

How can Land Use Planning and Architectural Design be Combined to Create a New Form of Residential Lakeshore Development?





Project Title and Signature Page:

A Design Thesis Submitted to the
Department of Architecture and Landscape Architecture
of North Dakota State University.

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Degree of Master of Architecture

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Thesis Abstract:

This thesis envisions itself into the future to answer the questions of how we can allow numerous people to have the opportunity to acquire a residential waterfront property when the value of land continues to increase, and waterfront space proceeds to become more limited. With waterfront value increasing and space becoming more and more limited only a sparse amount of people get to experience the luxury of living on the water. I believe that a new area could be developed on multiple waterfront properties (lakes and oceans) that would allow additional waterfront views while allowing the value to be lower than other waterfront homes. The project would stay on the mainland and not require any special services to access via transportation or utilities services. The area would only be allowed to have residential structures in it, while also allowing shared access to some locations within the community. To understand the best design for the proposed waterfront space, a question is posed: **How can the forming of land and the design of architecture be combined to create a new form of residential lakeshore properties?** The new development will focus on producing the most waterfront views while still allowing the structures to feel like a home and allowing privacy to everyone. Having multiple communities with an option like this would allow more people to have a better chance of obtaining a waterfront property, while also potentially lowering the cost of surrounding waterfront value.

Keywords: Residential, Waterfront Property, Mainland, Communities



Thesis Narrative:

Since the time humans began building civilization, societies have sought out land around waterfronts. The reason societies were built around water were because of the benefits it supplied to the community. The main benefits of living by water were, steady supply of drinking water, produced an abundant amount of fertile land for growing crops, and allowed for a simple form of transportation.

Nowadays, living by the water is less of a necessity and more of a luxury. I understand that societies still use water in the same ways, and in many other ways, but with the advancement of technology there is no need to be exactly on the waterfront; instead it is a desire. Which leads me to my next point of over consuming.

As society, humans tend to be a little greedy and always want more, whether that is more wealth, more time, or more love. The greed that I am referring to in this is the greed for property. As someone that has grown up across the street of lakeshore properties, I have seen many changes on my lake. Whether that was little family cabins, RV/Campgrounds, or the lake's sand bar, that have all been destroyed to allow for new buildings.

Now, I am not against upgrading a cabin, taking a campground out to allow more housing, or taking empty lots and developing them. The problem that I have is that the 1/3 mile of campground shoreline that was destroyed for 8 lots, or the 1/10 mile of sandy shoreline developed into 2 lots. The amount of waterfront land on my home lake of Sugar Lake that is being taken because of greed is already too much, now imagine how much land on every lake, and ocean shoreline that have been taken because of greed. Not only is greed taking more and more land, but the value of land is becoming increasingly more valuable, which makes it more difficult for the average person to purchase a waterfront property.



Thesis Narrative:

On average an oceanfront property is valued at 45% higher than the homes located in the same zip code, lakefront are valued at 25% higher, and riverfront are valued at 24% higher. This thesis will try to answer a question that hits home for me; how can land use planning and architectural design be combined to create a new form of residential lakeshore developments, while maintaining a reasonable price?

This design is intended to be a concept design, which is located on a lakefront property, however, I intend to create a base design that can be used for multiple other waterfront properties in the future.

This research is based on the idea of zero-lot-line housing, cohousing, and shoreline development. Zero-lot-line housing is a portion of residential estate, where the structure's edge borders, or is in close proximity to the edge of the property line. Similar to zero-lot-line housing, cohousing is a community of personal residences assembled directly around communal spaces. Wrapping this all together will be the research and planning of shoreline development for my site. These studies will decisively show how case studies can be investigated and evaluated to distinguish designs that can be applied for potential projects. The awaited discovers from these studies are that a well-designed waterfront property will be able to prosper based on the idea of zero-lot-line housing, cohousing, and shoreline development.

The goal of this research is to identity a way in which designing in close proximity on shorelines can be done, while still allowing privacy, great views, and a sense of home. Creating this space will allow more civilians the ability and comfort to purchase waterfront properties.

Thesis Narrative:



Figure 2 | Concept Waterfront Design



Project Typology:

The proposed design will be a residential waterfront community. The community will be on mainland and will allow the most waterfront views, while continuing to be a private residence.

Residential- Designed for citizens to reside in.

Waterfront- A region that edges on a body of water.

Community- A group of individuals that reside in the same position or have a distinct characteristic in common.

Mainland- The principal land of an area on shore, which is not built on or surrounded by water.

The intended design has components of various building typologies, for instance, cohousing, zero-lot-line, lake resorts, and waterfront properties.

Project Typology:



Figure 3 | Zero-lot-line Housing



Figure 4 | Cohousing



Figure 5 | Resorts

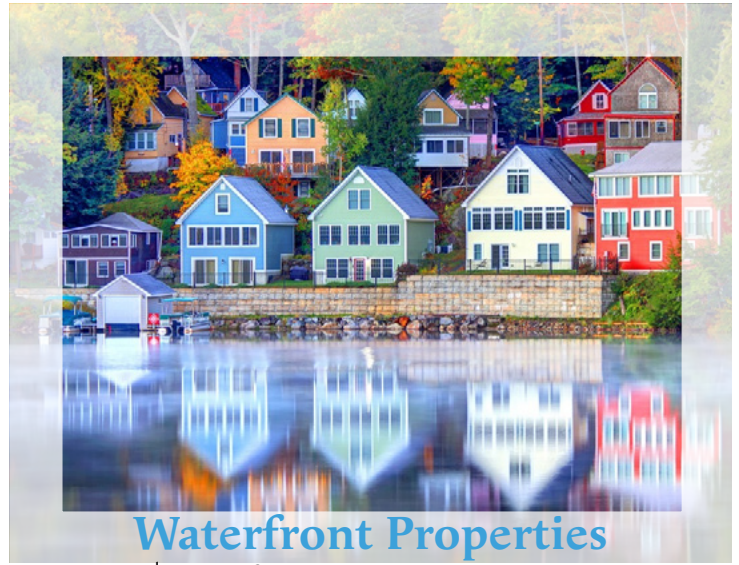


Figure 6 | Waterfront Properties

Case Study: Asher at Playa Vista

Project- Asher

Location- Los Angeles

Builder- KB Home, Los Angeles

Architect- Robert Hidey Architects, Irvine, California

Land Planner- B3 Architects, Santa Barbara, California

Completion Year- 2014



Figure 7 | Asher at Playa Vista

Case Study: Asher at Playa Vista

Modern Family Homes

3-Story Detached Residences

Approximately 2,435-2,757 Sq. Ft.

2+ Rec Rooms - 5 Bedrooms

2 Full + 2 Half Bathrooms - 4 full + 2 half Bathrooms

2-Car Private Garage and Guest Space



Figure 8 | Asher at Playa Vista

Case Study: Asher at Playa Vista

Different Style Home: Used to accommodate the needs of different family types. Using approximately the same square footage, Figure 8 has an extra bedroom and different spaces than Figure 9 to accommodate for larger families.



Figure 9 | Ashar at Playa Vista

Case Study: Asher at Playa Vista

Adjoining Rooms: Defined as rooms that are situated next to each other. Asher at Playa Vista use this strategy very well throughout the structures. Adjoining rooms are a great way to minimize overall square footage, while keeping multiple spaces.



Figure 10 | Ashar at Playa Vista



Figure 11 | Ashar at Playa Vista

Case Study: Asher at Playa Vista

Zero-Lot-Line Housing: Zero-lot-line housing is a portion of residential estate, where the structure's edge borders, or is in close proximity to the edge of the property line. Traditionally, zero-lot-line housing placed a wall directly on the property, however, they are built a couple feet off the property line nowadays. Zero-lot-line housing differs from condominiums because it is a single-family building that stands unattached. Asher at Playa Vista is a perfect use of zero-lot-line construction. Asher consists of 14 3-story dwelling units created per acre on a site of 2.55 acres.



Figure 12 | Asher at Playa Vista

Case Study: Asher at Playa Vista

Research Findings:

Asher at Playa Vista is a modern example of zero-lot-line housing. By creating adjoining rooms, designing vertically, and using zero-lot-line housing, you can create all necessary spaces for living, while still being comfortable and not using too much land. However, it is important to remember not to make every house the same, as not every family is the same. By creating different floor plans, you invite different families into the community, creating a more diverse neighborhood.



Figure 13 | Asher at Playa Vista

Case Study: Lange Eng, Denmark

Project- Lange Eng Collective Living

Location- Lange Eng, Albertslund, Denmark

Type- Residential, Multi Unit Housing

Firm- Dorte Mandrup Arkitekter

Completion Year- 2009



Figure 14 | Lange Eng, Denmark

Case Study: Lange Eng, Denmark

Lange Eng Collective Living have 54 privately owned houses and apartments that hold roughly 200 residents, around 100 adults and 100 children. Dwelling size varies from 775 square feet to 1453 square feet, with the dwelling size of the community being 67,737 square feet.

Dwelling size of Community	Residents	Size per Capita
67,737 Sq. Ft.	200 Persons	Approx. 338 $\frac{\text{Sq. Ft.}}{\text{Person}}$

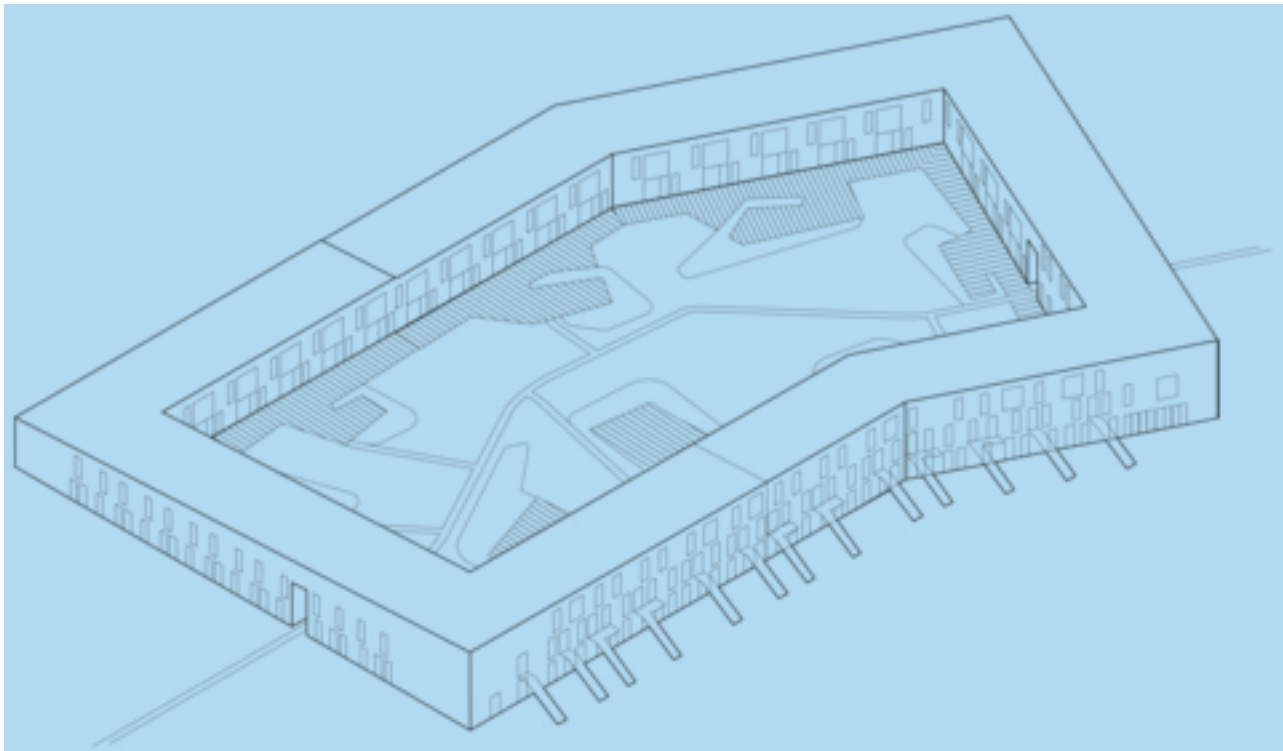


Figure 15 | Lange Eng, Denmark

Case Study: Lange Eng, Denmark

Cohousing: Defined as a community of personal residences assembled directly around communal spaces. The term originated in Denmark in the late 1960s and has grown ever since. The residences are independent; however neighbors collaboratively plan and manage community activities and shared spaces. Cohousing is a great way to create housing in a compacted area and is expanding rapidly all around the world.



Figure 16 | Lange Eng, Denmark

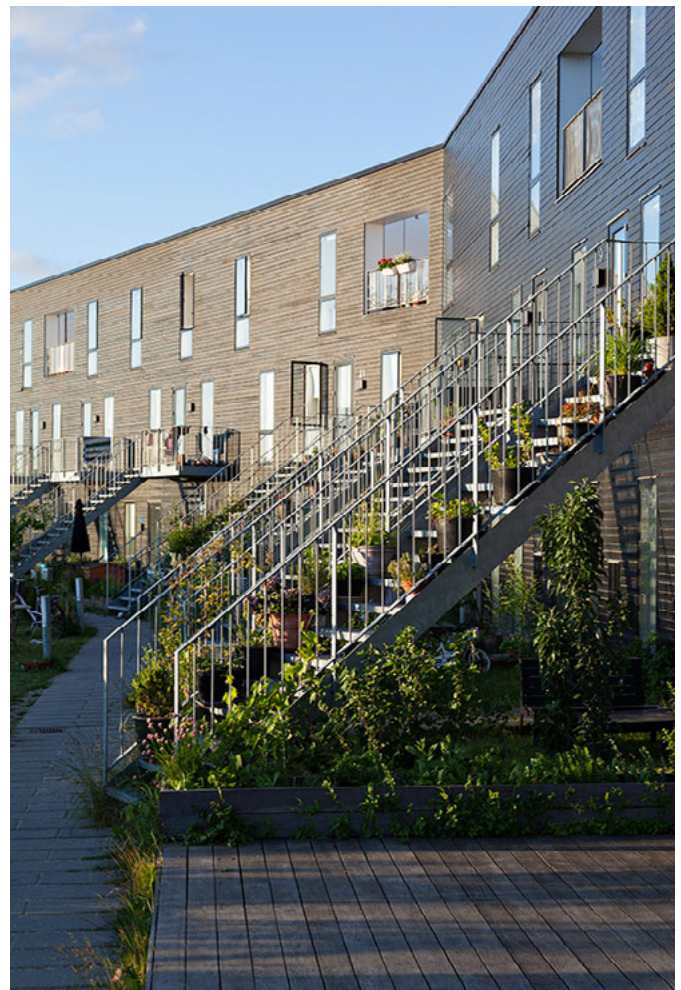


Figure 17 | Lange Eng, Denmark

Case Study: Lange Eng, Denmark

Community Spaces: Used in cohousing developments, community spaces are a great way to limit the amount of spaces needed in each dwelling unit, while allowing residents to connect and grow relations with other residents. Lange Eng has several community spaces which include, several recreational areas (different areas for different ages), outdoor playgrounds, playrooms for children, vegetable gardens, movie theaters, indoor gym, and a communal kitchen/cafeteria. However, residents have to work together and share work responsibility to maintain community spaces. For example, Lange Eng serves dinner on all evenings of the week except Saturday. Families can choose to enjoy dinner with the community at the cafeteria, or they can choose a take-away option; and families only have to pay for dinners they eat. Regardless the amount of food they take, all adults have to take their time working in the kitchen. This happens every six weeks for two-three consecutive days.



Figure 18 | Lange Eng, Denmark



Figure 19 | Lange Eng, Denmark

Case Study: Lange Eng, Denmark

Research Findings:

Lange Eng is a very impressive community that is thriving and keeping residents happy. Overall, there has been nothing so far that has caused any special challenges. When asked about the absence of a fence for security, residents said that there were no problems because they know everybody in the community and would recognize a stranger instantly. Lang Eng has shown that cohousing provides a sense of well being, a sense of belonging, and provides security. It also shows how much easier life can be if you work together. At Lang Eng, residents share and exchange many items with each other. There are storage rooms and shelves located within the community for items that former item owners didn't need anymore such as, children clothes, toys, books, and household equipment. Residents even share skills with each other, such as home repairs. In conclusion, this suggests that new communities being developed could benefit from many of Lang Eng Strategies.



Figure 20 | Lange Eng, Denmark

Case Study: Marmalade Lane, United Kingdom

Project- Marmalade Lane Cohousing

Location- Cambridge, United Kingdom

Type- Residential, Multi Unit Housing

Architects- Mole Architects

Contractor- Coulson Building Group

Completion Year- 2018



Figure 21 | Marmalade Lane, UK

Case Study: Marmalade Lane, United Kingdom

Marmalade Lane Cohousing consist of 42 dwelling units which are a mix of 2-5 bedroom terraced houses and 1-2 bedroom apartments. It also houses many shared outdoor spaces and a common house for all residents to use. In total the Marmalade Lane Cohousing covers approximately 46,285 square feet.



Figure 22 | Marmalade Lane, UK



Figure 23 | Marmalade Lane, UK

Case Study: Marmalade Lane, United Kingdom

Community Spaces: Marmalade Lane is another important example of the use of community space. There are an abundant number of shared spaces and communal facilities integrated in the design to cultivate community strength and sustainable living.

The community spaces include shared gardens, which is the focal point of the complex, for growing food, socializing, and quiet contemplation. It also includes a common house which includes a playroom, guest beds, laundry facilities, meeting rooms, and a large hall/kitchen for shared meals and parties. Finally, it includes a workshop and gym located around the facility. To maintain these spaces, every resident in the community contributes and works together to keep their community operating smoothly.



Figure 24 | Marmalade Lane, UK



Figure 25 | Marmalade Lane, UK

Case Study: Marmalade Lane, United Kingdom

Sense of Place: This cohousing complex is part of a greater residential area. The idea was not to make the complex separate from the rest, but to integrate it into the broader area. It follows existing form which was created by the surrounding townhouses and streets. Each entrance area of every housing unit was created to connect directly to the side-walk without any features interrupting, to create a sense of place. To keep each unit individual the material was changed to be different from the adjacent building.



Figure 26 | Marmalade Lane, UK

Case Study: Marmalade Lane, United Kingdom

Spatial Organization: Marmalade Lane cohousing is split into four sections, three of which are housing and apartment units, and one that is the common house. The living room and bedroom of the residential units are oriented to the south and east to maximize the absorption of light into those spaces, while also having a nice view of the courtyard. The common house is situated in a position that acts as a gateway between public and cohousing areas. This helps inspire residents to spend time collectively through all of the communities activities.



Figure 27 | Marmalade Lane, UK



Figure 28 | Marmalade Lane, UK

Case Study: Marmalade Lane, United Kingdom

Research Findings:

Marmalade Lane has not only created a beautiful looking complex, but also a well designed space that fits in with the surrounding areas. By using community spaces, creating a sense of place, and spatial organizing, Marmalade Lane Cohousing has created a place for inter-generational living, multinational groups, retired, young couples, and single persons, to live in and connect within.



Figure 29 | Marmalade Lane, UK

Case Study: Minnesota Shoreline Regulations

Minnesota shoreline requirements are a very important topic to cover when talking about waterfront properties. It can be difficult and challenging to design around them, but they are meant to protect the natural habitat of our waters. There are many pros that come with these regulations.



Figure 30 | Lake Shoreline

Case Study: Minnesota Shoreline Regulations

Minnesota Department of Natural Resources

According to Minnesota Department of Natural Resources “The single most important thing you can do is maintain and/or restore natural vegetation along your shoreline. Natural vegetation:

- Holds soil in place protecting shorelines from increasingly intensive rain events and rising water levels
- Slows runoff and stores moisture
- Filters out nutrients, which along with rising lake temperatures, accelerates algae blooms
- Provides habitat so species can survive in a changing climate
- Increases property values by keeping lakes clean”



Figure 31 | Lake Shoreline



Figure 32 | Lake Shoreline

Case Study: Minnesota Shoreline Regulations

Minnesota Department of Natural Resources

According to Minnesota Department of Natural Resources “Setbacks vary depending on the shoreland classification of the water body, and whether or not the lot is serviced by sewer. Check with your local planning and zoning administrator to find out what shoreland setbacks apply to your property.”

“Height limits in shoreland areas are put in place to preserve the natural character on a body of water and are meant to keep development below the tree line. The state shoreland rules establish that all structures in residential districts in cities, except churches and nonresidential agricultural structures, must not exceed 25 feet in height.

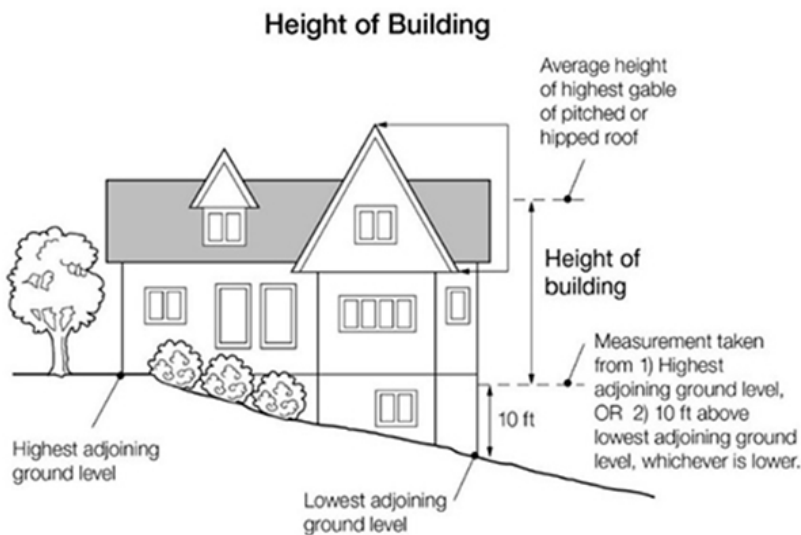


Figure 33 | Lake Shoreline

Check with your local planning and zoning administrator to verify the height allowed on your property.”

Case Study: Minnesota Shoreline Regulations

Minnesota Department of Natural Resources

According to Minnesota Department of Natural Resources “The shoreland rules allow each lot to have one water-oriented accessory structure within the required setback from the ordinary high water level (OHWL), provided it is:

- No larger than 250 square feet,
- Located at least 10 feet from the OHWL,
- Less than 10 feet in height, and
- Not connected to sewer and water.

The structure must also meet floodplain elevation requirements. Check with your local planning and zoning administrator to verify what is allowed on your property under the local shoreland ordinance.”

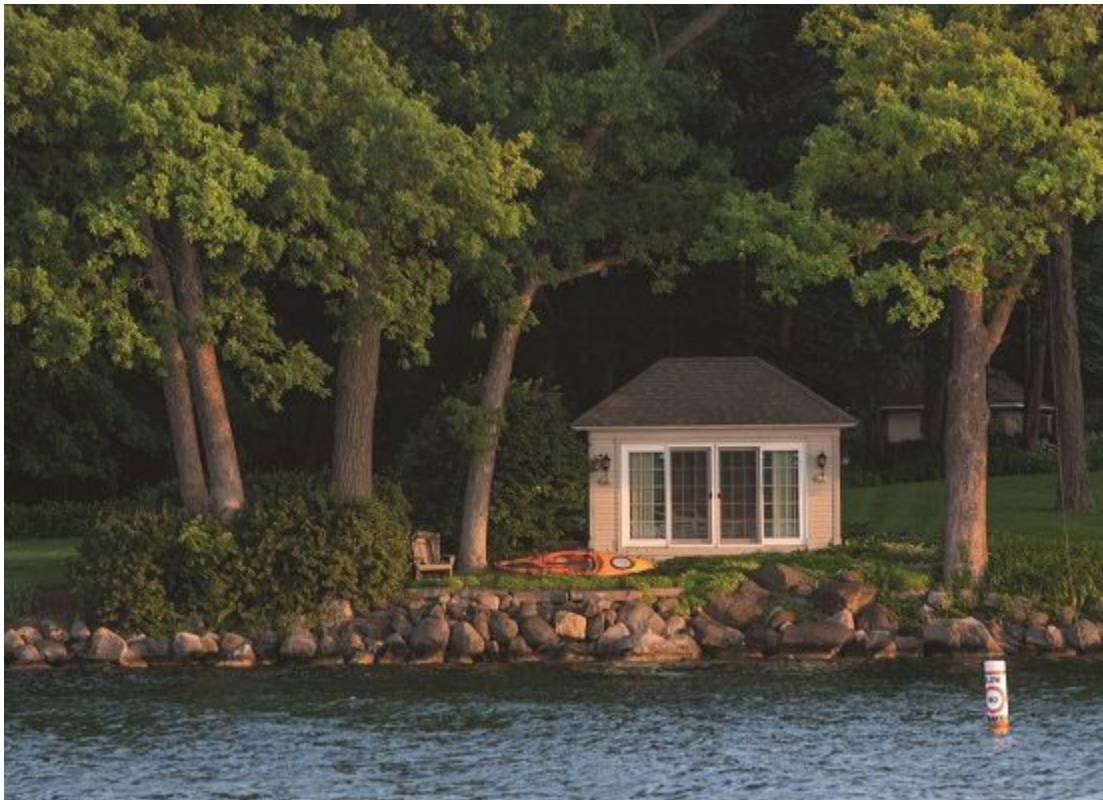


Figure 34 | Lake Shoreline



Case Study: Minnesota Shoreline Regulations

Minnesota Department of Natural Resources

According to Minnesota Department of Natural Resources “A DNR permit is required for marinas, and the permit requires consistency with local zoning. The area must be zoned to allow marinas, or the local government must grant a land use permit for the marina. Also, as part of permitting, DNR must find that the marina is sized consistent with the demand for mooring spaces in the area and the watercraft to be served.”

Under Minnesota Public Water Rules 6115.0210, Subp. 5, facilities must meet the following general criteria:

- Be the minimal impact design solution for the need, as compared to all reasonable alternatives.
- Minimize encroachment, change, or damage to the environment, particularly the ecology of the waters.
- Be consistent with floodplain, shoreland, and wild and scenic rivers management standards and ordinances.
- Mitigate adverse effects on the physical or biological character of the waters through feasible and practical measures.
- Be consistent with water and related land management plans and programs of local and regional governments, provided they are consistent with state plans and programs.

Case Study: Minnesota Shoreline Regulations



Figure 35 | Lake Shoreline



Figure 36 | Lake Shoreline

Case Study: Minnesota Shoreline Regulations

Research Findings:

Minnesota Department of Natural Resources is trying to protect all bodies of water and has many regulations on developing around them. Before building you have to talk to city officials and coordinate plans. It is important to talk to local officials to find out what is allowed on your site, because it can vary in many locations. Certain construction will require different permits. Overall, it is important to remember that you should disturb the shoreline as little as possible and if needed to minimize it as much as the task will allow.



Figure 37 | Lake Shoreline

Project Justification:

With the cost of living increasing and the amount of available land decreasing it is becoming harder to find houses to live in. Not only is it becoming complicated to find houses, but also especially challenging to find your dream home or dream location. This new way of residential waterfront property development will help bring more residential housing to communities and give more options for citizens to live in their dream location.

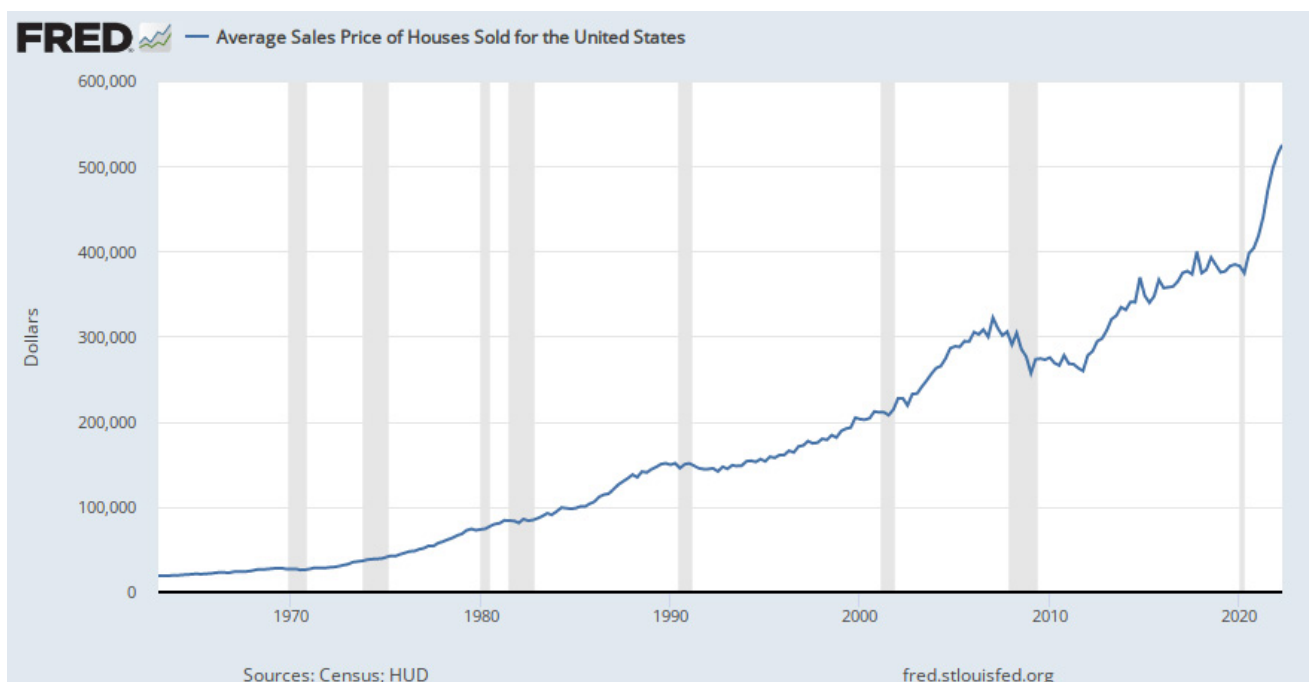


Figure 38 | House Pricing Graph



Project Emphasis:

Primary Emphasis

The Project will emphasize in the creation of a residential waterfront community that has established a sense of equality. The community will give each structure a view of the water, while still having shared access to the shoreline and marina. The overall goal of this community is to create a place that everybody living here gets the same characteristics as the rest of the community.

Secondary Emphasis

A secondary goal of this project is to research ways to control flooding of the community. Whether that is the rise of ocean level for coastal communities, or a heavy snow melt for inland water communities on lakes and rivers. Research into flood walls and drainage systems will be conducted to protect these communities.

Additional Emphasis

Another important goal for this project is to not disturb natural habitats. It is important to understand the affect that building close to the shoreline or changing the shoreline has on an environment. This project is meant to be designed for people that love lakes and the environment of it, by following important standards we can protect the shoreline from eroding, create clearer water, and allow a better habitat for underwater life to prosper.



Project Emphasis:

Additional Emphasis

A further goal for this project is to build a community that can foster connections with one another. Growing up in a rural area I wasn't exposed to gathering with neighbors and growing connections with one another. Since moving to a city, I have realized how important that is and how many benefits that can bring. In this project, I want to incorporate spaces throughout the community where people can have opportunities to interact with one another. A few ideas in which I can incorporate that is by creating shared beach shoreline, and a fireplace/patio space everyone gets to use.

Additional Emphasis

The final goal for this project is to allow enough storage. While living on the lake it is hard to find storage or build it without compromising views or land usage. By creating a community on the lake, it is going to be even more difficult to find storage. An idea that I have to solve this problem would be by creating a storage area on the front side of the community that each house has its own storage unit.

Major Project Elements:

Public spaces

Beach Shoreline-

Not only does a sandy shoreline look amazing on waterfront properties, but for some people it brings relaxation. By creating a beach area, you can create a “get away” space for many of the residents.

Dock/Marina-

It is important to remember that some people don't just want to live on the water for the view. Having an area of quick access to go on a boat, kayak, paddle board, etc. is a considerable advantage of being on a waterfront property.

Entertainment-

A community isn't just a place, but also the people. To have this community prosper, people will have to trust and be close to their neighbors. By creating an entertainment space, the community will have a chance to come together and become closer with each other.

Programmatic Spaces

Dock/Marina

Beach

Entertainment

Estimated Spatial Usage

Large

Small

Major Project Elements:

Private spaces

Residences-

The accommodation of the community will involve single family homes that will be assembled to form a close community where families can interact with each other. By creating individual homes, it gives a sense of privacy.

Storage-

There is already limited space on shorelines, but while trying to create a whole community on the shoreline there will be even less. People have a lot of stuff and much of it could be valuable to them. In this community, we will focus on creating spaces for residents to use for storage.

Programmatic Spaces

Residences

Storage

Estimated Spatial Usage





User/Client or Audience Description:

Individual Residents

As an individual resident there needs to be privacy and spaces where you can be alone. By creating single family homes, it creates a space that only belongs to the individual which gives a sense of privacy.

Parent Residents

As a parent resident there needs to be a mix of privacy and activities, as well as safety. It is important for parents to feel like their kids can go around the community and be safe, while still having privacy for their families to gather and be together.

Children Residents

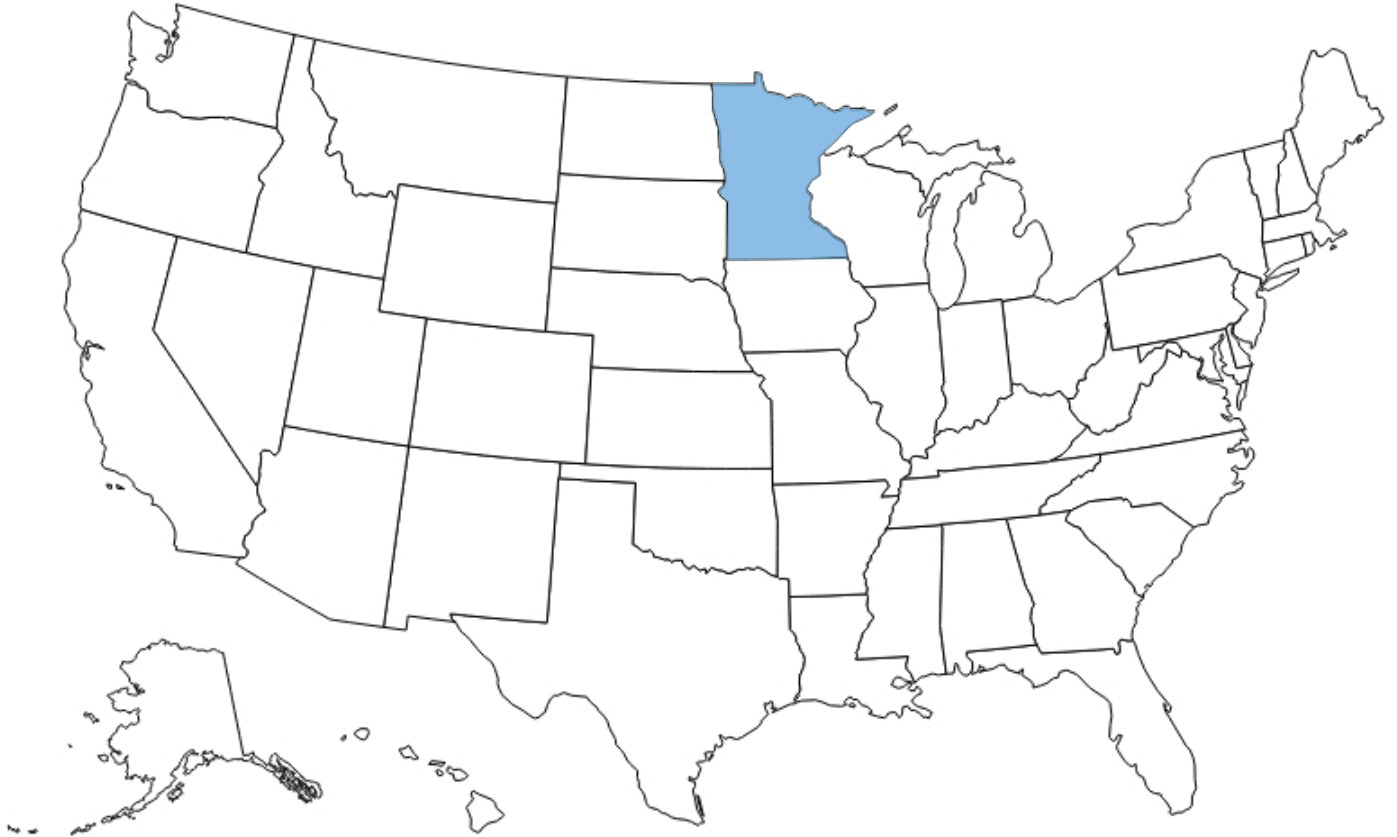
As a child resident there needs to be activities for children to play. There also needs to be space and areas where children can play together and build connections with other kids in the community. Finally, kids can be unsafe at times, so it is very important to have a sense of safety throughout the community.

Guests

Many individuals/families invite guests to their homes. In this project, with the housing being constructed close together it is necessary to have spaces around the community that guests can hang out at and have large gatherings around.

Site/Context:

Figure 39 | Site Region



Why is this specific site appropriate for the proposed project?

Region: Midwestern United States

Minnesota, located in the upper Mid-West of the United States, is a fitting location for this project because of the amount of waterfront properties throughout the state. Minnesota also known as “Land of 10,000 Lakes” has over 14,000 bodies of water. This is equal to more than 90,000 miles of shoreline. With this much shoreline around the state, I believe that it is the perfect place to create a new design for waterfront properties.

Site/Context:

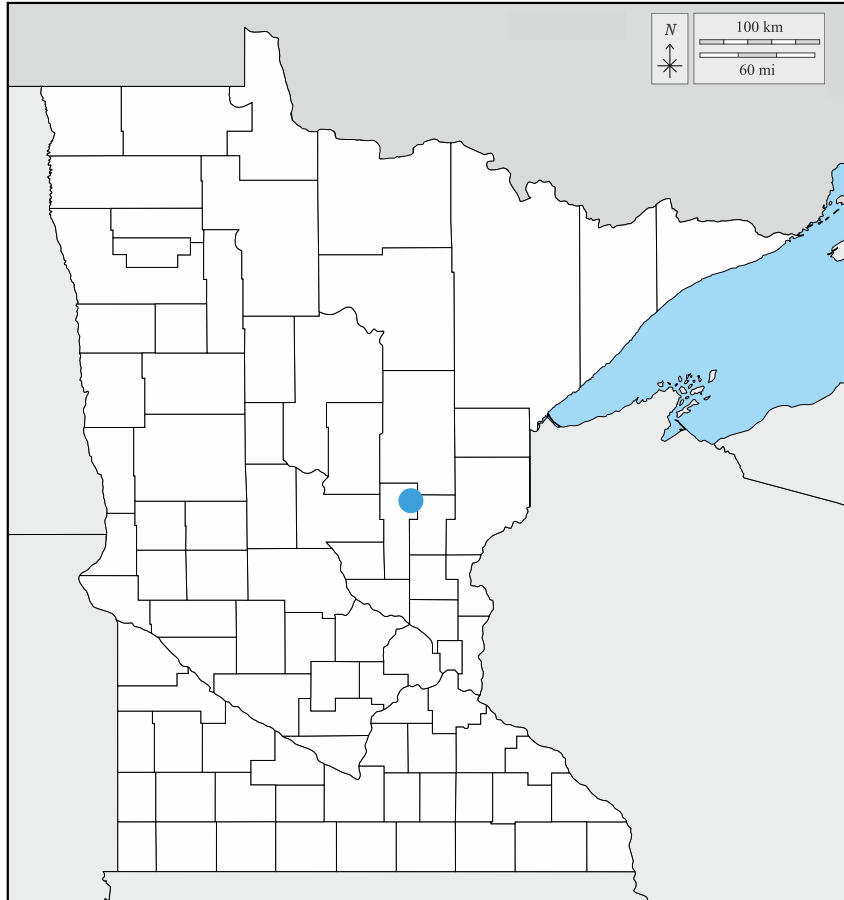


Figure 40 | Site City

Why is this specific site appropriate for the proposed project?

City: Isle, Minnesota

Isle, Minnesota, is located approximately an hour north of central Minnesota. Sitting on the edge of the second largest lake within the boarder of Minnesota, Mille Lacs Lake. This lake is the perfect spot to build for this project because of the amount of shoreline and undeveloped land in this area. Also, it is a massive lake, so bringing attraction to it will not overwhelm the lake.

Site/Context:

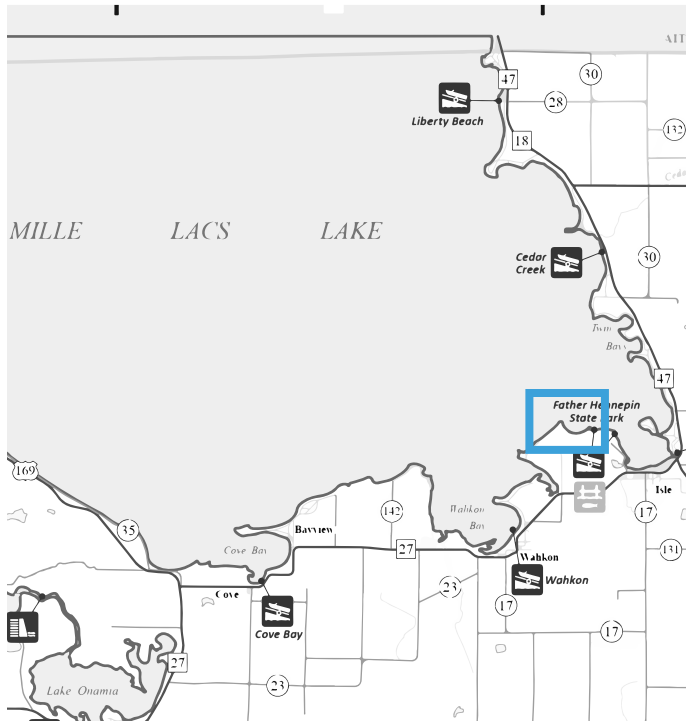


Figure 41 | Site Area



Figure 42 | Site Area

Why is this specific site appropriate for the proposed project?

Site: On 45th Ave by Pope Point Lookout

Located on the southeast corner of Mille Lacs Lake this site has great terrain with an amazing view of the lake. Also, it is positioned away from main roads which gives it a sense of privacy. This site has not yet been developed which gives this project a lot of area to construct on. Overall, I believe that this site is the perfect place to build a community and develop a new form of residential waterfront properties.

Site/Context:

Photos of Site:



Figure 43 | Site



Figure 44 | Site

Site/Context:

Photos of Site:



Figure 45 | Site



Figure 46 | Site



Figure 47 | Site



Figure 48 | Site

Site/Context:

Photos of Site:



Figure 49 | Site



Figure 50 | Site

Site Analysis:

Site Contours:

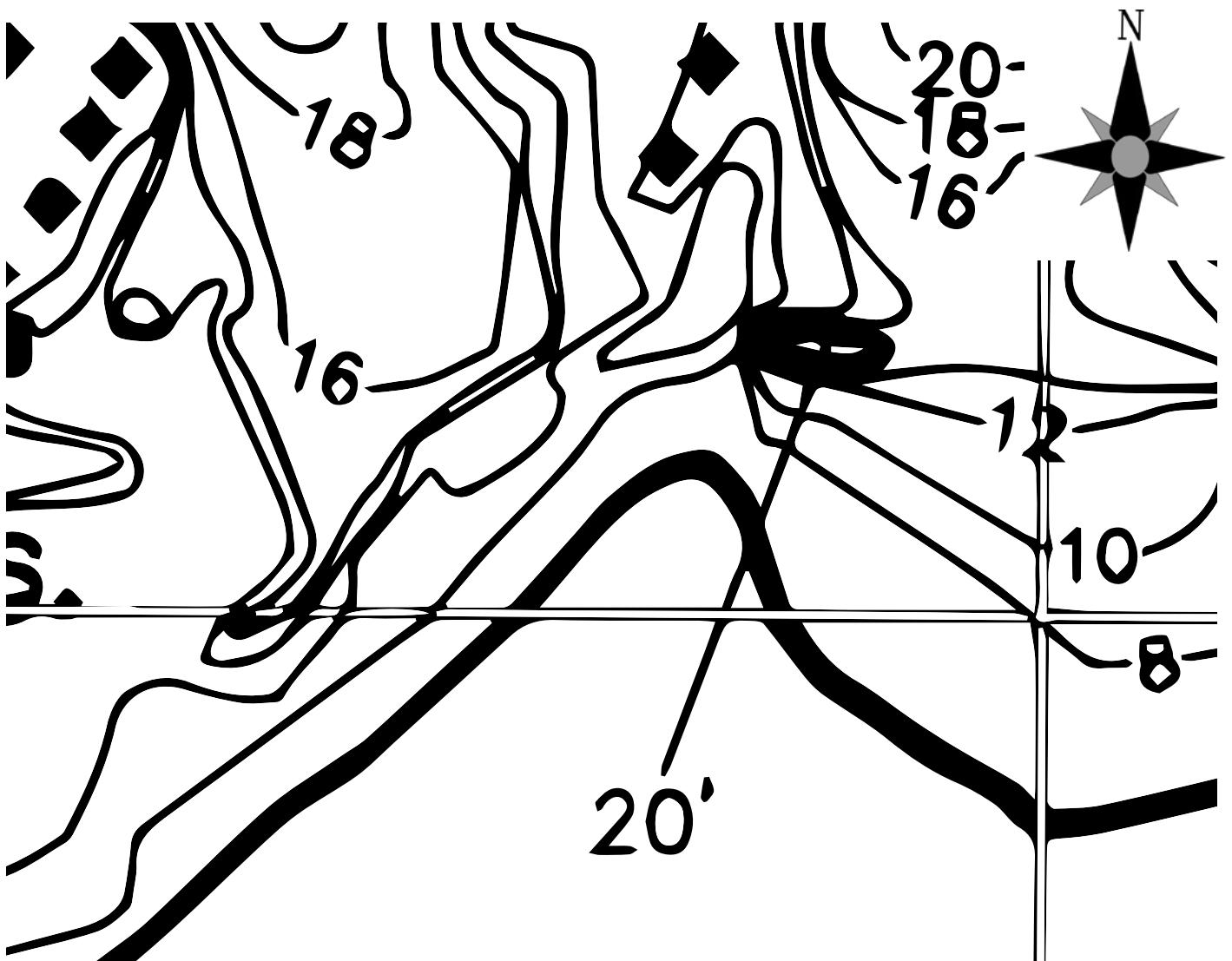
Mille lacs Lake has a very unique terrain around the shoreline. However, this site is relatively flat. The flat site makes it easier to build on, but also creates some challenges. With the land being so low to the water level, there is a chance of flooding on the site. Also, since Mille Lacs Lake is such a large lake in the spring time when the ice is melting, it can cause ice shoves. Ice shoves are when winds create friction on the ice surface. This causes ice sheets to generated momentum, shoving large amount of thick ice slabs onto the shore, which can possibly damage property.



Site Analysis:

Water Depth:

The depth of water is important to think about while building a marina. Knowing water depths allows people to understand the best place for boat traffic. As the resident of a community, the last thing you want to do is worry about hitting your boat motor on a rock every time you leave and return from the lake. Also if there are any shallow areas around the community, it is best to mark them with a buoy, so your residents understand to stay away from that area.



Site Analysis:

Flood Zone:

10-year flood elevation	25-year flood elevation	50-year flood elevation	100-year flood elevation	500-year flood elevation
1253.40 ft	N/A	1253.90 ft	1254.10 ft	1254.40 ft



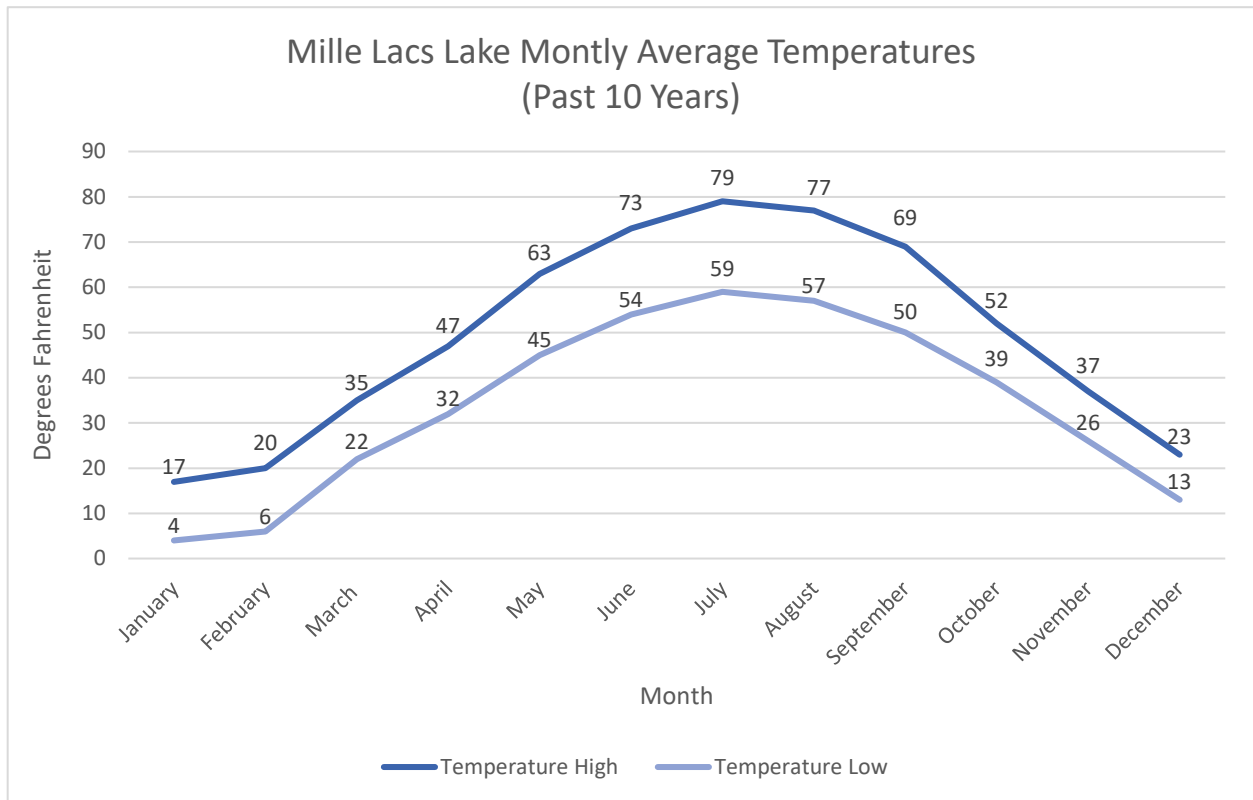
Key

■ 1% Annual Chance Flood-Hazard

Site Analysis:

Site Climate:

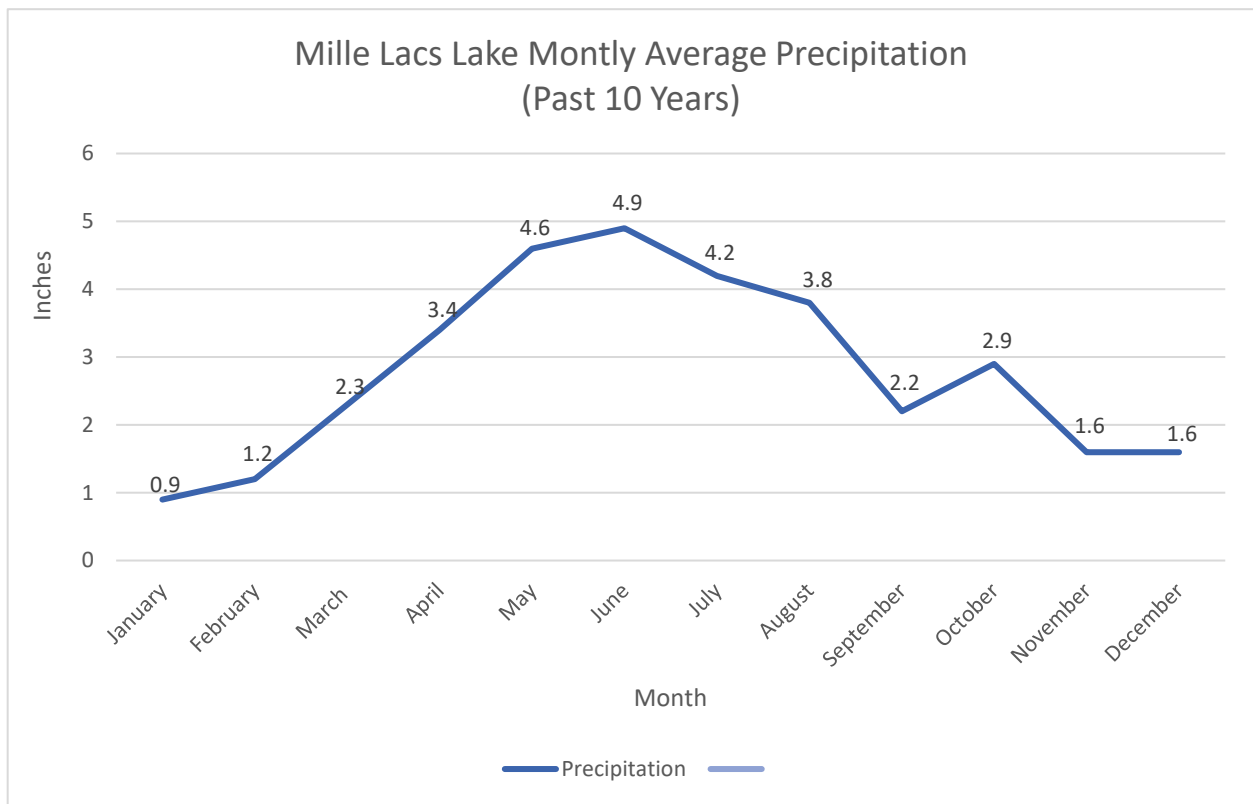
July is the hottest month for our site with an average high temperature of 79 degrees Fahrenheit, which ranks it as cooler than most places in Minnesota. There are 3 'comfortable' months with high temperatures that range from 70-85 degrees, which include June, July, and August. Overall, the Bestplaces Comfort Index for Mille Lacs Lake ranks at a 9.2/10 for summer. However, winters aren't as nice with the coldest month being January with an average high temperature of 17 degrees.



Site Analysis:

Site Climate:

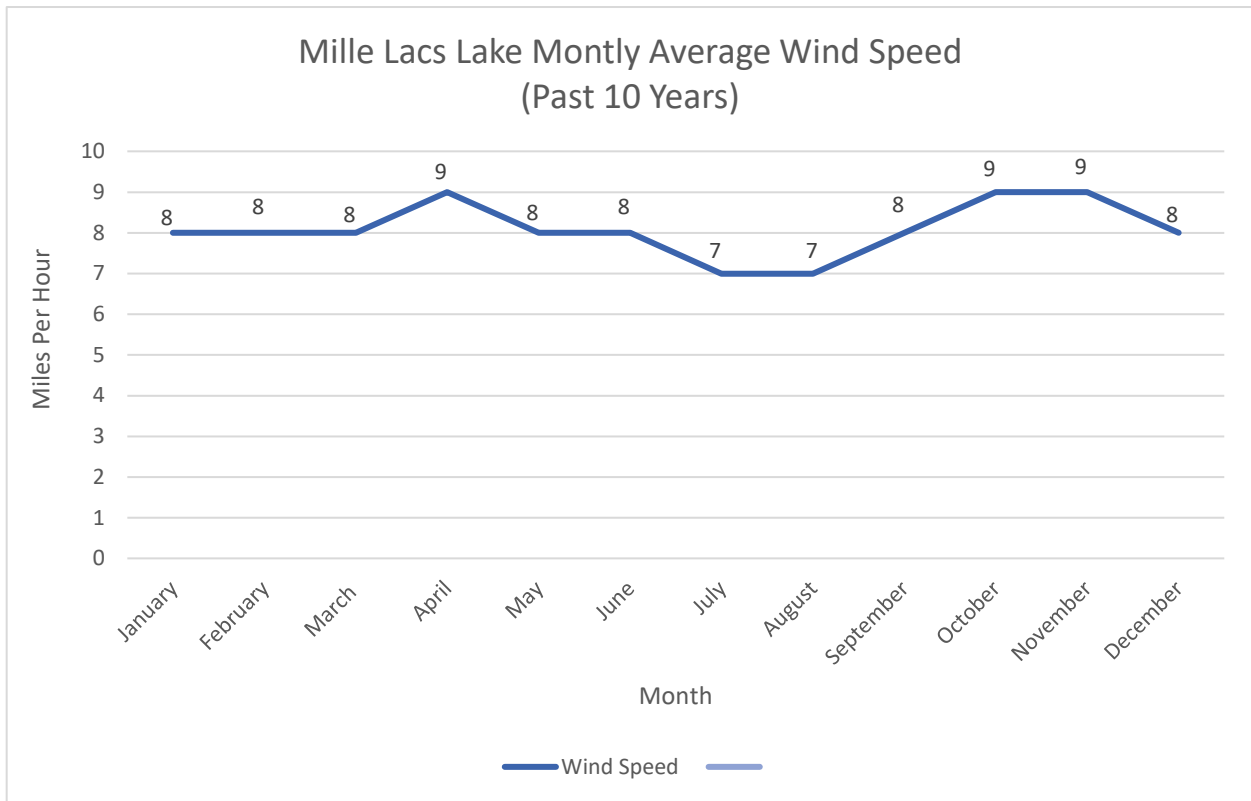
Mille Lacs Lake receives precipitation an average of 91 days per year. It receives an average of 29.2 inches of rain a year, and an average of 43.5 inches of snow.



Site Analysis:

Site Climate:

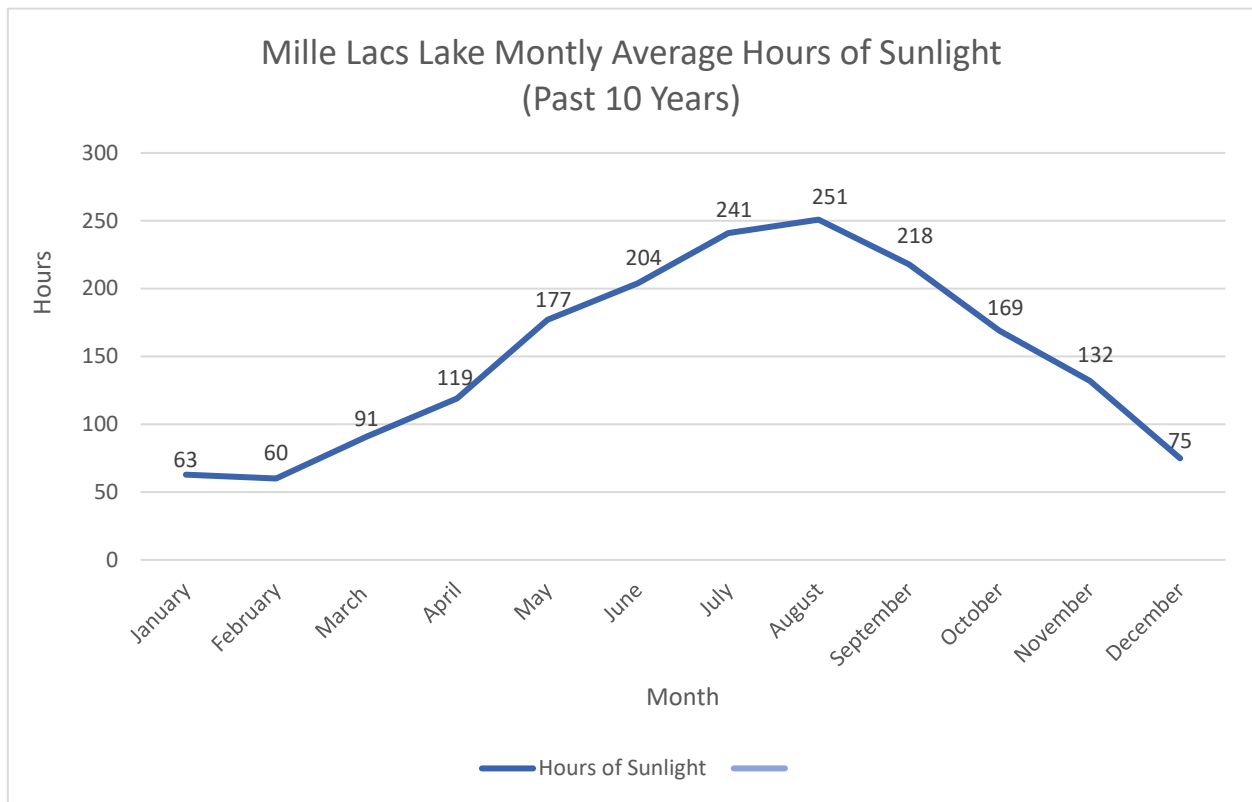
On Average the wind speed is 7-9 mph year round. However, the site is located right off the lake, on a peninsula, so it will receive more wind than surrounding areas.



Site Analysis:

Site Climate:

August is the high month with average hours of sunlight with an average of 251 hours. While February is the low month with an average of only 60 hours of sunlight for the month.



Historical, Social & Cultural Context:

Site History:

Our site has been untouched over the past 20 years, as demonstrated by the photos displayed below. However, the adjacent site to the southwest has grown at a minor rate.

April, 1991



Figure 51 | Site History

August, 2003



Figure 52 | Site History

Historical, Social & Cultural Context:

April, 2011



Figure 53 | Site History

April, 2015



Figure 54 | Site History

May, 2021



Figure 55 | Site History

Historical, Social & Cultural Context:

Site History and Culture:

Our site is located in the Mille Lacs region which is home to the Dakota and the Ojibwe. These tribes occupied Mille Lacs region from primitive times until 1740s. After a battle between the two tribes, the Dakota were forced to reposition to another territory. For the next 110 years the Ojibwe lived in the Mille Lacs region until 1854 and 1855 when the United States government made treaties with them. At that moment, much of the northern land of Mille Lacs was ceded to the United States. Overtime, the Ojibwe were pressured to give up the land granted to them; however, they resisted and were allowed to stay in the area. This region is now called the Mille Lacs Reservation.

Mille Lacs Reservation Boundaries

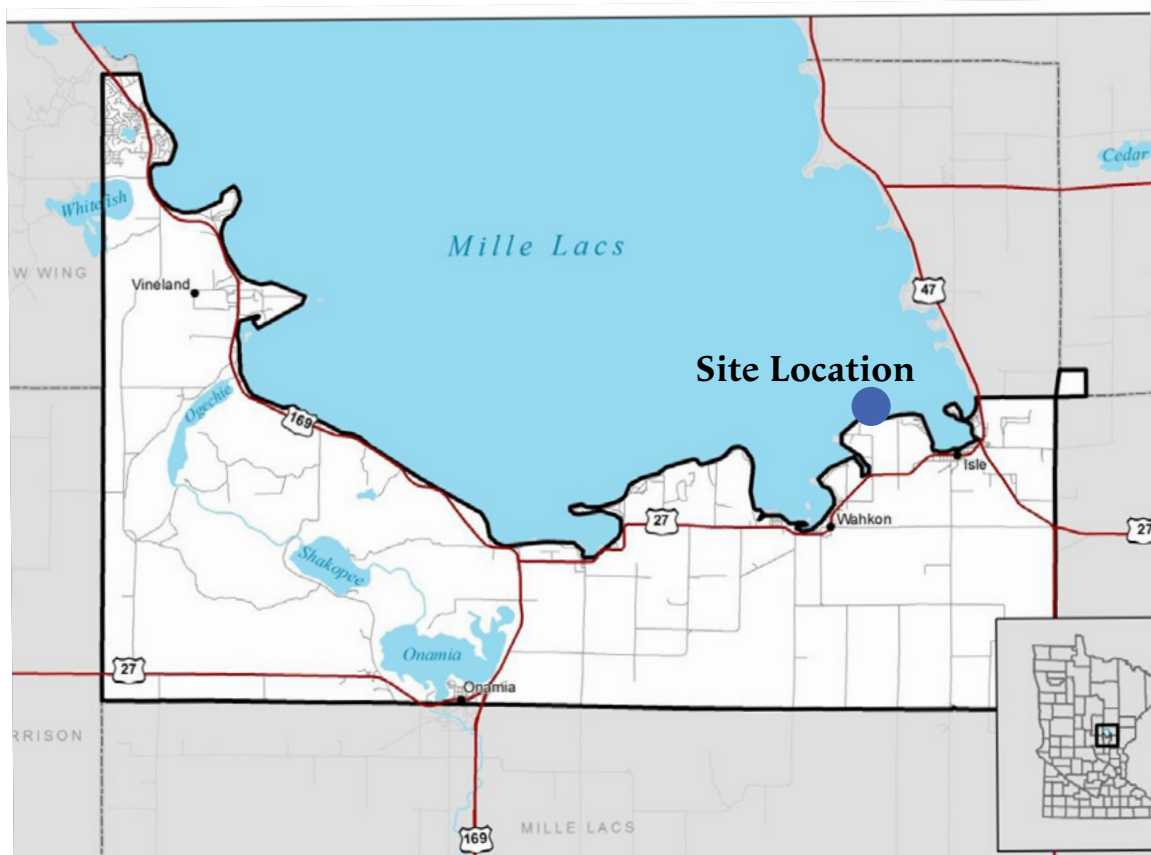


Figure 56 | Site Culture

Research Results:

How can land use planning and architectural design be combined to create a new form of residential lakeshore development?

The research conducted was meant to help answer the question stated above. The information collected is intended for architects and interior designers who will be designing spaces for future lakeshore properties. The main point of this research was to study ways in which you can design a lakeshore property and be as efficient as possible with land use, while still allowing a sense of privacy.

Case studies were done to identify patterns in modern cohousing and zero-lot-line housing, while also looking at what makes these communities work so well. The case studies reviewed were:

- Asher at Playa Vista
- Lange Eng Cohousing Community, Denmark
- Marmalade Lane Cohousing Community, United Kingdom
- Minnesota Shoreline Regulations

In addition, a site analysis was done for the selected site. As stated in my thesis narrative, this design is intended to be a concept design, which is located on a lakefront property, however, I intend to create a base design that can be used for multiple other waterfront properties in the future. I understand every sites varies, but I analyzed topics that would be apparent in many waterfront properties.

On the upcoming pages, I will be describing the techniques that I identified as the most important while designing a new lakeshore development.



Research Results:

Zero-lot-line Housing

The most important aspect about zero-lot-line housing is it is a great use of land, while still giving a sense of privacy. By leaving a few feet between each structure it gives the illusion of more privacy, while only using a very small amount of extra land.

Spatial Organization

By having great spatial organization not only can you eliminate problems on the site, but you can also create amazing spaces. While designing on a waterfront property there will be many challenges including, flooding, natural light, and in colder temperatures, ice shoves. By creating good spatial organization you can eliminate all of these problems. Also, with zero-lot-line housing everything is so dense, so it is important to understand positioning of structures and how that will effect the movement of pedestrians.

Community Spaces

Community spaces give a place to communicate, connect, play, and relax. While living in compacted spaces, it's good to have spaces where you can do things that you wouldn't be able to do in your own yard. It's great for kids to go run around in a safe place, adults can connect with other community members, it can also be used for large community or family gatherings to take place. There are so many benefits to community spaces.



Research Results:

Limit Disturbing the Shoreline

The most important design technique to follow while building on a waterfront property is to limit disturbing the shoreline as much as possible. Natural vegetation does so much in protecting the body of water. Most people want a perfect shoreline with no obstructions, but it is important to leave as much natural vegetation as possible for the protection of the body of water.

Different Style Homes

While creating a development, it can get a little repetitive. However, many families are different and the design must account for that. By creating many different floor plans for the structures, it allows different family types more opportunity to join the community. By having different family types, it creates a healthier community.

Adjoining Rooms

Adjoining rooms are an excellent technique to use while designing compact spaces. It is a great use of space, while still making the rooms feel different. By adjoining room you can also create more rooms throughout the structure, which allows more uses throughout.



Performance Criteria:

Performance Criteria #1

Performance Measure: Space allocation is measured using square footage as the unit.

Performance Measure Source: Obtaining the performance measure from spatial programs, floor plans, and site plans.

Performance Analysis: Analyzing performance measure through computer models and drawings.

Performance Judgment: Judgment of performance will be done based on number of buildings on the site, amount of usable space within each house, and it will be based on square footage.

Performance Criteria #2

Performance Measure: Behavioral Performance is measured using usage patterns.

Performance Measure Source: Obtaining the performance measure through paths, structure placements, and interior room placements.

Performance Analysis: Analysis of the circulation throughout the sites/buildings and calculate the amount of time it takes to get to certain places will be conducted. Analyzing performance measure through drawings and computer models

Performance Judgment: Judgment of the performance will be done by making sure everyone has equal paths around the community and calculating the time to make sure certain spaces aren't too far away for a particular individual.



Performance Criteria:

Performance Criteria #3

Performance Measure: Environmental Impact using square footage as the unit.

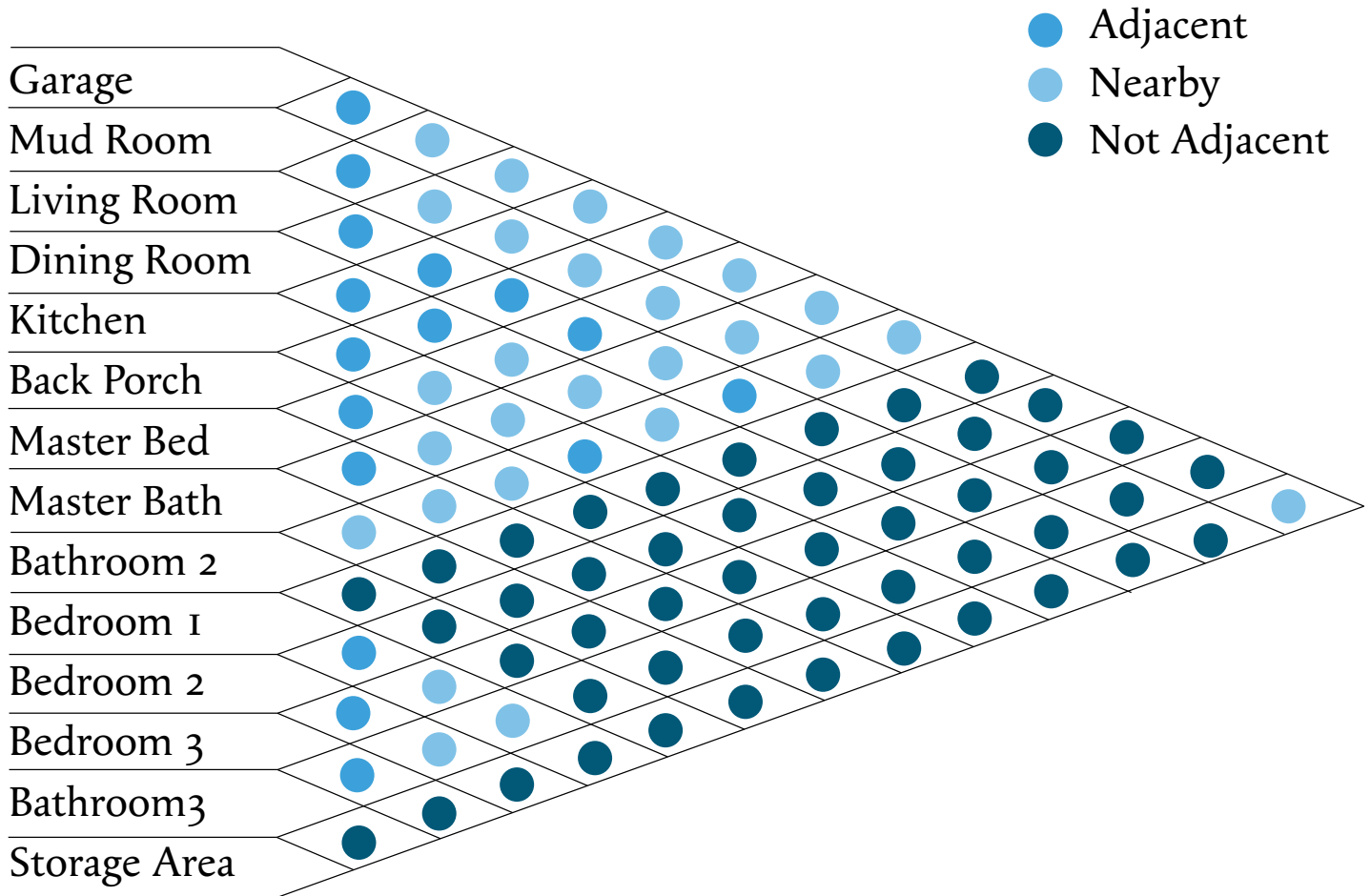
Performance Measure Source: Obtaining the performance measure from shoreline and shoreline vegetation.

Performance Analysis: Analyzing performance measure through the measurement of shoreline and vegetation before and after buildings and marina are placed. This will be completed through computer models.

Performance Judgment: Judgment of performance will be done by using a ratio of undisturbed shoreline before and after structures are placed. By using a ratio, I will know the percentage of shoreline that was disturbed, and I can adjust shapes and positioning of structures until I receive I ratio that I want.

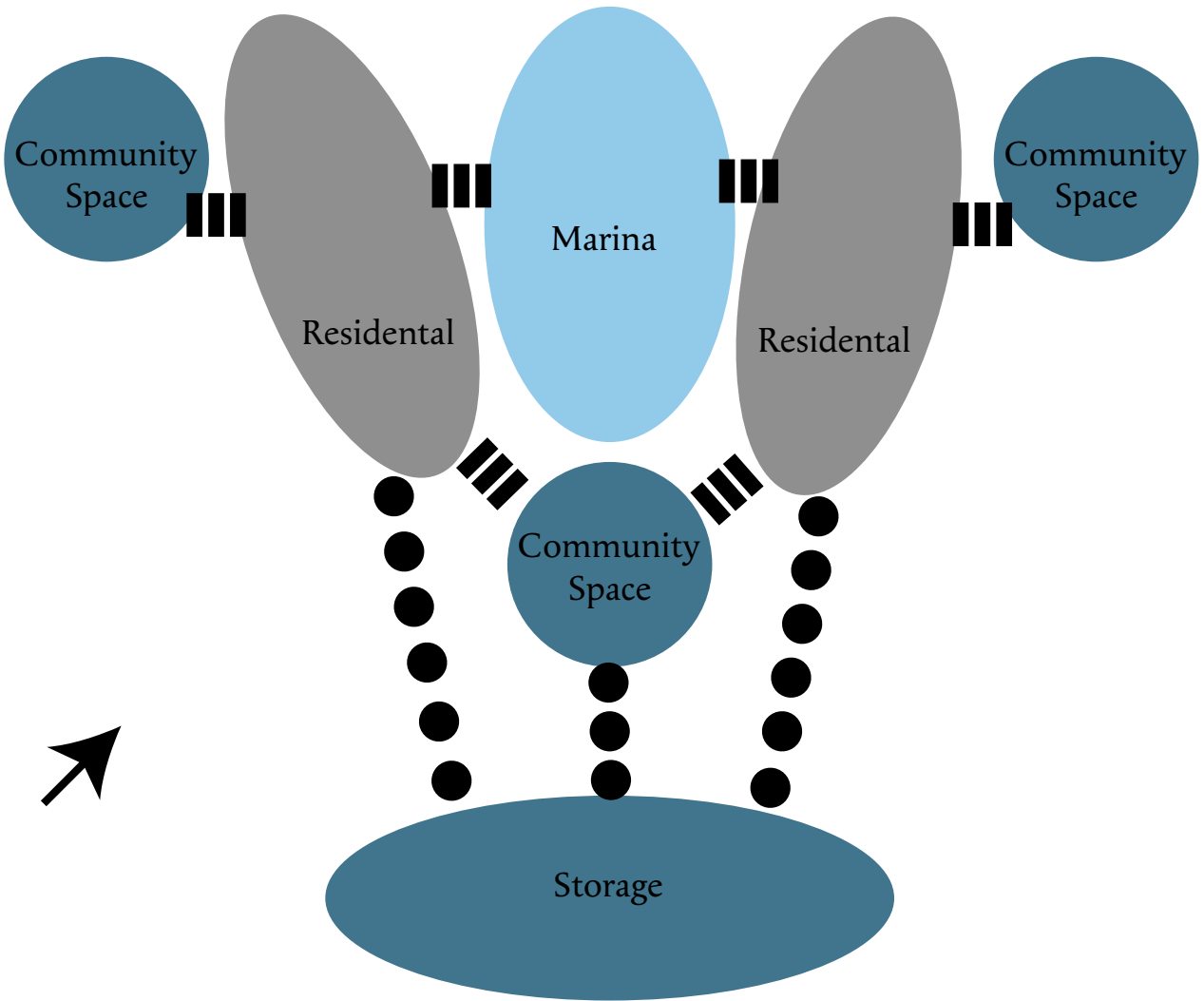
Performance Criteria:

Space Interaction Matrix



Performance Criteria:

Space Interaction Net



- Major Adjacency
- Minor Adjacency
- Entry

Goals of The Thesis Project:



Physical Goals

- Design the residential waterfront community in a way which does not negatively impact the environmental health of the body of water.

- Create a space where individuals and families can enjoy time with each other as well as the community.

- Create a system that will protect the community from:
 - Rising water or flooding

 - Traffic

 - Break-in

Theoretical Goals

- Bring knowledge to designers and architects of a new way to develop waterfront properties.

- Demonstrate importance of research-based design.



Goals of The Thesis Project:

Social Goals

- Identify how architecture can positively effect communities and create relationships throughout it.
- Identify how to allow more houses on waterfront properties and show how it improves the local community as well as the water life.

Personal Goals

- Develop more knowledge on:
 - Waterfront property development
 - Cohousing and Zero-lot-line housing
 - How landscaping and architecture can come together to create better spaces
- Take in as much information as I can from my professors and apply it to my thesis research and design.

Plan for Proceeding:

Research Direction

Theoretical Premise

- Precedents in cohousing projects
- Precedents in zero-lot-line housing
- Identify flood control strategies for waterfront properties
- What challenges become present when changing the topography?

TOOLS: Waterfront property visits, Construction documents, DNR shoreline regulations

Project Typology

- Identity Community and City goals and values

TOOLS: Mille Lacs Lake Watershed Management, Waterfront Property Owners, City of Isle

Historical Context

- What affect does zero-lot-line have on neighbors?
- What creates successful cohousing?
- What kind of construction has taken place on the lake?

TOOLS: State/County/Local History

Site Analysis

- What opportunities are there for the change of typography?
- How will wind and waves affect the community?

TOOLS: Site visits, government weather websites

Programmatic Requirements

- How to unify the small community with spaces?
- How to allow for best views while still allowing privacy in the structures?

TOOLS: Cohousing case studies

Plan for Proceeding:



Design Methodology

System of Methods

1. Unifying idea
2. Topic research leading to the discovery of new ideas and tools to help you answer related questions
3. Testing of new ideas and tools
4. Formulation of your own design opinions
5. Formulate those opinions into a proposed intervention

Types of analysis

Qualitative Analysis

- Interpret data/information through investigation

Quantitative Analysis

- Compare intervention and see if it compares with the goals and values of the client and community

Exploration

- Examine how qualitative and quantitative analysis can answer/improve the design, as questions arise throughout the design process

Plan for Proceeding:

Documentation of Design Process

Medium for design investigation

- Hand Sketching
- Hand Modeling
- Computer Representation

Software for Investigation

- Autodesk Revit
- Sketchup

Software for Representation

- Adobe Indesign
- Adobe Illustrator
- Adobe Photoshop

Design Preservation Methods

- Creating/investigation of representation
- Advisors feedback taken and utilized
- Weekly meetings with main advisor
- Document research material and keep list of sources
- Back up information regularly
- Update thesis book regularly

Publication of Material

- NDSU Institutional Repository
- Hard Cover book format

Presentation Intentions

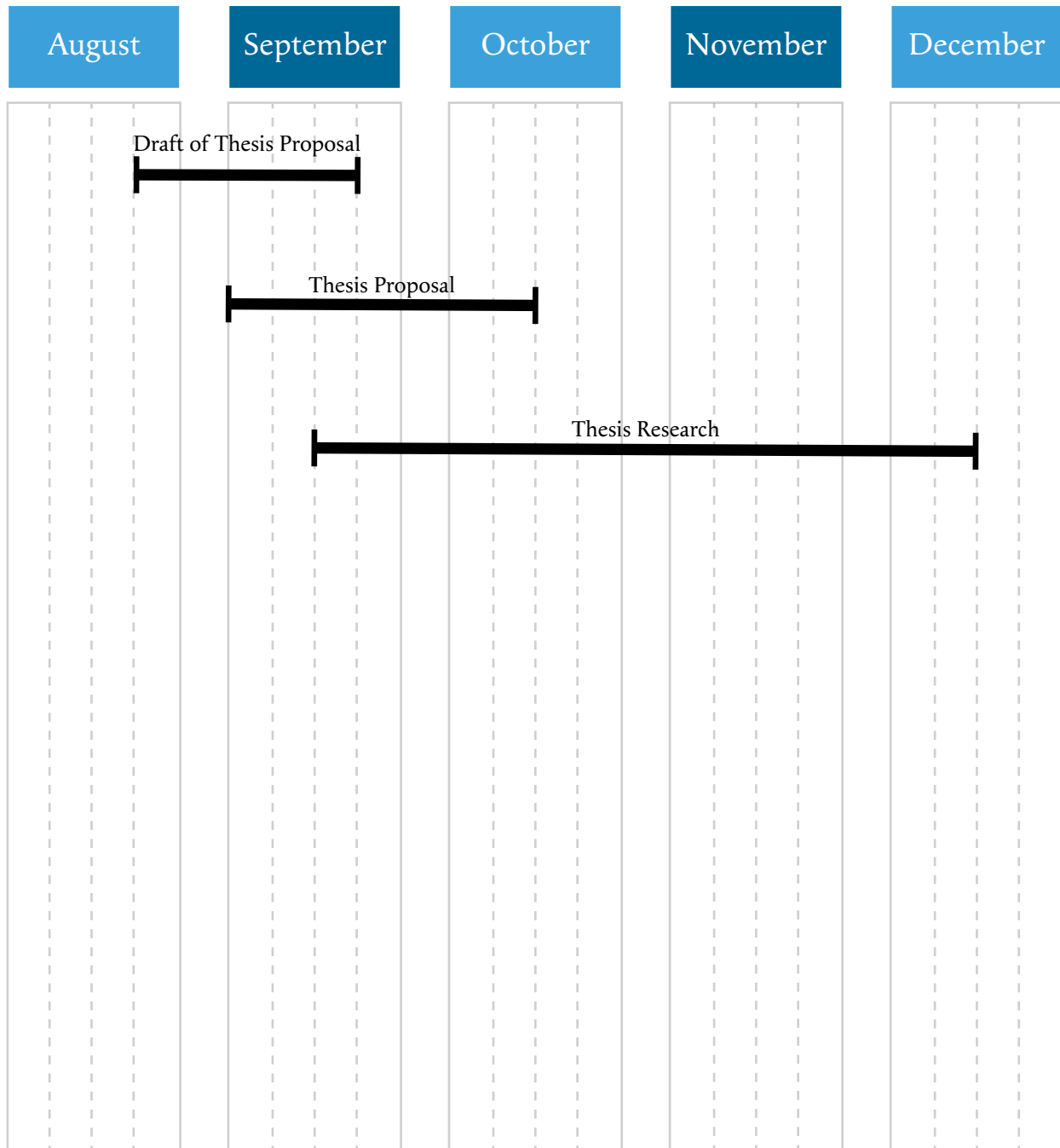
- Power Point Presentation
- Presentation boards
- Final Model

Documentation Organization

- Will be the date at the end of each category on the schedule

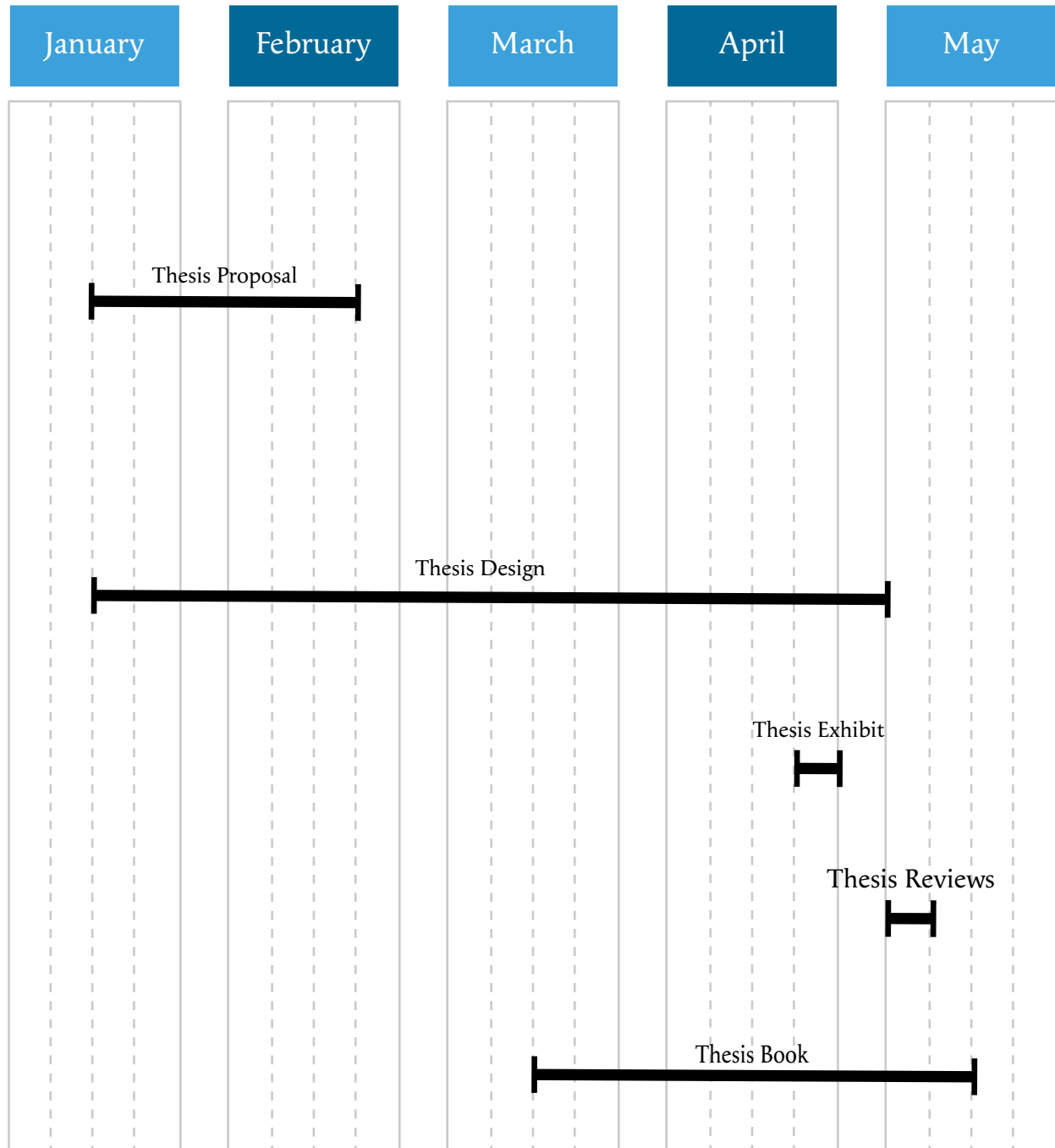
Plan for Proceeding:

Thesis Schedule



Plan for Proceeding:

Thesis Schedule





Design Solution:

Concept Design:

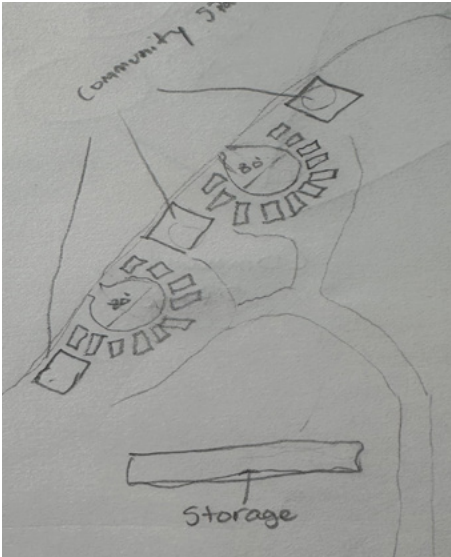


Figure 57 | Concept Design

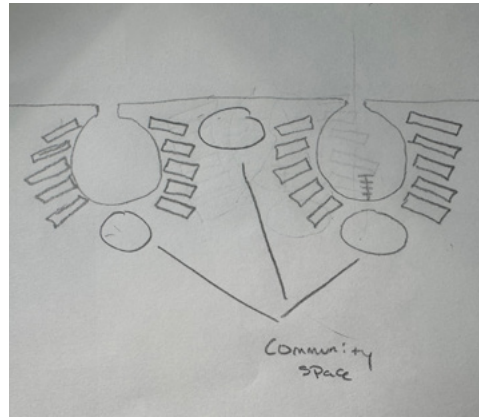
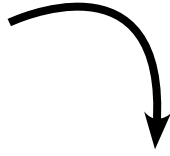


Figure 58 | Concept Design

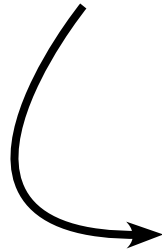


Figure 59 | Concept Design

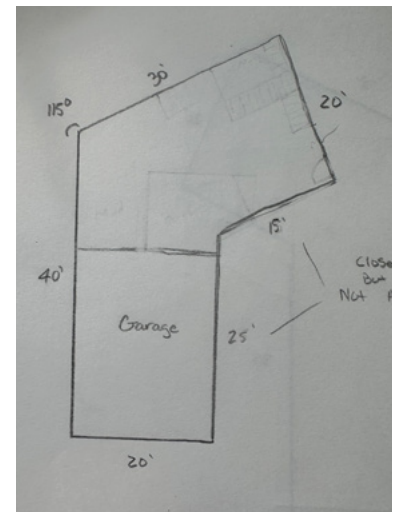
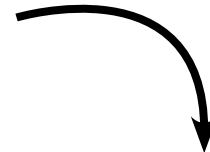


Figure 60 | Concept Design

Prototype Design:

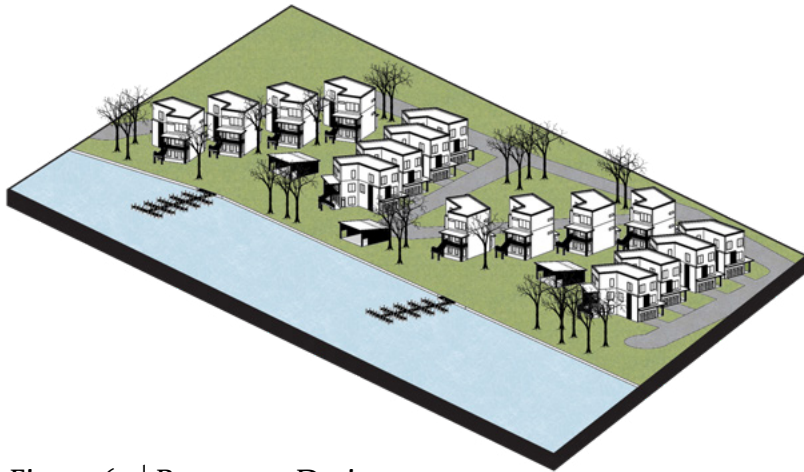


Figure 61 | Prototype Design

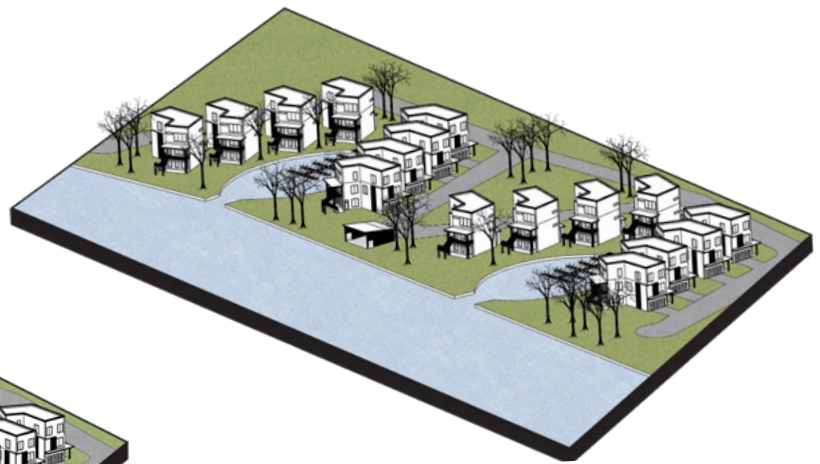


Figure 62 | Prototype Design

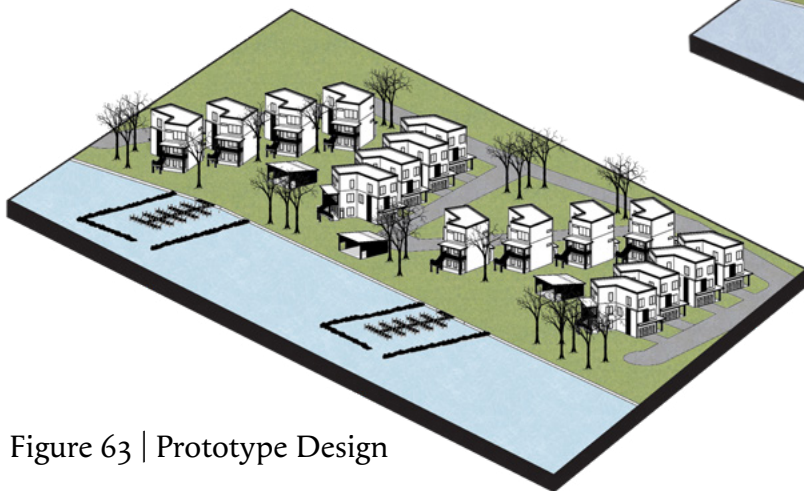


Figure 63 | Prototype Design

This Design uses Zero-lot-line housing in two U-shaped formations. This creates the best use of land, while still allowing each complex to have a great view of the water and have privacy from other people in the community. This is a concept design so it will have to adapt to each site differently. The prototype designs show how the design may differ from large lakes, to small lakes, to the ocean. The site plan shows how you can manipulate the prototypes to move with the land and still create views, privacy, and an abundance of community spaces.

Site Design:



Figure 64 | Site Design

Site Design:

Community Spaces

Community spaces give a place to communicate, connect, play, and relax. While living in compacted spaces, it's good to have spaces where you can do things that you wouldn't be able to do in your own yard. It's great for kids to run around in a safe place, adults can connect with other community members, it can also be used for large community or family gatherings to take place. There are so many benefits to community spaces. That is why this design has implemented five different community spaces throughout the community.



Figure 65 | Community Space

Site Design:



Figure 66 | Community Space



Figure 67 | Community Space

Site Design:



Figure 68 | Community Space



Figure 69 | Community Space

Residential Design:



Figure 70 | Residential Design

Residential Design:

Level 1

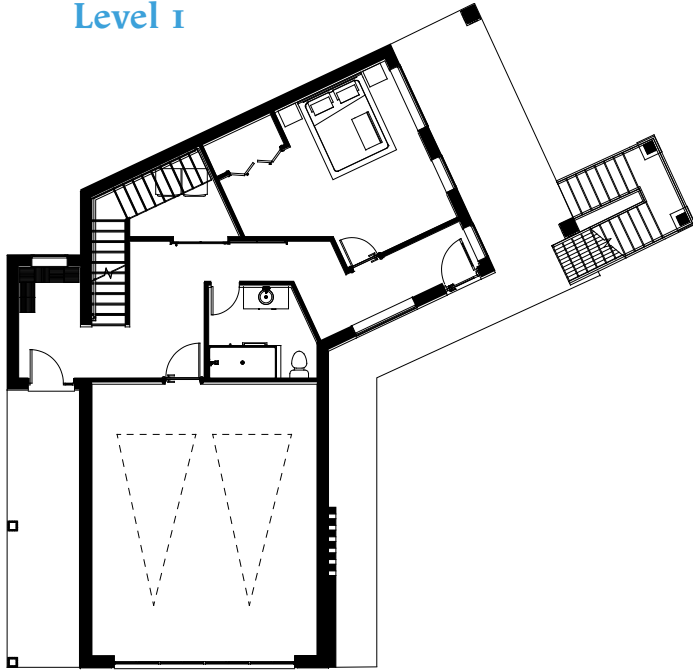


Figure 71 | Floor Plan

Level 2

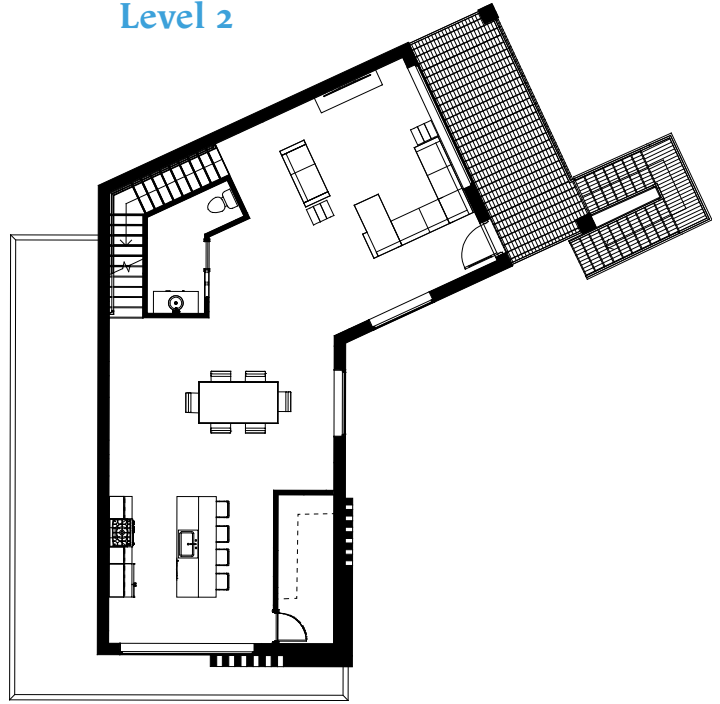


Figure 72 | Floor Plan

These floor plans were designed with the intent to create the most spaces, while keeping the square footage of each residential unit at a minimum. To accomplish this goal, adjoining rooms and combined spaces were utilized throughout the design. This is an excellent technique to compact spaces, while still making rooms feel different. Also, it can create more rooms in the structure. The floor plans were also designed to allow natural light into each room, while still allowing privacy from other residents.

Level 3

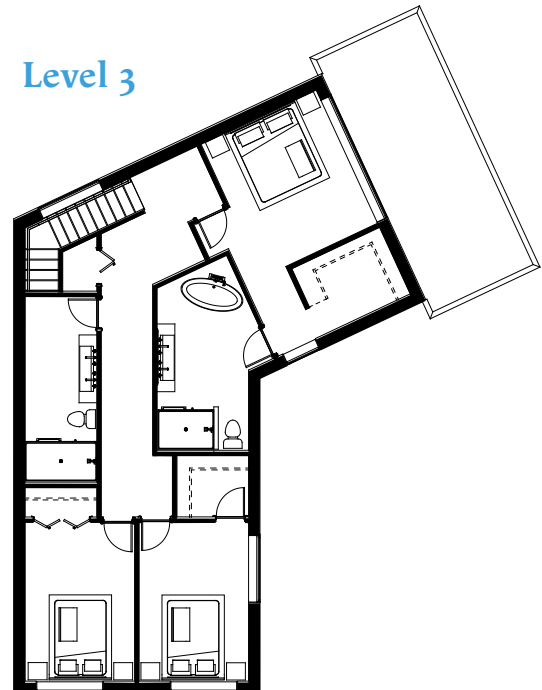


Figure 73 | Floor Plan

Residential Design:

Level 1

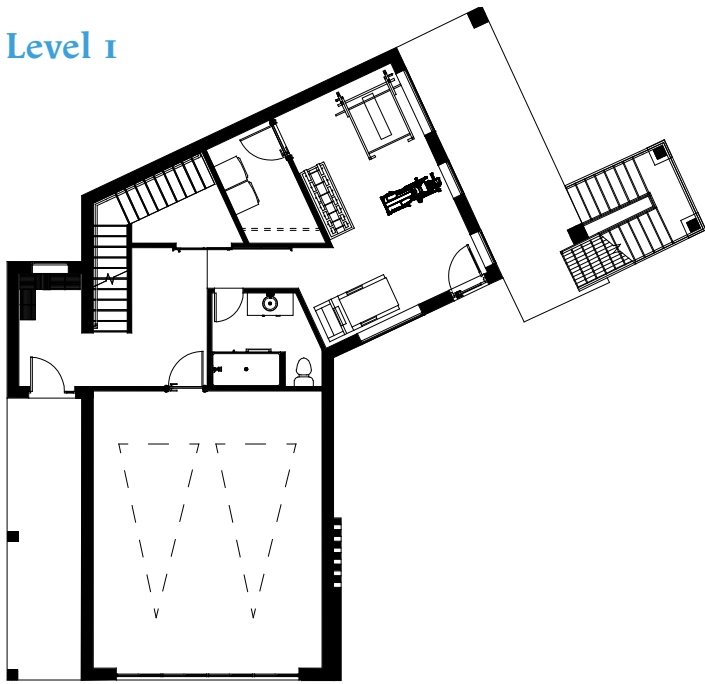


Figure 74 | Floor Plan

Level 2

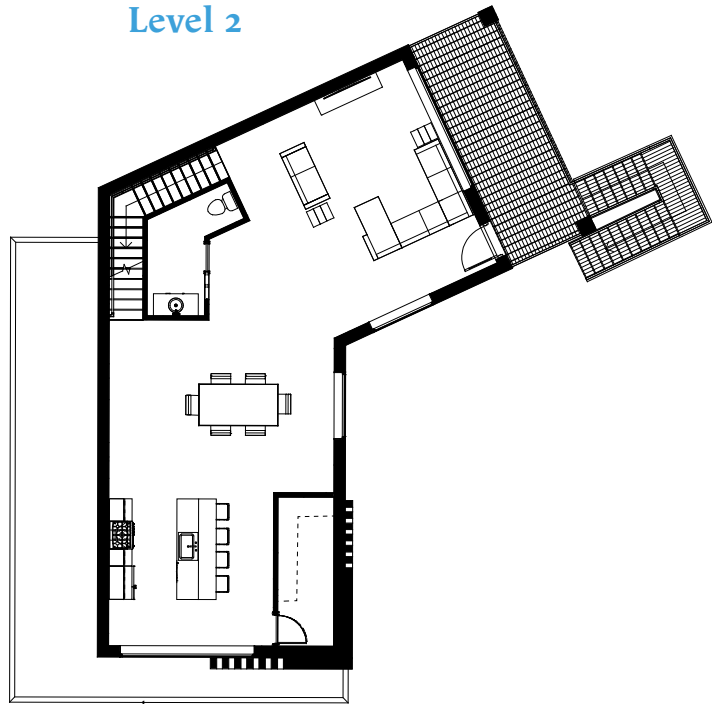


Figure 75 | Floor Plan

The Final technique used in the design was creating different style homes. By creating different floor plans, it can allow different family types to join the community, creating a healthier more diverse community. In this unit level 1 and level three were changed to accommodate a smaller family, which allows more room for other spaces.

Level 3

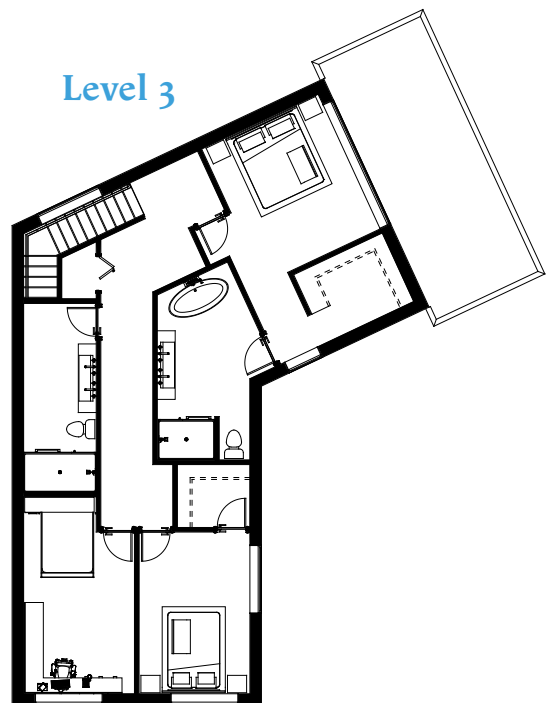


Figure 76 | Floor Plan

Residential Design:



Figure 77 | Residential Design



Figure 78 | Residential Design

Residential Design:



Figure 79 | Residential Design



Figure 80 | Residential Design

Residential Design:



Figure 81 | Residential Design



Figure 82 | Residential Design

Geothermal Closed Loop System Pond/ Lake Ground Loop

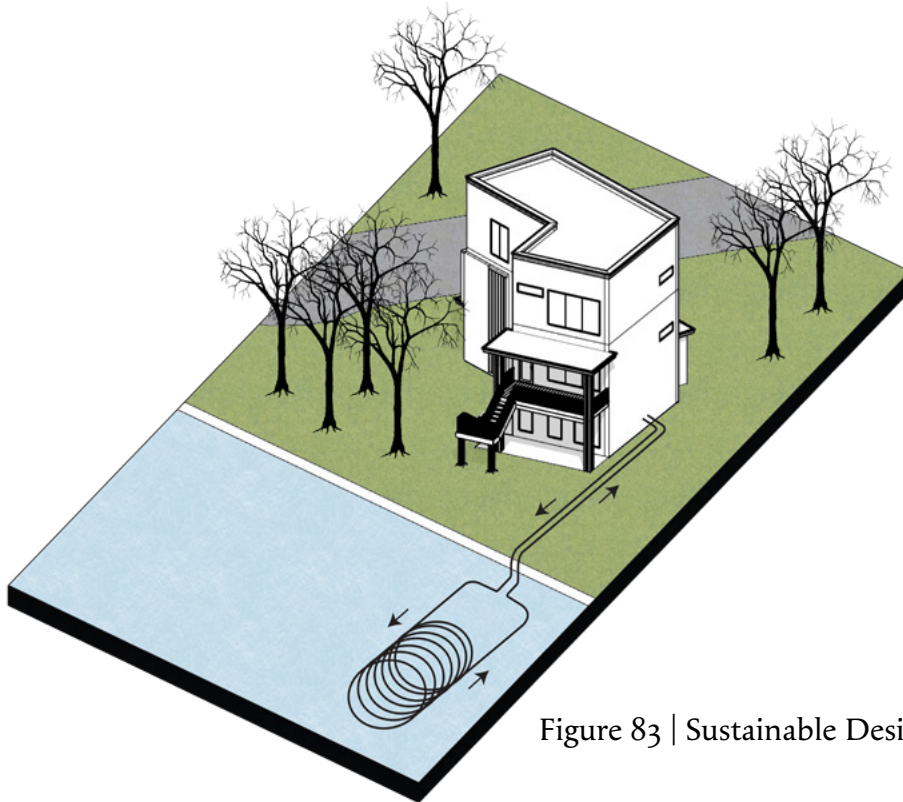


Figure 83 | Sustainable Design

A pond / lake ground loop is a series of plastic pipes filled with heat-transfer fluid and submerged in a nearby pond or lake with adequate size, depth, and flow. The loop connects to an indoor geothermal heat pump and uses the pond or lake water as a heat source or heat sink. The supply line pipe is run underground from the building to the water and coiled into circles at least eight feet under the surface to prevent freezing. Ground loops work for both heating and cooling buildings and are maintenance-free and don't require cleaning or re-charging. Geothermal ground loops can last 50+ years, even up to 100 years! There is a 25 to 50 percent savings on heating and cooling costs compared to conventional fossil fuel systems. They have a payback period of between 5-10 years according to the Department of Energy.

Sustainable Strategies:

SIPs (Structural Insulated Panels)

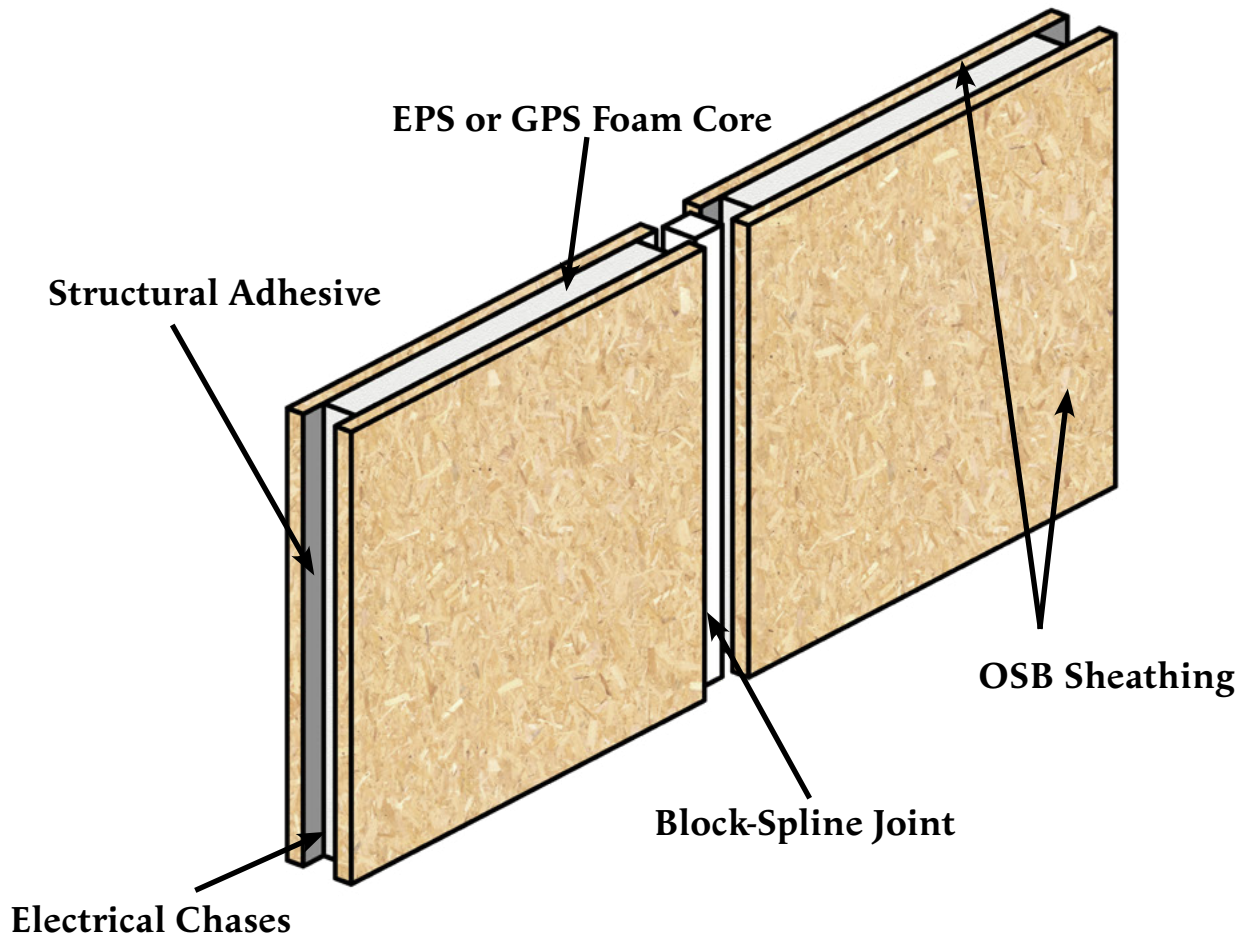


Figure 84 | Sustainable Design

SIPs are high-performance building systems for residential and light commercial construction. They are precisely manufactured under factory controlled conditions and fit nearly any building design. SIP panels are a great method to reach standards for Air Infiltration, R-Values and continuous insulation while significantly reducing time and labor. SIPs are known to be about 50% more energy-efficient than traditional timber framing. A SIP building envelope has minimal thermal bridging and delivers excellent airtightness, which lends itself ideally to LEED and net-zero-ready building standards. A BASF time-motion study confirmed that SIP panels reduce jobsite labor needs by 55%.

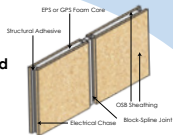
Final Board:

Residential Waterfront Property Development



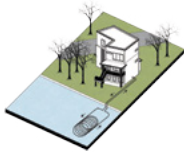
Sustainable Strategies

SIPs (Structural Insulated Panels)

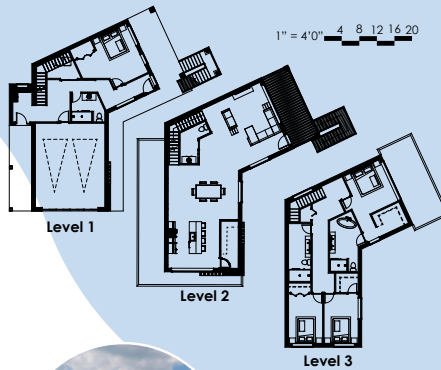


The innovative panels consist of an insulating foam core sandwiched between two structural facings, typically oriented strand board (OSB). SIPs are known to be about 50% more energy-efficient than traditional timber framing. A SIP building envelope has minimal thermal bridging and delivers excellent airtightness, which lends itself ideally to LEED and net-zero-ready building standards.

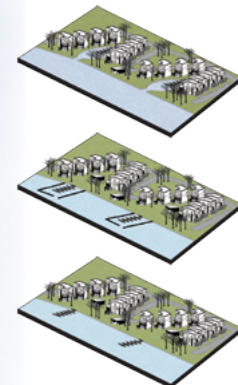
Pond/Lake Ground Loop



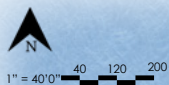
Closed loop systems constantly circulate heat-transfer fluid within buried or submerged plastic pipes. A supply line pipe is run underground from the building to the water and coiled into circles at least eight feet under the surface to prevent freezing. Geothermal ground loops can last 50+ years, even up to 100 years! Ground loops are maintenance-free and don't require cleaning or re-charging. These pumps generate 25 to 50 percent savings on heating and cooling costs compared to conventional fossil fuel systems. Creating a payback period between 5-10 years according to the Department of Energy.



Prototype Designs



This Design uses Zero-lot-line housing in two U-shaped formations. This creates the best use of land, while still allowing each complex to have a great view of the water, and have privacy from other people in the community. This is a concept design so it will have to adapt to each site differently. The prototype designs show how the design may differ from large lakes, to small lakes, to the ocean. The site plan shows how you can manipulate the prototypes to move with the land and still create views, privacy, and an abundance of community spaces. Community spaces give a place to communicate, connect, play, and relax. While living in compacted spaces, it's good to have spaces where you can do things that you wouldn't be able to do in your own yard. It's great for kids to go run around in a safe place, adults can connect with other community members. It can also be used for large community or family gatherings to take place. There are so many benefits to community spaces. That is why this design has implemented five different community spaces throughout the community.



1



2



3



4



5

1. Beach/Pavilion Area
2. Marina/Dock
3. Community Garden
4. Playground
5. Storage Unit

Figure 85 | Final Board

Final Model:

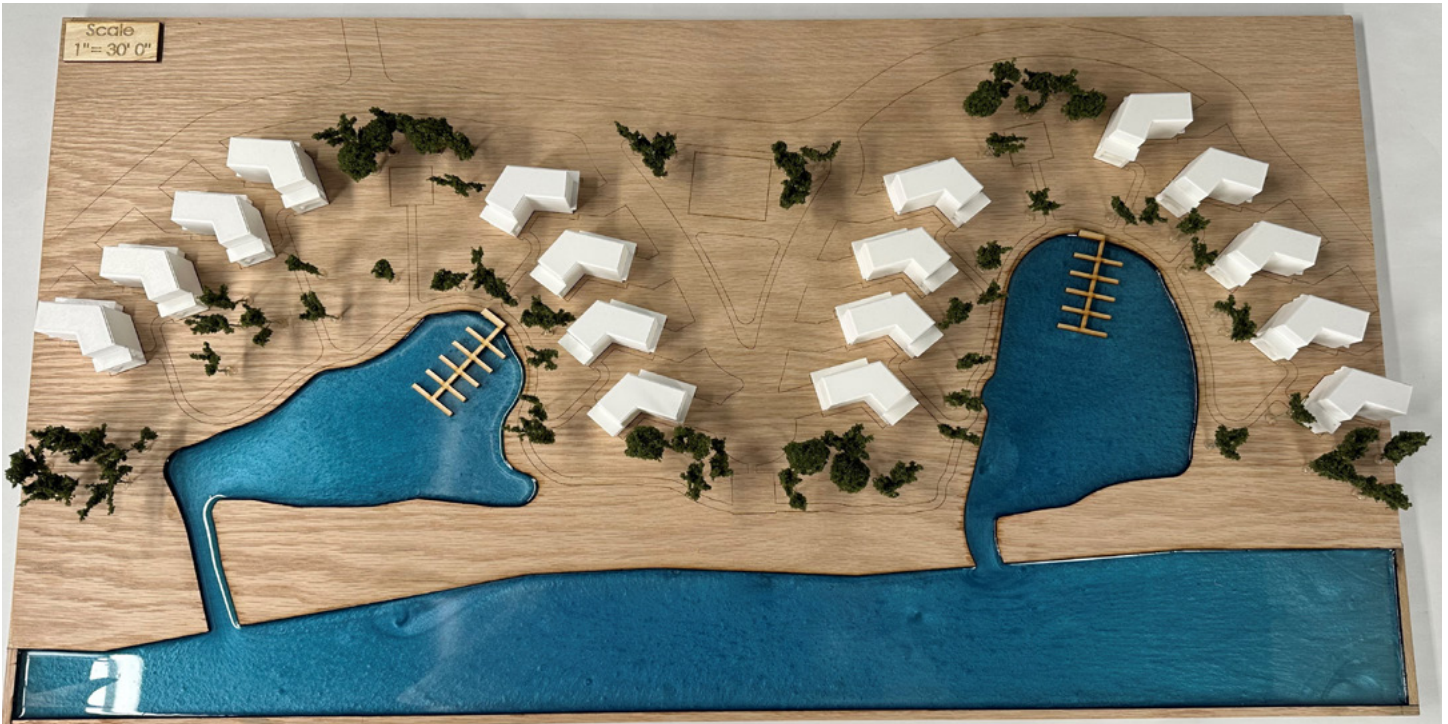


Figure 86 | Final Model



Figure 87 | Final Model

Final Model:



Figure 88 | Final Model



Figure 89 | Final Model

Final Model:



Figure 90 | Final Model

Appendix:

Reference List

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Appendix:

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Appendix:

2nd Year (2019-2020)

Ronald Ramsay

Boat House Project

Emily Guo

Faculty Oriented Building Design

3rd Year (2020-2021)

Regin Schwaen

Brick Structure

Paul Gleye

Concrete Structure

4th Year (2021-2022)

David Crutchfield

Miami High-Rise Capstone

David Crutchfield

Urban Infill Design

5th Year (2022-2023)

Cindy Urness

Otte Wetlands Center

Cindy Urness

Residential Waterfront Development



Trenton Peterson

Thesis author & designer