Floodplains and the Proximate Principle: A Case for Floodplain Linear Parks in Roanoke, Virginia

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Introduction

The intention of this paper is to argue a position for the use of floodplain linear parks as a means of urban flood mitigation. Current approaches often focus on protecting existing and future structures via the use of costly-engineered solutions such as dams and floodwalls. My argument is that the same money can be used to restore the floodplain by removing such structures and establishing a park system that will serve as a valuable public amenity, while allowing flooding to occur with minimal damage produced. In the long run, such a park will provide a greater return on the investment than other potential solutions. A discussion of the "Proximate Principle" will describe how this works. From an environmental perspective, the importance of such a park will be discussed by placing it in the context of the green infrastructure concept, which is essentially an umbrella term for ongoing efforts to better integrate human and natural systems. Three case studies are presented that demonstrate examples of such park systems and the effects they had on local economies and communities. These studies begin demonstrating the social connotations for such a project as well. Throughout this paper, ties are made to the city of Roanoke, Virginia (where the project portion of this thesis takes place) to demonstrate the relevance of floodplain linear parks to the city.

The second part of this paper documents the design phase of this thesis and includes all information pertaining to the analysis and design processes. Because any proposal to relocate property is sensitive, site analysis was a large component of this project to ensure that all design decisions are justified by being solidly grounded in facts. The design represents a conceptual idea, however given the scale and complexity of the project; development of a plan that can be considered a final solution is not feasible. The project is rather intended to form a foundation from which other studies and designs can be implemented. Ideas on what these studies and designs may be are presented in the "Conclusion / Reflection" section.

The Urban Machine

Definition of Green Infrastructure

A growing concept today in the field of urban planning and design is that of a "green infrastructure." As defined by Benedict / McMahon (2002), green infrastructure is:

> "…our nation's natural life support system – an interconnected network of waterways, wetlands, woodlands, wildlife habitats and other natural areas; greenways, parks, and other conservation lands; working farms, ranches and forests; and wilderness and other open spaces that support native species, maintain natural ecological processes, sustain air and water resources and contribute to the health and quality of life for America's communities and people."

As noted by Steve Ducham (2000), the notion of an interconnected system is what separates the idea of green infrastructure from our current parks, which Ducham describes as consisting mainly of "protected residual open space". He goes on to note that green infrastructure "refers to the underlying functional components of the system". When viewed as a critical element of urban infrastructure, city parks and open spaces provide numerous opportunities to enrich the urban environment, providing social, economic, and environmental benefits. Historically however, they have been designed as an afterthought to other structural elements (Shirvani, 1985, pg 28). As noted by Bunster-Ossa (2001), emphasis is placed on "positive mass" (buildings, roads, etc.) with open or "negative spaces" consisting of a standard pallet of parks, plazas, and gardens intended to soften the hard landscape. This approach to open space design is indicative of the common perception of the city as a machine as opposed to a living system. The green infrastructure approach however, recognizes the functional value of open spaces and seeks to capitalize on such values. It emphasizes the design and planning of such spaces in a

more integrative way that recognizes both human and natural processes, and treats parks as more then just space fillers.

Roanoke and the "Urban Machine" Concept

As noted by Hough (1995), the modern city has typically been viewed as "a product of cheap energy, economic forces, high technology, and a view of nature that is under control." The origins of this perception can be traced to the origins of human settlement in America. As European settlers arrived, they viewed the new world as a land with endless economic opportunities, where the natural resources were abundant and inexhaustible. As with many cities throughout the world, commerce was the determining factor on where and how cities were developed, with transportation corridors being the primary catalyst of growth.

Roanoke, Virginia is no different. The city is located on former salt marshland that would dry in the warmer months and leave a salty residue on the ground (White, 1982). These "salt licks", combined with the numerous springs, streams and creeks in the area made it a popular gathering ground for wildlife and consequently, Native American hunters. The only transportation routes were wildlife trails, which often marked the path of least resistance. Many current roads follow the path of these trails. The streams and springs, combined with the fertile land along the floodplain also attracted the earliest European settlers to the region. Mills were constructed on most streams to process wheat into flour, which was the second largest crop after hemp (White, 1982). These mills and farms marked the earliest stages of commerce in the region.

The first significant attempts to control nature came in the early 1800's as the growing population began viewing the salt marshes not as a source of sustenance like the Native Americans did, but as a source of disease. As a consequence, the first public outcries were made to drain the marshlands. The outcries would eventually be recognized as the marshes were drained to create stable land for construction.

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Despite an increasing population, growth in the Roanoke Valley was hampered by the lack of accessibility. In 1815, an unsuccessful attempt was made to create a navigable route up the Roanoke River from North Carolina, to be used for tobacco shipment (White, 1982). This trend changed however in 1852 with the coming of the Virginia-Tennessee Railroad, which acted as a magnet for business in the town of Gainesboro (soon to be the city of Roanoke). With the railroad came new opportunities in tobacco warehousing and processing, which became big business for the town. The economy of the town was further bolstered in 1881 with the announcement that the Norfolk-Western Railroad (formerly AM&O), seeking to profit from coal deposits in West Virginia, was to connect with the Virginia-Tennessee line in the town (White, 1982). Recognizing the significance of the situation, citizens of the town offered to pay for rights-of-way, as well as a new terminal to ensure the railway came to town. The Roanoke Land Improvement Company was formed to develop areas around the terminal, which at the time were primarily agricultural or swamps. As expected, workers flocked to the area, and in 1882 the city of Roanoke was born.

Throughout the country and prior to the nineteenth century, when populations were small and resources abundant, provision of basic services, such as potable water and waste disposal, was the responsibility of individual residents (Poole, 1998). Wells were dug for water and waste was disposed of in streets and rivers. As populations grew, pollution of water supplies and outbreaks of disease made it clear that a new system was needed. With the growing population brought on by the coming of the railroad, new emphasis was placed on improving the sanitary condition of Roanoke. Until then, wastes were dumped directly into the many streams running through the region, wells were deemed unfit for consumption, and calls were still being made to drain and fill the swamps (White, 1982). In 1883, new water mains were laid to provide waste removal and clean water, and money was procured for the draining of the swamps (White, 1982). From this point, the city infrastructure began to improve and expand with the addition of new sewage lines, telephones, streets and other public amenities such as schools, jails, and courthouses. The first electric lighting was provided in 1886 and streetcars provided transportation throughout the city.

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The advent of the automobile has had perhaps the most profound impacts on the urban environment. With its rise from an item of luxury to an item of necessity came an added emphasis on the provision of roads, parking lots, and other car related services. This detracted emphasis from pedestrian amenities, resulting in increased dependence on the automobile. The affect of the auto began hitting Roanoke around 1929 as they replaced streetcars for transportation, and the greater independence they provided caused an exodus to the outskirts of the city (White, 1982). Commercial industries followed the migration and the beginnings of sprawl in Roanoke began and continue to this day. As in many cities, sprawl created an economic vacuum in the downtown region. Projects intended to rejuvenate the downtown area include the Roanoke Civic Center, Market Square, and Center in the Square. Though these projects were successful, rejuvenation efforts still continue today, providing opportunities to transform Roanoke from an urban machine to an urban ecosystem.

Summarizing the Urban Machine Cycle

This section provided some historical context about Roanoke, the location of this thesis design study. It also demonstrated the cycle of development that is common to all American cities and indicative of the urban machine perception. Exploitable resources and a means of reaching them provide the catalyst for settlement. Settlement requires improved transportation routes that provide important lifelines to more stabilized regions. Improved transportation routes create a greater flow of goods and people. Increasing populations create increased consumption and provision of resources. This in turn requires continuing improvements to the city infrastructure that provide those resources, which in turn requires money to make the necessary improvements. A strong economy is therefore essential for a strong city. A strong economy requires greater commercial investment,

which draws more people to the region, thereby increasing the population. As populations increase, so too does the demand for housing and the price of land. This increase in demand creates an increase in property values and consequently, an increase in property taxes paid. This is good for a community as it provides greater revenue with which to make necessary community improvements, thereby further increasing the demand to live there. With this increase also comes greater incentive to develop all available land, thereby maximizing the tax revenue generated by the land. Without a strong tax base, the city cannot maintain the necessary amenities needed to sustain a thriving urban population and the quality of life will begin decreasing, along with the desire to live there. This all leads to the conventional wisdom that development is the optimal use of vacant land, as development increases the tax base. Parks and other open space amenities are often low on the priority list for funding as they have previously been viewed only as a cost with no return on the investment. A direct link can therefore be made between the deterioration of the natural environment within cities and the current perception of the city as an urban machine. Combating this will require a greater understanding of the economic role of such spaces and how they fit in the urban development cycle.

History of the Green Infrastructure Concept

Unlike the urban machine concept, which places most emphasis on the human ability to control nature, the green infrastructure concept recognizes humans and human development as being part of a larger system, a system that works in conjunction with natural process; a system in which the fundamental laws of nature are used to inform design (Beatley and Manning, 1997).

While the concept of utilizing natural process to inform design can be seen in early projects such as the Boston Fens by pioneer landscape architect Frederick Law Olmsted, Ian McHarg is often credited with bringing the concept to the forefront of design, thanks to his 1969 book *Design With Nature*. Early in the book he states, "If one accepts the simple proposition that nature is the arena of life and that a modicum of knowledge of her processes is indispensable for survival and rather more for existence, health and delight, it is amazing how many apparently difficult problems present ready resolution" (1969, pg. 7). McHarg goes on to suggest a design process based on intensive analysis of ecological processes. His plan separates various ecological phenomena into layers and then based on those layers, utilizes a point system to determine the most appropriate land uses for given areas of a site. This system proved to be the catalyst for modern day GIS technology.

Since *Design With Nature*, there have been many designers and scientists advocating the use of natural processes to inform design. Greenwood and Edwards (1979) note that "If the environment hospitable to life is maintained by the living systems themselves, then the crucial factor in our environment may well be the mechanisms that provide maintenance functions for the ecosystems." This statement suggests that the maintenance of natural processes is critical for the overall welfare of the ecosystem, and therefore humans. Spirn (1984) suggests "In themselves, the forces of nature are neither benign nor hostile to humankind. Acknowledged and harnessed, they represent a powerful resource for shaping a beneficial urban habitat; ignored or subverted,

they magnify problems that have plagued cities for centuries, such as floods and landslides, poisoned air and water." Hough (1995) notes that "Design thinking must go further [then current approaches to environmental issues] and ask: how can human development processes contribute to the environments they change? Habitat building – creating those conditions that permit a species to survive and flourish – is a basic motivation of all life forms." I appreciate this comment (1996) because it goes beyond merely recognizing natural processes and suggests that human development can occur in a way that actually enhances such processes. Van Der Ryn and Cowan offer 5 principles for ecologically sensitive design. Those principles include: 1) solutions grow from place 2) ecological accounting informs design 3) design with nature 4) everyone is a designer 5) make nature visible. These principles again reflect the importance of humans in the design process and suggest that solutions need to consider the needs of and involve the community in the design process to adequately address the ecology of place. Poole (1998) makes the statement "Abstract models, labels, and images of 'nature' and 'city' ignore the natural biophysical systems that constitute significant and vigorous components in the formation of the city's cultural and physical development. Indeed, the natural systems are the original and enduring spatial, temporal, and climatic components that cultural entities engage and within which they develop." This statement speaks not only to the importance of recognizing natural processes, but also to their ability to influence urban form, and more specifically, the form of city infrastructure.

All of these resources support the notion of green infrastructure, with its emphasis on the system and natural process as opposed to the random placement of parks and open space. Benedict and McMahon (2003) further refine this concept by stating 4 key points regarding green infrastructure, which include:

1) Creating an interconnected system of parks and open space is manifestly more beneficial than creating parks in isolation.
2) Cities can use parks to help preserve ecological functions and to protect biodiversity.

3) When planned as part of a system of green infrastructure, parks can help shape urban form and buffer incompatible uses.
4) Cities can use parks to reduce public costs for stormwater management, flood control, transportation, and other forms of built infrastructure.

While these points suggest certain benefits of a green infrastructure network, the idea itself is still a bit obscure. Furthermore, the benefits mentioned in these points are difficult to quantify and therefore difficult to sell. In a capitalistic society that sets prices based on competition in a free market, how can open space that provides intangible benefits compete with development that has clear economic benefits? If properly planned using concepts of landscape ecology and natural process as a model, a green infrastructure network clearly has ecological, aesthetic, recreational, and many other benefits. In order for it to become an integral part of the urban infrastructure, a truly critical part of the machine, it needs to respond to the driving force behind urban success, which is the economy. What is needed is an open space planning process that responds to both natural and economic forces to achieve the maximum benefits from both.

From an environmental perspective, the idea that interconnected green spaces are more beneficial than parks in isolation is based on concepts of landscape ecology and supported by Landscape Ecologist Richard Foreman in the article "*The Missing Catalyst: Design and Planning with Ecology Roots*" (2002). In the article, Foreman identifies 7 trends that are likely to become important for designers and planners. They include:

1) Make the "indispensable spatial patterns" of nature the top priority in all projects
2) Aggregate land uses yet maintain small patches and corridors of nature throughout developed areas
3) Provide for horizontal ecological flows or natural processes
4) Create anthropocentric spatial patterns that mimic those of nature

5) Incorporate at least one bio-rich place in every project
6) An ecologically optimum sequence for changing a landscape will provide the directional and time dimensions for planning and design
7) Ecologically integrate road networks into the landscape

These trends begin to suggest ways of integrating ecological processes into the built environment, however, like most sources, they suggest that an interconnected network of parks and green spaces should be designed and planned prior to development. How then can we establish such a system in already developed urban areas? Hough (1995) offers an answer to this by noting that natural processes continue to function in the most urbanized areas. It can be seen on underused or idle lands in the form of naturalized plant communities. "Look behind the petrol station, the forgotten space used as a junkyard, the alley tucked away behind the city's main thoroughfares or the backs of many abandoned buildings in the poorer parts of town, and you will find magical places of dense forests and varied groundcovers that have appeared on their own" (Hough, 1995; pg 109). While the majority of naturalized plant species found in such areas are exotic and considered weeds, these residual spaces provide significant environmental benefits and should be managed accordingly. They are rich in ecological significance and offer a low cost opportunity to enrich the urban environment. Being however that these spaces are located in areas of seemingly poor development potential, how can their value be demonstrated in order to promote greater investment in their care and upkeep? Stein and Millar (1998) note that funding for the management of residual space is often first to be eliminated from the budgets of the responsible authorities, as these spaces are considered decorative items, not critical to the functioning of the city. They go on to state that such spaces "can become a showcase for a new urban open space typology, a working environment where man-made and natural laws operate simultaneously." I agree.

Green Infrastructure: Problems and Opportunities

Though the term may be new, the concept of green infrastructure is not. It is in fact supported by some of the most respected members of the design and planning profession. Despite this fact, open space planning and provision typically comes secondary to other forms of built infrastructure; it is viewed more as a cost then an investment. This is in part due to the perception of parks as a luxury item, not a functional part of the urban environment. Historically, parks were nothing more then luxury items. Today however, recognizing the potential environmental benefits that green spaces provide, planners and designers are seeking more functional ways of utilizing them in urban and suburban environments. The green infrastructure is difficult to implement however, particularly in urban environments, given the high value of land and the un-quantifiable benefits of open spaces. A park planning process must therefore be developed that recognizes natural processes as well as human ones, such as economics.

The Economics of Green Infrastructure

Within the field of Urban Forestry, many studies have been conducted documenting the benefits of trees, parks and other open spaces. Such benefits include air pollution reduction, mitigation of urban heat islands, stormwater runoff reduction, and provision of wildlife habitat, to name a few. The green infrastructure concept seeks to capitalize on these benefits by utilizing green space to mitigate common environmental problems in urban areas. For the purpose of this study however, I will concentrate on the relationship between green space and property values, as I feel this can potentially provide a valuable tool to promote investment in the urban green infrastructure.

The Value of Green Space

It is well documented that trees increase property values. Miller (1997) discusses several studies indicating that parcels containing trees can sell for anywhere between 15% and 27% more then un-wooded parcels. These increased property values translate into increase tax revenue generated. Dwyer (1992) estimates that a 5% increase in residential property values will result in a $25 increase on a $500 annual tax bill, which translates to $1.5 billion when considering all single-family homes in the U.S. Nowak and Dwyer (2000) also note that the benefits go beyond parcels containing trees and suggest that parks and greenways, especially those with an "open space character", also have a positive impact on adjacent property values. A study conducted by Luther and Gruehn (2001) in Berlin addresses this exact issue. The study was intended to combat a cost-cutting trend throughout Europe caused by the common perception of local authorities that parks are not worth more then minimal investment. By statistically analyzing pre-determined factors potentially affecting land values, the study addressed the following questions:

- Do individual open space-related location criteria have a positive effect on land value? If so, how great an affect?
- Do individual health-related location criteria have a positive effect on land value? If so, how great an effect?

Results of the study indicate that land values are related to the distance of the plot to the nearest neighborhood open space, with values decreasing as the distance to such open space increases. Specific results pertaining to various conditions are as follows:

- Plots located near playgrounds are considerably more expensive then those without playgrounds nearby
- Plots located with at least 2 listed gardens in a 300M radius average approximately 20% more then those without gardens nearby
- Visual quality of the street has a direct positive impact on property values
- Preferred locations are those that make a compromise between distance to open space and the urban center.

Studies such as this begin to emphasis the valuable relationship between open space and property values, thereby demonstrating the potential for using parks to stimulate community investment.

<u>The Proximate Principle</u>

The study documented above is a good example of what John Crompton (2004) refers to as the "Proximate Principle", which is essentially the capitalization of parkland into increased property values for adjacent landowners. The principle derives from the consistently documented fact that people are willing to pay more

money for properties located near green space. A commonly cited example of this principle in action is golf course development, as enhancement of property values is often a primary goal.

The notion of parks improving adjacent property values is not revolutionary; in fact it can be traced back for centuries. Spirn (1984) documents of history of connection between cities and rural areas, which begins millennia ago when the two were interconnected, continues through a period of disconnection as cities grew larger, and finally into the period of suburban or "garden city" development. It was within the period of disconnection that the economic value of parks began to manifest itself, as they became primarily the property of the wealthy and not the commoner. Crompton (2004) notes that in London, private parks were provided as a means of improving property values for the growing upper-class population. These parks were shaped as squares to maximize the units that could be located around them, thereby maximizing profits for landlords and developers. Today urban parks are considered important public amenities though their placement is often an afterthought to other forms of development. The Proximate Principle reveals however, that a more economically beneficial planning approach to parks and open space is possible.

To demonstrate the Proximate Principle, Crompton (2004) offers the following scenario:

A city issues a $1 million General Obligation bond to fund a municipal park project, with an annual dept charge of $90,000. The park to be created is 50 acres in size and of a rectangular shape. Around the park are 3 zones of development (zones A, B, and C), with zone A being on the perimeter of the park and Zone C being farthest away. For the purpose of demonstration, the following assumptions are made:

- 70 home lots are located in each of the 3 zones
- Incremental property premiums for zones A, B, and C are 20%, 10%, and 5% respectively

- Annual property taxes are 2% of the total property values
- The average property value for homes outside of the 3 zones is $200,000

Considering this, the annual additional revenue the city generates from the increased property taxes is $98,000. This is sufficient to pay for annual debt charges, with $8,000 extra.

While this is a simplified scenario, it demonstrates the general concept. Many factors relating to design and economics can change these values in either a positive or negative direction. Understanding these factors is therefore critical to developing a design process that extracts maximum capital benefits from parks.

From an economic perspective, the obvious factors include property tax rates and average home values, as these will have a direct positive or negative impact. From a less obvious perspective, Crompton notes the following factors:

- The use of state or federal grants will decrease the reliance on municipal tax revenues to fund a project, thereby increasing the monetary benefits of the park to the municipality
- Tax benefits to the municipality will continue to accrue after the bond obligation is fulfilled
- Less quantifiable benefits provided to the community via air pollution reduction, storm runoff reduction, aesthetics, etc., are not factored into the equation
- The improved quality of life a park system can provide will attract more residents and private investors to the municipality

More relative to this paper however, are the factors directly influencing property premium values, as these will directly influence the design and planning of a park system. The following is a general summary of the results of

many studies presented by Crompton (2004). These empirical studies used statistical analysis of tax records to assess the specific impacts of parks on property values under a variety of conditions.

Distance from a given property to the park – The scenario presented earlier identifies three zones around the perimeter of the park, each radiating progressively farther from the park edge. The premium increase values of 20%, 10%, and 5% associated with zones A, B, and C respectively, reflect the documented fact that benefits accrued by property owners decrease with increasing distance from the park. While these premium percentage values are not static, they reflect the results of numerous studies conducted throughout the U.S. on the affects of parks and property values, and serve as a good rule of thumb. Another rule of thumb is that the outer perimeter of zone C is approximately 500 feet (a 3 minute walk or 3 blocks) from the park perimeter. Beyond this, property premium incentives drop off significantly, and are negligible beyond 2000 feet.

Total amount of park edge – as mentioned earlier, the number of homes within the parks range of influence directly impacts additional revenue generated. In addition, homes located on the park perimeter generally experience a greater increase in home premiums than those farther away. For these reasons, urban areas typically benefit more from parks then suburban areas and linear parks provide more benefits then square or circular parks.

Type of park / usage – The type and usage of a park can have significant impacts on the economic benefits of that park. Urban or active recreation parks that contain ball fields and courts typically have less, if not negative impacts on property values, as opposed to natural or passive recreation parks that contain preserved natural vegetation, which typically have strong positive impacts. An explanation of this is that active parks draw large crowds and often contain high intensity lighting, making them a nuisance to adjacent property owners. Greatest

benefits of such parks are derived from properties near but not adjacent to them, as these residents get to enjoy the benefits without experiencing the problems.

Location of the park – Benefits derived from a park, as mentioned earlier, are influenced by its location within an urban or suburban neighborhood, with urban areas obtaining the greatest benefits. Suburban neighborhoods have more open space readily accessible, so the perceived benefits of the park are less significant. This demonstrates the influence of supply and demand, the greater the supply, the less the demand. Private yards also tend to detract significance away from parks. Accessibility to the park is also an issue, as a park that cannot be accessed by adjacent properties has little if no positive impact on the property values.

Size of the park – Large parks tend to provide greater overall benefits to adjacent property owners, however the total benefits provided by a series of small parks, equal in total size to the large park, is greater. This again emphasizes the importance park edges.

Maintenance and park condition – Poorly maintained parks or open spaces tend to have negative impacts on adjacent property values. Parks that tend to attract undesirable (criminal) behavior also reflect negatively on adjacent properties.

From a green infrastructure perspective, two things in particular intrigue me about the results of these studies, the first of which is the relationship between the amount of park edge and economic benefits achieved. The positive relationship between the two indicates that greenways are a potentially ideal scenario. This is important given the emphasis placed on interconnectedness within the green infrastructure, a function appropriately

by greenways. The second is the relationship between un-maintained areas and property values. As mentioned earlier, these forgotten, residual spaces provide potential connecting opportunities within the green infrastructure. Demonstrating that improvement of such spaces will positively impact adjacent property values, and consequently tax revenues, may provide the incentive necessary to invest more funds in them.

Greenways

As defined by Schwarz and Flink (1993), a greenway refers to "a wide variety of linear open spaces that provide connections and thereby foster movement of some sort, from neighborhood bicycle routes, to pristine wildland corridors that guide migrating wildlife in their seasonal travels." They often originate from an existing corridor of some sort, be it a river, railway, or wildlife path and create the linkages of a green infrastructure network. Walmsley (1996) notes again that such linkages are best planned prior to development and that in urban areas the remaining opportunities are along natural corridors and other residual spaces that should not be disregarded. This again returns us to the question of demonstrating the value of such spaces so as to promote greater investment in them, a question that the Proximate Principle can help answer. Crompton (2004) however, notes that definitive results regarding the impact of greenways on adjacent property values is inconclusive and that opinions of such trails vary from negative to positive. Of the negative opinions, the dominating concern is lack of privacy, which needs to be considered when planning such linear park systems.

Roanoke River Floodplain

Considering the discussion thus far, it is my general position that floodplains should compose the backbone of the urban green infrastructure, and I say this for several reasons.

First, streams and rivers are the natural drainage system of a watershed. They provide a direct natural connection between the city and outlying rural areas.
Second, floodplains represent an opportunity to construct a linear park system and natural open space quality, which according to the proximate principle can provide numerous economic benefits to the community
Third, floodplains are by definition an area subject to periodic flooding, which indicates the potential danger of developing there.
Fourth, a great deal of money is already spent in such areas to either repair damage or prevent it from occurring.
Fifth, stream corridors often contain many of the forgotten residual spaces mentioned earlier as an opportunity for green infrastructure development.

How then can floodplains be transformed into a flood protection device while still capitalizing on the urban benefits of such areas? Can the creation of a floodplain park system achieve this? Can an analysis / design process be created to address such issues?

<u>Floodplain Management</u>

Urban flooding is perhaps the most costly and dramatic consequence of human development interfering with natural processes. According to the VA Department of Conservation and Recreation, floods cause an average of $3 billion in damages in the U.S. annually and cost approximately 200 people their lives. According to the Federal

Emergency Management Agency (FEMA), Tropical Storm Jeanne caused over $1.6 million in flood damages in VA alone, the majority occurring within the cities of Roanoke and Salem. Flooding in the Roanoke region however is nothing new. In fact it dates back as long as settlements existed in the region, with the first documented deaths occurring in 1749 when Peter Kinder and his wife were washed away one night, along with their house that was located at the mouth of Peter's Creek (named after the man) and the Roanoke River (White, 1982; pg 1). Despite the common occurrence of flooding along the Roanoke River, settlers and businesses continually made their homes there. The earlier discussion on the history of Roanoke explains why. While development within floodplains is justifiable in earlier years given the hard living conditions and limited technology, today it seems an invitation to disaster, yet we continue to do it.

Given the unpredictability of flood events, achieving complete protection is neither practical nor possible. The Federal Emergency Management Agency (FEMA), the agency that oversees the National Flood Insurance Program (NFIP), therefore determined the acceptable level of risk to be 1%. This means that each year a given area has a 1% chance of being flooded. This area is defined as the 100-year floodplain (implying that it occurs only once every 100 years) and is noted on Flood Insurance Rate Maps (FIRM's) as flood-zone A. Development within this floodplain is limited but not prohibited. However, if flood insurance is to be offered on such structures, the community must first participate in the NFIP and therefore must adhere to floodplain development guidelines as determined by state and federal standards. Despite the term "100-year" floodplain, studies predict that structures located within it have a 26% chance of experiencing flood damage over the course of a 30-year mortgage (Shepard, 1994). There is also concern about using the 100-year floodplain as a standard, as it can produce a false sense of security and result in devastating losses should that flood level be exceeded. In Johnstown PA, 76 people were killed when a 500-year flood struck in 1977, flooding 136 communities (Shepard, 1994). In 1993, flood levels along the Mississippi and Missouri Rivers far exceeded the 100-year level resulting in almost $20 billion in damages (Shepard, 1994).

While a detailed discussion of floodplain management is not necessary for this project, it is perhaps relevant to note that the VA Department of Conservation and Recreation is the overseeing authority, with local governments responsible for establishing and enacting floodplain management zoning. Zoning must meet minimum standards set in state model ordinances, however localities can be more restrictive to ensure greater protection. To aid localities, the Virginia Floodplain Management Association (VFMA), consisting of state and local professionals, was created to serve as the organizing unit for floodplain management. On the national level is the Association of State Floodplain Managers (ASFPM), which serves a similar role. The ASFPM encourages communities to go beyond merely participating in the NFIP, and notes that many communities are "moving beyond simply administering floodplain management regulations and managing floodplains based on principles of sustainability and multi-objective management." Such creative approaches that are "efficient in their performance, and comprehensive in their efforts" are, according to the ASFPM, necessary for effective floodplain management.

Roanoke River Flood Reduction Project

An urban flood reduction plan typically seeks to increase the amount of flow a flood prone section of river can accommodate. This often involves channel deepening or the construction of floodwalls or levees. While effective in the short term, these approaches do little to address the root causes of flooding and often result in the decreased quality of the riverine environment and the increased likelihood that a catastrophic event will occur in the future (Middleton, 1999; Foreman, 1995). While I understand and appreciate the practicality of such approaches, I question if a more sensitive approach is available that engages the floodplain rather then controls it.

The Roanoke Flood Reduction Project, as proposed by the Army Corps of Engineers (ACE) is a good example of the standard approach. As stated earlier, the Roanoke River has been the source of flooding problems since the earliest settlers arrived in the region. While all rivers experience occasional flooding, the problem with the Roanoke

River has been exacerbated by the heavy urbanization of the area in and around the floodplain as it extends through the cities of Salem and Roanoke. It is estimated that approximately $1 billion in properties are at risk within those two cities. To alleviate such problems, the ACE proposes several treatment options to be implemented throughout the city as appropriate. Those options include:

- Channel widening via benched terraces extending 1 to 2 feet above the average stream flow over most of the project length
- Snag and debris removal throughout project area
- Approximately 6,402 linear feet of training walls along the top of the bank consisting of earth berms, composite walls, or steel and concrete walls
- Slope protection via rip rap and earth crib walls within bench cuts and near development
- General landscaping activities

While these solutions do have their place within a flood reduction project, they present some design problems as well. Bench terraces will hold back floodwaters, however they can also be aesthetically unappealing and serve as a barrier disconnecting residents and communities from the river. The removal of snags and debris allows for more unrestricted flow, however it also reduces aquatic habitats, facilitates streambank erosion, increases stream temperature, and reduces the input of organic matter into the river. Training walls are again unsightly and decrease access (both visual and physical) to the river. Riprap as a slope stabilizer is also unsightly and limits the ability of natural vegetation to re-colonize the stream banks. The Environmental Impact Statement (EIS) for this project supports these concerns. The following is a list of general issues identified by the EIS.

- Loss of forested habitat

- Loss of riparian vegetation
- Increase in silt and sediments, thereby reducing water quality
- Potential water temperature increases
- Loss of wildlife habitat due to crib wall placement and debris removal
- Aesthetic concerns do to loss of vegetation, riprap walls, and slope protection
- Potential loss of small, unidentified wetlands due to fill activities (the project contains no efforts to restore or create wetlands to mitigate flood levels)

Despite these concerns, the ACE identifies this plan as the only practical solution to the flooding problems of Roanoke. Part of the intention of my thesis is to see if this is true.

Perhaps the best way to gauge the appropriateness of the proposed plan is to review the many letters received by the ACE from various organizations expressing their concern over it. The "Friends of the Roanoke River" for example, noted in a letter that the cost-benefit ratio is at break even with the benefits being so minimal that the project should be killed. They also expressed concern over the removal of streamside vegetation and the use of riprap as an erosion control measure. The "Roanoke Valley Urban Forestry Council" expressed interest in seeing a full range of alternatives that address the flooding problem throughout the drainage area. They are also concerned about the potential loss of tree cover, effects on tributary streams, and effects on the proposed greenway plan. They also asked the ACE to consider the possibility of innovative financing to purchase flood prone properties. "Pathfinders for Roanoke Valley Greenways" is especially concerned with the beauty and health of the river after project completion, citing specifically the use of riprap and the removal of vegetation. They note that the Roanoke River Greenway will be the backbone of the entire network and should be incorporated into the flood reduction plan. With regard to the proposed plans to alter the stream channel, the Environmental Protection Agency emphasizes the use of non-structural methods such as floodplain preservation

and flood proofing as an alternative or in combination with the structural alternatives. In fairness, the ACE recognizes these concerns and is taking measures to alleviate them. A floodplain park however, can potentially eliminate them.

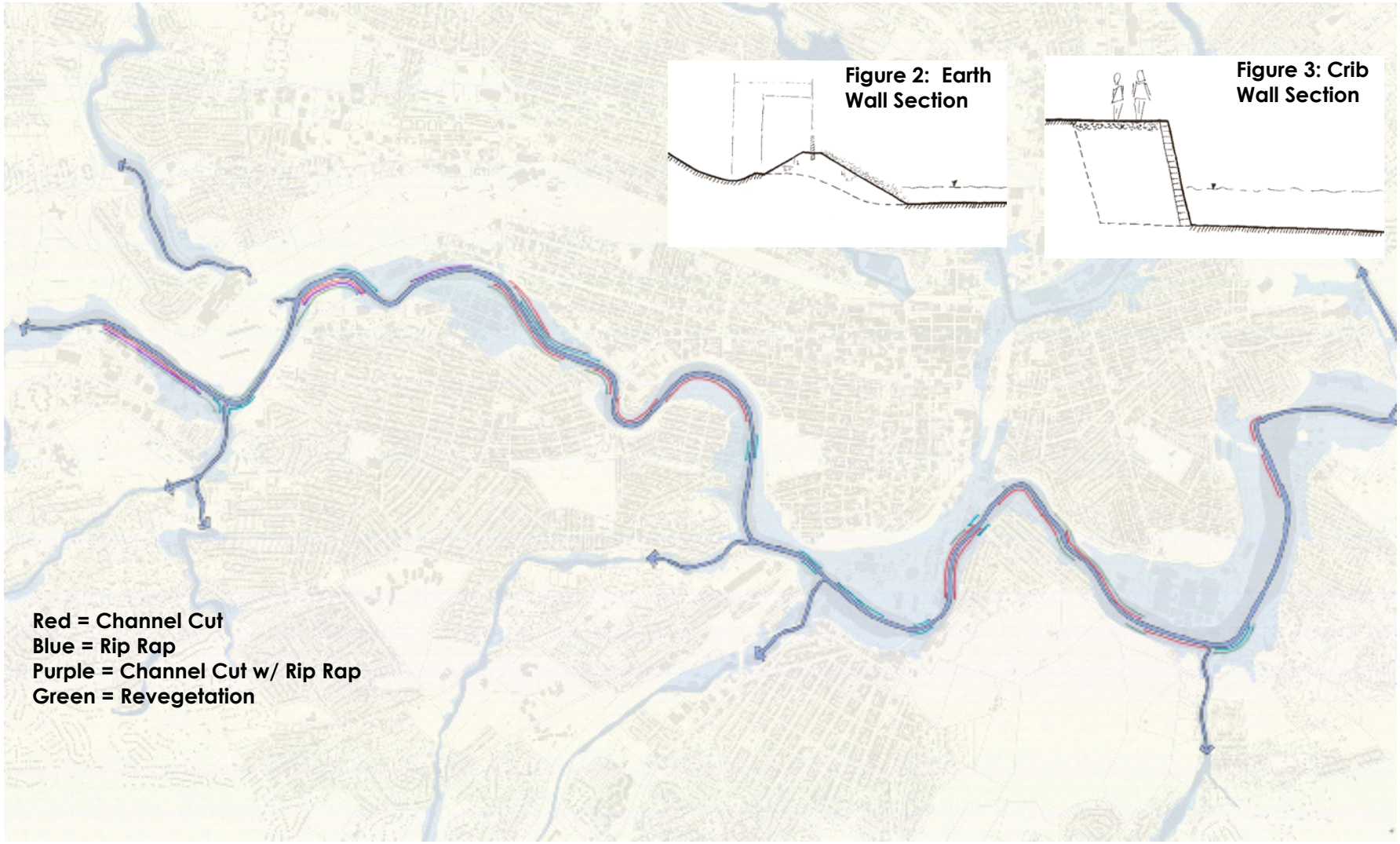


Figure 1: Proposed Flood Reduction Project

Figure 2: Earth Wall Section

Figure 3: Crib Wall Section

Floodplain Restoration Case Studies

The following case studies were obtained from design magazines and Internet searches. They represent examples how a natural water feature can positively impact the adjacent urban center, provided the opportunity is seized upon. The first two studies address flood reduction issues similar to those in Roanoke. The last study demonstrates how a city similar to Roanoke successfully transformed a dying waterfront into a cultural and economical centerpiece. All represent examples of what could be.

Napa River Floodplain Restoration

The floodplain of the Napa River as it flows through the Napa Valley in California, like many urban floodplains, has been heavily infringed upon and consequently experiences frequent flooding. Disliking the proposed plan by the Army Corp of Engineers, which involved widening, deepening, and walling in the river, a group of citizens formed to create the "Friends of the Napa River" (Friends) organization. Friends quickly gained support of fellow citizens as well as the San Francisco Bay Regional Water Quality Control Board, California Dept. of Fish and Game, and the U.S. Fish and Wildlife Service, all of which rejected the Army Corps proposed plan. As an alternate plan, Friends organized several community meetings, and with the help of Landscape Architect Daniel Iacofano, developed the "Living River" concept in which the river is connected to the floodplain, is able to move freely, offers wildlife habitat, and sustains a food web (Owens-Viani, 2005). It was anticipated that improved habitat would improve aesthetics and adjacent property values. With this concept in mind, a coalition of interested parties worked with the Corps of Engineers to reach a compromise between environmental restoration and flood control. Some of the issues faced during the project include the following:

- Organizing all of the stakeholders and ensuring adequate community input

- Develop a working, multi-disciplinary team to address all necessary issues
- Acquiring the land necessary to implement environmental restoration projects
- Dealing with contaminated industrial sites
- Integrating riverfront redevelopment with overall revitalization strategies
- Balancing urban and ecological needs, and merging design aesthetics

These are for the most part, standard problems associated with any large-scale restoration or redevelopment projects. What intrigues me however is the outcome of the project so far. It is estimated that commercial property values have increased by 20% while flood insurance premiums have decreased by the same amount (Owens-Viani, 2005). The notion of the floodplain acting as a catalyst for urban revitalization provides interesting opportunities and a valuable tool for promoting the investment in such projects.

www.friendsofthenapariver.org

Buffalo Bayou Restoration

Another more substantial project currently underway is the restoration of the Buffalo Bayou as it flows through Houston. Representing a major waterway from Galveston Bay inland, Buffalo Bayou provided the resource to make Houston a thriving port city. However, shallow waters, frequent flooding, and an abundance of mosquitoes instigated many structural changes to the river. It was widened and deepened in the early 1900's, and two major reservoirs intended to control flooding were constructed in the1940's. In addition it was typically viewed as more of a nuisance then a resource (despite the fact that the city evolved because of it).

Seeking to provide the city with an identity, a master plan for the restoration of the Bayou was created in 2002. The planning strategies behind the plan include (BBP, 2005):

- Rehabilitate the bayou as an ecologically functional system
- Increase floodwater conveyance capacity
- Promote low-impact development
- Improve visibility of the bayou
- Ensure equity of access
- Increase residential opportunities downtown
- Maintain affordability
- Create new jobs and revenue
- Promote joint public-private development

While these strategies are general in nature, they hint at the many issues faced with trying to implement a project such as this. Among them are achieving a balance between natural conservation and urban development. Where does the fulcrum of this balance lie? As noted by landscape architect Kevin Shaley, the river has lost its equilibrium and the idea is to give the river the shape, profile, and area to regain it (Owens-Viani and Wilson, 2004). How can this be achieved in an urban area? Another major concern is implementation of the plan, as the city does not have the money to do so. Much emphasis is therefore being placed on private investment, which is predicted to total $5.6 billion over the next 20 years, compared to $800 million in public costs over the same time frame (BBP, 2005). As with the Napa River floodplain restoration, the bayou restoration is intended to act as a catalyst for urban revitalization. An initial investment is made, which in turn promotes further private investment in the region. With such investment comes greater tax revenue, which in turn allows additional investment in the buffalo restoration project. If successful, such a plan represents a capital investment project that respects both natural and human processes, as mentioned earlier.

www.buffalobayou.org

Given that most urban flooding problems originate upstream, an emerging and well-documented approach to flood mitigation begins with restoration of the watershed. Constance Hunt (1997) documents the "natural storage approach" to flood mitigation, which involves the restoration of historic floodplains upstream, thereby slowing the volume of water reaching urban centers. This idea is supported by Orie Loucks (1990) who discusses the importance of shallow depressional wetlands in reducing the rate of stormwater discharge and improving overall water quality. Beth Middleton (1999) also supports the idea in her discussion on the importance of seasonal flood events in maintaining the ecological integrity of riverine communities. What I appreciate about the two case studies presented however is the recognition of the need to restore the natural function of floodplains, while also recognizing the urban context in which the floodplains lie. Both projects recognize the potential importance of the floodplain in improving the quality of life within cities, attracting tourists to the region, and serving as a catalyst for economic growth. Though not specifically stated, this recognition demonstrates an understanding of the floodplains as being critical elements of the urban infrastructure, the green infrastructure.

Chattanooga Riverfront Restoration

A final case study reviewed is the Chattanooga Riverfront Park, which is praised as a model example of sustainable riverfront redevelopment. With a population of approximately 150,000, Chattanooga is about 1.5 times the size of Roanoke, however both represent small cities. Originally an industrial city, the economic situation in Chattanooga deteriorated throughout the 60's and 70's, abandoned factories littered the Tennessee Riverfront, and a 1969 the city held the distinction of having the worst air quality in the nation (rivercitycompany.com). A public participation process entitled "Vision 2000" was initiated in 1984 to generate ideas about what could be

done to revive the city. The general agreement was that the river needed to be freed from the industrial factories and reconnected with the city. This would require introducing more people friendly amenities to the waterfront, which began with the opening of the Tennessee Aquarium on a former industrial site in 1992. Since then, many public spaces and attractions have been added, all connected by an 8-mile river walk. Tourism to the city is on the rise and the economy is once again booming but this time with industries that celebrate the river rather then hide it.

The similarities between Roanoke and Chattanooga go beyond size. Like many cities, both are striving to overcome economic recessions of the 60's and 70's and both have a desire to increase tourism to the region. Both have significant rivers flowing through their borders (though the Tennessee is much larger) and both riverfronts were popular places for industrial uses. Though flooding is not cited as a common problem in Chattanooga as it is in Roanoke, the similarities between the cities make it a good example of how reconnecting the river to the city can improve the overall quality of life for residents and bolster a growing economy. It is significant to note however that the Tennessee River flows through downtown Chattanooga whereas the Roanoke River is a bit removed. This will undoubtedly affect the strategies used in determining appropriate riverfront uses between the cities.

Though many differences exist among these three case studies, the overriding similarity is the use of the river as a means of reviving the local economies. Each project recognized the social, economic, and environmental significance of the respective river and successfully implemented a plan to capitalize on it. Roanoke, though not in bad shape now, has an opportunity to improve the overall quality of the city. Flooding is a problem that exists and needs to be addressed, however it can be addressed in a fashion that preserves the status quo or in a fashion that seeks overall enhancement of the city. The green infrastructure concept, the Proximate Principle, and the case studies all indicate that a linear park system created via floodplain restoration is the most ecologically,

case studies all indicate that a linear park system created via floodplain restoration is the most ecologically, economically, and socially beneficial way of doing so.

Conclusions / Position Statement

From an environmental, economic, and social perspective, floodplain linear parks are a superior alternative to other built forms of urban flood reduction. Promoting their use however, first requires overcoming the common perception that parks are merely luxury items, not worthy of a significant investment of public funds. The Proximate Principle indicates however that this is not the case. Studies continually indicate that properties located near parks sell for more then those that are not. The conditions driving this phenomenon can be used to explore various park configurations to determine which, if any is appropriate. In our capitalistic society, this cost / benefit analysis will provide a valuable tool for influencing public decision makers and ensuring maximum benefits are derived from a park project.

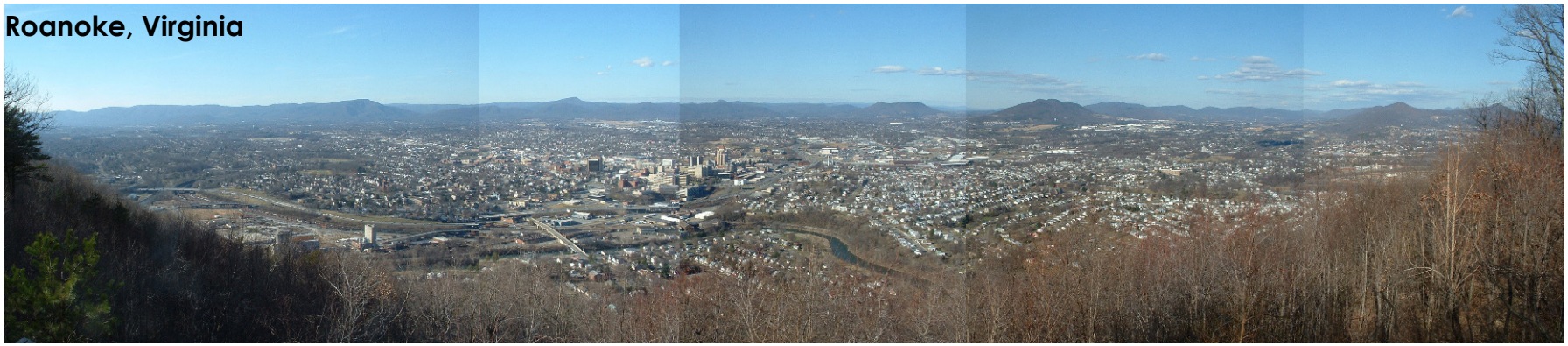
Part II: Analysis and Conceptual Plan for a Roanoke River Floodplain Linear Park

The remainder of this document will focus on the design portion of the thesis, which takes place in the city of Roanoke. My overall intention is to demonstrate that a flood control alternative that views the problem from a park planning rather then engineering perspective is feasible and can provide numerous benefits to the community that standard flood reduction techniques do not. Roanoke provides the ideal forum for this study given its ongoing struggle with flood reduction control, the expressed interest by representatives of the Parks and Recreation Department in similar studies, the need for revitalization in certain neighborhoods, the abundance and accessibility of city GIS data and other pertinent information, and its convenient location. My overall objective is to develop a vision of what the Roanoke River floodplain can be. This will include a large-scale conceptual master plan that demonstrates how such a park can benefit the city (economically, ecologically, and socially), as well as smaller vignettes of critical areas. The objective is to develop a product that can be used to sell the idea to the city council. The design must therefore be solidly grounded in facts and present realistic scenarios of what could be done. Site analysis is therefore the most critical component of the design process, as it will be used to justify all design decisions made. Considering the scale and complexity of the project however, determining what conditions to look for is the first question to be addressed. Aside from general site conditions (location, land use, access, etc.) I will look at the site from an economic, ecological, and social perspective, as my position statement implies. To do this I will consider 3 guiding resources: the Proximate Principle (economic), Green Infrastructure (ecological), and the Roanoke Comprehensive Plan (social). These themes will be used to identify conditions to look for during the site analysis phase, which combined will form a template from which to base design decisions. Identified conditions will initially be general in nature but will become more refined as the project scale narrows. The guiding resources will also change as the project scale narrows, as specific economic data replaces the Proximate Principle, ecological inventories and studies replace Green Infrastructure, and community involvement replaces the Comprehensive Plan. For the purpose of this project however, analysis will not reach these levels. I instead intend to set the stage for studies such as these to be completed in the future.

Conducting the site analysis involved 3 primary phases: GIS, Synthesis, and Site Visits. GIS was the most critical method as it allowed large quantities of information to be organized and analyzed relatively quickly. Without GIS technology and the comprehensive database of information provided by the city, I do not believe this project could be completed in a reasonable time frame. The synthesis phase involves drawing conclusions from GIS and other data sources and transferring this information to a base map. This I found opened the door to new questions not immediately seen, and prompted additional analysis of the site. Site visits are critical in that they provide a true picture of the site that GIS information does not. Apparent opportunities found during the GIS and synthesis phases can quickly change to constraints upon a visit to the site. Combined, these 3 phases formed a revolving process of analysis that produced a continuous flow of questions and answers. Eliminating any of these phases will severely weaken the analysis and consequently, the justification of design decisions.

As mentioned, design was heavily based on site analysis and involved a continuous process of trial and error. Decisions were made and then analyzed to determine their appropriateness. To begin, maximum and minimum buyout scenarios were established and analyzed to determine their opportunities and constraints. These identified the limits of what could be done. A more idealized plan was then explored, first by defining boundaries, then land uses, critical areas, and more specific site plans. Through a constant filtering process of design and analysis, a conceptual plan was developed that accurately reflects the economic, ecological, and social components of the project, while maximizing floodplain protection and minimizing the need for flood control measures.

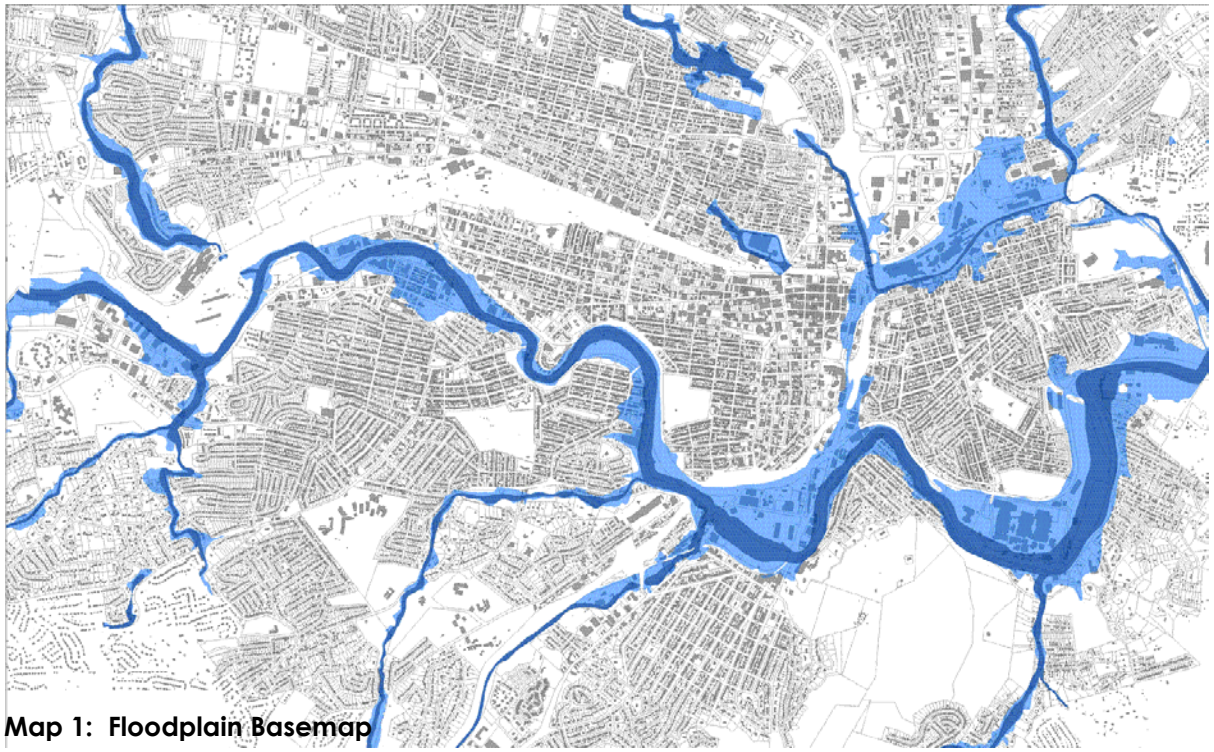
Site Description



Established in 1884, Roanoke is today one of the largest cities in Virginia with a population of almost 95,000. It is located in the valley west of the Blue Ridge Mountains, and 168 miles west of Richmond. It also lies adjacent to interstate highway 81, which is a major transportation corridor, and marks the halfway point between New York City and Atlanta. This geographic location makes Roanoke a hub for shipping and transportation industries and an ideal stop over destination for through travelers. In addition, Roanoke lies just west of the Blue Ridge Parkway, one of the most visited national parks in America, and just east of the Appalachian Trail, one of the most popular hiking trails in America. It is therefore situated in prime position to capitalize on the business generated from the many passing tourists, most with outdoor activities in mind. A signature park system may just be the catalyst needed.

The actual project site includes the entire 10-mile length of the Roanoke River floodplain as it extends from the city of Salem in the west to Vinton in the east. Properties in both the floodway and 100-year floodplain will be analyzed to determine the most appropriate buyout level to pursue. The project boundaries do not end here however. For a project of this scale, it is necessary to consider all adjacent communities to understand how they will be affected and what actions taken within the floodplain can help these communities.

The floodplain in general contains a variety of land uses including existing parkland, single and multi-family residential, industrial, commercial and vacant parcels. This variety provides a number of opportunities and constraints, all of which will need to be understood to create a successful design. Buying out properties is understandably a sensitive issue so all decisions must work for the greater good of the community. For this reason, I again emphasize the importance of comprehensive site analysis and a continuous process of design refinement.

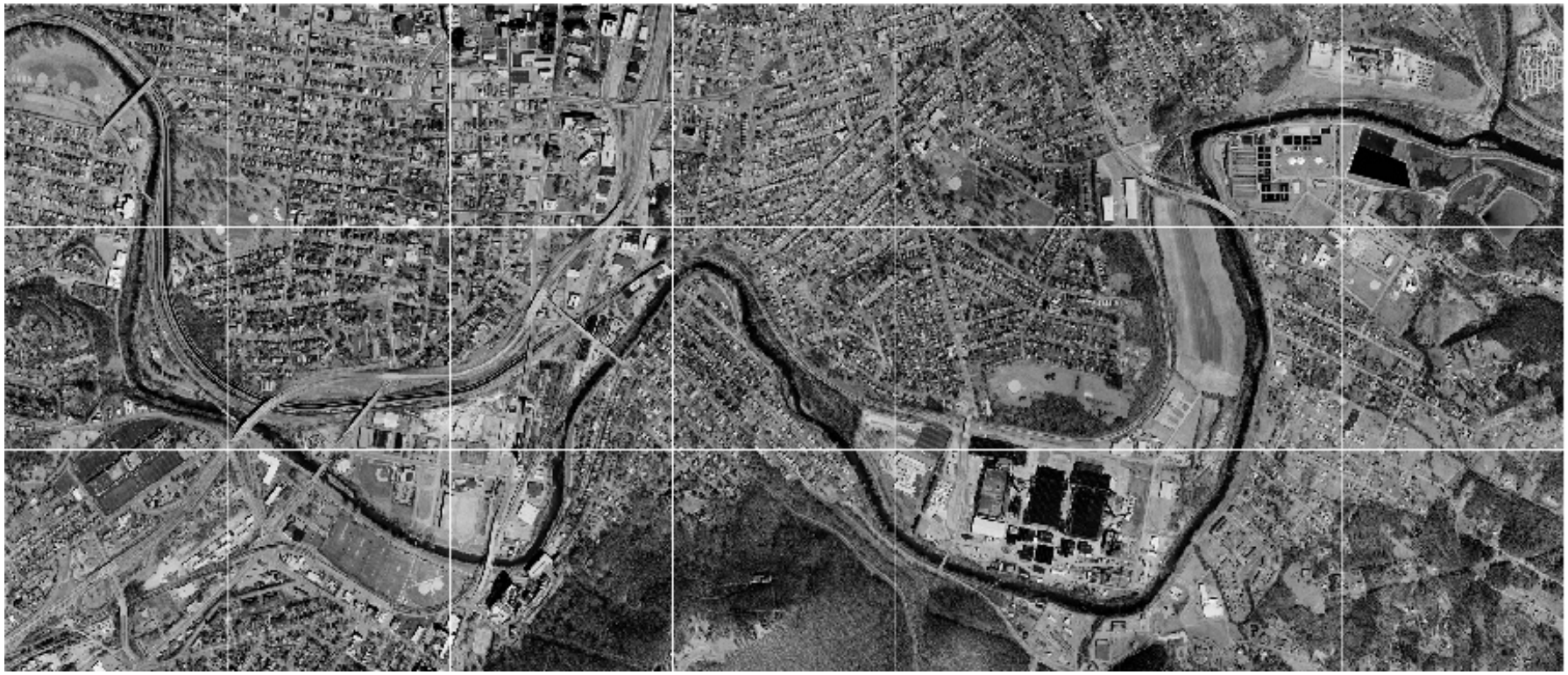


Map 1: Floodplain Basemap



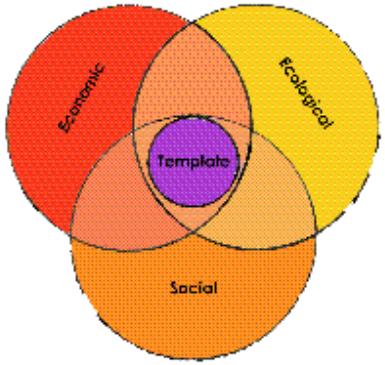
Images of the floodplain

Aerial photograhps downloaded from www.roanokeva.gov



Analysis Introduction

The following pages represent the analysis portion of this project. It is separated into four categories, general analysis (context), proximate principle, green infrastructure, and comprehensive plan, as these represent the major components of the analysis. Each category contains a list of the conditions analyzed and the conclusions drawn from each analysis. GIS, site visit, and synthesis information is also presented to support the conclusions. GIS maps are separated into western and eastern halves of the floodplain due to the overall scale of the project site.



Economic - Proximate Principle

Ecological - Green Infrastructure

Social - Comprehensive Plan

Figure 4: Conditions Diagram - Successful demonstration that the floodplain park system concept will work requires consideration of economic, social, and ecological factors. failur to consider any of them will severly weaken justification for the plan. The template represents the conclusions drawn from analysis of these factors.

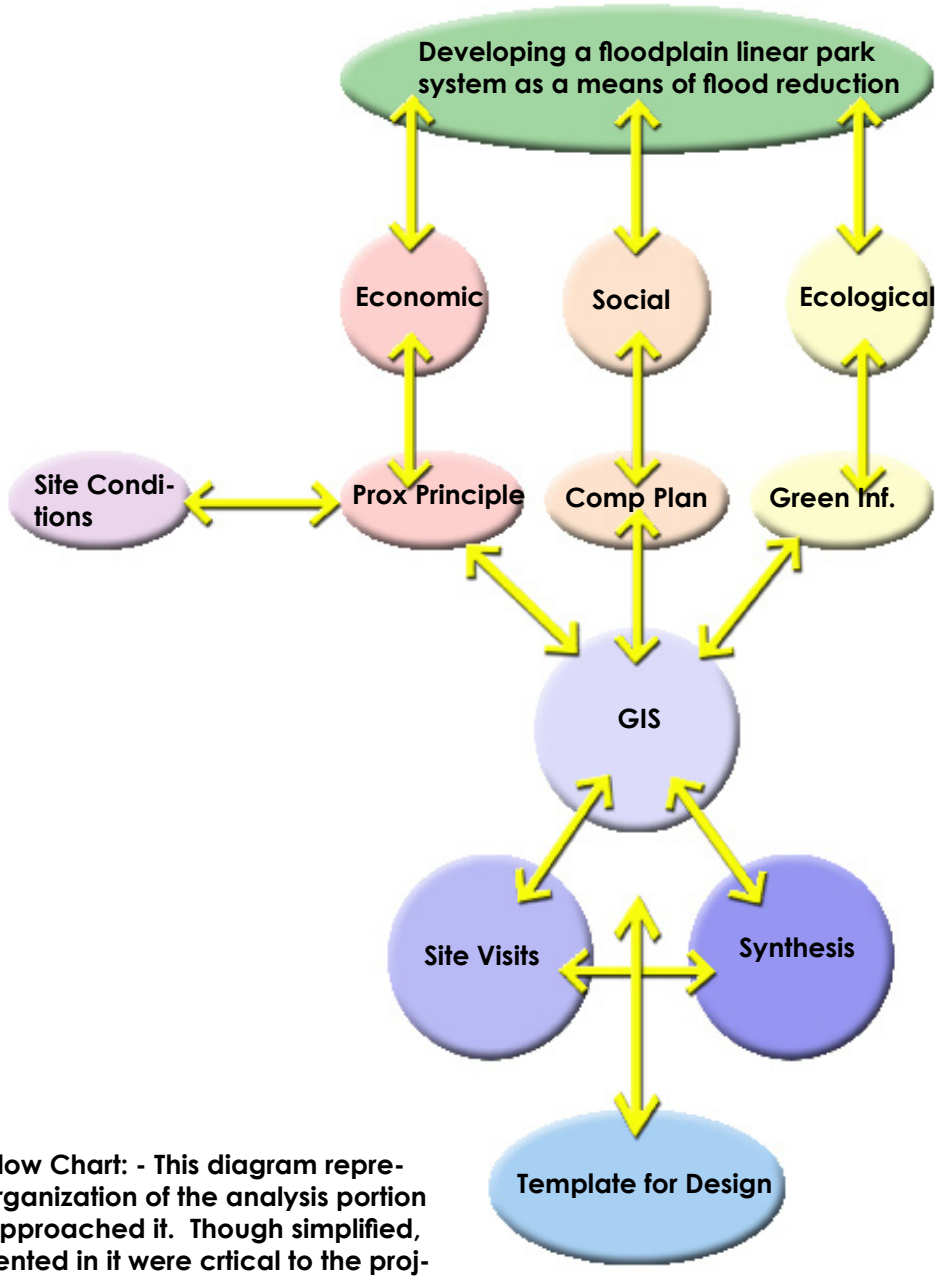


Figure 5: Analysis Flow Chart: - This diagram represents the general organization of the analysis portion of this project as I approached it. Though simplified, all elements represented in it were crtical to the projects success.

Conditions Identified:

Land use by parcel – These include 4 categories, Industrial Commercial, multi-family residential, single family residential, and vacant land. Land use designations where further identified via site visits and examination of current zoning.

Buildings in the floodplains – This includes all structures that intersect the designated floodway, 100-yr floodplain and 500-yr floodplain.

Owners of interest – Ownership information may determine areas of opportunities and constraints, as it may be easier to work with some owners then others. Properties owned by non-profit groups or community organizations may show greater willingness to work with the city then private owners.

Physical attributes – Topography, roads, railroads, and the general layout of the city all play potential roles in developing a floodplain parks plan.

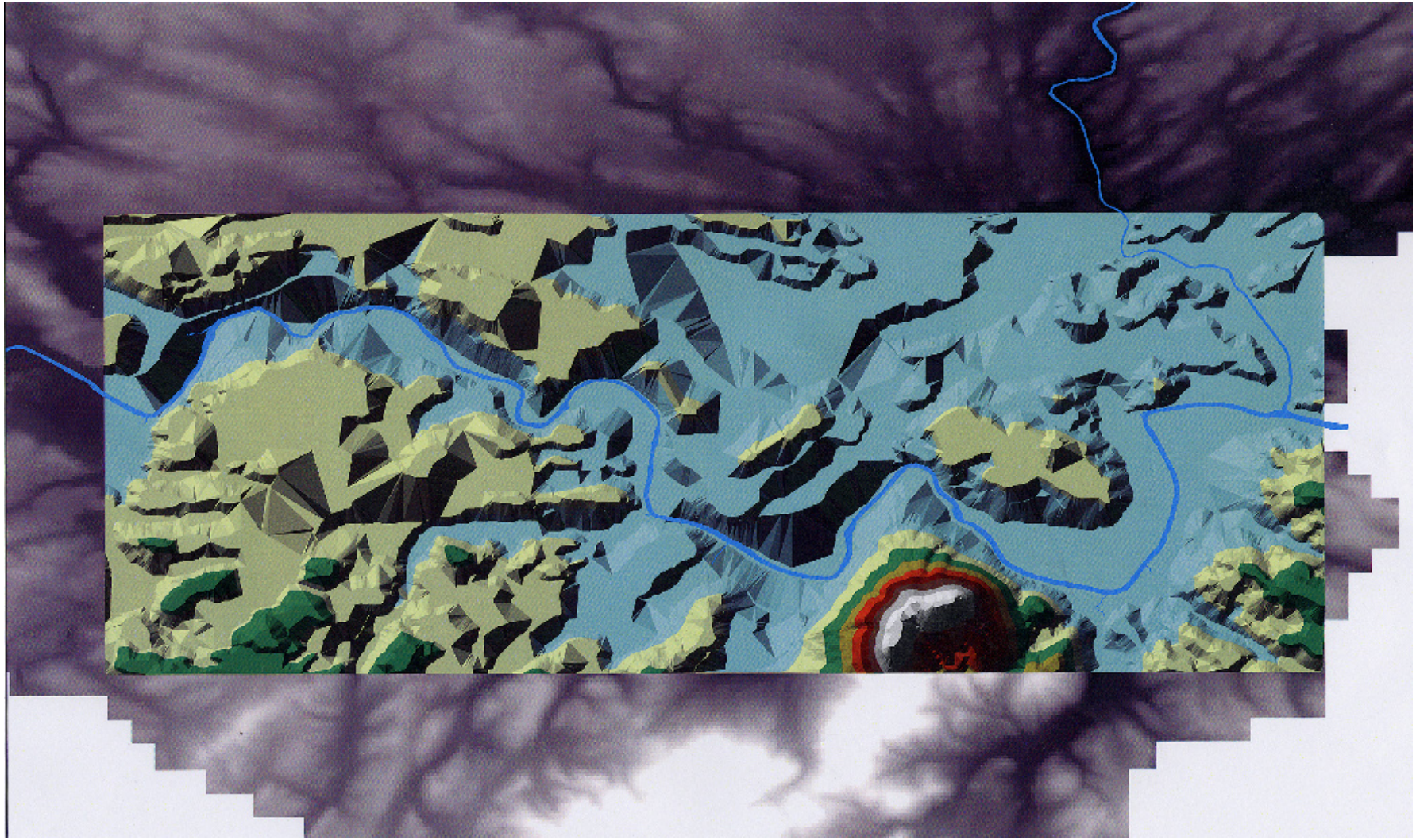
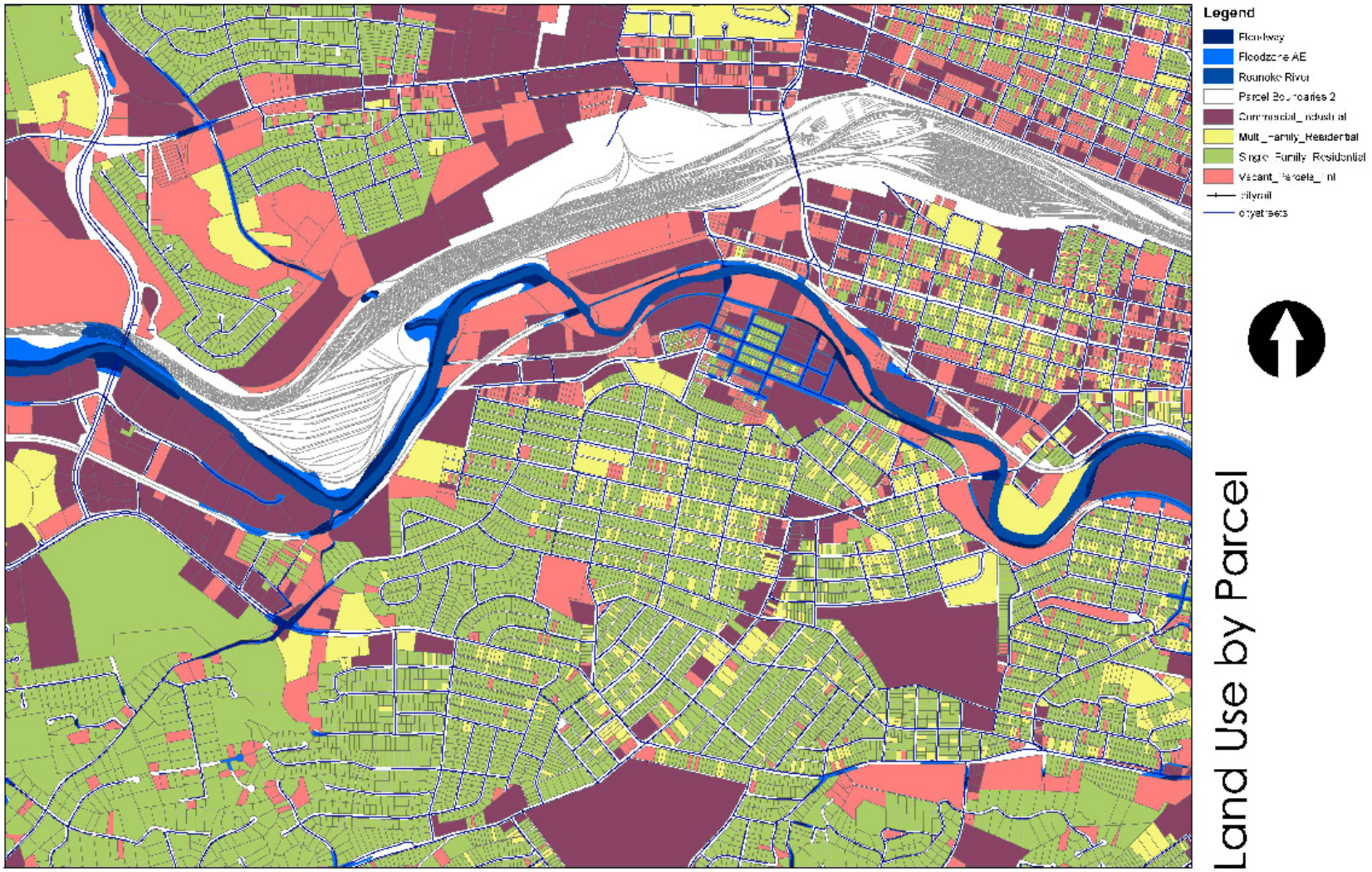
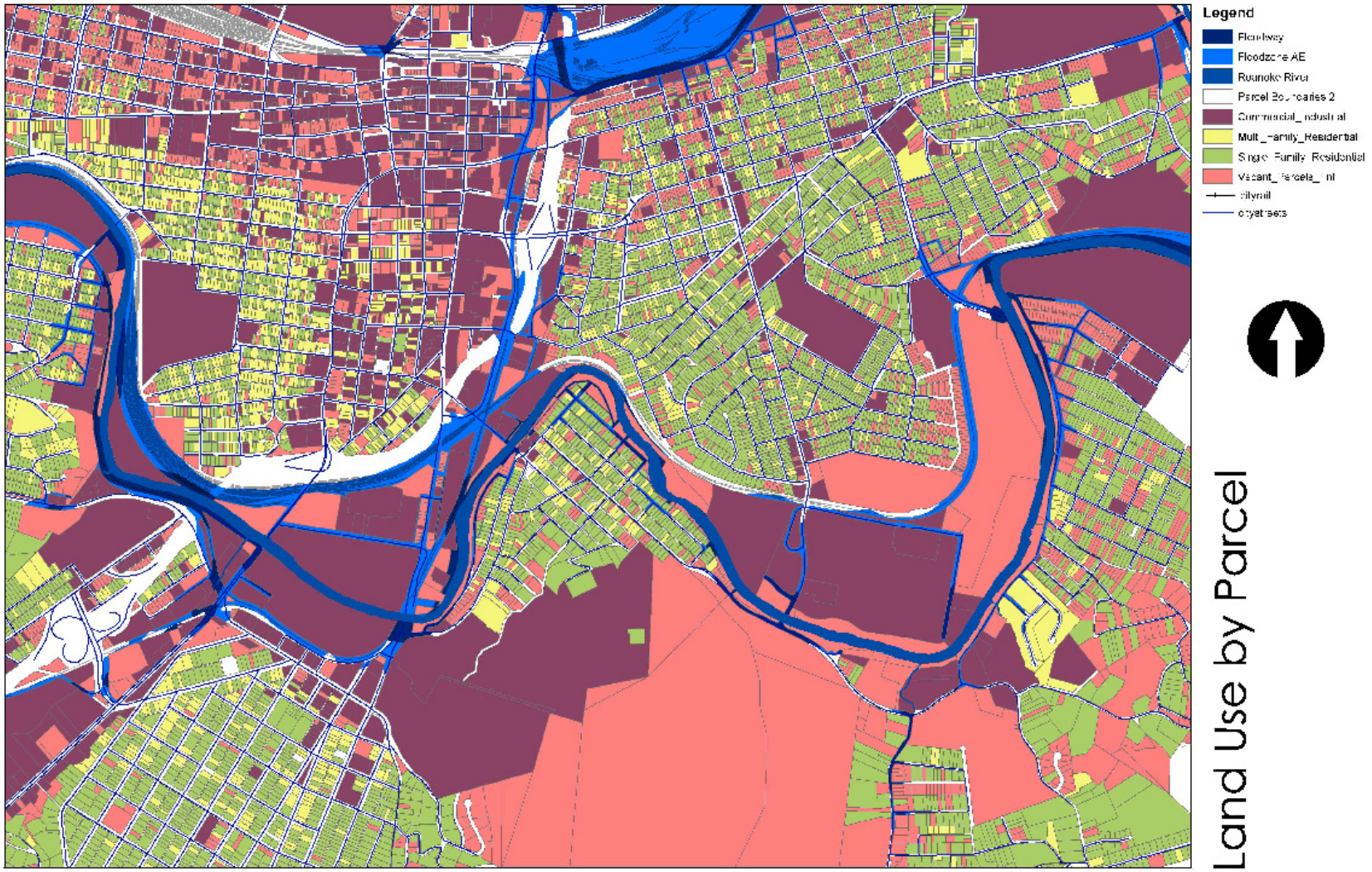


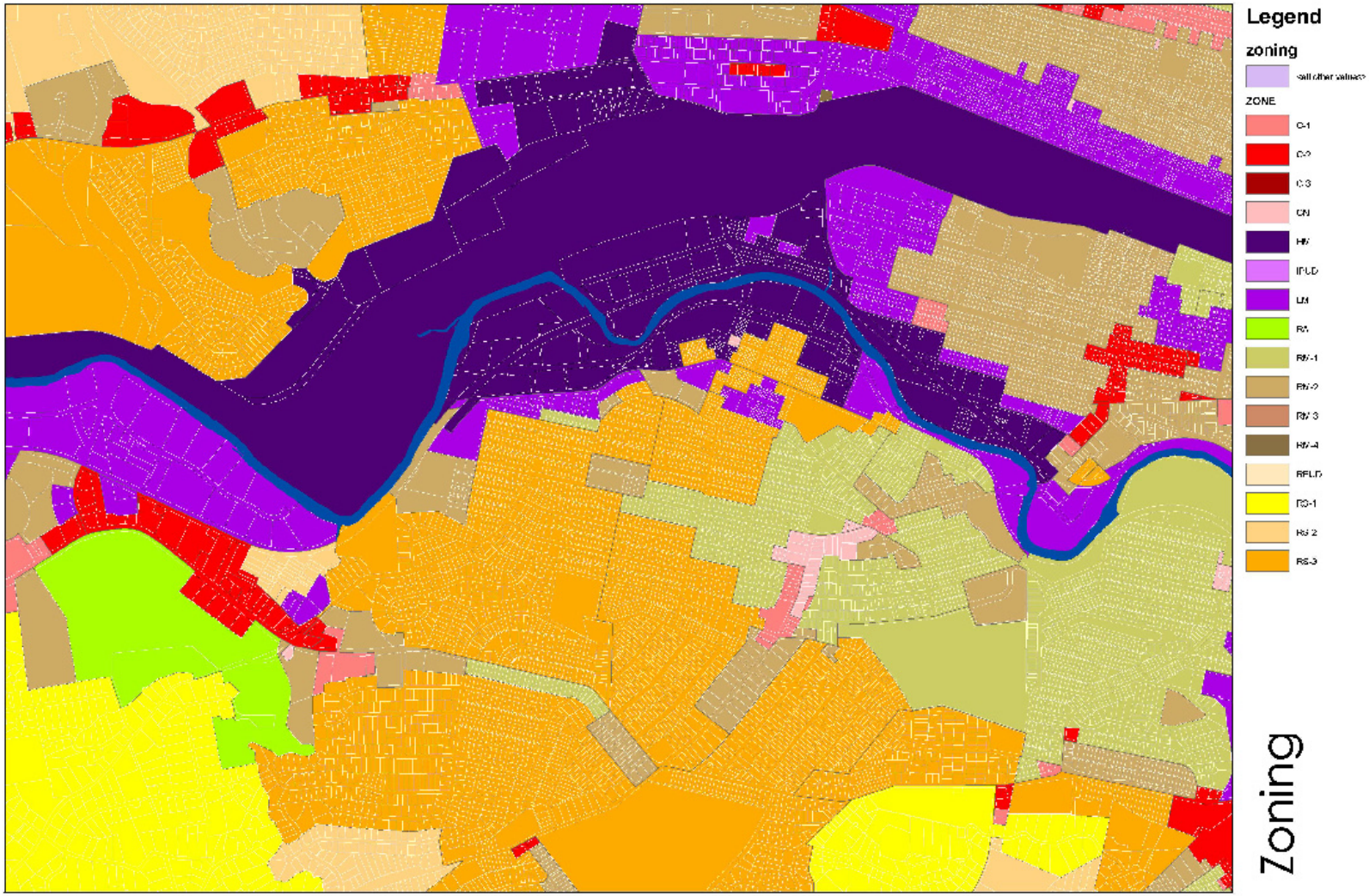
Figure 6: GIS Topographic Study

There is a good deal of topography along and adjacent to the Roanoke River, as this topographic analysis reveals.

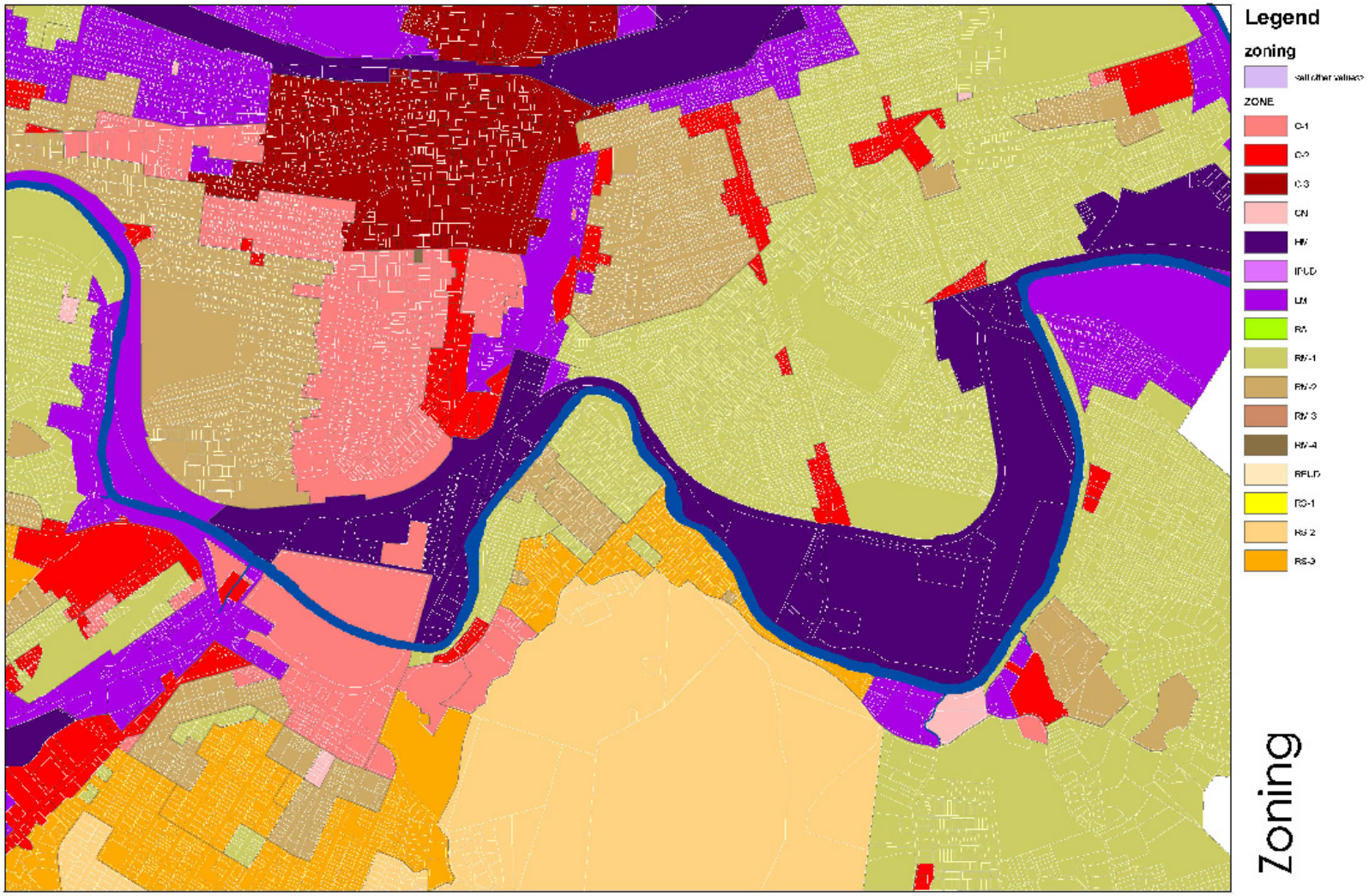


Map 2: Land Use By Parcel


Legend
Floodway
Floodzone AE
Roanoke River
Parcel Boundaries 2
Commercial_Industrial
Multi_Family_Residential
Single_Family_Residential
Vacant_Parcels_nl
cityroll
citystreets
Land Use by Parcel


Legend
zoning
<all other values>
ZONE
C-1
C-2
C-3
CN
HV
IPUD
LM
RA
RM-1
RM-2
RM-3
RM-4
RPUD
RS-1
RS-2
RS-3
Zoning

Map 3: Zoning


Legend
zoning
ZONE
C-1
C-2
C-3
CN
HV
IPUD
LM
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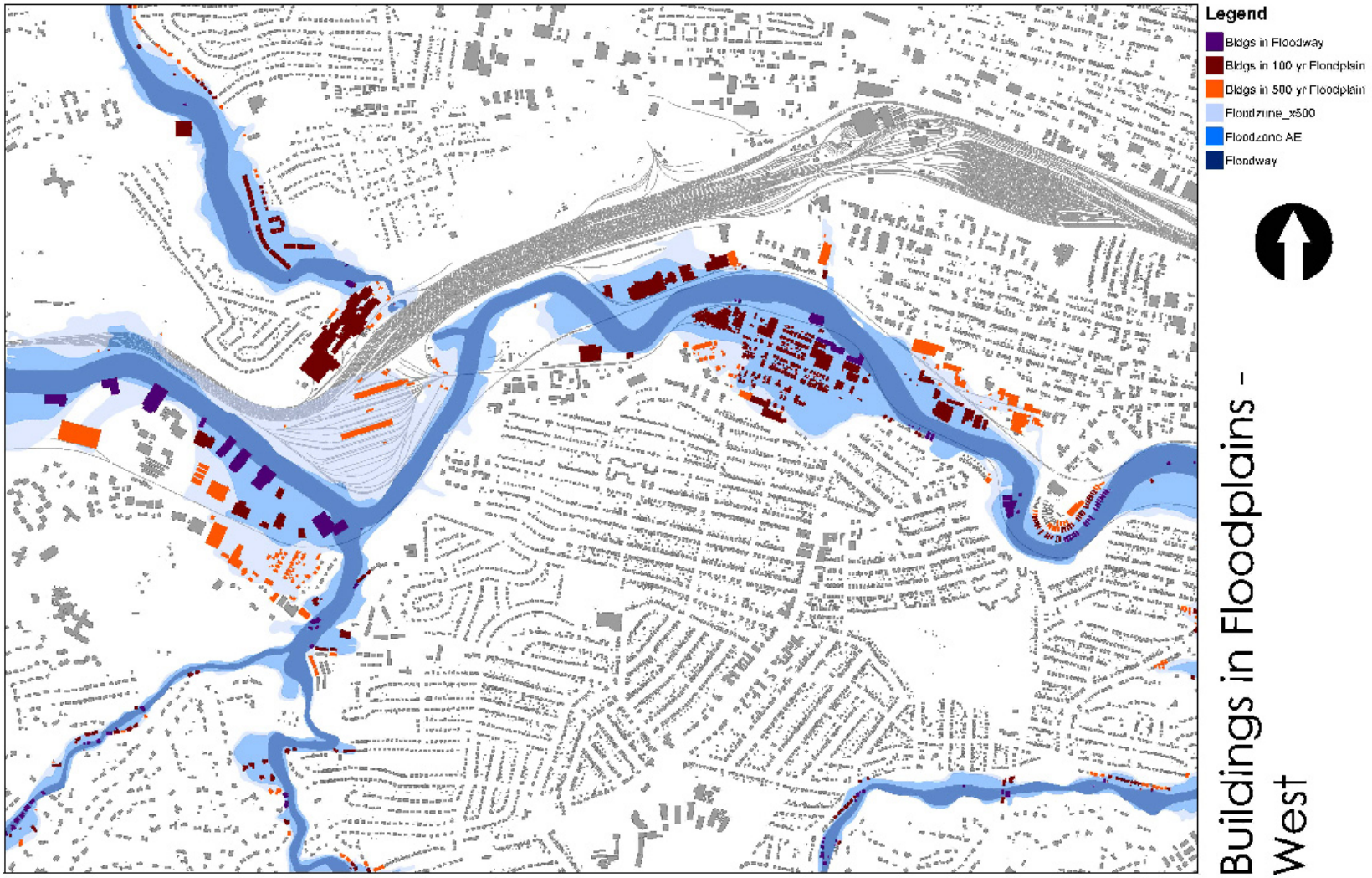
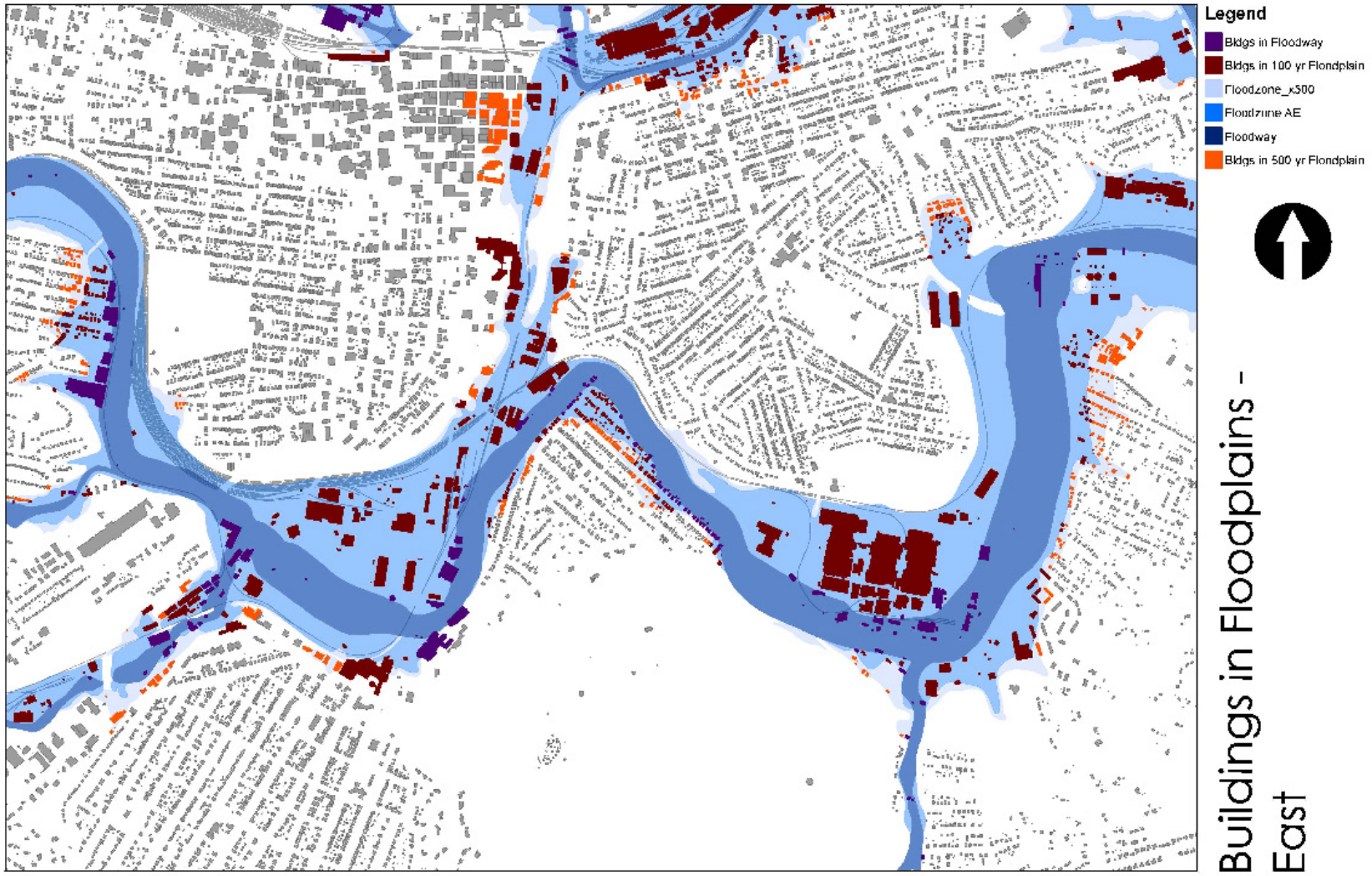
RM-4
RPUD
RS-1
RS-2
RS-3

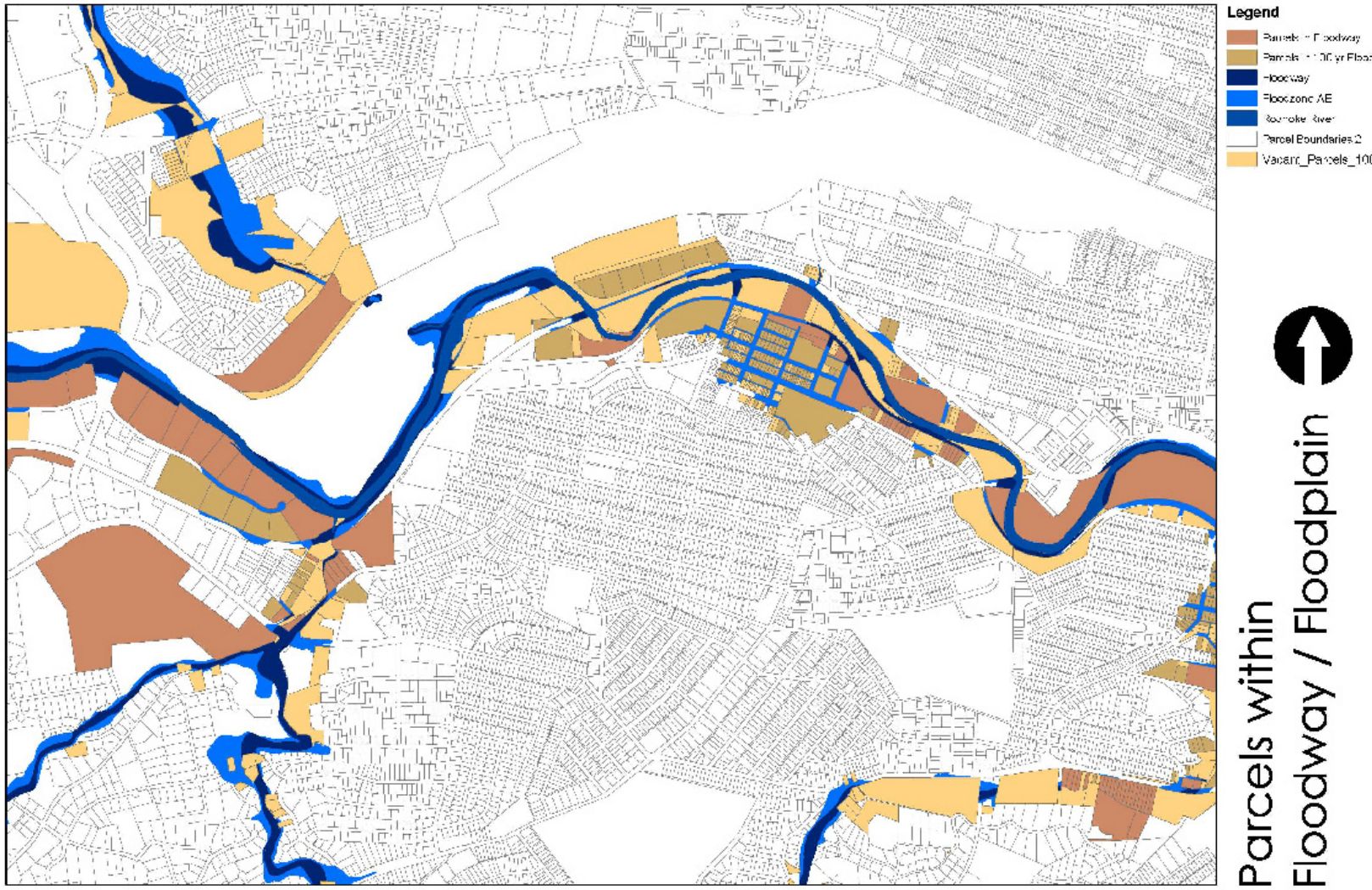
Zoning



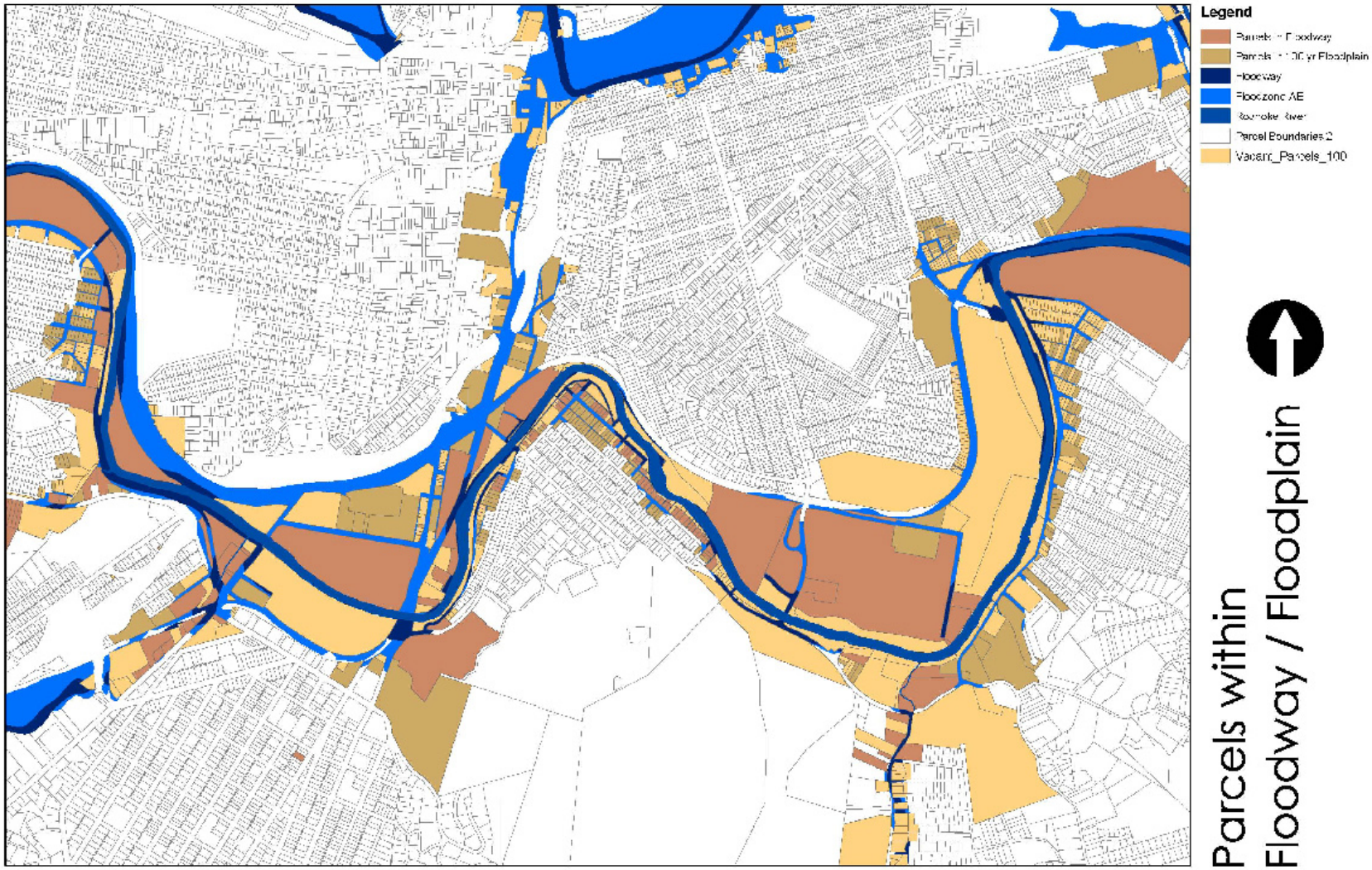
Map 4: Buildings in the Floodplain



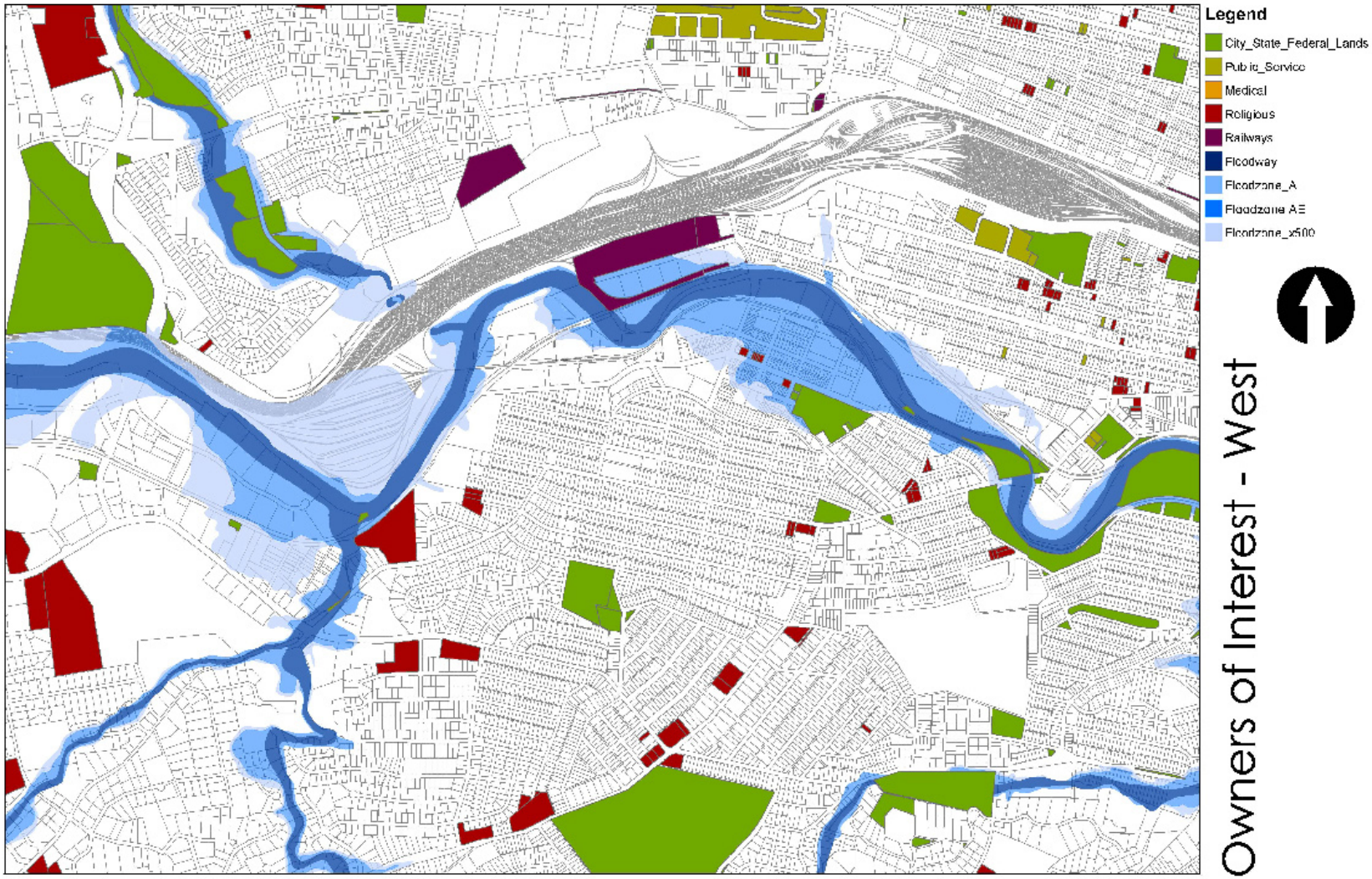
Buildings in Floodplains - East



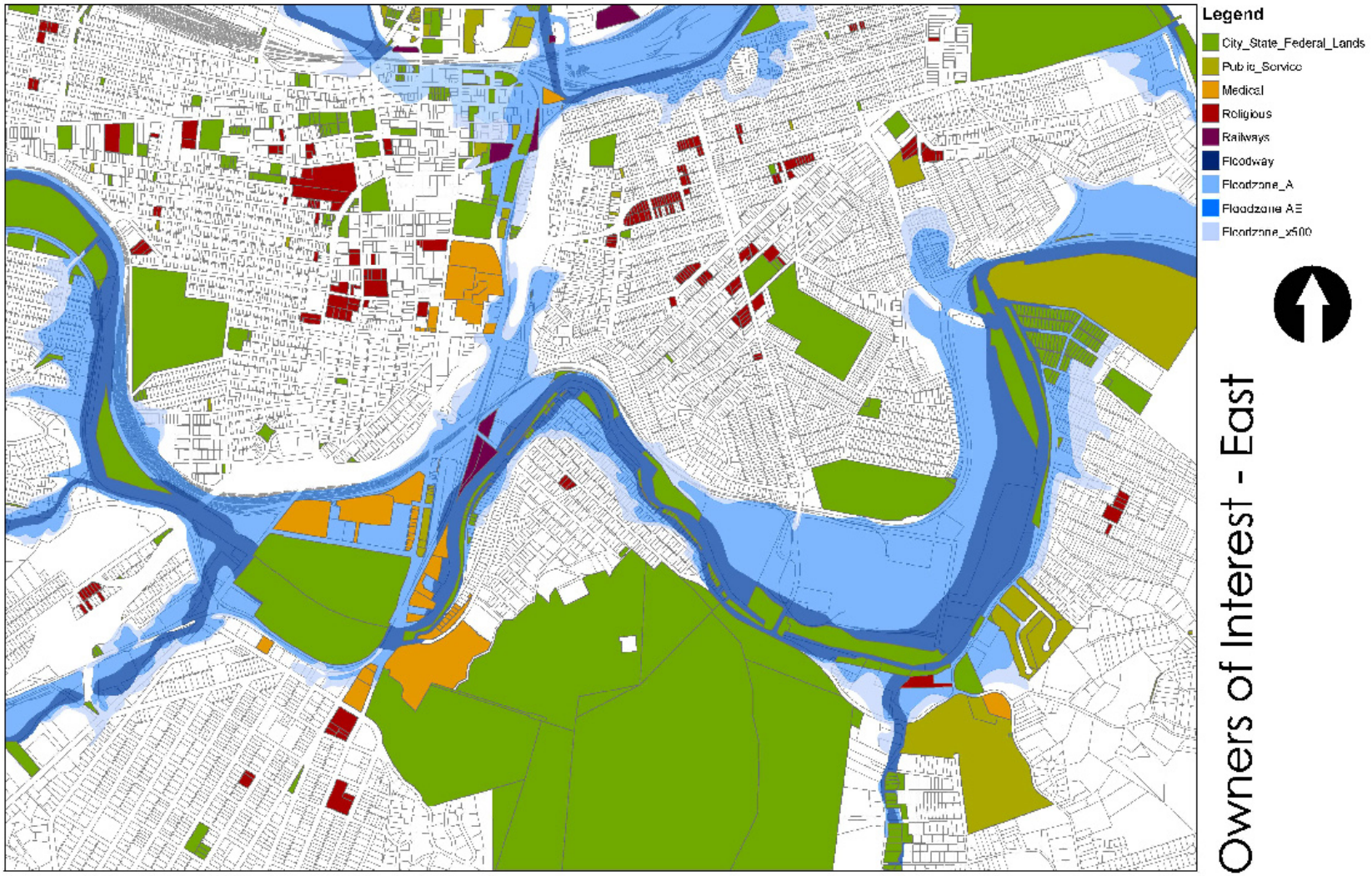
Map 5: Parcels Within the Floodway / Floodplain



Parcels within Floodway / Floodplain



Map 6: Owners of Interest


Legend
City_State_Federal_Lands
Public_Service
Medical
Religious
Railways
Floodway
Floodzone_A
Floodzone AE
Floodzone_x500
Owners of Interest - East

Proximate Principle Analysis

Conditions Identified:

- Barriers separating Residential areas from the floodplain
- If residents cannot access the park, the property value is typically not affected

- Areas that will not benefit from the park due to their current land use - Residential properties are typically the only properties to experience an increase in property value do to park proximity. Industrial and Commercial areas are therefore excluded.

- Large masses of residential homes adjacent to the floodplain - these areas will likely generate the greatest increase in tax revenue with the create of a park within the floodplain.

- 150, 300, and 500 foot buffers of the floodway and floodplain - studies indicate that the rate of property value increase has a negative relationship with distance to the park with virtually no measurable benefits experienced after 500 ft (3 blocks, 3 minute walk).

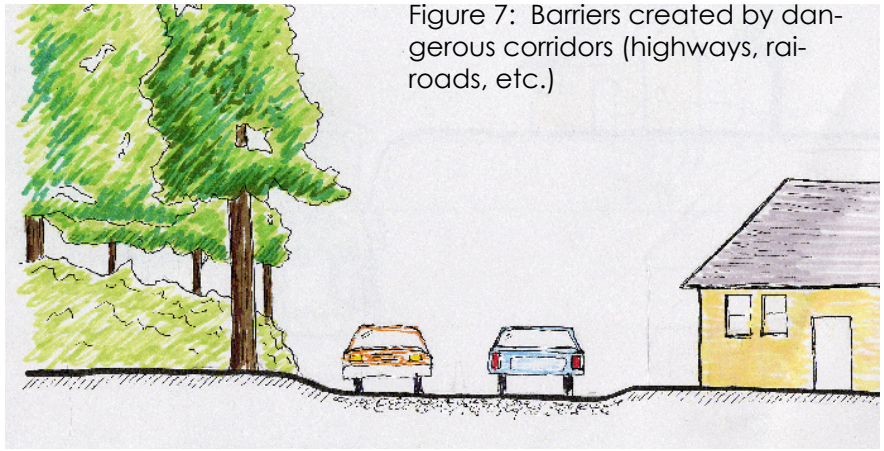


Figure 7: Barriers created by dangerous corridors (highways, railroads, etc.)

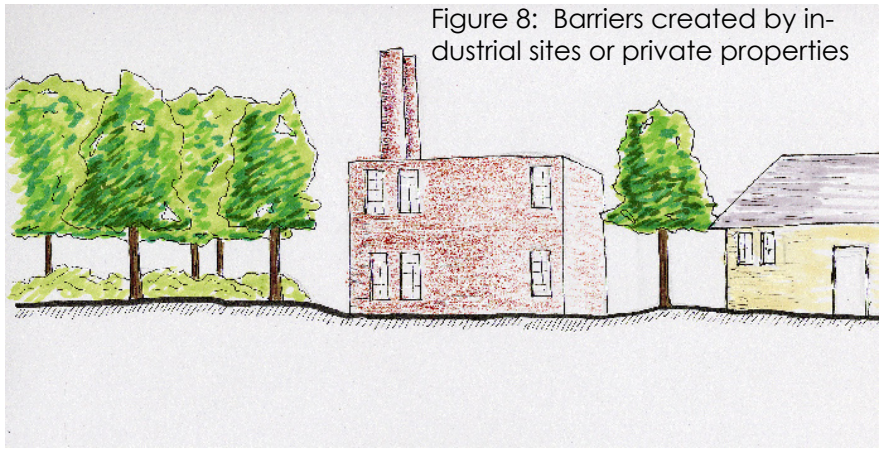


Figure 8: Barriers created by industrial sites or private properties

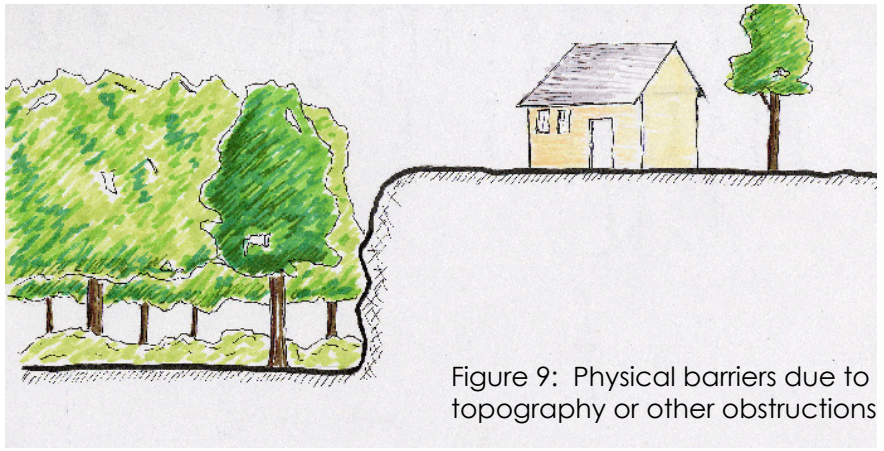
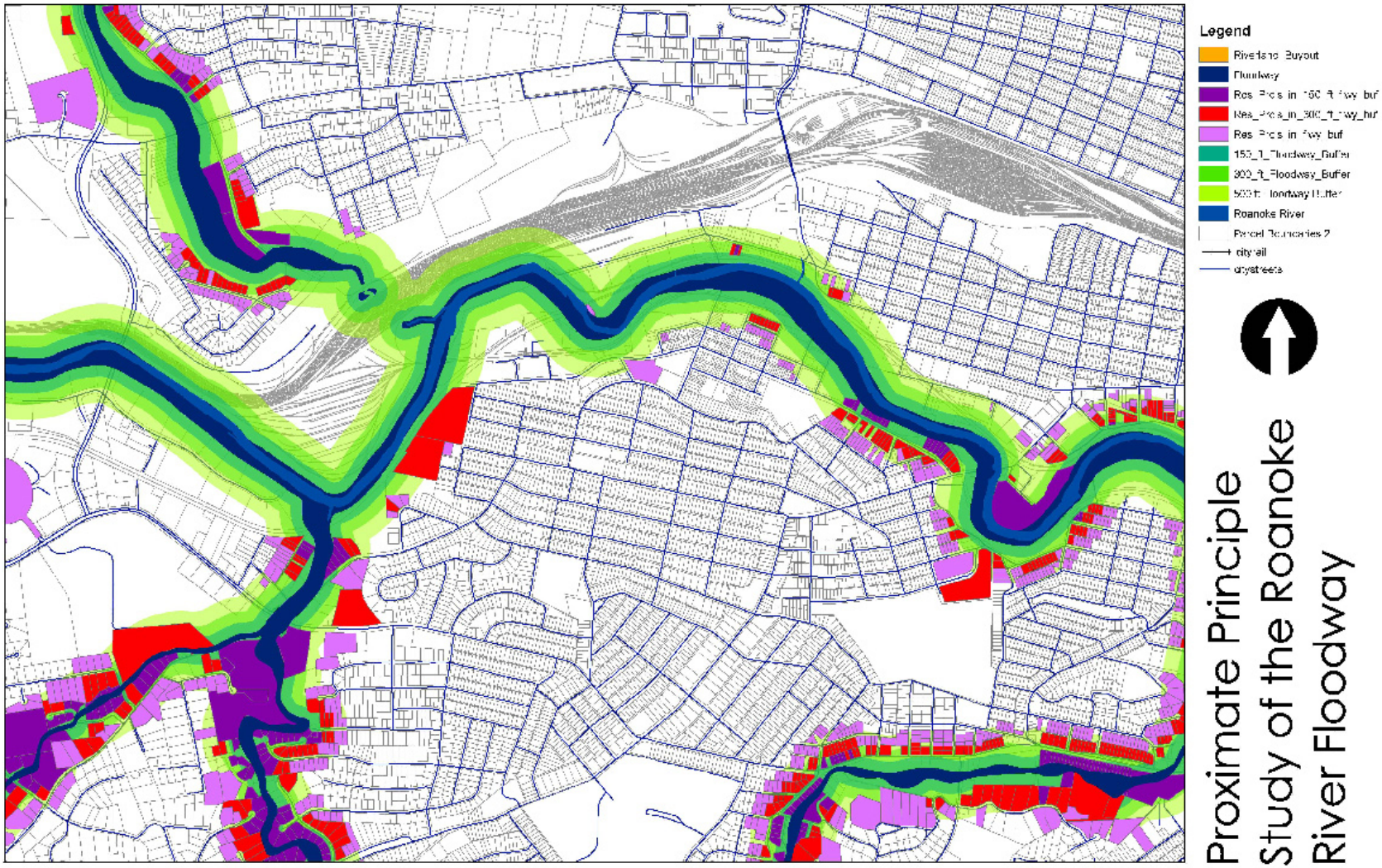


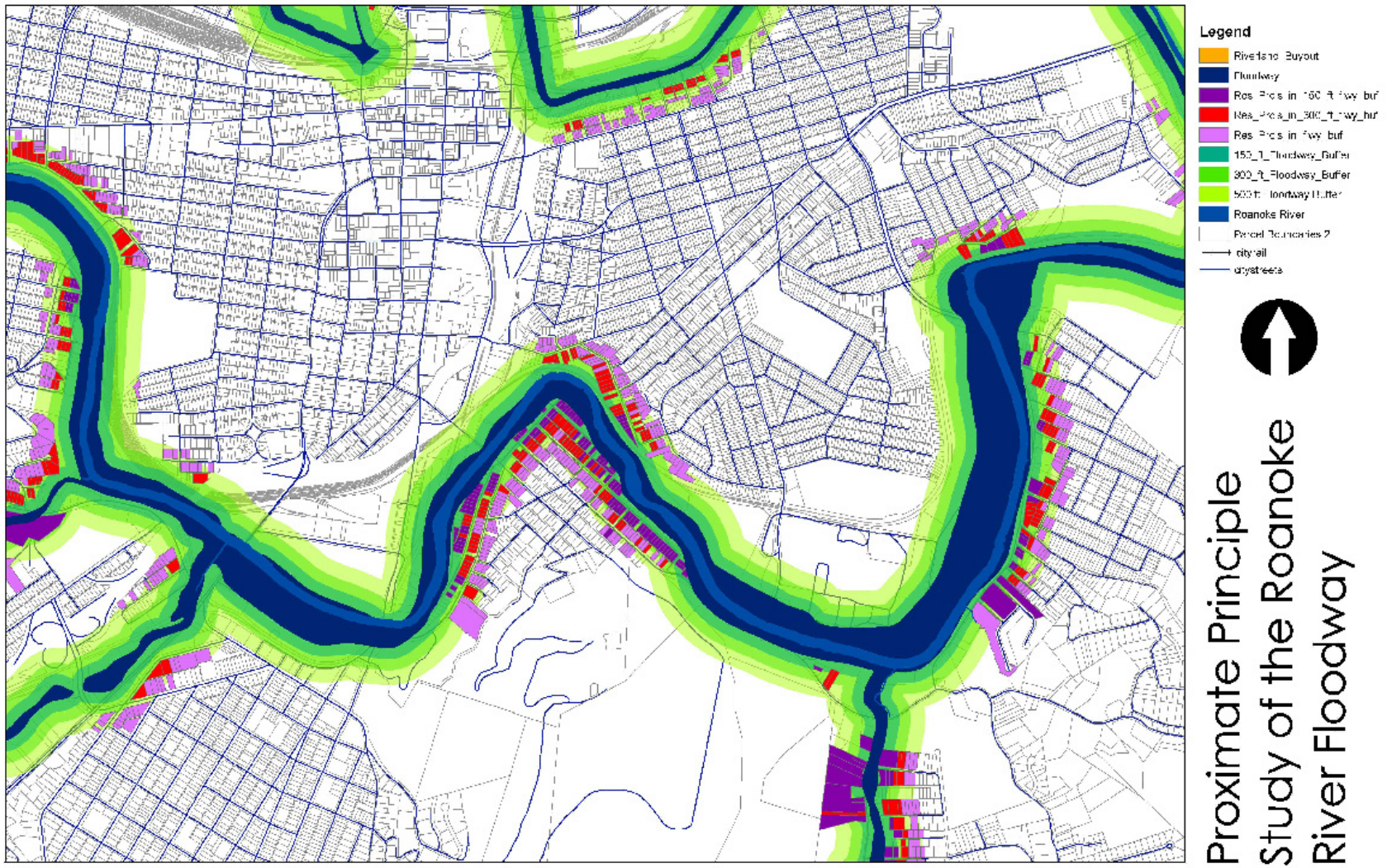
Figure 9: Physical barriers due to topography or other obstructions

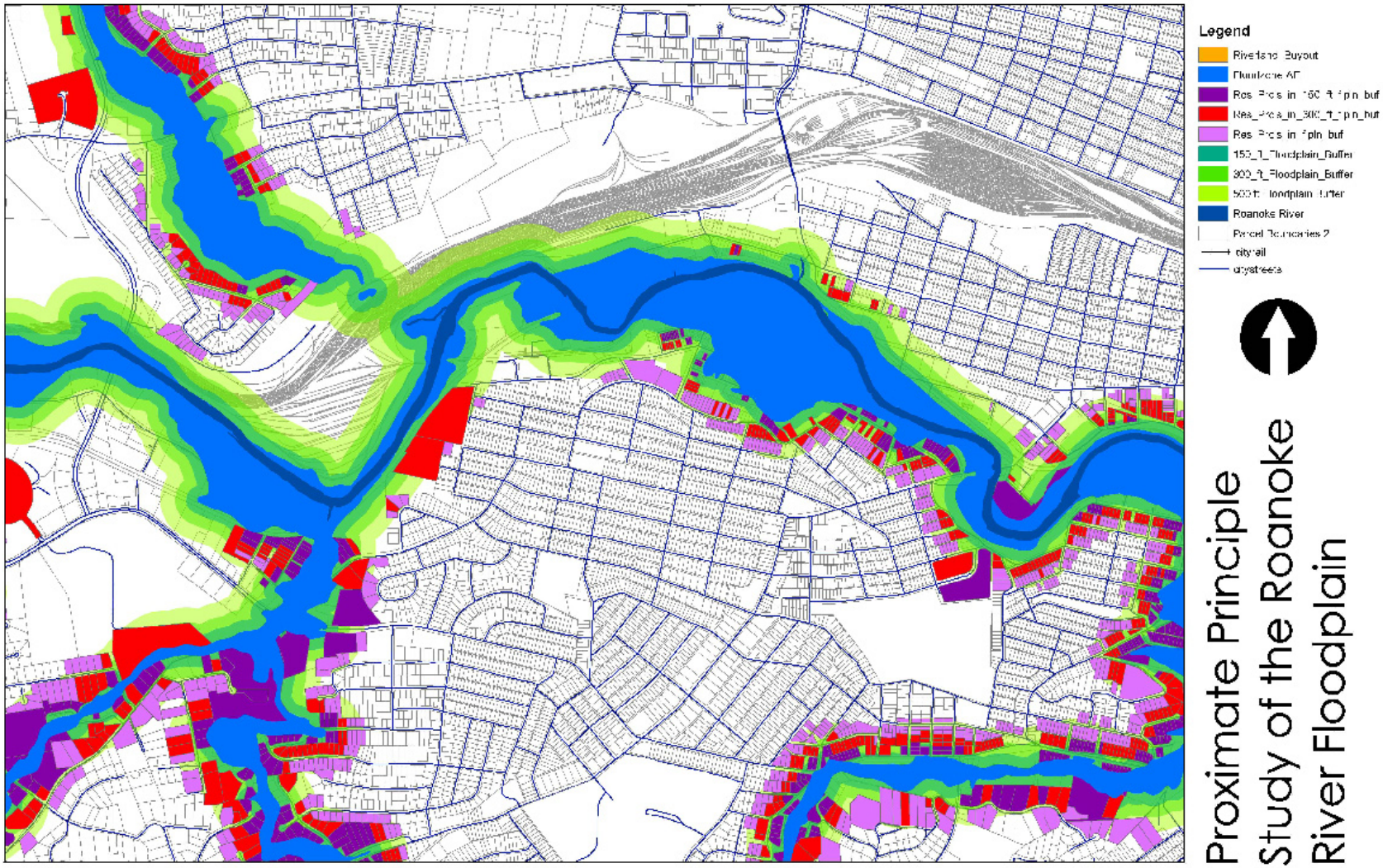
Common example of topgraphic and railroad barriers (River is to the right)



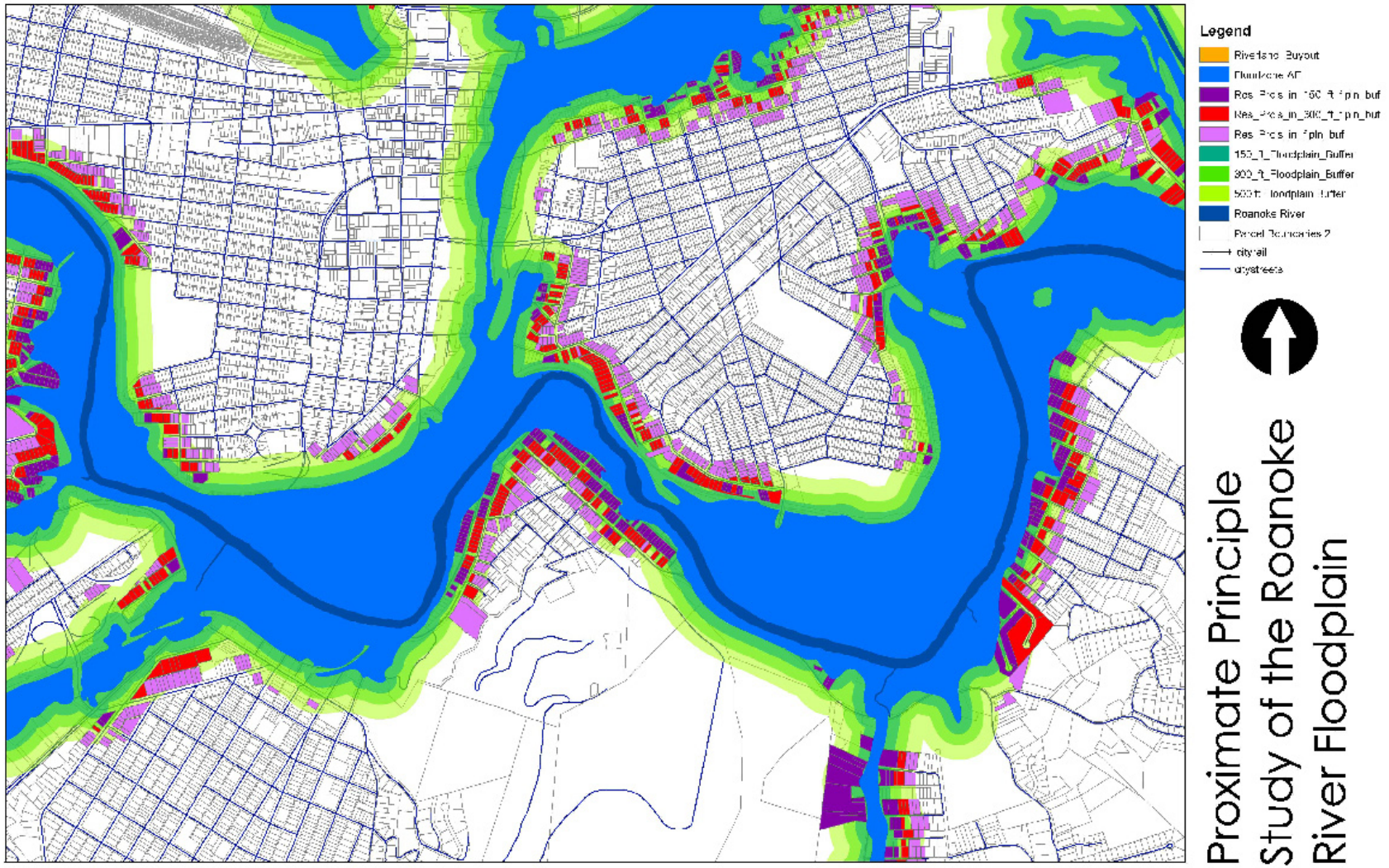
Map 7: Proximate Principle Study of Floodway

These Proximate Principle maps include all floodplains including those of tributary streams. The focus of this project however is strictly the Roanoke River.

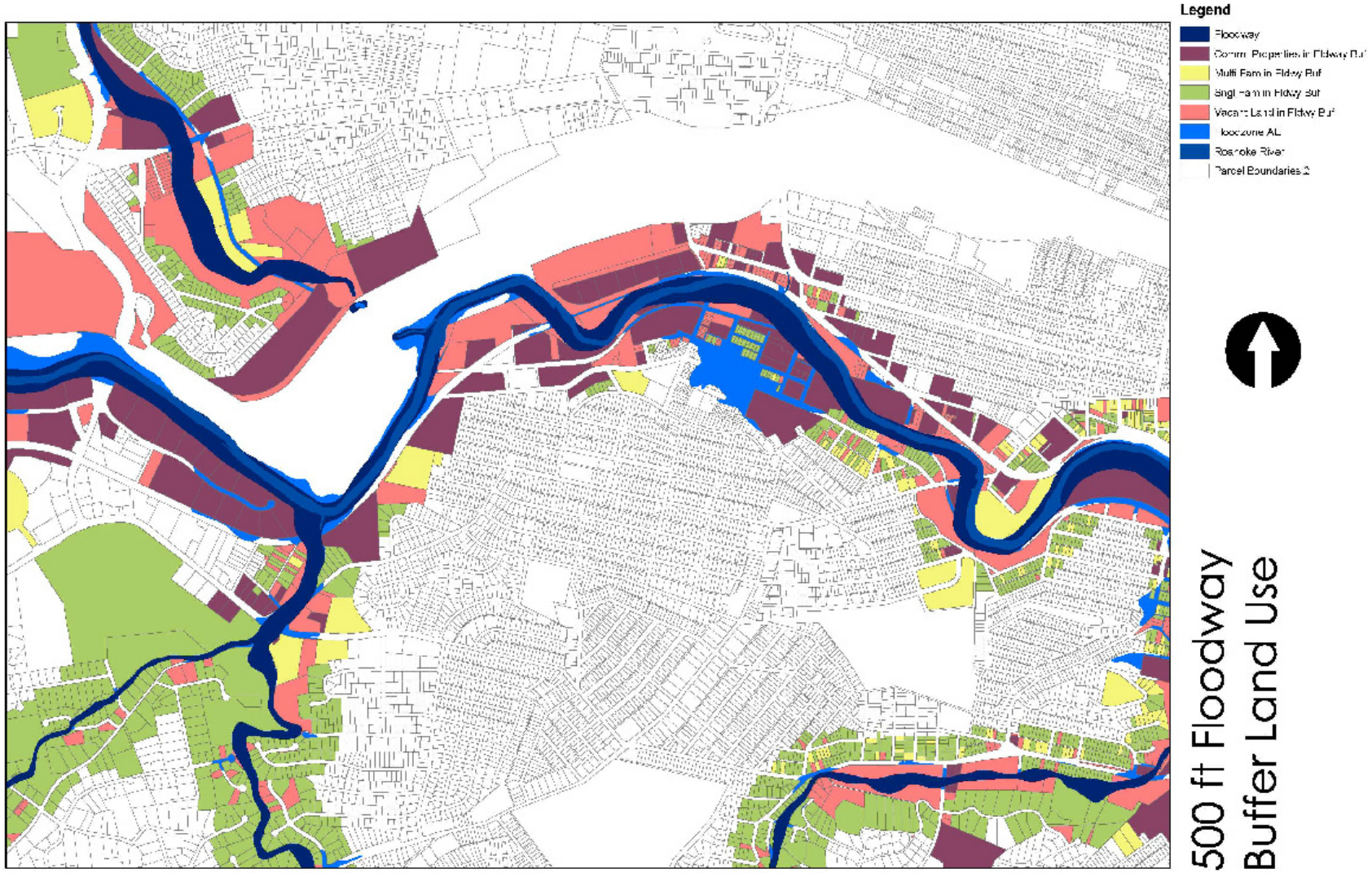

Legend
Floodway
Roanoke River
Proximate Principle
Study of the Roanoke
River Floodway



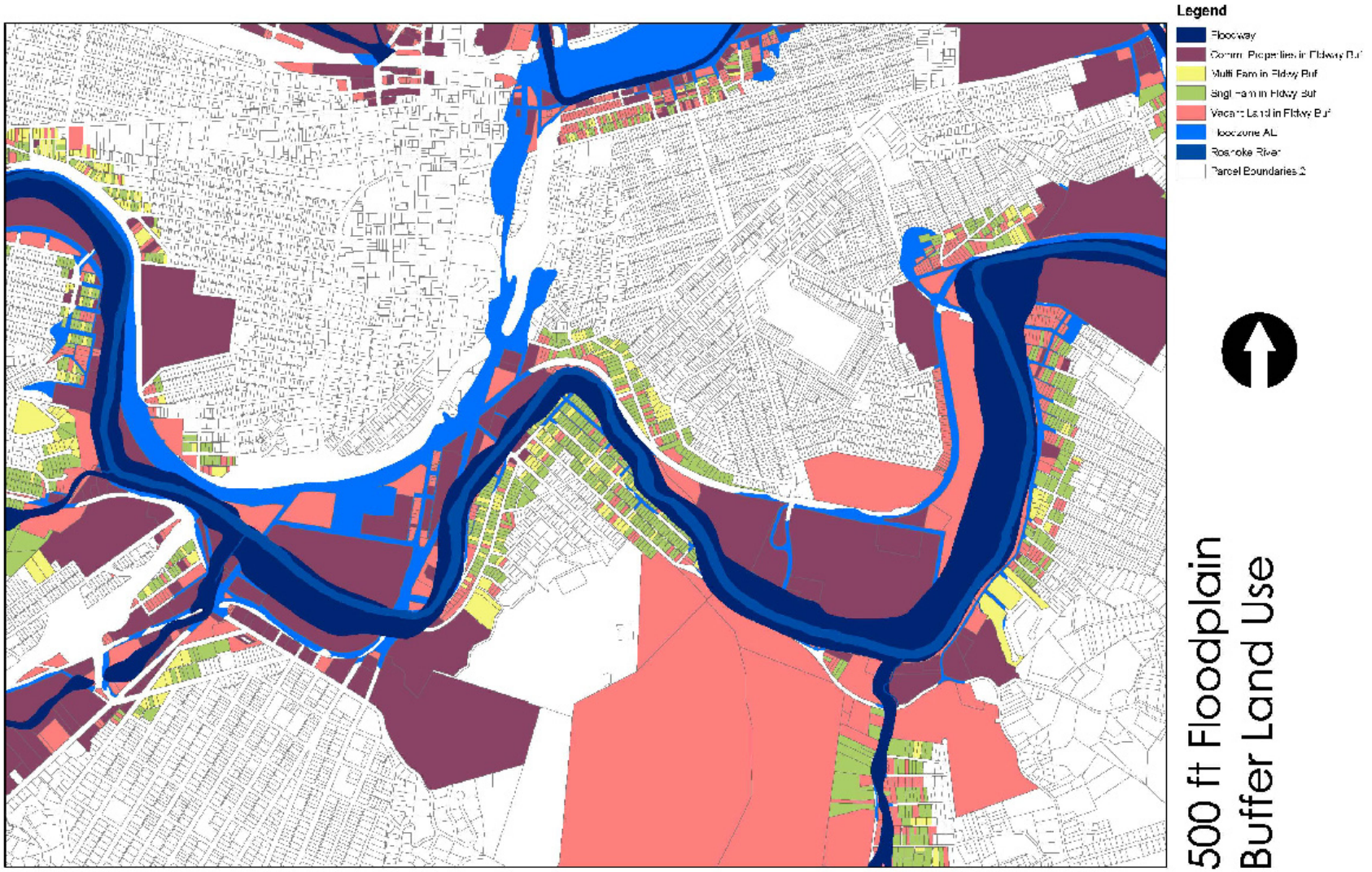
Map 8: Proximate Principle Study of Floodplain

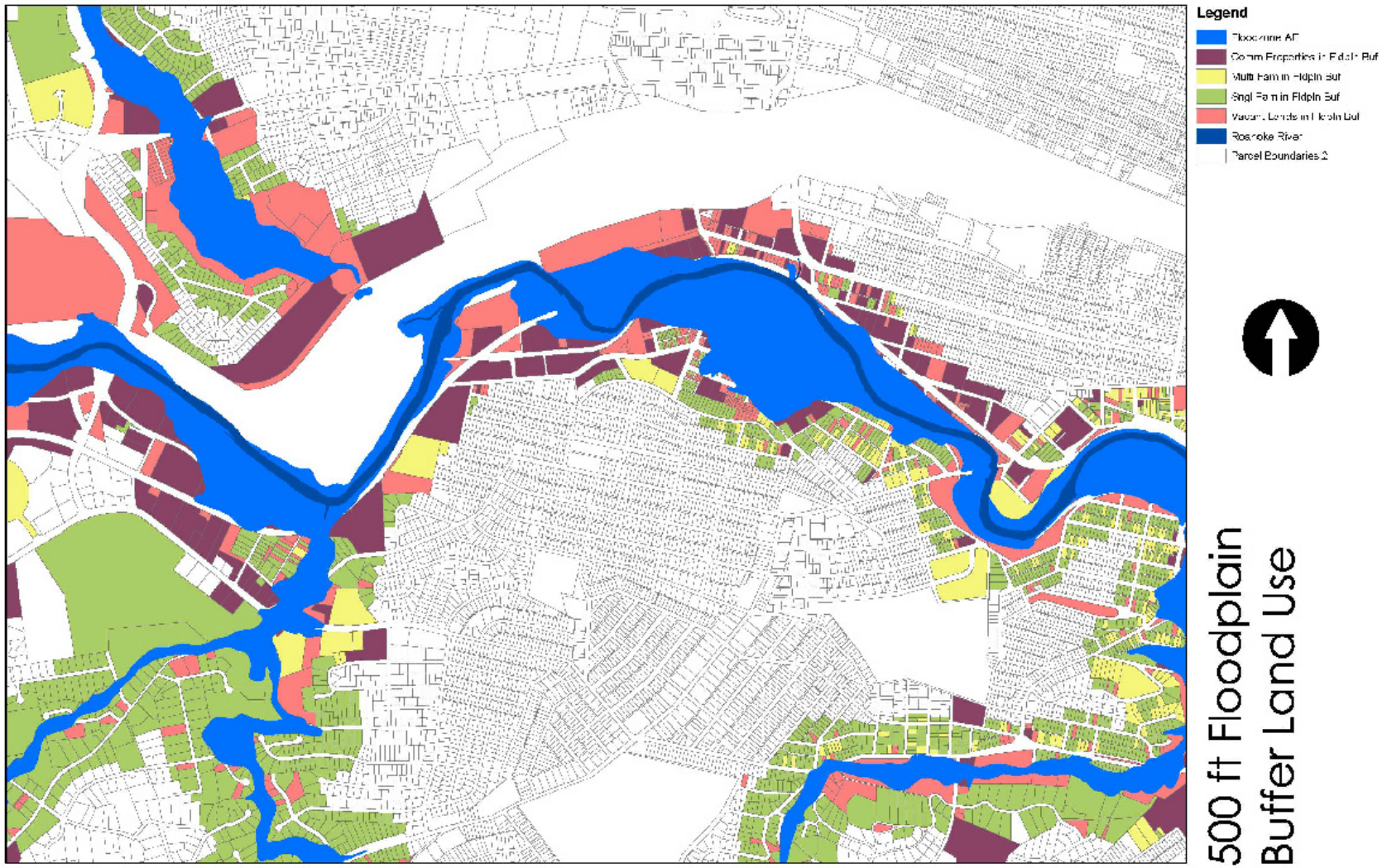


Proximate Principle
Study of the Roanoke
River Floodplain

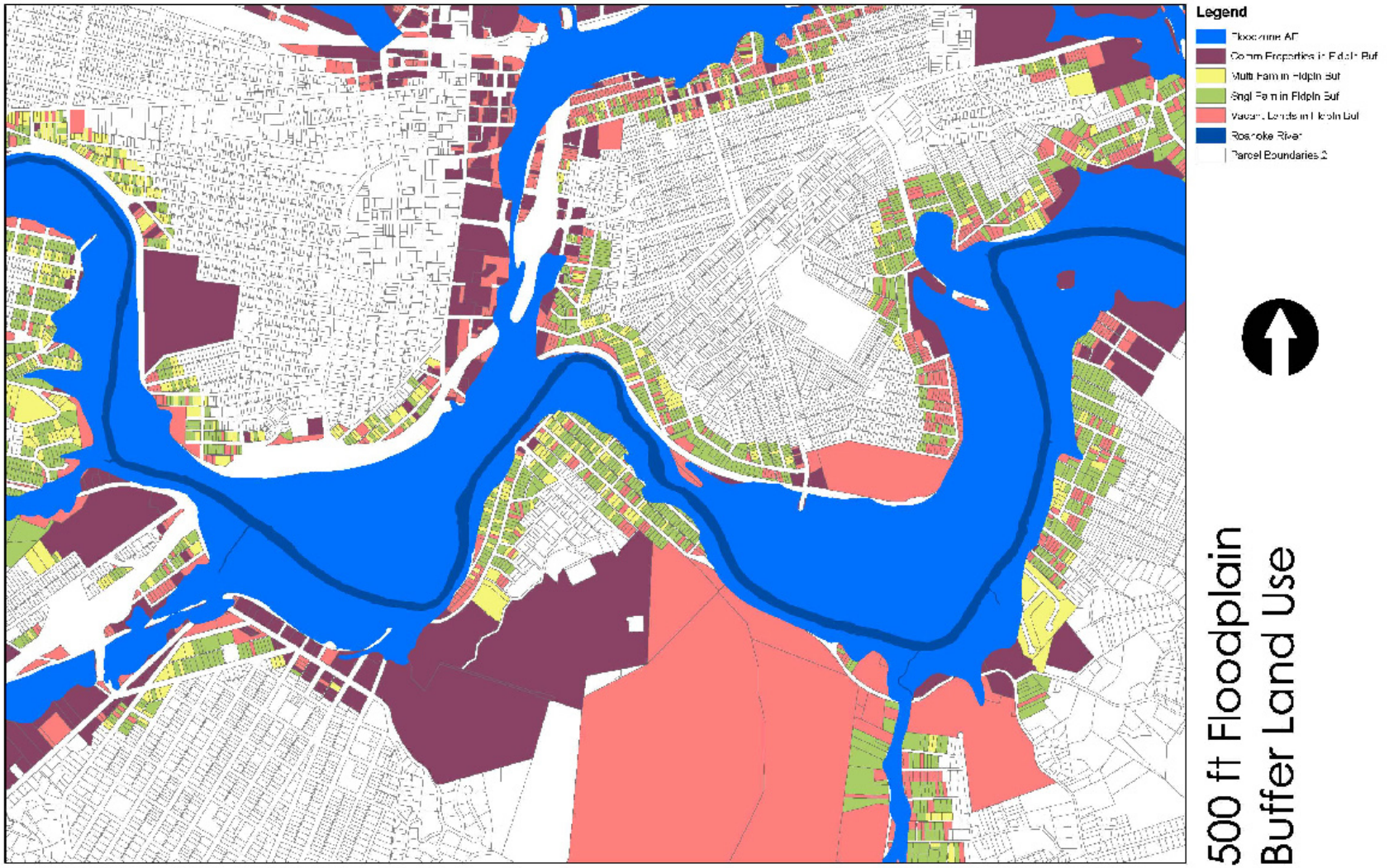


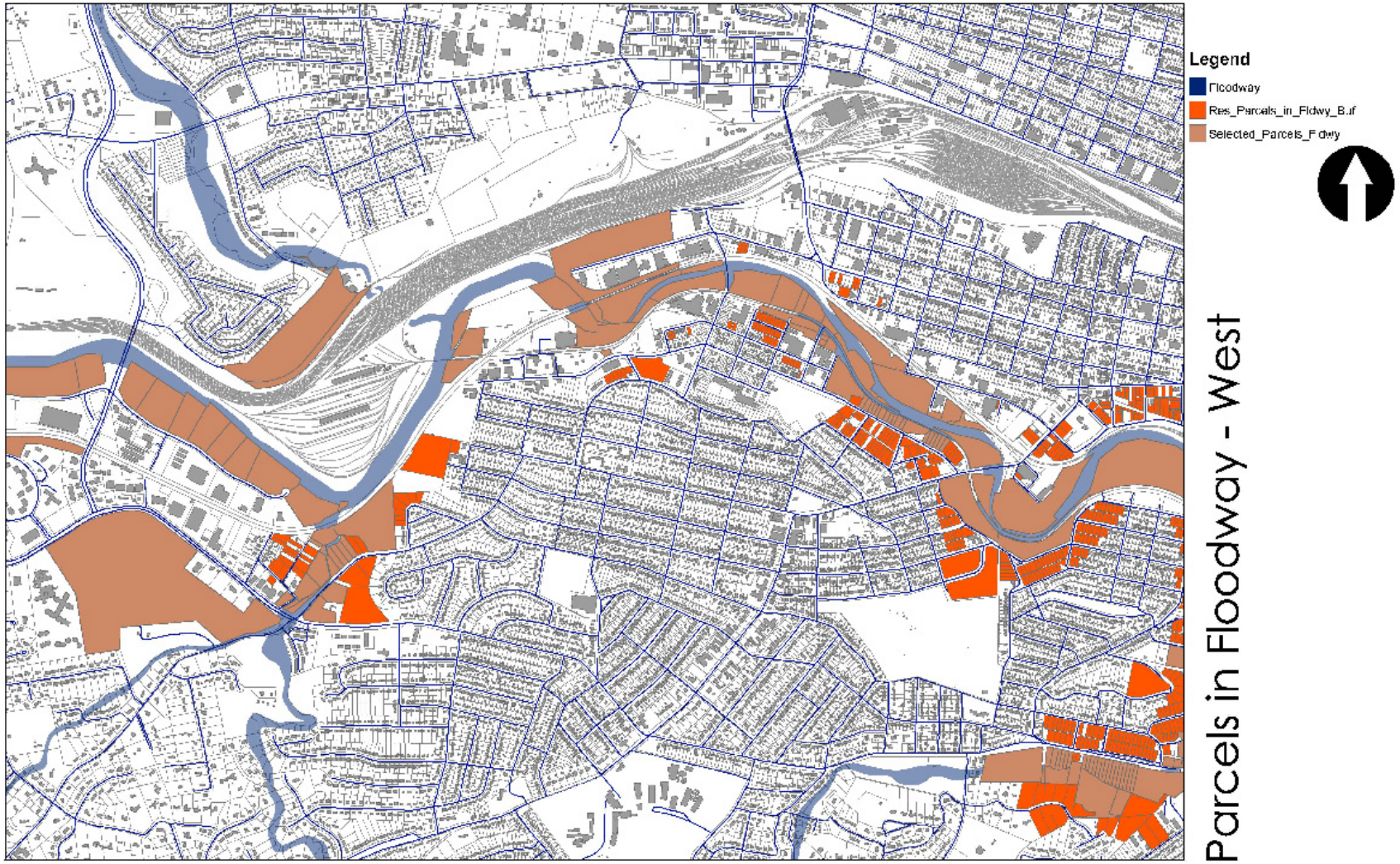
Map 9: Land Use in 500 ft Floodway Buffer


Legend
Floodway
Comm. Properties in Fldwy Buf
Multi Fam in Fldwy Buf
Sngl Fam in Fldwy Buf
Vacant Land in Fldwy Buf
floodzone AE
Roanoke River
Parcel Boundaries 2
500 ft Floodplain
Buffer Land Use

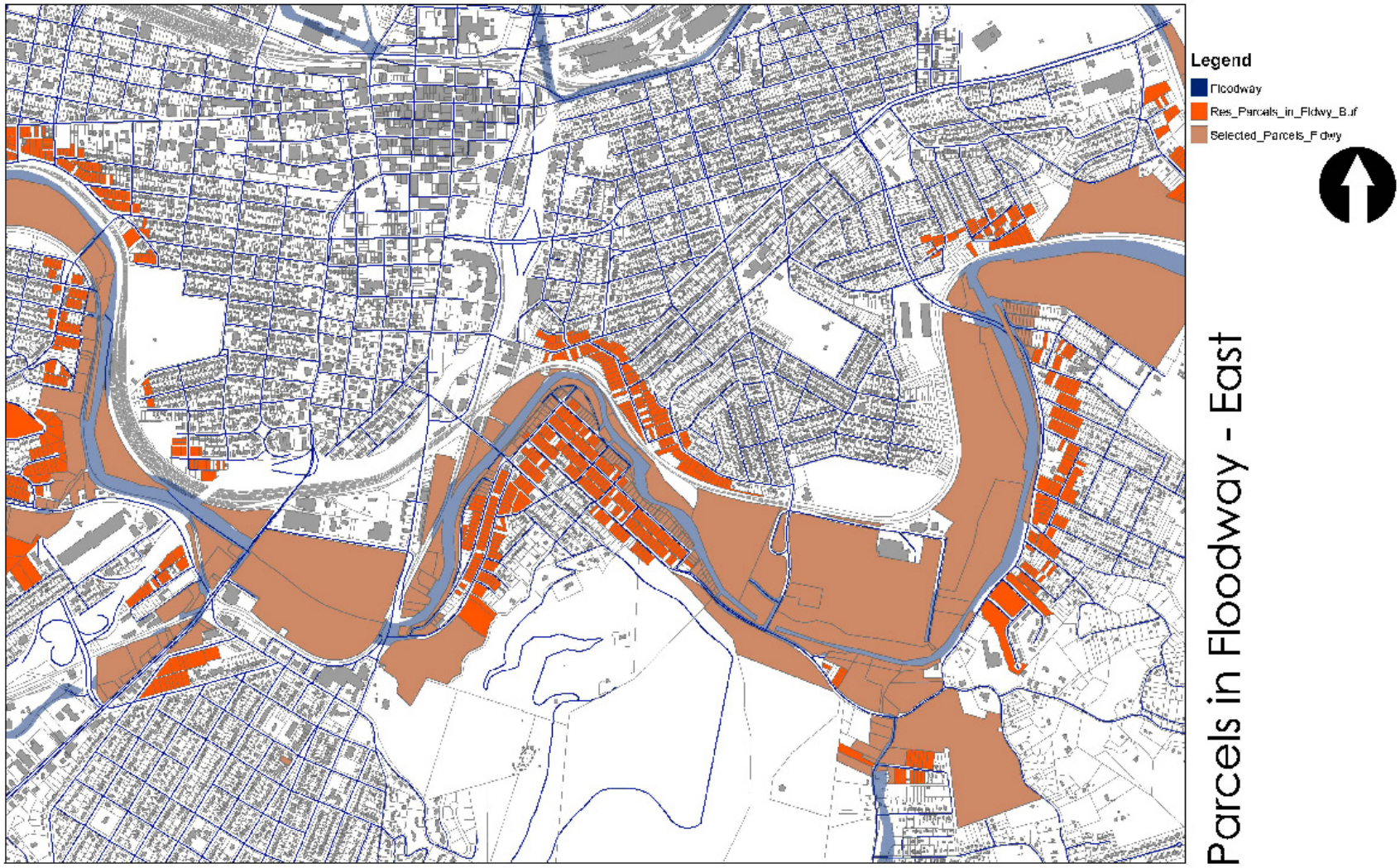


Map 10: Land Use in 500 ft Floodplain Buffer

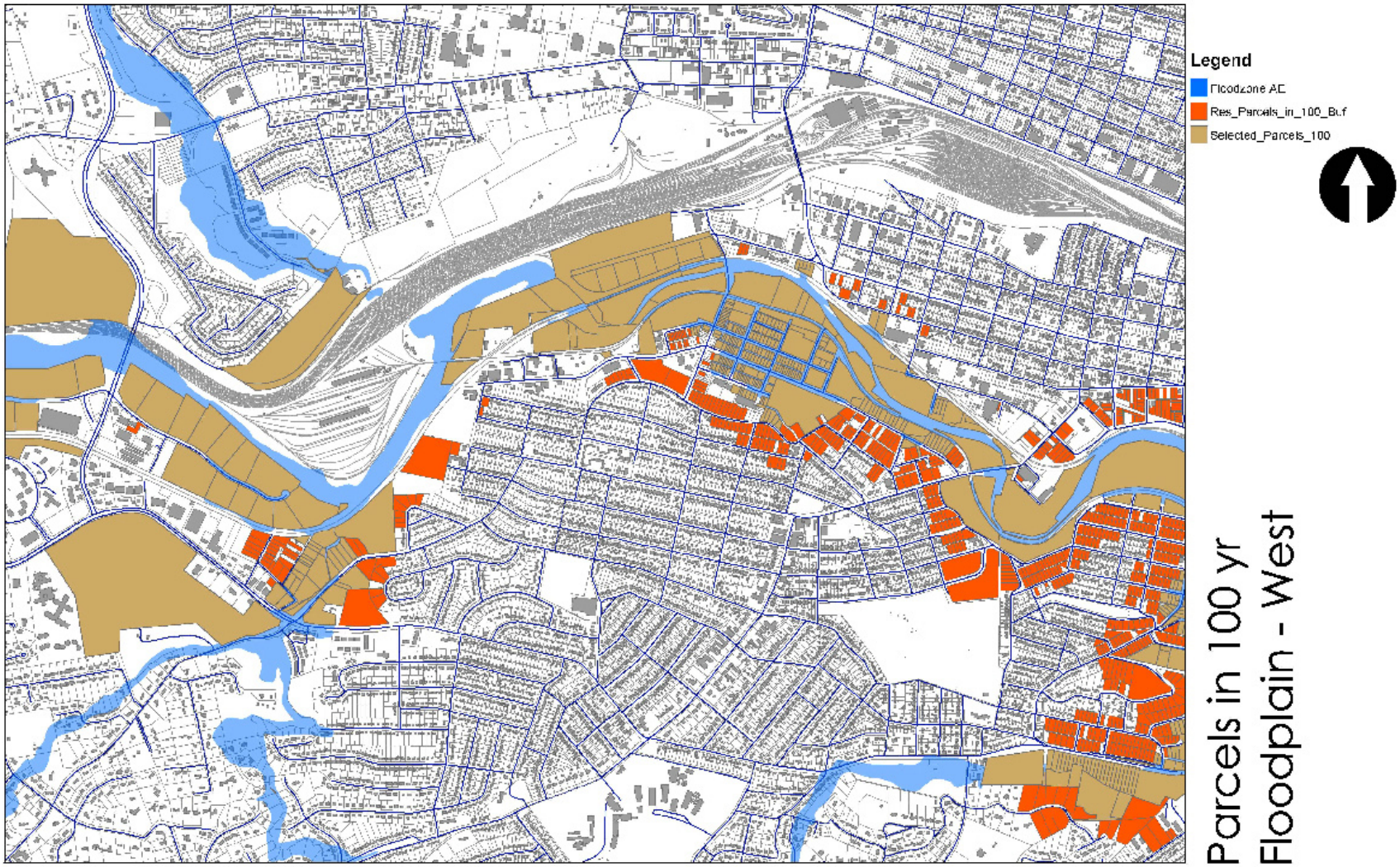

Legend
Floodzone AE
Comm Properties in Fldpln Buf
Multi Fam in Fldpln Buf
Sngl Fam in Fldpln Buf
Vacant Lands in Fldpln Buf
Roanoke River
Parcel Boundaries 2
500 ft Floodplain
Buffer Land Use



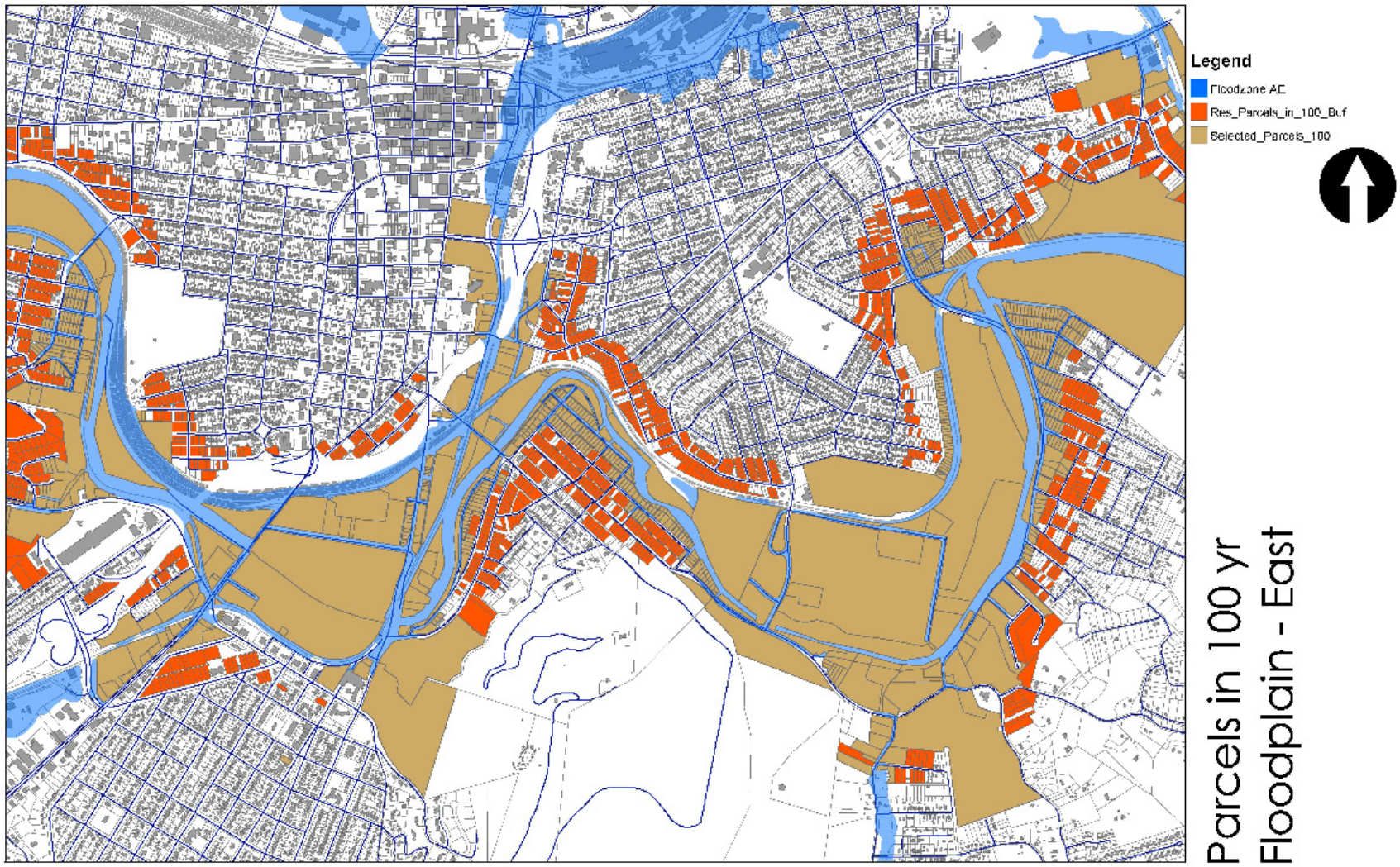
Map 11: Parcels in Floodway



Parcels in Floodway - East



Map 12: Parcels in Floodplain



Parcels in 100 yr Floodplain - East

Proximate Principle Analysis Conclusions

Within and adjacent to the Roanoke River floodplain are several immovable barriers in the form of Railroad tracks or topographic features. These will need to be mitigated via improved connection corridors if the adjacent communities are to benefit from a floodplain park system. There are also several barriers in the form of industrial parks, which can potentially be purchased and incorporated into the park or worked around via the use of greenways. Working with the owners of such properties to allow passage through them is also an option. There are several areas where residential communities lie adjacent to the floodplain and access is unimpeded. These areas provide the greatest opportunities in terms of benefits to those communities.

Opportunities:

1, 3, 4, 5, - These areas all lie adjacent to residential communities and therefore stand the greatest chance of benefiting from a park system.

2 – This area is surrounded on three sides by the Roanoke River and lies almost entirely in the floodplain. It also contains the primary vehicular access route between the Hurt Park neighborhood and the river. This access route also contains several commercial properties, making it a potential candidate for community rehabilitation.

Constraints:

- Railroad yards to the North of the river represent significant immovable barriers bisecting the city and separating residential areas from the river.
- Industrial parks within the floodplain also separate residential areas from the river thereby making them too significant barriers
- Railroad corridors along the river are also immovable barriers but can potentially be mitigated using existing or new access points.

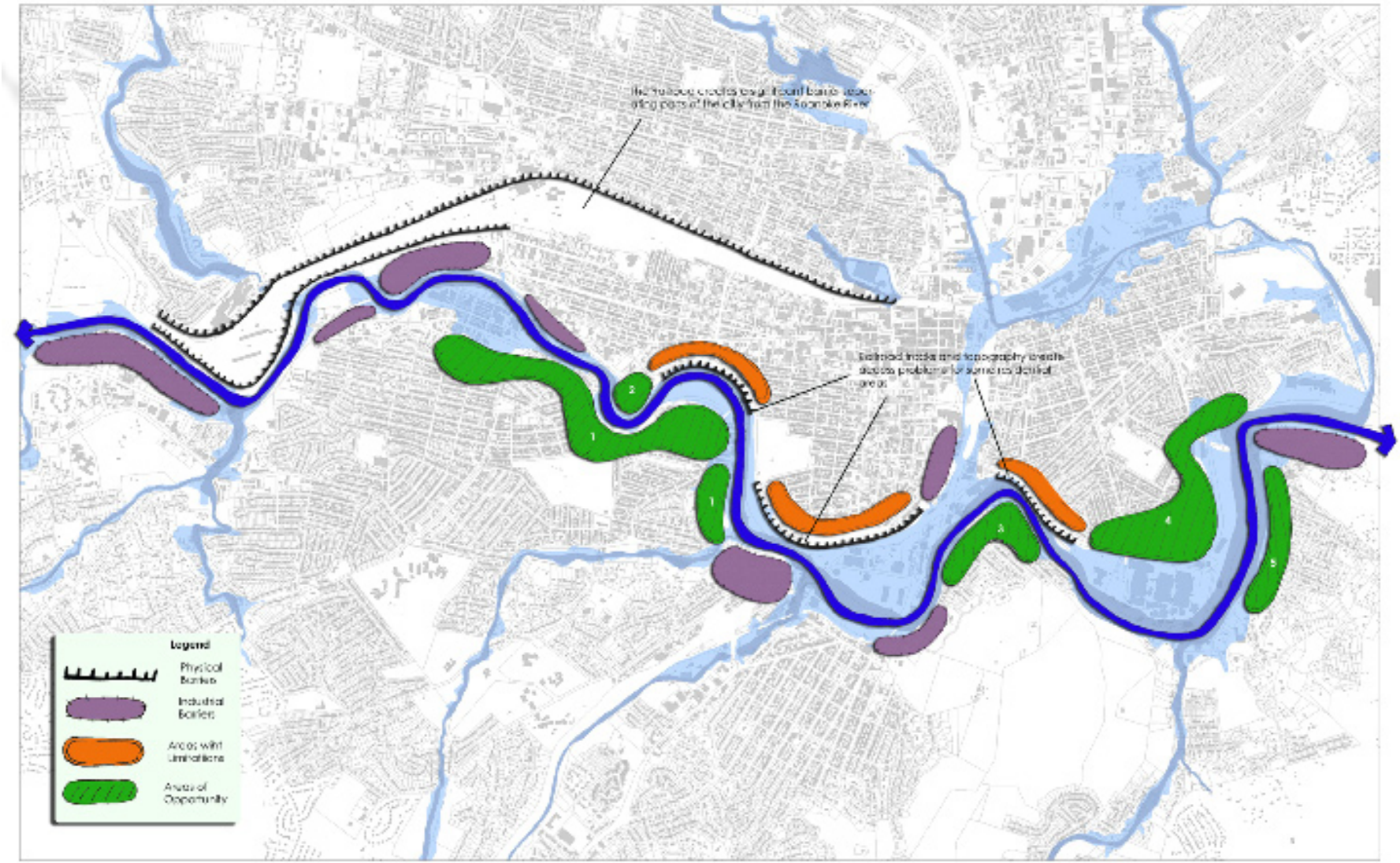


Figure 10: Synthesis of Proximate Principle Analysis

Conditions Identified:

- Areas of ecological significance – This includes existing wetlands, wildlife habitats, and other areas that provide some environmental service.

- Existing or proposed greenways – The city of Roanoke already has a comprehensive greenways plan being put into effect. Understanding where these greenways lie will provide further incentive for protection of the floodplain, as many of them intersect it at some place. Greenways also provide the critical connections need in a green infrastructure network.

- Existing parks or natural areas – There are many passive and active recreation facilities in Roanoke. Protection of the floodplain will provide an opportunity to connect many of them.

- Residual green space established on vacant or neglected parcels – Residual green space represents a hidden opportunity to create valuable green corridors throughout urbanized areas.

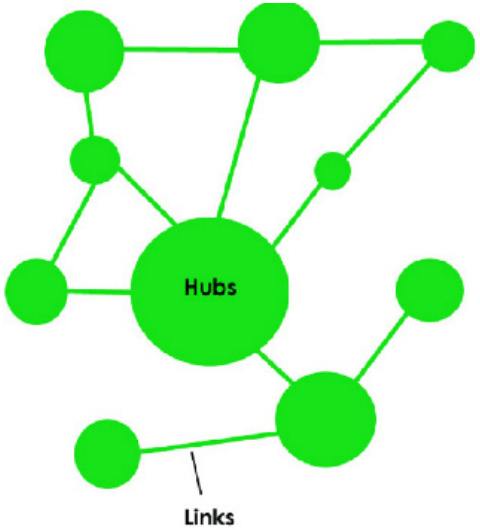


Figure 11: Green Infrastructure Diagram 1

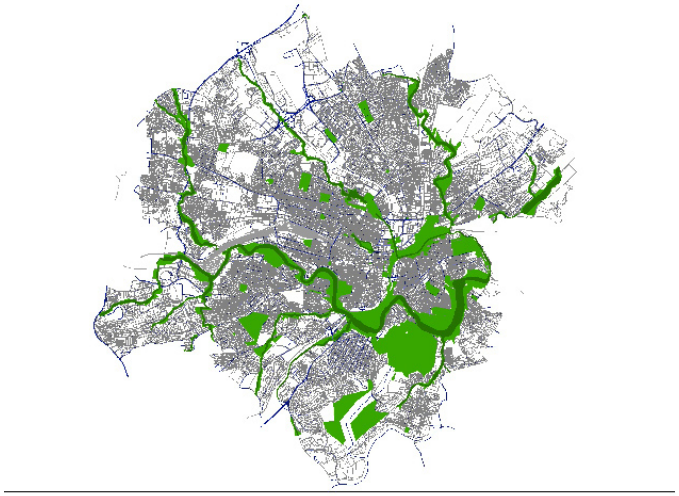
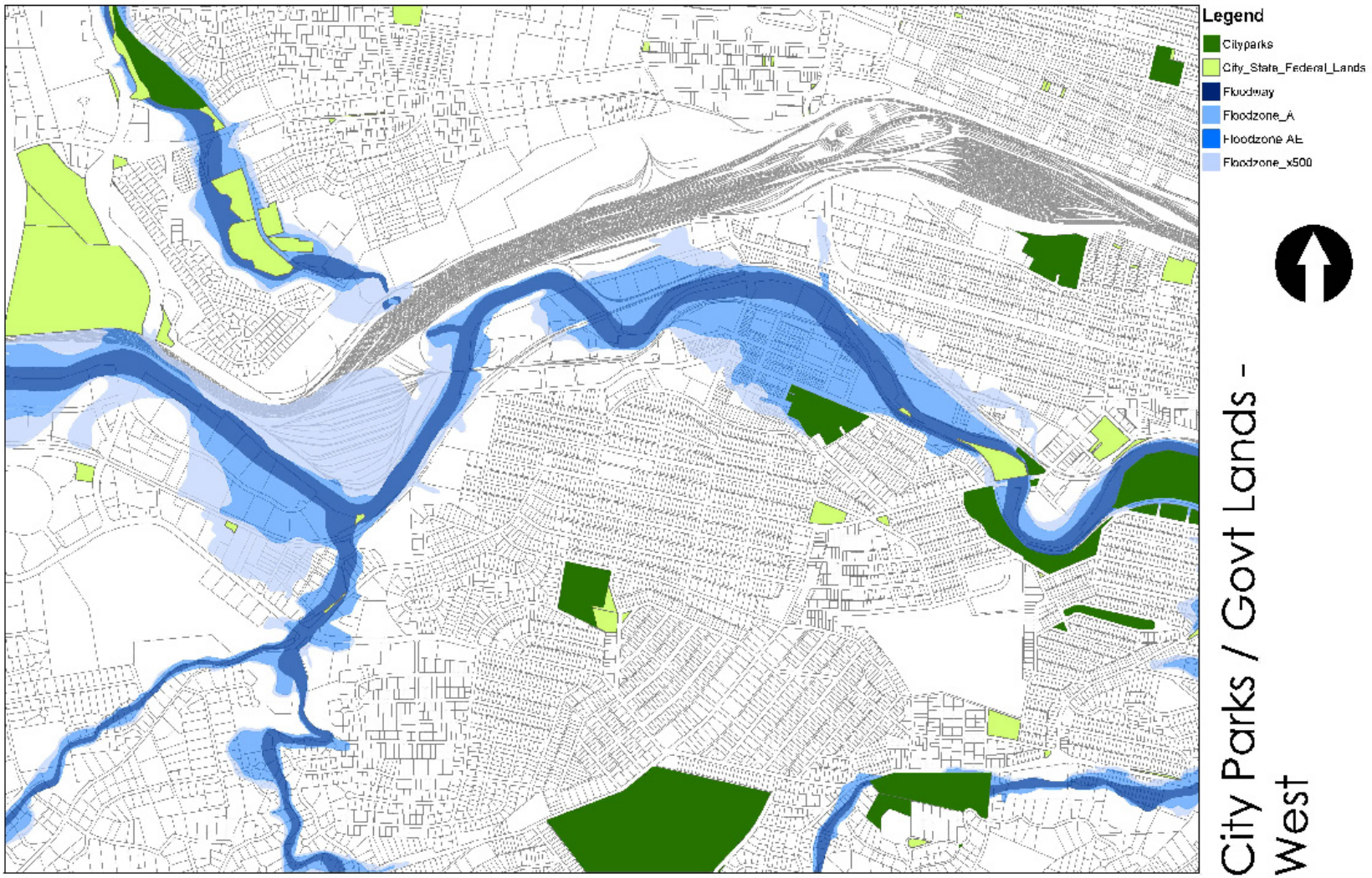
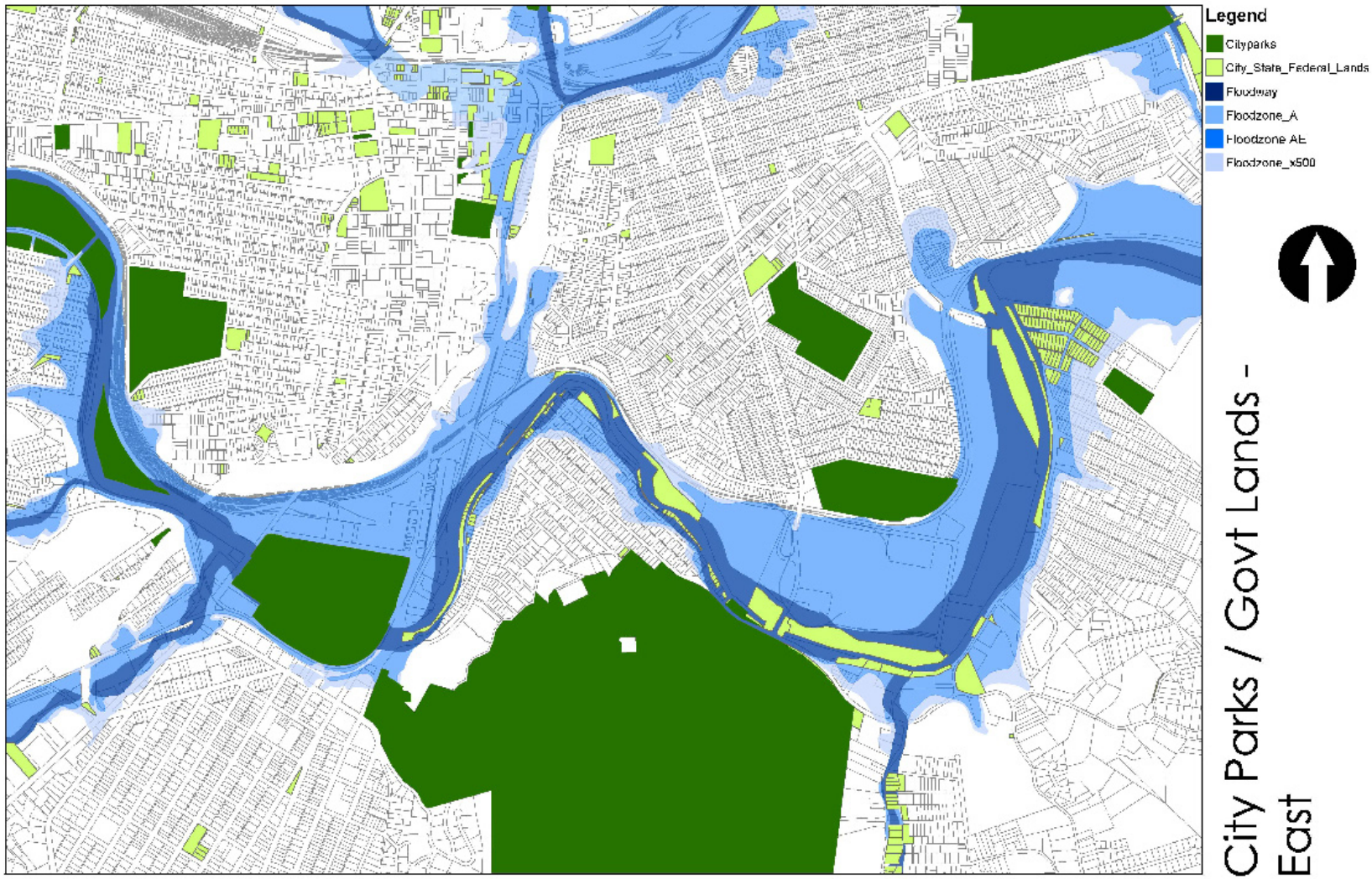


Figure 12: Green Infrastructure Diagram 2 - This diagram demonstrates how floodplains serve as important connections within an urban green infrastructure network.



Map 13: City Parks and Government Lands



City Parks / Govt Lands - East

Green Infrastructure Analysis Conclusions

The city of Roanoke already has an impressive park system with most neighborhoods having easy access to recreational facilities. It also has a comprehensive greenways trail program, again providing access to most communities. The adjacency of the Blue Ridge Parkway and Appalachian Trail further strengthens the potential of the city's green infrastructure. The Tinker Creek greenway is already being developed (point 5) connecting the river to northeastern communities within the city. A greenway plan is also being implemented along the Roanoke River between Wasena Park and the Riverland Neighborhood, connecting eventually to Mill Mountain Park. Development of the floodplain into a park will tie the network together and serve as the backbone of the whole system.

Opportunities:

1 – This junction where the tributary meets the Roanoke River is also the intersection of 2 proposed greenway trails, potentially serving as a valuable access point

2 – This area is already vacant, consisting primarily of residual green space, thereby serving as a potentially valuable connection point.

3 – The Junction of the Mill Mountain and Roanoke River greenway consists primarily of vacant parcels.

4 – This large space already contains a community park and many vacant parcels making it a potentially easy connection point between the Morningside neighborhood and the Roanoke River.

5 – Tinker Creek is a major tributary to the Roanoke River and intersects it at this point. A greenway is already established along Tinker Creek making this area an opportunity to extend the greenway into the floodplain.

Constraints:

- Constraints primarily include the abundance of development along the floodplain and the perceived inferiority of open space.

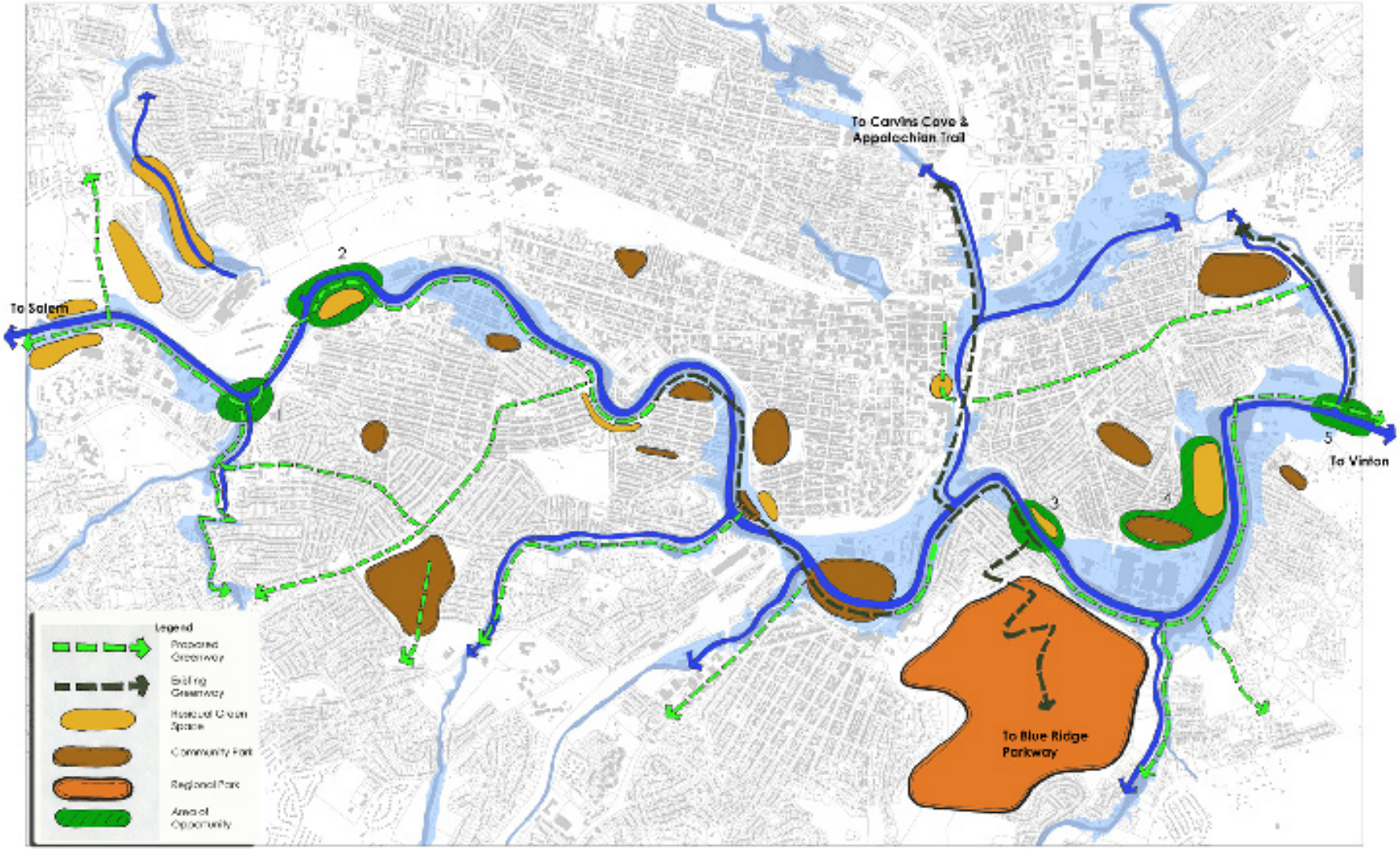


Figure 13: Green Infrastructure Analysis Synthesis

Conditions Identified:

- Village Centers – The comprehensive plan expresses a strong interest in creating commercial hubs within all of the neighborhoods.

- Areas in need of revitalization – Some neighborhoods are in worse shape then others, particularly north of the Roanoke River. These neighborhoods therefore stand to benefit the most from an adjacent park system.

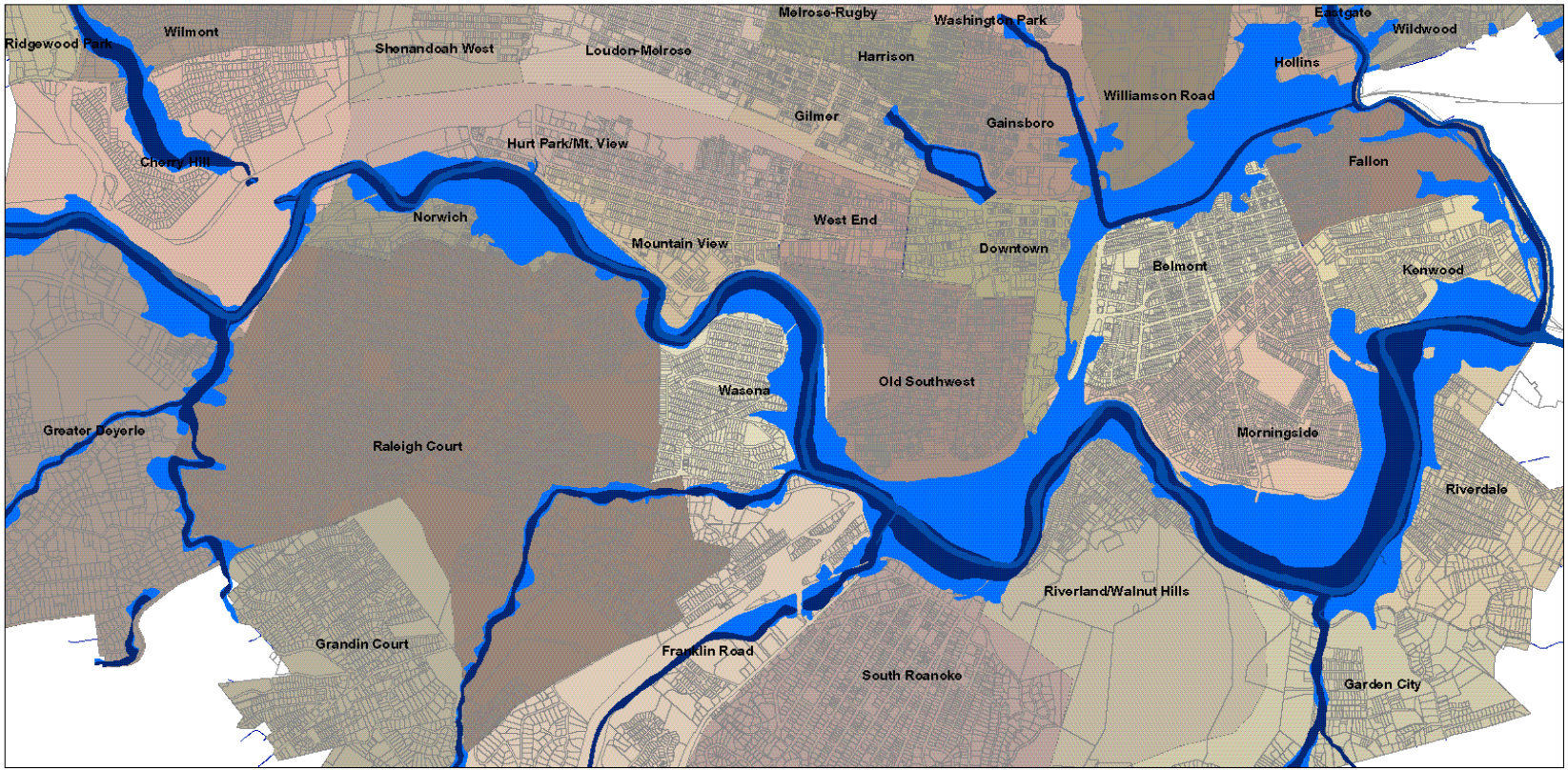
- Areas of economic importance – It must be recognized that the industries located within the floodplain provide many jobs within the adjacent communities. It is therefore not to the benefit of those communities to buyout those properties without providing an alternative area within the city to relocate.

- Places of interest within the neighborhood – Places of cultural significance should not only be protected but enhanced to continue promoting a sense of place within the city.

- Existing points of connection – Currently, there are a limited number of access points between the city and the river. These should be enhanced to better promote the river as the significant natural resource that it is.

- Community priorities – What do the residents see as important and how can their interest be addressed?

- Community character – What is the overall feel of the neighborhoods and how can that best be preserved?



Map 14: City Neighborhoods

Cherry Hill

A draft neighborhood plan is currently under way

Greater Deyerle

Annexed from Roanoke County in 1976, Greater Deyerle is one of the least populated communities in Roanoke. Many houses are located on multiple acre lots and residents take pride in the pastoral quality of the neighborhood. They do not want high-density residential or commercial development to take away from the

quality of life. Homes are typically well maintained and above average in market values. Noted priorities for the community include:

- Maintaining the pastoral quality
- Maintain single-family zoning
- Establishment of a commercial center (rather then strip commercial environment)
- Resolve flooding problems around Norwood and Chesterton Streets

Important Features:

- Pastoral quality
- Numerous lakes and green spaces
- Barnhart cemetery
- Blue Ridge Industrial Park
- Plantation homes built in 1800's
- Archeological sites near mud lick

Norwich

Settled in the late 1800's with foundries and factories, Norwich flourished throughout the 20th century until flooding washed away many of its manufacturing facilities. Current land use is primarily residential with some light industrial facilities along the perimeter.

- Housing renovation and revitalization
- Physical improvement of neighborhood gateways and side streets
- Encourage the establishment of a vibrant village center
- Develop a recreational use plan for the HM-zoned parcels
- Improve Norwich Park

- Improve Norwich Park

Important Features:

- Norwich Park
- Historic homes
- Small Village Center
- Spur of Norfolk & Southern Railroad
- Roanoke Avenue
- Church
- Historic elementary school
- Possible archeological significance of riverfront properties

Raleigh Court

Raleigh Court is noted as one of the most appealing neighborhoods in Roanoke, containing a variety of housing options, as well as a well-maintained commercial center (Grandin Village), which still contains small neighborhood businesses. Maintaining the traditional residential character is a primary concern of residents. Some primary concerns include:

- Preservation of the self-sustaining community
- Reducing or maintaining the number of multi-family units
- Improved maintenance of neighborhood parks and properties
- Establishing a regional plan for floodplain management
- Important Features:
- Grandin Village

- Mud Lick creek, Brandon Ave., & Grandin Rd. as possible greenway corridors
- Schools, fire station, library, post office

Hurt Park / Mountain View / West End

Development in this area started in the early 20th century and evolved around the railroad. These neighborhoods today feature excellent examples of early architecture and approximately half of the area is listed as a historic district. These are no longer the premier residential neighborhoods they once were but they have retained their historic character and offer commercial and residential redevelopment opportunities. High priorities include:

- Zoning changes to ensure compatibility between new and existing homes
- Infill housing development
- Small business development and revitalization
- Code enforcement
- Infrastructure improvement
- Improved community appearance by attracting new residences

Important Features:

- Historic districts
- Examples of early architecture
- Railroad
- Enterprise Zone One
- The Jefferson Center / Office District
- Village Center along 13th St.

Wasena

Established in the 1920's, Wasena is one of Roanoke's first suburbs, with long time residents and a stable housing market. It is known and named for its scenic views of the surrounding mountains. Priorities within this community include:

- Establish a greater mix of uses in industrial zones
- Strengthen the village center
- Maintain the current housing structure
- Maintaining the existing quality of life
- Control of flooding issues

Important Features:

- Wasena park
- Village Center
- Roanoke ice and cold storage building
- Roanoke River greenway

Franklin Road

The Franklin Road neighborhood contains three major arterial roads and is consequently concerned with traffic problems. These roads (primarily Franklin Rd.) are also the location of major commercial corridors. Priorities include:

- Re-zoning and better delineation between commercial uses throughout the neighborhood
- Continued development of greenways

Important Features:

- Franklin Rd., Colonial Ave, 581
- Virginia Western Community College

Old Southwest

Annexed from Roanoke County in 1890, Old Southwest is one of the cities oldest neighborhoods and still maintains much of its architectural heritage. It was listed on the National Register of Historic Places in 1985 and is part the cities Neighborhood Preservation District (H-2). Despite a deterioration of the community after WWII, It has experienced increased home ownership starting in the 1970's and many historical buildings have been restored. Major concerns within the neighborhood include:

- Rezoning to establish a greater balance between single and multi-family homes
- Code compliance enforcement to ensure proper property maintenance
- Increased infill of vacant lots
- Strengthening of village centers
- Increased establishment of greenways

Important Features:

- Riverside Center for Research Technology
- Jefferson Center
- Downtown
- Highland Park

South Roanoke

South Roanoke is and has been one of the cities most desirable communities since the 1700's. It initially contained the cities only spring (Crystal Spring), and the later development of Mill Mountain into a park helped retain the community's desirability. Major concerns include:

- Maintaining the neighborhoods character
- Improving residential streets that are also used as thru ways

- Protecting elements of historical or architectural significance

Important Features:

- Mill Mountain
- Roanoke Medical Center
- Village Center on Crystal Spring Ave.
- Historical and architecturally significant buildings (Fire Station #8)
- Roanoke River

Riverland / Walnut Hills

Located at the base of Mill Mountain, these neighborhoods are comprised primarily of single-family units with a high home ownership rate. Priority initiatives include:

- Traffic calming
- Housing maintenance and upkeep
- Strengthening the village center
- Minimizing flood damage
- Enhancing the Walnut Ave gateway
- Protecting the Roanoke River and Mill Mountain

Important Features:

- Mill Mountain
- Roanoke River
- Walnut Ave (connecting to Blue Ridge parkway)
- Carilion Roanoke Medical Center
- Roanoke River and Mill Mountain Greenways

Morningside / Kenwood / Riverdale

These three neighborhoods are a mix of residential, commercial, and industrial uses. Urban forests, Mill Mountain, the Roanoke River, and the close proximity to downtown make it a scenic and convenient place to live. Development was attracted to the area by the American Viscose plant, which closed in 1958. Top priorities include:

- Zoning changes
- Strengthening village centers
- Improving housing maintenance
- Improvement of main corridors

Important Features:

- Jackson and Morningside Park
- Jackson Park library and middle school
- Several village centers
- Parkside Plaza
- Former American Viscose Plant

Garden City

A draft neighborhood plan is currently underway

Belmont

One of the city's oldest neighborhoods, Belmont's development is closely tied to the railroad with most homes being built between 1890 and 1950 for railroad workers. Since WWII however, homeownership rates have declined and the neighborhood today is the target of revitalization efforts. High priorities include:

- Improved housing
- Strengthening of village centers
- Improved gateways to the neighborhood
- Eliminate vagrancy

Important Features:

- Fallon and Jackson Park
- Neighborhood focal points (fire house #7)
- Community Gateways (Campbell, Tazewell, Elm, & Albermarle Avenues)
- Historical and architectural qualities
- Village Center
- Tinker Creek Greenway
- Railroad and railroad related structures

Downtown

Downtown Roanoke is the commercial heart of the city and centers around Market Square. Efforts are currently underway to extend the vitality of the Downtown area down Jefferson St. to connect with numerous amenities, including the Carilion Medical Center and Victory Stadium located in the Roanoke River floodplain.

Comprehensive Plan Analysis Conclusions

The most significant observation made from the comprehensive plan analysis is the role the Roanoke River plays as a barrier separating the city, with neighborhoods to the north being in greatest need of revitalization and the more suburban neighborhoods to the south being content with their current status. Many proposed village centers where identified, however in some situations attention may best be focused elsewhere. These are addressed in the proposed design.

Opportunities:

1 – The communities of Hurt Park and Nowich (north and south of the river respectively) are both in need of revitalization. The river corridor between them currently contains many vacant parcels, presenting a potential opportunity.

2 – The current location of victory stadium lies between Downtown and outlying residential neighborhoods. It is transected by several major roads (Jefferson St. Rt 581, Franklin St) and contains many vacant or industrial sites. This site can potentially serve as the anchor for the Roanoke park system.

3 – The intersection of Walnut Ave and the Roanoke River lies between Mill Mtn. and Downtown. It therefore serves as a gateway for visitors traveling to and from the Blue Ridge Parkway. Currently however, un-kept industrial buildings and railroad yards greet visitors.

4 – The corridor along Bennington Rd lies adjacent to 2 residential neighborhoods and 2 proposed village centers.

Constraints:

- There are many large industrial parks within the floodplain, including the Roanoke Industrial Park in Morningside, which likely provide many jobs for nearby residents. Removal of such properties may therefore have a negative impact on the community.

- It is important to maintain an unbiased perspective when considering which areas to buy out to ensure that lower income families (often located in less desirable areas such as floodplains) are not being unintentionally discriminated against.

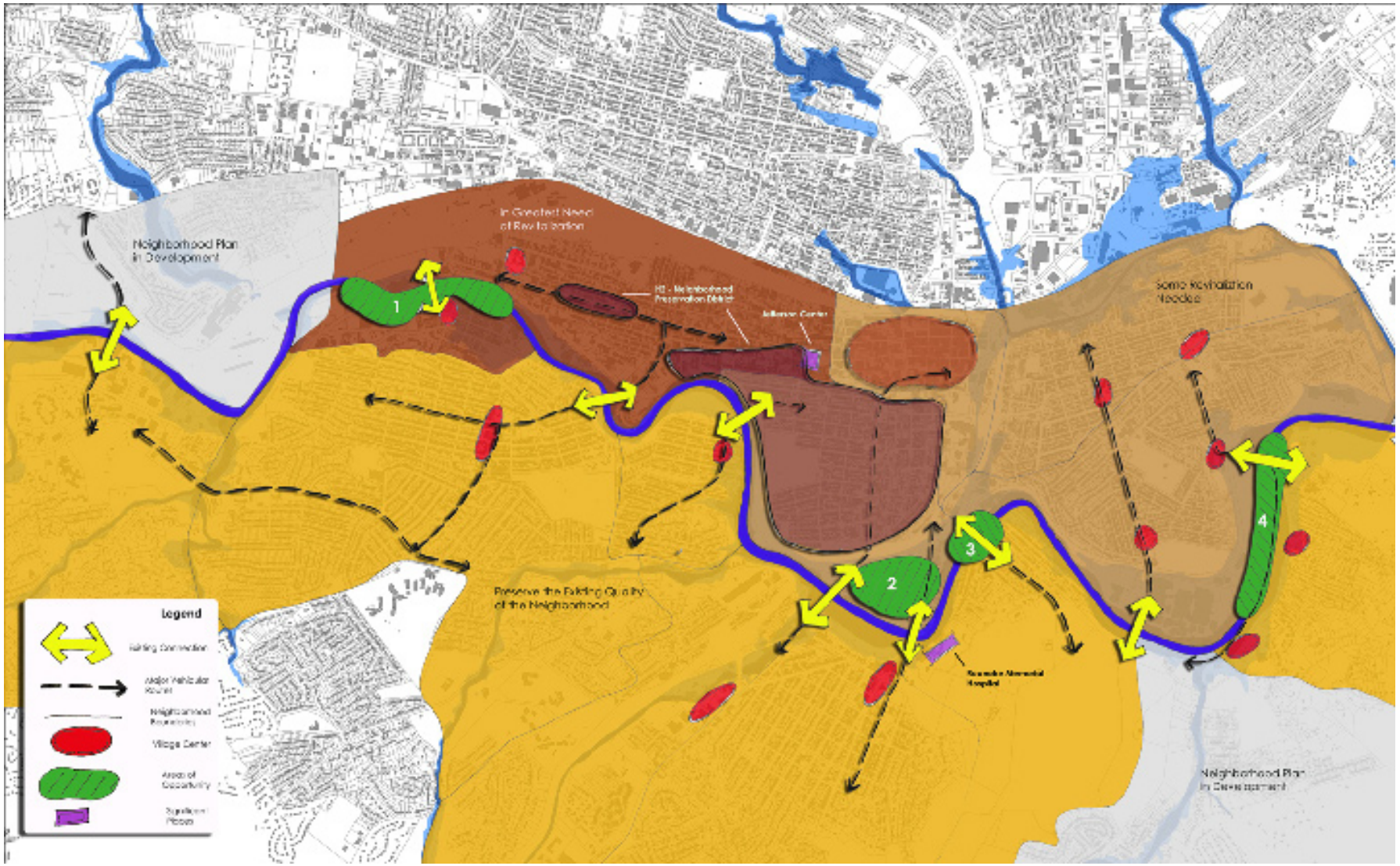


Figure 14: Comprehensive Plan Analysis Synthesis

Design

The following section represents the design portion of this project and begins with diagrams of the general process. A large-scale land use conceptual plan is presented as well as several smaller vignettes of potential site plans. Given the large scale of the project and limited time frame available, these vignettes represent merely a rough exploration of what possibilities specific sites hold. The focus is instead on the conceptual land use plan which is a more realistic scale from which to work at this stage of the project.

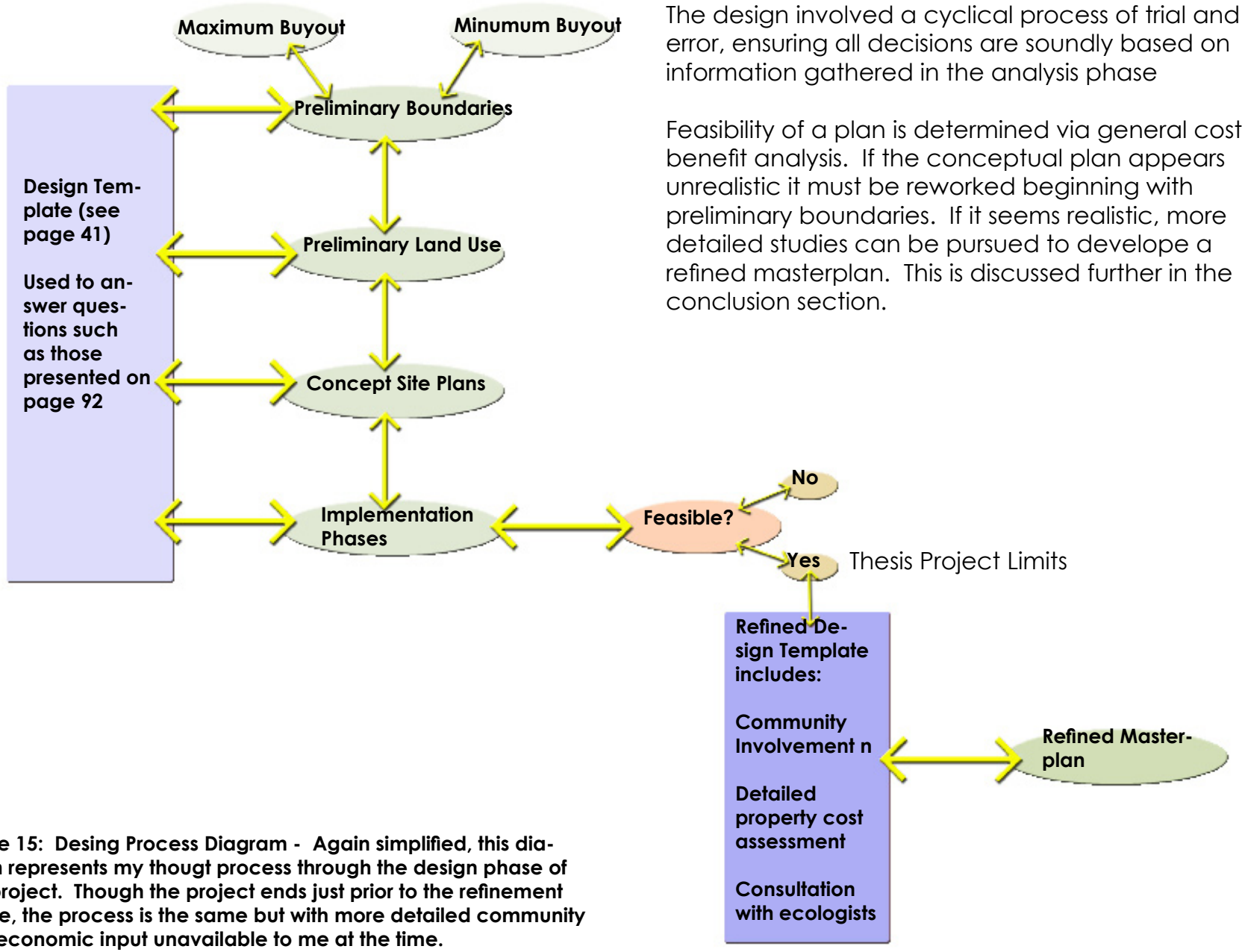


Figure 15: Desing Process Diagram - Again simplified, this diagram represents my thougt process through the design phase of this project. Though the project ends just prior to the refinement phase, the process is the same but with more detailed community and economic input unavailable to me at the time.

The design involved a cyclical process of trial and error, ensuring all decisions are soundly based on information gathered in the analysis phase

Feasibility of a plan is determined via general cost benefit analysis. If the conceptual plan appears unrealistic it must be reworked beginning with preliminary boundaries. If it seems realistic, more detailed studies can be pursued to develope a refined masterplan. This is discussed further in the conclusion section.

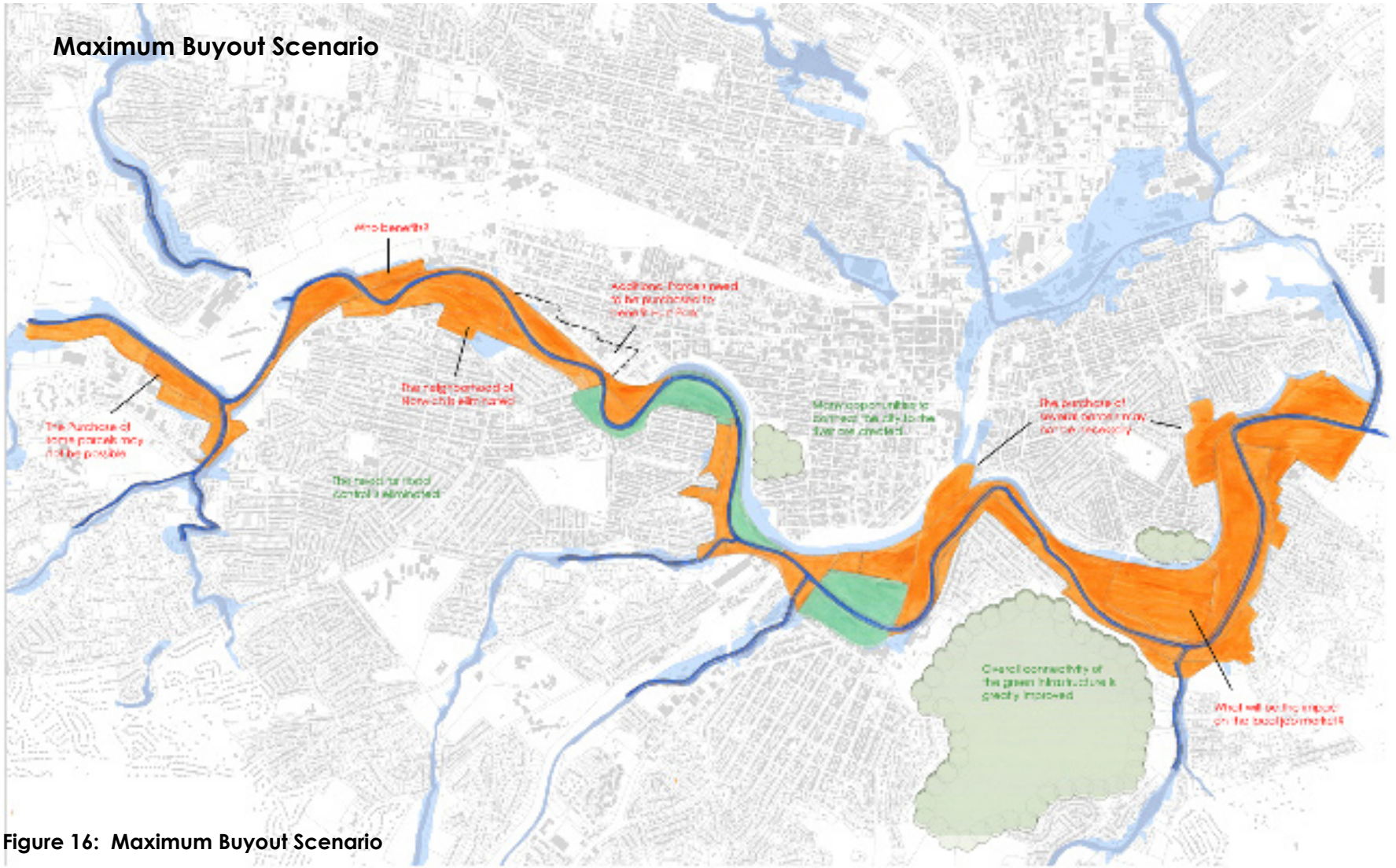


Figure 16: Maximum Buyout Scenario

The maximum buyout scenario explores the possibility of purchasing all properties within the 100 yr floodplain. While this will eliminate the need for additional flood control measures, it is a costly and unnecessary solution.

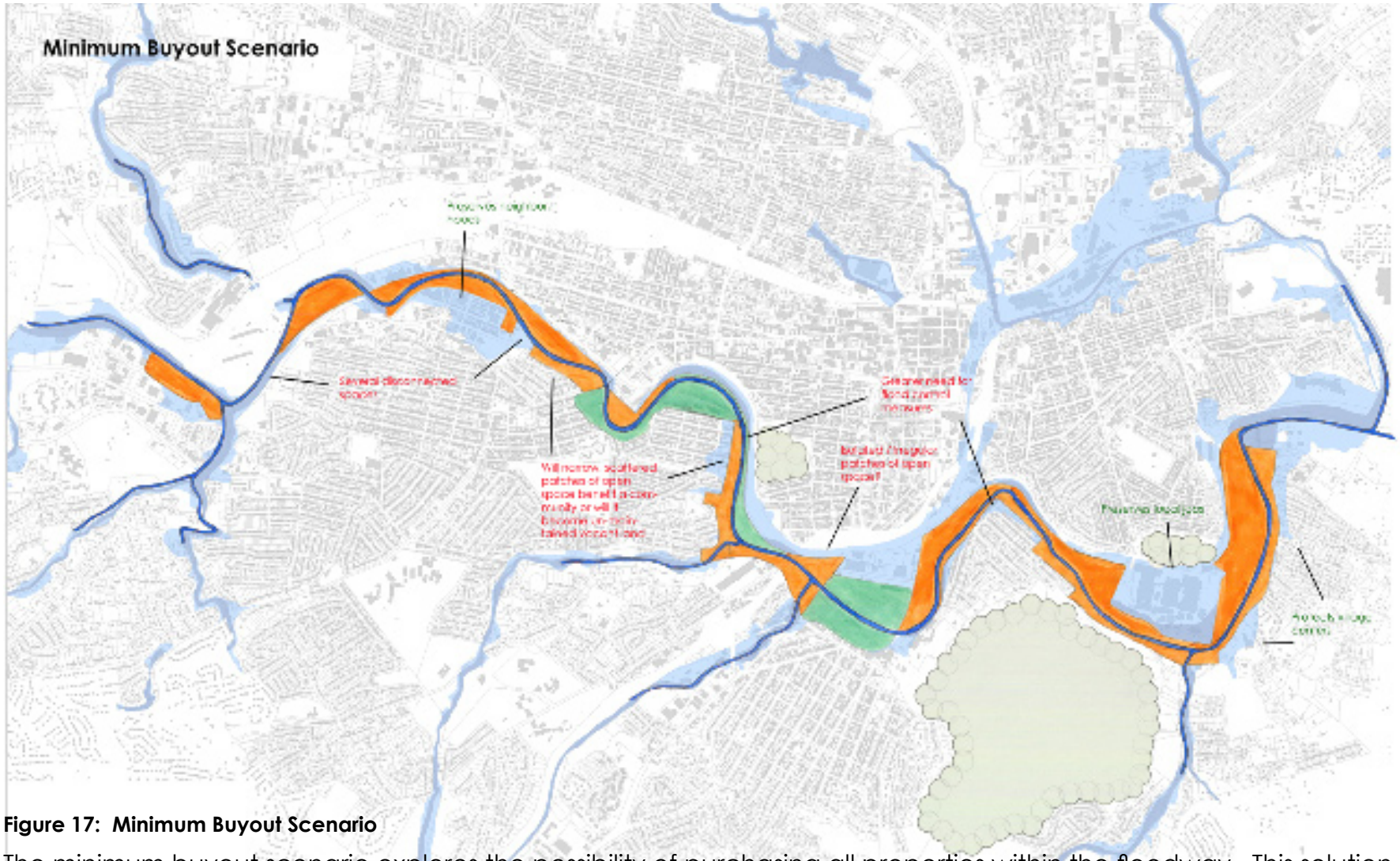


Figure 17: Minimum Buyout Scenario

The minimum buyout scenario explores the possibility of purchasing all properties within the floodway. This solution is more reasonable in terms of cost, however additional flood control measures are needed and it does not fully capitalize on the opportunities that the Roanoke River offers. These scenarios represent opposite ends of the spectrum with the ideal scenario falling somewhere in between. The intention of the following design is to begin defining what that ideal scenario is.

Formulating a design for this project began by defining existing boundaries of the floodplain. I found in many areas the floodplain was defined by railroad tracks or roads, which provide a convenient boarder within which alternative buyout scenarios can be explored. It is however no surprise to find railroad tracks and roads within the floodplain as they often follow a path of least resistance, which is often a stream corridor. They also represent fairly permanent structures, which will be costly to re-route, if it is even possible. Maintaining them is therefore the more cost effective option.

In areas where such structures do not clearly define the floodplain, parcel boundaries where used. This begins the difficult task of determining which parcels should be purchased and which should be protected. To do this I questioned issues such as:

- What is the current state of the property? (vacant, rented, etc.)
- What is the cost of the property?
- Can it be easily relocated?
- Will purchase of such properties bisect or disrupt the community structure?
- How significantly are the properties affected by flooding?
- Is there a specific alternative use for the property?
- What will be the benefit to adjacent properties?
- Do many residential property values stand to increase by transforming the area into parkland?

To answer such questions, I referred back to the analysis documented earlier. The result is the plan presented in the following pages, which I believe is a realistic portrayal of what is possible to create with the money already designated for flood damage reduction. Such a plan will significantly reduce the need for potentially

environmentally damaging flood control measures, while providing the city with a signature park system that will attract new residents and tourists to the area, thereby improving the city's economic situation.

Figure 18: Roanoke River Perception Diagram – As seen in the comprehensive plan analysis, the Roanoke River forms a perceived divider between the northern and southern sections of the city.

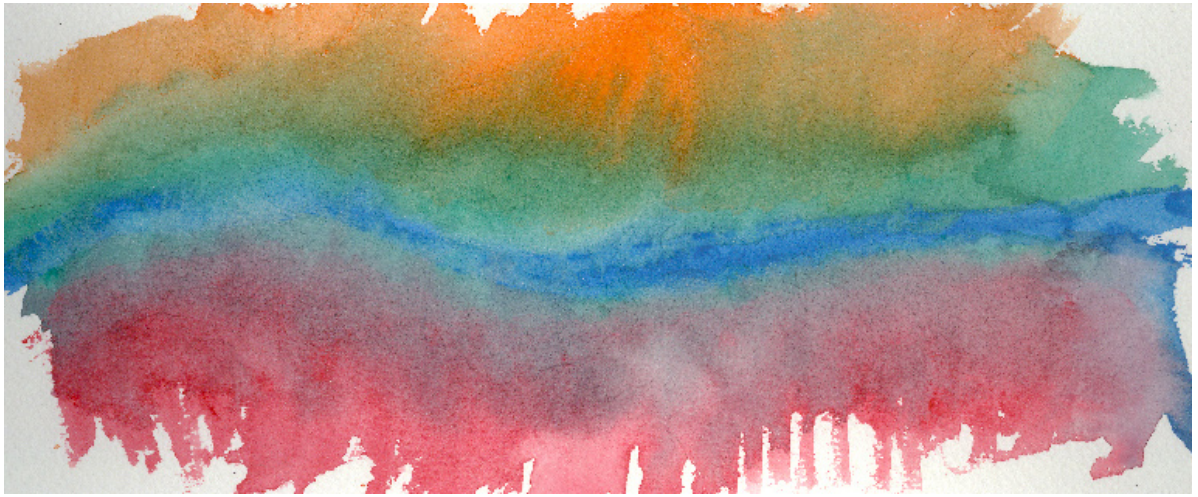


Figure 19: Design Concept Diagram - A park system along the floodplain can begin merging the city back together

Figure 20: Conceptual Land Use Plan (east)

This plan utilizes the Roanoke River Floodplain Park as a potential catalyst for village center development, particularly in the Hurt Park and Riverdale neighborhoods. All areas where economic development (red) is proposed have existing commercial establishments in the area, though not all are designated as village centers. Locating such centers adjacent to the park will allow each to benefit from the other.

Several industrial parks (purple) are maintained throughout the floodplain, as purchase of such areas will not necessarily benefit nearby residents due to lack of proximity or access. These sites are also expensive and provide employment for residents. Purchase of them is not viewed as practical.

Some flood control measures will still be necessary with this plan where residential (orange) commercial or industrial sites are maintained within the floodplain. The Norwich neighborhood lies entirely in the floodplain and will require the most protection. Allowing the river to flood in all other areas of the park however will alleviate some pressure on the river thereby further reducing the magnitude of flood protection needed elsewhere.

Many existing parks (light green) are incorporated into this plan and existing access points are accentuated, thereby maximizing the access of all adjacent neighborhoods to this common area. Extensive networks of multi-use trails will help further connect the neighborhoods.

Figure 21: Conceptual Land Use Plan (west)

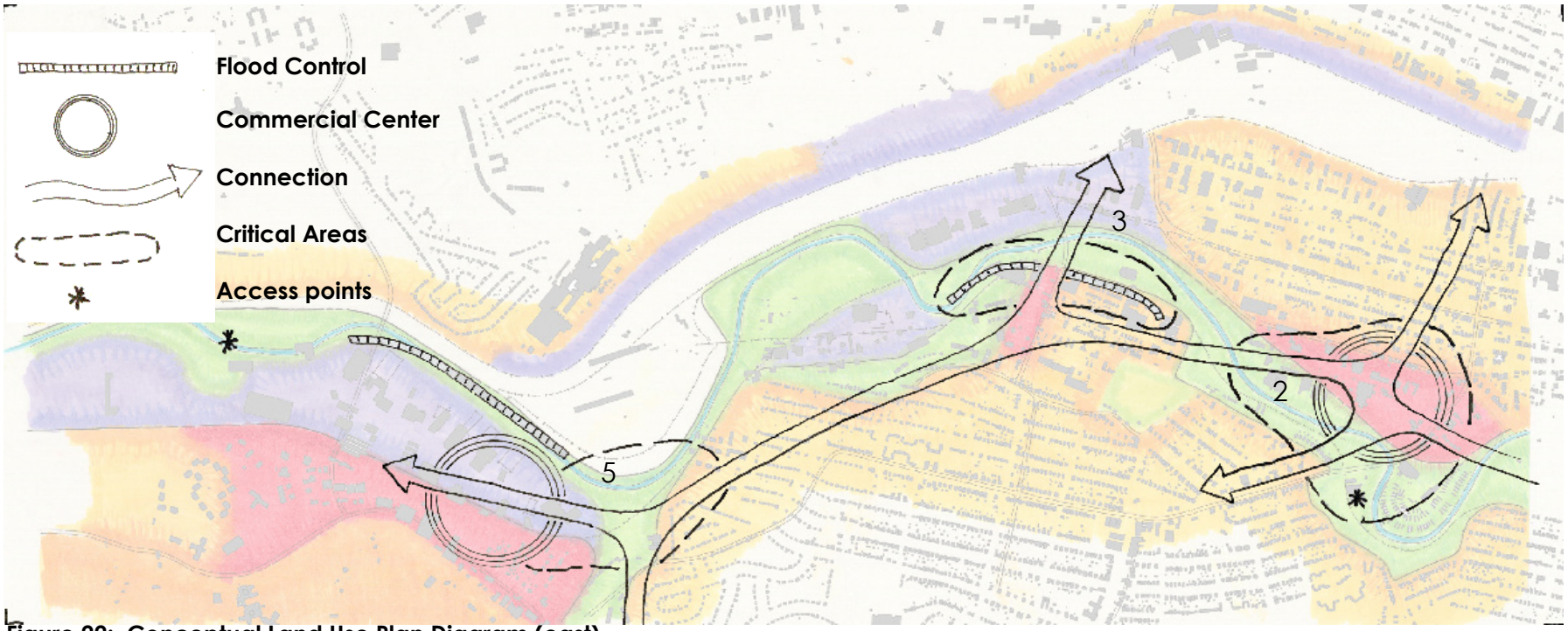


Figure 22: Conceptual Land Use Plan Diagram (east)

This diagram expresses the overall intent of the proposed land use plan. Commercial areas are centered on already existing commercial cores and areas of high traffic flow. These areas used in conjunction with the floodplain parks will enhance the flow of visitors throughout the city and help revitalize deteriorating neighborhoods. Several areas are still in need of flood control, particularly Norwich and the industrial park near the western boarder of the city, however it is severely reduced. Priority areas are designated depending on the ease of implementation, proposed benefits to the town, and the likelihood of the site serving as a catalyst for expansion of the parks. The highest priority area I believe is the Walnut St gateway to the city given is location near downtown, the likelihood of it benefiting adjacent residential areas, and the potential the for serving as the anchor of the whole park system. Other critical areas are labeled according to their potential importance, which in turn can help a phasing process for project implementation.

1- Walnut St gateway - This can serve as a demonstration site and the anchor of the park system.
2- Hurt Park access point and commercial center – Though not proposed as a village center in the Compre-

hensive plan, this area has good access to the river, lies along a significant transportation corridor, and con tains vacant lands and commercial establishments.

3- Norwich – The neighborhood lies entirely in the floodplain and is in need of both flood protection and revitalization.
4- Riverdale Village – This area runs parallel to the river, already contains a vacant floodplain, and is transected by a major transportation corridor. Though the comprehensive plan identifies 2 village centers, I believe the focus should on the corner where the Food Lion exists today.
5- Greater Deyerle – This area again can serve as a demonstration site given its adjacency to a strong commercial corridor and populated residential neighborhoods.

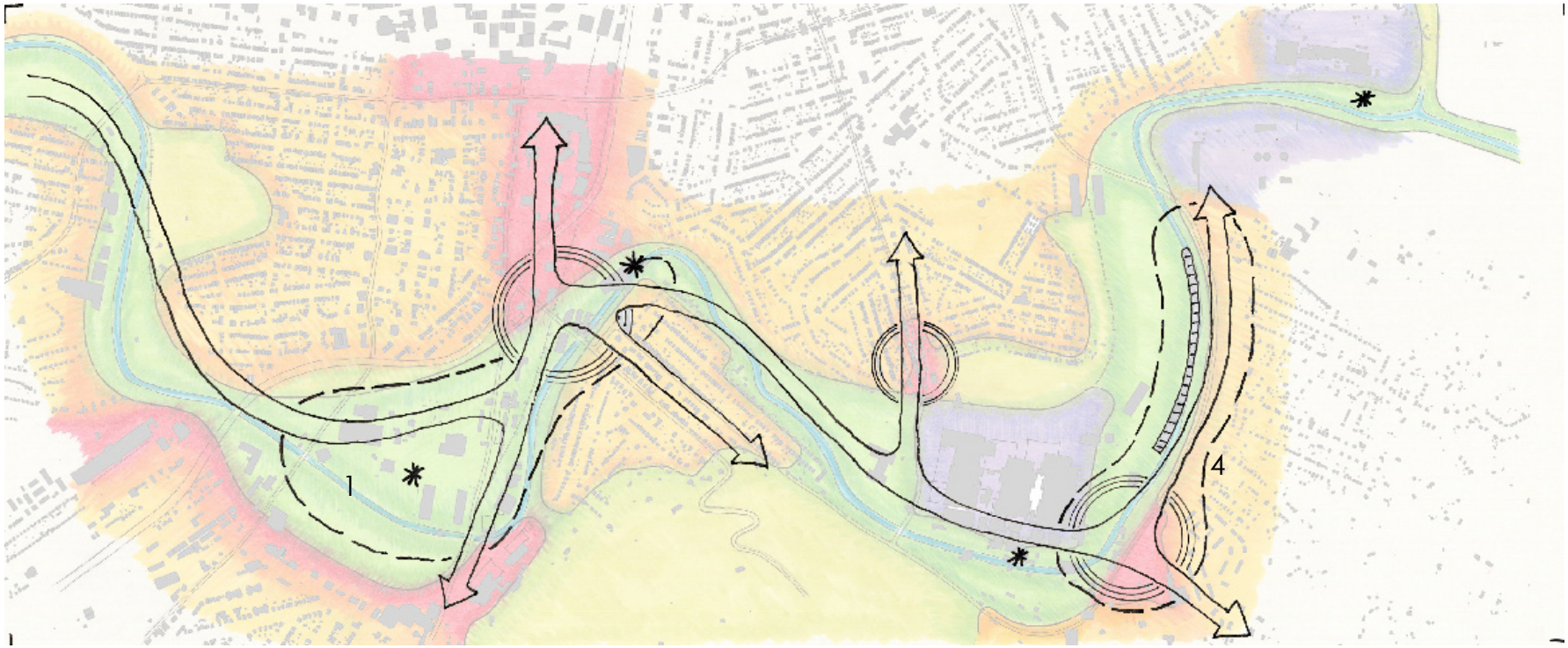


Figure 23: Conceptual Land Use Plan Diagram (west)

Figure 24: Riverdale corridore Plan - Features include a village center at the intersection of Rt 116 and Bennington St, greenway corridore around the Roanoke Industrial Park, parking and picnic services, pedestrian bridge connecting both sides of the river.

Figure 25: Riverdale Greenway Sketch 1

Figure 26: Riverdale Greenway Sketch 2

Figure 27: Walnut St gateway development Plan - Features include a sculpture garden in place of the existing salvage yard, molded land forms that reveal a changing landscape as floodwaters rise, commercial corridor connecting the park to Jefferson St, restora-tionn of selected buildings for use as an information center and park office and maintenance facilities.

Figure 28: Walnut St gateway and sculpture garden Sketch - view from Walnut St bridge facing west

Figure 29: Roanoke Memorial Hospital grounds Sketch- View from Riverland greenway segment facing upstream

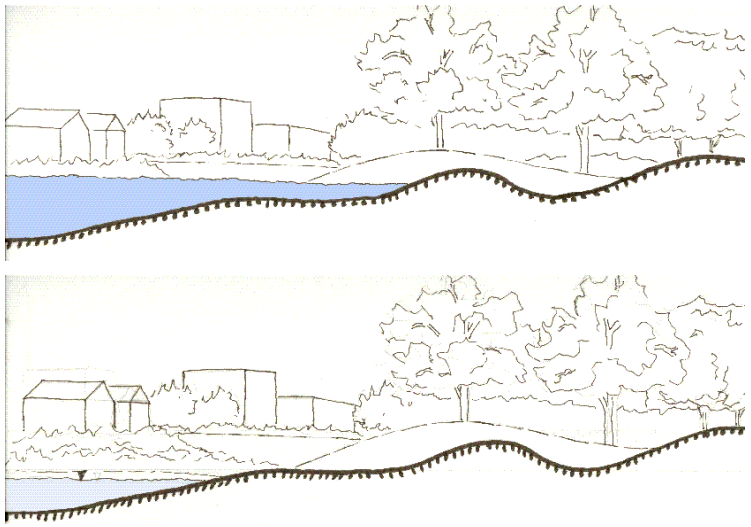


Figure 30: Sculpture Garden Cross Sections - As the water rises, the landscape transforms to the view of spectators on the Walnut St. Bridge

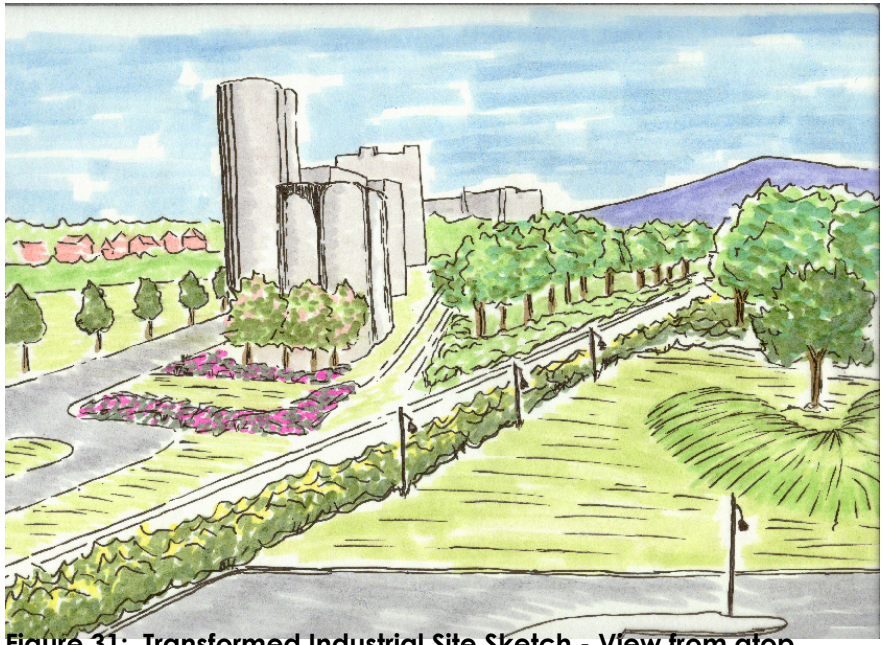


Figure 31: Transformed Industrial Site Sketch - View from atop the Hospital Parking Garage

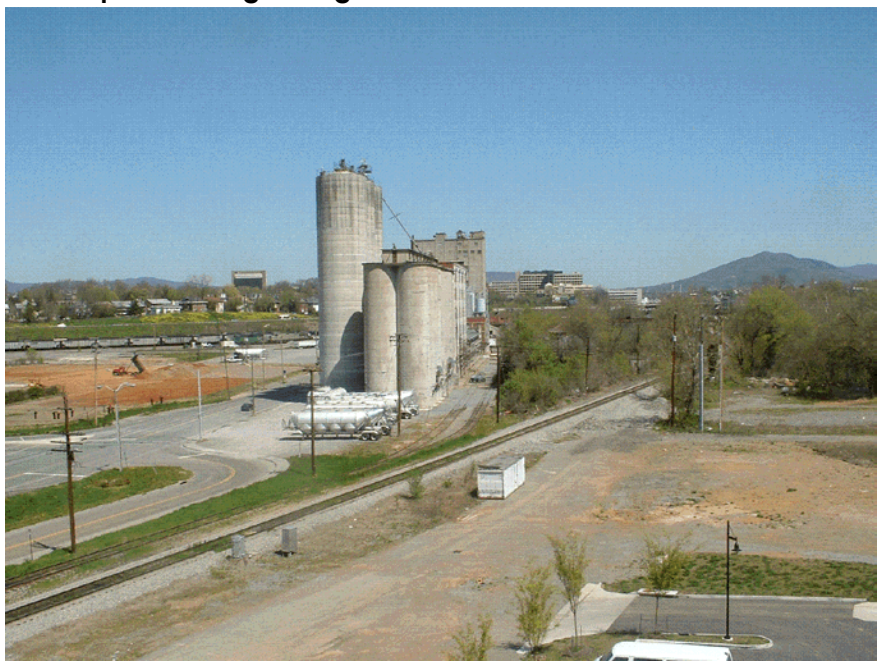


Figure 32: Hurt Park Access Point Plan - Features include additional park, beach for canoe and fishing access, and a village center along 13th street

Figure 33: Hurt Park Neighborhood Access Point Illustrative - View from railroad tracks in Wasena Park

Figure 34: Hurt Park redevelopment perspective - Hypothetical perspective representing the possible redevelopment of Cleveland Ave, located adjacent to the flooplain (left) as a commercial center

Conclusions / Reflection

I stated throughout this thesis that this design is intended as a starting point, a conceptual idea for spawning new questions and sparking others imaginations on what the floodplain can become. While this is true, the plan presented is an ambitious though realistic option. It is the outline of a roadmap to solving flooding problems in Roanoke, while addressing community needs and pulling the city together. The design reflects all conditions documented in the analysis section, which are all based on facts. While buying out any property is a sensitive issue requiring detailed cost analysis and consideration of how to adequately compensate the owner of such properties, this plan is not radical in its proposal and balances any potential buyouts with the perceived economic, ecological, and social gains. This cost / benefit approach to design is critical when convincing city council members that this is a legitimate alternative for spending city revenue. Selling a concept however is always more difficult then selling a proven product. I believe the first step in project implementation is therefore to focus on critical areas as demonstration sites, while developing a long-term strategy for the rest of the floodplain. Such a strategy can be incorporated into the cities comprehensive plan, which already looks ahead to the year 2020. In the mean time I believe focusing city resources on the critical areas identified on pages 96 & 97 is the best start. These sites can in turn serve as catalysts for the future development of the floodplain park. They also present interesting study areas for exploring in greater detail how parks can serve as a catalyst for neighborhood revitalization, a study that is beyond the scope of this paper. The next step in this project will also require greater community input for the development of specific plans. This thesis project can be used to spark conversations within the community, ultimately leading to a more specific vision based again on community needs and detailed cost and property analysis. Again using the comprehensive plan and developing separate visions per neighborhood is a feasible approach. Though this is a long-term project spanning perhaps decades, if properly implemented, it will be an investment that gives the city a signature park, transforming it into a stronger tourist destination.

Given the imagination and knowledge that Landscape Architects bring to the table, we are poised to play an important role in solving many problems associated with today's society. While this project focused on flood control, it provided me with an overall glimpse of the economic, political, social, and ecological factors that determine how things are done. This I believe is invaluable. Looking at a project site the size of a floodplain with only limited time to do so leaves little room for focusing on details. Each question I found leads to many others and it can at times become overwhelming. In a way however, it was also encouraging as I recognized that had I been conducting this project as a paid employee with a much lengthier timeline, I easily could do so while always encountering new and interesting issues.

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