



04 **Evaluation + Recommendations**



ALTERNATIVE A

Ecusta Line Extension Alignment

Route Description

This alternative assumes the City of Hendersonville *can* acquire the remaining active Ecusta Line (owned by Watco) that extends from the Ecusta Trail (under construction) north to 4th Avenue East. Alternative A would convert the remaining rail line to a paved shared use path that would extend to a point just north of 4th Avenue East to form an extension of the Ecusta Trail. From the end of the Ecusta Line, a sidepath along 4th Avenue East would continue east into Jackson Park to connect with the existing Oklawaha Greenway. An optional rail-with-trail segment is also included between 4th Avenue East and 7th Avenue East. This rail-with-trail is along the active Zirconia Line (owned by Watco) and connects the 7th Avenue Historic District.

Length

~6,240 linear feet (1.2 miles)

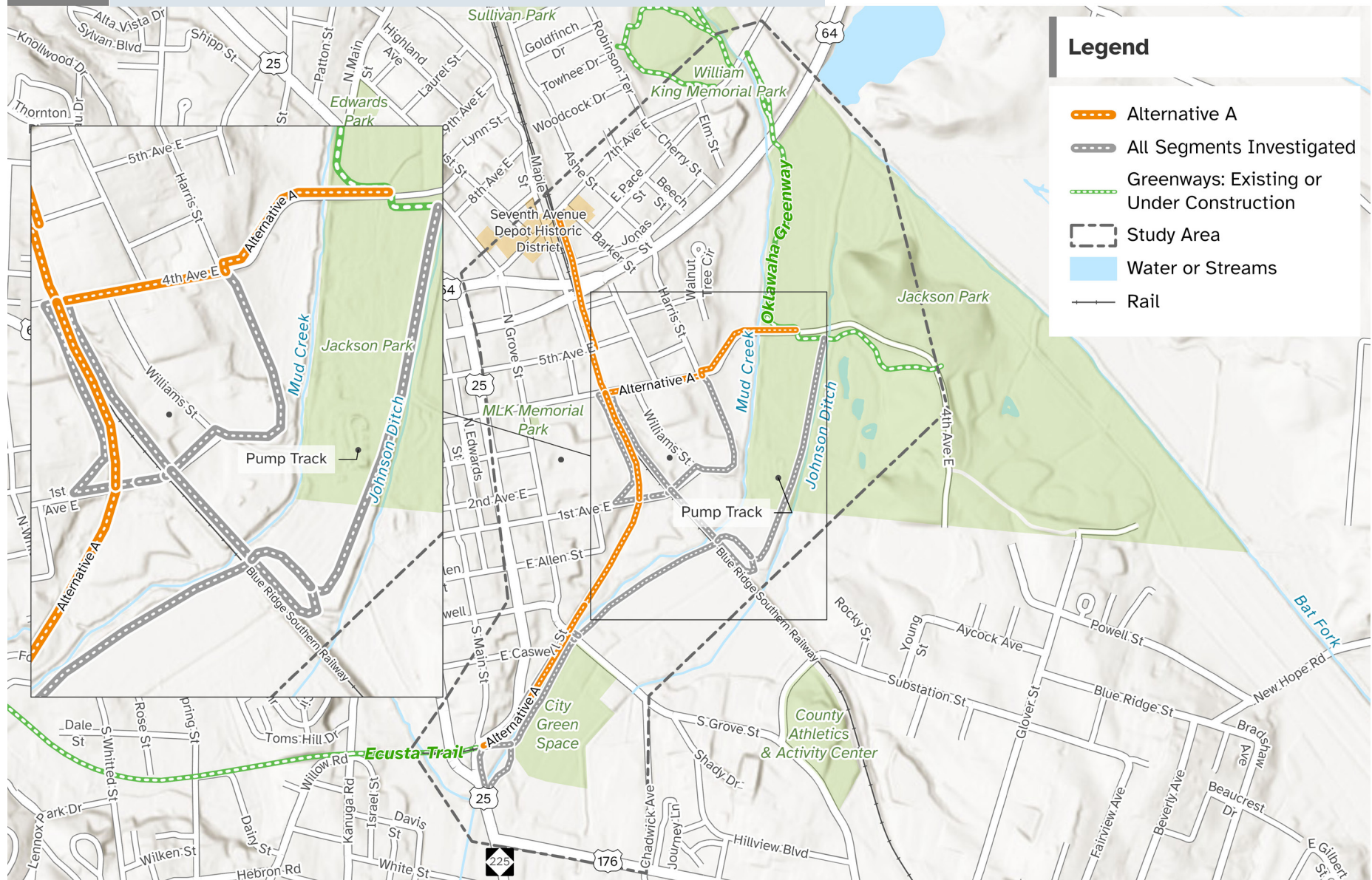
Alternative A Pros

- Most direct route to downtown and 7th Avenue.
- Provides access to neighborhoods that could use the greenway for transportation.
- Mostly off-road alignment would separate users from vehicular traffic.
- Avoids many floodway and environmental constraints.
- Provides a variety of user experiences.

Alternative A Cons

- Less direct connection to the Oklawaha Greenway and Hellbender Trail system.
- The connection to the Oklawaha Greenway and the Hellbender System will require a new sidepath along 4th Avenue East and a new bridge over Mud Creek.
- Would need to receive NCDOT approval to travel under the US 64 elevated structure.
- Requires right of way purchase from Watco.
- The segment between 4th Avenue East and 7th Avenue East will require Watco rail-with-trail approval. If that is not feasible, this segment will need to be removed from Alternative A.
- Crossing on South Grove Street has some sight line limitations and would require installation of a Rectangular Rapid Flashing Beacon (RRFB).

Map 32. Alternative A



ALTERNATIVE B

Floodplain Restoration Projects Alignment

Route Description

This alternative assumes that it is *not* feasible to convert the remaining active Ecusta Line to a greenway. From the Ecusta Trail section that is under construction, Alternative B would depart from the rail bed at a point just east of South King Street and turn south to cross Mud Creek via a proposed pedestrian bridge. On the south side of Mud Creek, it would continue to the east on City-owned land. It would cross South Grove Street and then follow a proposed sewer easement to connect to Jackson Park as it passes under a railroad bridge. This alternative would connect to the existing Oklawaha Greenway in Jackson Park and then continue west towards downtown as a sidepath along 4th Avenue East. This alternative also includes an optional* greenway spur between 4th Avenue East and 7th Avenue East, generally following the Watco rail right-of-way, connecting to the 7th Avenue Historic District. This alternative will require modifications to the existing dog park layout and fencing in order to separate the greenway.

**In the event that Watco will not allow the segment between 4th Ave and 7th Ave, this spur trail to 7th Ave will need to be removed from Alternative B.*

Length

~8,045 linear feet (1.5 miles)

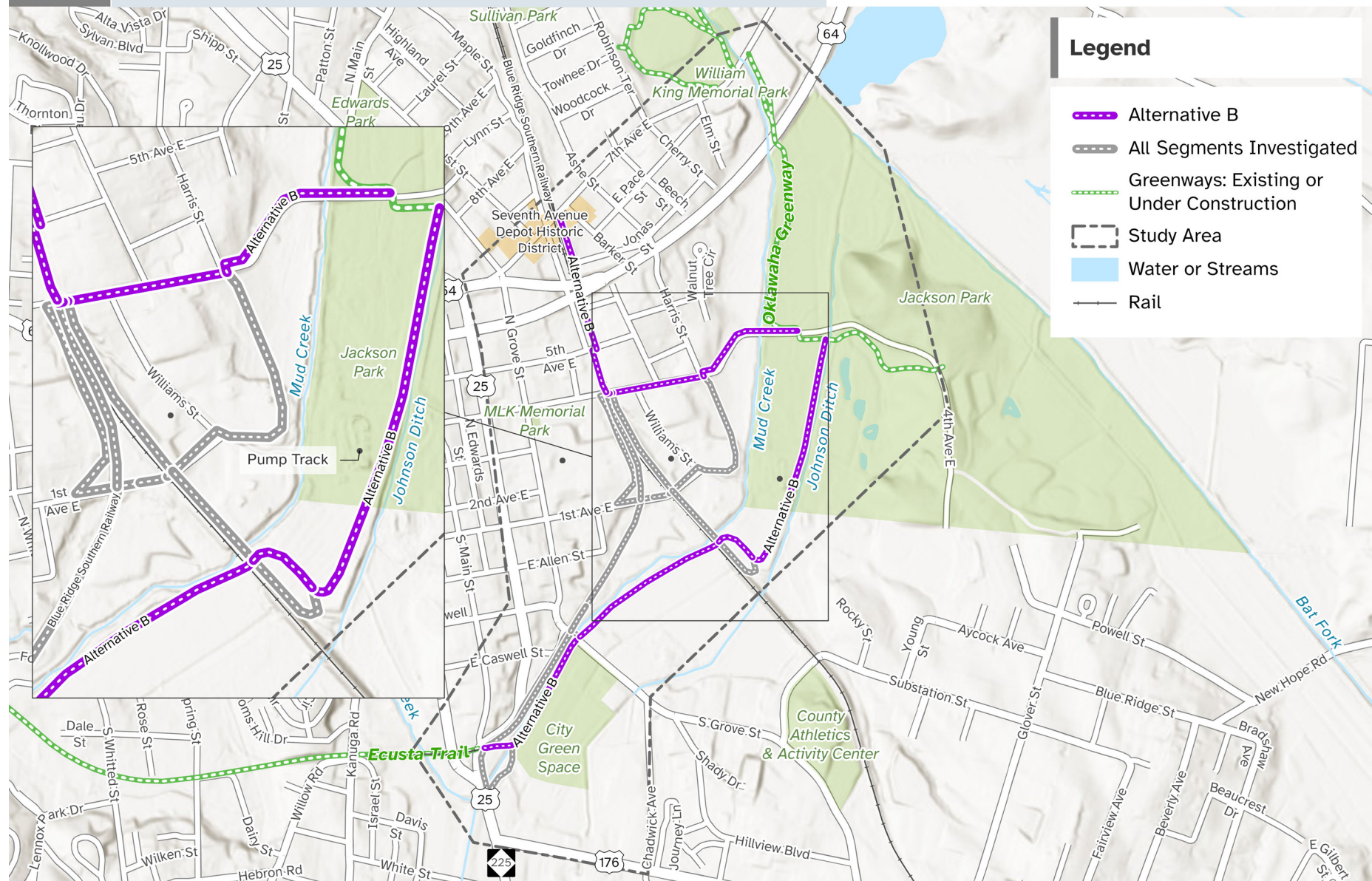
Alternative B Pros

- Provides a more direct connection to Jackson Park, the Oklawaha Greenway, and the Hellbender Trail system.
- High quality user experience along Mud Creek.
- A mostly off-road route that separates greenway users from vehicular traffic.
- Much of the greenway can be designed, permitted, and constructed with other City projects that are already underway.

Alternative B Cons

- Would require a pedestrian bridge over Mud Creek.
- Less direct route to downtown and 7th Avenue than Alternative A.
- The connection to downtown from the Oklawaha Greenway and the Hellbender System, will require a new sidepath along 4th Avenue and a new bridge over Mud Creek.
- Much of this route is in the Mud Creek floodway and will be prone to flooding. Regular maintenance will be required after flooding events.

Map 33. Alternative B



EVALUATION CRITERIA

By considering all possible segments that could comprise a greenway connection, the project team could then determine the preferred alignments. To arrive at those preferred alignments, a prioritization strategy was necessary.

Evaluation criteria aid this decision-making process by assigning a value to each criterion and alignment. The evaluation criteria considered for the Above the Mud Greenway include those in **Table 2 - Evaluation Criteria**.

Table 2. Evaluation Criteria

ABOVE THE MUD GREENWAY EVALUATION CRITERIA	
	<p>DIRECTNESS OF CONNECTION</p> <p>Based on a comparison of alternatives, how direct is this route for users to access Jackson Park, the Oklawaha Greenway (Hellbender Trail system), downtown, and the 7th Avenue Depot Historic District?</p>
	<p>ABILITY TO ACQUIRE ENVIRONMENTAL PERMITS</p> <p>Based on known natural and human environmental impacts (e.g. flood zones), how likely is it that this option can be permitted?</p>
	<p>QUALITY OF USER EXPERIENCE</p> <p>What level of user experience does this route alternative offer in terms of visual surroundings, separation from hazards, personal safety, and connection to nature and topography (including accessible grades)?</p>
	<p>AVAILABILITY OF RIGHT-OF-WAY/ANTICIPATED PROPERTY OWNER COOPERATION</p> <p>To what degree is right of way available or held by cooperative property owners?</p>
	<p>SECONDARY BENEFITS</p> <p>Beyond the primary project goal, how well does this project provide opportunity for secondary benefits such as access to under-served populations (equity), economic development, connections to community resources, sense of place, etc.?</p>
	<p>SEPARATION FROM MOTORIZED TRAFFIC CONFLICTS</p> <p>How well does this alternative separate users from motorized traffic conflicts to provide higher levels of comfort and to limit traffic impacts?</p>

Table 2. Evaluation Criteria (Continued)

ABOVE THE MUD GREENWAY EVALUATION CRITERIA	
	ABILITY TO CONSTRUCT Based on an investigation of physical obstacles and constraints (e.g. roads, utilities, topography, buildings, waterways, etc.), how likely is it that this alternative can be built?
	ALIGNMENT WITH COMMUNITY GOALS Based on community leadership, public feedback, adopted planning efforts and stated local goals and objectives, what is the anticipated level of community support for this alternative?
	COST EFFECTIVENESS Based on a comparison of alternatives, what is the cost effectiveness of this alternative?
	POTENTIAL FOR FUNDING Compared to other alignments, how likely is this route to qualify for known grant and funding opportunities?
	POTENTIAL FOR TIMELY IMPLEMENTATION How likely will this project be able to be funded, designed, permitted, and constructed as compared to other alternatives?

DECISION MATRIX & SCORING

The project team developed a systematic scoring methodology to assist in identifying preferred alignments that will contribute to the overall goals of the project and to meet stated evaluation criteria. Based on a comparison of alternatives, the two primary alternatives (and their respective sub-alternatives) were assigned a ranking based on how it meets the criteria:

- | | |
|-------------------|-------------------|
| 1 – Below Average | 3 – Above Average |
| 2 – Average | 4 – Highest |

The outcome of this scoring is illustrated in **Table 3 - Evaluation Criteria Scoring**. After the ranking was completed, the alignments were presented to the committee and stakeholders. After this feedback was gathered, the highest ranked alignments were studied for cost estimating purposes.

Table 3. Evaluation Criteria Scoring

CRITERIA	ALTERNATIVE/ SCORE	
	ALT A	ALT B
Directness of connection to Jackson Park, Oklawaha Greenway (Hellbender Trail system), downtown and 7th Avenue Historic District	4	4
Ability to acquire environmental permits	4	3
Quality of user experience	4	4
Availability of right-of-way (anticipated property owner cooperation)	2	4
Secondary benefits	4	4
Separation from motorized vehicle conflicts	4	4
Ability to construct	4	4
Alignment with community goals	4	4
Cost effectiveness	4	3
Potential for funding	4	4
Potential for timely implementation	3	4
TOTAL	41	42

RECOMMENDATIONS

The evaluation criteria scoring resulted in two highest scoring alternatives for the Above the Mud greenway: Alternative A and B, both scoring 40.

Both alignments ranked the highest (a value of 4) for directness of connection, quality of user experience, secondary benefits, separation from motorized vehicle conflicts, and alignment with community goals.

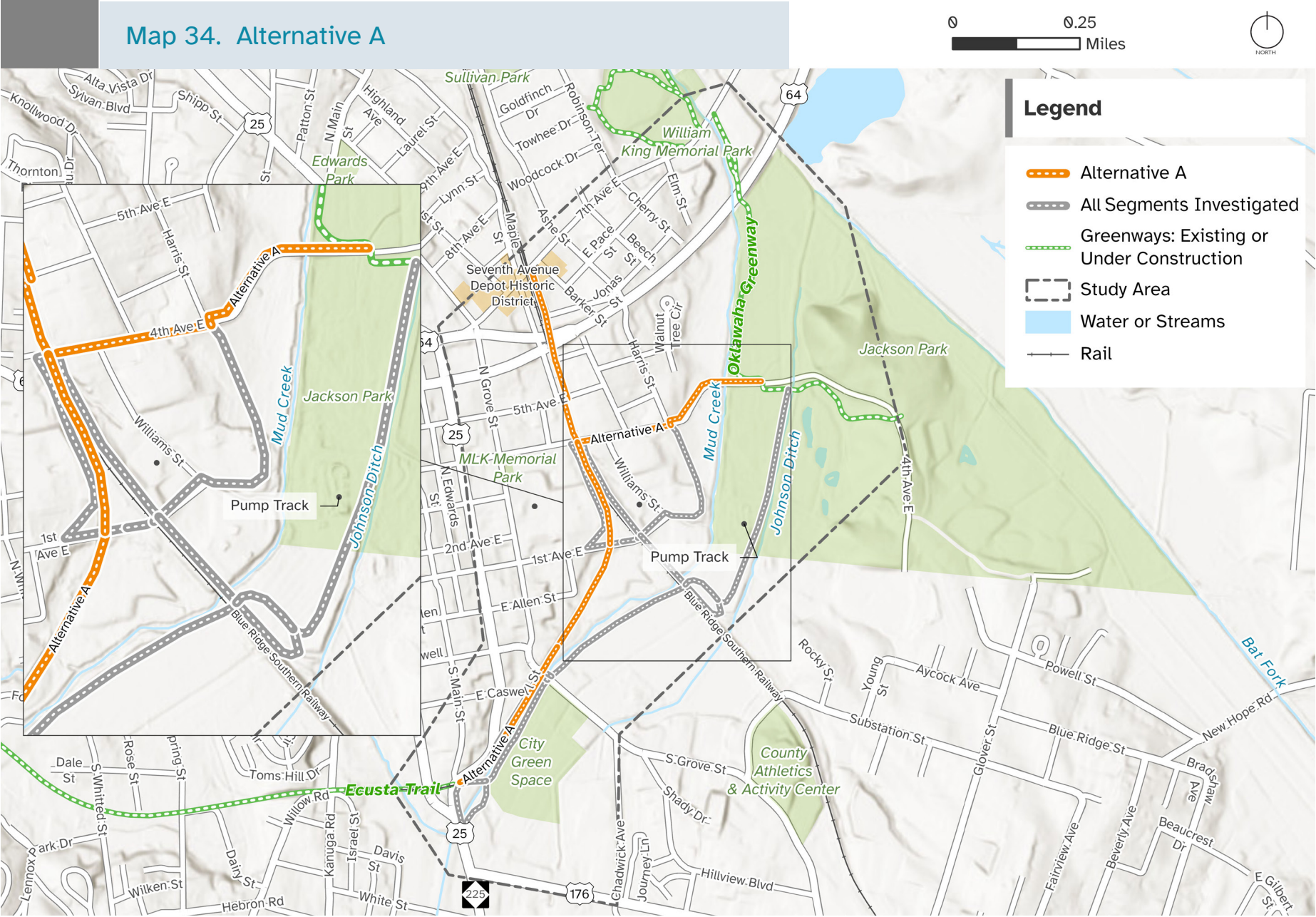
Alternative A ranked higher for ability to acquire environmental permits, cost effectiveness, and potential funding. Alternative B ranked higher for ability to acquire right-of-way, ability to construct, and potential for timely implementation. This suggests that while Alternative A provides some cost-effectiveness, the implementation schedule of Alternative A may be more than Alternative B.

Given the high scores of both projects and how each provides a benefit that is unique from the other, both alternatives are recommended as a part of this study.

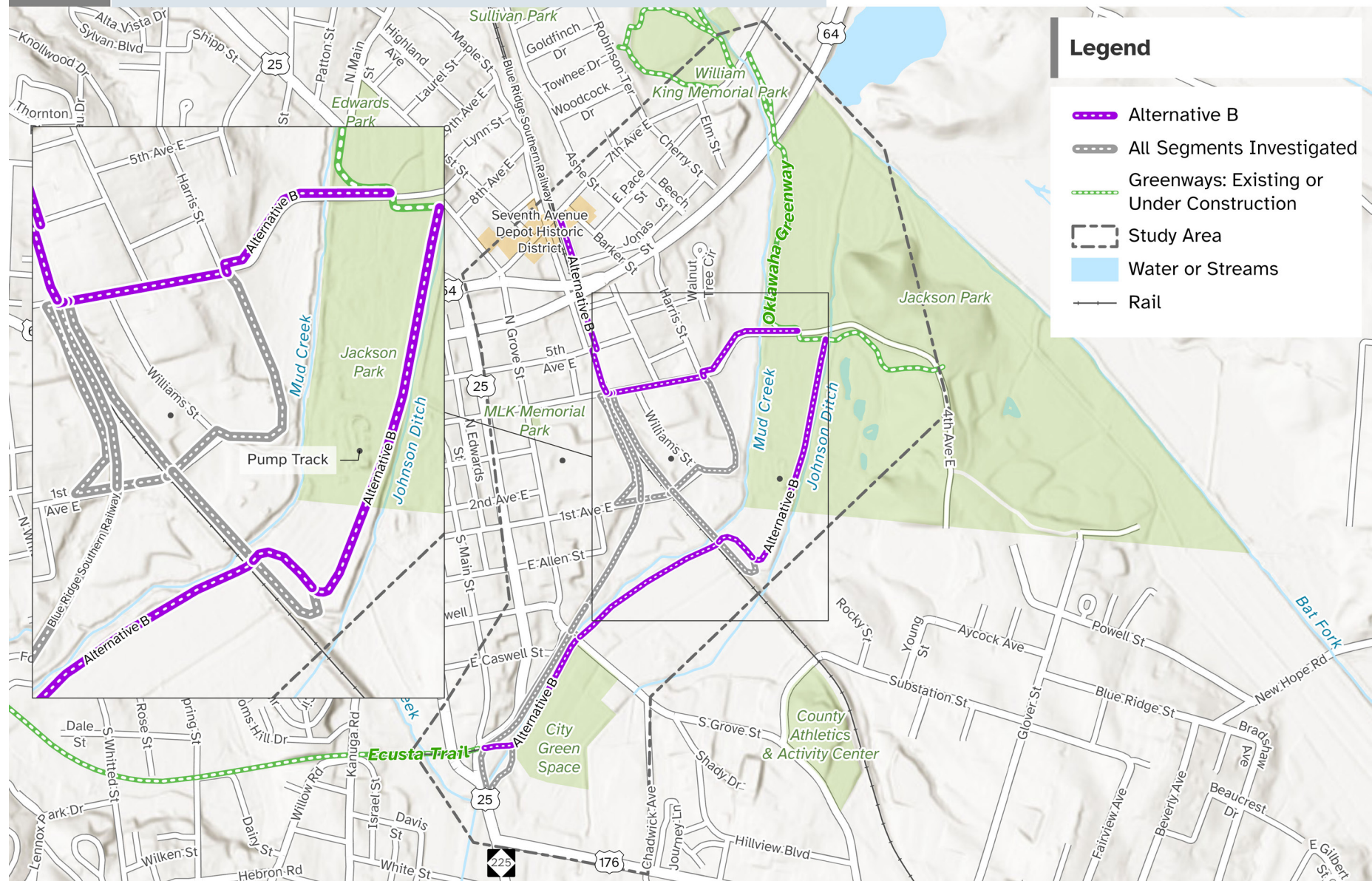
Chapter 5 presents a phasing strategy that will enable both to be implemented as funding becomes available. Individually, Alternative A or B would provide a much-needed connection. Together, they will create a truly comprehensive network for people walking and biking.



Map 34. Alternative A



Map 35. Alternative B



DESIGN CONSIDERATIONS

Design considerations for greenways are crucial to their success and sustainability. Thoughtful design ensures that greenways are safe, accessible, and welcoming for all users, incorporating elements like adequate lighting, clear signage, and connectivity to key community areas. These considerations include:

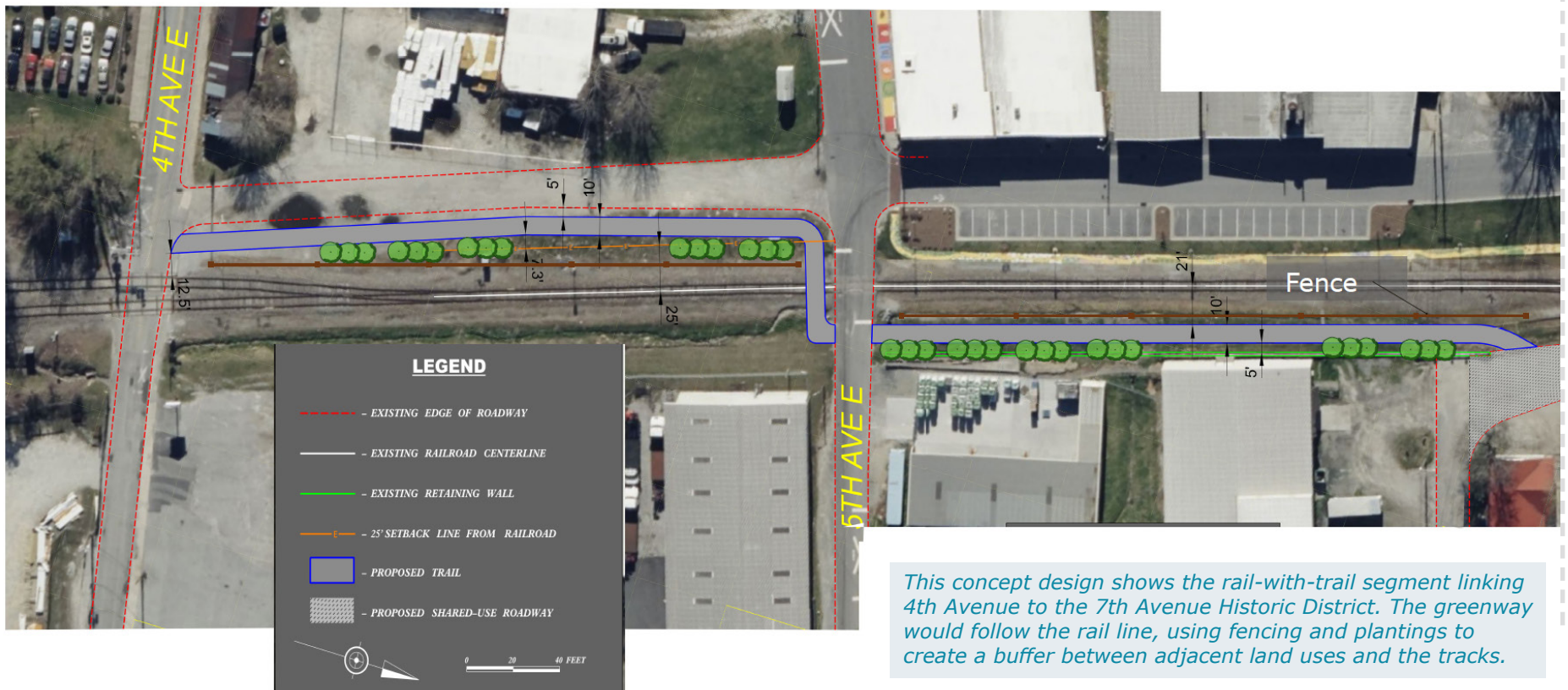
- Greenways in active rail corridors
- Materials selection
- Trailhead/parking
- Greenway amenities

- Wayfinding and branding
- Retaining walls
- Greenway crossing design

Greenways in Active Rail Corridors

When planning for greenway corridors in active rail corridors, safety for the trail users, rail line operators, and general public is paramount. Numerous challenges, including limited right-of-way width, insufficient space for setbacks, concerns about trespassing, and the need for multiple crossings can significantly

Image 40. Rail-with-Trail Concept Design Section 1



impact project feasibility. Moreover, there may be a need to allocate space for potential future freight or commuter rail service expansion. These considerations must be addressed during the planning and design phases to effectively navigate constraints and challenges and align with Watco standards to gain formal approval.

In many cases, the installation of fencing will be essential to delineate greenway usage. Many standards indicate that fencing should be at least 5 feet tall. Setbacks from active rail lines will vary based on factors such as train speed, frequency, and available right-of-way, all in alignment with safety standards

and regulatory guidelines. Whenever possible, wider paths and enhanced landscaping should be incorporated for added safety and aesthetic appeal.

The concept design illustrated in **Image 40 - Rail-with-Trail Concept Design Section 1** and **Image 41 - Rail-with-Trail Concept Design Section 2** shows the rail-with-trail alignment between 4th and 7th Avenues. The concept calls out the existing edge of roadway, railroad centerline, existing retaining wall, and the 25' setback from the rail line.

Image 41. Rail-with-Trail Concept Design Section 2



This concept design shows how the greenway will utilize an existing (low volume) street for a constrained segment under the US 64 bridges and connect directly to the 7th Avenue Historic

MATERIALS & AMENITIES CONSIDERATIONS

Various factors should be considered when deciding on what surface material a greenway or sidepath should comprise. Considerations include user type (e.g., bicycle or horseback), user demographics (e.g., age which could be an indication of ability level), environmental factors (e.g., topography), cost, maintenance, and funding requirements. Options for surfaces include:

Paved Surfaces

For paved surfaces, asphalt and concrete are common options. Asphalt is popular due to its cost-effectiveness and suitability for various trail types. On the other hand, concrete offers greater durability but comes with a higher initial cost. Concrete surfaces are often preferred for urban settings or areas prone to heavy flooding, where resilience to high volumes of users and water damage is essential.

Image 42. Asphalt Greenway Example



Source: Martin Johnson

Image 43. Concrete Greenway Example



Source: High Line Network

Natural Surfaces

Natural surface options include compacted aggregates and compacted native soil. Compacted aggregates, typically using granite fines, offer a durable and affordable alternative to paved greenways. However, proper compaction and drainage management are needed to prevent erosion and maintain accessibility. Compacted native soil is another economical choice but requires careful compaction and drainage control to maintain trail integrity and accessibility requirements. Both options necessitate annual maintenance, including re-compaction and potential soil additions in erosion-prone areas.

Image 44. Aggregate Trail Example



Source: Vermont Rail Trails

Image 45. Native Soil Trail Example



Source: Green Circle Trail

Retaining Wall Considerations

In areas with topography such as Hendersonville, constructing a greenway will likely require a retaining wall to achieve accessible grades - The Americans with Disabilities Act (ADA) requires a greenway to have a 5% or less longitudinal slope. Retaining wall design offers a multitude of approaches and a variety of retaining systems, each tailored for specific applications in soil retention and slope stability. When future retaining walls are designed and constructed, careful attention should be given to the intricacies of each design approach, including construction methods and the conditions under which they are used.

Image 46. Retaining Wall Example (Purple Martin Trail)



In greenway design, retaining walls may be necessary to address slopes or elevation changes along the greenway route. These walls provide stability and prevent soil erosion while ensuring the safety and accessibility of the pathway for users.

Maintenance Considerations

Proper maintenance is critical to ensure that the infrastructure we build can be safely accessed well into the future. Shared use paths should be kept clear of debris and damage so that their surfaces are traversable and curb ramps should be ADA accessible. As much of the study area is in a floodway, it is important to install stormwater mitigation elements and make sure to address maintenance issues after heavy rains and flooding. The following includes maintenance considerations for the long-term viability of this pedestrian connector project:

- Developing an inventory of facilities and assets (signs, bridges, pavement, etc), which will allow the City to understand routine vs. substantial maintenance needs.
- Estimate of baseline maintenance based on City and County costs on other systems.
- Consider available technologies to monitor maintenance, including Esri systems.
- Acquire the final ADA inspection checklist from the contractor prior to project acceptance.
- Establish a maintenance plan and funding resources for repairs to sidewalks, greenways, and curb ramps. More details on development of a maintenance plan are provided in the FHWA 2013 publication, *A Guide for Maintaining Pedestrian Facilities for Enhanced Safety*.

Greenways in Floodplains

Areas along creeks and rivers are prime for greenway development, however, these corridors are also susceptible to flooding - people in Hendersonville experience this conflict every time the Oklawaha Greenway closes after a flood event. Following are some of the materials to consider when developing greenways in flood prone areas, with a focus on the durability of surfaces:

- Crushed rock is prone to erosion, asphalt can be damaged by running water, and while concrete may withstand submersion, severe stream bank erosion can still pose a threat.
- Concrete with transverse saw cuts offers resilience in flood-prone regions, but at a significant cost.
- Alternatively, asphalt provides a smoother and more cost-effective option, though it requires more frequent repairs and can retain heat. Reinforcing asphalt paths with a deep base and strategic stone placement can enhance their durability during floods.

Designing greenway facilities with flooding in mind can safeguard habitats and riparian zones. Implementing erosion control measures like vegetative buffers and stormwater retention devices can prevent soil erosion and protect water quality.

For the Above the Mud greenway, materials resistant to water, corrosion, and erosion—such as concrete, steel, or composite materials—are recommended for bridges and other infrastructure. While these areas are prime for greenway development, it is crucial to weigh the maintenance costs, particularly when they face sediment inundation during floods.

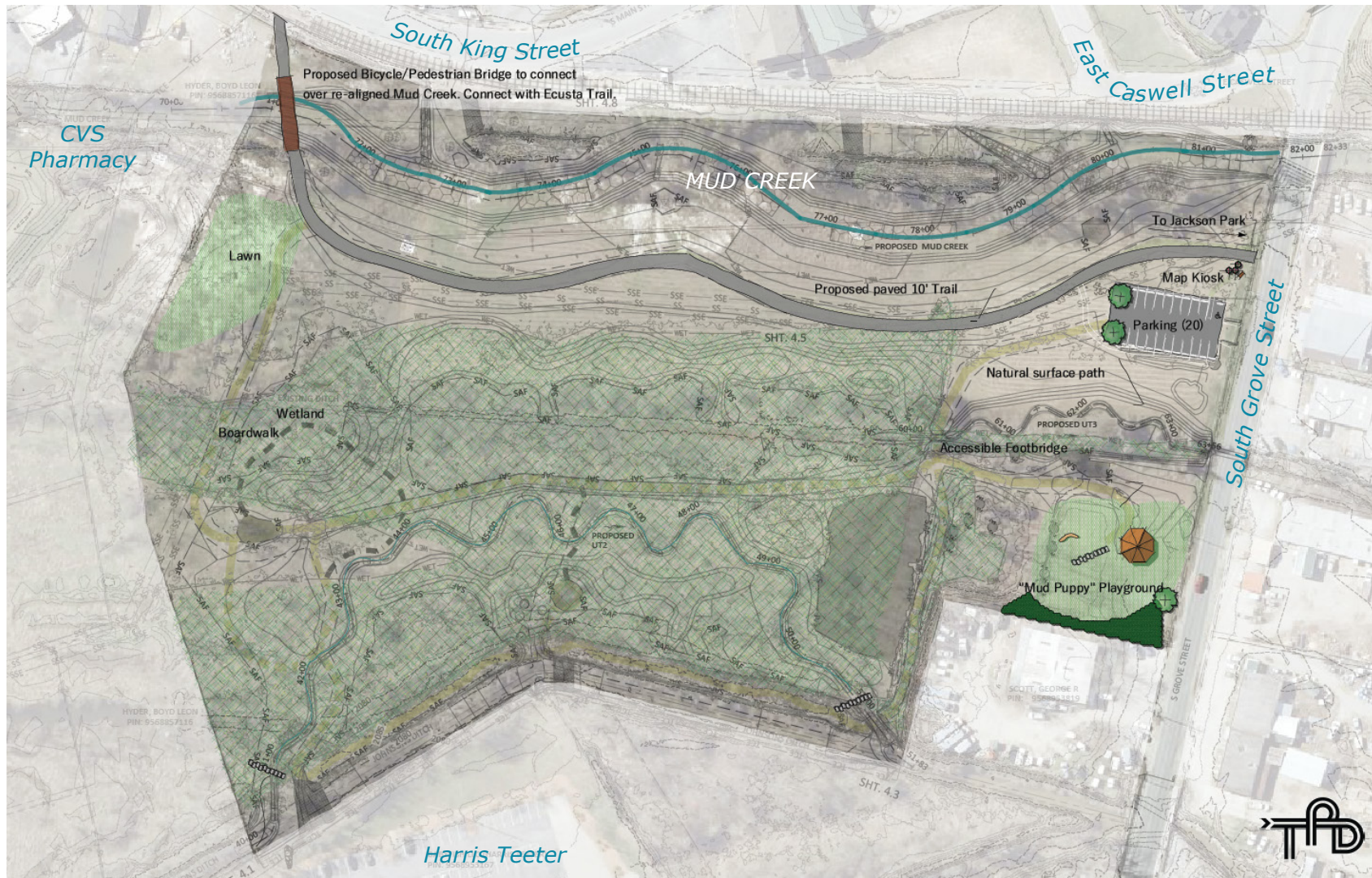
Image 47. Flooding on the Oklawaha Greenway (2024)



Source: Dean Hensley (Hendersonville Times-News)

Mud Creek is prone to flooding following heavy rainfall, leading to temporary closures of greenways like the Oklawaha Greenway. Post-flooding maintenance is needed to ensure these greenways remain open and functional. Tasks include clearing debris, addressing silt buildup, and repairing any damaged amenities.

Image 48. Concept Design for City-owned Greenspace on South Grove Street



Source: City of Hendersonville

The City of Hendersonville is conducting extensive floodplain restoration. The design team collaborated on that project to identify a location for a future greenway to be used for the "Above the Mud" connector. This concept for the City green space on S. Grove Street shows a greenway trail running parallel to Mud Creek. The trail will be elevated higher than the rest of the property so that when floods occur, the trail will be less impacted.

Trailhead/Parking

Jackson Park is a gateway to recreation, outdoor activities, and multimodal transportation. Connecting the Above the Mud greenway to Jackson Park will bolster the park's amenities and offer people a way to arrive at the park on foot and bike. Jackson Park currently offers parking and a trailhead to the Oklawaha Trail. For the Above the Mud project, the park will also serve as a trailhead, parking, and greenway access point.

The City of Hendersonville is working on a flood restoration project on City-owned property (shown on maps in Chapter 2). As a part of this project, parking and a trailhead are recommended. **Image 48 - Concept Design for City-owned Greenspace on South Grove Street** illustrates the site concept for this project.

This project incorporates the City's previous design efforts for a trailhead at the Ecusta Trail terminus, at the intersection of South Main Street, South Church Street, and South King Street. This concept, shown in **Image 49 - Trailhead Concept at Ecusta Trail Roundabout**, integrates NCDOT's plans to build a roundabout at the Ecusta Trail terminus. It provides a vision for a gateway to downtown, with the Ecusta and Above the Mud Greenways front and center.

This early concept provided by Kimley-Horn consultants shows how multiple projects can work in tandem to result in the best possible outcome for the community. This effort takes ongoing communication and coordination across various agencies and decision points.

Image 49. Trailhead Concept at Ecusta Trail Roundabout



Source: Kimley-Horn

Greenway Amenities

Greenways such as the Above the Mud can offer a range of amenities to enhance the user experience. These amenities include benches, trash receptacles, restrooms, dog waste stations, entrance signs, and wayfinding signage, such as those currently offered in Jackson Park and along the Oklawaha Greenway. The City is exploring opportunities for additional restrooms on City-owned property within the Above the Mud greenway study area.

Lighting is important in high-traffic areas, intersections with roads, and areas with low visibility such as beneath bridges or overpasses. To ensure that Above the Mud operates well as a transportation option, lighting will be an important consideration to foster a sense of safety.

Centerline striping on the greenway is recommended in areas with high user volumes, tight or blind corners, intersections, or under bridges. Lane markings can help separate traffic flow, reduce conflicts, and enhance user experience. This feature is beneficial in extensive greenway networks, such as the future 30+ mile system comprised of the Above the Mud, Ecusta, and Oklawaha greenways.

Image 50. Jackson Park Picnic Shelter



Source: Henderson County

Places of respite, with shade and seating, are important for parks and can be useful at trailheads and along the length of a greenway.

Image 51. Center Line Striping on the Oklawaha Greenway



Source: Friends of the Oklawaha Greenway

Wayfinding & Branding

Users of greenways generally are unconcerned about municipal boundaries or what agency owns a particular facility. What matters more to a user is that the facility is intuitive, accessible, and gets them where they need to go. As the Above the Mud greenway will be a part of a network of City- and County-maintained facilities crossing through public and private land, it is important that partners collaborate on a branded wayfinding system that is consistent across all segments of the trail network. These planning efforts are currently underway with the Ecusta Trail partners and will ensure that users have the information they need to make decisions about their trip.

Signs for nearby parks are located along the Oklawaha Greenway. This type of wayfinding is helpful for visitors and will be especially important once the Ecusta Trail connection is made and there are more crossings and access points.

Image 52. Wayfinding Signs on the Oklawaha Greenway



Source: Dean Hensley (Hendersonville times-News)

Image 53. Ecusta Trail Logo



Source: Friends of the Ecusta Trail

The Ecusta Trail has its own branding and logo. Since Above the Mud is a short segment, it likely will not have its own branding.

Source: FHWA



Rectangular Rapid Flashing Beacons (RRFB)

Pedestrian and bicyclist visibility enhancement at a midblock crossing that accompanies a warning sign and consists of two rectangular yellow indicators each with an LED light that flash with an alternating high frequency.

Source: Portland Bureau of Transportation



Crosswalks

Designated areas where pedestrians should cross the street. A crosswalk can be marked or un-marked at an intersection, or can be marked as a mid-block crossing. They may feature signage, pavement markings, and traffic control measures such as stop signs, traffic lights, or flashing devices.

Source: City of San Francisco



Curb Ramps

Sloped surfaces that facilitate the transition between the greenway and the street. When designed in compliance with ADA regulations, ramps enable individuals using mobility devices to easily access and leave the greenway to cross a street or get to a parking facility.

Source: New York Post; Maricopa Association of Governments



Pedestrian Signal Heads & Push Buttons

Installed at signalized intersections, these allow people to activate the walk/don't walk pedestrian signal, indicating whether it is safe to cross the street. A countdown timer is helpful for people to gauge remaining time to cross.

Greenway Crossing Design

At-grade roadway crossings present potential conflicts between greenway greenway users and motorists. However, with well-designed crossings, many operational issues can be mitigated, enhancing safety and comfort for all users. Each crossing should be studied and designed to meet state and national standards for crossings. These standards indicate various safety countermeasures that can be applied based on location specific factors and engineering judgment. In busier urban crossing scenarios, additional safety measures such as physical mid-crossing protection, user-activated signals, and proactive traffic calming treatments may be necessary. Several key assumptions apply to all crossings:

Vehicular Scale Signage: Signage alerting motorists to the presence of the greenway should be placed near the crossing, adhering to Manual on Uniform Traffic Control Devices (MUTCD) standards. If the greenway runs parallel to the street, signage should be installed beforehand to notify motorists in advance.

High Visibility Design: Crossings should be designed for high visibility, using lane markings and signage in compliance with MUTCD standards.

Surface Material: Where the greenway intersects with sidewalks, a concrete surface should be applied for durability and accessibility.

Pedestrian Activated Signals: Mid-block crossings of major streets should feature pedestrian-activated traffic signals.

ADA Compliance: All crossings must comply with Americans with Disabilities Act (ADA) and/or Public Right-of-Way Accessibility Guidelines (PROWAG) guidelines, incorporating detectable warnings and other ADA components according to the latest standards and local regulations.

Stormwater Management: Opportunities to integrate stormwater management elements and pervious surfaces should be considered to establish the greenway corridor as a resilient amenity.

The following resources represent some of the best practices and should be considered in the planning and design of pedestrian crossings for the Above the Mud greenway. Hendersonville's pedestrian plan, *Walk Hendo*, is another helpful resource.

North Carolina Pedestrian Crossing Guidelines (2018)

provides guidance on when to consider marking crosswalks at uncontrolled approaches for pedestrians, when to install pedestrian signal heads at existing signalized intersections, and when to provide supplemental treatments at a crossing location. More information can be found [HERE](#).

FHWA's Proven Safety Countermeasures Initiative is the culmination of over 15 years of safety work available in an online tool that can be used to address a variety of areas that impact pedestrian crossing safety including:

- Crosswalk visibility enhancements and lighting.
- Leading pedestrian intervals.
- Medians and pedestrian refuge islands.

- Rectangular Rapid Flashing Beacons (RRFBs).
- Pedestrian Hybrid Beacons (PHBs).

More information can be found [HERE](#).

FHWA's Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations

provides guidance for uncontrolled crossings to help local and state agencies "improve quality of life for pedestrians of all ages and abilities." The guide includes a process for evaluating crossings and determining appropriate countermeasures for specific crossing conditions based on engineering which includes data collection, site condition analysis and crash history review. More information can be found [HERE](#).

FHWA's Improving Visibility at Trail Crossings presents a systemic approach to reviewing existing crossings or planning for improved at-grade trail crossings with engineering countermeasures, such as enhanced signs and traffic controls. More information can be found [HERE](#).

Image 54. Midblock Crossing (Oklawaha Greenway)



Source: Google Streetview

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05 **Implementation**



OVERVIEW

The findings presented in this report offer an implementation plan for multimodal investments that will connect the Ecusta Trail with the Oklawaha Greenway. This chapter presents project cutsheets, which provide a concise project snapshot to enable the City and its partners to advance these projects. The cutsheets are standalone details that provide route alternative descriptions, phasing options, cross-sections, maps, visual representations, and planning-level cost estimates.

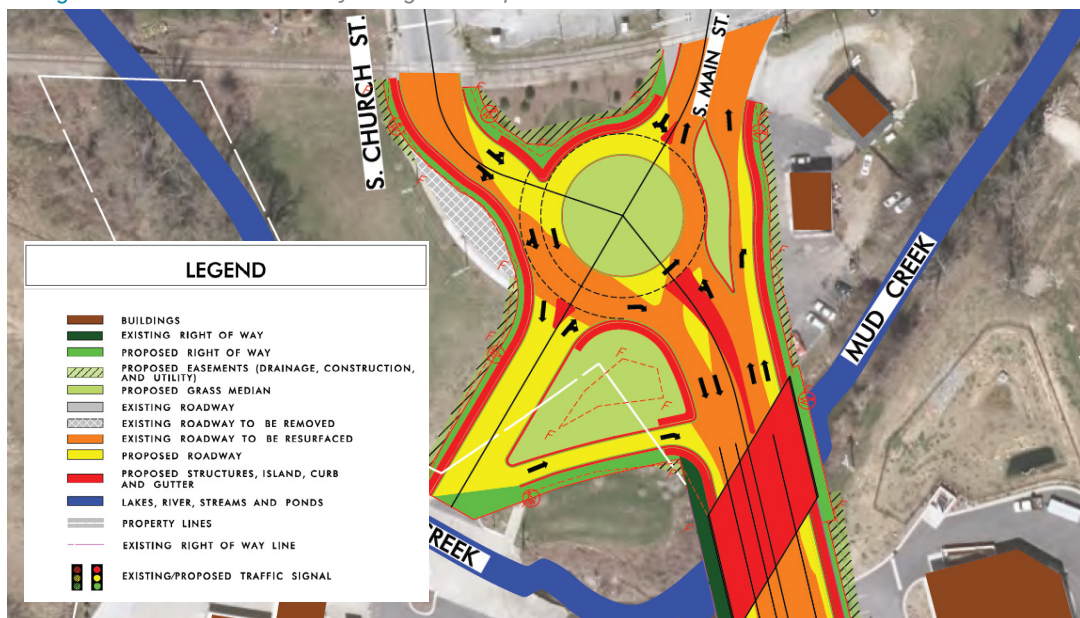
Also essential to project advancement are key local and regional partnerships, which are outlined in this chapter. Finally, this chapter contains an action plan, delineating tasks, designating lead agencies and primary partners, establishing an implementation timeline, and defining metrics for gauging success.

PHASING STRATEGIES

When developing an implementation and phasing plan, certain factors are reviewed that may impact the timing of project implementation. During this analysis, we often split projects into phases based on the following factors:

- Availability of right-of-way and property ownership.
- Permitting challenges including NCDOT coordination, flood impacts, environmental impacts, etc.
- Project needs, such as a segments with a known safety and crash history that is constructed first to prioritize for safety improvements.
- Project cost.
- Potential funding and matching funds.
- Project partnerships.

Image 55. U-6049 Preliminary Design Concept



Source: NCDOT

Coordination and communication between NCDOT and the City of Hendersonville can help make sure that final designs reflect recommendations for the Above the Mud greenway connection.

For example, NCDOT's South Main Street bridge replacement and intersection improvement project (U-6049) is still in the preliminary design stage. This presents an opportunity to coordinate design efforts of the Ecusta Trail and the Above the Mud connection into the final engineering plans. By aligning these projects early on, there is flexibility for revisions and the introduction of new ideas as NCDOT progresses with the project. This proactive approach may prevent redundancies and potentially save costs during the design and construction phases.

Note that the lower ranked route alternatives are also potentially viable and should not be wholly ruled out. If future opportunities and constraints arise that change the dynamic of the final outcome, the City should adapt.

When developing an implementation and phasing plan, certain factors are reviewed that may impact the timing of project implementation. For the implementation phasing analysis, we often split projects into phases based on the following factors:

- Availability of right-of-way and property ownership (including railroads)
- Permitting challenges including NCDOT coordination, flood impacts, environmental impacts, and the like.
- Project needs such as segments with a known safety and crash history or key network gaps may be prioritized for implementation sooner.
- Project cost
- Potential funding sources and the availability of matching funds.
- Project partnerships

The phasing and prioritization strategies are relatively simple for this project since there are two recommended alternatives (Alternative A and B) that can be advanced immediately. These alternatives serve different connections yet work together for a more complete greenway network.

Several early action implementation recommendations were identified based on the following understanding:

- Implementation of Alternative A and B will require early coordination with other partners and planned projects.
- Alternative B has elements that make it more time sensitive to build upon synergies with other projects in progress.
- Alternative A will require more time to reach an agreement with the railroad. Therefore, coordination should begin as soon as possible.

Early Action Implementation Recommendations

1. Begin coordination with Watco to negotiate railroad right-of-way purchase and/or easements as needed.
2. Work with Henderson County Parks and Recreation to develop a unified approach to the greenway sections in Jackson Park. This approach may address items such as who will fund, maintain and design the greenway in the park. This conversation may also include items such as the exact alignment of the greenway, design standards, funding and ownership/maintenance decisions. Note that community members have indicated the importance of maintaining access to the creek from the dog park. This alternative will require modifications to the existing dog park layout and fencing in order to separate the greenway.
3. Apply for design and construction funding grants and reimbursement programs (see funding section). Prioritization recommendations are as follows:
 - Prioritize funding for the Mud Creek Bridge: The City of Hendersonville is currently working on a design and permitting for the Brevard Church Site, just south of Mud Creek where a new greenway bridge would need to be incorporated into the floodway permitting and final grading plans for the site. As such, funding and design for a greenway bridge at this location is a high priority. If this connection is not integrated with the project, floodway permits may be challenging to acquire as a standalone project.
 - Incorporate the Alternative B segment from South Main Street to Jackson Park with other City projects.
 - City of Hendersonville "Brevard Church" Site: This funded project is a floodplain restoration project that is currently in the design stage. The project will include design and construction of the portion of Alternative B that runs through the site. Given site constraints and complex floodway modeling that is underway, the future Mud Creek Bridge should be advanced quickly in order to ensure that floodway impacts can

be minimized and that engineering efforts can work together to achieve the floodplain restoration and greenway connectivity goals.

- City of Hendersonville Sewer Project ("Interceptor"): The City is working on a sewer extension project that could include a trail easement allowing for Alternative B to be constructed between South Grove Street and the Scott Site Floodplain Restoration Project.
- City of Hendersonville "Scott Site" Floodplain Restoration Project: This floodplain restoration project is in the early planning stages and funding is pending. Similar to the Brevard Church Site, this project would include the design and construction of the Alternative B greenway through the site and complete the connection to the Watco Zirconia Line railroad underpass into Henderson County property which connects to Jackson Park.
- Prioritize, or phase, remaining greenway segments together or as smaller stand-alone projects as funding opportunities and partnerships become available. Sections that will function as stand-alone facilities are as follows:
 - Alternative A Segment: Rail-to-trail conversion of remaining section of the active Ecusta Line between South Main Street and 4th Avenue.
 - Alternative A and B Segment: Rail-with-trail connection between 4th Avenue and 7th Avenue.
 - Alternative A and B Segment: 4th Avenue sidepath from the northern end of the Ecusta Line to the Oklawaha Greenway in Jackson Park.

This approach to prioritization is intended to be nimble allowing the City and greenway partners to pivot based on funding opportunities and partnerships that may arise.

PREFERRED ALTERNATIVE CUTSHEETS

In order to evaluate phasing strategies, project cut sheets were developed for both Alternative A and B, presented on the following pages. They include implementation details such as:

- Project map and description of improvements
- Right-of-way availability and property acquisition needs
- Permitting needs
- Cost estimates for survey, design and construction

Explanation of Cost Estimate Items

It should be noted that cost estimates are not based on actual survey and design. As such, these planning level costs should be revisited as the project details and preliminary design investigations are completed.

Baseline Construction

This value reflects an opinion of the probable cost for a contractor to construct the described improvements during the current calendar year and is based on recent bid prices for similar projects. These detailed estimates for various project elements are included in the Appendix.

Survey / Design Services

This value reflects an opinion of the cost for consulting firms to obtain survey, design the project for permitting and approvals, and provide construction documents to be used in bidding the project for construction. Various funding sources can impact the necessary approvals, design formats/standards, and permitting requirements. In addition, certain environmental items identified during preliminary design can escalate costs. As such, this cost should be revisited as funding is identified, with completion of design work in stages and an evaluation of project cost and permitting needs to be revisited after preliminary design.

Right-Of-Way (ROW) Acquisition

Many projects have impacts on properties that are outside of the public right-of-way (ROW). Before construction can begin, there are various ROW tasks that must be completed, ranging from purchasing property to obtaining permanent or temporary

easements for the facility and related construction impacts. Depending on the type of ROW task, there is a cost associated with property purchase and/or easements as well as the cost for legal work and right-of-way survey and exhibits. If federal funds are used for the project, the ROW negotiations must be in line with the Federal Relocation Assistance and Real Property Acquisition Policies Act of 1970 (aka Uniform Act). Accurate ROW costs require current market research and appraisals; as such, a special ROW firm may need to be hired to navigate the process. Any ROW costs should be calculated at a later date after additional investigation, as individual segments of the preferred route move into design and implementation.

Escalated Construction

The baseline construction estimate is based on current year costs. Given that it will take time to get a project through funding, ROW, design and permitting stages, there is a need to escalate costs to account for inflation that will occur between now and the estimated year of construction.

Construction Engineering + Inspection Services

Depending on the funding source, varying levels of construction engineering and inspection (CEI) services are expected. CEI services are typically a percentage of the estimated construction cost based on the project size and elements of construction. This study assumes 7.5% for preliminary engineering and another 7.5% for final engineering.

Total Budget Estimates

At the planning level or project cost estimating, there are always detailed items that may be necessary that are unforeseen at the planning stage. As such, a project contingency is assumed to help address these unknown and unforeseen costs. Contingency percentages can vary depending on how advanced the design of the project is and the likelihood of unknowns. At the planning level, a higher contingency is often used to ensure that the project is not underfunded. A 20% contingency was assumed for this project given that no actual design has been completed. The final budget for the project is based on the sum of the above items. The values were rounded to the nearest dollar.

ALTERNATIVE A

Ecusta Line Extension Alignment

This alternative assumes the City of Hendersonville can acquire the remaining active Ecusta Line (owned by Watco) that extends from the Ecusta Trail (under construction) north to 4th Avenue East. Alternative A would convert the remaining rail line to a paved shared use path that would extend to a point just north of 4th Avenue East to form an extension of the Ecusta Trail. From the end of the Ecusta Line, a sidepath along 4th Avenue East would continue east into Jackson Park to connect with the existing Oklawaha Greenway. An optional rail-with-trail segment is also included between 4th Avenue East and 7th Avenue East. This rail-with-trail is along the active Zirconia Line (owned by Watco) and connects the 7th Avenue Historic District.

PROJECT SNAPSHOT

- Location:** Extends the Ecusta Trail from the terminus at South Main Street up to 4th Avenue East and connects to Jackson Park along 4th Avenue East. Optional spur (pending Watco approval): Extension north to 7th Avenue East.
- Facility Type(s):** Conversion of rail line to paved greenway; Paved sidepath along 4th Avenue East; Optional spur (pending Watco approval): Paved greenway extension to 7th Avenue East.
- Total Length:** ~6,240 linear feet
- Structures:** One (1) greenway bridge over Mud Creek at 4th Avenue East
- At-Grade Road Crossings:** Five (5)
- Greenway Connections:** Oklawaha Greenway (Hellbender Trail system); Ecusta Trail
- Destinations Served:**
- Jackson Park
 - City Operations Center
 - 7th Avenue Historic Depot and commercial district

POTENTIAL REAL ESTATE ACQUISITION NEEDS

- Railroad right-of-way

POTENTIAL PERMITTING NEEDS

- Erosion and sedimentation control permit
- NCDOT encroachment agreement
- Optional 7th Avenue East extension requires Watco encroachment permit
- Floodway permits for Mud Creek crossings

COST ESTIMATE

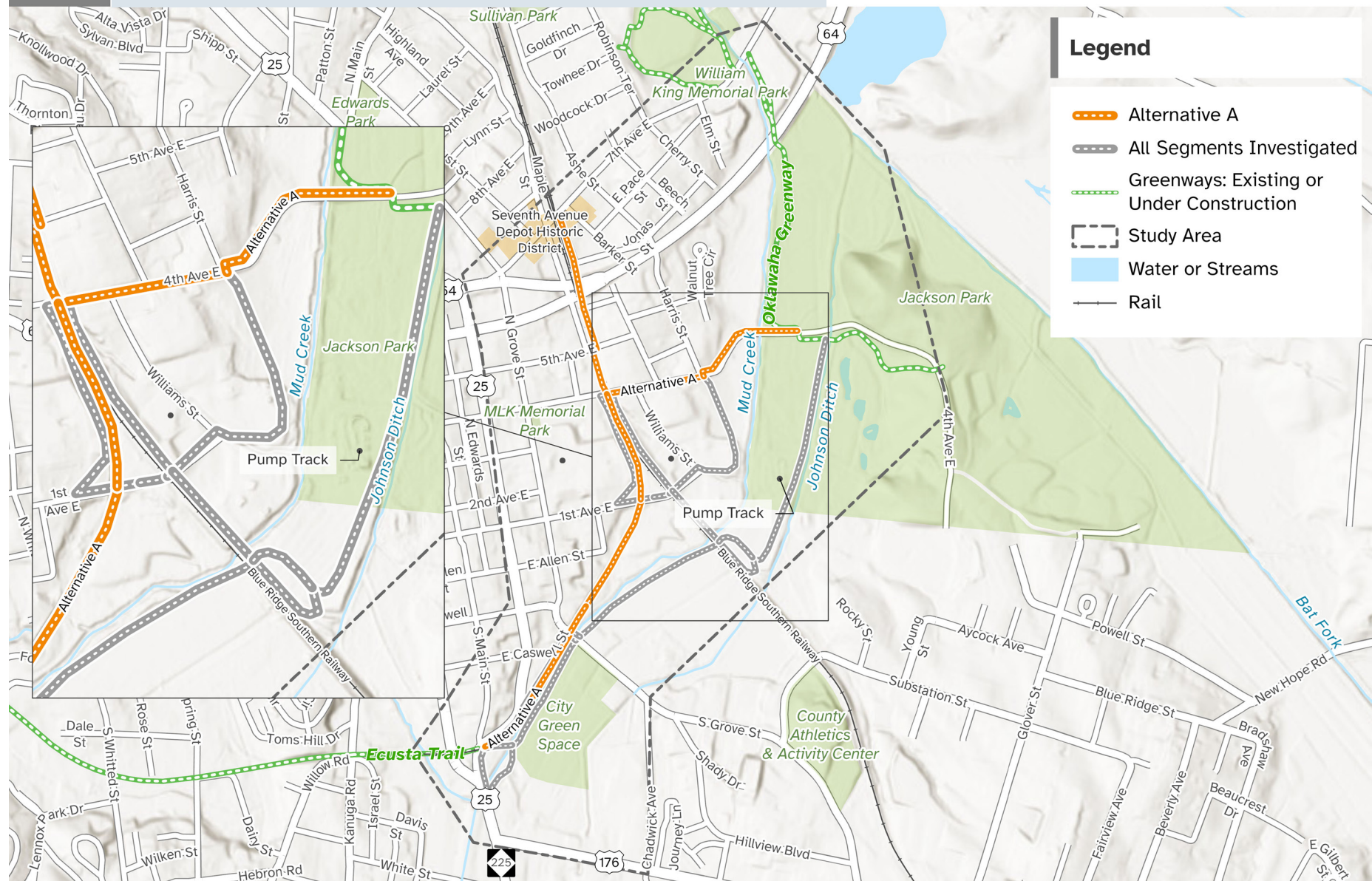
Baseline Construction	\$3,000,000
Engineering Design & Inspection	\$1,010,000
Utilities	\$110,000
Right-of-Way	\$600,000 *
Additional Contingency (20%)	\$950,000
Total Estimated Budget	\$5,670,000

See Cost Estimate Summary in Appendix for breakdown, assumptions, and exclusions.

* Value is estimated pending negotiations with the rail corridor owner. Based on recent rail line acquisitions in the region, the purchase of the remaining 3,300 linear feet of the Ecusta line could range from \$325,000 - \$625,000.

NOTE: The segment from 4th Avenue East to 7th Avenue East is included in the cost estimate (approximately \$1.4 million).

Map 36. Alternative A



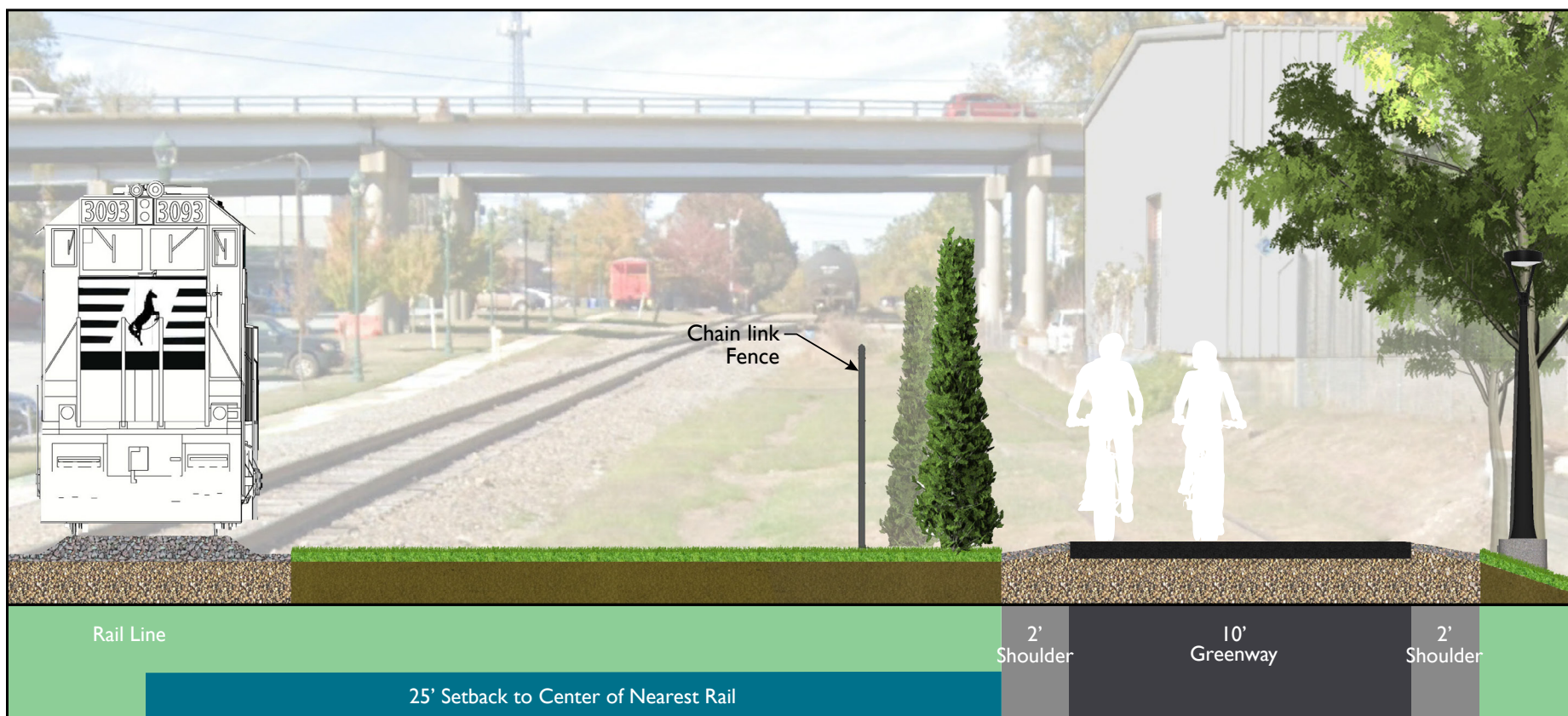
Typical Cross-Section

ALT A

For Alignment A, there are two typical treatments:

1. A 12' greenway as a rail-to-trail conversion from South King Street to the Seventh Avenue Depot Historic District.
2. Along 4th Avenue East, the treatment is a 10' paved sidepath (12' where feasible) that parallels the roadway.
3. From 4th Avenue East to 7th Avenue East, the recommended treatment is a 10' rail-with-trail (12' where feasible) as illustrated in **Image 57 - 10-Foot Rail-With-Trail Typical Cross-Section**.

Image 56. 10-Foot Rail-With-Trail Typical Cross-Section



When considering a greenway alongside a rail line, it's crucial to recognize that while these greenways can provide connectivity and accessibility, they also pose safety concerns due to the proximity of active rail operations. Therefore, ensuring a safe distance and appropriate barriers between the greenway and the railway is paramount to prevent accidents and enhance user security.

Image 57. Rail-With-Trail Rendering



It might be a good idea to address potential issues such as noise, vibrations, and visual impacts associated with train traffic. Implementing sound barriers, landscaping, and aesthetic enhancements can help mitigate these challenges and create a more pleasant greenway experience.



ALTERNATIVE B

Floodplain Restoration Projects Alignment

This alternative assumes that it is *not* feasible to convert the remaining active Ecusta Line to a greenway. From the Ecusta Trail section that is under construction, Alternative B would depart from the rail bed at a point just east of South King Street and turn south to cross Mud Creek via a proposed pedestrian bridge. On the south side of Mud Creek, it would continue to the east on City-owned land. It would cross South Grove Street and then follow a proposed sewer easement to connect to Jackson Park as it passes under a railroad bridge. This alternative would connect to the existing Oklawaha Greenway in Jackson Park and then continue west towards downtown as a sidepath along 4th Avenue East. This alternative also includes an optional greenway spur between 4th Avenue East and 7th Avenue East, generally following the Watco rail right-of-way, connecting to the 7th Avenue Historic District. This alternative will require modifications to the existing dog park layout and fencing in order to separate the greenway.

PROJECT SNAPSHOT

Location: Connects to the Ecusta Trail terminus at South Main Street and crosses Mud Creek to south side to Jackson Park. Also includes sidepath on 4th Avenue East to downtown. Optional spur (pending Watco approval): Extension north to 7th Avenue East.

Facility Type(s): Paved off road greenway from Ecusta Trail to Jackson Park; Paved sidepath on 4th Avenue East; Optional spur (pending Watco approval): Paved greenway adjacent to rail line between 4th Avenue and 7th Avenue.

Total Length: ~8,045 linear feet

Structures: Two (2) greenway bridges over Mud Creek (one near South Main Street and one near 4th Avenue East)

At-Grade Road Crossings: Six (6)

Greenway Connections: Oklawaha Greenway (Hellbender Trail system); Ecusta Trail

Destinations Served:

- Downtown via 4th Avenue East
- Jackson Park
- City Operations Center
- 7th Avenue Historic Depot and commercial district

POTENTIAL REAL ESTATE ACQUISITION NEEDS

- Easements will be needed along 4th Avenue East

NOTE: The majority of this alternative is on current or planned City or County land as well as a planned sewer easement.

POTENTIAL PERMITTING NEEDS

- Erosion and sedimentation control permit
- NCDOT encroachment agreement
- Optional 7th Avenue East extension requires Watco encroachment permit
- Floodway permits for Mud Creek crossings

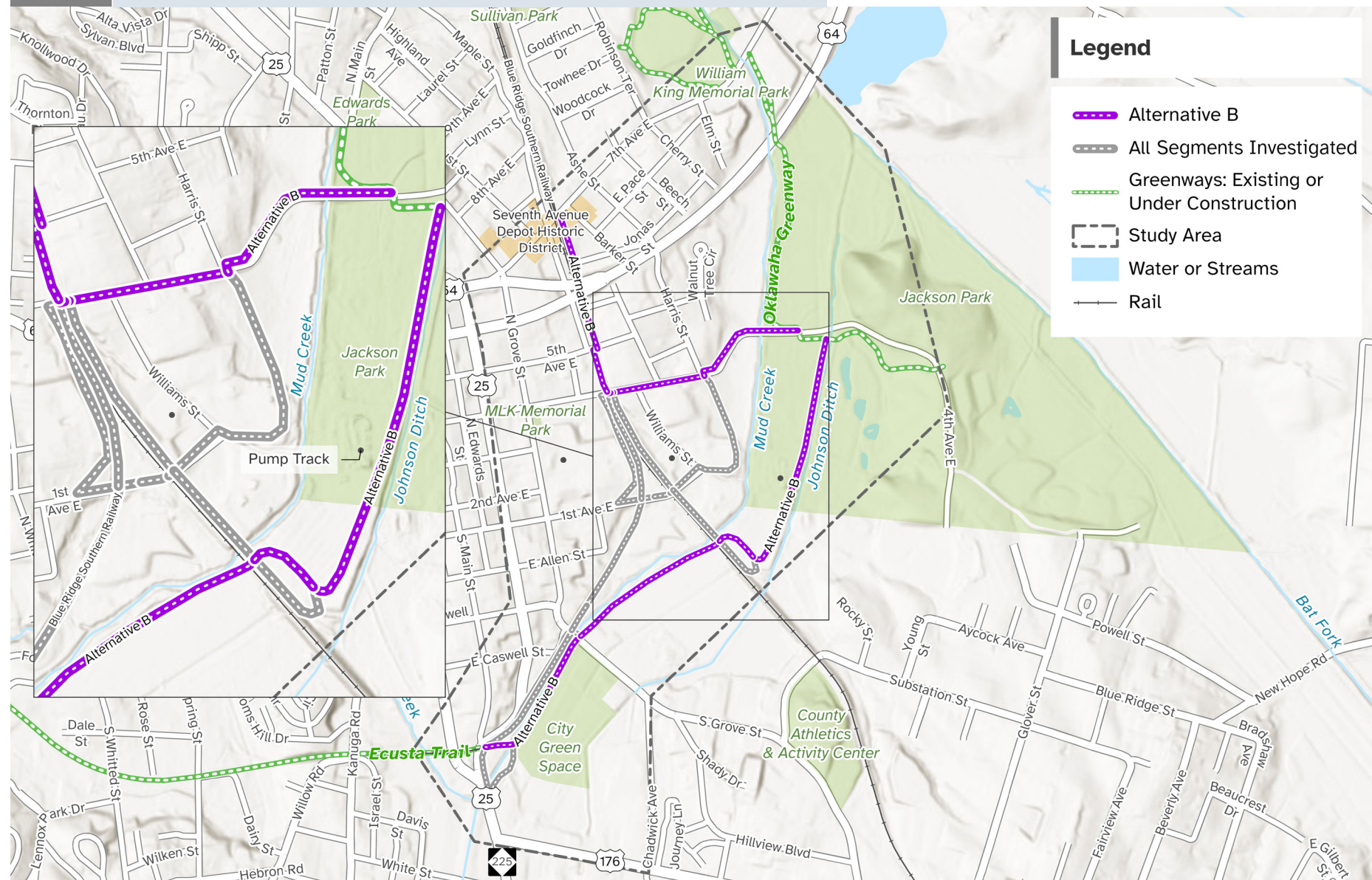
COST ESTIMATE

Baseline Construction	\$3,720,000
Engineering Design & Inspection	\$1,250,000
Utilities	\$110,000
Right-of-Way	\$200,000
Additional Contingency (20%)	\$1,060,000
Total Estimated Budget	\$6,340,000

See Cost Estimate Summary in the Appendix for breakdown, assumptions, and exclusions.

NOTE: The segment from 4th Avenue East to 7th Avenue East is included in the cost estimate (approximately \$1.4 million).

Map 37. Alternative B



Typical Cross-Section

ALT B

Alignment B includes three typical treatments:

1. A 12' greenway connecting from South King Street to Jackson Park, traversing City-owned land and a proposed sewer easement.
2. Along 4th Avenue, the treatment is a 10' paved sidepath (12' where feasible) that parallels the roadway. This is illustrated in **Image 59 - 10-Foot Sidepath Typical Cross-Section**.
3. From 4th to 7th Avenue, the recommended treatment is a 10' rail-with-trail (12' where feasible). See *Images 40 and 41 for a conceptual design*.

Image 58. 10-Foot Sidepath (12-Foot Where Feasible) Typical Cross Section on 4th Avenue East



Image 59. Trail Along Mud Creek Rendering

