



*of the*

Ann and Roy Butler  
Hike-and-Bike Trail

# Final Report

March 2021



## Acknowledgments

The Trail Foundation would like to thank everyone that made this Safety & Mobility Study a great success. We express our great appreciation to the City of Austin Parks and Recreation Department and the City of Austin Urban Trails Program, Public Works Department for their co-sponsorship of this project along with The Trail Foundation. This effort will help us to establish a vision to ensure the Trail will continue to be a natural sanctuary for all Austinites and visitors.

We would like to thank our project team for their tireless work and flexibility through this challenging time of the COVID-19 pandemic. Thank you to our team lead consultant, Nelson\Nygaard, led by Drusilla Van Hengel and Alyson Fletcher. Thank you also to the team members, Studio Balcones and Oldner Lighting.

We also wish to thank all the stakeholder groups that provided us with insightful thoughts, comments, and feedback on the Trail.

Finally, thank you to all the community members that provided feedback through our public surveys. We value your input greatly to help shape this study and determine steps to move forward.

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# EXECUTIVE SUMMARY

## *Envisioning a safe and comfortable experience of the Ann and Roy Butler Hike-and-Bike Trail for all.*

The Butler Hike-and-Bike Trail Safety and Mobility Study was developed to provide the Trail Foundation, Austin Parks & Recreation (PARD), and the City of Austin Urban Trails Program, Public Works Department with a realistic implementable plan for conserving natural spaces while offering the highest quality user experience on Austin's treasured Ann & Roy Butler Hike-and-Bike Trail.

The study builds on earlier work, such as the Holly Shores Master Plan and the Southeast Shores Master Plan, and provides recommendations to work with adjacent planning efforts, such as adjacent redevelopments and the Zilker Metropolitan Park Vision Plan.

A detailed analysis of the Trail and key connections, combined with community conversations and surveys, identified the top issues affecting safety and mobility. Among the criteria assessed were pathway dimensions and ability to accommodate different users; surface materials and conditions; multimodal conflicts (e.g. tripping hazards, pathway impediments, and more); access and circulation to, from, and within the Trail; intersection and infrastructure hazards; and more. An assessment of Butler Trail landscape and lighting elements – current and historical – was also reviewed to ensure that recommended projects and initiatives respect and further the Trail's character and long-term sustainability. Outreach and engagement, including web-based outreach, focused stakeholder interviews, and Technical Advisory Committee input, highlighted the top issues of concern as trail width and trail conditions including trail surface, adjacent drainage or erosion, and edge issues. Other identified issues include connections to the Trail and to the on-street All Ages and Abilities network, lighting, accessing the trail, and directional signage.

All of the above, combined with trail best practices, informed a set of potential recommended policies, projects and initiatives that are detailed in this document. Maps, graphics, and tables describe potential projects to address Trail safety and mobility, in four quadrants defined by the Lake and I-35. Each quadrant map is followed by a plan view and a conceptual graphic of four priority projects. These projects rose to the top given their ability to address key issues and to incorporate principles elevated and cultivated through this study process, particularly in places that fill gaps in past planning attention and investment.

These maintenance and enhancement investments will ensure the Trail continues to support a safe, sustainable, and equitable environment for Austin's current and future residents and visitors.



# 1 INTRODUCTION

The 10-mile Ann and Roy Butler Hike-and-Bike Trail, along with Lady Bird Lake that it surrounds, is located in the center of Austin, Texas, which is one of the fastest growing cities in the country. In a city of more than one million, known for its active outdoor life, the popular and heavily used Trail has more than 4.5 million visits a year. The Trail and the Town Lake Metropolitan Park in which it is located are considered by many to be Austin's most beloved and restorative natural amenities – sources of beauty, pride, history, and health. They are iconic treasures that define Austin's quality of life for residents and visitors alike.

As Austin grows, so does use of the Trail and this has impacted the Trail experience for everyone using it. This study is establishing a vision to ensure that with increased growth, the Trail will continue to be a natural sanctuary for all Austinites and visitors.

Building on previous planning efforts, this study identifies key policies, design strategies, and potential projects to enhance the Trail network to accommodate a varied and growing number of users in a way that creates a safe and comfortable experience for all on the Ann and Roy Butler Hike-and-Bike Trail. A key challenge (and opportunity) of this study is to continue to balance the need to upgrade the Trail in a manner that provides sufficient space to serve existing and future users while continuing to provide respite and relief to increasing numbers of Austin residents.

At the same time, strategies must respect both the ecological functions of the adjacent lands and water and the locally beloved park setting, characteristics that present considerable impediments to achieving wider path dimensions to accommodate increasing demands.

The recommendations included in this document are intended to prevent unintended impacts that could overwhelm or significantly alter the nature of the Trail. The aim is to be strategic in the approach, with limited but impactful and cost-effective strategies and initiatives that improve safety and comfort for all while enhancing the park setting, the watershed, and user experience.

This study was conducted by an interdisciplinary team of transportation planners, landscape architects and ecologists, and lighting designers with experience in trail safety and access,





placemaking, trail materials and plant sciences, riparian and environmental restoration and resiliency, and balancing lighting safety needs while complying with Dark Sky guidelines. The process was guided by a technical committee comprised of representatives from the City of Austin Parks and Recreation Department; Public Works' Urban Trails Group in City of Austin Urban Trails Program, Public Works Department; and the City of Austin Transportation Department.

The guiding principles to accomplish this vision as study recommendations are funded, designed, and implemented include:

- Maintain Trail character as a place of respite
- Steward the natural habitat and ecology along the Trail
- Use universal design to support accessibility for all
- Accept crowding at locations where more capacity is needed but the park width and slope prohibit widening and alternative routing options are not possible
- Maintain slow speeds on the Trail
- Integrate the Trail into the larger mobility ecosystem
- Expand sense of safety, welcome, and place
- Align with national trail design standards and improvement practices



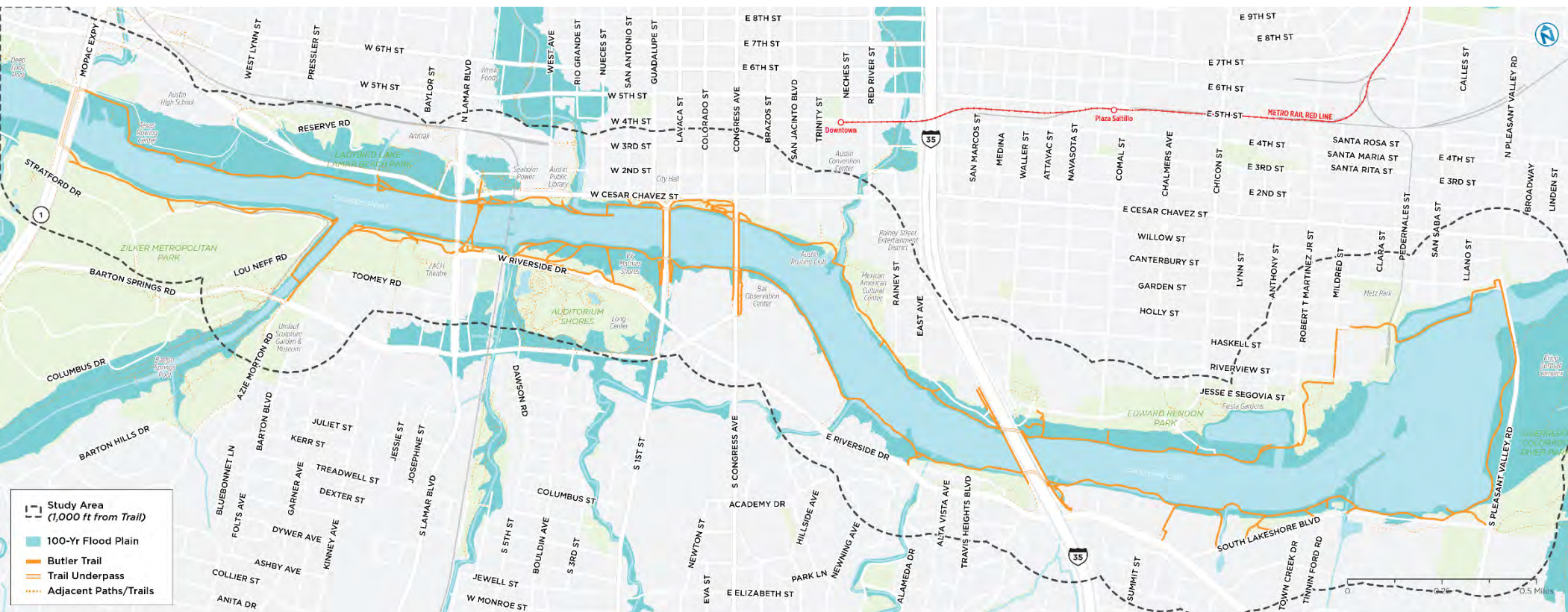




## 2 STUDY AREA

The Ann and Roy Butler Hike-and-Bike Trail, found in the heart of Downtown Austin, circles the edges of the Colorado River and Lady Bird Lake from Mopac Expressway to South Pleasant Valley Road. The Trail provides an attractive off-street recreation destination for people walking and riding bicycles, while also providing transportation connections to neighborhoods and destinations along a peaceful nature path, with skyscrapers appearing over treetops in the skyline. This study area includes the Ann and Roy Butler Hike-and-Bike Trail plus adjacent on- and off-street trail, sidewalk, and bikeway connections in the area captured below.

Figure 2-1 Study Area Map







With rising population and tourist activities, Downtown Austin is growing rapidly. The Ann and Roy Butler Hike-and-Bike Trail is a welcome respite from the increasing density, with over 4.5 million visits a year.

The [Austin Strategic Mobility Plan \(ASMP\)](#), adopted by City Council on [April 11, 2019](#), describes actions to meet Austin's future transportation needs. The improvements will increase access to the Ann and Roy Hike-and-Bike Trail through various modes of transportation. For example, additions to [Tier I and Tier II Urban Trail Networks](#) will provide network enhancements directly to the Ann and Roy Butler Hike-and-Bike Trail as well

as to connecting facilities. On the streets, Austin's All Ages and Abilities Bicycle Network envisions comfortable and connected streets with enhancements that include protected bicycle lanes, buffered bicycle lanes, quiet streets, and bicycle lanes. Further, plans for transit improvements will put even more users within walking distance to the Trail from nearby transit stops.



### All Ages and Abilities Bicycle Facilities

are places to bicycle (primarily on-street) designed to provide a low-stress experience that is comfortable for people of all ages and abilities. Facilities include protected bike lanes, neighborhood bikeways on quiet local streets, and a supportive network of urban trails. The 2019 Austin Strategic Mobility Plan identified a Bicycle Priority Network of such facilities, supporting a goal of having 50% of the Austin population choosing non-driving means of commuting to work. The Butler Trail is designated as part of this network.

### Urban Trails

are wide, paved shared use trails built to connect to and from the sidewalk and on-street bicycle networks. The City's 2014 Urban Trails Plan identified 407 miles of trails to be developed as part of this network, with 47 of them being Tier I (higher priority) and 360 miles being Tier II (lower priority). The City of Austin is currently in the process of updating its Urban Trails Plan. Portions of the Butler Trail were identified as Tier I trails, while most of the Trail was designated as Tier II.



### 3 HISTORY

In the earlier half of the 20<sup>th</sup> century, the Colorado River was prone to flooding that contributed to stripping the trail area of Downtown Austin clear of vegetation. Human disturbance, development, and land management practices have also led to de-vegetation on a regular basis, further exacerbated by flood events. After two earlier attempts to control the floods, the Tom Miller Dam was constructed in 1940 to form Town Lake (renamed Lady Bird Lake in 2007). However, the grading and subsequent impoundment of the lake with the construction of the Longhorn Dam in 1960 is one of many examples of woodland clearing caused by human disturbance. Aside from areas recently disturbed by floodwater, almost the entirety of the Lady Bird Lake area is a floodplain terrace that would naturally be wooded.

From 1971 to 1976, the Town Lake Beautification Committee was active in the creation and development of parklands surrounding the fabricated lake. The Committee was led by Lady Bird Johnson, Les Gage, Ann Butler, and Roy Butler, who at the time was serving as the Mayor of Austin. Inspired by the Thames Path in London, the Committee established landscaped hiking trails and scenic walking areas to supply residents and visitors peaceful gathering spaces and a rural oasis in the growing City of Austin. The Town Lake Hike-and-Bike Trail was eventually renamed the Ann and Roy Butler Hike-and-Bike Trail to honor the Butlers' legacy of leadership in realizing the vision of the Trail around Lady Bird Lake.

As the Trail's popularity grew and cultural shifts led to increasingly intensive physical exercise use on the Trail, a series of pedestrian and bicycle-focused civic projects were carried out to create safer connections between trail segments. These included a pedestrian walkway beneath the Mopac Expressway constructed in 1973, which now forms the Trail's west end. In 1989, Austin's City Council approved a construction project to add wide pedestrian lanes on both sides of the Drake (South 1<sup>st</sup> Street) Bridge. In 2001, the James D. Pfluger Pedestrian and Bicycle Bridge was opened to provide a safe car-free alternative to the Lamar Boulevard Bridge to connect the north and south shores. A 1.1-mile boardwalk was constructed on the south side of the lake in 2014 completing the last missing link in the scenic 10-mile loop. In 2018, another section of boardwalk was built under the north side of the Ann W. Richards Congress Avenue Bridge to move users safely and smoothly from east to west while also mitigating erosion issues in this high demand area with steep dropoffs.



Given the ongoing core value of the Trail to the community, The Trail Foundation (TTF) was formed in 2003 in dedication of protecting, enhancing, and connecting the Trail for the benefit of all. Much of The Trail Foundation's efforts focus on the preservation of this space, and TTF's ecological and habitat restoration work aims to reverse disturbances and "stripping" caused by people in the earlier half of the 20th century (as described above). The Trail Foundation also manages circulation and safety policies on the trail, which have shifted as a

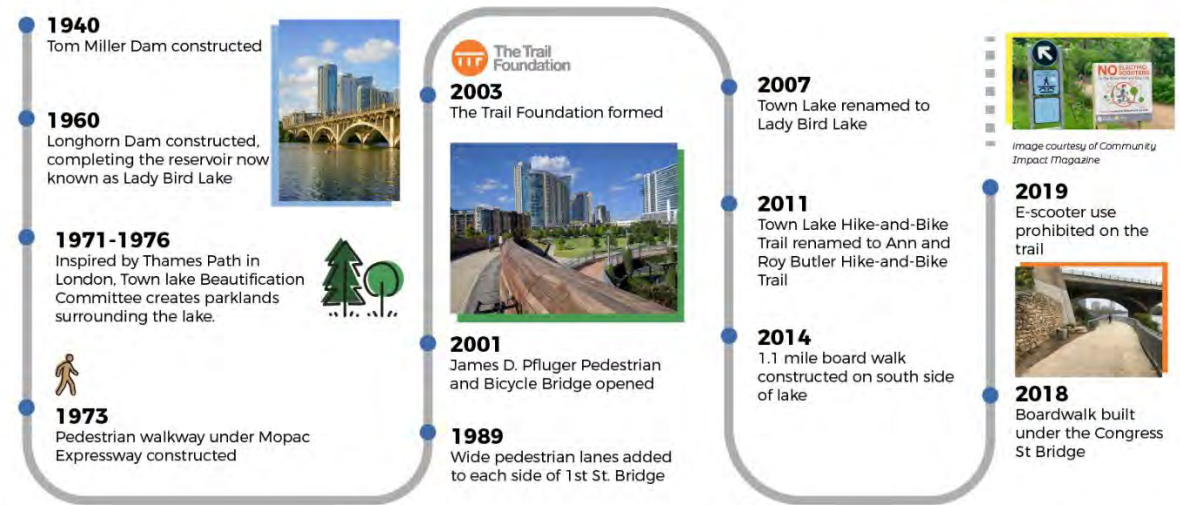


Figure 3-1 Trail Timeline

variety of electric scooters and bikes emerged in Austin. In June of 2019, TTF posted signs on the Butler Hike-and-Bike Trail reinforcing the safety regulation that e-scooters are not allowed to be used on the Trail. However, they are allowed on the Pfluger, Drake, and Congress Avenue bridges intersecting with the Trail. Austin Parks and Recreation Department is also currently running a pilot allowing e-bike use on five Austin trails including the Butler Hike-and-Bike Trail.

The Trail Foundation also operates in partnership with the Parks and Recreation Department and the Public Works Department to conduct ongoing maintenance, planning, design, and trail improvement projects and related community engagement.

The respective roles and maintenance responsibilities of The Trail are as follows:

- **Austin Parks and Recreation Department (PARD)** - responsible for the maintenance and operations of all parkland around Lady Bird Lake, including maintenance of facilities and assets, responding to safety concerns (trail surface issues, tree safety response, etc), and monitoring current conditions. Implements capital projects as prioritized through comprehensive park planning efforts (e.g., Holly Shores trail re-alignment).



- **Public Works Department** - responsible for maintenance of bridges, street-level sidewalks, and boardwalks that are included within the Ann and Roy Butler Hike-and-Bike Trail System. Examples are the Pfluger pedestrian bridge and the Boardwalk. The Public Works Department Urban Trails Program also maintains the electronic trail counters. The Urban Trails Program also coordinates with PARD to improve the network of urban trails by developing connections and cultivating better access.
- **The Trail Foundation** - works as a direct partner to PARD, supporting its efforts by assisting in fundraising and by implementing capital projects, providing maintenance support for those projects, providing ecological restoration services to the natural areas, implementing green infrastructure projects, spearheading planning studies for the improvement of the space, and offering support in other endeavors. TTF is also entering into an agreement with the City to increasingly take over the maintenance and operation responsibilities of the parkland around Lady Bird Lake.
- **Watershed Protection Department** – collects and removes trash that flows into the lake and connecting creeks.





## 4 PREVIOUS PLANNING EFFORTS

This study builds on the foundation of twenty recent planning efforts that centered on the Trail as a vital Austin Asset for recreation, physical activity, and mobility.

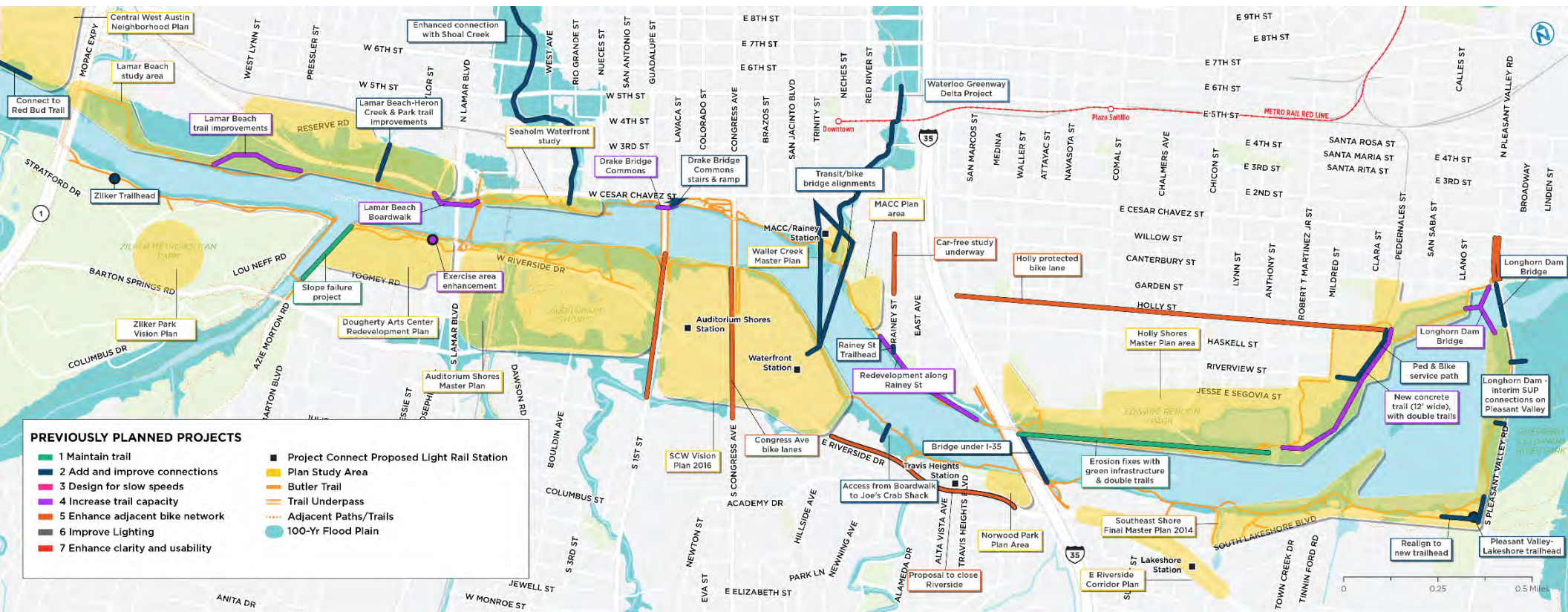
- Project Connect (In process)
- The Zilker Metropolitan Park Vision Plan (In process)
- Dougherty Arts Center Redevelopment Plan (In process)
- Austin Strategic Mobility Plan (ASMP, 2019)
- ULI Advisory Services Panel Report (2019)
- Our Parks, Our Future Long Range Plan (2019)
- Austin Pedestrian Safety Action Plan (2018, incorporated into the ASMP)
- Seaholm Waterfront Concept Study (2017)
- The Trail: Economic Impact Analysis (2016)
- South Central Waterfront Vision Plan (2016)
- Vic Mathias Auditorium Shores Master Plan (2016)
- Austin Bicycle Plan (2014, incorporated into the ASMP as the Bicycle Priority Network)
- Austin Urban Trails Plan (2014)
- Lamar Beach Master Plan (2014)
- Holly Shores / Edward Rendon Sr. Park at Festival Beach Master Plan (2014)
- Southeast Shore Park and Trail Master Plan (2014)
- Norwood Park Plan (2011)
- Central West Austin Neighborhood Plan (2010)
- Waller Creek District Master Plan (2010)
- The Trail at Lady Bird Lake Vision Plan (2008)





Documented in the map below are the key recommendations within the study area from these planning documents.

Figure 4-1 Map of previously planned projects relevant to the Safety & Mobility Study





The following City of Austin projects that fall within the Butler Hike-and-Bike Trail have funding and are slated for near-term implementation and will all have safety and mobility benefits:

- [The Festival Beach Erosion Control Project](#)
- [The “Wishbone Bridge” at Longhorn Dam](#)
- [The Holly Shores Lakefront Trail](#)

Additionally, The Trail Foundation developed a list of 15 projects to celebrate its 15<sup>th</sup> anniversary in 2018. The goal was to complete these projects in five years. Figure 4-2 shows the locations and descriptions for the 15 projects.

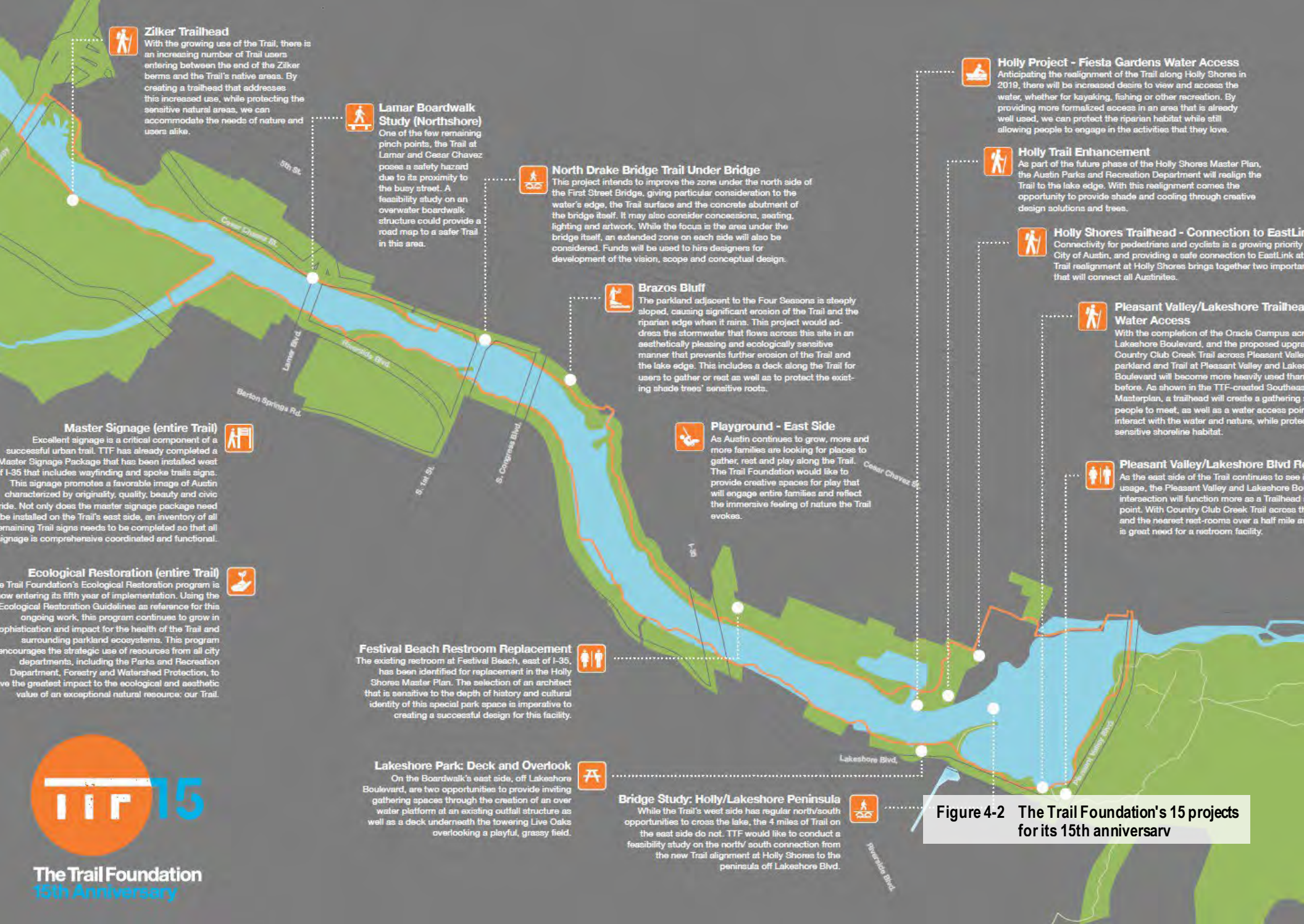
As of January 2021, The Trail Foundation has made progress on many of the projects. These include:

- **Master Signage** – Wayfinding and spoke trails signs have been installed west of I-35 only.
- **Ecological Restoration** – This process is ongoing and based on Ecological Restoration Guidelines.
- **Drake Bridge Commons** – The Trail Foundation commissioned a conceptual design and conducted public outreach.
- **Brazos Bluff** – Completed in June 2020.
- **Festival Beach Restroom Replacement** – Completed in June 2020.
- **Holly Project** – Completed masterplan.

The outstanding projects to be completed include:

- Zilker Trailhead
- Lamar Boardwalk Study (Northshore)
- Playground – East Side
- Holly Shores Trailhead
- Pleasant Valley/Lakeshore Blvd Restroom
- Pleasant Valley/Lakeshore Trailhead and Water Access
- Bridge Study: Holly/Lakeshore Peninsula
- Holly Trail Enhancement
- Lakeshore Park: Deck and Overlook





**Figure 4-2 The Trail Foundation's 15 projects for its 15th anniversary**



## 5 EXISTING CONDITIONS

### PEDESTRIAN AND BICYCLE ACTIVITY

Over 4.5 million visitors made use of the trail in 2020. According to the 2016 Trail user survey conducted as part of the Butler Trail Economic Impact Analysis, 95% of all users report use of the Trail for recreation, while only 5% use the Trail for commuting. Of those that use it for recreation, about 50% live next to the Trail.

For this study, volunteers conducted counts at fifteen different points along the Trail on Saturday, March 7, 2020 from 9 to 11 AM and on Wednesday, March 11, 2020 from 4 to 6 PM. Direction of travel and mode (bicycle, pedestrian, other) were recorded in 15-minute intervals. Volume and mode results are mapped in Figure 5-1 and Figure 5-2, where higher counts are represented with thicker bars. At most locations on the weekday PM peak, these screenline counts observed roughly three quarters of passing users being on foot and one quarter being on bike. On weekend mornings, about 90% of users were on foot and 10% were on bikes. On both weekdays and weekends, the modesplit of users on foot is highest in the western and central portions of the Trail, whereas the percentage riding bicycles was higher east of I-35 than it was in sections west of I-35.



The City of Austin Urban Trails Program, Public Works Department also maintains five continuous count stations on the Trail. Ecocounters record pedestrian and bicycle activity 24/7 at each station. Data from these stations were used to identify and understand daily and hourly patterns of use, including identifying peak user hours to inform the timing of the volunteer Trail counts. The Ecocounter data also confirms that very few users make use of the Trail before sunrise or after sunset on any day of the week, a condition likely influenced by the minimal presence of trail lighting. That said, the highest use of the Trail on weekdays is between 5 PM and 9 PM<sup>1</sup>. The number of people using the Trail at the continuous count station locations can be seen in Figure 5-3 and Figure 5-4.

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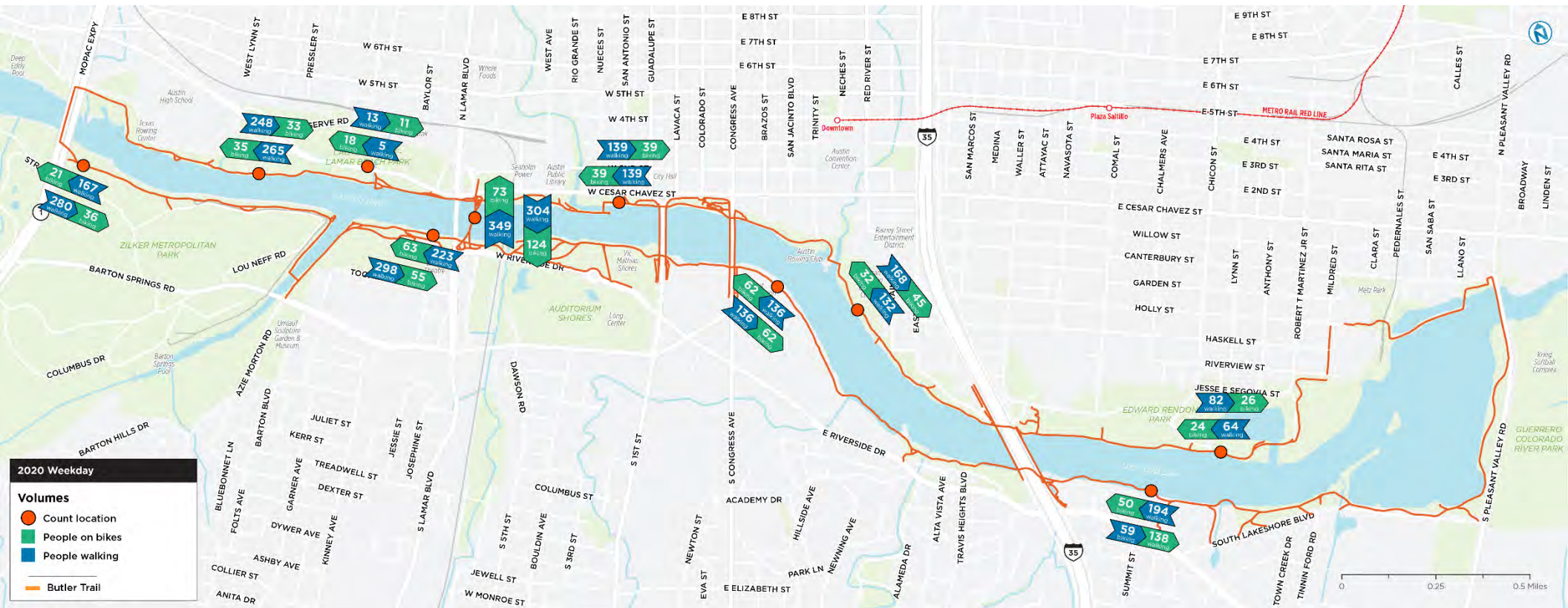
<sup>1</sup> From an analysis of on-trail user counts collected via EcoCounter from March 25-31, 2019





The count data from both the volunteer counts and the Ecocounter stations were used to identify locations where there may be crowding on the Trail. These figures were also cross-referenced with community and stakeholder input. Locations identified as too narrow per the counts, community input, or compared to national standards are highlighted and addressed in the coming sections.

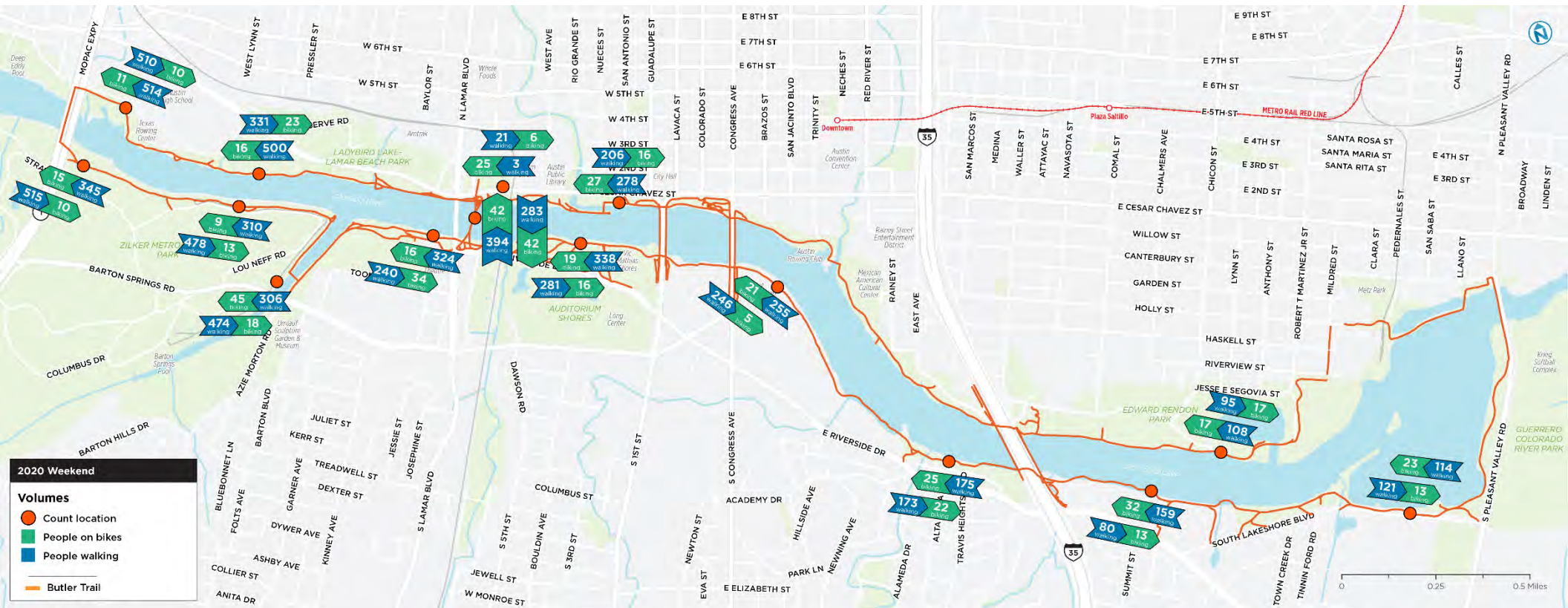
**Figure 5-1 Wednesday PM Trail User Counts by Direction\***



\*Numbers represent sum of peak hour (the four, consecutive 15-minute intervals with highest volumes) between 4-6p. For all locations, the peak hour is 5-6p



Figure 5-2 Saturday AM Trail User Counts by Direction\*



\*Numbers represent sum of peak hour (the four, consecutive 15-minute intervals with highest volumes) between 9-11a. The peak hour varies by location.





Figure 5-3 EcoCounter WeekdayAM Trail Count Data – April 2019\*

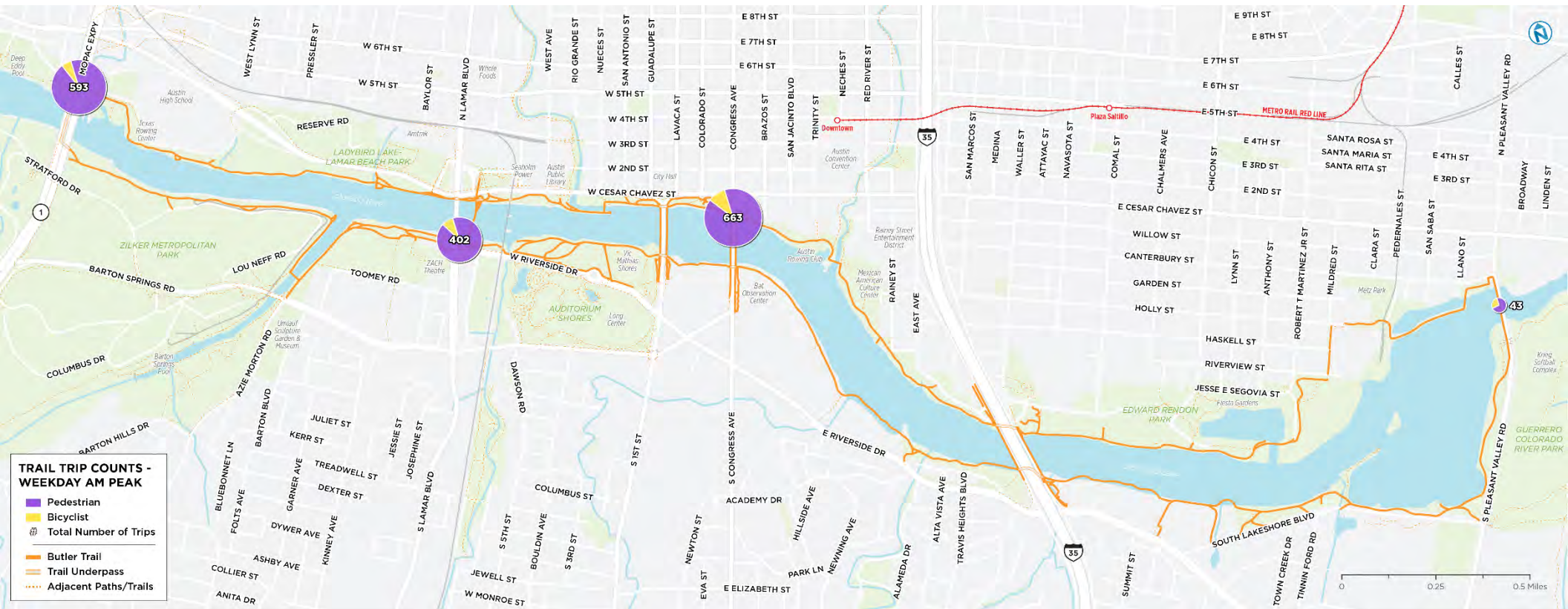
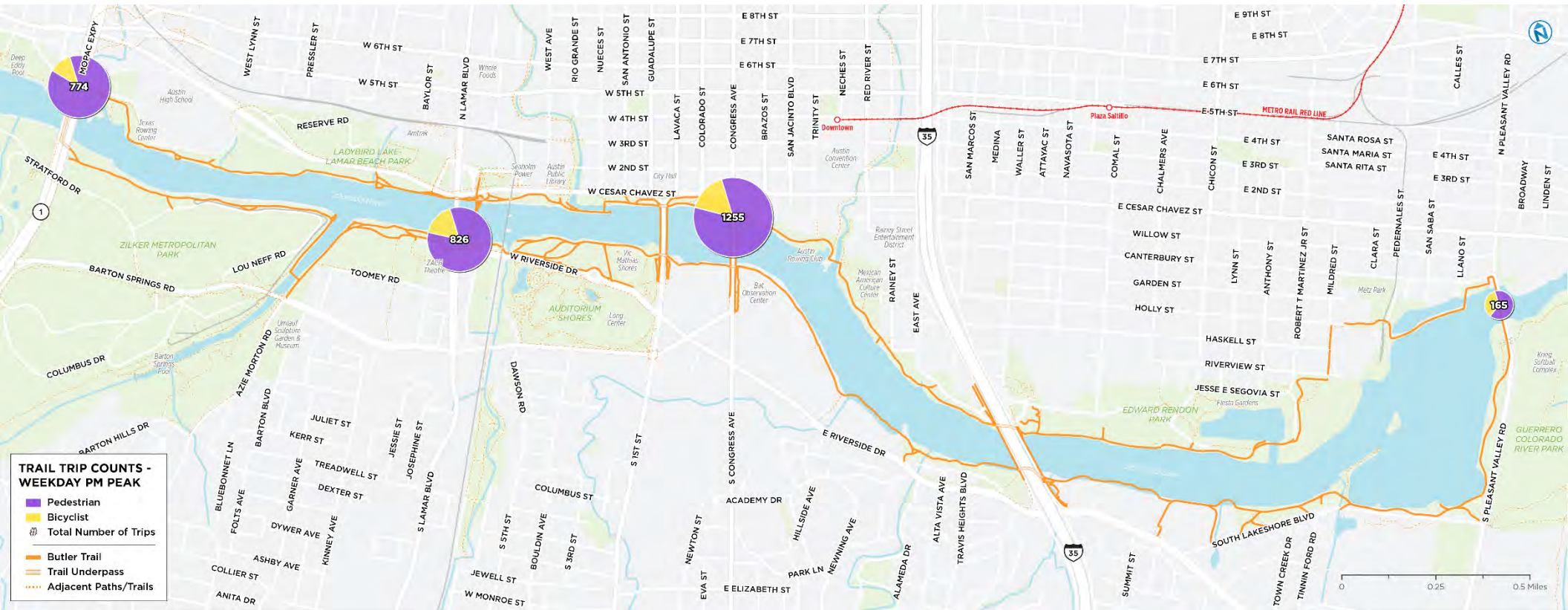






Figure 5-4 EcoCounter Weekday PM Trail Count Data – April 2019\*



\*PM peak average for 5-8PM on Weekdays in April 2019

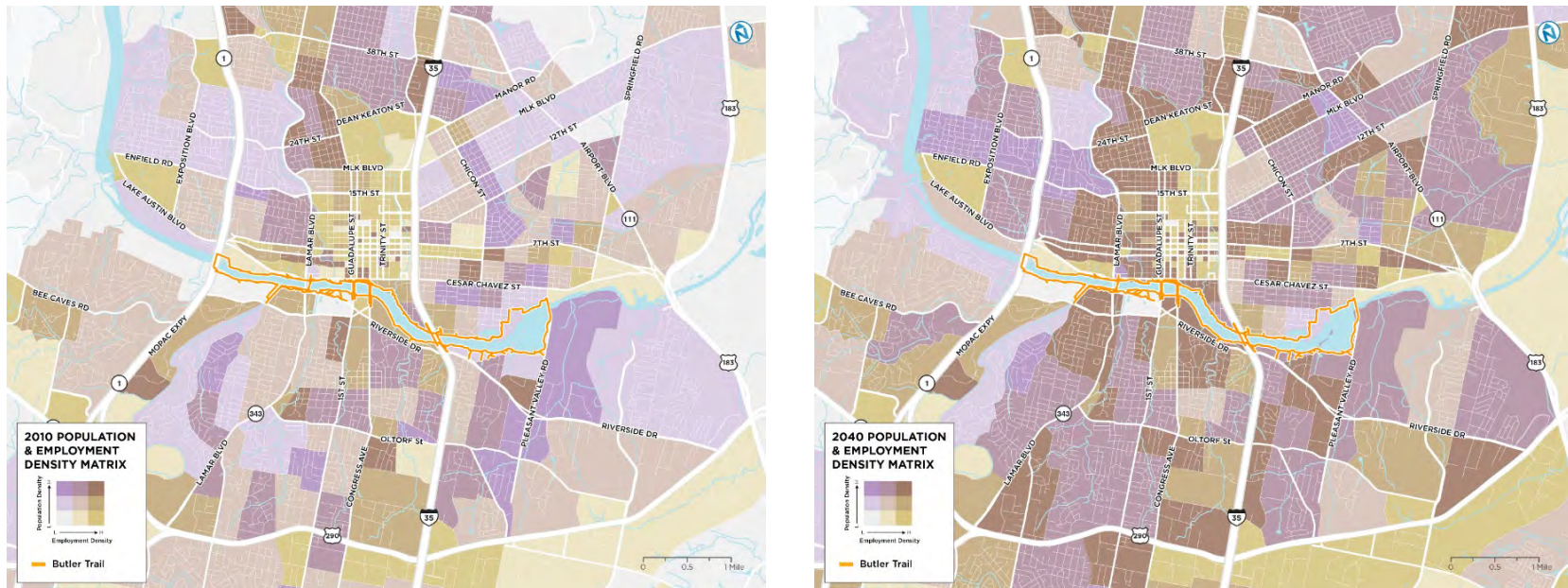


## A GROWING CITY

The residential and employment density in the vicinity of the Trail has doubled in the past 10 years and is projected to double again by 2040 according to regional growth models. This has and will continue to place demand on trail use, particularly on the eastern portions of the Trail. A key charge of this study is to ensure safety for all trail users, preserve the restorative experience of the Trail, invite new users, and balance equitable investments across different sections of the trail.

Historically, investments to the Trail have been focused in the western project area for two reasons. First, the eastern terminus of the Trail was formerly defined by the I-35 overpass bridge. Second, unequal distribution of capital and power resulted in wealthier neighborhoods in the western project area having more resources to organize and voice requests for investments to the trail segments and connections in their area.

**Figure 5-5 Density of Residents and Employees in the Vicinity of the Trail - 2010 and Projected 2040 Growth**











## PATHWAY CHARACTERISTICS

### PATTERNS OF USAGE & SPATIAL CONDITIONS

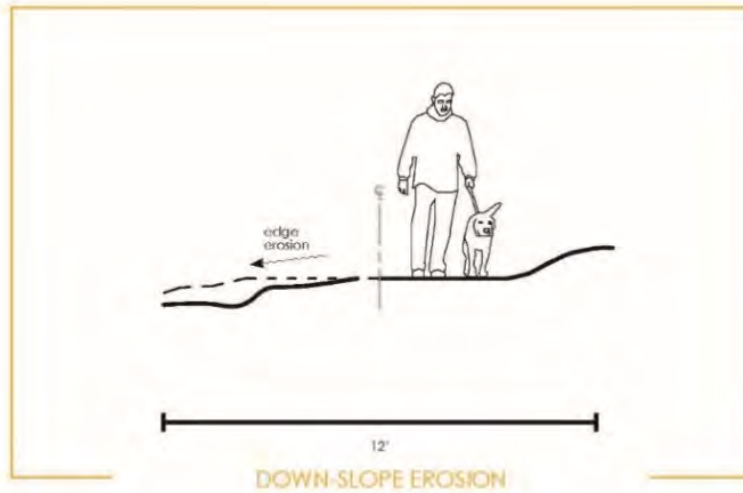
The path offers a variety of trail characteristics, including pinch points, widening of paths, formal pathways, informal social paths, and pathways to wander off the through trail to ecological destinations. Ultimately these pathway conditions are addressed through materials solutions and through decisions about width and edge conditions.

### MATERIALS

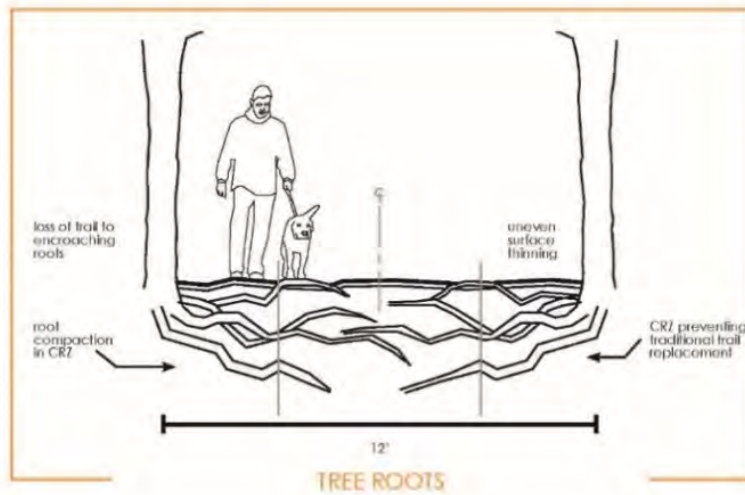
The current trail conditions contribute to safety concerns for both pedestrians and cyclists on the Trail, and can limit the accessibility of the trail for all users who may have different abilities. One element of this study is the creation of a problem-solving toolkit to help address issues related to materials, erosion, and maintenance on the Trail. While many of the solutions may apply to numerous trails, the toolkit has been designed specifically for the needs and use of The Trail Foundation, to promote safety and mobility. The table at right lists pathway concerns with regard to materiality that are addressed in the toolkit.

Figure 5-6 Pathway Concerns

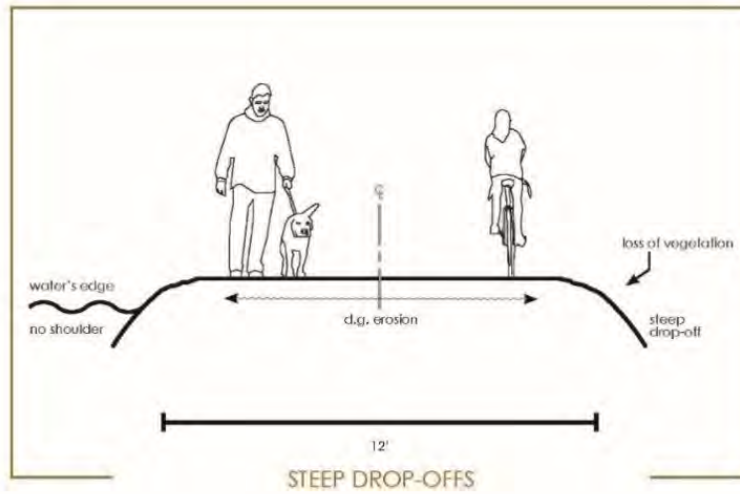
Pathway Concerns
Down Slope Erosion
Surface Issues due to Tree Roots,
Steep Drop-Offs,
Up-Slope Erosion & Deposition,
Compaction / Low-Points
Pinch Points (Caused by walls, trees, fences, etc.)
Excess Overland Flow
Unstable Material (Loose Gravel)
Shoulder Paths / Widening Paths / Widening
Concentrated Rilling
Low Water Crossing
Sharp Edges



**Down Slope Erosion.** Often a condition on the lake side edge of the Trail, resulting from unstable material and lack of vegetation. Erosion of the Trail immediately impacts lake water quality.

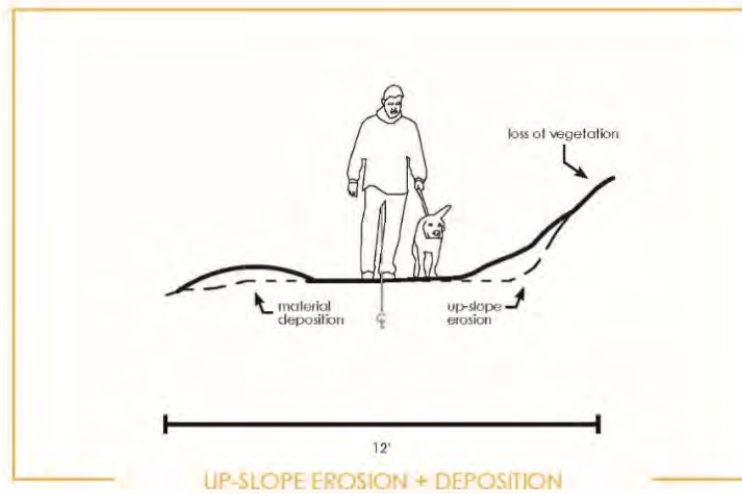


**Tree Roots.** This condition impacts pedestrians and cyclists, creating hazardous conditions, as they can cause tripping and be slippery. It also impacts the health of the tree and may contribute to future erosion if it leads to tree failure.



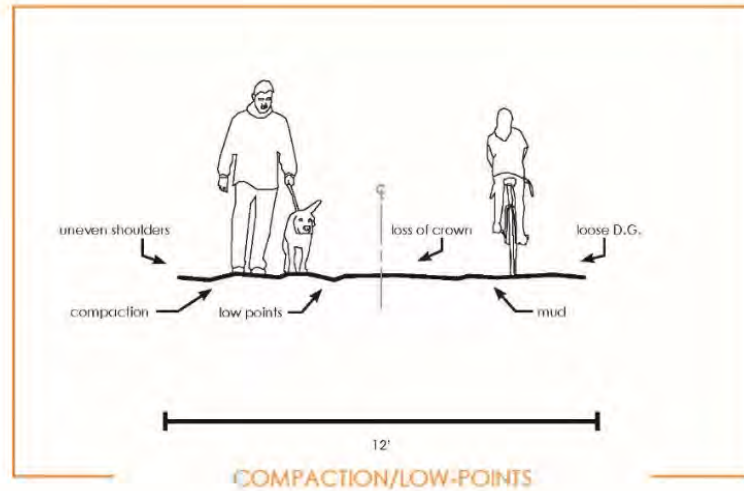
**Steep Drop-Offs.** This condition can cause unsafe conditions especially at pinch points and locations with constrained widths. Steep grades tend to lead to loss of vegetation and erosion.



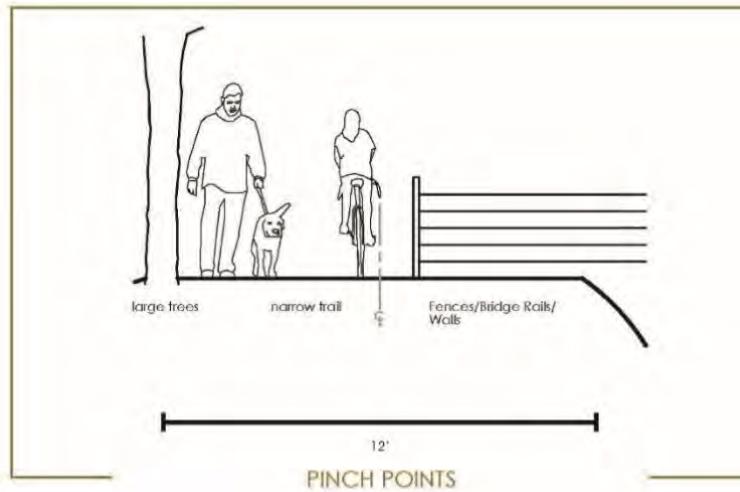


**Up-Slope Erosion + Deposition.** This condition causes material to be deposited on the Trail surface and often continues to migrate with heavy use, affecting the Trail width and adding loose material or mud. Steep grades tend to lead to loss of vegetation and erosion.

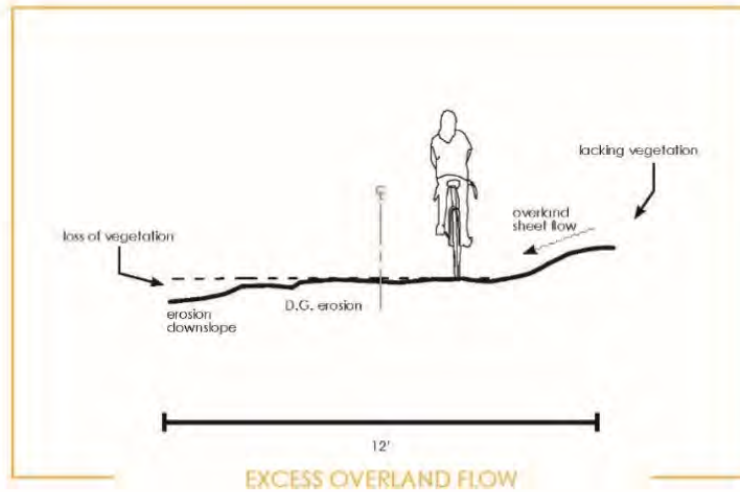




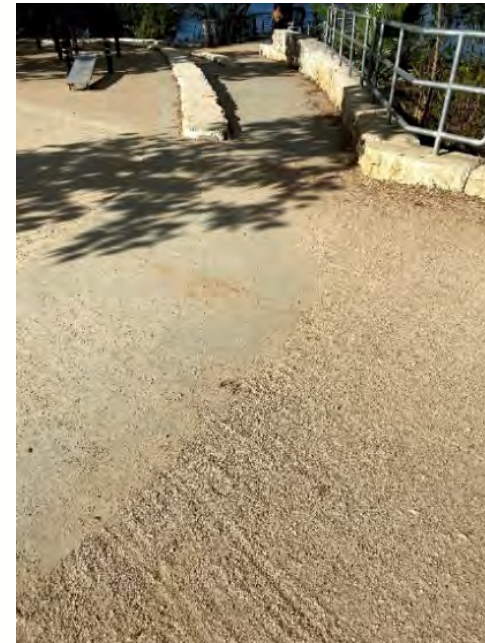
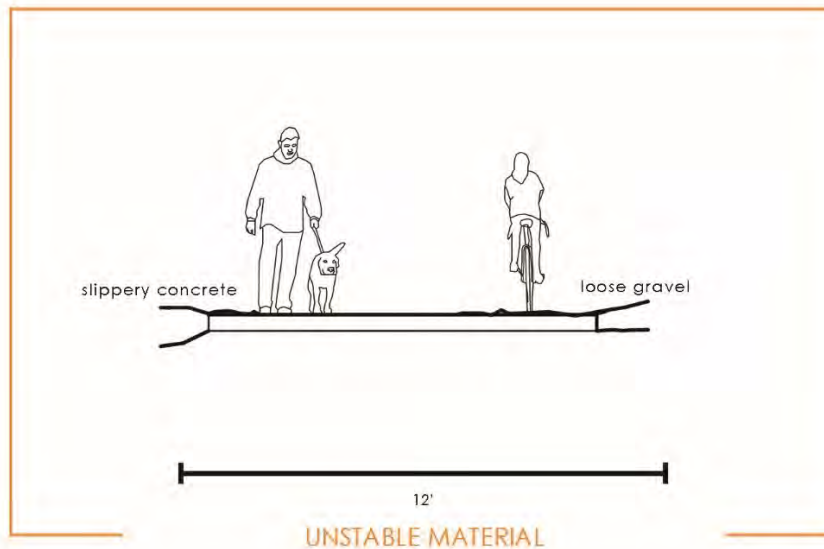
**Compaction/Low-Points.** This condition is the result of a lack of crown and improper trail installation, as well as irrigation runoff from adjacent privately owned land. Compaction leads to low points, which leads to pooling, which leads to more compaction.



**Pinch Points.** Pinch points are caused by narrow conditions, often due to adjacency to a bridge abutment, retaining wall, fence, trees, private development, etc. It is unsafe as it causes a bottleneck and is particularly challenging on a multi-use path, leading to more frequent user conflicts.

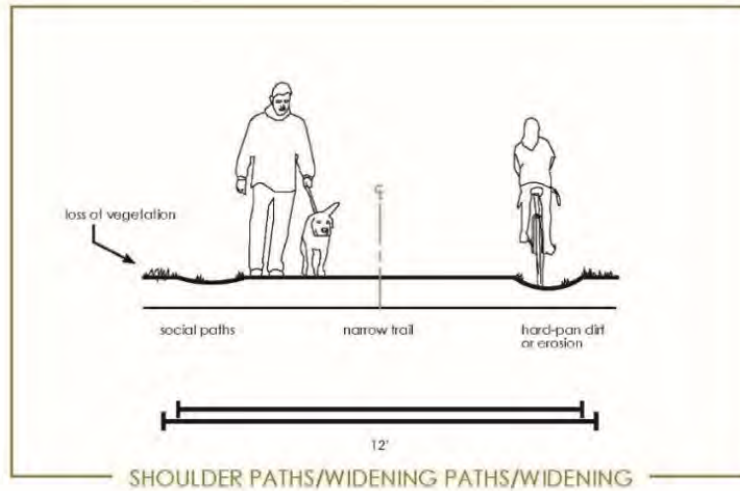


**Excess Overland Flow.** This condition can be caused by both stormwater and irrigation runoff. Often the upland slope lacks vegetation, or heavily irrigated sod is unable to capture all of the water. On the downslope, erosion occurs which impacts lake water quality and loss of habitat.

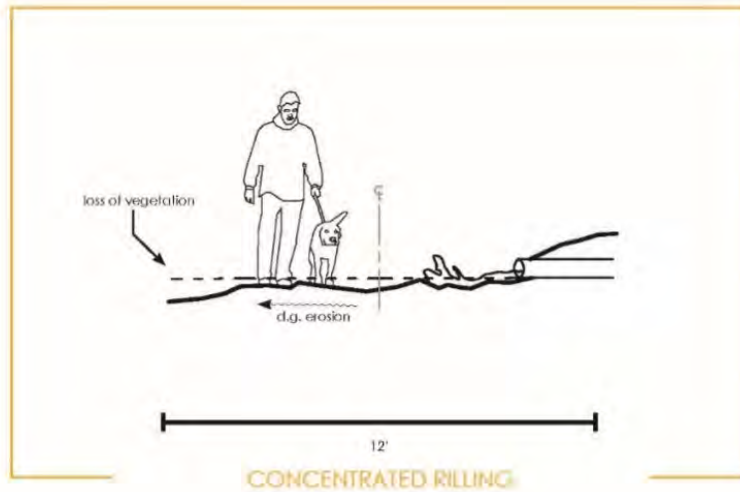


**Unstable Material.** This condition is caused by loose gravel and is a safety issue as it can be slippery, especially when it migrates over concrete or permeable pavers. Unstable material can slough off into the lake impacting water quality and aquatic habitat.

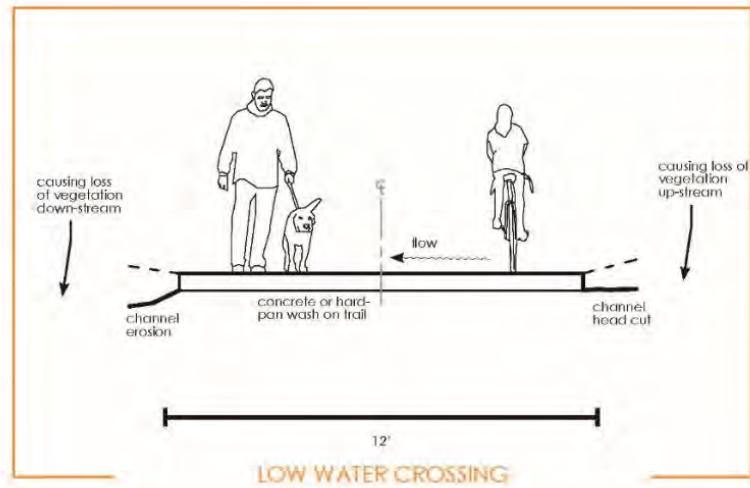




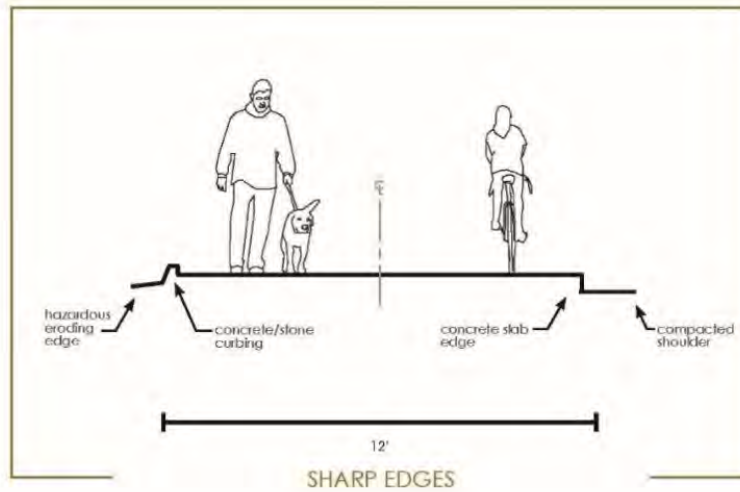
**Shoulder Paths / Widening Paths / Widening.** This condition occurs at pinch points, sharp turns, or an unconstrained path, where users create social paths parallel to the Trail, eventually merging and widening. This can lead to hazardous edge conditions including bare ground, erosion, compaction, and loss of vegetation/habitat.



**Concentrated Rilling.** This condition creates uneven surfaces that are difficult to navigate and leads to erosion, loss of vegetation, and the loss of the Trail's crown and defined edges.



**Low Water Crossing.** This condition occurs where there is no infrastructure for overland stormwater from adjacent parkland or development to run anywhere but over the Trail and into the lake. This leads to unsafe edge conditions, sedimentation and debris on the Trail, and loss of soil negatively affecting tree health.



**Sharp Edges.** This condition can be caused by concrete slab edges, curbing, hazardous erosion, or a compacted shoulder condition. It is a hazard for both pedestrians and cyclists, leading to more accidents on the Trail. Sharp edges can cause further erosion and loss of vegetation and habitat.



**Figure 5-7 Trail Materials Matrix**

The following chart summarizes cost, durability, albedo (surface reflectivity), pros and cons, and safety concerns as they relate to materials that are currently used on the trail, as well as for alternative materials that could be safety and mobility solutions.

Material/ Product	Cost	Maintenance	Durability	Infiltration	Albedo	General Pros	General Cons	Notes	Safety Concerns
<b>Decomposed Granite</b>	\$26.20 per ton (\$5 per 1 sf of trail without labor)	▪ High	▪ Low	▪ Average	▪ Neutral	<ul style="list-style-type: none"> <li>▪ High erosion potential</li> <li>▪ High Maintenance</li> </ul>	<ul style="list-style-type: none"> <li>▪ Most prone to slipping (of the D.G. options)</li> </ul>		<ul style="list-style-type: none"> <li>▪ Potential slipping due to erosion</li> </ul>
<b>Stabilizer (Water-Based Binder)</b>	\$3 per pound (need 15lbs. per 1 ton of Decomposed Granite) = \$71.20 per ton (mixed) (\$13.56 per 1' of trail without labor)	▪ Low	▪ High	▪ Average	▪ Neutral	<ul style="list-style-type: none"> <li>▪ Only requires compaction for activation</li> <li>▪ Softer surface for walkers/joggers</li> </ul>	<ul style="list-style-type: none"> <li>▪ Requires mixing</li> <li>▪ Requires proper install</li> </ul>		<ul style="list-style-type: none"> <li>▪ Less prone to slipping than Decomposed Granite without stabilizer.</li> <li>▪ The slipping potential is a concern for bikes</li> </ul>
<b>Stalok (Wax-Based Binder) Or Organic-Lock (Non-Local Alternative)</b>	\$240 per ton (fluctuates based on supplier) (\$45.71 per 1' of trail without labor)	▪ Low	▪ High	▪ Very Low	▪ Neutral	<ul style="list-style-type: none"> <li>▪ Only requires compaction for activation</li> </ul>	<ul style="list-style-type: none"> <li>▪ Local source unknown</li> <li>▪ Not Porous</li> </ul>		<ul style="list-style-type: none"> <li>▪ Less prone to slipping than Stalok Concentrate</li> <li>▪ Difficult to repair; surface density like asphalt.</li> </ul>
<b>Presto Geoblock Cells</b>	<ul style="list-style-type: none"> <li>-Pro-plus (heavy duty): \$2-2.25</li> <li>-Pro-lite (light duty) \$1.60-1.90</li> </ul> (without labor cost)	▪ High - Maintain level of cell infill material	▪ 20+ years	<ul style="list-style-type: none"> <li>▪ High (also depends on fill material)</li> <li>▪ 1000+ in. per hour</li> </ul>	▪ Fill-material dependent	<ul style="list-style-type: none"> <li>▪ Opportunity for vegetation where would otherwise be pavement.</li> <li>-LEED credits</li> </ul>	<ul style="list-style-type: none"> <li>▪ Proprietary Cost</li> <li>▪ Cost</li> </ul>	<ul style="list-style-type: none"> <li>▪ Recycled HDPE</li> <li>▪ Grass or gravel filled</li> <li>▪ 10 yr. Warranty</li> <li>▪ Almost no maintenance</li> </ul>	<ul style="list-style-type: none"> <li>▪ Potential trip hazard (exposed cells)</li> </ul>



Material/ Product	Cost	Maintenance	Durability	Infiltration	Albedo	General Pros	General Cons	Notes	Safety Concerns
<b>Glow Stones</b>	<ul style="list-style-type: none"> <li>Contact for volume discount price</li> </ul>	<ul style="list-style-type: none"> <li>Debris removal</li> </ul>	<ul style="list-style-type: none"> <li>Maintains glow but fades by about 10% per year</li> </ul>	<ul style="list-style-type: none"> <li>None</li> </ul>	<ul style="list-style-type: none"> <li>High</li> </ul>	<ul style="list-style-type: none"> <li>Potentially provides illumination for wayfinding</li> <li>Non-toxic</li> <li>Doesn't expand/contract</li> </ul>	<ul style="list-style-type: none"> <li>Potentially will get covered by dirt/debris</li> <li>Cost</li> </ul>	<ul style="list-style-type: none"> <li>Off-white/yellow</li> <li>Potential LEED points</li> </ul>	<ul style="list-style-type: none"> <li>Negligible</li> </ul>
<b>Porous Pave Rubber Surfacing Material</b>	<ul style="list-style-type: none"> <li>\$8-9.50 per square foot.</li> </ul>	<ul style="list-style-type: none"> <li>Requires regular maintenance cleaning, application of UV protection coating</li> </ul>	<ul style="list-style-type: none"> <li>12+ yrs.</li> </ul>	<ul style="list-style-type: none"> <li>High (up to 2000gal. per sq. foot)</li> </ul>	<ul style="list-style-type: none"> <li>Color Dependent</li> </ul>	<ul style="list-style-type: none"> <li>Resistant to freeze/thaw</li> <li>Can get help to earn LEED credits.</li> <li>Soft surface for walkers/joggers</li> </ul>	<ul style="list-style-type: none"> <li>Maintenance requirements</li> <li>Durability concerns</li> <li>Cost</li> <li>May be damaged by dog claws or wildlife digging</li> </ul>	<ul style="list-style-type: none"> <li>100% recycled tires</li> <li>With proper aggregate binder, substrate can handle 80,000lb. loads.</li> </ul>	<ul style="list-style-type: none"> <li>Low</li> </ul>
<b>Pervious Concrete</b>	<ul style="list-style-type: none"> <li>~\$10-13 per sq. ft.</li> <li>Up to 50% more expensive than conventional asphalt/concrete + 1-2% of construction cost for maintenance.</li> </ul>	<ul style="list-style-type: none"> <li>Vacuum Sweeping, Pressure Hosing, Chip Seal</li> </ul>	<ul style="list-style-type: none"> <li>Less durable than traditional concrete/asphalt.</li> <li>~20-40 year life expectancy</li> </ul>	<ul style="list-style-type: none"> <li>High (15-25% void space with flow rates around 480in./hour)</li> </ul>	<ul style="list-style-type: none"> <li>Color dependent</li> </ul>	<ul style="list-style-type: none"> <li>Reduces runoff and pollution loads.</li> <li>Water detention</li> <li>Softer visual look than regular concrete</li> </ul>	<ul style="list-style-type: none"> <li>More labor-intensive than traditional concrete/asphalt.</li> <li>Not as strong as asphalt and concrete.</li> <li>Cost</li> </ul>	<ul style="list-style-type: none"> <li>Suitable for low traffic sandy soils and shallow slopes.</li> <li>Infiltration capacity of soils needed (&gt;.5in/hr.)</li> <li>Can be cost effective when it reduces size of or eliminates need for curb and gutter conveyance systems and retention ponds.</li> </ul>	<ul style="list-style-type: none"> <li>Low</li> </ul>

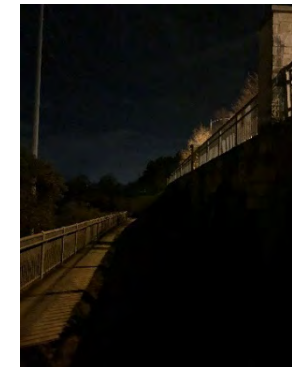
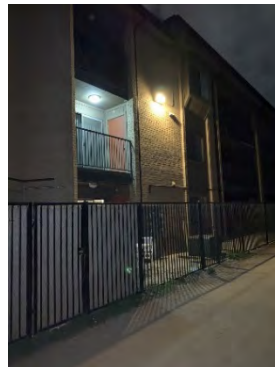
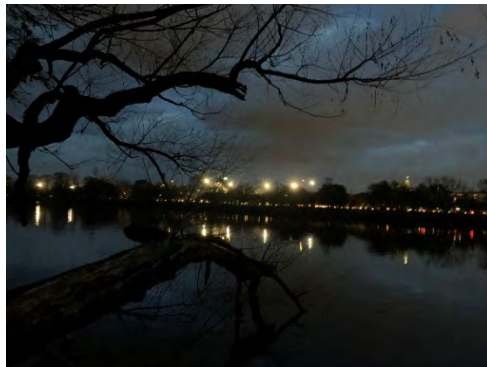


Material/ Product	Cost	Maintenance	Durability	Infiltration	Albedo	General Pros	General Cons	Notes	Safety Concerns
<b>Asphalt</b>	<ul style="list-style-type: none"> <li>▪ \$2-5 per square foot. + Sealing and crack fill costs</li> </ul>	<ul style="list-style-type: none"> <li>▪ Sealing (~5 years)</li> <li>▪ Fixing cracks (annually)</li> <li>▪ Unraveling edges without a curb and gutter</li> <li>▪ Resurfacing every 10 yrs.</li> </ul>	<ul style="list-style-type: none"> <li>▪ 30+ yrs.</li> </ul>	<ul style="list-style-type: none"> <li>▪ None</li> </ul>	<ul style="list-style-type: none"> <li>▪ Very Low</li> </ul>	<ul style="list-style-type: none"> <li>▪ Little maintenance compared to Porous and Pervious Paving</li> </ul>	<ul style="list-style-type: none"> <li>▪ Environmental impacts of manufacturing process.</li> <li>▪ Encourages skateboarders, scooters, and road bikes + increased speeds.</li> <li>▪ Increased water and pollutant runoff.</li> <li>▪ Leaches harmful chemicals.</li> <li>▪ Cost</li> <li>▪ Hard on runners' knees</li> </ul>	<ul style="list-style-type: none"> <li>▪ No curing time for asphalt</li> <li>▪ Harmful impact to adjacent trees and vegetation</li> </ul>	<ul style="list-style-type: none"> <li>▪ Asphalt potentially slippery, harder landing surface</li> </ul>
<b>Concrete</b>	<ul style="list-style-type: none"> <li>▪ \$12-18 per square foot.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Fixing cracks; Removing graffiti, gravel, silt, soil, and vegetation that washes onto the surface during storms</li> </ul>	<ul style="list-style-type: none"> <li>▪ 50+ yrs.</li> <li>▪ More durable than asphalt</li> </ul>	<ul style="list-style-type: none"> <li>▪ None</li> </ul>	<ul style="list-style-type: none"> <li>▪ Very high (light grey)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Less maintenance than Porous and Pervious Paving</li> </ul>	<ul style="list-style-type: none"> <li>▪ Environmental impacts of manufacturing process.</li> <li>▪ Encourages skateboarders, scooters, and road bikes + increased speeds.</li> <li>▪ Increased water and pollutant runoff.</li> <li>▪ Leaches harmful chemicals.</li> <li>▪ Cost</li> <li>▪ Hard on runners' knees</li> </ul>		<ul style="list-style-type: none"> <li>▪ Potentially slippery, harder landing surface</li> </ul>



## LIGHTING ISSUES AND OPPORTUNITIES

Many segments of the Trail have issues with excessive light glare and trespass: light is thrown from nearby roadways, bridges, sports fields, parking garages, adjacent properties, and from the trail itself. This trespass and glare disrupts the visual hierarchy and trail experience while also negatively impacting the riparian zone of the lake. Good lighting will allow users to safely enjoy the trail while mitigating ecological effects. There are specific areas shown in Figure 5-8 where Xs indicate areas of low headroom that are unlit and Os indicate areas identified by users as feeling unsafe; both pose a pointed issue for trail user safety and should receive prioritized attention. Solutions in these areas should be designed with future trail lighting in mind. Other strategies such as shielding fixtures, changing lamps on the fixture to reduce output and color temperature, redirecting the fixture, and adding motion sensors will go a long way in improving the nighttime trail experience without installing additional fixtures. Unlit pathways will benefit from breadcrumb lighting to aid in nighttime orientation while helping protect the night sky and ecosystem. Many trail users supplement the lack of lighting with bright headlamps and bike lights, which can cause temporary blindness for other trail users. Education and signage could promote an etiquette of modifying this behavior to ensure safer experiences among all trail users.

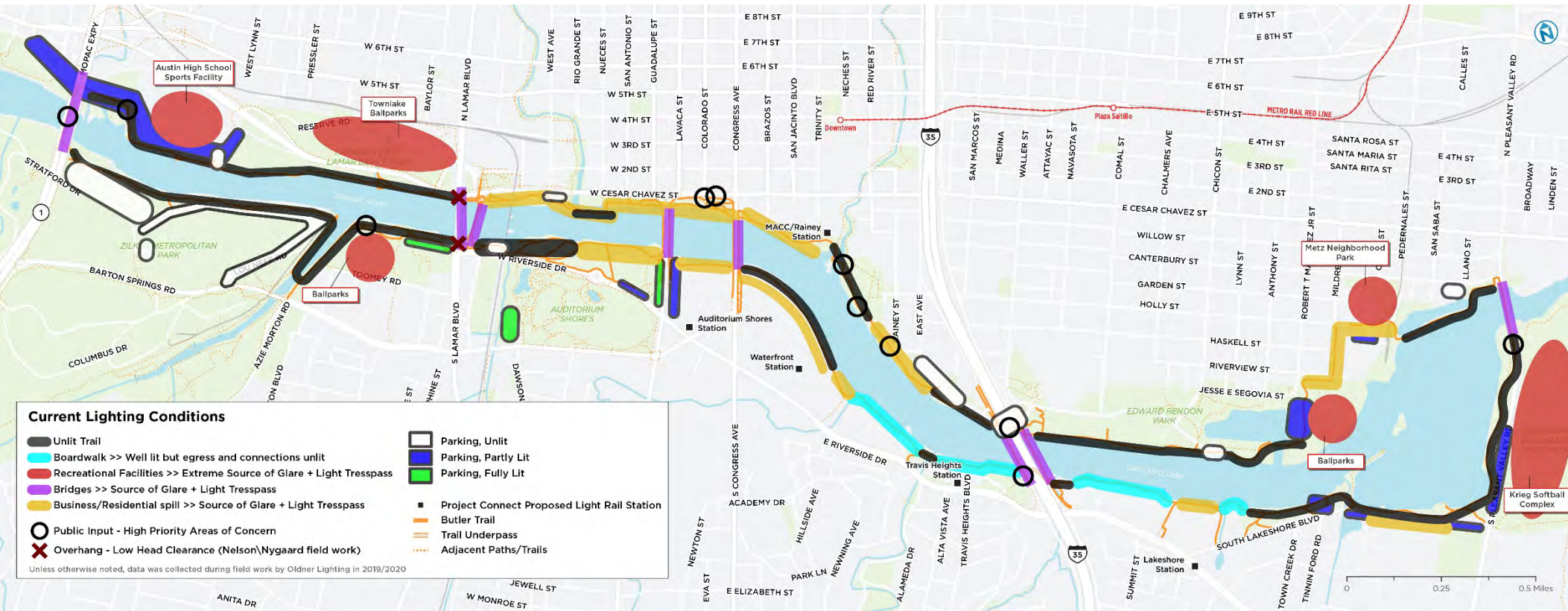


**Examples of light glare** that could impair vision and also create light pollution, and example of light trespass making dark areas even darker





Figure 5-8 Current Lighting Conditions





## PATHWAY CONFLICTS

A pathway conflict is a situation where the flow of users is hindered in some way. This may be due to a variety of causes such as an obstacle or protrusion, pinch points created by high demand, use by high-speed bicyclists, a sharp turn, walls, limited vertical clearance, uneven surfaces, etc. Places of pathway conflicts due to narrow widths or other conditions were gathered through community input, analysis of future growth, and field review. The photos below capture examples of typical pinch points. Additionally, some areas of the Trail take sharp turns with limited visibility, where these user speed differentials can cause conflict. Other natural barriers like walls, low overhanging bridges, and steep dropoffs can also lead to crowding amongst trailgoers. Similarly, uneven surfaces and sharp edges at the sides of the Trail can create user hazards because they reduce the effective width available for travelling linearly and navigating around other users.



Additionally, as described earlier, the Trail is experiencing the demand pressures of population growth. Much of the Trail will be susceptible to increasing complaints about user conflicts and pinchpoints due to expected growth in Austin. A shared use trail modelling exercise found that, with growth, all users' quality of experience could degrade over time if safety and mobility strategies are not deployed on the areas in segments near the red and orange circles below. According to the FHWA's trail level of service calculator<sup>2</sup>, wider or separated trails provide a higher quality experience in the face of higher volumes of people both walking and bicycling than narrower ones.

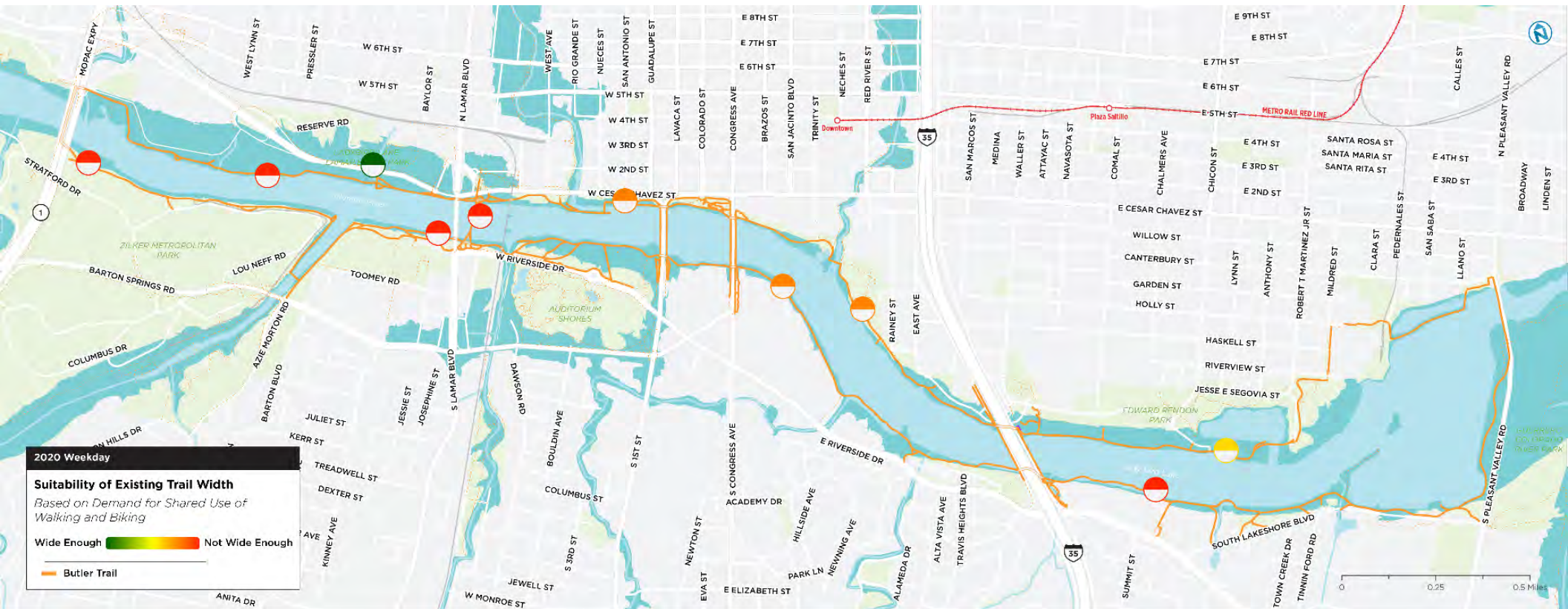
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<sup>2</sup> <https://www.fhwa.dot.gov/publications/research/safety/pedbike/05138/ref.cfm#ftn8>





Figure 5-9 Suitability of Existing Trail Width Based on Demand for Shared Use of Walking and Biking







## Trail Design Best Practices

The American Association of State Highway and Transportation Officials (AASHTO) is a standard reference for trail width guidance with an emphasis on comfort and speed. AASHTO recommends a minimum of 10 feet for multi-use trails; however, where heavy use is anticipated, a 12 to 14-foot width is recommended.<sup>3</sup>

Occasionally, providing separate, parallel paths (or treads) for different users may be desirable. For example, a primary, hard-surfaced path can be provided exclusively for bicyclists, with softer shoulders set aside for pedestrians and equestrians. Single shoulders should be at least 5 feet wide, while dual shoulders (one on each side) should be between 2 and 2.5 feet wide. Adequate sight distances for cyclists are critical for user safety; AASHTO recommends that multi-use trails provide a minimum sight distance of 150 feet. Ideal grades over long distances for bicyclists are less than 3 percent (typical for former railroad corridors), although up to 5 percent is acceptable. Although AASHTO summarizes guidance for multi-use facilities that might be less recreational and nature-oriented than The Butler Trail, many of the guidelines should still be heeded given the high volume of use.



## Types of Trail Users

In addition to trail width, accommodating the many users of a multi-use trail requires planning for surface type, vertical clearance, and trail amenities.

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<sup>3</sup> Guide for the Development of Bicycle Facilities, American Association of State Highway and Transportation Officials, Washington, DC, 1999.



## LOCAL AUSTIN TRAIL GUIDELINES

As mentioned in the introduction, the Trail is located within the Austin Urban Trails Network and the on-street All Ages and Abilities Bicycling Network, meaning it is a piece of a mobility ecosystem serving comfortable and accessible recreation for a wide range of users. The width significantly impacts the safety, comfort, and experience of the trail. It also impacts the ability of the trail environment to be a low-stress space shared by a diverse set of user abilities. Given trail users of different speeds often need to pass each other during their journey, adequate room must be available to see and navigate safely and courteously around other trail users.

The AASHTO Guide for the Development of Bicycle Facilities recommends that trails are as large as 14 feet wide if they carry over 300 total users during the peak hour and if more than 30% of the total users are walking. According to Austin Municipal Code, 12 feet (plus 2 feet of shoulder on either side) is the maximum allowable width of a hard surface trail close to a waterway (according to LDC 25-8-261).<sup>4</sup> Like the Code, the 2014 Austin Urban Trails Plan recommends 12 foot wide trails with a standard 2 foot shoulder on either side within an overall trail corridor area width of 20 feet wide, but it also recommends creating a double trail with a buffer when trails accommodate a higher level of cycling usage. The trail width varies over the course of its width: in some locations, it is as narrow as 8 feet wide, while in others it is as wide as 20 feet. The recently constructed boardwalk is 14 feet wide. The City's Urban Trails Master Plan is currently undergoing an update which could re-evaluate and redefine these standards.

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<sup>4</sup> <https://app.box.com/s/i80p4ee7vytuq67k9pgz> and <https://www.municode.com/webcontent/15309/1300/1302S-1.pdf>



## 6 EQUITABLE ENGAGEMENT

### ENGAGEMENT GOALS

#### **Build awareness and excitement for the trail study**

- Listen to and acknowledge community concerns regarding trail safety and comfort
- Share the study goals, progress, timeline, and next steps
- Communicate why feedback is important and how feedback is being used

#### **Reach a variety of users and community interests to create recommendations that are comprehensive and equitable**

- Target traditionally underrepresented stakeholders in public process, i.e. Communities of Concern, such as people of color, people with disabilities, and people with low incomes
- Learn from neighborhoods and populations that are not using the trail because of safety perception or other infrastructure concerns
- Learn about expected population, employment, and tourism growth
- Provide varied types of activities and venues through which to provide feedback, recognizing that certain demographics may need specific engagement techniques, including Spanish language translation
- Leverage existing stakeholder networks to engage wider community

#### **Inform study priorities and actions**

- Identify where the public is uncomfortable and what scenarios need to be addressed

#### **A NOTE ON THE COMMUNITY ENGAGEMENT PROCESS**

This study was undertaken during the COVID-19 pandemic, requiring the elimination of planned in-person activities, which were intended to be focused at key community-serving destinations that support people with limited English proficiency and constrained mobility options. This study respects the legacy of residents who have lived in Austin for generations, while also anticipating the future needs of its changing community. Future engagement for specific projects should be focused on these groups to ensure inclusive engagement in project development and design. Despite the pandemic, this effort had the highest online survey participation rate of any Trail Foundation planning effort yet to date.





- Generate solutions for future projects and maintenance that are sensitive to ecological concerns
- Identify programming opportunities
- Communicate next steps & foster ongoing community support

## TECHNIQUES UTILIZED



**Online Engagement** – Information around this study’s purpose and background, the study’s timeline, and key information around upcoming and past events was hosted online using landing pages on both the Trail Foundation’s and City of Austin’s websites. The landing pages provided direct links to provide public input, and contact information for additional questions.



**Virtual Maps and Surveys** – Interactive wikimaps of the project area provided participants an avenue to identify specific areas of interest, with options to include additional detailed comments. Visitors were also provided the option to report details about their demographics and how they are typically involved with the Trail and the City of Austin.



**Focused conversations** – To inform the study’s sense of safety issues and the community’s relationship to the Trail, focused stakeholder meetings were conducted in Spanish or English. The project team reached out to 54 groups representing demographics of people within biking distance of the Trail, community-based organizations, elected officials, major employers and business associations, and organizations invested in trail and open space access in Austin. Throughout Spring and Summer 2020, the study team spoke with about a dozen stakeholders to identify existing challenges and concerns, priority actions, locations for improvements, and implementation strategies. Because of physical distancing in response to the global pandemic, in-person engagement was not possible and phone calls were the primary structure of these engagement efforts. Given limited bandwidth from community members due to working from home, remote schooling, and city-wide lockdowns, the timeline of outreach was doubled to enable more time for reaching groups.



## **Focused Community Stakeholder Interview Participants**

### **Community-Based Organizations**

Austin Runner's Club

### **Equity Communities**

City of Austin's Office of Equity

### **Elected Officials**

Office of Representative Natasha Harper-Madison (District 1)

Office of Representative Kathie Tovo (District 9)

### **Major Employers and Business Associations**

Hyatt

Movability

Presidium Real Estate

### **Conservancies and Non-Profits**

Shoal Creek Conservancy

Pease Park Conservancy

### **City of Austin Representatives**

City of Austin Parks and Recreation Department (PARD)

City of Austin Active Transportation Department (ATD)

Youth Forest Council Program



## WHAT WE HEARD

### Wikimap Input | March 4, 2020 – June 30, 2020

Ninety-five public comments on the Wikimap illustrate where people experience user conflicts, narrow pinch points, lighting issues, and wayfinding concerns. The map below shows a concentration of concerns at the bridges over Barton Creek and Longhorn Dam, lighting issues on the north side, and wayfinding issues at Holly Shores and the I-35 bridge.

Figure 6-1 Map of Concern Areas Garnered through Wikimapping

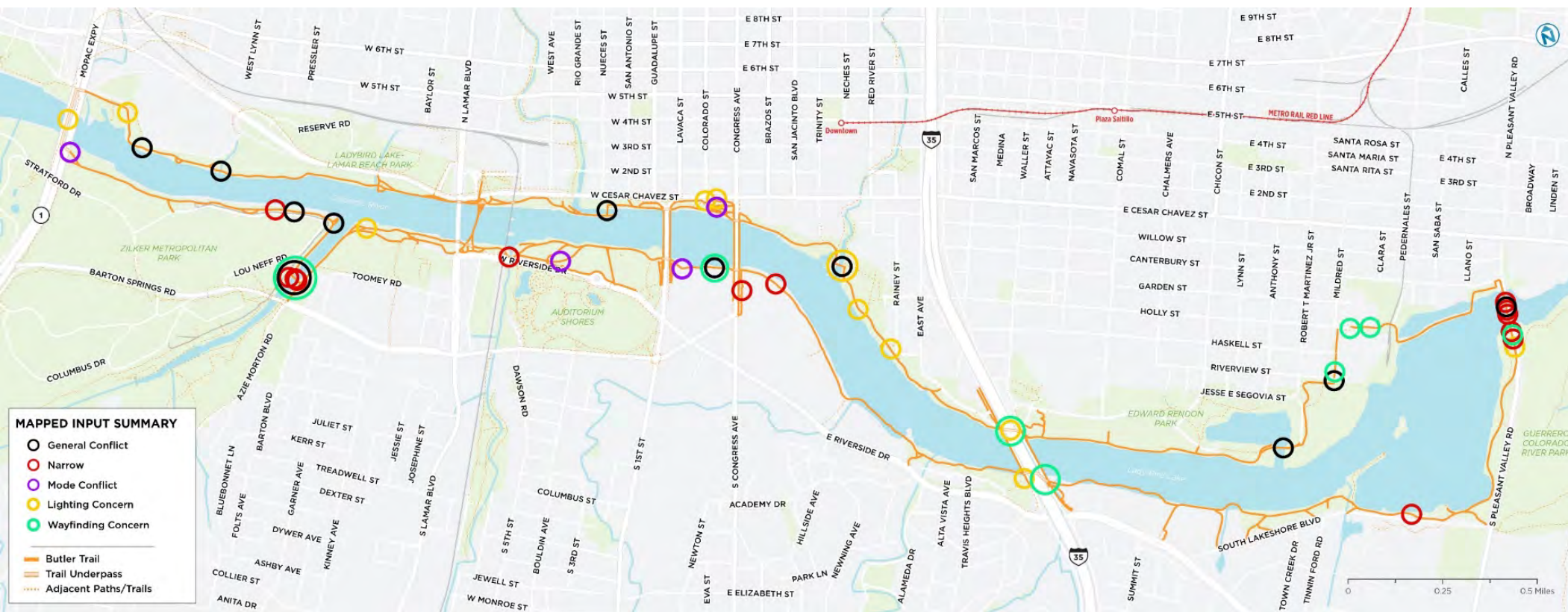


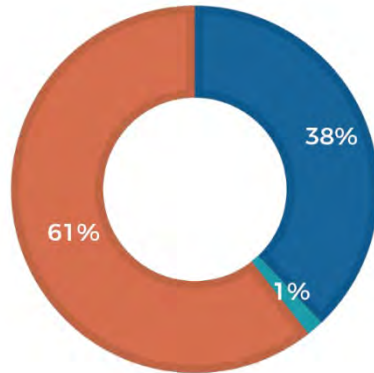




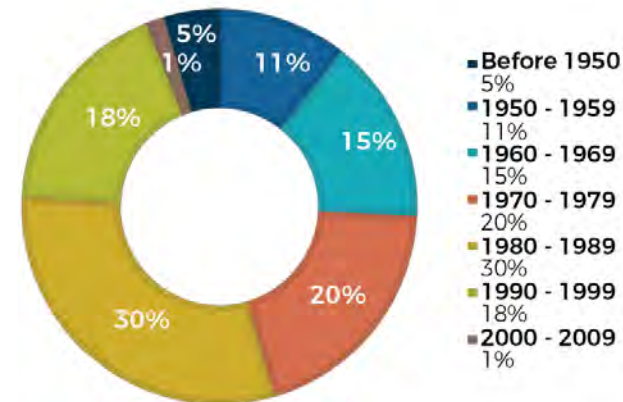
Figure 6-2 Demographics of Wikimap Survey Participants (n=95)

### Pronouns

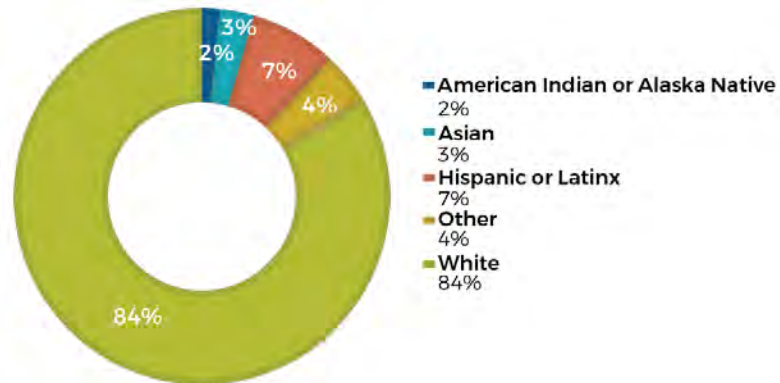
■ He / him / his 38%  
 ■ Other 1%  
 ■ She / her / hers 61%



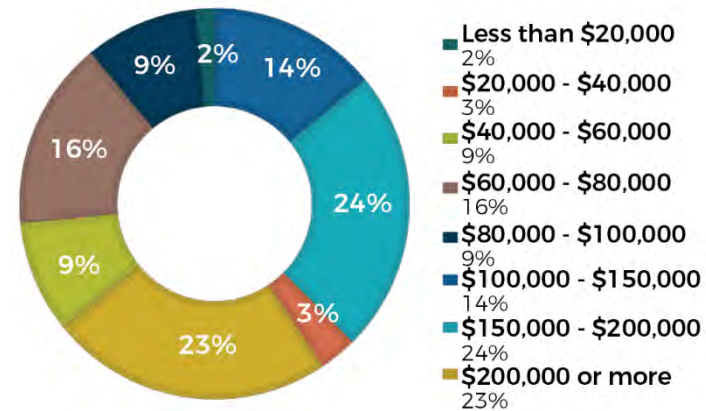
### Age by Birth Year



### Race



### Household Income





The project team analyzed the results and convened with key community stakeholders for further discussions. Six distinct categories of trail conditions were developed to integrate the nuances of public comments, stakeholder feedback, and technical review. These were included in the second round of community engagement, the Online Survey.

### Focused Conversations

Online survey questions and trail recommendations were informed by the following recurring key areas, topics, and issues:

- Problems when the Trail goes down to a six foot width
- Safety concerns surrounding the speed of bicyclists using the Trail
- Problems created by erosion on the banks of the Trail and the lake
- Maintenance problems associated with heavy rain
- Concerns about poor drainage around Auditorium Shores
- Desire for more trail stability and hardening of the surface
- Desire for better fencing of the off-leash area at Auditorium Shores
- Desire for new but limited and targeted trail lighting
- Desire for restrooms and water fountains to accommodate families and other user groups
- Request to identify parking lots accessible along the Trail
- Desire to expand the Trail westward
- Wanting easy stand-alone maps along the Trail, ideally multilingual
- Concerns about gentrification and displacement in neighborhoods surrounding the Trail
- Seaholm Intake facility area
- Narrowness of the Trail around the Pleasant Valley bridge

### Safety and Mobility

The primary safety and mobility issues that surfaced during the course of the study are

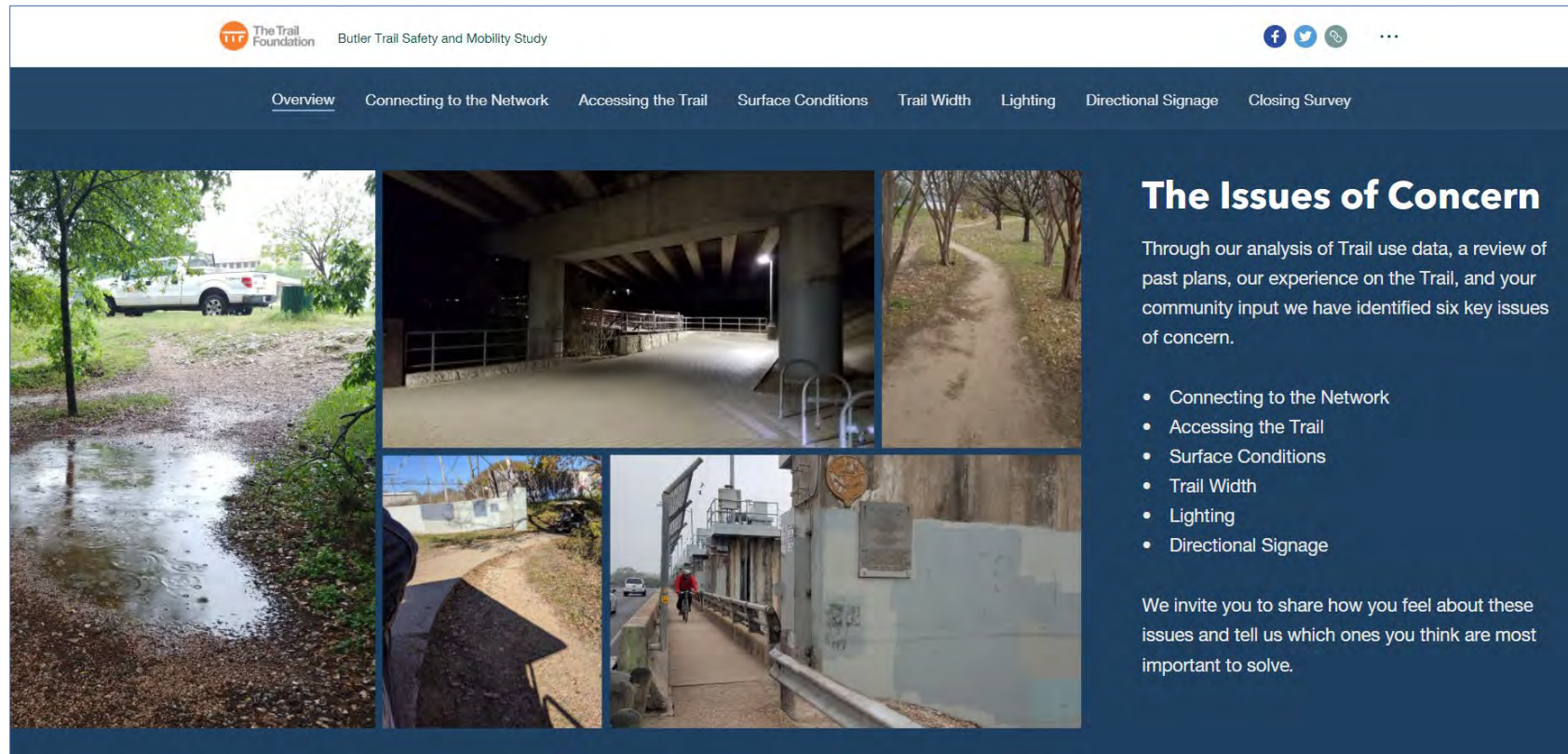
- User Conflict and Trail Width
- Surface Conditions
- Connections to the Street Network
- Lighting
- Accessing the Trail
- Signage



## Online Survey | October 16, 2020–November 13, 2020

Informed by Wikimap comments and extensive field review, an online storymap was developed to engage the community around improving mobility and safety related to network connections, trail access, surface conditions, trail width, lighting, and wayfinding. 662 people responded to one or more questions embedded in the storymap.

Figure 6-3 Fall 2020 Community Engagement through Storymap Tool







## FINDINGS

Storymap participants were introduced to each of the issues of concern with brief descriptions and example images of locations on the Trail where the condition exists. Participants voted at the end of each category chapter whether or not the condition was important to them. Results are compared in the figures below.

**Figure 6-4 Community Survey Input on the Importance of Solving Categorical Trail Issues**

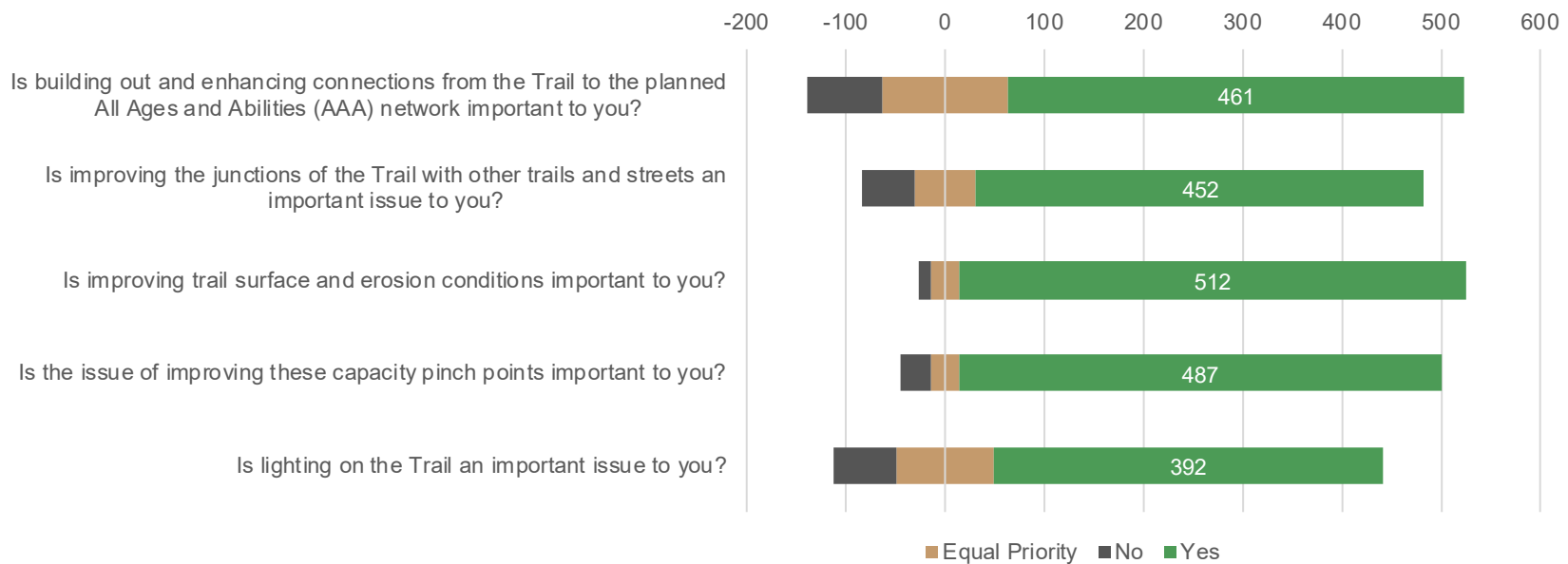


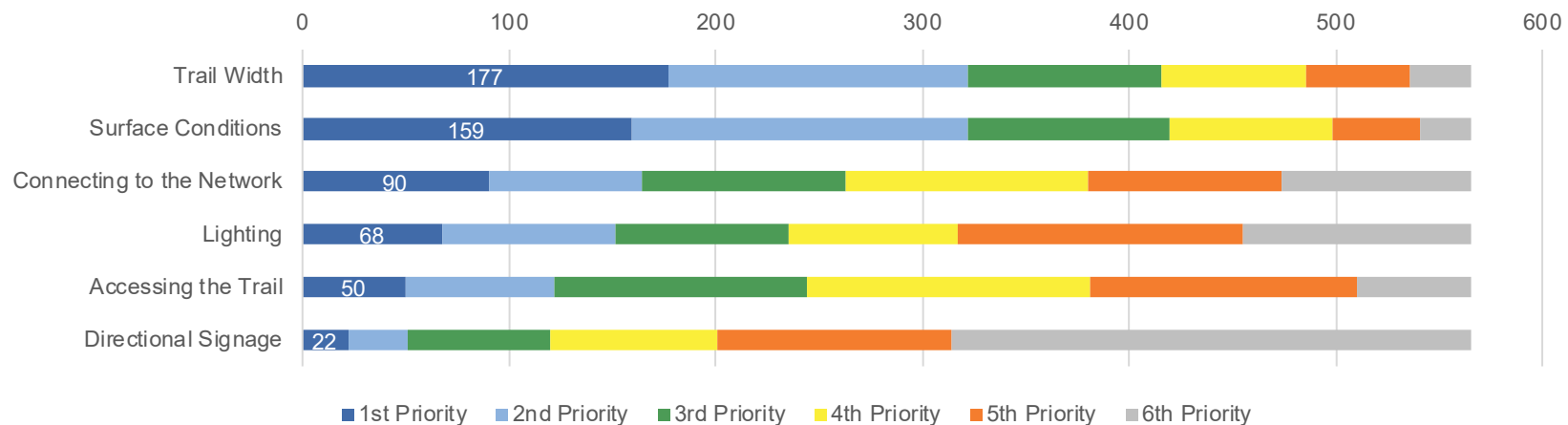


Figure 6-5 Community Survey Input on the Ranked Relative Importance of Categorical Trail Safety and Mobility Issues

Question	No	Equal Priority	Yes	Total Participants*
<b>Trail Width</b> - Is the issue of improving these capacity pinch points important to you?	-32	-13.5	487	546
<b>Surface Conditions</b> - Is improving trail surface and erosion conditions important to you?	-14	-13.5	512	553
<b>Connecting the Network</b> - Is building out and enhancing connections from the Trail to the planned All Ages and Abilities (AAA) Network important to you?	-75	-63	461	662
<b>Lighting</b> - Is lighting on the Trail an important issue to you?	-63	-49	392	553
<b>Accessing the Trail</b> - Is improving the junctions of the Trail with other trails and streets and important issue to you?	53	-31.5	452	568
<b>Directional Signage</b> - Is providing more directional signage important to you?	-125	-68.5	283	545

\* Each ranking question had a different number of responses, ranging from 545 to 662.

In the Closing Survey, participants were asked to rank their order of priority regarding the six categories featured in the Storymap. Trail width and surface conditions were a first or second priority for the majority of participants.



**69% of respondents indicated** that it is more important to focus on smaller and more numerous projects that address issues across a larger area than to solve multiple issues with a few large projects.



## Key Comments by Category

Participants provided 158 open-ended comments at the conclusion of the survey. The comments below are included to illustrate a sampling of the broad range of opinions about the key safety and mobility issues of trail width, surface conditions, and lighting.

### Trail Width

“My priority concern is separating pedestrian and bicycle users on the trail.”

“The trail shouldn’t continue to grow wider and wider, or feature more lights, more signs, more paved access, etc to accommodate more humans”

“Painting a line in the center to divide the directions and adding a bike/scooter lane to the outer edge of the two lanes would be ideal.”

“Improvements to the trail, particularly to make it safer and friendlier for cyclists and pedestrians to share.”

“Where ever possible, keep commuter/faster cyclists on surface streets.”

“Separate trail for bikes, separate trail for walkers and push strollers.”

“First priority-widen trail where possible”

### Surface Conditions

“I hate the portions that have been replaced with concrete.”

“The surface should remain natural (crushed granite or similar) as much as possible to maintain its natural feel and not allow the trail to become just another urban sidewalk trail, like every other city in the country.”

“The trail width is way too small and it needs to be paved.”

### Lighting

“Please keep the trail unlit! Use only extremely limited lighting in a very few needed (safety) locations”

“Please install lights in the section of the steep down hill section after the Zilker tracks where over by Zilker Metropolitan Park.”

“Your eyes cannot make out the surface of the bridge because of [headlights from oncoming car traffic.]”





## 7 POTENTIAL PROJECT DEVELOPMENT

Using the work to this point, potential project locations were identified through a combination of daytime and nighttime field review, existing and future conditions analysis compared to trail safety and access best practice, and public and stakeholder input. There are many solutions to address the locations identified as having safety and mobility issues. Due to the unique and varied contexts in which the issues are found, it is important to be flexible in recommending the specific projects at each location. Figure 7-1 shows the potential project types by issue. A selection of the project types is further defined in the glossary below.

Figure 7-1 Project Type, by Issue

Issue	Potential Project Types	Intended Outcome
Trail Width	<ul style="list-style-type: none"> <li>▪ Double trail</li> <li>▪ Trail widening</li> <li>▪ Alternative trail</li> <li>▪ Alternative route on-street (Protected bike lanes or bike boulevards)</li> <li>▪ Meandering paths</li> <li>▪ Boardwalk</li> <li>▪ Slow Zones</li> </ul>	<ul style="list-style-type: none"> <li>▪ Minimize conflicts</li> <li>▪ Increase capacity</li> <li>▪ Increase sense of safety and comfort for all trail users by reducing speed differentials</li> </ul>
Trail Conditions including Trail Surface, Adjacent Drainage or Erosion, and Edge issues	<ul style="list-style-type: none"> <li>▪ Path stabilization</li> <li>▪ Slope stabilization</li> <li>▪ Culverts</li> <li>▪ Vegetation</li> </ul>	<ul style="list-style-type: none"> <li>▪ Sustainably maintain trail</li> <li>▪ Support ecological restoration</li> </ul>
Connections to the Network	<ul style="list-style-type: none"> <li>▪ Trail extensions</li> <li>▪ All Ages and Abilities network gap closures</li> </ul>	<ul style="list-style-type: none"> <li>▪ Add or improve connections to the Trail from other trails and the All Ages and Abilities on-street cycling network</li> </ul>
Lighting	<ul style="list-style-type: none"> <li>▪ Mitigate glare and light trespass through Neighborhood Outreach Program</li> </ul>	<ul style="list-style-type: none"> <li>▪ Improve visual environment and comfort for all trail users while minimizing impact on local ecosystem</li> </ul>



Issue	Potential Project Types	Intended Outcome
	<ul style="list-style-type: none"> <li>Improve lighting in areas perceived as unsafe by public</li> <li>Improve nighttime wayfinding of unlit trail</li> </ul>	<ul style="list-style-type: none"> <li>Increase sense of safety and comfort for all trail users</li> <li>Improve orientation while keeping unlit areas naturally dark</li> </ul>
Accessing the Trail	<ul style="list-style-type: none"> <li>Formalize or improve trailhead connections at street</li> <li>Improve surface conditions at steep or acute entry points</li> </ul>	<ul style="list-style-type: none"> <li>Increase sense of safety and comfort for all trail users</li> </ul>
Directional Signage	<ul style="list-style-type: none"> <li>Directional signs</li> <li>Wayfinding signs</li> </ul>	<ul style="list-style-type: none"> <li>Enhance the clarity and usability to support a high quality of experience.</li> </ul>

## Project Type Glossary

- Double Trail: when two parallel trails are aligned closely together, side by side, with a buffer of varying width in-between (also known as dual track by some guidebooks)
- Alternative Trail: a double trail aligned far apart from each other
- Alternative Route on street: a comfortable connection to a street facility for walking or cycling
- All Ages and Abilities Facility (AAA): a facility designed for a comfortable and safe experience suitable to a wide range of cycle users
- Meandering Path: sinuous narrow low-impact foot paths for people to get off the trail and explore nature
- Boardwalk: a trail deck over water, often deployed when insufficient park land width exists for the capacity of users and/or to navigate around trail easement issues
- Slow Zones: where none of the above solutions are viable to ensure comfortable and safe usage among trail users, signs and material treatments could be installed to encourage slower travel and to discourage passing amongst trail users. This is an uncomfortable trail condition that should only be deployed at the most highly-constrained of locations.

## Process for Defining and Selecting Potential Projects

The following process was utilized to assign potential project types to locations along the trail:

- Identify locations where technical analysis (including field surveys) and community input converged
- Confirm primary issues at each location



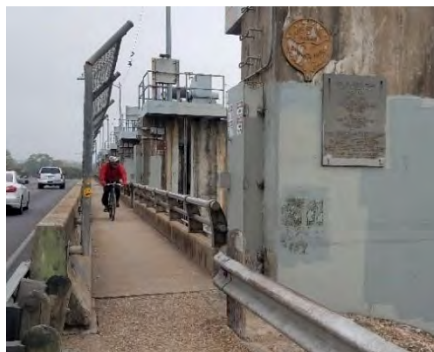
- Narrow down potential set of projects by ensuring potential project set and individual projects will:
  - Address project principles
  - Comprise a balanced list of potential projects across all quadrants of the Trail
  - Ensure suite of projects adds attention beyond areas of continued investment, attention, and past planning
- Define projects by walking through a topical decision tree that teases out geographical and regulatory opportunities and constraints respective to each location (See following sub-sections for examples)
- Recalibrate set of projects across their service of meeting the project principles





## TRAIL WIDTH AND USER CONFLICT

During the study process, trail width was consistently raised as an issue through online mapping and in focus groups, and it was the issue with most interest of solving in the Fall 2020 storymap engagement. During the last City of Austin Urban Trails Plan process (2013-2014), Austinites expressed that widening trails was one of the most important actions for improving the experience of Urban Trails.



As pictured above, the Longhorn Dam bridge currently has a narrow, four-foot-wide sidewalk with a fence on one side and a high railing on the other, making it too narrow for people to walk or bike past each other while using this crossing. Interim bridge improvements will start in Spring of 2021 and a study is moving forward to build a new bridge alternative to this crossing (known as “the wishbone bridge”). Similarly, in an area where structures come close to the trail near the Austin Statesman site, trees and fencing create pinch points around the trail, creating blind spots and forcing people to cross paths while using the trail. But even in less narrow locations, trail width is reportedly a concern because of the large numbers of people walking and bicycling there.

Obstacles or narrow sections along the trail create pinch points that can cause conflicts between people walking or biking. Conflicts may also arise where there are many people using wider parts of the trail due to overcrowding or speed differences between people walking and bicycling. However, in areas where people are using the trail as part of a longer ride, widening may lead to higher and more dangerous speeds. Additionally, widening the trail may not be an option in all locations due to adjacent barriers, likelihood of erosion, and/or ecological factors.



## Potential Solutions

### Projects

Preventing user conflicts and relieving some of the pressures of future growth could be resolved through projects that increase capacity through widening, divert people to parallel and alternate paths, and encourage trail use at slower speeds to prevent user conflicts. Potential project types such as double trails, alternate trails, meandering paths, and slow zones are discussed in more detail in Section 7. Without such capacity-building solutions, the trail becomes less safe, less comfortable, and higher stress, especially as the area around the downtown trail will continue to grow over time. Additionally, Slow Zones design for slower speeds, which will make incidents less severe, if they do happen. Importantly, any future trail width solutions need to honor the ecological value of the habitat within the 100-year flood plain.

Nevertheless, there will be select locations where more capacity is needed but where the park width and adjacent slope prohibit widening and alternative routing options are not possible. Given the experience of these locations will be uncomfortable and potentially unsafe, strategies like accepting crowding and discouraging trail user passing should only be deployed in the most highly constrained of locations.

Figure 7-2 illustrates the decision tree framework used to make project recommendations in Section 14.

### General policy and design recommendations:

- Plan to accommodate people bicycling separately from people walking throughout the trail, either via wider trails (14 feet or more), double trails, alternative trails and routes running parallel or on-street low stress bikeways, diverting people walking to exploratory meander trails where they can engage more closely with nature at a slow speed, and creating boardwalks and slow zones where the park right-of-way is already constrained or less than 20 feet.
- Clear vegetation to maintain trail width and visibility
- Ensure at least two feet clear zone on either side of the trail, where possible
- Advocate for All Ages and Abilities (AAA) bicycle network implementation, especially on streets parallel to the Trail
- Consider the offset of adjacent uses and the level of activity they generate when considering the width needs of the Trail and the clearance between activity zones and the pathway of users
- Preserve the low-stress, peaceful, and restorative quality the Trail has today



## Trail Width Guidance

- Any segment of trail less than 12 feet wide will need a solution, which could be widening, double trail, alternative trail or route, or creating a boardwalk. If none of these are feasible, the user behavior of the trail must be controlled or the quality of the trail user experience will diminish. In some locations, the use and demand of the trail is so high that this threshold for minimum width will have to be greater than 12 feet.
- Based on local and national guidance and standards (summarized in more detail in the existing conditions section), this study recommends the trail be at least 14 feet wide with 2-foot shoulders on either side of the trail. In locations where this is not easily achievable (such as at Zilker Park and near Rainey Street), a double trail should be implemented. Near the Hyatt and the Congress Street underpass, a boardwalk could eventually be utilized to expand the trail width; until then, slow zone strategies should be piloted. At each of these sites, material conditions are also contributing to the need for alternate capacity options: given erosion around steep cliffs (like at Zilker) and/or pooling of water in an already limited right-of-way that gets very little sun during the day (like near the Hyatt and Congress Street).
- Unless the trail alignment already exceeds this width, this study recommends that a single trail alignment should never be wider than 20 feet, plus the shoulders.
- Using meandering wildflower foot trails can help relieve pressure from the main trail and should be explored and piloted in The Trail Foundation and PARD's habitat restoration efforts.





Figure 7-2 Decision Tree for Selecting Projects Addressing Trail Width Issues





## SURFACE CONDITIONS

Rapid increased use of the Trail has strained maintenance resources. This has led to erosion exposing tree roots and creating sharp edges along the Trail, among other challenges. Systematic and programmed trail maintenance projects will prevent erosion and slippery conditions from becoming a safety or environmental risk.

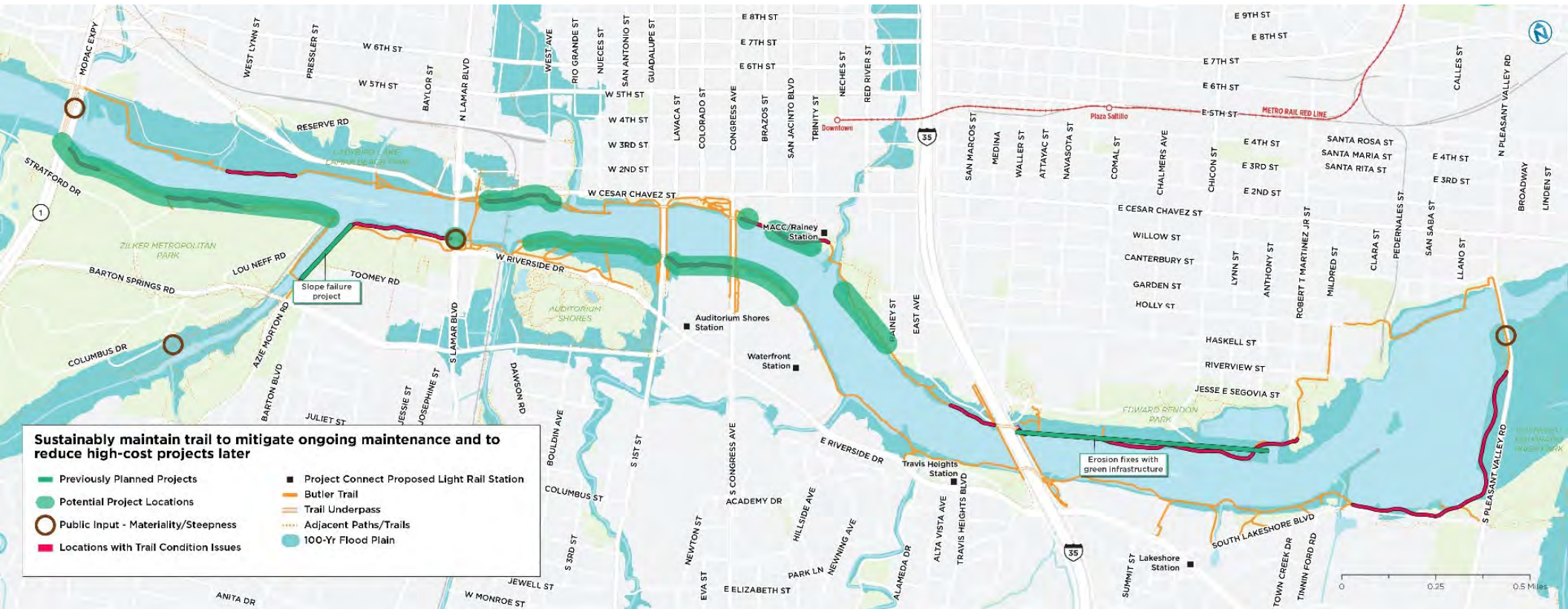
As pictured, along W Cesar Chavez Street there are a number of erosion challenges including sharp edges along concrete segments. Near Metz Neighborhood Park (pictured at right), soil erosion has also created sharp edge hazards where the gap between the concrete trail drops to the adjacent dirt.

Slippery and uneven surface conditions were key issues raised during conversations and in the Fall 2020 storymap engagement.





**Figure 7-3 Material Erosion and Safety Hazard Areas**





## Potential Solutions

The toolkit illustration below shows how a combination of potential solutions could address the typical surface and material conditions that were discussed in Section 5.

Figure 7-4 Surface Conditions Toolkit

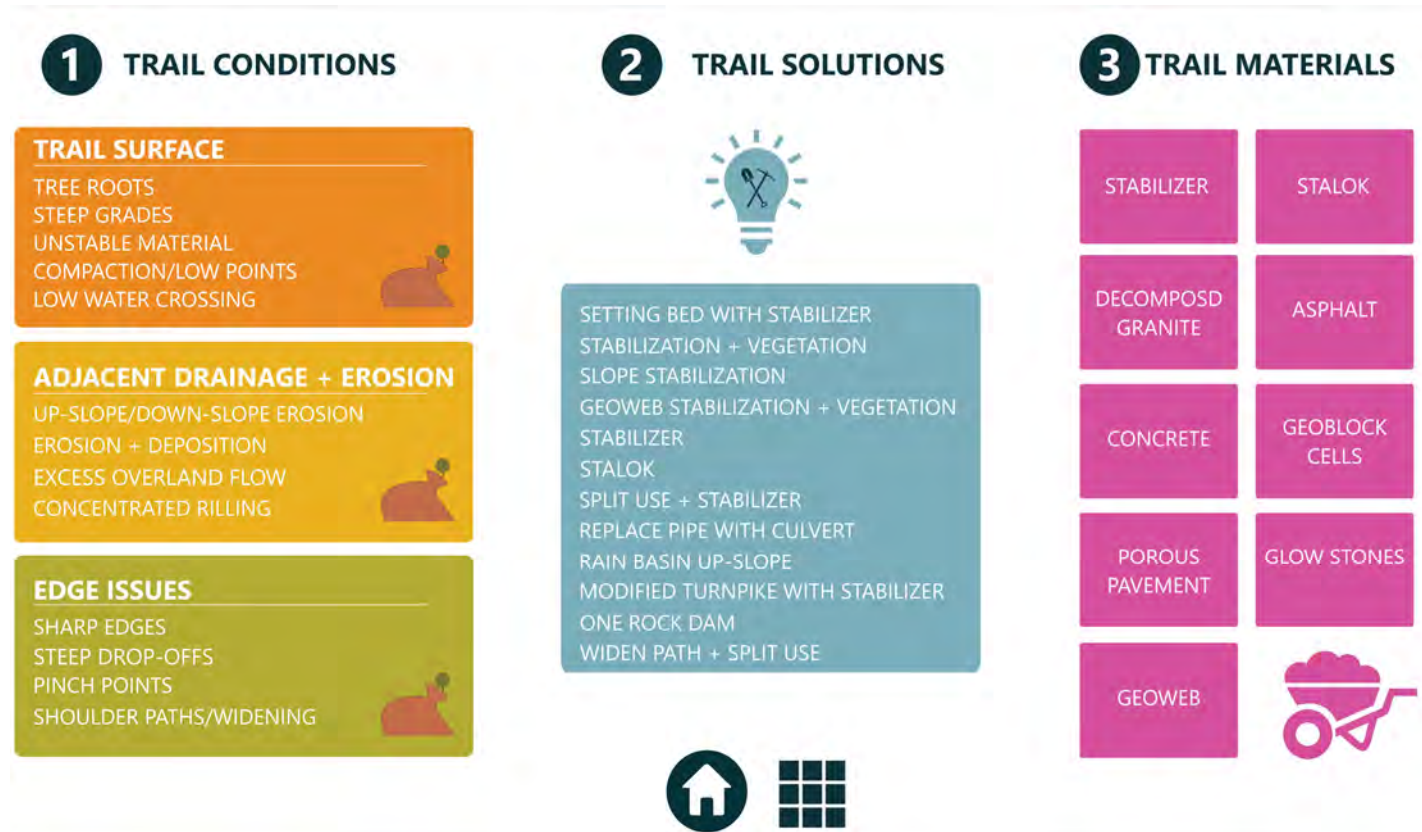


Image from: Studio Balcones





## Projects

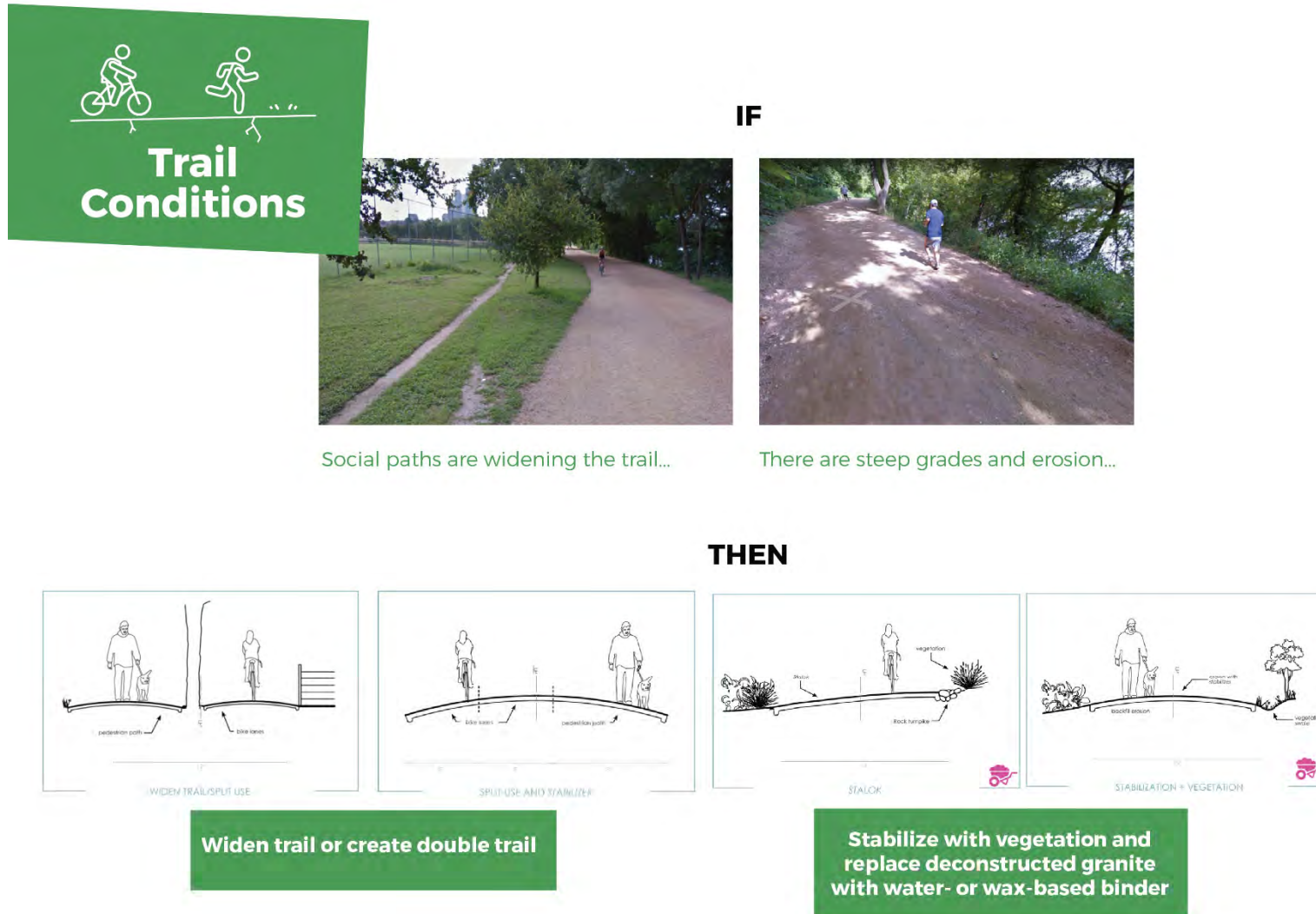
Figure 7-5 illustrates the decision tree framework for addressing key trail conditions. It can be used to develop projects where conditions related to informal social paths, erosion, and slope are a concern.

### General policy and design recommendations:

- Utilize trail conditions toolkit to work through issues at each site condition
- Sustain use of deconstructed granite and like materials, but pilot the use of new stabilizing material technologies to increase the stability and longevity of the material, and pilot new edge treatments to reduce material runoff and settling
- Pilot technologies to reduce bumping of the trail through tree root growth
- Ensure edge vegetation is cleared regularly
- Explore ways to alter fences and other boundaries such that they do not pose vertical constraints and safety hazards at edge of trail
- Improve drainage to reduce rutting on trail – could involve capturing runoff in culverts and rain gardens before it reaches the trail



Figure 7-5 Decision Tree for Selecting Projects Addressing Surface Condition Issues





## CONNECTING TO THE NETWORK

The Butler Trail is located in the center of a developing network of multi-use urban trails, serving as a hub for trail connections that extend across Austin. However, there are many places where connections to nearby trails are absent or underdeveloped. In addition, there are gaps between the built or planned All Ages and Abilities (AAA) on-street network and the trail that can make it difficult for youth and older adults to get to and from the trail and their homes. New trail connections and protected bike lanes or neighborhood greenways are instrumental for filling those gaps.



Compared to trail width and surface conditions, connecting to the network is a lesser priority. This could be a reflection of the large number of users who drive to various trailheads to enjoy the Trail.

## Potential Solutions

### Projects

Projects that close gaps between the Trail and people who live within walking and bicycling distance increase connectivity, which makes the Trail more accessible overall. For example, as pictured above on the left, though much of South Lamar currently has bike lanes, low stress cycling infrastructure has not yet been constructed on the section between Barton Springs Road and Riverside Drive to connect where the Trail meets Lamar at the Pfluger Bridge. The Canterbury Street trailhead north of the





Longhorn Dam is crisscrossed by social trails and does not have a clearly defined connection to the bike network. And as pictured above at right, providing AAA facilities and sidewalk along N Pleasant Valley Road could improve connections to the Trail from the southeast.

Figure 7-6 illustrates opportunities to connect to trails and the All Ages and Abilities network. New safe and comfortable walking and bicycling connections will reduce the need for people who live nearby to drive to the Trail.

Figure 7-7 shows how to determine if trail connections are needed, and was used to make project recommendations in Section 14.

### **General policy and design recommendations**

- Collaborate with adjacent landowners to build connections to trailheads as a component of redevelopment projects
- Advocate for implementation of key AAA connections to the Trail
- Coordinate with Public Works Department and PARD to define project limits in consideration of access points on the Trail

**Figure 7-6 Recommended projects considered the opportunities to connect to trails and the planned All Ages and Abilities Network**

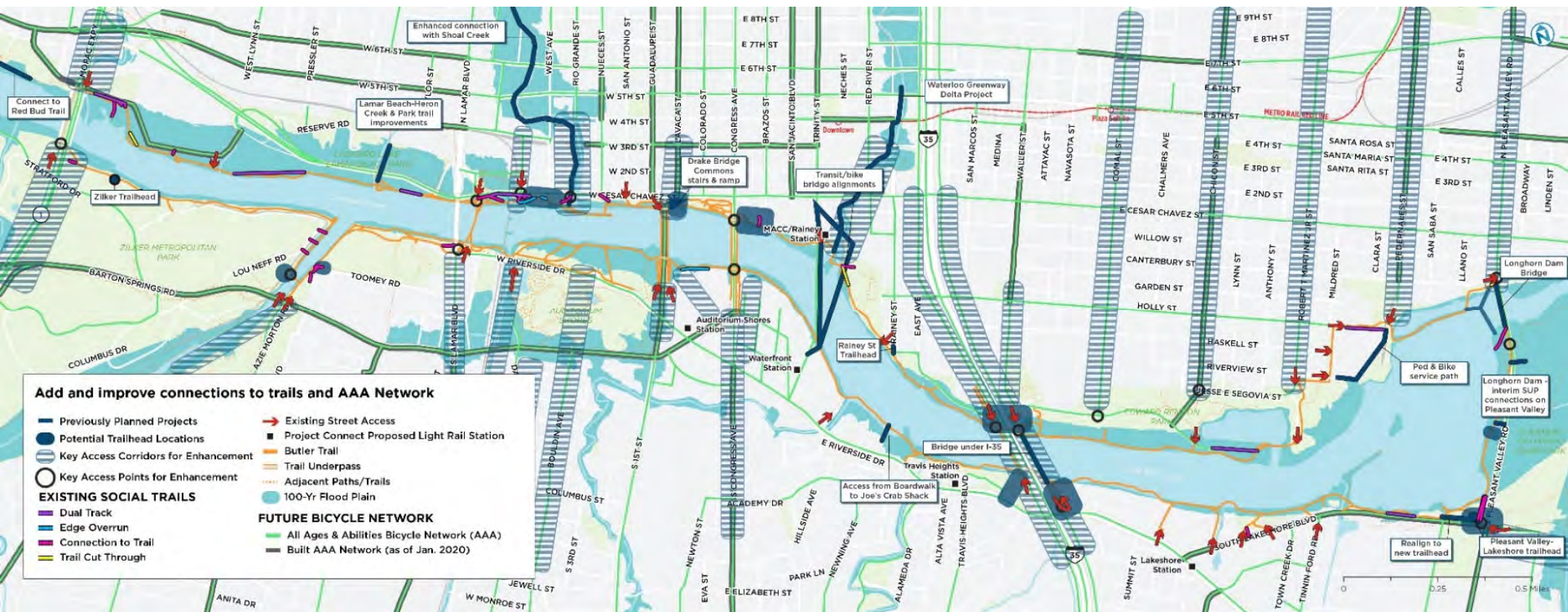




Figure 7-7 Decision Tree for Developing Solutions for Connecting The Trail to The All Ages and Abilities Street and Trail Network



**IF**

It is hard or unclear how to get to the Trail from the citywide biking and walking network...



**THEN**



**Build out the AAA and sidewalk network leading up to the Trail**





## LIGHTING

Texas has beautiful night skies and its stars have even been sung about. We can do a lot to preserve our view of the night sky and the ecology that relies on darkness by sticking to the basics of good lighting: aim lights down, keep them shielded and low to the ground, keep their color temperature warm, use only as much light as is needed, and keep lights on only when needed. Good lighting helps us enjoy a space at night because we feel comfortable and safe; however, lighting disrupts local ecosystems and a balance between safety and ecology must be found. About 50% of the Butler Trail is unlit, while other areas suffer from excessive lighting, badly aimed lighting, and/or light trespass. The public expressed mixed feelings about the importance of and need for more lighting, and did not see it as important as other issues such as trail width and surface conditions. Improvements should be prioritized through the following hierarchy:

- 1<sup>st</sup> **Improve Mobility Safety** – Address any areas deemed unsafe because of low visibility.
- 2<sup>nd</sup> **Mitigate Light Trespass** - A neighborhood outreach program should be initiated to persuade neighbors of the merits of good lighting in order to eliminate light pollution and trespass around the trail. Examples of good and bad aiming/shielding conditions are illustrated in Figure 7-8.
- 3<sup>rd</sup> **Upgrade/Replace Existing Lighting Fixtures** – As existing trail fixtures are replaced, conform to good lighting criteria. Best practice lighting fixtures are shown in Figure 7-10.
- 4<sup>th</sup> **Add Lighting** - Trail segments bordering the commercial, residential and downtown areas should be fitted with a lighting system that will reduce the contrast between the dark trail and the brightly lit perimeter.
- 5<sup>th</sup> **Improve Unlit Paths** – Unlit areas far from commercial areas/trailheads should be lit by low scale bollards acting as beacons. These visual breadcrumbs can be located at inflection points to enable wayfinding and decision making while causing minimum impact to naturally dark areas.



## Illuminance Levels and the Nighttime Visual Experience

Light levels are based on illuminance readings (i.e. measuring light before it falls on a surface) whereas we experience light as luminance (i.e. light that is reflected after it hits a surface). Light levels are therefore not to be relied on as the only way to define good or safe, they are however an important part of a design and one of the few objective systems for measuring light.

**Current Trail light levels** were measured at ground level in September 2020, the day after a new moon while the sky was partly cloudy. The measured Trail light levels at various locations include:

- Unlit Trail: max 0.05fc to min 0fc.
- Boardwalk: max 3.2fc to min 0.7fc.
- Trail bordering Commercial/Residential areas: varies according to light trespass levels.
- Pfluger Bridge, max 1.5fc to min 0.5fc.
- S 1st Bridge, max 1.5fc to min 0.5fc.
- Lamar Bridge (walkway under), max 6.5fc to min 0.1fc.
- Congress, I-35 and North Pleasant Valley bridges have no dedicated pedestrian/trail lighting.

**Current lighting on the Trail** - There are approximately 40 instances of lighting on the trail. Appendix A, Lighting Data Collection describes the dozens of conditions on the Trail where there is light trespass and/or glare. The best lighting on the Trail is on the boardwalk however that also has great room for improvement as the light fixtures spill light onto the lake, the walkways are generally overlit, and the contrast between boardwalk light levels and the connecting path are too extreme.

**Brightness and Contrast** - Lighting is typically the last layer in our designed environment. As a result, the conditions and built elements are almost exclusively designed to function for daylight use only. How artificial illumination behaves in a space and how we experience it are dependent on the basic geometry, proportions, materials and finishes of the space. The overriding common element on the Trail is the path and variations in its design determine what kind and how much lighting is needed. The main factor affecting this is color. Lighter surfaces save energy because they need only a fraction of the light of darker surfaces, for illumination. Lighter finished surfaces, that offer a higher visual contrast to their surroundings improve safety, hazard avoidance, orientation and wayfinding.



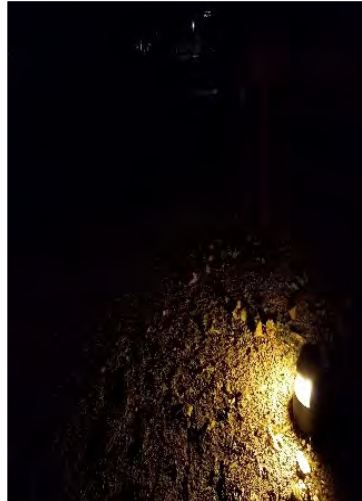
## Potential Solutions

Lighting of the Trail should be planned only after the glare and trespass mitigation effort has been completed. Areas bordering commercial and residential areas should be generously lit to visually override the glare and light trespass they receive. Trailheads, connectors, signage, bridges, tunnels should have higher light levels than the path. Most of the path is currently unlit and will be better served with select lighting interventions that complement the trail rather than some continuous (and expensive) lighting treatment. Lighting interventions should focus on path inflection points (where path makes a sharp turn), decision points (forks or other occurrences where users have options) and work-out stations, water fountains, restrooms, art installations etc. The unlit parts of the trail are appreciated, and the user survey indicated that overall, lighting is not an important issue nor priority for users. Overall the comments reflect the dual nature of lighting, that both too little and too much light can be unsafe.

Potential lighting upgrades exist at many locations along the Trail. Two examples are shown in the photos above.

Figure 7-8 illustrates basic solutions to address light trespass from adjacent areas onto the Trail.

Figure 7-9 illustrates two conditions, a bridge and a sharp turn. Strategies that reduce the height and increasing the quantity of light fixtures subconsciously trigger speed reductions in cyclists that improve safety.



This foot-level light occurs regularly around the Trail but it lights too little of an area, and poses a trip hazard, especially when not casting light. Many of these are in poor repair because they are difficult to fix.



In many locations, like in the I-35 underpass pictured above, excessive lighting makes non-illuminated areas even darker while also having detrimental ecological effects.





Figure 7-8 Solutions to Address Light Trespassing onto the Trail

**SPORTS LIGHTS**



**WALLPACKS / BARN LIGHTS / FLOOD LIGHTS**



**STREET LIGHTS**



Image from Oldner Lighting



**Figure 7-9 Strategies for Using Lighting to Enhance User Safety on Bridge Approaches and on Sharp Turns**

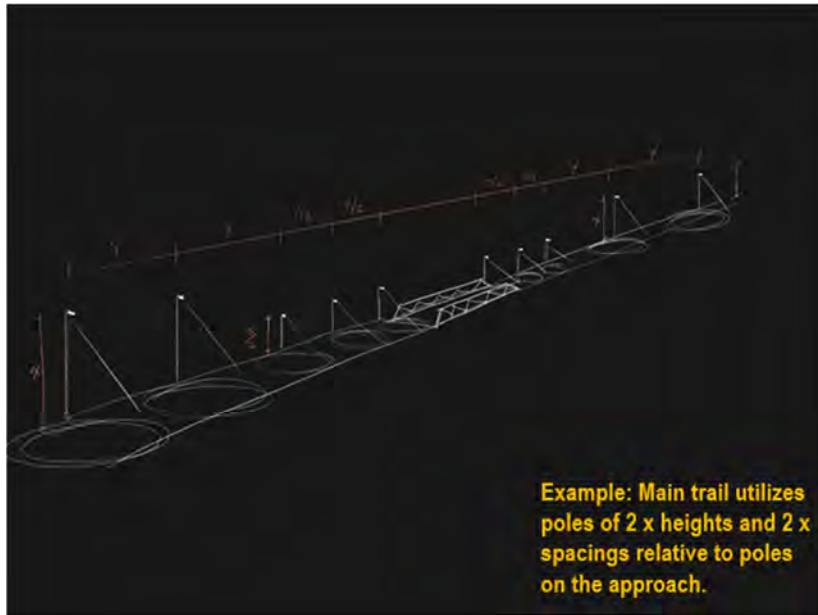


Image from Oldner Lighting

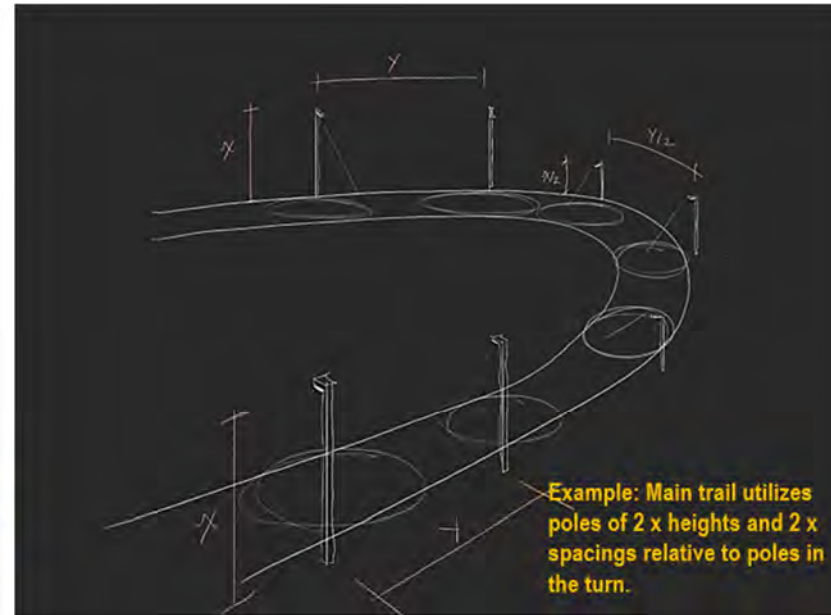




Figure 7-10 Best Practice Lighting Examples



Insight Solutions/Marker



GeoTacks/FireTacks



Apex/Road Reflector



PTA Laboratory/Cyclepath



Solar Lighting/Lummi



Mathieu Lehanneur/Clover



FirstLight/PLB Bollard



SIARQ/Urban Hub



Beacon/Viper



Bega/Bollard



Bega/Wallpack



Moon Visions/Bullet

**Passive lighting** (Row 1); **Hybrid solar fixtures** (Row 2); **Active conventional light fixtures** that require power sources (Row 3).





Lighting projects are described in Figure 7-11. These can be completed on their own or in combination with other projects. Figure 7-15 offers a decision tree to guide the selection of appropriate trail lighting solutions.

Figure 7-11 Recommended Solutions for Improving Lighting Conditions







## Best Practices for Lighting

Unfortunately, any artificial night light will disrupt a riparian zone's natural order. Mammals, insects, birds, reptiles, amphibians, fish, and plants are all affected. The lighting of the trail must mitigate these effects while providing a safe and enjoyable environment for the human users. The principles outlined in the Butler Trail Lighting Design Guidelines and national guidance have specific elements directed toward protecting the riparian zone and the good news is that many of them are good for humans too. Containing, controlling, and choosing the right kind of light can be done by aiming it only where it is needed, turning it off when it is not needed and using only a warm light source.

### Butler Trail Lighting Design Guidelines

1. Aim light only where it is required.
2. Equip light fixtures with optics so that the 50% light intensity of any light fixture does not land outside the edges of the Trail path, to negate light trespass. \*
3. Position light fixtures as far as possible from the Lake - to minimize disruption to riparian zone. \*
4. Establish higher light fixture density on the border of commercial and residential areas, at trailheads, and at signage points.
5. Illuminate Trail with gradations in brightness.
6. Light paths currently unlit and far from commercial areas /trailheads with low scale bollards acting as beacons. These will serve as visual breadcrumbs, located at inflection points to enable wayfinding and decision making while causing minimum impact to naturally dark areas.
7. Meet City of Austin code requirements.
8. Use light fixtures that adhere to a functional aesthetic, reflect the Trail's character, and strengthens its identity.

\* Exceptions permitted where light fixture locations, topography and path geometry do not allow for these goals to be met - each exception to be reviewed and approved by TTF/city lighting responsible.

The International Dark Sky Association (IDA) and Urban Night Sky Place (UNSP) guidelines provide guidance on the minimum requirements for pursuing Night Sky certification of the Trail at a future date. Adhering to these guidelines ensures nighttime visual quality and comfort and also protects the trail ecology.



## Illuminating Engineering Society of North America (IESNA) Lighting Guidelines

Recommended values for illumination from the Illuminating Engineering Society of North America (IESNA) are listed in

Figure 7-12. While the American Association of State Highway and Transportation Officials also provide lighting guidance, it supports the use of IESNA guidelines for pedestrian ways and bikeways.

IESNA guidelines vary depending up the type of area:

- High Pedestrian Activity Areas - Commercial areas in urban environments, where the Trail borders commercial properties.
- Medium Pedestrian Activity Areas - Areas with moderate night pedestrian activities, such as bridges.
- Low Pedestrian Activity Areas - Residential, rural, semi-rural areas, such as where the Trail is unlit or on a boardwalk.

Figure 7-12 Illuminating Engineering Society of North America Guidelines for Lighting Outdoor Pedestrian Areas

Table 16-1. Recommended Values for High Pedestrian Activity Areas

Maintained Illuminance Values for Walkways/Bikeways			
	$E_{avg}$ (lux/ft)	$E_{v,min}$ (lux/ft)	$E_{avg}/E_{min}^*$
Mixed Vehicle and Pedestrian	20/1.9	10/0.9	4.0
Pedestrian Only	10/0.9	5/0.5	4.0

Table 16-2. Recommended Values for Medium Pedestrian Activity Areas

Maintained Illuminance Values for Walkways/Bikeways			
	$E_{avg}$ (lux/ft)	$E_{v,min}$ (lux/ft)	$E_{avg}/E_{min}^*$
Pedestrian Only	5/0.5	2/0.2	4.0

Table 16-3. Recommended Values for Low Pedestrian Activity Areas

Maintained Illuminance Values for Walkways/Bikeways			
	$E_{avg}$ (lux/ft)	$E_{v,min}$ (lux/ft)	$E_{avg}/E_{min}^*$
Rural/Semi-Rural Areas	2/0.2	1/0.1	10.0
Low Density Residential (2 or fewer dwelling units per acre)	3/0.3	1/0.1	6.0
Medium Density Residential (2.1 to 6.0 dwelling units per acre)	4/0.4	1/0.1	4.0



### International Dark Sky Association (IDA) Model Lighting Ordinance (MLO) Lumen Levels

Lumen levels are to be kept to International Dark Sky Association (IDA) Model Lighting Ordinance (MLO) limits. The trail extends through extremely varied parts of the city, from near total darkness to Downtown which means the usual method to establish lumen limits (as specified by the IDA Model Lighting Ordinance) is made more difficult. This will involve keeping a record of the total lumens used in lighting the trail, the trail areas in square feet and designating areas to relevant MLO zones as described in Figure 7-13 and Figure 7-14.

**Figure 7-13 Comparison of Model Lighting Ordinance Zones and Butler Trail Conditions**

IDA-MLO Zone	Equivalent Butler Trail Condition
Zone 0	Unlit Trail
Zone 1	Unlit Trail and low lighted residential developments
Zone 2	Trail bordering low lighted recreational and residential developments
Zone 3	Trail bordering commercial and well-lit recreational developments
Zone 4	Not applicable



Figure 7-14 Extracts from International Dark Sky Association (IDA) Model Lighting Ordinance (MLO) Regarding Lighting Zones and Lumen Limits

ZONE	Recommended Uses or Areas	Considerations
0	Lighting Zone 0 should be applied to areas in which permanent lighting is not expected and when used, is limited in the amount of lighting and the period of operation. LZ-0 typically includes undeveloped areas of open space, wilderness parks and preserves, areas near astronomical observatories, or any other area where the protection of a dark environment is critical. Special review should be required for any permanent lighting in this zone. Some rural communities may choose to adopt LZ-0	Recommended default zone for wilderness areas, parks and preserves, and undeveloped rural areas.  Includes protected wildlife areas and corridors.
1	Lighting Zone 1 pertains to areas that desire low ambient lighting levels. These typically include single and two family residential communities, rural town centers, business parks, and other commercial or industrial/storage areas typically with limited nighttime activity. May also include the developed areas in parks and other natural settings.	Recommended default zone for rural and residential areas.  Includes residential single or two family; agricultural zone districts; rural residential zone districts; business parks; open space include open space include preserves in developed areas.
2	Lighting Zone 2 pertains to areas with moderate ambient lighting levels. These typically include multifamily residential uses, institutional residential uses, schools, churches, hospitals, hotels/motels, commercial and/or businesses areas with evening activities embedded in predominately residential areas, neighborhood serving recreational and playing fields and/or mixed use development with a predominance of residential uses. Can be used to accommodate a district of outdoor sales or industry in an area otherwise zoned LZ-1.	Recommended default zone for light commercial business districts and high density or mixed use residential districts.  Includes neighborhood business districts; churches, schools and neighborhood recreation facilities; and light industrial zoning with modest nighttime uses or lighting requirements.
3	Lighting Zone 3 pertains to areas with moderately high lighting levels. These typically include commercial corridors, high intensity suburban commercial areas, town centers, mixed use areas, industrial uses and shipping and rail yards with high night time activity, high use recreational and playing fields, regional shopping malls, car dealerships, gas stations, and other nighttime active exterior retail areas.	Recommended default zone for large cities' business districts.  Includes business zone districts; commercial mixed use; and heavy industrial and/or manufacturing zone districts.
4	Lighting Zone 4 pertains to areas of very high ambient lighting levels. LZ-4 should only be used for special cases and is not appropriate for most cities. LZ-4 may be used for extremely unusual installations such as high density entertainment districts, and heavy industrial uses.	Not a default zone.  Includes high intensity business or industrial zone districts.

Lighting Zone	LZ 0	LZ 1	LZ 2	LZ 3	LZ 4
Allowed Lumens Per SF	0.5	1.25	2.5	5.0	7.5
Allowed Base Lumens Per Site	0	3,500	7,000	14,000	21,000





## Equipment, Control, Maintenance

The saying “an ounce of prevention is worth a pound of cure” can be applied to lighting equipment. Most lighting equipment maintenance issues can be avoided with high quality products and installation.

LEDs are extremely efficient and long-lasting. Although they are advertised as a “fire and forget” technology requiring low to zero maintenance, the quality of component parts can vary. The complete life cycle costs of LEDs depend on the drivers and the cables that feed them. Drivers are essential for handling the power to the LEDs but often have lifetimes only half of the LEDs themselves. Cables can be eaten through by insects at any time. During procurement, the rated lifetimes of LEDs and drivers should be considered, along with manufacturer’s advice on best practice installation procedures.

Fixtures should be selected that provide elements of future proofing and can provide short lead time replacements for drivers and LED modules. Solar powered fixtures will offer easier install with no power to be drawn but result in higher maintenance costs as battery packs will require replacement every 3-5 years.

## Other Technical Requirements

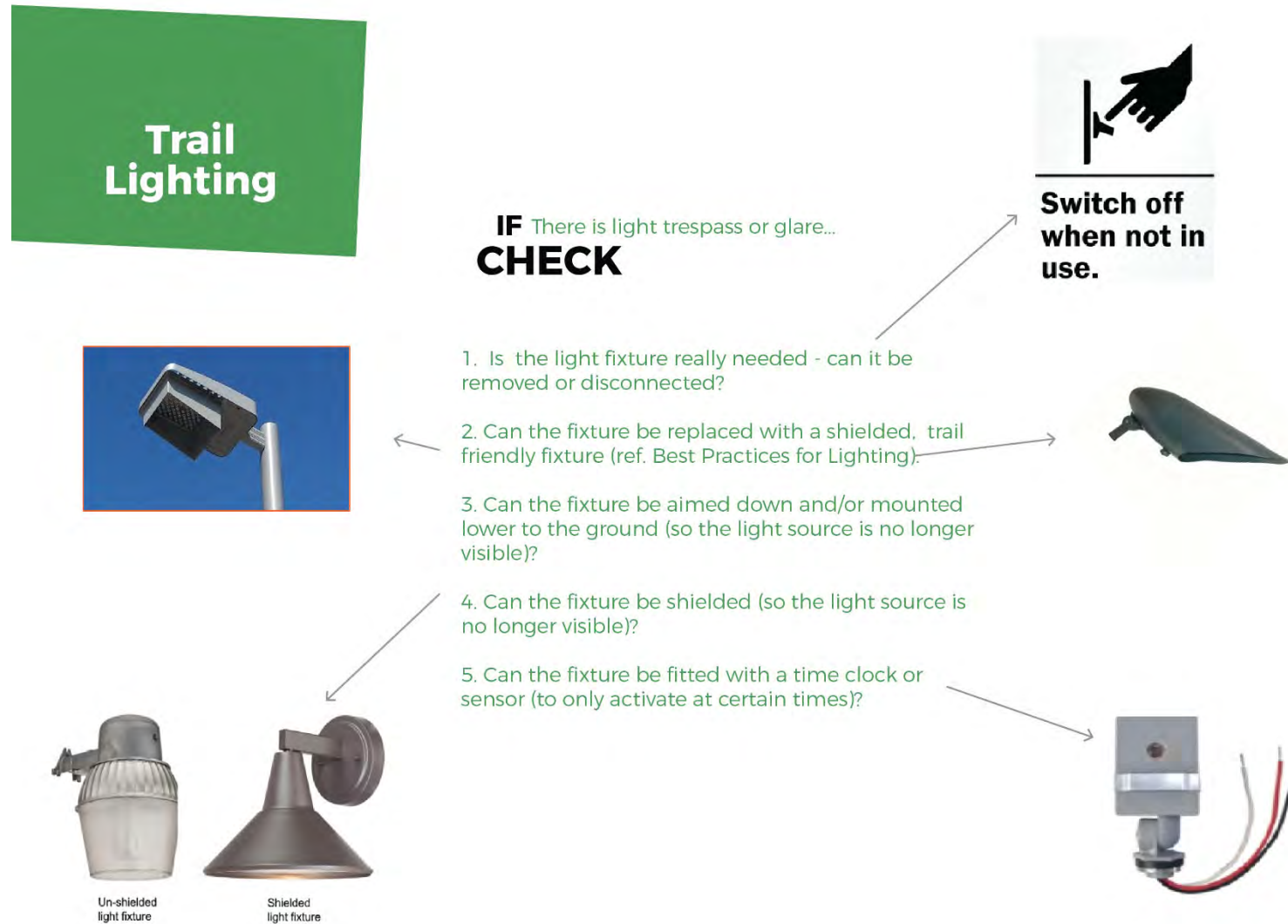
- Light fixture selection is to be kept to a minimum, e.g. one type of bollard, pole-light, guardrail light, step-light, area light should suffice.
- Light fixtures should not be mounted higher than 16’ to mitigate risk of glare.
- Light fixtures are to utilize LED light sources or equivalent technologies of superior energy efficiency and light quality.
- LED light fixtures should be adequately heat-sinked and weather proofed for Austin’s extreme climate and the Trail’s lakeside environment.
- Light fixtures should be “full cut-off” as per the IESNA definition.
- Shielding requirements should be applied. Neither the light fixture’s light source nor lens may be visible from a distance less than H, where H = the mounting height of the fixture.
- All lenses are to be deep regressed.
- All correlated color temperatures (CCT) of sources are to be 2700K or less and manufactured with a binning quality control of 3 MacAdam ellipse or less. Warm light sources (3000K or less) have been shown to be the least disruptive to our health however, warmer sources than 2700K do not offer good color rendering and are often not commercially available.
- Maintain a Color Rendering Index (CRI) value of 80 or more.



- Light source frequency is to be above 90Hz and may not produce harmful or noticeable flicker.
- Fixtures should be activated only during hours of darkness. This may be achieved:
  - By way of motion sensors - to activate when user approaches,
  - By way of time clock and sensor - to turn off one hour after trail closing and turn on one hour before opening, or
  - Where safety considerations require other methods of activation and scheduling.
- All LED drivers are to be mounted above grade and protected from the elements.
- Light fixtures should be certified according to IESNA LM standards, specifically performance and lifetime.



Figure 7-15 Decision Trees for Enhancing Trail Lighting



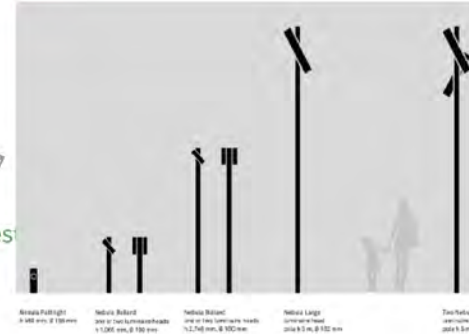


## Trail Lighting

**IF** Additional lighting is needed...  
**THEN**



1. Keep light fixtures to appropriate scale and aesthetic.
2. Keep light fixture quantities to a minimum.
3. Shine only light where it is needed.
4. Keep the color of the light to 2700K or warmer.
5. Prevent glare by ensuring lights are aimed down and shielded.
6. Ensure light fixtures are on a time-clock or equipped with a motion sensor.
7. Keep to a family of fixtures to strengthen the visual identity of the trail.
8. Add solar powered lights to remote sections without power.



Recube



EnGoPlante



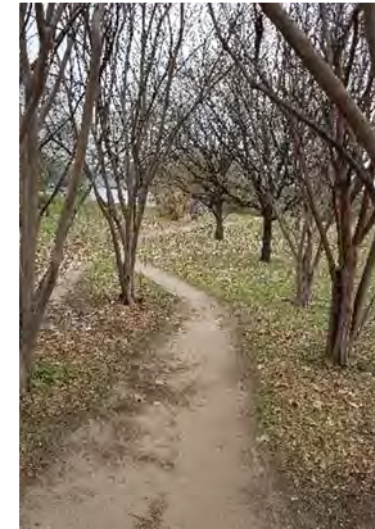
SIARQ/Urban Hub, Barcelona





## ACCESSING THE TRAIL

There are a number of places where adjacent trails or streets end at the trail. At some of these junctions it is not clear how to easily get on the Trail. In some places, trail users trample on natural spaces to gain access to the formal trail. Creating formalized trailheads and trail connections will improve accessibility and protect landscaping.



## Potential Solutions

### Projects

New and more prominent trailheads that are accessible to all trail users will preserve the spaces that are not meant for walking or biking along, and will allow adjacent ecology to remain undisturbed.

For example, a lack of a trail connection at the crosswalk near Walter Seaholm Drive (pictured above) has led to a widespread swath of social footpaths around the area, not to mention there is not a smooth and accessible connection to the curb ramp and pedestrian signal. A similar condition has occurred near the corner of South Pleasant Valley Road and South Lakeshore Boulevard, where the junction between trail connections and desire lines needs further development.

Figure 7-16 illustrates how to identify and solve common trail access issues. It was used to make project recommendations in Section 14.



## **General policy and design recommendations**

- Collaborate with adjacent landowners to formalize trailheads as a component of redevelopment projects
- Coordinate with Public Works Department and PARD to define project limits in consideration of access points on the Trail

Overarching strategies and policies will be implemented over time as funding becomes available.



Figure 7-16 Decision Tree for Addressing the Intersections Between the Trail and the Street and Trail Network



(Social Paths = informal dirt paths, also commonly called goat paths, cow paths, duck paths, and “desire lines”)





## WAYFINDING AND SIGNAGE

At junctions along the Trail, it can be difficult to navigate if you are not very familiar with the Trail or you are looking for a new destination. Signs exist, however they are not located at every junction or access point to ensure intuitive navigation and provide confirmation to users that they are going in the desired direction. Given that many creeks and trails intersect with the Trail, having more directive signage would mitigate detours and ensure a comfortable, convenient, and welcoming experience of the Trail.

Hoteliers interviewed during our focus groups also mentioned that visitors would like to be able to take along a copy of the map and to know more about what to expect, such as if visitors head out for a run at dusk, they know that the trail will be very dark during their return trip after sunset.



## Potential Solutions

### Projects

Under I-35 on the north side of Lady Bird Lake, there is very little signage to indicate where the trail flows through this area or where the multi-use path bridge takes you to and from here. On the western side of the trail, the Barton Creek pedestrian bridge occurs at the junction of multiple trail splits, and, due to lack of signage, it is unclear whether users should continue over the bridge or straight down the creek to stay on the Trail. Figure 7-17 shows additional locations where orientation signage could





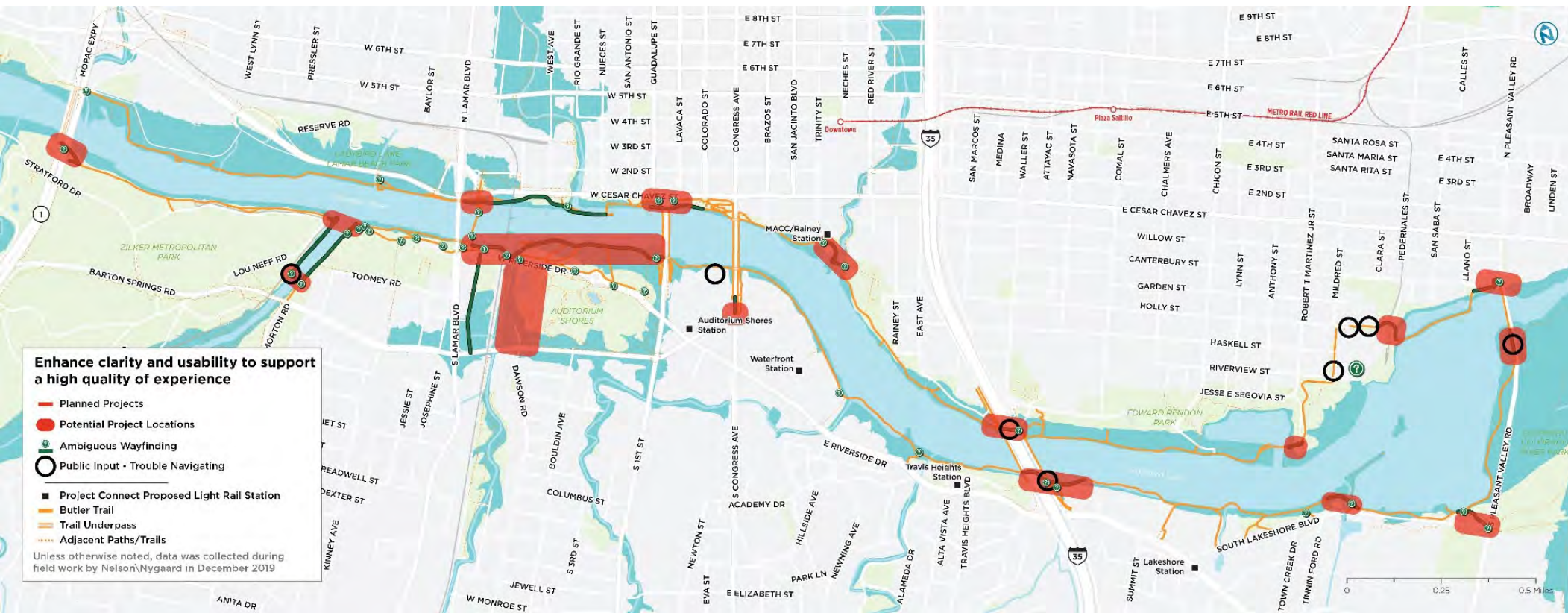
improve the user experience. The decision tree in Figure 7-18 shows how to identify and address a directional signage issue. It was used to identify projects described in Section 14.

**General policy and design recommendations:**

- Develop consistent wayfinding sign brand
- Install wayfinding signs at trail locations identified in this study
- Continue to use TTF branded signs to communicate trail user expectations and announce initiatives
- Develop maps for distribution to places who regularly serve visitors from outside of Austin



Figure 7-17 Areas Where Orientation Signage Could Improve User Experience



In the above map, dark green lines indicate zones of ambiguous wayfinding.



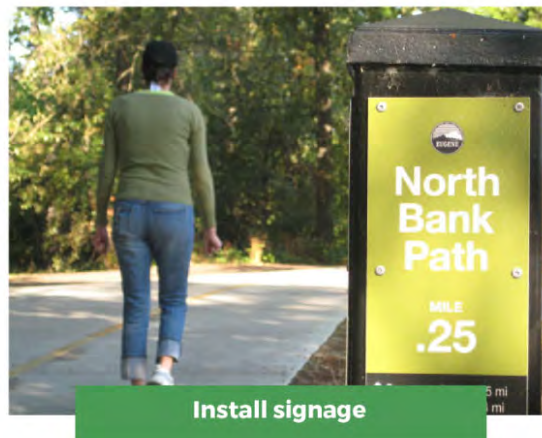
Figure 7-18 Decision Tree for Addressing Wayfinding Issues

**IF**



It is unclear which way the trail continues at this location, or a junction is not clearly signed...

**THEN**



Eugene, OR  
AmericanTrails, Photo by StuartMacdonald



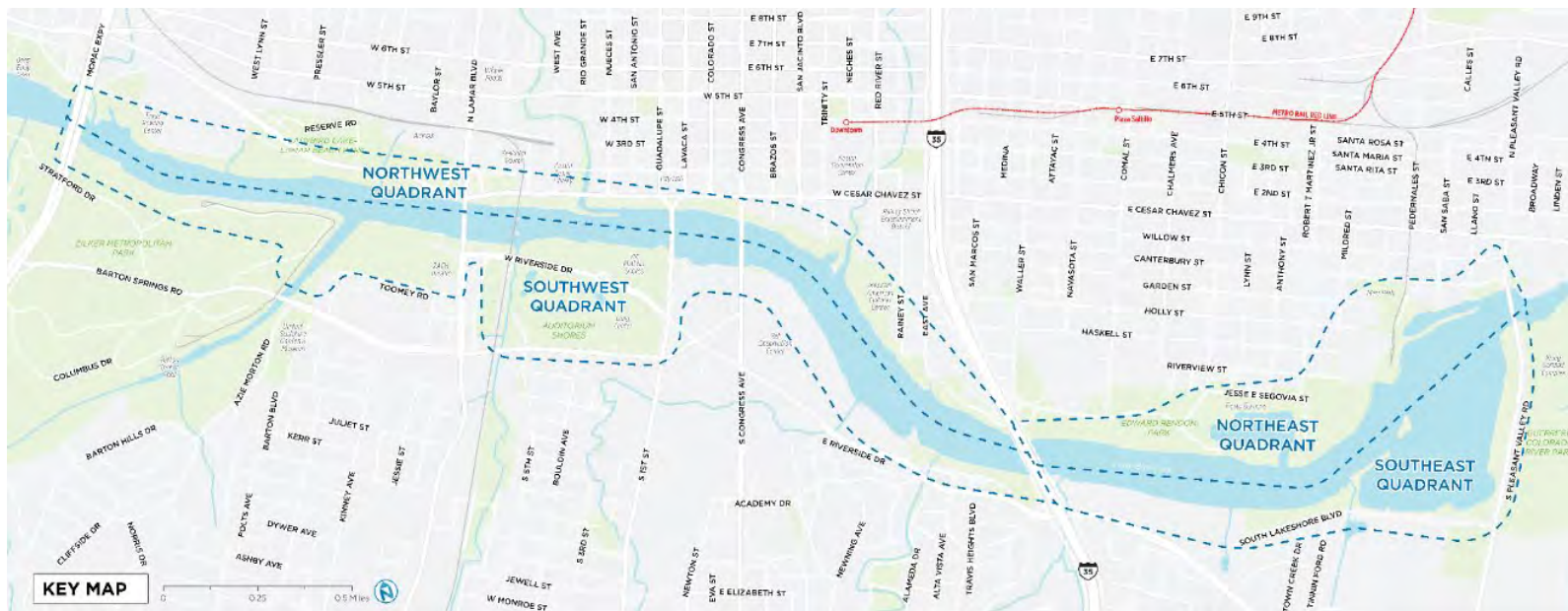


## 8 POTENTIAL SAFETY AND MOBILITY PROJECTS

As discussed in the project development, project type, and issues guidelines sections, potential project locations were identified through a combination of daytime and nighttime field review, existing and future conditions analysis compared to trail safety and access best practice, and public and stakeholder input.

On the pages that follow, you will find maps, graphics, and tables describing the location of potential projects to address Trail safety and mobility. The map below identifies the quadrants for potential project locations presented in the maps and tables that follow.

**Figure 8-1 Quadrant Key for Potential New Project Locations**







Each quadrant map will be followed by a plan view and conceptual graphic of priority projects within each quadrant. One project was selected from each quadrant of the trail to further develop through a site plan and a concept design. The intent of choosing these projects was both to illustrate scalable solutions that could be applied through other potential projects and to position the ideas for fundraising towards their design development and implementation. The four projects selected rose to the top given their ability to solve issues and to incorporate principles elevated and cultivated through this study process, particularly in places that fill gaps in past planning attention and investment.

The concept designs on the pages that follow illustrate the following potential projects (each quadrant is color keyed as indicated below):

**Northeast Quadrant: #3, #4, #5, #6** – Connection Improvements, Stormwater Upgrades, and Weaving with Tejano Cultural Trail

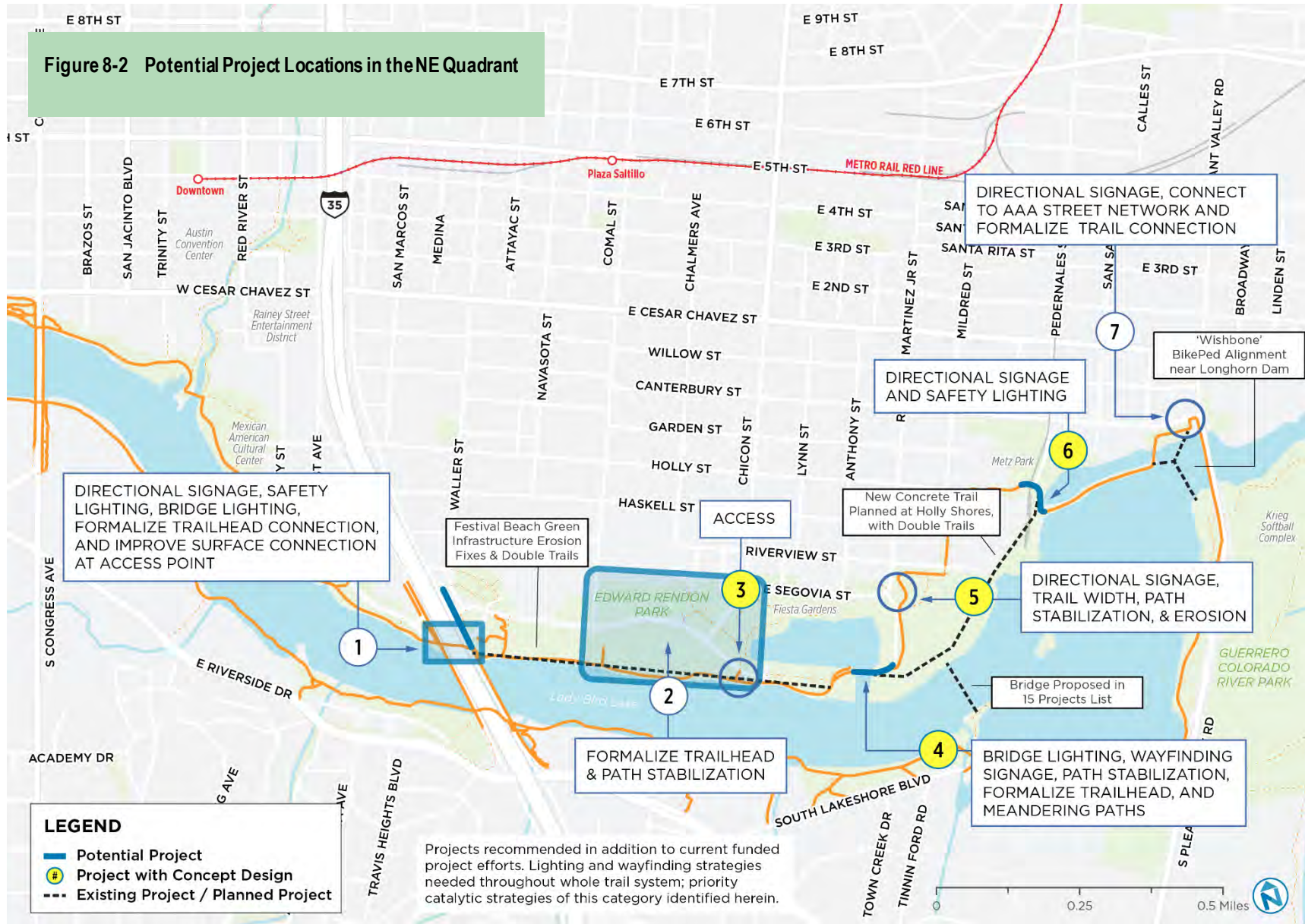
**Southeast Quadrant: #10** – Formalizing Trailhead Connections at Pleasant Valley & Lakeshore Blvd

**Southwest Quadrant: #21, #22, #23** – Double Trail from Mopac to Pfluger, Adding New Barton Creek Bridge

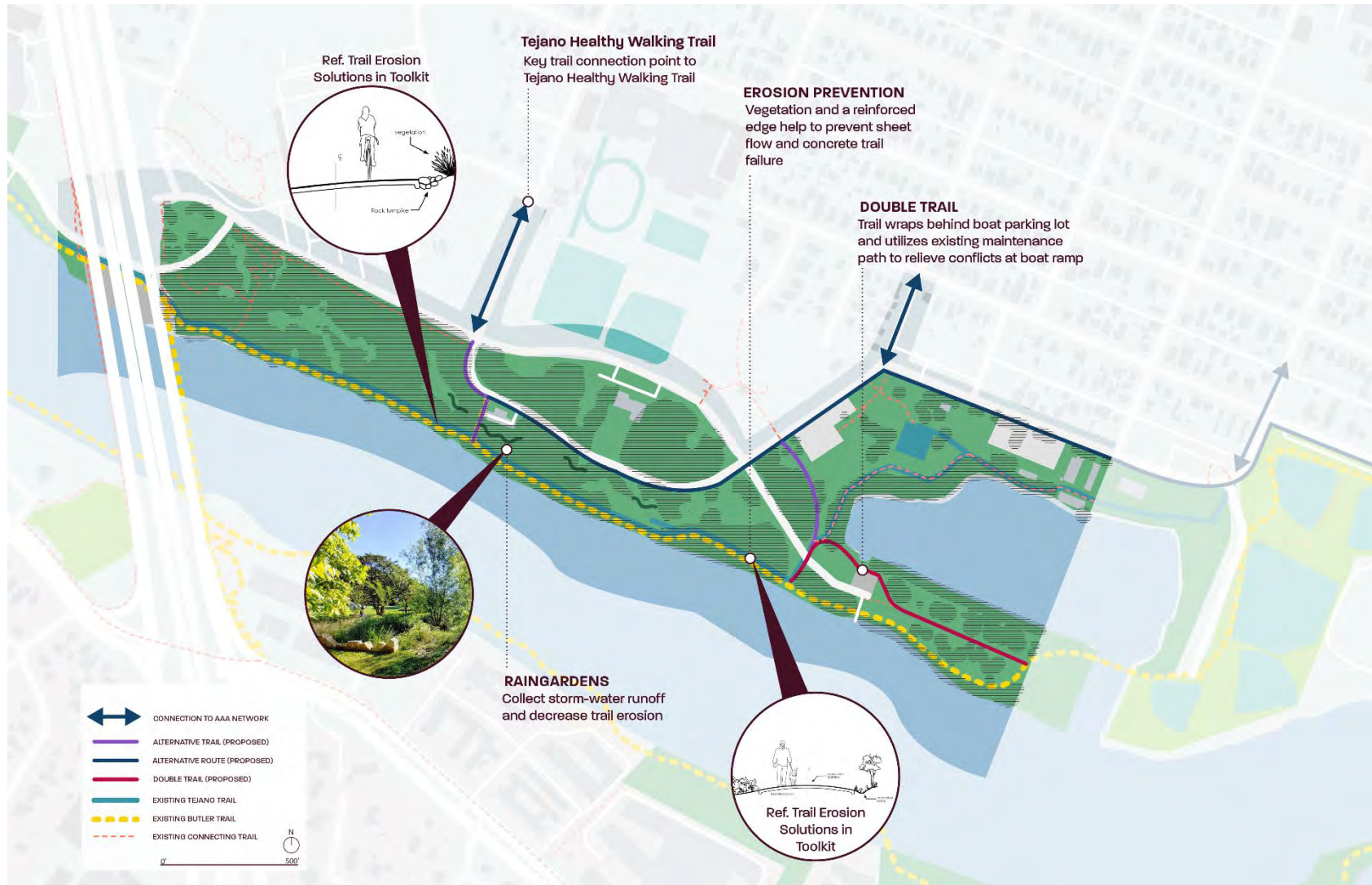
**Northwest Quadrant: #26** - Lamar Beach Bridge Pinch Point Solutions and Meander Paths



**Figure 8-2 Potential Project Locations in the NE Quadrant**

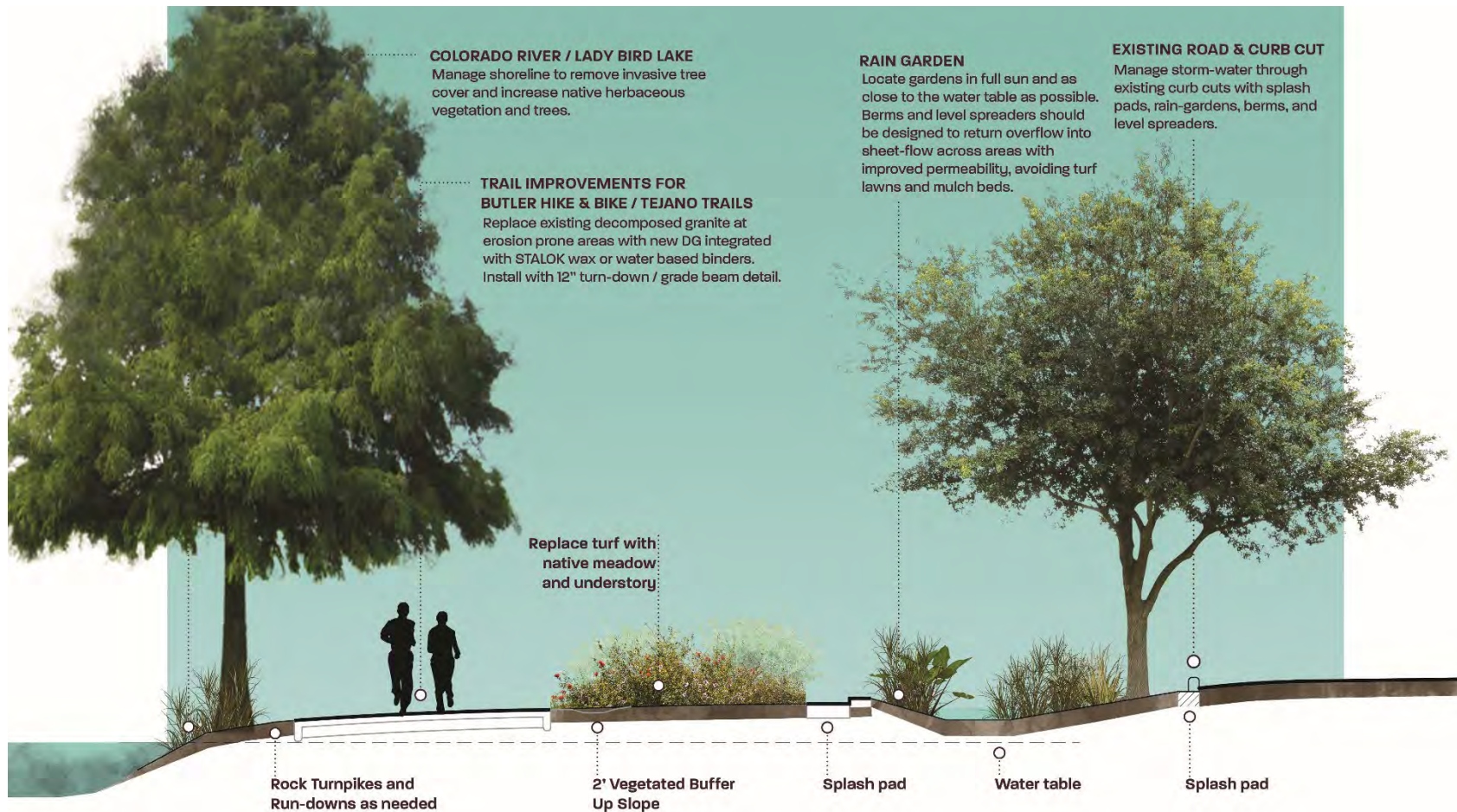






**Priority Safety and Mobility Concept for Northeast Quadrant**  
**Illustration of Projects #3, #4, #5, #6 – Creating Connection Improvements, Stormwater Upgrades, and Weaving with Tejano Cultural Trail**

Graphic by Studio Balcones



**Priority Safety and Mobility Concept for Northeast Quadrant**  
**Illustration of Projects #3, #4, #5, #6** – Creating Connection Improvements, Stormwater Upgrades, and Weaving with Tejano Cultural Trail

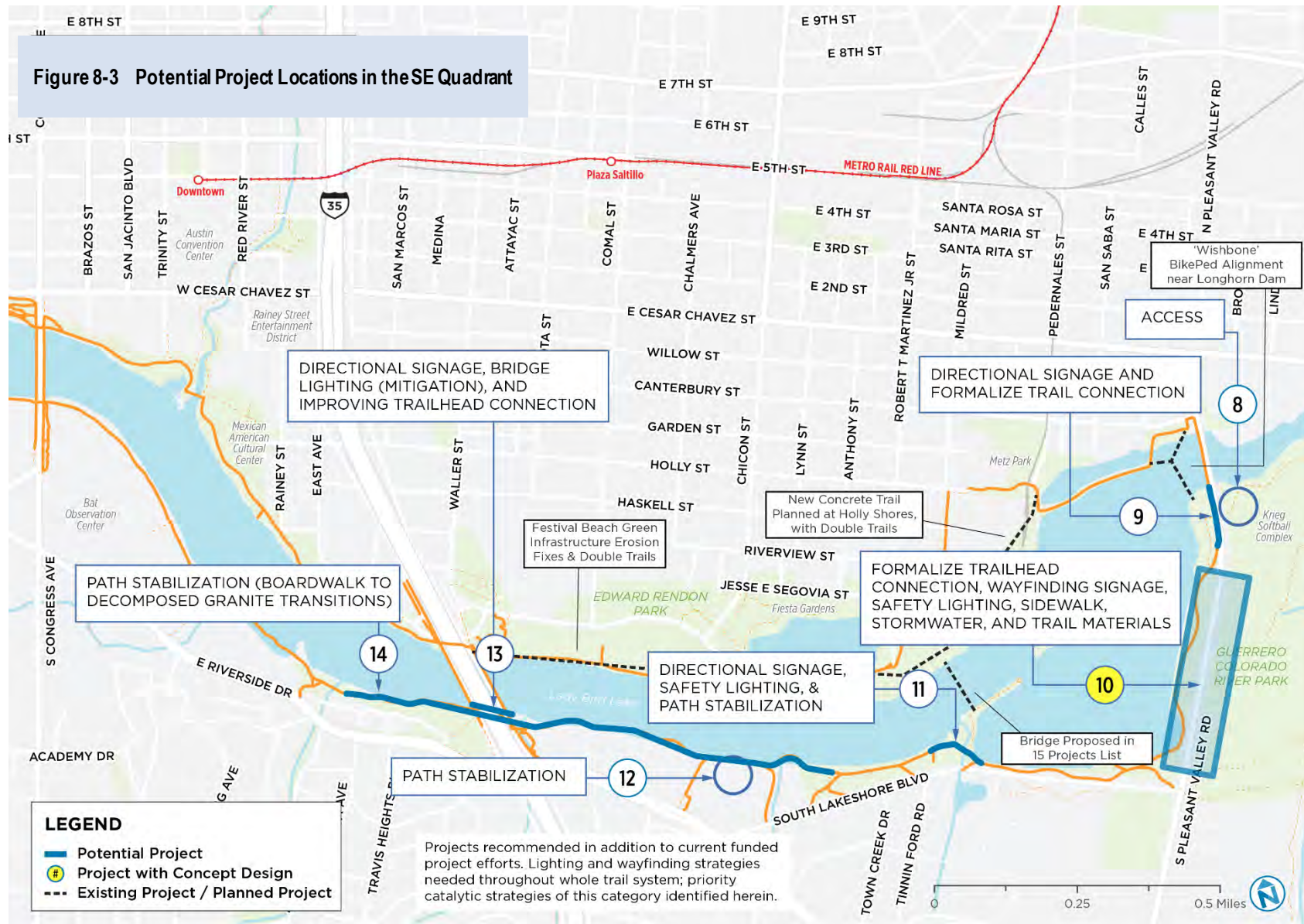
Graphic by Studio Balcones



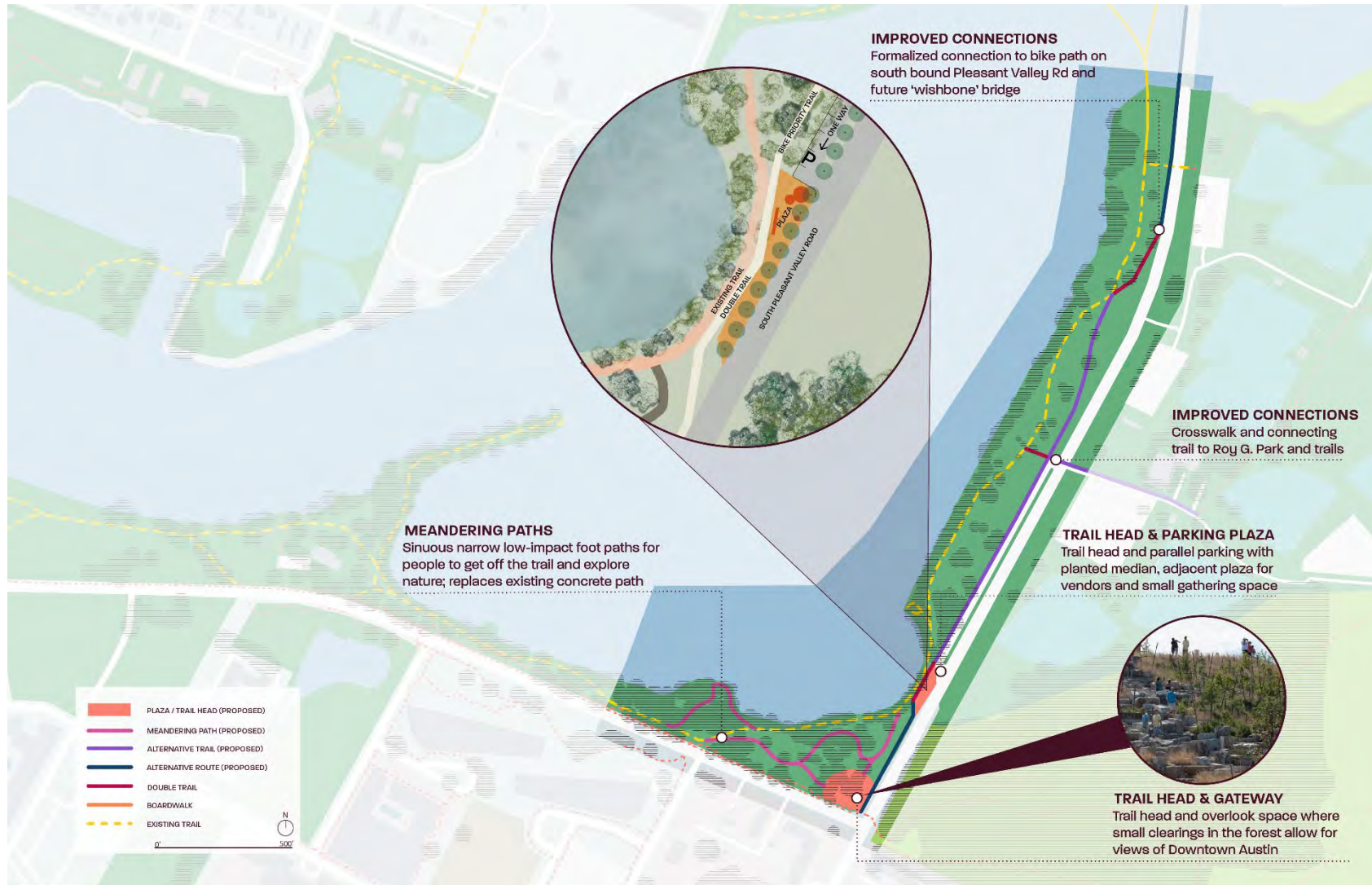


### Lighting to Enhance Safety & Mobility for Northeast Quadrant

Graphic by Oldner Lighting







**Priority Safety and Mobility Concept for Southeast Quadrant**  
**Illustration of #10 – Formalizing Trailhead Connections at Pleasant Valley & Lakeshore Blvd**

Graphic by Studio Balcones



**Priority Safety and Mobility Concept for Southeast Quadrant**  
**Illustration of #10 – Formalizing Trailhead Connections at Pleasant Valley & Lakeshore Blvd**

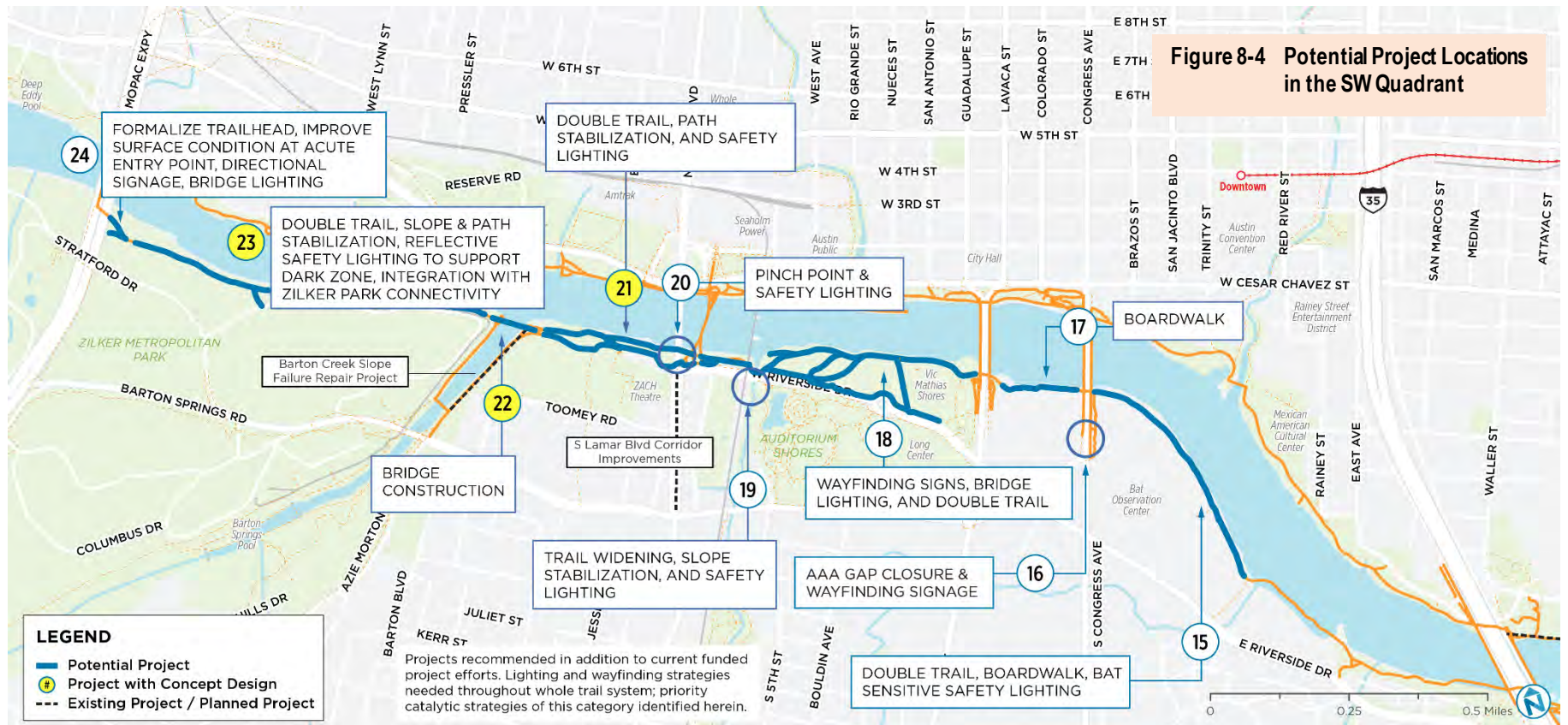
Graphic by Studio Balcones



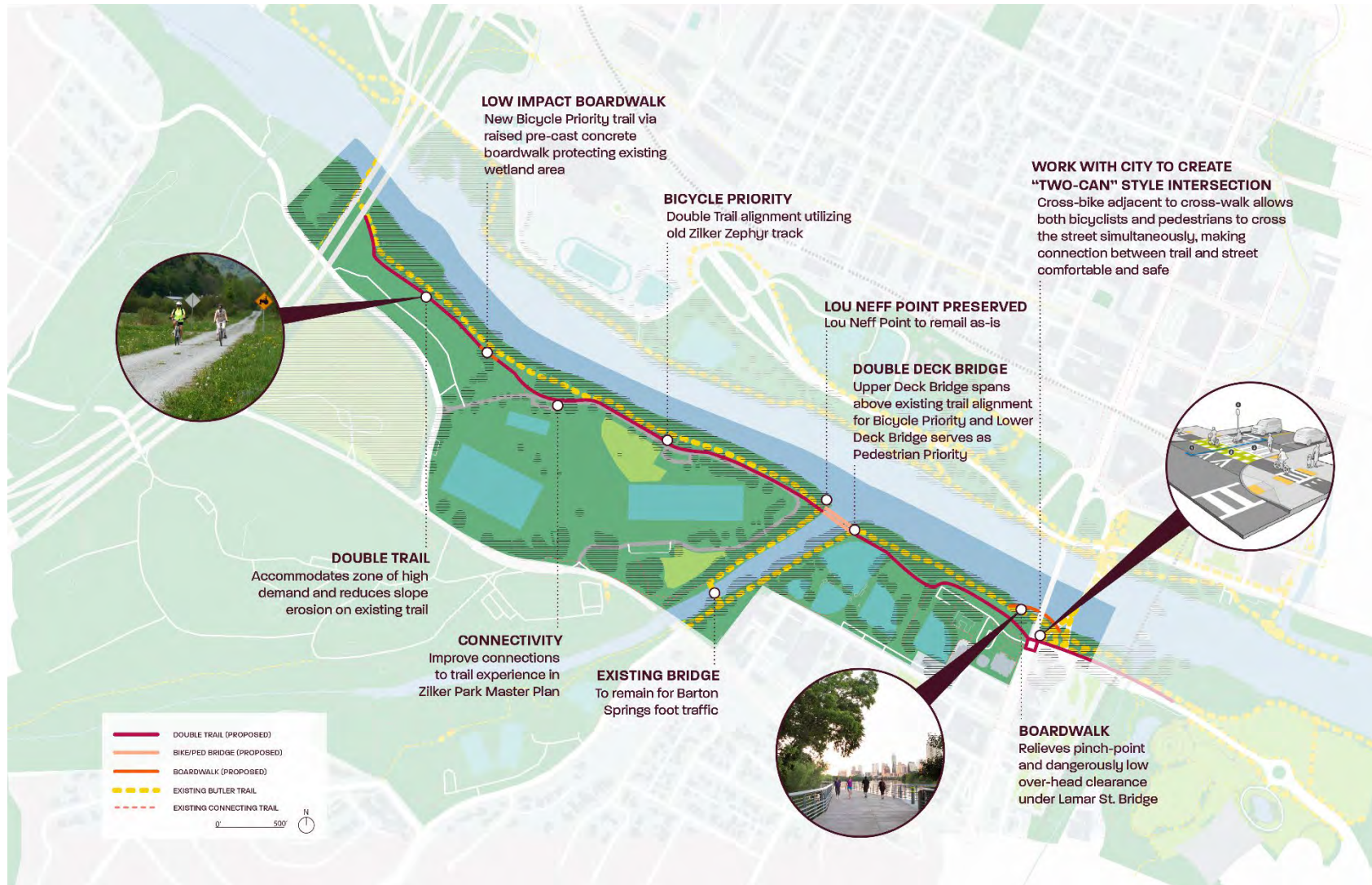


## Lighting to Enhance Safety & Mobility for Southeast Quadrant

Graphic by Oldner Lighting



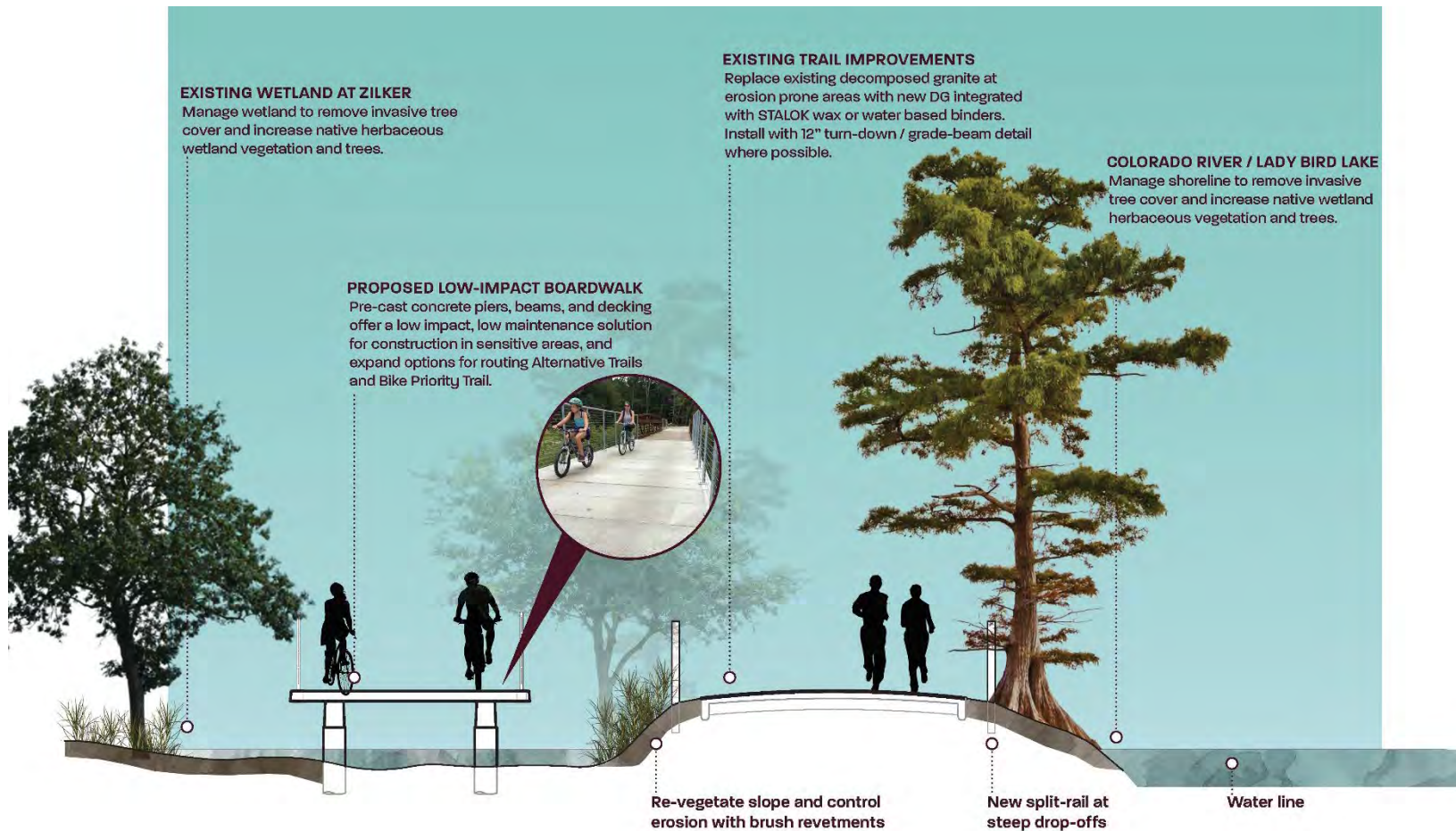




**Priority Safety and Mobility Concept Southwest Quadrant**  
**Illustration of #21, #22, #23 – Double Trail from Mopac to Pfluger, Adding New Barton Creek Bridge**

Graphic by Studio Balcones





**Priority Safety and Mobility Concept for Southwest Quadrant**  
**Illustration of #21, #22, #23 – Double Trail from Mopac to Pfluger, Adding New Barton Creek Bridge**

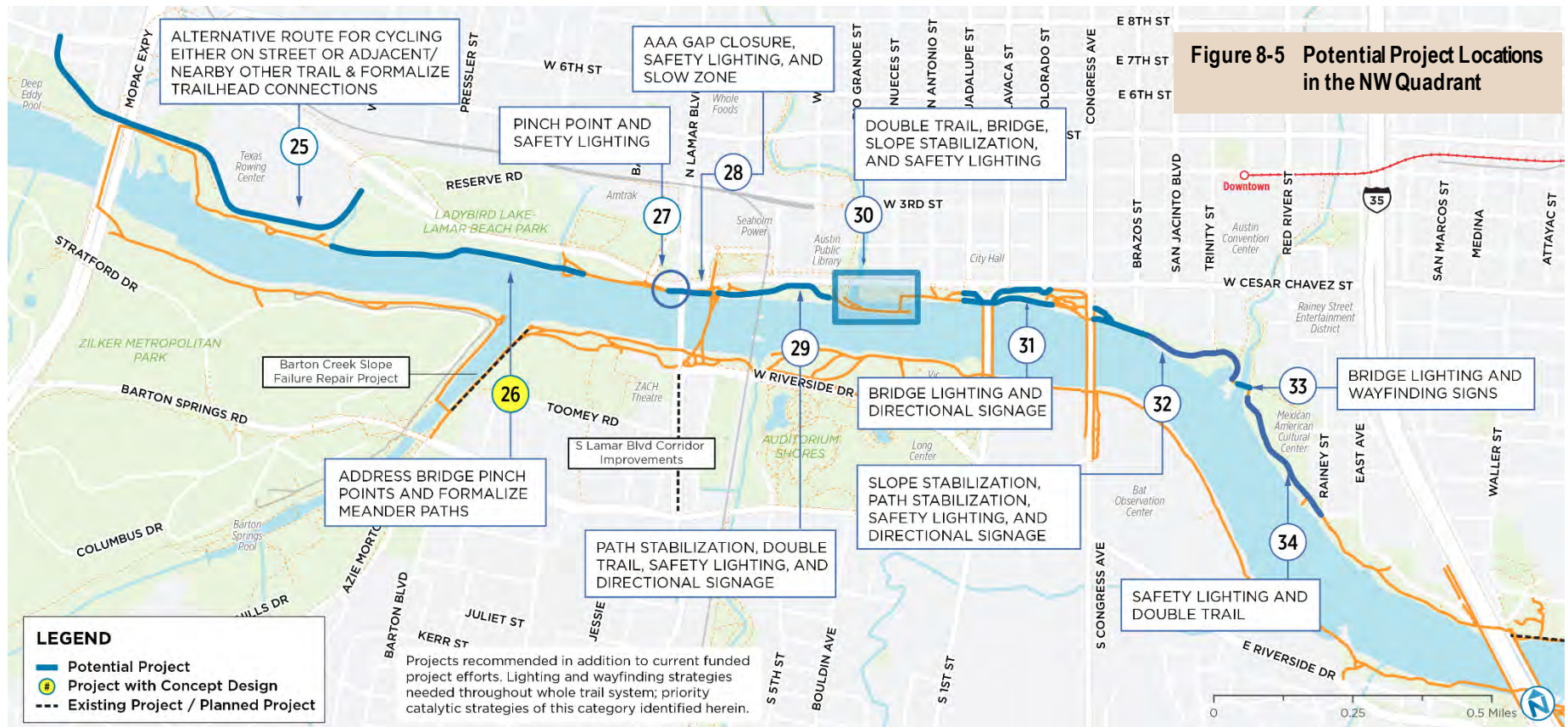
Graphic by Studio Balcones



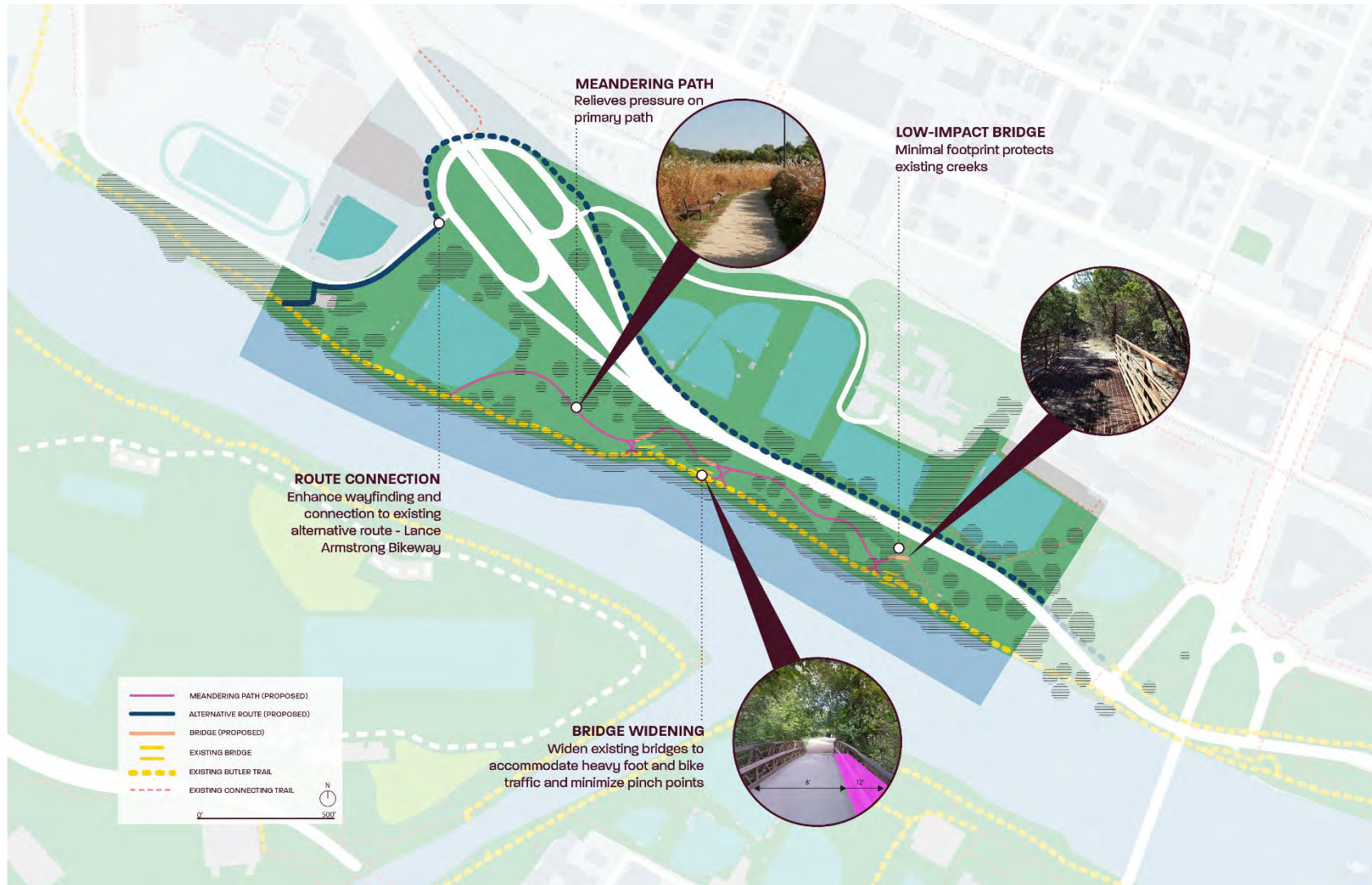
### Lighting to Enhance Safety & Mobility for Southwest Quadrant

Graphic by Oldner Lighting









**Priority Safety and Mobility Concept for Northwest Quadrant**  
**Illustration of #26 - Lamar Beach Bridge Pinch Point Solutions and Meander Paths**

Graphic by Studio Balcones



**Priority Safety and Mobility Concept for Northwest Quadrant**  
**Illustration of #26 - Lamar Beach Bridge Pinch Point Solutions and Meander Paths**

Graphic by Studio Balcones





### Lighting to Enhance Safety & Mobility for Northwest Quadrant

Graphic by Oldner Lighting





**Figure 8-6 Summary Table of Potential Project List** (including issues addressed) Note: Projects illustrated with concept designs have highlighted ID #s.

ID	Trail Quadrant	Project	Project Location	15 for 15	Primary Issue (Described in Text) Plus Other Supportive Elements (◆)					
					Connecting	Access	Surface Conditions	Width	Lighting	Wayfinding
1	NE	Directional signage	Under I-35 (N)		◆	Formalize trailhead connection	Improve surface connection at access point	◆	Safety and bridge lighting	◆
2	NE	Formalize trailhead	Chicon St Key Access Corridor, Comal St Key Access Corridor		Formalize trailhead	◆	Path stabilization	◆	◆	◆
3	NE	Access	Chicon Parking Lot/Boat Ramp Crossing			Formalize connection between parking lot and ramp				
4	NE	Bridge lighting	East Approach to Festival Beach		◆	◆	Path stabilization	Meandering paths	◆	Wayfinding signage
5	NE	Directional signage	Camacho Activity Center Parking			◆	Erosion (concrete to DG transitions), Path stabilization	Widen trail		◆
6	NE	Directional signage	Across Pedernales St			◆	◆	◆	Safety lighting	◆
7	NE	Directional signage	North Approach to Longhorn Dam	◆	Formalize trail connection		◆	◆	Bridge lighting	◆
8	SE	Access	S Pleasant Valley Rd & Krieg Softball Complex Access			Relocate fence blocking access from bus stops and crosswalk				



ID	Trail Quadrant	Project	Project Location	15 for 15	Primary Issue (Described in Text) Plus Other Supportive Elements (◆)					
					Connecting	Access	Surface Conditions	Width	Lighting	Wayfinding
9	SE	Directional signage, bridge lighting, formalize trail connection	South Approach to Longhorn Dam		◆	◆	◆	◆	◆	◆
10	SE	Formalize trailhead connection	S Pleasant Valley Rd & S Lakeshore Blvd Trailhead & Connections	◆	◆	◆	Trail materials, stormwater management	Sidewalk	Safety lighting	Wayfinding signage
11	SE	Directional signage	Across Peace Point Peninsula				Path stabilization	Meandering paths	Safety lighting	◆
12	SE	Path stabilization	AML and kayak launch				Adjacent private land irrigation runoff management			
13	SE	Directional signage	Under I-35 (S)			Improving trailhead connection			Mitigate bridge lighting, safety lighting	◆
14	SE	Path stabilization	Boardwalk to DG transitions				◆			
15	SW	Double trail	Congress St to East Bouldin Creek				Boardwalk	◆	Bat sensitive safety lighting	
16	SW	AAA gap closure	S Congress Ave junction with trail			◆				Wayfinding Signage
17	SW	Boardwalk	Hyatt to South Congress St				Boardwalk	◆		



ID	Trail Quadrant	Project	Project Location	15 for 15	Primary Issue (Described in Text) Plus Other Supportive Elements (◆)					
					Connecting	Access	Surface Conditions	Width	Lighting	Wayfinding
18	SW	Wayfinding signs	Pfluger Bridge to S 1st St				◆	Double trail	Bridge lighting	◆
19	SW	Trail widening	Across West Bouldin Creek				Slope stabilization	◆	Safety lighting	◆
20	SW	Pinch point	Under N Lamar Blvd					◆	Safety lighting	
21	SW	Double trail	Barton Creek to Pfluger Bridge				Path stabilization	◆	Safety lighting	◆
22	SW	Bridge construction	Across Barton Creek				Path and slope stabilization	◆		◆
23	SW	Double trail	Alignment parallel to Zilker Park, from Mopac to Barton Creek				Path and slope stabilization	◆	Reflective safety lighting	◆
24	SW	Formalize trailhead	Junction between trails, Mopac Underpass, and Zilker Park	◆		Improve surface condition at acute entry point			Bridge lighting	Directional Signage
25	NW	Alternative route for bikes on parallel street	Veterans Drive from Mopac to Cesar Chavez St		Formalize trailhead connection			◆		
26	NW	Address bridge pinch points, formalize meander paths	Austin High Boat Launch to Heron Creek				◆	◆		
27	NW	Pinch point	Under N Lamar Blvd				◆	◆	Safety lighting	
28	NW	AAA gap closure with slow zone	N Lamar Blvd to Walter Seaholm Dr	◆	◆	◆	◆	◆	Safety lighting	◆





ID	Trail Quadrant	Project	Project Location	15 for 15	Primary Issue (Described in Text) Plus Other Supportive Elements (◆)					
					Connecting	Access	Surface Conditions	Width	Lighting	Wayfinding
29	NW	Double trail	Shoal Creek to the Pfluger Bridge				Path stabilization	◆	Safety lighting	Directional signage
30	NW	Double trail	Shoal Creek		◆		Slope stabilization		Safety lighting	◆
31	NW	Directional signage	Colorado St to Guadalupe St	◆					Bridge lighting	◆
32	NW	Slope and path stabilization	Waller Creek to S Congress Ave				◆		Safety lighting	Directional signage
33	NW	Wayfinding signs	Across Waller Creek						Bridge lighting	◆
34	NW	Double trail	Rainey St to Waller Creek				◆	◆	Safety lighting	

Note: Some projects identified as part of this study process overlap with The Trail Foundation's 15 projects for its 15<sup>th</sup> anniversary. Column "15 for 15" in the table above identifies this overlap, however the proposed project may vary slightly from what was outlined in The Trail Foundation's anniversary project proposal.

Highlighted ID numbers = potential projects illustrated with concept plans and designs in this chapter.



## 9 IMPLEMENTATION PRIORITIES

The team approached this study with a balance of sustainability, preserving the natural aesthetic and experience of the Trail, and developing recommendations to upgrade and improve the Trail to provide sufficient space and safety for an increasing number of users.

Considerations were taken for topography, existing vegetation, natural features, erosion patterns, and pedestrian and bicycle usage and growth patterns, substandard conditions, and safety concerns. In order to enhance ecological, mobility, and safety aspects of the trail it is essential to be able to work within the current 50-foot setback in a thoughtful and balanced way. Implementation of these recommendations is dependent upon advancing a code amendment that permits capital and maintenance projects that improve ecology, safety, and mobility of the trail and its surrounding environment within the 50-foot setback of Lady Bird Lake. Without such an amendment, we will not be able to address current environmental, mobility, and safety issues with Austin's most loved and utilized trail.

Keys to project implementation are the immediate next steps:

- Amendment of the existing Land Development Code or relevant Environmental Criteria Manual to ensure that the identified capital and maintenance projects recommended here are able to be implemented within the 50-foot setback of Lady Bird Lake.

### Design Principles

Additional study, consideration of environmental needs, and engagement are necessary to advance any of the safety and mobility projects. As projects are developed and designed in the future, the following principles are recommended for the basis of design:

1. Maintain trail character as a place of respite
2. Steward the natural habitat and ecology along the Trail
3. Use universal design to support accessibility for all
4. Accept crowding at locations where more capacity is needed but the park width and slope prohibit widening and alternative routing options are not possible
5. Maintain slow speeds on the Trail
6. Integrate the Trail into the larger mobility ecosystem
7. Expand sense of safety, welcome, and place
8. Align with national trail design standards and improvement practices



- Continued collaboration among The Trail Foundation, PARD, PWD, and WPD with key partners to deepen engagement and refine the scope of recommended projects in a thoughtful, balanced, and ecologically supportive manner.
- Clarify maintenance requests, responsibilities, and management with adjacent landowners and partners.
- Evaluate pilot results and confirm policy on the use and regulations of electric-powered micromobility devices on the Trail.

In considering which projects to do first, the Trail Foundation should first invest in slope stabilization and erosion projects that will address surface conditions to avoid more costly and environmentally sensitive projects later. While these projects are being scoped, funding should be pursued for projects that address trail width concerns, starting with locations east of I-35.