Biotopia:
An Interdisciplinary Connection between Ecology, Suburbia, and the City

by

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In an era when cities and towns are changing rapidly, public spaces are the key to reviving civic engagement. By re-introducing these public realms as ecological environments, we can re-structure the organic growth of civic tissue, re-define the city street into a park environment, and reveal the ecological landmarks that once beautified the landscape. These ecological landmarks will be used as corridors, nodes of circulation and storm water management to not only creates a regenerative landscape but to create a connection between ecology, suburbia and the city.

The public realm in America has two roles: it is the dwelling place of our civilization and our city life, and our physical manifestation of the common good. When we degrade the public realm, we will automatically degrade the quality of our city and our city life, plus the character of all the enactments of our public life and communal life that takes place there. The public realm has to inform us not only where we are geographically, but has to inform us where we are in our culture, where we’ve come from, what kind of people we are, and it needs to afford us a glimpse as to where we are going.

The past sixty years has engendered a decentralization of the city and a loss of our public realm. Suburbia was created and the absence of
community development within cities increased. The lack of social economic interaction now challenges each city today. The inabilities to obtain a socially sustainable closed-loop system lifestyle are some of the challenges families continually battle.

Transformation, succession and operation will help to emphasize and revitalize the downtown riverfront district in Nashville, Tennessee and create a living, dynamic entity that connects you to suburbia and an ecological dwelling environment. A naturalized mouth and iconic identity to the river will create a comprehensive plan for addressing urban design and the connection between the two sides of the river. Transportation, naturalization, sustainability and other ecological issues will be addressed in the development of a sustainable “green city,” a new destination where city, river and suburbia interact in a dynamic and balanced relationship creating an urban estuary.
Research: Rediscovering Community

Introduction of Suburbia/City Development

Albert Einstein once said that the individual, if left alone from birth, would remain primitive and beast-like in his thoughts and feelings to a degree that we can hardly conceive. The individual is what he is and has the significance that he has not so much in virtue of this individuality, but rather as a member of a great human community, which directs his material and spiritual existence from the cradle to the grave.

In other words, one’s own existence in a community is created out of habit and out of comfort. If we grew up in suburbia then it is likely that we’ll strive to always live there. It is human nature for us to conform to what we’ve always known and shun the presence of change; sameness equals safely. Suburbia has become the dwelling place of our civilization and of our livelihoods. It is the places most call home.

The existence of suburbia escalated post World War II, moving out of the industrial revolution and into the “American Dream.” This ideal utopia slowly became a domain where people drove around, found themselves standing before and inside singular objects, experiencing activities entirely familiar and engaged in situations in such a way that they engender predictable situations. Everything emanates as one, creating no individuality or significant difference in appearance (Lerup 2005).

As the suburban era heightened, it engendered a decentralization of the city and a loss of the public realm. In 1956, the Federal Highway Act set out to disperse our factories, our stores, our people, in short, to create a revolution in living habits. Highways were allowing cities to expand rapidly into surrounding rural areas, turning huge patches of once green countryside into vast, smog-filled deserts that are neither city, suburb, nor country. The ability to define place, a body
of culture was lost. The public realm was no longer creating the dwelling place of our civilization, city life, or showing our physical manifestation of the common good. When we began to neglect our public realm, we automatically degraded the quality of our city and our city life, plus the character of all the enactments of our public life and communal life that took place there. The public realm has to inform us not only where we are in our culture, where we've come from, what kind of people we are, but it needs to afford us a glimpse as to where we are going (Kunstler 2001).

In an era when cities and towns are changing rapidly, public spaces are the key to reviving civic engagement. An urban condition that would re-define the city street into a park environment, re-structure the organic growth of civic tissue, unveil the ecological landmarks of history, and blend the social/economical classes, would help structure the emerging problems with city environments. This would allow for a space that focuses on the quality of human life within a family atmosphere to be structured within the realm of the central business district, thus allowing the public realm to rebuild itself and the focus of life to return to the city's core.

In order to look at how this development can occur, we first need to look at the history of cities. One of the most important facts about cities from the beginning of recorded history until the fairly recent past was the sharp distinction between urban and rural ways of life. Within the city wall of most early cities, a visitor would see a dense mass of building, congested streets, and a rich and highly dynamic urban life offering many choices. A few miles outside the walls, however, the same visitor might see nothing but croplands and rural villages. The pace of daily activities here would be slower, the environment less quick to change, and social and political life completely different. Within the walls, for example, of Sienna, Italy and the piazza Del Campo, here you have a Tuscan hill town surrounded by farmland and vineyards, but inside the city a vast dynamic social awareness evolves (Lerup 2005). People are always in the streets, shopping, eating, and in the piazza gathering, playing, reading; the sense of place, community and density of life changes. The unique combinations of natural and man-made assets distinguish it from other locales, strengthening its civic center, and creating a good example of urban development. These early cities should have become a
benchmark for what was to come for the future of American cities, but there became many attributes that did not allow this to happen.

This idea of rediscovering community within a city context allows for an outdoor living room to take place. Downtown cities have become a place for suburbia to travel to in order to see ball games, go to nightclubs, visit museums, or do some shopping. As downtowns begin to redefine themselves as tourist destinations, places of entertainment, places for dwelling, and places for leisure, it appears that they have become a more valued part of the larger urban world (Lerup 2005). There is still a problem though that exists within the dwelling of most cities today. The single mid-rise condo development is all that occurs downtown, with no amenities geared towards families and the quality of human life. Most do not sustain an urban playground or green fabric. These condos are geared towards the single young working class and the elderly retired.

There have been a few cities in America that have realized if they want to be marketable in this changing world, they would have to fix some of these problems that occur within their cities urban fabric. Some proposals have been to emphasize the importance of natural features, for example a river could become an environmental, recreational and economic development asset instead of a divider or barrier within a city. Others have included pocket parks, light-rail infrastructure, and greenways instead of motorways. These assets can offer a better quality of life, retain and attract citizens and raise capital.

When looking at the growth and urban development of cities today and seeing how certain places like Portland, Oregon, are re-structuring their context to better serve their community, I began to look at cities that needed this type of growth and infrastructure to occur; a city with a non-developed urban core close to the city center and the lack of sustainable, ecological elements that would help to emphasize a more unique context and be able to sustain itself and change with time.

My studies brought me to Nashville, Tennessee; a city that has been working to renovate its downtown district but has neglected its riverfront which splits the city and disregards the east side connecting into neighborhood districts. This riverfront divide became the site in which an ecological urban community within a
city context could occur. When designing an urban development within a city context, the history of the city can play an important role. To understand how the city was formed and developed can help drive a concept for design.

**History of Nashville**

Nashville, Tennessee, was originally established on the bluffs overlooking the Cumberland River, as you can see from Figure 1.1, shown by the small diagram in the middle. The yellow square represents the public square; the blue dots show locations of freshwater springs and streams. You can see here how the establishment near the public square started to become this cluster city on the banks to the west of the river. Nashville was first settled by Native Americans in what is now called Sulfur Dell and the east bank Industrial area.

In 1775, Richard Henderson purchased the west bank bluff areas from the Cherokee Nation. This area was later settled in 1779 by James Robertson and John Donelson. Fort Nashborough, a two acre settlement on the top of the bluffs, was built in 1779 just north of the quarter size replica that exists today. This was just the beginning of Nashville’s development on the riverfront.
As the city's capacity increased, the growth spread outwards from the river. Development along the east side was beginning to be established. Figure 1.2 shows Nashville just before the Civil War. The downtown had grown significantly and East Nashville was now extending all the way to the floodplain.

In 1858, Nashville briefly turned its direction towards sports. A national baseball league was formed, and some 50 teams travelled the country. Games drawing as many as 3000 fans were hosted in various cities including Nashville with its Sulfur Dell Baseball Stadium. Along with baseball, horse racing became a major spectator sport for the area with its own race track just north of the Lower City Island.

1861 would usher in the Civil War, and by 1862 the Union Navy had seized most of the navigable rivers that connected the Confederacy, including the Cumberland River. Sulphur Dell Springs served as a source of drinking water, while nearby Sulphur Dell Streams served as a means of disposing urban sewage.

In 1887, the island north of the city was renamed Burns Island, while upstream of Nashville, the island adjacent to the Omohundro Treatment plant was renamed Nashville Island. By this time, mills were filling...
in the floodplain areas south of downtown between the Cumberland River and Brown’s Creek. The rises of industry lead to further pollution and dismay of the cities development.

By 1889, it was considered the height of the Industrial Revolution. Nashville’s City Wharf served as a shipping port of logging, textile mills, and other goods. In 1891 Arthur Dyer founded a company called the Nashville Bridge Company (NABRICO). His company began as a bridge building enterprise for most of the Southeast and some countries in South America, eventually expanding into barge-building and WWII warship building. In the 1990’s the company would relocate downstream to Ashland City to make way for the new Titans football stadium in downtown.

The Tennessee Centennial and International Exposition of 1897 celebrated the 100th anniversary of Tennessee’s entry into the union in 1796. Figure 1.3, on the previous page shows the diversion channel that had been cut to the northwest. Around this time period, Shelby Park, which included Shelby Pond, in East Nashville was being used for swimming and ice skating due to the fact that it was built in low elevations and prone to flooding. Also at this time, the urban growth...
and the resulting increases in population density would require a second waterworks in 1889. Although population density was growing, the expansion of the city was pushing farther away from the riverfront were industrial presence was heightened.

The turn of the century was the height of the steamboat era, but also the start of the railroad era. Railroads were popping up all over the country along riverfronts. Railroads were often built in the lowest lying lands to avoid extreme changes in elevation.

By 1908, Nashville began treating its drinking water with chemicals as the development began to expand into the floodplains. The diversion channel to the northwest still existed but by 1927, Sulphur Springs would be closed due to over pollution from Sulphur Dell Streams, and Nashville would experience its worst flooding in history.

By the 1930’s both sides of the river were built out. When comparing a 1930’s Army Corps of Engineer’s map to a 2005 GIS topography map, the topography that exists today is not the same as what had existed as recently as 1930. Further investigation showed that prior to 1930, the alluvial riverbanks were higher in elevation than the river plains that were located behind the river’s edge. The river banks functioned as a natural levee, perhaps formed through years of alluvial sedimentation and deposition. This means that the river’s edge was actually higher than the river plains that extend up to 500’ further back towards East Nashville. The areas behind the levee in the river plains, shown in Figure 1.6 in red, were always part of Nashville’s landscape. The levee was a sacred site for Native American communities as many of their settlements were located along these banks.

After 1930, Nashville increased its industrial presence along the water’s edge, taking advantage of both river and rail near downtown. Nashville filled in many of these low lying river plain areas to raise building out of the floodplains. It is estimated that Nashville filled in these areas with almost 10 million cubic yards of fill to try and bring these areas out of the floodplain.

Figure 1.7 on the following page, shows an aerial map of 1959, and when compared to an aerial map of 2005, there are some significant changes especially along the periphery of downtown. It appears the I-24 loop which separates East Nashville from downtown is under construction here. This photograph also still
shows the old street grid of Edgefield, a community that extends to the east banks of the Cumberland right across from the city center. There are also significant differences in industrial/farmland ratios. Areas to the north of downtown on the East bank, and south of downtown along the west bank in 1959 were used as farmland; a suitable land use for land falling within the 1 in 100 year-floodplain.

With the changed in construction of the inner I-24 loop around downtown the farmland seized to exist. The highway infrastructure increased the appeal of land use for transitory industrial or warehouse facilities.

Nashville sits at the cross axis of major continental interstates, I-24, I-40, and I-65. The land adjacent to the Interstate was cheap and strategically located to take advantage of Nashville’s regional position.

The 1960’s brought with it a second wave of industrialization. Unlike the industrial revolution which was linked to advancements in rail, manufacturing processes, and river transport, this new shipping and storage industrialization was linked to the highway systems and the increase in interstate shipping.

In the 1960’s the Nashville Bridge Company was still launching barges into the Cumberland from its production facility along its eastern bank. The river was still a main focus of the city’s industry. Due to this increase over the years, the cities density spread further away from the original settlements (Nashville Design Center).

Conclusion

This decrease in city density occurred in many affluent cities at this time, which is now perhaps the single most important fact in urban development of our
era. There are few urban areas in the world today that exhibit densities anything like those that characterized most large cities from Mesopotamian times throughout the nineteenth century. Where 150,000 people per square mile was once a standard urban density, it is rare to find densities of even 25,000 people per square mile in affluent cities today, and most urban dwellers live in densities lower still (Bingham 1984). By studying the history, we can begin to see further on how certain fundamentals in planning and design principles should be considered when developing an urban context and bring the focus back to the city and create a density and livability similar to that of the original settlements.

Livability is best defined at the local level, where a community is keenly aware of its character. Its identity can be embodied in its physical features and in the actions of its residents. (Kunstler 2001). An area focused on meaningful spatial experiences, mixed-use development, density, effective planning for regional transportation, street-savvy design, physical health and community design, public safety, personal security, sustainability, diversity, centrality, connectivity, and proximity will create a place of value, a place of memory, and a place worth caring about. An identity inextricably linked to a place, a community and a landscape; a product of time and circumstance, where each decision is shaped in response to past decisions, existing conditions, and newly arising needs. Where history is irreversible, but allows for a reconciliation of built environments that can become repositories for the personal and collective memories of our lives as individuals and as members of communities, thus allowing for a layering of new social, economic, and cultural impetuses relative to natural and historic traces to occur, creating a past, present, and promise of the future (Lukez 2007).

With identity become landmarks. Landmarks allow us as individuals and a society to gauge our bearings both in space and in time. Churches, courthouses, rivers, streams, and monuments are just a few landmarks that allow us to develop strong associations with places and feel secure in our identification with our place in the world. Landmarks, physical and historic, are often absent in neighborhoods because development has wiped away most traces of the past (Lukez 2007).

This regional area in Nashville already has existing conditions of landmarks and identity to help
define the space. By revitalizing the riverfront, unveiling historic streams and re-structuring the community, this area will become a network of great mixed-use, mixed-income neighborhoods where it’s just as easy to walk and take transit as it is to drive. A space for living that has everything you need and the essences of life all within an arm’s reach.
Research: Experiential Landscape/Biotope

Experiential Landscape is a term that can be used to conceptualize a holistic relationship of outdoor open space and a range of human experiences. Its intention is to provide a means by which experiential aspects of people-space relations can become more prominent (Thwaites and Simkins 2007). In other words, it is looking at the character of outdoor spaces and being able to analyze how they have changed over years and how new ones can be made in their place.

Experiential landscape is a spatial and experiential whole constituted from outdoor places that people use during ordinary daily life. It is the realm usually encountered sub-consciously, the ordinary setting of daily routine and the incidental spaces and features people encounter which through regular use come to mean something, rather than special places that would make a conscious or planned decision to visit, for days out and holidays for example. This might be generalized as the built environment made from the collective of building edges and doorways, streets, yards and alcoves, alleys and squares. The experiential landscape is the mundane rather than the special because most people’s routine experience, that which impacts on the quality of daily life most, happens here (Thwaites and Simkins 2007).

This concept becomes a totality of varying spatial volumes experiences sequentially. Gordon Cullen captured the essence of this when he talked of passing through a town as “a journey through pressures and vacuums, a sequence of exposure and enclosures, of constraints and relief” (Cullen 1961).

Outdoor spaces in an urban development become the journey and sequence of what people feel and do as they move about. The spatial surroundings forms and configurations both engender and become infused with
experience. This holistic conception of human-environment relations, is similar to that advocated by for example, philosopher Arnold Berleant who, suggests that we must try to re-conceptualize our world to take into account that we do not exist in isolation from our environment but rather as a part of a continuity that includes it. It is a view that heightens the ethical responsibility for how we design and make changes in this realm because as Berleant point out, “what we do in environment we do to ourselves,” (Berleant 2007).

Throughout history urban ecological landscapes have become little to non-existent. This idea of a biotope (an area of uniform environmental conditions providing a living space for a specific assemblage of plants and animals) restoration has come to the forefront. The preservation, regeneration, and creation of natural environmental settings has allowed for places to create a sense of identity within coordination to neighborhoods or city quarters and districts. Reconstructing rivers to restore their natural qualities, leaving native plants and trees, building nature parks along motorways, making school gardens or ponds by considering the ecosystem, and bearing in mind ecological considerations in private gardens are all aspects to consider when creating a biotope/ecological community. These aspects should not only fit into a city on a macro-scale but should fit into ordinary people’s daily activities and lives in a micro-scale. This type of system is an organization of functions that enhances the experience of daily life, a system that could be brought to Nashville’s riverfront property to expand and revitalize the natural landscape and allowing a development of structural mixed-use complex’s to occur.

The idea of an experiential, biotope, ecological landscape is about making damaged ecosystems whole again. The riverfront in Nashville has been dilapidated for so long and run down by industry that it needs an invasive restoration. Reintroducing missing plants and animals to create an intact web of life, understanding the historical conditions that led to the present conditions, creating or rebuilding soils, and eliminating hazardous substances is only the start to renewing the decades of damages.

We have lived in a world of fragmentation for so long, that our natural areas are penetrated by development, diminished in size, and split apart (Hellmund and Smith 2006). Waterways and the vegetation that protects them have been exposed to
contaminates which has created places of despair. People live their lives separated from the natural world, their habitat is defined in large measures by automobiles, and the built environment. Neighborhoods are segregated by race and class and while the economy is in turbulent times, it requires the relocation and migration back into the city, displacing people from family, community, and place (Hellmund and Smith 2006).

An ecological system, like the ones that have been explained, do not only have to occur within a riverfront or park atmosphere, they can begin to take linear paths and construct greenways instead of roadways. Because of their linearity and their ability to wind through spaces, they can connect a variety of habitats and communities while creating a regional cohesion and link. This type of system would tie together and restore a significant measure of ecological functions to what would otherwise be isolated natural areas and exposed waterways (Hellmund and Smith 2006). This would bring nature and people into closer contact, providing regular opportunities to experience and learn about nature closer to home while also creating a connection between people, as they would use the trails for recreation and transportation.

As the evolution of developing landscapes occurs in America, it has become a tyranny of small changes. People increasingly dominated landscapes, while natural flow and disturbance patterns became intentionally and unintentionally interrupted, as new social connections were created (Hellmund and Smith 2006). In the area around the riverfront in Nashville, structural development is inevitable. In order for the city to grow with the population, a mixed-use development needs to occur. In this context, greenways are of upmost importance. They do more than just stem the tide of lost natural features; they will create new, positive social functions in the midst of what might otherwise be disorganized development patterns.

The next three figures on the following page, illustrate how the developments of landscape areas have occurred in the United States over the past 60 years. The effects of development on natural landscape, shown here, allow a visual illustration of how natural flow has been degraded and interrupted. The mistakes of the past are irreversible and with the ever changing world heading towards sustainability, it is important to look back at these natural features as enhancements upon
our city and utilize them as greenways, water management, places of recreation and gathering to allow for a better quality of land use and everyday life.
Research: Integral Urbanism

“As we are a part of nature, so are our habitats including our cities. Over the last century, however, urban development has treated the city as a machine for efficiently sheltering and protecting and for moving people, money, and goods.”

--Nan Ellin

This idea of industry driving the city has forced urbanism away from cities cores over the past 60 years. The idea of integral urbanism begins to reclaim and redevelop the urban contexts of natural landscapes within a city environment by demonstrating five qualities:

1. & 2. Hybridity and Connectivity: the process of bringing activities and people together, rather than isolating objects and separating functions. These qualities also treat people and nature as symbiotic, as well as buildings and landscape-rather than oppositional.

3. Porosity: the process of preserving the integrity of that which is brought together while allowing mutual access through permeable membranes, rather than the modernist attempt to dismantle boundaries and postremogeniture fortification.

4. Authenticity: this involves actively engaging and drawing inspiration from actual social and physical conditions with an ethic of care, respect, and honesty. Like all healthy organisms, the authenti-City is always growing and evolving according to new needs that arise thanks to a self-adjusting feedback loop that measures and monitors success and failure.

5. Vulnerability: this call upon us to relinquish control, listen deeply, value process as well as product,
and re-integrate space with time (Ellin 2006).

This idea of integral urbanism preserves buildings, neighborhoods, and natural landscapes that we value, rather than neglecting, abandoning, or erasing them from our urban heritage; it rehabilitates, reclaims, restores, and renovates what is under performing and adds what we do not have. Whether this concept is applied to existing urban fabric or to new development, it is designed to activate places by creating thresholds, places of intensity and density, where a range of people and activities may converge. It provides places to congregate along with synergies and efficiencies, while also liberating time and energy for collaborative envisioning and implementing desired change (Ellin 2006).

The ultimate result is more conservation and less waste, more quality public spaces and less distrust and fear, more quality time and less commuting time, and more pro-action and less reaction. For this to occur, separation has to seize and convergence with space, time, people, activities, businesses and so forth have to merge to generate new hybrids for future developments. While integrating the functions that the modern city separated, integral urbanism also seeks to integrate:

1. Conventional notions of urban, suburban, and rural to produce a new model for the contemporary city
2. Design with nature
3. Local character with global forces
4. The design professions
5. People of different ethnicities, incomes, ages, and abilities (Ellin 2006).

The urban and environmental challenges of the last century have prompted a reconsideration of values, goals, and means of achieving them, particularly over the last decade. In contrast to the fast-paced more-is-more mentality, the appeals of simplicity, slowness, spirituality, sincerity, and sustainability are clearly on the rise. Learning from the inherent wisdom of nature and cities of the past, we are infusing new developments with contemporary sensibilities (Ellin 2006).

The idea of what constitutes place has broadened in stages over the last half century. Through the mid-1970’s, the practice of urban design focused almost exclusively on the “public realm” - streets and other
public spaces, particularly in cities - at a time when the flight of people and jobs to suburbs raised questions about the future of cities as a form of human settlement. In the late 1970’s and the 1980’s, three landmark books - Jane Jacob’s Death and Life of Great American Cities, Kevin Lynch’s Image of the City, and Christopher Alexander’s Pattern Language - inspired urban designers to broaden their focus to include the quality and character of entire neighborhoods and districts. As urban disinvestment began to slow and then reverse in the 1990’s, the field scope expanded to include planning the revitalization of entire cities. In the early 2000’s, growing awareness of the environmental costs of sprawl and automobile dependency widened the field’s boundaries again, as urban designers searched for ways that humans can achieve a more balanced fit with nature at a regional level (Brown, Dixon, and Gillham 2009).

As the field’s physical scope has expanded, so have the ways in which it touches the human experience. Urban designers initially sought to restore a sense of human scale and activity to cities ravaged by decay and by renewal efforts that focused more on cars than people. Later on, practitioners and others began to view urban revitalization more as a way to address social challenges and to increase economic opportunity. In recent years, urban designers have added addressing sustainability, building community, and protecting human and environmental health to their charge (Brown, Dixon, and Gillham 2009).

Although there remains numerous obstacles along this path to integral urbanism, we are nonetheless passing through a rare historic moment when what is good for urban growth and development is aligning with political, economic and social trends. Integral Urbanism’s program typology seeks to integrate all functions of life - living, working, circulating, playing, and, creating; everything a community needs to operate economically well into the future. Its conventional notions of urban, suburban, and rural as well as private and public realms create the character and center of built and un-built systems. The architecture and landscape architecture, structural and environmental systems will allow people of different ethnicities, income, and ages to come together in one community to enjoy the amenities, to live and to work.
Phytoremediation

Due to the conditions of much of the surface land encompassing the Cumberland River in Nashville, Tennessee, which consists of Brownfield/industrial yards, remediation of the soil is required. Phytoremediation is the name given to technologies that utilize plants as the catalyst for change in purifying the soil and groundwater of a previously industrial occupied site; allowing many industry sites to be remediated with the use of plants naturally. This process allows the natural state of the land to be redeveloped over time, versus excavating the land (dig and replace method), which can be done within days. Although phytoremediation processes takes longer, it is more ecologically friendly and cost effective. Dig and replace methods cost between $10 and $1000 per cubic yard, were phytoremediation methods cost approximately $0.05 per cubic yard.

Figure 4.1 Diagram showing cost vs. time
There are several different types of phytoremediation methods that are used according to what type of contamination has affected the soil and in the way plants deal with the contaminants (removal, immobilization, degradation), as well as in the type of contaminant that the plant species can target (organic or inorganic contaminants). Since each process uses different species of plants to clean different types of contaminants, it can take anywhere from 3-12 years to fully clean the land.

Phytostabilization

Phytostabilization is the process in which plants are used to immobilize metals and radionuclides in the soil (and thus minimize their mobility in water or dust). This process immobilizes the contaminants in soil through absorption and accumulation by roots, adsorption onto roots, or precipitation within the root zone of plants (see figure 4.2), and the use of plants and plant roots to prevent contaminant migration via wind and water

Figure 4.2 Phytostabilization Process
Source: Phytotechnology Technical and Regulatory Guidance Document

Figure 4.3 Benefits of Phytostabilization
Source: Pierzynski et al., 2001, Copyright Kansas State University
erosion, leaching, and soil dispersion (EPA, 2). Plants species are selected based on local conditions and native flora, soil composition, and plant tolerance to the contaminants. This technology influences the contaminants’ mobility in different ways. The amendments directly alter the soil factors that influence metal mobility; proteins and enzymes are released by the roots into the adjacent soil, leading to precipitation and immobilization of the contaminants either in the soil or on the root surface, the contaminants are taken up by the plants and sequestered in the root system, or the surface of the soil is vegetated, and the vegetation acts as a barrier for physical contact and to minimize erosion by wind and water (EPA, 4). This process is shown in Figure 4.3 on the previous page and takes approximately 3 years to work.

**Phytoextraction**

Phytoextraction is the technique which is used to remove contaminants from soil or sediment by having plants take them up and store them in aboveground, harvestable tissues. The contaminants are generally removed from the site by harvesting the plants. This technique is mostly applied to heavy metals and
radionuclides in soil, sediment, and sludges (EPA, 2). See figure 4.4 and 4.5. Phytoextraction closely resembles the operations conducted in conventional agricultural farming and uses typically smaller plants with a shallow root system that grow relatively slowly. These plant species, called hyper accumulators are used to boost this technology. This process is the best approach to remove contaminates primarily from the soil and isolates it without destroying the soil structure and fertility. This process is a short and continuous remediation that occurs within 5 years.

_Phytodegradation_

Phytodegradation is the breakdown of organics, taken up by the plant to simpler molecules that are incorporated into the plant tissues. This process removes most fuels and solvents. It uses yeast, fungi, bacteria and other microorganisms to remove these components.

Many different compounds and classes of compounds can be removed from the environment by this method, including solvents in groundwater, petroleum, and aromatic compounds in soil, and volatile compounds in the air (EPA, 5). This process needs approximately 8 years to be successful.

_Phytovolatilization_

Phytovolatilization involves the use of plants to take up contaminants from the soil, transforming them into volatile form and releasing them into the atmosphere. This process is primarily used for the removal of mercury and has to be monitored due to the fact that Mercury, when released into the atmosphere is likely to be recycled by precipitation then redeposit back into the ecosystem. This technology can approximately take up to 12 years to fully clean the soil.
Case Study: Lower Don Lands

*ARCHITECT: MICHAEL VALENBURGH
*BUILD TYPE: LANDSCAPE URBANISM
*LOCATION: TORONTO
*RIVER + CITY + LIFE: A GUIDE TO RENEWING

The program includes:
- 75 percent residential
- 25 percent non-residential
- Light rail transit
- Multiuse trails
- Iconic bridge

An integration of urban form and natural processes became the bold new approach to the revitalization of three hundred acres of largely vacated port lands southwest of downtown Toronto. This project's emphasis is on environmental standards, strong design review, and a focus on the public realm. The goal is to liberate the river mouth and use its renaturalization to reinvent a portion of the city.

The Don’s River, whose once distinctive ravine carved through many of the city’s neighborhoods, and whose waters once entered Lake Erie, at a fertile estuarine marsh, has become a part of Toronto’s industrialization. The mouth of the Don was channeled, and the marshlands were carved up and filled in to allow for warehousing and harbor facilities. The goal of this project is to liberate the river mouth and use its renaturalization to reinvent this area of the city. (Stross Landscape Urbanism)
The objectives are to:

1. Naturalize and rehabilitate the mouth of the Don River utilizing an ecosystem based approach
2. Provide flood protection for Spill Zones 1 and 2
3. Maintain the provision for navigation and existing flood protection through sediment, debris and ice management
4. Integrate existing infrastructure functions that could not be reasonably moved or removed (including road, rails, utilities, trails, and power)
5. Encourage additional compatible recreation, cultural heritage opportunities and public/handicap accessibility
6. Contribute to the revitalization and sustainability of the waterfront and coordinate with and inform other planning and development efforts and associated certain and foreseeable infrastructure
7. Design and implement this project in a manner consistent with TWRC’s Sustainability Framework and applicable provincial legislation
Within this project scheme, the public realm becomes a terrain where novel urban design techniques were tested. But beyond the aesthetic signature or master plan vision, the challenge is fundamentally about performance. This scheme imagines how green technologies and urban design concepts might be brought together in a multilayered system. But the healthy functioning of this system would need to be continuously evaluated against performance standards. (Stoss Landscape Urbanism).

The data managed and collected were in areas such as flood control, soil evaluation, plant and animal biology, traffic engineering, building design, public process, graphic identity and information management.

The aim of this projects process is to create a new urban infrastructure that would perform ecologically but neither mimic nor aestheticize the relationship between nature and the city.
The Port Lands on the Don’s River is an extensive underutilized area that presented an unprecedented opportunity for waterfront revitalization. Most of the Port Lands is in public ownership and is within a 20 minute walk to downtown Toronto.

This analysis of the waterfront revitalization has shown how a city can create an ecological living environment within a city context. This project creates a powerful tool for the design of urban territories, in which synthetic solutions create large-scale systems, and where engineered infrastructures complement natural systems. The plan will naturalize the mouth of the river and transform the areas around into an array of parks and green spaces along with mixed use communities.
Called head to tail: running in clusters of compact densities, the head and tail types consist of a hooked bar of stacked townhouses, with higher towers on either end of a roof terrace. Private access to all units is made through an adjacent walkway that is punctuated at two points between the founding 46 meter x 46 meter templates. The towers rise eight storeys in the optimum scenario, but tilt out slightly at the fifth storey to organize a series of non-overlapping views. Their orientation creates large, open in-between spaces that could accept a wider natural landscape, or a finer grain of detached housing.
Case Study: Transforming Akureyri

*ARCHITECT: PAUL LUKEZ
*BUILD TYPE: LANDSCAPE URBANISM AND DEVELOPMENT

*LOCATION: ICELAND

*IDENTITY = SITE + TIME

The program includes:
- Pedestrian trails
- Landscape connections
- Expanding botanical gardens
- Gardens
- Repositioning the harbor
- Creating infrastructure that will respond to environment

The revitalization of downtown Akureyri, Iceland is aimed at emphasizing the beauty of the landscape while mitigating certain environmental factors to create a more hospitable atmosphere. A new center for global warming capitalizes on the city’s proximity to the polar icecaps and offers opportunities for economic expansion, along with the expansion of the existing botanical gardens and repositioning the harbor to accommodate large ships.

Figure 6.1 Plan Rendering of entire project
To alleviate some of the harsher forces of Iceland’s climate, paths that will negotiate between the city’s buildings will help to block certain conditions. By cladding buildings in reflective surface materials and erecting tall buildings to block strong winds, the downtown will become more inviting to pedestrian traffic.
The emphasis of this project is to transform the environment so that it stimulates the senses and heighten a sense of well-being for the individuals and the communities; to aspire to provide intellectually satisfying solutions to complex problems, which are rooted in ongoing research into the transformation of materials, construction and design processes.
ENTROPY, EXCISION, EXCAVATION

Figure 6.6 Studies of structure + environment by Paul Lukez
This project shows the relationship between structure and the environment; how a building's relationship to a waterfront and inclimate weather work together to create a pedestrian livable community. A small portion of the waterfront will be surfaced with greenways and parks, while hardscape squares are created within the structures to create an environment protected from the weather conditions.

This revitalization project will help focus attention back to the waterfront and improve conditions into a more sustainable and habitable environment.

Figure 6.7 Diagram outlining the overall planning area

Figure 6.8 Planning process in phases
**Case Study: Pier 57, Hudson River Park**

*ARCHITECT: LOT-EK  
*LOCATION: NEW YORK CITY  
*BUILD TYPE: MIXED USE/URBAN:  
  CULTURE/EXHIBITON + RETAIL/RESTAURANT/  
  URBAN MARKET + PUBLIC SKY PARK + TRIBECA  
  OUTDOOR CINEMA  
*SIZE: APPROX. 400,000SF

The program includes:
- A Contemporary Culture Center
- Contemporary Art Galleries
- A Small Boat Marina on the south side
- Cafes along the public esplanade
- Food, Retail and Urban Market
- Sky Park with an Outdoor Movie/Performance
- Amphitheatre

The proposal for pier 57 seeks to transform this utilitarian industrial building into a thoroughly open and public building that weaves within its four-level existing structure. The outdoor environment of the Hudson River Park is elevated onto the roof plane and wraps within the structure to create cultural and leisure indoor activities.

Figure 7.1 Perspective rendering view of project
The main design goals for this project are to restore and enhance the rich historic character of the pier; to open up its structure both in terms of views and accessibility; to reconnect all its four levels to the Hudson River Park and to the city at large; to reactivate the structure with existing cultural, leisure and marina activities; to apply sustainable criteria both in construction materials/methodology and in the management of energy and water.
Figure 7.4 Plan breakdown of the site surrounding areas

Figure 7.5 Rendering showing upper park

Figure 7.6 Rendering showing upper deck and theatre
Figure 7.7 Section analysis of structure components
Case Study: Changsha Zedquarter

*BUILD TYPE: URBAN RENEWAL
*LOCATION: CHANGSHA, CHINA
*MIXED USE RESIDENTIAL / COMMERCIAL URBAN REGENERATION

The Program Includes:
- Hotel and bar
- Offices
- Showflats
- Conference facility
- Cinema
- Restaurant
- Car
- Sports facilities including swimming pool

The 1.4 hectare ‘ZEDquarter’ master plan is a new urban expansion to the regional city of Changsha, the capital of the Hunan Providence in China.

The residential density will be between 120 and 150 large two and three bed homes per hectare, with considerable commercial space and lively shop lined streets. All parking is below the residential blocks, with only zero emissions pool cars above ground for convenience.
The urban block enclosed reduces the urban heat island effect through encouraging prevailing wind to blow hot stale air through the whole site, therefore dropping the ambient hot summer temperatures around 3 degrees. This allows the heat pump cooling system for the homes to be powered by solar electricity, with undulating landscape gardens covering mixed use commercial and community facilities including a covered farmers market.
Biomass is a waste to energy, gas distilled system that uses agricultural waste to produce energy. A closed loop material model, with waste, in the form of biomass, is being used to generate methane for fuel or used as compost in the fields. This energy conversion is achieved by a pyrolysis technique. Dried solids, mixed with air, are heated to a high temperature (since the amount of air is strictly controlled, the solids give off their gases without combustion); these gases in turn pass through a vortex core at a temperature of 1,200 degrees Celsius where they are cleaned of their tars and oils. The hot clean gas then passes directly to a power gas generator which produces electricity and hot water. After gasification only a small proportion of the fuel solids remain, having been reduced to a sterile ash. This ash can be then recycled into cement aggregate.

**BIOMASS:** Plant matter such as trees, grasses, agricultural crops or other biological material can be used as a solid fuel, or converted into liquid or gaseous forms, for the production of electric power, heat, chemicals, or fuels.

Figure 8.4 Diagram of how a biomass system functions

Figure 8.5 Diagram of a biomass system
Specially modified wind driven ventilation cowls integrated into the balcony structures encourage cross ventilation without using electricity, with passive heat recovery and super insulation based on the bedzed model.

A mountain bike training track climbs over the roof gardens, showing how high densities good amenities and opportunities to take exercise can be achieved around public transport nodes, minimizing the need for private car use. It is hoped that this type of alternative relatively low rise urban model will replace the energy intensive tower blocks prevalent in many Chinese cities.
Program

CHALLENGE: TO PROTECT THE ECOLOGICAL CONDITIONS OF THE SITE AND TO ENSURE SAFETY, ACCESSIBILITY AND ATTRACTION, ALLOWING TOURISTS AND LOCALS TO USE THE SITE AS AN URBAN PARK AND AGRICULTURAL DWELLING FACILITY.

ATTRIBUTES:
SITE OPPORTUNITIES:
* PRESERVATION OF VEGETATION
* UNVEILING BURIED RIVERS AND SPRINGS
* CREATE ALTERNATIVE FLOOD CONTROL / WATER MANAGEMENT
* PROTECTION OF WILDLIFE
* RE-USE OF ABANDONED INDUSTRIAL BUILDINGS

FUNCTIONALISM:
* NETWORK OF PATHS - LINK CONTEXT & SITE
* SHIPPING DOCKS / INDUSTRIAL BUILDINGS INTO EDUCATION / SPORTS FACILITIES, RESTAURANTS, SHOPS
* INTEGRATION OF MODERN ART / ICONIC FEATURES INTO PARK & PENETRATING LAND PROVIDING SEATING, ENVIRONMENTAL INTERPRETATION, LIGHTING AND DISPLAYING OF NATIVE PLANTS

RELATIONSHIP TO URBAN CONTEXT:
* PARK MERGES INTO URBAN FABRIC BY EXTENDING THE ADJACENT CIRCULATION FLOW INTO THE PARKS CIRCULATION NETWORK
* THROUGH ADAPTIVE URBAN FACILITIES AND WATER ELEMENTS PEOPLE WILL BE ABLE TO EMBRACE THE RIVER AND CONNECT BACK INTO THE SURROUNDING CONTEXT
* HISTORICAL LANDMARKS ALONG WITH ICONIC MODERN ART FEATURES WILL DRAMATIZE THE CHARACTER OF THE SITE IN AN ARTISTIC WAY CONNECTING BACK TO HISTORY AND TO THE FUTURE

ENVIRONMENTAL RESPONSIBILITY:
* REDUCING, REUTILIZING, AND RECYCLING NATURAL AND MAN-MADE MATERIALS
* USE OF NATIVE VEGETATION, SOIL AND NATURAL HABITATS
* STRUCTURES ARE REUTILIZED FOR EDUCATIONAL, RECREATIONAL, AESTHETIC AND FUNCTIONAL PURPOSES
This projects programming is unique for the fact that it will be covering approximately 74 acres of land and primarily be focusing of the revitalization of the waterfront and how that can be distributed throughout the site to create a more dynamic mixed use community. The elements that should be changed and should be kept within the site are outlined as followed:

**SHOULD BE CHANGED:**
- More access to water
- Structures engage and connect to the waterfront
- Structures gain access to greenways
- Riverfront becomes park for event access
- Link riverfront to neighborhoods/ pedestrian greenways
- Brand identity / create distinct icon or public image
- Enhance historic / educational opportunities
- Re-define identity / re-use of industrial section
- Add pedestrian bridges & pathways over river
- Improve historical culture
- Create water management system

**SHOULD BE KEPT:**
- Skyline preservation
- Views from bluffs
- Accessibility to river
- Wildlife species
- Natural bank forms
- Existing views
- Vegetation on banks
- Existing riverbed - stone walls
- Fort Nashborough
- Historic industrial structures
- Maintain music city identity
- Boat docks
- Railroad access
- Public art
- Existing public space
- Existing greenways
- Retain stadium

Along with these aspects, the main focus is going to be on persevering view corridors, re-connecting the community to the waterfront, creating a varied and compelling skyline, and creating streetscapes that are pedestrian and bike friendly. These aspects will be structured around a commercial district of restaurants, bars, shopping, doctor’s offices, daycare facilities, dance, music, karate, and acting studios, along with an amphitheatre and residential district.
PARK PROGRAM:
* MULTI-PURPOSE PLAYING FIELD
* BICYCLING CIRCUIT
* EXCERCISE CIRCUIT
* JOGGING CIRCUIT
* KAYAKING
* BASKETBALL
* VOLLEYBALL

STRUCTURE:
* SHELTERS FOR SHADE AND GATHERING
* COMFORT STATION/RESTROOMS
* MAINTENANCE + OPERATIONS OFFICE
* SEASONAL CONCESSION
* KAYAK STORAGE

PLAY AREAS:
* PLAY STRUCTURES, SWINGS
* WATER PLAY
* EDUCATIONAL PLAY
* DOG RUN

PASSIVE & CULTURAL + ECOLOGICAL:
* OVERLOOKS
* INTIMATE SEATING AREAS
* LAWN AREAS
* SETTINGS FOR IMPROMTU EVENTS AND CULTURAL ACTIVITIES

*Mixed Use Program:
* RESTAURANTS
* RETAIL STORES
* COMMERCIAL OFFICES (VAIRED SIZES)
* DOCTORS OFFICES
* DAYCARE FACILITES
* SCHOOLS
* CHURCHES
* DANCE STUDIOS
* KARATE STUDIOS
* MUSIC STUDIOS
* ACTING STUDIOS
* RESIDENTIAL
Urban history is replete with examples of cities whose original uses and forms no longer meet their respective requirements and capacity as they’ve developed. The intent of this thesis is to create a regenerative environment suitable for everyday life now and for the future.

Nashville, the second largest city in Tennessee, has been working for some time to renovate its downtown area and attract first-class amenities. Areas of downtown, notably the District, have stylish older buildings re-purposed into shopping and nightlife areas. Nashville is also the heart of Vanderbilt University and Fisk University, which adds a college-town dimension with the expected amenities. Beyond tourism and music, the economic base encompasses government, banking, finance, insurance, and medical. Nashville has a high growth rate and relatively low cost of living, but also has some emerging problems with growth and sprawl.

When examining this city, an urban condition that would re-define the city street into a park environment, re-structure the organic growth of civic tissue, unveil the ecological landmarks of 1800’s Nashville, and blend the social/economical classes, would help structure the emerging problems with the city environment. This condition would allow for a space that focuses on the quality of human life within a family atmosphere to be structured within the realm of local neighborhoods and the central business district, thus allowing the public realm to rebuild itself and the focus of life to return to the city’s core.
The study area considered both sides of the Cumberland River as it passes along both the East and West banks of downtown Nashville. This area encompasses 5.5 miles of river, 1860 acres of land, and 380 acres of water. It is broken down into three sectors, up river, mid-river and down river. The river flows South to North, and is similar in scale to that of Central Park in Manhattan. It would take about 30 minutes to bike the study area and 2 hours to walk it if you could.

In its existing condition, Nashville’s riverfront creates a separation and barrier between the downtown district and East Nashville, an area of low income housing and neighborhoods. On the East side riverfront, the area mainly consists of brownfield land and industrial yards.

Although the Cumberland River is still a working river today resulting in a lot of industrial land use around the banks, there has begun to be a shifting land value change as the industrial warehouses become less dependent on the river. Also, as property values rise, these types of industries are re-locating further outside the city where land is cheaper.
An analysis of the topography allows for a breakdown of the areas character and appearance. The long interaction of the Cumberland River on the limestone valley has created a unique topography of higher bluffs and hills over a lower river plain, therefore the site is distinguished by extreme topographical change. Within the riverbanks themselves, a total of 145 feet in elevation change happens from river level to the top of the bluffs.

This study also shows that the areas right around the surface of the river is the lowest level lands and as the city spreads out, it increases in elevations within certain sections.

By observing the elevations of the land regionally, there are patterns of low lying areas that reach into sections of East Nashville, almost like fingers stretching up from the riverbank. These areas are good observations into how water drainage from outer areas runs back to the river and could allow for green pathways to be design and occur along the neighborhoods.
A preliminary land surface area analysis for the study area revealed that the largest current land use is parking lots. Parking lots weave through much of the industrial and warehouse areas. The Titans football stadium currently has 7000 surface lot spaces, 4000 which are reserved for game-day tailgating.

An analysis of the concentration of people in the area, shows that along the riverfront, workers are the main source of population along with a high density of homeless. This homeless concentration is due to the fact that the waterfront has been exploited over time and run down by industrial yards. Most residential developments occur on the west side of the river closest to the downtown district.
The leisure features in and around the riverfront shows that the main concentrations of parks and activities to the East of the river are approximately 1 mile away from the riverfront bluffs. Within that 1 mile stretch, 90% of the land is industrial. There is no connection from East Nashville to the river’s edge, therefore creating a separation within the city.

The water surface analysis shows us that 300’ of the river’s width is reserved for commercial traffic. The Cumberland River is still very much a working river, although is not as wide as many other working rivers in the south, it is wider than some of the recreational rivers. Along the study area there are 12 river terminals and 4 fleeting areas for barges. The remaining water surface area is available to recreational boating services, but this area is tight, constricted, and potentially hazardous as the outside curve below the bluffs is most difficult for barges to navigate.
The study area is a complex relationship of ownership and overlapping regulatory jurisdictions which include railroads, US Coast Guard, Tennessee Department of Environment and Conservation, Metro Council Districts, Metro Planning Community Plan Areas and Planning Subareas, Zoning Metropolitan Development and Housing Agency Redevelopment Districts. Metro, State, and Federal governments have significant land holdings within the study area.

On the following page, when looking more in-depth at the specific regions right around the riverfront, you begin to see just how many brownfield lands exist and how it is creating no means of circulation around the riverfront and a disconnection between downtown and East Nashville. LP Field, where the Tennessee Titans Football team play, is the only appeal for people to congregate on the East side and that only occurs 10 times a year. Most of the historical aspects that have been preserved occur within the downtown district on the west side of the Cumberland.
Figure 10.10 Natural and cultural legacies

Source: Nashville Design Center
Site Analysis

This site, which can be seen highlighted in Figure 11.1 on the following page, is located east of downtown directly across the Cumberland River focusing around LP Footfall Field. This became the specified location of interest for my intervention for the fact that 96% of the land consists of brownfields, it sits along the riverfront being able to utilize the advantages water has to offer and it can become the link that re-connects the city with East Nashville. This site has the potential to be a great unifier for the city’s core districts, regional transit, and the neighborhoods that surround.

In the current condition, the downtown district has the historic structures, the country music hall of fame, the Ryman auditorium, and all the country bars and restaurants to begin to create an identity. This area east of downtown only has a football stadium used 2 weeks of the year to help create a destination and a place of activity. There is no clear, overriding identifiable element to unify this community.

This space allows for all the opportunities to create this biotope environment along the water’s edge and throughout the site in specific locations along with a new community that consists of dense mixed-use facilities focusing around the connection between the city, this new community, and the existing community already established in East Nashville. The majority of the amenities within this context will focus on the quality of family life and what is needed for a family to live near a city core but have the facilities that suburban communities have to offer.
Figure 11.1 Site map
Figure 11.2 Site map - main concentration
Figure 11.3 Aerial view of site
Figure 11.4 Contextual photographs
Conceptual Design

After analyzing the site and looking at the major elements that need to be focused on within the context of the site, I began to look at the framework of Nashville that needs to be built up first in order for the intervention of this new eco-community to work. This vision is something that would occur over the next 50 years to create a better quality of life. It is focused on 4 major elements:

1. Shrinking of the city: as people are moving back closer to the city's core, the restructuring of its elements needs to occur.
2. Connection of neighborhoods to city core: taking the elements neighborhoods offer and attract people and being able to recreate them with this new direction within a mixed-use community.
3. Connection of this new eco-community to work: creating pathways that are safe, environmentally friendly and attract people to walk or ride a bike to and from home and work.
4. Time: if one lives closer to work, time lost isn’t spent in a car traveling in traffic and the quality of time spent with family increases.

Evolving environments help us to orient ourselves as individuals and as a society, so having an area that can adapt over time and become sustainable is very important. This aspect of being able to layer new social, economic, and cultural impetuses relative to natural and historic traces, allows the past, present and future to be interconnected.

This new eco-community is an area that will begin this transformation into a sustainable future; to shift the way of thinking. Figure 12.3 shows a breakdown pyramid of how today standards occur versus how they need to begin to occur, dealing with transportation.
strategies. Cities today have been slowly transforming to meet the needs of the ever-changing world. Figure 12.4 shows how cities have been able to alter their uses and forms to meet today’s capacity. It breaks down the two major cities in America with the highest density designed around a livable, walkable lifestyle. No other city will be able to grow to meet these standards, but they can convert their existing conditions in a smaller scale to function more appropriately.

Using the ideas of how big cities work but being able to bring it down in scale is shown in a diagramatic order in Figures 12.5-12.7. This regional plan begins to form a framework for how Nashville can begin to grow. How infrastructure has shaped the city over the years and how new light rail infrastructure could begin to take form and re-connect the city within and to outlining areas.

To pin point the exact intervention of this new eco-community this type of framework has to occur on a larger scale, otherwise this new community would stand alone and just be creating a new division within the context of the city and established neighborhoods. There would be no re-connection from one to the other.
and there would be no public realm that would bring both sides of the river into one location as a link.

Figure 12.3 Diagram showing the trend of cities in america

Figure 12.4 Diagram showing the development of cities
Figure 12.5 Regional plan of nashville showing framework context
Figure 12.6 Regional plan of Nashville showing framework context within my site
Figure 12.7 Regional plan divided into sections
A city is a place that becomes a repository of memories that have existed there over time. Its form and shape is in response to past decisions and existing conditions. When looking at the regional plan of Nashville, you see how the Cumberland River has become this divider between the city due to the industrial revolution. We see that there is only one pedestrian bridge and it only links the football stadium with downtown, other than that, there are 3 major highway infrastructure bridges that connect the two sides.

When breaking down the location and zoning in on the section directly north of the stadium that incorporates two access points across to downtown; one in which runs through East Nashville at a slower speed, while the other is a major access point that crosses elevated above the site from East Nashville into the city; you begin to see how this space could become the site of my intervention, eco-community, as it is a central location between both sides. This is shown on the next 4 pages Figure 12.14 - Figure 12.20. These diagrams begin to break down the site into blocks, approximately 340’ x 325’ and begin to show how a block can begin to react with the street, the waterfront, and the ecology. It also begins to establish the density of the area along with the different functions of streets, from pedestrian and bike, to electronic vehicles, to main access roads for all. Before this process, I did some concept diagrams of how a block could be organized. Figure 12.8 - Figure 12.13.
Figure 12.14 Conceptual plan of existing and proposed elements 1

Figure 12.15 Conceptual plan with massing element 1
Figure 12.16 Conceptual plan of existing and proposed elements 2
Figure 12.17 Conceptual plan with massing element 2
Figure 12.18 Conceptual plan of existing and proposed elements 3

Figure 12.19 Conceptual plan with massing element 3
Figure 12.20 Conceptual plan with massing element 3

Figure 12.21 Conceptual plan with massing element 4
Figure 12.22 Detailed idea of how a street could begin to react with the waterfront

Figure 12.23 Idea of how the riverfront can be designed
Figure 12.24 Idea of how the river walk can be designed
Figure 12.25 3D study massing model
This redevelopment plan is the start to revamping the cities inner core. It is a means to clean up all the brownfield lands and reconnect the city to its self. Studies show that within an inner city urban development, the built environment will influence both recreational and utilitarian physical activity. An environment that provides facilities for active recreation, such as nearby parks, multiuse trails, and even appealing sidewalks or public spaces for evening strolls, will promote recreational physical activity. On the utilitarian side, environments that facilitate commuting by foot, bicycle, or transit (most transit riders are also walkers or bicyclist, since they have to travel somehow to and from the transit stop) help incorporate walking or bicycling as a daily routine (Hellmund and Smith 2006). Environments that locate stores, theaters, and other destinations within walking distance of home and work have the same potential, a strategic opportunity since non-work trips account for the majority of trips people make.

These leisure opportunities, indoor entertainment centers, waterfront restaurants, picnic points, sports fields, esplanades, festival lawns, and an outdoor music pavilion associated all along a riverfront will help shape the urban development and rediscover this sense of dwelling within a cities urban core.

Nashville, just like many American cities, is arranged according to the orthogonal grid that eases traffic flow but often lacks public gathering places for leisure, socializing and dwelling. The ultimate goal of this ecological development is to create a life as efficiently and elegantly as biological systems, in order to achieve and maintain a high quality of life well into the future. This community will help in creating a stronger economic base and a more empowered and engaged citizenry. It will contain a place comprised of all the organs of civic and communal life and be deployed in an integral fashion. It will extend the ordering and design of a landscape beyond the conventionally accepted ecological systems and into an explicitly social and urban relationship.

Transformation, succession and operation will help to emphasize the site’s role as a living, dynamic entity. This urban form is determined by the natural features such as the riverfront and the unveiling of the natural springs that existed into the early 19th century, creating a modern ecological development. Not only will this community promote greener lifestyles, give access to
light-rail transit, create a civic square and a safe environment to raise a family, it is a space that is also built around time; the proximity and axis of the means of our lives and how meaningful spatial experiences create benefits and balance.
Through further research and development and examining variances in the site and the conceptual ideals that could take place there, a re-examination of the current conditions and contexts lead to a change in how the ecological aspects are to be developed. Due to the fact that this site has been contaminated from its presence as an industrial yard for over 100 years, a thorough investigation into what types of remediation needs to be established, along with how this remediation can continue to occur once built structure is placed on site. Figure 13.1 shows a breakdown analysis of the types of remediation that were discussed earlier and what types of contamination they are best used for. This analysis will be used further to break down the site into different sections of remediation.

By thinking about how this idea of phytoremediation can continuously occur and develop a self sustaining
ecological site, the idea of designing by nature instead of designing by structure became the main focus.

Although focusing on the ecological aspects of the site is imperative, a re-look back at the regional ideas of the site and the original conceptual base, shown in Figures 13.2-13.3, needs to occur first in order to build a solid foundation. The main concept is to build a community within the context of the city realm and East Nashville suburbs and re-focus the center of the attention back to the Cumberland River and its ecological aspects, instead of pushing away from it. This is the idea of re-connectivity. If there is no directional connections East to West, this new eco-community would sit alone and fail as an urban context.

Figure 13.2 shows the idea of how the city, outlined in orange, can connect into this new eco-community, highlighted in gray, and then up into East Nashville through some sort of pathway cutting through iconic nodes or stopping points, such as a transit hub, shopping center, or historical landmark. Each node can become the identity of the area while creating connections and accessibility; safe pathways from one area to another.
When these connections are established on a macro scale, focus within the micro-scale of the area of intervention and its current conditions needs to be established. Shown in figure 13.4, is a breakdown of the sites current features, or lack thereof. As you can see, the majority of the site and surrounding context is surface parking lots. The only existing green spaces are the areas that surround the entries and exits of the highway infrastructure. The main industrial buildings sit to the far north of the site and consist of storage warehouses for construction equipment, a car dump yard and mechanical/chemical facilities.

These current conditions show how isolated this area has proceeded to since the industrial revolution and has created a place of despair. This area sits only a couple hundred feet from downtown and directly north of the Titans football stadium. It is an area in which people drive through and interact with on a daily basis. To keep this type of interaction within the context that it sits has only degraded the downtown district and made the area less pedestrian friendly. It has created a focus that was once towards the Cumberland River in the early 1800’s, to be brought to a street level downtown.
The next focus of study began to look at the section of land directly north of the football stadium and begin to break down its functions. Since there is an established connection of roads from east to west, along with the proposal of a light rail transit and greenway system, the idea of an inner linking system within the context of the community needs to be provided also. Figure 13.5 shows a diagrammatic idea of how re-introducing a river from the 1700’s would begin an axis where an eco environment could be created, thus allowing connection points, or civic uses along that river. This in turn creates visual contacts, north to south within the site. These pathway links will create an active connection; a path filled with experiences and memories that re-define the city street into a pedestrian friendly inhabitant.

Figure 13.6 shows a diagram of how the water flow system would occur. The Cumberland River flows south to north, allowing the river being unveiled to run east to west and flow into each other. This idea begins to focus on how the flow of nature can interpret how the flow of people can occur. It is much nicer to walk along the water or a greenway, than it is to walk along a highway,
thus re-introducing the idea of designing by nature, and allowing the natural landscape to form and establish itself.

Figure 13.7 begins to break down the context of the site into sections that will be established. The two red directional paths are the main road infrastructure connections that will incorporate a light rail transit. The green section is the ecological park/civic center area that will embody the historical river and create access points and agricultural educational facilities. The two areas that will touch the eco-park will consist of smaller retail facilities along with cluster housing units, providing a dense livable neighborhood. Moving outward will be two areas providing standard mixed use complexes, including commercial office buildings and a higher density framework. Most traffic would be occurring in this section, the farthest from the ecological landscape and allow for the natural aspects to be sustained easier.

After analyzing the aspects of the site and the sections that will be established, the next step is to look back at the sites remediation tactics. To design by nature and allow the natural settings to be re-established, first the site needs to be decontaminated. Breaking down the areas into what type of industry was present on site allowed for an investigation into what type of remediation is going to occur in what area. Figure 13.8 on the following page shows how this breakdown is to be composed. Each symbol represents one of the four technologies that will be incorporated into the sites remediation stage and design phase. These four technologies were broken down in figure 13.1 and shows which remediation strategy works best for what type of industry occurred on site.
The industrial remediation analysis shown here illustrates that the worst contamination occurs to the northeast, then to the northwest closest to the riverfront and works its way down towards the southwest and across to the southeast which has the least amount of physical damage. This breakdown allowed each section to be evaluated separately in order to determine what species of plant life would occur to remediate the soil in that particular zone. A section diagram on the following page shows the division of each component and how it is working on the site from north to south. The type of plant life is displayed along with the idea that this remediation would continue to occur in swales long after the initial cleaning phase. To be able to keep a continuous process long after its initial remediation, would create a sustainable environment and keep the ideals of an ecological landscape intact over time. This is of the upmost importance when dealing with an industrial site and then structuring dwelling units, civic centers and commercial districts in the same place. To clean a site and then re-damage it would be opposing the ideals of creating a sustainable ecological environment in the first place. To be able to design an
interdisciplinary connection between the suburbs and city through this eco-zone, part of this process needs to be preserved so that the community can learn and understand how important our environment truly is and what needs to occur to keep it rich and alive. If a community can be involved in processes like remediation, the quality of life changes and people will respect the area in which they live, work and play because they will understand the inner workings of its features.

Once the remediation has begun and the historic river is cut through the land, the site would begin to restructure the natural settings that once occurred, especially in and around the water. Figure 13.10 shows the typical occurrence of plant life around a waterfront, growing out into the riparian, or bank of the river,
area of highest elevation around the flow of water. These studies of plant life and natural environmental growth lead to an understanding of how the site is to be developed.

The next eight pages show the phasing process of how the land is to be developed over time; growing from the ecological phases into the construction of the built environment. This ultimately leads to the final plan and redevelopment of this site as a whole community.

The first seven phases consist of the progression of the ecological landscape when the historic river is reconstructed and the land is left to grow naturally. By phase five, green pathways of remediation are constructed that will later exist as green corridors in-between the neighborhood blocks and create a visual and physical connection to the ecological park and civic centers, while continuously cleaning the land over time. Phase six shows how water channels will be constructed so that when built structure is fabricated, storm water run-off will flow into these water channels, be filtered and lead back into the river or recycled for irrigation.

This system of storm water management that mimics nature, allows for the progression of natural elements to occur at every block within the community. This in turn integrates water corridors into the building and site development and helps to reduce the damaging effects on the land and pollution into the rivers. The introduction of these water channels and remediation swales at every other interval eliminates the need of sewers and drainage systems at the street level and directly connects the storm water runoff into a natural system creating a sustainable approach. These systems create a giant living machine that works along with the ecological environment and stitches together the natural land surface area and open space within the context of the site along with the regional plan including the city and East Nashville.

Phase seven illustrates the final ecological development that is to occur throughout the site along with the water channels and remediation swales. The ecological park was designed by allowing nature to grow fully up from the riverbanks and stretch into certain sections of the overall site. The river that runs east to west throughout the site is the main focal point and iconic feature. This is the point of active interaction with nature and with civic, community involvements. It is the central zone that feeds into East Nashville through a water corridor and visually into the downtown district
with its expansive green open space and active recreation areas.

Figure 13.11 exhibits a section study, cutting the site from west to east and looking at how the spatial relationship between the green corridors, the water corridors, the built structure and the street level coexist. This investigation allowed a dimensional breakdown to occur and see how the interaction from one block to the next could connect before actually designing out the community neighborhoods.

The next eight phases in the design development stage begin to transition into where, what and when built structure will be erected. Once phytoremediation has decontaminated the soil, the first order of structural emergence needs to be the revitalization of the existing industrial buildings that are kept and being used as an adaptive reuse Aeroponic farming facility.

Aeroponic farming is the process of growing plants naturally without dirt or pesticides. It uses air instead of soil and artificial lights instead of sunlight. It uses a nutrient rich water system that sprays the produce for 5 seconds every 20 minutes. This allows for no growing season, thus producing organic quality produce and herbs year round. This will not only benefit the residents and restaurants on the site but allow for a farmers market that will enrich the lives of everyone in Nashville.

Phase nine and ten begin the first stage of infrastructure development; the design and implantation of pedestrian and vehicular corridors. Before any new
construction can be executed, pathways allowing trucks and equipment need to be established. In these two phases you can see the breakdown of the blocks and how the green remediation corridors happen in-between the blocks while the water corridors are developed within the street level and main access roads. Each road is designed wide enough for vehicular traffic but allowing the free range of vehicular traffic throughout the site at anytime contradicts the idea of creating a clean ecological sustainable site. Therefore each road is considered a pedestrian corridor or electronic vehicular path and the main gas powered vehicles are left at the parameters of the site. Although the access roads within can be used for emergency purposes, deliveries, moving, or garbage pick-up. Figure 13.12 demonstrates just how far a typical person can walk within 5 minutes, which is equal to 1320’, or half of the site, making the context very manageable for only pedestrian walkways and bikeways.

The next development in construction, phase eleven and twelve begins the process of structural execution. These two phases are built up first according to the type of remediation that occurs in this section. Due to the fact that this area was the least contaminated allowed for the revitalization of the land to take place within 3-5 years, thus providing construction to occur at an early stage. A transit hub, school, housing, retail and commercial lots are to be built in the first sequence to allow for a variety of uses to begin to take place, and
provide useful spaces for residents right away. The expansion of the civic core, a museum and library will be constructed within the second phase along with an expansion of mixed-use facilities and cluster housing units. From this point on, phases thirteen and fourteen broaden the scope of mixed-use, retail and cluster housing infrastructure and define the civic core with connection bridges and pavilions and an amphitheatre close to the riverfront. The final development plan, phase fifteen, shows how the site will fully interact as a whole. This entire expansion, once construction is undertaken, would be executed within twenty years.

The revitalization of this industrial site set the course of action for determining how the built structure was to be developed. This process combined with the water management system lead the entire sites topography to have the highest elevation on the parameters and step down as it reaches the ecological park. Thus creating a natural flow of water to run-off the buildings, enter the water channels, be filtered and released back into the rivers. This is shown in Figure 13.28, which breaks down the site in section from north to south. This section also demonstrates the levels of density change. Just as the site steps down as you reach the eco-park, so do the levels in built structure. The highest levels reach ten stories on the furthest north and south blocks and is brought down to one and two stories as it touches the boundary to the eco-park. The least amount of impact on the eco-park will keep a continues growth of natural features and be able to sustain the land well into the future.
Figure 13.13 Phase I, unveiling the historic river

Figure 13.14 Phase II, the riparian landscape forms
Figure 13.15 Phase III, upland landscape forms

Figure 13.16 Phase IV, upland landscape expands
Figure 13.17 Phase V, greenways are constructed through remediation

Figure 13.18 Phase VI, water channels are constructed for water management
Figure 13.19 Phase VII, final configuration for ecological systems

Figure 13.20 Phase VIII, revitalizing industrial building to be kept
Figure 13.21 Phase IX, structuring of pathways through eco park

Figure 13.22 Phase X, structuring of vehicular and pedestrian pathways
Figure 13.23 Phase XI, construction of phase I, transit hub, school and mixed-use commercial and cluster housing development

Figure 13.24 Phase XII, construction of phase II, expansion of civic building, library and museum, along with increasing the mixed-use commercial and housing units
Figure 13.25 Phase XIII, construction of phase III, entire southern half is fully built expanding the civic core and housing neighborhoods.

Figure 13.26 Phase XIV, expansion to northern portions of the site and development of agricultural facilities and fields.
Figure 13.27 Phase XV, final plan of entire site built up
The next set of figures show a breakdown of certain areas on site and how their interaction begins to take place and how the site begins to feel. These renders are a set of ideals as to how the design strategies start to shape the built environment. Through these images you can begin to see how the natural features have transpired into creating an eco-park while also using those natural elements into the built structure. Figure 13.32 on the following page, illustrates the interaction of the cluster housing units with the green remediation corridors. Each unit is stacked strategically in order for private green roof spaces to occur for each unit, while
on the ground level each unit has a private green space used for agricultural gardens, and resisting the typical American lawn. This allows for an extension of agriculture means from the public level in the eco-park, down to the private level within the blocks.

Figure 13.31 Render showing the elevated highway that crosses south of the historic river at the parameter of the eco-park creating an area to incorporate a farmers market and pedestrian corridor

Figure 13.32 Render showing the interaction between a green remediation corridor and the cluster housing units

Figure 13.33 Render showing the transit hub and its interaction with the elevated highway, water channels and park
The design aspect of this project stemmed from the ideas of creating a regenerative ecological landscape within an urban dwelling, mixed-use community. In order for this ecological park to function and have character, its conditions need to work accordingly with society and grow with time.

The vision of the park is to offer a generous and beautiful regenerative landscape that will include areas of cultivation of agriculture, growth, heath and recreation, leisure, public gardens, orchard and berry fields along with access to the water and wildlife conservation refuges. This allows an active character foundation and an expansive neighborhood of public user groups, families and individuals. This large scale interaction with the land will create a unique opportunity to become a leading edge model for growth and sustainable management practices.
Figure 13.34 Plan breakdown of park functions
Figure 13.35 Render showing the public gardens and flower festival park
Figure 13.36 Render showing the leisure park

Figure 13.37 Render showing the park and interaction with the lake
Figure 13.38 Render showing the recreational/fitness park

Source: Field operations for Shelby Farms Park

Figure 13.39 Render showing the ideas of the agricultural center
Source: Field operations for Shelby Farms Park
Figure 13.40 Render showing ideas of the crop and research field
Source: Field operations for Shelby Farms Park

Figure 13.41 Render showing ideas of orchard and berry fields
Source: Field operations for Shelby Farms Park

Figure 13.42 Render showing ideas of the refuge and wildlife conservation park
Source: Field operations for Shelby Farms Park
Conclusion

The following project was presented as a research development hypothesis that gave a resolution to solving the problems urban history has forced upon cities. Cities today are replete with examples of how our evolving environments, over the decades, created functions to public realms that no longer met the same standard and lacked the capacity to grow as the industrial revolution came to the forefront, and suburban transformation spread. Cities were divided, forcing divisions between neighborhoods causing places of despair and damaging effects on urbanization. Natural features were polluted and sites that were once the height of character became the deficient result of change as history progressed. This change forced downtown areas to become places of business only and city life seized to exist.

Through research and development, the city of Nashville became the perfect example of how urban history has affected the riverfront through downtown and created a lifeless division. By giving an inward expansion and allowing the center of the city to be focused back to the Cumberland River, re-defines the link between the city and surrounding suburbs. A mixed-use dense and diverse building structure is used in the forgotten areas of the industrial revolution and helps to define an ecological regenerative environment that not only allows local food production and storm water management tactics, but sets a new catalyst in development by layering the social, economic and cultural aspects of society.

By designing through nature and creating circulation patterns built from the natural flow of plant and water life and remediation methods, allows pockets of continuous growth and cleaning of the site well into the future. This site therefore becomes a multimodal, urban
agricultural regenerative landscape. A place that not only re-connects the city, but creates an understanding of complex issues and a prototype that can expand into other cities and civic spaces.
Works Cited


