THE RANGER STATION AT PANDAPAS POND:
INHABITING AN EDGE

InHabit

InHabit

Introduction:

InHabit is a project designed with the understanding that a person is innately connected with nature. Once immersed in that nature, the person becomes aware of their surroundings and begins to connect with and inhabit the space.

In nature, animals, plants, fungi, all inhabit a specific place, a niche within the greater context of the natural environment. This concept of a niche can be extended to the placement and the aesthetics of a building.

Design should be responsive to the context or site in which it is placed. This context is the niche in which the building thrives. In this case, the building is a walkway, a connection between locations, a method of transport, but also of safety and protection.

Can we inhabit the place created by the need to remain connected? Also, how does a building respond to the site and adapt to its respective niche?

Welcome to InHabit.

Project Submittal

The Ranger Station at Pandapas Pond: Inhabiting an Edge

This Thesis project submittal to the faculty of Virginia Polytechnic Institute + State University is in partial fulfillment of the requirements for the degree of Master's of Science in Architecture.

Keywords:

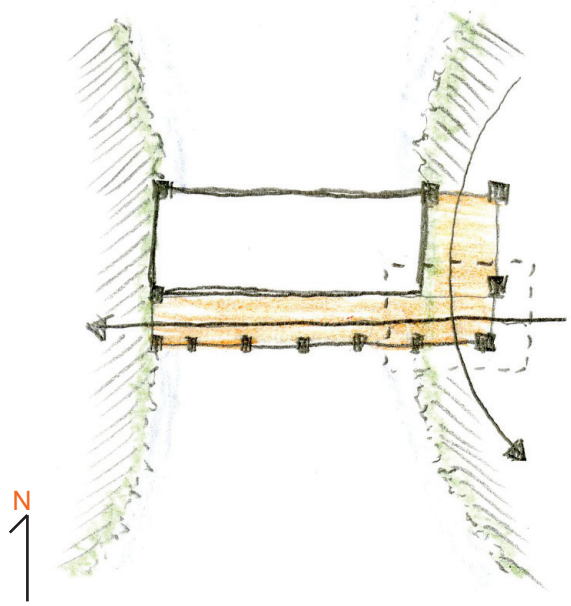
Bay, Dimensional Lumber, Environmental Design, Glu-laminated Beams, Human Scale, Material, Module, Modularity, Modular wall, Pallet, Parallel Frames, Ranger Station, Reclaimed Materials,

Abstract:

This thesis work is the continuation of an intervention into the reuse of pallets that are common in construction. A system of bays for a parallel frame design will use these pallets as a diaphragm and as modules to create space. This shell will create an environment at the scale of the user, such that form is in response to the user, the context, and the module.

Thesis Student

Primary Advisor



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Thesis Statement:

InHabit is at its core a response to the environment. While its form is geometric, other elements respond directly ot the conditions of the site.

The success of this type of response is often measured in the quality of one's connection to nature. In this instance the ranger station as a walkway is meant to serve as a connection to the community and as a connection to nature.

Program:

Ranger Station

The intervention must be able to not only provide a place for a Forest Service Ranger to work, but also allow for the movement of visitors along the existing trail.

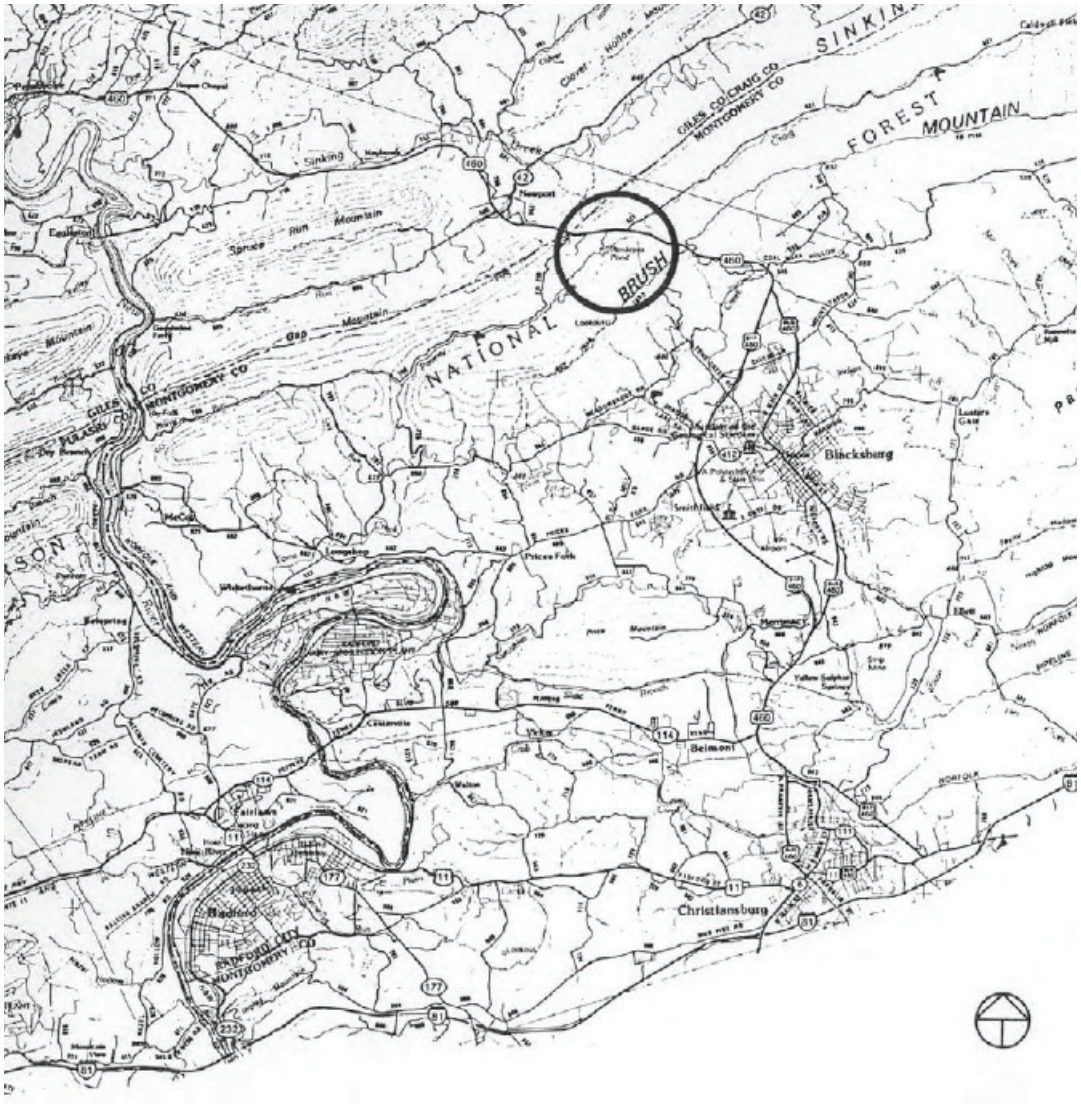
These two spaces must interact with each other, but not interfere with the ability of each to serve its function. Even though the park closes at dusk, the space is designed for short-term overnight stay.

Overall Footprint of station: 304ft^2
Overall Footprint of walkway: 800ft^2

Necessary Rooms and Footages:

Enclosed Units	96ft^2 each
Circulation	592ft^2
Bathroom	96ft^2

Site Description: Placement Options



PANDAPAS POND
LOCATION

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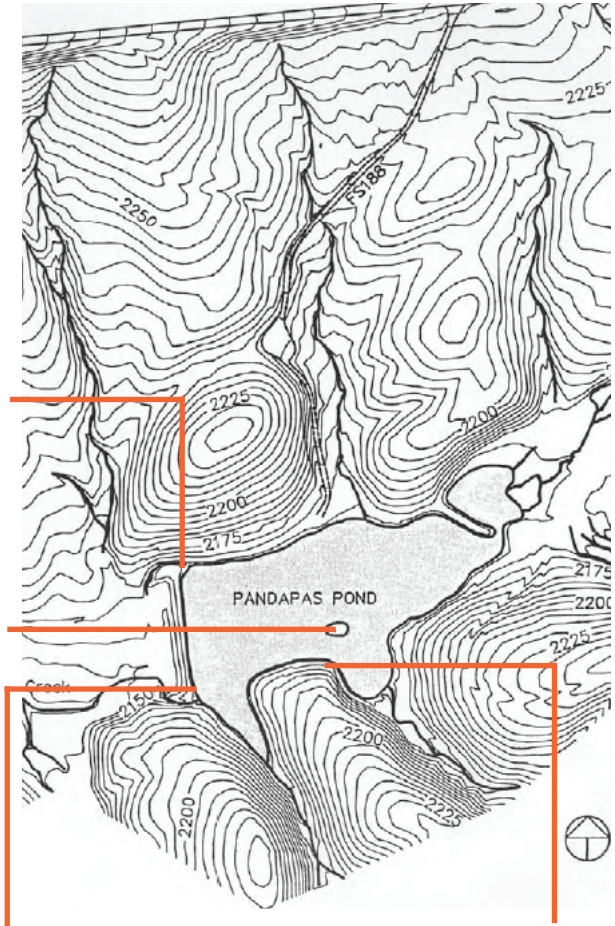
DESCRIPTION:

Information from the United States Forest Service (USFS) locates Pandapas Pond in the George Washington and Jefferson National Forest in Virginia.

The site was originally developed to function as an economic development, rather than a natural park. The land was sold to the USFS on the condition that it would serve as a recreational area for the surrounding community. The area gradually evolved from an ecological trail to the network of trails and picnic areas today.

According to a study completed by the USFS, the area is expected to have a population of about 300,000 within a one hour radius of the site, but is not expected to attract visitors outside of a 15 mile radius. Therefore, the park will have many visitors, but not be overwhelmed and over-trafficked.



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Description:

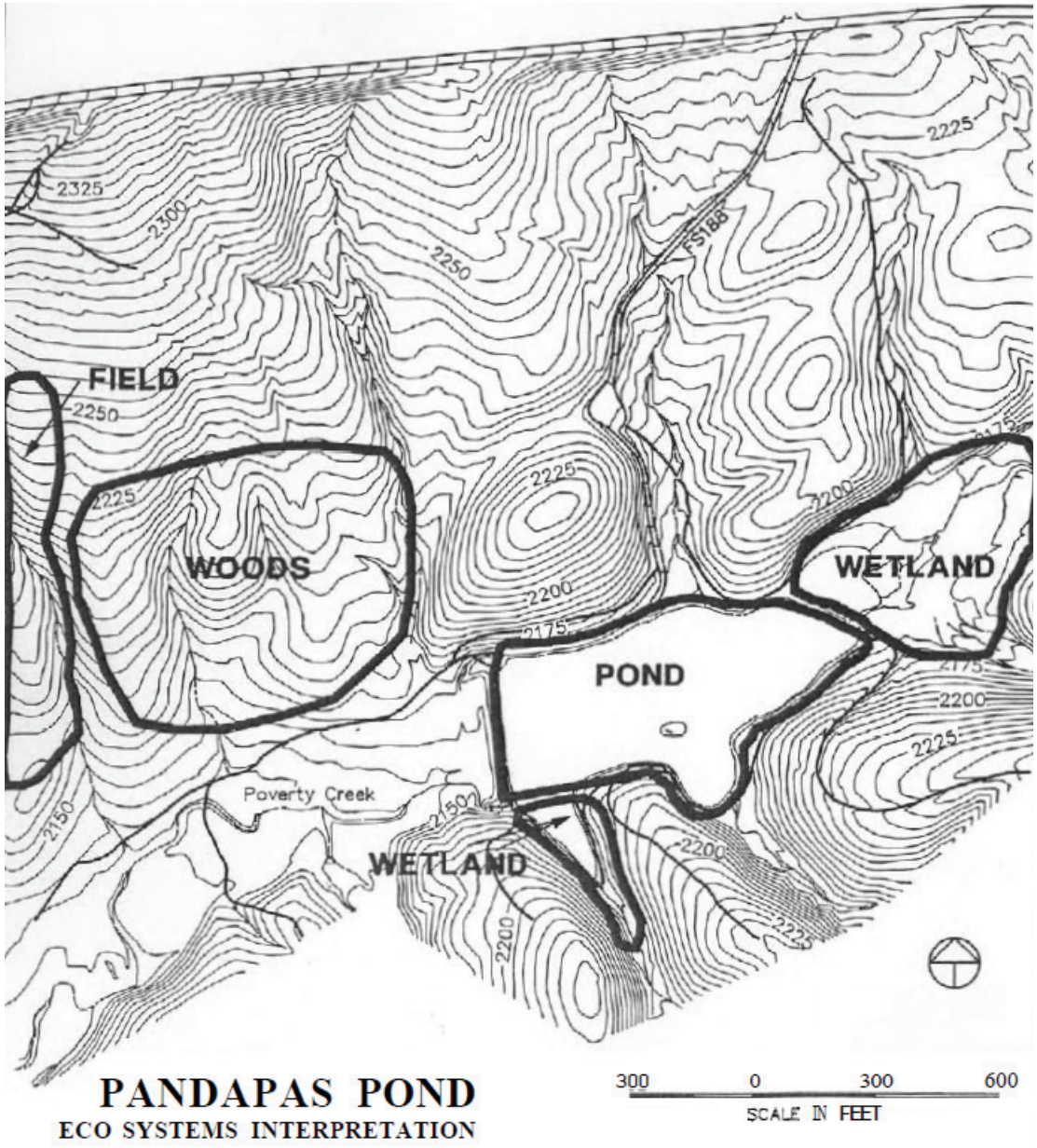
The site is a man-made lake nestled between two ridge lines. As such, the south faces of the ridges receive much of the sun and cast shadows upon the north facing slopes.

In the main portion of Pandapas pond there is an island covered in undergrowth. The project will serve as a ranger station looking out over the water towards the island, marking the edge of the pond.

During the warmer parts of the year, it allows for large amounts of lilies to grow on the surface of the pond. During the winter these lilies die off, clearing the surface of the lake.

There are two main areas, the wetlands to the northeast and the pond to the southwest.

To the left there are multiple views of the island as well as a picture of the spillway in the northwest portion of the pond.



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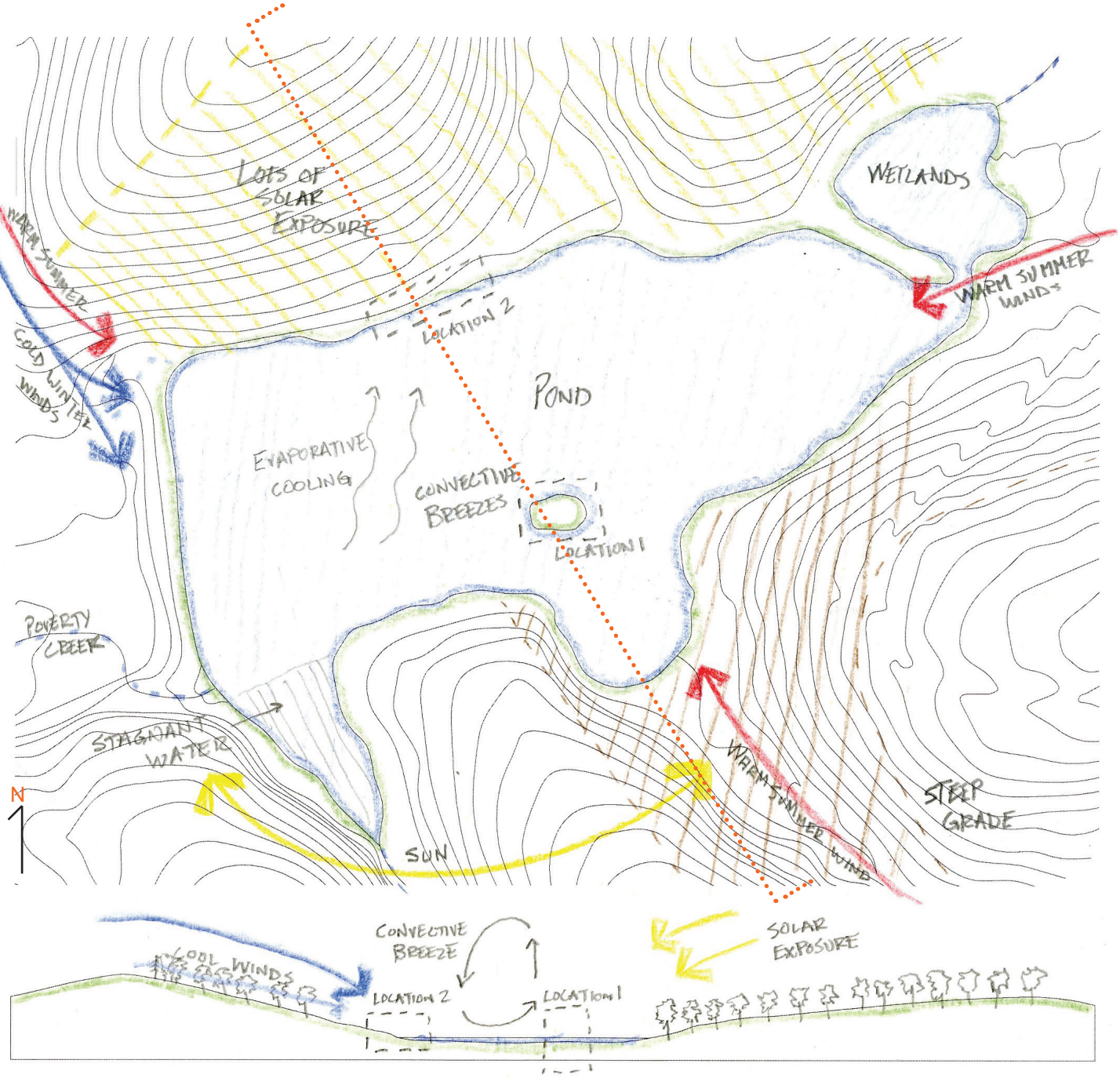
Description:

Pandapas is in close proximity to Virginia Tech and provides an opportunity for recreational, educational and scientific exploration.

When referring to the niche environments that both animals and the building will need to adapt to, Pandapas has four unique environments: two wetland areas, the main pond, woods, and an open field. These four areas can be seen in the image to the left, outlined in black.

The flow of water travels from the wetlands into the pond and then out the spillways to Poverty Creek. This flow is not strong or fast, but keeps the water from stagnating.

The ranger station will be placed somewhere in the vicinity of the main pond and will need to respond to the conditions of the micro-climate as well.



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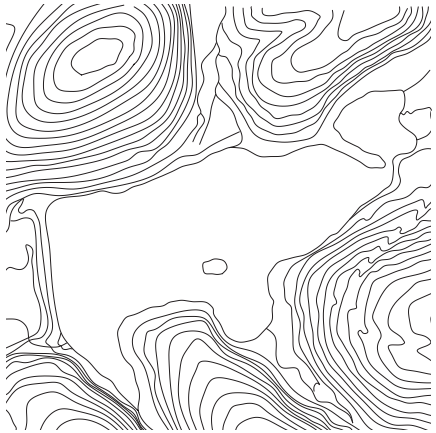
Description:

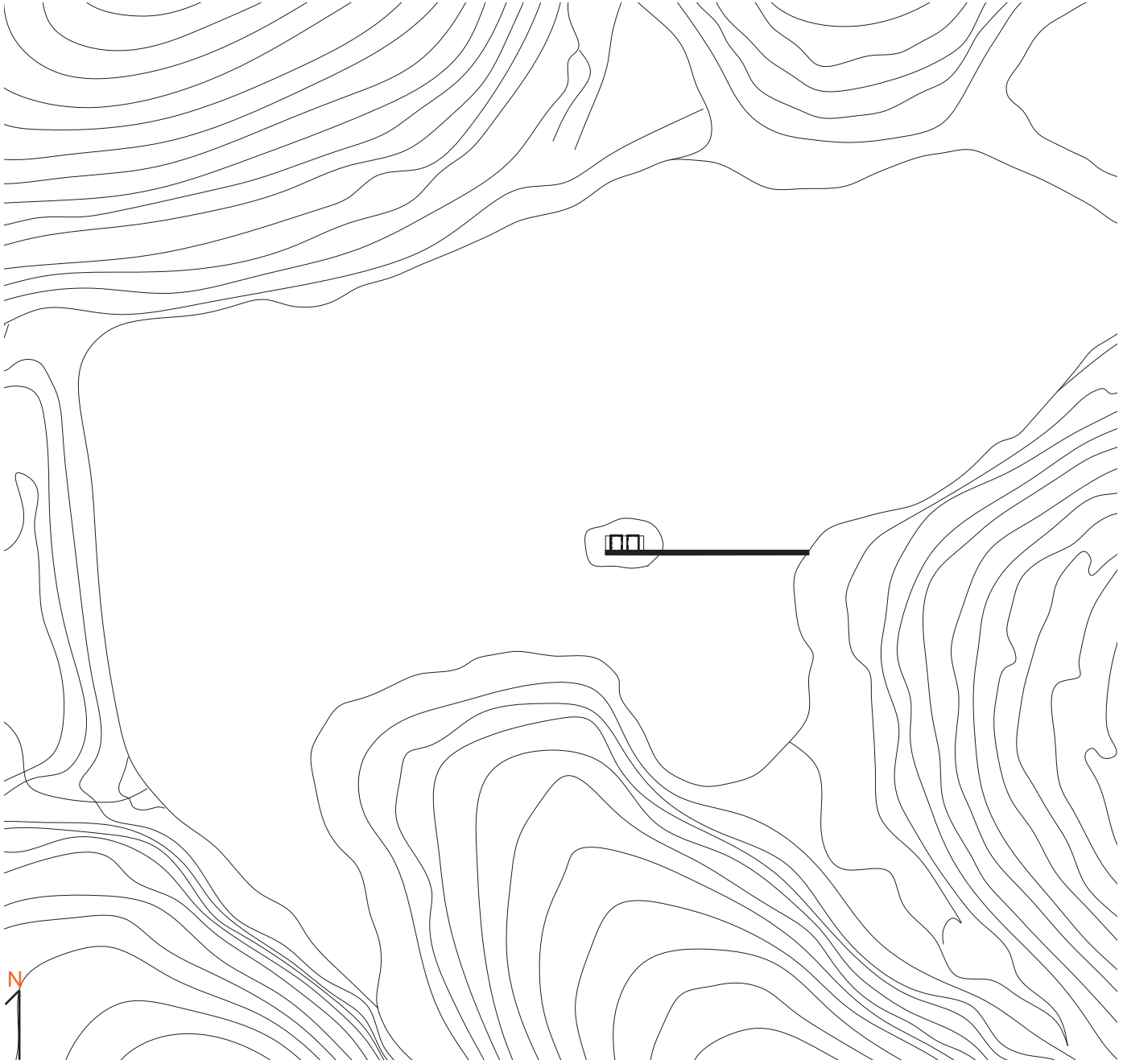
This is the analysis of the site before the intervention of the ranger station.

The topography alters the standard wind pattern for the area. Summer winds from the southeast also come from the east northeast. The topography also casts long shadows onto the pond, which will help guide the location of the project based on the need to incorporate passive solar into the design.

Also admitting summer breezes but blocking clod winter winds will need to be reflected in the placement and design of the structure.

The location of the ranger station needs to be highly visible and serve as a landmark on the pond.





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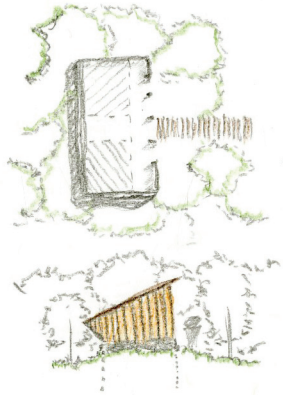
Description: Site Option 1

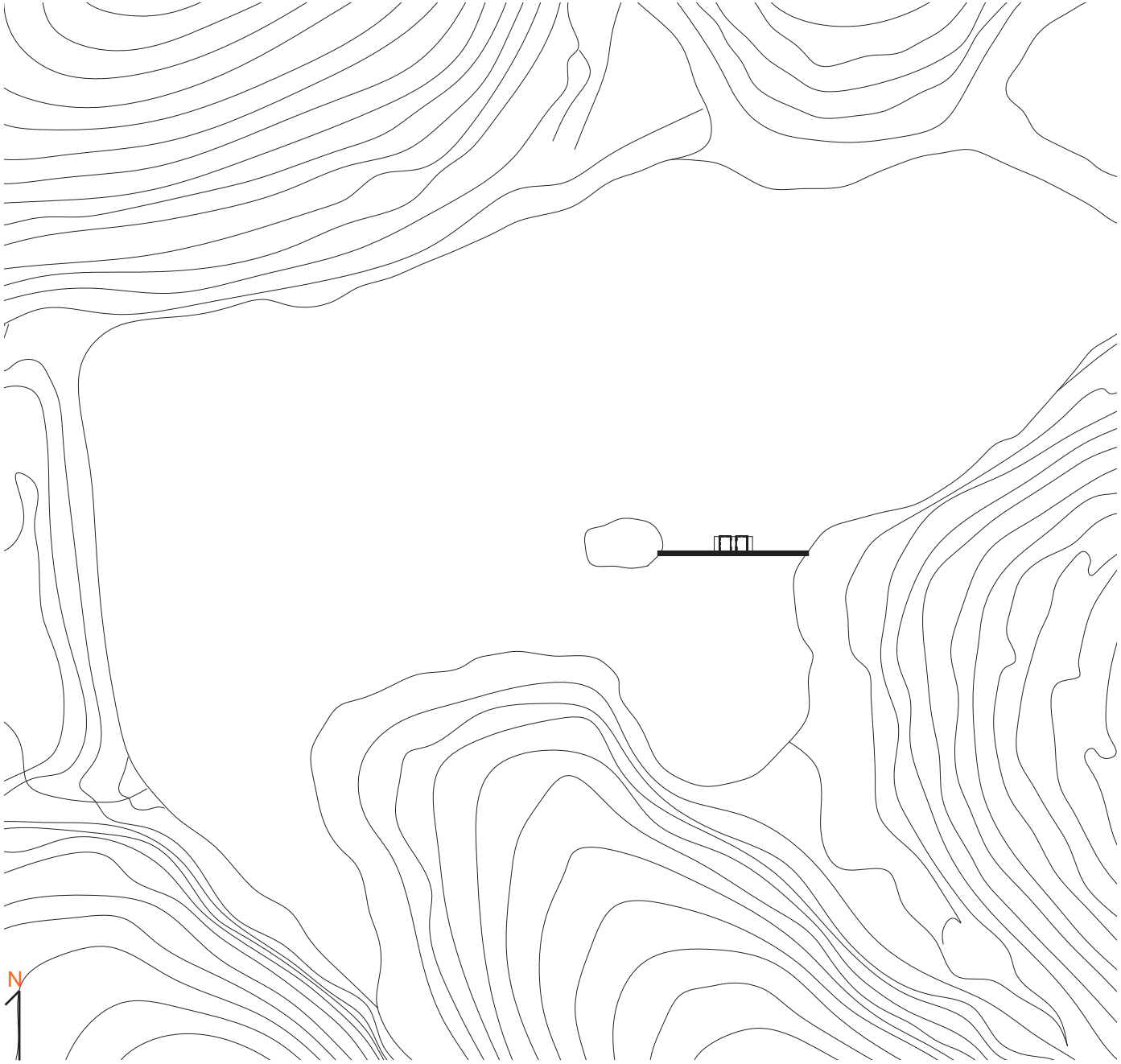
The first option would be to place the ranger station directly onto the island in the main part of the lake.

This would make the ranger station a prominent feature of the view when entering the site. It would become a landmark and a destination for visitors walking around the lake.

The island is shaded by the northern slopes which makes it difficult for solar strategies to be implemented.

Furthermore the island is the nesting site for geese and other birds which does not make the island a viable location.





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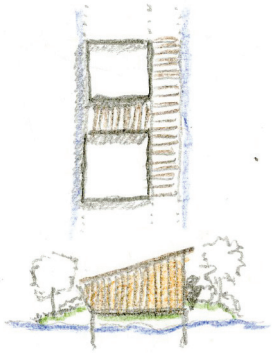
Description: Site Option 2

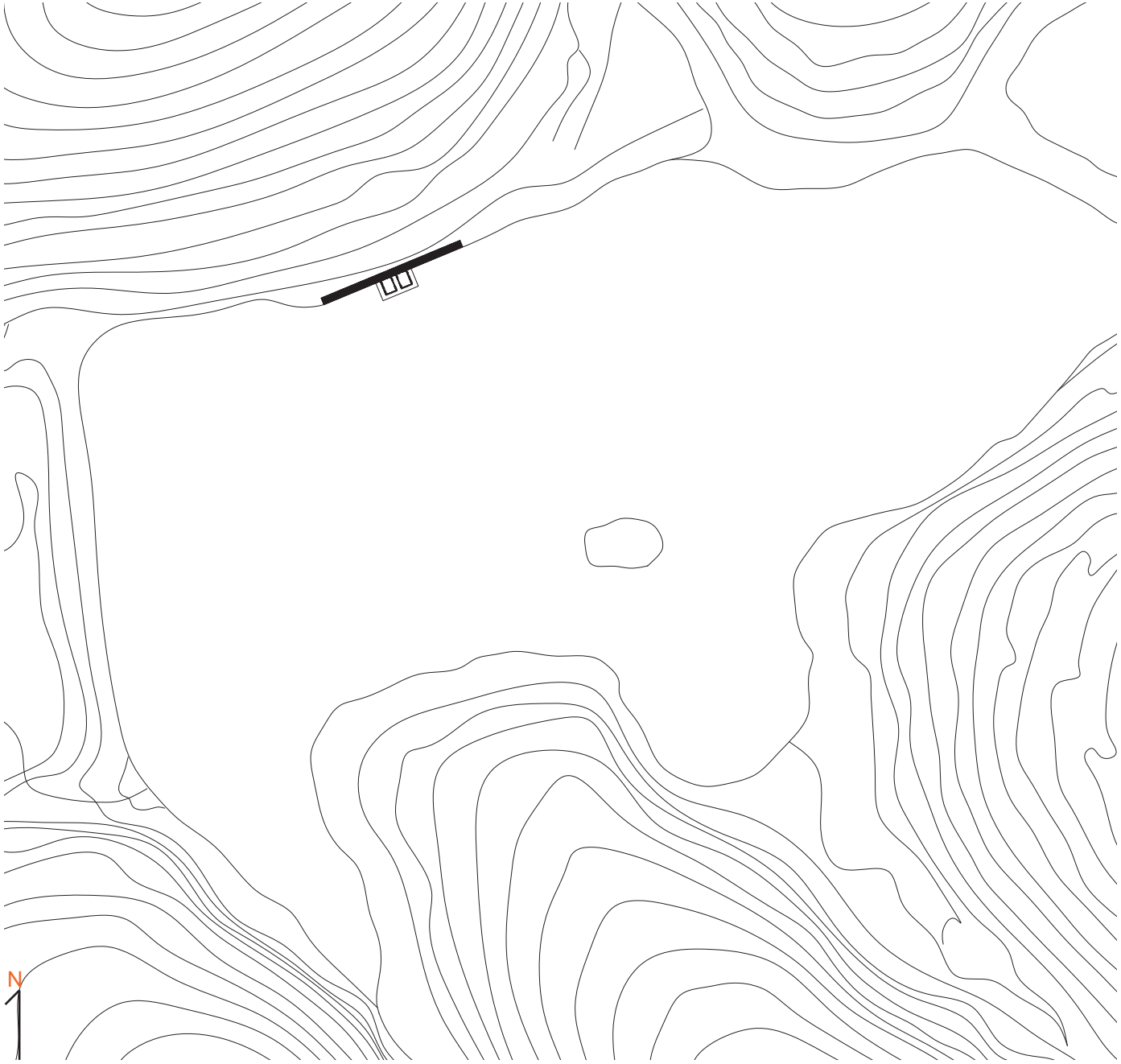
The second option would be to place a bridge to connect the island to pond edge.

The ranger station would then be a set of modular units along the length of the bridge. These units could be added to over time as the program of the ranger station expanded.

The station is taken off of the island. However, its location could hide it from view behind the island. Also, the ranger station is still shaded by the northern slopes, making solar strategies difficult.

While the station no longer directly interferes with the nesting sites on the island, solar techniques are not as effective. Therefore the location is improved, but not ideal.





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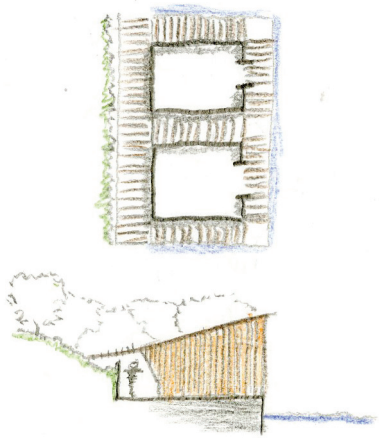
Description: Site Option 3

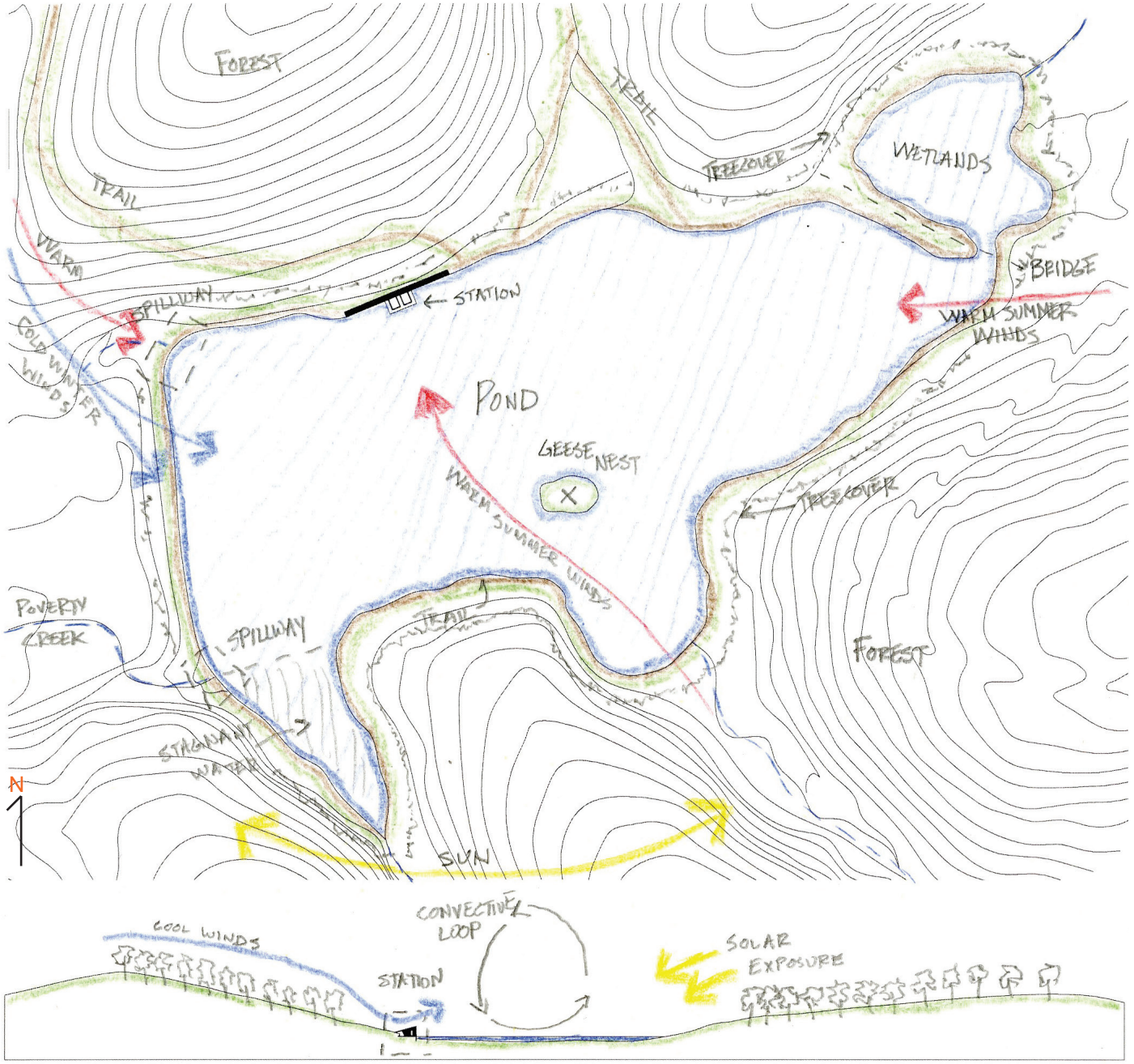
The third option for the ranger station would be along northern shoreline of the main pond, between the two entrances from the lower parking lot.

This location does not interfere with the nesting and is neither hidden by the island nor shaded by the northern slopes, allowing for passive solar techniques. This location allows for the station to be bermed in to the hill, winds from west-northwest are blocked, rolling off the roof of the structure and allows for glazing to the southeast.

Since the shoreline is relatively straight, and uses the path as a circulation corridor, the site allows for the later expansion of the station if the program expands.



Site Analysis:
An Intervention Along the Edge



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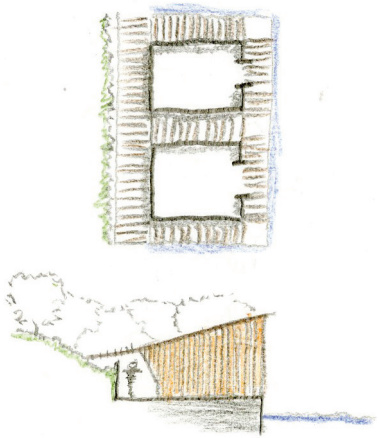
DESCRIPTION:

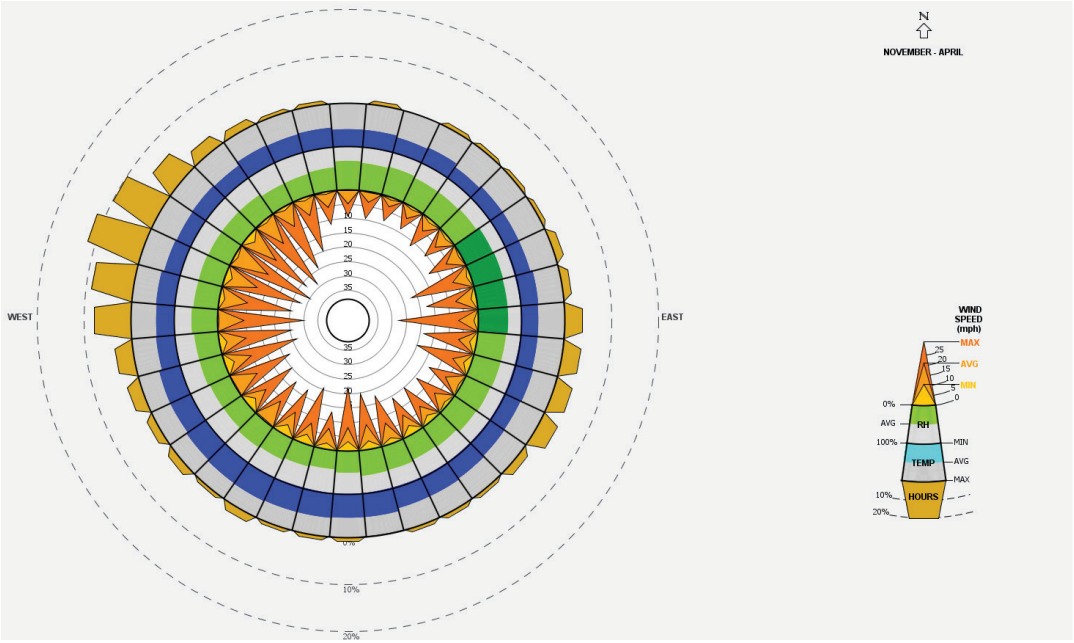
This is the analysis of the site with the ranger station placed along the edge of the pond.

With the station placed along the edge it looks out over the lake, greets the visitors, and uses south-east glazing for passive solar techniques. The orientation also allows for evaporative cooling from off the pond

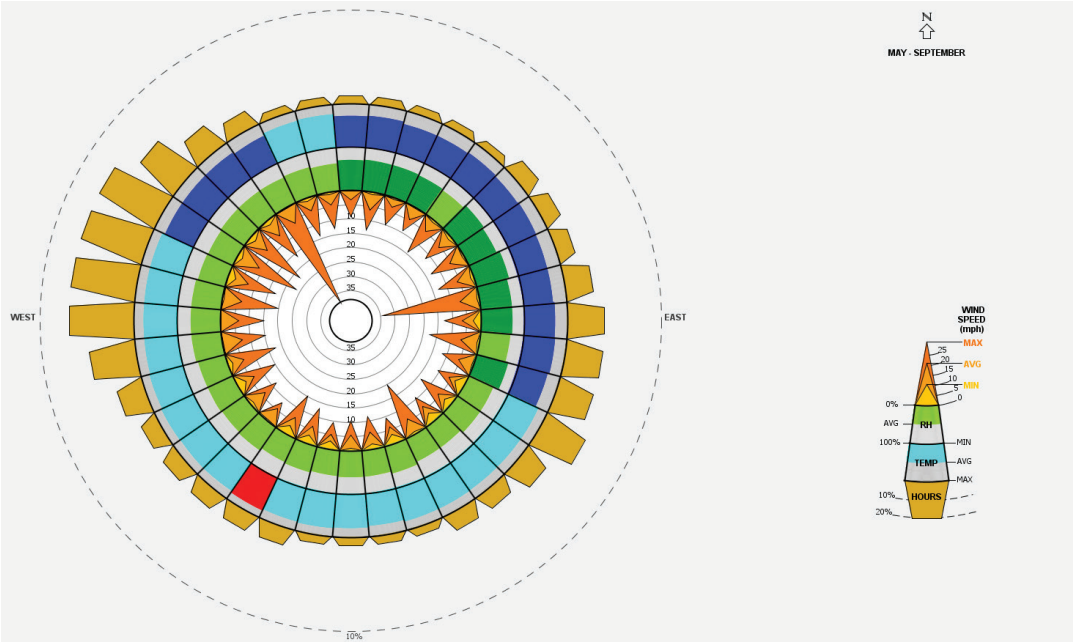
This design using modules as different rooms maintains a smaller scale of structure, and allows for an interface or connection between the visitors, the ranger and nature.

The circulation of the existing trail becomes a part of the station, and walkways around the modules allow visitors approach the station during a typical walk around the pond.





Winter Wind Rose



Summer Wind Rose

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Description:

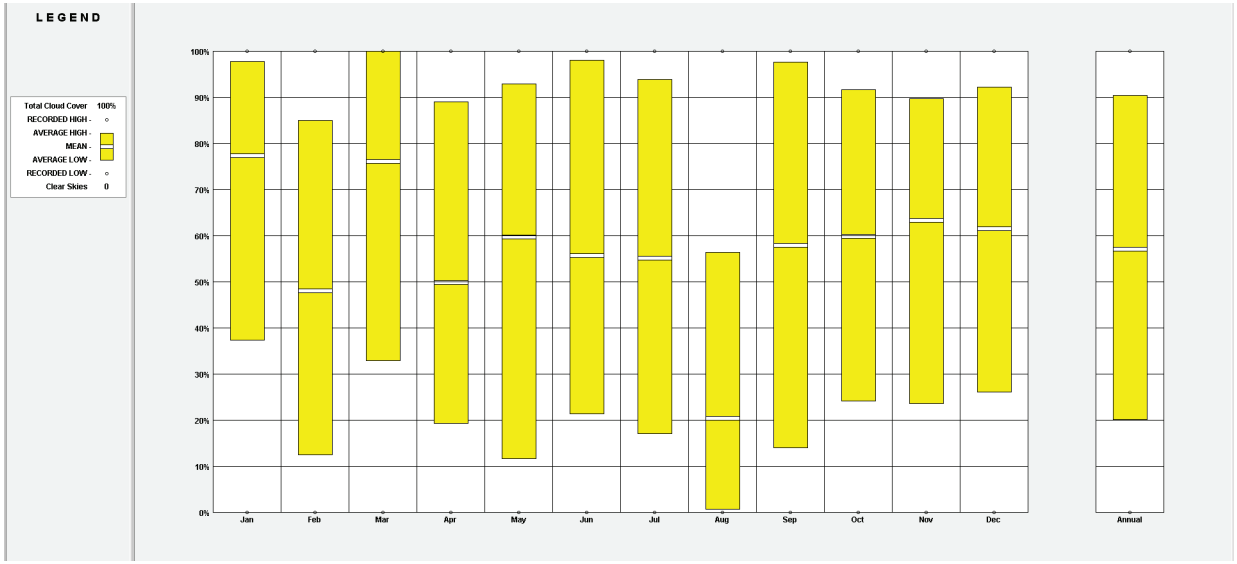
One of the two main techniques that will be implemented in the ranger station will be the use of natural ventilation.

In the winter, the wind mainly comes from the west-northwest. These winds are not desirable and will need to be designed for and mitigated. Some techniques include windbreaks and berming.

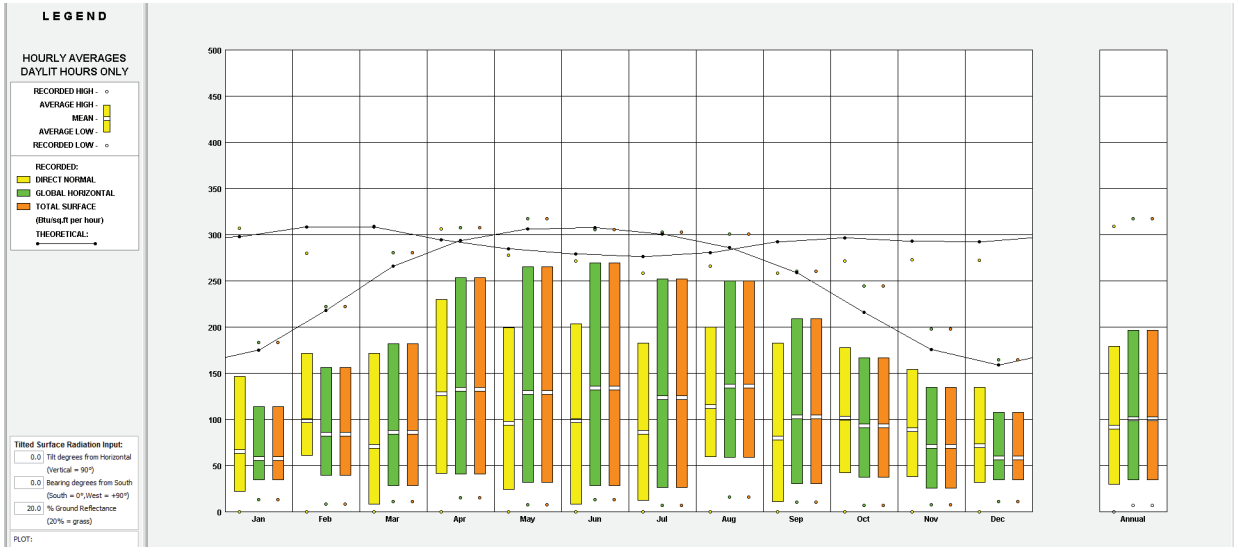
In the summer, the wind still comes from the west-northwest, but also from the southeast. These southeasterly winds are desirable in the summer in order to cool and provide natural ventilation for the structure.

This natural ventilation can also be supplemented by forced convection with fans.

These winds also have a large amount of relative humidity. However, we can still use the water of the pond as a source of evaporative cooling.



Sky Cover Range



Radiation Range

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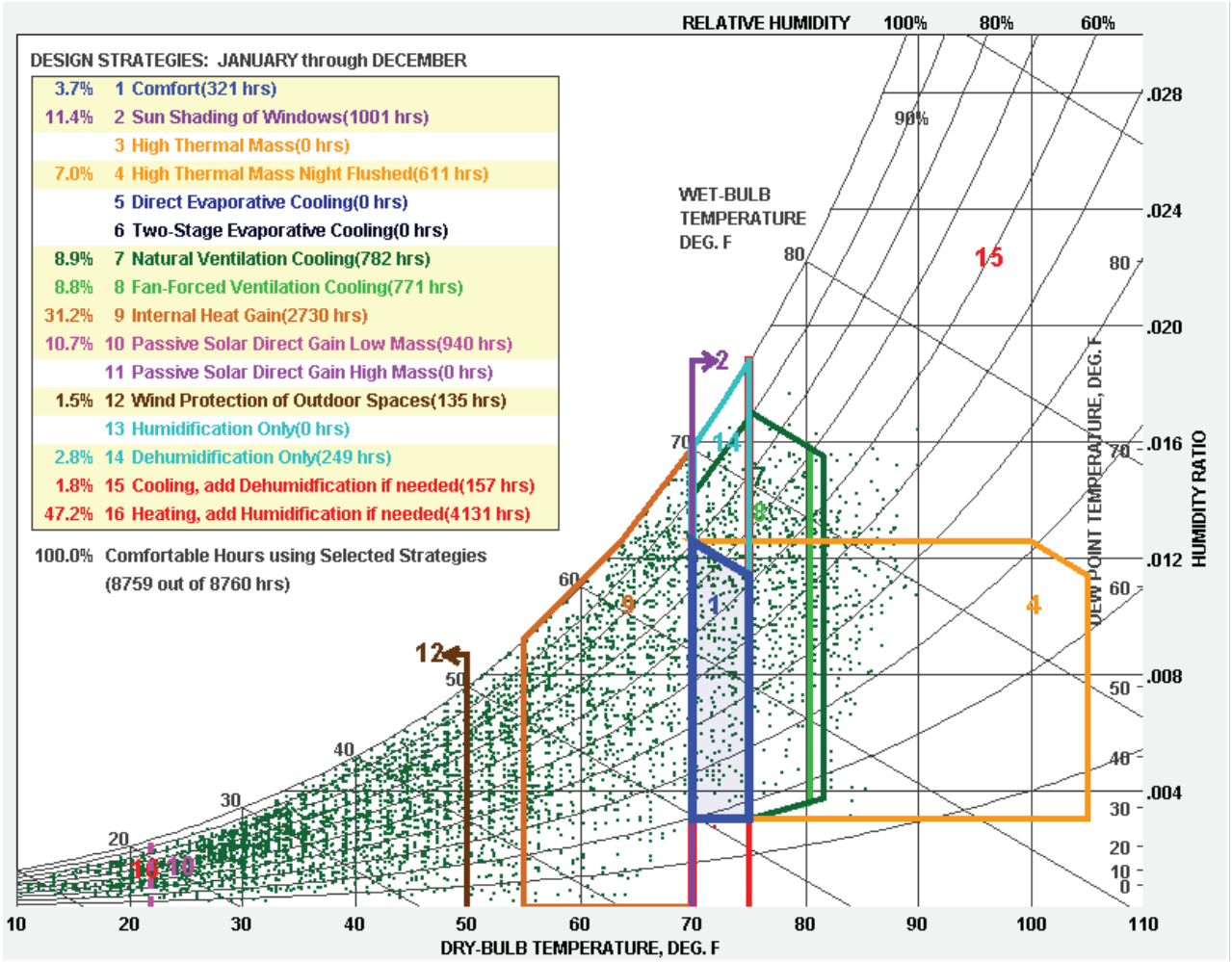
Description:

The other of the two main techniques that will be implemented in the ranger station will be the use of passive solar radiation as direct solar gain.

Since there is a large amount of sky cover, solar panels and solar hot water are not as effective. Also, the average solar radiation further backs this claim.

However, these still allow for the use of direct solar gain as a supplementary heating source during the winter when south-facing windows are implemented. Using a thermal mass, this heat can then be stored during the day and radiated to the space at night.

While, a majority of the year requires heating, during the summer, shading techniques will also keep unwanted direct solar gain from entering the structure. These shading devices also keep unwanted low angle light from the east and west from casting glare into the space.



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DESCRIPTION:

Taking these two main concepts of utilizing natural ventilation and passive solar radiation gain for heating, a vast majority of the year is comfortable to the occupants.

By using shading in the summer, and direct radiation gain in the winter, the range in which a space is comfortable without using active techniques is increased. By relying less on active systems, less energy will be used in the space.

It is useful to minimize the number of techniques used in order to maintain a cohesive structure. If a building is completely optimized for performance, then the structure can suffer from a loss of aesthetic consistency.

Since the structure is envelope-dominated, the active system will be primarily used for heating the structure.

Precedent Work:
Writing a Repeating Bay Construction

Short Story Inspiration from 2012

Excerpt from: A Moment of Warmth by Kenneth Black

I had not really thought about it before. The process of getting up early in the morning for studio had become typical. But you know, sometimes typical can be good too.

The morning was crisp, and cool. The leaves had changed to their shades of orange, red, and yellow, preparing to drop for the winter. I walked up to the meeting spot and sat on the stone wall. There were four of us, not many this week I was told, but then again, camera trapping is not your typical Saturday morning. We all piled into the van and headed out for the station.

It was almost comical. All of us dressed like marshmallow men, as if a snowstorm were about to hit campus: heavy coats, boots, rip-stop pants. No one was going to take a chance on being any more cold and miserable than we had to be up on Salt Pond Mountain. Though it was fall here, it was already in the depths of winter there. We flew down 460 towards West Virginia. That was one thing I never understood about wildlife folks: their innate desire to drive very, very fast.

“You doing alright Ken,” someone asked.

I said nothing. My white knuckles should have said it all for me. I shook my head yes. After traveling for a little while the van made a quick right onto a smaller road and started our ascent up the mountain. I noted that there was still color in the trees.

“Silly freshman,” I was told that this would not last.

We continued up the road and it began to wind around the different ridges as we continued to climb. This road was not meant for the light hearted. There were several instances where rounding a ridge meant a turn in the road that was almost 180 degrees. I imagined something like a large semi-truck could not handle this kind of turn, and even go over the edge. Of course to add to the fast driving, we were told that cars had gone off of the edge.

I fear the abyss, the edge.

We rounded one of the hairpin turns and it was everywhere. Snow was everywhere. It was like a person had painted the ground white. What was fantastic was that we were the first to drive over the snow, leaving a trace for a small while of where we had come from, aimed towards our destination. We went up over a hill and came upon Mountain Lake Hotel. As we roared past, the scene blanketed in snow, stood tranquil against the hillside, waiting for visitors.

It was a place, a fortress, lost in time.

The road changed from pavement to gravel, signaling our arrival to the station. The dull roar that the vehicle made on the gravel drowned out almost everyone’s conversation. That continuous roar, almost like a steady wind, created an entirely different place. We suddenly came out of the trees and then we arrived. I had lost concentration and the station melted into the trees.

The station was hidden in the landscape it studied.

We retrieved our gear that was stored in the main station. An impressive stone structure in its own right, it dwarfed the cabins that stood in its shadow along the meadow clearing. Hidden in the trees, the cabins looked akin to nestled burrows in nature.

The wind, which had been relatively tame seconds before began to howl, ripping through the meadow, throwing snow everywhere. In a small moment the scene was lost in snow.

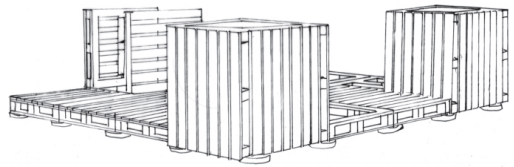
I jogged over to the first set of cabins near the edge of the clearing trying to get out of the wind. I was surprised. What I thought was one of two cabins turned out to be a set of almost a dozen hidden in the tree line. I approached one, raised on a thin concrete plinth, trying to float above the rising snow.

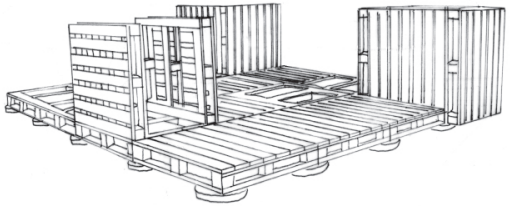
As I reached the edge of the plinth, I was greeted by a small two step stair, and came under a small awning. That’s when I realized that the wind was mainly blocked by the barrier the awning provided. The space was not large, but just by cutting the wind, I felt invited to the structure. I wanted to know more. I reached for the door. It was unlocked and I stepped inside.

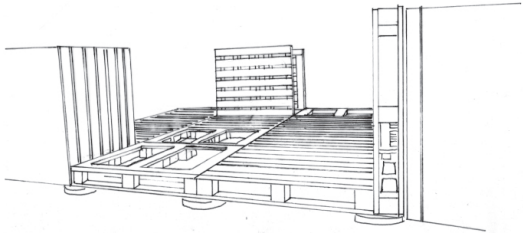
The outside, which had been a warm wood shell, revealed an entirely different interior. The uniform exterior morphed into a repetitious bay, spaced by… pallets? They were pallets, things forgotten and discarded to be left to the elements, which were now providing the character of a sheltering space.

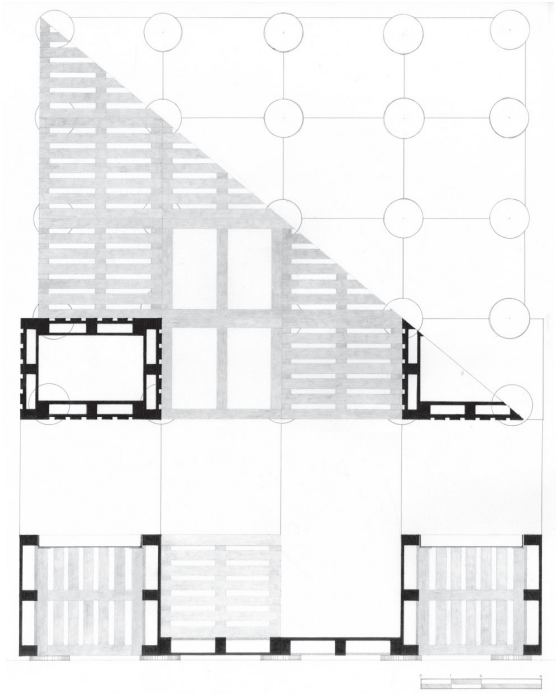
Light flooded in from a large bank of windows that ran the length of the cabin, falling and breaking upon the rough brick floor and volume that rose vertically through the space. I leaned to the left and saw that the brick tower was actually a bathroom. I stepped inside. The space was very narrow, but all through the space, the shadow of tree branches danced along the tall walls, radiating down from a large skylight overhead. The opening looked as if were simply open, the edge of the volume blending into the light shining through.

And in that moment I felt its warmth.









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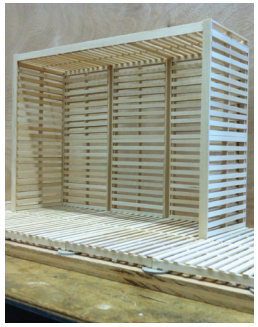
Reshape, Inform, Inspire:

This project was a competition from the Town of Blacksburg in which the prompt was to reuse pallets in a creative or original way. The result of this project, a deck and planter system, began a line of work involving pallets and structural systems.

The staining then gives the pallet a new aesthetic character in addition to practical protection from the elements. Finally, each renewed pallet is placed into a system which relates one to the other. This system then becomes an environment in which new growth arises.

The footing became an exploration rather than just a problem to be solved. We wanted to integrate another element into the project, in addition to the pallets, that originated from a reclaimed material. The system reshapes the function and identity of the pallet, becoming more than landfill waste. The reshaped pallet informs the user of the possibilities by demonstrating a particular method of pallet reuse.

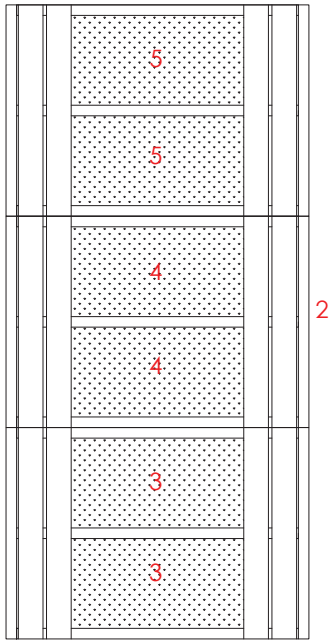




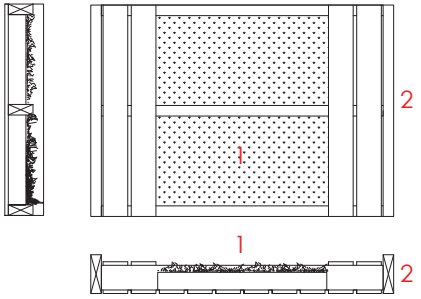








Combined Roof Segments



Segment Sections + Plan

Pallet with 1/4" per foot slope

Legend
1 Module
2 2x6 Stringers
3 2.5" Lite Module
4 4.25" Standard Module
5 6" Deep Module

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Preliminary Wooden ExoSkeleton:

The preliminary Wooden ExoSkeleton was created out of the study of a bus stop made from pallets. After starting the project it was apparent that, although the bus stop motif was used in this instance, the structural system that was devised could be used in many applications.

After revisiting the ExoSkeleton system of using the pallets as a structural diaphragm, the rectilinear frame was broken, making the sloped wall and roof of the ranger station. The system retains the concept of compressing pallets between parallel frames, making a series of bays to construct space. While this original wall system is very simple, and not weather tight, the ranger station adds complexity by becoming both weather and waterproof.

The significance of the study is to show the potential for a repeating frame of pallets to make almost any size of structure. That, as a frame, the structure would be extruded into any length using the width of the pallets as the increasing depth. As long as the structure had pallets of similar width per frame unit, you could build a deeper structure. Furthermore there was also the potential to hang installations within the structure, using it as a gallery space. The pallet has become a catalyst for discovery.

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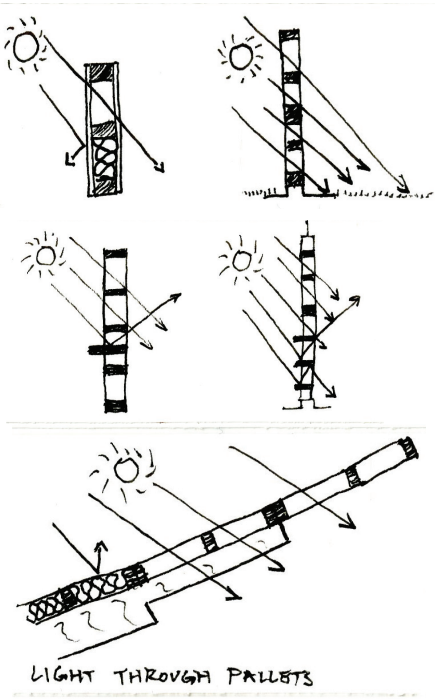
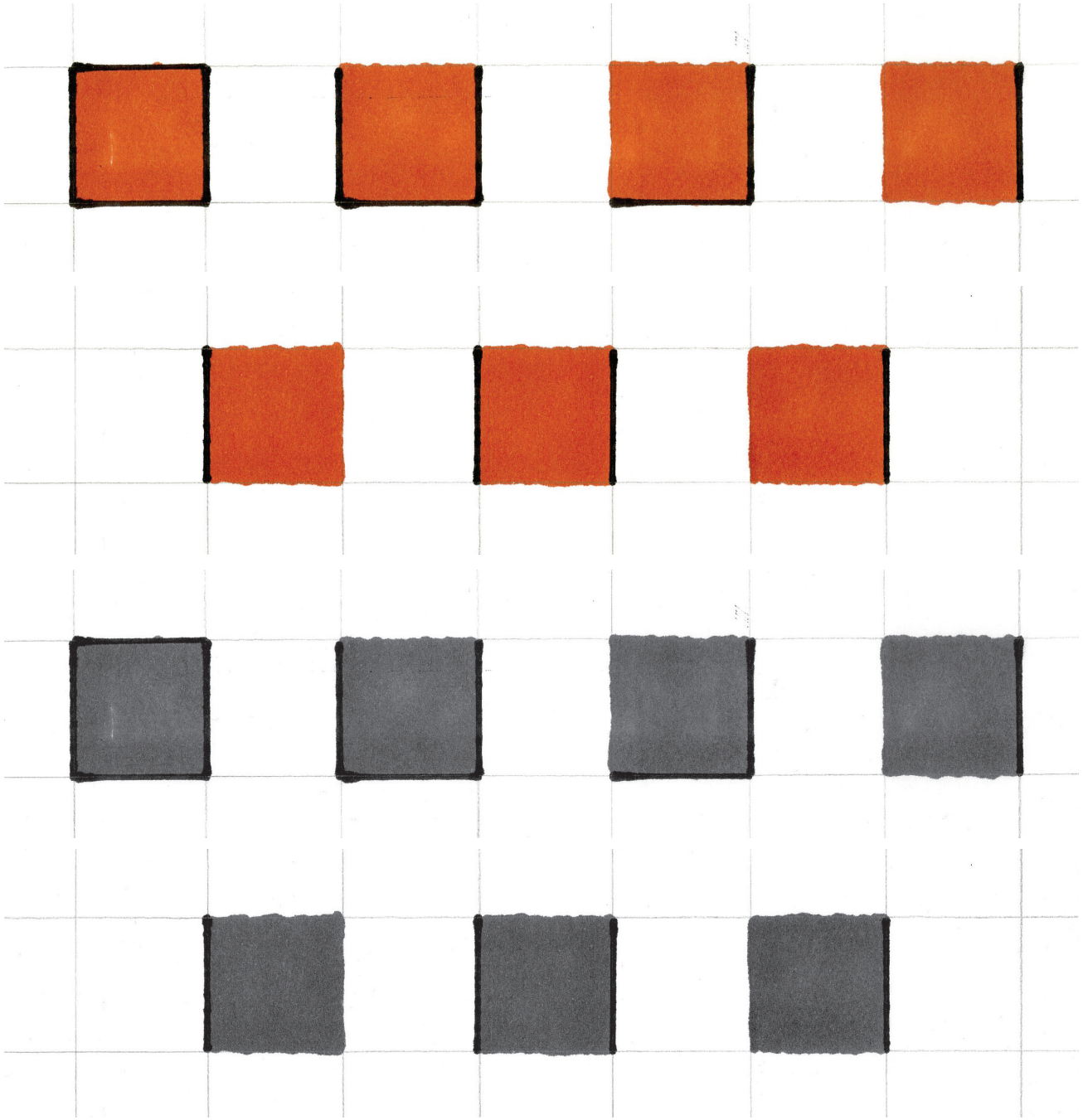
FULL SCALE TEST SECTIONS:

Depending on the types of pallets and the spacing and material composition, different light qualities can occur. With the placement of insulation into the section light is blocked, while portions without insulation become windows.

The full-scale construction of the wall section mainly used 2x dimensional lumber at 3.5 and 5.5 inch depths. In some instances this made the depth of the wall greater than the stud supports; however, when a 2x6 was used small protrusions from the modular system delineated the number of bays.



SCHEMATIC DESIGNS



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A Series of Color:

An orange-brown color, terracotta was selected from the Pandapas Pond site as a base color for the study. A series of colors was chosen for the project from the original terracotta base.

The study began with hard lines on each edge of the color square to determine how the edge condition could be resolved between an area of the intervention and the surrounding environment. To the left is a series of seven possible choices while only using the base terracotta color.

The edge without mediation is loose, flowing and bleeding into the white space, but noticeable. However, the black line is a hard, even edge between the two spaces. Furthermore. When all of the edges are marked, the terracotta appears cut-off from the exterior space.

In the greyscale equivalent, the hard edges are still present, creating a similar feeling of separation between the color an the interstitial space of the page.

From this study some level of transparency in the plan and section must be implemented in order to have a connection with the site, environment and nature.

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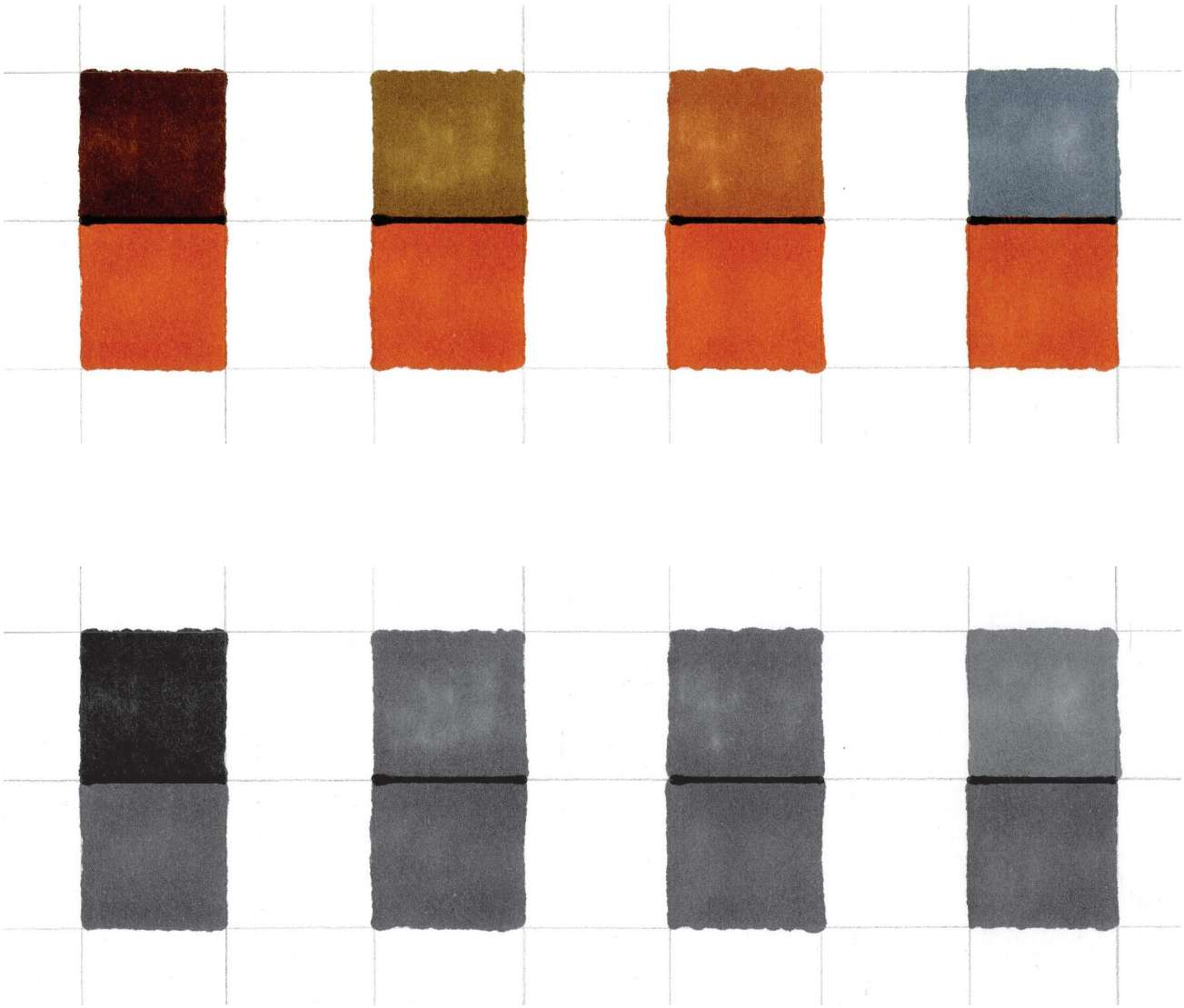
A Series of Color:

The next phase of the study, after looking at the single base color, was to expand the range of the series of colors to determine a pallet of colors to use in the structure.

By using the base terracotta color from the site, other colors were matched for similar characteristics, either similar shades or perceived desirable contrasts.

Based on the study, two of the colors, yellow orange and tan did not fit the criteria and were selected out. The colors chosen to work with were the base color, terracotta, dark umber, dark brown, burnt sienna and contrasted with 70 percent grey.

The colors were placed to see how they interacted adjacent to each other without a hard line division. This comparison was performed in relation to an idea of melding spaces while maintaining a connection with the exterior.



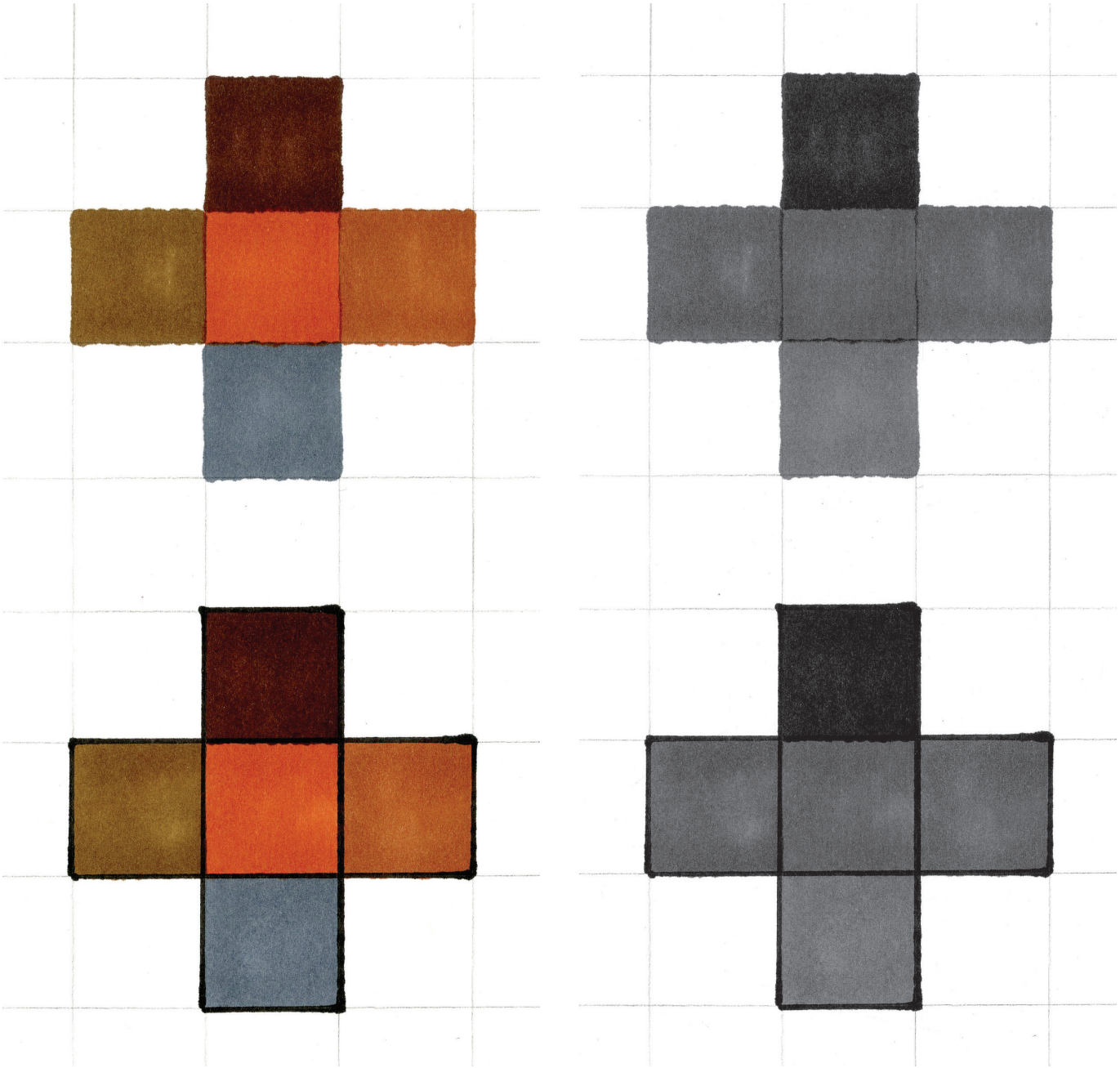
InHabit

A Series of Color:

In the next stage of the study, after the complete transparency between the two edges, each secondary color was compared to the base color, separated by a hard, black line.

While there was not a direct connection or touching of each set of colors, the proximity of colors to each other still maintained a connection between the colors.

What is interesting to note is that each color could leave an imprint or color even in greyscale. The memory of a deeper color is revealed in the greyscale. This memory of the deep umber, reflected in the greyscale could be brought into the ranger station. If we return to the conceptualization of the designed space, the space should have a memory of the surrounding environment reflected within the building.



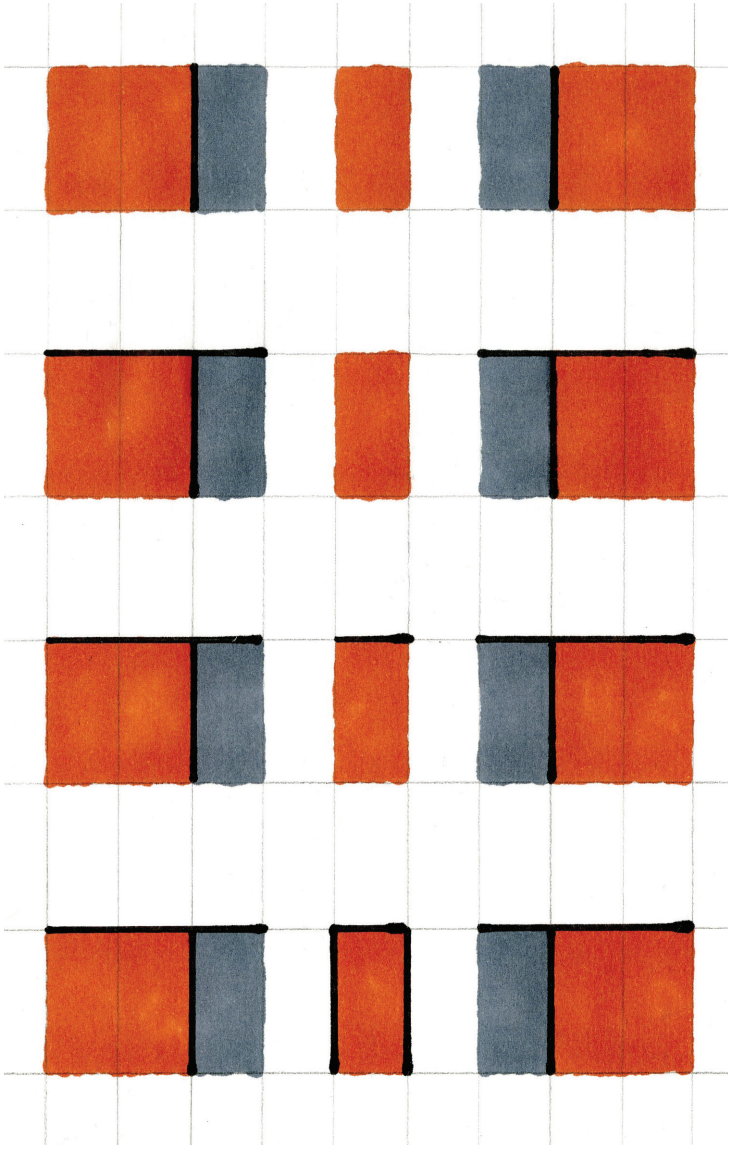
InHabit

A Series of Color:

Then, the whole set of colors was placed together in a cross, with and without a black dividing line.

From this study, the color pallet was decreased to two main colors for the project as to not compete with the wide variety of colors in the natural environment. A set of two colors is not overwhelming, but all five colors in the set at once could be distracting,

The two colors chosen were the base terracotta color from the site and the grey, the color of concrete. Terracotta and grey are both colors from the earth, terracotta reflects the rich color of the natural soil and grey reflects the color of the man-made plinth.



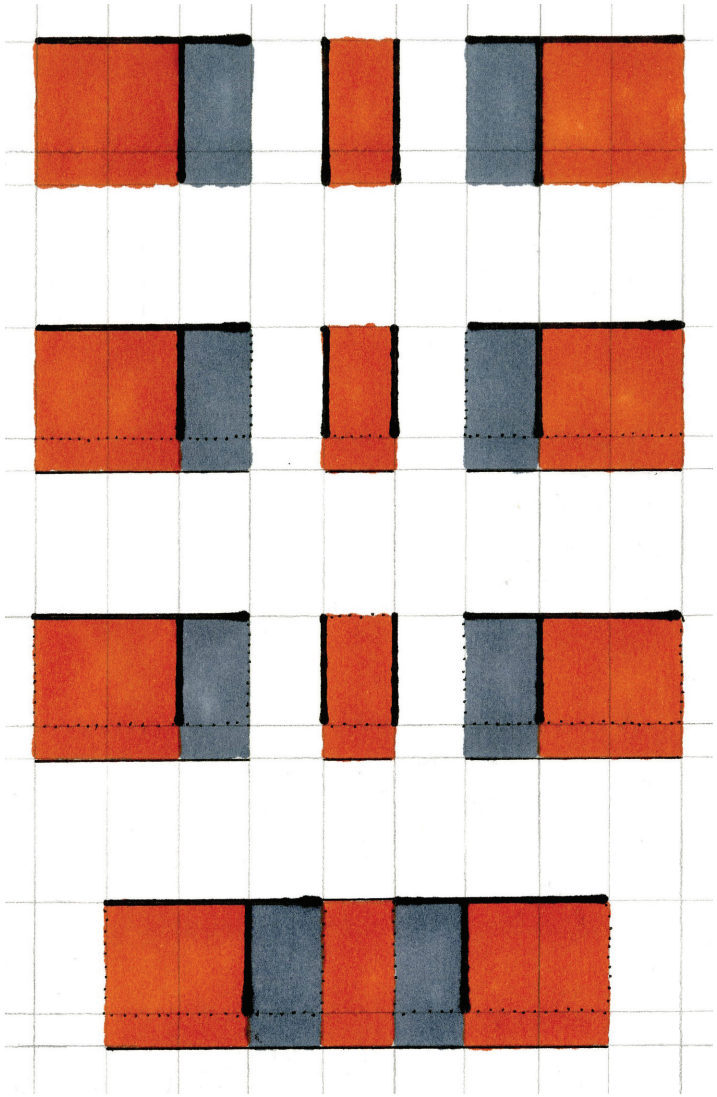
InHabit

A Series of Color:

Using these two colors, a study was conducted on how the plan of the ranger station's modules could be divided into a sequence of spaces.

At first, each color was divided by a solid black line designating inside from outside. Then a line was added to the northern side as this edge may be bermed into the site. Next a black line was added to the single unit in the center to see how a single unit would behave. In the final iteration, the single unit is enclosed on three sides to determine how the smallest space would react with two adjacent spaces.

From these studies, it was confirmed that full transparency and full opaque edges were not desirable for the plan of the ranger station.



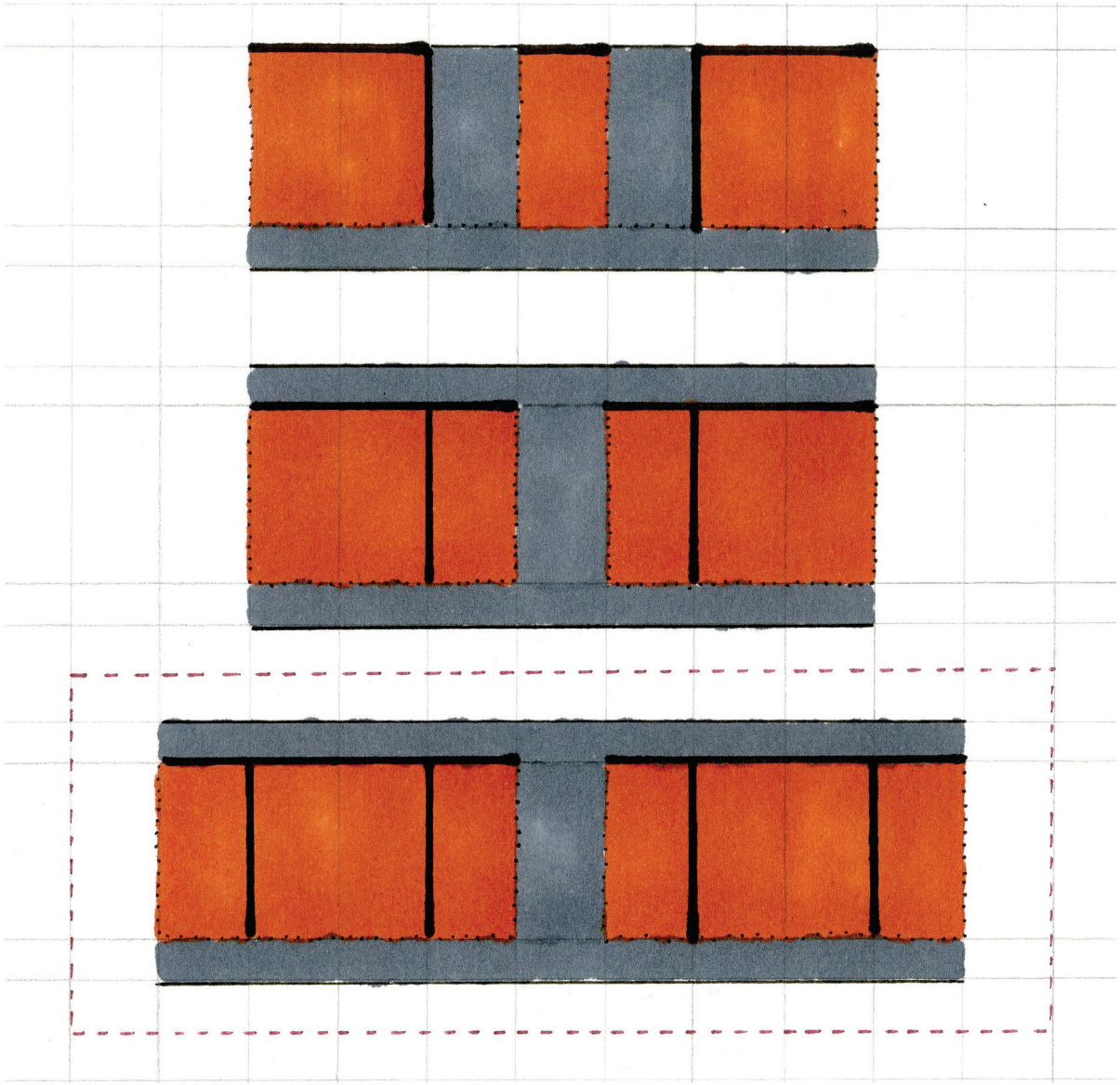
InHabit

A Series of Color:

A second set of spatial studies was conducted from the original set of iterations by opening up one side of the smallest unit.

From this initial move, some circulation was added to the southern edge of the plan by pulling back the opaque walls. A semi-transparent edge was added to mediate the change from interior to exterior space, while maintaining a connection with the surrounding environment.

The last iteration shows all of the spaces added back together with a smaller hard edge added to denote the change from the plinth to the water's surface.



InHabit

A Series of Color:

These final three iterations of the ranger station plan involve the method of circulation and varying levels of transparency in the sequence and connection of spaces.

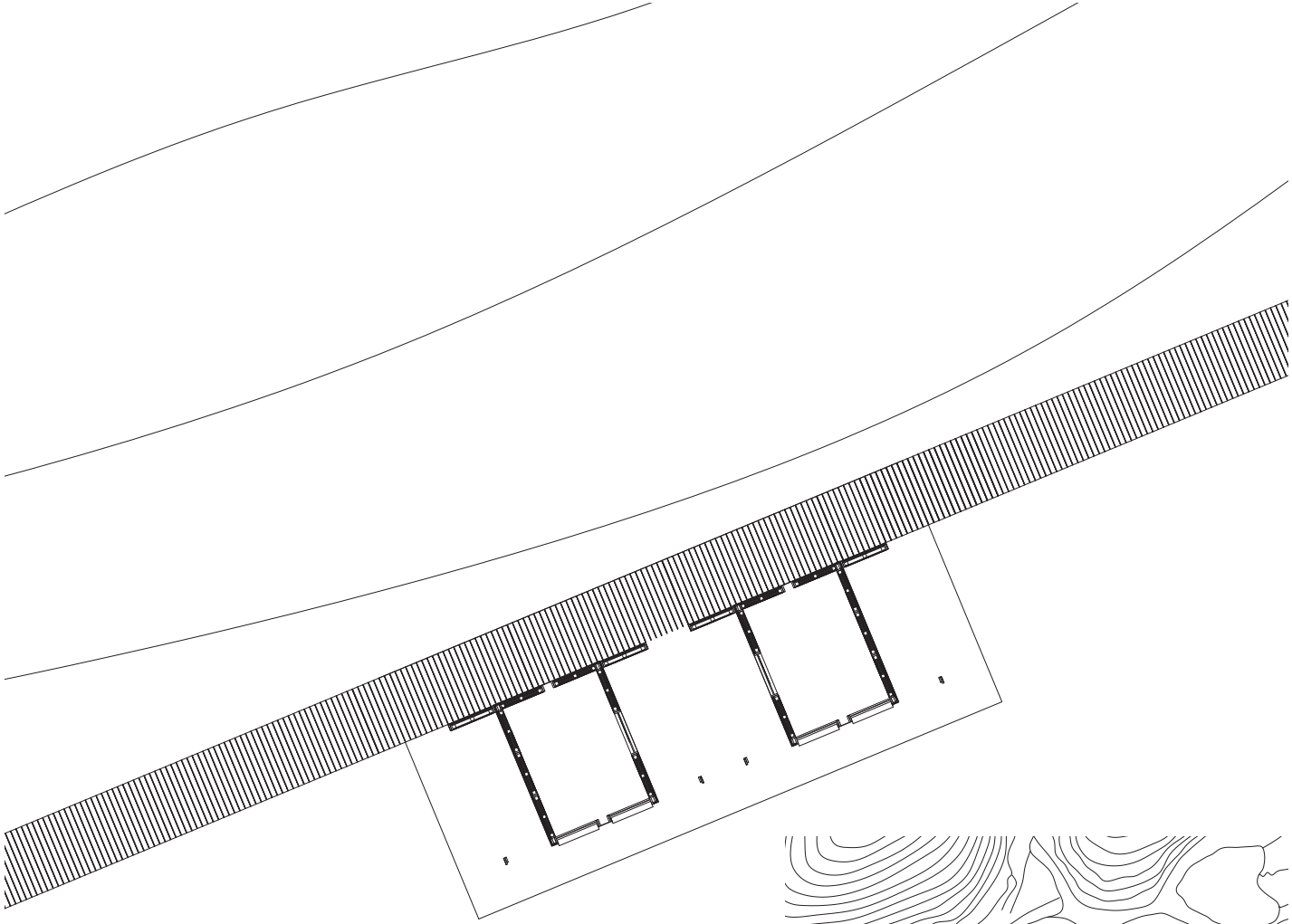
The first iteration reverses the transparency of the middle unit, maintaining a connection with the circulation and exterior to the south.

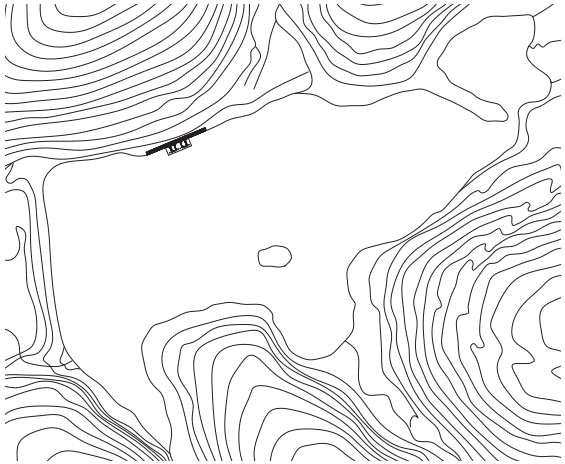
The second iteration reverses the center, making the middle the circulation and a permeable edge into a part of the ranger station.

The last iteration shows two full modules of the ranger station with an exterior circulation both on the north and south edges. The circulation serves as a buffer between the semi-transparent edge of the interior modules and the edge of the circulation and the surrounding environment.

The plan reflects four areas of engagement with nature. First, in nature itself, second, along the exterior circulation on the plinth, third, in the semi-transparent modules, and then finally in the middle of each module with south facing exposure. Even in the most removed portion of the ranger station, there is still a connection back to nature.

Schematic Designs: Applied





Ranger Station Plan

Scale: 0 48” 96” 144” 192” N

InHabit

A Series of Color:

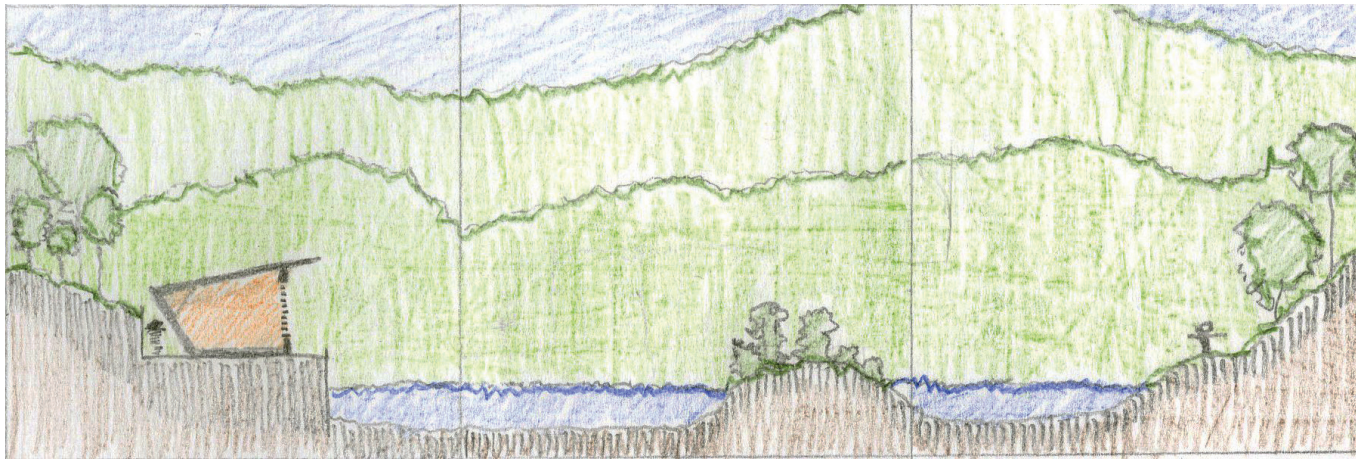
This is the plan of the ranger station based off of the color studies. The plan has a set of formative properties that guide the sequence of space, including the dimension of a pallet and the color studies.

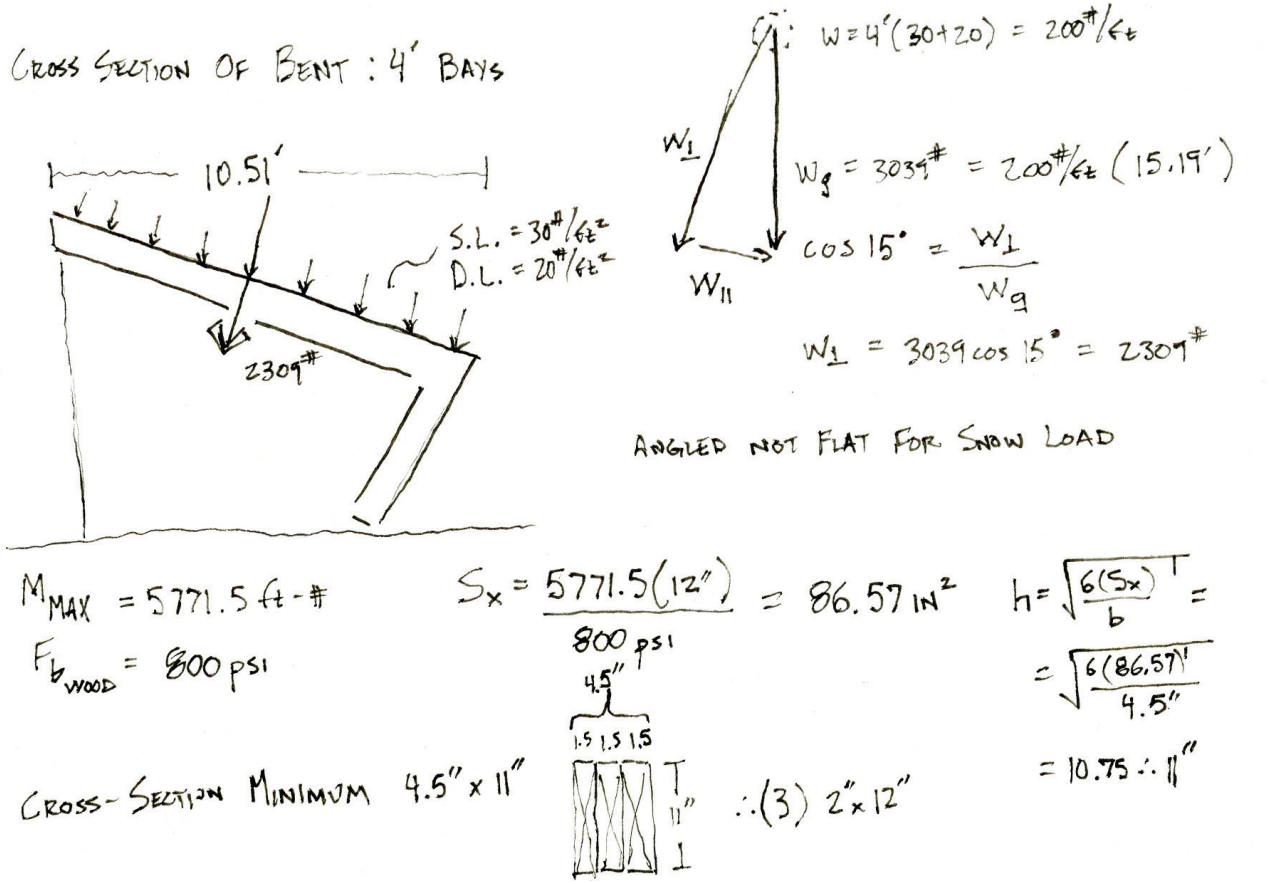
As the organizational forces of the plan of the ranger station come into a definite existence, it assumed a sequence of spatial formations reflecting the color study at a module of the pallet.

This allows the inter-relationships of the spaces to be governed by a higher principle that stands above any single space.

It is inherent in the nature of the whole that a specific stage or space arises first and another as the last, with a sequence of spaces mediating the process.

Finally, from the color study, there is a development of one design out of another, that there is transition from another. However, there is no finish, but a continuous becoming in the design.





InHabit

Section Along the Edge:

While the color study provided the impetus for the design of the plan, the abstract realm of architecture must always be brought back into the concrete and become measurable.

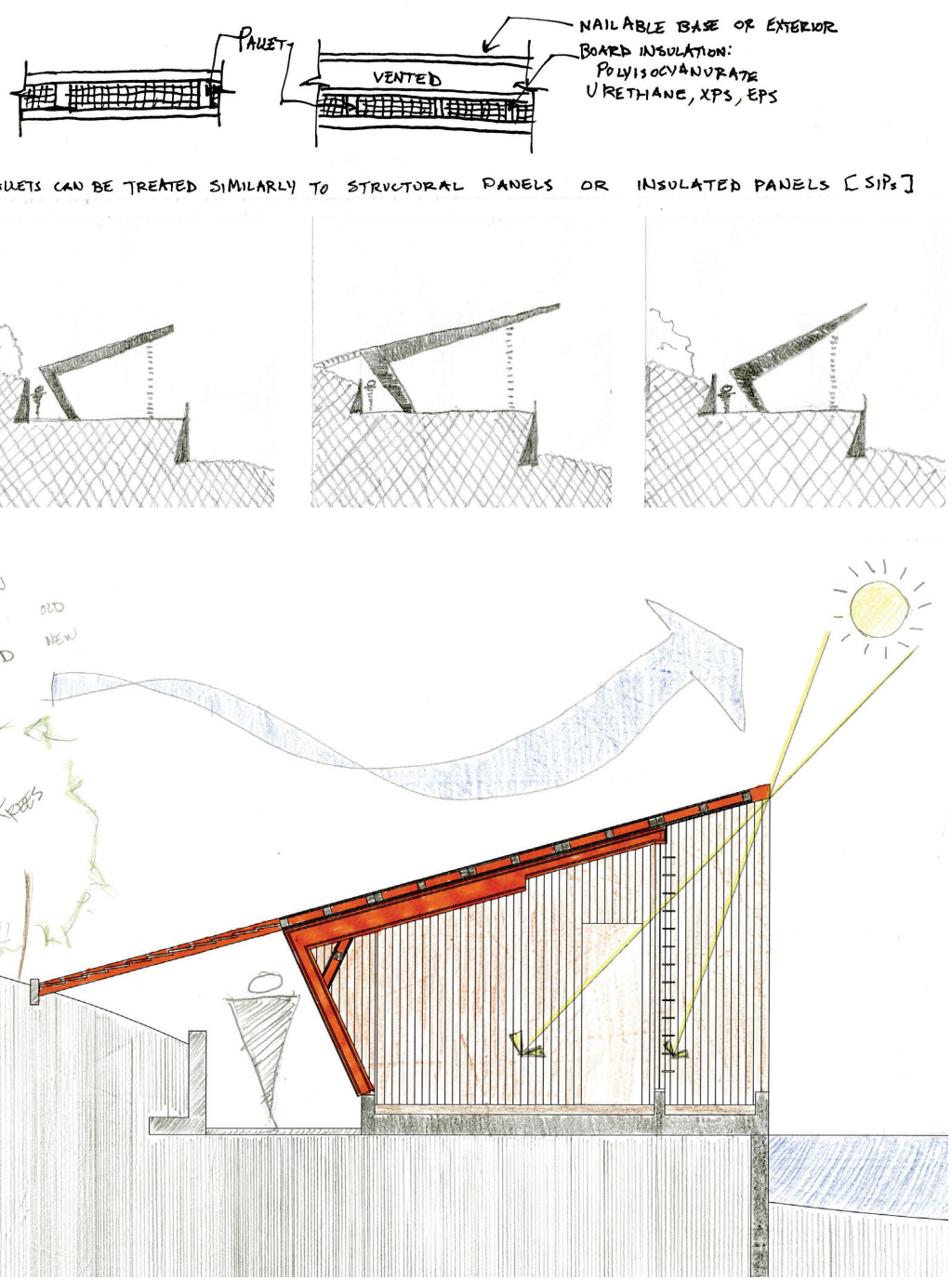
This does not end the ability of the design to continue to become more, only that facets of the design are verified within the possibilities of physics.

These forces are not investigated with the intention of limiting the design, but informing it. In this case the main beam or bent structure is informed by the forces of gravity and rotational motion.

In section, the bent undergoes the most forces at the right angle at the lower end of the roof slope. Therefore, the section will thicken at that point and then taper to the far end of the bent.

By having a sloped roof, the total forces due to snow loads are lowered, making the cross section thinner, but also opens the structure to the south, inviting light and nature into the space.

The artistic impulse of design must also be supplemented by scientific thinking.



INHABIT

NATURAL VENTILATION:

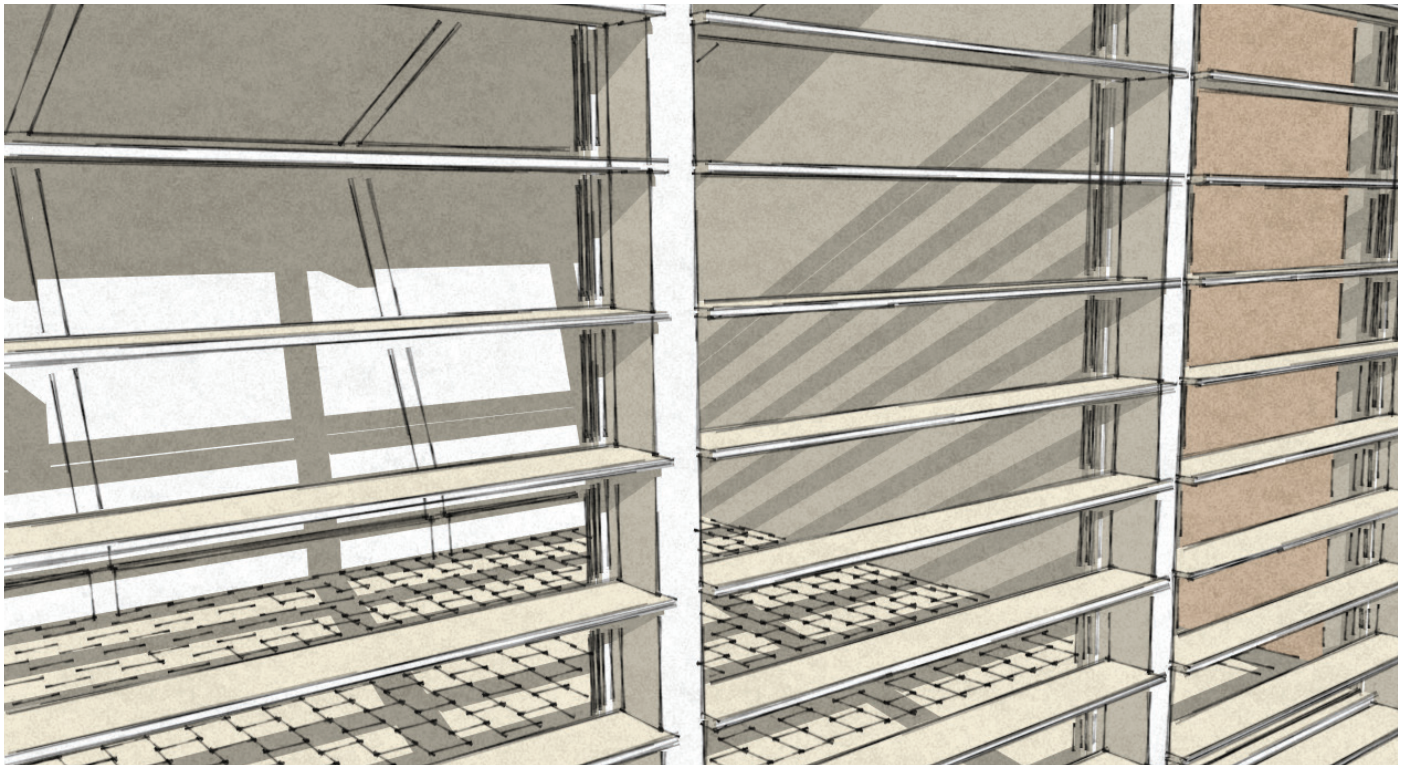
The station will use natural ventilation to cool the space in the summer.

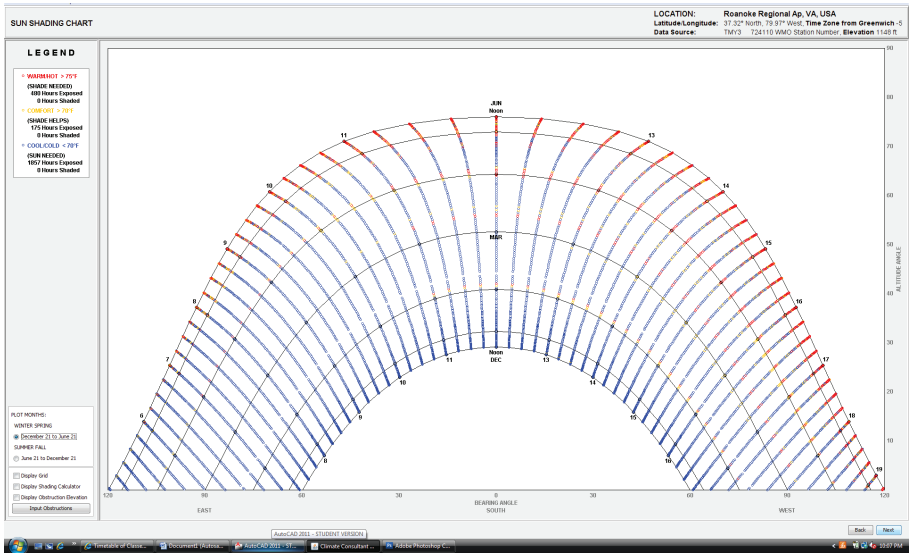
This passive cooling will occur from the resulting convection within the station. Windows on the windward side of the section (left) will allow air to enter and then operable windows in the clerestory on the leeward side (right) will draw air through the structure.

The section of the ranger station works to take advantage of the surrounding site conditions. The slope of the roof continues undesirable winds up and over the structure when the louvers are closed during the winter. These louvers open in the summer allowing the winds to enter in and between the modular units.

The southern windows with the roof overhang and louvers admit sun during the winter but block high angle summer sun. These windows are operable and can be opened during the summer to admit summer breezes off of the pond.

Since the space is small and the overall wind speed due to the trees and local micro-climate, much of the natural ventilation will come from thermal buoyancy as shown in some of the sketches to the left.





Existing Site Analysis: Sun Shading Diagram

BASED ON SUN SHADING ANGLE: $\alpha = 55°$

DIVISION BY FACADE CHARACTERISTICS

$h = 0.5''$
$d = 5.5''$

USE DIMENSIONAL LUMBER: NOMINAL 1x6

$\therefore \tan^{-1}\left(\frac{H}{d}\right) = \alpha$

$H = 9.0$ INCHES

$\therefore \tan^{-1}\left(\frac{9}{5.5}\right) = \alpha$

RESULTANT $\alpha = 58.6° > 55°$

$\therefore$ RECALCULATE

$\tan^{-1}\left(\frac{H}{d}\right) = \alpha_2$ $\quad H = 8.0$ INCHES

$\tan^{-1}\left(\frac{8}{5.5}\right) = \alpha_2$

RESULTANT $\alpha_2 = 55.5° > 55°$

$\therefore$ OK

SOLUTION: USE FIXED LOUVERS

InHabit

Daylighting: Computer Modeling

There are two different slopes to the roof, one shallower and one steeper over the main ranger's quarters. This steeper slope allows the interior space to open vertically as the user walks down the spine of the module.

The opening effect makes the space appear larger even though the total height of the structure is still under 12 feet. The difference in height is mediated by a larger clerestory window above the either pallet modular wall or glass louvered facade. Both conditions allow for light to penetrate deeper into the space as most of the shell is opaque. The brace continues to mediate the corner of the frame, responding to the difference in slope.

The louvered facade needs to respond to the southern lighting conditions in order to be applicable to all possible station positions on Pandapas Pond.

InHabit

Possible OverHead Lighting:

This study looked at how the natural lighting condition would be in the exhibition area for the public.

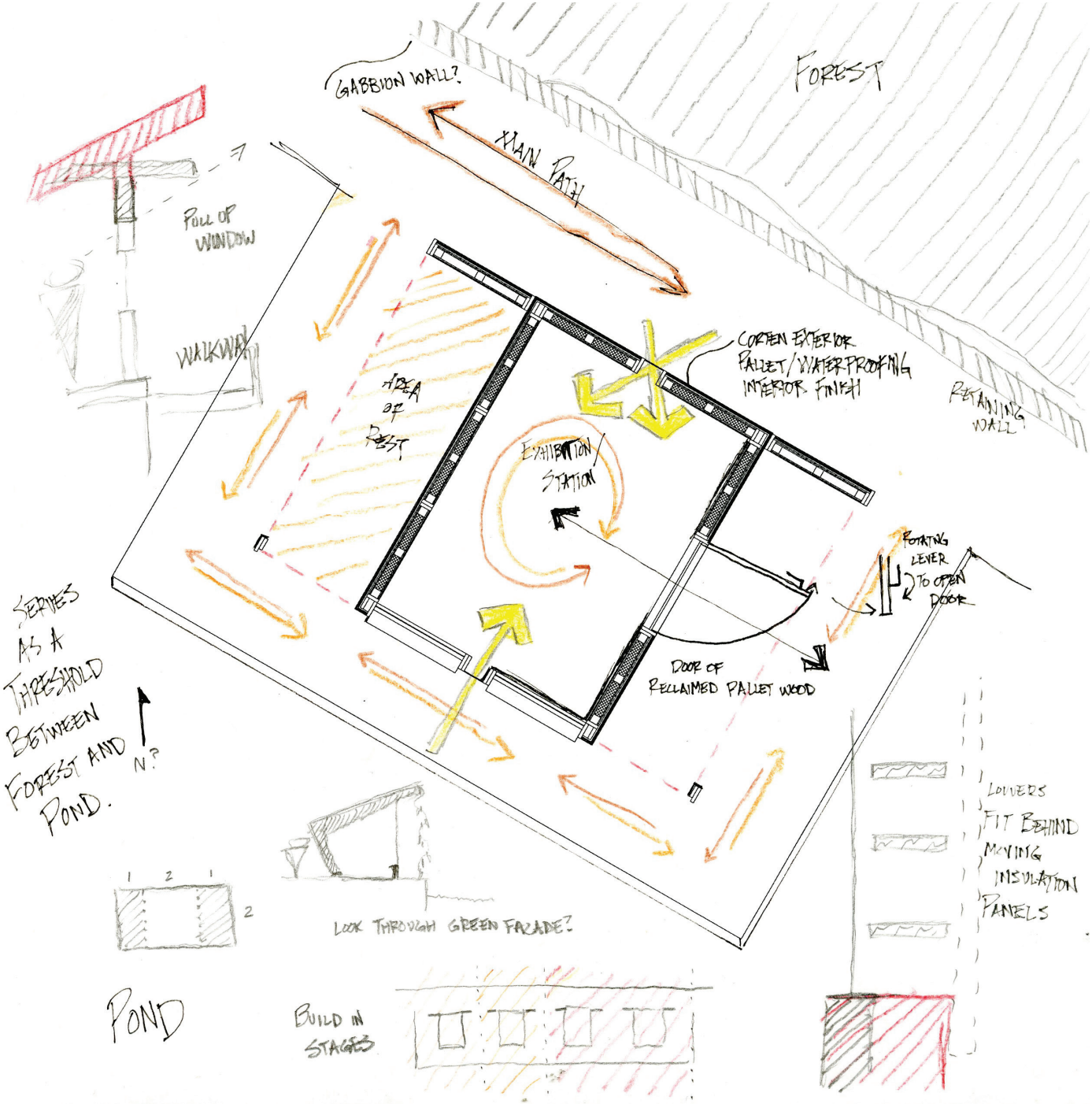
While it appears that the exhibition module has too much glazing, the glass is low-e, admitting light but not as much heat. By giving the exhibition area a large amount of glazing, the space will reflect the surrounding conditions but remain a shelter from undesirable conditions.

During different time of the year varying amounts of light will be admitted through the trees.

During the spring a green light would be transferred to the space by newly grown leaves. During the summer the full growth of the tree would shade the space, During the fall multi-colored leaves could send filtered light into the space. During winter the leaves would have fallen allowing for the maximum amount of light into the space.

The most important factor to the design remains the connection back to the landscape and nature.

Design Response



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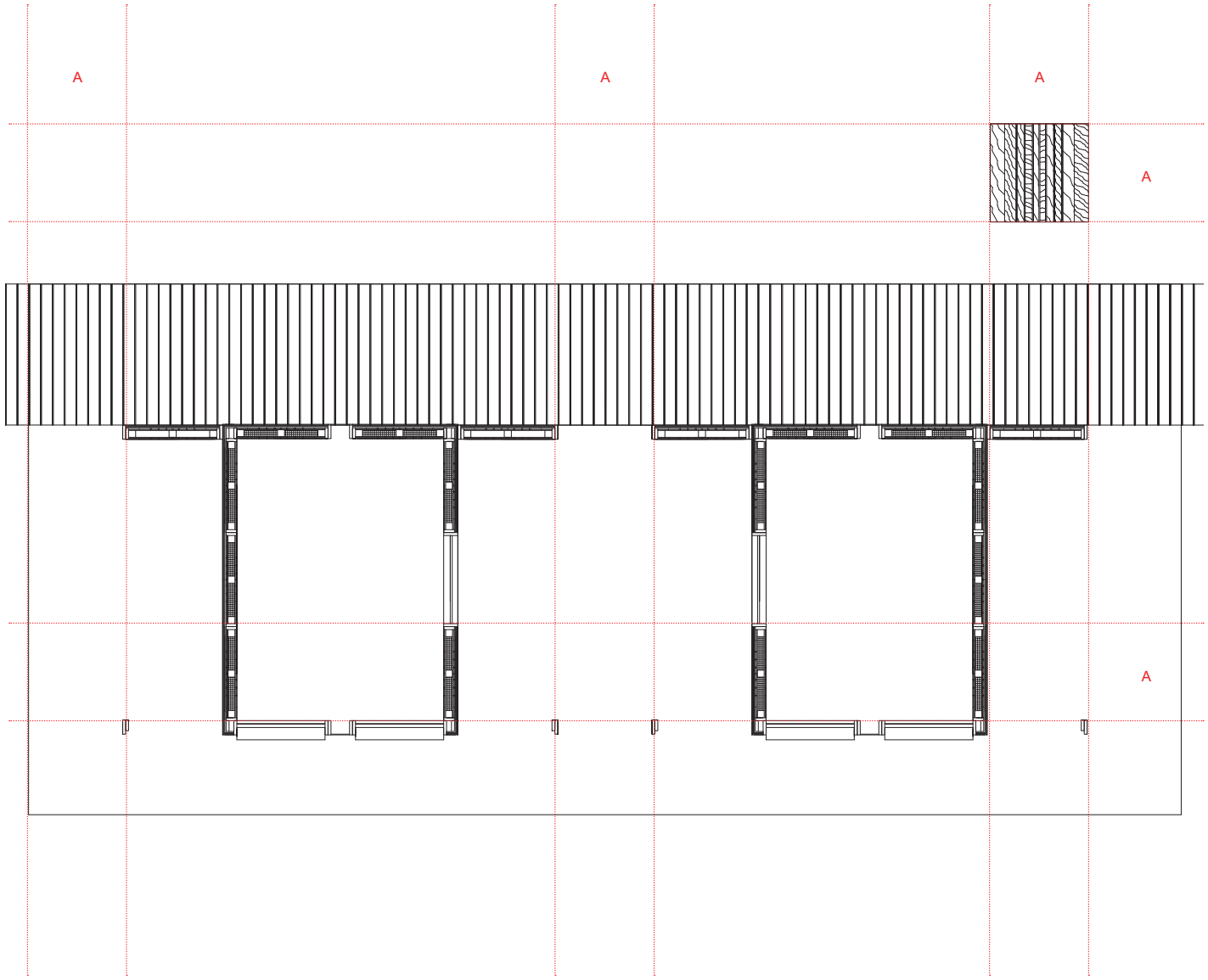
A User's Response:

When deprived of the primary, direct interaction of nature, one begins to express the longing for it.

Since the ranger station is a very small structure, it needs to be a place that is bigger than its official footprint. The space should have a memory of the surrounding environment reflected within the building.

By having a relatively open facade towards the south, reflected light and color can enter into the interior space.

This intervention is a place for the park ranger, as the structure it has a programmatic role to fulfill, but also celebrates the role of the ranger.



Ranger Station Plan: The Pallet

Scale: 0 24” 48” 72” 96”

InHabit

Ranger Station Plan:

The basis for the ranger station is a series of small modules, with paths cut through the modules. These cuts through the plan create different sized spaces that respond to the program and programme of the project. While the program guides spaces based more on function, the programme maintains the presence and atmospheric qualities of the project.

The floor plan of the ranger station is set on a module based upon the dimensions of a pallet. While the pallet itself cannot become the structure of the ranger station, the pallet orders the space and the bay size of the project. The resultant bay size then informs the location and use of different materials.

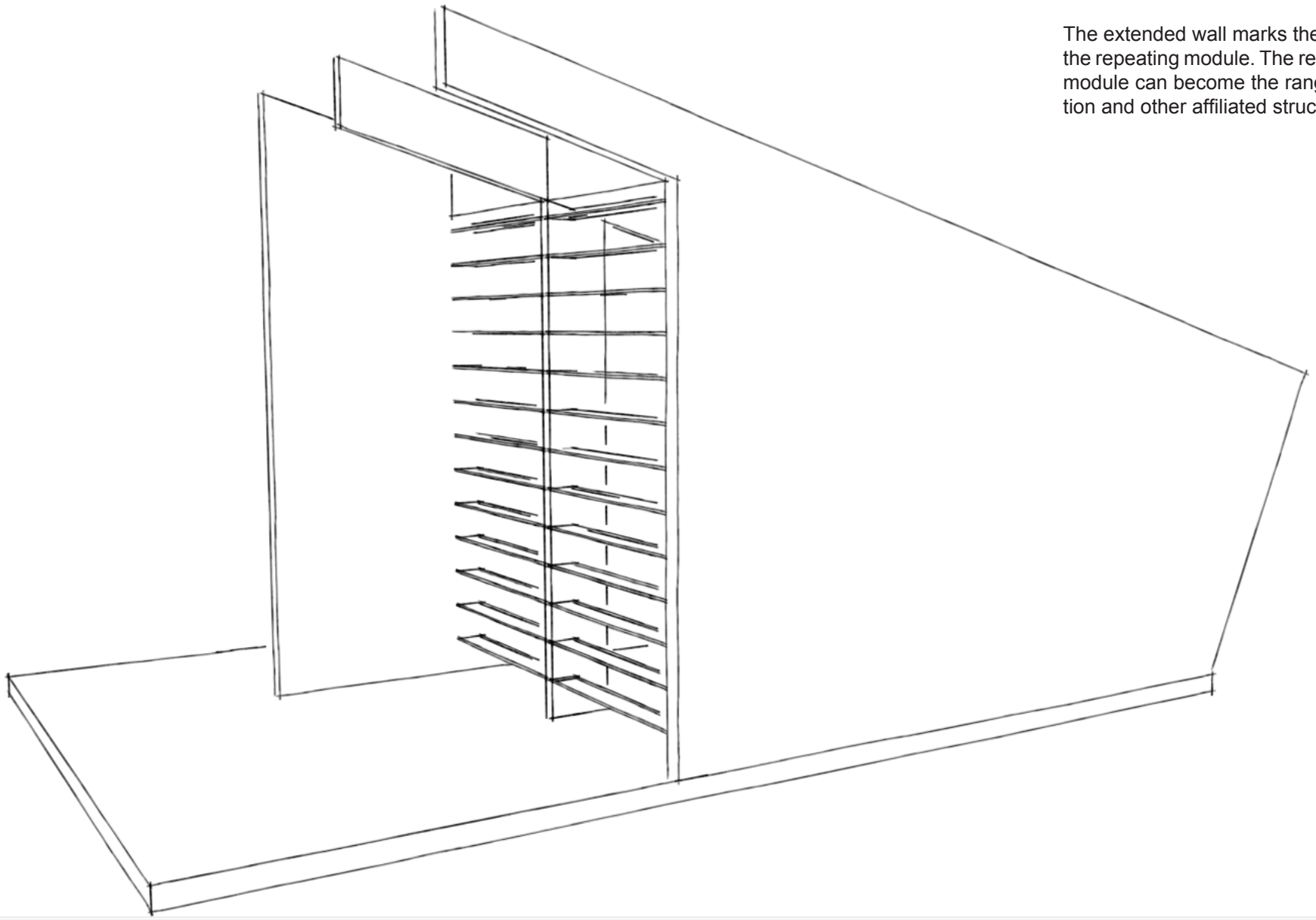
The pressed concrete walkway to the north continues the path around Pandapas Pond, and the concrete pier out into the pond serves as a place to gather and rest, separate from the movement on the pathway.

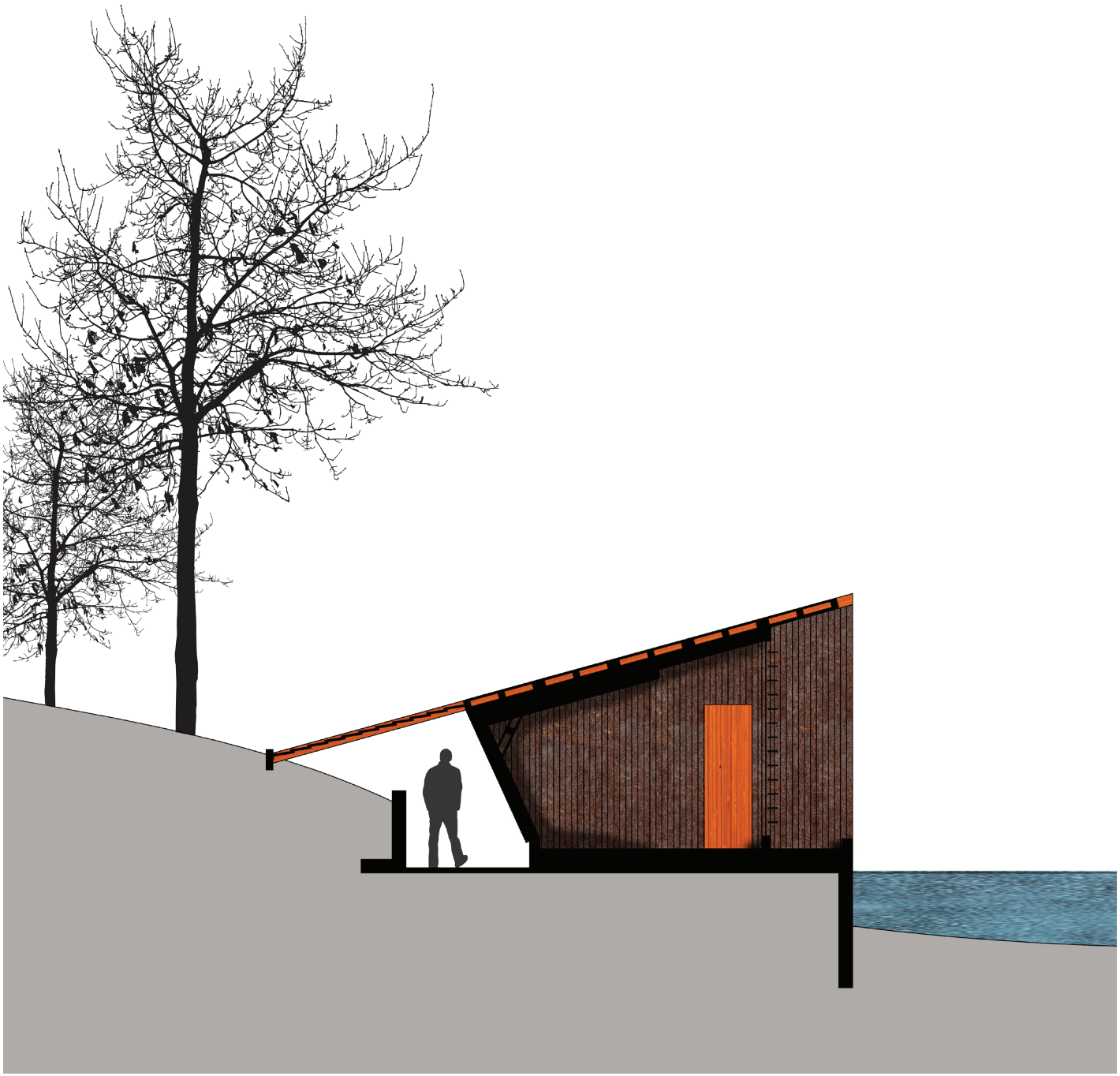
There are two structures, one is the office for the ranger the other is an exhibition for the public to view, about the park and surrounding opportunities.

InHabit

The Module:

The extended wall marks the end of the repeating module. The repeating module can become the ranger station and other affiliated structures.





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Section:

The section of the station responds to the stresses that are incurred within the structure. For example, the frame thickens in the areas of increased moment in order to compensate for larger forces. Then, as the frame extends across the width of the enclosed space, the thickness of the beam in the frame decreases, responding to lower stresses. The final thickness at the far end is that of the pallet. What this means is that not only does the pallet regulate the width of each frame and bay, but also the thickness of the beam as each decrease in thickness is the depth of a pallet.

The entryway greets users, becoming a transition area from the outdoors and the interior of the station. The exterior of the station is clad in vertical bands of wood, which acts as a rain screen for the structure. The vertical boards make the station appear taller with out extending into the tree canopies. The plinth runs the entire length of the structure to lift the station above the ground plain in order to account for accumulation of snow. The window extends the perceived interior space of the station, and also allows for the expansion of the station if needed.

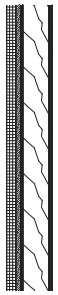
DESIGNING A WALL: APPLIED

Wall Assembly at Stud	R-values	
	With Insulation Panel	Without Insulation Panel
Outside Surface: 15 mph winds	0.17	0.17
Expanded Polystyrene 2"	8.00	N/A
Wood Drop Siding 1"X8"	0.28	0.28
Vapor Retarder Felt	0.06	0.06
Plywood Douglas Fir (0.5")	0.52	0.52
2x6 Stud (5.5")	6.88	6.88
Wood Panels (0.75")	0.95	0.95
Interior Surface: Still Air	0.68	0.68
Total	17.54	9.54

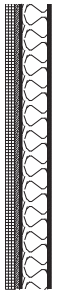
Wall Assembly Not at Stud	R-values	
	With Insulation Panel	Without Insulation Panel
Outside Surface: 15 mph winds	0.17	0.17
Expanded Polystyrene 2"	8.00	N/A
Wood Drop Siding 1"X8"	0.28	0.28
Vapor Retarder Felt	0.06	0.06
Plywood Douglas Fir (0.5")	0.52	0.52
BATT Insulation (5.5")	21.00	21.00
Wood Panels (0.75")	0.93	0.93
Interior Surface: Still Air	0.68	0.68
Total	31.64	23.64

Wall Assembly at Window	R-values	
	With Insulation Panel	Without Insulation Panel
Outside Surface: 15 mph winds	0.17	0.17
Expanded Polystyrene 2"	8.00	N/A
Vertical 3.5in Air Cavity	0.91	N/A
Double Pane Window	2.00	2.00
Interior Surface: Still Air	0.68	0.68
Total	11.76	2.85

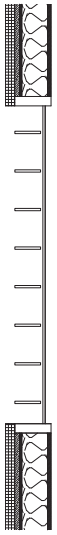
Assumptions:
Assumed from the text that 1 inch of wood framing is R=1.25
Studs were at 16 o.c. therefore, .75 is insulated space and .25 is framing
Air Cavity created by the nighttime insulation assumed: no leakage and parallel surfaces
Areas calcualted using percentages of total wall area. Example: .3 is 30 percent of the wall
R-values range from 2.85 to 31.64
U_{ow} is created from area weighted average of R-values over the wall



Wall Section 1: At Stud



Wall Section 2: With Insulation



Wall Section 3: At Window

InHabit

Calculation of U-values:

These U-values are calculated for the winter condition on the exterior. Since there is a large amount of glazing, one of the main features of the facade is the movable insulation panels for nighttime insulation.

To the left is each of the wall section conditions for both when the insulation is present over the wall, or over the window at both a stud and insulation cavity.

Wall Section 1 is the wall assembly at each wall stud. Wall Section 2 is the wall assembly over the cavity insulation, and Wall Section 3 is at the main glazing over the south facade.

These sections are taken from the south-facing facade with glazing. The other facades are reflective of wall section 1 or wall section 2 without external insulation panels, but with rigid insulation under the Wood Drop Siding.

Calculating R-value of whole wall surface by areas
Daytime R-value with window: Open Window, Covered Wall, Covered Wall Studs
R= 2.85(.3)+.75(31.64)(.7)+.25(17.54)(.7) 20.54

Nighttime R-value with window: Covered Window+Wall+Studs, Open Wall+Studs
R= 11.76(.3)+.75(31.64)(.35)+.75(23.64)(.35)+.25(17.54)(.35)+.25(9.54)(.35) 20.41

Nighttime R-value with no insulation panel: Open Window, Open Wall, Open Studs
R= 2.85(.3)+.75(23.64)(.7)+.25(9.54)(.7) 14.94

Using Area Averaged R-values: U-values= 1/R
Daytime Open:
U_{ow}= 1/20.54 = 0.0487

Nighttime Closed:
U_{ow}= 1/20.41 = 0.0490

Nighttime No Panel:
U_{ow}= 1/14.94 = 0.0669

U-values < 0.11 therefore ok

Q (heat loss in BTUs/hr)
Daytime Open: Q=UAΔT
U= 0.0487 Q=0.0487(120)(52.3)= 305.55
A= 12'(10')=120ft^2
ΔT= 65°F-12.7°F= 52.3°F

Nighttime Closed:
U= 0.0490 Q=UAΔT
A= 12'(10')=120ft^2 Q=0.0490(120)(52.3)= 307.50
ΔT= 65°F-12.7°F= 52.3°F

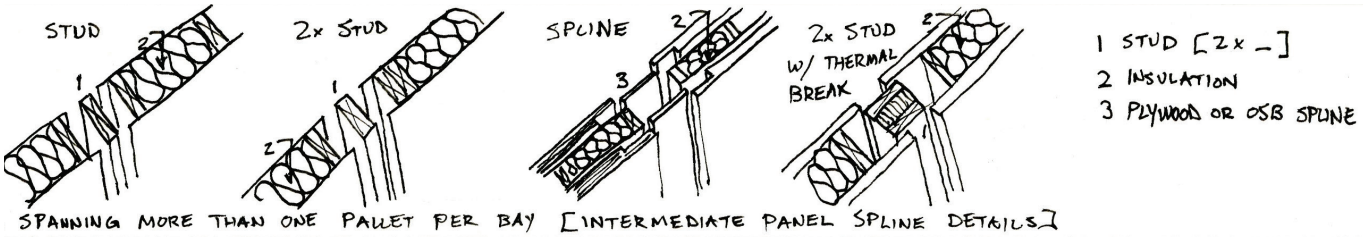
Nighttime No Panel:
U= 0.0669 Q=UAΔT
A= 12'(10')=120ft^2 Q=.0669(120)(52.3)= 420.08
ΔT= 65°F-12.7°F= 52.3°F

Assumptions: 12.7°F was used for 99.6% heating requirement days covered

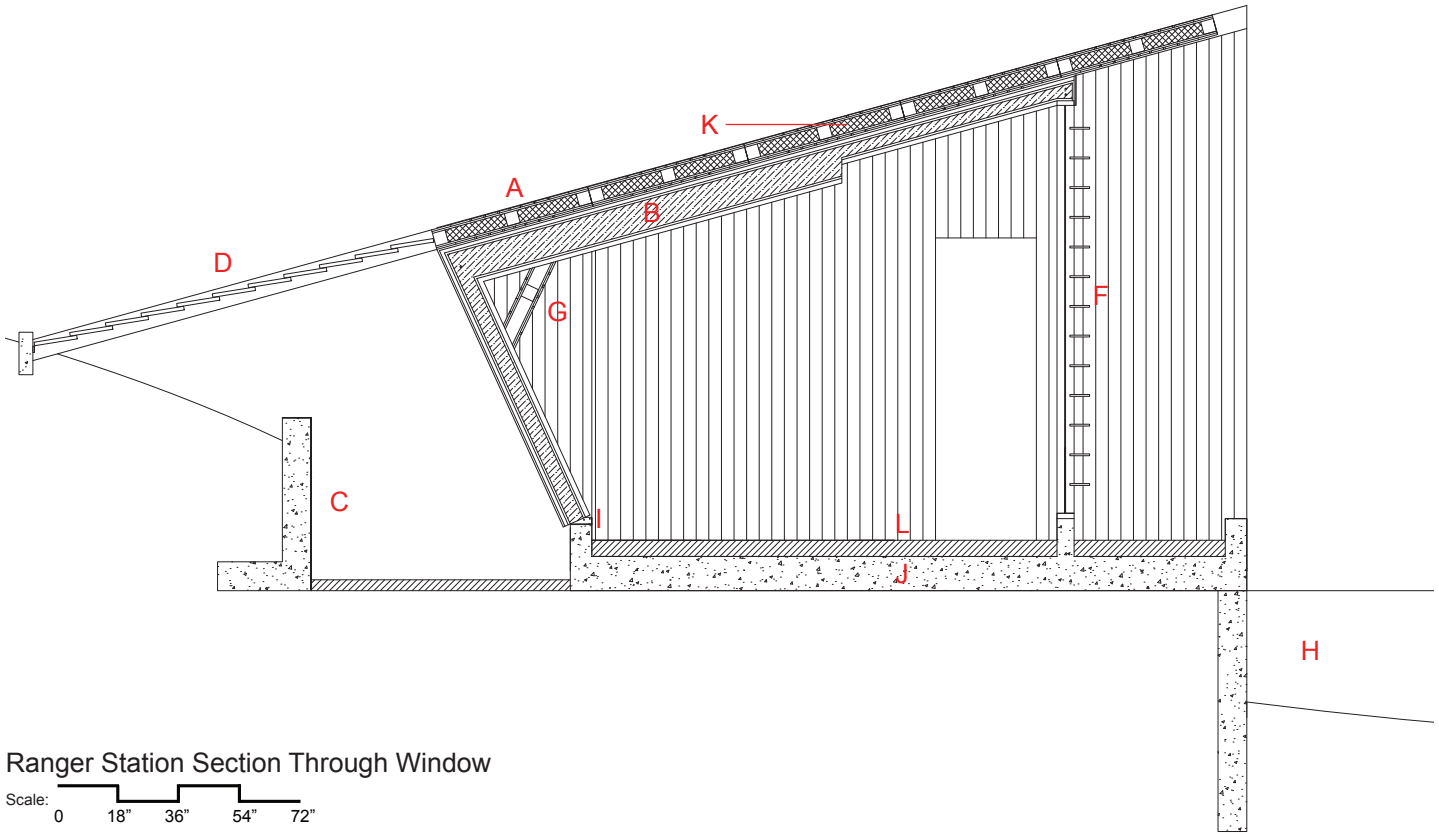
INHABIT

CALCULATION OF U-VALUES:

To the left is the continuation obtaining the area-weighted average U-value.



Possible Methods of Joining Bays



Ranger Station Section Through Window

Scale: 0 18" 36" 54" 72"

LEGEND

A Pallet
B Wooden Exoskeleton
C Concrete Retaining Wall
D Operable Louvers
E Skylight
F Fixed Louvers
G Pallet Brace
H Pond
I Hinge Bracket
J Structural Concrete
K Insulation
L Finished Concrete Layer

INHABIT

SECTION THROUGH WINDOW:

As mentioned before, the section incorporates pallets both as a structural and as an aesthetic reclaimed material.

To the left is the section through the glass facing southeast, towards the lake. This section is the prototypical section for the module that can be repeated to make a series of structures along the pond's edge.

Since each module is an extrusion of a bay system, each bay must be fastened to each other. The sketches above show possible methods of connecting the bays together, either with a stud, spline, or stud with a thermal break.

Acknowledgments

An iteration on A Theme

The Ranger Station at Pandapas Pond: Inhabiting an Edge

This project is an iteration of how I try to engage with architecture. As such I have had the continued support of many people who continue to make my education possible.

I wish to thank my studiomates, who without their presence, design would be a quiet and sullen place. To learn with and from others is a privilege that made studio a wonderful expe-rience. I wish the best of luck to us all as we move forward into the future. Their support has allowed me to engage with architecture at full-scale while enjoying the presence of others.