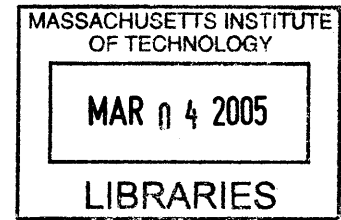


**Perceptions of the Natural**

by

**Renata Filipovic**

Bachelor of Interior Architecture  
University of Oregon, 1998



Submitted to the Department of Architecture in Partial  
Fulfillment of the Requirements for the Degree of

**Master of Architecture**  
at the  
**Massachusetts Institute of Technology**

**February 2005**

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## **Perceptions of the Natural**

by

Renata Filipovic

Submitted to the Department of Architecture on January 14, 2005 in Partial Fulfillment of the Requirements for the Degree of Master of Architecture

### **Abstract**

This thesis takes on the difficulty of defining a clear line that connects and separates natural and artificial in a contemporary landscape. It is a proposal for a park that addresses the image and understanding of nature. Playful, perverse, and perpetually unfinished elements use the existing infrastructure, the by-products of research facilities, land-filled grounds and the sky above as primary design materials to identify the invisible character of ongoing mediation between organic and manufactured systems. Using relationships that flow and have flowed through the site, the park invites the body and mind to navigate a complex environment and to engage with the underlying issues that form and characterize it.

Thesis Supervisor: J. Meejin Yoon  
Title: Assistant Professor

## **Acknowledgments**

I would like to thank my thesis committee for their invaluable input over the course of the semester. Thanks to Meejin Yoon who had the patience and courage to let me find my own way, to Pierre Thibault for always being unshakably positive, and to Arindam Dutta for being sincerely interested and engaged with all of our projects no matter how bizarre our ideas got.

My experience at the MIT's Department of Architecture would not have been the same without the friendship and support of the Level I crowd. Meeting and working with each and every one of you made this whole experience worthwhile.

And my deepest gratitude goes to Mark Lambertz for always being there for me.

## **Perceptions of the Natural**

### Table of Contents

|    |                      |
|----|----------------------|
| 08 | Introduction         |
| 12 | Site/Scene           |
| 26 | Conceptual Strategy  |
| 28 | Along                |
| 30 | Across               |
| 32 | Vegetation           |
| 34 | Elements             |
| 38 | Sky Garden           |
| 48 | Earth Maze           |
| 54 | Infrastructure Fence |
| 62 | Study Models         |
| 64 | Bibliography         |

## Introduction

## Nature and Artifice in Contemporary Landscape

### Nature

The Latin word *natura*, coming from *natus*, means to be born. It signifies the forces and processes that produce and control all the phenomena of the material world.<sup>1</sup>

### Artifice

The word itself comes from Latin *artificialis*, meaning belonging to art, or from French *artificium*, signifying craftsmanship, and referring to what is caused by human-generated forces or influences rather than from nature. It is produced, often made in imitation or simulation of something natural. It is artificial in result, as well as in process, since it does not arise from natural growth nor do vital processes characterize it.<sup>2</sup>

Given the above definition of nature one can assume that humans, as well as the products and processes they have developed, are also part of the complex natural system. However, the definition of the artifice brings the artificial (i.e. man-made) in opposition to the natural. It appears that defining natural and artificial and attempting to establish a clear distinction between the two is an impossible task. As technology (as the main protagonist of the artificial) developed over the years, it shrank in its size at the same time. It has moved from colossal industrial to the imperceptible nano, molecular and genomic, and with that the conception and perception of the natural has been vigorously challenged.

Life in harmony with nature, our dependence on nature's seasonal cycles and its fruits for immediate survival, is a thing of the past. This dependence is transferred to the employment of genetically modified products and engineered environments. The mediation and modification of the natural has moved to levels invisible to the gaze, yet it is still affecting the image and understanding of nature. Thus the main interest of this thesis is to make this intricate negotiation between organic and manufactured visible.

From the very beginning of civilization technology has been developed to calm and cultivate the savage nature. The median between wilderness and complete artifice were gardens, cultivated fields and parks. They have been considered safe havens of captured landscape, often representing a physical realization of the understanding of the world at the time of their conception.



Such environments clearly express a desire and ideology to create order and assert power within nature, since nature in them is tamed, manageable and predictable. However, at the same time gardens and parks reflect social, economic and cultural attitudes of a given society; they employ artifice and celebrate new technologies that create them.

This thesis proposes a design of a park as an expressive ground of our relation to nature, as a physical reflection of the worldview in time and place of expanding (yet visually shrinking) sciences. By addressing processes that exist on the site and by proposing new relationships between them this project reengages a human body and mind with the environment. It provides a place to walk, pause, look and think; a place with complexity of landscapes where one can 'get lost' (in thought and in space). It is a place of contemplation about past decisions and actions, about new inventions, natural cycles and their relation to the urban environment.

Images from the project site, September 2004



<sup>1</sup> The American Heritage Dictionary of the English Language. Houghton Mifflin Company, 2000. and Oxford English Dictionary online (<http://dictionary.oed.com.libproxy.mit.edu>)

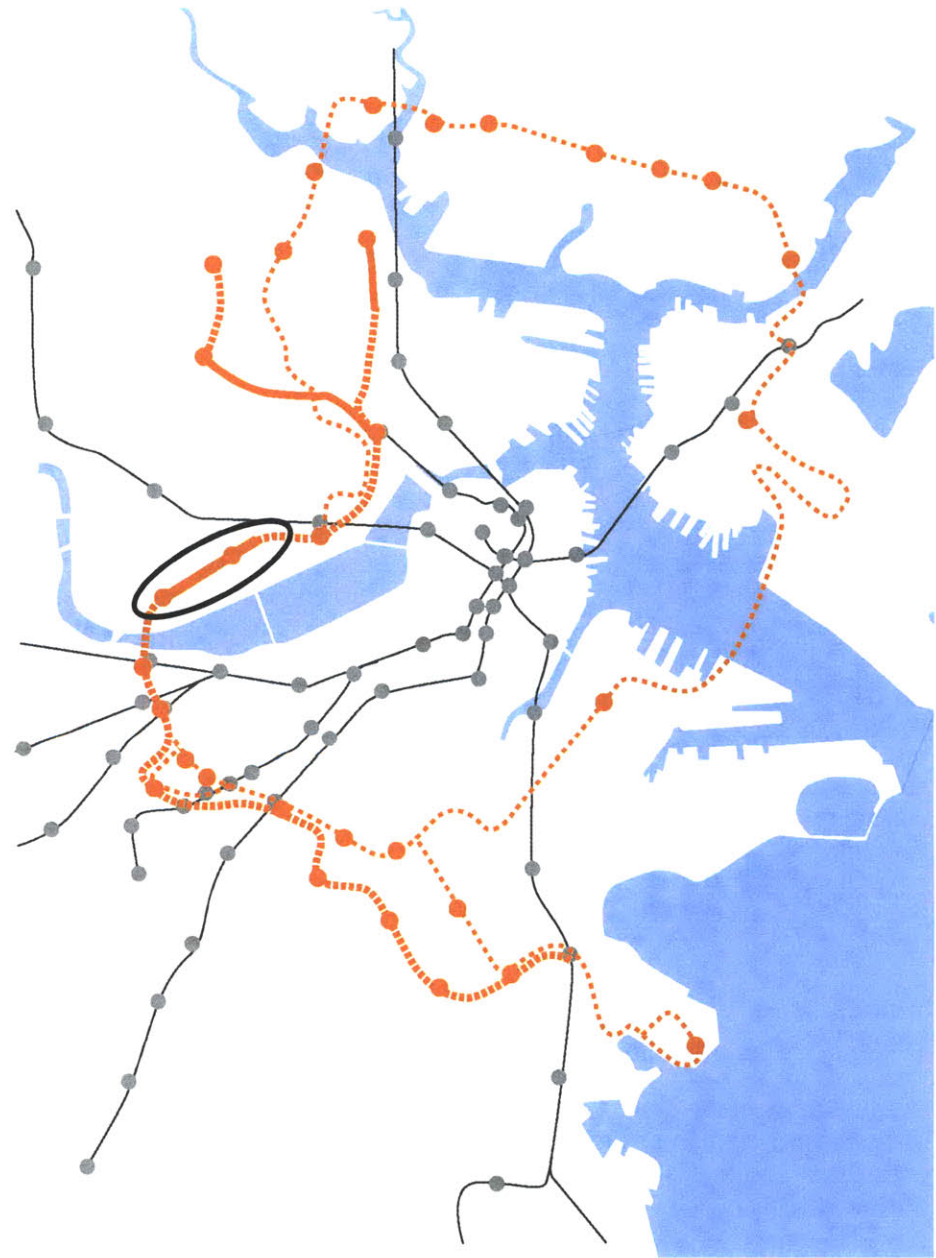
<sup>2</sup> Ibid.



**Site/Scene**



Boston metropolitan area rail system  
The project site is circled (Image from MIT Urban Design Studio Fall 2003 archives)



The selected site for the project is a leftover space in backyards of old urban developments, wedged between the two competing powers of the MIT and the Cambridgeport community. The site stretches along the railroad tracks from Massachusetts Avenue to the Memorial Drive, and its width spans across open lots adjacent to the tracks between Albany and Vassar streets. Rich with history and alive with traces of industrialism, this overlooked ground is a valuable piece of land that could contribute to the improvement of a tense relationship existing between the neighborhood community and the institute if its design allows for gathering, learning and exploration.

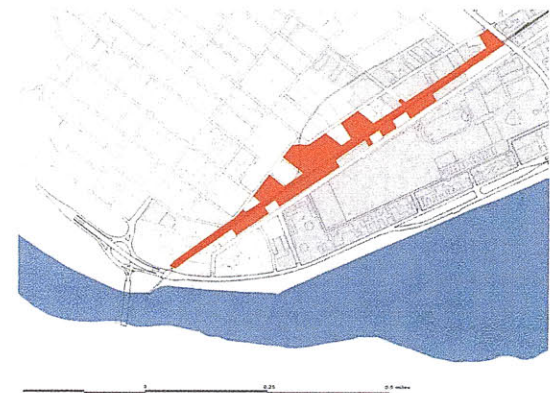
## History

John Winthrop founded New Towne in 1630 at the hilly north bank of the Charles River. It became known as Cambridge eight years later. The river delta was wide and unruly, subjected to daily water fluctuations affected by tides of Atlantic Ocean, the grounds were swampy and uninhabitable, and Boston was accessible only via an eight-mile long ferry ride.<sup>1</sup> Today, however, Cambridge and Boston sit only a few hundred feet apart, stitched together by several bridges spanning across tamed waters. The Charles River floats quietly between them, providing a shimmering mirror image of their architectural skylines. In the course of about four hundred years the natural surroundings of the region have been repeatedly altered and perturbed by the growing population. The site of the project lies in the old tidal and marshland region of the Charles River delta, which was uninhabitable until the mid 1800s when settlers built seawalls and began to landfill the area. Construction of the Grand Junction Railroad in 1853, which was partially built on new embankments and stilts over marshes, connected Cambridge to the neighboring ports and industrial centers.<sup>2</sup> In 1910 the landfill was complete and by 1916 Massachusetts Institute of Technology, previously stationed in Boston, purchased the grounds for the development of a new campus.<sup>3</sup>

## Landfill

The entire site of the project is not a natural geological formation, but rather an artificial construct of urban developments of the 19<sup>th</sup> century. Types of landfill considered acceptable in the Boston area depended heavily on theories of disease prevailing at the time of development. Thus, the fill materials recommended for use between the 1830s to early 1900s when this site was filled were “clean gravel”

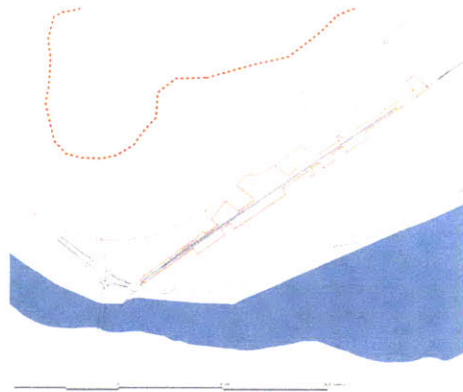
The project site is a long narrow strip of land along the railroad tracks between the MIT campus and the Cambridgeport neighborhood.



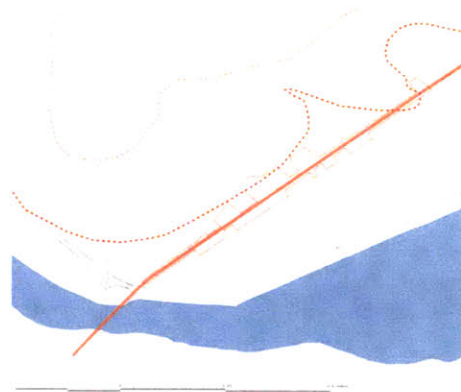
and “cellar dirt”. Anything devoid of organic matter was considered safe of “loathsome smells” and therefore not hazardous to human health. Clean gravel, which was nothing more than a mixture of gravel and dirt, as well as earth excavated during construction of new buildings, known as cellar dirt, were primary materials used in landfill enterprises. These two materials were frequently accompanied by household (coal) ashes and dredged fill from the bottom of the harbor and rivers. By 1900s trash and construction debris gained recognition as safe fill due to the newly accepted germ disease theory.<sup>4</sup> The project grounds were therefore filled with a variety of materials over the period of seventy years, with the top layer most likely comprising of various kinds of waste.

Dashed orange line at diagrams below indicates solid ground. Beyond this point were marshes and tidal flats of the Charles River basin.

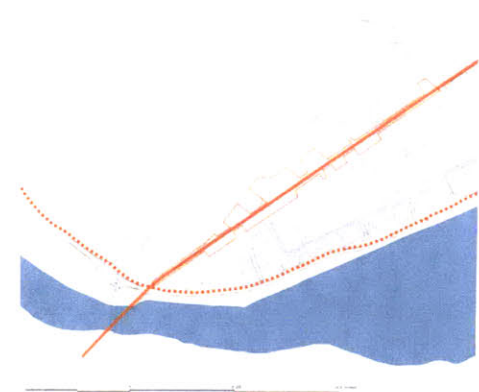
1630



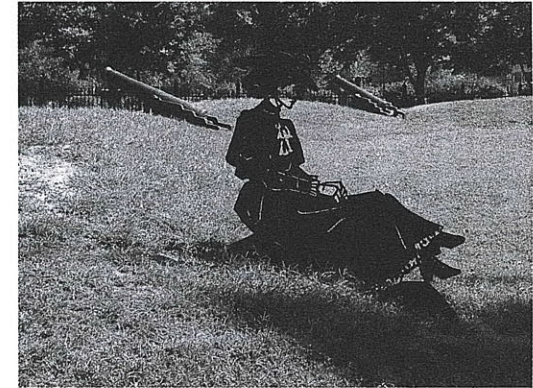
1853 - Grand Junction Railroad



1910 - Landfill completed







### Fort Washington Park

Fort Washington Park at the Southwest end of the tracks is one of the three earthen forts along the Cambridge side of Charles River constructed in 1775 by order of George Washington with the purpose of securing a stronghold for the American Minutemen fighting the British Army. These embankments, which became a commemorative park in 1857, are the only surviving remnants of the Revolutionary War in Cambridge. Due to the industrial nature of the neighborhood the park deteriorated quickly and it only became completely restored in 1993 with the joint efforts of the Cambridge Historical Commission and the new citizen's group the Friends of Fort Washington.<sup>5</sup>

Fort Washington Park with Grand Junction embankment, mid 1800s (Cambridge Historical Commission Archives)



<sup>1</sup> "A Brief History of Cambridge, Massachusetts" from Cambridge Historical Commission website: <http://www.cambridgema.gov/~Historic/cambridgehistory.html>

<sup>2</sup> Cambridge Historical Commission documents

<sup>3</sup> History of MIT from <http://libraries.mit.edu/archives/mithistory>

<sup>4</sup> Gaining Ground: A History of Landmaking in Boston, Nancy S. Seasholes

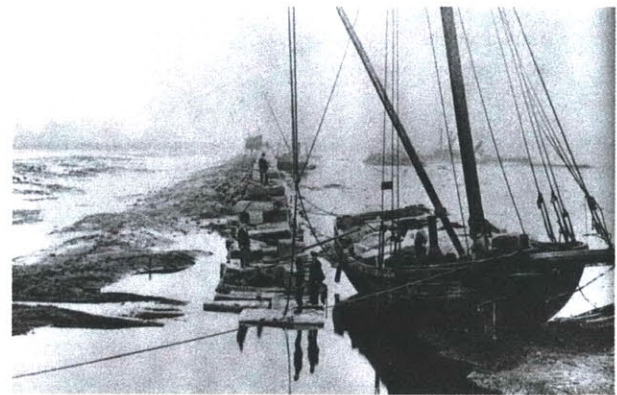
<sup>5</sup> Cambridge Historical Commission

On the left images from the park today,  
September 2004

Harvard Bridge (Massachusetts Avenue),  
Cambridge marshlands and Grand Junction  
rails in the foreground, 1891  
(Cambridge Historical Commission Archives)



Seawall at Charles River, 1897 (Cambridge  
Historical Commission Archives)



## Context

Most of the grounds, including the land on which railroad tracks lay, are owned by the Massachusetts Institute of Technology. Albany Street houses environmentally demanding research labs such as the Nuclear Research Center located in MIT buildings NW12 and NW13. Next door is the Francis Bitter Magnet Laboratory in NW14 and NW15, while the Plasma Science and Fusion Center occupies a large space of the building NW21. Further down the street is a graduate residence hall in building NW30, next to which lies an independent biomedical company. A homeless shelter and the Millenium Pharmaceutical buildings complete the list of structures located on the north side of the railroad tracks. Fort Washington Park, which is surrounded by grounds for truck parking and construction waste dumping for MIT, is the last element on the north side of the site.

On the Vassar side, south of railroad tracks, starting from Massachusetts Avenue lies a Metropolitan Storage Warehouse with the MIT's four story West Garage (W45) adjacent to it. The historic Heinz building is also owned by MIT and it bears number W59, while parking lots and a two story office building separate it from Simmons Hall (W79). This is followed by more ground parking area, building W89 that is used as a Professional Learning Center, and finally a row of small biotechnology companies.

The diagram on the right shows a vibrant mixture within the Cambridgeport neighborhood that lies at the edge of MIT campus. The grey shade represents MIT grounds, orange are MIT research laboratories, pink are biotechnology companies and purple represents warehouse based businesses. The neighborhood area immediately adjacent to the project site is the only region of Cambridgeport left with mixed use zoning where housing intermingles with small businesses and light industries. This fact is crucial in preserving the fine grain character of the area which could potentially aid in developing an even livelier community serving both campus and city residents.<sup>1</sup>

Image from MIT Urban Design Studio  
Fall 2003 archives

<sup>1</sup> "The future of the edge" An examination of the intersection of MIT and Cambridgeport; MIT fall 2003 Urban design studio report





## Character

Odd and quirky are adjectives that best describe the character of the site. It is a three quarter mile long narrow strip of land with a few interest points along the way, comparable to MIT's famed infinite corridor. The tracks do not seem to lead anywhere, and the grounds adjacent to it have become a dumping ground for MIT facilities. It is a backyard for research laboratories lined with nuclear reactor, chillers, giant nitrogen and argon tanks, fenced in high voltage meters, pipes, wires, and various other functioning or discarded equipment. It is unkempt and disorderly, fences are long, tall and tampered with, windows boarded up. A series of old chimneys that never smoke march down the site, yet steam appears to pour out of every other crevice so that on rare occasions one can experience a true atmospheric show.

Large puddles of water collect at junctions between crossings after every rain or snowfall. They remain there blocking the access for a long time, mirroring the sky, the clouds from chillers, lab equipment and buildings around. These puddles express indirectly the nature of the impermeable soil below.





Reflecting and separating  
Images from the site, September 2004

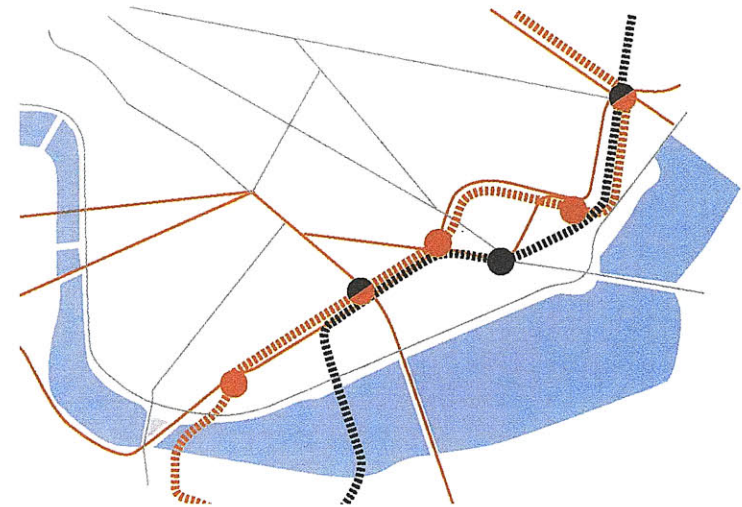


## Railroad

The railroad tracks are owned and operated by the CSX Corporation and are used infrequently for freight train and locomotive transfers between North and South station. There are a maximum of three scheduled train crossings per day, and all transfer happens at a low speed of 15mph.

These tracks are part of the future Boston metropolitan transportation development proposal for the Urban Ring (see page 11), which would directly connect all neighboring towns in the region. The diagram on the right shows in black a proposal for an underground railroad, and in orange is a light rail system which would use the existing CSX tracks.

On the right is the section of the Urban Ring going through Cambridge with two stops proposed at the project site. Oposite page shows 'fog' over tracks (Images from MIT Urban Design Studio Fall 2003 archives)



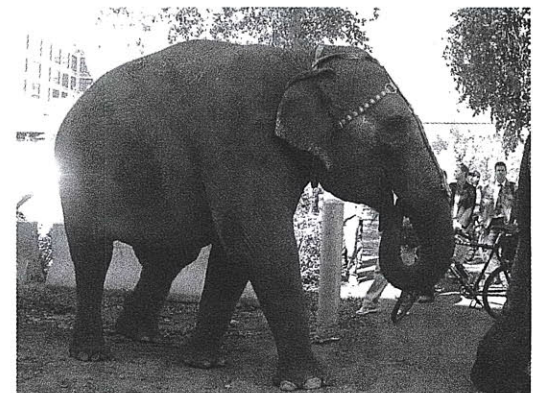
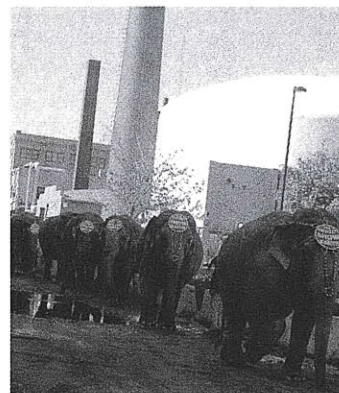
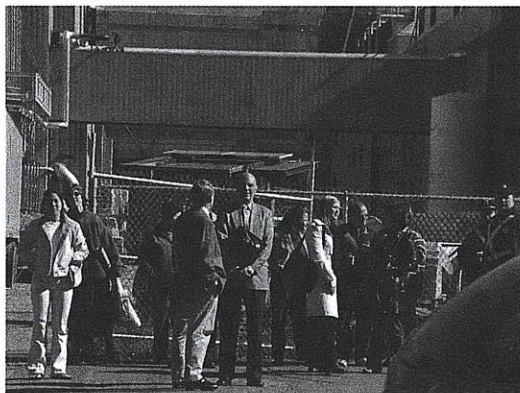




A more notable use of the tracks is that they house Ringling Brother's circus wagons for two weeks every October. At the beginning and the end of their stay elephants and horses parade down the tracks via Massachusetts Avenue and further across the Longfellow Bridge to the Circus grounds at Boston's Fleet Center. They attract a curious and puzzled audience as they leave behind a smell of manure and bits of hay.

### **Inhabitants**

The site is a place for homeless men and circus elephants, both regularly finding a refuge and a temporary home along the rails. Wild grasses and bushes take over the area during spring and summer months, attracting whole colonies of insects and birds, thus creating a green strip between MIT and Cambridgeport. The fact that this urban space in the center of Cambridge has been forgotten, that unexpected and extraordinary things happen here, and that it represents a soft edge between two very disparate communities makes it an extremely appealing place for exploration.



Ringling Brother's Circus procession on  
the left, October 2004

Wild grasses taking over the tracks on the  
right, September 2004



## **Conceptual Strategy**

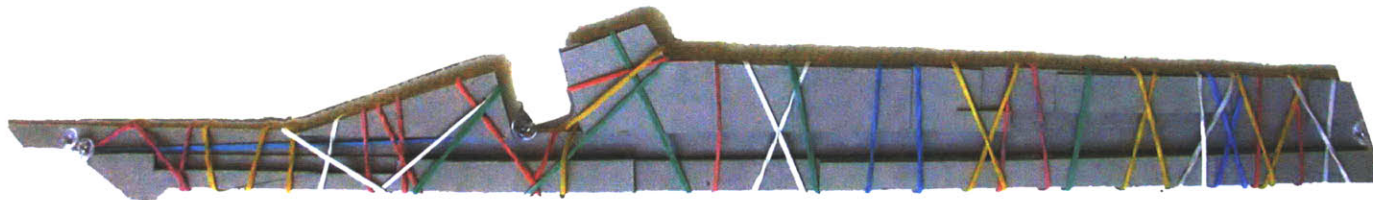
Aside from tackling the natural and artificial dichotomy, the main goal of this proposal is to create an environment with multiple opportunities for communication and interaction across the tracks, meaning to improve the relation between the neighborhood and the institute, while at the same time creating a park which invites one to pause and explore.

The conceptual strategy I have adopted draws inspiration from Peter Kubelka's most recent film "Poetry and Truth" (2004) in which he uses discarded archival reels of advertisement footage to make his film and his point. Similarly, I use the existing infrastructure of the site, the by-products of research facilities, the land-filled grounds and the sky above to create the park. The main goal is to set a stage for a perverse and perpetually unfinished environment, which derives its form and character by exposing processes that already exist or have existed on the site. Additionally, new programmatic elements are introduced that visually express tension and mediation between the natural and the artificial, and encourage interaction across the tracks. Therefore the character of the park will change with time and with programmatic insertions and subtractions.

Four separate systems work together to create a cohesive union:

1. Along the tracks
2. Across the tracks
3. Vegetation
4. Programmatic elements

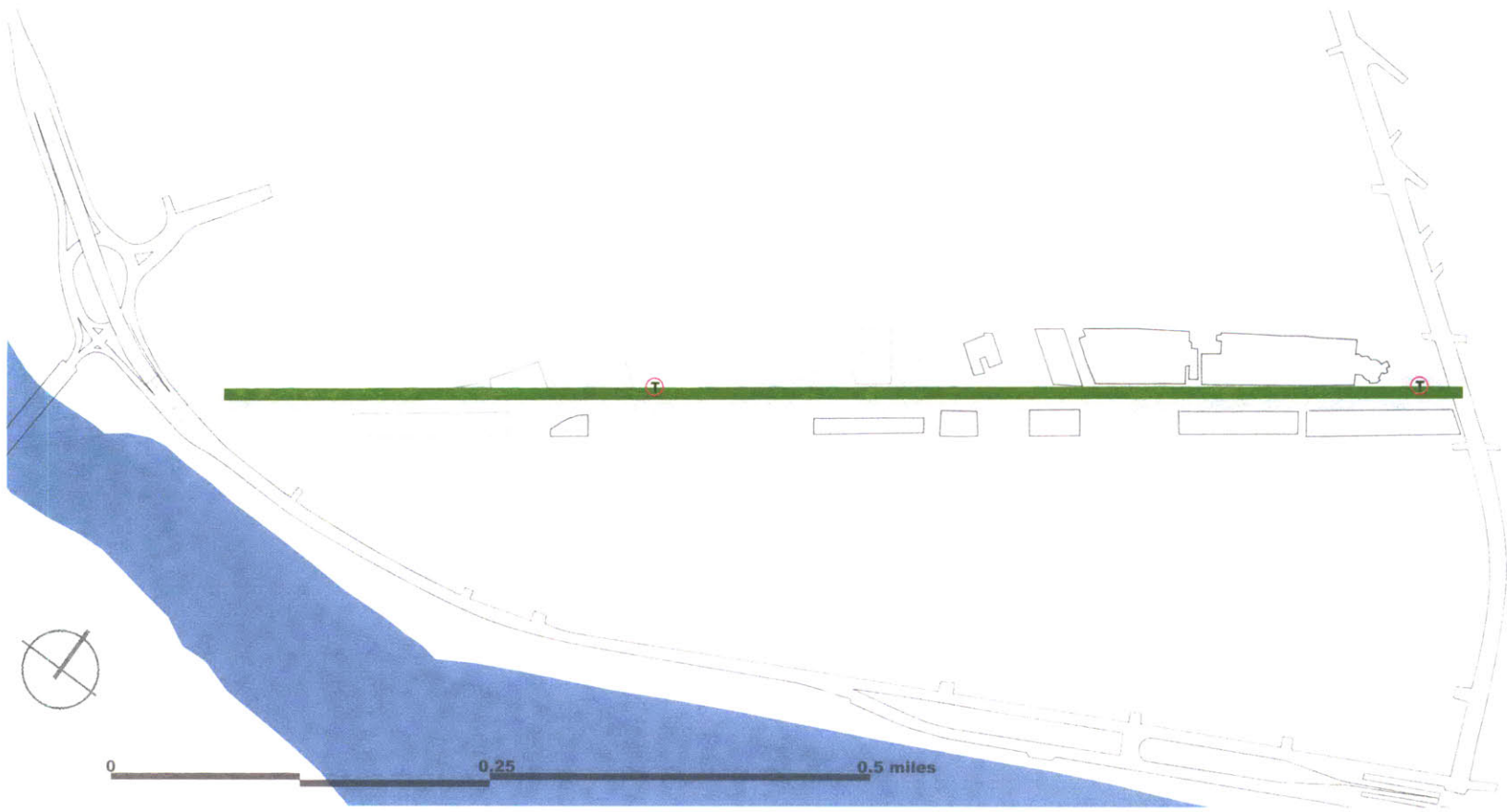
Concept model



**Along the tracks**

Only one rail track will be active and in use for light rail with two proposed stops at the length of the site. One stop is located at the Massachusetts Avenue crossing and the other at the Fort Washington Park. The area occupied by the second rail will be left as a continuous strip of wildlife. The site will be incorporated with the "Green Ribbon" trail system proposed by the Open Space Committee in 1999. This proposal calls for a multi-use pedestrian and bike path along the CSX tracks.

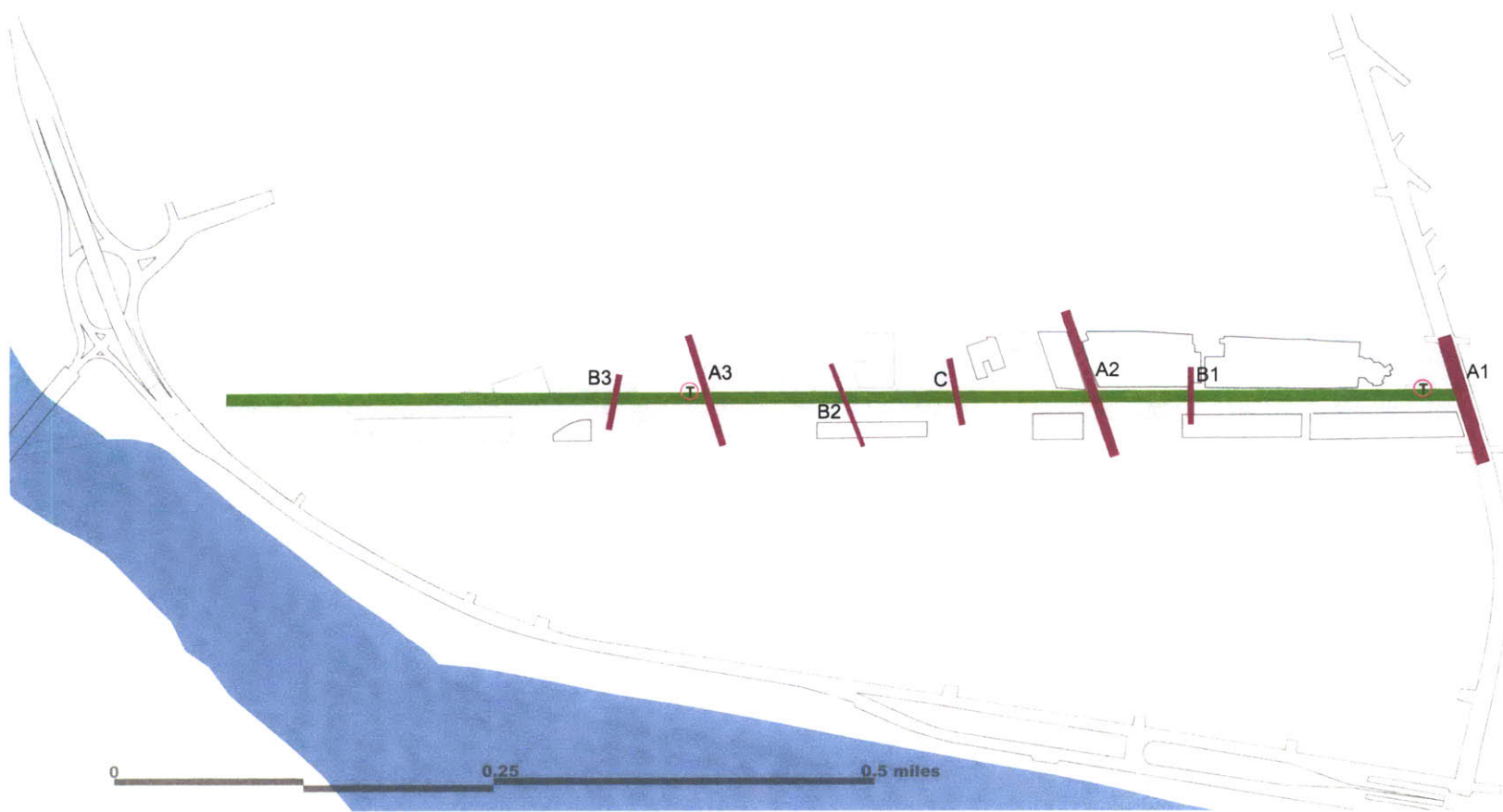




### **Across the tracks**

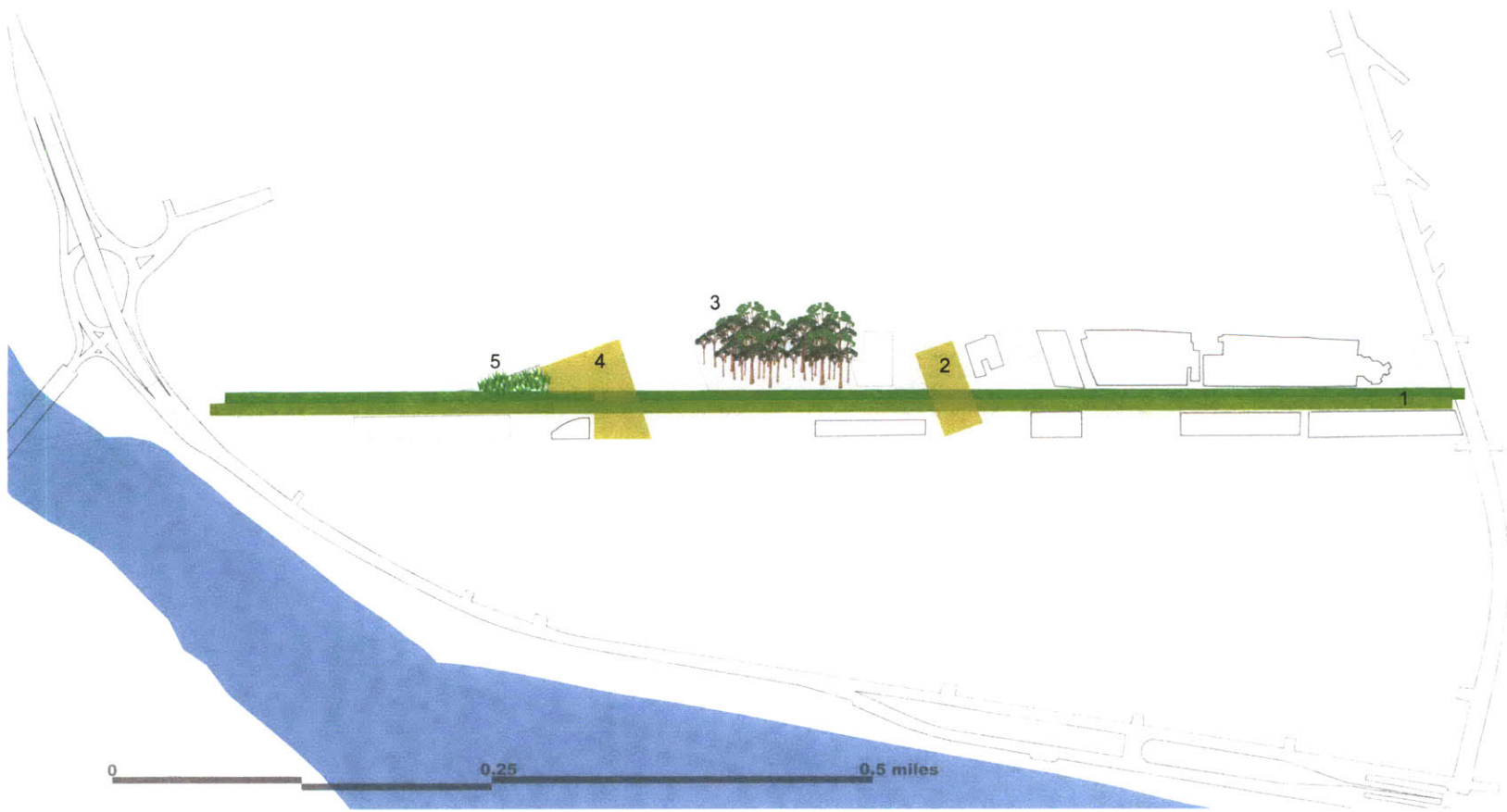
Multiple crossings along the length of the site are closely incorporated with other programmatic elements, which open opportunities to traverse the tracks at, above and below grade.

- A. At grade:
  - 1. Massachusetts Avenue (existing)
  - 2. Sidney Street
  - 3. Fort Washington Park (existing)
  
- B. Above grade:
  - 1. West Garage (existing)
  - 2. Simmons Hall
  - 3. Sky Garden
  
- C. Below grade:
  - Earth Maze



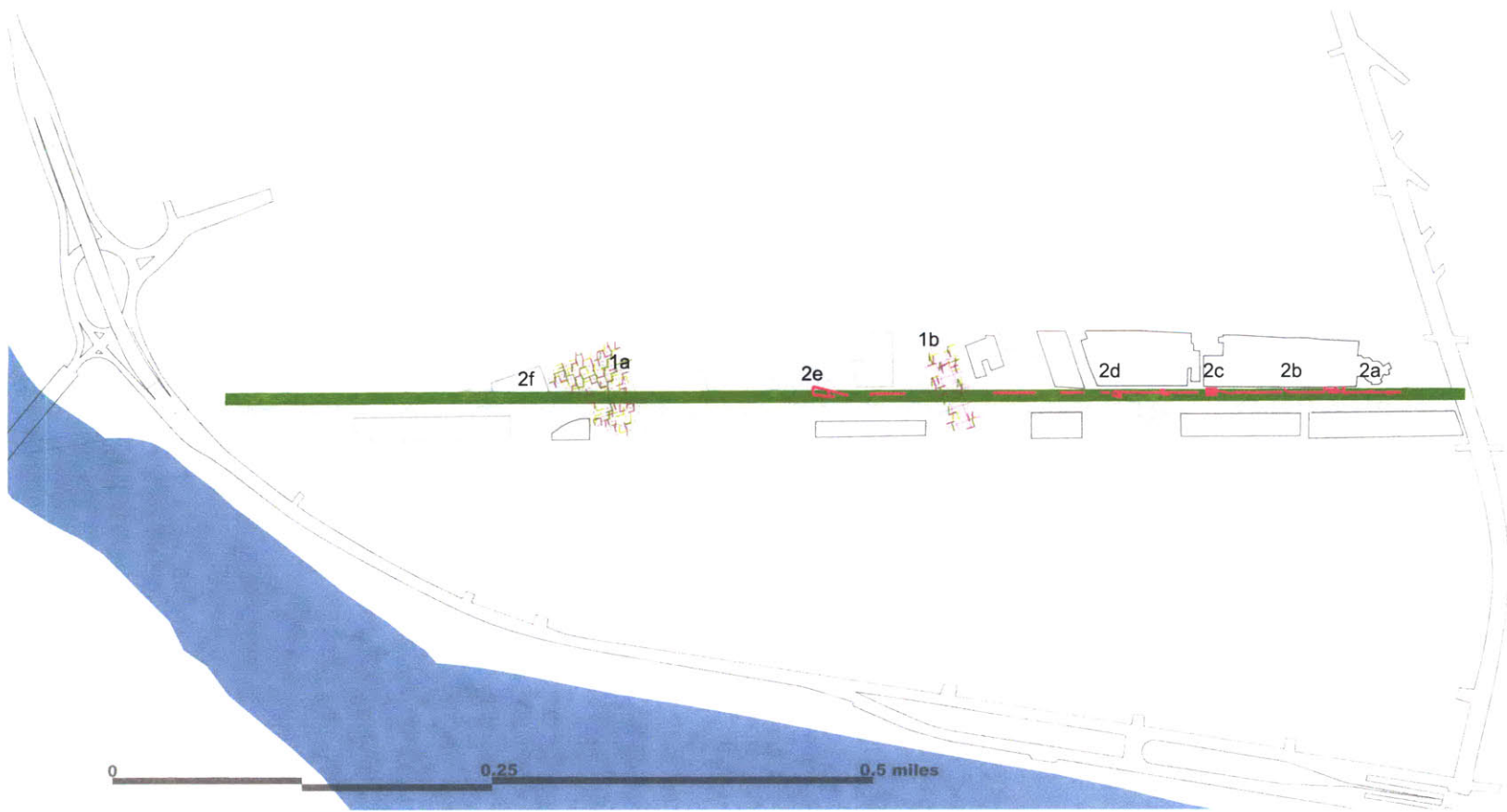
## Vegetation

1. Wild grasses strip stretches along the tracks through the entire site. It is trimmed once a year, but otherwise it is left unattended.
2. Winter garden is part of the Earth Maze element. It consists of series of water pools and its flora.
3. Mulberry tree grove is planted on a hill of excavations from Earth Maze. The top layer of the hill is fertile loam necessary for a thick grove of mulberries. Trees are planted 10 feet apart.
4. Phytoremediation area is a large space planted with fast growing phreatophyte poplar trees with purpose of cleaning the soil for future community gardening. The projected clean-up time needed is between 20-30 years. Hydrogardens are dispersed on scaffolding between the trees as temporary community gardens.
5. Spinach hill is a leafy vegetable garden field planted on the roof of the proposed farmer's market. The spinach is grown and harvested by scientists for research and by locals for food.



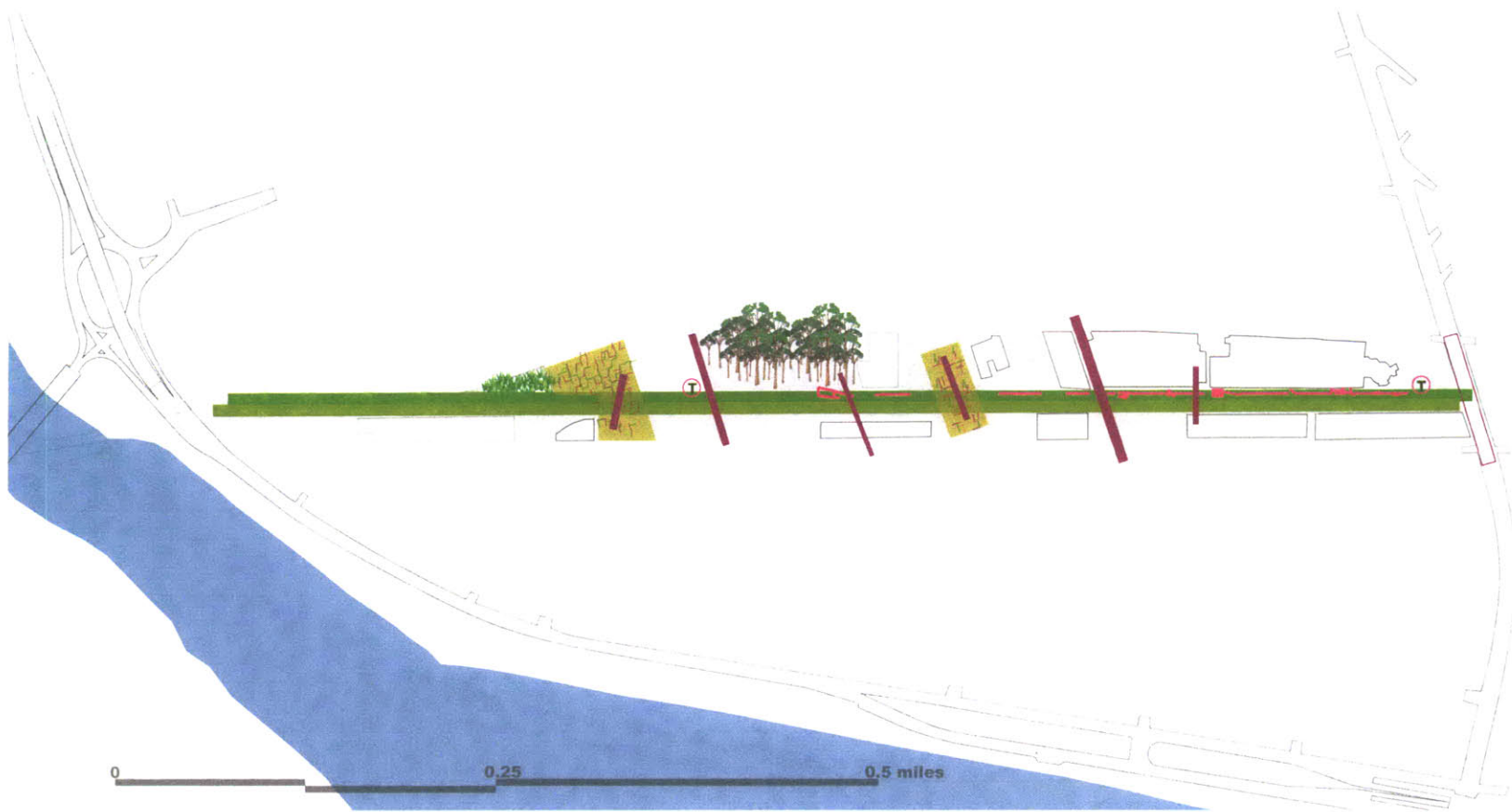
## Programmatic Elements

1. Scaffolding:
  - a. Sky garden scaffolding is a system of catwalks and stairs which host small parcels of community gardens. The system is up to thirty feet high. The scaffolding is organized into a three dimensional maze which leads through tree tops of the phreatophytes, and across the tracks.
  
  - b. Earth maze is the reversal of the sky garden scaffolding system. It hangs from the grid structure up to thirty feet deep, rather than reaching up into the sky. Together with the system of earth excavations it completes the maze which enables one to cross the tracks below grade.
  
2. Infrastructure fence is a linear element in contrast to the localized scaffolding. It is a continuous system of metal sheets of varying perforation densities which snakes along the buildings shielding them, while at the same time exposing chillers, pipes, gas tanks and other lab equipment. This element houses a series of follies that use lab waste and by-products for their effects:
  - a. Steam folly
  - b. Hot water folly
  - c. Magnet window
  - d. Plasma sound folly
  - e. Silk worms facility and mulberry hill
  - f. Spinach hill with the farmers market below

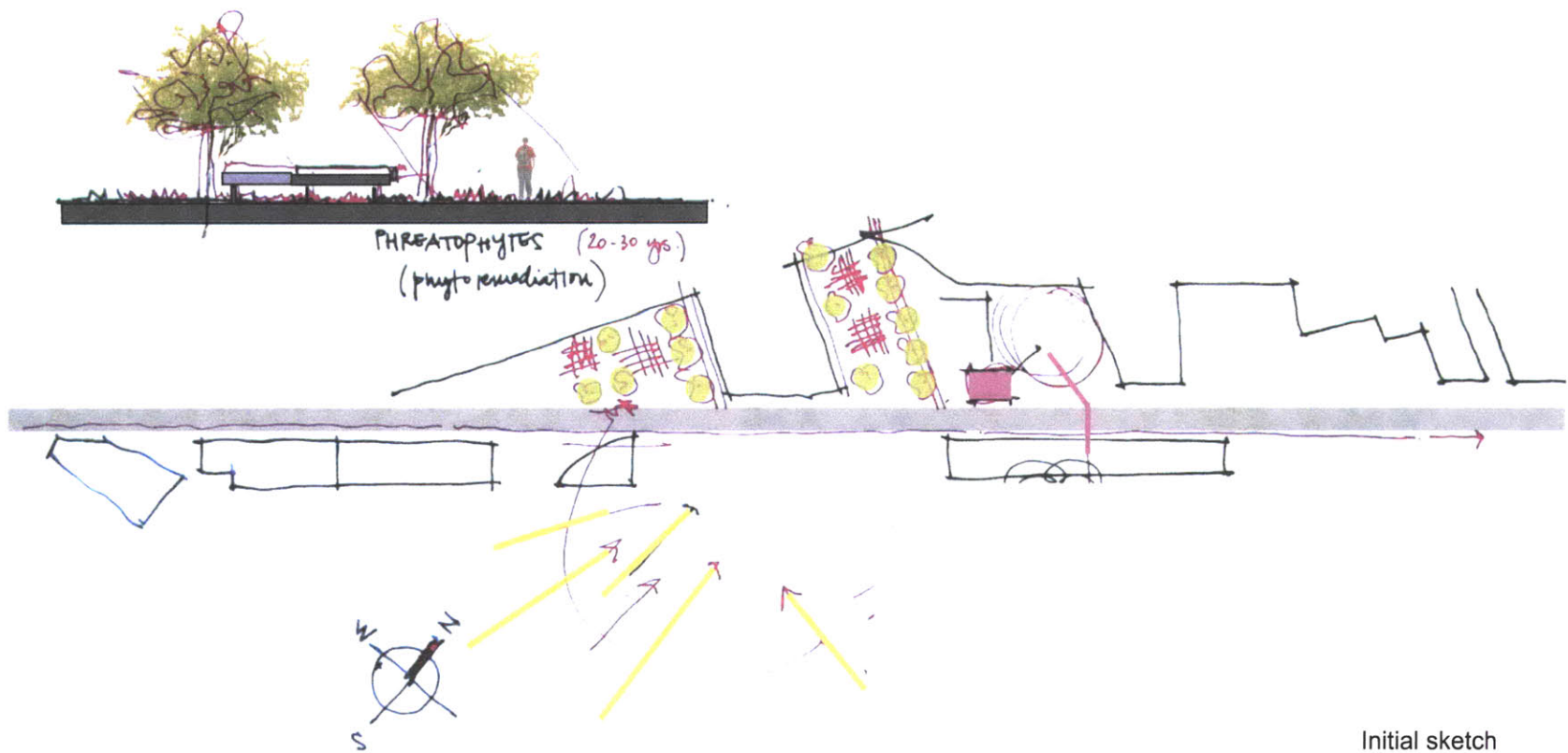


Site plan with all four systems



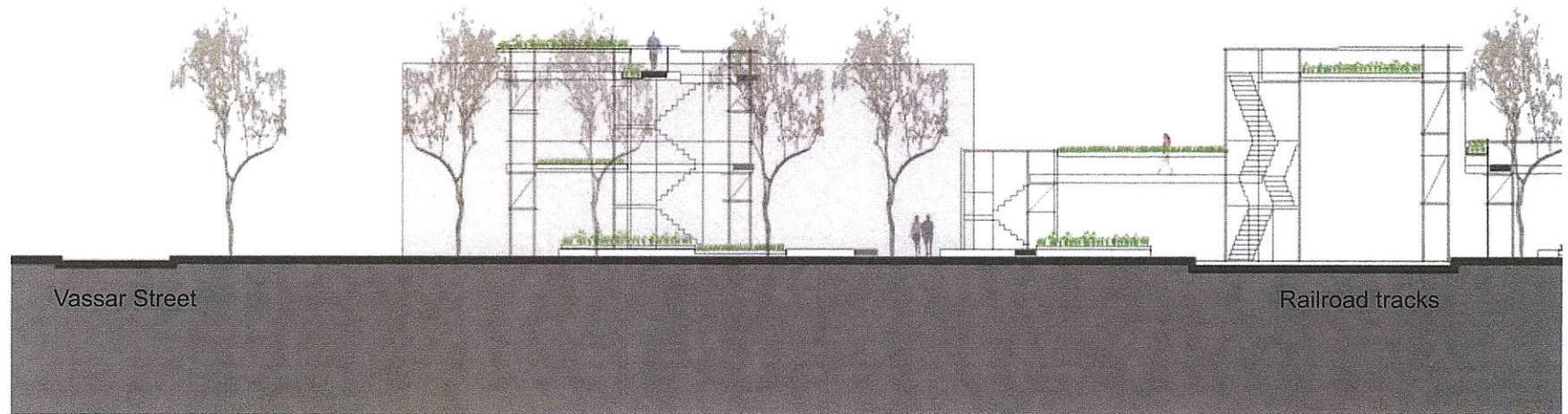


**Sky Garden**



Planning a community garden on the brown field site where soil is infertile and heavily polluted seemed as a daunting task. The problem could be resolved in two ways: one providing a quick fix of bringing a new layer of fertile loam, and the other long term solution that would require years of planning and organization to clean up the existing soil. The long term option was more appealing not only because it resolved the pollution problem almost completely but it also promised design challenges. Thus I proposed to plant phreatophyte poplar trees which are fast growing and have an ability to clean the soil from toxic materials within twenty to thirty years. The trees were to be planted on the grid at minimum of 15 and maximum of 60 feet apart. Within a few years they would reach their full height of 20 to 30 feet.

This portion of the project became a perfect opportunity to combine my initial interest in sky, as the only 'natural' (directly unaffected) element of the environment, with the highly artificial landscape of gardens. Since the existing soil was useless for gardening, the proposed vegetable lots could be raised from the ground and organized in any configuration that was desirable using only water and minerals for plant growth. Thus placing hydrogardens at different levels above the ground brought focus to the sky, to the artificial character of the process of gardening and to the poplar trees engaged in the environmental cleanup. The gardens are set within a system of scaffolding on three levels, from the ground to the treetops. The trees, scaffolding and the garden lots work together in creating a three dimensional maze which changes its character with seasons and over the years.



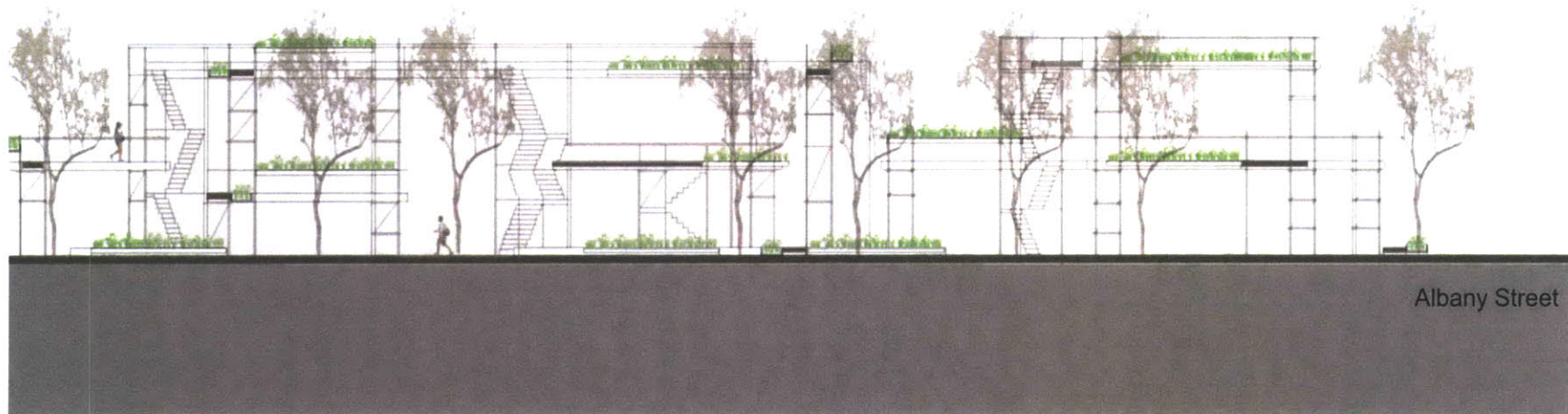


A standard garden lot size for the urban community garden is approximately 15x30 feet. The hydrogarden lots in this project are divided in narrow strips of 4x15 or 4x30 feet and are located along each catwalk.

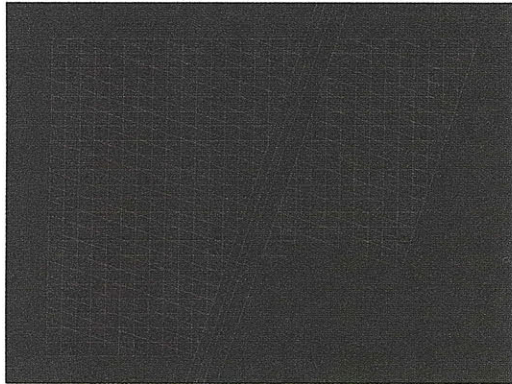
This temporal project is phased as following:

- Year 1            Planting of trees and installation of the lowest level of hydro gardens
- Year 5            Stairs and second level of scaffolding and garden lots are constructed
- Year 10           Third level of scaffolding and gardens are complete, the site can be traversed in the air.
- Year 20           Soil is clean and gardens can be planted on the ground. The scaffolding and the sky gardens remain as the three dimensional maze.

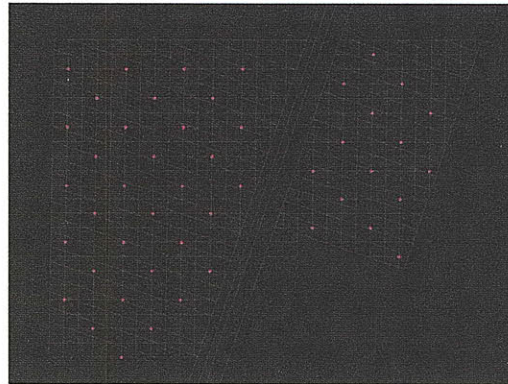
Cross section through sky garden shows how this playful system of gardens bridges over the tracks and allows for alternative and safe crossing of the railroad tracks



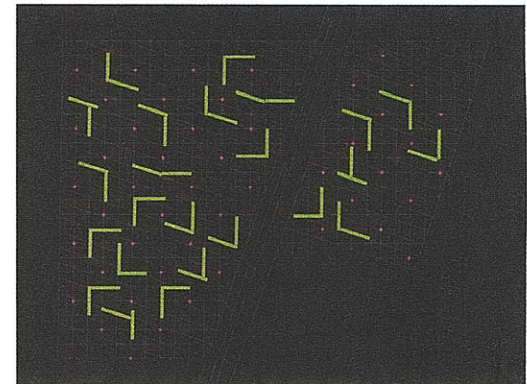
The grid is derived from the geometries existing on the site



Year 0:  
Poplar trees are planted

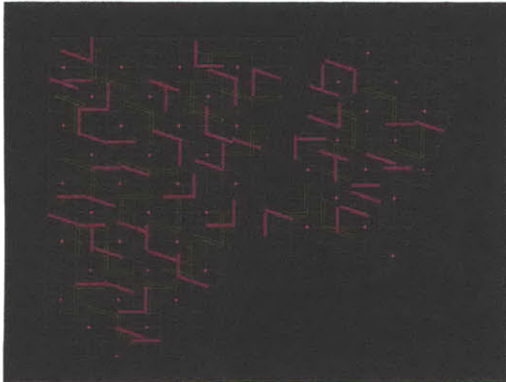


Year 1:  
First level of hydrogardens

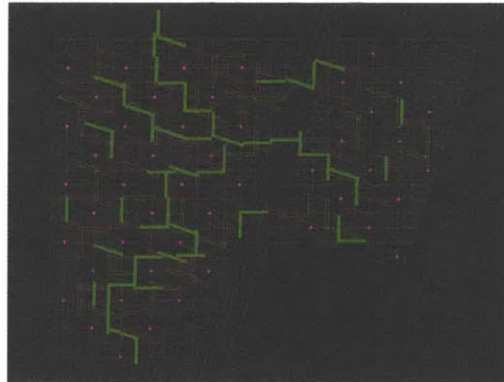




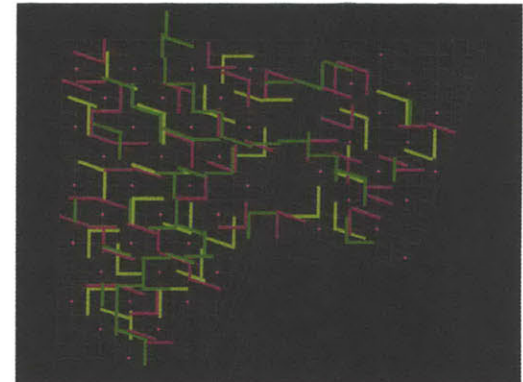
Year 5:  
Second level of gardens and scaffolding



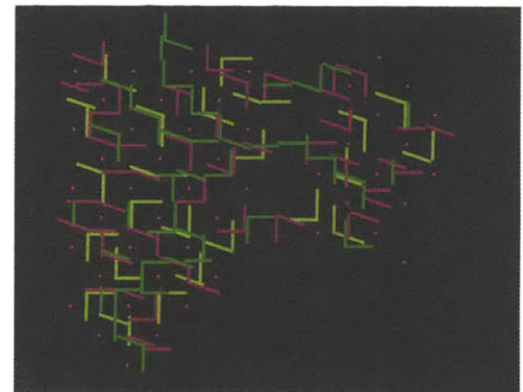
Year 10:  
Third level of gardens and scaffolding

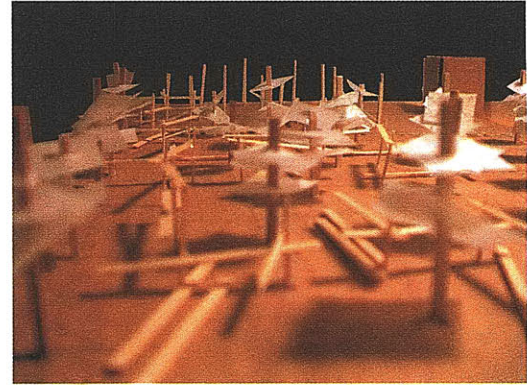
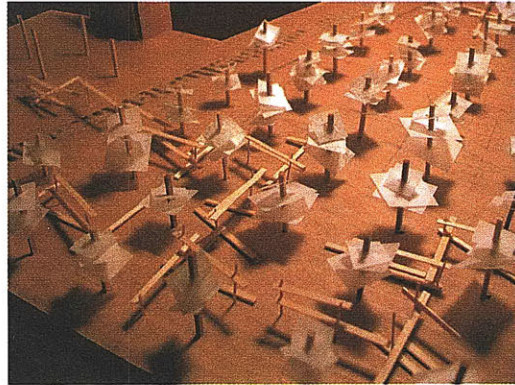
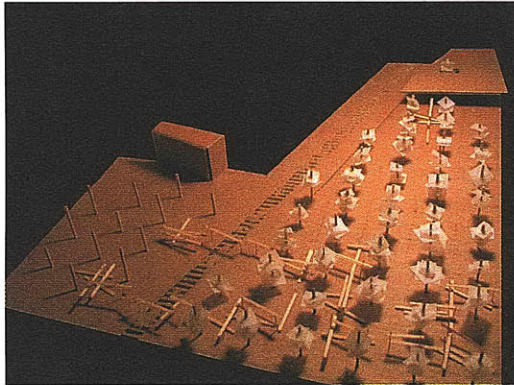


Year 15:  
All levels superimposed



Year 20:  
The soil is clean and gardens can be  
planted directly on the ground. Scaffolding  
and the sky gardens remain as another  
park folly



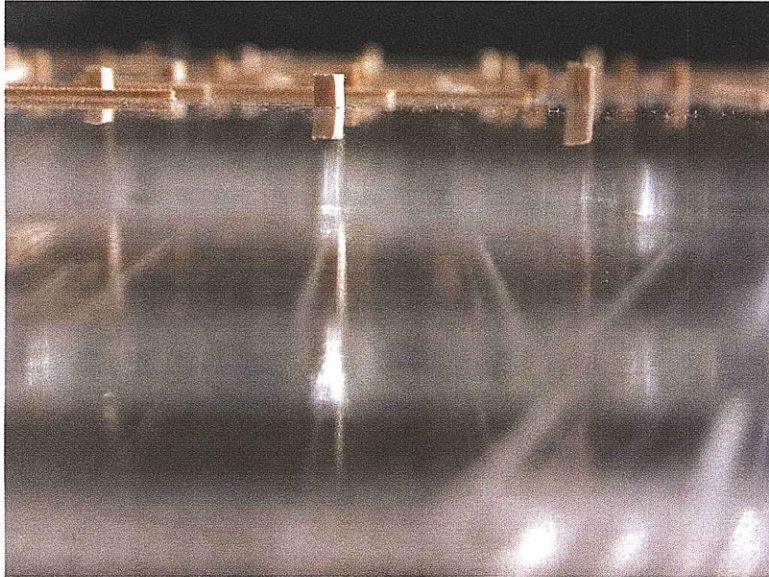


Three views of sky garden model with only a portion of scaffolding built

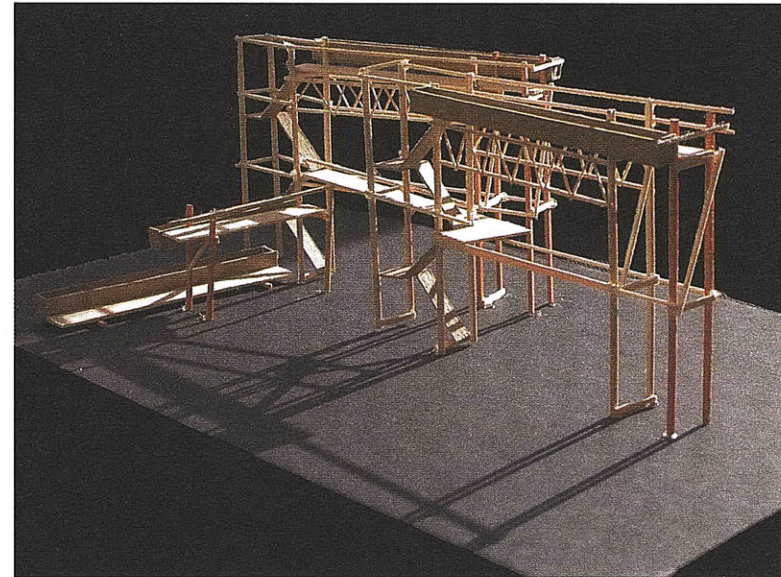


Initial sketch of a stroll through treetops



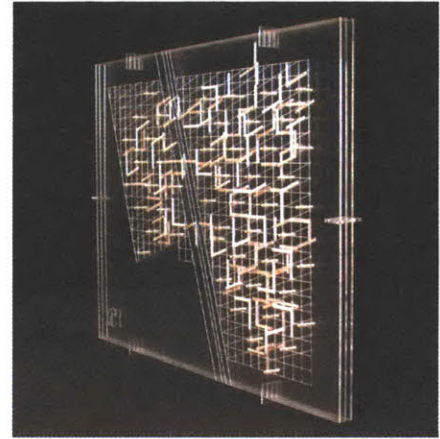
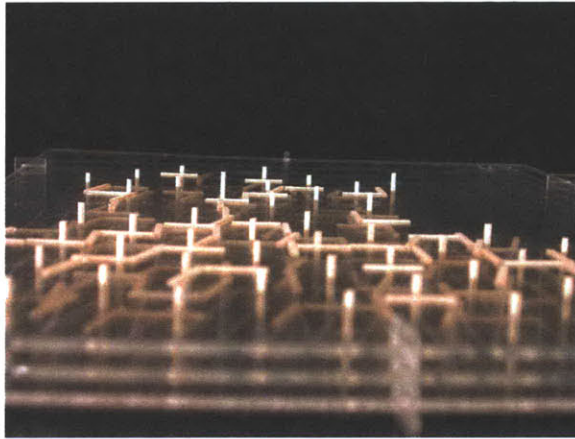
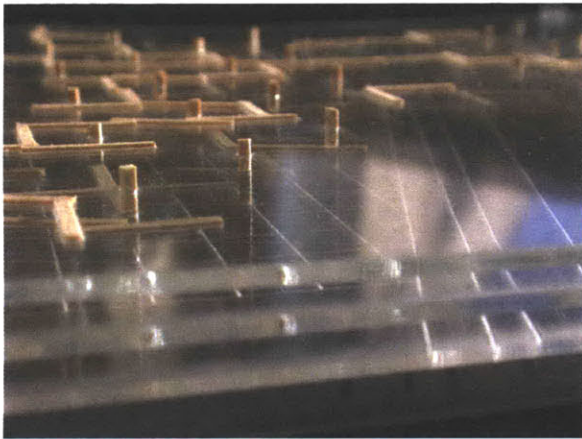


View of the sky garden time model



Model of a typical scaffolding construction for sky gardens with planting boxes at all three levels

Three views of the sky garden time model  
Each layer of plexi glass represents one phase of the project with garden elements shown in wood. Transparency of the model enables one to perceive the three dimensional nature of the maze at year 15.



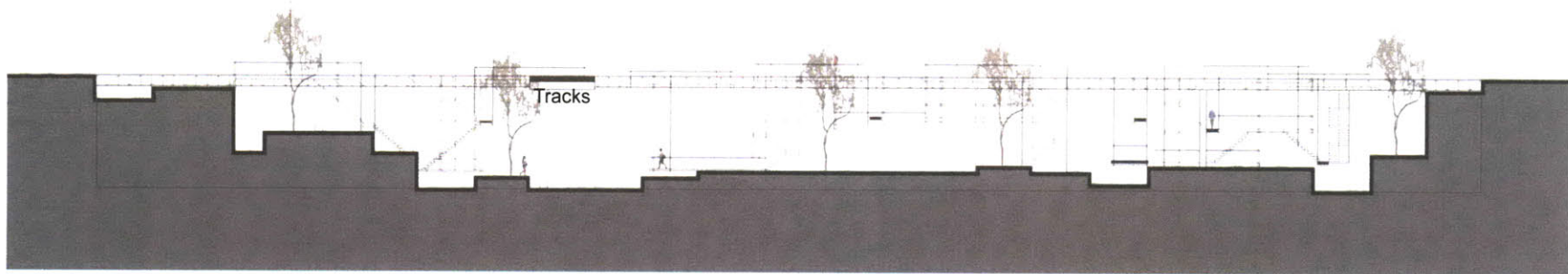
## Earth Maze



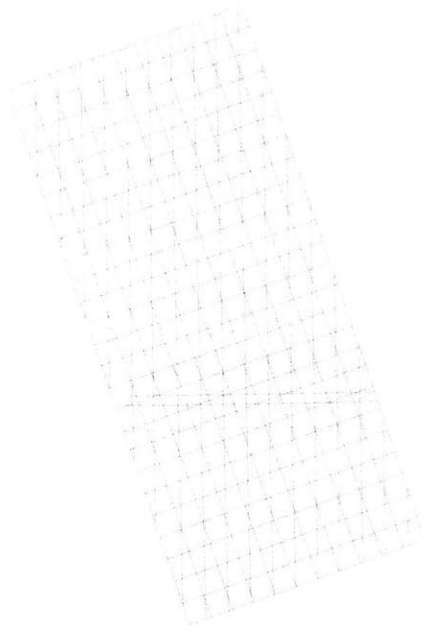
The earth maze is conceived as the opposite to the sky garden. While the hydrogardens reach into the sky, the catwalks of the earth maze stretch down into the excavated ground. Both use the same scaffolding elements, but where one rises up from the ground plane, the other hangs from the system of trusses below the ground plane. The earth maze addresses frequently forgotten fact that everything around is built on the landfill, that the entire environment is a result of industrial endeavors. The excavated ground is held back with the system of retaining walls some of which are made of thick glass that afford views into the layers of landfill, thus becoming framed archeological exhibits of the past developments.

The earth maze is composed of four major elements: the ground excavated to various depths, water pools at the lowest levels of excavations, and the system of scaffolding that hangs down from the structural grid. The ground and water elements cannot be reached or the area traversed without the system of scaffolding in place. Vice versa, one could not move across the area using only the system of scaffolding. One system supports and completes the other, creating a three dimensional maze in the ground that allows one to cross below grade from one side of the tracks to the other.

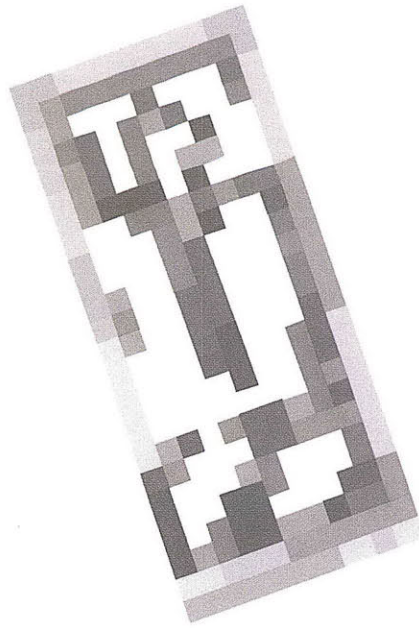
Longitudinal section through the Earth Maze



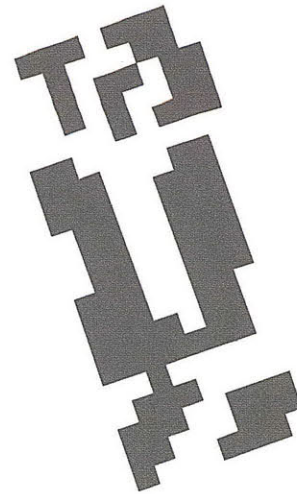
The grid



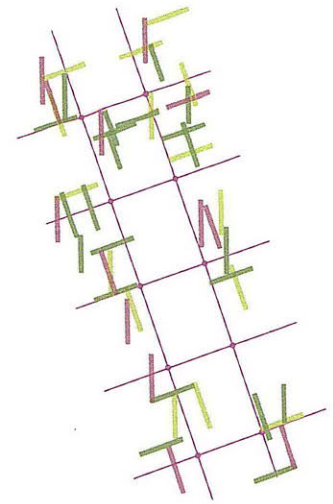
Earth layers



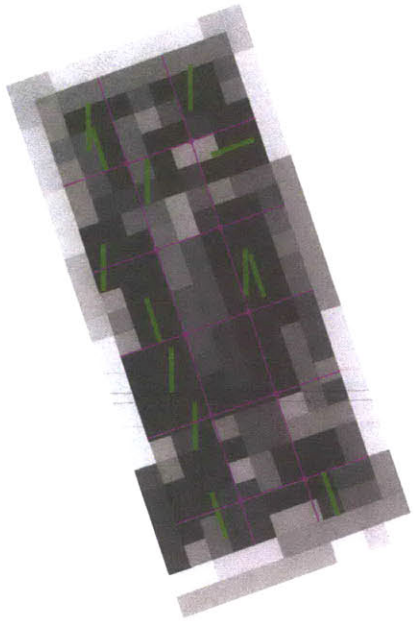
Water pools



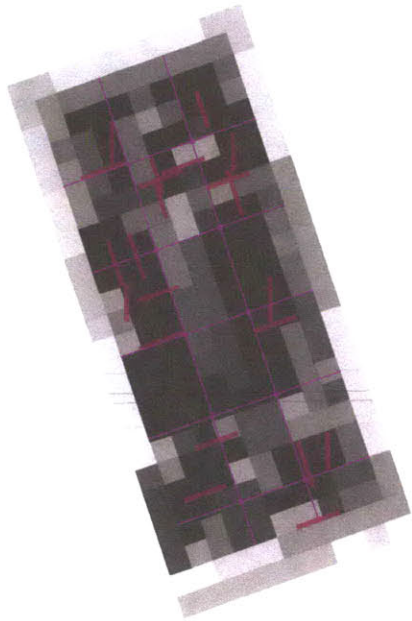
Structural trusses with suspended scaffolding



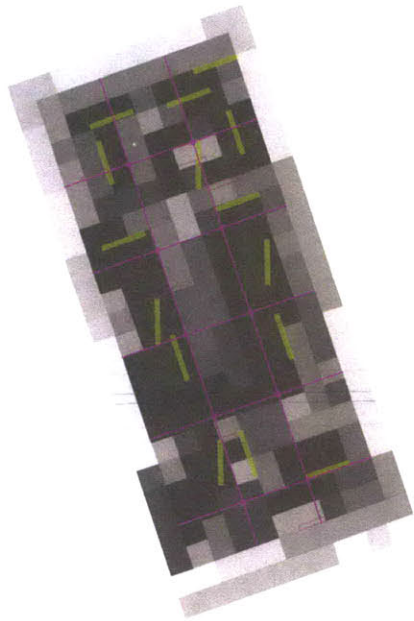
Top level of scaffolding



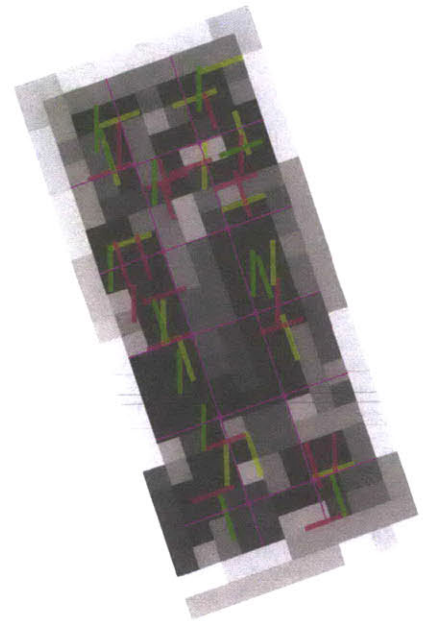
Second level of scaffolding reaches deeper into the earth



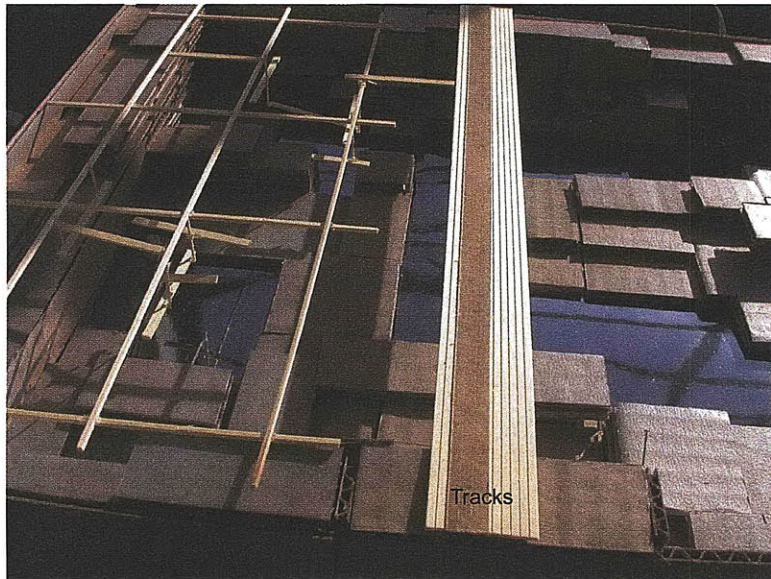
Lowest level of scaffolding leads one to the water pools



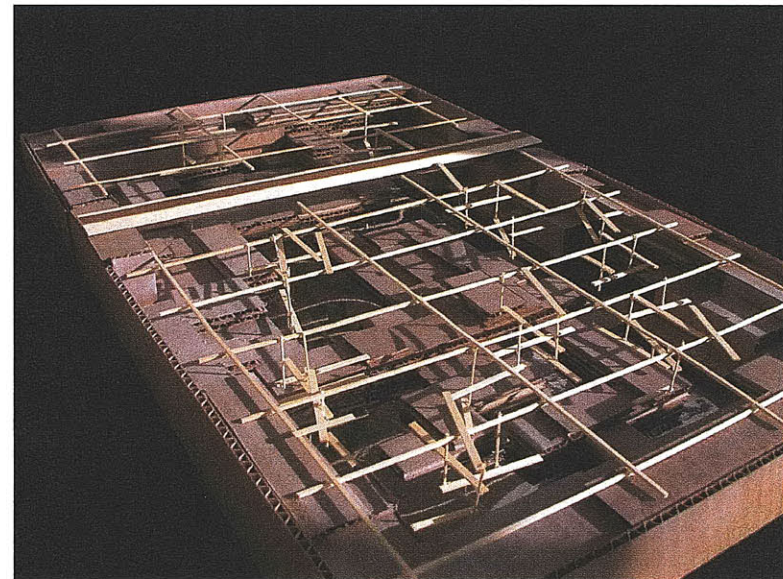
All levels of scaffolding and earth superimposed





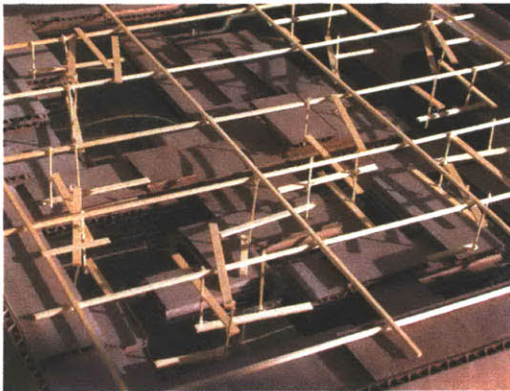


Earth maze model with the left side of the tracks shown with truss and scaffolding in place, while the right side is missing these elements in order to expose layers of earth and water

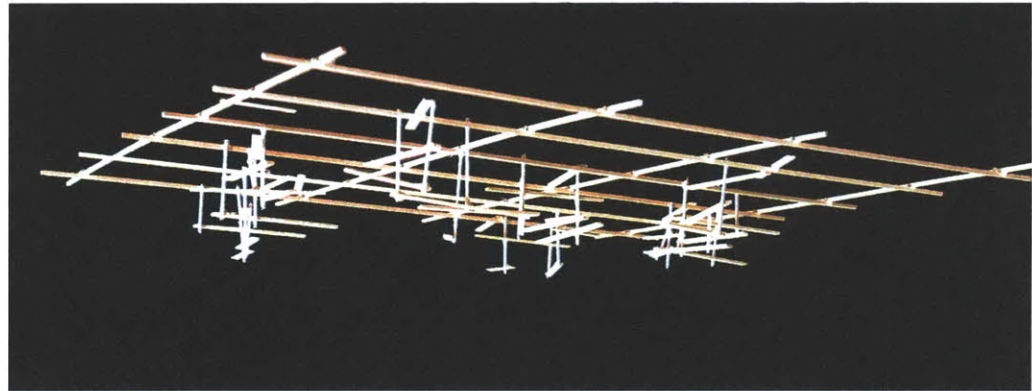


View of the Earth maze model looking North

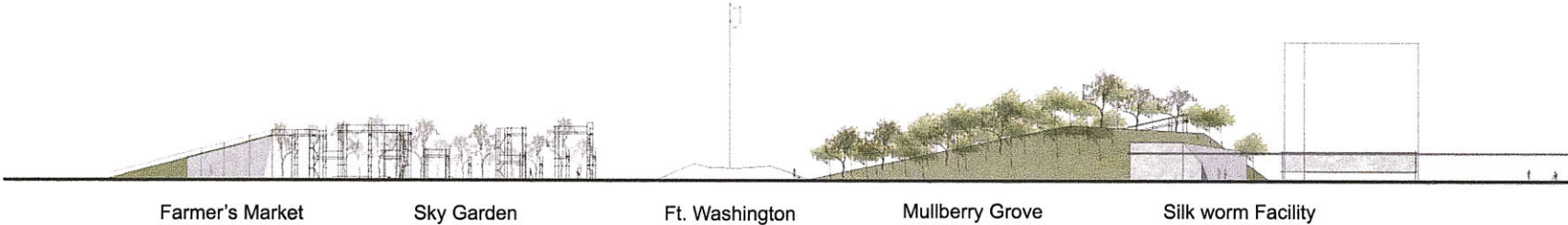
View of the Earth maze model



Scaffolding is hung from the system of trusses spanning between earth walls and posts at maximum distance of 60 feet making trusses at most 3 feet deep



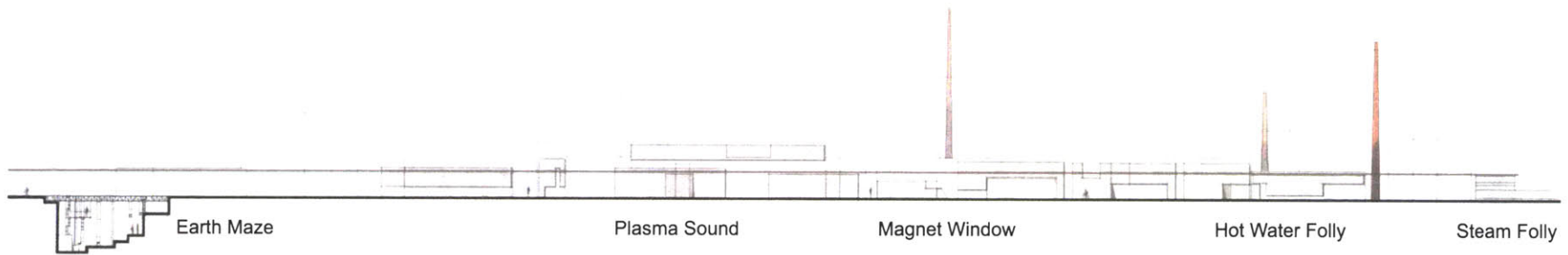
**Infrastructure Fence**





The fence element is linear, stretching almost the entire length of the site, accentuating the narrow and long character of this place, but providing several important events along its path. The fence is not continuous, but broken and frequently meandering around the tanks, chillers and pipes that support the research facilities on the site. The perverse character of this element comes from the fact that it conceals buildings and exposes the guts of the structures along the tracks, and furthermore it uses these infrastructural elements and it's by-products to empower a series of follies that are housed within its perforated walls. The section that stretches at the bottom of these two pages shows the location of the following follies:

- a. Steam folly
- b. Hot water folly
- c. Magnet window
- d. Plasma sound folly
- e. Silk worms facility
- f. Spinach hill

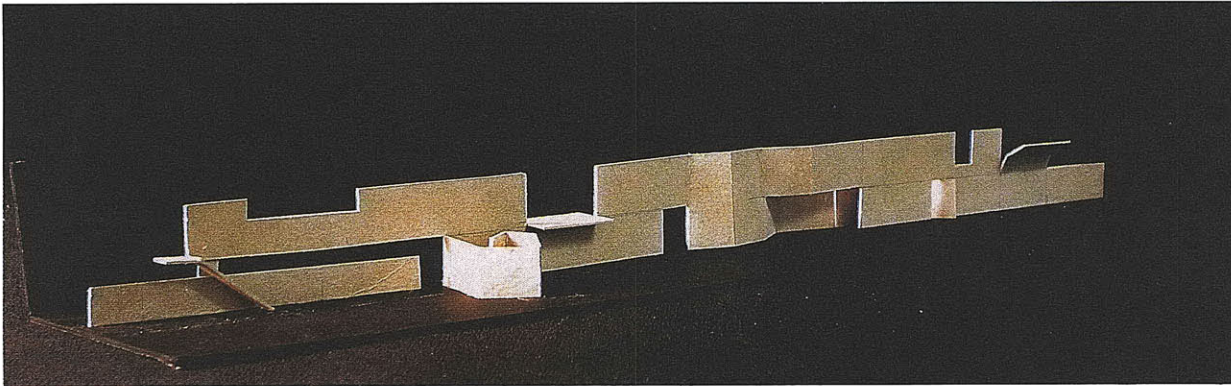


Section through the hot water folly with the magnet window in the background.  
The hot water is a by-product of the nuclear research center. Rather than being cooled the portion of the water is collected in the basin of the folly chamber allowing for the creation of a hot and humid micro climate. The remaining hot water is channeled along the fence to the silk worm facility.



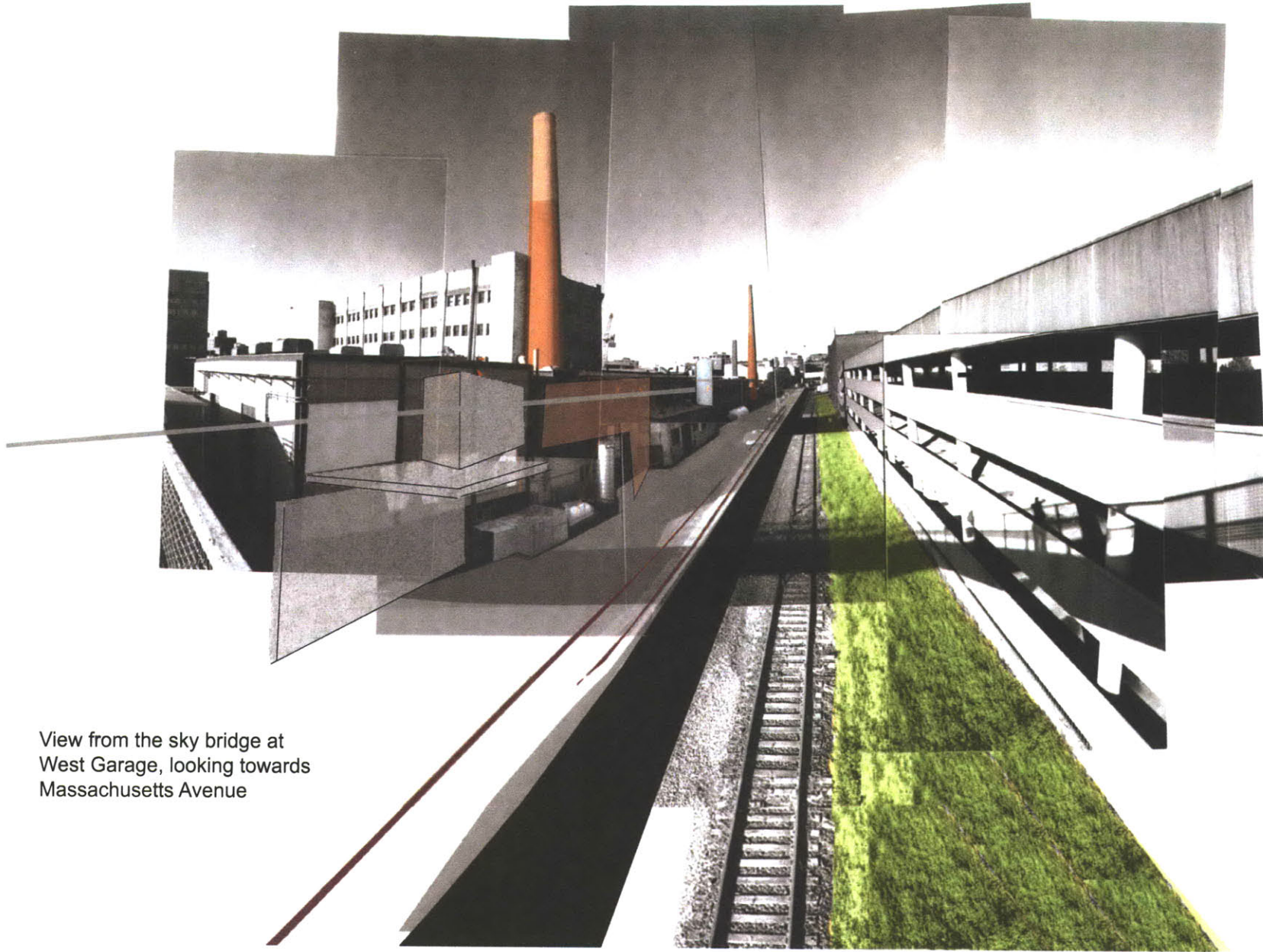
Section through mulberry grove with the silk worm folly below. Silk worms are grown by scientists for their fibers that inform nano technology research. The mulberry leaves are the sole diet for the silk worms. The Simmons' sky bridge connects the hall with the park across the tracks.



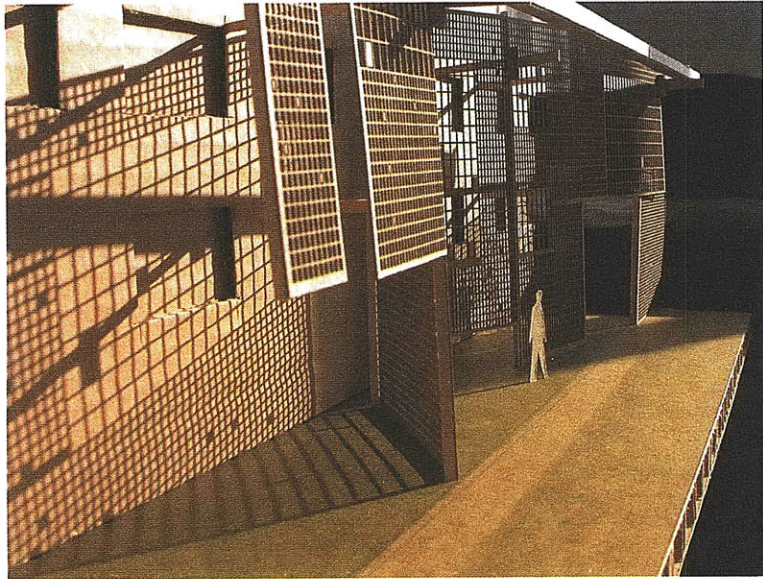


Study model of the fence element along research lab facades

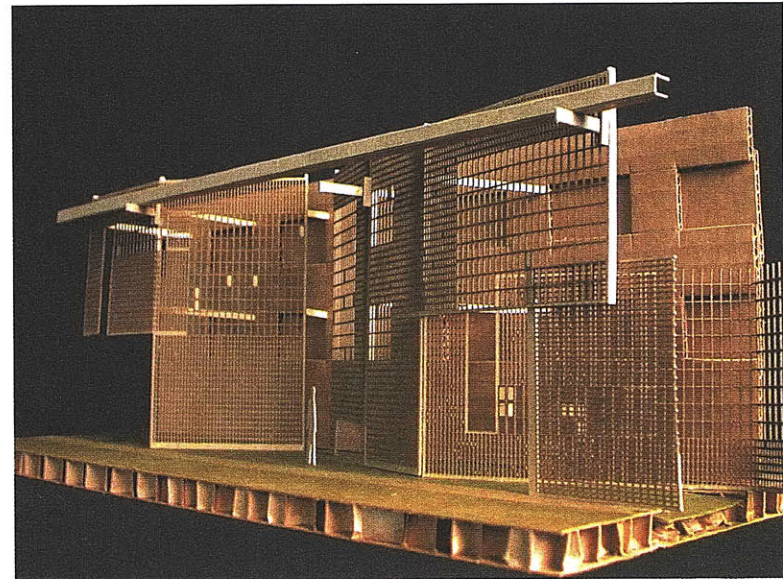




View from the sky bridge at  
West Garage, looking towards  
Massachusetts Avenue



Different fence perforation densities allow for varying penetration of light

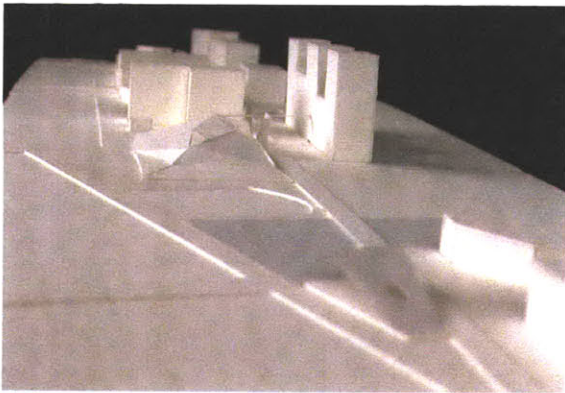


The fence meanders along the buildings' facades opening at infrastructure elements and engaging follies. The top of the fence holds ducts and pipes that support other programmatic elements down the tracks. For example, a pipe that stretches from the nuclear reactor channels hot water to the Silk worm Farm.

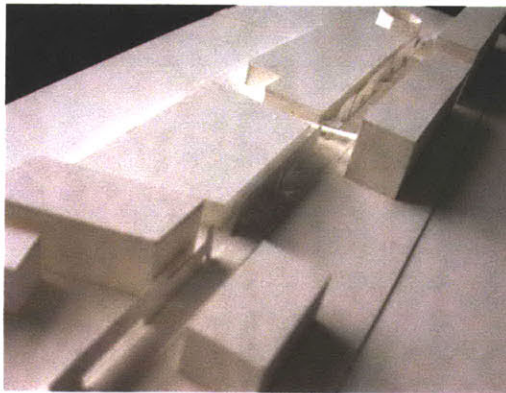


Three views of the overall site model built at the 1:200 scale

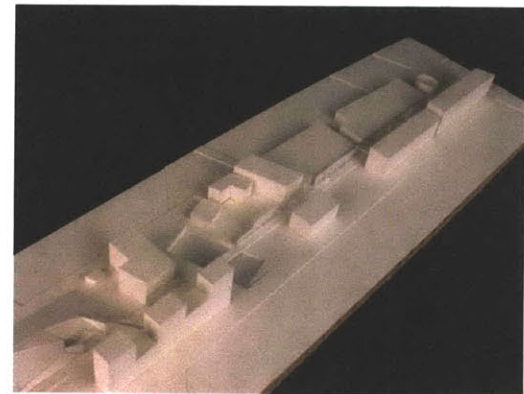
Looking from the Spinach hill towards Simmons Hall sky bridge and Mulberry Grove



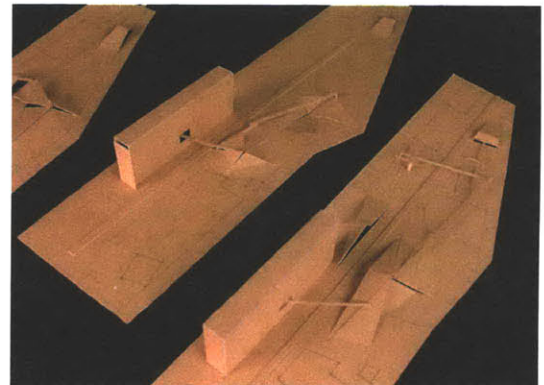
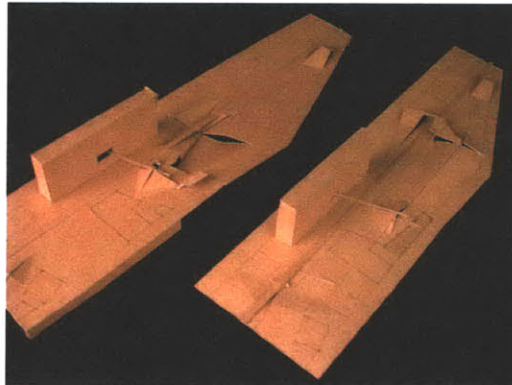
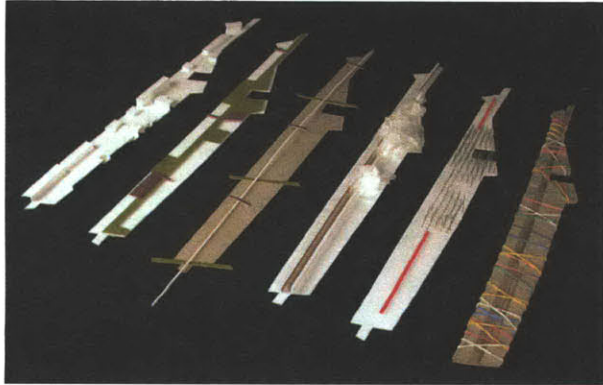
Infrastructure fence between buildings



Bird's eye view of the model looking towards Massachusetts Avenue



## Study Models



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