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Give Us Back Our River's Edge: An Analysis Of Man Made Flood Controls Along The Mississippi River

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GIVE US BACK OUR RIVER'S EDGE: AN ANALYSIS OF MAN MADE FLOOD CONTROLS ALONG THE MISSISSIPPI RIVER

A Thesis

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Abstract

Settlement and engagement along a river's edge can be seen throughout human history. The direct proximity to a water's edge has both physical and mental benefits, as well as economic value. However, throughout the last century, cities and their citizens along the Mississippi River have become disconnected from their water's edge; due to man-made interventions for increased flood control and advancements in the maritime industry. These interventions appeared to be prudent at the time and contributed to many cities' economies to growth, poor planning and placement of these interventions created barriers between citizens and their water's edge. This thesis analyzes cities along the Mississippi River and their quantitative connection to the water's edge and identifies potential areas of improvement through the analysis of current successful solutions. Beginning the largest southern city on the river, New Orleans, LA, I will visit, document, and geospatially analyze 12 cities along the Mississippi River, ending in Minneapolis, MN. The goal for this research is to offer any river city the tools to identify, document, and calculate any man-made barriers placed between their city and their river's edge. If any issues of disconnection through man-made barriers are identified, cities can utilize these findings with successful solutions from the 12 cities studied along the Mississippi River to determine potential improvements that will fit their unique site and specific needs.

Chapter 1. Benefits To Water Proximity

There is an inherent understanding that humans have been drawn to water. Whether it is being used for travel and commerce or agriculture, water has played an essential role in human evolution. While the effects of green infrastructure have been proven and well-documented, it seems as if minimal research on the effects of rivers, lakes, and oceans and their relationship to better physical and mental well-being have not been explored in the same depth. In a recent study by Micheal Depledge, an Environment and Human Health professor at the University of Exeter Medical School, clear evidence was found that the closer an individual lived to a coast, the healthier and happier that citizen would be. Although this study focused directly on the mental and physical health of citizens in relation to their proximity to the UK coast, Dr. Depledge and his team hope to repeat and study the same research with proximity to lakes and rivers.[1] While these future research assignments begin to take shape and the conversation of what Dr. Depledge calls "blue health" rises to the conversation, we must understand the importance water plays in our daily lives and how any disconnection from this asset can cause issues in our relationship with it. As cities today increase in population and density, direct access to water will play a vital role in our overall health and wellbeing. Along with designing spaces that focus on green infrastructure, landscape architects must understand the importance water plays in our lives and create solutions to any current or future disconnections from this vital asset. Often, we discuss how to solve problems that affect the ground on which we walk, forgetting about the water that allowed us to get there. If the human population is expected to continue to grow on land, we must understand that our relationship with water and the ground

[1] "Being near a body of water makes us calmer and healthier ...." Accessed February 11, 2020. https://globalnews.ca/news/4320204/lake-water-mental-health-blue-space/.

are one in the same. A great amount of research has been conducted on the importance of waterfront developments, but I have found a lack of research on what happens when access to our water has been disconnected or denied. Whether directly or indirectly, any barrier that separates humans from their water will have a negative effect and it is this issue that I have studied along the Mississippi River.

This thesis discusses and analyzes how and why cities along the Mississippi River have become increasingly disconnected over the last century through the placement of man-made barriers such as roads, railroads, levees, floodwalls, and large industrial complexes. It is these exact barriers that have caused a clear and distinct line of separation between citizens and their water's edge. Like any barrier in the world, they can have both a positive and negative affect. I will be analyzing their extent of disconnection throughout 12 cities along the Mississippi River with the goal to identify possible design solutions on how to work with any barrier that may cause a visible or physical disconnection between citizens and their water's edge.

1.1. Notes

"Being near a body of water makes us calmer and healthier ...." Accessed February 11, 2020. https://globalnews.ca/news/4320204/lake-water-mental-health-blue-space/.

Chapter 2. Introduction of the Author

The acknowledgment or observation of these man-made barriers did not simply appear overnight. Having lived in Baton Rouge, LA, a southern city along the Mississippi River, for the last decade, I have listened to locals, experienced it first-hand, and even felt this obvious disconnection from the river. These various barriers are a sprawling combination of transportation infrastructure, earth mounds, and industrial complexes that inhibit citizens from the water's edge.

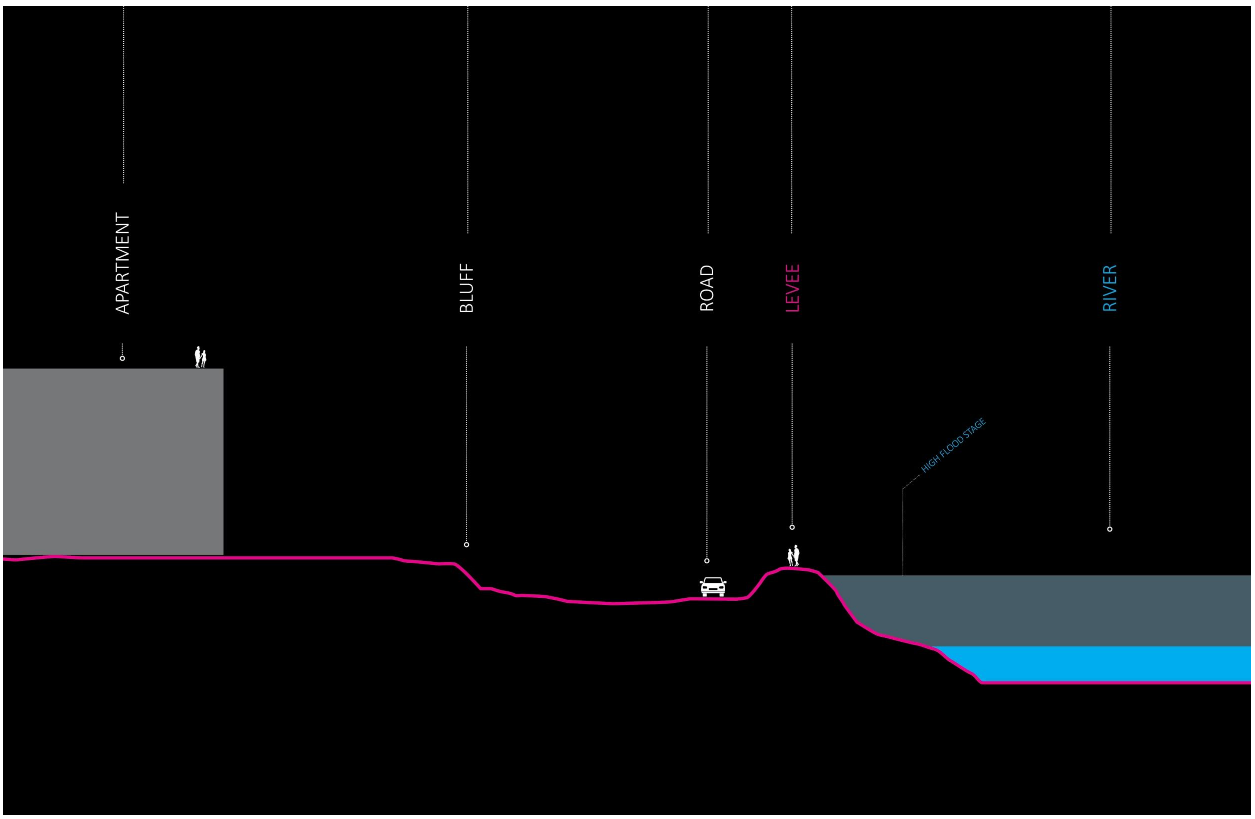

Figure 1. Diagrammatic sectional cut of current residential relation to the river.

My neighborhood sits atop the city's natural bluff, an elevation increases from the river's edge of no more than 20 feet. Despite living 500 feet from the river's current edge, which is

contained by a levee or earth mound sitting over 25 feet in height, I am unable to see the water. The water only comes into view during the spring and summer months after seasonal water level rise due to spring rains and snow melts from the northern states. In order to reconnect or visually engage with the water, I use two methods. The first method requires walking down the natural bluff and finding access points along the levee and climb over the 400-foot-wide and 25-foot-tall levee. The second method is finding a visible connection allowing oneself to reconnect to the water's edge. This typically requires getting on top of a private building rooftop, an option that many residents unfortunately do not have the option to do. If a citizen of Baton Rouge, LA does not have access to a larger downtown building with roof access, or they do not see these access points along the levee, how can we expect them to engage with the river daily? This builds on the question of whether these physical barriers have caused a lack of interest and engagement with the Mississippi River. During my ten years as a resident of Baton Rouge, LA, I have calculated over 1,500 days with direct interaction with the river, bypassing these man-made barriers. During these times of engagement with the river, I would often find myself alone in the spaces that I occupied. This sense of isolation raised questions on the value that citizens place on the river and why these park spaces or non-designated park spaces are often left empty? It should be noted that Baton Rouge, LA has been working hard over the last three decades to combat the issue of disinterest along the river due to separation from man-made barriers. With investments in amenities, such as park spaces, boardwalks, and attractions along the river, the city of Baton Rouge has seen an increase of people along the water's edge.[2] From conversing with local

[2] "Plan Baton Rouge scores big in its 20-year quest to revitalize ...." Accessed June 19, 2019. https://www.businessreport.com/politics/plan-baton-rouge-downtown-20-years.

planners in the area, there has been a notable increase in citizen engagement with the river, but I still find the current amount of citizens along these amenities to be lackluster. Due to this observation, one begins to wonder if more attractions are required to draw more citizens past the barriers and re-engage with the water's edge. Leading me to my next question of how substantial is this disconnect caused by these barriers?

While formulating questions as to how strong this disconnection may be, I would often ask friends and residents how they felt about the barriers between them and the river? Their responses had a common theme. Whether growing up or living in Baton Rouge, residents never seem to have the opportunity to engage or see the river due to the levee, transportation infrastructure, or industrial complexes. They discussed how there was a lack of programming along the river's edge to warrant visitors up the levee wall to reconnect with the hidden water. There were the occasional stories that absolutely shocked me, learning that a few citizens that have lived in Baton Rouge, LA for over 40 years, only 2 miles from the water's edge, had never seen the river. After interacting with Baton Rouge residents, it became clear that serious questions must be addressed

2.1. Notes

"Plan Baton Rouge scores big in its 20-year quest to revitalize ...." Accessed June 19, 2019. https://www.businessreport.com/politics/plan-baton-rouge-downtown-20-years.

Chapter 3. Research Questions

When dealing with such a large and complex research proposal, the outline and questions would need to be broad enough to cover an area that would deliver real results, but specific enough to analyze their issues and solutions. To form the structure for this research proposal, three questions were created that specifically targeted my observations and concerns.
What are the physical barriers causing a visible and physical separation from the Mississippi River? Do these barriers exist in cities along the Mississippi River and if so, which has the worst separation? What creative solutions have cities used to help reengage their citizens to the water's edge?

The Mississippi River is home to over 128 communities and cities living along the river's edge. In order to narrow down a set of cities to investigate, a strategic approach would need to be devised in order to discover, document, and analyze these potential barriers along the 2,148 mile stretch of land.[3] Site visits would be required to gather evidence of potential barriers and their disconnection in other cities. During these site visits, ground and aerial images, field notes, and measurements of the barriers would be gathered for analysis. With no more than 30 days' time to conduct the field work, 12 cities would be chosen to conduct site visits, offering enough time to gather evidence of potential barriers along the Mississippi River's edge that are causing potential disinterest.

3.1. Notes

"Mississippi River Facts - National Park ...." Accessed April 14, 2018. https://www.nps.gov/miss/riverfacts.htm.

[3] "Mississippi River Facts - National Park ...." Accessed April 14, 2018. https://www.nps.gov/miss/riverfacts.htm.

Chapter 4. Mississippi River Site Context and History

In order to discover these man-made barriers along the Mississippi River, we must quickly understand the basics of this complex, natural system. Beginning its journey in Minnesota, at the breakwater of Lake Itasca, traveling over 2,148 miles south, the river drains 1.5 million cubic feet of water per second into the Gulf of Mexico.[4]

Figure 2. The Mississippi River from its source in Minnesota.

The river touches over 10 states and has a drainage basin that collects from over 41 percent of the continental United States, an area of 1,245,000 square miles, transporting 230 million tons of sediment, creating a dynamic and ever shifting river bed that continually creates issues for

[4] "Mississippi River Facts - National Park ...." Accessed April 14, 2018. https://www.nps.gov/miss/riverfacts.htm.

shipping channels.[5] The Mississippi River, like many rivers around the world, is not the sole provider of water along the drainage basin. Many rivers and tributaries converge into the Mississippi River, creating an immense water highway, offering access for shipping goods and people throughout much of the United States.[6]

This water highway has allowed humans to connect, transverse, and settle along its shoreline, creating a unique and elaborate history over the last few thousand years. With evidence of early settlements along its river banks from the Woodland Period of North America around 1000 BCE, this river has had many different settlers along its shoreline.[7] However, it was not until the early 1600s when European settlers migrated to the New World and staked claim to this incredible asset while establishing new colonies and cities along the river.

Offering a clear path from the Gulf of Mexico to the Great Lakes, and even northeast parts of the continent, this water highway allowed easy migration. In the early 19th Century, the United States gained full ownership of the Mississippi River via the Louisiana Purchase. The increase in land saw a trend of human migration and settlement along the river.[8] During the large growth experienced in the 19th century, innovation in transportation and industry drastically

[5] "Mississippi River Facts - National Park ...." Accessed April 14, 2018. https://www.nps.gov/miss/riverfacts.htm.

[6] "River and Basin Facts - Upper Mississippi River Basin." Accessed January 13, 2019. http://www.umrba.org/facts.htm.

[7] "Native Americans - Army Corps of Engineers Rock Island District." Accessed January 14, 2019. http://www.mvr.usace.army.mil/Portals/48/docs/Recreation/ODM/pdf/Native%20Americans.pdf.

[8] "Louisiana Purchase - Office of the Historian." Accessed January 14, 2019. https://history.state.gov/milestones/1801-1829/louisiana-purchase.

changed and improved life along the water's edge. New technology, including the steam boat, railroad lines, and steel barges, allowed for safer and more efficient methods for transportation while battling the strong river current.[9] Due to the increased efficiency in transporting goods, many cities along the river expanded their infrastructure to handle the increased traffic at the cost of disconnecting their citizens from the water's edge. Today the Mississippi River has 41 port cities, including 21 Louisiana.[10] Despite the success of the steam engine, the diesel engine soon surpassed it as the primary way to power transportation on the river. Diesel engines increased the ability to move goods up the river almost 20 times more than steam engines.[11] It is through these technological advancements that the human population along the Mississippi River grew at an incredible rate. The current population of approximately 63,000,000 people, roughly one-fifth of the United States population, live within 15 miles of the river's edge. Both large settlements along the river and innovations have led to the Mississippi River becoming the largest water highway commerce in the world, with an annual gross revenue of 400 billion dollars and employing over 1.3 million jobs.[12]

[9] "A History of Steamboats - (USACE) - Mobile District." Accessed February 5, 2019. https://www.sam.usace.army.mil/Portals/46/docs/recreation/OP-CO/montgomery/pdfs/10thand11th/ahistoryofsteamboats.pdf.

[10] "Waterway Systems - Mississippi River System Port Map - WPS." Accessed March 1, 2019. http://www.worldportsource.com/waterways/systems/maps/Mississippi_River_System_4.php.

[11] "Barge | Encyclopedia.com." Accessed March 11, 2020. https://www.encyclopedia.com/social-sciences-and-law/political-science-and-government/naval-and-nautical-affairs/barge.

[12] "MRCTI in the News — Mississippi River Cities and Towns ...." Accessed July 1, 2019. https://www.mrcti.org/mrctiinthenews.

The Mississippi River plays both a vital role in our economy as well as our hydrology. As the nation's largest drainage basin, the Mississippi River basin stretches over 31 states before emptying into the Gulf of Mexico. The water cycle is the explanation of how water evaporates from the surface of the earth, rising high into the atmosphere, then cooling and condensing to form rain or snow in clouds, thus falling again to the surface as precipitation.[13] This water then finds its way back to the ocean through a series of small creeks, lakes, and rivers. When the United States experiences large amounts of precipitation during the spring, along with snow melting from the winter, streams, lakes, and even rivers can begin to overflow and flood. This influx of precipitation creates issues for any settlements within a flood zone.[14] As cities began to settle and expand along the Mississippi River's edge, extreme environmental events, such as seasonal flooding, began to create new concerns. To better manage seasonal flooding, cities along the river began to see the water's edge as a location to control this natural issue, drawing a hard line along its banks. This outlook of controlling a river's natural flow and widening would allow cities to remain and develop in otherwise unsafe areas. The presence of flooding is nothing new to the Mississippi River and the settlers along its shoreline. Since the 1800s, cities along the Mississippi River felt the real and concerning issues of settling along a complex and changing system.[15] With floods reaching new settlements, destroying houses, farms, and lives, the United

[13] "The Water Cycle | Precipitation Education ...." Accessed March 11, 2019. https://pmm.nasa.gov/education/water-cycle.

[14] "5 Reasons Why 2019's Mississippi River Flood is the Most ...." Accessed March 11, 2019. http://mississippiriverdelta.org/5-reasons-why-2019s-mississippi-river-flood-is-the-most-unprecedented-of-our-time/.

[15] "Mississippi River Flood History 1543-Present." Accessed March 11, 2019. https://www.weather.gov/lix/ms_flood_history.

States knew they had to try to control the Mississippi River. This task would later be debated as both a success and a failure.[16] Cities and landowners attempted to control the river by constructing levees, typically less than 7 feet tall, but many larger floods would pinpoint weaknesses in the levees.[17] The issue of flooding and controlling the river would continue for several decades until the decision on how to handle the predicament turned over to the US Army Corps of Engineers.[18] Despite a large coalition in the US Government that thought a levee system would be safest for the populated areas along the river, many argued this could lead to more severe flooding in the future. To settle the debate, in 1850 Federal Government appropriated $50,000 to study mitigating flooding problems[19]

Two studies were conducted, the first by Captain Andrew Humphreys and the second by an engineer named Charles Ellet, Jr, whose studies produced startling conclusions.

"The extension of the levees along the borders of the Mississippi, and of its tributaries and outlets, by means of which the water that was formerly allowed to spread over many thousand square miles of lowlands is becoming more and more

[16] "A brief history of the creation and growth of the Army ... - Grist." Accessed April 3, 2019. https://grist.org/article/cutraro/.

[17] "History – Southeast Louisiana Flood Protection Authority West." Accessed April 3, 2019. https://slfpaw.org/home/about-us/history/.

[18] "Controlling the Project Flood - Mississippi Valley Division." Accessed April 9, 2019. https://www.mvd.usace.army.mil/Portals/52/docs/Controlling%20the%20Project%20Flood%20info%20paper.pdf.

[19] "USACE website - About - History - Brief History of the Corps." Accessed April 15, 2019. https://www.usace.army.mil/About/History/Brief-History-of-the-Corps/Improving-Transportation/.

confined to the immediate channel of the river, and is therefore, compelled to rise higher and flow faster, until, under the increased power of the current, it may have time to excavate a wider and deeper trench to give vent to the increased volume which it conveys."

He mentions that the effects will only increase cultivation, man-made cutoffs, and the ultimate lengthening of the delta. These factors, when combined will only increase the probability and magnitudes of flooding along the river. According to Ellet, *"It is shown that each of these causes is likely to be progressive, and that the future floods throughout the length and breadth of the delta, and along the great streams tributary to the Mississippi, are destined to rise higher and higher, as society spreads over the upper States, as population adjacent to the river increases, and the inundated low lands appreciate in value."*

However, Ellet's opinion on the matter would be neglected and the two Army Corps Engineers, Captain Andrew Humphreys and Lieutenant Henry Abbot, opinions would become the consensus for the next 140 years.[20] Their study would conclude that levees would be the best methods of flood damage control and since 1882, the United States Army Corps of Engineers in conjunction with the Mississippi River Commission extended the levee system from the area of Cairo, IL to the mouth of the Mississippi Delta in Louisiana.[21]

[20] "Joe Rawley | WGNO | Page 170." Accessed March 13, 2020. https://wgno.com/author/jnrawley/page/170/.

[21] "USACE website - About -History - Brief History of the Corps " Accessed April 13, 2019. https://www.usace.army.mil/About/History/Brief-History-of-the-Corps/Improving-Transportation/.

Unfortunately, the new system of control brought only temporary relief. In 1927, the United States felt the true wrath of the Mississippi River. For many, the Great Mississippi Flood of 1927 is considered to be the nation's worst natural disaster.[22] When heavy rain began to pour into the central basin of the Mississippi in the summer of 1926, tributary rivers began to pour what they could into the Mississippi River. The combination of continuous rain and lack of widening from control structures increased the Mississippi River's water level. In March of 1927, flooding peaked in the lower Mississippi River causing 145 places to become flooded. The flooding water from the Mississippi River reached an area of 27,000 square miles of land. This rage of water would leave 700,000 people homeless. This damage reached a monetary report of nearly $1 billion, which at the time was one-third of the United States Federal budget. If this event would occur today, the total damage would be estimated around $950 billion.[23]

After water levels normalized, the United States Army Corps of Engineers was charged with the incredible act of attempting to tame the Mississippi River. Passage of the Flood Control Act of 1928 led to the installation of the longest system of levees ever built. The following decades saw the Corps of Engineers construct levees of the east and west side of the Mississippi River. Sites were chosen from extensively conducted surveys in the early 1930's. The levees installed by the first settlers were small by today's standards and lacked the height to fight the

[22] "Mississippi River flood of 1927 | American history | Britannica." Accessed May 1, 2019. https://www.britannica.com/event/Mississippi-River-flood-of-1927.

[23] "The Great Mississippi Flood of 1927 - National Geographic." Accessed May 1, 2019. https://www.nationalgeographic.com/culture/2001/05/mississippi-river-flood-culture/.

growing volume of water from flooding.[24] These new, taller levees ultimately allowed for better flood management and expansion of cities along the water's edge over the next 90 years. Despite better flood management, engineers and government officials did not account for the disconnection these barriers would cause between the citizens and the water's edge.

Over the next 91 years, 22 floods occurred on the Mississippi River, even with the Flood Control Act of 1928's attempts to prevent future flooding along the river. In 2019, we witnessed the longest flood of record on the lower Mississippi River, starting from December 28th, 2018 through August 10th, 2019.[25]

It was during these 22 flood events that the United States Corps of Engineers would add additional flood structures to cities in the form of floodwalls or additional levees.[26]

As humans began to settle along this incredibly powerful and unique asset since the 1700s, we have seen natural disasters, provoked man-made responses to allow human settlement to remain in unsafe zones along the river’s edge. Even though the United States Corps of Engineers has created a system allowing humans to remain along the river’s edge, their solutions to control flooding caused another issue in the form of a hard line of separation between cities

[24] "Evolution of the Levee System Along the Lower Mississippi ...." Accessed March 11, 2020. https://web.mst.edu/~rogersda/levees/Evolution%20of%20the%20Levee%20System%20Along%20the%20Mississippi.pdf.

[25] "5 Reasons Why 2019's Mississippi River Flood is the Most ...." Accessed August 23, 2019. http://mississippiriverdelta.org/5-reasons-why-2019s-mississippi-river-flood-is-the-most-unprecedented-of-our-time/.

[26] "History of Levees - FEMA.gov." Accessed March 19, 2019. https://www.fema.gov/media-library-data/1463585486484-d22943de4883b61a6ede15aa57a78a7f/History_of_Levees_0512_508.pdf.

and their shoreline. It is this issue of separation caused by the new barriers that I raise the questions on just how disconnected we have become from this once connected asset? With over 128 cities and communities along the shoreline, the exact questions on where to begin my research and the system I would need to select the most effective sites to study became just as complex as the history and hydrology of the Mississippi River.

4.1. Notes

1. "facts - Upper Mississippi River Basin." Accessed January 13, 2019. http://www.umrba.org/facts.htm.

2. "Native Americans - Army Corps of Engineers Rock Island District." Accessed January 14, 2019. http://www.mvr.usace.army.mil/Portals/48/docs/Recreation/ODM/pdf/Native%20Americans.pdf.

3. "Mississippi River - History and economy | Britannica." Accessed January 14, 2019. https://www.britannica.com/place/Mississippi-River/History-and-economy.

4. "Louisiana Purchase - Office of the Historian." Accessed January 14, 2019. https://history.state.gov/milestones/1801-1829/louisiana-purchase.

5. "A History of Steamboats - (USACE) - Mobile District." Accessed February 5, 2019. https://www.sam.usace.army.mil/Portals/46/docs/recreation/OP-CO/montgomery/pdfs/10thand11th/ahistoryofsteamboats.pdf.

6. "Mississippi River | American Rivers." Accessed March 1, 2019. https://www.americanrivers.org/river/mississippi-river/.

7. "Waterway Systems - Mississippi River System Port Map - WPS." Accessed March 1, 2019. http://www.worldportsource.com/waterways/systems/maps/Mississippi_River_System_4.php.

8. "Barge | Encyclopedia.com." Accessed March 11, 2020. https://www.encyclopedia.com/social-sciences-and-law/political-science-and-government/naval-and-nautical-affairs/barge.

9. "MRCTI in the News — Mississippi River Cities and Towns ...." Accessed July 1, 2019. https://www.mrcti.org/mrctiinthenews.

10. "The Water Cycle | Precipitation Education ...." Accessed March 11, 2019. https://pmm.nasa.gov/education/water-cycle

11. "5 Reasons Why 2019's Mississippi River Flood is the Most ...." Accessed March 11, 2019. http://mississippiriverdelta.org/5-reasons-why-2019s-mississippi-river-flood-is-the-most-unprecedented-of-our-time/.

12. "Mississippi River Flood History 1543-Present." Accessed March 11, 2019. https://www.weather.gov/lix/ms_flood_history.

13. "A brief history of the creation and growth of the Army ... - Grist." Accessed April 3, 2019. https://grist.org/article/cutraro/.

14. "History – Southeast Louisiana Flood Protection Authority West." AccessedApril 3, 2019. https://slfpaw.org/home/about-us/history/.

15. "Controlling the Project Flood - Mississippi Valley Division." Accessed April 9, 2019. https://www.mvd.usace.army.mil/Portals/52/docs/Controlling%20the%20Project%20Flood%20info%20paper.pdf.

16. "USACE website - About - History - Brief History of the Corps." Accessed April 15, 2019. https://www.usace.army.mil/About/History/Brief-History-of-the-Corps/Improving-Transportation/.

17. "Mississippi River flood of 1927 | American history | Britannica." Accessed May 1, 2019. https://www.britannica.com/event/Mississippi-River-flood-of-1927.

18. "The Great Mississippi Flood of 1927 - National Geographic." Accessed May 1, 2019. https://www.nationalgeographic.com/culture/2001/05/mississippi-river-flood-culture/.

19. "Evolution of the Levee System Along the Lower Mississippi ...." Accessed March 11, 2020. https://web.mst.edu/~rogersda/levees/Evolution%20of%20the%20Levee%20System%20Along%20the%20Mississippi.pdf.

20. "USGS Current Conditions for USGS 05331000 MISSISSIPPI ...." Accessed March 11, 2020. https://waterdata.usgs.gov/nwis/uv?site_no=05331000.

Chapter 5. Site Selection and Methodology

To narrow down a set of cities to visit along the Mississippi River, I would need to analyze the amount of time required to document a site and the findings. After conducting a trial run in Baton Rouge, it was determined that a minimum of eight hours would be needed to accurately document any connections or barriers along the river's edge. With 30 days to conduct research, 12 site visits would be allowed including travel time between each city. Upon completion of the trial run, a final methodology would be created to allow accurate repetition and replication of my field work and site documentation. This methodology will potentially become the toolkit that similar river cities can utilize to accurately identify their barriers and possible design solutions. To select sites from the 128 cities and communities, it is important to understand that each city along the Mississippi River offers various changes in its topography and thus, a different relationship with the water. For instance, New Orleans, LA sits below sea level with a river width of 3,200 feet and a depth of over 191 feet. In contrast, Minneapolis, MN which lies over 2,000 miles north of New Orleans, LA is raised 13 feet above the Mississippi River with a river width of 789 feet and an average depth of 9 feet.[27] To better visualize these typographies, refer to appendix B. Understanding that no two cities are alike along this river, it was important to select cities that would offer a wide range of interactions with the water based on their natural typography. By creating both a population table and sectional cuts of the cities to better review their relationship to the water, criteria were built to narrow down the 12 cities to conduct field research. Using a range of populations from >50,000, 50,001 - 250,000, and

[27] "USGS Current Conditions for USGS 05331000 MISSISSIPPI ...." Accessed March 11, 2020. https://waterdata.usgs.gov/nwis/uv?site_no=05331000.

250,001- 1,000,000, along with measurements of linear riverfront access in mileage and sectional cuts, the following cities were selected.

1. New Orleans, LA - 393,292 - 25.8 miles
2. Natchez, MS - 14,886 - 3.0 miles
3. Memphis, TN - 652,236 - 24.2 miles
4. Cape Girardeau, MO - 39,151 - 5.95 miles
5. Saint Louis, MO - 318,069 - 19.2 miles
6. Hannibal, MO - 17,590 - 4.60 miles
7. Quincy, IL - 40,303 - 2.50 miles
8. Davenport, IA - 102,320 - 9.31 miles
9. Dubuque, IA - 58,276 - 7.75 miles
10. La Crosse, WI - 51,834 12 miles
11. Winona, MN - 26,928 - 7.44 miles
12. Minneapolis, MN - 422,331 -19.41 miles

Figure 3. United States map illustrating site selected.

The 12 cities chosen each represent unique interactions and natural landscapes that make up the Mississippi River. Having selected the sites to conduct the field research, a methodology

would be needed to ensure an accurate collection of data and documentation throughout each visit. The trail experience in Baton Rouge, yielded development of a pre-site analysis, on-site documentation procedure, and a post-site visit analysis. The following will outline the exact procedure conducted on each city.

Pre-site analysis procedure:

1. Utilizing open-source GIS software, such as Google Earth Pro, the linear distance of the riverfront access of the city and communities would be measured. This measurement is based on the municipal boundaries of the city to ensure accurate and repeatable measurements throughout the 12 cities.
2. Identify any park space or open land along the cities shoreline which would become the starting point for each site visit. Upon arriving at the point of interest, a quick observation of the surroundings would be conducted to gauge whether or not adjustments would be required.
3. Utilizing Google Earth Pro, any man-made barriers along the municipal riverfront access would be identified. The barriers can include roads, railroads, levees, floodwalls, and maritime or industrial complexes. During this point of the analysis, no measurements are required just their location along the riverfront of each city.
4. Identify any airspace restrictions in the chosen sites before conducting small unmanned aerial system flights. Following all legal requirements written by the Federal Aviation Administration, all flight operations were sent to the proper authorities or agencies.

Once all riverfront park spaces, man-made barriers, and all flight procedures have been identified and triple checked, it was time to begin the site documentation procedure. Taking from the pre-

site analysis, the new information will be used to select the exact sites visited within each city, chosen on the presence of both connections and barriers.

On Site Documentation:

1. Using the identification of riverfront park spaces, these locations will be used as the starting point for arriving into the city. If a park space was not present, an alternate location where citizens would usually meet and gather will be substituted (eg. a parking lot or business that is located in close proximity to the river).
2. Depending on the linear distance of the city or community boundaries along the riverfront access, 1, 3, or 5 sites will be visited. In order to determine how many sites to visit, the total mileage of the riverfront will be taken from the linear measurements based on the municipal boundaries and create one site visit for every five linear miles. For example, New Orleans, LA has 25.8 linear miles of riverfront access so 5 sites were chosen throughout the riverfront to be visited and documented.
3. Once the number of site visits were created per city, I would arrive at each site and conduct the following procedures to document the presence of either a connection with the water's edge or a disconnection. It should be noted that the site visits start at the southern part of the city and finishes on the northern end. If only one site was required in the city, the most central location that offered either a connection or barrier would be determined. If the town or city had both a connection and a barrier in close proximity and only required one site to visit, both sites would be visited, and the following site documentation procedure would be performed.

a. Collecting ground imagery with human scale. Using a tripod and a camera, I would place the camera 100’ away from the identified obstacle or connection and walk as close as I could to the edge. Using a timer on the camera, I would capture my path to the obstacle or edge and allow a human scale to be placed next to the either the barrier or connection. This procedure would ultimately allow me to gauge a sense of scale to the space or barrier and capture visual evidence of restrictions through materials and or signage.

    i. Along with capturing a human scale figure, I would also take the camera off the tripod and walk the site to gather site imagery of the barriers from various angles, including 45 degrees and close shots of either the connection or the barrier. The goal was to gain better insight or site inventory to offer potential solutions or examples on how cities worked with these barriers to offer solutions in my research.

b. Aerial Imagery with and without human scale. Ensuring all flight procedures were safe and legal, checking both FAA requirements and general airspace procedures, I would find a safe location to launch the small unmanned aerial system (sUAS) and fly to a height of no more than 400 feet. Once in the air, I would either adjust the position of the sUAS to capture the extent of the barrier and or the connection in one frame. The goal is allow the reader to compare the ground imagery with the aerial imagery with both site context and structural context. If permissible, I would fly the sUAS directly over the barrier to get a top down view of the direct barrier, gaining a better understanding of the scale of the barrier and its purpose.

    i. Once the barrier or the connection was captured, I would then rotate the sUAS and begin to capture images of the surrounding to gain a better perspective of the site's surroundings and potential clues to help identify connections. This would usually include capturing roads, railroads, baton ramps, docks, even parking lots.

c. After visiting the sites in each city, I would review and back up the files before moving onto the next site. This was important to ensure the site was documented correctly and to not overwrite any information during the next site visit.
d. After all the necessary sites were visited and documented throughout the city, I would then begin to either walk or bike the surrounding sites. Utilizing a digital camera, I would capture moments or spaces that would offer further insight into how the city manages their relationship to their water's edge.

Post site analysis:

After Taking the linear measurements of the municipal boundaries for each city's riverfront access, the locations of the barriers, and the site visits, it was time to conduct a sectional analysis for each city. The following will outline the procedure conducted to gain the necessary information to be used in the analysis.

1. Utilizing Google Earth Pro, pinpoint all the man-made barriers and places visited in the city to create sectional cuts. These sectional cuts would be taken perpendicularly from the river, starting 100 feet from the river's edge and extending into the city until until I reached the first residential sector of the space.
2. Along with the sectional cuts, measure the extent of any man-made barriers that run parallel to the shoreline of the river. In order to be considered a barrier that caused a separation, it would have to be the last element before the water's edge. If there was a park that was adjacent to the water's edge, but had the presence of either a road, railroad, floodwall, or industrial complex between it and the river, then this would constitute a separation. Therefore, it would need to be recorded and measured to understand the length to compare its extent to the overall riverfront mileage.
3. Using the identified barriers and the criteria that outlines a separation, locate, and measure its linear length. Then taking the total linear mileage of the riverfront access for each city, divide the total amount of park spaces along the river against the total linear shoreline of the city. For example, New Orleans, LA has 25.8 miles of riverfront along its municipal boundaries, with only three park spaces to offer a direct connection with no

interference to the river's edge totaling 2.88 linear miles. Giving us a 2.88/25.8 or 11% of the total mileage accessible to the river.

Once all three procedures were conducted for each site in the 12 cities, it was time to begin cataloguing the information to begin my site analysis. This analysis would become the basis for the report on how barriers placed along the Mississippi River have caused issues of separation for the citizens and their water's edge. It would also identify unique solutions to reconnect citizens back to the water's edge discovered in the field work. To review the site visit documentation and calculations for each of the 12 cities, please refer to the Appendix A.

5.1. Notes

"USGS Current Conditions for USGS 05331000 MISSISSIPPI RIVER AT ST. PAUL, MN." Accessed March 11, 2020. https://waterdata.usgs.gov/nwis/uv?site_no=05331000.

Chapter 6. Site Analysis

Stretching from New Orleans, LA to Minneapolis, MN, the journey up and down the river totaled 4,233 miles. During this one-month field work, I was able to observe and experience details that did not show up on my preliminary research. Even using modern advanced geo spatial data analysis tools, many issues or solutions were missed that would change my perspective of this project. It cannot be stressed enough how important it is to strap on your boots, get outside, and place yourself on-site. It was during this trip that my impression of the river and the barriers that lined the river that would forever change my view of our connection to the water's edge. This new realization that not all cities along the river were the same and their interaction with the water may differ from not only man-made barriers, but also their natural typography. During the field work, I was able to observe several barriers that were placed along the water's edge to either help prevent flood related issues or increase maritime infrastructure. These barriers would not remain the same throughout the entire length of the river, changing every few hundred miles as I traveled north. It should also be noted that although my research is focusing on man-made barriers, natural elements of the river, such as bluffs or slopes can also act as an inhibitor to our interaction with the edge. It should be noted that the Mississippi River is a complex and forever changing environmental asset. This asset is not the same as the first settlers encountered and one that will not look the same over the next century. Before discussing the analysis on each city or sector of the river, it is important to understand how the site visits have allowed barriers to be defined. A barrier or disconnection from the river can come in many forms, some relatively small, while others are so cumbersome, they will certainly never be

removed from the edge. In order to understand the level of restriction from the water's edge, I have divided the barriers from least resistant to most difficult to pass.

1. Roads
2. Railroad tracks
3. Flood Walls
4. Levees or Earth Mounds
5. Industrial / Maritime Complexes

These five barriers are evident throughout the entire length of the river, but while some cities contain all five, more northern cities along the river may only have a few, if only one. Figure 4 illustrates the difficulty in either passing the barrier related to their size on the landscape or the restrictions placed on passing due to safety concerns or personal restrictions.

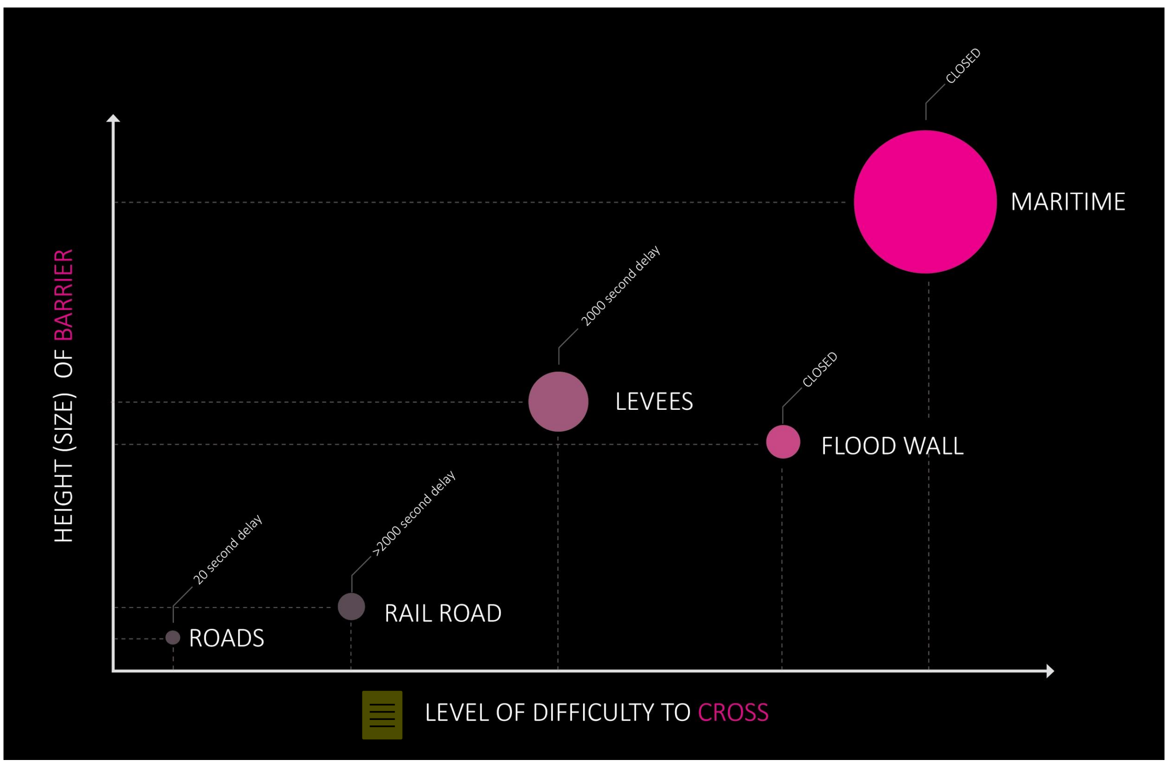

Figure 4. Barrier heights and their difficulty to cross.

Beginning with roads, usually designed anywhere from 20 feet to over 60 feet wide, this low-profile barrier will only stall the visitor to the river for a few moments. The reason for the temporary moment of separation to access the river is due to motor traffic and pedestrians. Waiting for a moment to safely cross the street and gain access to the water's edge, the road is a physically low barrier to restrict access to the river. From there we move to the next barrier in the form of a railroad, this again is a low-profile barrier, usually only 8" tall and at major crosswalks or road intersections. This barrier is required to be flush with the road or sidewalk for American Disability Act compliant. This barrier again causes temporary delay in the form of a moving train. From observations and experiences, a train can hinder you from crossing the railroad anywhere from 90 seconds to over 2000 seconds, or (30) minutes. This usually depends on the number of boxcars attached to the locomotive. This 2000 second delay may only occur a few times per day or once a week and with some patience, you can find your way to the water's edge with ease. The third barrier is a flood control system in the form of levees or earth mounds. Usually 20 feet tall, this 15% sloped earth mound makes it difficult for anyone to climb the average 350 foot wide flood structure unless there are ADA compliant ramps along the barrier.[28] The fourth barrier again is a flood control structure and comes in the form of a flood wall, usually constructed with steel and concrete. This flood control structure varies from 6 feet to over 20 feet tall and only a few feet wide and is dependent on the volume of water it is trying to hold back.[29] A floodwall is often placed in locations where space is limited and the construction

[28] "Levees - Mississippi Valley Division." Accessed March 11, 2020. https://www.mvd.usace.army.mil/Portals/52/docs/Levees%20info%20paper.pdf.

[29] "Barriers - ASFPM." Accessed March 11, 2020. https://www.floods.org/ace-files/documentlibrary/committees/floodproofing/june_2013_flood_barriers.pdf.

of a levee system is not possible. The structure has the ability to open at various points along the wall to allow access to the water's edge, park space, or complexes that may lie on the other side. These gates become closed and sealed to contain the Mississippi River during high flood stages, preventing any flooding from occurring. The closure of the floodgates can occur for several months, typically sealed from February through August, leaving cities completely disconnected with their water's edge for most of the year.[30] The fifth and final barrier is a mix of many of the segments just discussed. The industrial complexes that line a majority of the river are filled with roads, railroad lines, flood walls, warehouses, and much more. They can range from 100 feet wide to, in some extreme cases, stretch over 2500 feet wide. Although they are very important to the city's economy, this barrier has been identified as the largest and most cumbersome barrier along the river's edge, causing the greatest disconnections for the citizens. Evidence of these five barriers can be seen throughout most of the river's edge, however only a few cities have all 5 barriers along their water's edge.

[30] "Floodgate Summary – Southeast Louisiana Flood Protection ...." Accessed March 11, 2020. https://slfpaw.org/floodgate-summary/.

Figure 5 illustrates the presence of barriers in each city. For example, New Orleans, LA has all five barriers: roads, railroads, floodwalls, levees, and industrial complexes.

Figure 5. Barrier identification along the Mississippi River and their total presence in each city.

To better illustrate and visualize these man-made barriers and their layouts, 3D models and diagrammatic sections have been created to show typical scale, location, and use of barriers. Figure 6 illustrates the landform barrier known as a levee or earth mound. This large sculpted collection of soil varies in height from 10-22 feet, with a width of 300 feet or more. The levee's slope of 15% makes it difficult for anyone to casually walk up the thick grass slope. In fact, it is often used to train LSU's football athletes during the summer months, due to the high slopes.

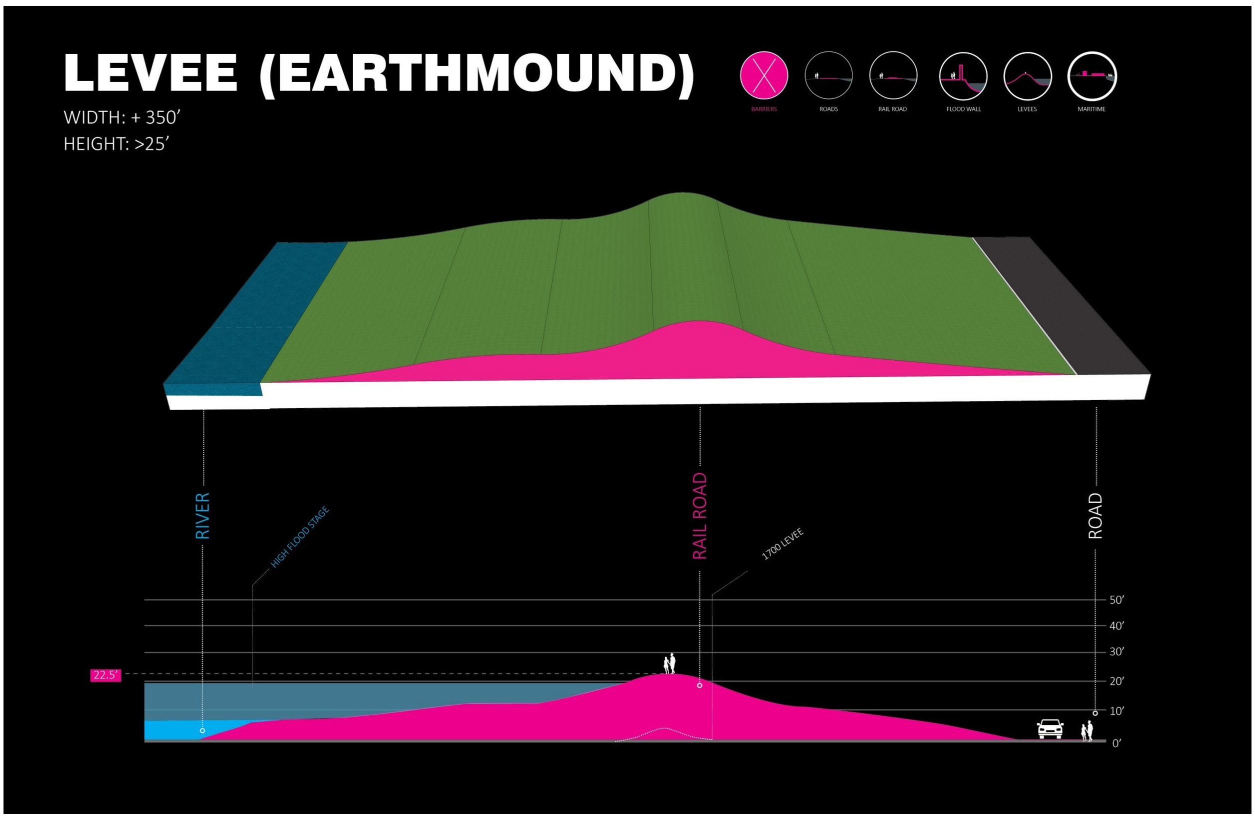

Figure 6. Diagrammatic sections to illustrate scale of a typical levee in southern Louisiana.

Figure 7 illustrates the constructed barrier of a flood wall. This barrier can be found throughout various points along the Mississippi River, mostly found below the city Dubuque, IA. This physical flood control system is made of concrete, brick, steel, and stone, and can range in height from seven feet to over 16 feet tall. The purpose of a flood wall is to control any water from entering the city's landscape by blocking off the access to the river, only gained back through floodgates that open during low water levels.

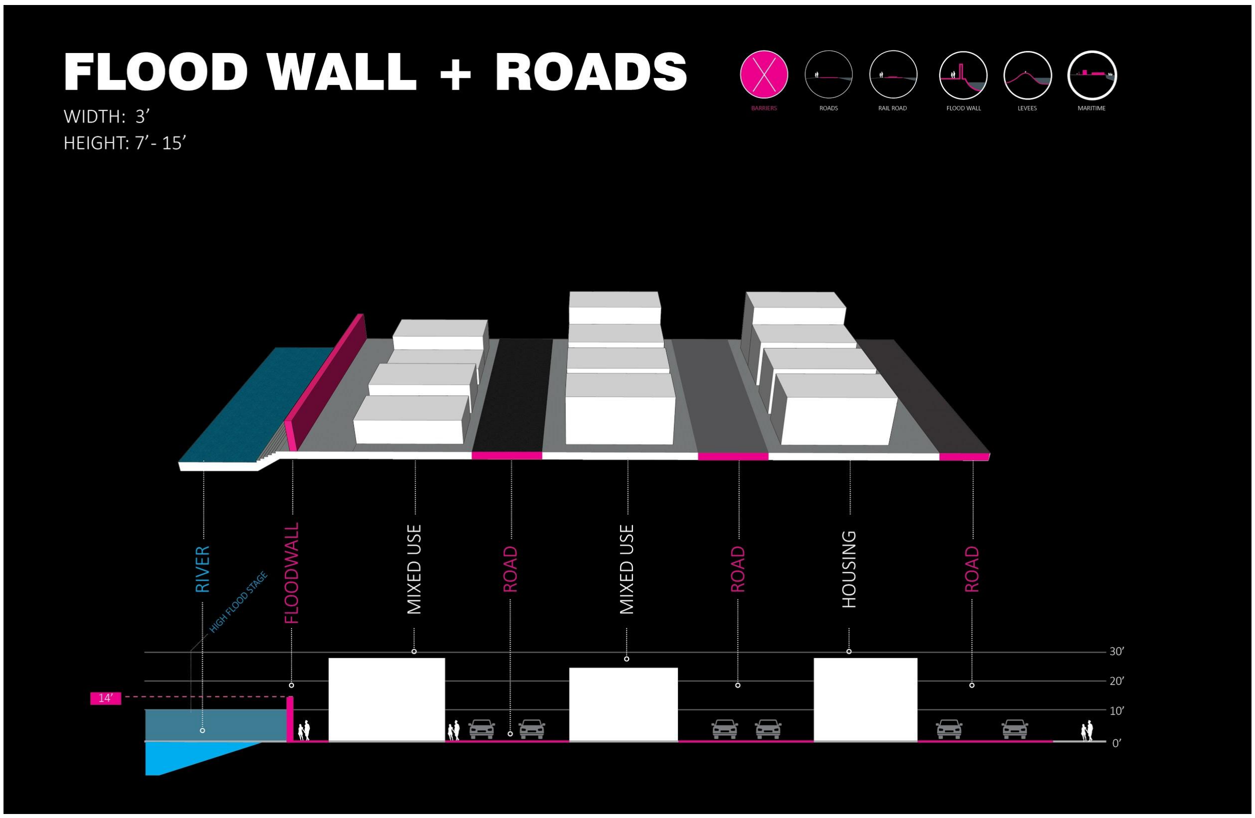

Figure 7. Diagrammatic sections to offer scale and locations of floodwalls and gates structures.

For some cities, this barrier will be open for most of the year, especially when the water level is lower and below the flood line. During the spring and summer months when the snow begins to melt and the spring rains begins to fall, this gate will be closed and sealed off to hold back the powerful Mississippi River. New Orleans, LA has a few of these flood controls

throughout their landscape along the river, as well as Cape Girardeau, and Hannibal, MO. The presence of these barriers is not seen often past the convergent point near Saint Louis, MO, but a few cities have recently added these structures due to new flooding issues.

Figure 8 illustrates the complex set of barriers that can be found throughout industrial complexes along the Mississippi River. Cumbersome in their layout and planning, not all will fit one type, but they seem to carry a familiar pattern of barriers. Many, if not all, industrial sites will require a large fence to keep children, and even adults, from accidentally or purposely entering the site.

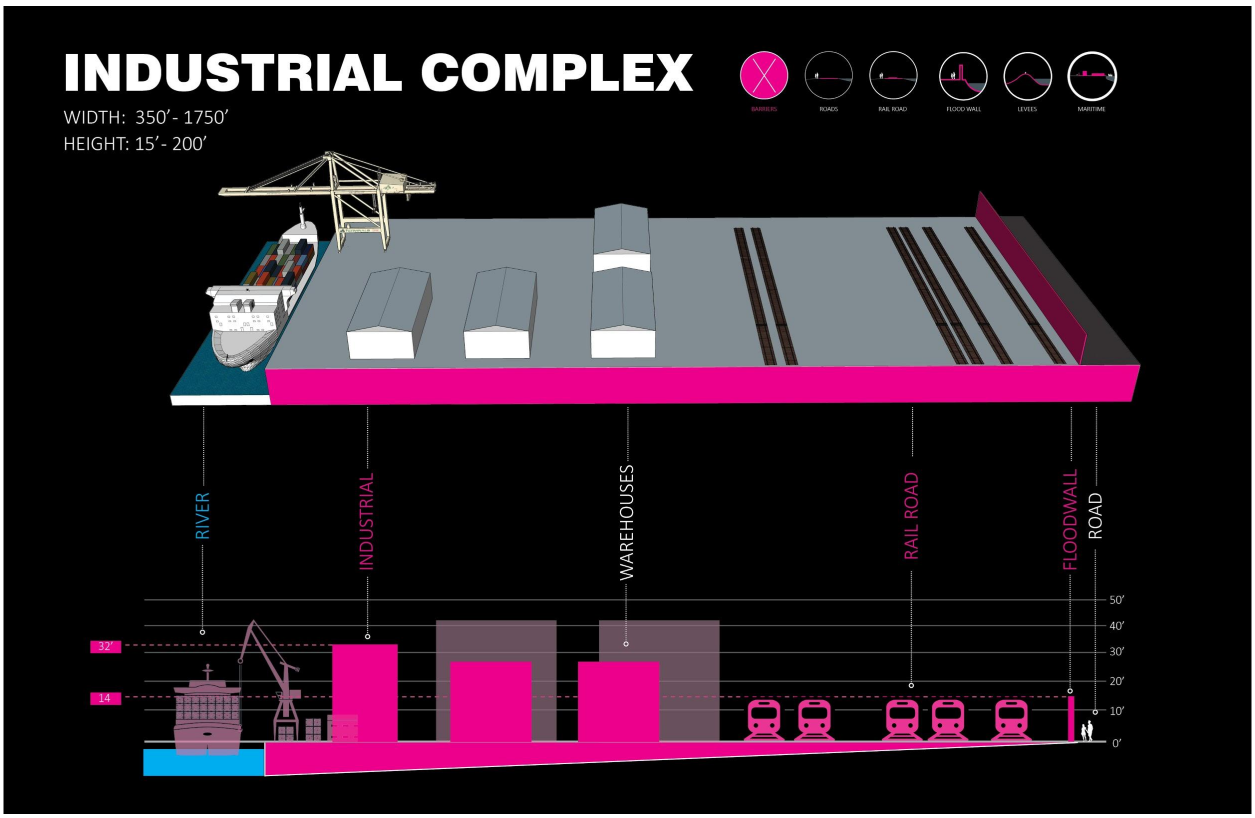

Figure 8. Diagrammatic sections to offer scale of typical barriers in an industrial complex.

This prevents injuries from occurring due to heavy equipment being moved on site or exposure to dangerous chemicals in the area. This fence will almost always be met with caution

and warning signs or other visual cues to warn anyone from entering the site. The next restriction is a set of railroad tracks that seem to almost scar the landscape. Depending on the site, you can find a single set of tracks or dozens. this varies on the size of the complex or the need for ground transportation. Next, you will find various types of warehouses, large shipping cranes, and roads that are used to push the cargo or goods throughout the site. In some cases, you will find floodwalls in the same complex, although not typically due the placement of ports in non-flood zones, these barriers are usually closer to the city than the river. Combined, these barriers found in industrial complexes have caused the separation for citizens to access their river's edge. With a more in-depth description of the barriers and their relation to the water's edge, a calculation of their presence in each of the 12 cities has been created. To review the findings, please refer to Appendix A. Site Analysis.

6.1. Notes

"Levees - Mississippi Valley Division." Accessed March 11, 2020. https://www.mvd.usace.army.mil/Portals/52/docs/Levees%20info%20paper.pdf.

"Barriers - ASFPM." Accessed March 11, 2020. https://www.floods.org/ace-files/documentlibrary/committees/floodproofing/june_2013_flood_barriers.pdf.

"Floodgate Summary – Southeast Louisiana Flood Protection ...." Accessed March 11, 2020. https://slfpaw.org/floodgate-summary/.

Chapter 7. Discussion

In the beginning of this research, the initial concern was to how the city of Baton Rouge became so disconnected from the water's edge and whether this issue of man-made barriers existed further up the river. After studying the vast history of the river, creating a methodology to collect the necessary data, and analyzing findings, my stance on the issue of this disconnection has altered. Upon further review of my geo-spatial calculations of barriers present compared to total riverfront access in each city, I am under the impression that these man-made barriers have not caused a clear and hard line of separation between citizens and their water's edge, although each city suffers from the presence of these barriers as seen throughout each of the 12 cities studied. They seem to have all found creative ways to offer new methods to regain access to the water's edge. From riverfront parks built into levees, murals installed along flood walls to remind citizens of the history of the river and its presence, each city found creative solutions to stimulate interest back in the disconnected asset. Further analysis on each city and their design solutions will be needed to offer a toolkit that could help similar river cities find solutions to meet their unique needs. I believe there are some collaborations that can be drawn from the site visits and site analyses that may further explain the reasoning as to why southern cities may suffer from a greater presence of these barriers versus their northern counterparts. The reason for this greater connection does not come from the city's lack of investment in waterfront properties, but rather from two variables. The first is the topography of the river and its depth. Port cities such as New Orleans, LA offer a river width of 3,200 feet with a river depth of 191', allowing for larger shipping vessels to enter the space with little interference from the river's bottom and surrounding landscapes. Refer to Appendix B for further detail. The further north you travel

along the river, the shallower the water depth becomes, thus increasing the issue for vessels to navigate the changing riverbeds from shifting sand drifts. Although large barges and towboats can operate in shallow waters, depths of 9 feet or more, the narrowing of the river's width as you travel north also poses issues on how many barges or the volume of goods that can be safely transported. This issue compounded with the amount of locks and dams that are found after Saint Louis, MO slow down operations, making it less affordable to ship goods using barges versus railroads or 18 wheelers. The second factor is the location along the river and its proximity to the Gulf of Mexico. Of the major 41 port cities along the Mississippi River, 21 of them are located here in Louisiana, primarily due to the proximity to the Gulf of Mexico. With its direct connection to other oceans, this body of water allows companies to easily and affordably ship goods to and from surrounding countries.[31] It should also be noted that due to the location of southern cities along the Mississippi River drainage basin, larger amounts of water are discharged past the city every second.[32] This funneling effect causes larger volumes of water to pass the southern cities, thus increasing the risk for flooding and requiring man-made flood control systems. Combined with Louisiana's proximity to the Gulf of Mexico, their width and depth of the river, and their location at the bottom of the drainage basin, these cities along the river without a doubt have the largest presence of barriers along their shoreline.

[31] "Louisiana Ports: The Industry that Drives all Others - DNR ...." Accessed March 11, 2020. http://www.dnr.louisiana.gov/assets/OC/env_div/gw_res/Events/UpdateonLaPorts_JoeAccardo_PortsAssnofLa.pdf.

[32] "Mississippi River Facts - National Park ...." Accessed March 11, 2020. https://www.nps.gov/miss/riverfacts.htm.

Figure 9. Aerial image of Downtown Baton Rouge Levee Theater.

Although cities like New Orleans and Baton Rouge, LA suffer from the enormous presence of man-made barriers in the form of levees, floodwalls, railroad lines and large industrial complexes, there is evidence that the cities are discovering clever solutions to offer spaces for citizens to re-engage with the water's edge. Baton Rouge, LA for example has undergone extensive construction and investment in the last 30 years along its downtown levee system. These civic projects aimed to offer new park spaces and attractions to bring new interest back to the water's edge. Whether it was the 6,000 linear foot levee walking path that I use every day to bike to and from campus or the Levee Theater, an open air amphitheater built into the levee apron with a seating capacity of 5,000 people, these creative solutions offer citizens a way

to live in a symbiotic relationship with these otherwise obtrusive man-made barriers.[33] For New Orleans, LA, their creative solution was to literally climb over the mandatory flood wall through steel bridges and elevators. Once the visitor was able to cross the barrier, they would then have access to Crescent Park, a one-mile linear park along the Marigny neighborhood built in 2010.

Figure 10. Crescent Park and the steel bridge for pedestrian access to the riverfront park.

Although cities along the Mississippi River have benefited from the installations of flood control systems and the presence of industrial complexes, they have also recognized that these assets have altered their direct connection with their river's edge. Fighting to take back control, cities have studied their opportunities along their shoreline, understood the limitations of their budgets, and offered solutions to bring new interest back to the water's edge. Along with continued research in the matter and further discussion with experts, I will build upon my findings to offer

[33] "Baton Rouge Riverfront Plan 1990 - Downtown Development ...." Accessed March 11, 2020. https://downtownbatonrouge.org/uploads/docs/ddd_scan_BR_riverfront_dev_plan_1990_lowres1.pdf.

a workflow chart that will offer similar river cities the methodology to identify their rate of disconnection along their water's edge. Along with this analysis workflow, I will identify how cities across the Mississippi River have solved their disconnection from man-made barriers to allow city officials to identify potential design solutions that match their unique issue. There is no doubt that humans will continue to settle along or near water and if we value these flood control systems and the maritime industry, we must remember how important it is to remain connected with our river's edge, thus working in tandem instead of separated. Water access is a human right, not a privilege and it is from this research that I ask anyone reading this paper to ask yourself if your city suffers from a disconnection along your water's edge?

7.1. Notes

"Louisiana Ports: The Industry that Drives all Others - DNR ...." Accessed March 11, 2020. http://www.dnr.louisiana.gov/assets/OC/env_div/gw_res/Events/UpdateonLaPorts_JoeAccardo_PortsAssnofLa.pdf.

"Mississippi River Facts - National Park ...." Accessed March 11, 2020. https://www.nps.gov/miss/riverfacts.htm.

"Baton Rouge Riverfront Plan 1990 - Downtown Development ...." Accessed March 11, 2020. https://downtownbatonrouge.org/uploads/docs/ddd_scan_BR_riverfront_dev_plan_1990_lowres1.pdf.

Appendix A. Site Analysis

01: New Orleans, LA

Pre-site:

1. Linear distance of shoreline: 25.8 miles.
2. Park or green space identified: 3 locations.
3. Identify and locate man made barriers: 5 barriers identified.
    a. Roads
    b. Railroads
    c. Levees
    d. Floodwalls
    e. Industrial complexes
4. Review airspace to conduct sUAS operations: Clear for flight.

On site: Conduct aerial and ground images to capture human scale adjacent to either barriers or direct connection to the riverfront.

Site 01: The Fly - Audubon Park.

Site 02: Port of New Orleans.

Site 03: First Street Wharf.

Site 04: Crescent Park (North Entrance).

Site 05: Crescent Park (South Entrance).

Post site:

Site 01: The Fly - Audubon Park.

Site 02: Port of New Orleans.

Site 03: First Street Wharf.

Site 04: Crescent Park (North Entrance).

Site 05: Crescent Park (South Entrance).

Disconnection to connection ratio based on linear shoreline mileage access:

- Total Linear Mileage of shoreline: 25.7
- Total Linear Mileage of riverfront access in the form of parkland space: 2.88
- Percentage of barriers present along shoreline: 89%

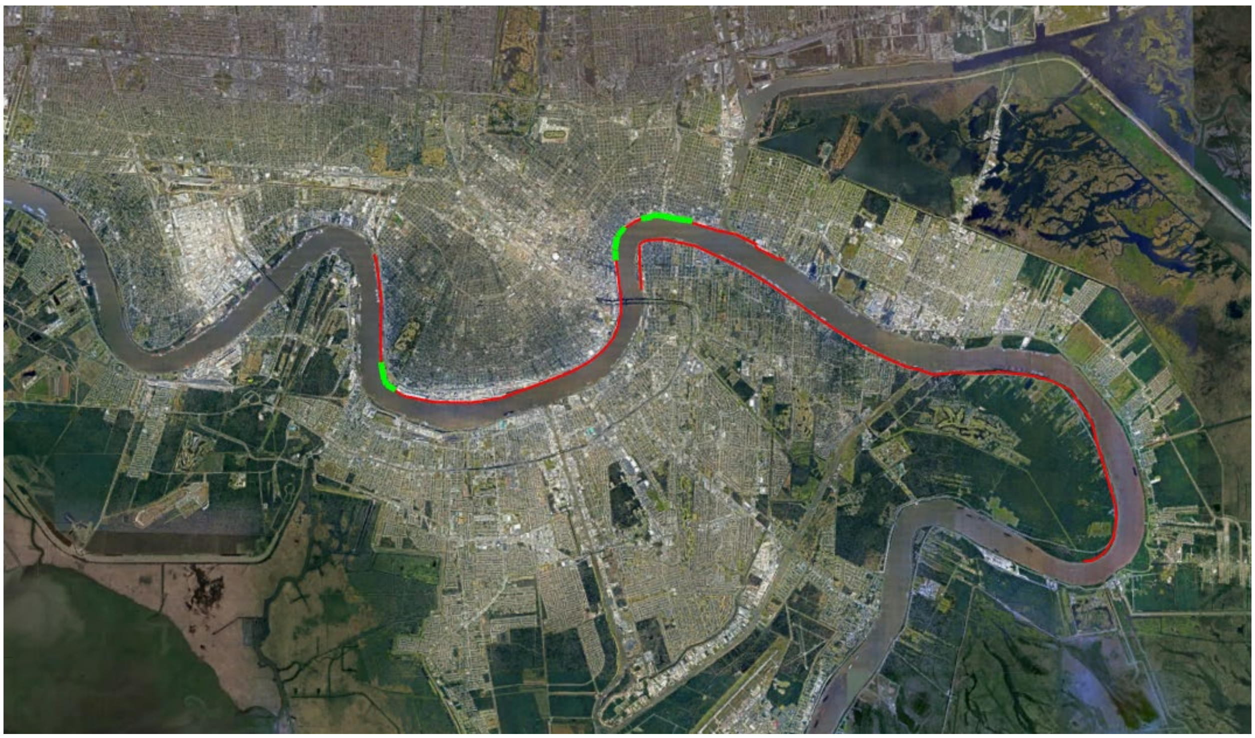

Figure 11. New Orleans, LA linear riverfront access (red) and their recreational spaces (green).

Observations or Notes: The river is so large and so violent in the amount of water that rushes that no person is allowed or will even swim in the river. No kayaks or even recreational boats are present, only large industrial towboats and their steel barges.

New Orleans, LA barriers

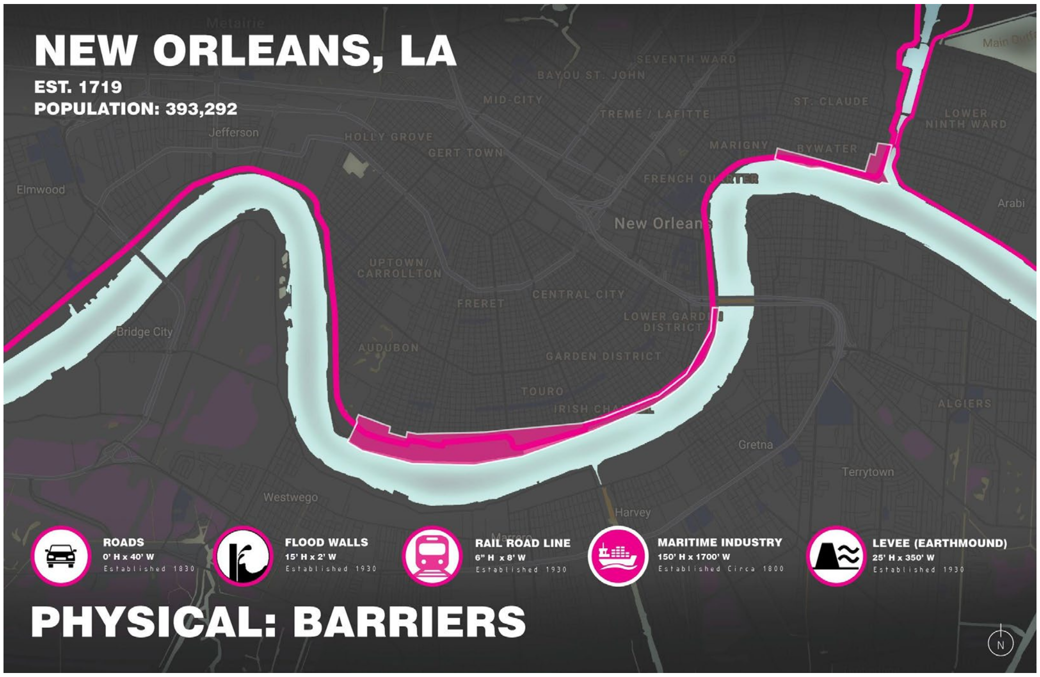

Figure 12. Map of New Orleans, LA and the barriers identified geo-spatially.

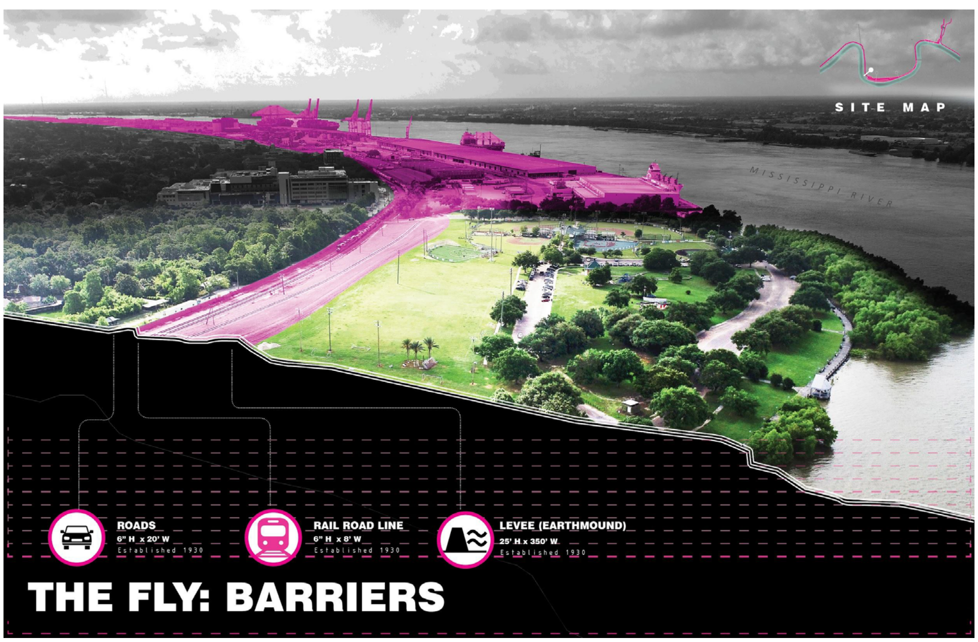

Figure 13. Aerial image of first site visit at the Fly. New Orleans, LA.

Figure 14. Aerial image at second site visit. Port of New Orleans, LA.

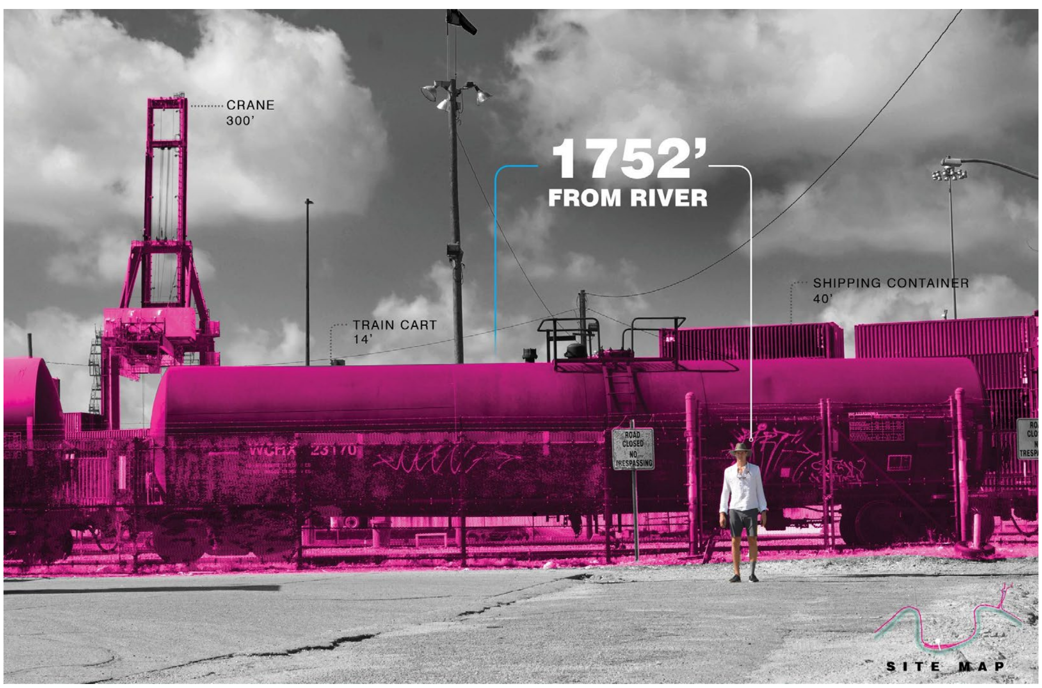

Figure 15. Ground image at second site visit. Port of New Orleans, LA.

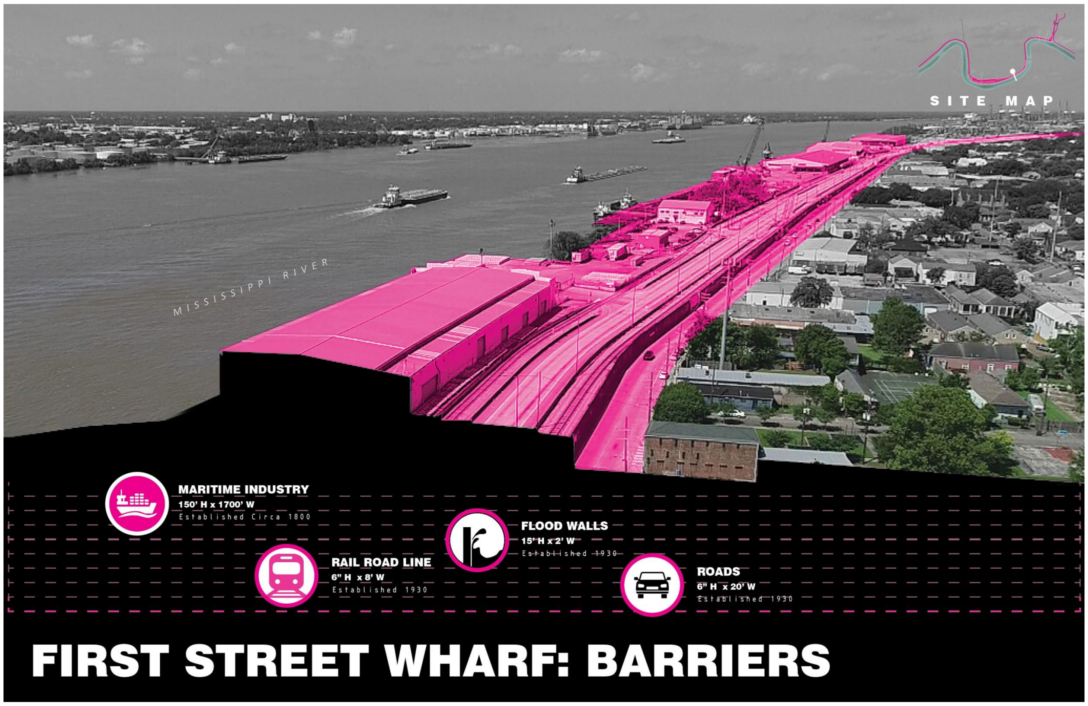

Figure 16. Aerial image at third site visit. First Street Wharf.

Figure 17. Ground image at third site visit. First Street Wharf.

Figure 18. Aerial image at fourth site visit. Crescent Park.

Figure 19. Ground image at fourth site visit. Crescent Park.

Figure 20. Aerial image at fifth site visit. Crescent Park.

Figure 21. Ground image at fifth site visit. Crescent Park.

New Orleans conclusion: It is clear upon arriving into the city of New Orleans that this city is without a doubt a port city, if not the largest I have ever experienced. Large cranes and industrial complexes fill the sky with what seems to be the entire shoreline, matched only in height by the skyscrapers of the downtown area. From my experience along the 5 sites, I was met with levees, floodwalls, railroads, and even large industrial complexes, that were filled with warehouses larger than anything I have experienced before. The little connections that this city does have to offer are large in acreage but smaller in linear distance. The average park space along the river's edge was less than one mile in length and roughly 10 acres in area. The parks along the water's edge were filled with locals and visitors alike, all amazed by the size of the river and the continuous presence of industrial complexes that line the adjacent shoreline. It is without a doubt that this city needs more connections to the riverfront, but with limited real estate due to the presence of the maritime industry and flood control systems, the city will have to be creative to offer new solutions to their citizens. The best evidence of new creative solutions came in the form of Crescent Park, a one mile long linear riverfront park on the west side of the city. This relatively new park is a great example of how a city has literally bridged the gap over these important flood walls by utilizing large steel structures to allow citizens and visitors alike to climb over and regain access to the river's edge. Once you find yourself over the flood wall and into the park space, you almost fall in love with the city again. Gazing over the Mississippi River you are met with the skyline views of the downtown area, a scene that reminds you this is in fact, a river city. Filled with new amenities and urban landscape design materials, this park space offers visitors the chance to relax and reconnect with the water. In conclusion, this historic port city suffers from a poor disconnection caused by barriers that line 89% of the shoreline, only

offering the remaining 11% or 2.88 miles of riverfront access to the public. It should be noted that these man-made barriers will not be removed anytime soon, both flood control systems and the industrial complexes help save the city from flooding events and help gross over $100 million in revenue each year from shipping goods throughout the world. These barriers are here to stay, and the city will have to find creative ways to offer small pockets of connection back to the river's edge.

02: Natchez, MS

Pre-site:

1. Linear distance of shoreline: 2.88 miles.
2. Park or green space identified: 1 location.
3. Identify and locate man made barriers: 3 barriers identified.
    a. Roads
    b. Railroads
    c. Industrial complexes
4. Review airspace to conduct sUAS operations: Clear for flight.

On site: Conduct aerial and ground images to capture human scale adjacent to either barriers or direct connection to the riverfront.

Site 01: Natchez Bluff Walking Trail.

Post site:

Site 01: Natchez Bluff Walking Trail.

Disconnection to connection ratio based on linear shoreline mileage access:

- Total Linear Mileage of shoreline: 2.88
- Total Linear Mileage of riverfront access in the form of parkland space: 0.82
- Percentage of barriers present along shoreline: 72%

Figure 22. Natchez, MS linear riverfront access (red) and their recreational spaces (green).

Observations or Notes: Natchez's position along the top of their natural bluff played a strategic role in many battles by offering views miles up and down the river. This height advantage offered a way to see oncoming threats to help ready the troops for battle. Of course, there has not been a battle since the mid-19th century, but nonetheless this bluff is breathtaking.

Figure 23. Aerial image of Natchez, MS riverfront.

Figure 24. Ground image of Natchez, MS riverfront. Blocked off due to flooding.

Natchez, MS Conclusion: An historic town located on the top of a natural bluff, this was a unique experience for me for I have never seen the Mississippi River from this height advantage. Upon arriving at the Natchez Bluff Walking Trail, you are immediately met with a view that stretches for miles both up and down the river, reminding you of the scale of the Mississippi River and all its glory. This small stretch of land or park space that sits on top of the bluff is rather underwhelming. Park benches are falling apart and the only chance to catch some relief from the summer sun came in the form of shade from large oak trees that lined the parking lot. In order to engage with the river's edge, one would have to walk down the bluff's road, a 22% slope, making it very difficult to achieve if you have any disabilities or issue with heavily sloped terrain. Shuttles were available to help assist visitors and locals down the slope. In conclusion, the park may be lacking the big city amenities, but their little town charm and views of the river make it a pleasant experience and a unique perspective. Although the bluff may hinder your ability to reconnect with the water's edge directly, the space offers visible connection well beyond what I have experienced. With 2.88 miles of linear shoreline along the river and only 0.82 linear miles of riverfront access in the form of a boat landing and a casino, this small town along the river offers 28 percent connection percentage to their water's edge. It should be noted that although the bluff elevation and issue of slope do play a role in hindering citizens or visitors from connecting with the water, this issue did not make the list of barriers for it was not man-made.

03:Memphis, TN

Pre-site:

1. Linear distance of shoreline: 30.5 miles.
2. Park or green space identified: 5 locations.
3. Identify and locate man made barriers: 4 barriers identified.
    a. Roads
    b. Railroads
    c. Levees
    d. Industrial complexes
4. Review airspace to conduct sUAS operations: Clear for flight.

On site: Conduct aerial and ground images to capture human scale adjacent to either barriers or direct connection to the riverfront.

Site 01: Tom Lee Park (south end).

Site 02: Tom Lee Park (north end).

Site 03: Beale Street Landing.

Site 04: Cobblestone Landing.

Site 05: Mississippi River Park.

Post site Analysis:

Site 01: Tom Lee Park (south end).

Site 02: Tom Lee Park (north end).

Site 03: Beale Street Landing.

Site 04: Cobblestone Landing.

Site 05: Mississippi River Park.

Disconnection to connection linear shoreline mileage calculations:

- Total Linear Mileage of shoreline: 30.5
- Total Linear Mileage of riverfront access in the form of parkland space: 16.21
- Percentage of barriers present along shoreline: 47%

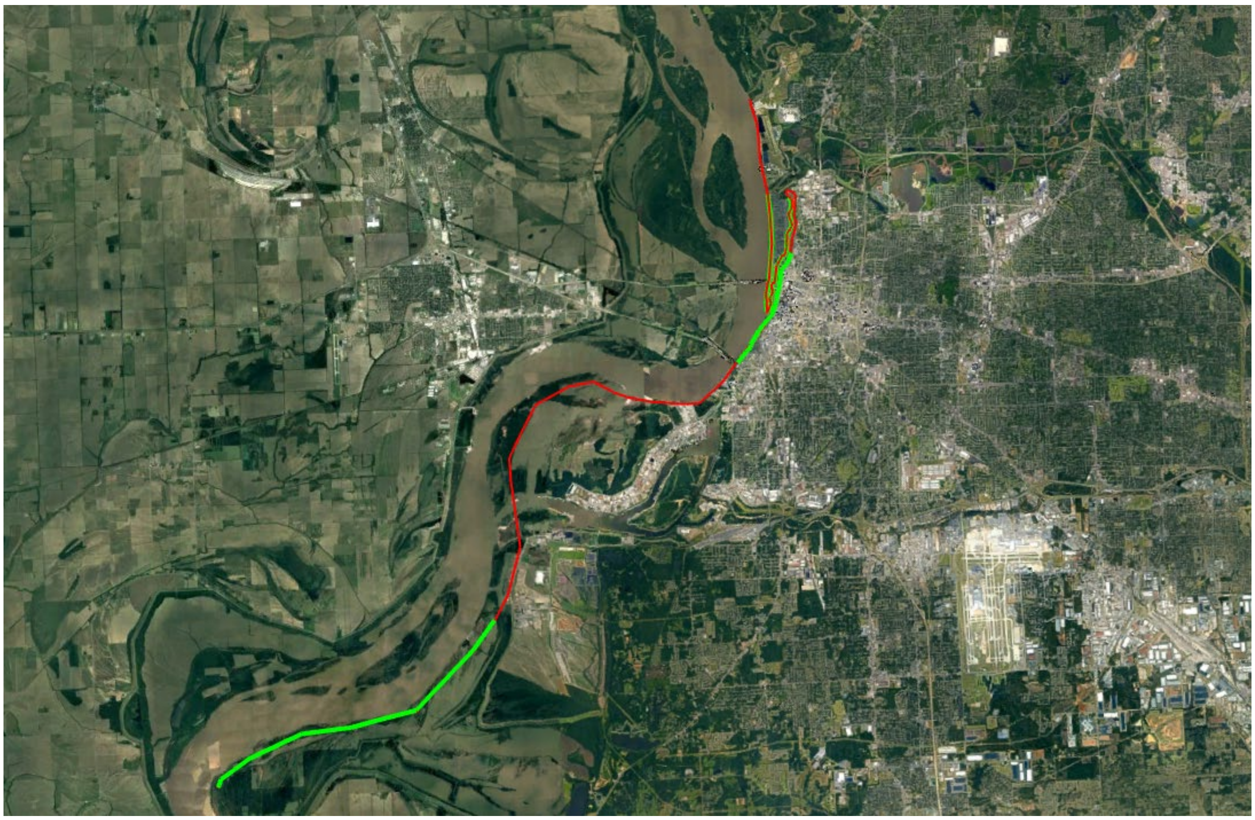

Figure 25. Memphis, TN linear riverfront access (red) and their recreational spaces (green).

Observations or Notes: Again, we are met with another natural bluff along the river and without a doubt the reason for its exact establishment on the river. This bluff is roughly half the scale of the bluff experienced in Natchez, MS but nonetheless, most of the city will not have to worry about the river flooding their property.

Figure 26. Aerial image of Memphis, TN riverfront. Tom Lee Park below natural bluff.

Figure 27. Aerial image of Memphis, TN riverfront. Beale Street Landing below natural bluff.

Figure 28. Aerial image of Memphis, TN riverfront. Cobblestone Landing.

Figure 29. Aerial image of Memphis, TN riverfront. Mississippi River Park.

Conclusion: Upon arriving in Memphis, TN it was clear that this city loves its river and their connection to this asset is evident in the long linear waterfront developments that stretch miles down the shoreline. Starting in the southern portion of the city, you are met with a large open grass park called Tom Lee Park. Roughly 15 acres in size, this space offers open lawns, boardwalk style paths, and large building structures with restrooms and amenities. Although this park space is lacking some of the more modern amenities, you don't have to wait long to find them at Beale's Street Landing just half a mile up the river. An exciting side note is Tom Lee Park will undergo a $55 million renovation over the next 3 years to include more modern amenities and open programmed spaces for the citizens. As we begin to travel north along the linear riverfront park, you are met with state-of-the-art designed spaces, a similar setting to spaces that can be found in larger cities like Boston or New York City. Beale Street Landing is the city's main connection for cruise ships or steamboat tours to connect with the land and allow visitors to gain access to the shoreline. It is in this zone that we find the best programmed spaces, which is understandable given the nature to impress visitors who enter the city from the cruise ships. Moving further north, just another half mile, you are met with a narrow squeeze of programmed park space, known as Cobblestone Landing. After running through the narrow walking path along Cobblestone Landing, you come out to yet another state-of-the-art park system. Filled with modern tree houses for the kids to enjoy and little pop up coffee shops that seem to almost compliment the native meadow program that surrounds the site. At this time in the space, it should be noted that the main downtown central business district sits just behind me, just on top of the natural bluff. In conclusion, this city may sit on top of a natural bluff, but the people have taken claim to the river at the bottom of it. With new park developments just

wrapping up and more in the pipeline, this city is without a doubt in love with the river and will do everything they can to ensure the connection only grows. With only 47% of the riverfront denied access due to barriers, this city has one of the best connections thus far and citizens can feel this connection as they flocked to the parks every night to catch a summer sunset.

04: Cape Girardeau, MO

Pre-site:

1. Linear distance of shoreline: 5.94 miles.
2. Park or green space identified: 1 location.
3. Identify and locate man made barriers: 4 barriers identified.
    a. Roads
    b. Railroads
    c. Levees
    d. Industrial complexes

4. Review airspace to conduct sUAS operations: Clear for flight.

On site: Conduct aerial and ground images to capture human scale adjacent to either barriers or direct connection to the riverfront.

Site 01: Cape Girardeau River Tales Murals.

Post site Analysis:

Site 01: Cape Girardeau River Tales Murals.

Disconnection to connection linear shoreline mileage calculations:

- Total Linear Mileage of shoreline: 5.94
- Total Linear Mileage of riverfront access in the form of parkland space: 0.67
- Percentage of barriers present along shoreline: 89%

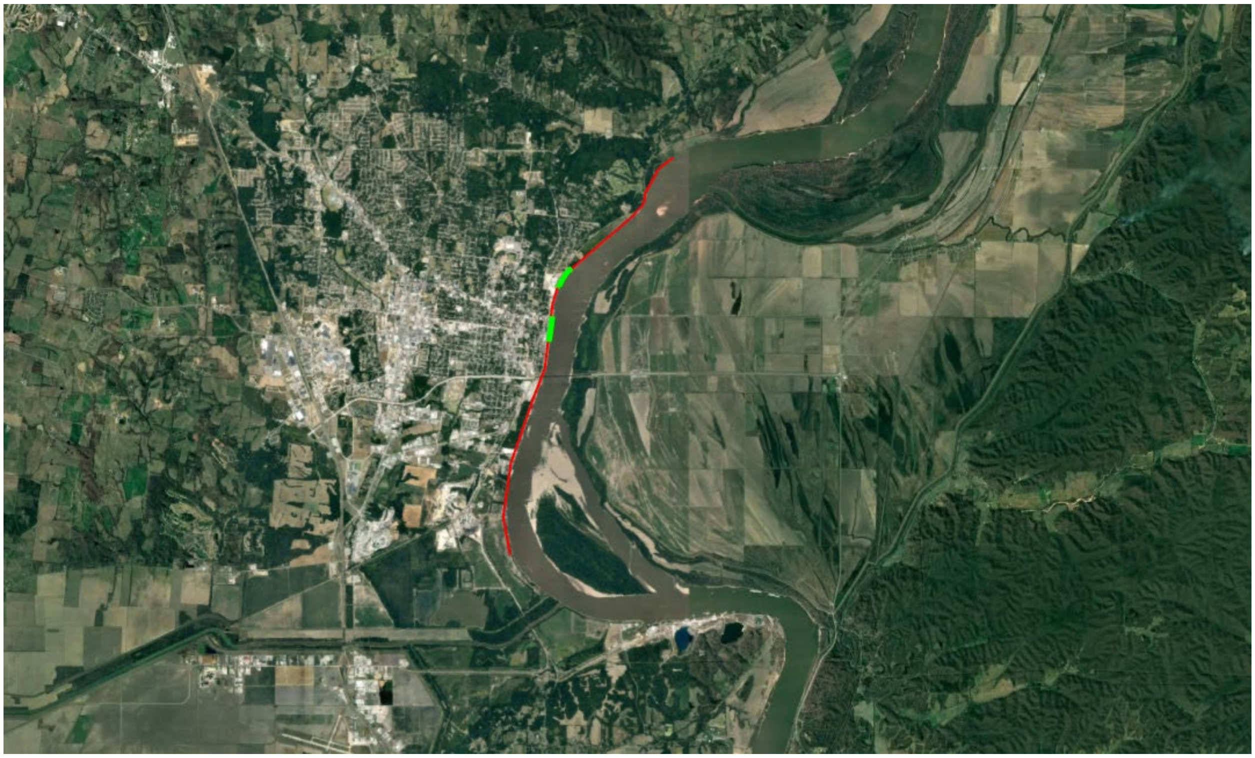

Figure 30. Cape Girardeau, MO linear riverfront access (red) and their recreational spaces (green).

Observations or Notes: Although small, this little town is filled with big hearts. While during my routine coffee shop visits to gain internet access, a few locals overheard my conversation about my journey and asked if they could help in any way. After engaging in the opportunity, they walked me around the town, introducing me to key players in the government. After the grand tour I was asked to join them for a dinner party and of course, I accepted because where I am from, you don't turn down a dinner party.

Figure 31. Aerial image of Cape Girardeau, MO. Downtown with floodwall.

Figure 32. Ground image of Cape Girardeau, MO. Human scale next to floodwall.

Conclusion: Cape Girardeau, MO is a small town along the Mississippi, but don't let that fool you. This small town has plenty of exciting things to offer visitors and locals, but the one thing they suffer from is a large barrier that separates them from the Mississippi River. Since the Great Mississippi Flood of 1927, A flood wall has been necessary to contain the seasonal flooding of the Mississippi River. Taking several months for the river to fully reach its flood stage, this city is often closed off from any access with the river around the end of winter. Although this is not the tallest structure or barrier that I have come across so far, it certainly has a different feeling to its facade. With no way to connect or even document the river, I was forced to gather as much evidence or interviews as I could to gain insight on just how the citizens interact with the water's edge. After speaking with some great locals in a small coffee shop, it became apparent that this is just the way of life in this small town that sits alongside one of the world's largest rivers. Accepting it for what it is, this town has done its best to find ways to remember the river and the history that sits behind this cumbersome wall. Along the 15-foot-tall barrier that stretches over 1000 feet, you will find art installations offering a timeline of events to the city's history with the water and important figures that have come out of this small town. Trying to find alternative ways to visually reconnect with the river, I searched for potential public rooftop access around the local businesses. Unfortunately, no such development existed. Potentially this is a strategy that Cape Girardeau, MO could utilize to help citizens regain visual connection with the water's edge when the flood gates become sealed off for most of the year. In conclusion, this small town was filled with numerous happy people even though they were far from connected to the water that helped build their landscape, an odd paradigm sense we know that water proximity and connection play a role in overall happiness and better health outcomes.

It is my opinion that they need to find alternative ways to allow citizens or visitors to re-engage with the water during the times that the floodwalls are closed off. It should be noted that even if the flood walls are open, this barrier still stands in the way of seeing the water. The view of the water is only regained if you were to transverse through the floodgate.

05: Saint Louis, MO

Pre-site:

1. Linear distance of shoreline: 19.2 miles.
2. Park or green space identified: 2 locations.
3. Identify and locate man made barriers: 4 barriers identified.
    a. Roads
    b. Railroads
    c. Levees
    d. Industrial complexes
4. Review airspace to conduct sUAS operations: Not clear for flight.

On site: Conduct ground images to capture human scale adjacent to either barriers or direct connection to the riverfront.

Site 01: J&D Streett Company Industrial Site.

Site 02: 1st Street and Sydney Street.

Site 03: Gateway Arch National Park.

Site 04: Cotton Belt Freight Depot.

Post site Analysis:

Site 01: J&D Streett Company Industrial Site.

Site 02: 1st Street and Sydney Street.

Site 03: Gateway Arch National Park.

Site 04: Cotton Belt Freight Depot.

Disconnection to connection linear shoreline mileage calculations:

● Total linear mileage of riverfront access in the municipal boundaries: 19.2

● Total linear mileage of riverfront access in the form of parkland space: 2.30

● Percentage of barriers present along shoreline: 88%

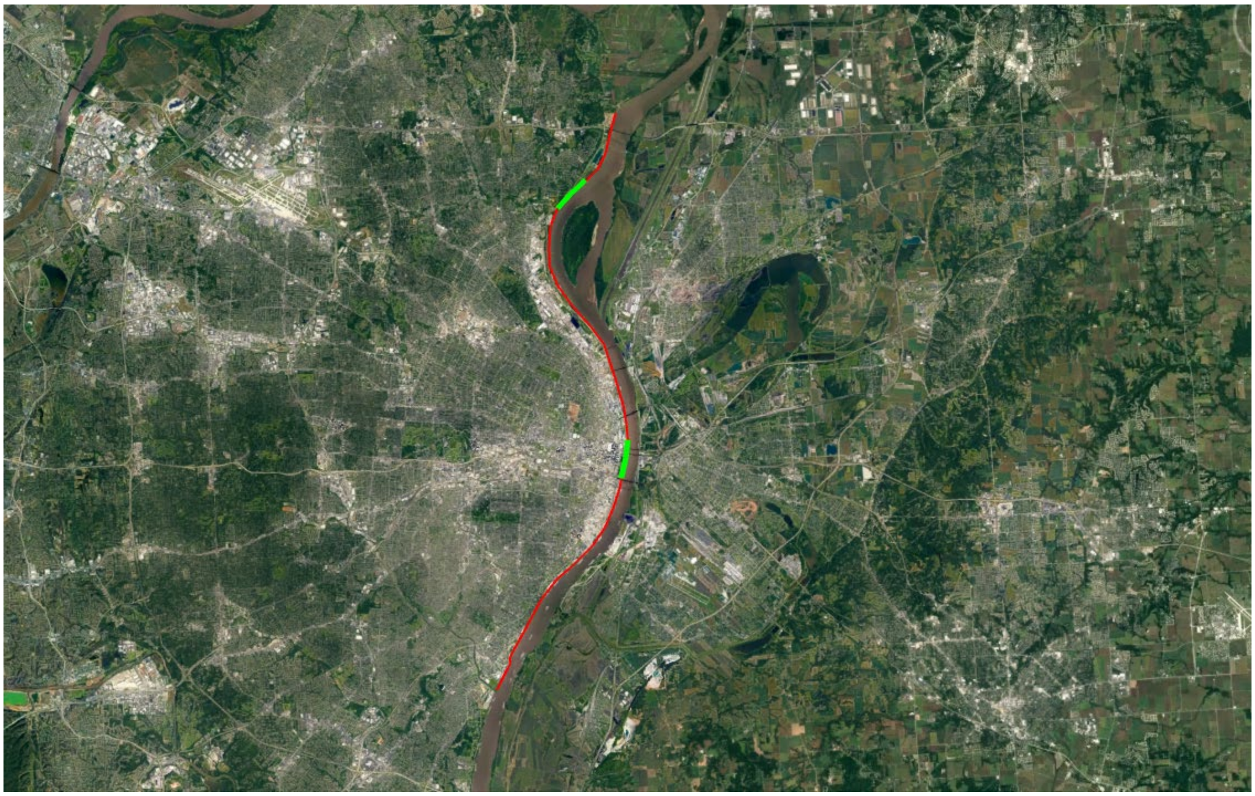

Figure 33. St. Louis, MO linear riverfront access (red) and their recreational spaces (green).

Observations or Notes: I have never seen more clay bricks in my life. Building after building seemed to be constructed with what has to be the most abundant source in the local area. Although I was shocked to see the brick, I will say that it is far more pleasant than any other gray

concrete building that can be found in the southern states along the river. With ample amounts of river sand, concrete is very affordable down here, making it a great candidate for construction.

Figure 34. Ground image at site one, J&D Streett Company Industrial Site in Saint Louis, MO.

Figure 35. Ground image at site two, 1st Street and Sydney Street in Saint Louis, MO.

Figure 36. Ground image at site three, Gateway Arch National Park in Saint Louis, MO.

Figure 37. Aerial image at site four, Cotton Belt Freight Depot in Saint Louis, MO.

Conclusion: Saint Louis, MO is a city that completely shocked me upon arrival. It almost felt as if New Orleans, LA was moved up river and placed in the midwest. The presence of industrial complexes lining the river's edge was almost identical to that of New Orleans, LA, if not greater. Whether it was railroad lines, flood walls, or massive warehouses, I could not seem to find any access to the river as I traveled to my 4 sites. Becoming discouraged, I continued my research onto the 3rd site, GateWay Arch National Park, a 17-acre site that seems to literally poke through the barriers that line the river's edge. Upon arriving at the site, I was immediately relieved to feel the cool air rushing off the water, a feeling of 10-15 degrees cooler than the downtown urbanscape that I had weaved through to find this park. The park was stunning, filled with modern amenities and materials everywhere. Open green space that seemed to almost allow the mind to forget the issues of disconnection or the overwhelming amount of clay bricks that build

the city's skyline. After enjoying my time in the park, gathering data and collecting notes, it was time to visit the remaining site. It should be noted that during my three days in the city, I revisited the national park three times. Not enough time to take in its grandeur and impressive list of amenities, but enough time to admire the 300-foot steel sculpture-like building called the Arch, placed along the river's edge in 1960. The 4th site, Cotton Belt Freight Depot, was again something of a contradiction. It is completely disconnected from the river's edge and abandoned, but possessed the largest mural that I have ever seen, stretching over 60 feet tall and 300 feet long. This colorful mural lined the adaboned factory, offering travelers along the perpendicular bridges a ray of hope for the city and their run-down spaces. In conclusion, this city has a similar vernacular to that of New Orleans, LA, filled with evidence to suggest this port city values their commerce more than their connection to the water for recreational purposes. With 88% of the water's edge filled with barriers, this city must soon revisit any potential land opportunities to offer methods and spaces to re-engage citizens back to the river's edge. It is from my observations that the city should seriously study the cost benefits for revitalizing Cotton Belt Freight Depot.

06: Hannibal, MO

Pre-site:

1. Linear distance of shoreline: 4.61 miles.
2. Park or green space identified: 1 location.
3. Identify and locate man made barriers: 4 barriers identified.
    a. Roads
    b. Railroads
    c. Levees
    d. Industrial complexes
4. Review airspace to conduct sUAS operations: clear for flight.

On site: Conduct aerial and ground images to capture human scale adjacent to either barriers or direct connection to the riverfront.

Site 01: Nipper's Park.

Post site Analysis:

Site 01: Nipper's Park.

Disconnection to connection linear shoreline mileage calculations:

- Total Linear Mileage of shoreline: 4.61
- Total Linear Mileage of riverfront access in the form of parkland space: 0.37
- *Access to one of the park spaces may be closed due to seasonal flooding.
- Percentage of barriers present along the shoreline: 92%

Figure 38. Hannibal, MO linear riverfront access (red) and their recreational spaces (green).

Figure 39. Aerial image of floodwall and the Mississippi River in Hannibal, MO.

Figure 40. Aerial image of floodwall and levee park on the Mississippi River in Hannibal, MO.

Conclusion: Hannibal, MO sits a few miles north of Saint Louis, MO. After a 45 minute drive, I arrived in the town and easily found my way down to the river's edge. Upon arriving at the site, I was met with another flood wall. This one reached only 12 feet tall, but it appeared to be under construction at the time. An alarming fact to see, especially considering a small amount of water that was leaking from the bottom of the wall into a nearby storm drain. In further inspection, the construction materials were being used to increase the flood wall's height, allowing for sand bags to be filled in the gap, thus increasing the height of the wall. This of course was done to keep any potential rising water from entering the city during the nation's longest flood stage along the Mississippi River. After witnessing locals roam the area, I deemed it was safe to investigate the levees that surrounded the wall. After climbing to the top of the levee, I found a small quarter acre park on top, filled with plenty of seating and small flower gardens. This was a

clear sign that flooding occurs enough to build a park space to regain access with the river when the floodgates are closed, this is both a physical and a visual connection. Gaining access to the small park, I was able to finally see over the barrier where it was clear that the river had taken over their entire riverfront parks. The water was extremely high, the only evidence of a park came in the form of playground equipment and shade structures poking out from the water, indicating a connection to the water. I later learned from locals that were there to investigate the water's height that the floodwall was placed there after the 1993 flood that caused millions of dollars in damage to the city. It was at this time that I also learned that the small park that was currently under water was soon to be renovated to better accommodate the increase of steam boat cruises that usually dock during the spring and summer months. In conclusion, this small town seems to understand what it means to live with the seasonal floods and embraces the closure of the walls with evidence of offering connections during this time with parks that line the levees that hold back the water's edge. With only 8% of its linear mileage dedicated to park space, the city must do everything they can to offer temporary moments of connection when seasonal flooding threatens their city and causes the flood gates to become closed.

07: Quincy, IL

Pre-site:

1. Linear distance of shoreline: 4.93miles.
2. Park or green space identified: 1 location.
3. Identify and locate man made barriers: 3 barriers identified.
    a. Roads
    b. Railroads
    c. Industrial complexes
4. Review airspace to conduct sUAS operations: clear for flight.

On site: Conduct aerial and ground images to capture human scale adjacent to either barriers or direct connection to the riverfront.

Site 01: Edgewater Park.

Post site Analysis:

Site 01: Edgewater Park.

Disconnection to connection linear shoreline mileage calculations:

- Total Linear Mileage of shoreline: 4.93
- Total Linear Mileage of riverfront access in the form of parkland space: 3.0
- Percentage of barriers present along the city's shoreline total linear mileage: 40%

Observations or Notes: Another small town filled with industrial complexes, but something was different about their placement, they were placed further back from the water's edge and up the embankment of the city, offering a pleasant surprise.

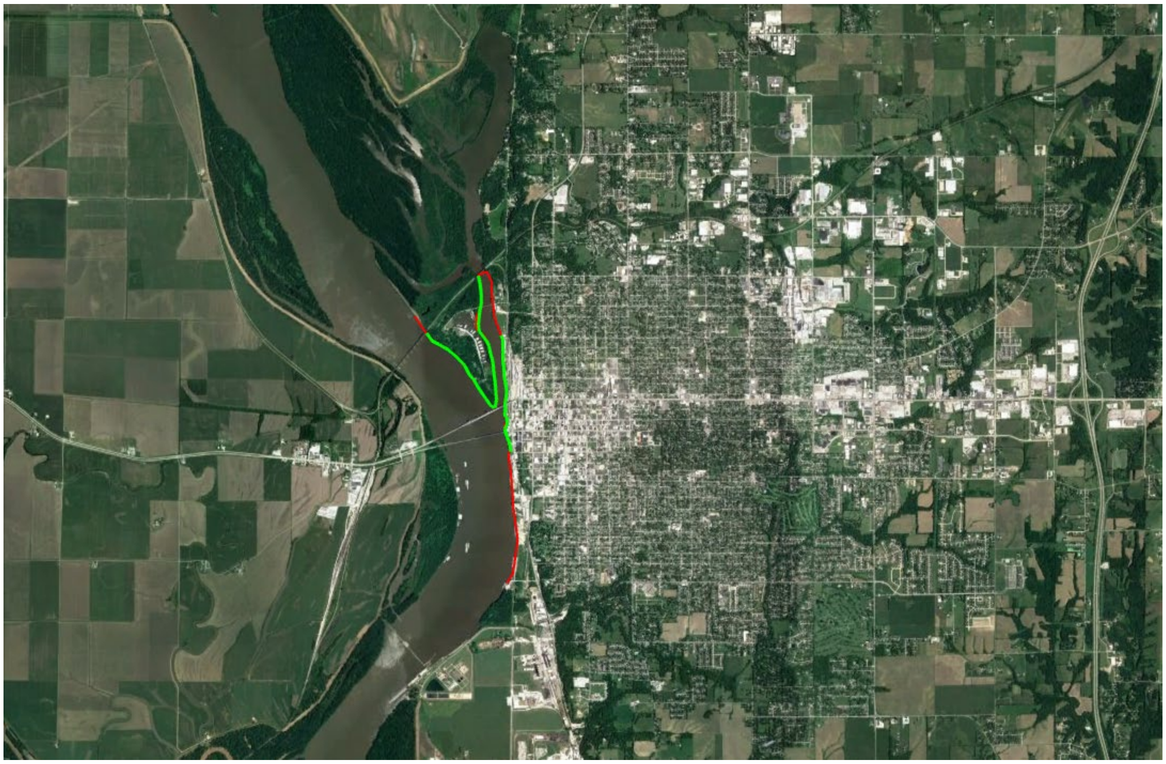

Figure 41. Quincy, IL linear riverfront access (red) and their recreational spaces (green).

Figure 42. Aerial image of riverpark on the Mississippi River in Quincy, IL.

Conclusion: Upon arriving in the small town of Quincy, IL, accessing the water’s edge was not difficult. Met with only a few barriers, my site visit to Edgewater Park allowed for a clear and rather pleasant experience along the river. Although, the access was easy and at the time the weather was very enjoyable, the one observation that stuck out was the lack of citizens or locals utilizing the space. The park space was lined with small mom-and-pop shops, shaded structures, and plenty of seats to just take in the beautiful sunset that was occurring during this documentation. I cannot cast a judgement as to why there was a lack of visitors to the site on such a beautiful day. With clear evidence of man-made barriers, such as industrial complexes, this small town has done an incredible job to offer an immense amount of riverfront property back to the citizens. With only 40% of the total riverfront shoreline filled with barriers, this small town knows the importance of directly connecting with the water’s edge.

08: Davenport, IA

Pre-site:

1. Linear distance of shoreline: 9.31 miles.
2. Park or green space identified: 1 location.
3. Identify and locate man made barriers: 3 barriers identified.
    a. Roads
    b. Railroads
    c. Industrial complexes
4. Review airspace to conduct sUAS operations: clear for flight.

On site: Conduct aerial and ground images to capture human scale adjacent to either barriers or direct connection to the riverfront.

Site 01: LeClaire Park and Bandshell.

Post site Analysis:

Site 01: LeClaire Park and Bandshell.

Disconnection to connection linear shoreline mileage calculations:

- Total Linear Mileage of shoreline: 9.31
- Total Linear Mileage of riverfront access in the form of parkland space: 7.47
- Percentage of barriers present along the city’s shoreline total linear mileage: 20%

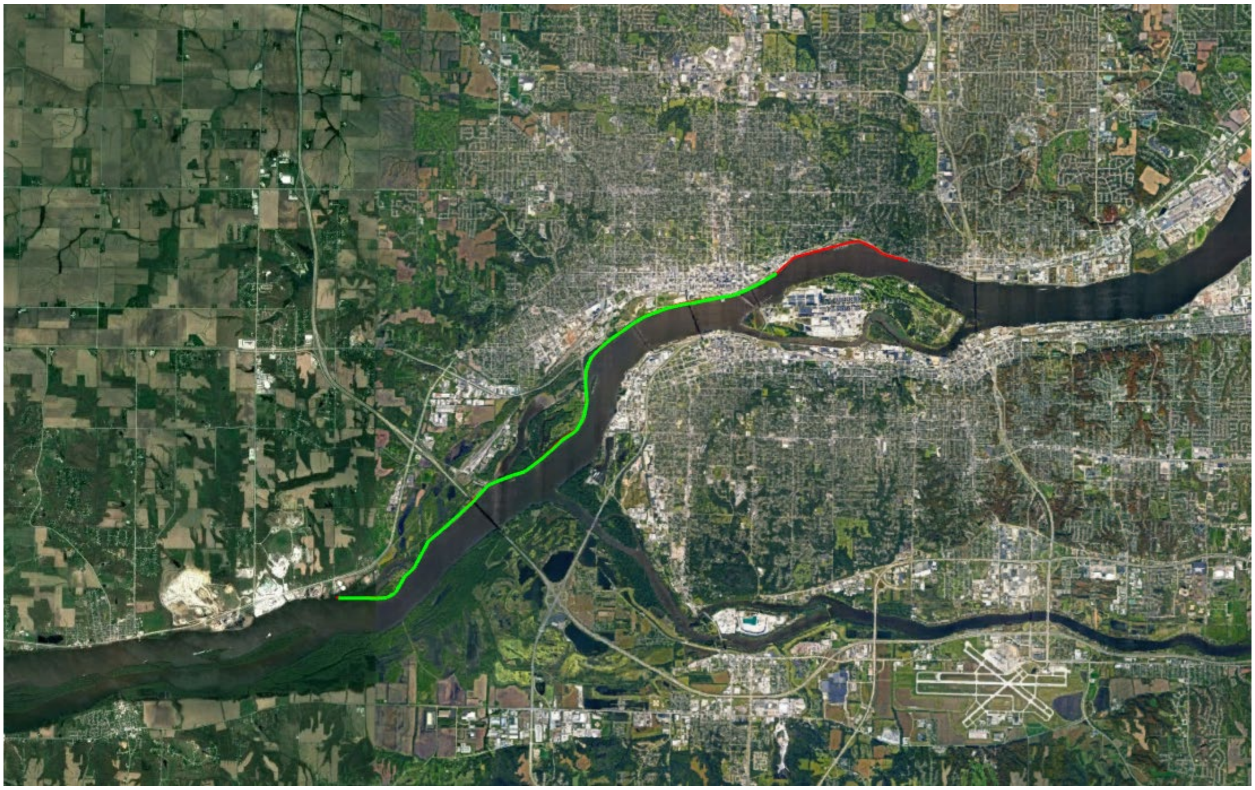

Figure 43. Davenport, IA linear riverfront access (red) and their recreational spaces (green).

Observations or Notes: Although I did not define water as a barrier, a reason because it is not man-made, this city showed evidence of a recent flood with road closures, sand bags lining near buildings, and water marks on many structures along the river's edge.

Figure 44. Ground image of road closure signage along Davenport, IA riverfront park.

Figure 45. Aerial image of flooded riverfront park in Davenport, IA.

Conclusion: My site visit to Davenport, IA was without a doubt the most unique in the sense that this city offers an extensive waterfront park, stretching over 3 miles long and filled with open green spaces, museums, and even baseball stadiums and amusement parks. But none of these were accessible to study or even approach due the river becoming a barrier for the first time in this study, caused by extreme seasonal flooding. Upon arriving, it was clear that the water had just resided from the waterfront. Evidence of this came in the form of river silt or mud that seemed to line the entire space. I was unable to get closer to the site due to road closures and my knowledge of the difficulty maneuvering through river silt or mud on foot. Taking advantage of the sUAS, I was able to fly the entire site and capture evidence of the extensive damage that occurred. Water marks reached over 6 feet on structures and sand bags were being used over 1500 feet back from where I stood, indicative of how far the water caused issues to the citizens. It was not until my post-site analysis that I learned just how much riverfront space this city has to offer. With over 80% of its shoreline dedicated to the river's edge, this city of 100,000 has an incredible connection to the Mississippi River. But with continuous seasonal flooding threatening the city, the need for flood control systems are a must and will soon line the edge of the river and potentially cause a barrier for the citizens and their water's edge. I hope the city studies how other cities have utilized creative solutions to still engage citizens with the river while providing safe flood control systems.

08: LaCrosse, WI

Pre-site:

1. Linear distance of shoreline: 15.35 miles.
2. Park or green space identified: 1 location.
3. Identify and locate man made barriers: 3 barriers identified.
    a. Roads
    b. Railroads
    c. Industrial complexes
4. Review airspace to conduct sUAS operations: clear for flight.

On site: Conduct aerial and ground images to capture human scale adjacent to either barriers or direct connection to the riverfront.

Site 01: Cross streets and Division Street.

Site 02: Jay Street Pier.

Site 03: Riverside Park.

Post site Analysis:

Site 01: Cross streets and Division Street.

Site 02: Jay Street Pier.

Site 03: Riverside Park.

Disconnection to connection linear shoreline mileage calculations:

- Total Linear Mileage of shoreline: 15.35
- Total Linear Mileage of riverfront access in the form of parkland space: 13.13
- Percentage of barriers present along the city's shoreline total linear mileage: 15%

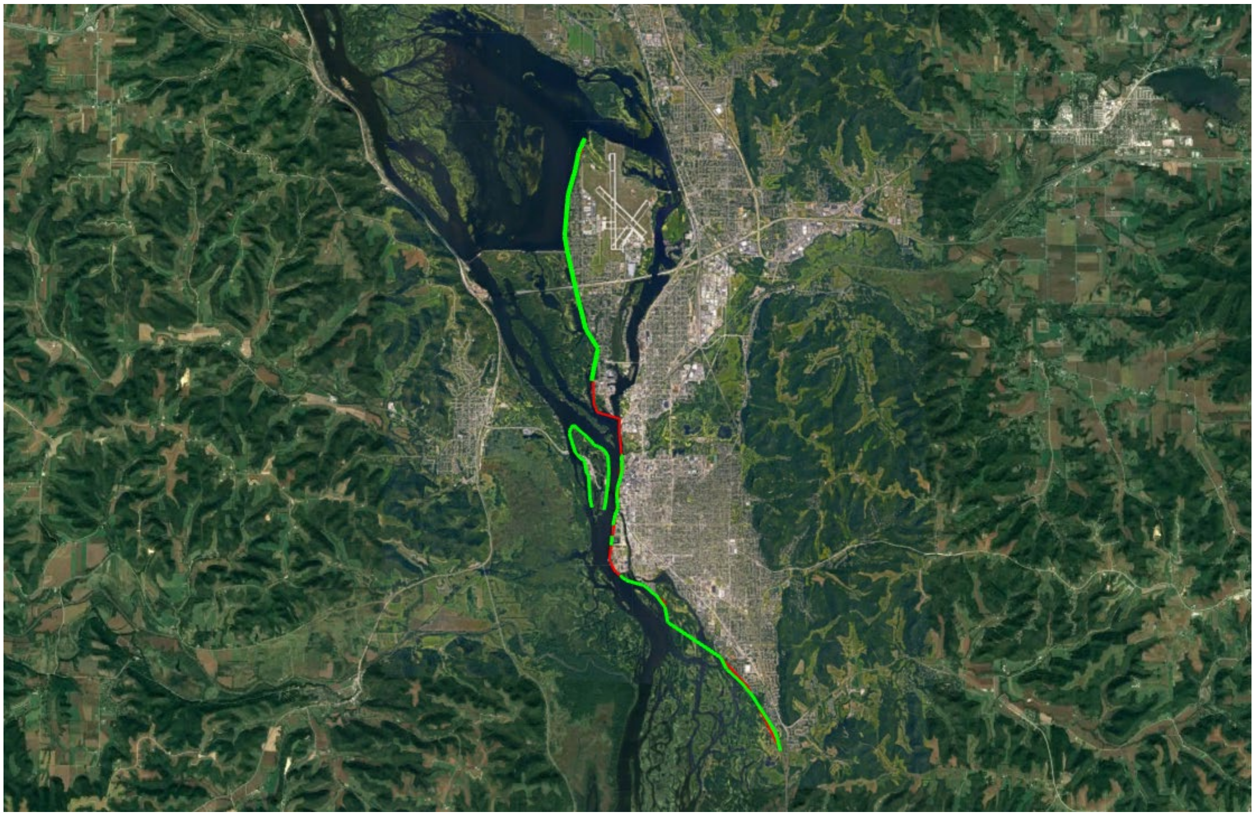

Figure 46. La Crosse, WI linear riverfront access (red) and their recreational spaces (green).

Observations or Notes: This was the first time I began to see small recreational boats line the edge of the river, an observation that sets the scale of the river and how safe it may be for people to interact with it.

Figure 47. Aerial image of La Crosse, WI riverfront park.

Figure 48. Ground image of La Crosse, WI riverfront park with human scale.

Conclusion: Although the percentage of barriers along the shoreline is low in this small city, it should be noted that a majority of these linear miles are in fact residential homes that line the river's edge. This was not discussed as a barrier for they offer individuals a connection to the water's edge, where other barriers have a clear, hard line that disconnects all citizens from accessing the shoreline. While most of the city center has a strong connection to the water's edge, either through walking trails or compact riverfront parks, the city has the presence of industrial complexes that line the water's edge of the river. During my visit, a small, riverfront festival was underway which brought large crowds around 20,000 or more to the riverfront parks. The music, street food, and activities for the children were sufficient evidence that the city embraces the space along water's edge. Even though the city suffers from various forms of disconnection, the park spaces that sit along the river's edge are quite scenic. Filled with modern amenities, impressive museums, and gardens, this small town certainly understands the importance of their riverfront connection and works hard to keep up the spaces that they do have to offer.

10: Dubuque, IA

Pre-site:

1. Linear distance of shoreline: 7.75 miles
2. Park or green space identified: 1 location
3. Identify and locate man made barriers: 3 barriers identified.
    d. Roads
    e. Railroads
    f. Industrial complexes

4. Review airspace to conduct sUAS operations: clear for flight.

On site: Conduct aerial and ground images to capture human scale adjacent to either barriers or direct connection to the riverfront.

Site 01: Miller Riverview Park.

Site 02: River's Edge Plaza.

Site 03: Dubuque Shot Tower.

Post site Analysis:

Site 01: Miller Riverview Park.

Site 02: River's Edge Plaza.

Site 03: Dubuque Shot Tower.

Disconnection to connection linear shoreline mileage calculations:

- Total Linear Mileage of shoreline: 7.75
- Total Linear Mileage of riverfront access in the form of parkland space: 2.0
- Percentage of barriers present along the city's shoreline total linear mileage: 75%

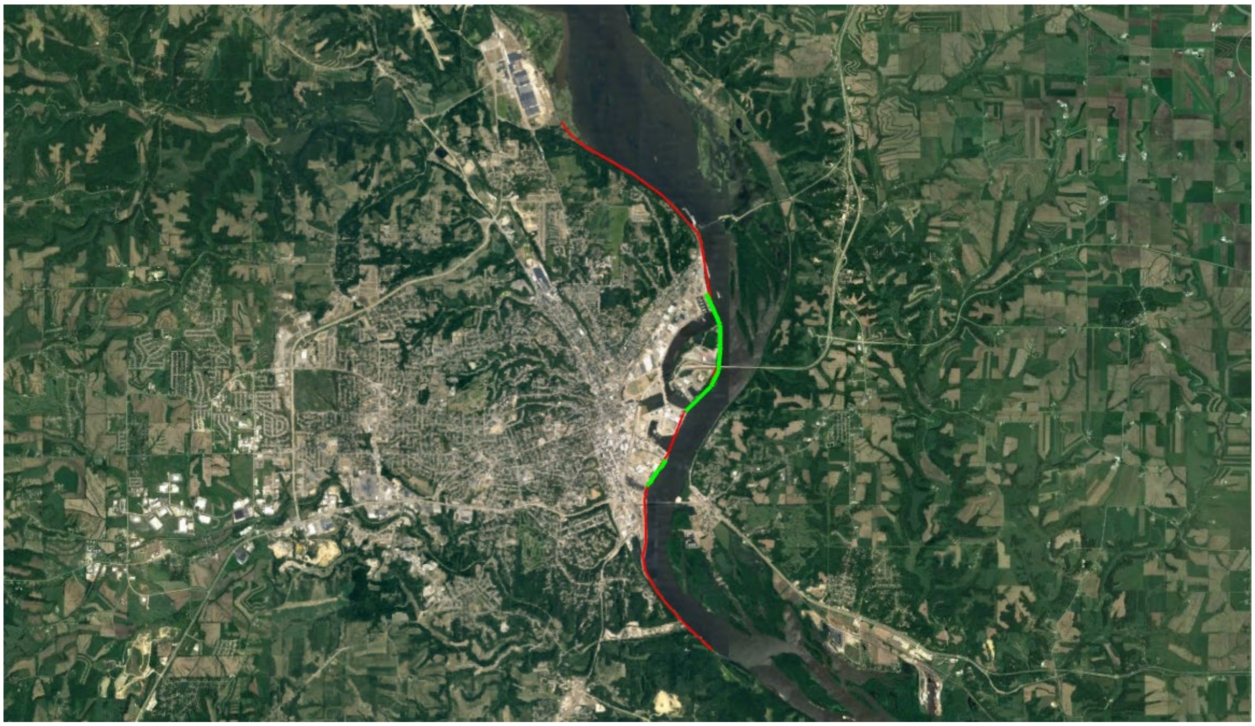

Figure 49. Dubuque, IA linear riverfront access (red) and their recreational spaces (green).

Observations or Notes: Although we will be discussing the river's edge and the city's relationship to this space, it should be noted that the city of Dubuque highly respects and values the use of public art installations. With over 40 large public murals from world-renowned artists, this downtown space is quite pleasant to stroll through.

Figure 50. Aerial image of Dubuque, IA riverfront park.

Figure 51. Aerial image of Dubuque, IA riverfront industrial complexes.

Conclusion: This small city in Iowa is a rare mix of industrial ports and historical museums. Although the city has 85% of its shoreline dedicated to industrial complexes, there is strong

programming along the river's edge to offer citizens plenty of space to reconnect to the Mississippi River. Upon visiting the sites, I am still filled with mixed emotions on how to rate this city's connection to the river. On one hand, I am constantly reminded of the industrial presence filled by warehouses and shipping ports around almost every corner. On the other hand, I am filled with a sense of pride to the river from the presence of the National Mississippi River Museum and many parks along the water's edge. This town may seem gray from the numerous industrial complexes that line the water's edge, but they have masked this issue with new brighter colors that line throughout the downtown murals from international artists. This collection of public art is beyond impressive. An accomplishment that I know did not happen overnight and probably was met with many obstacles. Nonetheless, this was most likely a tactic to combat the overwhelming sense of brick and dust that lingered from the port industrial complexes.Along with the public art, the Mississippi River Museum was an incredible wealth of knowledge to the vast history that lies within the river. This small town has done an incredible job to try and rebalance the scale caused by the placement of man-made barriers along the shoreline.With bright colors that fill the public walls, to smaller open parks that line the water's edge, this town is working with the current barriers to offer the citizens a better connection to the water's edge.

11: Winona, MN

Pre-site:

1. Linear distance of shoreline: 7.74 miles.
2. Park or green space identified: 3 locations.
3. Identify and locate man made barriers: 4 barriers identified.
    d. Roads
    e. Railroads
    f. Levees
    g. Industrial complexes

4. Review airspace to conduct sUAS operations: clear for flight.

On site: Conduct aerial and ground images to capture human scale adjacent to either barriers or direct connection to the riverfront.

Site 01: Levee Park.

Site 02: Ace Hardware on Riverview Drive.

Post site Analysis:

Site 01: Levee Park.

Site 02: Ace Hardware on Riverview Drive.

Disconnection to connection linear shoreline mileage calculations:

- Total Linear Mileage of shoreline: 7.74
- Total Linear Mileage of riverfront access in the form of parkland space: 4.46
- Percentage of barriers present along the city's shoreline total linear mileage: 43%

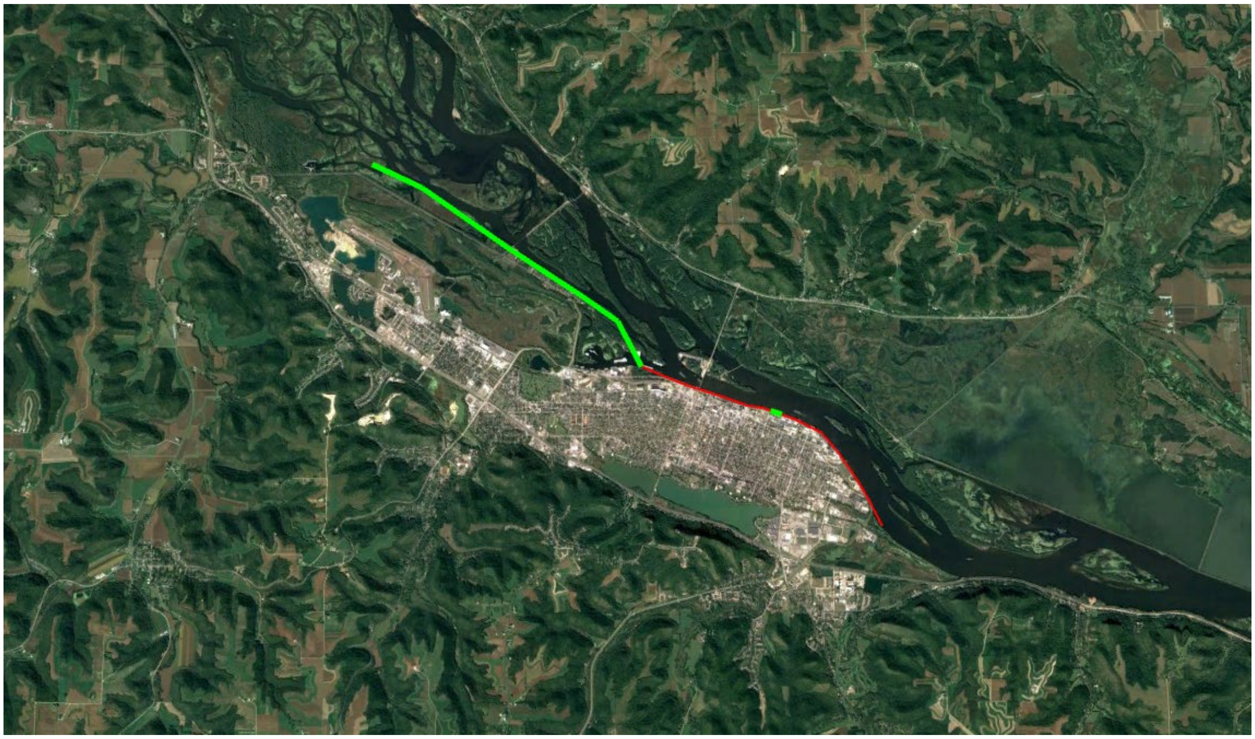

Figure 52. Winona, MN linear riverfront access (red) and their recreational spaces (green).

Figure 53. Aerial image of Winona, MN Levee Park.

Conclusion: This small town in Minnesota is unique to other towns or cities due to the surrounding mountains that cause you to forget that you are in fact on the Mississippi River. I found myself gazing upon their mass more than the river itself. Upon arriving at Levee Park, I was pleasantly shocked to see what appeared to be new construction on riverfront development. Although this small park, roughly 5 acres in size, sits between the river and a set of train tracks, the designers definitely understood the surrounding issues and accomplished an incredible design to incorporate the man-made barrier into the space. Winona offers a rare typography in its surroundings, casting a beautiful scenery and with only 43% of the shoreline line with man-made barriers this city clearly values the little riverfront access they have to offer.

12: Minneapolis, MN

Pre-site:

4. Linear distance of shoreline: 19.41 miles.
5. Park or green space identified: 20 locations.
6. Identify and locate man made barriers: 4 barriers identified.
    a. Roads
    b. Railroads
    c. Railroads
    d. Industrial complexes

4. Review airspace to conduct sUAS operations: clear for flight.

On site: Conduct aerial and ground images to capture human scale adjacent to either barriers or direct connection to the riverfront.

Site 01: Booms Island Park.

Site 02: Water Power Park.

Site 03: Central Mississippi Riverfront Regional Park.

Site 04: 35W Bridge Memorial.

Site 05: Scherer Park.

Post site Analysis:

Site 01: Booms Island Park.

Site 02: Water Power Park.

Site 03: Central Mississippi Riverfront Regional Park.

Site 04: 35W Bridge Memorial.

Site 05: Scherer Park.

Disconnection to connection linear shoreline mileage calculations:

- Total Linear Mileage of shoreline: 19.41 miles.
- Total Linear Mileage of riverfront access in the form of parkland space: 17.17
- Percentage of barriers present along the city's shoreline total linear mileage: 12%

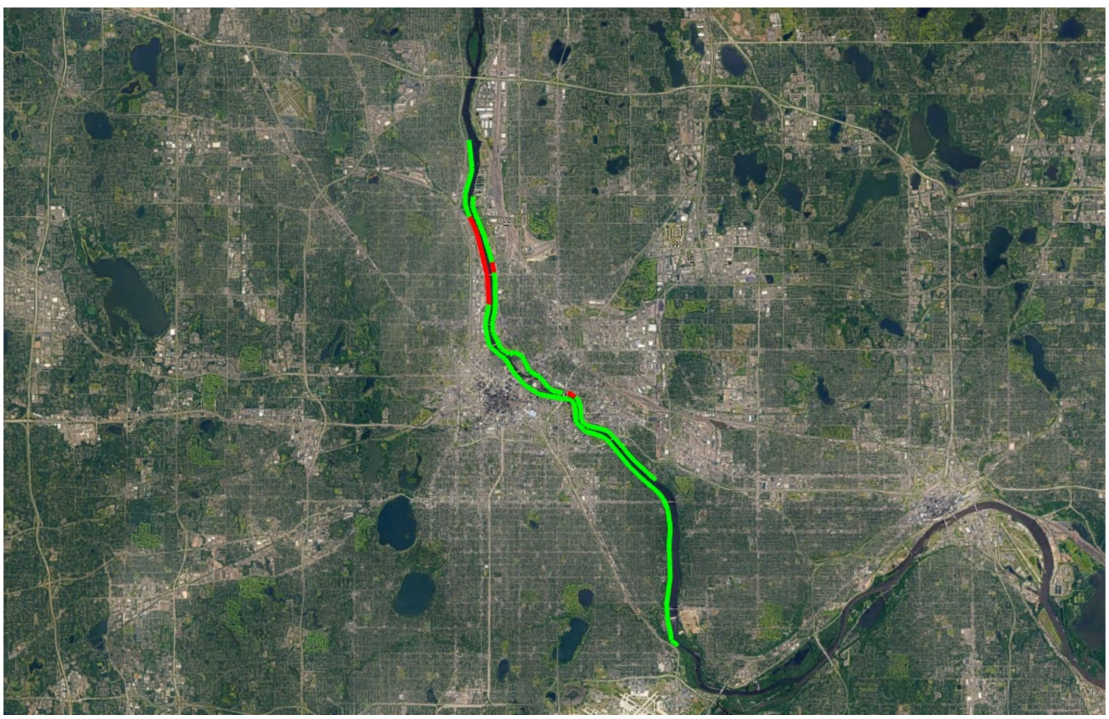

Figure 54. Minneapolis, MN linear riverfront access (red) and recreational spaces (green).

Figure 55. Aerial image of Boom Island park in Minneapolis, MN.

Figure 56. People crossing streets near Stone Bridge Crossing.

Figure 57. Cyclist and bystander enjoying the Mississippi River view.

Figure 58. Citizens and visitors enjoying the river festival.

Conclusion: There is no greater contrast than New Orleans, LA to Minneapolis, MN. Arriving at the river’s edge was not a difficult task. I was immediately met with a swarm of people flocking to the amenities that lined the river’s edge. I immediately felt a surreal feeling due the amount of people hanging out around the water's edge. It is something I had never seen before. Bikes lanes lined nearly every street, running along the entire length of the river. Open green spaces were everywhere to be found, often filled with either locals or visitors, some were there to take in the summer sun, while others were active playing games in the lawns. During my time in Minneapolis, there were river festivals, museums, and extensive parks along the river’s edge. A few locals were kind enough to show me around the city while explaining its history to the river. It was fascinating to learn that residents grew up swimming in the river. Another contrast to cities on the river in the South, where the water is too polluted and the current far too strong. Minneapolis, MN offered direct access to the river’s edge and with 12% of its edge filled with man-made barriers, this city is by far the best connected to the river compared to the other cities visited.

Appendix B. Sections

Figure 59. Sectional cut along Minneapolis, MN.

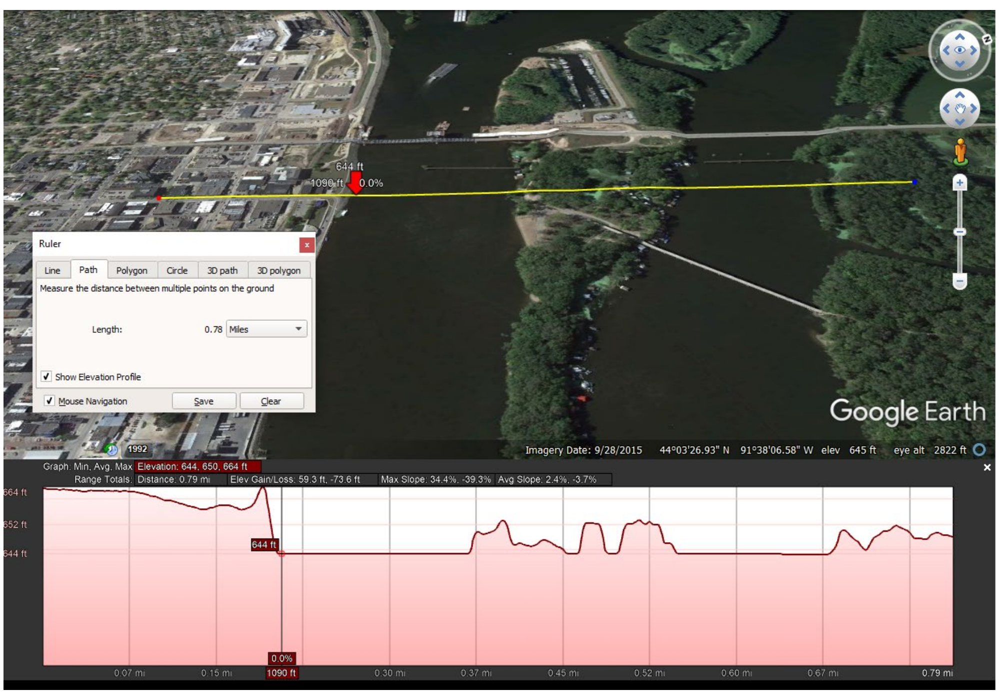

Figure 60. Sectional cut along Winona, MN.

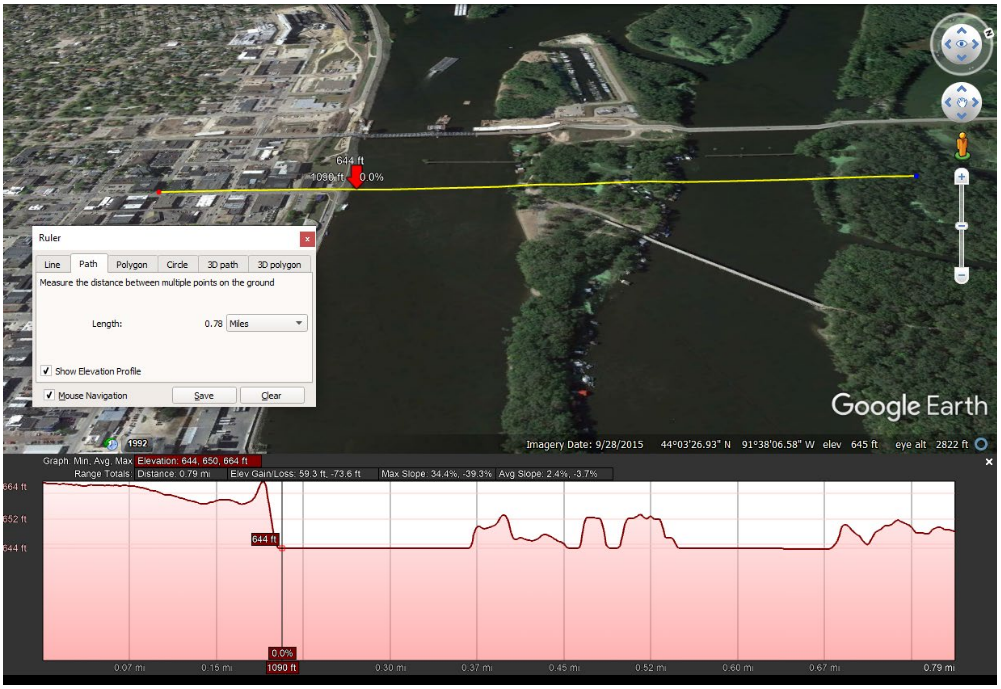

Figure 61. Sectional cut along La Crosse, WI.

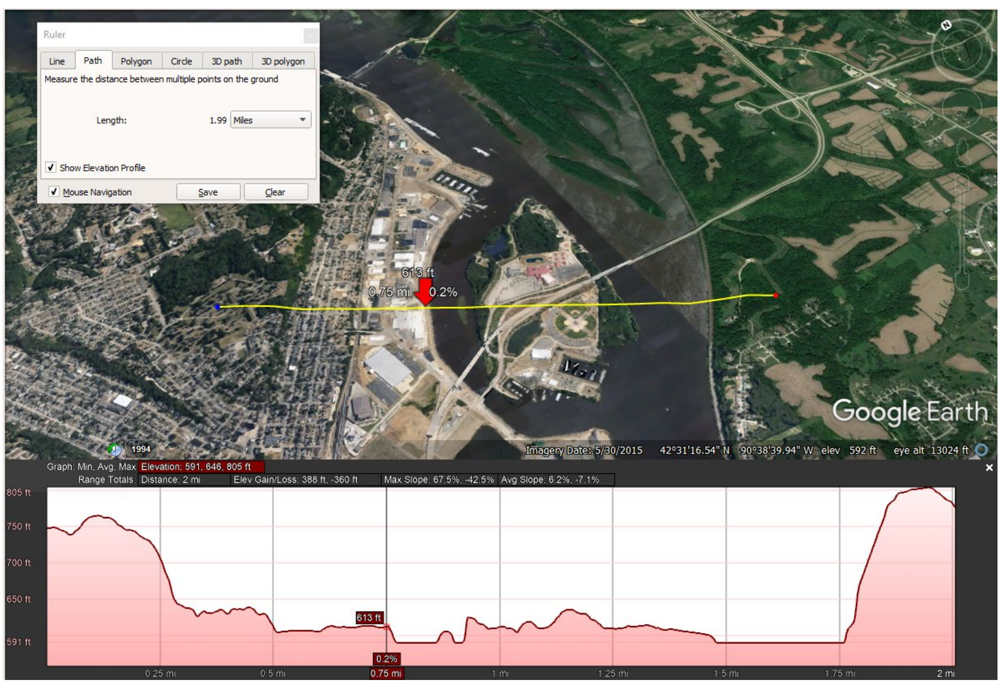

Figure 62. Sectional cut along Dubuque, IA.

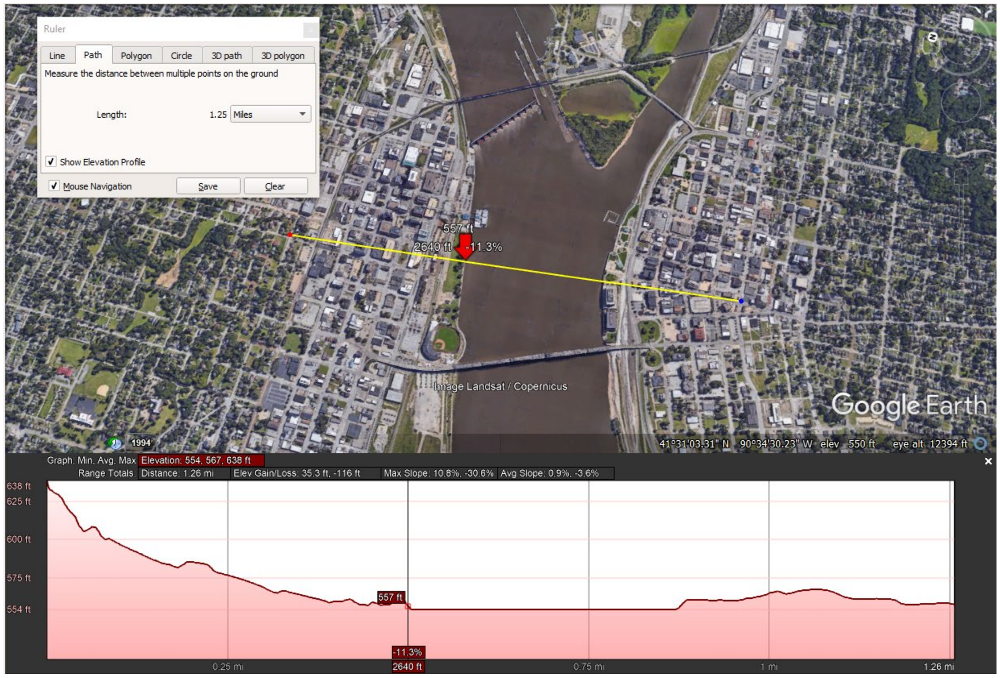

Figure 63. Sectional cut along Davenport, IA.

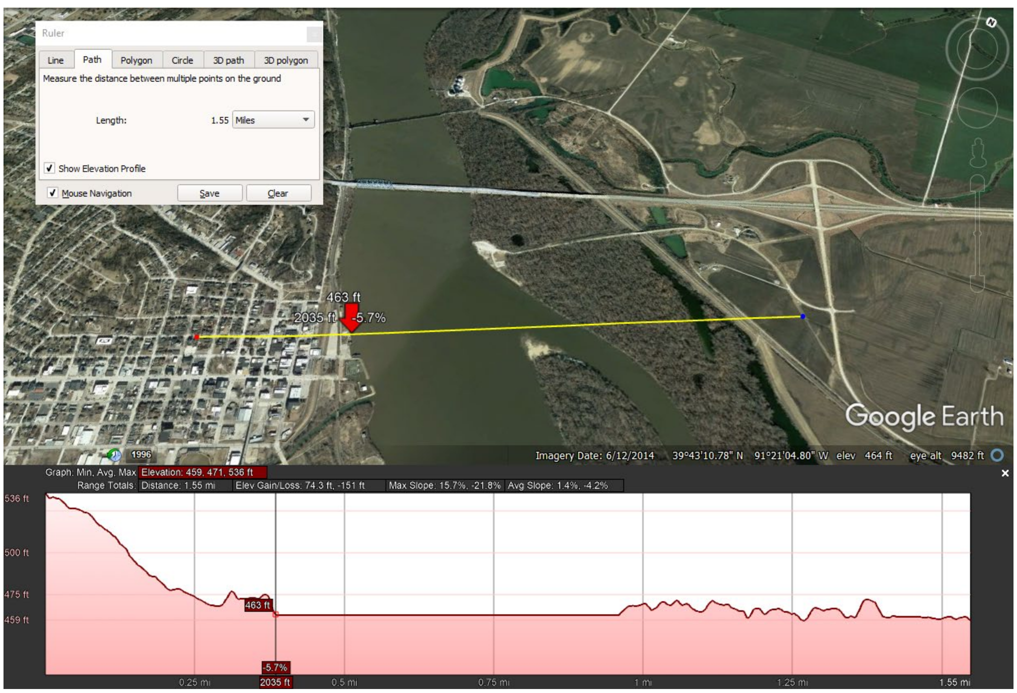

Figure 64. Sectional cut along Hannibal, MO.

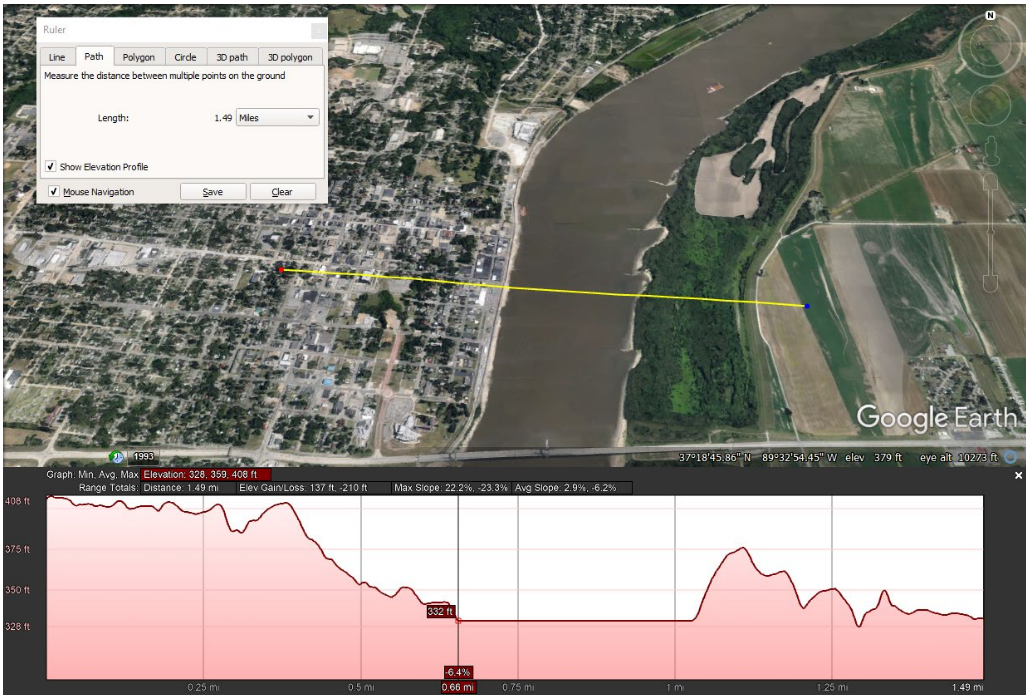

Figure 65. Sectional cut along Cape Girardeau, MO.

Figure 66. Sectional cut along Memphis, TN.

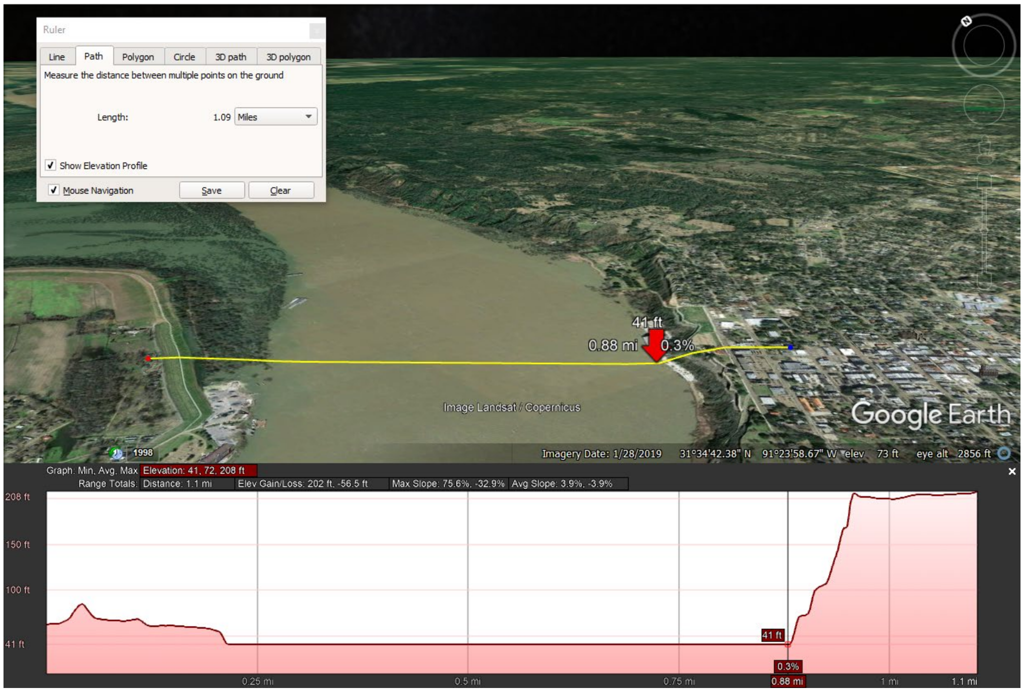

Figure 67. Sectional cut along Natchez, MS.

Figure 68. Sectional cut along New Orleans, LA.

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Vita

Taylor, born in New Orleans, LA worked as landscape architect for several years in Dallas and Houston, TX after receiving his bachelor's degree from Louisiana State University. As his interest in urban design along waterfronts grew, he would begin to gravitate back towards Baton Rouge, LA where he would enter the Robert Reich School of Landscape Architecture as a master's candidate. Upon completion of his master's degree, he will begin work on helping river cities develop along their water's edge.