APPLICATION OF RESILIENT POST-INDUSTRIAL DESIGN INTERVENTIONS ON A SMALL-SCALE RIVER SITE: PURITAN-WELLINGTON MILL IN ATHENS, GEORGIA

by

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(Under the Direction of Shelley Cannady)

ABSTRACT

With significant development pressure in urban areas, abandoned post-industrial sites across the United States become potential sites for future use and redevelopment. Three projects in the United States and in France demonstrate the significant landscape design potential of these sites as resilient urban spaces. The purpose of this thesis is to explore how small-scale post-industrial sites along rivers in urban areas can be designed with resilient landscape design principles. Comparative case study analysis was conducted across three small-scale post-industrial project sites along rivers or creeks (Bethlehem SteelStacks Arts + Cultural Campus in Bethlehem, Pennsylvania, USA; West Point Foundry Preserve in the Village of Cold Spring, New York, USA; and Saint Ouen-Park of the Docks in Paris, France) in order to determine resilient design approaches and solutions to typical post-industrial landscape sites. These findings were then applied in the design of an abandoned post-industrial site in Athens, Georgia, the Puritan-Wellington Mill.

INDEX WORDS: post-industrial landscape, resilience, post-industrial sublime, urban resilience, landscape architecture

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DEDICATION

I would like to dedicate this thesis to my dog Mr. Kilosaurus Rex. Without his unconditional love and affection, I would undoubtedly not be in this position today.

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I would like to acknowledge the assistance of faculty who have been helpful along this journey including Shelley Cannady who has been both an excellent adviser as well as friend, and Georgia Harrison who helped me get into this program in the first place. I would like to thank my family, in particular my mother who was always available for a phone call if I was stressed or just needed to talk to someone. I would like to thank my friends and classmates especially Saadia Rais, Matt Quirey, and Liz Solomon. Additionally, I would like to thank my adviser from Sewanee, Dr. James Davidheiser, who showed uncommon kindness, understanding, and faith in me as a wayward twenty-something and whose enthusiasm for life is still an inspiration to me.

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CHAPTER 1

INTRODUCTION

1.1 Problem Statement

Post-industrial sites are often historically significant to a region's growth, and the Puritan-Wellington Mill is an excellent example. Located at 1120 Macon Highway in Athens, Georgia, the mill was a part of the southeast's booming cotton industry in the years leading up to the Civil War, with Athens playing a significant role in a post-war effort to industrialize the South (Figure 1). Mills which processed cotton were numerous in the Athens area due to the abundance of freshwater rivers and creeks which provided power and water for industrial processes. While many of these mills have been preserved or converted into commercial or residential uses, the Puritan-Wellington Mill has been neglected and left to decay since its closure in 1986. While the mill has slowly fallen into ruin, Athens has grown and moved beyond its industrial past. What was originally a rural area has now begun to urbanize, leaving this mill, its history, and our relationship to the past vulnerable to eternal neglect or demolition.

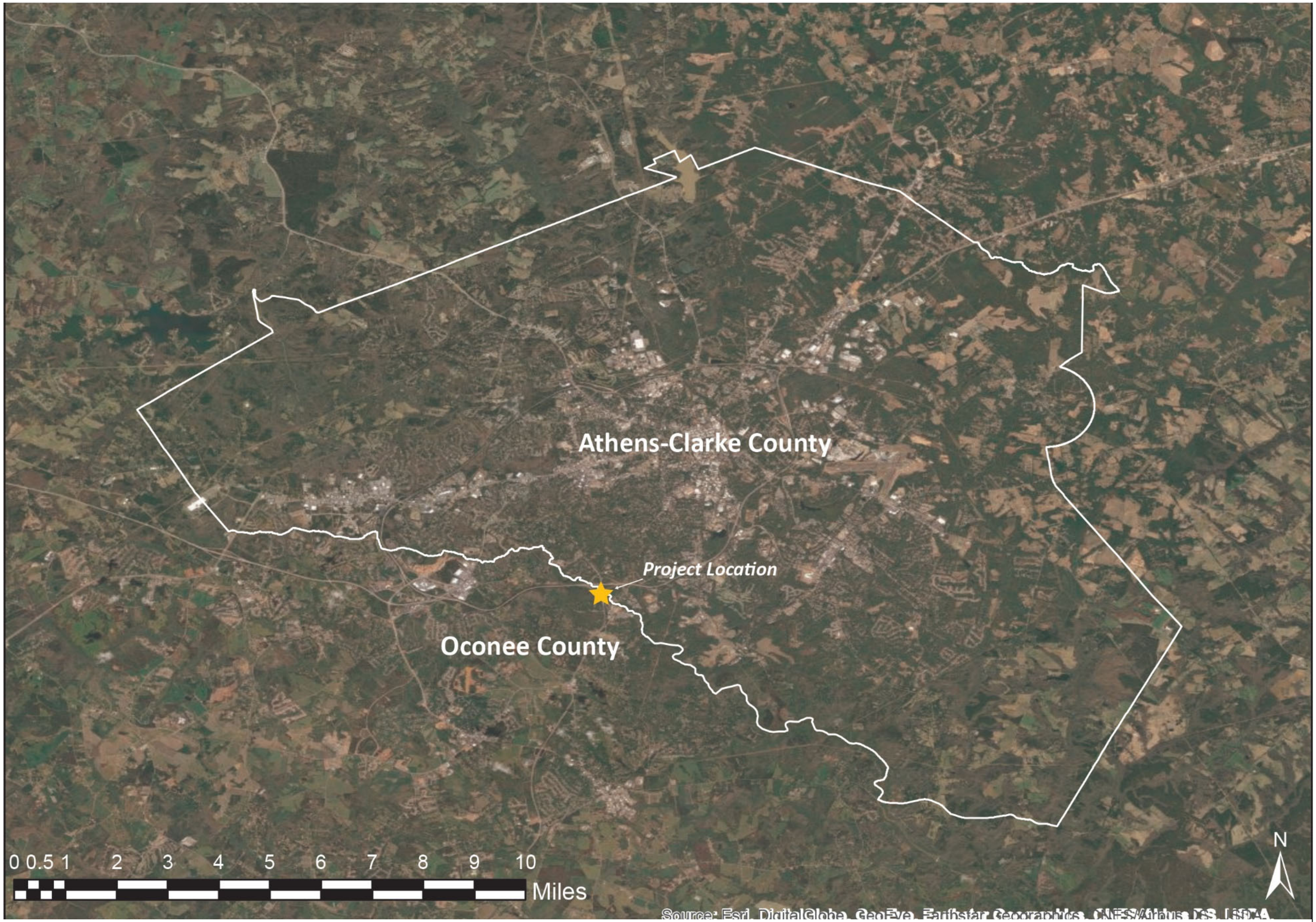

Figure 1:Athens-Clarke County and surrounding area showing site location

1.2 Justification

As Athens urbanizes and expands into formerly rural areas, a new set of challenges has emerged on both a local and a regional scale. Widespread anthropogenic environmental degradation on a scale never before seen means that new perspectives on urban land development are required. Human populations, especially in urban areas, are exceptionally vulnerable to environmental, economic, and social disturbances. Urban systems are complex and require a range of approaches. Resilience—the capacity of a system to recover from disturbance—has become the goal of many cities around the world seeking to adapt to the effects of environmental degradation and climate change. Contemporary resilience theory offers a framework which acknowledges the dynamic, unpredictable nature of urban systems, and emphasizes designing urban form to be flexible and capable of recovering from a disturbance in a variety of ways.

The nature of many disturbances requires planning and design at an urban scale, which means resilience theory is typically conceptualized and operationalized at the scale of a city or region, rather than specific sites within those larger contexts. However, the piecemeal nature of land development in many urban areas, which may or may not be guided by large scale resilience goals, means that a resilience approach to guide small-scale landscape site design is necessary. This approach allows small-scale sites to explicitly contribute to large-scale system resilience.

1.3 Research Questions and Objectives

Post-industrial sites such as the Puritan-Wellington Mill are an opportunity to realize this type of resilient small-scale site design while also creatively revealing, respecting, and reinterpreting industrial heritage and our relationship to the past. Due to the abundance of similar sites in most post-industrial societies, this approach possesses a high level of replicability. This thesis seeks to answer the question: What is the best approach through application of resilient landscape design principles to small-scale post-industrial sites along rivers in urban areas?

1.4 Methodologies

The methodologies used in this thesis are comparative case study analysis and historical site research on the proposed project site. Case study research follows an adaptation of the Landscape Architecture Foundation's case study methodology. Case study analysis is conducted through an assessment of case study performance in terms of seven resilience dimensions, which yields an array of design approaches and solutions with varying levels of suitability for this site. These findings are then aggregated based on their respective resilience dimensions in order to generate design approaches and solutions best suited to contribute to the resilience of this site design typology. Historical research was conducted on the Puritan-Wellington mill site as well as the history of industrialization and mills in the Athens area. A thorough site inventory and analysis was conducted. The case study findings are then applied in the design process of the project site, with the goal of designing a resilient small-scale post-industrial site.

1.5 Thesis Structure

Chapter 2 is an exploration of the primary theoretical and philosophical discourse related to post-industrial landscapes and the post-industrial sublime aesthetic and how it relates to design. Post-industrial landscapes offer a unique physical and aesthetic framework which lends itself to innovative design solutions. This chapter also explores the relationship between sustainability and resilience, and to what extent resilience is an aspect of sustainability or represents a paradigm shift, including the shift away from stable-state equilibrium towards dynamic multiple steady-state equilibrium. The culmination of this chapter is an overview of the state of contemporary urban resilience theory, which embraces dynamic equilibrium and urban systems-level planning and design approaches. Issues associated with the inadequacy of large-scale resilience theory applied to small-scale site design are then discussed. Finally, the author then proposes a synthesized definition of resilience accompanied by eight resilience dimensions which will be used in this thesis as criteria to evaluate case study sites.

Chapter 3 contains case study research and analysis. The three case study sites are: Bethlehem SteelStacks Arts + Cultural Campus in Bethlehem, Pennsylvania, USA; West Point Foundry Preserve in the Village of Cold Spring, New York, USA; and Saint Ouen-Park of the Docks in Paris, France. The case study research establishes site history, design development, and programmatic elements.

Chapter 4 is an assessment of case study performance in terms of seven resilience dimensions: biological & social diversity; multifunctionality; modularity & redundancy; flexibility; adaptability; connectivity; and inclusivity. This assessment also included an evaluation of applicability to the Puritan-Wellington Mill site.

Chapter 5 is an exploration of the Puritan-Wellington Mill site history from its origins as a grist mill in the 1840s, through its closure in the 1980s, up to its present day uses. Following this is a detailed graphic site inventory of physical conditions including digital mapping and photographic documentation, and a composite analysis of those conditions.

Chapter 6 begins with a summary of resilience findings from Chapter 4 establishing project objectives to achieve resilience based on the seven resilience dimensions. Two functional design concepts based on unique design scenarios are proposed, which are then evaluated for potential strengths and weaknesses. This process informs a synthesized functional design concept best suited to achieve resilience. This functional design concept is then used as the basis for a final design master plan of the Puritan-Wellington Mill site, including an illustrative plan and multiple perspectives of key site elements.

1.6 Limitations and Delimitations

There are several limitations and delimitations in this thesis. The first is the limitation of time and financial resources which would have enabled the author to visit case study sites in person. In-person site visits may have allowed for more in-depth site analysis. Instead, the author had to rely on what was available through literature and internet searches.

The second limitation, also related to time, is that one aspect of resilience theory as applied to urban design necessitates community and stakeholder input and feedback in the design process. The limitation of time required the author to approximate community and stakeholder input. However, the design of the site inherently accommodates changing future community and stakeholder needs through flexible design solutions.

The first delimitation is that the age of case study sites impacts the availability, existence, or volume of certain resources relating to the site design, peer reviews, criticism, and other aspects of case study research. The older a site is, the more information there tends to be available.

The second delimitation is that case study sites are limited to the United States and France. These are both characteristic post-industrial societies and experienced industrialization at similar times. They are, therefore, most instructive for application to sites in those general geographic locations.

CHAPTER 2

LITERATURE REVIEW

2.1 Post-Industrial Sublime

The beautiful and sublime are commonly talked about with regards to 18^{th} century landscape painting. Beautiful objects, whether in reality or represented as art, may fill us with a pleasant feeling and seem to confirm the hope that we live in a world full of harmony and purpose (Mul 2011). Connected to Romantic ideals of nature as distinctly separate from and unspoiled by humans, in the 18^{th} century, emerging notions of the sublime experience also explicitly asserted the dominance of reason over nature, and of our attempts to dominate and control it (Boetzkes 2010).

The sublime refers to the wild, limitless wonder of nature, contrasted starkly with the harmonious experience of beauty—it is characterized by experiences which upset our hopes for harmony (Mul 2011). It is characterized specifically by things that surpass our understanding or imagination due to their unbounded, excessive, or chaotic character. It has been defined by Edmund Burke as a "delightful terror"—the delight only being possible because the viewer never actually is in danger (Burke 1859).

Burke understood the sublime as a "feeling of astonishment triggered by a drive for self-preservation in the face of nature" (Boetzkes 2010). He insists on the double meaning of "astonishment" as a sentiment that encompasses both terror and respect, and is akin to physical pain in how it may immobilize and flood the mind (Burke 1859). The sublime is characterized by the tension between a sense of being overwhelmed by natural forces on the one hand, and the drive to contain it on the other. Crucial to Burke's concept of the sublime is disorientation caused by obscurity, darkness, silence, and magnitude—essentially the fear of the unknown and unknowable. Despite the human desire to control and dominate nature, the mind, then, is incapable of mastering its surroundings (Boetzkes 2010). It's here that we start to see how the sublime might be applied to and reinterpreted for contemporary post-industrial landscapes.

If the Burkean concept of the sublime deals with the overwhelming feeling of awe, terror, and of respect for the natural world caused by experiences or representations of a certain chaotic and unknowable quality (Burke 1859), how can this idea be applied to the remnants of the industrial revolution, and subsequent disappearance or collapse of industrial economies and infrastructures? How has the proliferation of technology, as well as the rampant consumerism and associated waste it inevitably produces changed our relationship with nature and with the sublime (Zylinska 2016)?

The post-industrial sublime is often characterized by fear and awe in the presence of immense and overpowering industrial structures and systems, the exponential growth of digital technology, as well as fear and awe of our own self-destructive power in the form of nuclear weapons and anthropogenic climate change (Mul 2011). The human species is simultaneously confronted by the endless and limitless possibilities of human existence, as well as the immediate prospect of human extinction. The disintegration, decay, and demolition of industrial structures is a potent visual reminder of this phenomenon, both in the foreshadowing of what may lie ahead, as well as in the demonstration of the inevitability of entropy and time.

However, post-industrial landscapes also demonstrate the capacity of living things to reclaim degraded industrial sites and the potential of the environment to heal itself. Industrial waste sites known as brownfields helped create the necessity for techniques such as bio- and phyto- remediation, and are the perfect opportunity for their application. The post-industrial sublime as an aesthetic is a way of reframing our relationship to nature and of recognizing our limits, as well as those of nature (Boetzkes 2010).

Post-industrial landscapes serve not only as a philosophical framework, but also as a physical framework within which to operate as designers—the designer can respond to the aesthetics and form of use-specific industrial structures. Aesthetic and formal contrast is possible between organic and inorganic, loose and rigid, ephemeral and permanent, natural and unnatural, and growth and decay. Post-industrial landscape design embraces and reinterprets for a new sociocultural paradigm. In the face of throwaway consumerism, to reuse and reinterpret becomes an act of defiance. Post-industrial landscape aesthetics suggest a shift in aesthetic priorities towards an appreciation of sustainability, adaptive reuse, and resilience.

2.2 Example of a Large-Scale Post-Industrial Landscape Development Project

Widespread decline in the steel and tire manufacturing industries in Turin, Italy by the 1980s meant that a massive swathe of the city center became unused, as the factory structures deteriorated into useless eyesores. Local urban regeneration efforts in the late 1990s yielded a series of design interventions along the river, among them Parco Dora. Five areas make up the park, three of which are named for industrial companies that once occupied the site: Ingest, Vitali, and Michelin. While the river, traffic arteries, and residential areas are prominent features of the site, its distinctive character is drawn from what remains of its industrial past. The park's areas are connected to one another, as well as to adjacent neighborhoods via paths that align with surrounding street grids, creating for locals a sense of belonging to their area. Series of squares, promenades, ramps, and paths frame meadows and tree copses which contrast with the views of the city and remaining industrial structures. Cooling towers, steel substructures, and concrete foundations remain and form the framework within and around which the park has been designed. A 700m long elevated walkway connects the three northern areas, providing a new layer of perception and vistas that extend beyond the park. Remaining steel columns resemble a "futuristic jungle," as lush vegetation and public life have breathed new life into an artificial and degraded environment, altering and also respecting Turin's industrial heritage ("Parco Dora" 2014).

2.3 The Relationship Between Sustainability and Resilience

The effort by the U.N.'s Brundtland Commission to define sustainability in 1987 reflected the need to compromise between the 'growth' and 'no-growth' factions of the environmental movement of the 1960s and 1970s. Sustainability, according to the widely accepted Brundtland report, is defined as: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (Jarvie 2016). It represents a middle ground that allows for development, while also pacifying critics of such development by codifying certain sustainable principles: resource equity, embodied energy, global community, economics, renewability, traditional wisdom, institutional change, and technology. Further efforts in Europe in the early 1990s contained prescriptions for planning and building strategies intended to improve environmental sensibility (Steele 2005).

Alan Berger, landscape architect and MIT researcher, suggests that landscape architecture has been traditionally more concerned with discrete places and locations, making parks and other designed spaces, rather than truly large-scale systemic processes (Abelman n.d.). Berger says "the main issue for me is that landscape architecture is not doing a great job addressing the larger-scale environmental issues that are currently affecting urbanized regions in the world. Rather, landscape architecture tends to still be focused on discrete locations and places and unfortunately too often on superficial cosmetics" (Berger 2009.) Berger goes on to criticize landscape architecture as failing to stay ahead of the most pressing concerns of our age: global warming, rapid urbanization, and changing land use. Jaques Abelman writes that, while landscape architects do deal with "plants and soil and water, and therefore the living environment," there is nothing inherently ecologically intelligent about what he refers to as "standard landscape architecture."

Landscape architecture's SITES rating system was developed in an attempt to follow in the footsteps of architecture's LEED system, which is a green building certification system providing third-party verification that a building or community was designed and built using strategies to improve performance across metrics such as CO_2 emissions reduction, energy savings, and improved indoor environmental quality (U.S. Green Building Council n.d.). Sustainability in the SITES system is defined as "design, construction, operations, and maintenance practices that meet the needs of the present without compromising the ability of future generations to meet their own needs (ASLA n.d.). Similarly composed to LEED, SITES enables the designer to accumulate points based on criteria such as plant selection and rainwater management, with a system of guiding principles such as "design with nature and culture." Abelman argues, however, that this system is still lacking, specifically in a holistic, as opposed to a purely quantitative approach, and that the emerging philosophy of regenerative design may help fill in the gaps that remain when one attempts to apply sustainability to a much larger, even global context (Abelman 2009). Regenerative design is a process-oriented systems theory-based approach to design, which describes processes that renew and restore degraded environments, differing essentially from sustainable design in that sustainability seeks to maintain a given systemic equilibrium, while regenerative design seeks to not only maintain, but to improve a system (Lyle 1994). Its goal is not only to maintain current human modes of consumption, argues Abelman, but to reintegrate human systems within natural ones, creating systems so efficient there is a net gain, thereby going a step beyond conventional sustainability. Applying a holistic approach to design, the designer is able to see not only the characteristics of a given site and the elements of design, but how they relate to one another and evolve over time, which can be referred to as systemic thinking, or "finding the different systems at work in a specific place, on as many different levels as possible." While this approach requires complex diagrams showing energy and material flows, designing spaces for human use and interaction requires nuanced, quantitative thinking. It requires the use of dialog, narrative, and metaphor: what may collectively be referred to as " story of place." It asks: How has a place functioned throughout history with regards to plants, animals, people, geology, hydrology, and climate? Is it healthy now? What may have caused it to flourish or wither in the past? What is the system's future potential? (Abelman n.d).

Throughout human history, people have employed concepts of sustainability to all aspects of the built environment, whether they were aware of such actions as distinct concepts or not. Widespread understanding of and acceptance of our role in climate change and environmental degradation has led to cultural shifts towards being less wasteful of our natural resources. Under the umbrella term of sustainability, the building arts have adopted new sustainable design principles to varying degrees, allowing us to continue to develop while also respecting the natural environment and what has come before us. But sustainability, like design, is a dynamic and living process (Williams 2007). Contemporary resilience theory, with an emphasis on systems thinking and contextualism, offers a new path forward.

Over 50% of the world's population now lives in cities—a number predicted to increase to 70% by 2050 (UN Habitat 2006). As our understanding of cities shifts towards dynamic, self-organizing systems, the concept of sustainability must change. The widely accepted Brundtland definition of sustainability—that sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Brundtland et. al 1987)—suggests that the needs of future generations can be known and therefore accommodated in current design and planning processes. However, it is clear that human activities are shaping geologically significant conditions and processes, and a new direction—resilience—is needed (Quigley et. al 2018). Whereas sustainability focuses on an ideal urban form that supplies critical ecosystem services, it must now also build resilience capacity (Ahern 2013).

Sustainability discourse seeks an ideal set of responses which are replicable across scales and contexts. These responses are not necessarily location and community specific, but instead are inflexible and static. It assumes we can predict the needs of future generations, and does not fully reflect dynamic multiple state equilibrium or allow for system evolution. Furthermore, sustainability alone fails to provide cohesive system level coordination or planning. Where sustainability envisioned durable, stable, sometimes formulaic "fail-safe" urban design mechanisms and conditions, non-equilibrium theory emphasizes the inherent unpredictability of disturbance and change in ecological and urban systems. "Safe-to-fail" design mechanisms anticipate disturbance and failure—thereby contributing to system resilience (Ahern 2011).

The modern era of the 20th century was dominated by an equilibrium or deterministic view of nature and science. In the developed world, science and technology were relied upon to meet societal, economic, and environmental needs (Ahern 2011). This equilibrium view denies the inherent spatial and functional dynamics of complex, self-organizing socio-economic systems (such as cities), which are subject to disturbances both frequent and infrequent and across scales (Ahern 2013). This reality is reflected in the rise of chaos or non-equilibrium theory in the latter half of the 20th century.

Non-equilibrium theory argues that natural and cultural systems are inherently variable, subject to disturbance and evolution, and that ecosystems are always in a state of dynamic tension as opposed to stability, which translates into the most basic definition of resilience, which is "the capacity of a system to respond to change or disturbance without changing its basic state". In recognizing ecosystems as dynamic with multiple possible stable states, Holling's work departed from the "stability" paradigm of ecology. Specifically, it emphasized the ability of an ecological system to continue functioning when faced with a disturbance, but not necessarily to remain the same (Holling 1973).

The inherent unpredictability of many such disturbances means that cities require resilience in order to have the capacity to recover without changing fundamental state—all of which contributes to sustainability over the long term. This means that delivery of ecosystem services can be accomplished over time, in a context of expected and unexpected disturbances.

In this way the fundamental sustainable urban form question is reframed to ask "how can city form be organized to build its resilience capacity?" (Ahern 2013). While sustainability may be understood as a synthesis of three dimensions—economic, social equity, and environmental—when viewed in a non-equilibrium framework resilience theory assumes the role of the fourth dimension of sustainability. This takes sustainability and resilience specifically beyond simply consideration of urban form to engage a more broad and nuanced set of social, economic, and environmental issues and strategies. Ahern argues that strategic, systems-level thinking is needed for urban sustainability and resilience in a non-equilibrium context to be successful (Ahern 2013).

Ahern details five strategies for structuring discourse on urban sustainability and resilience, which align closely with the predominant social-ecological resilience paradigm. The first strategy is biodiversity enhancement and protection. In urban contexts, biodiversity can be understood in terms of response diversity—a diversity of species and ecosystems collectively supporting specific functions (such as precipitation interception of urban trees) but which respond differently to changes and disturbances. Biodiversity directly supports ecosystem services and processes, which supports its inclusion in any resilience argument (Ahern 2011). Biodiversity can also be understood through a social lens, as a socially diverse city can support social services and cultural programs that help it remain vibrant, equitable, and attractive to outsiders and investors (Ahern 2011).

The second strategy is building urban ecological networks and managing connectivity. While urban connectivity is well-developed for functions such as transportation and communication, connectivity of landscape and ecosystem services is less prevalent. As a guiding principle of connectivity in urban contexts, spatial organization of ecosystem services such as supporting pedestrian transportation and stabilizing urban hydrology has the potential to support urban resilience goals. Exemplified by multifunctional networks such as greenways and ecological corridors, connectivity is achieved through the combination of social and ecological goals.

Third, in the context of urban resilience, multifunctionality involves deliberately providing multiple ecosystem services in the inherently limited space of an urban environment. One common means is "spatial stacking", where functions are efficiently organized to operate within the same space. Another is "time shifting" where spatial uses are organized based on the time of day. An added benefit of such approaches is the ability to garner significant public support from a diverse range of stakeholders. A common example of multifunctionality in the landscape are stormwater wetlands which process and clean highway runoff as well as function as habitat.

Fourth, build redundancy and practice modularization. Redundancy and modularization are ecological strategies which spread risk, in contrast to the primary modern development paradigm of centralization, efficiency, streamlining, and redundancy elimination. By definition these are not safe-to-fail systems and catastrophic consequences follow when they inevitably do (for instance the levees during Hurricane Katrina). Therefore, resilience theory suggests a modular approach composed of redundant, decentralized elements which minimize and contain system failures. Landscape-based stormwater systems, which capture, store, and infiltrate rainwater locally are an example of compartmentalized solutions which contribute to hydrological and water quality benefits, as well as reducing load on combined sewer systems.

Fifth, practice adaptive design and implement “safe-to-fail” design experiments. Since landscape design is inherently location-specific, that uniqueness of place also may limit the transferability of innovations developed in one location to another in different circumstances. With a lack of time and an imperative to act, this limits location-specific research and contributes to conservative, status quo-preserving design solutions and a lack of innovation. Adaptive design calls for a different professional strategy which factors in uncertainty and incomplete knowledge. By framing proposals as hypotheses, designs function as experiments to test them. However, this still presents a risk of failure and therefore a reinforcement of status quo solutions. “Safe-to-fail” design experiments which incorporate performance monitoring and testing are scaled down to minimize risk of failure while still providing important insights which can advance professional knowledge in conjunction with development and construction (Ahern 2013).

Meerow et. al argue that the conceptual fuzziness and lack of clarity around the definition of resilience enable it to function as a “boundary object,” a common object or concept that transcends disciplines and can foster collaboration. While providing their own contribution to ongoing debate about resilience, they also identify common perspectives and their potential shortcomings. They argue that there are five key conceptual tensions within resilience discourse: (1) equilibrium vs. non-equilibrium resilience; (2) positive vs. negative conceptualizations; (3)

mechanism of system change; (4) adaptation vs. general adaptability; and (5) timescale of action. A sixth tension deals specifically with how "urban" is defined and characterized. Resilience, in their view, "refers to the ability of an urban system—and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales—to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future capacity" (Meerow et. al 2016).

Socio-ecological resilience theory understands systems as constantly changing in nonlinear ways, meaning it is highly relevant approach for dealing with future climate uncertainties. Within the socio-ecological systems (SES) framework, resilience is defined as "the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks". Multiple-state equilibrium embraced by the SES framework suggests that systems possess different stable states, and when disturbed may "tip" from one to another. Crucially, this perspective marks a departure from so-called "engineering" resilience, which emphasizes a steady state of equilibrium to which a system reverts after disturbance (Meerow et. al 2016).

While resilience is almost uniformly presented as a desirable goal, some research indicates potential problems concerning who benefits and who loses in certain resilience scenarios, as well as the possibility of non-desirable outcomes being quite resilient. For instance, fossil fuel dependence and poverty are highly undesirable yet very resilient states (Meerow et. al 2016). Additionally, the authors point to social theory questioning whose resilience is prioritized in the case of politics and power inequalities. In an attempt to inject equity and contextualism into the resilience framework, Meerow et. al suggest that designers acknowledge the variable nature of resilience, which often necessitates tradeoffs. Furthermore, designers should also always consider who is defining the resilience agenda and for whom, to ensure that those in power are not prioritizing one group's idea of resilience at the expense of another (Meerow et. al 2016).

Neuman states that resilience is an "inherent property of nature, both of living beings and ecosystems." However, simply acknowledging this fact and attempting to replicate inherent resilience in designed systems can be problematic. In Neuman's view, in the face of neoliberalism, climate change, and widespread environmental degradation, a nuanced understanding and application of resilience is needed. He states that, while much positive change has been effected, the incremental nature of these changes in the face of the driving forces of society mean aggregate progress towards resilient goals has been marginal (Neuman 2019).

Neuman argues that, while the sustainability of political, institutional, and economic paradigms becomes more questionable, resilience—as a new metaphor for achieving sustainability—may in fact be a hindrance to society's efforts to be more sustainable. Due to the inherent unsustainability of systems of governance, markets, and politics, resilience may not be the most appropriate response for many institutions—especially if those institutions are responsible for creating the problems in the first place. While the largest and most powerful institutions are now increasingly deemed "too big to fail", this precludes learning and adaptation—two key tenets of resilience theory. Instead of artificially supporting non-resilient systems, they should be dismantled and redesigned with the ideas of learning, self-organization, and adaptive capacity (Neuman 2019).

In 1973, ecologist C.S. Holling first elucidated the most basic and formative definition of resilience which, coupled with the ideas of dynamic multiple stable state equilibrium formed the basis of contemporary socio-ecological resilience theory. Whereas sustainability is predominantly identified with an equilibrium view of nature and culture, resilience embraces the inherent unpredictability of systems. Many competing and complementary definitions of resilience have been put forward, all of which contribute significantly to the goal of supporting urban resilience. While the predominant socio-ecological resilience framework, augmented with an emphasis on "safe-to-fail" adaptive design, addresses many issues associated with earlier, less fluid engineering definitions, it still leaves much to be desired. Addressing the subjective nature of resilience which can contribute to power and decision-making inequalities, Meerow et. al suggest that designers must confront the issue of community perspective. The designer must ask "for whom do we design?" and "which perspectives and needs are being included or excluded?" Neuman argues that resilience should always be questioned, and that many existing systems are quite resilient and yet not beneficial, and should in fact be dismantled and redesigned.

2.4 Justification for Appropriateness of Resilience Concepts to Small-Scale Resilient Landscape

However, it is the author's opinion that due to an understandable focus on urban systems, all fail to acknowledge the reality that much actual landscape design is done piecemeal, on small sites, with little to no coordination between design firms, planning entities, and stakeholders. Therefore, there is great potential in formulating an idea of resilience better suited to small-scale projects that allows them to be more than simply lip-service to the concept of resilience.

Resilience is typically conceptualized at larger scales, often with “urban” resilience being the smallest unit possible to consider (Meerow et. al 2016). Operating within a political or municipal framework which does not provide overarching resilience guidelines, small-scale landscape sites suffer from a lack of actionable, applicable resilience metrics or attributes which designers can target. Ultimately, an aggregation of independently conceived small-scale sites designed with resilient landscape design principles may function as a whole to contribute to greater urban or regional resilience.

The nature of land development (i.e. fear of economic risk, political pushback, the piecemeal nature of property ownership) in urban areas is such that in many municipalities there are significant difficulties initiating and accomplishing necessary resilience projects at the scales often required, even when urban planning policies are in place to promote resilience (Ahern 2013). It is my opinion that small-scale resilient landscape design has just as much to offer as large-scale resilient design, and to exclude approaches to small-scale site design in research and practice is both wasteful and impractical. While small-scale sites obviously have limitations as far as the scale of potential problems and associated responses, this does not mean that they should be limited in terms of applying resilience innovation, concepts, and metrics in the design process. Small-scale sites approached with resilient landscape design principles have the potential to contribute to overall community resilience.

2.5 Synthesized Hybrid Small-Scale Resilience Definition

Small-scale resilience is the capacity of a site to support large-scale resilience goals through consideration and application of eight resilience dimensions which are: biological and social diversity, multifunctionality, redundancy, flexibility, adaptability, connectivity, inclusivity, and historic-cultural significance incorporation.

2.6 Summary of Key Dimensions of Resilience

The following eight resilience dimensions form the resilience metrics on which the subsequent case study analysis is based. Case studies are assessed based on how they perform in terms of each resilience dimension, including specific site features and programmatic elements that contribute to that dimension. It is understood and expected that there is necessarily some overlap between dimensions. Furthermore, it is understood that resilience may be an incidental by-product of certain design approaches but that this does not detract from their performance or degree of applicability.

1) Biological and social diversity: Biological and social diversity contribute to response diversity which increases the likelihood of important functions persisting through disturbances. Biological diversity should be supported through incorporation of sustainable, low impact development principles as well as ecologically sound planting design and bio-physical systems such as bio-swales and permeable paving. Social diversity should be supported by providing programming and physical space dedicated to community events and shared experiences.

2) Multifunctionality: Sustainable ecosystem service provision and site programming should be accomplished through the intertwining of functions in space and across time using methods such as “spatial stacking” and “time-shifting”.
3) Modularity/ Redundancy: Risk spreading should be accomplished through modularity of functions and site-contained design solutions which serve to decentralize and/or provide backup to larger system processes.
4) Flexibility: Physical design and associated programming should be inherently flexible to account for a variety of intended and unintended uses which may change over time in response to disturbances.
5) Adaptability: Can be operationalized through the application of adaptive design, as well as “safe-to-fail” experiments (Ahern 2011). Building on the well-established concept of adaptive management, which establishes a means for testing, learning, and improving on designs as a way of reducing uncertainty, safe-to-fail experiments avoid the intellectually stifling political and economic risks often associated with experimental design approaches (Ahern 2013).
6) Connectivity: Building urban ecological networks and anthropocentric physical connectivity contributes to both ecosystem services as well as ecological robustness. As a guiding principle of connectivity in urban contexts, spatial organization of ecosystem services such as supporting pedestrian transportation and stabilizing urban hydrology has the potential to support urban resilience goals. Exemplified by multifunctional networks such as greenways and ecological corridors, connectivity is achieved through the combination of social and ecological goals.

7) Inclusivity: may be realized through the incorporation of diverse perspectives and community-driven resilience priority goals. In design situations which preclude community involvement, the designer attempts to incorporate perspectives other than their own, and consider critical questions such as: for whom, to what, at what cost, and why? Additionally, the designer should attempt to prevent exclusionary physical design or programming interventions.

8) Historic-cultural significance incorporation: involves the incorporation, preservation, reuse, or reinterpretation of both historically and culturally relevant physical structures, spaces, stories, and/or landscapes into the design. These elements are important in that cultural and historical narratives are shared among people and form the basis of human understanding and interaction, and these elements are an embodiment of those narratives. A community with a more thorough understanding and appreciation of shared history and culture possesses a greater ability to respond positively to disturbances, thus contributing to resilience. Eliminating them from the design essentially erases them from history, while maintaining, preserving, or creatively reinterpreting them signals an ongoing understanding and dialog with those narratives.

CHAPTER 3

CASE STUDIES

3.1 Case Study Resilience Assessment

Case study sites have been individually evaluated based on the eight (8) resilience dimensions to determine overall resilience of the site design. Because resilience is inherently open-ended and difficult to quantify, as well as context-dependent, a ranking system is inappropriate for these assessments. Additionally, for the purpose of drawing qualitative conclusions as a designer which I will apply to my project site, qualitative evaluation of these case studies is appropriate. Therefore, a thorough and consistent assessment of case study resilience through the lens of each resilience dimension is offered.

3.2 Case Study Selection Criteria and Methods of Analysis

Case studies were selected based on the following criteria:

- Location: along rivers or streams in North America and Europe
- Age: less than 40 years old
- Project size: small-scale, defined as less than 30 acres of active designed space (excluding acreage to which landscape design solutions are not applicable—for instance, water bodies)
- Overall landscape typology: small-scale derelict post-industrial landscape redevelopment projects in urban areas near rivers or streams

- Methods of analysis: site analysis; historical analysis; design process analysis; archival materials (news articles, public records); bibliographic and internet searches

Numerous case study sites were evaluated to determine which fit these criteria the best. Potential case study sites which did not possess a significant degree of landscape design involvement were not considered useful to generate relevant landscape design assessments. Therefore, sites which were approached primarily from the perspective of conventional commercial building adaptive reuse were not considered, as this thesis approached redevelopment explicitly from a landscape design perspective. Additionally, for the purposes of generating diverse assessments, case study sites needed to possess a significant range of design approaches.

3.3 Case Study I

Part I

Project Name: Bethlehem SteelStacks Arts + Cultural Campus

Location: Bethlehem, Pennsylvania

Date designed/planned: 2009-2013

Construction completed: 2015

Cost: approximately $70 million (Steelstacks, n.d.)

Size: 9.5 acres

Landscape architects/designers: Wallace Roberts & Todd (WRT)

Client: Bethlehem Redevelopment Authority

Consultants: Boyle Construction (construction), Levan Associates (fabrication and erection), Simpson Gumpertz & Heger, Maser Consulting (structural), HDR (civil), Lehigh Valley Engineering, Inc. (MEP), L'Observatoire International (lighting), Local Project, Bluecadet (historic interpretation), Patrick Cullina (horticulture) (Brezar, Babič, and Gligić 2017).

Part II

Context: Located in the heart of the Rust Belt, and situated along the Lehigh River in Bethlehem, Pennsylvania, Bethlehem SteelStacks is a former steel manufacturing plant which has been converted into a public park (Figure 2). For nearly a century the plant served as the economic lifeblood of Lehigh Valley, employing tens of thousands of people while supplying steel that helped build skyscrapers, bridges, and even the U.S. Navy. Rather than demolishing the mill or letting it fall into disrepair, however, the community rallied around it, leading to the creation of a TIF (tax increment financing) district on the property.

Figure 2: View of park with Levitt Amphitheater in the foreground during a performance (Jeffrey Totaro)

Project background & history: Founded in Pennsylvania's Lehigh Valley in 1857, Bethlehem Steel Corporation would eventually occupy 1,800 acres along the Lehigh River. In 1995, they closed this plant, which seemingly brought to an end a long history that shaped the culture of this area (Wallace, Roberts and Todd, n.d.). Bethlehem Steel was a 20th century industrial powerhouse, at one point operating seven blast furnaces producing over 3,000 tons of iron per day. (SteelStacks, n.d.). Of those seven, the five oldest remain standing at twenty stories tall (ASLA 2017).

Part III

Genesis of project: In an effort to revitalize the site for future uses, the Bethlehem Redevelopment Authority in conjunction with the nonprofit ArtsQuest and the City of Bethlehem (SteelStacks, n.d.) established Bethlehem Works, a 126-acre 20-year tax incremental finance district in 2000, which led to the development of new industrial parks and transportation facilities on large sites at the eastern end of the former plant, and the 9.5 acre SteelStacks Arts + Cultural Campus which now occupies the western end, adjacent to the city's South Side neighborhood (Wallace, Roberts and Todd, n.d.).

Design, development, and decision-making process: The SteelStacks campus sits within Bethlehem Works, a 126-acre parcel which is part of the largest brownfield in the U.S. The overriding design intent focused on capturing the overwhelming scale and mass of the monumental blast furnaces, creating a backdrop for year-round festivals, art, and music events. A critical component of the site design is the lighting, which was intentionally created to help the site transform from daytime to evening experiences (Figure 3). At night the furnaces are spotlighted with a colored lighting system that highlights their scale. Working within the existing fabric of this abandoned site, the design team sought to selectively transform key elements in order to create new perspectives and emphasize certain experiences (ASLA 2017). Contaminated soils on site, which could not be disturbed or penetrated, presented a number of design challenges. In an effort to increase pervious surfaces, extensive areas of existing building foundations were removed, which served to minimize stormwater runoff. To address the site's lack of biodiversity and biomass, extensive plantings were implemented, and a low level of illumination was proposed as a means of minimizing energy consumption (Wallace, Roberts and Todd, n.d.). A key functional transformation involved creating space for the Levitt amphitheater along the axis of the main entry from town. To accomplish this, the roadway was curved (Figure 4)—creating a unique circulation experience and emphasizing a sense of arrival as the curve coincides with the blast furnaces (ASLA 2017).

Figure 3: Lighting is a key design element (Christenson Photography)

Materially, the designers settled on a combination of self-rusting and galvanized steel, dark pavers, granite, concrete and molten-like bonded aggregate to echo and reinforce the site's rugged industrial spirit. Since summer heat is a primary concern, shade trees were located at the entry court, picnic, and play areas.

The pedestrian promenade, named the Hoover-Mason Trestle, allows visitors the opportunity to experience an entirely new vantage point, framing choreographed views outwards towards historically and culturally important items (Figure 5). This steel promenade was designed to float over the existing structure, and is meant to weather to blend in with the existing structure over time while also being visually distinct—juxtaposing the old and the new. All new planters and surfaces are supported by a new external steel structure that attaches at the existing railroad tracks—with plantings softening the harshness of the existing structure. The planters were laid out to frame the existing trees on the trestle structure (Figure 6), and were augmented with a highly seasonable native plant selection to provide year-round interest and structure (ASLA 2017).

Figure 4: Before and after showing new road curve (Google Earth; Christenson Photography)

Figure 5: Hoover-Mason Trestle (Halkin Mason Photography)

Figure 6: Plantings to soften the hard structural lines (Halkin Mason Photography)

Role of Landscape Architects: WRT functioned as prime consultants for this project, guiding the park vision. In this role, they managed a multidisciplinary team of consultants including artists, lighting designers, graphic designers, engineers and soil remediation specialists (ASLA 2017).

Program Elements: Socially, the project has engaged and strengthened the local community, contributing to the ongoing growth and success of local arts and cultural organizations, and allowing them to significantly expand their offerings. The park functions as a "town green" and provides flexible space for future uses that will contribute to regional development goals that will bring new urban life to the heart of Bethlehem in support of regional development initiatives (Wallace, Roberts and Todd, n.d.).

Diverse, flexible, and active program elements include an entry court facing the Bethlehem Visitor Center for gathering and orientation (Figure 7); flex spaces for smaller performances and overflow events; a reading and theater space; public art integration; family-friendly picnic and play area; an elevated pedestrian promenade allowing visitors to experience the industrial archaeology of the site, following the same path along which raw materials to produce steel were delivered (Figure 8); interpretative signage and wayfinding including an interactive digital app (Figure 9); and an outdoor amphitheater hosting over 50 concerts every summer (ASLA 2017).

Figure 7: Performance space (Paul Warchol)

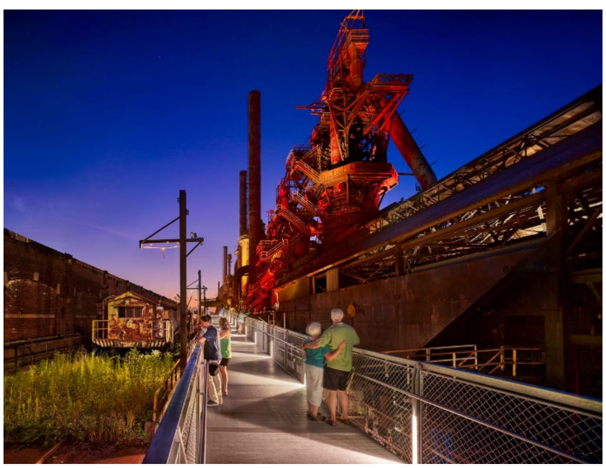

Figure 8: Walkway following original path of raw materials (Halkin Mason Photography)

Figure 9: Interpretive signage (Bluecadet)

Maintenance & Management: Newly established campus nonprofits (including Friends of Levitt Pavilion SteelStacks and Penn State Master Gardeners) and local tourism organizations provide landscape maintenance, funding, and support services to visitors (Wallace, Roberts and Todd, n.d.).

<u>Part IV</u>

Peer reviews: "A very successful project that fits in with the industrial past, not blowing it away but actually playing off it." 2017 Awards Jury (ASLA 2017).

WRT was also awarded the 35th annual Urban Land Institute (ULI) Global Awards for Excellence, recognized as a prestigious real estate development industry honor. Tony Hanna, the Executive Director of the Redevelopment Authority of the City of Bethlehem, called SteelStacks "an excellent example of how communities can work together to find creative solutions for reusing abandoned industrial sites and brownfields" (Business Wire 2014).

Significance and uniqueness of project: Bethlehem SteelStacks represents a new landscape typology for small post-industrial cities and a means of leveraging the authenticity of these abandoned sites to rediscover economic and social value. The adjacent campus uses and tenants are benefiting from the project's success, suggesting the potential for similar projects to spur and sustain economic growth and contributing to the vitality of the neighborhood and Lehigh Valley region. After decades of economic disinvestment following the closure of this iconic plant, this design provides an important positive link to the site, which both educates and creates a sense of community for locals and visitors while respecting the embedded history of the place (Wallace, Roberts and Todd, n.d.). Furthermore, while the reinvigorated and repurposed site attracts new visitors, it also allows former Bethlehem Steel employees and their families to once again inhabit the site (ASLA 2017).

Future issues and plans: Officially opening in 2011, the scope and function of the campus is an ongoing additive and transformative process. Currently three phases (Figure 10) have been completed (ASLA 2017).

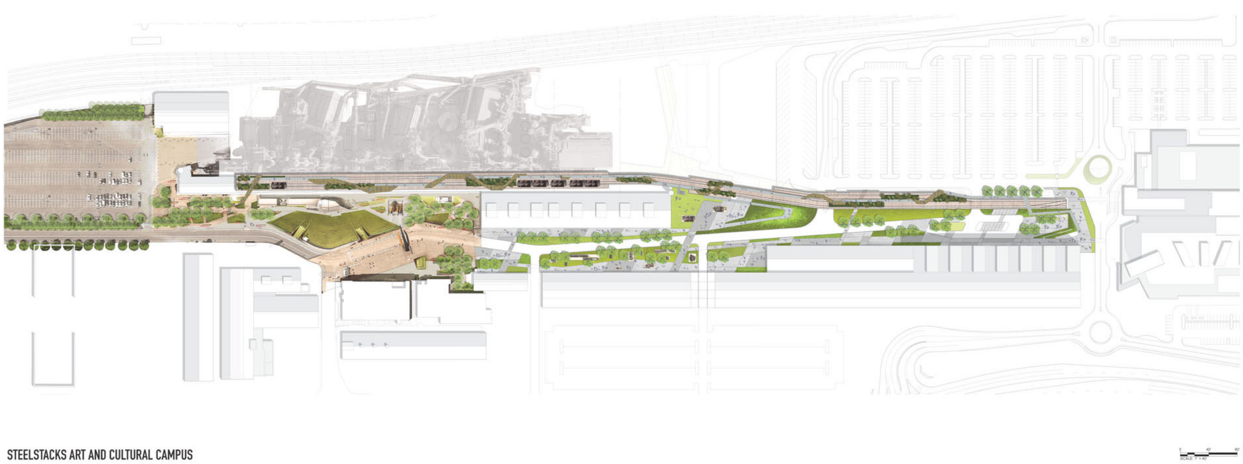

Figure 10: Site plan showing completed phases (WRT)

3.4 Case Study II

Part I

Project Name: West Point Foundry Preserve

Location: Village of Cold Spring, New York

Date designed/planned: 2006-2013

Construction completed: 2013

Cost: $3.5 million

Size: 87 acres (approximately 30 acres of active designed space)

Landscape architects/designers: Mathews Nielsen Landscape Architects (MNLA)

Client: Scenic Hudson, Inc.

Consultants: GHD Consulting Engineers (engineering), Li/Saltzman Architects and Liam O'Hanlon Engineering (historic stabilization), C&G Partners (exhibit and interpretive design), Badey and Watson Surveying and Engineering (survey), Frederick P. Clark Associates (traffic), Hartgen Archaeological Associates (archaeological monitoring), Slocum Consulting (estimator), Ecosystems Strategies (environmental), Putnam History Museum (historic images)

Part II

Context: West Point Foundry Preserve is the site of a former 19th-century foundry located in the Village of Cold Spring, New York. The project occupies 87 acres of a forested valley which opens up to the Hudson River (Mathews Nielsen Landscape Architects n.d.). The foundry is on the National Register of Historic Places (DuRussel 2014).

Project background & history: (Reut 2015) Created at the request of President James Madison to address national armaments production following the War of 1812, the foundry was in operation between 1817 and 1911, reaching a peak during the Civil War and going on to contribute heavily to the American Industrial Revolution (Holmes 2012). Producing cannons during the Civil War, the West Point Foundry continued to produce metal furniture, water pipes, and other equipment after demand for cannons disappeared. The invention of the Bessemer process for cheaply producing steel, however, would be the beginning of the end for the foundry. In time, nearly all the structures collapsed or were demolished, leaving only one original structure still standing—a two-story Victorian brick office building (Soodalter 2014).
The foundry site never became a state park or preserve, and so although it had seen human activity for centuries, its character was more a result of accumulation than of intention or design. A successional forest laced with volunteer trails, the site's history had largely begun to disappear (Reut 2015).

Part III

Genesis of project: The Scenic Hudson Land Trust sought out MNLA to transform this 19th and early 20th century post-industrial site into a park, revealing its industrial and ecological history (Holmes 2012) (Figure 11). The site's marsh served as a dumping ground for toxic metals for years, but in the 1990s it underwent a huge Superfund cleanup (Soodalter 2014), which required the excavation and disposal of 189,000 tons of contaminated material between 1988 and 1992 (Reut 2015).

Design, development, and decision-making process: MNLA aspired to stimulate both the mind and the senses by educating visitors on the foundry's industrial significance as well as revealing the area's rich ecological bounty (Figure 12).

Figure 11: Site plan showing circulation (MNLA)

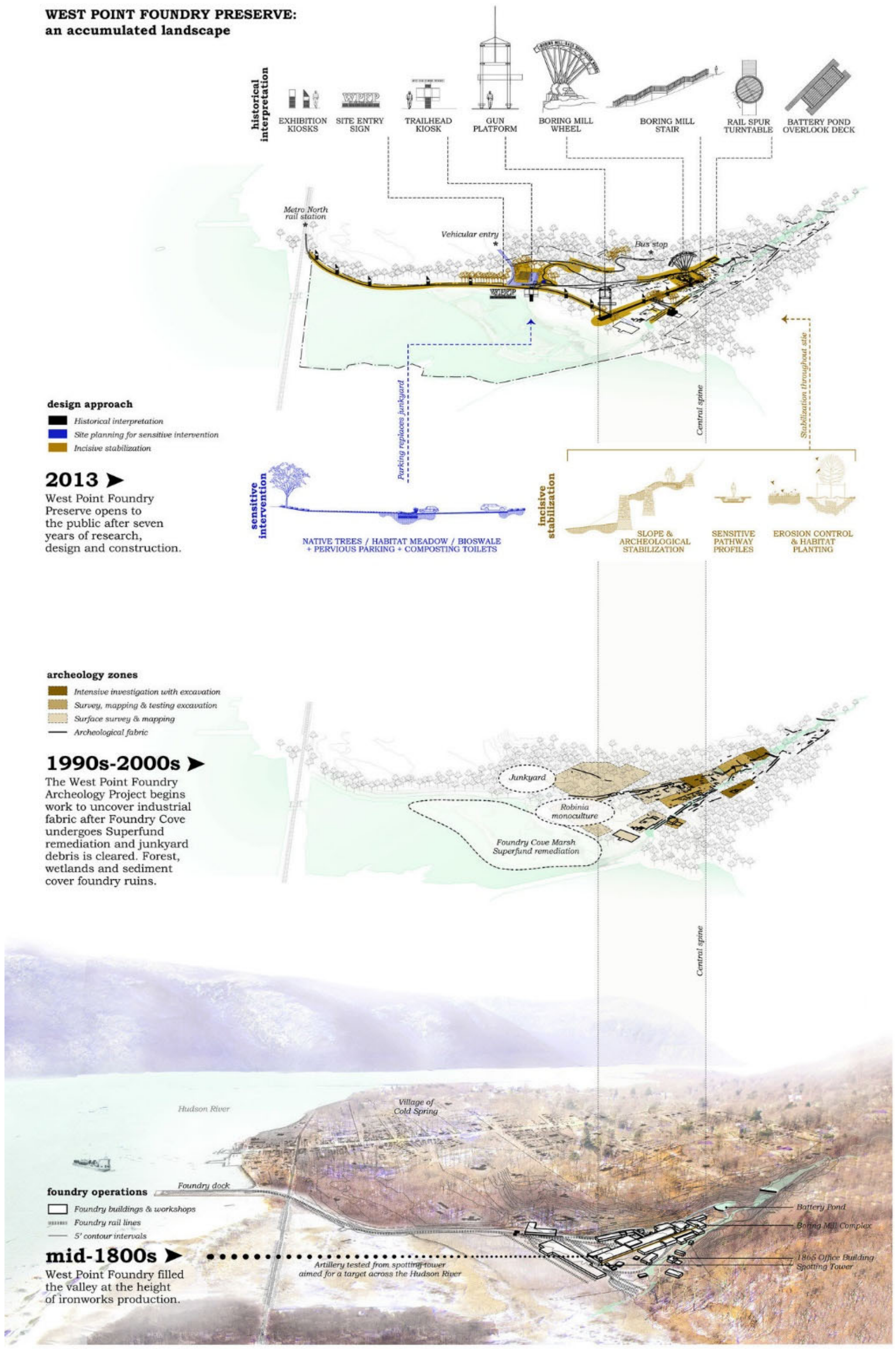

Figure 12: Design process showing site evolution (MNLA)

Working closely with an archaeological research team from Michigan Technological University's Industrial History and Archaeology program, the designers developed a sustainable plan over eight years of site research. (Holmes 2012). The archaeological research unearthed over 145,000 foundry-related artifacts while cataloging the footprints of its 15 or so buildings (Figure 13).

Figure 13: Archaeological artifacts (MNLA)

MNLA worked with New York's State Historic Preservation Office to develop a plan to stabilize many of the ruins and to sensitively enable visitor access. In an effort to avoid the site becoming a theme park, interpretive elements were created with the intention of recalling the past, not re-creating it (Davis 2017). On the holistic and interdisciplinary approach they took to site design, MNLA Principal Kim Mathews stated that "as leaders of a team that includes wetland scientists, preservation architects, archaeologists, exhibit designers, and engineers, our vision for this project is to convey not only the scale of the immense foundry and its workings, but to bring the sights, sounds and stories of the historic Village of Cold Springs to life" (Holmes 2012).

The project utilizes and respects the property's inherent natural beauty, as well as historic paths and rail lines which connect the foundry structures. Interpretive displays illuminate the foundry's role in the Civil War, as well as its contribution to the Industrial Revolution (Figure 14). The foundry's cove showcases a remarkable variety and abundance of wildlife, which is described in educational exhibits highlighting the ecological renewal of the preserve's marsh. Viewing the property as an accumulation of layers of history and natural processes, design interventions create an active and informational park experience. (Mathews Nielsen Landscape Architects n.d.).

Water is an integral part of the site today, just as it was historically. Both the sound and story of water play an important role in the park experience (Mathews Nielsen Landscape Architects n.d.). Foundry Brook, which powered the foundry, flows into the site, which sits predominantly within the Hudson River's floodplain. This presented a design challenge to make the park accessible and tolerant of floods. This requirement informed the plant selection in terms of erosion control and restoration (Reut 2015).

Role of Landscape Architects: Primary designer

Program Elements: To minimize impact on the land, the park trails follow the original rail route through the site (Davis 2017) In an effort to create a walking narrative among site ruins, interpretive signage is placed near important sites along the path (Fazzare 2013) (Figure 15). In an homage to the past, the newly designed West Point Foundry Preserve logo plays off the original foundry stamp (Reut 2015). Interpretive stations sit unobtrusively atop gabion structures designed to be filled loosely with salvaged bricks from the site—a simple way of incorporating fragmented materials from the site without attempting to reproduce or reconstruct it (Reut 2015) (Figure 16).

Figure 14: Path along old rail line (MNLA)

Figure 15:Signage at important sites (MNLA)

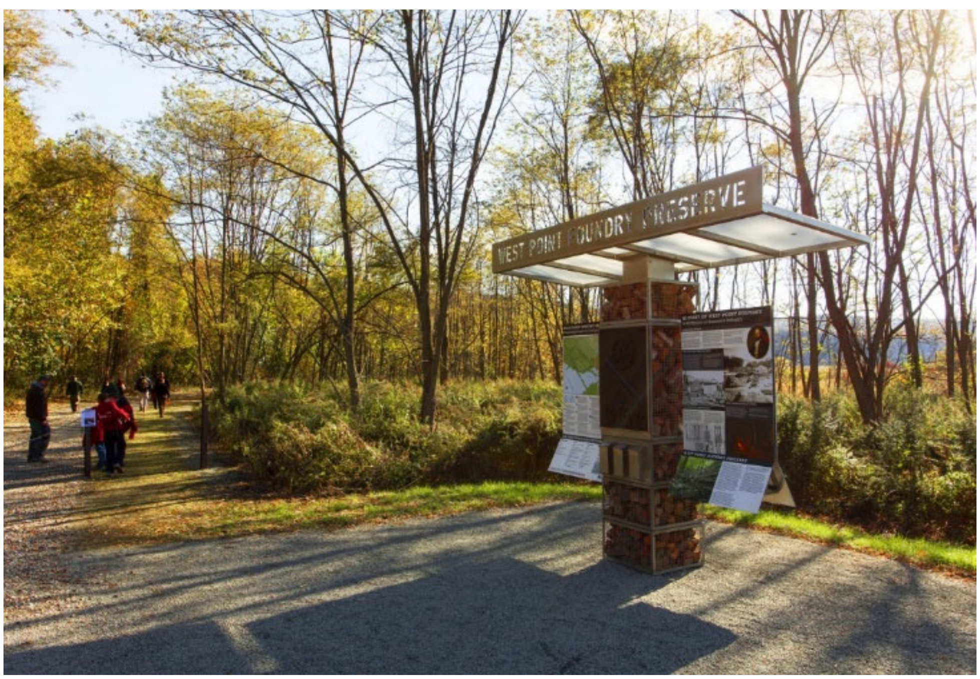

Figure 16: Gabion structure filled with bricks recovered on site (MNLA)

The site's planting is understated—meant primarily to augment what was already in place, relying more on careful edits than wholesale changes. In highly eroded or disturbed areas, planting was more intensive, primarily with native species. Begun as a pilot for the Sustainable Sites Initiative in 2014, this project received certification in 2014 (Reut 2015).

Platforms and decks create moments of intentional pause, marking important ruins or objects of significance. MNLA also designed three new sculptural structures, including a 33-foot-high gun platform approximating the sighting tower used to test cannons produced by the foundry in its heyday, as well as an interpretive water wheel sculpture (Figures 17 & 18). A new stair leading to a ridge above the site was used as an opportunity to insert text and images alluding to the use of water on site (Reut 2015) (Figure 19). While much of the site's circulatory design was dictated by the existing historical fabric, considerations about amenities and connections to regional pedestrian, cycling, and car infrastructure meant that practical necessities such as parking were located on areas most recently disturbed, such as a cleared junkyard (Reut 2015).

Maintenance & Management: The property is now owned and maintained by the non-profit Scenic Hudson.

Figure 17: Sculptural homage to cannon platform (MNLA)

Figure 18: Sculptural water wheel recreation (MNLA)

Figure 19: New stair with descriptive signage (MNLA)

Part IV

Peer reviews: This project is a recipient of multiple awards, including the John Augustus Roebling Award for Contributions to Industrial Archaeology (Mathews Nielsen Landscape Architects n.d.).

Significance and uniqueness of project: The design addressed the complexity of revealing industrial archaeology while also negotiating public access to this sensitive historical and ecological landscape.

With the goal of heightening experiential possibilities on the site, MNLA turned to digital technology to communicate in an innovative way. While much of the site's industrial history is still buried below floodplain soils, the design sought to turn the foundry into an outdoor museum featuring interpretive elements. One conventional means of communicating information to visitors is signage placed along the park trails, but it is also paired with a mobile application providing an audiovisual tour of the site, including a digital representation of the site's machine shop. Linked to each interpretive element is a component allowing visitors to explore the site's ecological beauty in person, while also experiencing its cultural history through historic maps, photographs, and oral histories. The rebuilt water wheel sculpture is connected to the mobile application, allowing visitors to hear the sound of the trickling stream used to power the foundry (DuRussel 2014).

Future issues and plans: While archaeological research is ongoing, there is still much that is unknown and left to discover, dependent primarily on funding (Reut 2015).

3.5 Case Study III

Part I

Project Name: Saint Ouen-Park of the Docks

Location: Paris, France

Date designed/planned: 2010

Construction completed: 2013

Cost: approximately $33 million

Size: 29.7 acres

Landscape architects/designers: Agence Ter

Client: Sequano Amenagement

Consultants: BERIM (engineering and cost), Coup d'Eclat (lighting), Biotope (ecological), ISL (geo-engineering), Phytorestore (hydraulic and pond ecology), Skatepark Service Conseil, Razel (main construction) (Barbra 2017).

Part II

Context: Park of the Docks is part of the Integrated Development Zone, which is a 247-acre area on the banks of the Seine. The park is located on the edge of Saint Ouen's historical center, at the gates of Paris. Saint Ouen is a former monofunctional industrial area, home to extensive docks. It is now converted to an extensive open space on the banks of the Seine. A complex urban context, Saint Ouen is rapidly changing from a predominantly industrial past (Brezar, Babič, and Gligić 2017).

Project background & history: Saint-Ouen is a northern industrial suburb of Paris, bounded on the northwest by the Seine River, along which are vast docks. (The Editors of Encyclopedia Brittanica 2017). Beginning with the opening of a water station on May 25th, 1830, the industrial heritage of Saint-Ouen is extensive and deeply embedded in the neighborhood. Located at the gates of Paris along the Seine River, the water station allowed boats to avoid numerous bridges and became a strategic place for Paris' early industrialists to establish warehouses and industries. Furthermore, the docks established at Saint-Ouen allowed for the efficient connection of river and rail transportation networks, and the Saint-Ouen Docks became an important metalworking location, persisting into the mid-20th century (Seine-Saint-Denis Tourisme, n.d.).

Park of the Docks is a part of a larger urban renewal goal to develop an ecological neighborhood in this area of Paris which has seen significant decline in industrial use and neighborhood quality of life (Brezar, Babič, and Gligić 2017). In addition to the establishment of the new Park of the Docks, the area has seen investment in housing, retail, and schools to create an "eco-quarter" (Seine-Saint-Denis Tourisme, n.d.).

Part III

Genesis of project: Park of the Docks is a regeneration of an industrial dock site, with the explicit goal of sustainably developing and reinvigorating the area around the new urban park to reduce the negative impact on the area's ecosystems (Moshrefzadeh 2017). The objective was to create an inclusive and democratic space that would welcome both local residents as well as visitors. An overall theme of water and connection to water was emphasized throughout the project.

Specifically, it highlights how the park collects and treats rainwater in relation to the Seine, the region's largest waterway.

Design, development, and decision-making process: It is imagined as alternating hollow and solid forms, leading to the formation of two distinct types of place: spaces for natural processes and gardens for public use. This creates an interplay between accessible and visible natural processes, which gives structure to the park. Planted areas including meadows and swales accommodate rainwater during storms (Figure 20). The designers intended to create different forms of contrasting experience and atmosphere, seen in the interplay between exposed and shaded areas, quiet versus busy and active spaces, and expansive views versus distinct framed vistas. This is seen in a sequence of compositions and orientations of elements in the park landscape.

Functionally, the park emphasizes collection and treatment of rainwater. Swales, small "valleys", ponds and large sunken depressions gather both rainwater and highway runoff before it is allowed to enter the Seine. The park performs as a hydrologic system, in essence a huge reservoir filtering and slowing down water—much of which is used to provide irrigation for on-site plantings (Figure 21). Additionally, a wide range of fauna are supported by the different rain gardens, including frogs, tritons, dragonflies, and other birds and insects.

Figure 20: Vegetated bioswale for treating and storing stormwater runoff (Agence Ter)

Figure 21: Aerial rendering showing stormwater storage before entering the Seine River (Agence Ter)

Role of Landscape Architects: Agence Ter functioned as lead consultants on this project, with the mission of design and execution of the park.

Program Elements: Park of the Docks is home to diverse programmatic elements and structures. First, an educational greenhouse (1400 m^2) is linked to the allotment gardens (5000 m^2). The greenhouse contains meeting spaces, a kitchen, a large experimentation and event space and gardening supplies. It serves as a focal point for many of the park functions and programs (Brezar, Babič, and Gligić 2017). Gardeners, local associations, the general public, and schools use the greenhouse (Figure 22). Educational and cultural opportunities are provided by an apiary, as well as an open kitchen and exhibition space (Seine-Saint-Denis Tourisme, n.d.). Second, allotment gardens—which were in place before the development of the project and maintained as a part of the new project—allow for local cultivation of food (Figure 23). Further diverse uses are seen in a skatepark on one edge of the park which is linked to a multifunctional outdoor amphitheater. Lastly, three playground areas located on different parts of the park were designed for multiple age groups, making use of the topography and context of the site.

The different spatial and temporal scales of the park and surrounding historic area are linked by a wide plaza with a pervious gravel surface, providing an overview of the park as well as a defined entrance (Figure 24). Park of the Docks demonstrates how performance landscapes built upon natural systems like water filtration and storage can be combined with an active park in an urban area, becoming a destination and focal point of the neighborhood as well as providing important hydrological and ecological benefits (Brezar, Babič, and Gligić 2017).

Figure 22: Greenhouse for propagation and educational activities (Agence Ter)

Figure 23: Allotment gardens (Agence Ter)

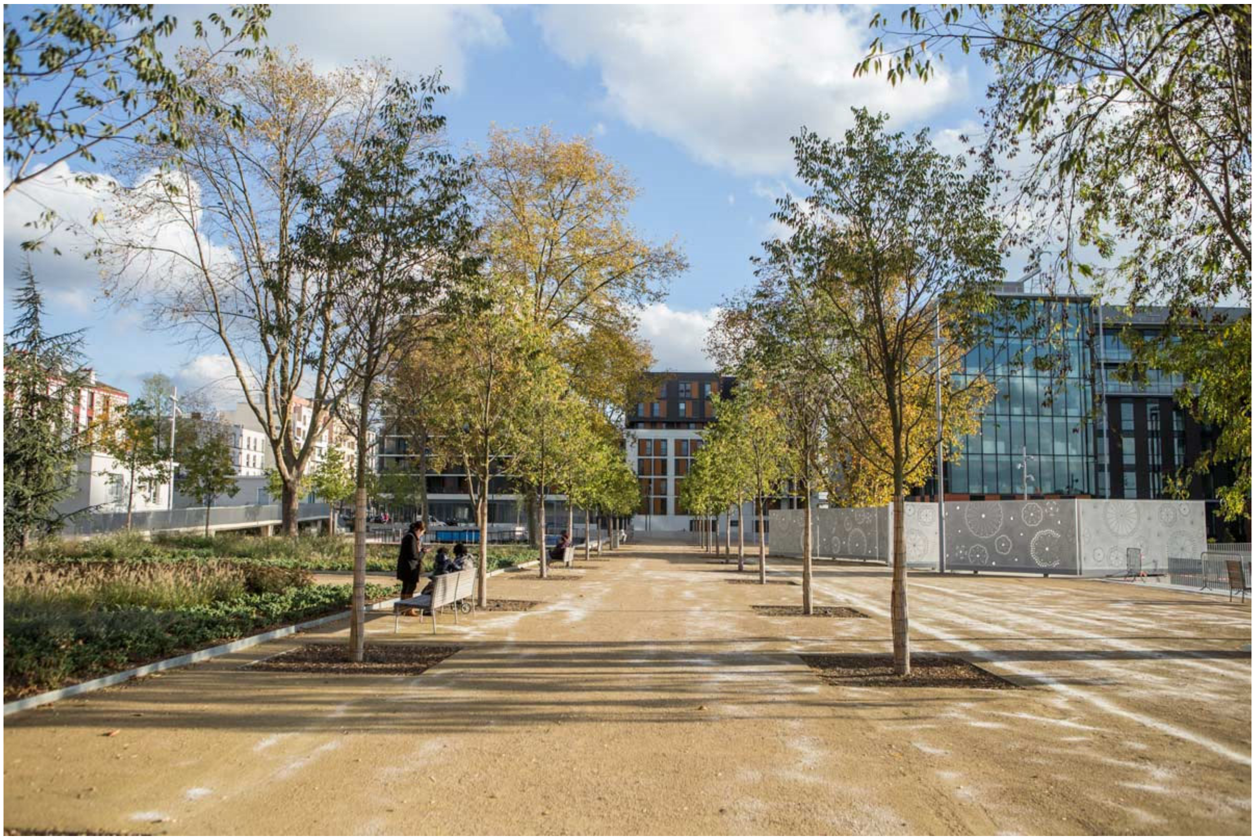

Figure 24: Large open plaza with pervious gravel surface (Agence Ter)

Part IV

Peer reviews: Park of the Docks is the winner of the 2017 Landezine International Landscape Award. The LILA jury highlighted the project's solutions concerning water resilience and social equity. Specifically, Agence Ter succeeded in designing a multifunctional and inclusive social space, offering various uses to different age and demographic groups. In functional landscape terms, it also succeeds as a water filtration and detention system (Brezar, Babič, and Gligić 2017).

Significance and uniqueness of project: Park of the Docks is an example of a successful project combining social equity and resilience goals. The incorporation of community garden space is also a unique element not often seen in urban parks, as well as a demonstration and educational greenhouse (Brezar, Babič, and Gligić 2017).

Future issues and plans: The creation of a collaborative web-based application called NUM-CITY provides communication and information to and from local inhabitants and workers. Data is collected related to energy consumption, waste sorting, local goods exchanges, and air quality, resulting in real-time evaluations of the sustainability and resilience of the park and surrounding eco-quarter. Specifically, this allows the developer to track whether expected performance was achieved in design related to the reduction of greenhouse gas emissions. These easily accessible public results also may incentivize inhabitants to modify their behavior to contribute to ecological and carbon footprint goals (Moshrefzadeh 2017).

CHAPTER 4

FINDINGS

The following tables (Table 1, Table 2, and Table 3) show an assessment of how each site performed with regards to each individual resilience dimension, as well as an assessment of level of applicability for specific programming, physical design, or policy measures for the Puritan-Wellington Mill site.

4.1 Case Study 1: Bethlehem SteelStacks Arts + Cultural Campus

Table 1

Resilience Dimension	Assessment and Applicability
Biological & Social Diversity	**ASSESSMENT:** • The implementation of extensive native plantings throughout the site increases biological diversity in the area. • Containment of hazardous waste contributes to a healthier environment for plants and wildlife. • In terms of social diversity, the project's emphasis on placemaking and diverse community gatherings (most, if not all, available for free) strengthens social bonds and income accessibility.
	SITE APPLICABILITY: Extensive native plantings and space for diverse community gatherings and events are both highly applicable.
Multifunctionality	**ASSESSMENT:** • Large open spaces can be dedicated to art installations, musical performances, farmers markets, and other community events as needed. • Nighttime versus daytime lighting and programming takes advantage of time-shifting—a method of programming a space differently based on time of day—to get more functionality out of

	the same spaces. • Passive pollinator habitat and rainwater filtration are accomplished through extensive plantings.
	SITE APPLICABILITY: Time-shifting in terms of daytime versus nighttime programming; pollinator habitat and rainwater filtration could be enhanced on the site.
Modularity & Redundancy	**ASSESSMENT:** • While not explicitly addressed on site, the SteelStacks campus contributes to regional redundancy in terms of having decentralized gathering places—only necessary in times of emergency.
	SITE APPLICABILITY: Redundancy could be operationalized on the Puritan-Wellington site in this manner.
Flexibility	**ASSESSMENT:** • Spatial flexibility in the SteelStacks campus design allows for a range of future spatial uses responding to unknown disturbances or community needs.
	SITE APPLICABILITY: Highly applicable
Adaptability	**ASSESSMENT:** • While not explicitly designed as such, the campus design itself is a test of the viability of post-industrial landscapes as community spaces. Future designs can build off of its successes and failures.
	SITE APPLICABILITY: Opportunity for additional adaptive design measures and experimentation on such a unique site.
Connectivity	**ASSESSMENT:** • Large-scale regional anthropocentric and ecological connectivity is poor on this site, but local connectivity is enhanced through improved pedestrian access.

	SITE APPLICABILITY: Local connectivity is improved through enhanced micromobility access, but connection to larger networks is imperative.
Inclusivity	**ASSESSMENT:** • ADA access throughout contributes to an inclusively designed project, as does a significant amount of free and low-cost entertainment options such as free concerts and art installations. • This serves to make the site accessible to people of all socioeconomic backgrounds.
	SITE APPLICABILITY: Low-cost or free access to arts and cultural programming is essential for inclusivity of design.
Historic-cultural significance incorporation	**ASSESSMENT:** • The historic blast furnaces on site are a prominent feature of the design • Paths of raw materials and manufacturing circulation were emphasized • Interpretive signage along new pathways educates visitors on the site history
	SITE APPLICABILITY: Maintaining historic structures is highly applicable, as is interpretive signage and emphasizing industrial processes and circulation

4.2 Case Study 2: West Point Foundry Preserve

Table 2

<table>
<tr><th>Resilience Dimension</th><th>Assessment and Applicability</th></tr>
<tr><td rowspan="2">Biological & Social Diversity</td><td>ASSESSMENT:
This design enhances what is already an ecologically rich and valuable property through augmented native plantings in strategic areas.
Social diversity is not explicitly supported.</td></tr>
<tr><td>SITE APPLICABILITY: Enhancement and augmentation of existing biological diversity is highly applicable.</td></tr>
<tr><td rowspan="2">Multifunctionality</td><td>ASSESSMENT:
Multifunctionality is limited due to the archaeological sensitivity of the site property.</td></tr>
<tr><td>SITE APPLICABILITY: Spatial multifunctionality may be limited by similar sensitivity concerns.</td></tr>
<tr><td rowspan="2">Modularity & Redundancy</td><td>ASSESSMENT:
Joining a multitude of other parks along the Hudson River, this site contributes to open space modularity and redundancy of important hydrological functions.</td></tr>
<tr><td>SITE APPLICABILITY:
Similarly, the Puritan-Wellington site would join a local network of river-adjacent green spaces in the Athens area.</td></tr>
<tr><td rowspan="2">Flexibility</td><td>ASSESSMENT: This site was not explicitly designed with flexibility in mind, and site programming is somewhat limited to its intended use.</td></tr>
<tr><td>SITE APPLICABILITY: N/A</td></tr>
</table>

Adaptability	**ASSESSMENT:** • Ongoing archaeological excavations and how to approach them while also enabling public access in such a sensitive setting is a significant learning opportunity.
	SITE APPLICABILITY: N/A
Connectivity	**ASSESSMENT:** • This site demonstrates excellent physical connectivity as it is integrated into the existing regional cycling and pedestrian networks. • Ecological connectivity is enhanced and protected through the protection of the site's existing ecological bounty.
	SITE APPLICABILITY: Physical and ecological connectivity through connections to existing cycling and pedestrian networks is desirable and highly applicable.
Inclusivity	**ASSESSMENT:** • This design of this site was accomplished in an inclusive manner, evidenced by the incorporation of local community members, archaeologists, and other scientists who were able to give input that shaped the way the designers approached the project.
	SITE APPLICABILITY: Incorporating the perspectives of key stakeholders is generally applicable, but for the purposes of this thesis is impractical.
Historic-cultural significance incorporation	**ASSESSMENT:** • The historic foundry buildings were preserved and made a key component of the design • Archaeological work revealed other artifacts of historic and cultural significance • Interpretive signage and sculptures educate and reveal key site history and cultural narratives
	SITE APPLICABILITY: This approach is highly applicable

4.3 Case Study 3: Saint Ouen-Park of the Docks

Table 3

Resilience Dimension	Assessment and Applicability
Biological & Social Diversity	**ASSESSMENT:** • Diverse native plantings and habitat for wildlife contributes to local and regional biological diversity. • Park of the Docks contributes positively to social diversity as well. Programming options for all socioeconomic backgrounds as well as group events strengthens social bonds. • Allotment gardens create shared community space for growing food.
	SITE APPLICABILITY: All aspects of biological and social diversity seen in Park of the Docks are highly applicable.
Multifunctionality	**ASSESSMENT:** • Spatial stacking is achieved on this project through the combination of space for growing food as well as providing pollinator habitat and stormwater filtration and infiltration. • Time shifting also contributes to multifunctionality on this site—seen in the diverse array of programming in the educational greenhouse.
	SITE APPLICABILITY: Highly applicable.
Modularity & Redundancy	**ASSESSMENT:** • By contributing to regional hydrological functionality through on-site green infrastructure, this project is an excellent example of modularity of function. • Similarly, allotment gardens allow for local food production, thereby contributing to decentralization and a redundant food network.
	SITE APPLICABILITY: Highly applicable.

Flexibility	**ASSESSMENT:** • This project was designed with dedicated flexible open spaces which can be used for a variety of purposes, as well as the educational greenhouse which can be used for numerous functions.	**SITE APPLICABILITY:** Applicable.
Adaptability	**ASSESSMENT:** • The neighborhood mobile application allowing communication and feedback between the designers, developers, and local inhabitants is an excellent example of adaptability and allows the project and functionality of the space to evolve over time based on shifting community needs.	**SITE APPLICABILITY:** In an ideal scenario, such an application is highly applicable. If the Puritan-Wellington site were to be developed, a similar app would be applicable, but it is outside the scope of this thesis.
Connectivity	**ASSESSMENT:** • This project fits within a revitalized eco-neighborhood, which facilitates both enhanced micromobility infrastructure for local residents but also increased provision of ecosystem services and enhanced ecological health.	**SITE APPLICABILITY:** Highly applicable.
Inclusivity	**ASSESSMENT:** • This site features exceptional functional inclusivity, as seen in the provision of dedicated play spaces for youth of all ages. • Inclusivity in the design process is also evident and ongoing, as evidenced by the mobile application allowing local inhabitant feedback.	**SITE APPLICABILITY:** Functional inclusivity is highly applicable, as is community-generated and initiated programming.
Historic-cultural significance	**ASSESSMENT:** • Historic docks and industrial structures were not a significant part	

incorporation	of this design, but the condition of them prior to design is unknown • This design does not place a significant emphasis on historic or cultural narratives or structures related to industrialization
	SITE APPLICABILITY: not applicable

The previous case study findings have been summarized and grouped based on their respective resilience dimensions into the following chart (Table 4), with a focus on findings with high levels of site applicability.

Table 4

Resilience Dimension	**Summarized Case Study Findings**
Biological & Social Diversity	• Extensive native plantings and space for diverse, inexpensive community gatherings • Enhance and augment existing biological diversity • Creation of wildlife habitat; programming for individuals and groups of varying socioeconomic backgrounds; shared community garden space
Multifunctionality	• Time-shifting: different spatial uses depending on time of day • Multifunctional spaces that provide ecosystem services as well as programmatic uses • May be limited by sensitivity of historical elements • Spatial stacking: combining different functions or programmatic elements into the same space
Modularity & Redundancy	• Decentralized gathering place relevant in times of disturbance contributes to regional redundancy • Can contribute to open space modularity and redundancy of important regional hydrologic and ecosystem functions • Community gardens allow for local food production which contributes to decentralization and a redundant, local food supply
Flexibility	• Spatial flexibility allows for a range of future uses responding to unknown disturbances or community needs • Flexible outdoor and indoor open spaces suitable for a variety of purposes

Adaptability	• Opportunity for adaptive design and experimentation • Post-occupancy establishment of community feedback loop*
Connectivity	• Enhance micromobility access and connections • Physical connectivity through connections to existing cycling and pedestrian networks • Enhanced ecological connectivity through connection to greenways and corridors
Inclusivity	• Inclusive design enabling access for individuals regardless of physical ability • Financial inclusivity to prevent alienation of lower-income groups • Functional inclusivity in terms of dedicated play spaces for youth of all ages and abilities • Future development of community generated and initiated programming* • Incorporation of perspectives of key stakeholders when possible* **impractical for the purposes of this thesis*
Historic-cultural significance incorporation	• Interpretive signage at important site structures and along site pathway • Preservation, interpretation, and/or creative reuse of historic structures • Emphasis on historic and cultural narratives related to industrialization and other things of significance to the site and surrounding community • Creatively interpret and reveal key site history and culture

CHAPTER 5

SITE HISTORY, INVENTORY, AND ANALYSIS

5.1 Puritan-Wellington Mill Site History

Introduction

Abandoned mill sites across the South dot the landscape, a reminder of a bygone industrial era. While many have been placed on the National Register of Historic Places or have been preserved through some level of development and design intervention, others are left to decay and be overtaken by nature. The seemingly haphazard nature of preservation versus neglect of many of these structures, stories, and landscapes reinforces the necessity of exploring creative means of redevelopment. In order to understand the importance of these sites, and why respectful, thoughtful reinterpretation and renewed use might be appropriate, it is important to first look generally at the origins of southern mill sites in Georgia and specifically at the origins of the Puritan-Wellington Mill in Athens.

Before the Civil War

In an effort to guarantee southern economic stability and independence, many southern planters began to divert capital towards the establishment of a local textile manufacturing economy. While the idea of manufacturing was anathema to many in the agrarian South, the move to diversify was eventually embraced as the only way to guarantee a fair and stable market for southern goods, and ultimately to increase political leverage. While the earliest attempts were largely failures, investors learned from these mistakes. Small factories located on rural river sites became the standard, not only to minimize riparian rights conflicts, but also to minimize investment risk. Instead of opening one single large factory (in comparison to northern factory sizes) many smaller factories were built, with complex interlocking groups of owners and investors which served to minimize both competition and risk. The first three successful textile factories in the Athens area—the Georgia Factory, the Athens Factory, and the Camak Factory (renamed Princeton Factory in 1835)—were all built in the early 1830s and constituted the first generation of Athens industrial endeavors (Gagnon 2012).

Initially, slave labor (specifically children) was seen as the logical choice to staff these factories (Gagnon 2012). Antebellum Athens was, in historian Ernest Hynds words, a "fairly well-defined class system at the top and half the population living in slavery at the bottom" (Hynds 1974). Over time, however, a number of factors contributed to a decline in use of slave labor. Slave owners perceived that due to a lack of incentives for improvement, factory slave labor would not produce the required quality of materials. Additionally, slave labor was actually more expensive than free white labor, because slaves were rented to the factories by their owners. Records indicate that a small number of slaves were still owned by the Athens Factory until the end of the war, but it is likely that they performed the tasks deemed too degrading for the white laborers. Furthermore, while it is unknown how much of the labor force at what would later become the Puritan Cordage Mill was made up of slaves, it is likely that in the years leading up to the Civil War slave labor was used (Gagnon 2012).

As the population of Athens increased before the Civil War due in large part to the strong cotton economy, the extension of rail lines tied it to other major cities in the South in a growing network of agriculture and manufacturing. Based on slave labor and the natural resource of the

Oconee river, Athens grew considerably during this time period, and a number of new mills opened (Thomas 1992). Learning from past economic struggles, a number of ancillary industries began to arise in Georgia. While the majority were related to cotton manufacture, Athenians also began to diversify and expand artisan manufacturing, the most important being a paper mill. As the medium for all business transactions and printing news, along with an ample supply of the necessary clean fresh water, paper mills were a logical choice (Gagnon 2012).

In 1849, Albon Chase, retired editor and master printer of Athen's *Southern Banner* and John S. Linton, agent of the Athens Factory, built the Pioneer Paper Manufacturing Company (Gagnon 2012; Thomas 1992). Built upon a stone basement on a site previously occupied by William Lumpkin's grist mill at the confluence of Barber and Mcnutt Creeks, they constructed a two-story wooden factory half a mile downstream from the Princeton Factory. Although reportedly making large profits throughout the 1850s, several fires and floods caused frequent setbacks. On August 27th, 1852, a large flood damaged a portion of the factory including the dam and a bridge across the creek. Disaster struck again on April 23rd, 1858, as the main mill burned, destroying nearly everything including raw materials and machinery. The mill would resume operations in April of 1859, however, after the purchase of new machinery (Gagnon 2012). Providing work for many of the free white poor, another fire in the early 1861 reportedly threw many out of employment (Parr 1993; Hull 1906).

During and After the Civil War

Due to the high demand for all types of textiles and manufactured materials, many Georgia factories profited from wartime production. Despite the destruction of many factories in the region by Union troops, much of the manufacturing capability of Athens was spared due to a lack of direct fighting in the area, and many local factories were able to survive the war relatively unscathed from a financial standpoint (Gagnon 2012). One skirmish, however, took place in the immediate vicinity of the Puritan Cordage site (Figure 25). In July of 1864, in an attempt to enter Athens and destroy the Cook & Brother Armory and the Athens Foundry, two cavalry units were sent north from Madison. A local militia led by Colonel Andrew Young removed the planks from the covered wooden bridge which once crossed at the confluence of Barber and McNutt Creeks, and set up a series of trenches and cannons on the opposite hillside. After coming under fire from the Confederate cannon, the Union troops decided that the bridge was too well defended and they withdrew, marking the end of the only battle fought in Clarke County (Parr 1993).

Reports suggest that the paper mill was considered in excellent condition in 1866, and the addition of lanterns to its insurance policy suggests work after dark—an indication of prosperity. In 1870, under new ownership, the facilities were expanded and the equipment updated. A large brick addition was added in order to improve the function of the water wheel, and by 1871 the factory was producing both wrapping paper and over 4,000 pounds of printing paper daily (Gagnon 2012).

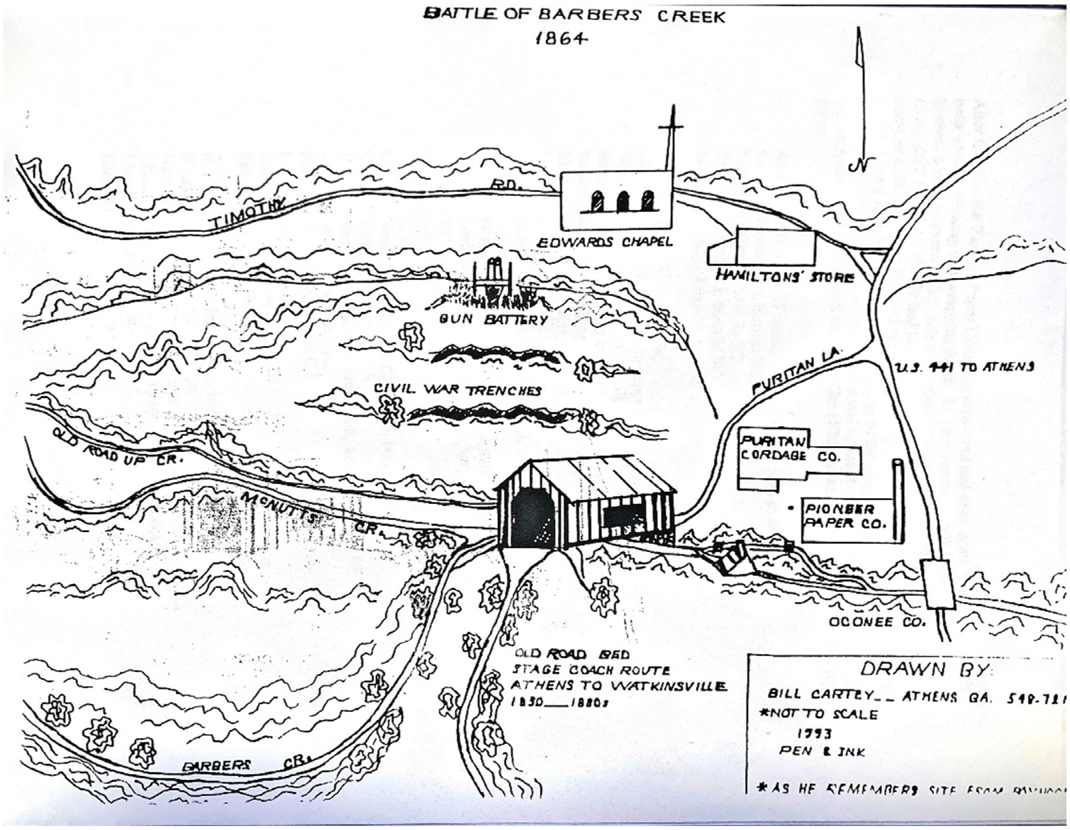

Figure 25: Hand drawn map showing details of Battle of Barber's Creek (Larry Parr)

1871-1887 Pioneer Paper Manufacturing Company

As the Pioneer Paper Mill continued to grow in the postwar years, so too did the necessity of having employees live nearby. Workers needed to live close to the mill due to travel limitations by horse and poor road conditions. In this period the mill and surrounding mill village, known alternately as Paper Town and Paperville, grew substantially.

In 1884 the company shifted away from making paper with linen and cotton rags, and turned to paper made of pulpwood using updated machinery. While it was reportedly a far superior product, heavy expenses incurred in the process of updating machinery and structures ultimately led to the company's failure, and it was sold in 1887 (Parr 1993).

Alpha Company

This short-lived enterprise signaled an abrupt shift from producing paper to cotton rope and twine, and is when it first becomes known as the Cord Mill. Fire insurance maps show the same buildings, but used for different purposes. The Alpha Company would go out of business within a few years, but census records indicate that most of the employees (and therefore likely residents of Paperville) were still working at this new cotton mill (Parr 1993).

Mallison Braided Cord Company

Described as one of the most successful periods of the mill, this iteration towards the end of the 19th century produced braided cord, clotheslines, rope, and webbing, and these products were distributed across the United States and Canada. The ready supply of water, proximity to the railroad, and the availability of cotton meant that the mill prospered into the early part of the 20th century.

1910-1941

In 1920, fire destroyed many of the original buildings, except the spinning room and two warehouses. Sanborn fire insurance maps from 1926 show significant changes in the structures on site, after the main building was rebuilt in 1922.

Wehadkee Yarn Mills

In 1944, the mill was purchased by Wehadkee Yarn Mills who operated it for only two years during WWII. During this period the mill shifted production due to the war, and manufactured cartridge belts, tent rope, and other types of cotton rope.

Puritan

Puritan Cordage Mills of Louisville Kentucky purchased the mill and all of its property. The mill prospered in the years after WWII, which also saw a shift in the makeup of employees due to the increased mobility afforded by the automobile. During this period, the company formed two new divisions; one which produced cotton mop heads, and the other which produced plastic clothing and sport lines.

Wellington & Closure

Wellington, which owned several other cotton mills in the Southeast, purchased the mill in 1968. By this point the surrounding mill village no longer supplied the majority of mill employees. New OSHA regulations concerning cotton mill dust levels ultimately led to the closure of the spinning mill at the plant due to prohibitive costs. In 1985, after several years of only running at partial capacity due to market saturation of cordage manufacturing capacity, it was announced that the mill would close. Many employees accepted jobs at other mills as regional businesses consolidated, but the impact of American firms importing cheaper cordage products from overseas ultimately spelled the end of cotton and associated manufacturing in the region. Finally, in December of 1986, the mill closed its doors for the last time (Parr 1993).

Recent History and Larger Athens Context

Fire proved to be a problem not only when the mill was operational but also many decades after it closed its doors. In May of 2015, another fire destroyed the main factory building, one of the earlier buildings on the site. Foul play was ruled out, but the presence of antiquated construction techniques, large timber beams, as well as frequent trespassers meant that a fire was always a possibility. (Prochaska 2015). In July 2019, fire struck again. This time one of the buildings closer to McNutt Creek burned. Although the original stone foundations and brick walls are still visible, the footprint of the building is now a twisted mass of burnt metal, brick, and masonry (Ford 2019).

A popular spot to swim, hang out, and engage in illegal activities during the warm summer months, the dam and swimming hole—locally known as "Redneck Beach"—have seen significant issues. Vandalism and littering are a significant problem along McNutt Creek and on the mill property, as well as contamination of the water by pet feces (Fields 2015). Water quality data indicates significant levels of E. coli in the stream, making it a significant health hazard for swimmers. EPA recommendations limit recreational uses in water bodies where E. coli levels exceed 320 colony forming units. According to tests, measurements from four Redneck Beach locations indicate levels of 449.5, 428, 383.5, and 215 cfu/mL, far in excess of the EPA's recommendations. While many E. coli are not detrimental to humans, many are pathogenic and pose significant risks to swimmers, especially to children, the elderly, and pregnant women (Odom 2018).

Tragedy struck on June 1st, 2018, as two students from Oconee County drowned in McNutt Creek during a period of intense flooding. The day after the incident, the Oconee County Sheriff's Office reported the water to be moving at 3,000 cubic feet per second—15 times the average of 200 cubic feet per second (Lefevre 2018). In owner Michael Conway's opinion, the increased runoff from the new shopping center construction on the opposite bank of McNutt Creek may have exacerbated flood conditions, as there was previously a significant vegetative buffer on that side of the creek (Odom 2018).

Predictably, the fires, vandalism, and deaths have led to change. After numerous incidents on the property, owner Michael Conway instructed police to enforce no trespassing signs. Local resident Dennis Hale acts as a de facto caretaker and warden of the property, whose owner now lives out of state (Fields 2015).

While numerous other historic mills in Athens have undergone transformations in recent times, the Puritan Mill is now in a state of advanced decay and neglect. Structurally unsound buildings mean that typical approaches to historic industrial building and land reuse may not be a viable option. Newspaper articles from the last few decades indicate interest in the Puritan Mill as a potential home for the Athens arts community, primarily because of the ability to colonize a "ceded void" and to grow organically within an already built structure. In one author's words, similar abandoned mill sites have the potential to function as "new creative hubs established on the foundations of the former cotton industry" (Williams 2011). Additionally, the establishment of regional trail networks connecting artistic hubs resonates more with the creative class due to a preference for alternative transportation and cycling. Indeed, a proposed spur of the North Oconee River Greenway would follow McNutt Creek past the Puritan-Wellington Mill, providing important micromobility connectivity to the project site (Williams 2011).

5.2 Historic Photographs

Historic photos from the Cooper Collection show what the site looked like in the 1970s in the years preceding its closure (Figures 26-29).

Figure 26:View of two buildings (Owens Library_CED_Cooper Collection)

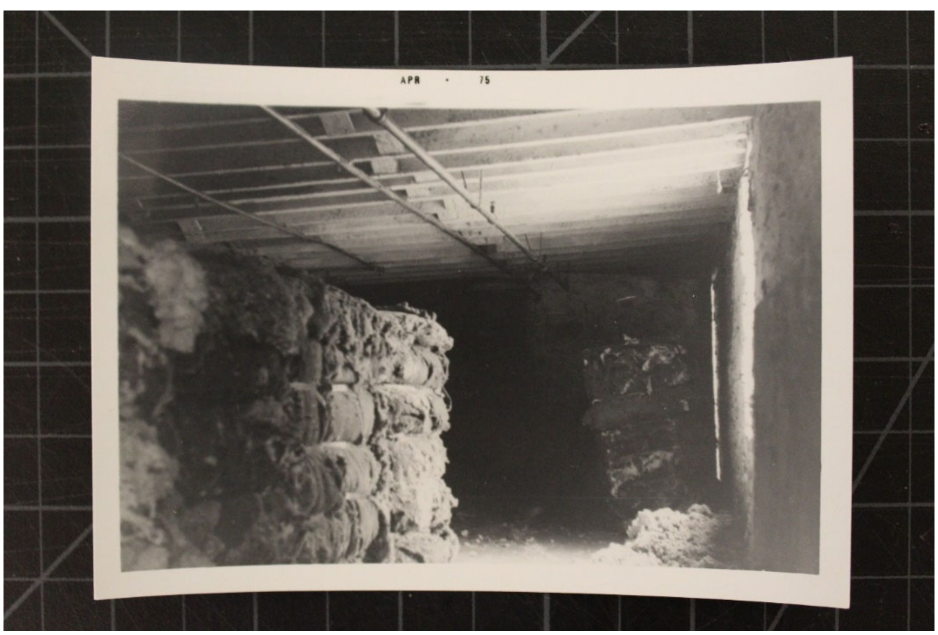

Figure 27: Cotton stored in oldest building (Owens Library_CED_Cooper Collection)

Figure 28:View of oldest building from road side (Owens Library_CED_Cooper Collection)

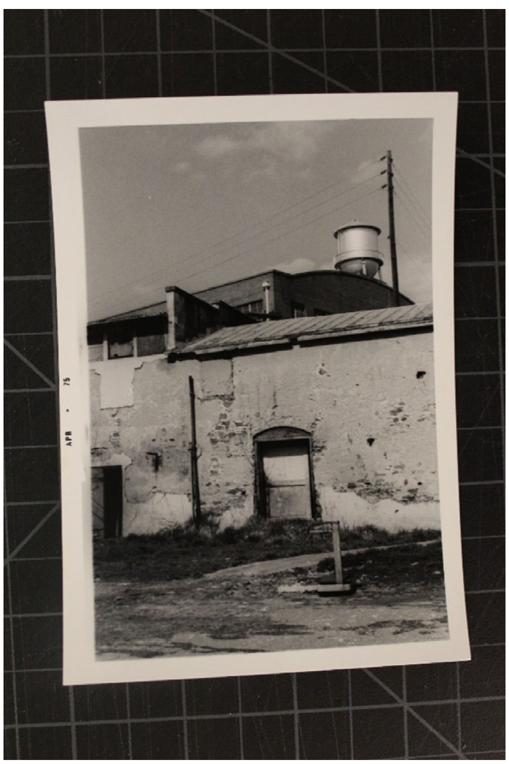

Figure 29:View of oldest building from creek (Owens Library_CED_Cooper Collection)

5.3 Site Inventory Mapping

The project boundary, existing structural footprints, and the locations of historically significant structures and human activity are shown in the following structural inventory map (Figure 30).

Water quality on this section of McNutt Creek is heavily impacted by fecal contamination, likely from a combination of leaking sewer pipes and pet waste runoff. Its current 4a classification means that it does not currently support fishing or recreational activities (Georgia Environmental Protection Division 2018). Floodplain designation AE, correlating to a 100-year event, is shown in the following inventory map (FEMA 2016). General overland drainage patterns are also shown (Figure 31).

A slope map showing areas of steep versus shallow slope was generated using 1-foot contours obtained from the Athens-Clarke County Geospatial Information Office (USGS and ESRI), as shown in the following slope map (Figure 32).

Predominant soil profiles and hydrologic soil groups indicating relative drainage capacity are included in the following soils inventory map (Figure 33). Hydrologic soil groups (HSG) are categorized A, B, C, or D. Group B soils have moderately low runoff potential when thoroughly wet, meaning that water transmission through the soil is unimpeded. Typically, these soils are composed of 10-20% clay and 50-90% sand, with loamy sand or sandy loam textures. Group D soils have high runoff potential, meaning water transmission is very restricted. Dual hydrologic soil groups (A/D, B/D, and C/D) are used for certain wet soils (in this case in the floodplain), which are within 24 inches of the water table. When adequately drained, these soils function based on the first letter of their classification but when undrained they function as group D soils

(Mockus 2007). In the case of this project, the Madison sandy clay loam soils (MiC3) located on the northeastern part of the project site are HSG B, with a typical slope range of 6-10%. Madison-Louisa complex soils (MiE3) which are exposed on the lower part of the site are also HSG B with a typical slope range of 10-25%. These soils have experienced significant erosion of upper layers. Soils in the Madison series were once typically covered in hardwood forests, and are suitable currently for crop production. Chewacla soils and alluvial land (Cob) are seen in the floodplain and are classified dually as HSG B/D. These soils are subject to frequent deposition of sediment and alluvium from surrounding soils and are within 24 inches of the water table. Alluvial soils are typically too wet for crop production. Madison sandy clay loam soils are also seen in the MmE2 soils. What sets the MmE2 soils apart from the MiC3 soils is primarily the typical slope range, which is 15-28%. MmE2 soils occupy only a small portion of the property, and are classified in HSG D. Because of their upslope location in relation to the central and northwestern part of the site, however, their extremely limited water transmission ability means they contribute significantly to downslope runoff (Robertson 1968).

An inventory of existing vegetative conditions is shown in the following vegetation inventory map (Figure 34). This map also shows riparian ecological corridor connectivity gathered from the National Ecological Framework. Developed by the Environmental Protection Agency, the NEF provides a model showing natural landscape connectivity in the United States with the purpose of aiding the protection of natural ecosystem processes (Richardson 2013). Vegetation within the property boundary consists of a typical disturbed urban mix of native and invasive species. Observed species include (but are not limited to) sycamore, water oak, Eastern

Red Cedar, Chinese privet, white pine, broomsedge, poison ivy, mimosa, sumac, river birch, river oats and wild blackberry.

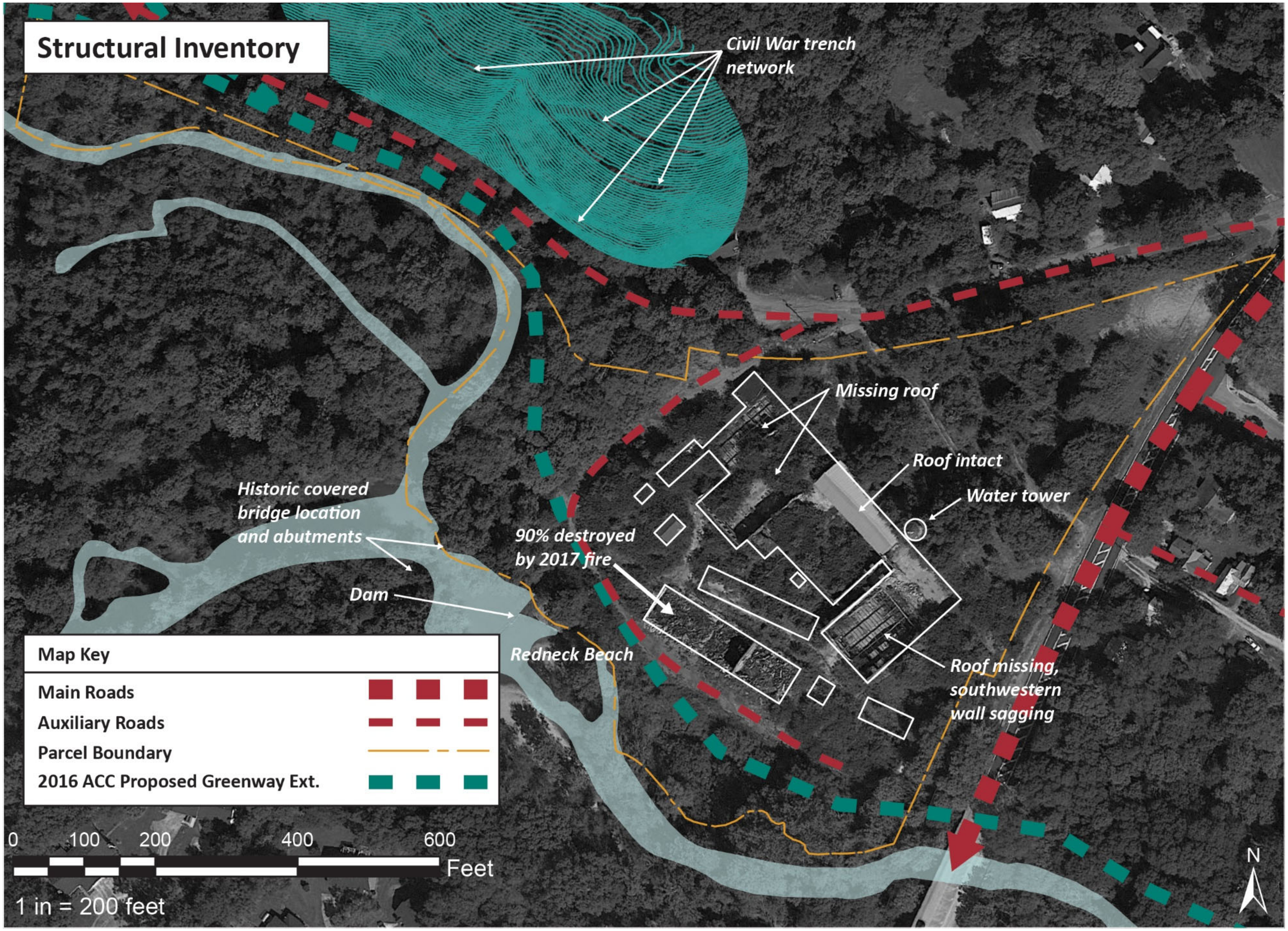

Figure 30: Structural inventory map (author)

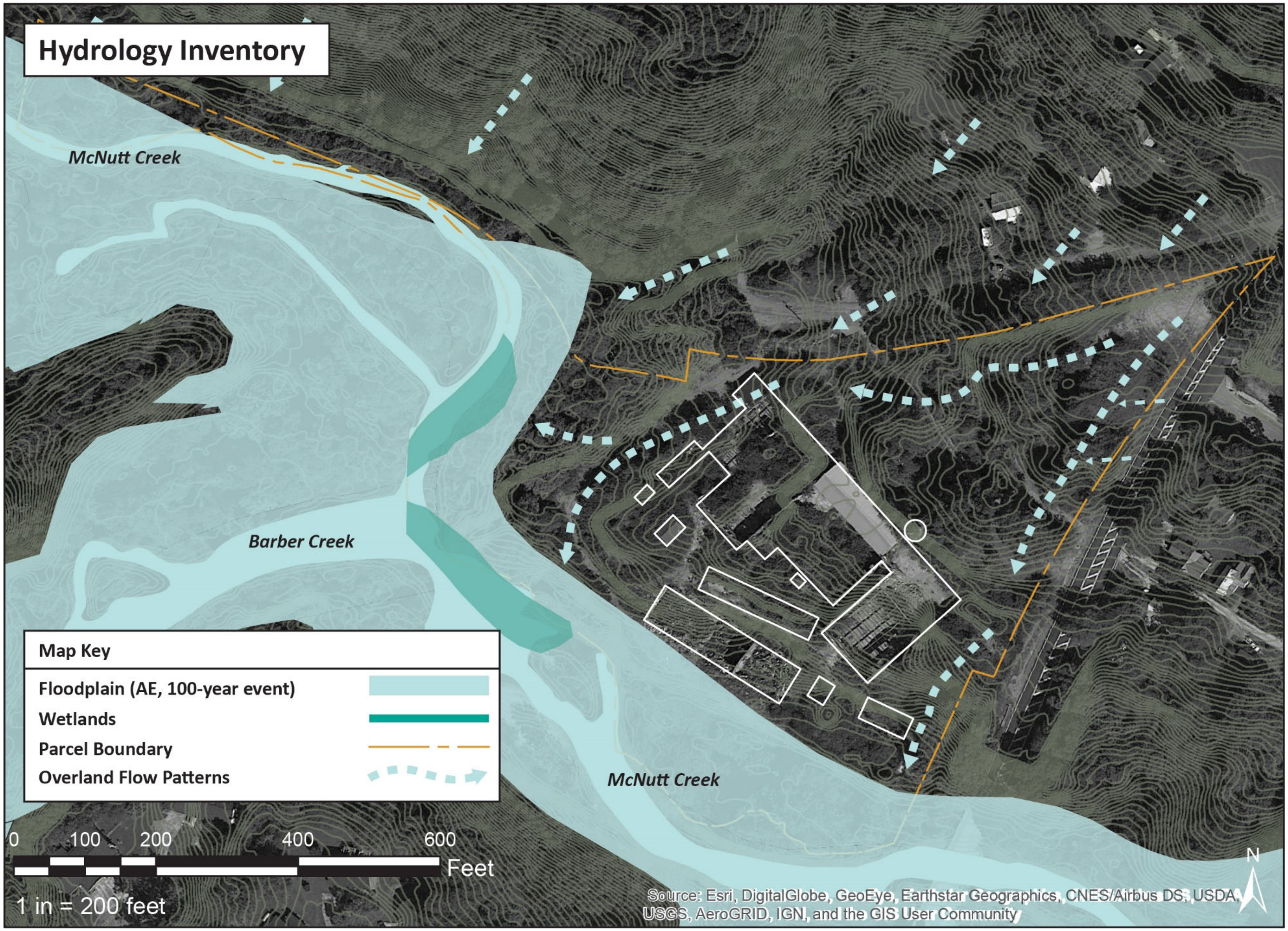

Figure 31: Hydrology inventory map (author)

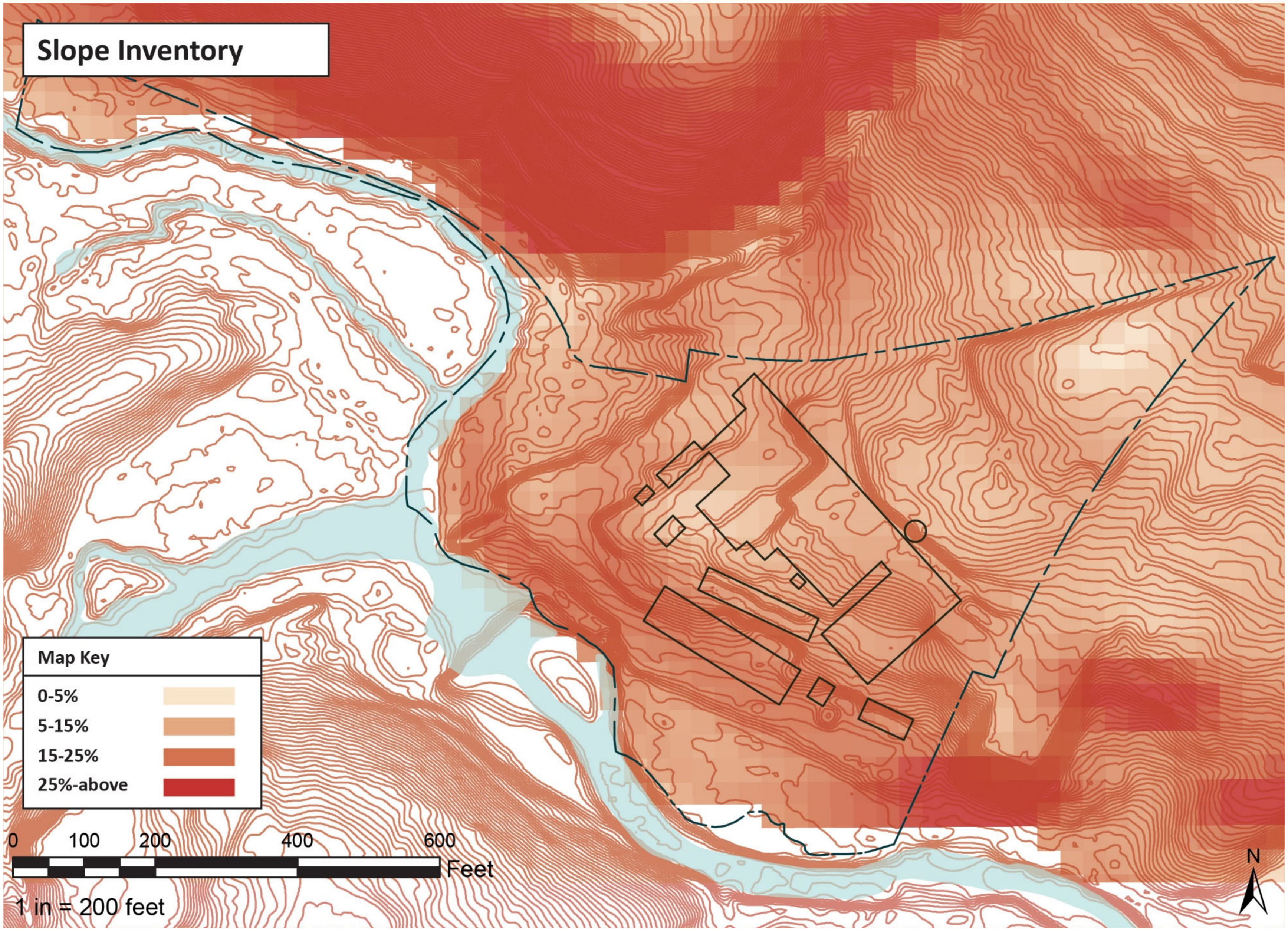

Figure 32: Slope inventory map (author)

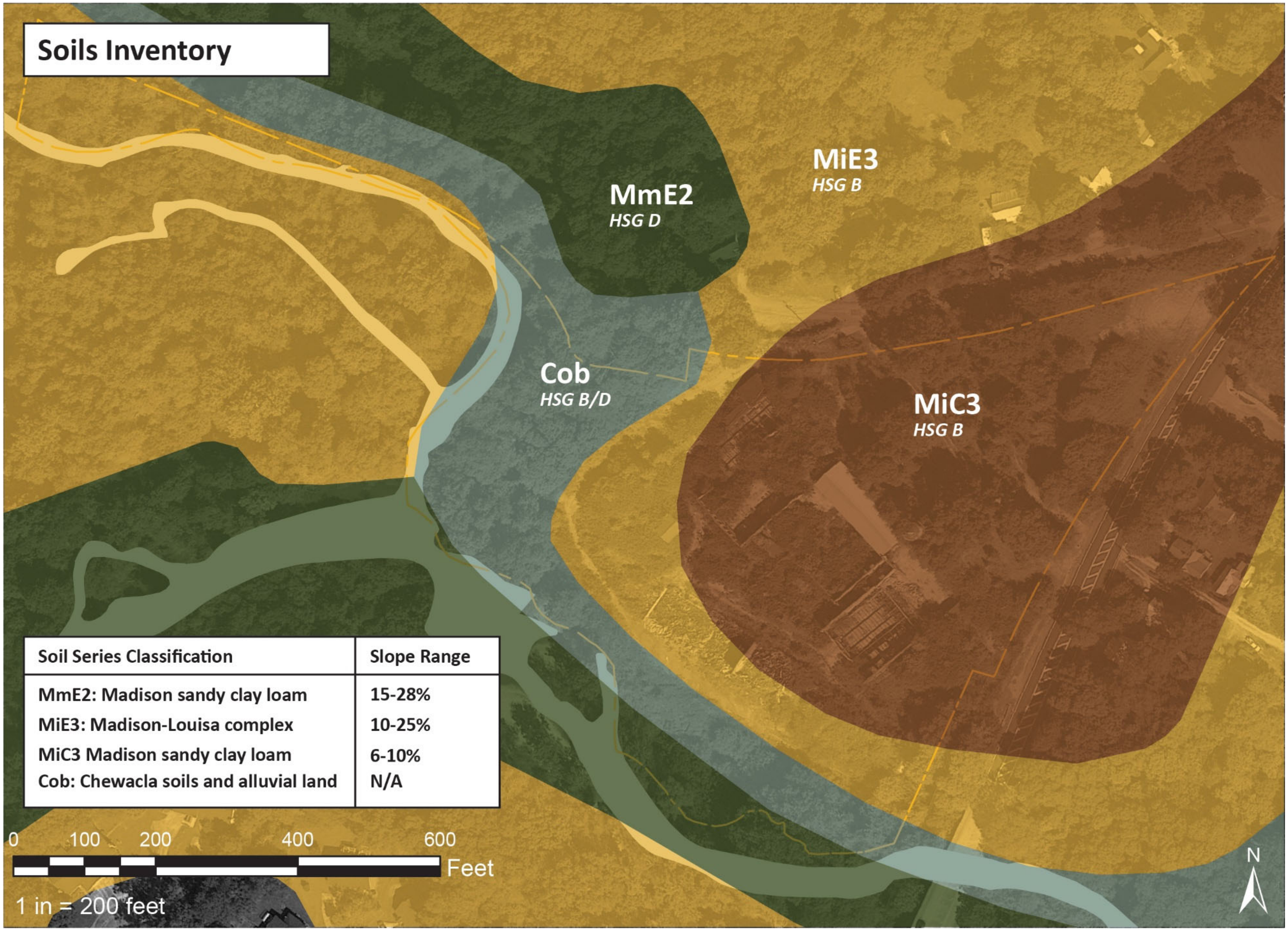

Figure 33: Soils inventory map (author)

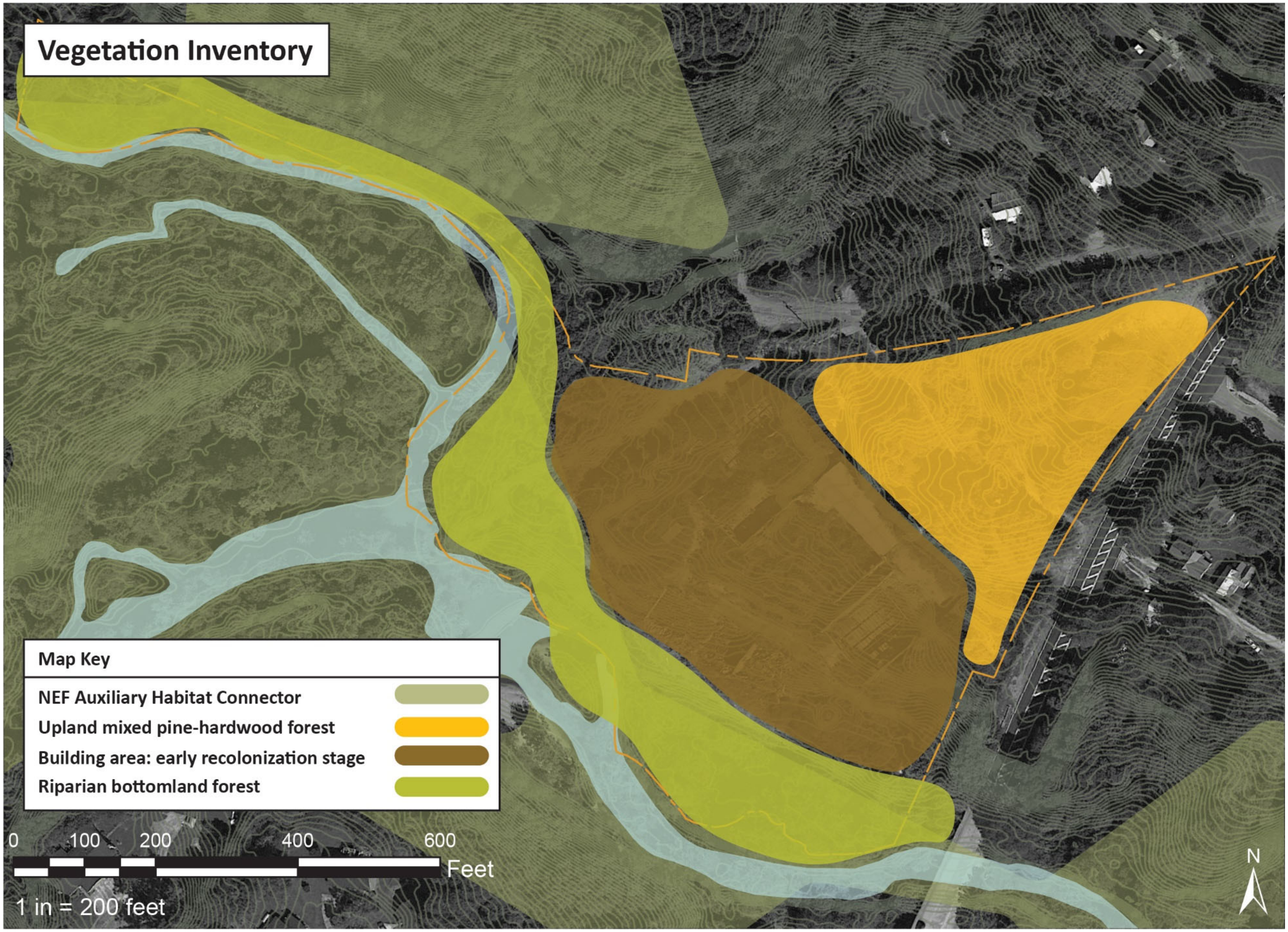

Figure 34: Vegetation inventory map (author)

The previous inventory mapping was used to generate a composite analysis map (Figure 35). This map is a reflection of the author's thorough analysis of the site conditions, and is an aggregation of the most important inventory data which will be used in the subsequent chapter to generate design concepts. This map identifies five primary areas across the project site with the purpose of guiding the placement of site amenities such as parking as well as ideal locations for new circulation patterns, gathering points, and ADA-accessible ramp locations. Table 5 presents a detailed suitability assessment for different proposed uses of the site.

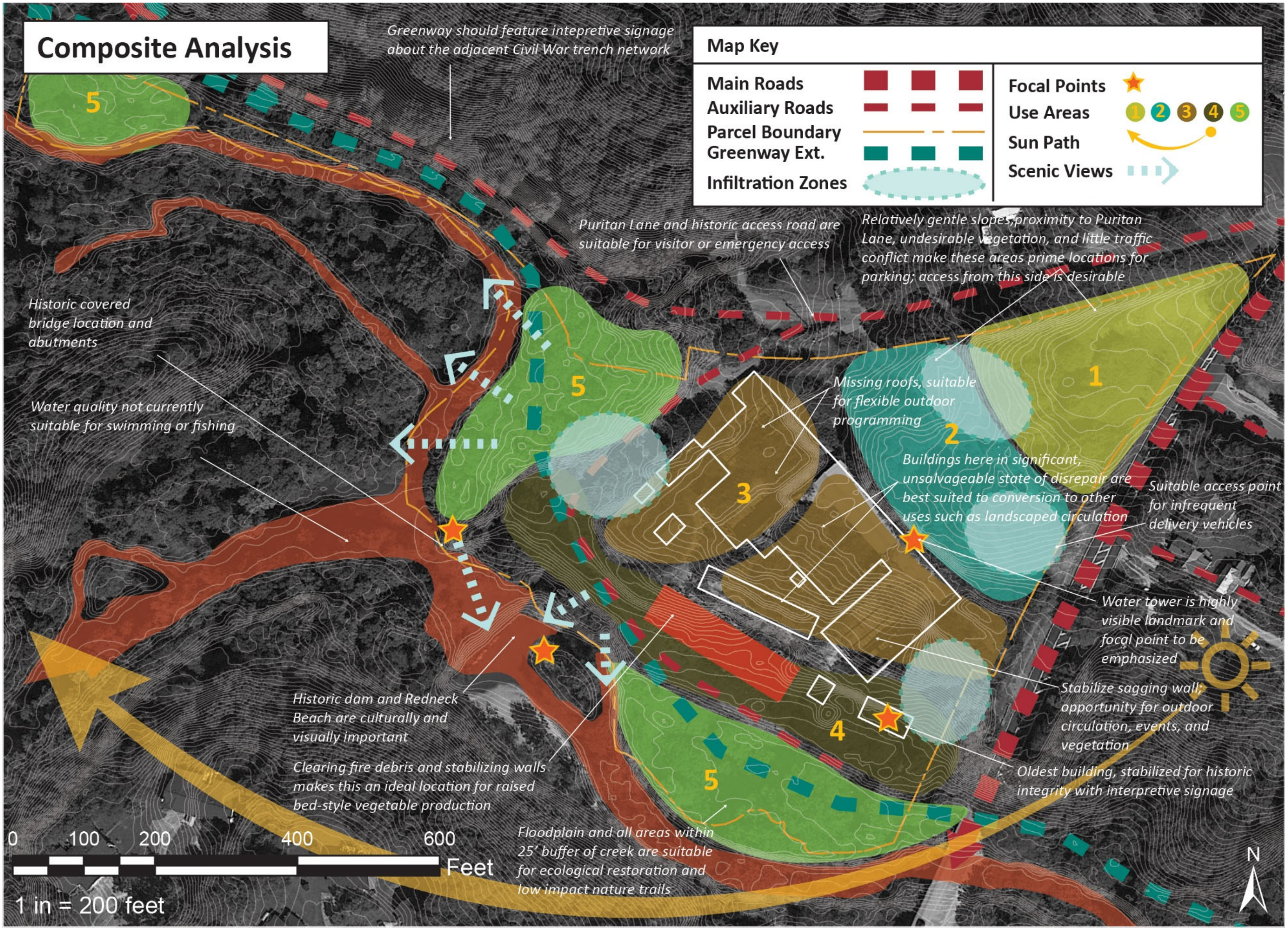

Figure 35: Composite analysis map showing suitability and unsuitability for different uses (author)

Table 5: Suitability Assessment

Proposed Use	Suitability	Unsuitability
Parking	• Areas 1 and 2 are the most likely candidates for parking • They feature relatively consistent flat slopes, are already used as off-street parking, and contain significant invasive vegetation for removal	• Access to other areas of the site for parking is limited and significant slopes prevent parking
Commercial or retail activity	• The largest remaining building with a roof would be suitable for conversion to studio space for artists or limited commercial activities with a significant remodel	• Nearly all buildings on site are missing their roofs or are structurally not suited to typical adaptive reuse for commercial or retail purposes
Water recreation	• The creek edge is suitable for passive recreation • Future improvements in water quality would open up the creek for recreation	• Both Barber Creek and Mcnutt Creek are considered to be unsuitable for active water recreation due to high levels of fecal coliform contamination
Vegetable production	• Area 4 is suitable for raised bed-style crop production due to its flat slope and southern exposure	• Areas of the site too close to the highway (risk of runoff contamination) • Areas too close to the floodplain (risk of flooding contamination) • Areas where the slope is too steep
Ecological restoration	• The floodplain is suitable for ecological restoration as it is significantly compromised with	• Building footprints and historically significant areas are unsuitable for traditional ecological

	invasive vegetation • Areas of the site outside building footprints are suitable for habitat restoration	restoration
Runoff infiltration	• Areas 2,3,4, and 5 are suitable for water infiltration interventions due to soil suitability and proximity to highway and upslope runoff flows • Would supplement upstream wetland areas	• Areas 4 and 5 contain soils which are too close to the water table and floodplain to serve as effective infiltration areas • Area 4 contains significant swathes of pavement
Entrance and exits	• Primary visitor entrances and exits should, when possible, be located along Puritan Lane in Areas 1 and 2 to minimize conflict with highway traffic • Emergency access is best suited to old access road into property off Puritan Lane • Access for delivery vehicles, farm trucks or food trucks is suitable for Area 2 from the highway as these would be infrequent occurrences therefore causing little traffic conflict	• Access from the highway is unsuited to primary visitor entrance and exit due to traffic conflict
Greenways and trails	• Areas 4 and 5 contain historic access roads and existing pavement suitable for paved greenway extensions • Ramped access to the rest of the site is possible	• Greenways rely on low slopes typical in areas adjacent to streams, therefore upslope location is not suitable

	from downslope through Area 4 and from upslope through Areas 1 and 2	
Park open space for recreation and gathering	• Areas 3, 4, and 5 contain significant space suitable for park open space and recreation activities • Pre-existing areas cleared of vegetation • Low slopes	• Open space and recreational activities should be located as far as possible from the highway due to excessive car noise and speed
Historical interpretation	• Bridge abutments which supported the historic covered wooden bridge are suitable for historic interpretation • All historic structures and paths on site are suitable for interpretation • While physically outside property limits, the Civil War trench network could be referenced in interpretive signage	
Flexible programming space	• All historic buildings (except the oldest structure at the southeast corner of the site) would be suitable for flexible outdoor programming	• The oldest building is small in size and should be preserved as is to limit further damage

5.4 Photographic Site Conditions Inventory

In order to fully document unique site conditions that mapping is unable to capture, the author has included the following photographs. An aerial drone perspective of the site is shown in Figure 36, demonstrating the extent to which the site vegetation is overgrown. Figure 37 is a view inside the largest building that still has a roof. Structural decay and colonization of vegetation are shown in Figures 38 and 39. The next photograph is taken from the ground floor of the former cotton processing building, with a view of the water tower (Figure 40). The 2017 fire destroyed the roof and the majority of the building shown in Figure 41, leaving a twisted mass of burnt metal roofing, wood, and masonry. Graffiti on the site is both interesting and, at times, obscene, and this photograph documents both the graffiti and evidence of post-industrial decay. (Figure 42). The final photograph shows the paved road which was used for site access when the mill was still operational, slowly being taken over by flood silt deposits and vegetation (Figure 43).

Figure 36: Aerial drone perspective of site showing overgrown vegetation (author)

Figure 37: View inside largest building with roof (author)

Figure 38: Structural decay (author)

Figure 39: Vegetation colonization (author)

Figure 40: View of water tower (author)

Figure 41: Burned out building from 2017 fire (author)

Figure 42: Graffiti on industrial ruins (author)

Figure 43: View of old access road being overtaken by sedimentation and vegetation (author)

CHAPTER 6

DESIGN EXPLORATION AND APPLICATION

Chapter 6 includes summarized case study findings, which are used to develop project objectives. Specific project objectives are then summarized according to which resilience dimension they contribute, and programmatic and design elements are proposed which are best suited to achieving those objectives. Building off of the previous case study findings in Chapter 4 and site history, inventory, and analysis in Chapter 5, two functional design concepts are proposed which explore different design scenarios with the purpose of generating project design possibilities which can accomplish project objectives. The first scenario focuses on enhancement of ecological and physical resources, while the second focuses on food production and community. The strengths and weaknesses of these concepts are then evaluated, and a final functional design concept is proposed combining the most desirable elements from each scenario. This functional design concept is then used as the basis for a conceptual project design, realized through a plan view rendering and multiple perspective views illustrating project elements.

6.1 Summary of Case Study Findings and Project Objectives

These findings support resilience in at least one of eight dimensions: biological and social diversity, multifunctionality, modularity and redundancy, flexibility, adaptability, connectivity, inclusivity, and historic-cultural significance incorporation. The following table is a repetition of summarized case study findings from Chapter 4 (Table 4).

Table 4

Resilience Dimension	**Summarized Case Study Findings**
Biological & Social Diversity	• Extensive native plantings and space for diverse, inexpensive community gatherings • Enhance and augment existing biological diversity • Creation of wildlife habitat; programming for individuals and groups of varying socioeconomic backgrounds; shared community garden space
Multifunctionality	• Time-shifting: different spatial uses depending on time of day • Multifunctional spaces that provide ecosystem services as well as programmatic uses • May be limited by sensitivity of historical elements • Spatial stacking: combining different functions or programmatic elements into the same space
Modularity & Redundancy	• Decentralized gathering place relevant in times of disturbance contributes to regional redundancy • Can contribute to open space modularity and redundancy of important regional hydrologic and ecosystem functions • Community gardens allow for local food production which contributes to decentralization and a redundant, local food supply
Flexibility	• Spatial flexibility allows for a range of future uses responding to unknown disturbances or community needs • Flexible outdoor and indoor open spaces suitable for a variety of purposes
Adaptability	• Opportunity for adaptive design and experimentation • Post-occupancy establishment of community feedback loop*
Connectivity	• Enhance micromobility access and connections • Physical connectivity through connections to existing cycling and pedestrian networks • Enhanced ecological connectivity through connection to greenways and corridors
Inclusivity	• Inclusive design enabling access for individuals regardless of physical ability • Financial inclusivity to prevent alienation of lower-income groups • Functional inclusivity in terms of dedicated play spaces for youth of

	all ages and abilities • Future development of community generated and initiated programming* • Incorporation of perspectives of key stakeholders when possible* **impractical for the purposes of this thesis*
Historic-cultural significance incorporation	• Interpretive signage at important site structures and along site pathway • Preservation, interpretation, and/or creative reuse of historic structures • Emphasis on historic and cultural narratives related to industrialization and other things of significance to the site and surrounding community • Creatively interpret and reveal key site history and culture

The following table establishes project objectives best suited to contribute to the eight resilience dimensions (Table 6), derived from the summarized case study findings in Chapter 4 and adapted to this project site. Specific programmatic and design elements which are best suited to achieving these objectives are also proposed as guides for the subsequent functional design concept exploration.

Table 6

Resilience Dimension	**Project Objectives**	**Programmatic and Design Elements Best Suited to Achieve Project Objectives**
Biological & Social Diversity	• Establish or enhance biological diversity and wildlife habitat • Create programming accessible to people of all socioeconomic backgrounds	• Greenhouses for native plant propagation • Artist and maker space • Riparian buffer restoration • Orchard • Vegetated bioswales • Native upland forest

		patches • Educational greenhouse activities
Multifunctionality	• Time-shifting: incorporate different spatial uses depending on time of day • Spatial stacking: combine different functions or programmatic elements into the same space	• Pervious parking • Bioswales and forest for habitat and hydrologic function • Pocket parks and open space
Modularity & Redundancy	• Provide space for local community food production • Provide space for decentralized gathering • Contribute to regional hydrologic and ecosystem service function	• Community rental garden space • Farmer's market • Bioswales as decentralized water treatment • Decentralized gathering spaces
Flexibility	• Provide flexible indoor and outdoor spaces for variety of purposes	• Food truck and market space • Live music and performance space • Art installation space
Adaptability	• Incorporate experimentation and adaptive design opportunities	• Opportunity for studies post-occupancy* • Adapted programming based on future feedback * **impractical for the purposes of this thesis*
Connectivity	• Provide and enhance physical connectivity to existing micromobility networks • Provide and enhance ecological connectivity through connection to greenways and corridors	• Greenway connection • Riparian buffer restoration • Enhanced micromobility infrastructure (sidewalks, paths)
Inclusivity	• Enable access for individuals regardless of physical ability or socioeconomic background	• ADA accessible paths • Inclusive play areas • No-cost events and

	• Incorporate dedicated play spaces for youth of all ages and abilities	programming
Historic-cultural significance incorporation	• Creatively interpret and reveal key site historical and cultural narratives • Maintain post-industrial ruins on site	• Interpretive signage and other sculptural elements • Stabilize, preserve, and reuse historic structures on site • Pathways on site which allow for safe interaction with ruins

6.2 Functional Design Concepts

The following functional design concepts explore the strengths and weaknesses of two unique design scenarios in order to generate ideas for how best to accomplish project objectives. A synthesized functional design concept is then proposed combining the strengths of both concepts.

Concept I: Enhancement of Ecological and Physical Resources

Project Scenario: The first concept focuses primarily on realizing resilience through physical connectivity and ecological connectivity—specifically as a means of highlighting, protecting, and restoring natural resources and ecosystem function (Figure 44).

Strengths:

- Significantly restored native riparian buffer provides excellent habitat for wildlife and reinforces the site's connection to larger ecological patches.
- Greenway connects the site to existing micromobility networks.

- Pocket parks along the greenway allow for public areas for rest and recreation as well as other functions depending on necessity.
- Vegetated bioswales filter runoff from the highway and surrounding area, slow stormwater volume, and help to reduce dangerous flooding conditions in an increasingly urbanized context.
- Converting the largest remaining building structures on site into greenhouses for native plant propagation and educational activities contributes to community programming and native biodiversity.

Weaknesses:

- Large swathes of physical space dedicated solely to ecosystem services mean there is less space for human use of the site.
- This concept pushes parking further from the site, potentially creating a hindrance for less mobile individuals.
- Spatial multifunctionality is limited.
- Site history is not emphasized, thereby missing an opportunity to forge connections with the local community and visitors.

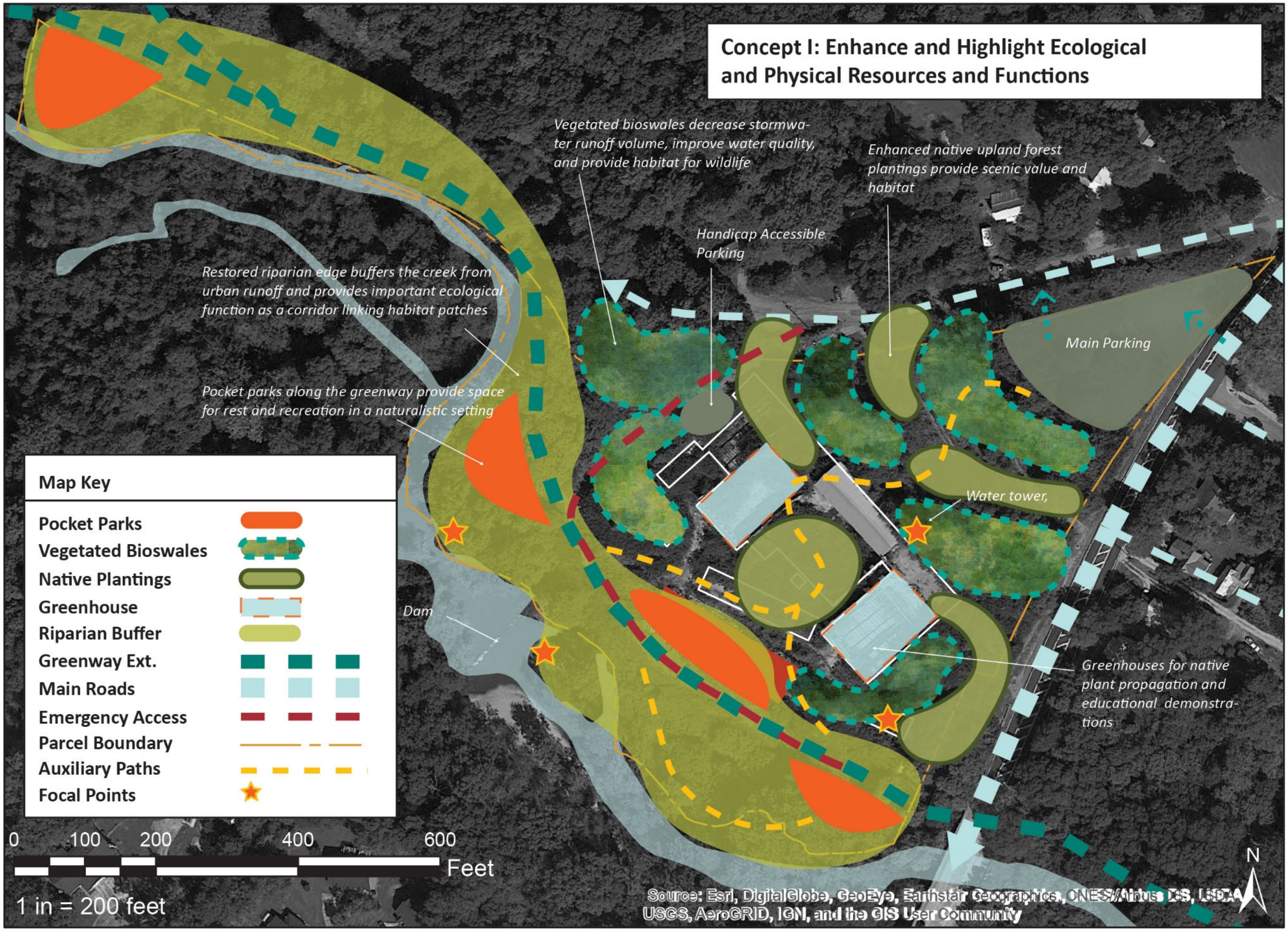

Figure 44: Concept I Functional Diagram (author)

Concept II: Provide Space for Food Production, Community Functions, and Artists

Project Scenario: The second concept focuses primarily on realizing resilience through local food production, programming to strengthen community, and support for local artists and artisans (Figure 45).

Strengths:

- Significant amounts of space are dedicated to community rental garden plots, increasing Athens residents' ability to grow their own food and alleviate local food insecurity.
- Flexible event space enables a range of future uses.
- A native upland forest buffer decreases highway noise and filters some stormwater runoff.
- Parking is located closer to the building, making it easier for individuals to access the site.
- An easily accessible market space and food truck plaza creates opportunities for diverse outdoor community programming.
- Converting the only building that still has a roof into artist and makers' spaces supports an economically fragile local artistic and artisanal culture.
- Flexible event and performance space further contribute to local culture.

Weaknesses:

- Educational opportunities are limited by a lack of space dedicated to them.
- This scenario also does not incorporate site history into the design in a meaningful way.

- Human interaction with native ecology is significantly more limited in this scenario, thereby missing an opportunity to create and reinforce visitor connections.

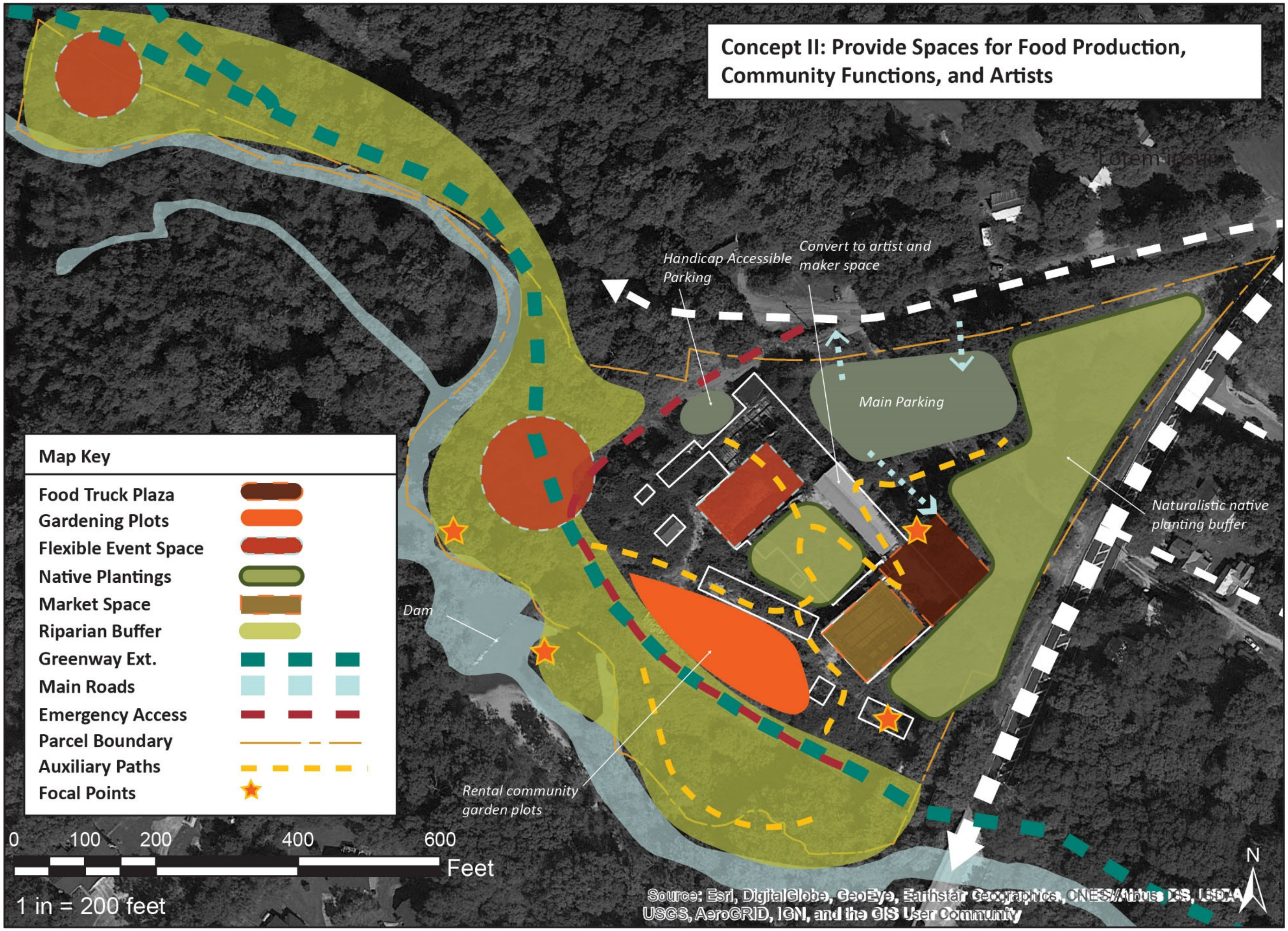

Figure 45: Concept II Functional Diagram (author)

Final Concept: Resilient Small-Scale Post-Industrial Landscape in an Urban Area

Project Scenario: The final functional design concept focuses on realizing resilience through a synthetic combination of the previous concepts (Figure 46). This concept explores a balance between multifunctional space for community interaction and functional ecosystem integrity, without sacrificing one for the other.

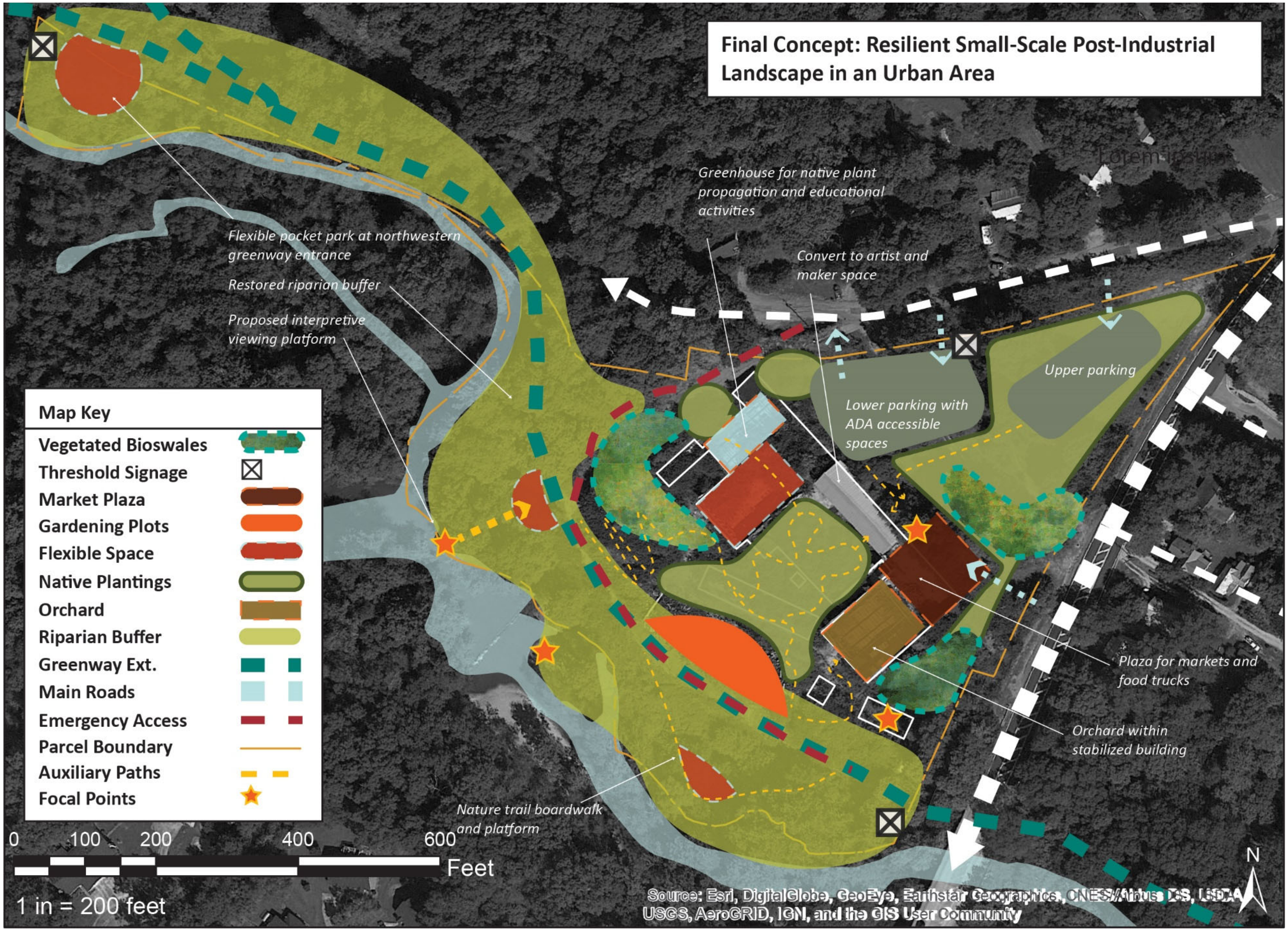

Figure 46: Final Concept Functional Diagram (author)

6.3 Design Proposal: Puritan-Wellington Mill

The Puritan-Wellington Mill is a resilient small-scale post-industrial landscape project located along McNutt Creek in Athens, Georgia. This project site possesses a number of unique contextual circumstances which make this design development proposal ideal, including its location along a future greenway extension, its proximity to expanding development patterns and major roads, and its location in an area otherwise lacking in public park space (Figure 47). Post-industrial structural remains are utilized both functionally and aesthetically to frame and provide space for diverse activities and ecosystem functions, while also providing a connection to the site's industrial past and Athens' historical connection to the southern cotton and textile industry through interpretive signage and choreographed circulation through the historic mill ruins (Figure 48). The old covered wooden bridge abutments are used as supports for an interpretive viewing platform along McNutt Creek accessible from the greenway, providing views of the historic dam as well as local flora and fauna (Figure 49). While located outside the physical limitations of this thesis, the historic Civil War trench network located on the adjacent parcel are historically and culturally important. Thus, interpretive signage is placed along the greenway extension at the bottom of this slope, indicating the locations and significance of these fortifications. Interpretive signage throughout the site is located at other significant points of interest including the individual mill buildings, the interpretive viewing platform, the floodplain boardwalk, and old access roads. This serves to educate visitors about shared history and cultural narratives, thus strengthening local historic-cultural resilience.

In an effort to provide space and support for the vibrant Athens arts and artisan community, this concept establishes studio and maker space in the only large remaining building that still has a roof, adjacent to a flexible outdoor performance and exhibit space (Figure 50). Native plant propagation and educational activities are supported through the conversion of another building into a dedicated greenhouse, while local food production is accomplished through the creation of rental community garden plots along the greenway in the ruins of the building damaged in the 2017 fire (Figure 51). Locating rental community garden plots here allows for micromobility access to the garden plots, thus filling a potential need for local residents (including dorm and apartment-bound students who often do not have a yard or space at home) to grow their own vegetables. This design solution is also intended to support community food security in the event of a potential future food network disruption.

Further contributing to food production while also creating a shaded space to linger or stroll, an orchard planted on the grid of exposed steel structural supports for the old cotton drying building is circled by an elevated floating walkway extending around the inner perimeter of this building (Figure 52). This walkway has a ramp which descends to the ground floor, and connects on the second "story" of the building to a multifunctional space intended primarily for farmers markets, food trucks, and arts and crafts fairs. A connection to the North Oconee River Greenway follows an original access road through the site and provides enhanced micromobility access and recreational opportunities through multifunctional pocket parks along its length. This greenway extension also contributes to local ecological connectivity, tying this site in with regional riparian corridors and habitat patches (Figure 51). A boardwalk extends from the greenway out over the floodplain, providing visitors the opportunity to observe and interact with native flora and fauna in an ecologically restored riparian buffer. In the middle and upper portion of the site, vegetated bioswales have been located in areas likely to experience significant runoff from either the highway, parking lots, or adjacent hillsides. Water filtration through the swales will contribute to local hydrological function and reduce flooding severity, while native vegetation provides habitat for numerous wildlife species. Upland native forest patches further contribute to habitat and local ecosystem function, as well as providing an opportunity for visitors to stroll along several paths that wind through them.

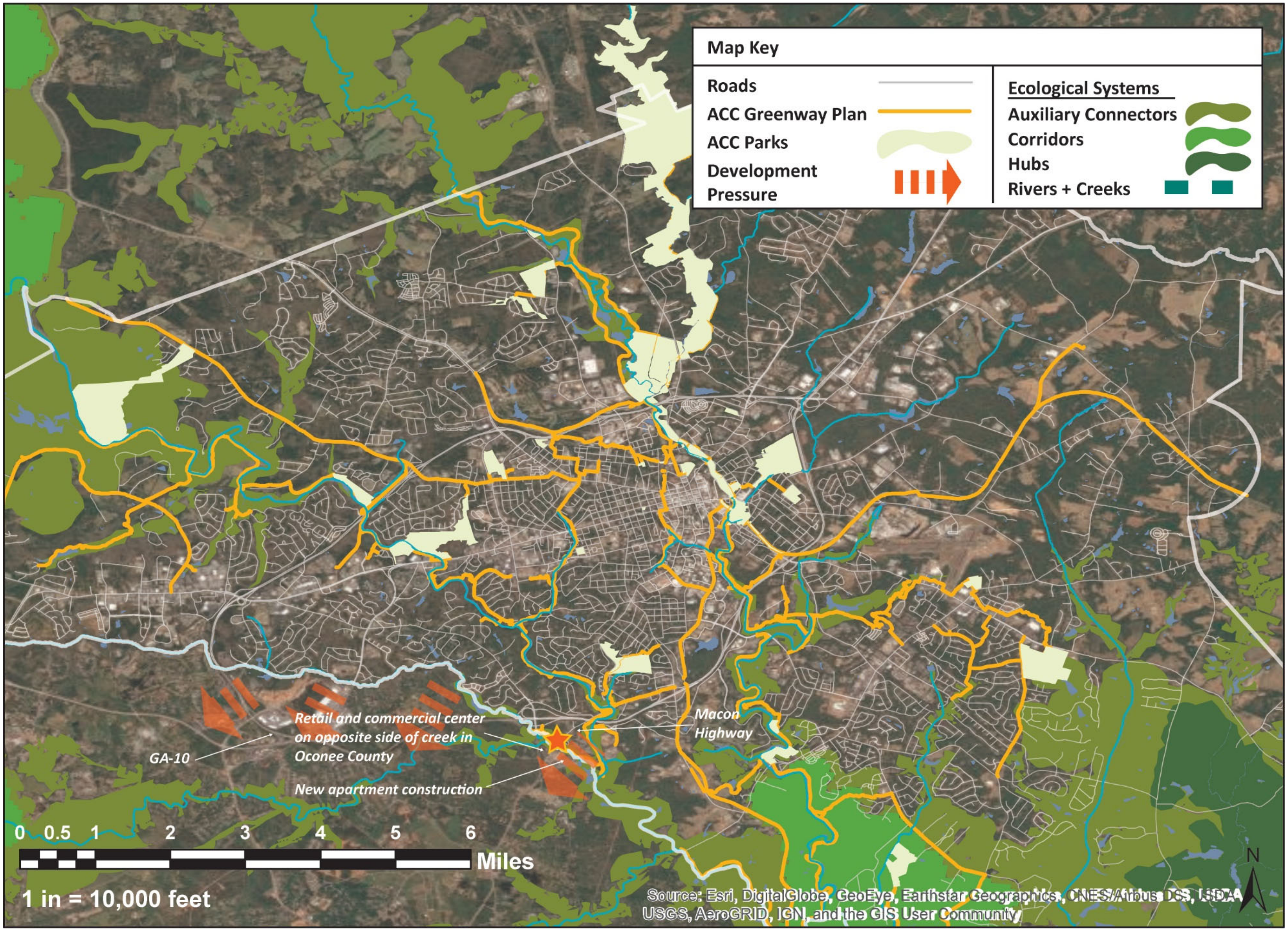

Figure 47: Context map showing site location in relation to parks, greenways, development pressure and areas of ecological value (author)

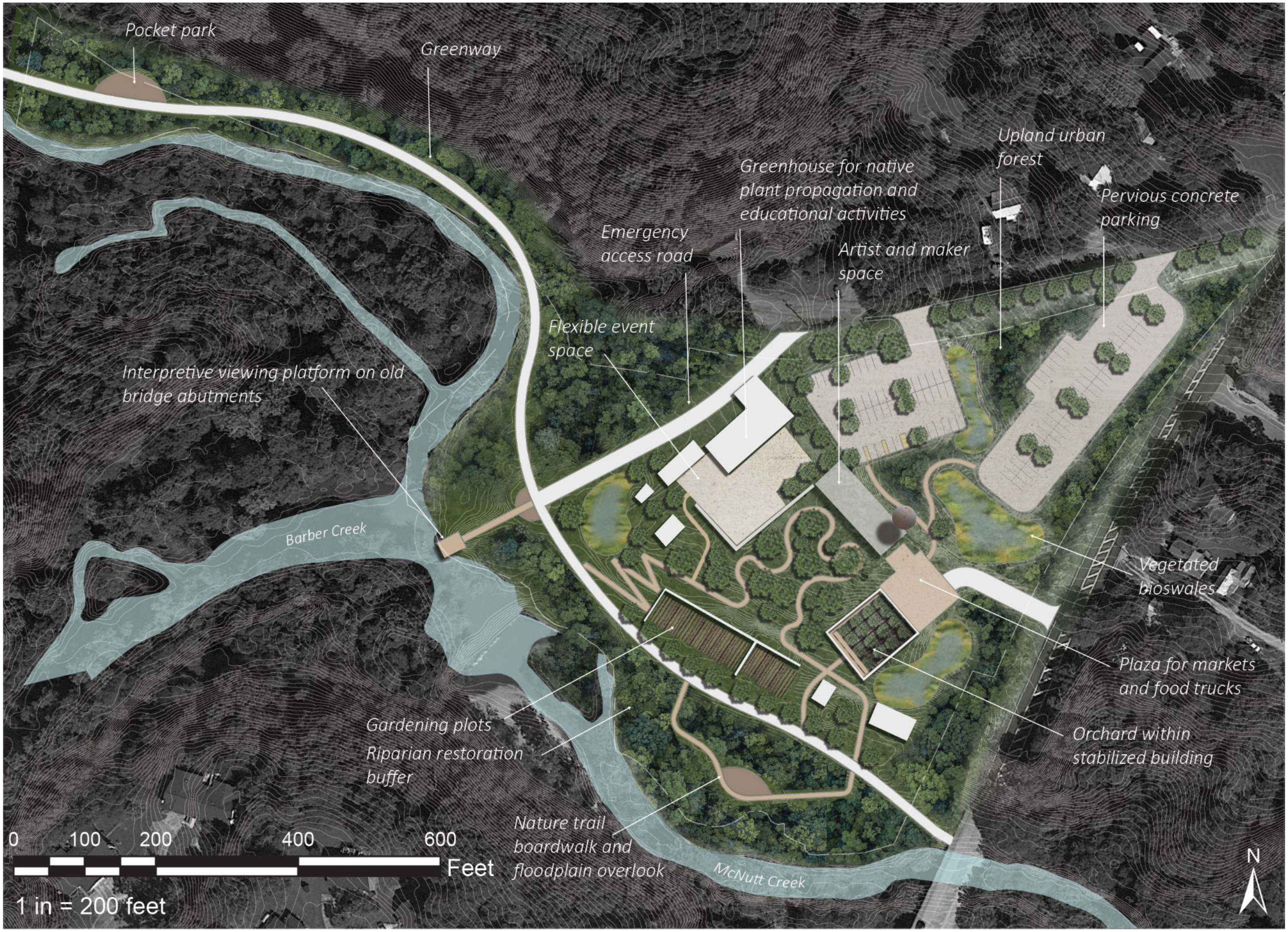

Figure 48: Plan view rendering of final design proposal (author)

Figure 49: Interpretive viewing platform from abutments of historic wooden bridge (author)

Figure 50: Flexible outdoor performance space situated in building ruins (author)

Figure 51: Greenway and ecological corridor passing through site with adjacent community garden spaces (author)

Figure 52: Orchard and elevated walkway within grid of building ruins (author)

CHAPTER 7

CONCLUSION

This thesis explored contemporary resilience theory and its suitability for application to abandoned post-industrial landscape sites, specifically small-scale sites in urban areas. Contemporary resilience discourse almost universally considers application to large-scale urban systems, at the exclusion of small-scale site design. While resilience theory is typically conceptualized at larger scales such as cities and regions, this thesis demonstrated that urban resilience theory can also be explicitly applied to smaller scales as well. However, contemporary urban resilience theory as such is insufficient and lacks both coherence and an acknowledgement of the reality of landscape development in urban areas, which is often piecemeal and lacking in urban systems level resilience goals. Therefore, it was adapted in this thesis to consider the significant differences in scale and applicability of certain design approaches and solutions in order to be more useful to landscape designers.

Through a literature review of the evolution of resilience theory, a synthesized small-scale resilience definition was proposed:

> Small-scale resilience is the capacity of a site to support large-scale resilience goals through consideration and application of eight resilience dimensions which are: biological and social diversity, multifunctionality, redundancy, flexibility, adaptability, connectivity, inclusivity, and historic-cultural significance incorporation.

Applying these eight dimensions of resilience to three case study sites (Bethlehem SteelStacks Arts + Cultural Campus, West Point Foundry Preserve, and Saint Ouen-Park of the Docks), comparative case study research and analysis established case study performance assessments of resilient design approaches and solutions and their level of applicability to the Puritan-Wellington Mill site. With a focus on findings with high levels of applicability to the Puritan-Wellington Mill site, an aggregation of these findings yielded appropriate resilient design interventions for each respective resilience dimension.

A detailed site history exploring past uses and establishing the historical and cultural significance of the site was conducted, as well as an inventory and analysis of physical site conditions, which included historic photographic documentation as well as the author's photographic documentation of the site's current state of decay and neglect. Composite site analysis established suitability and unsuitability for a range of uses on the site.

The case study findings informed the development of project objectives best suited to contribute to the seven resilience dimensions for the Puritan-Wellington Mill site. Specific programmatic and design elements best suited to achieving these objectives were also proposed as guidelines for the exploration of functional design concepts. Two functional design concepts were developed to test design approaches. The first concept focused on realizing resilience through the enhancement of ecological and physical resources, with a focus on physical and ecological connectivity as a means of highlighting, protecting, and restoring natural resources and ecosystem function. The second concept focused on realizing resilience through providing space for food production, community functions, and artists, with a focus on programming to strengthen community bonds and providing support for local artists and artisans. Strengths and weaknesses of both concepts were discussed, leading to a synthesized final design concept focused on realizing resilience through a balance between multifunctional space for community interaction and functional ecosystem integrity. This final concept was then used to develop a design proposal for the Puritan-Wellington Mill as a small-scale resilient post-industrial landscape project located on McNutt Creek in Athens, Georgia. This project utilizes the remaining historic structures as a physical and aesthetic framework for the design, thus providing a connection to the site's industrial past as well as Athens' connection to southern industrialization. Within this physical framework, the design proposal incorporates the established project objectives in order to achieve the eight dimensions of resilience, demonstrating the potential for small-scale sites designed with resilient landscape design principles to contribute to large scale urban resilience goals, whether or not those goals are explicitly acknowledged at an urban level.

This proposal also differs significantly from conventional mill redevelopment projects in that its redevelopment is fundamentally not seen as a profit-making enterprise but rather as a public good funded by taxpayer dollars. Thus, the conversion of existing structures or new development of commercial buildings is not a necessity since successful development will not be predicated on the realization of future profits, allowing the ruins to remain primarily intact. While not a profit-making enterprise, some revenue to offset development costs and taxes could be generated through vendor fees applied to the proposed farmers and craft markets as well as rental fees applied to private events in the park such as weddings, conferences, or parties. While currently owned by a private citizen, the overarching vision for this project, if pursued in reality, would explicitly necessitate the purchase of this parcel from the current owner by Athens-Clarke

County. This vision places the Puritan-Wellington Mill Park in the growing network of greenways and public parks in Athens, with the recommendation that it be developed and managed by the city with ongoing input from the community including local residents, university students and faculty, and other stakeholders. Furthermore, purchase of this property by the city would allow for a more engaged and active incorporation of the adjacent parcel (already owned by the city) containing the historic Civil War trench network than was possible within the limitations of this thesis.

This design supports regional biodiversity through native plant propagation and education; urban social diversity and community through flexible programming and events; multifunctionality through vegetated bioswales and upland forest which provide both habitat and hydrologic function; modularity and redundancy through provision of decentralized gathering spaces and localized hydrologic function; flexibility through spatial allocation which allows for a diverse array of potential uses; adaptability through the future possibility of community-initiated programming and post-occupancy evaluations; physical and ecological connectivity through the greenway corridor and improved micromobility infrastructure; inclusivity through the incorporation of accessible events and spaces to individuals of all socioeconomic backgrounds and physical abilities; and finally historic-cultural significance incorporation through the preservation and creative reuse of industrial mill ruins along with interpretive signage to educate visitors on site history and enrich local understanding of shared history and culture.

Further research opportunities are as follows:

- To obtain community and stakeholder feedback on this and similar sites in order to establish contextual needs related to resilience,

- To conduct additional case study research cross-analyzing sites in different parts of the world to better understand how resilience might change based on geographic and cultural differences.

REFERENCES

Abelman, Jacques. N.d. New Terms of Engagement: Defining Sustainability for Landscape Architecture.https://groundcondition.wordpress.com/essays/new-terms-of-engagement-defining-sustainability-for-landscape-architecture/

Ahern, Jack. 2011. "From Fail-Safe to Safe-to-Fail: Sustainability and Resilience in the New Urban World." *Landscape and Urban Planning* 100 (4): 341–43. doi:10.1016/j.landurbplan.2011.02.021.

Ahern, Jack. 2013. "Urban Landscape Sustainability and Resilience: The Promise and Challenges of Integrating Ecology with Urban Planning and Design." *Landscape Ecology* 28 (6): 1203–12. doi:10.1007/s10980-012-9799-z.

American Society of Landscape Architects. n.d. "The Sustainable Sites Initiative: SITES." https://www.asla.org/sites/

Barbra, JOSÉ Juan. "Park of the Docks in Saint Ouen by Agence Ter." Metalocus, August 9, 2017. https://www.metalocus.es/en/news/park-docks-saint-ouen-agence-ter.

Beller, Erin E, Erica N Spotswood, April H Robinson, Mark G Anderson, Eric S Higgs, Richard J Hobbs, Katharine N Suding, Erika S Zavaleta, J Letitia Grenier, and Robin M Grossinger. 2019. "Building Ecological Resilience in Highly Modified Landscapes." *BioScience* 69 (1): 80–92. doi:10.1093/biosci/biy117.

Berger, Alan. 2009. "An Interview with Alan Berger." Interview by Matteo Poli. *Abitare.* February 10, 2009. http://www.abitare.it/en/architecture/2009/02/10/an-interview-with-alan-berger-2/.

"Bethlehem SteelStacks Arts Cultural Campus." Landezine. June 22, 2017. Accessed April 23, 2018. http://www.landezine.com/index.php/2017/06/bethlehem-steelstacks-arts-culture-campus-by-wrt/.

Boetzkes, Amanda. "Waste and the Sublime Landscape." *RACAR: Revue D'art Canadienne / Canadian Art Review* 35, no. 1 (2010): 22-31. http://www.jstor.org.proxy-remote.galib.uga.edu/stable/42630816.

Brezar, Zaš, Aljaž Babič, and Lara Gligić, eds. "Bethlehem SteelStacks Arts + Cultural Campus." Landezine. Landezine, June 22, 2017. http://landezine.com/index.php/2017/06/bethlehem-steelstacks-arts-culture-campus-by-wrt/.

Brezar, Zaš, Aljaž Babič, and Lara Gligić, eds. "Saint Ouen-Park of the Docks." Landezine. Landezine, September 5, 2017. http://landezine.com/index.php/2017/09/saint-ouen-park-of-the-docks-by-agence-ter/.

Burke, Edmund. *A Philosophical Inquiry into the Origin of Our Ideas of the Sublime and Beautiful: With an Introductory Discourse concerning Taste, and Several Other Additions*. New York: Harper, 1859.

Davis, Lisa S. "Industrial Strength: Cold Spring, N.Y.: National Trust for Historic Preservation." National Trust for Historic Preservation, December 5, 2017. https://savingplaces.org/stories/industrial-strength-cold-spring-ny#.XpcMD8CSmCp.

DuRussel, Lisa. "Living in a Digital World, Part 2: Using Technology to Engage with Nature." Metropolis, January 28, 2014. https://www.metropolismag.com/sustainability/living-in-a-digital-world-part-2-using-technology-to-engage-with-nature/.

Edwards, Brian. February 1, 2010. "A Short History of Sustainable Development." https://www.thenbs.com/knowledge/a-short-history-of-sustainable-development

Fazzare, Elizabeth. "Open> Mathews Nielsen's West Point Foundry Preserve Park Sustains Landscape, History." The Architect's Newspaper, October 28, 2013. https://archpaper.com/2013/10/open-mathews-nielsens-west-point-foundry-preserve-park-sustains-landscape-history/.

FEMA, ed. "National Flood Hazard Layer Status." FEMA.gov. Federal Emergency Management Agency, September 29, 2016. https://www.floodmaps.fema.gov/NFHL/status.shtml.

Gagnon, Michael J. 2012. *Transition to an Industrial South: Athens, Georgia, 1830-1870*. Louisiana State University Press.

Grande, John K. "Beauty Going Nowhere." *Art Papers* 28, no. 6 (November/December 2004): 22-27. Art & Architecture Source.

Heyman, Stephen. "Peter Latz: Rehabilitating ... - The New York Times." The New York Times. December 30, 2015. Accessed April 23, 2018. https://www.nytimes.com/2015/12/31/arts/international/peter-latz-rehabilitating-postindustrial-landscapes.html.

Holling, C.S.. 1973. "Resilience and Stability of Ecological Systems." *Annual Review of Ecology and Systematics* 4: 1. http://search.ebscohost.com.proxy-remote.galib.uga.edu/login.aspx?direct=true&db=edsjsr&AN=edsjsr.2096802&site=eds-live.

Holmes, Damian. "West Point Foundry Preserve Breaks Ground." World Landscape Architecture, June 21, 2012. https://worldlandscapearchitect.com/west-point-foundry-preserve-breaks-ground/#.XpcHo8CSmCo.

Hull, Augustus Longstreet, and Henry Hull. 1906. *Annals of Athens, Georgia, 1801-1901*. Banner Job Office.

Hynds, Ernest C. 1974. *Antebellum Athens and Clarke County, Georgia*. University of Georgia Press.

Jarvie, Michelle E. "Brundtland Report." Encyclopædia Britannica. Encyclopædia Britannica, Inc., May 20, 2016. https://www.britannica.com/topic/Brundtland-Report.

"LEED Rating System." LEED rating system | U.S. Green Building Council. U.S. Green Building Council. Accessed May 1, 2020. https://www.usgbc.org/leed.

Lyle, John T. 1994. *Regenerative Design for Sustainable Development.* Canada: John Wiley and Sons, Inc.

Mathews, Kim. 2013. "Smart, Green, And Connected". Presentation, National Building Museum, April 17, 2013.

Mathews Nielsen Landscape Architects. "West Point Foundry Preserve." Projects - West Point Foundry Preserve - Mathews Nielsen Landscape Architects, 2020. https://mnlandscape.com/projects/west_point_foundry_preserve.

Meerow, Sara, Joshua P. Newell, and Melissa Stults. 2016. "Defining Urban Resilience: A Review." *Landscape and Urban Planning* 147 (March): 38–49. doi:10.1016/j.landurbplan.2015.11.011.

Meerow, Sara, and Joshua P. Newell. 2020. "Urban Resilience for Whom, What, When, Where, and Why?" *URBAN GEOGRAPHY* 40 (3): 309–29. Accessed April 2. doi:10.1080/02723638.2016.1206395.

Middlehurst, Steve. "1.6 The Sublime in Contemporary Art." Steve Middlehurst Landscape. March 14, 2017. Accessed April 23, 2018. https://stevemiddlehurstlandscape.wordpress.com/2017/02/12/the-sublime-in-contemporary-art/.

Mockus, Victor. “Hydrologic Soil Groups.” Essay. In *National Engineering Handbook*, edited by Claudia C Hoeft, 210th ed. Vol. 1. Natural Resources Conservation Service, 2007.

Moshrefzadeh, Mandana. “Paris, Docks De Saint Ouen.” TUM Wiki. TUM, August 23, 2017. https://wiki.tum.de/display/sddi/Paris%2C+Docks+de+Saint+Ouen.

Mul, Jos De. "The Technological Sublime." Next Nature Network. July 17, 2011. Accessed April 23, 2018. https://www.nextnature.net/2011/07/the-technological-sublime/.

Neuman, Michael. 2019. “Is Resilience Planning’s Holy Grail?” *TPR: Town Planning Review* 90 (2): 109–15. doi:10.3828/tpr.2019.9.

Norton, Bryan G. 2005. S*ustainability: A Philosophy of Adaptive Ecosystem Management*. Chicago: The University of Chicago Press.

Parr, Larry. 2001. *Paper Town/Cord Mill: A 150 Year Old Community*. L. Parr.

"Parco Dora." Landezine. April 7, 2014. Accessed April 23, 2018. http://www.landezine.com/index.php/2014/04/parco-dora-latz-partner-landscape_architecture/.

Owens Library_CED_Cooper Collection. Athens, Georgia, n.d. Cooper Collection. College of Environment & Design Owens Library.

Quigley, Mura, Neale Blair, and Karen Davison. 2018. “Articulating a Social-Ecological Resilience Agenda for Urban Design.” *Journal of Urban Design* 23 (4): 581–602. doi:10.1080/13574809.2018.1440176.

Reut, Jennifer. 2015. “A Past, in Pieces: The Roaring Industry of the West Point Foundry Was Stilled Long Ago. Mathews Nielsen Created a Preserve in the Hush of What Was Left Behi Mathews, Kim. 2013. "Smart, Green, And Connected". Presentation, National Building Museum, April 17, 2013. http://search.ebscohost.com.proxy-remote.galib.uga.edu/login.aspx?direct=true&db=bvh&AN=731821&site=eds-live.

Richardson, John. “NEF-National Ecological Framework.” EPA Region IV, 2013. https://gis1.state.ga.us/download.asp?dataID=44173

Robertson, Stanley M. *Soil Survey: Clarke and Oconee Counties, Georgia*. Washington, D.C.: U.S. Soil Conservation Service; for sale by Supt. of Docs., U.S. Govt. Print. Off., 1968.

Schippers, Peter, C. Heide, Hans Koelewijn, Marleen Schouten, René Smulders, Marleen Cobben, Marjolein Sterk, Claire Vos, and Jana Verboom. 2015. “Landscape Diversity Enhances the Resilience of Populations, Ecosystems and Local Economy in Rural Areas.” *Landscape Ecology* 30 (2): 193–202. doi:10.1007/s10980-014-0136-6.

Soodalter, Ron. “The Guns of the Hudson.” The New York Times. The New York Times, January 24, 2014. https://opinionator.blogs.nytimes.com/2014/01/24/the-guns-of-the-hudson/?_php=true&_type=blogs&_r=2.

Sopher Sparn Architects, LLC. June 18, 2015. "The Roots of Sustainable Architecture." http://www.sophersparn.com/the-roots-of-sustainable-architecture/

Steele, James. 2005. *Ecological Architecture: A Critical History.* London: Thames and Hudson.

“SteelStacks Arts + Cultural Campus: 2017 ASLA Professional Awards.” SteelStacks Arts + Cultural Campus | 2017 ASLA Professional Awards. ASLA, 2017. https://www.asla.org/2017awards/320207.html.

“SteelStacks Arts and Cultural Campus.” Wallace, Roberts, and Todd. WRT. Accessed April 15, 2020. https://www.wrtdesign.com/work/steelstacks-arts-and-cultural-campus75.

The Editors of Encyclopaedia Britannica. “Saint-Ouen.” Encyclopædia Britannica. Encyclopædia Britannica, Inc., June 30, 2017. https://www.britannica.com/place/Saint-Ouen.

Thomas, Frances Taliaferro, and Mary Levin Koch. 2009. *A Portrait of Historic Athens & Clarke County*. 2nd ed. Publications (Wormsloe Foundation). University of Georgia Press.

Tourisme, Seine-Saint-Denis. “Saint-Ouen Docks.” Seine-Saint-Denis Tourisme. Accessed April 15, 2020. https://uk.tourisme93.com/saint-ouen-docks.html.

UN Habitat. 2006. “State of the World’s Cities” 2006/07. Earthscan, London.

USGS, and ESRI, eds. “Contour and LIDAR Downloads.” Athens-Clarke County Open Data. Accessed May 12, 2020. https://data-athensclarke.opendata.arcgis.com/app/d00ef68c82f64c88833ab7c15dd08255.

“Water Quality in Georgia.” Water Quality in Georgia. Georgia Environmental Protection Division, 2018. https://epd.georgia.gov/watershed-protection-branch/watershed-planning-and-monitoring-program/water-quality-georgia.

“What Is SteelStacks?” SteelStacks. ArtsQuest. Accessed April 15, 2020. https://www.steelstacks.org/about/what-is-steelstacks/.

Williams, Daniel E. 2007. *Sustainable Design: Ecology, Architecture, and Planning*. Hoboken: John Wiley and Sons.

“WRT's Design for SteelStacks Awarded ULI Global Award for Excellence.” Business Wire, October 23, 2014. https://www.businesswire.com/news/home/20141023005131/en/WRT%E2%80%99s-Design-SteelStacks-Awarded-ULI-Global-Award.

Zylinska, Joanna. "Photography After the Human." *Photographies* 9, no. 2 (2016): 167-86. doi:10.1080/17540763.2016.1182062.