

Urban Essentials

by

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Preface

The purpose of this document is to explore the idea of decentralizing the industry of agriculture. If there were any larger intention that should be taken away from this document, it would be that all those who come in contact with the project should see that the project in its entirety is pragmatically achievable. The project is meant to demonstrate a means of decentralizing the industry of agriculture to a regionally, local level.

If a prototype similar to this project were developed, it would severely impact the means by which local production and consumption is managed. Other industries could easily achieve similar goals of decentralization, and this idea has potential to solve many economic, sociological, and environmental issues currently plaguing our global society.

The project would not have been possible without the instruction and guidance of the project mentor, Tom Laging. Other mentors and advisors were, Mark Hoistad, Martin Despang, Kim Todd, Dennis Born, Tim Hemsath, Doug Jackson, Sharon Kuska, and Nate Krug. Without their guidance, the project would not have been achieved.





Table of Contents

- 3.....Abstract
- 4-5.....Prolog
- 7.....Process
- 9-19.....Site Selection
- 21-47.....Research/Analysis
- 49-51.....Intent Narrative
- 53-63.....Process Documentation
- 64-83.....Final Design Documentation
- 85.....Bibliography
- 87.....Acknowledgements



Abstract

Industrial development throughout the world has led to a global society. Although sharing of information and technology is beneficial in many ways, these global means have also created many issues that are not always contributing to economic and social societies. International business is not only unsustainable for environmental reasons, but it also often means that many unethical decisions are made for the purposes of cheap labor, mass revenue, and other un-amiable intentions. The Urban Essentials project's purpose is to create an urban area that searches for a solution against these capitalistic means of business. This idea is realized in the project by concentrating on the industry of agriculture.

Agriculture is the vital connection with the earth that mankind has, to produce food that sustains life in urban settlements. It is the most essential daily element to our survival in cities throughout the world. This project will bring agriculture into the city of Lincoln. The industry of agriculture within the city will also network with the regional industry to create a local agricultural network. In the city there are large growing facilities that are capable of producing agricultural products indoors.

The city center of Lincoln will host one of these growing facilities. Located directly below this facility is a market area. The market will sell fruits, vegetables, herbs, and other products grown above. The market also has ample space for hosting other market venues, which are intended to be locally, owned small businesses. The building is part of a larger urban fabric in which agriculture functions as an industry within the city, independent of outside sources.

Prolog

While examining urban sprawl, it is important to also examine the psychological aspects of the society engaged in the sprawl. When looking at a city like Lincoln, it can be noted that the automobile is heavily embedded into the culture. So far embedded that most living in the city are not accustomed to completing daily tasks, like buying groceries or going to the bank, by means of walking. There is a mindset in the majority of American culture that has little regard for a healthy lifestyle that could be better achieved by means of human force as a means of transportation. It is also logical to think that this lifestyle that would be healthier for the individual body, is also healthier for the environment. However, it should be considered that it may not be that most people wouldn't walk to complete daily tasks, should they have the opportunity. Perhaps the nature of our government and economy severely affect the way we shape our daily lives.

Due to the capitalistic nature of the American economy, cities have suffered greatly. After WWII, housing development began to fall on the outskirts of cities. Following the people, other businesses and industries also began to relocate. Because of the easy use of the automobile and inexpensive fuel, it was generally thought that having more space was a positive thing. However over the last sixty years it has become more apparent that having more space is not always a positive idea.

Since homes, businesses, schools, shops, and industrial structures became more spaced apart, it meant that those activities must be accessed via an individual automobile. Today, most of our cities, including Lincoln, are haunted by large corporate businesses that rely on franchise-

type businesses or corporate means which control mass amounts of our economy. In the case of Lincoln, often these businesses continually develop further away from the center of the city with large parking lots in front of the buildings. This clearly demonstrates the type of urban area they are trying to maintain. It becomes nearly impossible to access these stores without the use of an automobile.

Several consequences erupt from this situation.

One, and possibly the most pressing issue, is the fact that cities which do not encourage human contact via simple means of day to day interaction, essentially commit suicide for a local culture and society that functions as one unit for the betterment of that unit. It is difficult to care for one's neighbor without acknowledging a neighbor's existence. For example, if a person lives in a home in the suburbs with a large garage, how does that person relate to other people in his or her local community? Given the opportunity this person could potentially walk from his kitchen to garage every morning and get in his car. He then presses a button, and a garage door raises. He drives for fifteen minutes and parks in a parking structure, and then walks across a skywalk to his office where he sits in his cubical for eight hours, and only interacts with his surrounding cubical neighbors who do the same job he does. At 5:00 he walks back across the skywalk to his car, and safely drives into his garage closing the garage door behind him. He then goes inside, and remains a lump on a couch for the remainder of the evening.

This person, should he exist, has in one entire day only had human interaction with his colleagues who have the

exact same experiences each day as he does. He doesn't see other people with other cares or concerns. Rather, he sees only cars with silhouetted images that seem to be other humans. If he doesn't see and know other people and acknowledge their presence in the slightest manner, how can he possibly feel any regard to existing in a large global society?

It is that day-to-day human interaction that allows us to accept that we are a small part of a huge society. If each of us were able to see thousands of people walking around each day, we most certainly would be forced to acknowledge our own insignificance. Therefore, it must be assumed that the gentleman, who only sees cars and not people each day, must find it more difficult to acknowledge these facts.

So, those who can say that they do not care about the future of our environment and economy because it will not affect them as individuals within their lifetimes, can be assumed to have achieved these ideas through their lack of interaction with society. These selfish ideas have not only been imbedded into our culture by means of lack of human interaction, but they are also the nature of capitalism. Capitalism, put simply, is merely a means of gaining capital, money, to further one's own wealth with little regard for the rest of society.

How is it that one who has lived the majority of his life, say forty years or so, within a capitalistic society, suddenly is supposed to care about daily tasks like recycling? If he does not see another doing the same task, what stops him from placing a can in a waste bin rather than a can bin?

Without further governmental encouragement via policy, it is nearly impossible to change a society just by giving one the opportunity to suddenly recycle, particularly when it is most often more difficult to recycle.

This document is not about recycling or global warming although those things may be affected by the impacts of this project. The main goal of this project is to create a sustainable local economy. Through this economy a sustainable society can function dependent only on itself. Business can and should function with the outside global society, but it should be done through ethical means.

The idea is to attack capitalism from a new angle. This project will do so by striving to de-centralize industry in a backward manner. First, by looking at a global situation and then focusing downwards to a local community and society. If economies, industries, cities, countries, and global societies can begin to function with less dependence on a global economy, then they are more likely to survive as independent entities. It is important for cities to remain independent to retain cultural diversity, civic pride, and ability to survive as a larger society. Individual ownership of one's own business increases personal pride in one's own life, city, economy, and world. It is much easier for these local businesses to exist when they aren't competing against giant corporate businesses that also happen to destroy the intimate urban fabric of cities like Lincoln.

What does all of this mean?

In no way does this project intend to write policy, nor does it intend to rely on a 'grass-roots' means of influencing

society, urban design, and architecture. Rather, it is about finding a new way of approaching the process of design. The project intends to be an initiative and starting point for a city like Lincoln to begin striving toward a better lifestyle for citizens and a stronger society.

The downtown Lincoln area is the ideal place to begin making a stand toward a different lifestyle. At this point it may be too radical to tell Lincoln residents that the lifestyle that they choose is 'destroying the world'. While a case could be made to demonstrate this, the Urban Essentials project will take a less direct approach toward advocating the same message. Many residents in Lincoln have most likely never had the opportunity to live a lifestyle which does not revolve around the automobile. This project will further insinuate the idea of living in an environment that has a more 'ideal' lifestyle. This idea can be seen as already being activated through the increasing housing developments currently being erected in downtown Lincoln.

As the housing market in downtown Lincoln rises, it should be noted that the markets of other businesses in the downtown area are decreasing, stagnant, or nonexistent. This project will address certain voids in the market. One main void to be addressed is the lack of a place to buy groceries in the downtown area. As we look at existing grocery stores around Lincoln, one must cross a war zone of cars from the sidewalk to the entrance of the store. This is not a new story. It exists in many types of business in Lincoln and in many other American cities. If one needs to be a pedestrian in Lincoln, he or she must walk along giant streets with no buildings on the either side, rather empty parking lots and voided spaces.

A grocery store in downtown Lincoln can begin to change the outlook of many on completing daily tasks like buying groceries. This will not only give more residents the opportunity to live without a car, but it can also engage the mindset of many citizens in Lincoln, so that the store can make a small contribution to society by demonstrating the lack of need for individual transportation. The store also provides the daily essentials for the community in which it will be located.



Process

In the case of Urban Essentials the problem for a building is approached in a contrasting manner. A large dilemma concerning global economies, global businesses and corporations, and global industries was realized. A proposition to solve a portion of this large issue was realized. That proposition dealt entirely with the industry of agriculture. After concluding that the international production and trade of agricultural products is currently achieved by way of immoral practices, it was decided that the decentralization of this industry to a regional level near Lincoln, NE would become the main objection. From this point a system of urban agriculture within the city whose purpose is primarily for the production of food was developed. Various structures within the city also were located to produce interior agricultural products and to distribute and temporarily store these products. For an architectural design a structure that would house a market and an indoor growing facility were located within the urban area. The building was then designed around contextual site restraints. Programmatic considerations were then maximized for product and leasable space within the given volume the site allowed.



Site Selection

The location of the site was chosen based upon several factors. The contextual environment, current and future access to the site both pedestrian and public transportation, and current site usage were all contributing factors to choosing the most appropriate site.

Currently the Urban Development office in Lincoln is coordinating two very large projects that are adjacent to the site. One is located directly west of the site, and the other is located on the northwest corner of 14th and Q streets. Together these two developments will make for 338 new residential units available. Based upon the downtown-housing ratio of 1.3 persons per household unit, which was achieved using demographic statistics according to the Downtown Neighborhood Association, this would add an additional 439 residents to the area.

In terms of the Urban Essentials project, these other developments are seen as catalyst developments that will provide a larger permanent population who will use and interact with the grocery market/ growing facility.

The location of the site based upon its other surroundings is important and significant. The site is adjacent to Centennial Mall. Centennial Mall is a partial road/ urban park that connects the Nebraska State Capitol Building to the University. This connection is valuable to the Urban Essentials project due to the opportunity of public interaction within public spaces that also processes civic importance.

Currently there are four blocks located on Centennial Mall, which possess park-like atmospheres. Some of which is

beautifully landscaped space. Unfortunately, these spaces are severely underutilized. After observing these spaces, the most dependable and continuous use is by smokers who work in the State Building, a block from the State Capitol. Urban Essentials will encourage more public interaction on the Mall.

Due to the site's location to the university, there are increased levels of student pedestrian traffic in comparison to other areas throughout the city. There is a coffee shop that was recently built on the far west side of the Urban Essentials site. This venue encourages more pedestrians in the area, as well as the outdoor seating increases activity on the street. Overall, the addition of the coffee shop has been a great success to the site. The Urban Essentials project should encourage the same street activity via a similar use of space on this portion of the lot.

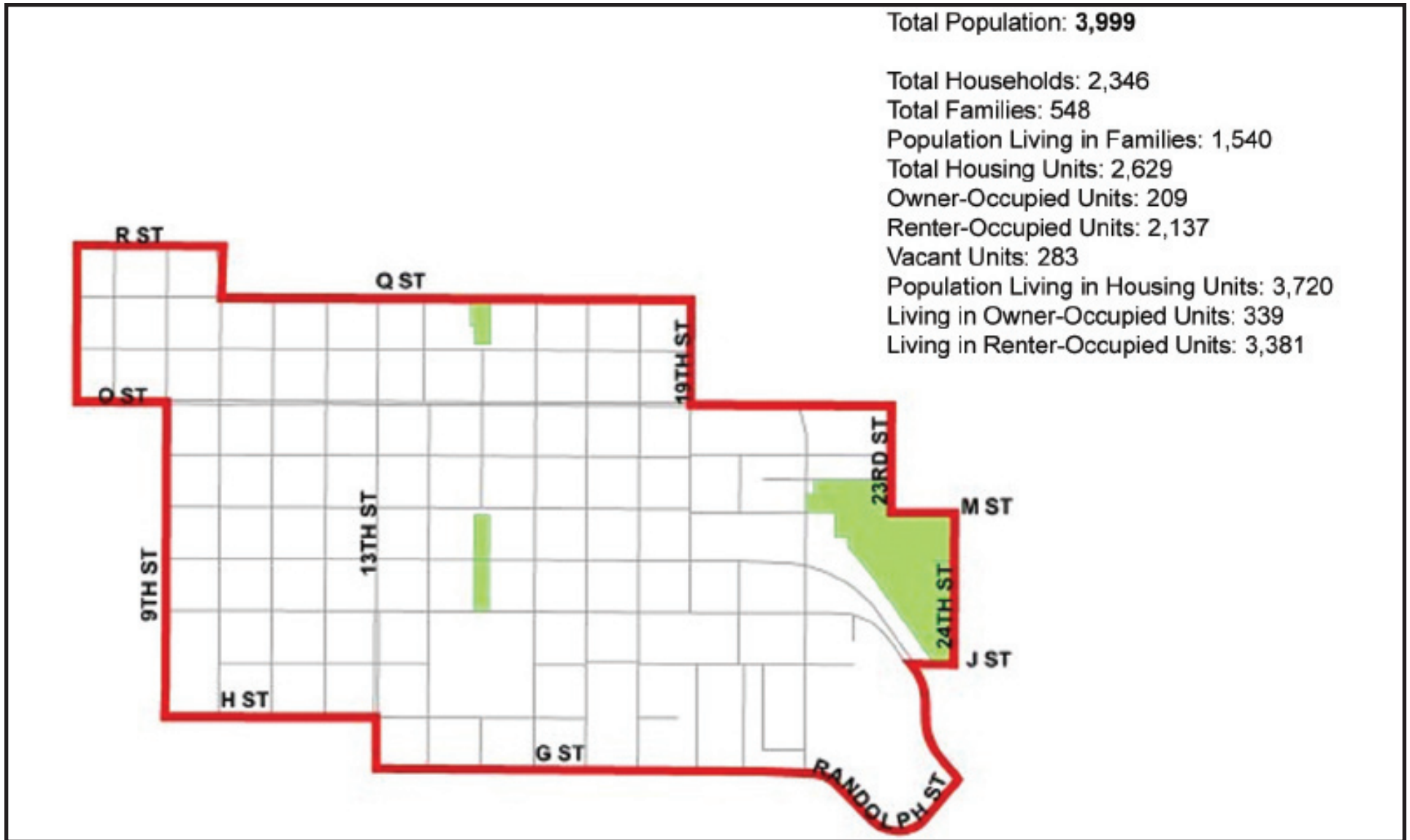
Unfortunately, this coffee shop, called Kopeli, is owned by a local fast-food restaurant chain. Through other observations throughout the city this chain depends on drive through services to provide service to customers. A drive through service point has also been added Kopeli. The addition of this drive-through space makes it one of three small fast-food chains on the site. The other two are called Amigos and Arbys. In addition to these drive-through spaces, there are parking lots and setbacks for the buildings. All of these factors combined disrupts the unity of the urban area. There is a complete lack of an urban façade with the exception of the west side of the site. The Arbys restaurant located on the far eastern portion of the site also has a parking lot adjacent to the urban park.

It is entirely inappropriate to have drive-through venues located in what should be a dense urban area. This was indeed another reason for choosing the site. The loss of these three structures will not hinder the urban area. Urban Essentials will require the removal of these three structures. This will leave the site clean and flat.

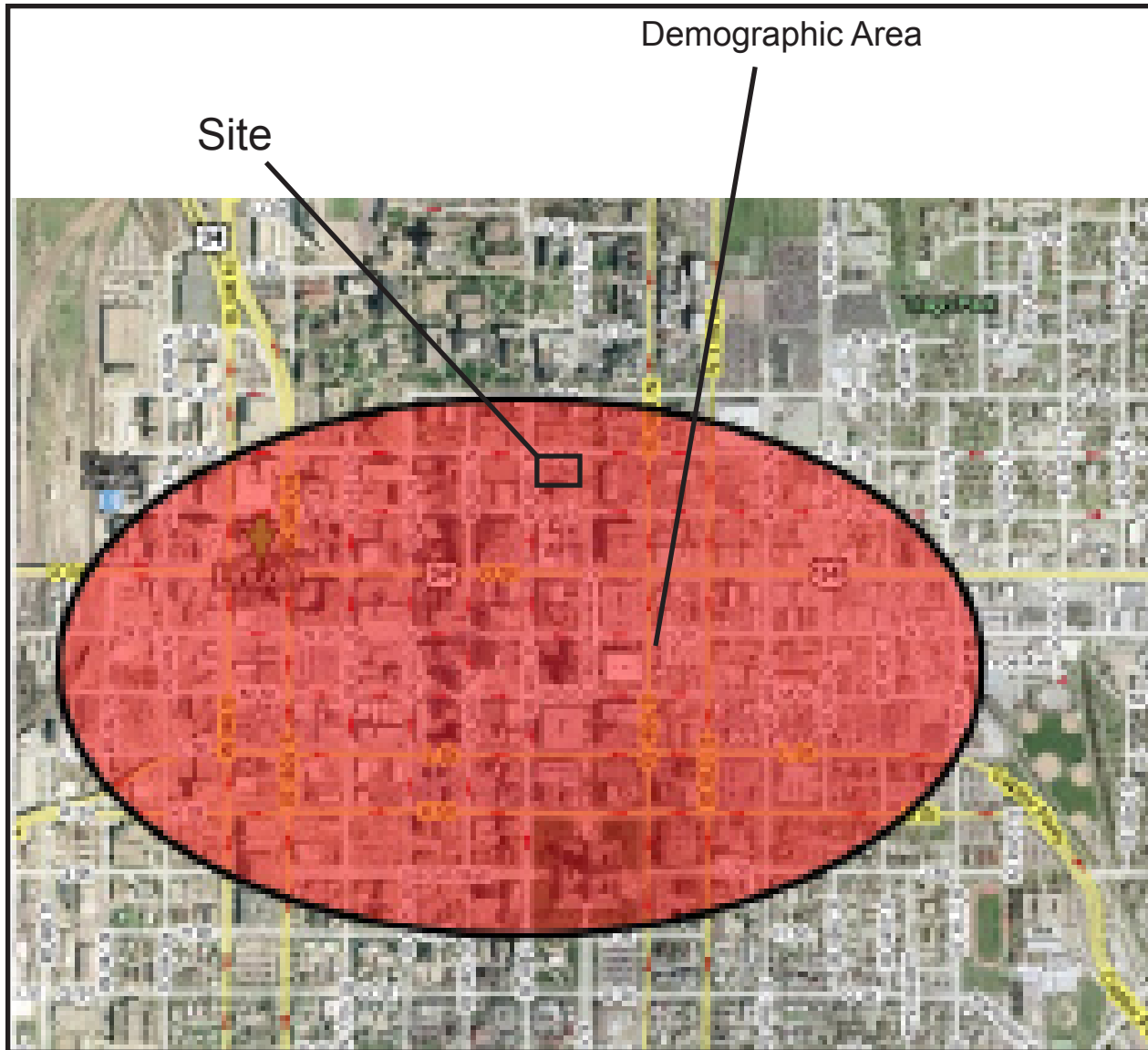
Additionally, the city of Lincoln is proposing a new bus shuttle, which will make a circle around the site. It will travel along P & Q streets between the Haymarket and Antelope Valley areas. This would place the market in the center of these developments. The city of Lincoln is proposing this new shuttle along what the city wants to become a retail corridor. The market will become the center of this retail corridor. Appropriately so given the parameters and objectives of the project.

The diagram, on page 12, shows that the site is located at the intersection along the P/Q corridor and Centennial Mall. This location is as a keystone in the urban fabric based upon the intentions and future development within the city. Locating a market on the site is an ideal use for the site. By placing a growing facility above the market, many original objectives can be achieved. Most obviously of these objectives is the availability of social change through architecture.

Downtown Demographics- according to the Urban Development Office



Housing Demand



Population living in Downtown Lincoln
2005-2006 = 1,500

338 new units to be added in new buildings x 1.3
(household ratio) = 439 additional residents

Total Population = 1939

Projection of population over a 10 year period (from
2003-2013) for Antelope Valley and Downtown ac-
cording to the Downtown Neighborhood Association

Increase in...

Rental Units - 1,385

Sale Units - 465

Total - 1850

$1850 \times 1.3 = 2405$

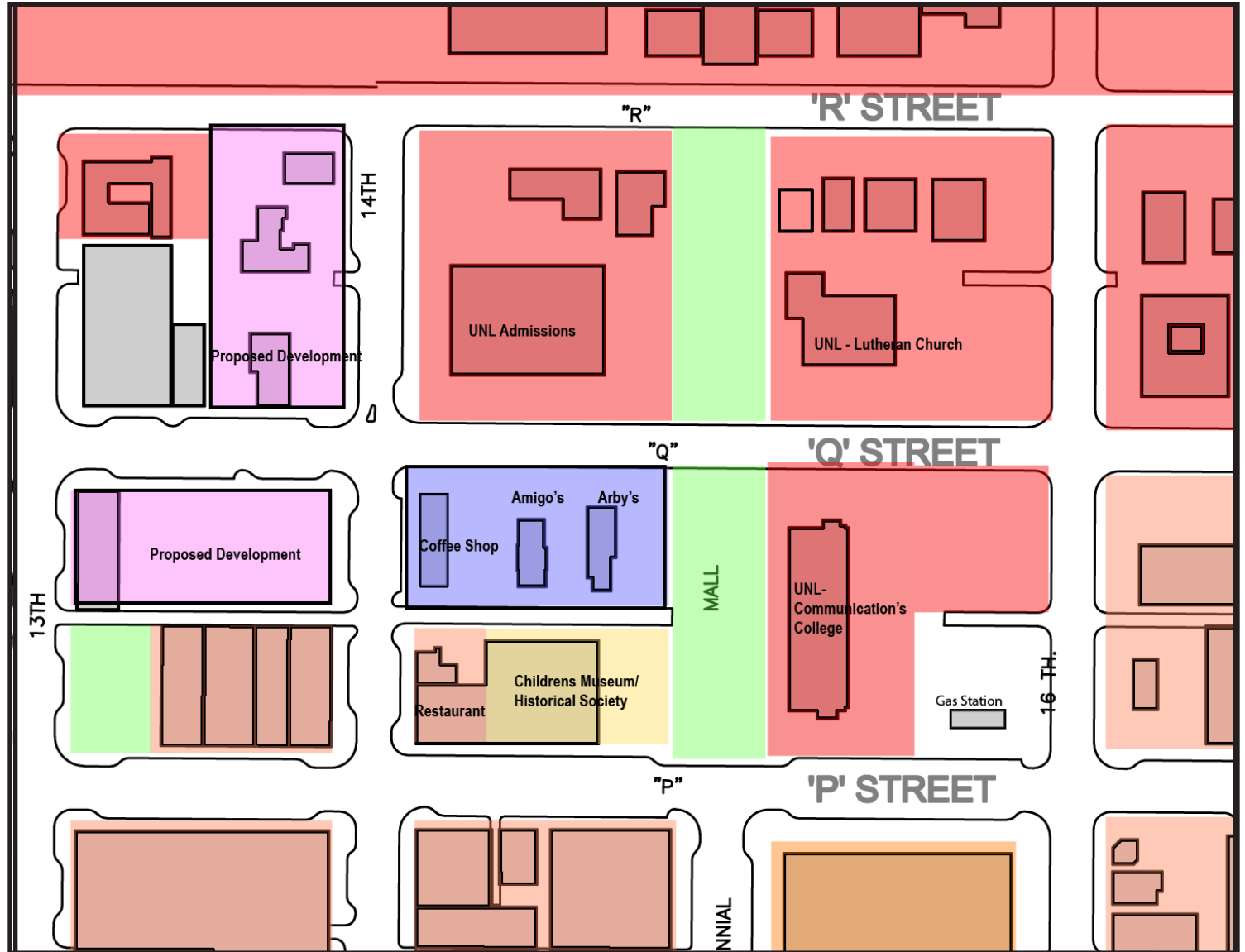
$2405 + 1500$

Total Population = 3905

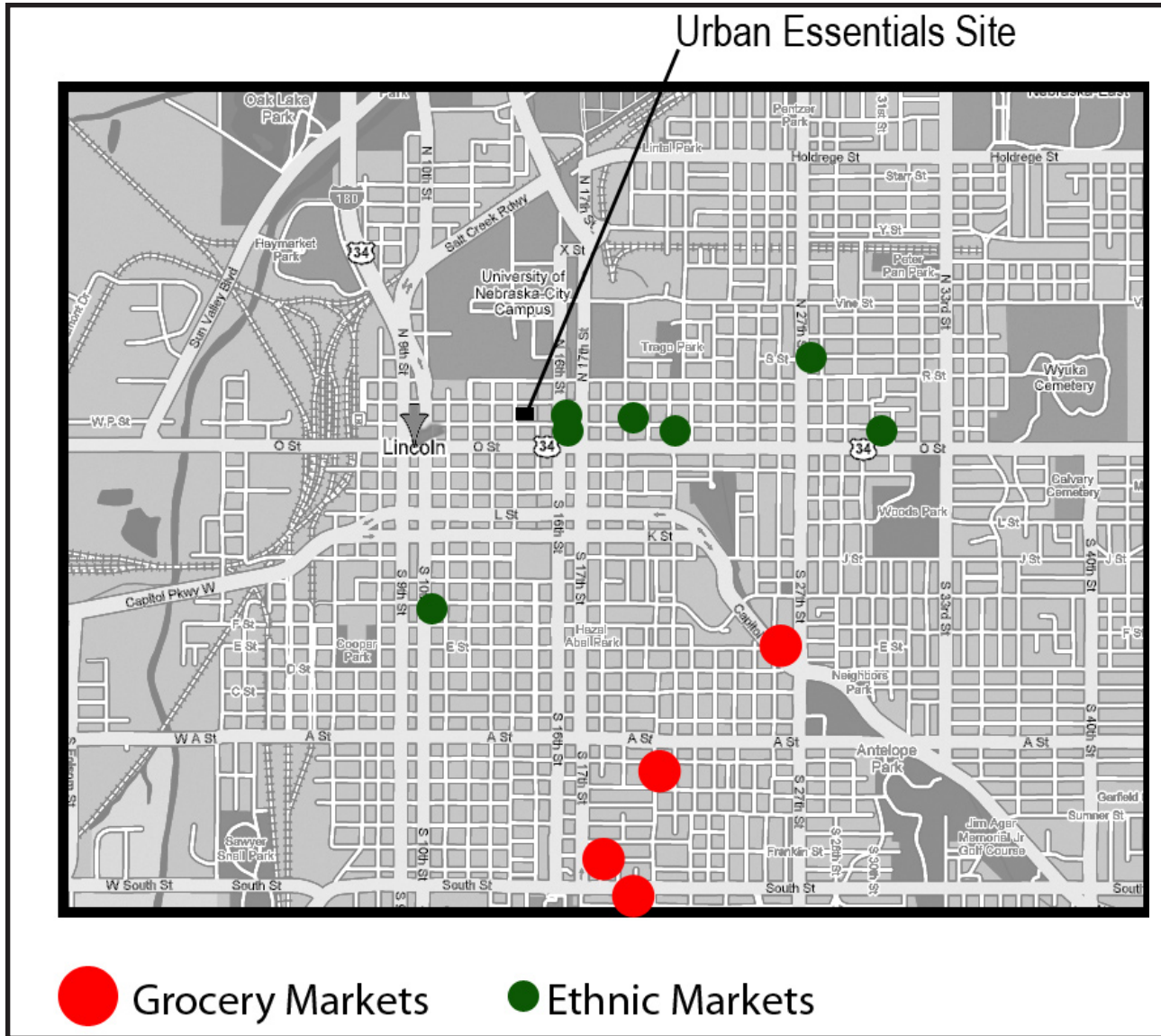
Site Adjacency Spatial Usage



There is a large mixture of development near the site. This should add to the site given the adjacent urban park. However, the park is severely underused. The parking spaces between the children's museum and the urban park certainly do not contribute to the atmosphere of the park. Having a market venue in the area may increase pedestrian traffic and make the street livelier.

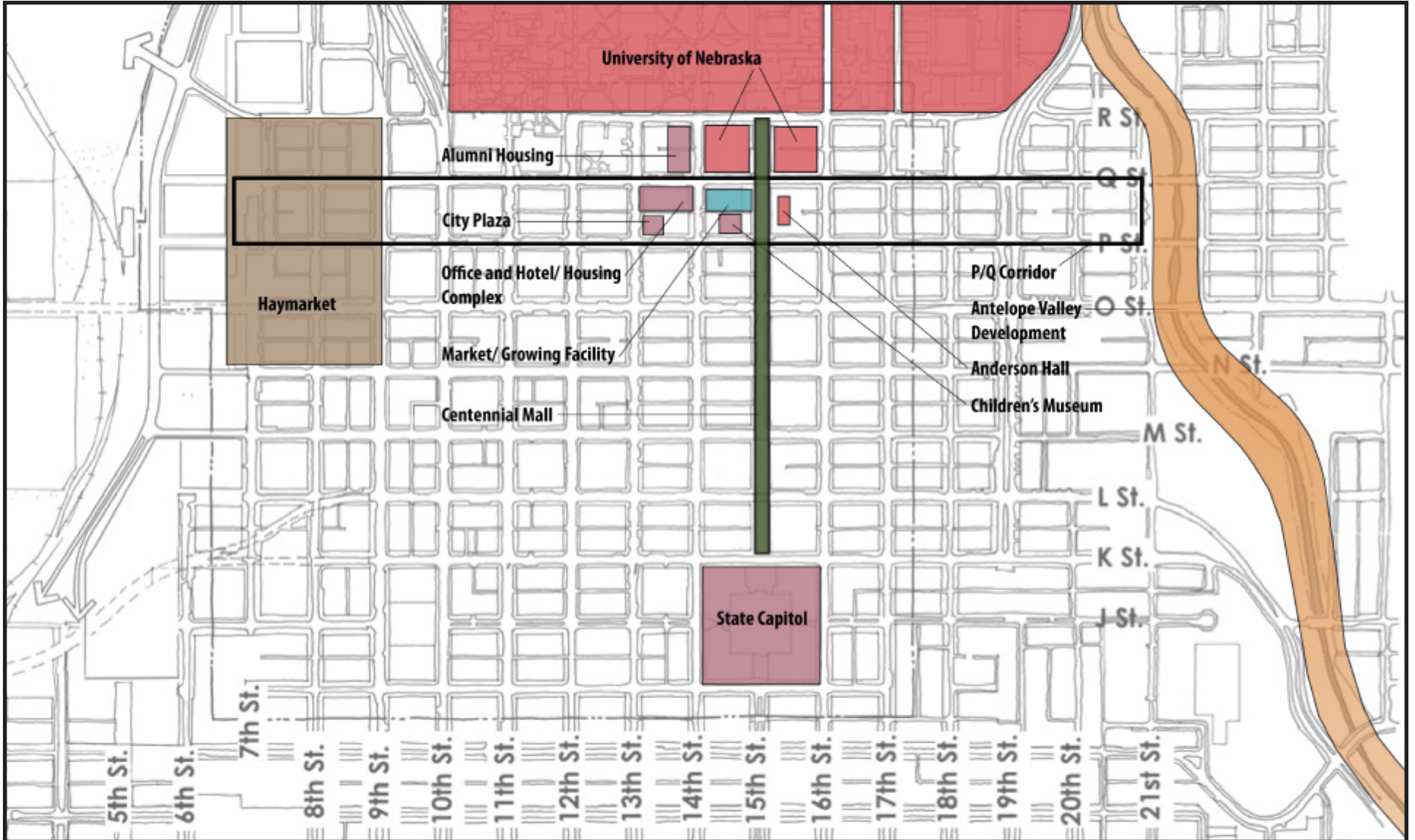


Market Analysis



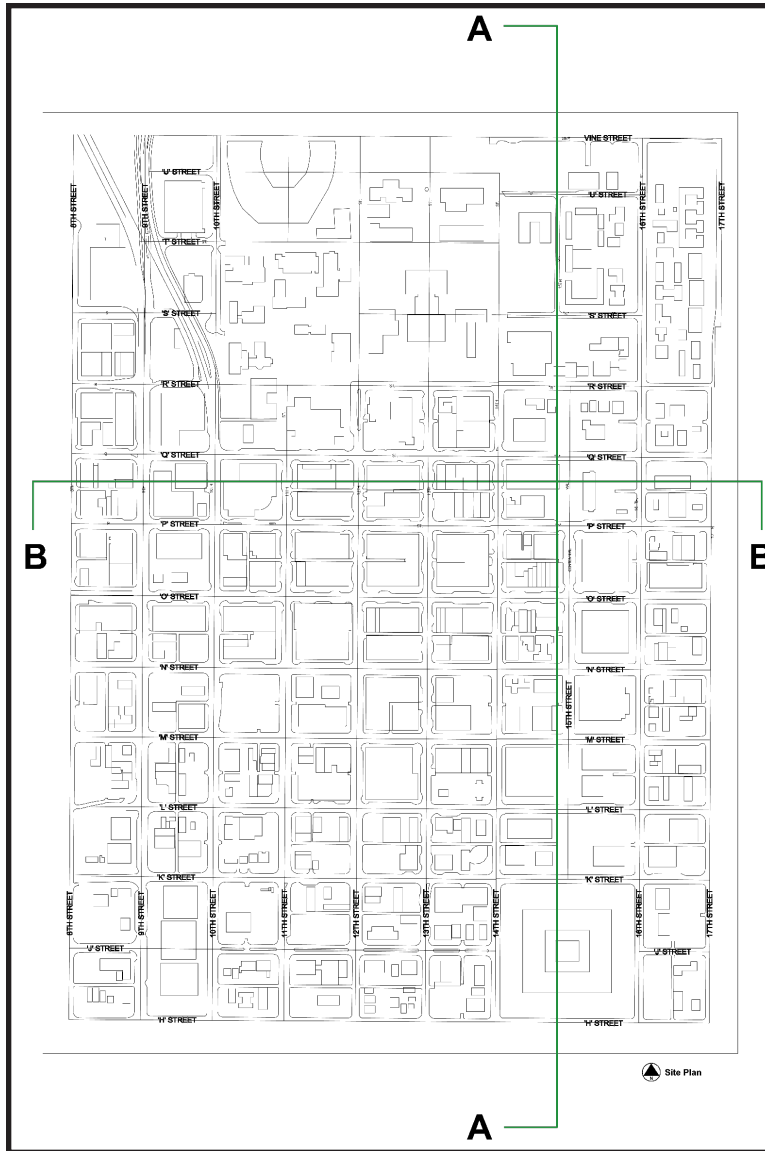
Currently there are no grocery markets within walking distance of the downtown district. There are many small ethnic markets in the area, but there are no larger markets where fruits, vegetables, meats, dairy products, and other needs are available. This makes it difficult for downtown residents to purchase their daily needs.

Other Developments

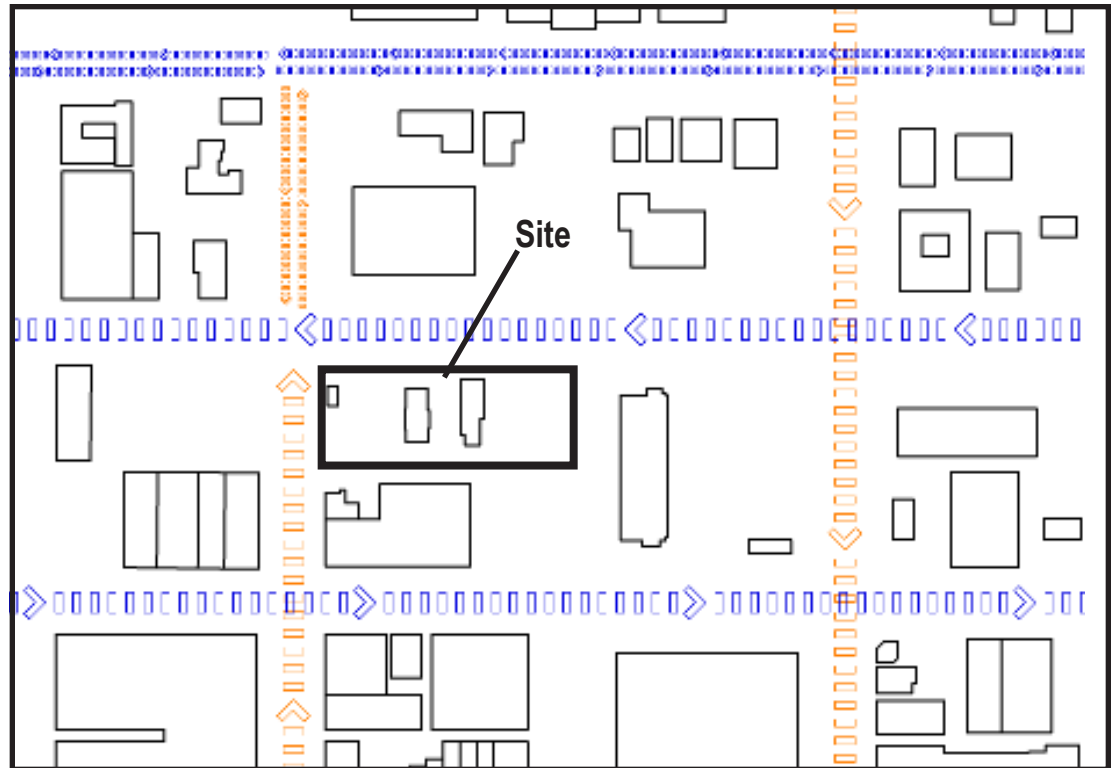
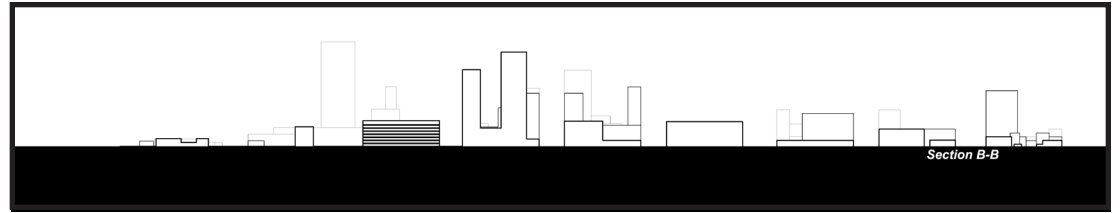


The above diagram shows the location of the site in relation to existing and future developments.

Site Information



The above image shows a site plan with section cuts and street labels.



The drawing above shows the vehicular traffic direction on the streets near the site. Many of these streets are one-way streets.

Adjacent Site Developments

Farmer's Market

The largest of Lincoln's farmer's market is currently located in a district called the Haymarket. This district is Lincoln's historic district. It has specialty shops, restaurants, office space, and residences. It is well developed with little leasable space vacant in comparison to the rest of the downtown area.

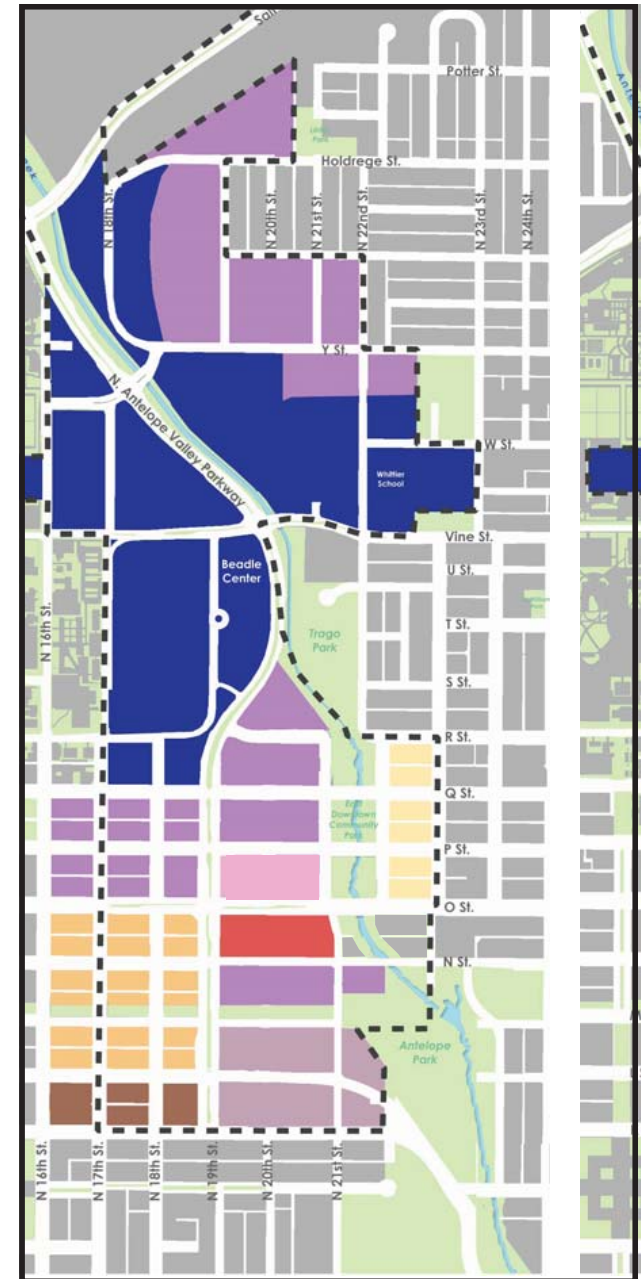
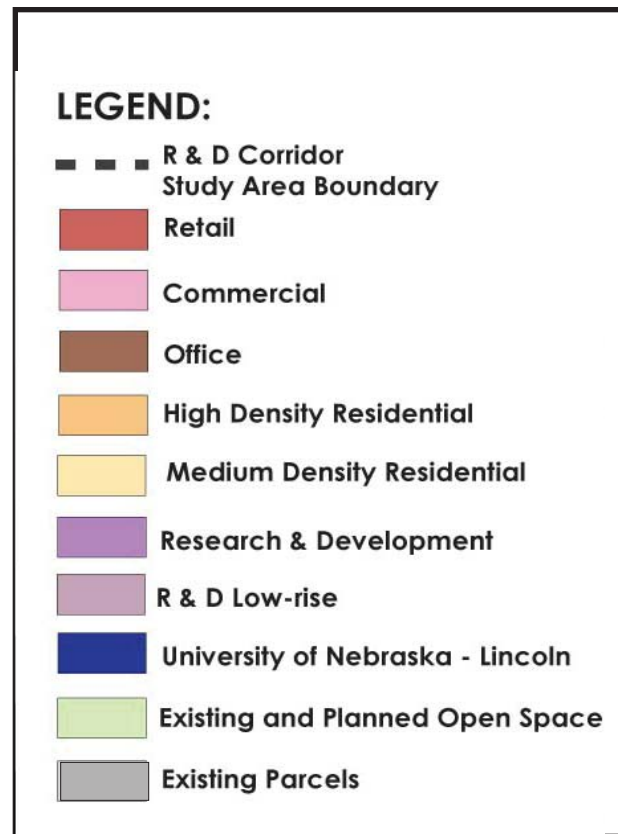
The market itself has nearly 200 vendors, according to the Haymarket's website. It runs from early May through mid October each year. The market in the morning is crowded and excels in portraying what a market should be like. Interaction among citizens is outstanding with pedestrian visitors crowding the streets and unlike any other experience in Lincoln. However, the market is only on Saturdays, and is located in a space that has adequate business.



The image above is of a vendor at the Farmer's Market in Lincoln's Haymarket. The image was taken from <http://www.historichaymarket.info/>

Antelope Valley

Antelope Valley is a development that is still under construction. Antelope Valley Creek was piped and buried under much of the city of Lincoln many years ago. The concept for the new development is to uncover and celebrate the creek throughout the city. Near the Urban Essentials project is an area that will be highly developed as a public space near the creek. A lot of high density residential will also be added to the area. This will provide additional customers to the market due to its proximity to the Antelope Valley Development.



The image above depicts the future types of development along Antelope Valley Creek. The image and key to the right were taken from <http://lincoln.ne.gov/city/urban/AVindex.htm>.

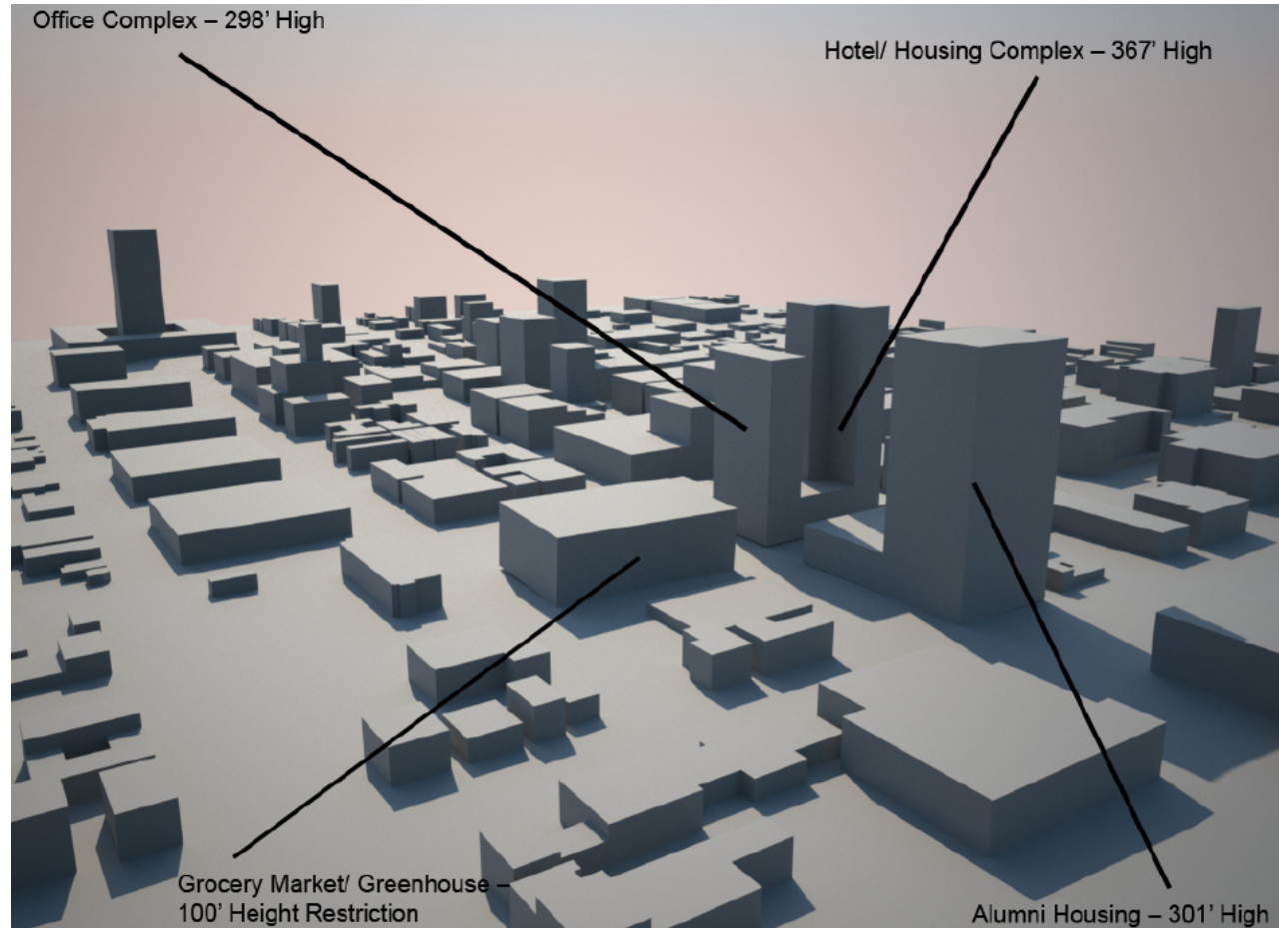
Catalyst Developments

Two developments located west and northwest from the Urban Essentials project will add a significant amount of site activity. Although these two projects are still in the stages of negotiation, in terms of the Urban Essentials project they will be referenced at their stage in development as of September of 2007 according to the Urban Development Office in Lincoln, NE.

The development directly west of the Urban Essentials site will be developed into a large multi-use building. A large parking structure will be located under a hotel, office, and housing complex with retail on the ground level. It will have two towers of 298' and 367' high. The complex will be quite large with many permanent and non-permanent patrons.

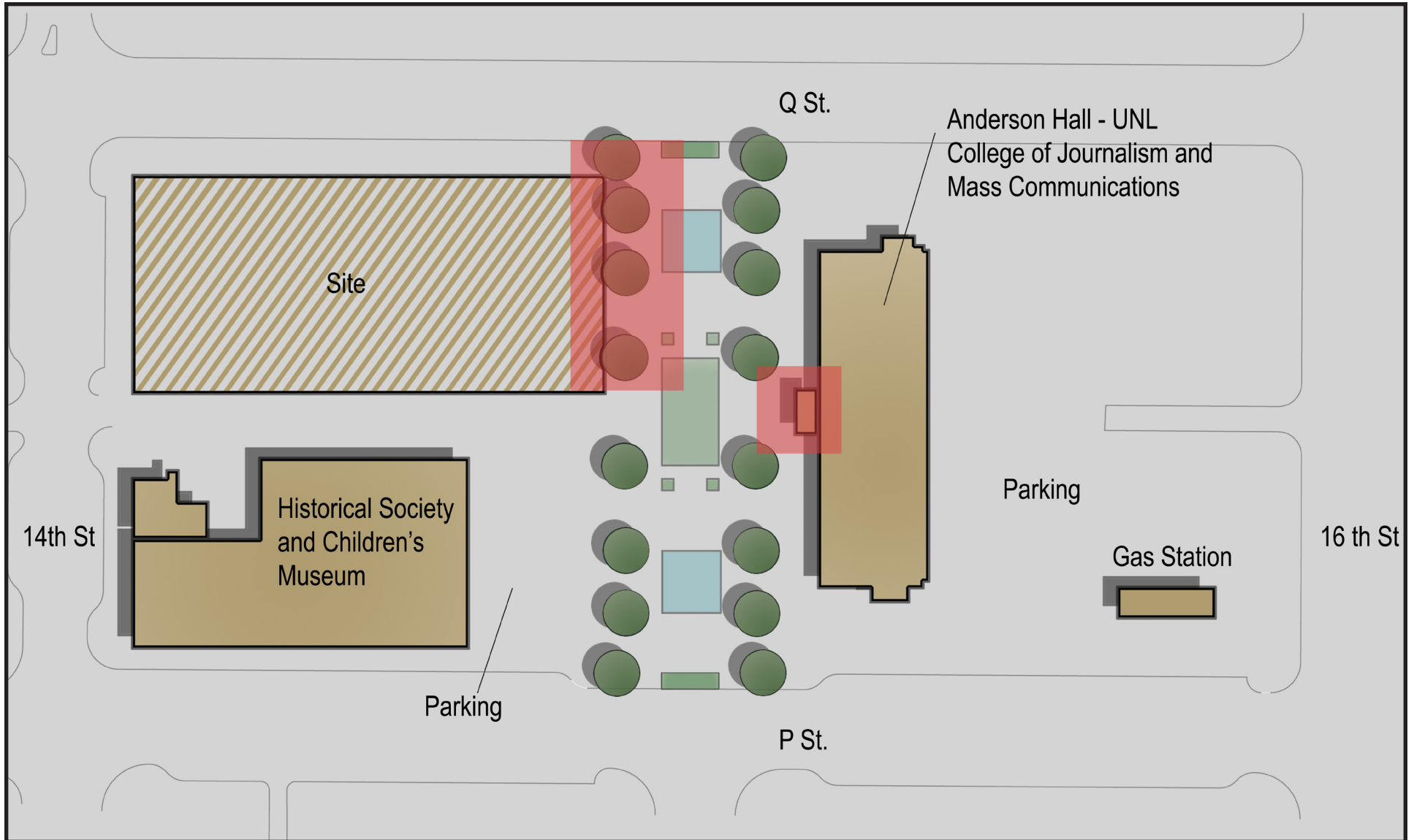
The development to the northwest will host another large parking structure with retail on the ground level on the south portion of the building. The north portion of the building will be used for alumni housing for the University with retail also located on the ground level. The tower on the north part of the site will be 367' high.

According to the Capitol Environs District, a group that regulates the design of the buildings adjacent to Centennial mall, building heights along Centennial Mall are limited to 100' in height. This is due to the Capitol building being in direct sight on the mall. It also has restrictions regarding material types. It states that masonry materials are encouraged. For the circumstances of this project, material guidelines will not be incorporated due to the large contribution the structure will bring the mall in terms of street activity as well as economic development.



The above image depicts the building height and location on the Urban Essentials site as well as the Catalyst Developments building heights adjacent to the site.

Urban Park Existing Plan



Above is a drawing of the immediate park adjacent to the site. This is one of four smaller parks located on Centennial Mall. Existing trees, grass, and water features are shown. Highlighted in red are places of interaction. The red square on the right indicates an outdoor area from Anderson Hall. There are currently chairs and tables, which are used by students and faculty within the Communications Department. The red square on the left indicates the most important area of interaction from the site to the urban park.

Urban Park Images



Images above show the urban park area. The large fountains on are un-useful most of the year, and in the summer of 2007 they were not turned on at all. They are made of concrete, and are not contributing to the overall environment. While many plants in the park are beautiful much of the landscape is cracked and worn. There also is a complete lack of enclosure in the space.

Grocery Market Business Type

Since the project does not have a real client, there was an opportunity to design the business type for the project. The most important aspect in choosing a business type was considering what is appropriate for the location of the new store. Due to the dense urban area, as well as the projects intentions to create a socially sustainable and decentralized business type, any sort of corporate or chain type business was frowned upon.

Another important idea is that the grocery store would sell the produce grown above in the growing facility. So, the relationship between the store and the growing facility is important. In order to effectively work with the regional farming network, the store's produce section must be a well-managed system. Some fruits and vegetables may be purchased from local farmers and then sold in the store. Due to the climate of the regional area, farmers aren't able to grow produce year round. So, the in those seasons the growing facility can make up for the loss of product. However there are some local indoor growing facilities to date. One, according to Delsie Ervin, the produce director with Open Harvest, is located in Nebraska City. Its primary purpose is to produce tomatoes year round. Therefore, the indoor growing facility in Lincoln would not need to produce an abundance of tomatoes since most of the tomatoes could be purchased and resold from the existing facility.

While this accommodated for the local product needed. Much of the produce, which we are accustomed to, is not grown locally. Products like bananas, oranges, and lemons are not grown in the regional area, but these products could be grown indoor with the appropriate climate controls. If concentration on these products throughout specific

times of the year corresponded with the need of the store below, adequate produce of all types could be provided to customers due to change-out of plants. Also, due to the building height restriction, it may not be possible for this one facility to produce the needs of the store. In this case other facilities located throughout the city and regional area could make up for the main facility.

As far as a business type, a large-scale cooperative would probably work best. After examining Whole Foods Market and Open Harvest, it is more believable that a business like this business type could exist. While Whole Foods Market's intentions towards sustainable agriculture are amiable, the business still seems to be mainly profit driven.

After observing Delsie Ervin's close relationship while working with local farmers at Open Harvest, the care taken to enhance the local community and economy is remarkable. The business truly becomes based upon the intimate relationship between the farmer and the produce director.

While in the store, I observed a farmer bring in a box of tomatoes through the front door. The farmer and Delsie knew each other by name, and greeted each other on a personal level. This is a shockingly different experience than the relationship at a loading dock at a big box store.

Open Harvest is currently a small store, and the Urban Essentials store would be much larger. So, within the structure itself a larger relationship would have to exist among the produce department in the store and the management in the growing facility. Also, a well-organized

cooperative business would need to exist within the regional area to sustain regional area.

However, this does not seem inconceivable. Networks already exist amongst local farmers. To enhance and create a stronger network is the real goal. The issue is working with grocery stores to allow them to buy into the cooperative, and then the network must create bylaws and regulations of what should be grown when and where. Talents and knowledge from all farmers and grocers should be shared and utilized to form a network of small businesses that support one another and act as a unit against large corporations and global value chains.

Whole Foods

Whole Foods is the world's leading retailer of natural and organic foods. It was founded in Austin, Texas in 1980, and currently has more than 270 stores throughout North America and the UK. Whole foods supports organic farming, which they say is the best method to promote sustainable agriculture and good conditions for farm workers.

According to Keith Dubas, the chair of the Open Harvest's board of directors, Whole Foods has a difficult time obtaining

enough local, organic produce to supply its stores. This is a main reason to control the size of the store, and to keep the COOP on a regional level.



Open Harvest - COOP

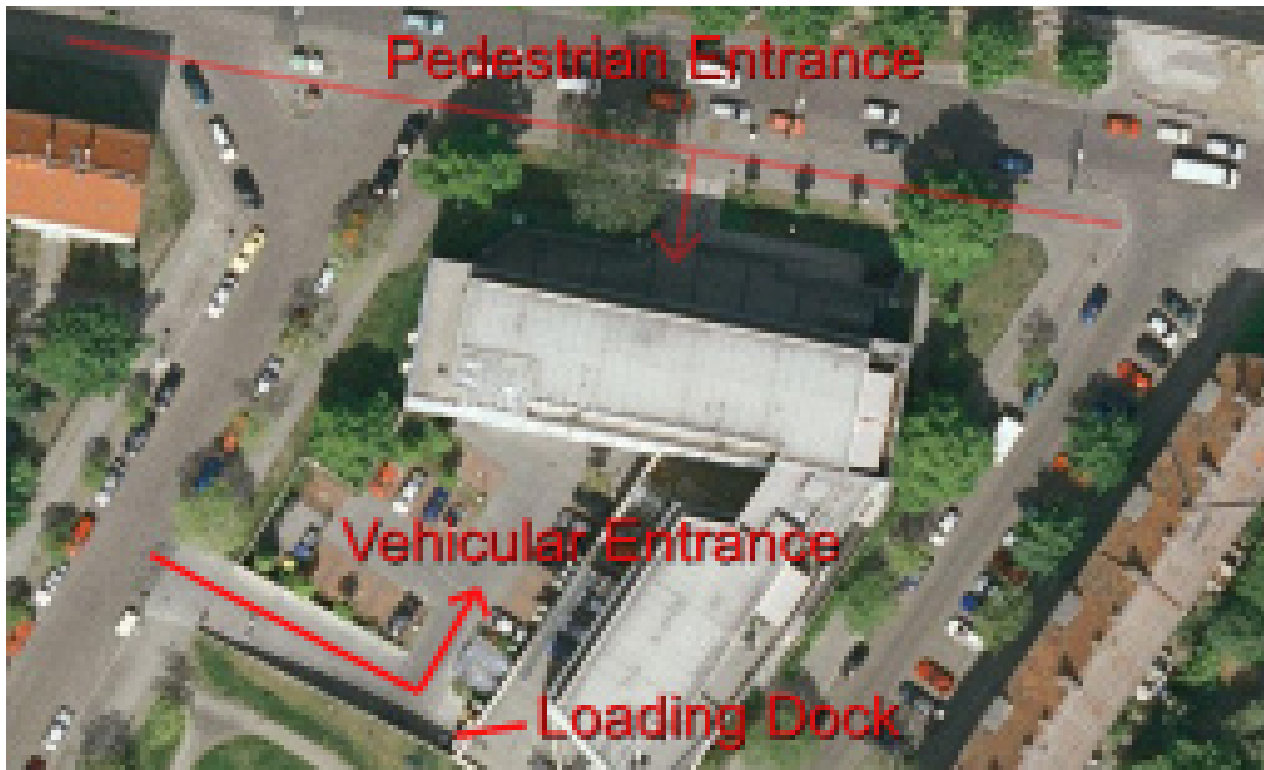
Open Harvest is a cooperative grocery market in Lincoln, NE. It originally began as a 10-person member buying club called People's Food co-op. Over the course of 37 years it has grown into a small business with over 2000 members. It is currently in the need of expansion due to the need for more space.

The main difference between the mission of Open Harvest and Urban Essentials is that Open Harvest's main goal is to provide nutrition. As a result of this things like sustainable agriculture and sustainable local economies happen. Urban Essential's overarching goal is to achieve a sustainable local economy through the decentralization of industry. As a result of that goal, better nutrition can be provided to customers, among other benefits.



Grocery Markets - Berlin

As many grocery markets in the US, particularly in Lincoln, continue to be developed with large parking lots and little regard for dense urban spaces, it was concluded that examining markets in other cities was a more appropriate means of examining issues regarding site access issues. Two markets in Berlin, Germany are presented. These projects are both owned by a grocery chain called Lidl.



This particular store is located below grade. The pedestrian entrance is accessible on the North side of the building via stair or a ramp. The vehicular entrance and the loading dock are on the South entrance and also located below grade. They are accessible via a parking ramp. While the building does not completely maintain an urban façade, the built and vegetative landscape are used to delineate spaces.



This market is similar to an American market with the store set back from the street. The pedestrian and vehicular entrances are in the same location. The loading dock is on the back of the building. The ramp to the loading area actually descends closer to the building so that the loading dock is on the same grade as the store.

Conclusions

After examining these two markets as well as individual participation of shopping in various markets and urban settings throughout a lifetime, it was observed that due to the dense urban nature of the *Urban Essential* site, maintaining an urban façade was essential to the adjacent site context. Parking and Loading docks must be accommodated by means that are sensitive to these urban issues.

Urban Farm Analysis



Pasona O2: Underground Urban Farming

Pasona is a 10,000 sq ft underground operation in Tokyo used for the purpose of growing plants. The complex was created to provide jobs for unemployed youth and middle-aged people seeking second careers. Other intentions were to educate workers about agriculture, and to increase the popularity of agriculture among workers. The complex is located under a 27 story office building in Tokyo's busy financial district. According to greenshorticulture.co.uk, the urban farm has been deemed a great success.

"We see this space as a showroom of farming in the midst of a metropolis," said Keisuke Nemoto, manager of the PR and planning division of Pasona Inc., a staffing agency which opened the underground farm.

"We do not aim to grow produce here to put on the market," he said. "We created this place so that people could know more about farming, and to increase the number of 'fans of farming,' so that -- eventually -- we can promote job opportunities in that area."

"In the absence of sunlight, the plants are sustained by artificial light from light-emitting diodes, metal halide lamps, and high-pressure sodium vapor lamps. The temperature of the room is controlled by computer, and the vegetables are grown by a pesticide-free method in which fertilizer and carbon dioxide are delivered by spraying. Hydroponics, in which plants are grown in water and hardly any soil is used, is one of the methods of cultivation used in the facility."

Quotes from http://www.treehugger.com/files/2007/07/pasona_o2_urban.php



Conclusions

Pasona revealed information regarding artificial lighting better than all other case studies. Nearly any plant seems to have the capability to be grown with artificial lighting. Various types of artificial lights can be used to grow plants in Pasona including: fluorescent, light-emitting diodes, metal halide lamps, and high-pressure sodium vapor lamps.

An interview was conducted with a greenhouse supervisor

at the University of Nebraska at Lincoln, Stacy Adams. In regards to lighting he stated that red and blue colored lights are often used in greenhouses to help plants flower and fruit.

6 Growing Rooms

Room 1 – Flower field. White LEDs are used. Plant cultivation by RGB LED. Metal halids spotlights are used.

Room 2 – Herb field. Metal halids spotlights are used.

Room 3 – Shelf rice field. Metal halids lamps and high-pressure sodium lams are used.

Room 4 - Fruit/ vegetable field. Cultivation of tomato by hydroponics 3 wavelength, 5,000 deg. K, High-frequency fluorescent lamp.

Room 5 - Vegetable field. Metal halids spotlights are used.

Room 6 – Seeding room. Lettuces are being grown with fluorescent lams. 2xFour steps cultivation bed.



Cuban Urban Farms

Cuba's urban farms developed out of pure necessity of survival for its urban districts. The end of the cold war and the collapse of the Soviet Union cut off nearly all food supply to Cuba, and forced cities to immediately adapt urban agriculture. Some 57% of Cuba's food intake was imported, and it was estimated that the population relied on other countries for over 80% of all their protein and fats. The Soviet collapse also led directly to an 80% reduction in fertilizer and pesticide imports. Prior to 1989, most of Cuba's intensive agriculture was dependent on these imports - their disappearance was thus a disaster for its agricultural system.

As oil imports crashed, Cubans looked for ways to reduce their dependency on it. In agriculture, this meant reducing transportation, refrigeration and storage costs by relocating agricultural production closer to the cities. Bio-control agents were also developed, which farmers can use instead of pesticides to protect their crops.

Presently many of the urban gardens throughout the country are government run. These 2,730 gardens employ approximately 22,000 workers. The majority of these interior urban gardens are used to grow vegetables and herbs. The Cuban government also has 4,347 larger intensive gardens on the outskirts of cities mainly used to grow fruit.





Conclusions

While Cuba's urban farms developed out of necessity for survival, many aspects of the situation are interesting. In comparison to many of the other case studies regarding urban farming, this project had less of an intention to create a sustainable economic and environmentally friendly project. Rather, the country wasn't trying to save money on oil imports. There was an extreme loss of oil, and a sudden lack of means to transport, refrigerate, and store food, so the food must be grown near the population consuming it.

As much of the world begins to look at relocating some agriculture to urban areas for reasons of decentralization of industry, rise in oil prices, use of organic grown produce, and job opportunity, Cuba is a step ahead of the rest. They have a well-developed system, despite many other governmental and economic factors hindering the ability to alleviate poverty in the country.

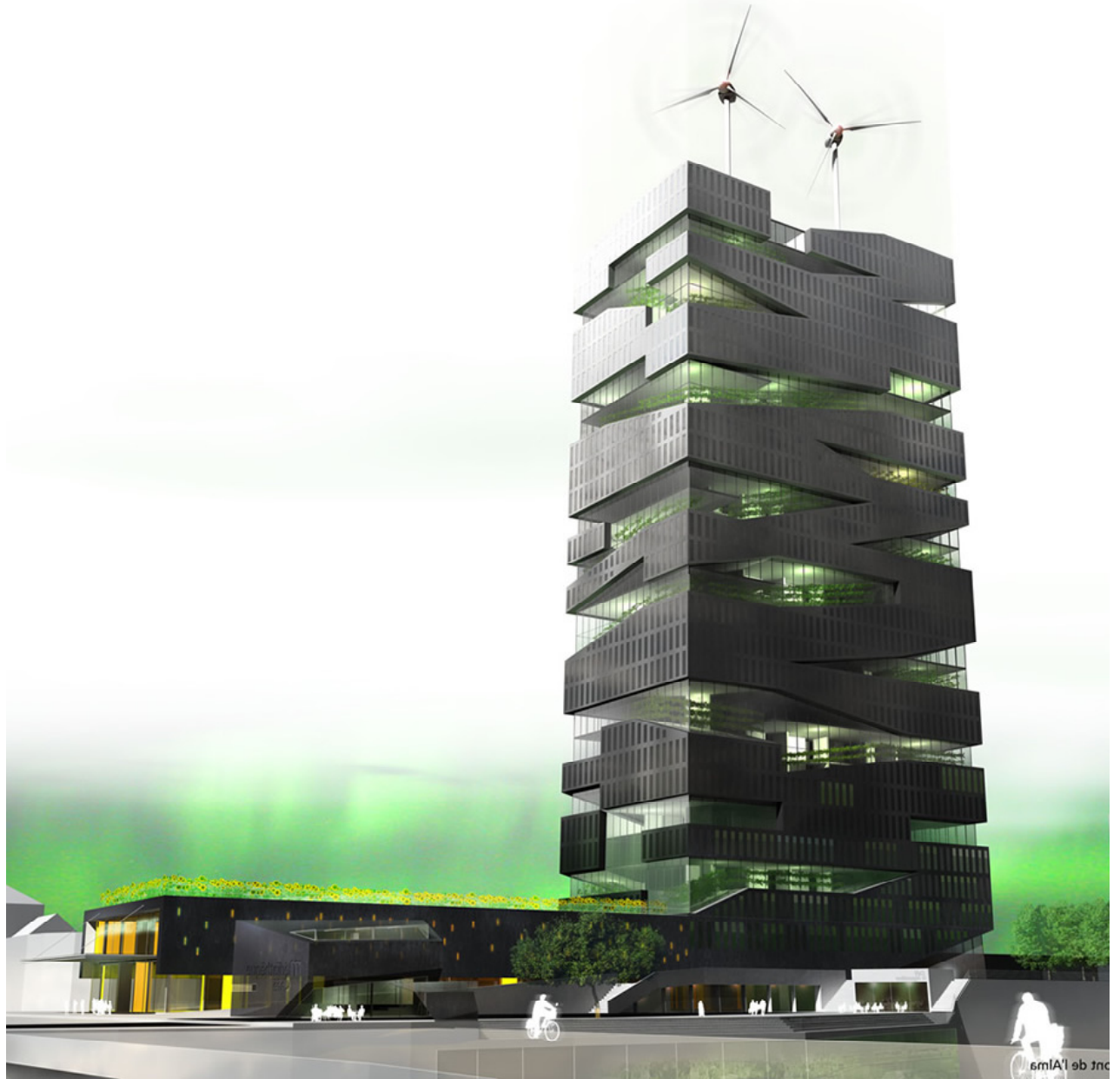
"The vegetables grown in urban gardens are for the most part organic, largely due to the dearth of chemical crop treatments. While playing up the health benefits of organic produce, the Castro government casts much of the blame for food scarcities on a 37-year-old economic embargo maintained by the United States. But the problem also stems from inefficiency and a lack of individual incentives within the state-dominated agricultural system." – Cityfarmer.org

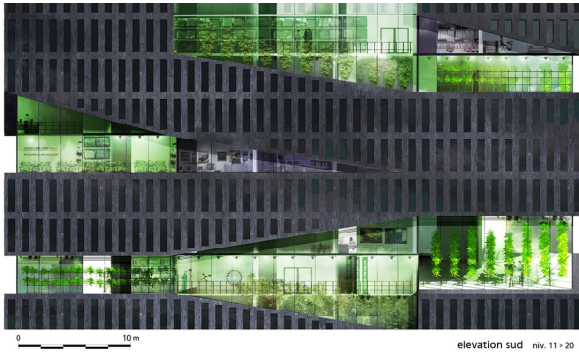
Despite this bitter remark towards the US government, Cuba may not have such a bad situation. Organic grown produce is continuing to grow in popularity and with rising oil prices urban farms within Cuba's cities may ease relief which are beginning to put strain on more developed countries.



Sky Farms

The project Sky Farm by Dr. Dickson Despommier is a conceptual urban agriculture project. Dr. Despommier works in the Environmental Health Science Department at Columbia University, and his largest project is Sky Farm. This project was most useful to Urban Essentials as many of the objectives, goals, and designs are similar. Despommier's main concern deals with the extreme growth rate of the human population, and the fact that there is not enough food production and agricultural space to accommodate this growing population.





collecting the water of evapotranspiration

-VF adds energy back to the grid via methane generation from composting non-edible parts of plants and animals

-VF dramatically reduces fossil fuel use (no tractors, plows, shipping.)

-VF converts abandoned urban properties into food production centers

-VF creates sustainable environments for urban centers

-VF creates new employment opportunities

-We cannot go to the moon, Mars, or beyond without first learning to farm indoors on earth

-VF may prove to be useful for integrating into refugee camps

-VF offers the promise of measurable economic improvement for tropical and subtropical

-LDCs. If this should prove to be the case, then VF may be a catalyst in helping to reduce or even reverse the population growth of LDCs as they adopt urban agriculture as a strategy for sustainable food production.

-VF could reduce the incidence of armed conflict over natural resources, such as water and land for agriculture

Advantages of Vertical Farming by Dr. Despommier

-Year-round crop production; 1 indoor acre is equivalent to 4-6 outdoor acres or more, depending upon the crop (e.g., strawberries: 1 indoor acre = 30 outdoor acres)

-No weather-related crop failures due to droughts, floods, pests

-All VF food is grown organically: no herbicides, pesticides, or fertilizers

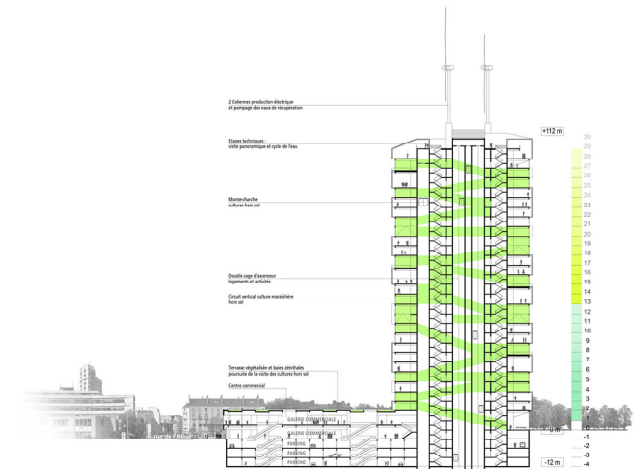
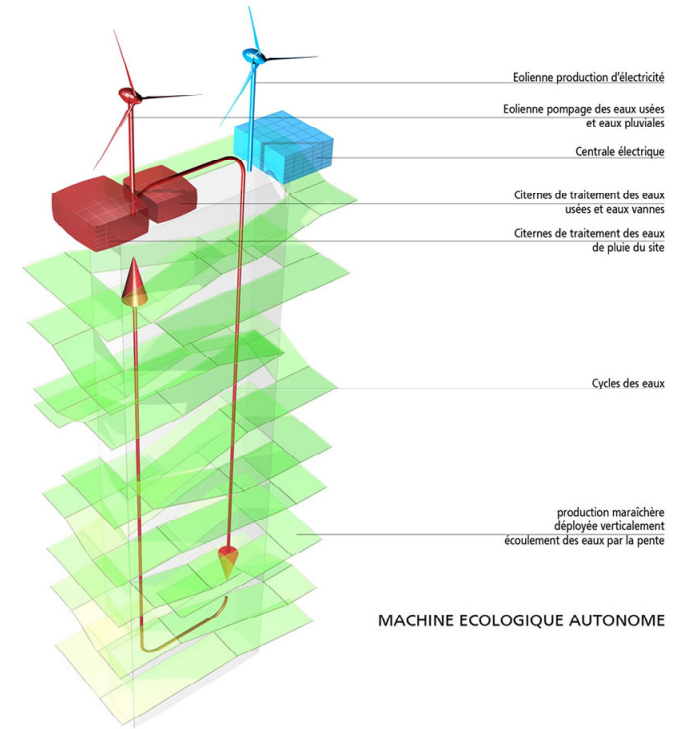
-VF virtually eliminates agricultural runoff by recycling black water

-VF returns farmland to nature, restoring ecosystem functions and services

-VF greatly reduces the incidence of many infectious diseases that are acquired at the agricultural interface

-VF converts black and gray water into potable water by

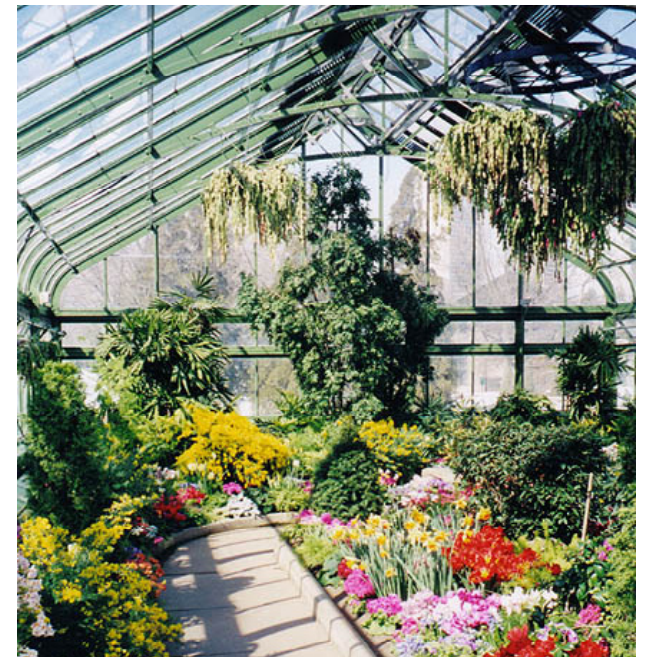
*VF means Vertical Farm.



Designing a Growing Facility

Interior spaces that are used for the purpose of absorbing heat and sunlight to grow plants are typically referred to as greenhouses or conservatories. Greenhouse structures are generally used to produce large amounts of plants either for their fruit or to later sell the plants themselves. The Urban Essentials project will be using its growing facility mainly for the purposes of producing fruits and vegetables. Therefore greenhouse structures were analyzed for the purpose of this project.

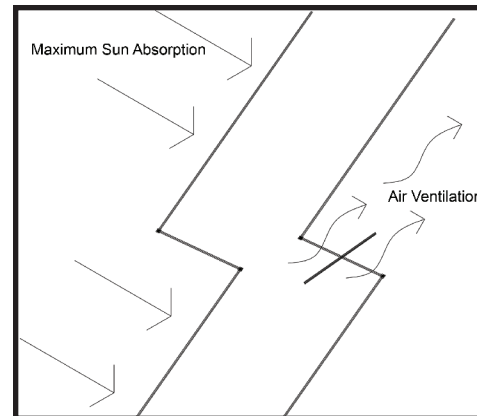
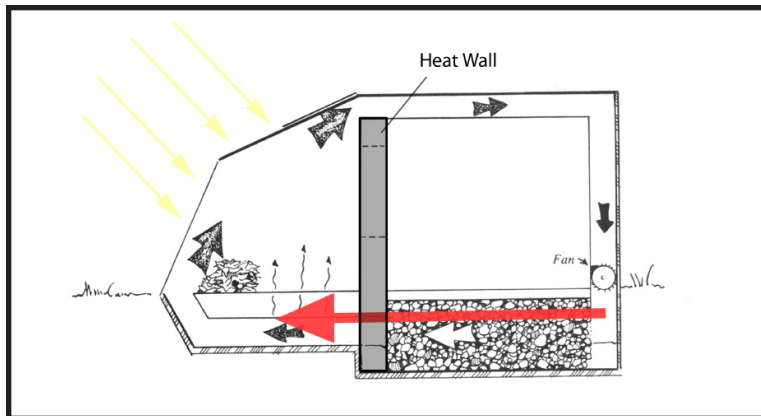
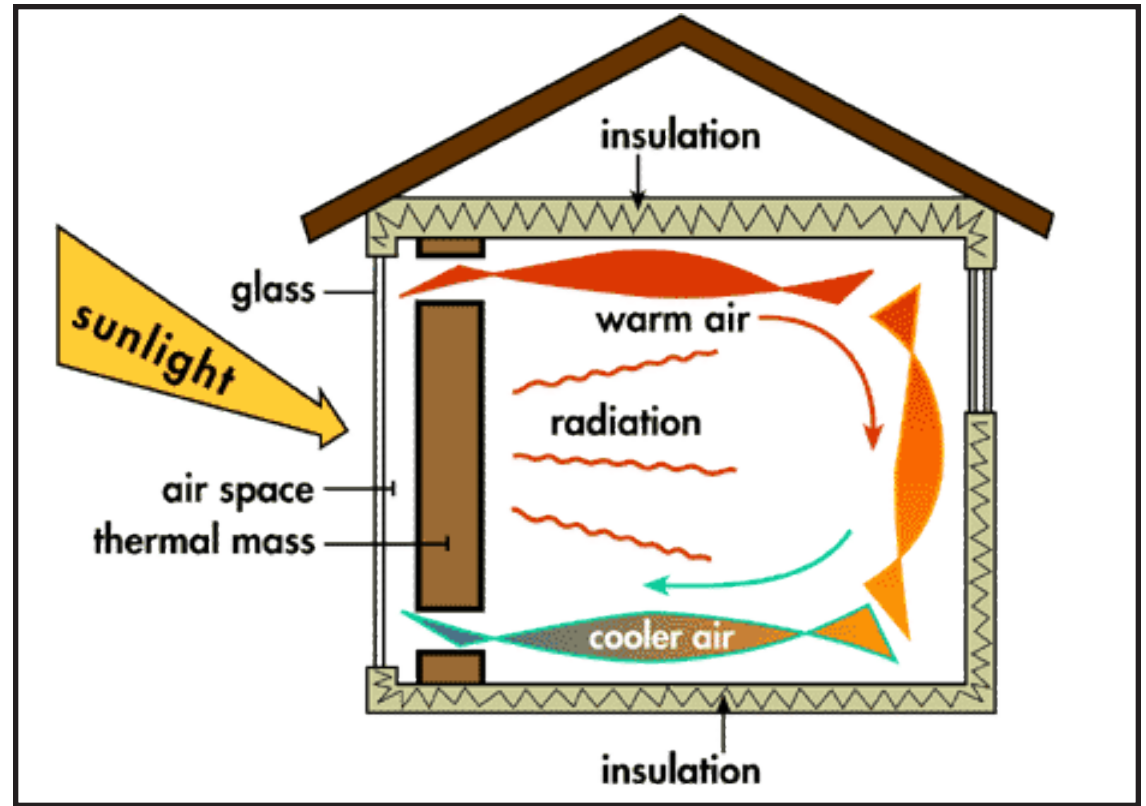
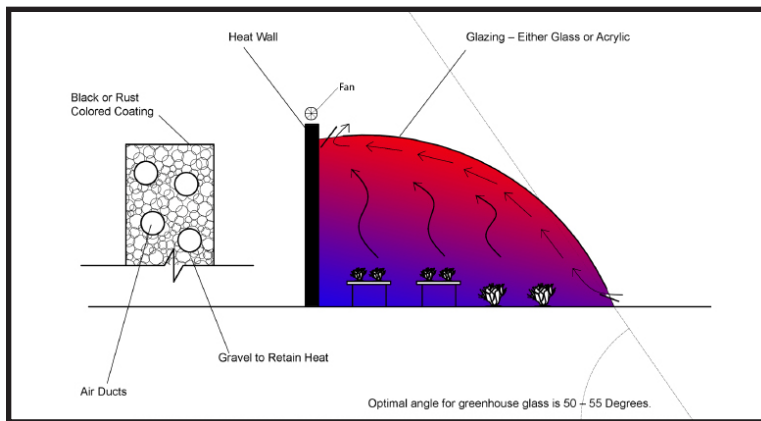
A vast majority of greenhouse structures have a utopian design, which ultimately are a prototype with very little design. So, the precedents that were analyzed are mainly to understand the various systems, which are used in these facilities.



Passive Design

Heat Walls

These walls collect heat during the day; store the heat in the walls, so that air can be circulated throughout the greenhouse during the night. This is a passive means similar to thermal massing. It is common in greenhouses to use similar systems to save energy. It is a fairly simple system that is ideal for a greenhouse due to energy loss through the glass or acrylic surfaces.



In addition to using heat walls in the growing facility, the ventilation system should also be passive. A double skin façade could be used to ventilate the system as needed. The second layer of glass would also provide another surface of insulation, which will be beneficial as Lincoln experiences severe hot and cold temperature throughout the year. While this ventilation system may need to be backed up by secondary systems, it will be used as the primary system that will suffice for much of the year.

Image taken from *The Food and Heat Producing Solar Greenhouses*.

Organic Re-use



By reusing water and organic waste a city can start to become dependent on itself without outside sources. This structure has the capability to produce food for the local residents. If it can also use only resources to make the food within the city, then this building can become independent from outside needs.

Soil needs in nature require organic waste from animals and other plants in order to allow plants nutrients. If organic waste from plants in the growing facility as well as human waste is used in a similar way, plants in the growing facility can receive nutrients without importing mass amounts of soil and water from outside sources. This technique is more resourceful and will have a lower life cost, despite a larger upfront cost.

To materialize this idea, small-scale residential applications were first examined. In these examples chutes from a toilet takes organic waste into a storage area where it decomposes. Toilet paper can be thrown into these devices as well. After the waste has decomposed it can be taken to a gardening area and used as fertilizer.

On a more industrialized scale, larger devices could be used to treat and store the decomposed matter prior to its usage in the growing facility.

While this process might seem somewhat ghastly, as a human race we can no longer afford to maintain our ignorance to the effect that we have on our environment. Currently, Lincoln's sewer waste is treated and dumped in to Salt Creek, a creek near Lincoln.

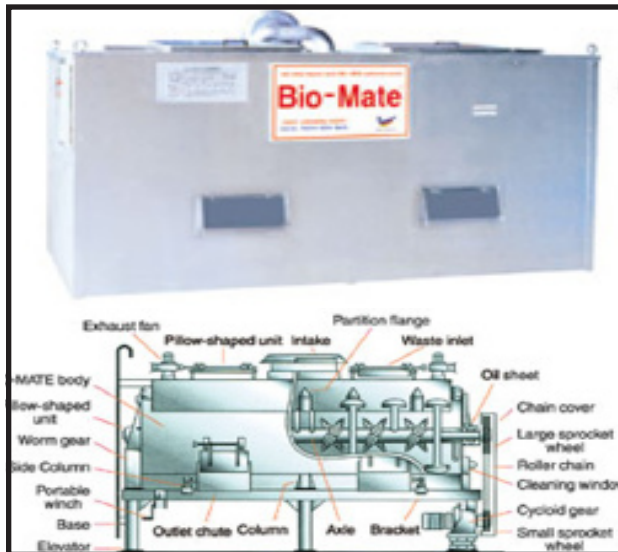
If this concept were taken from a small scale to a large scale, immense changes could occur. If an entire city encompassed the growing of fruits and vegetables outdoors as well as indoor, similar systems could be used throughout the city. In the next portion of this document, it will be suggested that all rooftops and available open spaces in the city will be used for agriculture.

A system could be used to accommodate the entire city that would provide organic matter to the rooftops of all of these various agricultural systems. When the city is able to cycle from growing food, to consuming food, to producing waste which is the reused to grow more food, it then functions as a continuous loop that has little impact on the outside environment. Once this cycle is perfected, it can then be studied and applied to industries other than agriculture.

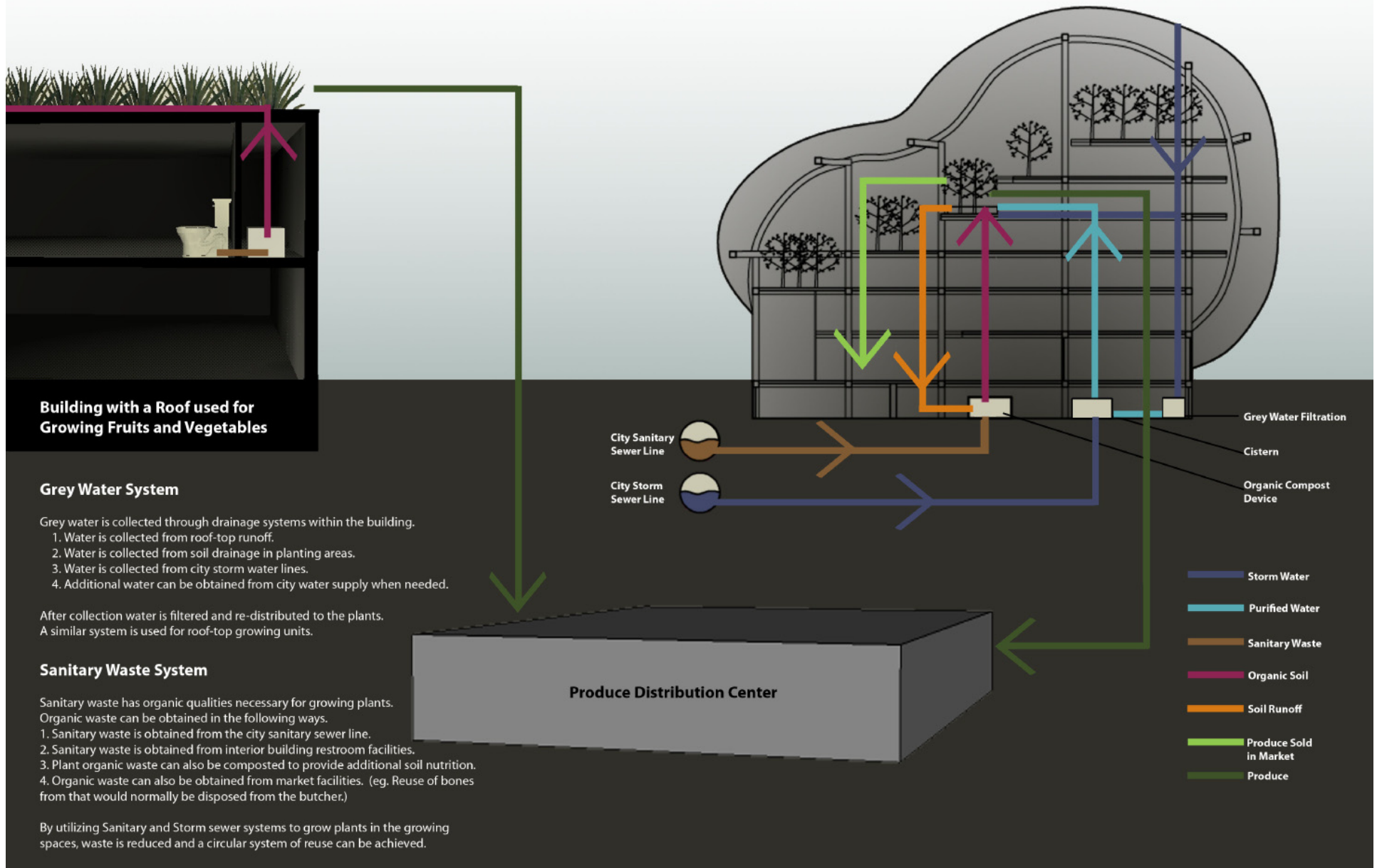
Bio-Mate

A product called biomass has been developed. Below are details from the system's website, <http://www.sentech.com.my/Bio-Mate/Works.asp>, explaining the functionality of the system.

BIO-MATE is an in-vessel fully automated on-site composting machine that operates using electricity. It requires very minimal maintenance and it is user friendly. By using our high-temperature aerobic enzymes, organic waste can be fully compost in between 24-48 hours. Our composting process is an aerobic process, therefore bulk agent such as wood chips, rice husk, paperboard, etc is needed for the composting process. Once organic waste (e.g. food waste, meat, fish, bean curd lees, etc) is collected, it can be charge into the tank directly. It can be discharge on a daily or weekly basis based on the need and want of the individual. Then end product can be used as fertilizer/soil conditioner.



Sanitary and Storm Systems



Sun Studies

Images below indicate the amount of sunlight that can be penetrated to plants in the growing spaces due to the terracing. Many interesting observations were discovered through these studies.

1. Due to the angle of the winter sun, natural light can reach deeper spaces on each floor plate than the summer sun.
2. The nearly three hundred foot tower to the West of the

site will actually help to regulate sunlight throughout the year, rather than restrict natural light.

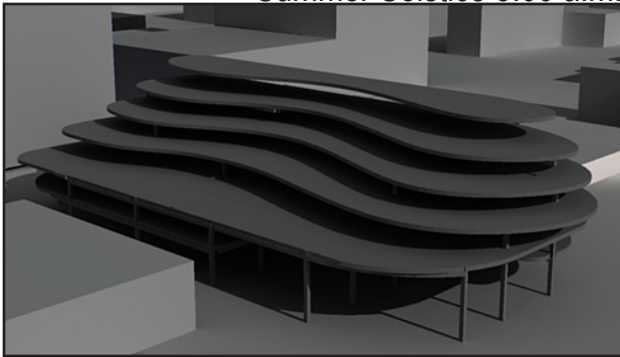
a. The 4:00 P.M. renderings indicate this idea. The shadows from the building onto the growing facility indicate that the time of day in which the entire building will be in shade is relatively similar throughout the year.

b. Animation studies comparing the two solstices indicated

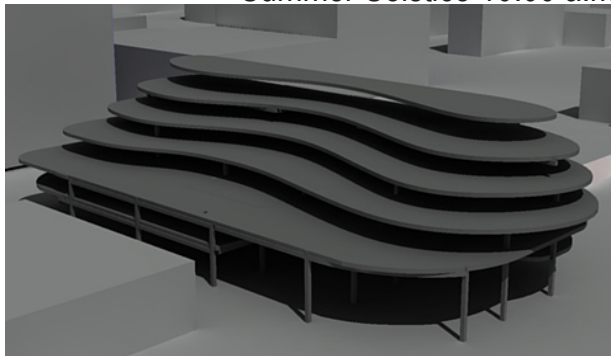
that there would be a maximum of two hours difference as to the time the building became engulfed in full shade throughout the year.

c. This works in favor of the project because regulation of light is important to maintain a consistent amount of fruits and vegetables year round. According to Stacy Adam, a greenhouse director at UNL, regardless of the amount of sunlight, traditional greenhouses often have artificial lighting

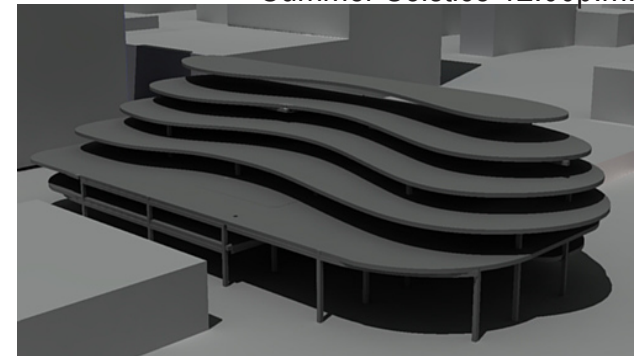
Summer Solstice 8:00 a.m.



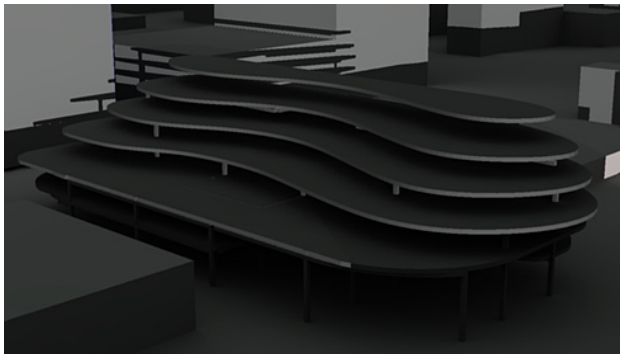
Summer Solstice 10:00 a.m.



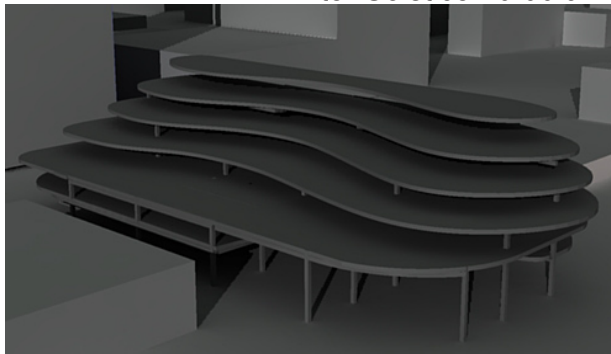
Summer Solstice 12:00p.m.



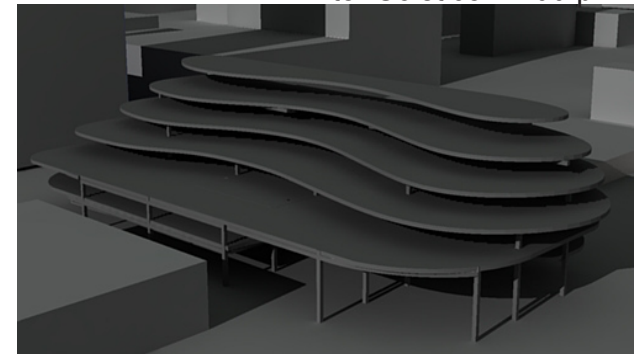
Winter Solstice 8 :00 a.m.



Winter Solstice 10:00 a.m.



Winter Solstice 12:00 p.m.



to make plants fruit and flower at specific times. Therefore, if this growing facility will be used to produce fruits and vegetables year round with a grocery market dependent on consistent amounts of produce to sell, it would then be better to have a controlled amount of natural light.

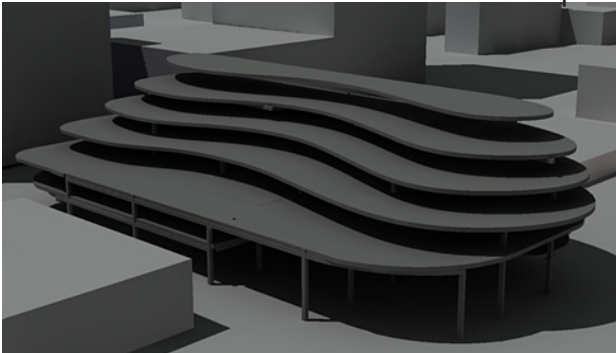
i. In theory to produce fruits and vegetables at a maintained rate year round, one could plant a green pepper plant once a week every week throughout the year. With consistent

natural light year round, the plant can be 'tricked' into thinking that it is always summer due to the controlled environment. Since there were plants that were planted each week, the store below would be able to rely on a consistent amount of produce year round.

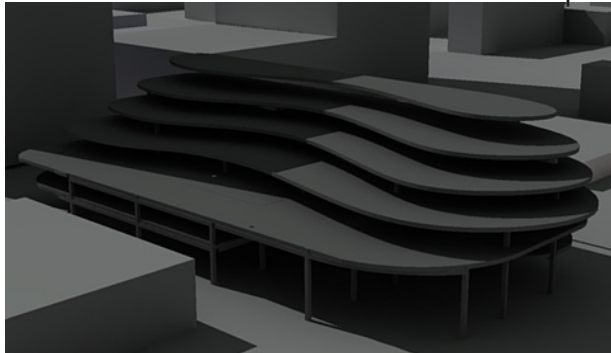
ii. Having this control will also allow for changes to be made when necessary. Eg. If there was to be an increased need for a specific type of produce, the growing facility could

respond to that need with a minimal amount of difficulty.

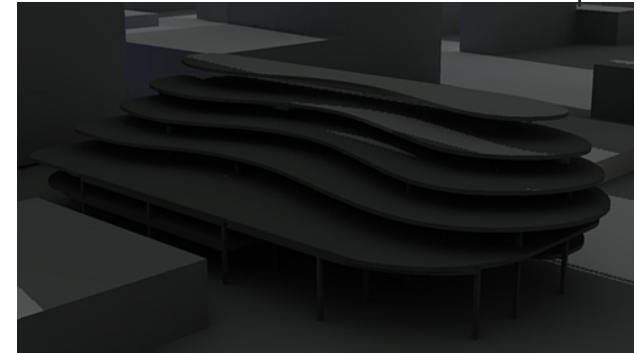
Summer Solstice 2:00 p.m.



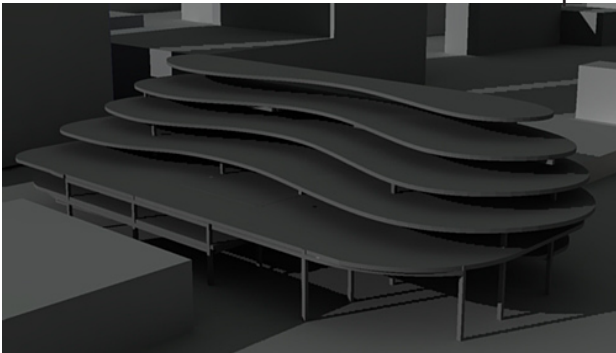
Summer Solstice 4:00 p.m.



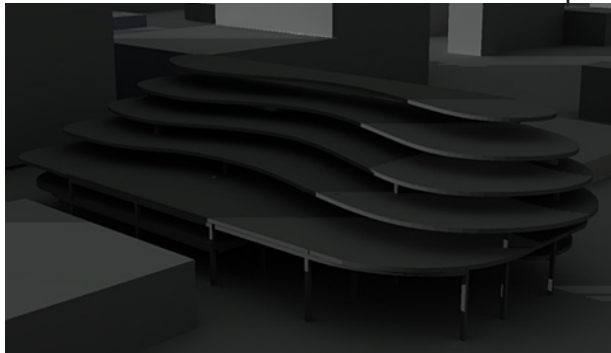
Summer Solstice 6:00 p.m.



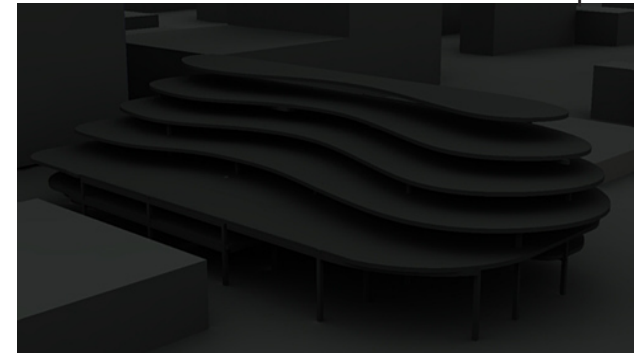
Winter Solstice 2:00 p.m.



Winter Solstice 4:00 p.m.



Winter Solstice 6:00 p.m.



Terraced Floors

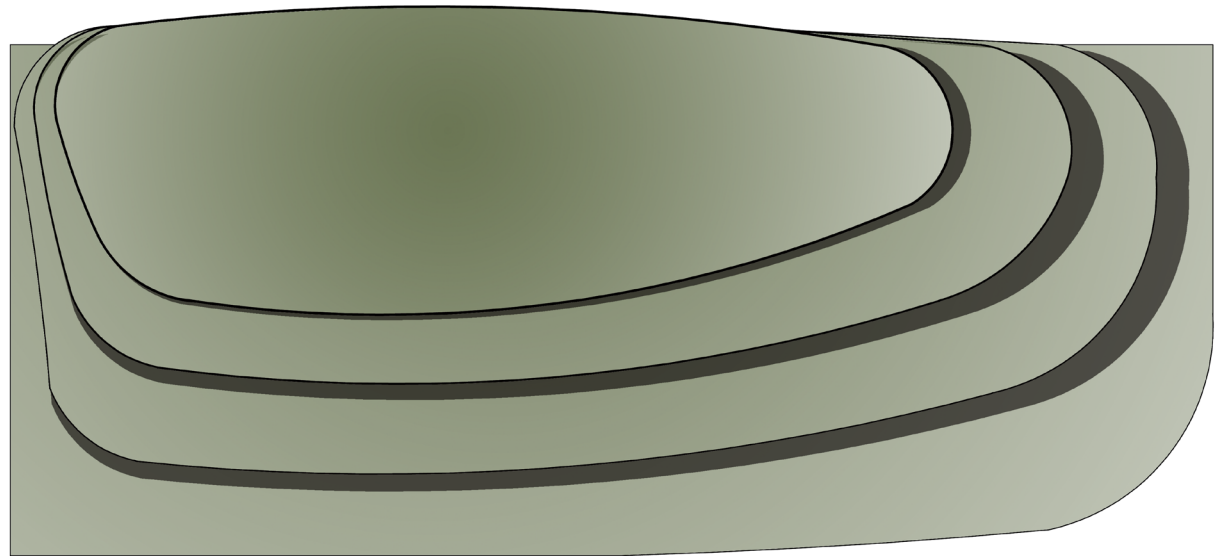
Terracing Guidelines

These guidelines relate to diagrams that were conceived in November of 2007, and are based off the floor plans at that stage in the design.

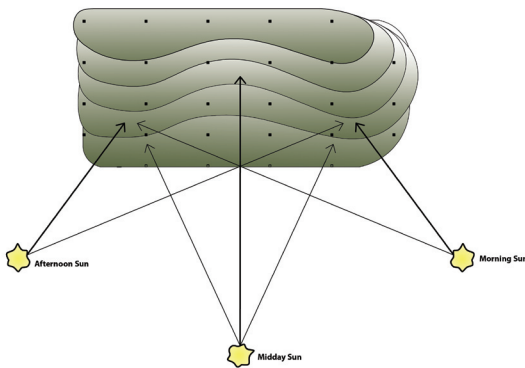
The upper five floors are terraced to the north. This was initially derived from the local farming landscape to make a connection to traditional agricultural practices. However, there are greater advantages aside from the visual connection.

1. On floors three to six, the terracing allows more natural light to reach a larger amount of floor space. Light is penetrated to inner spaces on each floor plate.

2. By creating concave and convex surfaces, more daylight is able to reach more spaces in the growing areas. As the sun rotates throughout the day, daylight can be gained in multiple areas in the growing facility.



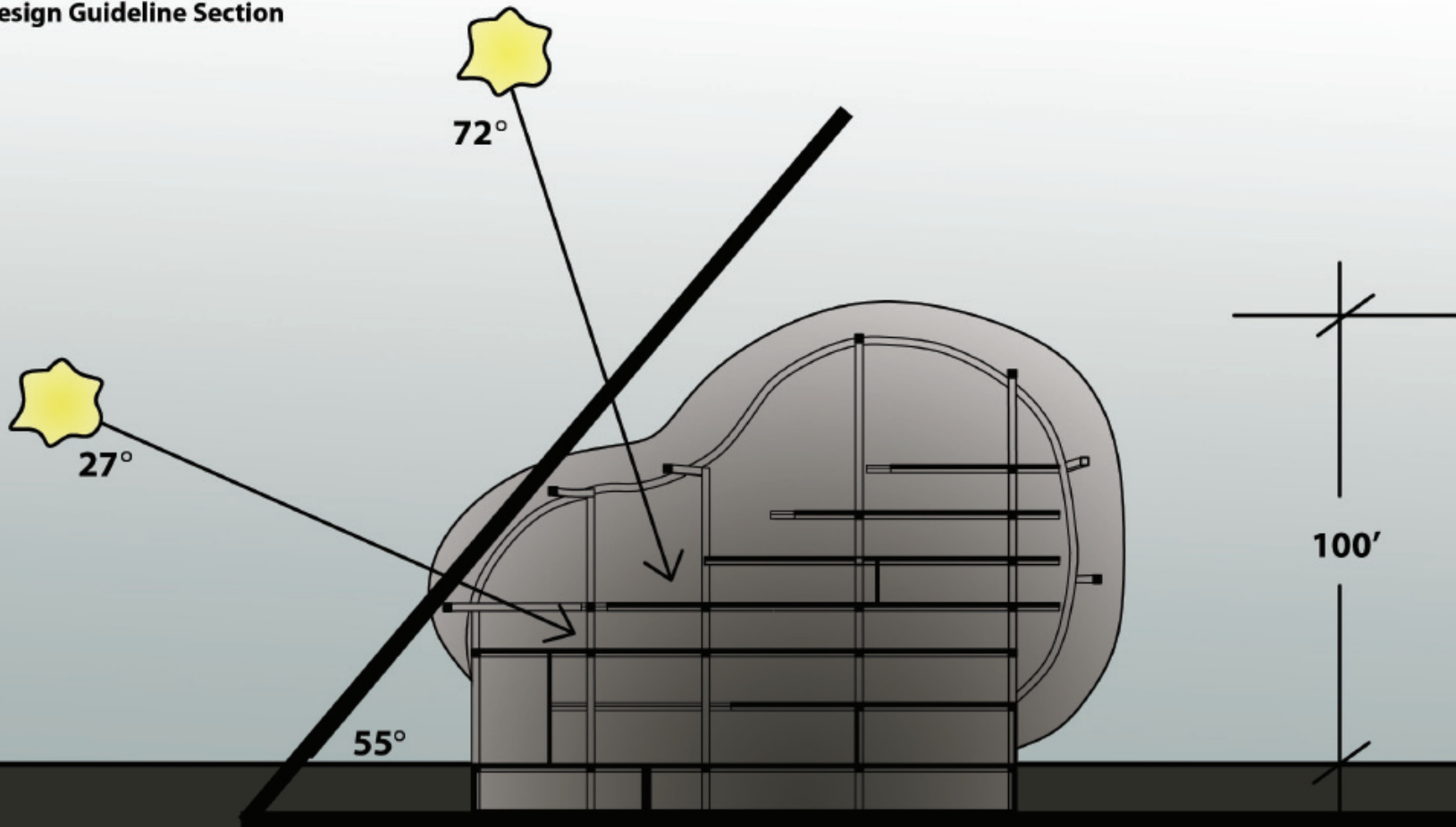
Final Designed Terraced Floors -Levels 3 through 6



The ability to have adequate daylight for plants in the growing facility to reduce the need for artificial lighting is important to save energy within the building. A major issue with this need is the location of the new development to the west of the site. Depending on the time of year this building blocks daylight for the building completely between the hours of 4 and 6 pm. During summer months more daylight is received from the west as shadows from the large structure rotate. This light doesn't take effect until late in the evening, and the sun is so low at that time that the light doesn't make a significant difference in terms of providing daylight for the growing of plants. For these reasons the daylight from the east in the morning is more reliable and important.

Additionally, site restrictions limit the height of the building to 100'. This limits the design opportunity to maximize growing space by means of height. Therefore a terraced system was developed to maximize daylight. By carefully calculating the greatest distance of floor to ceiling height while maximizing the number of floors using in the growing space based on the summer sun angle in Lincoln, NE, a maximum amount of growing space can be achieved with direct sunlight and artificial sunlight.

Design Guideline Section



Extreme Solstice Angles

Since the sun angles vary greatly throughout the year, floors in the growing facility have been terraced to the north to allow for a greater amount of growing space that will still receive natural light.

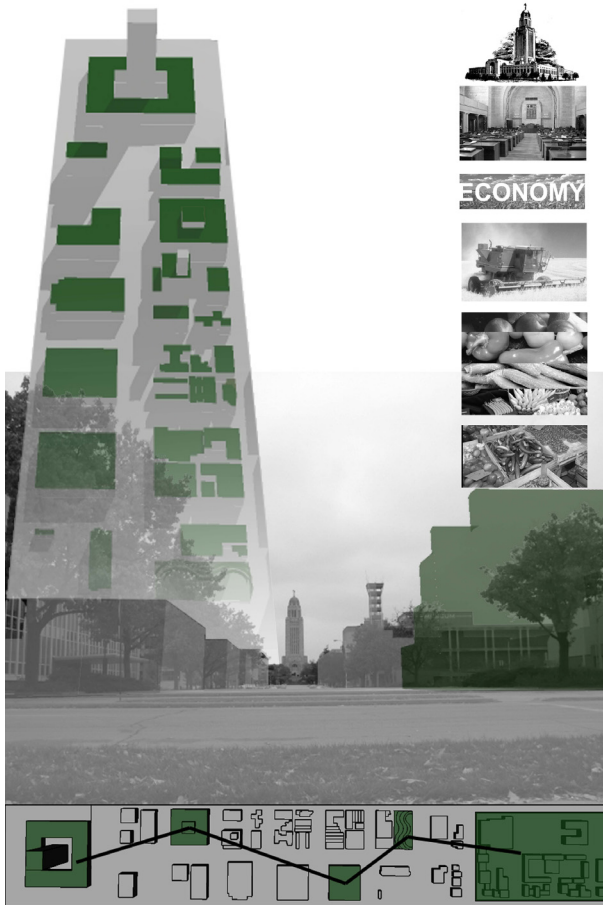
Optimal Glass Angle for Sun Absorption

According to ... the optimal angle to position glass is 10 – 15 degrees greater than the latitude of the geographical location. Lincoln's latitude is 41 degrees north. Therefore, the glass should be positioned at an angle between 51 and 56 degrees to penetrate the most light for optimal plant growth.

Height Restriction

According to the Capitol Environs Committee, who created the design standards for the Nebraska State Capitol District, there is a one hundred foot height limitation for buildings built on Centennial Mall.

Urban Design



In the goals and objectives set out by this project it was particularly important that the regional industry of agriculture becomes decentralized in the southeast portion of Nebraska. Within this idea cities and towns in this regional area must become self-supporting entities, as much of the agricultural land available is used for the growing of crops to feed livestock and more recently to supply ethanol companies with corn and beans for 'bio-fuel'.

The main idea concerning the urban design is to input agriculture into the city. Within the downtown area, agriculture is grown on the all rooftops in the city. Throughout the remainder of the city, agriculture would be grown on flat roofs of buildings and in community gardens that are located on the ground.

The combined images to the left demonstrate the first phase of the project. The diagrams are meant to portray the rooftops on Centennial Mall as growing areas. To have an important impact with initial steps of implementation of growing agriculture in the city, roofs in the most important governmental areas will be constructed first. This statement is meant to be bold and to show legislative support for the project. Not only will the State Capitol have agriculture on its roof, it will also be completed first. This statement will show that no building is to be exempt from this movement. Also along Centennial mall are the Federal and State office buildings. These structures are all in line with the growing facility, which makes for a strong cohesive system of agriculture in a controlled area. After these buildings

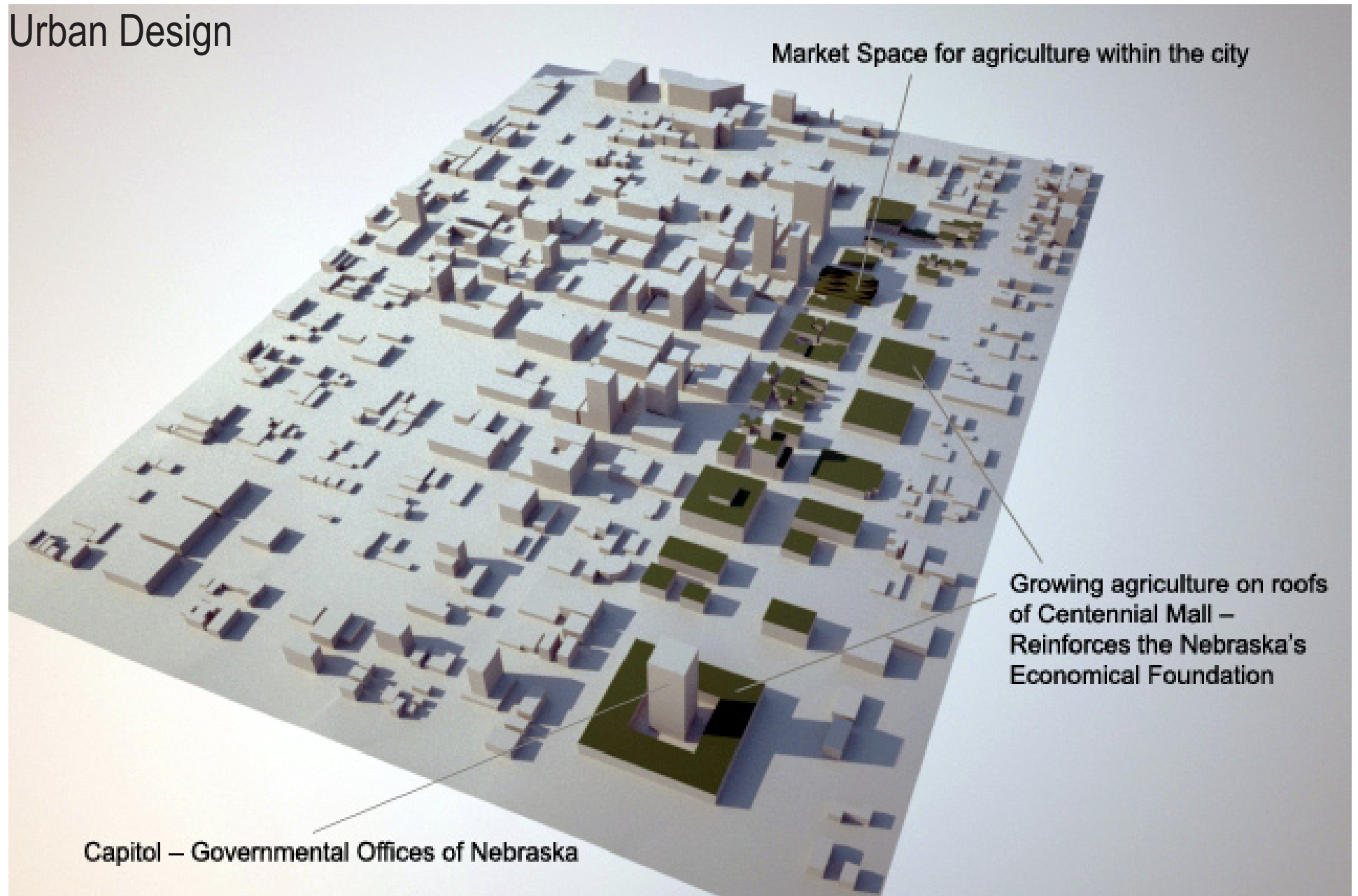
have all been renovated, the remainder of the buildings in the downtown area will also be renovated. Finally, all other buildings throughout the city will be renovated in the years following.

In addition to the rooftop growing spaces, produce distribution spaces will be implemented throughout the city. The downtown structure will be located on a lot that is currently being used for parking south of the Haymarket area. It is located near the railroad, allowing for transport of goods throughout the regional area via rail. It would also be accessible to trucks to transport goods. This structure will mainly be used to exchange goods, store goods temporarily, and for the arrangement of transporting goods.

Each of these rooftop gardens has various different business opportunities. They can be managed by a large city system. Or, the companies occupying the building can manage them. If the structure is a residential building, then residents could rent portions of the available land to grow what they wish. If it is a small business or office building, then the business could allow employees to rent land or organize the land through the company.

As for the regulation of the construction of the rooftop gardens, implementation is mandatory for all new construction. Renovation is done to all existing structures at specific times based upon each building's location within the city in regards to the phasing plans.

Urban Design



Phasing

In order to develop a city design incorporating growing spaces on all roofs in Lincoln, the plan to incorporate this must be phased.

Phase 1

- Construct market/ Growing facility.
- Construct growing spaces on roofs along Centennial Mall.

Phase 2

- Construct growing spaces on all roofs in the central city.

Phase 3

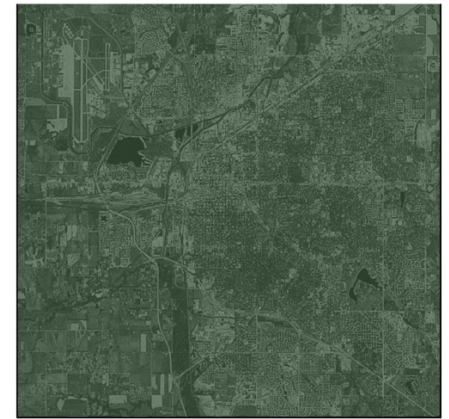
- Construct growing spaces on all roofs throughout the city.



Phase 1



Phase 2



Phase 3



Design Process



The Design Process

The first objectives to combine a market and growing facility were to determine the parameters that should be contained within the market and growing facility. Since there was no real client with particular design specifications needed, the program was approached differently. The amount of space needed in the market and growing facility could not be defined through a clients needs. Initially, this created issues with determining square footage requirements and other restrictions.

Defining what the market was helped the project to overcome those barriers. The site is fairly small, 140' x 300', for a market to provide loading access as well as storage, offices, freezers, and retail spaces all on one floor. The idea of having everything on one level is a typical precedent that was misleading for several months in the project. Once these activities were split into different areas and floors, the project became much more simple.

Providing a loading dock for the building became a dreadful task. The first few months of the project were spent providing access to the building not only to large delivery trucks, but also to driving customers. About three months into the first semester, a decision was made to locate the loading dock on the lower level. This idea had also been contemplated earlier in the semester, but parking was also provided in that scheme on the lower level with the loading dock.

The new scheme was to have only loading, storage, and space for the massive system requirements for the building on the lower level. This allowed for a minimal amount of

storage to be kept on the grocery market level, making for a more simple circulation concept to be achieved. It also created a common area for other spaces in the building to be serviced.

From here it was possible to create a market that could be large or small. This changed on a weekly basis. New concepts were continuously explored. At times the grocery market was to be a two-story space. At one time the market occupied the lower level and the ground level with parking above the market.

However throughout the entirety of the project small venue market retail was desired. This was always seen as a small bakery that could have walkup pedestrian traffic as well as service to the grocery market. Much time was spent trying to provide direct access from the market an outdoor window or entrance.

Connecting the two venues created two issues. One issues was that the bakery and other traditional market venues, such as a butcher or deli, would most likely be managed and owned by the grocery market. An overarching goal to have personal small-scale businesses that promote civic pride and a sustainable local economy would be likely to fail with this arrangement. Secondly, considering a circulation path that made sense with the needs of the smaller venues as well as the needs of the larger store made it nearly impossible to provide a clean and simple floor plan.

A decision was then made that the small venues did not have to be connected to larger store. The store could still

sell the items made by the smaller venues providing several advantages to customers and business owners. Since the larger market is likely to have longer business hours than a bakery, the bakery has a longer daily profitability range by selling its goods to the grocery market. It also provides continuous business to the smaller businesses. As well as it makes for a more manageable grocery store, and provides more convince to customers.

Locating the grocery store throughout the 100' high x 140' wide x 300' long structure also was difficult. It was particularly complex when loading, small venue spaces, storage, and parking were all located on the main level with the grocery store. As stated earlier the grocery store was at times more than one level. It was sometimes on the ground level, and it was sometimes on the second level. Eventually the decision to keep the store one level was made to simplify the circulation patterns throughout the building and due to the lack of need for small venues, loading, and storage on the same level as the store.

From the beginning an idea of having a farmer's market on the exterior of the building was concluded as a positive addition to the urban area. First, a farmer's market would create much needed lively activity on Centennial Mall. It would also provide more continued business to the small business venues. It also creates a central market node in the city center.

After contemplating for many months how the farmers market should function in the urban area, a decision was made to take out the underused park and pave it with

materials that distinguished from its concrete neighbor streets. Due to this decision, it made a other programmatic needs fall into place.

The ground level would be underutilized if it were used only as a space for a grocery store. It was then decided that the grocery store would be located on the second level. This freed up the ground level to take on more exciting venues. Some of these venues include an open interior market that would function year round. Many small retail spaces were also provided to allow small businesses space. These would be unconventional spaces in comparison to typical retail in the local area. They would be used to house a butcher, deli, bakery, café, coffee shop, and other venues typically seen with a market. However, there are also spaces that allow start-up businesses the opportunity to receive instant pedestrian business with little to no rent. This would be provided through programs like micro-financing and other government programs similar to this type of development. Often, in these types of spaces, businesses are allowed to stay for a limited amount of time and once they achieve an adequate profitability, they move elsewhere. This technique in the market building can help to provide business owners with a place to start, sort of a kick-off space for their business. It will also create a more sustainable local economy focused on small business owners rather than large retail corporations.

After the market portions of the building were decided, decisions could be made for the growing facility. Due to the 100' height restriction set by the Capitol Environs District, it was decided to maximize the growing space to the largest possible output. This decision came after a vast amount of contemplation of product need for the local area. Research was done on the amount of produce a store might need. Research was also conducted regarding the types of fruits and vegetables that were grown in the local area. This provided with information about what times of year certain products would be available to purchase from local farmers throughout the year.

After several weeks of studying, this was determined to be unsolvable within the time period of the project and availability of information to the author. Despite this drawback, many things were learned from talking with local grocers. For example, after discussing produce purchasing with the produce director at Ideal market in Lincoln, availability of certain types of produce came year round to the local area. He indicated that

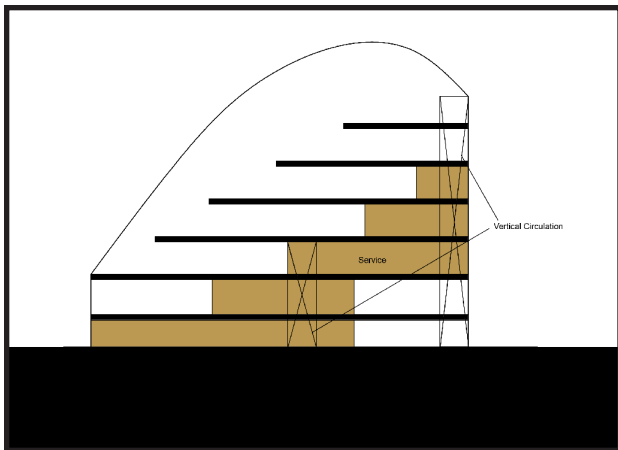
there was an indoor tomato growing facility near Beatrice, NE. Since Beatrice is located in the regional area, their products could be sold in the market. This means that the growing facility in Lincoln would not need to grow as many or any tomatoes in the building.

The types of produce grown in the facility as well as the amount can only be determined on a day-to-day basis and would change frequently. Therefore, the only solution would be to provide different types of spaces with varying microclimates, as well as to maximize the growing space on the site.

November 2007

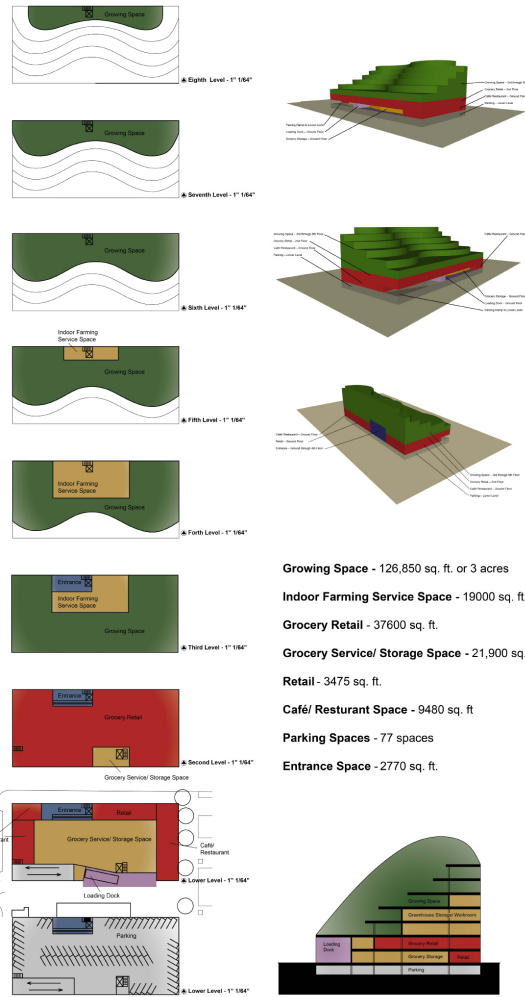
As of November of 2007 the project dealt a lot with the access issues associated with the building. The images to the right depict two separate programmatic designs. These designs were exploring ways of servicing the building and where to locate parking.

At this point in the design process the terraced floors were introduced to allow light to the lower floors. Due to this terracing a lot of time was spent to figure out how to service the top floors. The section below shows one concept of the service needs. Locating service elevators was the most daunting task. Just as the floors would be terraced the design below demonstrates how the service areas could also be terraced allowing access to the upper floors of the growing facility. The main disadvantage to this scheme is that a large service elevator must be placed on the north side of the building. This facade is important due to the visual access for onlookers. Therefore, an opaque material should be used to cover the facade in order to maintain this service scenario.



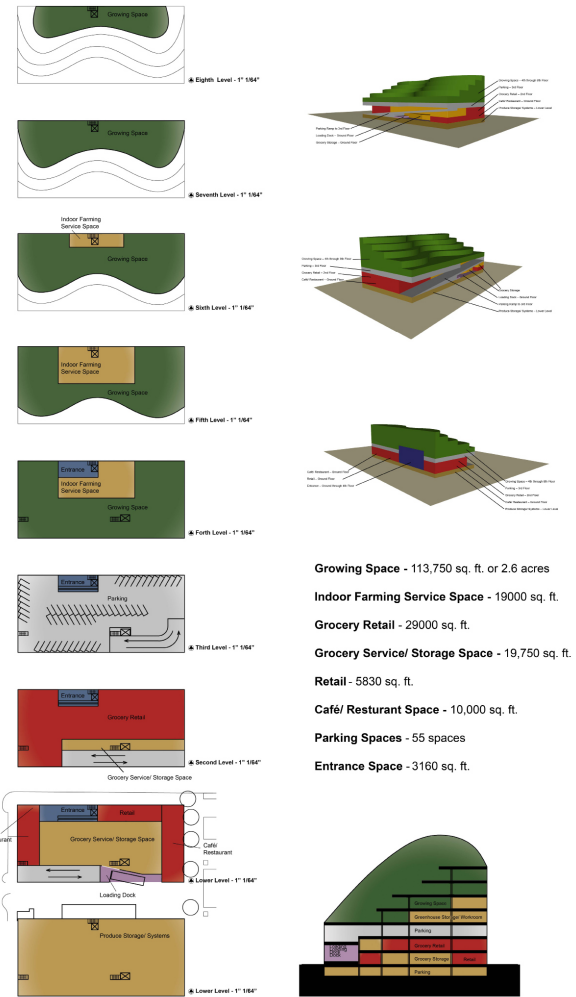
Floor Plan Option1

Summary – The parking is located on the lower level providing greater use of the above floors. Retail and Service are located on the ground level utilizing storefront entrances on the north, east, and west facades. Grocery Retail is located on the Second floor with a large entrance from the north facade. The main entry also connects up the first level of growing space. The third through eighth floors are used as interior growing space.



Floor Plan Option2

Summary – The lower level is used for storage of produce grown in the indoor growing spaces and other mechanical systems. Retail and Service are located on the ground level utilizing storefront entrances on the north, east, and west facades. Grocery Retail is located on the Second floor with a large entrance from the north facade. Parking is located on the third floor with a parking ramp connecting from the ground level and proceeding along the south façade of the building. The fourth through eighth floors are used as interior growing space.

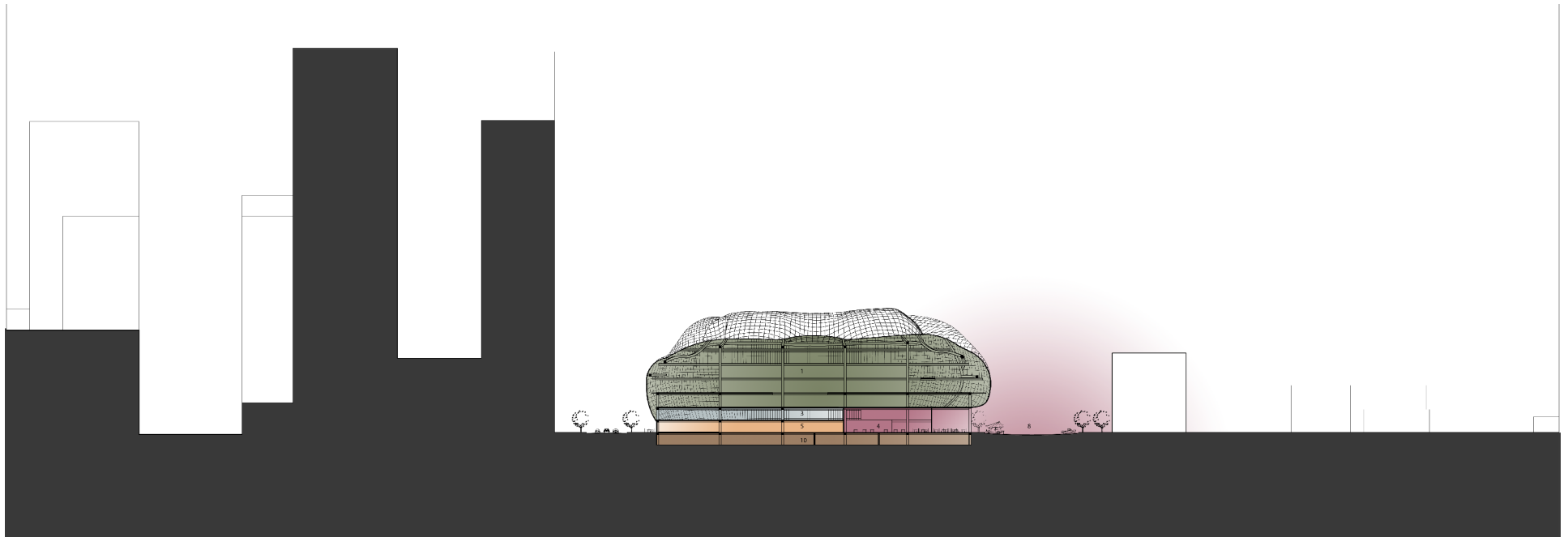
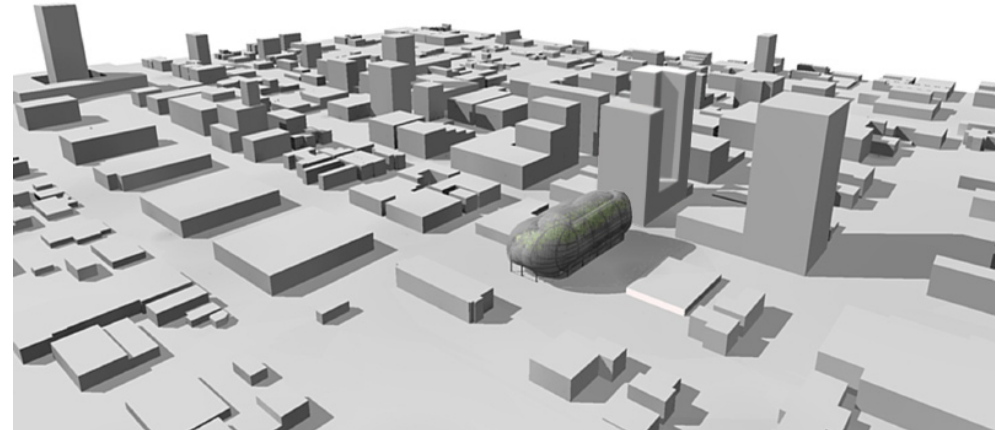


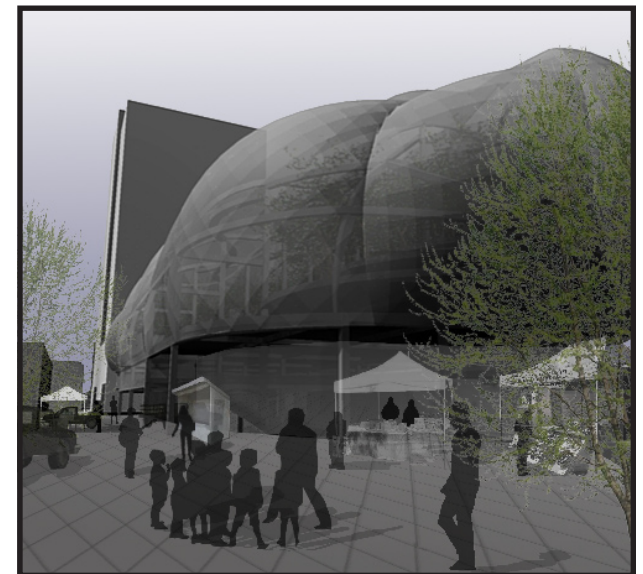
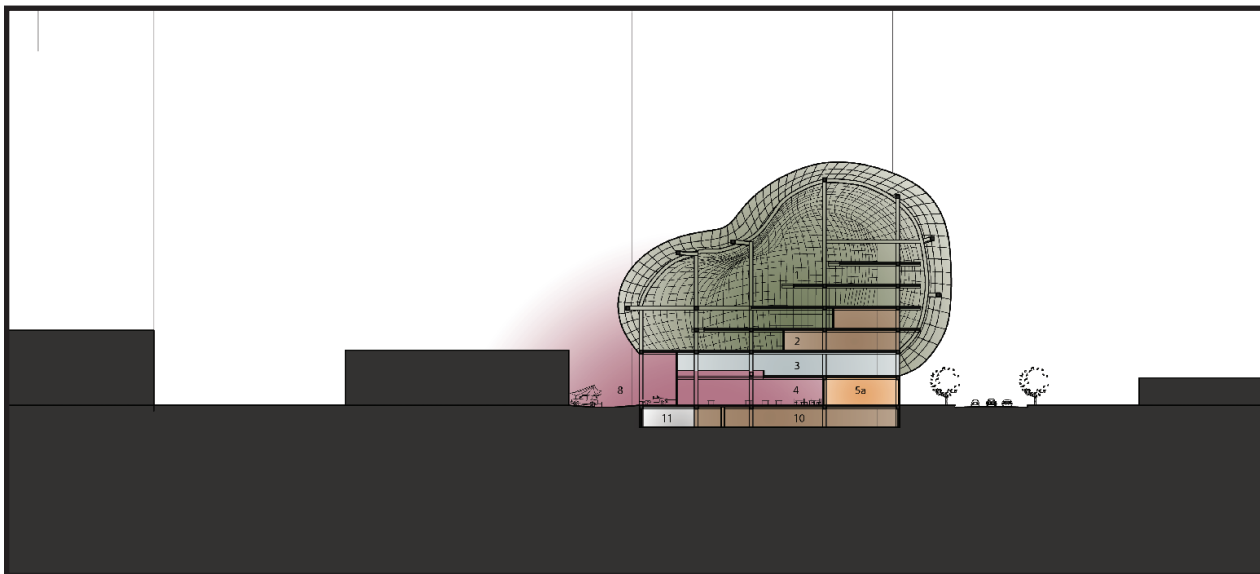
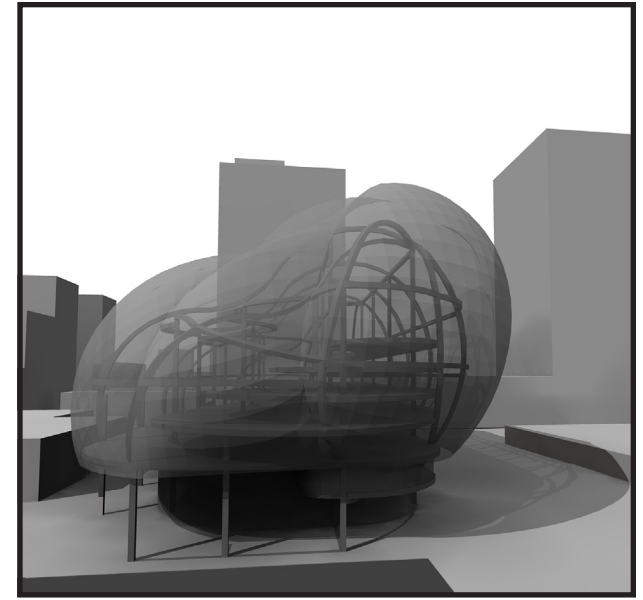
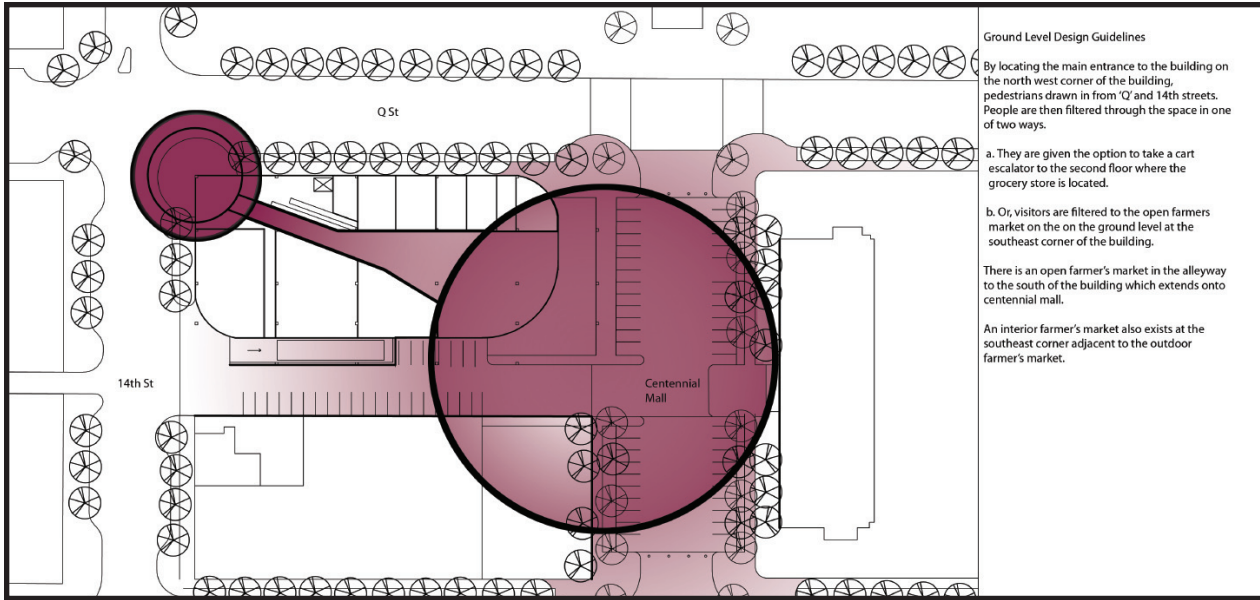
December 2007

The design in December demonstrated the project's first jump into the design of the shell for the building. The structure of the design was obscure in that it was based off design of the structure of the lower portion of the building.

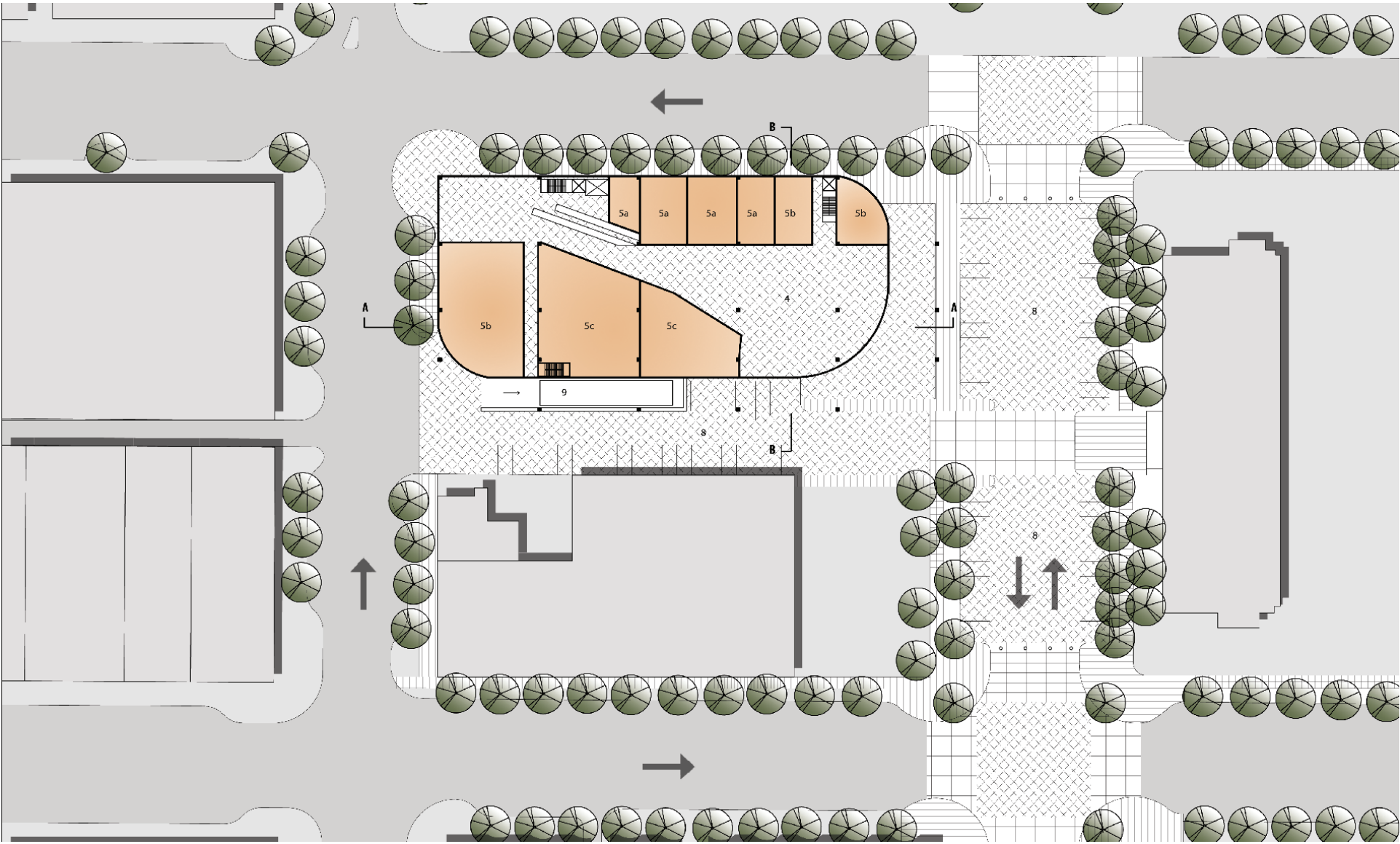
For the most part the access issues were resolved. Service for the building now took place on the lower level of the building. Large trucks are able to enter on the southwest corner of the site. A large ramp takes trucks to the lower level, where they are able to back into a loading dock, and finally turn back to drive up the ramp.

Centennial Mall was also turned into a large space for a farmers market. Materials are made of several different types of segmented materials in contrast to the adjacent concrete streets. Bollards are used to at the intersections of 'P' and 'Q' streets to block off vehicular access. This makes the farmer's market free for pedestrians to roam on market days, and it allows vehicular access and parking for market customers on non-farmer's market days.

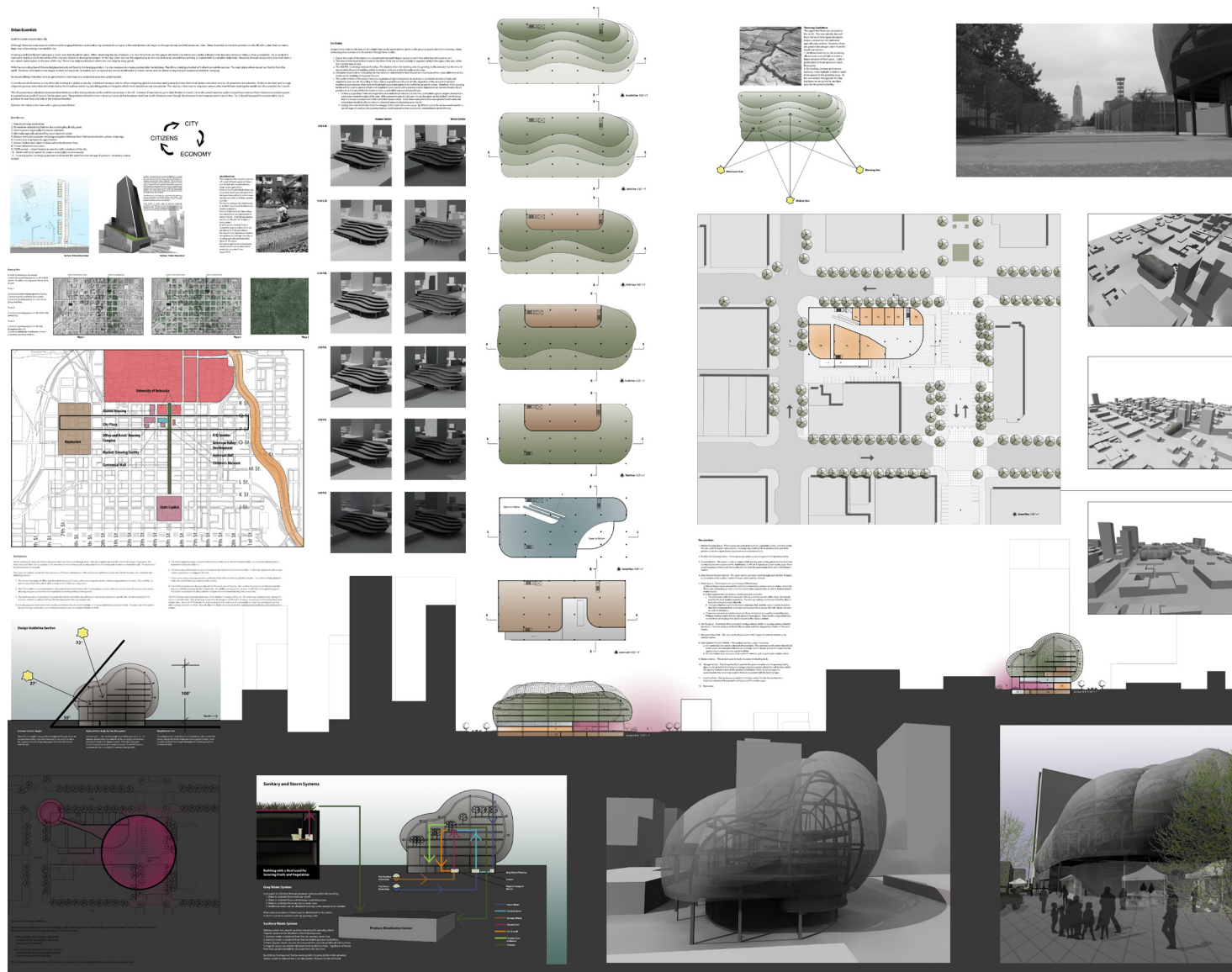




Site Plan as of December 2007

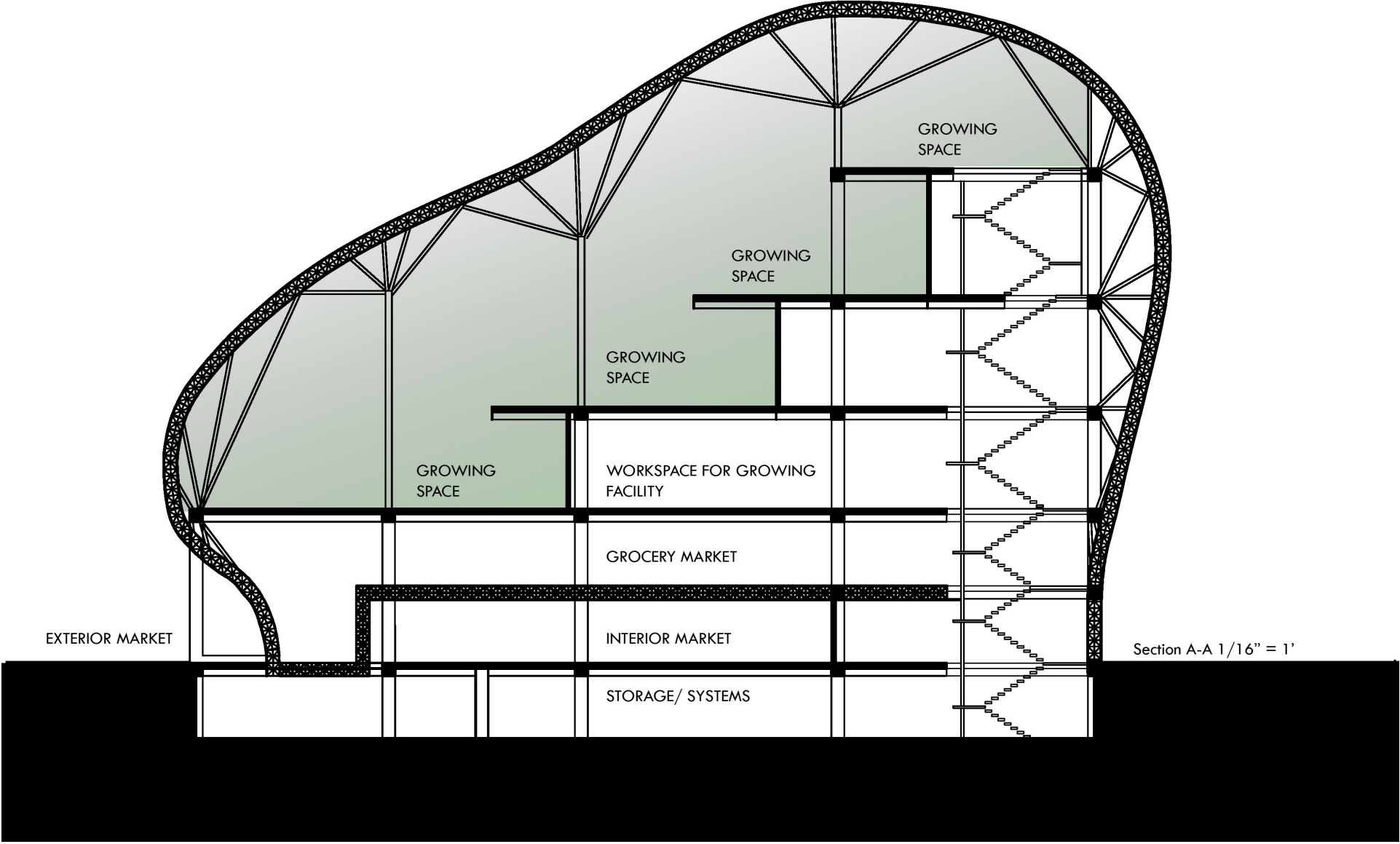


Design Boards December 2007



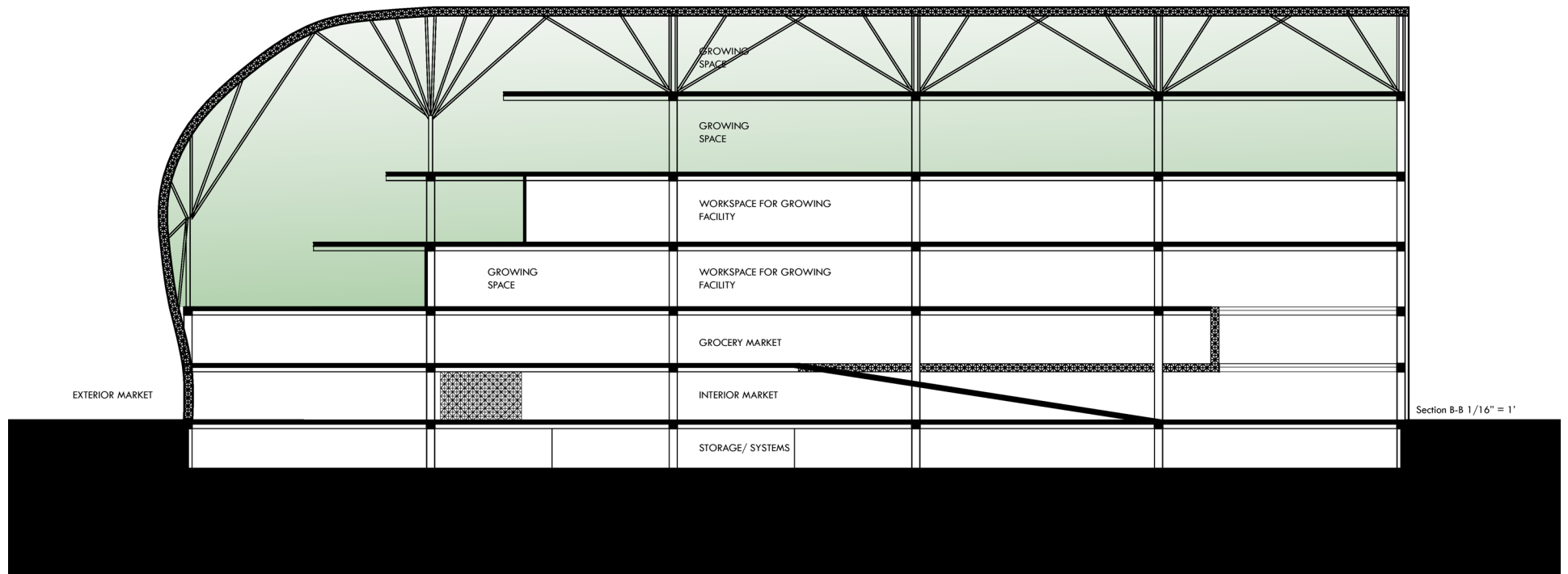
The above image is of the boards presented for December's review.

February 2008



In December the primary issue of the design was the shell for the building. The structure of the shell was trying to relate to the lower structure holding up the floors. This made the structure awkward and visually unpleasing. After the decision to use a space frame was made, the design of the shell became simpler. In February the design still included vertical supports that provided additional structure to the space frame.

Concentration on the shape of the shell as it related to the floor plans as well as the containment of the growing areas were two areas of focus. The growing facility became a separate conditioned space. This space is indicated in green in the two sections. Using glass at the north side of each floor allowed for the separation of environments.



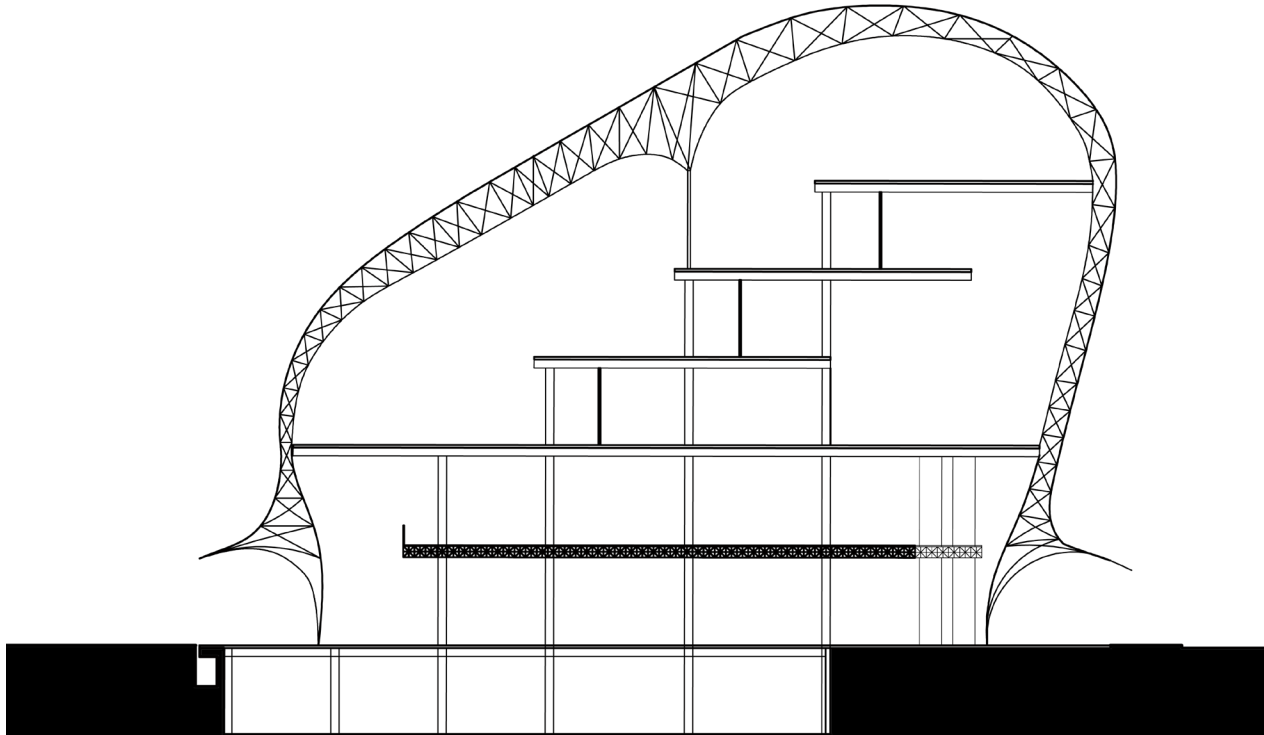
Process Section

After the February review, it was agreed upon by all critics that the space frame needed to be deeper which would then require less vertical structure. This section shows the interpretation with one vertical support. It also explores a means of providing covering over the exterior pedestrian areas.

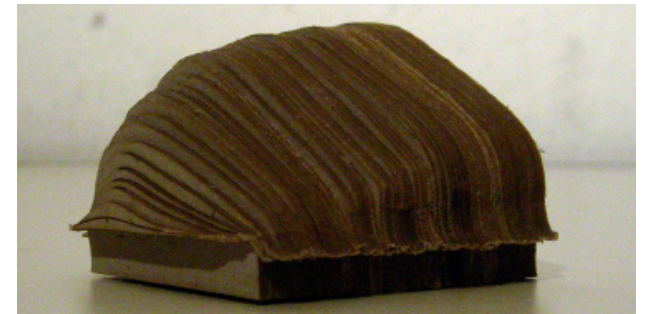
After analyzing this drawing, it was noted that in order to maintain strength, the depth of the canopy must remain the same throughout the span. Only when the space frame

meets the ground should it change in form.

This canopy can also be seen in two of the process models. These models demonstrated two main facts. One, the shape of the canopy, while it didn't look as bad in section, looked unpleasant in the model. Two, after making small sections of the first model with the laser cutter and gluing them together, it was simpler to understand the complex curves that the space frame needed to accommodate.



Process Model B

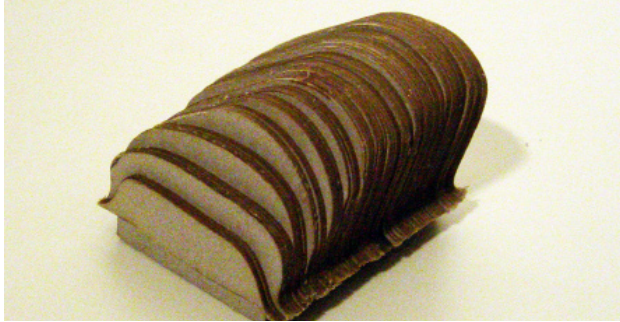


Process Mode C



Process Model C

Laser Cut Process Models

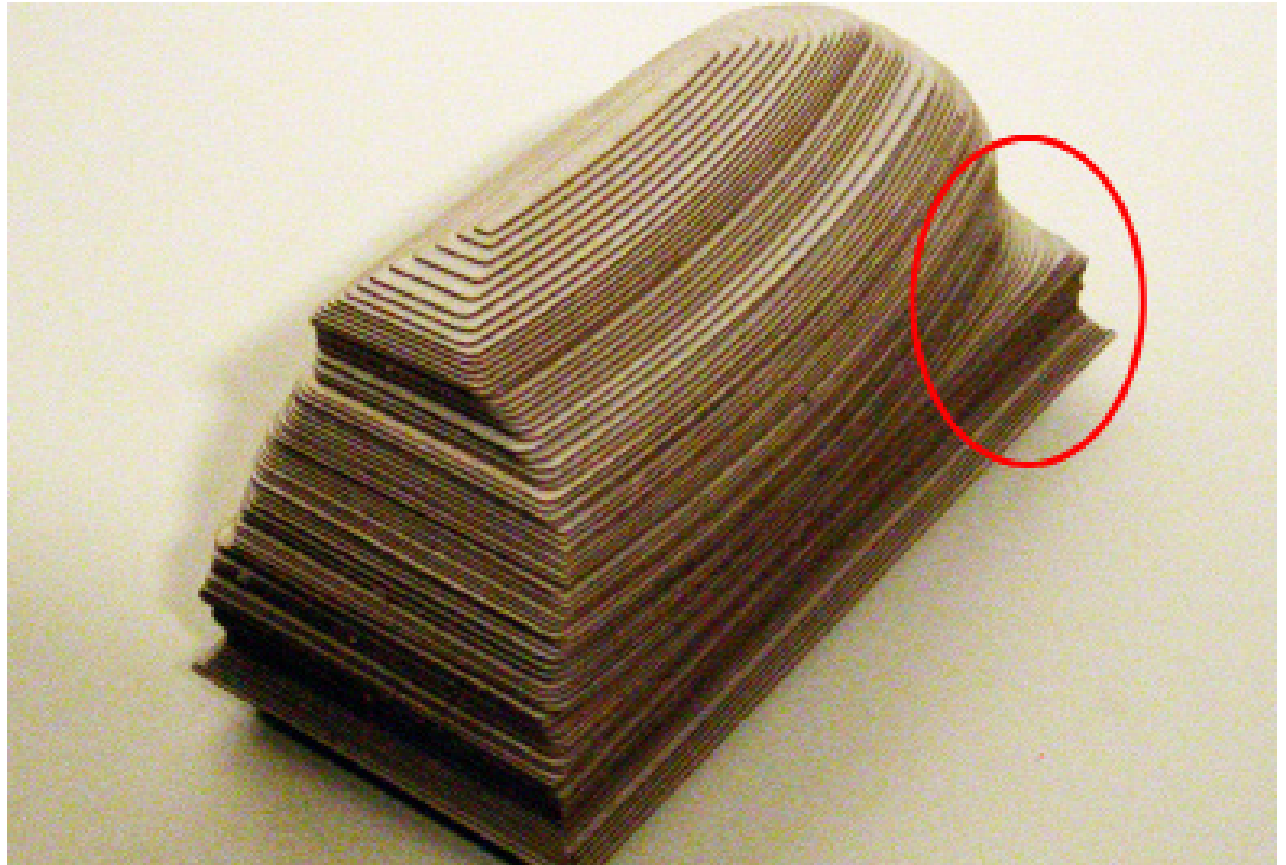


Process Model B

The use of the architecture department's laser cutter was vital to the design of the space frame. Due to the terraced floors in the growing facility and the need for the structure to then form around a square base made the design of the space frame complex. Ultimately it was those multifaceted forms that guided the decision to use a space frame for the structure of the skin.

Prior to the model making process the form of the building was fairly conceptual and undefined. The models aided to find errors in the design, and provided a means to understand and draw the form.

Process model A was made based upon the design as it stood in February. The model was made by drawing each layer of chipboard in AutoCAD as it would fit around each floor plan. Many lessons were learned from this model. One, the scale of the model is disproportionate in height. This is due to the lack of compensation for the layers of glue. Two, working with the layers in plan made it difficult to achieve the true form of the space frame. Three, it identified significant errors in the design that were unpleasant. The



Process Model A

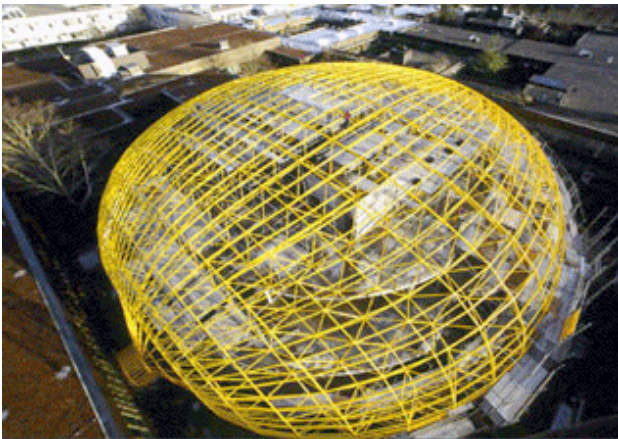
ways in which the corners of the building formed from around to square was awkward. The west side of the building also didn't form with the rest of the building. It needed to take on a more aerodynamic form to identify with the shape of the rest of the building.

Process Model B revealed the disadvantages of using the layers in section. These layers were once again drawn to form around floor plans. However, this model did not

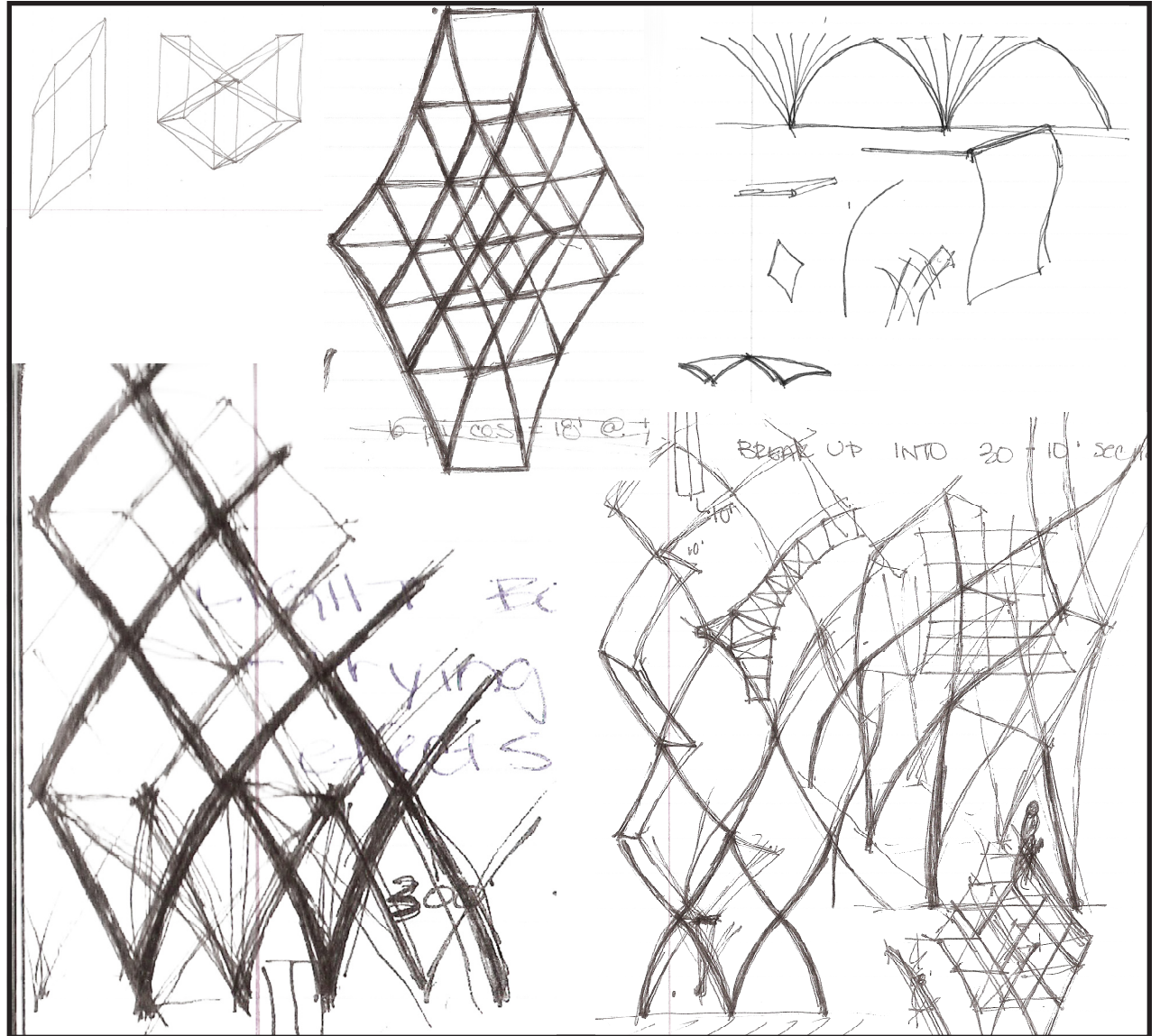
reveal the three-dimensional curves of the structure. It did, however, inform decisions as to ways of correcting this issue.

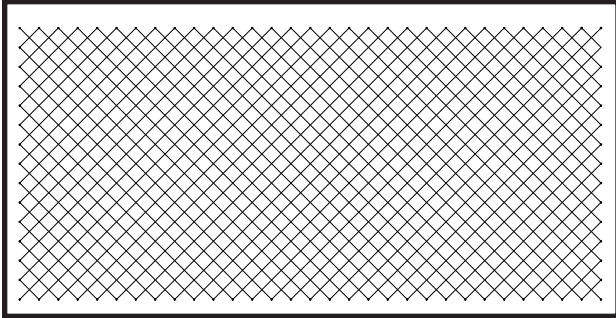
Process Model C finally achieved the three-dimensional curves necessary to design the space frame. It also revealed the odd and uncomfortable shape of the canopy which was later redesigned.

Designing the Space Frame



The images above are inspirational designs by Future Systems. They have worked on many projects involving curved glass. Both images were taken from their website, <http://www.future-systems.com/architecture>.

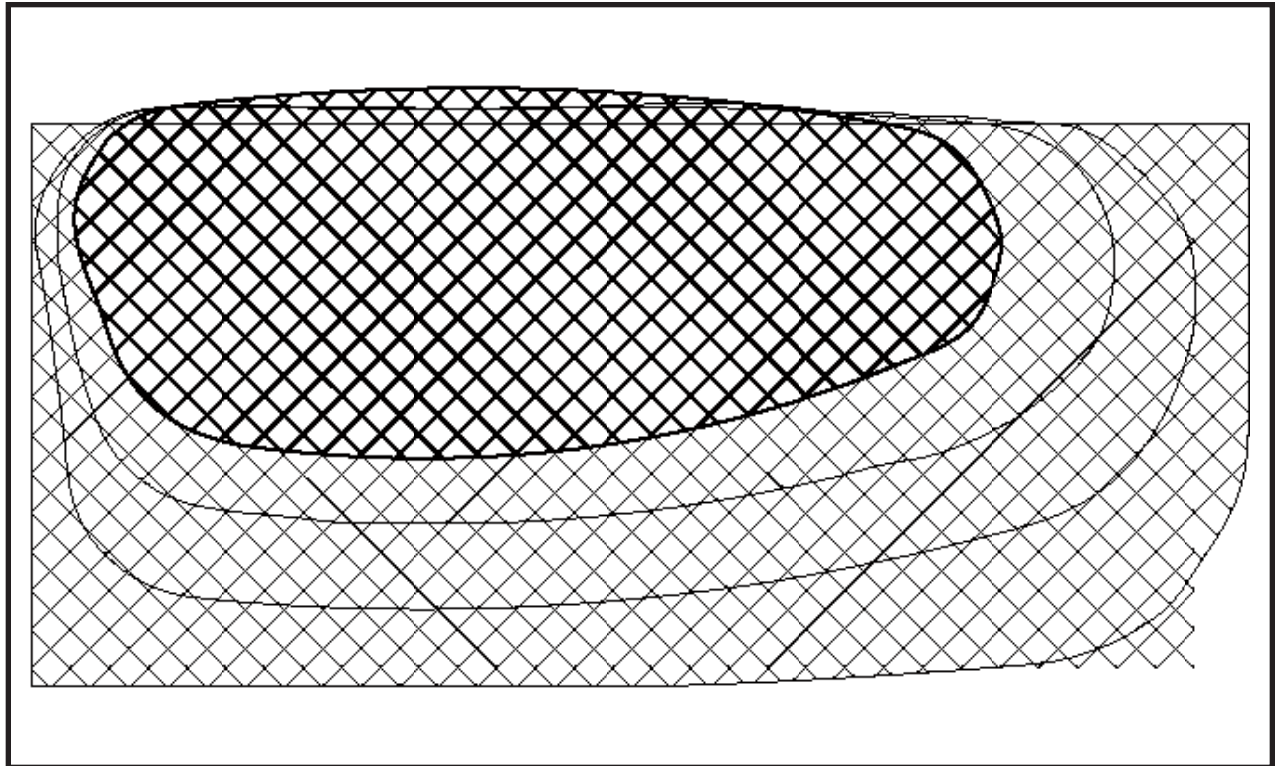




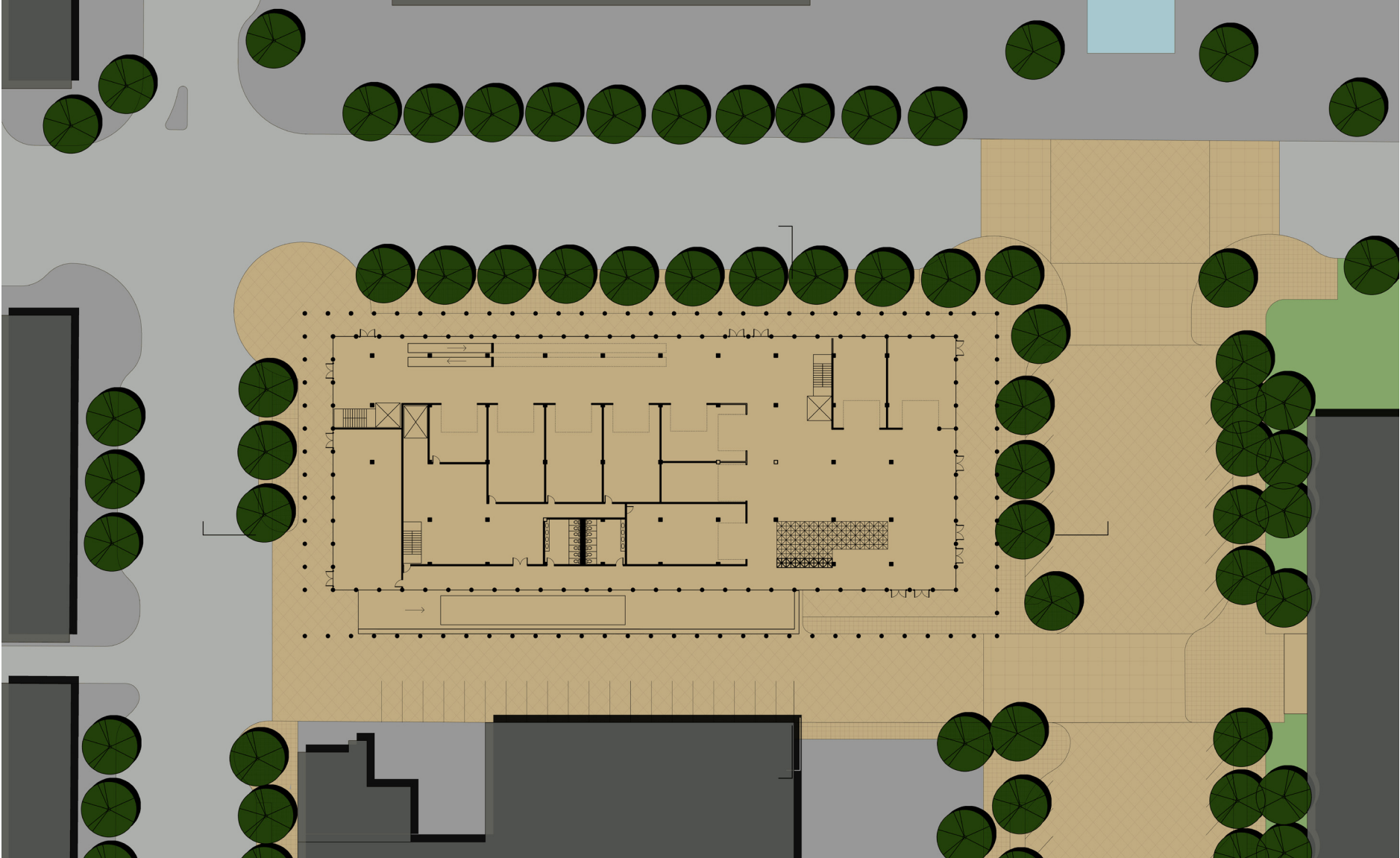
After conceiving a greater idea about the complexity of these curves, it was time to design the curves exactly to fit to the floor plans and sectional needs. A grid was arranged at 45-degree angles in plan in opposing directions. This grid helped to establish where the exterior and interior structural members of the space frame are placed. The exterior grid was set up with 10' spacing between the members on the ground level. This helped to establish the regularity of the space frame as it met the ground and the foundations below the ground to create an even distribution of load as well as repetitive clean and simple urban fabric.

After the grid was established, it was applied to each floor individually. So, the grid was applied to each floor directly above the grids located on the floors below. As the grid touched the edge of a floor plate, a line was extended 18' in the 'z' or the vertical direction. Each vertical line was then connected with a curve until there were curves extruded around the entire structure. From each base point on the ground level, a 10" steel form was extruded to fit the curve. After all steel rods were extended, the exterior of

the structure was complete. The interior was then formed using the same system. The base points on the ground level were offset in the center of the exterior members. This is where the strength of the space frame was achieved because the middle members connecting the exterior and interior members were able to equally distribute the weight of the structure.



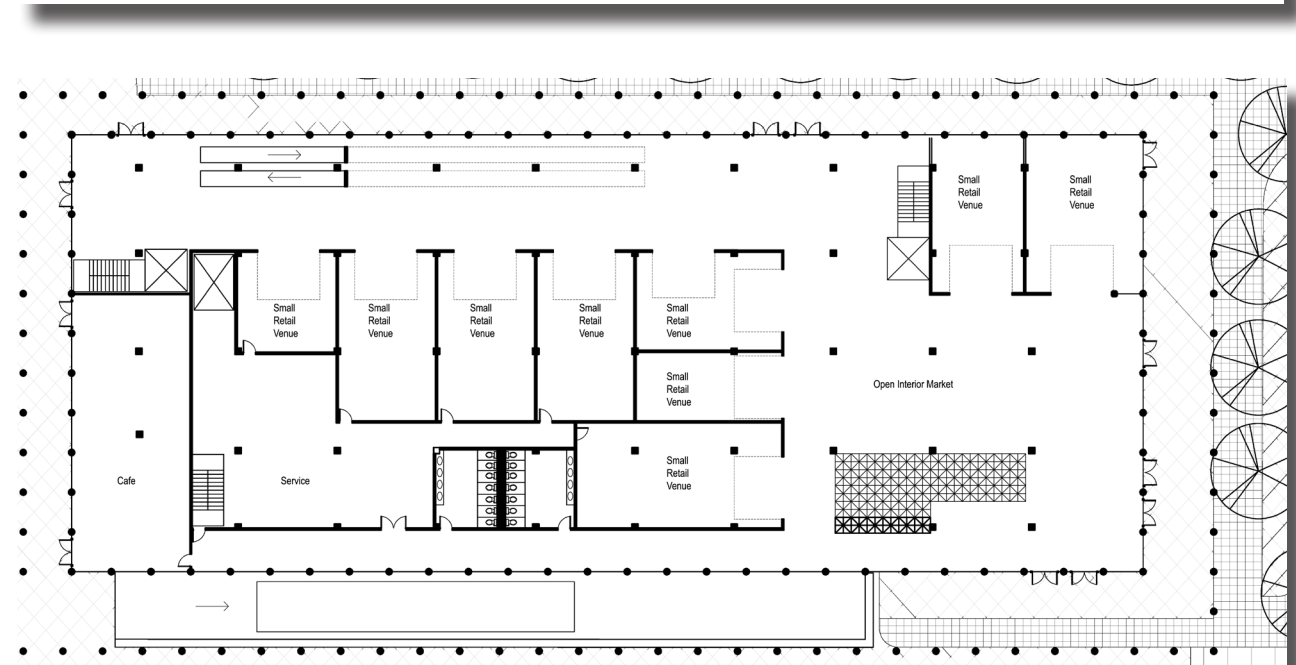
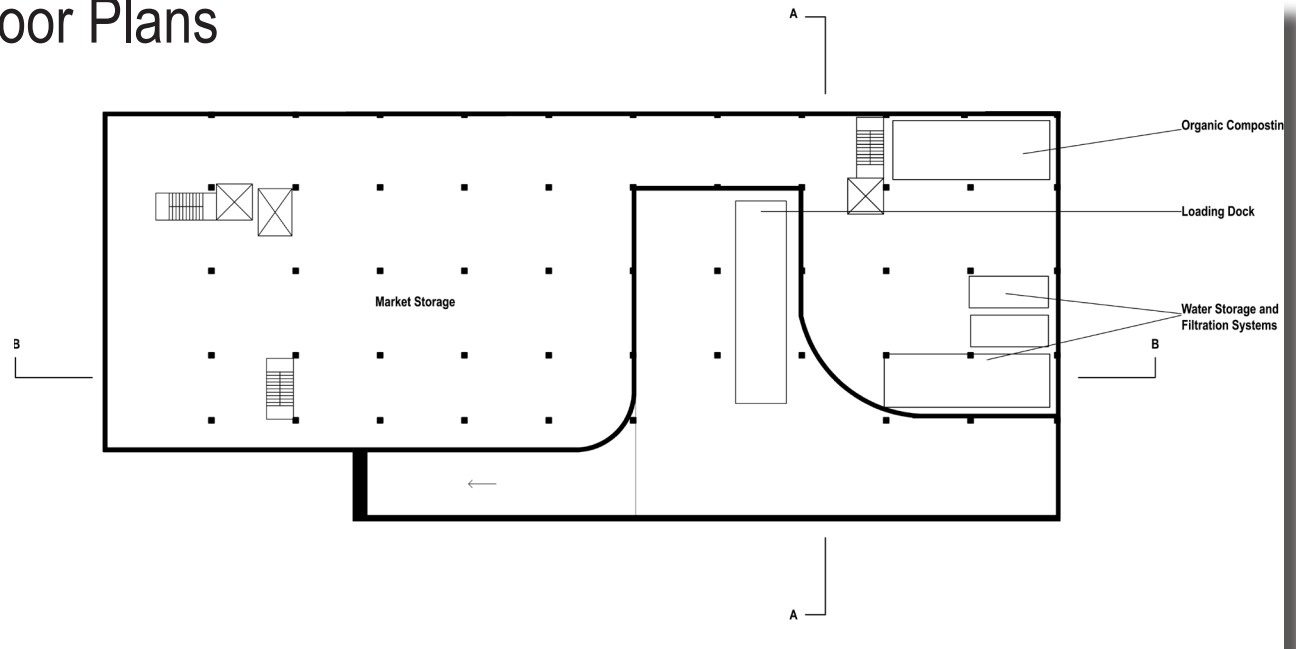
Site Plan



Lower Level and Ground Floor Plans

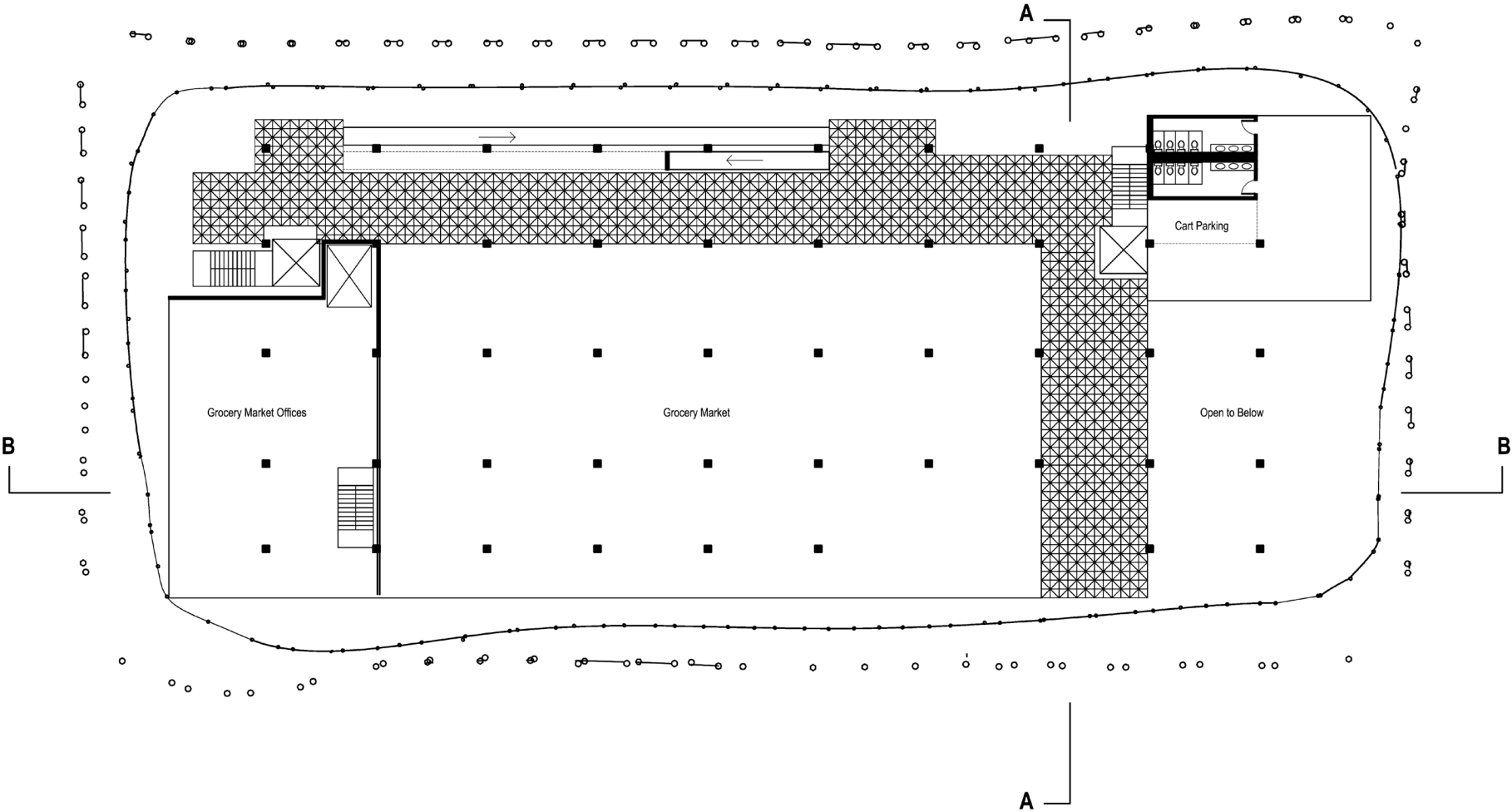
The lower level of the building is used for the loading and unloading of goods. It is accessible to trucks via a ram on the south side of the building. Also located on the lower level is the majority of the storage for the grocery market, as well as storage for the other market venues. The buildings many large system requirements are also located here.

The ground level of the building will be used mainly as an open market. The west side of the building is used as a cafe or coffee shop, similar to its existing use. Large ramps are accessible at the northwest corner of the building. These ramps bring users to the second and third floors of the building. The market venue spaces have large glass overhead doors that can pull down at night or create open free spaces during the day. There is also a large interior farmer's market area on the southeast corner of the floor plan. In the space any sort of small venue can be set up temporarily. Adequate storage was provided near the restrooms to allow for various tables and displays for the venues to be stored. The northeast corner has two smaller venues. Ideal businesses located here would be bakeries, delis, or coffee shops. Tables could be placed on the interior and the exterior providing lively activity and seating.



Second Floor Plan

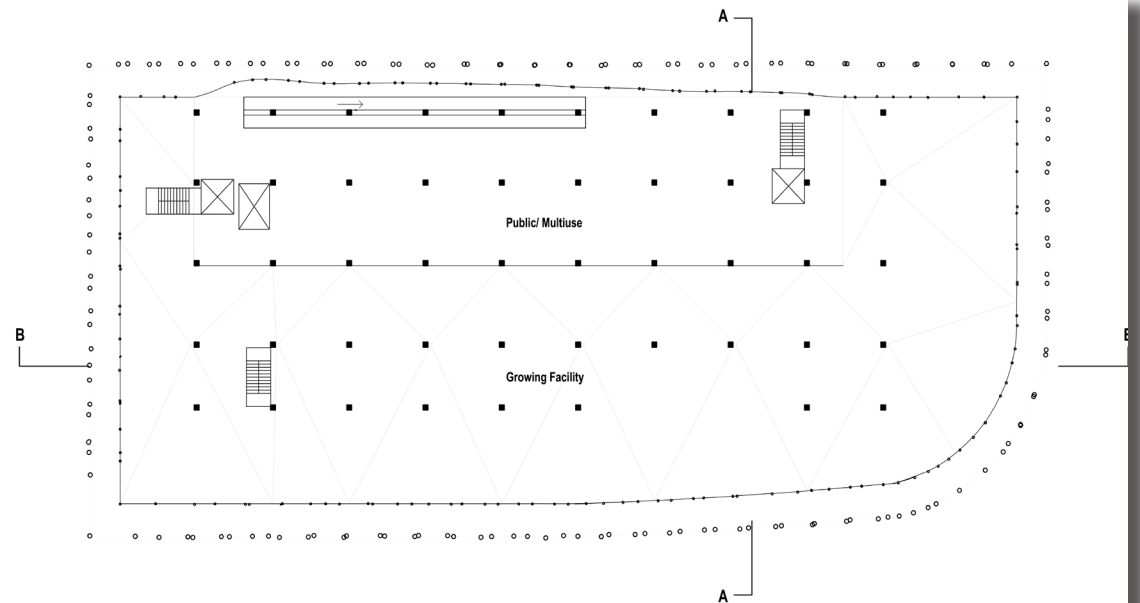
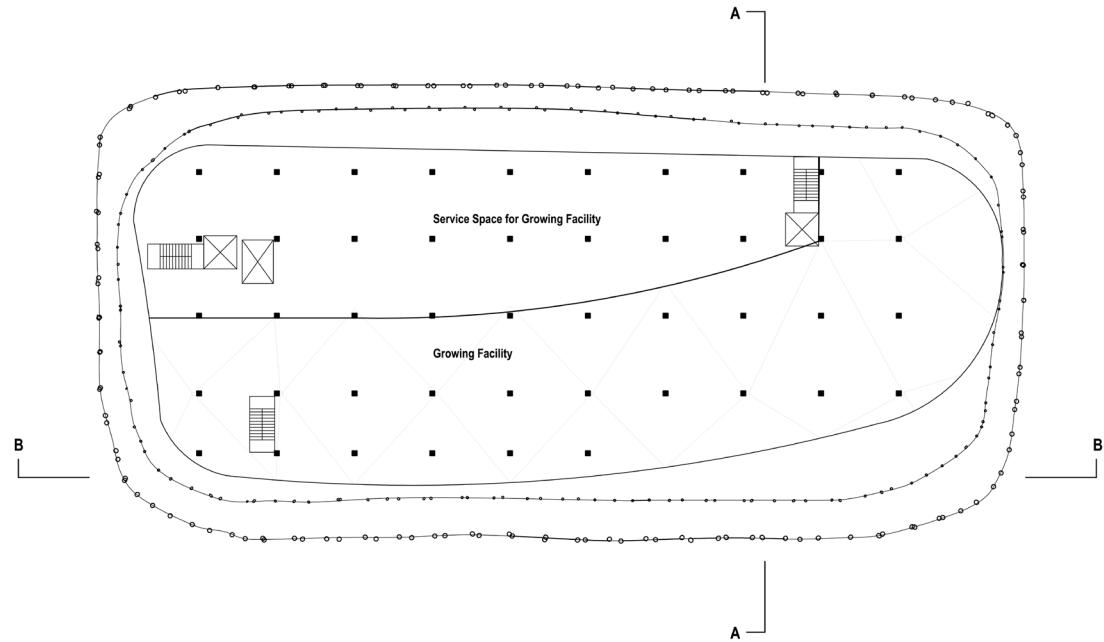
The interior space frame is most visible in the second floor plan of the building. It separates the moving ramps from the market area. Also located on the second floor is a service space for the market area. In this space, offices for the market as well as a small amount of storage are provided. Restrooms and cart parking are located on the northeast corner of the floor plan. All other space is used for the grocery market.



Third and Forth Floor Plans

The two lower levels of the growing facility will be used mainly for the growing of green vegetables and other plants that like cool climates.

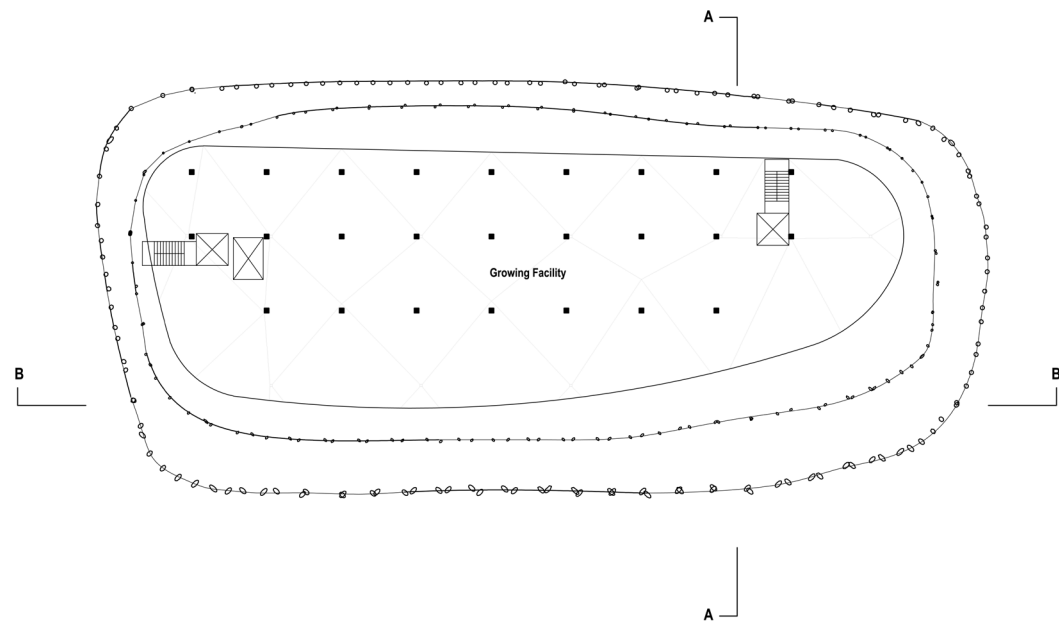
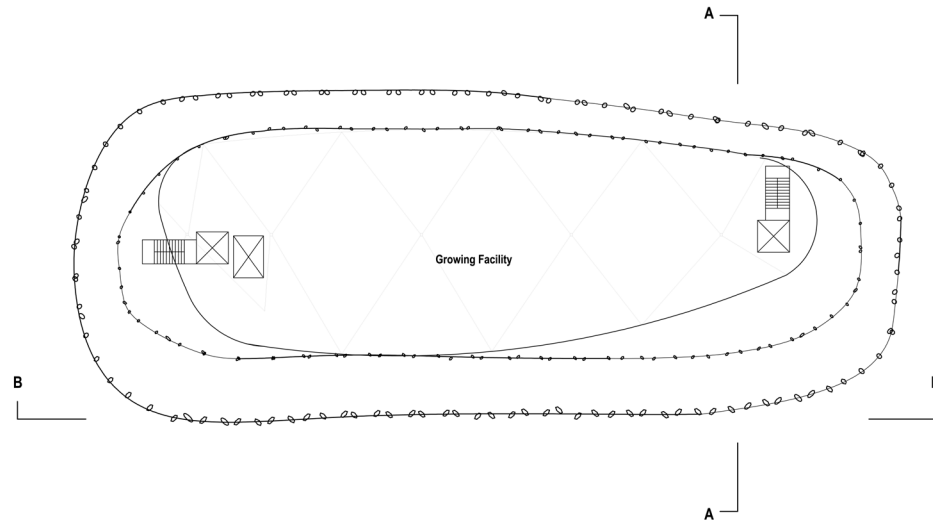
The third floor is also accessible to the public. The non-growing space can be used as market space and as a learning center.



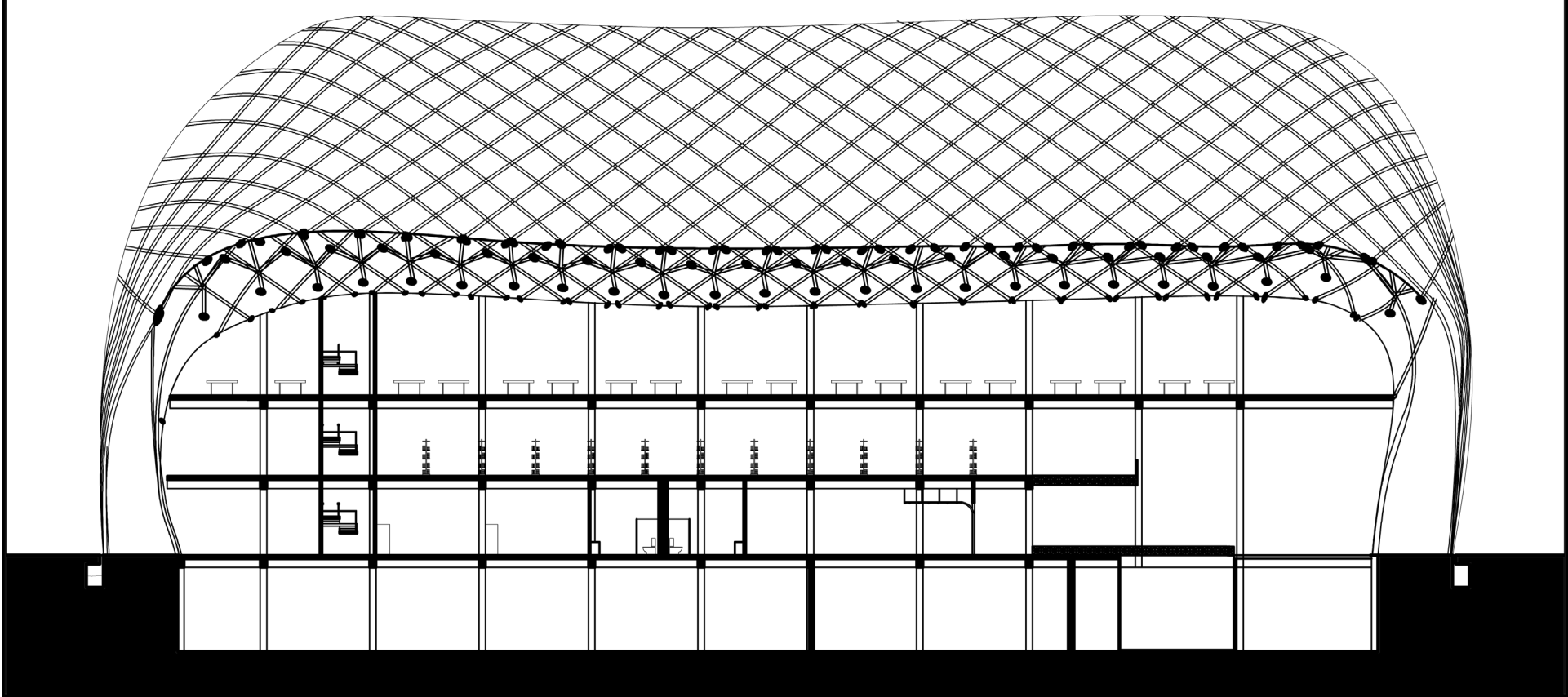
Fifth and Sixth Floor Plans

These are the top two floors. Both floors are used for the growing of fruits and vegetables. The upper floor is designed with a minimum of 25' in height in the center. This allows for small trees to be grown in this area.

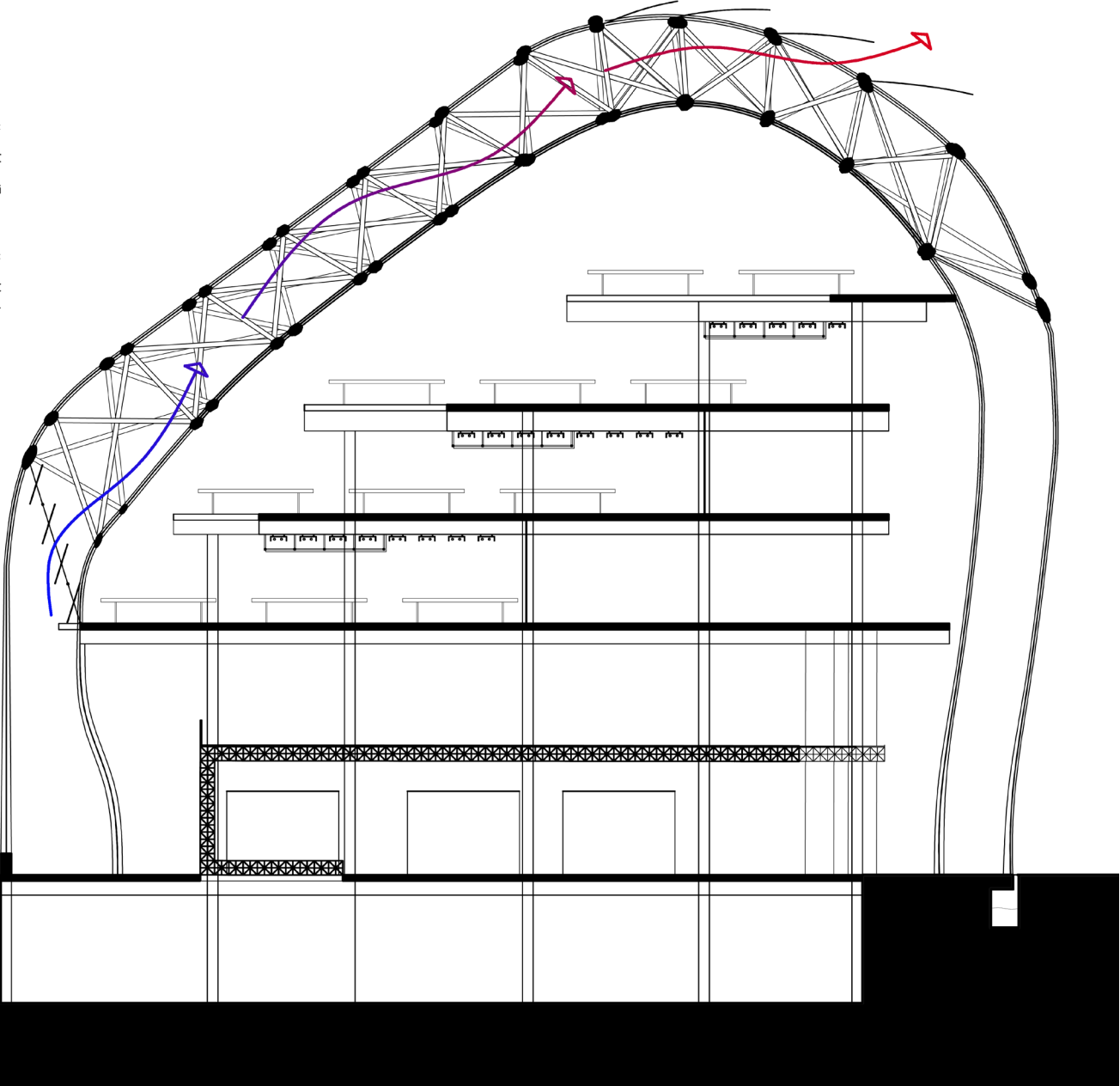
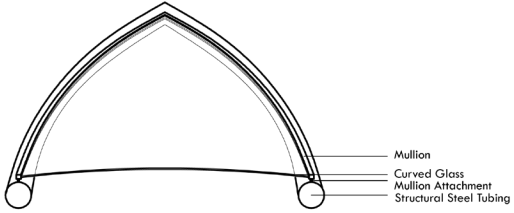
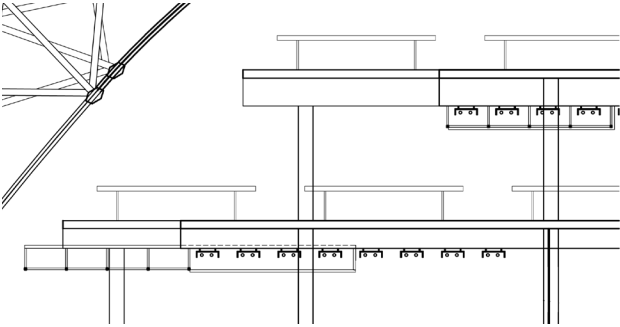
This floor may also mainly be used to grow citrus fruits and other fruits and vegetables that require warm climates as the heat will rise and make this the warmest microclimate throughout the building.



Section B-B



Section A-A

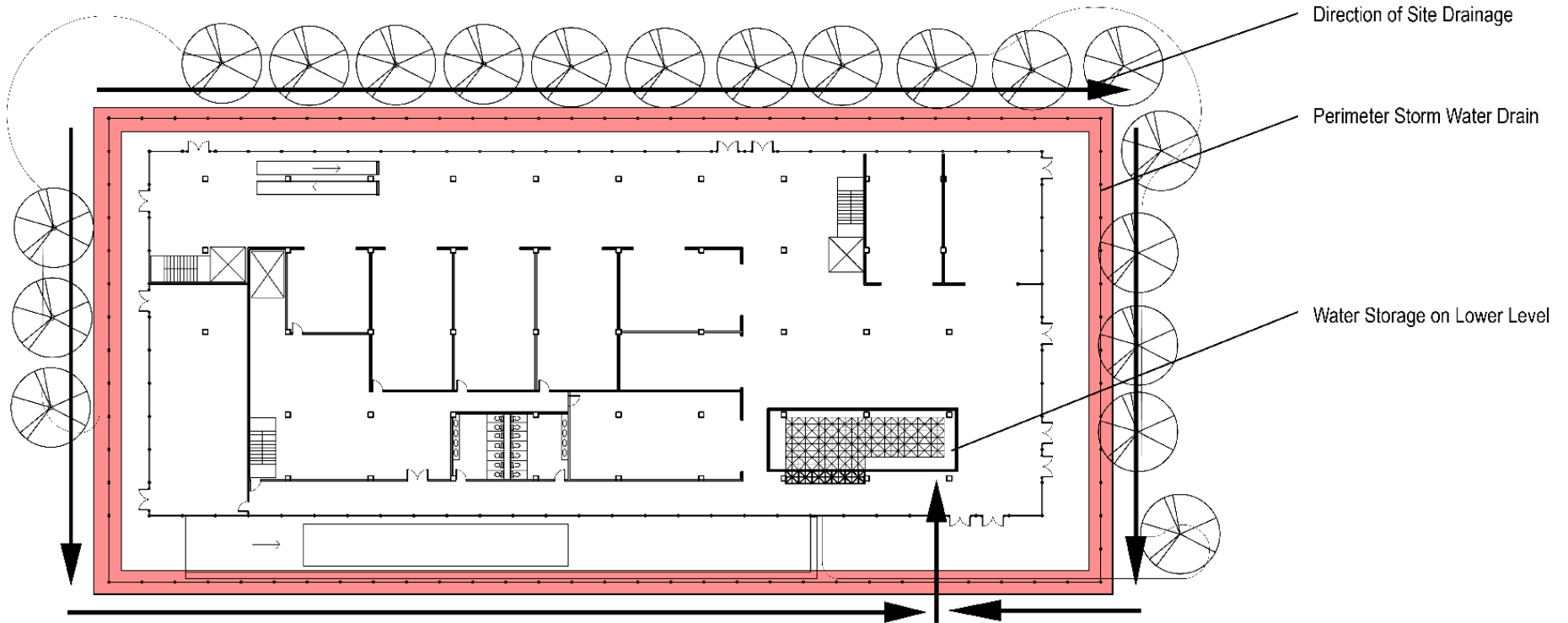


Storm Water Drainage

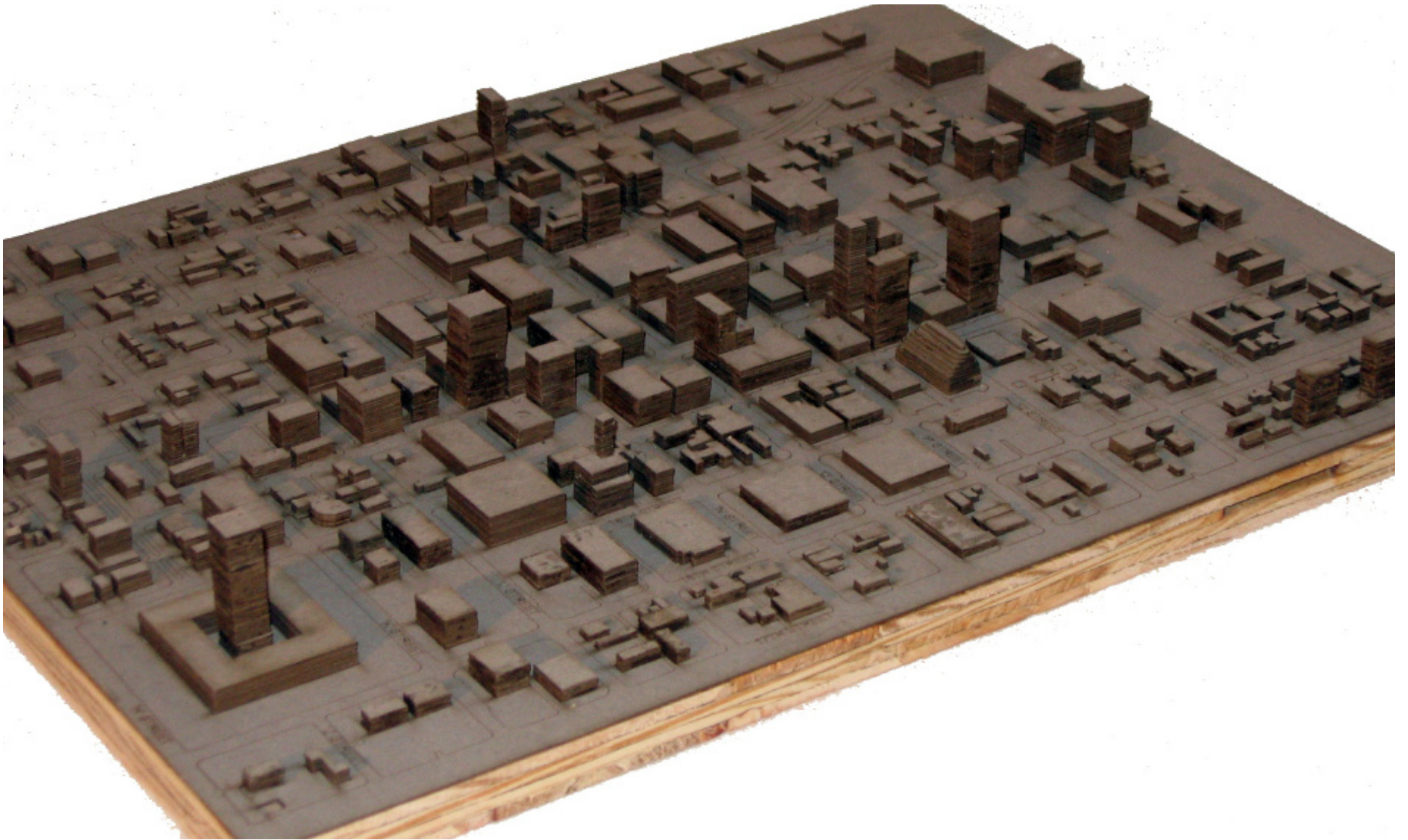
The final design of the storm water drainage system accepts that water will flow along the exterior of the space frame. This fact was utilized by designing a drain along the perimeter of the base points of the space frame. Water then flows to the lowest point of the drainage system into a storage tank located below the finish of the interior space frame.

space frame to inform building users of the reuse of water. It also creates a unique sitting area in the large interior market. Often in large mall spaces a water features are used as attraction points with seating. This is similar, but rather than having spectacle water fountains, the spectacle is the confusion of the building user for the containment of the water under the seating area.

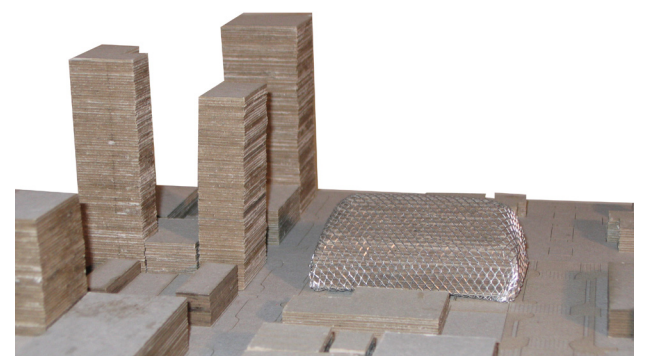
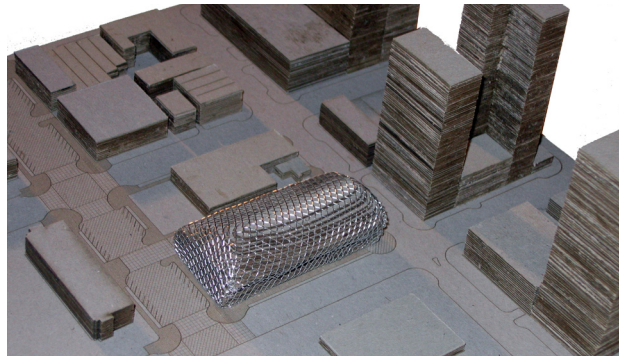
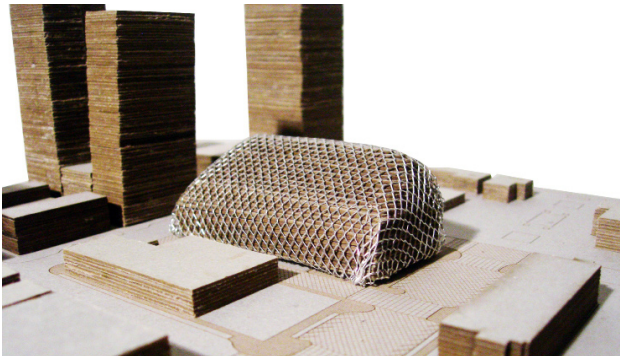
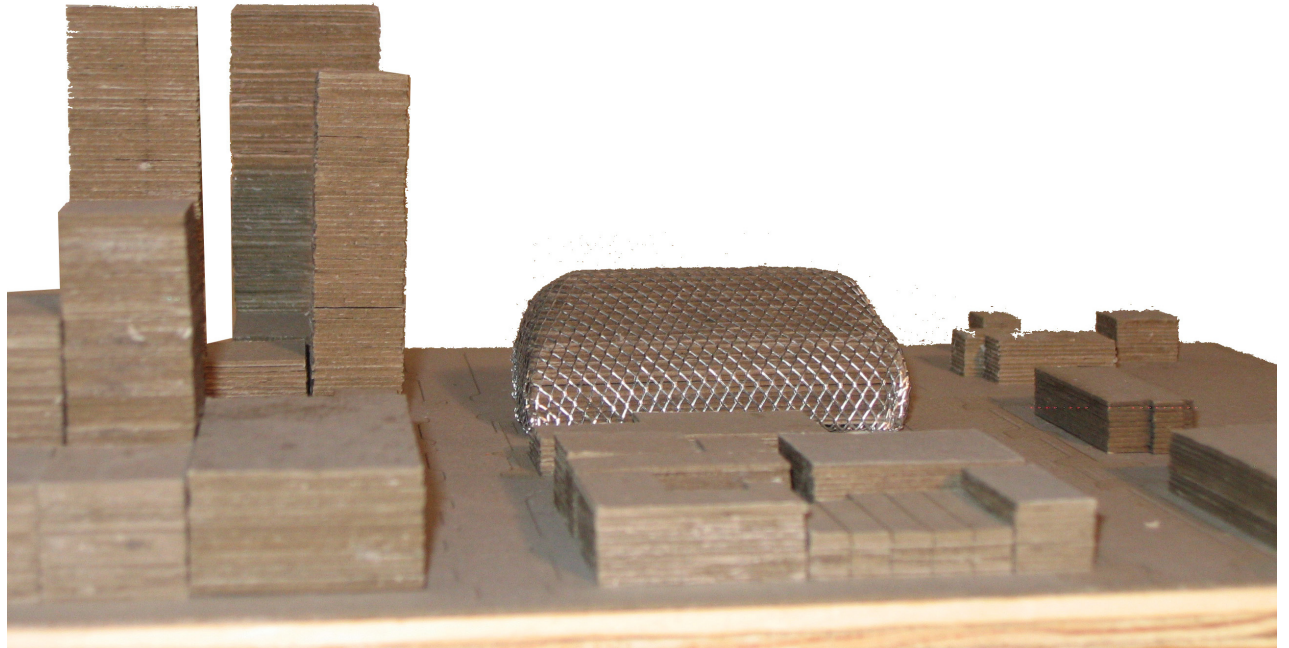
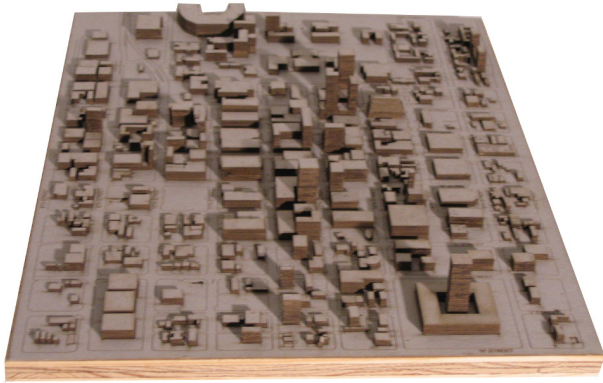
The storage tank is located at the end point of the interior



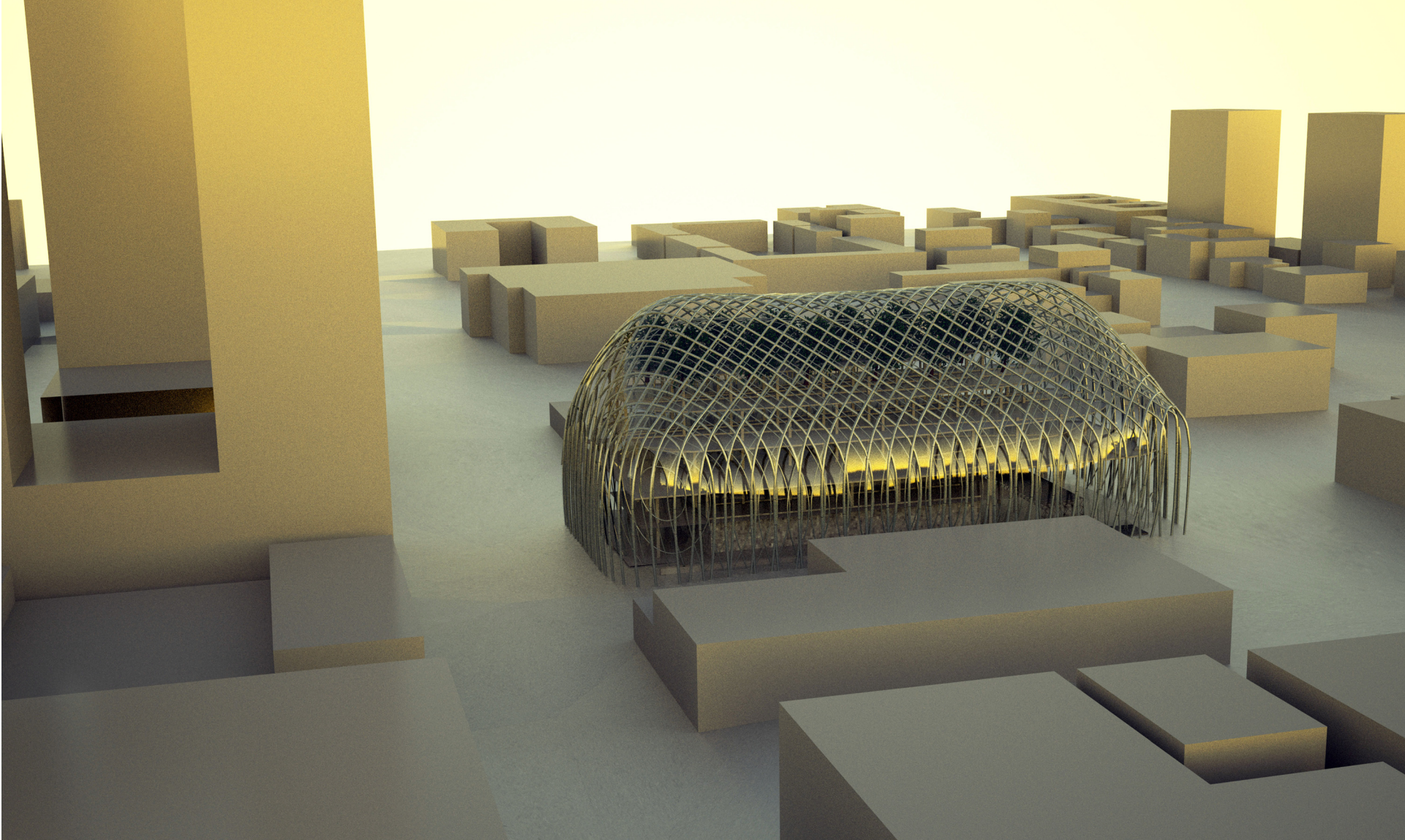
1" = 300' Site Model



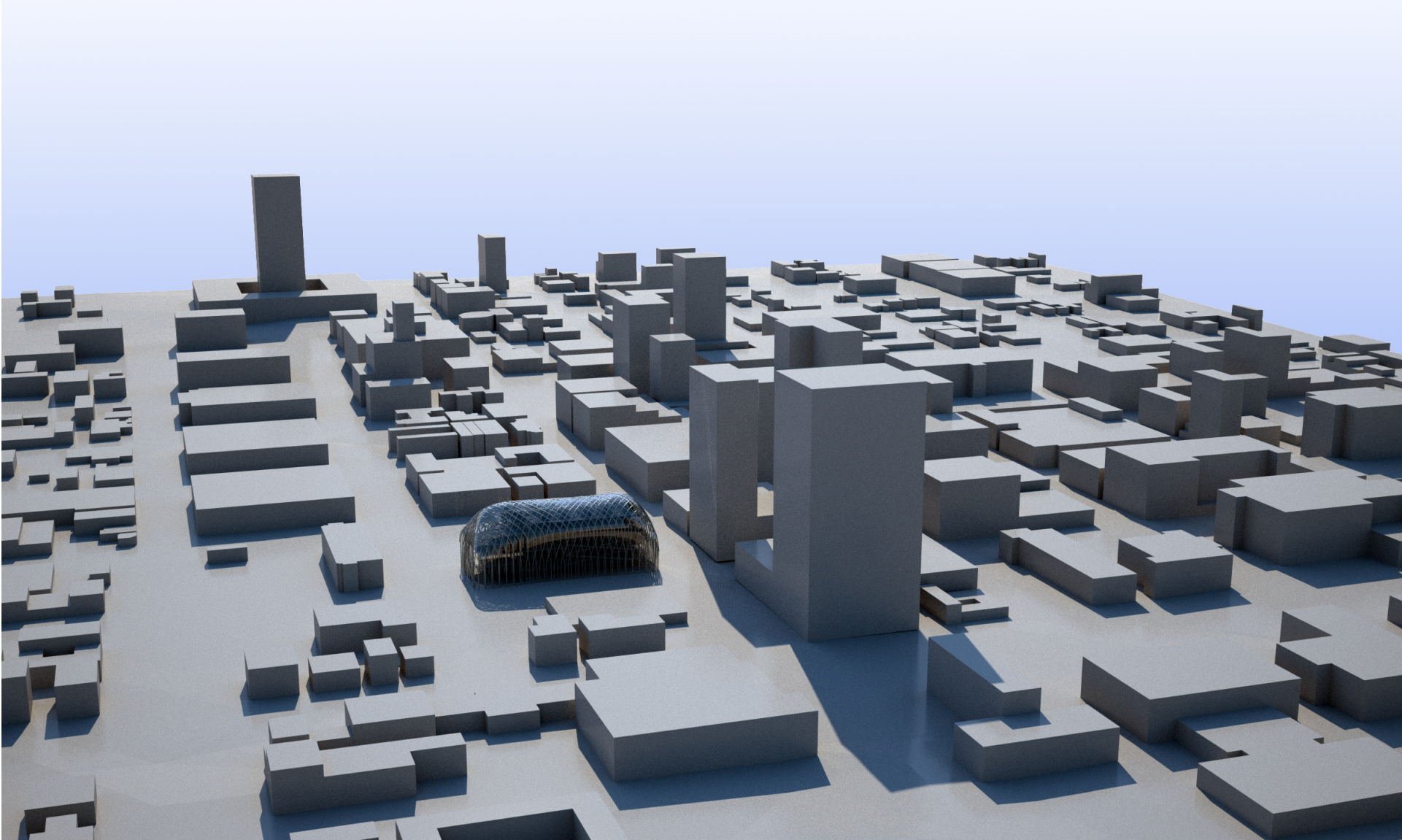
1" = 100' Site Model



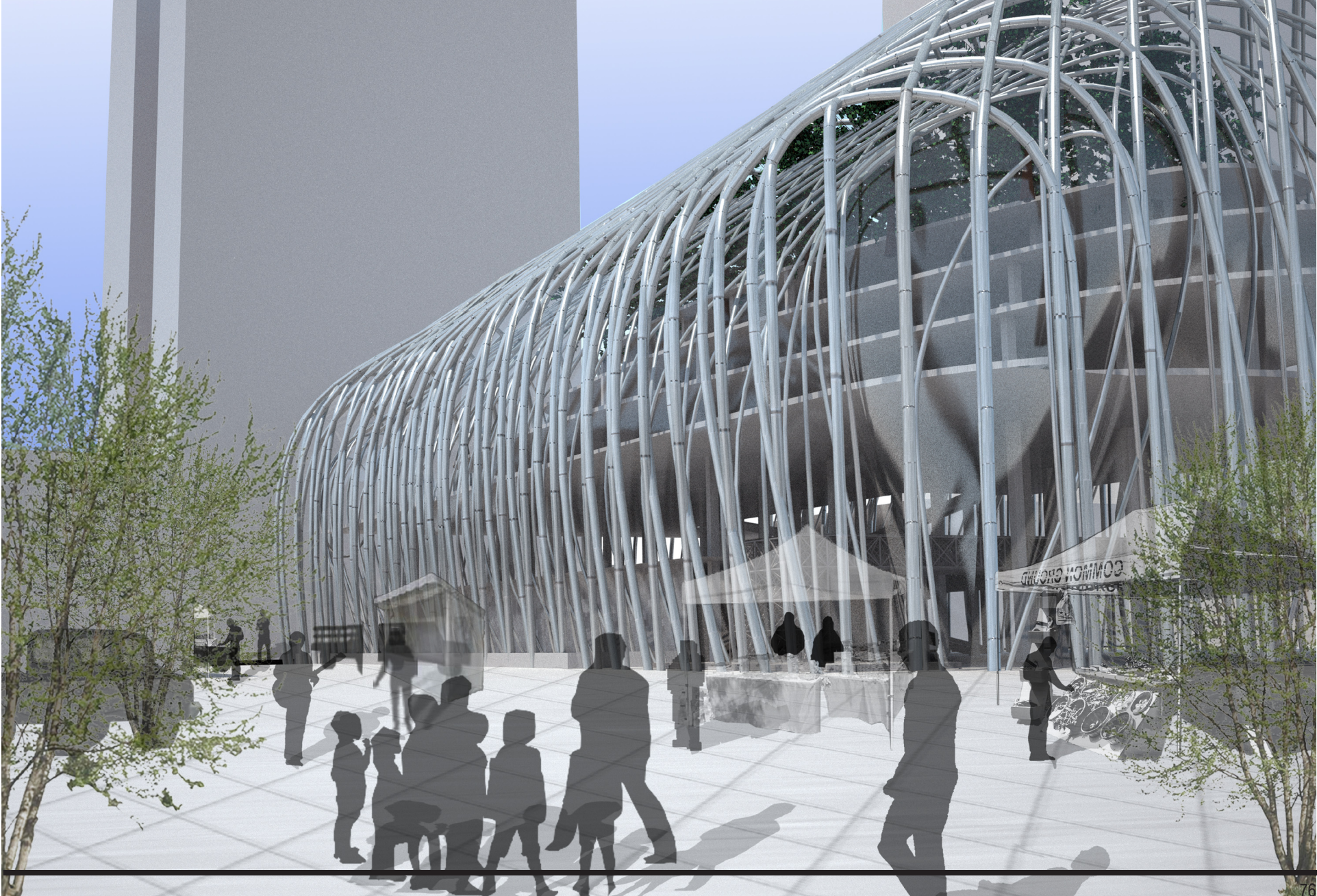
Southwest Bird's Eye View



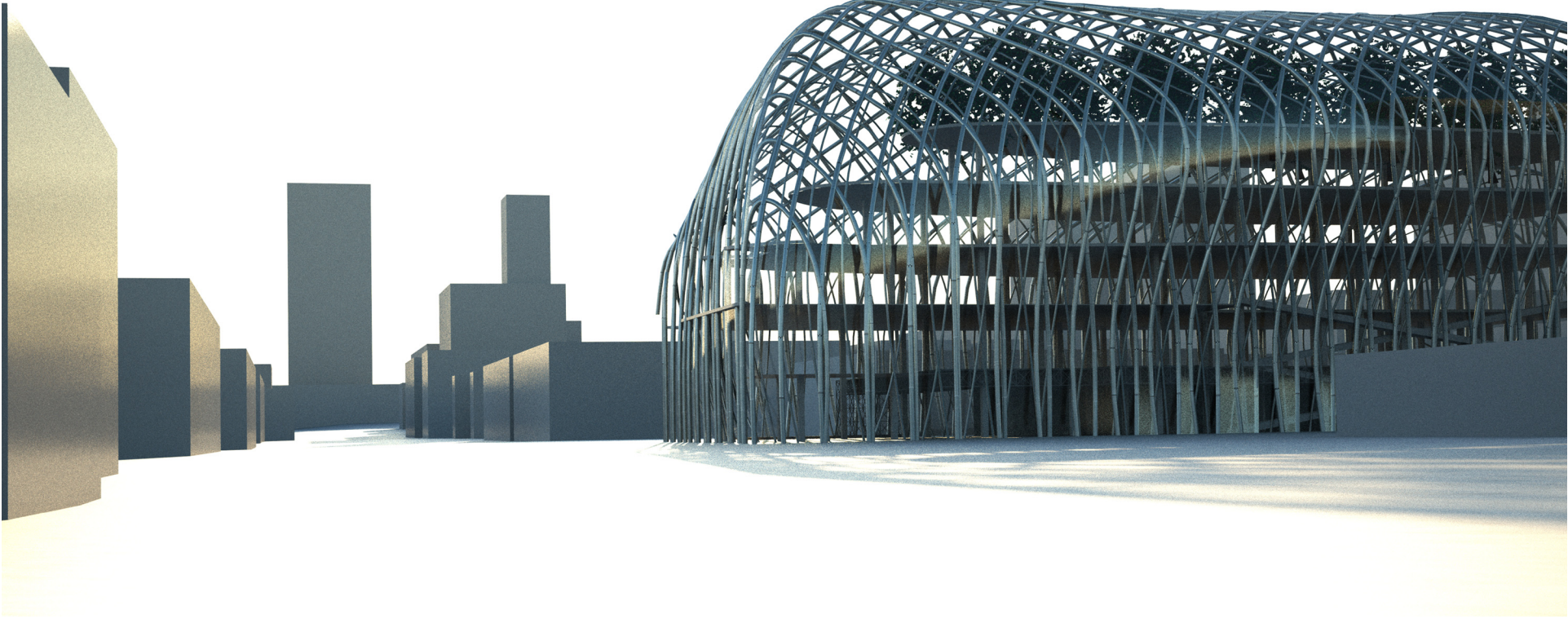
Northeast Bird's Eye View



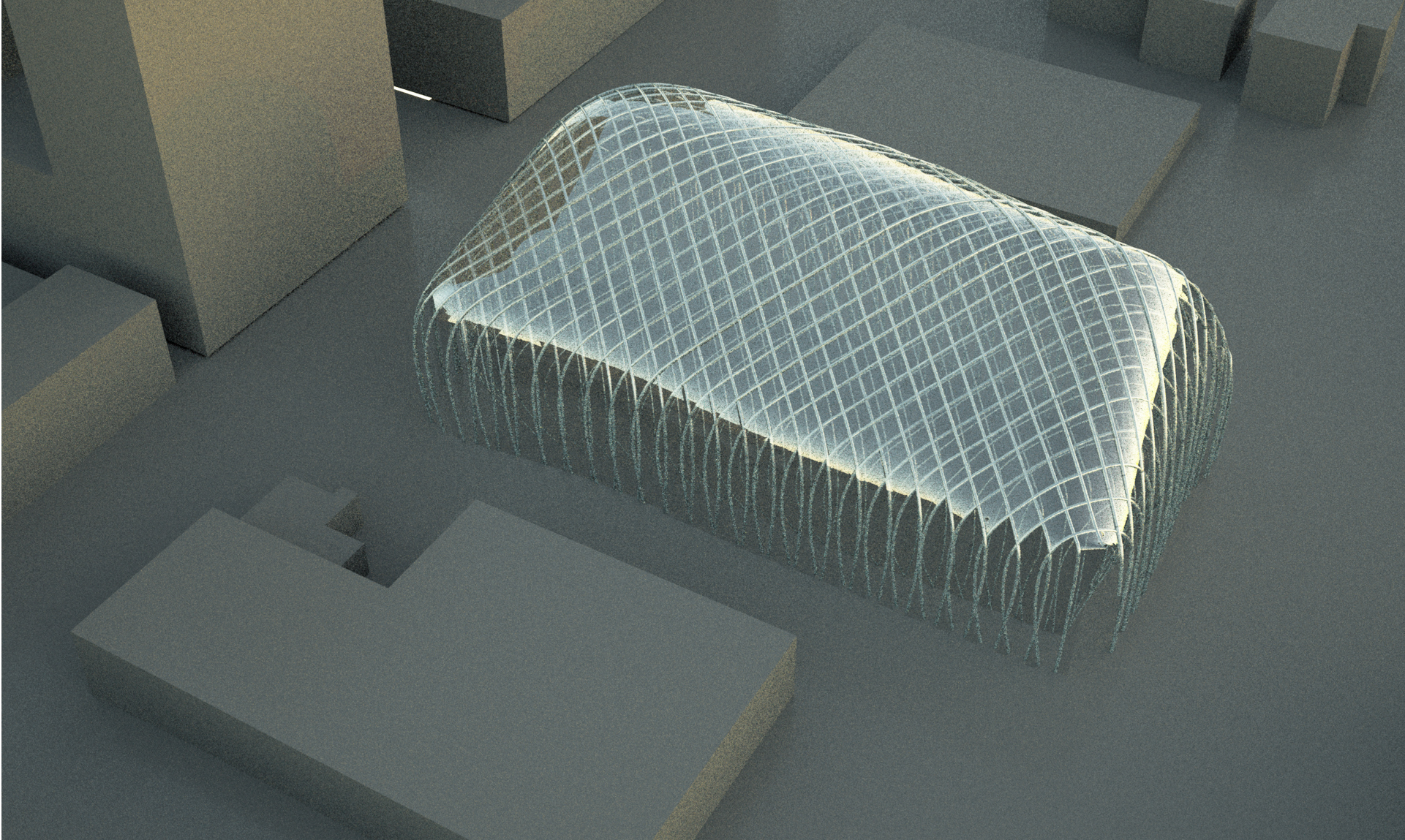
Southeast View



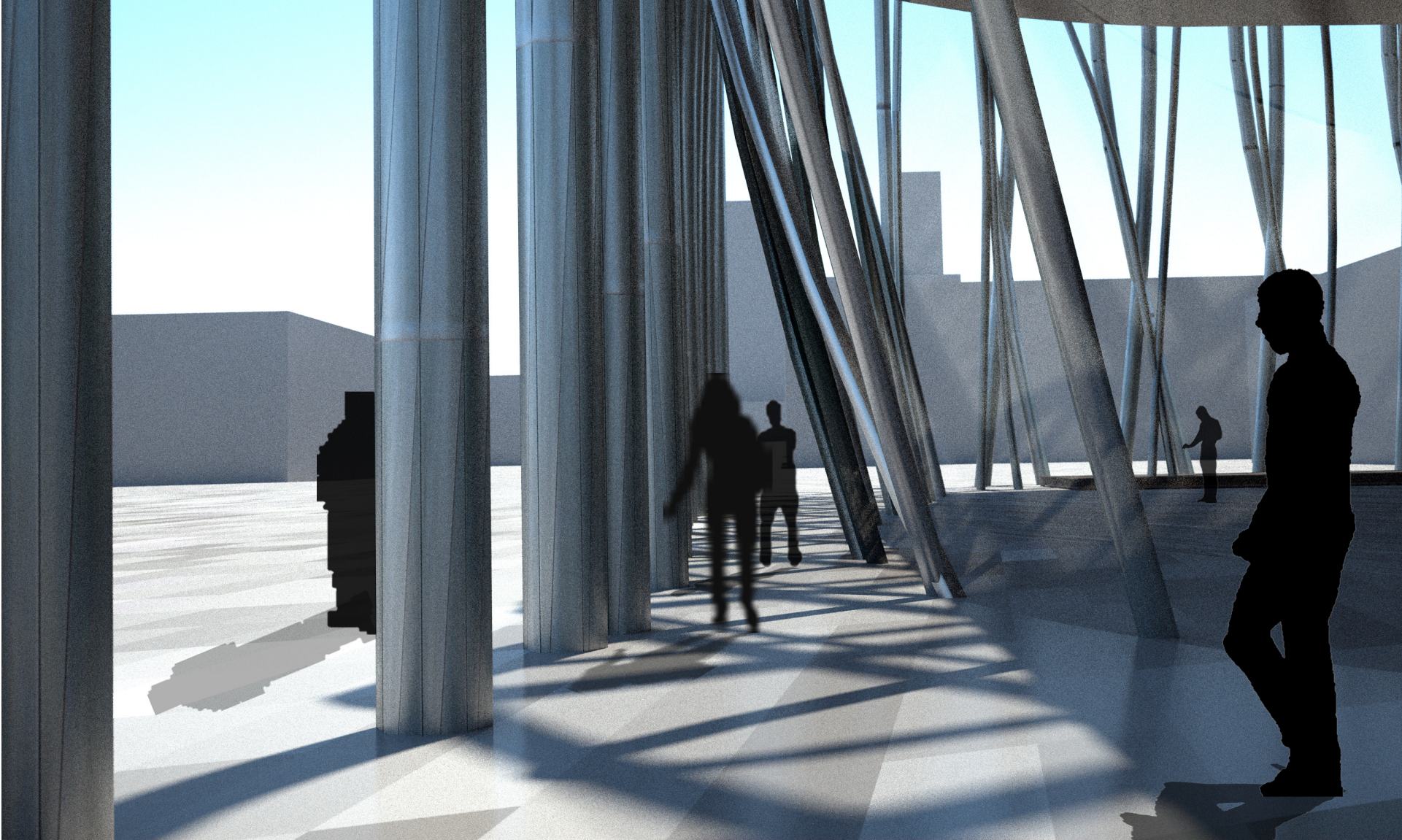
Northeast View



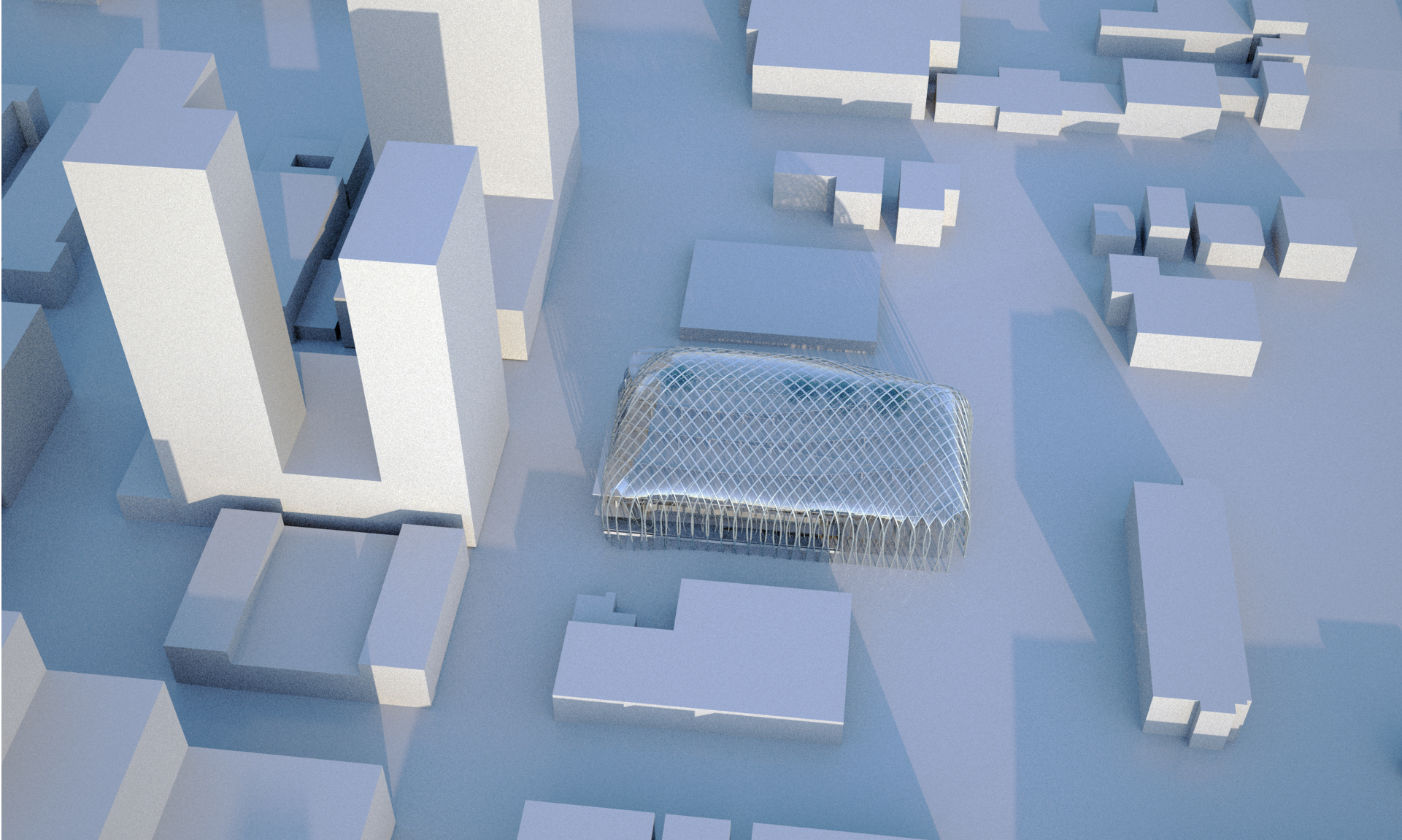
Southeast Bird's Eye View



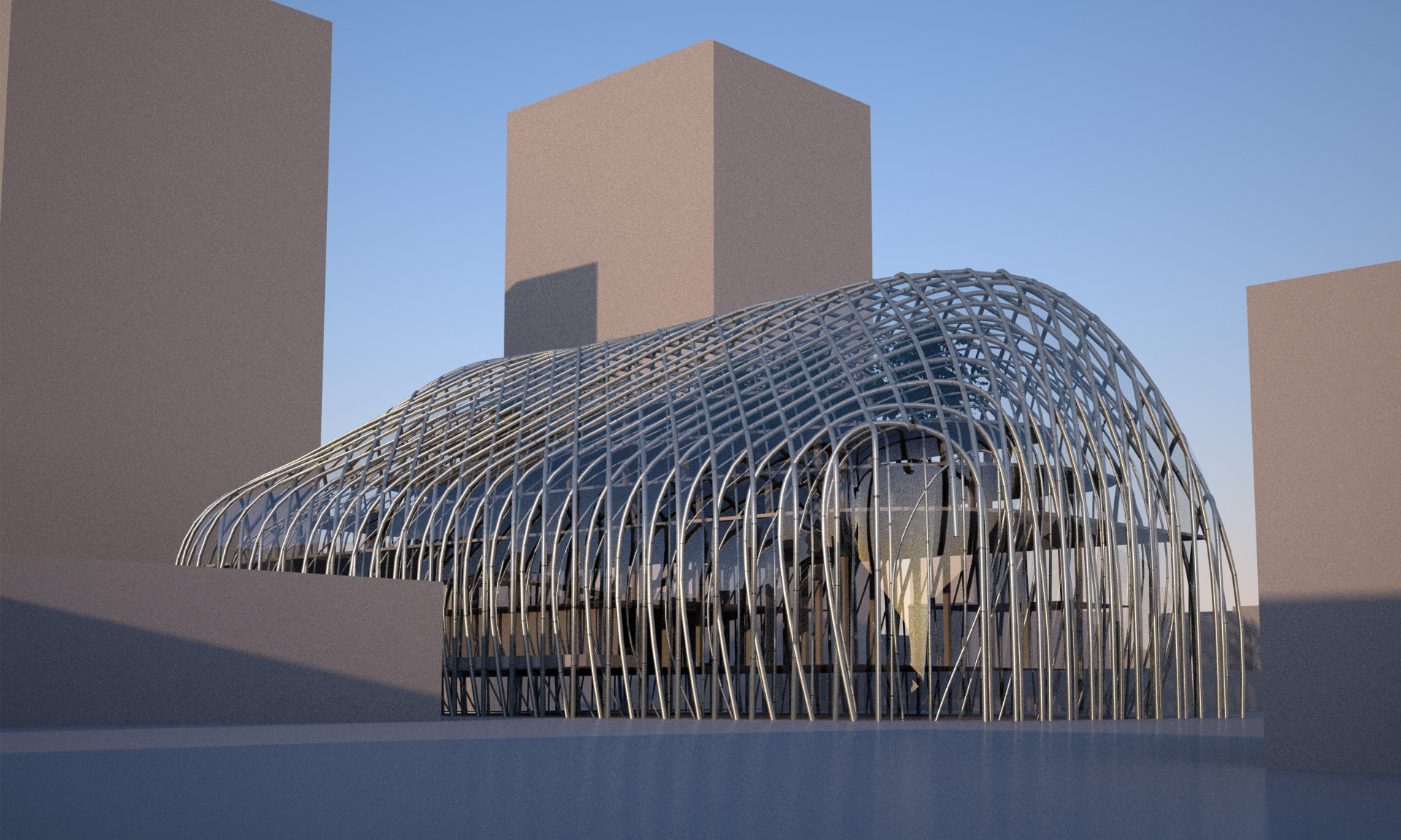
Ground View Between the Space Frame



Southwest Bird's Eye View



Southeast Bird's Eye View



Interior Space Frame

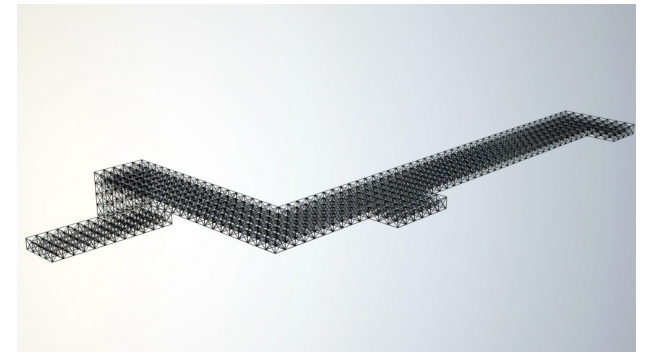
The interior Space frame is meant to lead visitors through the public spaces within the building. It begins at the stair near the entrance of 14th and 'Q' Streets. It runs in-between the first and second floor and continues until the lower market spaces end. It then turns right to run along Centennial Mall and through the open space in interior market area.

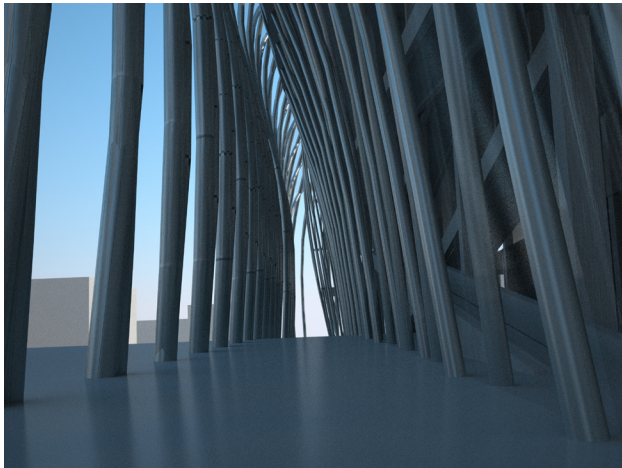
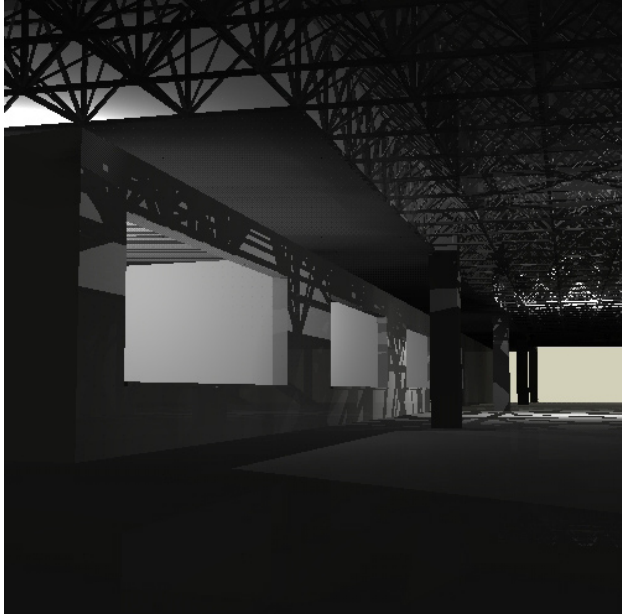
Once the space frame reaches the end of the building near the intersection of the alley and Centennial Mall is turns vertically and moves down to the floor of the ground level. It doesn't meet the ground. It stops two feet above the ground and covers the water collection tank located in the lower level of the building. Here it is clad entirely in glass and acts as a seating bench above the water that is collected around the site. This gives building users visual access to the water collection, and perhaps informational displays could be displayed allowing building users to become aware that the purpose of the collection is to supply water to the plants. The goal of making the water collection visible to building users is to make them aware of the natural resources necessary to provide their agricultural purchases.

The space frame also acts as a lighting fixture for the building at night. This highlightst the circulation and public spaces, particularly in the evening. On the second floor there is a surface layer of glass attached to the space frame allowing people to walk on it. Access to this area may be achieved by the large moving walkways, which have been angled to accommodate vertical circulation for people and grocery shopping carts.



These walkways also extend to the third floor allowing public access to the first level of the growing spaces. Shoppers and visitors are able to access the third floor, which is imperative to allow for cultural change towards agriculture and to accomplish many of the goals set forth in the initial conception of the project. These moving walkways would also be seen from the exterior of the building provoking onlookers of the building to see the obscure large circulation structures.





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