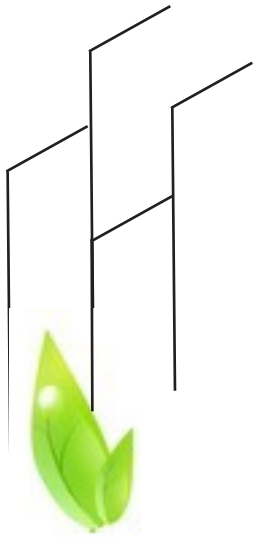

# COMPRESSED AGRICULTURE INITIATIVE

**by Thomas Homic**

# RESTORING AGRICULTURE TO THE URBAN CULTURE

# COMPRESSED AGRICULTURE INITIATIVE

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

By

Thomas Homic

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

Mark Th. Bomhorst May 9th, 2013
Primary Thesis Advisor

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Thesis Committee Chair

May 2013
Fargo, North Dakota

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# Abstract

Increasingly within urban population growth there is a greater demand on the agricultural resources needed to keep these populations properly fed. As these stresses on the agricultural space and supply chain increase, they can lead to dangerous lapses in feeding growing urban populations. How can architecture respond to urban centers that have an ever increasing need for agricultural space and stabilize food supplies in those communities?

This system is an agricultural typology with commercial and educational elements to facilitate the project requirements. This project begins to address the demand for a stable food supply while by bringing nutritious foods right into the hungry population's very urban fabric and does so while maintaining a very tight footprint. Individuals and groups will work on their own properties and within the urban farm space to refine technologies and methods for improved harvest yields. Urban farm employees will also assist the community through hands on education, seminars, and resources to promote and educate the community on how to best grow food in areas lacking sufficient land for traditional methods.

Under developed, vacated, and neglected lands that are almost completely abandoned in parts of the city will be cleaned, tested, analyzed and a phased plan of action will be created for each area of the newly recovered farm lands. There will be a main plot of land utilized by the main urban farm itself, and then smaller parcels of private or public lands will also be designated by their owners to be utilized for agricultural purposes.

Compressed urban farming will not only provide food but a community connection to each other and the soil while improving the local air, and water quality.

Justification: This system design is needed now more than ever with projected urban population growth each year, and ever decreasing available agricultural lands and increasing distances to those that remain. Depleted and missing farms leave larger and larger urban populations at the mercy of supply disruptions, but can be corrected through improved planning and initiatives such as mentioned in this plan. Currently many European, Asian, and Middle eastern nations with large or growing populations and lacking suitable arable lands to feed these populations, are purchasing land for

farming, thousands of miles from where the food will be consumed. This urban farming system however

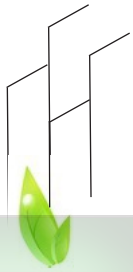
maintains local growth for local use, decreasing labor, fuel, environmental and spatial impact.

# COMPRESSED AGRICULTURE INITIATIVE

## Statement of Intent

# Problem Statement

How can architecture respond to urban centers that have an ever increasing need for agricultural space and stabilize food supplies in those communities?



# Statement of Intent

**PROJECT TYPOLOGY**

This project utilizes a mixed use agricultural building and agricultural field structures along with a mixed use commercial & educational center.

**CLAIM**

Architecture can help to provide greater agricultural productivity within urban centers lacking sufficient agricultural land for traditional methods.

**THEORETICAL PREMISE - UNIFYING IDEA**

Members of the community, business, or government can come to the urban agriculture center where their individual needs will be assessed and their land tested for positive and negative elements. Coindividuals and groups will work on their own properties and within the urban farm space to refine technologies and methods for improved harvest yields.
The under developed, vacated, and neglected lands that are almost completely abandoned in parts of the city will be cleaned, tested, analyzed and a phased plan of action will be created for each area of the newly recovered farm lands. There will be a main plot of land utilized by the urban farm itself, and then smaller parcels of private or public lands will also be designated by their owners to be utilized for agricultural purposes.

Communities and urban farmers have an ability to solve the issues caused by depleted arable land resources within and near urban centers. Having a stable food source is critical to every community but is increasingly becoming more tenuous.

**JUSTIFICATION**

This system design is needed now more than ever with projected urban population growth each year, and ever decreasing available agricultural lands and increasing distances to those that remain. Depleted and missing farms leave larger and larger urban populations at the mercy of supply disruptions, but can be corrected through improved planning and initiatives such as mentioned in this plan. Currently many European, Asian, and Middle eastern nations with large or growing populations and lacking suitable arable lands to feed these populations, are purchasing land for
farming, thousands of miles from where the food will be consumed. This urban farming system however
maintains local growth for local use, decreasing labor, fuel, environmental and spatial impact.

# COMPRESSED AGRICULTURE INITIATIVE

## Proposal

# Interest Narrative

Since I was very young I have always worked in the gardens at home and grown food and enjoyed the fresh foods provided by them. I learned from a young age the difference in quality and taste of food between the gardens and the grocery. There was no comparison, the gardens easily won in taste, texture, and quality. As I grew older I started to learn of added benefits that the gardens provided, this one was an economic benefit. Why pay the grocer for what can be grown at home and done so with far better results? Beyond the improved quality and low cost there are also benefits in longevity and nutrition as well.

When I looked at the community around me, and the fast pace of growth, it was shocking how fast we were destroying the farms that feed the city. Every year that passed the farms receded further into the distance and new housing is all that stood in their place. I began to think about this more and more, and began to think about the quality of the food again and the time it must take to get that food to the city since so much farm land is now gone. What if those supply chains were to suddenly break?

What could be done about this issue I thought, and it struck me one day while I was traveling through large swaths of land once full of houses but now destroyed by urban blight. With farms being pushed further out, we can add them back in where the houses are no longer. Where entire city blocks are now gone, burned to only a memory, we can once again build farms where they once were, here in the heart of the city. No more long supply chains and no more unripened fruit because of those long distances. What can not be grown here in the new fields can be grown in the gardens.

There shall be a new farm, an urban farm, one that not only grows food to sell year round, but one that educates and encourages urban farmers to grow in their yards and exchange ideas and excess produce for what they need. This Urban farming center will be an educational center as well as a market and even a home for the workers.

Once there was a great love for the home garden throughout the Detroit area, but many people have lost the knowledge of what to do and how but still hold the desire to grow their own food. Community test gardens prove this to be true, as members of the community when given guidance and supplies have flocked to grow their own food. One garden in particular has grown not just full but expanded to three times its size by community demand... and that was just one neighborhood.

This agricultural and educational center has the opportunity to not only bring the community together, but clean the vacant neighborhoods, remove condemned structures and in turn reduce crime. The large footprint of the agriculture initiative will further bridge the gap between neighborhoods once isolated from each other by a ruined urban wasteland. This urban agriculture will not only be an economic boon to the city, but an attraction for the Greater Detroit communities, as well as a pleasant sight and stabilizing element that helps to promote regrowth of the city around the farm.

# Client and User Description

This project is designed for the Ignacik Consortium (IC) and Southeast Michigan Council of Governments (SEMCOG) with Ignacik Consortium being the primary client (linking this project with their surrounding urban development projects) and SEMCOG being a partial investor with particular requirements that must be included in the project.

Ignacik Consortium (IC) is a private collection of corporations owned by the Ignacik family. The IC seeks success through innovation in progress while benefiting the communities in which they reside.

Southeast Michigan Council of Governments (SEMCOG) is a 160 member government organization residing in the 7 counties surrounding the City of Detroit in the southeastern section of Michigan. SEMCOG operates to promote improvements that benefit the regional needs as a whole from commerce and transportation through parks and recreation.

This project is a pilot program to begin a series of urban farms, individual gardening and redevelopments to the City of Detroit as well as other communities that have faced deterioration through similar urban blight. The goal is two-fold, strengthening food quality and stability while assisting in clearing the way for urban restoration surrounding the farm.

The design will be utilized by IC employees as well as people living in the SEMCOG communities as well as being a pilot program site for the SEMCOG urban food supply stabilization program. Peak usage of this system will take place during market hours, educational seminars and classes, as well as planting, harvest, and special events. There is a set demand for parking that will be maintained parking spaces for market and educational space use. Overflow parking requirements will be met through use of open lands not being used for agricultural purposes. The site is large and fits within the chosen blight zone where most land is owned by the City of Detroit. The site is restricted based on IC redevelopment plans that will take place surrounding the agricultural initiative.

Site concerns that must be remediated through the project are segments of the site that are polluted from heavy industry once located in parts of the site. These locations will be remediated using various methods and will be off limits to planting of food stuffs until remediation has been completed. These locations will however produce non edible products that will still provide for the program success.

Due to the wide range of ethnic and cultural groups living in the SEMCOG region, this project is to be designed for as wide a variety of persons as possible.

# Project Elements

Compressed Agricultural Initiative (CAI) will consist of an assortment of buildings to complete its mission as required by IC and SEMCOG.

Agriculture Commerce and Education Center (ACEC)

The ACEC will contain an educational test bed for hydroponic education and improvements as related to research and community education.

Classroom and seminar spaces will also be available for various educational and community needs.

Hydroponic farming systems will be integrated into the structure as part of the year round fresh foods production request by IC

Limited residential space will be included in this development to give living quarters for the full time employees of this facility needed for off hour emergency response and general facility caretaking.

Commercial spaces will be provided along the public face of the site in order to not interfere with the city's commercial fabric, while providing space for the market and community food exchange.

Waste Remediation and Hydroponic Towers (HRHT)

Each HRHT will be responsible for site runoff remediation to not contribute to further environmental impact on the overall ecosystem.

These towers will assist in remediation of high toxicity locations within the site assisting in bringing all land into agricultural production.

These systems will assist local waste treatment.

Horizontal Agriculture Beds

These raised farming beds are designed to increase duration of growing season while improving depleted soils they protect.

Improved planting symbiosis also will drastically improve these growing beds while inhibiting weed growth.

This system will also assist in monitoring conditions to improve care of plants and help improve output.

Equipment and Produce Storage

This structure will store the additional localized equipment, seeds, harvested product, and other material needed for operation of the system.

Produce Processing Facility

This facility will be utilized by the farm as well as the community to process harvests and farm wastes into longer term storage (flash frozen produce, etc) or into by-products (mulch, etc) or secondary products (flour, etc.)

# Site Information

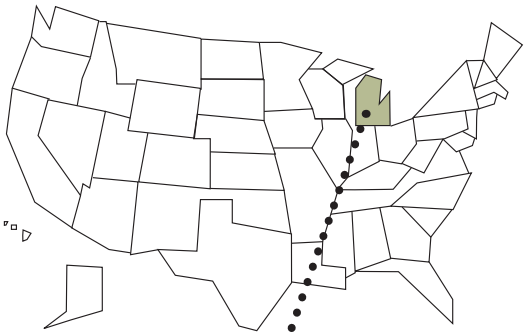


Figure 1. United States Map
(State of North Dakota Web site)

Figure 2. State of Michigan Map
(Wikilmages)


Figure 3 City of Detroit Map
(Wikilmages)

# Site Information

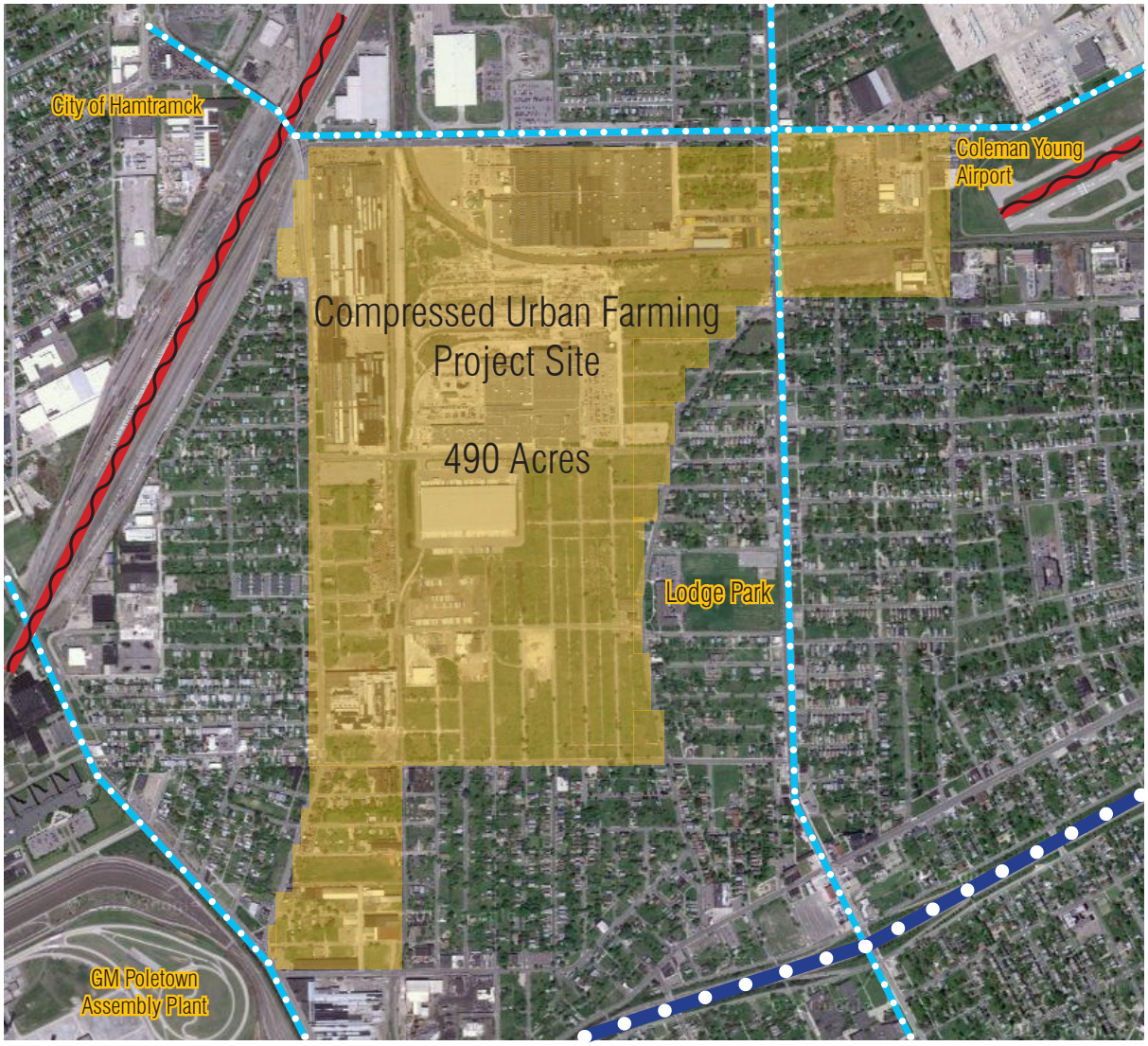



Figure 4. Site Satellite Image (Google Maps ) - Site Information

# Site Description

**Border: Lynch Rd > St Cyrill > Miller St > Foster St > Strong St > Mt Elliott St > Brockton St**

This site is located in an area that is mostly vacant land now. This area was once a vibrant working class neighborhood with major factories to the west and south with mostly residential areas to the east. Little of this area remains and what is left is highly neglected, and the industrial plants that are on the site are mostly abandoned or used for storage.

The city airport (to the east, mostly private planes) and main rail trunk line (to the west) are marked with a red and black bar denoting both their location and that they are noise producing locations.

The lighter blue bar represents main roads surrounding the site, while the dark blue bar represents the Interstate.

This site requires some demolition and a good amount of cleaning to prepare it for the project. The fact that it is both vacant and neglected benefit the project as there will be little competition for acquiring land and land values are low. Furthermore the City of Detroit is interested in supporting agricultural growth as a remedy to the large open tracts of land especially in this area. Another excellent idea for the location of the development is available transportation for the SEMCOG community as well as the site being deep in the heart of the Greater Detroit urban fabric. Being in the heart of the city will facilitate the mission to bringing food growth and stability into the urban culture.

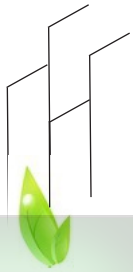
# Project Emphasis

This project will explore many different elements related to the urban agriculture project. The primary emphasis will be  on larger scale urban farming followed by small scale individual plot urban farming. These two aspects are the driving force of this project and will therefore comprise the lions share of attention.

The next aspect of the project will focus on the main result of the previously mentioned project focus of urban farming. This resulting element is food supply stability within the urban setting. The macro and micro scale farming will improve food chain stability by distributing it throughout the city in both large and small scale formats. With greatly reduced distance between plantings and dinner plates there will be far less opportunity for food supply disruption.

Due to locally produced foods the next aspect of the program emerges. Food quality will improve dramatically as there will be little need to harvest unripened foods for long transportation. With these locally grown foods there will be improved nutrition as well due to improved care and decreased spoilage time.

Finally there will be another aspect that comes from this project, urban renewal. This aspect will be sparked by the very nature of the project and the required process to bring this plan to fruition. The urban renewal may be a derivative aspect but will none the less be promoted in the project as it is needed to maintain the stability of the farm itself. With a strong community comes a strong farm.



# Research Direction

Research and design for this project will be based on scientific research into current processes employed by other projects of this nature. Further study will be conducted into the historic methods used by various cultures in urban farming. These methods and practices will be examined and compared with each other and reviewed for direct or modified suitability for the project site.

Further research will be conducted on site and within the community to determine the best possible strategy for proceeding with the agricultural program. This research will include site specific positive and site specific negative aspects that will need to be addressed.

# Plan

Mixed method quantitative and qualitative analysis and a concurrent transformative strategy will be utilized in this process along with graphic and digital analysis of the information. Along with the rest of the information there will be interviews related to this project in order to bring further light to this issue.

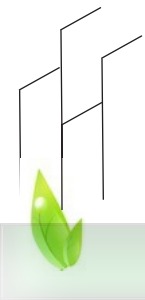
This strategy will be guided by the theoretical premise as the previously mentioned quantitative and qualitative information is being gathered. The information will be prioritized based on the main needs of the project and as permitting will continue through to the sub points of the program.

Integration of this researched information will take place multiple times during the process to further refine the direction of each point and the entire project. This information will be represented in both graphic and textual format.

The quantitative data will include direct measurements of the site.

# Documenting

The resulting project will be displayed in a mixture of written text bound into a book, photo documentation, presentation boards, recorded process work, and a model. These recorded materials will be added to the digital repository and made available for scholarly research. Recording of this information will occur for each task in regular intervals with the majority of the information being finally recorded at the end of each main task's completion. Each interval will be a collection of a few days in a row or up to a week of work in a row depending on the task.



# Timeline

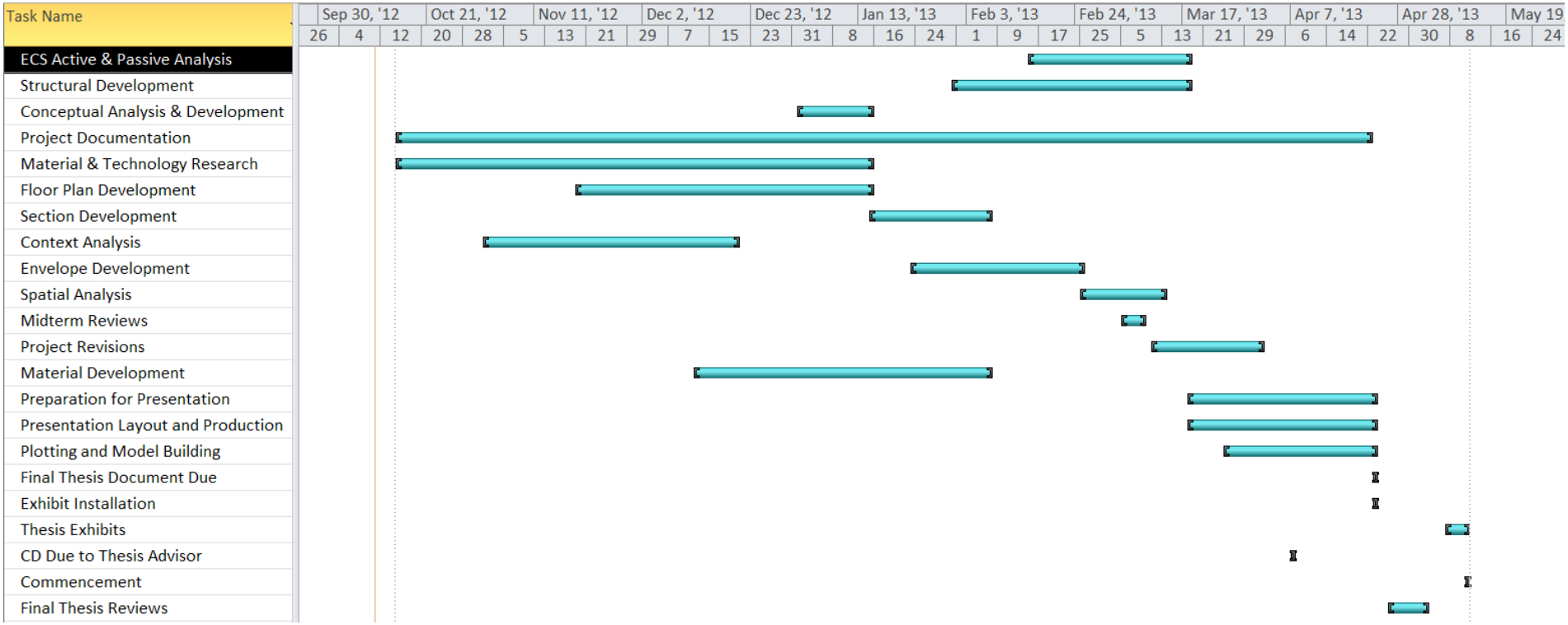



Figure 5. Timeline (Microsoft Project)

# Previous Projects

2009-2010

Fall Semester

Japanese Tea House - Professor Stephen Wischer

Minneapolis Rowing Club (Boat House) - Professor Stephen Wischer

Spring Semester

Metaphor Chair - Philip Stahl, AIA

Montessori School - Philip Stahl, AIA

Hemmah House - Philip Stahl, AIA

2010-2011

Fall Semester

Hotel project (Wood Construction) - Professor Regin Schwaen

Snow Symposium Competition - Professor Regin Schwaen

US Bank / Kilbourne Group Competition (Brick Construction) - Professor Regin Schwaen

Spring Semester

Children's Museum (Steel Construction) - Professor Steve Martens

Dinosaur Museum (Concrete Construction) - Professor Steve Martens

2011-2012

Fall Semester

Capstone Project, San Francisco Highrise - Professor Frank Kratky

Spring Semester [Study Abroad - Lille, France]

Lille Fortification Park Improvement - Professor Paul Gleye

Foch Park, Canal, and Commercial Improvements - Professor Paul Gleye

2012-2013

Fall Semester

St Ahab Catholic Chapel (addition) - Professor Ronald L M Ramsay

Shaolin Temple - Professor Ronald L M Ramsay

# COMPRESSED AGRICULTURE INITIATIVE

## Case Studies and Typological Research

# Fiera di Milano Exhibition Centre; Milan, Italy

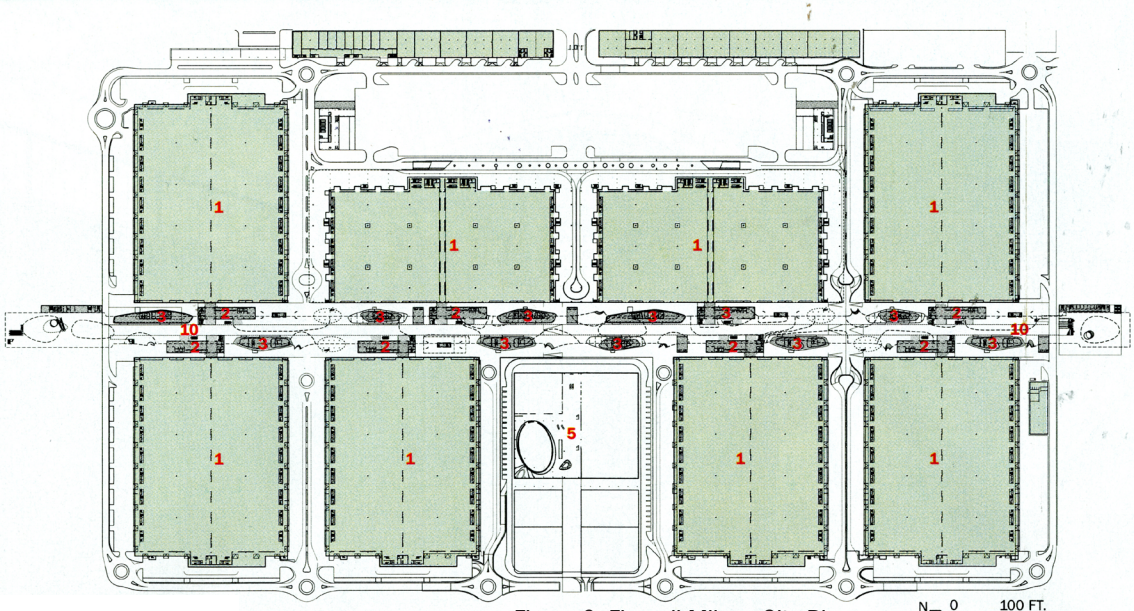
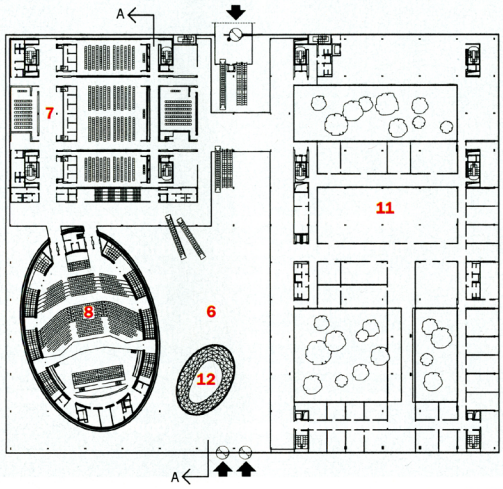



Figure 6. Fiera di Milano Site Plan




1. *Exhibition hall*
2. *Meeting space*
3. *Restaurant*
4. *Offices*
5. *Service center*
6. *Entrance hall*
7. *Conference room*
8. *Auditorium*
9. *Technical center*
10. *Canopy*
11. *Walkway*
12. *Entrance cone*

Figure 7. Fiera di Milano Floor Plan

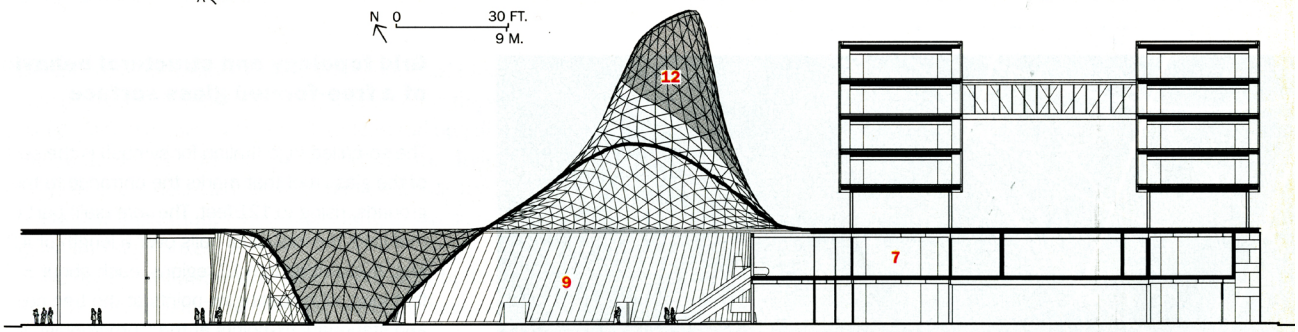



Figure 8. Fiera di Milano Section 1

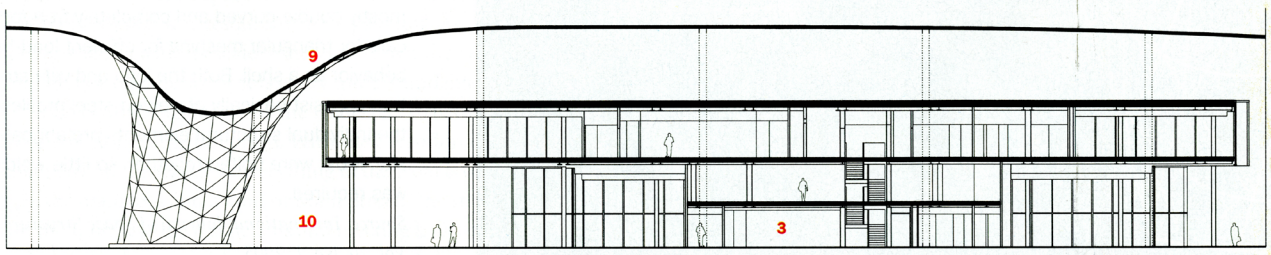



Figure 9. Fiera di Milano Section 2

Figure 10. Fiera di Milano Structure (whole)

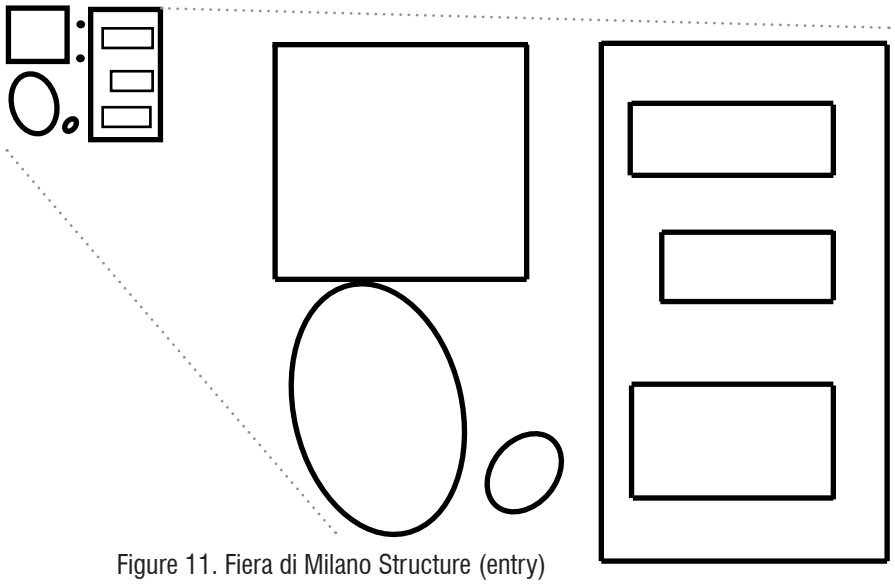
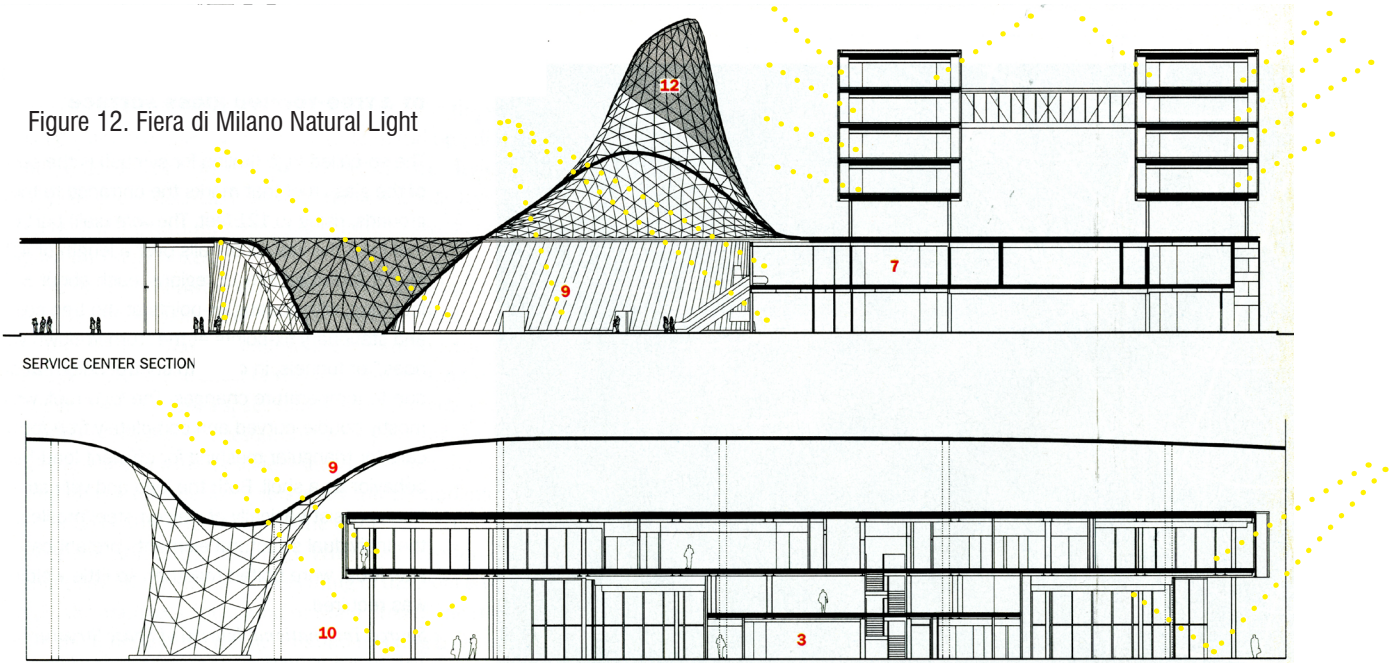


Figure 11. Fiera di Milano Structure (entry)

Figure 12. Fiera di Milano Natural Light



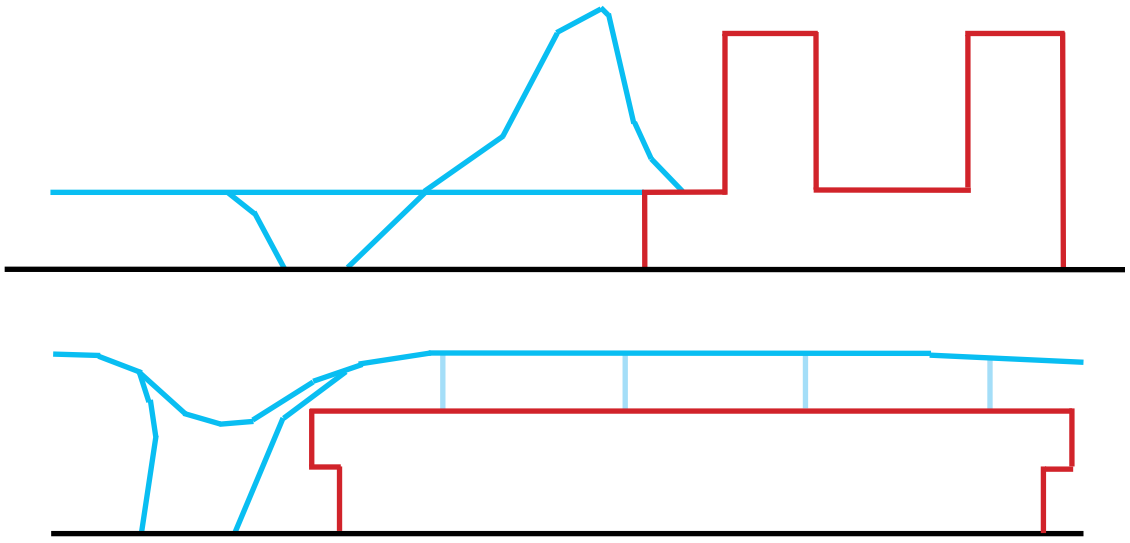



Figure 13. Fiera di Milano Hierarchy

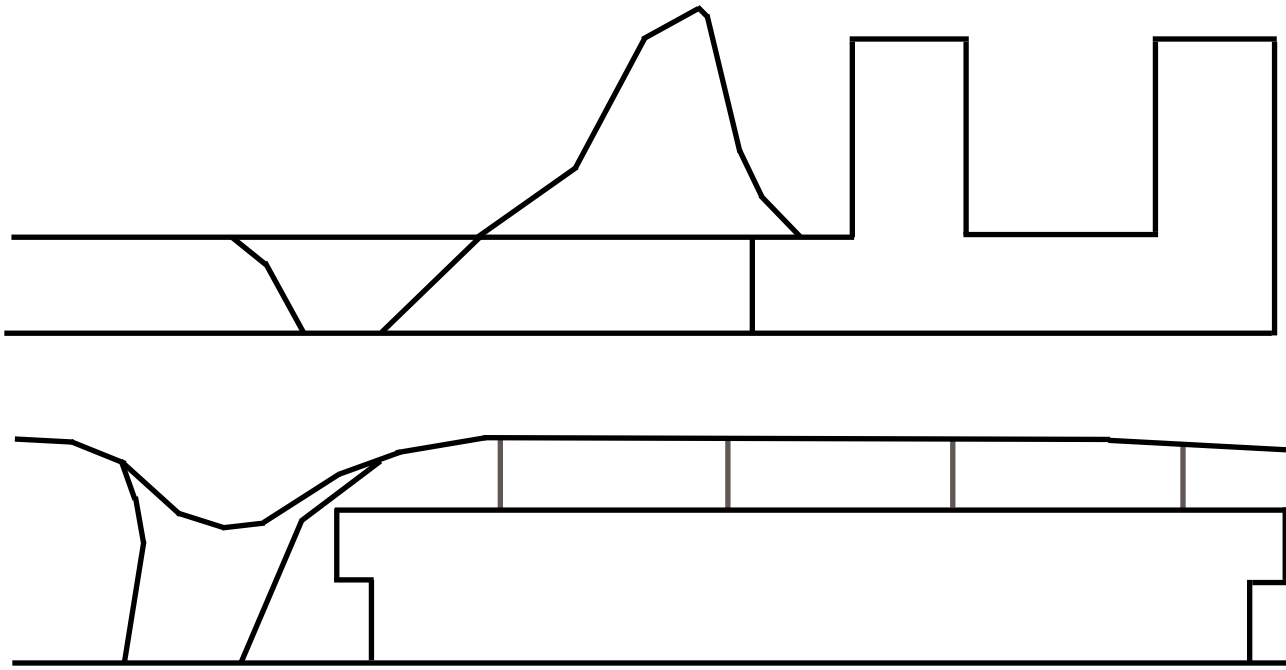


Figure 14. Fiera di Milano Massing

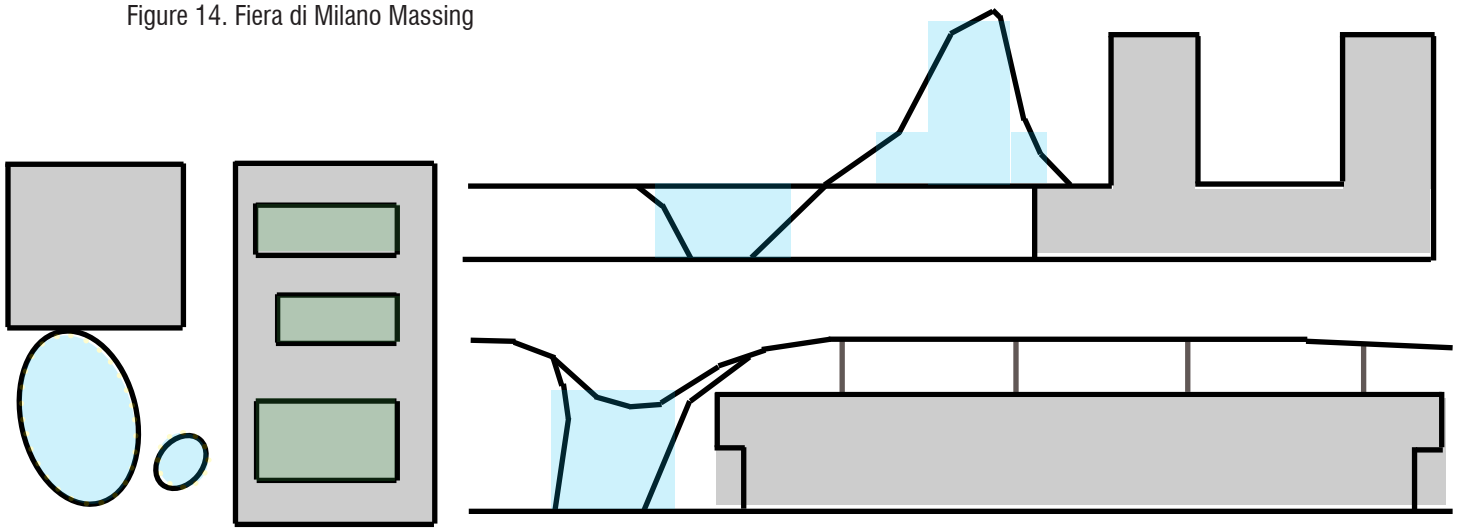


Figure 15. Fiera di Milano Geometry

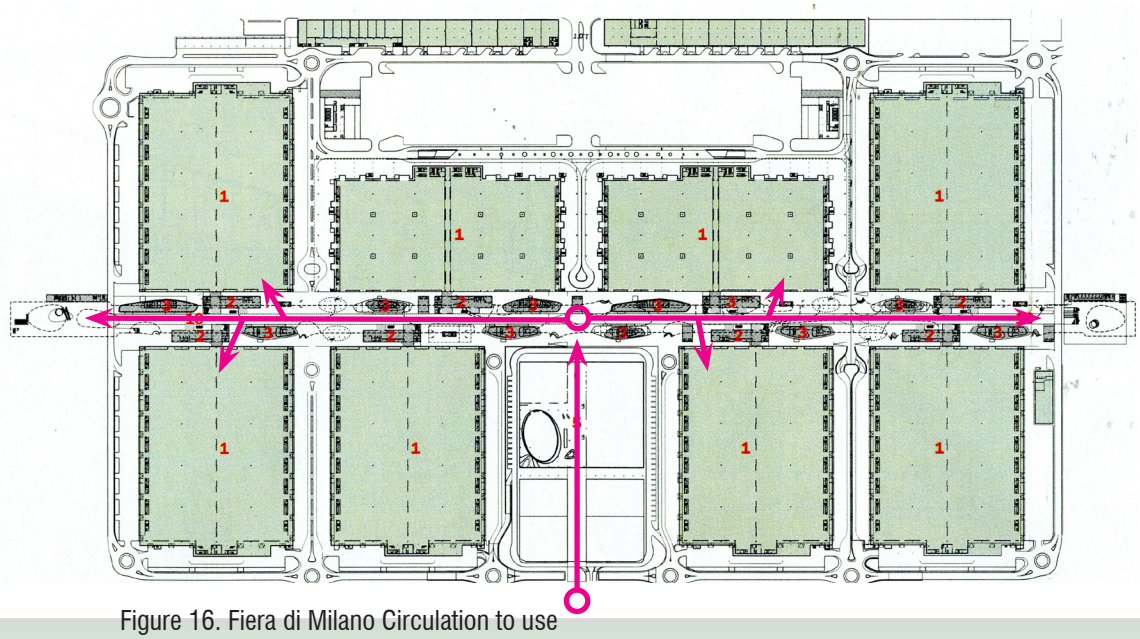


Figure 16. Fiera di Milano Circulation to use

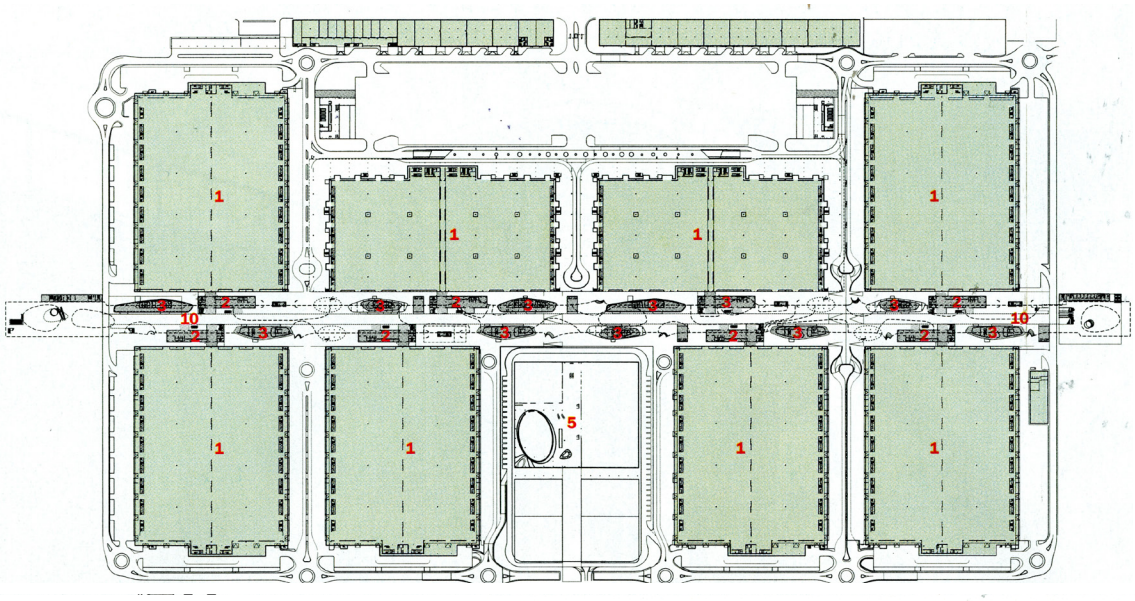
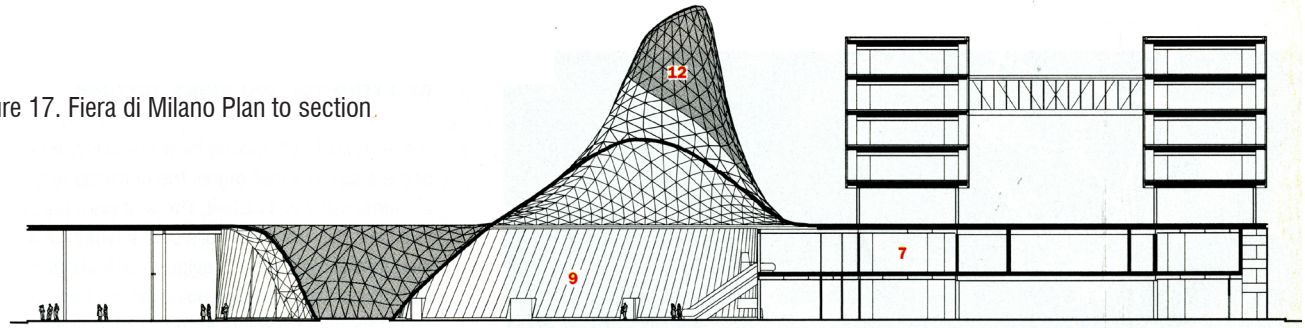
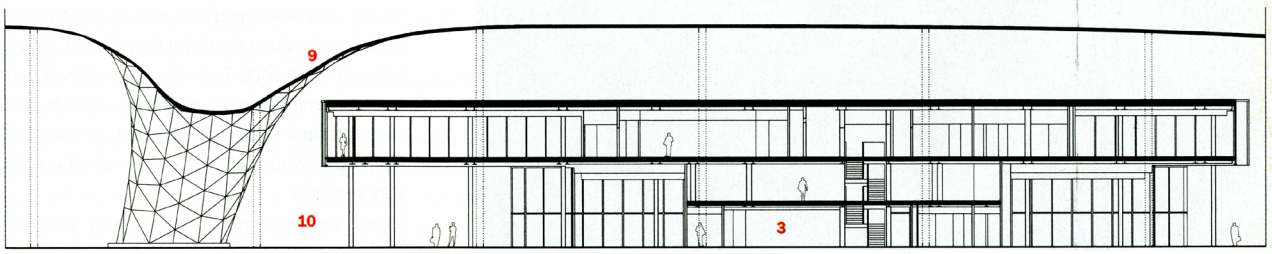



Figure 17. Fiera di Milano Plan to section




SERVICE CENTER SECTION



## FIERA DI MILANO EXHIBITION CENTRE; MILAN, ITALY

Milan's exhibition center is a mixed use convention center that is both indoor and outdoor with the outdoor areas being covered by a glass roof. The exhibition center is located outside the main part of the city and is actually located in the suburb of Rho. The exhibition and convention center is 3,710,000 sq ft of indoor space with an additional 650,000 sq ft of outdoor space. This convention center is not a single building but a series of buildings with a glass covered pedestrian walkway, display area, and outdoor restaurant seating area that acts as a bridge and overflow for larger exhibitions.

The particular characteristic that makes this case of interest is that it is a public, mixed use, enclosed and covered open air space. This covering especially is uniqe in that glass is used to shelter the pedestrians below from weather rather than using a solid material. This covered walkway allows for sunshine to still reach the walkway below while giving occupants protection against the elements.
Another characteristic of the walkway's design is the elegant lightweight appearance and delicate members used to hold the structure in place. Rather than go for an efficient only design, there is function and elegance taken into consideration.

Overall the design is one that can be easily expanded upon if need arises. The design is able to be expanded with little noticeable impact upon the existing exhibition spaces since they are not one contiguous connected space, but rather a series of independent but connected spaces.

Mixed use elements blended together to create the convention center are another important aspect of this case study, as the agricultural center being designed contains mixed use elements that must be both separated and accessibly together.

As mentioned before the convention center has a mixture of uses all in one facility. These various uses are exhibition halls, meeting spaces, restaurants, offices, a conference center, and a technical center.

## RESEARCH FINDINGS

The Milan convention center is similar to the other case studies in that it is a publicly used space with restricted private space incorporated into the design. This space is also similar in that it is inside a city rather than in a rural setting. The grounds of the convention center also include several maintained garden spaces scattered throughout the grounds.

The divergence of this project from the others comes in multiple forms. Fist the space's typology differs from the other case studies being a convention center. Second it is a series of structures that form a whole, but are indirectly connected to each other using the covered walkway as a unifying element. This allows the system to be expanded upon easily without disruption of existing exhibition spaces. Third the space is mixed use whereas the other case studies are single use typologies. Fourth, the convention center's gardens are more for visual effect rather than built to serve a utilitarian purpose, unlike the other two case studies.

Environmentally this site utilizes rainwater to water the sites outdoor garden spaces throughout the convention center grounds. The grounds also include natural spaces throughout the pedestrian areas, meeting spaces, and office areas that provide permanent green space.

Responding to social aspects, this site creates spaces for those workers and visitors of the convention center to enjoy outdoor dining and sightseeing along the central connection strip. This covered walkway creates a social and connective link for the entire center from the entry through all parts of the structure. Also this center by nature is a socially connective typology where people gather to present information, transact trade, conduct meetings and business, as well as socially interact.

Culturally this site creates a meeting point for members of the local community to meet as well as holding larger scale exhibitions including artwork and performances. This site in one of many new developments in Milan particularly designed to highlight the financial well being and cultural sophistication of Milan as they prepare for the upcoming Milan Olympic games.

This site is not just a location for the city of Milan, but for the greater Milan area to have as a large scale and small scale community gathering space. Also, as mentioned previously, this is designed as a political and social statement to the world that Milan is a city with culture, money, and is a place of interest to the world.

In general I believe Milan expo center wanted to provide a modern clean look for it's new facility in light of the upcoming Olympics. They also were interested in having as many opportunities available to be publicly useful. In order to carry this from idea to a built design, they opted for a series of smaller structures that could be built at different times, renovated independently, operated independently, but still be cohesive. Their design also gave them flexibility to expand without much modification to the overall image of the building, and can do so without closing the expo center down during construction.
I believe this building is a great flexible concept as well as embodying the design elements of Milan, the design heart of Italy. This structure is practical stylish and Italian sleek.

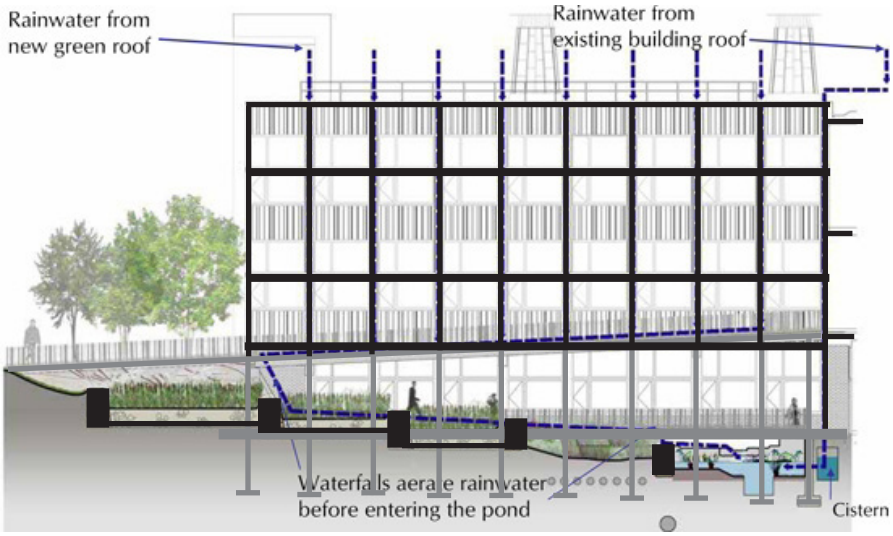



Figure 18. Sidwell Friends School - Sectional Elevation


Figure 19. Sidwell Friends School - Site & first floor plan

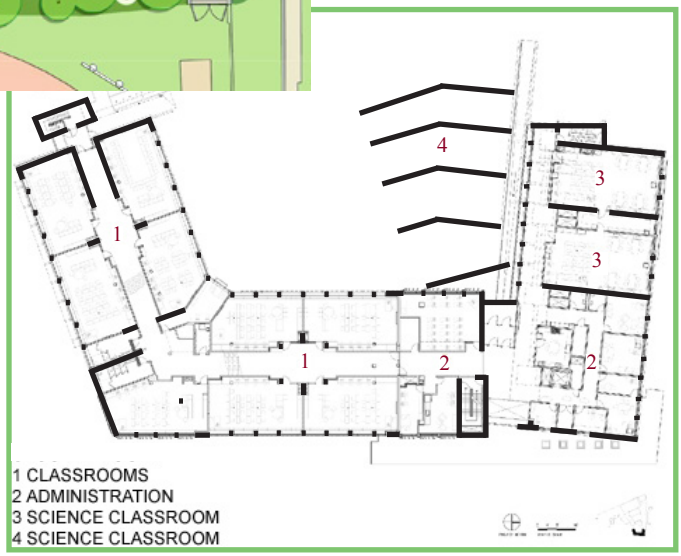



Figure 20. Sidwell Friends School - 2nd floor plan

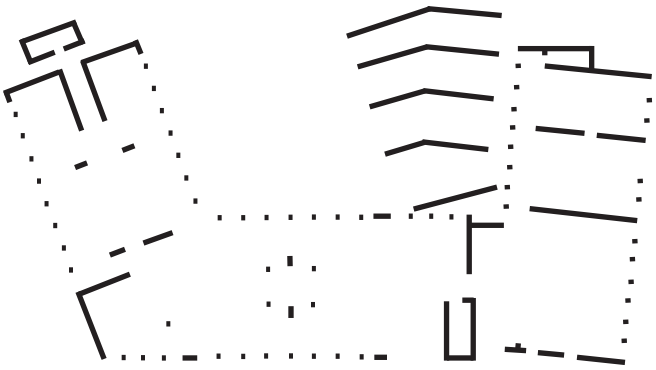
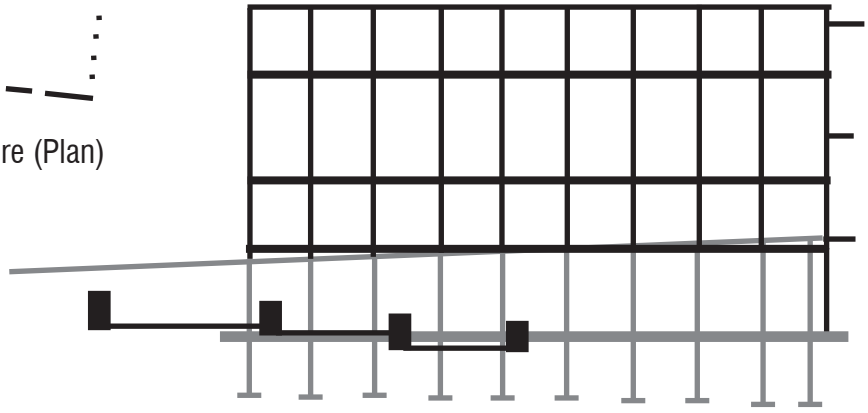


Figure 21. Sidwell Friends School - Structure (Plan)

Figure 22. Sidwell Friends School - Structure



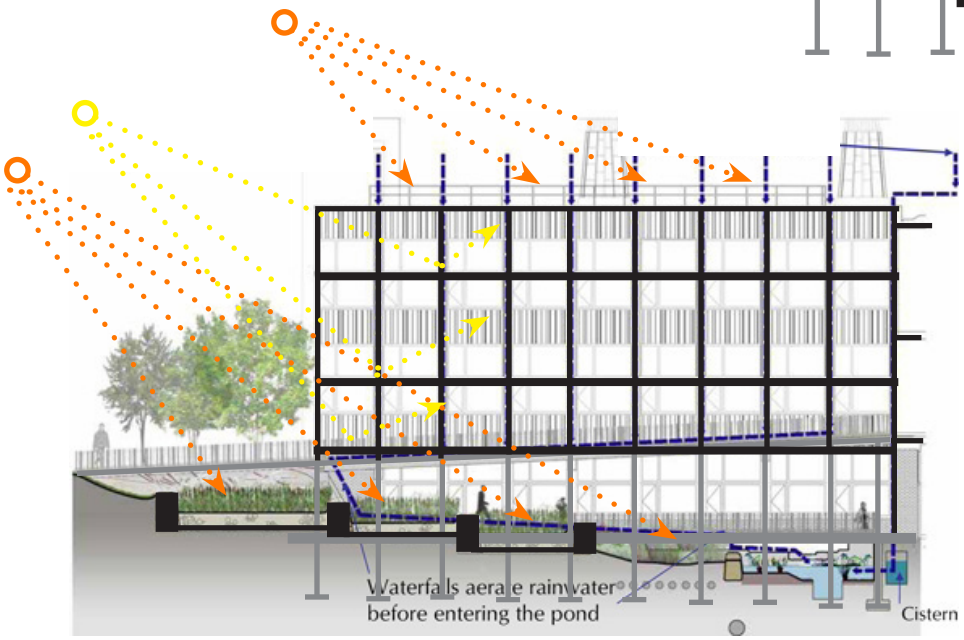



Figure 23. Sidwell Friends School - Natural lighting

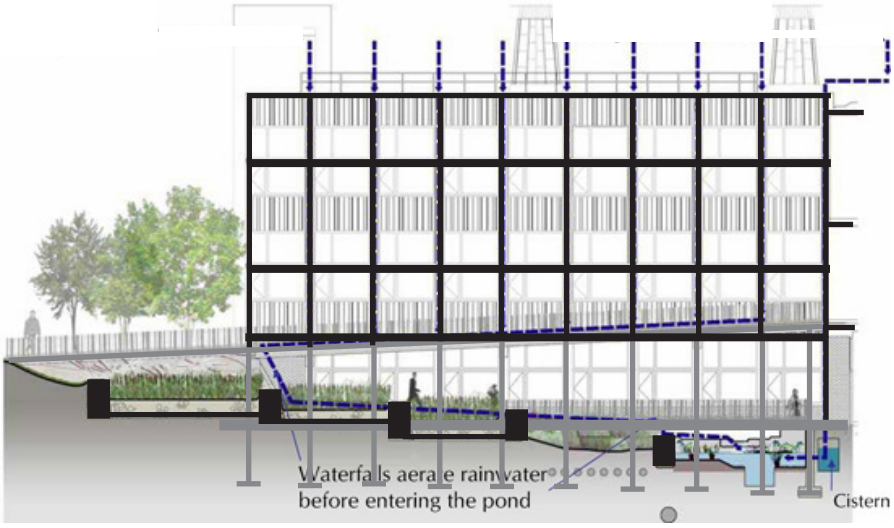
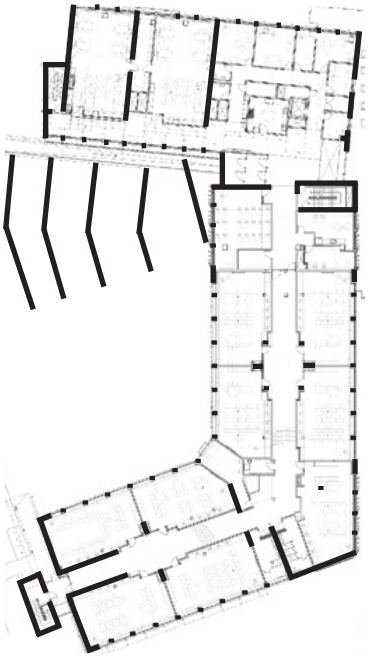



Figure 24. Sidwell Friends School - Plan to section



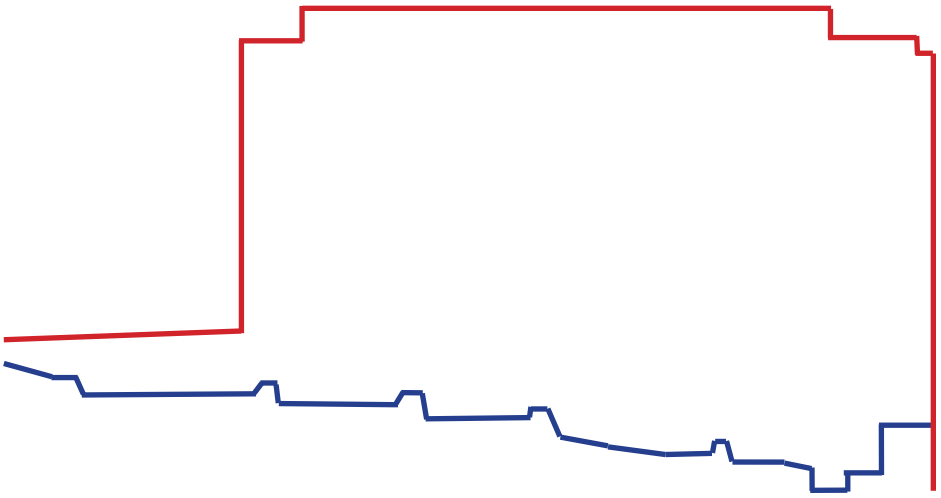


Figure 25. Sidwell Friends School - Massing

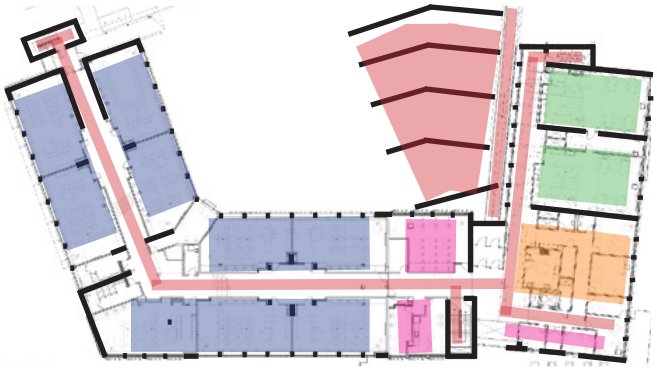


Figure 26. Sidwell Friends School - Hierarchy

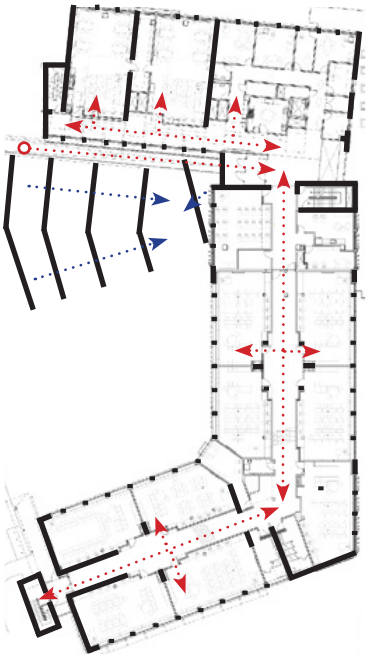


Figure 27. Sidwell Friends School - Circulation to space

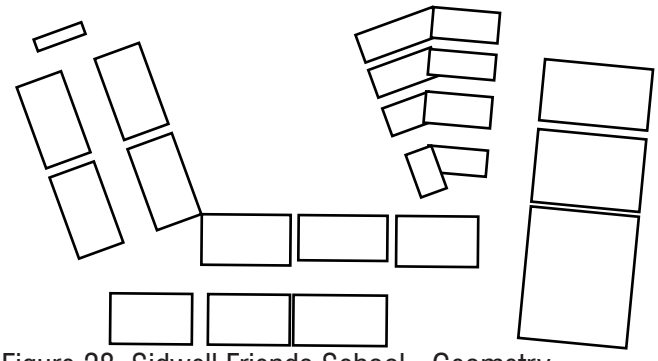


Figure 28. Sidwell Friends School - Geometry

**Sidwell Friends School; Washington, D.C.**

Sidwell Friends School is a private exclusive school for children of politicians, diplomats, and other high ranking individuals. The school is located inside a residential neighborhood of Washington, D.C.. Sidwell school sits on 25 acres of land. this three story school is designed to be secure, environmentally friendly, and visually open.

Special elements of this case study include the integration of environmentally sustainable technologies presented in a way the students in the school can learn about how the system works. Furthermore, the design encompasses both indoor and outdoor elements that work together to create an environmentally sustainable system as well as present the technologies utilized in making this design a sustainable system.

Elements of the school include public and private spaces, open air spaces and systems located on and next to the school building, as well as the use of environmentally sustainable technologies both man made and nature based.

## RESEARCH FINDINGS

This case study is similar in nature to the other studies presented in that it has beneficial environmental impact for being a built environment. There are also public spaces (outdoor environmental interpretive display) and private spaces (the school building.)

Sidwell differs in regards to the typology being a school as well as being designed more for specific environmental recovery systems which are also designed to be showcased to the public. These environmental recovery systems are also different, being a complex system designed to not just use rainwater but also to treat waste and grey water. This typology's main function is not so much a public and community feature but a restricted access private school, unlike the near full public aspects of the other two case studies.

Environmentally the building's systems treat waste waters and reuse the water on landscaping and in grey water needs within the building. This design uses 93% less district water. (Sidwell Friends School, 2012)

This building is designed to utilize the latest advancements in building design and surpasses environmental requirements. This site attempts to showcase how new construction and educational techniques should be achieved today both in the building and in their methodology. This site responds to the cultural as well as social requirements placed upon it by not keeping the design hidden, but make it available to be seen and understood by the public. The layout of this site also utilizes good sight lines and lighting techniques along with the most recent education methodologies in the design of the site and structure.

This school seeks to attract and retain a particular clientèle. This clientèle is rich, powerful, educated, socially connected, cultured, and driven. Attracting and retaining this type of clientèle will require embodying the same aspects in themselves as the clients they seek. The parents will not send their children to any school, they want their children to meet or exceed their own standing in life. In order to do this, they'll have to have an excellent education, and to make the most of this education the building should be just as sophisticated as the education their children should receive.

As society and culture move toward an environmentally harmonious architecture and lifestyle, so should their school building, and so should the education within. That is exactly what this school does, it presents the best possible education it can make available, the best possible building to house the students that not just lives the message they teach, but teaches it as well. Further this building is designed with the latest and most up to date layouts and designs to assist in educating and protecting students.

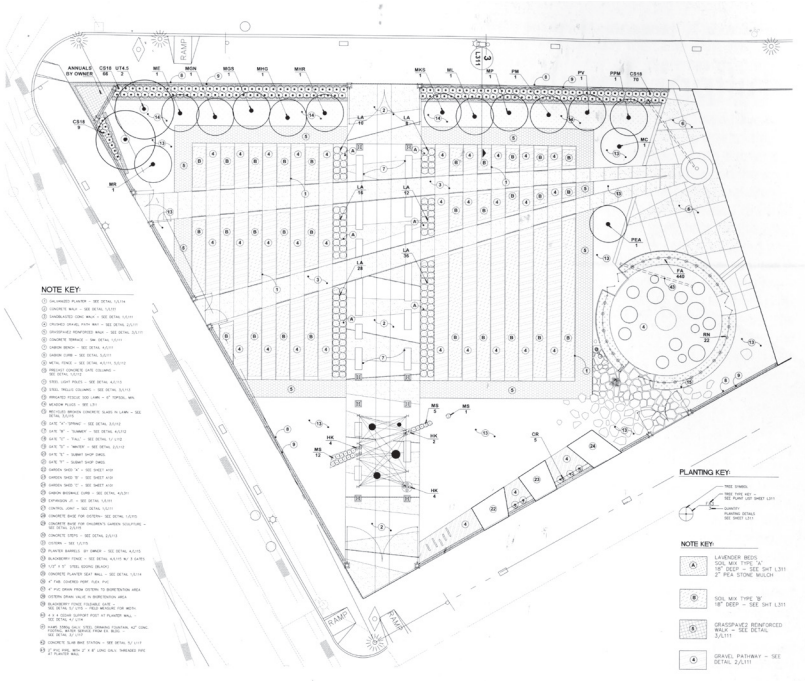



Figure 29. Lafayette Greens - Site Plan

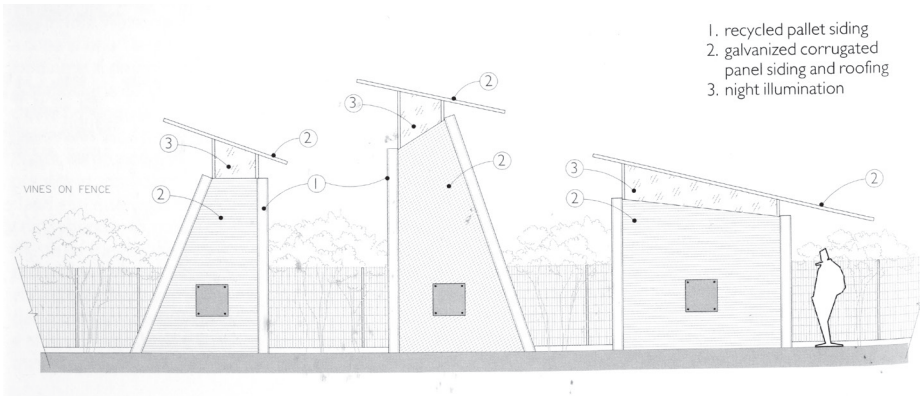



Figure 30. Lafayette Greens - Elevation

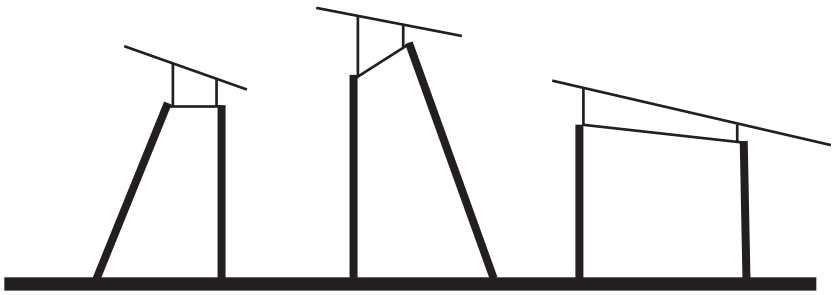


Figure 31. Lafayette Greens - Section

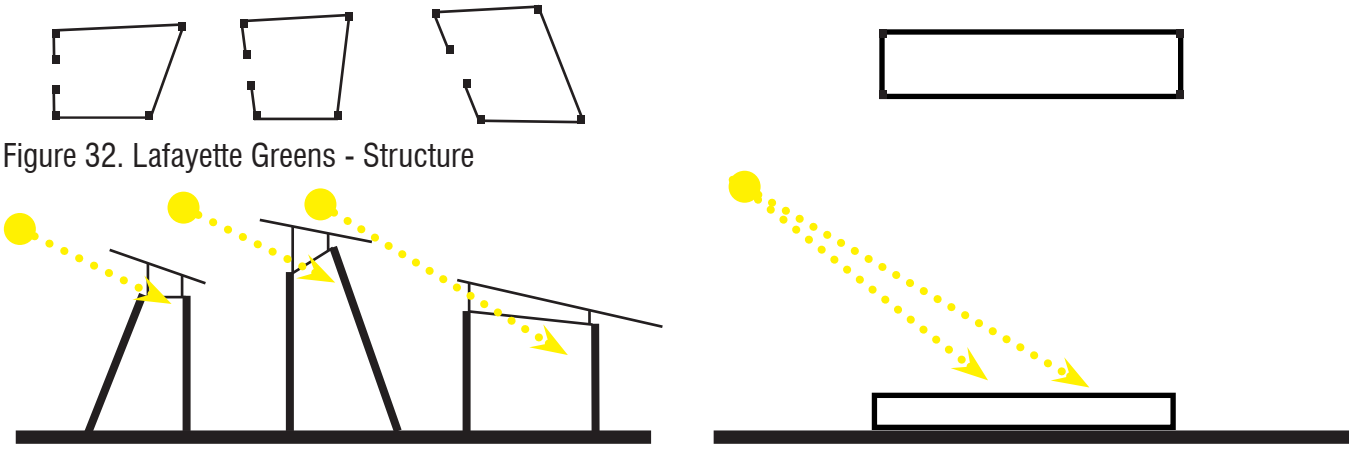


Figure 32. Lafayette Greens - Structure



Figure 33. Lafayette Greens - Natural Light

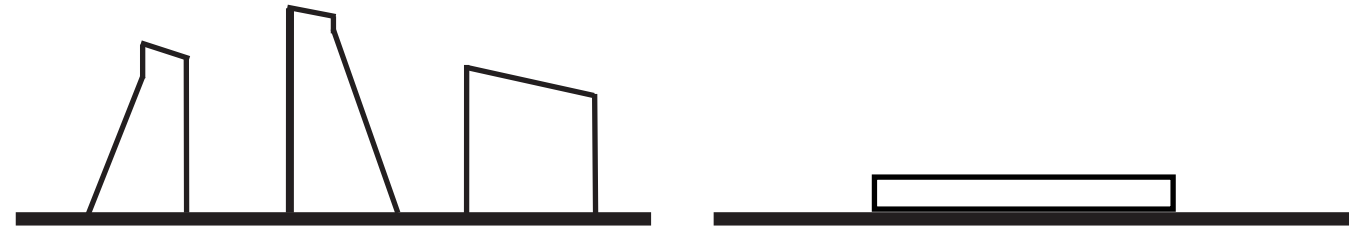
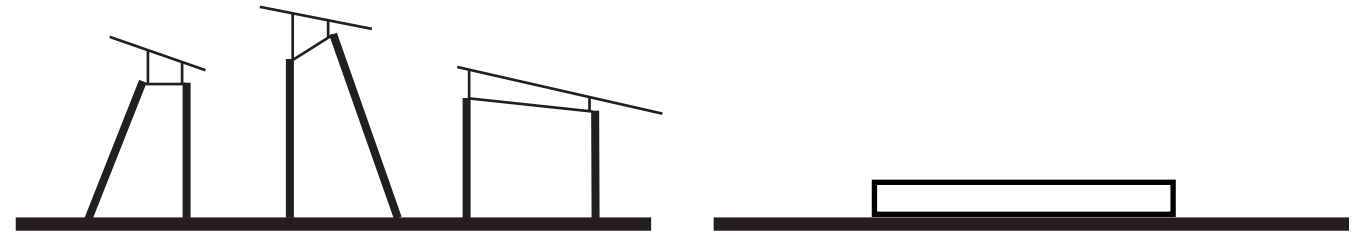


Figure 34. Lafayette Greens - Massing



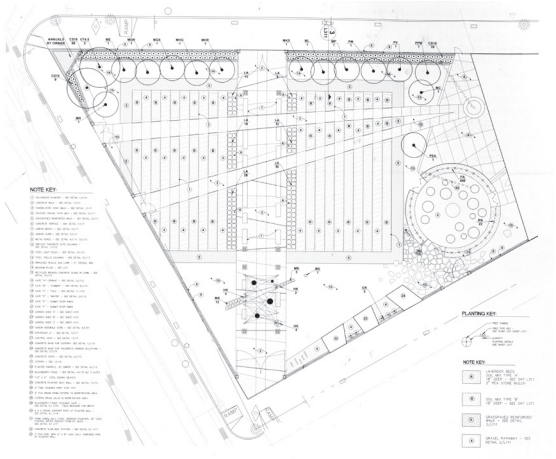


Figure 35. Lafayette Greens - Plan to Section

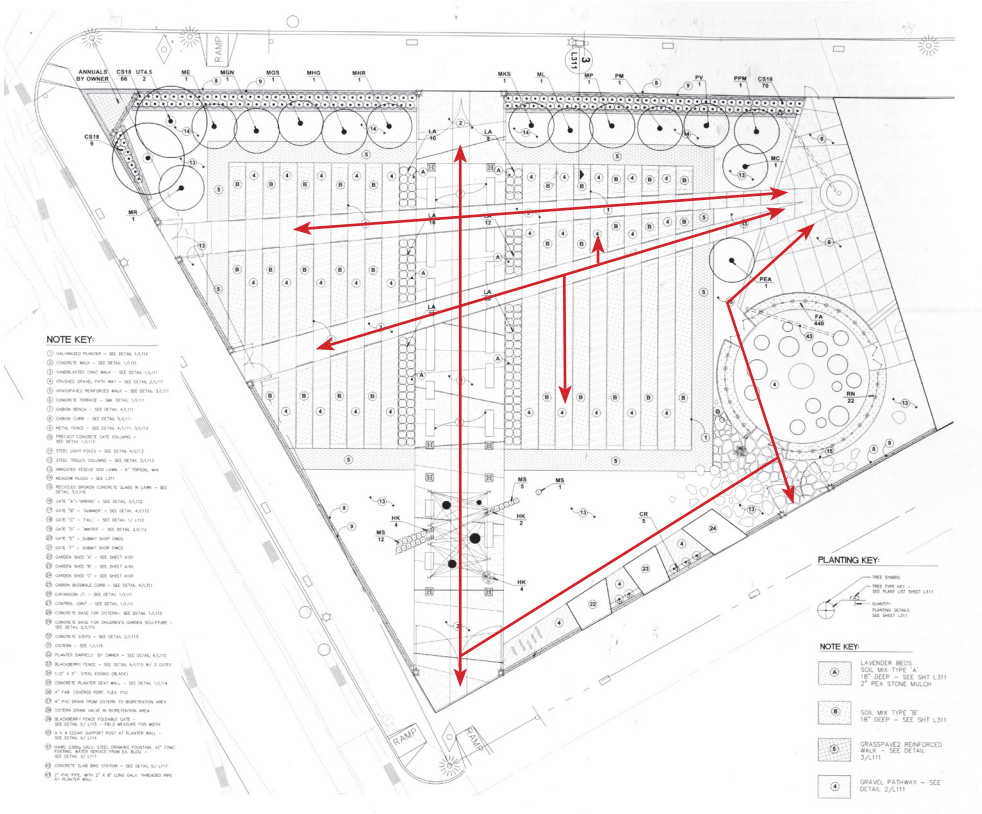



Figure 36. Lafayette Greens - Circulation to Use

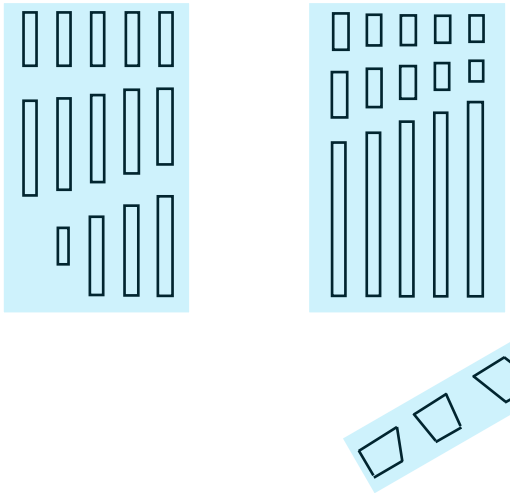


Figure 37. Lafayette Greens - Geometry

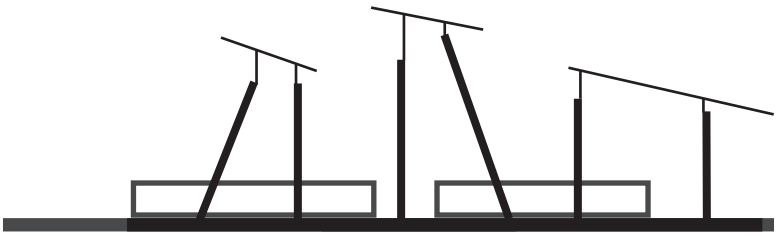


Figure 38. Lafayette Greens - Hierarchy

**Lafayette Greens ; Detroit, MI**

This project is a large community garden located in the downtown area of the city of Detroit. This project sits on .85 acres and is located on the former site of the Lafayette building.
This case is a large community garden with outdoor social space and is designed to be more than just a food garden, but includes flower beds and trees to improve its visual impact in the downtown space. Social spaces have been designed directly into the project allowing members of the community garden and others in the community to have a place to gather and enjoy this urban green space. This project also includes a couple small structures used to store equipment for tending the garden spaces. The planting beds are raised bed systems since the site's ground is heavily disturbed with demolition in fill. Further the development uses flower and shrubbery beds to create a visual appeal as well as a visual break along the project edge. The designers had also used trees to give elevation to the site so the site is not so flat in a tall downtown environment.

This study and the other studies are again publicly used spaces, but some of the beds are 'privately' tended spaces allotted to their community members. This site is almost completely open to the elements with exception of the storage structures on site. There is some cover granted by the trees on site the entry canopy, and the table umbrellas in the social area, but these are more for shading than actual weather cover. This site is also another example, as with the other projects, of green space that relies and utilizes natural water whenever possible.

This project however diverges from the other programs in that it's designed to be harvested for food. The Milan convention center was more for the visual characteristics rather than an agrarian purpose. The Sidwell Friends School's green space system was designed as a waste processing system and not designed as for human consumption. However this system is designed with visual elements as well as agrarian purposes in mind. This project also utilizes natural weather patterns more like the Milan project and not as designed as the Sidwell project.

Lafayette greens has a beneficial impact on it local community by providing open growable land within a very artificial dense urban area, as well as allowing space for the growth of trees and other natural planting. This area is able to absorb more of the rainwater on the site rather than collecting and depositing it in drains as the buildings surrounding the site.

Community efforts are essential to grow a strong knit community, especially one that is located in the downtown area. There is little opportunity in the downtown area for residents to happen upon each other, and therefore strike up a conversation or friendship. Many times these neighbors would lead rather solitary lives since there is little interaction time available between their apartment door and the car they'll use to drive to wherever they are headed. Unless there is some interaction possible in those brief few moments, there will be few other opportunities for neighbors to 'bump into' each other. This garden space provides one of those outlets for neighbors to gather and get a chance to know each other. This area provides them with an area to enjoy working on their own gardening projects while helping each other out with gardening needs. This is an excellent opportunity for conversation, knowledge sharing, social gatherings, and community building.

Culturally this site is excellent as it is an education opportunity, a chance to learn and share knowledge with each other. This exchange of knowledge in itself is a cultural exchange, but it also opens the door for further exchange as the residents of this area get to know each other and share with each other their interests and build connections.

The greens allows people from all levels and walks of life living in the downtown area to come together. This space is a 'neutral' area where it's not about who you are or what you do, it's about the plants and your community. Each person's job and position are rather meaningless in the very nature of why they are there, a lawyer is no better than an accountant or a city clerk at tending gardens. They each have information they can share, and help each other to tend these plots. Since their social, political, and professional aspects are not applicable, they rather much don't exist with regards to this site. This site is an equalizer.

This concept is an excellent example of a way to bring a community back together that is currently left with little opportunity to do so based on trends and habits of modern society. People no longer gather on stoops and fewer people regularly walk to go shopping. These residents needed a common ground, a community space to collectively inhabit and begin to interact. This space provided them with this opportunity and has allowed them to further build their bonds to each other.

The reuse of this space is an excellent concept, since this space could have been left vacant and created a further divide in the community as a vacant lot or a parking lot. Visually this site would have been a negative element in the community visually and mentally as well as being a negative element for pedestrian traffic. This site however has been changed dramatically and is now a piece of the community and a drawing element that is positive toward pedestrians, positive toward perception, positive toward development. This space further improves the downtown area by returning some natural elements into this land of concrete. There are only small outcropping of planned green space throughout the downtown area, however this element creates additional space that is more than just visually available, but is interactive.

The lessons and benefits a community gardening can impart are personal, cultural, social, financial, and can give an individual great pride in seeing the fruits of their labor.

# TYPOLOGICAL SUMMARY

Each of the case studies that were examined for this project were chosen because of overall qualities that relate to the project as well as individual components that made these projects unique from the rest.

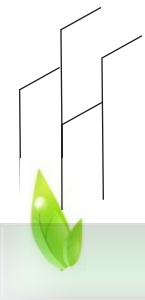
The studying of the case studies has changed concepts regarding the future design of the project by inclusion of particular elements in the design. The Milan exposition center, as an example, has changed thinking about modularity and expansion elements in the design as well as integration of water collection systems in the shape of the structure itself.

Each of these studies had common points with each other and in particular with the project itself. These included the use of environmentally beneficial systems being integrated into the project's structure. Furthermore these systems should be utilized as an educational tool to show how systems can be integrated with the structure and then integrated further with each other to produce superior results.

Separation of public and private spaces was also an important concern as the project will have a mixture of public and private spaces. These separations must not be harshly handled, but produce an elegant method of separating these spaces visually as well as physically.

Mixed use was another concern, but was not a common characteristic in the studies but is a main component in this project as there will be many differing functions in this project. The Milan Exhibition center was of particular value in this regard as it handled flexibility of space and freedom of operation of these spaces as a unit whole or as independent spaces without dramatic modification.

The varried weather conditions between the sites has given a new perspective on the overall design of the project and given interest in changing the design to be dynamic and adjust for seasonal change, taking a distinct appearance and design for each season.



Each typology was a differing social connectivity type but each of these differing elements are all part of the compressed agriculture design. There is a social - educational (Sidwell), social - community (Milan), and social - equalizing (Lafayette) element amongst the three projects.

Each project was successful in taking each of its component needs and making them integrate with each other to create a cohesive whole. For example, Sidwell school wanted to have an educational tool for their students, but they also wanted to educate the public about what they were doing. The school was able to functionally make take these environmental components and make them fully accessible to the students for education while still making these elements available for the public to understand.

Spatially these projects also did an exceptional job. Lafayette greens was able to utilize the work space of the growing rows to create visual and walking paths taht encouraged free movement on the site while still restricting spaces to create a more intimate feeling in the social interactive space.

# COMPRESSED AGRICULTURE INITIATIVE

## Theoretical Premise Research

# Current Research

As the global population grows each year there are more and more people that need a place to live. These people are choosing more often to live within cities rather than living on farms. The population growth is a source for alarm since the growth of the population is exceeding the growth of the agriculture to feed each of these new citizens. (UN-FAO, 2011)

## PRESSURE ON AGRICULTURE

Demand for food is projected to increase steadily as urban population centers rapidly grow within the next few decades. This growth can spell disaster for urban stability if production levels do not meet the demand. These growth projections show not a small growth in demand for agricultural products, but at least a projected doubling of food production will be required as reported by the United Nations and the US Department of Agriculture. (Heisey, Wang & Fuglie, 2011) These reports including ones by David Tilman, Regents Professor of Ecology at the University of Minnesota's College of Biological Sciences report that food production will double by the year 2050.(Tilman, Balzer, Hill & Befort, 2011)

## DIVERGENT THOUGHT

These changing demands on the food supply can be met by traditional methods agriculture has used, such as growing farms further and further out from the urban centers and encroaching on unspoiled ecosystems. However we have alternatives to this method of agriculture if society is willing to change their methods and plan ahead to create a more stable, more productive method of farming that does not push their natural environment further away, but lets it get closer to their cities for them to enjoy. Continuing with the current method of farming poses a problem on three fronts; First being the destruction of large amounts of natural habitat that are required for living in a natural environment rather than one that is sterile and manufactured. As urban populations increase, so do suburban populations seeking to reconnect with the natural environment by consequence destroying that natural environment they sought to live within.

How does that happen? As urban populations grow, and reduce the natural environment inside cities, segments of the population find this lack of nature too cold and unnatural for their liking. As such they move to suburbia which builds on natural lands and farm lands to create these ‘natural’ homes they seek. These residents seek the picturesque scene, the view, but they aren't the only ones driving suburbia. As rural populations empty into urban centers many of these people choosing opportunities of the larger cities find suburbia to be their prime choice to be in a major city while still seeking a manageable more natural landscape. (Cox, 2009) (Kunstler, 2001)

Suburbia uses more land per house and business as well as building on existing farms and natural lands. Second issue is the distances between the population centers and their food source. The increase of the urban population mentioned is placing a greater demand on urban food production, thus more farms. The increase in urban population leads to an increase in suburban population which leads to greater distance between population and food since farms are located just outside urban/suburban areas. Third issue is the methods used in current farming practices. These methods when misapplied produce damage to natural ecosystems they neighbor, many times in the form of oxygen depletion and various pollutants that kill aquatic life. (U.S. Environmental Protection Agency, 2012) There are also issues with introduction of plant species into the natural environment such as genetically modified crops that overpower existing plants and create a highly susceptible mono-culture ecosystem. (Altieri, 2000) Further there are uses of harmful pesticides, herbicides and over fertilization of lands which lead to runoff that is damaging to the surrounding environment. These current farming methods lack water recovery and treatment methods that would mitigate these issues as well as containment of agricultural plants so they do not enter the surrounding natural ecosystems. Last, but not least, controlled urban farming methods that this proposal puts forth will allow for multiple growth periods throughout the year, as well as enhanced control of growth and waste within the system to prevent damage to surrounding lands while dramatically increasing yield over current farming methods. In some cases using 70% less land, 85% less water, and tripling yields, with some cases increasing yield by a multiple of 10. (Trabish, 2012)

Is this system such a change in direction from what society has done in the past? No, this is in fact a return to the past with modern innovation brought into the planning. Throughout human history communities have kept agriculture mixed into urban areas until they reach a certain size and land becomes too ‘valuable’ to use for farming.

Many times urban centers have chosen buildings over food plots in hopes of housing more people within cities. This however is not the case with all cities, especially 'garden cities' that were designed to have natural settings and gardens integrated directly into the urban fabric. Therefore the concept is to reintegrate agriculture into the urban fabric where it has been lost for so many years through single use planning.

## FOOD CHAIN SECURITY

If we look at situations where cities and countries have been cut off from their distant food supplies either by embargo, war, or transportation failure we begin to see mass starvation, food riots, and urban collapse.

Agricultural collapse is not a theory that has not been seen previously, but a fact witnessed even as recent as 1990 in Cuba. The collapse of the Soviet Union and in turn the collapse of the COMECON trade block. This left the people of Cuba in a tight spot with drastically reduced fuel, fertilizer, machinery, pesticides, and everything else needed to produce food using the mechanized farming methods. Transportation was still possible, but would have been quite difficult, and increasingly unreliable. These factors led to one of the largest urban farming programs in recent memory.

Stuck between starvation and sudden change, the people of Cuba turned to urban farming. This method used natural pest control, small plot farming, very short supply lines, and an improved quality in the food's nutrition, longevity, and quality.  (Nigel, 2008)

This is just one example of what can happen when there is an agricultural collapse, but one that was able to be caught before it happened. The people of Cuba could see the increasing instability and approaching collapse, and what effect it would have on their current methods. What about locations where there is little warning or planning for the collapse of the food supply chain. Even if there is warning, what of those cities that can not produce food immediately, locally, due to failure of farms when the planting season has already passed?

The answer is simple, starvation, civil unrest, and a sudden urban collapse. Could these situations be prevented? Of course these situations could be prevented or at least partially mitigated until the situation can be fully resolved. This would only require some prior planning, development and integration of some urban farming and food preservation methods. Implementation of just a few urban farms and their food retention and waste reduction systems would go a long way toward preventing sudden food supply collapse. Cities currently hold very little food in reserve on any given day, estimates of food reserves have been recorded as low as 1 day's food supply as reported by the USDA. Furthermore strategic food reserves within the United States have been decreasing steadily in the last decade.
(USA Today, 2008)

These scenarios are becoming ever more pressing as the population centers swell with more and more people living in the urban centers. The solution does not need to be forced dispersal of urban populations into rural areas of the country. We do not need to re-purpose population into professions they have not chosen. What we require is a method to decrease the external demands on the supply chain, make urban agriculture easily achieved, socially supportable, and give the urban centers a buffer to protect against agricultural failure. An example of success in this concept can be seen in the WWII Victory garden program. The USDA records show that even without full participation in the program the united states brought 44% of its fresh vegetable production into the urban core.  (Heimer, 2008)

The benefits of this system can be extended to more than just fresh vegetables, but to all food stuffs as can be seen in Cuba. The overall import of food into a city can be decreased dramatically leading to importation of foods that can not be grown locally, manufactured products (chips, pop, etc), out of season items, and a reduced amount to make up for what is not grown within the urban farm network.

Further benefits of this system would be a re-greening of cities and vastly improved and cared for natural environment. Food wastes would be reduced due to longer lasting freshly harvested product, as well as reuse programs utilizing livestock and composting systems. (Stuart , 2009)  Urban dwellers who can produce excess food would be able to gain additional income from sales of their garden’s production. Even the natural environment would benefit greatly from this new agricultural system since there would be less need for packaging and its inevitable waste.

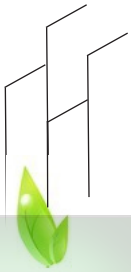
Less transportation means less fuel used in transportation, thus improving air quality as well as decreasing transportation congestion. (Heimer, 2008) Improvements in flavor of foods will also be noticed as properly ripened foods reach people's dinner tables, along with varieties of flavors produced from 'heirloom' varieties. Increased nutrition will also not be left out of the equation. Food is perishable, and the first thing to go is not the appearance of foods, but the nutritional content. Food quickly loses nutritional content as time passes especially if mishandled, as evidenced by a study on spinach by Penn State University. (Penn State University, 2005) Preservation methods must also be addressed since some preservation and food processing techniques will severely harm the nutritional content of food. (Madden, 2010) Last but not least there will be improvements in total nutritional content due to changes in crop species and treatment of soils. There has been recorded loss of micro nutrient content in food since the turn of the century as recorded by the USDA nutrient statistics. (Marler & Wallin, 2006) Each of these facts are supported by multiple studies conducted by the USDA and UN-FAO (United Nations Food and Agriculture Organization.)

Individual farming is not the only method being advanced in this proposal, but a fully operational urban farm with its own land and utilization of leased lands. This system is being devised to create a mixture of year round food production as well as seasonal growth beds throughout the city.

This system seeks to make urban agriculture once again socially desirable and of personal interest while making the process much easier to accomplish. The permanent urban farming centers will readily provide assistance in understanding where and how to do urban farming, organize group farming, sell supplies, and even do their own mass farming.

Anyone reading this might be asking themselves, why should we create year round farming and why shouldn't we just farm the way we always have farmed? The answer in short is as follows: land usage, food quality and supply chain issues demand change.

Providing  urban centers with the required food to feed the larger numbers there needs to be large amounts of plants, or more productive ones, to grow these foods. Since we do not have the horizontal space to grow all these foods utilizing current farming methods we need to look at enhanced methods of creating the food we need. But that's not the only improvement that is granted by the new system. Since there is less area to cover, it's easier to tend to the needs of the plants which leads to enhanced output and enhanced quality.



Research and documentation of production yields of well maintained enclosed farms have shown a proven increase of production by a factor of 3 to 21 times over current farming practices through decrease in required space, improved nutrients, and removal of pests. (Trabish, 2012) Now take into consideration the multiple harvests per year that this system will allow and that's a staggering increase of the food yield from urban lands.

The drastic increase in farming yields are partly due to regular nutritional and watering regimens that allow plants to produce rather than trying to just survive. (Alsever, 2010) (Trabish, 2012)

Utilization of natural pest control whenever possible to not harm the consumers of food production from the urban farm will be a high priority. Properly maintained and tended enclosed farming systems are also able to produce as much as they do when properly run because they are able to keep natural predators away thus saving food. These predators include animals, insects, and fungus that can not be easily controlled in a continually open environment, but can be more easily handled in a controlled environment.

**SYMBIOTIC FERTILIZATION**

Another method being incorporated into this system that can not be achieved in current agriculture is pairing of planting for symbiotically enhanced production. This system is utilized in small plot and traditional farming but is unable to be replicated in current agricultural practices due to cumbersome agricultural implements designed for one and ONLY one crop.

The current system can't produce the same quantities of food as USDA research and historical research have shown, without the use of large amounts of fertilizer and additives. (Hemenway, 2001) However when various selected pairings of plants are grown together they each provide the nutrients the other needs to grow, and thus they do not deplete the soil in the same manner as current practices, and as such they self fertilize the group.

Decreasing the needs of fertilizer further decreases the costs and manpower associated with crop production as well as reducing the possibility of leaching into the environment while still receiving the same benefits.

## WATER PURIFICATION

Included in this system is a water purification and treatment center that will allow new water, local water runoff, waste water, and water recovery from the agricultural system to be purified to two points.

The first purification is a grey-water system that will freshen the water to the point of use in non potable situations, and requires less space and material for this process. The second process is a potable system that takes the grey-water and continues the purification until it is usable for human consumption. Excess water and excess treated waste waters will be reintroduced into the natural environment allowing the continuation of the natural water cycle.

Current practices require large amounts of space and a great amount of material to produce either one of these results. Existing practices are also labor and machinery intensive.

Incorporated in this design is a local waste and grey-water purification system allowing for nutrient extraction, harmful organism removal and improved water quality for the surrounding area, including, where available, aquifer recharging. Reasoning for this inclusion are made ever present when the site is considered and the need for project site water runoff mitigation. This system has the capacity to produce water for the surrounding neighborhoods while caring for its own needs and resolving local waste waters. Reduction on demands of urban infrastructure will allow the local community to enjoy higher quality water at low cost while reducing the city's maintenance needs on existing water treatment equipment and pump stations. Furthermore the natural system will allow for a more profitable less demanding method to produce quality water and waste mitigation for both the local population as well as the farm's systems. (Fabrizi, 2011)

## FOOD WASTE

Particular attention will be paid in this method to not only increase food production within the city, but decrease food waste within the city itself, thus reducing the overall food requirements.

Studies have shown large and unnecessary food waste in urban centers as well as in the agricultural sector. Enormous wastes are present in agricultural production when food does not meet sizing or visual restrictions placed by the purchasers. However these foods were not rejected due to being unpalatable or unusable for any other reason than their appearance. This is due to both current practices as well as lack of traditional and new waste recovery methods. (Stuart , 2009) Utilizing new methods and rediscovering traditional waste recovery methods will allow for greater reduction in trash and reduction in requirements of urban food needs but turning trash into a productive resource.

Rejected food ends up going to waste, when it could instead be utilized in other methods that do not require it to be in its original form such as potato chips, tomato sauce, and other products.

Wastes of materials do not stop there but continue into the restaurant industries especially fast food restaurants. Any foods not meeting standards, or food that is not made to the correct order are tossed into the trash, never to be consumed or utilized for any reasonable purpose. Further there are wastes that can be found and are seemingly 'unavoidable' such as peelings and other such by products of food usage. These wastes can be avoided by utilizing changes in production, distribution, storage, consumption, and disposal. A recent study by Tristram Stuart has shown that in countries such as the United States, there is waste up to three times the amount needed to feed the population. (Stuart , 2009)

Spoilage of food can be mitigated through improved planning, processing, food exchange programs, and many other methods to reduce this loss of food. Furthermore, unavoidable wastes from food use such as trimmings can be repurposed for use in agriculture and landscaping, thus reducing further the waste within the food supply.

**RESULTS**

Much of what society deems valuable is determined by what it does for us either personally or economically. In this case through the use of integrated planning and enhanced design of the farming systems and structures, the system will reach two-fold into improvement of individuals personally / physically as well as helping the community and the individually financially. This urban restoration of the lost agricultural fabric will not only help the local environment, but will provide security in times of shortage, save the community money, provide education, and even enhance the beauty of the community.

# RESEARCH SUMMARY

This project is a mixed use agriculture and education center that is operated as partially public and partially private. The design is to address concerns with urban food supply, general food nutrition, community interaction and involvement on a large and local scale, and even address waste issues in the food supply.

This project is located in a heavily deteriorated section of the city of Detroit, MI, on a site located in the heart of the city itself, and at the transportation heart of the greater Detroit metro area.

The project is aproximately 490 acres of land located within the city of Detroit, and is mostly vacant land at this point.

The concept behind the research portion of this program was to identify what the concerns were in the field regarding the topic. Then take these newly discovered concerns and attemt to identify the most important needs among them and make these elements the top priority in the design.

Examining the information from the research, it is going to be very important to create an efficient system that is comfortable to use and helps memebrs of the community to gather together and learn about growing their own food, and then taking this knowledge and carrying it through when they get home. Furthermore it is hoped that this project would inspire home gardeners to share this knowledge with their neighbors and not only get them involved, but create a community bond between each other.

While conducting the research there was much more information and many more issues discovered regarding the topic, the site, and the solutions. These issues are not negative but positive elements with regard to the design.

Each 'negative' element led to a more interesting solution than was previously considered. The design, though still forming, has taken a far more noticeable direction after uncovering the information presented in this research.

One major element in the design that is going to have to be addressed will be expansion capabilities in the design, and the ability to operate segments independently or collectively and repair or expand segments of the facility without interfering with the operation of other systems.

Another aspect this project seems to call for is the integration of elements and technologies directly into the structure that will interact with the overall design. These elements not only will operate independent, but should also interact with each other to create a living network that each part enhances the function of the rest of the design.

Existing elements in the design are the agricultural beds themselves, hydroponic systems, research, education, food processing facilities, waste recovery, a restaurant, food storage and exchange, and water treatment systems. Each of these elements should be as natural as possible so they are not a net draw, but a net gain on the system and its environment and community.

# HISTORICAL CONTEXT

Concepts related to farming within an urban centers are not new ideas and have existed since the start of human settlement. There are many examples from historic through the modern age and right into today's cities that provide examples of urban farming and it's place within the landscape.

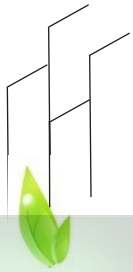
## SIMILARITIES

Garden cities, COMECON's collapse effecting Cuba, Victory gardens, vertical farming projects, native farming, and home gardens are just a few examples of modern and historic projects similar to the proposal made within this program.

Garden cities were designed with the intent of bringing both natural landscape and food plots within city limits and thus removing the grime of the city and replacing it with natural beauty. Added benefits of this system included the capacity to grow food within the city and reduce dependence on external farming. These garden cities were designed to and have proven themselves to be able to maintain a mostly internally generated food supply. (Howard, 1902)

COMECON, the trade organization of the Soviet Union provided Cuba with a source for fuel, machinery, and supplies needed to operate current industrialized food production. However, this all changed with the collapse of the Soviet Union, and Cuba was left without industrialized farming capacity. Their solution was to utilize all the land within a city they could in order to provide food for their community. Thus lawns, yards, flower boxes, and even medians all became farming resources. This system allowed for local food production that prevented mass starvation, and gave Cuban cities the buffer they needed to utilize less intensive farming close to the city, and remaining trade to provide the rest of their needs. (Nigel, 2008)

Victory gardens as mentioned before were utilized during WWII in the United States as a means of reducing the demands on farms and transportation systems. Efforts from the victory gardens brought 44% of vegetable production into cities and gave freedom to existing resources. (Heimer, 2008)



These newly liberated food resources were utilized in the war effort along with the now less congested transportation networks that moved war materials to factories and on toward Europe.

Native civilizations that had settled communities were well versed in agricultural techniques. One of these methods in particular was the use of ‘sistered’ crops. These crops provided each other with the nutrients they needed to grow stronger and healthier and produce more food together than they did separately. These techniques have existed for centuries and have proven extremely valuable to farming until the advent of modern industrialized farming.

Home gardens utilizing techniques such as the ‘sistered’ crop method as well as others have worked in conjunction with preserving techniques to provide food during the growing season as well as during times when food can not be grown. These home gardens and preservation methods can be found throughout history in nearly every settled civilization as well as in some nomadic civilizations.

## SOCIETAL CONNECTIONS

There has been a growing trend in society especially since the 60s within the United States and globally to create a more natural waay of living, one that is easier on the environment within we live.

Changes in every segment of society have been seen and there has been growing concern over the methods used in every part of society from manufacturing, energy usage, materials we use, through even our food.

This growing concern over our food is two fold, firstly it concerns how we grow our food and secondly if the food is of a healthful quality. Regarding food production’s sustainable methods physically as well as environmentally, there have been concerns about both. Physically the current methods are quite labor, machinery, fuel and material intensive. This concern leaves many people wanting a change to a new way to produce our food, one that utilizes less resources to produce the same quantity of food. The next concern was over the environmental impact. These concerns generally exist over the amount of land utilized by farming and its encroachment on natural lands, as well as the use of chemical fertilizers, artificially genetically modified foods, herbicides, runoff, and many other environmental concerns.

These concerns have lead to a return to urban farming in the form of personal garden plots as well as increasing popularity of community gardens. These local gardening methods are a quickly growing trend in society with numbers of community gardens increasing rapidly. Their popularity comes from fresh foods that are not mono-culture varieties but include various 'heirloom' or pre industrialized farming varieties of food. These gardens, in many cases, shy away from artificial herbicides and pesticides in favor of natural alternatives. These gardens are also favored for their production of fully ripened, full flavor foods which are not commonly available from current farming practices. Many times foods are grown to pre ripened conditions and then harvested, shipped to where they are to be sold, and then artificially ripened using artificial methods. Though these foods are now 'ripe' they lack in qualities such as flavor and shelf life, and some suspect they even lack full nutritional impact.

As such, with these growing concerns over local vs AgriBuisness, many more people seek to start their own food gardens and preserve their own foods.

Another concern mentioned is the growing distance between farms and the dinner table. This concern is made ever more clear by situations like Cuba, and regions that face war or poor reliability of transportation networks for various reasons.

As cities are designed without their historic inclusion of agriculture, they are at increasing risk, with an ever growing danger to increasing urban populations. Due to these risks involved there is a growing trend to both grow more food globally as well as to attempt to bring food back into the communities and as such create stronger safer communities.

## LOCAL CONTEXT

Physically this project is located in the heart of one of the physically largest urban centers in the United States. The greater Detroit area is over 32 miles of development out from city center in every direction. This urban landscape contains few of the farms it once boasted, and as such the farms have moved to the outer ring around the city and suburbs.

The community in particular surrounding the project site has faced extreme economic downturn and neglect leaving the project area's 490 acres almost completely empty. This site was once completely developed with various residential commercial and industrial structures. The site has long since collapsed, and now only has a few structures left on the site.

The community surrounding the project site however is still mostly intact, but sits next to a mostly undeveloped and neglected hole in the cityscape. Socially the greater Detroit area has long had a strong tradition with growing food in backyard gardens, especially the neighboring 'inburb' cities located less than 1 mile away from the site. Looking closer at the project site there is a need to clean up the neglected site and remove the blighted structures that still exist on the site. These existing structures, and lack of community in the area to watch over the site have led to problems in crime in the surrounding existing community.

Local examples of redevelopment, maintenance, and care taking of other large local sites have shown extreme drops in their local crime rates as well as dramatic increase of community involvement, property maintenance, neighborhood watch and interest in development of vacant properties. An example of this being the redevelopment of G.M. Gear and Axle by American Axle and Manufacturing.

## THE SITE, A CLOSER HISTORIC LOOK

Mainly inhabited by immigrants and local working class families, the area supplied much of the labor for the surrounding factories such as Sherwin Williams paints, Dodge Main assembly, General Motors gear & axle, and many other large raw material, slaughterhouses and finished product production facilities. This community is nestled in between a major rail artery to the northwest, Detroit City airport to the northeast, Interstate 94 to the south and factories on both sides.

This site developed quickly to meet the growing demands of the booming manufacturing industries surrounding this area including but not limited to the auto industry. Development of this neighborhood started close to the turn of the century, mostly during 1900 through the 1930s. Being developed quickly this area was rather homogenous in character and designed as modest but comfortable working class homes. (Bukowcyk, 1982)

The community consisted of local families, and immigrants from many nations including Poland, Checkoslovakia, Italy, Germany, Russia, and Austria among others. These immigrants built a comfortable community, and the area was generally a good place to live. These immigrants had strong ties to their local community as could be seen by the construction of their local parish. The major parish in the project site was Ss Cyrill and Methodius Slovak Catholic Church. This parish was clearly the product of a close knit community, and served as a center of many social activities. The parish church, school, sports facilities, religious residences, library, and other facilities were constructed into an enormous building resembling a castle in both appearance and size.

The area began to fall on hard times as factories began to decline in production, and again during the Detroit race riots of the 60's and subsequent plant closure and relocations that soon followed. The local plants were located in a civilly turbulent city with the factory populations already starting to depart for the safer suburbs. Furthering the troubles for the local plants, they were starting to be outdated in design and technology. As such the corporations moved their production facilities to new locations closer to their workers, away from increasing crime rates around the facilities as well as into newly designed and fitted manufacturing facilities. Further damaging the neighborhoods were civic improvement projects including interstate construction and the Detroit Medical Center complex which each tore the overall neighborhood apart. (Bukowcyk, 1982)

With many factories leaving the local area, and many ones remaining having their worker base not in that community, times were tough. The local community left for the new suburban life, closer to work, and with safer communities for their families.

Many years of economic decline and neglect left the area battered and mostly missing by the 1980s. One last blow finally broke the local community apart with the demolition of enormous tracts of neighborhood, industry, and commercial property in order to construct the G.M. 'Poletown' assembly plant. This completely gutted the middle portion of the community and separated it with an inaccessible fully enclosed manufacturing facility. In the early 80s, with almost none of the surrounding parish community (buildings and people) left, Ss Cyrill Parish even moved to the suburbs to reunite with its parish community that once called it home. (Bukowcyk, 1982) (Forgotten Detroit, 2004)

Over the next 25 years many of the remaining buildings were burned and razed, and those that were not fell into disrepair. These dilapidated neighborhoods filled with criminal activities and became the home of biker and street gangs leaving the surrounding community to avoid this area. Eventually city funds paid for the demolition of much of the rest of the structures in the area in order to preserve the surrounding neighborhoods and make way for industrial redevelopment.

## THE SITE AND CITY TODAY

Currently there are only a few dozen structures total across the 490 acres of the site, most of which are not in good shape, and the remaining factories in the area are either turned into warehouses or have had their structures removed to be used as parking lots for new vehicles from the nearby GM Poletown assembly plant. The now empty fields that comprise the former neighborhood are overgrown and strewn with trash and illegally dumped debris.

Detroit today is seeking new ways to restore the various ‘holes’ in the cityscape. These efforts are an attempt to fill in the missing pieces of the city for continuity sake as well as for crime reduction, community reconstruction, restoring tax revenue, removal of blight, and many other reasons. Detroit is seeking developments especially for this area in order to breathe new life into this long neglected missing neighborhood. Local crime has been reduced, and the city and state are now providing tax incentive and economic assistance for the development of this land into a productive, maintained development that will begin to improve not only it’s area, but the area surrounding it as well. (State of Michigan, 2012)

Large tracts of undeveloped land such as the project site are being examined for possible redevelopment into larger planned developments. These development options range from enormous new factories to expo centers to amusement parks and movie production studios, and even restoration of long gone urban farms. That is where this project comes into focus as a location for an urban farm located near the junction of multiple major Interstate, freeway, and major roads. This site is ideal for a multi county urban farming education center as well as community resources and a working farm. With mostly vacant land, and great connectivity this site is ideal for the implementation of the growing trend toward urban farming and food stabalization of urban centers.

# THESIS GOALS

Compressed agriculture exists for many reasons, but mainly these reasons can be derived into three main categories. This thesis exists for personal, professional, and academic reasons.

**PERSONAL**

Almost everyone in my city had a lively and well maintained garden, yard, and home. If something was not well maintained or something was out of place, it was very unusual to see, not because we were forced to maintain the appearance of our yards, but that there was so much pride everyone took in maintaining their homes.

Since very young I have enjoyed working in the garden at home with my family. We didn't have much yard to call our own, being in the center of a major city, but what we did have we made sure it was well tended. Our garden was filled with flower, food, and decorative foliage. This space was a great pleasure to look at, and even provided food for us to eat and trade with our neighbors whom were growing other things. As a community we would trade food across the fences, and travel down the street to make trades. We grew vegetables, many times a good number of tomatoes, but down the street was the mini fruit orchard, a pocket vineyard, potatoes, and everything else you could imagine.

One thing that drew our community together was that we all cared for our neighborhood, our homes, and our gardens. It's really impressive how too many tomatoes can get you to speak to the guy with too many peppers or the lady with too many pears.

But this was not the whole benefit of growing our own food in the yard, it taught that you had to do things within a certain time or you wouldn't get quite what you hoped. Working the land not only gave me a strong understanding of where my food came from, but gave my family far less expensive far tastier food that we only needed walk outside to acquire.

The reason I mention this story is that I believe communities are missing this connection to their property, missing this great benefit to their health, and missing this connection to their local community as well. With this compressed agricultural system and community education

I believe others can experience this same satisfaction, same benefit, and same growth in community. That is one reason I'm interested in this thesis topic.

Another reason is that I believe cities are missing a great resource as they cut themselves off from their agricultural past, and even as they remove agriculture from their cityscapes. Food is no longer something you or your family grow, it's now no different to many people than a hat or a pair of shoes. These items come from somewhere, and some people truly have no idea where it comes from, it just appears on the shelves and no one asks who, what, when, why or how. All most shoppers know is that there is food in that store and that's all they care about. But with these long distances to where we get our food from, there are great issues I believe with shortage from embargo, shortage from damage to transportation lines, and many other things which can stop stores from carrying one or more foods. However if these foods are grown at home, neither broken truck nor empty wallt will stop a person from being able to walk into their yard and enjoy foods grown in their own yard.

Lastly, I'm also interested in the current approach to farming, and though it's improved considerably, I believe it can still improve further. Various products when grown at home have a considerably more complex flavor because they were allowed to fully ripen before picking. This is something long line food sourcing has trouble with. If you pick it ripe and ship it long distances it's almost ready for the compost heap by the time the consumer gets a chance to purchase. However if you pick if fresh and sell it locally, there is still plenty of time on the clock to make it into delicious recipes.

One other issue I find with farming is the use of expensive equipment and lots of resources to produce food seems rather laborious and financially demanding especially now with patented crops, fertilizers, and herbicides. I believe variety of foods and variety of species of food is the way to go. Need to stop a plant ailment from spreading? use a different species in the area that's not affected.

**PROFESSIONAL**

Professionally I believe this project is a great idea, and can become a fascinating design that could lead to changes in civic design. Shock the neighbors by installing a farm next door, and then wow them with the beautiful, useful, and meaningful architecture that makes it all work.

Often the structures on farms are completely utilitarian, seemingly efficient, but are they truly efficient? I believe their are not truly efficient, but each individual part has been engineered to serve its singular function. Aesthetically these current structures are less than appealing and not as useful as they appear. Long past are the creative and iconic structures of past farming techniques. We now but single purpose built, ineffective, but seemingly efficient structures but we can do better, we can demand better, we can design a new way forward, or at least the first step.

Professionally I believe architects can retake their place in designing agricultural structures, and not just ones that meet the engineering specifications, but ones that will inspire photographers, be a joy to see as you pass, and even be an excellent neighbor in the city.

Professionally this structure should exemplify what an architect does, and that is to give what the client asks for, and then give them even more. This structure should not just take the individual systems and give them a home, but find a way as any good design does, and integrate these into one pleasing harmonious and inspiring design that will last the test of time.

**ACADEMICALLY**

Again, this project has many good points that integrate various academic principles into one. This structure has the capacity to integrate experimental and current design technologies into the physical systems. This design is also important because it allows for the physical alignment, layout, and technologies required to operate a low or zero energy structure that will not only benefit those that inhabit the structure, but will also be beneficial to those in the surrounding community as well for multiple reasons.

This structure will require not only the function to be well calculated, but will also require the form to be aesthetically pleasing while at the same time being meaningfully designed to enhance the experience of the end users and benefactors.

Thus, this structure is an excellent case for form, function, and phenomenology, as well as a chance to integrate new techniques in a private and community structure with mixed use utilitarian and educational requirements.

# COMPRESSED AGRICULTURE INITIATIVE

## Site Analysis - Quantitative

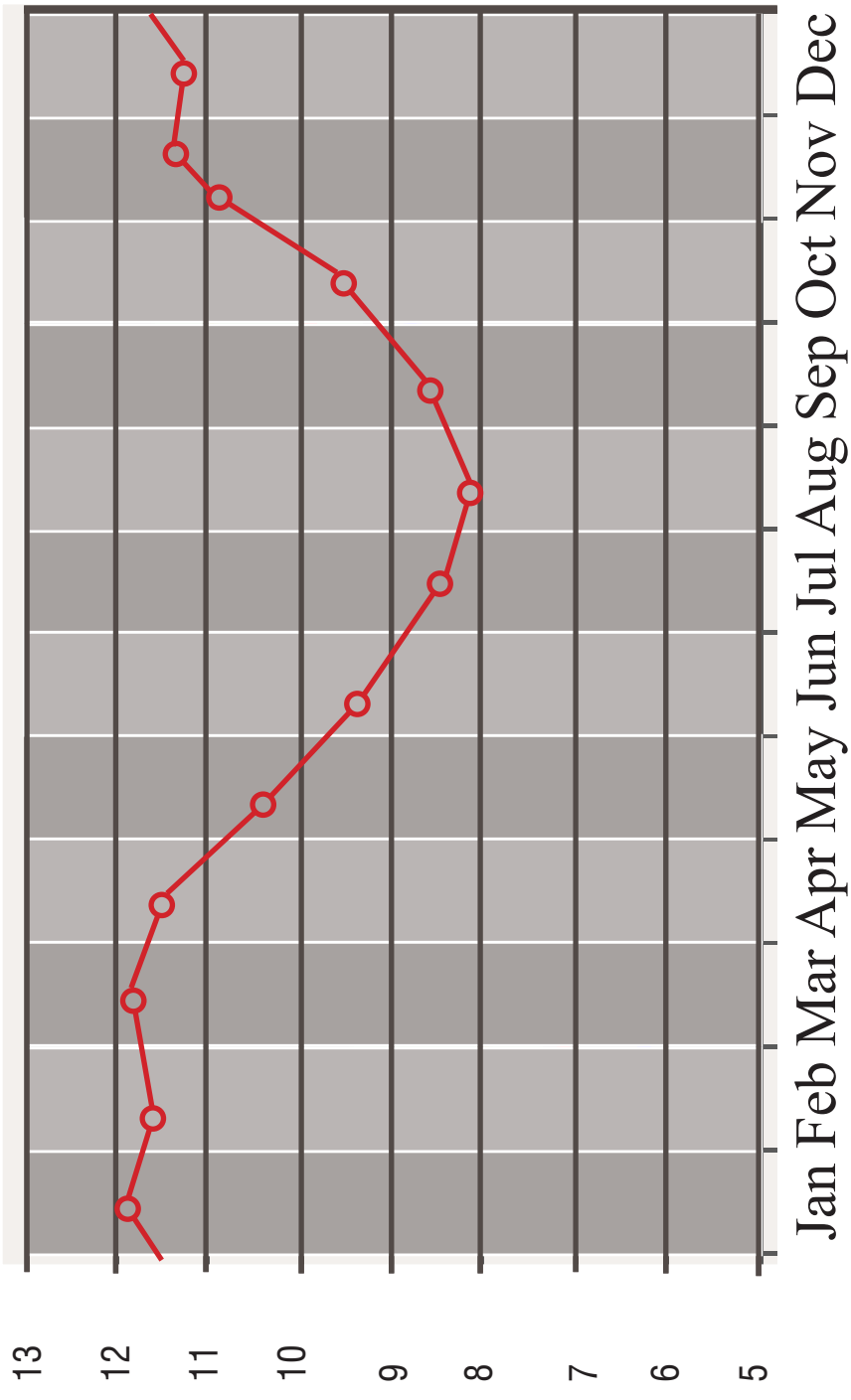





Figure 39. Graph - Wind Speed (MPH)

# Temperature

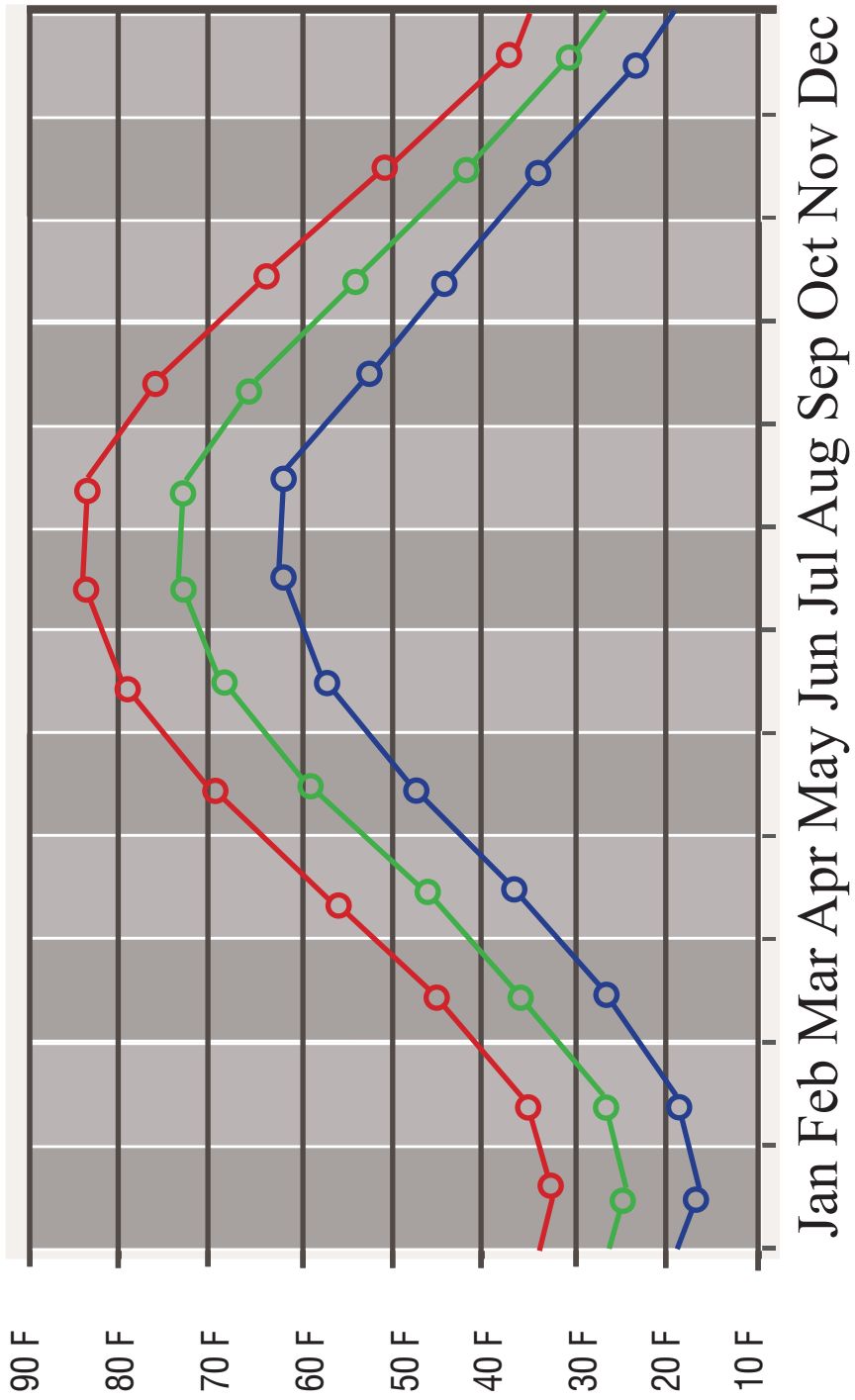



Figure 40. Graph - Temperature

# Humidity

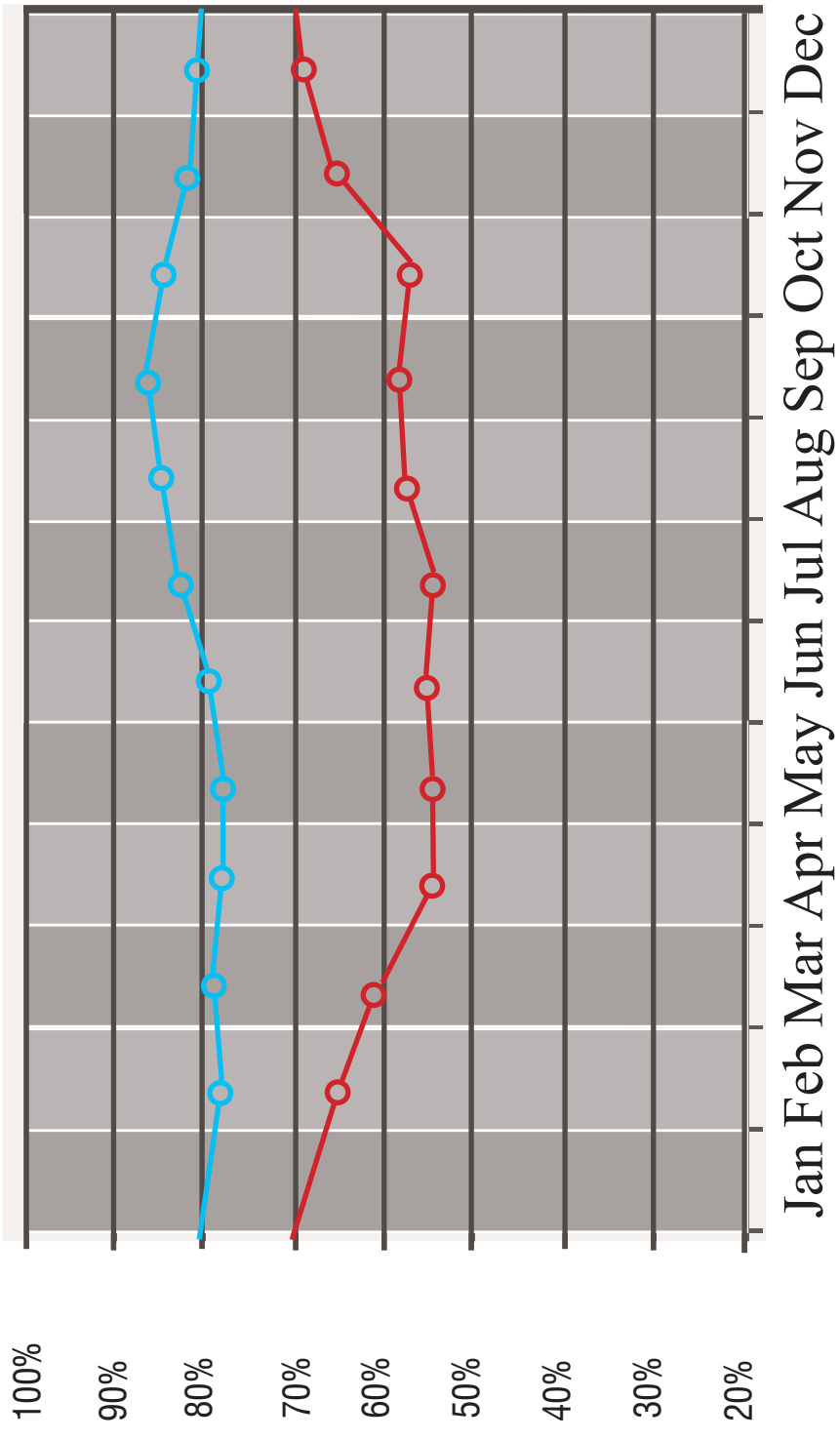





Figure 41. Graph - Humidity

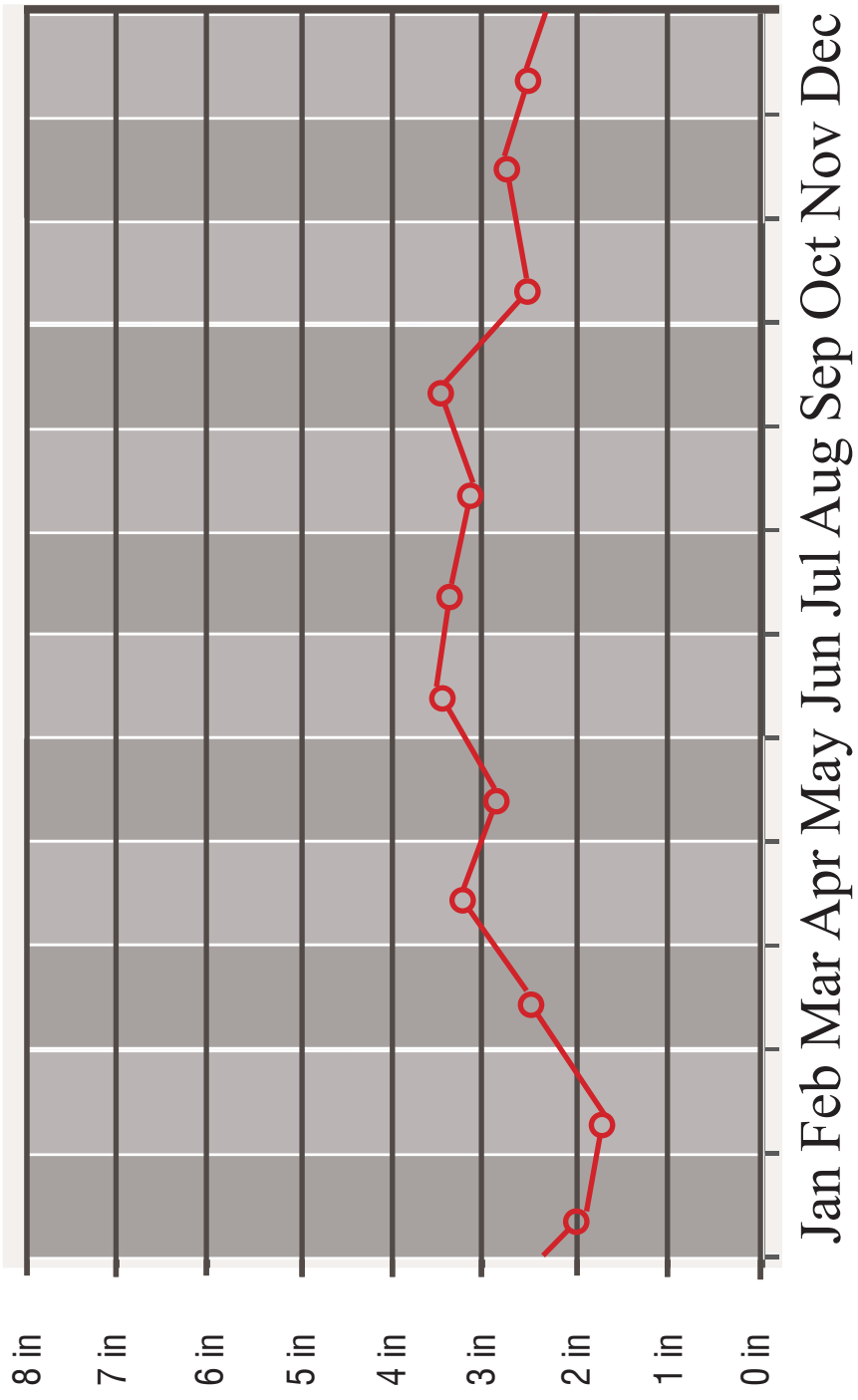



Figure 42. Graph - Percipitation

# Cloudiness

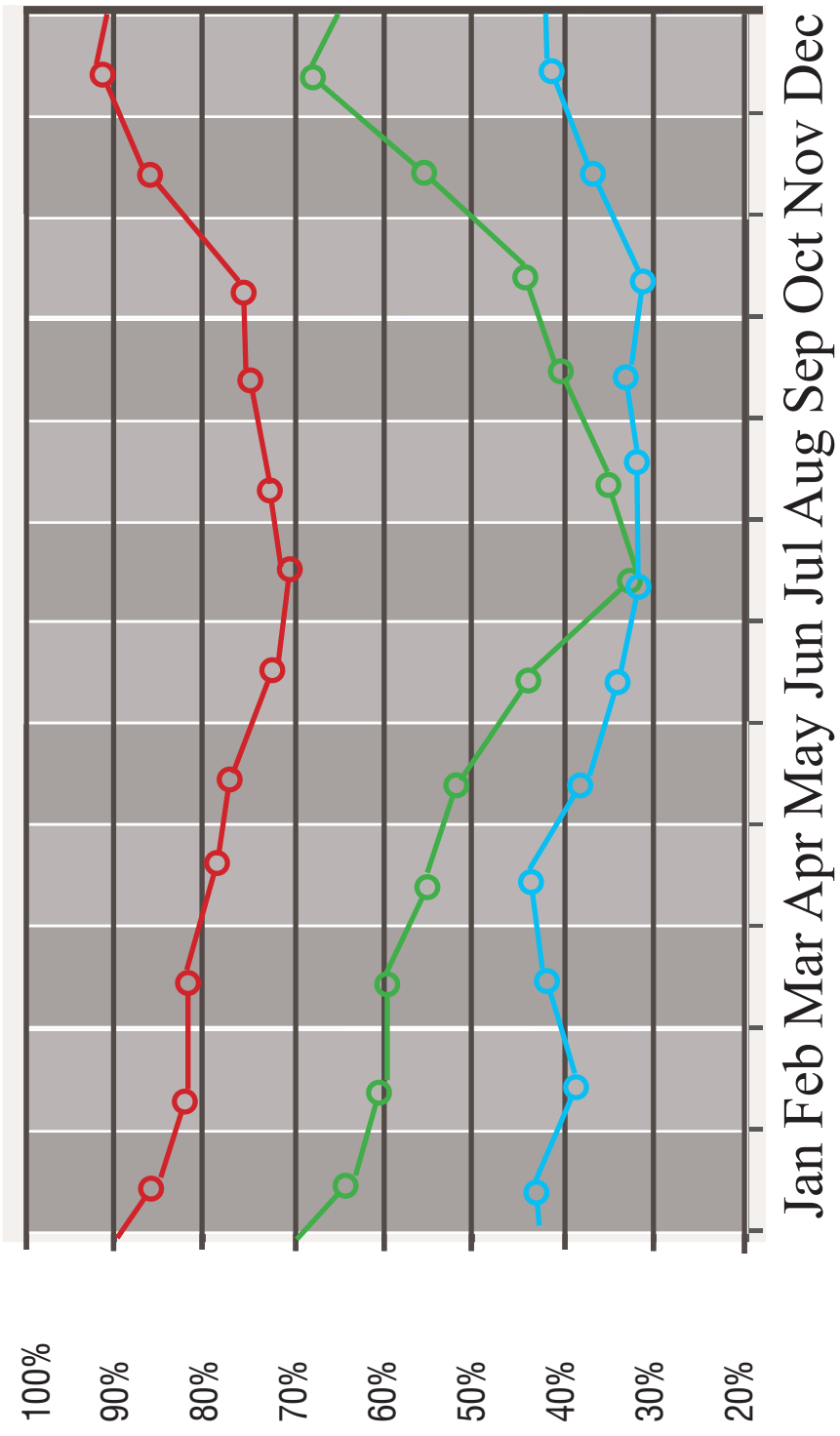



 Figure 43. Graph - Cloudiness

# Sun Path

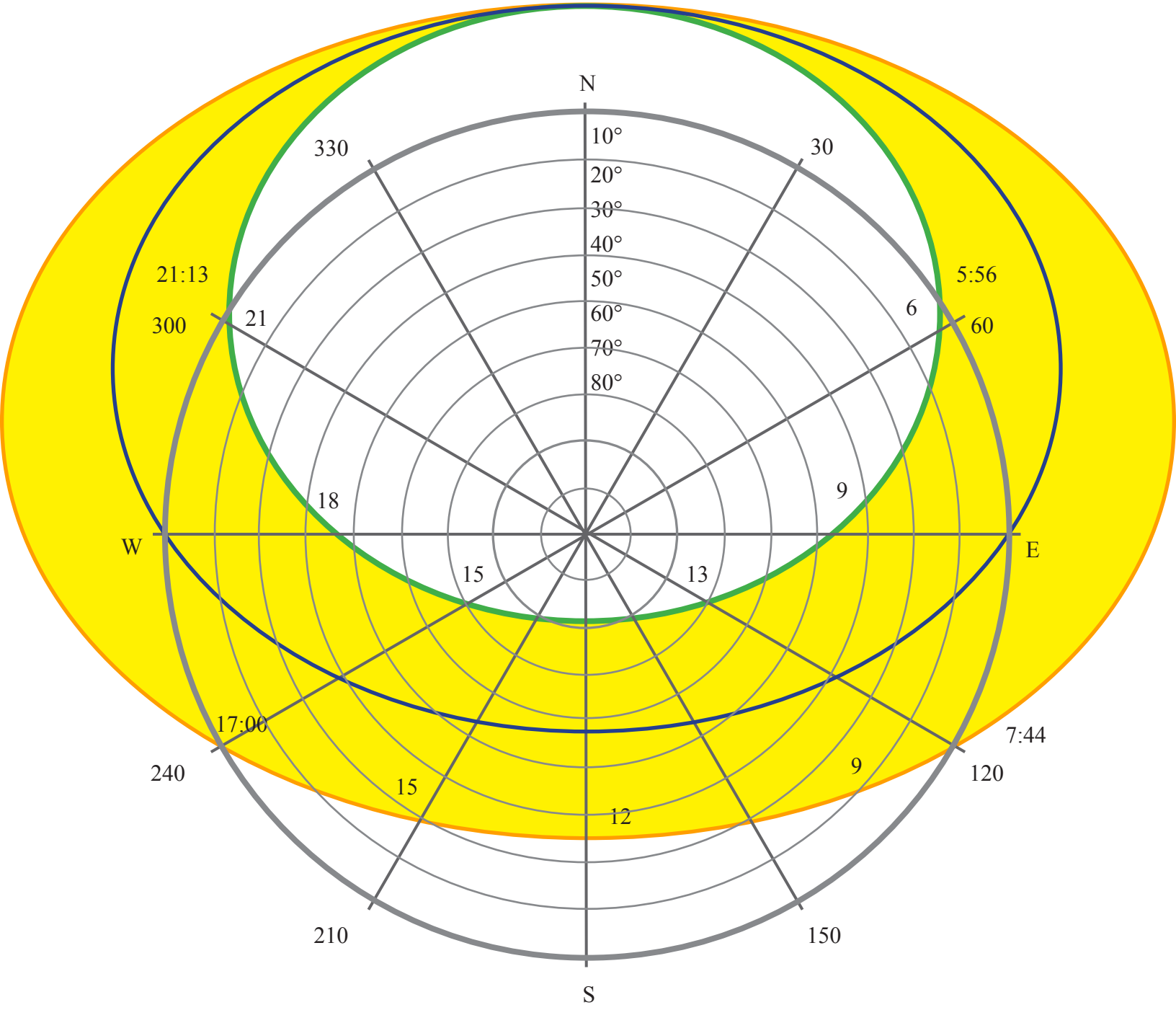



Figure 44. Sun Path

# Wind Direction

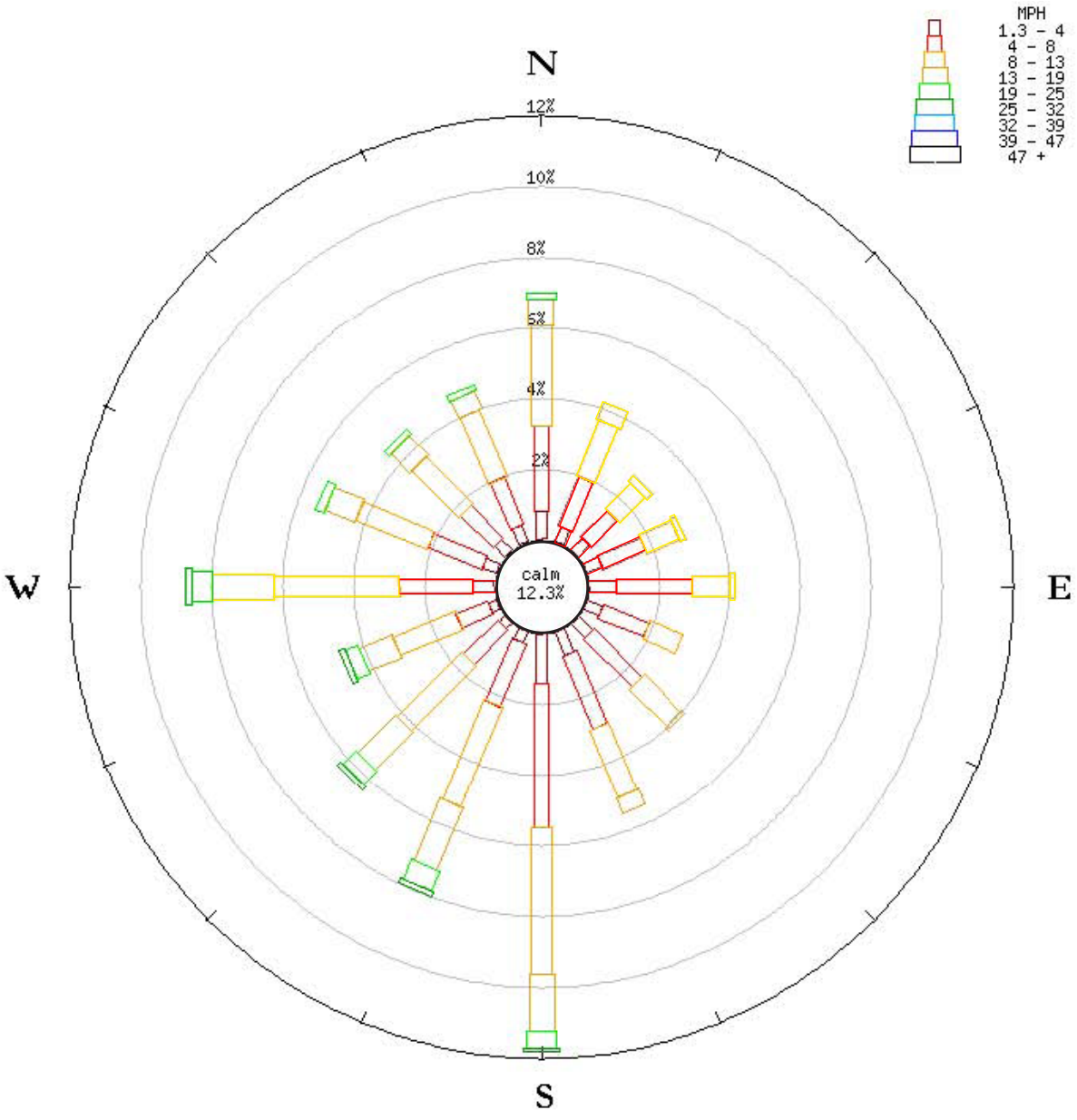
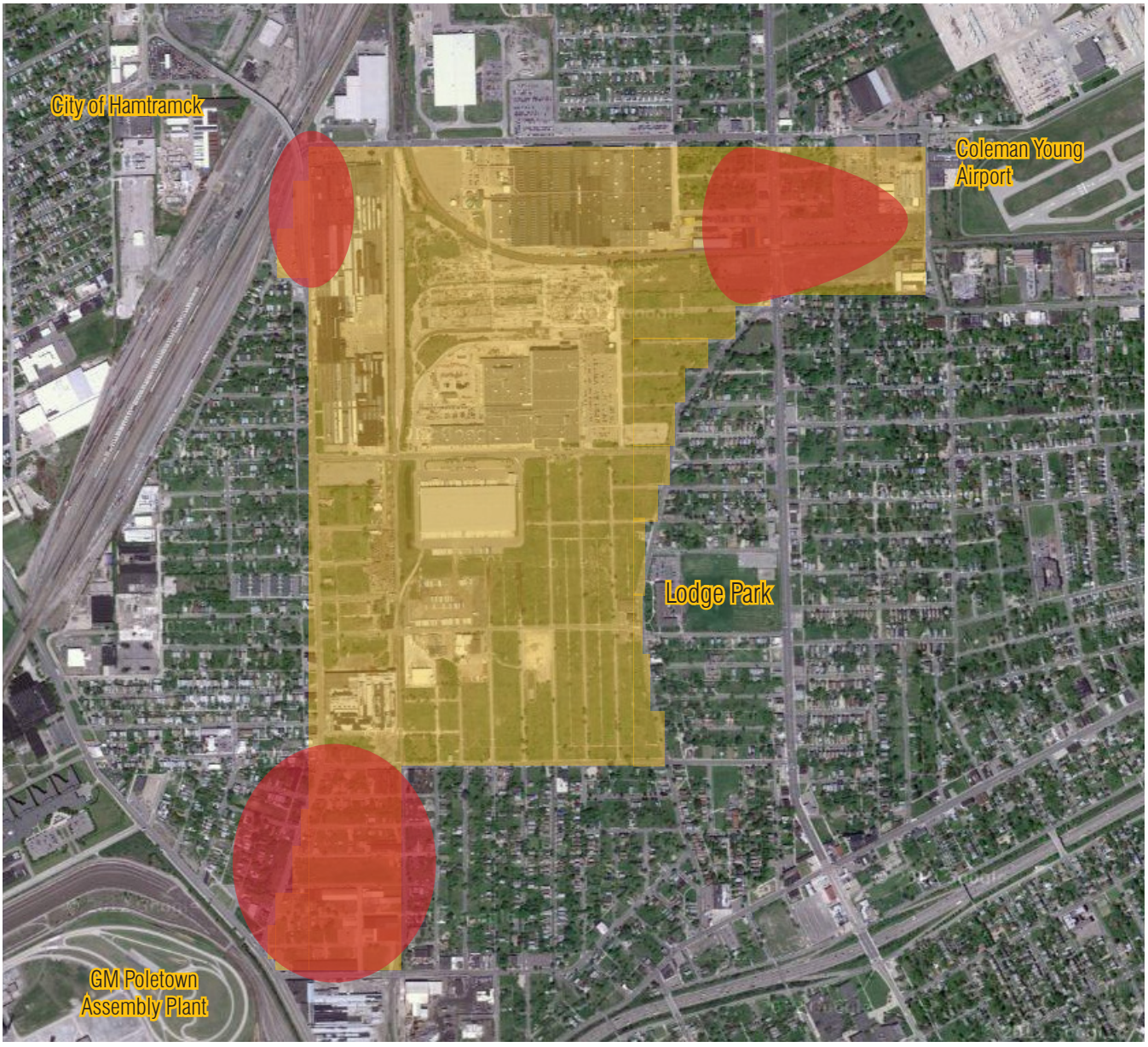





Figure 45. Wind Direction

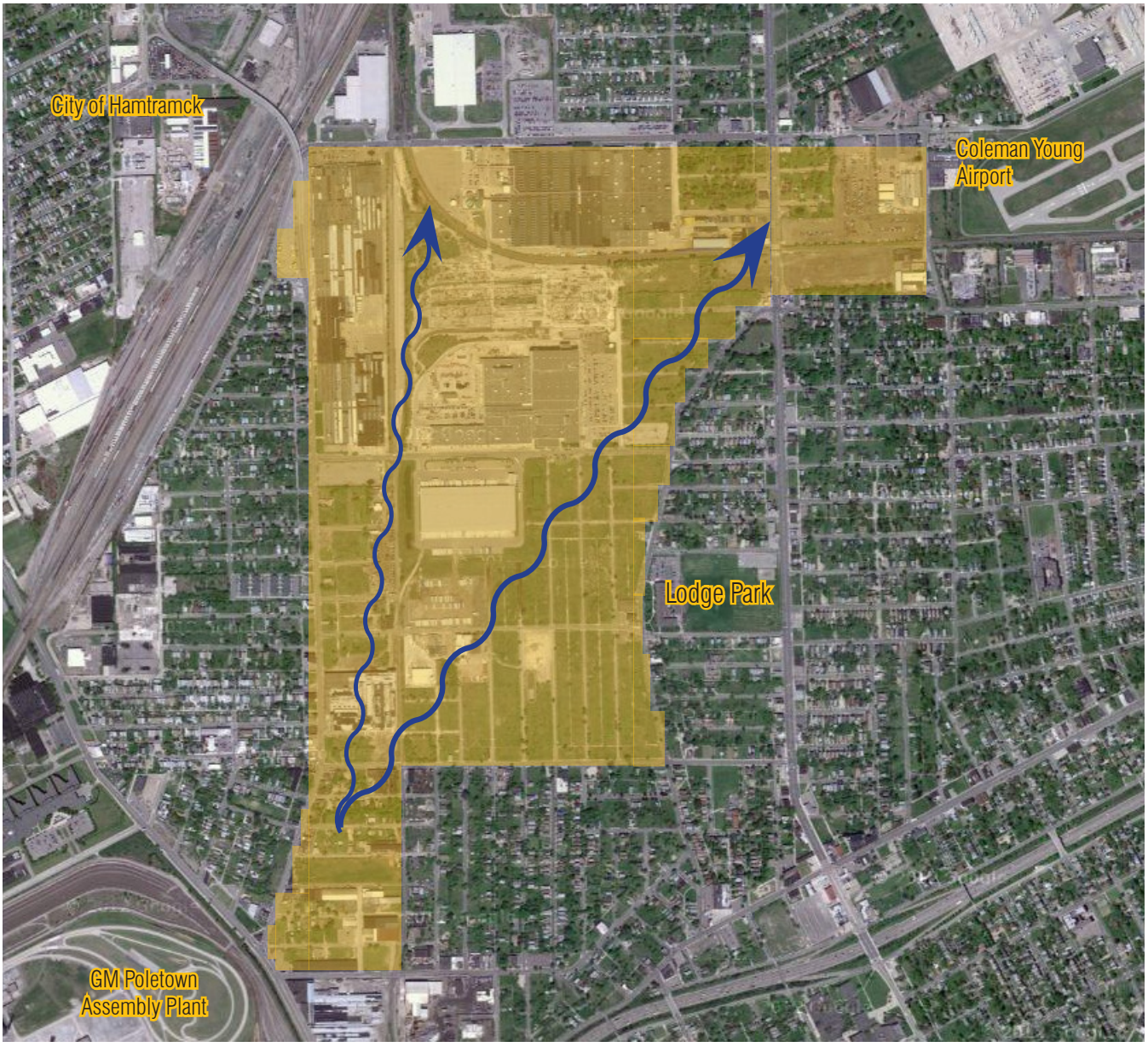
# Shading




Areas of shading concern due to existing Infrastructure of structures bordering site.

Figure 46. Site Map - Shading

# Topography and Wind



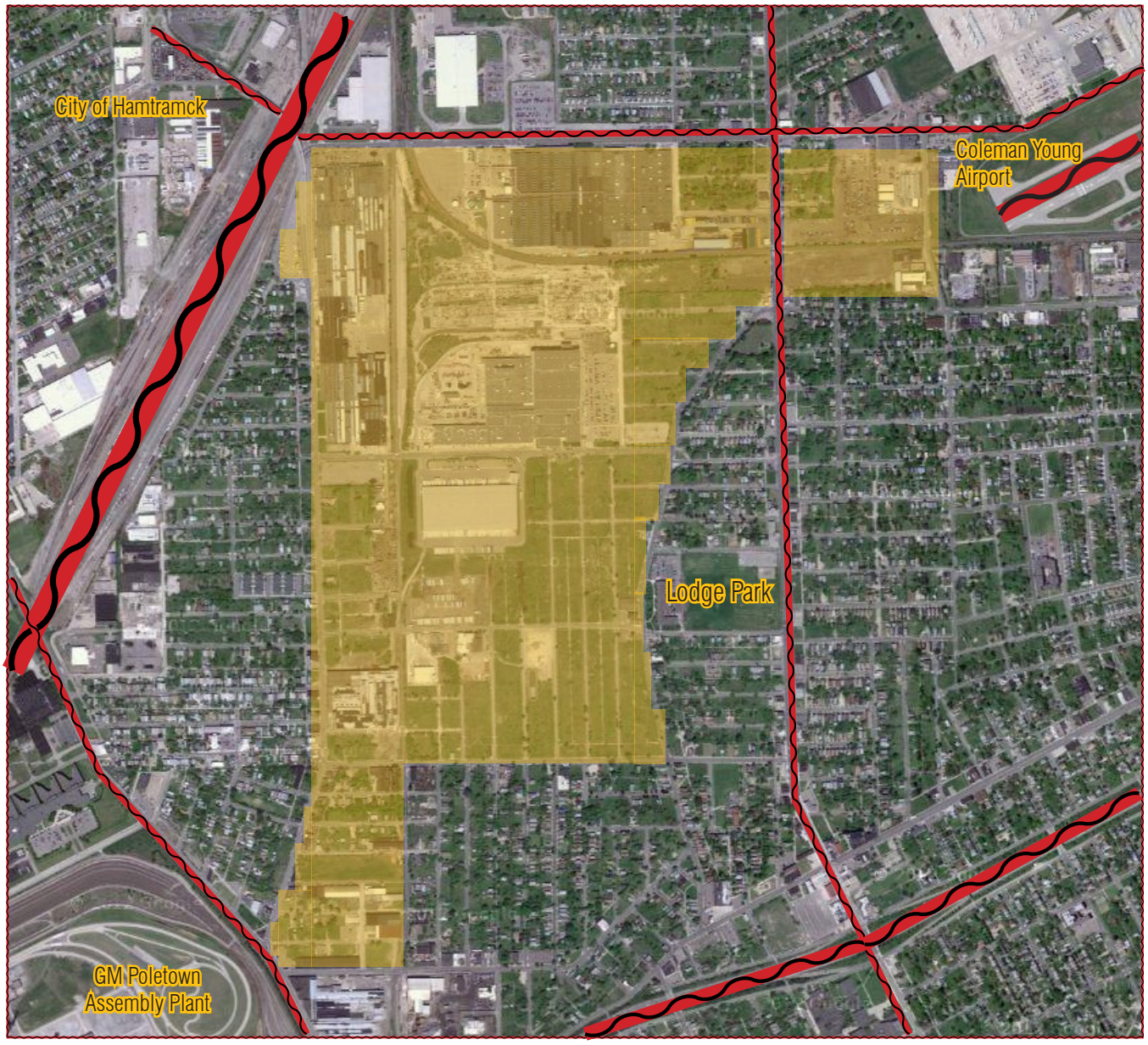

Site holds constant topographic level.
Site contains slope toward existing roadways from center of blocks.

Wind flow direction across site due to prevailing wind patterns and unrestricted flow across landscape. Only remaining major structures are in the upper center and divide but do not inhibit the wind.



Figure 47. Site Map - Topography and Wind

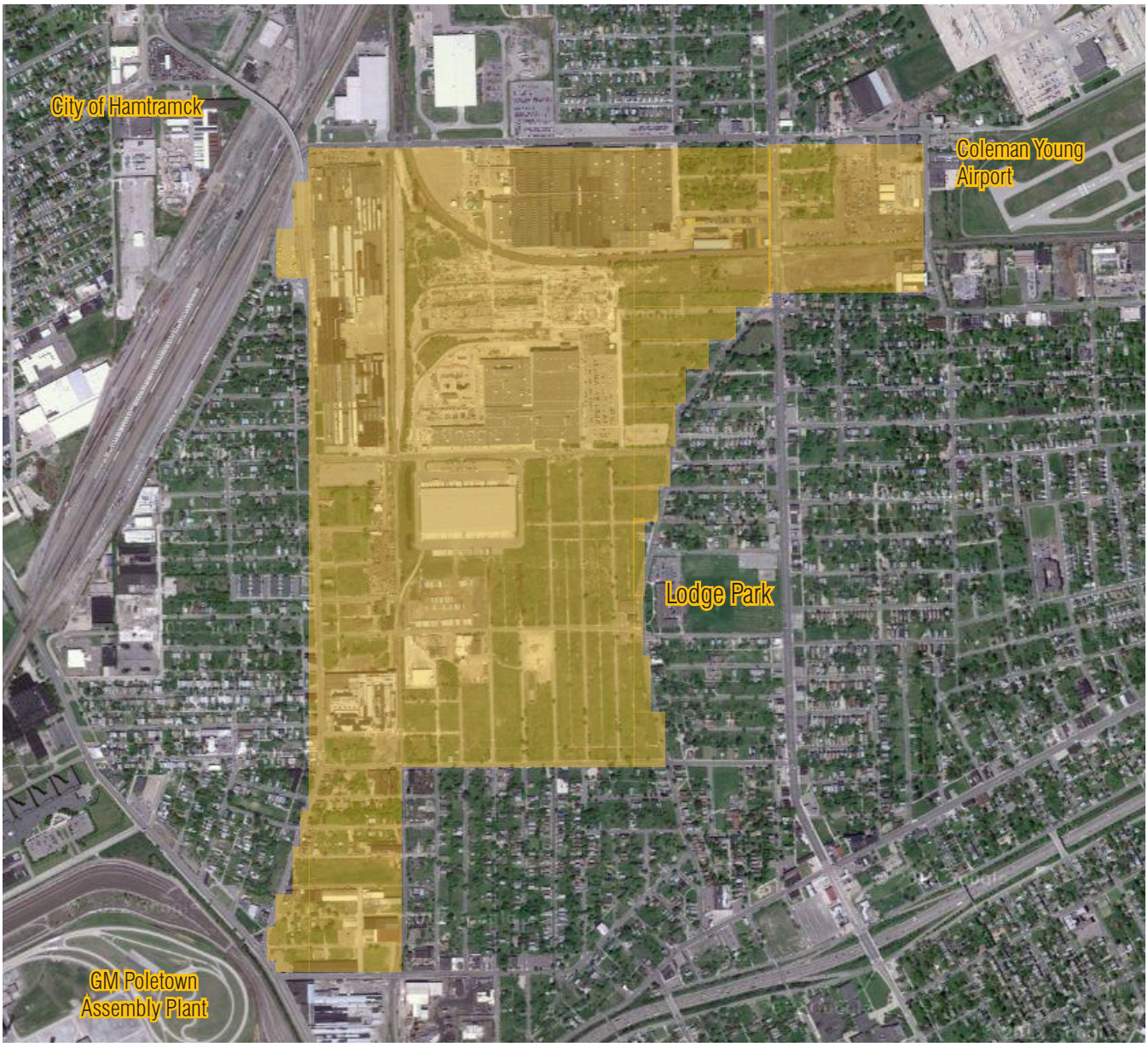
# Noise




Major Noise Sources

Figure 48. Site Map - Noise

# Slope

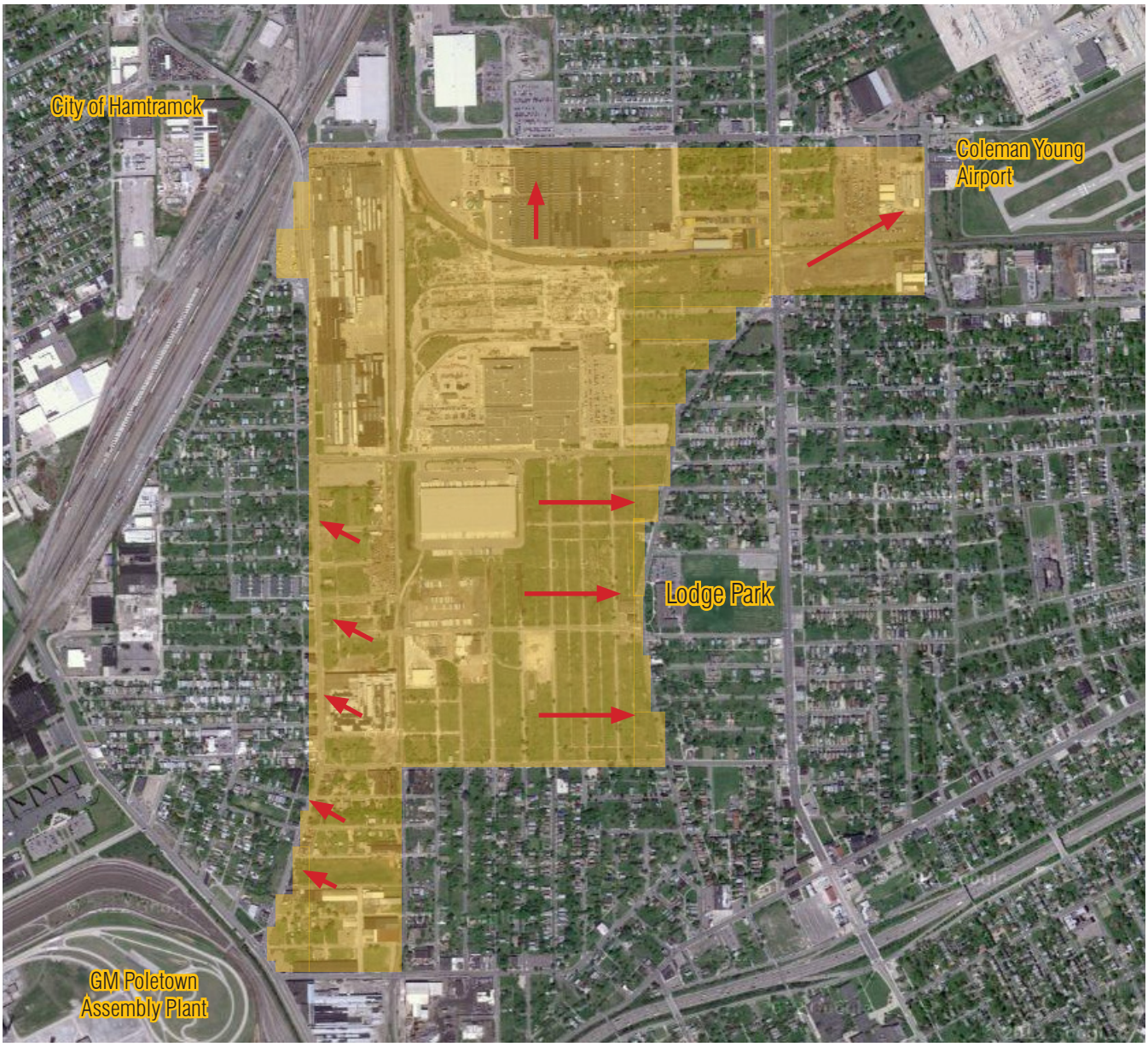



Non continuous slope across site. Slope across site graded toward streets and drain access. Slope ranges between 1% and 5% depending on the areas across the site, with an average slope of 2-4%



Figure 49. Site Map - Slope

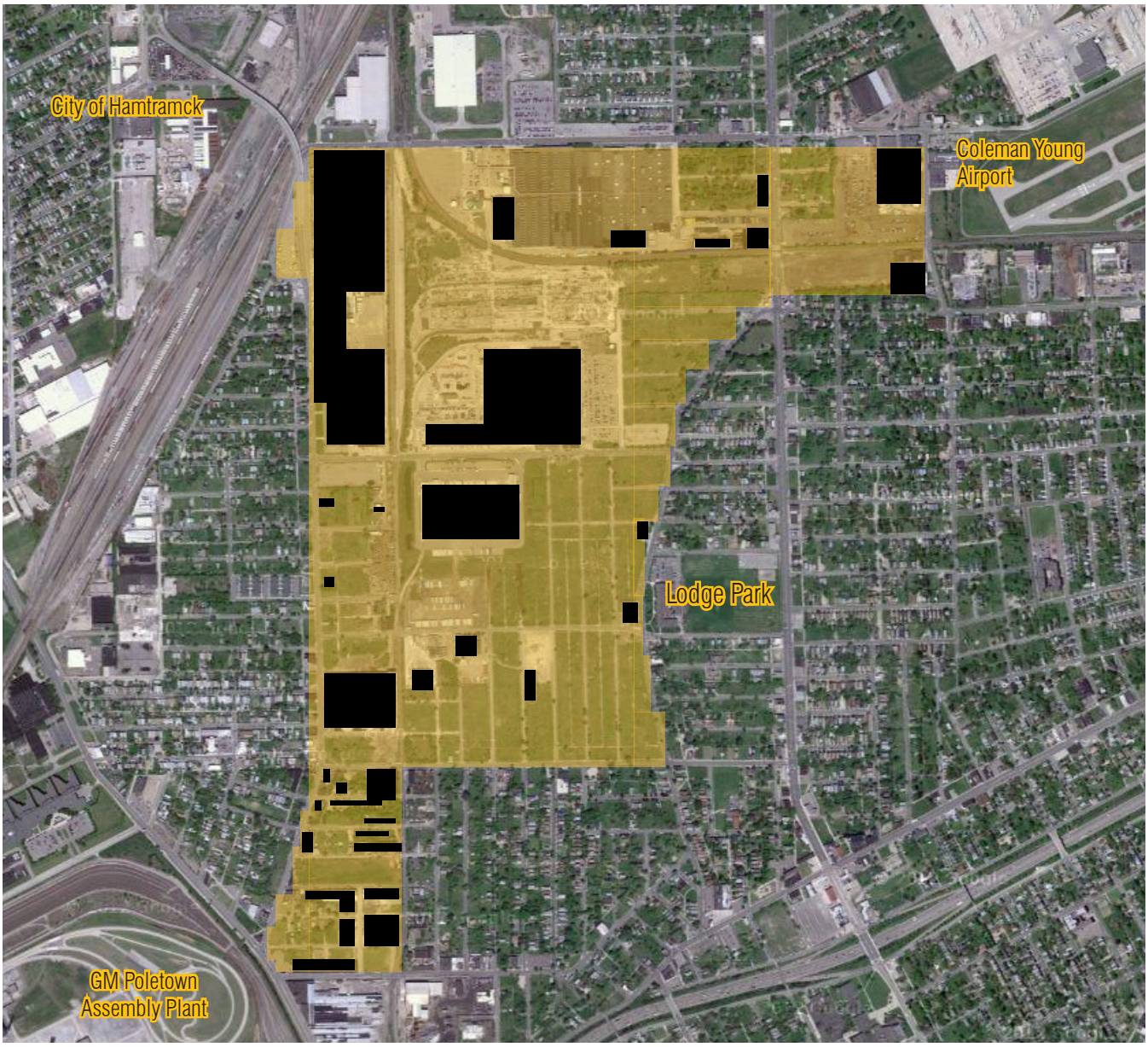
# Views




Arrows indicate reasonable or good views from the site.

Figure 50. Site Map - Views

# Built Features




Highlighted in black are the remaining structures on the site.



Figure 51. Site Map - Built Features

# Geometries

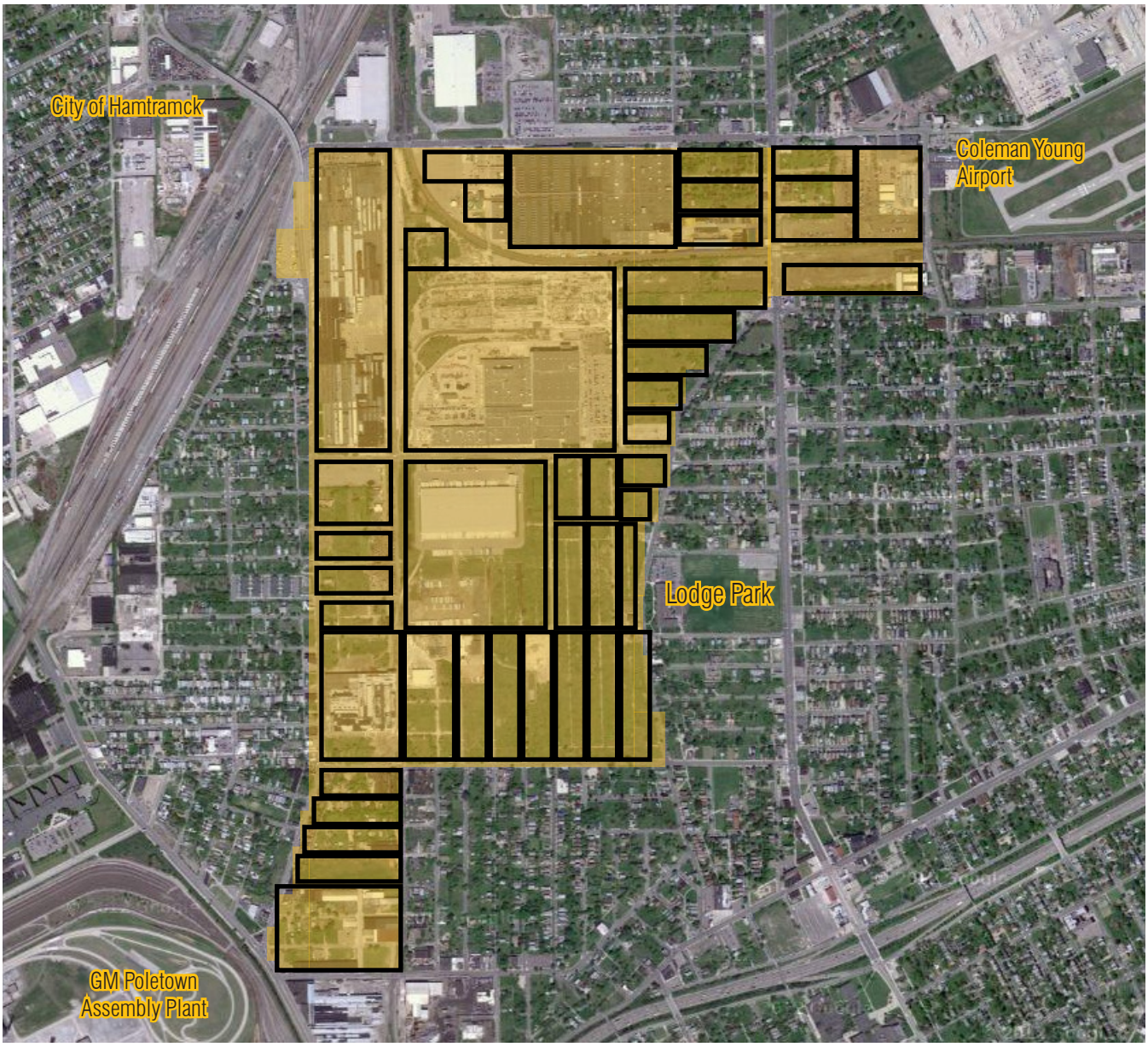
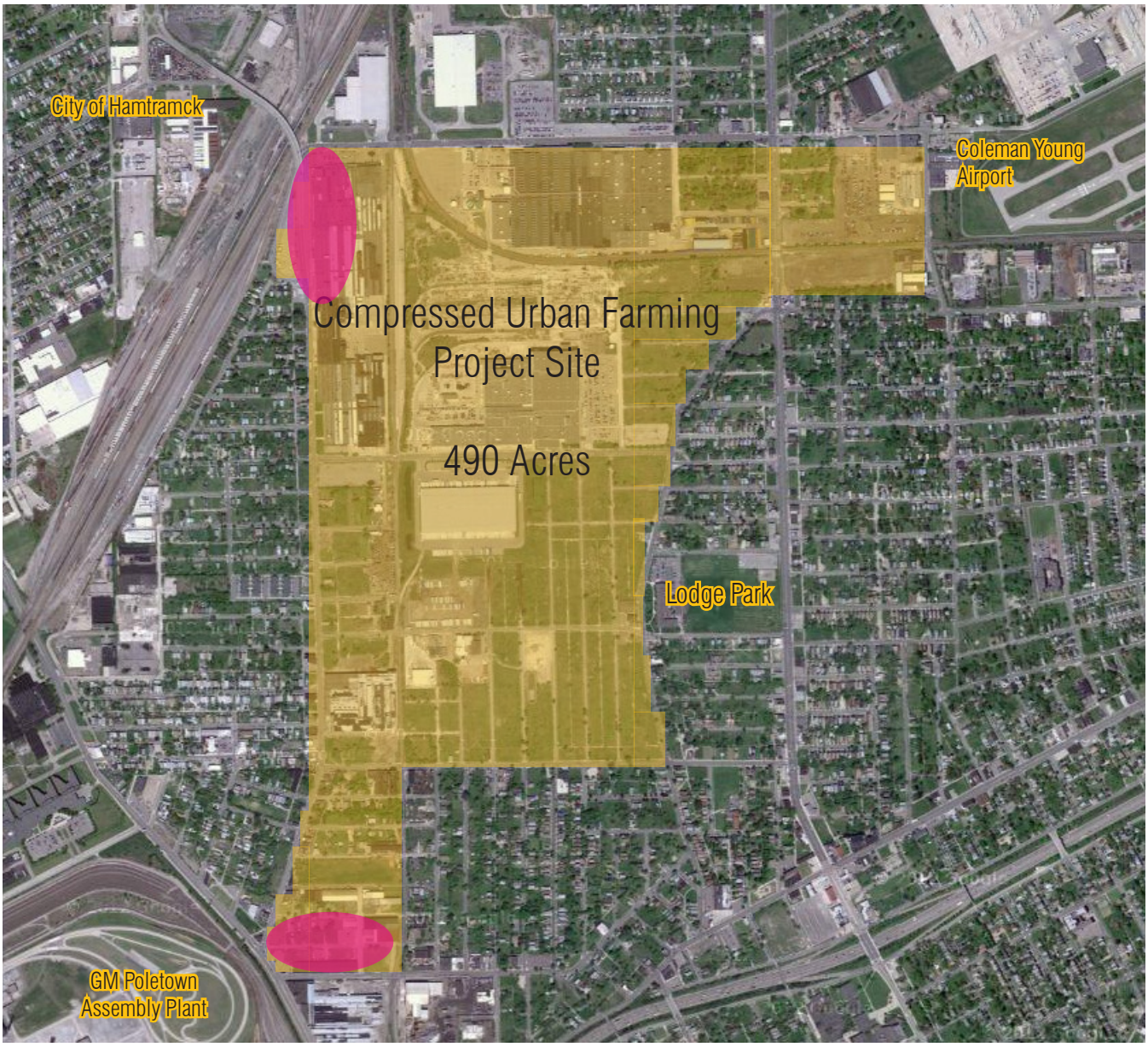



Figure 52. Site Map - Geometries

# Hieght and character of surroundings



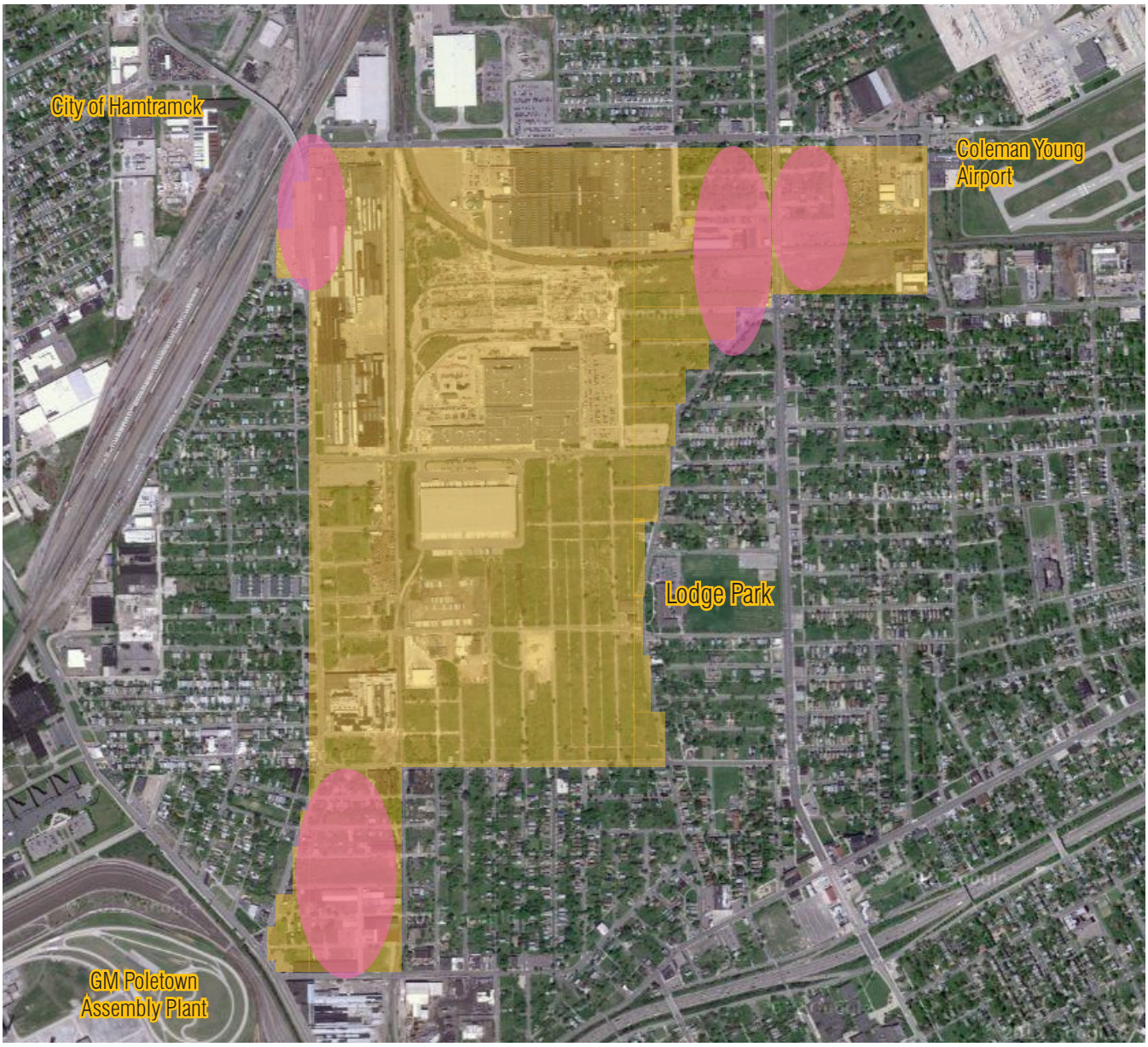

All other edges not mentioned have single story or unimposing 2 story structures located across street from the site.

Northwestern obstruction is a 3 story tall bridging system that only poses lighting concerns during certain parts of the day.
The southern obstruction is a 3 story tall factory built very close to the street and casts a shadow across the lower edge of the site for part of the day.



Figure 53. Site Map - Height and character of surroundings

# Light

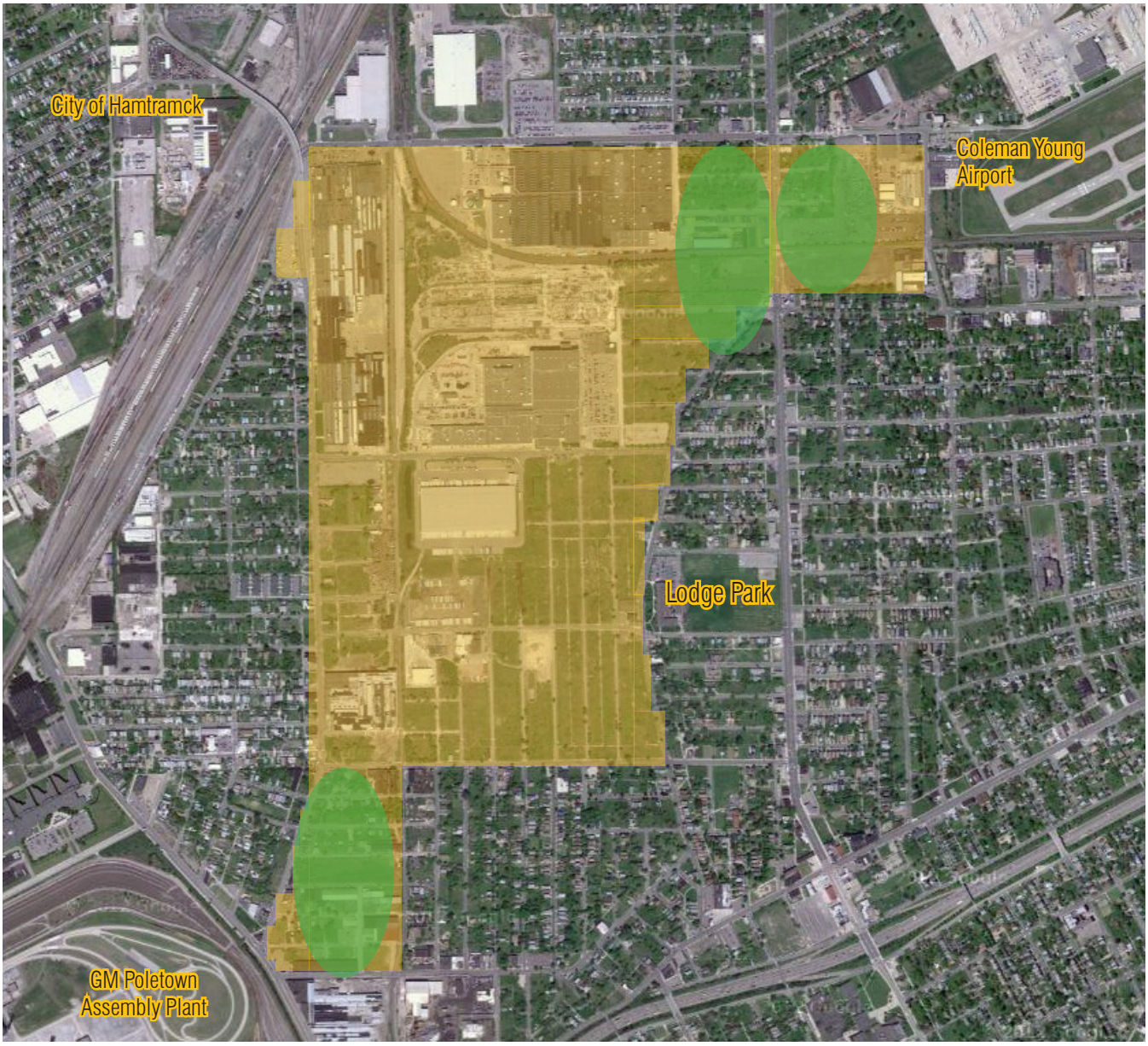



Unobstructed lighting is available across most of the site with exception of areas with trees, and near off site developments.

Trees or edge lighting obstructions

Figure 54. Site Map - Light

# Vegetation



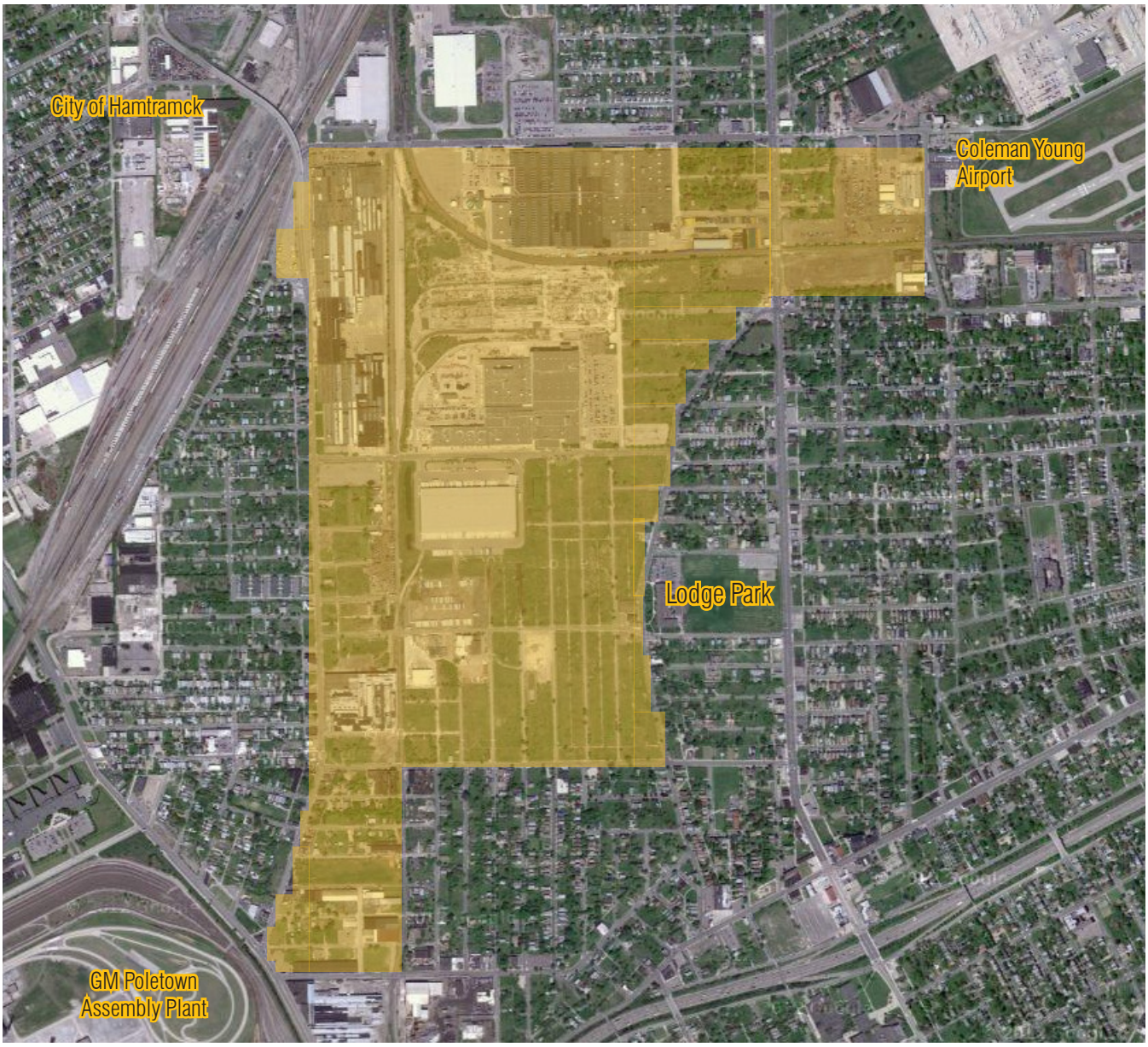

Vegetation across the site is mostly grasses and weeds. There are occasional trees and bushes remaining from the past neighborhoods. Most trees are found along the edge of the site and in the northeast and southwest corners.

Tree zones



Figure 55. Site Map - Vegetation

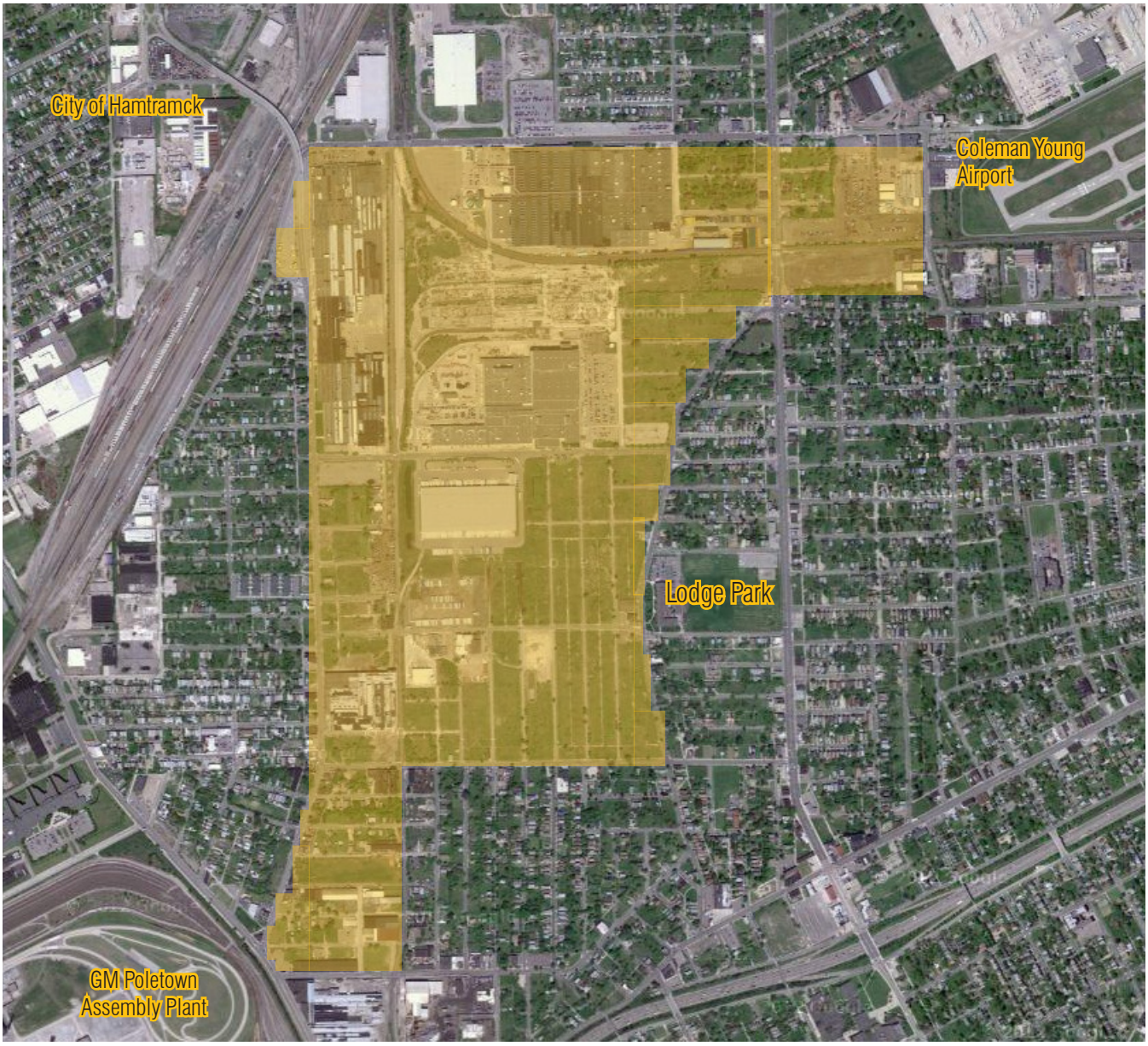
# Human characteristics




Across the entire site there are signs of prior use from pieces of demolition debris, illegally dumped materials, dilapidated structures, decommissioned factories, rail lines, parking lots, and remnants of streets and utilities.

Figure 56. Site Map - Human characteristics

# Natural water

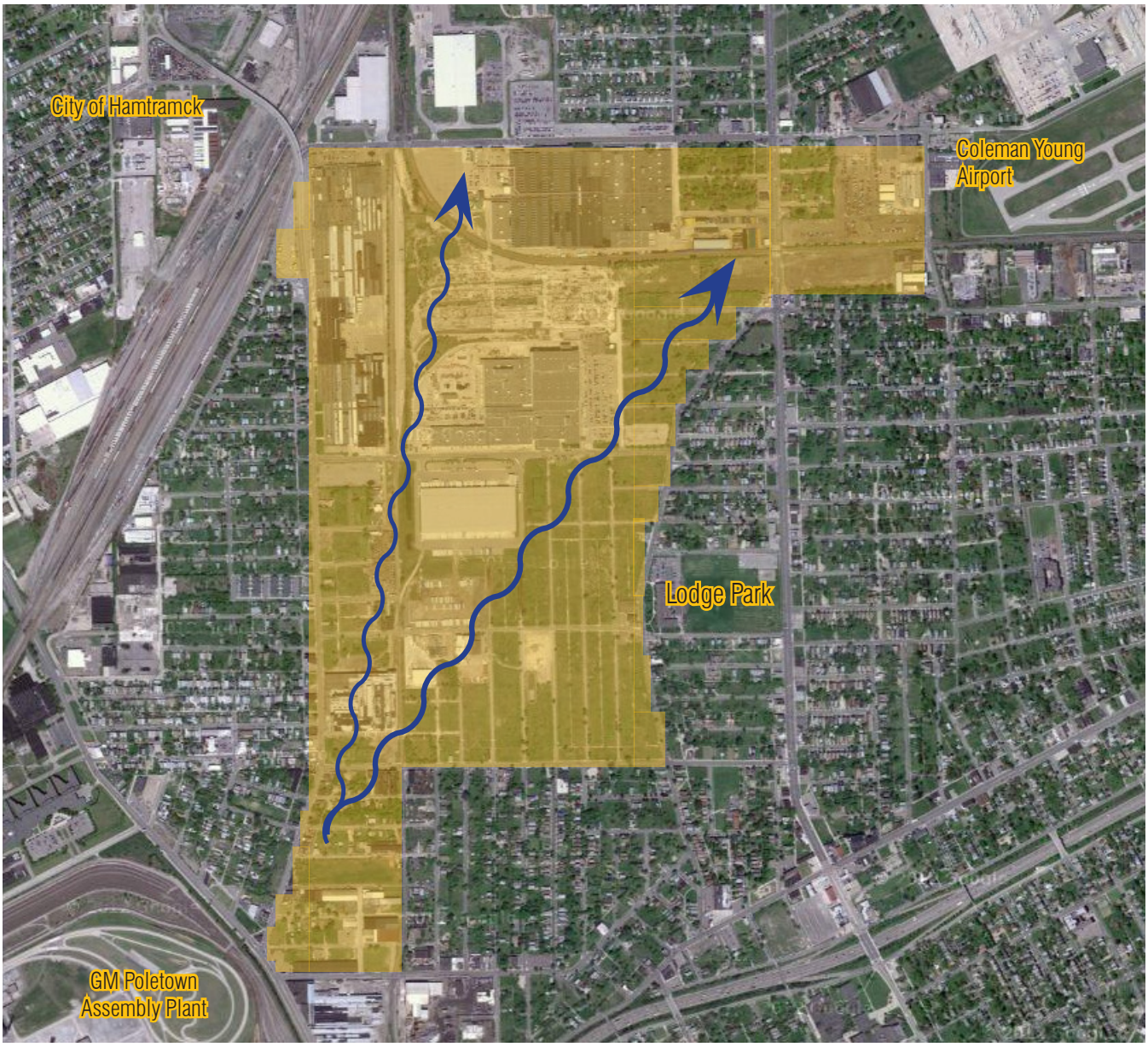



The site contains no visible water features and due to existing drainage systems any excess water drains into storm drains.



Figure 57. Site Map - Natural water

# Structures and Wind

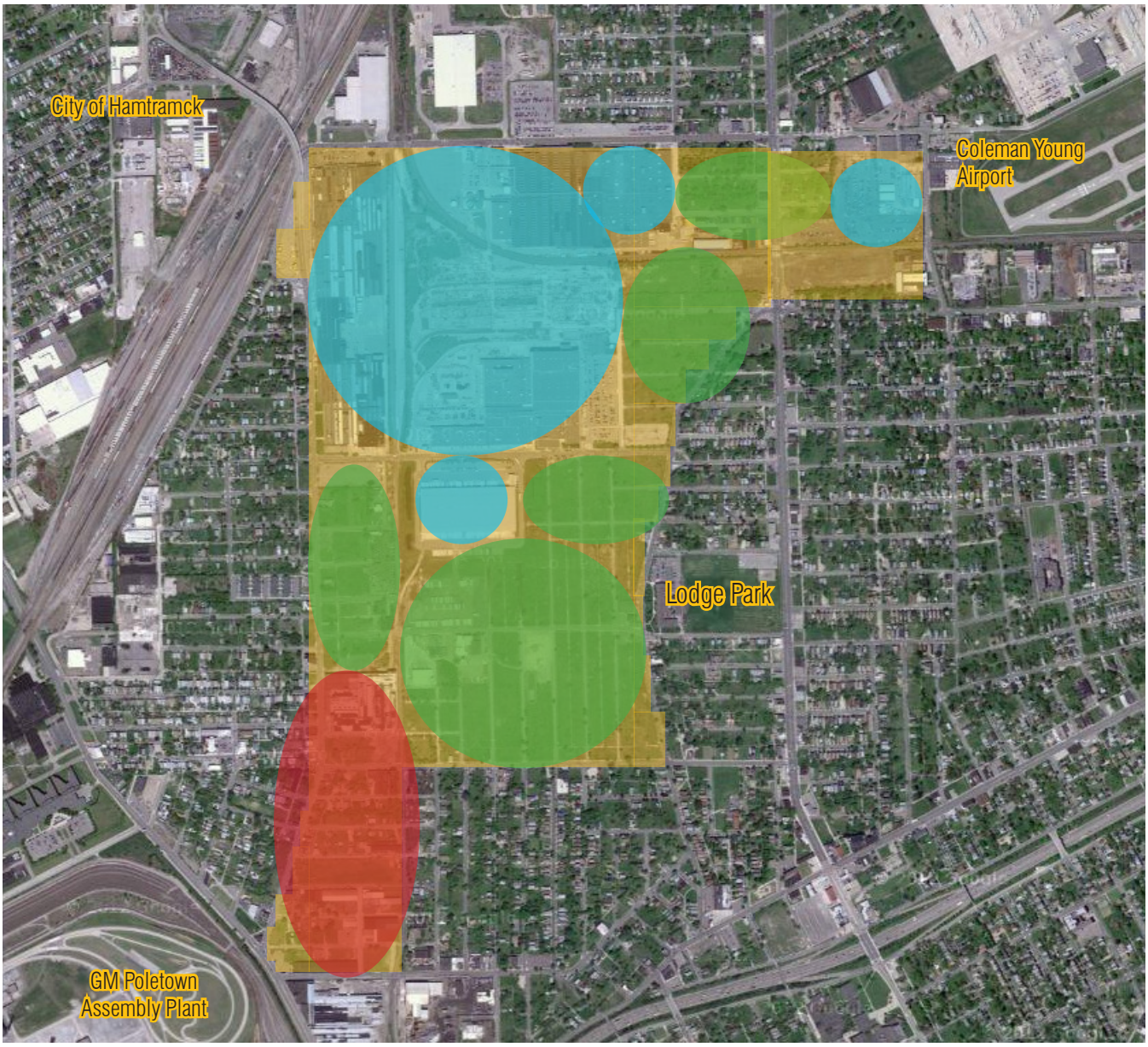



Project site is mostly demolished and remaining development includes large amounts of parking lot space for new vehicle storage and remaining abandoned parking lots.

Wind flow direction across site due to prevailing wind patterns and unrestricted flow across landscape. Only remaining major structures are in the upper center and divide but do not inhibit the wind.

Figure 58. Site Map - Structures and wind

# Distress




Project site contains distressed buildings, distressed open lots due to illegal dumping, and factories buildings now used mostly for storage or parking lots.

Distressed Buildings and Lots

Distressed Lots

Storage

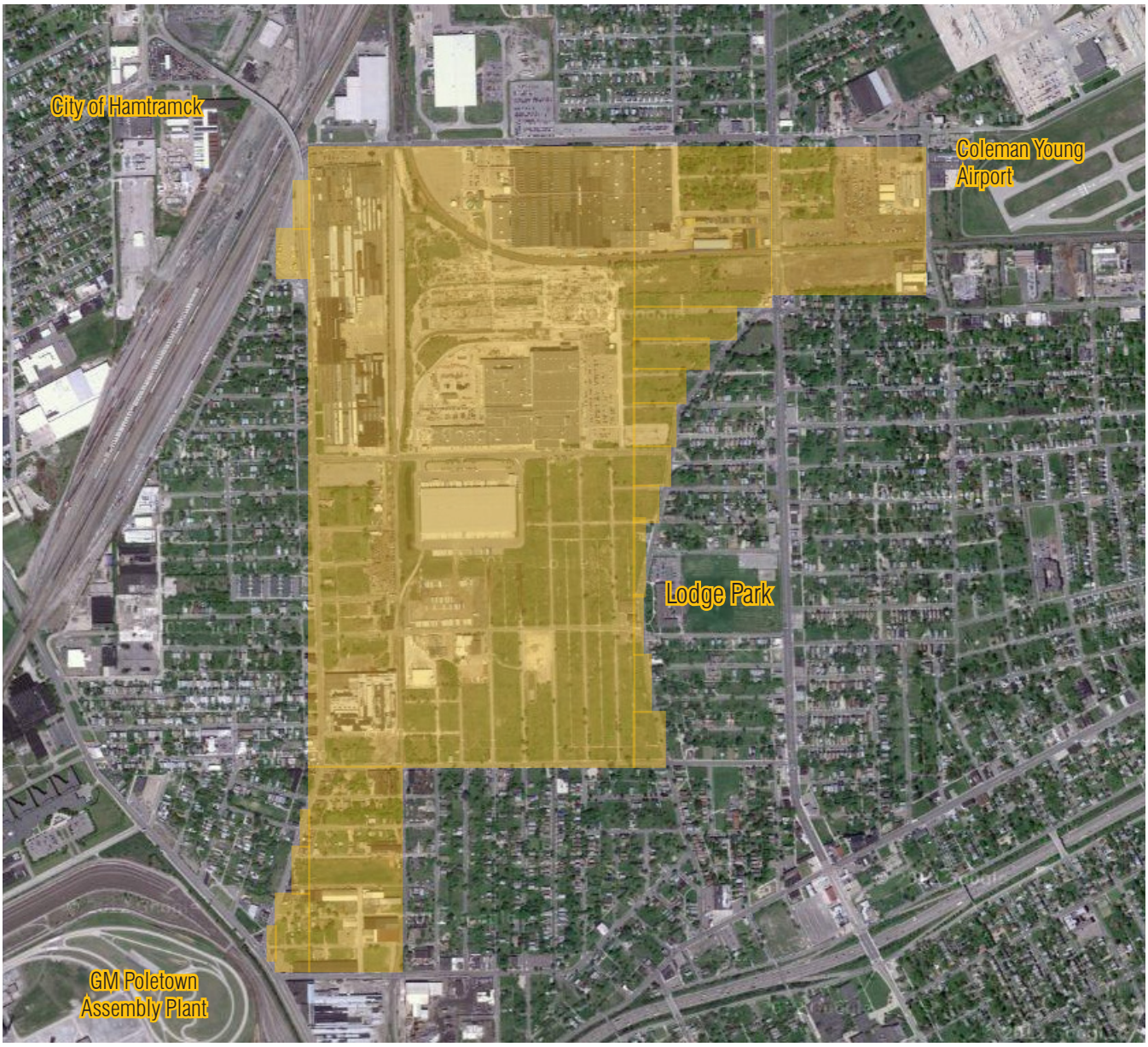


Figure 59. Site Map - Distress

# COMPRESSED AGRICULTURE INITIATIVE

## Site Analysis - Qualitative

# Soils and Moisture retention



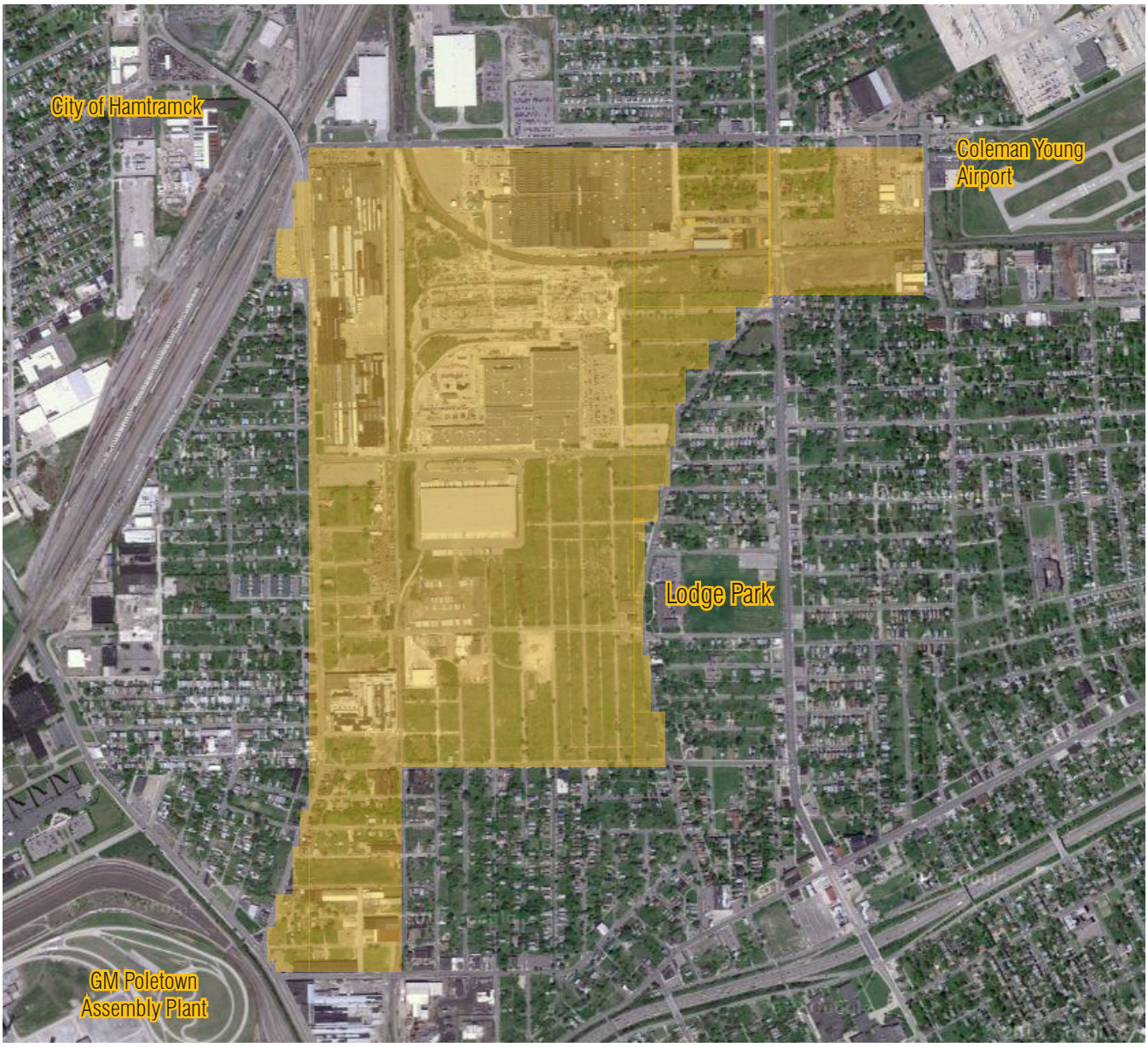

Soils across the site are mixed due to development and demolition. Overall the soil type is a mixture of tended garden soils with engineered soils from construction and demolition debris mixed together. Further complicating matters are airborne deposits of pollutants from surrounding past industries.

The general soil composition is good with moisture retention, has good drainage, has organic matter partially restored due to environmental recovery, but lacks in nutrients.



Figure 60. Site Map - Soild and Moisture retention

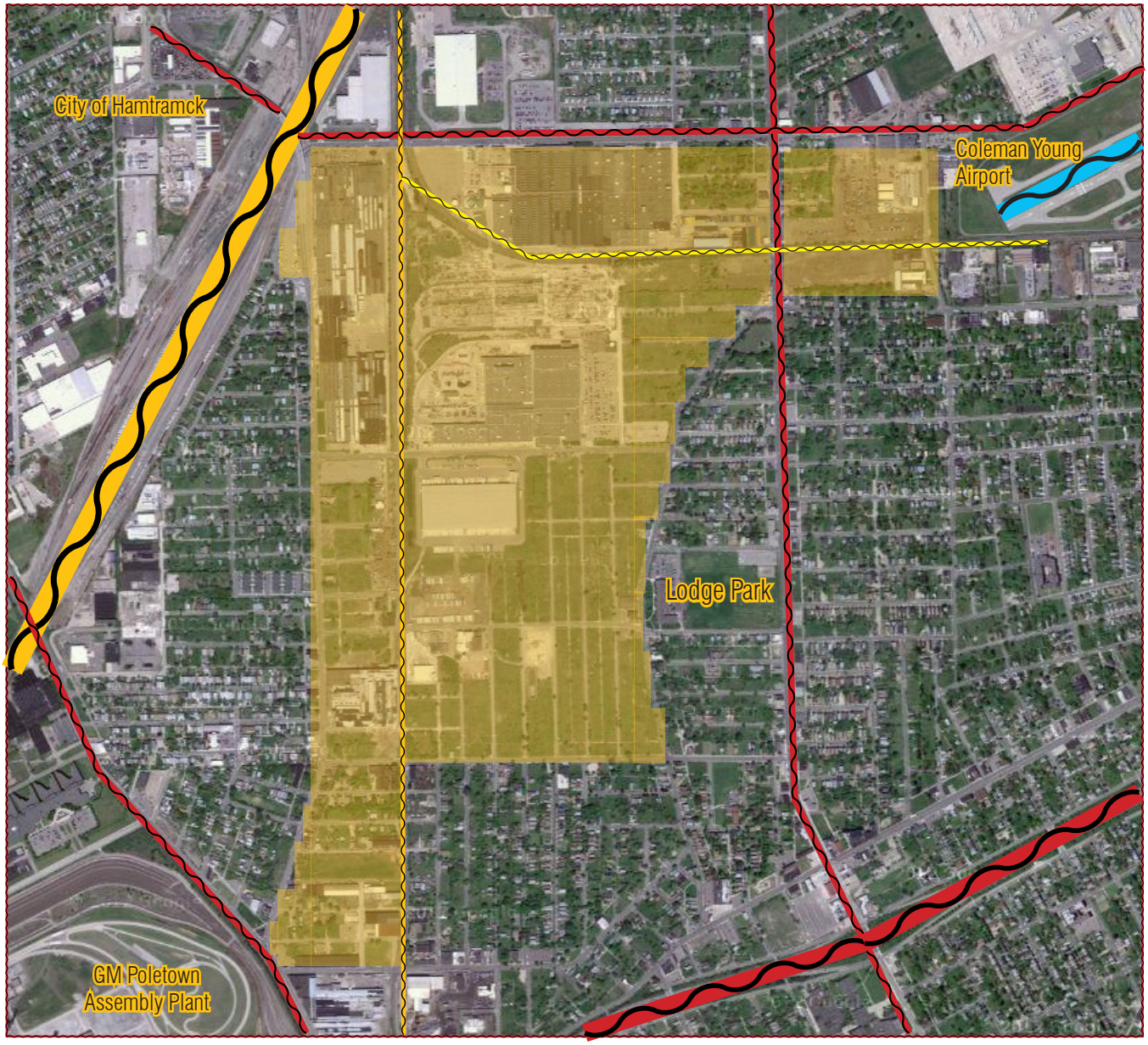
# Utilities




Utilities and connections are located across the entire site and include telephone, fiber-optic, cable, electrical, water, sewage, storm drains, and natural gas

Figure 61. Site Map - Utilities

# Traffic




Vehicle traffic major routes (Thicker line is higher volume)
Very little traffic within site

Railroad traffic (Thicker line is higher volume)
Large bar is a main trunk, small lines have limited rail traffic

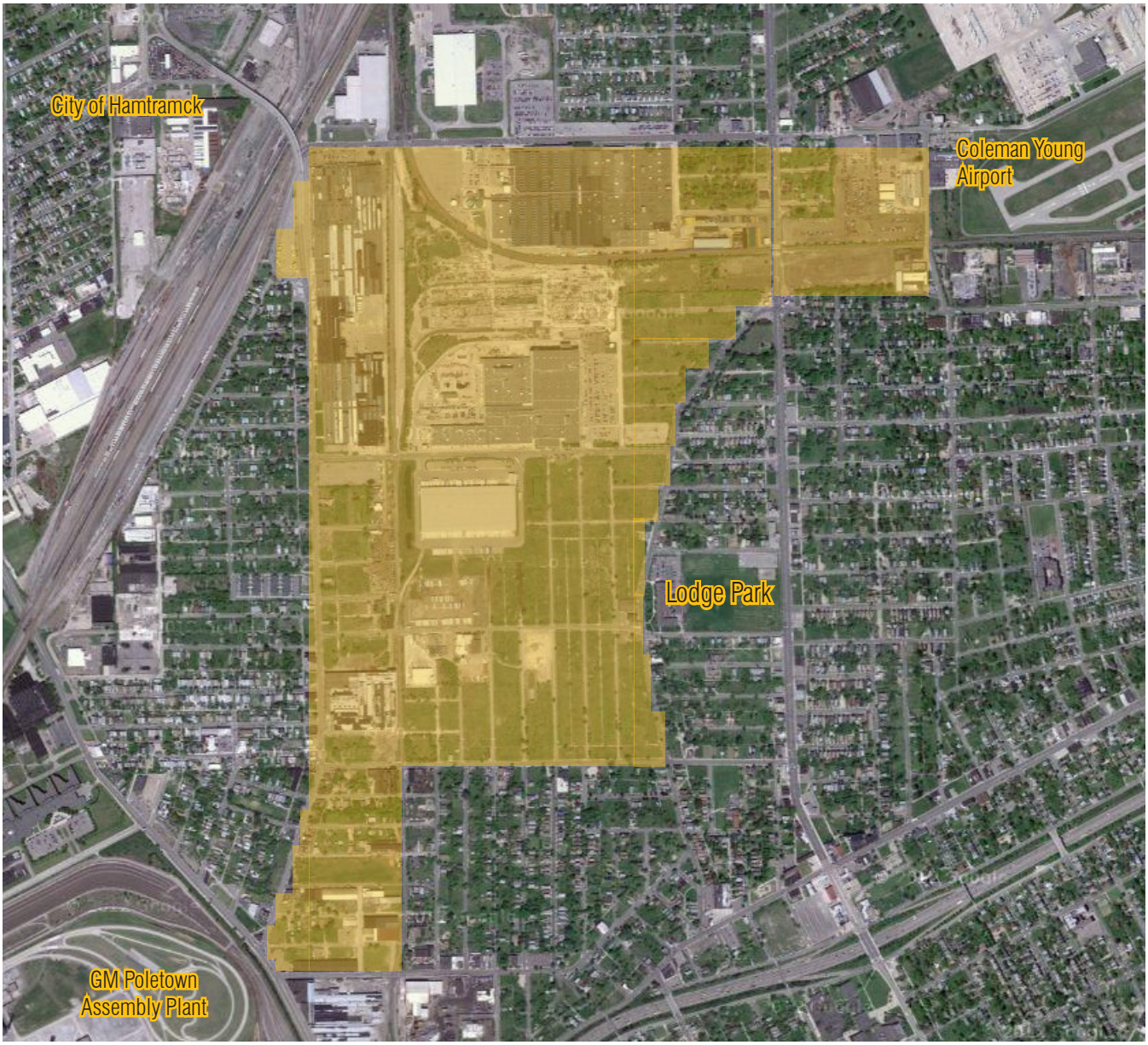
Airport / air traffic is low, and mostly private aircraft

Site pedestrian traffic is extremely low and intermittent.



Figure 62. Site Map - Traffic

# Topography

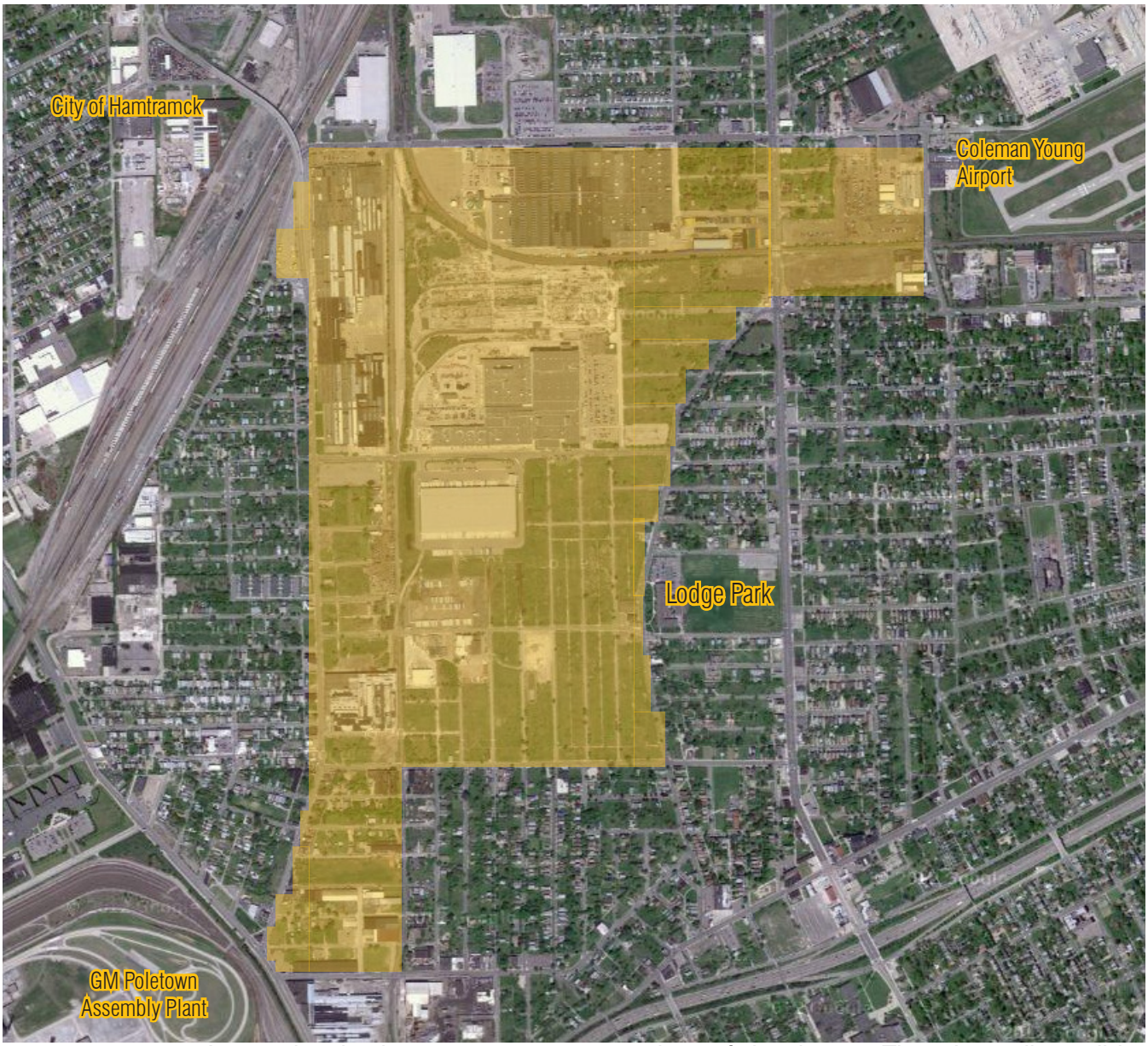



The entire project site resides within the same rough topographic level. This site was leveled in an urban expansion project around 1900 with all hills and valleys being leveled out and all water features being removed.

Small scale topographic changes are drainage sloping toward streets & alleyways, and the height change from street (bottom of curb) to city lot (top of curb.)
Non continuous slope across site. Slope across site graded toward streets and drain access. Slope ranges between 1% and 5% depending on the areas across the site, with an average slope of 2-4%

Figure 63. Site Map - Topography

# Site Character



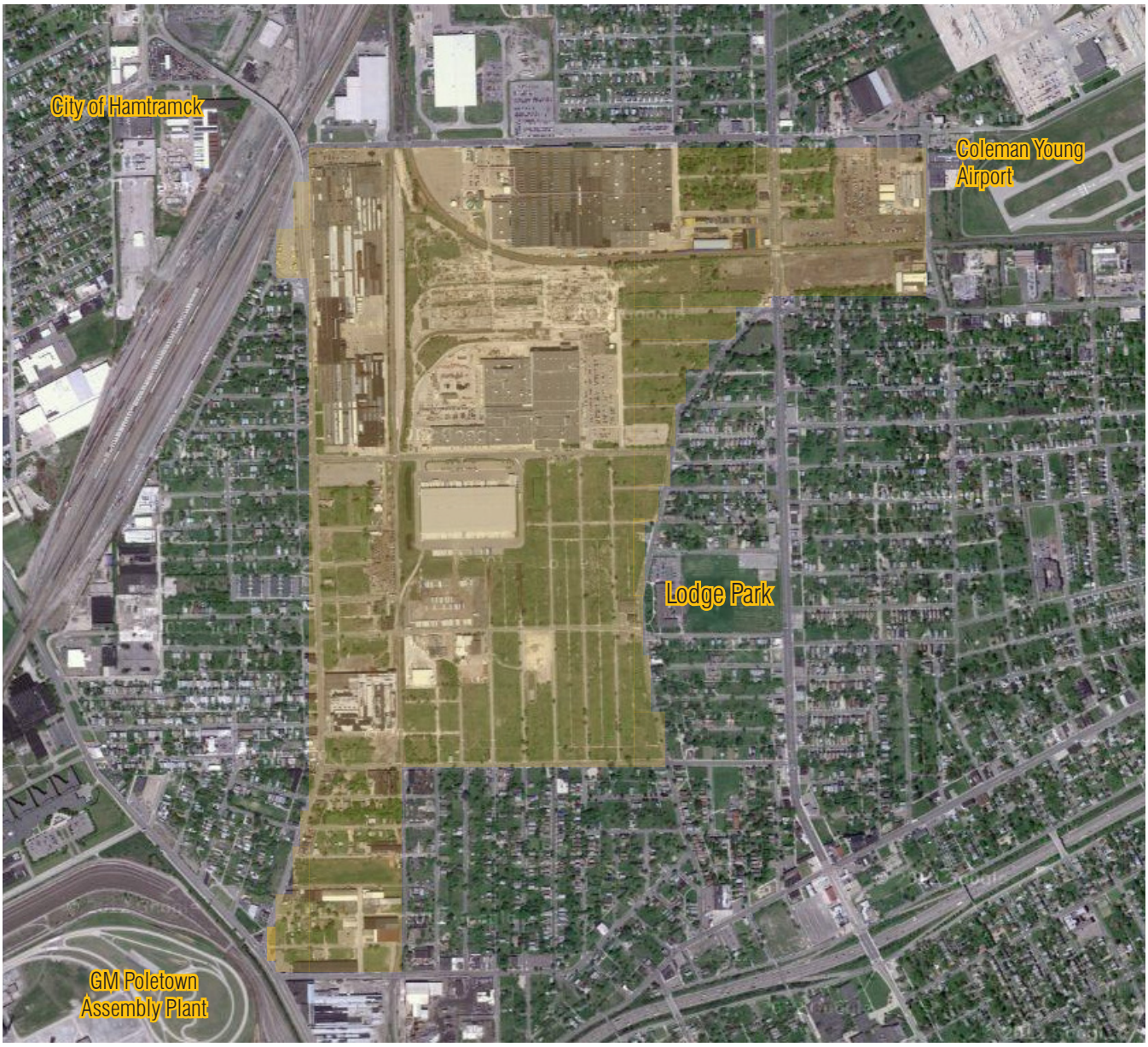

Across the site there are not very many signs of site change. There Is no discernible erosion with all demolition and vacated sites having been stabilized by natural plant reestablishment. Only active storage sites using dirt lots for storage have signs of disturbance due to vehicular traffic.

There are no areas which present signs of muddy water or water based erosion. There are however structures that are in a dilapidated and decaying state along the southern edge of the site. and northeastern corner.

In general the trees on the site are in an unkept state with no tree maintenance having been performed on them, however for the most part they seem to be in good shape.

Figure 64. Site Map - Site Character

# Aerial imagery




Satellite image of site.

Figure 65. Site Map - Aerial imagery

# Roads on site

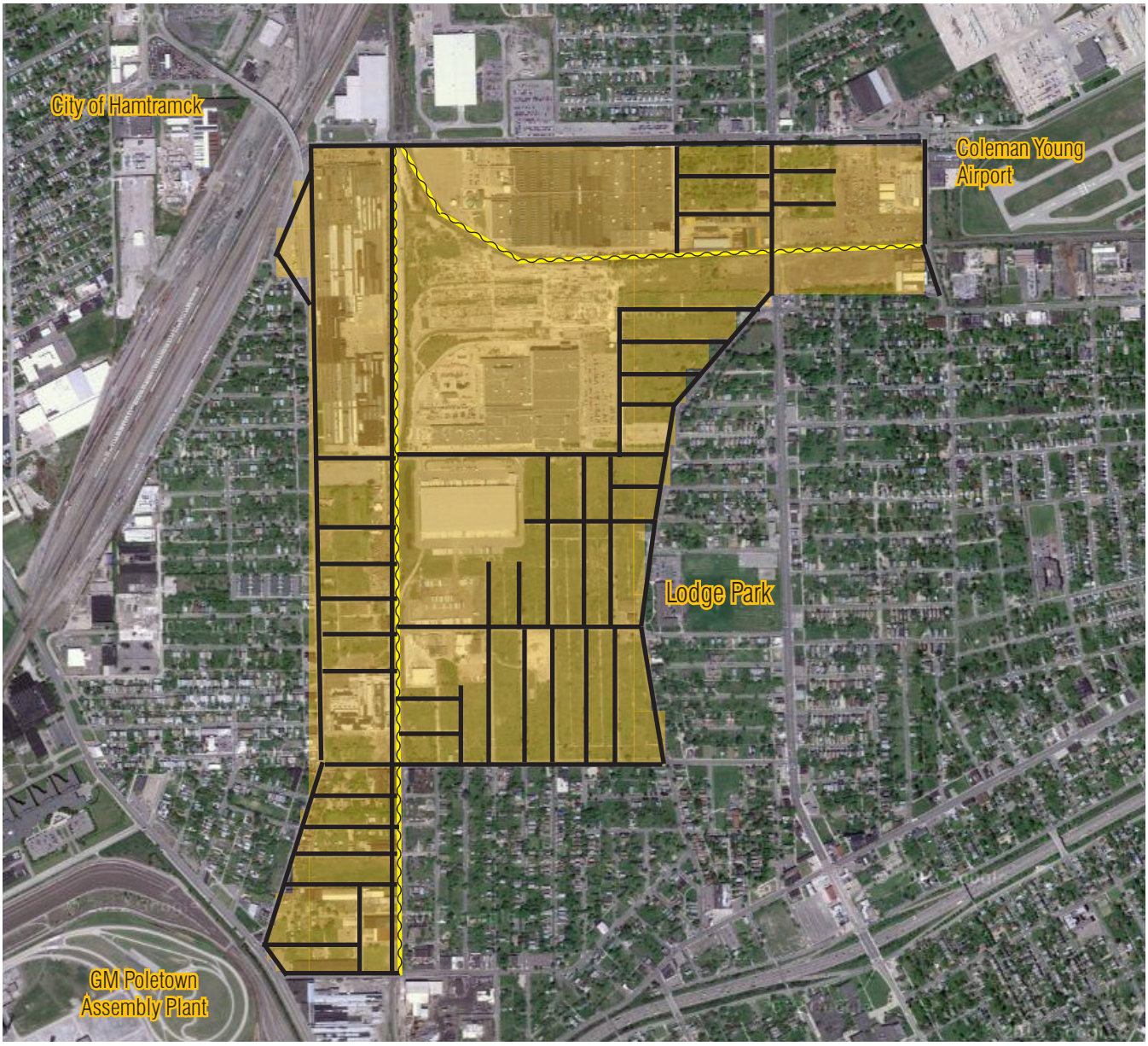





Figure 66. Site Map - Roads on site

# Interaction Matrix

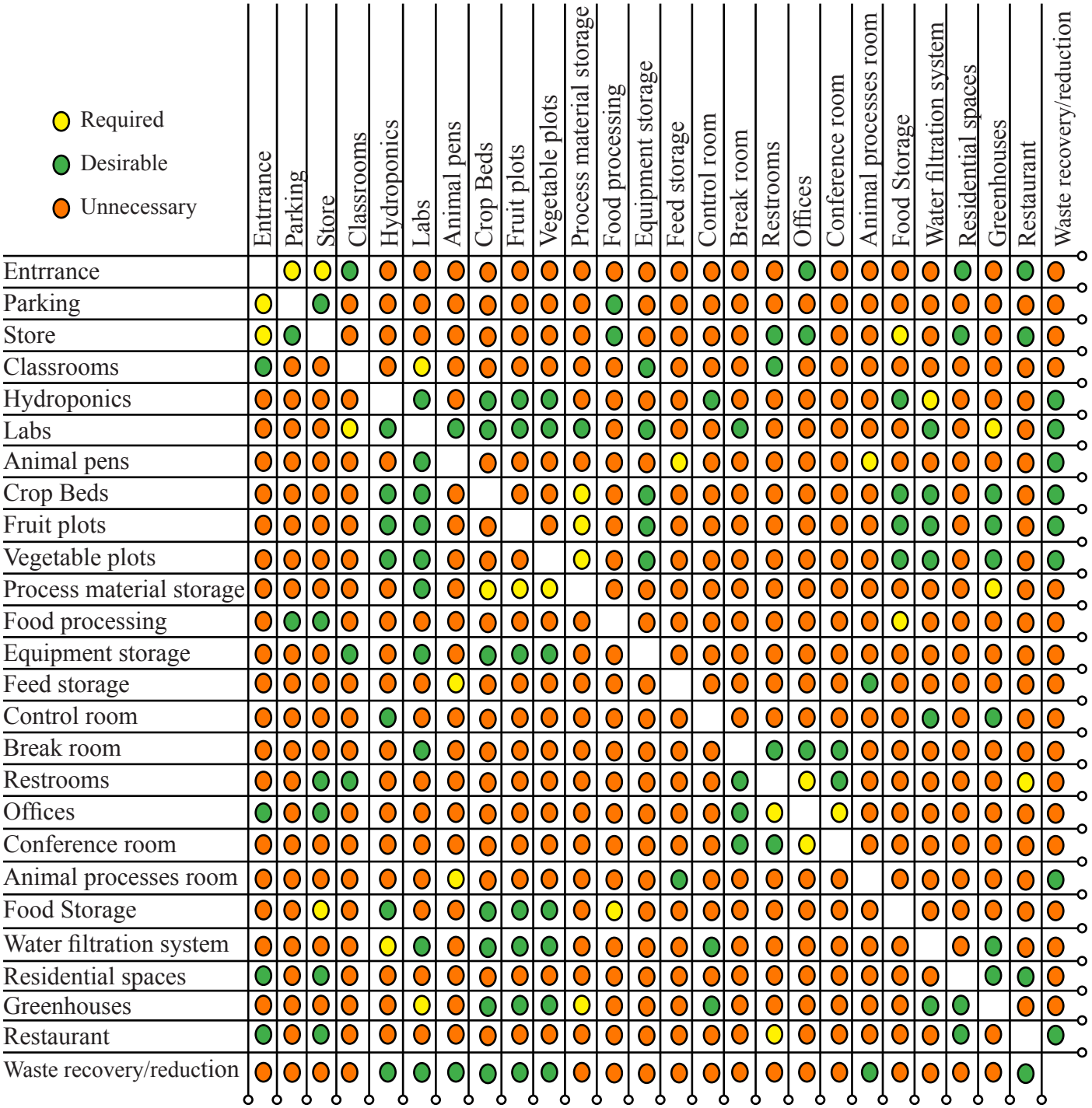



Figure 67. Interaction Matrix

# Interaction Net

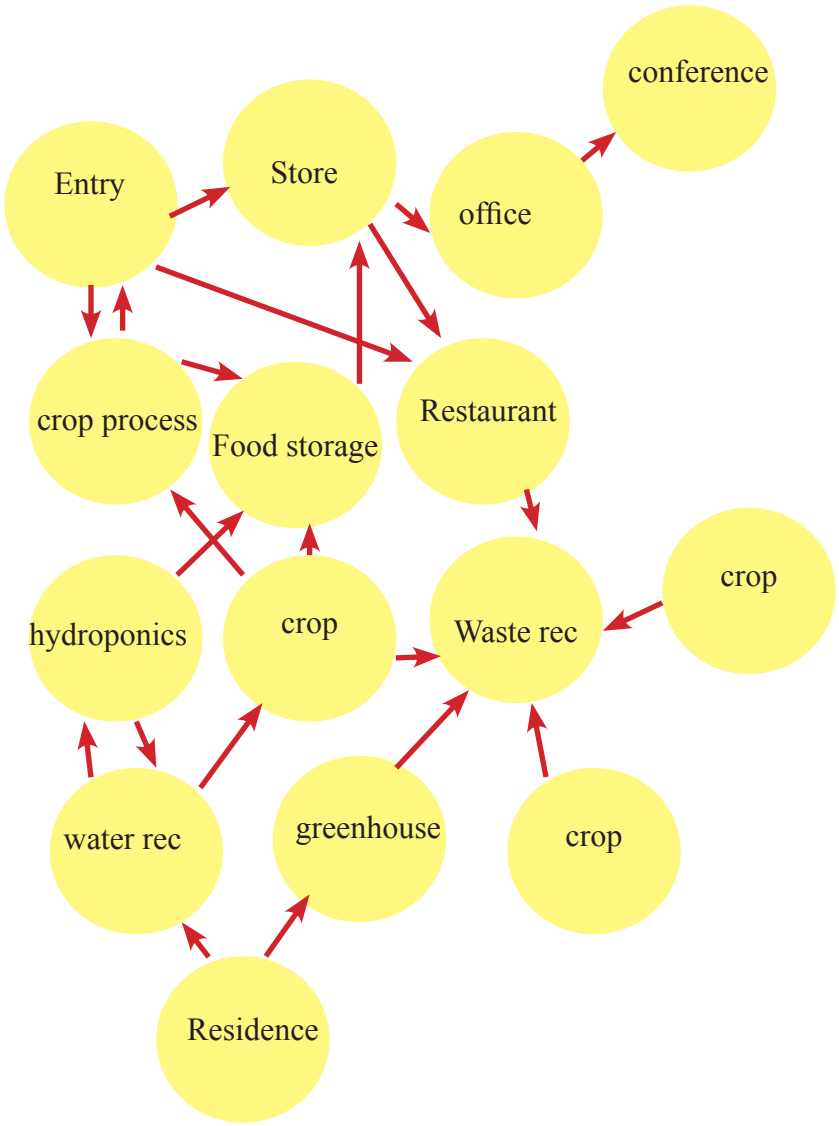





Figure 68. Interaction Net

# Process

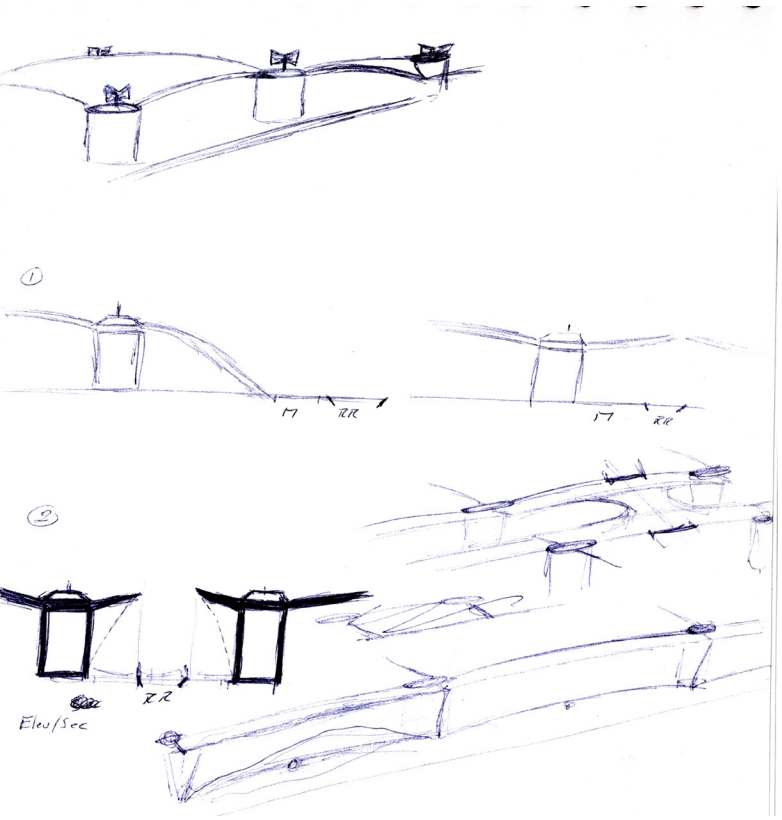



Figure 69. Process Drawing - Old field structure design

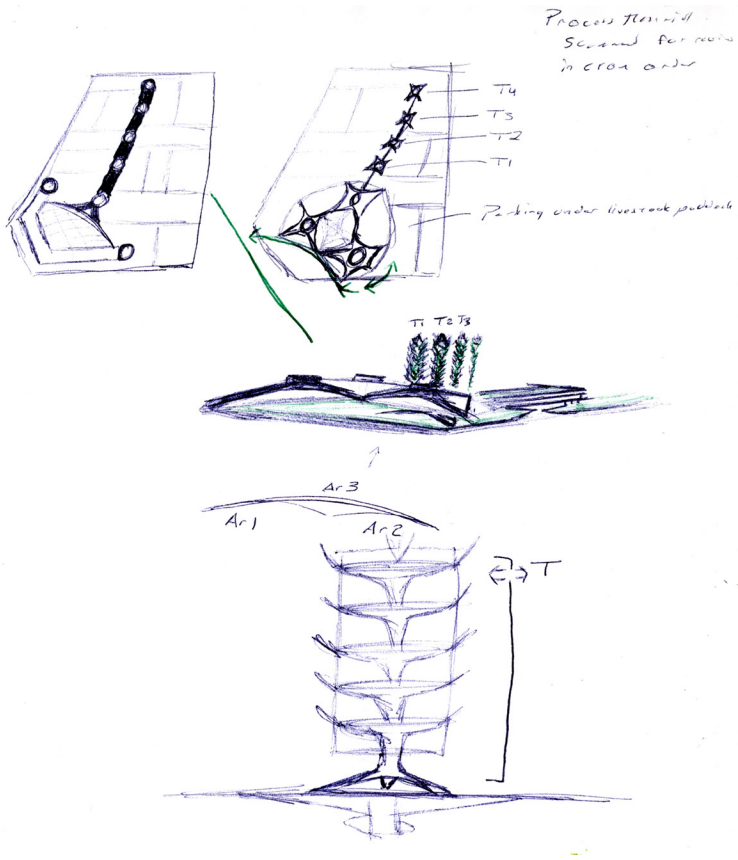
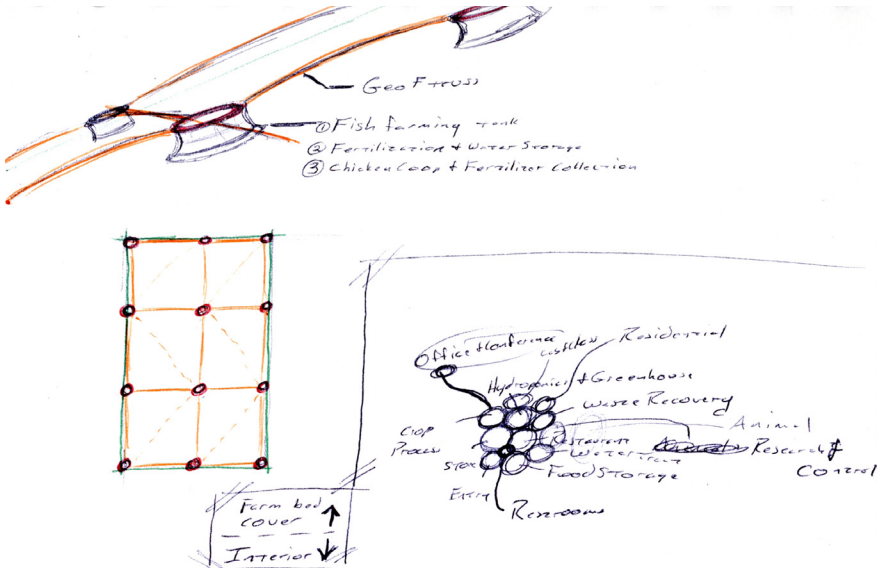



Figure 70. Process Drawing - Main building and treatment towers origninal design.

Figure 71. Process Drawing - Field structure layout and interraction net.



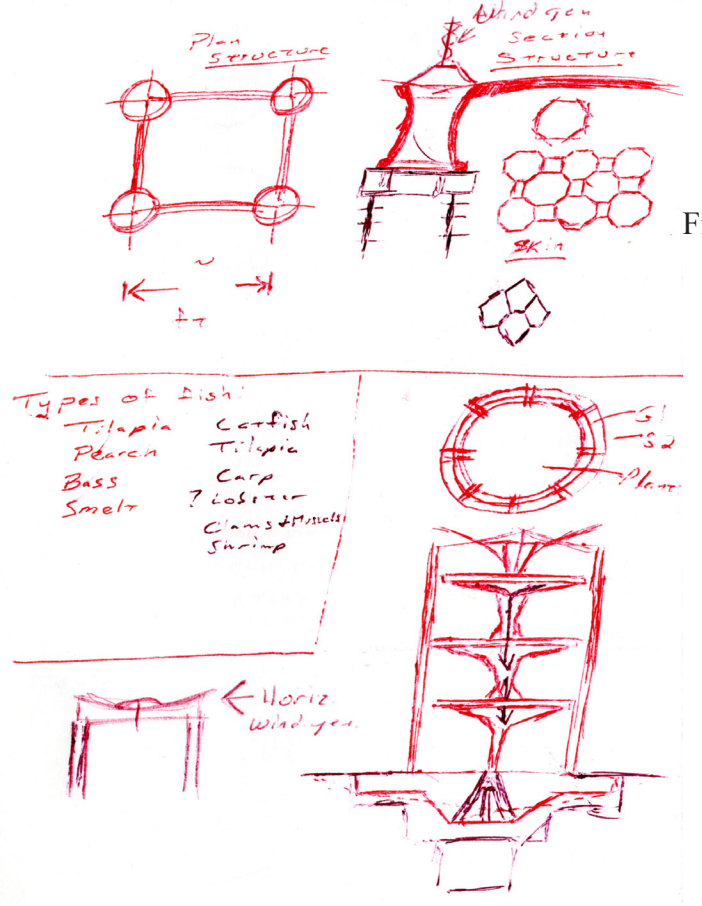



Figure 72. Process Drawing - Changed field structure & fish types.

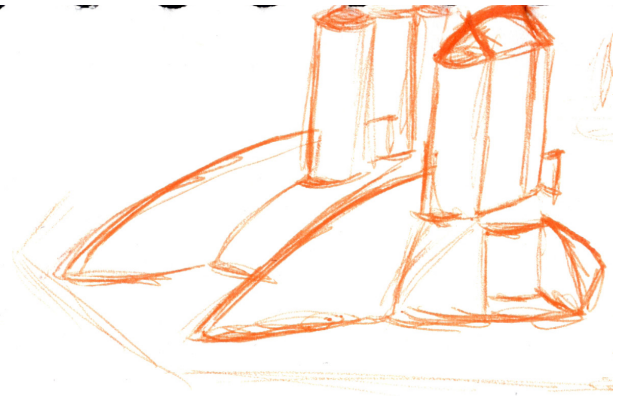
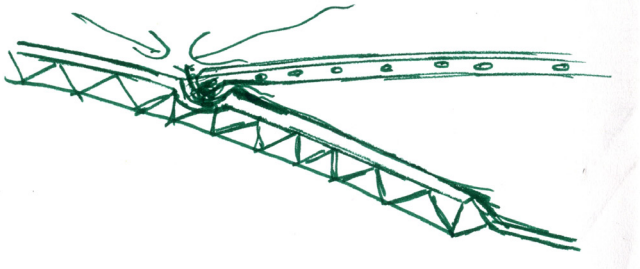


Figure 73. Process Drawing - Concept treatment towers and main building.

Figure 74. Process Drawing - Concept roof drains.



# Systems

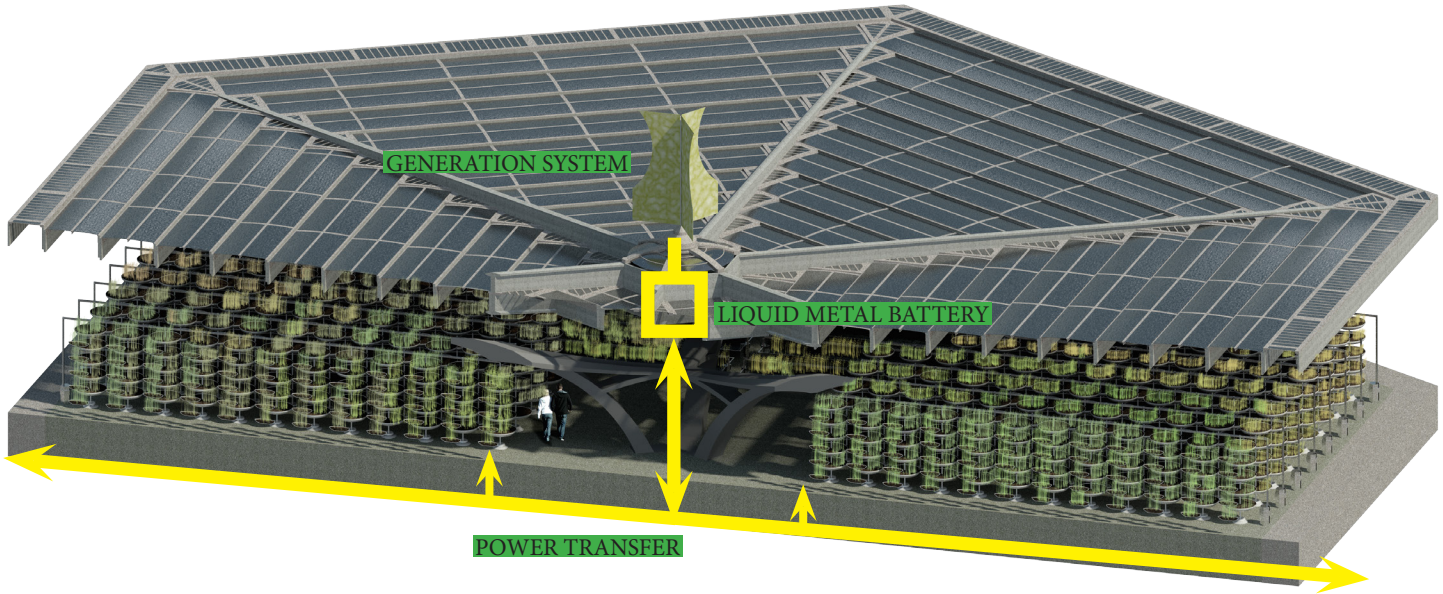



Figure 75. System Drawing - Energy System

## ENERGY SYSTEMS

Electrical power is produced on the roof of the facility and then tranferred to the molten salt battery system until needed. this system has great capacity and can charge and discharge and variable speeds. The energy is distributed site wide as needed.

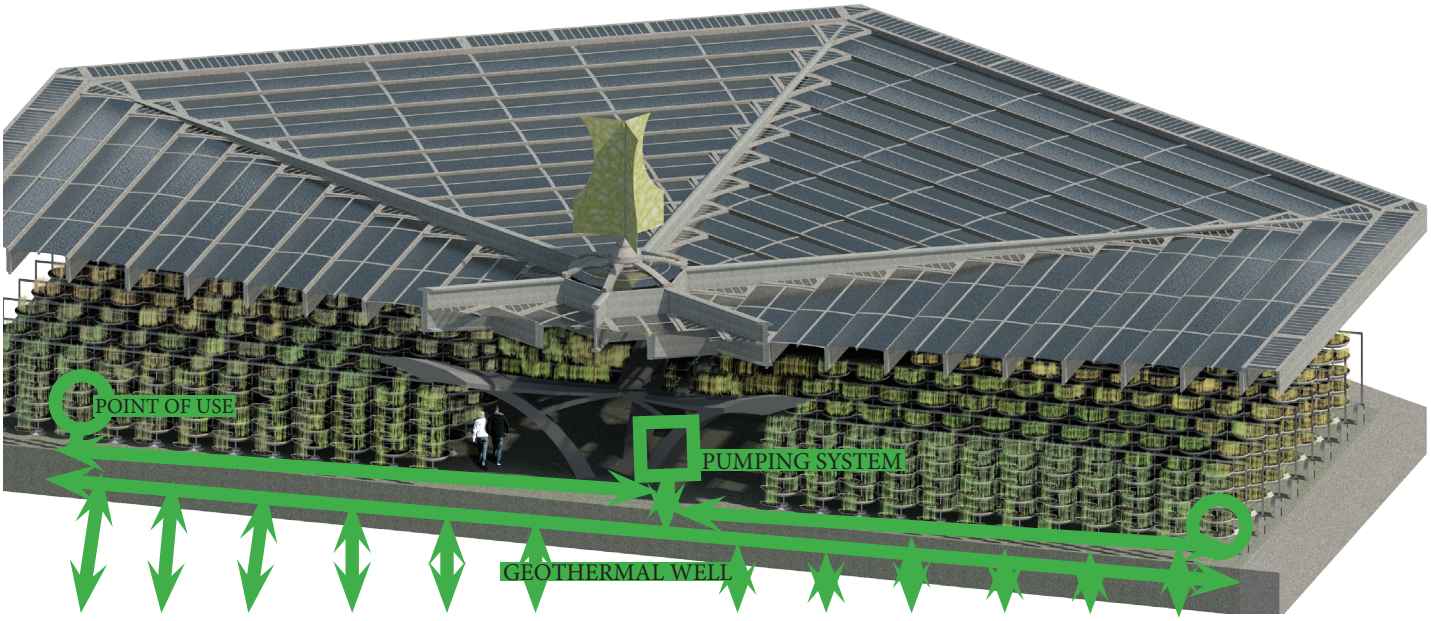



Figure 76. System Drawing - Geothermal Well

## GEOTHERMAL WELL

The geothermal well allows for both heating and cooling of the facility. this unti distributes the heating and cooling across the facility to minor heating and cooling units in the main field structure as well as into a point of service system at the hydroponic system itself. Thus the facility is heated and cooled directly where needed and not just as a whole. This allows the facility to manipulate the temperature at the growing beds and allows for optimal environment for that particular plant variety.

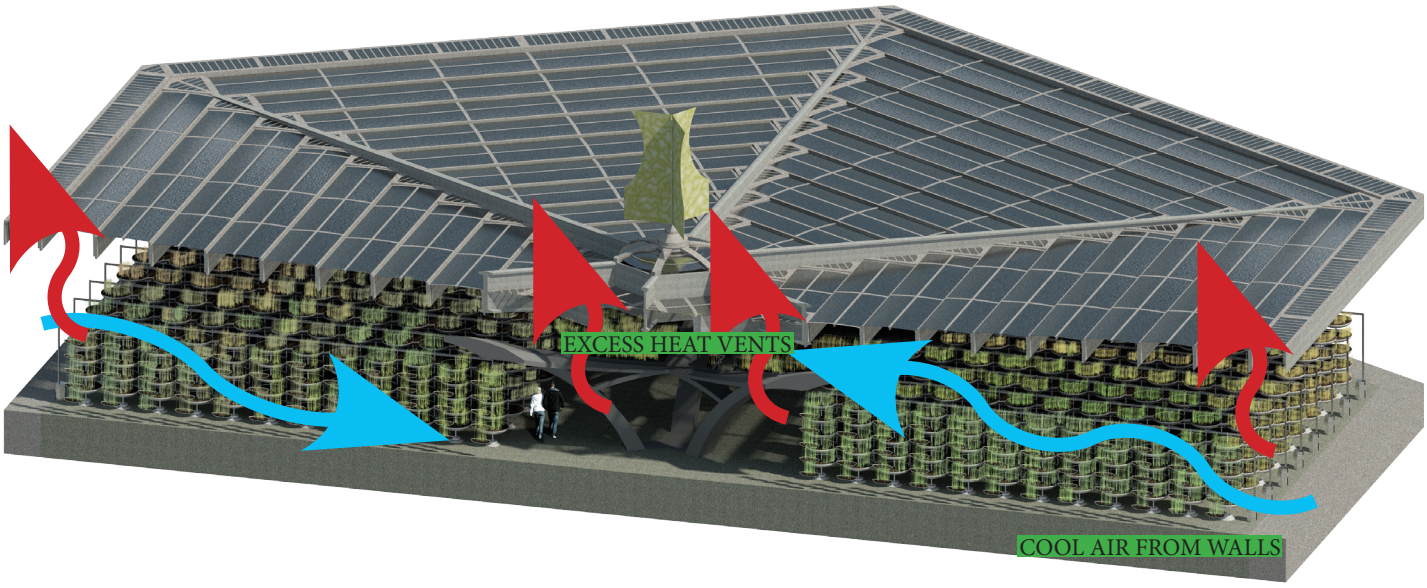



Figure 77. System Drawing - Natural Ventilation

## NATURAL VENTILATION

The walls of the field structures are designed to allow cooled air to be pulled in along the designed vegitation along the perimiter. This air is being drawn from cooler shaded areas and pushes the hot air up through the venting systems in the roof. The vents can also be opened up to allow for free air passage during the summer months.
The perimiter walls are also designed to operate in a similar function and allow for the upper 2/3 of the the perimiter glass to open for free flow of summer breezes.

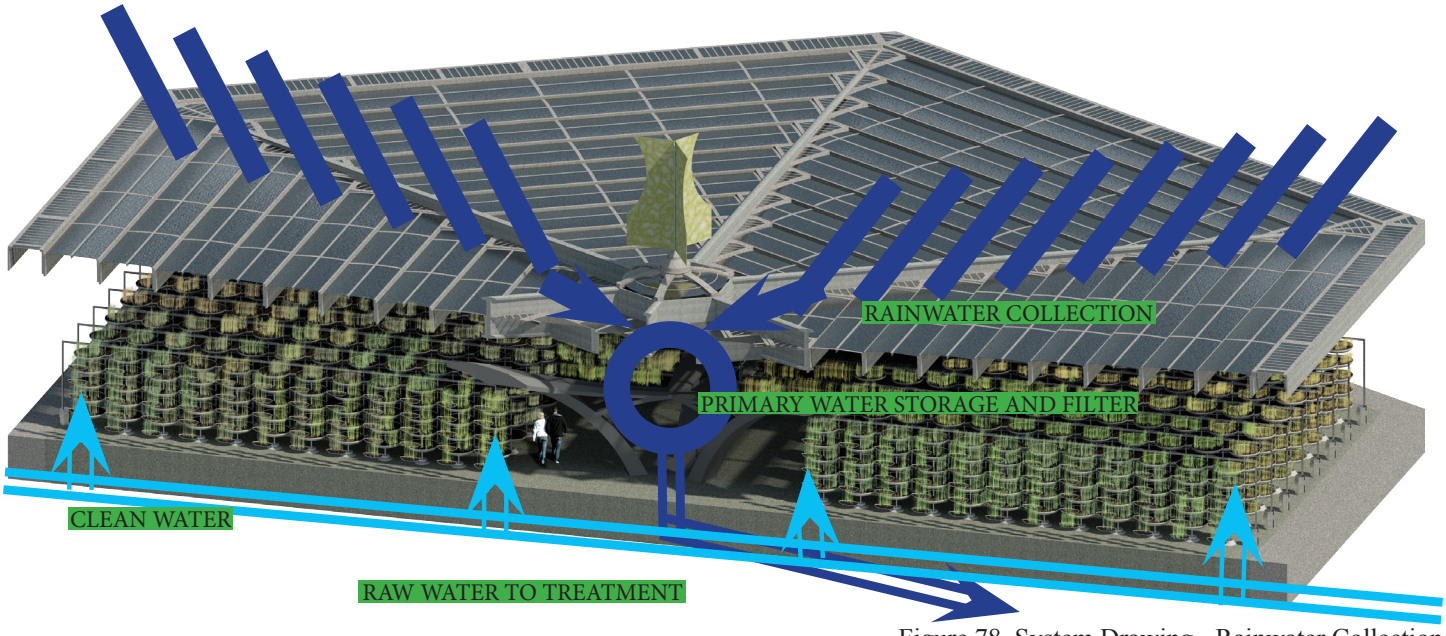



Figure 78. System Drawing - Rainwater Collection

## RAINWATER COLLECTION

The rainwater that falls on the roof and the melting snow are collected, processed, and reused as a free water source.
There is a primary water holding unt just below the power generation system. This holds the water and performs initial filtration until the tratment facility is ready to process the water held in the basin.
The tratment tower and its process are shown above left. Water enters the primary cleaning tank, then gets purified further as it filters across each treatment level in the towers before being stored for later use.

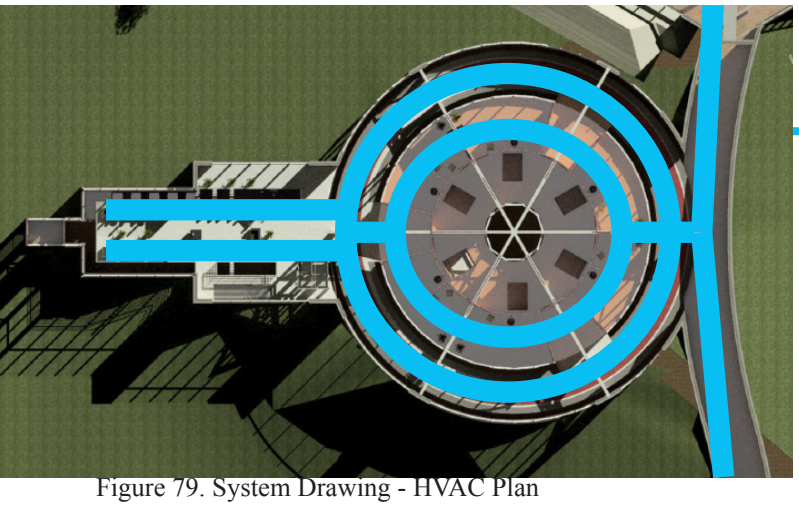


Figure 79. System Drawing - HVAC Plan

Figure 80. System Drawing - HVAC Section

HVAC SYSTEM

Buit into the floor are the HVAC and other systems for the facility. This structural, hollow center flooring allows the facility to maintain clean lines while still providing all the services.

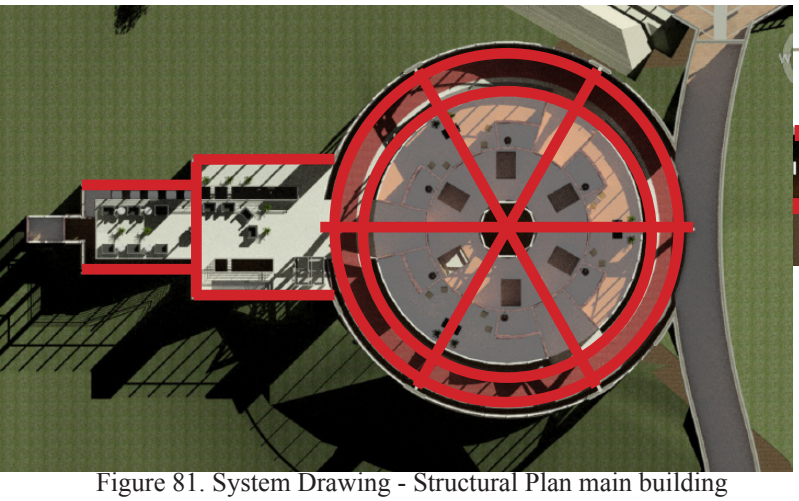
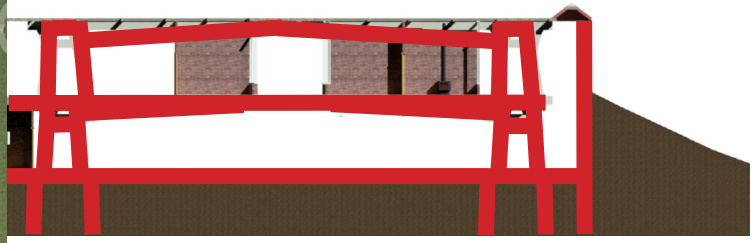


Figure 81. System Drawing - Structural Plan main building

Figure 82. System Drawing - Structural Section Main Building



STRUCTURAL SYSTEM

The structure of the facility rests in the armature system tied together with the structural flooring and bearing walls. This system is extremely strong since each part braces the other in multiple directions.

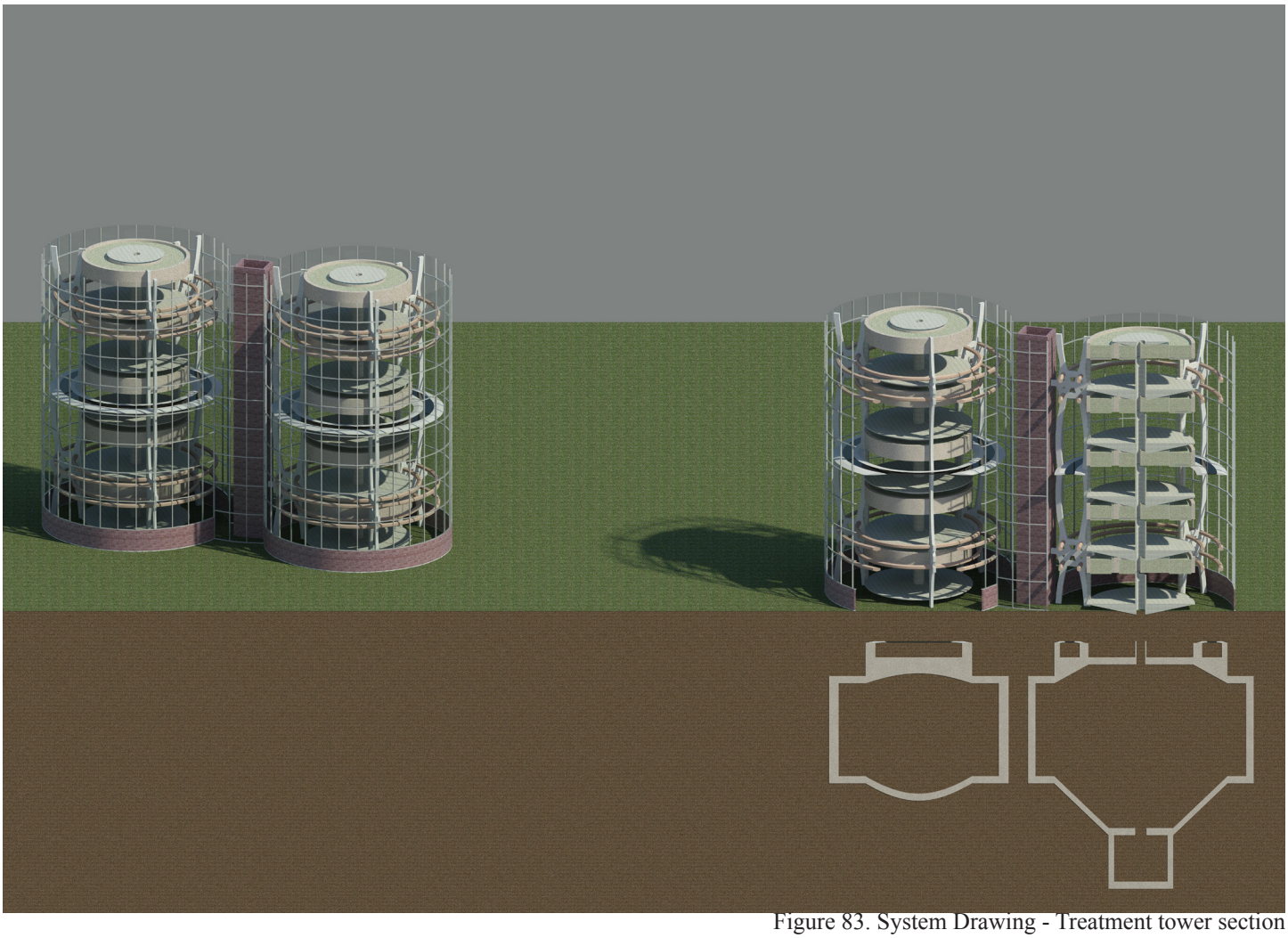


Figure 83. System Drawing - Treatment tower section

WATER TREATMENT TOWERS

The towers pictured to the left are artificial wetland water treatment facilities. These are a combination of natural and mechanical water purification with a heavy slant for natural water treatment.

This system mimics the natural water purification process as much as possible and works to process the water collected from the roof of the farming facility. The image to the right is a water reservoir found throughout the facility. These reservoirs colllect all water from the roof and distribute it to the water storage pond on site as well as to the treatment towers.

These processing facilities will not only process water from the facility but also water from the surrounding community, thus decreasing the work load on the city wastewater treatment facilities. First run water (collected rain) can be processed into potable water for use at the facility as well as use by the surrounding community, again decreasing demand on the city's water treatment facilites.

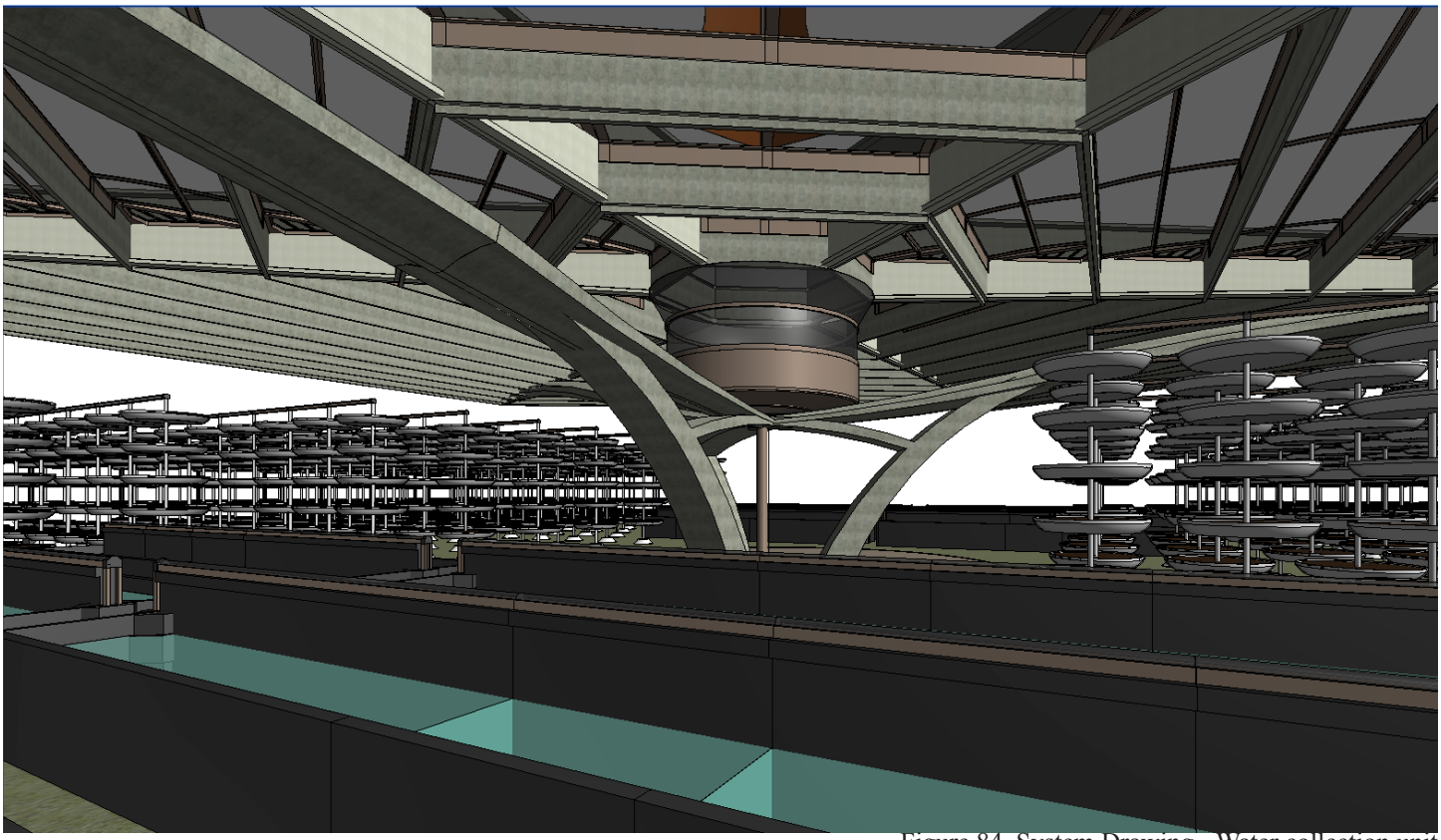


Figure 84. System Drawing - Water collection unit

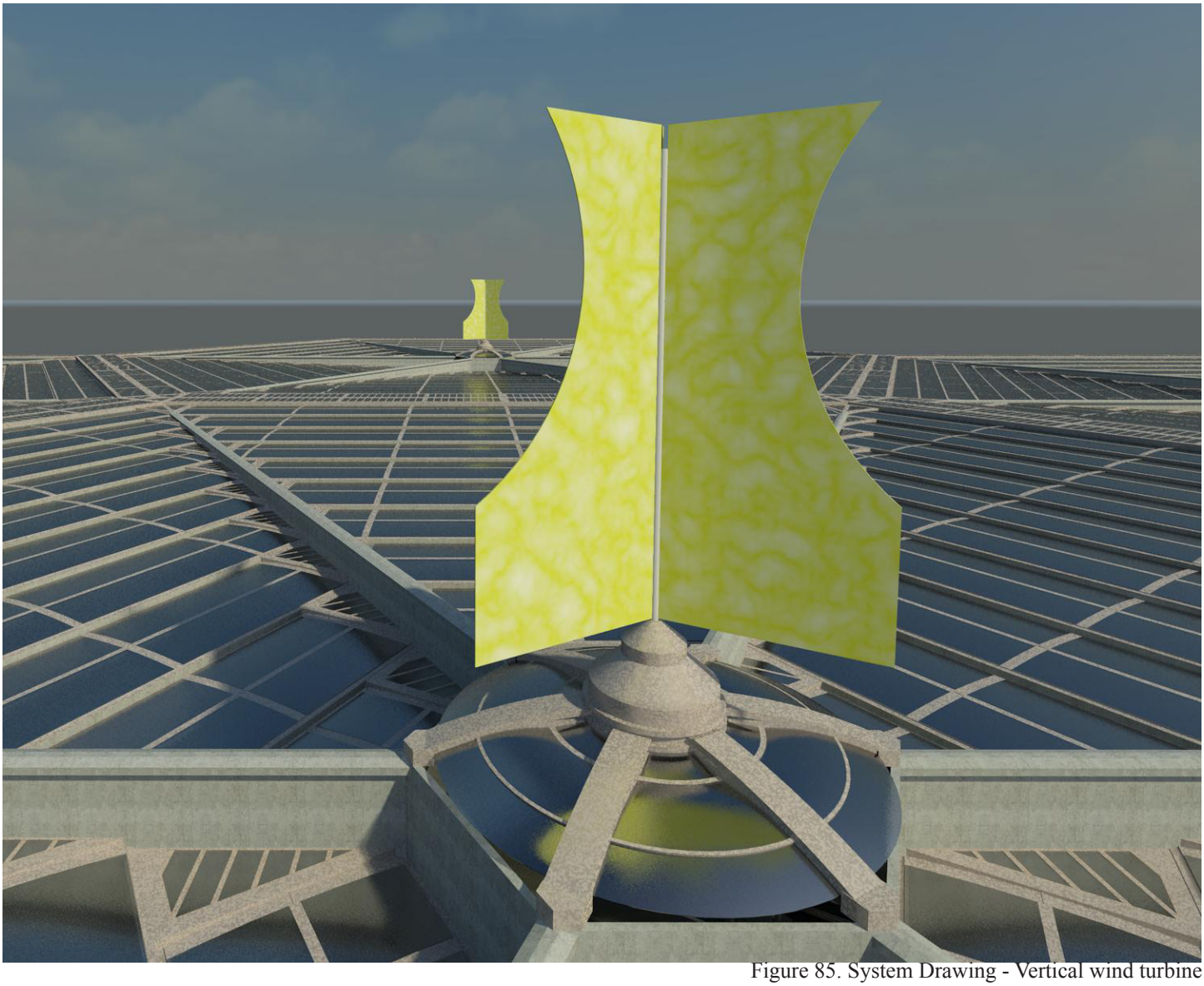


Figure 85. System Drawing - Vertical wind turbine

POWER PRODUCTION

This facility utilizes horizontal
wind generators and solar production across the roofing structure. This energy is captured and stored in molten salt batteries located just under the generator systems. These molten salt batteries can store large amounts of energy and do so at a pace traditional batteries have not been able.

These batteries will allow for storage and usage of energy that will optimize the potential of solar and wind power generation and allow the facility to operate independently.

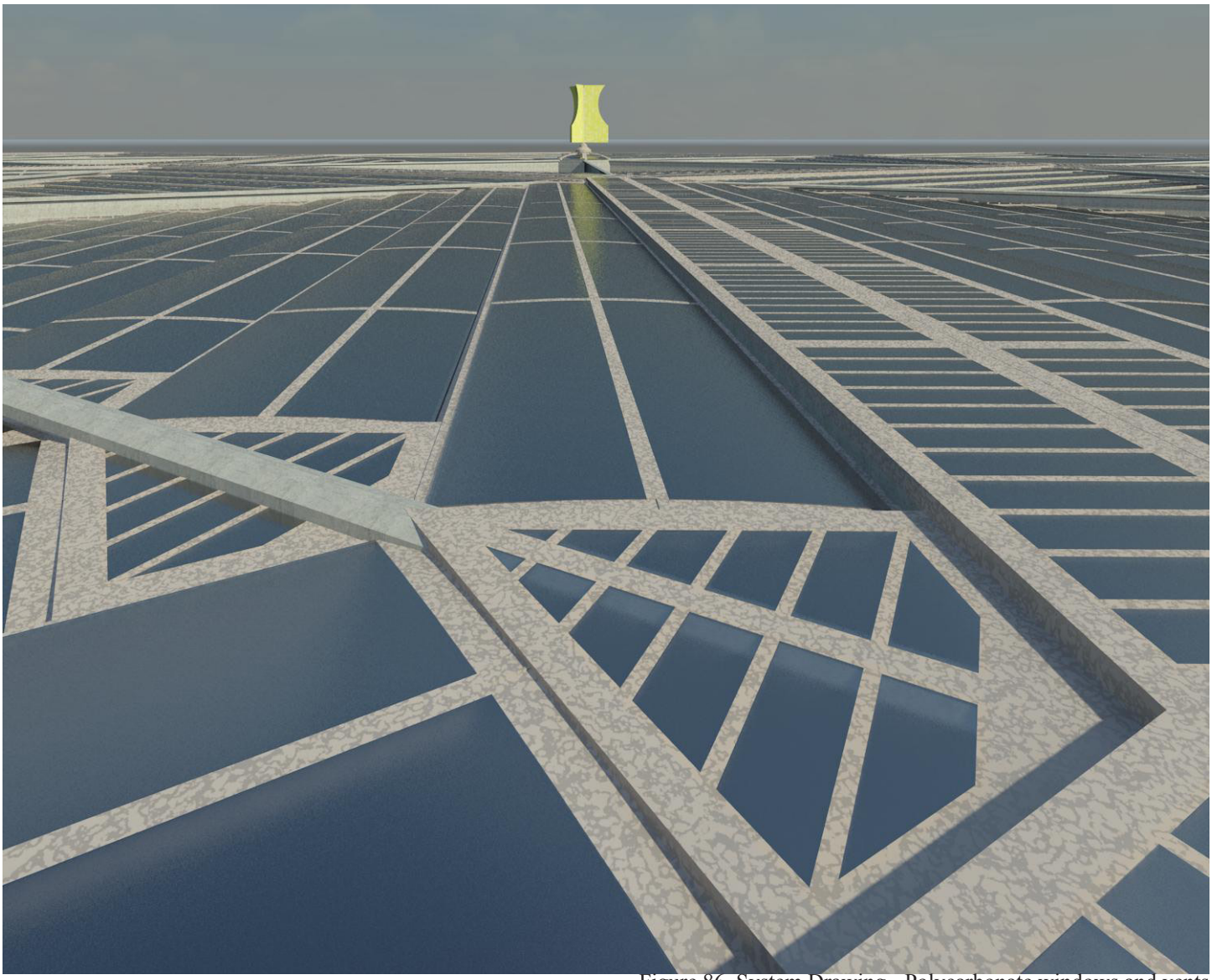


Figure 86. System Drawing - Polycarbonate windows and vents

POLYCARBONATE

The windows used on the facility are designed using Polycarbonate, and can be both lighter and stronger than traditional glass.

This system was chosen for both of the above reasons as well as for its ability to be manufactured in far greater lengths than glass manufacturers can provide.

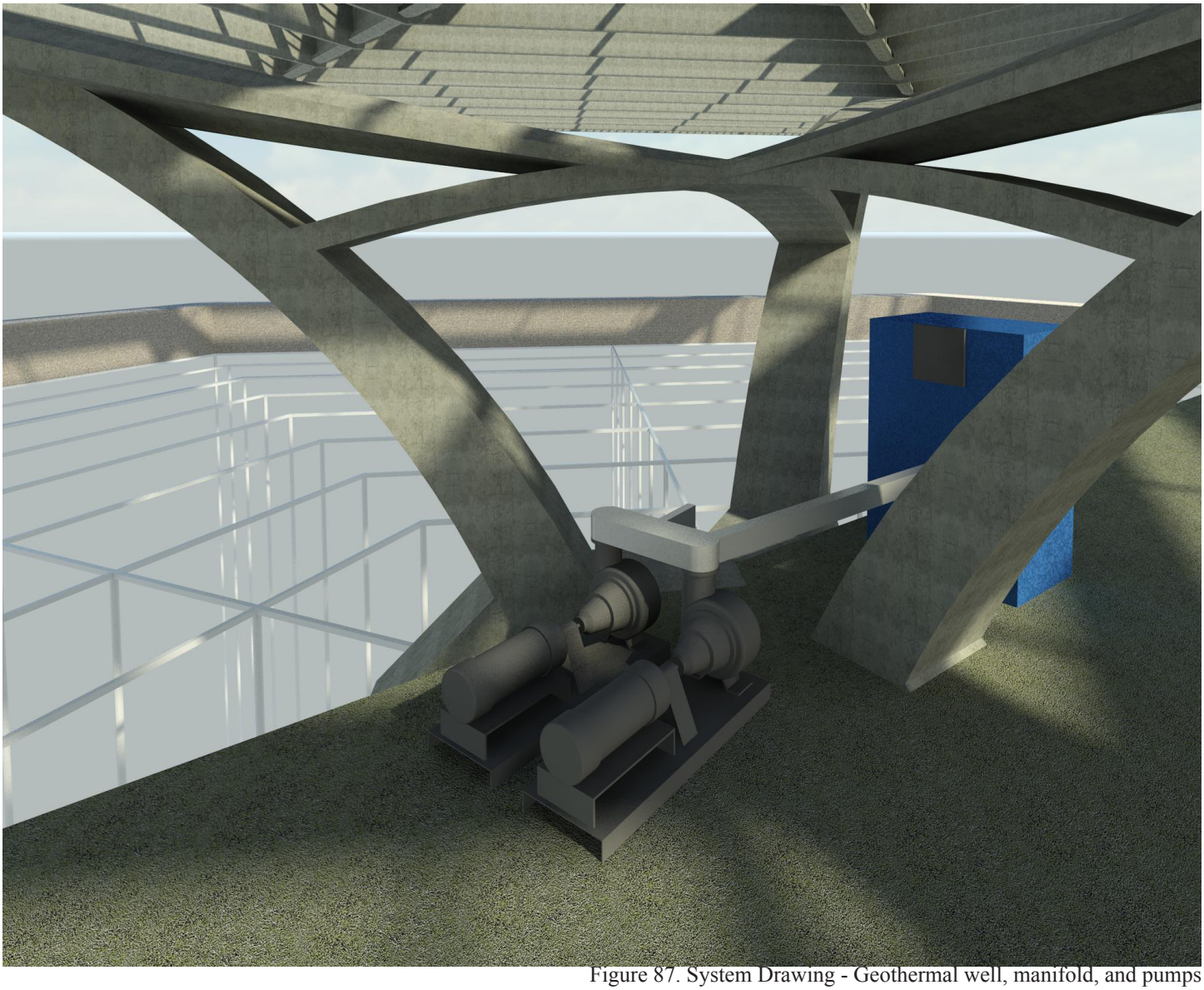


Figure 87. System Drawing - Geothermal well, manifold, and pumps

GEOTHERMAL BASED HVAC

This facility is heated and cooled using geothermal heating and cooling systems. This particular system will utilize a shallow type geothermal well to allow easier replacement of any damaged lines. The lines will also utilize an alternate glycol mixture that is unpleasant tasting to animals and will be safer to the environment.

This system is extremely efficient and utilizes a fraction of the power to produce the same results as traditional systems. Tied together with the large amounts of facility wide power generation and improved insulation with the use of natural systems when possible, this facility will be extremely efficient.

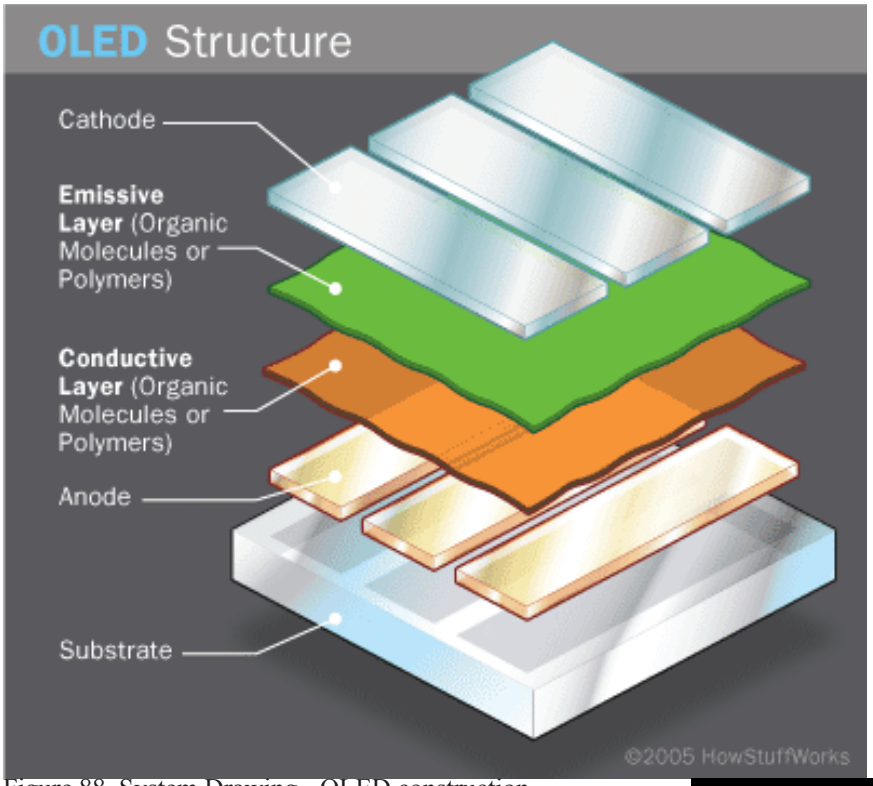


Figure 88. System Drawing - OLED construction

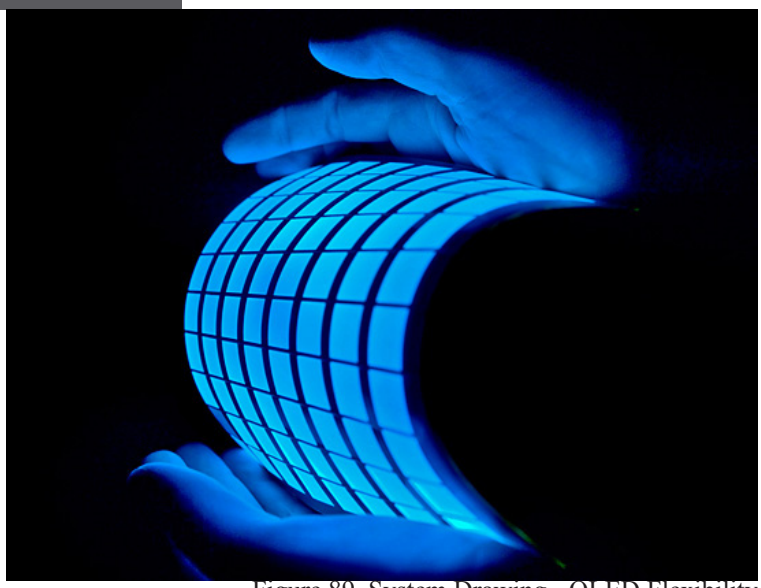


Figure 89. System Drawing - OLED Flexibility

OLED (organic light-emitting diode)

The use of this lighting system in the project allows for lighting to be in tight locations such as on the structure of the hydroponic towers pictures to the right. These lights can help to provide additional light when winter decreases natural lighting.
This lighting system is also used along the under surfaces of the farming unit structure to provide work lighting at night.

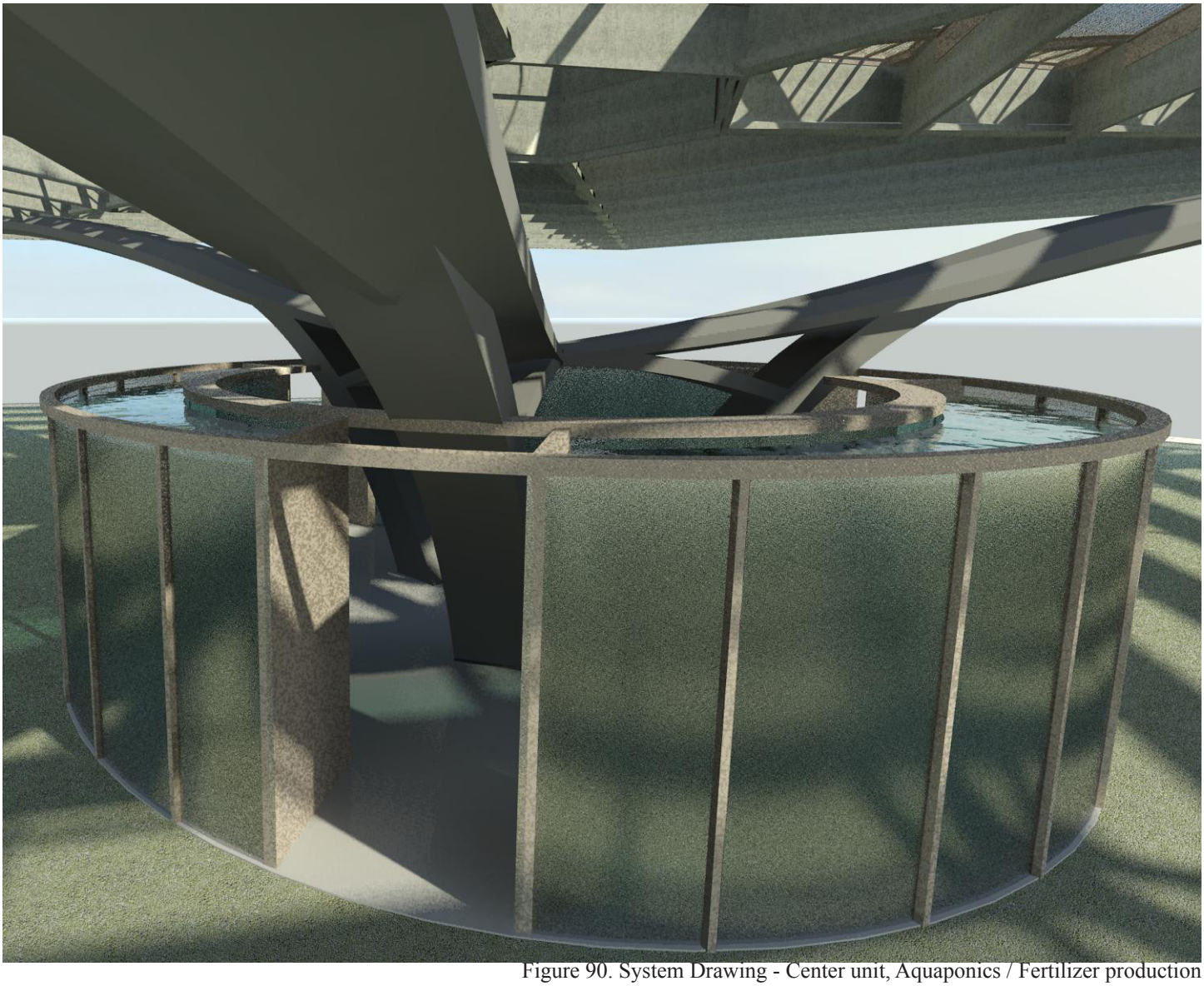


Figure 90. System Drawing - Center unit, Aquaponics / Fertilizer production

CENTER PRODUCTION UNITS

There are multiple types of units that can be used surrounding the structure of the farm cover. These units provide additional food production such as the one pictured below. The unit below is a mockup of an on site fish production system. This system produces the food on site for the fish, and allows fast growing vegetarian type fish species to be produced such as Tilapia.

Other center unit types include:
Compost with mushroom production
Chicken and other small birds
Apiaries (Bee farming.)
HVAC / Mechanical

Figure 91. System Drawing - Images related to alternate center unit usage.

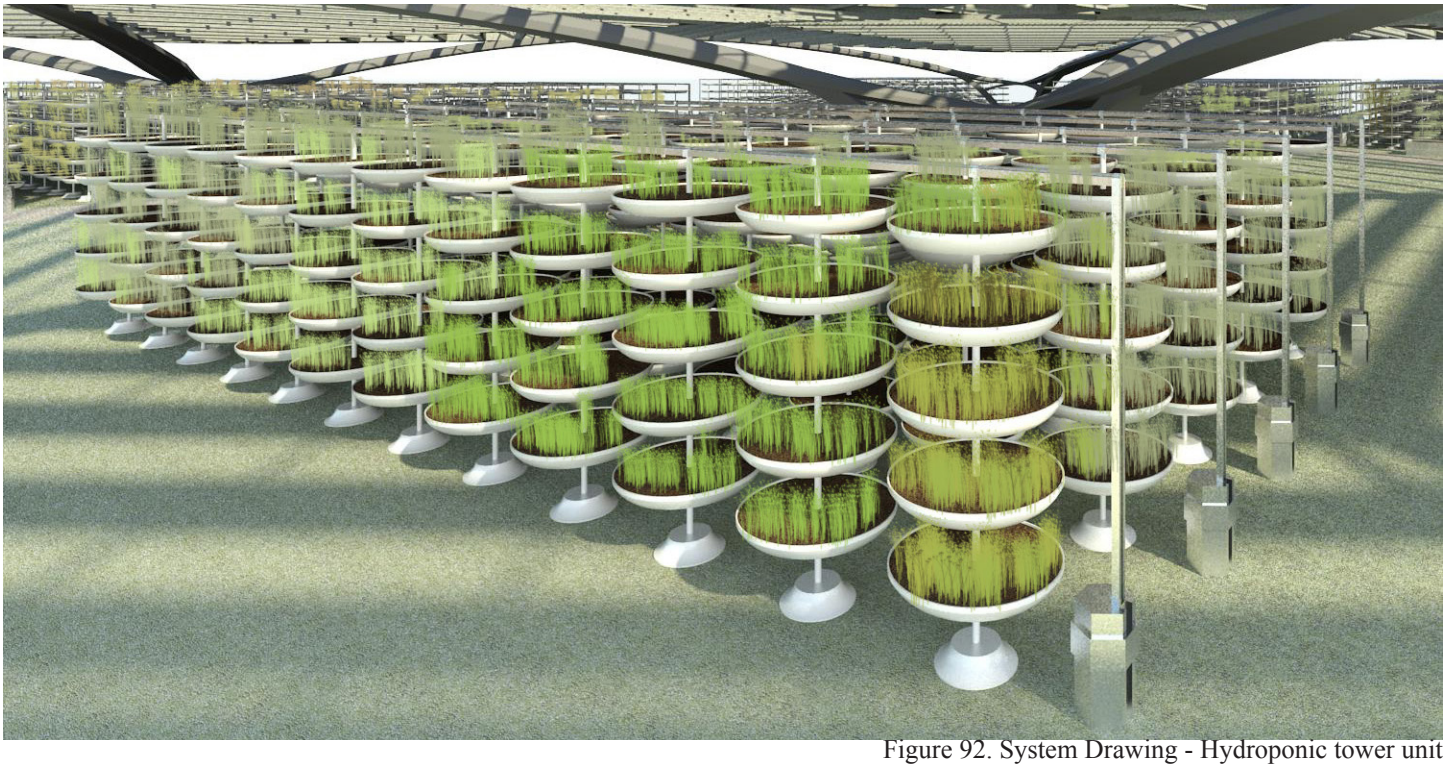


Figure 92. System Drawing - Hydroponic tower unit

## HYDROPONIC SYSTEMS

One of the main parts of the project is the hydroponic stacked farming system which will allow far improved growth of plants due to regular water and fertilization along with improveed lighting, temperature and pest control. This system is proven to boost particular crop yields at or over 5 times their normal yield.

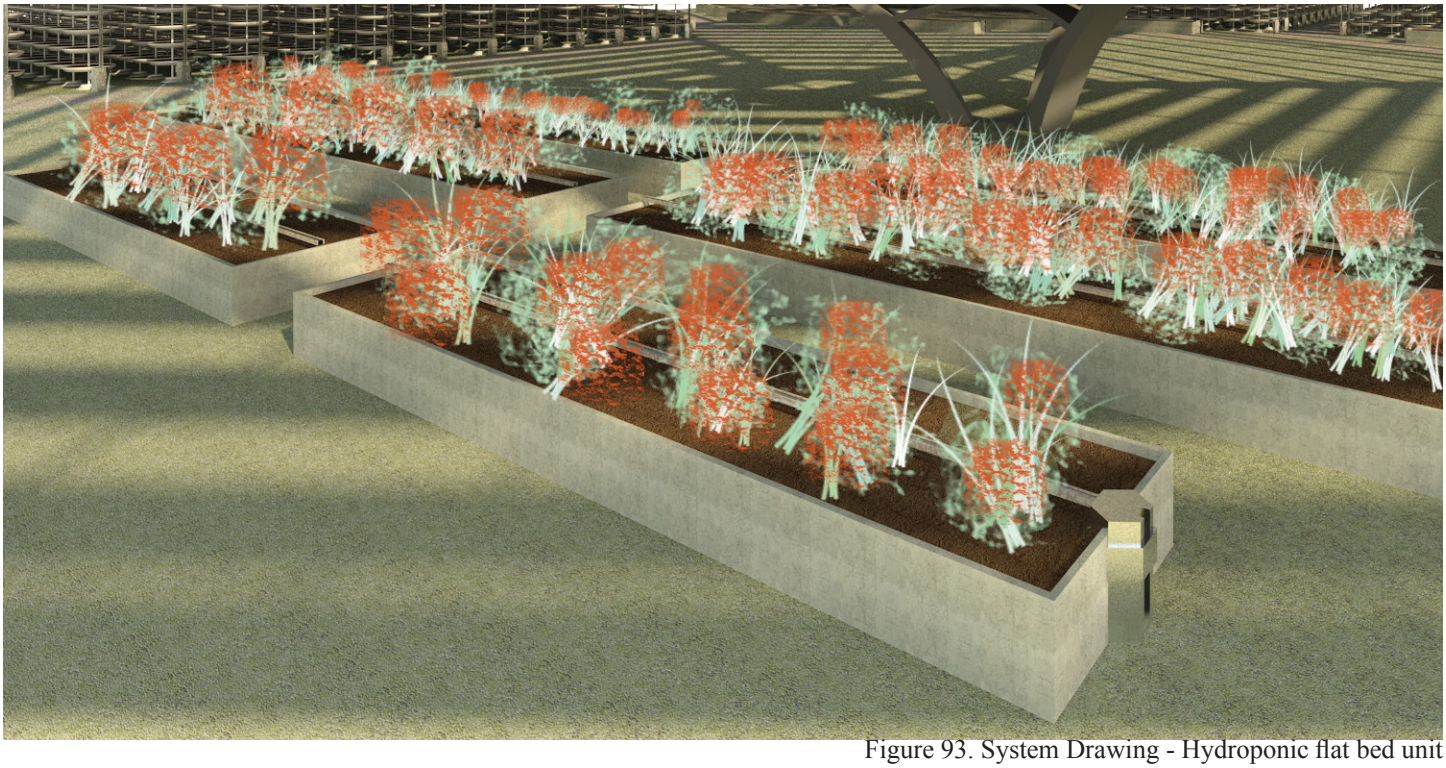


Figure 93. System Drawing - Hydroponic flat bed unit

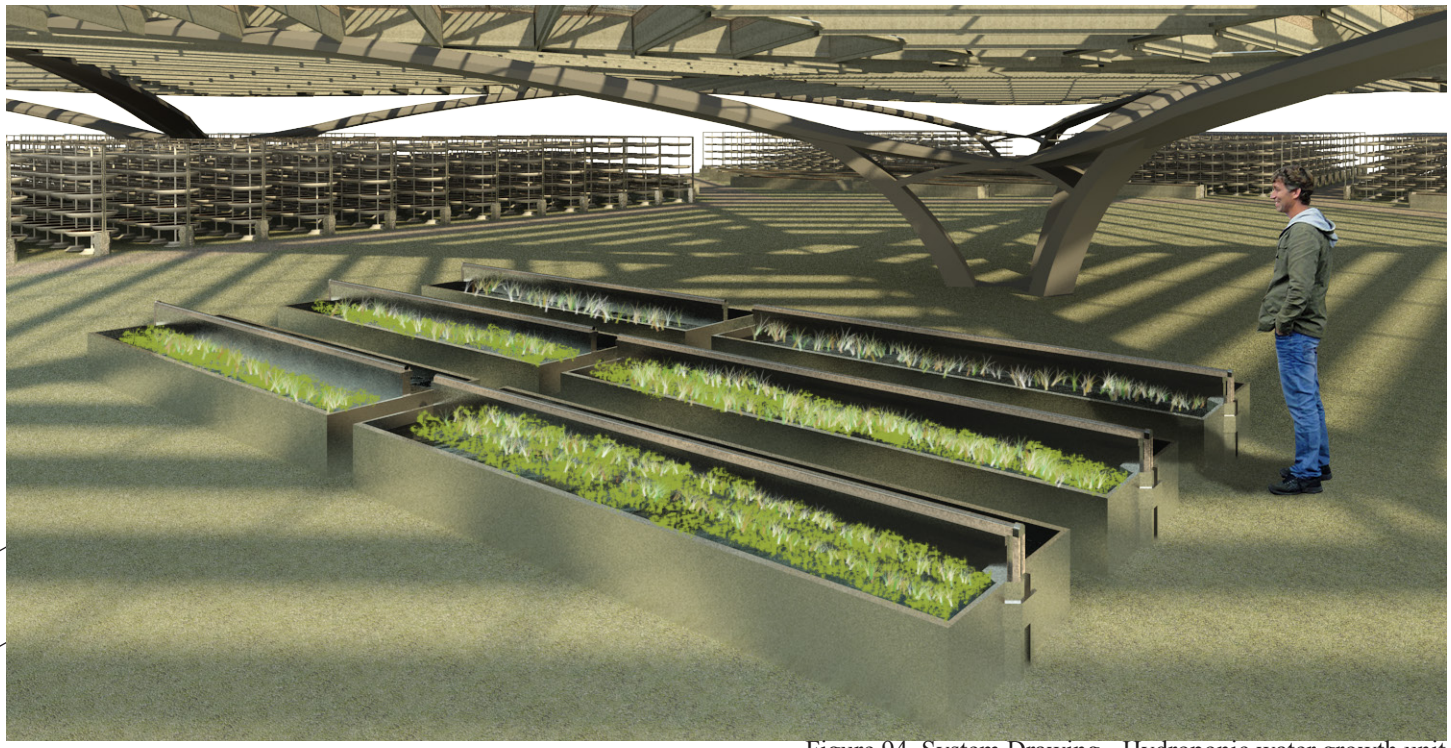


Figure 94. System Drawing - Hydroponic water growth unit

# Perspectives

Figure 95. Perspective - Public gardens

Figure 96. Perspective - Entry main building

Figure 97. Perspective - Research labs

Figure 98. Perspective - Restaurant and Bar

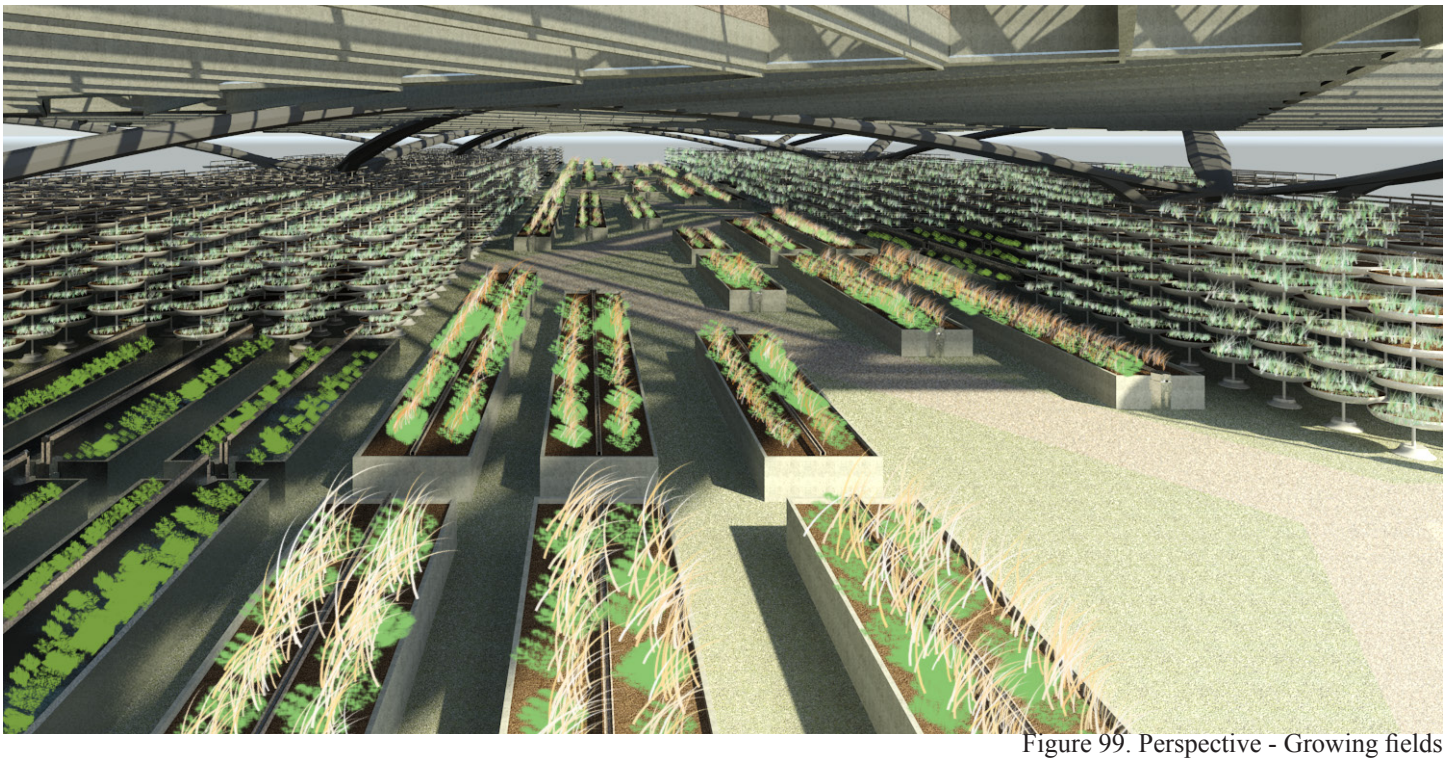
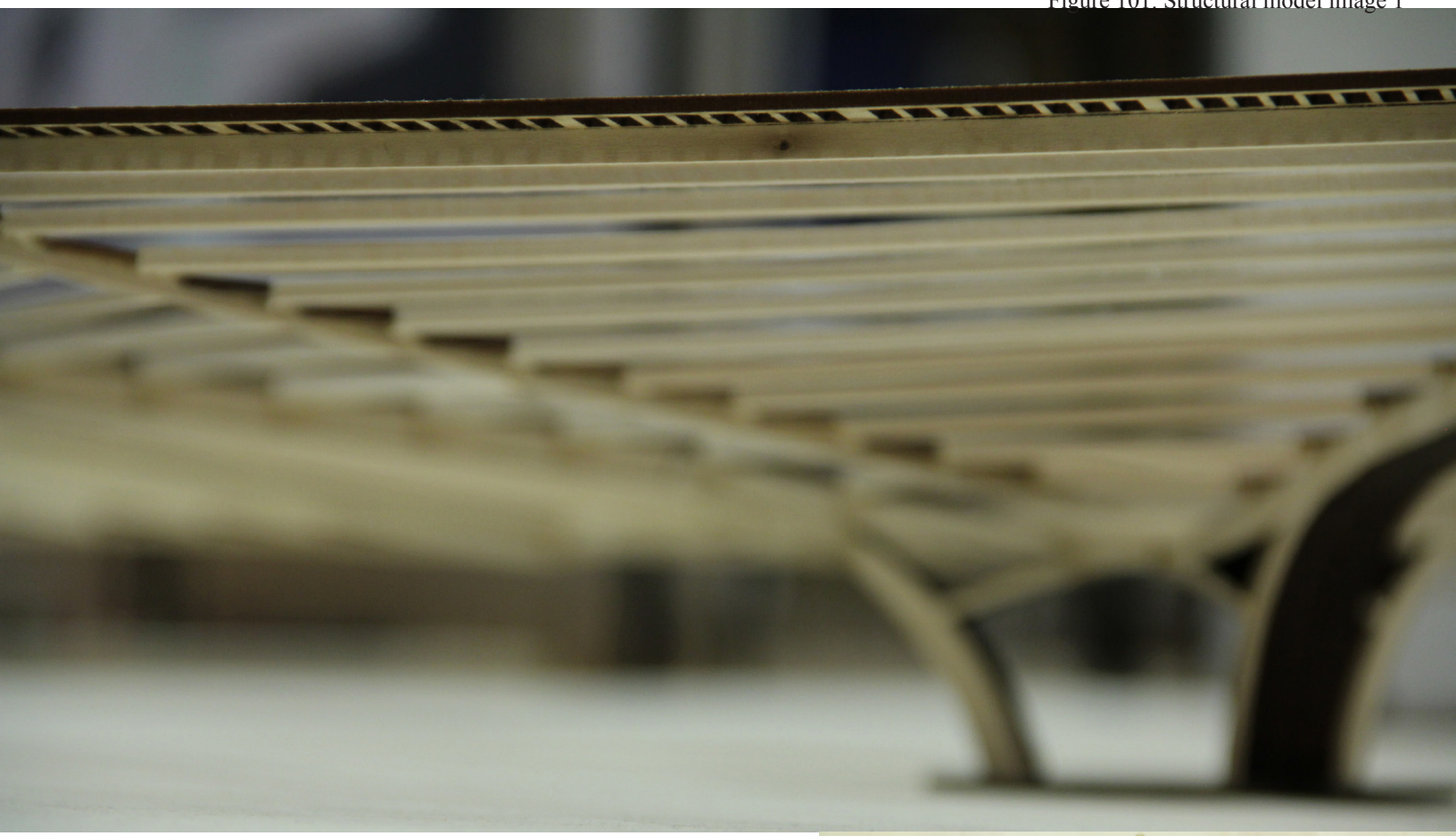


Figure 99. Perspective - Growing fields

Figure 100. Perspective - Treatment towers

# Model

Figure 101. Structural model image 1

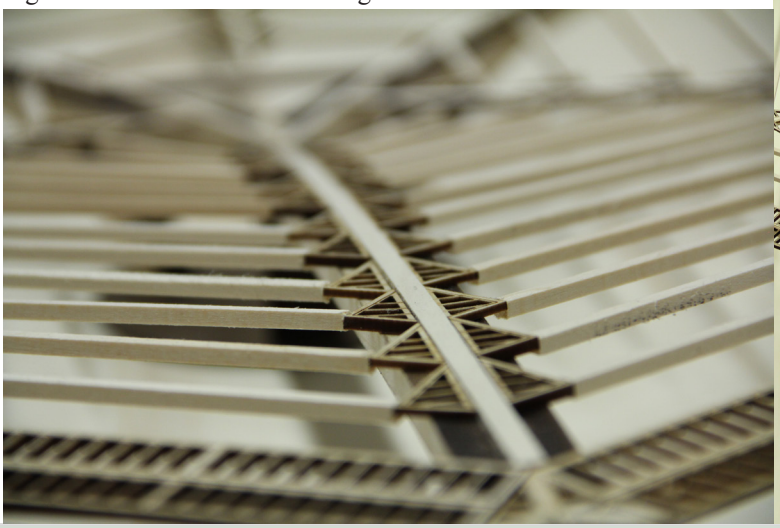


## STRUCTURAL MODEL

This model represents one of the Growing field structures and the venting positions along the edges of each unit.

Figure 102. Structural model image 2

Figure 103. Structural model image 3



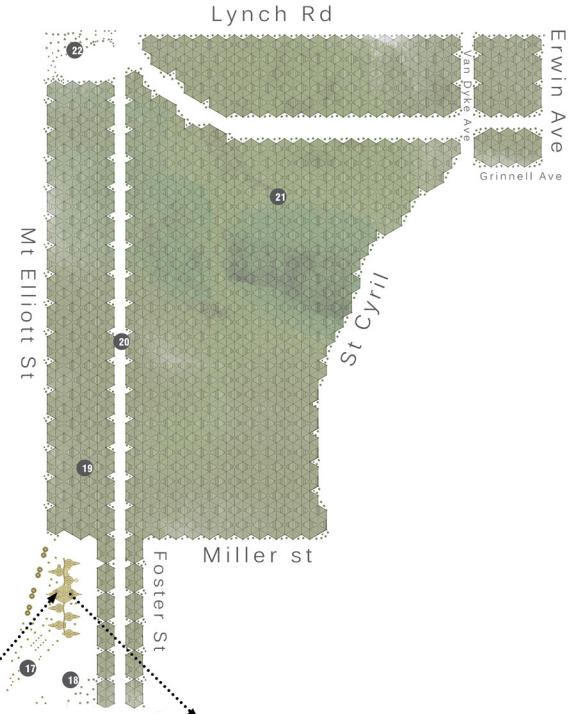

by Thomas Homic

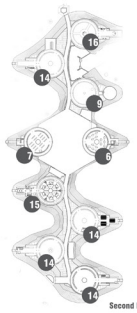
# Compressed Agricul

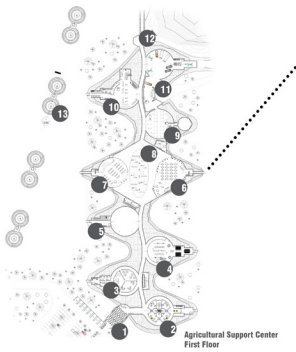

Figure 104. Presentation Board 1



Figure 106. Presentation Board 3

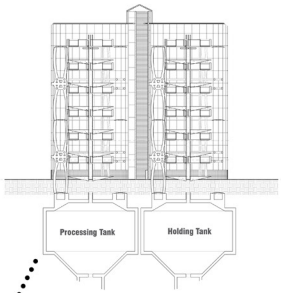



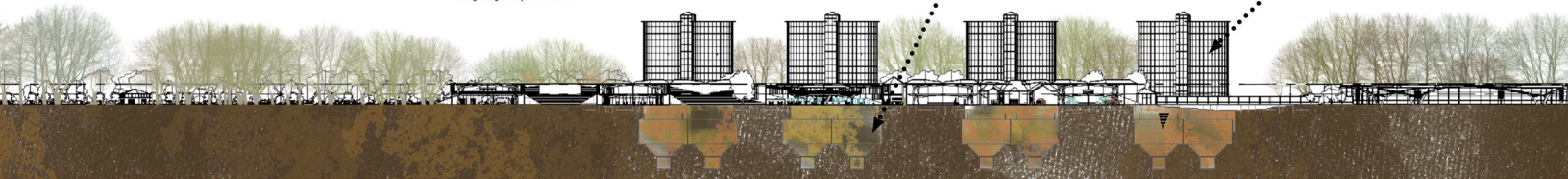

| | | |
|---|---|---|
| 1 | Entrance | 300 sqft |
| 2 | Office | 400 sqft |
| 3 | Classroom | 3000 sqft |
| 4 | Research labs | 4000 sqft |
| 5 | Flex space | 2500 sqft |
| 6 | Organic restaurant | 6000 sqft |
| 7 | Market | 6000 sqft |
| 8 | Display and Seating space | 4500 sqft |
| 9 | Food Storage | 6500 sqft |
| 10 | Food Processing | 3000 sqft |
| 11 | Garage | 4000 sqft |
| 12 | Public access to growing fields | |
| 13 | Water treatment towers | |
| 14 | Greenhouse (lab space) | 3000 sqft |
| 15 | Caretaker and Eco-tourism suites | 4000 sqft |
| 16 | Repair equipment and facilities offices | 700 sqft |
| 17 | Parking | |
| 18 | Public Gardens | |
| 19 | Public access growing fields | |
| 20 | Railroad and maintenance road | |
| 21 | Restricted access growing fields | |
| 22 | Experimental 'natural' fully edible garden | |

* Total site property 490 Acres
** Total growing field space 400 acres

Water collected from the growing field's roofing system and surrounding neighborhood is processed in the water treatment towers into potable and greywater. The 'first run' water is collected and processed into potable water for the facility and neighborhood. Reuse water is processed to be used by agricultural systems, allowing for maximum use of site resources and minimal intake from exterior water sources.

Water is first processed through the primary processing tank then pumped into the tower where gravity filters it through the simulated wetland process. Water is then stored in the holding tank until needed.



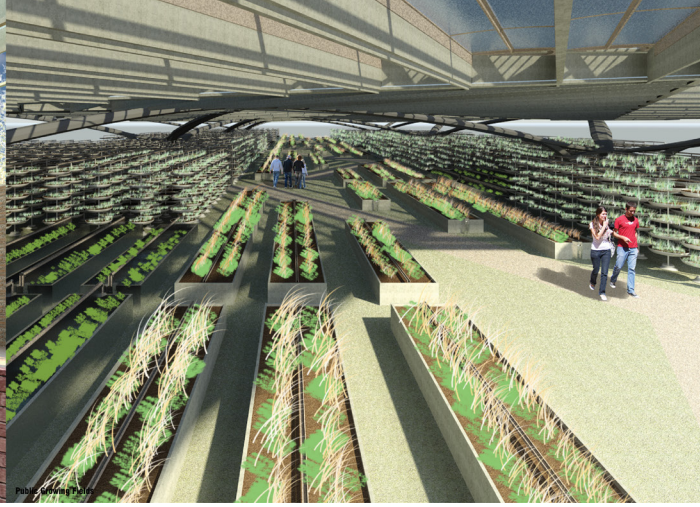




Figure 105. Presentation Board 2

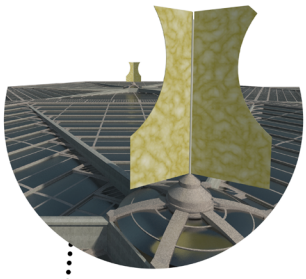
nd water processing system utilizes
antings to filter out pollutants in the
se plants can be easily replaced as
the end of their life cycle, and are
aced by new plants grown in the ag-
upport center.
n utilizes a primary tank that ex-
ge objects that snuck into the sys-
breaks down any organic matter
acterial processes. These process-
hanced by use of products such as
an all natural supplement to greatly
teria's natural processes.
essed, the water passes through
of the treatment tower and until the
ade usable.

Vertical wind generators allow for greater torque and output from less wind over traditional towers. These generators are also lighter, require less maintenance, removes bird impact concerns, and can be outfitted with solar cells in place of sails.
Energy is collected into and distributed from a series of molten salt batteries designed to both quickly or slowly charge or discharge. This battery type was specifically designed for use in solar and wind power generation to increase capacity and decrease wasted energy.

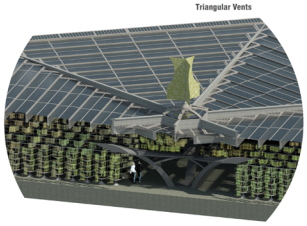
Polycarbonate glass is used in place of traditional glass to improved light spectrum characteristics, increased durability, and decreased weight. Triangular venting systems along each beam naturally cool the space.

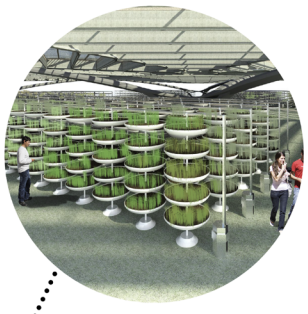
The structure of the system is designed as a series of arches forming a dome net. This net is designed to work in compression and tension to support the polyglass roofing.
Heavy objects such as the power generation and water collection systems are centered over the main supports where load transfer is most effective.
The canopy over the growing fields allows the system to optimize growing yield limited by a short season to year round.

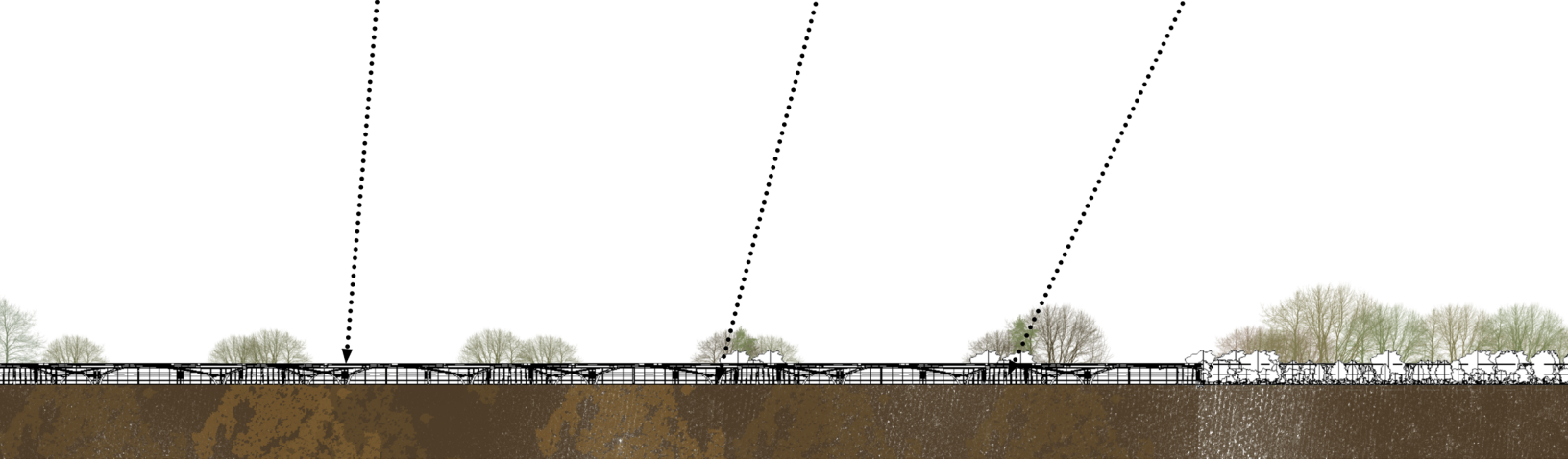
The growing beds (tower, oversize, and water types) are designed as an integral piece of the HVAC system. Each unit heats or cools depending on the need. These growth beds monitor the plant's needs from water and light through heat and pH. Supplements are used when lacking. An example of this is the use of growth spectrum organic light emitting diodes (OLEDs) that are superior in energy usage, are extremely thin, and are able to be shaped as a skin for the hydroponic units. These units therefore can be fully or partially lit, assist in controlling the local temperature as well as humidity and other aspects.



Triangular Vents







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"Why NDSU? Meat science... Yes, we have that". - Prof. Andrew 'Doc' Mara