Final Design Document Fall 2019

Team: Lakota

Projects: Greenhouse and Small Houses

Date: 11/22/19

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Executive Summary

The Purdue EPICS LAKOTA Team is a three-way partnership between Purdue University, Oglala Lakota College (OLC), and the South Dakota School of Mines and Technology (SDSMT). This partnership was established with the goal of combating the issue of food sovereignty on the Pine Ridge Reservation in South Dakota, as well as assisting with cultural learning on the OLC campus.

There are currently two different projects in the LAKOTA team: installing a greenhouse on OLC campus, as well as designing sustainable and affordable small housing. The original goal for the greenhouse project was to have a multipurpose facility on OLC Rapid City campus, that would assist with teaching OLC students and community members about their culture. Oglala Lakota College received a grant for $40,000 from AIHEC (American Indian Higher Education Consortium) to construct a pre-designed greenhouse kit on their Rapid City Campus. The project has since encountered a few complications with this pre-built model, and had to get custom designed parts of it to comply with South Dakota building codes. The Greenhouse team has been working with OLC on the interior design for the greenhouse, while the small house design team has been assisting OLC with designing a foundation for the houses, and adding energy efficient elements to the design.

The Greenhouse team is currently working to finalize all interior components: Beds, Tables, Shelving, and Irrigation. While most have been completed, there are still final adjustments that need to be made with the irrigation layout and design. The greenhouse is currently being manufactured and will be delivered to OLC. The foundation will be poured in advance of this, to ensure the greenhouse gets put up quickly. This greenhouse has a high probability of being featured in February in the First Annual Lakota Food Summit, put on by the Lakota Food Sovereignty Coalition.

The Small House team is in the initial stages of involvement with this project, and is currently working towards a foundation design recommendation for the already completed house blueprints. The overall plan to have the blueprints ready for distribution. Extra input from outside sources has been consulted to assist with the project.

Team Member List

Team Member	Year	Major	Role
Jonathan Damon	Junior	Civil Engineering	Project Manager
Sami Bijonowski	Senior	Civil Engineering	Design Lead
Katie Johnson	Junior	Aerospace Engineering	Design Lead
Jacob Lundgren	Junior	Civil Engineering	Financial Officer
Jonah Adler	Freshman	First-Year Engineering	Team Member-Small House
Elijah Klein	Freshman	First-Year Engineering	Team Member - Greenhouse
Malcolm MacDonell	Freshman	First- Year Engineering	Team Member - Greenhouse
Shiying Chen	Junior	Agricultural Engineering	Team Member - Greenhouse
Elijah Marcum	Freshman	First-Year Engineering	Team Member - Small House
Rasik Mennow	Freshman	First-Year Engineering	Team Member - Small House
Megan Reger	Freshman	First-Year Engineering	Team Member-Greenhouse
Derrick Ford	Senior	Transdisciplinary Studies in Technology	Team Member-Greenhouse

Greenhouse Project

SECTION 1 - PROJECT IDENTIFICATION

PROJECT OBJECTIVE STATEMENT

The Greenhouse Project aims to design and be involved with the installation and construction of a year-round functional greenhouse being put on Oglala Lakota College's Rapid City campus. This facility has the intent of promoting food sovereignty across the Pine Ridge reservation in South Dakota by educating community members and producing fresh food. The second goal of the project is to use this greenhouse as a model to research and create more sustainable greenhouses across the reservation.

DESCRIPTION OF THE COMMUNITY PARTNER

Our community partners are Oglala Lakota College and the residents of the Pine Ridge Native American Reservation. This reservation is home to about 3,500 people facing a poverty rate of 47.4%. Despite this, the Lakota tribe has been able to sustain a very rich and vibrant culture, especially in agriculture. The Lakota people have a variety of prayers for growing, nurturing and harvesting plants. They also have special techniques for farming that have been passed down through generations. By having these strong traditions, the Lakota people have been able to stay connected with their ancestors and their history.

STAKEHOLDERS

Our stakeholders include the Oglala Lakota College (OLC) and the residents of the Pine Ridge Indian Reservation. The Greenhouse team at Purdue are creating a design that will serve to benefit the residents of the reservation by designing a facility and learning environment to use for a cultural and educational benefit. Since the project will be located on the Oglala Lakota College Campus, they are a vital stakeholder, and will be responsible for maintaining and paying for the facility. The project's goal is to impact the community, so the voices of the residents and elders are just as important. We have several student and faculty contacts at OLC and SDSMT that we work side by side with to help us contact the stakeholders and gather information. OLC and SDSMT are working closely with the He Sapa (Black Hills) Lakota elders

and the Cultural Advising committee that has been established in sharing the heart of this vision.

PROJECT SCOPE

The final decision was the Junior Teaching Greenhouse from the Greenhouse Megastore. The size of the greenhouse is 18 x 36 x 10.5 feet. The original Junior Teaching Greenhouse kit did not meet the city wind and snow load requirements, so Greenhouse Megastore re-designed the kit to meet these standards. We are currently designing the interior of the greenhouse, which includes irrigation, lighting, heating, aquaponics, and layout.

We plan to have a business model for selling plants and shrubs produced in greenhouse, to help local people out of food shortage and high food prices. When the project is finished, we tend to provide local people a good place to get fresh food, a place to learn about modern advanced agricultural production in greenhouse, and a good reputation for purdue in Rapid city.

USER NEED LIST

Project	**Greenhouse**	
Number	*User need*	*Stakeholder*
1	Cultural plants (will be picked by them)	The tribes that make up OLC.
2	No cement floor	The tribes that make up OLC.
3	Try to make as energy efficient as possible	The tribes that make up OLC.
4	Try to involve the community as much as possible	The tribes that make up OLC.
5	ADA Accessibility	Anyone that will be inside the Greenhouse

EXPECTED OVERALL PROJECT TIMELINE

Original timeline:
*dates are no longer accurate

We have run into issues with our timeline due to things beyond our control, such as city paperwork and coding, so right now we do not have a concrete date for delivery, but we estimate that it will arrive in 4 weeks. This puts our original timeline back 5 weeks, and once we know the date of delivery we can order our first set of interior items, the tables. We do not want to order the tables until we know because they need to have a place to go, and cannot sit outside where they may be stolen or vandalized.

Here we have a sequence of events that need to/will be done in the next couple of weeks.

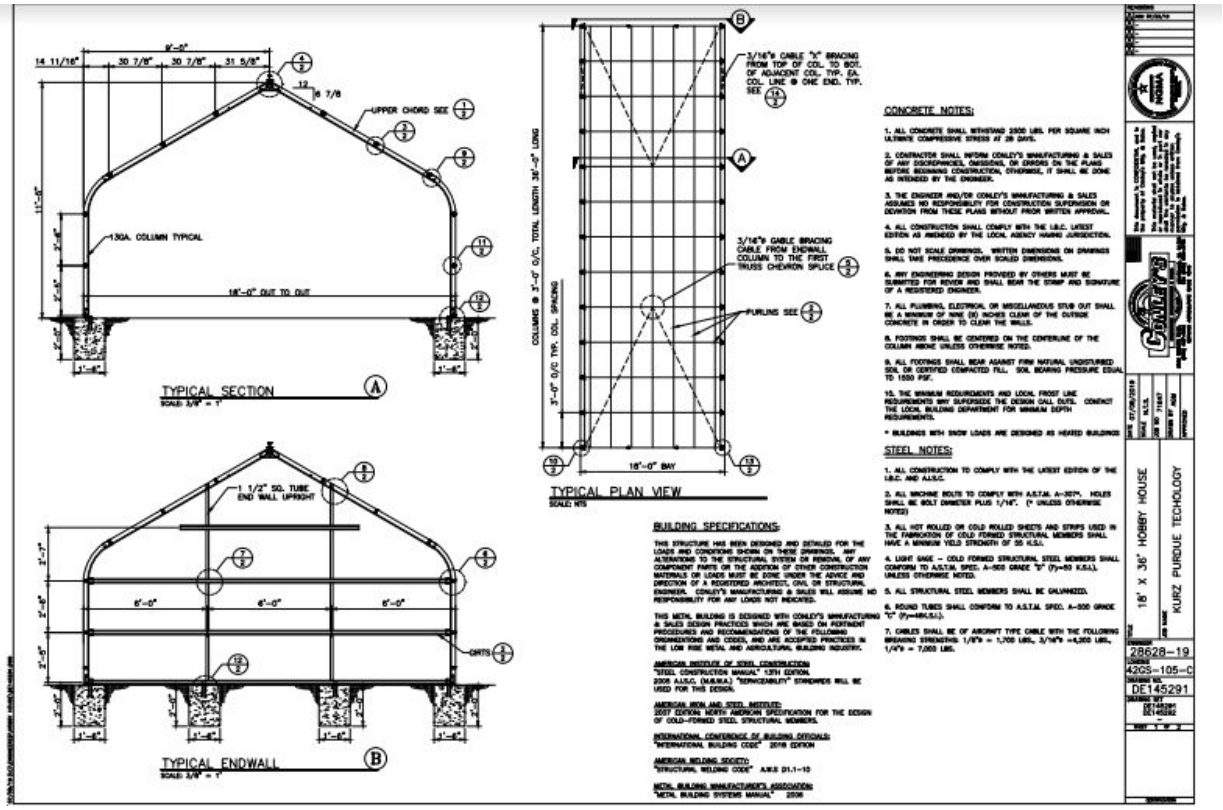
1. Order interior components
2. Greenhouse Foundation Laid
3. Gravel Floor Laid
4. Greenhouse Constructed
5. Interior Set-Up

SECTION 2 - SPECIFICATION DEVELOPMENT

Project	**Greenhouse**		
Number	*User need*	*Specification number*	*Specification*
1	Greenhouse specifications		
		2.1 2.2	18 by 36 ft As energy efficient as possible

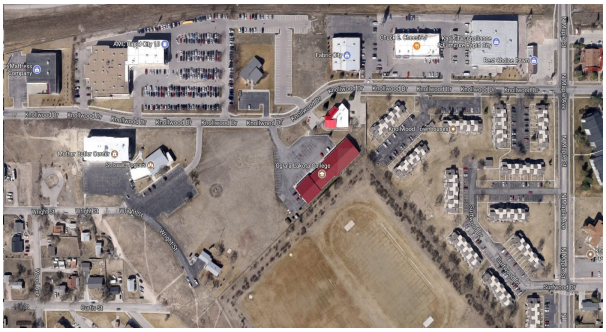
		2.3 2.4 2.5	Do not use electricity for the primary source of heating Have an irrigation system that conserves water Window roof
2	Structure must withstand the weather		
		4.1	Large hail (“baseball”) 70 mph winds 100+ f degree weather <0 f degree weather snow pile up

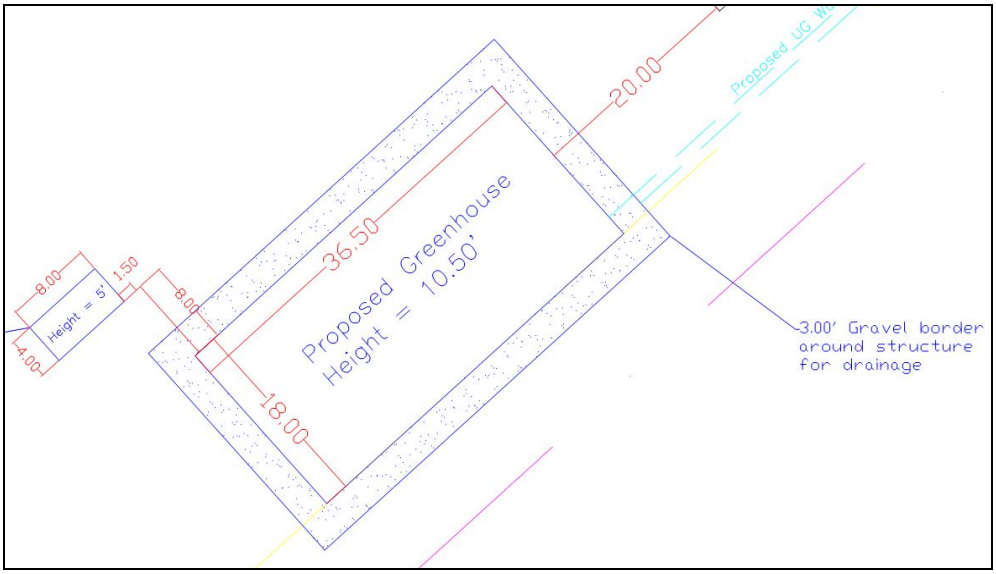
GREENHOUSE SPECIFICATIONS



Location

Oglala Lakota College, Rapid City Campus
1275 Knollwood
Rapid City, South Dakota 57701





DESCRIPTION OF THE USE CONTEXT

The greenhouse will be used to produce fresh produce and to educate community members. The “Junior Teaching Greenhouse” is considered on the small side of production greenhouses at 18 x 36 x 10.5 feet. The greenhouse will be used year-around however, and different plants will be grown according to their appropriate seasons. Employees at OLC will maintain and run the greenhouse. ADA accessibility was an expressed concern because it is likely that community members with disabilities will use the greenhouse, so we designed the interior of the greenhouse to meet those standards. A serious concern was that the snow load could be too great for the structure of the greenhouse. However, the Greenhouse Megastore custom-designed our greenhouse to handle the South Dakota snow loads.

Food sovereignty is the right people have to healthy and culturally relevant food produced through ecologically sound and sustainable methods. As the project aims to promote food sovereignty, the plants that will be grown in the greenhouse will coincide with the project partner's wishes. Culturally important plants like sage, sweet grass, and buffaloberry will be stressed.

BENCHMARKING

The greenhouses at the Purdue Horticulture Facility were utilized to get a better understanding about what a professional greenhouse is made out of and what it takes to build one. We were able to meet with the facility's manager several times to discuss the different aspects of the greenhouse including what material they used for the exterior (polycarbonate/glass) and how much that type of facility would cost (300 per square foot, if on the cheap side). We also talked extensively with him about irrigation systems and the pros and cons of different set ups. With these pieces of information we were able to get a better understanding of how to go about designing and making decisions for our greenhouse.


We also used Camp Riley, a previous EPICS project, as a model for our design for ADA accessible gravel flooring. Camp Riley made a wheelchair accessible path using 53 gravel with a layer of ¼ minus on top. They then used a plate compactor to compact it, making it as smooth as concrete.

SECTION 3 - CONCEPTUAL DESIGN

FIELDS OF RESEARCH

Plant information-

Berry shrubs, basic food and traditional plants are three main types we are going to plant in the greenhouse. Berry shrubs will be our main focus on the greenhouse, based on the requirement from OLC, we plan to have around 50% of berry shrubs, and the rest will consist of basic food and traditional plants that popular among local people. OLC tend to sell those plants to local people and build up a business model, the money earned will be used for the maintenance of greenhouse.

We combined suggested plant list given by OLC and our recommendation list together, summarize their growing condition into a whole Excel sheet, such as water requirements, light requirements, suitable growing soil PH, suitable growing temperature, etc. Later we select some plants from the list that we are more easily to grow, quicker to mature, have similar growing period from the list, and get rid of plants that need extreme growing environment, for example, we delete blueberry from our list because it need very acidic soil.

Link for plant information summary:
https://docs.google.com/spreadsheets/d/1zQD86P53PL5sj9d0DvuPwOVJaBKjdhnnzx0U85vAIoM/edit#gid=0

We separate them into different levels of water requirements and make sure we conclude with 2-3 types of plants for different levels of water requirement.

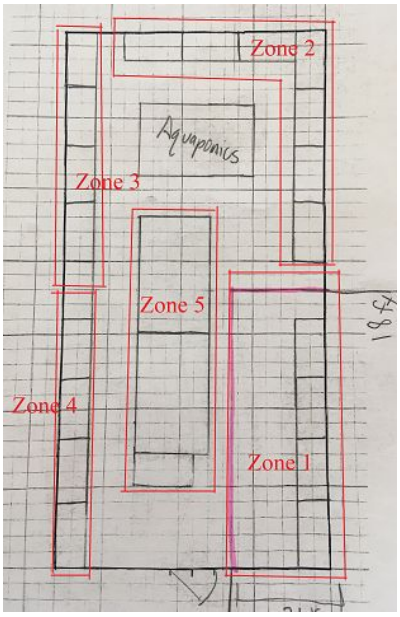
Plant information for each zone:

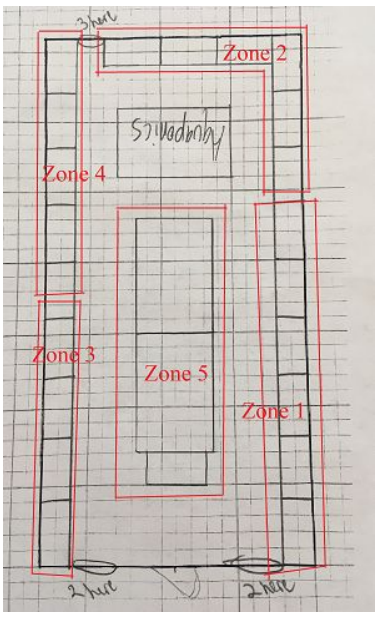
Plant	Water Requirement	Temperature Range	Grow Period	**Zone**
Lavender	1/2 - 1" per week	68-86°F Need stratification	Plant in March, harvest in June - Sept	**1 (Cold) for stratification, later in zone 3 (Less wet area)**
Sweet Grass	1-1.5” per week	60 - 75°F Need stratification	Plant in Feb, harvest in late June - early July	**1 (Cold) for stratification, later in zone 4 (Normal wetness area)**
buffaloberry	1/4” per week	-63 - 83°F Need stratification	Plant in March, harvest in June - Sept	**1 (Cold) for stratification, later in zone 2 (Drought area)**
currant	1/3” per week	-40 - 90°F Need stratification	Plant in March, harvest in second May - June	**1 (Cold) for stratification, later in zone 2 (Drought area)**
sage	1/2 - 1" per week	65-75°F Need stratification	Plant in April, harvest in anytime second year	**1 (Cold) for stratification, later in zone 3 (Less wet area)**
tomato	1/2 - 1" per week	65-85°F	Plant in April, harvest in July - Sept	**3 (Less wet area)**
cabbage/kale	1-1.5” per week	60-65°F	Plant in April, harvest June or August - Oct	**4 (Normal wetness area)**
Wild Licorice	1" per week	68-77°F	Plant in March, harvest July - October	**4 (Normal wetness area)**
strawberry	1-2" per week	60-80°F	Plant in March, harvest in second May	**5 (Most wet area)**
raspberry	1-2" per week	70-75°F	Plant in March, harvest in second June - August	**5 (Most wet area)**
Mint	1-2" per week	55-75°F	Plant anytime before August, harvest anytime after 3 months	**5 (Most wet area)**

Zoning-

Based on different water requirement of plants, we decided to separate the whole greenhouse into 5 zones for plants with different levels of water requirement and also one area for aquaponics. We set zone 1 for cold stratification for some plants that need this period before seed germination, zone 2 for plants that need less water, zone 3 for plants whose water requirement is a little less than normal water requirement, zone 4 set for normal wetness area, and zone 5 for mostly wet area.

Two possible zoning map we came up with inside greenhouse are shown below. These two zoning maps are similar, just a slight difference in the area of zone 1. Zone 1 in map 1 is bigger than map 2, but they are both set near the door so we can save some energy to heat this area, because we don’t need that much heat for this cold zone.





Cold stratification-

Cold stratification is the process that a seed has to go through in order to germinate. This replicates what seeds go through in nature. In order to prevent a seed from sprouting in the middle of the winter, some plants adapted so that their seeds would not sprout unless they got a period of cold. We now must replicate this in the greenhouse in order to get the seeds to sprout. There are five plants which we intend on growing which require undergoing this process. They are sage, currant, lavender, buffaloberry, and sweetgrass. To replicate this process for those plants we need keep the seeds at 34ºF-41ºF for about 2 months. We are either going to divide the greenhouse with an insulated curtain to separate the warm and cold areas, or buy a minifridge to put the seeds in. If we went with the minifridge option, we would put the seeds in bags filled with some soil into the fridge.

Lighting-

Five (5) 550 watt LED grow lights will be providing 2,750 watts across the 360 sq ft floor plan. These lights are programmable with timers and dimmers, as well as being linkable, so that their power pull is less, along the same line. Another note with the supplemental lighting plan, the corner lights will receive a 12 degree inboard cant and and a 5 degree medial cant. This spectrum overlap will put up within the 30 lumens/sq ft threshold and maximize lighting plan.

Heating-

The greenhouse kit that was ordered from the Greenhouse Megastore originally came with a heater that provided insufficient output for operation during the winter, after doing several calculations and having discussions with the employees at Greenhouse Megastore, the team was able to get a free upgrade of the heater to one that will be sufficient for year round growth. Calculations on cost to run the heater need to be redone to match the new one being installed.

Interior Automation-
Throughout the project, automation has been a key piece in the end goal and we have insured that this is a possibility for all aspects of the greenhouse. We have done this by making sure that the equipped heater has a thermostat to maintain an internal temperature, researched several possibilities for irrigation automation and decided on a valve that is bluetooth/app accessible to ensure ease of use, and equipping a dimmer/timer for the lighting plan.

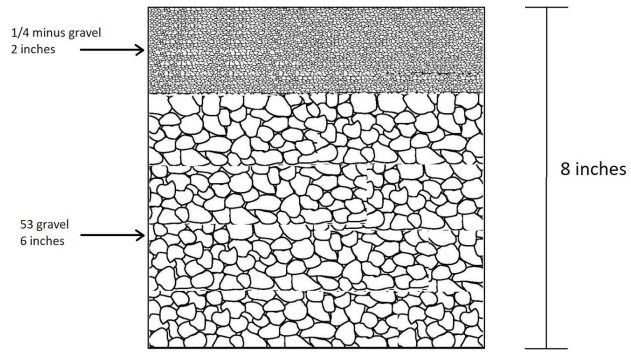
Aquaponics-
The greenhouse has been planned to have an aquaponics system functioning inside it. The team is working on establishing a collaborative joint effort with Western Dakota Tech to utilize their expertise with creating aquaponics systems. This would also provide our team with another link to the community and more people that will be on site in Rapid City if help is needed in the greenhouse. The goal of the aquaponics system is to test growing options and show other people how aquaponics can be set up and operated, therefore it is planned to take as little space away from the growing potential of the greenhouse as possible.

Supplementary Power-
During one of our conference calls, our project partner Jim mentioned that Oglala Lakota College experiences power outages sometimes, which could be a hazard for the greenhouse depending on the weather and how long the power is out for. We've decided that the only thing in the greenhouse that needs to be powered at that time is the heater, to ensure that the plants don't (potentially) freeze. The heater requires very little power, so it would need only a small generator. The issue we are running into is that a small generator cannot (or should not be) hooked into the system to automatically kick on when the power goes out. This means that someone would need to be on site to know that the power went out and to turn on the generator for the greenhouse. This could be a problem when the weather is very bad and no one can make it to the college, or if the power goes out when no one is around so we don't know the power is out. We are still looking into a way to make backup power possible.

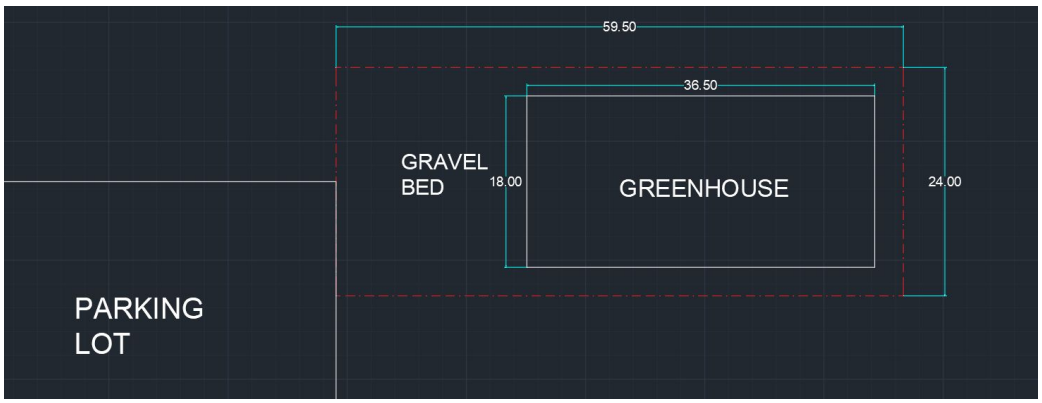
Gravel Plan-

With the help of our faculty advisor in Construction Engineering and Management, we decided the floor would need to be 6 inches of 53 gravel with 2 inches ¼ minus on top, which would then be compacted using a plate compactor. Below you will see a cross section illustrating that. Also below are 2 options for the arrangement of the gravel. The first option is a simple 59.5ft x 24ft gravel rectangle, and the second option would be to have a 42.5ft x 24 ft gravel rectangle with a 17ft x 6ft gravel path leading from the door of the greenhouse to the parking lot. Both of these options ensure that a wheelchair would not have to wheel on grass to get to the greenhouse. This is something that would have to be implemented before the greenhouse is installed, and it would only require at max a week (generously) to finish.

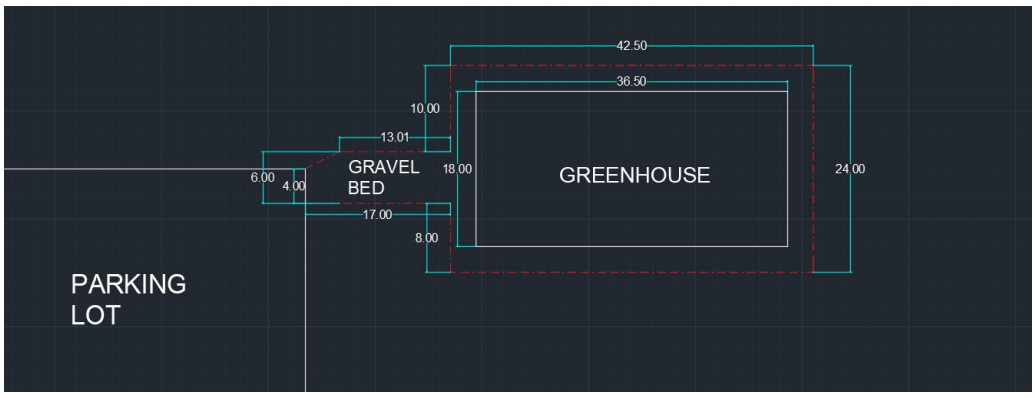
Vertical cross section of gravel layout design



Option 1:

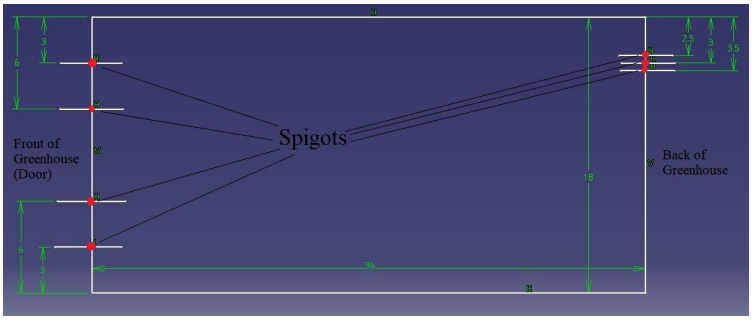


Option 2:



Irrigation plan- Our irrigation plan is similar to the irrigation that the Purdue Horticulture Greenhouses use. Each zone will have their own spigot and timer, so that they can have different amounts of water. There will be one or two (depending on the size of the table) main poly tubes running the length of the zone with smaller poly tubes attached to drippers running off into the pots. Below is a picture from the Purdue Horticulture Greenhouse that we used as a

model for our system. We also contacted Loyal Plumbing and told them where in the greenhouse we want the spigots.



CONCEPT GENERATION

In order to truly understand and picture the amount of space someone in a wheelchair would need and how much mobility and reach they would have, we used tables to mock up some of our walkway sizes and used a wheelchair (see pictures below). We determined that although ADA standards require a 3 foot walkway, it was very difficult to turn around and work in the beds, so we decided that beds needed 4 feet aisle (because there isn't much space underneath for the wheelchair, unlike with the tables). We also determined that it would be harder for someone sitting down to reach far back on a bed or table, so one sided access had to be less than 3 feet deep.

PROTOTYPING

Irrigation prototyping, April 2019

Curtain prototyping, November 2019

SECTION 4 - DETAILED DESIGN

BILL OF MATERIAL (B.O.M)

Does not include aquaponics, an approximate price for a possible system used by Western Dakota Tech is $3,300

	Greenhouse Megastore			
item	price	quantity	total price	link
Table, 4ftx2ft	172.89	19	3284.91	https://www.gree
Table, 5ftx8ft	337.79	2	675.58	https://www.gree
IIRI Irrigation Controller	229	5	1145	https://www.gre
pruner	9.99	5	49.95	https://www.gree
Soil(3.8 compacted	19.5	3	58.5	https://www.gree
Traditional Inserts(606)	4.99	20	99.8	https://www.gree
		total:	5313.74	

item	store	price	quantity	total price	link
3/4 inch poly tubing	drip depot online	23.5	3	70.5	https://www.dripc
poly to hose female adapter	drip depot online	1.98	5	9.9	https://www.dripc
pressure		7.95	5	39.75	https://www.dripc
backflow preventer	drip depot online	2.47	5	12.35	https://www.dripc
200 mesh filter	dripworks online	12.95	5	64.75	https://www.dripv
end caps for 3/4 tubing	drip depot online	1.46	5	7.3	https://www.dripc
1/4 inch poly tubing	home depot	4.16	4	16.64	https://www.hom
goof plugs	drip pdepot online	0.09	100	9	https://www.drip depot.com/item/goof-plug-size-quarter-inch
barb coupler	drip depot online	0.09	200	18	https://www.dripc
zip ties	walmart	4.85	1	4.85	https://www.waln
hole puncher	drip depot online	1.67	2	3.34	https://www.dripc
Gardening Gloves	Walmart in Rapid city	5 for 3 pair	15	25	https://www.waln
Hose	Walmart in Rapid city	19.46	1	19.46	https://www.waln
Trowel	wolfgarten website	$5.99	5	29.95	https://wolfgarter
Soil rake with handle	wolfgarten website	9.99	5	49.95	https://wolfgarter
Storage totes	walmart	14.88	5	74.4	https://www.waln
outlet timers	amazon	8	6	48	https://www.ama
			total:	503.14	

SECTION 5 - TRANSITION REPORT

POINT OF CONTACT FOR FUTURE TEAM MEMBERS

Name: Katie Johnson (Design Lead)

Email: john2116@purdue.edu

Phone: 765 - 588 - 8382

Name: Jonathan Damon (Project Manager)

Email: jdamon@purdue.edu

Phone: 917-693-4251

POINT OF CONTACT AT THE COMMUNITY PARTNER ORGANIZATION

Name: Jim Sanovia

Email: jsanovia@olc.edu

Phone: 605-519-3850

CURRENT PROJECT STATUS

Project is currently in the final stages of detailed design and the team is planning on delivering a constructed greenhouse by the end of next semester and aims to then develop a user manual and a more sustainable guide for recreating this project on different locations across the reservation.

Major Roadblocks: Communication with our project partner, Greenhouse Megastore, and contractors in Rapid City.

Future Events: Lakota Food Sovereignty Coalition Summit on Feb 18th in Rapid City - possible involvement with the greenhouse

Here we have a sequence of events that need to/will be done in the next couple of weeks.

1. Order interior components
2. Greenhouse Foundation Laid
3. Gravel Floor Laid
4. Greenhouse Constructed
5. Interior Set-Up

Small House Project

SECTION 1 - PROJECT IDENTIFICATION

The purpose of these small houses is to give the tribe members sustainable, affordable housing designed for South Dakota weather. These houses are designed to be built quickly and in such a way that adding on attachments is simple. Much of the housing on the reservation is overcrowded and in disrepair. Along with our project partners, we are attempting to improve the housing situation by providing access to high quality 640sqft houses. These structures can also be used as temporary disaster relief shelters. Much of the reservation can be crippled by extreme weather events, such as flooding from snow thaw that can burst pipes and block off roads. With these houses they could have a safe place to stay while repairs are being completed.

STAKEHOLDERS

This project is intended to affect the community as a whole by increasing the quality and availability of housing, and our project partners in particular have vital interest in this project as residents in the Pine Ridge Reservation or nearby area themselves. Currently there are 2 houses built with plans for four more this year. After a design is decided upon for this project, the houses can be put in place and made move-in-ready very quickly.

PROJECT SCOPE

OVERALL TIMELINE:

The timeline for this project is fast paced. We would like to see these houses benefiting the community as soon as possible, there is already a high demand for them. Because of this, we have put together the following timeline. We are constantly adding to it as new concerns and tasks pop up, but as it stands the general timeline is shown below.

2019-2020 Small House Schedule	
Oct	Research Foundations
Nov	Make a Foundation Reccomendation
Dec	
Jan	Final Design
Feb	Begin Construction (Depends on Foundation
Mar	
Apr	
May	Finish construction
Jun	Family moves in

The results of this project are going to initially be a suggestion of a foundation to use for the small houses. Eventually the partners would also like a manual relating to how to construct the houses. At this time the scope is specifically the foundation, we have assumed the houses themselves are structurally sound. Our scope does not include other features that may be necessary, such as stairs to get into the house.

SECTION 2 - SPECIFICATION DEVELOPMENT

DESCRIPTION OF THE USE CONTEXT

The intention for this project is to deliver a foundation recommendation to our project partners. Next semester, we will look more into finding a PE in South Dakota that would be willing to work with us to create a final design that would work for all the houses currently being produced. One factor that dramatically affects this project are the environmental conditions in South Dakota. The main concerns that could affect our recommendation for a foundation are snow, and wind loads. We are currently waiting on the results of soil testing in the area in question which will give us information such as the shear strength and bearing capacity of the soil, which will also greatly affect the decision. Also this project must keep in mind that the foundation should be designed to be as affordable as possible. The foundation will be built far from major cities, and that could be costly if the foundation type our team recommends requires large equipment to construct. Other factors to be aware of are the harsh winters in South Dakota, which could affect construction time and cost, and how long the foundation will take to construct as we are trying to get these up and running as quickly as possible.

BENCHMARKING

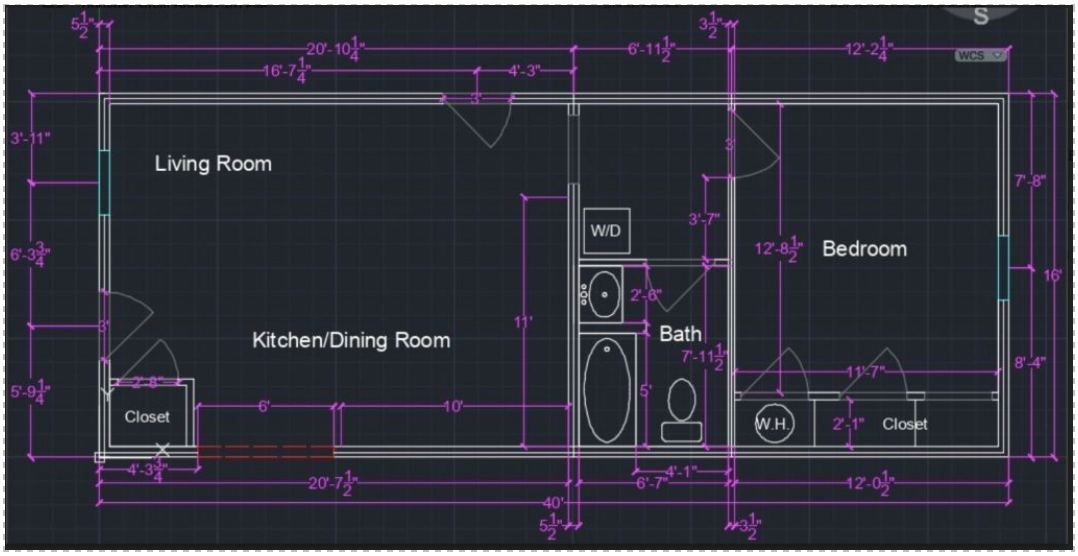
Over the course of our research, we have come across a number of projects that resemble what we are trying to do. At its core, designing a foundation is something that remains pretty consistent between varying projects, and therefore looking at what similar projects have done is extremely useful. For this project, we looked at a project done by Habitat for Humanity, and a Rural Studio project done at Auburn University. There are some current housing projects at other reservations across the united states, particularly with the Navajo Tribe in Arizona, but details about it are not available to the public. The Habitat for Humanity houses were designed to be put on a raised foundation, like the pier and beam type that we were originally asked to design. We are also looking into helical piers. The designs we've found for this are mostly for larger structures, but keeping this in mind we have been looking into a scaled down version. The final foundation type we are considering is a continuous footer design, which is a very common foundation type. To benchmark this type, we have looked at design guides from various agencies like FEMA to get and idea of how it should look.

SECTION 3 - CONCEPTUAL DESIGN

CONCEPT GENERATION

We generated conceptual designs for multiple different types of foundations based upon recommendations from Jim, the project partner. We're in the process of analyzing the pros and cons of each foundation and conceptual design so we can eventually make a recommendation about which one is best for the project. The conceptual designs were constructed so we could visualize each design and see possible pros and cons.

CAD:



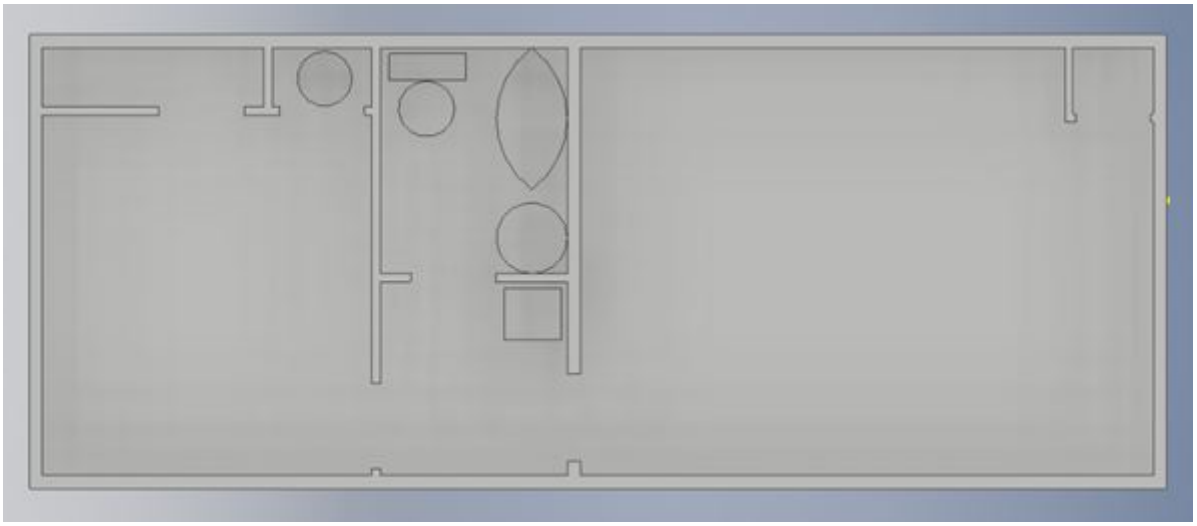


Figure 2: CAD 2D Layout of the interior of the house.

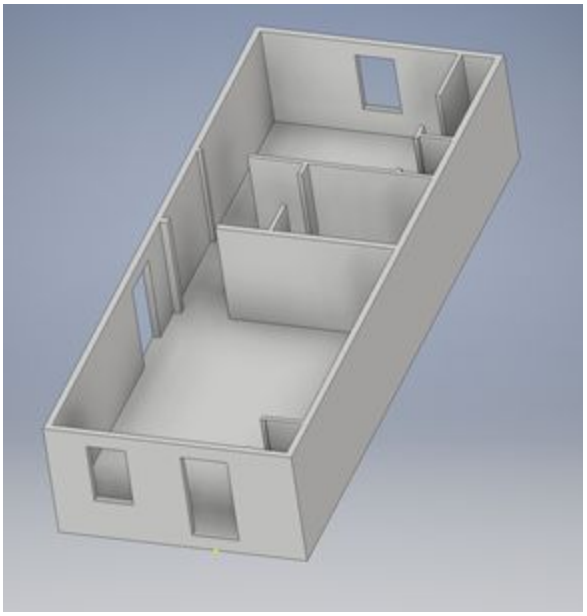
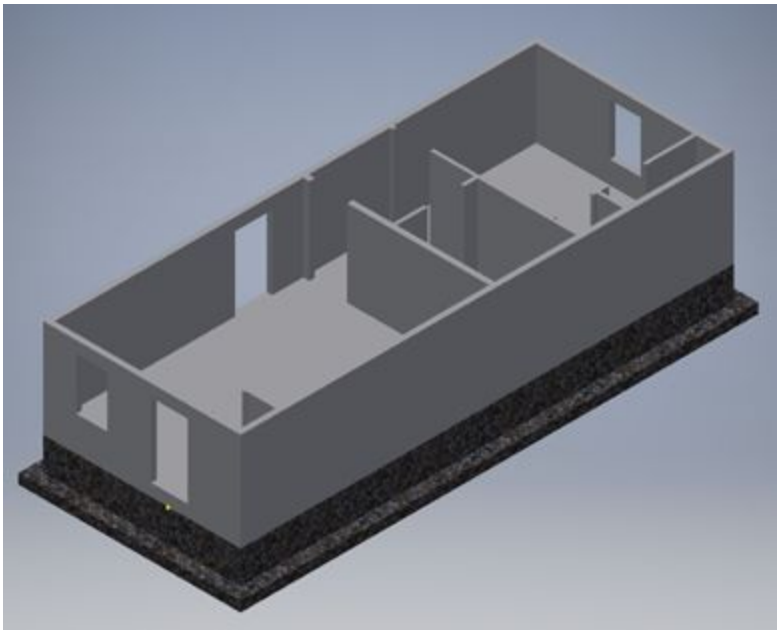
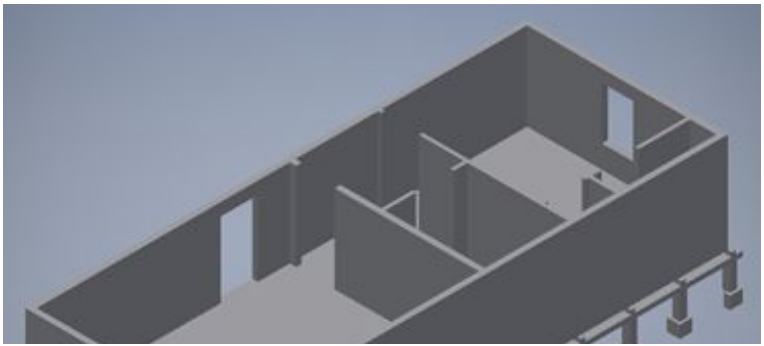


Figure 3: 3D file for house, showing basic interior.





Concepts Generated:

We are working on concepts for each of the following foundations:

- Continuous Footer
- Slab
- Helical
- Pier and Beam

CAD files seen above are for Continuous footing and Pier and Beam foundations. We have not yet generated conceptual designs for slab or helical foundations. Helical will end up looking similar to this:

Slab will look similar to this:

SECTION 4 - TRANSITION REPORT

POINT OF CONTACT FOR FUTURE TEAM MEMBERS (E.G DESIGN LEAD)

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CURRENT PROJECT STATUS

We are currently in the Conceptual Design Phase with this project. While the houses themselves are currently in production, a final design for the foundation has not yet begun. We have looked at four different types of foundations, starting with pier and beam which was the requested type, and slab, continuous footer, and helical piers as a means of comparison to figure out what would work best for this project.

A major roadblock we have run into over the course of this semester is that our team lacks the knowledge and technical experience needed to actually put together a design for the foundation. After consulting with our advisors and outside experts, we have reevaluated the scope of our project, and are instead looking to make a recommendation on what type of foundation best fits this project.

We have also looked into ways to make the house more sustainable. This goal has been put on hold as the more pressing need for a foundation was given precedence, but it is something we will return to in following semesters. This goal has previously been called Net-Zero. The purpose

of this is not to make the house state of the art and completely energy efficient, but to implement sustainable measures that reduce the cost of living, and are a better cultural fit for the community.

To continue this project, the focus and scope has shifted since mid semester review and going into next semester. We learned over recent weeks that our previous goal is unrealistic for our team given our lack of knowledge and experience in the structural field, and the ethical concerns with designing a foundation without that background. These last few weeks we analyzed all of our research about the foundations and consulted experts in the field to make a recommendation about which foundation is best suitable for this project.

Next semester, we plan to further develop the plans for the foundation, create a highly detailed CAD file for the Small Houses to be used by residents, and to refocus on making the plans more sustainable and the changes we can make to the future designs.