



ECOLOGICAL URBANISM: EMBEDDING NATURE IN THE CITY

Alyssa Renee Tope, 2018



Thesis Defense

ECOLOGICAL URBANISM: EMBEDDING NATURE IN THE CITY

Alyssa Renee Tope

Thesis submitted to the faculty of the Virginia Polytechnic Institute and State University in partial fulfillment of the requirements for the degree of

Master of Science in Architecture
Urban Design Concentration

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ABSTRACT

Urban designers are trained to think systematically, to simultaneously see the big picture for numerous human systems in the city—including multiple modes of transportation, barriers faced by the city’s inhabitants, and food and waste systems—and synthesize them into a coherent design. However, many urban designers use architecture as their sole means of shaping our cities, rather than employing other design disciplines as well. One solution to this limited focus on the built environment is “landscape urbanism” which recognizes that cities (like landscapes) are constantly undergoing processes of change. First appearing in the 1990s, landscape urbanism is a theory that argues that the best way to organize a city is through the design of its landscape, rather than the design of its buildings. At its best, landscape urbanism encourages a new way to understand cities: through the horizontal domain that acts as every city’s connective tissue. At its worst, landscape urbanism can emphasize a purely aesthetic view of nature in the city, rather than recognizing its full potential as an additional functional system within the urban landscape. This failing of landscape urbanism can be addressed by its next evolution: ecological urbanism.

As MIT Professor and Landscape Architect Anne Whiston Spirn writes in *The Granite Garden*, we need to recognize nature as “an essential force that permeates the city.” By embracing the presence of nature’s processes within the city, we can create an ecological urbanism that combines human and natural systems for the betterment of both. “The realization that nature is ubiquitous, a whole that embraces the city, has powerful implications for how the city is built and maintained and for the health, safety, and welfare of every resident” (Spirn 5).

Currently, the Anacostia River and the neighborhoods to the east are neglected parts of Washington DC, and most of the river’s tributaries are buried underground. This neglect is similar to cities’ historic disregard for the productive processes of nature, settling instead for a superficial, idealized abstraction of nature in the city. What if the city decided that instead of viewing urban streams as a nuisance that needed to be hidden, the Anacostia River and its tributary system could provide a beautiful, functional, and memorable organizational structure for the East of the River neighborhoods? Highlighting the presence of this large natural system within the city could be an opportunity to develop an “urban ecology” and frame our future relationship with nature.

Using Washington DC’s Anacostia River, its tributaries, and the East of the River neighborhoods as its framework, this thesis explores a possible step past landscape urbanism by advocating for an ecological urbanism that demonstrates how human and natural systems can work together in an urban environment in a way that is ecologically productive, regionally connected, and mutually beneficial.

ECOLOGICAL URBANISM: EMBEDDING NATURE IN THE CITY

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GENERAL AUDIENCE ABSTRACT

Urban designers are trained to think systematically. They must simultaneously see the big picture for numerous human systems in the city—including multiple modes of transportation, barriers faced by the city’s inhabitants, and food and waste systems—and synthesize them into a coherent design. However, many urban designers use architecture as their sole means of shaping our cities, rather than employing other design disciplines as well. One solution to this limited focus on the built environment is “landscape urbanism” which recognizes that cities (like landscapes) are constantly undergoing processes of change. First appearing in the 1990s, landscape urbanism is a theory that argues that the best way to organize a city is through the design of its landscape, rather than the design of its buildings. At its best, landscape urbanism encourages a new way to understand cities: through the horizontal domain that acts as every city’s connective tissue. At its worst, landscape urbanism can emphasize a purely aesthetic view of nature in the city, rather than recognizing nature’s full potential as an additional functional system within the urban landscape. This failing of landscape urbanism can be addressed by its next evolution: ecological urbanism.

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To my friends and family,

Thank you for your endless support. I would never be here without you.

To James,

Thank you for putting up with “stressed Alyssa” for so long and for helping me remember that life after grad school does exist. Your unconditional love and support helped to keep me sane.

To Bob, Robin, Ryan, Mahkam, Jasmine, Vova, Zach, Yaminah, and all my friends at the WAAC,

Thank you for contributing to the very special place that is the WAAC. You all taught me so much and grad school never would have been the same had you not been on the journey with me.

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Thank you for helping me discover my passion for urban design and its ability to tackle the “big sticky problems” that first drew me to the design profession.

Susan Piedmont-Palladino

Thank you for the numerous opportunities you have given me, from being a GTA, to interning at the National Building Museum, to recommending me for the Office of Planning internship, to the 1968 exhibition. The list goes on from there! All of these experiences have added immeasurably to my graduate experience.

Paul Kelsch

Your classes taught me that despite my education in architecture and urban design, I am a landscape architect at heart. Hopefully I can carry the lessons you taught me forward and create an ecological urbanism you can be proud of!

David Lever

Your introduced me to urban design through your classes and I couldn't be more grateful. I don't know if I will ever make it to the end of the extremely long reading list you gave us, but I won't stop trying!

Thor Nelson

I am so grateful to have had my internship at the Office of Planning for the past year. You have been a fantastic mentor who has taught me about the difference between urban design and city planning, and (most recently) the importance of mindfulness.

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INTRODUCTION

This thesis has gone through many evolutions over the past year.

Phase 1: The Site. The original inspiration for this project was Poplar Point, a location along DC's Anacostia River that served as the site for my Master of Architecture thesis in 2017. It is a 110-acre site plagued by numerous issues that combine to make it heavily under-utilized: it is located on a polluted river, in a flood plain, and on a site that is primarily reclaimed land; it has limited bridges across the river, and is surrounded by neighborhoods with high poverty rates, low food access, and minimal job opportunities; and it is disconnected from these nearby neighborhoods by a six-lane freeway. If those were not enough of a challenge in themselves, an additional challenge was to try and "solve" all of these issues without prompting the social or economic displacement of the existing residents.

Phase 2: The River. While I was able to address some of the above issues with my previous thesis, these pervasive problems clearly required an urban-scale solution. Although my original plan was to design an urban development on Poplar Point, I quickly realized that Poplar Point would not be my final site, but rather my point of beginning. This is because the poor conditions that plagued the site were also true of the entire east side of the Anacostia River. Thus, my problem grew from finding an answer for how to design one specific site to finding an answer for how to design along a riverfront in a way that addressed both human and environmental concerns.

Phase 3: The Tributaries. Near the end of the research semester, I realized that while widening my scope to include the riverfront would solve some of the area's concerns, it would not address the need to connect the East of the River neighborhoods to the river or the issues within the neighborhoods themselves. The answer to this problem came after discovering that the Anacostia River's existing tributary system is currently almost completely buried in sewers beneath the city. These tributaries afforded me an opportunity to create a system of ecological corridors that connect the neighborhoods to the river, physically, visually, and symbolically. This system could demonstrate a new way of integrating nature and the city in a way that is mutually beneficial and could create a new and unique urban design aesthetic.



The Site



The River



The Tributaries

RESEARCH AND ANALYSIS

“To the idle eye, trees and parks are the sole remnants of nature in the city. But nature in the city is far more than trees and gardens, and weeds in sidewalk cracks and vacant lots. It is the air we breathe, the earth we stand on, the water we drink and excrete, and the organisms with which we share our habitat.”

-Anne Whiston Spirn

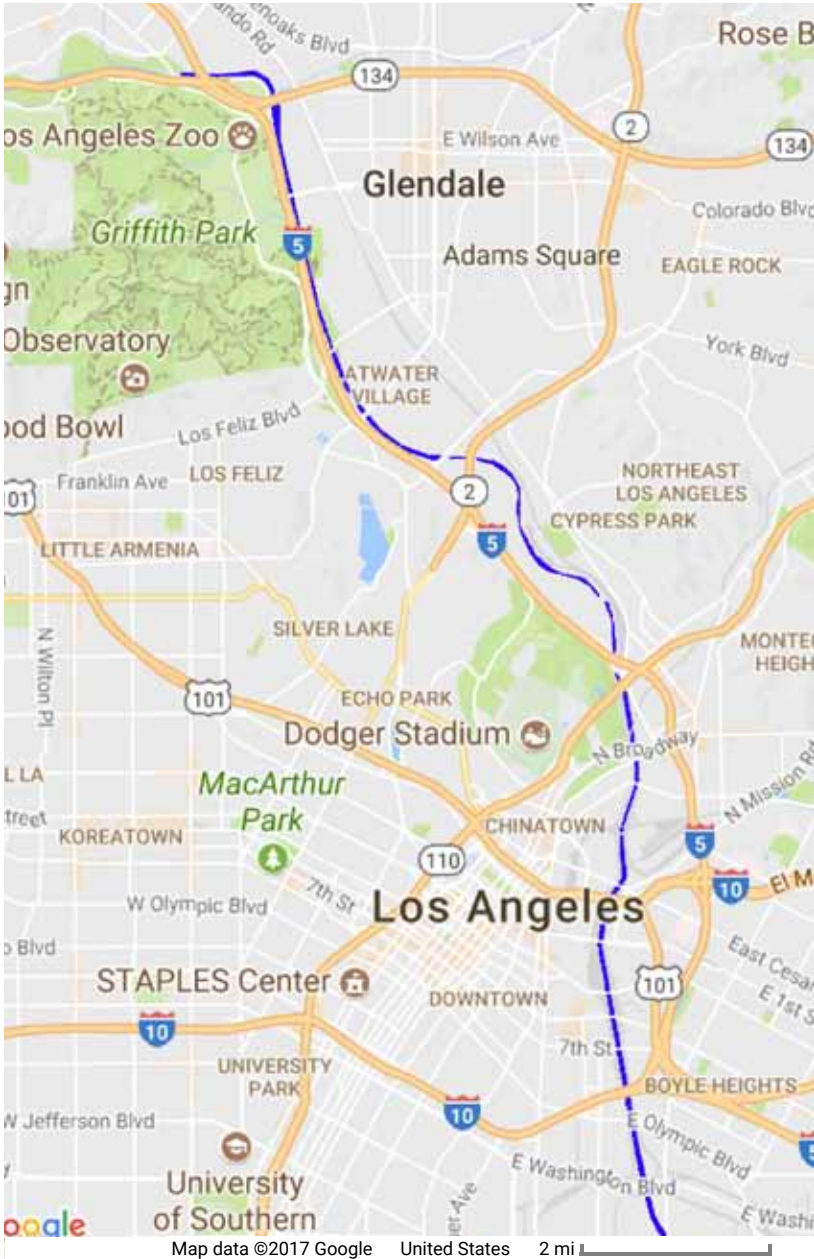
CASE STUDIES

Once my thesis topic grew from a specific site to the entire Anacostia River, I began looking at examples of urban river restorations from other cities around the world that adhered to a similar ecological mindset. The following pages highlight three of the case studies that most influenced this thesis. All maps are shown at the same scale.



Photographs and Renderings of Case Study Rivers

CASE STUDY | LOS ANGELES RIVER ECOSYSTEM RESTORATION PROJECT



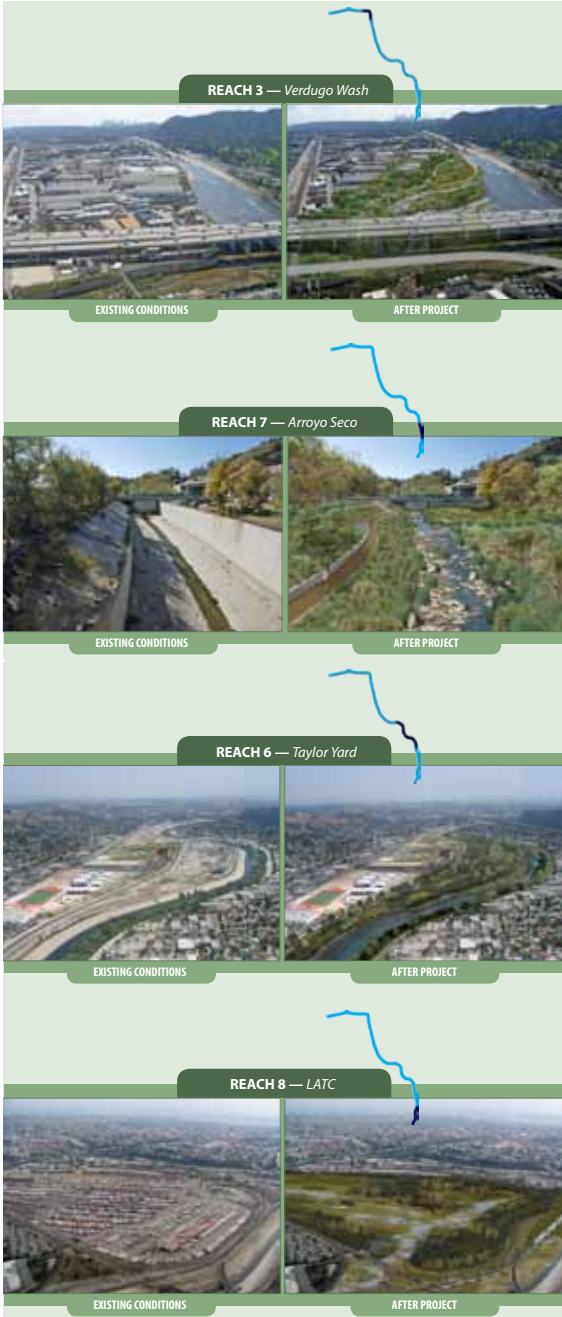
Rendering of Restored River

In 2006, the U.S. Army Corps of Engineers (USACE) began the ARBOR Study to look into the potential of restoring an 11-mile stretch of the Los Angeles River running from Griffith Park to Downtown Los Angeles. By 2016 the study was completed and the restoration project was approved by city council.



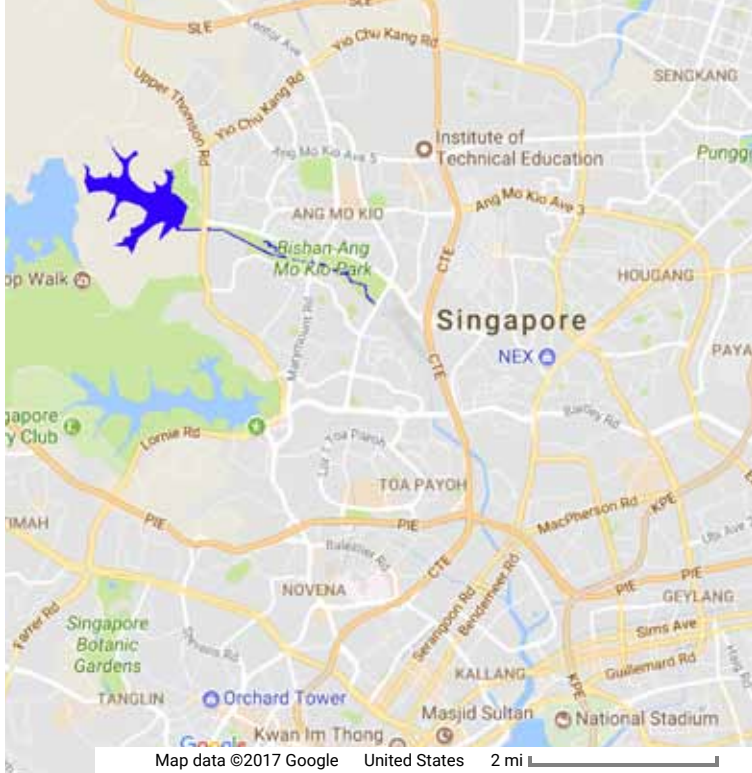
11-Mile Full River Strategy

The project proposes restoring the native aquatic riparian ecosystem. This would benefit the LA River ecosystem (see map above) while maintaining existing levels of flood risk management. This \$1 billion project would revitalize the river, taking it from its current status—a cement-lined channel—and transforming it into a vibrant, naturalized river.



Before/After Series

CASE STUDY | BISHAN-ANG MO KIO PARK - KALLANG RIVER, SINGAPORE



Photograph of Recreation at Bishan-Ang Mo Kio Park

In 2006, Singapore launched the Active, Beautiful, Clean Waters Program (ABC Waters) in order to utilize the country’s waterways, reservoirs, and other water infrastructure to their full potential. By integrating the drains, canals, and water bodies with the surrounding environment in a holistic way, the ABC Waters Program aims to improve the quality of water and community life.



Photograph of the Park at Night



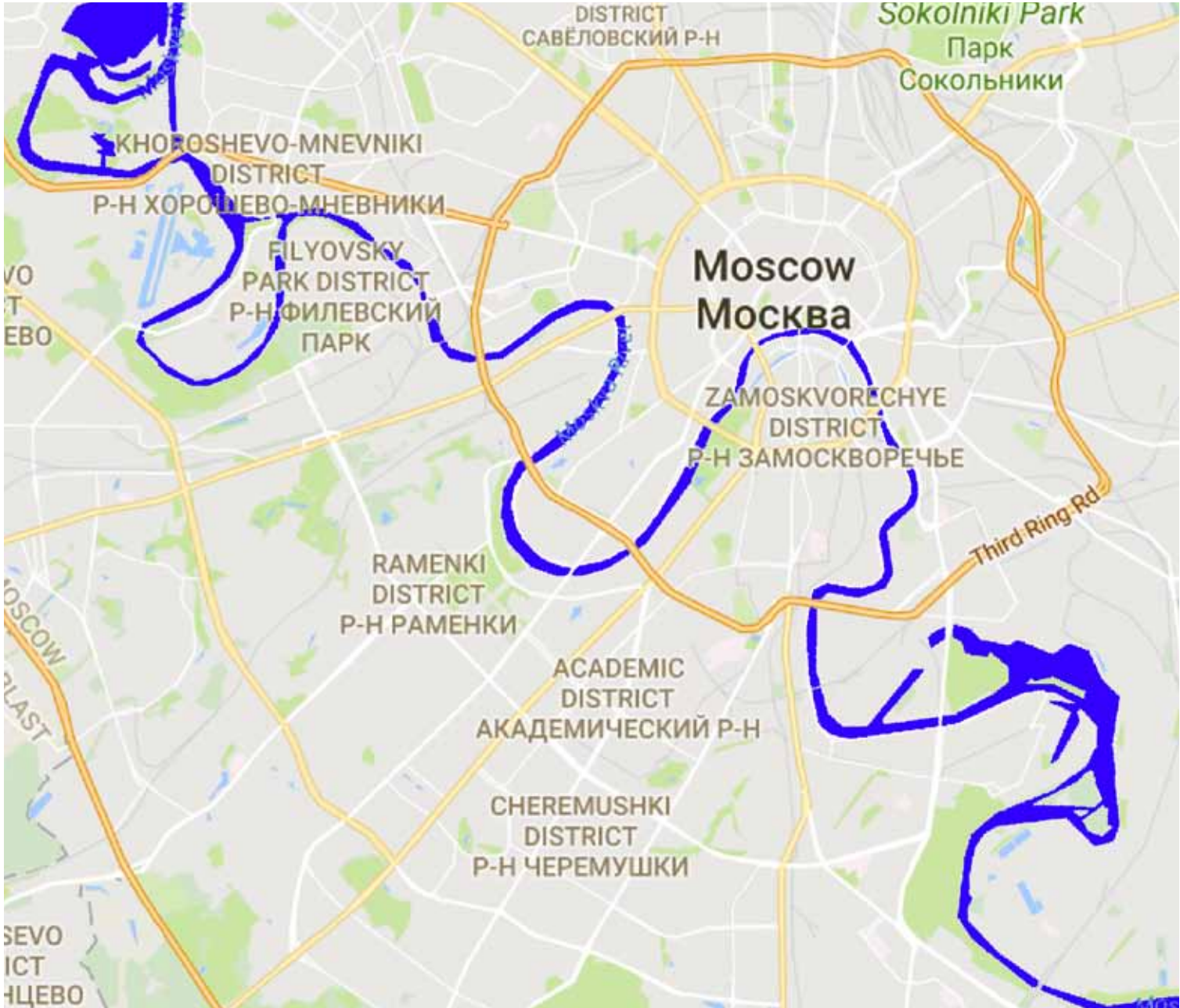
Aerial Photograph of Bishan-Ang Mo Kio Park



Map of Park, Other ABC Water Program Sites, and the Surrounding Watershed

Bishan-Ang Mo Kio Park is a project along Singapore’s Kallang River, meant to turn a concrete canal into a picturesque river. Under the ABC Waters Program, civil engineering techniques and natural materials were combined to soften the edges of the river, give it a natural appearance, and prevent soil erosion. This change is not only aesthetic, but has attracted wildlife to the area. Additionally, the river channel was designed to act as a flood plain and is linked to a network of drains in the city. During dry weather, water is confined the riverbed. However, in the event of a storm, the surrounding park provides flood protection for the city.

CASE STUDY | MOSKVA RIVER - MOSCOW, RUSSIA



Aerial Rendering of Proposed Design for Moskva River



Renderings of Proposed Public Spaces Along River

In 2014, the Fourth Annual Moscow Urban Forum announced a competition to transform the Moskva River from a *barrier* to a *link* within the city. The goal was to “restor[e] its historical status as the city’s heart and most important transportation route” (Stott). The winning design came from the Russian firm Project Meganom.

Project Meganom proposed a network of active transit corridors that included infrastructure for walking, cycling, and public transit. The design also included a series of ports that would act as major nodes, connecting the transit system down to the river with a ferry and high-speed water transport on the river itself. These nodes would also create public spaces along the river, offering spaces for communication, creativity, education, and cultural activities.

SITE SELECTION

This thesis encompasses the Anacostia River, its tributaries, and the East of the River neighborhoods. Rather than developing a design that could be placed anywhere across the globe, this thesis was intentionally designed to be contextual. Contextual design is characterized by making design choices based on conditions specific to the site and its surrounding area, such as historical, cultural, environmental, and physical characteristics. Working with and building from the existing characteristics is not only necessary to help prevent cultural gentrification (i.e., existing residents feeling out of place) but is also necessary when thinking on an ecological scale (for example, working with existing topography and drainage patterns). Therefore, after exploring case studies of urban rivers around the world, I researched and analyzed the history and current conditions of the Anacostia River.

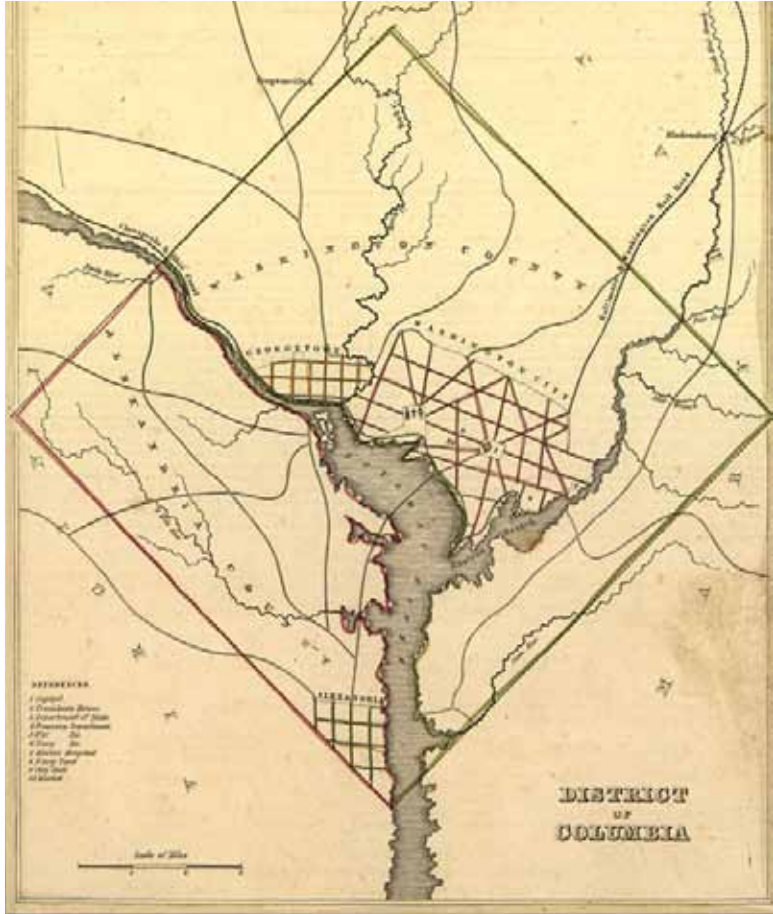


Google Earth Image of the Anacostia River

SITE HISTORY



1791



1835



1891



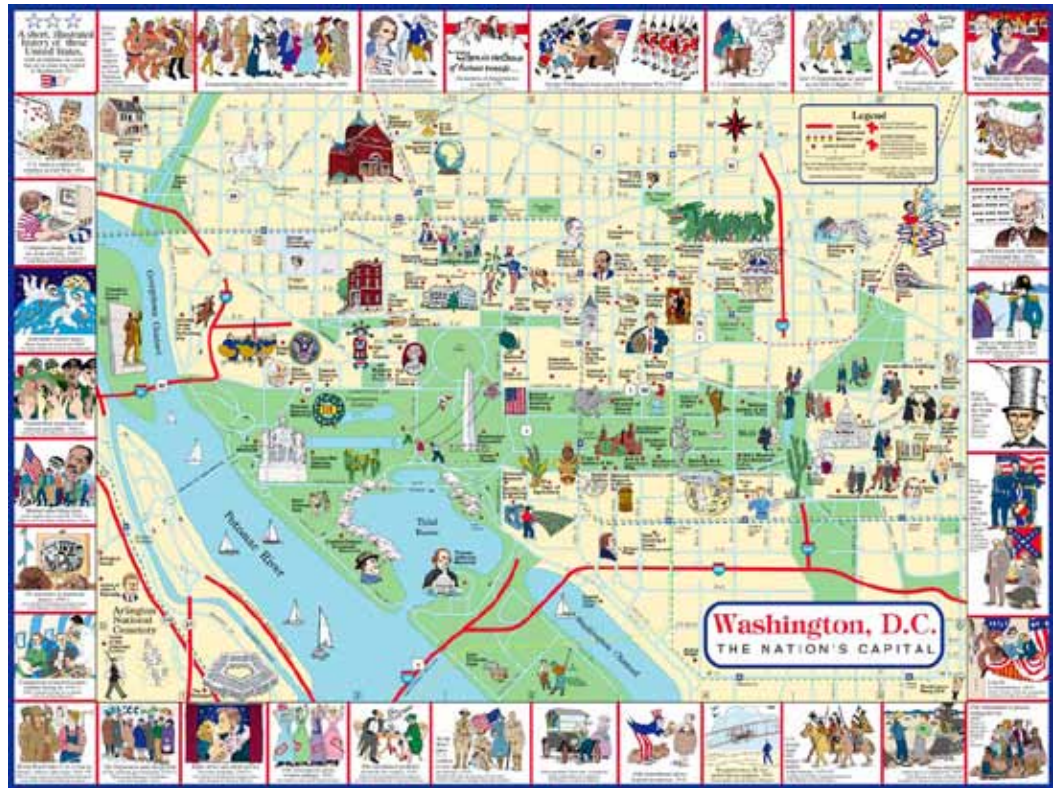
2018

SITE HISTORY | SYMBOLIC HISTORY



1791 Map of the L'Enfant City at the Confluence of the Potomac and Anacostia Rivers

When searching for a location for the United States' capital city, President George Washington carefully selected an area measuring 100 square miles, sited at the confluence of the Potomac and Anacostia Rivers. Although this move symbolically gave each river equal footing, long-range planning efforts favored the Potomac River because the Founding Fathers thought it offered the best access to the Ohio River Valley and other ports along the Atlantic seaboard. In addition, city planner Pierre L'Enfant's centerpiece for DC was the National Mall, which connects to and directs views across the Potomac River, towards the nation's "destiny" to the West. Thus, the Potomac River took on a federal and national importance, leaving the Anacostia to be characterized as DC's "second river," "forgotten river," or "backyard" (due to it slowly becoming the location for unwanted land uses). In fact, many tourist maps (like the one shown below) neglect to even include the Anacostia River or any of the neighborhoods to the east on the map at all.



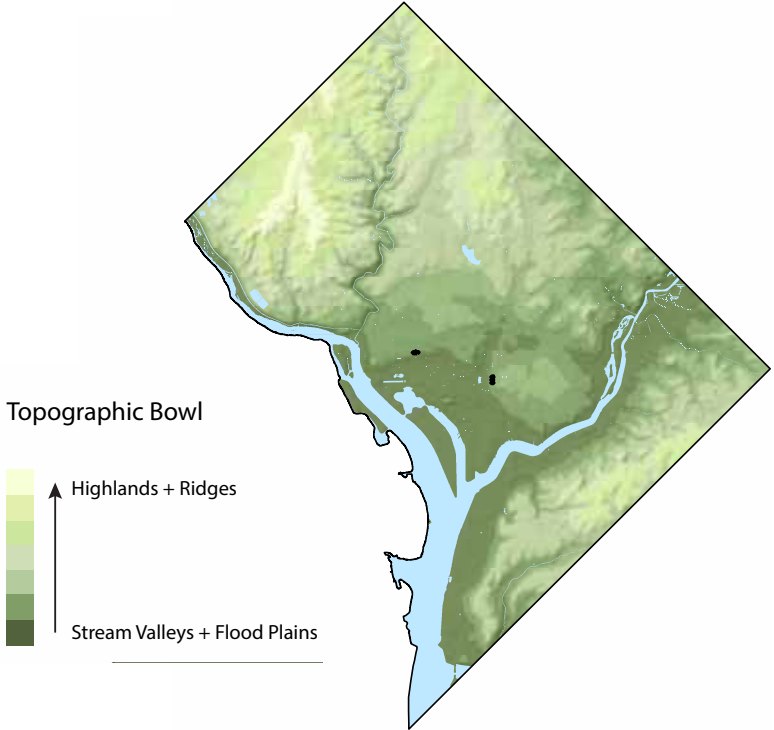
Tourist Map of DC (Anacostia River is Not Included)

SITE HISTORY | ENVIRONMENTAL HISTORY

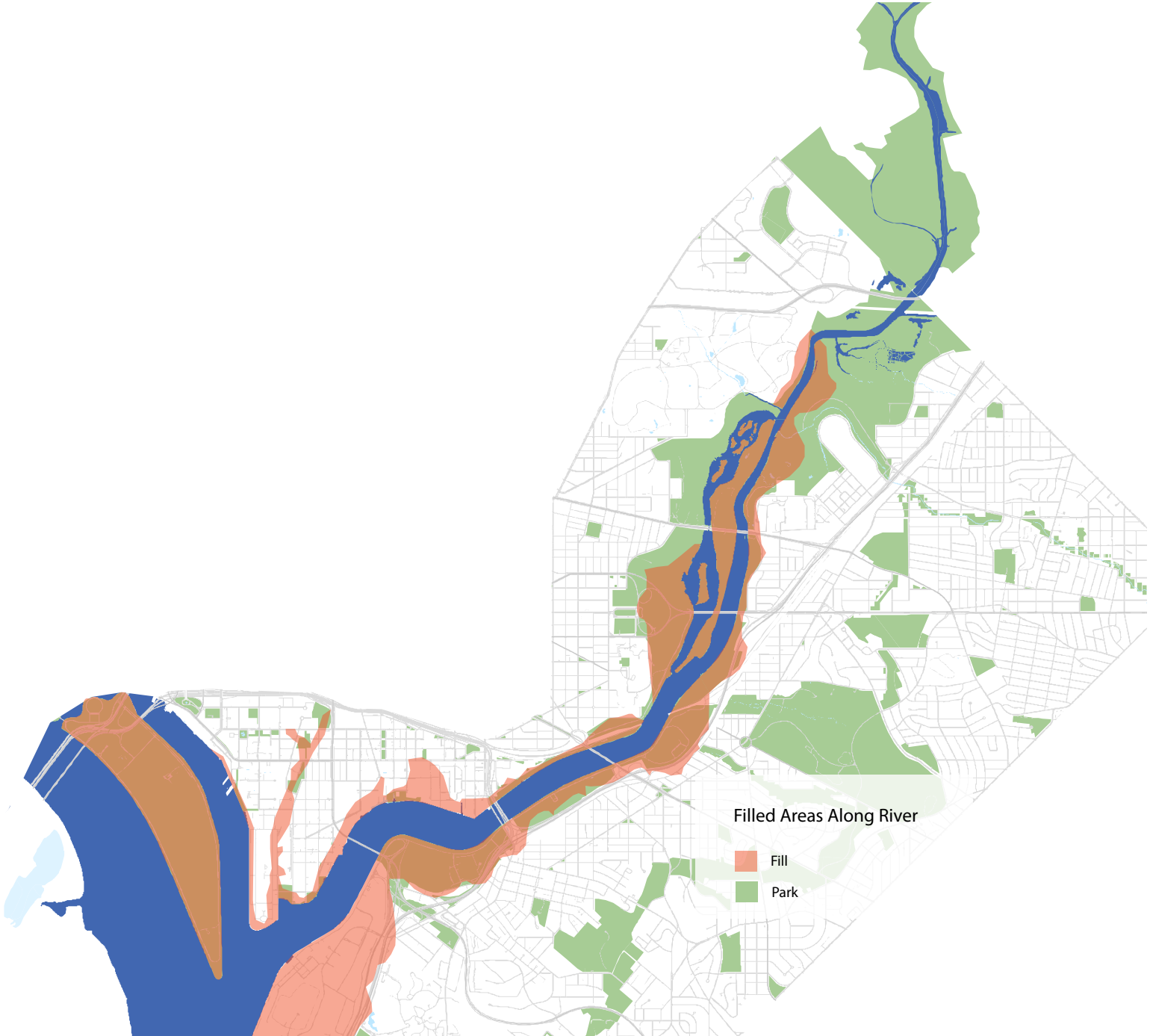
Landscape conditions also contributed to the Anacostia River being forgotten and under-utilized. Since it was surrounded by lowlands that experienced tidal and seasonal flooding, the land was used for industrial and military uses as well as staging areas for Navy Yard laborers.

ENVIRONMENTAL TIMELINE:

- **Pre-Colonial times:** Lush habitat and diverse ecosystems supported Nacotchtank Indians for 1,000 years.
- **Late 17th Century:** The Anacostia served as a primary transportation route (40’ deep channel acted as passage for ocean vessels up to Bladensburg, MD), contained an ample supply of fish (sturgeon and shad), and its riverside forests began to be clear-cut in order to use fertile soils for extensive tobacco farming.
- **1799:** The Navy Yard established in SE DC as a main port for receiving materials and ship construction (last ship was built in 1876).
- **1860s:** The river’s depth shrunk from 40’ to 8’, and it was polluted and silted by the clear-cutting of forests, tobacco farming, and industrial activities.
- **1880s:** DC constructed a sewage system which began dumping waste into the Anacostia.
- **1902–1926:** The shallow, polluted waters caused the riverbanks to become mosquito breeding grounds, so in order to prevent the spread of diseases like malaria, the Army Corps of Engineers dredged the riverbed, filled in flats, and constructed levees. DC was growing only in the NW quadrant and didn’t think it needed the reclaimed flats, so in 1919, the flats were formally declared to be parkland. Tons of dredged riverbed were used to create Kingman and Heritage Islands.
- **1945:** Population growth led to suburbanization and highway-building, causing more contaminated runoff into river.
- **Today:** 70% of watershed is urbanized; only 25% of original forest cover remains.



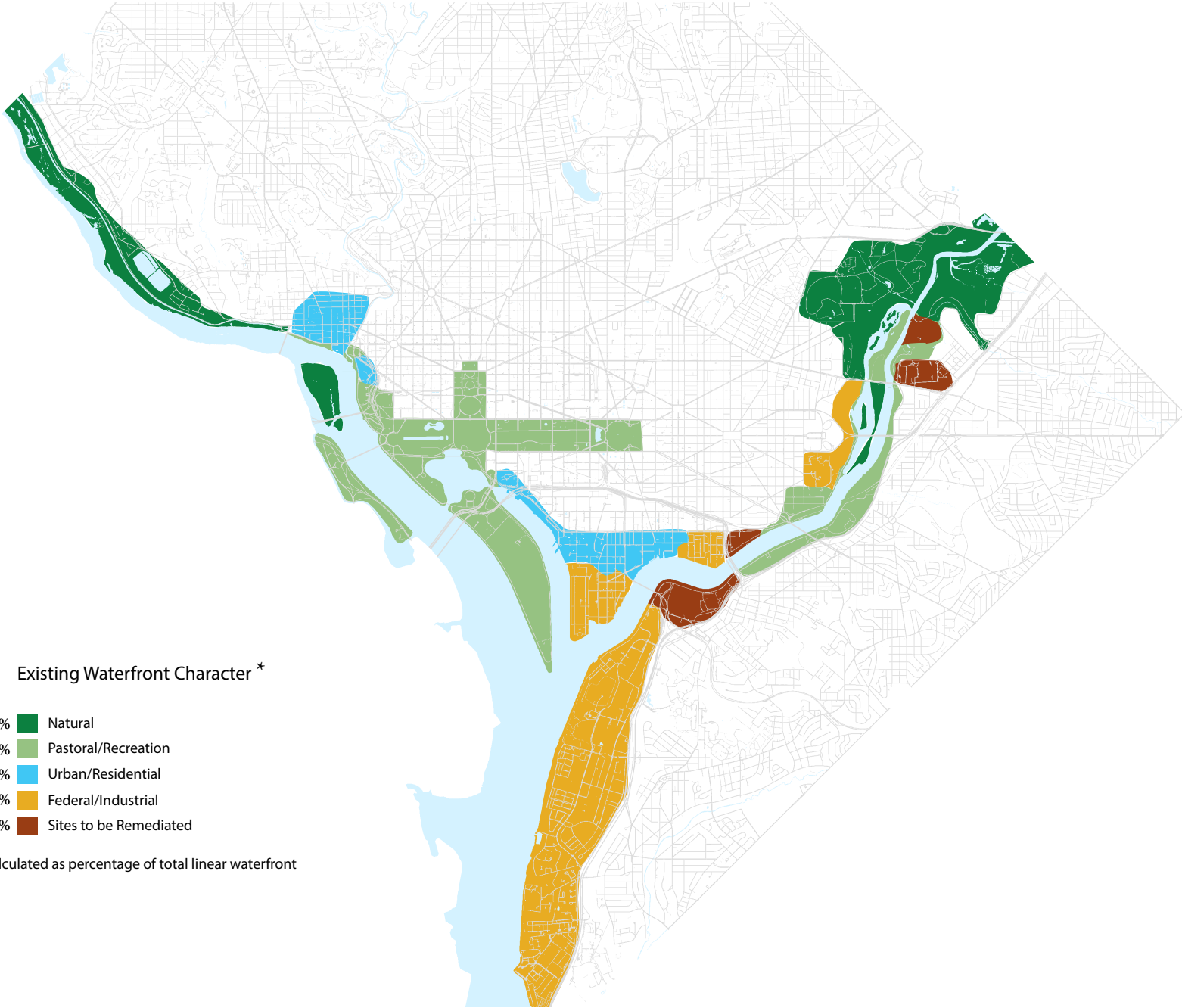
Topographic Map of DC



Map of Reclaimed Land Filled by Army Corps in the Early 1900s

CURRENT CONDITIONS

The East of the River neighborhoods are currently divided from the rest of Washington DC by numerous physical, economic, and social barriers.



CURRENT CONDITIONS | PHYSICAL BARRIERS

The most obvious physical barrier to the East of the River neighborhoods is the river itself. When compared with other urban rivers from around the world, the Anacostia has far fewer pedestrian crossings. The diagrams below show that while the Anacostia's width is comparable to the Seine in Paris or the Thames in London, it has less than half the number of pedestrian-accessible bridges. Similarly, the existing pedestrian space on Anacostia bridges is considerably less than, and contains far less street furniture (street lights, benches, etc.) than that of the Seine and Thames.



6 Crossings
17 Crossings
WASHINGTON, D.C.



24 Crossings
PARIS, FRANCE



13 Crossings
LONDON, U.K.



Benning Road



Pont de Bir-Hakeim



Southwark Bridge



Pennsylvania Ave

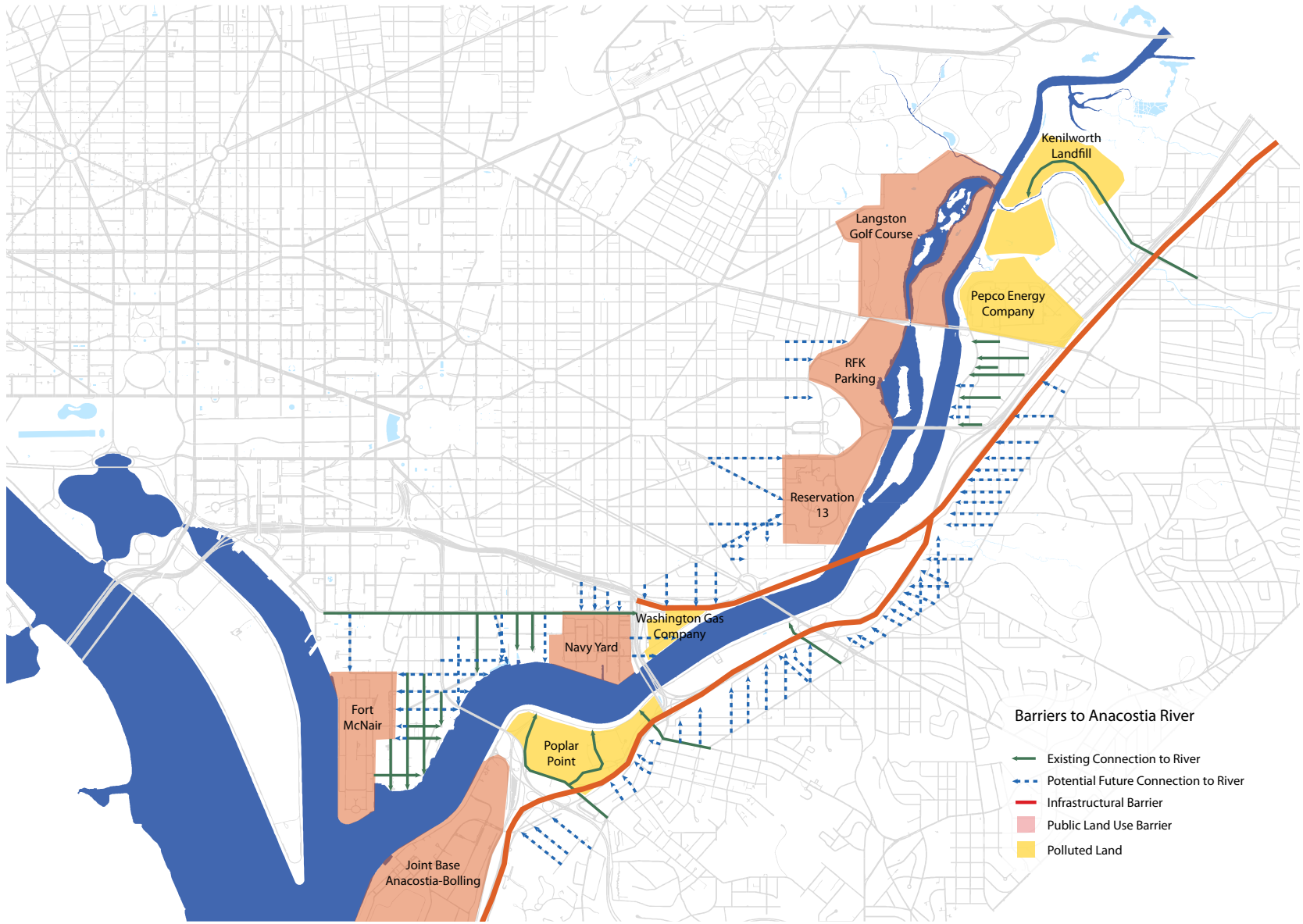


Pont Royal



Blackfriars Bridge

Existing Pedestrian River Crossings
Possible Future Pedestrian River Crossings



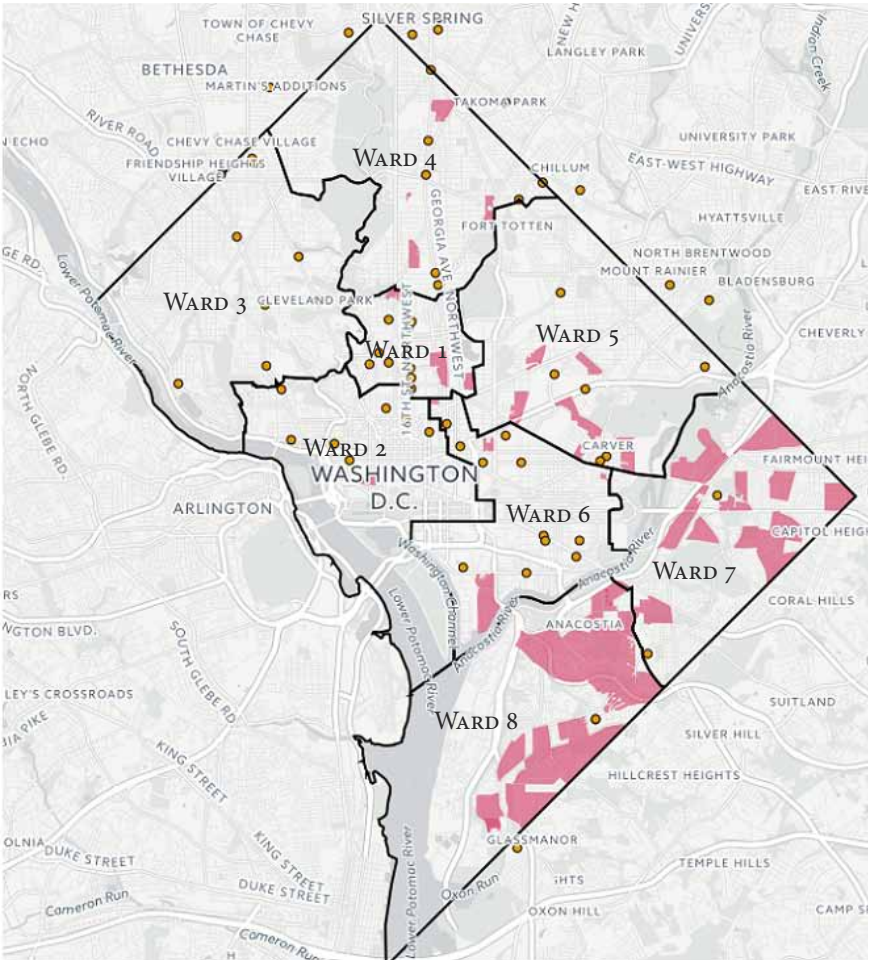
In addition to the lack of connections across the river, there are also many barriers that prevent people from accessing the river in the first place. The map above shows many public land use barriers along both sides of the Anacostia, including several sites owned by the federal government for military use. There are also numerous sites that are fenced off from the public due to contamination from previous pollution. Finally, Highway 295 and the railroad block all but a few streets from connecting to the river's edge, further preventing pedestrian access and causing the riverside to be vastly under-utilized.

CURRENT CONDITIONS | SOCIAL & ECONOMIC BARRIERS

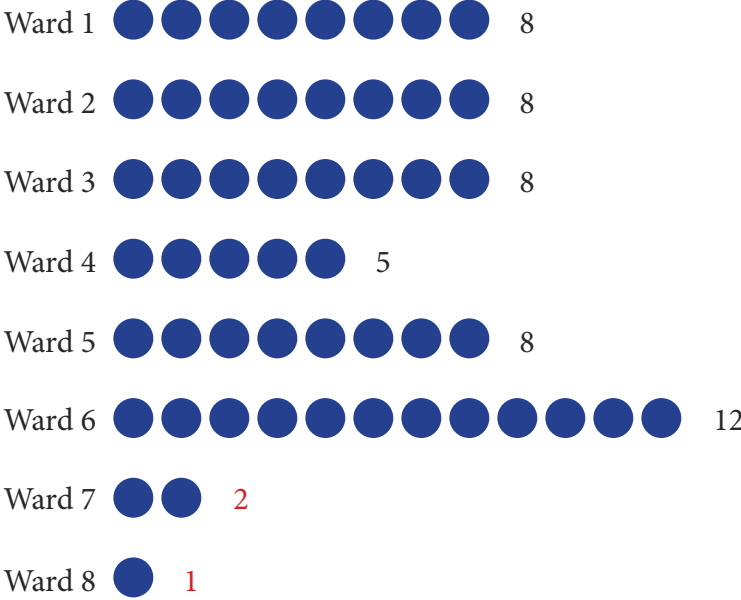
SOCIAL & ECONOMIC BARRIERS TIMELINE:

- **1854:** “Uniontown” was established as a whites-only working-class settlement for Navy Yard workers in the area now known as Historic Anacostia.
- **1865:** In the years after the Civil War, DC’s African-American population increased to approximately 60,000 (half the city’s total population).
- **1867:** The Freedmen’s Bureau obtained land at Barry’s Farm through a program whose purpose was to construct housing and fund schools for former slaves. It created the first home-owning African-American community in the nation’s capital.
- **1877:** Abolitionist Frederick Douglass bought his future home, Cedar Hill, in the middle of the Anacostia neighborhood.
- **1940s–1960s:** The largest urban renewal project in the US took place in Southwest DC and displaced an entire African-American neighborhood, forcing residents across the river and resulting in even higher concentrations of public housing in Anacostia.
- **Today:** The East of the River neighborhoods (also known as Wards 7 and 8) have long been thought of as the “forgotten” quadrant of DC. According to the American Community Survey Data, though both neighborhoods carry similar population size, those to the east of Anacostia suffer from 20.71% unemployment and 53.18% child poverty, compared to 6.63% and 20.46% (respectively) on the western side of the river. Much of Wards 7 and 8 also have minimal job opportunities and are considered food deserts—areas that 1) are located more than half a mile from a grocery store or supermarket, 2) have low rates of car access, and 3) have a high poverty rate (shown on the map to the right).

Food Deserts in DC (shown in red)



Grocery Stores in DC per Ward



Source: DCGIS data from opendata.dc.gov

	West of the River Census Tracts	East of the River Census Tracts
Population	22,194	21,007
Median Value of Owner-Occupied Housing	\$648,259	\$255,553
Renter Occupied Units	50.24%	73.09%
Unemployment	6.63%	20.71%
Child Poverty	20.46%	53.18%

Source: 2013 American Community Survey Data

RELATIONSHIP BETWEEN THE CITY AND THE RIVER

Cities have long shown “... a disregard for the processes of nature. Nature has been seen as a superficial embellishment, as a luxury, rather than as an essential force that permeates the city” (Spirn 5).

Studies show that natural amenities such as oceans, lakes, rivers, and hills have the potential to make nearby neighborhoods more socioeconomically stable, and vice versa. “Natural features contribute to civic stability—and rivers are often an untapped amenity” (Moser). Similar studies also show that “on average, rivers...are a disamenity for households, but where a river is a positive amenity, it has similar effects as oceans and lakes” (Lee and Lin). The fact that rivers are, on average, disamenities suggests that they are untapped potential. Cities grew up around rivers because they were a necessity for drinking water, transportation, and other industrial uses. However, now that these functions of urban rivers are less common, we are discovering new opportunities for urban rivers.

As Michael Kimmelman writes about Rotterdam, Netherlands, “What holds true for managing climate change applies to the social fabric, too. Environmental and social resilience should go hand in hand, officials [in Rotterdam, Netherlands] believe, improving neighbourhoods, spreading equity and taming water during catastrophes.” Project leader Wynand Dassen confirmed this idea, saying, “We believe you get the smartest solutions when communities are engaged and help make the links between water and neighbourhood development” (Kimmelman).

RELATIONSHIP BETWEEN THE CITY AND THE RIVER | EXISTING & FUTURE VIEWPOINTS

EXISTING RELATIONSHIP: IDEALIZED ABSTRACTION



Washington Memorial Reflecting Pool



WWII Memorial



Meridian Hill Park

The current relationship urban dwellers have with water (and nature in general) is to treat it as an idealized abstraction. This is especially true of DC, where reflecting ponds and fountains abound. This mindset greatly limits water's (and nature's) potential to be intertwined with urban life in a more meaningful way.

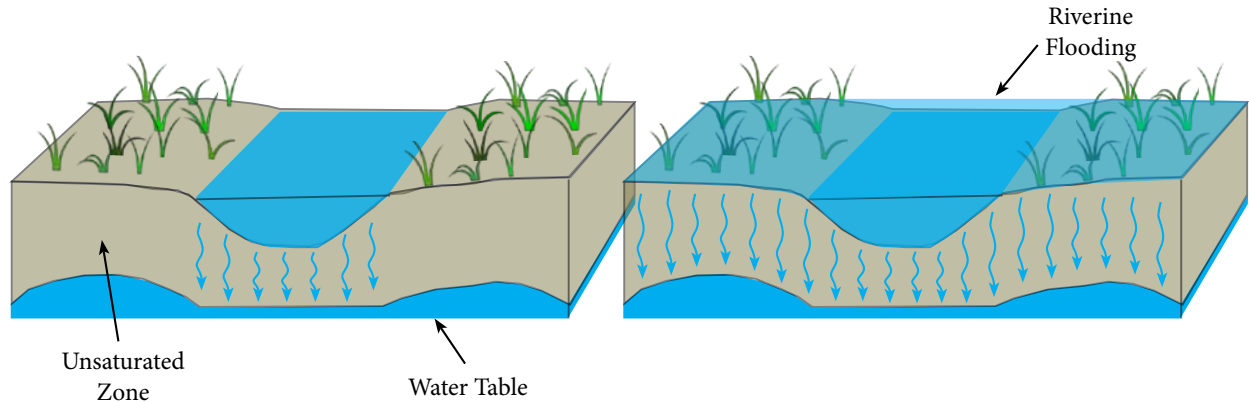
FUTURE RELATIONSHIP: PRODUCTIVE, REGIONALLY CONNECTED, URBAN ECOLOGY



Reconstructed Wetlands Naturally Clean Pollution and Provide Greater Habitat Diversity



Anacostia River Trails Follow the River, Emphasizing its Regional Connectivity



Rivers Allowed to Flood Outside their Boundaries Recharge Aquifers and Add Nutrients to Soil

RELATIONSHIP BETWEEN THE CITY AND THE RIVER | SYMBIOTIC RELATIONSHIP TIMELINE

PAST

COMMENSALISM—
 A relationship wherein one party obtains food or shelter from the other party, without harming that party (i.e. small groups of humans didn't cause significant change in the larger ecosystem).



Ancient Egyptians Farmed along the Nile - Three Seasons: Inundation (flooding and silt deposit), Planting, Harvesting

Bathing, drinking, fishing, cleaning, cooking, farming

While most people may think of a symbiotic relationship as two organisms benefiting from one another, there are actually three subsets of symbiotic relationships which, range from harmful to beneficial. These subsets—commensalism, parasitism, and mutualism—are also perfect descriptors of cities' relationship with nature over time.

PRESENT

PARASITISM—
 A relationship wherein one party (the parasite) nourishes itself to the disadvantage of the other party (the host).



Regionally Connected Shipping - Pollution + Sedimentation



Water Cooling and Power Generation - Pollution



Combined Sewer Outflows - Waste Disposal



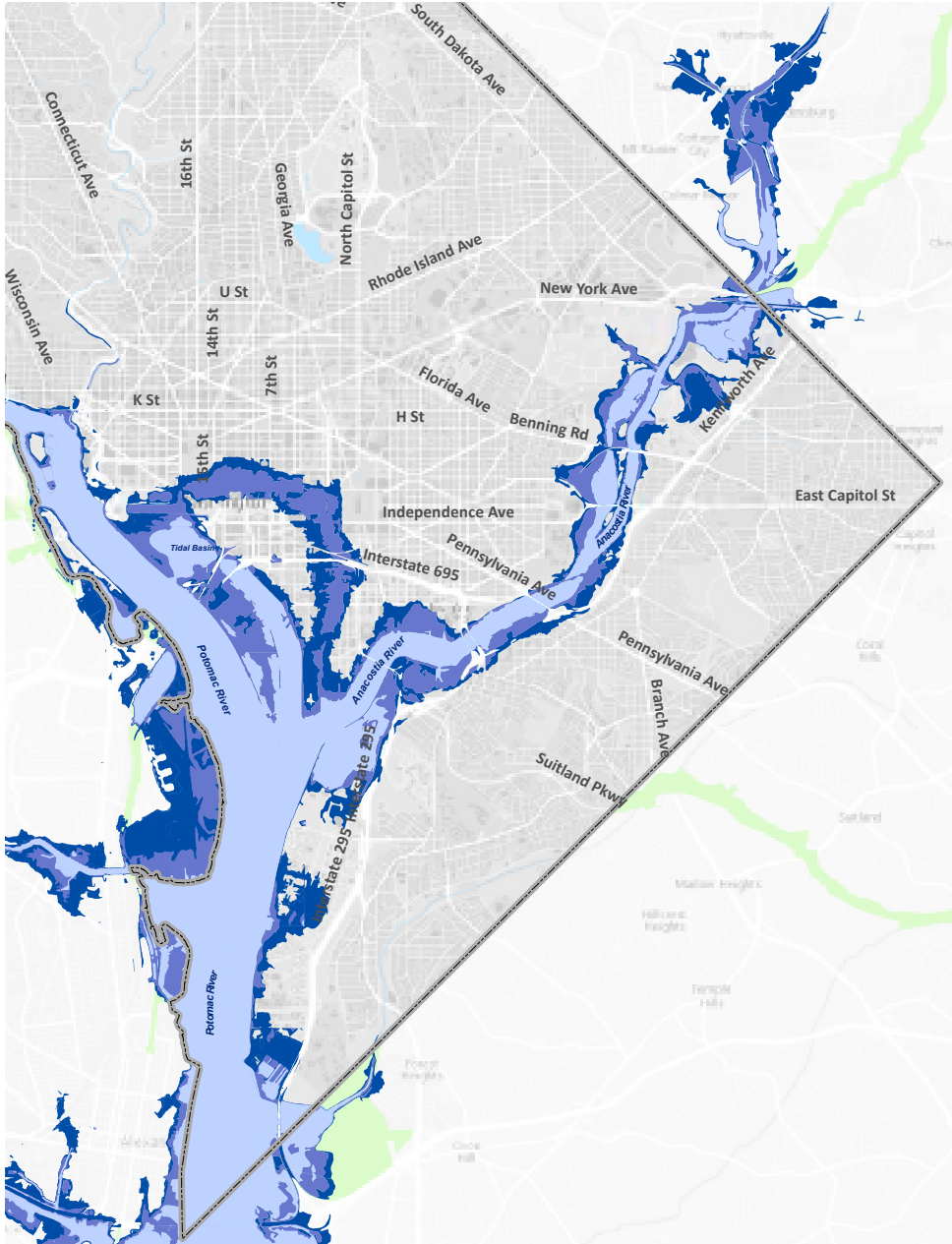
Tobacco Farming - Deforestation + Sedimentation + Pollution (Pesticides)

FUTURE

MUTUALISM—
 A relationship from which both parties benefit.

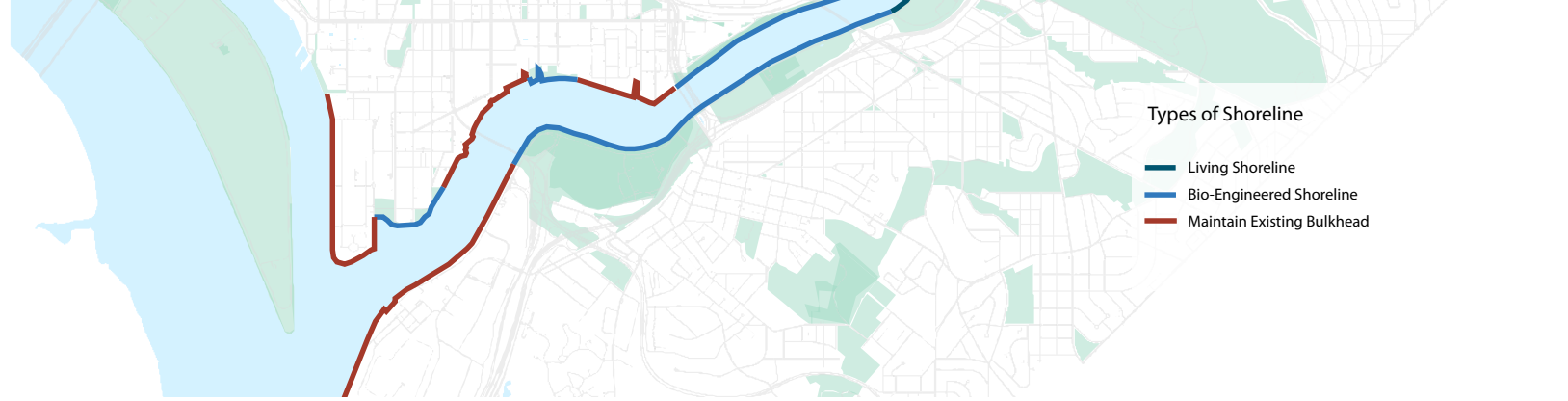
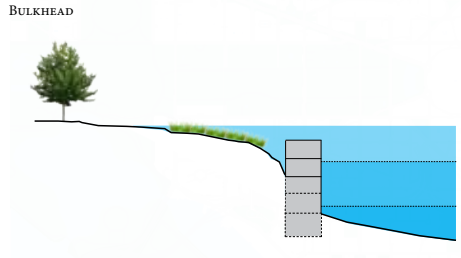
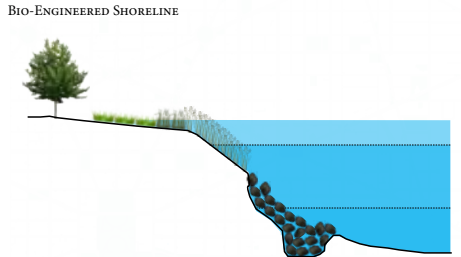
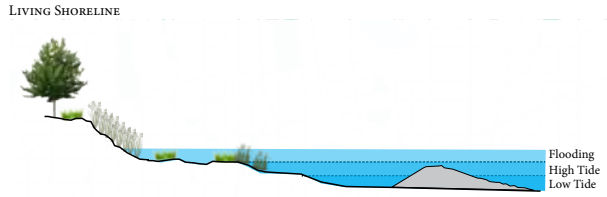
- Regionally Connected
- Ecologically Productive (Farming)
- Restored Wetlands
- Decontaminated Riverbed
- Connection to Nature within the City
- Flood Protection/Prevention
- Recreation
- Upgraded Waste Treatment System
- Increased Health of People and River
- Reconnecting Neighborhoods to and across River
- Increased Ecosystem Services
- Destination for City Residents
- Balance of Productive and Inhabitable Green Space

FURTHER ANALYSIS DRAWINGS

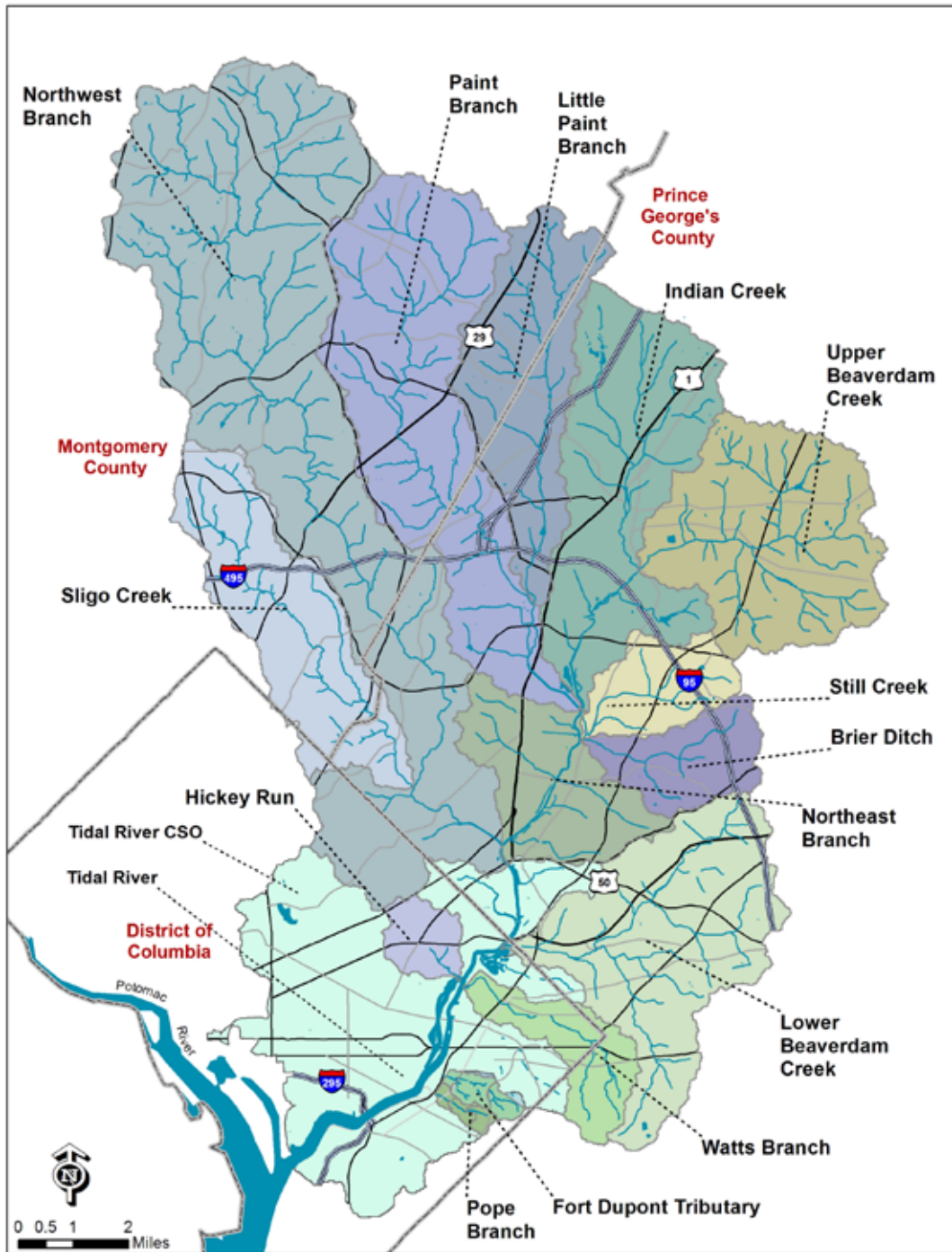


Of the 2800 acres along the Anacostia River (as defined by the Anacostia Waterfront Framework Plan), 20% of the land is in the 100-year floodplain and an additional 10% is in the 500-year floodplain.

Source: DCGIS data from opendata.dc.gov

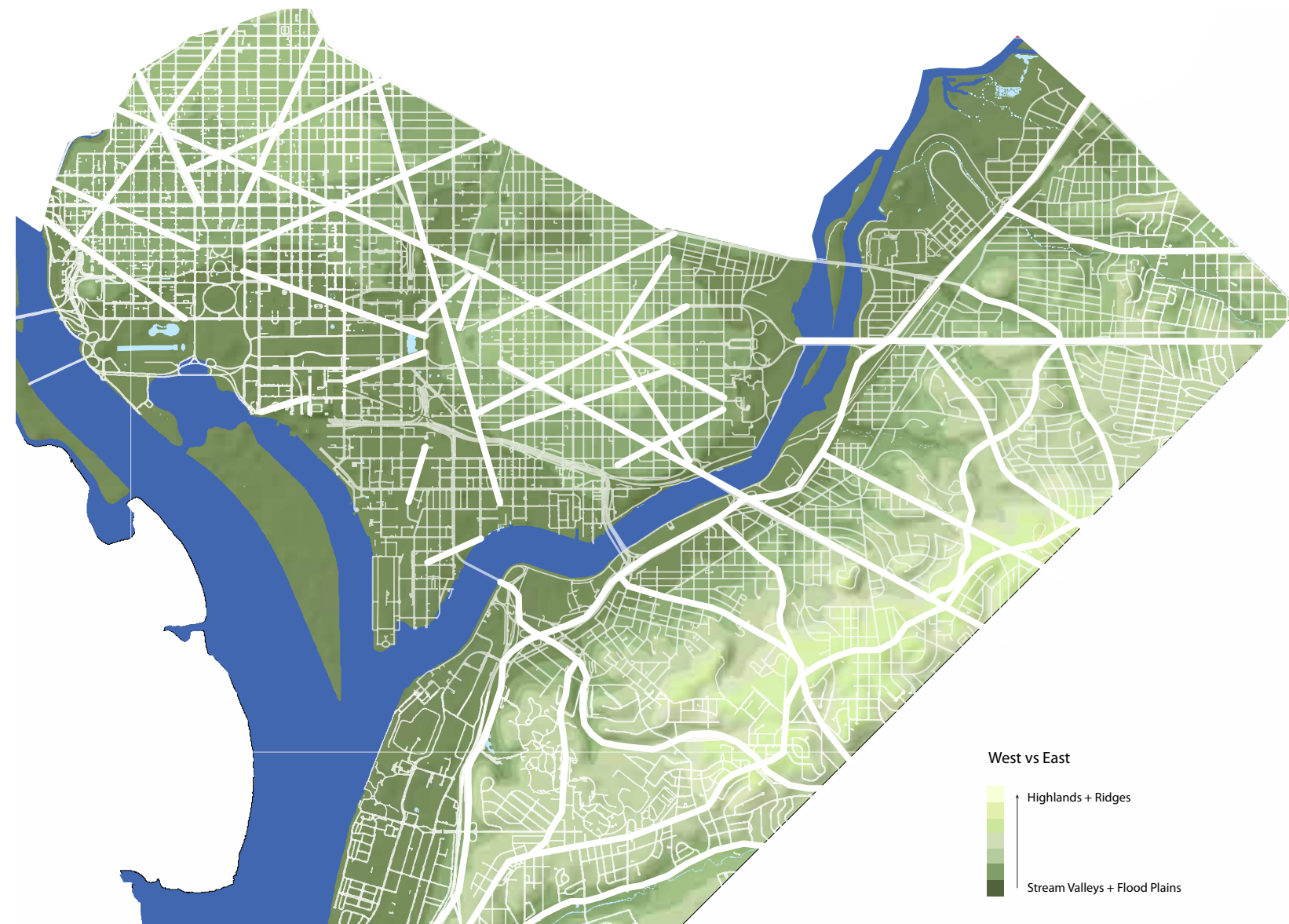


Most of the Anacostia River's shoreline is currently "protected" from flooding by aging, crumbling bulkheads (the graphic above shows how the bulkhead's limited height allows for flood waters to eventually spill over them, and then begin eroding the soil behind the bulkhead). Rather than spending exorbitant amounts of money to rebuild the bulkheads, the graphic above envisions employing more natural shorelines that are often better flood protectors. The one advantage of a bulkhead is that it takes up less room horizontally and allows for a hard edge at the river. This technique could still be used in the existing commercial and institutional areas along the river's edge.



The vast majority of the Anacostia River's watershed is in Maryland, outside of the control of DC's government.

Source: US Army Corps of Engineers



Topography plays a large role in defining the character of the streets on each side of the river. On the west side of the river where L'Enfant laid out the original plan for Washington DC, topographic change is minimal and streets are rectilinear. On the east side of the river, however, the land rises drastically from the river to the DC border. Most of the main streets are therefore curvilinear, often following the topography or old stream beds. The difference between the L'Enfant plan for DC and the topography-driven plan east of the river is emphasized and celebrated in my design.

FINAL DESIGN OVERVIEW



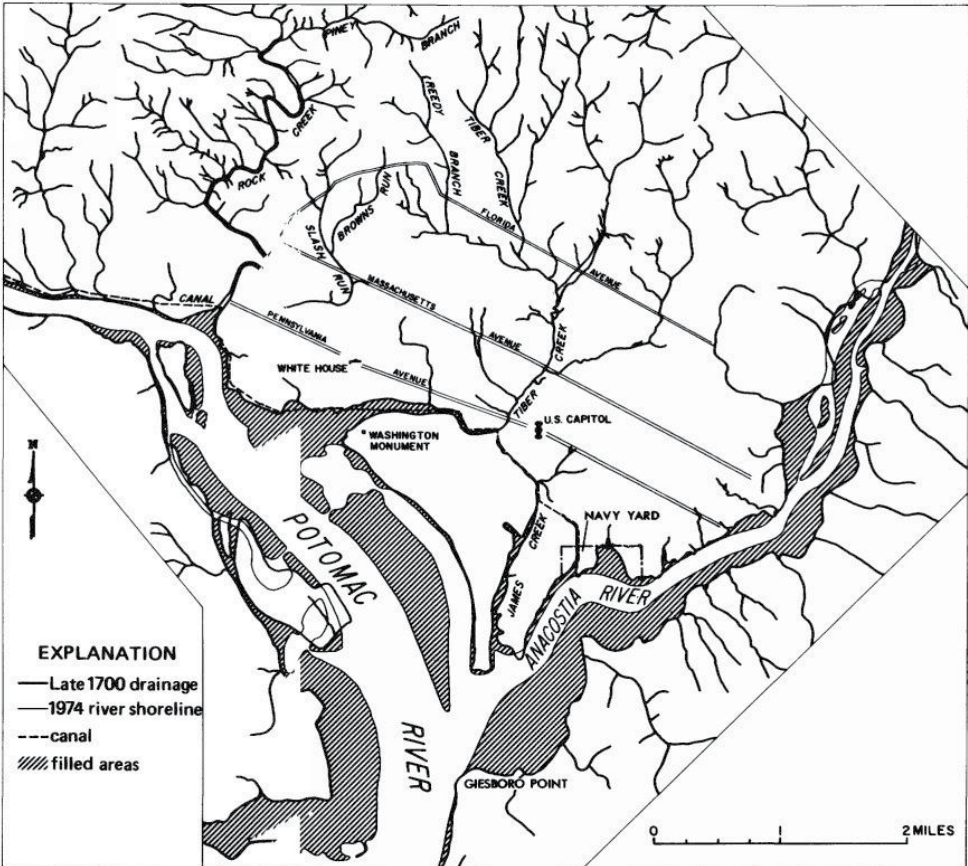
Full River Strategy Drawing

TRIBUTARY STREETS | CONNECTING NEIGHBORHOODS TO THE RIVER

After researching and analyzing the barriers and opportunities for the Anacostia River and the East of the River neighborhoods, I began to wonder how the neglected neighborhoods and the neglected river could work together to overcome their existing barriers. This was the moment that led me into the final phase of my thesis: connecting neighborhoods to the river through what I came to refer to as “tributary streets.” (Note: a “tributary” is defined as a stream that flows into a larger river.)

The map to the right shows Washington DC’s historical tributaries, spreading across the city and draining into the Potomac and Anacostia Rivers. As the city densified over time, many of these streams were buried underground in pipes for convenience and safety reasons. However, burying these streams negatively impacts the water quality of both the stream and the river, and minimizes ecosystem and species diversity in the region.

Thus, “daylighting”—or digging up the streams, returning them to the surface, and restoring them to a more natural state—would not only be ecologically beneficial, but, if done right, could provide mutual benefits to the surrounding neighborhoods by providing them with ecological and commercial corridors, spread across all of the East of the River neighborhoods, that connect from DC’s eastern boarder down to the river.

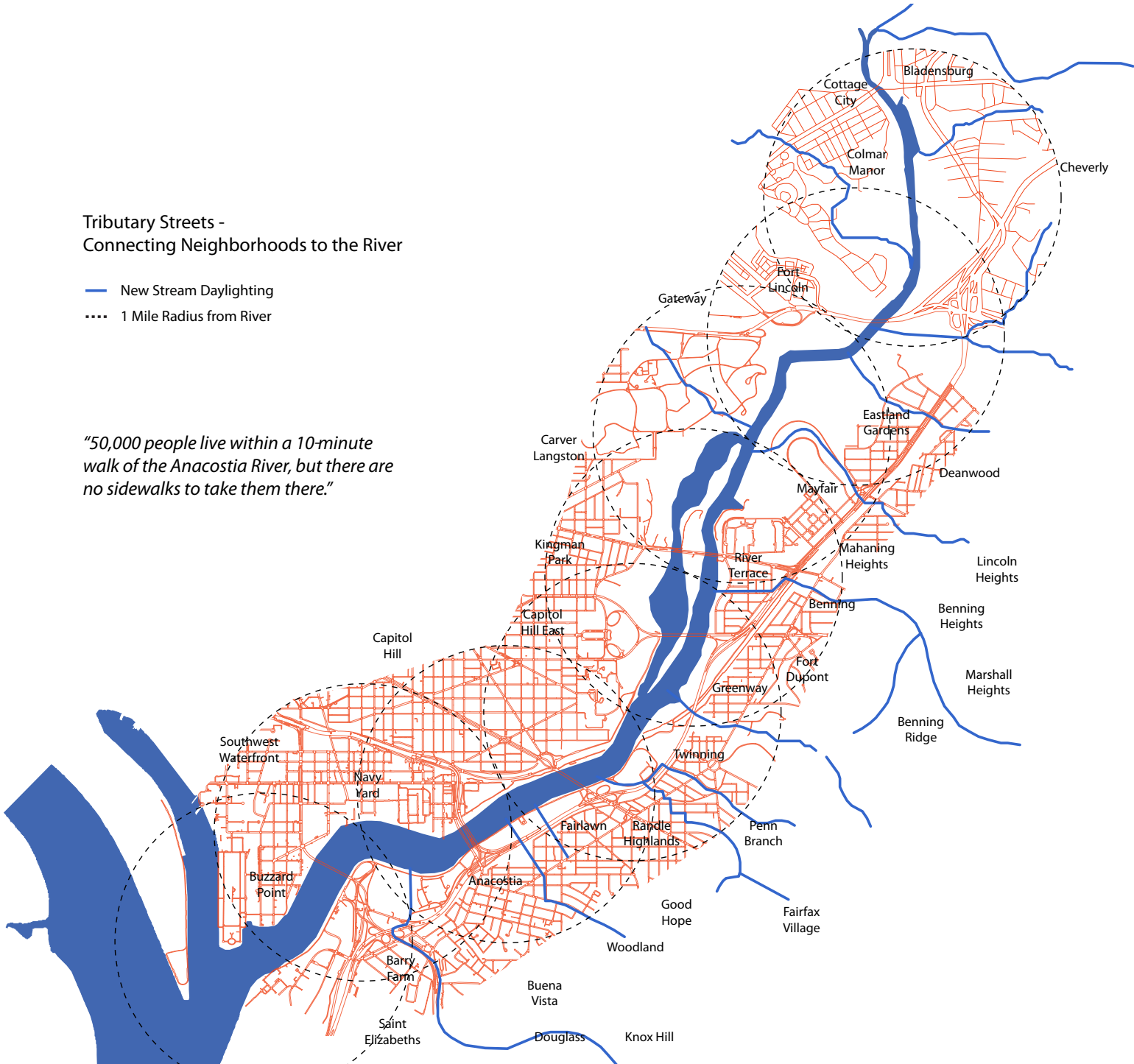


Stream network and river shorelines of the central Washington DC area in the late 1700s, compared to 1974 river boundaries.

Tributary Streets - Connecting Neighborhoods to the River

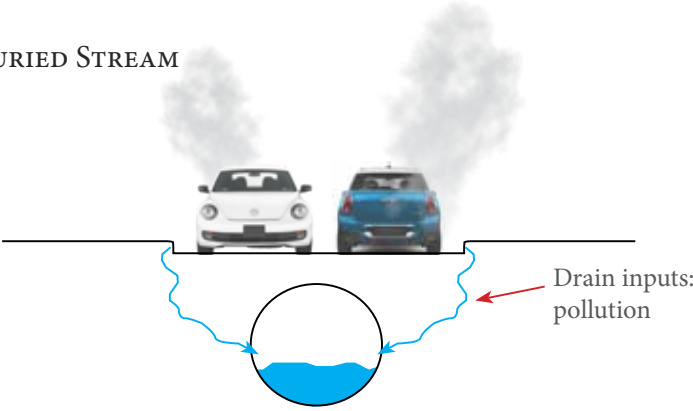
- New Stream Daylighting
- 1 Mile Radius from River

“50,000 people live within a 10-minute walk of the Anacostia River, but there are no sidewalks to take them there.”

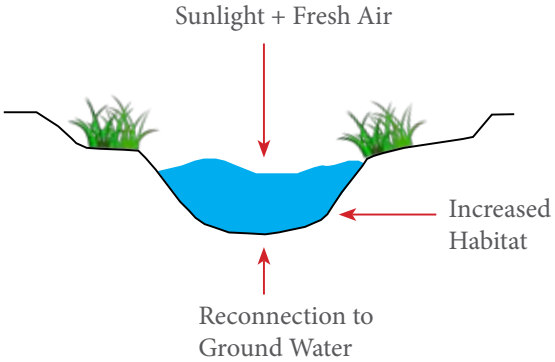


TRIBUTARY STREETS | MUTUALISTIC BENEFITS

BURIED STREAM



DAYLIGHTED STREAM



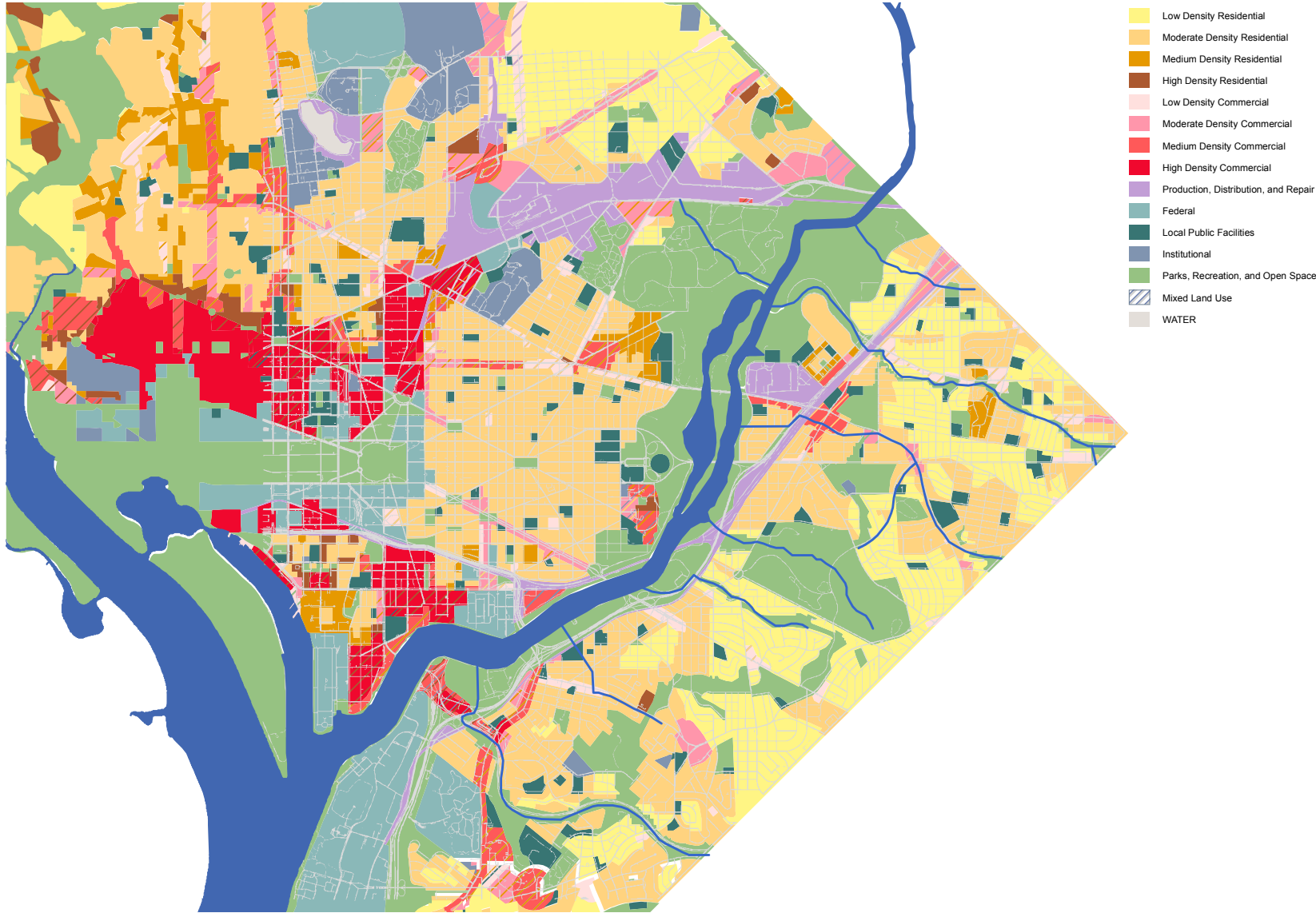
ECOLOGICAL BENEFITS

- Increases river water quality
- Traps sediment + filters contaminants before they reach the river
- Increases wetland and wildlife habitat
- Expands stream channel capacity
- Makes pollution more visible, promoting better public stewardship of rivers

HUMAN BENEFITS

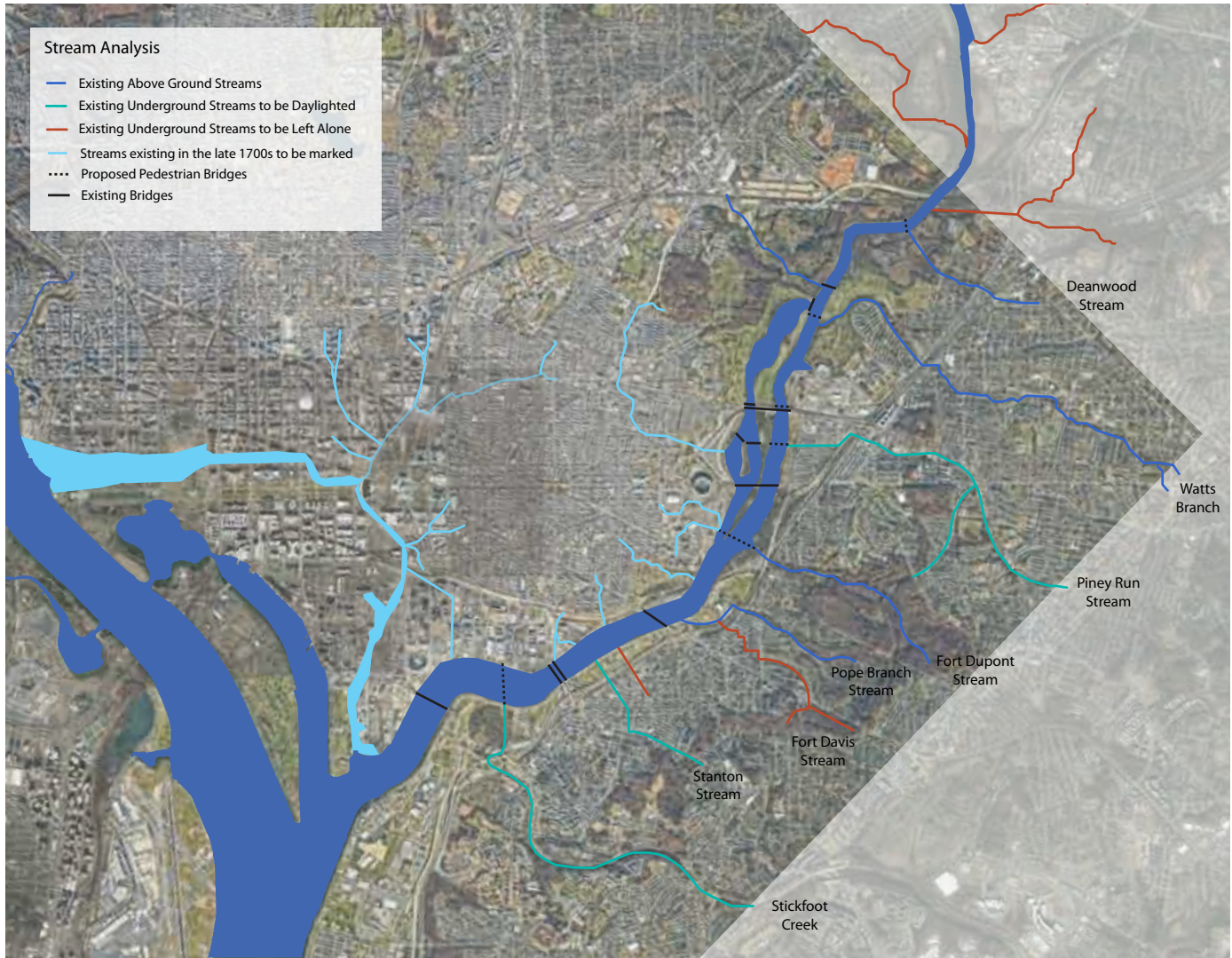
- Enhanced pedestrian space
- Educational opportunities
- Easier access to nature/river
- Sense of identity
- Reduces flood risk downstream
- Reduces heat island effect
- Path directly to waterfront
- Beauty and enjoyment

As seen in the Current Land Use plan below, the East of the River neighborhoods are almost entirely made of up low-density residential land use. Many current residents have lived in the area for decades and love their neighborhoods, but complain about the lack of basic amenities such as good hospitals, commercial shopping areas, local businesses, and most importantly, grocery stores. Therefore, by utilizing the streams as not only ecological corridors, but also higher-density commercial corridors, tributary streets can bring a mutually beneficial solution to the neighborhoods and the river.

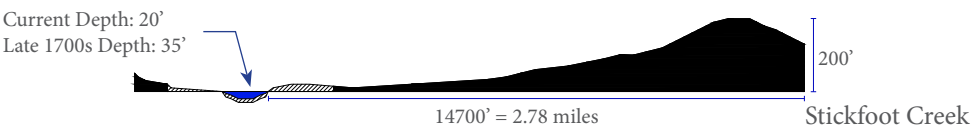
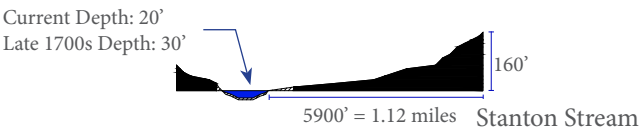
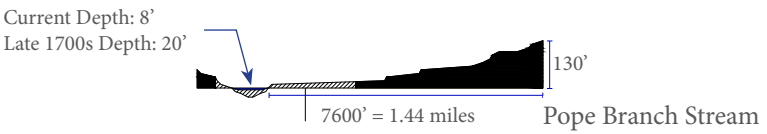
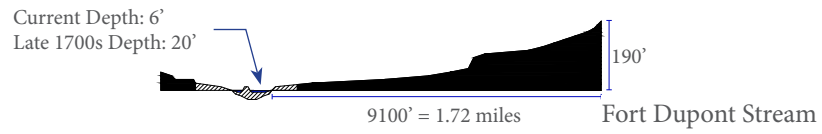
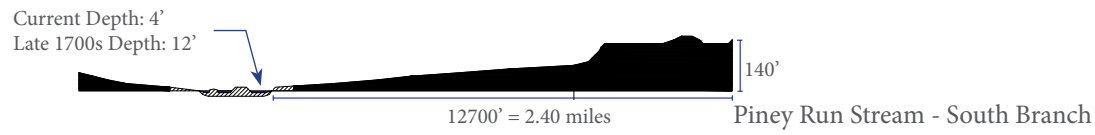
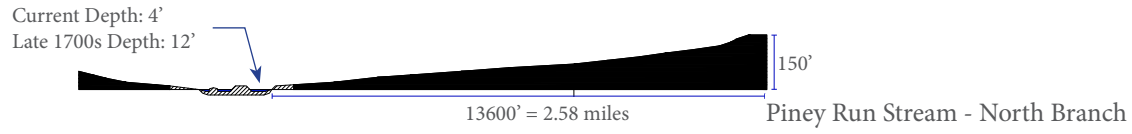
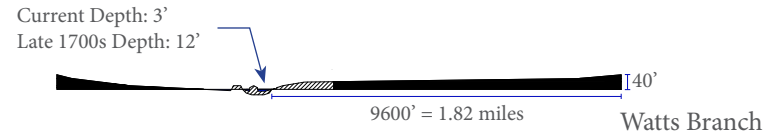
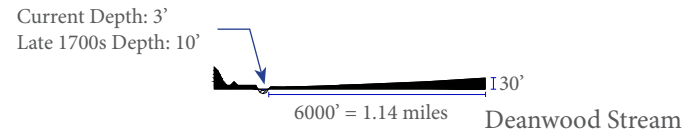


Current Land Use Plan

TRIBUTARY STREETS | STREAM ANALYSIS



When deciding which of the streams were most appropriate to be included in this plan, I needed to eliminate a few of the options. Although my original thought was to include the “entire” Anacostia River, up to its most northern port in Bladensburg, Maryland, I eventually decided to include only the section of the river and streams within DC’s borders because the conditions of the East of the River neighborhoods I had identified were not necessarily true of Maryland. Two other streams were eliminated as well, one simply because of its short length, and the other because of its close proximity to its sister stream, adding too much cost without enough benefit.



Transects of Selected Streams

Horizontal Scale
0 1000'

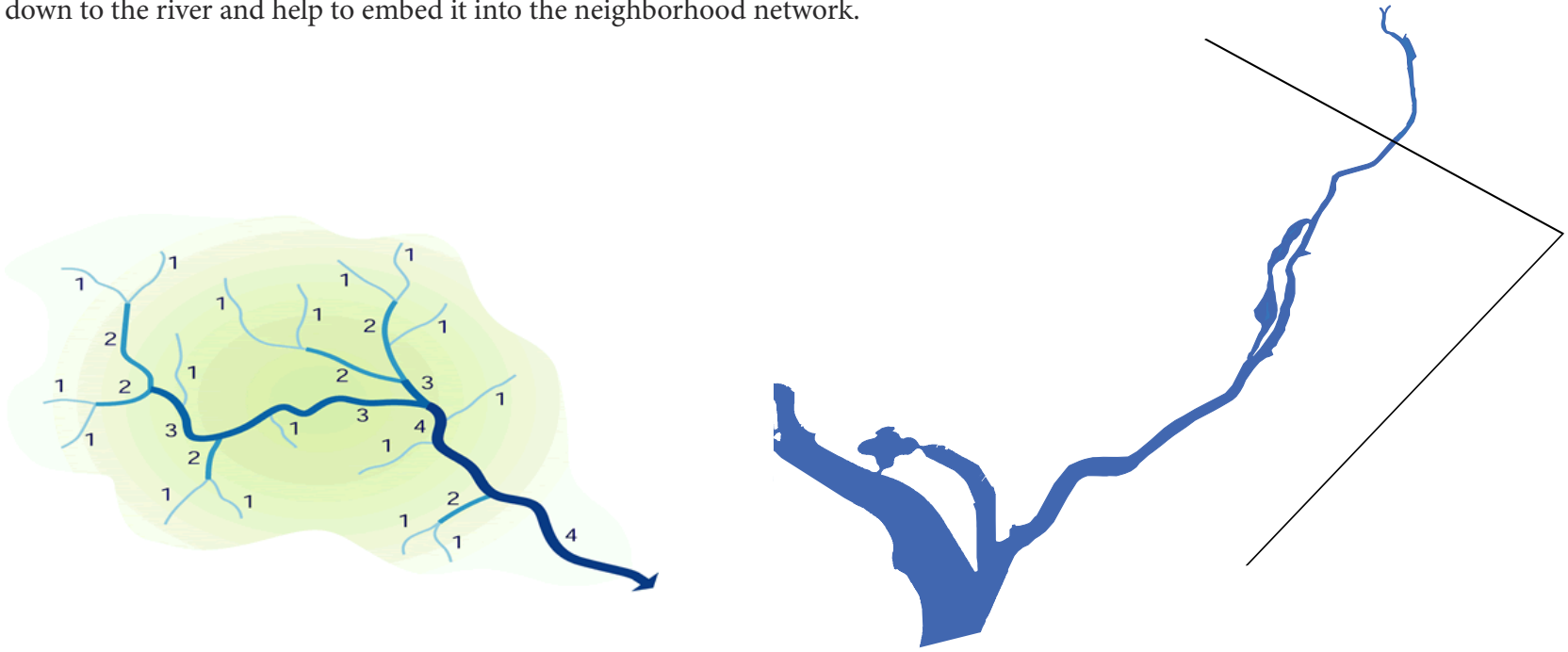
Vertical Scale
0 100'

Fill added by the Army Corps of Engineers (1892-1941)

FULL RIVER STRATEGY | STREAM ORDER

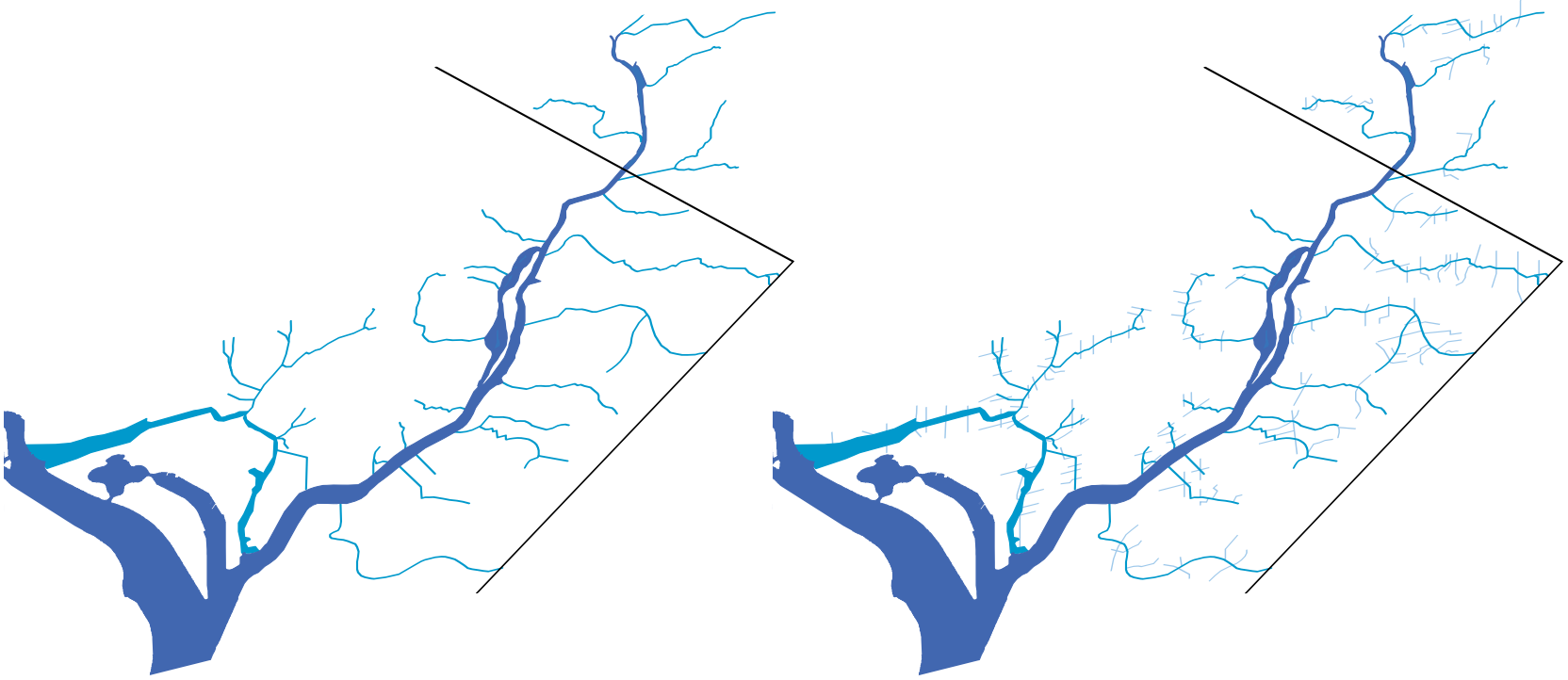
The Anacostia River is currently thought of as a lone entity, solely acting as a separator, dividing the East of the River neighborhoods from the rest of the city. However, if the river could be more readily perceived and understood as part of a larger, connected network, it would help the river become physically and symbolically embedded within the city.

This idea is illustrated below, inspired by stream orders within a river system. Stream orders classify streams based on their size. As smaller streams slowly merge and become larger streams, they form a river system that spreads far beyond the bounds of the river itself. Extrapolating on this idea, the diagrams below show how pedestrian paths lead to the ecological and commercial corridors along the streams, which in turn lead down to the river and help to embed it into the neighborhood network.



Strahler Stream Order Diagram

“3rd Order Stream” | River: Separator

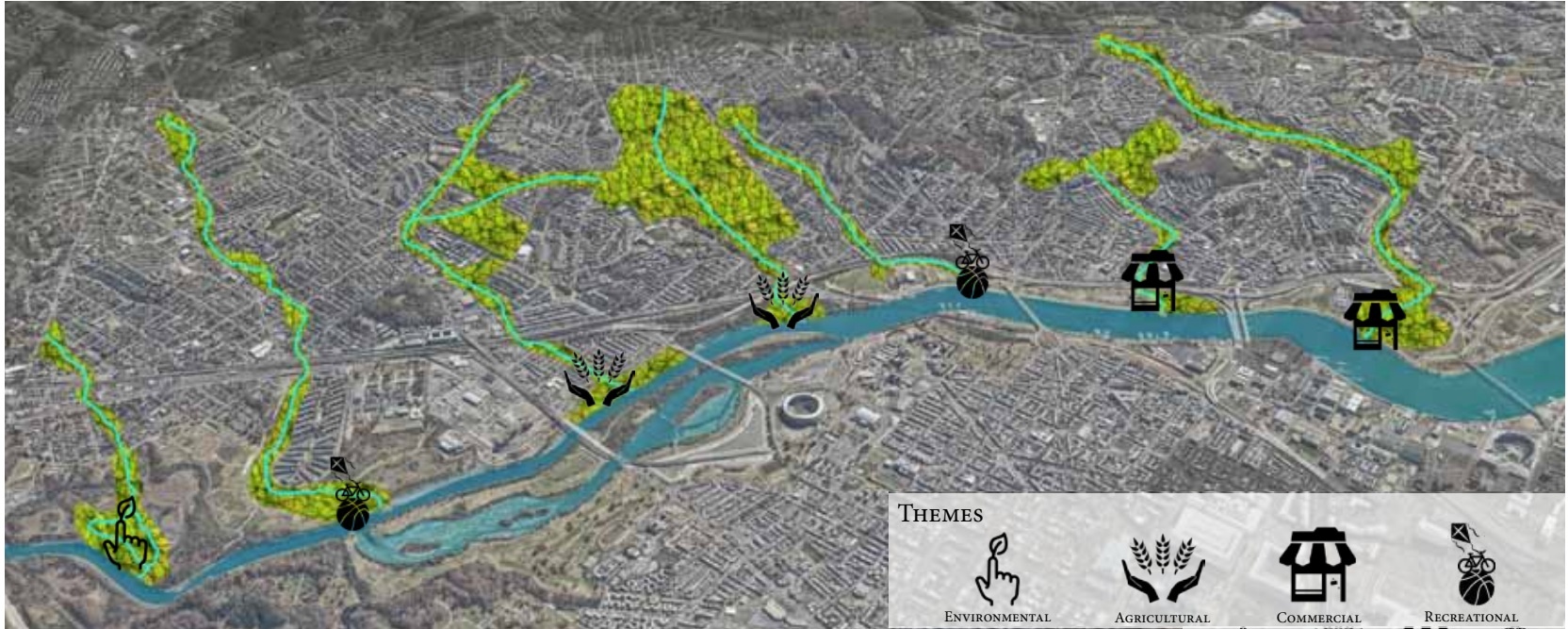


“2nd Order Stream” | Streams: Connector

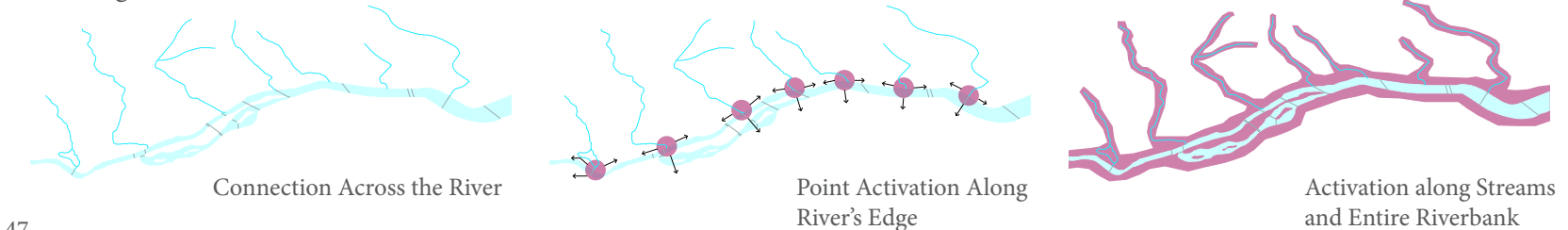
“1st Order Stream” | Pedestrian Paths: Embedded

FULL RIVER STRATEGY | STREAM THEMES & REOCCURRING INTERSECTIONS

In order to conceptualize a solution that spanned the length of the river and across the seven streams, it was necessary to identify themes that could simultaneously provide each stream with an individual identity and tie the river and the East of the River neighborhoods together as one cohesive urban design aesthetic. By building on the existing conditions of each of the seven selected streams, as well as identifying what was missing, four overarching “themes” or characters emerged: environmental, agricultural, commercial, and recreational. Each stream will begin with an eye-catching development (acting as a point of activation along the riverbank) and have a constant character for its entire length, but will also respond to individual circumstances. Finally, I identified reoccurring conditions that each stream will intersect with on its journey down to the river. Each of these intersections were given design strategies in order to act as a guiding framework that will help tie the streams together physically, visually, and symbolically.



Activating the Waterfront Over Time



(PEDESTRIAN) BRIDGE OVER RIVER

- New construction bridges allow pedestrian, bicycle, and mass transit only
- Retrofitted bridges designate at least one lane for pedestrian/bike, which must include a variety of street furniture along the length of the bridge and a safety barrier to car traffic
- Utilize blank space (on ground or solid railings) for murals inspired by adjacent neighborhoods

CONFLUENCE OF STREAM AND RIVER

- Public art
- Celebrate neighborhood history/important landmarks/existing character (it is the first thing someone on an Anacostia boat tour would see and would learn to associate each stream with)
- Help to prevent cultural gentrification by working with communities to design their own entrance/introduction to their community

RIVERSIDE

- Program that relates to stream theme
- Emphasis on ecological restoration
- Includes dock for riverboat stop and kayak/canoe landing
- Emphasis on edge condition through design that helps land and water meet in a meaningful way (e.g., giving space back to the river or creative flood control)

RECLAIMED LAND

- Inspired by landscape architecture ideal of balancing cut and fill
- Emphasize fill's status as a man-made landscape through techniques such as earthwork, natural materials, or juxtaposition of natural and man-made elements

URBAN PLAZA

- Gives residents varied experience of interacting with stream
- Emphasis on play and curiosity
- Creates distinct and memorable “place” for transit stop
- Integrates hardscaping with streambed

RESIDENTIAL

- Provides linear neighborhood park
- Public space that helps to bridge separation between private/public functions of neighborhood
- Integrated with street/sidewalk infrastructure to act as stormwater management (located by front yard/public area rather than private backyard)

INFRASTRUCTURE CROSSING

- Shift in priorities: Stream flow and pedestrian connection to waterfront takes precedence over highway traffic
- Car traffic along the Anacostia Freeway is made aware of the rhythm of stream crossings through presence of vegetation, (representations of) water, and other simple features that add beauty to the freeway experience without becoming distracting

URBAN CORRIDOR

- Required to treat all wastewater on site (taking away the number one pollutant source of the Anacostia River)
- Collect rainwater on rooftops to use as landscaping irrigation and water features
- Bioretention cells in streets purify water before it is added to stream

PARK

- Program that relates to stream theme
- Stream is allowed to expand its boundaries and the way people interact with it
- Includes creative water quality treatment, stormwater management, and/or interactive water features

TYPICAL STREET

- Playful, colorful markings allow pedestrians to continue following the stream path while it is briefly underground (markings change depending on the neighborhood to act as a simple wayfinding/character-defining method for pedestrians)

Reoccurring Intersections: The conditions above are experienced by each stream in different combinations and for different spans. However, the consistent design strategies and stream themes will connect the streams together into a coherent whole.

INDIVIDUAL STREAM ANALYSIS



ENVIRONMENTAL



AGRICULTURAL

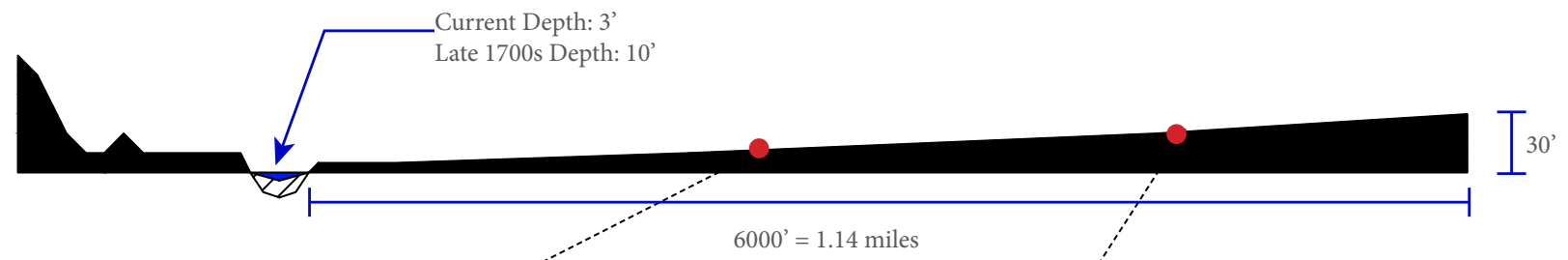
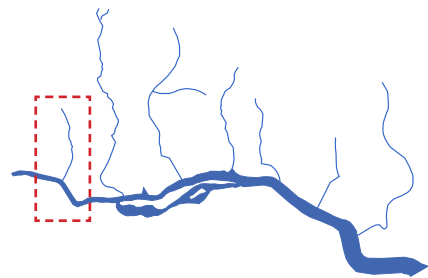


COMMERCIAL

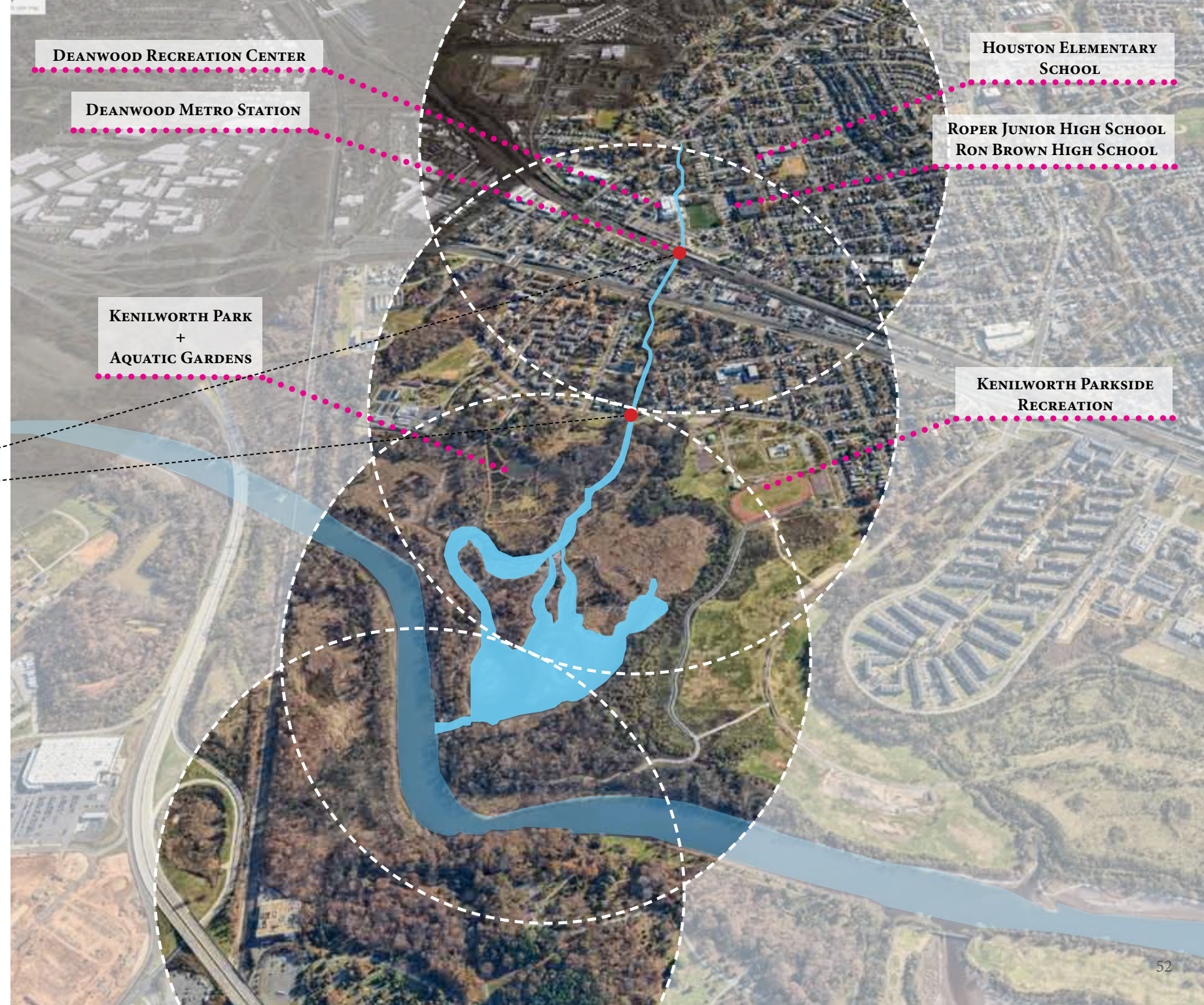


RECREATIONAL

DEANWOOD STREAM | EXISTING CONDITIONS



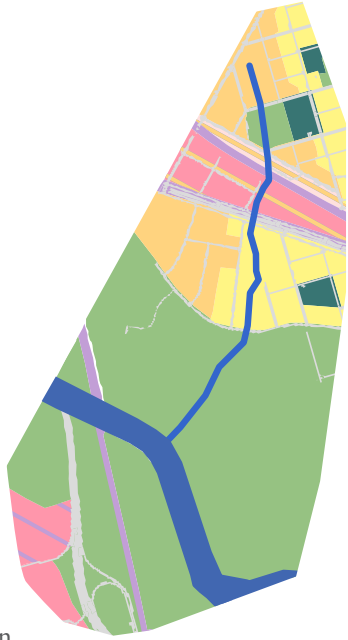
Existing Conditions



DEANWOOD STREAM | FUTURE DESIGN

STREAM THEME: ENVIRONMENTAL

RIVERSIDE PROGRAM:
KENILWORTH PARK AND AQUATIC GARDENS

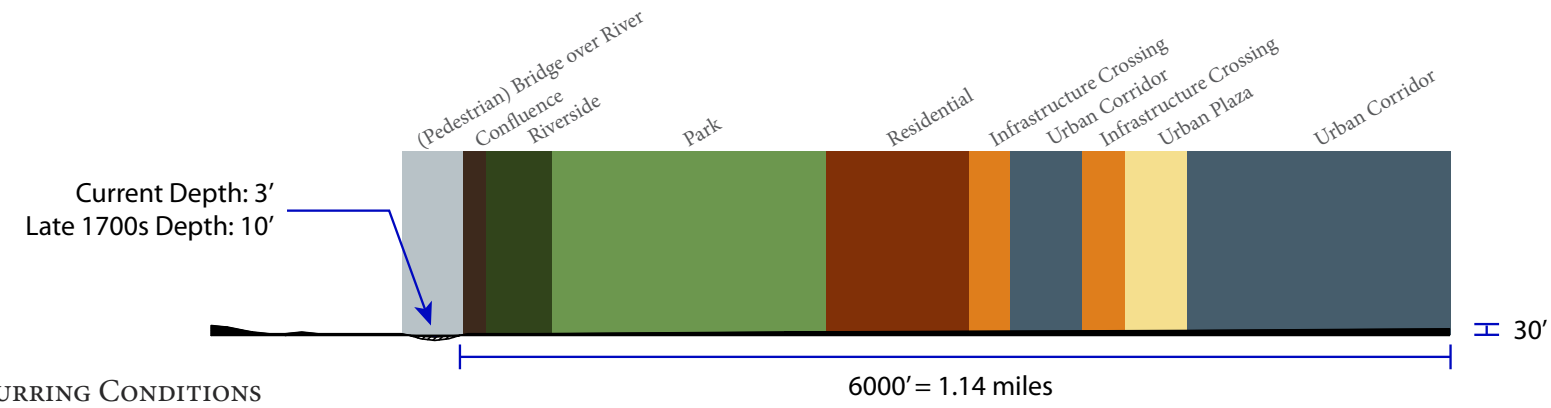


Current Land Use Plan

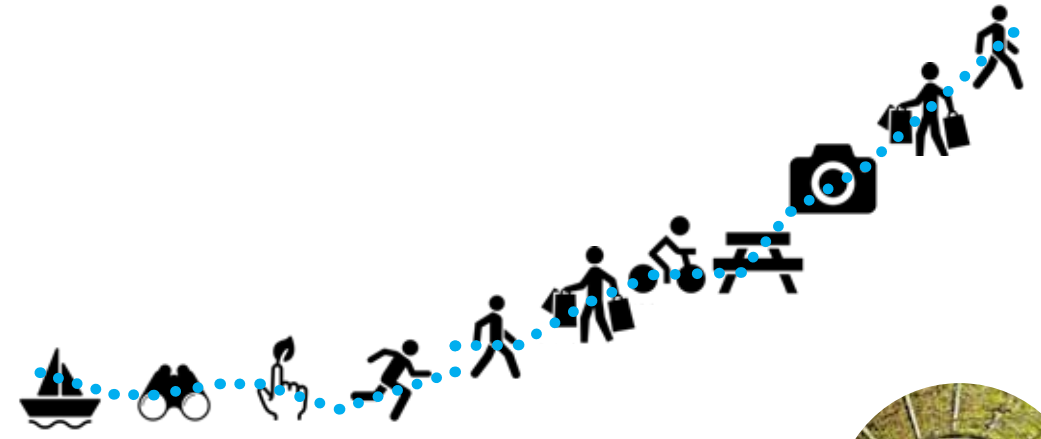
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- Moderate Density Residential
- Medium Density Residential
- High Density Residential
- Low Density Commercial
- Moderate Density Commercial
- Medium Density Commercial
- High Density Commercial
- Production, Distribution, and Repair
- Federal
- Local Public Facilities
- Institutional
- Parks, Recreation, and Open Space
- Mixed Land Use
- WATER



Recommended Future Land Use Plan



REOCCURRING CONDITIONS

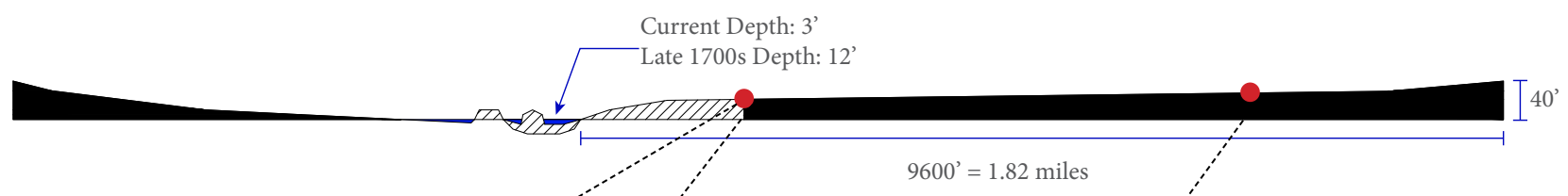
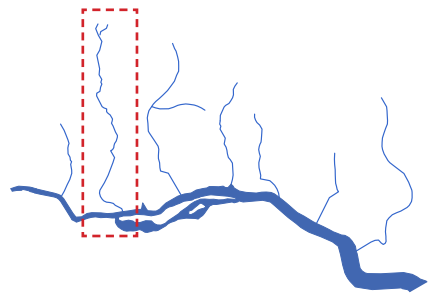


ACTIVITIES

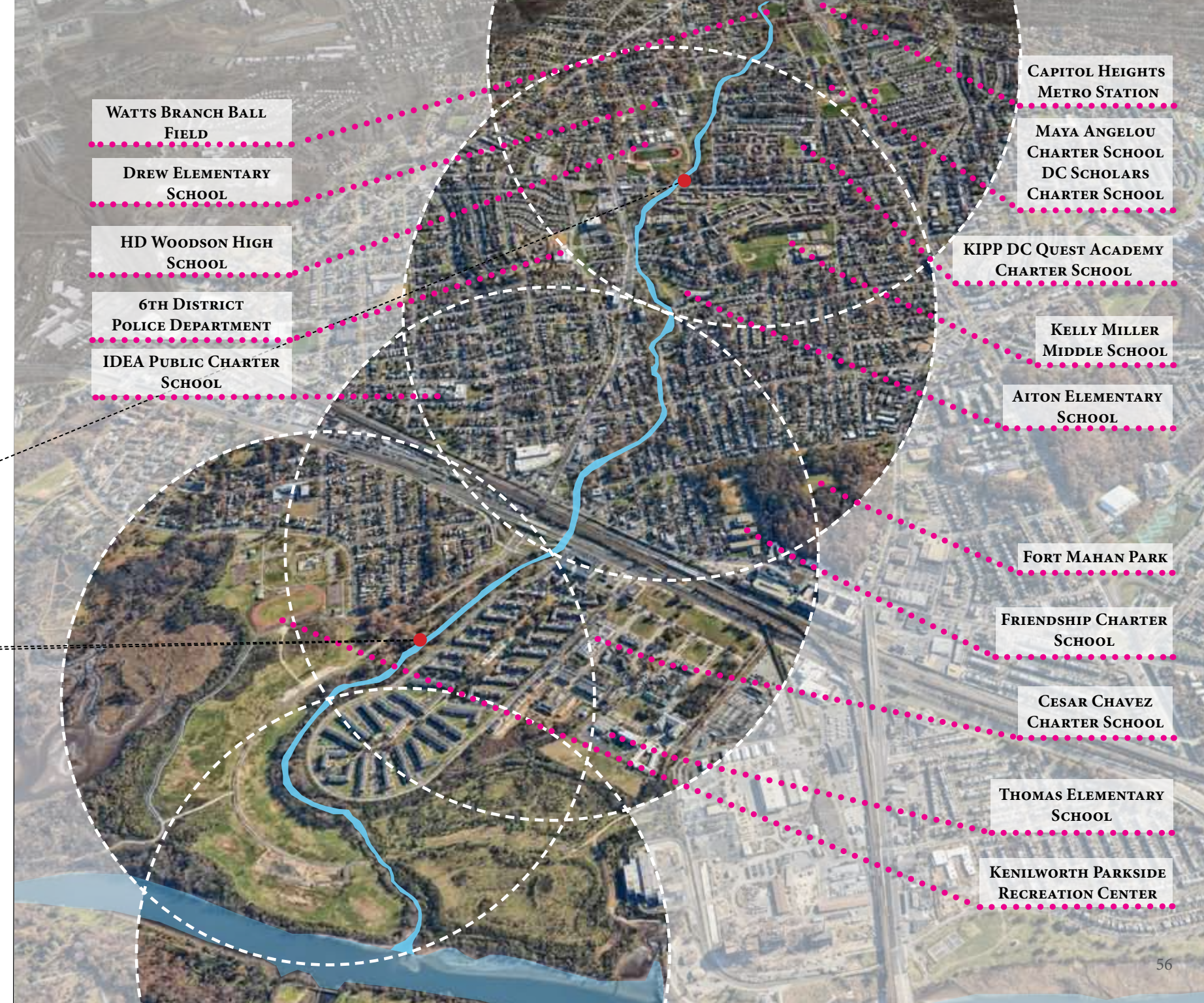


MATERIAL EXPERIENCE

WATTS BRANCH | EXISTING CONDITIONS



Existing Conditions



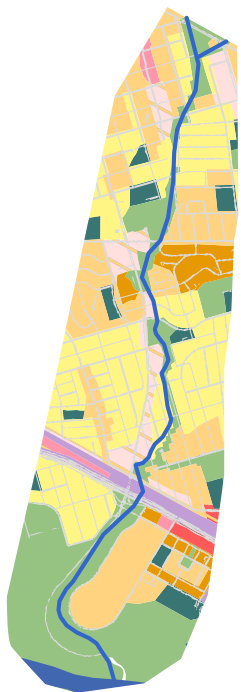
WATTS BRANCH | FUTURE DESIGN

STREAM THEME: RECREATIONAL

RIVERSIDE PROGRAM:
NATURAL POOLS AND "PLAY" WETLANDS



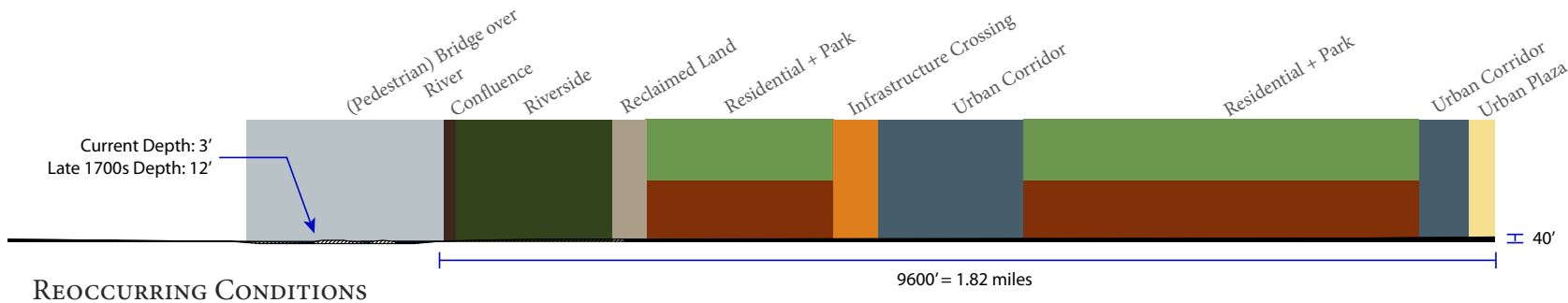
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- Local Public Facilities
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- Parks, Recreation, and Open Space
- Mixed Land Use
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Current Land Use Plan



Recommended Future Land Use Plan

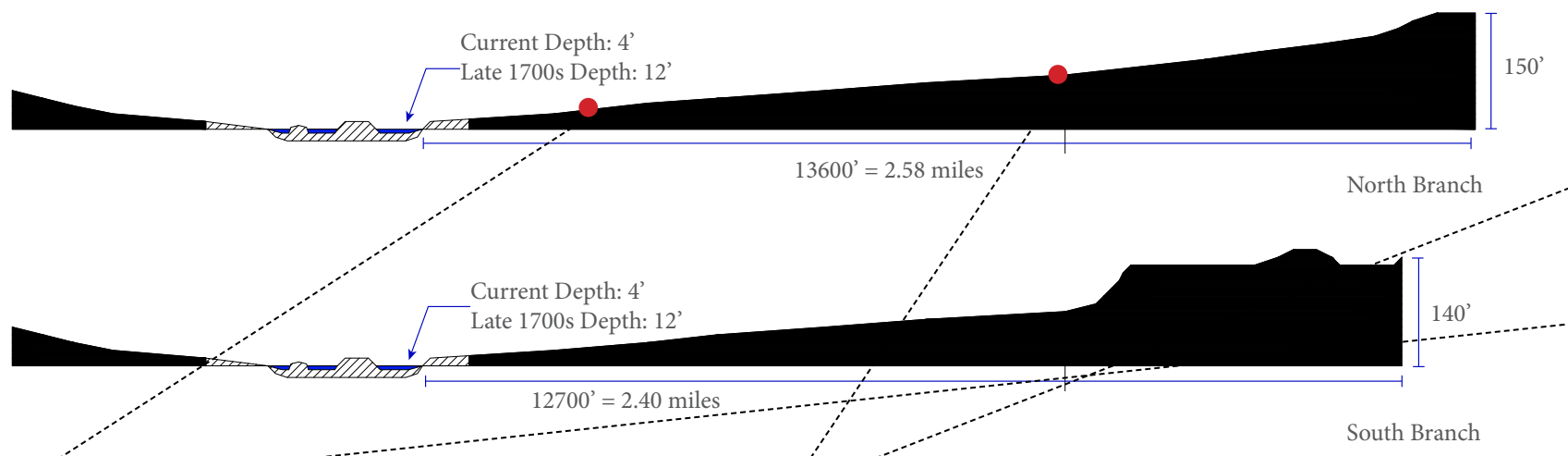
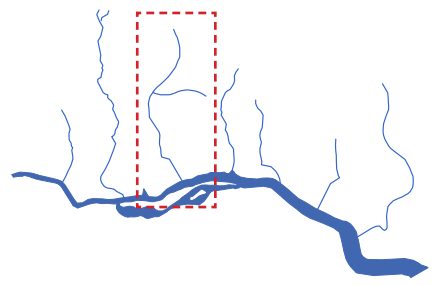


ACTIVITIES

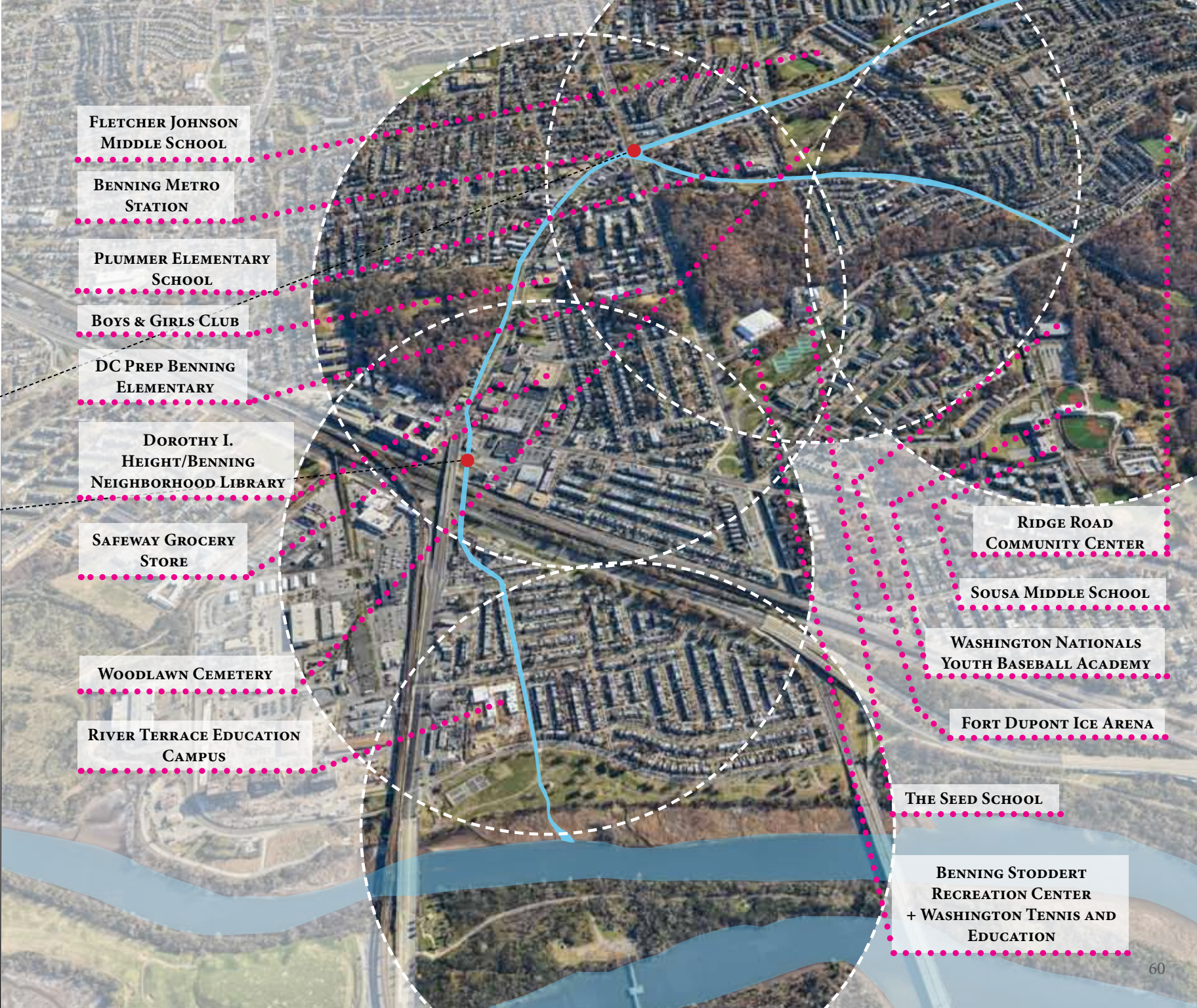
MATERIAL EXPERIENCE



PINEY RUN STREAM | EXISTING CONDITIONS



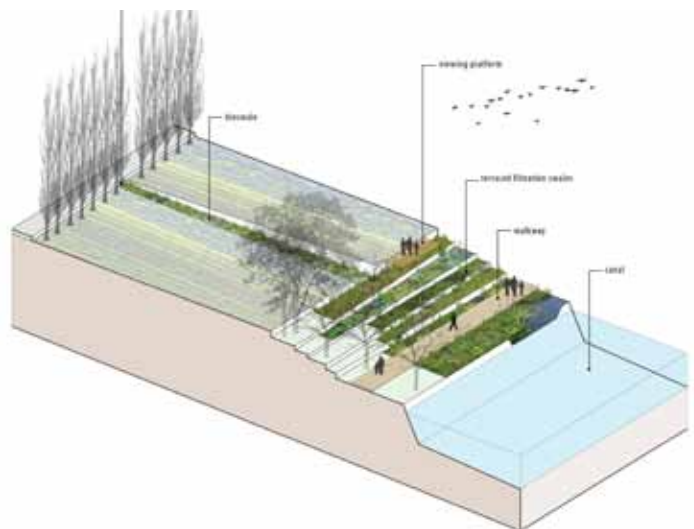
Existing Conditions



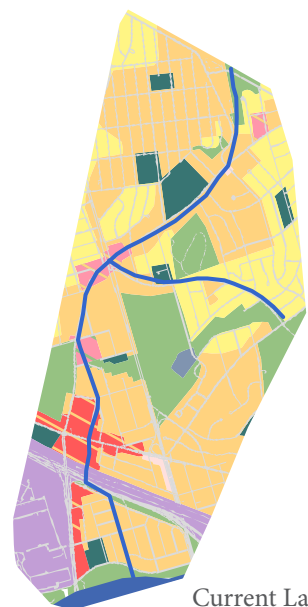
PINEY RUN STREAM | FUTURE DESIGN

STREAM THEME: AGRICULTURAL

RIVERSIDE PROGRAM:
AGRICULTURAL PIERS



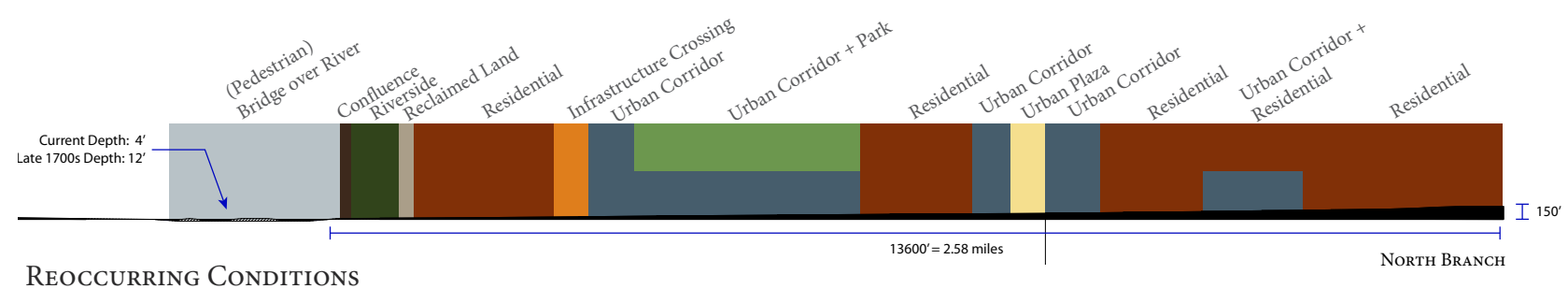
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- Medium Density Residential
- High Density Residential
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- High Density Commercial
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- Parks, Recreation, and Open Space
- Mixed Land Use
- WATER



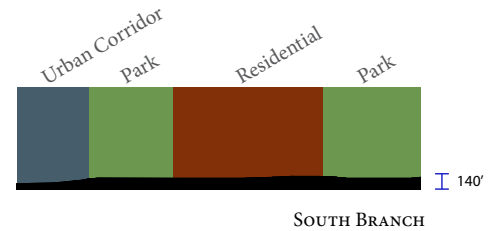
Current Land Use Plan



Recommended Future Land Use Plan

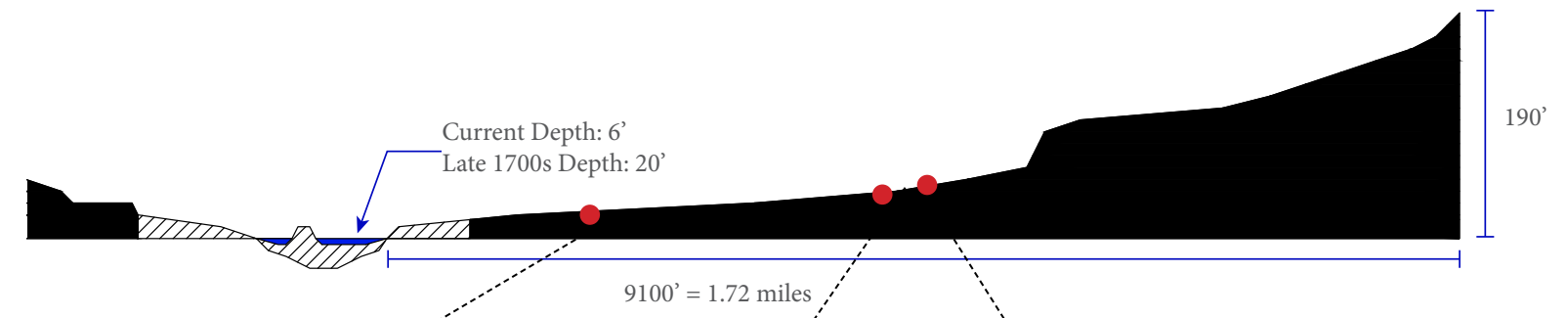
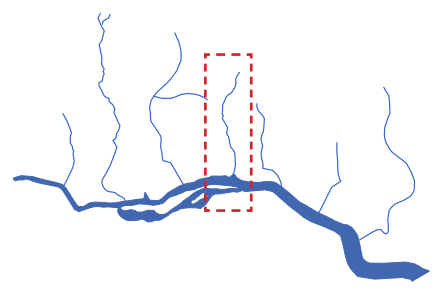


REOCCURRING CONDITIONS

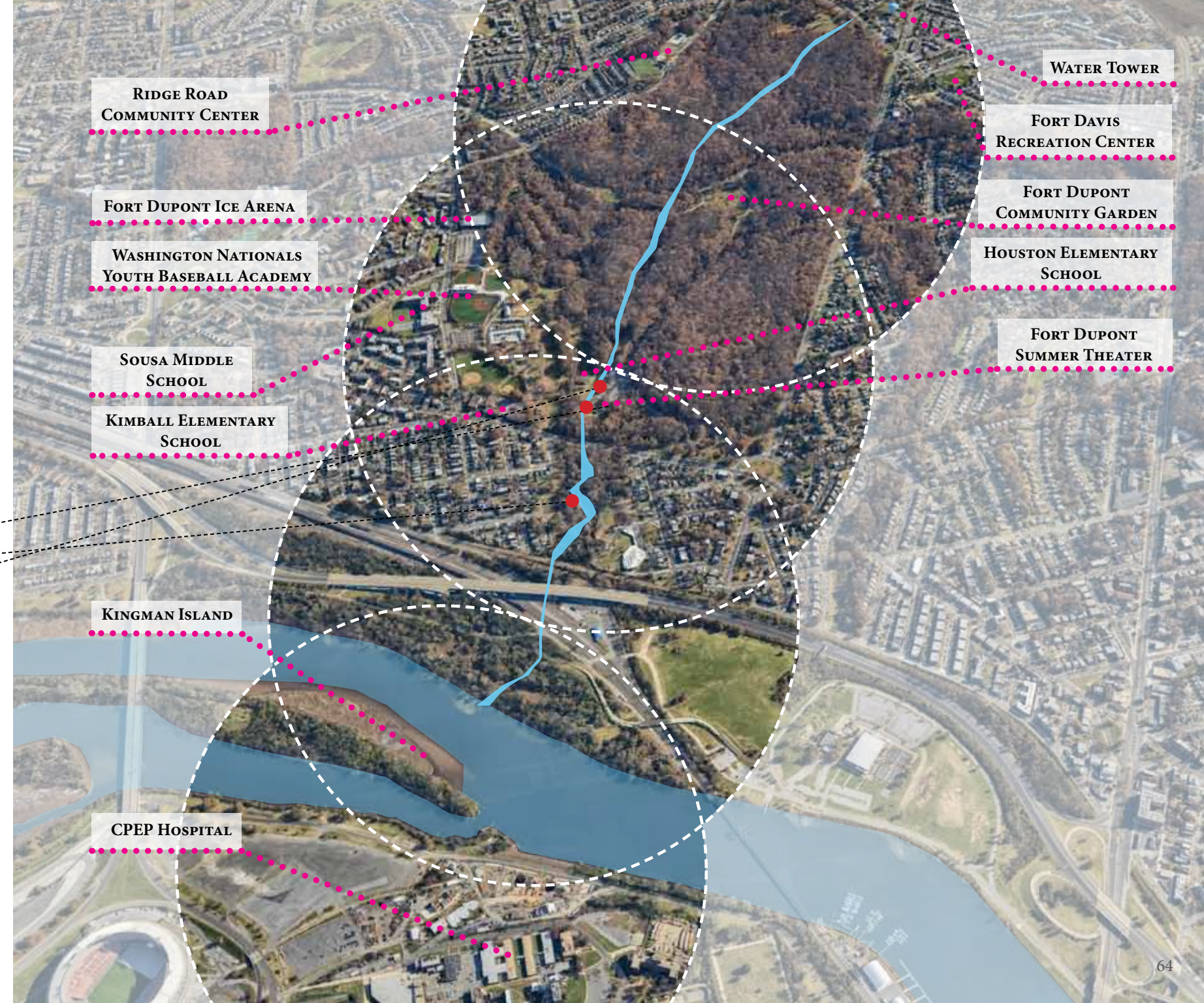


MATERIAL EXPERIENCE

FORT DUPONT STREAM | EXISTING CONDITIONS



Existing Conditions



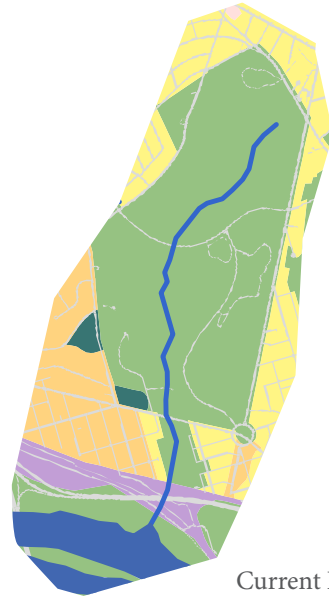
FORT DUPONT STREAM | FUTURE DESIGN

STREAM THEME: AGRICULTURAL

RIVERSIDE PROGRAM:
FLOATING AND HYDROPONIC GARDENS



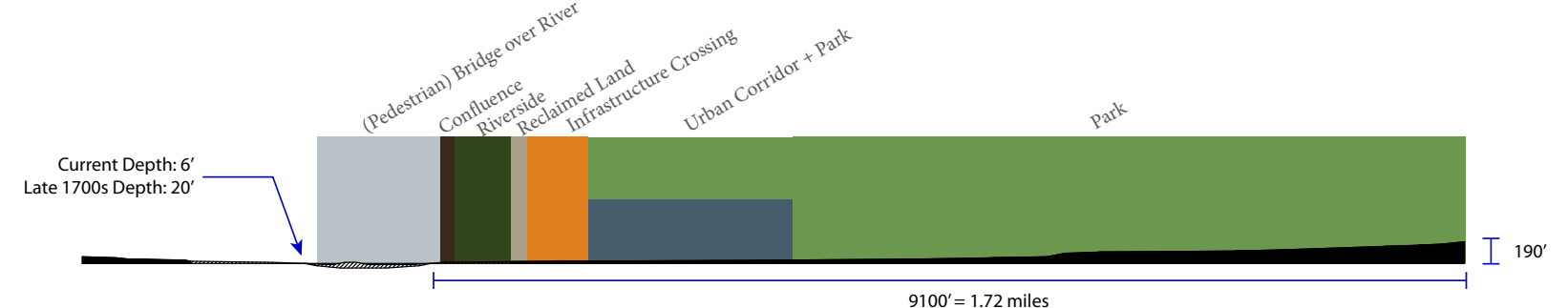
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- Low Density Commercial
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- Medium Density Commercial
- High Density Commercial
- Production, Distribution, and Repair
- Federal
- Local Public Facilities
- Institutional
- Parks, Recreation, and Open Space
- Mixed Land Use
- WATER



Current Land Use Plan



Recommended Future Land Use Plan



REOCCURRING CONDITIONS

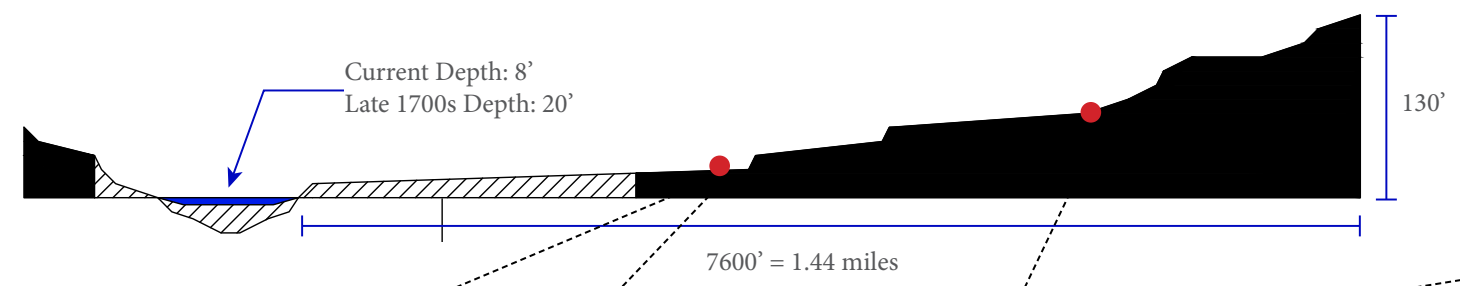
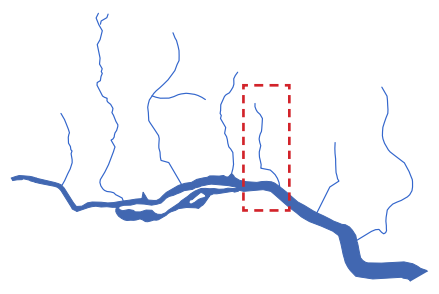


ACTIVITIES

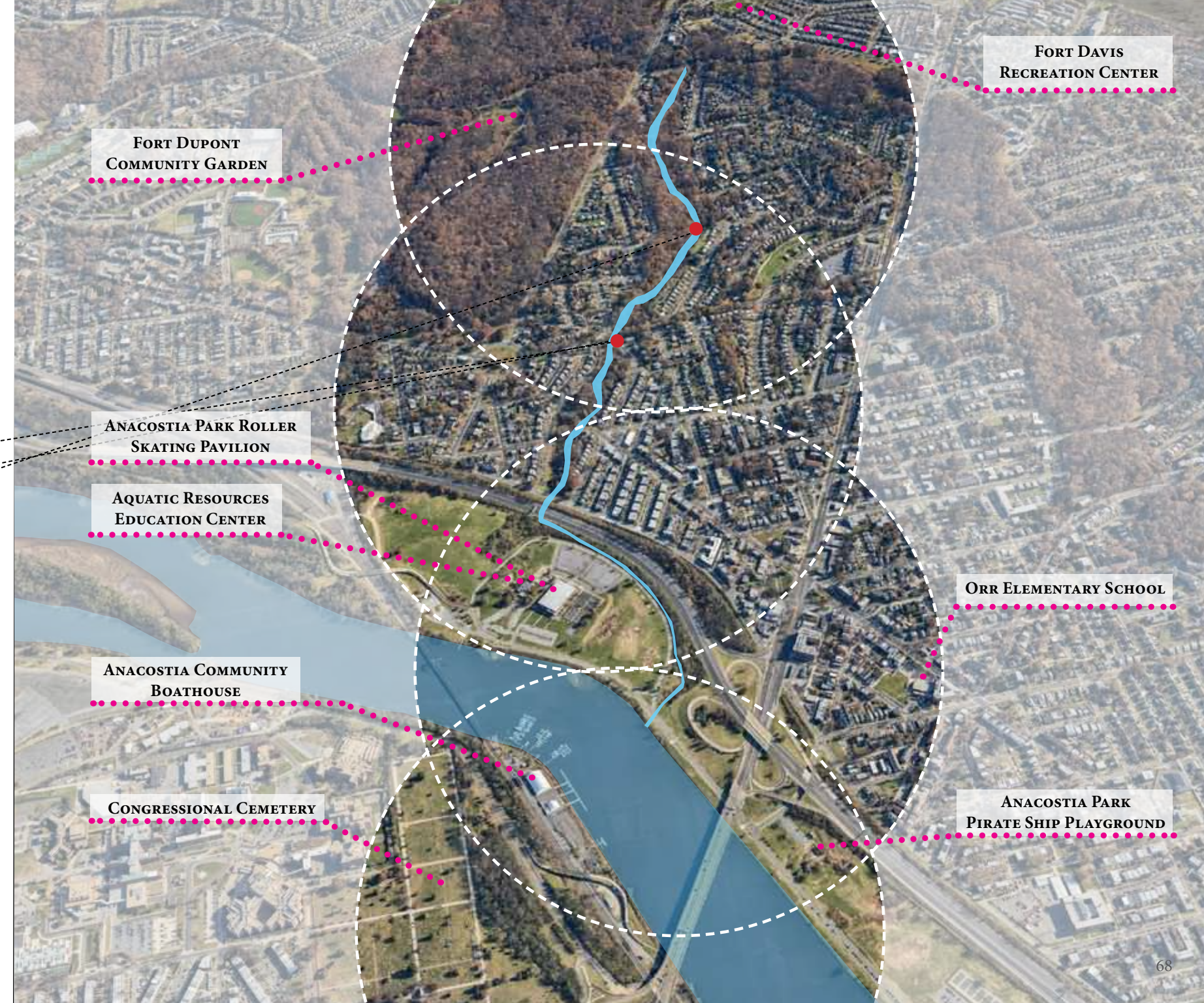


MATERIAL EXPERIENCE

POPE BRANCH STREAM | EXISTING CONDITIONS



Existing Conditions



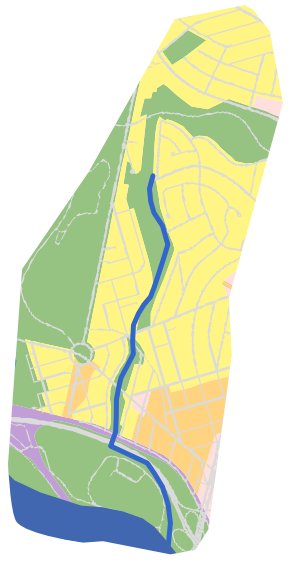
POPE BRANCH STREAM | FUTURE DESIGN

STREAM THEME: RECREATIONAL

RIVERSIDE PROGRAM:
ROLLER SKATING PAVILION AND WELLNESS CENTER



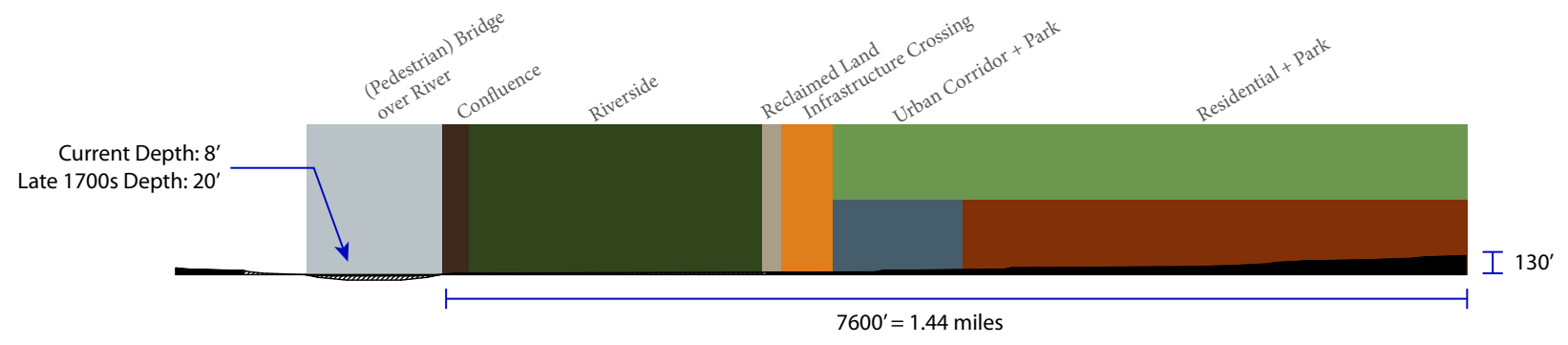
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Current Land Use Plan



Recommended Future Land Use Plan



REOCCURRING CONDITIONS

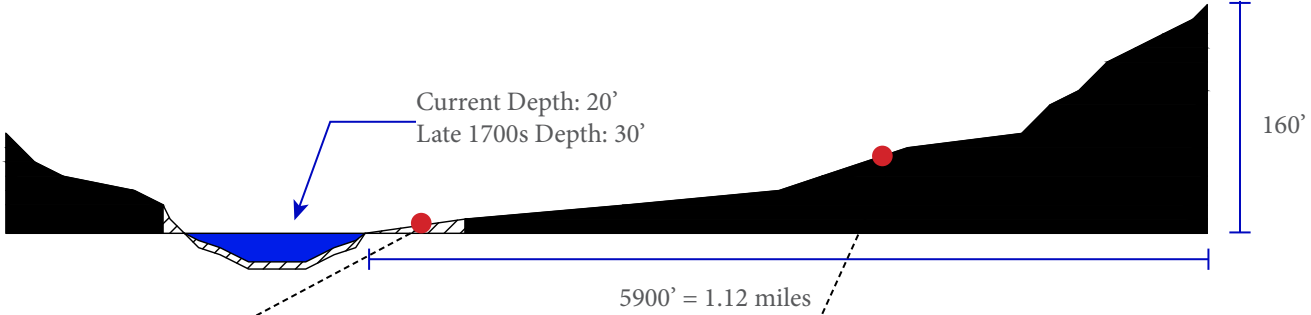
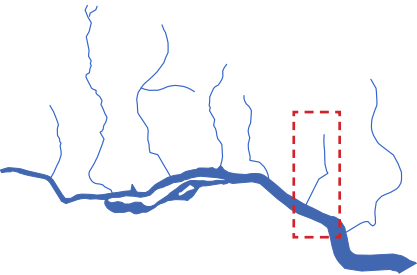


ACTIVITIES

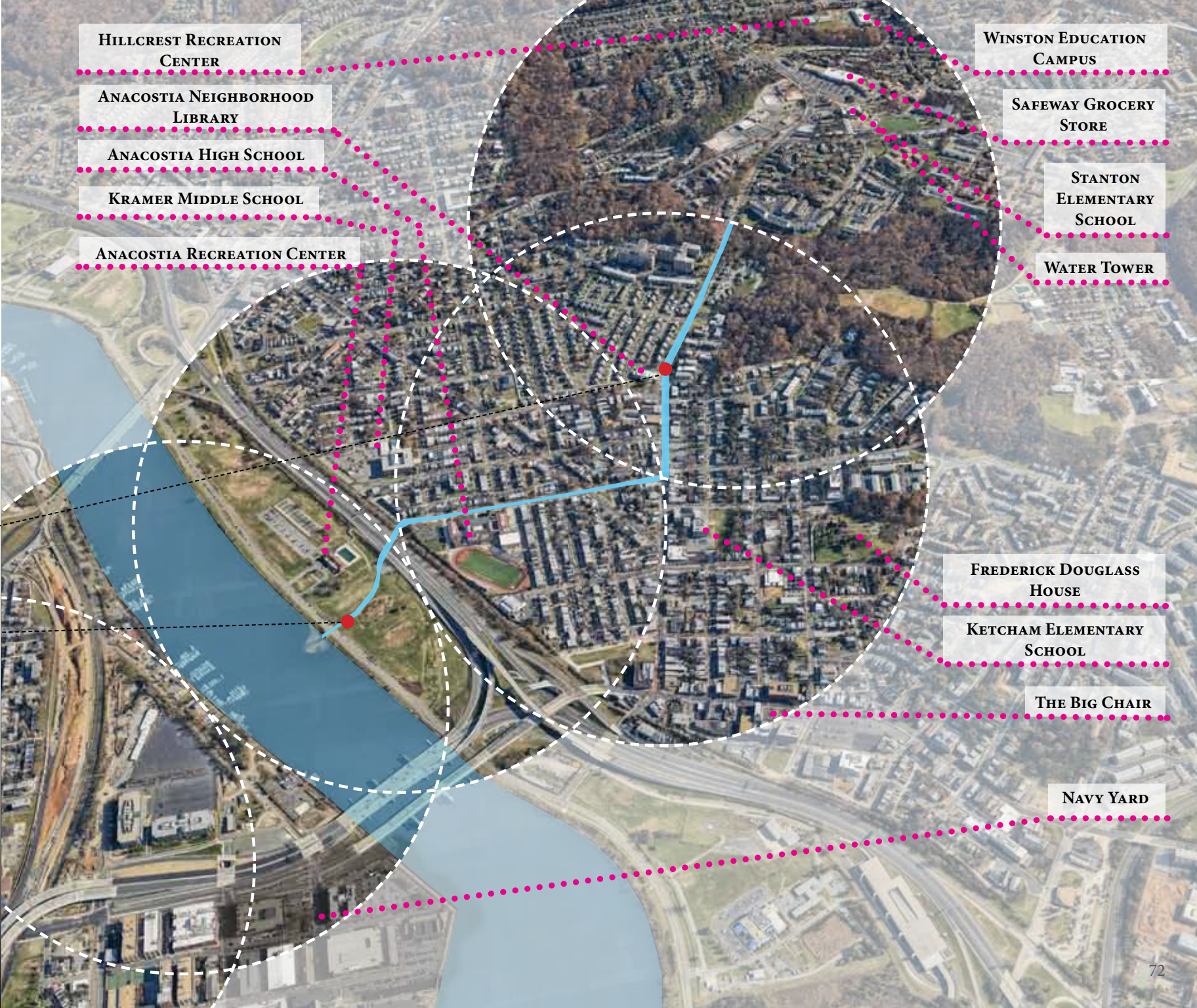


MATERIAL EXPERIENCE

STANTON STREAM | EXISTING CONDITIONS



Existing Conditions



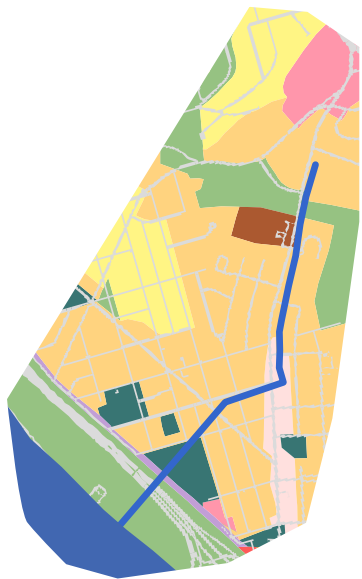
STANTON STREAM | FUTURE DESIGN

STREAM THEME: COMMERCIAL

RIVERSIDE PROGRAM:
11TH STREET BRIDGE DEVELOPMENT



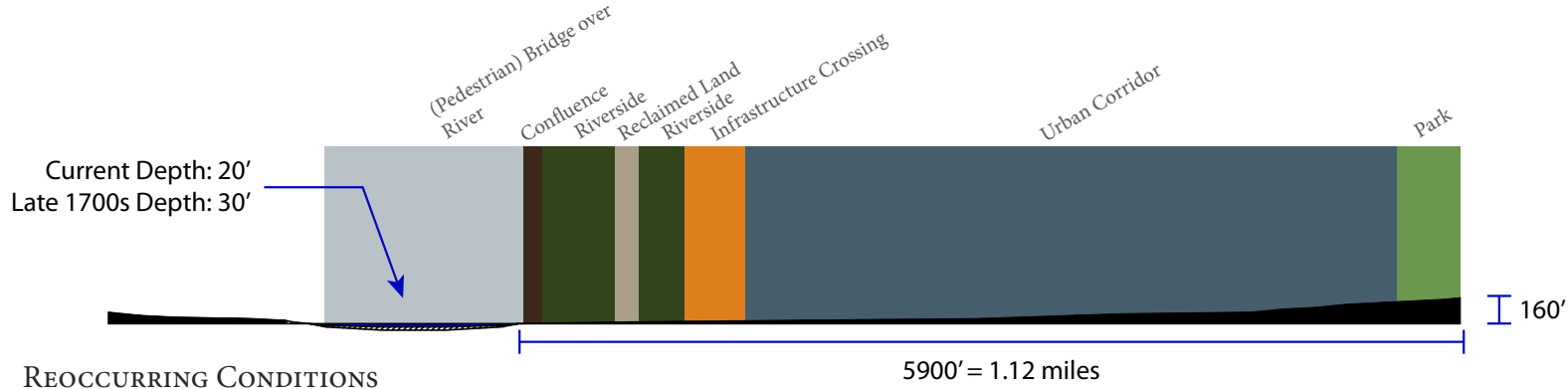
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Current Land Use Plan



Recommended Future Land Use Plan

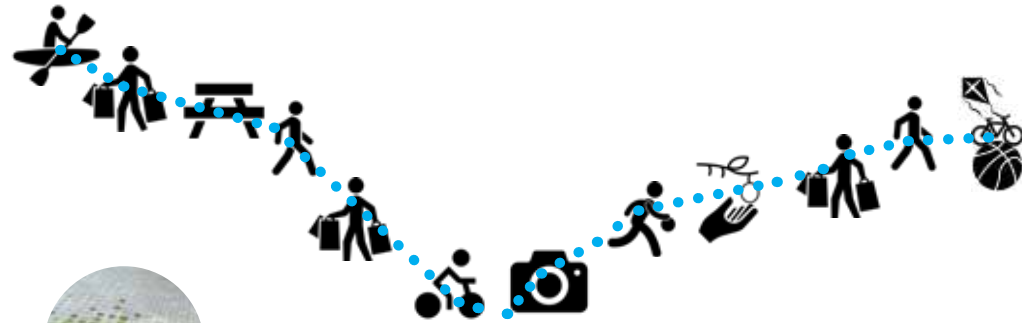


REOCCURRING CONDITIONS

5900' = 1.12 miles

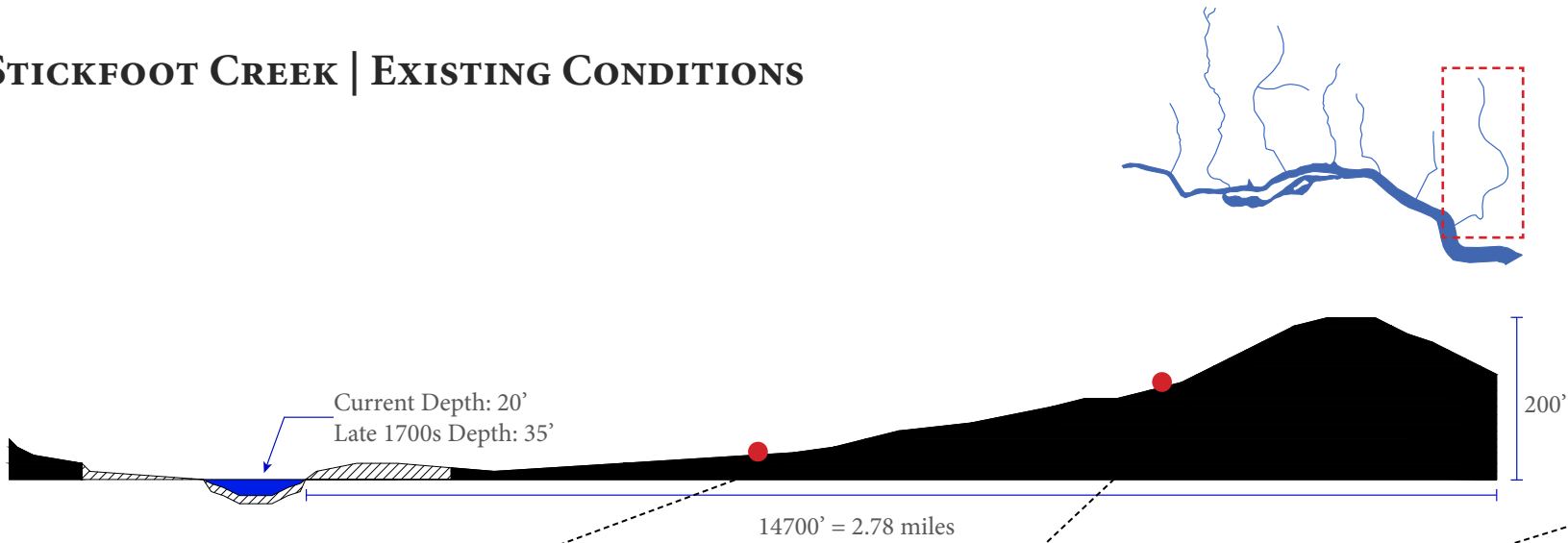
160'

ACTIVITIES

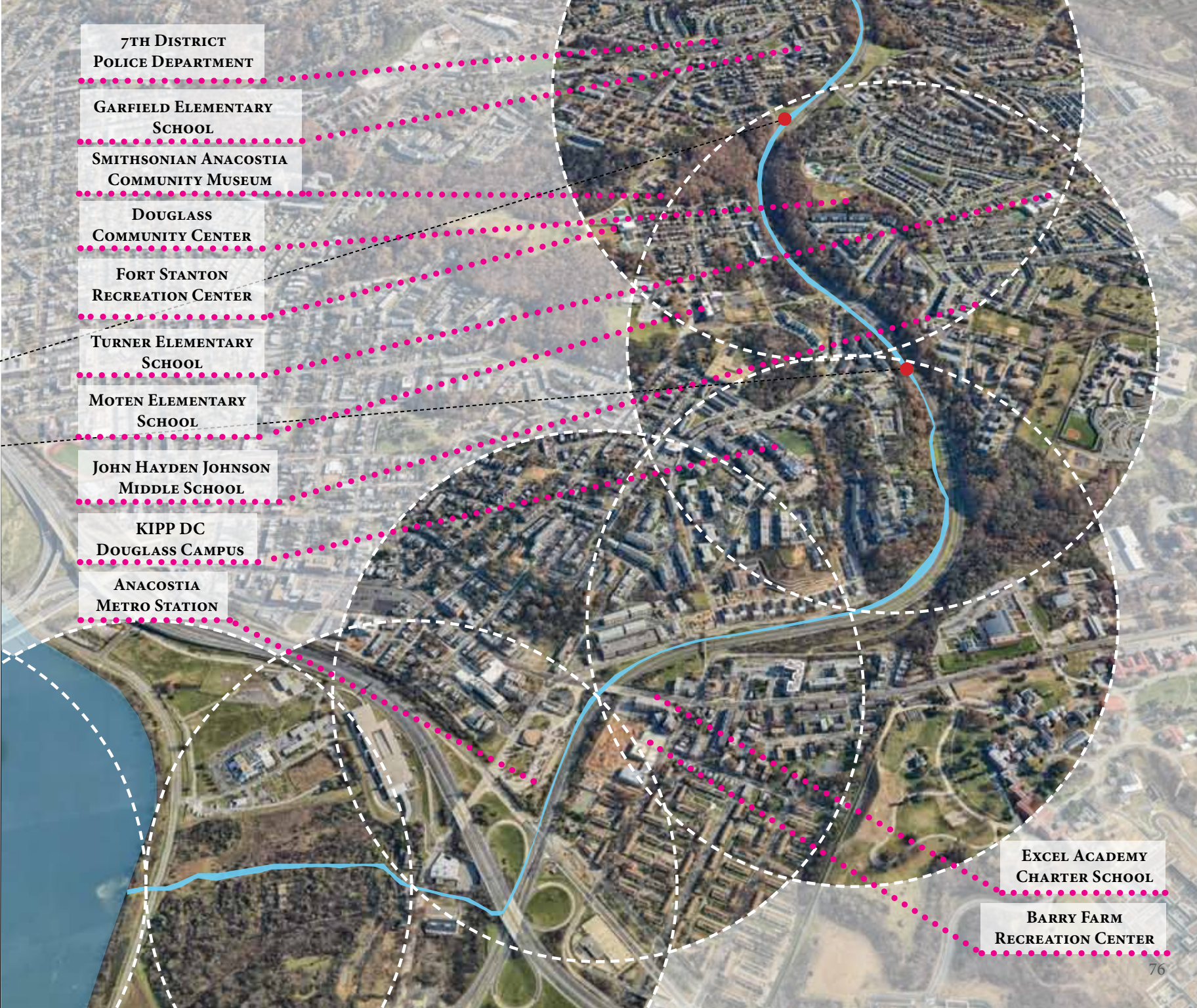


MATERIAL EXPERIENCE

STICKFOOT CREEK | EXISTING CONDITIONS



Existing Conditions



STICKFOOT CREEK | FUTURE DESIGN

STREAM THEME: COMMERCIAL

RIVERSIDE PROGRAM:
TIDAL MUSEUM AND
POPLAR POINT DEVELOPMENT



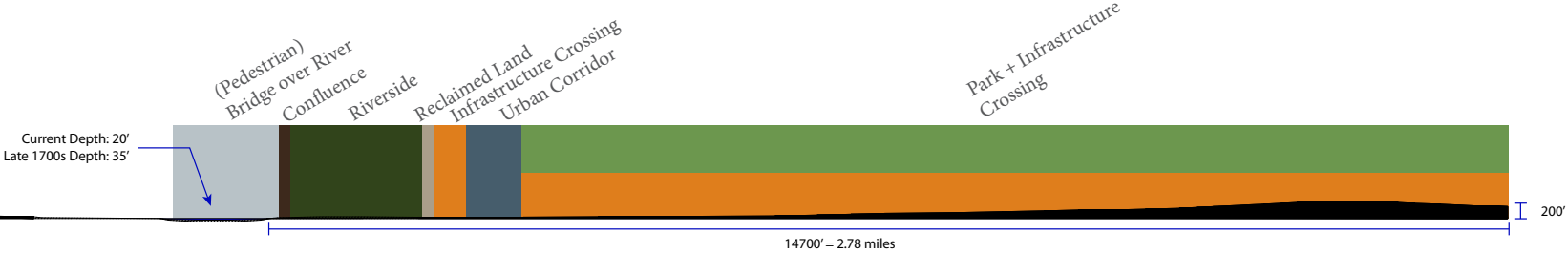
- Low Density Residential
- Moderate Density Residential
- Medium Density Residential
- High Density Residential
- Low Density Commercial
- Moderate Density Commercial
- Medium Density Commercial
- High Density Commercial
- Production, Distribution, and Repair
- Federal
- Local Public Facilities
- Institutional
- Parks, Recreation, and Open Space
- Mixed Land Use
- WATER



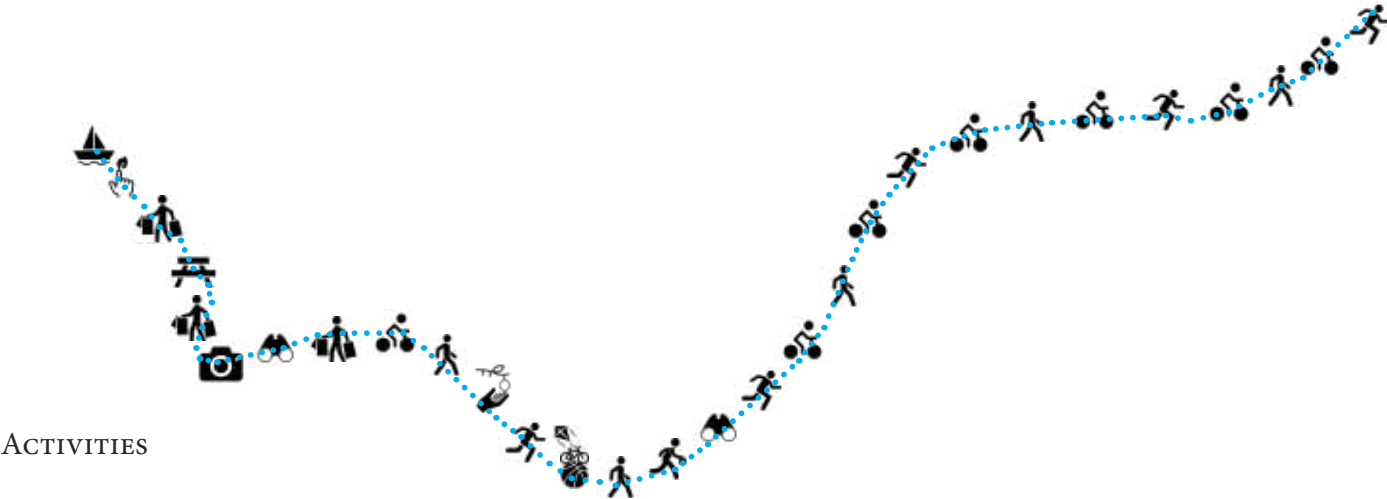
Current Land Use Plan



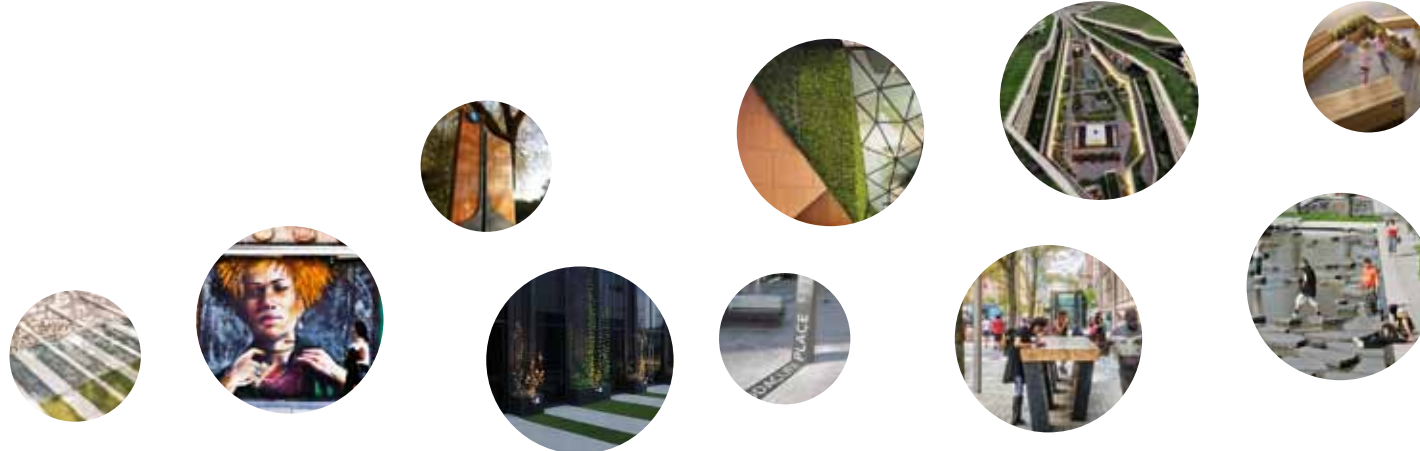
Recommended Future Land Use Plan



REOCCURRING CONDITIONS

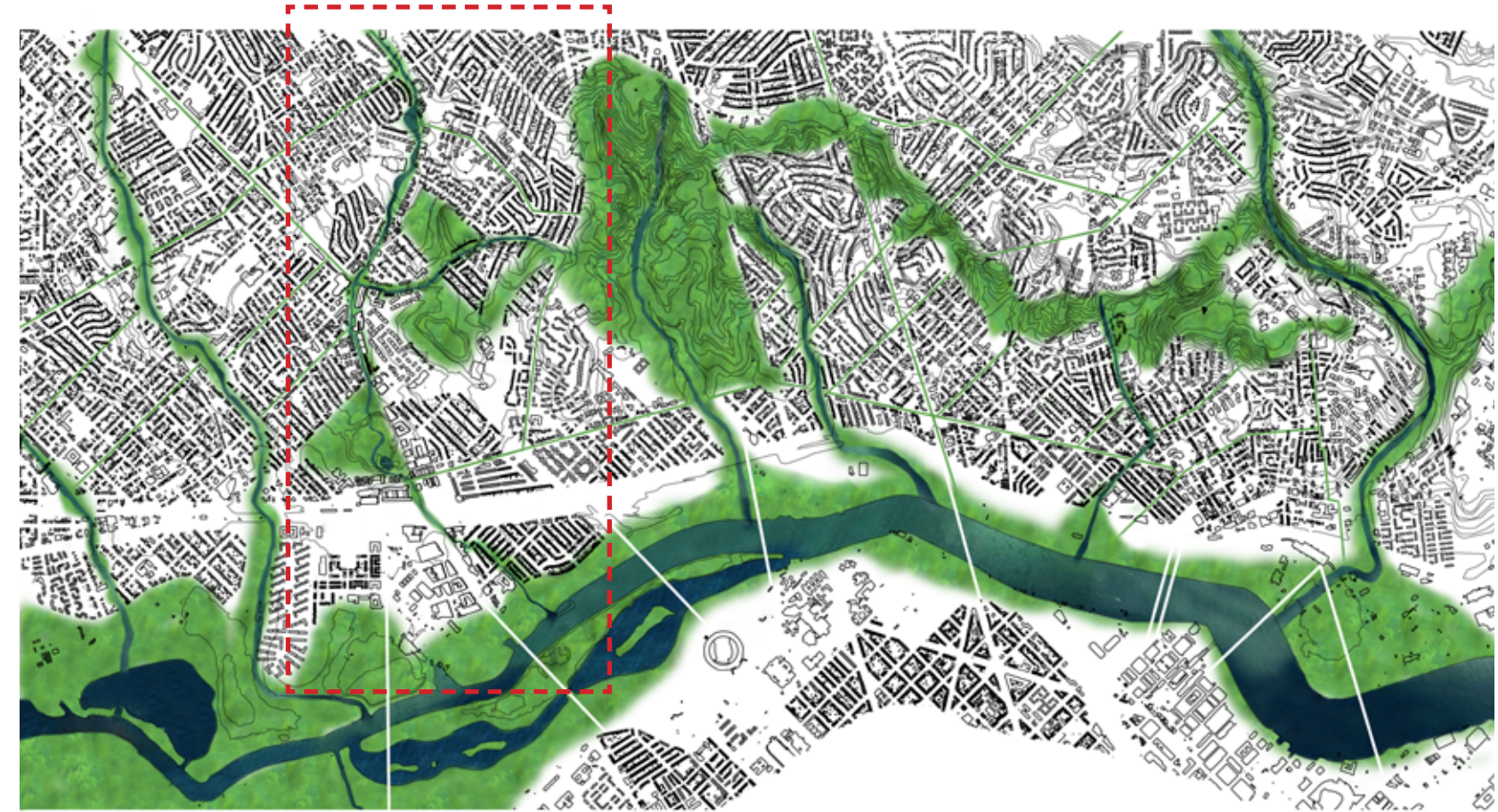


ACTIVITIES



MATERIAL EXPERIENCE

PINEY RUN STREAM



Full River Rendering



After analyzing the existing conditions of each stream and planning its future, the final stage of my design was to deep dive one of the streams and use it as a proof of concept for how the rest of the streams could be designed in the future.

I chose Piney Run Stream because its agricultural theme would allow me to address the lack of food access in the surrounding neighborhoods, because the stream passed through a wide variety of the outlined intersection types, and because it could make the biggest design impact since the existing stream is almost entirely buried underground.

Each of the red dots on the opposite page outline the location of a design intervention at one of the reoccurring intersections with the stream. The following pages provide plans, sections, and renderings of the imagined future for Piney Run Stream, beginning at the confluence of the river and the stream and moving eastward into the neighborhoods.



Piney Run Stream



PINEY RUN STREAM | CONFLUENCE OF RIVER AND STREAM: PUBLIC ART

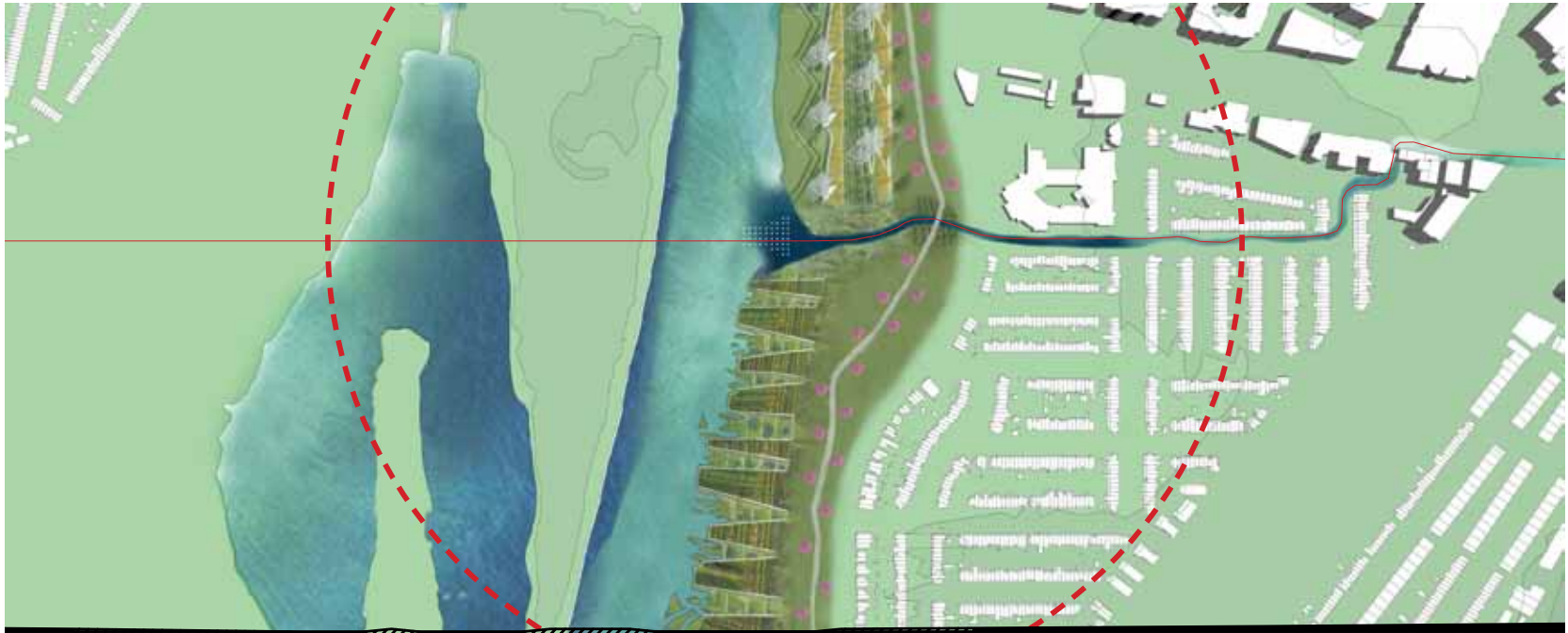


Woodlawn Cemetery

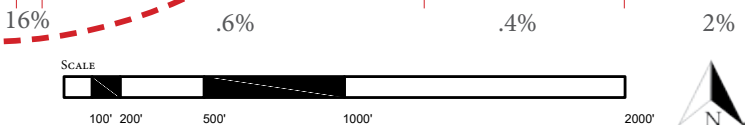


Engraved Pier

Woodlawn Cemetery is a historically significant cemetery next to Piney Run Stream where numerous prominent African Americans from DC are interred. Although the community wants to turn the cemetery into a memorial park, it currently sits in disrepair due to lack of funds. This public art piece celebrates the cemetery's significance, drawing it into the public eye. The posts in the water are each engraved with the names of those interred in the cemetery. In order to view all the names, visitors can kayak between the piers, encouraging more water activities on the river. The piers also light up at night to create a beautifully eerie spectacle.

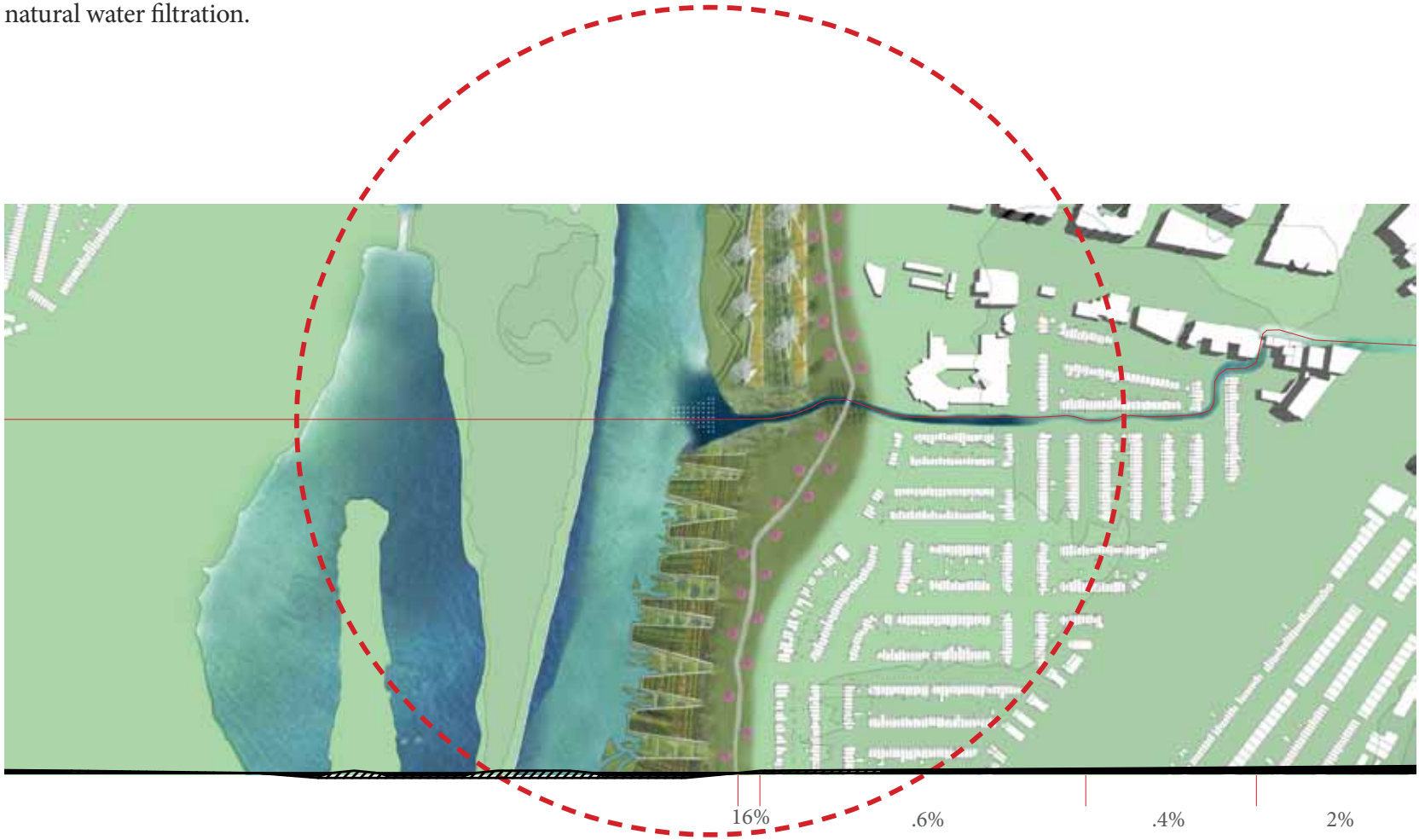


Plan View and Section View Including % Slope Change

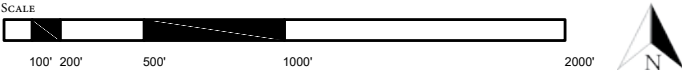


PINEY RUN STREAM | RIVERSIDE: AGRICULTURAL PIERS

The agricultural piers are perhaps the best example of a mutualistic relationship between humans and nature in this design. Learning from the Ancient Egyptians, these piers will be farmed in accordance with the Anacostia's flooding season. Crops will be harvested before flooding season, and then the flood gates at the end of each pier (which protect the crops from possible out-of-season flooding) will be opened, which will allow the land to flood, recharge the groundwater aquifers, and restore nutrients to the soil. During extended dry seasons, the piers may also be irrigated with diverted stream and river water. Finally, between each pier will be wetlands and tidal marshes, returning the currently reclaimed land back to the river and acting as natural water filtration.

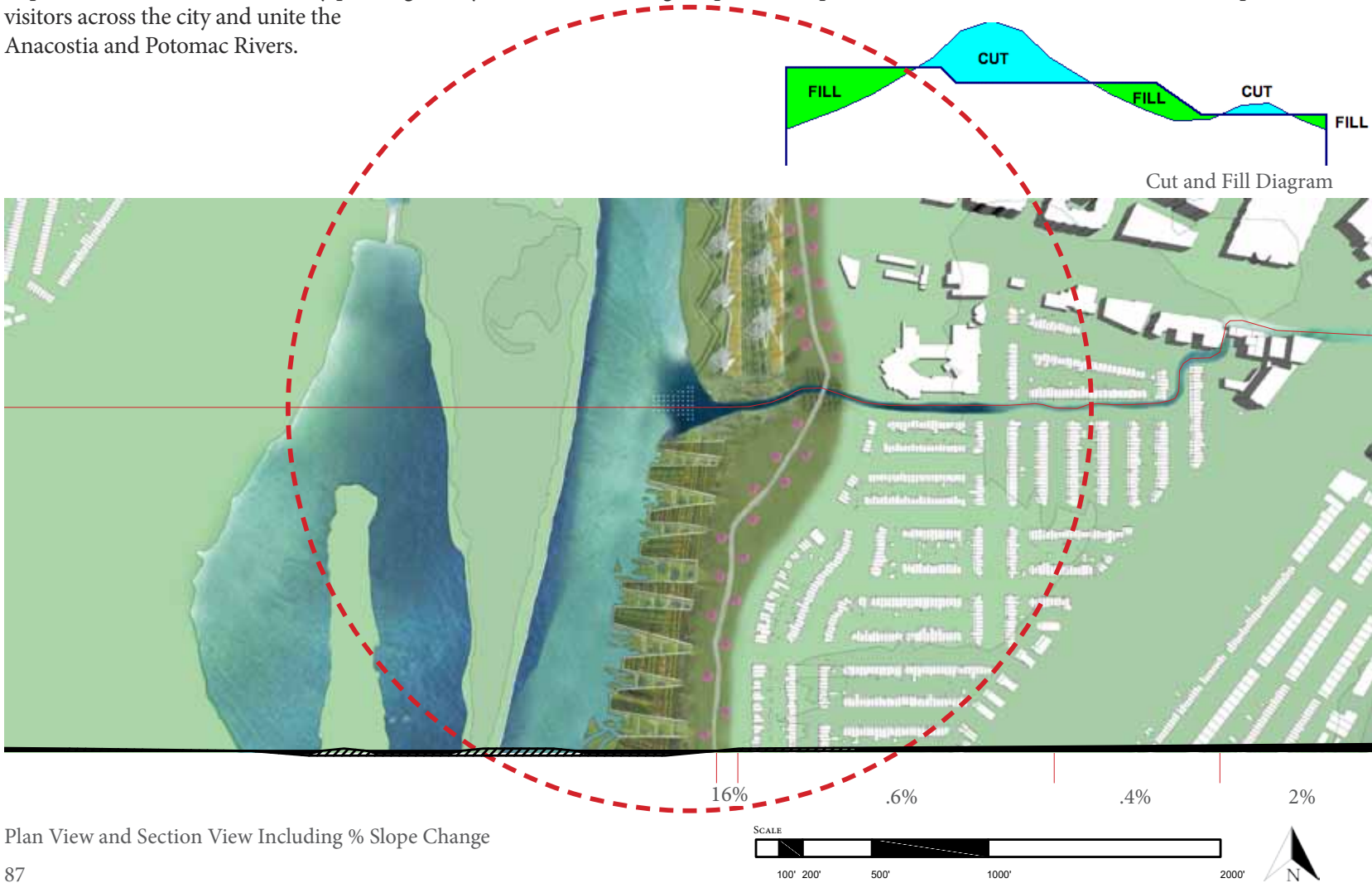


Plan View and Section View Including % Slope Change



PINEY RUN STREAM | RECLAIMED LAND: EARTHWORK

Reclaimed land is often referred to as “fill” because it is soil or sediment that is dug up from one location and used to fill in another. A sustainable practice in landscape architecture is the idea of balancing cut and fill so that all of a site’s soil is able to stay on the site and no extra soil needs to be brought in. Drawing inspiration from this practice, when the stream intersects with the reclaimed land, the concepts of cut and fill are played with artistically. Earthwork mounds (reminiscent of Maya Lin’s *Wave Field*) emphasize the fact that the reclaimed land is human-made by exaggerating the land shapes. This “fill” is balanced by the “cut-through” of the stream and pedestrian paths. Also, each year, the Cherry Blossom Festival brings visitors from across the world to the Potomac Tidal Basin, once again asserting the Potomac’s importance over the Anacostia. By planting cherry blossom trees along the pedestrian paths near the Anacostia as well, this will help to draw visitors across the city and unite the Anacostia and Potomac Rivers.



Plan View and Section View Including % Slope Change



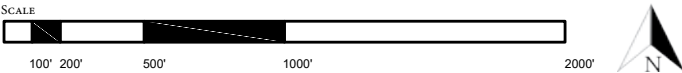
PINEY RUN STREAM | INFRASTRUCTURE CROSSING: WATER BRIDGE

The water bridge is a visual representation of this thesis' argument for a shift in priorities: recognizing that natural processes and pedestrians should take precedence over highway traffic (which has historically caused streams to be buried and cut neighborhoods off from nearby waterfronts). The typical way pedestrians are able to cross large highways is either a tunnel underneath or a bridge that arches over the top of the highway. Studies show that neither of these situations are ideal for pedestrian safety because it takes the pedestrian out of the plane of the rest of the street, and therefore out of the public eye, leaving them vulnerable. However, the water bridge needs to remain slightly angled downhill in order for the stream to flow, so both the pedestrians and the stream are able to remain in the visible street plane while the highway below is re-graded to dip under the water bridge (section and elevation on following page).



.6% .4% 2% .6% 1%

Plan View and Section View Including % Slope Change





Pedestrian Experience on Water Bridge



Experience Driving Under Water Bridge



Elevation



Section

Car traffic along the Anacostia Freeway is made aware of the rhythm of the seven stream crossings through the presence of vegetated walls and representations of water (such as the hanging blue iridescent lights shown above) that add beauty to the freeway experience without becoming distracting. Also, as a nod to the stream's past burial in pipes beneath the ground, the tunnels the cars enter are constructed with large corrugated pipes.

If in this or other stream locations the highway is unable to be re-graded beneath the water bridges (due to water table height or other concerns), an alternative could be to start the water bridge further upstream at a higher elevation. By the time it reaches the highway crossing, the appearance could be much more similar to ancient aqueducts (see rendering to the right), which were the original inspiration for the water bridge. The heightened bridge height could also allow the water bridge to interact with green rooftops of nearby buildings, possibly providing pedestrian access or irrigation.

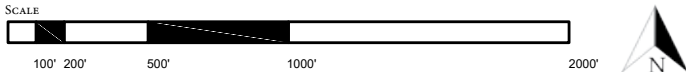


PINEY RUN STREAM | PARK: FOOD FOREST

As previously mentioned, the East of the River neighborhoods have very low food access. One strategy that other cities in similar situations are employing is a food forest. A food forest is a forest that is strategically planted with edible vegetation (from herbs to fruit trees) and allows residents to informally pick what they need, when they need it, for free. This food forest also includes a fishing pond for neighborhood residents to enjoy. The hardscaped edge of the park that meets the street is designed with raised agricultural beds to provide a productive version of park landscaping that is traditionally only aesthetic.



Plan View and Section View Including % Slope Change

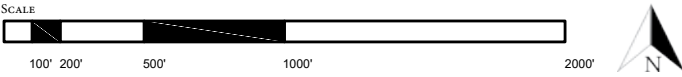


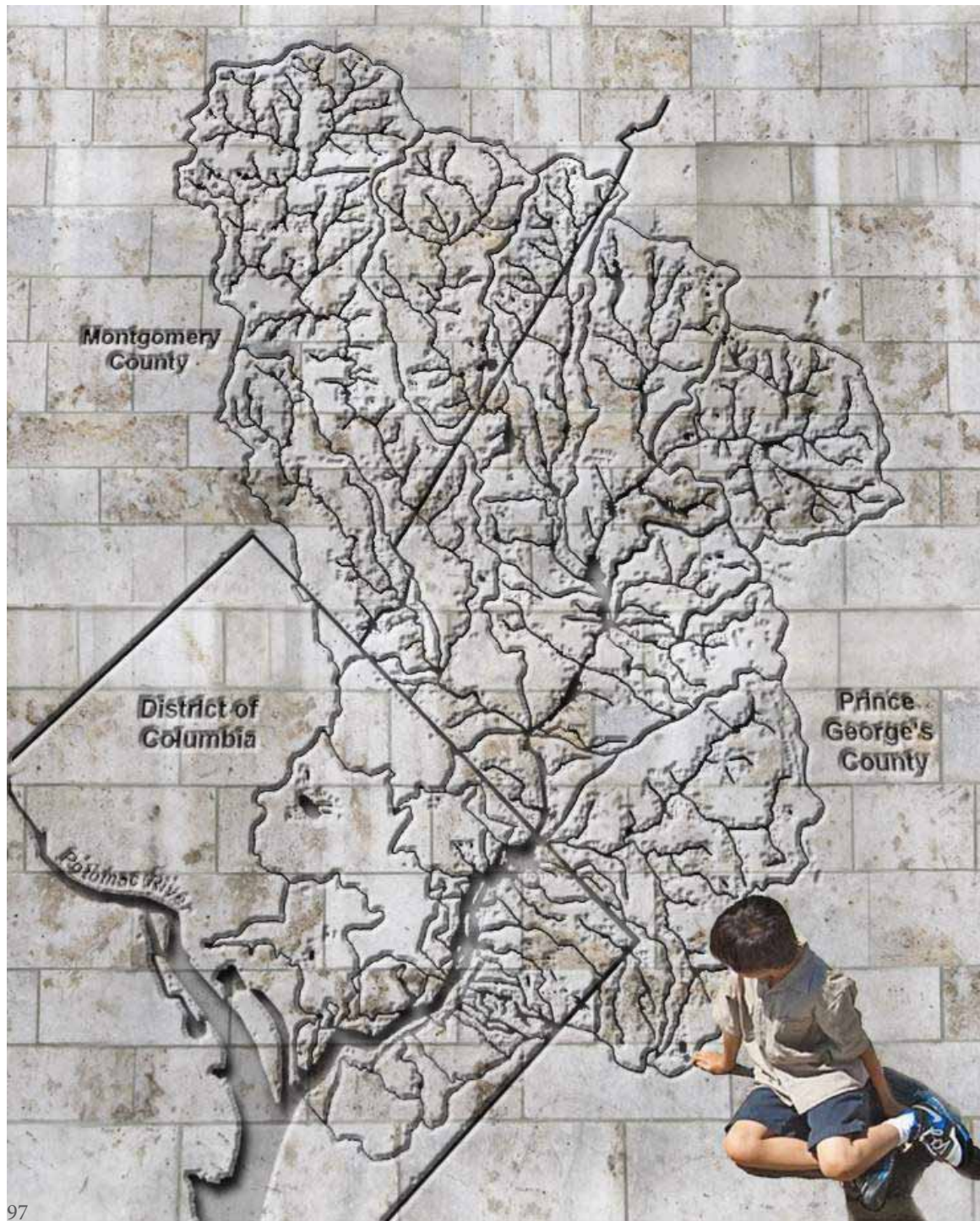
PINEY RUN STREAM | URBAN PLAZA: SPLASH & SKATE PARK

It is important to allow residents to interact with the stream in numerous ways so that it becomes embedded in the community. This urban plaza is located at the Benning Road metro stop and is hardscaped to allow residents, visitors, and families to have a unique experience with the stream that is focused on fun instead of ecological restoration. The painted hardscape is also a public art piece that residents can help design, in order to introduce visitors to their neighborhood when they step off the metro. Furthermore, the stream passing by this location will help visitors coming out of the metro stop to orient themselves simply because of the direction of water flow. Humans intuitively understand that following water downstream will eventually lead them to the river. This “follow the water” intuition will help residents and visitors alike find their way through the neighborhoods more easily.



Plan View and Section View Including % Slope Change





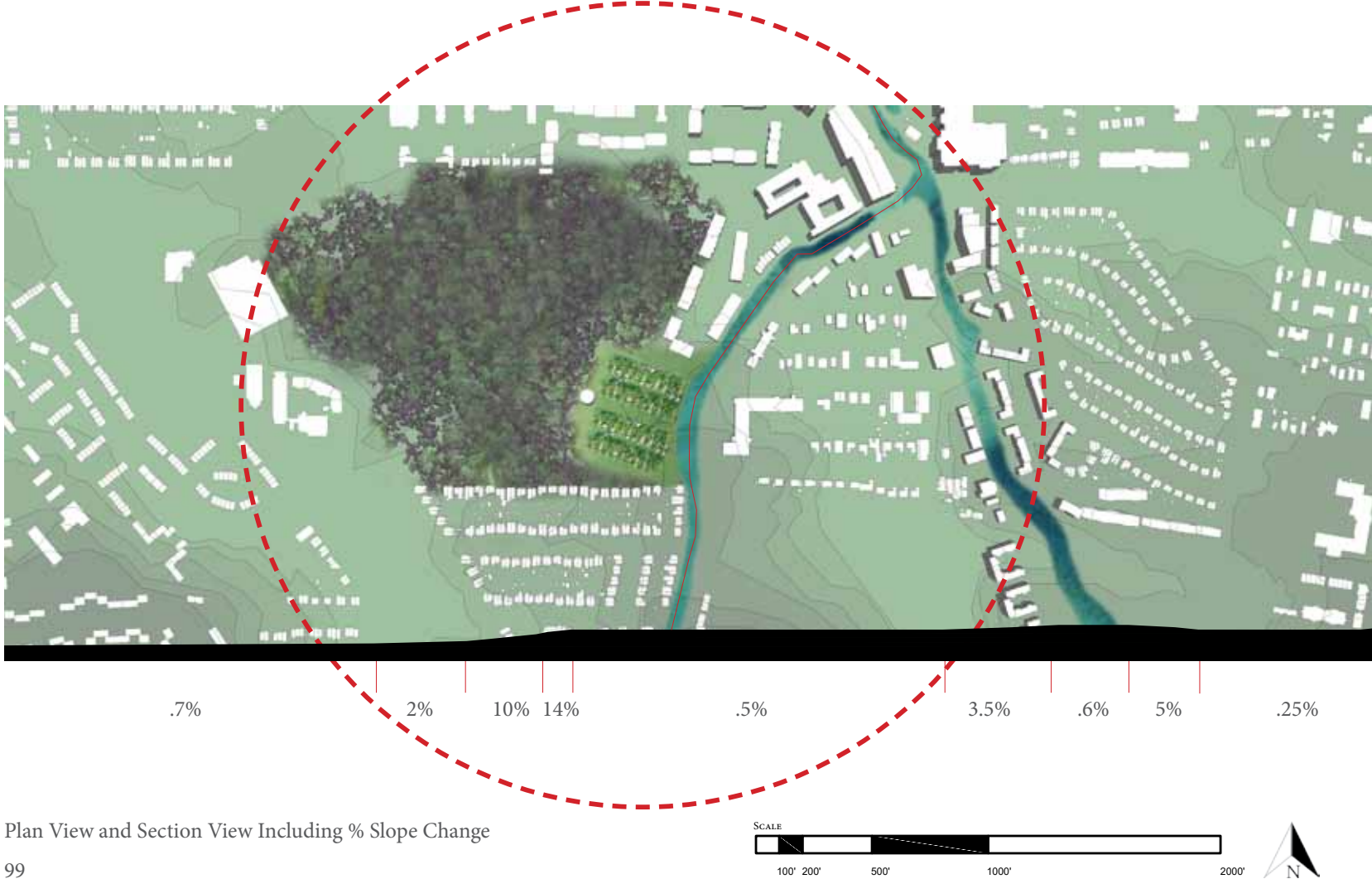
Within the urban plaza, this engraving of the Anacostia's watershed reminds viewers of the regional connectivity of the stream in front of them. When it rains, water runs through the engraving, demonstrating water movement through the river system.



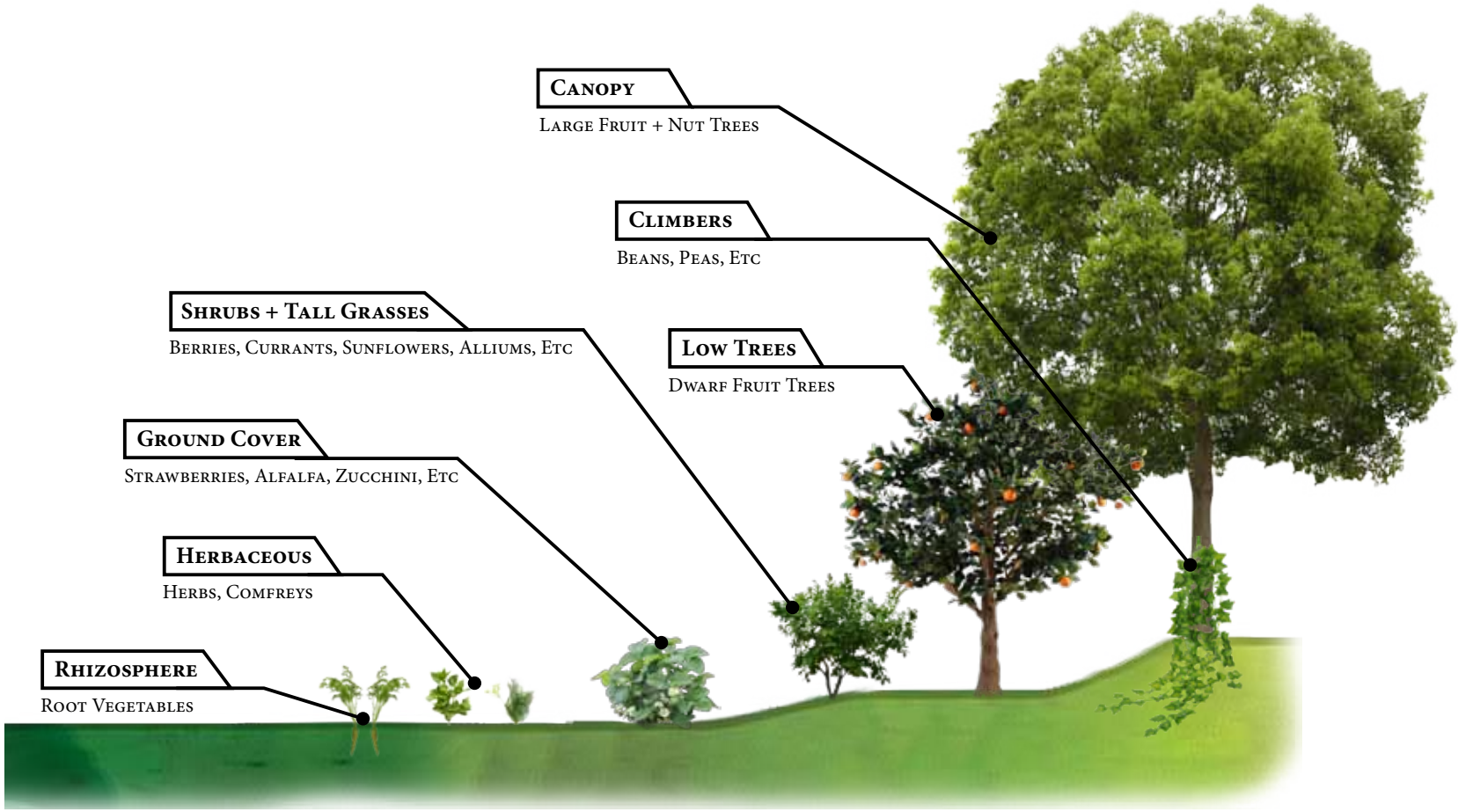
Splash & Skate Park Rendering

PINEY RUN STREAM | PARK: COMMUNITY GARDEN

This smaller park, near the end of the stream, provides residents with another method of fighting low food access: a community garden. Here, residents learn to plant, grow, and harvest their own food. Each of the raised garden beds is irrigated by a small water tower near the rear of the park. This water tower is reminiscent of the larger water towers throughout the East of the River neighborhoods that help create water pressure for residents living in the highest elevations. The proximity of the garden to the school across the street also allows for educational food growth opportunities for students.



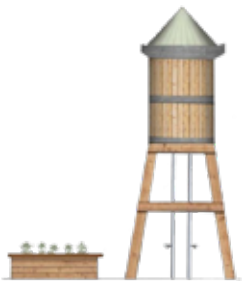
PINEY RUN STREAM | FOOD FLOW



MOST INFORMAL: FOOD FOREST

“Food deserts,” or areas with low food access, cannot be “fixed” with one solution. Along the length of Piney Run Stream, multiple solutions (from informal to formal) are offered to help address this problem. The goal is to give residents as many options and opportunities as possible to find fresh, healthy food within their community.

A water tower (inspired by others in the area) irrigates the gardens



Raised Garden Beds with internal water catchment

SEMI-INFORMAL: COMMUNITY GARDEN



Agricultural land on “piers” with wetlands in between; water from stream is diverted into irrigation canals



SEMI-FORMAL: AGRICULTURAL PIERS

Community members add food waste to public compost bins, which are then used to fertilize agricultural lands at the river

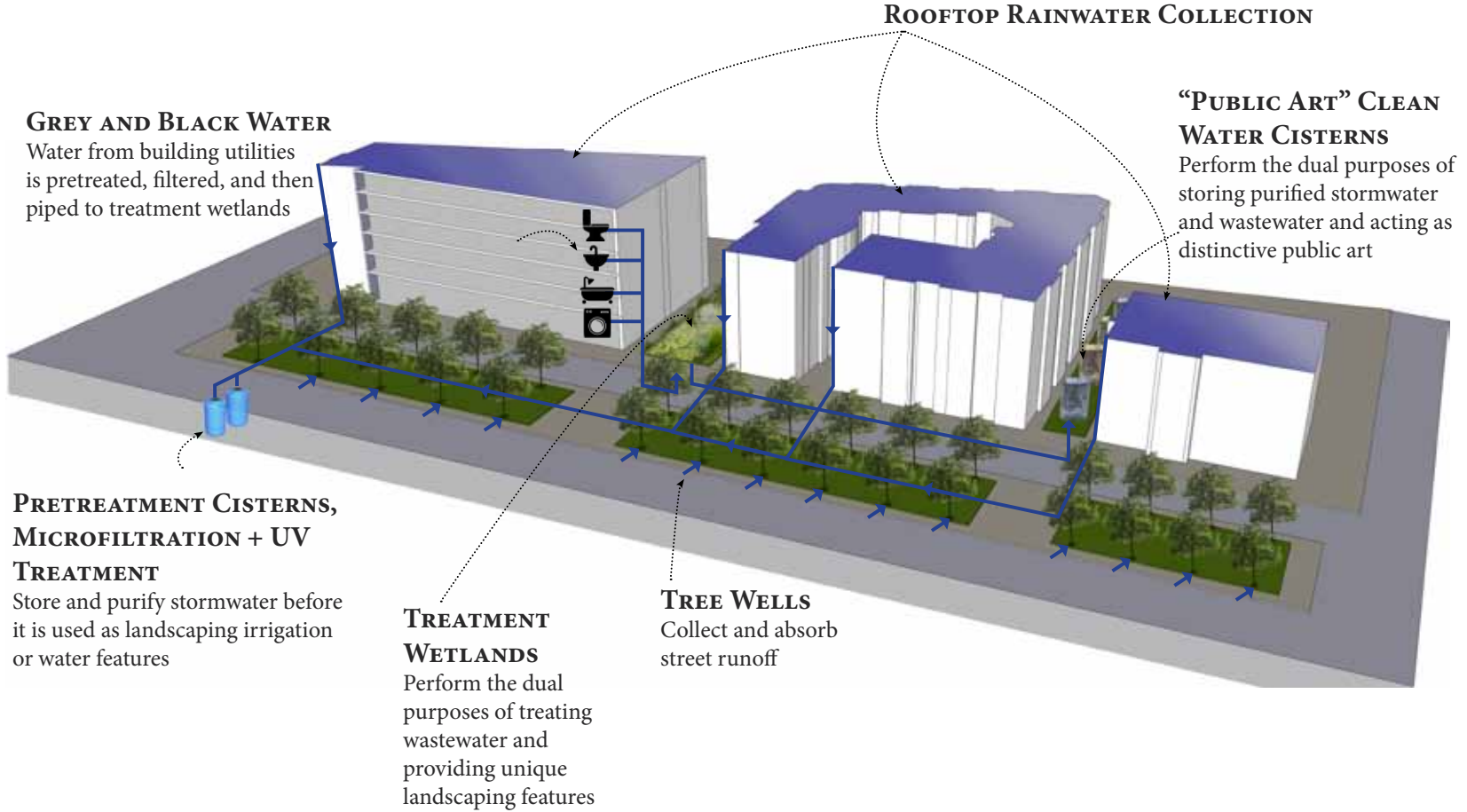


Member Volunteer Program provides opportunities for eligible Co-op members to volunteer with non-profit community partners, in exchange for discounts at the Co-op



MOST FORMAL: FOOD CO-OP

PINEY RUN STREAM | ON-SITE WATER TREATMENT



One of the main reasons that the Anacostia is currently so polluted is that the city has dumped wastewater into the river for decades. Although the city government is currently taking steps to minimize this issue on the city scale, it can arguably be more effectively addressed on a site scale. All new construction associated with the stream corridors will be required to have on-site wastewater treatment. Inspired by Hassalo on Eighth (see below), new developments will include treatment wetlands, rooftop rainwater collection, and water cisterns that act as public art pieces. By treating waste water at its source, before it is even added into the city’s sewer system, we can drastically reduce or even eliminate future pollution in the Anacostia River.



Hassalo on Eighth, Portland, OR
Biohabitats

CONCLUSION

“Nature pervades the city, forging bonds between the city and the air, earth, water, and living organisms within and around it. In themselves, the forces of nature are neither benign nor hostile to humankind. Acknowledged and harnessed, they represent a powerful resource for shaping a beneficial urban habitat; ignored or subverted, they magnify problems that have plagued cities for centuries, such as floods and landslides, poisoned air and water. Unfortunately, cities have mostly neglected and rarely exploited the natural forces within them.”

-Anne Whiston Spirn

Washington DC, like many cities across the world, has abused the natural forces present in the city for most of its history, by clear-cutting its riverside forests, burying its streams, and polluting its rivers. This thesis offers a way for the city to move forward and acknowledge the natural processes within the city. By highlighting the productivity of the landscape, this thesis envisions a relationship between humans and nature that is mutually beneficial.

Since urban designers are trained to see in systems, it is our responsibility to design and advocate for a way that human and natural systems can work together. Having a large natural network like the Anacostia river system running through our city is an opportunity to develop an “ecological urbanism” and frame our future relationship with nature. By acknowledging and harnessing the city’s natural processes, we can create a comprehensive solution for a neglected river and neglected neighborhoods that can become a celebrated framework for urban transformation and guide the planning and design of the East of the River neighborhoods for the next 100 years.

2018 was declared by DC’s mayor to be “The Year of the Anacostia.”
Let’s see how far we can take that, shall we?

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