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RICHMOND RIVERVIEWSHED ANALYSIS



Designed by Author

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VCU L. Douglas Wilder School of
Government and Public Affairs

Masters of Urban and Regional Planning

RICHMOND RIVERVIEWSHED ANALYSIS

Prepared for :
THE DEPARTMENT OF PLANNING AND DEVELOPMENT REVIEW (PDR)
THE CITY OF RICHMOND



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SUMMARY

The James River is a popular destination for Richmond's residents. The river is an important part of recreational, social, and cultural life for the people of Richmond. A group of citizens concerned about Kepone's effects and other environmental threats founded the James River Park System was formed in 1972 to protect and restore the river.

This Plan covers the south side of the James River. The river divides the North and South sides of Richmond. The viewpoints fall under the Census tract of 610. Swansboro, Woodland Heights, Manchester, Old Town Manchester, Central Office, and Blackwell neighborhoods constitute a portion of them with the 610-census tract.

Although the north of James river is major destination point. The Richmond Riverfront analysis emphasized the importance to be given to the south side of the river. In order to increase the significance of the south side thus, this plan will be focusing on the existing conditions, discusses the accessibility issues, perform viewshed analysis and create standards for access in the right – of – way.



CHAPTER 1: INTRODUCTION

1.1 PLAN PURPOSE

One of Richmond's greatest assets is the Richmond Riverfront, as well as its views and natural landscape, which are one of the unique attractions that strive for the sense of place, quality of life, and prosperity attractiveness of the city. James river is a combination of natural and built environment. It is a confluence of Cowpasture River and Jackson River which flows right through the City of Richmond. The city has an advantage in having a range of river views:" distant and proximate, panoramic and discrete, public and private, general and priority [1]."

It is important that future growth along the Riverfront must embrace the value of river views by protecting property rights and providing appropriate development. The plan purpose is to identify significant viewpoints, perform viewshed analysis and show each view with greater up to date accuracy and create standards for access in the right – of – way.

1.2 CLIENT DESCRIPTION

The Department of Planning and Development Review (PDR) of the City of Richmond serves as the primary client for this plan. The PDR wanted to take the Richmond Riverfront Viewshed Study (which was conducted during 2013 – 2014) to next level by showing each view in GIS. The PDR no longer has the GIS files related to the Richmond Riverfront Viewshed Study, hence they wanted to re-create the files in GIS.

1.3 PROBLEM STATEMENT

The spotlight of Richmond Riverfront Viewshed Study was the landscape elements or features associated with views. It demonstrated that any changes to the current landscape would affect views, so it is necessary to protect and enhance the landscape. The viewshed analysis provided the necessary summary of the viewpoints identified with the set of techniques and procedures to be carried out with the help of the public inputs. Identifying, enhancing, and preserving the landscape elements or features associated with views were the objectives of this study. The study also identified challenges such as poor access to the river. In the analysis it was mentioned that there are some accessibility issues that prevent good views of the river such as with the East Byrd Road which has a potential to be a good open space that uncovers virtuous views of the scenery. Due to the lack of mobility, it has lost its place in the top viewpoints list. The viewshed function was performed over the entire digital surface model data on the prioritized viewpoints. The analysis also emphasizes the importance to be given to the south side of the river because the south side river is the main background for many other river views from the north side of the river, just like the downtown skyline.

2.1.1 JAMES RIVER HISTORY

The James river is the Virginia's largest river watershed. 3000 years ago, James river basin served as a settlement for Native Americans. Early settlers of Virginia and of the James River basin viewed the river as a lifeline for food, travel, and defense from enemies with the rest of the world. The first permanent English settlement in America settled across the James river. Besides with the colonist's movement along the James river so did the capital move from Jamestown to Williamsburg in 1699 and finally to Richmond in 1780. The James river paved entrance for British forces to invade Virginia's capital during the revolutionary war and the lower James acted as battle ground during 1812. During the Civil war, Union forces held at the mouth of the James river. The civil war along James river forced the Union to consider slavery called "Contrabands". The North and South fought over the control of James river. The North tried to cut off supplies from abroad and the South fought to keep union forces from using the river.

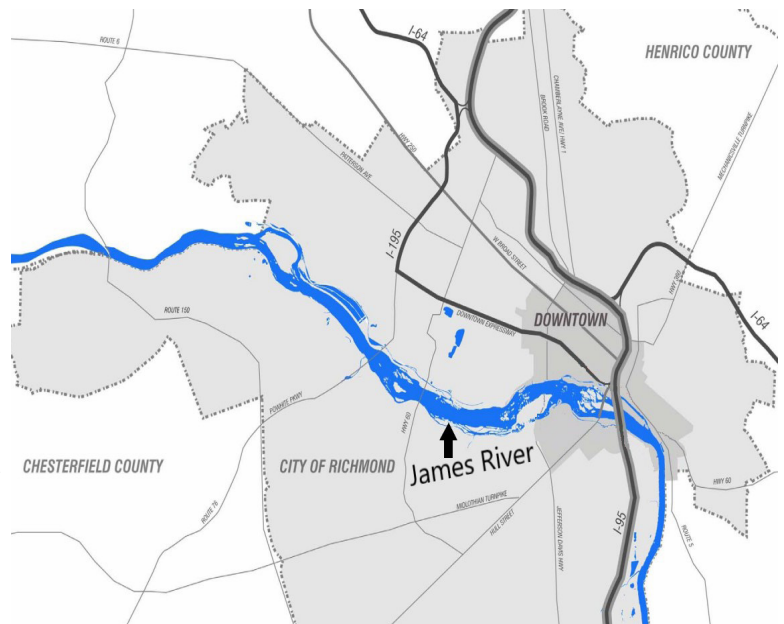


FIG2: JAMES RIVER

2.1.2 The Canal Walk

As Richmond lies on the banks of the River, George Washington had a vision to improve transportation and trade for Richmond region by making the river a gateway to the west through a canal system to connect James river with river Ohio. The canal construction began in 1785 and was half completed by 1851 at Buchanan covering a total length of 197 miles with 90 locks and a total lift of 728 ft, but it could never reach Ohio. The canal was very busy during the 1850's while the traffic peaked during the 1860's. The canal transported various agricultural produce of the James river valley was along with manufactured goods from Richmond along the coast and abroad. Thus, it has played a crucial role in the economic and social life of Virginia. Nevertheless by 1880, the railroad became more efficient method of transportation which was built to replace the James river canal [2]. For decades, the Canal walk has become Richmond's one of the most attraction point, entertaining both the localities and visitors. The Canal Walk runs 1,25 miles along the James River and the Kanawha and Haxall Canals and has access points nearly every block between 5th and 17th Streets. People are using canal for walking, biking, and other activities.

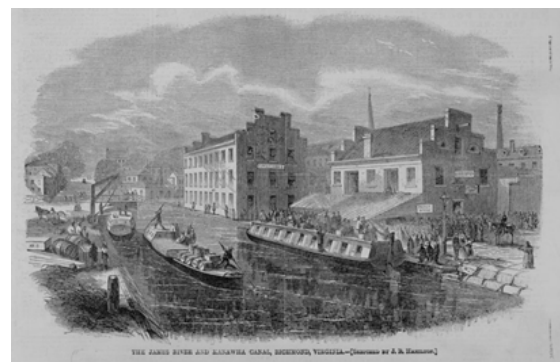


FIG3: THE JAMES RIVER AND KANAWHA CANAL

2.1.3 PROTECTION AND RESTORATION OF JAMES RIVER

Understanding and knowing the past of river preservation and safety is important because it helps the city recognize and take the appropriate steps to preserve the river's viewshed if necessary, in the future. In August 1969, Hurricane Camille hit Virginia at category five and destroyed Richmond by setting new flood records with water levels reaching up to 28ft. Between 1969 and 1987, James river in Richmond experienced nearly eight major floods. This resulted in floodwall construction that could protect the city from about 32ft of flood for the length of 2 miles on the south and 1.2 miles on the north side banks of James river. Despite passing Clean Water Act in 1972, three years later in 1975 a harmful chemical called Kepone was found in the James river as a resultant of illegal dumping of this toxic pesticide Kepone. Workers fell ill from exposure to the neurotoxin and government has halted the production. This chemical caused damage not only to the river but also to the river ecology that further resulted in the state to shut down the entire river and its tributaries to fishing. It led to an economic disaster for watermen. At the time James river was known as one of the most polluted rivers in America. To purge Kepone out from James river it was estimated that it could last from 10 year to if not 100 years [3]. A group of citizens concerned about Kepone's effects and other environmental threats founded the James River Association in 1976 to protect and restore the river. Soon the citizens have recognized the James river could serve as a recreational area and worked towards improving access to the river, and therefore led to the creation of James River Park. In the past there has been some efforts put in order protect the James River Park, summarized in the timeline below:

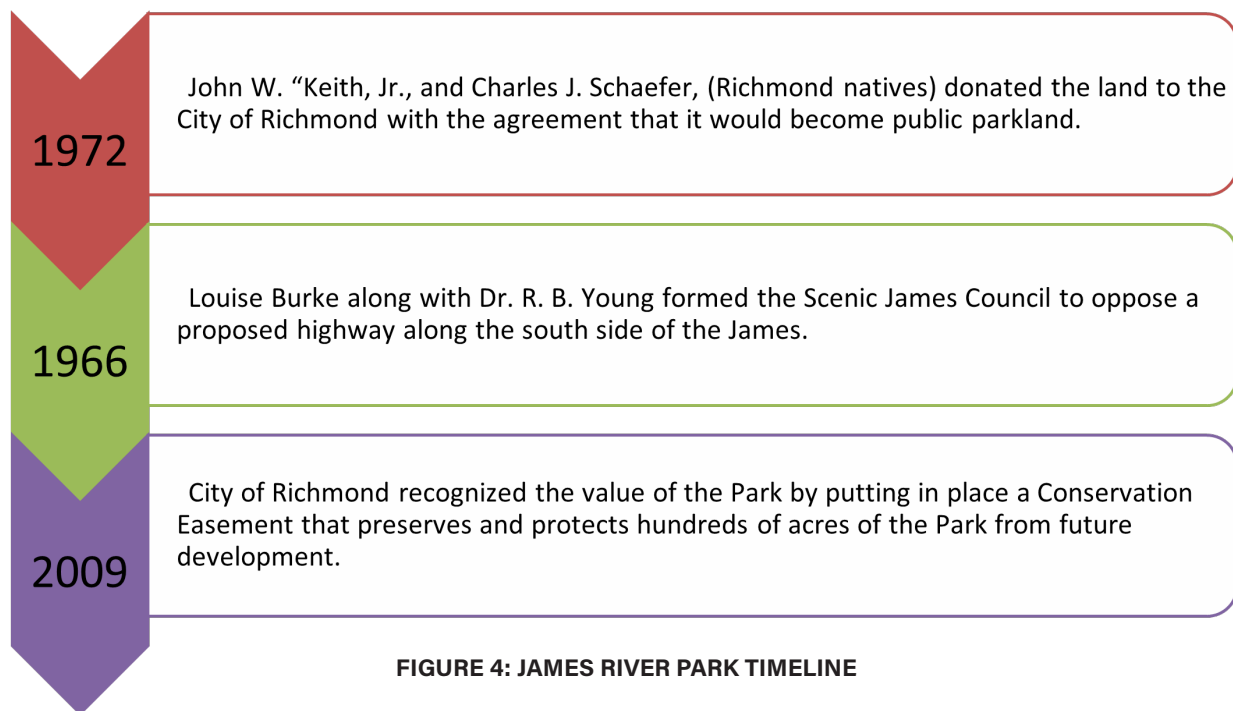


FIGURE 4: JAMES RIVER PARK TIMELINE

Since the creation of the park, it has grown from nearly 100 acres to over 600 acres. Today there are over 22 miles of trails both for bikes and foot traffic with diverse types of trails with ranging difficulty level from easy to advance. Of them the buttermilk and North Bank trails is very popular and is also technically challenging [4].

For this study, I focused on the south side of the river including the census tracts 305, 412, 413, 610 to look at demographic, socio economic trends and other important information.

2.2 LITERATURE REVIEW

The perspective of view differs from the case of irregular surfaces to flat surfaces. A viewshed map will help in resolving the real-world problems such as (i) finding the best outlook in a park (ii) finding the ideal spot for placing of forest fire watchtowers in environmental planning (iii) measuring wildness quality and distribution in protected landscapes (iv) identification of best routes with largest views for hiking trails, v) for determining maximum coverage of the given viewpoint. The viewshed model should be developed with an assumption that a given observer, should have no obstacle to get a perfect view from a given viewpoint [5].

Before conducting the viewshed analysis it is also important to study the viewers and viewer groups. The viewers can be groups that can be based on the areas of recreational, residential, businesses, historical sites, and travelers (interstate and other highway users). To measure public concern for the scenic quality it is important to understand and analyze visual sensitivity which is dependent on are the viewer(s) attitude and the types of activities a viewer(s) is engaged during a viewing at a view. High level of sensitivity is typically observed with the areas where people live, and with people who engage themselves in some recreation activities associated with the views. On the other hand, areas such as industrial or commercial uses take place it is considered to have low to moderate visual sensitivity level because such types of uses have no relation with the surrounding environment. These concepts can only be applied when evaluating the visual landscape and assessing the importance of a viewpoint where a viewshed analysis help in determining if a viewer group falls within an area of predicted visibility. It is important to have a framework for Park management system in making decisions to protect the resources, identify resource conditions and Visitors experience [6] and thus the factors which help in determining the viewer groups are:

- 1) Viewer type: Types of viewers will vary based on the geographical region as well as by the viewer group.
 - i. Local community: People who live in local area and / or nearby surroundings.
 - ii. Commuters: People who get to experience the view during their commute to work.
 - iii. Visitors: People who purposely visit the area to experience the nature and the appearance of natural landscape or historical sites or any type of recreational activities associated with the views.
- 1) Classification of the viewer: the viewer group and the associated viewer can be distinguished based on the viewer's residency, visiting purpose to recreational / open space or tourist, commercial use, and workspace.
- 2) Number of viewers: the number of viewers is explained by the number of people visiting to experience the view.
- 3) Duration of the view: it indicated the amount of time a viewer spends time by looking at the view.

- 4) Viewer activities: Activates such as observation the view or engaging in other activities such as recreational activities or spending quality time by relaxation.

Besides, it is also required to explore and study the available resources associated with the views such as a collection of GIS data, reviewing the reports such as master plans or any previous plans that are required along with the site visits.

Viewshed analysis can be conducted in different ways such as i) bare earth topography with no trees or buildings helps in understanding the influence of terrain on blocking the view., and ii) one with the inclusion of trees and buildings for more realistic illustration of the land feature [7].

To conduct viewshed analysis the following tools are required:

- 1) ArcGIS: of many sources ArcGIS is one of the best sources for conduction Viewshed analysis [8].
- 2) Landscape data: GIS terrains are represented by n-point-grid called Digital Elevation Model (DEM) [9].

2.3 THEORETICAL FRAMEWORK

I feel The Just city and the Radical Planning best fits the plan at this stage. In the Just City approach to planning, Fainstein explains that she does not like to explain the theory of a good city which is based on the conditions for human flourishing as the goal. Instead, she conceptualized mainly three principles that are democracy, diversity, and equity in the development and evaluation of public policy [10]. According to her believes that any policy/plan should be examined based on its contribution to urban diversity, democracy, and equity. In her example of New York City, she argues that the city's plan justified diversity by calling for mixed – use and mixed income development. In relation to equality, the city spread resources throughout the five boroughs in the city especially in low income and minority areas. However, the city paid little attention to the outcomes of these projects on the people living there creates differences between the haves and the have-nots [11].

This framework relates to my project in many ways. On the economic side, any new development along the river will impact the surrounding areas in terms of home values changes especially for those homes who loses the view of the river etc. On the other hand, due to the new developments the density rises and thus leads to more diversity and better lifestyle. Thus, before for any developments are approved, the impacts of these developments on the surroundings should be studied and there is a need to determine whether the outcome is equitable for both the existing and new developments.

Radical Planning has two aspects. The first is an anarchist- inspired approach emphasized on decentralized control and encourages in experimenting with alternatives. The second approach is structurally oriented. It takes Marxist direction by focusing on the impacts of the economic system and the role of planning in the class struggle. The first group of radical planning includes the environmental aspects while the second group of the planning proposes the governmental control of the means of production, which means that profits should not govern the government and should be in a way that meets the societal needs [12].

The reason behind these two planning processes is that the James river park or the Belle Isle is said to have many visitors and it should be not limited to any certain group of people nor should be against minorities using them. While on the other hand, radical planning is because Richmond city is growing day by day and many proposals and projects are very concerning because of the intention behind them in the construction of tall buildings on the banks of the James River. If these projects or proposals get into actions, then there will be a major loss in terms of destroying the nature views as well as discourages people in using the parks or trails as they will no longer have a beautiful view.

CHAPTER 3: STUDY AREA

The analysis conducted in the Richmond Riverfront Viewshed Study emphasizes the importance to be given to the south side of the river. So, for this Professional Plan my focus point will be the views from the south. The viewpoints fall under the Census tract of 610. Swansboro, Woodland Heights, Manchester, Old Town Manchester, Central Office, and Blackwell neighborhoods constitute a portion of them with the 610-census tract, while Manchester falls into the census tract entirely.

For the Richmond Riverfront viewshed analysis study, during the public meetings votes were collected for the viewpoints using various methods such as labeling of viewpoints on a paper map using arrow stickers, marking directly on the georeferenced PDF map and through the digital photos. After merging all the distributed votes collected with the public input it resulted in the final best river viewpoints. The below map displays the best viewpoints from the South Side.

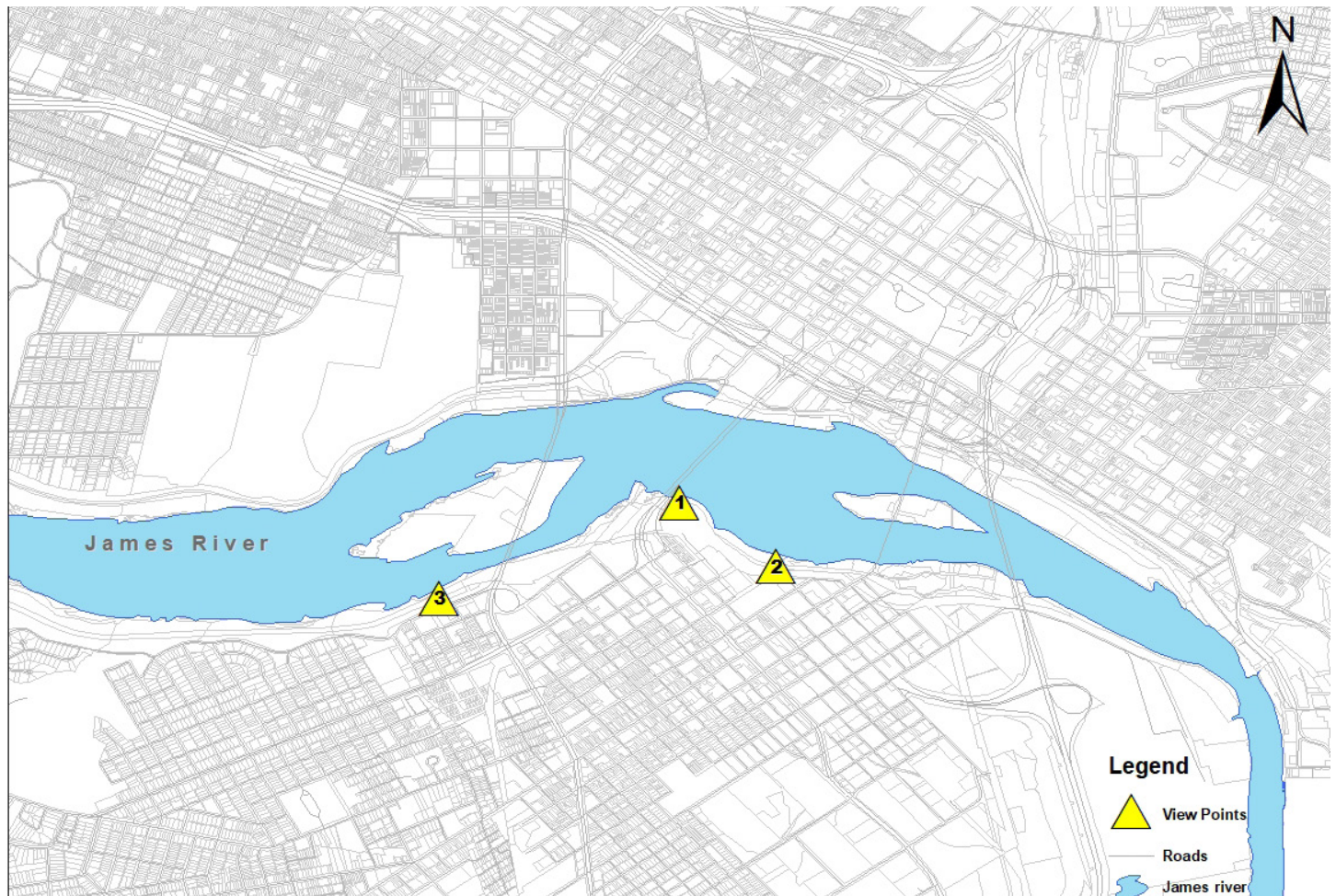


FIGURE 5: VIEWPOINTS FROM SOUTH SIDE



FIGURE 6: VIEWPOINT 1



FIGURE 7: VIEWPOINT 2



FIGURE 8: VIEWPOINT 3

ZONING

Figure 9 shows that the Neighborhood containing the study area poses Business, Residential and River front Zones. In Business district the building heights 35ft for B-3 zone, for B-5 & B-6 it is minimum of two stories to maximum of five stories & four stories respectively, for B-7 there is a maximum of five stories and for B-4 minimum of three stories while there is no maximum limit for this zone. In Residential zones for R-5, R-6, R-7 & R-53 the maximum height is 35ft, for R-63 & R-8 maximum height is three stories and for R-73 the maximum height is 150 ft. Finally, in the Riverfront District for RF-1 and RF-2 the minimum height is two stories, and the maximum is six stories for RF-1 and thirteen stories for RF-2. Anything that obstructs the view from being seen at primary locations it causes visual effect to that view. Hence it is important to identify and study the geographies for which effects may occur especially the Riverfront Districts as they have the potential to block the views of the Riverfront.

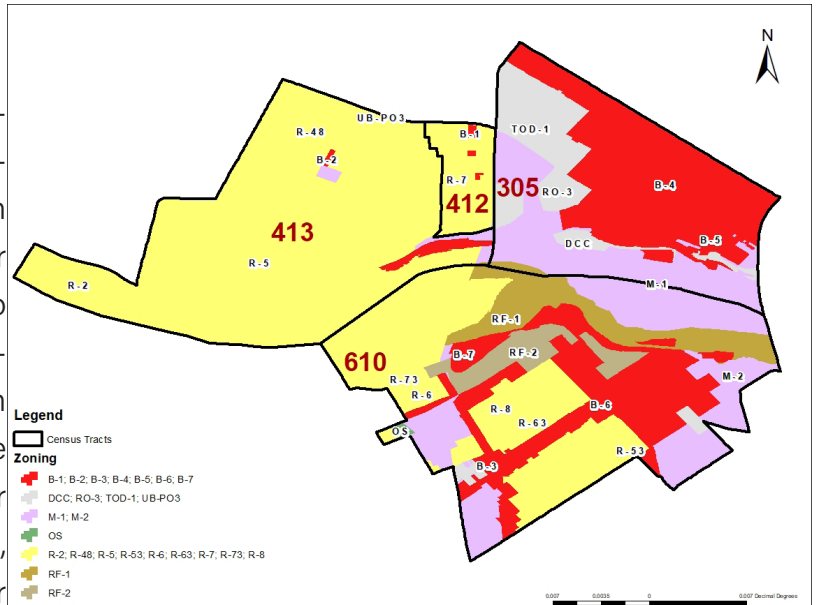


FIGURE 9: STUDY AREA ZONING MAP

FLOOD PLAIN

Figure 10 shows that 100-year and 500-year flood plain of the Neighborhood. It is clear from the figure that 500-year flood plain drowns the Easter part of the Neighborhood.

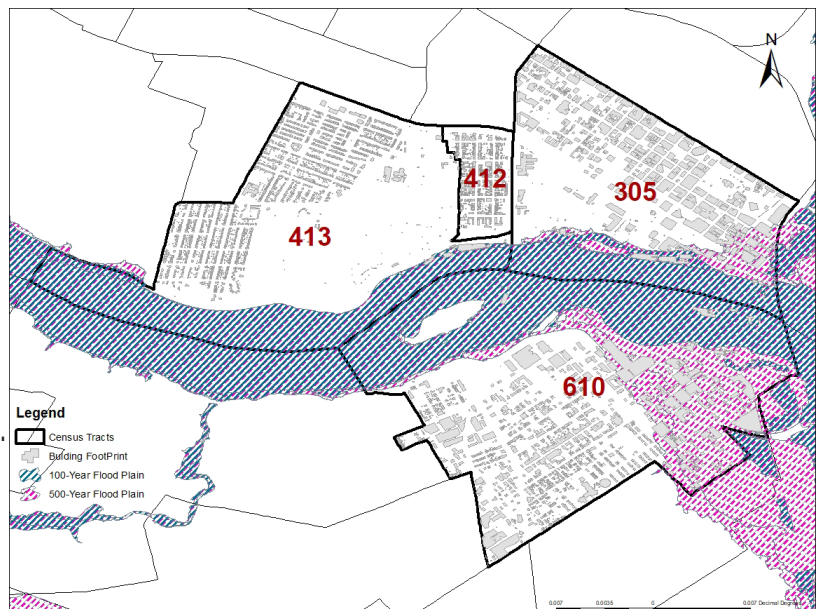


FIGURE 10: STUDY AREA FLOOD PLAN MAP

by walking and bicycle with 23% and 15% respectively. However, 30% of the responders expressed their deterrent to visit park due to lack of parking [15].

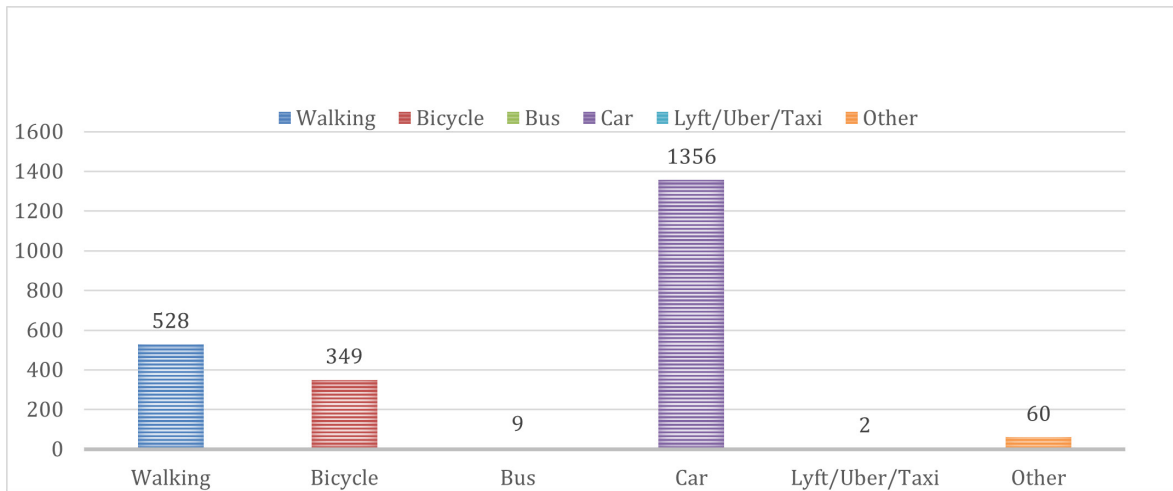


FIGURE 11: PRIMARY MODE OF TRANSPORTATION TO PARK

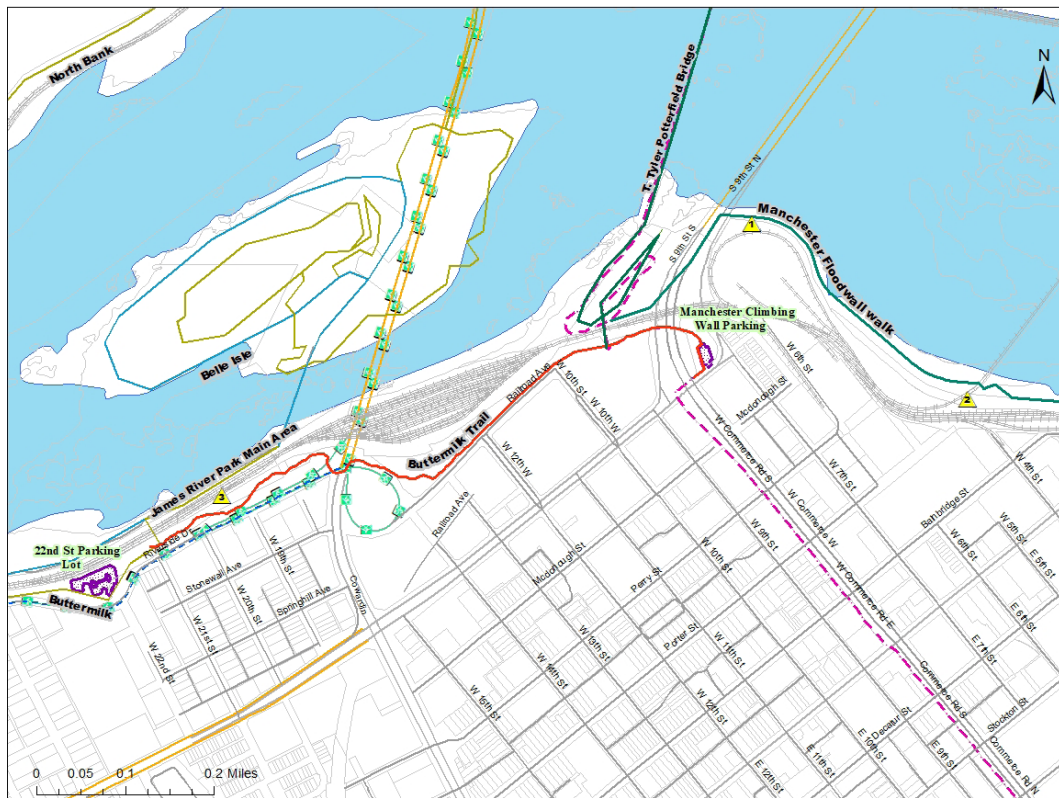


FIGURE 12: ACCESSIBILITY MAP

Legend

- Viewpoints
- T. Tyler Potterfield / Shared Use Path
- Manchester Floodwall/ Shared Use Path
- Buttermilk Trail
- Ashland - Petersburg trail
- James River Park Main Area
- Parcels
- Railroad
- Designated Bike Lane
- Shared Bike Lane
- US - 1 Bike lane
- Major Routes
- James River
- Designated Parking Area

PARKING FACILITY

A majority of the visitors accessed the park using car. However, the park has very limited parking during the peak hours and people park on street in the nearby neighborhoods. The following map highlights the location of dedicated parking facilities and on-street parking areas around James river.

There are only two designated parking spots with limited parking capacities for the JRPS. One parking lot is located on Riverside dr is the 22nd St Parking Lot and the other on W 11th street is the Manchester Climbing Wall Parking. The 22nd St Parking Lot is connected to Buttermilk walking trails whereas the Manchester Climbing Wall Parking is connected to Manchester Floodwall walk. Currently there are no parking charges for these parking lots for city residents and non- residents. The on-street parking streets are W 22nd St, W 21st St, W 19th St, Stonewall Ave, and Riverview Pkwy. Because of these on street parking, the residents on those streets always have issues with their privacy as well as parking issues.

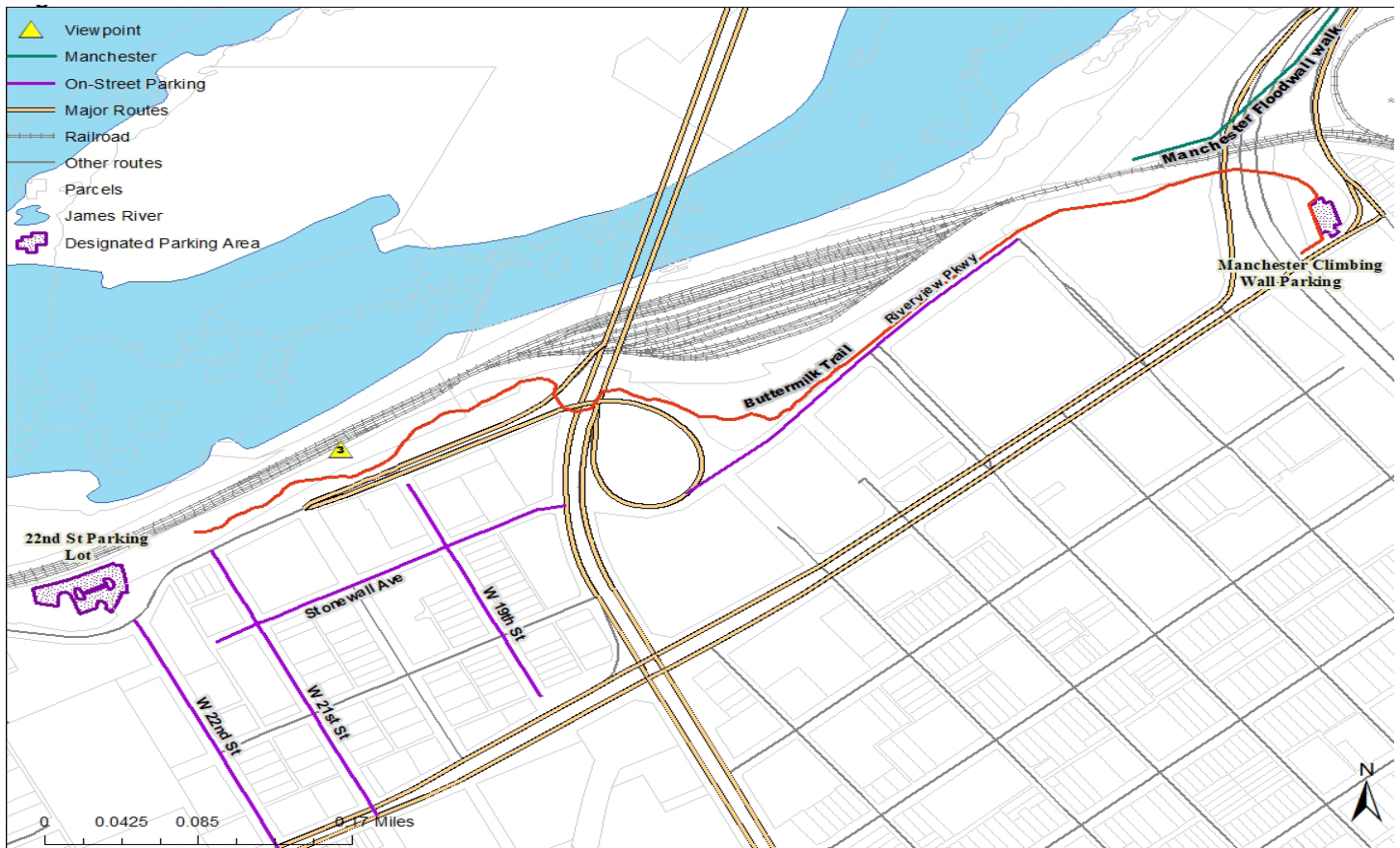


FIGURE 13: PARKING FACILITY

In addition, there are new developments such as residential and commercial projects proposed on the south side of James river which may result in increased traffic flow and congestion. The below map shows the upcoming developments in the area.

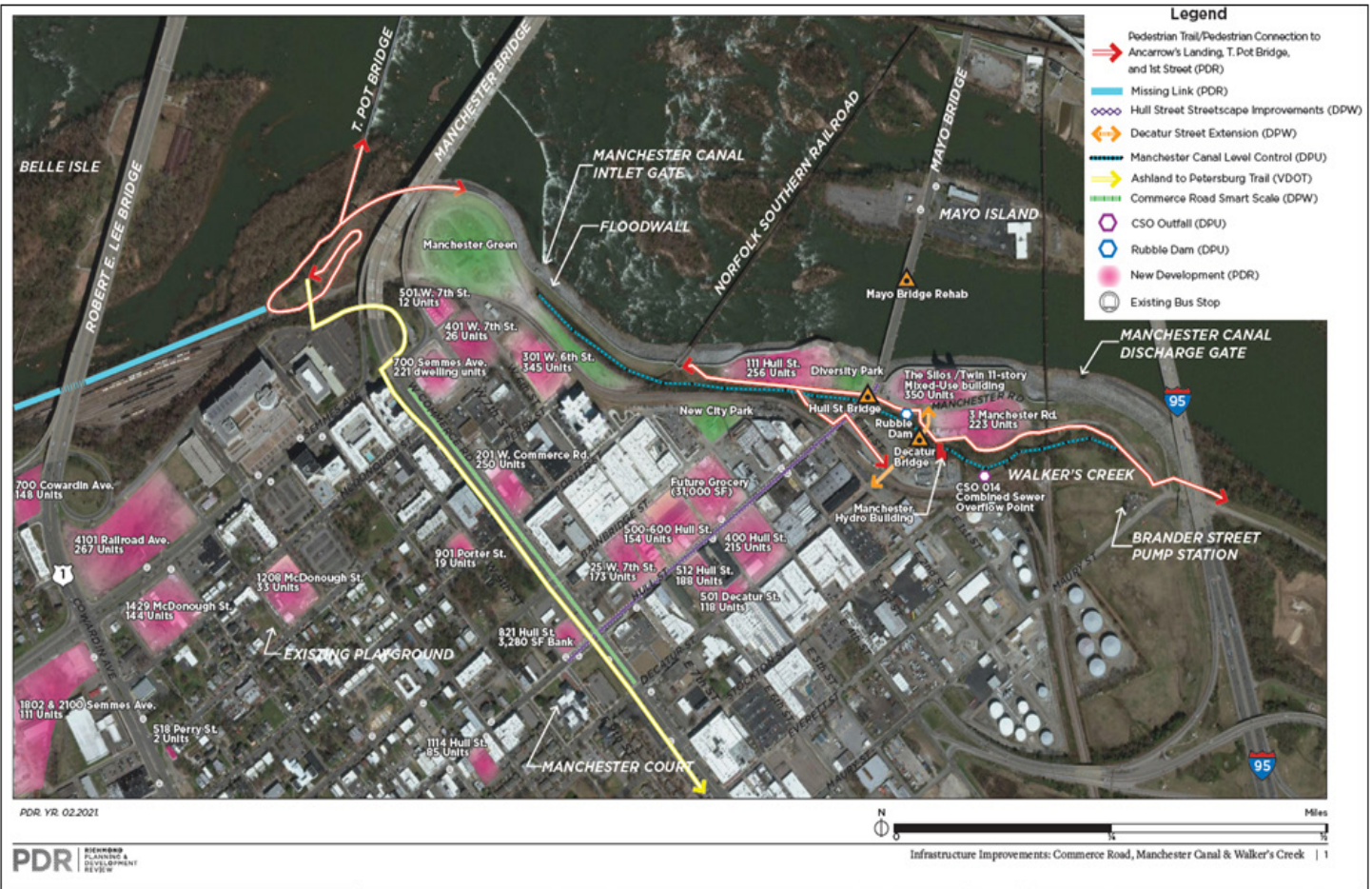


FIGURE 14: INFRASTRUCTURE IMPROVEMENTS: COMMERCE ROAD, MANCHESTER CANAL AND WALKER'S CREEK

BICYCLE AND PEDESTRIAN FACILITY

The only bike route that passes across the James river is the US 1 Bike Lane which is on either side of the Lee Bridge. The existing bike routes and facilities can be classified into designated bike lane which is on street buffered/non-buffered bike lane, shared lane is a segment of road with pavement markings such as a sharrow, and shared use path is a separated bicycle and pedestrian facility [16]. Designated bike lanes are present on US 1/301 from the intersection of Riverside Dr. of Oregon Hill Pkwy, on US 60 from S 9th St to E Canal St and from Semmes Ave intersecting Cowardin Ave. There is only one Shared lane which is along the Riverside Dr. and lastly the Manchester flood Wall Walk and the T. Tyler Potterfield bridge are the two Shared use paths. VDOT initiated the Ashland to Petersburg Trail project which is a shared use path. "This trail is an opportunity to "connect the dots" and establish another long-distance trail that provides opportunities for active transportation, recreation, and economic development" [17].

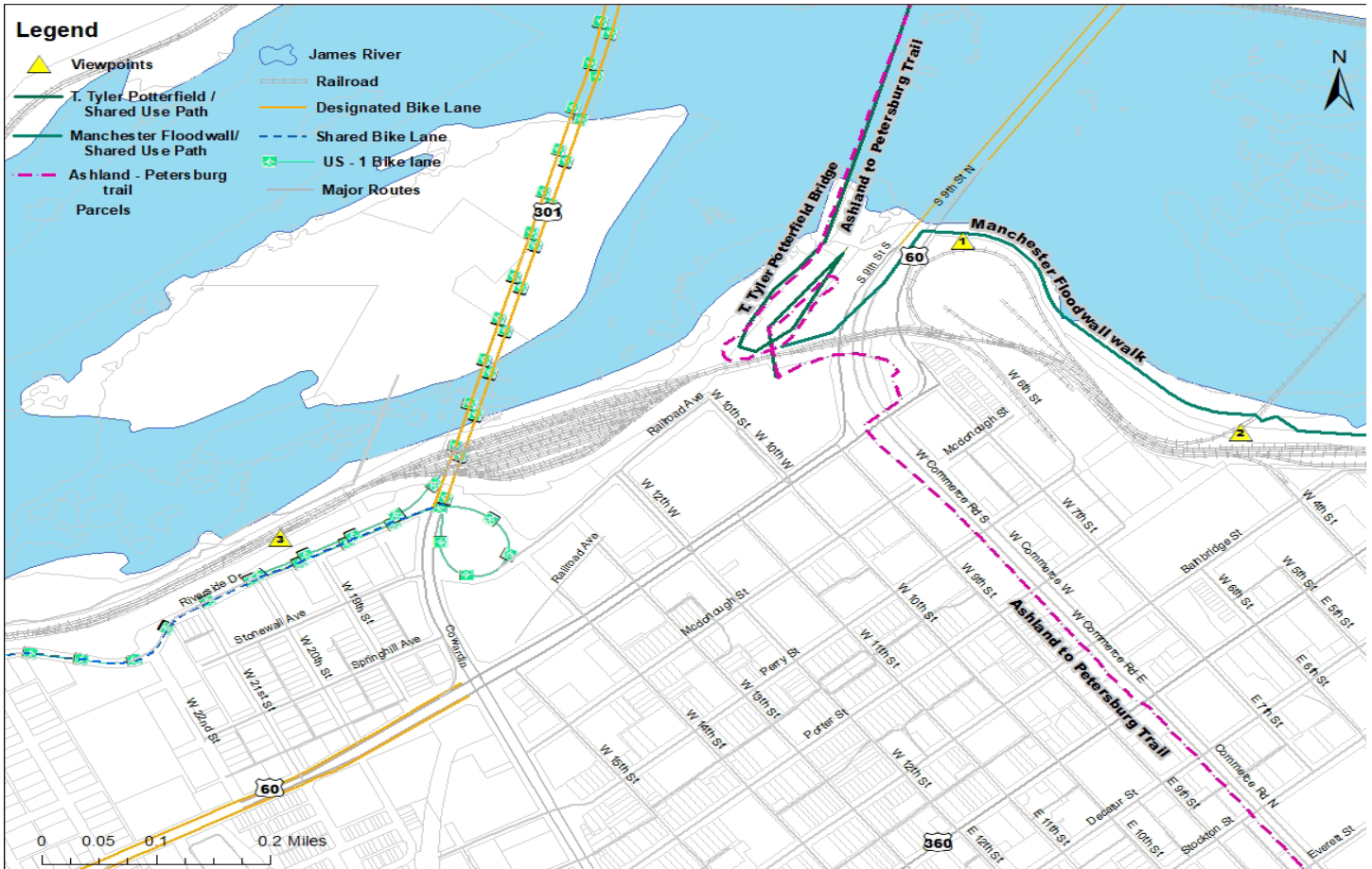


FIGURE 15: BIKE FACILITY MAP

The following figure 16 displays the different categories of bike lanes along the south side. The standardization lacks in all the categories of bike lanes and varies from street to street.

FIGURE 16: BIKE LANE CATEGORIES



DESIGNATED BIKE LANE



SHARED LANE



SHARED PATH LANE

With over 22 miles, the trails around James River Park act as a transportation hub for pedestrians and cyclists. The Buttermilk trail is the most popular loop amongst others in the south side as it is connected to the Belle Isle which is the most popular visiting site on the James River. These trails are diverse in nature ranging in their difficulty level from easy to advanced. People interested in advanced level of type of trail can hike from Buttermilk trail to T. Tyler Bridge and all the way to Manchester Floodwall walk while enjoying the nature and the beautiful skyline of the Richmond Downtown.

According to Venture Richmond it is found that visitors to T. Tyler Potterfield have increased about 45% in 2020 and one of the reasons that has been observed for this increase is the effect of the pandemic. Also, there is a missing link in between James river Park Main area to T. Tyler Potterfield Bridge. With improving the facilities on the trails for pedestrian and bikers and the addition of Ashland to Petersburg trail in the future it is expected to see more percent of visitors accessing the river and contribution towards multimodal transportation. Also, this could encourage people to avoid automobile usage.

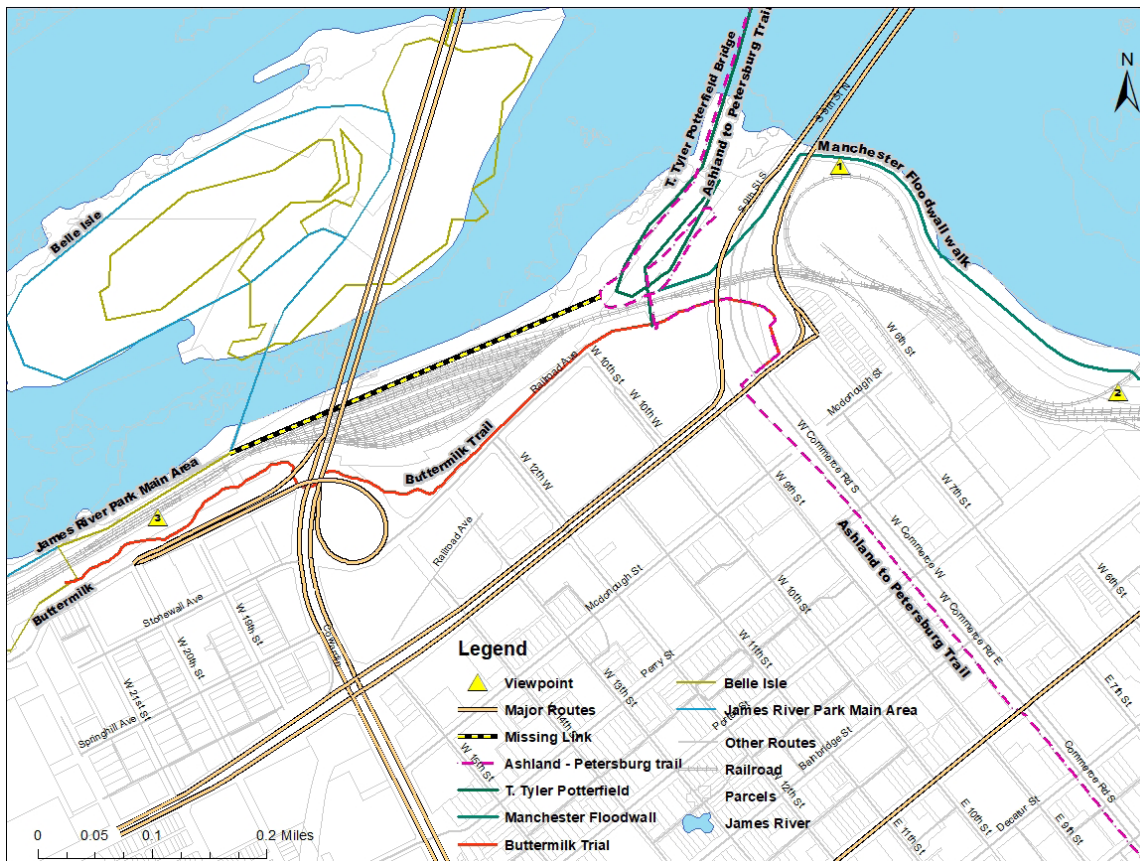


FIGURE 17: JAMES RIVER PARK TRAILS MAP

3.2.2 VIEWSHED ANALYSIS

The second analysis performed is the viewshed analysis study. This analysis is to capture the nature elements of the river as well as the downtown skyline which are visible from the James Parks' viewpoints. Identifying such viewpoints would further enable the need to protect these areas from future development as well as preserving the views for future generations.

For this analysis, the viewshed tool in ArcGIS software was used to calculate the visible and non-visible areas of the viewpoints. The following is a step-by-step methodology carried out in ArcGIS software.

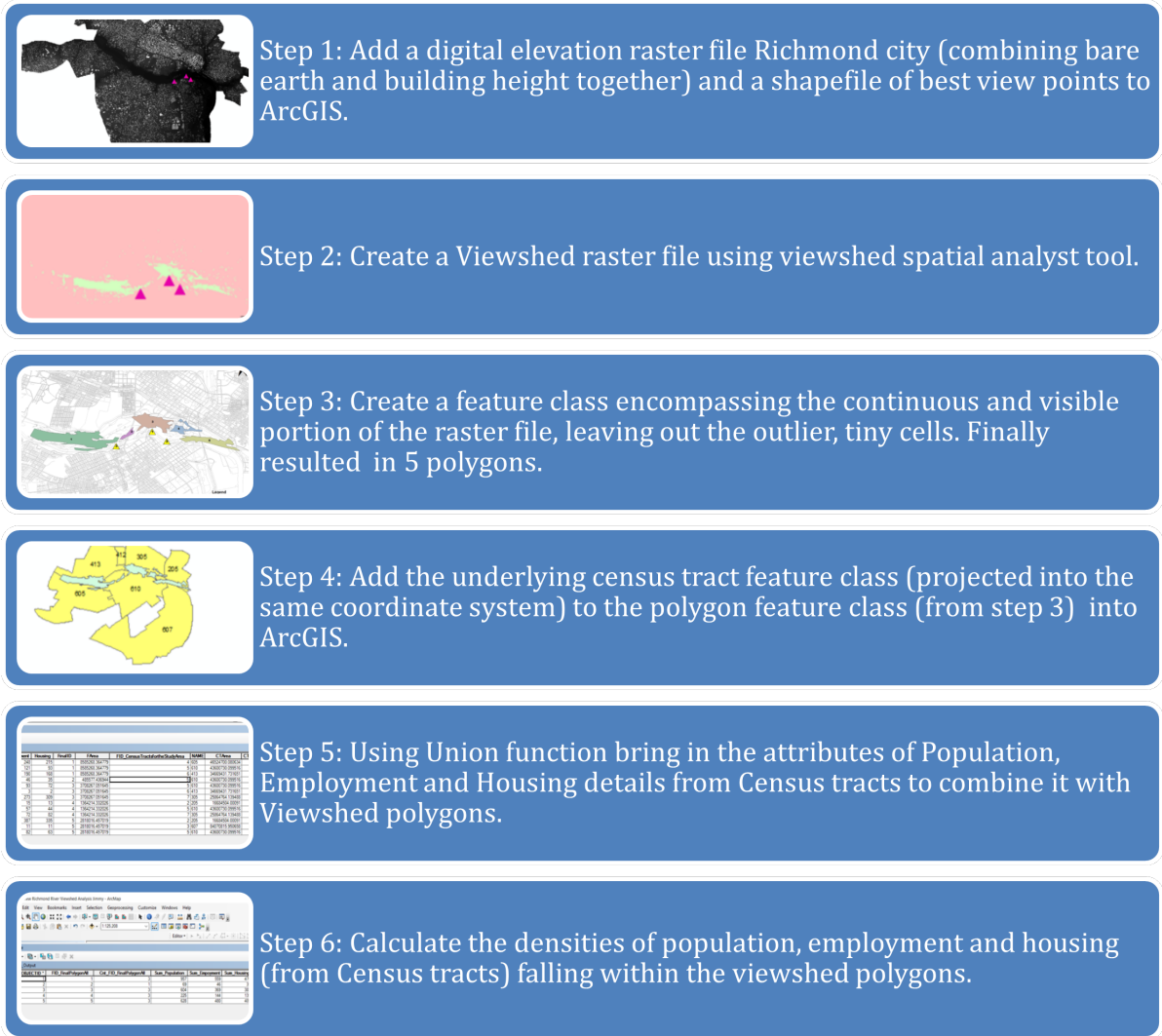


FIGURE 18: VIEWSHED METHODOLOGY

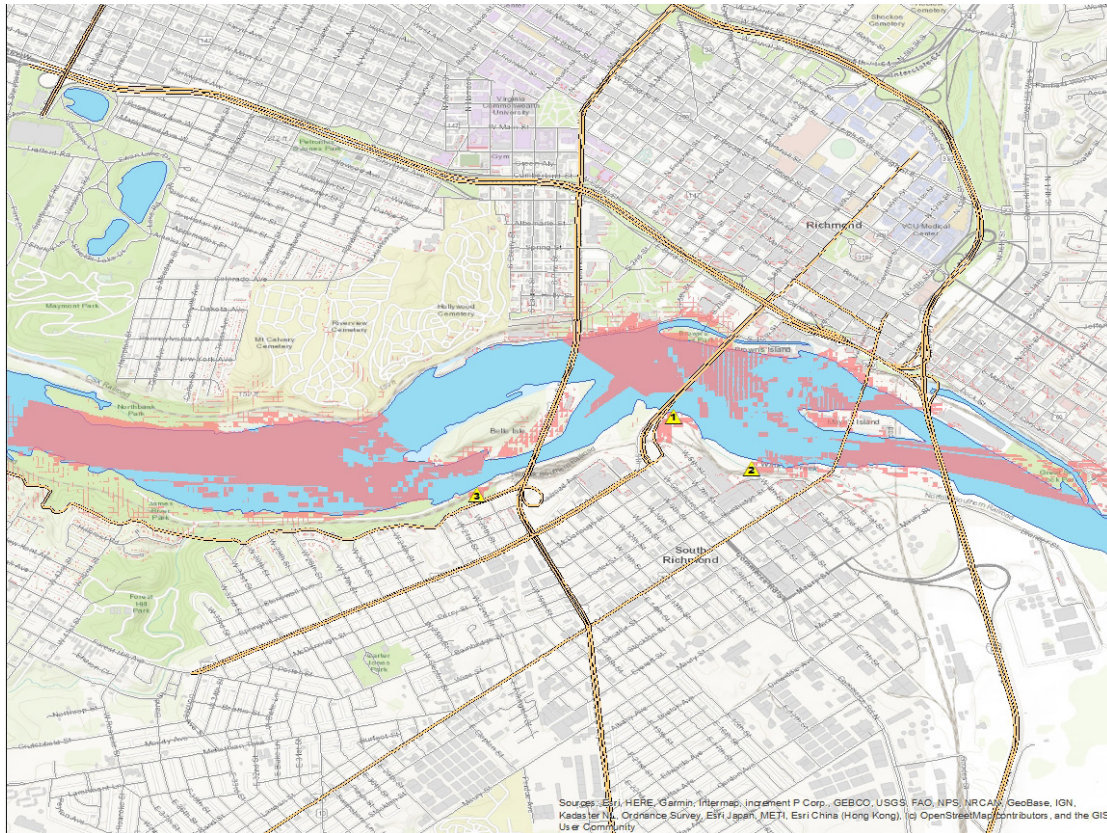


FIGURE 19: VIEWSHED ANALYSIS MAP

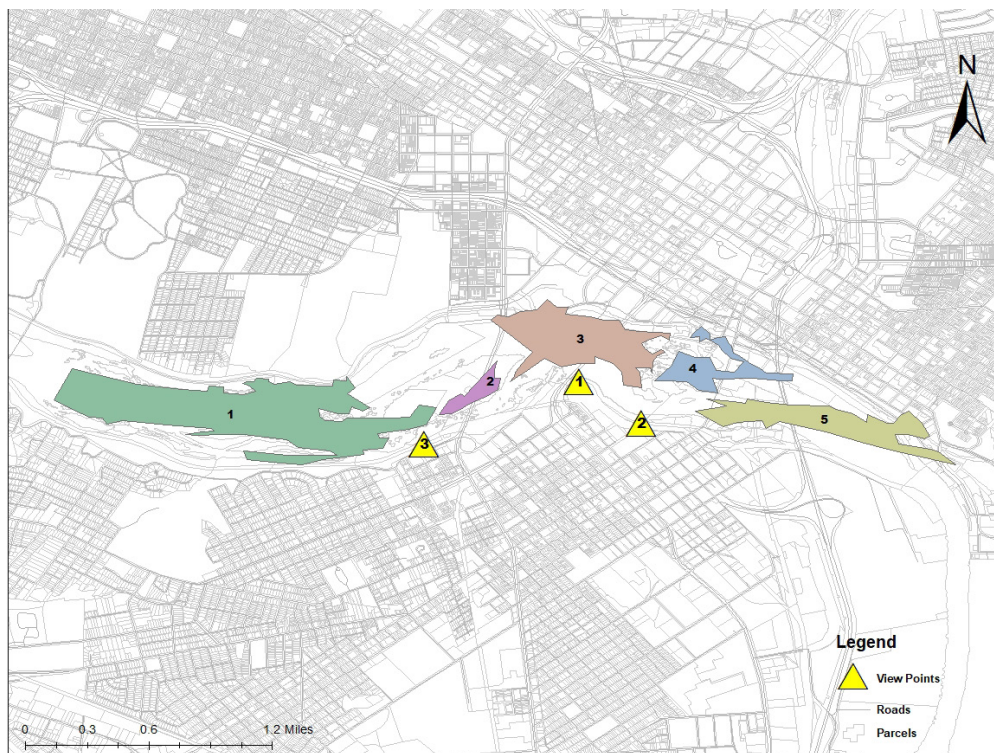


FIGURE 20: VIEWSHED POLYGONS

The results calculated from Step 6 (displayed in the figure 20 and table 2) such as the population, employment and housing densities would enable to plan for future developments efficiently without obstructing the views. Polygon 1 which falling under the viewpoint 1 has the highest densities of population,

employment and housing followed by Polygon 5 which falls under the viewpoint 2.

Polygon Number	Population	% Population	Employment	% Employment	Housing Unit	% Housing Unit
1	957	39%	559	35%	476	33%
2	69	3%	46	3%	35	2%
3	604	24%	369	23%	383	27%
4	225	9%	144	9%	139	10%
5	628	25%	480	30%	409	28%

TABLE 2: SOCIO-ECONOMIC ANALYSIS TABLE

It is important to infer from this analysis is that it is very important to look for any developments in the viewshed area which in turn might increase in these numbers and can negatively impact the beauty of the view.

3.2.4 LAND USE ANALYSIS

The Richmond 300 is a very important tool which guides the City in shaping the future of the communities. It is clearly evident from the below map that in the viewshed 95% of the future land use is designated as Public Open Space. If the future developments are planned according to this master plan, then there should be no problems that might effect in preserving the view of the river and in turn could promote tourism and attraction spots in the future.

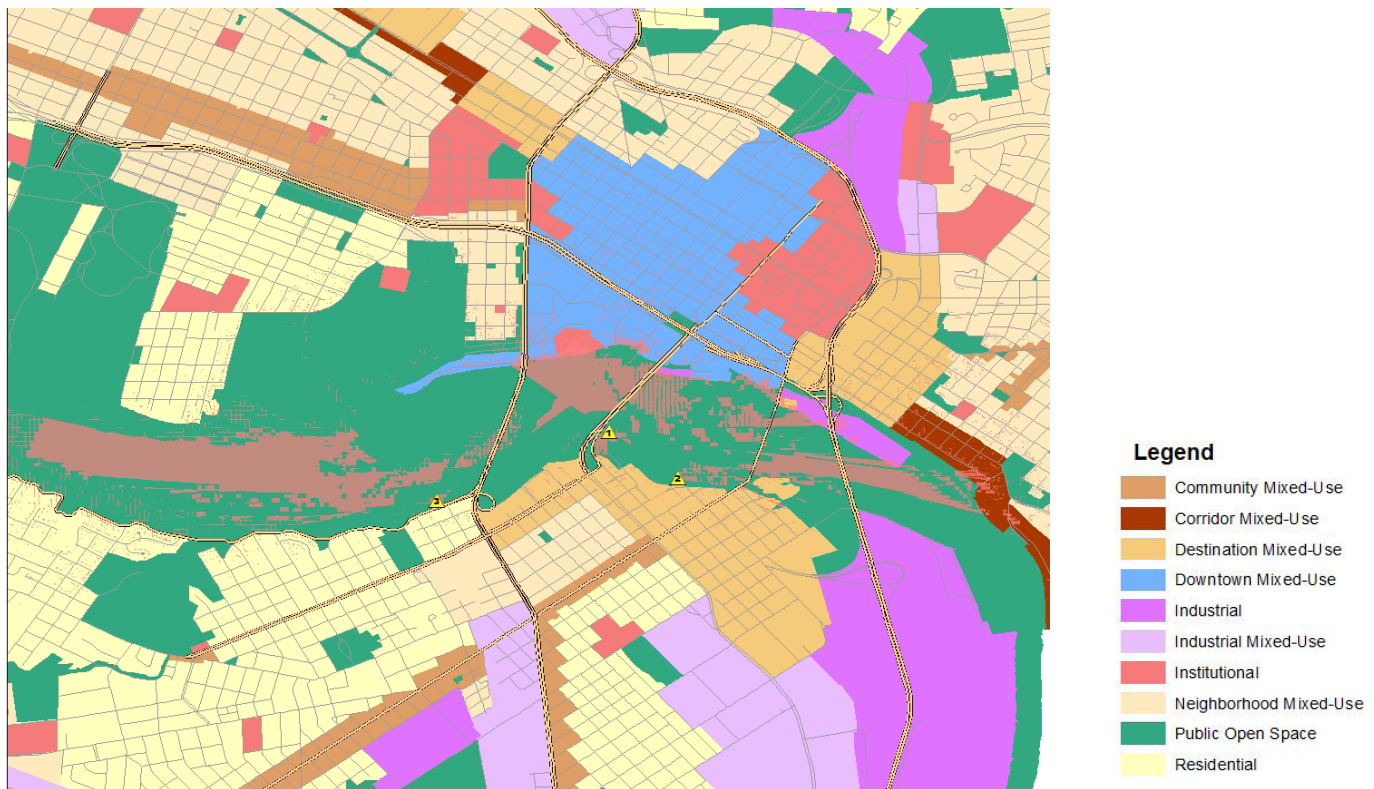


FIGURE 21: MASTER PLAN LAND USE VIEWSHED ANALYSIS

Land Use	Land Area (Square feet)	Percentage
Corridor Mixed-Use	337706.47	2%
Destination Mixed-Use	51368.78	0%
Downtown Mixed-Use	148109.43	1%
Industrial	120780.54	1%
Institutional	106482.43	1%
Public Open Space	16158717.49	95%
Unknown Land Use	38178.5	0%
Total of the Viewshed	16961343.64	

TABLE 3: MASTER PLAN LAND USE ANALYSIS ANALYSIS TABLE

CHAPTER 4 RECOMMENDATIONS

4.1 GOALS AND ACTIONS

Goal 1: Improve access

Action 1.1 Provide dedicated bicycle lanes to encourage the usage of micro-mobility modes.

Action 1.2 Discourage parking by imposing high fees for parking on-street and at dedicated parking facilities during high-demand peak times.

Action 1.3 Provide setting up of docking stations to park bicycles and other micro-mobility modes.

Action 1.4 Improve GRTC bus services by providing frequent services during peak demand through efficient route planning.

Goal 2: Promote tourism activities.

Action 2.1 Retrofit historical buildings to encourage visitors' footfall at James Park.

Action 2.2 Install wayfinding signages and set up kiosks according to relevant laws standards, to allow free flow of visitors around trails.

4.2 IMPLEMENTATION TIMELINE

Goals & Actions	1-2 years	5 years	10 years
Goal 1: Improve access			
Action 1.1 Provide dedicated bicycle lanes to encourage the usage of micro-mobility modes.			
Action 1.2 Discourage parking by imposing high fees for parking on-street and at dedicated parking facilities during high-demand peak times.			
Action 1.3 Provide setting up of docking stations to park bicycles and other micro-mobility modes.			
Action 1.4 Improve GRTC bus services by providing frequent services during peak demand through efficient route planning.			
Goal 2: Promote tourism activities.			
Action 2.1 Retrofit historical buildings to encourage visitors' footfall at James Park.			
Action 2.2 Install wayfinding signages and set up kiosks according to relevant laws standards, to allow free flow of visitors around trails.			

TABLE 4: IMPLEMENTATION TIME LINE TABLE

CONCLUSION

The Richmond Riverfront Viewshed Study stated that it is important that future growth along the Riverfront must embrace the value of river views by protecting property rights while providing appropriate development. This professional process outlines that, promoting the best viewpoints as a tourist attraction and improving access further contributes to the South side's significance. From this plan It has been identified that by promoting the viewpoints as tourist attractions from the South, park visitors are encouraged to see those enticing views and also by restoring of historic buildings on the Belle Isle thereby contributes to the growth of tourism. On the other hand, Improving of access can be achieved by various ways such as encouragement of multi modal transportation, converting parking areas to paid parking and providing facilities for pedestrian and bicycle users.

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