Farm-at-Table

Reshaping how restaurants impact the food system
through permiculture design practices

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Table of Contents

Abstract

The farm-to-table restaurant concept is one of the fastest growing trends in one of our nation's largest sector, the food industry. This movement is in response to people becoming more cautious of the quality of food they put into their bodies. Select restaurateurs have devoted their craft to providing their guests with the healthiest and freshest quality products they can. This type of restaurant is rising in popularity in communities from coast to coast. However, the farm-to-table restaurants only make up a small percentage of the total number of restaurants in the United States. The farm-to-Table restaurants have a direct relationship with local farmers in their region, to help provide them with fresh seasonal produce for their menus. The problem with the farm-to-table restaurant concept is that it is a niche market. Roughly a third of the restaurants in Colorado and the U.S. are corporate chain restaurants. Due to the high demand these corporate stores put on the agricultural industry, food distributors are forced to acquire food from different parts of the country and/or continent.

This thesis focuses on developing a system that can be added to the existing building of one of these corporate restaurants that will help to provide more people with the ability to eat and enjoy fresh produce. Furthermore, alleviating the issues that the limited local farmers can not, by meeting the produce needs of the corporate restaurant by reducing the distance the food travels from hundreds if not thousands of miles away, to just a few feet. The evidence from the precedent work and design studies, will show that it is possible to redesign the unused and/or underdeveloped areas within a restaurant to grow the produce needed for the restaurants menu on the premise of the restaurant. The farm-at-table concept gives their guests the ability to see the food they are eating being grown in front of them, while giving them an experience they will not find anywhere else.

Establishing the Farm-to-Table Parameters

What does it mean to acquire "local" produce? Although there is no real definition of the term"local", the meaning varies depending on who's being asked. In an urban context "locally sourced" could mean the food is produced within the fabric of the city and/or within the city limits. In a more rural setting, the term could mean the food is sourced from local farms within the county and/or region. No matter what geographical context one lives in, opinions change. Locally produced might mean food produced from within a 100 miles up to 500 miles, the same city, the same county, or even the same region or state. Regardless of where one lives the principles of "locally grown'' are the same.

Local food growers and farmers pride themselves on providing their customers with the freshest and most nutritious produce they can. Giving the consumer a direct relationship with the grower/farmer allows them to have a deeper understanding of how the food is grown, processed, and sold to them. For this thesis "locally grown" will refer to food, specifically produce, that is produced and sold within a 250 mile radius and/or within the same state. The criteria for the premise of this thesis' definition of "local grown" is based from the understanding of the knowledge gained from the precedent research for this thesis.

We live in a society where people are becoming more aware, curious, and interested in the quality of food they eat. The Farm-to-Table movement is the fastest growing trend in America, today. This movement relies on local farmers and growers to provide the restaurant(s) with locally grown produce and other goods. However, to date, this movement has only encompassed privately owned "mom and pop" restaurants. The movement has yet to branch into the corporate sector of the market. The reason is primarily due to the fact that the corporate restaurants use to much food for the local farms to produce. Therefor, other solutions have to be found in order to bring the corporate sector into the farm-to-table movement. With all the existing restaurants, many of them have spaces within the building that are underutilized and/or underdeveloped. Working within the context of the existing footprint of a restaurant can the architecture be redesigned to meet the food production needs of the restaurant.

Many of these restaurants have been there for centuries, steeped in history within the community and lasting memories from the patrons, By redesigning the existing footprint of a restaurant can the history of the site, integrity of the building, memories of the patrons, and materials of these buildings be saved? Can we create through architecture, a space that not only provides people with fresh food but also educates them of the importance of building and repurposing sustainably; while encouraging them to live a healthier lifestyle by providing them with fresh organic food.

The Importance of a Local Food System

The effects of the farm-to-table movement have reached far beyond the local restaurants and farms. The distribution companies have gotten so many inquires into where their food is coming from, that they have initiated programs to reconnect with local farmers to provide those clients with the freshest produce as possible. Two of the largest food distribution companies in Colorado, Sysco and Shamrock, have made great strides to acquire as much of their produce from local farming as possible.

Sysco is meeting the needs of its clients with their company FreshPoint.

"FreshPoint, has developed an online tool that enables customers to "define their own local" within a distance they choose with the ability to sort by crop or growing method. FreshPoint developed a national database of local farms covering a full range of products including fruits, vegetables, and other specialty items that enables them to share information with their customers about the people that grow their food and the communities where they live and work" (Sysco 2016).

Shamrock has partnered with Marcon, a special buying cooperative in Salinas, California. Marcon is committed to...

" providing the highest quality and freshest produce available. Produce packed under the Markon Ready-Set-Serve® and First Crop® labels guarantees a higher standard of quality than regular USDA specifications" (Shamrock 2018).

Shamrock has also established a direct working relationship with other buyers in various regions across the southwest, United States. These buyers hold the same quality of standards to insure the freshest quality produce for its consumers within that region (Shamrock, 201). Dave Vito, a senior branch manager for Shamrock says "their company strives to acquire 25% of the food they distribute to be sourced locally". With the industry standard for any distribution company is required to source at least 8% of their food to be sourced locally. This means that Shamrock is well ahead of other companies in terms of trying to provide their stores with as much local grown fresh produce.

These two companies desire to transition into establishing a better relationship with more local farming is imperative to the continual growth of the farm-to-table movement. The fact that these two major distribution companies are willing to adapt their business strategies to meet the needs of the changing economic interests, gives hope that this movement is only in its infan.

The majority of all the restaurants in the Denver area use either Sysco of Shamrock to acquire their food products. Meaning that not all the food being delivered to the restaurants meet the criteria of being qualified as locally sourced. This is especially true when it comes to the corporate franchised sector of the restaurant industry. The number of corporate restaurants puts a strain on the agricultural industry in a way that the local farmers can not facilitate. The strain on the local industry leaves the distribution company to acquiring more food from beyond the context of the local standard. The corporate franchised sector of the restaurant industry makes up roughly one-third of all the eating establishments in the United States, according to the National Restaurant Association. In the Denver area there are approximately 4,363 restaurants (Colorado Restaurant Association). If one-third of the restaurants in the Denver area are corporately owned and/or franchised, then that means there are potentially 1,454 locations that are serving their patrons food that is potentially days if not weeks old.

This thesis focuses on the redesign and development of the underutilized and/or unused spaces within a corporate chain restaurant, to accommodate its produce usage by adding a greenhouse to the existing structure. The results of this thesis will help provide a precedent for alternative growing and cultivating methods for produce, not only for corporate chain restaurants but potentially any restaurant with similar parameters and values. If there were a way that we could allow buildings to be able to grow produce on location, then there would be less strain on the local agricultural industry to meet the enormous demand from all the corporate stores. The evidence shown through the precedents and concept design development will help enforce the important role this type of installation will have on the restaurant, and the experience the people will have while dining there.

Pioneering a New Era

The farm-to-table movement would not be successful if it were not for the local farms surrounding the Denver area, these farms help supply and support this thriving movement. These local farms are imperative to the survival of the cause. Due to the severity of the short growing seasons here in Colorado, most of these farm-to-table restaurants have a working relationship with more than one local farm. This movement is possible by the collaboration of multiple hands tilling the land, to cultivate the delicious fruits and vegetables to meet the seasonal needs of their restaurateurs.

Salt is owned and operated by Chef Bradford Heap, and designer Carol Vilate, located in historic Tom's Tavern in Boulder, CO. Shortly after opening Salt Chef Heap bought a 10-acre farm called Colterra. In conjunction with Colterra, Chef Heap has a working relationship with eight other local farms (Colterra, 2018). These farms range from organic seasonal vegetables, goat farm for cheeses, pig and cattle farms (Colterra, 2018). If Chep Heap did not have the working relationship with local farmers then the success of his restaurants would not be what they are today.

Chef Seidel owner of Fruition Restaurant in Denver, bought a farm in Larkspur, minutes south of Denver. At the Fruition Farm, they are constantly improving their growing methods to decrease cost and increase productivity (Fruition). The farm used to kept their plants heated by big expensive heaters, Chef Seidel and his team have developed sustainable cost effective ways to keep their plants warm all year round. By implementing individual insulated heated growing beds, constructed with recycled materials that drastically reduced heating costs, and allow them to grow year round (Fruition).

Having a working relationship with local farmers, artisans, and craftsmen are imperative in the success of the farm-to-table concept, especially within the urban context. This relationship also encourages and re-energizes local businesses, by supporting them and giving back to the community. The design for this thesis builds upon those principles and pushes the movement into the corporate sector of the market.

Changing the Playing Field

The GrowHaus is a 4,000 sq.ft. greenhouse in Commerce City, Denver. The GrowHaus is located in the Elryia-Swansia neighborhood, the most polluted neighborhood in the state of Colorado, and just recently named the most polluted neighborhood in the county (Svaldi). This urban farm acts as a catalyst for sourcing organic food for the many people being affected by being in a food desert. A food desert is defined as someone that does not have access to healthy nutritious food (i.e. a grocery store), within one mile of where they reside (USDA). The closest grocery store to the Elryai-Swansia neighborhood is more than two miles away. Much of the produce grown in the GrowHaus is shipped to local Denver farm-to-table restaurants (Farm). However, any of the residents in the neighborhood are more than welcome to walk into the GrowHaus' fresh market and purchase anything grown on the premises. The fish they use in their aquaponic system are tilapia. These fish not only supply the system and the plants with the proper amount of nutrients, but they also are a source of income for the GrowHaus. The GrowHaus sales the tilapia once they are fully grown to anyone that wants to buy them, alive (Farm). They mainly sell them to local restaurants and locals in the Denver area. The design of the GrowHaus utilizes an underdeveloped block in a polluted area of Denver. This allows the Growhaus to focus on the production, distribution, and education of fresh organic food within the city of Denver (Farm). Providing goods to 40 local restaurants and the public with fresh organic foods (Farm. The GrowHaus is a good precedent because it shows how a dilapidated site can be transformed into an agricultural oasis in one of the most polluted areas in the state. Furthermore, solving the issue of a food desert as well as improving the air quality in the neighborhood.

This is inside the greenhouse at the GrowHaus (Credit Photo to Author)

While the GrowHaus takes advantage of a vacant lot within the urban context, there are other types of agriculture practices that uses no land to grow their crops.

Z-Farming is categorized as the non-use of land or acreage for farming activities (Thomaier). There is a wide range of different types of Z-Farming, from rooftop gardens, roof-top greenhouses, vertical farming, indoor farming, soil-based, hydroponic, or aquaponic gardening techniques (Thomair). Z-Farming practices focus on adapting underutilized spaces within an urban context to accommodate different growing mediums without the use of any land (Thomair). This form of farming not only focuses on how to grow with no land but also why. Through this education of why it is important, the farmers can show others the positive implications that result from this type of farming, and the financial economic gain. Requiring green infrastructure and urban agriculture to become the social norm for any commercial building in any urban context. There are Z-Farming installations across the globe.

A form of Zero Farming is exactly what I am doing in my project. Since I am reconfiguring the underutilized-space in the restaurant to accommodate a greenhouse. Z-farming is a great precedent to understand that there are people all over the world already focused on creating more urban environments that can support and sustain agricultural practices in different global urban contexts. In cities across America growers are finding alternative ways to utilize the wasted spaces within their cities to grow vegetables, by converting old buildings.

AeroFarms is an aeroponic farm in Newark, NY., a 20,000 sq. ft. facility that produces 2 million pounds of produce a year (Aerofarm). They use a patented aeroponic system that uses 55% less water than traditional farming practices and is able to grow plants in a fraction of the time due to their lighting strategies implemented (Aerofarm). This company is excellent precedent for this thesis. This company has turned an underutilized dilapidated industrial building into a thriving urban farm. AeroFarms have redesigned and developed a old factory building into a thriving greenhouse. They did not change the footprint of the building, nor did they alter the exterior of the building. By reconfiguring the interior spaces to allow for a stacked horizontal trough system, much like a aquaponic system, this allows the system to be lighter and use less water. However, the system employed by Aerofarms uses a misting application to the roots of the plants instead of a having the roots submerged in a trough of flowing water (Aerofarm). The particulates from the fish waste will clog the system, a strategic dose of organic nutrients are added to the system to provide the plants with the nutrients needed to grow. Stacking the horizontal rows of plants vertically they can optimize the limited space available and increase the amount of plants that can be grown. The lighting design within the building is designed to simulate the red spectrum of daylight plants need to thrive. Furthermore, by adding the LED lights to the system helps to eliminate harmful molds and bacteria that are common in greenhouse systems. Due to the misting system, they can't use fish to fertilize the plant, to solve this issue Aerofarms uses an organic nutrient rich solution the plants need. The entire system combined together eliminates the use of herbicides, pesticides, and chemicals, which provides the consumer with a product that is healthy, fresh, and tasty. From converting dilapidated industrial buildings to constructing new greenhouses the possibilities are endless when it comes to urban agriculture.

Ceres Greenhouse Solutions is a Boulder-based company that is leading the field in both commercial and residential year-round greenhouse design. The strategies Ceres have imployeed into their greenhouse designs have made them one of the top greenhouse companies in Colorado. Ceres focuses on the entirety of the greenhouse, from geothermal heating of the structure, to the thermal integrity of the walls, and the solar properties of the glazing material. Every aspect of the greenhouse is examined and optimized for sufficient effectiveness (See Appendix A). Ceres is a great precedent for this installation due to their unique properties for the intense Colorado seasons. Ceres has set the bar in innovation in greenhouse design. From local businesses to alternative farming practices around the globe, more and more people are becoming aware of the importance of developing different strategies to how we interact with our food system.

Understanding the Site

Denver has more farm-to-Table restaurants than any other city in the United States. Yet if compared to the total amount of restaurants in Denver to the total number of Farm-to-table restaurants, there is only one farm-to-table restaurants to every 115 other restaurants.

Data collected and graph formulated by thesis author, 2018

Although Denver is paving the way for the Farm-to-Table movement, there is still a long ways to go. With potentially a third of the restaurants in the metro area classified as corporate franchised stores, the question is, what is stopping these corporate restaurants from adopting the practices associated with the Farm-to-Table movement? Corporate restaurants can range from fast-food, fast-casual, casual dining and fine dining establishments. These restaurants are a staple in the lives of millions of people across the country. Some of the reasons this sector of the restaurant industry is so affluent is the accessibility, convenience, and affordability the restaurants possess for the people and their prospected communities.

The site for this thesis project is in Littleton, Colorado. The restaurant is a corporate franchised store that has been there for approximately 27 years. It is considered a casual dining establishment, that has 25 locations in the state of Colorado. The restaurant is located on “restaurant row” a stretch of Wadsworth from Highway 28 heading south to Bowles. Within this 3-mile stretch of Wadsworth there are 41 restaurants that range from fast food to casual dining establishments. The restaurant was chosen because it is the employer of the student writing this thesis. Also it is the reason behind this thesis. It is because of the quality of food that was noticed being served to the guests compared to the quality of food that was noticed being served by the local Farm-to-table restaurants. For this design thesis the site design goals are as listed:

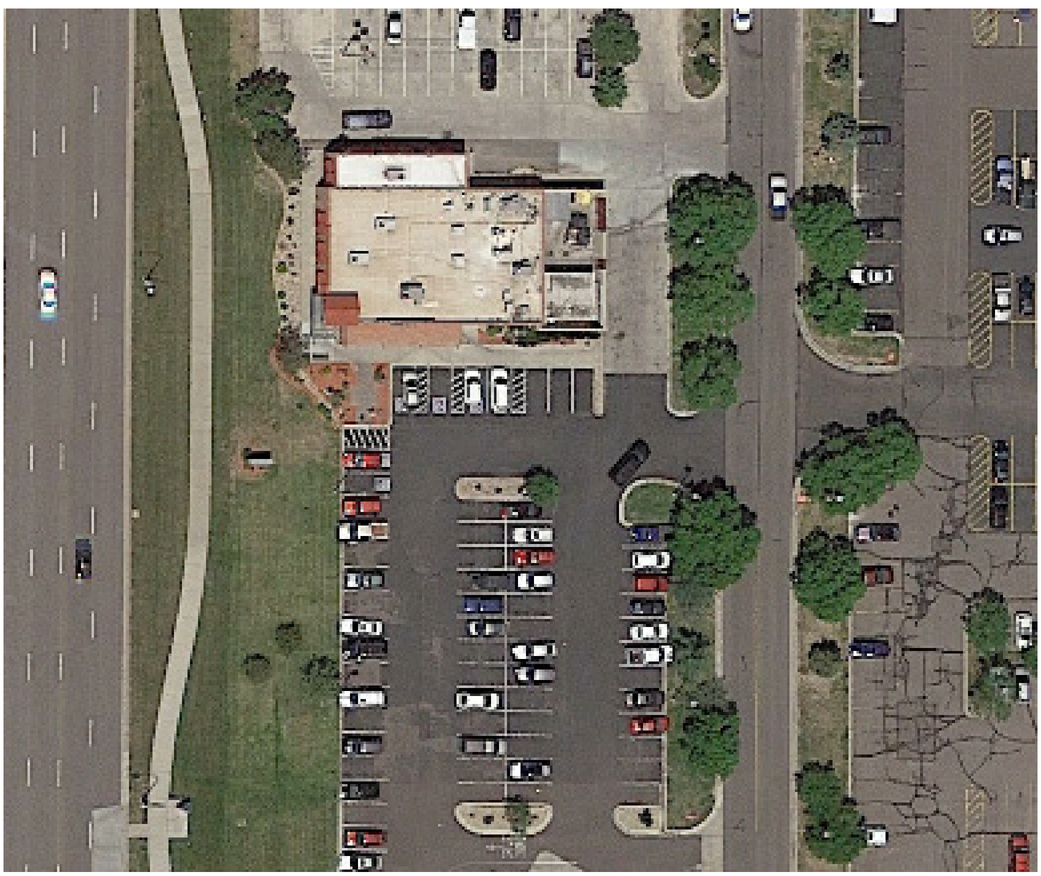
1. Working within the confines of the existing footprint of the restaurant, reconfigure and repurpose the areas within the building that can accommodate a growing system that will grow produce for the restaurant.
2. Focus on making the project as economical as possible, by infringing into the existing building as little as possible.
3. Create an experience for the patrons that they can not experience anywhere else on “restaurant row”. The restaurant has great southern exposure giving the site an ideal location for a design intervention.

By keeping the existing building footprint the same and modifying the roof to accommodate the the greenhouse will provide enough space to grow the produce. Not demolishing the building will allow the restaurant to remain open for the majority of the remodel. The site around the restaurant is all parking and road. On the north and south there is parking and towards the west is Wadsworth Blvd. and to the east is a shopping center. The building itself has great southern exposure from the position of the parking lot, this is especially key when dealing with sunlight for the greenhouse.

Working within the confines of the original footprint (See Appendix 1) of the restaurant will help minimize cost of the remodel. Keeping the initial cost as low as possible while providing the greatest impact within the restaurant will benefit the restaurants bottom line. To help recoup the initial investment of the remodel reconfiguring the seating around the bar area to maximize seating will help increase total sales.

By increasing the restaurant seating capacity will increase revenue, from this increase the restaurant will be able to get a faster full return on their original investment.

In an industry that is saturated with options, setting one's identity apart from the rest is essential in creating that memory that is part of the dining experience. Furthermore, bringing the farm inside the restaurant creates a unique experience for the guests. By allowing the guests to be immersed in the growing process opens up the opportunity to teach people the importance on growing local. Image above shows the location of the restaurant and the context of the surrounding site. Image shows the location of the restaurant and the context of the surrounding site.



The Strategic Plan

The first step was to get the restaurant to agree to share the data needed to get started. They obliged on one condition, that their name not be mentioned in the paper. The data collected from the restaurant showed every type of produce the restaurant used, on a weekly, monthly, and yearly basis. It showed how much the restaurant spends annually on all the produce. It also showed the amount of waste from each item and the days on hand of each item, which refers to the items shelf life. Once all the data was collected, there were inconsistencies in the numbers that where provided from the restaurant. The restaurant does a count on the food every week. These errors could be from a number of factors, including improper counting, insufficient counting, waste, or an error in the data entry. Regardless, these were errors in the data that had to be worked around. Reverse engineering the data to fill the voids was necessary to compile a more accurate total tabulation of all numbers. For example: if there was not a total yearly cost of an item, then by taking the price per unit (per case), quantity per case, and each weekly usage for the year, could be used to tabulate the missing data. Not all the produce the restaurant uses is able to be grown on site. Items such as apples, peaches, lemons, and limes can not be grown in Colorado. Therefore, reaching a 100% produce usage for the restaurant to be grown on site can not be reached. However, this thesis will focus on all the produce that can be grown on site, in a year-round greenhouse.

After totaling up how much produce the restaurant uses which is 21,000 - 25,000 lbs. of produce annually. The next step was to determine the amount of space each type of produce would need to grow to meet the restaurants needs (See Appendix 4). Then, strategically placing the plants in the greenhouse to maximize growing efficiency. According the the farmers almanac, not all produce can be grown next to each other. For example: cabbage can not be grown next to lettuces such as iceberg or romaine. However, cabbage can be grown next to broccoli, and/or celery. However, spinach can be grown around any type of produce. Determining which plants can be grown around others is essential to having a greenhouse that can continually meet the produce needs.

Designing to Meet Needs

Given the existing layout of the building and the context of the site the best solution that was determined was to put the greenhouse on top of the roof of the restaurant. This will maximize production while minimizing construction cost as much as possible. Creating a second story greenhouse will provide enough space to grow all the produce the restaurant needs. On top of the restaurant there is 5,813 sq. ft. of usable space, after reconfiguring the HVAC and Air-conditioning systems to the north side of the roof. In the back dock area, there is 976 sq.ft. of usable space, once the trash is relocated to the north side of the building. After compiling all the space needed to grow all the produce, there needed to be a total 7455 sq. ft. of greenhouse space. This was an issue, because after the space that could be converted within the restaurant only amounted to 6,789 sq.ft.

Red square designates area in front of store for added greenhouse space (Photo credit to Google Earth)

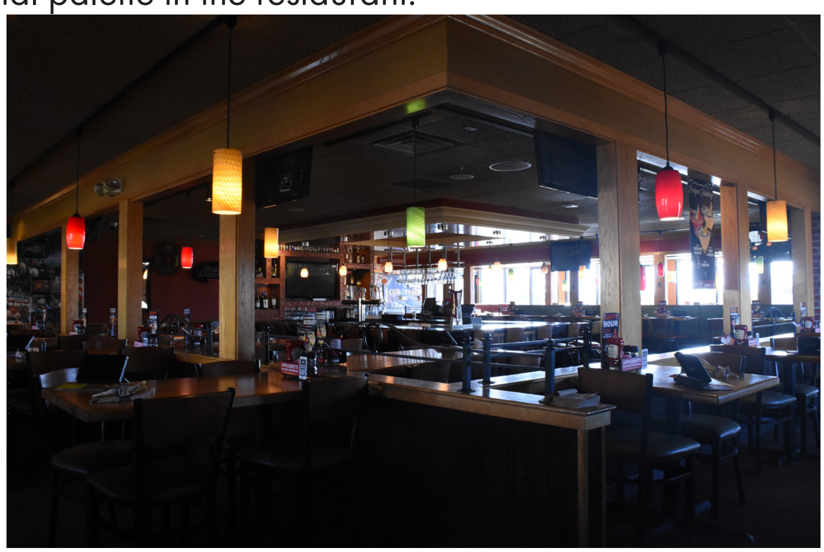
To get the square footage needed, repurposing the area in front of the restaurant that is mulch and rock to a useable greenhouse space will give enough space to accommodate the 670 sq.ft. missing from the greenhouse. By creating a greenhouse in the front of the restaurant it gives the guests entering the building a chance to be immersed in the greenhouse. Allowing them to walk around and through and see the plants growing while they eat.

The bar area of the restaurant will get a makeover as well. By repositioning the bar along the wall of the kitchen, it opens up the opportunity to increase the seating in the restaurant This will allow for an additional four tables with six chairs at each table to be added. Also the bar will be enlarged to add an additional four bar stools. See Appendix 2.

There are a series of columns throughout the restaurant that are utilized to cary the added load of the greenhouse on the roof.

The remodel of the restaurant maximizes the seating and also creates a sustainable food system within an urban area. However, unless the proper lighting is installed the greenhouse will not be able to be as efficient as it needs to be. Both the lighting in the restaurant and the greenhouse is crucial to the success of the design. In the greenhouse the lighting will potentially help with the reduction of mold and pests, and the lighting within the restaurant can balance out the contrast of the daylight and the material palette, making for a more comfortable dining experience.

The lighting in the greenhouse is predominately ambient and task lighting. With linear lighting along the floor to break up the different areas within the greenhouse and suspended pendant lighting for efficient plant growth and health. The lighting in the restaurant is predominately pendant lighting that is not that efficient, and the contrast between the daylighting and the dark material palette in the space strains the eyes. By removing the pendant lighting and lightening up the material in the space provides visually a more comfortable and inviting space to be in. The picture shows the contrast between the daylight and the dark material palette in the restaurant.



Credit picture to Thesis Author

The picture shows the contrast between the daylight and the dark material palette in the restaurant. It also shows the series of columns in throughout the restaurant that will help support the rooftop greenhouse

The IES handbook is the lighting industry standard for luminance levels. For the food service sector the light levels vary depending on the tasks being performed. The handbook states that in the dining area the recommended luminance levels should be between 50 lux - 200 lux. Depending on the ambiance of the restaurant, and material palette, the levels may vary. For this remodel the projected levels will vary depending on what part of the restaurant one might be in. For example, the bar area is a more communal space where the luminance levels will be higher, compared to areas outside the bar will be more intimate and private, those levels will be lower. In conjunction with light levels, color temperature (CTT) is important as well. In the bar area the color temperature will be a little cooler than other dining areas in the restaurant. Since the bar is a more communal space the projected CTT will be 3,500K. The cooler temperature in the bar, is to promote activity and open the space up but also enhance the colors of the food on the plates and on the walls. The light level in the bar will be 150 lux. on the table tops. In the area surrounding the bar the CTT will be warmer, somewhere between 2,700K - 2,900K. In these areas the ceilings are lower creating a more private and intimate ambiance. the lighting should compliment the different zones within the restaurant. The lighting levels will be lower, around 50 lux. - 75 lux. The levels are sufficient enough to see the colors on the plate and read the menu, but low enough to capture the more private feeling desired. In these areas the tables are lite with down-lighting (See Appendix). The Lighting in the greenhouse is predominantly linear pendant lighting. In the greenhouse the lighting is more about spectrum rather than the luminance. Plants require different spectrums of light at various times throughout their growth cycle. For example, blue light helps encourage leaf growth, while red and blue mixed together help promote the plant to flower and produce produce (Nelson, 2014). The luminaire types can be found in Appendix .

Finding Solutions

There are essentially two parts to this remodel, first the environmental aspect which is the greenhouse and the architectural aspect which is the redesign of the bar area to make the remodel more cost effective. Redesigning the front of house of the restaurant will help with the initial cost of the remodel. From the remodel the seating in the restaurant will be increased from 48 tables with 179 chairs to 52 tables with 203 chairs. The bar transformation will increase the seating from 18 to 22 barstools. The restaurant averages anywhere from $50,000 to $75,000 a week depending on the time of year (Diaz, 2018). The total amount of produce used by the restaurant is 21,000 - 25,000 lbs. of produce annually. The existing annual cost of the produce that can be grown in the greenhouse is approximately $17,500 - $22,000. The space needed to grow enough food for the restaurant requires a 7,455 square feet footprint. To increase the yield production of the greenhouse stacking the plants vertically in a trough system the amount of food that can be produce is now tripled, given the vertical height of the greenhouse.

The redesign of the rooftop of this restaurant will help to alleviate some of the overall annual food cost. However not all the produce can be grown. This is because most of the tree bearing fruits such as oranges, apples lemons, and limes can not be grown for two reasons, one there is not enough space and those types of fruits are not conducive to the climate in Colorado. However, for the majority of the produce that is used in the restaurant the space provided by the rooftop greenhouse allows the space to grow enough food not only for this restaurant but also another two to three other stores. The findings from this thesis shows that the greenhouse can grow approximately 50,000 - 75,000 lbs. of produce annually. By growing the produce on site the restaurant could save $15,000 - $20,000 a year. Furthermore, by redesigning the front of house of the restaurant the annual revenue can be increased to $175,000 - $200,000 annually. The initial cost of the remodel could range from $750,000 - $850,000.

The cost analysis of the remodel is broken down by trade, with an estimated cost for labor and materials for each trade. The initial cost of the remodel could range from $750,000 - $850,000. The breakdown of each trade is as follows:

The plumbing will consist of replacing all the old piping in the building and any/all new piping for the greenhouse system, the labor and materials. Estimated total cost: $50,000-$60,000

The electrical will consist of replacing all the bad wiring and all new wiring for the restaurant and greenhouse. Estimated total cost: $25,000 - $30,000

The HVAC will consist of removing, reconfiguring and replacing the HVAC ductwork for the restaurant and the greenhouse. Estimated total cost: $60,000 - $70,000

The structural changes and bar relocation will consist of all structural modifications to the restaurant to accommodate the rooftop greenhouse and to move the bar to the back wall and closing off the kitchen. Estimated total cost: $130,000 - $140,000

The rooftop greenhouse and back loading dock modification will consist of installation of the greenhouse, building out a new trash area on the north side of the building and any modifications to the back dock area. Estimated total cost: $300,000 - $400,000

The growing system for the greenhouse will consist of all new growing mediums and associated mounting systems, water tank, and all other accessories. Estimated total cost: $25,000 - $30,000

The Lighting system for the restaurant and greenhouse will consist of all the removal of the old lighting and replacing with new lighting and all the luminaires. Estimated total cost: $85,000 - $90,000

This new system will also take a new staff to run it. Hiring one or two people to manage the project and the system will create new jobs. The down side is the added annual cost for the restaurant. Providing the employees with the sufficient income needed for the extra work and the hiring of new staff members could potentially cost the restaurant an added annual cost of $50,000 - $60,000 just in the added income for old and new employees. The annual operating cot of the greenhouse will potentially cost. The annual operating cost of the size of greenhouse installed could range from $15,000 - $20,000. All the added costs of the annual cost of the remodel will potentially cost the restaurant approximately $65,000 - $80,000. The upfront cost ranging from $750,000 to $850,000. The salary increases and added annual operating costs will total approximately $65,000 to $80,000.

This means that the restaurant could potentially get a full return on their investment respectfully within five to six years. When dealing with a franchise that has multiple locations within an area this is crucial to making the project more affordable and economically justified.

Adding the greenhouse to the restaurant benefits architecture by establishing a precedent that a building existing structure can be modified to accommodate multiple programs. By repurposing an area of a structure that is normally only used to house the HVAC systems and air-conditioning units to a usable space that produces enough food for the business and the community solidifies the fact that we can rethink how we design buildings in an urban context. The architecture of this thesis benefits the design by allowing the building to become a living system within the community. The architecture then begins to give back to the community by sharing the benefits of the fresh and healthy food by informing people the importance of alternative methods of agriculture by the sharing the knowledge of growing local.

In Closing...

The effect that the restaurant industry puts on the local and national agricultural industry, if not gone unchecked will continue to deteriorate the system. We as a society need to start to develop alternative ways that we interact with our food system. There are over a half a billion restaurants in America, and a third of those restaurants are corporate franchised stores (statista). The farm-to-table movement is one of the fastest growing trends in the food industry. However this movement is limited to the local farmers that can provide the fresh produce as needed. The corporate sector is to large for the local farmers to meet the needs of the large chain restaurants. If the movement is to progress and grow, then alternative means of growing locally need to be found. This thesis tackles this issue. By reconfiguring the underutilized and underdeveloped spaces within a corporate restaurant a program was developed to be able to house most of the restaurants produce needs to be grown on site. This was accomplished by adding a greenhouse on the top of the restaurant. To offset the initial cost of the remodel the bar area of the restaurant was also redesigned to maximize seating capacity to increase the stores annual revenue. This is especially important to the restaurant because unless an economical solution is found then the chain restaurant swill potentially not make the transition. Why is this important?

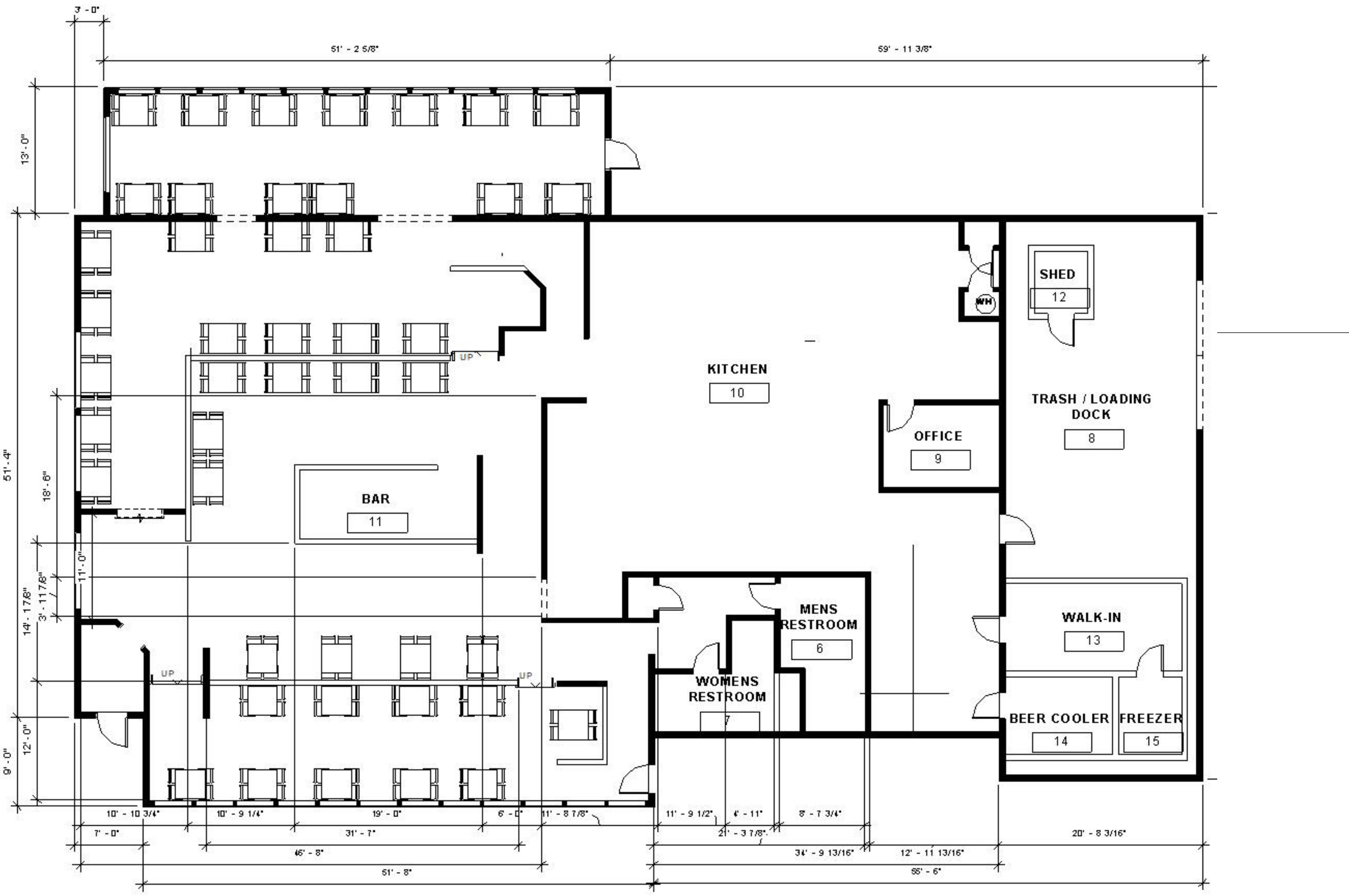
We live in a society that is continually growing. However, we are running out of land to grow. Finding alternative ways to grow food without the use of land will be important to future generations. With more and more people moving to urban areas, food has to travel further to reach the majority of the people. By reducing the distance food travels provides people with a more healthy and nutritious option to their daily diet. Although the Farm-to-Table is on the right path to help alleviate these stresses, it is limited. Expanding the movement to accommodate the corporate sector is beneficial to a multitude of people. This thesis shows that it is possible to redesign an existing restaurants structure while maintaining its original footprint to accommodate its produce needs.

By accomplishing the design, the remodel now becomes more cost effective for the business and provides produce for multiple stores from just one location. Furthermore, in an industry that is saturated with options giving a restaurant the identity that sets them apart from the rest. Benefiting not only the restaurant but also provide the guests with an unique experience that hopefully will spark more restaurants to find alternative ways of growing and acquiring their produce. Everyone should have access to fresh nutritious food.

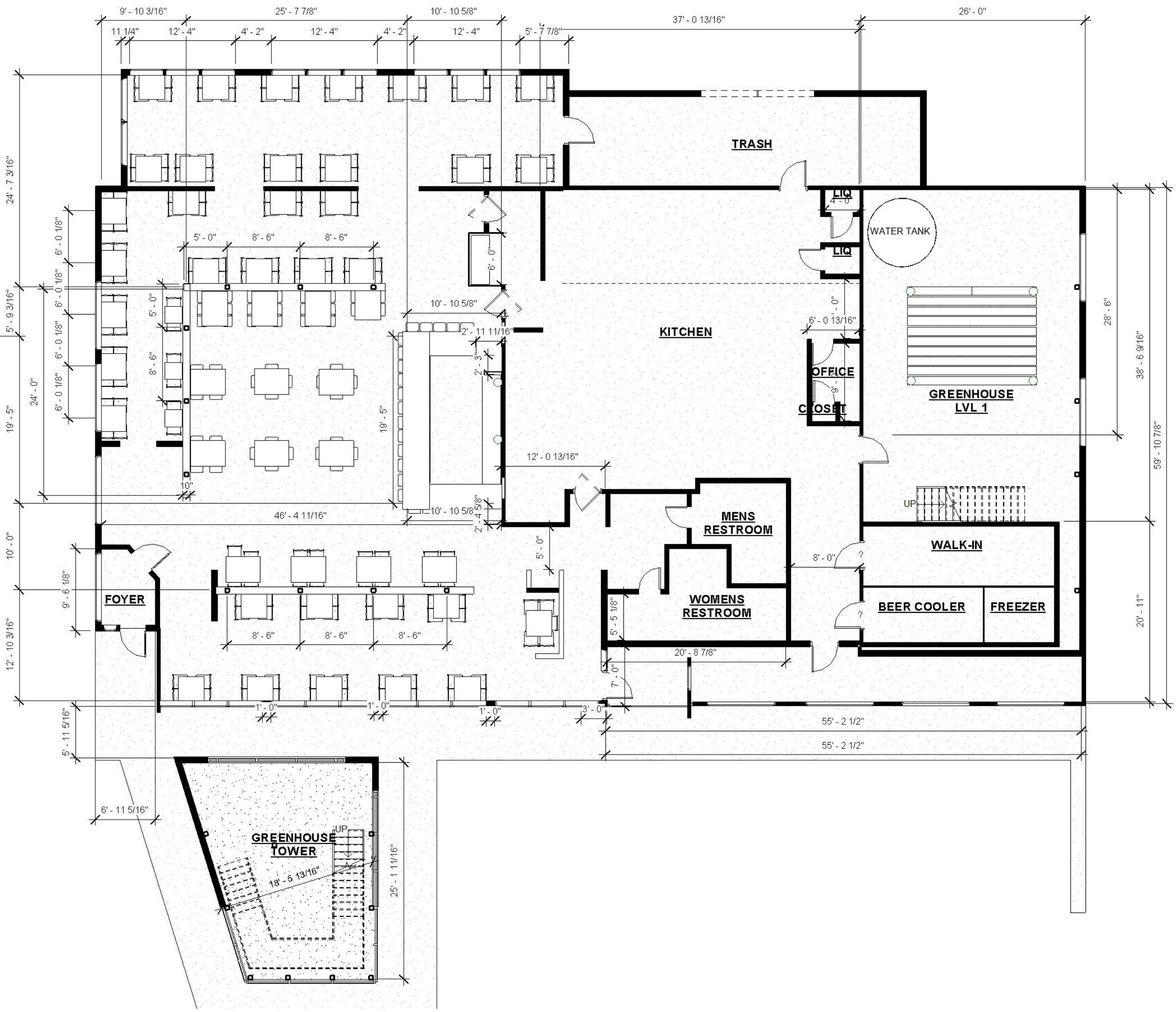
The architecture of the restaurant in this thesis was redesigned in a way that provides the guests with a healthy food alternative, while keeping the integrity of the existing building. This was accomplished by reconfiguring the underutilized rooftop and underdeveloped back loading dock areas of the restaurant. The building is approximately 30 years old. The structure of the restaurant is still strong and functions sufficiently. However, some of the systems within the restaurant are starting to fail, such as the plumbing, and electrical, primarily due to the age of the building. The redesign shows that it is possible to fix the failing systems, and bring the farm to the restaurant, without demolishing the building. The architecture also solves the issue of providing the restaurant with the food needed for the menu. By adding the greenhouse to the roof of the restaurant, brings the farm directly to the restaurant, reducing the distance the food travels to just a few feet. Reducing the distance the food travels provides the guests with a more fresh and healthy food alternative. The local farmers are not able to produce the amount of food the corporate restaurants go through, therefor the architecture solves the issue of the local farmer and the corporate restaurants. The significance of this thesis provides a precedent to architecture that we can repurpose existing buildings to accommodate multiple programs within the building. Ultimately breathing new life into the building by giving the structure a new identity. By giving the building a new identity the restaurant becomes a life-source for the community and the people that eat there. This is essential to the environmental design field because it provides a precedent that we can make buildings live for us, not us live for the building. The redesign of the restaurants architecture further educates people on the importance of how to grow locally in an urban context. By giving people this knowledge of growing local and eating healthy through architecture, then we start to empower people.

Appendix 1

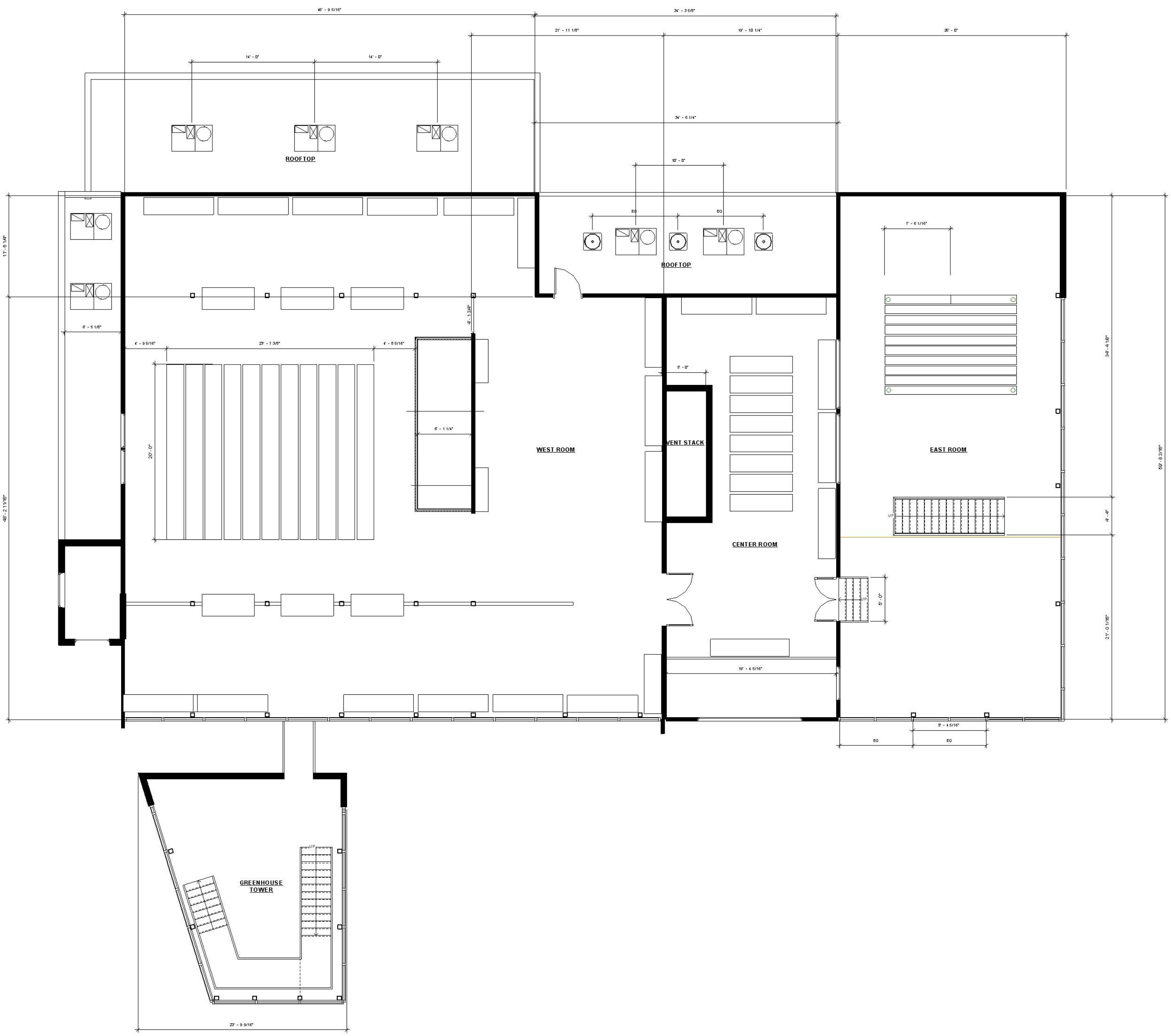
Original Restaurant Floor Plan



Redesigned Restaurant Floor Plan

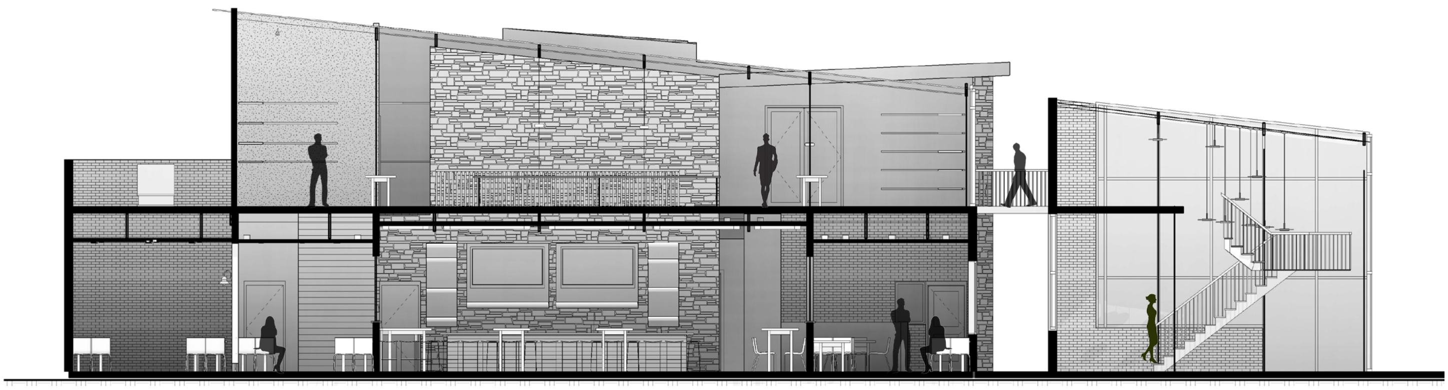


2nd Floor Greenhouse



Appendix 2

Building Sections

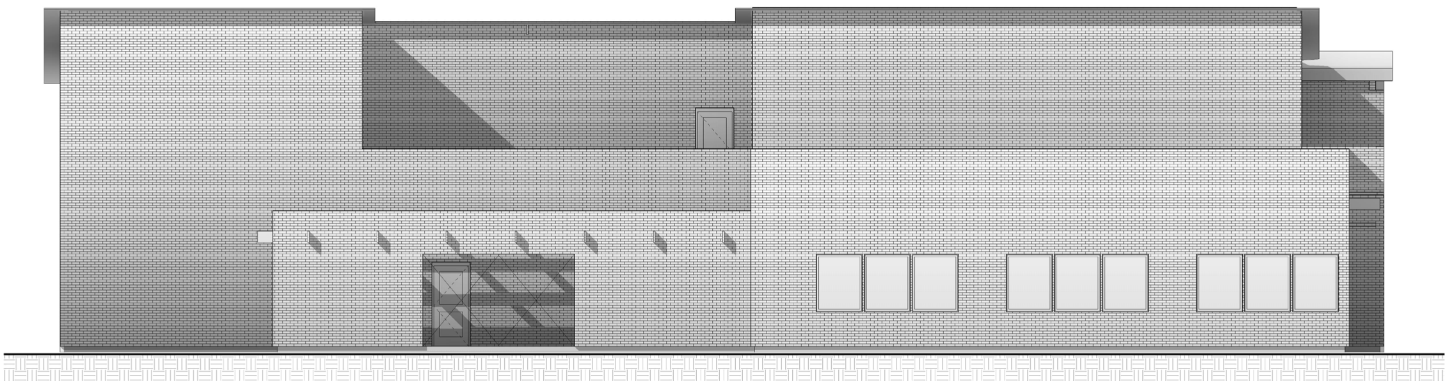


North / South Section

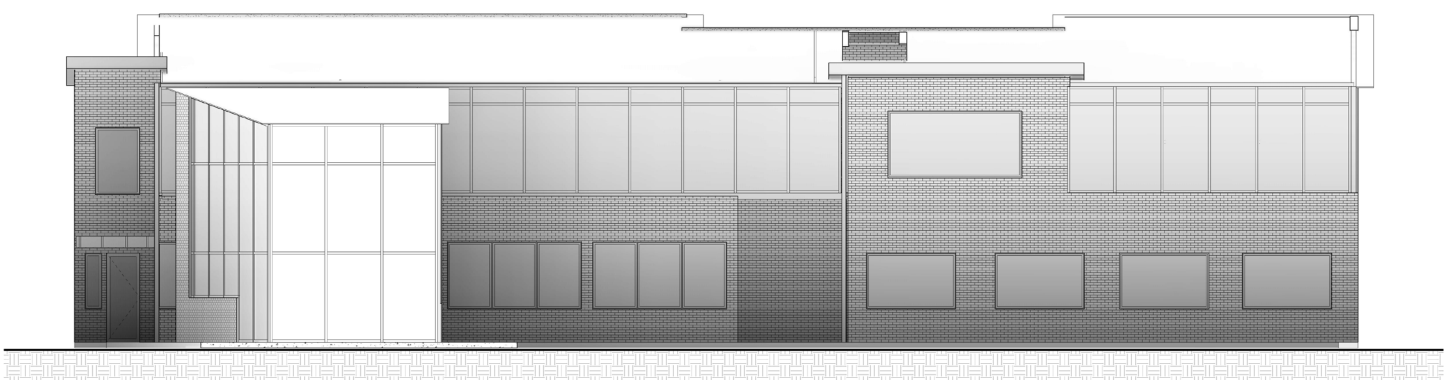
East / West Section

Appendix 3

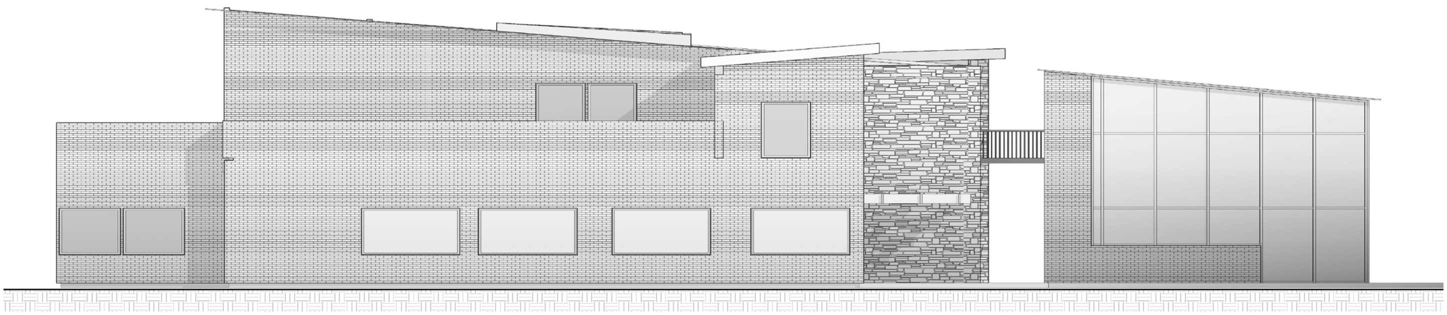
Elevation Views



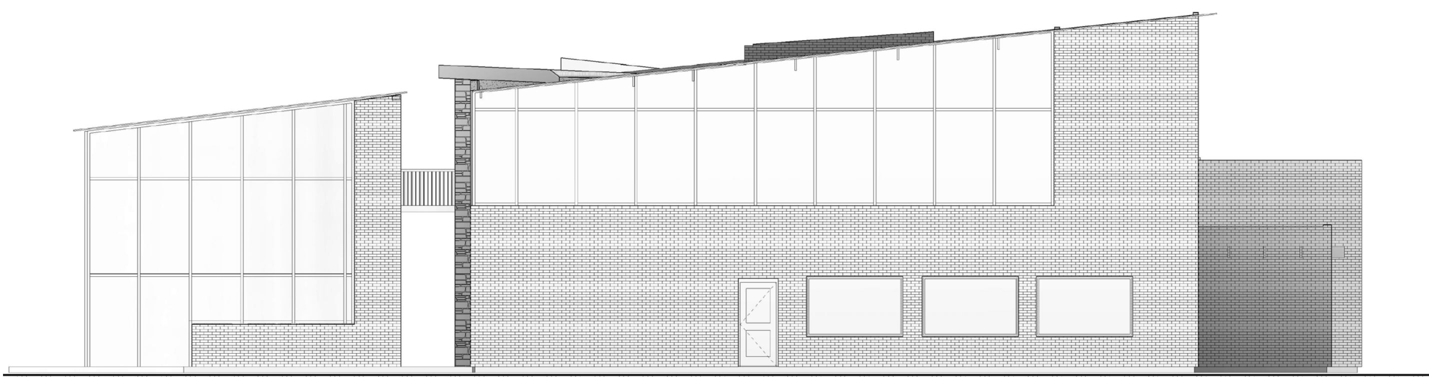
North Elevation



South Elevation



West Elevation

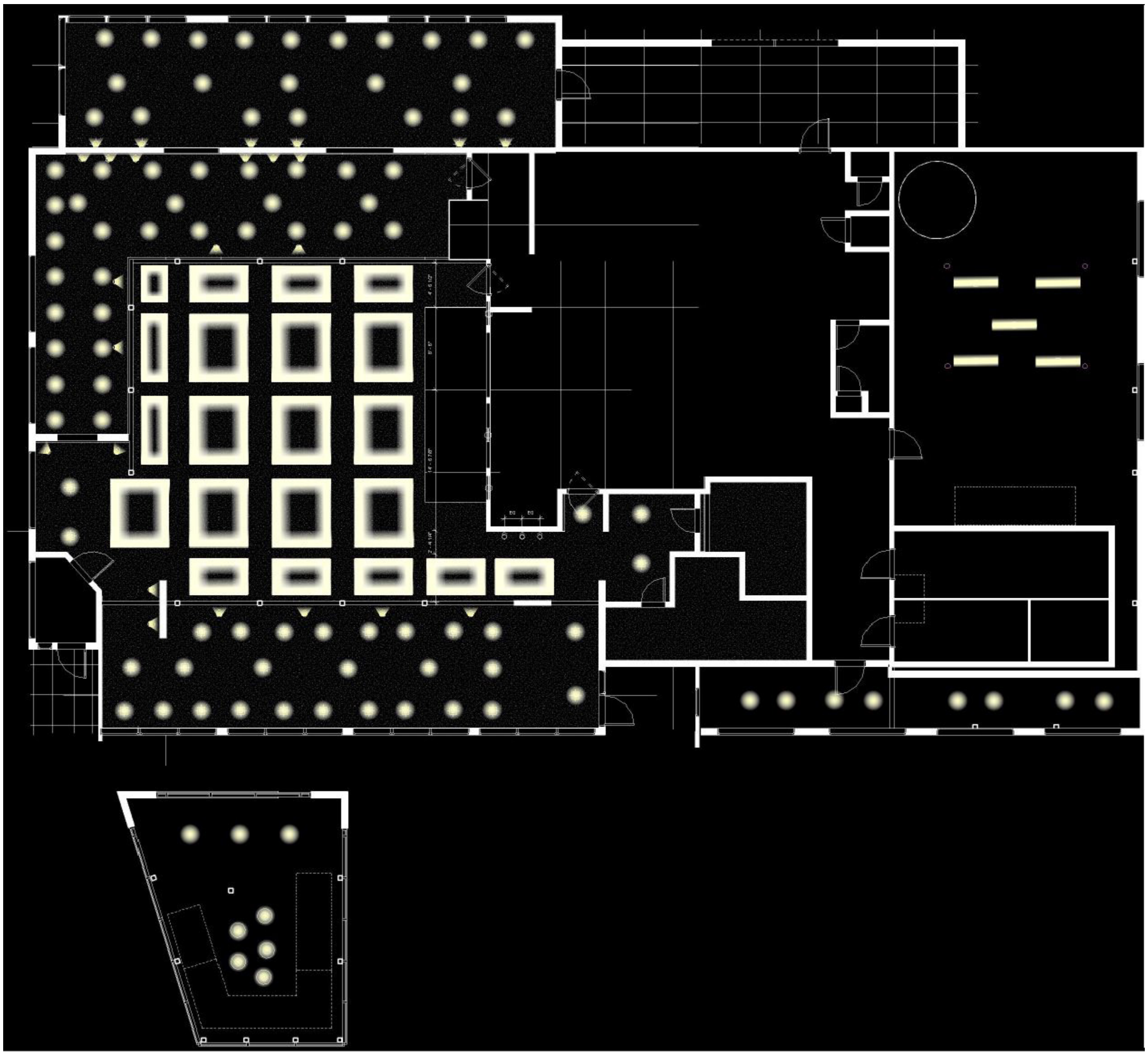


East Elevation

Appendix 4

Light Maps

Restaurant RCP Light Map

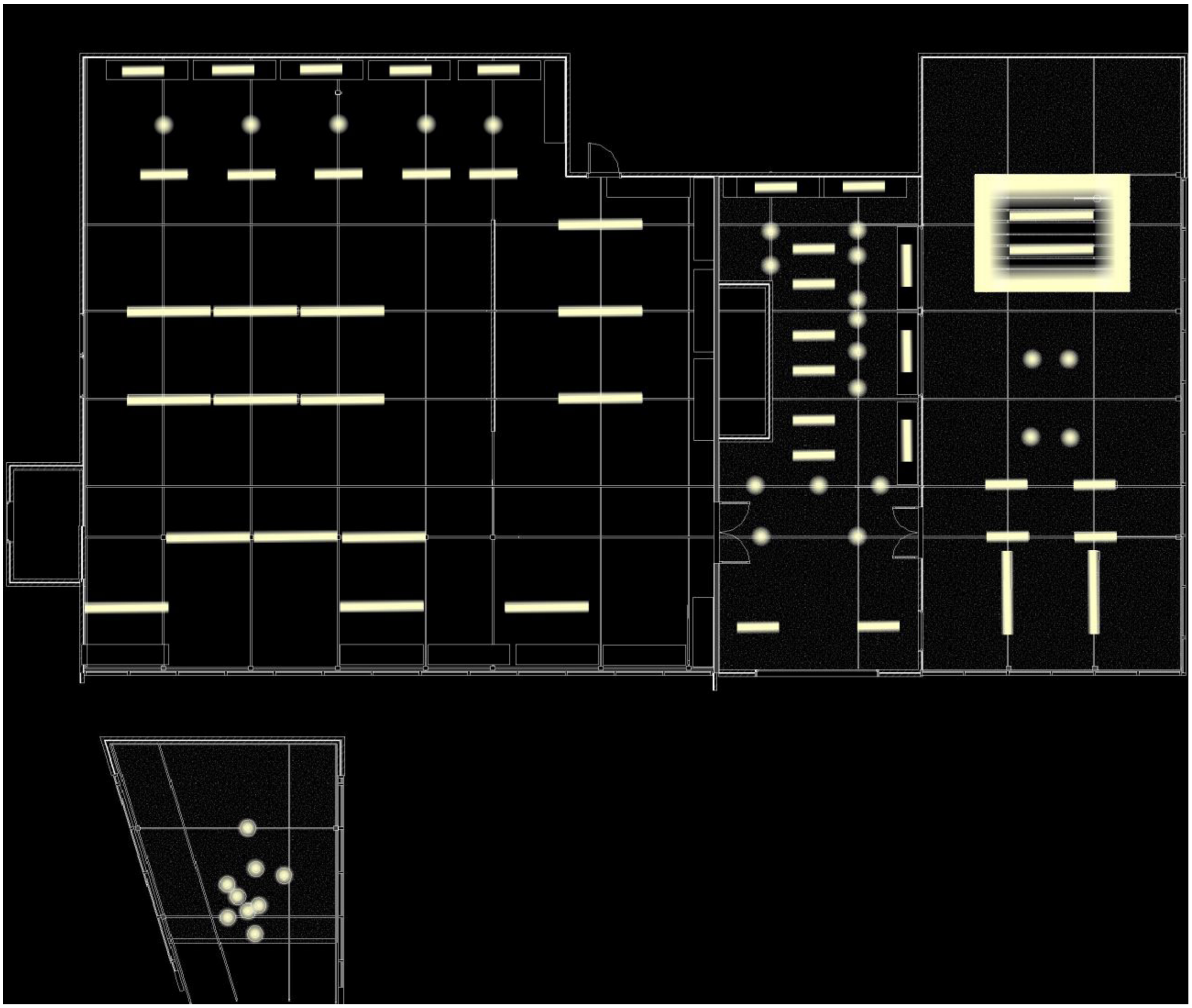


The lighting in the restaurant is comprised of threee different types of lighting, downlighting, wall washing, and linear pendant luminaires. 1. Is the wall washing that illuminates the plants and the walls in certain areas of the restaurant that accentuate walls through transition corridors. 2. Is the downlighting above all the tables and also illuminating the transitional corridor. 3. is the pendant lighting in the bar area providign ambient lighting.

1.

2.

Greenhouse RCP Light Map

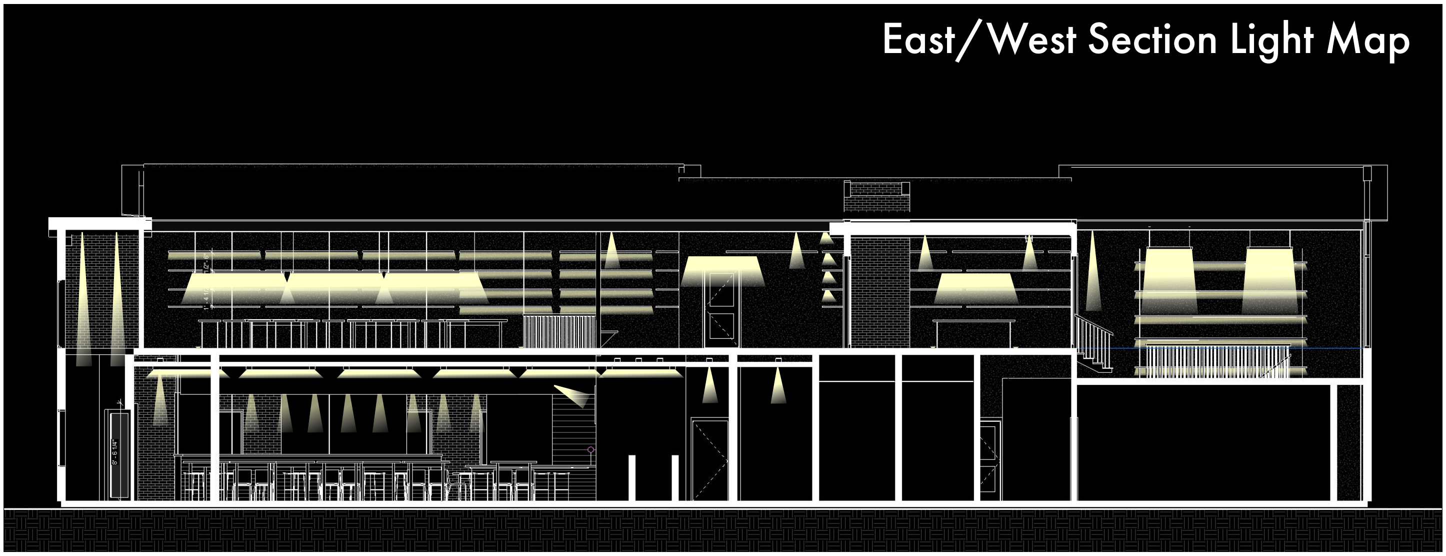


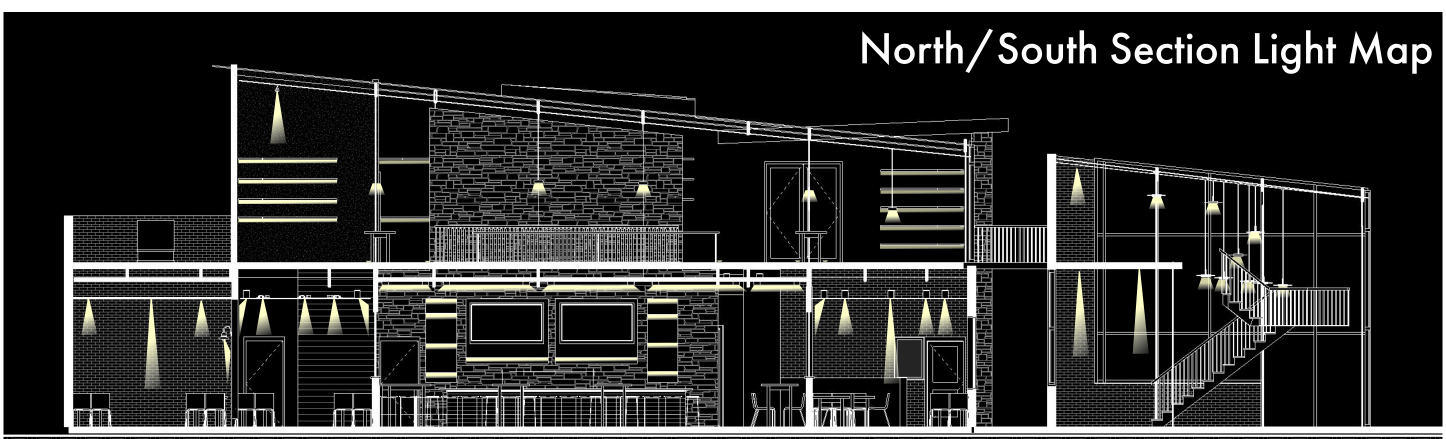
4. Is the lighting over the vertical growing system that provides enoughlighting for all the plants. 5. Are the lights over the plants in the open area of the greenhouse. 6. Is along the transition areas of the greenhouse that seperates the different zones within the greenhouse.

4.

5.

6.


East/West Section Light Map


North/South Section Light Map

Appendix 5

Is a list of every item of produce that can be grown in the greenhouse.

The graphs in this appendix represents the annual weekly usage for each item of produce.

Leafy Greens

Iceberg Lettuce:

Price per Case: $18.15

Quantity per Case: 24 heads

Weight per Unit: 1.05 lb.

Count per Plant: 1

Plant Growth Time: 60 - 70 days

Yearly Usage: 1,776.96 lb.

Yearly Cost: $1,343.87

Plant Spacing: 12”

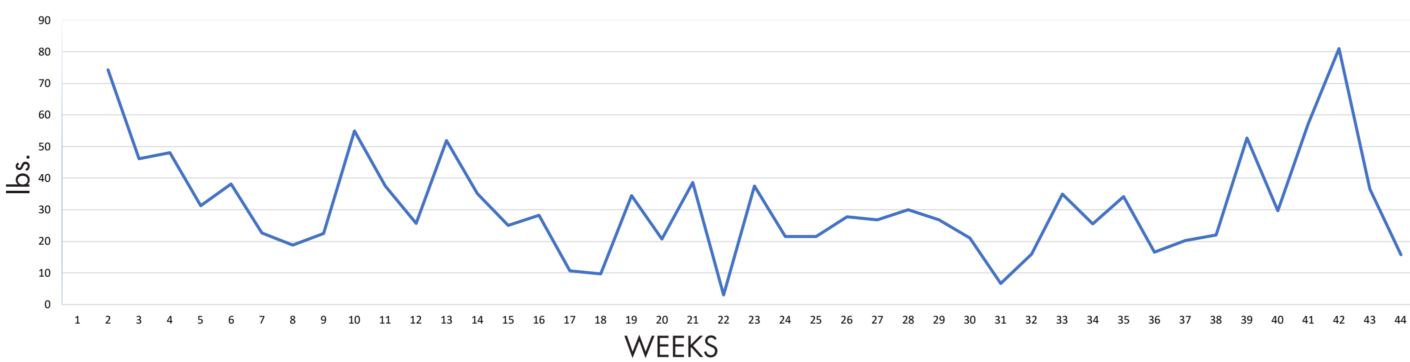
Row Spacing: 12”

Highest Week Usage: 81 heads

Total Needed Daily: 12

Total Needed to be Grown: 840 heads

Total Square Footage: 675 ft2



Romaine Lettuce:

Price per Case: $14.16

Quantity per Case: 6/2 lbs.

Weight per Unit: 1.38 lb.

Count per Plant: 1

Plant Growth Time: 75 - 85 days

Yearly Usage: 2,281.07 lb.

Yearly Cost: $2,691.66

Plant Spacing: 12″

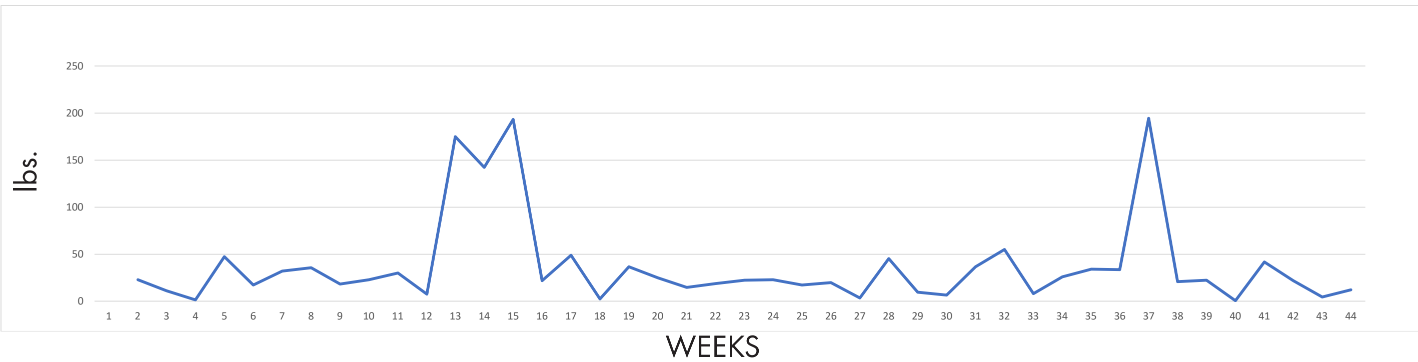
Row Spacing: 12″

Highest Week Usage: 194 heads

Total Needed Daily: 9

Total Needed to be Grown: 672 heads

Total Square Footage: 750 ft2



Spring Mix

Price per Case: $7.35

Quantity per Case: 1/3 lb.

Weight per Unit: 1.22 lb.

Count per Plant: 1

Plant Growth Time: 60 - 70 days

Yearly Usage: 92 lb.

Yearly Cost: $676.20

Plant Spacing: 12″

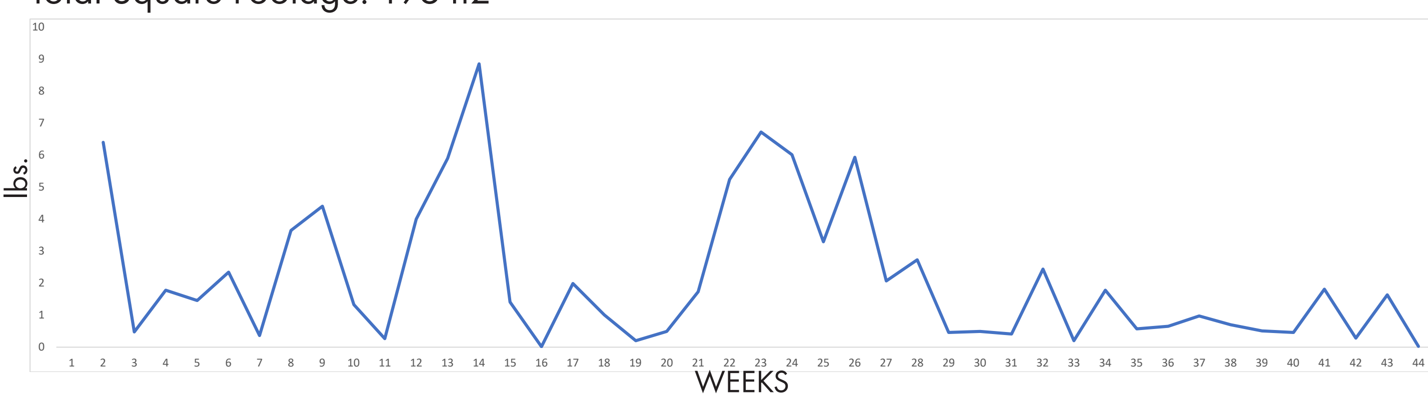
Row Spacing: 12″

Highest Week Usage: 9 heads

Total Needed Daily: 4

Total Needed to be Grown: 196 heads

Total Square Footage: 196 ft2



Spinach

Price per Case: $13.71

Quantity per Case: 4/2.5 case

Weight per Unit: 0.55 lb.

Count per Plant: 1 bunch

Plant Growth Time: 42 - 56 days

Yearly Usage: 229.50lb.

Yearly Cost: $1,261.32

Plant Spacing: 12"

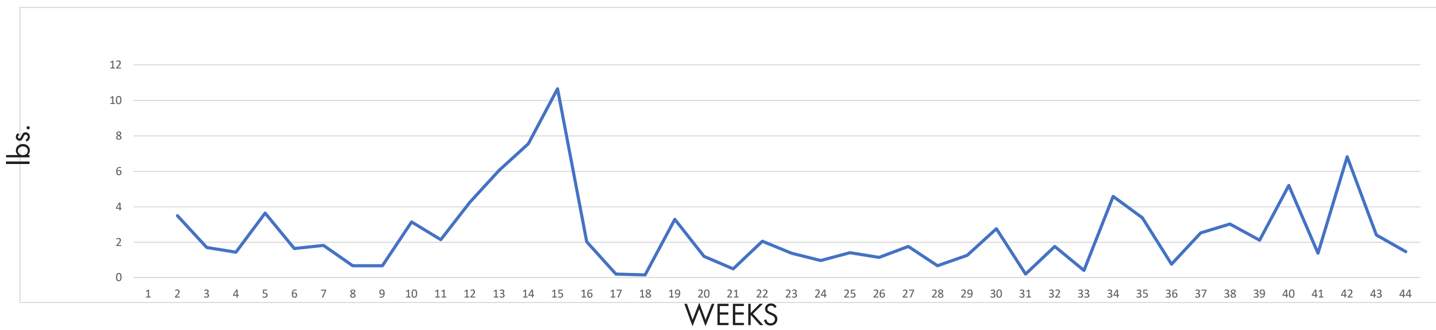
Row Spacing: 12"

Highest Week Usage: heads

Total Needed Daily: 2

Total Needed to be Grown: 112

Total Square Footage: 125 ft2



Herbs

Cilantro

Price per Case: $7.67

Quantity per Case: 2 /1 lb.

Weight per Unit: 0.18lb.

Count per Plant: 1 bunch

Plant Growth Time: 45 days

Yearly Usage: 89.61 lb.

Yearly Cost: $343.65

Plant Spacing: 6"

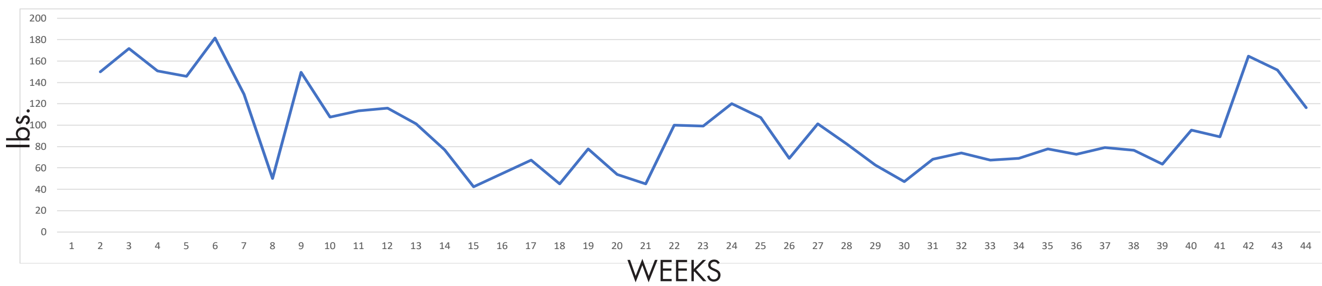
Row Spacing: 6"

Highest Week Usage: 181

Total Needed Daily: 2

Total Needed to be Grown:

Total Square Footage: ft2



Parsley

Price per Case: $10.30

Quantity per Case: 1/1 lb.

Weight per Unit: 0.13 lb.

Count per Plant: 1 bunch

Plant Growth Time: 70 - 90 days

Yearly Usage: 38.3 lb.

Yearly Cost: $394.49

Plant Spacing: 6"

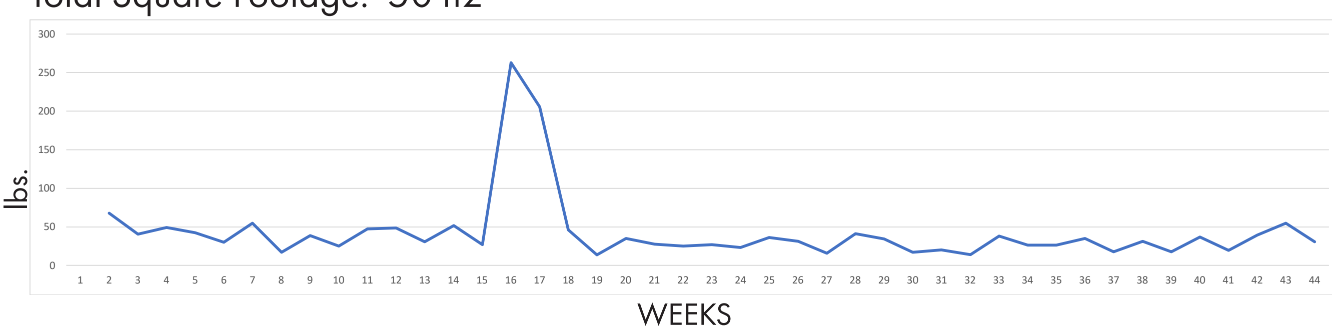
Row Spacing: 6"

Highest Week Usage: 38.3 oz.

Total Needed Daily: 1

Total Needed to be Grown: 70 bunches

Total Square Footage: 50 ft2



Mint

Price per Case: $6.80

Quantity per Case: 1/4 oz.

Weight per Unit: 0.13 lb.

Count per Plant: 1 bunch

Plant Growth Time: 90 days

Yearly Usage: -- lb.

Yearly Cost: $--

Plant Spacing: 8"

Row Spacing: 8"

Highest Week Usage: -- heads

Total Needed Daily: 1

Total Needed to be Grown: 90 bunches

Total Square Footage: 50 ft2

Basil

Price per Case: $11.80

Quantity per Case: 1/1 lb.

Weight per Unit: 0.16 lb.

Count per Plant: 1 bunch

Plant Growth Time: 75 days

Yearly Usage: 451.2 lb.

Yearly Cost: $332.76

Plant Spacing: 12"

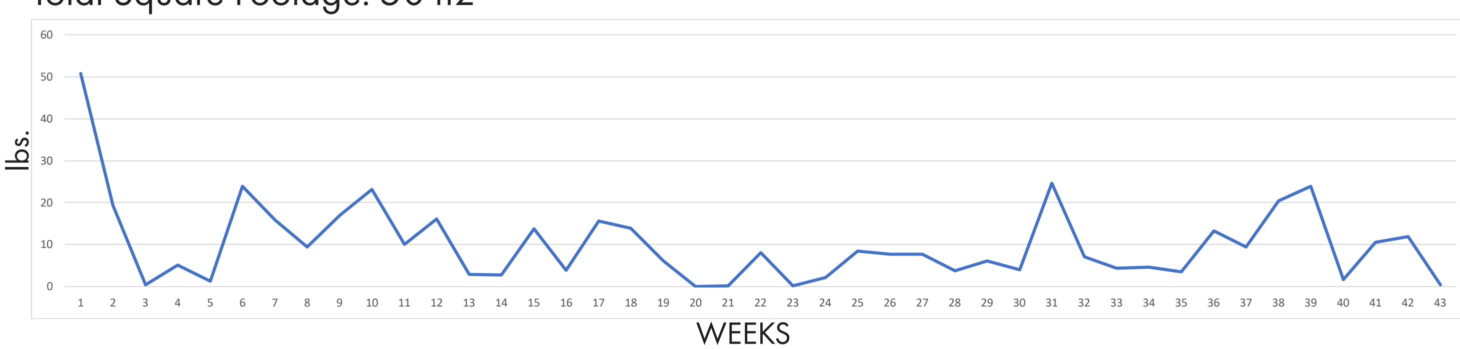
Row Spacing: 12"

Highest Week Usage: 50.57 oz.

Total Needed Daily: 1 bunch

Total Needed to be Grown: 75

Total Square Footage: 50 ft2



**Mint was one of the items that were missing, resulting in some of the reasons there was insufficient data. This was one of the limitations of this thesis.*

Stems / Bulbs

Celery

Price per Case: $26.96
Yearly Usage: 643.89 lb.

Quantity per Case: 1/30 lb.
Yearly Cost: $578.64

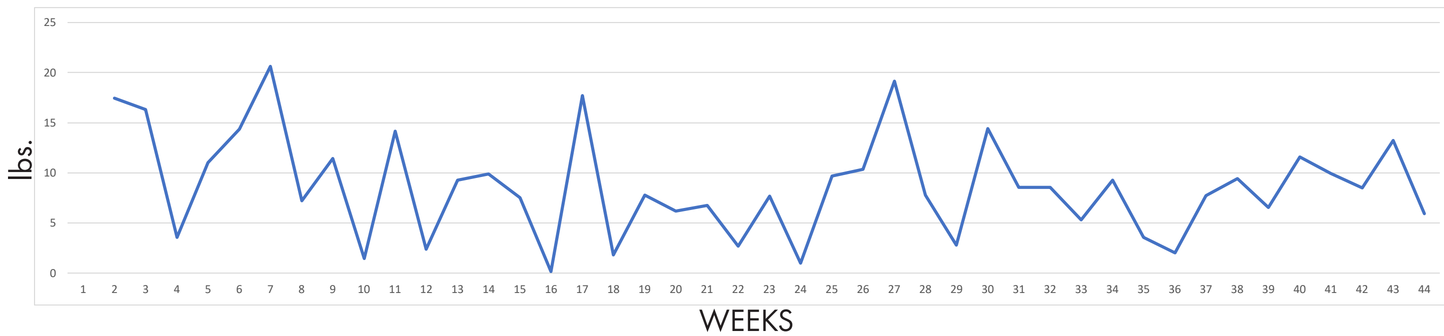
Weight per Unit: 1 lb.
Plant Spacing: 12"

Count per Plant: 1 stalk
Row Spacing: 12"

Plant Growth Time: 85 - 120 days
Highest Week Usage: 20.63 stalks

Total Needed Daily: 4
Total Needed to be Grown: 360

Total Square Footage: 370 ft2



Cabbage

Price per Case: $12.81
Yearly Usage: 1,678.60 lb.

Quantity per Case: 4/5 lb.
Yearly Cost: $1,075.14

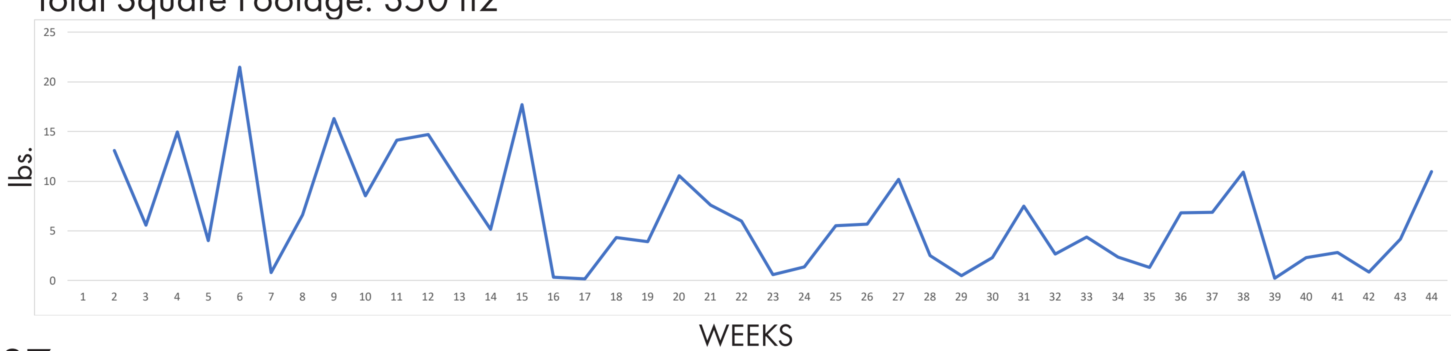
Weight per Unit: 2 lb.
Plant Spacing: 18"

Count per Plant: 1 head
Row Spacing: 18"

Plant Growth Time: 70 days
Highest Week Usage: 21.52 heads

Total Needed Daily: 2 heads
Total Needed to be Grown: 140

Total Square Footage: 350 ft2

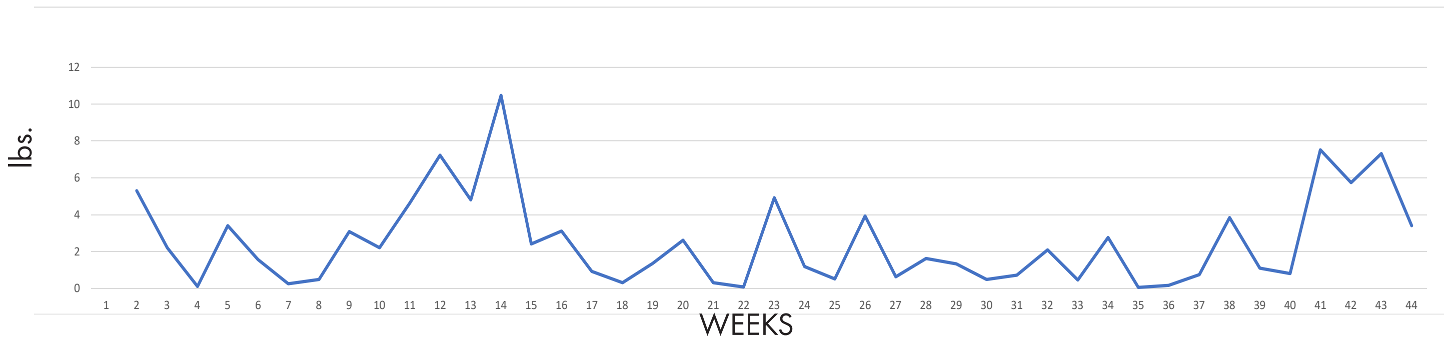


Red Cabbage

Price per Case: $10.71
Quantity per Case: 2/5 lb.
Weight per Unit: 2.04 lb. lb.
Count per Plant: 1 head
Plant Growth Time: 70 days

Yearly Usage: 378.47 lb.
Yearly Cost: $405.34
Plant Spacing: 12”
Row Spacing: 12”
Highest Week Usage: 10.46 heads

Total Needed Daily: 1 head
Total Needed to be Grown: 70 heads
Total Square Footage: 90 ft2

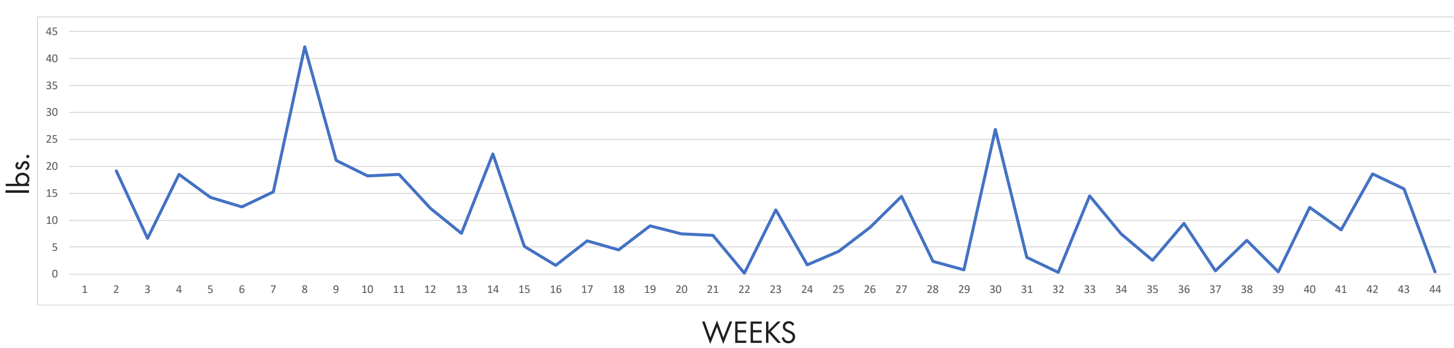


Broccoli

Price per Case: $22.76
Quantity per Case: 6/3 lb.
Weight per Unit: 1.34 lb.
Count per Plant: 1 bunch
Plant Growth Time: 100 - 150 days

Yearly Usage: 1,669.94 lb.
Yearly Cost: $2,111.55
Plant Spacing: 12”
Row Spacing: 12”
Highest Week Usage: 42.17

Total Needed Daily: 8
Total Needed to be Grown: 1,232
Total Square Footage: 1,250 ft2



Root / Tubers

Yellow Onions

Price per Case: $--.--

Quantity per Case: -- lb.

Weight per Unit: 1.00 lb.

Count per Plant:

Plant Growth Time: 100 - 175 days

Yearly Usage: 1,669.941,153.20 lb.

Yearly Cost: $--.--

Plant Spacing: 12”

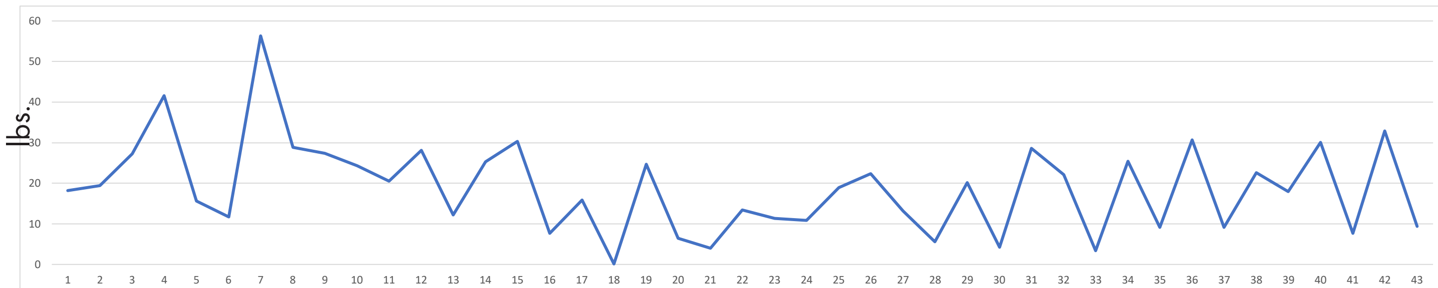
Row Spacing: 12”

Highest Week Usage: 56.31 heads

Total Needed Daily: 4

Total Needed to be Grown: 700

Total Square Footage: 840 ft2



WEEKS

Red Onions

Price per Case: $--.--

Quantity per Case: --

Weight per Unit: 1.35 lb.

Count per Plant: 1

Plant Growth Time: 100 - 175 days

Yearly Usage: 863.77 lb.

Yearly Cost: $--.--

Plant Spacing: 12”

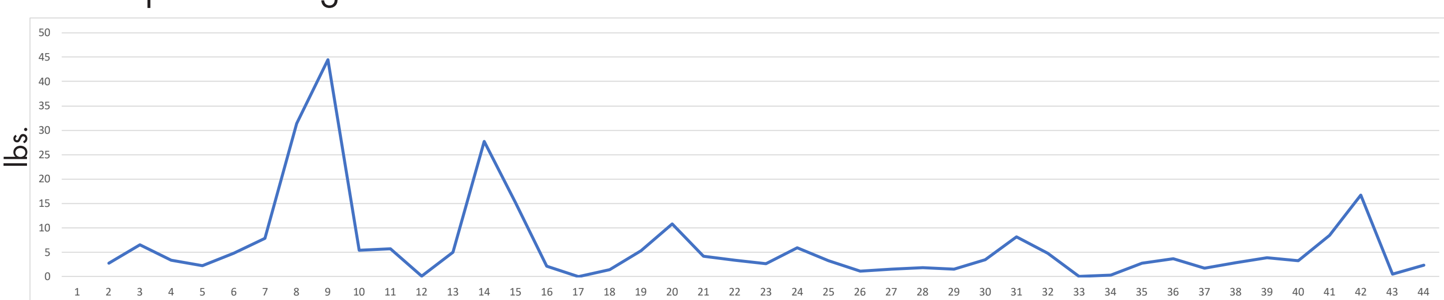
Row Spacing: 12”

Highest Week Usage: 31.43 heads

Total Needed Daily: 5

Total Needed to be Grown: 875

Total Square Footage: 875 ft2



WEEKS

Green Onions

Price per Case: $8.05

Quantity per Case: 2/1 lb.

Weight per Unit: 0.2 lb.

Count per Plant: 1

Plant Growth Time: 70 - 90 days

Yearly Usage: 44.10 lb.

Yearly Cost: $177.50

Plant Spacing: 4”

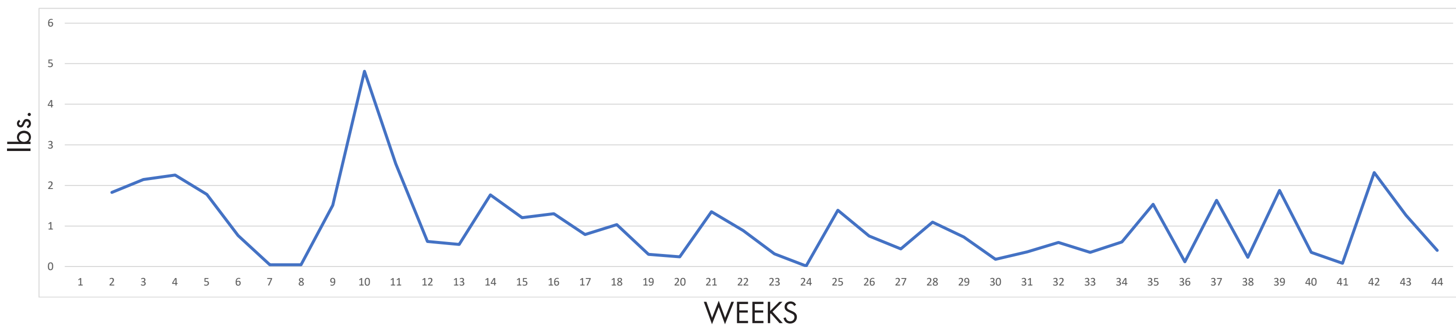
Row Spacing: 4”

Highest Week Usage: 4.81 heads

Total Needed Daily: 5

Total Needed to be Grown: 455

Total Square Footage: 80 ft2



Potatoes

Price per Case: $--.--

Quantity per Case: --

Weight per Unit: 0.75 lb.

Count per Plant: 2-5

Plant Growth Time: 70 - 90 days

Yearly Usage: 2,012.50 lb.

Yearly Cost: $--.--

Plant Spacing: 4”

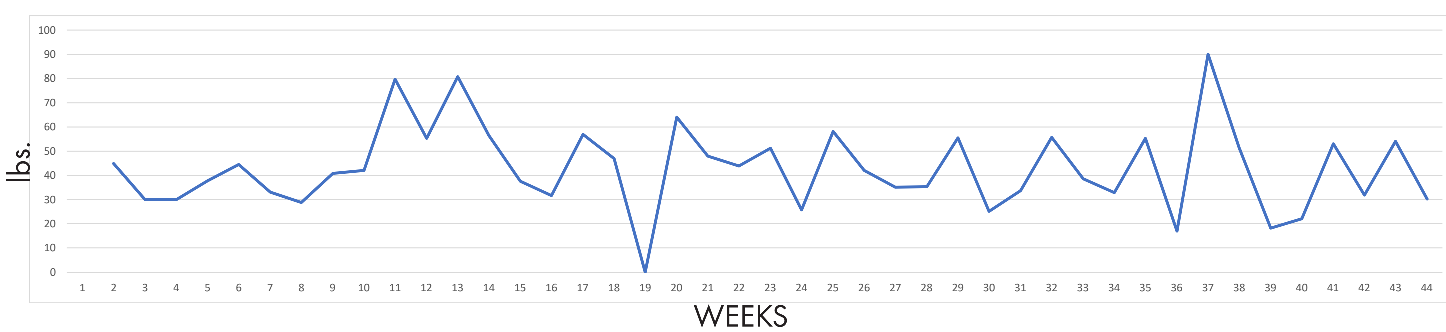
Row Spacing: 12”

Highest Week Usage: 90.01 spuds

Total Needed Daily: 15

Total Needed to be Grown: 683 spuds

Total Square Footage: 340 ft2



Red Potatoes

Price per Case: $--.--

Quantity per Case: --

Weight per Unit: 0.3 lb.

Count per Plant: 5 - 10

Plant Growth Time: 70 - 120 days

Yearly Usage: 1,069.00 lb.

Yearly Cost: $ --.--

Plant Spacing: 6”

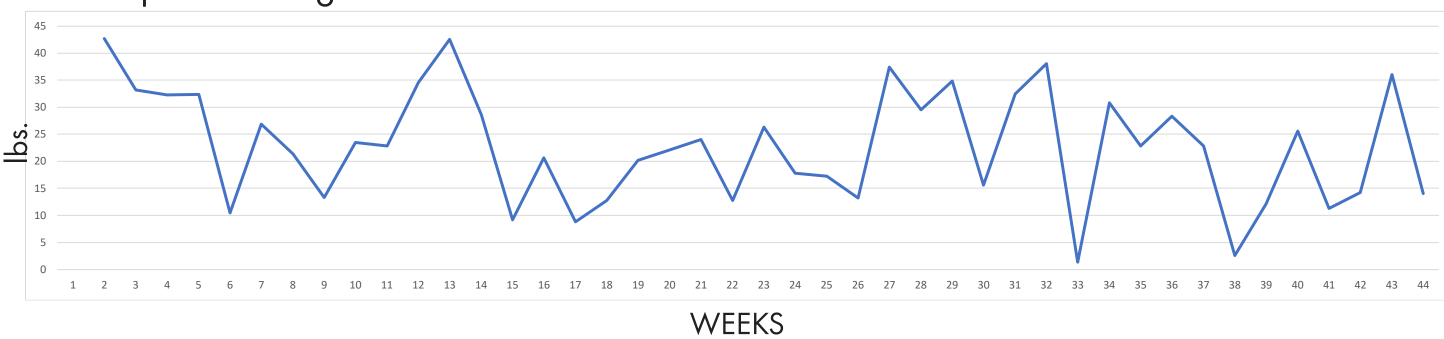
Row Spacing: 6”

Highest Week Usage: 42.67 spuds

Total Needed Daily: --

Total Needed to be Grown: --

Total Square Footage: -- ft2



Carrots

Price per Case: $14.25

Quantity per Case: 4/5 lb.

Weight per Unit: 0.13 lb.

Count per Plant: 1

Plant Growth Time: 70 - 80 days

Yearly Usage: 524.81 lb.

Yearly Cost: $

Plant Spacing: 4”

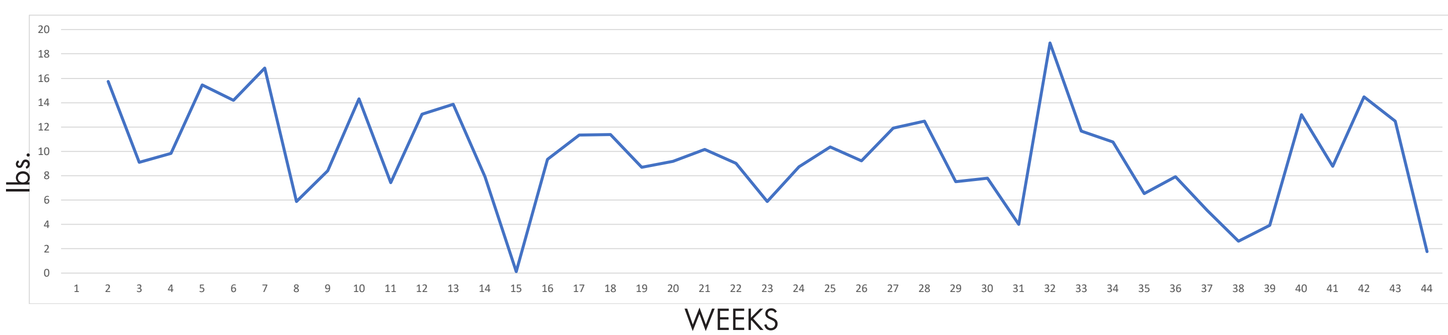
Row Spacing: 4”

Highest Week Usage: 18.92

Total Needed Daily: 12

Total Needed to be Grown: 1092

Total Square Footage: 436.80 ft2



Seeds / Pods

Tomatoes

Price per Case: $20.40

Quantity per Case: 1/25 lb.

Weight per Unit: 0.4 lb.

Count per Plant: 12 - 15

Plant Growth Time: 40 - 60 days

Yearly Usage: 2,721.63lb.

Yearly Cost: $2,220.85

Plant Spacing: 24”

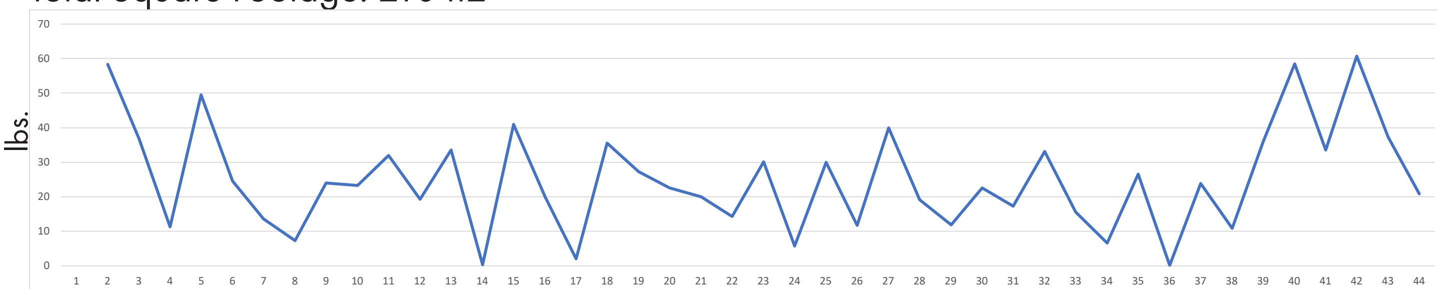
Row Spacing: 30”

Highest Week Usage: 60.67 heads

Total Needed Daily: 25

Total Needed to be Grown: 42 plants

Total Square Footage: 210 ft2



WEEKS

Grape Tomatoes

Price per Case: $9.85

Quantity per Case: 1/5 lb

Weight per Unit: 0.04 lb.

Count per Plant: 50 - 70

Plant Growth Time: 70 - 80 days

Yearly Usage: 139 lb.

Yearly Cost: $273.83

Plant Spacing: 24”

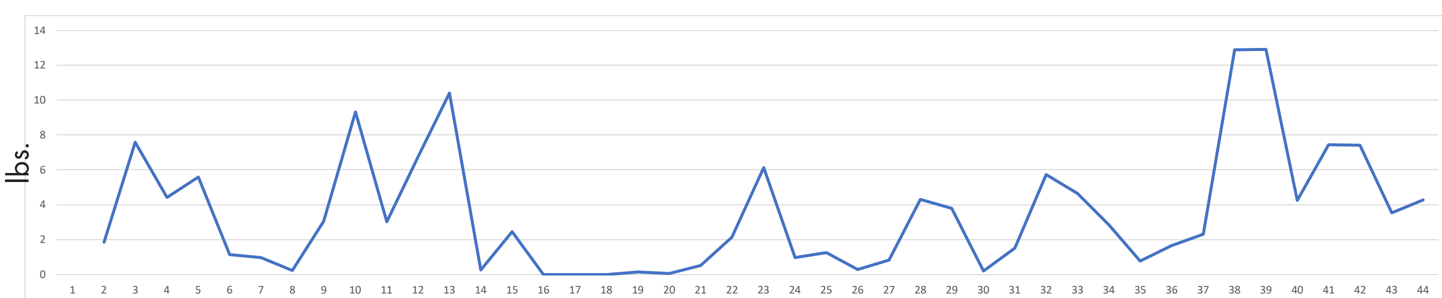
Row Spacing: 30”

Highest Week Usage: 10.39 lb.

Total Needed Daily: 30

Total Needed to be Grown: 36 plants

Total Square Footage: 180 ft2



WEEKS

Green Beans

Price per Case: $--.--

Quantity per Case: 11

Weight per Unit: 0.01 lb.

Count per Plant: 25 - 50

Plant Growth Time: 50 -55 days

Yearly Usage: 978.95 lb.

Yearly Cost: $--.--

Plant Spacing: 4”

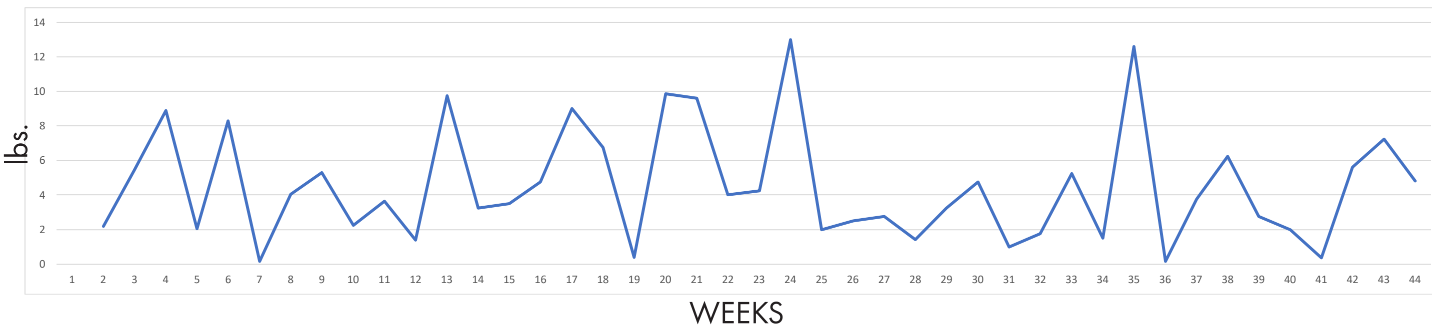
Row Spacing: 12”

Highest Week Usage: 9.85 lb.

Total Needed Daily: 3 - 4 lb.

Total Needed to be Grown: 80

Total Square Footage: 36 ft2



Squash

Price per Case: $7.95

Quantity per Case:

Weight per Unit: 2 lb.

Count per Plant: 3 - 12

Plant Growth Time: 60 days

Yearly Usage: 548.68 lb.

Yearly Cost: $872.40

Plant Spacing: 24”

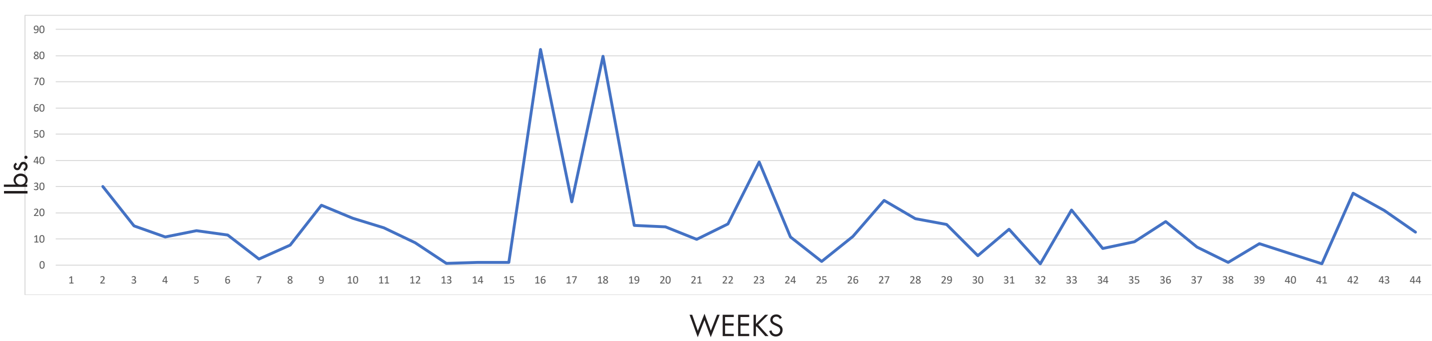
Row Spacing: 24”

Highest Week Usage: 79.84

Total Needed Daily: 9

Total Needed to be Grown: 50

Total Square Footage: 216 ft2



Edamame

Price per Case: $25.36

Quantity per Case:6/25 lb.

Weight per Unit: 0.26 / cup.

Count per Plant: 2.5 lb.

Plant Growth Time: 75 - 85 days

Yearly Usage: 79.1 lb.

Yearly Cost: $--.--

Plant Spacing: 12”

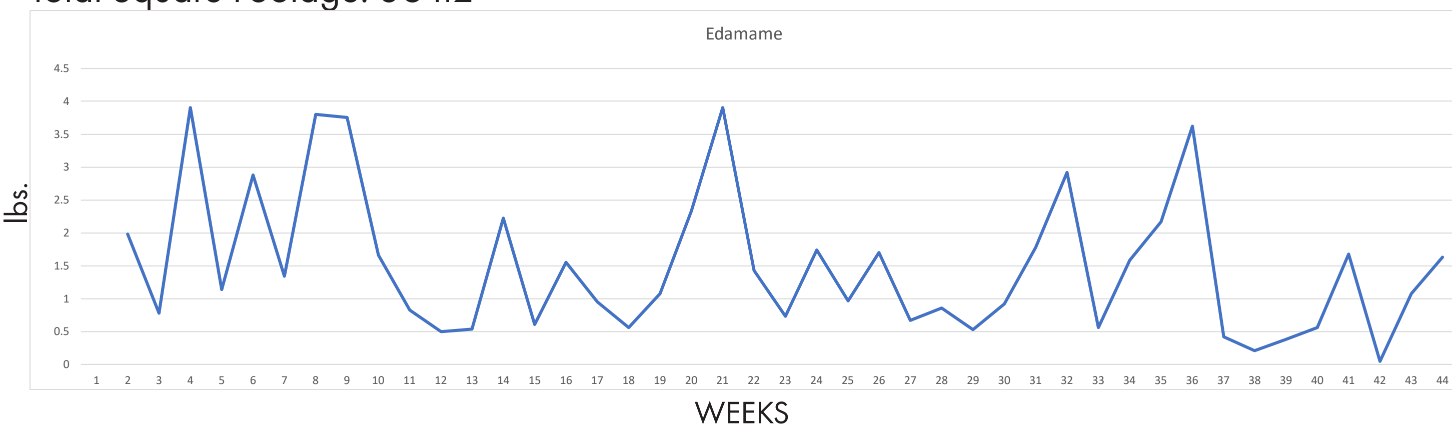
Row Spacing: 12”

Highest Week Usage: 3.9 lb.

Total Needed Daily: 1.5 lbs

Total Needed to be Grown: 33 plants

Total Square Footage: 36 ft2



Green Peppers

Price per Case: $--.--

Quantity per Case:--

Weight per Unit: 0.44 lb.

Count per Plant: 10 - 12

Plant Growth Time: 60 - 90 days

Yearly Usage: 21 lb.

Yearly Cost: $--.--

Plant Spacing: 18”

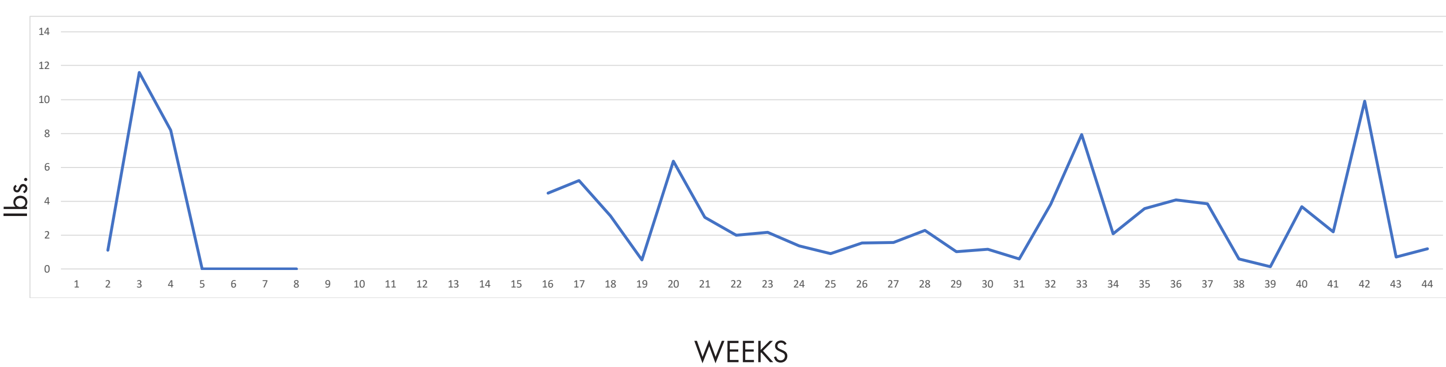
Row Spacing: 18”

Highest Week Usage: 11.6

Total Needed Daily: 5

Total Needed to be Grown: 39 plants

Total Square Footage: 90 ft2



Red Peppers

Price per Case: $24.80

Quantity per Case: 1/ CTN

Weight per Unit: 0.33 lb.

Count per Plant: 10 - 12

Plant Growth Time: 60 - 90 days

Yearly Usage: 371.65 lb.

Yearly Cost: $--.--

Plant Spacing: 18"

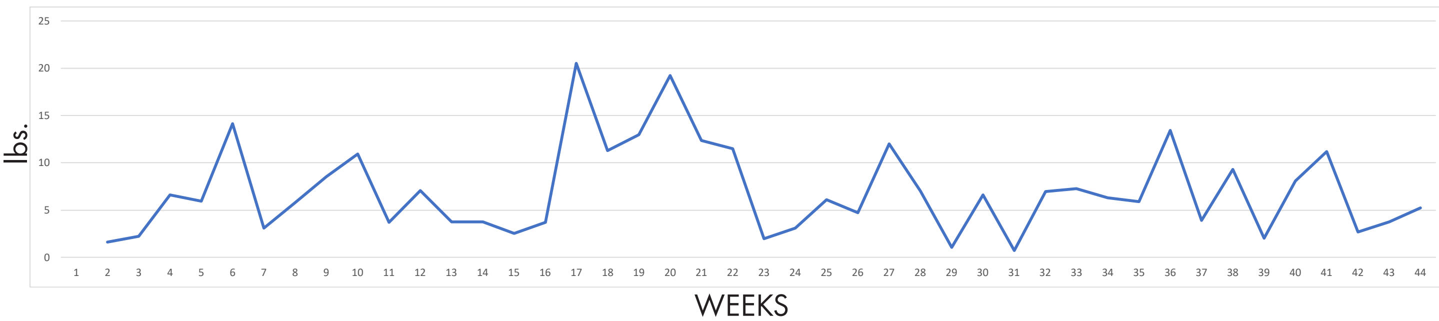
Row Spacing: 18"

Highest Week Usage: 20.52

Total Needed Daily: 9

Total Needed to be Grown: 70 plants

Total Square Footage: 162 ft2



Jalapenos

Price per Case: $9.45

Quantity per Case: 1/5 lb.

Weight per Unit: 0.06 lb.

Count per Plant: 25 - 35

Plant Growth Time: 55 - 85 days

Yearly Usage: 210.53lb.

Yearly Cost: $397.90

Plant Spacing: 12"

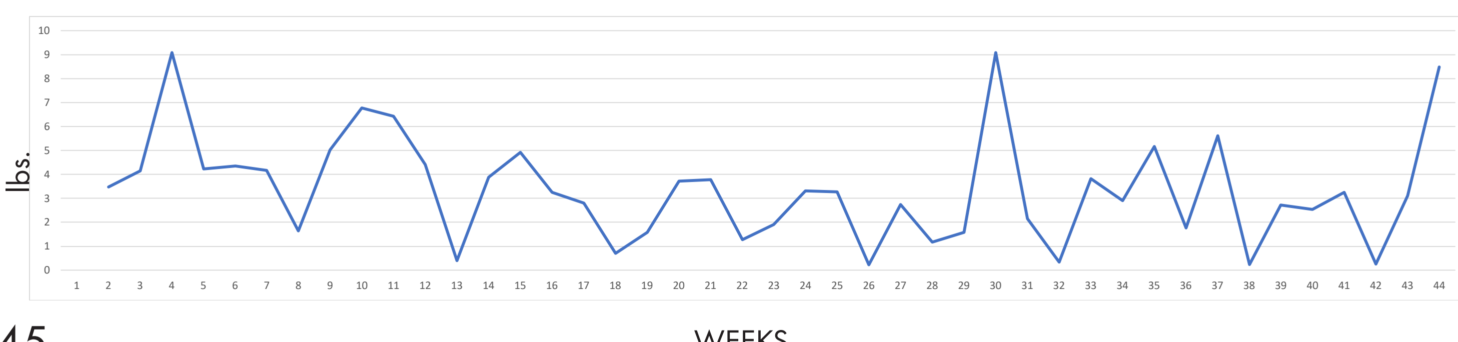
Row Spacing: 12"

Highest Week Usage: 9.1 lb.

Total Needed Daily: 20

Total Needed to be Grown: 73 plants

Total Square Footage: 84 ft2



Zucchini

Price per Case: $6.95 | Yearly Usage: -- lb.

Quantity per Case: 1/5 lb. | Yearly Cost: $--.--

Weight per Unit: 0.33 lb. | Plant Spacing: 24”

Count per Plant: 10 - 25 | Row Spacing: 24”

Plant Growth Time: 60 days | Highest Week Usage: --

Total Needed Daily: 7 | Total Needed to be Grown: 27 plants

Total Square Footage: 120 ft2

**Mint was one of the items that were missing, resulting in some of the reasons there was insufficient data. This was one of the limitations of this thesis.*

Cucumber

Price per Case: $12.54 | Yearly Usage: 726.9lb.

Quantity per Case: 1/24 CT | Yearly Cost: $178.51

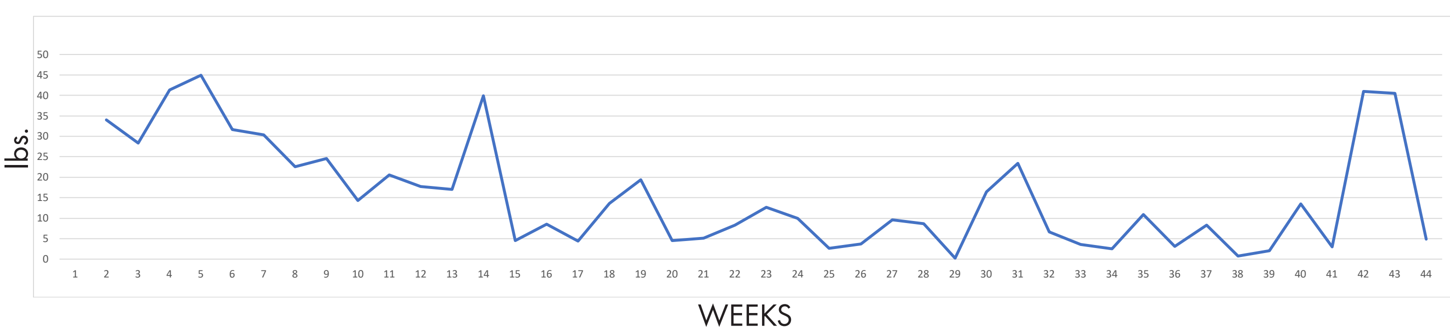
Weight per Unit: 0.33 lb. | Plant Spacing: 36”

Count per Plant: 10 - 12 | Row Spacing: 12”

Plant Growth Time: 50 - 70 days | Highest Week Usage: 44.99

Total Needed Daily: 5 | Total Needed to be Grown: 37 plants

Total Square Footage: 111 ft2



Fruits

Strawberries

Price per Case: $16.52

Quantity per Case: 8/1 lb.

Weight per Unit: 0.05 lb.

Count per Plant: 2 - 3 lb.

Plant Growth Time: 28 - 42 days

Yearly Usage: 289.40 lb.

Yearly Cost: $452.91

Plant Spacing: 20”

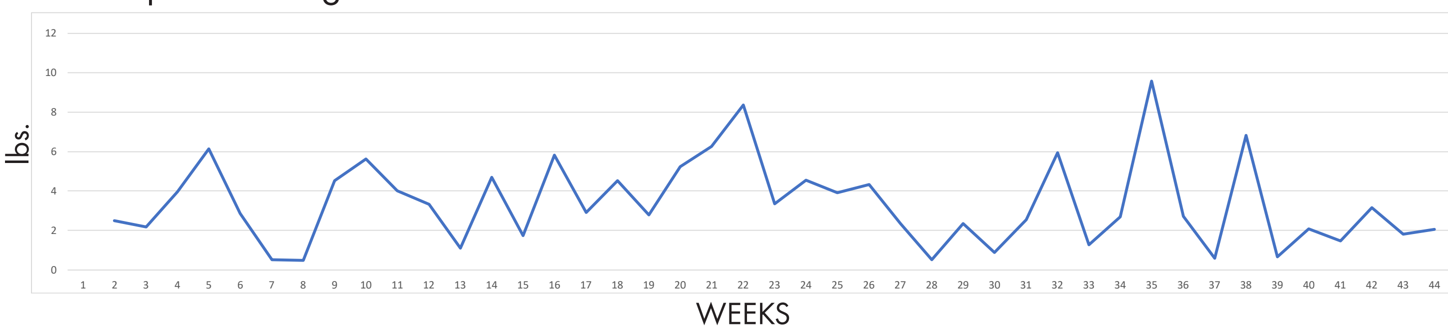
Row Spacing: 36”

Highest Week Usage: 9.58 lb.

Total Needed Daily: 60 - 70

Total Needed to be Grown: 74 plants

Total Square Footage: 480 ft2



Blackberries

Price per Case: $--.--

Quantity per Case: --

Weight per Unit: -- lb.

Count per Plant: 10 - 20 lb.

Plant Growth Time: 35 - 45 days

Yearly Usage: 54.80 lb.

Yearly Cost: $--.--

Plant Spacing: 24”

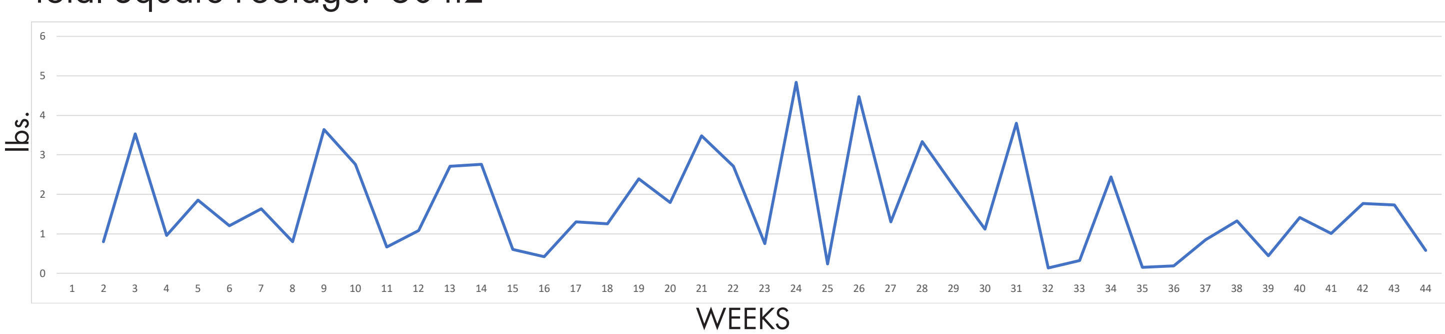
Row Spacing: 24”

Highest Week Usage: 4.83 lb.

Total Needed Daily: 30 - 40

Total Needed to be Grown: 9

Total Square Footage: 60 ft2



Appendix 7

Renderings

This is a night time view of the newly remodeled restaurant

Original Plan

As one enters the restaurant this is the view from the front door.

This is the repostitioned bar along the back wall. that closes off the kitchen.

Original View

Top pictures are of current conditions. The bottom two renderings of what the rooftop will look like after the installation of the greenhouse.

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