

Modular landscapes

by

Simon Worthley

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submitted in partial fulfillment of the requirements for the degree

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College of Architecture, Planning & Design

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Approved by:

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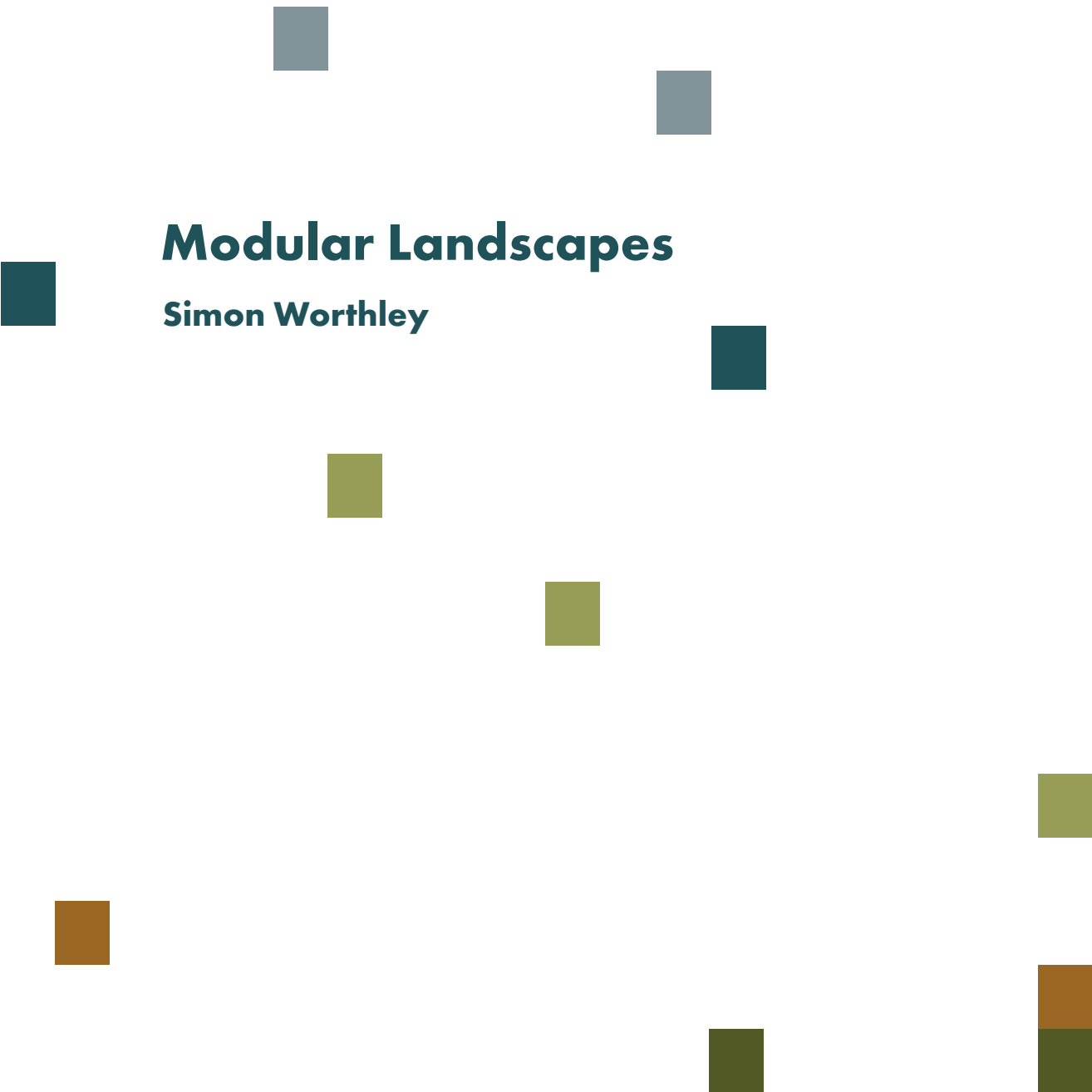
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## **Abstract**

The United States is currently in a housing crisis due to construction costs and market demand (Stein 2019; Reuben and Lei 2010). Because of these challenges, many people have been looking into creative new ways to build houses more efficiently. The aerospace and automotive industries inspire this thinking through their manufacturing methods, where each component is precisely created and efficiently assembled in a factory and then transported where needed. Modular construction offers interchangeability, efficiency, and precision. While there have been many advancements within modular buildings, little attention has been given to integrating them into the surrounding landscape. Biophilic design is an important consideration when creating comfortable spaces for people and incorporating these designs into the surrounding context. This study utilizes modular and biophilic design strategies to understand how to make a modular landscape that integrates into the surrounding environment.

A collection of colored squares arranged in a circular pattern around the title. The squares are in various colors: dark teal, grey, olive green, brown, and dark olive green. They are positioned at different angles around the central text, creating a decorative border.

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## Abstract

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### Modular Landscapes

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Masters Reports Submitted in partial fulfillment of the requirements for the degree of:

Master of Landscape Architecture (MLA)

Major Professor: Howard Hahn

Kansas State University

College of Architecture, Planning, and Design

Department of Landscape Architecture & Regional and Community Planning

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Currently, there is a housing crisis in the United States (Stein 2019; Reuben and Lei 2010). This can easily be seen by identifying the number of Americans who are “cost-burdened” (spending over 30% of their annual income on rent) or “severely cost-burdened” (spending over 50% of their annual income on rent). In 2017, 37.8 million people in the United States were cost-burdened, and 18.2 million were severely cost-burdened (Trambley 2021). A similar study later in 2022 by Harvard found that “42 million households were cost-burdened: nearly 1/3 of all households in the United States” (Whitney 2024). This is even more prevalent for renters, as half of all renters are classified as cost-burdened (US Census Bureau 2024).

One adverse outcome of the housing crisis is the rising number of people experiencing housing insecurity. According to Stein, “even those with full-time jobs simply cannot afford stable housing. Last year, about 2 million people in the United States went homeless, and 7 million more lived in precarious housing situations—doubled or tripled up, couch surfing, or sleeping in shift beds” (Stein 2019, 54). People with full-time jobs are being priced out of a place to live. The increasing size and cost of housing contributes to the crisis. On average, American homes have doubled in square feet per inhabit from 551 square feet in 1973 to 1,058 square feet in 2015 (Ward et al. 2020, 3).

Trambley identifies that only 8% of homes built in 2014 were under 1,400 square feet (2021, 930). This highlights a gap in the housing stock for smaller, reasonably priced homes. There has also been an exponential increase in housing costs: housing prices doubled between 1998 and 2021, rent has increased 40% since 2000, while wages have only increased 8% (Trambley 2021, 927; U.S. Government Accountability Office, 2023; Rueben and Lei 2010). Various factors contribute to

the increased cost of housing, including “land values, construction costs, materials and labor, development fees, permitting and development timelines, and regulatory requirements.” (Trambley 2021,926- 927). The current housing crisis highlights how the construction industry needs to be innovatively addressed.

This research stems from a competition, the Gateway Decathlon, that was focused on creating innovative housing options. Various universities were to compete based on ten criteria and each team’s ability to fully construct their house in ten days (Gateway Decathlon n.d.). Unfortunately, the competition was indefinitely put on hold. Nonetheless, this competition functioned as the starting point for this study. Led by Associate Professor of Architecture Todd Gabbard, Kansas State University's four design goals for the competition were simple, intuitive, replicable, and affordable. Another important aspect the KSU team considered was how the modular system could be scalable in different environments and reconfigured into various housing types and densities.

This study's idea began with this competition, where we broadened the modular building concept to include a modular landscape. Additionally, we considered the benefits of biophilia and how we could integrate nature into these designs. Combining these two goals was the initial inspiration for this design: creating a modular landscape and promoting biophilia. The intent was to consider how to integrate each modular building into their respective sites and create comfortable outdoor spaces where people want to spend time. We developed the following research question with these two goals: modularity and biophilia.

**Research Question** // How can modular landscape elements combine to create various designs that flexibly integrate into their environment and create a biophilic experience?

Context

Literature Review

Typology

Landscape Elements

Precedents

Residential Landscapes

Temporary Landscapes

Amenity Decks

Design

GWD

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Design Strategies

Prefabrication

Reconfigurability

Nature in the Space

Natural Analogs

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Glossary

**Amenity Deck //** A shared outdoor space on a building, typically a high-rise apartment or condominium, designed with outdoor amenity spaces.

**Biophilia //** The idea that people innately prefer nature, other living things, and the natural environment.

**Cost Burdened //** Spending over 30% of your income on housing.

**Cognitive //** Relating to your ability to think, reason, and remember.

**Cottage Court //** Small-scale detached single-family housing arranged around a central green space.

**Fractal //** A naturally recurring pattern with a similar structure at different scales.

**Groundcover Planting Layer //** Plants that fill in the gaps between the structural and seasonal layers.

**Housing Insecurity //** Unsteady living conditions such as homelessness, overcrowding, and couch surfing.

**Microclimate //** The small variability of atmospheric conditions (wind, sun, humidity, and temperature).

**Modularity //** Dividing a system into different components.

**Natural Analogs //** Patterns and structures that resemble nature.

**Nature in the Space //** Incorporating natural elements that engage our five senses.

**Nature of the Space //**Creating outdoor rooms with various experiences.

**Physiological //** A term used to identify bodily functions.

**Psychological //** A term used to identify a person's mental and emotional state.

**Prefabrication //** Assembling components in factories before transporting them.

**Reconfigurability //** The ability to rearrange components.

**Residential Landscapes //** The design of the outdoor space surrounding a home.

**Seasonal Planting Layer //** Plants chosen for specific colors or textures in different seasons.

**Structural Planting Layer //** Tall plants that tower over smaller plants.

**Temporary Landscapes //** Impermanent installations like parklets and pop-up parks.

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# Modularity

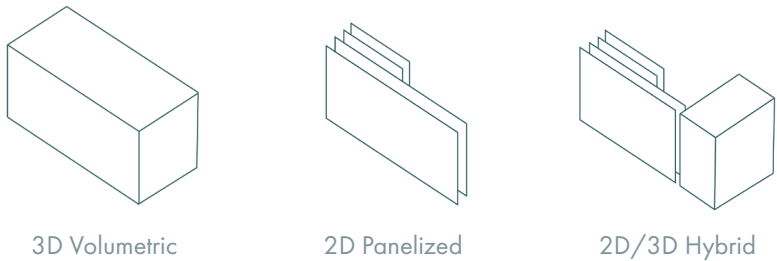
Many companies have been developing innovative construction methods to address the housing crisis and the costs associated with traditional construction methods. One such method is modular construction, which has become increasingly popular due to technological developments that have enhanced efficiency and precision.

Modular construction is known for its efficiency. Project timelines can be accelerated between 20-50 percent, which benefits developers by allowing them to make quicker turnarounds on projects (Bertram et al. 2019). On top of saving time, modular projects can save up to 20% of construction costs (Bertram et al. 2019; Subramanya et al. 2020). Cost savings vary depending on the complexity of each project and result from less on-site labor, less redesigning, and less interest with a land development loan. However, with modular construction, there is more off-site labor, design, logistics, and transportation (Bertram et al. 2019). Still, modular construction is more efficient in terms of time and money. Notable savings come from reduced labor costs, protection from weather, and reduced rework (Bertram et al. 2019; Subramanya et al. 2020).

The precision of modular architecture increases efficiency and reduces waste. Loizou et al. found a “47.9% decrease in the cost of waste for large structures” (2021, 1). Construction activities currently create about 40% of landfill materials (Loizou et al. 2021). Modular construction dramatically decreases waste, making modularity more sustainable and material-conscious. This reduction in waste does come at a cost; higher quality materials are required to achieve the precision needed to decrease waste successfully (Loizou et al. 2021). Despite the materials cost, construction cost still tends to be less. The development of modular construction is still developing and will only become more efficient.

There are many definitions of modularity. We will examine two distinct types: prefabrication and reconfigurability.

**Prefabrication** is where a product is fabricated off-site in a controlled environment and transported to the site (Haas et al. 2000; Jiang et al. 2019, 1). There are different types of prefabrication, including 3D volumetric, 2D panelized, and 2D/3D Hybrid (Bertram et al. 2019).



**3D volumetric** are fully completed units that can be assembled like Lego bricks. This option has the most potential for efficiency, but it has increased transportation costs (Bertram et al. 2019).

**2D panelized** consists of prefabricated wall sections that are easily configured together. This method is more efficient to transport but, overall, more costly than the 3D volumetric, especially for onsite work (Bertram et al. 2019).

**2D/3D hybrid** strategically chooses complex rooms to prefabricate with 3D volumetrics, while the simple rooms are 2D panelized. For example, Bathrooms are usually 3D volumetrics, while the other rooms are made from 2D panels (Bertram et al. 2019).

< Figure. 1. Three types of prefabrication.

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**Reconfigurability** is another aspect of modularity. It describes how elements can be rearranged (Stryker 2010). Within product design, there are three different types of reconfigurability: slot architecture, bus architecture, and sectional architecture (Ulrich 2003; Seo et al. 2019).



**Slot Architecture** is where each component cannot be interchanged. Each element has a specific purpose within a system. For example, the pieces of wood that combine to create a chair must be placed in particular locations; no other configuration would make the chair. Once it is built, each piece does not move. (Ulrich 2003; Seo et al. 2019).



**Bus Architecture** is a system with a common core to which other components can attach. One example is a laptop with a USB port. The computer functions as the common core, with USB ports for different attachments such as a keyboard and mouse. This design type allows many attachments to the base component (Ulrich 2003; Seo et al. 2019).



**Sectional Architecture** is a system in which all interfaces are the same. These elements are flexible and can be maneuvered into different forms. An example includes sectional sofas, where each piece can be rearranged in various forms (Ulrich 2003; Seo et al. 2019).

The modular construction industry focuses on manufacturing efficiency and precision, with little regard for where the modules are placed. This study addresses this challenge by integrating a modular landscape into its site. To achieve this, I will identify what makes suitable outdoor spaces and investigate the benefits of biophilia.

<<<  
Figure. 2. Slot Architecture has fixed components. Photograph by Matt Bango.

<<  
Figure. 3. Bus Architecture has attachments. Photograph by Kaboompics.com.

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Figure. 4. Sectional Architecture is the most flexible. Photograph by Eric Petschek.

**Context**

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# Benefits of Biophilia

To understand the meaning of biophilia, it is easiest to break it into its root words; “bio” comes from the Greek word life, while “philia” comes from love. Combined, it means the love of life (Heerwagen 2008, 228). This natural affection has been seen throughout history, from animal cave drawings to the built environment's historic patterning. Looking at history, we see that “biophilic design is not a new phenomenon; instead, it is the codification of human intuition for what makes a space a good place for humans” (Browning et al. 2014, 6; Ryan et al. 2014, 63). Humans enjoy being in natural environments, and until recently, they have learned to adapt and work with the environmental forces around them. The challenge today is reincorporating nature into the environments people inhabit. Many studies, some of which are covered here, identify the health benefits of biophilic design. These benefits range from cognitive to psychological to physiological.

Cognitive benefits from biophilia include learning and thinking logically and creatively (Browning et al. 2014, 11). Looking at the workplace, “employees on average spend 9.04 days per year in a state of low or sub-optimal work performance due to health issues” (Mitchell & Bates 2011). This unproductivity adds up to almost two work weeks each year and could be mitigated by implementing biophilic strategies in the workplace. For example, workplaces with indoor vegetation and natural wood finishes increased perceived productivity by 6% and creativity by 15% (Interface 2015). It is exciting to see the increased productivity when small interventions like indoor vegetation and natural wood finishes are added. Similarly, viewing nature for as short as 40 seconds helps our brain quiet and “operate in a state of ‘soft fascination’” (Lee et al. 2015). Natural sounds also have benefits (Ryan et al. 2023, 26). One study compared the impact of masking noises with silence. The masking noises they used were spring water, instrumental music, vocal

music, white noise, and pink noise. The results showed a significant increase in errors when listening to all sounds except water. Water had the inverse effect, significantly decreasing the number of mistakes. (Haapakangas et al. 2011). These studies show the cognitive benefits of biophilic elements.

Stress Reduction is the most prevalent psychological benefit. For example, the mental and emotional benefits of being in nature can happen in only 5-20 minutes (Brown, Barton & Gladwell 2013; Barton & Pretty 2010; Tsunetsugu & Miyazaki 2005; Browning et al. 2014, 14). This short, impactful amount of time can be understood by looking at how our brains work; viewing natural scenes stimulates our visual cortex and triggers pleasure receptors in our brain (Browning et al. 2014; Ryan et al. 2023). These studies show that our brains are wired to enjoy biophilic elements.

Our physiological system is also impacted by biophilia, including muscle relaxation, lowering blood pressure, and faster recovery times (Park et al. 2009; Ulrich 1984; Browning et al. 2014, 11). One example is “Shinrin-yoku,” or “forest bathing.” Forest bathing has decreased cortisol levels in people who walked through a forest compared with those who walked in a city area (Tsunetsugu et al. 2005). Walking in nature benefits our health, even to the point of lowering our stress. One of the most popular examples of biophilia benefit was Ulrich's research when he observed different hospital patients. Half of the patients had a window with a natural view, while the other half had a view out to an adjacent brick building. In testing these two different environments, he identified the people who had the natural view then had a shortened hospitalization recovery time, requested fewer pain medications, and perceived the experience better than the patients with the view to the adjacent building (Ulrich 1984; Abboushi et al. 2019; Browning et al. 2014).

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| <b>Typology</b>          |  |
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| <b>Precedents</b>        |  |
| Residential Landscapes   |  |
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| Amenity Decks            |  |
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| GWD                      |  |
| Salina                   |  |
| <b>Design Strategies</b> |  |
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| Reconfigurability        |  |
| Nature in the Space      |  |
| Natural Analogs          |  |
| Nature of the Space      |  |

# The Biophilic Framework

Understanding what elements create these cognitive, psychological, and physiological benefits is essential to successfully implementing biophilia. William Browning, Catherine Ryan, and Joseph Clancy created a practical framework called 14 Patterns of Biophilic Design (Kellert 2008; Browning et al. 2014). Professionals have utilized this resource to identify the success of their projects (Downton et al. 2016, 64). We will use the same framework to help organize and understand biophilic design elements.

The three overarching categories of biophilia are nature in the space, natural analogs, and nature of the space (Kellert et al. 2008).

**Nature in the Space** describes incorporating natural elements. Some specific elements identified as significant are “water, large trees, flowers, and rich vegetation” (Heerwagen 2008, 227). These elements create a multi-sensory experience with a “variety in patterns, textures, light, and colors” (Heerwagen 2008, 228). The strength of these natural elements is how they engage multiple senses—for example, hearing the wind blowing through the leaves, seeing the movement of the grass and the trees, feeling the rough texture of bark, and even smelling the fragrance of flowers. On top of engaging multiple senses, nature's seasonal change adds a layer of fascination (Heerwagen 2008, 229). Unlike unnatural images, people are not bored looking at real scenes (Kellert 2018; Biederman & Vessel 2006, found in Browning et al. 2014).

According to the 14 Patterns of Biophilia, the categories within nature in the space include:



**Visual Connection with Nature.**  
“A view to elements of nature, living systems, and natural processes” (Browning et al. 2014, 24). Natural views include water, vegetation, and terrain. Simulated examples include a koi pond, a green wall, and a video of nature scenes (Browning et al. 2014, 25).



**Non-Visual Connection with Nature.**  
Connecting to nature with other senses: hearing, smell, taste, and touch (Browning et al. 2014, 26). Natural examples include fragrant plants, textured materials, and a crackling fire. Simulated examples include edible gardens, textured fabrics, and nature sounds (Browning et al. 2014, 27).

<<  
Figure. 5. Visual Connection to Nature. Photograph by Ryutaro Tsukata.

<  
Figure. 6. Fire engages multiple senses: sight, smell, touch, and hearing. Photograph by Roya Ann Miller.

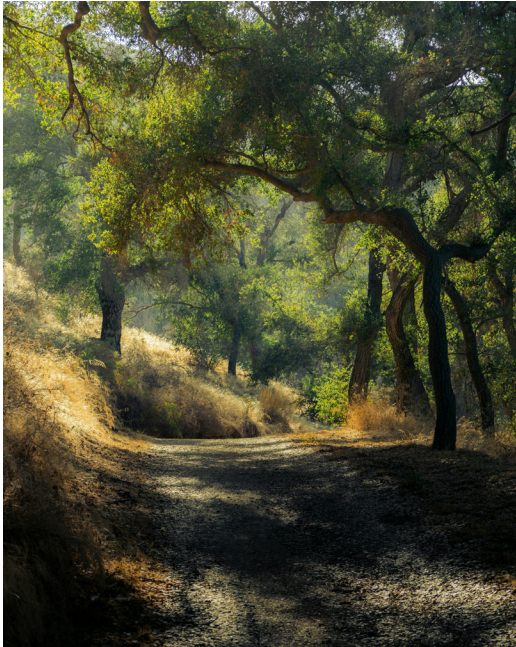
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**Non-Rhythmic Sensory Stimuli.**

A non-rhythmic movement that creates a brief distraction, helping combat fatigue. Natural examples include plants rustling, animal movement, and cloud movement. Simulated examples include fabric that moves with the wind, nature sounds broadcasted at unpredictable intervals, and changing shadows (Browning et al. 2014, 29).



**Thermal & Airflow Variability.**

Subtle changes to the microclimate that mimic natural environments. Natural examples include solar heat gain, shade, and vegetation that changes with the seasons. Simulated examples include cross ventilation, HVAC delivery systems, and window glazing (Browning et al. 2014, 31).



**Presence of Water.**

Water “enhances the experience of a place through seeing, hearing or touching water” (Browning et al. 2014, 32). Natural examples include rain, rivers, and oceans. Simulated examples include a water wall, a fountain, and water imagery. (Browning et al. 2014, 33).



**Dynamic & Diffuse Light.**

Creating changes in light that resemble natural light variability. Natural examples include daylight from multiple angles, direct sunlight, and seasonal light. Examples include light distribution, personal lighting, and circadian color reference (Browning et al. 2014, 35).

Figure. 7. Grass movement varies based on wind. Photograph by Jeffery Czum.

Figure. 8. Sun, shade, and wind impact the microclimate. Photograph by Thomas Parker.

Figure. 9. Everybody loves water. Photograph by Mourad Saadi.

Figure. 10. Trees create shadows of dappled light. Photograph by Matthew Goeckner.

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**Connection with Natural Systems.**  
Connecting people to the natural processes and seasonal changes of an ecosystem. Examples include weather patterns, animal behaviors, and seasonal patterns. Simulated examples include wildlife habitats, exposure to water infrastructure, and designing with natural materials (Browning et al. 2014, 37).

**Natural analogs** describe the abstractions of nature in the built environment. This can be seen in the patterns incorporated into designs, including furniture, flooring, facades, and more. Natural materials effectively incorporate biophilia into a design because of their tactile qualities and intriguing patterns. One example of this natural patterning can be seen in wood flooring. Each floor tile is the same size and made of the same material, yet when looking closely, there are subtle differences between each plank (Kellert 2018). Texture is another aspect to consider with natural analogs because these textures historically impacted humans' feelings of safety and security (Kellert 2018). Textures help people feel comfortable, and natural materials are one typical example of natural textures.

Complex but coherent designs are essential to biophilia because they resemble natural structures. Fractals are one example where there is a naturally recurring pattern at different scales. Fractals can be understood by looking at a tree. A tree has a trunk. That trunk supports several branches that support a network of smaller branches. This complex network of branches supports a collage of similar but unique leaves. Once more, these leaves have various forms, colors, and networks of veins. Fractals are a process of zooming in with a simple pattern to create a complex structure (Mikiten et al. 2000; Sorvig and Thompson 2018; Trombin 2020). People thrive in fractal environments and have been identified as having the highest aesthetic value (Trombin 2020,10).

According to the 14 Patterns of Biophilia, the categories within natural analogs are illustrated and described on the following pages:

< Figure. 11. Leaves changing color in the fall create seasonal interest. Photograph by Simon Berger.

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**Biomorphic Forms & Patterns.**

Materials that are intentionally formed, patterned, or textured to resemble nature. Some examples include fabrics, furniture details, woodwork, and railings (Browning et al. 2014, 39).



**Material Connection with Nature.**

Using local and natural elements such as wood, leather, and stone. These elements have a tactile quality that people prefer. (Browning et al. 2014, 41).



**Complexity & Order.**

Patterns resembling those found in nature, such as fractals and tessellations. These patterns create a visually engaging surface with an overall understandable pattern (Browning et al. 2014, 43).

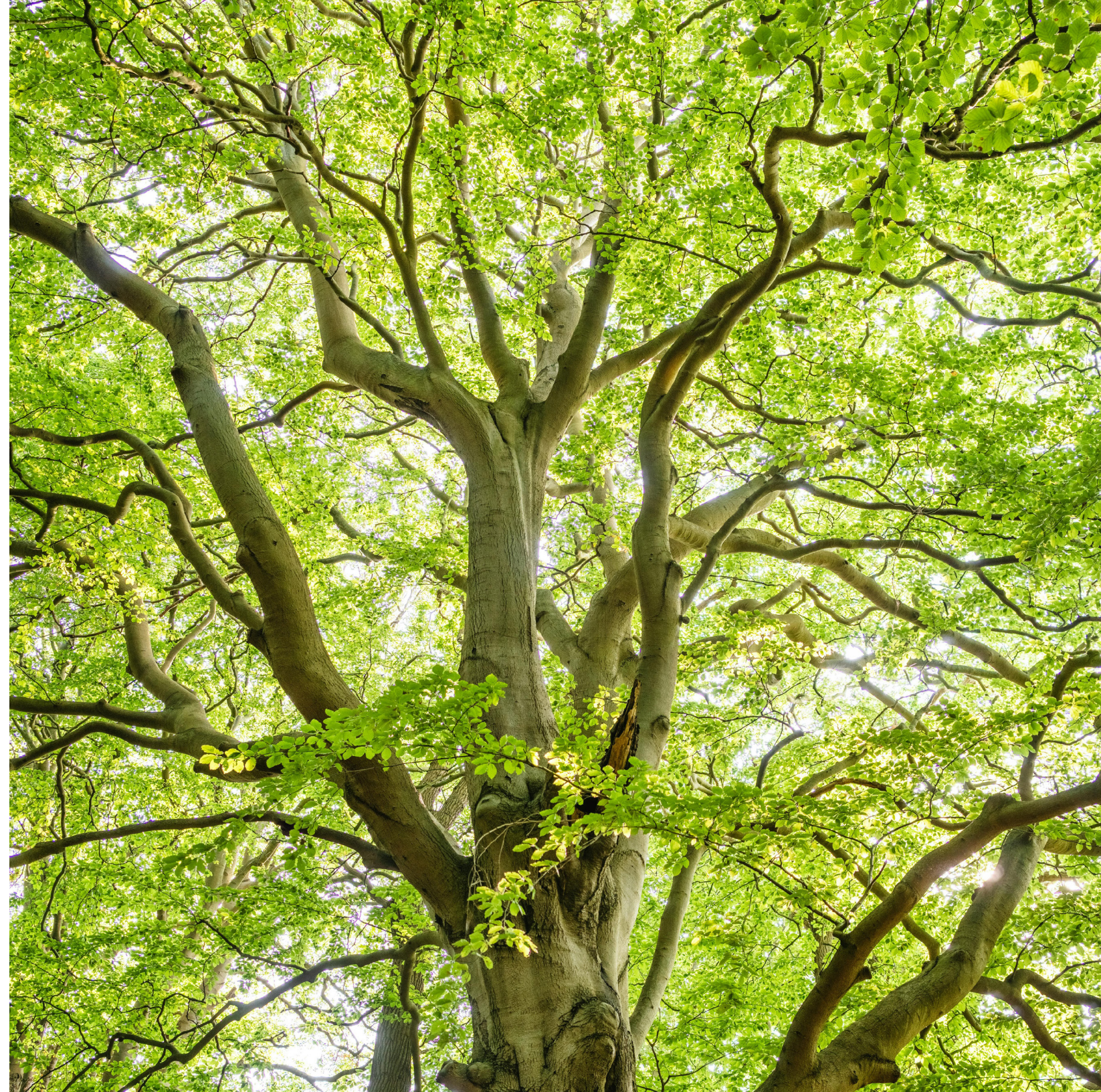
|     |                                                                                                |                          |                        |  |
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| <<< | Figure. 12. Bridge that resembles natural forms. Photograph by Willian Justen de Vasconcellos. | <b>Context</b>           | Literature Review      |  |
| <<  | Figure. 13. The wood bench has a visual and tactile appeal. Photograph by Laura Tancredi.      | <b>Typology</b>          | Landscape Elements     |  |
| <   | Figure. 14. A simple pattern that creates a complex form. Photograph by Gul Isik.              | <b>Precedents</b>        | Residential Landscapes |  |
|     |                                                                                                |                          | Temporary Landscapes   |  |
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**Nature of the Space** describes the overall configuration of an environment. Human preferences for natural spaces tie back to historical environmental interactions. The savanna hypothesis highlights human preference for a savanna-like environment, with unhindered views of the land (Orians and Heerwagen 1992). This idea eventually developed into a prospect and refuge theory, where people preferred an unhindered view in front of them while having a protective buffer behind them. Applying these ideas, it is essential to consider creating spaces where people's backs are protected, yet they can look out toward a view (Alexander 1977, 559). Curating these experiences is essential for people to feel comfortable in their environments.

According to the 14 Patterns of Biophilia, the categories within the nature of the space are illustrated and described on the following pages:

>  
Figure. 15.  
One example  
of a complex  
yet coherent  
design in nature.  
Photograph by  
Felix Mittermeier.



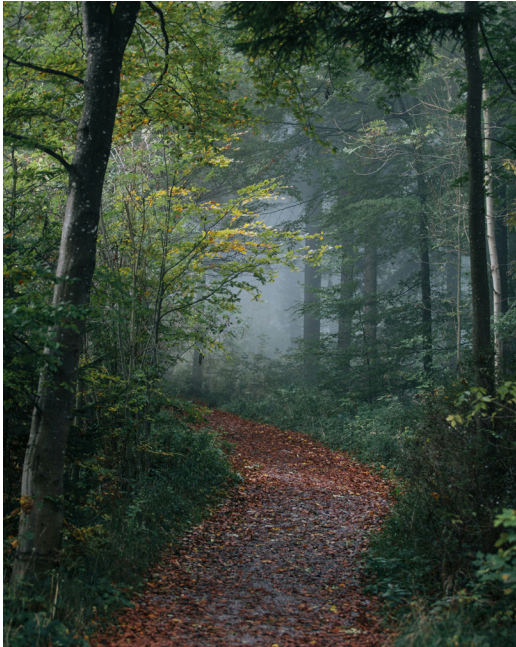




**Prospect.**  
Unobstructed views over long distances. This helps people feel safer and more in control of the land around them. Some examples include seeing further than 20 feet, partition heights of less than 42 inches, and using transparent materials to allow visual connections (Browning et al. 2014, 45).



**Refuge.**  
A space that makes people feel protected from something behind or overhead. Some examples include a lowered ceiling or canopy and small alcoves off the main area (Browning et al. 2014, 47).



**Mystery.**  
Partially obscuring views to create curiosity and anticipation. An example includes winding paths with one or more edges obscured (Browning et al. 2014, 48).



**Risk/Peril.**  
“An identifiable threat coupled with a reliable safeguard” (Browning et al. 2014, 50). Some examples include objects that appear to be testing gravity, a transparent floor plane, and proximity to predatory animals (Browning et al. 2014, 51).

Figure. 16. Unhindered view across a vast landscape helps people feel safe. Photograph by Mladen Janic.

Figure. 17. The tree creates a feeling of protection. Photograph by Susanne Jutzeler.

Figure. 18. The curving trail creates curiosity. What is around the corner? Photograph by Marco Meyer.

Figure. 19. Small wooden bridge over a roaring river. Photograph by Maximilian Oeverhaus.

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## Methods

Methods Overview

Using information about modularity and biophilia, this study focuses on three methods: a typology of elements, a precedent study, and a projective design. Each helped answer the research question of flexibly integrating modular landscapes into different environments.

Typology of Landscape Elements

The first step is creating a typology of landscape elements for outdoor spaces. The typology was developed by looking at precedents to identify the most common elements in outdoor spaces. The typology consists of twelve categories with four different forms the landscape element could appear as. The landscape elements included here are intended to function as general forms that can be applied in various ways. The landscape elements within this study were evaluated based on their potential for modularity and biophilia. Identifying the potential of modularity helped determine how each element could be more efficient and reconfigurable. Modularity was assessed based on the six design strategies of modularity identified in the literature review. The biophilic design strategies used the 14 Patterns of Biophilic Design highlighted in the literature review (Browning et al. 2014). Combined, these design strategies informed how each landscape element has the potential for modularity and biophilia.

Precedent Studies

Once the typology identified potential forms for landscape elements and evaluated them based on modularization and biophilia design strategies, fifteen precedents were found to determine how each landscape element has been previously incorporated. Each precedent also used the same design strategies as the typology, evaluating the modularity and biophilic aspects seen within the project.

The precedents were separated into three different environments: residential landscapes, temporary landscapes, and amenity decks. Residential landscapes were chosen because of their biophilic potential. Temporary landscapes were selected to identify existing examples of modular systems. Amenity decks were picked for their modularity and the recent popularity of creating biophilic buildings. After the precedent studies, two tables summarize the information. The first table compares the modular and biophilic design strategies with each precedent, while the second table identifies which landscape elements were found in each precedent study. The focus of these precedent studies aims to determine how the landscape elements have been successfully integrated into existing projects and help identify common patterns to be incorporated into the projective design.

Projective Design

Next is the projective design. Due to the large number of existing precedents on temporary landscapes and amenity decks, projective designs were not created for those environments. Instead, the focus was on residential landscapes. Within the projective design, there are two different applications. First is the design for the Gateway Decathlon (GWD) project. The intent of using the GWD project was to design a modular landscape that successfully integrates with the modular house. GWD focuses more on modularity than biophilia, with a focus on reconfigurability. To see the construction documents of the modular landscape for GWD, see Appendix A. Once we identified the potential for modularity with GWD, the team shifted focus to a site in Salina, Kansas. This was used to test how compact modular housing units could be configured, clustered, and integrated into an existing neighborhood. Together, these two projective designs helped identify the potential for modular landscapes in the future to be incorporated into prefabricated houses in a biophilic way.

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# Design Strategies

## 6 Patterns of Modularity

### Prefabrication

- (M1) 3D Volumetric – Component parts designed, prefabricated, and assembled off site.
- (M2) 2D Panelization – Component parts designed and prefabricated but assembled on site.
- (M3) 3D/2D Combination – Component parts designed and prefabricated. Some elements are assembled off site, some are assembled on site.

### Reconfiguration

- (M4) Slot Architecture – Each component has a specific function and is not interchangeable.
- (M5) Bus Architecture – A system with a common core where components can attach.
- (M6) Sectional Architecture – A system where each component is interchangeable.

## 14 Patterns of Biophilia

### Nature in the Space Patterns

- (B1) Visual Connection with Nature – Views of nature.
- (B2) Non-Visual Connection with Nature – Hearing, smell, taste, and touch of nature.
- (B3) Non-Rhythmic Sensory Stimuli – Movement or sounds at unpredictable intervals.
- (B4) Thermal & Airflow Variability – Subtle changes to microclimate.
- (B5) Presence of Water – Water.
- (B6) Dynamic & Diffuse Light – Variability of light.
- (B7) Connection with Natural Systems – Connecting to seasonal changes and other natural systems.

### Natural Analogues Patterns

- (B8) Forms & Patterns – Forms, patterns, or textures that resemble nature.
- (B9) Material Connection with Nature – Using natural materials.
- (B10) Complexity & Order – Complex sensory information that adheres to an simple organizing pattern.

### Nature of the Space Patterns

- (B11) Prospect – Unobstructed views.
- (B12) Refuge – Protection from something behind or overhead.
- (B13) Mystery – Obscuring views to provoke curiosity.
- (B14) Risk/Peril – A perceived threat with visible safeguards.

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# Typology of Landscape Elements

This section aims to identify the most common landscape elements used to design outdoor spaces and evaluate them based on their potential for modularity and biophilia. This list is not representative of every possible landscape element found within outdoor spaces, nor does it describe every possible form these landscape elements can take. Instead, the intent is to identify the most common forms found in designs and summarize them in overarching categories. It also functions as a starting point to identify common landscape elements that have the potential to appear in a variety of shapes having a myriad of different textures.

The following page describes how the content is laid out throughout the typology.

This information aims to orient the reader to the overarching category of the page.

# Identification Code

## Overarching Category

Short description of the overarching category

The images help visualize the potential forms of these landscape elements.



### X1. Variation One

Short description of variation.

- M2 2D Panelization
- M4 Slot Architecture
- M5 Bus Architecture
- B8 Biomorphic Forms & Patterns
- B9 Material Connection with Nature



### X2. Variation Two

Short description of variation.

- M1 3D Volumetric
- M3 3D/2D Combination
- B8 Biomorphic Forms & Patterns
- B9 Material Connection with Nature



### X3. Variation Three

Short description of variation.

- B1 Visual Connection with Nature
- B2 Non-visual Connection with Nature
- B3 Non-Rhythmic Sensory Stimuli
- B5 Presence of Water
- B7 Connection with Natural Systems



### X4. Variation Four

Short description of variation.

- B1 Visual Connection with Nature
- B2 Non-visual Connection with Nature
- B3 Non-Rhythmic Sensory Stimuli
- B7 Connection with Natural Systems
- B8 Biomorphic Forms & Patterns
- B11 Prospect

The colored squares represent the overarching design strategies for modularity and biophilia. The color of each category is the same as the callout.

#### Context

Literature Review

#### Typology

Landscape Elements

#### Precedents

Residential Landscapes

Temporary Landscapes

Amenity Decks

#### Design

GWD

Salina

#### Design Strategies

Prefabrication

Reconfigurability

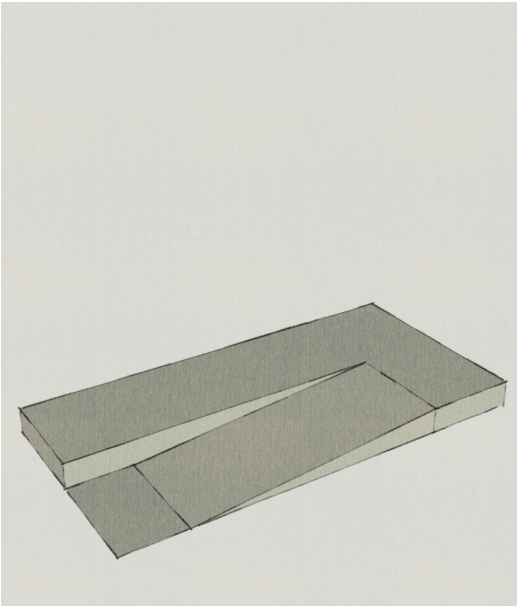
Nature in the Space

Natural Analogs

Nature of the Space

### Addressing Topography

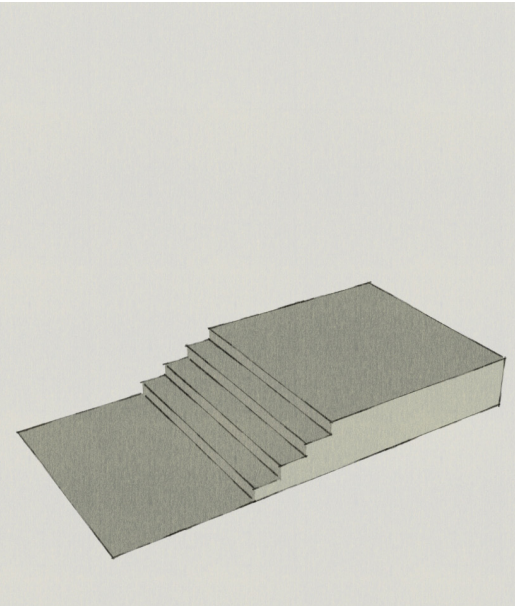
Addressing Topography describes how designs can work with existing land to create the desired outcome. Considering the topography impacts where people can go and can help control where the water flows.



#### A1. Ramp

Ramps are inclined planes that connect two different levels. The ADA requires ramps to be below 8.33% while an accessible path is less than 5% (U.S. Access Board 2010).

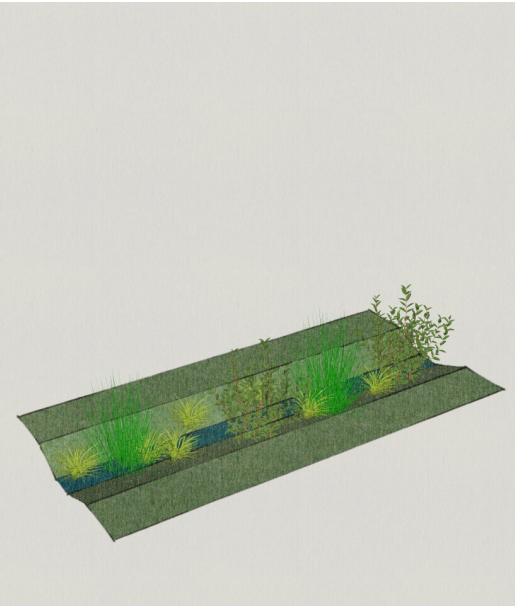
- (M2) 2D Panelization
- (M4) Slot Architecture
- (M5) Bus Architecture
- (B8) Biomorphic Forms & Patterns
- (B9) Material Connection with Nature



#### A2. Stairs

Stairs are a series of steps that help to connect two different levels.

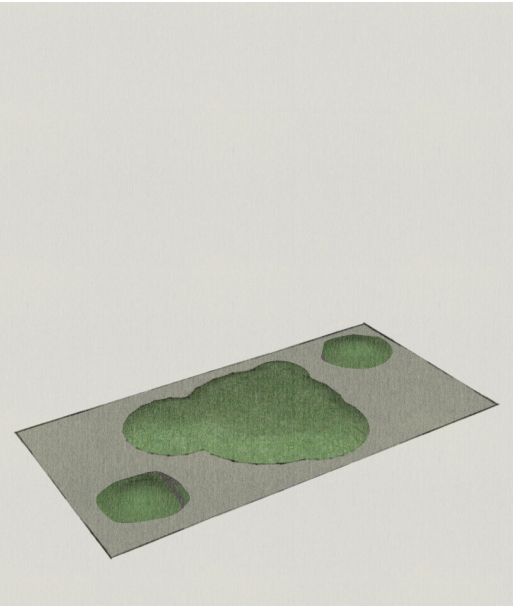
- (M1) 3D Volumetric
- (M3) 3D/2D Combination
- (B8) Biomorphic Forms & Patterns
- (B9) Material Connection with Nature



#### A3. Swale

An area where the land directs drainage.

- (B1) Visual Connection with Nature
- (B2) Non-visual Connection with Nature
- (B3) Non-Rhythmic Sensory Stimuli
- (B5) Presence of Water
- (B7) Connection with Natural Systems



#### A4. Mound

A raised area of earth that creates a hill or mound.

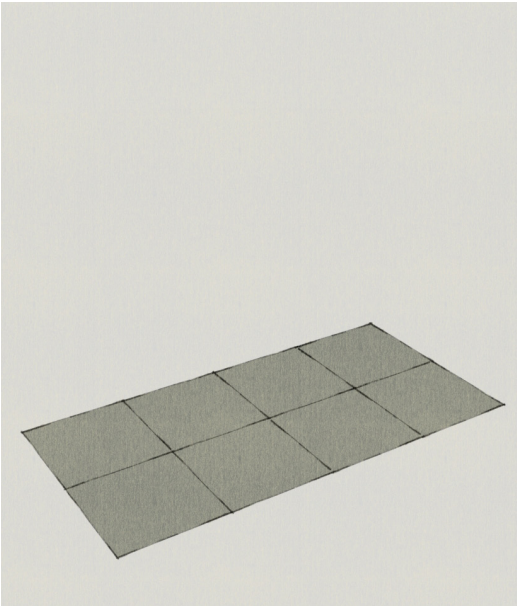
- (B1) Visual Connection with Nature
- (B2) Non-visual Connection with Nature
- (B3) Non-Rhythmic Sensory Stimuli
- (B7) Connection with Natural Systems
- (B8) Biomorphic Forms & Patterns
- (B11) Prospect

<<<< Figure. 20.  
Ramp.  
<<< Figure. 21.  
Stairs.  
<< Figure. 22.  
Swale.  
< Figure. 23.  
Mound.

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Ground Plane

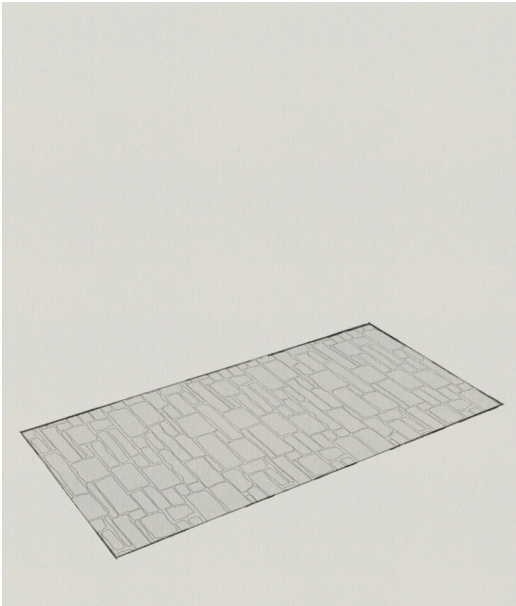
The ground plane describes surfaces and materials commonly walked upon. These different ground-plane elements help provide a firm, stable, and slip-resistant surface for people.



B1. Poured In Place

Materials like gravel, concrete, and asphalt are poured into place. These materials are initially malleable and fit into forms.

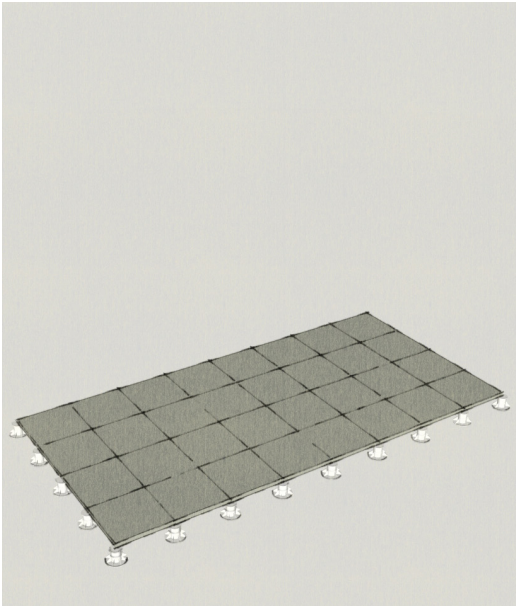
- (M2) 2D Panelization
- (B8) Form & Patterns
- (B10) Complexity & Order



B2. Unit Pavers

Concrete, brick, or stone pavers combine to create a surface.

- (M2) 2D Panelization
- (M4) Slot Architecture
- (B2) Non-Visual Connection with Nature
- (B8) Form & Patterns
- (B9) Material Connection with Nature
- (B10) Complexity & Order



B3. Pedestal Pavers

2'x2' pavers, commonly made of concrete or porcelain, that are supported by pedestals designed to disperse the load across a roof.

- (M2) 2D Panelization
- (M4) Slot Architecture
- (B2) Non-Visual Connection with Nature
- (B9) Material Connection with Nature



B4. Patio Deck

The patio deck is commonly seen in residential applications to create a patio space level with the main floor and is commonly made of wood or synthetic decking.

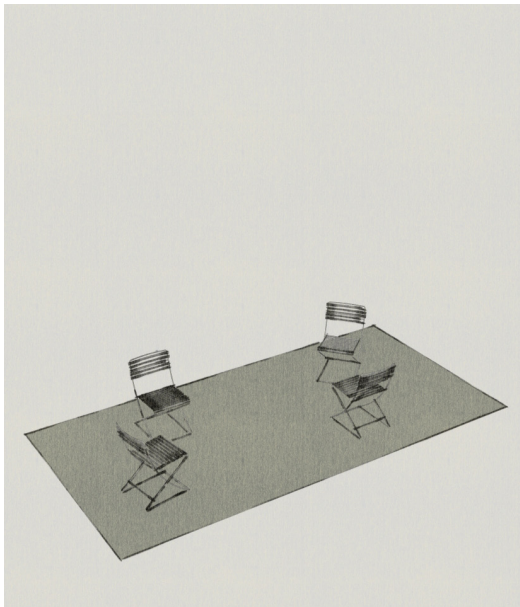
- (M2) 2D Panelization
- (M4) Slot Architecture
- (M5) Bus Architecture
- (B2) Non-Visual Connection with Nature
- (B9) Material Connection with Nature

|                                 |                                   |  |
|---------------------------------|-----------------------------------|--|
| <<<< Figure. 24. Pour In Place. | Context Literature Review         |  |
| <<< Figure. 25. Unit Pavers.    | Typology Landscape Elements       |  |
| << Figure. 26. Pedestal pavers. | Precedents Residential Landscapes |  |
| < Figure. 27. Patio Deck.       | Temporary Landscapes              |  |
|                                 | Amenity Decks                     |  |
|                                 | Design GWD                        |  |
|                                 | Salina                            |  |
|                                 | Design Strategies Prefabrication  |  |
|                                 | Reconfigurability                 |  |
|                                 | Nature in the Space               |  |
|                                 | Natural Analogs                   |  |
|                                 | Nature of the Space               |  |



Seating

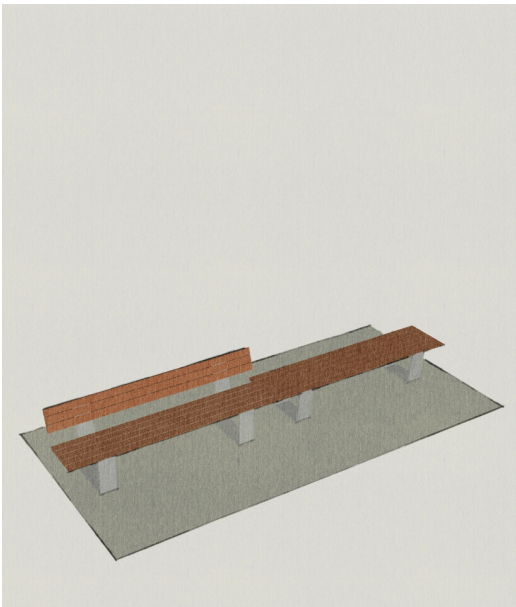
Seating is an essential element when designing outdoor spaces. People gather where there are seats (Whyte 1980). Seating is commonly used in conjunction with tables.



C1. Movable Seating

Movable seating is designed to be lightweight so that users can move each seat to their desired position, creating a sense of control (Whyte 1980).

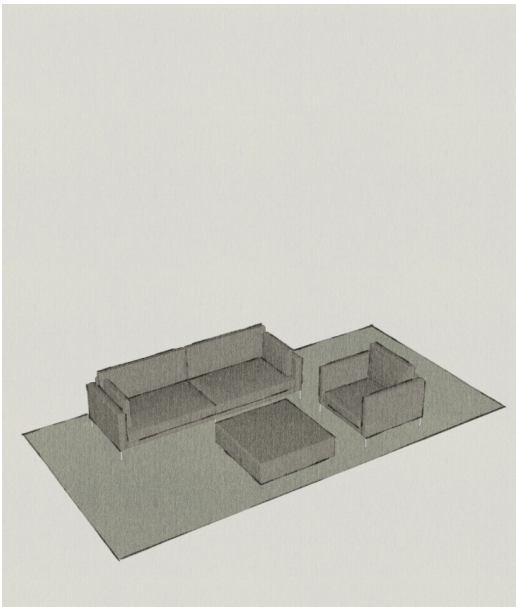
- (M1) 3D Volumetric
- (M6) Sectional Architecture
- (B8) Form & Patterns
- (B9) Material Connection with Nature
- (B10) Complexity & Order



C2. Fixed Seating

Fixed seating includes chairs, benches, and other elements that don't move. The weight of the seating element or bolting it to the ground keeps these elements fixed.

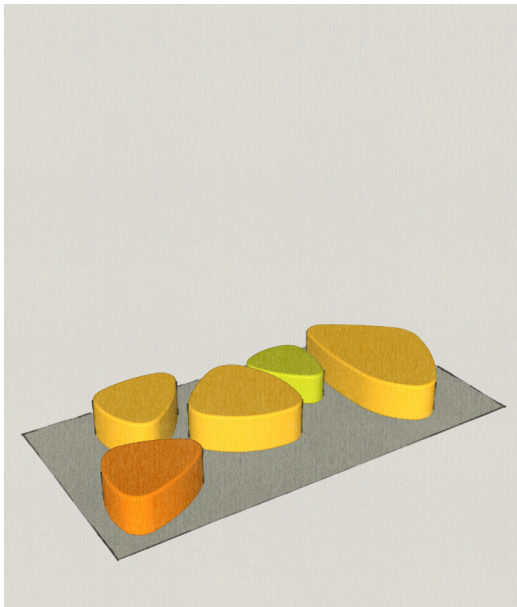
- (M1) 3D Volumetric
- (M2) 2D Panelization
- (M4) Slot Architecture
- (B8) Form & Patterns
- (B9) Material Connection with Nature



C3. Lounge Seating

A type of seating that is designed for comfort and relaxation. These seating elements commonly have cushions.

- (M1) 3D Volumetric
- (M5) Bus Architecture
- (M6) Sectional Architecture
- (B8) Form & Patterns
- (B10) Complexity & Order



C4. Abstract Seating

Abstract seating elements are designed to be visually interesting rather than functional, but they are still intended to be used as seats.

- (M1) 3D Volumetric
- (M4) Slot Architecture
- (B8) Form & Patterns
- (B9) Material Connection with Nature

<<<< Figure. 28. Movable Seating.  
<<< Figure. 29. Fixed Seating.  
<< Figure. 30. Lounge Seating.  
< Figure. 31. Abstract Seating.

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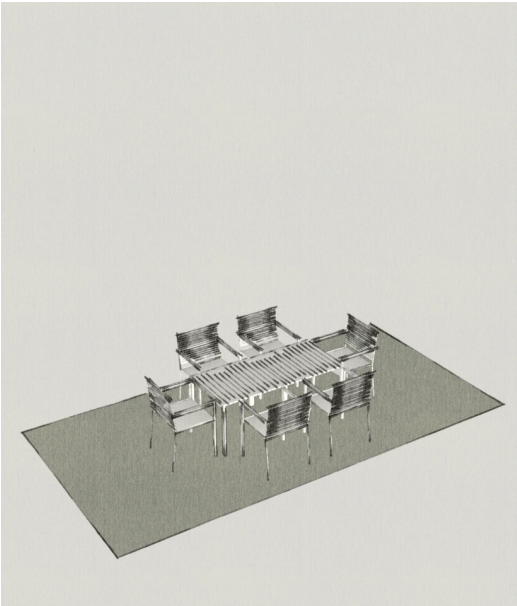
Nature in the Space

Natural Analogs

Nature of the Space

Tables

Tables are an important landscape element that provides a flat surface for placing objects. They are commonly designed with seating around them so that people can sit in a chair and place their belongings on the table.



D1. Large Table

A large table is commonly used for eating meals with others and as a gathering space for larger groups.

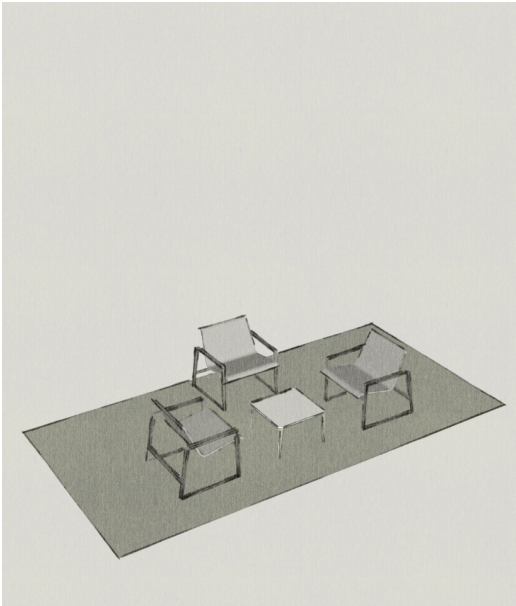
- (M1) 3D Volumetric
- (M2) 2D Panelization
- (M4) Slot Architecture
- (M5) Bus Architecture
- (B8) Form & Patterns
- (B9) Material Connection with Nature



D2. Small Table

Smaller groups of people use small tables. These are commonly found in coffee shops.

- (M1) 3D Volumetric
- (M2) 2D Panelization
- (M5) Bus Architecture
- (M6) Sectional Architecture
- (B8) Form & Patterns
- (B9) Material Connection with Nature



D3. Low Table

A low table is typically placed in front of, or next to, seating elements. Two common names are side table and coffee table.

- (M1) 3D Volumetric
- (M2) 2D Panelization
- (M5) Bus Architecture
- (M6) Sectional Architecture
- (B8) Form & Patterns
- (B9) Material Connection with Nature



D4. High Table

A high table describes tables that are at standing height. Bar-height tables with stools are one example.

- (M1) 3D Volumetric
- (M2) 2D Panelization
- (M4) Slot Architecture
- (M5) Bus Architecture
- (B8) Form & Patterns
- (B9) Material Connection with Nature

<<<<

Figure. 32. Large Table.

<<<

Figure. 33. Small Table.

<<

Figure. 34. Low Table.

<

Figure. 35. High Table.

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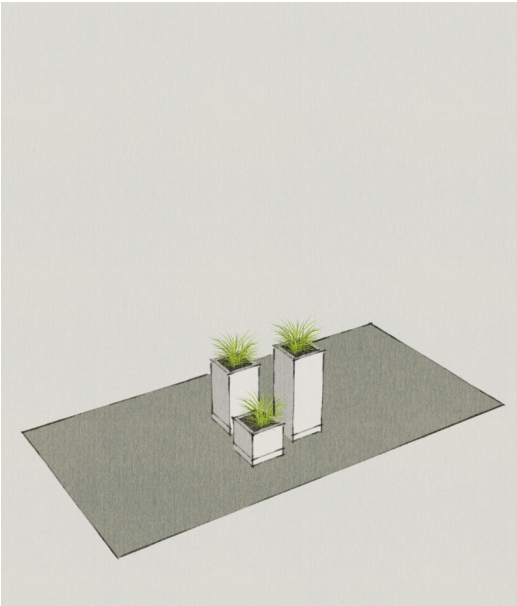
Nature in the Space

Natural Analogs

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Planters

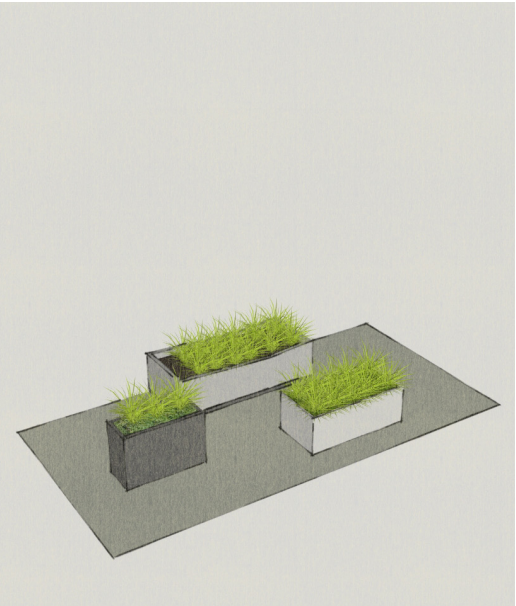
Planters are containers that hold soil and vegetation. They come in various forms and incorporate vegetation into the design.



E1. Movable Planter

Movable planters are small and lightweight so that people can move them.

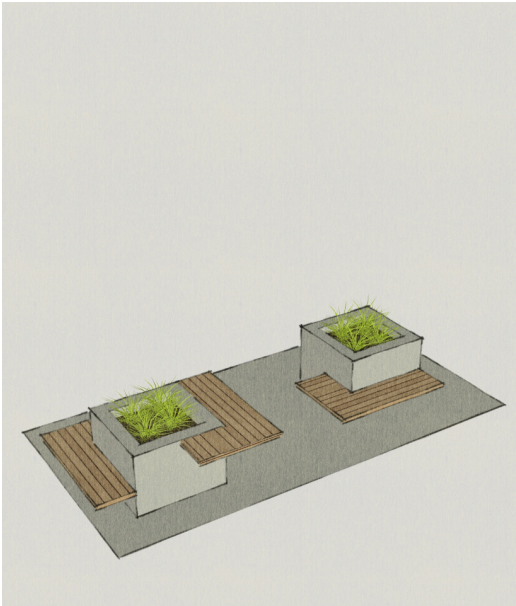
- (M1) 3D Volumetric
- (M6) Sectional Architecture
- (B1) Visual Connection with Nature
- (B2) Non-Visual Connection with Nature
- (B3) Non-Rhythmic Sensory Stimuli
- (B8) Forms & Patterns
- (B9) Material Connection with Nature



E2. Fixed Planter

Planters that do not move are fixed in place because of their weight, bolted into the ground, or cast into place with concrete.

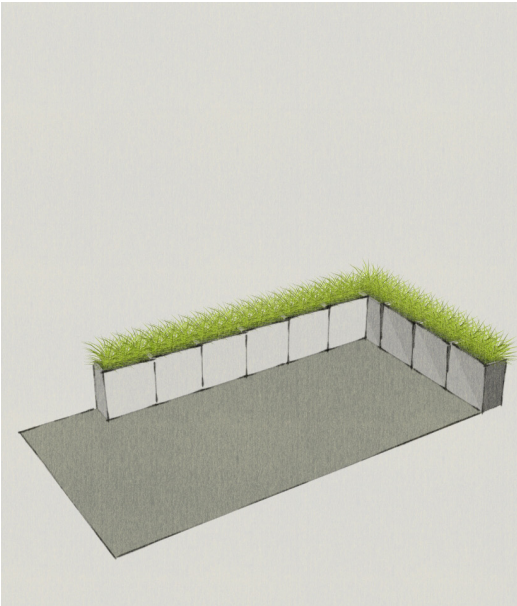
- (M1) 3D Volumetric
- (M5) Slot Architecture
- (B1) Visual Connection with Nature
- (B2) Non-Visual Connection with Nature
- (B8) Forms & Patterns
- (B9) Material Connection with Nature



E3. Planter Bench

A planter bench is a planter that also functions as a bench. The planter can function as a backrest.

- (M1) 3D Volumetric
- (M4) Slot Architecture
- (B1) Visual Connection with Nature
- (B2) Non-Visual Connection with Nature
- (B8) Form & Patterns
- (B9) Material Connection with Nature



E4. Divider Planter

Taller planters that function to divide spaces.

- (M1) 3D Volumetric
- (M3) 3D/2D Combination
- (B1) Visual Connection with Nature
- (B2) Non-Visual Connection with Nature
- (B3) Non-Rhythmic Sensory Stimuli
- (B8) Form & Patterns
- (B9) Material Connection with Nature

<<<< Figure. 36. Movable Planter.  
<<< Figure. 37. Fixed Planter.  
<< Figure. 38. Planter Bench.  
< Figure. 39. Divider Planter.

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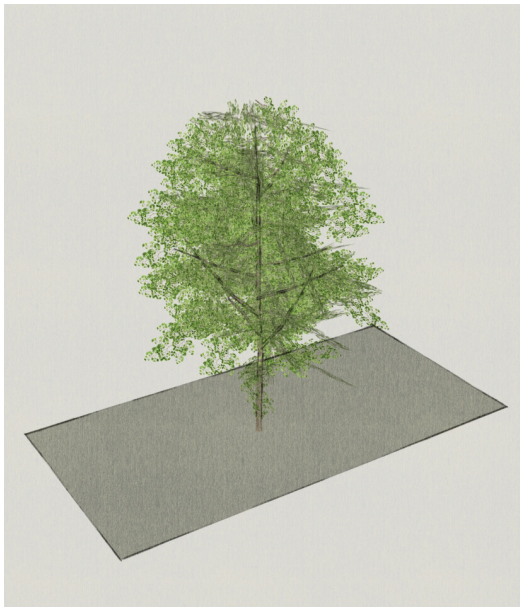
Natural Analogs

Nature of the Space



Vegetation

This vegetation section identifies the most common types of planting, which are essential when creating natural spaces.



F1. Trees

A tree is a large plant with a trunk and branches growing off of it.

- (B1) Visual Connection with Nature
- (B2) Non-Visual Connection with Nature
- (B3) Non-Rhythmic Sensory Stimuli
- (B4) Thermal & Airflow Variability.
- (B6) Dynamic & Diffuse Light
- (B7) Connection with Natural Systems
- (B10) Complexity & Order



F2. Shrubs

A plant smaller than a tree with several main stems coming from the ground.

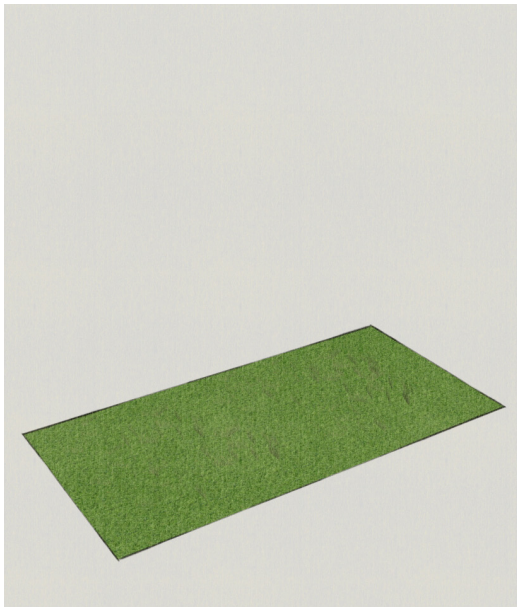
- (B1) Visual Connection with Nature
- (B2) Non-Visual Connection with Nature
- (B3) Non-Rhythmic Sensory Stimuli
- (B4) Thermal & Airflow Variability.
- (B7) Connection with Natural Systems
- (B10) Complexity & Order



F3. Perennials

Perennials are plants that die off in the winter and grow back in the spring.

- (B1) Visual Connection with Nature
- (B2) Non-Visual Connection with Nature
- (B3) Non-Rhythmic Sensory Stimuli
- (B7) Connection with Natural Systems
- (B10) Complexity & Order
- (B11) Prospect



F4. Groundcover

Groundcovers are low-growing plants that spread out horizontally. They are commonly used to prevent weeds

- (B1) Visual Connection with Nature
- (B2) Non-Visual Connection with Nature
- (B7) Connection with Natural Systems
- (B10) Complexity & Order
- (B11) Prospect

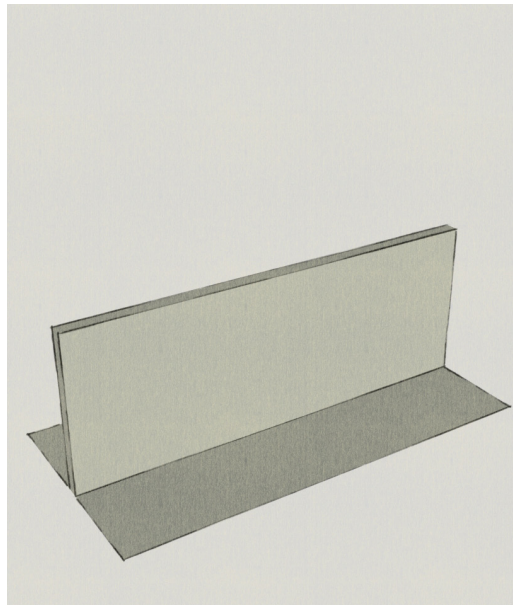
- <<<< Figure. 40. Trees.
- <<< Figure. 41. Shrubs.
- << Figure. 42. Perennials.
- < Figure. 43. Groundcover.

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## Vertical Elements

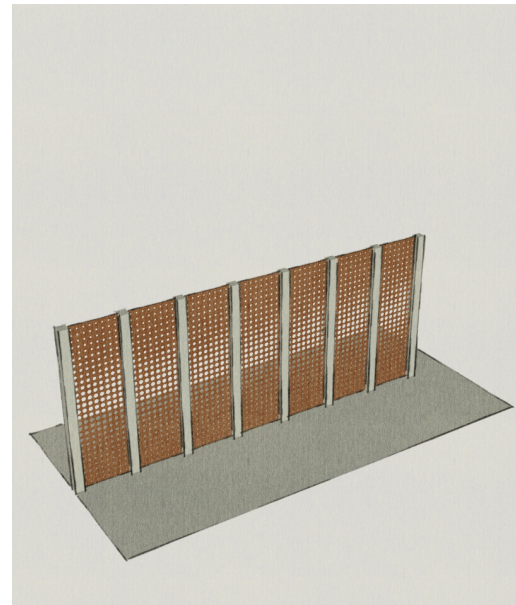
An overhead structure that provides shade and shelter for the user.



### G1. Solid Wall

Solid walls are impermeable. They are commonly made from bricks or stone.

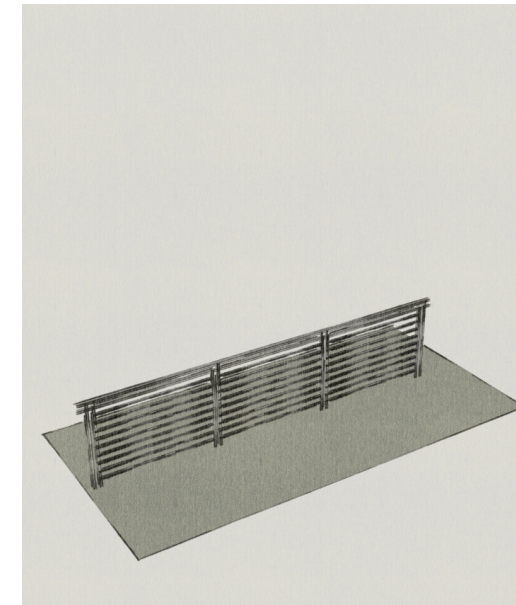
- (M2) 2D Panelization
- (M4) Slot Architecture
- (B1) Visual Connection with Nature
- (B4) Thermal & Airflow Variability
- (B9) Material Connection with Nature
- (B12) Refuge



### G2. Perforated Wall

Perforated walls can be made of panels with holes in them. They are commonly called screening walls.

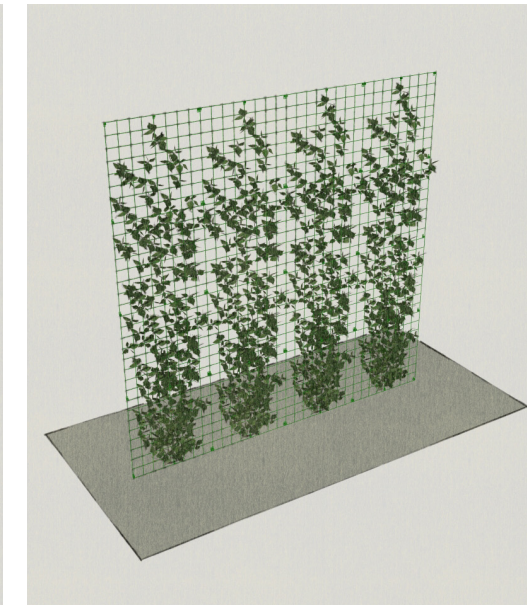
- (M2) 2D Panelization
- (M4) Slot Architecture
- (M5) Bus Architecture
- (B4) Thermal & Airflow Variability
- (B6) Dynamic & Diffuse Light
- (B8) Forms & Patterns



### G3. Railing

A railing is a barrier that prevents people from moving in a specific direction while still allowing visual connection.

- (M4) Slot Architecture
- (M5) Bus Architecture
- (B6) Dynamic & Diffuse Light
- (B8) Forms & Patterns
- (B9) Material Connection with Nature



### G4. Green Wall

A vertical structure with plants attached, either through a vining system or a planter box system.

- (M2) 2D Panelization
- (M4) Slot Architecture
- (M5) Bus Architecture
- (B1) Visual Connection with Nature
- (B2) Non-Visual Connection with Nature
- (B7) Connection with Natural Systems

<<<<  
Figure. 44. Solid Wall.

<<<  
Figure. 45. Perforated Wall.

<<  
Figure. 46. Railing.

<  
Figure. 47. Green Wall.

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## Shade Structures

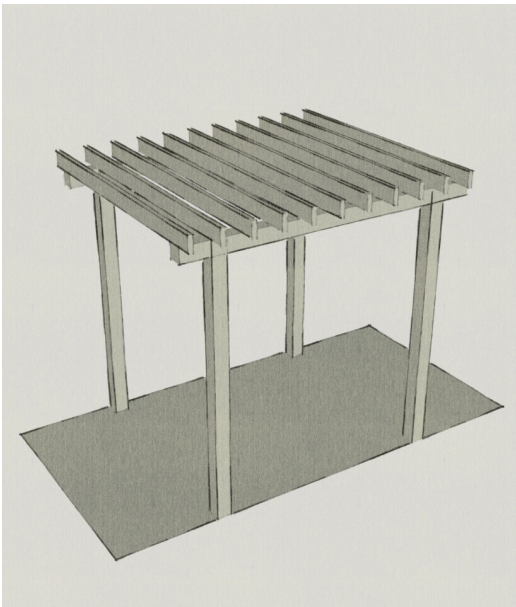
Overhead elements describe a structure that provides shade and shelter for the user.



### H1. Solid Shade Structure

A solid shade structure describes a roof made from a non-permeable material that protects against rain and sun.

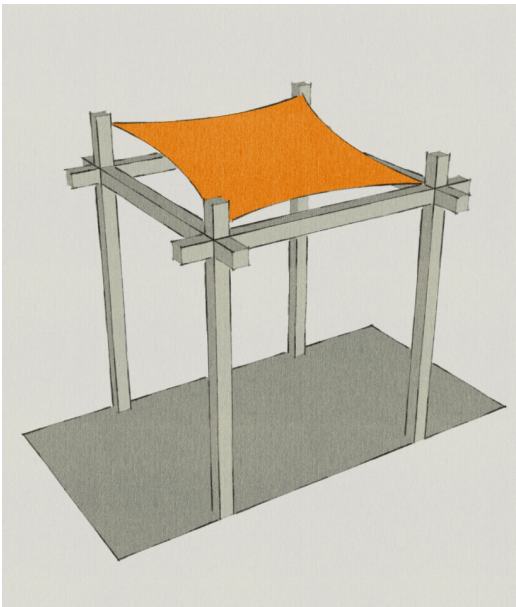
- M2 2D Panelization
- M4 Slot Architecture
- B4 Thermal & Airflow Variability
- B9 Material Connection with Nature
- B10 Complexity & Order
- B12 Refuge



### H2. Pergola

A pergola is a slatted shade structure that allows partial sun to enter. It is also commonly used to grow vining plants.

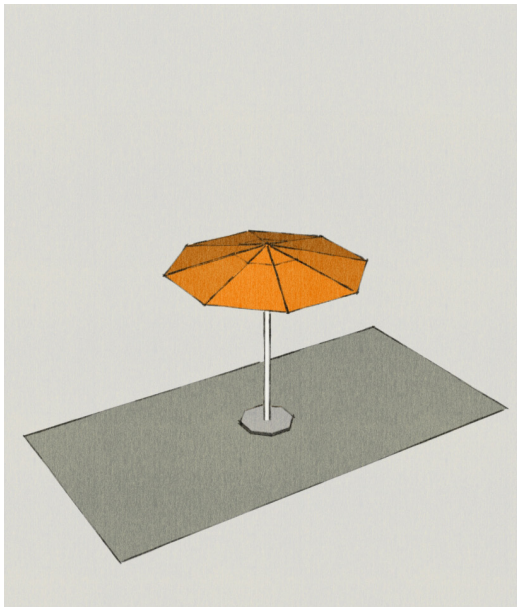
- M2 2D Panelization
- M4 Slot Architecture
- B4 Thermal & Airflow Variability
- B6 Dynamic & Diffuse Light
- B9 Material Connection with Nature
- B12 Refuge



### H3. Shade Sail

Shade sails are large, flexible fabrics stretched between various anchor points. They provide protection from sun and rain.

- M5 Bus Architecture
- B4 Thermal & Airflow Variability
- B6 Dynamic & Diffuse Light
- B8 Forms & Patterns
- B9 Material Connection with Nature
- B12 Refuge



### H4. Umbrella

An umbrella is an adjustable shade structure. The user can open and close it and even move it to a different location.

- M1 3D Volumetric
- M5 Bus Architecture
- M6 Sectional Architecture
- B4 Thermal & Airflow Variability
- B6 Dynamic & Diffuse Light
- B8 Forms & Patterns

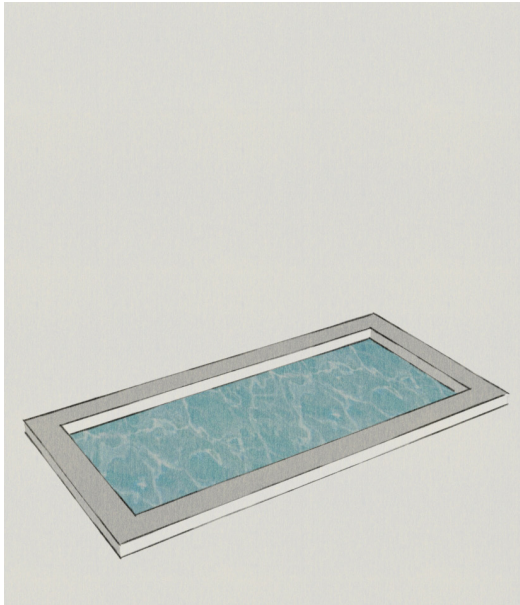
|      |                                    |                        |
|------|------------------------------------|------------------------|
| <<<< | Figure. 48. Solid Shade Structure. | Context                |
| <<<  | Figure. 49. Pergola.               | Literature Review      |
| <<   | Figure. 50. Shade Sail.            | Typology               |
| <    | Figure. 51. Umbrella.              | Landscape Elements     |
|      |                                    | Precedents             |
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|      |                                    | Amenity Decks          |
|      |                                    | Design                 |
|      |                                    | GWD                    |
|      |                                    | Salina                 |

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## Water Features

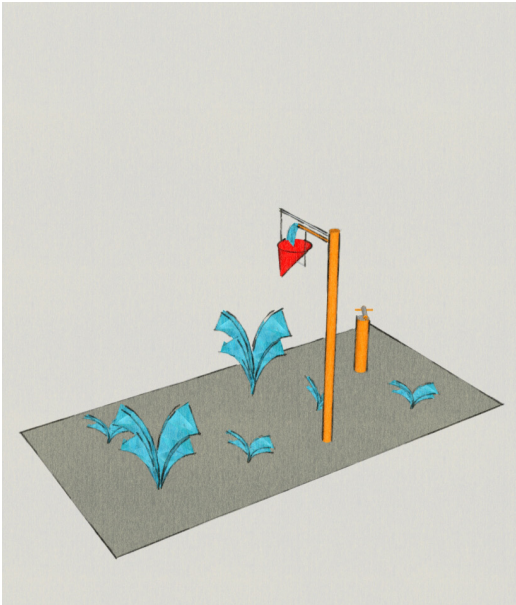
Water features describe landscape elements that incorporate water.



### I1. Pool

A small body of water that people swim in.

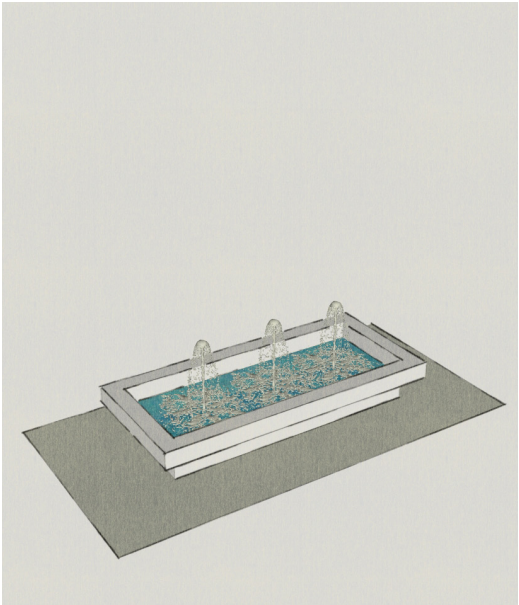
- (M1) 3D Volumetric
- (M4) Slot Architecture
- (B2) Non-Visual Connection with Nature
- (B4) Thermal & Airflow Variability
- (B5) Presence of Water
- (B6) Dynamic & Diffuse Light
- (B7) Connection with Natural Systems
- (B14) Risk/Peril



### I2. Splash Pad

Splash Pads are outdoor play features with devices that spray water.

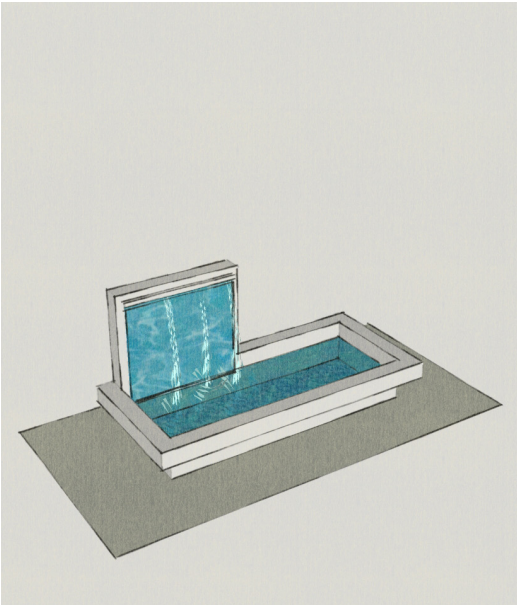
- (M1) 3D Volumetric
- (M4) Slot Architecture
- (B2) Non-Visual Connection with Nature
- (B4) Thermal & Airflow Variability
- (B5) Presence of Water
- (B6) Dynamic & Diffuse Light



### I3. Fountain

A fountain is a decorative element that sprays water from a jet.

- (M4) Slot Architecture
- (B2) Non-Visual Connection with Nature
- (B3) Non-Rhythmic Sensory Stimuli
- (B4) Thermal & Airflow Variability
- (B5) Presence of Water
- (B6) Dynamic & Diffuse Light
- (B7) Connection with Natural Systems



### I4. Waterfall

Water that flows over a vertical drop.

- (M4) Slot Architecture
- (B2) Non-Visual Connection with Nature
- (B3) Non-Rhythmic Sensory Stimuli
- (B4) Thermal & Airflow Variability
- (B5) Presence of Water
- (B6) Dynamic & Diffuse Light
- (B7) Connection with Natural Systems

- <<<< Figure. 52. Pool.
- <<< Figure. 53. Splash Pad.
- << Figure. 54. Fountain.
- < Figure. 55. Waterfall.

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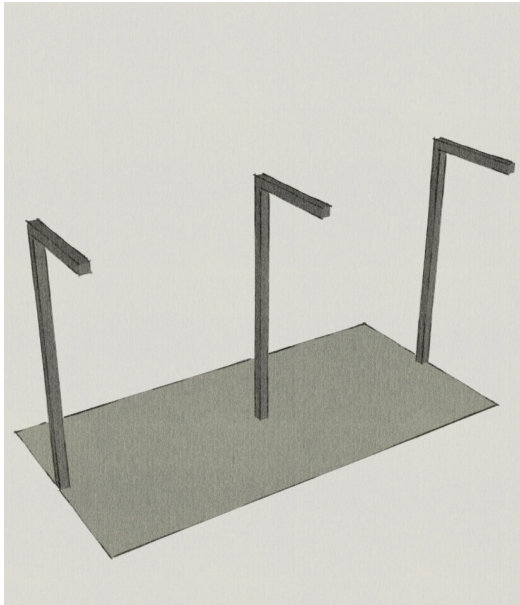
Natural Analogs

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# Lighting

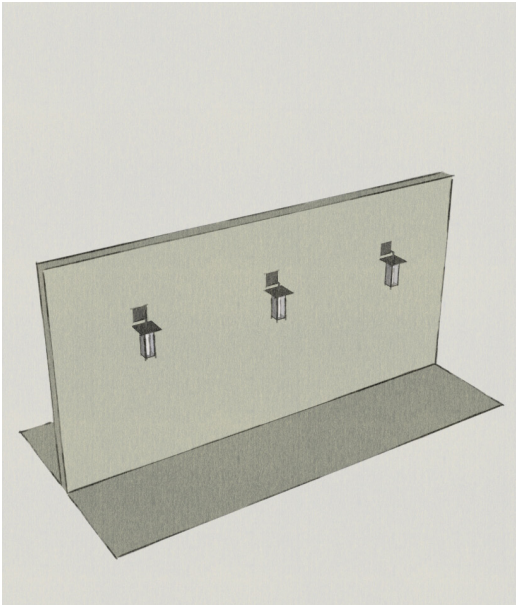
Lighting describes the illumination of a space at night.



## J1. Overhead Lights

Overhead lights shine from above. String lights and light poles are common examples.

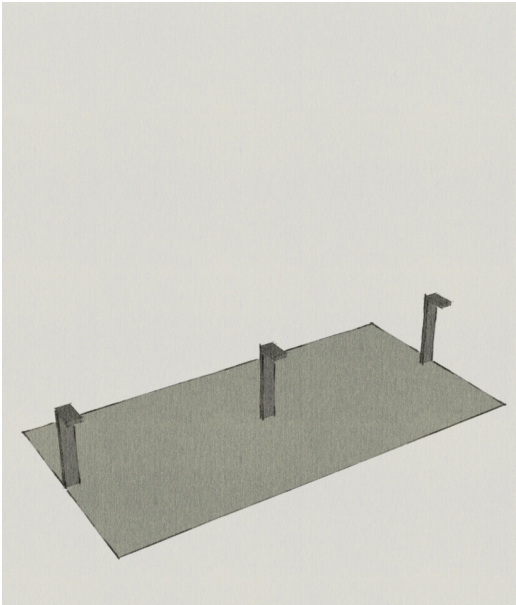
- (M1) 3D Volumetric
- (M4) Slot Architecture
- (M5) Bus Architecture
- (B6) Dynamic & Diffuse Light
- (B8) Forms & Patterns
- (B10) Complexity & Order
- (B12) Refuge



## J2. Wall Lights

Lights that are attached or integrated into a wall to provide lighting.

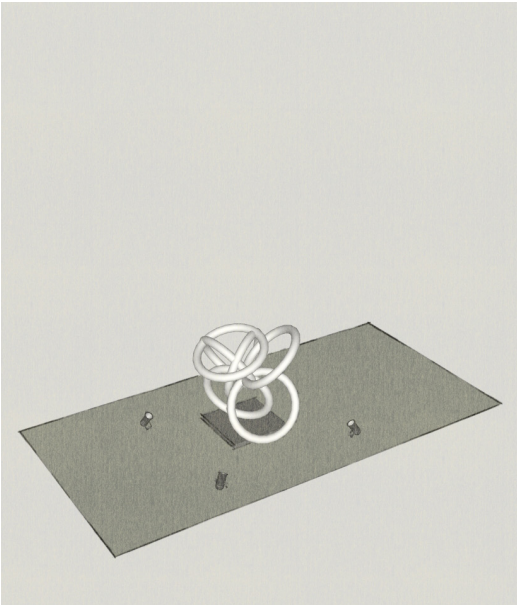
- (M1) 3D Volumetric
- (M4) Slot Architecture
- (B6) Dynamic & Diffuse Light
- (B8) Forms & Patterns
- (B10) Complexity & Order
- (B12) Refuge



## J3. Bollard Lights

Bollard lights describe the lighting that is below eye level and is used to illuminate pathways.

- (M1) 3D Volumetric
- (M4) Slot Architecture
- (M6) Sectional Architecture
- (B6) Dynamic & Diffuse Light
- (B8) Forms & Patterns
- (B10) Complexity & Order
- (B11) Prospect



## J4. Spotlights

Spotlights are lights pointed up to highlight specific elements like a tree or sculpture.

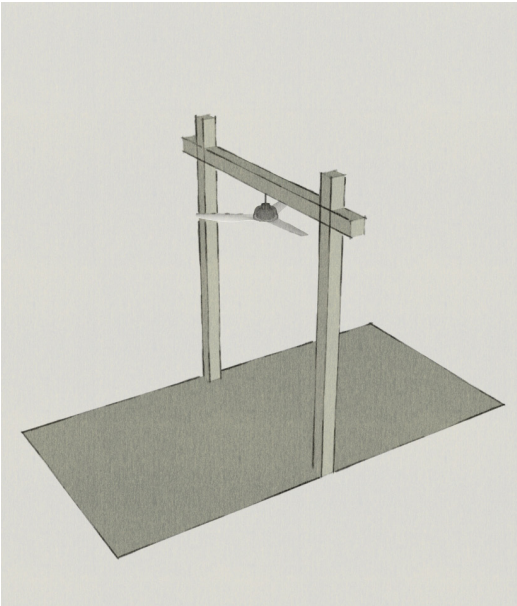
- (M1) 3D Volumetric
- (M4) Slot Architecture
- (M6) Sectional Architecture
- (B6) Dynamic & Diffuse Light
- (B8) Forms & Patterns
- (B10) Complexity & Order

- <<<< Figure. 56. Overhead Lights.
- <<< Figure. 57. Wall Lights.
- << Figure. 58. Bollard Lights.
- < Figure. 59. Spotlights.

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Electrical Elements

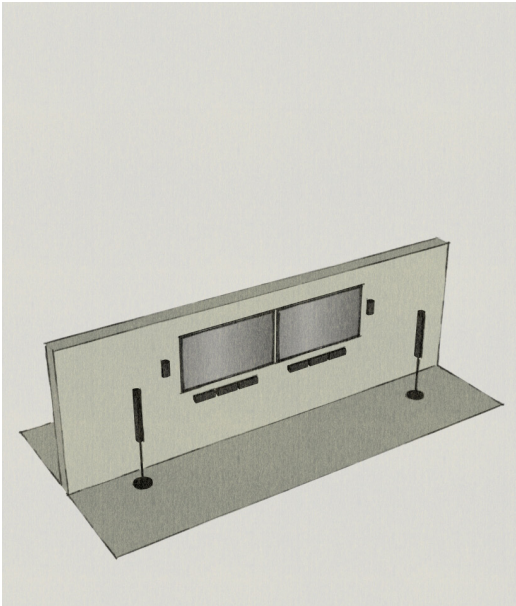
This category describes common landscape elements that require electricity.



K1. Fan

A fan has rotating blades to create a current of air to cool an area.

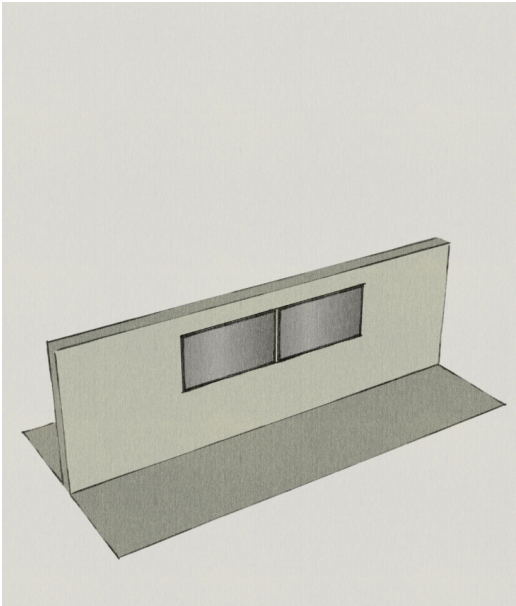
- (M1) 3D Volumetric
- (M3) 3D/2D Combination
- (M4) Slot Architecture
- (B4) Thermal & Airflow Variability
- (B6) Dynamic & Diffuse Light
- (B8) Forms & Patterns
- (B9) Material Connection with Nature



K2. Sound System

A sound system is a series of speakers that amplify sound so everyone can hear.

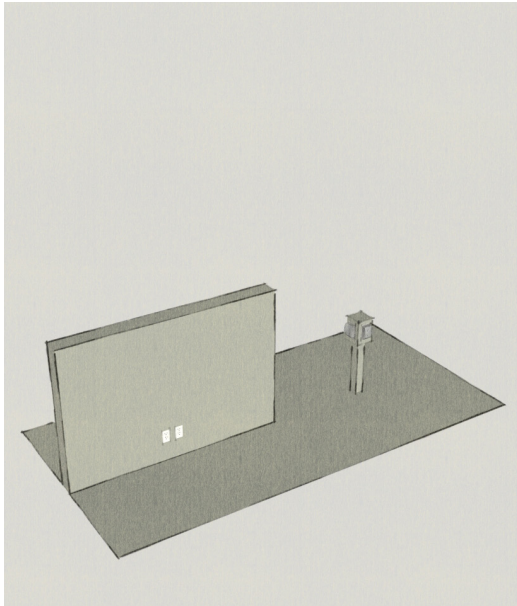
- (M1) 3D Volumetric
- (M5) Bus Architecture
- (B2) Non-Visual Connection with Nature
- (B3) Non-Rhythmic Sensory Stimuli



K3. TV

An electronic system that transmits moving images such as movies or sports games, or nature scenes.

- (M1) 3D Volumetric
- (M5) Bus Architecture
- (B1) Visual Connection with Nature.



K4. Power Outlet

A device that allows equipment to connect to the power grid. A typical example today is a phone charger.

- (M5) Bus Architecture

<<<< Figure. 60. Fan.  
<<< Figure. 61. Sound System.  
<< Figure. 62. TV.  
< Figure. 63. Power Outlet.

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### Comfort Elements

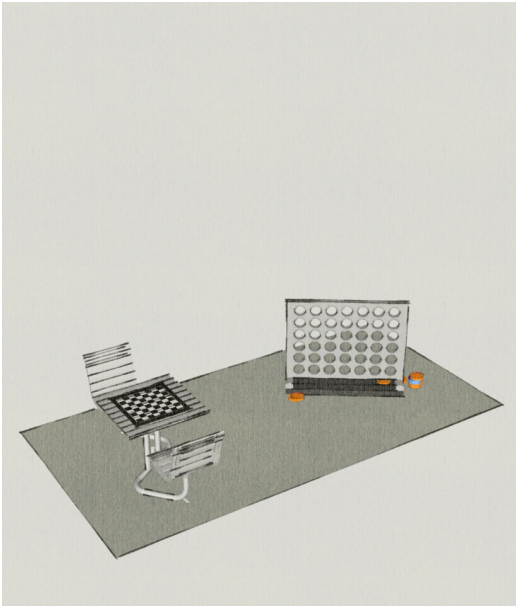
Comfort elements describe important elements that impact people's comfort as they use the space.



#### L1. Fire Pit

A fire pit is used to contain an outdoor fire.

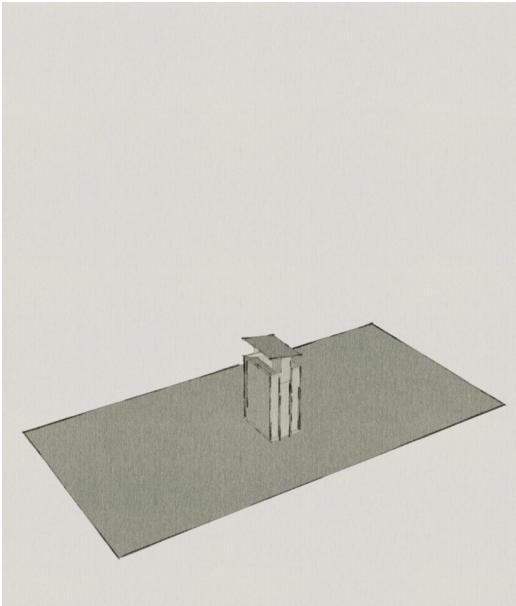
- (M4) Slot Architecture
- (M6) Sectional Architecture
- (B1) Visual Connection with Nature
- (B3) Non-Rhythmic Sensory Stimuli
- (B4) Thermal & Airflow Variability
- (B6) Dynamic & Diffuse Light
- (B9) Material Connection with Nature
- (B14) Risk/Peril



#### L2. Games

A set of elements used to compete with other people for fun. Some typical games are Connect Four and Chess.

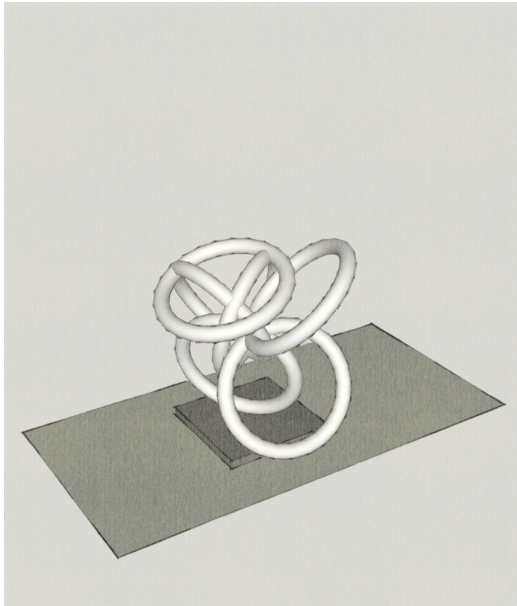
- (M1) 3D Volumetric
- (M6) Sectional Architecture



#### L3. Trash Receptacle

A trash receptacle is a container that holds garbage so people don't throw it on the ground.

- (M1) 3D Volumetric
- (M4) Slot Architecture
- (M6) Sectional Architecture
- (B8) Form & Patterns
- (B9) Material Connection with Nature
- (B10) Complexity & Order



#### L4. Art

Outdoor art, commonly in the form of sculpture, creates visual interest for people and helps to make each place unique.

- (M4) Slot Architecture
- (M6) Sectional Architecture
- (B8) Form & Patterns
- (B10) Complexity & Order
- (B13) Mystery
- (B14) Risk/Peril

<<<< Figure. 64. Fire Pit.  
<<< Figure. 65. Games.  
<< Figure. 66. Trash Receptacle.  
< Figure. 67. Art.

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Reconfigurability

Nature in the Space

Natural Analogs

Nature of the Space



## Design Strategies in Landscape Elements

[illegible]

<  
Table 1. Land-  
scape elements  
compared with  
the criteria  
modularity and  
biophilia.

[illegible]

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This section helps identify common landscape elements. Although each element can take many forms, this list captures the most common. The previous page visualizes common patterns for the design strategies within each of the landscape elements noted. The table is not meant to be used to identify which landscape element achieves every type of modularity and biophilia. Instead, it is intended to highlight the potential use of these landscape elements as they are designed.

**Prefabrication:** Many of the elements that we looked at, namely seating, tables, and planters, have the potential to be designed as 3D Volumetric, where they can be fully prefabricated and shipped to the site. At the same time, many landscape elements can also be 2D panelized and fully assembled on-site. One example is a table shipped with detached legs, allowing transportation efficiency. The category 3D/2D hybrid was found to have limited applications for the landscape elements. This occurred because the definition was derived from modular construction, where they fully prefabricate specific rooms that are more complex, such as bathrooms, and panelize the simple rooms. Despite the limited application for the hybrid, the prefabrication design strategy helped identify how these landscape elements could be prefabricated in the future.

**Reconfigurability** is the second design strategy used to evaluate landscape elements. It helped determine each element's ability to move. Some landscape elements were best defined as slot architecture, where they are fixed in place. Examples include addressing topography, the ground plane, and overhead elements. Other components, such as chairs, tables, and planters, have more variety in their applications, which can be slot or sectional architecture. Most of the furniture has the potential to be bus architecture.

**Nature in the Space** helped to consider how each landscape element could incorporate nature. The five categories that best achieve this are topography, planters, vegetation, water features, and fire features. Addressing topography and planters defined spaces for vegetation while the vegetation helped resemble a natural environment. Water and fire are two more natural elements that help further connecting with nature. These are both tremendous tools for designing and creating engaging landscapes. These five landscape elements help incorporate nature into space.

**Natural Analogs** were one of the most used design strategies. This is likely due to material considerations. Each landscape element has the potential to connect with nature through the materials, form, and patterns chosen. While these considerations were made for many of the landscape elements, some of the most consistent places they were considered were in the seating, tables, and planter categories. This section highlights the opportunity for many of these landscape elements to resemble nature.

**The Nature of the Space** was the least used design strategy because of its limited applicability. This section considers the overall experience within a site rather than each specific landscape element. This limits this section's application to the typologies but will be very useful in later evaluations.

This typology helps identify the potential forms in which these landscape elements can appear. One limitation of this typology is that it does not consider how these landscape elements function together. To address this, fifteen precedent studies were examined, identifying how these landscape elements are incorporated into existing projects. This highlights how these landscape elements are commonly combined today.

|                          |  |
|--------------------------|--|
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| GWD                      |  |
| Salina                   |  |
| <b>Design Strategies</b> |  |
| Prefabrication           |  |
| Reconfigurability        |  |
| Nature in the Space      |  |
| Natural Analogs          |  |
| Nature of the Space      |  |

## Precedent Studies

The following method aims to identify how the landscape elements identified in the typology have been implemented into built projects and evaluate how these designs have the potential for modularity and how they incorporate biophilia. Three different environments will be evaluated: residential landscapes, temporary landscapes, and amenity decks.

The following page describes how the content is laid out throughout the precedent studies.



1

Project Identification Information, including project name, location, and designer.

# Identification Code

## Project Name

Location XXX

Designer XXX

### Typology

- Stairs (A2)
- Swale (A3)
- Pour in Place (B1)
- Unit Pavers (B2)
- Patio Deck (B4)
- Movable Seating (C1)
- Trees (F1)
- Shrubs (F2)
- Perennials (F3)
- Solid Shade Structure (H1)

2

A list of the landscape elements is their corresponding identification code.

3

Photos of Precedent to Visualize how each landscape element is applied.

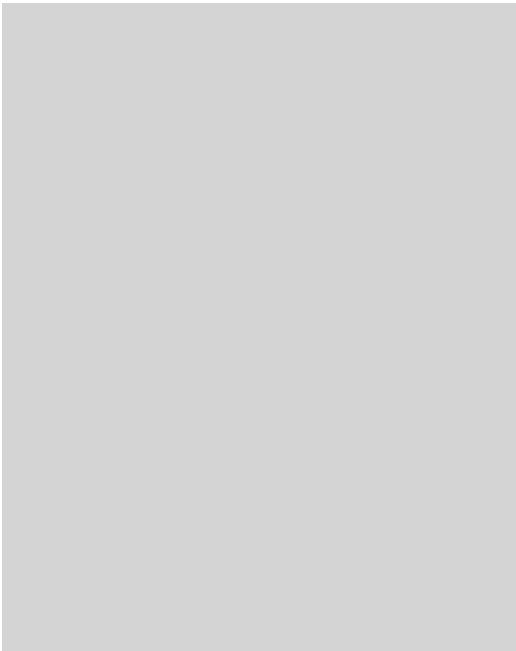
(F1) Typology call-outs on the landscape elements in the picture  
(H1)  
(C1)

4

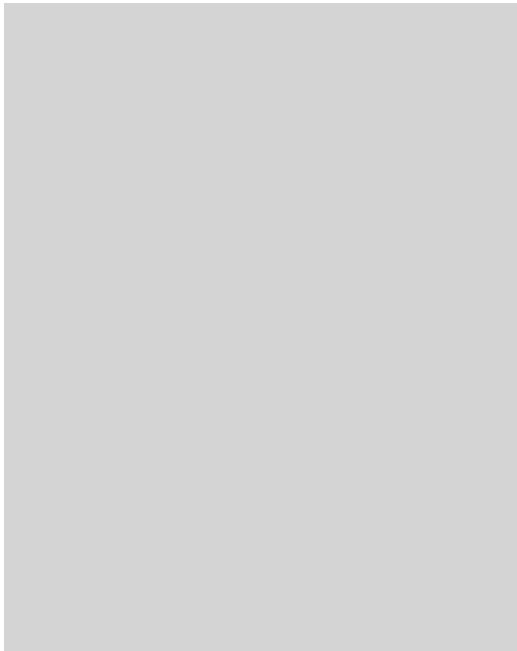
Text evaluating each precedent on the design strategies of modularity and biophilia.

There are five components of each precedent. The first component is the identification code with the project's name, location, and designer. This information is included to identify each project for reference purposes. The second part is titled Typology on the left-hand column of the page. The typology section intends to identify and

call out each landscape element seen within the precedent. The photos are the third component and help visualize the different landscape elements applied in real projects. The fourth component is the text. This text intends to evaluate each of the precedents based on the same design strategies as the typologies: modularity and biophilia. This text is summarized in



component five, the design strategies, which list the modular and biophilic aspects that apply to the design. The color squares on the far side of the page highlight the overarching categories of modularity and biophilia. Each category is color-coded and linked to the design strategies section as they did in the typology section.



### Criteria

- (M2) 2D Panelization
- (M4) Slot Architecture
- (M5) Sectional Architecture
- (B1) Visual Connection with Nature
- (B6) Dynamic & Diffuse Light
- (B7) Connection with Natural Systems

5

The colored squares represent the overarching design strategies for modularity and biophilia. The color of each category is the same as the callout.

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## RL. Residential Landscapes

Residential landscapes identify how landscape elements are applied around people's homes. Each precedent aims to identify human experience through smaller-scale designs made specifically for the residents. Even though there is some modular potential, these precedents focus on biophilia and the design of comfortable outdoor spaces.

Metrick Cottage and Boathouse

Location Canada  
Designer Akb Architects

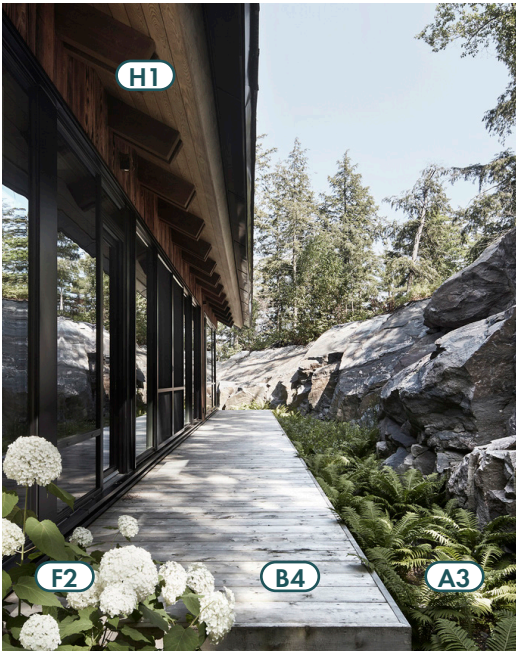
Typology

- Stairs (A2)
- Swale (A3)
- Pour in Place (B1)
- Unit Pavers (B2)
- Patio Deck (B4)
- Movable Seating (C1)
- Trees (F1)
- Shrubs (F2)
- Perennials (F3)
- Solid Shade Structure (H1)



Metrick Cottage and Boathouse uses natural materials like the wood deck and stone driveway so that users can interact with natural materials and textures. Other natural materials help connect with the surrounding environment—the vegetation changes depending on the season by changing color or losing foliage. The planting, especially the trees, helps

create dynamic shadows that are visually interesting. Views of nature are prioritized inside the house, with large windows oriented towards forested areas. This allows people to connect to nature, even within the home. This is beneficial, especially when the wind blows lightly, as the moving plants create visual interest.



The deck in this design creates a sense of refuge where the large rock outcropping next to the deck helps to develop a feeling of protection. At the same time, the deck helps create unhindered views by elevating the deck above the plants. Most components highlighted here are not reconfigurable. This limits the overall flexibility of space.



<<< Figure. 68. Visual connection through the house. Photograph courtesy of Shai Gil.  
<< Figure. 69. The back deck creates a refuge protected by adjacent rocks. Photograph courtesy of Shai Gil.  
< Figure. 70. The large window creates a visual connection to nature beyond. Photograph courtesy of Shai Gil.

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Criteria

- (M2) 2D Panelization
- (M4) Slot Architecture
- (M5) Sectional Architecture
- (B1) Visual Connection with Nature
- (B6) Dynamic & Diffuse Light
- (B7) Connection with Natural Systems
- (B9) Material Connection with Nature
- (B11) Prospect
- (B12) Refuge

Design Strategies

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POP-UP House

Location Essendon, Australia  
Designer FIGR Architecture & Design

Typology

- Unit Pavers (B2)
- Patio Deck (B4)
- Movable Seating (C1)
- Fixed Seating (C2)
- Lounge Seating (C3)
- Low Table (D3)
- Movable Planters (E1)
- Fixed Planters (E2)
- Trees (F1)
- Perennials (F3)
- Ground Cover (F4)
- Railing (G3)
- Solid Shade Structure (H1)
- Overhead Lights (J1)



The POP-UP House’s panelized wall systems allow the house to be opened up to feel more like an outdoor room. This creates some non-visual connection to nature through sounds and smells. These panelized windows are also great for airflow variability. A light breeze can help cool the house. There are moments of prospect and refuge

where a sense of protection is paired with a view in the other direction. The surrounding landscape helps visually connect the house to nature. This design also incorporates natural wood planks and bricks that help create a warm experience. Some elements within this design can be prefabricated and shipped to the project, such as the furniture and



the panelized wall system. Within the POP-UP House, there are all three types of reconfigurability. The deck system and pavers represent slot architecture since they are fixed. The panelized glass wall system represents bus architecture. Finally, the furniture and planters represent sectional architecture. These elements can be moved anywhere.



- Criteria
- (M2) 2D Panelization.
  - (M4) Slot Architecture
  - (M5) Bus Architecture
  - (M6) Sectional Architecture
  - (B1) Visual Connection with Nature
  - (B3) Non-Visual Connection with Nature
  - (B4) Thermal & Airflow Variability
  - (B9) Material Connection with Nature
  - (B11) Prospect
  - (B12) Refuge

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<<< Figure. 71. Interior/Exterior connection through a sliding glass wall. Photograph courtesy of Tom Blanchford.

<< Figure. 72. A small courtyard creates a sense of protection. Photograph courtesy of Tom Blanchford.

< Figure. 73. Material connection to nature through the brick. Photograph courtesy of Tom Blanchford.



RL3

Courtyard House

Location Hawthorn, Australia

Designer Ha Architecture

Typology

- Mound (A4)
- Pour in Place (B1)
- Unit Pavers (B2)
- Patio Deck (B4)
- Movable Seating (C1)
- Abstract Seating (C4)
- Large Table (D1)
- Fixed Planters (E2)
- Trees (F1)
- Perennials (F3)
- Ground Covers (F4)
- Perforated Wall (G2)
- Green Wall (G4)



The Courtyard House is centered around a small courtyard with a single tree in the middle. The surrounding walls create a feeling of protection and refuge. The panelized glass walls create a visual connection to nature within the home. A light breeze can flow into the house and create a comfortable microclimate. Natural wood's subtle variation of color and texture makes

it visually intriguing. The wood is slatted to allow light to enter the house and create dynamic shadows. This design has three types of reconfigurability. The ground plane represents slot architecture, where it is fixed in place. The furniture is usually sectional architecture, so users can move them as they desire, like the table and chairs. Finally, the panelized wall is bus architecture.



Criteria

- (M2) 2D Panelization
- (M4) Slot Architecture
- (M5) Bus Architecture
- (M6) Sectional Architecture
- (B1) Visual Connection with Nature
- (B2) Non-Visual Connection with Nature
- (B3) Non-Rhythmic Sensory Stimuli
- (B4) Thermal Airflow variability
- (B6) Dynamic & Diffuse Light
- (B7) Connection with Natural Systems
- (B9) Material Connection with Nature
- (B10) Complexity and Order
- (B12) Refuge



<<< Figure. 74. The ornamental tree functions as a living sculpture. Photograph Courtesy of Tom Ross.

<< Figure. 75. The small stone path creates a sense of playfulness. Photograph courtesy of Tom Ross.

< Figure. 76. The movable glass blends interior and exterior spaces together. Photograph courtesy of Tom Ross.

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Natural Analogs

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# RL4

## Dappled Backyard Retreat

**Location** Ravenswood, Chicago  
**Designer** Andrew Kibbe at Christy Webber Landscapes

- Typology
- Stair

A2
- Pour in Place

B1
- Unit Pavers

B2
- Patio Deck

B4
- Movable Seating

C1
- Lounge Seating

C3
- Large Table

D1
- Small Table

D2
- Low Table

D3
- Movable Planters

E1
- Fixed Planters

E2
- Trees

F1
- Shrubs

F2
- Perennials

F3
- Railing

G3
- Umbrella

H4
- Wall Light

J2



Dappled Backyard Retreat gets its name from the dynamic and diffuse light the surrounding trees create. These shadows help create non-rhythmic sensory stimuli and alter the micro-climate by blocking the wind and solar radiation. The surrounding vegetation, such as the red shrub and the yellowing tree, also creates seasonal interest on the site.

These subtle changes help people notice the changes in their environment. This backyard also creates a feeling of protection while providing some outward views. The ground level gives the feeling of refuge through the solid walls and screening vegetation. Climbing the stairs, another smaller patio offers a nice overlook and more unhindered views of



the surrounding context. Some elements, like the tables and chairs, have the potential to be fully prefabricated. At the same time, other components, such as the railing, are panelized. The elements within this design follow a similar pattern to the previous precedents, where the ground plane is fixed in place while the furniture is movable.

- Criteria
- M1

3D Volumetric
- M2

2D panelization
- M4

Slot Architecture
- M6

Sectional Architecture
- B1

Visual Connection with Nature
- B3

Non-Rhythmic Sensory Stimuli
- B4

Thermal & Airflow Variability
- B6

Dynamic & Diffuse Light.
- B7

Connection with Natural Systems
- B12

Refuge

<< Figure. 77. The outdoor patio space feels protected. Photograph courtesy of Christy Webber Landscapes.

< Figure. 78. The raised deck allows a view of the surrounding area. Photograph courtesy of Christy Webber Landscapes.

- Context
- Literature Review
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- Temporary Landscapes
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- Prefabrication
- Reconfigurability
- Nature in the Space
- Natural Analogs
- Nature of the Space



RL5

Backyard Garden

Location Montana  
Designer Blanchford Landscape Group

Typology

- Stairs (A2)
- Unit Pavers (B2)
- Movable Seating (C1)
- Fixed Seating (C2)
- Small Table (D2)
- Movable Planters (E1)
- Fixed Planters (E2)
- Planter Bench (E3)
- Trees (F1)
- Perennials (F3)
- Ground Cover (F4)
- Solid Wall (G1)
- Shade Sail (H3)
- Fountain (I3)



This backyard garden designed by Blanchford Landscape Group incorporates a water feature that functions in many ways. It creates the sound of running water, refracts light that creates interesting reflections, and promotes a comfortable microclimate. The shade sail blocks solar radiation, and the fence blocks wind, helping alter the microclimate.

These shade sails are a type of bus architecture since they are attached to a specific location and can be put up or taken down. The walls help develop a sense of protection. Other notable elements in this design are the planting and the paving. The planting is primarily low-growing ground covers that allow this small space to maintain a visual



connection, while the paving helps to create a natural texture for people. This design likely had some elements that were fully prefabricated and some that were partially prefabricated. The metal table and chairs were prefabricated and shipped as they were, while the two Adirondack chairs were likely shipped in pieces and fully assembled on-site.

Criteria

- (M1) 3D Volumetric
- (M4) Slot Architecture
- (M6) Sectional Architecture
- (B2) Non-Visual Connection with Nature
- (B4) Thermal & Airflow Variability
- (B5) Presence of Water
- (B6) Dynamic and Diffuse Light
- (B7) Connection with Natural Systems
- (B9) Material Connection with Nature
- (B12) Refuge

<< Figure. 79. A small courtyard creates a sense of protection. Photograph courtesy of Blanchford Landscape Design.

< Figure. 80. The water feature creates a natural sound that people prefer. Photograph courtesy of Blanchford Landscape Design.

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## TL. Temporary Landscapes

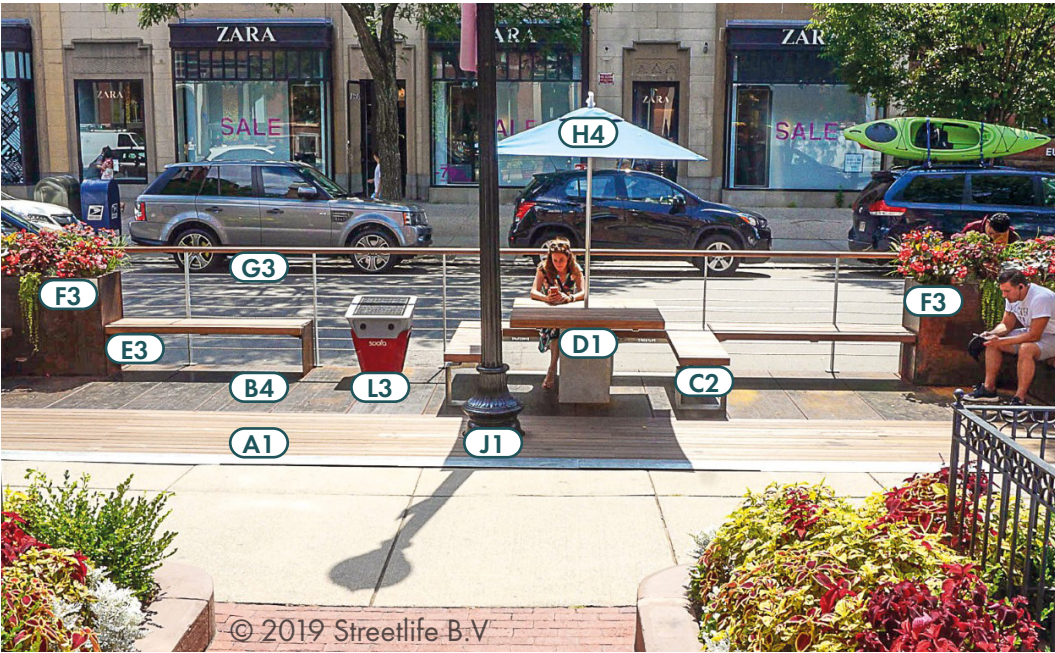
Because of their impermanent nature, temporary landscapes are conducive to modularity. The following precedents were chosen to understand how common modular landscape elements are used today. This study will evaluate the two types of temporary landscapes: parklets and pop-up parks.



Streetlife Parklet

Location Newbury St., Boston  
Designer Streetlife

- Typology
- Ramp (A1)
  - Patio Deck (B4)
  - Fixed Seating (C2)
  - Large Table (D1)
  - Fixed Planters (E2)
  - Planter Bench (E3)
  - Perennials (F3)
  - Railing (G3)
  - Umbrella (H4)
  - Overhead Lights (J1)
  - Trash Receptacle (L3)



The Streetlife Parklet reimagines how a couple of parking spaces are used. This design has four main elements: the deck system on the ground plane makes it level with the sidewalk, seating elements encourage people to use the space, a railing to protect users from traffic, and planters to incorporate natural elements. The planters create visual

interest, especially with the flowers, and help people witness seasonal changes as plants grow, flowers bloom, and eventually hibernate for winter. Other landscape elements, like the planters, tables, benches, and deck system, connect to nature through materiality. The tables and benches are made from natural wood, while the planters



are made of weathering steel, creating a rustic natural feeling. This parklet appears to be prefabricated in panels to make transportation easier. The landscape elements in this parklet are not reconfigurable; the planters, benches, and tables are all fixed in place. This inhibits the space's flexibility because it does not allow users to reconfigure any elements.



- Criteria
- (M1) 3D Volumetric
  - (M2) 2D Panelization
  - (M4) Slot Architecture
  - (M5) Bus Architecture
  - (B1) Visual Connection with Nature
  - (B7) Connection with Natural Systems
  - (B9) Material Connection with Nature
  - (B14) Risk/Peril

<<< Figure. 81. The parklet extends the sidewalk out into the street. Photograph courtesy of Streetlife.

<< Figure. 82. Native planting creates a connection to place. Photograph courtesy of Streetlife.

< Figure. 83. The rail protects people from going into the street. Photograph courtesy of Streetlife.

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- Prefabrication
  - Reconfigurability
  - Nature in the Space
  - Natural Analogs
  - Nature of the Space



Vestre Parklets 2.0

Location Unknown

Designer Vestre

Typology

- Ramp (A1)
- Patio Deck (B4)
- Movable Seating (C1)
- Fixed Seating (C2)
- Small Tables (D2)
- High Tables (D4)
- Planter Bench (E3)
- Shrubs (F2)
- Ground Cover (F4)
- Railing (G3)



Vestre Parklets 2.0 is similar to Streetlife’s Parklet, yet some notable distinctions exist. Vestre’s Parklet design differs because of its various seating types, including movable chairs, benches, and bar-height seating. This provides a variety of options for users. Some chairs can be reconfigured, allowing the user to have a sense of control over their environment.

The deck system and planters were likely prefabricated in panels and then shipped in pieces to be fully assembled on-site. At the same time, the seating elements were likely fully prefabricated and then placed on-site. The surrounding trees and planting help to connect this parklet with nature. This can be seen through the planters and the dynamic shadows



of nearby trees. These shadows create visual interest for people. Along with the connection to vegetation, this design connects the material to nature through their use of wood. The deck system, the seating elements, and the tabletops are made of wood. This allows the users to enjoy the tactile qualities of wood.



Criteria

- (M1) 3D Volumetric
- (M2) 2D Panelization
- (M4) Slot Architecture
- (M6) Sectional Architecture
- (B1) Visual Connection with Nature
- (B6) Dynamic & Diffuse Light
- (B9) Material Connection with Nature
- (B14) Risk/Peril

<<< Figure. 84. Movable chairs allow more control over the environment. Photograph courtesy of Vestre.

<< Figure. 85. The planter bench connects people to nature. Photograph courtesy of Vestre.

< Figure. 86. The seating element engages the user with the vegetation. Photograph courtesy of Vestre.

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75th Street Boardwalk

Location Chicago, Illinois  
Designer Site Design Group, Ltd.

Typology

- Patio Deck (B4)
- Movable Seating (C1)
- Fixed Seating (C2)
- Abstract Seating (C4)
- Large Tables (D1)
- Small Tables (D2)
- Divider Planters (E4)
- Perennials (F3)
- Ground Covers (F4)
- Solid Shade Structure (H1)
- Umbrella (H4)
- Games (L2)
- Art (L4)



75th Street Boardwalk connects with the natural systems through the grass planted along the perimeter of each parklet area. This vegetation creates a visually intriguing edge condition as the plants grow and the wind blows. The Nest, designed by Krueck Sexton Partners, is one landscape element that creates visual interest in this area.

It is the table with bench seating and the blue pergola structure surrounding it. Like the name alludes, it intends to resemble a bird's nest. This shade structure helps create a biomorphic design that provides a sense of protection. The deck system of the 75th Street Boardwalk was not prefabricated but constructed on-site, while other elements were fully



prefabricated, such as the Nest, the games, small tables, and seating. All elements incorporated into this design were reconfigurable. This allows the users to personalize these spaces by moving the site elements within the design. The temporary nature of this boardwalk encourages reconfigurability to test ideas and understand user preferences.



- Criteria
- (M1) 3D Volumetric
  - (M4) Slot Architecture
  - (M6) Sectional Architecture
  - (B1) Visual Connection with Nature
  - (B3) Non-Rhythmic Sensory Stimuli
  - (B7) Connection with Natural Systems
  - (B10) Complexity & Order
  - (B11) Prospect
  - (B12) Refuge

<<< Figure. 87. The Nest created a sense of protection. Photograph courtesy of Scott Shigley for Site Design Group.

<< Figure. 88. Games create an inviting environment. Photograph courtesy of Scott Shigley for Site Design Group.

< Figure. 89. Public art creates a sense of community. Photograph courtesy of Scott Shigley for Site Design Group.

Context

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- Amenity Decks

Design

- GWD
- Salina

- Design Strategies
- Prefabrication
  - Reconfigurability
  - Nature in the Space
  - Natural Analogs
  - Nature of the Space



TL4

Urbhang BEY

Location Beirut, Lebanon

Designer Livelicity

Typology

- Unit Pavers (B2)
- Movable Seating (C1)
- Abstract Seating (C4)
- Large Table (D1)
- Trees (F1)
- Ground Cover (F4)
- Shade Sail (H3)
- Games (L2)
- Art (L4)



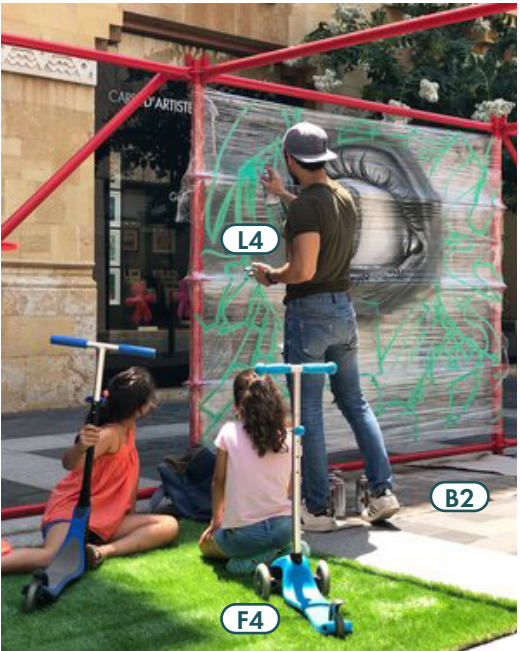
Urbhang BEY is a different type of temporary landscape. Instead of reimagining street parking, this project reimagines a plaza. This design responded to the existing paving patterns by designing a series of red structures that can be used in multiple ways. Examples include a hammocking area, a mini library area, a swinging area, a table area, and even an art area.



Urbhang BEY is an excellent example of bus architecture, with a common core (the red structure) and various landscape elements that can attach (bookshelf, swings, hammock, shade sail, table, and more). This design allows for a unique amount of flexibility where the red structure is fixed in place, but there is no limit to the potential attachments.



While this project was chosen for its modularity, biophilia has some possible applications. This design helps people engage with multiple senses through the texture of the grass squares and wood tables. Also the shade sail attached to the top of some of these structures can help give a sense of refuge and diffuse some solar radiation.



- Criteria
- (M2) 2D Panelization
  - (M4) Slot Architecture
  - (M5) Bus Architecture
  - (M6) Sectional Architecture
  - (B2) Non-Visual Connection with Nature
  - (B11) Prospect
  - (B12) Refuge
  - (B14) Risk/Peril

Figure. 90. Various components can attach to the common core. Photograph courtesy of Livelicity.

Figure. 91. Swings create a fun way to play for all ages. Photograph courtesy of Livelicity.

Figure. 92. Tables with the swing seats allow people to gather. Photograph courtesy of Livelicity.

Figure. 93. Temporary art installation. Photograph courtesy of Livelicity.

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Natural Analogs

Nature of the Space



Oasis Pop-Up Cooling Station

Location New York  
Designer Street Lab

Typology

- Pour in Place Asphalt (B1)
- Movable Seating (C1)
- Large Tables (D1)
- Movable Planters (E1)
- Perennials (F3)
- Splash Pad (I2)
- Games (L2)



The Oasis Pop-Up Cooling Station is another example of a pop-up park. These designs reimagine an entire street into a small water park for a day. This is achieved by blocking the street and implementing the pop-up park quickly. Due to the temporary nature of this design, all the elements in the design are highly reconfigurable and can fit in any location.

Street Lab has other pop-up parks similar to the Oasis, but this one was chosen because it incorporated water. The water feature engages people’s senses through hearing and touch and helps to cool the area around it, helping create a more comfortable microclimate. This pop-up park also has small planter boxes on carts that create visual interest.



Many elements in this design are fully prefabricated, so they are easy to place on the site, but some require assembly. The water feature is an example, as it must be fabricated in a series of panels and connected on-site. Everything in this design is highly reconfigurable, promoting flexibility and allowing these elements to be placed anywhere.

Criteria

- (M1) 3D Volumetric
- (M2) 2D Panelization
- (M6) Sectional Architecture
- (B3) Non-Rhythmic Sensory Stimuli
- (B4) Thermal & Airflow Variability
- (B5) Presence of Water.
- (B8) Forms & Patterns

<< Figure. 94. Street Life's Oasis reimagines how a street can be used. Photograph courtesy of Street Lab.  
< Figure. 95. Street Life's Oasis temporary water park. Photograph courtesy of Street Lab.

Context

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## AD. Amenity Decks

Amenity Decks were chosen for both their modularity and biophilic characteristics. These designs consider creating outdoor amenities on a structure. This environment was chosen to identify what landscape elements helped promote biophilia and how the design can be modular. Some of the amenity decks vary in size and form, but they all help to identify how the different landscape elements can be combined to form different outdoor amenity spaces.



# AD1

## Porte

**Location** Chicago, Illinois

**Designer** Confluence

### Typology

- Mound (A4)
- Pour in Place Concrete (B1)
- Pedestal Pavers (B3)
- Movable Seating (C1)
- Fixed Seating (C2)
- Lounge Seating (C3)
- Large Tables (D1)
- Small Tables (D2)
- Low Tables (D3)
- Trees (F1)
- Perennials (F3)
- Ground Cover (F4)
- Solid Wall (G1)
- Railing (G2)
- Pergola (H2)
- Shade Sail (H3)
- Pool (I1)
- Overhead Lights (J1)
- Sound System (K2)
- TV (K3)
- Power Outlet (K4)
- Fire Pit (L1)
- Trash Receptacle (L3)

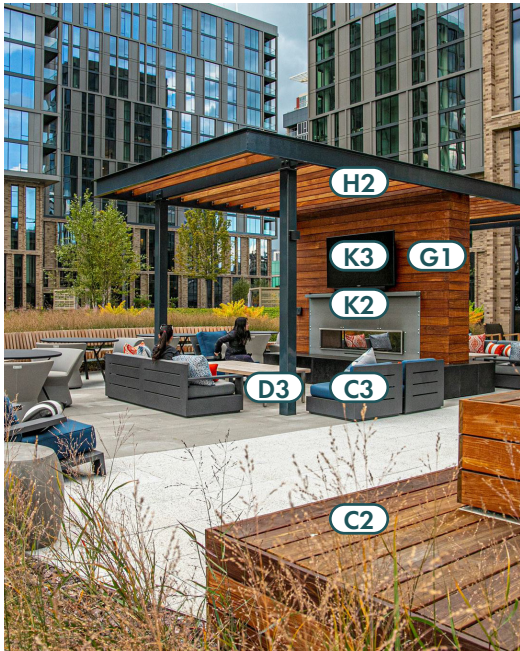


The Porte amenity deck connects with nature through its vegetation and use of a mound. This vegetation also helps people connect to the natural systems around them through the seasonal color change of specific plants, like the trees' red and yellow foliage. The unhindered views of the surrounding environment help connect people to the place.

Even in its rectilinear form, the pool creates an opportunity to engage multiple senses and helps alter the space's microclimate. Another element that helps adjust the microclimate is the shade structures with adjustable fabric to change the amount of solar radiation. The fire feature creates another non-rhythmic element that activates the space.



Some of the landscape elements can also be designed modularly. Many elements, like the furniture, are likely fully prefabricated and shipped to the site. Some elements in this design are not movable, such as the pool, the fireplace, electrical elements, and the paving. These elements are fixed in place by their weight or need to be connected to an energy source.



- Criteria**
- (M1) 3D Volumetric
  - (M4) Slot Architecture
  - (M6) Sectional Architecture
  - (B1) Visual Connection with Nature
  - (B2) Non-Visual Connection with Nature
  - (B3) Non-Rhythmic Sensory Stimuli
  - (B5) Presence of Water
  - (B9) Material Connection with Nature
  - (B11) Prospect
  - (B12) Refuge

<<< Figure. 96. Porte boasts a pool with surrounding lounge seating. Photograph courtesy of Confluence.

<< Figure. 97. Porte has a fireplace and power outlet as comfort elements. Photograph courtesy of Confluence.

< Figure. 98. The shade structure creates a feeling of protection. Photograph courtesy of Confluence.

### Context

Literature Review

### Typology

Landscape Elements

### Precedents

Residential Landscapes

Temporary Landscapes

Amenity Decks

### Design

GWD

Salina

### Design Strategies

Prefabrication

Reconfigurability

Nature in the Space

Natural Analogs

Nature of the Space



Hillshire Brands Roof Deck

Location Chicago, Illinois

Designer Confluence

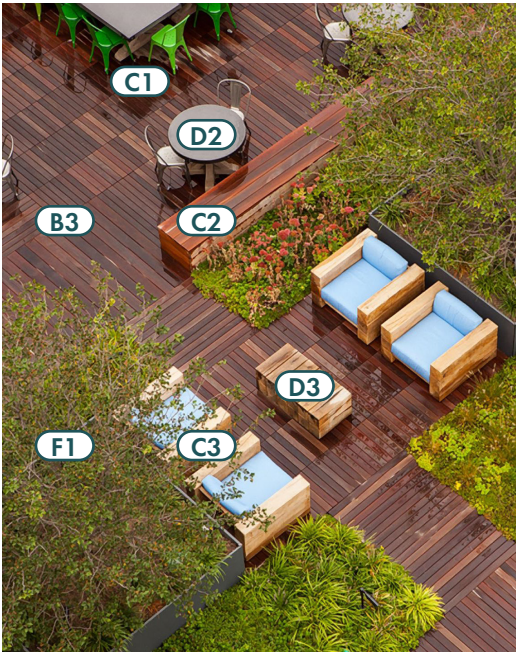
Typology

- Pedestal Pavers (B3)
- Movable Seating (C1)
- Fixed Seating (C2)
- Lounge Seating (C3)
- Large Table (D1)
- Small Table (D2)
- Low Table (D3)
- Movable Planters (E1)
- Fixed Planters (E2)
- Trees (F1)
- Perennials (F3)
- Groundcover (F4)
- Solid Wall (G1)
- Railing (G3)
- Pergola (H2)
- Overhead Light (J1)
- Power Outlet (K4)



In Hillshire Brands Roof Deck, the trees and perennials connect people to nature visually and through seasonal changes. These create an intriguing landscape and nonrhythmic interest, such as a breeze interacting with the trees. The natural materials, especially the wood in the pedestal paver system and lounge-seating elements, help create a tactical experience.

This wood pedestal pavers system also has a complex yet coherent design where the elements are laid out in short slats that combine to create an intriguing texture with various tones of brown. Many elements within this design were fully prefabricated and shipped to the site, such as the lounge seating and the low tables.



These two elements also have the potential to be flexible and moved around the site along with the other small tables and movable chairs. At the same time, some elements are not movable, such as the pergola structure and amenities below it. This design has specific areas that are flexible while others are fixed in place.



- Criteria
- (M1) 3D Volumetric
  - (M4) Slot Architecture
  - (M6) Sectional Architecture
  - (B1) Visual Connection with Nature
  - (B3) Non-Rhythmic Sensory Stimuli
  - (B7) Connection with Natural Systems
  - (B9) Material Connection with Nature
  - (B10) Complexity & Order

<<< Figure. 99. The lounge seating creates a comfortable place to relax. Photograph courtesy of Confluence.

<< Figure. 100. A variety of seating elements gives people options. Photograph courtesy of Confluence.

< Figure. 101. The grill area encourages people to enjoy a meal outside. Photograph courtesy of Confluence.

Context

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Typology

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Precedents

Residential Landscapes

Temporary Landscapes

Amenity Decks

Design

GWD

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Design Strategies

Prefabrication

Reconfigurability

Nature in the Space

Natural Analogs

Nature of the Space



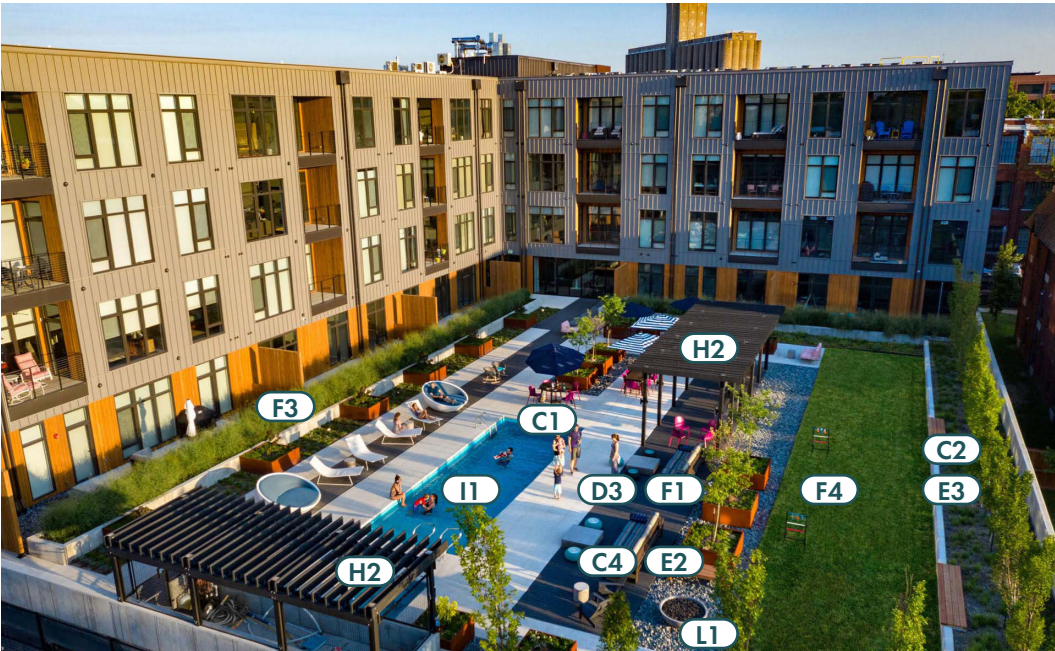
# AD3

## 4101 Laclede Amenity Deck

**Location** St. Louis, MO  
**Designer** Arbolope Studio

### Typology

- Pedestal Pavers (B3)
- Movable Seating (C1)
- Fixed Seating (C2)
- Lounge Seating (C3)
- Abstract Seating (C4)
- Large Table (D1)
- Low Table (D3)
- Fixed Planters (E2)
- Planter Bench (E3)
- Trees (F1)
- Perennial (F3)
- Groundcover (F4)
- Pergola (H2)
- Umbrella (H4)
- Pool (I1)
- Fire Pit (L1)



4101 Laclede Amenity Deck boasts a pool, lounge seating, fireplace, and a lawn game area. The primary attraction of this amenity deck is the pool, as people naturally prefer places with water. This water can function in a couple of different ways; it can evaporate to create a cooler microclimate, create a dynamic light effect with the sun's reflection off the water,

and engage nonvisual senses like touch and hearing. The planting around this amenity deck creates a visual connection to nature. These plantings have seasonal changes based on the time of year. These changes help people connect with their surrounding environment. This amenity deck is made up of a combination of fixed elements and movable elements.



Again, the landscape elements on the ground plane are fixed, including the pool, pedestal pavers, and planters, while the furniture is reconfigurable. Other not movable elements are overhead elements like the trees and the pergola structure. These elements are too heavy to be easily reconfigured.

### Criteria

- (M1) 3D Volumetric
- (M4) Slot Architecture
- (M6) Sectional Architecture
- (B1) Visual Connection with Nature
- (B2) Non-Visual Connection with Nature
- (B4) Thermal & Airflow Variability
- (B5) Presence of Water
- (B6) Dynamic & Diffuse Light
- (B7) Connection with Natural Systems

<< Figure. 102. The amenity deck offers a variety of amenities. Photograph courtesy of Sam Fentress.

< Figure. 103. The abstract lounge seating resembles nature. Photograph courtesy of Sam Fentress.

### Context

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### Typology

Landscape Elements

### Precedents

Residential Landscapes

Temporary Landscapes

Amenity Decks

### Design

GWD

Salina

### Design Strategies

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Reconfigurability

Nature in the Space

Natural Analogs

Nature of the Space



# AD4

## Montaje

**Location** Somerville, Massachusetts  
**Designer** Copley Wolff

### Typology

- Pedestal Pavers (B3)
- Movable Seating (C1)
- Fixed Seating (C2)
- Lounge Seating (C3)
- Large Table (D1)
- Small Table (D2)
- Low Table (D3)
- Fixed Planters (E2)
- Planter Bench (E3)
- Trees (F1)
- Shrubs (F2)
- Perennials (F3)
- Groundcovers (F4)
- Railing (G3)
- Pergola (H2)
- Overhead Lights (J1)
- Sound System (K2)
- TV (K3)
- Games (L2)



Montaje is another amenity deck with similar landscape elements. Like 4101 Laclede, this project has similar elements that are or are not reconfigurable, including the ground plane and planters. Due to their weight, the pergola structure and trees are also not reconfigurable. However, the furniture and seating elements are reconfigurable, which

allows them to be adjusted anywhere on the amenity deck. One unique landscape element in Montaje is the outdoor TV and speaker system. These elements are likely bus architecture, where they connect to the common core of an electrical outlet. The unobstructed view is one of this design's most notable biophilic elements. These views are paired with natural



plantings of grasses and shrubs to create an intriguing connection to nature. There is also a material connection to nature. For example, the concrete benches have wood surfaces on top, and the chairs and tables have natural wood surfaces. These seating elements highlight the preference for natural elements like wood.



### Criteria

- (M1) 3D Volumetric
- (M4) Slot Architecture
- (M5) Bus Architecture
- (M6) Sectional Architecture
- (B1) Visual Connection with Nature
- (B5) Presence of Water
- (B7) Connection with Natural Systems
- (B9) Material Connection with Nature
- (B11) Prospect
- (B12) Refuge

<<< Figure. 104. Unobstructed views of the surrounding environment. Photograph courtesy of Anthony Crisafulli for Copley Wolff.

<< Figure. 105. Games like bocce ball are surrounded by vegetation. Photograph courtesy of Anthony Crisafulli for Copley Wolff.

< Figure. 106. The pergola creates a sense of protection. Photograph courtesy of Anthony Crisafulli for Copley Wolff.

### Context

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One River North

Location Denver, Colorado  
Designer Mad Architects

Typology

- Stairs (A2)
- Pedestal Pavers (B3)
- Movable Seating (C1)
- Fixed Seating (C2)
- Low Table (D3)
- Fixed Planters (E2)
- Trees (F1)
- Shrubs (F2)
- Perennials (F3)
- Groundcovers (F4)
- Railing (G3)
- Solid Shade Structure (H1)
- Pool (I1)
- Water Fall (I4)
- Overhead Lights (J1)
- Spotlights (J4)



One River North is a unique amenity deck. The building is designed to have a biomorphic pattern that makes it look like the vegetation connects three parts of the building. The forms and patterns within this design directly emulate natural forms and create a visually appealing design. Many parts of this amenity deck have unobstructed views

of Denver and the mountains to the west, which creates an enjoyable prospect and refuge environment. The design also creates a visual connection to nature through the vegetation. This planting is highlighted at night with spotlights that help create a dynamic lighting experience. Additionally, there are two water features: the pool at the top of



the building and the waterfall near the stairs. This design has the potential to be prefabricated in pieces to be assembled on-site. This is especially true with the monolithic forms of the building façade. Most of the elements in this design are fixed into place, while there are moving chairs and a small table in some areas.



- Criteria
- (M2) 2D Panelization
  - (M4) Slot Architecture
  - (M6) Sectional Architecture
  - (B1) Visual Connection with Nature
  - (B5) Presence of Water
  - (B6) Dynamic & Diffuse Light
  - (B8) Forms & Patterns
  - (B11) Prospect
  - (B12) Refuge
  - (B14) Risk/Peril

<<< Figure. 107. Unobstructed views with overhead enclosure. Photograph courtesy of Parrish Ruiz de Velasco.

<< Figure. 108. The biomorphic forms of the building frame views of the city. Photograph courtesy of Parrish Ruiz de Velasco.

< Figure. 109. The waterfall element creates white noise. Photograph courtesy of Parrish Ruiz de Velasco.

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Design Strategies in Precedents

|                                   |     | Residential Landscapes |     |     |     |     | Temporary Landscapes |     |     |     |     | Amenity Decks |     |     |     |     |
|-----------------------------------|-----|------------------------|-----|-----|-----|-----|----------------------|-----|-----|-----|-----|---------------|-----|-----|-----|-----|
|                                   |     | RL1                    | RL2 | RL3 | RL4 | RL5 | TL1                  | TL2 | TL3 | TL4 | TL5 | AD1           | AD2 | AD3 | AD4 | AD5 |
| 3D Volumetric                     | M1  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| 2D Panelization                   | M2  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| 3D/2D Combination                 | M3  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Slot Architecture                 | M4  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Bus Architecture                  | M5  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Sectional Architecture            | M6  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Visual Connection with Nature     | B1  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Non-Visual Connection with Nature | B2  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Non-Rhythmic Sensory Stimuli      | B3  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Thermal & Airflow Variability     | B4  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Presence of Water                 | B5  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Dynamic and Diffuse Light         | B6  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Connection with Natural Systems   | B7  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Forms & Patterns                  | B8  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Material Connection with Nature   | B9  |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Complexity & Order                | B10 |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Prospect                          | B11 |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Refuge                            | B12 |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Mystery                           | B13 |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |
| Risk/Peril                        | B14 |                        |     |     |     |     |                      |     |     |     |     |               |     |     |     |     |

Analysis

The following two tables summarize the precedent studies. The first describes how each precedent incorporated the design strategies, while the second identifies which landscape elements appeared in each precedent. These tables identify patterns within the precedents and highlight how the landscape elements have been previously applied to promote modularity and biophilia.

The first table shows that most precedents had two of the three types of reconfigurability. Slot architecture was represented by the ground plane, while sectional architecture was represented by flexible furniture. Bus architecture was not identified in many precedents but is a place for potential future innovation. For prefabrication, many precedents were either 3D Volumetric or 2D Panelized, though this varied depending on the landscape elements and their function. Most landscape elements were fully prefabricated for the temporary landscapes as 3D Volumetric to be implemented and removed quickly.

Some common themes for biophilia were also identified. Nature in the space was found more often in the residential landscapes and amenity deck precedents, while the temporary landscapes had fewer natural elements. This is likely because of the temporary nature of their designs. At the same time, natural analogs helped identify which precedents incorporated natural materials. This category is interesting because most of the landscape elements have the potential to be created from natural materials, yet, in many of these precedents, they do not resemble natural patterns or materials. The nature of the space was more applicable because the precedent studies considered the overall environment instead of one landscape element. For this category, prospect and refuge were the most common.

< Table 2. Precedents compared with the criteria of modularity and biophilia.

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## Landscape Elements in Precedents

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< Table 3. The landscape elements compared with each precedent.

## Context

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landscapes 

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landscapes

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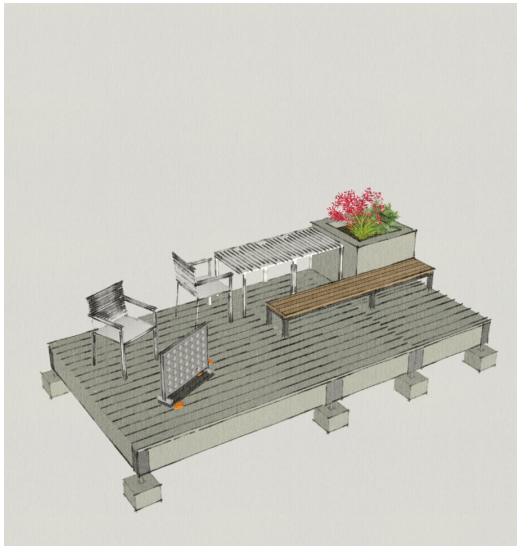
## Nature of the Space

Analysis

The second table identifies patterns relating to which landscape elements were most used throughout these precedents. These fifteen precedent studies represent a small portion of built work and may not represent every landscape environment, yet they help identify some common patterns. The most common elements in the table were the ground plane (B1-B4), seating (C1-C4), tables (D1-D4), planters (E1-E4), and vegetation (F1-F4). These five elements appeared throughout the different environments, yet they took on various forms in each environment.

The residential landscape's most common landscape elements were unit pavers (B2), a deck system (B4), movable seating (C1), fixed planters (E2), trees (F1), and perennials (F3). These common elements can be summarized in three categories: the ground plane, furniture, and vegetation. The ground plane is the first category, where the unit pavers and deck system create a firm, stable, and slip-resistant surface for other elements to be placed on top of. The second is furniture, especially seating, that invites and enables certain activities within a site. The third is vegetation that incorporates the natural patterns of trees and perennials to create a comfortable and visually intriguing space. These elements helped identify how to integrate buildings into the landscape and create a biophilic experience.

Overall, temporary landscapes involve fewer landscape elements than the other two environments, yet many incorporate similar elements. These precedents' most common landscape elements include a deck system (B4), movable seating (C1), fixed seating (C2), large tables (D1), shrubs (F2), groundcovers (F4), and games (L2). These landscape elements fit into categories like those of the residential landscape. First, the deck system addresses the ground plane by making the parklets level with the curb. The furniture includes tables, seating, and games for users to interact with and move.



The last category is vegetation, including shrubs and ground cover. The vegetation in temporary landscapes tends to be smaller than that of the more permanent designs of residential landscapes and amenity decks. Many residential landscapes incorporate trees and shrubs, while temporary landscapes incorporate smaller plants such as shrubs and perennials. The only exception is if there is existing vegetation adjacent to where the temporary landscape is being implemented. This is likely in response to the temporary nature of these designs, where it is a lot easier to move smaller vegetation like perennials and ground cover than it is to transport trees. One unique element that was commonly incorporated with temporary landscapes was games. These games create interest and encourage people to use them. Other elements, such as shade structures, water elements, and railings, were used in some designs to further contribute to the user's outdoor experience.

<< Figure. 110. The common landscape elements found in residential landscapes.

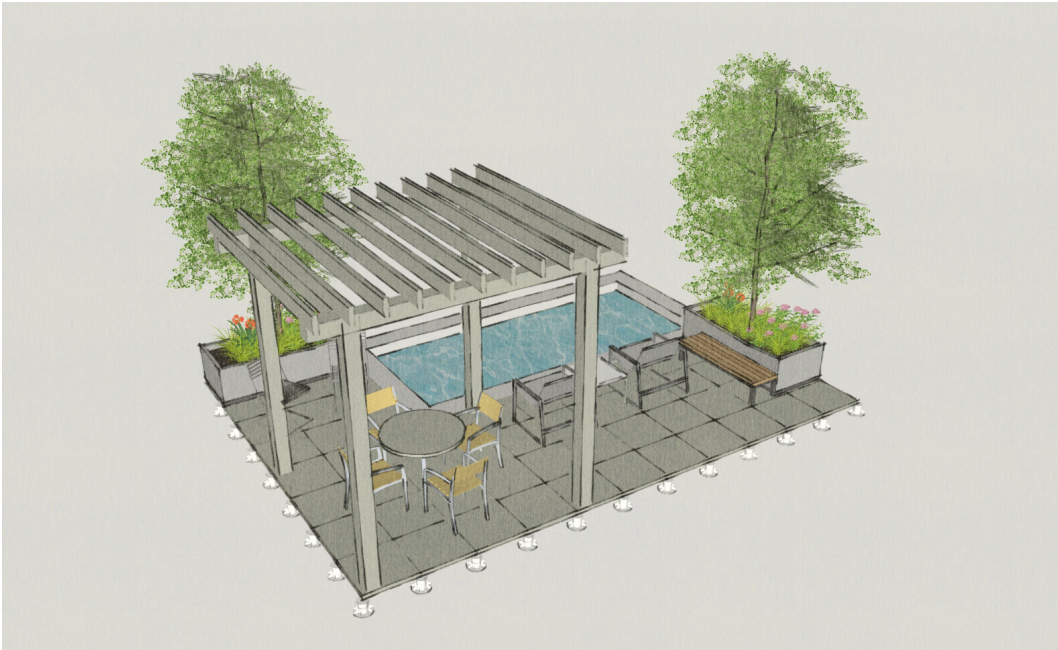
< Figure. 111. The common landscape elements found in temporary landscapes.

|                        |  |
|------------------------|--|
| Context                |  |
| Literature Review      |  |
| Typology               |  |
| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
| GWD                    |  |
| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
| Reconfigurability      |  |
| Nature in the Space    |  |
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| Nature of the Space    |  |



Amenity decks are the last environment evaluated in the precedent studies. These designs seem to have more consistent landscape elements than the other two. The landscape elements in all five precedent studies included pedestal pavers (B3), movable seating (C1), fixed seating (C2), trees (F1), perennials (F3), and ground covers (F4). Other elements that appeared in most precedents include lounge seating (C3), small tables (D2), low tables (D3), fixed planters (E2), a pergola (H2), a pool (I1), and overhead lighting (J1). These landscape elements can be summarized in similar categories to the previous two. First, these designs define the ground plane using pedestal pavers. Second, the furniture, including tables, shade structures, and lighting, was placed on the pedestal pavers. Third, the vegetation is incorporated with trees, perennials, and ground covers. These elements combine to create different outdoor rooms for users to enjoy. Additional landscape elements helped to further the users' comfort, including a pool, a TV, and a fire pit. The amenity decks were larger than the other evaluated environments, enabling them to incorporate more landscape elements.

Identifying three classifications within these designs was helpful: the ground plane, furniture, and vegetation. Each precedent represented at least these three classifications, while some had additional elements. It was interesting to see the variety of forms in which each landscape element appeared within a single design within the three classifications. For example, many designs have poured-in-place concrete and unit pavers; tables and planters can be added to seating elements to create more uses; and vegetation can take various forms by adding planting types such as shrubs, perennials, and ground covers. The variety of elements provides more interest in each precedent.



< Figure. 112.  
The common  
landscape  
elements found in  
amenity decks.

These three environments helped identify common landscape elements to see how they can be incorporated into different settings. Despite the value gained from evaluating the three environments, this study will focus on the residential landscape moving forward. The amenity deck and temporary landscape precedents have grown in popularity and already support many examples. Temporary landscapes have been so popular that there is an entire product line from companies like Streetlife and Vestre selling a parklet as a complete kit. The amenity decks are similar to the pedestal paver systems widely applied to many projects. On the other hand, residential designs have opportunities for innovation, especially with the deck system. For these reasons, the residential landscape will be the focus of the rest of this study.

|                          |  |
|--------------------------|--|
| <b>Context</b>           |  |
| Literature Review        |  |
| <b>Typology</b>          |  |
| Landscape Elements       |  |
| <b>Precedents</b>        |  |
| Residential Landscapes   |  |
| Temporary Landscapes     |  |
| Amenity Decks            |  |
| <b>Design</b>            |  |
| GWD                      |  |
| Salina                   |  |
| <b>Design Strategies</b> |  |
| Prefabrication           |  |
| Reconfigurability        |  |
| Nature in the Space      |  |
| Natural Analogs          |  |
| Nature of the Space      |  |

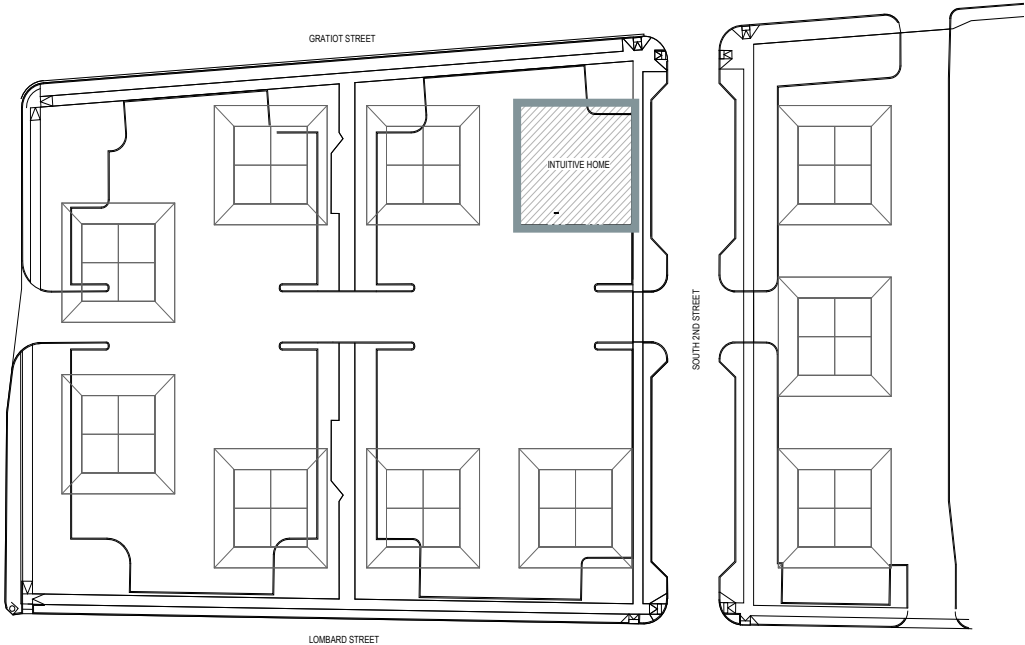
# Gateway Decathlon (GWD)

## Modular Landscape Prototype

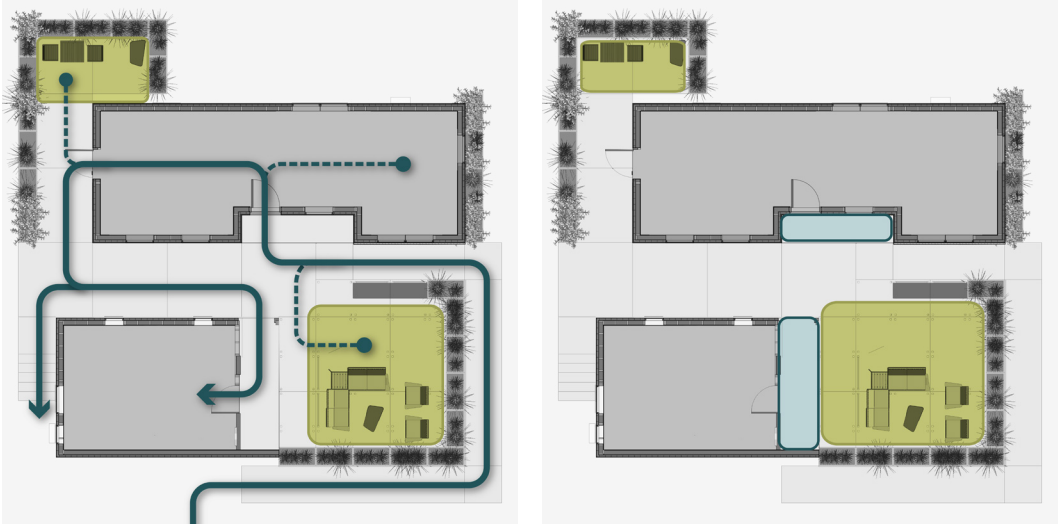
This next section focuses on creating a modular landscape prototype. Common landscape elements used from the typology and precedents were identified and then incorporated into the design of a modular landscape. This projective design focuses on bus architecture, a type of reconfigurability identified as having innovation potential. Additionally, biophilic design considerations will be considered throughout.



Site Analysis



This projective design started in response to the Gateway Decathlon(GWD), a competition focused on creating a modular building that could be fully implemented in less than ten days. As a landscape architecture student, I was in the group designing the surrounding landscape. Unfortunately, the Gateway Decathlon project has been put on hold indefinitely. This project helped develop a modular landscape prototype despite GWD not materializing. The site analysis was limited because of the competition's temporary nature. The competition site was an old parking lot in St. Louis, with one competitor per square. The competition helped create a framework for the modular landscape elements. The competition regulations also helped to guide the project.

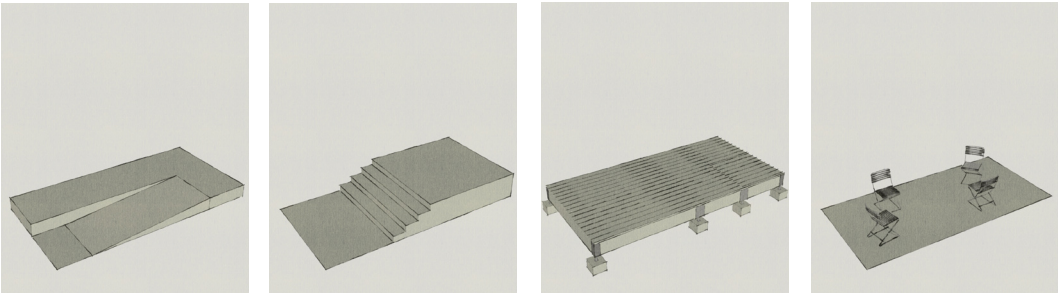


GWD influenced the way that we designed the outdoor spaces. Circulation was a significant focus, as hundreds of people would have circulated through the prototype during the exhibition. Even still, circulation helped identify how people would interact with the different spaces. The circulation starts with an accessible ramp that follows the deck's perimeter. This ramp terminates near the front door and allows the user to go into the larger unit, over to the smaller unit, or into the larger gathering space. There is a level of hierarchy that creates one larger gathering space and one smaller nook. The variety of spaces allows for a variety of functions.

Once the team identified the general parameters of the design, we began to consider the different landscape elements required to make a modular landscape system. Using the typology of landscape elements, we identified the components needed.

|                          |              |                                                              |
|--------------------------|--------------|--------------------------------------------------------------|
| <<<                      | Figure. 113. | Site context of the competition site in St. Louis, Missouri. |
| <<                       | Figure. 114. | Circulation through the GWD prototype design.                |
| <                        | Figure. 115. | Primary gathering spaces.                                    |
| <b>Context</b>           |              |                                                              |
| Literature Review        |              |                                                              |
| <b>Typology</b>          |              |                                                              |
| Landscape Elements       |              |                                                              |
| <b>Precedents</b>        |              |                                                              |
| Residential Landscapes   |              |                                                              |
| Temporary Landscapes     |              |                                                              |
| Amenity Decks            |              |                                                              |
| <b>Design</b>            |              |                                                              |
| GWD                      |              |                                                              |
| Salina                   |              |                                                              |
| <b>Design Strategies</b> |              |                                                              |
| Prefabrication           |              |                                                              |
| Reconfigurability        |              |                                                              |
| Nature in the Space      |              |                                                              |
| Natural Analogs          |              |                                                              |
| Nature of the Space      |              |                                                              |

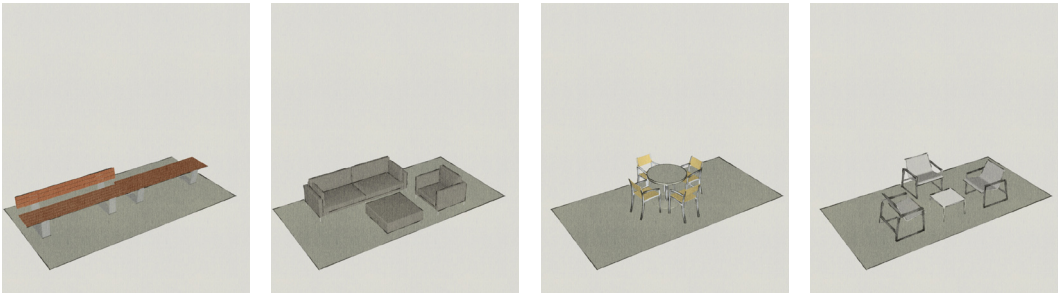
Deck Package



A1. Ramp      A2. Stairs      B4. Deck      C1. Movable Seating

The first two design considerations addressed elevational differences regarding a sloped path and stairs. These two elements accommodated the elevation change from the ground plane to the front door level. The sloped path was designed to maintain less than a 5% slope to comply with ADA and universal design (U.S. Access Board 2010). We designed the deck system to be level with the entrances and the top of the ramp. This was specifically chosen to achieve universal design throughout the site. The deck system was essential to achieving our goals and was one of the landscape elements I focused on, especially when considering opportunities for reconfigurability.

The three landscape elements identified so far, the sloped path, stairs, and the deck system, were found to have some commonalities. First, these elements were all applied to the ground to address topography and alter walking surfaces. Second, we found that these landscape elements are best if they are designed as slot architecture, meaning fixed in place. It is most beneficial that the walking surface is “firm, stable and slip resistant” (U.S. Access Board 2010). The ground plane was designed to be prefabricated and then placed on site. Once on-site, it was to be fixed. This limited easy reconfigurability but achieved a more important goal: creating a stable, walkable surface.

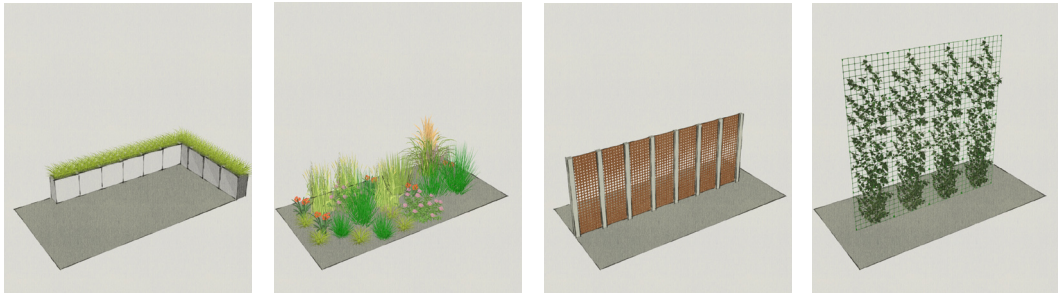


C2. Fixed Seating      C3. Lounge Seating      D2. Small Table      D3. Low Table

Another overarching category used in this design was the furniture, including seating and tables. Reviewing the precedent studies, we saw how vital seating is; only three precedents had a single type of seating, while the rest had various seating options. In this project, we utilized three types of seating: movable, fixed, and lounge. This variety of seating elements helps create flexibility. While identifying the significance of seating elements, we also focused on making them modular and biophilic. For many of the seating elements, modularity comes as sectional architecture, where every chair is entirely reconfigurable, allowing the users the most flexibility and control. A bench is an exception, where it is often fixed in place. While designing the prototype, we commonly placed the seating elements adjacent to the tables. For example, the movable seating was placed next to the small tables, and the lounge seating was placed with the low tables. The only exception to this rule was the bench seating, which could be placed by itself or adjacent to a table.

< Figure. 116. Eight landscape elements used in the GWD prototype.

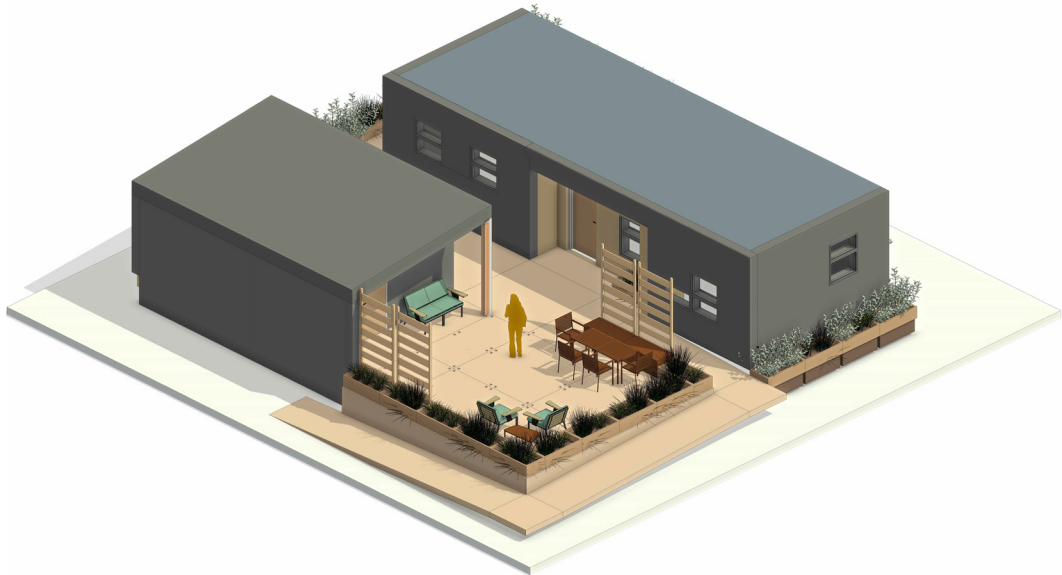
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| Context                |  |
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| Typology               |  |
| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
| GWD                    |  |
| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
| Reconfigurability      |  |
| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |



E4. Divider Planter    F3. Perennials    G2. Perforated Wall    G4. Green Wall

Other elements incorporated into this design were vegetation and walls. One of the goals of this design was not to have any railings, so instead of using a railing, the team incorporated a planter buffer. This helped define the edge for the small, intimate space, and large gathering space. The planters hold perennials and grasses. Low vegetation was chosen to allow an unobstructed view of the surrounding area. The planting creates a visual connection with nature through the unique patterns and forms.

Another way to include vegetation was through a green wall. This green wall achieved multiple goals. The first way is through a biophilic experience with a visual connection with nature. The second benefit is more practical as the green wall helps mitigate heat for the house. This passively cools the house, lowering the energy that must be used to cool the home. The green wall also has the potential for reconfigurability, with a series of similar planters attached to a frame. Each planter would be independent of the frame, allowing the planters to be adjustable based on the plant's needs. These planters could also attach to screening walls throughout the site, further creating a biophilic experience.



<< Figure. 117. Four landscape elements used in the GWD prototype.  
  
< Figure. 118. Gateway Decathlon Prototype design.

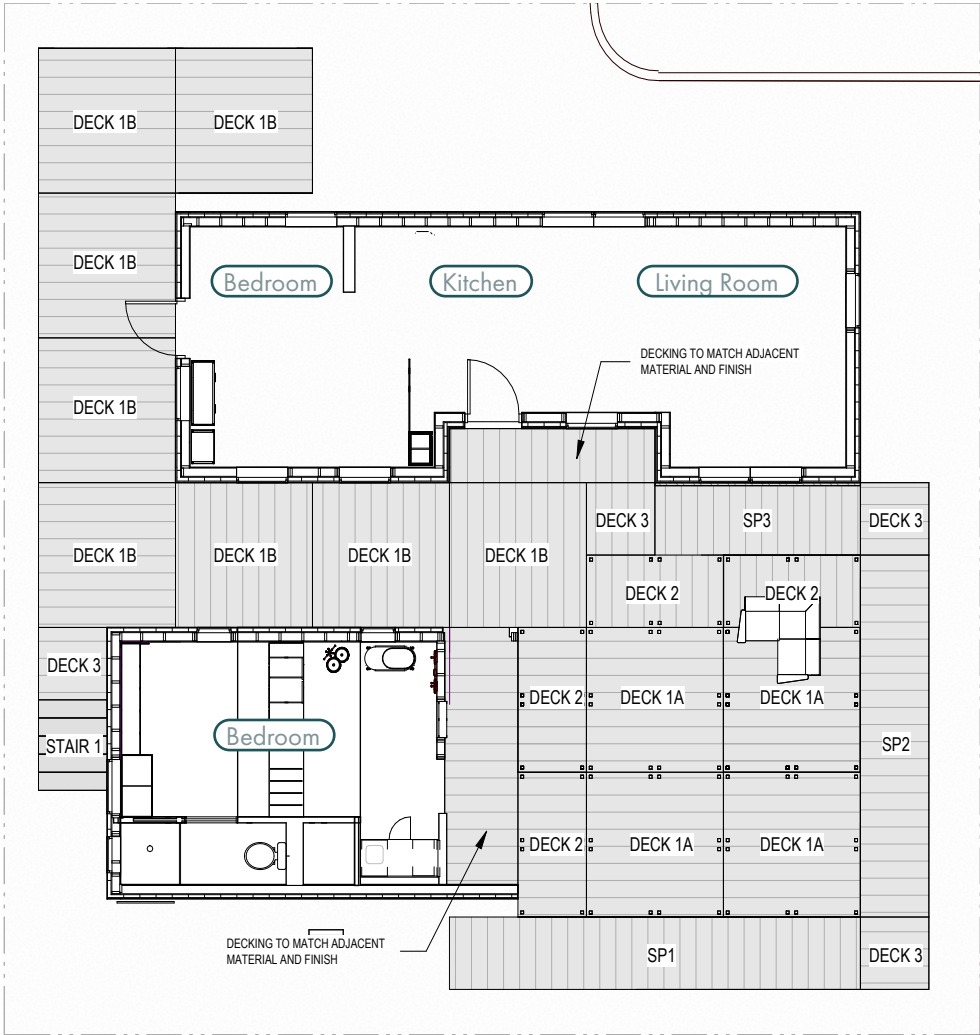
| Context                |  |
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| Literature Review      |  |
| Typology               |  |
| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
| GWD                    |  |
| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
| Reconfigurability      |  |
| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |



Looking at the precedents, we saw that many deck systems were slot architecture, while the furniture placed on top was sectional architecture. As we considered how to design this deck system, we saw an opportunity to create a deck system based on bus architecture. This design aimed to make the deck system the common core that other landscape elements attached to. The three components we focused on attaching to the deck were screen walls, planters, and tables. These elements were chosen due to their size and structure. They are not moved as often as other landscape elements like seat elements but can be moved.

The process in which we applied these modules helped us understand their potential application to other designs. In developing the deck modules, we identified the restrictions on transportation. We assumed semi-trucks would transport these modules, which have an average eight-foot width. In response, we made the maximum size of the module 8'x8'. We created two additional module sizes: 4'x8' and 4'x4'. These modules help address more nuanced conditions that the original 8'x8' module did not. Once we defined our module sizes, we began to apply it to the site. At first, we made the entire deck system from a 4'x4' module since it is the smallest module that can combine to create the larger modules. From there, we evaluated how to incorporate as many larger modules as possible to minimize the number of posts contacting the ground. The 8'x8' modules were most efficient due to the number of times they had to touch the ground. These modules' sizes also effectively utilize the span lengths for wood. This differs from pedestal pavers; instead of dispersing the load evenly across a large area, the deck system tries to direct the weight onto the posts. Once the deck system was laid out, we tried to maximize the number of larger modules to be more efficient on the number of times we had to contact the ground; instead of 98 posts, we cut it to 46.

Deck Modules



< Figure. 119. The different deck modules combine to create a solid surface.

Context

Literature Review

Typology

Landscape Elements

Precedents

Residential Landscapes

Temporary Landscapes

Amenity Decks

Design

GWD

Salina

Design Strategies

Prefabrication

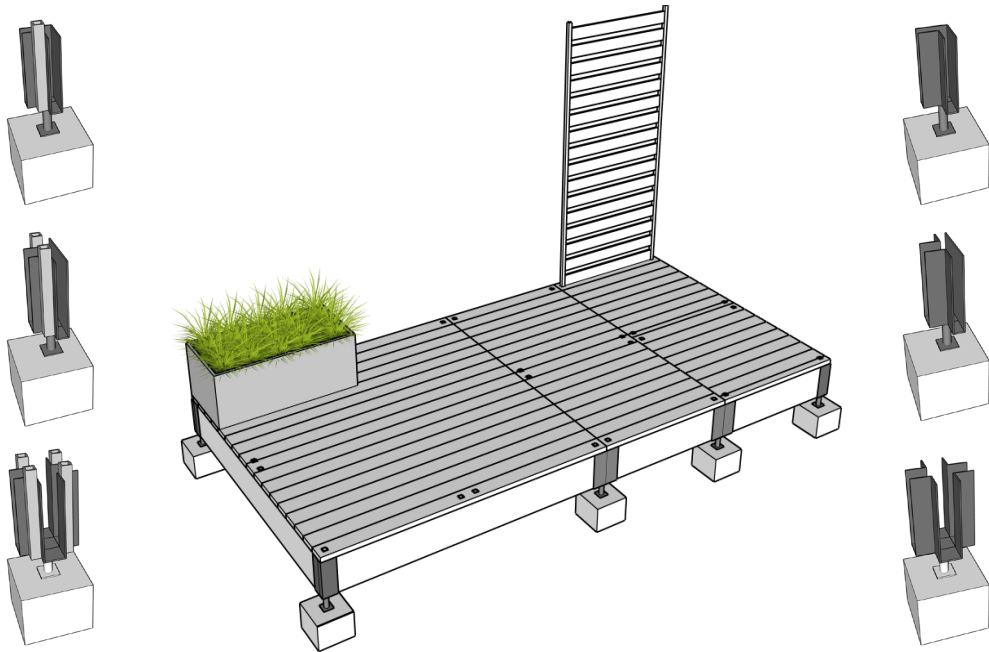
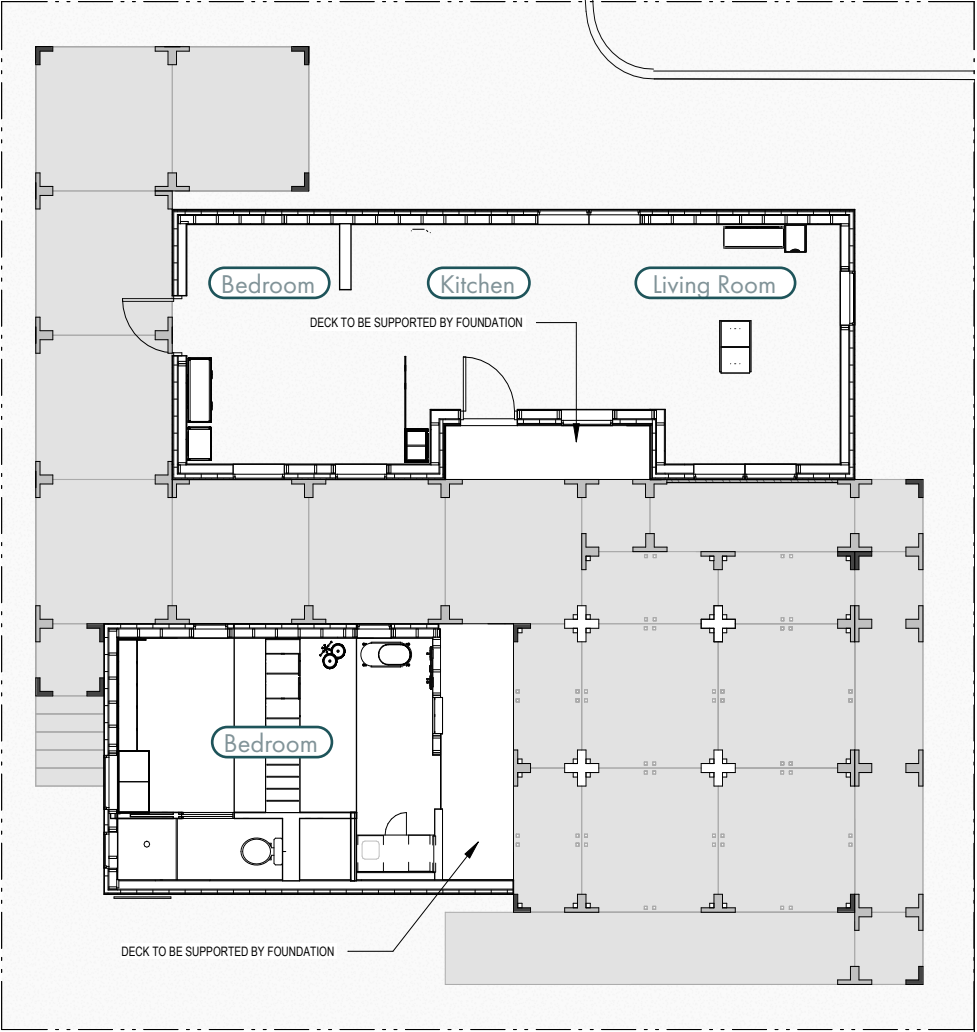
Reconfigurability

Nature in the Space

Natural Analogs

Nature of the Space

- Post Connection L+ 
- Post Connection L 
- Post Connection T+ 
- Post Connection T 
- Post Connection X+ 



In designing this deck system, we found a variety of ways that these modules can be assembled. To address all the conditions, there are a series of post connections with the deck system, represented above as L, T, and X, because of what each post looks like from the plan view. While these post connections are designed to function as the post for the deck, they also serve as the component that allows bus architecture. Within a specific post connection is a metal sleeve that is to be flush with the deck. These metal sleeves are where the deck system allows other elements to attach to create bus architecture.

<< Figure. 120. Post connections are strategically placed to limit the number of times the deck touches the ground.

< Figure. 121. Deck support pedestals and deck systems.

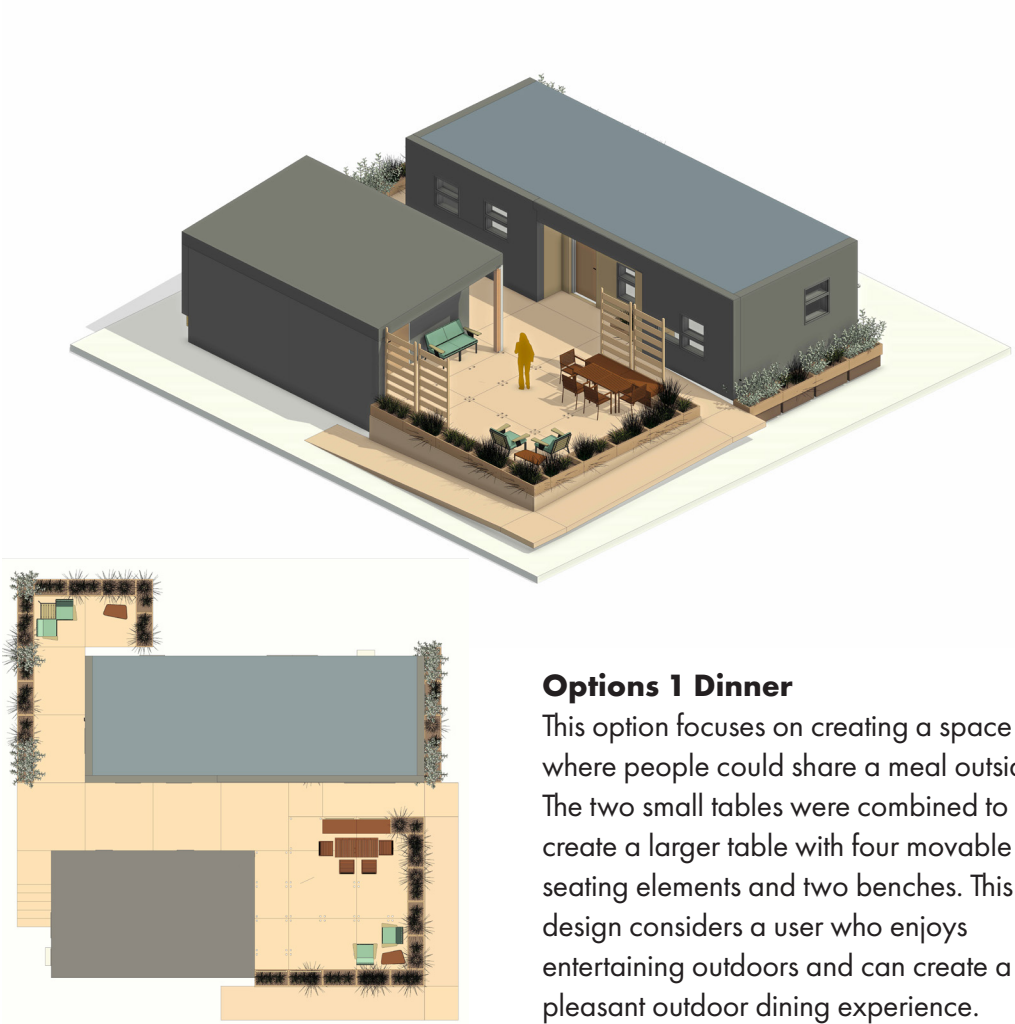
| Context                |  |
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| Literature Review      |  |
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| Landscape Elements     |  |
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| Amenity Decks          |  |
| Design                 |  |
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| Design Strategies      |  |
| Prefabrication         |  |
| Reconfigurability      |  |
| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |

Reconfigurability

Once we designed the deck system, determined the post connections to the ground, and how this project would be bus architecture, we shifted the focus to the components attached to the deck system. First, we partnered with a team of interior architecture students working on this project. With their help, we made a screening wall, a modular chair, and a bar cart. Each of these designs approached modularity differently. The screening wall was designed with a deck component, whereas the chair and bar cart were intended more as sectional architecture to be completely reconfigurable. The chair has an excellent sectional architecture aspect, designed as a chair with two armrests. The armrests are detachable, and the chairs can combine to form more of a sofa. Finally, the bar cart has two heights at which it can be fabricated and lowered to the level of a coffee table. For this design, we used the coffee table option.

With all these components, we wanted to see how successful the bus architecture was for the deck system. We tested this by quantifying the number of landscape elements we would use and then created three design alternatives, considering the common ways people may use their outdoor space. Each of the three designs has the same number of landscape elements as listed below.

- (C1) Four Movable seating elements.
- (C2) Two Bench Seating Elements.
- (C3) Six Lounge Seating Elements that can be combined to create a sofa.
- (D2) Two Small Tables that can be combined to create a large table.
- (D3) Two Low Tables.
- (G2) Four Screening Walls.

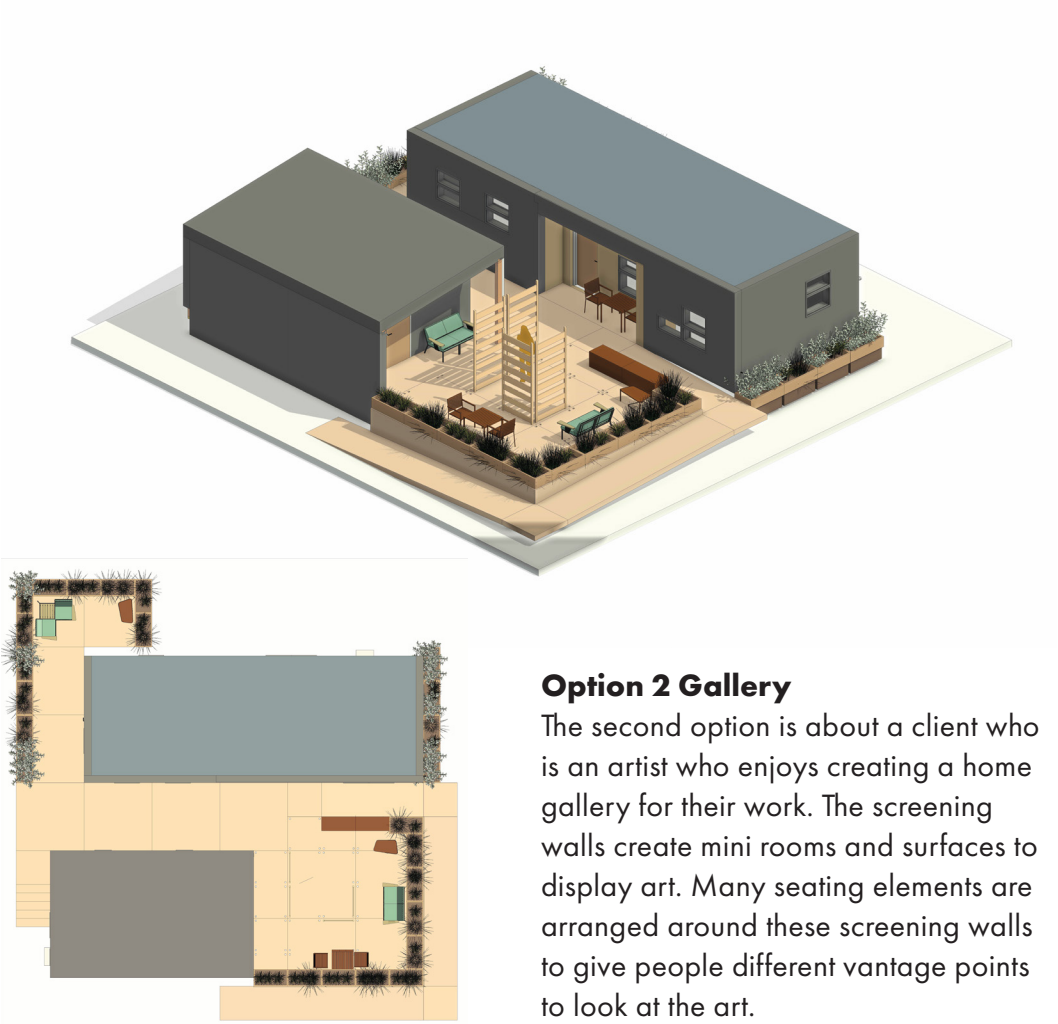


< Figure. 122.  
The dinner  
configuration.

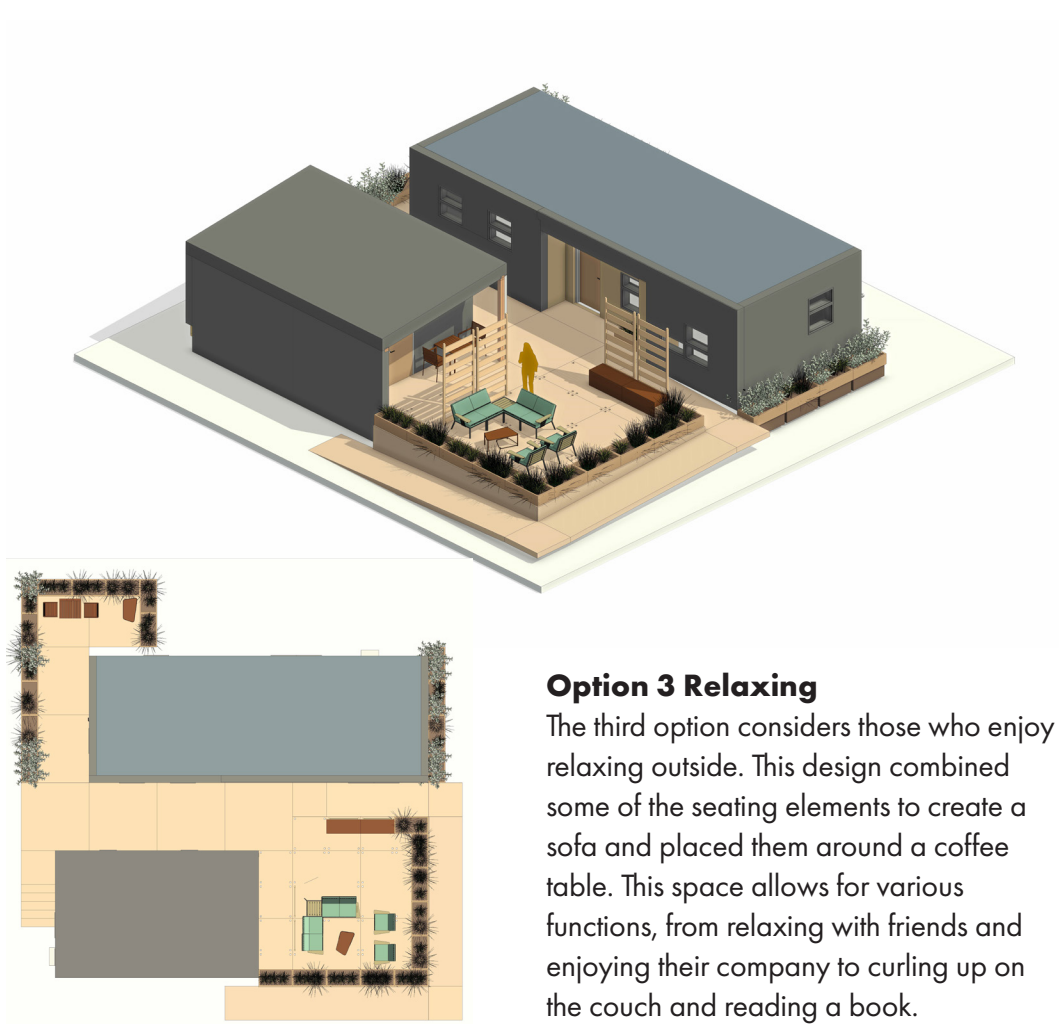
**Options 1 Dinner**  
This option focuses on creating a space where people could share a meal outside. The two small tables were combined to create a larger table with four movable seating elements and two benches. This design considers a user who enjoys entertaining outdoors and can create a pleasant outdoor dining experience.

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| Context                |  |
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| Typology               |  |
| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
| GWD                    |  |
| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
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| Nature in the Space    |  |
| Natural Analogs        |  |
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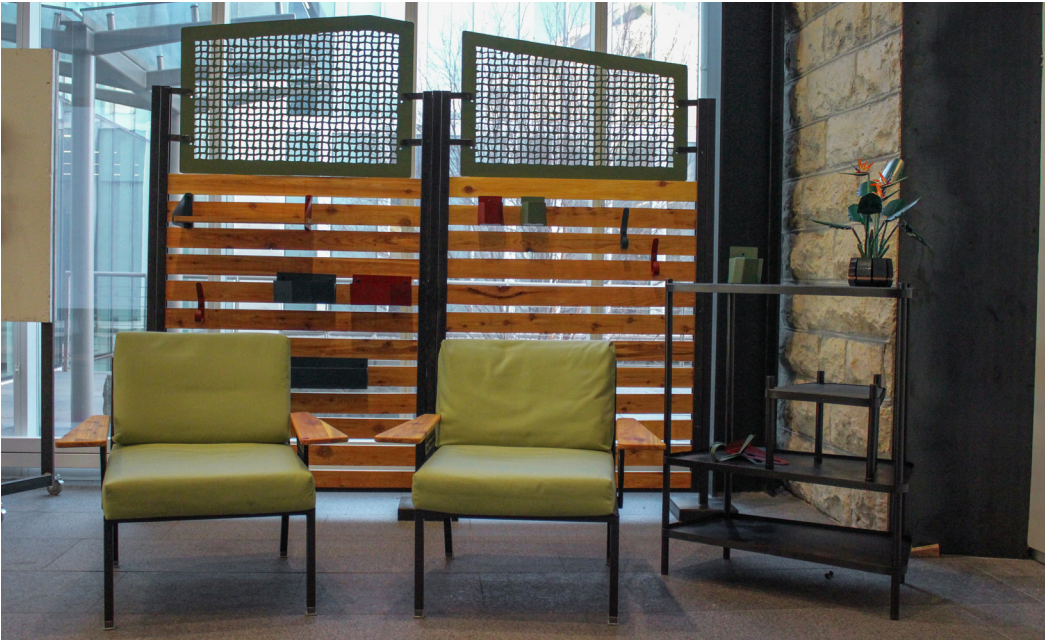
**Option 2 Gallery**  
The second option is about a client who is an artist who enjoys creating a home gallery for their work. The screening walls create mini rooms and surfaces to display art. Many seating elements are arranged around these screening walls to give people different vantage points to look at the art.



**Option 3 Relaxing**  
The third option considers those who enjoy relaxing outside. This design combined some of the seating elements to create a sofa and placed them around a coffee table. This space allows for various functions, from relaxing with friends and enjoying their company to curling up on the couch and reading a book.

<< Figure. 123.  
The gallery configuration.  
  
< Figure. 124.  
The relaxing configuration.

|                          |  |
|--------------------------|--|
| <b>Context</b>           |  |
| Literature Review        |  |
| <b>Typology</b>          |  |
| Landscape Elements       |  |
| <b>Precedents</b>        |  |
| Residential Landscapes   |  |
| Temporary Landscapes     |  |
| Amenity Decks            |  |
| <b>Design</b>            |  |
| GWD                      |  |
| Salina                   |  |
| <b>Design Strategies</b> |  |
| Prefabrication           |  |
| Reconfigurability        |  |
| Nature in the Space      |  |
| Natural Analogs          |  |
| Nature of the Space      |  |



In designing this prototype, modularity was not the only focus; we also considered how the components could help promote biophilia, first with the furniture and materiality and then with how these elements form space. Again, we worked with the Interior architecture students throughout this design process. Each of their designs incorporated biophilia differently. Tessellations and other natural patterns inspired Maegan Brookshire when designing the bar cart/coffee table. With these patterns, she focused on creating this bar cart to have a unique form. Sophia Burnett focused more on modularity when designing the seating elements; still, the curves and materials were designed to resemble nature. Isaac Caire's screening wall was



also focused on modularity rather than biophilia. Still, the screen wall was made of wood slats that helped it connect to nature. Other landscape elements like the deck system, bench, and seating wall were designed to be made from natural materials to further promote a connection with nature. In addition to the materials, the planters surrounded the edge of the small and large gathering spaces to connect people with their sense of nature. The vegetation in these planters can blow in the wind, creating a non-visual connection to nature. Finally, the design creates moments of prospect and refuge. The planting around the site is low enough to allow unhindered views, while the two buildings help to protect the user's back, creating a sense of protection.

<< Figure. 125. Outdoor Living Collection Designed by Meagan Brookshire, Sophia Burnett, and Isaac Caire in Furniture II Studio at Kansas State University.

< Figure. 126. The buildings create a sense of protection, while the plantings allow for visual connection.

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| Context                |  |
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| Landscape Elements     |  |
| Precedents             |  |
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| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
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| Salina                 |  |
| Design Strategies      |  |
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| Reconfigurability      |  |
| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |

Discussion

The prototype design created for the Gateway Decathlon helped identify how this process can work in the future and provided some helpful guidelines. Though the original rules for the Gateway Decathlon were helpful, they hindered the project from being completely realistic. One of the primary ways we experienced this was through the temporary nature of the exhibit. This design had to be fully implemented in ten days and removed quickly. The deck was designed to be prefabricated to achieve the quick installation and deconstruction goal. This would not be the case in the actual design. The deck system would be prefabricated similarly, but the foundation would be more permanent. Some landscape elements would be integrated into the ground, where the competition site was a flat asphalt parking lot, and nobody was allowed to break the ground plane. Also, the prototype was designed to circulate hundreds of people through the house for the exhibit rather than house a single family. The last limitation was the lack of a site. Instead of considering the surrounding context, existing conditions, and the integration into the neighborhood, the focus was only on the building modules and adjacent landscape elements. The focus rarely shifted from developing a way for this deck system to be realistically created.

Despite the limitations of the prototype, this project successfully achieved its purpose. This design demonstrated how to create a modular and biophilic landscape from the list of typologies. We learned critical considerations regarding modularity and the various landscape elements by designing this deck system. We first found that addressing topography and ground plane elements should be fixed so people could have a firm, stable, and slip-resistant ground plane. Next, we discovered that seating elements and tables were best designed to be fully reconfigurable; allowing this level of adjustability provided flexibility and a sense of control for the user. Finally, we identified the potential for how bus architecture could be applied to this modular deck system.

This design allowed various elements to be inserted into the deck system and fixed into place. With this bus architecture, we found how this design creates flexible and reconfigurable spaces that fit the user's needs.

Biophilia was considered through the landscape elements' materials, forms, and patterns and by creating specific spaces for people to feel comfortable. Specifically, the design used natural wood in many landscape elements, incorporated prospect and refuge, and integrated native planting to connect people to their environment. Some elements within biophilia were successfully achieved, yet some aspects were limited because of the site's limitations.

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| <b>Context</b>           |  |
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| <b>Typology</b>          |  |
| Landscape Elements       |  |
| <b>Precedents</b>        |  |
| Residential Landscapes   |  |
| Temporary Landscapes     |  |
| Amenity Decks            |  |
| <b>Design</b>            |  |
| GWD                      |  |
| Salina                   |  |
| <b>Design Strategies</b> |  |
| Prefabrication           |  |
| Reconfigurability        |  |
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| Nature of the Space      |  |

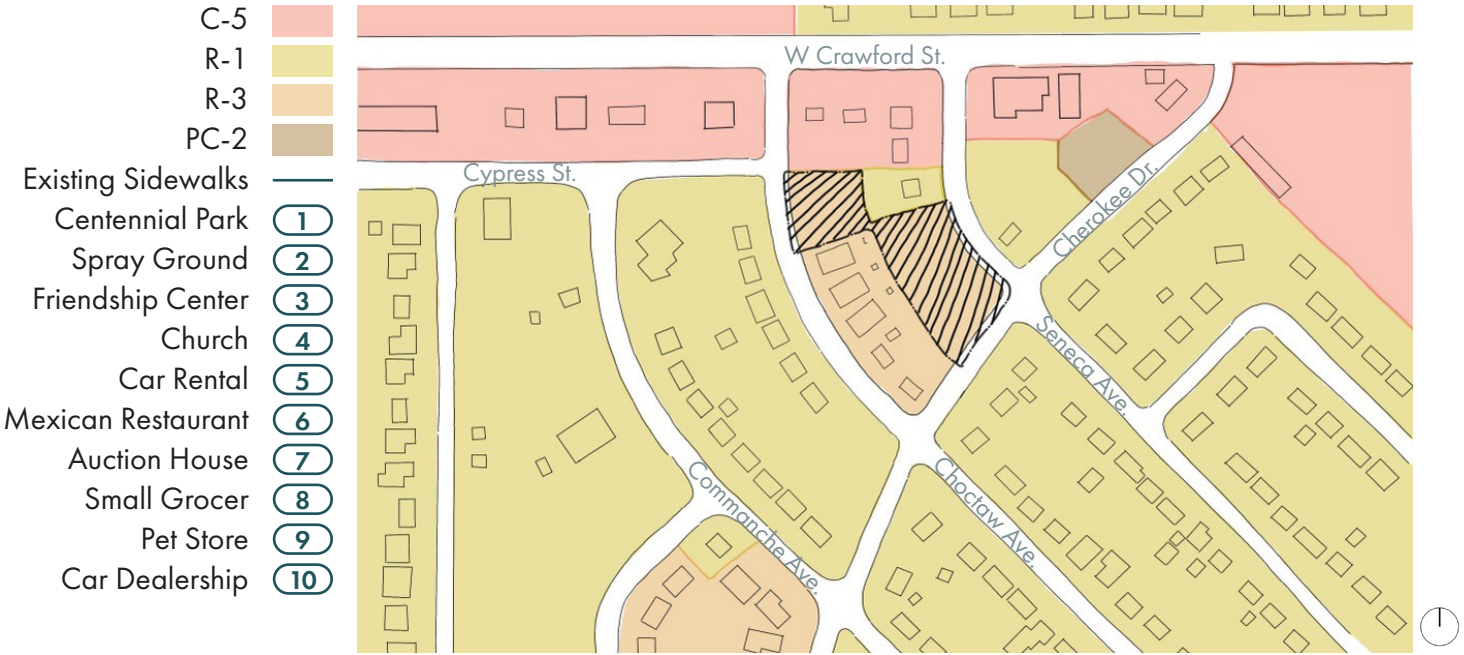


# Salina Site

## Modular Landscape Integration

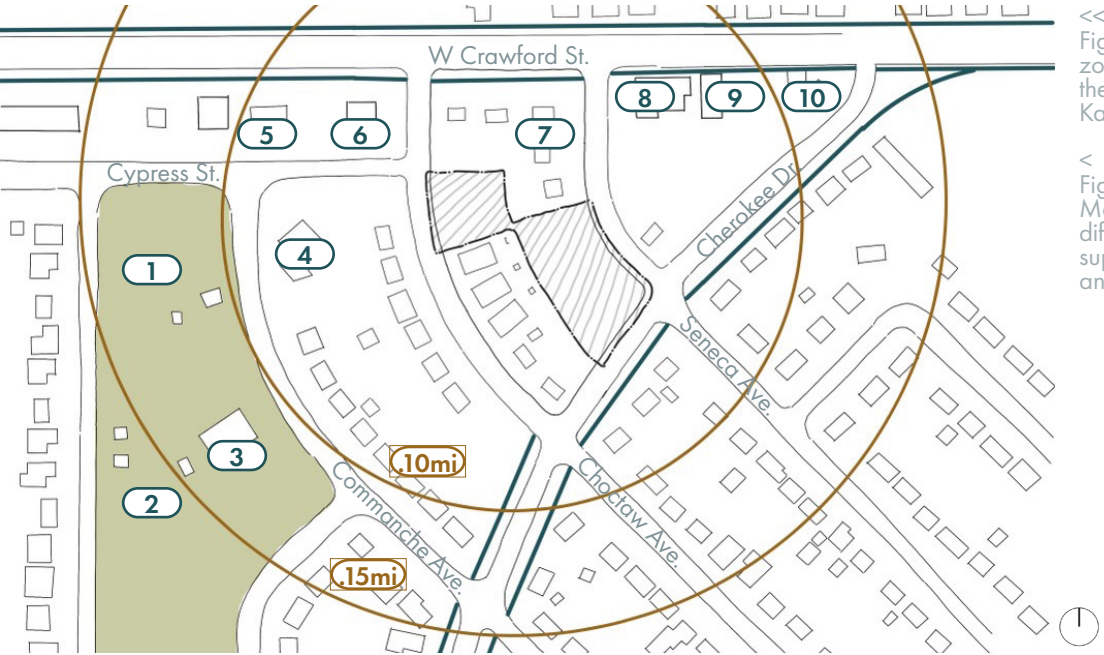
To address the limitations identified in the Gateway Decathlon prototype design, the team chose a site in Salina, Kansas, to implement the landscape elements on a block scale. Many of the same landscape elements from the GWD prototype were used to understand how these products could be applied in a more realistic residential design. In addition to implementing these designs, we created a small community of modular houses to identify how these homes could address missing middle housing. Missing middle housing describes housing types in between single-family homes and mid-rise apartments. Some examples of missing middle housing include duplexes, triplexes, townhomes, and cottage courts. These housing types provide different options for residents of different economic standing. For more information, Alison Snawerdt, a group member, focuses her research on missing middle housing (Snawerdt 2025).

Zoning



The first step of design was conducting a site analysis. This process identified helpful information about the existing conditions. Zoning helped determine how the surrounding land was being used. Most of the land along W Crawford Street is zoned as commercial (red) and has a series of businesses within this area. At the same time, most of the land is zoned as R-1 single-family residential (yellow). This represents much of the adjacent land use. Some areas, including our site, are currently zoned as R-3 multifamily residential, allowing more dwelling units. This zoning is more conducive to creating missing middle housing.

Surrounding Amenities



The site analysis identified the surrounding amenities and sidewalks as critical factors. Many amenities are within walking distance of the site, including a small grocer, a pet store, and a Mexican restaurant. Centennial Park is another important nearby amenity with outdoor recreation areas, a splash pad, and a Friendship Center community building. All these businesses provide access within walking distance. While these amenities are close, the neighborhood has limited sidewalks, potentially making people uncomfortable or unsafe walking on the street.

<< Figure. 127. The zoning around the site in Salina, Kansas.  
< Figure. 128. Model of the different deck support pedestals and deck system.

Context

Literature Review

Typology

Landscape Elements

Precedents

Residential Landscapes

Temporary Landscapes

Amenity Decks

Design

GWD

Salina

Design Strategies

Prefabrication

Reconfigurability

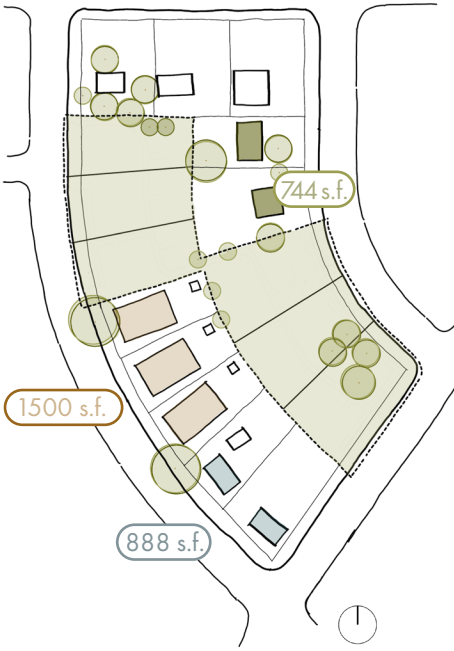
Nature in the Space

Natural Analogs

Nature of the Space

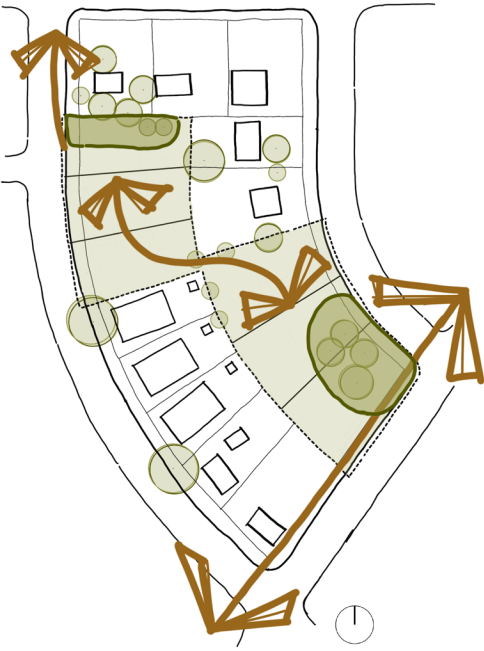
Site Analysis

Existing Housing



The Gateway Decathlon prototype’s building size fits nicely into the neighborhood's context with its two modules: 600 square feet and 300 square feet. For the Salina design, these modules are combined to create reasonably sized dwellings for the users, where each unit is 900 or 1200 square feet. The surrounding homes are similar, ranging from 744 to 1500 square feet (Zillow n.d.). Similar housing sizes help the GWD prototype fit well into the existing context. Another way to fit with the existing context is to consider the character of the existing housing; each existing house is a rectangle with a pitched roof. Existing vegetation was identified as another important consideration, especially the trees in the southwest and northeast corners.

Design Moves



Three design goals were identified from the site analysis. First, the existing trees are a great asset to the site's existing character, both in their ability to provide shade and help with water retention. These trees are a tremendous existing resource to be preserved. The second focus of this design is connectivity. With the proximity of the surrounding amenities, it is crucial to develop a path network through the neighborhood so that the residents can safely and comfortably access these nearby resources. Finally, it is important to integrate the design into the surrounding context through the housing size and character. These three goals provided helpful parameters throughout the design process.

Figure. 129. The yellow house adjacent to the Salina site.  
Figure. 130. Teal house adjacent to the Salina site.  
Figure. 131. Similar home size to the proposed design.  
Figure. 132. Image of existing trees on the Salina Site.  
Figure. 133. Design goals of connectivity and tree preservation.

| Context                |  |
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| Literature Review      |  |
| Typology               |  |
| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
| GWD                    |  |
| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
| Reconfigurability      |  |
| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |



Spatial Layout

The Duplex



Responding to the site analysis, we started to design different types of missing middle housing layouts, focusing on the organization of the homes. Throughout this process, we identified three ways to organize these homes and one design alternative for parking. The first design focused on duplexes, which had the most density. This used space most efficiently as two units shared a wall. Each unit has a small yard and a larger community space. The other two designs were inspired by cottage courts, which have parking on the site's periphery, while the dwelling units cluster around a small community lawn. The first cottage court design did not respond to the site at all and kept a rigid square form, while the second design responded to the site's unique shape, with the homes following

Cottage Court



Curved Cottage Court



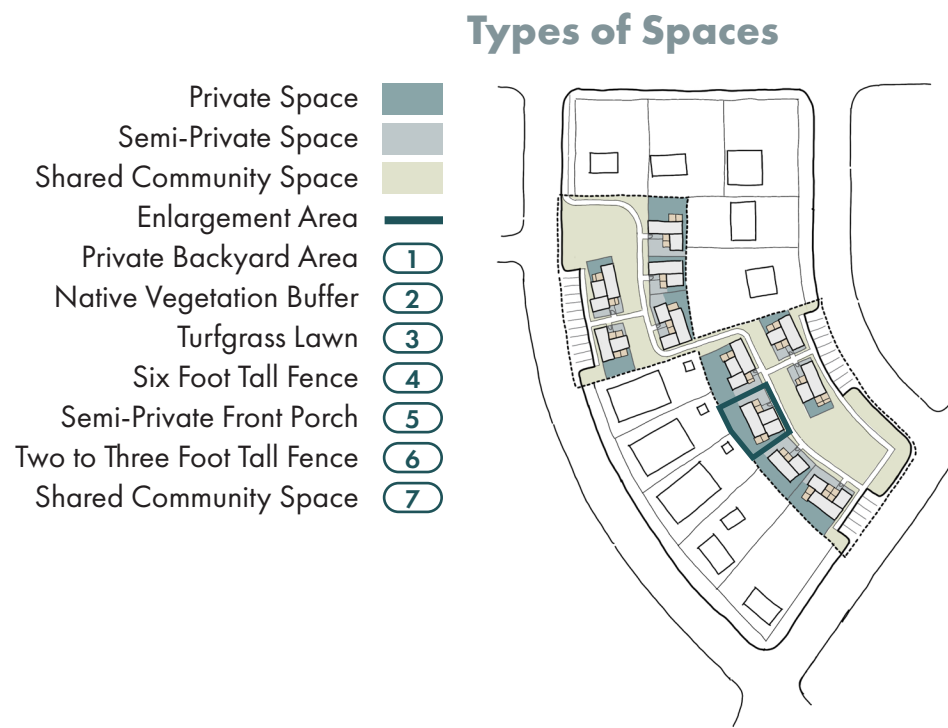
the curve of the parcel. Responding to the existing conditions allowed for more shared community green space for the residents, so we moved forward with this design. Once the cottage court was chosen, an additional design considered parking variations. Parking was important because it impacted how far the residents had to walk from their cars and if their cars were protected. The last design considers a protective roof above the car park to address this. The covered parking option shows an opportunity to protect the residents' cars, but it takes up more space than the alternative. Considering all these options, we moved forward with a curved cottage court without covered parking because it provided closer parking for the residents while taking up less space.

Covered Parking



<<<< Figure. 134. Configuration one, The Duplex.  
<<< Figure. 135. Configuration two, the Cottage Court.  
<< Figure. 136. Configuration three, The Cottage Court Reimagined.  
< Figure. 137. Configuration four, covered parking.

| Context                |  |
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| Literature Review      |  |
| Typology               |  |
| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
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| Salina                 |  |
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| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |



The difference between cottage courts and typical single-family housing is the allocation of public and private spaces. In this design, there are three types of space: private space, semi-private space, and shared community space. The private space includes the backyard and has a taller six-foot fence with a vegetative buffer. The porch area is a semi-private space about eighteen feet from the sidewalk. The short two to three-foot-tall fence allows visual connection throughout the neighborhood while distinguishing each resident's personal space. Finally, the shared community space has amenities that are shared by the residents with sidewalks that connect to each home. This cottage court design allows each resident to have both private and public spaces, with a focus on shared community spaces.



<< Figure. 138. The three types of spaces create a variety of experiences, with a focus on community spaces.

< Figure. 139. The fence and vegetation help to distinguish the type of space.

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| <b>Context</b>           |  |
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| <b>Typology</b>          |  |
| Landscape Elements       |  |
| <b>Precedents</b>        |  |
| Residential Landscapes   |  |
| Temporary Landscapes     |  |
| Amenity Decks            |  |
| <b>Design</b>            |  |
| GWD                      |  |
| Salina                   |  |
| <b>Design Strategies</b> |  |
| Prefabrication           |  |
| Reconfigurability        |  |
| Nature in the Space      |  |
| Natural Analogs          |  |
| Nature of the Space      |  |





Cottage courts are an uncommon house type in America today. While these homes are still single-family, they are distinct from typical single-family homes. Cottage courts have smaller homes with dwelling units of no more than 1,500 square feet (Chapin 2011). This housing size represents only 12% of the housing being constructed in 2023, with most housing ranging between 1,600 square feet and 3,999 (Emrath 2024). Another difference is the configuration of these homes; instead of having large private lawns for each house, a large, shared community space functions as a community yard. Now, small private yards surround each home to help define layers of personal space. In the book Pocket Neighborhoods, Ross Chapin describes the five layers of landscape elements



that help visually distinguish each resident's personal space. All five elements should occur within 18 feet of the sidewalk's edge, including a perennial border, a low fence, a private yard, a covered porch, and a railing on the covered porch (Chapin 2011, 80). These five elements helped create a framework to distinguish personal space while keeping each home connected to community spaces. The challenge with designing a cottage court is balancing the residents' needs for both community and private spaces. This approach helped guide the Salina design to consider the residents' personal space and to create a comfortable small, scaled community.

<< Figure. 140. The layers of personal space in a built project. Photograph courtesy of Ross Chapin Architects.

< Figure. 141. Rendering of the layers of personal space in the Salina design.

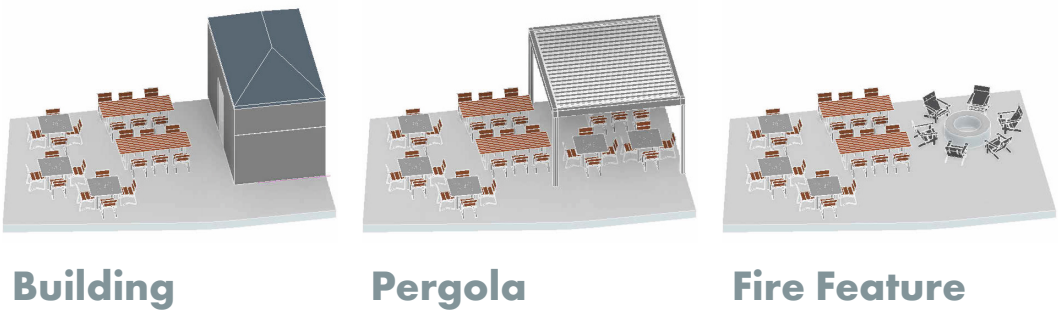
| Context                |  |
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| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
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| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
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| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |



Amenity Zones - Social Spaces



The focus shifted from the five layers of personal space to the shared community spaces. The community spaces are separated into three amenity zones with different programming. The first zone is a social space on the south part of the site. This amenity area focuses on flexible programming that enables people to come together and interact with their neighbors. To achieve this, all the tables and chairs are designed as sectional architecture so the space can be flexible and allow different activities. Along with the furniture, additional elements were identified to further the programming: a building, a pergola, and a fire feature. These landscape elements were intended to highlight this shared space's potential opportunities.



<< Figure. 142. Community space with pergola.  
< Figure. 143. Design alternatives for the social space.



| Context                |  |
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| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
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| Salina                 |  |

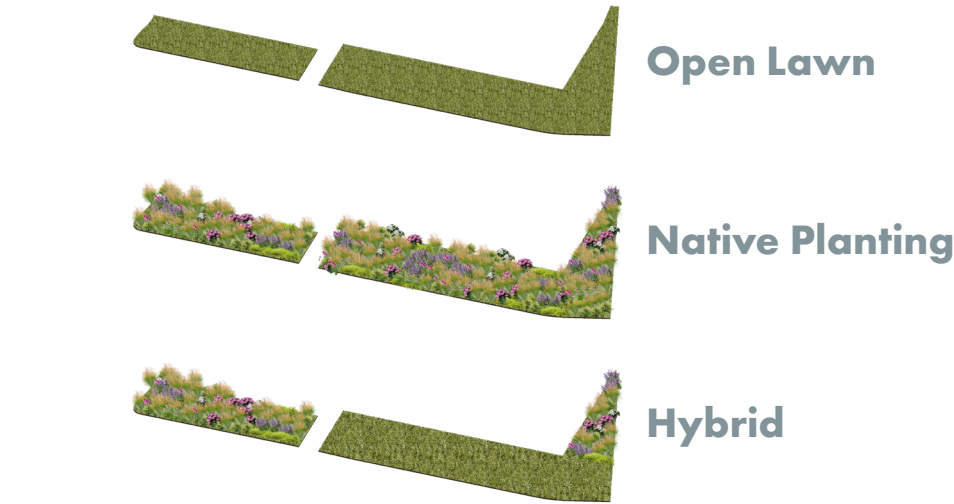
| Design Strategies   |  |
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| Prefabrication      |  |
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| Nature in the Space |  |
| Natural Analogs     |  |
| Nature of the Space |  |



Amenity Zones - Community Space



The second zone is the open space next to the path. The three different design options highlight the potential forms these spaces can take. The first form is an open lawn. This would allow the residents some recreational space they could run around and play on. The second option is focused on native planting. This design focuses on creating a planting area that resembles the native landscape. It would provide more functional ecological amenities, such as water retention and filtration, rather than recreational activities. The third option is a hybrid of the first two, where the open lawn is a recreational amenity for kids to play on. At the same time, native planting provides ecological functionality. All three options show how the open space can be tailored to the community’s needs.



<< Figure. 144. Open space with native planting and open lawn.  
< Figure. 145. Design alternatives for open space.

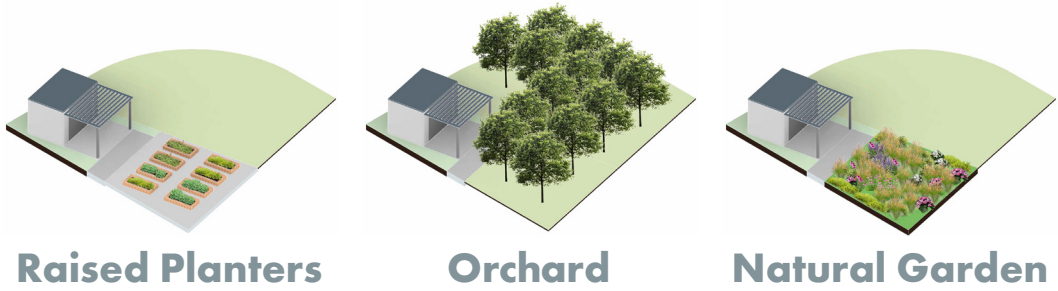
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| Literature Review      |  |
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| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
| GWD                    |  |
| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
| Reconfigurability      |  |
| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |



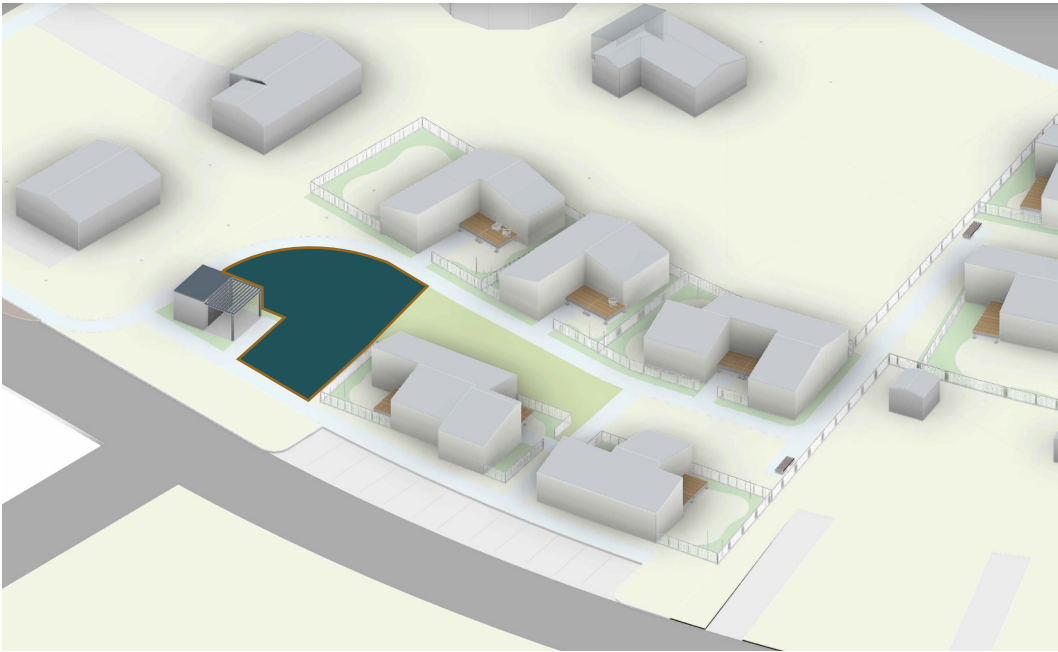
Amenity Zones - Garden Spaces



The third zone imagines the possibility of a community garden. Again, the three options identify different forms this could appear, though there are other options that can be tailored to the residents. Like the open space design, the first type of garden could be a natural garden, where the planting is focused on emulating a natural landscape. This garden would be designed primarily for its seasonal interest, while the other options consider a productive landscape, such as the second option, an orchard. This orchard could have edible plants that the community could help to take care of and share the produce. A similar option is a community garden with raised bed planters where the community could come together and help each other grow produce.



<< Figure. 146. Community garden with raised planters.  
< Figure. 147. Design alternatives for garden spaces.



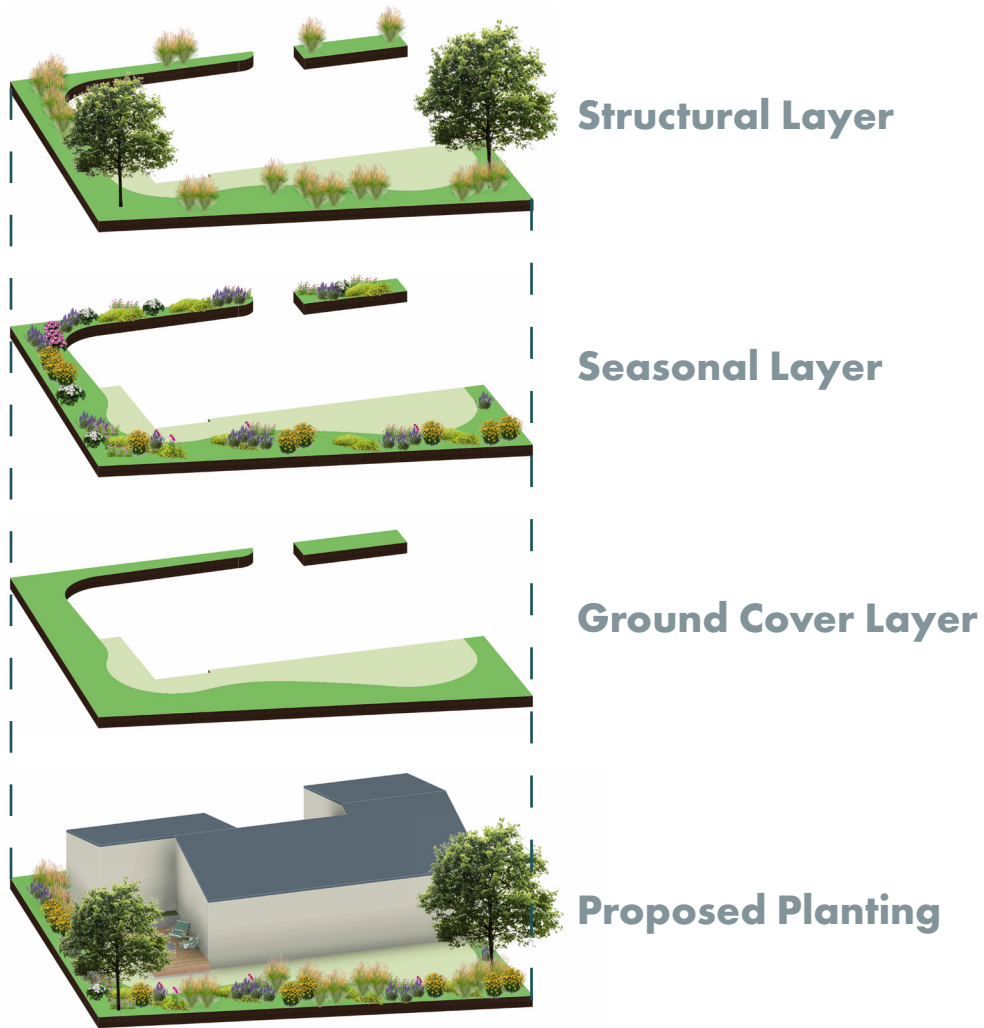
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| Literature Review      |  |
| Typology               |  |
| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
| GWD                    |  |
| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
| Reconfigurability      |  |
| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |



Planting Layers



With biophilia being the focus of the Salina design, planting was an important consideration throughout the design process. Thomas Rainer and Claudia West’s book *Planting in a Post-Wild World* helped identify common forms for a naturalistic planting design, including the structural, seasonal, ground cover, and dynamic filler layers (2015). These layers help create a general framework for this study's planting design. The following pages identify a general plant palette for which plants would appear in specific categories, while the rest of this study focuses on the conceptual layers within planting design. This study will focus on the structural, seasonal, and ground cover layers since the dynamic filler layer describes temporary planting while the other plants get established.



<< Figure. 148. The backyard shows the three planting layers.  
  
< Figure. 149. Axonometric of the three different planting layers.

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| Context                |  |
| Literature Review      |  |
| Typology               |  |
| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
| GWD                    |  |
| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
| Reconfigurability      |  |
| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |

Planting Layers



Structural Layer

- Trees**  
Cercis canadensis // Eastern Redbud  
Acer saccharum // Sugar Maple  
Juniperus virginiana // Eastern Red Cedar  
Quercus shumardii // Shumard Oak
- Edible Trees**  
Corylus Americana // American Hazelnut  
Carya Illinoensis // Pecan
- Grasses**  
Schizachyrium scoparium // Little Bluestem  
Andropogon gerardii // Big Bluestem  
Sorghastrum nutans // Indian Grass  
Bouteloua curtipendula // Sideoats Grama



Seasonal Layer

- Echinacea purpurea // Purple Coneflower  
Rudbeckia hirta // Black Eyed Susan  
Baptisia australis // False Indigo  
Ruellia humilis // Wild Petunia  
Dalea purpurea // Purple Prairie Clover  
Dalea candida // White Prairie Clover  
Mimosa microphylla // Sensitive Briar  
Amorpha canescens // Leadplant  
Chamaecrista fasciculata // Partridge Pea  
Desmodium canadense // Showy tick Trefoil



Ground Cover Layer

- Carex pensylvanica // Pennsylvania Sedge  
Erigeron pulchellus Michx. // Blue Spring Daisy  
Bouteloua gracilis // Blue Grama  
Callirhoe involucrata // Purple Poppy Mallow  
Sporobolus heterolepis // Prairie Dropseed
- Turfgrass**  
Fescue mix  
Zoyza Grass  
Lobelia cardinalis // Cardinal Flower



Filler Layer

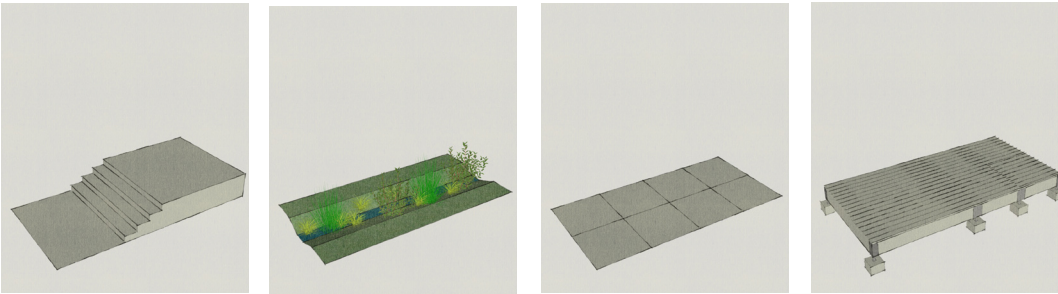
- Achillea millefolium // Common yarrow  
Aquilegia canadensis L. // Eastern Red Columbine

< Figure. 150. Sections that highlight the different layers of planting.

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| <b>Context</b>           |  |
| Literature Review        |  |
| <b>Typology</b>          |  |
| Landscape Elements       |  |
| <b>Precedents</b>        |  |
| Residential Landscapes   |  |
| Temporary Landscapes     |  |
| Amenity Decks            |  |
| <b>Design</b>            |  |
| GWD                      |  |
| Salina                   |  |
| <b>Design Strategies</b> |  |
| Prefabrication           |  |
| Reconfigurability        |  |
| Nature in the Space      |  |
| Natural Analogs          |  |
| Nature of the Space      |  |

Deck Package

Ground Plane

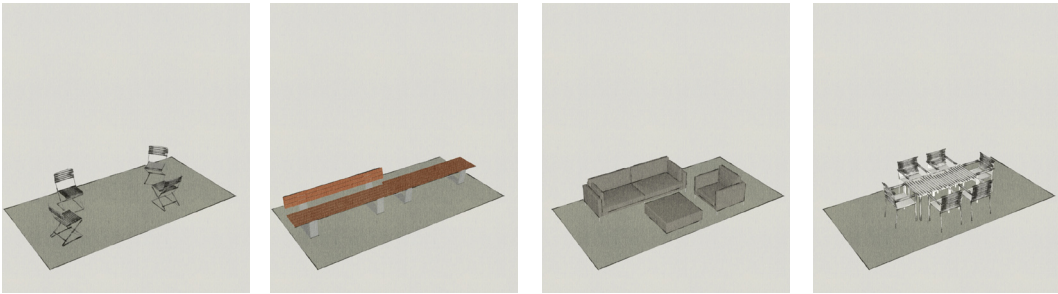


A2. Stairs      A3. Swale      B1. Pour In Place      B4. Patio Deck

Identifying the landscape elements used in the design was essential to creating these cottage courts. The following pages help determine how each landscape element was used within this design.

Within the general category of the ground plane, this design incorporates four common landscape elements. The first is stairs, which help people move from the sidewalk onto the deck system. These stairs do not have to be on every house, especially for accessibility. These other homes could have the front door level with the sidewalk for easier access. The sidewalks throughout the design are made of pour-in-place concrete (B1). This material helps create a firm, stable, and slip-resistant surface for people to walk on. The deck system (B4) is another common landscape element in this design. This deck system was identified to help define personal space, creating a comfortable outdoor room for people to enjoy and providing users with a sense of prospect and refuge. The last landscape element for the ground plane is swales (A3), which are used in native landscapes to retain water. These four landscape elements combine to define the ground plane and influence the circulation through the site.

Furniture



C1. Movable Seating      C2. Fixed Seating      C3. Lounge Seating      D1. Large Table

The following landscape elements can be summarized into the general categories of furniture and planters. These elements help define spaces further and create opportunities for people to use them.

Movable seating elements (C1) are the first landscape element in this category. These chairs are placed in the community gathering spaces with tables to allow for flexibility in how these spaces can be used. There are also some fixed seating elements (C2) throughout the site, commonly in the form of a bench. This type of seating helped to consider what specific views to frame while people sat on the bench. Lounge seating (C3) was another common landscape element on many decks. These lounge chairs create an experience that enables people to sit and relax. The adjacent landscape elements of the lounge seating elements varied from a fire pit to coffee tables. Despite the adjacent amenities, there was a typical pattern when designing the lounge seating areas; each lounge seating element was placed with prospect and refuge, where the home was at the chair's back while the yard was facing outward. This chair orientation helped create relaxing outdoor spaces for the residents.

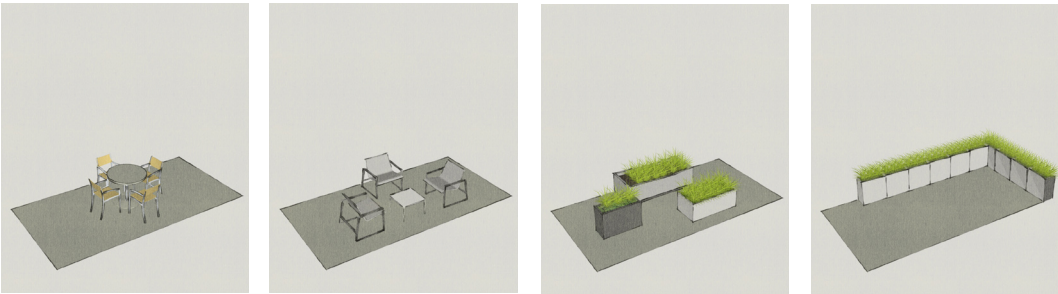
<< Figure. 151. Four ground plane elements were used for the Salina design.  
< Figure. 152. Elements were used for Salina's design: seating and tables.

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| Context                |  |
| Literature Review      |  |
| Typology               |  |
| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
| GWD                    |  |
| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
| Reconfigurability      |  |
| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |



Deck Package

Furniture

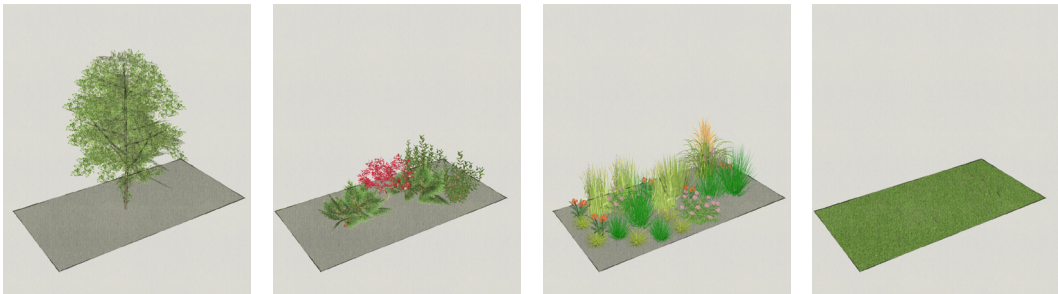


D2. Small Table      D3. Low Table      E2. Fixed Planter      E4. Divider Planter

Additionally, three types of tables were used throughout this design. The first type was a large dining table (D1). These tables were primarily placed in the community space to encourage the residents to gather and were made to be moved to allow for flexibility. Similarly, there are some smaller tables (D2) for smaller groups that help to add a variety to tables for people to use. These smaller tables are also placed on some deck systems to provide a place where people can enjoy the outdoors by having a meal outside or working outside if someone works from home. Coffee tables (D3) are on some other decks instead of the small table.

Planters were one more landscape element that this design intentionally used. The fixed planters (E2) created community garden beds. These garden beds are not movable but allow the community to join and help each other grow produce. The other type of planter was the divider planter (E4). Instead of using a low railing for the deck system, the divider planters functioned as a railing, allowing the residents to garden on their decks. These landscape elements further help determine different programming opportunities for people to use and experience the various spaces in the community.

Vegetation



F1. Trees      F2. Shrubs      F3. Perennials      F4. Groundcover

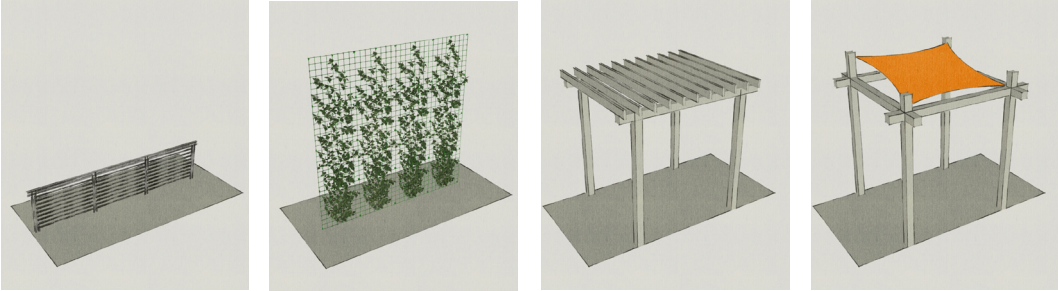
Like the other landscape elements, the vegetation helps define how people use specific areas while creating biophilic experiences. The trees (F1) help develop a sense of enclosure for the site and create shade to make more comfortable outdoor spaces. The existing tree's canopy was used to create comfortable outdoor spaces, while additional trees were planted to extend the existing tree canopy. Shrubs (F2) were another landscape element used in this design, but they had limited application because of the planting design approach. These shrubs helped create natural buffers for privacy in the backyards. While there were some shrubs, the planting predominately consisted of perennials and grasses (F3), like the existing context of Kansas. These plants helped create visual interest through different flowers, colors, and textures while allowing visual connection throughout the site. Finally, the ground cover (F4) was used in two ways. First, it was used as turf grass for some manicured lawns. These areas helped create small recreation spaces for people to use throughout the day. The ground cover layer was also used in the native planting designs. It functioned as a filler between the grasses and perennials—all the vegetation combined to create naturalistic gardens that resemble the native landscape while creating some recreation areas.

<< Figure. 153. Elements used in the Salina design: tables and planters.  
< Figure. 154. Four vegetation elements were used in the Salina design.

|                        |  |
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| Context                |  |
| Literature Review      |  |
| Typology               |  |
| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
| GWD                    |  |
| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
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| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |

Deck Package

Additional Landscape Elements

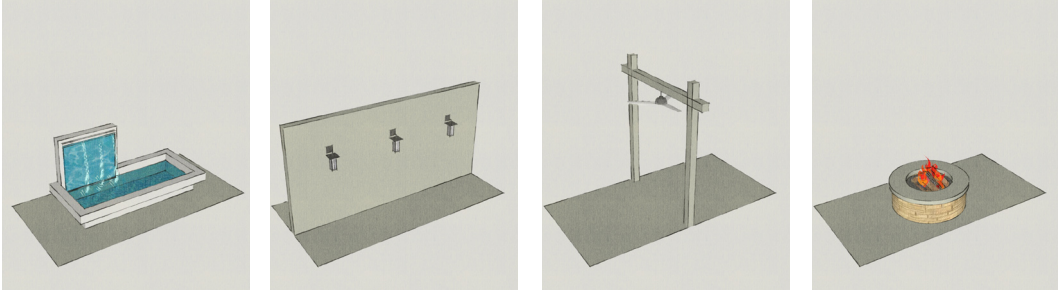


G3. Railing      G4. Green Wall      H2. Pergola      H3. Shade Sail

The remaining eight landscape elements further develop the programming and create unique spaces to encourage the residents to use them. The first two landscape elements help define boundaries. The railing (G3) describes a low fence. This fence delineates each resident's personal space and the deck system's edge. These fences are designed as shorter fences, around two to three feet tall, to maintain a visual connection to the surrounding neighborhood. The green wall (G4) allows visual interest on the side of the buildings and mitigates some of the solar radiation for the building.

Shade structures also helped develop the programming and added shared areas to the design. The two shade structures used in this design were the pergola (H1) and the shade sail (H2). The pergola was used in the community gathering space and can be incorporated onto the patio deck, while the shade sail was only used for the patio deck system. These shade structures help create shade and a sense of enclosure and help with the prospect and refuge design strategy. These shade structures add a sense of protection from above.

Additional Landscape Elements



I4. Waterfall      J2. Wall Lights      K1. Fan      L1. Fire Pit

The water feature (I4) creates an engaging experience for many senses. This design uses a rain chain for its waterfall. This is a functional form of a water feature since it uses water flowing off the roof in the rain, making the water falling more artistic than a gutter. This water feature would help connect people to their environment, especially during rain events, to see how the water flows from the roof into the cistern below. Another landscape element that is very helpful at night is lights. This design specifies wall lights (J2) connected to each home, illuminating the outdoor decks. Additionally, a fan (K1) can attach to a shade structure, which can help cool a deck off by creating air movement. Finally, the fire pit (L1) is the last specified landscape element. This fire pit is designed with chairs surrounding it since people enjoy gathering around a fire.

These landscape elements combine to develop the programming of this cottage court neighborhood, from community gathering spaces to private decks. After identifying all the landscape elements used in the design, it was important to confirm that it achieved its biophilic goals.

< Figure. 155. Eight additional amenities are used in the Salina design.

| Context                |  |
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| Literature Review      |  |
| Typology               |  |
| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
| GWD                    |  |
| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
| Reconfigurability      |  |
| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |



Nature in the Space



The nature of the space was achieved primarily through the vegetation, the fire pits, and the rain chain. The vegetation helped achieve many design goals, including visual connection with nature, dynamic and diffuse light, and connection with natural systems. The seasonal interest in the vegetation allows people to connect to their surrounding environment as they see the changes in the plants each year. The community garden can help people be attentive to the changes in the vegetation. Additionally, the fire pit engages many senses through the flickering light, the crackling sounds, the radiant heat, and the smell of smoke. The rain chain achieves a connection with water and natural systems. These combine to create an engaging biophilic experience in this design.



<< Figure. 156. Nature in the Space for Salina design.  
< Figure. 157. Photograph and design courtesy of Ross Chapin Architects. Danielson Grove in Kirkland, WA. Developed by The Cottage Company.

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|------------------------|--|
| Context                |  |
| Literature Review      |  |
| Typology               |  |
| Landscape Elements     |  |
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| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
| GWD                    |  |
| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
| Reconfigurability      |  |
| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |



Natural Analogues



The natural analog design strategies were achieved in the same way as in the Gateway Decathlon Prototype, through material connection with nature. The deck system is made of natural wood, just like parts of the coffee table and chairs. Using wood in landscape elements helps people connect with nature through the texture and patterns innate within wood, which people prefer. At the same time, the coffee table and lounge chairs have natural forms—especially the coffee table, which was inspired by tessellation.



<< Figure. 158. Natural Analogs for Salina Design.  
< Figure. 159. Wood deck from Conover Commons cottage court in Redmond, WA. Developed by The Cottage Company. Photograph and design courtesy of Ross Chapin Architects.

| Context                |  |
|------------------------|--|
| Literature Review      |  |
| Typology               |  |
| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
| GWD                    |  |
| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
| Reconfigurability      |  |
| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |



Nature of the Space



The nature of the space was further developed for the Salina site compared to the Gateway Decathlon Prototype. For this design criteria, this design focused on creating spaces with prospect and refuge. The patio decks were one area where this design strategy was effectively applied. The house's walls create a sense of protection from behind, while the low railing allows for unhindered views of the surrounding neighborhood. Adding a shade structure further creates a sense of protection from above. The other area used in this design strategy was the open spaces between the neighborhoods. The intent was to have low vegetation to allow for unhindered views and to create a curved path that partially obscures the view to develop a sense of mystery.



<< Figure. 160. Nature of the Space in Salina Design.  
< Figure. 161. Prospect and Refuge at Danielson Grove Cottage Court in Kirkland, WA. Developed by The Cottage Company. Photograph and design courtesy of Ross Chapin Architects.

| Context                |  |
|------------------------|--|
| Literature Review      |  |
| Typology               |  |
| Landscape Elements     |  |
| Precedents             |  |
| Residential Landscapes |  |
| Temporary Landscapes   |  |
| Amenity Decks          |  |
| Design                 |  |
| GWD                    |  |
| Salina                 |  |
| Design Strategies      |  |
| Prefabrication         |  |
| Reconfigurability      |  |
| Nature in the Space    |  |
| Natural Analogs        |  |
| Nature of the Space    |  |



Discussion

The Salina design helped identify how to integrate the Gateway Decathlon Prototype in an actual neighborhood context.

Organizing the buildings helped us to see how these modular buildings could be integrated on-site. First, we focused on missing middle housing to create more affordable housing options for people. Duplexes and cottage courts are the two potential options this design focused on; we chose the cottage court for this study. Cottage courts have a unique approach to single-family housing, where they are clustered in groups. Throughout this study, we found some notable design considerations when developing the cottage court. The first design consideration is the layout of the buildings. In cottage courts, these homes are placed close together and surround a shared green space. The overall structure of this design makes the cluster of homes inward-focused on the greenspace rather than outwardly focused on the street. This structure encourages the neighbors within the clusters to interact more since the front doors all open to the common green space.

Parking was another primary consideration for these cottage courts. In these designs, the car park is not adjacent to each resident's front door. Instead, it is clustered together on the edge of the site, with a sidewalk connecting each house. This approach to parking allows for less paving as there is no driveway for each house, and it encourages people to interact while they walk from their cars to their homes. In the design process, we designed two alternatives for parking, one with covered parking and one without. This alternative design shows how cottage courts can have covered parking. For this design, we found that the covered parking took up the space of an entire residential unit, so we chose to move forward with the uncovered parking option. This also allowed the design to have two smaller parking areas,



< Figure. 162. The site plan from Ross Chapin Architects shows phase one of Conover Commons in Redmond, Washington. Developed by The Cottage Company. Illustration courtesy of Ross Chapin Architects.

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| <b>Context</b>           |  |
| Literature Review        |  |
| <b>Typology</b>          |  |
| Landscape Elements       |  |
| <b>Precedents</b>        |  |
| Residential Landscapes   |  |
| Temporary Landscapes     |  |
| Amenity Decks            |  |
| <b>Design</b>            |  |
| GWD                      |  |
| Salina                   |  |
| <b>Design Strategies</b> |  |
| Prefabrication           |  |
| Reconfigurability        |  |
| Nature in the Space      |  |
| Natural Analogs          |  |
| Nature of the Space      |  |



Discussion

which helped create closer parking options for the residents. Parking for cottage courts is starkly different from a typical single-family home. Instead of each dwelling unit having a large driveway, the cottage court condenses the packing into one or two efficient parking lots. This frees up the rest of the space that would typically be used for driveways as an amenity for the community.

Another important design consideration for cottage courts is the distinction between public and private spaces. These cottage courts use five layers of personal space to help distinguish personal space, including a perennial buffer, a low fence, a private yard, a patio deck, and a fenced buffer. These layers of personal space help balance the connection between public and private spaces. In the book *Pocket Neighborhoods*, Ross Chapin identifies how these five layers are best when they create a buffer of about 18 feet from the sidewalk's edge to the front door. This spacing effectively separates the public and private spaces while not making the private spaces feel too isolated (Chapin 2011). While the front porches focus on visual connection, many backyard decks are designed more privately with taller fences and vegetative buffers.

For these cottage courts, we also found that the building shape impacted the experience of the deck systems for both the backyard decks and the front porches. Offsetting the building created little nooks for the decks and helped these deck systems better integrate with the building. This also helped create prospect and refuge where the house walls created a sense of protection, which could be developed further by adding a shade structure.



< Figure. 163. The five layers of personal space help blend the public/private spaces.

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| Amenity Decks            |  |
| <b>Design</b>            |  |
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| Salina                   |  |
| <b>Design Strategies</b> |  |
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Zooming out, we also found that considering the cottage court as a cluster was helpful. We had two clusters for the Salina site, the north and the south parcels; each cluster had similar programming, while each cluster provided for the community's needs. For example, the parking was not all placed on the south part of the site. Instead, the parking is placed in the north and south areas to provide easier access for the adjacent units. This proximity of the clustered amenities is important to consider when scaling these cottage courts to a larger area. Each cottage court requires basic amenities that should be in each cluster. In looking at some cottage court examples, it seems these amenity clusters work best when there are about ten or fewer units in a cluster (The Cottage Company 2024). This helps to maintain a small community feel that encourages community interaction and keeps the amenities within reasonable proximity.

Instead of giving everyone a driveway and private lawn, cottage courts focus on creating community spaces where the residents share the amenities. For the Salina site, we found it best if the programming was flexible for the residents. To do this, we used only three types of programming: social spaces, open spaces, and garden spaces. Social spaces focus on creating an outdoor living room where people can gather, talk, or even host a party (Chapin 2011). Open space consists of either an open lawn or native planting that the homes face. Finally, the garden space focused on how the residents could interact with the planting and even create a productive landscape where the community could share the produce. Ultimately, the programming of these cottage courts is best when flexible, but it intends to create amenities to encourage people to interact with each other.

Working with the existing conditions is another important lesson that we learned from Salina's design. The Salina site was on a curve, and we did not consider the curve in some of the iterations. However, we found the cottage court fit better when we responded to the surrounding context. Other existing conditions that we responded to were the housing size and character. The character of these homes can vary based on the neighborhood, and it is important to integrate these structures into the existing context. Looking at the adjacent homes, we found the housing size to resemble the surrounding context. While the housing size matters, it matters less than matching the character. The cottage courts are designed to be denser, with smaller houses than average. Because of this, the size of these housing units will vary. Comparing the size of the adjacent homes in Salina helped show that the cottage court homes are reasonably sized and use space more efficiently. We fit more homes and more shared community space than the surrounding single-family residential. This was achieved by reconsidering how we could use the driveway and large private lawns.

The planting aims to connect the community to nature. The first way planting achieved this goal was by reconsidering the amount of turfgrass. Instead of each home having a large yard surrounding the house on every side, the cottage court has a shared lawn in between all the homes. This helps achieve the higher density of the cottage court, miniaturizing the private grass lawns and replacing them with additional units. Miniaturizing the grass lawns helps reduce the maintenance and irrigation for the residents. Each home still has a small amount of turf grass, but most of the planting is native and adaptive perennials and grasses. These plantings create more visual and seasonal interest and require less maintenance.

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| <b>Design</b>            |  |
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Discussion

Designing a layered landscape was an important consideration throughout this design process. These different layers help emulate nature (Rainer and West 2015). When considering a layered landscape, it was helpful to consider how each type of planting would impact the user. We typically considered the form of the structural layers and flowers of the seasonal layers, while for ground covers, we focused more on their functionality.

Further into the planting design, we found it best to design the cottage court as a master plan rather than giving each resident creative freedom within their yard. Though there is an opportunity for the residents to plant and maintain certain types of vegetation in their private yards, it is best if the public-facing yards are cohesive throughout the design. This helps maintain some continuity throughout the cottage court cluster. These planting areas could help connect the residents and communicate a cohesive design.

Through this design process of exploring cottage courts and planting design, we better understood how biophilia can integrate these modular buildings into an environment. The cottage courts create pockets of prospect and refuge with the protected deck system and visual connection by having low plants so as not to obscure views. The planting creates distilled moments of natural beauty that surround people's homes and incorporates other biophilic aspects like a non-visual connection to nature and dynamic and diffused light.



< Figure. 164. The cohesive planting design for Greenwood Avenue Cottages. The project is located in Shoreline, WA. Developed by The Cottage Company. Photograph and design courtesy of Ross Chapin Architects.

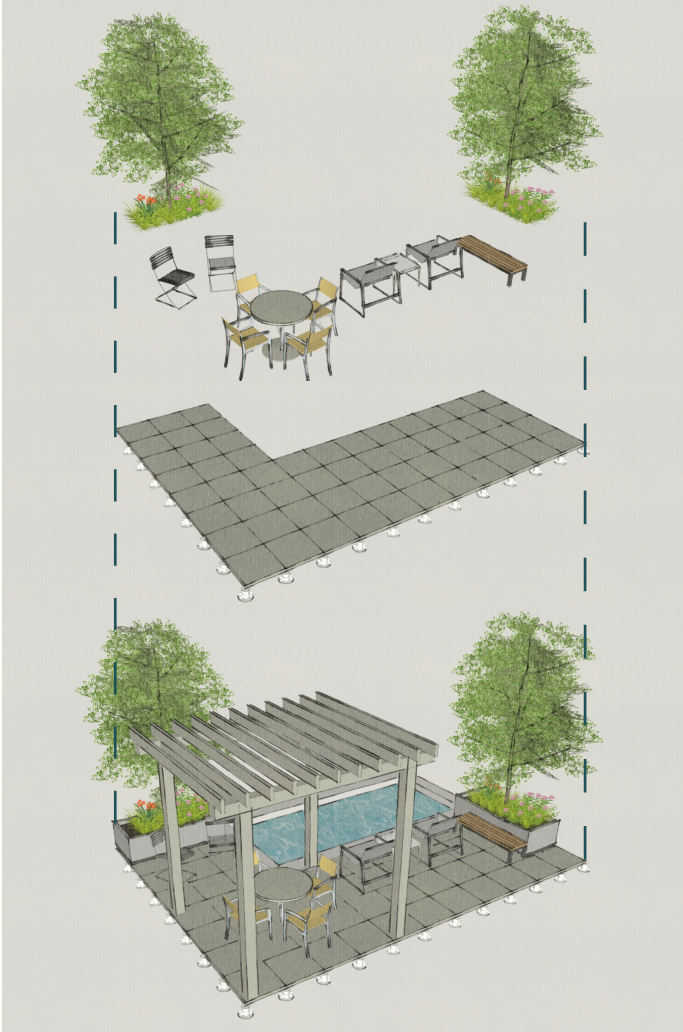
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| Literature Review        |  |
| <b>Typology</b>          |  |
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| Amenity Decks            |  |
| <b>Design</b>            |  |
| GWD                      |  |
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| <b>Design Strategies</b> |  |
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Discussion

Trees were one landscape element we focused on specifically. First, the existing trees were important to preserve. These trees already provide a nice canopy and ecological functions. Because of this, we preserved many of the trees on site. Existing trees are an asset for a site and should be preserved whenever possible. These trees help a site feel more integrated into a site and make the design appear to have been there a long time. Second, it is important to be considerate about the trees being planted, especially with the density of cottage courts. These trees can be a great asset by providing shade, but they can also threaten the tightly packed cottage courts below. If trees grow too large, they can lose branches and damage homes. For this reason, we found it best to consider using small and medium-sized trees near homes.

We found a typical pattern with our different landscape elements throughout this process. The first essential component of the design is the ground plane, which addresses the existing topography and specifies the different paving materials. The second essential component is furniture, from seating elements to tables. These elements identify the basic programming of space to define how someone can use the site. The third essential component is vegetation, which helps incorporate natural forms and patterns that create visual interest while further defining how specific areas are used. Finally, the fourth category describes additional landscape elements that help define a site's programming. This last section is where there are many differences when comparing different sites. Most projects have some form of ground plane, furniture, and vegetation, but many designs start to differ through the additional landscape elements.

Landscape Layers



Vegetation

Furniture

Ground Cover

< Figure. 165. Axonometric of the three most common landscape layers.

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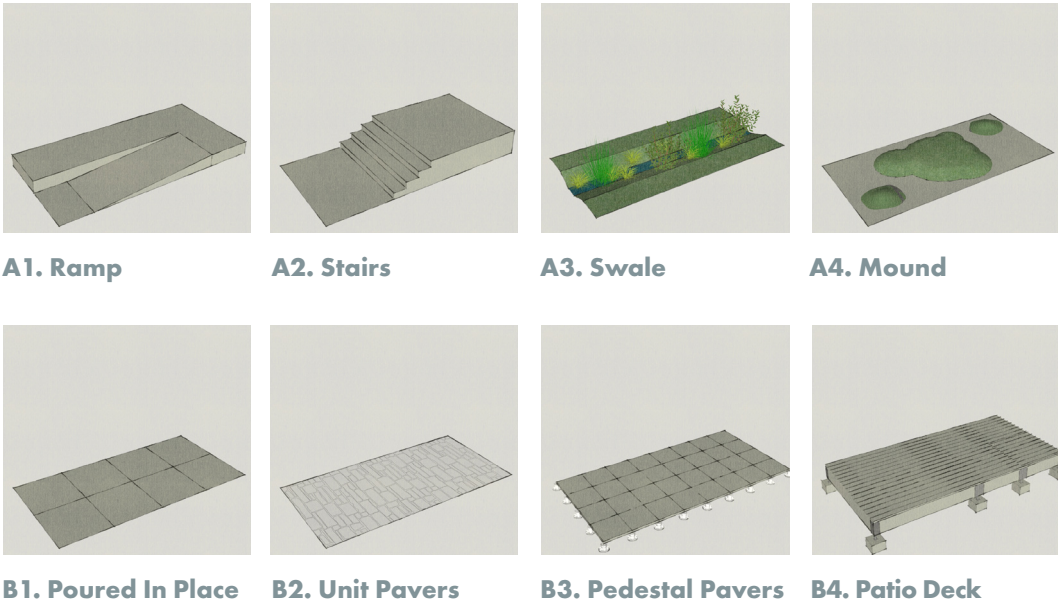
# Conclusion

Conclusion

This study helped create a modular landscape that integrated modular buildings within their surrounding environment. This process identified a pattern of the most common categories used in outdoor spaces: the ground plane, furniture, vegetation, and additional amenities. These categories helped create a framework of the basic landscape elements needed when designing the Gateway Decathlon Prototype and the Salina site. Each landscape element appears in many forms within these general categories. The ground plane, furniture, and vegetation were addressed in each design, while additional amenities varied based on the design. These categories helped create an overall framework for integrating a modular landscape into a site.

The ground plane is the most practical of the three base categories. It functions as the surface that people walk on and directs how people move through the site. The typology describes landscape elements addressing topography (A1-A4) and ground plane (B1-B4). There is limited reconfigurable potential, mainly because walking surfaces are best if they are firm, stable, and slip-resistant. This makes the ground plane the best slot architecture, where it is fixed in place. At the same time, potential innovations for bus architecture were expanded upon in the Gateway Decathlon prototype, where the deck system is fixed in place, with specific places to attach additional components. Like reconfigurability, there is potential to prefabricate the ground plane. For example, the GWD deck system was designed to be prefabricated in a series of panels that can be transported and applied efficiently. Additionally, there is biophilic potential for the ground plane, especially with natural analogs, through the materials used, the patterns created, and the organized complexity of the paving patterns. The modularity and biophilia design strategies combine to help understand the best way these modular landscapes are incorporated into an environment.

Ground Plane



< Figure. 166. The ground plane is primarily functional and considers how people move through a site.

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| Nature of the Space    |  |

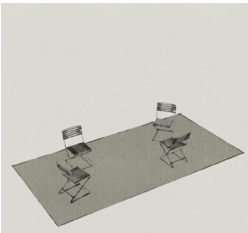


Conclusion

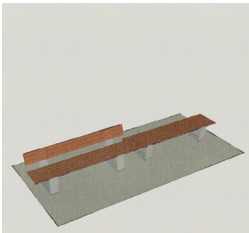
Placed on top of the ground plane is the furniture. This category describes the elements of the typology, including seating (C1-C4) and tables (D1-D4). Furniture has the most variety with reconfigurability; it can occur in all three types: slot architecture, bus architecture, and sectional architecture. Sectional architecture was the most popular as it allowed users a sense of control over their environment by moving the furniture where they wanted it. The second most common was slot architecture, where these landscape elements were fixed in place. Finally, bus architecture was used the least, but it has the potential, especially for the deck system designed for the Gateway Decathlon. For prefabrication, furniture is commonly found as 3D volumetric on 2D panelized; this varies based on the size of each landscape element, where larger landscape elements are commonly 3D volumetrics while the smaller landscape elements are 2D panelized. This can be understood by considering the restraints of vehicles. For biophilia, the furniture can have natural analogs that connect to nature through materials, patterns, and biomorphic forms.

The third base category is vegetation including Vegetation (F1-F4) from the typology. The vegetation had the most biophilic impact. It allowed visual connections to nature where users see the complex pattern of all the plants. It also creates non-rhythmic sensory stimuli and dynamic and diffuse light as wind and other environmental factors interact with the planting. This movement also connects with surrounding natural systems as people notice the vegetation changing throughout the seasons, especially with seasonal interest. Even the complexity and order of nature create visual interest for the users. These design strategies highlight how impactful incorporating natural materials into outdoor areas is. This is not to say that haphazardly placing plants in every square inch will lead to a biophilic experience. Instead, this vegetation needs to be thoughtfully considered, as Thomas Rainer and Claudia West describe in their book *Planting in a Post-Wild World* (2015). In the design of both the GWD prototype and the Salina site, it seemed the most influential was

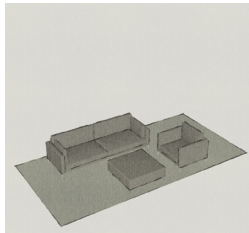
Furniture



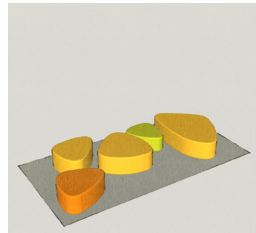
C1. Movable Seating



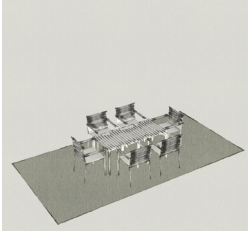
C2. Fixed Seating



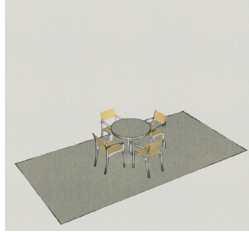
C3. Lounge Seating



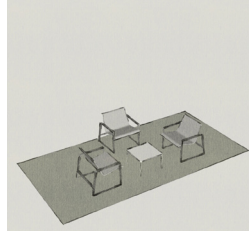
C4. Abstract Seating



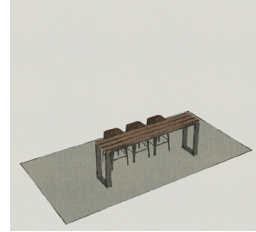
D1. Large Table



D2. Small Table

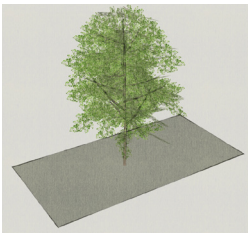


D3. Low Table



D4. High Table

Vegetation



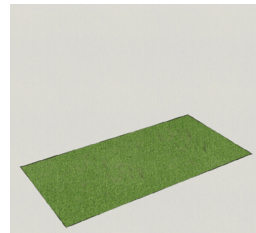
F1. Trees



F2. Shrubs



F3. Perennials



F4. Groundcover

<< Figure. 167. Seating and tables are the most common type of furniture.  
< Figure. 168. Vegetation helps integrate homes into their environment.

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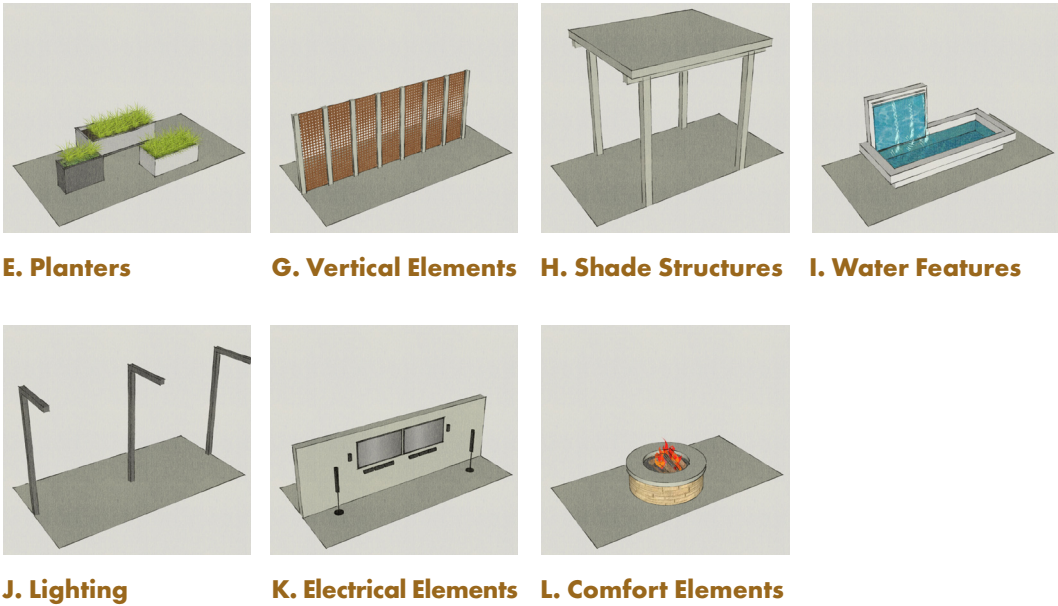
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## Conclusion

to integrate this modular landscape into their site through planting. We used the planting to imply visual buffers in the backyards of the Salina site while keeping the planting in the front yards lower to allow for visual connection. While the planting helped to integrate the modular buildings into the Salina site, there was limited opportunity for modularity. Since plants are natural materials, they are not prefabricated, and most commonly, once they are placed on the site, they are fixed there. The exception is through movable planters, which are more common in residential design. Despite the limited modular potential of vegetation, its importance cannot be overstated for the impacts of biophilia.

The fourth category describes the other landscape elements that can be added depending on the programming. From the typology, these landscape elements include Planters (E1-E4), Vertical Elements (G1-G4), Shade Structures (H1-H4), Water Features (I1-I4), Lighting (J1-J4), Electrical Elements (K1-K4), and Comfort Elements (L1-L4). This list of additional amenities can take many forms. These landscape elements are combined because they do not consistently show up like the forms above. Instead, these elements were used either in response to a design move or to help create an additional amenity. Two examples are a water feature and a fire pit. These both create a biophilic experience with natural elements that people generally like to be around. Both landscape elements further define the programming and develop the biophilic experience. Many of these landscape elements in this section have the potential for modularity and biophilia. Since this varies based on the project, this section intends to help create ideas about potential landscape elements that could be added to further the programming.

## Additional Amenities



< Figure. 169. Additional amenities help develop programming.

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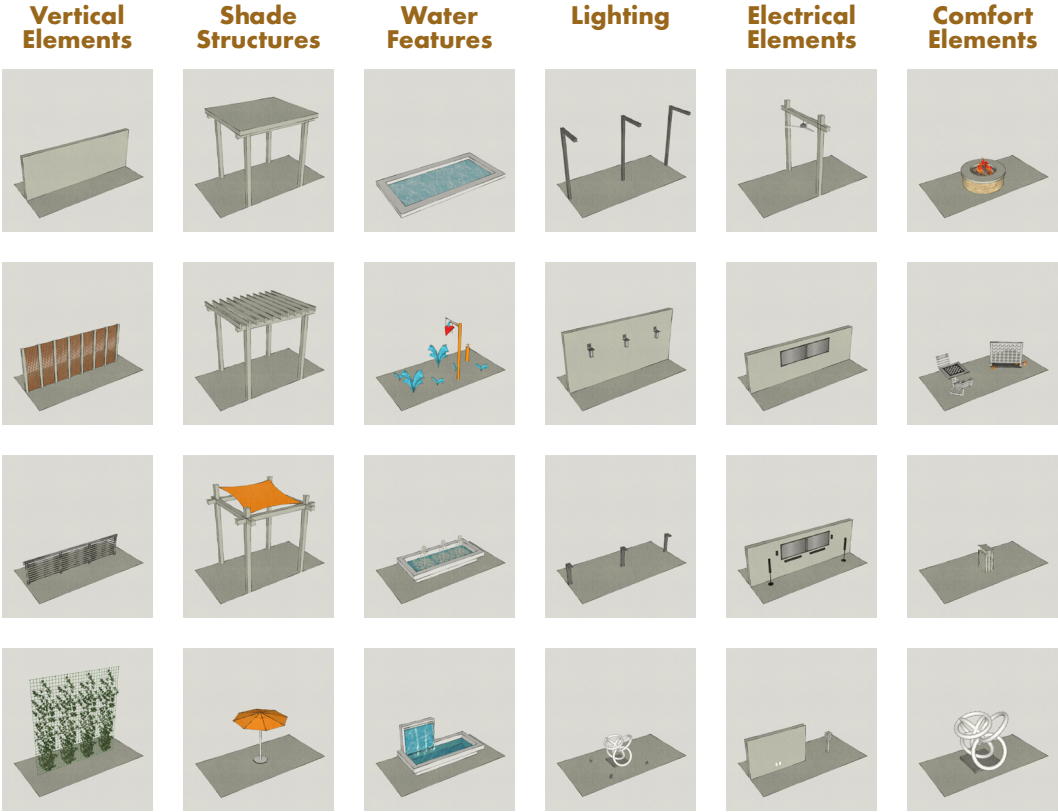
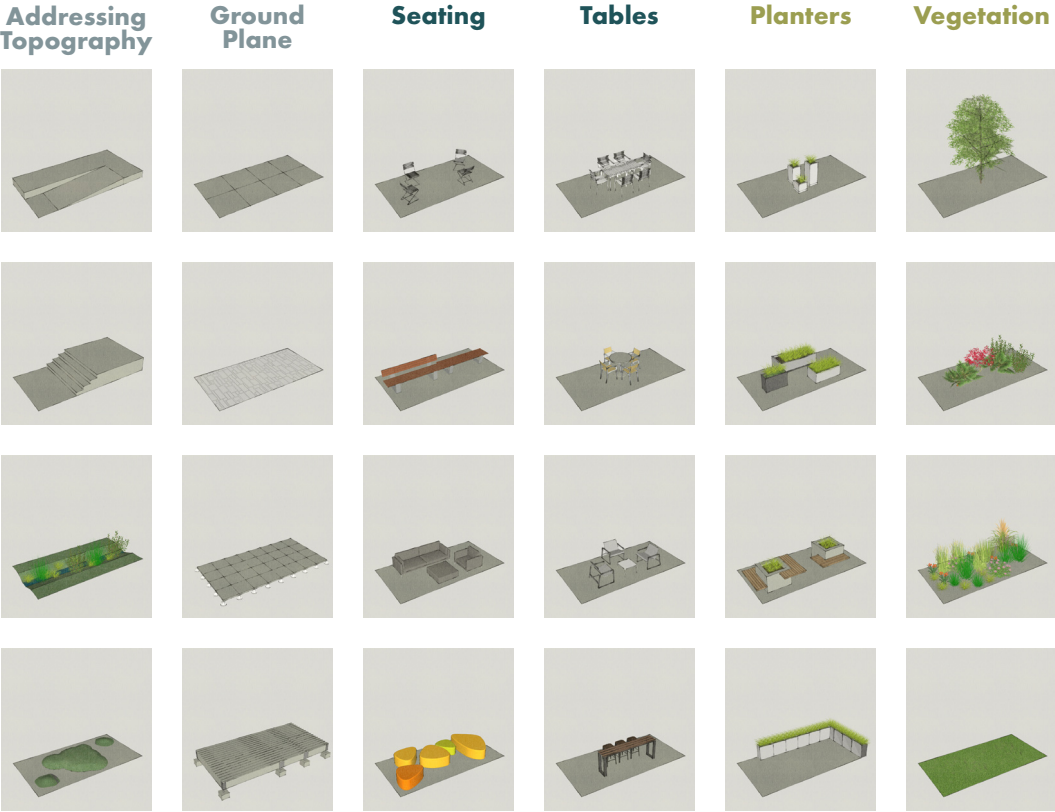


Ground Plane

Furniture

Vegetation

Additional Amenities



< Figure. 170. The 48 landscape elements in four overarching categories.

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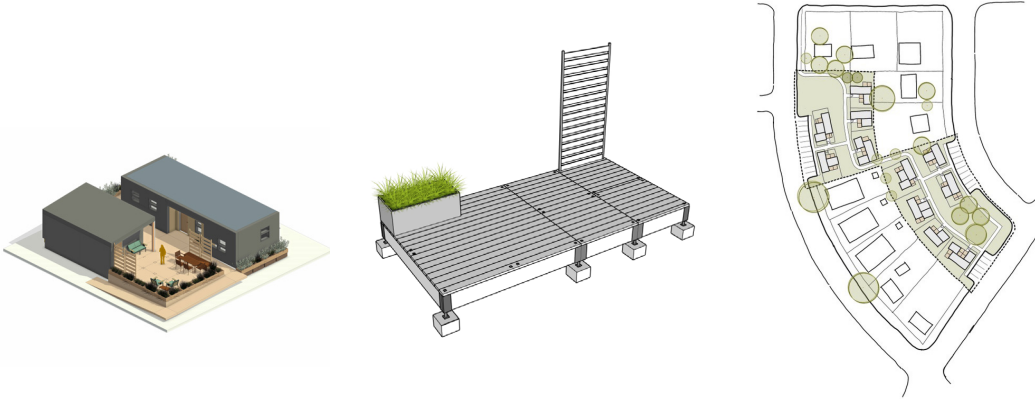
Nature of the Space

Conclusion

This study helps to identify exciting opportunities for innovation. The modular deck system helps to address the housing crisis through efficient fabrication and flexible integration into different environments. This design focuses on creating a modular deck system and considers the user experience by incorporating biophilia. This helps these modular homes to better integrate into their environment. Additionally, the deck system highlights an exciting opportunity for incorporating bus architecture. The flexibility of the bus architecture would allow people to customize their decks. They could pick and choose which landscape elements they wanted and place them on the deck. This allows each resident a sense of control over their environment while also providing a helping hand by specifying where the elements can attach to the deck. Users can personalize their deck system by selecting and organizing the landscape elements to create specific experiences.

To help people through this process, the landscape elements could be made into a product line with different base packages that residents could add to. I identified standard base packages and a process for creating positive outdoor experiences. The first step is to plan out the ground plane. This step includes organizing the deck system, identifying any stairs or ramp needs, and considering how a path would connect to the deck system. The second step is to choose the furniture. For this step, I have created categories of elements commonly used to create specific experiences. However, any landscape elements can be mixed and matched to create what the resident wants. The third step encourages the user to incorporate vegetation into this design. I can see the potential for this vegetation section to have different planting mixes to help users apply the three planting layers. Finally, the fourth step would be to offer additional amenities. These help further make each resident space unique and provide additional comfort elements. With the flexibility of bus architecture, additional elements could be implemented later as residents want to improve their outdoor spaces.

Innovative Housing Solutions + Modular Landscapes + Innovative Housing Organization



While these deck systems can be incorporated into any house, there is an opportunity to use this modular deck system in innovative housing solutions. Today, many modular home manufacturers are developing precise and efficient homes that decrease the cost of manufacturing. Additionally, people like Ross Chapin have begun to create innovative housing organizations where homes are clustered into small neighborhoods within neighborhoods (Chapin 2011). Pairing the ideas of prefabricated homes and pocket neighborhoods with modular landscapes creates exciting possibilities to address the housing crisis and create connected communities.

<<< Figure. 171. Innovative housing solutions with prefabrication.  
<< Figure. 172. Modular landscape's reconfigurability and bus architecture.  
< Figure. 173. Innovative housing organizations with pocket neighborhoods.

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Limitations and Future Research

The limitations of this design also describe exciting opportunities for future research.

The first limitation of this design occurred in the typology section. The 48 landscape elements represent a list of general forms rather than specific products within a product line. There is potential that other important landscape elements were not represented. A future study could address this by considering the different landscape elements and the standard forms in which they appear.

The second limitation of this design is the lack of a tangible product. This project has identified the potential for bus architecture and even created construction documents to understand how this could be built (see Appendix A). However, due to time and funding limitations, this deck system was not tested with actual materials. A future study could evaluate the potential application of a bus architecture deck system and identify all the components that could attach to the deck.

The third limitation of this design was the lack of a building design for the Salina, Kansas design. Since nobody on the Salina, Kansas design team was an architect, the buildings were highly conceptual. Because of this, the project could be further developed by architects who design the interiors of these modular homes. Despite this limitation, this design was able to show how it could be integrated into different sites.

Another limitation of this design is that it barely scratched the surface of missing middle housing and how to design cottage courts. There is potential for an exciting future study on how to scale modular housing units to different types of missing middle housing. This creates further opportunities to consider how these landscape elements can be implemented in different environments.

All the design strategies, especially the biophilic design strategies, have potential research opportunities in the future. For nature in the space, a study could evaluate the impact of vegetation on people's perceptions of the spaces around them. A similar study could explore natural analogs and assess the impact of people's perceptions of natural materials on paving and furniture. Further into natural analogs, future studies could focus on the impact of material texture on people's perceptions.

A study could also compare the ground plane, furniture, and vegetation to determine which has the most significant impact on outdoor spaces. Another potential future study could focus on the materials' texture within the three base categories. This study would identify where adding natural texture is most impactful. These future studies have exciting potential that could be missing middle housing options and make housing more affordable through prefabricated construction and compact site layout.

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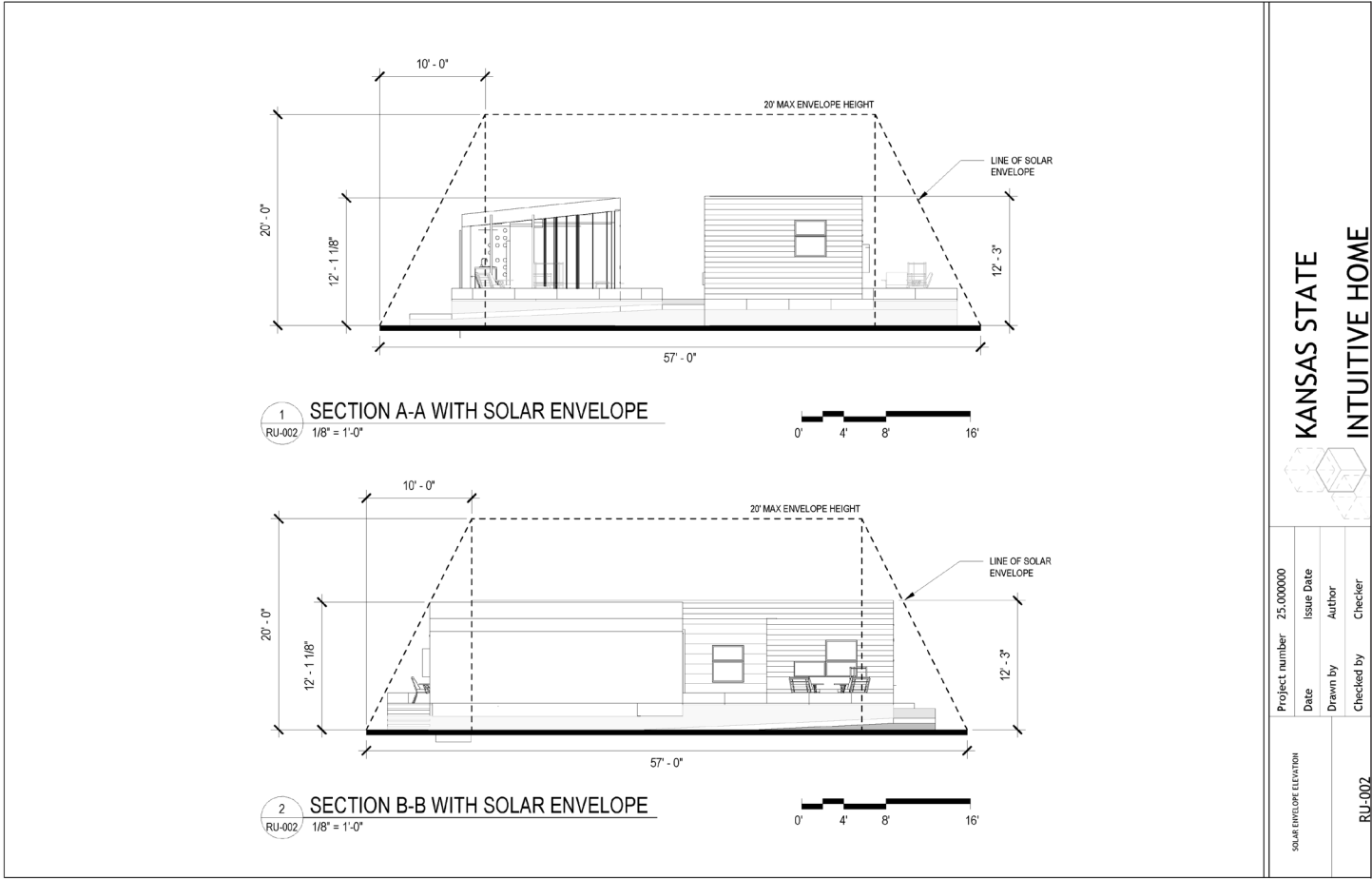
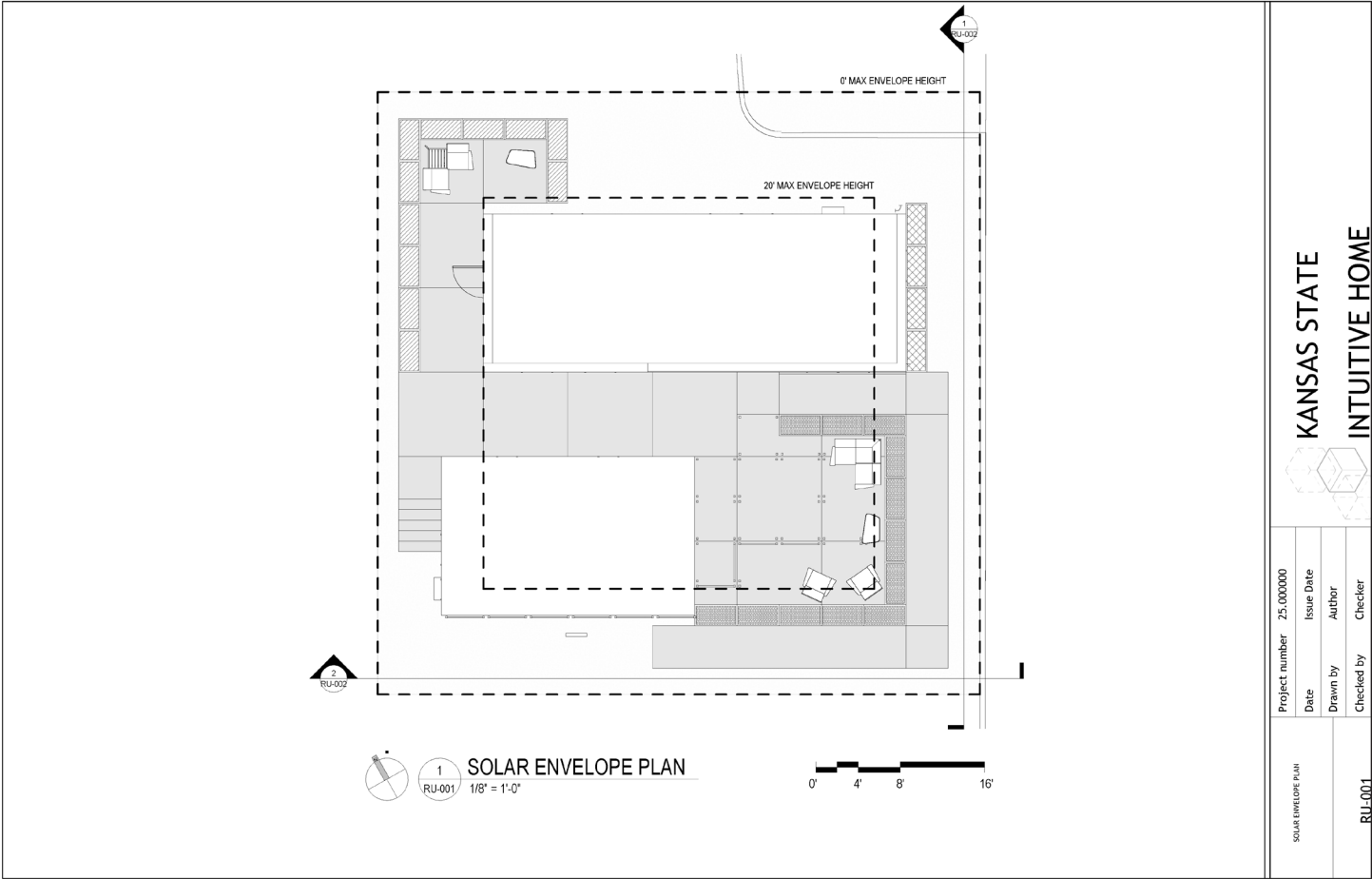
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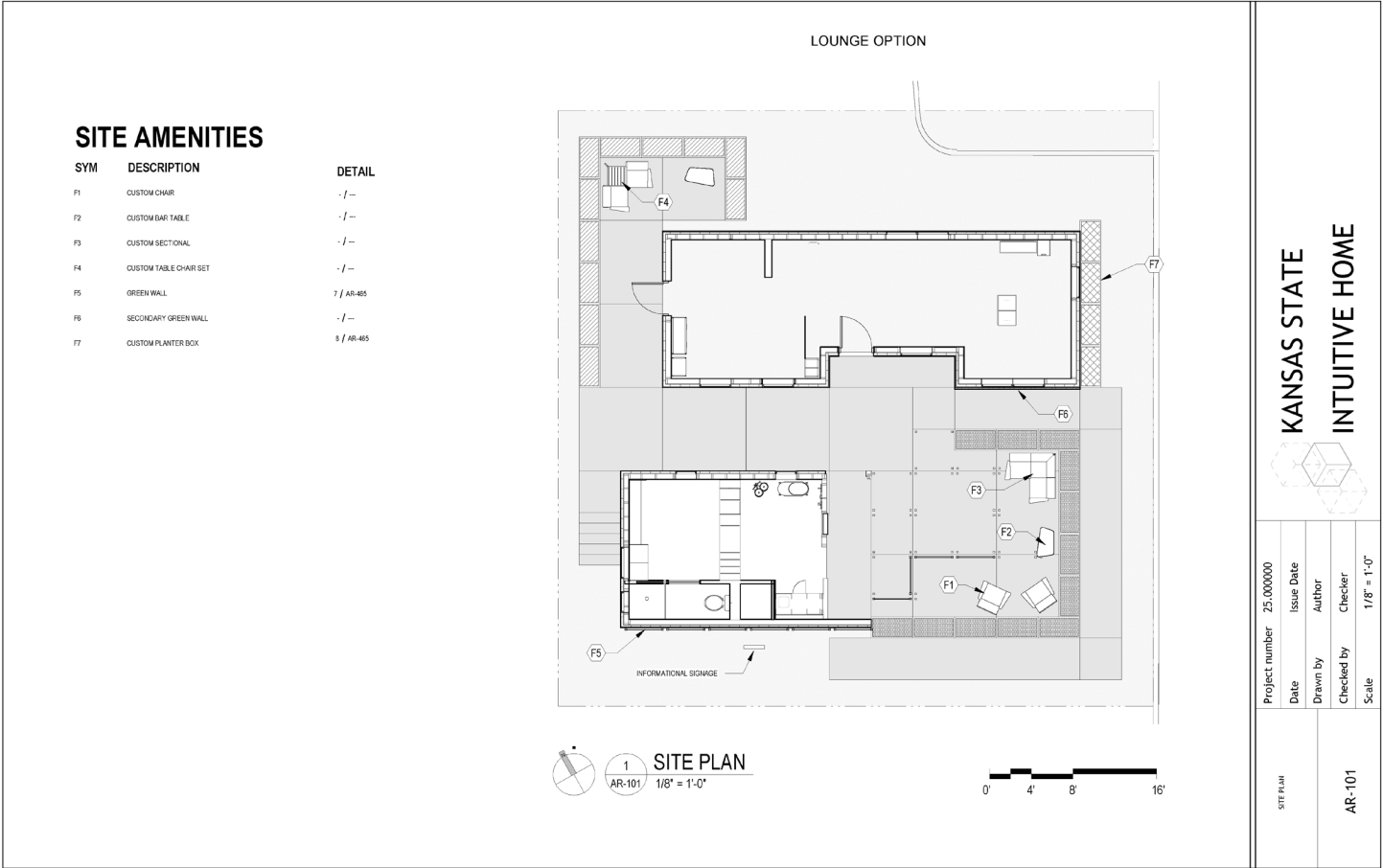
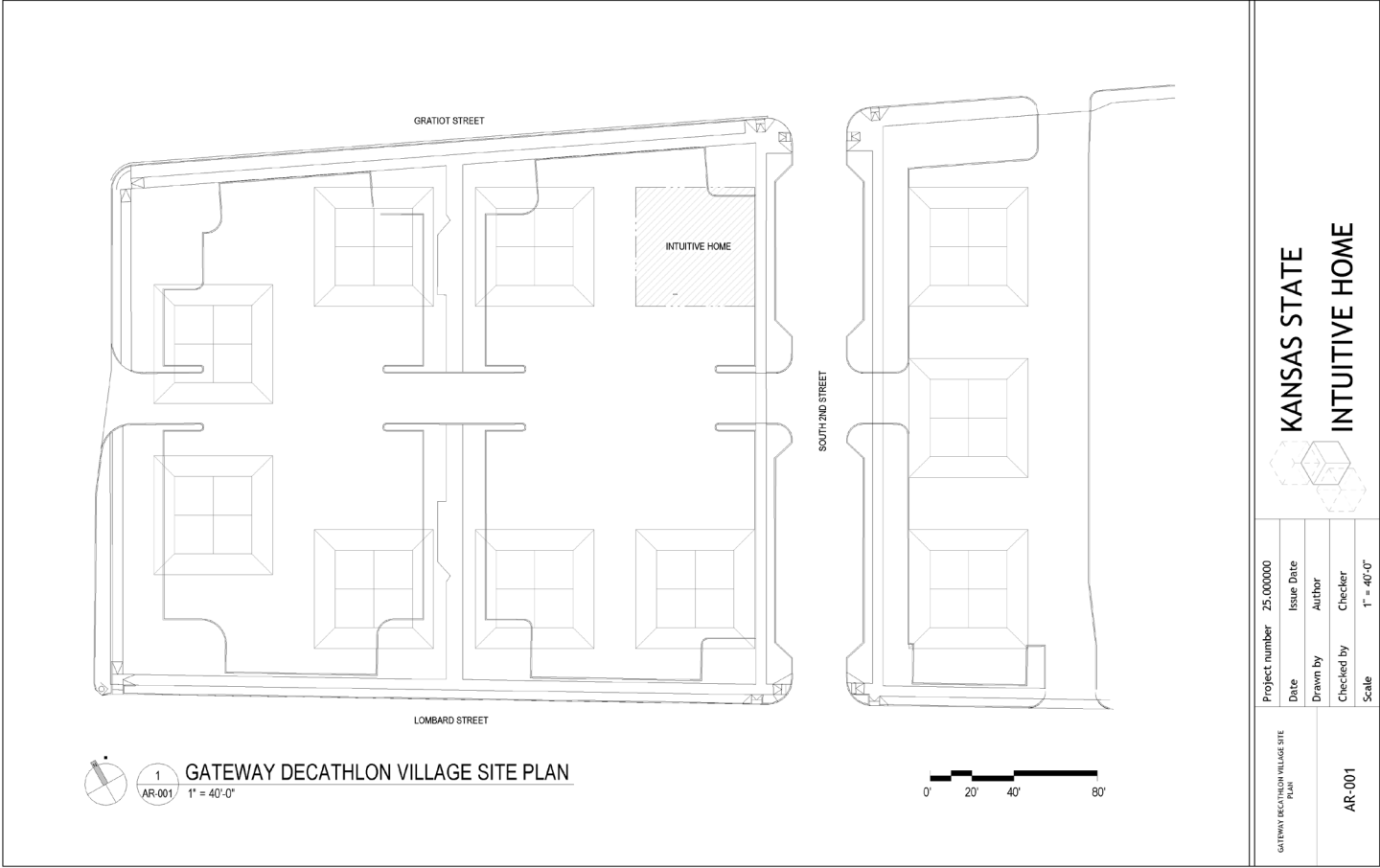
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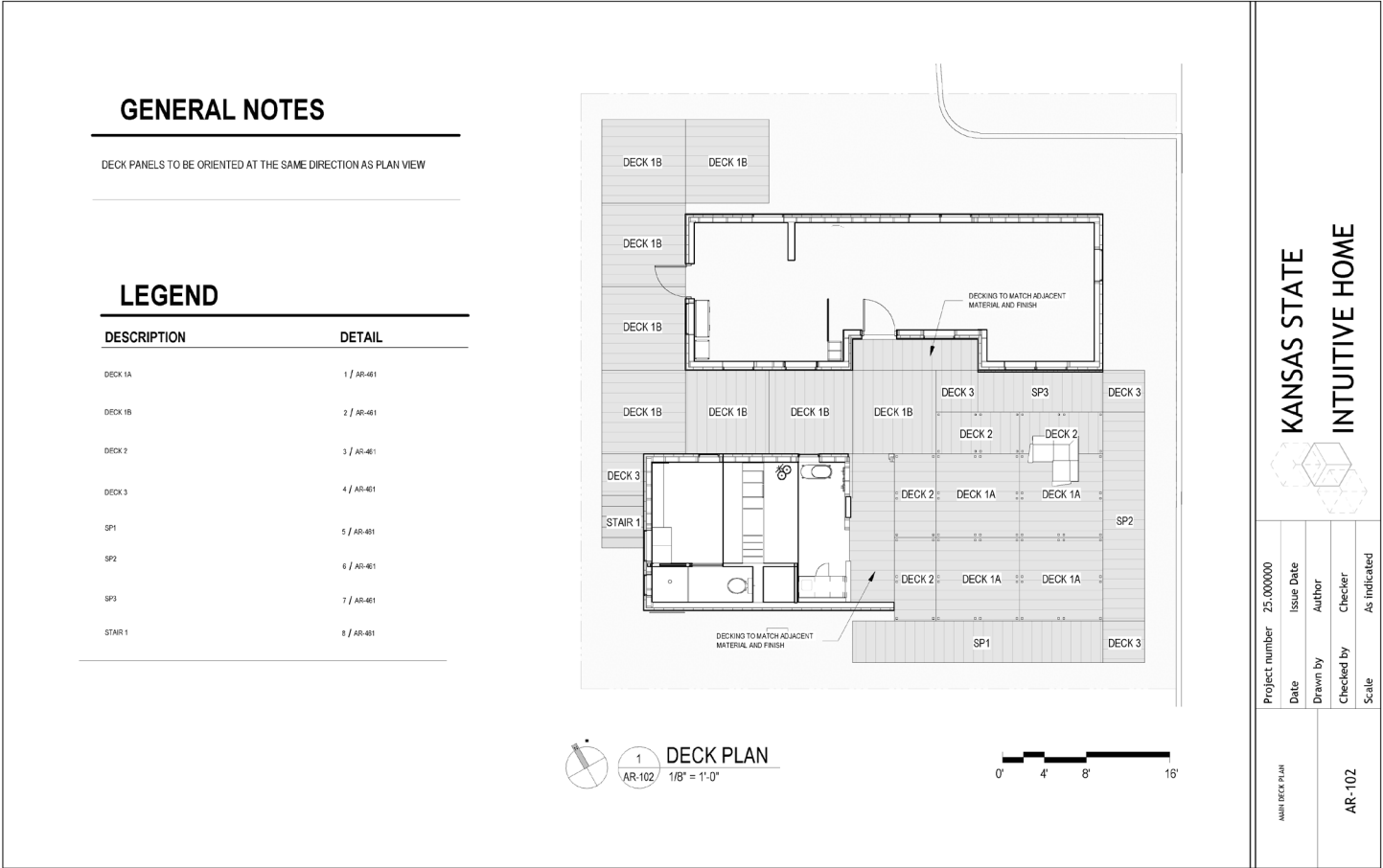
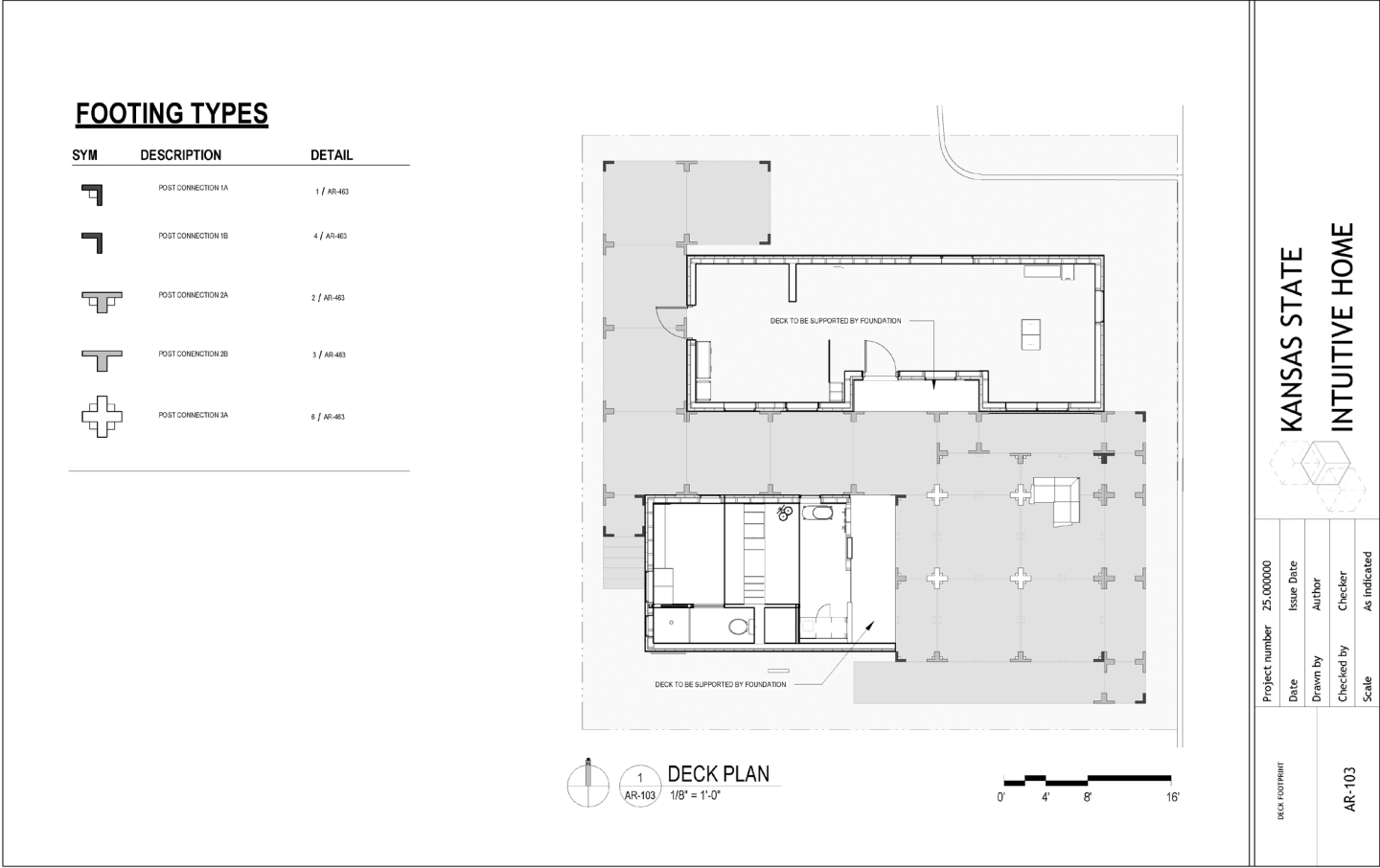
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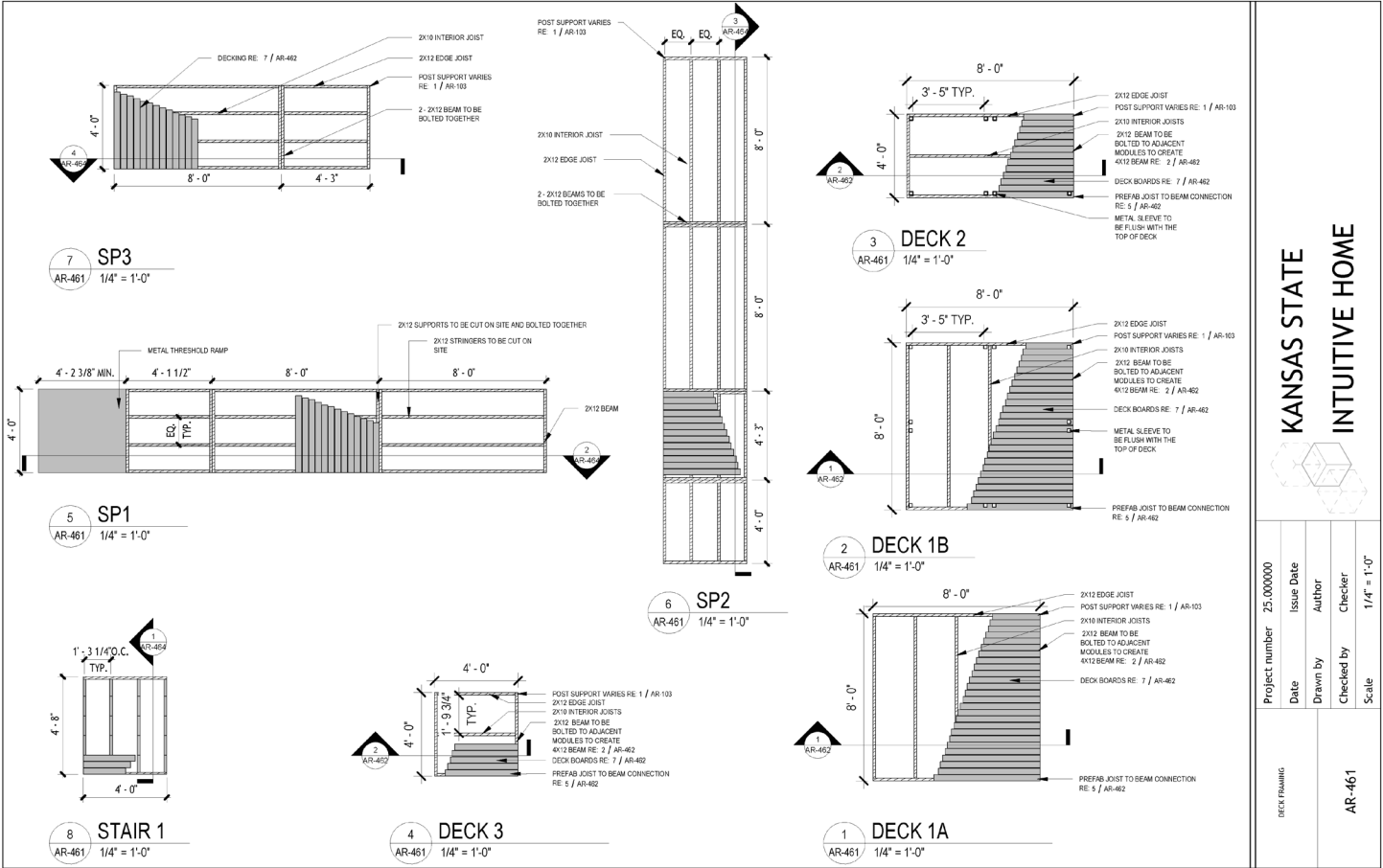
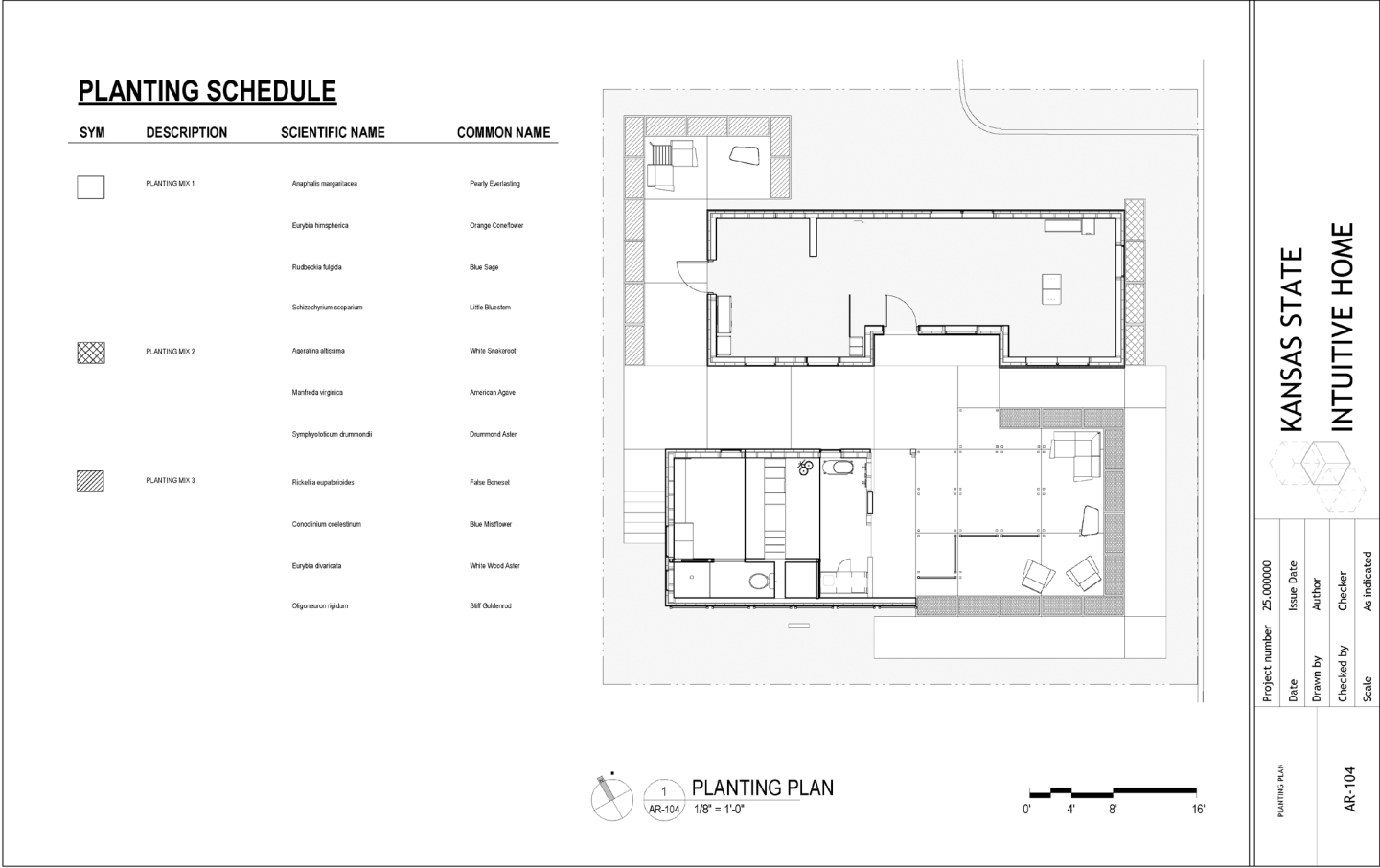


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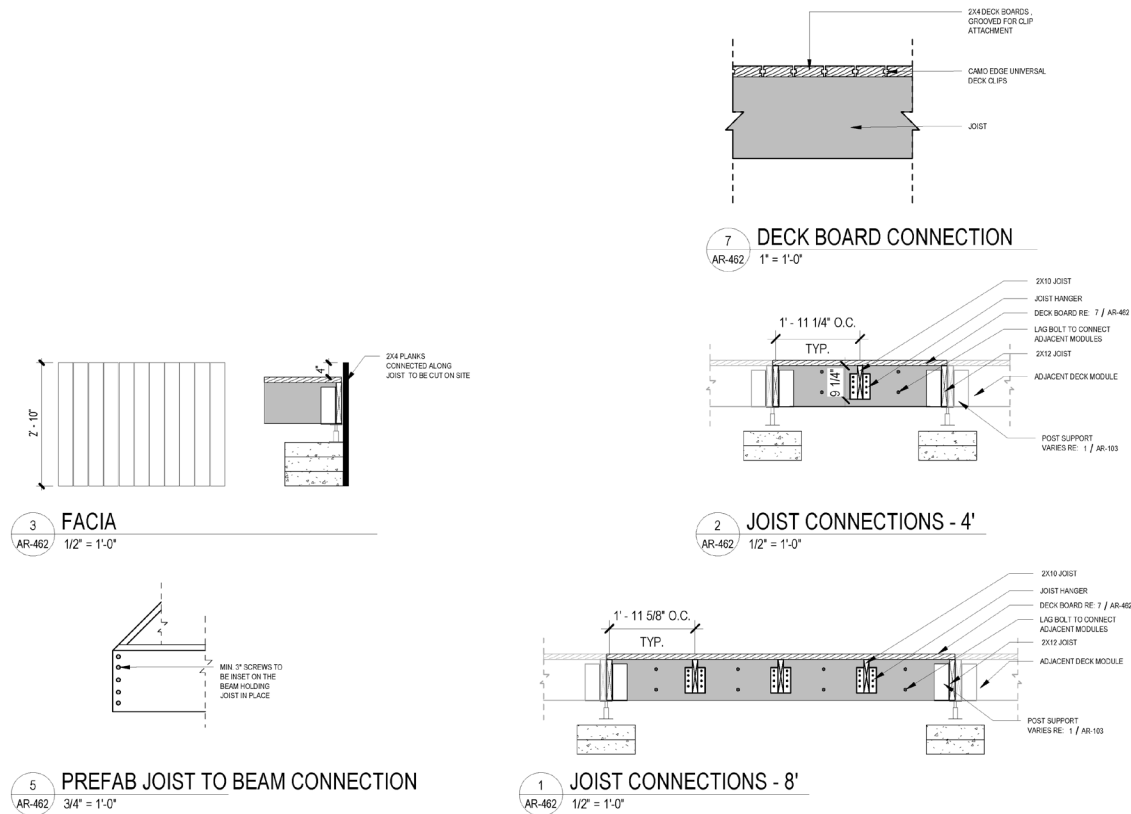
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MAIN DECK PLAN

AR-102

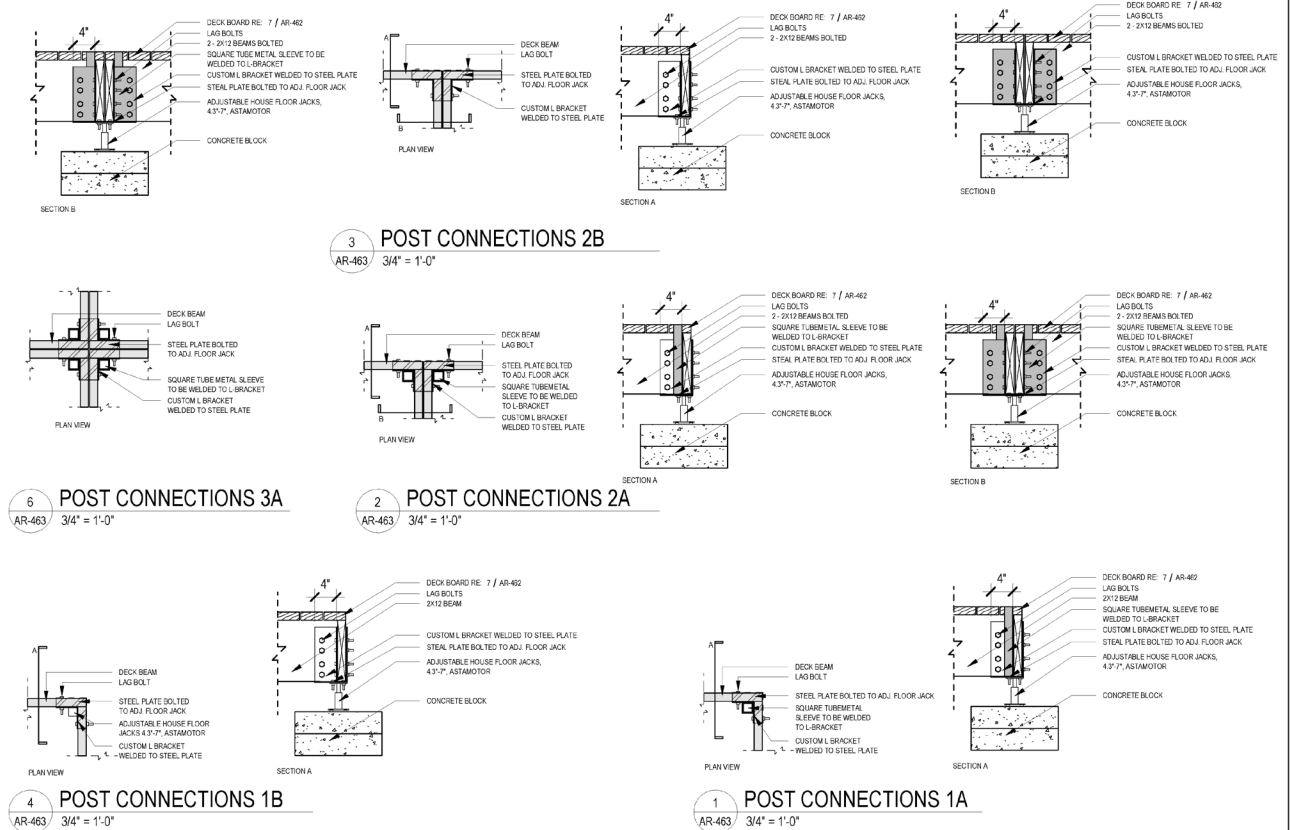






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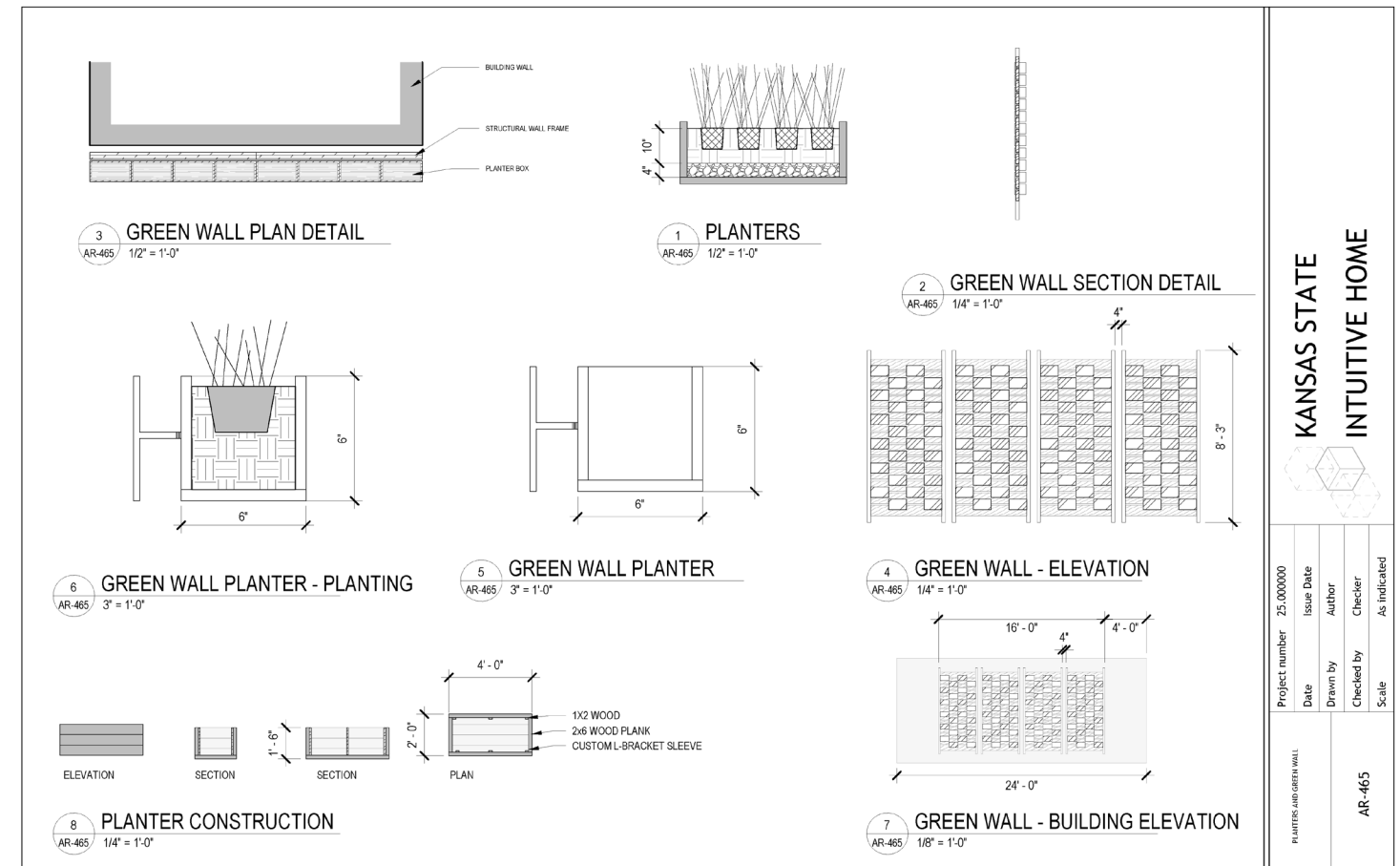
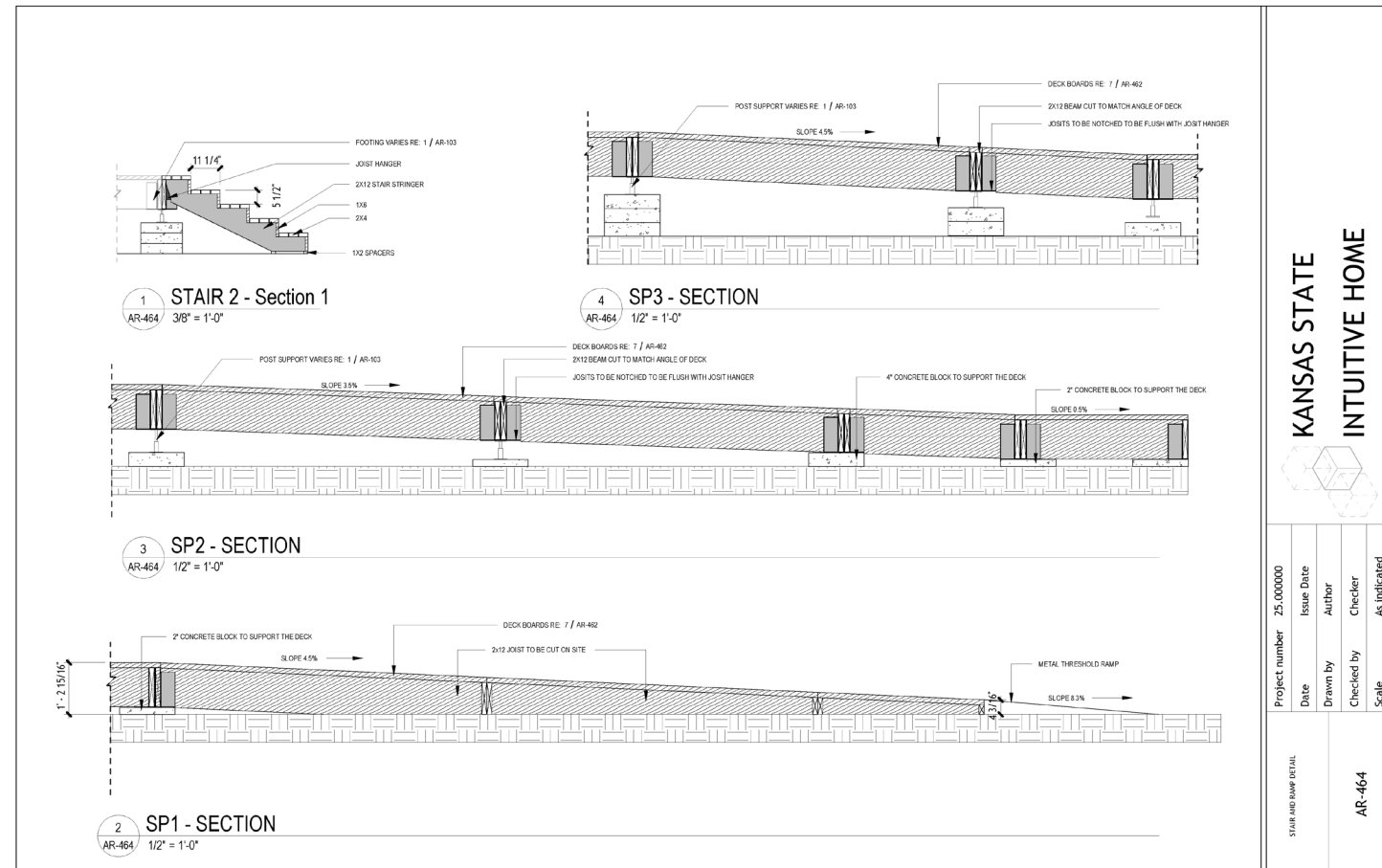
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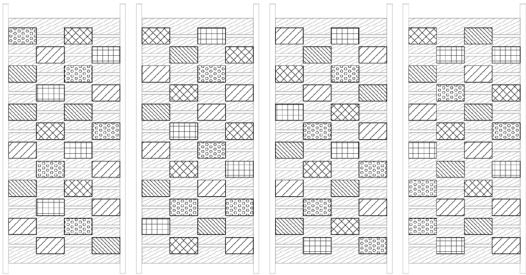
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AR-463



PLANTING SCHEDULE

| SYM | SCIENTIFIC NAME           | COMMON NAME         |
|-----|---------------------------|---------------------|
|     | Callitriche involucrata   | Purple Poppy Mallow |
|     | Euphorbia corollata       | Flowering Spurge    |
|     | Gaum t. triflorum         | Prairie Smoke       |
|     | Symphoricarpos albobaccus | Aronia arbutifolia  |
|     | Zinnia grandiflora        | Prairie Zinnia      |



1 GREEN WALL - PLANTING SMALL MOD  
3/8" = 1'-0"



KANSAS STATE  
INTUITIVE HOME

|                     |                |              |
|---------------------|----------------|--------------|
| GREEN WALL PLANTING | Project number | 25.000000    |
|                     | Date           | Issue Date   |
|                     | Drawn by       | Author       |
|                     | Checked by     | Checker      |
|                     | Scale          | As indicated |
| AR-466              |                |              |