The Ephemeral Population

Housing for a Transient Workforce

By: Eric Hoffer

THE EPHEMERAL POPULATION

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

By

Eric Hoffer

In Partial Fulfillment of the Requirements
for the Degree of
Master of Architecture

____
Primary Thesis Advisor

____
Thesis Committee Chair

April 2011
Fargo, North Dakota

NON-EXCLUSIVE DISTRIBUTION LICENSE

By signing and submitting this license, I, Eric Hoffer grant North State University (NDSU) the non-exclusive right to reproduce, translate (as defined below), and/or distribute my submission (including the abstract) worldwide in print and electronic format and in any medium, including but not limited to audio or video.

I agree that NDSU may, without changing the content, translate the submission to any medium or format for the purpose of preservation.

I also agree that NDSU may keep more than one copy of this submission for purposes of security, back-up and preservation.

I represent that the submission of my original work, and that I have the right to grant the rights contained in this license. I also represent that my submission does not, to the best of my knowledge, infringe upon anyone's copyright.

If the submission contains material for which I do not hold copyright, I represent that I have obtained the unrestricted permission of the copyright owner to grant NDSU the rights required by this license, and that such third-party owned material is clearly identified and acknowledged within the text or content of the submission.

IF THE SUBMISSION IS BASED UPON WORK THAT HAS BEEN SPONSORED OR SUPPORTED BY AN AGENCY OR ORGANIZATION OTHER THAN NDSU, I REPRESENT THAT I HAVE FULFILLED ANY RIGHT OF REVIEW OR OTHER OBLIGATIONS REQUIRED BY SUCH CONTRACT OR AGREEMENT.

NDSU will clearly identify the name(s) as the author(s) or owner(s) of the submission, and will not make any alteration, other than as allowed by this license, to your submission.

Name:____Date:_________________

Table of Contents

STATEMENT OF INTENT

Abstract

Western North Dakota is currently experiencing a tremendous oil boom which is attracting people from all over the country because of the prospects of money, work, and a better way of life. Communities are desperately trying to keep up with the needs that the industry demands. This thesis project will examine how these communities deal with the problems associated with an oil boom, how their decisions affect the viability and sustainability of the community in the long run, and what should be considered in order to ensure a positive future.

This is a residential typology that is able to respond to the volatility of the oil business.

Key Words: Oil, Community, Sustainability, North Dakota, Stanley, Infrastructure, Temporary, Housing, Details, Modular

Problem Statement

In what ways do oil drilling operations affect nearby communities?

Typology

This is a residential typology in the form of a housing community that is able to adapt to the various needs of an area in transition. Units must be self sufficient and flexibility is paramount.

Claim

Oil "booms" are a time of great economic growth and development which directly influence communities that find themselves close to drilling sites.

Premises

When discovered, oil attracts many companies and firms who wish to profit off of its acquisition.

The newfound oil discovery becomes the dominant factor in nearby communities' economies and, therefore, influences their decision making processes.

This dramatic change in their economy prompts rapid population growth which strains their infrastructures.

Theoretical Premise/Unifying Idea

During an oil boom, steps must be taken in order to prevent communities from collapsing when the boom ends.

Project Justification

When an oil drilling site is abandoned, so too is the community in which it created. In order for the community to continue to thrive, it is crucial that design decisions are sensitive to the volatility of the business.

PROPOSAL

Narrative

Miles of dirt roads, acres of rolling prairie, an endless expanse of uninterrupted blue sky. Small towns dot the landscape, gravitating near the major thoroughfare in hopes of enticing the rare passing motorist to stop at the local diner to eat, or the filling station to refuel. Tractors and large machinery can be seen tending the earth, like a ship sailing off into the horizon, they work into the night. Personal affairs are known by all, there are no strangers. People are friendly, always willing to lend a helping hand or talk about the local happenings over coffee. Life is simple, or so it seems to the outsider looking in.

Enter an Oil Boom...

The firms and companies who inevitably funnel into the small towns are, at first glance, a welcomed addition to the sleepy communities. Soon, however, the dirt roads become dust clouds from the unrelenting flow of oil related traffic and the expansive prairie is interrupted by oil derricks and natural gas flares. The lonely road which once crept through the countryside is replaced with a 4 lane highway, teeming with trucks frantically trying to keep up with the demands of supplying raw materials for the oil drilling effort. People are coming from all corners of the country with the prospects of money and a better way of life. It is a modern day gold rush and there is money to be made in mass quantities.

Oil becomes the dominant factor in the region's economy. New businesses sprout up overnight to meet the demands of the boom. Struggling farmers are crossing their fingers, hoping to answer the call of a "land man" asking permission to begin drilling which will lead to royalty checks many times their normal earnings. Morning coffee topics turn from "the price of a bushel" to "the price of a barrel." The farmer or ranchers' children are turning to oil instead of taking over the family business. As the economy begins to pick up, so too does the population of the small towns.

Narrative cont.

The influx of people puts a strain on the infrastructure and fundamental fabric of the community. Motels are booked years into the future. Mobile home parks begin to fill up. Make shift tent camps pop up in local parks. Water supplies take a double hit, one from the increase of the required potable water for people and one from the need of water for the oil drilling process. Human waste management becomes an issue. Treatment facilities cannot keep up with the increased demand. Furthermore, the mental strain imposed upon the people begins to mount. Higher crime rates, lack of living space, fear of oil prices falling, and fear of losing a loved one because of the dangerous nature of oil work all take their toll on the people. (Chuck et al., 2010)

The proposed project will study this scenario as it is playing out in real time, extract and analyze valuable information, and lead to a design recommendation that is both sensitive to the rich culture of the region, realistically and economically feasible to carry out, and able to withstand the ongoing cycle of oil booms.

I believe that the built environment has a profound impact on the people who experience it and, therefore, also on the success or failure of a community. The social, economic, and cultural effects that an oil boom has on small communities are remarkable. The sudden and urgent need for buildings in an oil boom economy is exciting for an architect, but should not be approached lightly.

User/Client Description

The land in which the housing community is built upon will be purchased by the city. The units, themselves, can be either owned by the residents or rented out by an investor. The users include both incoming oil workers or existing residents of the city of Stanley who have been displaced from their homes as a result of the inflated cost of living.

Number

70 units will accommodate about 120 people.

Peak Usage

Due to the residential nature of the project, the building will constantly be in use. However, the peak usage will be before and after normal business hours.

Parking

The facility will provide one space per unit plus additional spaces for guests.

Physical Restrictions

Oil work is dangerous and the spaces will be sensitive to the fact that debilitating injuries may occur. There are, however, no specific physical restrictions directly related to this user group.

Medical/Mental Issues

High stress levels associated with long working hours and fear of the dangerous nature of oil work.

Major Project Elements

Housing Units

The primary spaces will be housing in the form of one-three bedroom units. Each unit will have living space, bedroom(s), bathroom, and cooking space. Each unit will also be adjacent to a semi-private outdoor space.

Water and Waste Processing

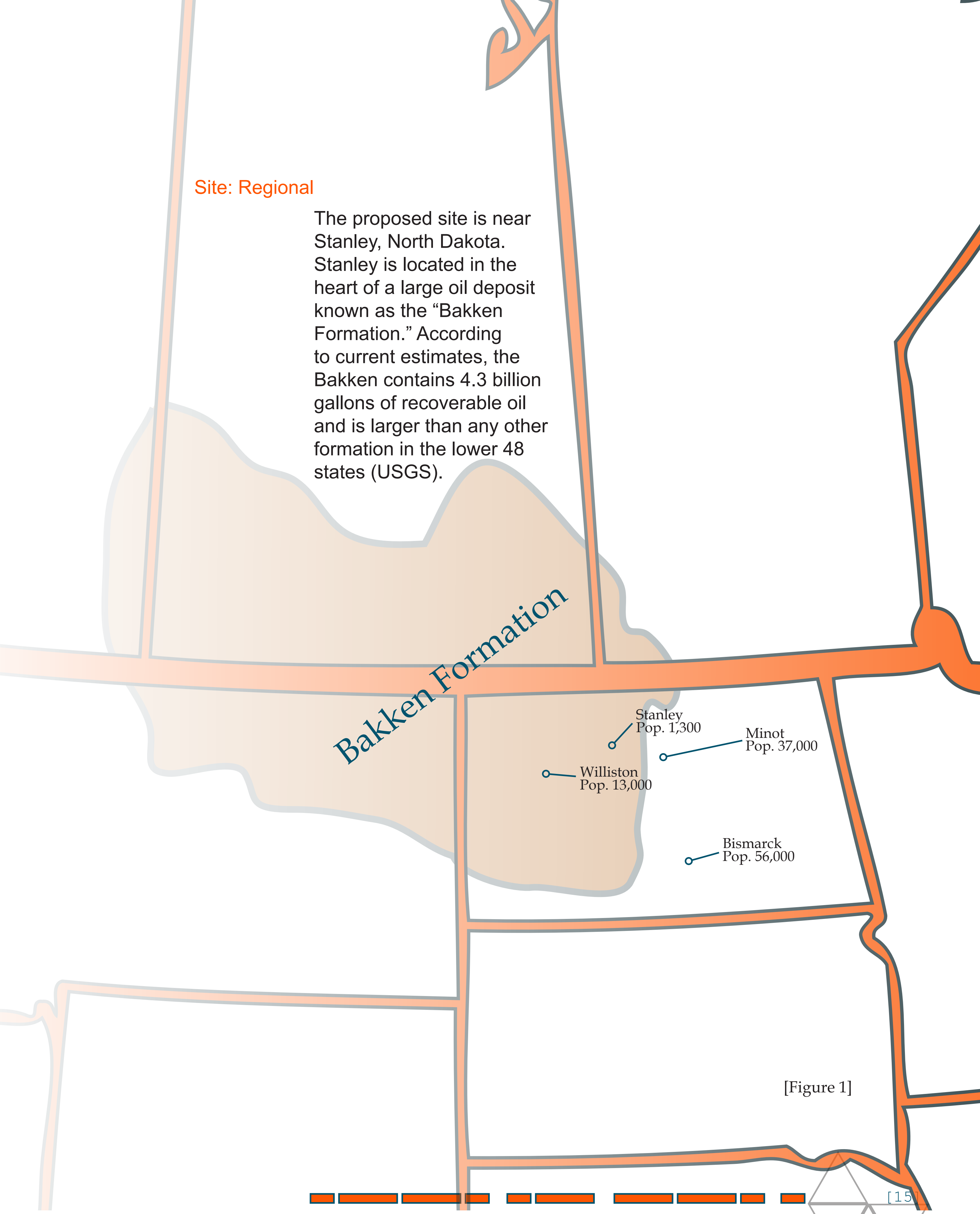
The facility will process its own water and waste in order to minimize the strain on the local infrastructure.

Parking

Parking area able to accommodate all residents, employees, and visitors. There will also be provisions made for buses and/or carpooling to and from job sites.

Site: Regional

The proposed site is near Stanley, North Dakota. Stanley is located in the heart of a large oil deposit known as the “Bakken Formation.” According to current estimates, the Bakken contains 4.3 billion gallons of recoverable oil and is larger than any other formation in the lower 48 states (USGS).



[Figure 1]

Site: Macro

The 40 acre site lies adjacent to a major highway, which runs across the entire state of North Dakota. It is also very near the Amtrak passenger railway, which stops in Stanley. The site is 1 mile from the center of Stanley and 1/2 mile from its eastern boundary. If needed, expansion space is located north of the site.

[Figure 2]

Site: Micro

The site is defined on the North by 62nd St. NW and to the South by US Highway 2. The site is bisected by a tributary of the Little Knife River. The site was chosen because of its unique landscape features and potential for water collection and recycling.

[Figure 3]

Project Emphasis

This project will examine how the built environment is affected by an oil boom economy. Due to the residential nature of the project, a strong emphasis will be palced on the individual and how the industry affects them personally.

It will then look for opportunities that present themselves and the ways in which these opportunities manifest, now and in the future. Specifically, this project will address the question, "What happens after an oil boom?"

Plan for Proceeding

Direction of Research

Research will be multi-faceted and conducted in such a way as to help further understand the Theoretical Premise/Unifying Idea. Areas of research will include project typology, historical context, site analysis and development, and programmatic requirements.

Design Methodology

I will be following a mixed method quantitative/qualitative approach, which means that both quantitative and qualitative data will be gathered concurrently. This data will be interpreted, analyzed, and reported, both visually and through text, throughout the entire research and design process.

Quantitative data, both statistical and scientific, will be gathered via local site visits, experimentation, and archival searches.

Qualitative data will be collected by site visits and observations, surveys, archival searches, and interviews.

Design Documentation

Sketches, photographs, drawings, prose, models, partis, and any other form of created media will be either scanned, photographed, or otherwise documented and placed in a master folder on my hard drive which will be sub-divided into categories. In order to maintain order and clarity of the process, each file will be dated by its date of creation. I will drop these files into the folder every 2 weeks.

All of this data will be placed in a folder on my final DVD submittal. Selected design processes will be documented in a section of this thesis book, which will be uploaded in its entirety, to the Digital Commons to be used by future scholars.

Previous Studio Experience

First Year

Spring 2007: Stephen Wischer
Spatial Studies and Drawing Techniques.

Second Year

Fall 2007: Stephen Wischer
A Place for Tea - Fargo, ND
Boat House - Minneapolis, MN
House for Twins - Fargo, ND

Spring 2008: Mike Christensen
Solid/Void Casting Studio

Third Year

Fall 2008: Ronald Ramsay
Fennimore County Jail - Agincourt, IA
Moorhead Public Library - Moorhead, MN

Spring 2009: Steve Martens
Northern Legacies Cultural Center - Fargo, ND
Structural Analysis

Fourth Year

Fall 2009: Darryl Booker
Vertical High Rise Community - San Francisco, CA

Spring 2010: Booker, Kratky, Gleye
Slum Rehab. - Santo Domingo, Dominican Republic
School: Marvin Windows Competition - Tanzania, Africa

Fifth Year

Fall 2010: Steve Martens
Historic Preservation: Christ Science Church - Fargo, ND

PROGRAM

Theoretical Premise Research

This thesis does not aim to debate our dependence upon oil and other fossil fuels, how fossil fuels are polluting our environment, and how we as consumers perpetuate this problem. Clearly, we must strive to use cleaner energy sources if we are to continue to advance as a society. Rather, it looks at current methods of retrieval and how the process itself affects the micro-ecology of small communities.

The research conducted on the theoretical premise and unifying idea explores, in depth, the different ways that an oil boom affects local communities. Specifically, it will address how the drilling process affects infrastructure. This will then be analyzed to see how it affects the individual who is living in the community.

Process and Means of Acquisition

In order to understand the complexities and subtleties of how the oil industry affects the world around us, it is important to become familiar with the current means which oil is obtained: from the initial land speculation and selection to the actual process of drilling and pumping crude oil and delivery.

The oil industry, and all who are associated with it, uses a vast glossary of seemingly foreign terms. Ryan Bakken of the Grand Forks Herald put together a (non-exhaustive) list of some of the more important terms (Chuck H. et al 2010):

Derrick: Tower constructed to lift and position the drilling string and piping over the well bore. Includes machinery for turning the drilling bit.

Fracking: The use of liquid, sand and chemicals shot through a bore hole to fracture oil-bearing rock formations, enhancing the recovery of oil.

Pumper: Also oil well pumper, wellhead pumper. A person who operates pumps and other equipment.

Horse head: Also pumpjack, nodding donkey, grasshopper, thirsty bird. Mechanical device used to pull oil from the ground.

Pig: A tool used to clean out oil or gas pipelines. When used to pump cement into well casing, it is called a plug.

Tripping pipe: Pulling the drill string out of the well bore and running it back in, usually to replace a drill bit.

Mud: A chemical mixture used to cool the drilling bit and blow rock debris clear from the drill bit and the bottom of the well.

Blowout: Uncontrolled flow of gas, oil, or other well fluids from a well during drilling due to formation pressure exceeding the pressure exerted by the column of drilling mud.

Blowout preventer: Device installed at the wellhead to prevent fluid and gas from escaping from the wellbore.

Casing: Steel pipe threaded together and cemented into a well as drilling progresses to prevent the wall of the hole from caving in during drilling and to provide a means of extracting oil or gas if the well is productive.

Doghouse: A trailer on the site of an oil rig.

Dry hole: Any well that does not produce oil or gas in commercial quantities.

Roughneck: Industry slang for a well floor hand.

Toolpusher: Also, pusher. Foreman in charge of the drilling rig operations and crew members.

Gopher: The lowest man on a job site, runs an array of errands. Also, greenie.

Spudding in: Beginning the actual drilling of well.

Wellbore: The hole made by a drilling bit.

String: The entire length of casing, tubing or drill pipe sent into a hole.

Seismograph: Apparatus used to measure and record vibrations in the Earth. It is used to detect possible oil-bearing structures.

Wildcat well: Also discovery well. A well drilled in a fairly new area.

Workover well: Crew carries out remedial operations on a producing well to restore or increase production.

Fishing trip: Tripping pipe to retrieve something dropped into the wellbore.

Mud motor: Pump pressure on this tool is used to turn and steer a drill bit.

Geronimo cart: An escape apparatus used to get off an oil derrick quickly and reach the ground safely.

Leasing

Before any drilling operations can begin, the landowner must first be contacted and a contract must be written. “Landmen” are people who work for an oil company and seek out these opportunities. In depth studies of geological formations take place long before the land owner is approached. Once the landmen are relatively convinced the land may contain oil, they approach the owner. Both the surface owner and the mineral rights owner (usually the same person, but not always) must agree upon the terms of the lease. During this negotiation period, things like signing bonuses and royalty percentages are worked out. (Oil + Gas 2006)

A signing bonus is a check issued to the owner before spudding in. The amount is usually related to the potential output of the land. If nearby land is producing, than the amount is great. If the well is to be a speculative wildcat, than the amount will be considerably lower. Royalty payments, on the other hand, are based on a pre-negotiated percentage of overall profits and paid to the owner on a fixed interval. (Oil + Gas 2006)

Once everything is agreed upon, the owner is presented with a lease. The lease is a comprehensive document which outlines each party’s responsibilities during the term of the lease. For instance, the oil company is required to make a reasonable attempt to secure a market for all of the oil and gas acquired from the site. Also, the Environmental Protection Agency (EPA) requires that the site be returned to an environmentally safe condition after production has ceased. These things are all meticulously defined and outlined in the lease. (Oil + Gas 2006)

Drilling

Before the drilling begins, a 3d map is produced using seismic technology. (Christ 2008). This creates a very detailed picture of the various layers of oil and gas. Once they have a target to aim towards, an oil drilling rig is assembled. The rig consists of a derrick , floor, drive mechanism, and mud handling unit. (Devold 2006). For safety, most rigs have switched to a top drive system, which suspends the drive mechanism near the top of the derrick, clear of the deck hands.

When the rig assembly is complete, actual drilling or spudding in begins. The drilling assembly, known as the string, consists of numerous threaded pipe segments, which are each about 100' long. Once the string is drilled to a depth of 100', the roughnecks disconnect the drive mechanism and add another segment of pipe. The deeper the target goal is, the more pipe sections are used. At the end of the bottom most pipe is the drill bit, or cone. Various types of drill bits are used for various types of rock. The Bakken formation consists mostly of very dense, hard shale. Because of this, conical diamond impregnated bits are used. (Christ 2008). As the string gets longer, it gets heavier, which decreases the amount of downward pressure needed to be applied. A very delicate balance must be struck between applied downward pressure and drill bit RPMs. Experienced toolpushers are essential to avoid breaking bits and the need for tripping pipe.

During the drilling process, a slurry known as mud is constantly being pumped into the wellbore. Mud does a number of things. First, it floats debris up to the surface. It also cleans and lubricates the string and cone. Mud handling is also a very delicate balance. Care is taken to have enough mud in the wellbore to create enough downward pressure to contain any blowouts.

Horizontal drilling is often used in the Bakken oil patch. In horizontal drilling, flexible steel casing is used between pipe segments to achieve the gradual bend. Horizontal drilling allows for greater production with less drilling sites.

Once the desired depth target has been achieved, Bakken wells often need to be fractured. The process, known as hydraulic fracking, sends a high pressure liquid (usually water) into the well bore, which causes small fractures in the shale to open up and allows oil and gas to flow freely. The fracking liquid also contains particles known as “propping agents” (usually sand), which prop open the fractures and keep them from closing back up under the enormous pressure of the earth. (Christ 2008).

When the well has been properly drilled and fracked, it must be “completed.” This process involves installing casing, which prevents the walls of the well from collapsing, and the extraction tubing. Next, workers install a well head, which is essentially a very complex series of valves. The well head is used to prevent blowouts and to control and monitor the flow of oil coming from the well. (Devold 2006).

Extraction

When the drilling is finished and the well has been completed, lifting methods are employed. On some very shallow wells, water can be pumped into the wellbore and the downward pressure of the water column is enough to bring the oil to the surface. In Bakken wells, the depth is too great for this and artificial lift methods must be employed. Most common (and recognizable) is the rod pump. Also known as Horse Head, donkey pump, thirsty bird, grasshopper etc., the rod pump uses a motor to drive a reciprocating beam. The beam is attached to a rod which goes down to the depth of the oil. The end of the rod houses a plunger-like apparatus which creates suction in such a way as to pump on both the up and down stroke. (Devold 2006).

Transferring and Processing

The oil, known now as crude oil, is stored in temporary holding tanks on site until it can be transferred to a refinery. This is usually done by truck.

Not all crude oil is the same. Crude oil is measured by its density (light to heavy) and sulfur content (sweet to sour). Density is classified by the American Petroleum Institute (API) gravity. The higher the API gravity, the lighter the crude. Light crude is usually considered to have an API gravity of 38 degrees or more. Sweet crude is usually defined as having less that .5% sulfur. (Neste Oil 2005).

Bakken formation crude has the benefit of being both sweet and light. (Wang 2008). This is important because light, sweet oil is much easier to refine and can be used for things such as gasoline and jet fuel. Light, sweet oil is also much more expensive so this creates a higher price per barrel.

In this report, the word infrastructure is used somewhat loosely in that it refers to anything needed to support a community or society. This includes "hard" infrastructure such as roads, sewers, water lines, and telecommunications, as well as "soft" infrastructure. Soft infrastructure includes ideas, social structures, and institutions required to maintain and support a community. Economic methodologies and conditions will also be considered in this section.

Affects on Infrastructure

The aforementioned process of drilling for oil affects the infrastructure of surrounding communities in many ways. The strain imposed upon roads, water supplies, waste treatment facilities, housing, law enforcement, local businesses, schools, and almost every other facet of society is enormous. The problems are actually rooted in a positive aspect: jobs. In today's economy, the job market in most of the country is struggling and unemployment is high. The need for help in western North Dakota is great, which causes people from all over the country to come. This, in turn, leads to increasing population, which strains the infrastructure.

The city of Stanley is one the communities which is being directly affected by this problem. Among the most pressing of these problems is housing.

Housing

The population of Stanley is estimated to have doubled since the 2009 census count of 1,200. (Donovan 2010). The influx of people coming to the area has caused a huge housing shortage.

Apartments are renting for 2-3 times their normal monthly rates and motels are booked a year ahead of time. Homeless shelters (in larger towns) are completely overwhelmed and at max capacity. Man camps, as they have come to be known, are popping up everywhere. These man camps are nothing more than mobile home trailers which have been partitioned off into sleeping areas. They usually have a centrally located place to shower and a group mess hall. Many companies include these living arrangements in their benefits package. (Donovan 2010).

The people who are not provided housing, may need to resort to more drastic measures. Many sleep in their cars or rent a bedroom from a local resident. The Tastee Freeze in Stanley has actually placed cots in their building and rents them out on a nightly basis. (Chuck H. et al 2010).

West of Stanley, in Williston, housing has come in a different form. Halliburton, a large oil company, has moved a portion of the 2010 Vancouver Olympic Village into town. Although this is a novel approach to solving the crisis, it barely scratches the surface. (MacPherson 2010).

If a person is able to find land to build a house on at a reasonable price, they are still hesitant because of the price of labor. It does not make economic sense to build a house for twice the amount it will be worth in a few years.

Roads

The increased traffic has caused the roads of western North Dakota to become congested and deteriorate much faster. County roads, originally intended to support cars and pick-up trucks, now have to deal with large machinery and semis. With a limited budget and a shortage of personnel, county governments are unable to keep up with the demand of fixing the pothole ridden roads. Also, the increase of traffic on gravel roads causes an almost constant cloud of dust. Residents are concerned that they are inhaling too much dust, which could lead to asthma and other health issues. Furthermore, ranchers are worried that their cattle may develop respiratory problems, costing them expensive veterinary bills and leading to lower product yields. (Rivoli 2007)

Water

As previously mentioned, drilling for oil requires an enormous amount of water for fracking the shale deposits. North Dakota has issued 39 water depot permits, 34 for groundwater and 5 for surface water. Of these 39, only 10 had been issued before 2007. As of August, there were an additional 52 new permits under review. In total, the state allows 858 million gallons of groundwater and 6.7 billion gallons of surface water to be taken annually for the drilling effort. Including pending permits, the oil industry wants and needs about 16 billion gallons of water annually. (Chuck H. et al 2010).

The two major sources of this water are Lake Sakakawea and the Missouri River. The lake has recently recovered from a long draught in which the water level dropped dramatically. The Army Corps of Engineers are concerned that a year of heavy water use, coupled with another draught, could cause the lake to fall again.

Water from these water “depots” is normally trucked to drilling sites which adds to the wear and tear of road conditions.

Waste

The biggest waste by-product of oil production in salt water. For each barrel of oil recovered, 2 barrels of salt water need to be disposed of. The salt water comes from underground rock formations which also contain oil. When the oil is reached, so is the salt water and it accompanies the oil to the surface. The salt water must be disposed of properly so as not to contaminate the soil and groundwater. (Ogden 2010).

The salt water is usually disposed of via a disposal well. This is a separate well that is drilled into a layer of strata which does not contain oil. The strata directly above and below the target layer act to “seal” the salt water when it is injected back into the ground. (Ogden 2010).

Another, indirect, waste product of the oil industry is human waste. Since the oil boom began, the city of Stanley’s small lagoons have been full. This is mostly due to the man camps which surround the city. Private septic tank companies have been servicing the toilet facilities at the man camps and dumping their loads in Stanley’s lagoon. The cost of building another lagoon is $1.2 million, a price tag too high for the already over burdened local government. In August 2010, Stanley prohibited incoming trucks from emptying sewage into their lagoons. (Chuck H. et al 2010). As a result, septic tankers are now driving further distances to dispose of their waste.

Affects on People

The nature of this thesis project requires an in-depth understanding of people who are both dealing with the invasion of the oil companies, as well as those who are a part of the “invasion.”

Perhaps invasion is the wrong word. The people who are coming to North Dakota are simply coming out of necessity. They are often times leaving behind family and friends because they cannot find work elsewhere. However, to the residents of the area who have grown to appreciate its tranquil and peaceful nature, it is just that: an invasion.

An Adversarial Relationship

The oil boom has been both good and bad in the eyes of North Dakotans. Good in that it has brought an enormous amount of wealth to the state and has almost single-handedly kept it out of recession. In fact, North Dakota has managed to grow its economy nearly twice as fast as every other state in the U.S. It has also maintained the lowest unemployment rate in the nation at 4.4%, less than half the national average. (Zumbrun 2009).

Bad, in that it puts a strain on our infrastructure and changes the fundamental nature of our culture. The oil workers have essentially taken over entire towns. The motels are booked so far in advance that it becomes impossible to book a room for a family member who is visiting, for instance. The population increase is also causing an increase in crime. This once non-issue is becoming more and more of an issue. (Chuck H. et al 2010).

The adversarial tension that exists between “locals” and “foreigners” is very apparent and is something that must be addressed in any design recommendation.

The Itinerant Population

The nature of the incoming population is an interesting dynamic which should not be overlooked. Upon investigation, the parallel between oil workers and other nomadic cultures becomes apparent. The definition of a nomad is “a member of a people who have no fixed residence but move from place to place usually seasonally and within a well-defined territory.” (Merriam-Webster 2010). No doubt, most of these people do not choose to lead a nomadic lifestyle, but the circumstances in which they find themselves force them to do so. With this lifestyle, comes a variety of issues that must be addressed in order to accommodate their needs.

Among these issues is how architecture responds to an itinerant population. The study of nomadic architecture provides some interesting insight on this topic.

How can a moveable architecture convey feelings of security, stability, durability, or (as Vitruvius might call it) firmness? Perhaps we draw conclusions too soon when we hear the word durability. It often connotes ideas of heaviness, permanence, and fixedness. However, as Prussin explains in her book, durability can describe something like an African Nomad's tent which is constantly being disassembled, moved, rebuilt, and improved upon. On the other hand, the word temporary is almost always associated with transience. If it moves, it is temporary. This, however, may not be the case.

> "Although mobility may be its underlying purpose, a moveable structure is not necessarily temporary. What is seemingly transitory and ephemeral, processual and only a body of images, is often, by its illusion of stability, more durable than our eroding stone monuments. (Prussin, 1995 pg. xvi)."

By studying nomadic and other vernacular architecture, one can begin to extrude the methods in which these structures create a sense of permanence and delight. These ideas can be transplanted into modern design.

What can we learn from nomadic people? Does our fixedness as a society impair our ability to make a living? What does it mean to make a living? Any one of these questions could be the topic of an entire thesis, yet they need to be answered, in part, in order to solve the problems associated with an oil boom.

Summary

The research conducted was done in order to fully understand the situation which is taking place in western North Dakota. By becoming familiar with the technical aspects of the oil industry, one is able to understand what the users of the proposed thesis project experience on a daily basis. This helped to actually define the user group in a more tangible way.

It is clear from the research that there are urgent problems which must be addressed. Housing is the main concern. The population of Stanley has doubled over the last year because of people looking for work in the oil field. The town simply cannot keep up with the housing demands. Rental rates have begun to skyrocket, forcing out existing residents who are unable to keep up with the inflation. Buildable land is scarce and furthermore, there is no incentive for people to build new homes because the price of labor has also been inflated.

The infrastructure of Stanley and other towns in the area are under great strain. Specifically, the waste management system needs to be fixed. The proximity of the proposed site to existing retention ponds provides a unique opportunity to address this issue in the design.

Also revealed in the research was the enormous amount of water required in the oil drilling process. With about 5,200 producing wells in the state and more being drilled everyday, the demand for water will only increase. State and county governments are doing their part in controlling this water usage, but any proposed design solution must be sure not to impose more strain upon the water supply, or any of the state's infrastructure for that matter.

Summary cont.

The oil industry has also impacted the roadway system in North Dakota. The roads were never meant to support high volumes of heavy trucks and machinery. This is causing a rapid deterioration of the state's roadways and some paved roads have been allowed to "go back" to gravel.

These problems all have a direct effect on the people of the city of Stanley. The psychological toll on both the existing residents, as well as incoming oil workers is great. Often, oil workers are leaving their families behind and coming to North Dakota in order to make a living in the struggling economy. The emotional stress associated with this can be overwhelming.

Furthermore, many members of this itinerant workforce feel as though they are outcasts. It is true that the oil boom has played a role in keeping the state of North Dakota, for the most part, out of a nationwide recession. However, residents of rural North Dakota are reluctant to give up their way of life.

The study of nomadic cultures and their architecture gave valuable insight on ways in which a modern design might respond to the needs of these people. Creative potential from nomadic architecture seems like an obvious avenue to explore. The emphasis on the process of creation and their desire for a very functional end product which responds to every need, aligns closely with what this thesis hopes to achieve.

Case Study 1

Linked Hybrid
Beijing, China
All images from Ivy (2010)

Architect: Steven Holl and Li Hu

Mixed use housing: Located in a former industrial area, the project includes housing, shopping, dining, education, and entertainment.

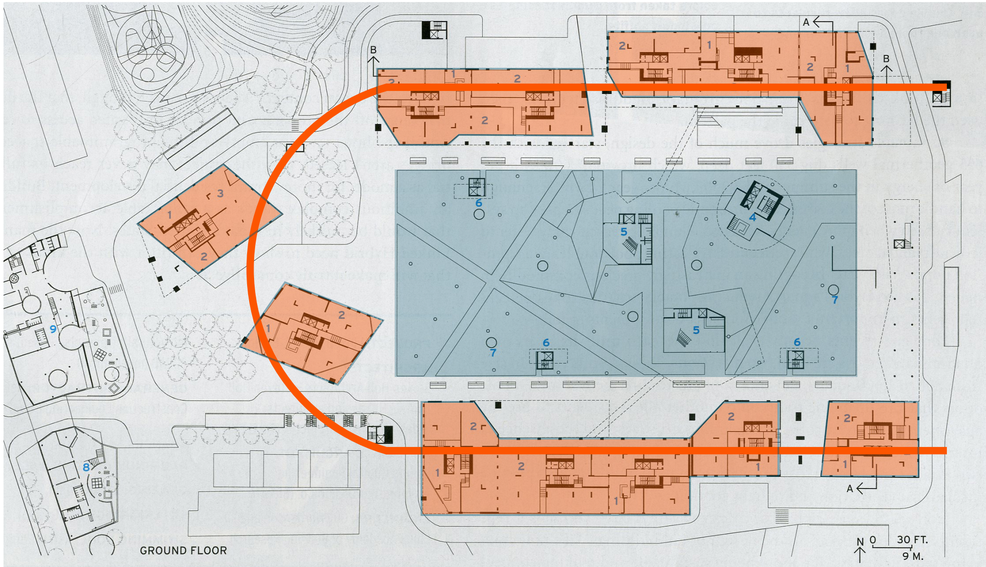
Designed by Steven Holl and his Beijing-based partner Li Hu, Linked Hybrid is a 2.37 million square foot mixed use complex located in an old industrial area of Beijing. The industrial nature of the site was important to the developer because it did not require any people to be relocated. The only demolition involved an old, vacant factory.

The complex consists of eight apartment towers ranging from 14 to 21 stories each as well as a hotel tower. The project was built by Beijing based developer Modern Green Development Company and uses a number of sustainable strategies.

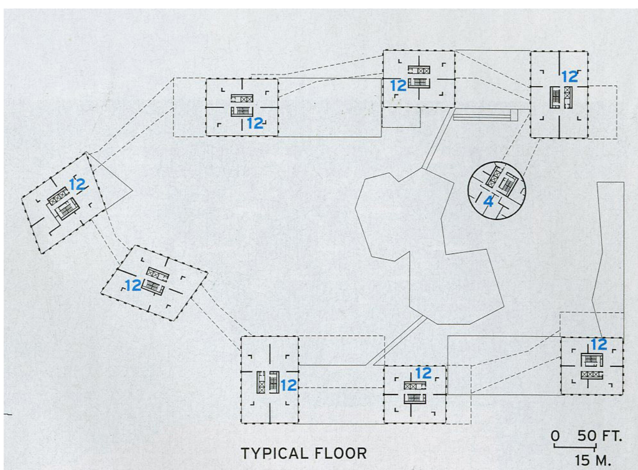
Some of these strategies include 655 geothermal wells, which provide nearly all of the complex's heating and cooling needs. The plumbing system recycles gray water and reuses it to irrigate plants. Also, the large reflecting pool acts as a retention pond. These things combined reduce Linked Hybrid's potable water usage by 41 percent.

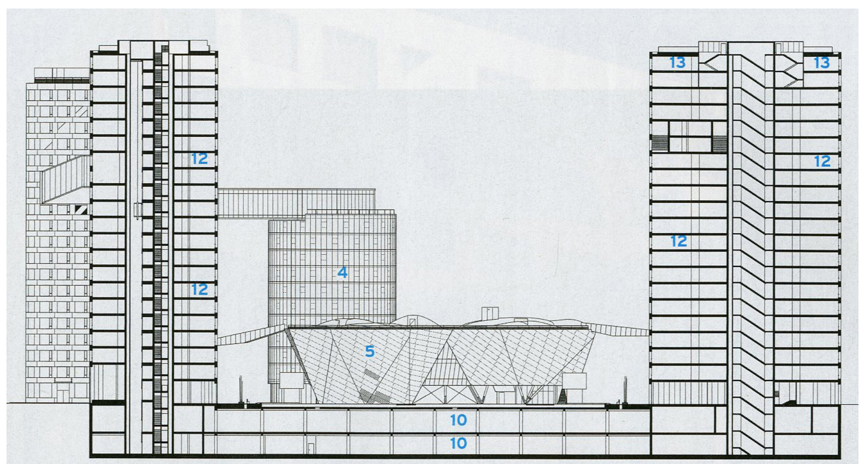
The architects took cues from polychromatic Buddhist temples in order to arrive at the color palette which adorns the aluminium window jamb soffits.

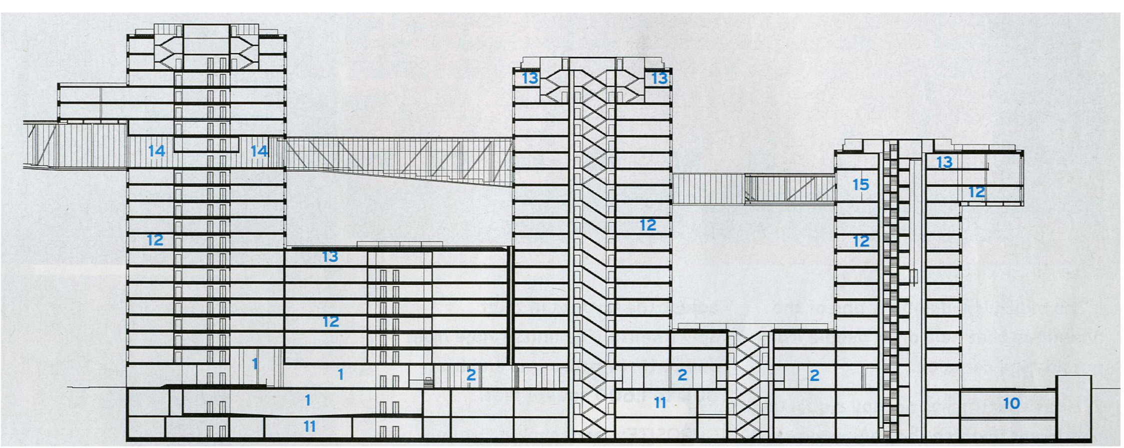
Case Study 1



The towers are arranged in a “U” pattern, which helps define the public plaza on the ground level. In the plaza, a central cinema complex marks the entry to the east. This, combined with the green park, defines a rectangle, which acts as a general gathering space. The space between the rectangle and the “U” of towers becomes circulation and a buffer between the park and the commercial space at the base of the towers.







1. Lobby
2. Commercial
3. Cafe
4. Hotel
5. Cinema
6. Teahouse/Parking Exit
7. Air Intake for Parking
8. Preschool
9. Kindergarten
10. Parking
11. Bicycle Parking
12. Apartment
13. Duplex
14. Gallery
15. Bar

Case Study 1

Spatial Layout

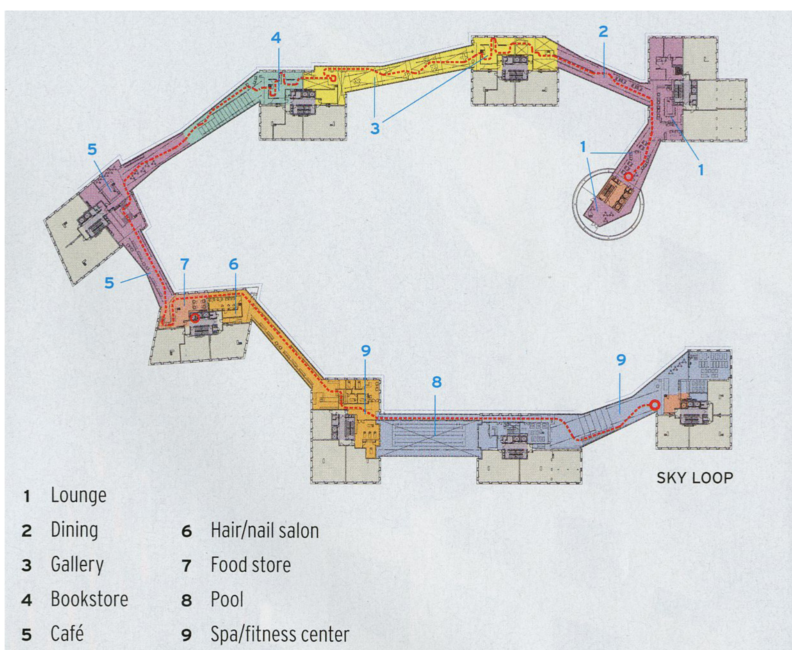
Great care was taken to organize the spaces in a way that is conducive to community interaction. Commercial functions occupy the bottom levels of the complex. The nine towers are arranged in a “U” shape, which creates a centrally located plaza. The plaza space is open and welcoming to pedestrian street traffic.

As one enters one of the eight apartment towers, a transition from public to private occurs. Each floor of the towers contain four living units. This allows ample natural lighting in each unit and (because each unit has two exterior walls) also provides cross ventilation via operable windows.

The on-site preschool and kindergarten are located at the perimeter of the site and have green roofs.

Sky Loop

Each of the nine towers are connected by a skyway system known as the sky loop. This system connects the towers at various floor levels. The sky loop contains functions which serve the residents of the towers such as restaurants, cafes, fitness center, and grocery stores. The views from the skyway system are spectacular and overlook both the central plaza and Beijing’s skyline.



Case Study 1

With 18 million residents and counting, Beijing is experiencing an economic boom. The limited space available for housing has forced designers to create vertical communities. The Linked Hybrid complex is a unique and functional solution.

The designers were very sensitive to the pedestrian passerby which is apparent in the way they have handled the ground level of the complex. Interesting formal elements combine with lush green space to create truly beautiful space that can be enjoyed by everyone.

The skyloop is not only a circulation system, but a way to bring the public up into the towers where, in most other residential towers, they are not allowed.

The spatial layout of Linked Hybrid seems to work nicely. The designers have managed to create public spaces which draw in customers for the various businesses at ground level while still separating the residences and creating privacy for the occupants.

Perhaps the most impressive aspect of this project is the way in which it meets and becomes a part of the site. This idea is very important to this thesis project because of the very sloped nature of the chosen site.

Above: The multi-plex cinema, which is centrally located in the public plaza, has a green roof which is accessible to the public. Also in this photograph is the hotel tower connected to the other towers at the top level via the sky loop system.

Left: The grass covered pavilion around the perimeter of the site houses a preschool and kindergarten connected by a bridge. Portholes dot the roof to allow natural light into these spaces.

Below: Located in a former industrial area, the project overlooks new housing developments in some directions and construction sites in the others. Also visible from a distance is the structural bracing patterns which were designed to withstand earthquakes.

Prefeb and Modular Housing

This study will be performed on prefabricated and modular housing in general. The individual cases to be examined are as follows: Museum of Modern Art exhibit entitled *Home Delivery: Fabricating the Modern Dwelling* and Paul Rudolph's Married Student Housing Project.

Home Delivery: Fabricating the Modern Dwelling
MoMA Exhibit, New York, 2008.
All images from Gonchar (2008)

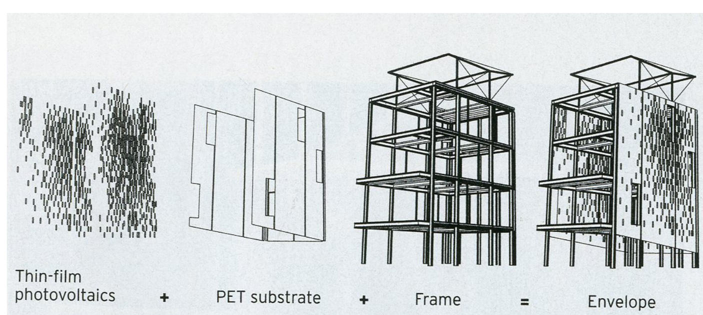
This MoMA exhibit features five designs done by various architects from across the globe. Each of them present a unique method of using prefabricated, modular parts to construct a house.

Case Study 2

The largest and perhaps most developed house in the exhibit is the Cellophane House designed by Philadelphia-based firm KieranTimberlake. This house consists of 14 units or "chunks," which are delivered to the site individually. The chunks are then hoisted by crane into their final positions.

The frames which make up each of the parts are constructed using off-the-shelf pieces of extruded aluminium and are fastened together using mostly manufacturer's standard fittings. There are very few custom parts to the Cellophane house.

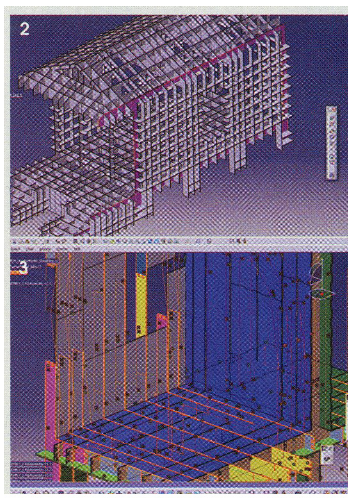
The skin of the house is made of a plastic polyethylene terephthalate (PET) which has integrated PV cells. An inner skin works to block UV light and slows heat gain. The cavity between the two layers traps heat in the winter and vents it during the summer.



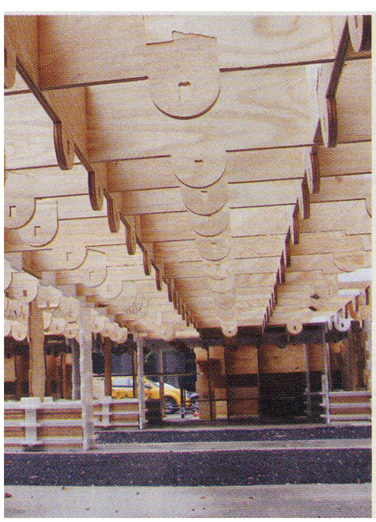
Case Study 2

Prefeb and Modular Housing

Another interesting installment of the exhibit was called A Decorated Shed. This project used digital technology to model and fabricate a 350 square foot dwelling, made from over 4,500 pieces of plywood cut from 600 sheets. The end result is a Victorian style house made entirely of plywood with no glue or fasteners of any kind.



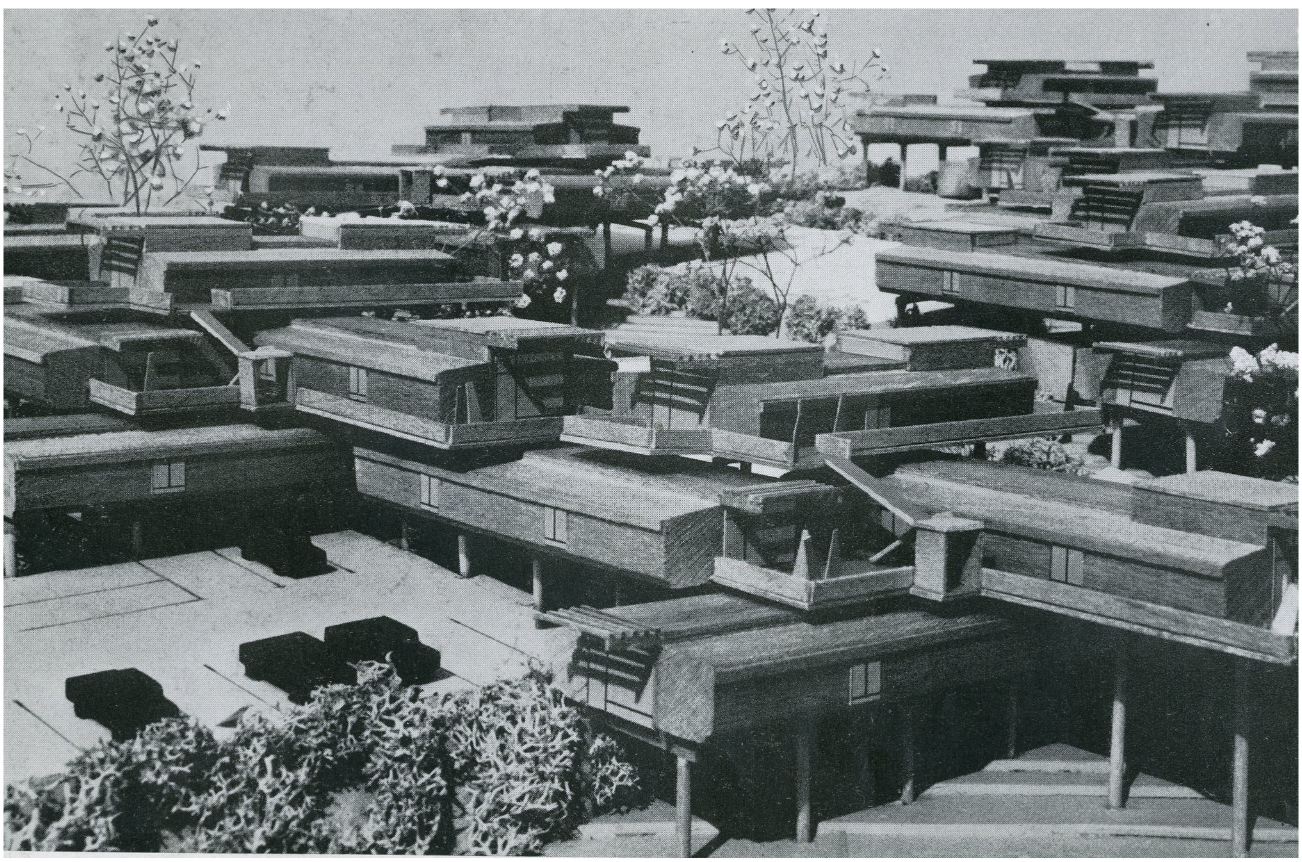
Although the construction of all of the houses at the MoMA exhibit went fairly smoothly, the problems that did arise usually had to do with how the structure met the ground. Since none of the houses have below ground foundations or footings, they had to deal with an uneven surface which caused their precisely milled components to be off slightly. To combat this, the pillars, feet, bases or whatever comes in contact with the ground had to be adjustable. While most of the planning was done ahead of time through BIM systems, this is an aspect of modular design that cannot be precisely calculated, and so some kind of adjustment system must be built in.



Case Study 2

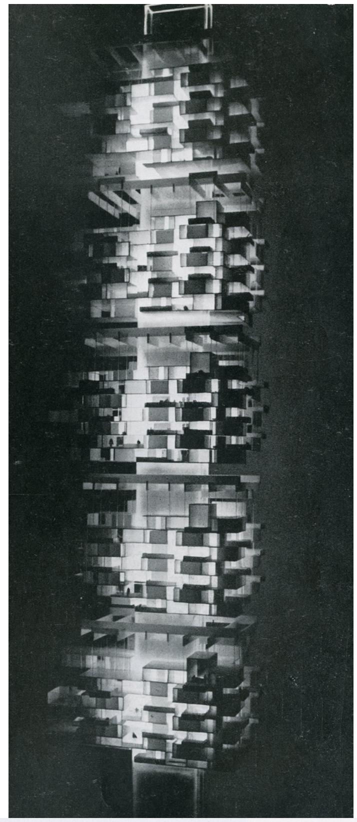
Prefeb and Modular Housing
Unbuilt Married Student Housing
Charlottesville, Virginia 1968
Paul Rudolph
All images from Rudolph (1970)

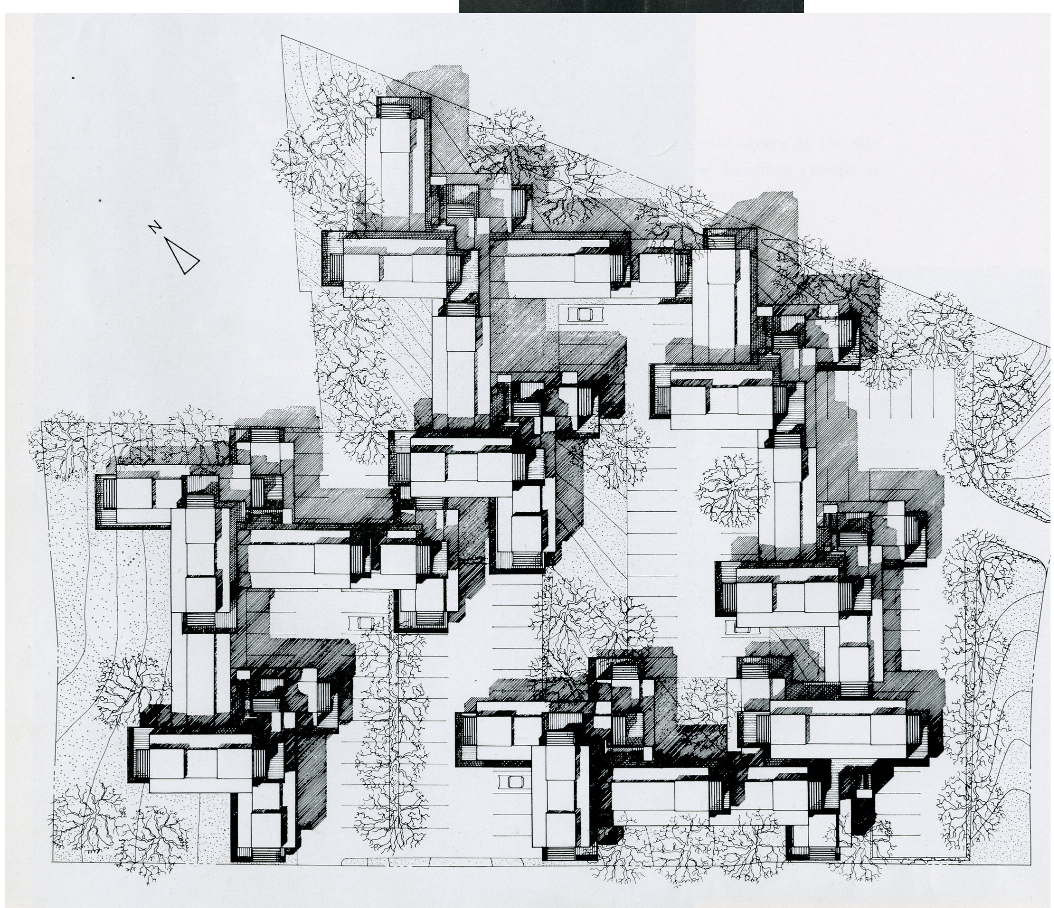
“The ‘Twentieth Century Brick’ can be constructed with outward folding parts permitting the 12-foot limit in width imposed on highway transport to be increased to 28 feet. This enables two two-bedroom apartments to be incorporated in a single unit, 28’x60’. These units are disposed in a cascading system down the hill, allowing the roof of one to become the terrace on the one above. The city fathers of Charlottesville prevented it from being built, not the trade unions, building codes, fire marshal or cost, the usual demons in such matters.” - Paul Rudolph



Case Study 2

Paul Rudolph envisioned the 20th century brick as a modular housing unit which could be transported to and placed upon the site with little need for assembly; a fully integrated house with all the amenities including cabinets, fixtures and appliances. They were meant to be versatile and could be placed on a flat surface, on a hill so that the roof of one became the terrace of another (previous and below) or vertically (right).

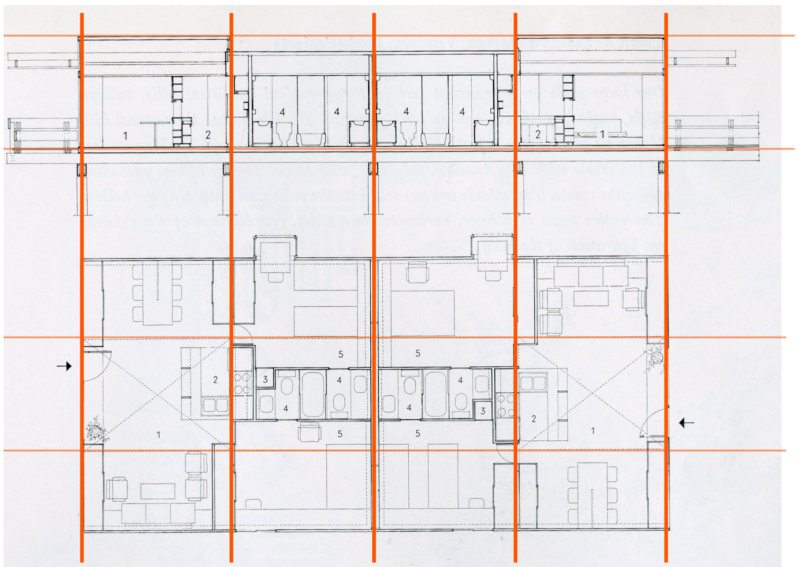




Case Study 2

Central to Rudolph's design, and any modular architecture, is the ability of his units to be constructed off site, transported to the site, and assembled quickly and easily. This idea is especially important in situations where there is an immediate need for housing such as the proposed thesis site.

Another idea, which is sometimes lost in modular architecture, is how it responds to people, community, and time. While ease of transport, construction, and reconfiguration are important, it is perhaps more important that the users feel a sense of security and durability in their homes and communities. A fragile balance has to be achieved between ease of use, function, and permanence.

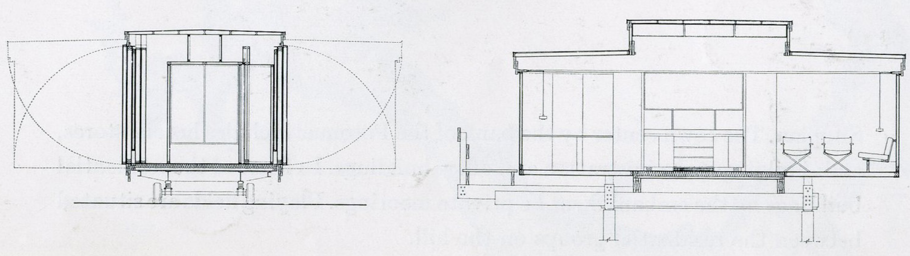


Section and plan: 1 livingroom, 2 kitchen, 3 installation vent, 4 bath, 5 bed-room.

The plan and section are arranged on a strict grid defined by the foundation system. Each grid line separates a major programmatic space from another with the center line being the one that separates the two living units. The overall height is mirrored in plan via the central space, which is also the hinge point. This is done so, when folded into its compact shape, it becomes a rectangular cube with equal height and width, which makes transportation easier.

Section of housing unit, closed, on its transporter (left).

The unit, folded out (right). Built-in kitchen is in the center, sitting area of livingroom on the right, dining area on the left.



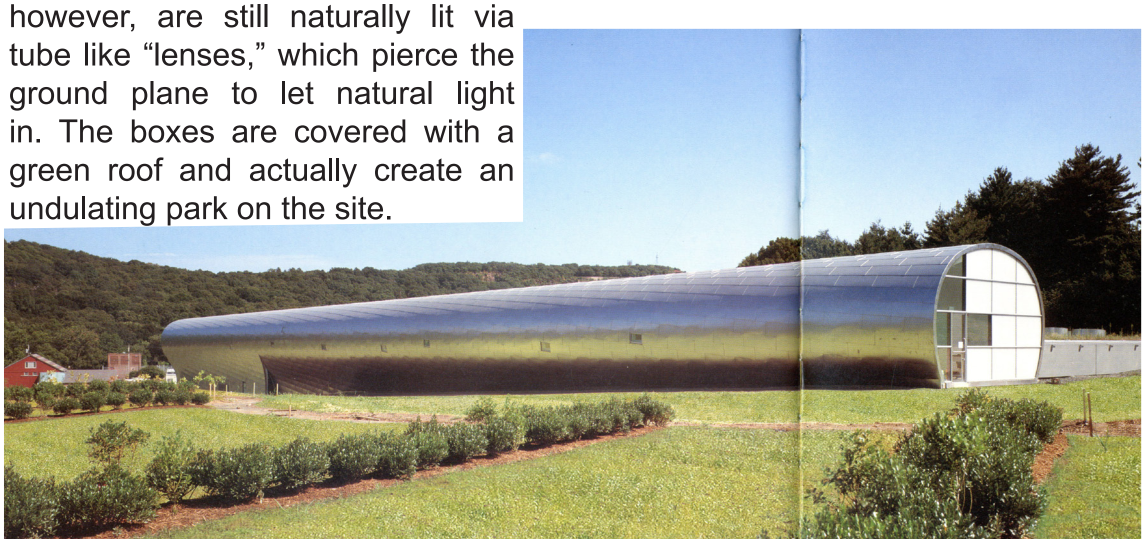
Case Study 3

Whitney Water Purification Facility

Hamden, Connecticut 2005
Architect: Steven Holl
All images from Woods (2007), Branch (2005)

The Whitney Water Purification Facility is the result of a community whose people were able to come together to help create an infrastructure building that can be enjoyed by everyone instead of being tucked away in an industrial park. Holl's design integrates the facility with the landscape and uses the process of water treatment as a metaphor.

Most of the facility is actually underground. Pumps, tanks, and other mechanical equipment are housed in sealed concrete boxes underground. Many of the spaces, however, are still naturally lit via tube like "lenses," which pierce the ground plane to let natural light in. The boxes are covered with a green roof and actually create an undulating park on the site.

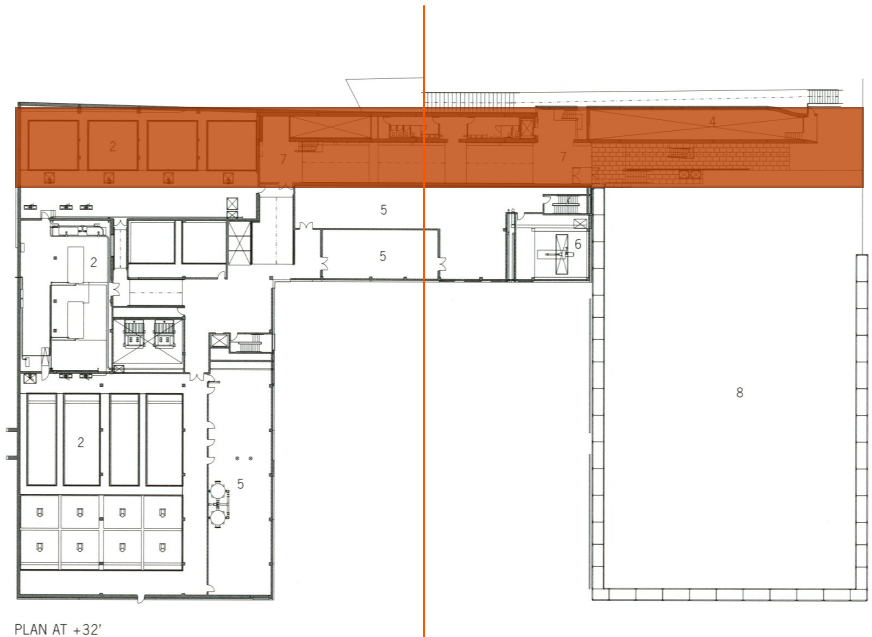


Case Study 3

The visible portion of the structure consists of a 360' long "sliver." Within this object is equipment, which could not be located in the underground concrete structures because of maintenance issues. The long sliver is also home to the public portion of the design.

Entry is achieved at the southeast side of the sliver. The approach draws the user along the stainless steel sliver and into the brightly lit vestibule.

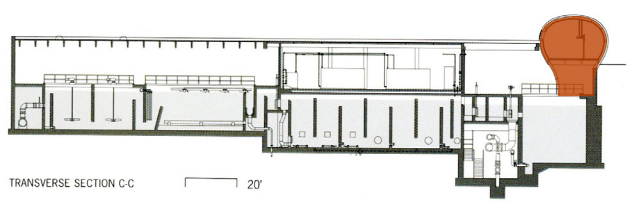
As shown, the plan is cut at 32' above the lowest point of the site, therefore, much of the underground elements are not shown on the plan. The spaces are divided in such a way as to separate the industrial functions and the public spaces, but to also allow a public user to experience and see how the process works.



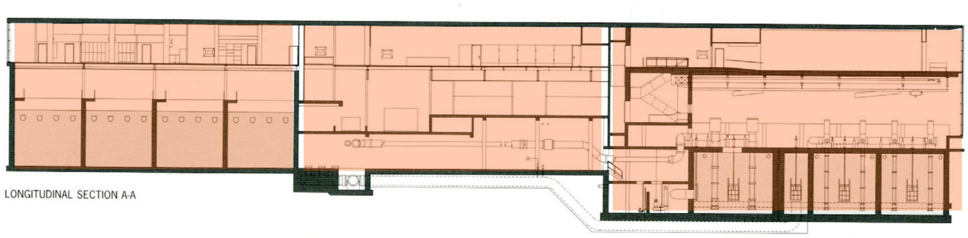
PLAN AT +32'

1 Chemical Storage
2 Process Area
3 Pump Room
4 Mechanical/Electrical
5 Residuals
6 Water Storage
7 Lobby/Exhibition Space
8 Filter Court

The floor plan is equally balanced by symmetry. The metal sliver-like corridor helps to arrange the spaces and separate programmatic elements. In section, the spaces are defined by a repeating pattern of cube like spaces.

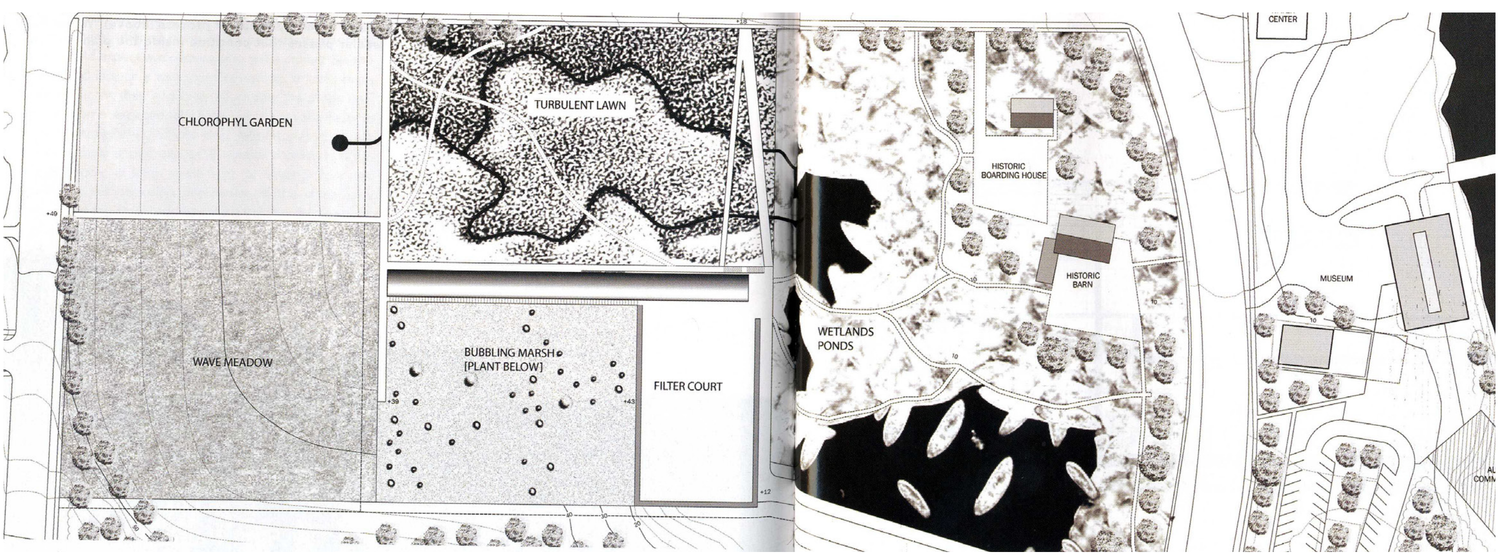


TRANSVERSE SECTION C-C



LONGITUDINAL SECTION A-A

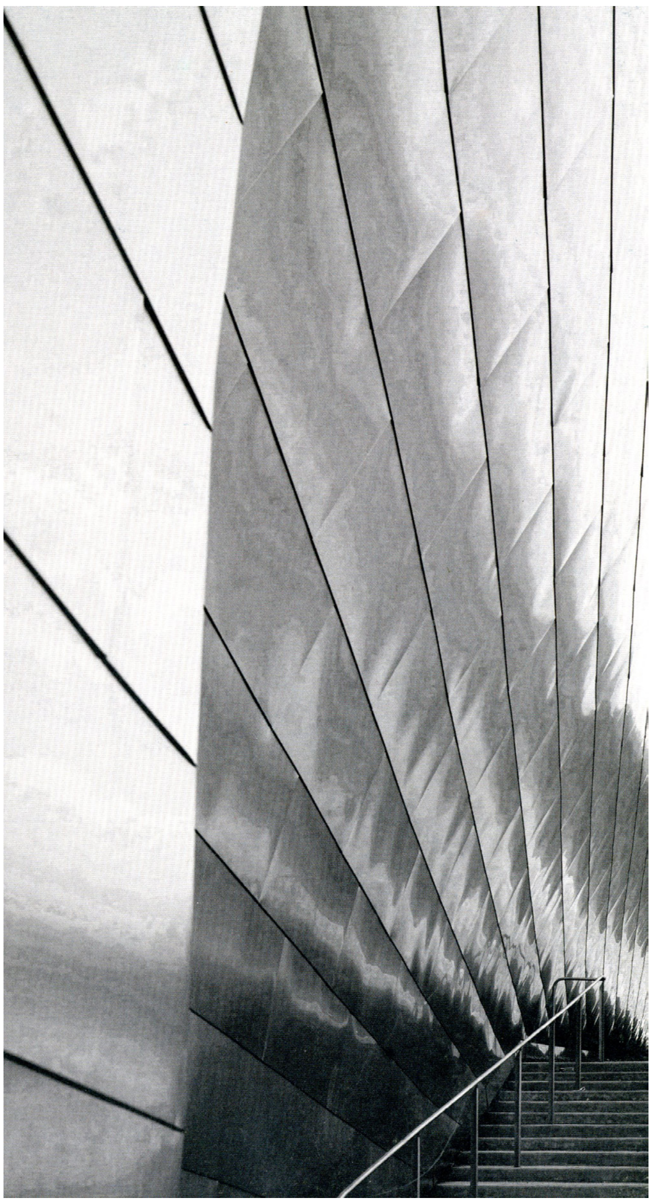
The majority of the site is actually a public park designed by landscape architect, Michael Van Valkenburgh. The site slopes from west to east which allows the water to flow gravitationally through the structure. Naturally, the processes which are required first in water filtration are located at the highest elevation, while the ones required last are at the lowest. Using the site as a way to lay out elements seems a very natural way to do it.



Case Study 3

Case Study 3

Holl has made the process of treating water very apparent in every space. The form and structure respond directly to the mechanical equipment it houses. Excellent daylighting is achieved using various techniques to allow light into the space. The building is a fine example of how a highly functional and industrial typology can be designed so as to be an asset to the community by being both environmentally responsible, as well as aesthetically pleasing.



Case Studies: Summary

The cases presented are very fine examples of typologies that will find their way into this thesis project. The mixed-use typology is inherently difficult to pin down and study. This thesis proposes a type of project which has never been done before. The only option for study, therefore, was to look at each element individually and attempt to relate them.

A common link between all of the case studies is the manner in which they come into contact with the ground. This aspect is very important to this project because of the sloped nature of the site. Each of the presented cases deals with this in a very different and unique way.

Regardless of typology or site conditions, I believe that the way the built environment meets the unbuilt environment is one of the most important elements of design. The bottom six feet of a structure is the portion which comes in direct contact with people. The juxtaposition between built and unbuilt is most noticeable here.

The case studies presented also vary widely in size. The relationship between size, scale, and typology is interesting. For this thesis specifically, it becomes very important. Housing is very personal and relatively small in scale. Users must feel comfortable and safe in their homes. They must feel a sense of ownership, pride, and permanence in their homes. Functional civic infrastructure buildings like a water treatment plant are oftentimes of a very large scale. They may feel somewhat monumental and cold. They are built for function and efficiency.

By combining the two typologies, an interesting question arises and must be dealt with. How do these two programmatic functions meet one another? In order to create a cohesive end product, this question must be answered. Failure to do so would lead to a thesis which solves two problems independently of each other. While this may suffice, I believe that integrating and overlapping the two functions will result in an architecture which is somehow greater than the sum of its parts.

Another common link between the case studies, and most architecture for that matter, is light. Light is always a driving force behind how a building is designed. Great care is taken to provide enough natural light for the users. This does not mean flooding every space with as much light as possible. Subtle techniques like screening can be used to create an atmosphere which is appropriate and specific to the program. In this way, light becomes much more than something which illuminates a room. It becomes visually interesting and is, in a large part, responsible for the character of each space.

Modular design was also examined in the case studies. The idea to create a modular system arose out of necessity: the need to solve the problems of the oil boom and ease the load on infrastructure quickly and efficiently. By fabricating parts off site and transporting them to the site on a strict schedule, the building can be constructed very quickly without clogging up roadways. Furthermore, the proposed modularity of the design allows for great flexibility. Buildings can be transformed and moved depending on the current needs of the community.

Community

How do we define community? How does the meaning of community change through time and place? These questions are central to the issues involved with the design of housing, specifically when housing design is aimed at a specific demographic.

This is true for a number of reasons, one of which involves the definition of community. The word community is used rather loosely in that it can describe a group of people and their lifestyles, a school of thought, a specific place, a number of places bound by a common link, or an assemblage of ideas, social constructs, infrastructure, etc. that make up a greater whole. It is also important to note that a community is more than the people who are in it. Communities usually exist before an individual is born into it and continues to exist if that individual leaves (Bartle 2010).

The idea that one can leave his or her physical community and still be a part of the community is very important. People usually consider the place they were born, or the place in which they spent the majority of their upbringing, to be home. It could be stated that each and every community is home to someone, somewhere. Therefore, it is imperative that communities be preserved in order to instill a sense of security and stability in our society.

This does not mean that communities cannot change or evolve; they most certainly do. It does raise an interesting question though. At what point has a community changed so much that it becomes unrecognizable by its original inhabitants?

I bring this up because it deals directly with the proposed thesis. The oil industry's demand for a workforce has forced a new demographic presence upon western North Dakota. With this new population came a new community. If the boom is considered to be temporary, than what happens to this community when it is over?

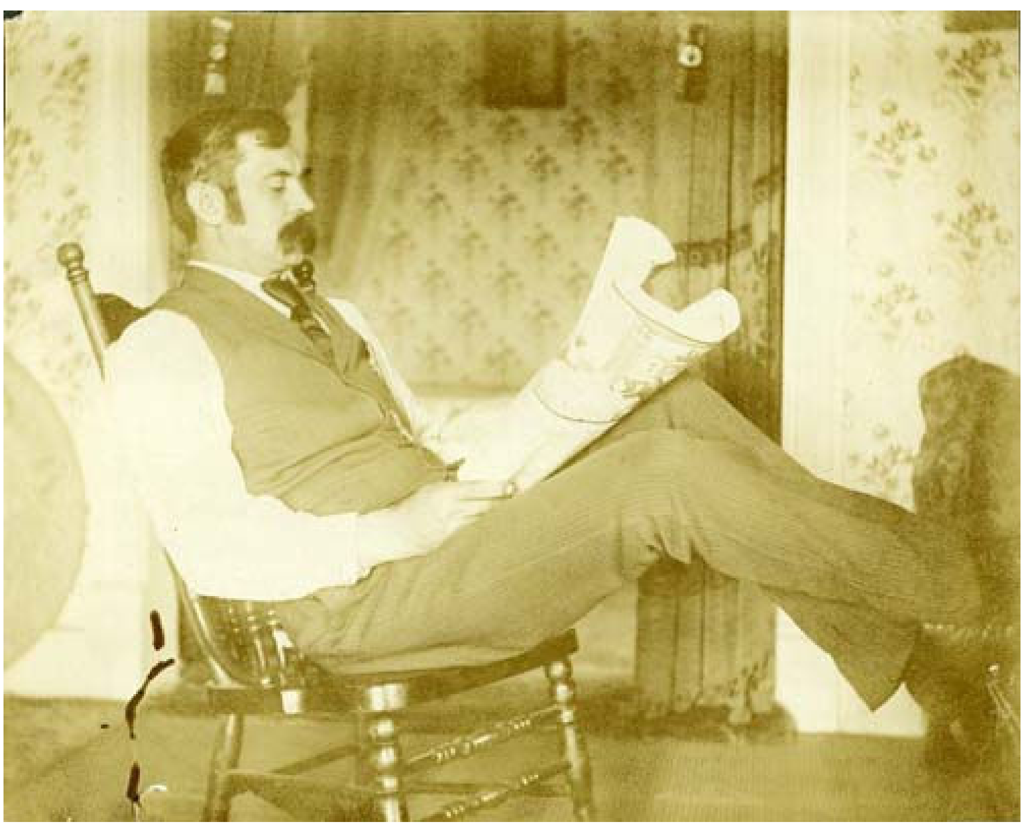
North Dakota has been drilling since the early 1950's, however, it was only until the advancement of horizontal drilling that the boom began (in about 2005). Current estimates are that new wells will continue to be drilled for at least 20 years and extraction will continue with a slow and steady decline in production until it is no longer economically feasible to pump: at least another 50 years. (Chuck H. et al 2010)

So, assuming everyone will leave when the oil is gone, this temporary community will be around for at least 50 years: a relatively short time frame, a generation or so. However, in this time frame, children will be born and roots will be planted that will stay with the people for a lifetime. The small communities of western North Dakota must take advantage of this time of economic growth and development and invest in their infrastructures. This will inevitably lead to an environment conducive to successful business ventures and cultural growth. People wanting to stay and invest in the community will not have to worry about the risk of a population collapse because, by the end of the oil boom, the community will be established to the point of being self sufficient and relatively immune to the affects of the oil and gas extraction business.

Stanley, ND

Knowing the history of the area in which an architectural project finds itself is important for many reasons. First, it can be an excellent source of inspiration and often can give meaning to a project. In an actual project where an architect would undoubtably meet with various members of the community, knowing some history of the site is a good way to establish rapport and validity which will translate into good design.

Stanley was founded around 1905 by George W. Wilson right around the time the Great Northern Railway made its way through the area. Common to most railroad towns, many of the first businesses were dedicated to serving the railroad and the people it brought through (Great Northern Historical Society 2010).

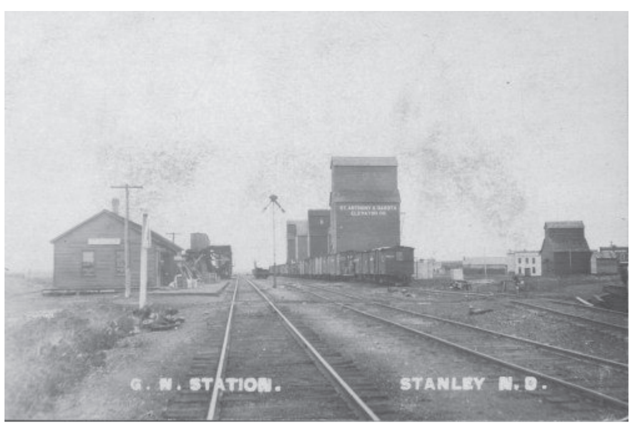


[Figure 4]

Shortly thereafter, GNR introduced the passenger train, Empire Builder. Named after the railway's founder James Hill, who dubbed himself the empire builder, the train quickly became known as one of the most luxurious passenger trains in the country. Still in operation today under Amtrak, the Empire Builder remains in top operation. It does a daily round trip between Seattle and Chicago and stops in many cities on the way, including Stanley (American Rails 2010).

[Figure 5]

View looking down main street in Stanley in the early 1900's. Several store fronts are visible along the gravel road. Carriages can be seen in the distance.



[Figure 6]

The Great Northern Depot in 1908.

Stanley, ND cont.

In 1926, the plans for a U.S. highway system were completed and soon after, U.S. Highway 2 was constructed. Running east-west across the state, U.S. 2 runs directly through Stanley and has become a major part of the town's viability. (U.S Highways 2010).

Since the discovery of oil in the sixties, western ND has been producing oil. There was a moderate, short lived, boom in the mid eighties. The population of Stanley had been holding steady at around 2,000 people since 1990. Recent advancements in drilling technology have sparked the biggest oil boom in North Dakota history and has caused the city of Stanley's population to grow for the first time in decades.

The Business of Extraction

Mankind has been using oil in some form since the beginning of recorded history. In ancient times, it was used primarily for medicinal purposes. The Bible even refers to oil "pitch" being used for building purposes to cement walls in Babylon.

It was harvested, at that time, from petroleum seeps. A seep is any place where liquid or gaseous hydrocarbons reach the surface naturally. Often this material is very thick and tar-like and is referred to as pitch. In 1543, Spanish explorer Juan Cabrillo noted Native Americans using pitch to seal their canoes, shelters, and footwear (PRI 2010).

As more people began settling in America, more uses for oil seepage developed. It was discovered that it made a great fuel for lamps when animal fat was in short supply. It was also used for lubricating machinery. Up until the mid 1800's, all of the petroleum had been harvested from seeps and only in small amounts. In the early days of drilling, oil was often looked at as a nuisance. Drillers would strike oil and drill past it in order to find water they were after.

The first oil well ever drilled for the sake of producing oil was in Pennsylvania in 1859. This well, known as the Drake Well after its founder Edwin Drake, would eventually start a worldwide search for petroleum and change our way of life.

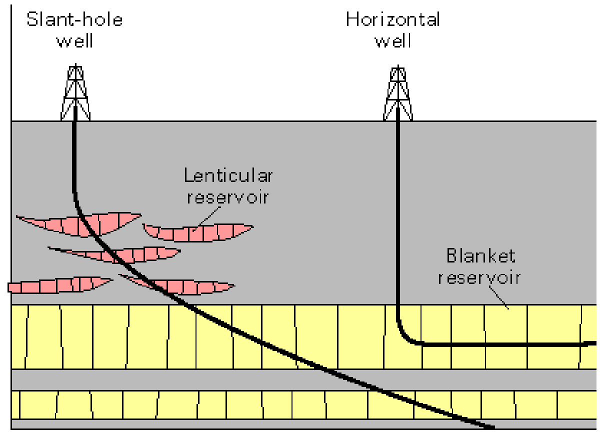
In 1850, leading Yale chemist Benjamin Silliman was hired to analyze the properties of oil for possible commercial sales. He found that it could be refined in a number of different ways, one of which produced a very high quality fuel (PRI 2010).

[Figure 7]

The Phillips well, on the right, and the Woodford well, on the left. Located in the middle of Oil Creek Valley (note the river at the right of the photograph), these two wells showed the early promise of the Oil Regions. The Phillips well was the most productive ever drilled to date, flowing initially at 4,000 barrels per day in October 1861. The Woodford well came in at 1,500 barrels per day in July, 1862. Note the wooden tank collecting the oil in the foreground, as well as the many different sized barrels in the background. At this time, barrel size was not yet standardized.(PRI 2010).

The Business of Extraction cont.

Since the first well over 100 years ago, oil drilling technology has remained relatively unchanged. It wasn't until recently that slant and horizontal drilling were developed. Slant drilling came first and allowed oil companies to drill at an angle which exposed more oil deposits and increased production. Recent developments in horizontal drilling allow drillers to reach a target depth and turn 90 degrees within a few feet. This allows them to "burrow" horizontally within an oil shale formation and increases the exposure to oil.



[Figure 8]

The Future of Extraction

> "The stone age didn't end because we ran out of stones."

This quote from former OPEC oil minister Sheikh Yamani is a perfect analogy for how technology evolves and leads to new ways of thinking. With recent advances in clean energy sources such as wind, water, solar, "clean" coal, and nuclear power, we are relying a little less on fossil fuels. However, we still rely almost completely on oil for our transportation and coal for our electricity (Fallows 2010).

Currently, fossil fuels such as oil and coal are the most efficient and cheap way to meet our energy needs, by far. It will take a major revelation in the energy sector to change this. Until then, sustainable energy strategies will continue to be a very small supplement to our overall energy needs (Fallows 2010).

It seems clear that we will rely on oil, natural gas, and coal for at least the foreseeable future. Only when alternative options become the cheapest, the most efficient, and the most marketable, will we begin to ween ourselves from fossil fuels.

Goals for Thesis Project

A graduate level thesis project exists in a number of separate realms, each of which has their own set of goals. This project will ultimately lead to a master's degree in architecture and by adhering to these self-subscribed goals, I can be sure to produce a project which is academically, professionally, and personally rewarding.

Academic

In the academic realm, this thesis project will develop a clear, concise, and thought provoking theoretical premise and unifying idea. This idea will be supported, verified, and modified by thorough research and analysis.

My use of past thesis projects as a source of information and guidance has proved to be invaluable. This project will be uploaded, in its entirety, to a digital repository. Its formatting and content, therefore, must be beneficial and easy to understand by future scholars who wish to use it for research purposes and thesis projects of their own.

The project will represent the culmination of my education and will, therefore, clearly demonstrate my understanding of it.

Goals for Thesis Project

Professional

In the professional realm, this project will serve as an example of what I am capable of doing. As a part of my portfolio, it will demonstrate my technical abilities as a designer and will be presented as such during interviews.

Personal

In the personal realm, this project will push the limits of what I am capable of. It will embody the finest work I have produced in my academic career. When it is complete, it will be something that I can be proud of, both in it's masterful graphic representation, superior design, and its theoretical premises.

This project will explore ideas that I personally find interesting and relevant. It, therefore, has a certain meaning to me and should show this in the final product.

The intense scheduling and planning portion of a thesis project will help teach me discipline and time management skills which are important and marketable in the professional environment.

Finally, this thesis project will serve as a transition between the academic and professional realms of the architecture profession. It will help prepare me for a lifetime of problem solving and design decisions.

Site Analysis

Narrative

Upon establishing a theoretical premise for this thesis project, I was sure that my site must exist in western North Dakota. The city of Stanley was always my first choice.

I am a North Dakota native (from Minot, about 100 miles north of Bismarck) who has relatives from rural western ND. As a child, I can recall stopping in Stanley for fuel and refreshments on almost every road trip. It was the perfect halfway point for us. We never actually ventured beyond the roadside convenience store. The childhood memories, along with the city's placement at the juncture of Highway 2 and 8, made it the perfect location.

The site visit began with the long voyage from Fargo. Each time I travel west across ND, I am always intrigued by the way the landscape changes. The red river valley, an ancient lake bed, is completely flat. The transition begins slowly, flat farm land turns into gently rolling hills. A steady increase in elevation always causes my ears to plug and pop. It seems as though the moment I reach the city of Minot, the landscape changes drastically. The sparse, gently rolling hills suddenly increase in number and size. They become an obstacle in which the road must wind itself around. Abundant, almost exclusive, farmland is replaced in part by ranches filled with cattle.

The site itself was loosely defined before I departed. When I arrived in Stanley, I found the county courthouse and talked to the county auditor. I told her what I was doing and where my site was. She immediately knew, without even looking at her records, who owned it and promptly looked up the phone number so I could gain permission to explore the land; a testament to the "everyone knows everyone" culture.

Narrative cont.

When I first saw the site in person, I was taken aback by how large it was. I drove along the dusty section road, which defined the north boundary of the site, and came to rest at the highest point on the site. From here I could see the city's inert landfill in the west, some retention ponds in the north, an RV park in the east, and Highway 2 in the south. I began to walk aimlessly around the site. The large hill, which lies in the center of the site, slopes down in three directions. I went south, towards the highway. The lowest point of the site is actually about eight feet below the driving surface of the highway. To my surprise, this was actually quite effective in muffling the noise coming from the speeding semis and trucks.

I happened to visit the site on a relatively warm day in early November. Although the season's first snow had already dusted the entire state, I noted how the south facing hills had already lost much of their snow cover. A light northwest breeze was enough to nip at my nose and face at the top of the hill, but I was nearly completely sheltered at the bottom.

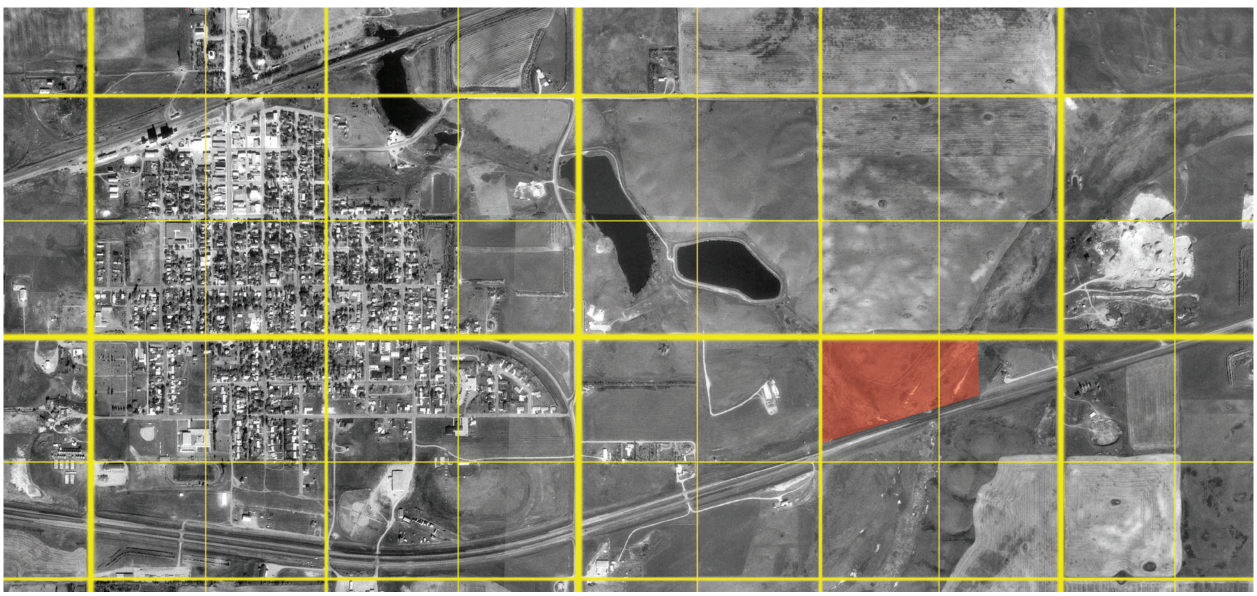
The site seemed almost completely void of any human interaction. It is overgrown with tall native grasses and weeds. The only sign of human intervention came in the form of a small drainage culvert near the base of the hill.

Overall, I was taken aback by the quiet and peaceful nature of the site, its panoramic views, and interesting topography. It was easy to imagine the site as a place where people could live and work.

Existing Grids

The existing grid established by the Land Ordinance of 1785 divides the area into townships, sections, and fractions of sections. The map shows a division down to quarter-quarter sections or 1/16 sections.

The proposed site lies in township 156, section 27. More specifically, the site is located mostly in the NW quadrant of the NE quarter of section 27. Denoted at S027 NWNE



[Figure 9]

Texture

The texture of the site is of a natural character and does not vary significantly. The texture is mostly defined by the state in which the native grasses are. Depending of the season, these conditions can change slightly. In the spring and summer, the grasses tend to portray a softer texture. In the fall and winter, the native grasses turn brown and give the site a slightly abrasive texture. With the addition of snow, the site looks more smooth and the grasses may be covered completely.

[Figure 10]

Geometric Relationships

Due to the fact that there are no built objects on the site and none immediately adjacent to the site, any geometric relationships are abstract or temporary. For instance, the highway on the south side of the site carries vehicles which could be considered a geometry and are related to the site itself and its topography.

[Figure 11]

Built Features

As mentioned, the site contains no built structures. There are however, some built features within eye-shot of the site. The barn, to the south, is the closest structure. Other structures can be seen in the distance.

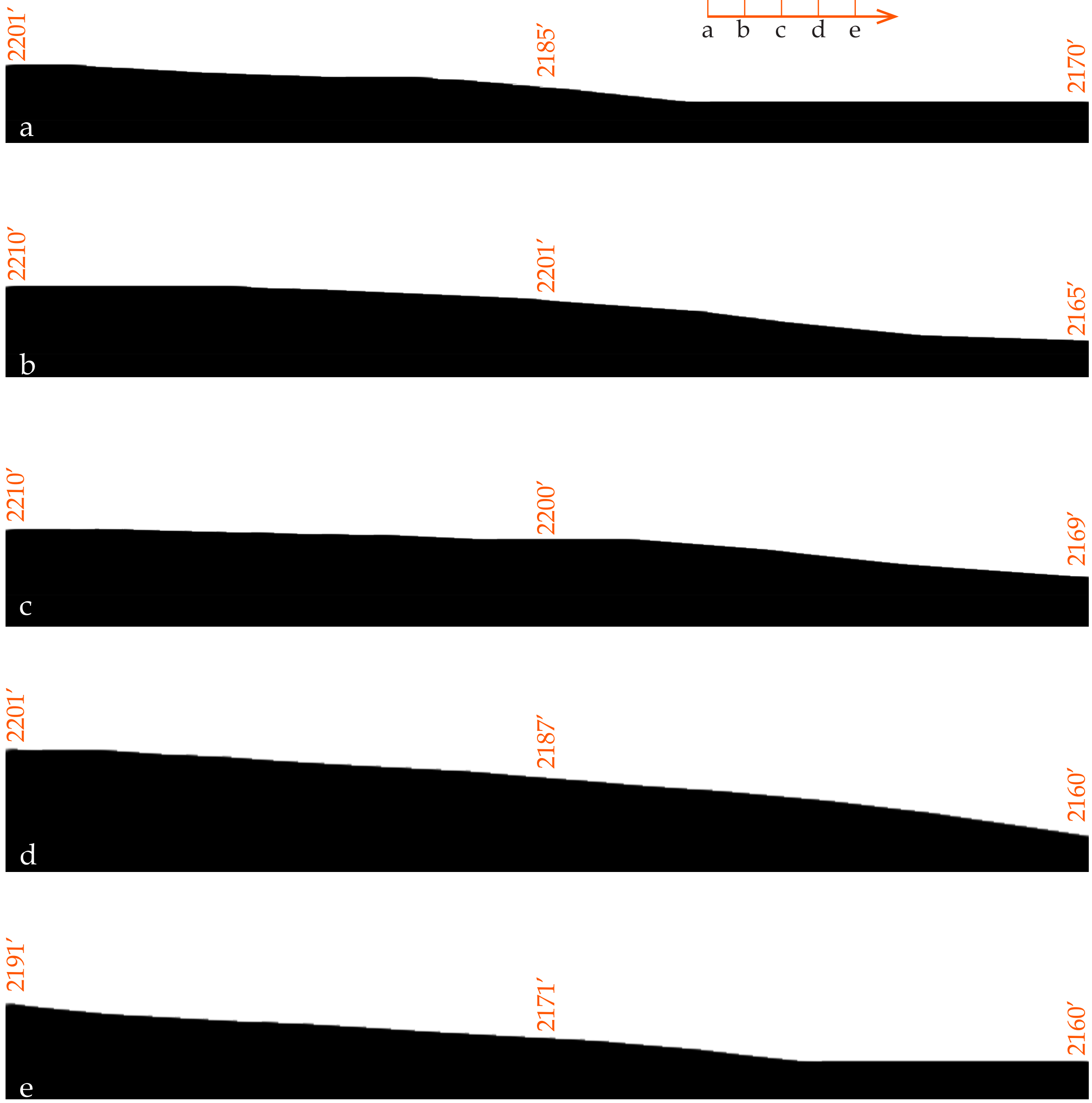
[Figure 12]

[Figure 13]

[Figure 14]

A series of North/South Sections looking east. Each section shows feet of topography. The cuts were taken at 200 foot intervals as one walks east across the site. Measurements are feet above sea level. Scale: 1”=140’

[Figure 15]



[Figure 16]

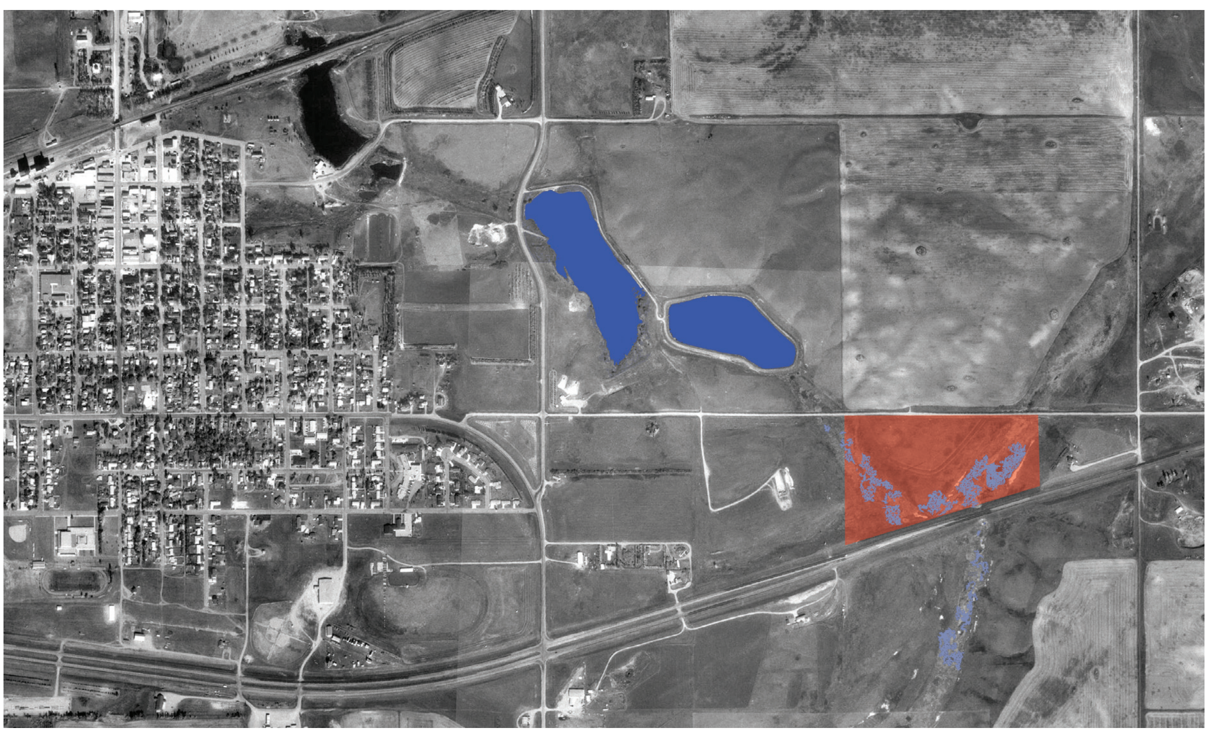
[Figure 17]

Light Quality

The quality of light varies greatly depending upon the season, time of day, and weather conditions. The site is, however, completely exposed. There are no tall structures or trees which block the site from natural light. During my visit on a sunny afternoon in mid November, the light was intense and warm. I remember thinking how vivid and sharp everything seemed.

Water

The site contains intermittent water in the form of a dried up riverbed. During periods of heavy rain, these low lying areas can fill with water. To the NW of the site are two ponds which are part of the Little Knife River water shed area. The site's topography does provide a unique opportunity to harness storm water for use as potable water.



[Figure 18]

Wind

The prevailing winds of the area are primarily from the northwest and can be very strong at times. The site's topography provides opportunity to block much of the cold northwest winds in the winter. In the summer, when the winds shift and are from the southwest, the site allows for utilization of the cool summer breeze.

Human Interaction

As mentioned, the site appears to be free from any human intervention. The large swale appears to have been formed by erosion from the little knife river. Presently, human interaction occurs only around the perimeter of the site in the form of roadways.

Distress

Overall, the site is in excellent overall condition. Any erosion caused by the little knife river seems to have ceased. Native grasses cover the site, which prevents any wind erosion and top soil depletion.

Soils

According to the USDA, the soils on the site are mostly “Zahl-Williams Loam.” This type of soil is classified as deep, well drained, moderately slowly permeable, and formed from glacial till. (USDA). These soils are suitable to build upon without any special engineering considerations.

Utilities

To my knowledge, there are not any utilities on the site itself. However, the adjacent structures do have full service utilities. It will be necessary to extend these to the site.

The city of Stanley actually pipes its water in from Ray, a city about 40 miles west. The water is stored in two locations. One is a water tower at the north end of town, near the courthouse. The other is in holding tanks just west of the proposed site.

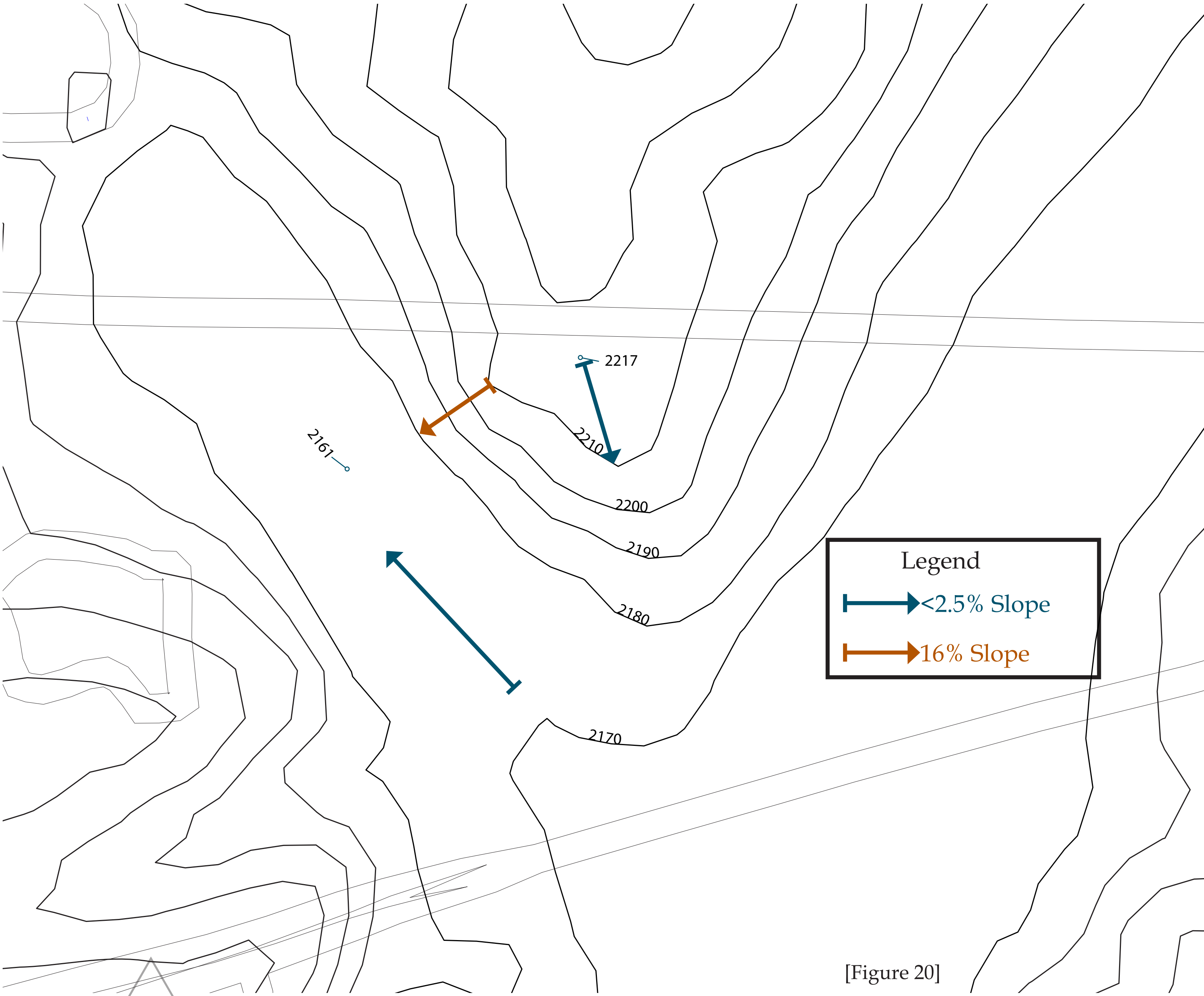
Traffic

The site does not currently have any vehicular or pedestrian traffic on it. It is, however, adjacent to a very busy highway. Noise levels from the highway only become a nuisance when standing within 50 feet of it. The site design must be sensitive to this fact.

[Figure 19]

Topography

The site falls from 2217 feet above sea level at its highest point to 2161 feet above sea level at its lowest. This is a drop of 56' over a distance of 700'. The steepest portion of the site has a 16% slope, which is too steep to comfortably walk on, and is nearly too steep for a vehicle to drive upon. The flat area on top of the hill, as well as the areas at the base of the hill, have a slope of 2.5% or less. These areas seem flat to the user, but still drain adequately and are suitable for all activities.



[Figure 20]

Site Character

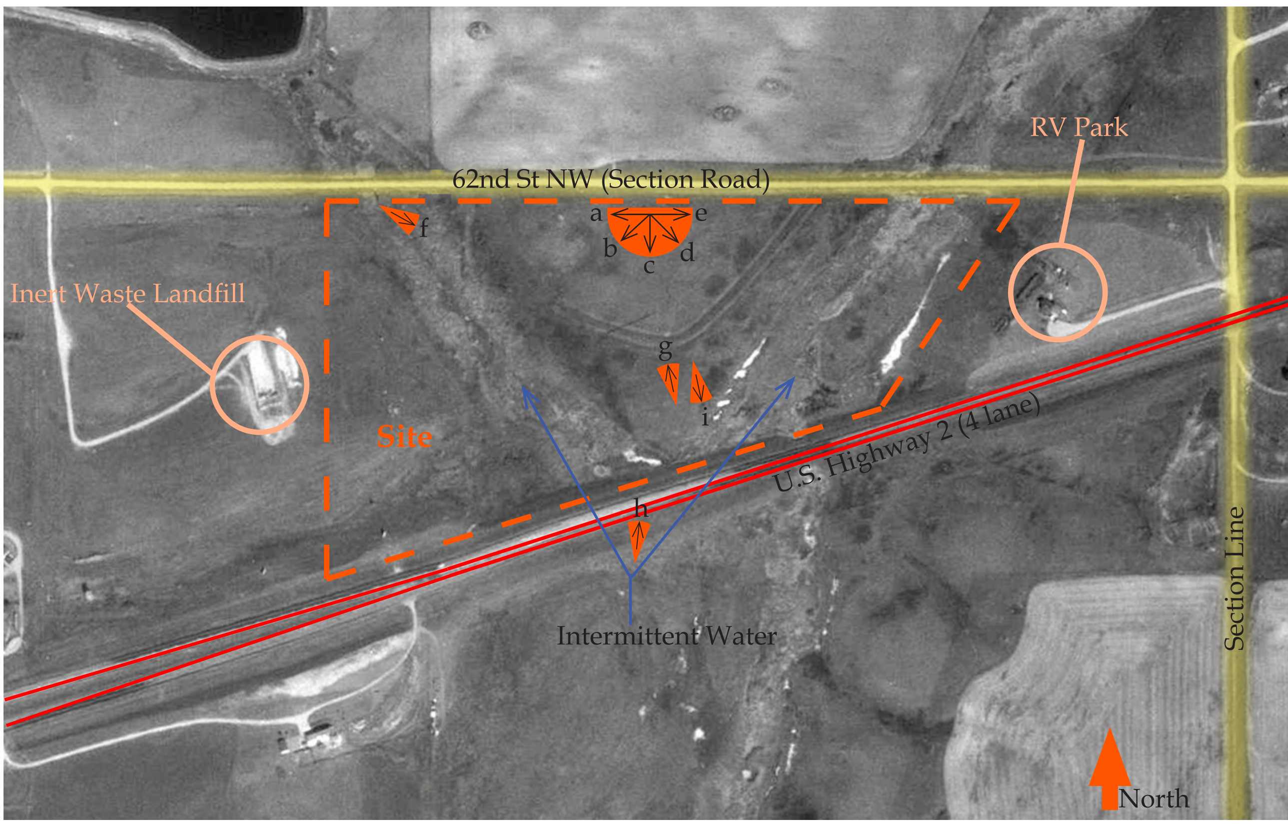
The character of the site is in its rolling topography, southern exposure, and proximity to the city of Stanley and major highways. Specifically, the topography provides natural shelter from cold winter winds and channels cool summer breezes. The south facing hillside provides more exposure to the sun and, therefore, increases the ability of a built structure to utilize passive heating techniques.

[Figure 21]

[Figure 22]

Base Map

The base map shows surrounding structures, roadways, and site characteristics. It is also used as a reference to orient one's self with the site photographs.



[Figure 23]

[Figure 24,25,26]


a


b


c

Site Analysis

[Figure 27,28,29]

d

e

f

[Figure 30,31,32]

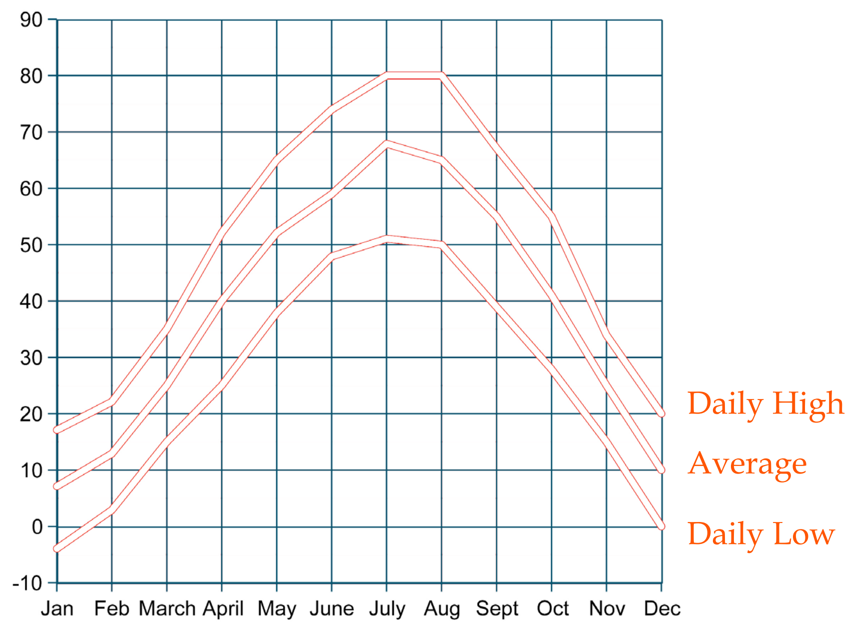
g

h

i

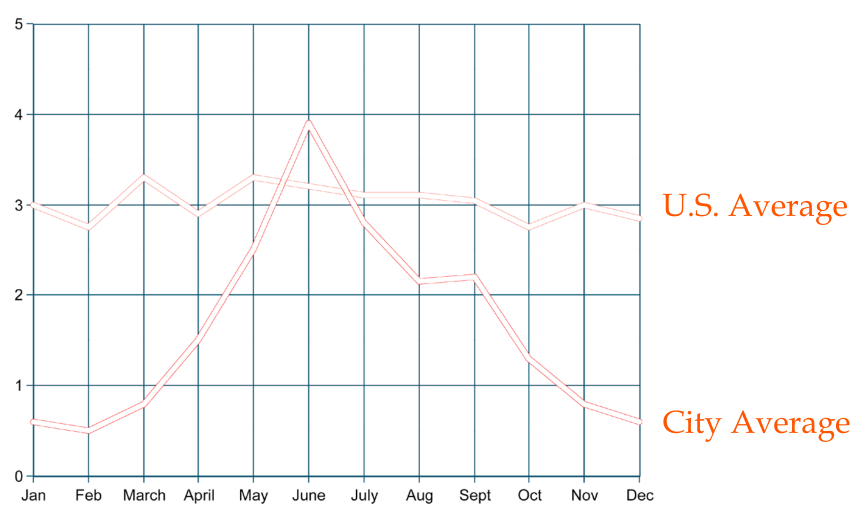
Climate Data

Annual Temperature (Deg. F)



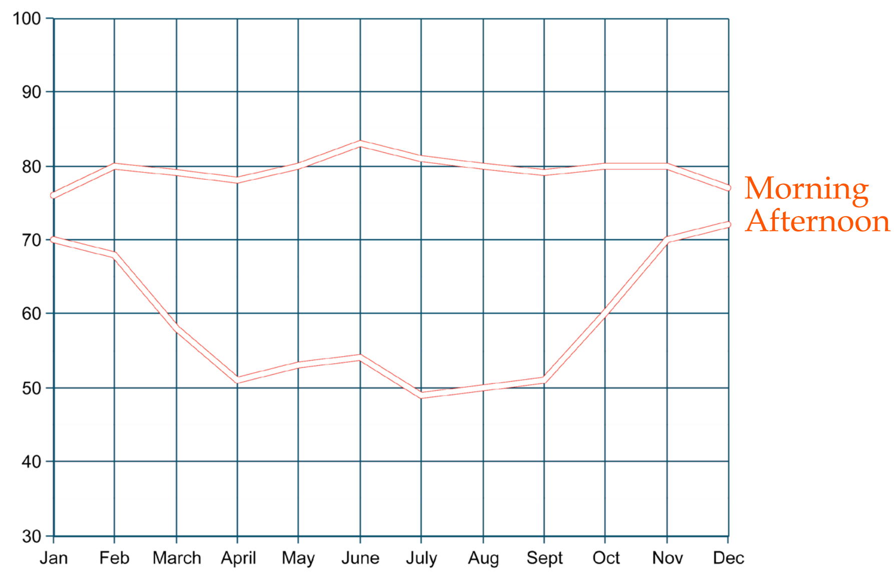
[Figure 33]

Annual Precipitation (Inches)



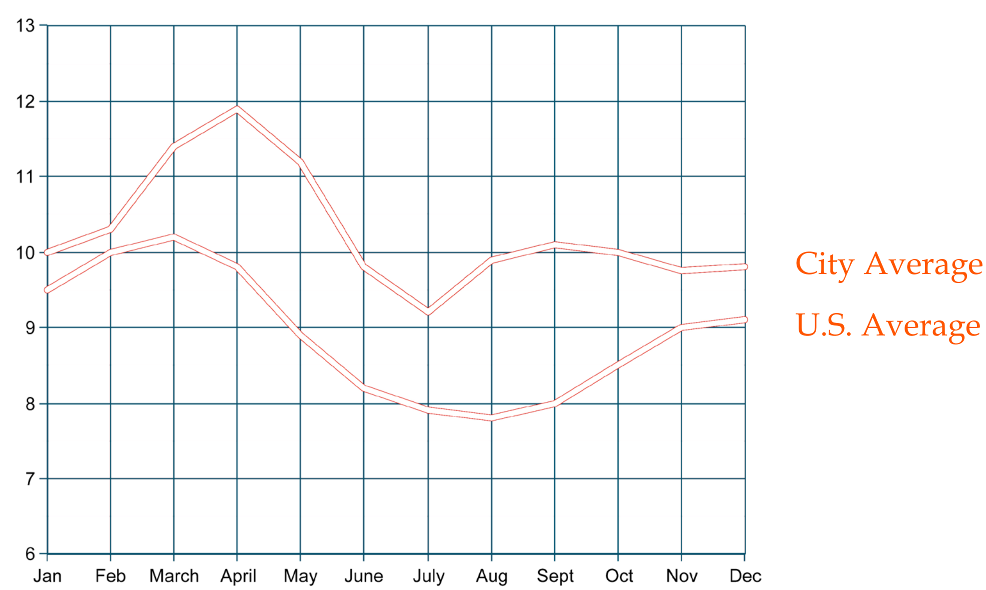
[Figure 34]

Annual Average Humidity Levels (%)



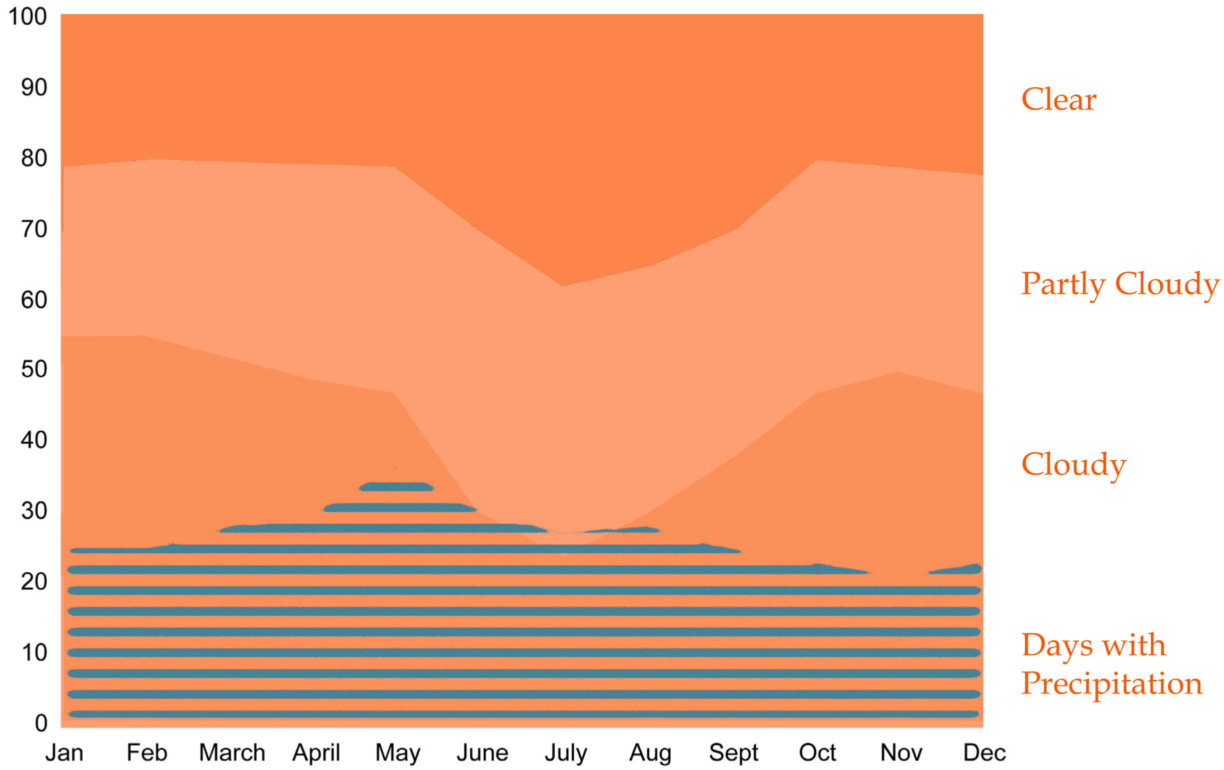
[Figure 35]

Annual Average Wind Speeds (Mph)

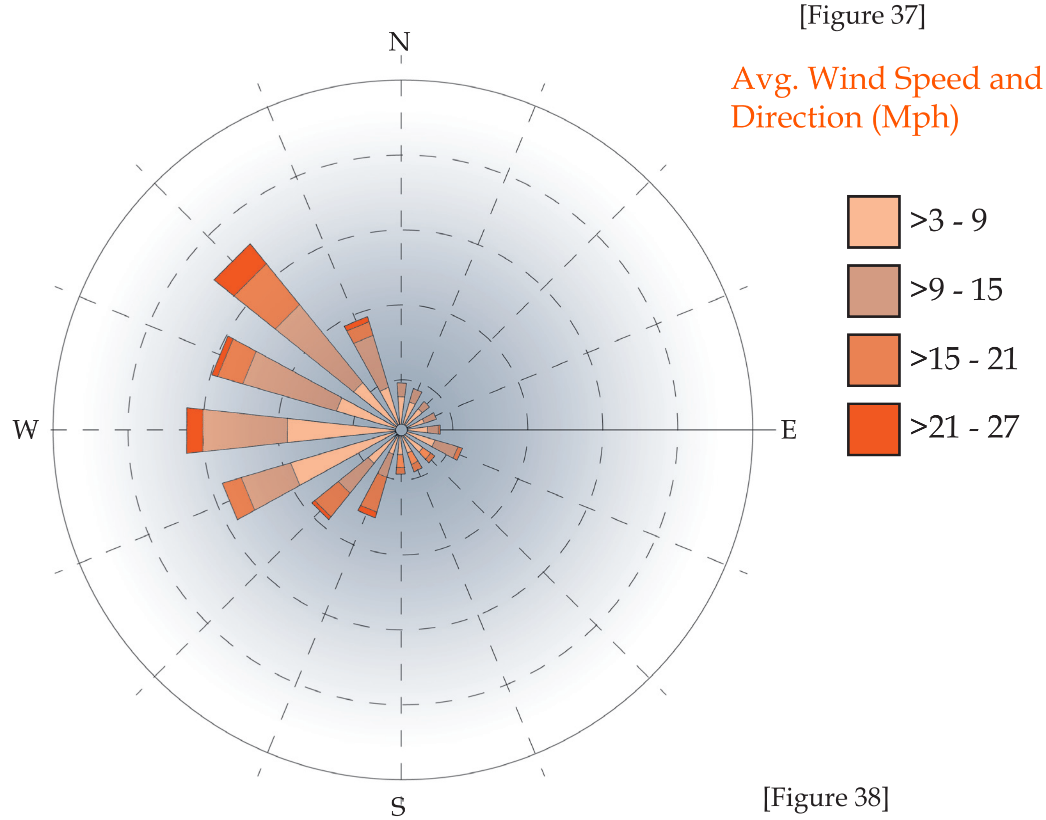


[Figure 36]

Annual Average Cloudiness (% of days)

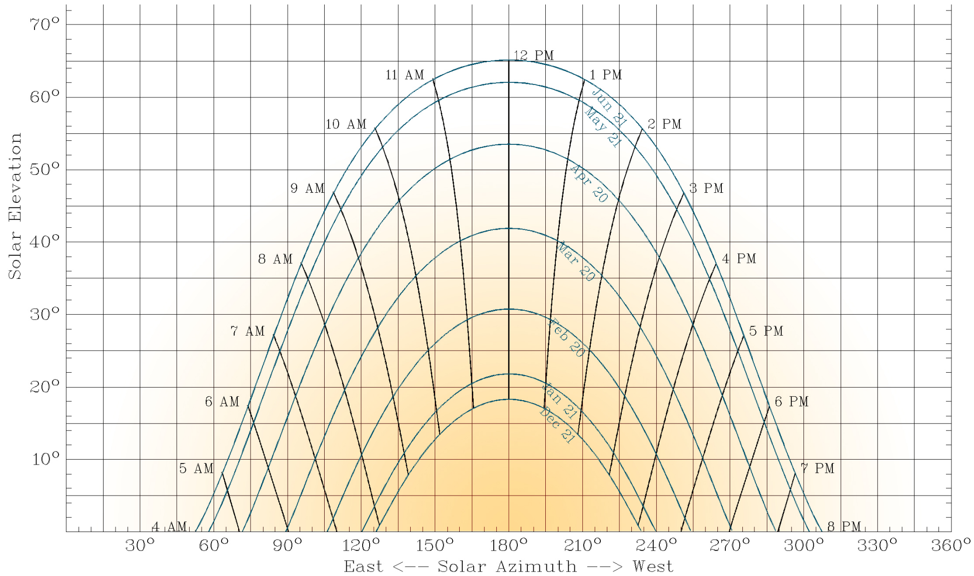


[Figure 37]



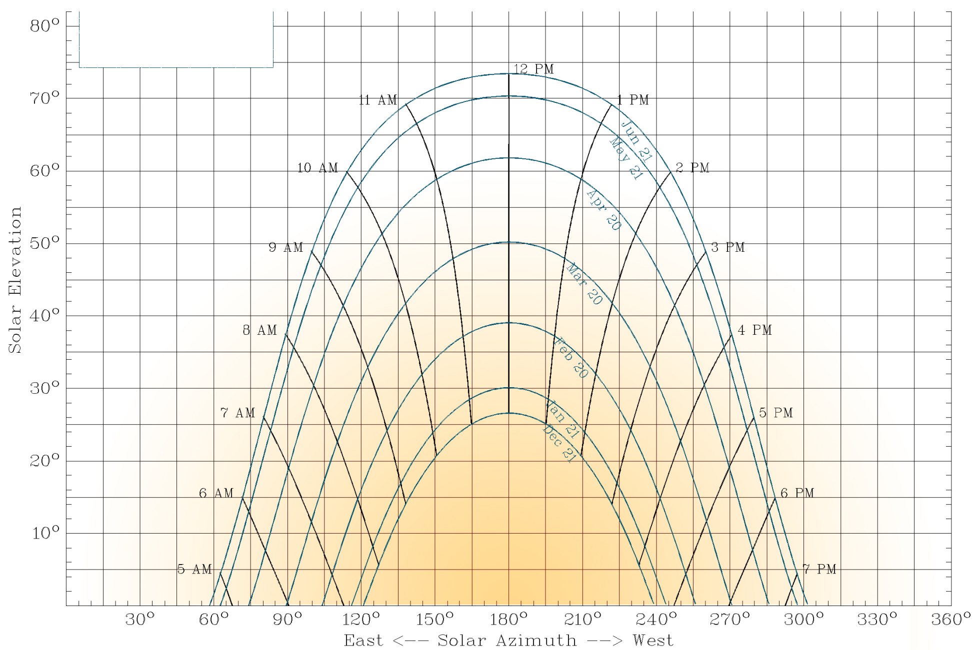
[Figure 38]

Sun Path Chart



[Figure 39]

The sun chart shows the position of the sun relative to the site throughout the year. The exact coordinates used to generate this chart are 48.3121 degrees North, 102.3613 degrees West. This is a point at the top of the hill on the site.



[Figure 40]

This sun chart is generated at 40 degrees North latitude and represents the perceived angle of the sun on a 15% south facing slope.

Space Allocation

Water and Waste Management

Water Purification Ponds

235,000 SF

Three ponds (settling, clarifying, and fresh water), each able to hold one year's capacity of water for the site, to be located in such a way as to allow for gravitational drainage between one another.

Chemical Storage

3,000 SF

Tanks holding chemicals such as chlorine which are added to the water at the last stages of purification.

Water Storage

5,000 SF

Tanks able to hold a two week supply of fresh, potable water. (32,000 gallons).

Pump and Process Area

15,000 SF

Area which houses all pumps and equipment necessary for final processing of water. Should be adjacent to water storage and chemical storage.

Office/Administration

1,000 SF

Offices for officials in charge of water recycling facility.

Auxiliary

7,000 SF

Restrooms, mechanical, circulation, and other spaces necessary for operation.

-80 gallons avg. water usage per person/day.

-200 total people on site on any given time.

=5,840,000 gallons/yr

-1 gallon of water = 0.1337 cubic feet

=780,808 cubic feet of water storage needed per pond

-Each pond is 10 feet deep.

=78,081 square ft/pond

*3 ponds

=234,242 square ft

= ~ 13% of total site area

This portion of the program was developed on a very basic level. The project, instead, focused on the housing units.

Space Allocation

Housing/Community

Housing Units

70,000 SF

70 units. Housing for about 120 people. Units are able to be linked to provide various sizes and suit any family dynamic. Each unit will have sleeping, cooking, living, and bathing spaces. An individual unit is about 950 sf.

Public Outdoor Space

Indefinite

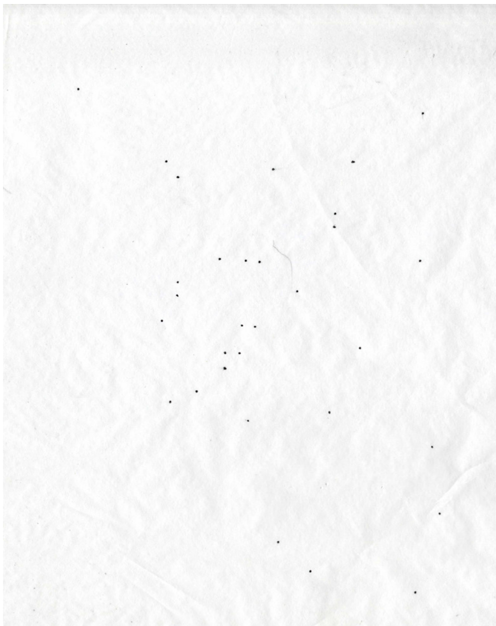
Parking

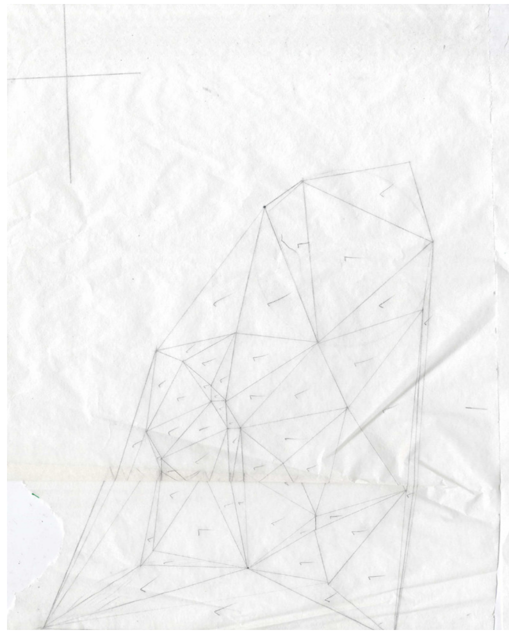
30,000 SF

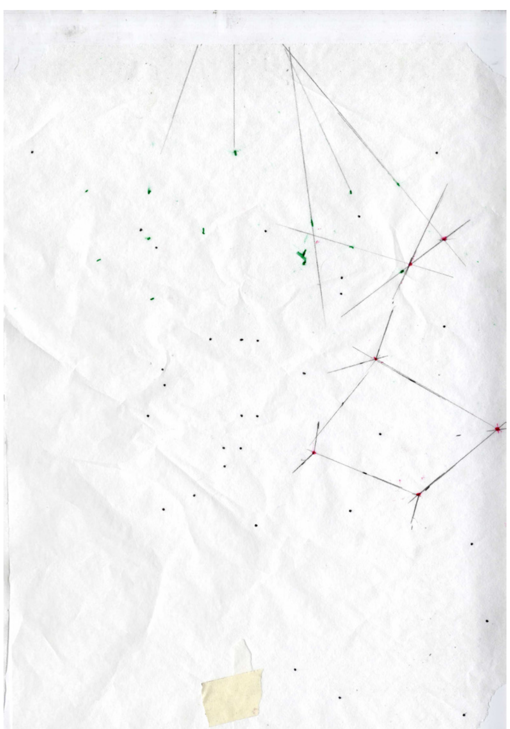
Auxiliary/Circulation

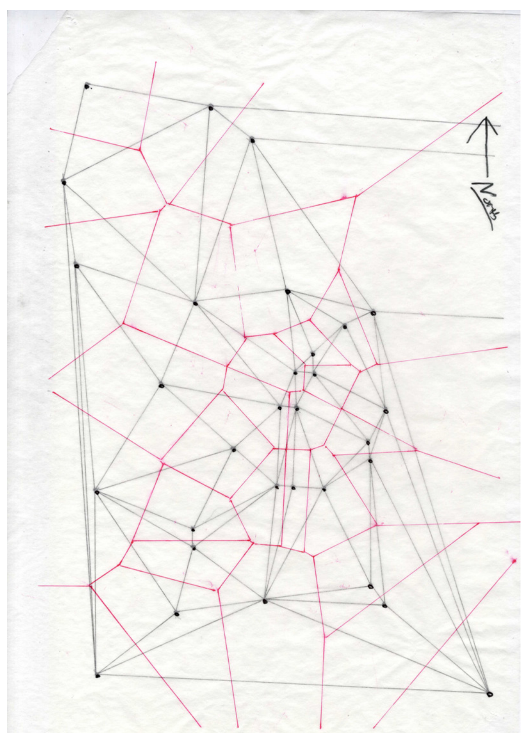
5,000 SF

Process

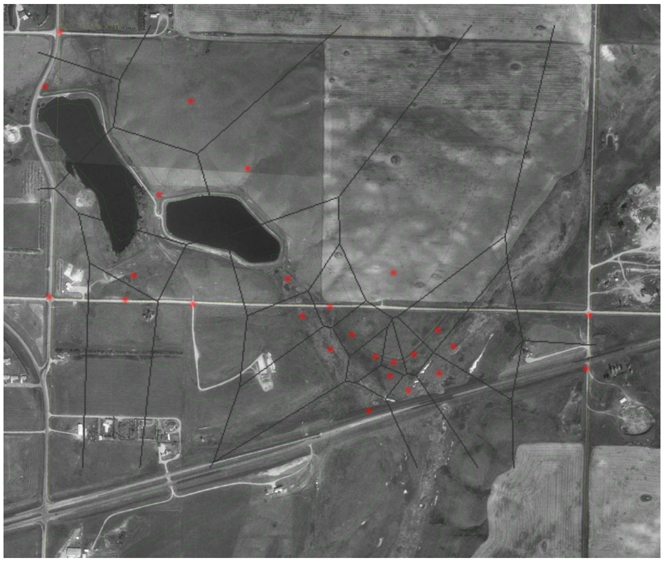


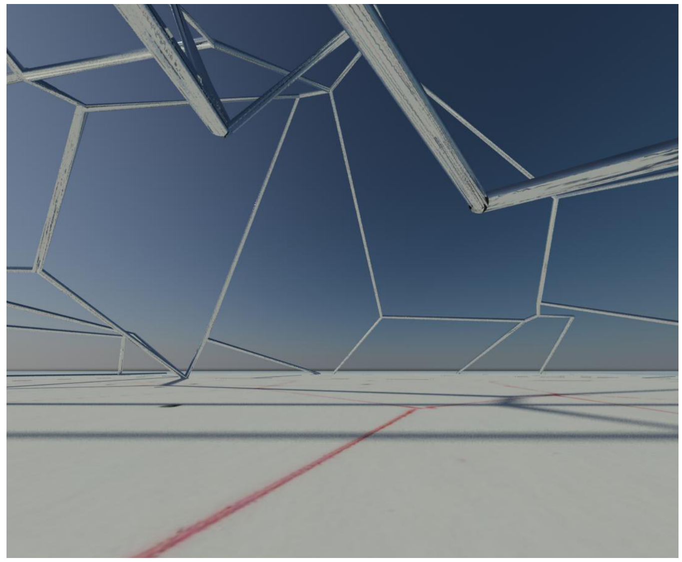


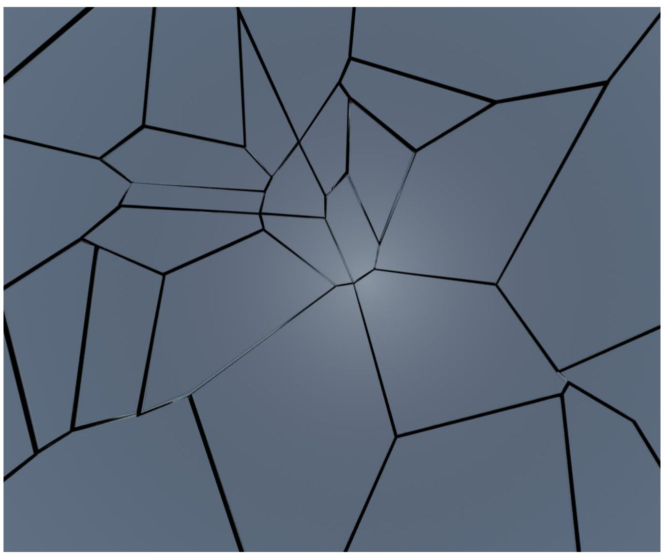


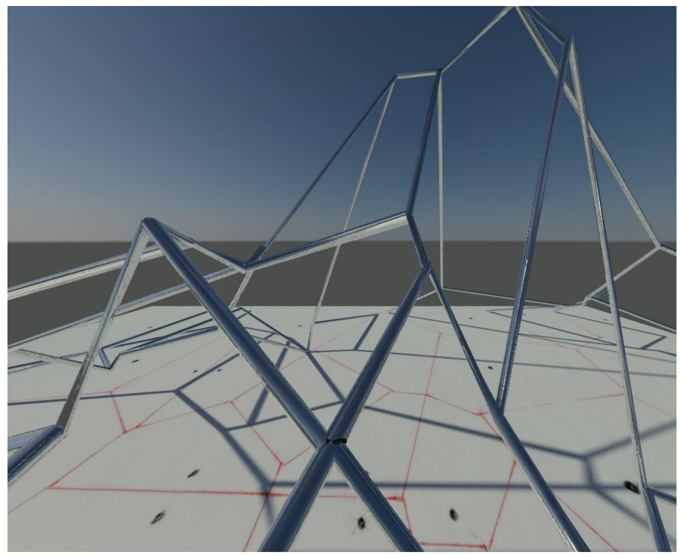


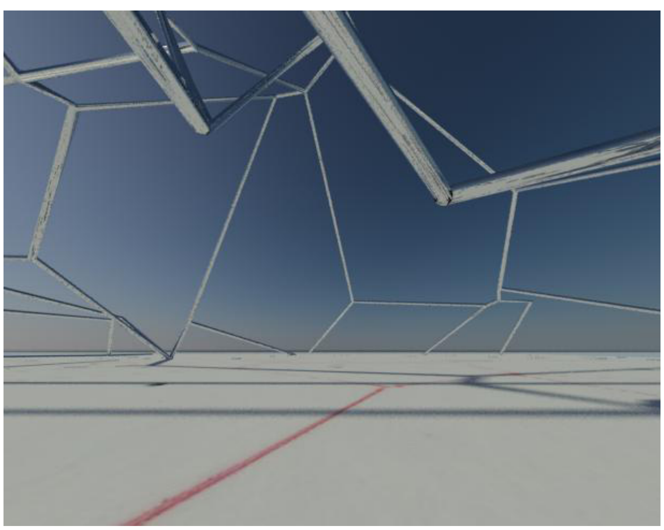
Process





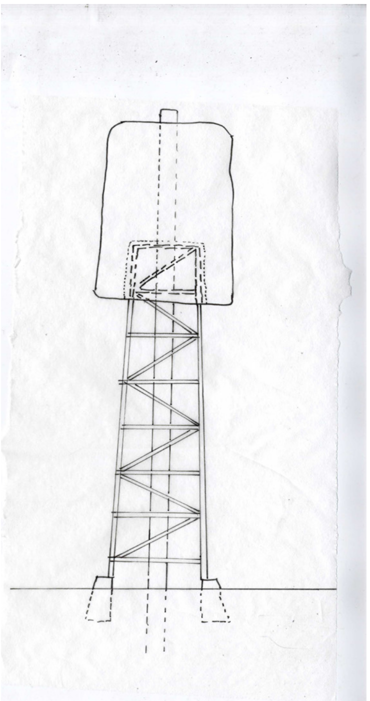


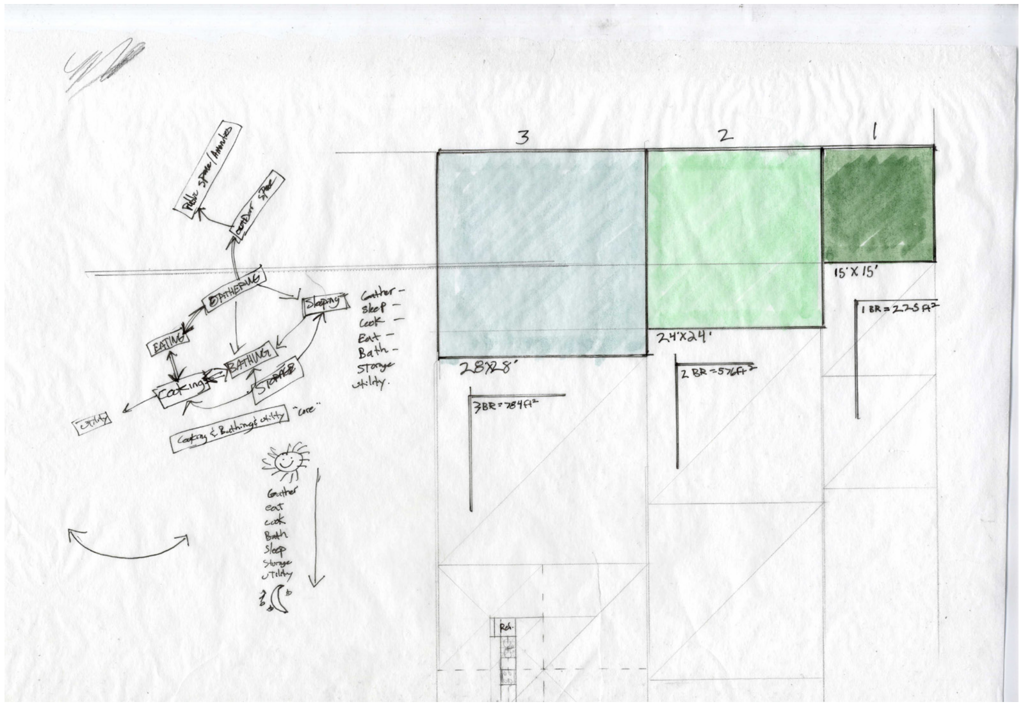


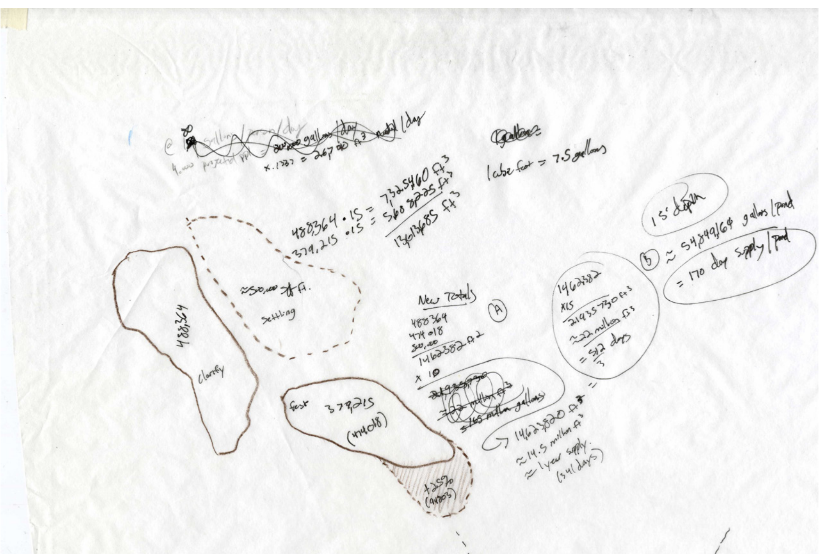


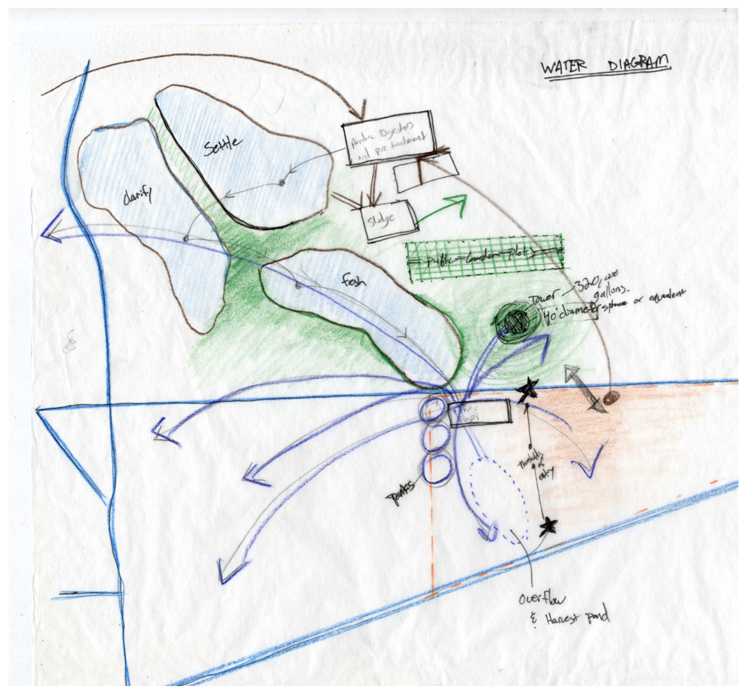
These ambiguous variations on a Voronoi diagram helped inspired the site layout and structural patterns of the project.

Process



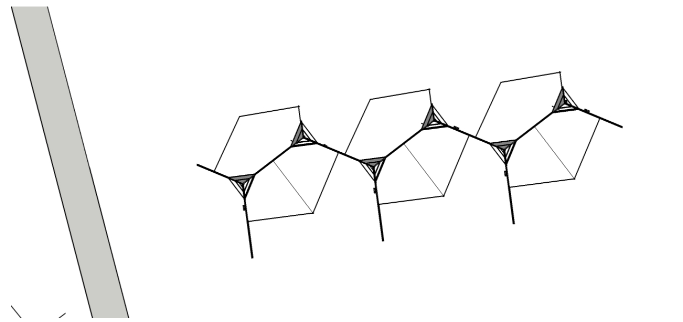


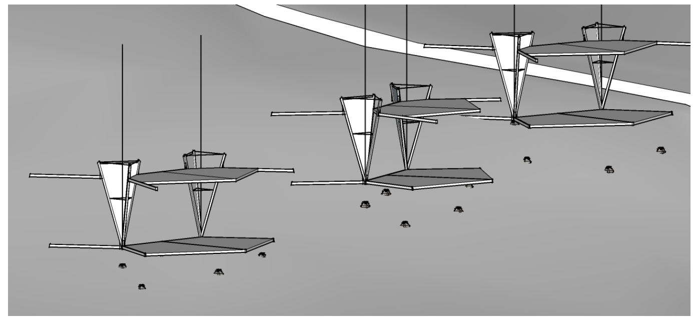


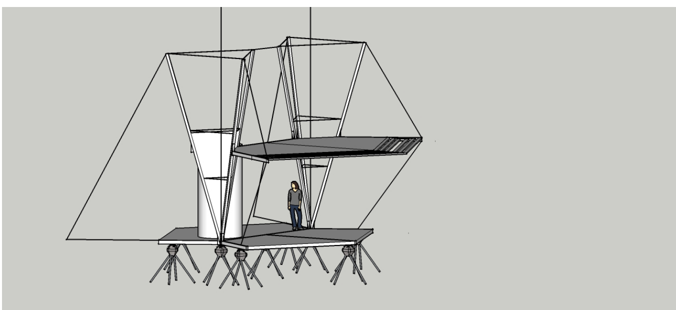


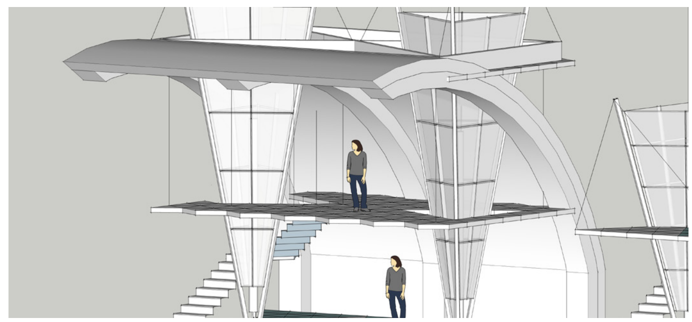
Various sketches showing site and space development.

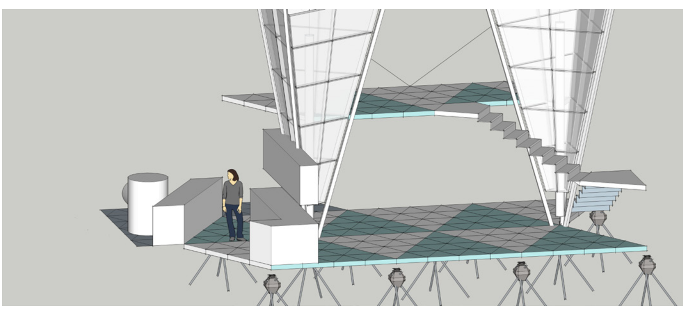
Process

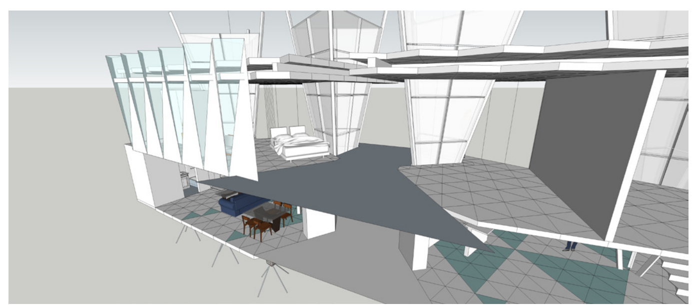


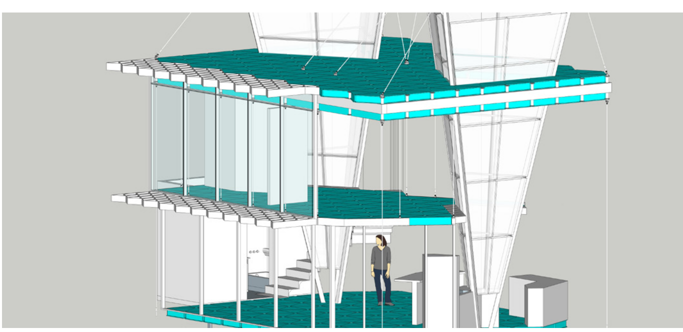


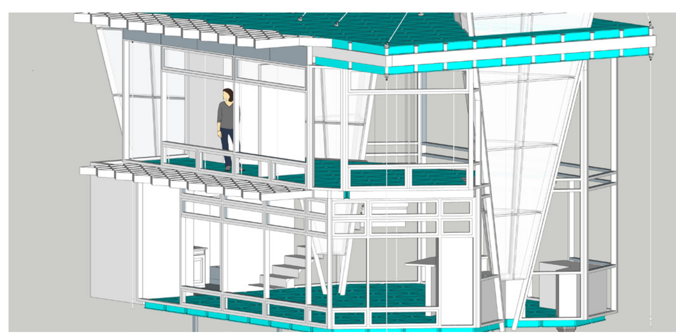




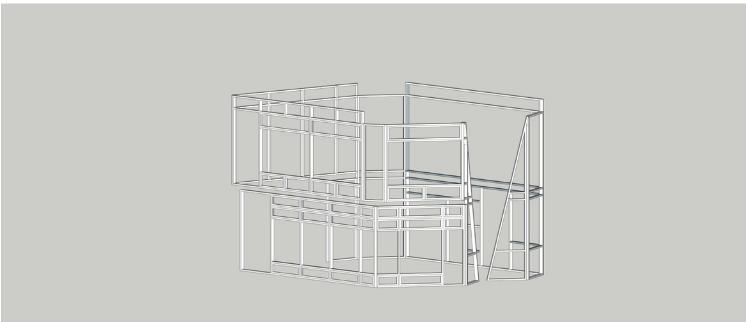


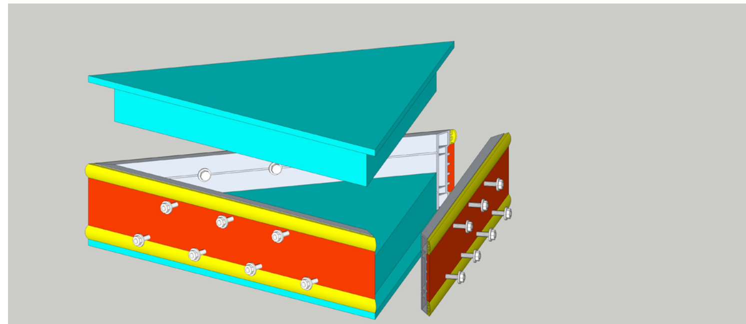


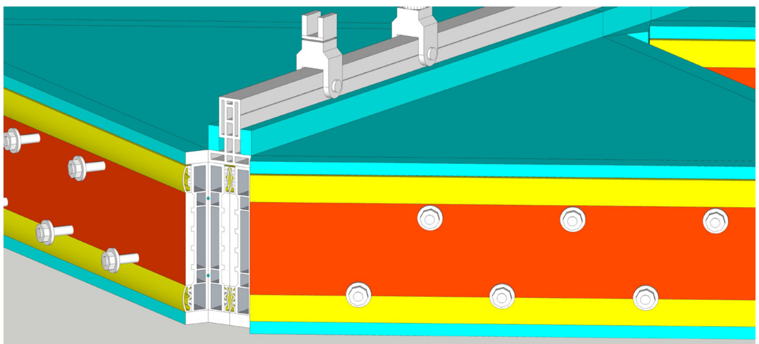


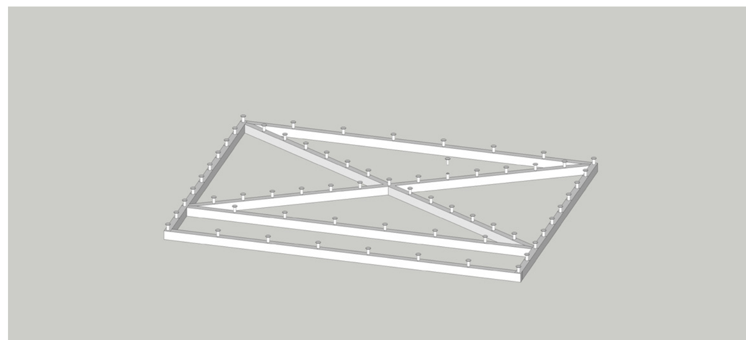


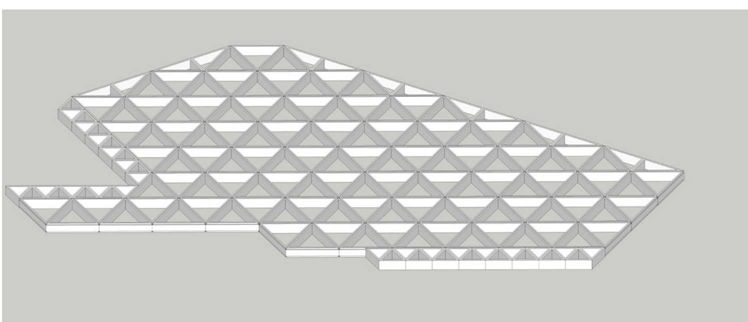
Process

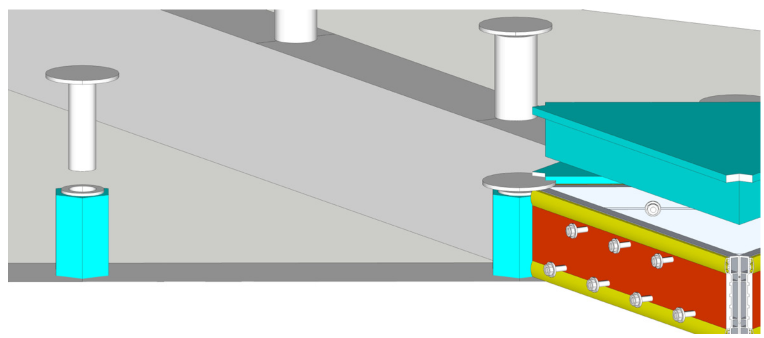


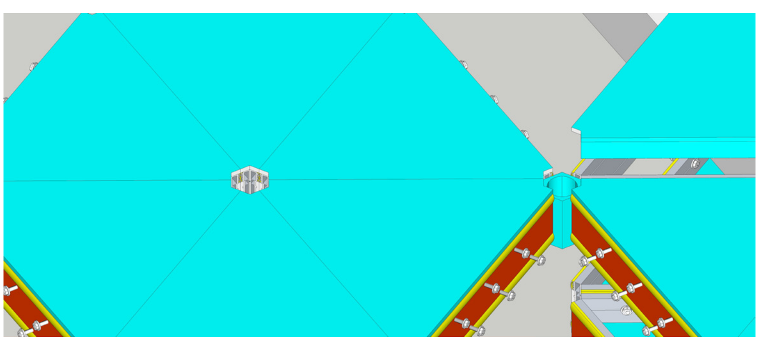


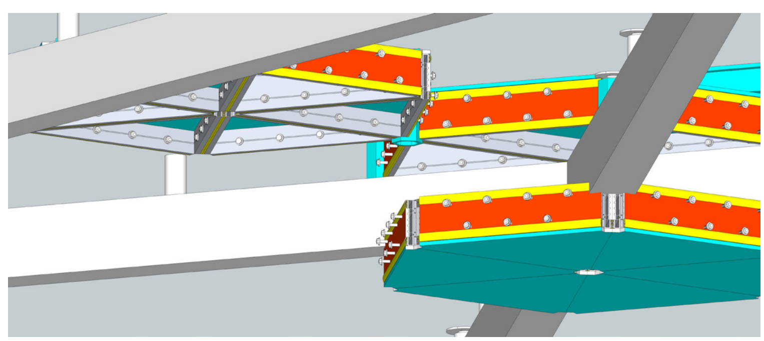




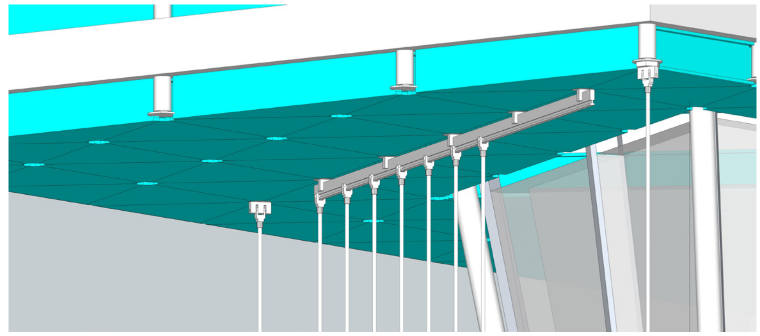


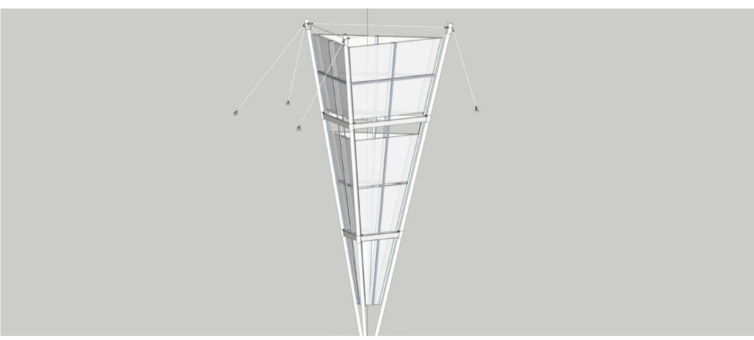


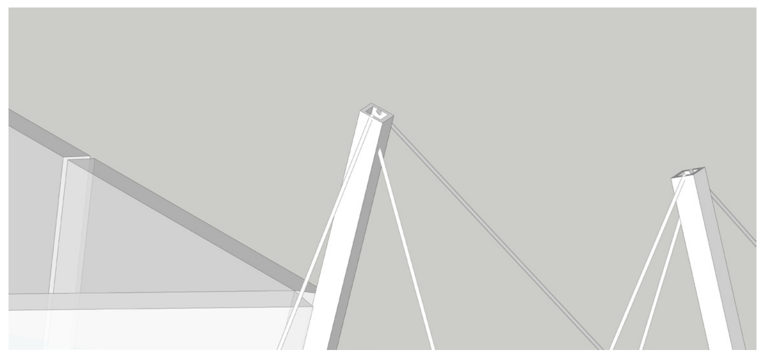


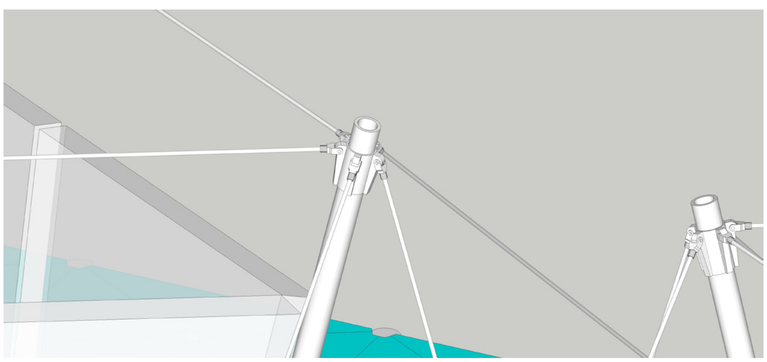


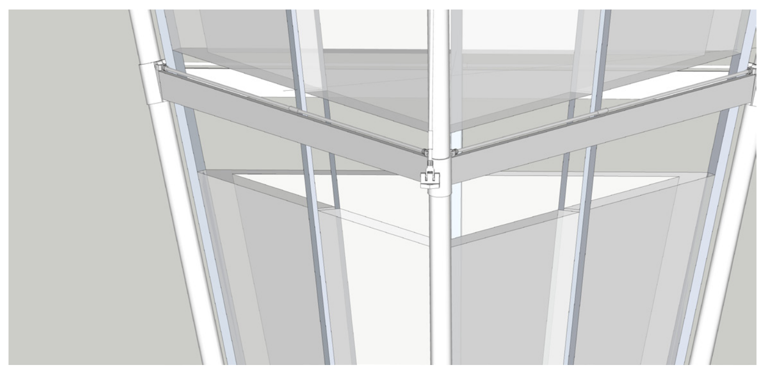
Process

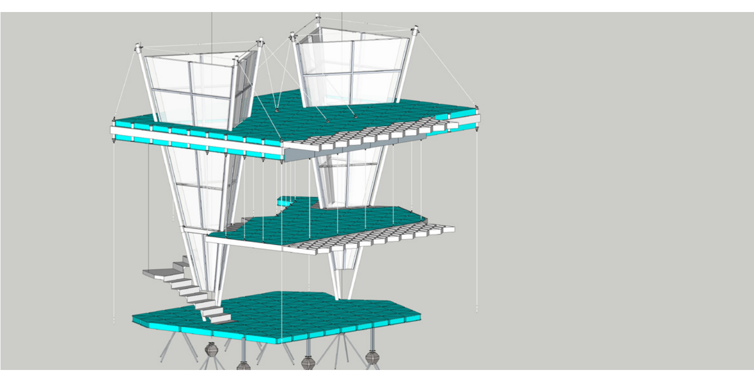


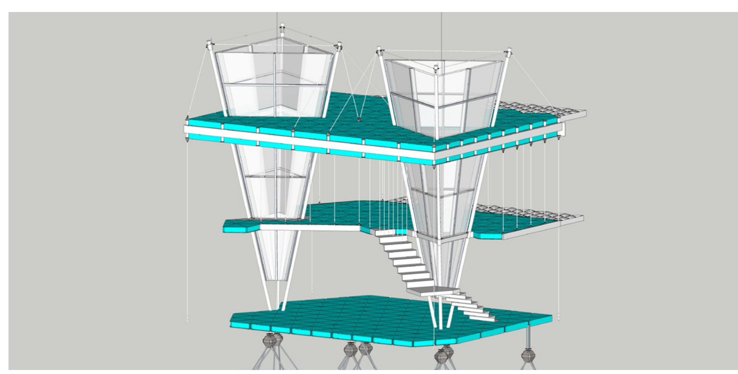




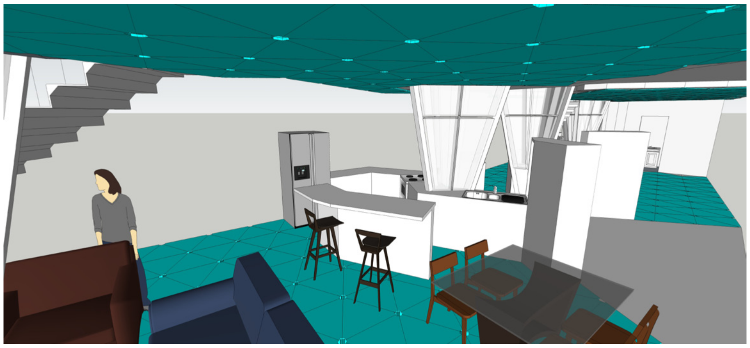


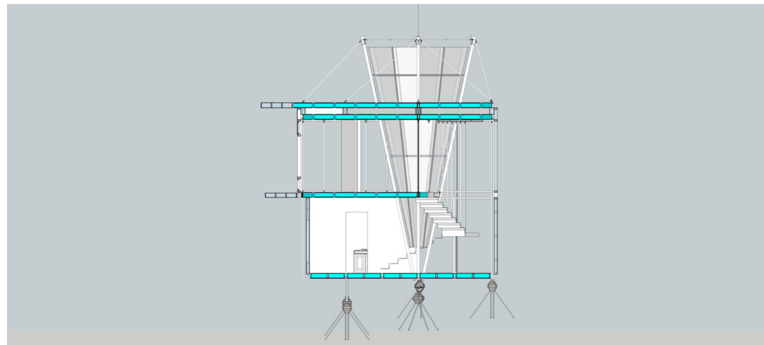


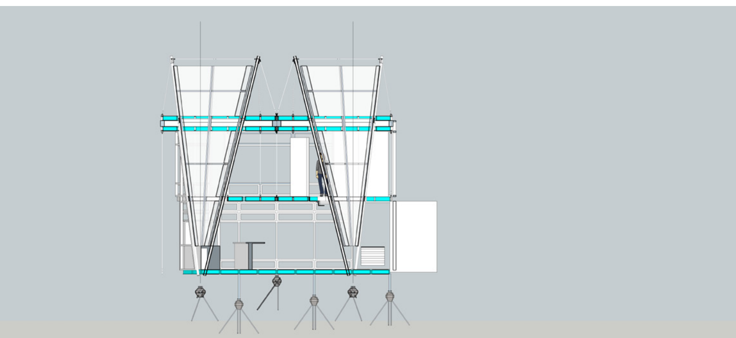


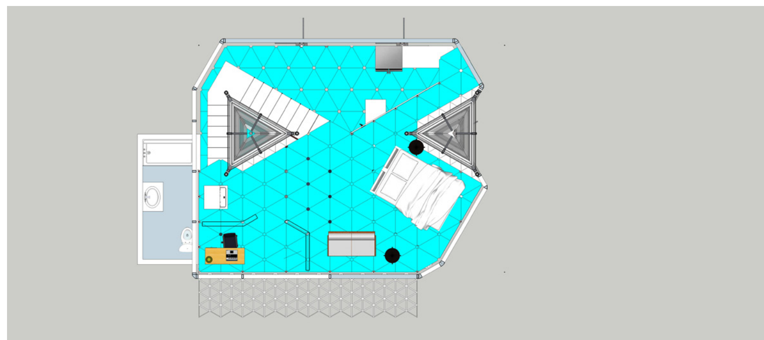


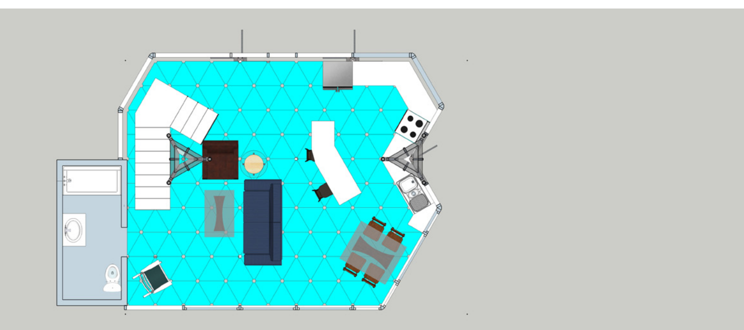
Process

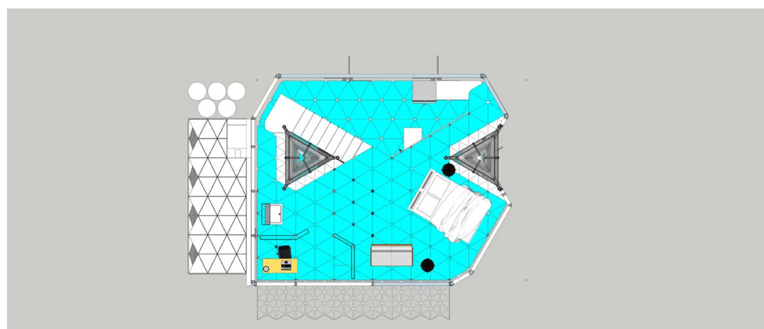


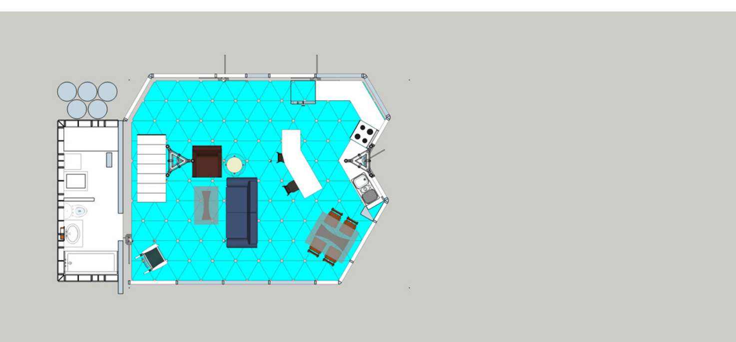


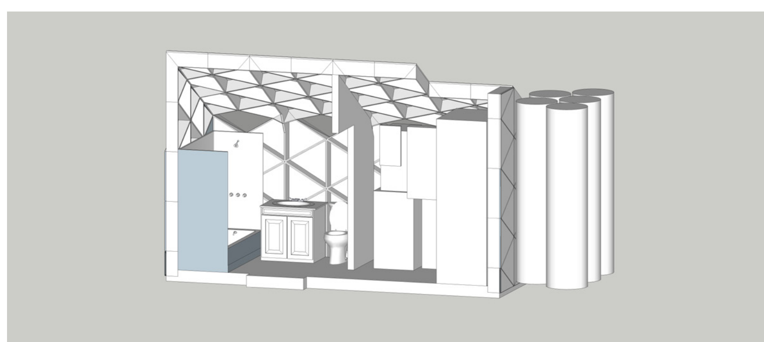




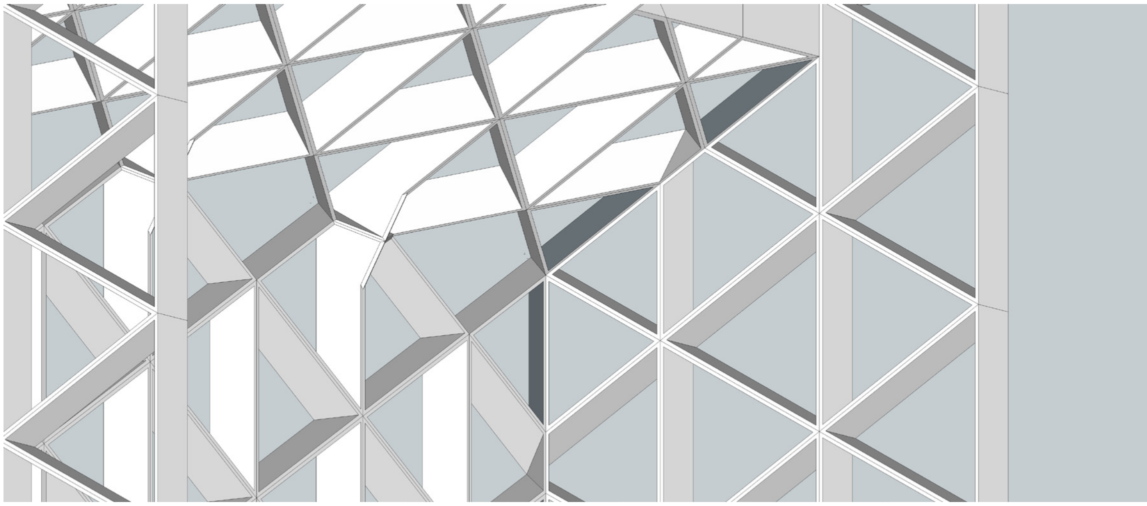


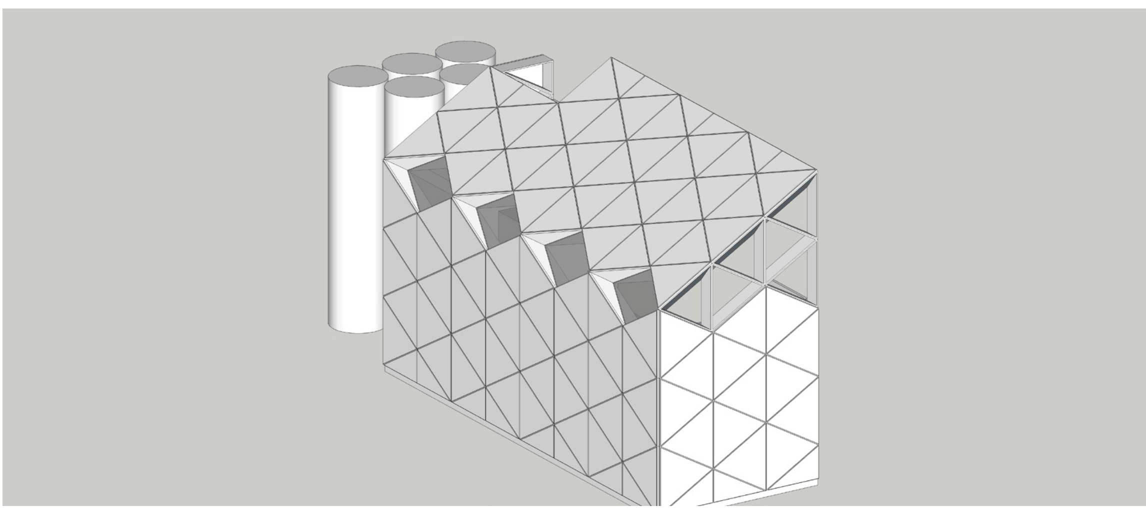


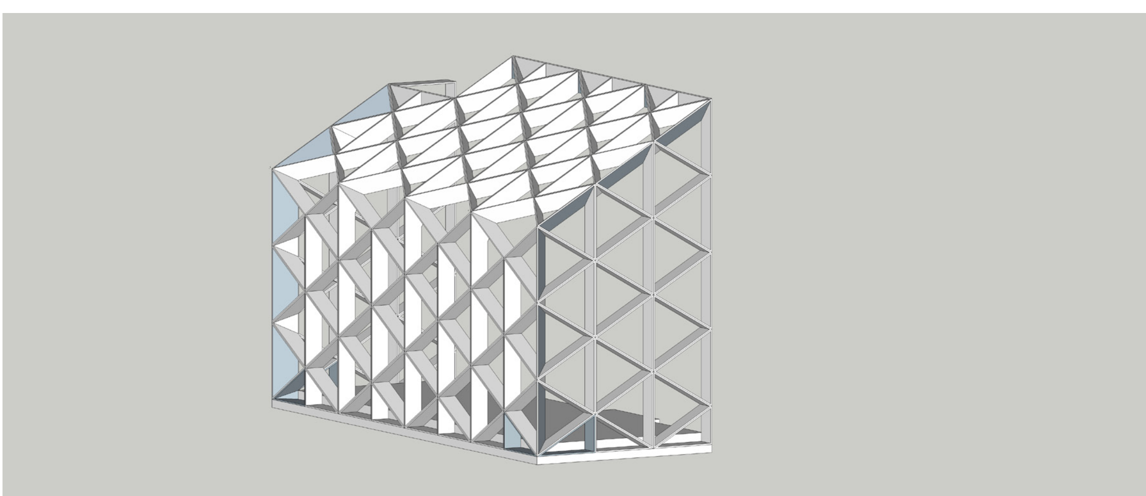


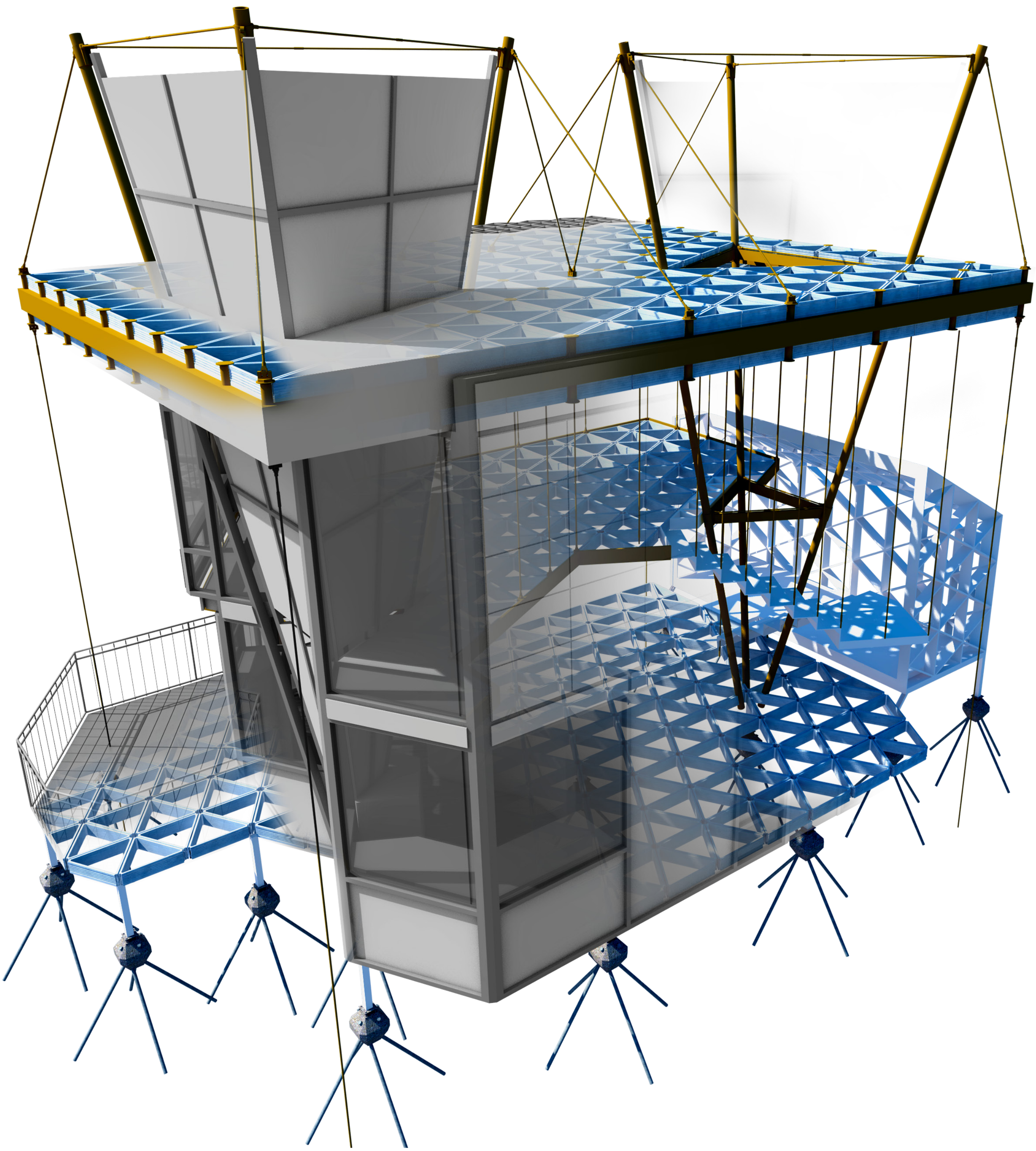


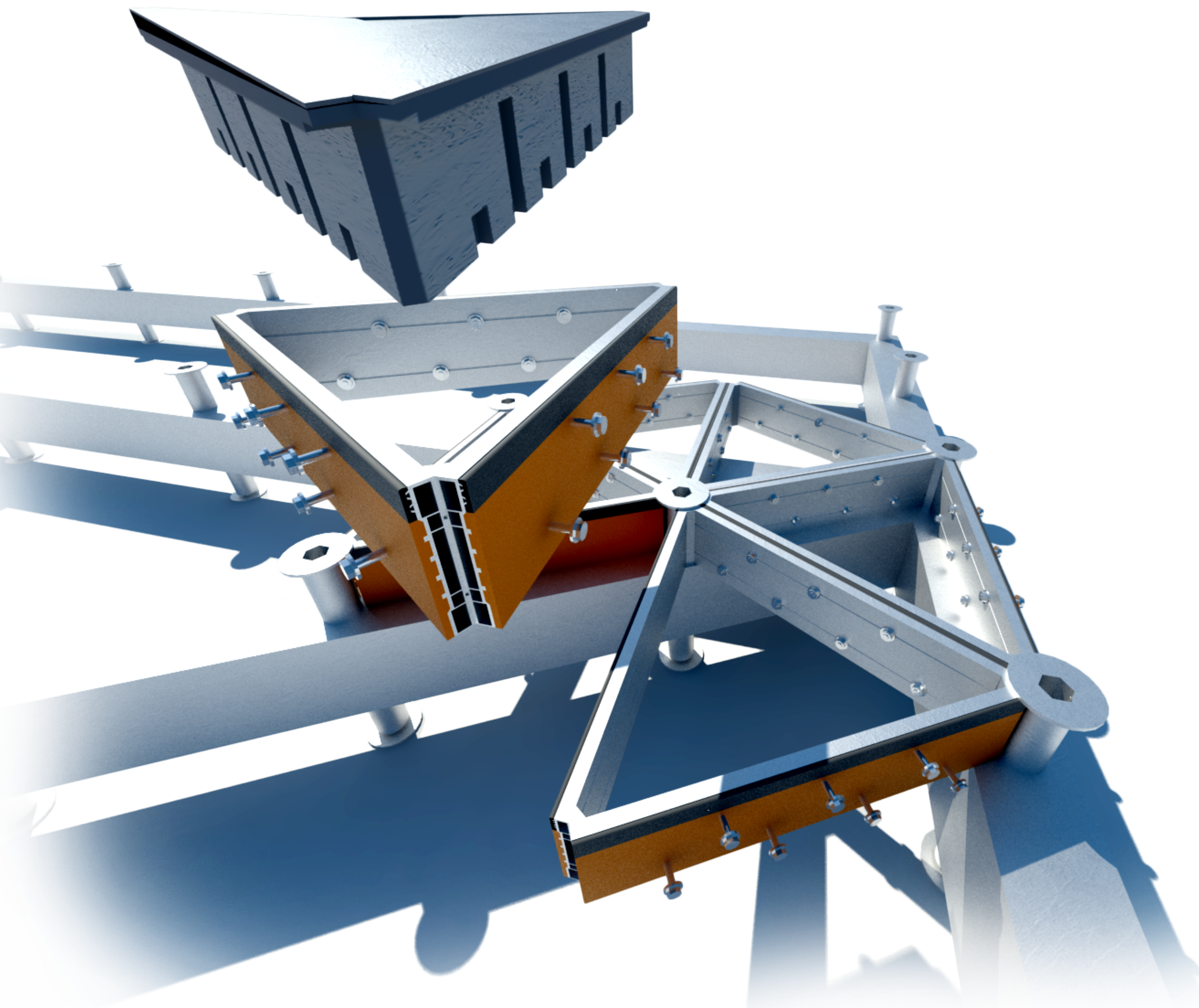
Process



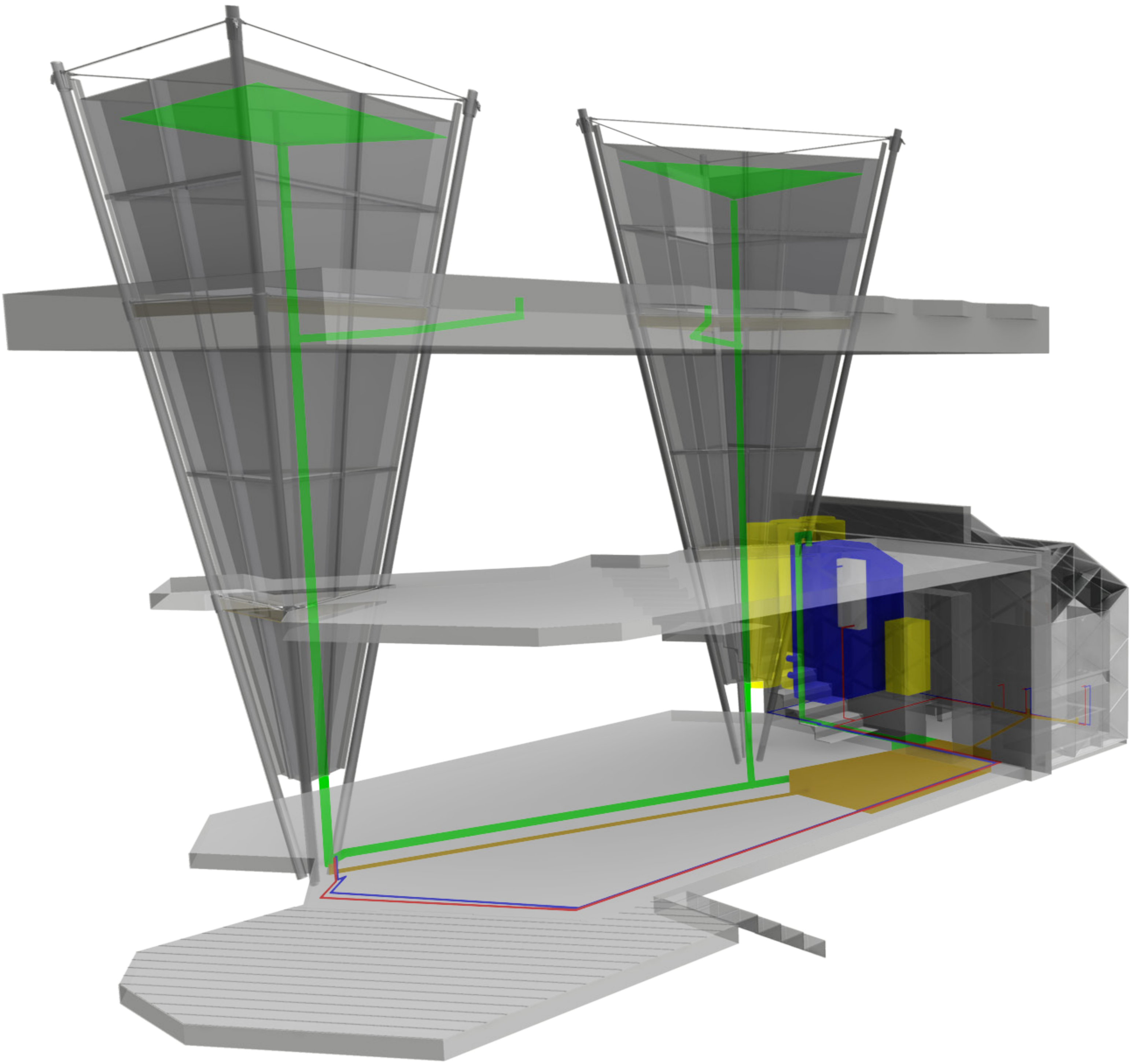




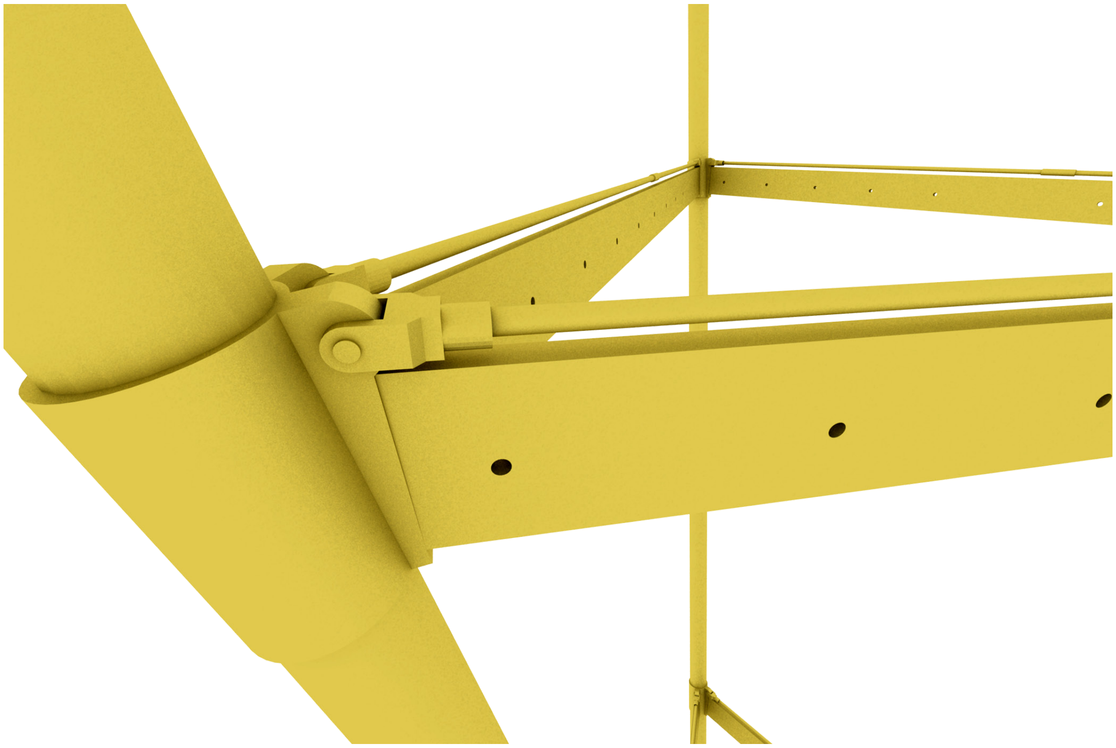


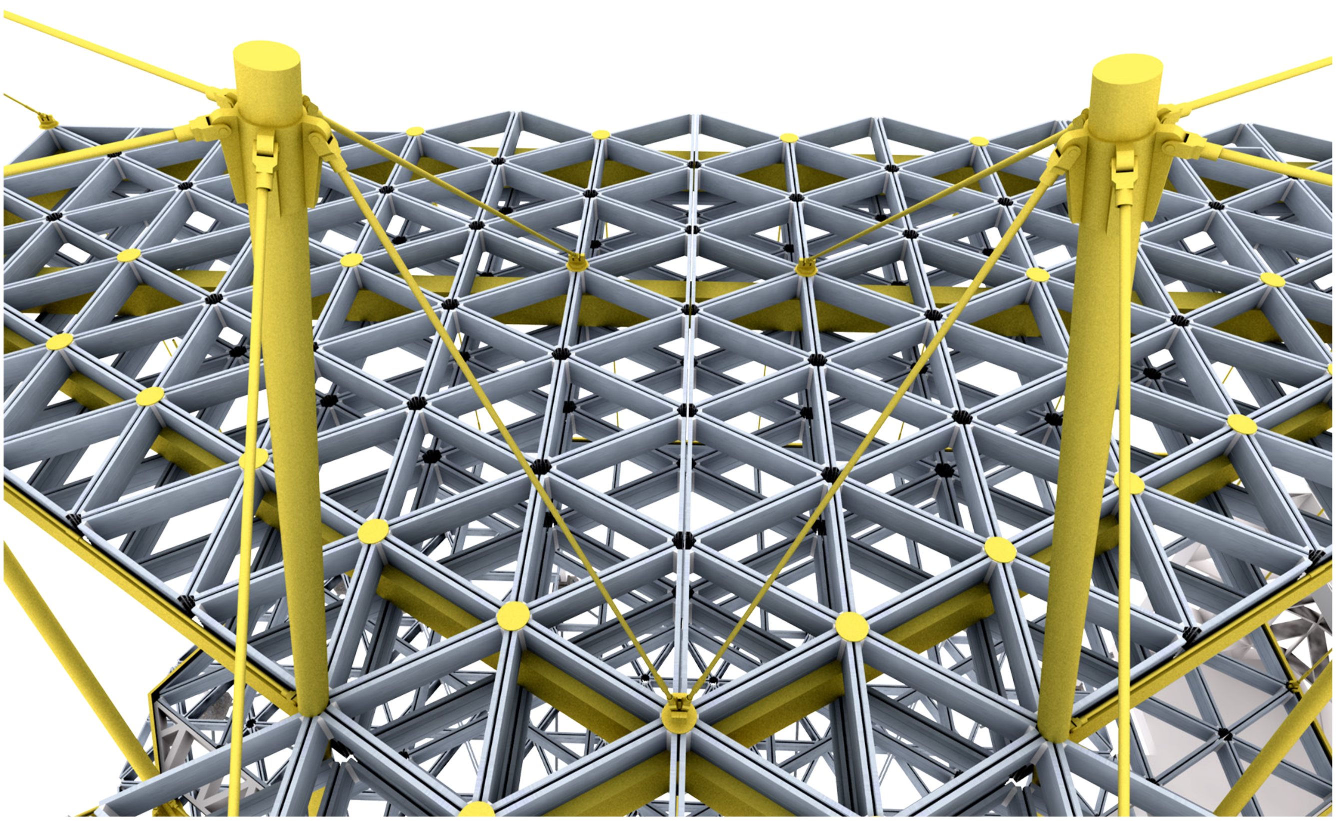


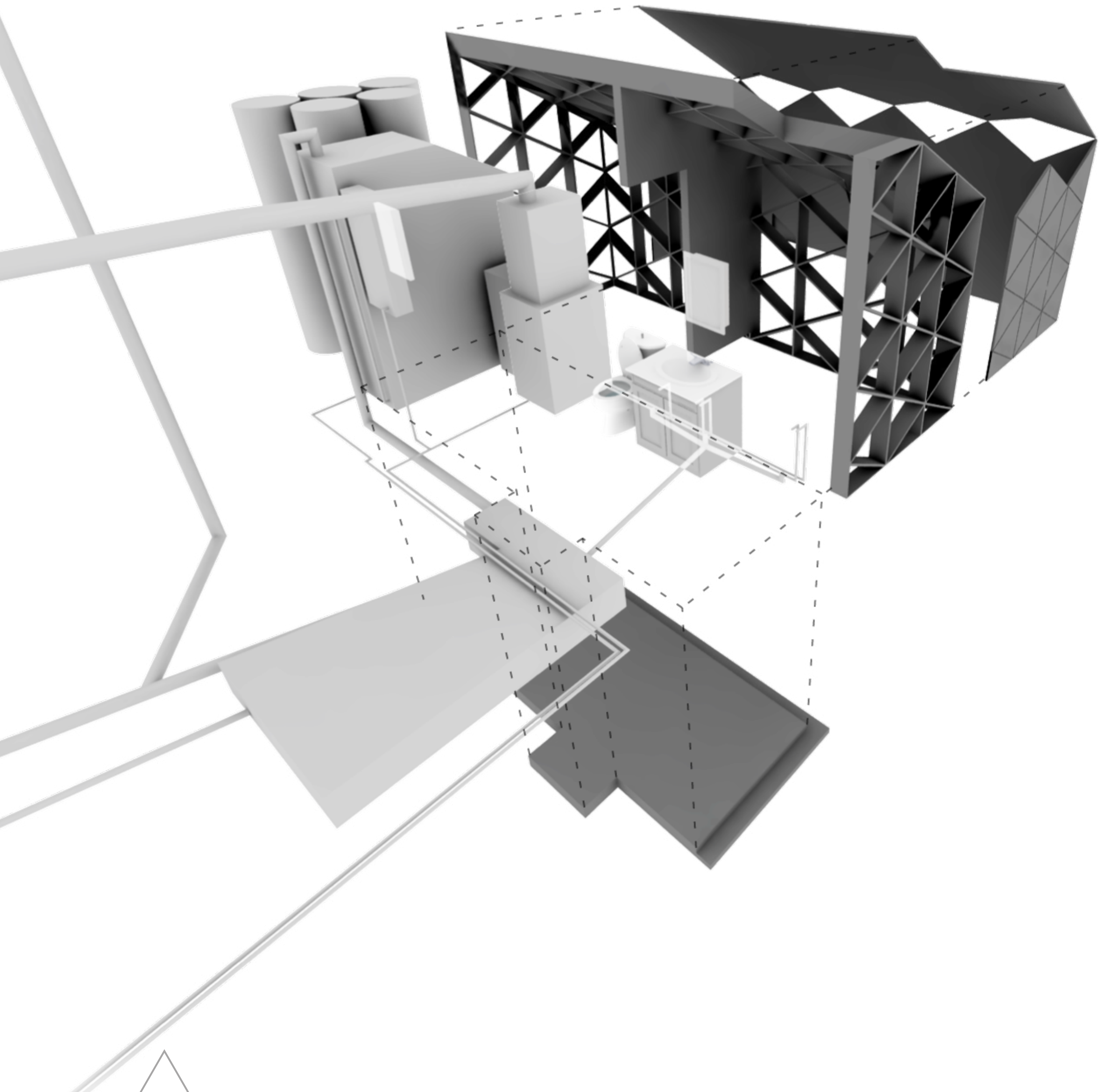
Final Drawings



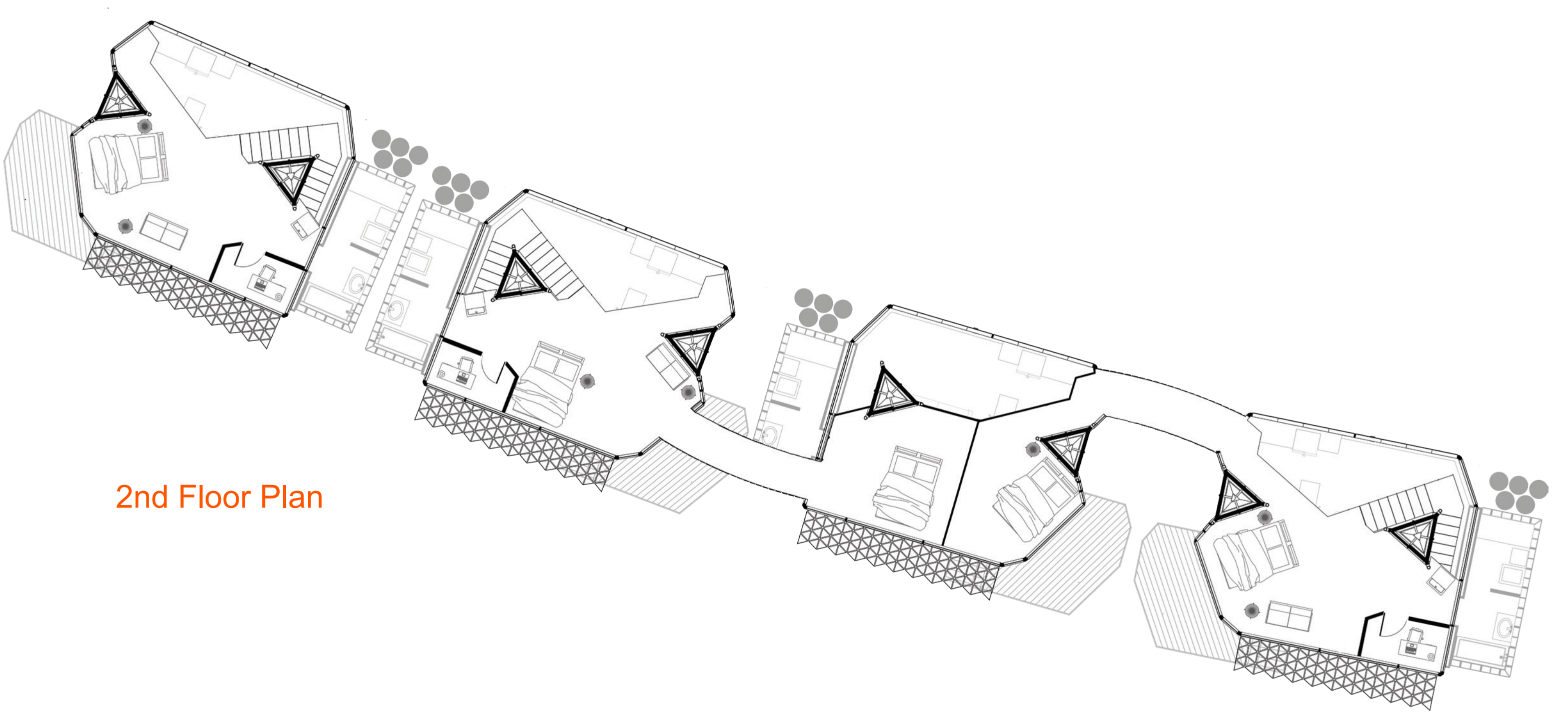
Final Drawings



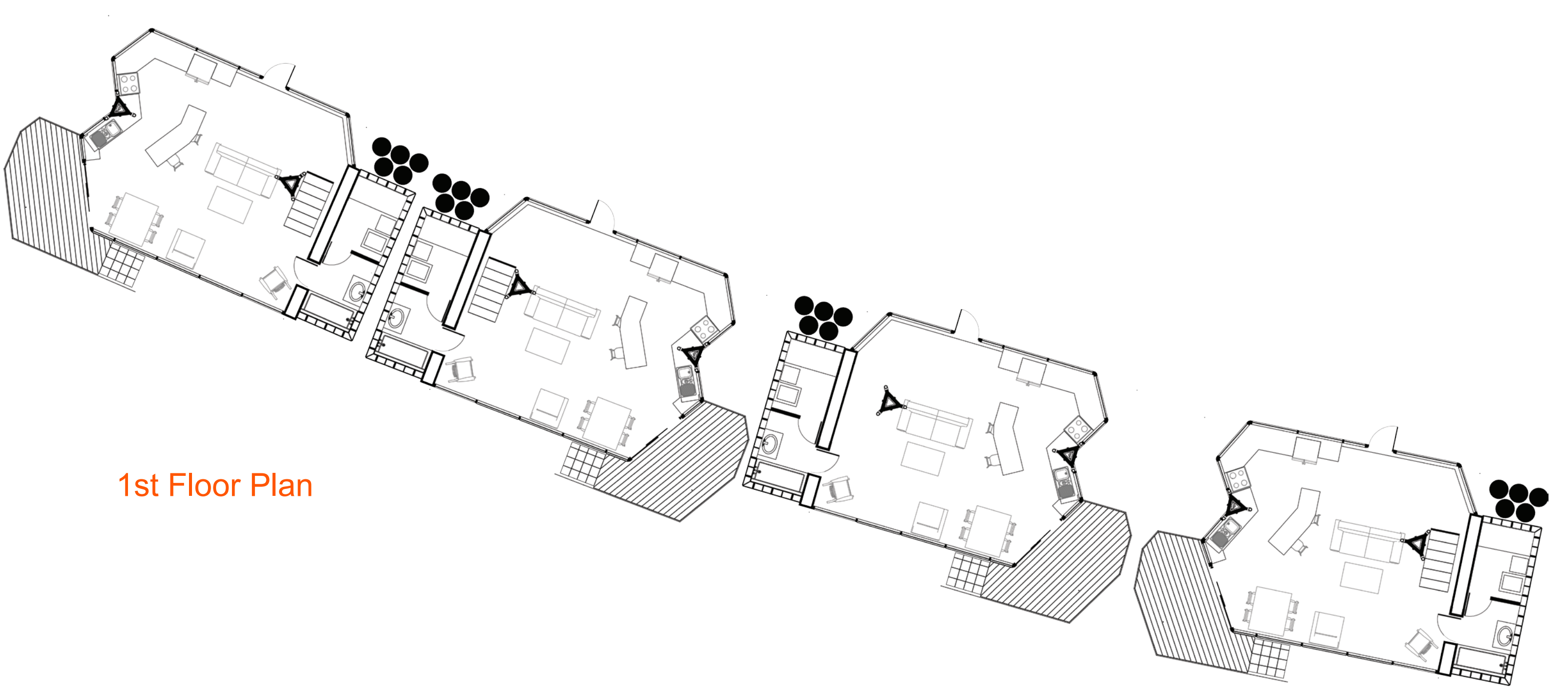




Final Drawings

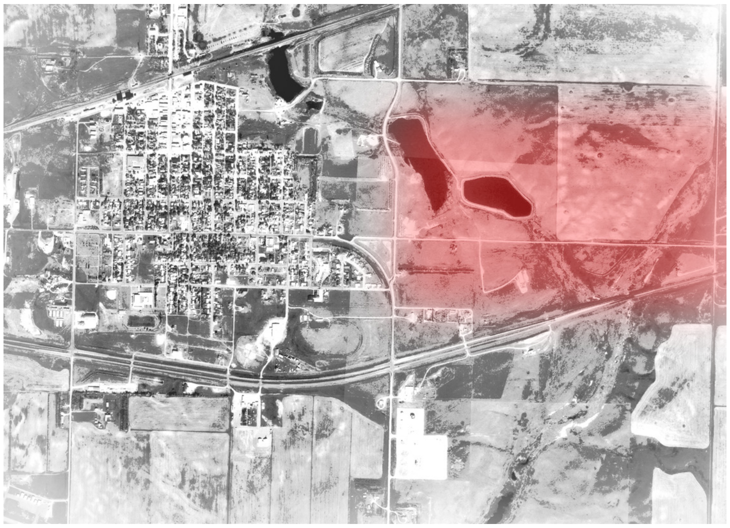


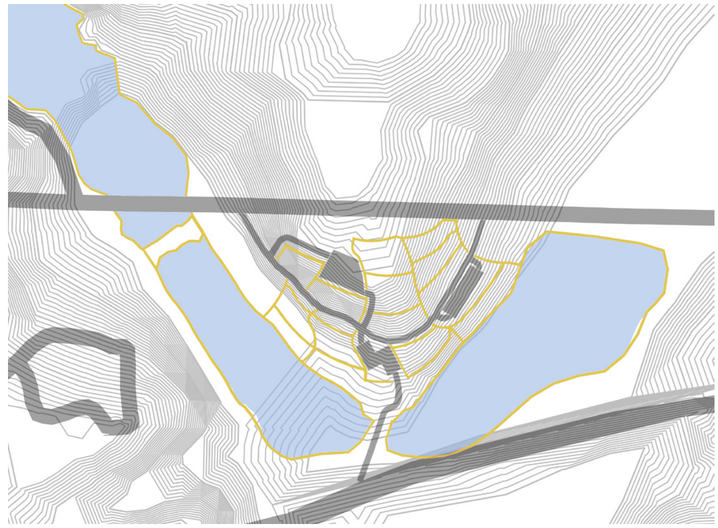
2nd Floor Plan

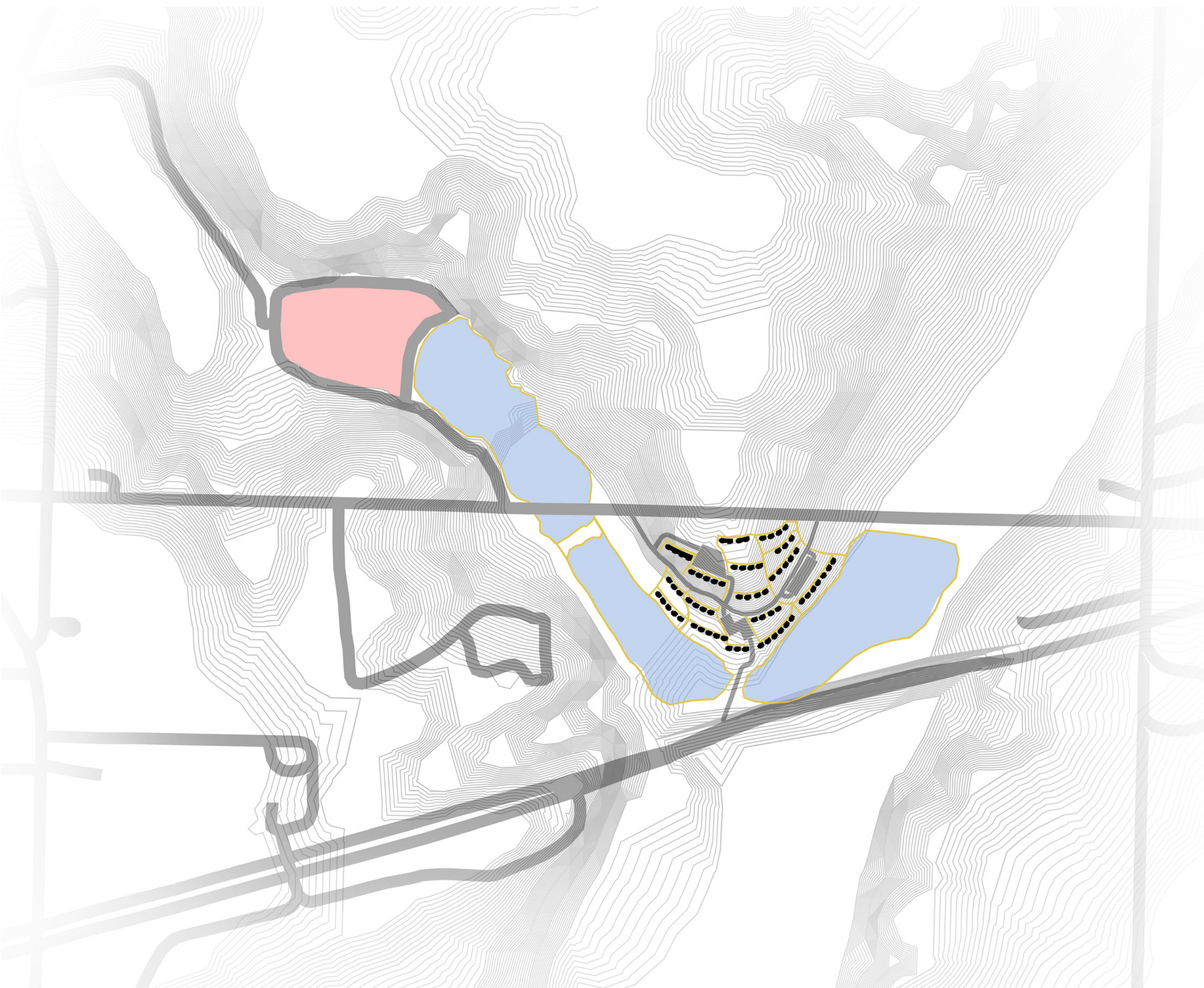


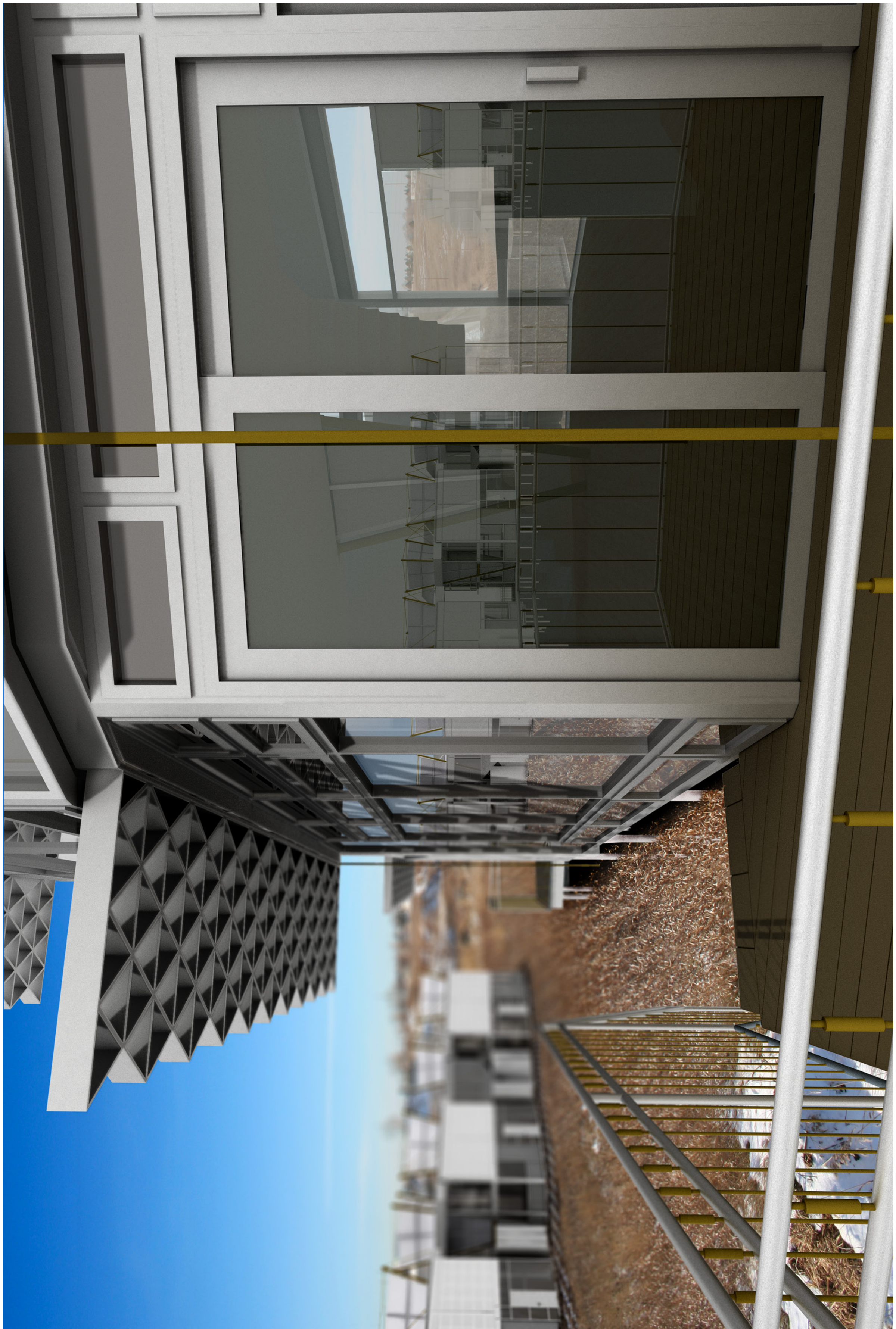
1st Floor Plan

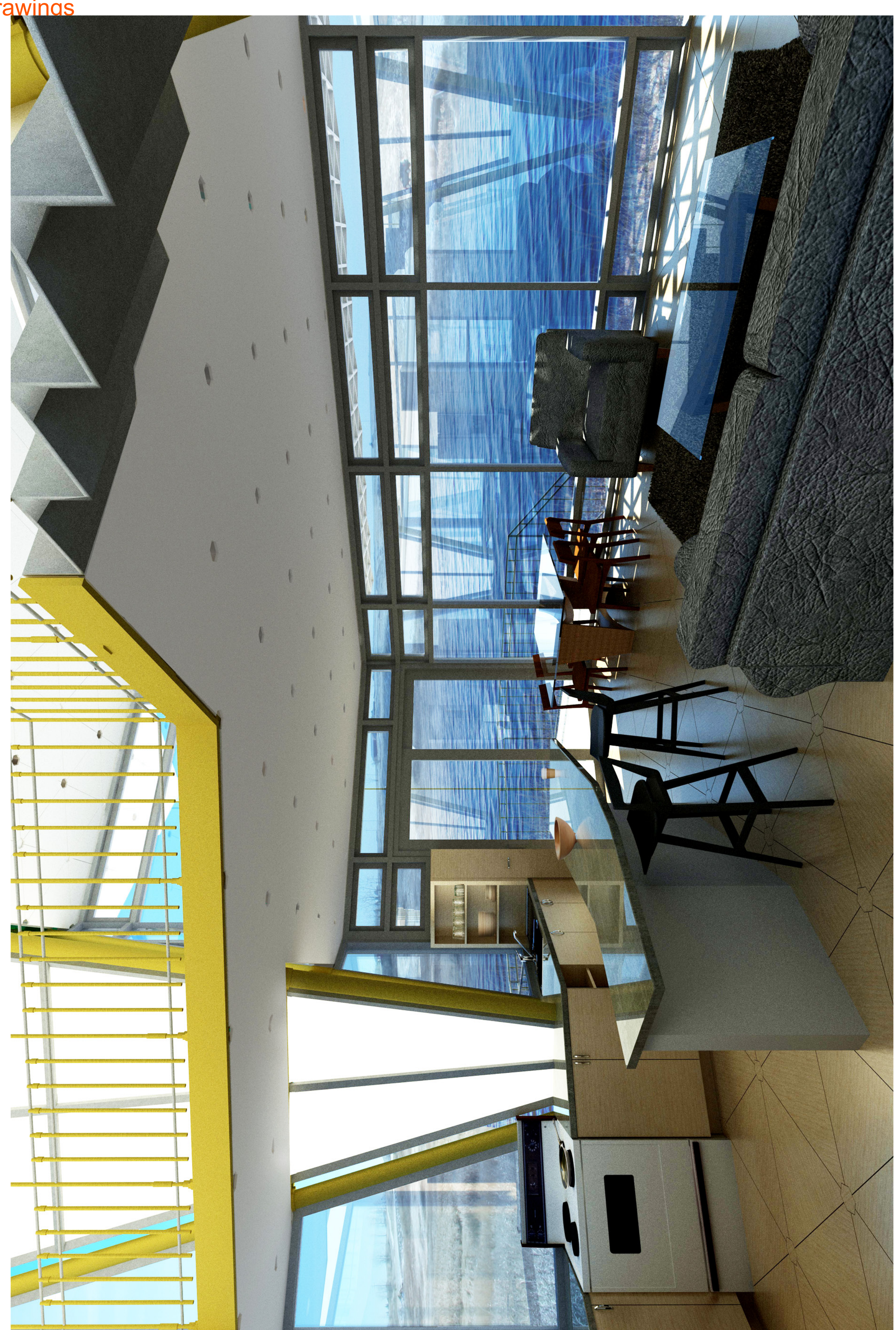
Final Drawings











Display

Display

Display

Display

Text

American Rails (2010). http://www.american-rails.com/empire-builder.html.

Branch, Mark Alden (2005 Oct.) Water Shed. *Architecture: The AIA Journal.*

Bartle, Phil (2010 June). What is Community? A Sociological Perspective. Retrieved from http://www.scn.org/cmp/whatcom.htm.

Chuck, H., Bakken, R., Lee, S., Koumpilova, M., Springer, P., Finneman, T., Call, L., Wallevand, K. (2010, Aug. 15-22). Running With Oil. Retrieved from http://www.runningwithoil.com

Christ, Steve (2008, June 19). Bakken Oil Drilling. Retrieved from http://www.wealthdaily.com/articles/bakken-oil-drilling/1366.

Devold, Havard (2006). Oil and Gas Production Handbook: An Introduction to Oil and Gas Production. ABB ATPA Oil and Gas.

Donovan, Lauren (2010, May 2). Temporary Housing Dots the Landscapes of Oil Towns. Bismarck Tribune. Retrieved from http://www.bismarcktribune.com/news/the-changing-landscape/article_5f4c4c8c-55ae-11df-998f-001cc4c03286.html.

Fallows, James (2010 Dec). Dirty, Clean Future. *The Atlantic.*

Gonchar, Joann (2008, Sept) Some Assembly Required. *Architectural Record.*

Great Northern Historical Society (2010 Nov). http://www.gnrhs.org/

Heisler, Todd (2010, April 26). In Focus: Housing Shortage. New York Times. Retreived from http://blogs.denverpost.com/captured/2010/04/26/in-focus-housing-shortage/1729/

Ivy, Robert (2010, Jan.) Linked Hybrid. *Architectural Record,* p 50-55

MacPherson, James (2010, April 14). Olympics housing to be moved to North Dakota Oil Patch. Bismarck Tribune. Retreived from http://www.bismarcktribune.com/news/state-and-regional/article_73e762e6-47d8-11df-a33b-001cc4c03286.html.

Merriam-Webster (2010). Merriam-Webster Online Dictionary. http://www.merriam-webster.com

Neste Oil (2005). http://www.nesteoil.com.

Ogden, Eloise (2010, Oct.) Inside Energy: ND Oil, Gas Development Still Booming. Minot Daily News.

Oil + Gas. (2006). Description of Oil Lease. Retrieved from http://www.oil-gas-leases.com/oil-lease-description.html.

Text

PRI Paleontological Research Institution (2010). History of Oil. Retrieved from http://www.priweb.org/ed/pgws/history/signal_hill/signal_hill.html

Prussin, Labelle (1995). African Nomadic Architecture: Space, Place, and Gender. Smithsonian Institution Press and The National Museum of African Art. Washington and London.

Rivoli, Jonathan (2007, Feb 2) Oil trucks take toll on county roads. Bismarck Tribune. Retrieved from http://www.bismarcktribune.com/news/local/article_193cffba-e387-5948-a8f1-9407f1372ad1.html.

Rudolph, P., Moholy-Nagy, S. (1970). The Architecture of Paul Rudolph. Praeger Publishers, Inc. New York.

U.S. Highways (2010 June) http://www.us-highways.com/

USDA (2010) Web Soil Survery. Retrieved from http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm

USGS (United States Geological Survey). (2008, April 10). Untitled. Retrieved from http://www.usgs.gov/newsroom/article.asp?ID=1911

Wang, Brian (2008 Feb. 6). Bakken Oil Formation Could Have 500 Billion Barrels of Oil in Place. Retrieved from http://bakkenoil.blogspot.com/2008/02/bakken-oil-formation-could-have-500.html.

Woods, Lebbeus (2007). Steven Holl: The Architecture Spoken. Rizzoli International Publishers, Inc. New York.

Zumbrun, Joshua (2009 June 30). What's North Dakota's Secret? Forbes Magazine Online. Retrieved from http://www.forbes.com/2009/06/30/north-dakota-hoeven-business-energy-economy.html

Images

Cover Image
Retrieved September 12, 2010 from http://www.neilpeterson.com/wp-content/uploads/2008/12/oil-pump.jpg

Figure 1
Hoffer, Eric A. Data retreived on October 5, 2010 from http://online.wsj.com/article/SB10001424052748703795004575087623756596514.html.

Figures 2, 3, 15, 18, 23
Retrieved on October 5, 2010 from Google Earth.

Figures 4, 5, 6
Retrieved on December 2, 2010 from http://digitalhorizonsonline.org/

Figure 7
Retrieved on December 2, 2010 from http://www.priweb.org/ed/pgws/history

Figure 8
Retrieved on December 2, 2010 from http://www.naturalgas.org/naturalgas/extraction_directional.asp

Figure 9
Hoffer, Eric A. Data retreived on December 6, 2010 from http://www.nd.gov/gis/

Figures 10-14, 17, 19, 21-22, 24-32
Hoffer, Eric A. Photographs taken on November 12, 2010.

Figure 16, 20
Hoffer, Eric A. Data obtained from http://www.topodepot.com

Figures 33-37
Hoffer, Eric A. Data obtained from http://www.city-data.com/city/Stanley-North-Dakota.html

Figure 38
Hoffer, Eric A. Data obtained from http://www.ndsu.edu/ndsco/windrose/mino/images/jan.png

Figures 39-40
Hoffer, Eric A. Data obtained from http://solardat.uoregon.edu/SunChartProgram.html

Eric Hoffer
Hometown: Minot, ND

Permanent Address
1760 42nd St. S #103
Fargo ND 58103

ericalanhoffer@yahoo.com
c. (701)833-2016

"You say the hill's too steep to climb,
Climb it.
You say you'd like to see me try?
Climbing."

-"Fearless" Roger Waters & David Gilmour