River Machine:
A Balcony for the City

A Thesis Presented for the
Master of Architecture
Degree
The University of Tennessee, Knoxville

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ACKNOWLEDGEMENTS

Thank you to my parents, without whom I would not have the opportunity to study this intriguing city.

ABSTRACT

The city of Knoxville, as it is today, lacks a certain level of connection with the Tennessee River. The goal of this thesis project is to identify the source of development away from the river, and to design a waterfront intervention, which will reflect community goals, as well as pay respect to the factors that have driven the development of Knoxville in the past.

Through the study of Knoxville's history, one can see a clear change in the geographical and social condition of the Tennessee River in Knoxville. Through the innovation of the Tennessee Valley Authority, the riverbanks were inherently changed. Through the introduction of an aspect of safety to the river, the city had the opportunity to grow into its new riverfront. However, development patterns are not easily changed, and the city of Knoxville continues to grow more in a Northern and Western trajectory, while downtown and The University of Tennessee remain virtually unchanged.

In the 1950s, the TVA completed work on a large infrastructural project to control the flow of the river, with the goal of producing hydropower, creating jobs, and improving quality of life in an agrarian society. Essentially, it was an economic experiment that resulted in an unprecedented change in the area. Knoxville has a very unique opportunity to engage a riverfront that does not flood, carry disease, and is reliably navigable for the first time in history. Many cities long for the opportunity to have the safety that Knoxville currently possesses.

The goal of the project, therefore, is to open up opportunities for Knoxville to develop in a new direction. The city can identify as a riverfront city, rather than simply as a city that happens to exist next to a river. The goal is to remove physical barriers from inhibiting public recreational access to the riverfront. It also includes some analysis of the urban fabric of Knoxville, in order to enhance access to campus and downtown riverfront sites. Two sites have been chosen to implement interventions, with connections between them.

TABLE OF CONTENTS

Chapter One : Knoxville, Tennessee 1
Founding of the City 1
The TVA: Impact 2
Opportunities 3
Chapter Two : Case Studies 6
Nashville, Tennessee 6
Hamburg, Germany 8
London, England 10
Chapter Three : Analysis of Physical Attributes of Site 12
Chapter Four : Design Strategies 19
Chapter Five : Conclusions 33
Works cited 35
Vita 38

LIST OF FIGURES

Figure 1.1. Diagram of dams along Tennessee River. 2
Figure 1.2. Aerial view of Knoxville in the Nineteenth Century. 5
Figure 2.1. Cumberland Park Riverfront development in Nashville. 7
Figure 2.2. HafenCity plinth strategy in contrast with traditional construction. 9
Figure 2.3. City of London Flood Plain map. 11
Figure 2.4. Aerial view of the Thames Barrier. 11
Figure 3.1. Ownership Diagram Map of Knoxville. 14
Figure 3.2. Primary Roads Diagram Map of Knoxville. 14
Figure 3.3. Secondary Roads Diagram Map of Knoxville. 15
Figure 3.4. Public Transportation Diagram Map of Knoxville. 17
Figure 3.5. Anchor Buildings Diagram Map of Knoxville. 17
Figure 3.6. Green Spaces Diagram Map of Knoxville. 18
Figure 4.1. Aspiration Diagram Map. 20
Figure 4.2. Master Plan. 23
Figure 4.3. Campus Site Plan. 25
Figure 4.4. Campus Site Plan, Section, Axon. 25
Figure 4.5. Rendering of raised highway experience. 27
Figure 4.6. Rendering of colonnade experience. 28
Figure 4.7. Downtown Site Plan. 30
Figure 4.8. Downtown Plan, Section, Axon. 30
Figure 4.9. Urban Balcony Rendering. 32
Figure 4.10. Urban Balcony Rendering. 32

CHAPTER ONE :
KNOXVILLE, TENNESSEE

Founding of the City

The city of Knoxville was founded by James White to become the political capital of the Southwestern Territory. The city was named for Henry Knox, Secretary of War in the Revolutionary War (History). It became an industrial power through three main factors. Railroads proved to be a strong draw for commerce. The river, while unreliably navigable, was also a means for commerce. Technology also provided a means for economic growth in the Tennessee Valley. Knoxville hosted the World's Fair in 1982. It was themed around energy, calling it the "Energy Turns the World" Fair. This highlighted Knoxville's prominent position in the field of energy production (History). Nearby, Oak Ridge National Laboratory currently employs over four thousand employees, and has worked on projects such as the Manhattan Project, as well as more current energy and sustainability efforts (ORNL). The Tennessee Valley Authority is also headquartered in Knoxville, and specializes in hydropower, dam building and maintenance, coal-fired power plants, and nuclear power (TVA).

The TVA: Impact

The Tennessee Valley Authority was established under Franklin Delano Roosevelt's New Deal legislation following the Stock Market crash of 1929. In 1933, legislation was passed to provide funding for an economic experiment in the Tennessee Valley ("Our History"). The goal was to generate hydroelectricity while creating jobs and improving standard of living in a largely depressed agrarian society. "Its first responsibility in operating its dams and reservoirs is flood control and navigation improvement" (Kyle, 4). A large part of this effort included the construction of hydroelectric dams along the Tennessee River, as well as reservoir dams in surrounding areas. As shown in figure 1.1, the river now has nine dams between Knoxville and Kentucky.

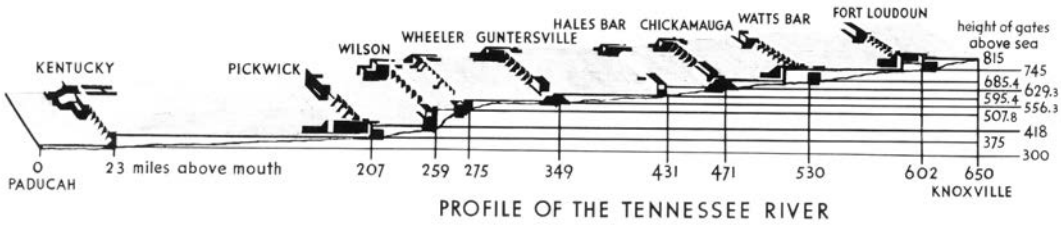


Figure 1.1. Diagram of dams along Tennessee River. (TVA)

This intervention has had a large impact on many aspects of the Tennessee Valley. Most importantly, the Tennessee River has become a highly controlled series of reservoirs. The water levels are controlled along the entire system, to work as a functioning unit to generate energy while also maintaining a certain condition of the riverbanks and the riverbed. This allows for easy navigation down the river, towards the Mississippi River. Each river dam has included within its construction a lock to allow for safe passage through the dam.

In addition to the introduction of navigation and flood control, the TVA interventions have reduced the risk of disease spreading through contaminated waters. Between the elimination of flood risk, navigation hazards, and disease, the river is altogether a much safer environment for public use.

Opportunities

The city of Knoxville has a unique opportunity within her grasp. There are many cities that try to combat the effects of flooding and tidewaters, but very few that can definitively say that they have won the battle. The change in the urban fabric of Knoxville since the TVA enacted

its interventions is insignificant, as one can see in figure 1.2. Knoxville once had a highly contentious relationship with the natural resources in the area. The river was unreliably navigable, but was subject to flooding due to soil destruction from years of overuse (Kyle, 4). For this reason, it was mainly a utilitarian asset not viewed as a natural resource. Through human innovation, that relationship has changed. Knoxville has a chance to redirect the development patterns that have been in place until now, but there are still some obstacles in the way of allowing public recreational use of the riverfront. There is a large, fast moving, four-lane road that runs along the riverfront all the way across the campus bank as well as the downtown riverbank. Additionally, downtown "proper" is approximately one hundred feet above the riverbank in elevation. With these physical barriers in the way of developing a pleasant riverfront experience, one must begin to think of the development of the riverfront in Knoxville as a design problem.



Figure 1.2. Aerial view of Knoxville in the Nineteenth Century. (History)

CHAPTER TWO :

CASE STUDIES

Case studies are a useful tool for designers to understand relationships, as well as precedents for a particular type of design. This project requires qualification of the aforementioned design problem. This chapter will highlight similar conditions in other places, in an attempt to draw conclusions from previous attempts to solve certain design problems.

Nashville, Tennessee

The city of Nashville, Tennessee is in a contextually similar place to Knoxville, but it was not part of the TVA projects. It sits on the banks of the Cumberland River. The design to engage the East and West bank of the river is designed by Hargreaves associates (Meinhold). It includes an area for children to play, as well as areas that families can enjoy. The design was inspired by the natural geology of the area, so it is inherently contextual (Meinhold). In figure 2.1, one can clearly see the relationship

between the park, the river, the city, and the main transportation routes. Spaces are defined through landscaping and pathways.

In Nashville, the downtown area sits directly adjacent to the riverbank. First Avenue runs parallel with the river, but Second Avenue, one block away, is treated as one of the main thoroughfares. First Avenue, therefore, consists of many of the back-of-house functions for the venues that operate out of Second Avenue. This treatment of the riverfront avenue is indicative of how Nashville does not identify with the river.



Figure 2.1. Cumberland Park Riverfront development in Nashville. (Meinhold)

Hamburg, Germany

Hamburg, Germany is an industrial and commercial powerhouse. It sits on the Ruhr River, which brings in much of the trade for the city. Hamburg is also no stranger to flooding. The city, over time, has implemented a series of dikes and levees to protect the center city from encroaching waters ("Flood Secure Bases"). However, there is a new development outside of the protected area called HafenCity. As a solution, rather than implementing the dike and levee system further, HafenCity is designed to be built entirely on plinths. These plinths will sit above flood levels, taking a passive approach to the problem of flooding. Rather than trying to prevent floods altogether, this project seeks to find a way that floodwaters and development can coexist. Additionally, by foregoing a new dike system, sightlines out to larger bodies of water can be preserved. The plinths also provide space for underground parking to serve the buildings ("Flood Secure Bases").

The plinth system has been mandated through the contractor and developer responsibility, so as HafenCity continues to grow, as will the plinth system ("Flood Secure Bases"). This case study shows how a city can implement an alternative way to think about flooding. In figure 2.2, one can see how the buildings are raised above the level of the flood waters.

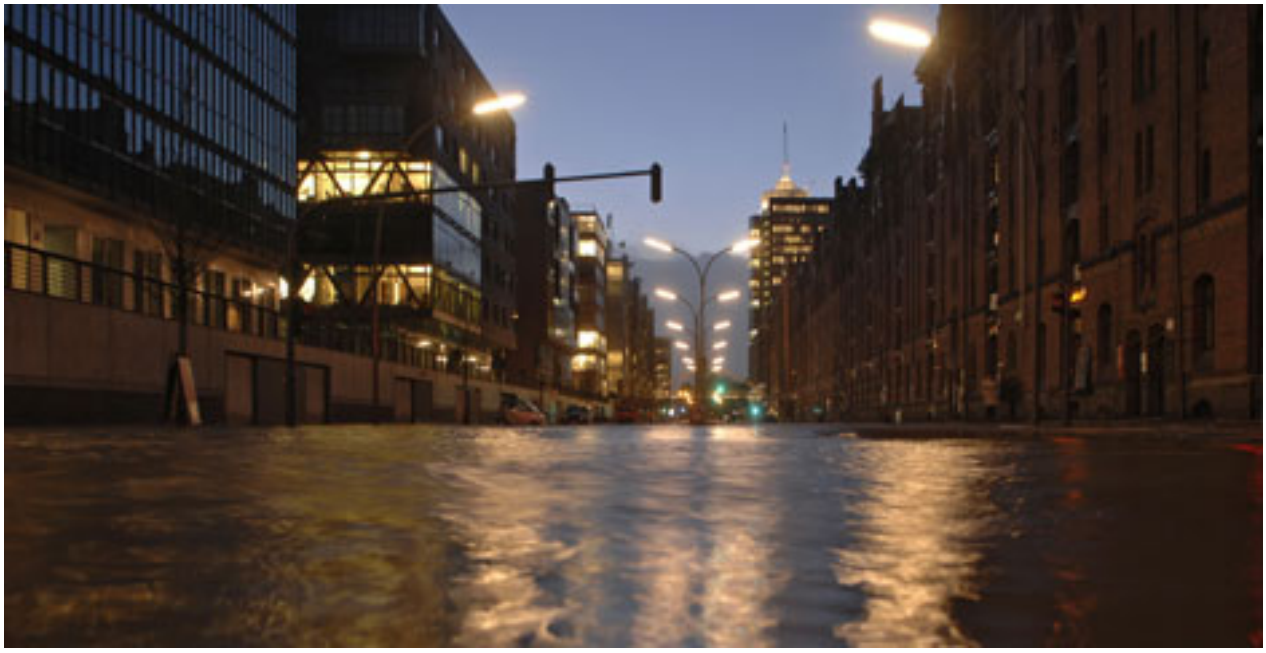


Figure 2.2. HafenCity plinth strategy in contrast with traditional construction.

("Flood Secure Bases)

London, England

The city of London, England sits on the Thames River. Throughout history, it has had a series of devastating floods. In particular, one flood in 1956 lead to a series of legislative moves to begin funding for a protective system for the city ("Timeline"). Figure 2.3 shows the flood plain of London. One can see that a flood of some severity would encompass much of London, to great detriment.

In response to the great risk posed by tidal floods, the Thames Barrier was built to protect the city of London. It operates to control the water flow, preventing tidal surges from reaching London. In a similar manner to the TVA, the Thames barrier has allowed the city to enjoy a relatively safe relationship to the River Thames ("Thames Barrier Project"). Figure 2.4 is an aerial view of the Thames Barrier. This intervention has allowed for the continued development of the riverfront. The Thames Riverwalk is a system of pedestrian trails along the river in the city to encourage pedestrian traffic along that route. Many of the walkways are raised above water level, however, disallowing direct access to the water ("Thames Path").

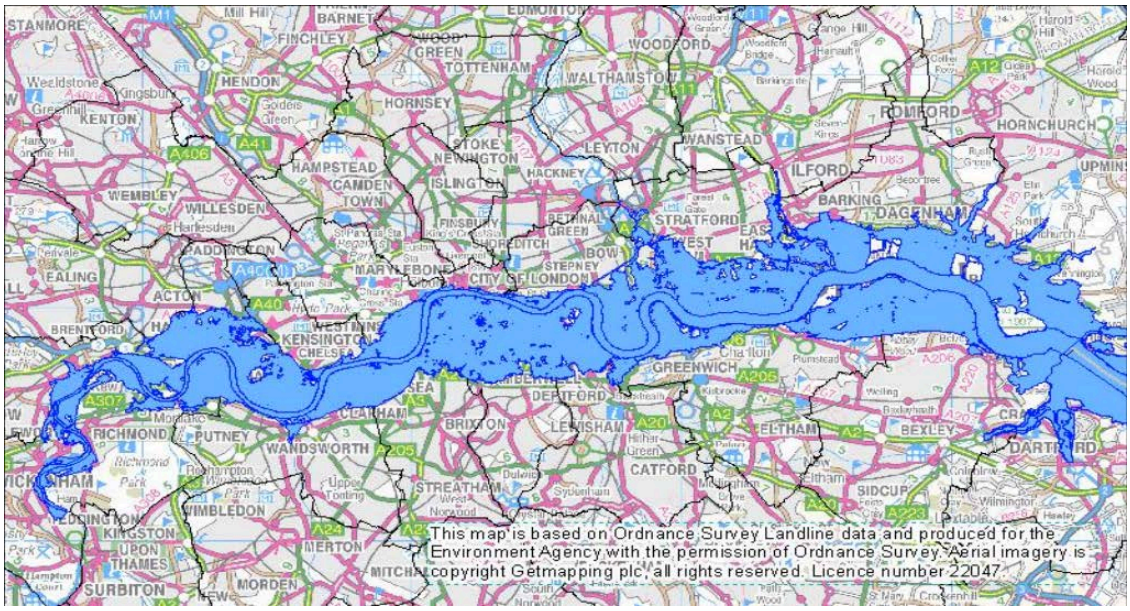


Figure 2.3. City of London Flood Plain map. ("Thames Barrier Project")



Figure 2.4. Aerial view of the Thames Barrier. ("Thames Barrier Project")

CHAPTER THREE :
ANALYSIS OF PHYSICAL ATTRIBUTES OF SITE

Before implementing any type of design on a site, it is imperative to understand what exists there. Therefore, a thorough analysis of the place, with relationship to the urban fabric of Knoxville is a driving factor of the project. Initially, one must understand ownership of the city. Districts are one of the most important factors in urban design, according to Kevin Lynch in his book *The Image of the City* (65).

In being able to understand the ownership and districts of the city, one can start to respond in a dynamic way to the complex dynamics of a city. The highlighted area is the campus of The University of Tennessee. The campus has a much different urban condition from the downtown area. It is much more pedestrian friendly, and has more of a landscaped atmosphere. Meanwhile, the downtown area is much more dense, with small dedicated areas of green, and otherwise a very "hardscaped" atmosphere.

Primary roads are the main means of connection between districts of the city. Figure 3.2 diagrams their locations. These axes across the city of Knoxville will figure into the final design of the riverfront intervention

strategy. They allow the inland portions of the city to relate to the river in some way. They literally draw a line connecting pieces of the city that otherwise do not relate to one another.

In conjunction with the primary roads of a city, secondary roads provide an extra level of connection through the city. One will notice in figure 3.3 that many of these secondary roads also provide a connection between the riverfront and the primary roads, or connection between primary roads themselves.

In understanding the connections across the city, one can begin to understand what makes a city work. The phrase 'urban fabric' refers to the metaphor one can draw between cities and textiles. Each small thread in the fabric ties to the next, creating a wide sheet that holds together through the strength of it's smaller parts. The characteristics of the fabric are given through the color, size, and material of the threads involved. In much the same way, a city operates through the use of it's smaller parts – blocks, roads, parks, buildings, building materials, sidewalks, and many other factors. A city gains it's unique character through the treatment of these contributing factors.



Figure 3.1. Ownership Diagram Map of Knoxville. (Map: KGIS)



Figure 3.2. Primary Roads Diagram Map of Knoxville. (Map: KGIS)



Figure 3.3. Secondary Roads Diagram Map of Knoxville. (Map: KGIS)

Public transportation is a means of transportation for many people. The city of Knoxville has a bus system that runs throughout the city. Not only do public transportation systems provide a cost-effective means of transportation, but they also reduce traffic on the roads. Figure 3.4 is a diagram summary of multiple routes that run through the chosen portion of Knoxville.

Buildings are an inherently important factor in the structure of a city. They define traffic patterns, density, and overall style of a city plan. Figure 3.5 diagrams the locations of the anchor buildings for this project. In essence, these are buildings that proved important to the design of the project.

Finally, green space is essentially the void within the density of the city. It provides a reprieve from the hustle and bustle of the city. It is an imperative part of any urban plan, as it helps to determine the center of activity for a city. Parks improve quality of life for a city's inhabitants. Figure 3.6 is a diagram expressing the green spaces in the chosen portion of Knoxville.

Infrastructure
Public Transportation



Figure 3.4. Public Transportation Diagram Map of Knoxville. (Map: KGIS)

Infrastructure
Anchor Buildings



Figure 3.5. Anchor Buildings Diagram Map of Knoxville. (Map: KGIS)



Figure 3.6. Green Spaces Diagram Map of Knoxville. (Map: KGIS)

CHAPTER FOUR :
DESIGN STRATEGIES

In view of the given information about the site, a broad set of ideals was created to guide the formation of the project. Location of interventions, depth of interventions, and program of interventions were all considered through use of these ideals. Figure 4.1 diagrams on a map the physical locations of these given aspirations. The diagram outlines potential locations for connection to the river, as well as the locations of natural resources, and existing infrastructural connections. Primarily, connection to the river can be achieved through utilization of geographical conditions. The natural resources define neighborhoods, as well as provide opportunity for public access to the river. First Creek, the Easternmost green area in the map, exists in a culvert beneath James White Parkway. Second Creek, in the middle, runs through World's Fair Park and separates downtown Knoxville from the University of Tennessee campus. Finally, Third Creek, the Westernmost green area separates main campus from the agricultural campus, runs directly adjacent to the University of Tennessee Gardens, and also runs adjacent to the chosen campus site, the water treatment plant and concrete factory.



Figure 4.1. Aspiration Diagram Map. (Map: KGIS)

In studying further the existing infrastructural axes created within the urban fabric of Knoxville, it became apparent that a bolstering of these conditions would best serve the purpose of allowing the city to grow in a new direction. The axes on the diagram shown in dotted lines are chosen opportunities for connection within the urban fabric itself. Improvements shall be made, such as widening sidewalks for safety of pedestrians and bicyclists, increasing tree density to provide shade, and lowering vehicular speed limits to allow these chosen avenues to become more public boulevards. By further connecting these boulevards to installations on the river, the urban condition of the city begins to enhance the experience at the river. One axis in particular, the East-West axis through the center of campus called Andy Holt Boulevard has a particular future in plan. In the campus master plan, released for 2016, the near-term intention of the University is to extend the pedestrian mall on this axis across the entire length of the line (Morris, 7). This increases safety of students walking between class, as well as enhances aesthetic beauty through given opportunities for landscape design and installed places for gathering out of doors.

The Southernmost existing axis on the map is Neyland Drive. It is a wide four-lane highway, which connects around the Southern perimeter

of the campus. The width of the road accommodates the large influx of visitors to Knoxville during football games, and is used daily for commuting students and faculty at the University. This "spine" in the map became the basis for the design of the master plan, as the main means of connection between the campus, World's Fair Park, downtown Knoxville, and the Tennessee River. While the size and location of Neyland Drive make it the perfect vessel for moving large amounts of traffic onto and off of campus, it also creates a large and dangerous physical barrier between the city and the river. This design problem calls for a balance between traffic control and the desire for safe passage across the road for pedestrians to travel safely to the riverbank.

The master plan for this project defines the more specific sites for intervention, as well as how the site might interact with the rest of the city. Figure 4.2 shows the master plan that was developed through these thought processes. It highlights the main areas, which were then studied in depth to enhance the ideas established here. The Westernmost portion of the map shows the campus of the University of Tennessee, where there is currently a water treatment plant and a concrete factory. Between these sites runs Neyland Drive. All three of these conditions together creates an area which completely prevents travel from campus to the river.

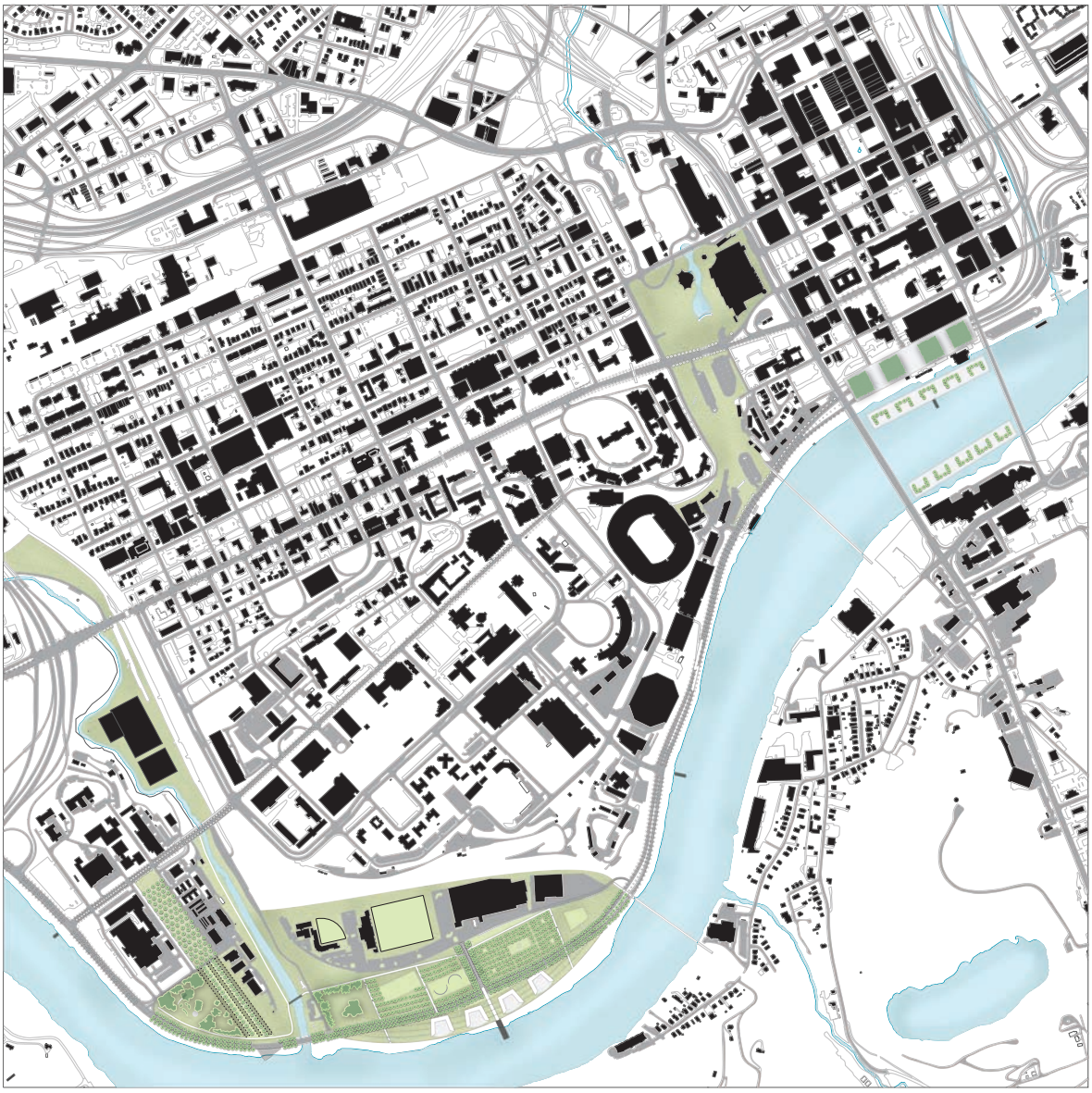


Figure 4.2. Master Plan.(Map: KGIS)

This master plan proposes that the water treatment plant and the concrete factory be completely removed from the site, save for some portions of the water treatment tanks for subsequent adaptive reuse. The barrier created by Neyland Drive will be addressed through an infrastructural change to the road itself. The road will be raised onto two separated overpasses, ten feet above the ground level, to allow for safe pedestrian crossing, parking, and tailgating space during football games.

To begin to describe the plan in more specifics, the larger campus site is designed to enhance the sporting facilities nearby, as well as provide an extension to the University of Tennessee Gardens to the West of the site. Figure 4.3. is a more detailed plan of the site, outlining individual spaces in the design, as well as the locations of various intervention buildings. Figure 4.4 is a plan, section, and axon drawing of a piece of the site. The purpose of a master plan is to propose an ideal condition; therefore the buildings proposed have potential, but are not specifically planned out in one way or another. The park area between the sporting facilities and Neyland Drive is divided into smaller spaces to break the overall size of the site down into more defined, human scale spaces. The placement of the groves of trees is determined through an

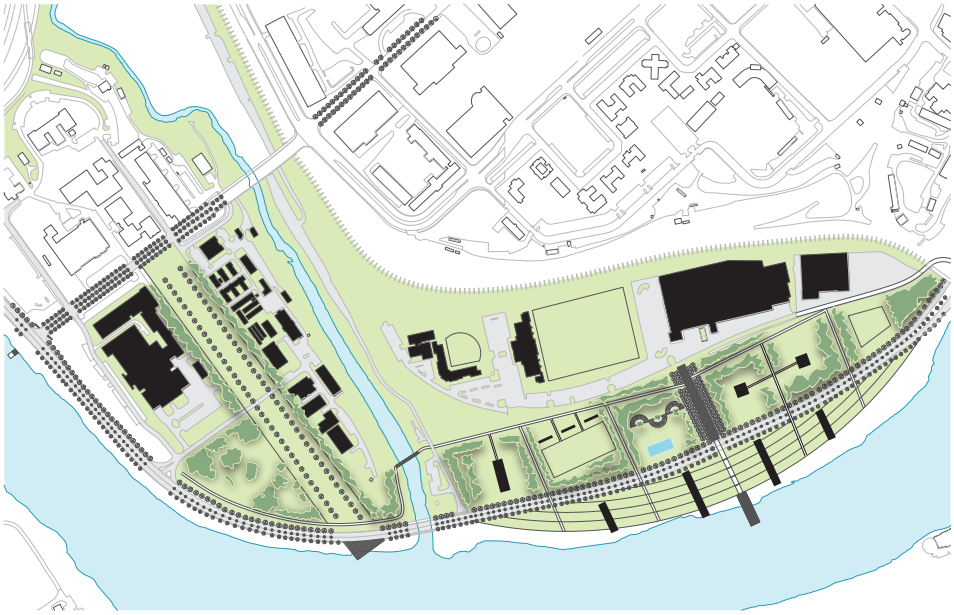


Figure 4.3. Campus Site Plan. (Map: KGIS)

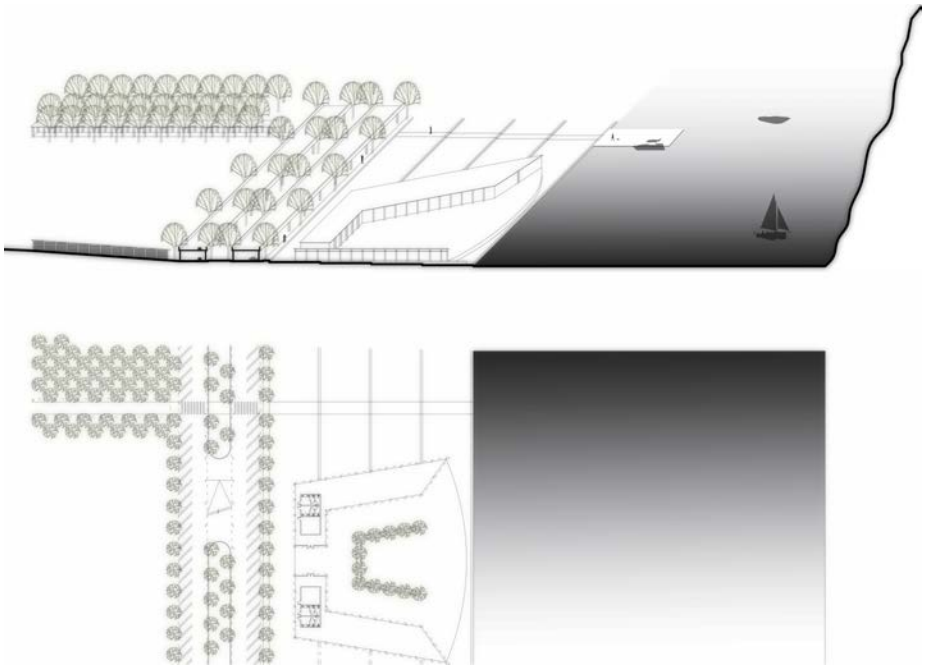


Figure 4.4. Campus Site Plan, Section, Axon. (Source: Author)

idea of alternating spaces, allowing each one to claim ownership with the sporting facilities or the terraced park.

In figure 4.5, one can understand the idea of raising the highway above the ground level. It provides many more opportunities along that corridor than would be available with ground level traffic. The trees are intended to create a canopy over the highway, giving a much more landscaped atmosphere to the road. It also allows the recreational use of the site to span across the road, which would otherwise have been inconvenient, difficult, or even dangerous.

In connection to the University Gardens, a new axis has been developed to draw people from the agricultural campus and one of the main axes across the site South into the site. Three colonnades have been installed to create obvious walking spaces along that wide boulevard. Figure 4.6 is an experiential rendering of how that space might feel. The colonnades alternate with lines of trees to create a perforated pattern of man-made and natural canopy along a long axis.



Figure 4.5. Rendering of raised highway experience. (Source: Author)



Figure 4.6. Rendering of colonnade experience. (Source: Author)

Down the river, following Neyland Drive towards downtown, the urban condition of the city changes from semi-urban on campus to dense urban in downtown, punctuated by the park atmosphere of Second Creek and World's Fair Park. Because the urban condition is dynamic, the response to it must also be dynamic. Therefore, a different intervention is necessary when addressing the downtown relationship to the river. The intervention here addresses several issues. First, there is a steep hill between the plateau on which the majority of downtown sits. Next, Neyland Drive still creates a dangerous physical barrier to public access, and finally, the Southern riverbank begs a response and activation.

Figure 4.7 is a site plan of the downtown area intervention. It spans the width between Henley Street Bridge and Gay Street Bridge – roughly one thousand feet. It is designed as an 'urban balcony' to extend the elevation of the plateau out over Neyland Drive, and to connect down to the river, where there will be a wide dock with moorings providing opportunities for installation of pavilions, cafes, seating areas, and more. Across the river, there will be a mirrored dock and moorings attached to the South bank. Access can be gained via the bridges or water taxi. Figure 4.8 is another plan, section, and axon drawing of the site.

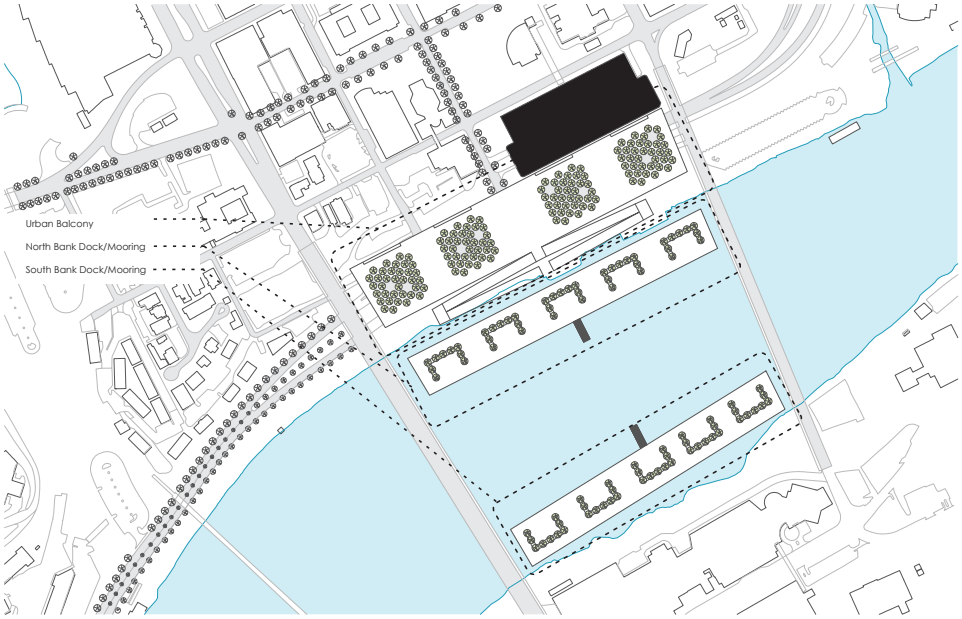


Figure 4.7. Downtown Site Plan. (Map:KGIS)

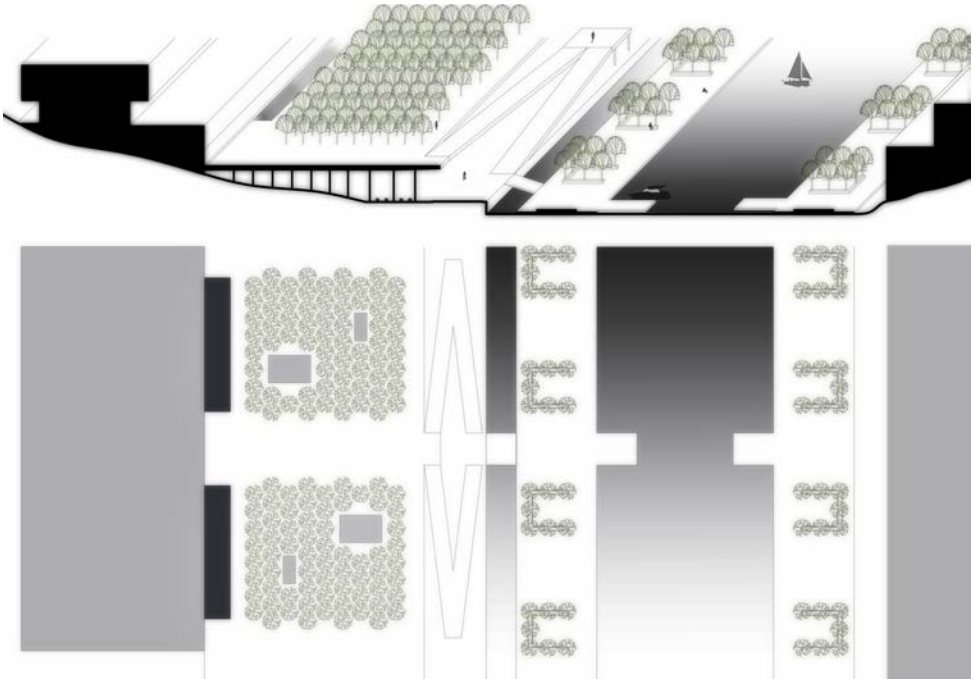


Figure 4.8. Downtown Plan, Section, Axon. (Source: Author)

The design of the urban balcony is arranged into four groves of trees, with a center axis leading to ramps that bring the occupant down to the river. The purpose of the hypostyle tree arrangement is to further break down the scale of the site and allow the massive span of the urban balcony to feel more intimate. There are breaks in the pattern within these groves of trees to allow for the construction or installation of pavilions, food stands, cafes, seating areas, or small shops. The open spaces between each grove of trees correspond with road access points, and the center of the City County building, to allow access from that building as well. Figures 4.9 and 4.10 are perspective renderings of how the hypostyle groves would look.

The docks have planters installed on the surface that provide shade to the occupants, as well as a ledge on the planter on which groups can sit. The intention is to create smaller outdoor rooms, again breaking down the scale to a more intimate space for people to enjoy. The trees planted here will have the same canopy effect as the hypostyle groves on the urban balcony, as well as the trees installed on the campus site and along Neyland Drive. The intention through all of these interventions is to extend the urban condition out across the river, while creating an outdoor space on the river between the bridges that define downtown Knoxville.



Figure 4.9. Urban Balcony Rendering. (Source: Author)



Figure 4.10. Urban Balcony Rendering. (Source: Author)

CHAPTER FIVE :
CONCLUSIONS

To conclude a thesis project, reflection upon the work is the most useful tool for a designer. This project presented challenges and design problems unique to this place. Knoxville is a singular city with a singular opportunity. The TVA interventions along the Tennessee River have freed Knoxville, for the time being, of fear of flooding. For the public, this opens up doors, which until now have been unheard of.

Master plans are not necessarily intended to reflect reality, practicality, or common sense. They are a reflection of the ideal condition that a place can embrace. In that sense, this project presented a real dilemma. How does a designer reflect practicality and vision in the same drawing? The balance between the two is something that proved to be a great challenge. There is also some difficulty in predicting the path an entire city will take in the future. One can attempt to effect change on the city through proposals like this one, but the course of history has proven time and time again that plans and actuality are often very different things. This project, for example, assumes that the population of Knoxville will grow to a size that can sustain such large infrastructural

spending. It also assumes that the dissolution of the TVA and failure of the dams are impossible, and that the safety of the river is given for an indefinite amount of time. While realistically, none of those things can be completely guaranteed. This level of assumption is where many of the problems of a master plan will arise upon its implementation.

The city of Knoxville, Tennessee is an intriguing place, with hidden secrets, fascinating stories, and powerful entities guiding it's growth. This project aims to insert natural resources into that list of guiding factors for Knoxville. By allowing Knoxville to identify with her location on the Tennessee River, this project aims to change the city into one, which embraces her unique location within the TVA territory and at the mouth of the Smoky Mountains. Knoxville can become a city that can only exist in one place, and one that will thrive in that location.

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VITA

Nicole Anne Drelich was born in New Jersey. She grew up in South Carolina, and studied Architecture and Spanish at Clemson University for her undergraduate degree. In that time, she had the opportunity to study for a semester in Barcelona, Spain. Following receipt of her Masters of Architecture degree, she plans on earning licensure and practicing Architecture in the Southeast.