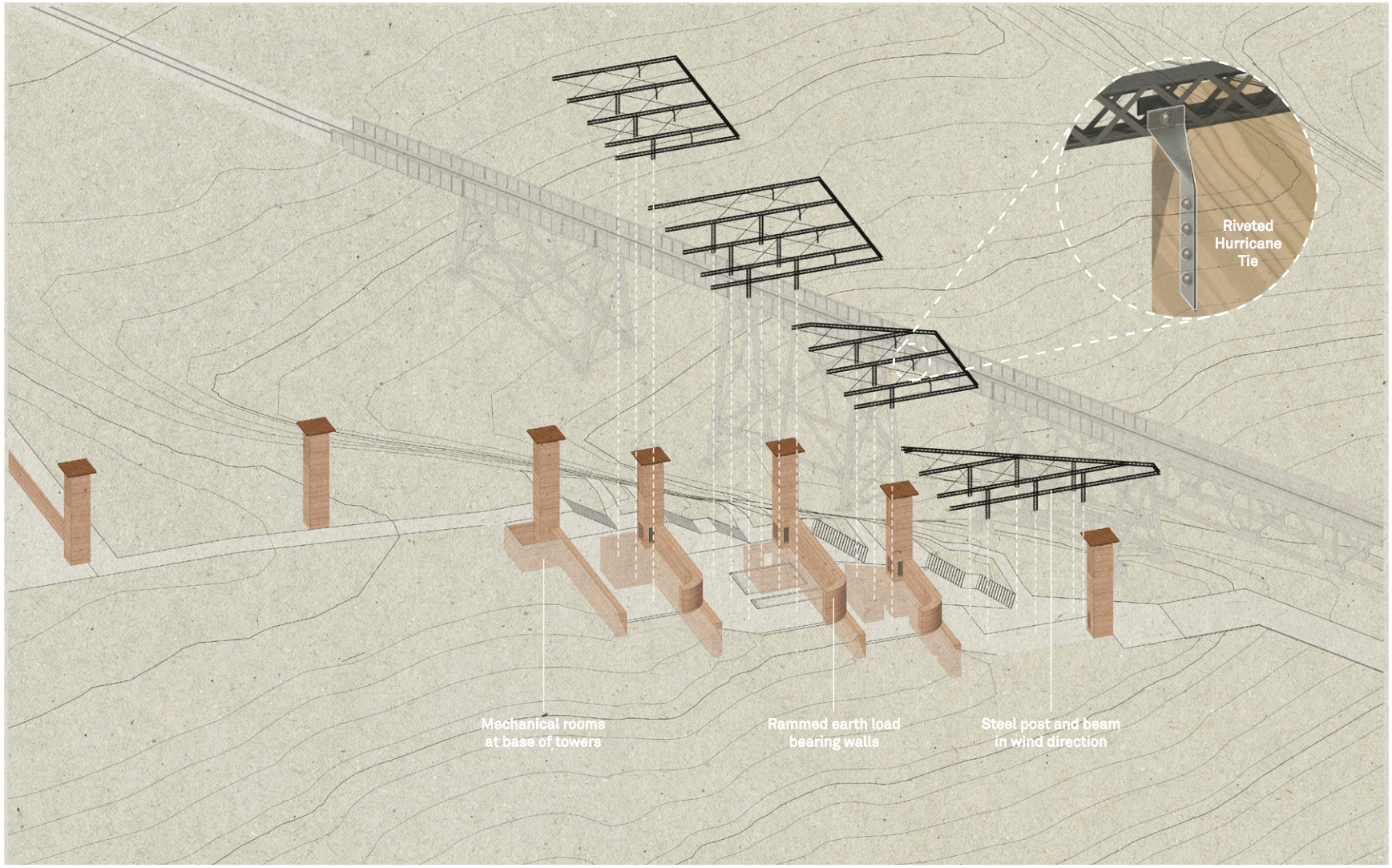


Axonometric of the west Lethbridge windy wellness centre showing its built in nature and connection to the pedestrian bridge.

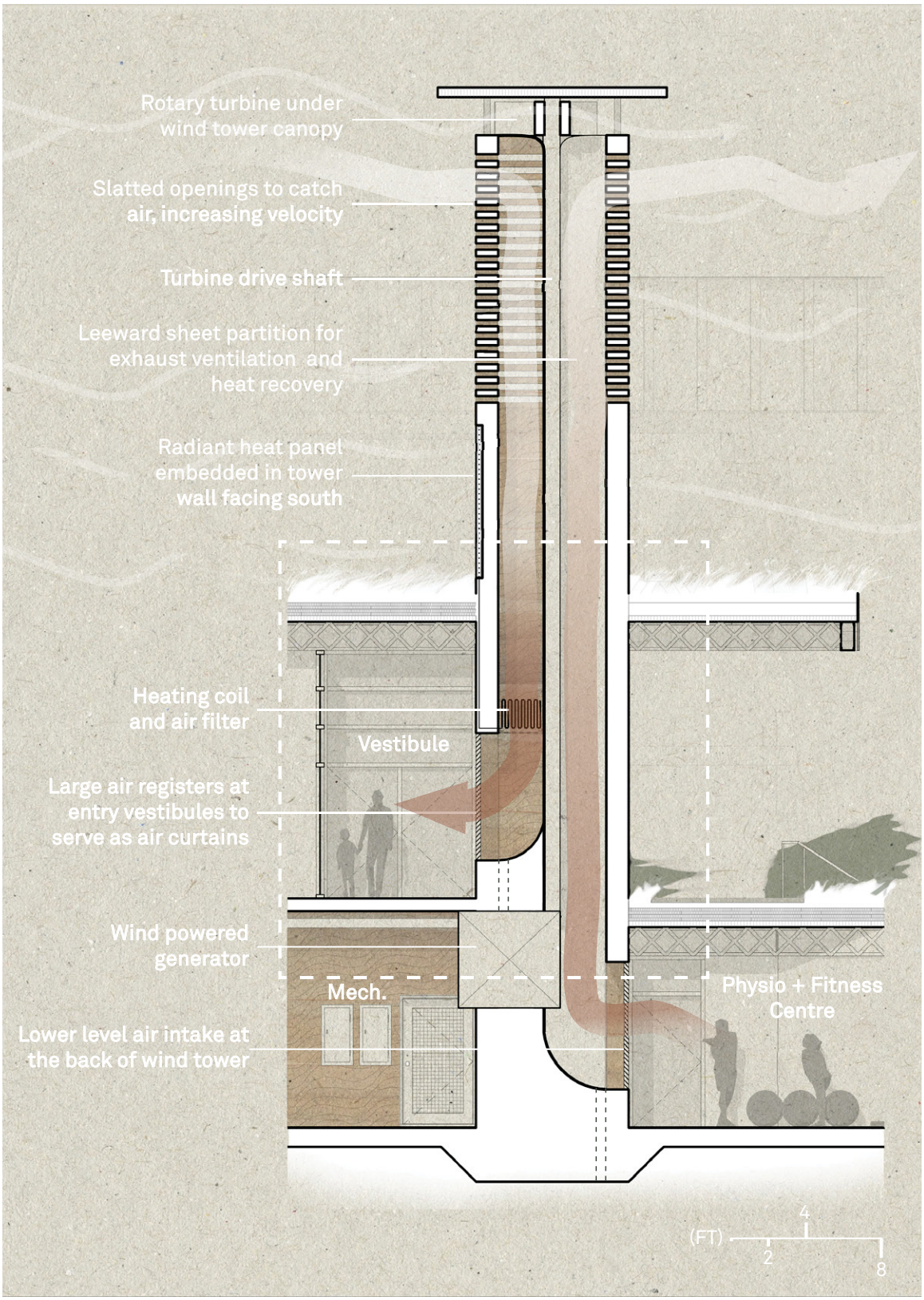
With the roofs masked in native grasses, the approaching local or visitor only sees the megalithic wind towers marching them toward the wellness centre with a large garden of native plants framing the stair and ramp access to the building along the west. Built into a natural coulee fault, the four-tier structure starts flush at the top of the coulees and cascades down to the proposed pedestrian bridge hanging under and through the structure of the train bridge. The form is oriented in the two most predominant wind directions—southwest and west-southwest—deflecting the chinook wind over the large, canopied roofs. The walkway clips to the coulee edge under the girder truss of the train bridge, creating an articulate threshold onto the pedestrian viaduct.

Following the stairs or path sheltered by native plants and grasses that flex in the wind, visitors are lead toward the pedestrian bridge, encountering each building level processionally. The top level is the wellness counselling and reception, the second level is the aero-therapy baths, the third level is the physiotherapy and fitness room and the bottom level, the most public and social level, is the bicycle rental and repair shop and the cafe/ flex space. This social level connects with the pedestrian bridge that is clad in a kinetic facade of swaying parallel rods that also flex in the wind, mimicking the plants and grassy roofs. Rammed earth wind towers for harvesting wind pin the roof planes to the coulee slope, with rammed earth walls extending horizontally as retaining walls, intended to weather into the landscape.

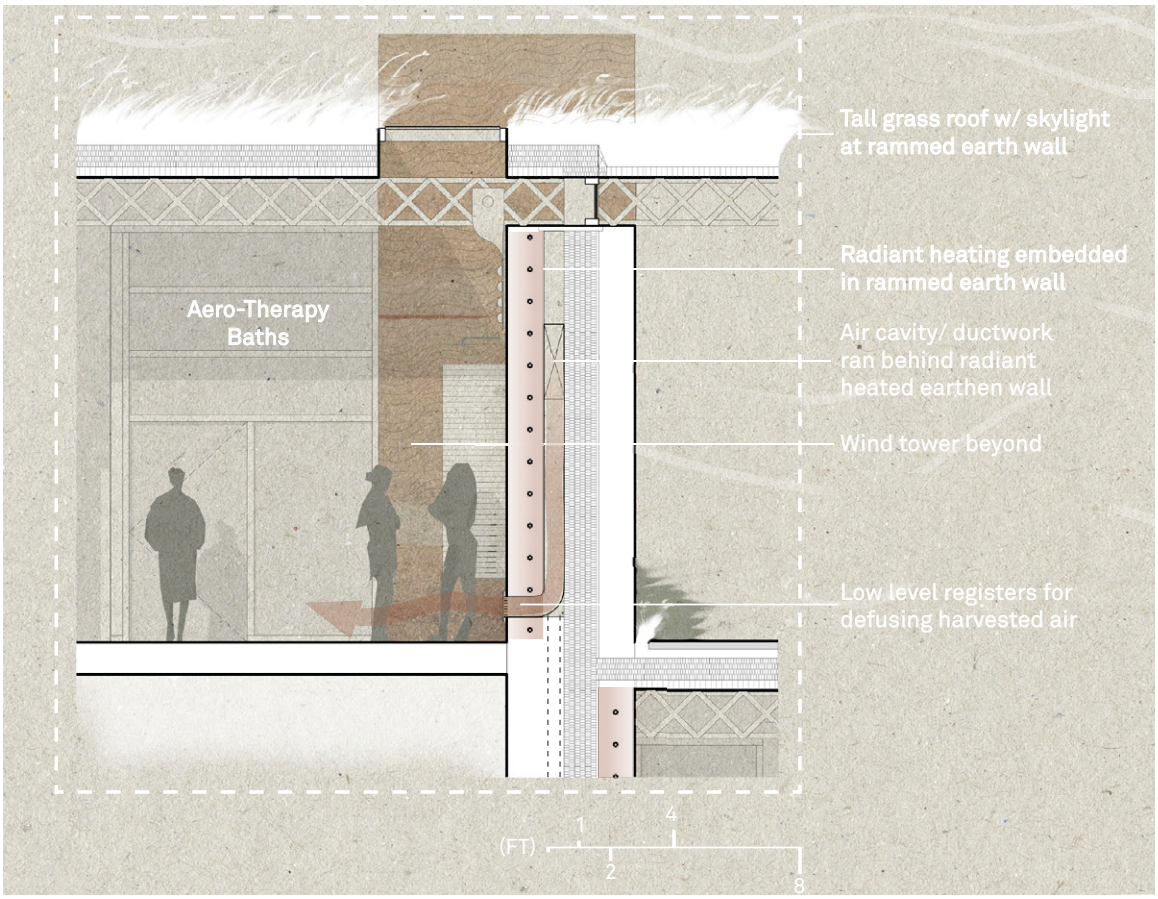
The structure of the building speaks two languages, acting as a metaphor for the meeting point between the coulee landscape and the bridge. The tectonic strategy borrows from the Lethbridge Viaduct, using a steel trestle inspired



Axonometric showing the relationship between the steel tectonic and earthen stereotomic structures with the wind towers that feed the mechanical rooms at their base.



Typical wind tower section indicating the intake and exhaust air systems.



Typical rammed earth wall section indicating the radiant heat toward the interior with the air cavity running through it.

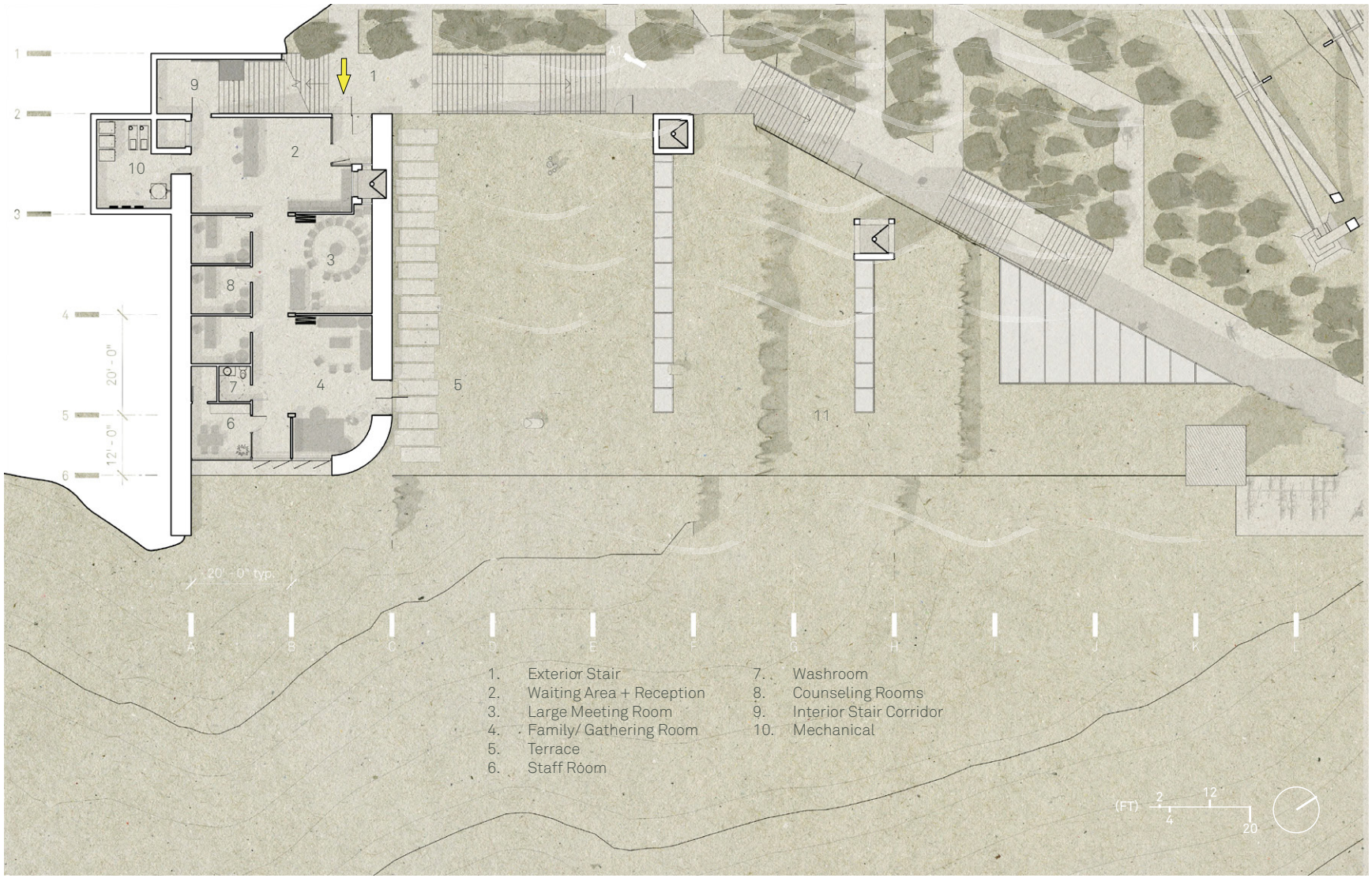
space frame, expressive of the wind's forces. This Frame grabs onto the thick earthen walls, with large exposed riveted hurricane ties, representing the need for anchoring in a windy climate.

Beyond weathering and structure, the earthen walls attach to the wind towers, acting as the distribution for the natural ventilation. As wind speeds tend to increase with height (Battle McCarthy Consulting Engineers 1999), the reinforced wind towers harvest air through scoops 24' above the roof levels. The air then travels through a filter and cavity behind the rammed earth walls. These thermally massive walls are conditioned by embedded radiant heating lines. The fluid in the lines is warmed by panels that capture solar radiation located on the body of the wind towers. The wind that the

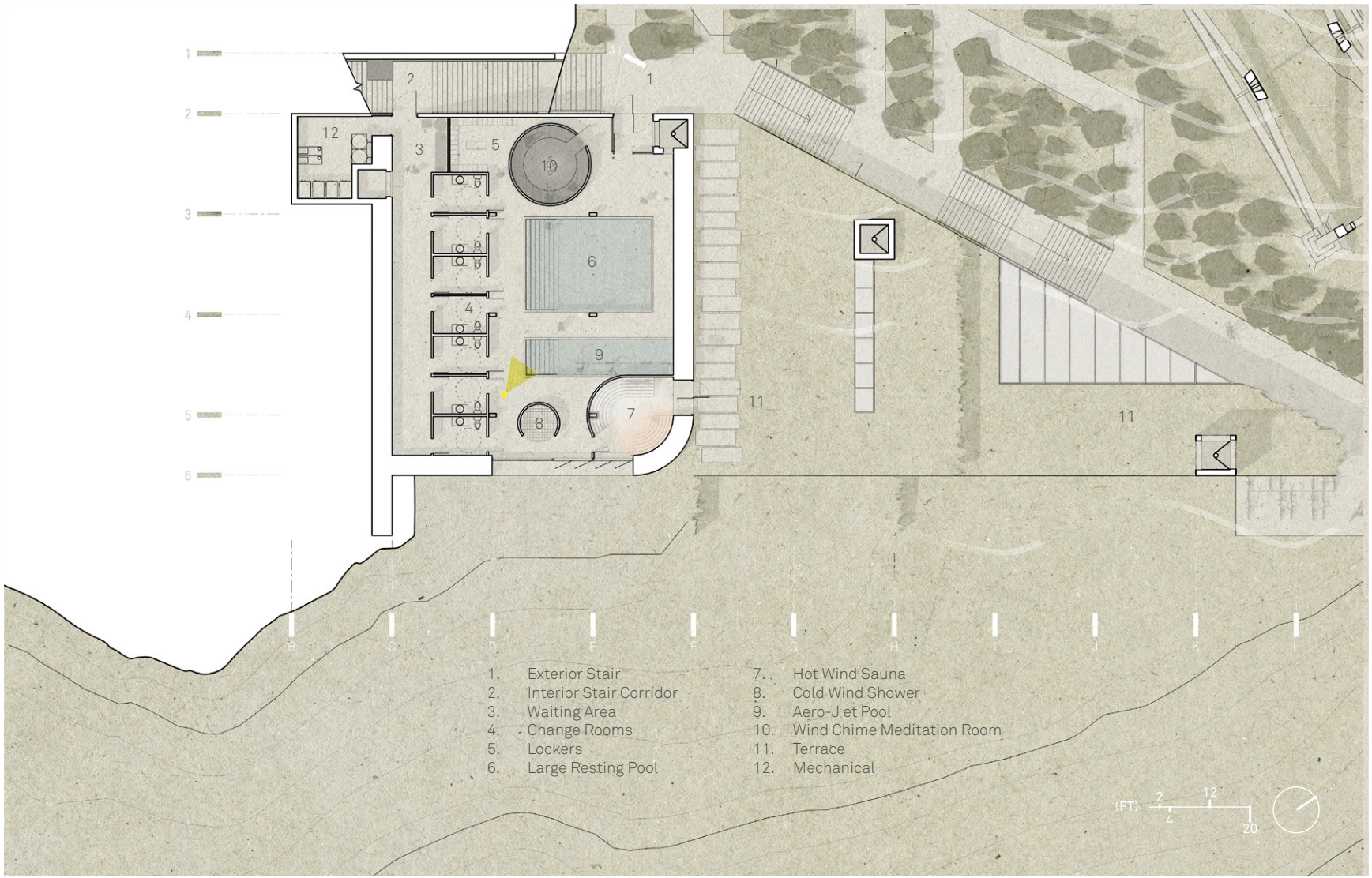
towers harvest picks up this temperature by running through the rammed earth wall cavity and is then pushed into the spaces through low level registers. Casement windows opposite the towers provide opportunity for cross ventilation during the summer months, with air being drawn out the partitioned back of the towers due to the negative pressure differential (Krautheim et al. 2014, 71). At the top of each tower, a rotary turbine catches wind from any direction, powering equipment such as pumps and generators in the mechanical rooms located at the base of each tower.

Continuing into the building, each exterior entrance features a pivoting rotary cam door that harvests the wind as a closing device, since wind and doors don't often mesh in Lethbridge. Each level enters at the wind towers, immediately presenting the wind harvesting technology to the visitor. In the wellness counselling level, the visitor is greeted by a reception with interior access to the lower levels of the building. This floor offers counselling and seasonal affective disorder therapy through individual and group counselling spaces. The group spaces are flexible with paneled partitions for variations in privacy and space size.

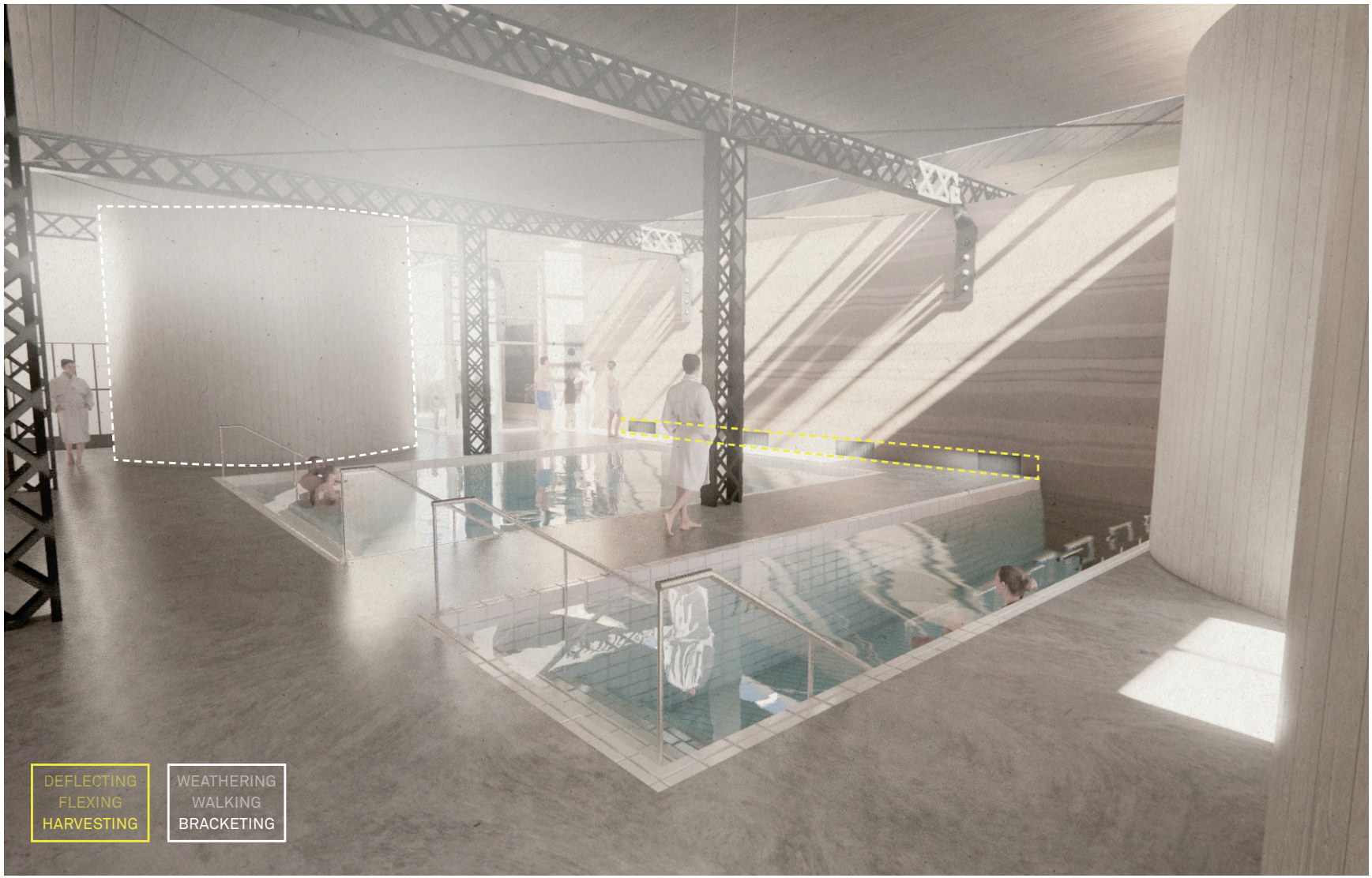
The second level down is the bathing facility as part of the wellness experience. Aero-therapy is introduced to bracket the phenomena of wind as a force for visitors to heal from. Primarily accessed through the interior stair corridor from the top level, the visitor passes through private and accessible change rooms, out into a collective locker room. Within the bathing area, the visitor can find a heat-cool-rest cycle for a discursive stroll around, tempered by the chinook winds. The wind sauna catches wind at the rounded earthen wall, through an embedded turbine. This turbine powers a basic resistance coil that super heats the interior portion of the



Level 4 – Wellness counselling floor plan.



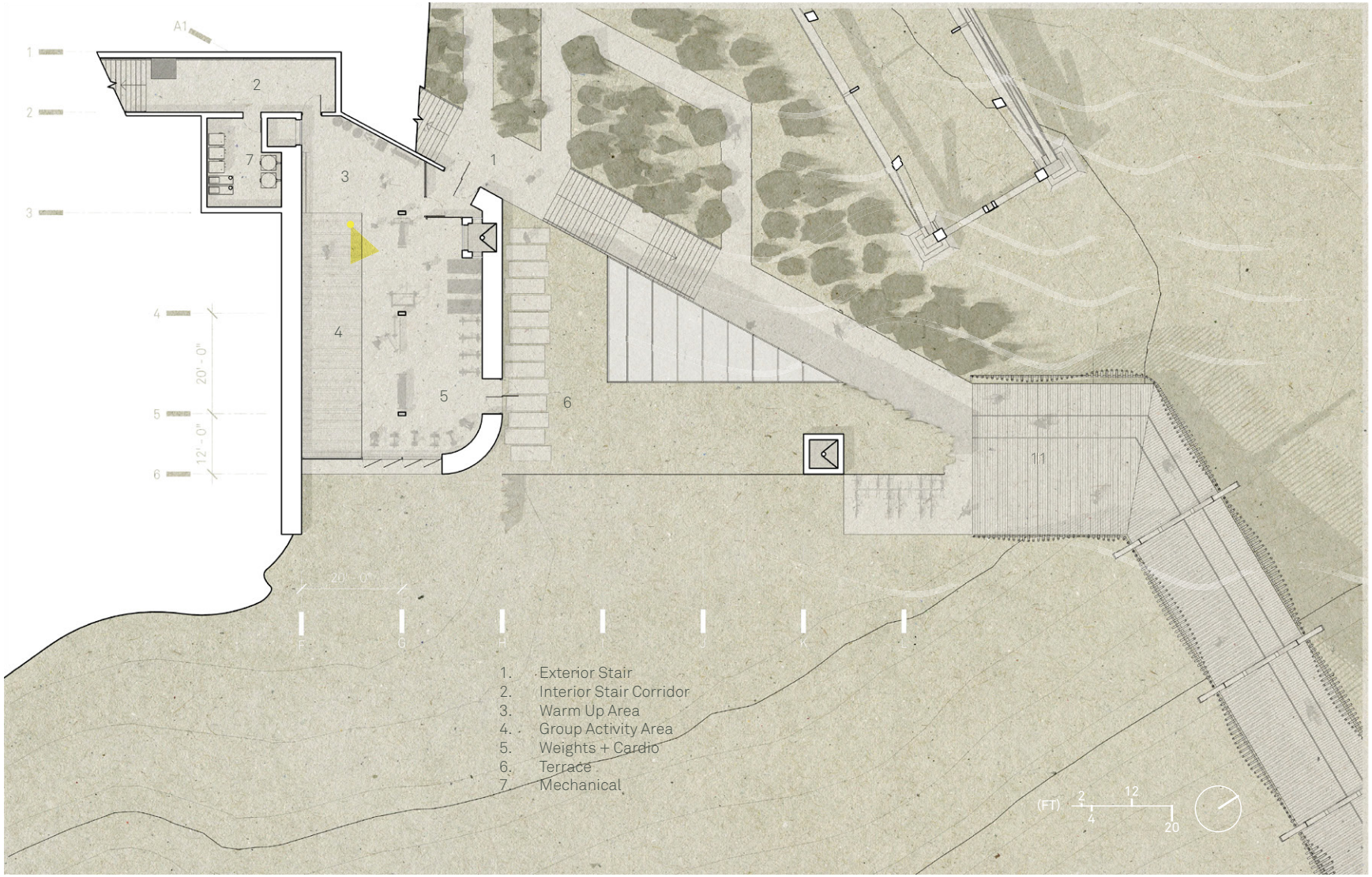
Level 3 – Aero-therapy floor plan.



An interior view from the aero-therapy baths looking across the resting pool and the aero-jet pool.

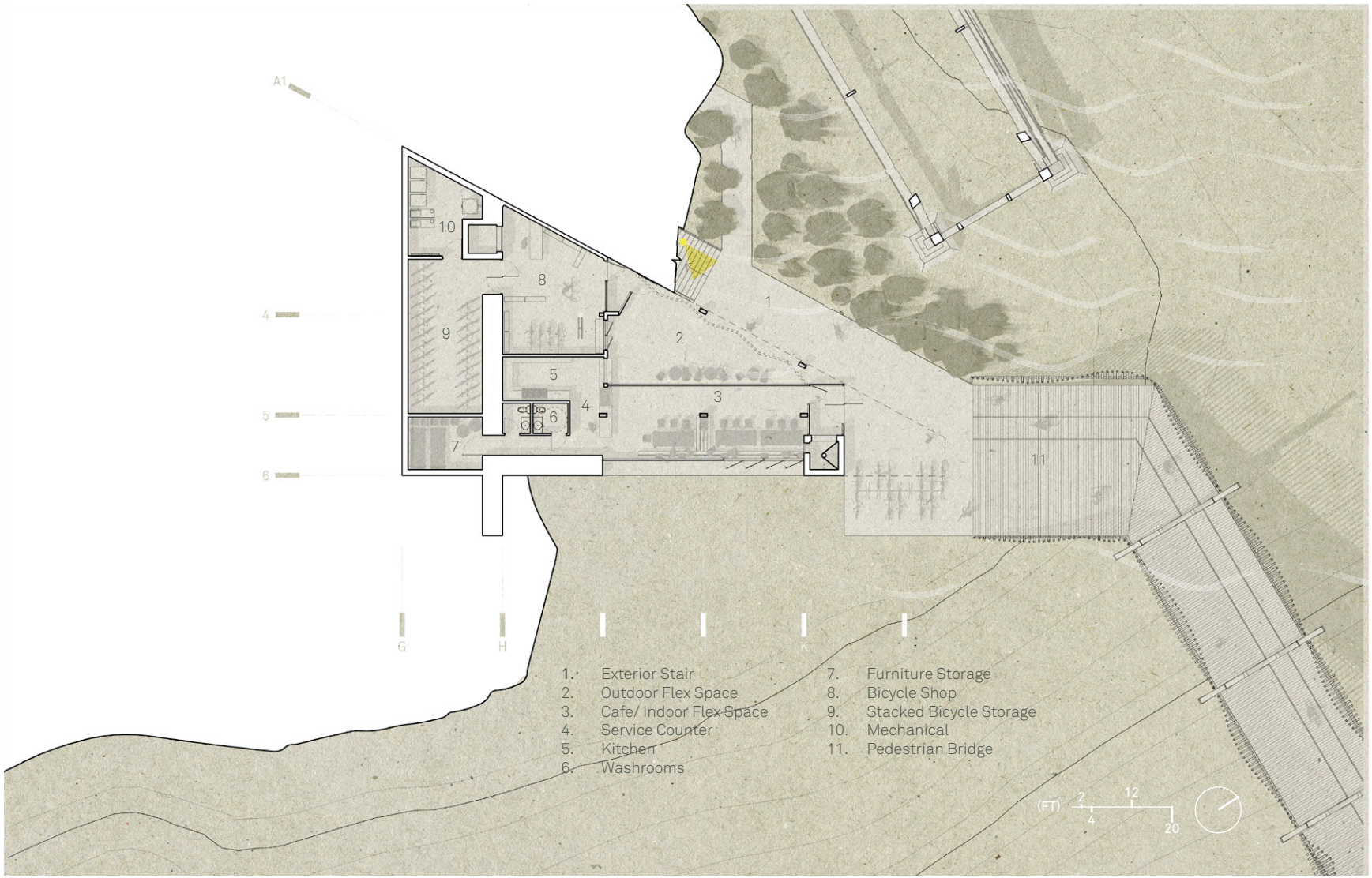
earthen wall. On windier days, the temperature intensity increases, prompting operable windows within the sauna to balance the temperature intensity. The cold wind shower operates through capturing unconditioned wind from the roof and channelling it straight down through a venturi on the visitors, creating a chilly and intense experience. This is the case for the aero jets in the therapy pool as well, although these submerged jets have valves for controlling pressure, much like traditional hydrotherapy jets. Finally, there is a low-light meditation room where wind resonates conical tubes penetrating the roof, creating a bracketed experience of wind as sound. The sensory wind spaces are clad in warm timber that will weather over time with human use. Skylights are located above all rammed earth walls, bathing them in sunlight to both add solar gains to the thermal mass in the winter while visually celebrating their importance in the connection to both the ground and the wind.

A third component to the wellness centre is the physiotherapy and fitness level. Also accessed either through the interior corridor or from the west exterior entrance, the space accommodates both individual exercise sessions and classes. Within this passively conditioned space, there is room for stretching and warm-up, group activities, access to the roof terrace for outdoor classes, views out to the coulees, and both cardio and weight training equipment. Torrefied wood boards that are found throughout the exterior also clad the ceilings of the interior spaces. Having the same material throughout the building unites interior with exterior but also creates a visual and haptic opportunity to experience the force of the wind. The char on the exposed boards outside will erode, creating a stark contrast to the boards located on the inside, further illuminating the finish of the environment.

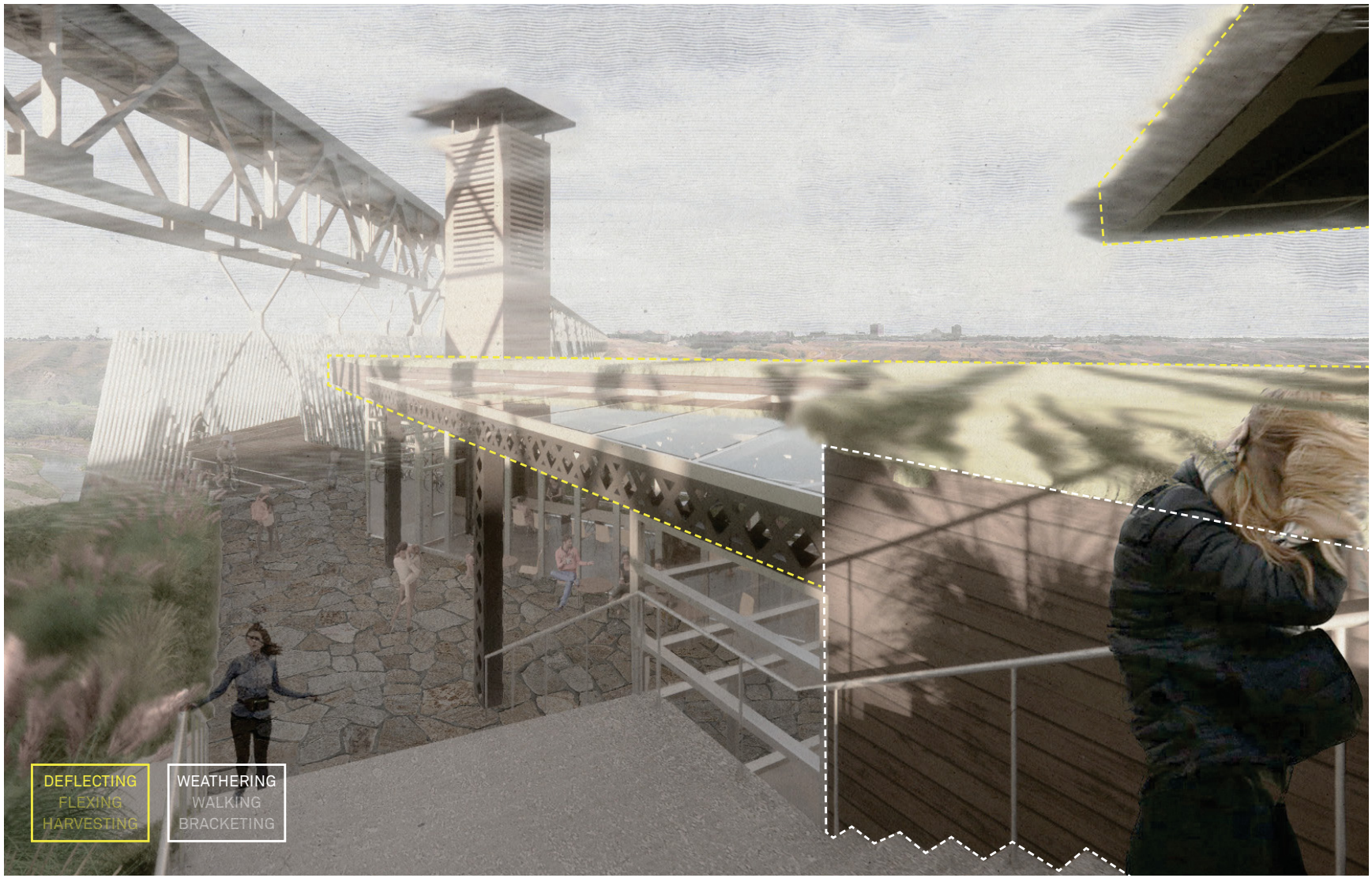


Level 2 – Physiotherapy & fitness floor plan.

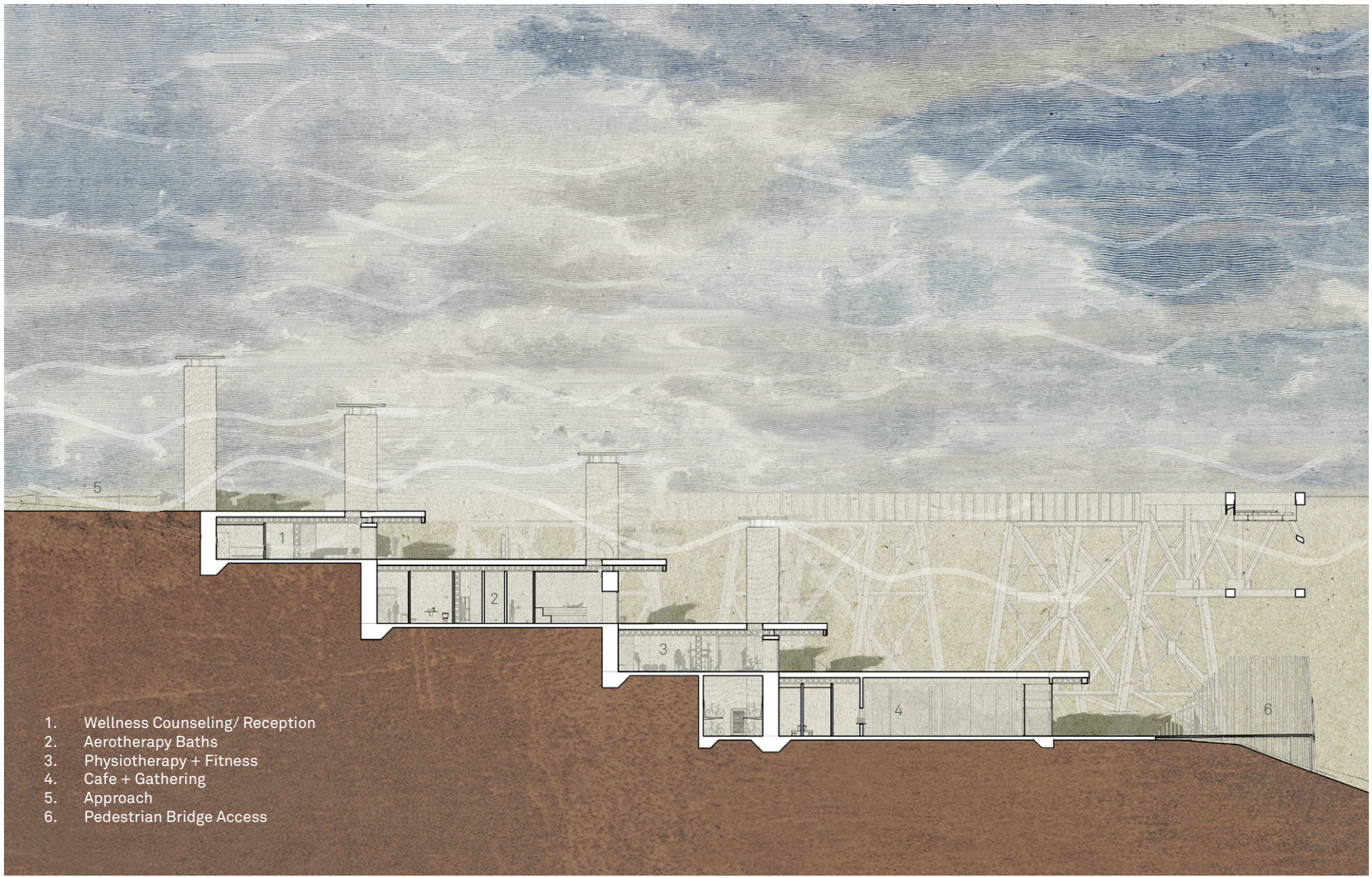
An interior view from the fitness area looking out towards the south side of Lethbridge and the river valley.



Level 1 – Gathering & bicycle shop floor plan.



An exterior view walking down the stairs along the west side of the building approaching the outdoor gathering space and bicycle shop.

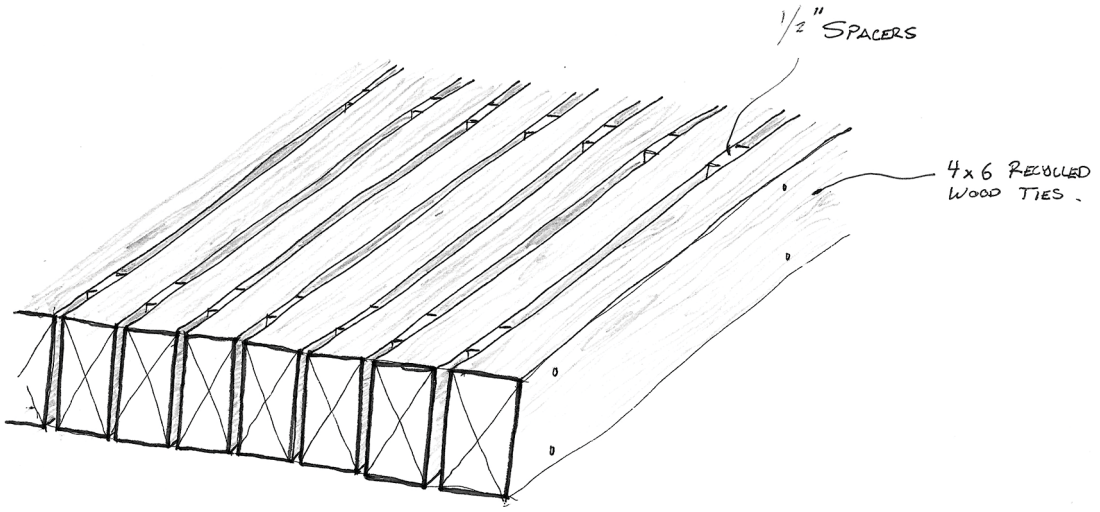


Longitudinal building section showing the relationship of the wind towers, rammed earth walls and the connection to the pedestrian bridge.

The bottom level deviates from the wellness clinic, combining wind sheltered flexible indoor and outdoor social space with a cafe. The outdoor area cuts into the building, revealed by a large glass canopy that allows ample sunlight to bathe the space while deflecting the wind over it. A long folding glass partition is provided that can operate in three ways: In regular scenarios, it can divide the cafe from the outdoor gathering space; during the summer, it can fold up entirely merging the cafe with the outdoors; and in the winter, or for special events, the partition can reach across to the exterior stairs, doubling the interior space. In addition, a bicycle and scooter rental and repair shop is included to support the west side subculture of downhill cycling while encouraging residents and visitors to traverse the bridge and explore the city. The combination of the shop and social space could be used to host cycling events in the summer, and with its movable glass partition, could host weddings and other gatherings during the winter. At this level, the height of the floor aligns with the first bottom chord of the steel trestles that the pedestrian walkway rests on, transitioning the coulee to the floating tectonics of the train bridge.

Part II: The Lethbridge Pedestrian Viaduct

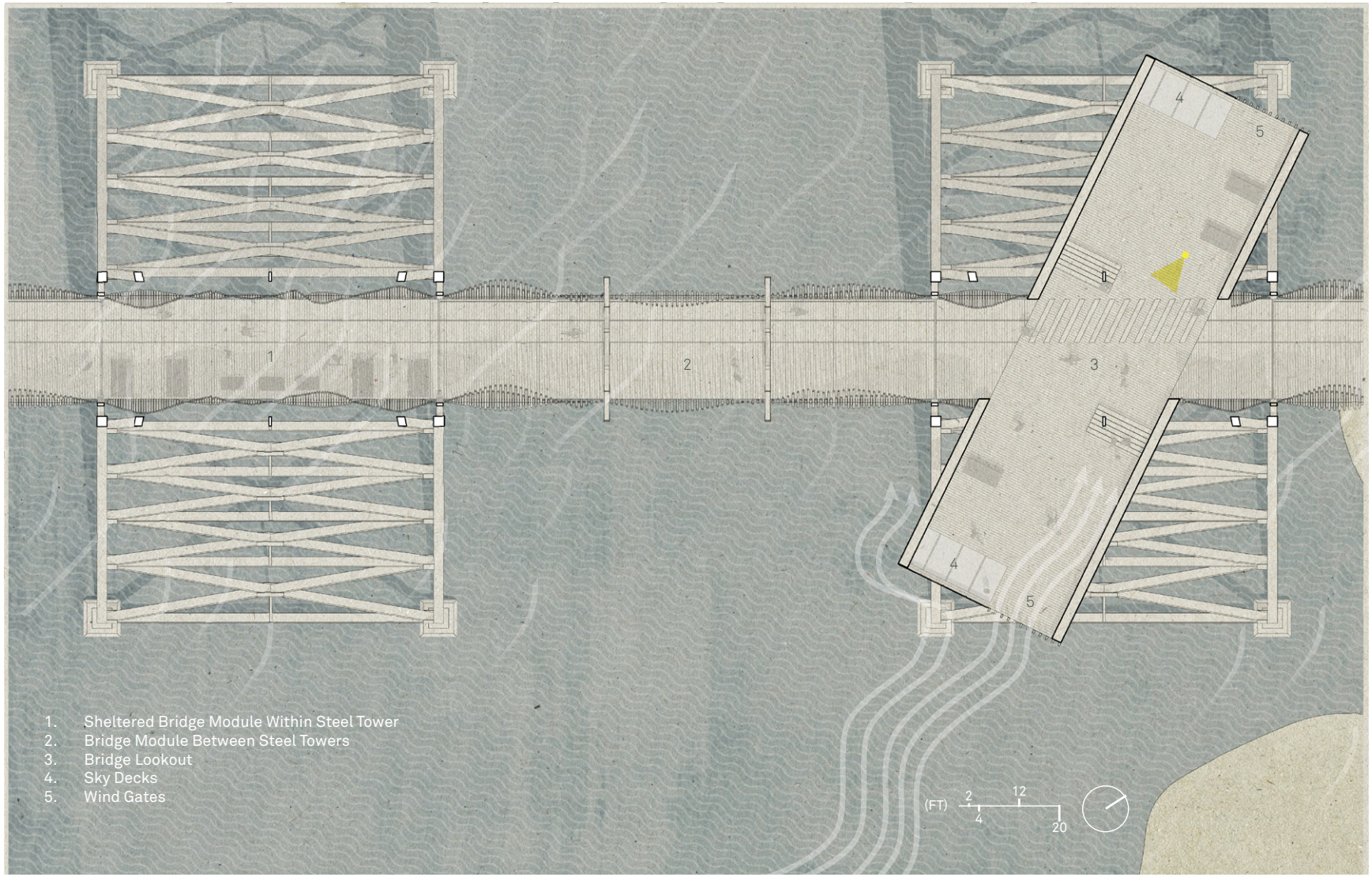
The second component to the design is a 20’ wide pedestrian bridge built into the Lethbridge Viaduct. Adapting the language of the train bridge, the construction consists of longitudinal steel girder beams at 10’ on centre, with perpendicular pressure treated and stained NLT deck, comprised of recycled railroad tie wood. Half inch spacers are provided between boards of the NLT deck to reduce the lifting force from the wind. A rhythmic facade of counterweighted 20’ aluminum bars are fastened to the edges of the walkway. These bars rock back and forth in the



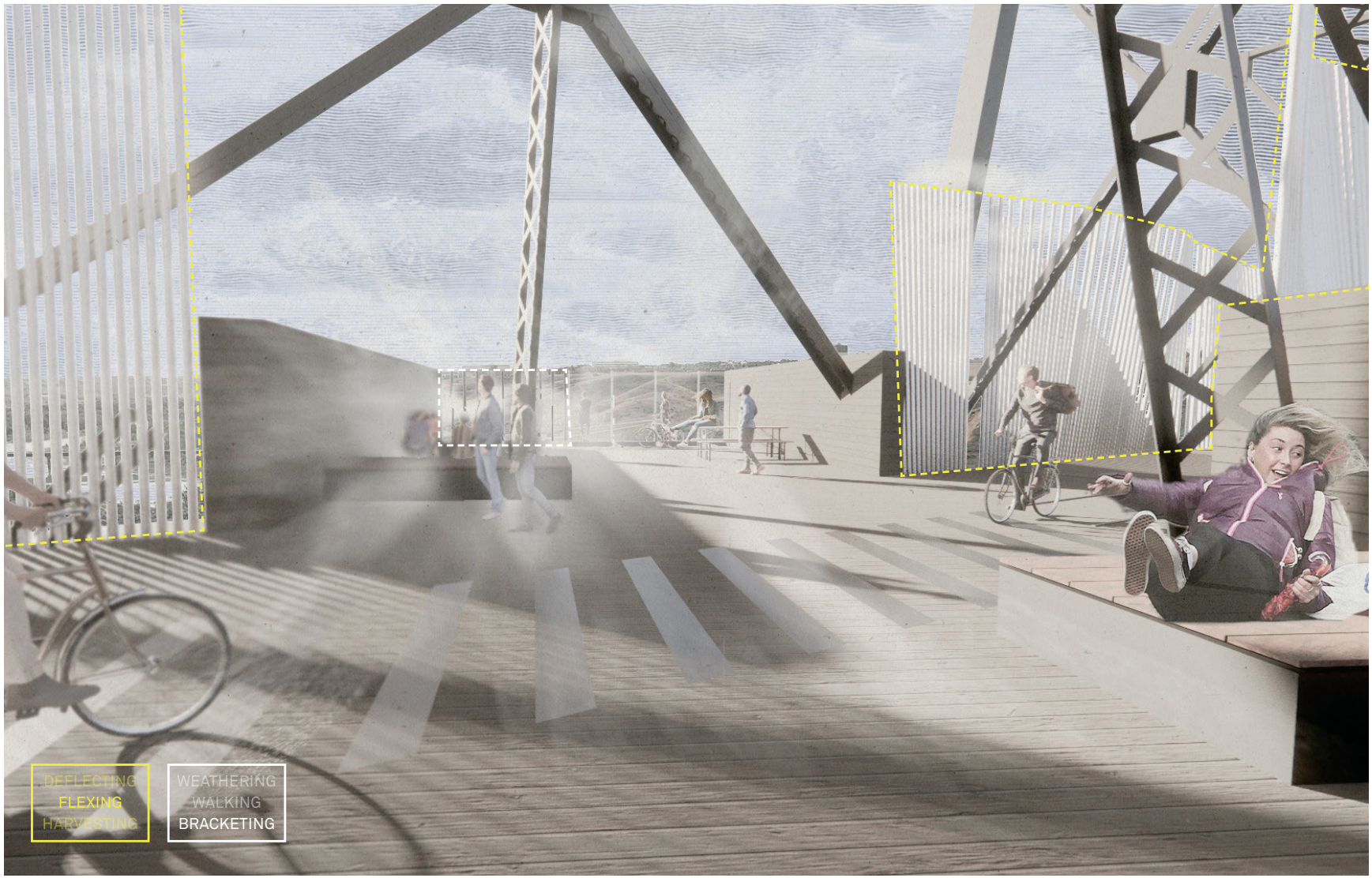
Sketch of the treated NLT boards with the 1/2” spacers to prevent significant lift.

wind, using the flexing method to kinetically remove energy out of the wind. These swaying bars visually capture the wind as waves passing through the bridge. Additionally, their height protects users from the dangers of being nearly 90 metres above the ground. Two continuous ‘fast’ lanes are stacked toward the north of the walkway for purposive circulation while the south half of the walkway is used for slower discursive walking. Considering the frequent over-designing of these types of trestle bridges, the relatively minimal dead and live loads of this design would have little effect on the integrity of the train bridge structure (Johnston 2008, 35).

Key map indicating the lookout site.



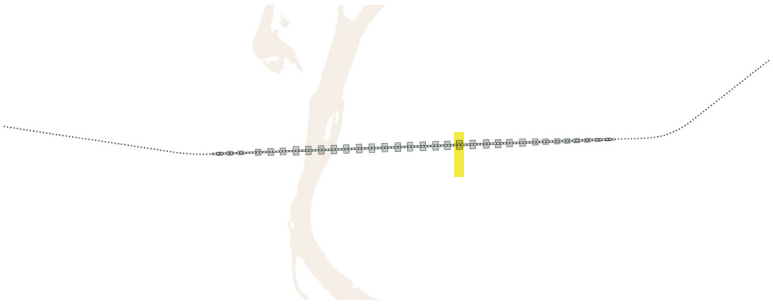
Pedestrian bridge floor plan at a typical trestle and lookout at tower 24.



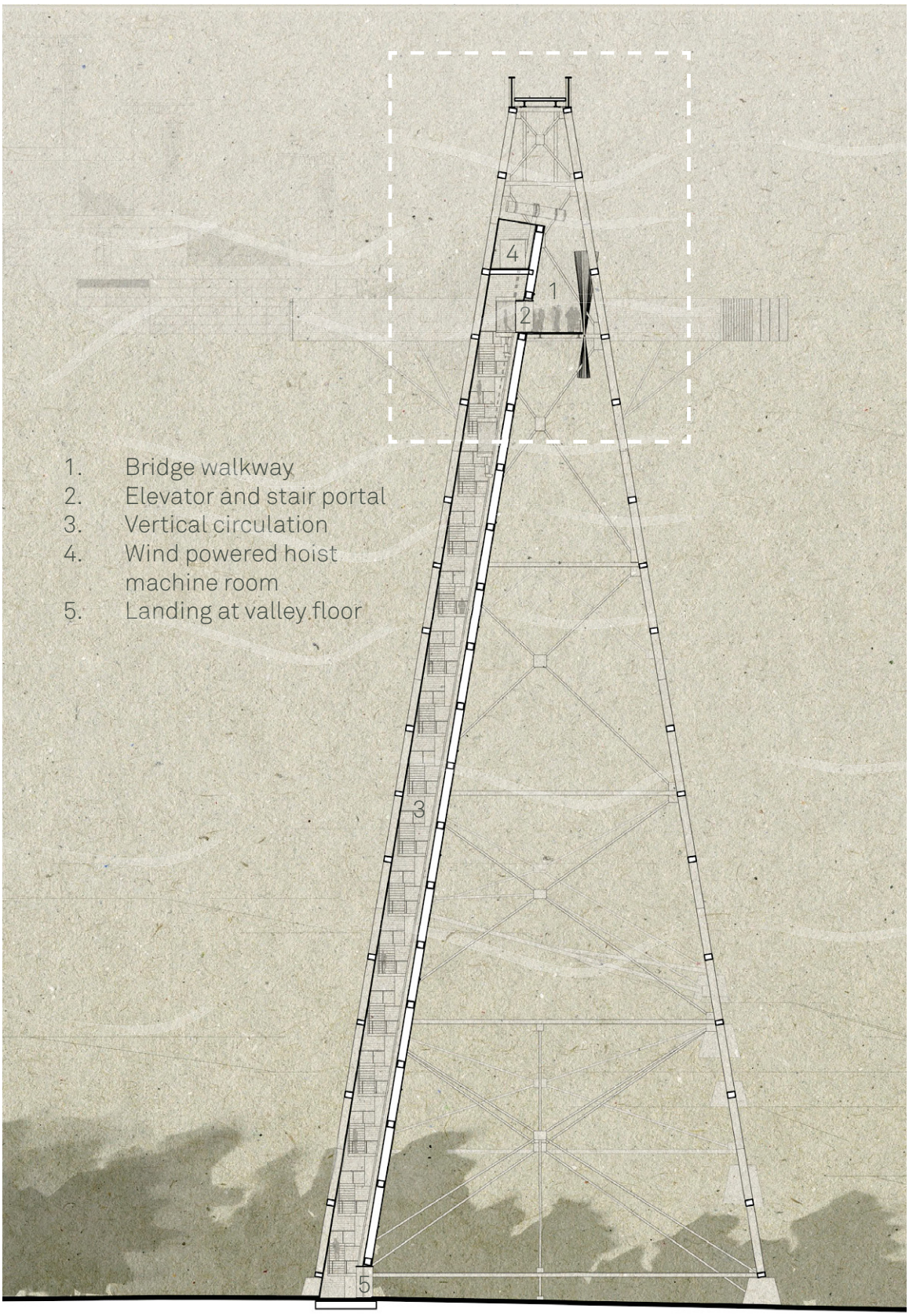
An exterior view looking south out from the bridge into the prominent wind direction.

The design is generally comprised of two modules, the first are the segments built within the steel trestle towers. In these spaces, the kinetic facade densifies, providing more wind protection for a variety of program use such as art shows, markets, and music festivals. The second module between these towers attach to the tower edges and hang from the massive steel girders above. The armatures that these segments hang from are designed as extrusions of the bents that the walkway runs through. On these in-between segments, the kinetic facade decreases in density, allowing variation in wind exposure and views of the valley. In addition to the two modules, there are two interventions along the mile long walkway.

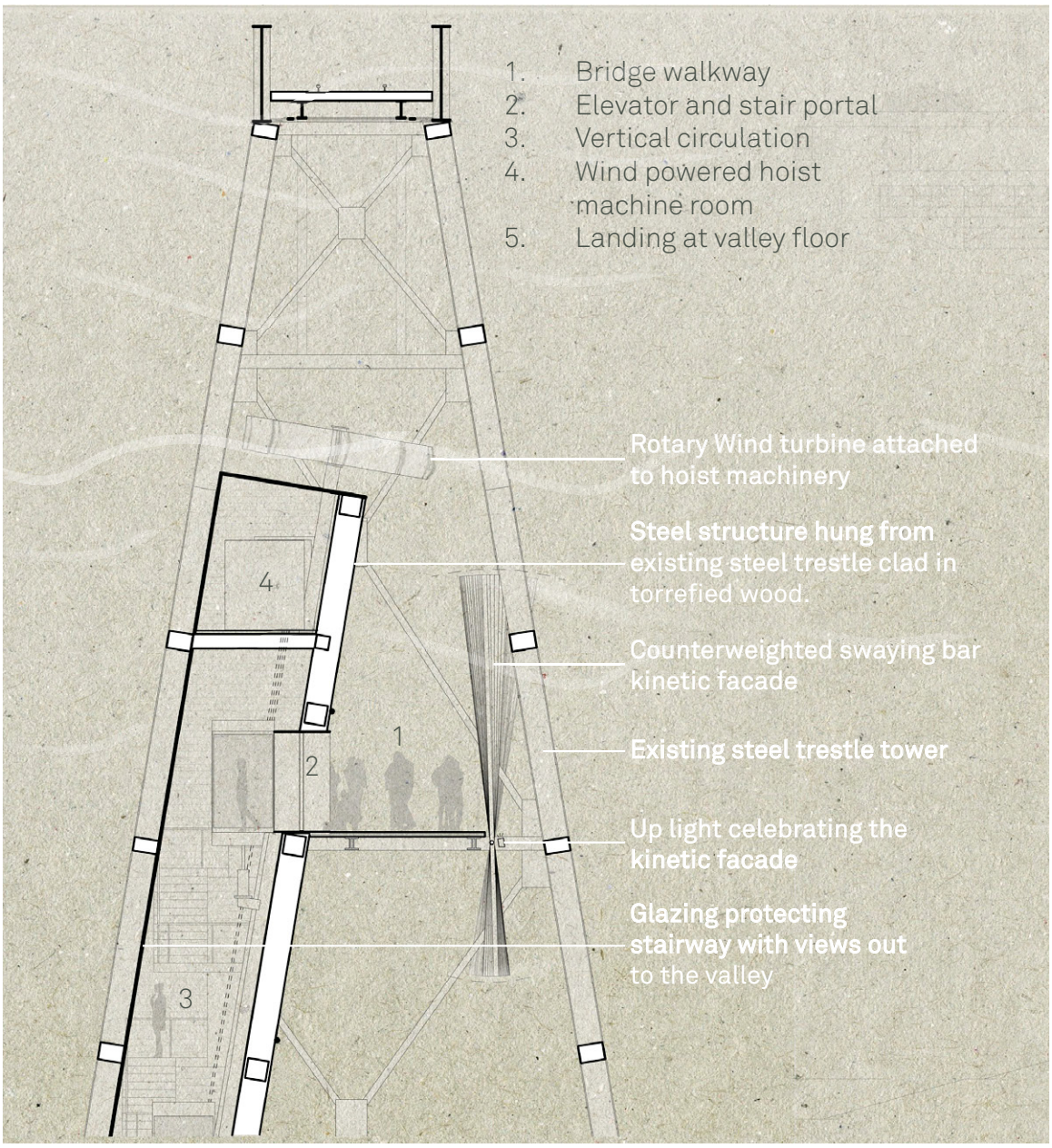
Located at tower twenty-four, a horizontal lookout breaks free of the linear walkway, creating a moment of sublime experience of both the wind and landscape. Oriented into the wind in the same direction as the wellness centre, the lookout is mirrored across the walkway, providing sweeping views of the valley north and south of the train bridge. The structure consists of a ‘U’ shaped framed truss clad in torrefied wood that slices through the kinetic facade. At both ends there is a viewing area protected by a glass wall with glass floor panels to enhance the floating sensation above the valley. Beside the protected area, there is a gate



Key map indicating the vertical circulation pillar site.



Cross section at vertical circulation pillar at tower 14.



Enlarged cross section at vertical circulation pillar at tower 14.

An exterior view looking the pedestrian bridge level entrance of the vertical circulation pillar.

open to the wind, fully unobstructed, creating a phenomenal sensorial experience of the wind's awesome power.

Further east, at tower fourteen, a second intervention penetrates the waving facade vertically. Using the same formal composition as the lookout, this 'pillar' of circulation hosts a staircase and a wind powered elevator that connects to the river valley. The wind turns a showcased turbine attached to a hoist room, enhancing the visual relationship between the wind and the design. This intervention is strategically placed so that the entrance lands at the road between the Helen Schuler Nature Centre and Fort Whoop-up both located minutes away on the valley floor. The ascension of the stairs or elevator could be embellished with interpretive information on the history of the construction of the train bridge, creating an educational opportunity. The pillar, like the lookout, is clad in the same torrefied wood that the wind will scour over time, creating a rich variation of texture in the material. An aluminium portal at the top and bottom of the pillar matches the materiality of the swaying, dancing bars, cuing the user of the entrance and exit.

The pedestrian bridge terminates at the east coulee, tying into the existing path networks that trace the road leading to downtown and the proposed north/ south bicycle network currently under construction. Although not in the scope of this thesis, the east side of the bridge could feature a second phase project that would complete the bookend of the pedestrian bridge. Designed using the same bioclimatic-sensory framework, this phase two could feature an architectural form that faced into the wind rather than sinking into the ground, exploring the implications of building form deflecting head on winds. Since it is particularly important to provide nature experiences to children at an early

Sketch of “phase II” east side of the bridge indicating a potential science and research centre.

age (Soga and Gaston 2016, 94), an educational aero-science centre could be proposed, introducing green wind technologies in the education of future generations. With many senior housing facilities nearby, this could be a great hub to meld young and old demographics. Additionally, the Wind Turbine Technician program at the Lethbridge College could also benefit from a satellite facility for practice and research, exploring the potential intersections of wind energy generation and load reduction at the building scale. There is even potential to continue this design strategy further west, integrating it into the coulee edge retail shopping that is part of the West Lethbridge Employment Centre area structure plan. Since the retail zone is already planned to be pedestrian oriented, this climate framework could provide a sensibility and continuity of wind protection and harmonization across the west side (City of Lethbridge Planning & Development Services 2013, 40–41).

An exterior aerial concept rendering of the wellness centre looking west.

Chapter 6: Conclusion

Cities in unique and intense climatic environments like Lethbridge continue to prioritize short term economics, standardization, and design trends, over regional sensitivity. This ‘brute force’ mentality is further engraining our western perception of nature as something separate from us by manifesting it in the built environment. As a result, we feel increasingly alienated from nature since the built environment, where we spend most of our time, is not perceived as natural. Although this extinction of experience of nature in our cities is posing a risk to health and well-being, it is also primarily a sustainability issue since a lack of exposure, and therefore emotional connection to nature, leads to apathetic environmental attitudes and behaviors. (Soga and Gaston 2016, 95–96).

In response to this brute force mentality, this thesis proposed a new and active approach to designing with climate by using a bioclimatic framework that responds to a climate through building form, material, and technology. Since the extinction of experience is a perceptive issue, this bioclimatic framework was augmented by theories for perceiving and experiencing the climate in material weathering, through multiple movement rhythms, and through building forms that concentrate the climate in wonderfully sensory ways. This bioclimatic-sensory framework was created to strike a harmony between the built environment and the most prevalent natural forces in intense climatic environments, revealing how nature experiences can be created through sensitive design consideration of formative climatic processes.

Lethbridge, Alberta, became the testing grounds for this dualistic framework where the chinook winds frequent chaotic velocities, and where the architecture of the city gives little acknowledgement to this phenomenon. By customizing the bioclimatic strategies to deflect the wind through building form, flex materials in the wind, and harvest the wind through towers and turbines, the intervention expressed how sensitive consideration of climate can manifest positive nature experiences through architectural design. The objective was to reframe the wind as a positive force in the built environment to Lethbridgites, combatting the extinction of experience, while ultimately advocating for design that is more environmentally sensitive and responsive to local climatic idiosyncrasies.

Designing with the wind was simply an example for designing with climates that are intense and in active confrontation with built environment. The intention of this thesis is to extend this theory beyond the Lethbridge example with the design framework exportable to other environments with intense climatic qualities such as heavy precipitation on the West Coast of Canada, or in dry, hot environments farther south. Although in each unique climatic region, the bioclimatic strategies of form, material, and technology will have to be customized to the climatic phenomenon, as we did here with the wind, the key is coupling existing bioclimatic research with perceptive theories. Coupling bioclimatic and perceptive strategies can emphasize the multi-sensorial qualities of a climate, while simultaneously reducing its negative impacts on thermal comfort and energy consumption. This multi-dimensional approach to climate sensitive architecture implies a new type of sustainability that addresses both

technical sustainability issues but also perceptive ones such as the extinction of experience exemplified in this work.

Additionally, since this work has already cultivated a unique response to windy environments, there is the opportunity for this bioclimatic-sensory framework to be adopted by other architects in the context of Lethbridge or other places with windy climates. This adoption implies a scalability. For instance, if designers and architects in Lethbridge began using this framework for new projects throughout the city, over time, there would manifest a formal grain to the city reflecting the wind seen throughout these works, especially if they aggregated together, as I had implied in the phase 2 extension of this project. Perhaps at the urban scale, this framework could too direct developments and even foster bylaws on pedestrian design, access, and material use. A possible next step could be exploring the adaptation of this bioclimatic-sensory framework to not just new projects, but also to existing buildings and urban spaces in Lethbridge, further expanding the possibility to shape our built environments in accordance with climatic characters.

To conclude, by designing with regional climates, and in the case of this thesis, the wind, we have bridged architecture and climate both technically and perceptively, conveying greater care for and relationship to nature, while exposing an important sensorial dimension of bioclimatic design. Let us abandon building only tolerable spaces that we eventually need to take reprieve in nature from, and instead seek a more intimate relationship with nature through our buildings by allowing the forces of nature to participate as an actor in their design.

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