

HYBRID INFRASTRUCTURES

RE:POSITIONING THE ANACOSTIA

Matt Kikosicki

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Abstract

**HYBRID INFRASTRUCTURES
RE:POSITIONING THE ANACOSTIA**

Matt Kikosicki

Chair of Supervisory Committee:

Rob Corser, AIA
Associate Professor
Department of Architecture

This thesis is an investigation of the civic potential of infrastructure. As cities continue to grow architects must address infrastructure as a powerful agent to shape cities and enhance urban environments. By engaging larger scales than are typically the scope of an architectural intervention architects can more effectively serve communities of ever increasing complexity. The site for the proposed intervention is the Anacostia River in Washington, DC, a river which has served as an infrastructural armature in the city for centuries. A new waste to energy processing facility sponsors a local food hub and scalable agricultural network with the goal of repositioning the river within the context of the Nation's Capital.



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To MacKenzie, for her unwaivering support.

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INTRODUCTION

Defining the Contemporary Infrastructural Paradigm

Rapid urbanization throughout the world is placing increasing pressure on existing infrastructure networks. The presence of the systems that carry water, energy, and people through our cities is pervasive, yet frequently hidden. The notion that infrastructure can or should exist on the urban fringe is no longer viable. Thriving communities will need to integrate with the nodes and networks of urban infrastructure as available open space becomes increasingly rare.

Concomitant with urban development is the threat to urban landscapes. Life in this increasingly networked environment has led to landscape's role as an integral and necessary part of this urban infrastructure. The intertwining of these natural and built systems has led to ecological crises in numerous global cities. As these hybrid networks continue to feel the pressure of urban growth designers must seek out means for these two elements to thrive and serve contemporary and future populations. By combining public landscape and public infrastructure new forms of urban space can be developed. A new paradigm for infrastructure can be designed, and it must be.

In 2009 The American Reinvestment and Recovery Act, commonly referred to as The Stimulus was signed into law, dedicating over \$60 billion to infrastructure improvement . With the nation's highways, bridges and other public infrastructure strained to the point of obsolescence, or worse, failure, the time to redefine infrastructure in the American urban landscape is now.

This thesis is an investigation into the how infrastructure can be re imagined in the modern city. The civic potential of urban infrastructure and the possibility for Architecture to operate at scales beyond its typical reach will be examined and tested. In investigating the potential for architecture to operate at the scales of infrastructure, landscape and the city a new paradigm for modern urban infrastructure can take shape. This thesis identifies new ways that architecture can engage with the large-scale complex networks that increasingly define the contemporary city.

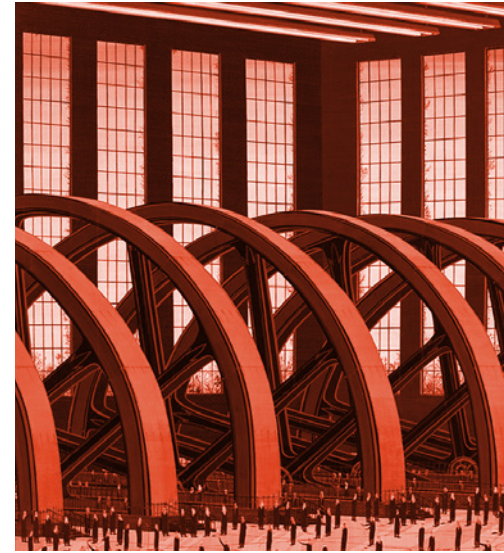


Fig 1: Sacral Contemplation, Artist Ian Davis



Fig 2: Sacral Contemplation, Artist Ian Davis

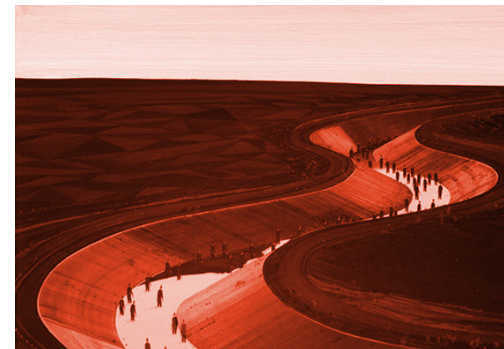


Fig 3: Sacral Contemplation, Artist Ian Davis

It is our responsibility
as architects, landscape
architects and planners
to find new ways to
reinvent public space,
public amenities and public
infrastructures

Michael Maltzan

THEORETICAL FRAMEWORK

The Civic Potential Of Infrastructure

The modern city depends on its infrastructure. This infrastructure is frequently taken for granted by an increasingly networked society. Our sociotechnical dependencies require massive but invisible infrastructural networks that facilitate contemporary life.

Integration by Infrastructure

Infrastructure exists in networks. Contemporary cities today are stitched together with a complex web of streets, with pipes below and electrical wires above. This extensive field ties the physical geography of the city together. While neighborhood boundaries, cultural enclaves, topography and zoning codes serve to parcel out the urban fabric, infrastructure connects. As Graham and Marvin contend, infrastructural networks integrate urban spaces and urban life.¹ Cohesive and intelligent infrastructure networks can support cohesive and intelligent urbanism.

The significance of infrastructure, both in physical scale and indispensability, necessitates sound management. This requirement has led to numerous municipal departments pervasive in small towns and



Fig 4: Control Center at Blue Plains Wastewater Treatment Plant, Washington DC.

large cities throughout the United States. These are often the organizations who bill citizens for access to the network and consumption; of water, electricity, data or otherwise. There is a characteristic of common ownership in urban infrastructure. It is not common to wonder who owns a bridge, or a sidewalk, or a storm drain. These are merely components of the urban environment that are only noticed when they fail. However, they exist with a purpose grounded in the public interest. We all benefit from them and they are shared among us. Infrastructure is the ultimate civic agent in cities

Public Utility

Infrastructures are perceived by their output, just as the water comes out of the tap, without fail and on demand. The physical processes by which that water is delivered are rarely considered. If widely available and universally accessible clean water and electrical service are signs of a thriving democracy, where do the processes behind these infrastructures intersect with the public realm? There are obvious needs to isolate the common citizen from some of the infrastructure on which they depend. Electrical substations present an example of potentially dangerous interactions between system and user. However, there are other opportunities for users to interface with the networks that serve them. The product of infrastructure in American cities is transparent and available. What if the physical manifestations of infrastructure have the same level of access?

City streets are often the back-drop for public life. As multi-functional infrastructure networks, streets facilitate movement and are often overlaid with municipal utilities. This is a clear example of the potential interactions between infrastructural networks and urban populations, yet not many people would consider a walk down the sidewalk as interacting with infrastructure. New models for heavier infrastructure can achieve this level of transparency.

Divisive Infrastructure

Infrastructure acts as a public agent linking disparate parts of our urban environment into a whole. However, disenfranchised communities often lack social and political agency. They often suffer from a compromised relationship with infrastructure. Modern urban development in the United States has long been preoccupied with extensive growth.² By constant extension and intensification infrastructure networks are operating under dynamic demands. As the network grows, shifts or re-centers it follows development patterns on the ground. Similar to most urban development there are frequently winners and losers in the game. The communities east of the Anacostia have long been subjected to the presence of infrastructural hardware and the negative aspects that accompany it.

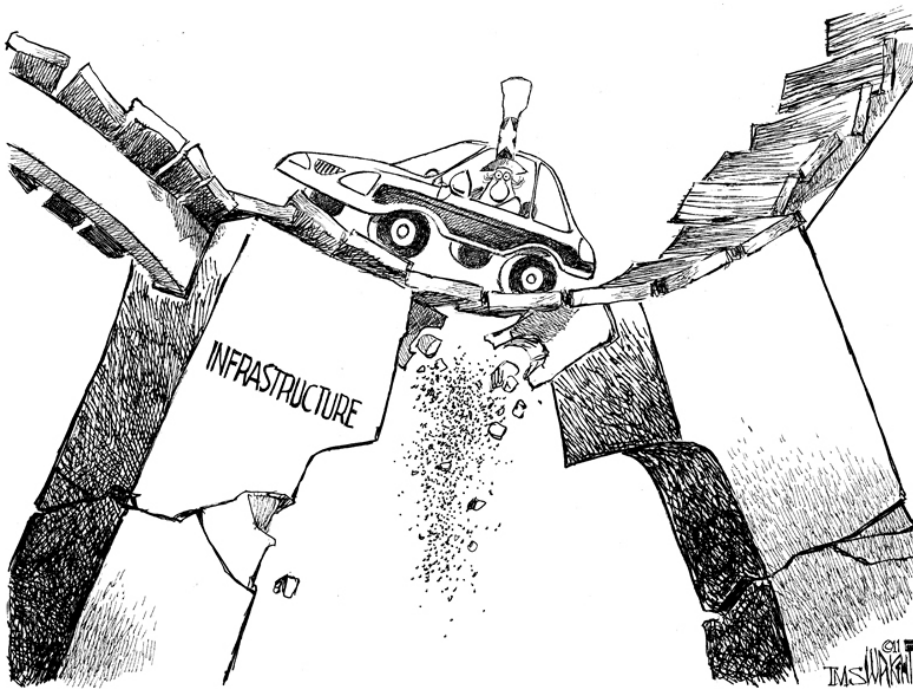


Fig. 5: Public Infrastructure as a Political Talking Point.
Source: goodolewoody.me

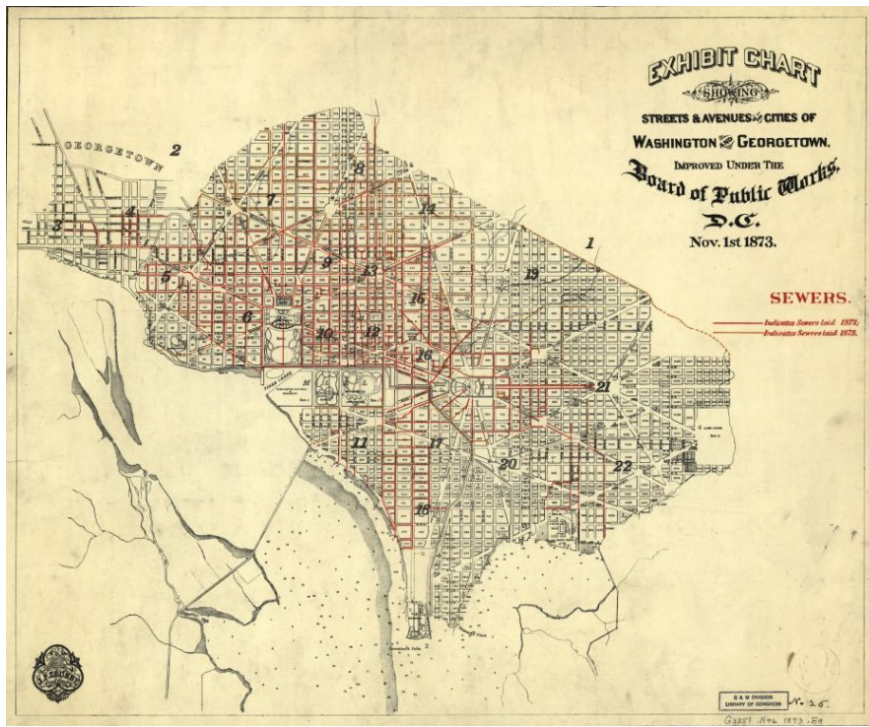


Fig. 6: DC Sewer Map, 1873 Showing service disparity between wealthier and more developed locales. Source: dcsymbols.com

According to Graham and Marvin “Social biases have always been designed into infrastructure systems, whether intentionally or unintentionally.”³

Whereas infrastructure may be expected for a certain community, another community may view the product of infrastructure as a privilege. Electrical service being restored after a storm, first in a wealthy neighborhood represents this disparity of access. The same can be said for the processes of infrastructure. While a community group replete with political capital may be able to fight a waste transfer station coming to the neighborhood, a disjointed neighborhood may not be heard by those making the decisions.

The dynamics of localized infrastructure development can result in places that are physically adjacent but relationally and economically isolated.⁴

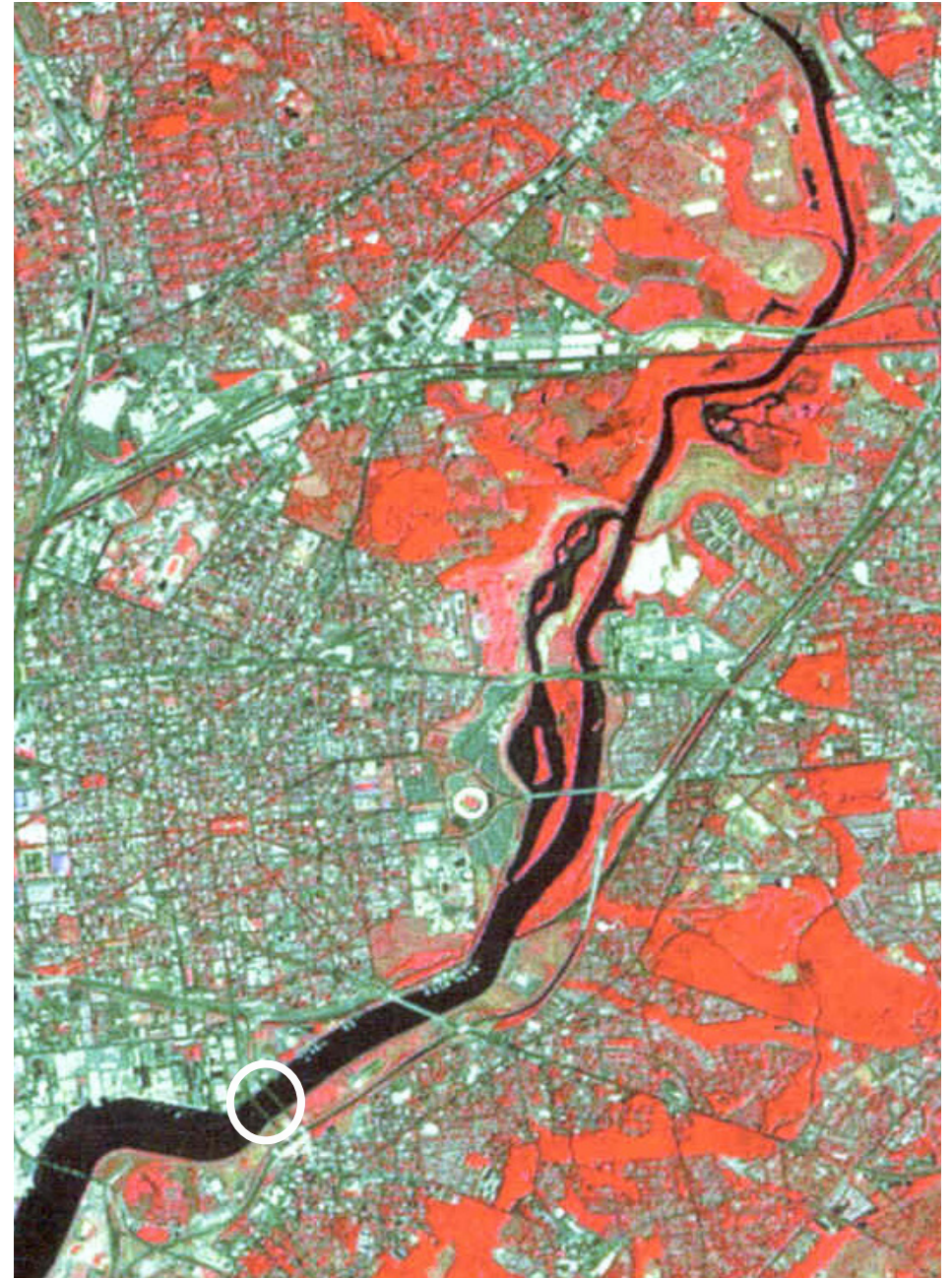
Often these disparities are evident within the infrastructure networks themselves. Social structures have long been embedded in infrastructural networks. The water system in ancient Rome was stratified to provide water first for public fountains, then public bath facilities with individual residences receiving water last in the event of a shortage.⁵ In the case of the Anacostia river in Washington DC the waterway has always been used to carry waste away from the city. When early sewer systems were developed, wealthier neighborhoods in the Northwest of the city benefited from having their waste transported far away to be dumped in the Anacostia. This system provided an out of sight, out of mind scenario in which only those living close to it knew the true deleterious effects of development on the river.

Infrastructural Landscapes and the Modern City

The modern city is characterized by a tension between infrastructure and the natural. Urban development and infrastructure share a contingent relationship, and with development often comes the loss of the natural environment. While most of the land in and around contemporary American cities is not in an undisturbed and natural condition, common conceptions of infrastructure represent the anti-nature of urban growth. Growth leads to greater demand on infrastructure, and this often comes as the expense of natural ecosystems. The False color image of the Anacostia taken by NASA demonstrate the current complex balance between nature and urban development that characterize the Anacostia.

The struggle between ecologies and infrastructure to coexist is rooted in their mutual need for space. In contemporary society, landscape and infrastructure typically operate at larger scales, relative to the scale of architecture and to the human. This immensity can lead to a sensation of the sublime in contemporary life in which the scale and complexity of systems, both synthetic and natural, can be awe inspiring. In his analysis of the Sublime David Nye notes that the term began to emerge in American culture around the 1820's when it was originally attributed to wild landscapes and powerful acts of nature such as floods and storms. Soon, as industrialization announced its presence in American

*Fig. 7: False Color Image of Anacostia River. Red Indicates Tree Cover.
Source: nps.gov NASA LANDSAT 7*



cities sublime began to drift to technological matters. The people of the young nation took pride not only in its natural beauty but its great public works.⁶ In the 1830's the Erie Canal was seen as a symbol of democracy, statecraft and know-how. It was a powerful infrastructural system for the movement of goods that doubled as a tourist attraction.

The notion of the technological sublime emerged from the historical narrative of Man bending Nature to his will. From the explorer taming the seas to discover and conquer new territory the myth evolved. As the effects of the Industrial Revolution were fully integrated with the American city the engineer became the new hero. The engineer used specialized knowledge and occasionally brute strength to carve out from nature a place for modern society. As Nye explains the Engineer became the prototype for a model citizen. Public works projects like the construction of the Brooklyn Bridge, completed in 1883, represented the complete subjugation of nature by man. No barrier was too big to cross, no body of water too powerful to divert.

As urban planners and engineers honed their craft in an atmosphere of reverence for technology the city began to be idealized as a machine. This new model of a city was something that could be built as a unified whole, tuned, and maintained. Logic and rational organization bolstered the notion of a city as a completely fabricated environment, unnatural

and a product of the latest science and technological advances.⁷

Medical science entered the fold as issues of sanitation began to plague growing cities. Wastewater and sewer infrastructures were now understood to be critical to healthy cities. The effectiveness of these systems was perceived to coincide with the quality of city life. The ability of infrastructure to purify the urban environment generated an understood value of infrastructural networks and the science behind them. As cities developed, the physical presence of the infrastructure needed to support the population became prominent features of the urban fabric.

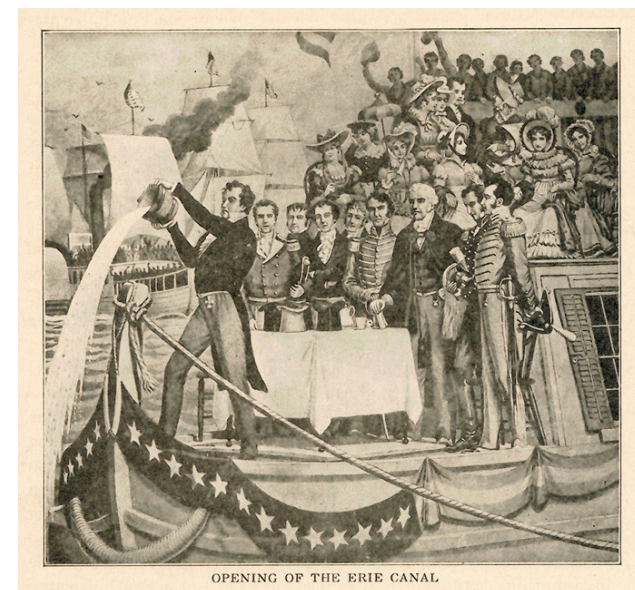


Fig 8: Celebration at the Opening of the Erie Canal. Engraving by Howard Pyle, Source: eriecanal.org

Landscape/Infrastructure

Recent thinking in the fields of landscape architecture and infrastructure design has asserted the value of ecologically supported infrastructure that is able to adapt to dynamic conditions.

In their book, *The Landscape of Contemporary Infrastructure*, Kelly Shannon and Marcel Smets state “once married with architecture, mobility and landscape, infrastructure can more meaningfully integrate territories, reduce marginalization and segregation and stimulate new forms of interaction.”⁸

The traditional model of infrastructure developed in the United States over the past decades has primarily focused on mono functional systems. By integrating landscape, infrastructure and ecological processes a new paradigm for infrastructure can emerge. By integrating infrastructural nodes into existing urban environments new spaces and uses can be defined. New models of infrastructure can become destinations in the city.⁹

Just as cities are now perceived as fabricated realities the natural systems within cities can no longer be idealized as truly natural. Thinking of the city as a system connected by infrastructural networks suggests that the

natural systems of a city should be considered as a continuous ecological system. By both establishing and augmenting urban landscapes the contemporary city can reap the benefits of landscapes that perform. This is not to discount the value of traditional landscape. The national mall in Washington DC was not conceived to perform an ecological function and yet it is a powerful figure in the network of flows in the nation's capital. However, landscapes, when augmented with infrastructure (or vice versa) can provide more than just pleasant views and space for recreation.

The 19th century brought the emergence of the urban park. Central Park in New York and other parks designed by Frederick Law Olmsted were developed to ensure the experience of nature in increasingly industrialized cities. In the contemporary city architects and landscape architects are presented with the opportunity to create a 'second nature' from underutilized places.¹⁰ This nature can be evidently shaped for and by the modern city. By building a performing ecology, second nature can be leveraged in a numerous ways to create positive outcomes for urban life.

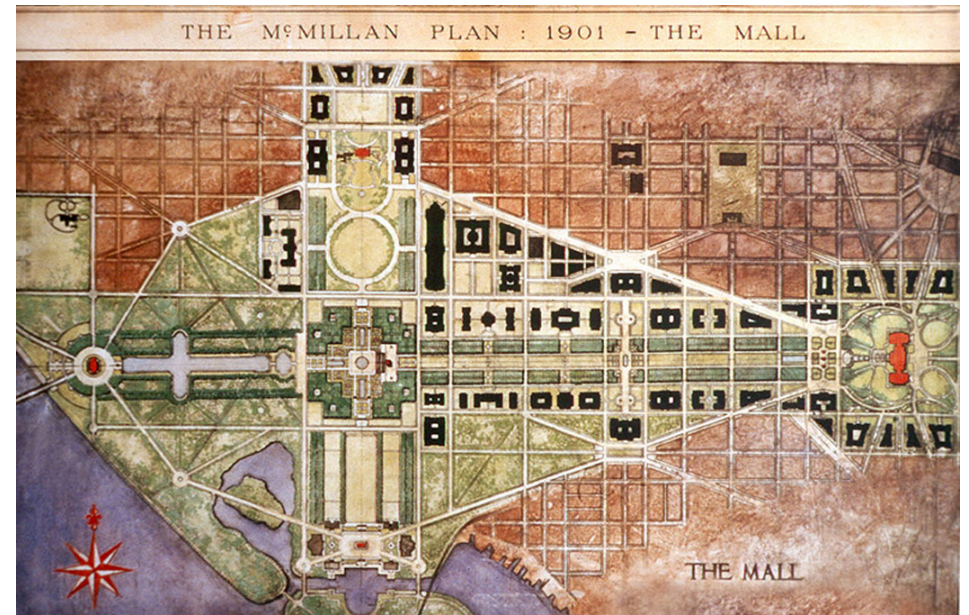


Fig 9: MacMillan Plan, 1901, Source: wikipedia.org



Fig 10: MacMillan Plan Aerial rendering, Source: library.cornell.edu

Landscape as Adaptable System

Buildings and landscape have unique relationships with time. Building and architecture have traditionally been perceived as a process or event that is complete when construction is finished. Landscape, on the other hand, is designed with the expectation of continuous development and change. Landscapes are continuously morphed to meet new uses and contingencies. They are constantly able to reconfigured or recovered.

James Corner writes about recovering landscape in three ways; recovering cultural memory, providing social function with program, and restoring or redefining ecological health. It is important, in this case, to understand landscapes, specifically urban landscapes, are part of larger networks. The notion of the picturesque, which still persists in the form of postcards and consumer media, sought to frame landscape as a static phenomenon. The advent of Google Earth has shifted this perspective to understand the extensive qualities of landscape networks. Corner suggests that this reconsideration of landscape has been facilitated by the land art of Robert Smithson and James Turrell among others. Corner claims that their work has repositioned landscape from a static image to be contemplated to “a shifting material field of natural processes engaged through motion and time.”¹¹ Applying the dynamic and expansive characterization of landscape to an architectural perspective should yield buildings that are no longer singular objects but site driven events that are closely connected to the surrounding context and ecologies.

A nation's capital should embody the finest in its contemporary architectural thought. As a city it should express our **highest aspirations for urban life**. No less than the more traditional rural environment, urban life is profoundly concerned with human needs. The art and design of changing cities aims not only at providing better homes and community facilities, more efficient transportation and desirable open spaces, but also a setting in which men and women can fully live up to their responsibilities as free citizens.

President John F. Kennedy, January 1963

SITE

DC's Forgotten River

Prior to the seventeenth century the Anacostia river was at the heart of thriving social and natural ecologies. With the advent of European settlement the river began its rapid decline and the river emerged as a seam in the fabric of Washington DC. Development of the United States capital largely ignored the Anacostia and the environs on its eastern shore. The Anacostia River has been the locus of nearly 400 years of infrastructural activity, and the river, its ecology and constituency have suffered greatly for it. The development that has previously threatened the river is the only thing that can save it. The river can become an asset for the city by embracing its complex infrastructural history. Restoring the aesthetic ideal of a river would deny this rich history. Instead infrastructure can be leveraged to create new forms of public and civic space that engage both regional and locally specific issues.



Fig 11: Map by John Smith, 1612 Source: ghostsofdc.org

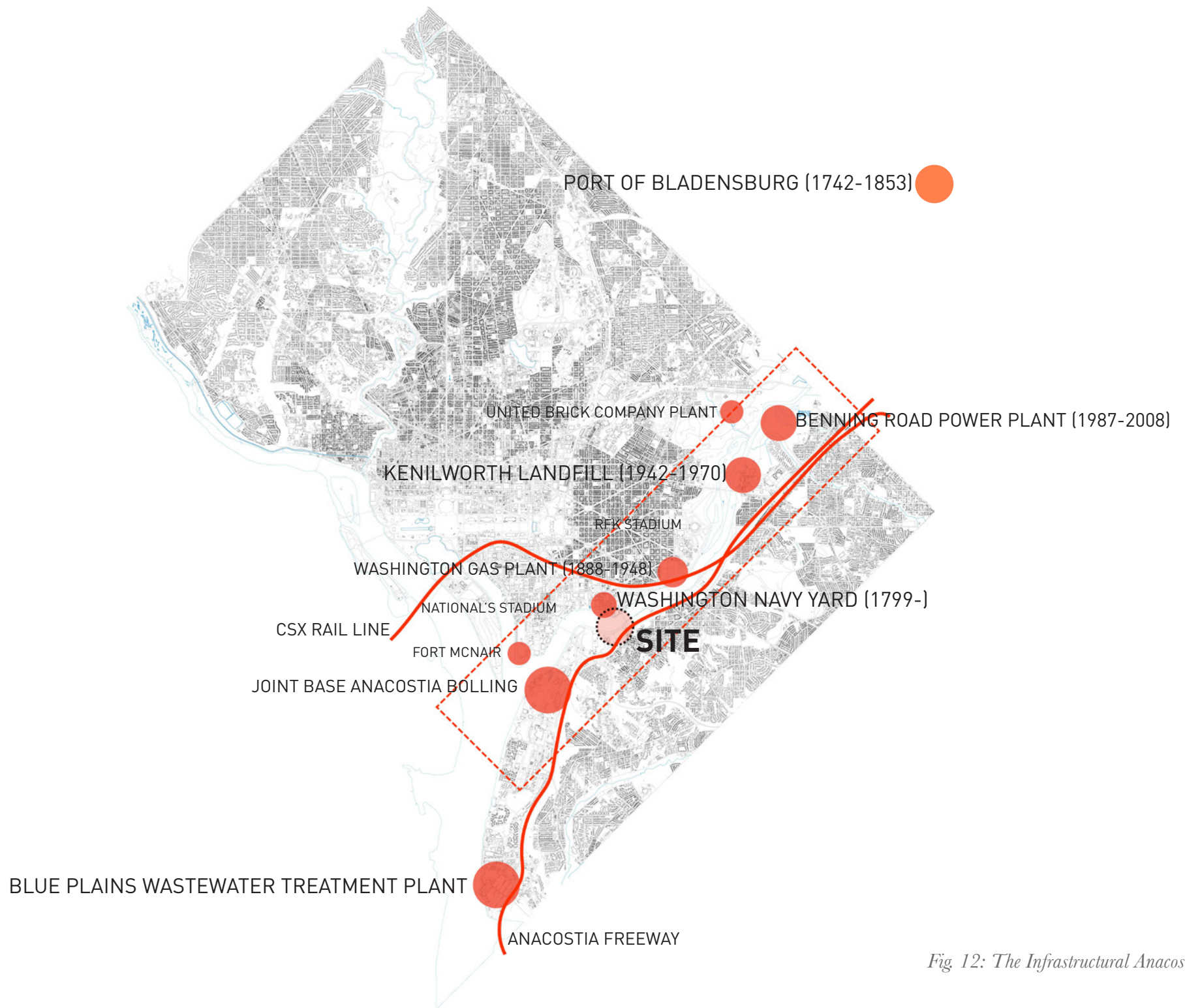


Fig. 12: The Infrastructural Anacostia

The Anacostia River

The site of investigation is the natural and infrastructural landscape of the Anacostia River and its environs. Located in Washington DC, the river bisects the city flowing north to south. The Anacostia has been a significant geographic feature in the region since before European settlement. The river has also played a significant role in the development of Washington D.C. and the surrounding communities. The semi-tidal river flows 8.7 miles from Prince George's County in Maryland and through Washington, D.C. where it empties into the Potomac. The river's 176 square mile watershed spans three political jurisdictions including the heavily developed Montgomery and Prince George's Counties and Washington D.C. The Anacostia watershed is part of the larger 64,229 square mile Chesapeake Bay watershed, the largest estuary in the United States.

The proposed intervention will be focused at the site of the relocated 11th street bridge in Southeast Washington. The now demolished bridge deck spanned from the Washington Navy Yard to Anacostia Park on the eastern banks of the Anacostia River. In 2012 the existing bridge deck was demolished and a new bridge was built directly to the north. The former bridge's pilings were retained to support a future pedestrian bridge and park. These pilings will support the portion of the



Fig. 13: View of site from Anacostia Park



Fig. 14: View of abandoned bridge pier

intervention that spans the river. The site is bound by the Washington Navy Yard to the north and the Anacostia Freeway to the south.

This site was selected for an architectural competition for a park design won by a team from OMA and Olin in November of 2014. This thesis emerged as a response to that competition and the notion that a critical investigation of the site would support more than a park. Engaging with the infrastructural history of the site could result in a civic space that acknowledges the complexity of the site.

This thesis investigates the role of the Anacostia River as an infrastructural landscape in the development of the Nation's Capitol. Fully understanding the current state of the city and of the river requires an examination of the river's history. This investigation will reveal the provenance of the contingent condition of the Anacostia as both ecological and infrastructural network. The unsettled state of the river is described by anthropologist Brett Williams as where "linked transformations in environment and social processes created unsettled, contradictory, and unjust relations between the people and the natural and built environments."¹² This tension will be investigated to define an architectural response that is rooted in the complex site.

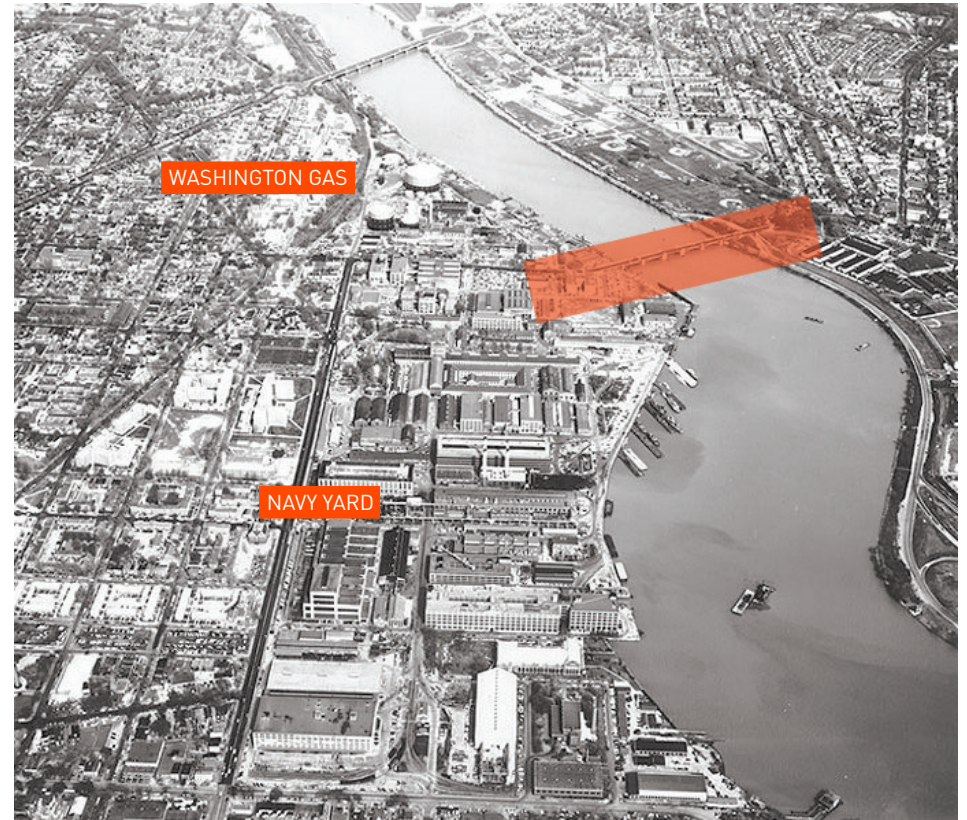


Fig. 15: Site Aerial with Navy Yard in foreground, 1960, Source: Wikimedia.org

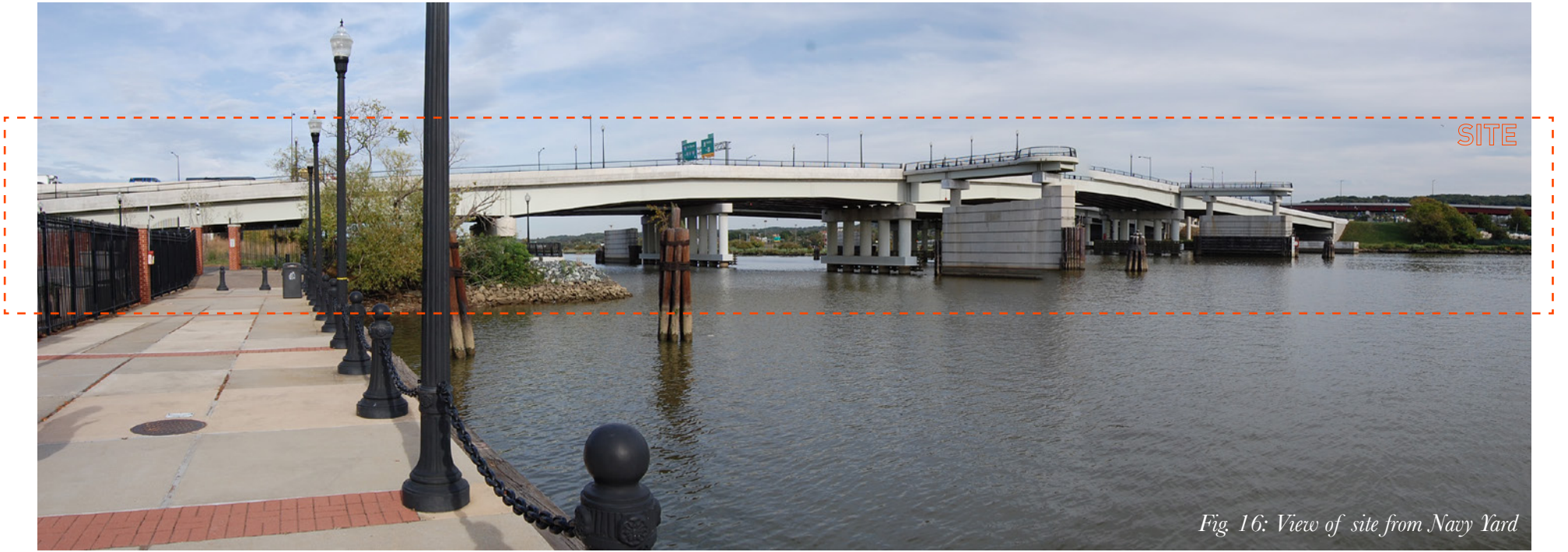


Fig 16: View of site from Navy Yard

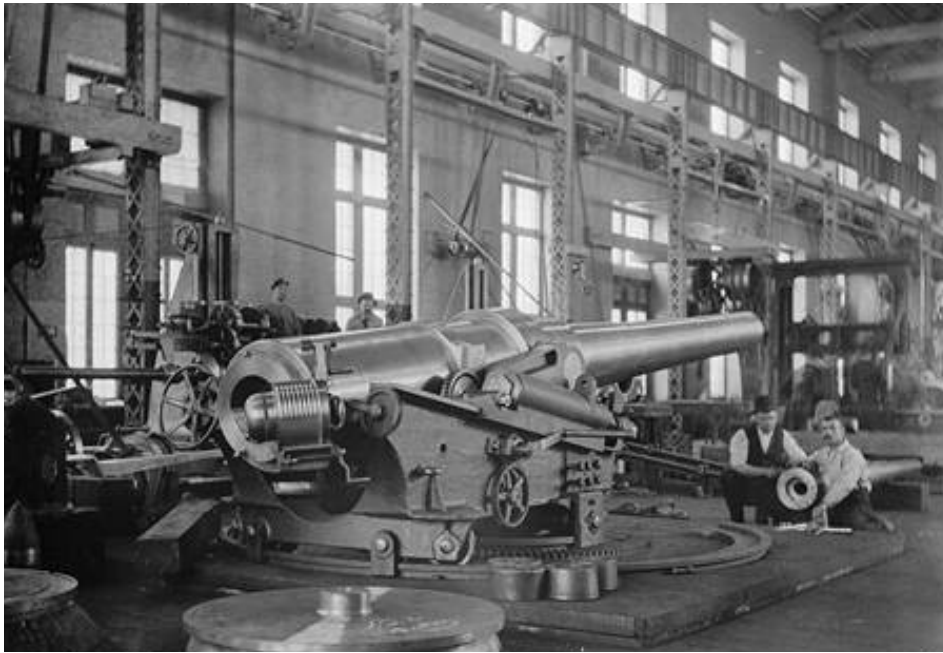
The History of a Waste Landscape

In his comprehensive history of the Anacostia River author John Wennersten writes; “From the colonial period to the present the river has been a manipulated environment.”¹³ Since the outset of European development along the river the Anacostia has maintained a unique balance of natural landscape and infrastructural development. When first explored by John Smith of the Jamestown colony in 1608, the region was inhabited by Nacochtank Indians. This small group had a long developed agrarian lifestyle centered close to the thesis site, at roughly the present day site of the Washington Navy Yard.¹⁴

Early European settlers quickly exhausted the fur trade in the region and forced out the native population. Farming soon became the principle means to make a living. The tobacco boom of the late 1680’s firmly established the lands around the Anacostia as a productive agricultural landscape. The epicenter of this agricultural network was the port at Bladensburg Maryland, where goods were shipped and received.

In the period from 1660-1690 the population of the Maryland Colony, of which the Anacostia was part, grew from 2,500 to 20,000 residents. The port of Bladensburg and the Anacostia River were the principle casualties of this growth. The rapid turnover of land from forest to fields generated excessive silt chocking the river. A single rainstorm could wash thousands of tons of topsoil into the Anacostia. Additionally, the rivers increasingly popular use as a dumping ground for ship ballast made the large portions of the river accessible to only the smallest of vessels. The rapid silting in of the Anacostia is likely the reason that the port of Georgetown on the Potomac was invigorated as large ships could still navigate its waters.¹⁵ The port of Bladensburg on the Anacostia was closed in 1853 after the reduced navigable depth, once over 40 feet, prevented the passage of commercial vessels.¹⁶

In 1791 Pierre L’enfant was commissioned by President George Washington to plan the new national capital between the Anacostia and Potomac rivers. At this point the President sought to redirect emphasis from the existing primary port of Georgetown to the Anacostia, which was perceived as a more promising option in the future. The establishment of the Washington Navy yard in 1799 was the first step in concentrating infrastructural development on the banks of the Anacostia.



1890



2010

Fig 17: Munitions manufacturing at Washington Navy Yard, Source: Library of Congress

Fig 18: Aerial view of Navy Yard with Anacostia and former 11th street bridge in foreground.

The Anacostia began to deteriorate as the new capital city was founded. Between the British Invasion and the Civil war the Anacostia was subjected to numerous stresses that would shape its future. As the population of freedmen and soldiers exploded, already over taxed sanitary systems were pushed beyond limits. Raw sewage was introduced into the Anacostia where soldiers bathed and children played causing significant outbreaks of cholera. At the completion of the war officials faced the prospect of rebuilding their city, which based on its public infrastructure was on the verge of collapse.¹⁷

An extensive sewer system to serve the city was developed in 1880. The new system ejected sewage directly into the Anacostia, however, from its opening, the system was plagued with operational troubles.¹⁸ Issues with wastewater and sewage fueled tensions between residents East of the River and the District into the 1920's. In fact, the sewer systems of the city have not been significantly upgraded since 1907.¹⁹

Solid waste disposal would soon join wastewater infrastructure along the Anacostia. In 1942 the city ran out of landfill space. The maligned Anacostia was considered as a possible location for disposal. A large marsh located across from the National Arboretum was selected and operated for thirty years as the Kenilworth Landfill. Today the landfill is capped with a park including hosting several sports fields.

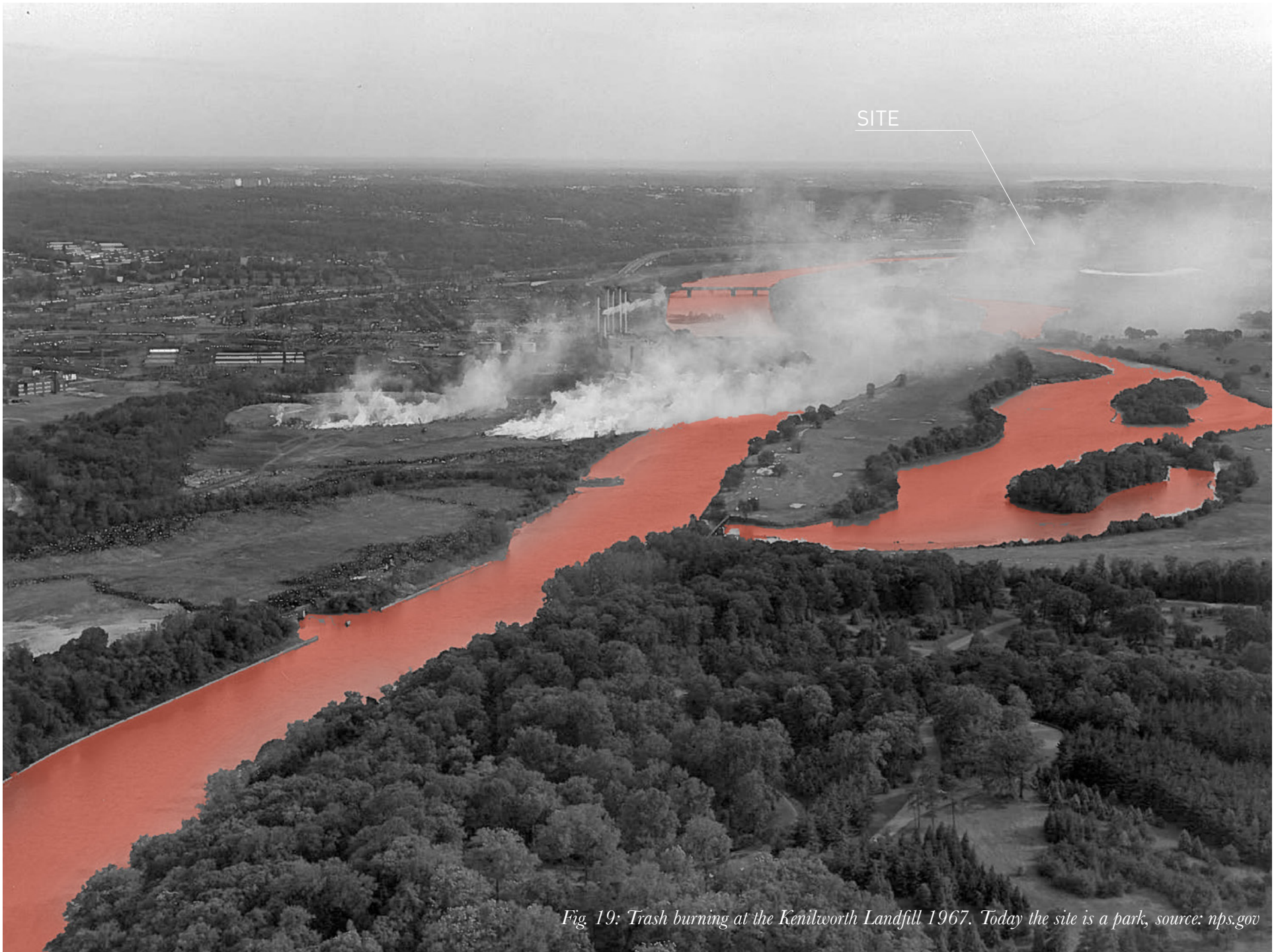


Fig. 19: Trash burning at the Kenilworth Landfill 1967. Today the site is a park, source: nps.gov

In 2012 the Benning Road Power Plant operated by local utility Pepco was shuttered. Originally constructed in 1906 the plant was the utility's first system wide power generation facility. The facility on the 77-acre site on the eastern shore of the Anacostia will be demolished leaving approximately two acres of buildings will remaining.

Today the Anacostia continues to be in an environmentally threatened state. The city's combined sewer system deposits massive amounts of solid waste into the river during rainstorms. Last year it is estimated that as much as 3 billion gallons of wastewater were released into the Anacostia and Potomac Rivers from the 17 combined sewer outfalls along their banks.²⁰ The rapid development of Washington DC and the surrounding suburbs have increased the environmental pressures on the Anacostia. Increased development has lead to extensive impervious surfaces leading to high levels of polluted run-off entering the river.

The combination of environmental degradation and aging infrastructure has left the Anacostia in a state of disuse. Recent increased attention on the issues facing the Anacostia focus primarily on environmental issues. This approach seeks to erase the infrastructural history of the Anacostia by narrowing its role simply to an ecological resource. In fact, the river is much more. The proposed design addresses this complex history by engaging both the ecological and infrastructural character of the Anacostia River.



Fig. 20: Benning Road Power Plant with Anacostia River in foreground

The Anacostia in Context

Research identified three primary open space networks within Washington DC. The National Mall and Rock Creek Park are both heavily used and possess clear identities. The Anacostia River landscape, on the other hand, does not possess a cohesive identity and is underutilized by residents.

The National Mall, as defined by the McMillan Plan, is the front yard of the United States. This grand and overtly civic space is representative of the democratic ideals of the United States. It is a place for ceremony and remembrance.

Rock Creek Park, designed by the Olmsted brothers, is a fundamental example of the romantic landscape. This lush park plays a vibrant role as a center of recreation in the heart of the city.

The Anacostia, on the other hand, lacks a powerful identity. The state of disuse, and the current role of the Anacostia as a repellent to human-focused development has created a powerful divide within Washington. By establishing an identity for the Anacostia River, this large urban network can be used to stitch two distinct parts of the city back into one urban whole.

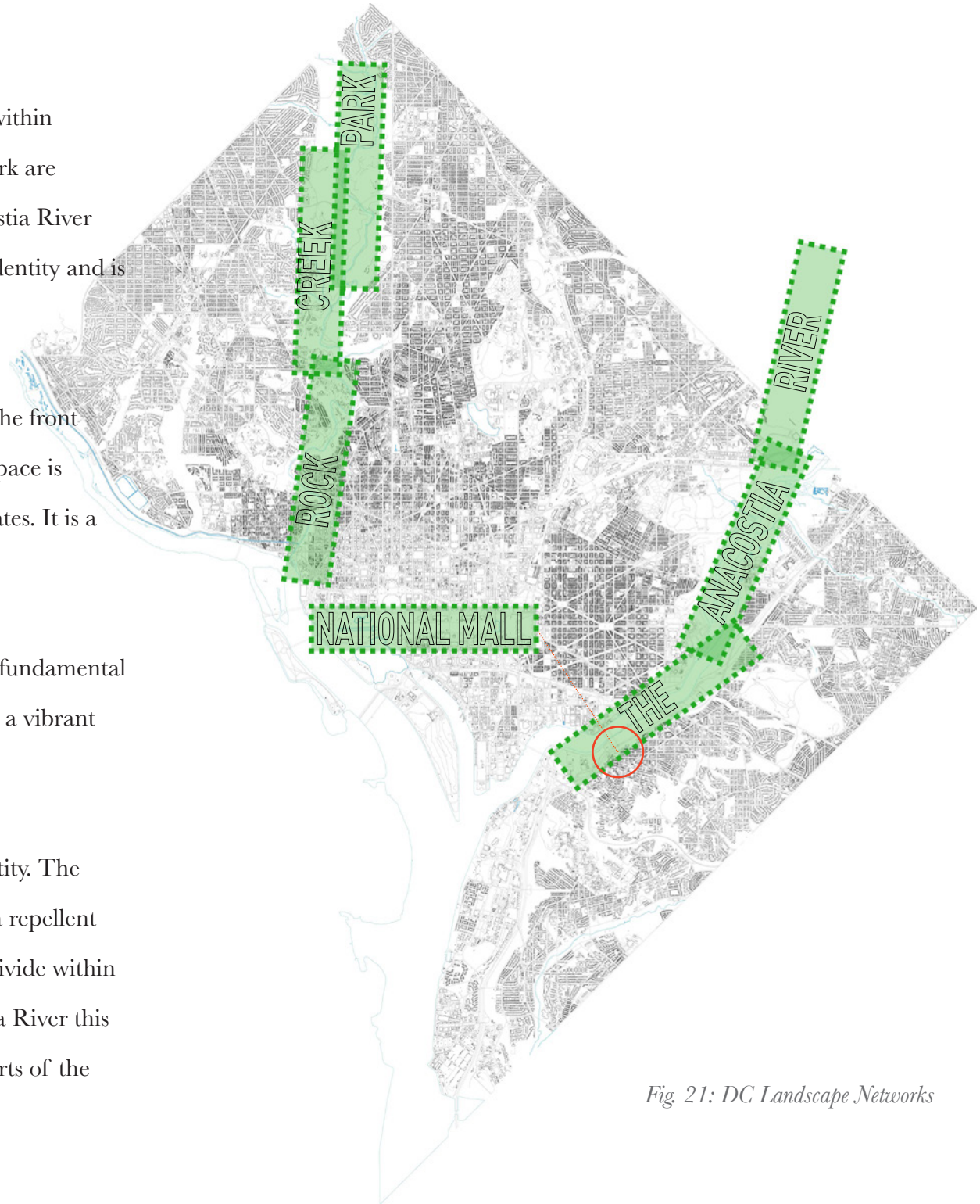


Fig. 21: DC Landscape Networks



THE NATIONAL MALL
CIVIC / CEREMONIAL





Fig 23: Rock Creek Park image collage

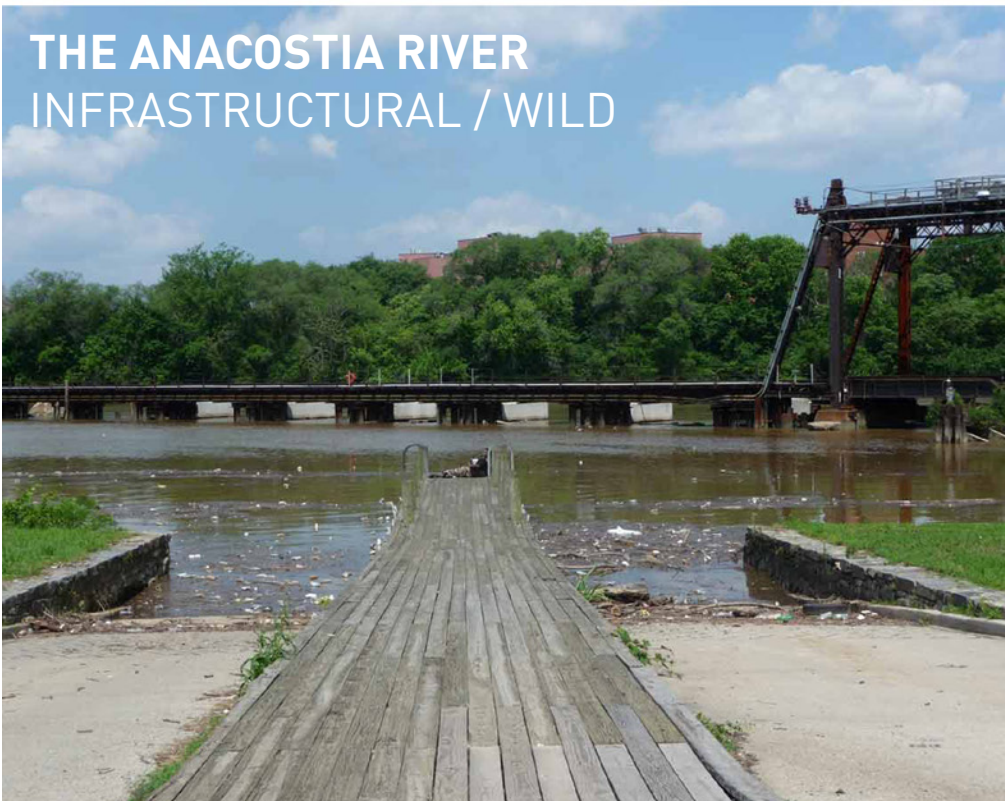


Fig 24: Anacostia River image collage

Anacostia as a Seam

The lack of identity of the Anacostia as a component of Washington has positioned the river as a strong cultural and geographic seam that bisects the city. The conditions on either side of the river are vastly different as made clear by the statistics in the following figure. The Anacostia neighborhood, the site of this intervention, is a place plagued with violent crime, high unemployment and food insecurity. Large parts of DC east of the Anacostia are considered food deserts. These neighborhoods have very few options for buying groceries and a high concentration of unhealthy food choices such as fast food restaurants. This has resulted in rates of childhood obesity significantly higher than other parts of the city.

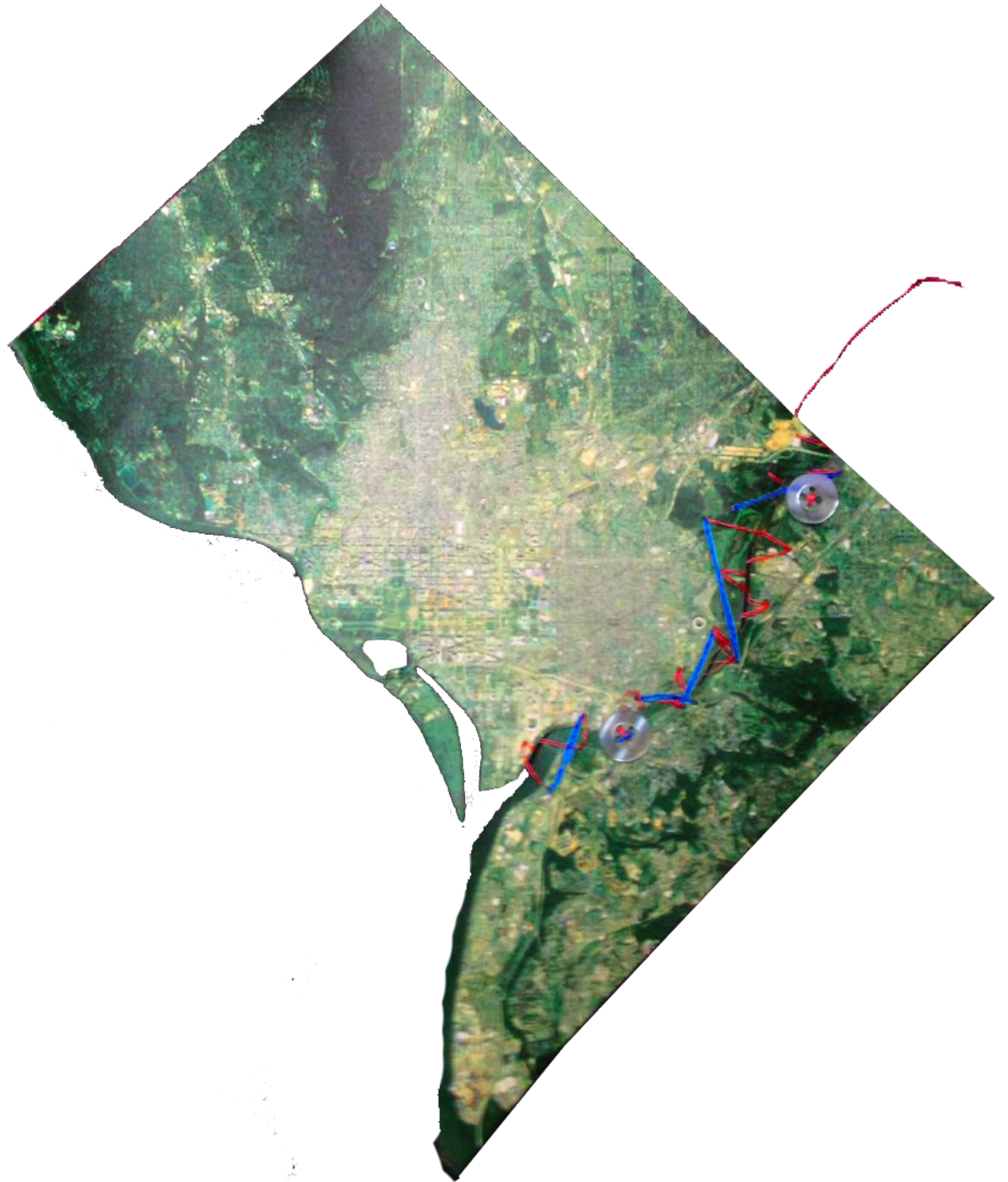


Fig. 25: Stitched Concept Model

MEANWHILE
EAST OF
THE RIVER...

WARD 8

AVG. HOUSEHOLD INCOME **\$44,076**

POVERTY RATE **35%**

UNEMPLOYMENT RATE **25.2 %**

OBESITY RATE **41.9 %**

PERCENTAGE OF PEOPLE IN POVERTY IN THE PAST 12 MONTHS FOR THE DC CENSUS TRACT: 2006-2010

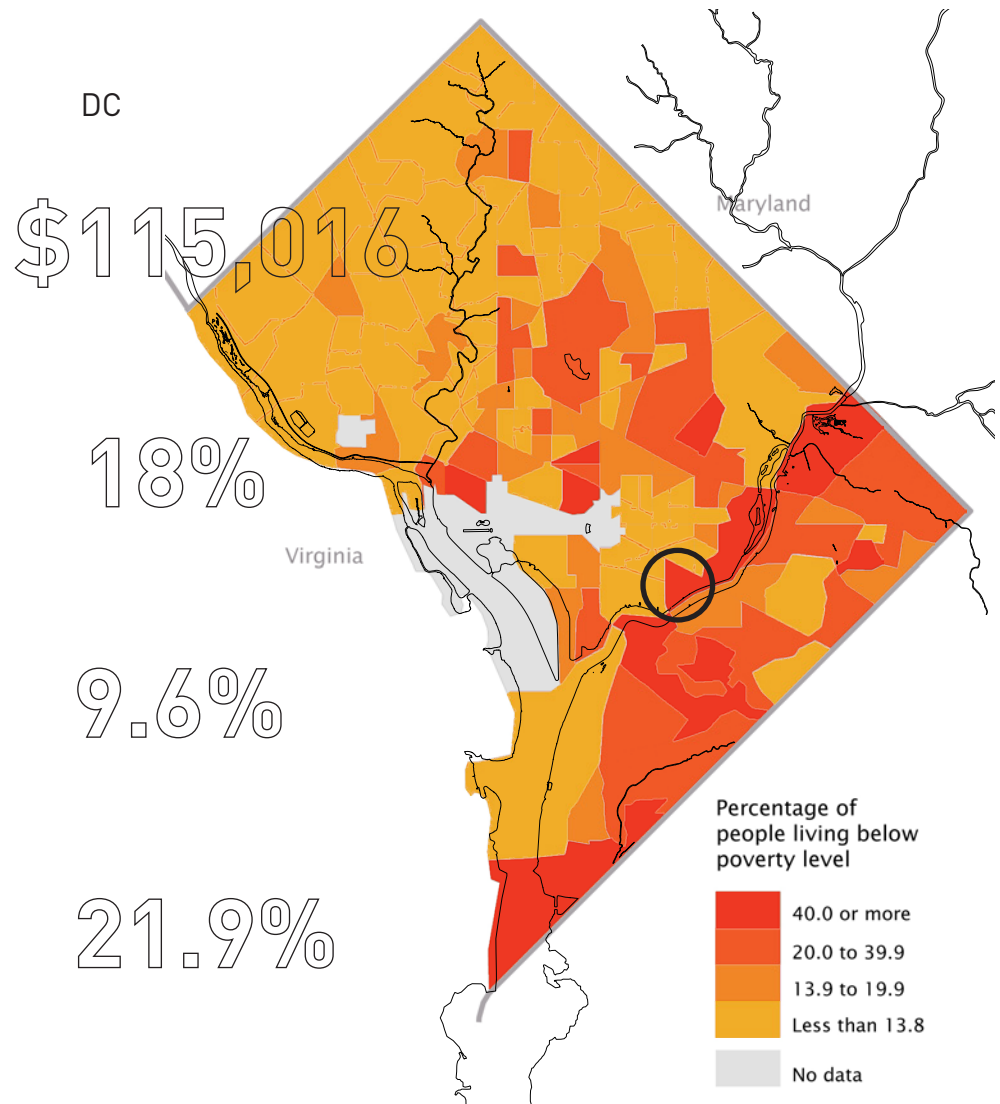


Fig. 26: Disparity between east and west. Data Source: Bloomberg 2011

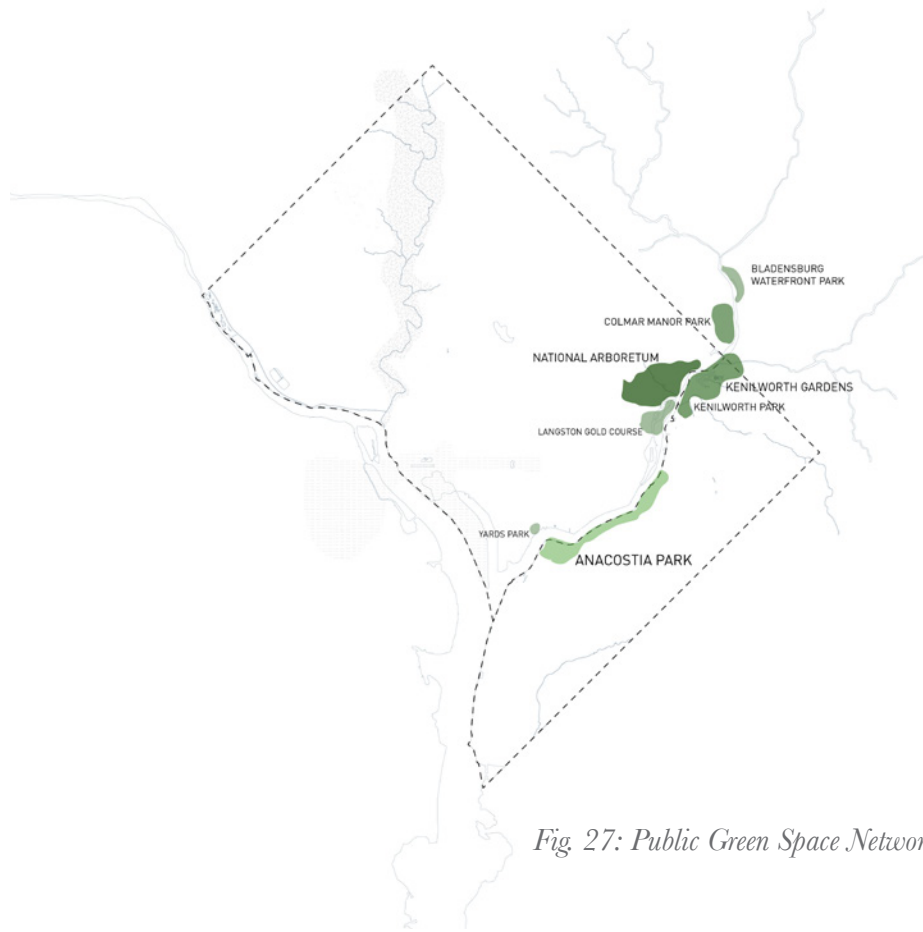


Fig 27: Public Green Space Network

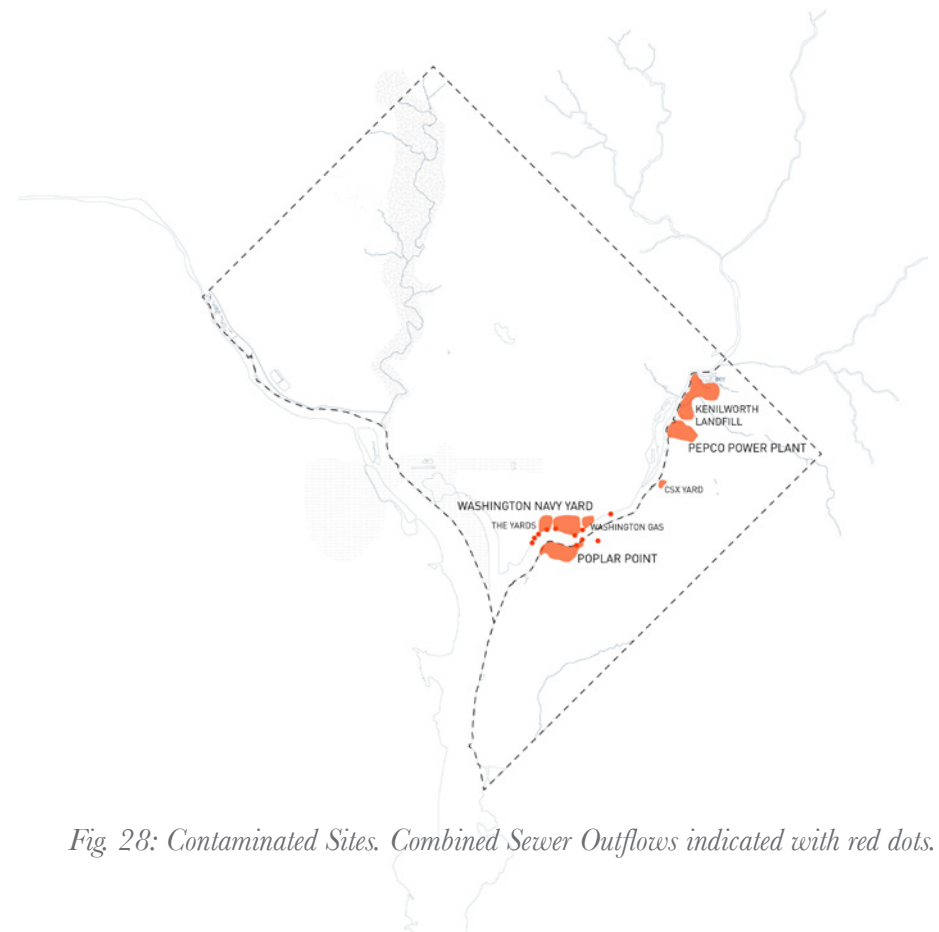


Fig 28: Contaminated Sites. Combined Sewer Outflows indicated with red dots.

Documented contaminated sites are located below or adjacent to many public spaces along the Anacostia. Combined sewer outfalls, indicated with red dots in the above diagram, introduce untreated waste water directly into the waterway.

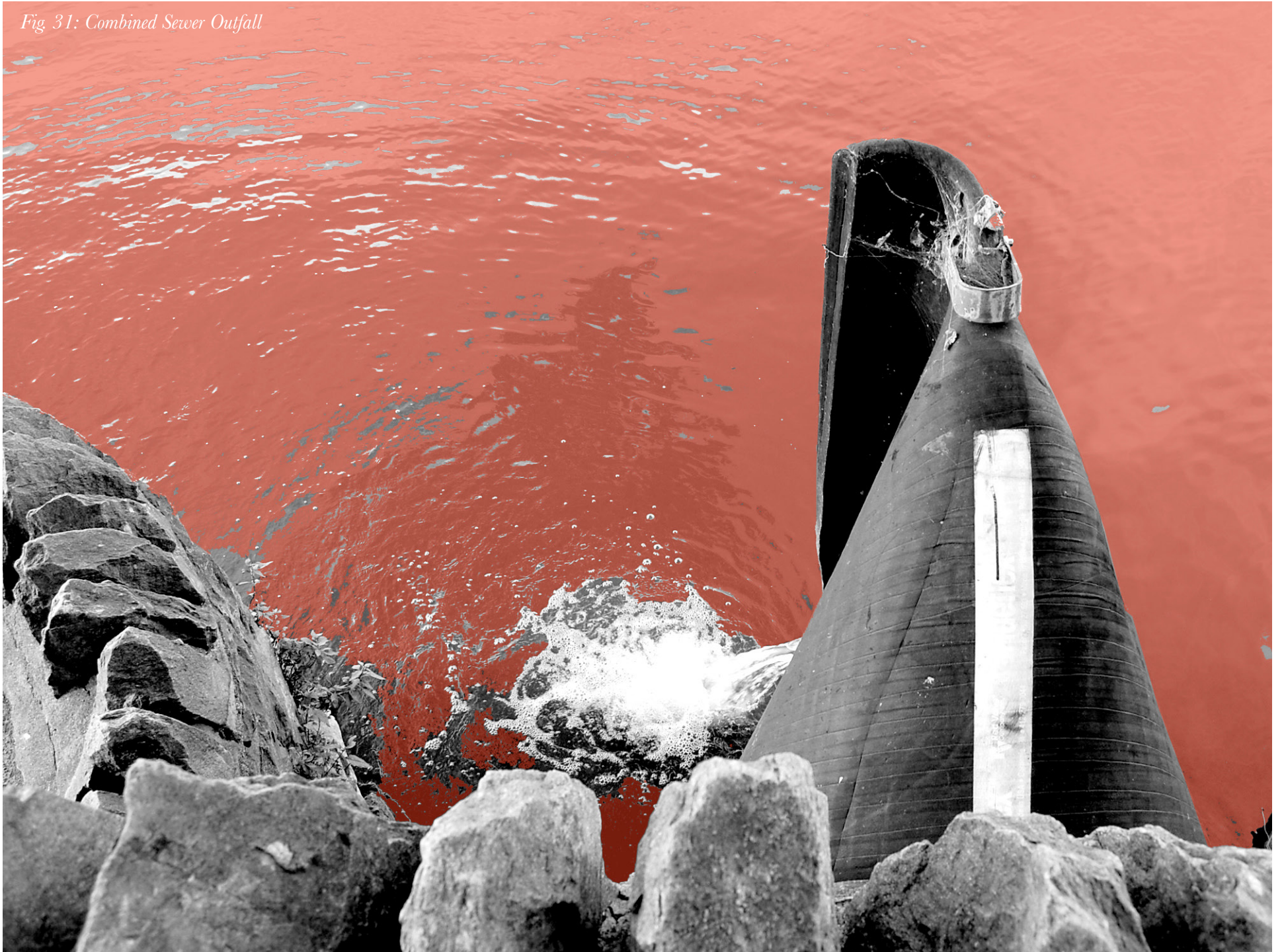


Fig 29: Combined Sewer Outfall from kayak



Fig. 30: Combined Sewer Outfall with crenellated top

Fig 31: Combined Sewer Outfall



The current polluted state of the river has been principally caused by DC's combined sewer system. Currently seventeen combined sewer outflows empty into the Anacostia and Potomac Rivers contributing between two and three billion gallons of untreated sewage into the local water systems. This waste water is intended to reach the Blue Plains Wastewater Treatment plant where it would be cleaned and sterilized before being released into the river and sent out to the Chesapeake Bay.

As the Blue Plains Treatment Plant is located south of the project site, on the East Bank of the river, even small rain events introduce sewage into the Anacostia. In this way the Anacostia is frequently serving as an auxiliary sewer system. Recognizing this issue the DC government has introduced a plan to divert all of the combined sewer outfalls into a large subterranean tunnel bored one hundred feet below the city and running along the Anacostia. The tunnel, indicated in the adjacent diagram, is slated to begin construction in 2018 and be completed in 2022.

While this massive infrastructure project will provide a significant improvement on the health of the river there is a larger issue with the Blue Plains Treatment Plant itself.

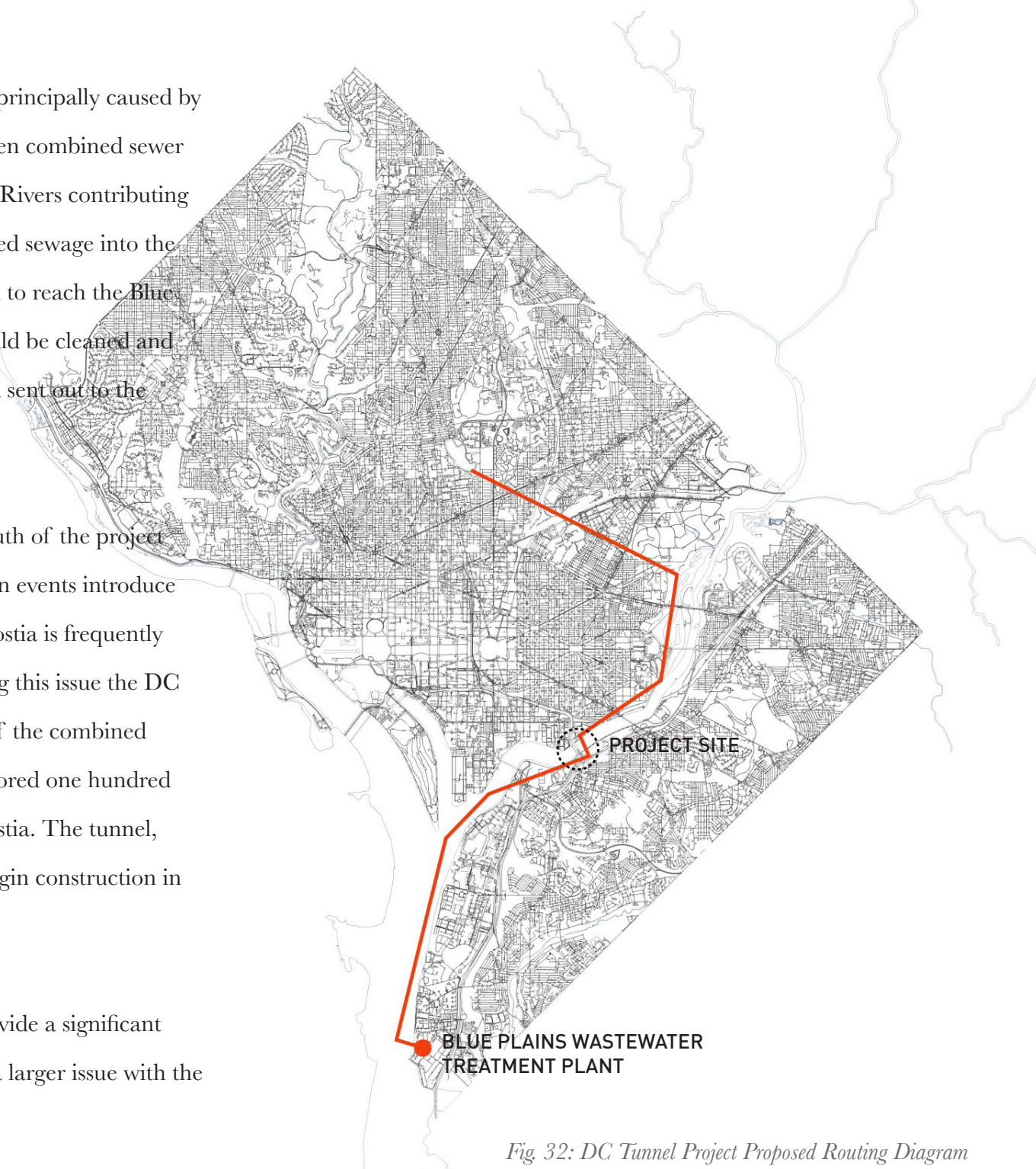


Fig. 32: DC Tunnel Project Proposed Routing Diagram

Blue Plains Advanced Wastewater Treatment Plant

The Blue Plains Treatment Plant, located south of the project site, is one of the largest wastewater treatment plants in the world. The plant has been operating at its current location since 1937. The current holdings of the plant consist of 153 densely packed acres that release a highly treated effluent back into the river and ultimately to the Chesapeake Bay.

The author conducted a tour of the Blue Plains facility in October of 2014. The scale of the facility is massive and inhumane. However, its technological advancement is equally arresting. While the plant wishes to continue its mission of innovation the plant is physically unable to expand. The numerous infrastructural elements operating along the Anacostia are all fighting for space, leaving the wastewater treatment plant hemmed in with no room to grow to increase capacity. As Washington DC and its environs continue to grow and densify increasing capacity and efficiency is of utmost concern for local utilities and officials. However, with the river to the west, Anacostia Freeway to the east and Joint Base Anacostia-Bolling to the north the plant cannot expand in area.



Fig. 33: Blue Plains Wastewater Treatment Plant



Fig. 34: Blue Plains Wastewater Treatment Plant, Source: aecom.com



BLUE PLAINS ADVANCED
WASTEWATER TREATMENT PLANT

Fig. 35: Blue Plains Facility Outline

Watershed v. Wastshed

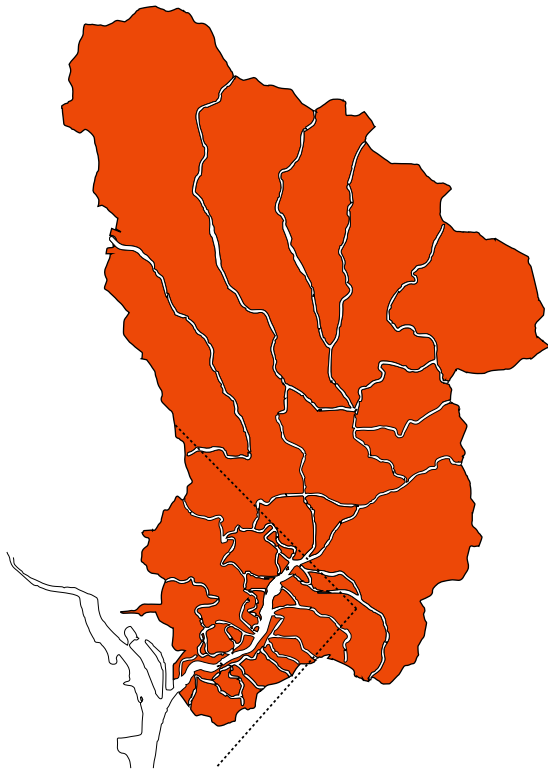


Fig. 36: The Anacostia Watershed

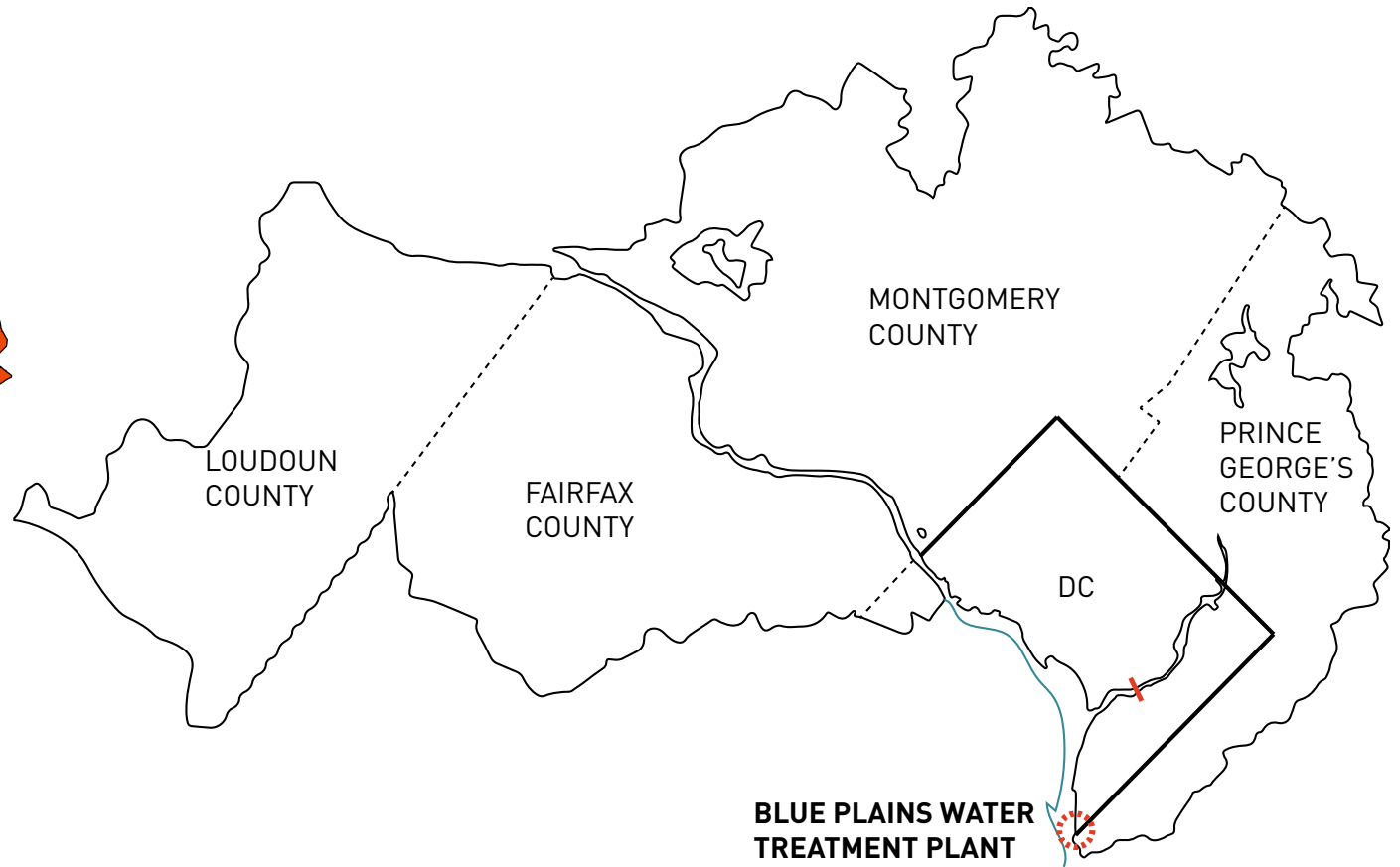


Fig. 37: The Anacostia Wastshed

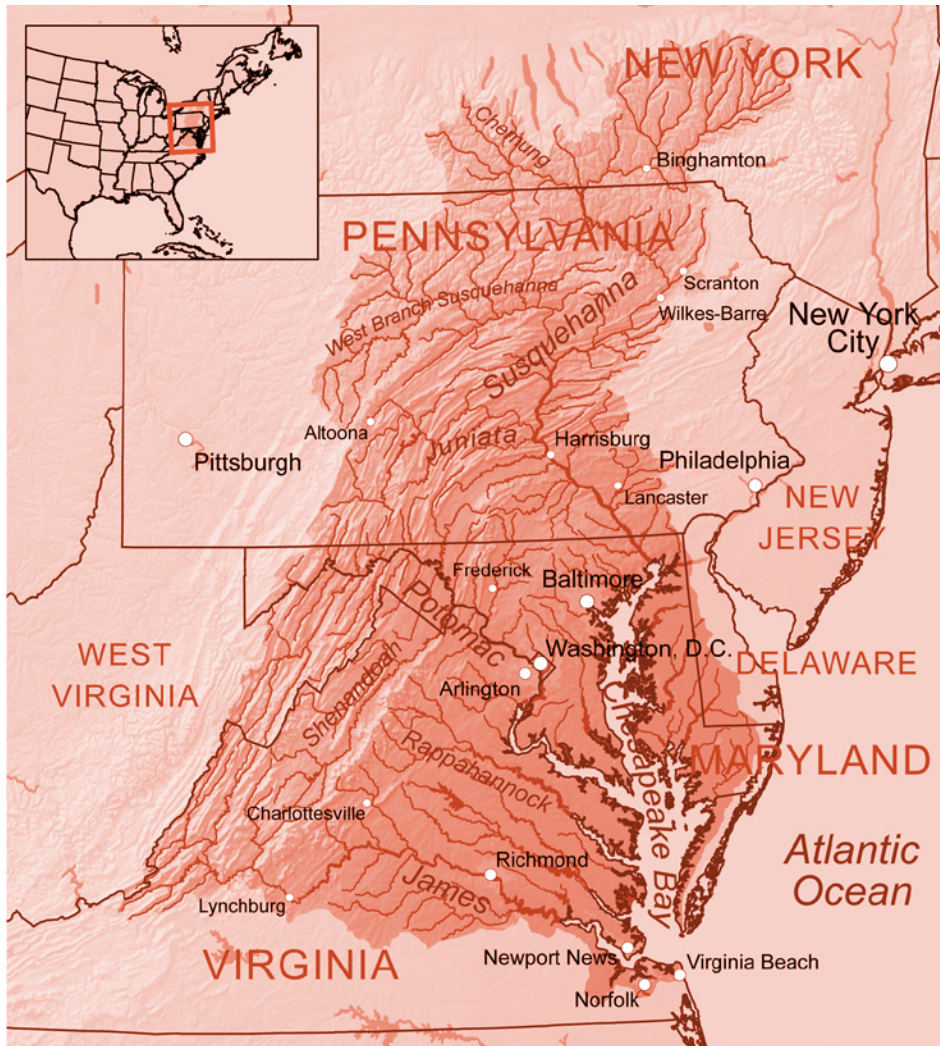
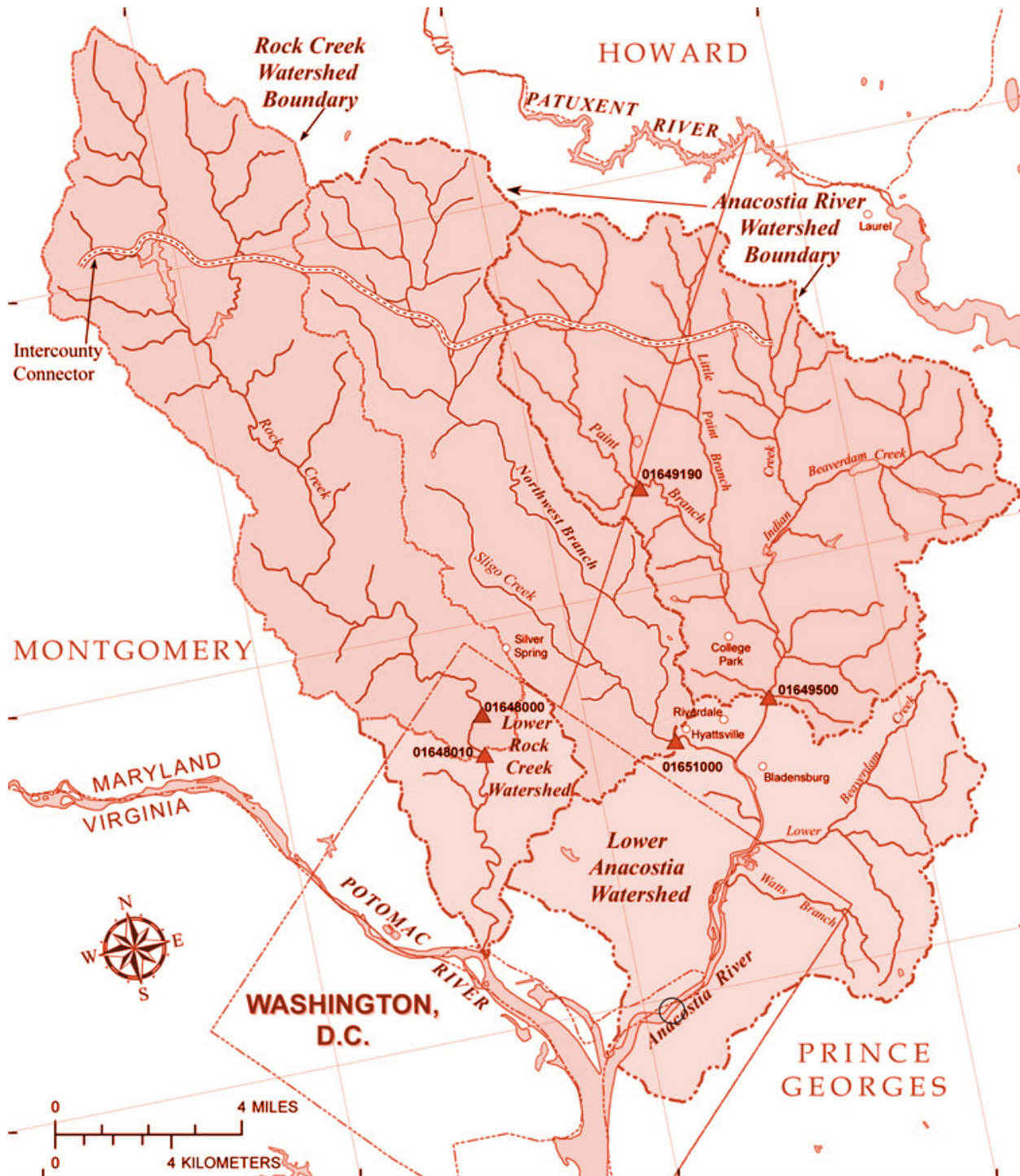


Fig 38: Chesapeake Bay Watershed, Source: wikimedia.org

Rivers are frequently studied in relation to their watersheds. This approach allows for the understanding of a river as a system that is effected by conditions well beyond its immediate surroundings. In the case of the highly urbanized Anacostia Watershed the surrounding region has played a key role in the destruction of the river.

Focus on the health of the Anacostia watershed was generated as a side effect of severe pollution in the Chesapeake Bay. The Anacostia flows into the Chesapeake which is the largest estuary in the United States. The bay's watershed, similar to the Anacostia's is highly urbanized. Significant sources of pollution include run off from developed areas and nutrient impacts from chicken farming on Maryland's Eastern Shore. Portions of the Bay were identified as marine dead zones in the 1970's with some persisting today. The threat to this significant natural resource brought the issues of the Anacostia into focus as a key source of harmful pollutants in the larger hydrology of the Chesapeake Bay Watershed.



ANACOSTIA RIVER WATERSHED

1,113,802 residents

176 square miles

49% in Prince Georges County

34% in Montgomery County

17% in District of Columbia

8.5 miles in length (tidal component)

Fig 39: Anacostia Watershed, Source: md.water.usgs.gov



Fig. 40: Comparison of watershed and wasteshed populations

The Anacostia River can also be understood in terms of its watershed. By routing the wastewater from such a large urban population along the Anacostia the river functions not only as a conduit for water but also as an infrastructural pathway for waste. The wastewater from 2.1 million residents and 17 million annual visitors are all routed to the Blue Plains Wastewater treatment plant. Urban development pressures operating at the regional scale are causing these numbers to increase almost daily.

The tension between the Anacostia as a natural or infrastructural network has created a complex and interesting situation for the river and Washington DC. This tension, evinced by the images below, reflects the true character of the river. While the river has always served as an infrastructural armature the Anacostia has retained at least a modicum of ecological function. By embracing the Anacostia as a wasteshed a new identity for the river can be envisioned that once again allows the river to serve as a productive network within Washington DC while also supporting the performative role of the river in the context of the watershed.

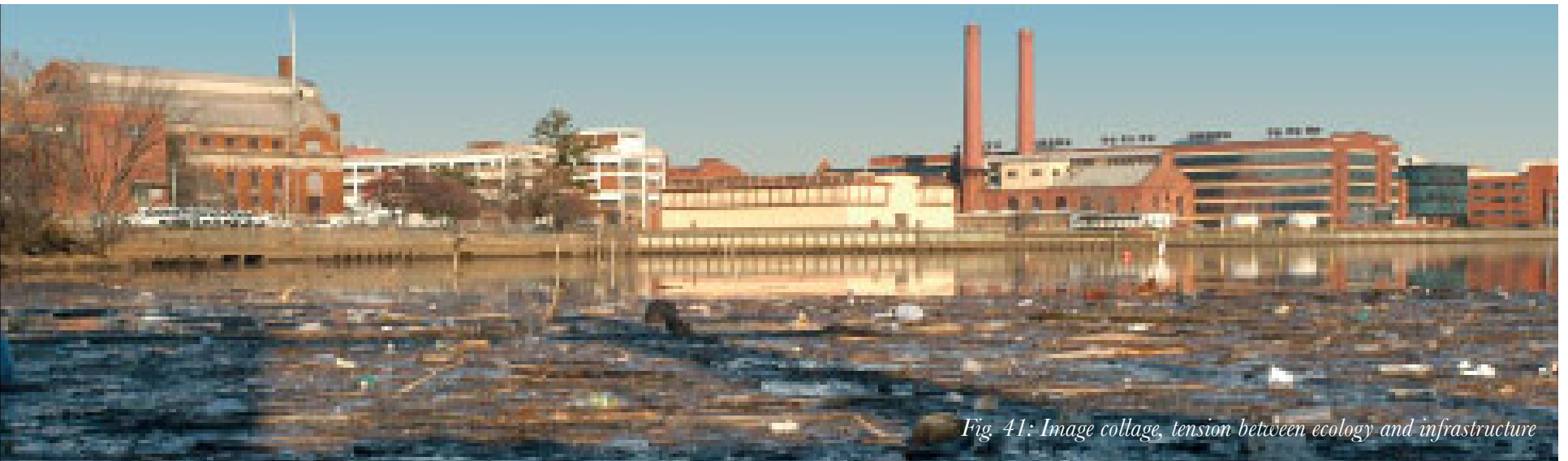
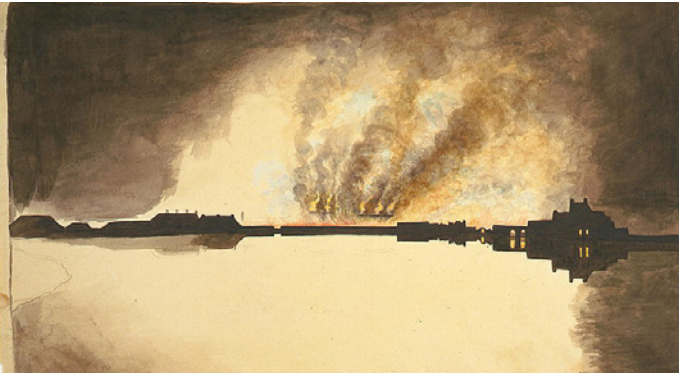


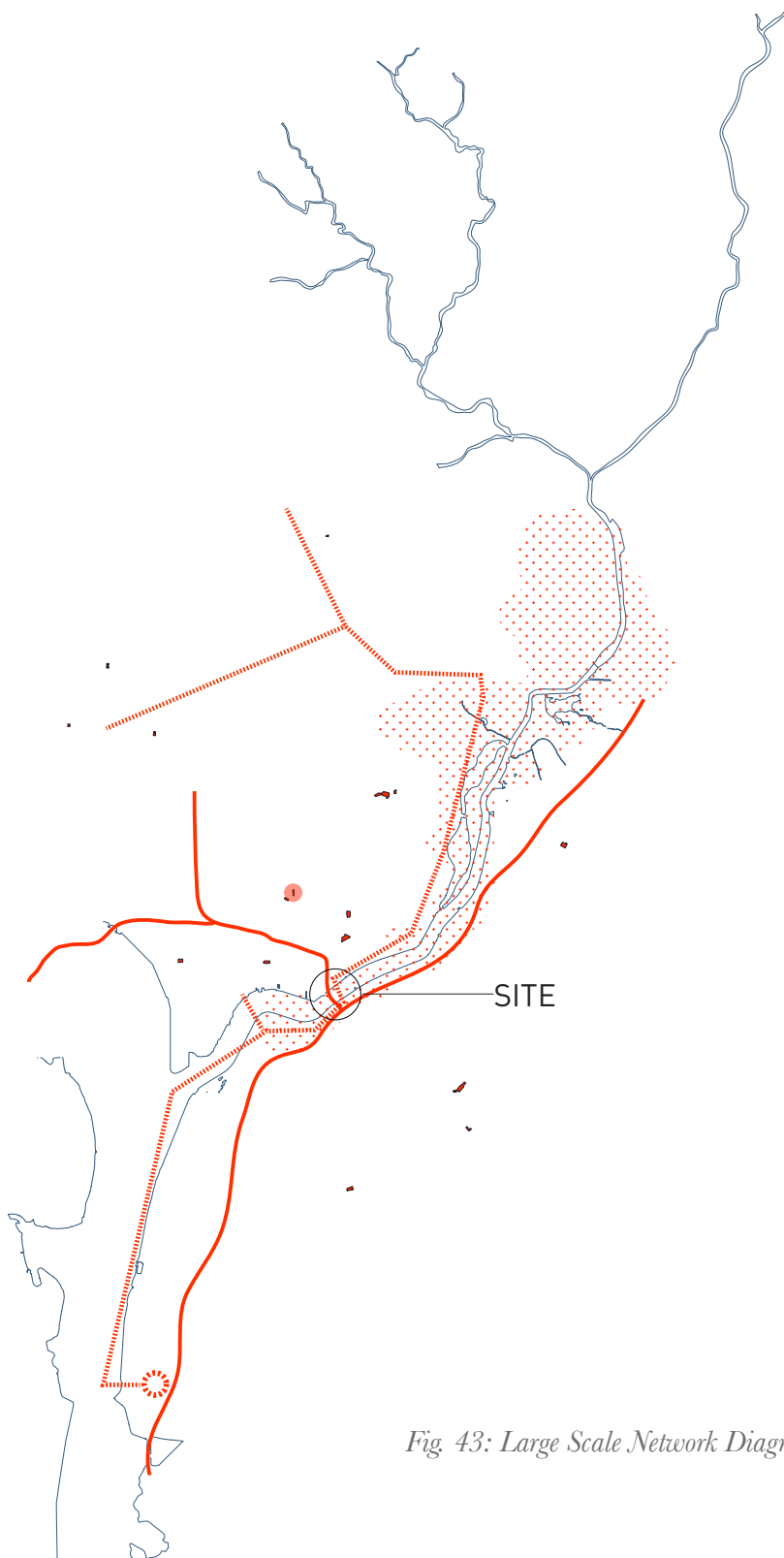
Fig. 41: Image collage, tension between ecology and infrastructure



Fig. 42: Egret fishing in combined sewer outfall

Now we're married
Never to part
Little Anacostia
Is sweet my heart.

The Washington Star on the opening of the Pennsylvania Avenue Bridge, 1890.



PROGRAM

Hybrid Infrastructures

The architectural program for this intervention operates on two scales. At the scale of the site it is proposed that the Anacostia reassert its productive utilitarian identity. By tapping into a the regional infrastructure of the DC tunnel project and addressing local issues the proposed intervention can operate at scales from the region to the building. Developing a waste to energy processing facility at the project site increases and distributes the capacity of the region's wastewater treatment infrastructure. Additionally, the by-products of this process can be leveraged to sponsor a scalable agricultural network that addresses the specific issues of health and food security that impact the Anacostia neighborhood. By developing the river as an agricultural network and energy production zone the Anacostia is able to define itself with a strong identity within the city.

Fig 43: Large Scale Network Diagram

Waste to Energy

At the scale of the building the intervention is a waste to energy processing facility that sponsors a local food hub. The waste to energy program includes pumping, dewatering, anaerobic digestion and gas combustion and biosolid generation.

Agricultural Network

Biosolids generated from the anaerobic digestion process are used to support an agricultural network along the river in the form of soil amendments and fertilizer. This agricultural program takes the form of modern midscale food production, community gardens, and hydroponic greenhouses. These greenhouses exist land-bound on the banks of the river and also in the form of floating greenhouses on barges. These floating greenhouses can move to other sites along the Anacostia and Potomac rivers. They can be used as floating farmer's markets, or shipping barges for both produce and biosolids.

Tower

Program related to these functions include administrative and engineering office spaces and are housed in a tower above the treatment facilities. In addition, laboratory testing facilities will monitor the activity of the plant. These laboratory spaces are also programmed with

research lab facilities for scientists and engineers to research and develop technologies that can serve both the Anacostia river and urban waterways throughout the united states. Reaching out to local schools including Anacostia High School will engage local students with STEM learning through class sessions and internships. In addition, engaging students with the complex ecologies of the river and the local energy infrastructure will inspire the next generation of citizens who will ultimately determine the country's future relationship with natural and infrastructural systems. The upper levels of the tower are reserved for The Anacostia Watershed Society and other non-profits dedicated to protecting the Anacostia River. Offering this privileged position at the top of the tower provides those working to better the Anacostia a clear vision of the scope of their efforts. Commanding views in all directions offer a visible understanding of the river system and the urban context of which it is an integral part

Wetlands and Pier Network

A network of boardwalks deployed on both sides of the river append and strengthen existing disconnected pathways through the site. These boardwalks allow visitors to intimately engage the ecology of the river. They also serve as piers for the network of floating barge greenhouses. Beneath the boardwalks are large sections of restored wetlands that draw attention to the performative function of the urban waterway to clean itself.

PROGRAM:
RESOURCE RECOVERY / WASTE TO ENERGY

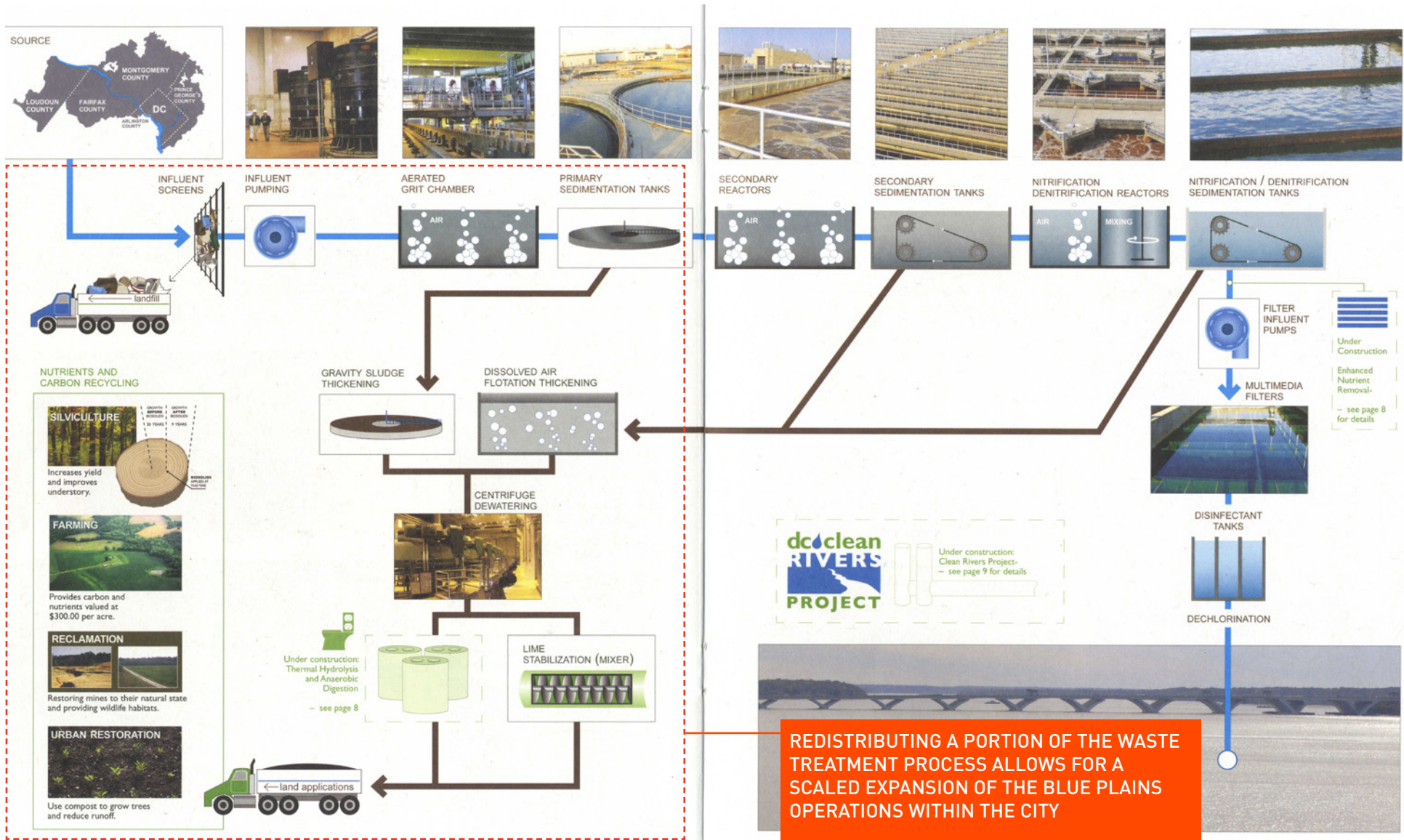


Fig 44: Blue Plains Treatment Plant Process, Source: Blue Plains Tour Brochure

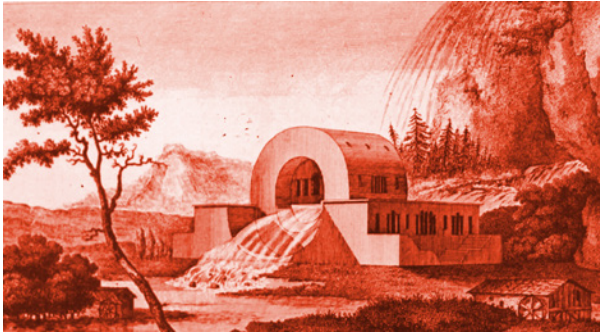


Fig. 45: C.N. Ledoux, River Inspector's House, 1804
Source: Archinect.com



Fig. 46: Ponte Vecchio Florence, 1345
Source: walkaboutflorence.com



Fig. 47: Raymond Hood, Skyscraper Bridges, 1929
Source: skyscraper.org

Bridge

A portion of the intervention is constructed on top of the abandoned pier structures of the demolished 11th Street bridge. A significant function of the proposal is a physical connection across the Anacostia River. There is a long history of bridge architecture including the Ponte Vecchio in Florence and Raymond Hood's theoretical proposals for skyscraper bridges that were examined as precedents.

Washington DC has a long history of monumental bridges that heighten the experience of moving over water. One such bridge is the ceremonial Memorial Bridge with its gilded lions leading to Arlington cemetery. These bridges also take the form of infrastructure with the Union Arch which has carried drinking water to DC since 1864. Notably, all of these bridges are located on the Potomac River. This project intends to address the disparity between these two rivers by proposing a new bridge typology that will be unique to the Anacostia and reflective of its larger context and the goals of the design intervention.

By creating a new and vital physical connection across the Anacostia this intervention will be a catalyst to connect two diverse communities from either side of the river. It can provide a means to move from bank to bank but also a place for disparate groups to meet and interact in a newly established spatial condition between both sides of the river.



UNION ARCH AQUEDUCT



CHAIN BRIDGE



FRANCIS SCOTT KEY BRIDGE



MEMORIAL BRIDGE



MEMORIAL BRIDGE



14TH STREET BRIDGE

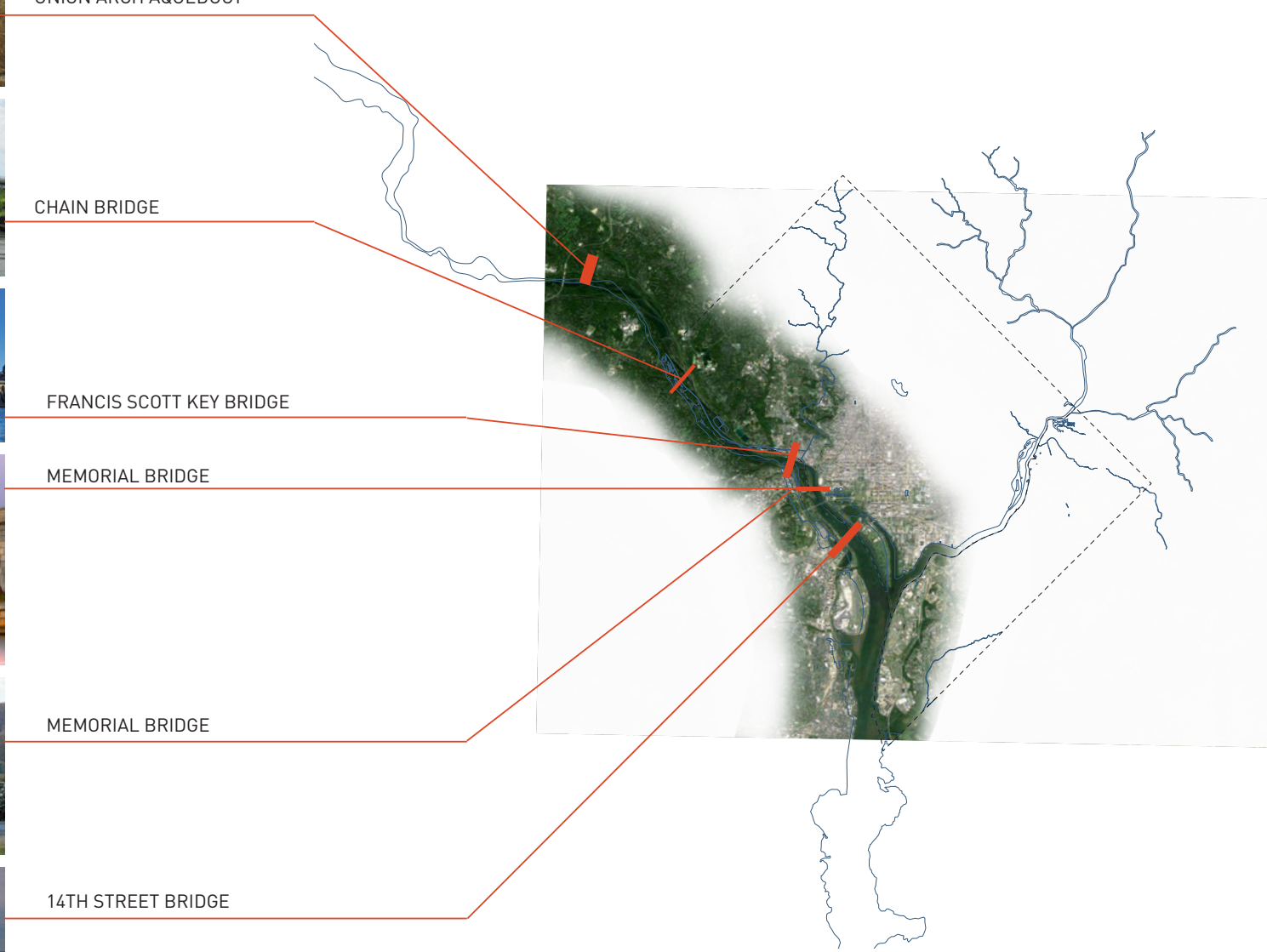


Fig. 48: Potomac Crossings Analysis

Local Food Hub

The waste to energy process yields by-products that can be used to sponsor an agricultural network. This newly defined agricultural space within the center of the city can support a vibrant local food hub.

The components of the food hub, in addition to the agricultural land, include a farmer's market, restaurant, and teaching kitchen.

The farmer's market provides a year-round market where residents can buy local produce and goods. This space, given its prominent siting will also become a popular destination in the city for tourists and residents from other neighborhoods.

The restaurant provides a unique experience where diners can consume fresh fruits and vegetables while looking out over the Anacostia and the plots where the produce was grown.

The teaching kitchen functions as an outreach program to educate residents young and old on how to grow and prepare healthy foods. With a tiered demonstration kitchen students can learn cooking techniques from local chefs. In addition, short-term leasable commercial kitchen spaces provide space and equipment for residents to process and prepare foods on a larger scale. These products can then be sold in the adjacent

public market. This operation can support new micro economies among residents based on bartering and the consumption and sale of local food products.

By providing infrastructure and program space for the food hub DC residents can have access to food that is more healthy and more fresh than food brought in from farms in other states. As the following digram indicates, much of the food sold in DC farmer's markets comes from up to 100 miles away. The fertile lands of the Shenandoah Valley in Virginia and West Virginia, the Lancaster region of Pennsylvania and the agricultural land along the Chesapeake Bay are all used as food sources for the Nation's Capital.

The food hub is not intended to replace the commercial agricultural network that serves the region. Nor is it intended to discourage the local resident from growing a tomato plant on their front porch. The adaptable solution occupies a space between these two scales. Instead, the goal of the local food hub is to engage the communities along the Anacostia River with the processes by which their food is grown and distributed thereby providing agency to affect their own health and well being.

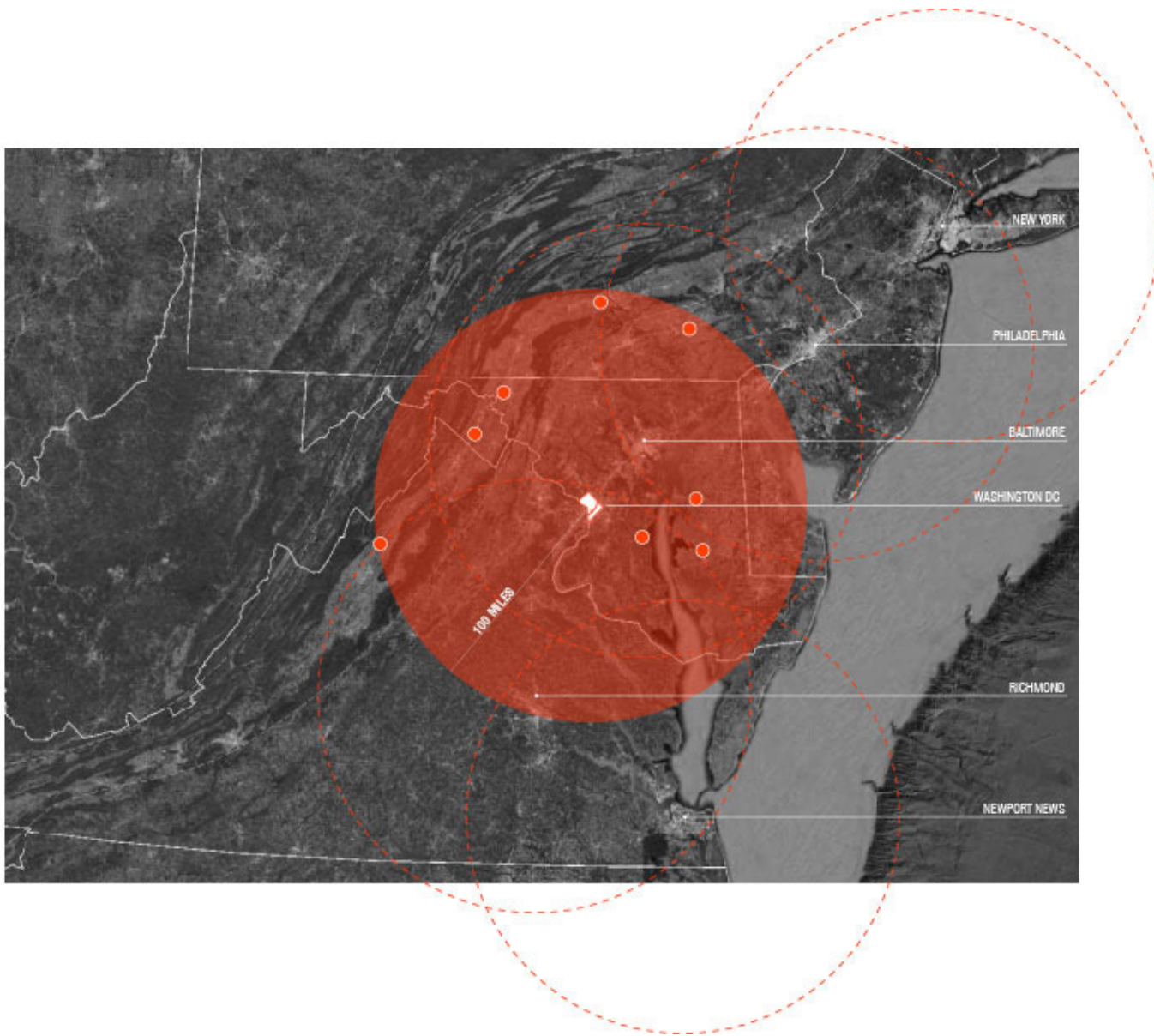


Fig 49: DC's "Local" Food Sources

Park

The bridge component of the site is augmented with a landscape ribbon that runs over top and along the enclosed program. This landscape component, along with the bridge deck plaza, offers a new type of urban space in Washington DC. The park provides new area for public space in the city directly over the Anacostia River. The spaces along this park range in size to support large scale events like rallies and concerts to small gatherings and leisurely walks. The exterior spaces and enclosed program are worked together to choreograph new views and new ways to engage with the previously under appreciated Anacostia River.

Observation Tower

Taking advantage of the technical requirement of an exhaust stack for turbine exhaust creates the potential for an observation platform. This space provides a potent position for visitors to grasp the scale of the Anacostia River as a network within Washington DC. By bringing visitors to a higher elevation they are afforded with a prospect that makes the extents of the river an intimately knowable phenomenon.

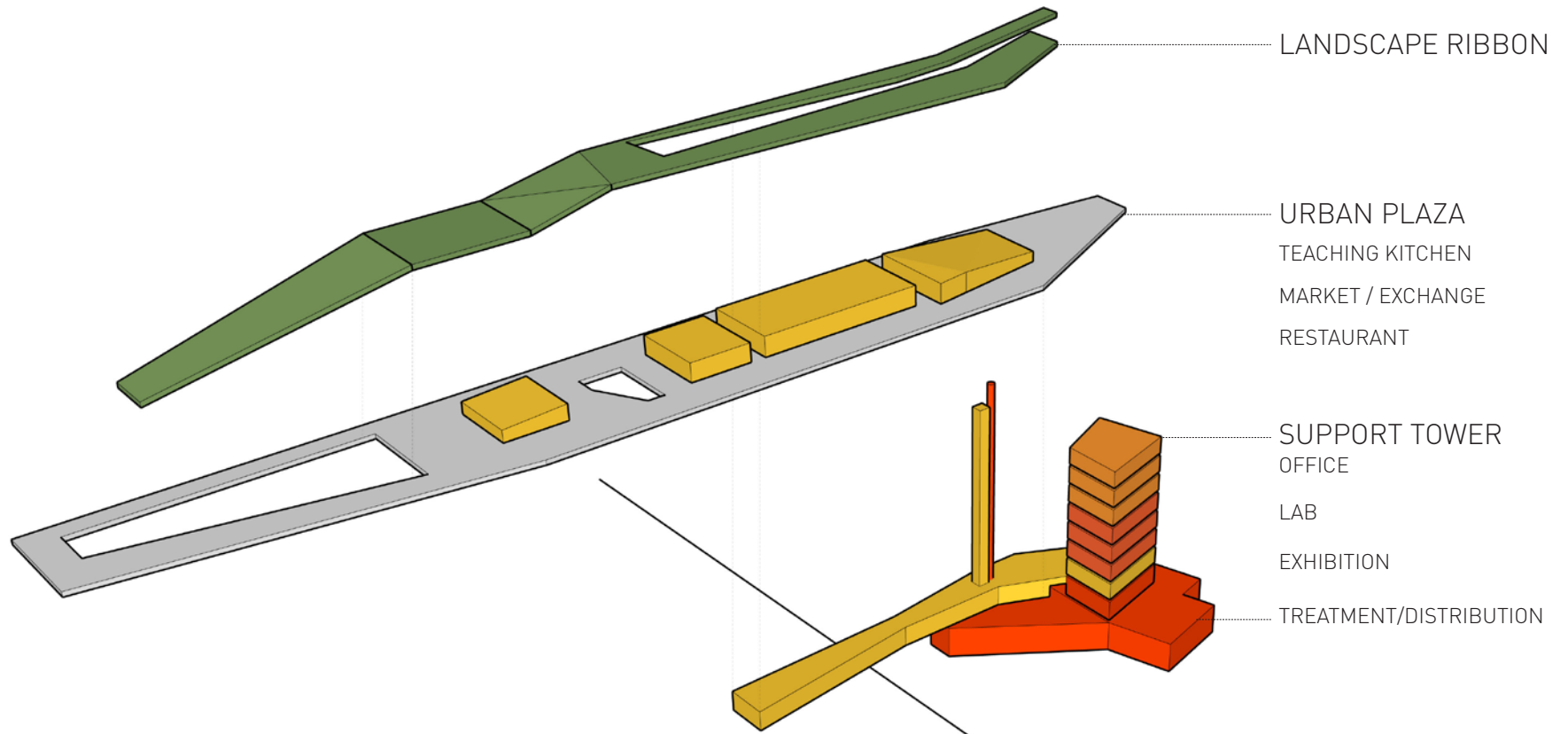


Fig. 50: Exploded Program Axon

CLIENT

The Hybrid Client

As political capital becomes more diffuse in the modern city it is critical that architects engage broad constituencies when working at a regional scale. Large scale infrastructure projects are inherently complex and it is critical that this complexity is embraced as an opportunity to create circumstances with multiple beneficial outcomes for diverse communities.

Possible enhanced benefits include:

DC Water distributes its footprint and generates usable energy reducing its bottom line electric bill. Power utility Pepco has a reduced demand from a large consumer and is provided with more grid stability. DC Public Schools is provided with enhanced experience based learning opportunities for its students. The Anacostia watershed society gains engaged and energetic stewards and allies.



Fig 51: Client Agency Diagram

To produce a relationship between different disciplines, it is necessary to place oneself on the [external] limits of one's own discipline.



Fig. 52: Large scale mapping exercise

DESIGN INTERVENTION

RE:POSITIONING

To properly address the regional and city scaled issues related to the site and program the design process began with mapping exercises at the scale of the entire city of Washington DC. The goal of redefining and repositioning the Anacostia relative to the remainder of the city required an understanding of the river system as one component of the larger urban network.

These mapping exercises were later distilled to concentrate the intensity of large urban scaled forces at the scale of the project site. This resulted in the reinvention of regional infrastructure networks at a local scale.

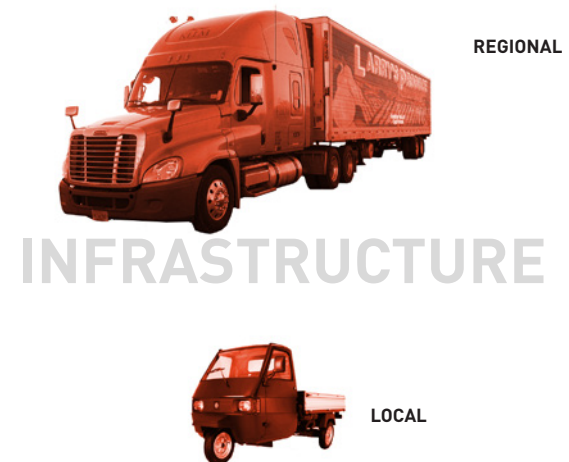


Fig. 53: Re-scaling regional networks to the site scale



The design process also emerged from the question of how architecture can relate to infrastructure and landscape. Typically both infrastructure and landscape exist at a scale larger than most buildings. This thesis addresses current notions of site and building as conditions that are much larger and more complex than is often assumed. Like infrastructure networks and ecological systems, buildings in urban contexts affect and are affected by a multitude of forces. Often these forces are generated beyond the bounds of what is typically understood as a project site.

Fig. 54: Confluence Diagram Infrastructure/Landscape/Architecture

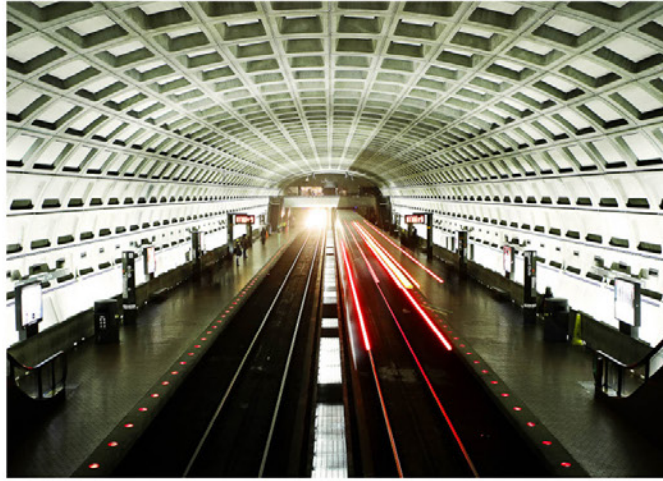


Fig. 55: Civic Infrastructure image analysis

Washington DC is a potent site for investigations at the scale of infrastructure. The city has many examples of infrastructural systems that are elevated beyond their bare utilitarian requirements. Such is the case of the DC Metro which provides a quality of space not typical in many urban transit systems. Additionally, DC plays host to numerous large civic structures, many of which have a similar scale to critical urban infrastructure. By examining the form and articulation of both civic and utilitarian environments the scheme was able to question and fuse these two modalities. In the case of the adjacent diagram the National Mall was distilled down to its fundamental condition. These parts and pieces were then rearranged according to the intervention site conditions. Grand stairs up to places of privilege are flipped to rise up and across the Anacostia. The green spaces and reflecting pools of the mall are configured to animate the bridge and the vertical landmark of the monument is redeployed as an exhaust stack.

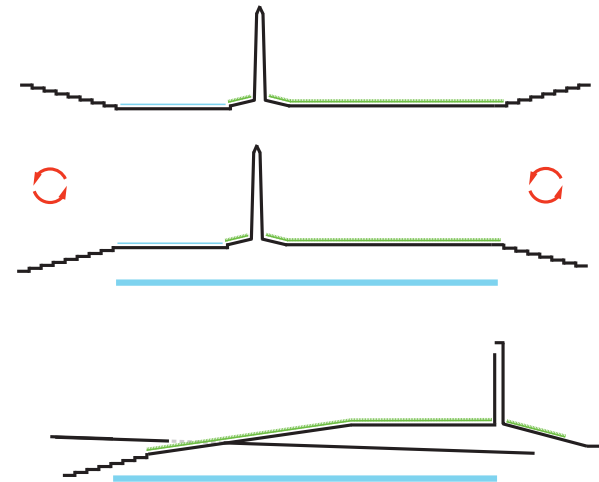


Fig. 56: Reconfiguring the National Mall

SCALABLE AGRICULTURAL NETWORK

In the development of the thesis several abandoned or obsolete infrastructural sites were considered for intervention. Those sites indicated on the adjacent map represent future sites in the repositioning of the Anacostia River. This project is intended to serve as a pilot project for new and retooled infrastructure projects along the river. This scalable network of sites can reestablish the river as a productive urban network that increases in intensity over the coming decades.

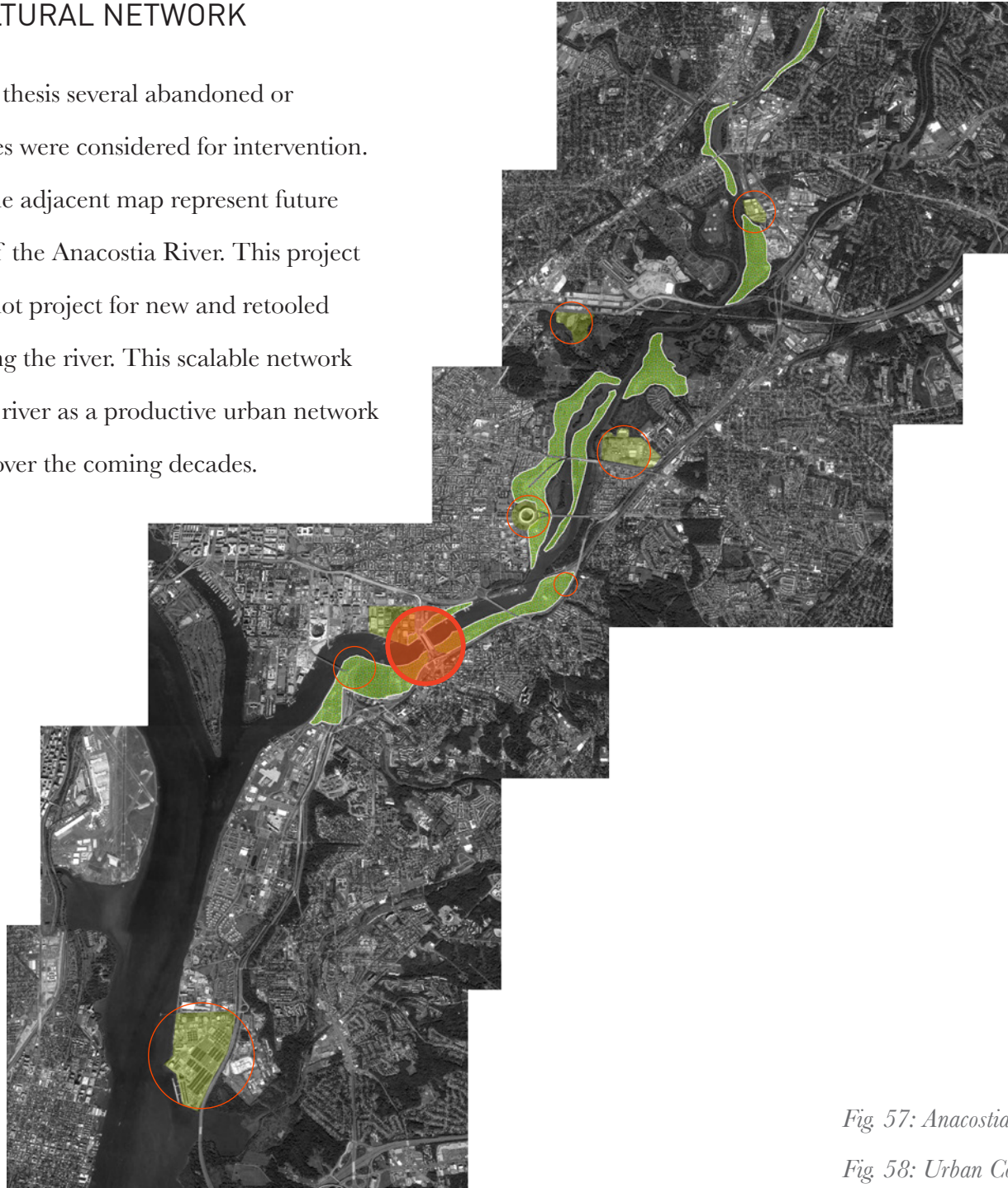


Fig. 57: Anacostia Network Phasing Plan

Fig. 58: Urban Context Plan





Fig. 59: Extending the site, creating new ground

The initial move addressing the site was to extend the landscape of Anacostia Park across the river to the more urban West bank. This approach was developed throughout the design process to generate a scheme that was not an object placed over the waterway but instead a weaving and intensification of the existing conditions on either side of the river. Understanding the waste to energy process and its site and regional implications and reconciling these with the site produced the initial sketches of the design intervention.

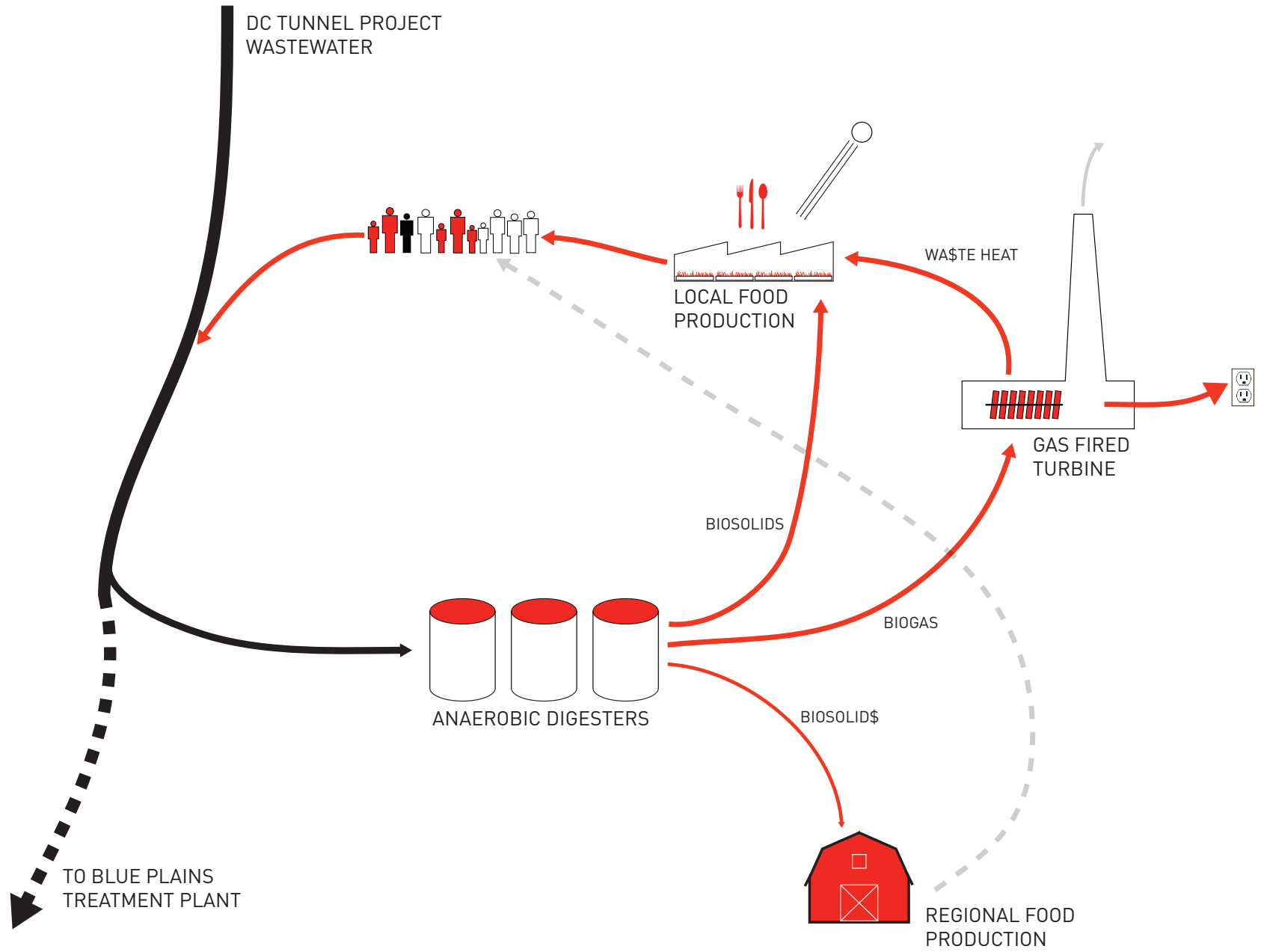


Fig. 60: Feedback loops diagram. Waste to Energy to Food to Waste.

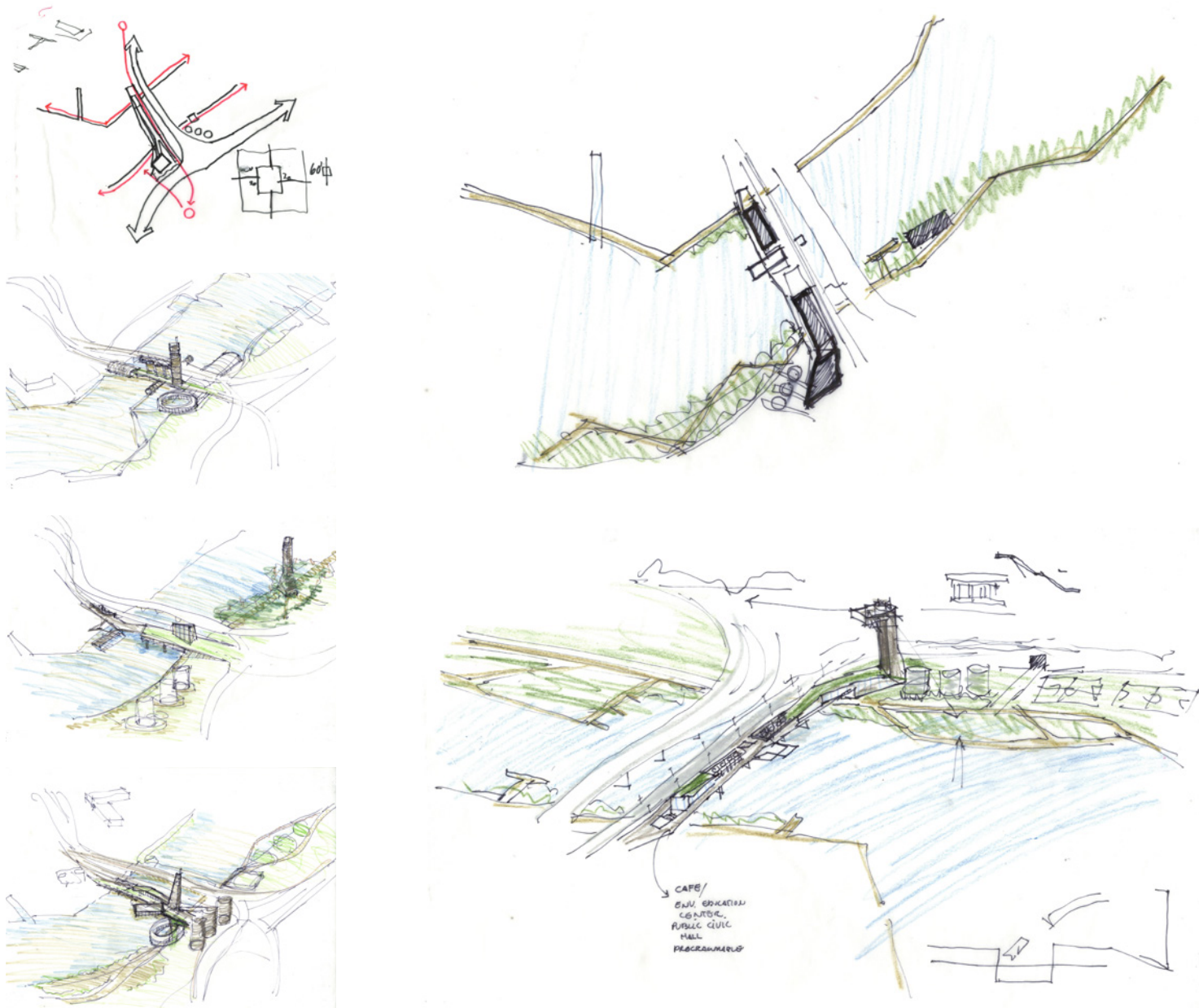


Fig. 61: Initial site studies.

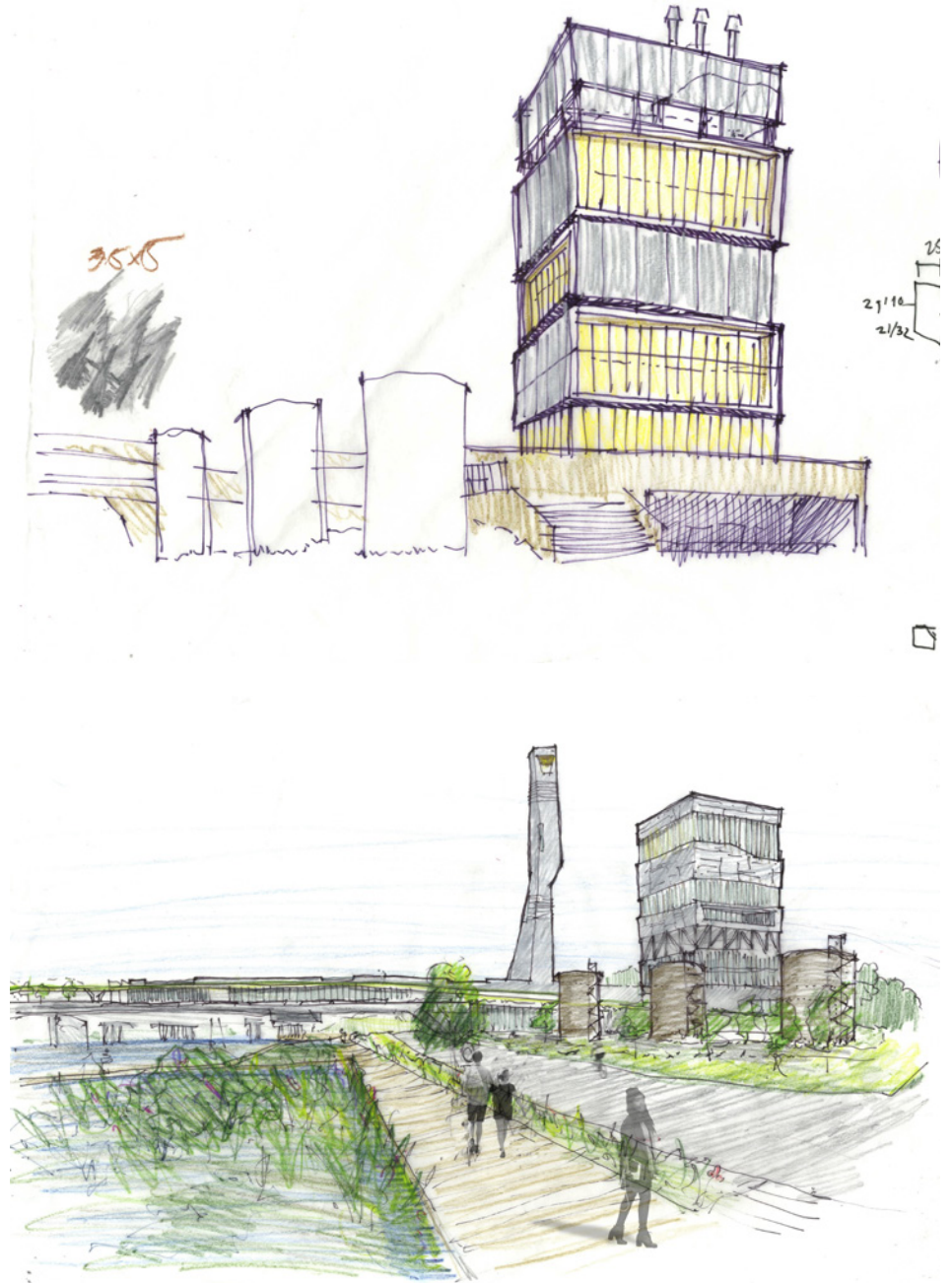
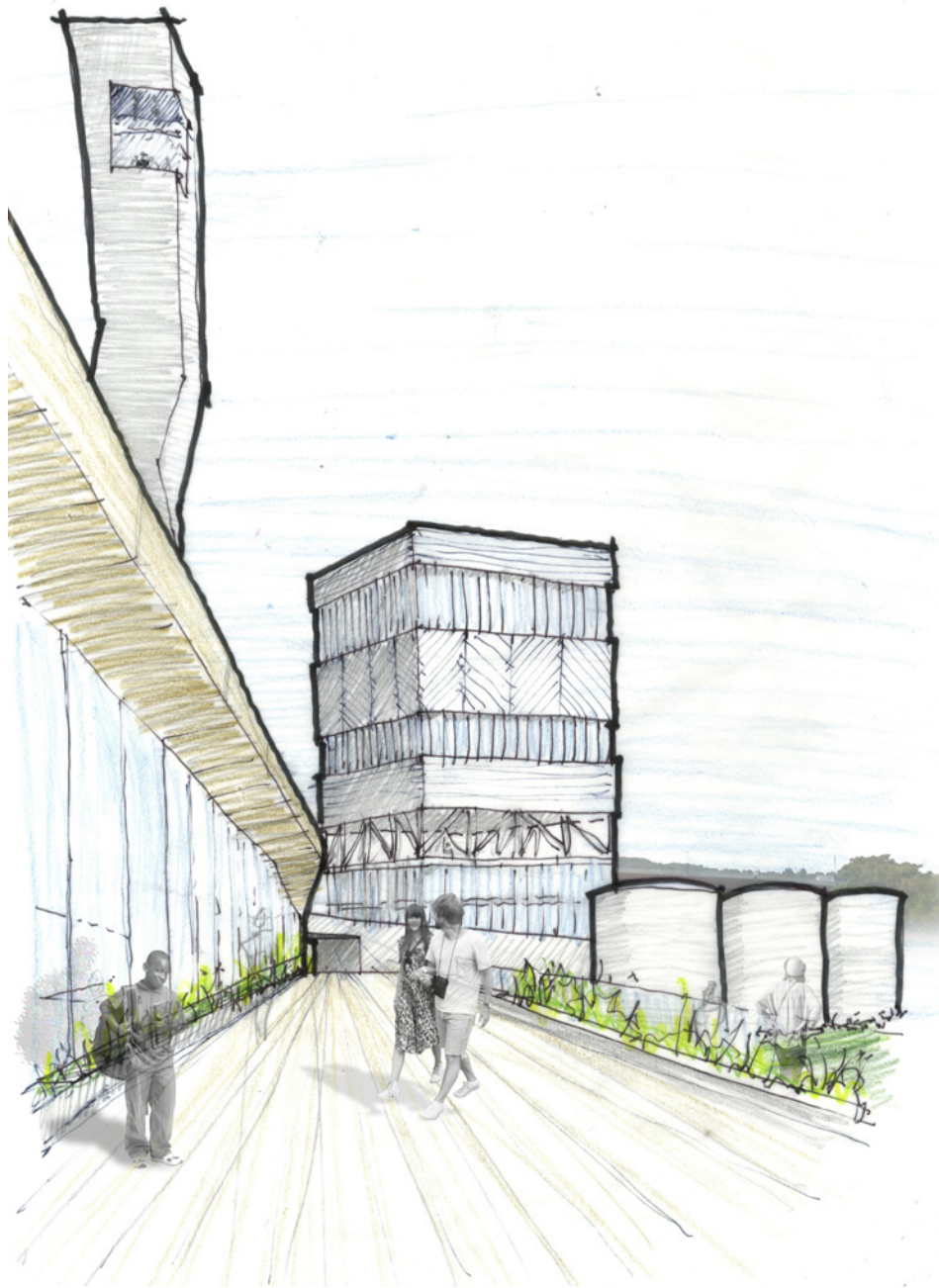


Fig. 62: Early visioning sketches and tower studies

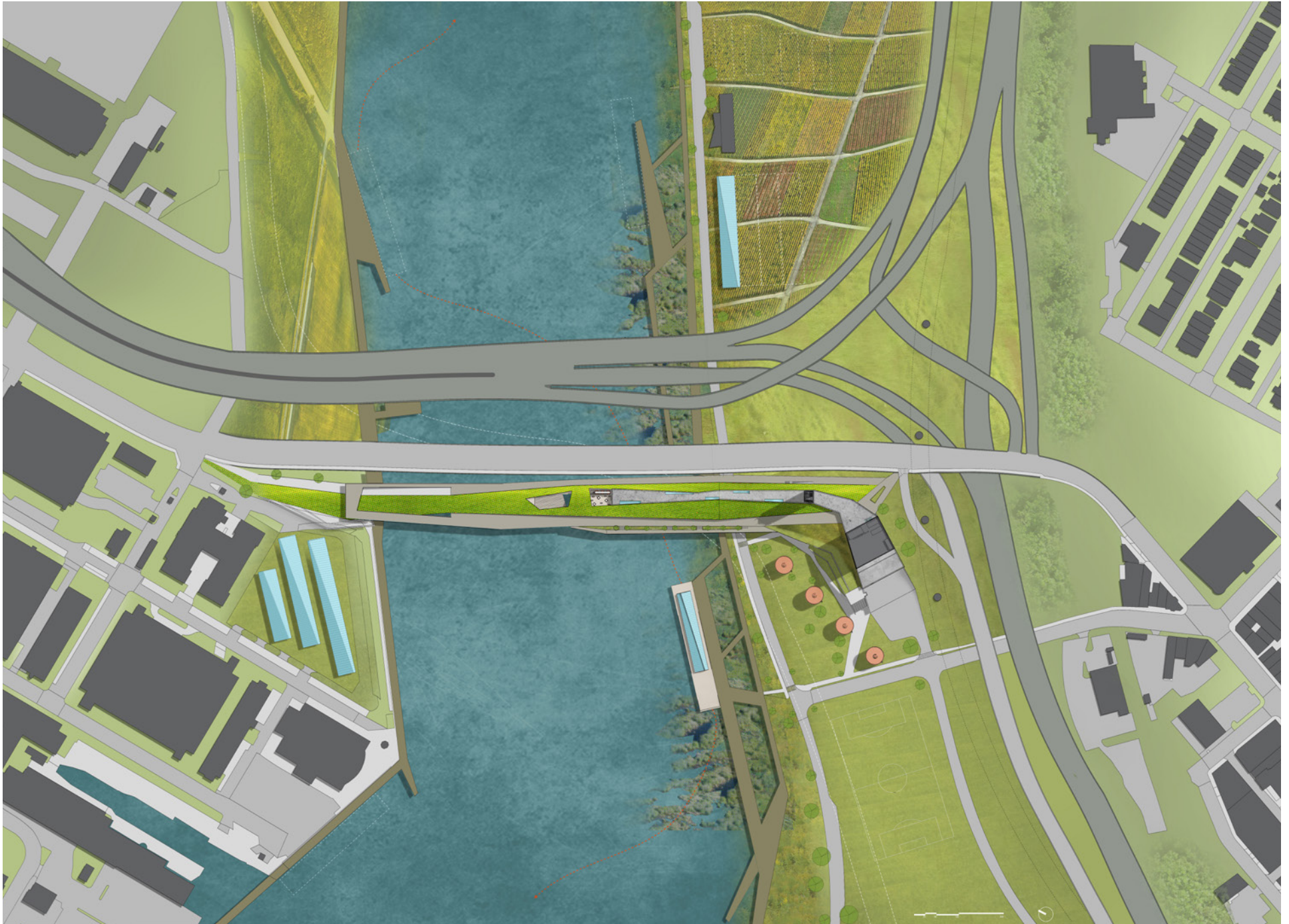


Fig 63: Site Plan showing landscape ribbon as connecting element. Greenhouses occupy the landscape with the ability to expand or contract as needed.

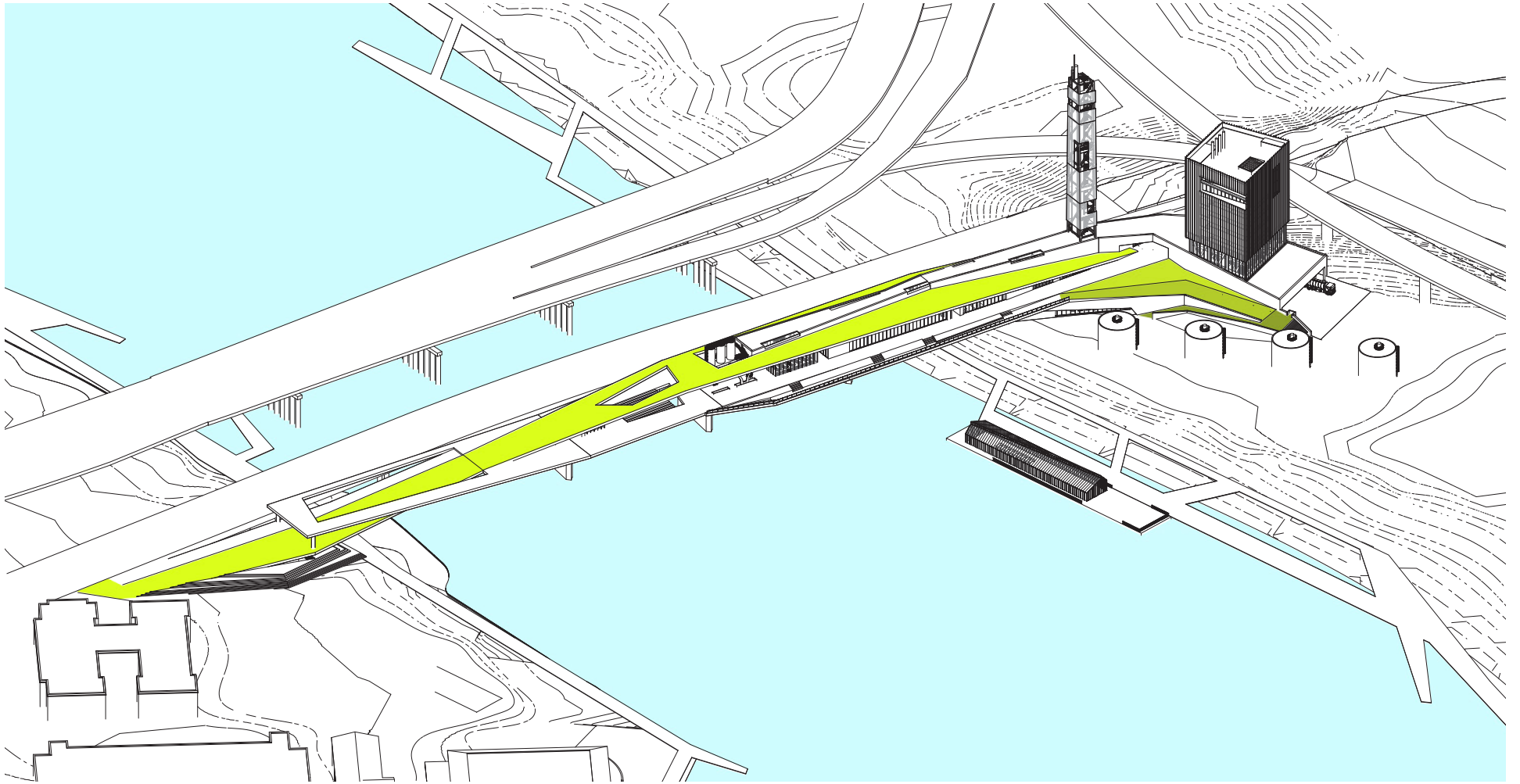


Fig. 64: Site aerial highlighting landscape ribbon as a unifying element

Sectionally, the project uses the most public program to bridge across the river. The bridge is anchored by a new landscape on the west bank and the largest architectural programs on the east. This approach inverts the spatial experience on the two sides of the river and positions the bridge deck as a place of exchange between two unique urban conditions. As visitors move across the bridge a changing sectional experience choreographs new views and spatial relationships with the river and the architecture. Passages between large public programs produce a permeable experience where users can move between either side of the bridge deck. The DC Tunnel sewer line is indicated in its proposed location 100 feet below ground.

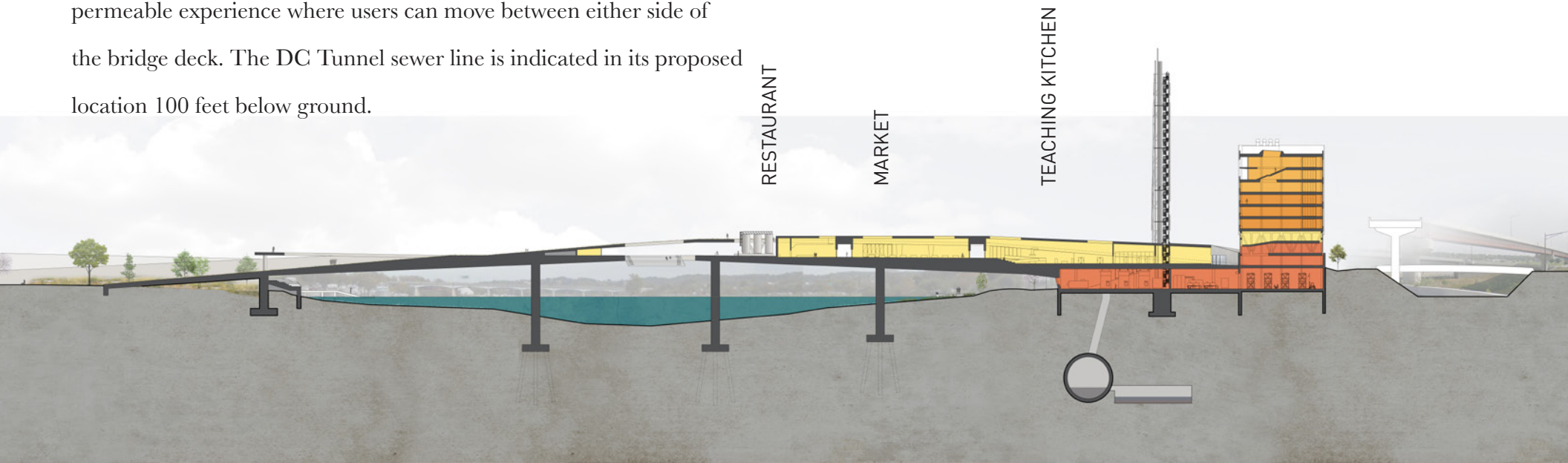
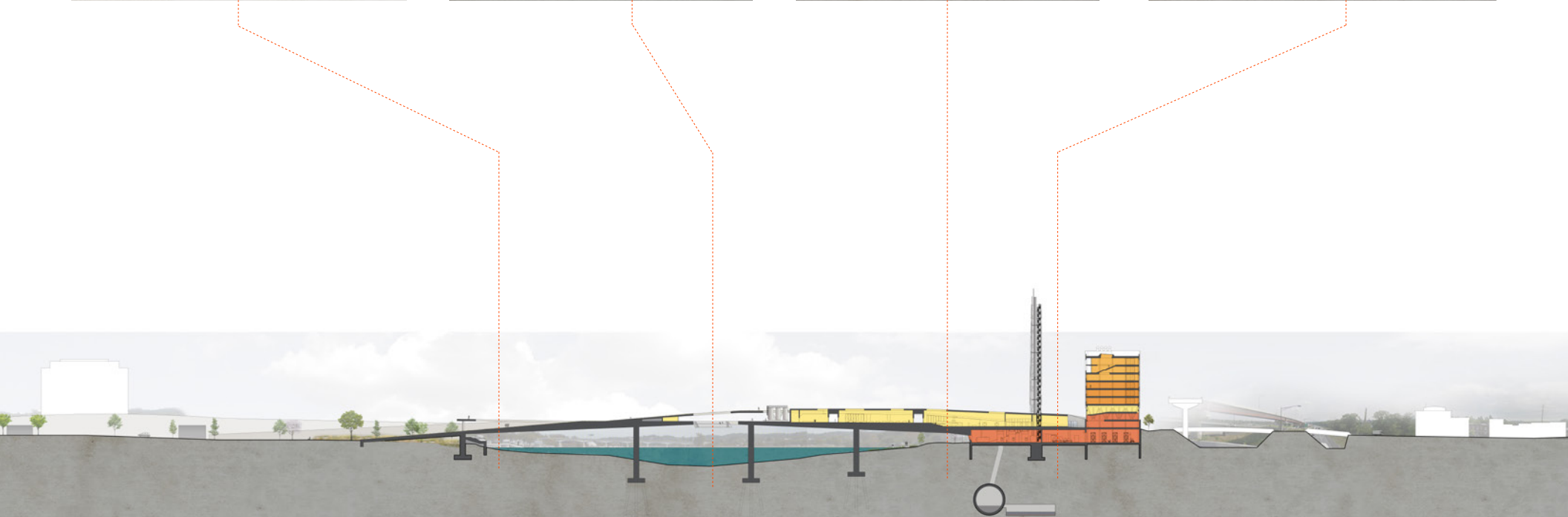
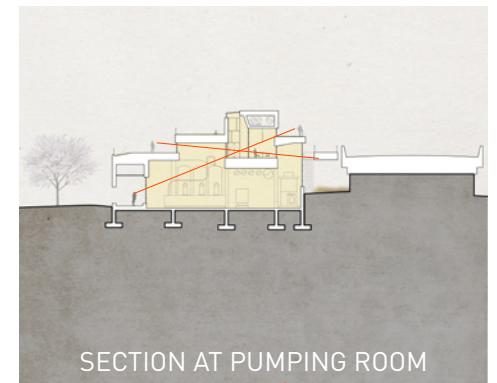
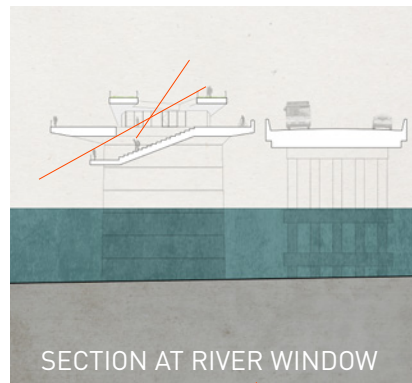
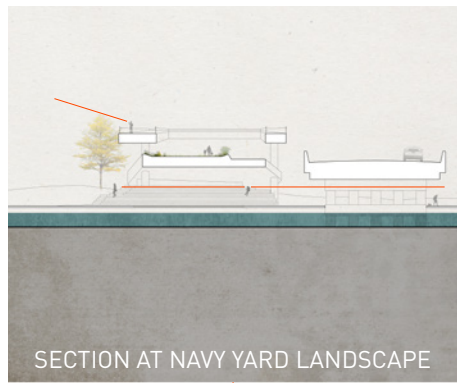


Fig. 65: Site section with DC tunnel project shown in its proposed location.

Fig. 66: Changing sectional experience moving across the bridge.



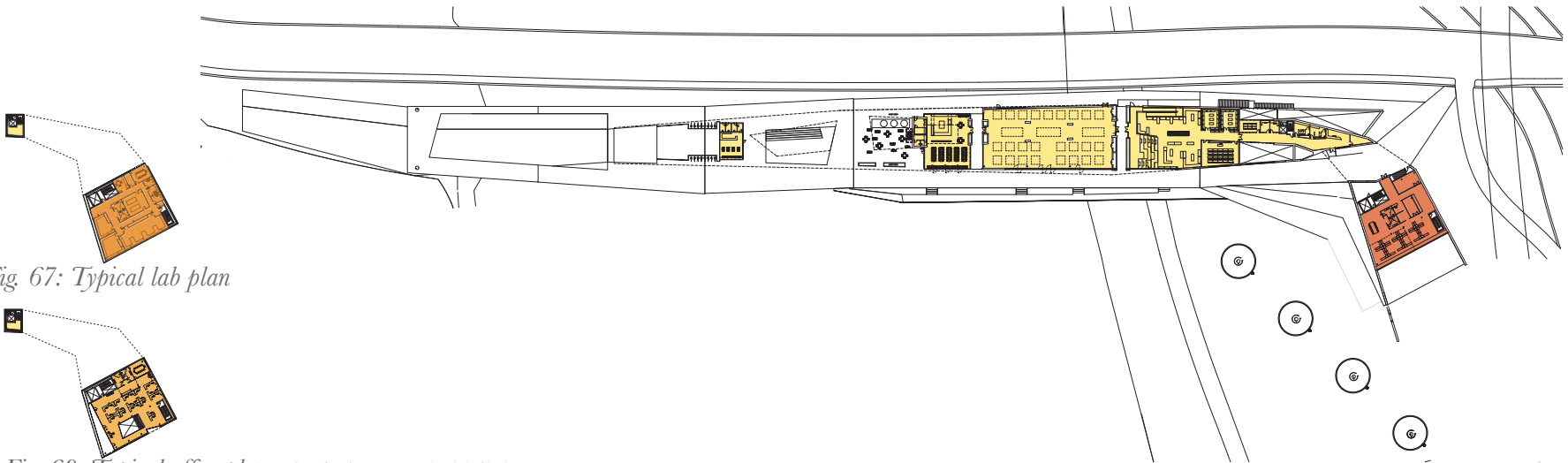


Fig. 67: Typical lab plan

Fig. 68: Typical office plan

Fig. 69: Bridge Deck Plan

The project places the most public programs on the bridge deck. Views into these lively spaces will create visual interest and catalyze interactions as people occupy and circulate on the bridge.

The large infrastructural elements are placed at the level with Anacostia Park. As park users circulate on the new boardwalk network they are provided opportunities to engage with food production in floating greenhouses and afforded views into the operations of the waste to energy processing facility.

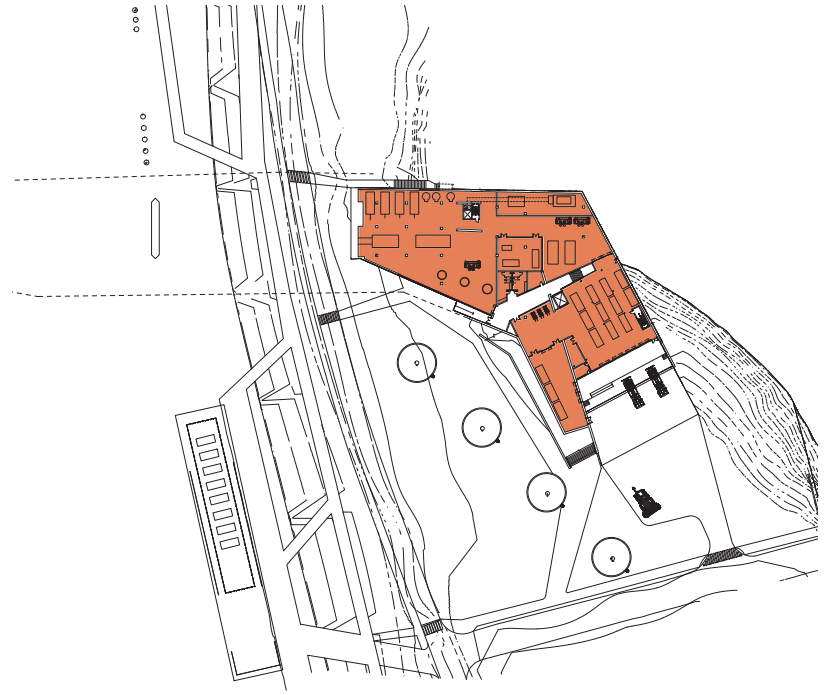


Fig. 70: Processing Level Plan



Fig. 71: The new boardwalk network and restored wetlands anchor circulation routes along the river's banks



Fig. 72: The project as seen from I-695 bridge



Fig. 73: The project as seen from MLK JR Avenue in Anacostia



Fig. 74: Phytoremediation along the river's contaminated sites can be phased to condition agricultural land as the network expands over time.



Restaurant diners enjoy fresh vegetables grown a short walk from their table. Thermal hydrolysis tanks used to treat biosolids are exposed at the mid span of the bridge reminding visitors of the complex operations facilitating their experience. A steel stair connects the bridge plaza to the landscape ribbon above.

Fig 75: View of Bridge Deck at Restaurant



The teaching kitchen supports a demonstration kitchen and commercial grade cooking equipment available for short term lease. Local students and community members take cooking and gardening classes. Setting the kitchen below the bridge deck showcases the activity in the kitchen to those outside on the bridge.

Fig 76: View of teaching kitchen and leasable commercial kitchen spaces



Fig 77: View of the river window from the landscape ribbon above the bridge. The articulation of bridge deck and landscape creates dynamic views of the river below.



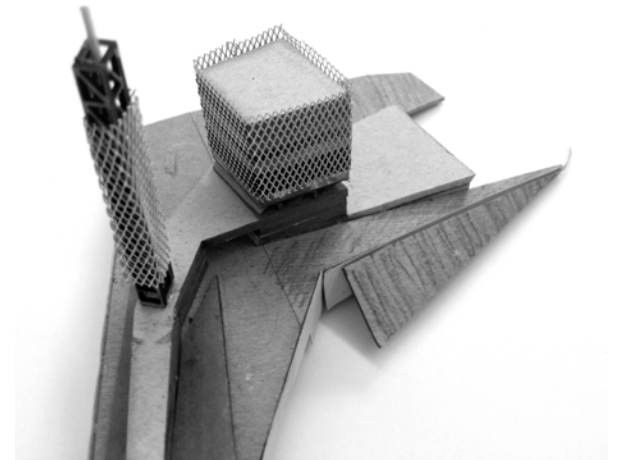
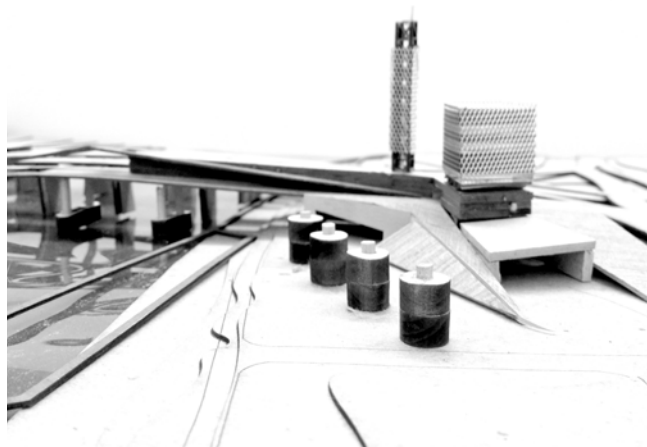
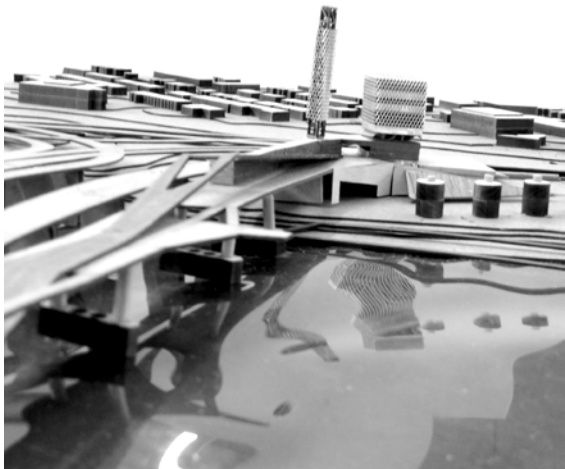
Fig 78: New office spaces for the Anacostia Watershed Society provide commanding views of the ecological network in their care.

Capturing waste heat from the biogas burning turbine for greenhouses allows the site to yield fresh vegetables throughout the year.



Fig 79: View of tower elements

Fig. 80: Model Studies



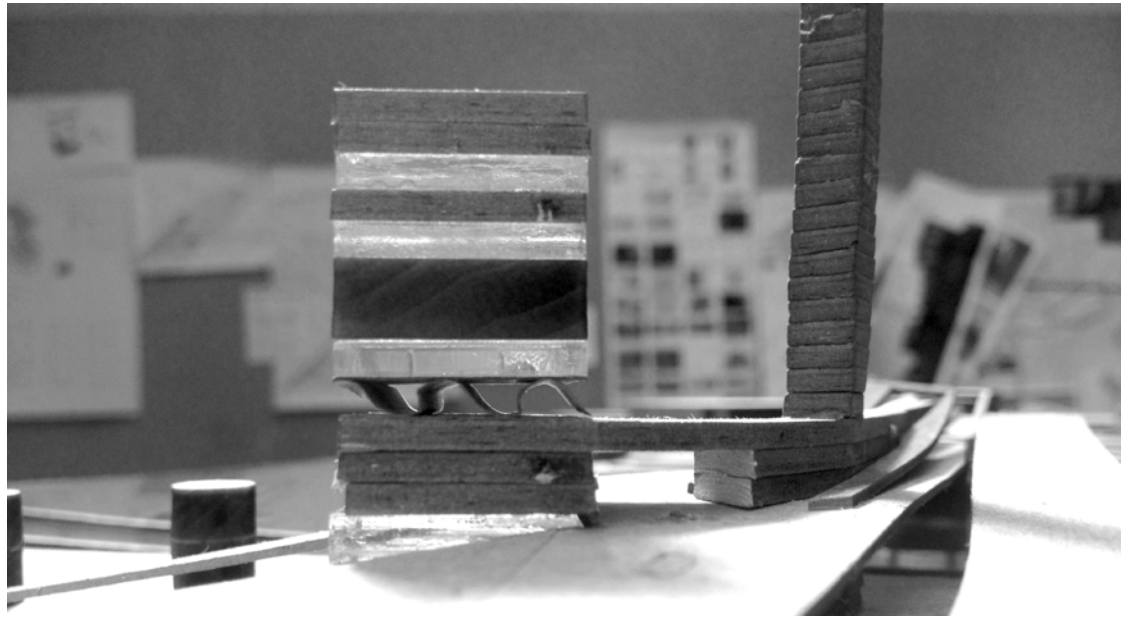
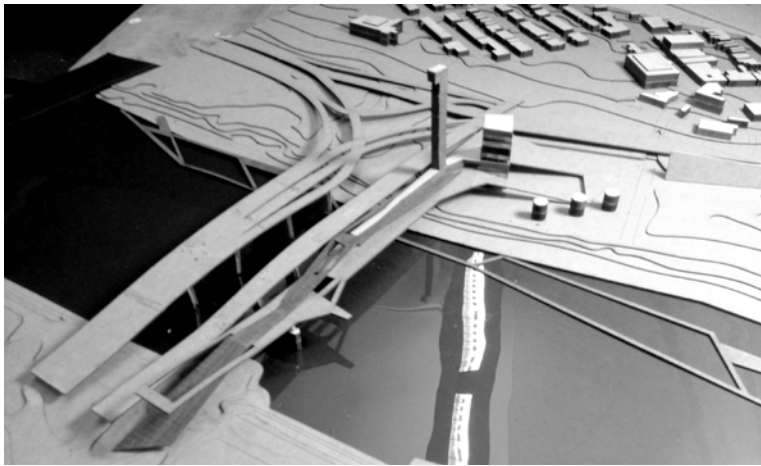
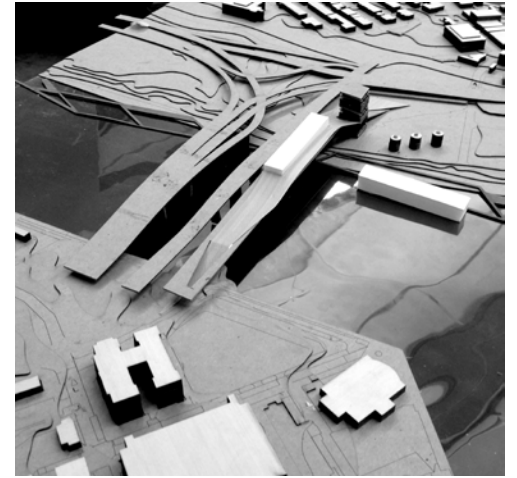
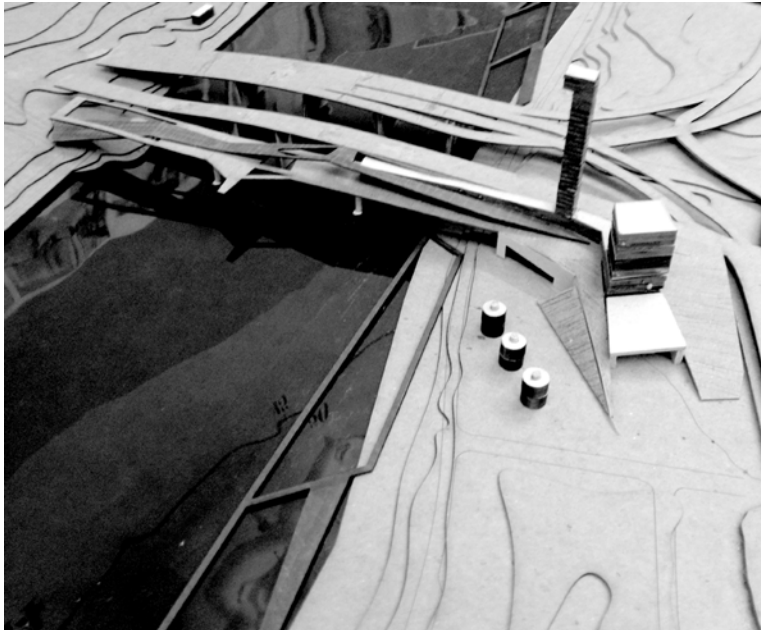


Fig. 81: Preliminary Model Studies

RE:VIEW

A public review of the thesis was held on December 1, 2014.

Jury:

Chris Patano_Patano Studio
Tim Fenlason_Jones Payne Group
Peter Cohan_UW CBE Architecture
Cory Mattheis_Miller | Hull
Sarah Hatfield_S+H Works
Ben Spencer_UW CBE Landscape Architecture
Andy Dannenberg_UW School of Public Health



Fig. 82: Review layout

Cory Mattheis
Peter Cohan
Tim Fenlason
Chris Patano
Sarah Hatfield
Ben Spencer
Andy Dannenberg

An engaging conversation ensued. Common themes in the comments were directed at the scale of the proposed design. While the scale was deemed appropriate for this project and site in particular the jury expressed interest in seeing how multiple similar projects could extend along the Anacostia at various scales. Possible scales mentioned were at the scale of the abandoned combined sewer outfalls or a smaller pedestrian bridge further upstream from the proposed site. At the heart of these comments was the desire to engage the Anacostia River as the whole site and how one framework or single design vocabulary could work along the eight miles of the river.

Additionally, the project site was questioned. Understanding that the bridge site was driven by the proposed 11th Street Bridge competition the jury was still interested in whether the project could be moved away from the existing bridges, and possibly increased in size or intensity on a less constricted site. Some of the residential streets on the East bank of the river were identified as potential new cross-river connections that could be used more intimately by the Anacostia neighborhood.

Other options including taking over the larger highway overpass, siting between the two existing bridges and locations both north and south of the selected site. Ultimately, the site used to test this thesis was a strong choice for its reuse of existing infrastructure to minimize impact on the hydrology of the river. Also, this site bolsters an existing connection across the river and it was determined that supporting an existing connection may be more effective than attempting to locate a new crossing. The notion of developing multiple bridges that link existing but severed streets was also mentioned. This approach was examined closely at the start of the thesis as illustrated in the stitched site concept model. Early on a decision was made to develop a single project that could serve as a prototype rather than a network of loosely defined site based cross-river linkages. However, the potential power of a multi-crossing scheme still intrigues the author and may be fertile grounds for further development and testing of the thesis.

A means to connect the site more effectively across the highway overpass from the east was suggested. This comment spoke to the constant question of the thesis as to where the focus of the intervention actually terminates. By deploying street treatment, signage, or enhanced pedestrian pathways the project could be more successfully linked to the commercial strip to the East. This would provide the mutual benefit of bringing more residents to the site while also connecting a struggling commercial district more strongly to the city as a whole.

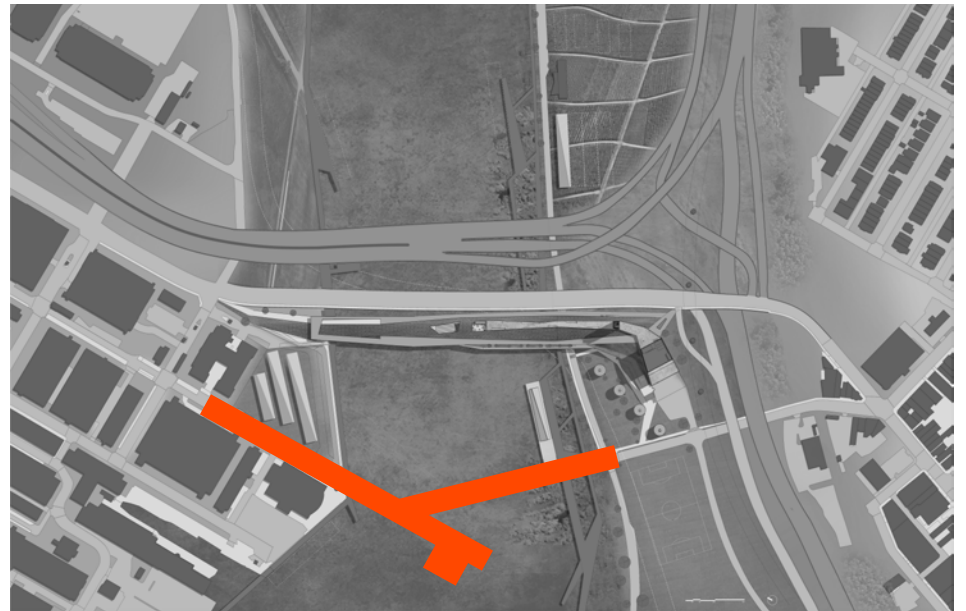
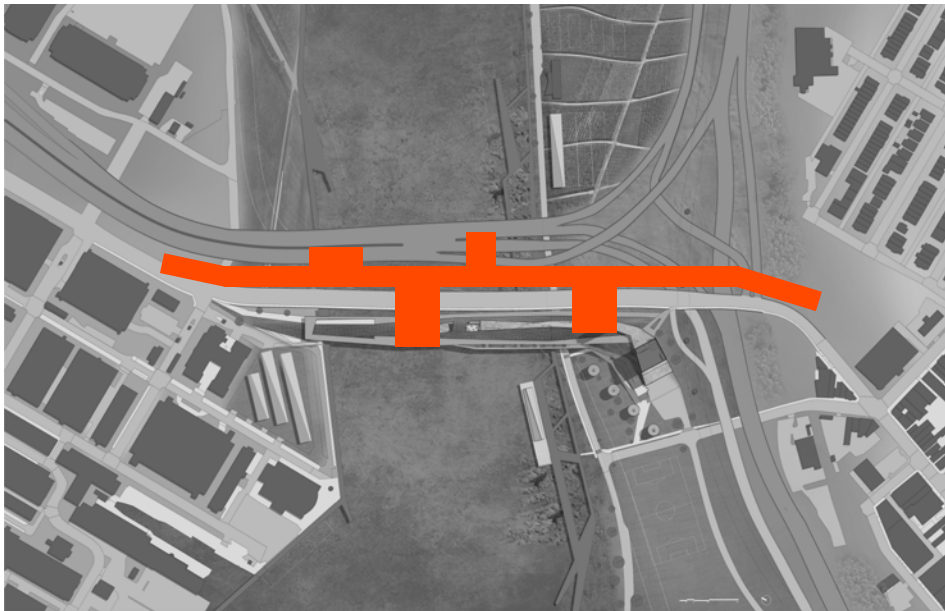
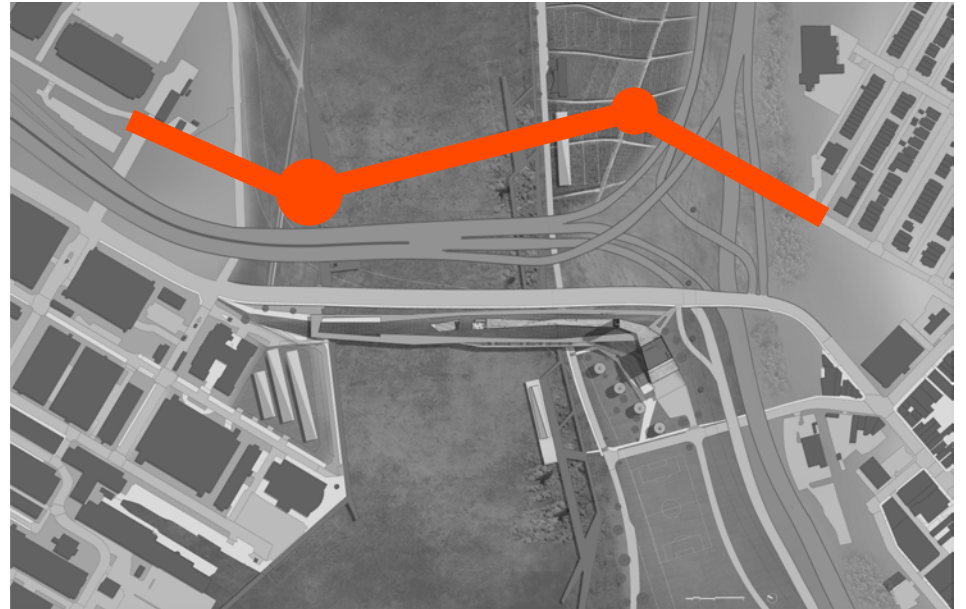
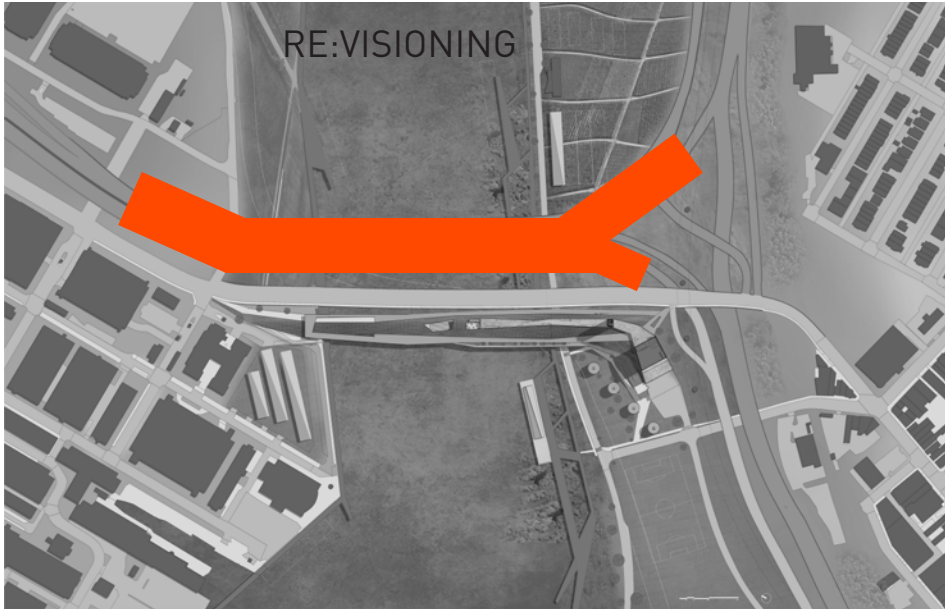
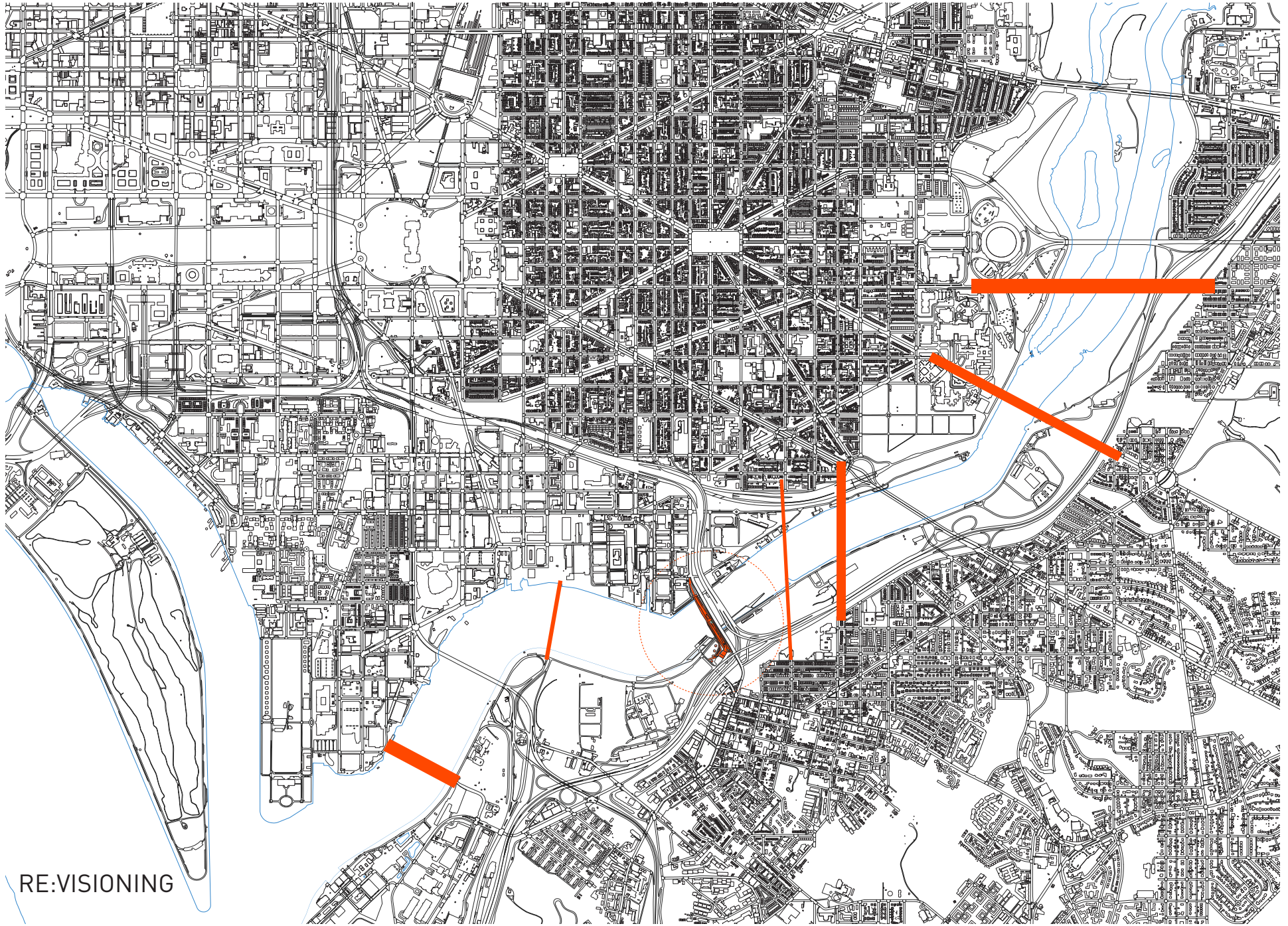


Fig. 83: Alternate sites suggested in the review. Illustrated above with potential conceptual partis.



RE:VISIONING

Fig. 84: Alternate sites suggested in the review. Illustrated above as conceptual network of crossings

Infrastructure
is much more
important than
architecture.

Rem Koolhaas

CONCLUSION

The Expanding Role of the Architect

Architects must begin to critically engage with urban infrastructure in both theory and practice. Thoughtfully designed infrastructure networks will be of the utmost importance as urban centers continue to grow world wide. This call to action is not based on a value judgment- that infrastructure should be the new focus of designers. However, it recognizes that as thinkers who shape cities architects must recognize large scale networks as potent design opportunities. Infrastructure projects embody the greatest potential to impact our cities and their role must be leveraged to create positive outcomes at local and regional scales.

In order to effect change with these types of projects architects will need to engage with leaders from diverse disciplines that have not traditionally been allied with Architecture. This thesis intends to be a starting point for that conversation. The issues addressed demarcate a larger arena for a dialogue about the role of architecture in the future of our cities to take place.



Fig. 85: Infrastructure network as the new civic space

END NOTES

1. Graham, Steven and Marvin, Simon *Splintering Urbanism*. New York, NY: Routledge, 2001. Print. p. 8
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3. *ibid*,10
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5. Offner, J.M. 'Are there such things as small networks?' In O. Coutard (ed.) (1999), *The Governance of Large Technical Systems*, London: Routledge, 217-38.
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13. Wennersten, John. *Anacostia The Death & Life of an American River*. Baltimore, MD: The Chesapeake Book Company, 2008. Print. (p. xi)
14. *ibid*, 8
15. *ibid*, 33-34
16. *ibid*, 63

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17. *ibid*, 71

18. *ibid*, 85

19. *ibid*, 195

20. "Cleaning Up the Anacostia River." Natural Resources Defense Council. NRDC, February 21, 2013. Web. May 30, 2014. <http://www.nrdc.org/water/pollution/fanacost.asp>

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