US 169/I-70 North Loop
Planning & Environmental Linkages Study

BEYOND THE LOOP

Urban Design Tech Memo

May 2018

BEYOND THE LOOP

Table of Contents

1. Table of Contents

List of Figures

List of Acronyms and Abbreviations

ADA	Americans with Disabilities Act
AM	Morning
APE	Area of potential effect
AST	Aboveground storage tank
ASTM	American Society for Testing and Materials
BGPA	Bald and Golden Eagle Protection Act
BMcD	Burns & McDonnell
BMPs	Best Management Practices
C-D	Collector-Distributor
CWA	Clean Water Act
dBA	A-weighted decibels
EDR	Environmental Data Resources, Inc.
EA	Environmental assessment
EIS	Environmental impact statement
EPA	US Environmental Protection Agency
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIRM	Flood Insurance Rate Map
GDAP	Greater Downtown Area Plan
GIS	Geographic information system
HCM	Highway Capacity Manual
HCS	Highway Capacity Software
I-29	Interstate 29
I-35	Interstate 35
I-70	Interstate 70
Hg	Hg Consult, Inc.
KCATA	Kansas City Area Transportation Authority
KC EDC	Kansas City Economic Development Council
KCK	Kansas City, Kansas
KCMO	Kansas City, Missouri
KDOT	Kansas Department of Transportation
L_{eq}	Equivalent sound level
LOS	Level of service
LUST	Leaking underground storage tank
MARC	Mid America Regional Council
MBTA	Migratory Bird Treaty Act
MDC	Missouri Department of Conservation
MDNR	Missouri Department of Natural Resources
MoDOT	Missouri Department of Transportation
MP	Milepost
Mph	Miles per hour
MPO	Metropolitan Planning Organization

NAC	Noise abatement criteria
NCHRP	National Cooperative Highway Research Program
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
PEL	Planning and Environmental Linkages
PM	Evening
RCBC	Reinforced concrete box culvert
ROW	Right-of-way
TAZ	Transportation analysis zone
TNM	Traffic noise model
TOD	Transit-oriented development
UG	Unified Government of Wyandotte County/Kansas City, KS
US-169	US Highway 169
USACE	US Army Corps of Engineers
USCG	US Coast Guard
USDOT	US Department of Transportation
USGS	US Geological Survey
USFWS	US Department of Interior Fish and Wildlife Service
UST	Underground storage tank
VMS	Variable message sign
Vpd	Vehicles per day
Vph	Vehicles per hour
WOUS	Waters of the United States

1. Introduction

This technical memorandum documents urban design evaluation of the existing conditions and evaluates the urban design character and opportunities of the strategies carried forth through the US-169/I-70 North Loop Planning and Environmental Linkages (PEL) Study.

The study is led by the Mid America Regional Council (MARC), the metropolitan planning organization for the Kansas City metropolitan region, in cooperation with Federal Highway Administration (FHWA), the Missouri Department of Transportation, (MoDOT), and Kansas City, Missouri (KCMO).

The PEL Study focuses on the development of a strategic plan that identifies and evaluates a set of reasonable strategies for the US-169 corridor, including access connections to the Downtown Airport, replacement or reuse of the US-169 Buck O'Neil Bridge over the Missouri River, and its connections into Downtown Kansas City and the surrounding freeway system. In addition, the Study focuses on the I-70 corridor which traverses the north edge of the KCMO Central Business District (CBD), improvement of traffic flow and better connection of the street grid between the River Market and Downtown Kansas City, Missouri. Additional issues to be considered will include access to the Port of Kansas City, airspace around the Downtown Airport, Missouri River navigation, bicycle and pedestrian accommodations on major bridges, impacts to existing transit and railroads, and opportunities to expand transit. As identified in the Study's Statement of Purpose and Need, the improvement strategies were developed and assessed in relation to their respective abilities to serve future access needs, mobility, safety, system preservation, and economic development/redevelopment opportunities.

The US-169/I-70 North Loop PEL Study covers the general area of the downtown Kansas City area bounded by the shaded limits depicted in **Figure 1-1.** Predominant highways addressed in the study include I-70 to the east, north, and west of the Kansas City, MO CBD, US 169 extending north from I-70 to approximately Route 9, and Route 9 to the east of US 169 extending north from the CBD to the Heart of America Bridge crossing of the Missouri River. While these routes comprise the primary focus of transportation related strategies in the study area, potential operational impacts to other proximate facilities in the region are included as part of the overall evaluation of the possible strategies considered in the Study.

The perimeter of the KCMO CBD is bounded by the circumferential interstate system consisting of I-70 to the east, I-70/I-35 to the north, I-35 to the west, and I-670 to the south **(Figure 1-2).** This system of highways is commonly referred to in the region as the Loop. I-70 connections to the Loop are at the southeast and northwest corners. I-35 connections to the Loop are at the northeast and southwest corners. For the purposes of discussion in this study, the area of I-70 comprising the north edge is referred to as the North Loop, and the segment of I-670 along the south edge is referred to as the South Loop.

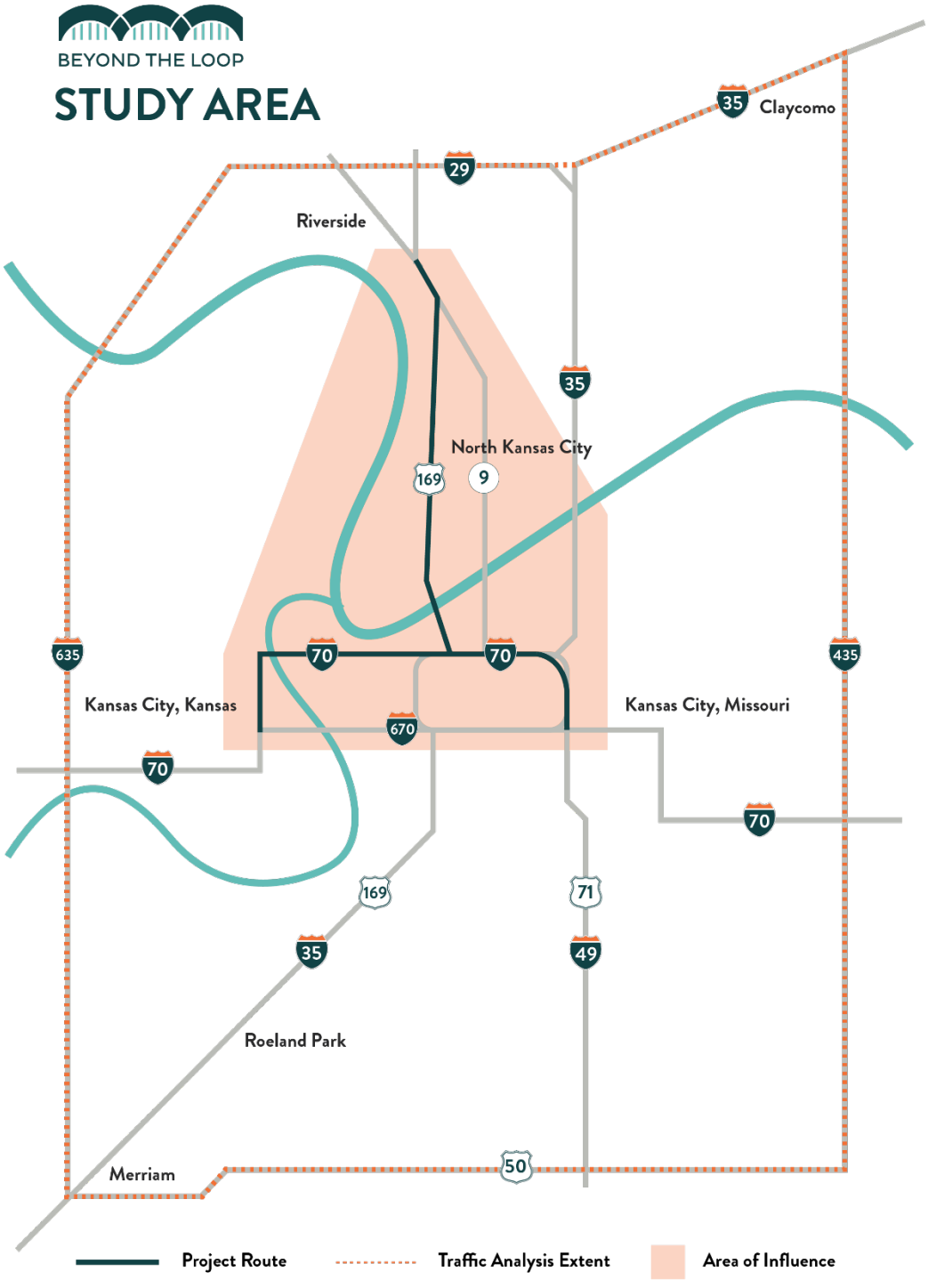


Figure 1-1 US-169/I-70 North Loop Planning and Environmental Linkages (PEL) Study Area Map

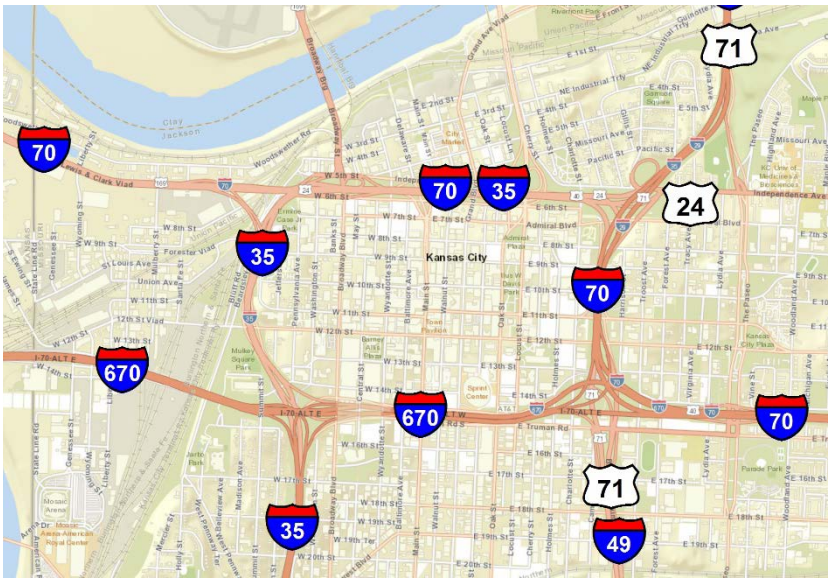


Figure 1-2 US-169/I-70 Loop

2. Study Area Context

2.1 History of Land Use

Land use was analyzed for all the jurisdictions within the study area. This includes Downtown Kansas City, Missouri, the West Bottoms, River Market, Columbus Park, Riverfront and Harlem neighborhoods, the Downtown Airport, and North Kansas City. The specific items that were researched included an analysis of:

Historic Aerial Images: Analyzing building massing's, the impact that the construction of the interstates had on the Central Business District and River Market neighborhoods is clear. A dramatic change can be seen from 1922 to 1969 with the addition of the highways and a steady decrease in buildings can be observed through 1995. A slight increase in building development can be observed in the 2000 and 2017 aerials as interest in urban living and development increased during that time but remains elusive adjacent the footprints of the interstate highways.

Historic Land Use: Looking at a sampling of years for the study area, it was clear to see the change in land use over time. For example, residential land uses were a major component of the Central Business District in 1971 but dramatically less in 1983 and 2003 with moderate gains observed in 2010 through 2017. This corroborates the reality of the decline in Downtown activity that Kansas City experienced in the 1980's and 1990's and the renewed interest and increased development that has taken place in recent years. While these maps clearly illustrate changes, the lack of changes in an area is an equally important observation that can be gleaned as well. For example, in the Columbus Park neighborhood, Multi-Family Residential has been the dominant land use for the past thirty years and very little changes can be seen during that time. Therefore, it can be interpreted that the Columbus Park has been relatively stable and has seen little to no new development for the past three decades. The complete compilation of historic land use research can be found in the Appendix.

Existing Land Use: Land use in 2017 was documented to understand the current conditions of the study area and to provide a point of comparison to both the historic land use and the future land use. The complete set of Existing Land Use maps can be found in the Appendix.

Future Land Use: How land is intended to be used in the future was a key component of this study. Any investment in major infrastructure that connects different jurisdictions that each dictate their own land use, should take those potential future uses into consideration. Future Land Use maps for Kansas City, Missouri, North Kansas City, and the West Bottoms portion of Kansas City, Kansas are provided and can be found in the Appendix.

2.2 Past Transportation Projects

Kansas City, Missouri was settled in in the mid 1800's on the banks of the Missouri and Kansas Rivers. The City developed a dense urban core that continued to expand outward as the population of the region grew and as was typical of American cities, grew while accommodating different innovations in transportation. Given its central location in The United States, Kansas City has always been an important ground transportation hub. This translates into the prevalence of Interstate Highways that overtime, were constructed through the existing dense urban core of the City. During the 1950's, the Downtown Loop which consists of Interstates 35, 70 and 670, was constructed and currently surround Downtown Kansas City on all four sides. In addition, construction of the Broadway Bridge (US-169) and The Heart of America Bridge (Rt. 9), added even more highway connections to the Downtown loop and City streets, clearly making the personal vehicle the priority on City streets.

In the decades that followed the construction of these transportation corridors, a sizable percentage of the City's population left to take up residence in the suburbs or other cities entirely with businesses soon following. This caused property values to plummet in much of the Downtown area but nowhere more than the land adjacent to the Interstate Highways as they were, and continue to be, a deterrent for urban development, existing and planned. The result of this was the demolition of large swaths of the urban fabric and the presence of surface parking lots, as that was one of the only economically viable land uses.

The north side of the Downtown Loop, referred to as the North Loop, arguably observed the impacts of this process more than any other parts of Downtown. Today, Interstates 35 and 70 have caused the urban fabric to be bisected into fragmented neighborhoods that overtime have lost their physical and psychological connection with one another. Due to the rising age of this infrastructure, several rehabilitation projects have taken place, but they have proven to be costly and ineffective at improving the quality of the urban environment.

2.3 Investment Trends

Investment is a key indicator into the health and vitality of a neighborhood and municipality. Looking at investments over a period of time provide greater clarity into not only what kind of development but how much development is taking place and the value of that development. Having a diversity in development is a good indicator of the trajectory that a City is on. This study looked at the investment trends of residential, commercial, hotel, office, mixed-use and industrial developments, both in terms of overall quantity and the value of those projects, over the past four decades for much of the study area.

The analysis of Investment Trends can be found in Appendix C.

2.4 Historic Landmarks and Districts

Taking inventory of Historic Landmarks and Districts was a necessary step in this study due to the ability of historic properties to be a driver for urban revitalization. The North Loop Study Area contains a multitude of historic buildings, districts, corridors, and structures that collectively tell the history of Kansas City and represent both an element of protection but also opportunity to bring increased vitality to the urban core.

The full list of historic properties and districts can be found in Appendix D.

2.5 Prior Planning Studies

Taking inventory of the multiple planning and design projects that have been recently completed or are about to begin around the Downtown Kansas City, Missouri, Kansas City, Kansas and North Kansas City jurisdictions was an important element of research. Understanding the goals and implications of these projects was crucial to document due to fact that the North Loop is the link between these different areas. Among others, the projects researched include the Kansas City Walkability Plan, the Second Street Infrastructure and Development Plan, The Wyandotte Unified Government Downtown Master Plan, and the Missouri River Recovery Program.

The full compilation of prior planning studies can be found in Appendix A.

2.6 Precedent Case Studies

Cities all over the world have recently been grappling with how to deal with outdated, insufficient and/or crumbling highway infrastructure. Depending on the regional or global context, these decisions are being made at a time when perspectives on urban design and development are shifting from a car dominated train of thought to one that is more focused on pedestrians and alternative modes of transportation. The implications of this shift are varied and vast and so a key step in the North Loop PEL process was for there to be an extensive period of research looking at precedents for urban highway projects.

Details that were researched include the type of project, length of the corridor, changes in amount of developable land because of the project, the cost and time frame of the project, impact on traffic either projected or realized, as well as financing strategies, and support needed from the public and government officials to make the projects a reality.

See Appendix B for the complete review of precedent urban highway projects.

3. Urban Design Opportunities

3.1 Improve Connections

When the Downtown Loop was constructed in the mid-1950's, neighborhoods that were once connected, no longer existed as one cohesive piece of urban fabric. With the introduction of the sunken interstates and their corresponding access points, a great divide was formed that not only created a physical divide, but a psychological one as well.

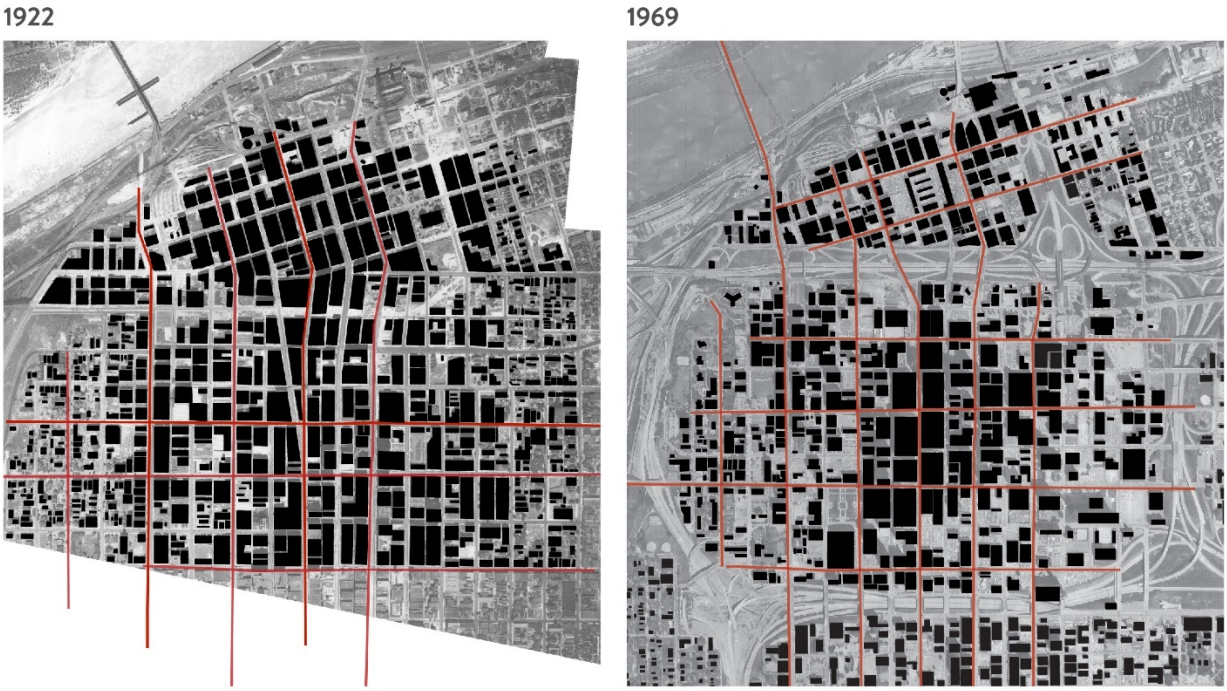


Figure 3-1 Aerial View of Downtown before and after Construction of I-70

Therefore, one of the most essential elements of the North Loop Study, is to determine how those physical and psychological connections can be improved in all the potential strategies. This includes vehicular, pedestrian, bicycle, and transit connections as well as a cohesive visual connection of buildings and open spaces that correlate to the different building stocks of the River Market and Central Business District.

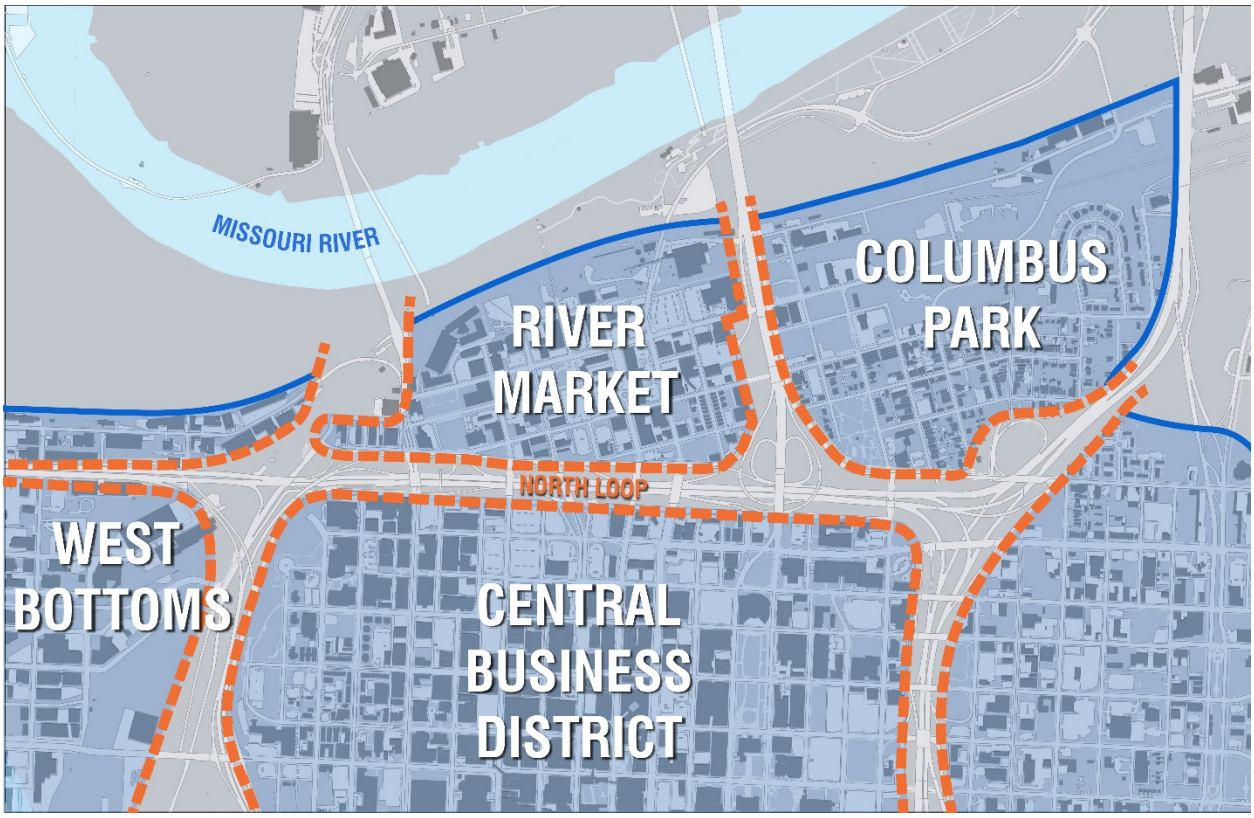


Figure 3-2 Districts Divided by Interstate System

3.2 Encourage Appropriate Development

Due to a renewed interest in urban living, the Central Business District and adjacent neighborhoods have experienced an uptick in development in recent years with a notable increase in new residential and commercial units. Both new construction and rehabilitated historic structures are contributing to this growth. Despite this trend, land adjacent to the interstate highways that surround the Central Business District, today primarily occupied by surface parking lots, have not seen the same level of investment. It is well documented that the presence of interstate highways has negative impacts on adjacent land values and thus are a depressant for new development opportunities.

The strategies for the North Loop afford different opportunities for more land to become available for development adjacent to the highway either through mitigated highway impacts or new parcels by means of a condensed or removed interstate. From an urban design perspective, it is important that any new development, no matter what North Loop strategy moves forward, be appropriately scaled, complement the existing character of the Central Business District and River Market, enhance the streetscape environment, be centered around transit, and provide units and services for a range of incomes.

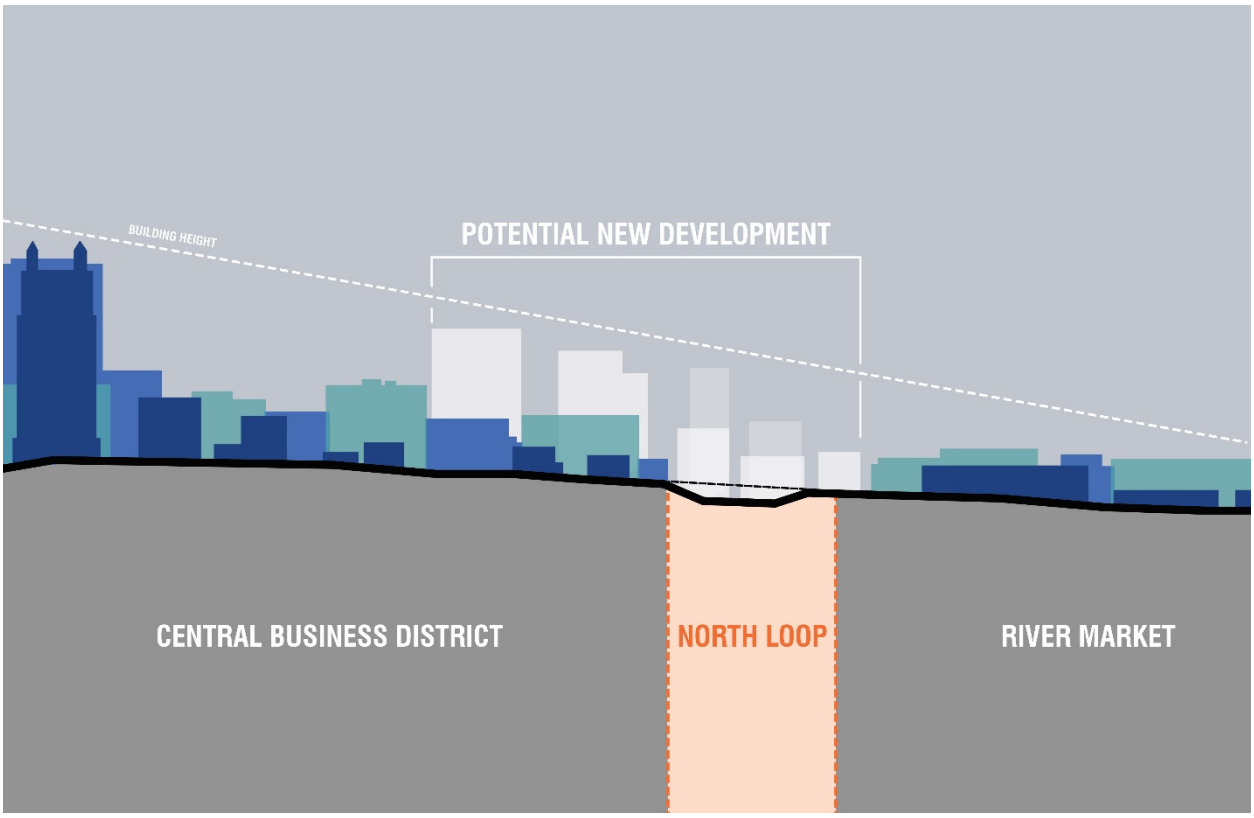


Figure 3-3 Scale of New Development Relative to Existing Urban Fabric

3.3 Integrate Open Spaces with Urban Fabric

One of Kansas City's most recognizable features is the prolific system of parks and boulevards that were a product of the City Beautiful Movement of the late 1800's and early 1900's. As was characteristic in this period of City development, master planned corridors, usually in the form of grand boulevards primarily focused on the automobile and connected large green spaces which served the community as recreational havens.

Despite this being the primary pattern of development for decades, there are relatively few open spaces located in Downtown Kansas City because the dense urban core preceded the City Beautiful Movement. Not every open space is treated equal in that different open spaces provide different amenities and opportunities for City residents. Therefore, larger parks, which often provide greater recreational opportunities have an intrinsically larger range of regular users than a smaller, neighborhood square or park. Studies show that residents who live within walking distance of green space, are more likely to exercise more frequently and therefore have a healthier lifestyle. Open space also provides vast environmental benefits ranging from improved air quality to animal habitats.

The North Loop currently occupies a large amount of land on the northside of the Central Business District and with any of the strategies, comes the potential to integrate open space and provide much needed green space in the urban core. The green space should be viewed as a conduit to connect larger City and Regional recreation corridors much the way the historic boulevards and parks were designed to

function, while also aiming to be an iconic space that becomes a heavily used, cherished and identifiable feature of Kansas City.

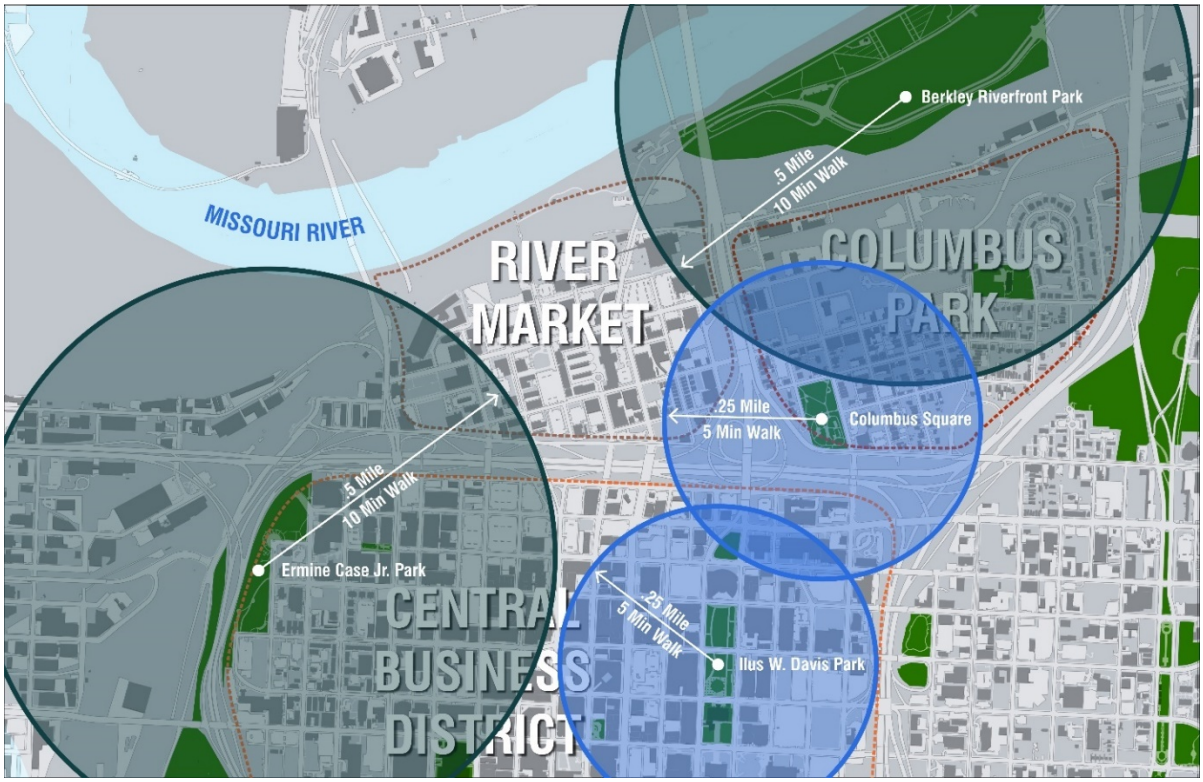


Figure 3-4 Map of Current Open Space in the North Loop Area

3.4 Incorporate Storm Water Management Techniques

There is a great opportunity to incorporate storm water management techniques into this plan with the goal of accomplishing many of the objectives previously listed and has the potential to make a significant impact on environmental challenges that the current stormwater infrastructure presents. This can be done by incorporating local and regional volume controls while also utilizing a combination of green and grey stormwater infrastructure. These systems provide an effective way to capture runoff from streets, walkways, and rooftops while also enhances the overall urban environment for all who use it.

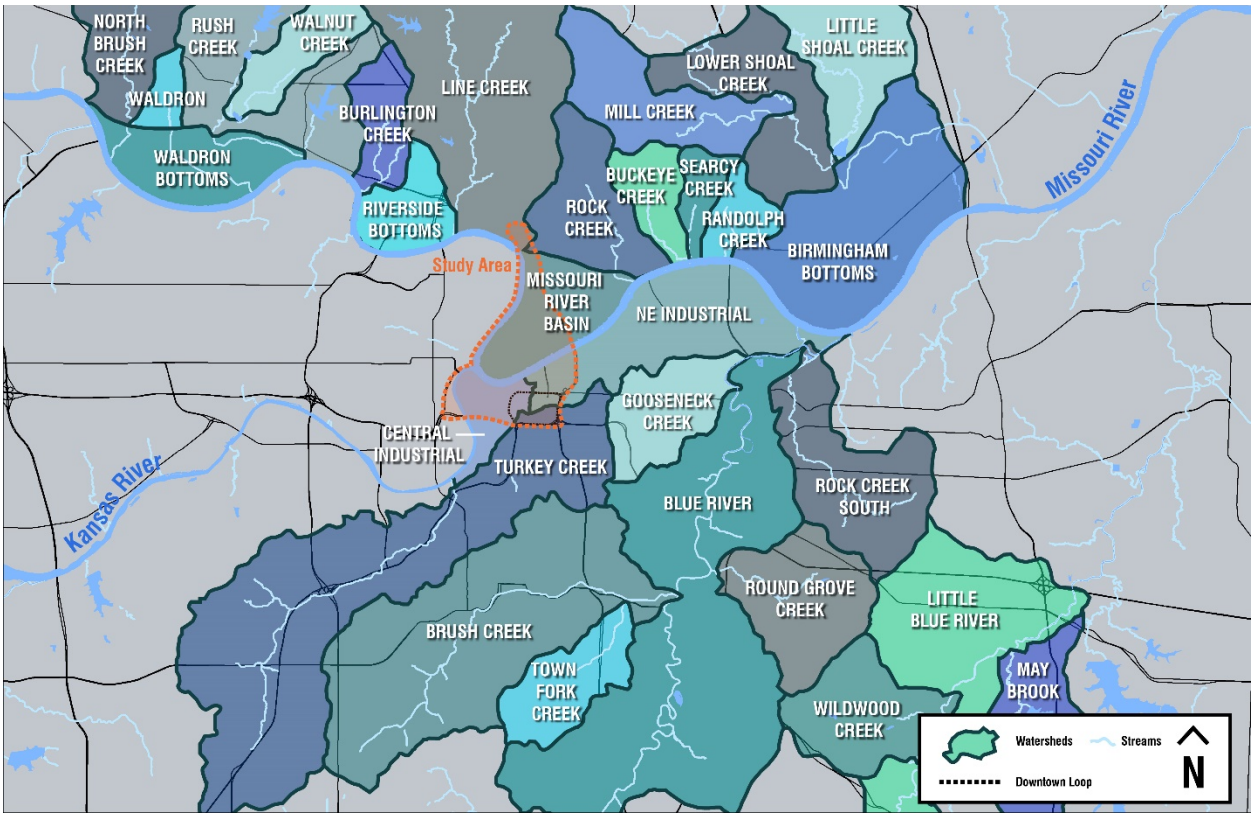
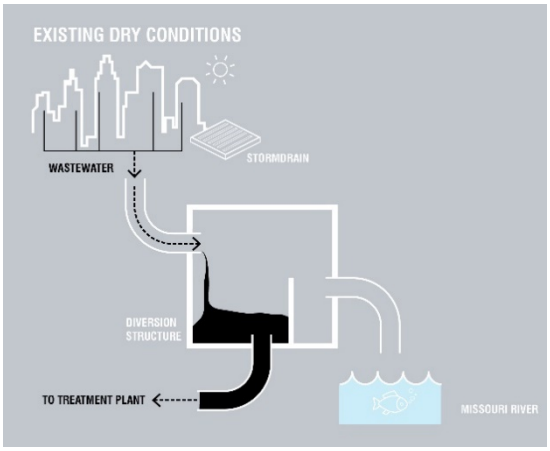


Figure 3-5 Map of Water/Sewersheds in the Kansas City Metropolitan Area

An urban environment consists of a system of watersheds and sewersheds. Watersheds are natural units of land, defined by topographical features such as ridges and divides, that collect water into a common drainage area. Sewersheds on the other hand, are man-made and utilize a system of drains and pipes to collect water within a given area, transport and discharge that water to a common drainage and/or treatment location. Sewersheds more or less are contained by and mimic the boundaries of natural watersheds as it is efficient to work within the confines of a naturally draining area. The Kansas City region is made up of countless watersheds ranging from small creeks and tributaries, to large streams and rivers. (See Figure 3-5). Ultimately, rain falling throughout the entire metropolitan area, drains to the Kansas and Missouri Rivers which in turn travels south to the Mississippi River and finally the Gulf of Mexico. How the land is used, whether industrial, agricultural or residential, is directly correlated with the quality of water that ends up in those tributaries and as the size of the watersheds scale up, so too does the amount of pollutants that enter the water system.

As Kansas City developed into the current day metropolis, the natural absorption qualities of soil were diminished due to growing urbanization. Because the water that falls during rain events must go somewhere, stormwater piping was constructed to direct water from the surface to a centralized discharge point. Like many cities in The United States, Kansas City has an extensive sewer and storm water infrastructure system to convey stormwater and prevent ponding. When these systems were constructed, it was economical to build one pipe, instead of separate lines, that would carry both sewage from buildings and storm water runoff to natural water bodies, such as the Missouri River. Eventually, the negative environmental impacts of this process were realized, and water treatment facilities were constructed to clean contaminated water. However, these facilities have never been able to treat all the contaminated water during storm events due to the high volume of material in the combined pipes. To

compensate for this fact, diversion structures were installed to redirect some of the increased volume of contaminated sewage and stormwater, that occurs during storm events, directly into adjacent water bodies in order to not overtax the water treatment facilities. These mechanisms are known as Combined Sewer Overflows (CSOs). This outcome continues the negative environmental impacts that have been a characteristic of stormwater infrastructure since their inception. A series of graphics illustrating this process can be found below.



During dry conditions, wastewater from buildings enters combined sewer pipes. Because there is no stormwater present, the wastewater enters the diversion structure without reaching the level of the overflow pipe. This means that all wastewater is directed to the water treatment facility and does not enter the Missouri River.

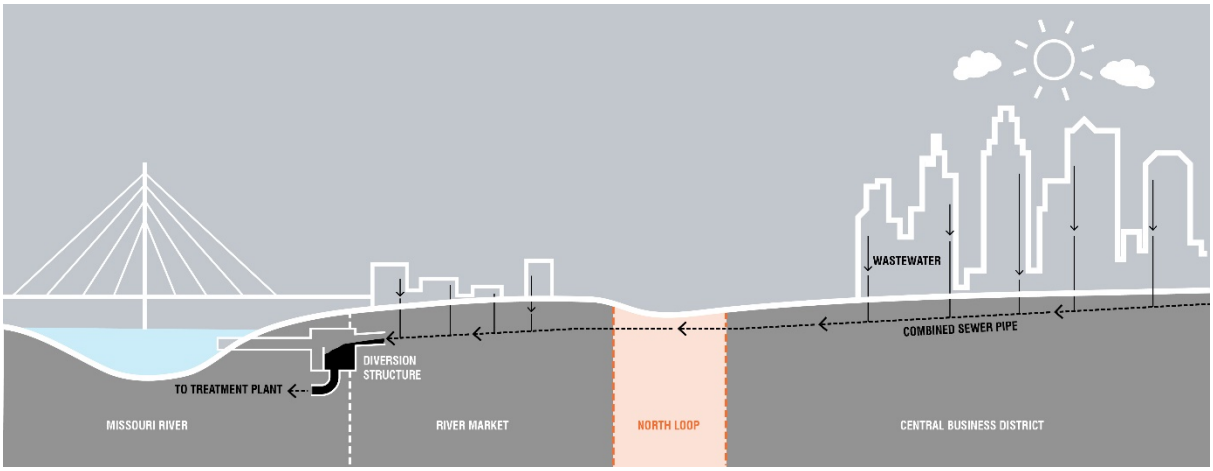
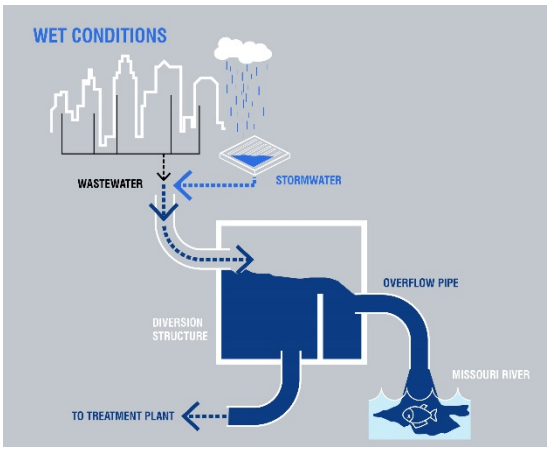


Figure 3-6 CSO Operation during Dry Conditions



During wet conditions, wastewater from buildings is combined with stormwater runoff coming from streets, building roofs and any other hard surface. When the combined materials enter the diversion structure, the level is high enough to enter the overflow pipe and dump into the Missouri River. This is to ensure that the wastewater treatment facility is not overburdened. Subsequently, the water quality of the river is negatively impacted.

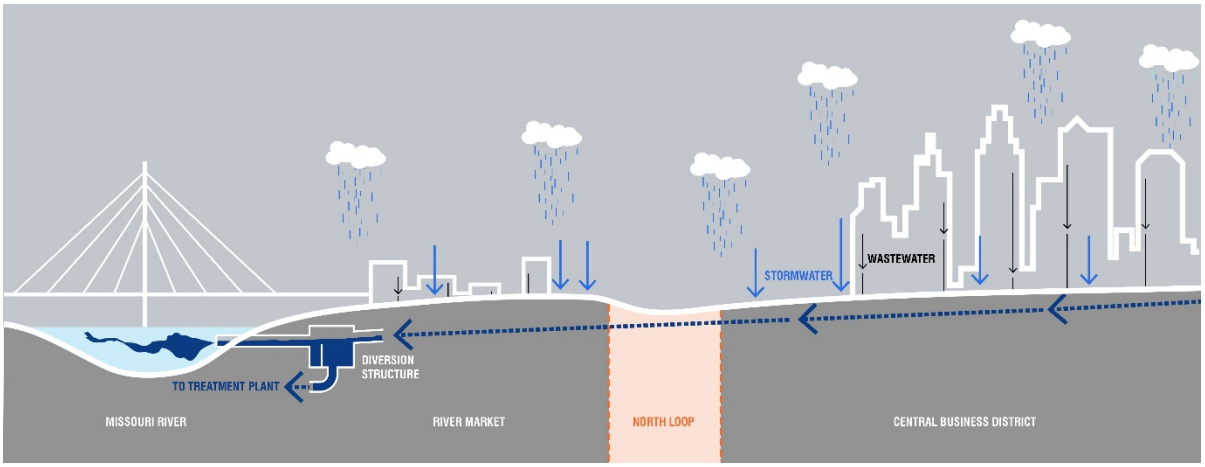


Figure 3-7 CSO Operation during Rain Event

This process happens regularly (during any storm event with a rainfall greater than .10”) and has extreme negative impacts on the Missouri and Kansas Rivers. Those contaminants then travel down river and feed into the larger natural water system of The United States creating large scale environmental issues for entire regions and ecosystems.

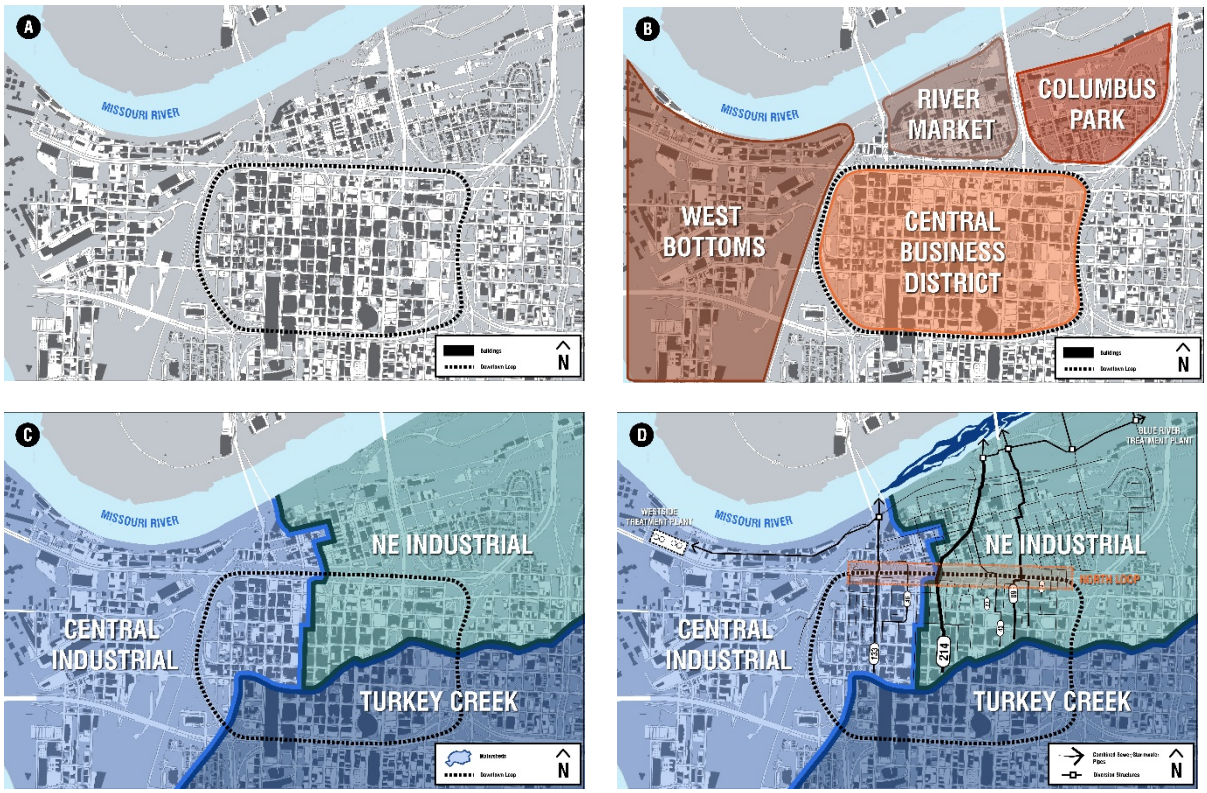


Figure 3-8 Inventory of existing Stormwater Management Infrastructure

A. Downtown Loop

B. Neighborhoods adjacent to Downtown Loop

C. Watersheds present within the Central Business District

D. Major combined sewer pipes that extend from CBD to Missouri River

The Downtown Loop area, which is immediately south of the Missouri River, consists of the Central Business District, West Bottoms, River market and Columbus Park neighborhoods. Three watersheds are in this immediate area; the Central industrial, NE Industrial and Turkey Creek. For this study, the NE Industrial and Central Industrial will be the focus due to the North Loop being located within these two watersheds. Image D documents the major combined sewer lines that extend from the Central Business District North, to the diversion structures. It is at these structures, that the untreated water is diverted to either the treatment facilities or the river, depending on the weather conditions.

To incentivize cities to mitigate the effects of the combined sewers, the EPA imposes fines on Kansas City through a Federal Consent Decree based on the quantity of contaminates that enter natural waterways. To alleviate this financial burden and restore waterways to a healthier state, the City of Kansas City has committed $2.5 billion over the next 25 years to eliminate unauthorized overflows of contaminated sewage into the Missouri and Kansas Rivers. As a part of this initiative, the City is continually looking for new opportunities to capture, control and convey storm water in an effective manner.

The existing EPA Consent Decree for Kansas City, Missouri did not anticipate any sizeable opportunities for addressing the existing stormwater and sewershed conditions in the downtown area. Any of the proposed improvements to the North Loop included in this study create new opportunities to address this condition in a manner that benefits the natural and built environment – but to varying degrees.

Retaining the freeway in some options will provide limited opportunities to address stormwater management needs while addressing the combined sewer overflow condition. This project represents an opportunity to actually improve this existing condition in downtown – not just mitigating the impacts of new transportation system improvements. Removing the freeway creates a tremendous opportunity for creating a new district with smart stormwater systems with integrated technology designed to serve as an attractive amenity. This feature could become an important and functional catalyst for revitalizing the area, contributing to a new urban redevelopment district that reconnects the River Market and Columbus Park neighborhoods with downtown's Central Business District.

There has long been a disconnect between the realm of water resource management and transportation planning. In addition to the Missouri River, future studies may assess how stormwater quantity and quality may be improved in the project corridor and in the broader study area. It is difficult to imagine that this project will have a dramatic overall impact on the quality of the Missouri River. But, treating water as an asset rather than a liability may create opportunities for more sustainable transportation and associated development outcomes.

Regardless of which alternative is considered for additional study and eventual implementation, the new infrastructure investment in streets, walkways, and utilities provides an unprecedented opportunity for Kansas City to take a big step forward in ultimately reducing the combined sewer overflow condition. While a goal of reducing the overflow condition to zero is ideal, this concept requires further study to develop an informed yet pragmatic vision for the future that can dramatically improve this urban area; creating a win-win for residents, businesses, and the environment.

There are two ways of obtaining this goal: Grey and Green stormwater infrastructure. A Grey System uses pipes and large tanks, located underground, to transport and store water during rainfall events when the storm water pipes are carrying a higher volume of runoff. After a period of time, the stored water is slowly released back into the system when it is not overburdened.

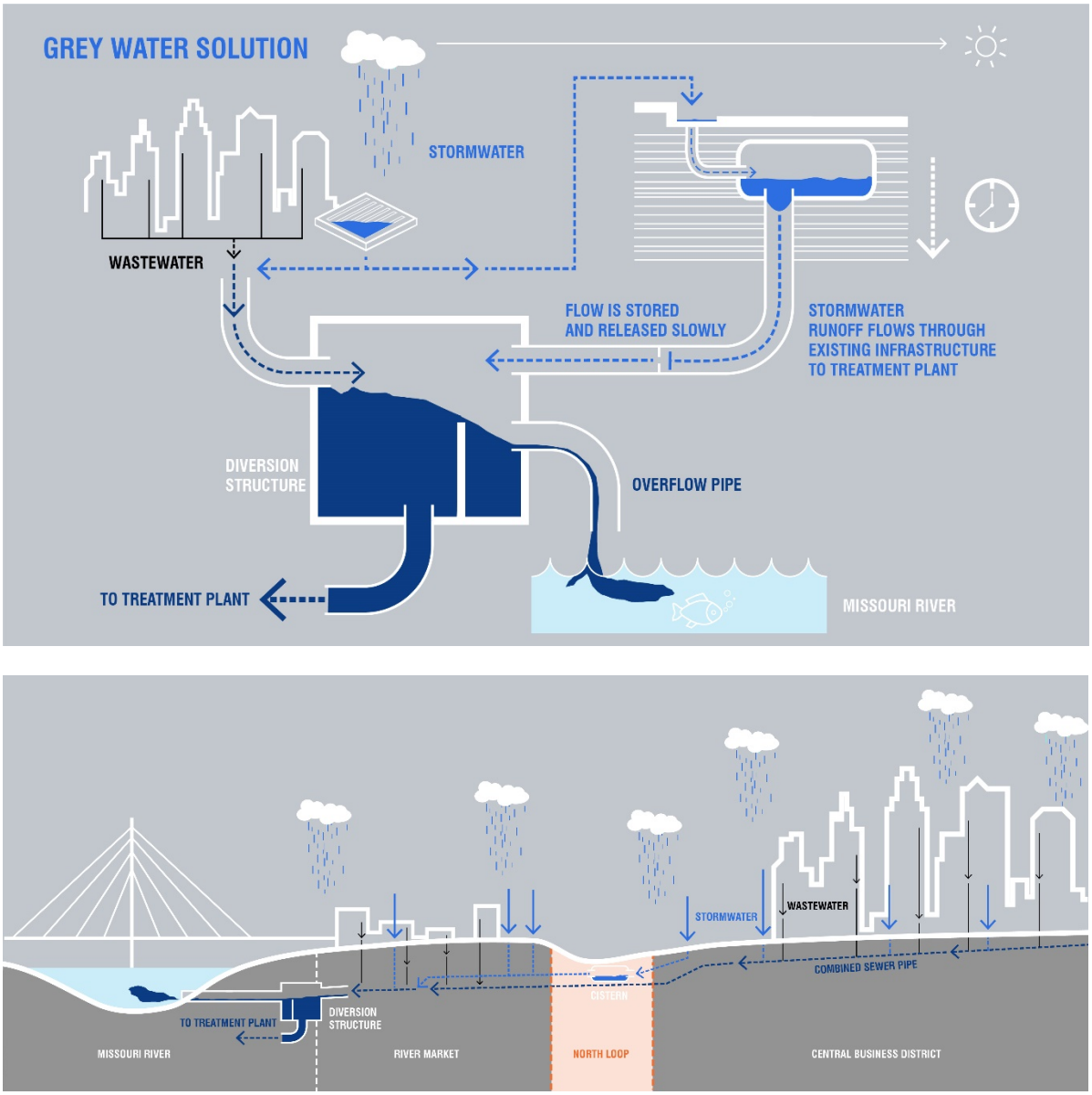


Figure 3-9 Grey Stormwater Mitigation Solution

Using a grey stormwater infrastructure solution, cisterns are used as a means to capture combined stormwater runoff and sewage underground for a prolonged period of time. Once runoff levels are reduced after a rainfall event, the combined material is slowly released back into the existing stormwater and sewage system. By holding the runoff and releasing it slowly, levels in the diversion structure do not reach the overflow pipe. Therefore, no contaminated stormwater enters the Missouri River. This also reduces the stress on water treatment facilities during rainfall events. Grey systems provide no benefit or

enhancement to the public realm and require regular servicing and maintenance to ensure that flows remain unimpeded.

The second way is using a combination of Grey and Green Stormwater Infrastructure (GSI) to capture, clean, contain and convey runoff.

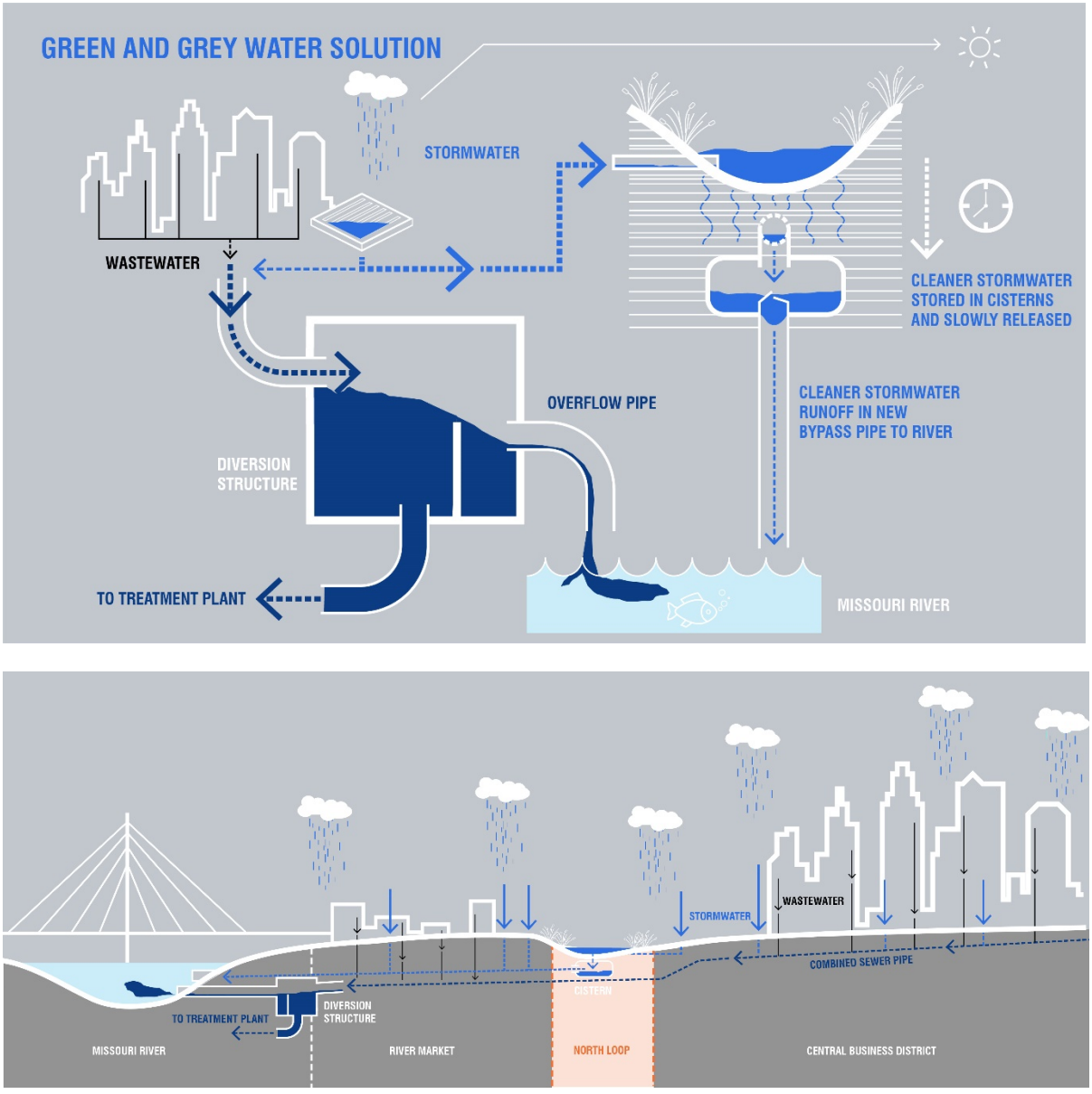


Figure 3-10 Green and Grey Stormwater Mitigation Solution

A combined green and grey stormwater solution aims to capture, clean, control and convey stormwater at a regional and local scale to provide a highly resilient and effective system. With green infrastructure, the water is captured and cleaned as it is absorbed by the plants and filtered through the soil. Green infrastructure includes bioswales, rain gardens, green roofs, tree trenches or large surface water capturing bodies (see figures below). The water is then stored in underground cisterns and after a period of time, the cleaner stormwater is released into a pipe which bypasses the existing diversion structure, empties directly into the Missouri River and does little harm to the natural environment. Beyond providing needed stormwater management, green infrastructure provides multiple functions that benefit the urban environment including improved aesthetics and creating a more resilient urban forest condition. This urban forest treats runoff as a resource that helps improve air quality, capture carbon, reduces summer time temperatures and energy needs, and creates a walkable and vibrant urban streetscape.

Stormwater Management Techniques

There are several different GSI elements that when implemented, would serve to more effectively manage stormwater over a larger area and enhance the overall streetscape environment. A list and description of those elements can be found below.

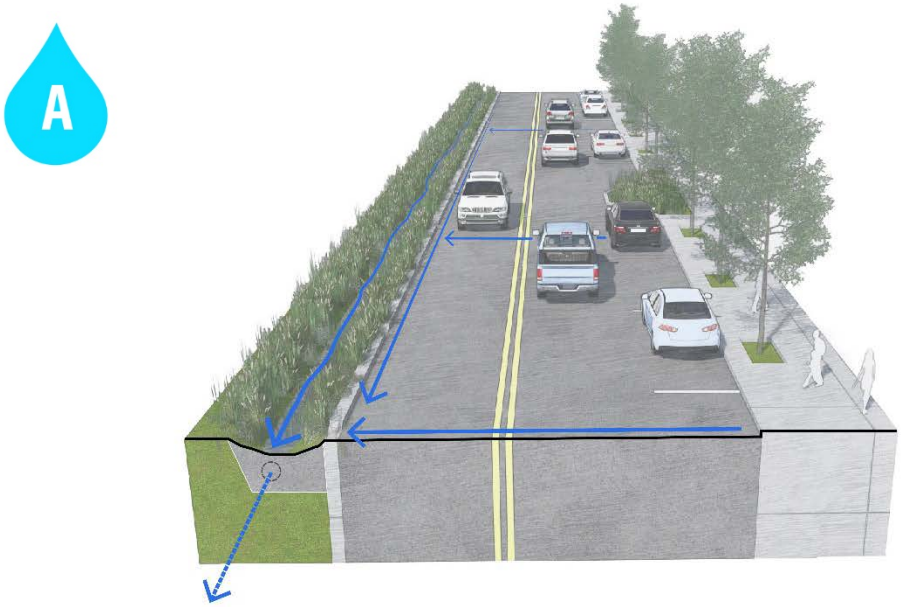


Figure 3-11 Bioswales

Bioswales are defined as a depressed linear landscape element that collects water. Using the basic functions of absorption, transpiration and filtration that vegetation and soils perform, stormwater is both cleaned and utilized in a bioswale. Often, underground perforated piping is present to receive additional stormwater that the plants and soil are unable to process during large rainfall events. Bioswales tend to be less urban in nature as they are difficult to incorporate into a typical city street environment but in some cases, they can be used without interrupting the normal operations of the street grid.

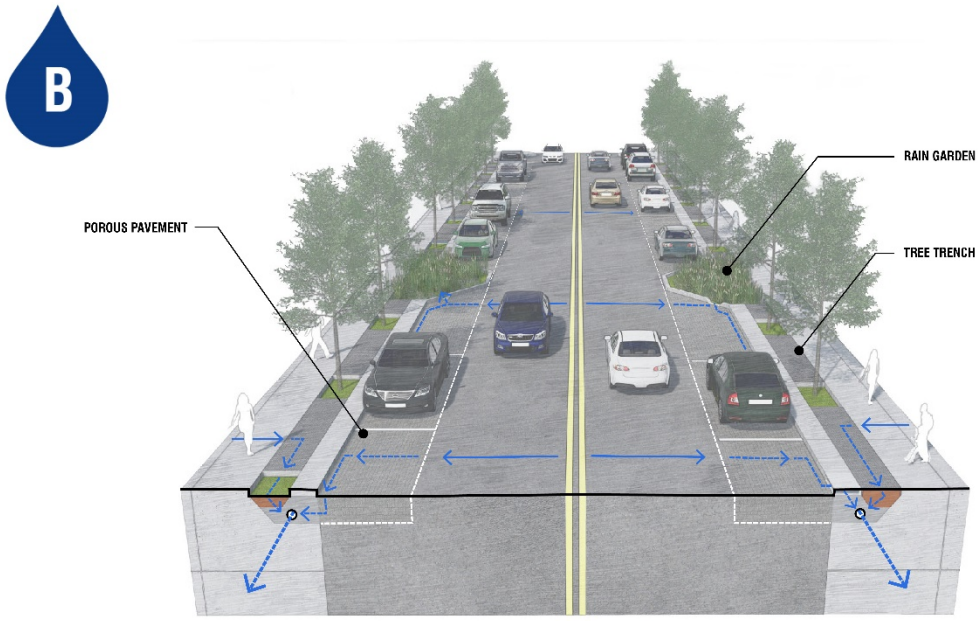


Figure 3-12 Diagram of Streetscape with Green Infrastructure

Designing streetscapes to incorporate GSI elements is a smart and effective way to manage stormwater over a larger area. As a part of a complete streets strategy, features such as bumpouts, on-street parking, street trees, sidewalks and bike lanes would be added and GSI can be seamlessly integrated with them.

Bumpouts on a complete street, act as a traffic calming element as well as a feature that defines travel versus parking lanes. Bumpouts should incorporate Raingardens that capture water from the street itself by using curb cuts to allow runoff to enter and percolate through the soil of the raingarden. This process acts as a cleaning process for the water. An overflow pipe will ensure that flooding does not occur.

On-Street Parking offers patrons of businesses and residents easy vehicular access while also providing an additional traffic calming benefit. Because parking lanes receive less wear and tear from traveling vehicles, Porous Pavement can be used in these areas as an effective way to allow percolation of water through and into a pipe below. The pipe would convey the stormwater to nearby tree trenches or raingardens to continue the cleaning process. Porous pavement can also be used where bicycle lanes or cycle tracks are present.

Street trees are a vital component of an attractive streetscape environment. Individual tree pits that street trees grow out of, can be a part of a single system known as a Tree Trench. Rainfall and runoff from the sidewalk enters the soil surrounding the base of the tree and/or infiltrates through a strip of porous pavement in between the individual tree species. Water percolates through layers of soil and sand being either taken up by the tree's roots or entering a perforated pipe which sends excess water into the existing stormwater system.

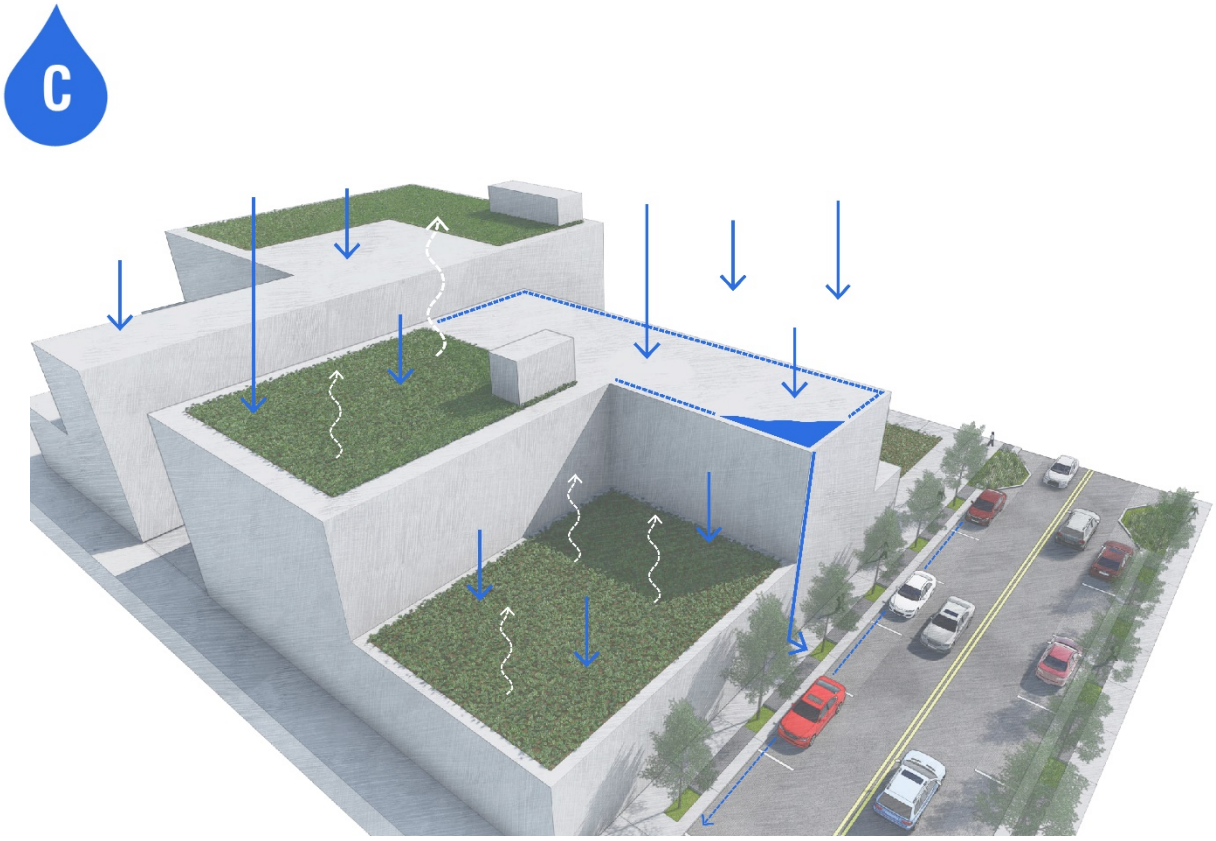


Figure 3-13 Diagram of Greenroofs to Control Release of Stormwater into CSO

Any new development as a result of the North Loop project, would be encouraged to incorporate green building techniques such as Green Roofs. Green roofs capture rain that falls on rooftops and stores the vast majority of that rainfall through vegetation and soil. Very little runoff therefore enters storm drains from rooftops. Green roofs also make buildings more energy efficient by regulating internal temperatures which reduces the need for both heat and air conditioning use.

Additionally, buildings could be designed to utilize stormwater runoff from cisterns located underground as a source for potable water in the building which makes use out of water that would ordinarily be an unused resource.

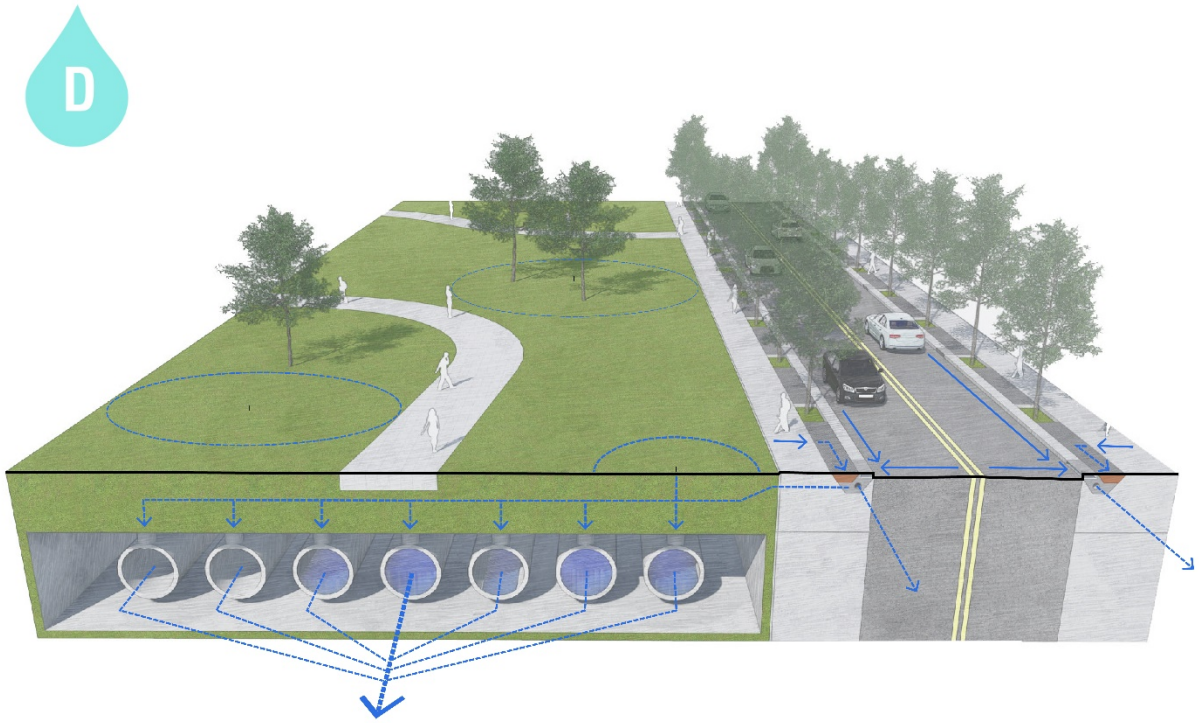


Figure 3-14 Diagram of Underground Stormwater Storage Cistern

Cisterns are a grey stormwater management solution. Large tanks located underground receive stormwater from pipes and hold it for a period of time. Once rainfall ends and the combined sewers are no longer carrying stormwater runoff, cisterns slowly release water back in the stormwater infrastructure using smart technology systems. Cisterns can operate independently as a purely grey water solution, or they can be combined with green infrastructure. The combination of the two is preferred due to their ability to collaborate with one another and offer a more resilient and effective storm water collection system. By combining them, water is filtered and cleaned from the plants and soil above, held in the cisterns, and then has the opportunity to be directed directly into the river because its cleaner state and thus avoids the water treatment process, saving both energy and funds. Otherwise, a grey water solution on its own, requires runoff to enter back into the existing stormwater infrastructure and be treated before entering into the river.

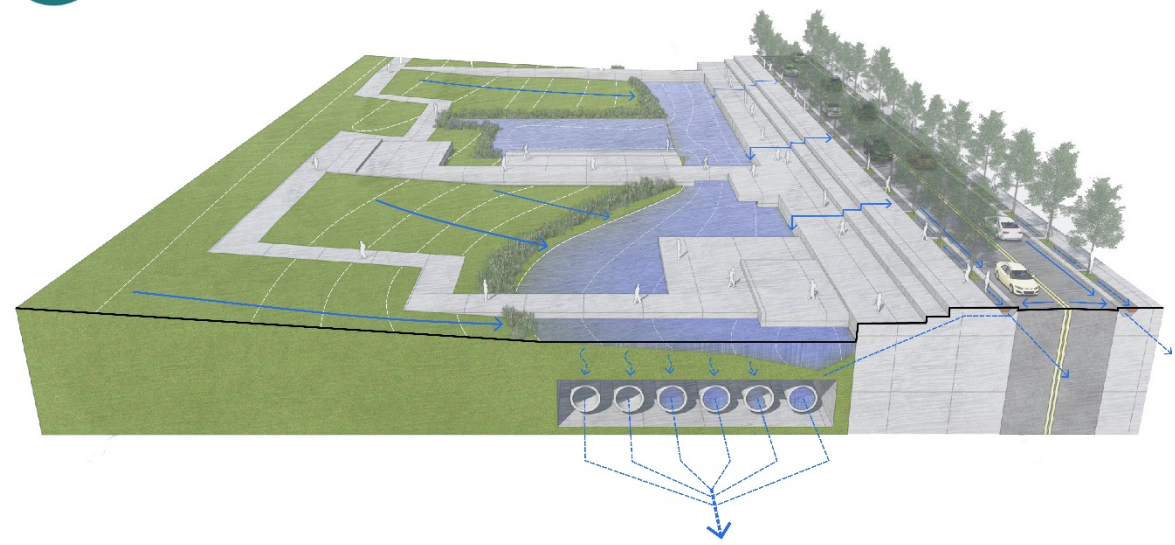


Figure 3-15 Diagram of At-Grade Amenity to Control Stormwater

All stormwater management techniques can operate on a range of scales. As GSI increases in size, it occupies a larger visual presence in the urban realm. Therefore, At-Grade Stormwater Treatment can and should simultaneously be viewed as a method to treat water and serve as a public amenity. After traversing through smaller GSI like raingardens or bioswales, stormwater would be piped to a centralized location where the landscape would collect and concentrate cleaner runoff in a localized area. As an element of design, this space would allow for a range of water levels depending on the rate of rainfall during a singular event or over a period of time. As an amenity, gathering and performance spaces would be incorporated with the water feature and create an active and vibrant public space. Development would be encouraged around these sites and in that way, a private public partnership could help facilitate some of the costs associated with the stormwater infrastructure in return for the increased demand for units overlooking an attractive urban space.

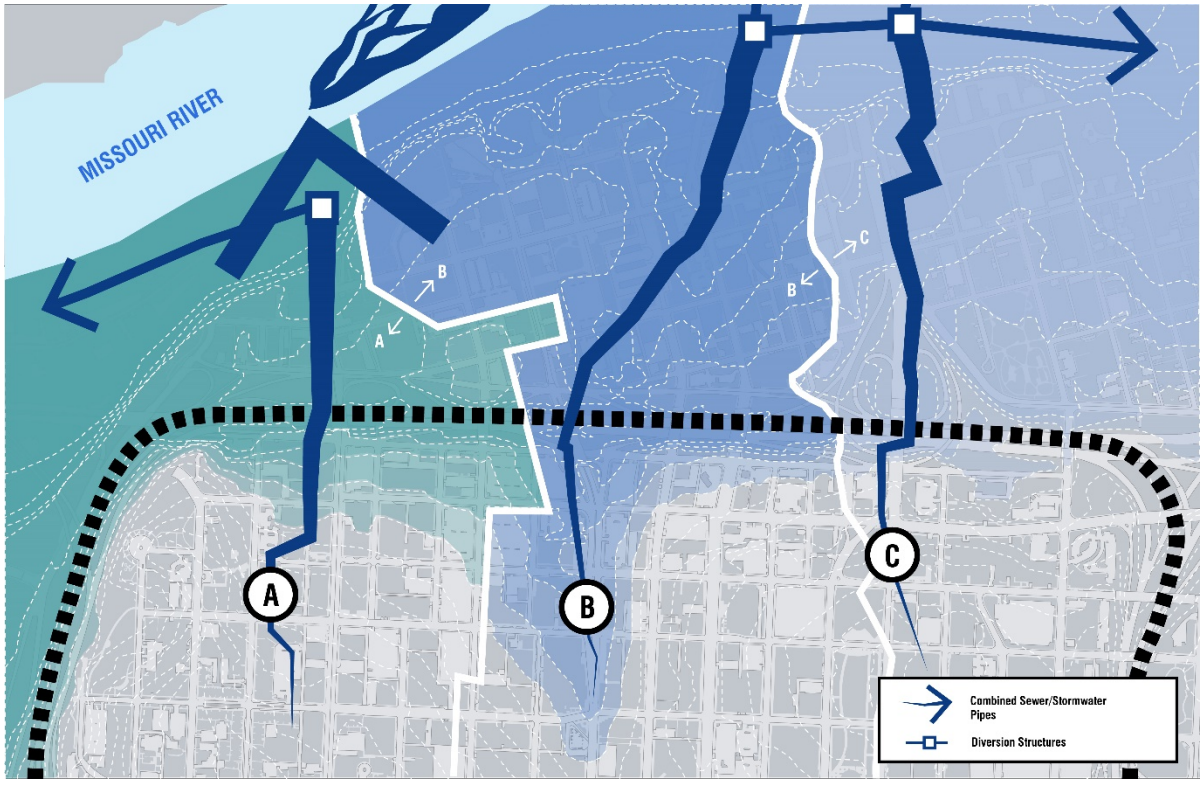


Figure 3-16 Diagram of Existing Infrastructure within Watersheds

The existing storm water infrastructure transports large volumes of untreated wastewater and storm through an extensive network of underground pipes. There are three arterial collector pipes that receive all of the waste material from smaller secondary pipes. The collector pipes direct material directly to the diversion structures which splits the volume to either the treatment facility or the river. The total CSO for these three pipes collectively totals 73.19 million gallons annually.

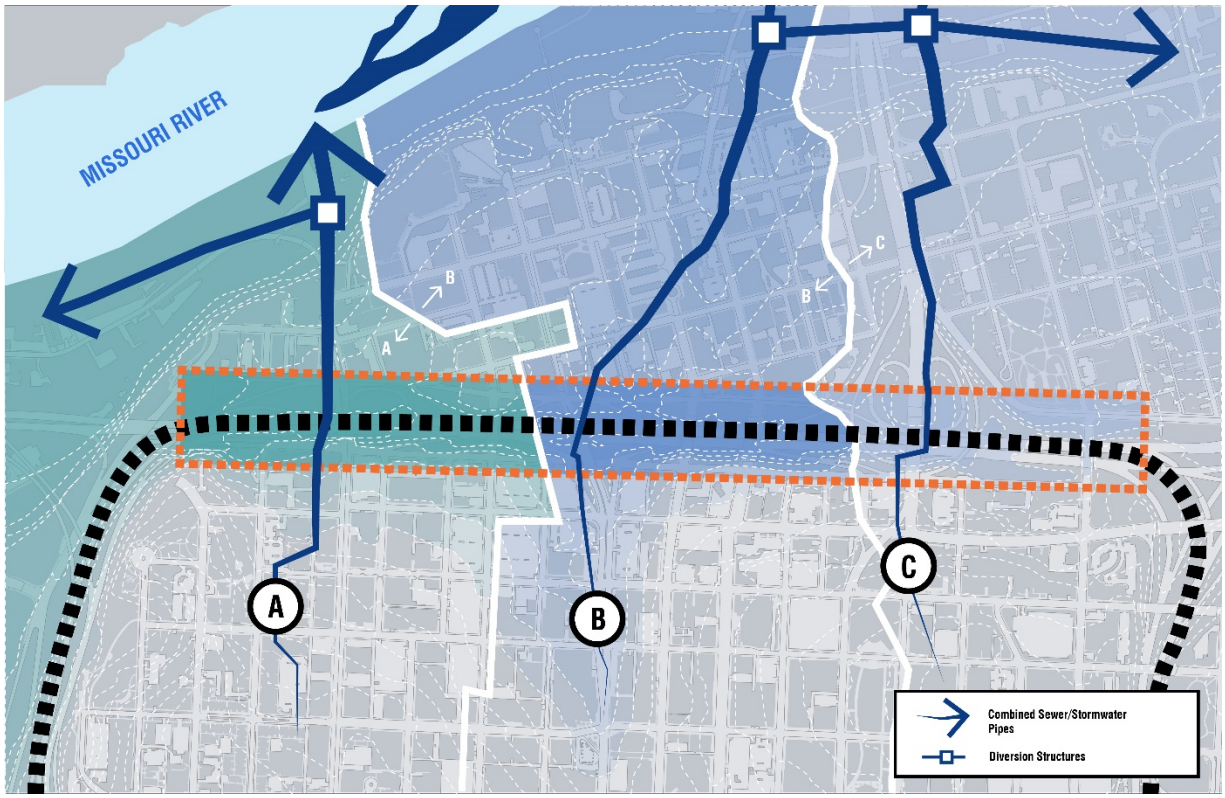


Figure 3-17 Zone of Direct Stormwater Influence Related to North Loop Strategies

As the strategies for the North Loop are factored into this scenario, there are two different zones of stormwater capture to be taken into consideration. In the above image, we see that if stormwater retention were a major component of the North Loop project, a majority of the stormwater directly from the footprint of the project area could be captured, controlled, cleaned and conveyed. By doing this, less water enters the combined pipes and as a result, less pollution enters the Missouri River.

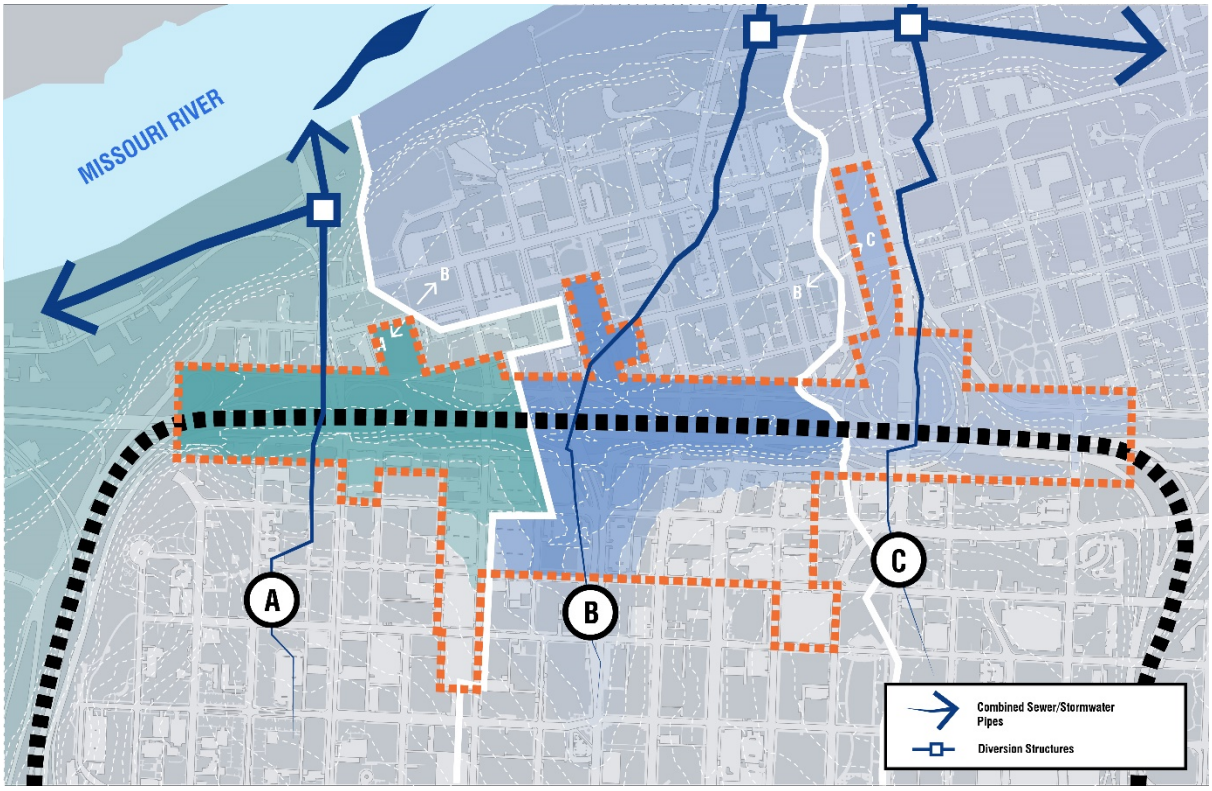


Figure 3-18 Zone of In-Direct Stormwater Influence Related to Adjacent Development

Changes to the North Loop will enhance the urban environment significantly with intact and cohesive neighborhoods focused on seamless connections and vibrant street-level activity. With these enhancements, adjacent underutilized lots become prime for redevelopment. With a comprehensive strategy for stormwater management and new development, spurred by the North Loop project, a significantly larger area is realized where stormwater management is a major component of any new public or private investments. This in turn will cause even less stormwater to enter existing infrastructure and continue to reduce negative environmental effects on the Missouri River.

Effective stormwater management is a vital component of a healthy urban and ecological environment. As the effects of climate change become more of an influence on urban and ecological environments, it is important to design systems that are resilient to climate change. Resiliency is defined as the ability of a system to absorb stresses and maintain function in the face of external forces imposed upon it by climate change. As climate change is expected to bring about severe swings in precipitation levels, stormwater management is inherently resilient due to its ability to reduce flooding, combat drought, augment groundwater supplies and reduce pollution in natural waterways. As this section outlines, stormwater should be considered a resource and should be managed through an optimized mix of affordable and sustainable green, gray and natural infrastructure.

4. Urban Design Evaluation of Strategies

4.1 Area A: Missouri River Bridge Strategies

There are four different strategies for a new Broadway Bridge each with different implications for physical connections, opportunities for new development and/or open space and the opportunity for storm water management.

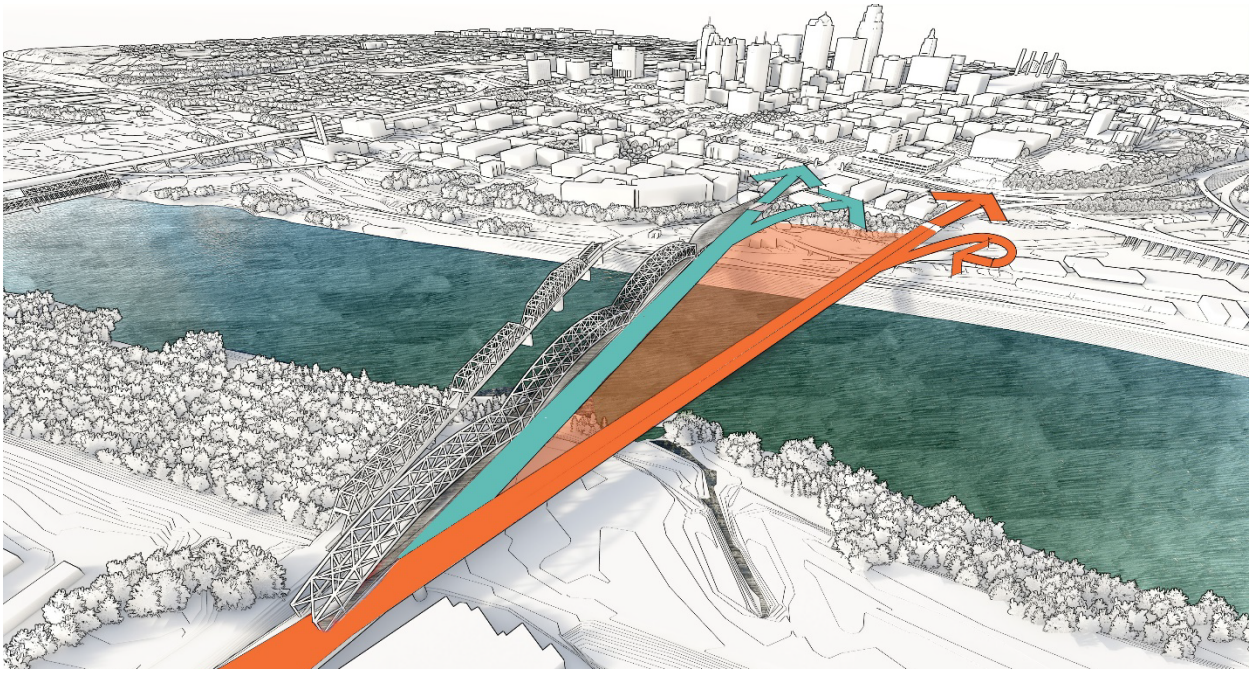


Figure 4-1 Range of New Bridge Alignment Locations

Strategy A1 – No Build Condition

- Connections – Existing issues remain when the current bridge alignment and connections to the River Market and Central Business District remain unchanged. Pedestrian and bicycle connections are not improved and remain unsafe in this strategy.
- Development – No new development opportunities are created.
- Open Space – No new open space opportunities are created.
- Storm Water – No new opportunities to mitigate storm water concerns

Strategy A2 - West Bridge Alignment

- Connections – A west bridge alignment would allow a direct connection for vehicles traveling from US-169 to I-35, reducing the congestion at the intersection of Broadway and 5th Street. The reduction of vehicular traffic in this area would allow for safer pedestrian and bicycle connections at the street level. Pedestrian and bicycle traffic on the bridge is improved with the addition of dedicated lanes.

- Development – No new development opportunities are created in the west alignment.

- Open Space – No new open space opportunities are created.

- Storm Water – The construction of a new bridge would allow for improved storm water collection, control, and conveyance in comparison to the current bridge.

Strategy A3 – Central Bridge Alignment

- Connections – A central bridge alignment would allow a direct connection for vehicles traveling from US-169 to I-35, reducing the congestion at the intersection of Broadway and 5th Street. The reduction of vehicular traffic in this area would allow for safer pedestrian and bicycle connections at the street level. Pedestrian and bicycle traffic on the bridge is improved with the addition of dedicated lanes.

- Development – No new development opportunities are created in the west alignment.

- Open Space – No new open space opportunities are created.

- Storm Water – The construction of a new bridge would allow for an improved storm water collection, control, and conveyance in comparison to the current bridge.

Strategy A4 – Adjacent Bridge Alignment

- Connections – An adjacent bridge alignment would allow a direct connection for vehicles traveling from US-169 to I-35, reducing the congestion at the intersection of Broadway and 5th Street. The reduction of vehicular traffic in this area would allow for safer pedestrian and bicycle connections at the street level. Pedestrian and bicycle traffic on the bridge is improved with the addition of dedicated lanes.

- Development – No new development opportunities are created in the west alignment.

- Open Space – No new open space opportunities are created

- Storm Water – The construction of a new bridge would allow for an improved storm water collection, control, and management in comparison to the current bridge

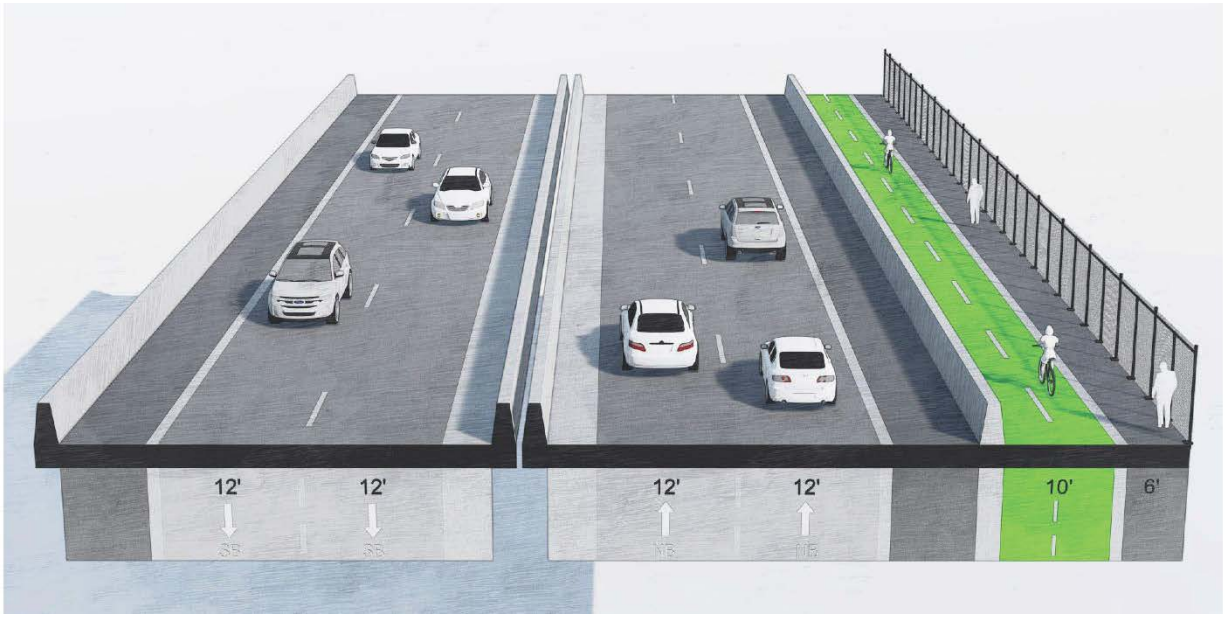


Figure 4-2 Diagram of New Bridge Lane Configuration

The proposed configuration of the new Broadway Bridge incorporates multiple modes of transportation. Two vehicular travel lanes measuring 12’ for both Northbound and Southbound traffic are located on one side of the new span. A 10’ cycle track is also proposed separated by a medium-high concrete barrier to ensure safety for cyclists. On the opposite side of the bridge, a 6’ path for pedestrians allows for sweeping views of the Missouri River and the Kansas City skyline.

4.2 Area B: North Loop Strategies

There are four strategies for the North Loop ranging from minor changes to complete removal. Each of the strategies has different implications for physical connections between neighborhoods, opportunities for new development and open space, and the ability to manage storm water.

Existing Conditions

Figure 4-3 Existing Conditions, View looking West along North Loop Corridor

From an urban design perspective, the North Loop highway has many negative impacts to the quality of the urban environment. First and foremost, the two neighborhoods adjacent to the North Loop, the Central Business District and the River Market, are disconnected both physically and more importantly psychologically and visually. Historically, these two neighborhoods were one cohesive unit, but were ripped apart with the construction of the north loop.

With so many ramps to and from the Interstate, Independence Avenue and 6th Street act as access roads for the interstate and make navigating along and cross those streets for both vehicles and pedestrians challenging.

The stormwater that enters the interstate contributes to the combined storm sewer and adds to the potential for diverted, untreated water to be released into the Missouri River.

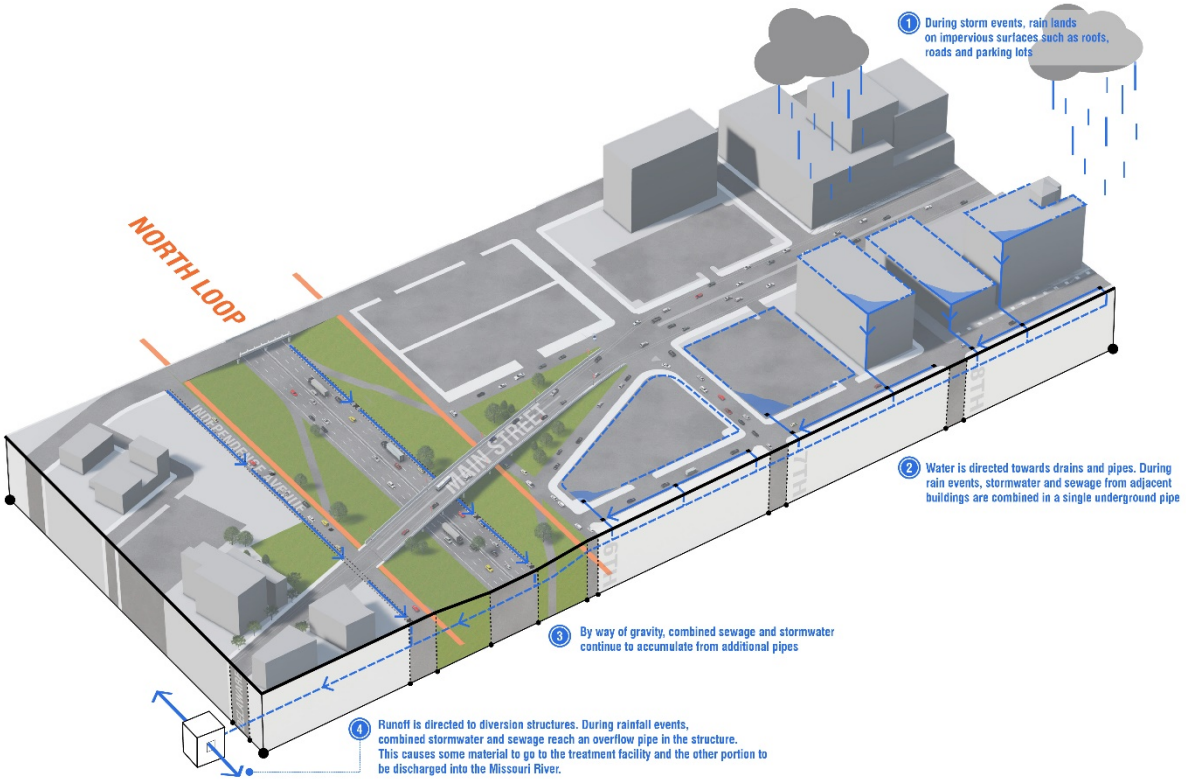


Figure 4-4 Existing Stormwater Conditions

The diagram above illustrates the existing storm water processes that have been mentioned earlier in this document. To briefly summarize, water falls on impervious surfaces such as roofs, streets and parking lots. Once on the surface, water is directed to storm inlets where it enters an underground pipe that is combined with sewage from adjacent buildings. Through the use of gravity, the combined material travels to a diversion structure where during high rainfall events, a portion enters an overflow pipe and is discharged into the Missouri River. The remaining material is directed towards a water treatment facility and upon treatment, is discharged into the river.

Strategy B1 – Access Consolidation

Figure 4-5 Strategy B1, View looking West along North Loop Corridor

- Connections – Strategy B1 eliminates a majority of the vehicular connections from the North Loop to the River Market and Central Business District. The elimination of these ramps pushes the vehicular connections to the west and east side of the Central Business District.

  Several opportunities for providing vehicular access to and from the north loop highway were evaluated as part of this strategy. Due to FHWA safety criteria and requirements, any access in the area between Broadway Boulevard and Charlotte was removed from consideration. These screened options are included in the appendix E. The benefit of this removal is providing the potential for more land to be available for redevelopment.

  The continuation of Independence Avenue from Broadway Boulevard to The Paseo improves the physical connections from the River Market to Columbus Park and the Pendleton Heights neighborhoods.

  Urban Design guidelines should be created to establish aesthetics for all bridge, street and other infrastructure elements related the North Loop.

- Development – New development property is reclaimed from highway right-of-way by the removal of ramps and lowering of Highway 9 to be an at-grade intersection. Location of properties listed below:

  - Northeast corner of Independence Avenue and Oak Trafficway
  - Property between Harrison and I-29
  - The removal of multiple ramps allows for the potential of development on both the north and south slopes of the North Loop. This would require the development to construct walls or build parking to allow for the North Loop to remain functional while providing connections from Independence Avenue or 6th Street.

- Open Space – Strategy B1 does not allow for the creation of open space. The North Loop's footprint remains much the same. Any new development that may occur in adjacent parcels would be encouraged to include small pocket parks or courtyards that would primarily serve the needs of those individual developments.

Figure 4-6 Strategy B1, Open Space Opportunities

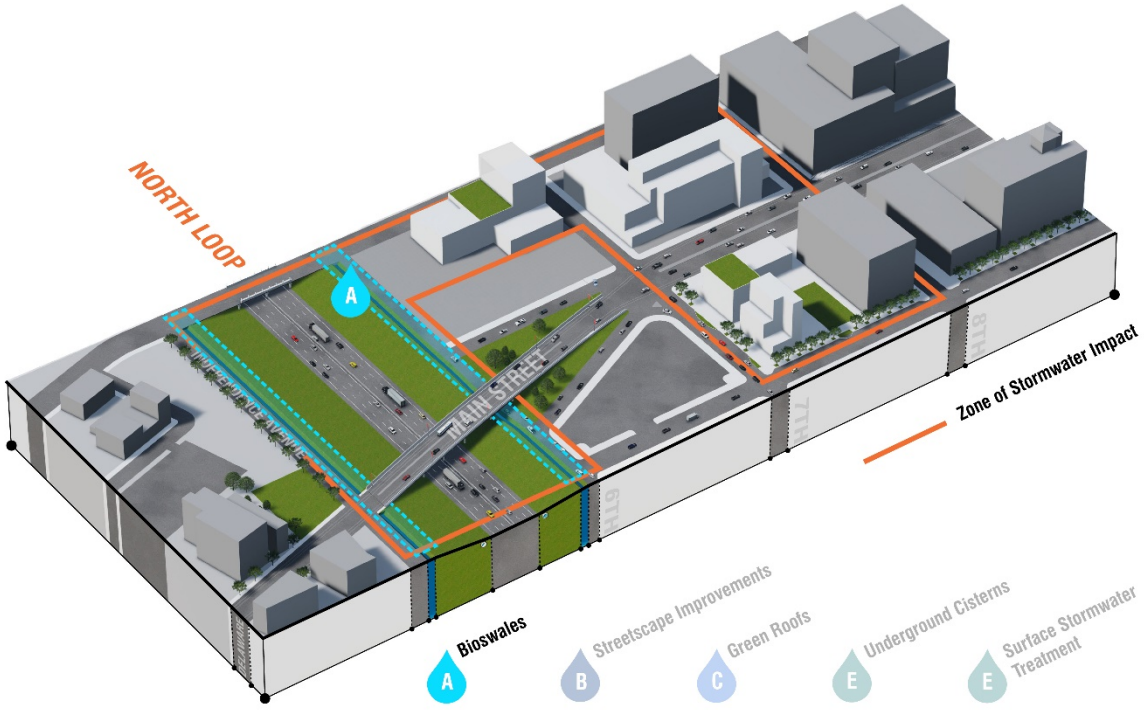


Figure 4-7 Strategy B1, Stormwater Management Opportunities

- Stormwater - With the removal of access ramps to the North Loop, Independence Avenue to the South and 6th Street to the North, remain as a more continuous urban street. However, the South side of Independence Avenue and the North side of 6th Street, will remain adjacent to a sunken interstate highway. Therefore, an opportunity for a bioswale along these edges is available due to their location along the fringe of urban conditions. The bioswales could collect water from Independence Avenue and 6th Street directly as well as to some degree, runoff from adjacent streets and surface parking lots.

  The removal of ramps allows for the possibility of utilizing the north and south side slopes of I-70 to collect, control, and convey storm water to help manage the current combined storm and sanitary concerns of the Central Business District. Large diameter pipes buried in the side slopes of the freeway would serve as an 'offline' storage and infiltration feature. Runoff would be diverted to the pipes during rain events for storage, and either a) slowly released back to the system following peak events, or b) infiltrated into the soils if suitable. Approximately 2 Acre Feet of storage could be utilized in this arrangement. This option is a Grey System and would contribute little to the above ground city fabric.

  As development begins to fill in underutilized parcels adjacent to the North Loop, buildings should follow Low Impact Development strategies by using green building techniques.

Strategy B3-6a – Compressed Footprint (South)

Figure 4-8 Strategy B3-6a, View looking West along North Loop Corridor

- Connections - The footprint of the North Loop is drastically reduced. North / South connections remain largely the same. The visual connection between the Central Business District and the River Market is somewhat improved. Independence Avenue will become a two-way street complete with traffic calming elements, public transportation infrastructure, on-street parking and ample streetscape amenities. 6th Street will also increase in traffic capacity and will be a two-way street with streetscape improvements and on-street parking.

  Several opportunities for providing vehicular access to and from the north loop highway were evaluated as part of this strategy. Due to FHWA safety criteria and requirements, any access in the area between Broadway Boulevard and Charlotte was removed from consideration. These screened options are included in the appendix E. The benefit of this removal is providing the potential for more land to be available for redevelopment.

  Urban Design guidelines should be created to establish aesthetics for all bridge, street and other infrastructure elements related the North Loop.

- Development – Shifting the North Loop to the South (towards the Central Business District) allows for some development opportunities along the North edge of the condensed highway. Incorporated into the wall infrastructure of the highway, parking would serve the development above. Development should be appropriately sized for its context and fit into the character of the neighborhood(s).

Figure 4-9 Strategy B3-6a, Open Space Option A

- Open Space – Strategy B3-6a presents different opportunities for increased open space in the North Loop area. Option A looks to solely utilize the strip of land on the North (River Market) side of the North Loop amongst potential new development. Due to the alignment of the highway and Independence Avenue, land becomes too narrow for development purposes. It is at these locations that open space would be appropriate. The open space would be linear in form and provide minimal recreational opportunities.

Figure 4-10 Strategy B3-6a, Open Space Option B

Option B utilizes the new parcels of land on the north side of the North Loop for new development. Structures shown in this option are the same as opportunity A. The open space incorporates multiple zones for stormwater collection, control and treatment before entering the combined sewer overflow system. Occupiable open space will be incorporated with the stormwater treatment to allow public interaction with the space.

Figure 4-11 Strategy B3-6a, Open Space Option C

This option adds a deck over the North Loop that spans between Walnut Street and Grand Boulevard. This new open space would provide a civic green and gateway between the River Market and Central Business District. Along with public space, stormwater collection and containment would be incorporated into the design of the space.

Figure 4-12 Strategy B3-6a, Deck Lid Open Space Amenity

- Storm Water – Many opportunities for small-scale storm water management will provide a large beneficial impact to overall water quality challenges for Kansas City. With the prevalence of linear stretches of small open space, tree trenches and bio-swales allow for storm water collection while also enhancing the streetscape environment. Other streetscape improvements such as rain garden bump-outs, pervious paving and added vegetation, will also serve to collect, control and convey storm water. The opportunities for small pocket parks is also available that can be utilized for storm water collection. Any new development will be encouraged to include green elements into their final design such as green roofs. A large pedestrian focused Tree – trench 'Filter Allee' adjacent to the freeway would provide stormwater storage/ filtering (neighboring streets) and air quality filtering (freeway exhaust). Tree trenches, porous paving, stormwater planters, and 'stormwater plazas'. All landscape areas would provide multiple functions, several ecosystem benefits and performance would increase over time.

Strategy B3-6b – Compressed Footprint (North)

Figure 4-13 Strategy B3-6b, View looking West along North Loop Corridor

- Connections - The footprint of the North Loop is drastically reduced. North / South connections remain largely the same. The visual connection between the Central Business District and the River Market is somewhat improved. Independence Avenue will become a two-way street complete with traffic calming elements, public transportation infrastructure, on-street parking and ample streetscape amenities. 6th Street will also increase in traffic capacity with streetscape improvements and on-street parking.

  Several opportunities for providing vehicular access to and from the north loop highway were evaluated as part of this strategy. Due to FHWA safety criteria and requirements, any access in the area between Broadway Boulevard and Charlotte was removed from consideration. These screened options are included in the appendix E. The benefit of this removal is providing the potential for more land to be available for redevelopment.

  Urban Design guidelines should be created to establish aesthetics for all bridge, street and other infrastructure elements related the North Loop.

- Development – Shifting the North Loop to the North (towards the River Market) allows for some development opportunities along the South edge of the condensed highway. Incorporated into the wall infrastructure of the highway, parking would serve the development above. Development will be appropriately sized for its context and fit into the character of the neighborhood(s).

- Open Space – With the opportunity for development also comes the opportunity for small open spaces. Pocket parks, streetscape improvements and connections with trails all combine to add recreational and civic spaces opportunities.

- Storm Water – Many opportunities for small-scale storm water management will provide a large beneficial impact to overall water quality challenges for Kansas City. With the prevalence of linear stretches of small open space, bio-swales allow for storm water collection while also enhancing the streetscape environment. Other streetscape improvements such as rain garden bump-outs, pervious paving and added vegetation, will also serve to collect, control and convey storm water. The opportunities for small pocket parks is also available that can be utilized for storm water collection. Any new development will be encouraged to include green elements into their final design such as green roofs.

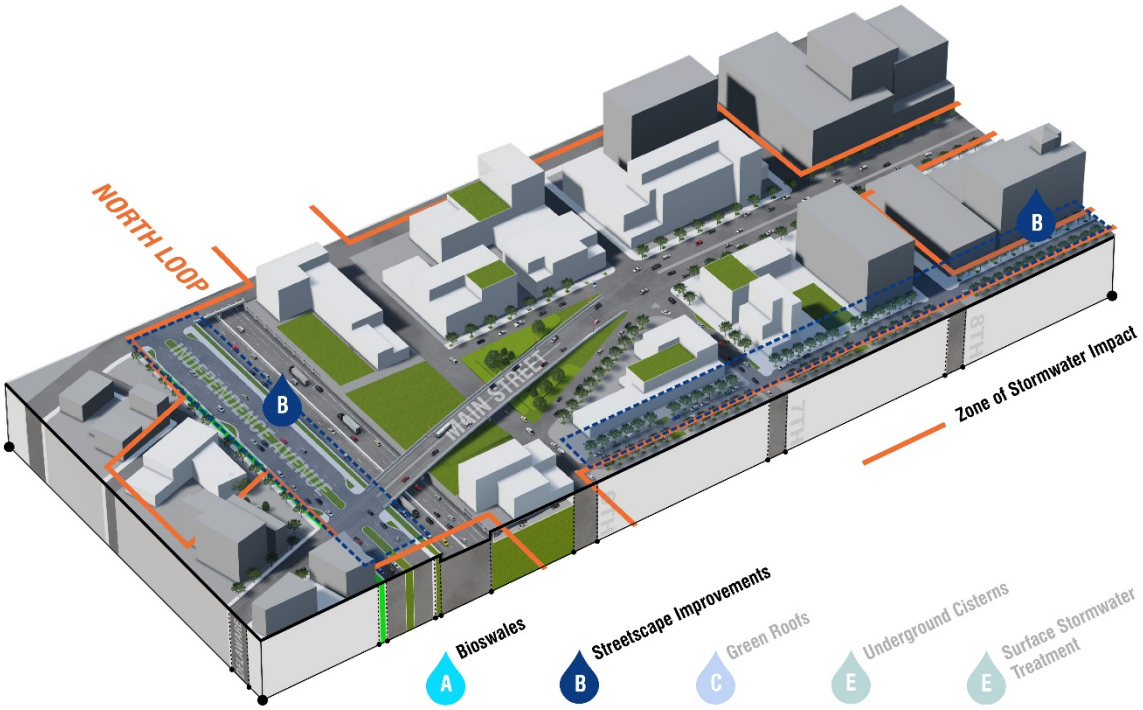


Figure 4-14 Strategy B3-6b, Stormwater Management Opportunities

Strategy B7-1 – Redesignate and Reclassify

Figure 4-15 Strategy B7-1, View looking West along North Loop Corridor

- Connections – With the complete removal of the North Loop, connections between the Central Business District and the River Market are much improved. Two sets of intersections, at 6th Street and Independence Avenue for each of the North / South roads will remain as well as the Main Street overpass over 6th Street. The visual continuity between the Central Business District and the River Market is greatly improved with the opportunity for large parcels to be developed. Independence Avenue will become a two-way street complete with traffic calming elements, public transportation infrastructure, on-street parking and ample streetscape amenities. 6th Street will also increase in traffic capacity and will be a two-way street with streetscape improvements and on-street parking.

- Development – The former footprint of the North Loop is available for development. The development will be appropriately scaled for the context of the Central Business District and the River Market. The development should help visually bridge the different building typologies present in those two different neighborhoods.

- Open Space – There are different opportunities for open space that the Redesignate and Reclassify strategy affords. One opportunity is similar to the other strategies with pocket parks being located along the corridor. The parks will be larger in scale due to more land being available. Utilizing the existing topography of the North Loop corridor and the fact that the Main Street Overpass will remain, the area under that overpass as well as that entire block, provides the opportunity for an iconic greenspace. Any new green space causes adjacent development to be more valuable as they will be located next to a public amenity.

Figure 4-16 Strategy B7-1, Series of Separated Open Spaces

Figure 4-17 Strategy B7-1, Series of Separated Open Spaces with Stormwater Collection

Figure 4-18 Strategy B7-1, Continuous Open Space

Figure 4-19 Strategy B7-1, Continuous Open Space with Stormwater Collection

Figure 4-20 Existing Condition

Figure 4-21 Civic Space and Stormwater Management within New Development – View 1

- Storm Water – All of the elements previously discussed, streetscape improvements, bio-swales, porous pavement, green building practices, all apply to this strategy. As mentioned earlier in this document, two solutions for storm water exist for this specific North Loop strategy; a grey water solution and a green infrastructure solution.

  A combination of development and open space in the footprint of the former North Loop could incorporate a grey stormwater infrastructure system. In large cisterns underground, runoff combined with sewage would be collected and stored. This option contributes very little to the urban realm and is not an ideal way to store combined material due to maintenance challenges.

  To alleviate those challenges, there is a possibility to separate stormwater and sewage upstream from the storage tanks. With new development, private partnership relationships could be made that ensures incentives for developers who contribute to the cost of green infrastructure implementation. If sewage and stormwater were to be separated closer to the source, cisterns located within the North Loop would store purely stormwater which allows for the opportunity to use that stormwater as a source of irrigation as well as potable water for potential Low Impact Development as well as serving the ultimate goal of mitigating CSO events due to the delayed and slowed release of material back into the stormwater infrastructure.

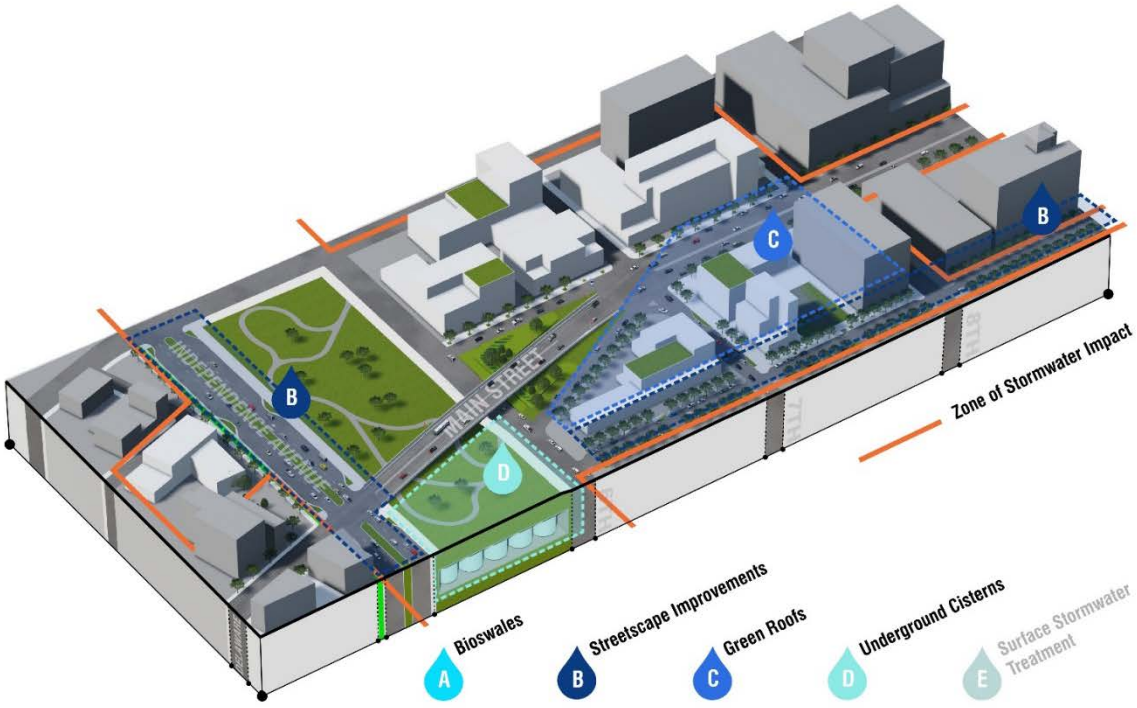


Figure 4-22 Strategy B7-1, Below Grade Stormwater Management Opportunities

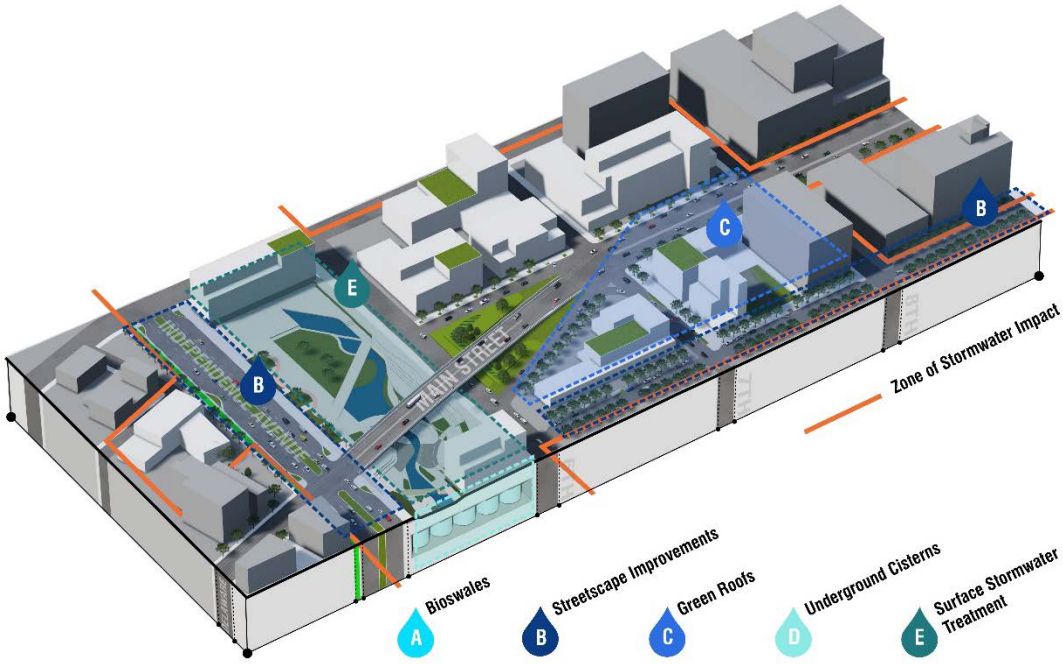


Figure 4-23 Strategy B7-1, At Grade Stormwater Management Opportunities

The natural topography of this corridor results in a depression around the Main Street overpass. As this would naturally be the drainage area for water, it makes sense to capitalize on those conditions and design a space where storm water can collect and become an asset for the urban environment. Surrounding the water feature, performance and gathering spaces collectively bring an increased level of activity and vibrancy to this area. New mixed-use development could also be incorporated with outdoor terraces and patios that seek to build off the moment of the public space.

Figure 4-24 Civic Space and Stormwater Management within New Development – View 2

Figure 4-25 Existing Condition

Figure 4-26 Civic Space and Stormwater Management within New Development – View 3

Independence Avenue

All of the North Loop strategies implies large scale changes and improvements to Independence Avenue. Once a major East/West corridor, the construction of the North Loop altered both its configuration and the flow of traffic along it. Therefore, Independence Avenue should be viewed as a corridor that seeks to efficiently move vehicles and public transportation, provide a safe route for cyclists, and be a pleasant environment for pedestrians.

Depending on the strategy selected for the North Loop, the options for Independence Avenue shift slightly.

Figure 4-27 Independence Avenue, 16’ Center Median

This option for Independence Avenue involves a 16’ foot median, two travel lanes in each direction, on-street parking, public transportation infrastructure, a 10’ cycle track, and sidewalks on either edge. As traffic calming elements, bumpouts will distinguish between the travel and parking lane while also providing opportunities for green stormwater infrastructure. Street trees will be incorporated to along the sidewalks and in the median to enhance the urban environment and improve air quality. The cycle track will be buffered from moving traffic by on-street parking, bollards and street trees.

Figure 4-28 Independence Avenue, No Median

Figure 4-24 shows alternative 2 for Independence Avenue. With the North Loop footprint being closer to Independence Avenue in this scenario, the median is omitted. Two travels exist for each direction, as well as on-street parking, public transit infrastructure, a 10’ cycle track and sidewalks. Street trees remain on the sidewalks and bumpouts continue to define the travel and parking lanes while providing the opportunity for green stormwater infrastructure. The cycle track is protected by on-street parking, bollards and street trees.

Figure 4-29 Independence Avenue, Reduced Lanes with Center Turn Lane

A third version of Independence Avenue reduces the number of travel lanes to one in each direction with a center turn lane. Public transportation is still a vital component of this configuration while also providing on-street parking, a cycle track and sidewalks on both sides.

4.3 Area C: Wheeler Airport and Harlem

With a new Broadway Bridge, comes the opportunity for better connections to both the Downtown Wheeler Airport and the Harlem neighborhood located along the Northern shore of the Missouri River across from Downtown Kansas City. Primarily an industrial area today, with better vehicular and transit connections, this area is ripe for redevelopment.

Strategies for Wheeler Airport

- Connections – The strategies proposed in the PEL Refined Strategies Report improve the control and access of vehicles moving along 169 and traffic entering and exiting the Wheeler Airport. Pedestrian and bicycle movement through this area is also improved by the accommodation of pedestrian / bicycle lanes on the bridge and allowing this movement to be facilitated safely through the proposed strategies.

- Development – No new development opportunities are created in the airport strategies.

- Open Space – No occupiable open space opportunities are created in the airport strategies.

- Storm Water – The possibilities for occupiable open spaces are limited in the current strategies for the airport, but where available open space should be utilized for stormwater management. This areas could be connected to the a larger system that facilitates a comprehensive stormwater solution with the airport, bridge, interchange, railroad, and potential future development in the Harlem district.

Harlem District

- Connections – Future opportunities to improve vehicular, pedestrian and bike connections with Harlem should be explored. These connections will increase the viability of Harlem as an area for future development.

- Development – The proximity of the Harlem district to downtown and the relationship between the property and the Missouri River makes this district a strong candidate for future development. Providing multiple connections into the district will improve the circulation patterns and help this district succeed.

- Open Space – If connections are improved, one possibility for this district would be as an open space and recreation field destination for residents of the River Market, Columbus Park, Central Business District, North Kansas City, and beyond.

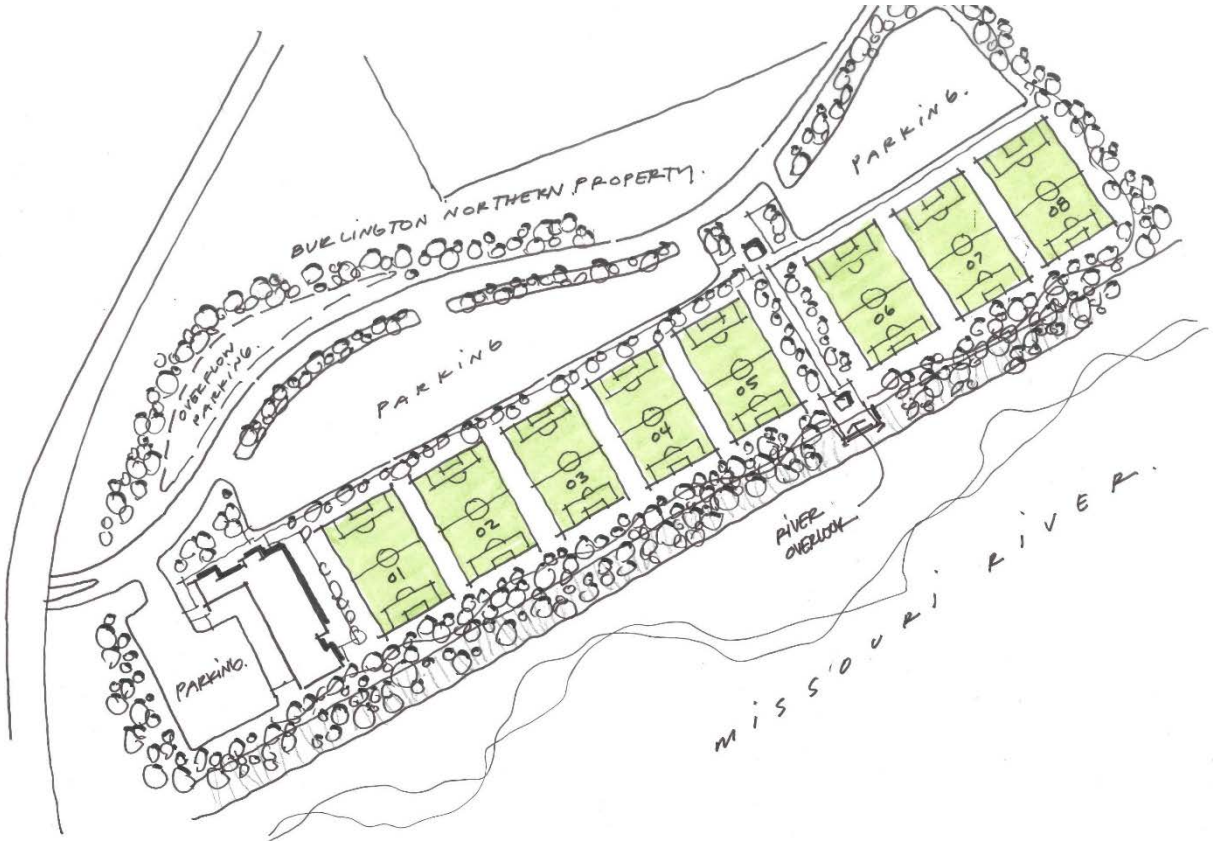


Figure 4-30 Harlem Open Space – Recreation Field Concept

- Storm Water – The development and improvements made in the Harlem neighborhood should take into consideration the proximity to the Missouri River and utilize a strategy for storm water collection, control, and management to improve any current storm water concerns. These strategies should tie into a comprehensive strategy that involves the railroad, airport and other adjacent land uses.

4.4 Area E: Missouri Route 9

Route 9 serves as a major North/South connection from the Central Business District of Kansas City to North Kansas City and points further north. The trajectory of Route 9 carries the elevated highway over the Missouri River via the Heart of America Bridge and through the River Market and Columbus Park neighborhoods. Due to it being elevated, the highway acts as a definitive border between these two neighborhoods. With the construction of Highway 9, Independence Avenue, which historically ran East/West uninterrupted from the Pendleton Heights neighborhood to the River Market, is forced to deviate to make room for the ramps and connections needed for the Highway 9/North Loop connection. From the perspective of land use and value, the areas adjacent to Highway 9 have been depressed since the construction of Highway 9. Furthermore, Columbus Park is physically isolated from surrounding neighborhoods because of highway and railway infrastructure on all four sides.

Strategy E2a – All At-Grade Connections, Existing MO-9 Alignment

Figure 4-31 Strategy E2a –Existing MO-9 Condition

- Connections – Strategy E2a proposes bringing Highway 9 to grade at the South terminus of the Heart of America Bridge. By doing this, new surface-level intersections are created at 3rd and 5th Street and Highway 9 becomes much less of a physical and visual divide between the River Market and Columbus Park neighborhoods. An existing cycle track on the Heart of America Bridge would continue uninterrupted parallel to Highway 9 and tie into a recommended cycle track on the reconfigured Independence Avenue.

- Development – With Highway 9 being brought down to grade, land that was formerly unusable / unattractive for development, now is situated on a major thoroughfare that brings the River Market neighborhood and Columbus Park neighborhoods together by means of an attractive streetscape, multiple scales of transportation and a cohesive urban fabric. Development should be appropriately scaled for its context and contain a mixed-use typology of office, commercial and residential uses.

- Open Space – The existing Highway 9 alignment does not allow for much added open space. However, with a more direct connection to the Heart of America Bridge cycle track, larger region-wide recreational connections are made.

- Storm Water – With large scale infrastructural changes to the existing highway and road network, any new configuration of Highway 9 has the opportunity to incorporate storm water infrastructure in the form of bioswales, rain gardens and porous pavement. Additionally, any new development should incorporate green building techniques.

Strategy E2b – All At-Grade Connections, Western Offset of MO-9 Alignment

Figure 4-32 Strategy E2a – All At-Grade, Existing MO-9 Alignment

- Connections - Strategy E2b proposes bringing Highway 9 to grade at the South terminus of the Heart of America Bridge on a more Western alignment. This implies that Highway 9 will deviate slightly from its current configuration and becomes a straighter axis between the river and the Central Business District. As in Strategy E2a, new surface-level intersections are created at 3rd and 5th Street and Highway 9 becomes much less of a physical and visual divide between the River Market and Columbus Park neighborhoods. An existing cycle track on the Heart of America Bridge would continue uninterrupted parallel to Highway 9 and tie into a recommended cycle track on the reconfigured Independence Avenue.

- Development – With a slightly more western alignment, opportunities for development are still present with only a small decrease in the amount of land available along the Western edge of Highway 9. As was the case in Strategy E2a, Highway 9 would incorporate alternative transportation options, enhanced streetscapes and an attractive street-level environment that is focused on the pedestrian. Development should be appropriately scaled for its context and contain a mixed-use typology of office, commercial and residential uses.

- Open Space – With the interest of keeping Cherry Street in its current location parallel to Highway 9 on the East side, a small linear green space is created. This green space has the potential to be a small neighborhood park that provides a calming buffer between Highway 9 and the Columbus Park neighborhood. Furthermore, this space could incorporate the cycle track from the Heart of America bridge and create a pleasant vegetated connection to Independence Avenue.

- Storm Water – Similar to Strategy E2a, large scale infrastructural changes to the existing highway and road network should incorporate storm water infrastructure in the form of bioswales, rain gardens and porous pavement. Specifically, the linear greenspace mentioned above, should incorporate a combination of green and grey infrastructure to capture, contain, clean and convey stormwater. Additionally, any new development should incorporate green building techniques.

Figure 4-33 Strategy E2b – All At-Grade, Western Offset of MO-9 Alignment

5. Economic Development

Each one of the scenarios for the North Loop considers the potential for new development parcels on land that currently is occupied by Interstate 70 or Highway 9. As previously discussed in Section 4.2, the removal or realignment of Interstate 70 could have a dramatic impact on the adjacent existing development parcels that are currently occupied by surface parking lots. This shift from being directly adjacent to the interstate to being reconnected to the city grid changes the perception of the role of these parcels in the urban fabric.

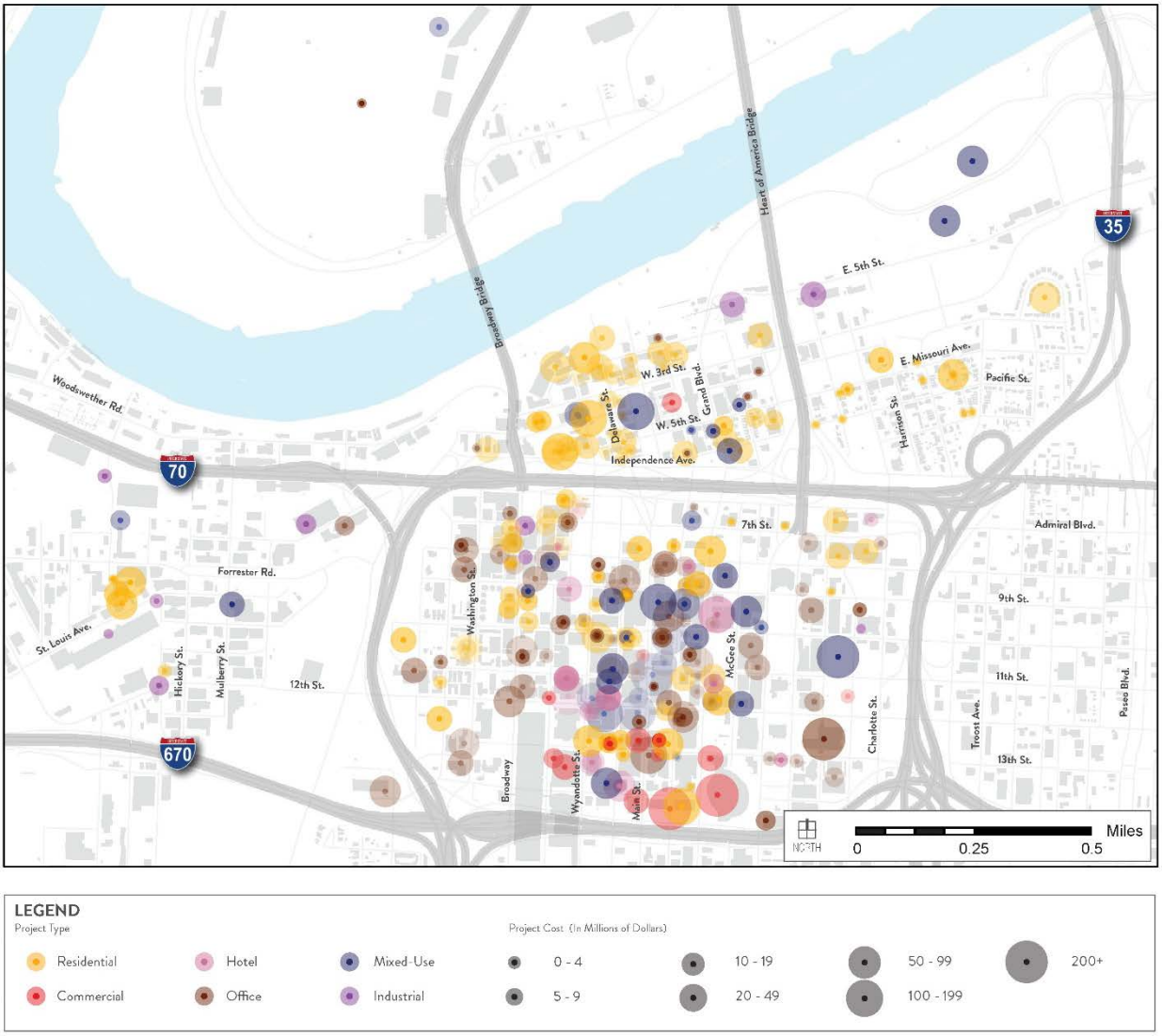


Figure 5-1 Overall Investment Trends from 1980 to Current

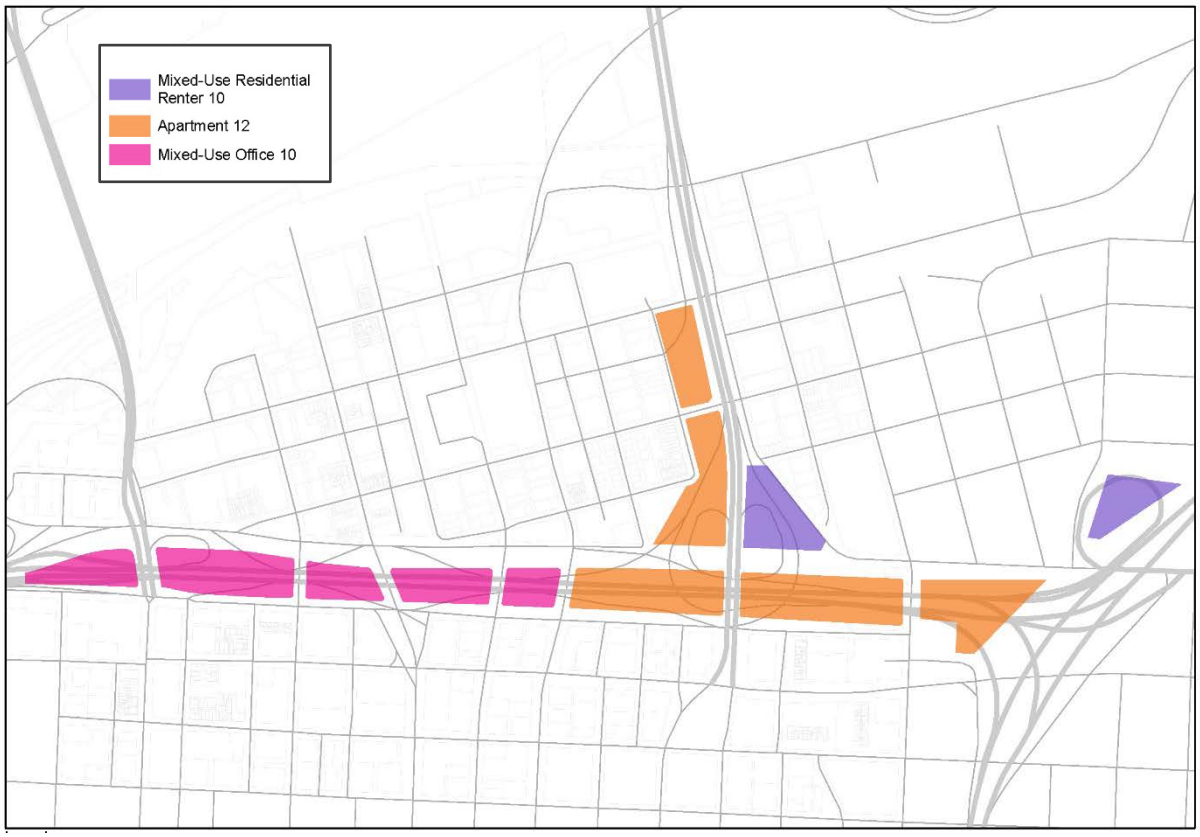


Figure 5-2 Development Scenario for New Parcels Created with Strategy B7-1 and E2a

The evaluation in this section focuses only on the new parcels created with Strategy B7-1 and Strategy E2a. The scenarios utilize three mixed-use development models in an attempt to allow for a variety of residential, commercial, retail, and office within the parcels. Multiple scenarios were explored with the range of development numbers listed below.

Category	Range based on Development Opportunity
Residential	2,277,815 to 3,037,090 square feet
Retail	315,630 to 315,630 square feet
Office	1,381,735 to 1,842,310 square feet
Population	3,650 to 4,865 residents
Households	1,815 to 2,425 households
School Aged Children	350 to 475 students
Employment	3,820 to 5,095 jobs
Property Tax Revenue	$2,978,880 to $3,971,840
Sales Tax Revenue	$5,940,560 to $7,920,745