THE SIOUX FALLS MPO MULTI-USE TRAIL STUDY

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INTRODUCTION

Sioux Falls' Big Sioux trail loop was one of the nation's first urban trails when it was developed as part of a major flood control project during the 1970s, and has served the entire metropolitan area for almost forty years. Since then, the city has continued to invest in the loop, including major reconstruction projects during 2010; established a system of on-street bicycle routes, reinforced by a growing infrastructure of bike lanes and sharrows; and completed an extension to the west side of the city to Legacy Park near 12th and La Mesa. Sioux Falls investments in trails and on-street facilities, along with other supporting efforts, won the city recognition as a Bicycle friendly Community by the League of American Bicyclists in 2010.

As Sioux Falls' growth to the west and south accelerated after 1990, demand for new trail facilities to serve emerging residential areas also grew. In 2001, the city's Bicycle Plan, developed to provide detail to general recommendations in the metropolitan area's Long Range Transportation Plan, identified four major trail priority trail projects:

- The paving of the last unpaved segment of the Big Sioux loop, around Joe Foss Field.
- A segment paralleling the pre-existing trail on the west side of the Big Sioux between Yankton Trail Park and Maple Street, completed during 2010.
- A northeast connection between the Big Sioux loop and Great Bear Recreation Area, in the process of implementation and negotiation for right-of-way.
- A west side trail along Skunk Creek and tributary drainages, from Legacy Park to Benson Road.

The 2001 plan also proposed trail network studies for rapidly growing areas south of 57th Street, and east from the Loop to Arrowhead Park and the Big Sioux River at Minnehaha County's Perry Arboretum. In 2007, the city retained RDG Planning & Design to complete the Sioux Falls Trail Master Plan, which presented detailed trail network concepts for the west side or Cherry Creek system to the new SDSU campus at North 60th Street; the east side or Arrowhead Corridor to the Arboretum and Arrowhead Park; and the south side, or Diamond Creek system to 85th Street.

At the same time, the towns of Brandon, Tea, and Harrisburg, once small rural towns, experienced rapid growth and emerged as integral members of the metropolitan community. All three towns attracted young households

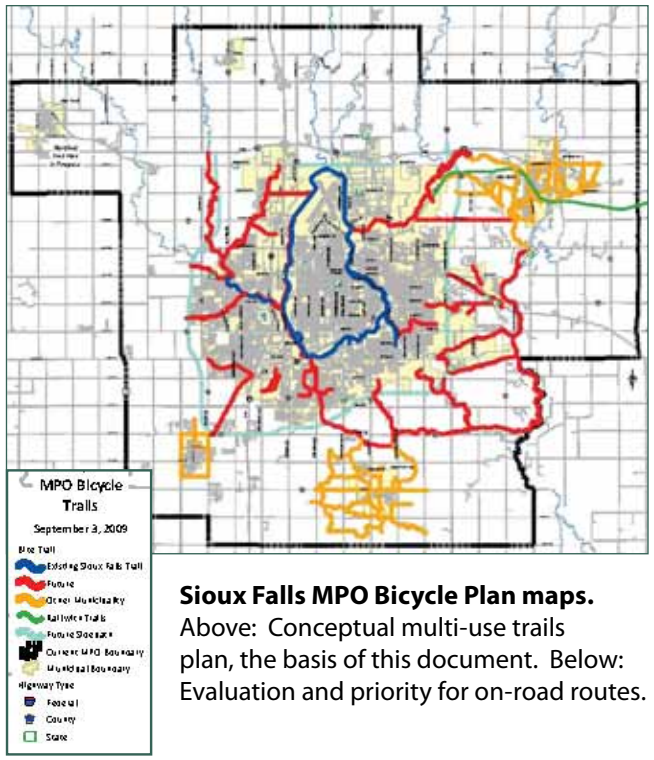
with a quality of life that combined city conveniences with small town intimacy and scale. With growth, these communities also began to develop internal trail facilities. Brandon built sidepaths along Holly and Sioux Boulevards to serve schools and major community facilities, and a connecting trail to Big Sioux Recreation Area, while Tea developed short trails in its city park and began implementation of a much more ambitious peripheral trail loop, called the Trail Around Tea. But with growing populations and trail interests, these suburban cities also became increasingly interested in linking their local trails to the Big Sioux Loop and other regional facilities.

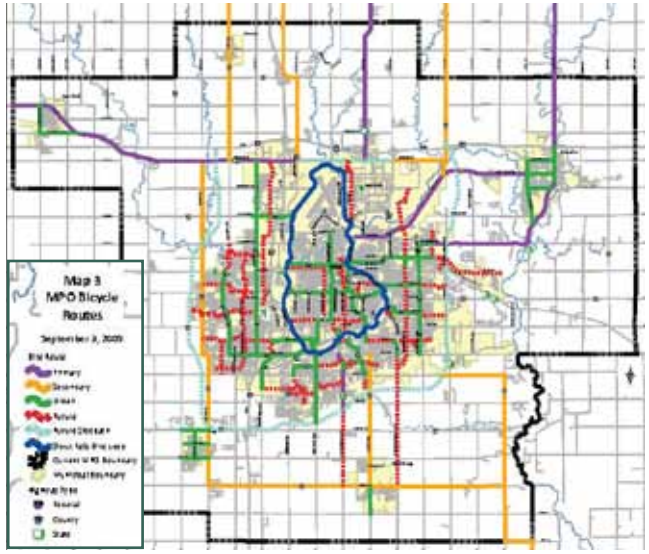
In 2009, the Sioux Falls Metropolitan Planning Organization (MPO) published a Bicycle Plan for the metropolitan area, establishing regional trails linking the Sioux Falls trail system to Big Sioux Recreation Area and Brandon, Tea, and Harrisburg as priorities. Short-term priorities in the MPO plan included:

- Completing a bicycle trail master plan connecting Big Sioux Recreation Area to Great Bear and the Arboretum.
- Incrementally developing planned community trail systems in Sioux Falls, Harrisburg, Tea, Hartford, and Brandon.
- Establishing future trail corridors included in community bicycle plans through subdivision platting, and defining them with low-capital, interim improvements.

The MPO plan's long-term priorities include master planning Tea, Hartford, and Harrisburg trail systems to Sioux Falls. The MPO plan also included two key conceptual maps, one indicating potential bicycle trail connections from the four metro area communities to Sioux Falls, and the other indicating on-road bicycle routes.

Objectives of this Study





Sioux Falls MPO Bicycle Plan maps. Above: Conceptual multi-use trails plan, the basis of this document. Below: Evaluation and priority for on-road routes.

Four Seasons on the Trail. Top: Ski season at Great Bear. Above: Bike trail at Big Sioux Recreation Area near Brandon.

While the MPO Bicycle Plan identified general directions and alternatives for trail connections between Sioux Falls and Brandon, Harrisburg, and Tea, it neither evaluated alternatives nor focused on a single most feasible concept that in turn would guide implementation policy. The overall purpose of this document is to do exactly this by:

Developing and evaluating various options for inter-urban connections in the metropolitan area and defining a most feasible concept for the Great Bear to Big Sioux, Sioux Falls to Harrisburg, and Sioux Falls to Tea study corridors.

Developing the most feasible concept in greater detail, including general alignment, cost, design characteristics, funding, maintenance, and sequencing.

The study includes the following sections:

Part One: Planning Process and Evaluation Criteria presents the techniques by which corridor alternatives were defined and evaluated.

Part Two: Trail Contexts and Infrastructure Types establishes the infrastructure types that various segments may utilize, the contexts that are appropriate for each type.

Part Three, Four, and Five: Trail Corridors presents trail alignment determinants and alternatives for the Big Sioux/Brandon, Harrisburg, and Tea corridors respectively, and identifies and details the features, probable costs, sequencing, and potential issues and contingencies of the "most feasible concept."

Part Six: The Metropolitan System relates individual trail studies to each other and to the existing and proposed metropolitan area trails and bikeway systems.

Part Seven: Design Standards establishes consistent guidelines for each infrastructure context, informing the specific design of each facility.

Part Eight: Regional Implementation Policies includes recommendations for critical issues such as roles and responsibilities of various levels of government, funding, maintenance, and interim development.

CHAPTER 1 | THE PLANNING AND EVALUATION PROCESS

The Sioux Falls Multi-Use Trail Study process used a variety of techniques designed to maximize participation by each community and the general public.

Components of the process included:

- An initial, two-day reconnaissance of the study corridors, taking place on August 9 and 10, 2010, during which consulting team members cycled a variety of potential routes and roads on all three of the study corridors. This session also included the initial meeting of the Project Committee, a committee of fifteen people including MPO and city staff members, administrators, public officials, and citizen groups. A list of committee members is included in the appendix to this study.

- A series of stakeholder group meetings, held in each community on August 18 and 23, 2010. These included a session in each community that involved city officials and interested members of the public and specific constituencies; a meeting with members of the metropolitan area bicycling community; and a general public meeting. The meetings considered alternative routes, investigated city perspectives and future plans, and considered preferences of user constituencies such as bicyclists. These discussions helped inform the "trail determinant" sections included in the parts of this document that address the specific study corridors.

- Trail design workshops, held in each study corridor on September 13-15, 2010. Each of the three days focused on one specific study corridor and included an initial inbriefing for participants (who included the consultant team, project committee members, public officials, and interested members of the general public); a supported group ride that covered most potential alternative routes and covered between 35 to 50 miles per day; an afternoon work session to develop alternatives based on the morning ride; and an evening presentation and discussion of options.

- Alternative development, taking place between the workshops and the project committee's evaluation meeting, developing four to five alternative concepts for each study corridor and a series of evaluative criteria described below to help identify the most feasible concept for each corridor.

- A Project Committee workshop on November 8, 2010, applying the evaluative criteria to the alternatives developed for each corridor, leading to a general consensus around a most feasible concept for each

area. In several cases, this workshop combined segments of different options to create entirely new alternatives. The emerging most feasible concept was then refined between the workshop and the November MPO committee meetings.

- Preliminary presentations to the MPO's Citizens Advisory Committee (CAC), Technical Advisory Committee (TAC), and Urbanized Development Commission (UDC) on November 17 and 18, 2010.

- Public open houses, with short presentations followed by one-on-one and small group discussions with property owners and constituent groups, held on December 8, 2010. Two separate workshops were held, one held at Tea City Hall combining the inter-related Tea and Harrisburg corridors, the other at the Brandon Council Chamber, addressing the Brandon/ Big Sioux to Great Bear corridor. Property owners received individual notifications of these open houses. Comments were submitted both in writing and on-line. Records of attendance and individual comments are included in the appendix.

- Based on the results of the December 8 open houses, further modification and development of the plan.

- Progress presentations of the preliminary draft to the MPO CAC, TAC, and UDC during their January 19/20, 2011 meeting cycles.

- Another series of public open houses of the completed plan draft, held in Tea and Brandon on February 8, 2011. Comments were submitted both in writing and on-line. Records of attendance and individual comments are included in the appendix.

- Adoption of the completed Sioux Falls MPO Multi-Use Trail Study by the MPO in March, 2011.

Evaluating Alternatives

The core of this plan is evaluating trail alternatives and identifying a most feasible concept for eventual implementation. Therefore, the factors selected to evaluate alternatives are extremely important and reflect the values and perspectives of the trail development program. Because these criteria reflect different objectives, they are not consistent with each other: an option that may rank high on one objective may have a low rating for another. For example, one alternative may offer a superior trail user experience, but might involve acquisition of private property over the objection of property owners. The result is that the trail project, while desirable from one perspective, would probably never be accomplished. In the case of trail development, the most feasible alternative often represents the best balance of different attributes.

The trail planning team, including the consultants and project committee, defined ten evaluative criteria:

Directness

A high-rated option goes from endpoint to endpoint directly, with little or no misdirection. It is not necessary for the route to travel in an absolutely straight line, but users should feel they are progressing toward the destination. A low-rated option is indirect to the point of frustrating users, or takes them far out of the way to provide a safe passage.

Trail Experience

A high-rated option will offer users a positive experience, consistent with or above expectations, providing a scenic route free of stress and conflict. A low-rated route is unpleasant, noisy, and unattractive, with conflicts and stresses that produce a neutral or negative experience.

Time Frame

A high-rated option is simple and economical enough to be fully realized within a realistic period of time, or developed as part of transportation projects that are certain enough

that trail completion is highly likely. A low-rated option depends on very long-term or highly speculative projects or funding.

Multiple Funding Sources

A high-rated option is eligible for funding from multiple sources, including other associated projects such as major street improvements, or fits within the structure of funding and resources that are relatively typical for the metropolitan area. A low-rated option depends on funding secured for the trail alone.

Safety and Security

A high-rated route is perceived as safe, provides visual contact without compromising the quality of the trail environment, has relatively good emergency access, and provides a facility free of traffic hazards. A low-rated route passes through environments that feel insecure, may be remote and inaccessible in emergency situations, or includes potential hazards.

Neighborhood Service

A high-rated route provides convenient access to existing or future residential areas and desirable support services. A low-rated route is separated from adjacent populated areas, and does not provide opportunities for future support services.

Ease of Acquisition

A high-rated option is relatively easy to acquire; part of another, non-trail project; makes extensive use of public land or easements; or is owned by property owners who support trail development or believe that a trail serves their self-interest. A low-rated alternative is difficult to assemble and requires involuntary acquisition, or is likely to generate considerable concern and possibly opposition.

Cost and Constructability

A high-rated option uses standard trail sections for most areas, with minimum need for special structures, difficult grading, or remediation of surface conditions. A low-rated alternative includes obstacles that require special structures or solutions that add considerable cost.

Connectivity

A high-rated option connects relatively directly and naturally to the Sioux Falls trail and bikeway system, without unusual structures, difficult passages, or gaps. A low-rated alternative requires substantial additional work or an expensive structure to link to the existing Sioux Falls trail and bikeway system, or leaves a significant gap that will not be comfortable for all users.

Responsiveness to User Groups

A high-rated route serves a wide variety of user groups and capabilities. A low-rated route has characteristics that limit the number of users and does not accommodate people of varying capabilities.

Applying the Criteria

In applying these criteria, the project committee and consultant team gave special weighting to three factors: trail experience, cost and constructability, and ease of acquisition. Team members individually scored alternatives on a “5” to “1” scale for each evaluative criterion. Overall scores were calculated, producing a maximum score of 65. Each team member then reported their score and overall evaluation of the alternative, and average scores for the alternative were calculated, leading to an overall ranking of options for each trail corridor. The team then discussed the results, using this discussion to arrive at a consensus choice for a Most Feasible Concept for each inter-urban corridor.

CHAPTER 2 | TRAIL CONTEXTS AND INFRASTRUCTURE TYPES

Multi-Use Trail on Separated Right-of-Way. Sioux Falls' Big Sioux Trail loop is an excellent example of a multi-use trail, and serves a wide variety of recreational and transportation users.

The three inter-urban trail corridors considered by this study will travel through different environments, potentially including parks and recreation areas, public properties, railroad corridors, and street environments of various types. Previous planning documents, including the Sioux Falls Trails Master Plan (2007) and the Sioux Falls MPO Bicycle Plan (2009), both address trail types and design, and this discussion refers to elements of this earlier work. The 2009 plan, by presenting separate regional plans for trails and on-street routes, assumed that the Brandon/Great Bear, Harrisburg, and Tea corridors considered in this document would be served entirely by off-road trails. However, right-of-way issues and other possible connections may produce hybrid facilities that assemble different types of facilities into cohesive routes.

This chapter reviews the various types of trails that will be used in various alternatives, and provides illustrative infrastructure design concepts. These components then help describe the various alternatives presented for each study corridor. More detailed design guidelines appear in Part Seven.

Infrastructure Types

Infrastructure types that are likely to be used in building these links include:

- Multi-Use Trails on Separated Right of Way
- Sidepaths on or Adjacent to Street and Roads
- Complete Streets, providing multi-modal access within street corridors
- Bicycle Lanes or Shoulders
- Bicycle Boulevards
- Designated Shared Routes

Multi-Use Trails on Separated Right of Way

Multi-use trails on separated right of way, specifically the Big Sioux loop, are the spine of the metropolitan area bikeway system. They are physically separated from motor vehicle traffic, and are distinguished from roadside paths, or sidepaths, by mostly operating independently of streets and road rights-of-way. Potential settings for multi-use trails in the three study areas include rivers and streams, minor drainageways, parks and greenways, public properties like schools, greenways, abandoned or active railroads, and utility rights-of-way and easements. State and local legislation prohibits development on 100-year floodplains and retains these floodplains on public ownership. These laws open significant opportunities on what is now private land when adjacent development occurs.

Multi-use trails serve the greatest variety of users, including bicyclists of all capabilities, pedestrians including walkers and runners, people in wheelchairs, in-line skaters, skateboarders, and people pushing baby strollers. Because they are separated from vehicular traffic, and often travel through scenic areas, they often offer the most comfortable and pleasant trail experience for the greatest number of users. On the other hand, their characteristic user mix can create conflicts between highly capable bicyclists and other, lower-speed users. Part Seven presents more complete design guidelines for multi-use trails. In the current study, their use is constrained by several important considerations:

- *Facility surface and width.* Ultimately, all multi-use trails in the inter-urban system will be hard-surfaced, and current Sioux Falls trails use both concrete and asphalt. The generally accepted minimum width for urban trails is ten feet with a minimum graded shoulder width of two feet on either side of the trail surface. In high-density areas, a 12-foot width is increasingly recommended with the popularity of more space-intensive wheeled uses, such as in-line skaters, recumbent bicycles and tricycles, and trailers. Therefore, settings suited to two-way, separated multi-use trails require a 14 to 16 feet minimum flat section without significant cross-slopes.

- *Availability and feasibility of right-of-way.* Separated multi-use trails are predicated on available land, and the probability of acquiring right-of-way on private property without the cooperation of the owner is remote. Even public utility easements can create challenges when the underlying land is privately owned. Thus, public lands provide the most immediately available corridors for trails. Private lands provide opportunities when land is about to be developed and the trail is incorporated into the project or subdivision design, and the developer understands the demonstrated economic and market benefits inherent in trail development. In some cases, tax advantages can motivate private property owners to donate trail rights-of-way or easements on land that is otherwise difficult or impossible to develop. Even on public land, adjacent neighbors concerned about perceived crime, vandalism, or compromised privacy can block or delay trail development. While this opposition abates over time as fears over trails generally prove unfounded and their benefits become clear, it is a factor to consider.

- *Grades.* Multi-use trails, as carriers of pedestrians, must comply with the Americans with Disabilities Act. In addition, many users find steep grades difficult or impossible to negotiate, and expect relatively easy grades on urban trail systems. Therefore, feasible multi-use trails should avoid steep slopes, or extensive use of switchbacks and retaining walls that add cost and reduce the usability of the facility. Grade issues are largely restricted to the Big Sioux/Brandon corridor.

Sidepaths

Sidepaths are multi-use paths separated from but along the side of roads and streets, usually found within or immediately adjacent to the street rights-of-way. Most sidepaths provide two-way operation, and in theory accommodate the same user groups as separated multi-use trails. Sidepaths are a source of great controversy within the bicycling community. They are popular with local and state trail developers, because they use existing street right-of-way, and minimize additional acquisition cost and property-owner opposition. They also address the concerns of some bicyclists who are uncomfortable with riding in mixed traffic, even with protected bicycle facilities. On the other hand, they present significant safety and operating dangers that can make them more hazardous in certain situations than on-road riding. In addition, cyclists who are comfortable with riding in mixed traffic, and in fact follow the League of American Bicyclists' Smart Cycling principle that "cyclists fare best when they act and are treated as the drivers of vehicles" believe with considerable justification that street

Sidepaths. Top: Sidepath on a four-lane divided arterial with access control (US 40, Lawrence , Kansas). Above: Sidepath or widened sidewalk in a residential context.

Sidepath Intersection Conditions. Top: Holly Boulevard in Brandon uses stop signs on the intersecting sidepath and extensive warning signs on the street. Above: Hudson River Greenway in New York, the nation's busiest trail, uses a signal cycle that prevents turns across the sidepath when the path has a green signal.

riding provides greater safety and that the presence of sidepaths could force them to use an inferior and less safe facility. The 1999 AASHTO Guide for the Planning, Design, and Operation of Bicycle Facilities was hostile to the sidepath concept, recommending that they not be used except in exceptional circumstances or on very long stretches of roads and bridges without driveways or intersecting streets. The proposed AASHTO guide, released for comment in February, 2010, is less hostile to their use, while taking note of their shortcomings:

> Although it is generally preferable to select path alignments in independent rights-of-way, there are situations where existing roads provide the only corridors available. . . Provision of a pathway adjacent to a road is generally not a substitute for the provision of on-road accommodation such as paved shoulders and bike lanes. . .

Paths can function along highways for short sections, or for longer sections where there are few street and/ or driveway crossings, given appropriate separation between facilities and attention to user safety at junctions. However . . . practitioners should be aware that two-way sidepaths can create operational and safety problems, primarily arising from the fact that bicycle traffic in one direction rides against the flow of adjacent roadway traffic, contrary to normal rules of the road and driver expectations.

The 2010 AASHTO draft establishes the following contexts for consideration of sidepaths:

- Roads with relatively high volume and high-speed motor vehicle traffic that discourages bicyclists from riding in the roadway, increases sidewalk riding, or lack capacity for either road improvements or use of parallel, lighter-volume routes.
- Short distance connections between low-volume local streets or separated trails.
- Roads with few driveway or street crossings.
- Settings where the path terminates into bicycle-friendly facilities at both ends.

Sidepaths have been used extensively in the three study area towns, and appear to work reasonably well for their intended users. In Brandon, sidepaths on both sides of Holly Boulevard from Sioux Boulevard to South Dakota 11 serve the high school, middle school, and commercial center at the highway intersection; and the Sioux Boulevard sidepath extends along the west side of the street from Aspen Boulevard to Bennis Elementary School and Big Sioux Recreation Area. A sidepath has recently been built as part of the CH 111 project between Brian Street and CH 106, forming the east leg of the proposed "Trail around Tea."

Because existing road rights-of-way are available, and may in some cases provide feasible routes for multi-use trail connections, sidepaths may well be integral to at least segments of the inter-urban trails. Part Seven presents design guidelines to make these facilities as safe as possible. However, use of sidepaths in constrained by the following limitations:

Safety issues related to rights-of-way and adjacent road section. The fundamental question about sidepaths from the point of view of the primary user group of an inter-urban system – bicyclists – is one of safety. Less experienced riders fear motorized traffic, not an unjustified fear in the face of both the distracted and raging motorist. Research indicates that sidepaths are safer than on-road travel between intersections, and more hazardous at crossings. There are intriguing and helpful findings within that overall conclusion. A study on sidepath selection completed for the Florida Department of Transportation by Sprinkle Consulting found that:

> - On high-speed roads (55 mph), a larger separation of sidepath to road produced lower crash rates. The opposite is true for lower-speed (35 mph) corridors.

As road speeds increase, the relative safety of a sidepath to on-road facilities increases.

- Crash rates are lower for sidepaths along 2- and 3-lane roads than along roadways with four or more lanes. (Note: This is probably explained by the fact that the two-way sidepath is more likely to be in the oncoming motorist's cone of vision on the narrower road.

Thus, the width of the right-of-way, degree of separation, and section of the adjacent roadway together help determine whether a sidepath lives up to the user's expectation of a safe trail environment.

Safety issues related to access and land use patterns. Sidepaths are demonstrably safer when there are fewer driveway or street crossings. Some state standards recommend that sidepaths be considered only when a corridor has fewer than eight crossings per mile. Sidepaths work best along limited access roads, such as the proposed South Dakota 100 ring, and are least appropriate along commercial corridors with visual noise and frequent accesses, or residential corridors with facing houses and driveways. Access and land use control can be significant issues in determining whether a sidepath provides a safe facility.

Directional design. Many of the traffic conflicts endemic to two-way sidepaths are created by their counterflow directions. Traffic turning into cross streets and driveways are not expecting or cannot easily see a bicycle coming in the wrong direction. With good directional information and intersection design, one-way sidepaths can minimize these conflicts and should be considered in certain locations (see concept illustrated in Part Seven).

Intersection design. Where intersections occur, street design should maximize the visibility of path crossings, reduce speeds of both through and turning traffic, and prevent driveway traffic from blocking the sidepath. In Brandon, the Holly Boulevard sidepath uses a contrasting pavement color at street crossings to increase visibility and maintain the path's visual continuity.

Complete Streets

Complete streets are designed to accommodate motor vehicle, bicycle, and pedestrian traffic and, where relevant, public transit. Complete streets may use a variety of design features to serve multiple modes, but usually involve sidewalks, bike lanes, and techniques to encourage a consonance between posted and design speeds such as medians, narrower lanes, and landscaping. Complete streets may be achieved through retrofits (including installing bicycle lanes such as along Sertoma Avenue north of 26th Street or through "lane diets," reducing the number of travel lanes to create space for bike lanes); street widening or major improvements; or entirely new streets. Complete street conversions are relevant to many potential segments in the study corridors, where two-lane rural section paved or gravel county roads will require upgrades as development and traffic increases. Examples are Minnesota Avenue from 85th Street south to Harrisburg; Cliff Avenue to Harrisburg, where traffic volume already exceeds the capacity of a rural highway; CH 110 from Tea-Ellis Road west; and Sundowner Avenue from Tea north to 69th Street.

Sidepath Intersection Design. Principal street intersection uses a right turn median to slow right turning traffic and provide a refuge for pedestrians and bicyclists on a sidepath. (Engelwood, Colorado)

Complete Street. This design uses bikelanes, medians, and a wide sidewalk to accommodate all users and control traffic speeds. (Ashwaubenon, Wisconsin)

Sidepath Intersection Conditions. Top: Holly Boulevard in Brandon uses stop signs on the intersecting sidepath and extensive warning signs on the street. Above: Hudson River Greenway in New York, the nation's busiest trail, uses a signal cycle that prevents turns across the sidepath when the path has a green signal.

Bicycle Lanes or Shoulders

Streets with bicycle lanes provide a designated lane for bicycles within the street channel, defined by pavement markings or color. Bicycle lanes always operate in the direction of traffic and should never produce a counterflow situation unless the counterflow lane is physically separated from the flow of motor vehicles. The 2010 AASHTO draft considers bicycle lanes to be "the appropriate and preferred bicycle facility for thoroughfares in both urban and suburban areas." Bicycle lanes may be used on streets with or without on-street parking, but are always separated from the parking lane. Buffered bike lanes may provide additional separation between bicycle and travel lanes. On roads with rural sections, paved shoulders also function as bicycle lanes, and this role may be reinforced by appropriate pavement markings.

Bicycle lanes have a number of advantages for transportation-oriented cyclists such as commuters. They allow bicyclists to ride at their own pace and encourage them to both ride with traffic and position themselves for high visibility to motorists. With bicycle lane, cyclists use the road system like other vehicles to reach their destinations. On the other hand, bicycle lanes may still be uncomfortable for many trail users, and are part of a road environment that lacks the quiet and calm of a superior trail experience.

Bicycle Boulevards

Bicycle boulevards make minor modifications to local streets to create through routes for cyclists, with pedestrians served by sidewalks. Some street modifications are designed to discourage or slow motorized traffic while maintaining local access. Typically, bicycle boulevards are members of urban grids that parallel or connect destinations also served by higher order streets.

Generally, bicycle boulevards are most applicable to dense urban grids, such as those found in established parts of Sioux Falls. The largely rural or low-density areas that separate the three communities from Sioux Falls lack this mature street system. However, the concept is applicable to developed areas north of 85th Street, and to connecting routes within the limits of the Brandon, Harrisburg, and Tea.

Bicycle Boulevard. Street modifications include special signage, pavement markings, removal of hazards like sewer grates, and traffic calming techniques. (Milvia Street, Berkeley, California)

Shared Roadways

Shared routes provide designated and signed routes for bicyclists without providing them with a reserved domain. Shared routes are fully shared by both motor vehicles and bicycles. Most of Sioux Falls' current connecting system uses signed and numbered shared routes. Variations include:

- Streets with shared lane markings ("sharrows"). Sharrows are used on routes that for various reasons (typically width or parking requirements) cannot accommodate bicycle lanes. They are appropriate on streets with speed limits of 35 mph and under, and may be used on local streets to mark routes, collectors, and minor arterials.

- Striped parking lane with sharrows. This treatment stripes a parking lane and employs the sharrow in the travel lane. On streets with a light demand for on-street parking, continuous areas inside the stripe provide cyclists not entirely comfortable with on-street riding a possibility of some refuge just inside the parking lane. This technique was recommended for certain settings in the 2007 Sioux Falls Trails Master Plan and has been used successfully on Ralph Rogers Road.

- Shared streets, without pavement markings other than share-the-road signage.

Shared roadways are useful as designated connections between neighborhoods and the "trunk" inter-urban trails that are the subjects of this study but generally do not meet the objectives of a multi-use trail.

Shared Roadways. Top: Parking lot is defined with a white stripe and a shared lane marking is used to indicate presence of bicycles and position cyclists away from door zone. Bottom: Use of shared lane marking (sharrow) to indicate continuous route and position cyclists on a low-volume street. (Burt Street, Omaha, Nebraska)

CHAPTER 3 | BIG SIOUX/BRANDON TO GREAT BEAR

This study corridor connects Big Sioux Recreation Area and Brandon to the City of Sioux Falls' Great Bear Recreation Area and Big Sioux River Trail. Big Sioux Recreation Area, a South Dakota Game, Fish, and Parks Department property, is a major regional recreational resource, offering camping, canoeing, hiking, picnicking, and related features.

From a trail perspective, the park includes a 1.5 mile path, connecting Parkview Boulevard and Ponderosa Drive in Brandon to the Park Street sidepath and Bennis Elementary School in the southwestern edge of the city. City sidepaths along Park Street and Sioux Boulevard and an internal trail behind lots between Birchwood Circle and Ponderosa complete a 2.8 mile paved trail loop.

On the Sioux Falls end of the connection, both the city and the MPO Bicycle Plan establish a connection between the Big Sioux Trail Loop, which crosses the Diversion Channel just north of the Big Sioux River confluence, with Great Bear Recreation Area. The City owns much of the property on the north shore of the Big Sioux and is in the process of securing right-of-way along the north side of the river to about Bahnson Avenue. Eventual riverfront right-of-way will extend through the city's wastewater treatment plant to about Timberline Road.

Holly Boulevard and Rice Street currently provide paved shoulders that receive frequent cyclist use. These shoulders should be retained in all options, and new road construction should provide for paved shoulders, with dual use as bike lanes.

An additional connection opportunity, identified in the 2009 MPO plan, is a connection along the Big Sioux River from Big Sioux Recreation Area to Minnehaha County's Perry Nature Area and Arboretum, north of South Dakota 42 and west of the Big Sioux bridge. This is the terminus of the Arrowhead Trail Corridor, discussed in detail in the Sioux Falls Trail Master Plan of 2007. While the Arboretum connection is discussed here, the alternative selection process focused on the Big Sioux/Brandon to Great Bear/ Sioux Falls connection.

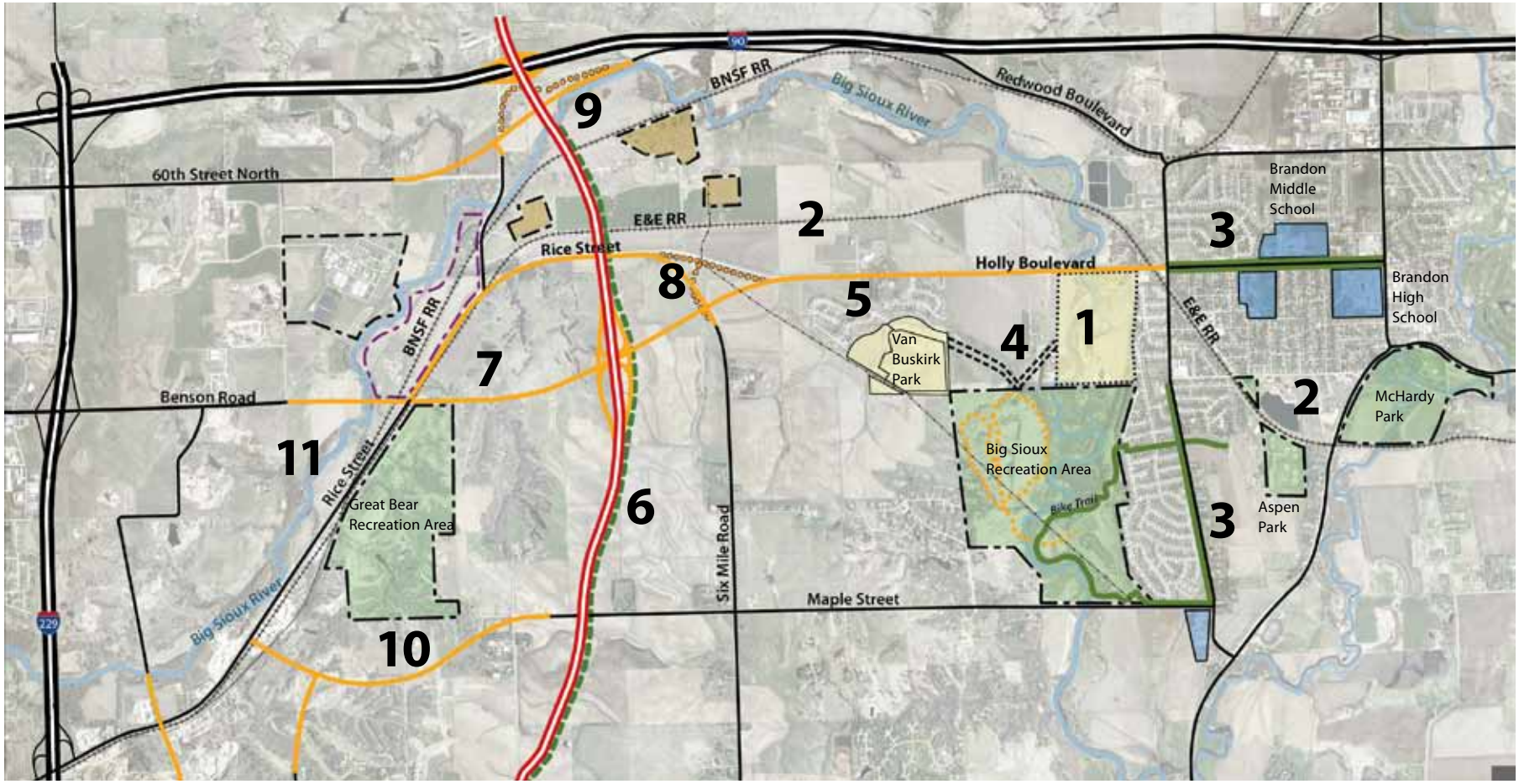
BIG SIOUX/BRANDON TO GREAT BEAR - Trail Determinants

Table 3.1: Big Sioux/Brandon Trail Determinants

Map Key	Segment	Description
1	Big Sioux Recreation Area Expansion	In late 2010, the Game, Fish, and Parks Department purchased property along the Big Sioux River north to Holly Boulevard.
2	Ellis and Eastern Railroad	The Ellis & Eastern, a locally-owned short line, receives little use north of Great Bear Recreation Area. The right-of-way through Brandon is almost never used, and tracks are removed east of Aspen Park. The right-of-way continues in a tunnel under SD 11 and forms the south border of Brandon's McHardy Park. Despite disuse, the railroad is not abandoned.
3	Existing City Paths	Facilities include sidepaths along Holly and Sioux Boulevards; and a short trail spur to Sioux Boulevard south of Ponderosa Drive.
4	Bluffs Sanitary Sewer Easement	Sewer serves the Eagle Creek and Bluffs of Brandon subdivisions. Easement runs along a drainageway in a northwest to southeast direction, and continues in the same direction through private property. It then turns to the northeast and north through the same property, and continues north to a lift station on the south side of Holly Boulevard, about 500 feet west of the Big Sioux River.
5	Bluffs of Brandon/Eagle Creek	Two adjacent, primarily single-family subdivisions with commercial and high-density residential uses along Rice Street/Holly Boulevard. Developments are bounded by a WAPA transmission line, designated as a greenway corridor in the development plan. Van Buskirk Park, a city park located along the drainageway and sanitary sewer easement, serves the Bluffs area.
6	South Dakota 100 (SD 100)	SD 100 will be a controlled access loop, interchanging with Interstate 90 near the existing 478th Avenue interchange and continuing around the east and south side of Sioux Falls to the existing Exit 73 (County Highway 106) on Interstate 29. The SD 100 project includes a continuous sidepath for pedestrian and bicycle use.
7	Benson Road extension	Benson Road currently interchanges with I-229 and terminates at Sycamore Avenue. It will be extended east with a grade separated crossing over the BNSF, E&E, and Rice Street rights-of-way, continue north of Great Bear Recreation Area, and interchanges with SD 100, connecting into Holly Boulevard. On completion, the Holly Blvd./Benson Road combination will be the primary east-west movement.
8	Rice Street Realignment	Rice Street, which becomes Holly Boulevard in Brandon and is the primary local trafficway between Sioux Falls and Brandon, will be realigned into Six Mile Road as part of the Benson Road extension. A portion of the existing Rice Street ROW will be vacated.
9	Redwood Boulevard Realignment	Redwood Blvd, now a gravel road west of Sioux Boulevard paralleling I-90, will be realigned with the SD 100 project, connecting to North 60th Street. This realignment does not include plans to pave Redwood Boulevard into Brandon.
10	Maple Street Extension	Long-term plans call for paving Maple Street, and connecting it to Rice Street. Sycamore Avenue would be extended north to intersect with Maple. Maple Street becomes Park Street in Brandon and is the southern boundary of Big Sioux Recreation Area.
11	BNSF and Yard Relocation	The Burlington Northern and Santa Fe main line follows Rice Street and the Big Sioux River through this study corridor. The City and BNSF propose moving the railroad's current switching and storage yard out of Downtown Sioux Falls to a location within this study area. The northeast transportation study assumed a site generally south of the extended Benson Road on the west side of the river, although final location is undetermined as of January, 2011.

BIG SIOUX/BRANDON TO GREAT BEAR - Trail Determinants

The northeast sector of the metropolitan area has undergone an extensive transportation planning process, related to system improvements and the development of the South Dakota 100 ring road corridor. These plans and other opportunities have a substantial impact on alternatives for the Brandon to Sioux Falls trail. Map 3.1 illustrates these plans and actions, keyed to explanations in Table 3.1 on the facing page



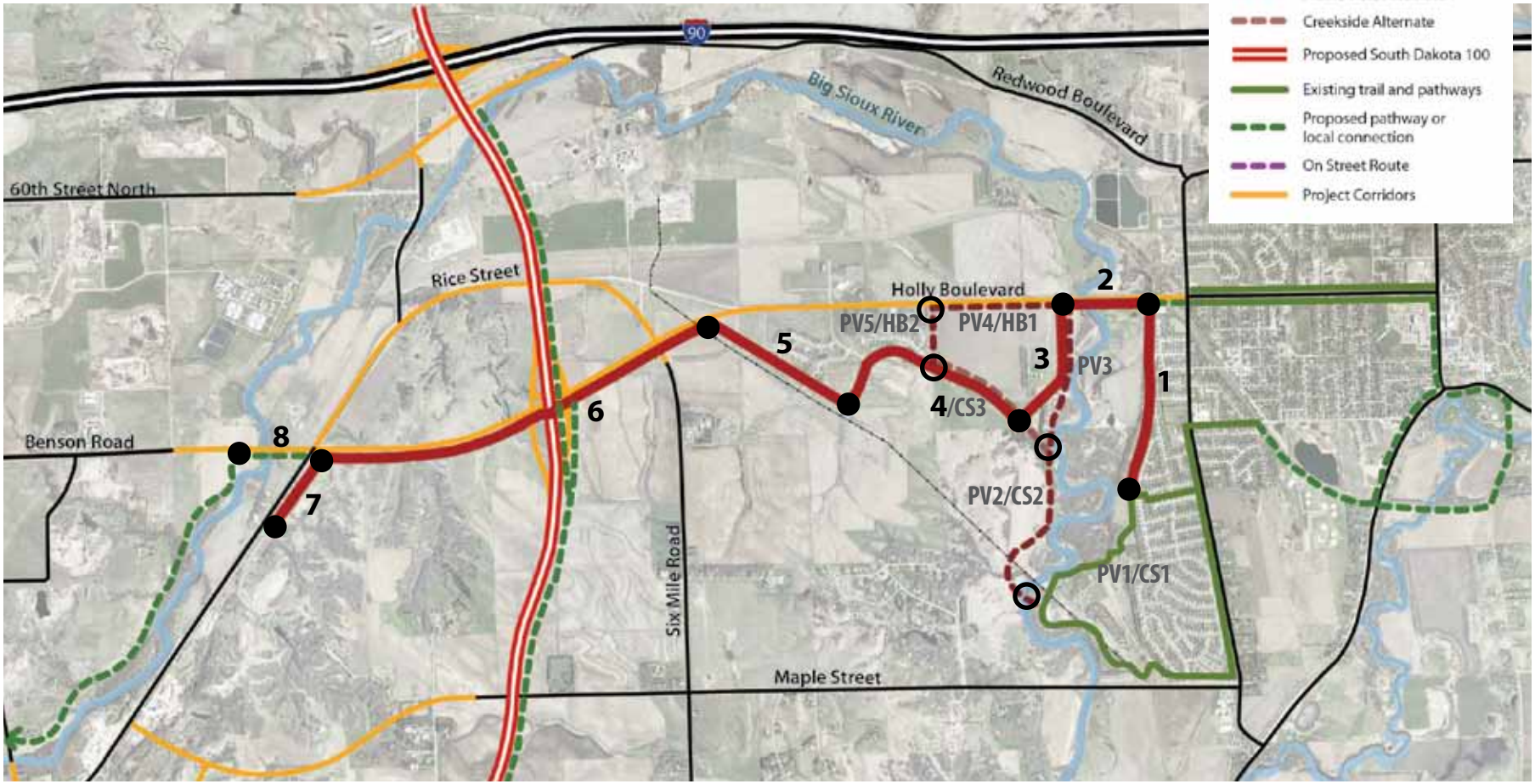
From Brandon, this option:

- Follows the eastern edge of the expanded Big Sioux Recreation Area to Holly Boulevard.
- Continues along the sanitary sewer easement that serves the Bluffs development and follows the WAPA power line easement to Holly Boulevard/ Rice Street.
- Uses a sidepath along the future extension of Benson Road to reach the Big Sioux River and trail, with a link to Great Bear Recreation Area.
- Provides alternatives if passage through private property is not permitted.

Table 3.2: **Big Sioux/Brandon Concept One**

	Map Key	Segment	Mileage	Description
	1	City Trail Spur to Holly Boulevard	0.79	Multi-use trail follows a level shelf and access road on the eastern edge of newly acquired Big Sioux Recreation Area expansion.
	2	Holly Boulevard Sidepath, Big Sioux to Lift Station	0.35	Two-way sidepath on south side of Holly Boulevard and over Big Sioux river bridge. Segment is free of intersecting streets and driveway crossings. Existing bridge shoulder is about 15 feet wide, adequate for two-way trail traffic and a residual road shoulder, with vertical barrier between roadway and path. A widening of Holly Boulevard into existing shoulders requires construction of a new pathway bridge.
	3	Lift Station to Creek along Bluffs Sewer Easement	0.54	Multi-use trail along existing sewer easement through private (Metz) property. Probable conflict with property owners current agricultural use.
	4	Bluffs Sanitary Sewer Easement, Big Sioux boundary to WAPA easement	1.03	Multi-use trail along drainageway at base of hills. After leaving Metz property, continues through Van Buskirk Park and through greenway corridors dedicated in plat to WAPA easement.
	5	WAPA right-of-way to Benson Road extension alignment	0.68	Multi-use trail along WAPA transmission line. Easement is designated as a greenway and trail corridor in Bluffs master plan.
	6	Benson Road extension, WAPA easement to Rice Street corridor	1.60	Two-way sidepath on south side of Benson Street extension, with access to the SD 100 sidepath. Requires access management along Benson Road.
	7	Rice Street/E&E corridor, Benson Road extension to Great Bear entrance	0.35	Ramp from Benson Road grade separation and multi-use trail along eastern side of Ellis & Eastern right-of-way.
	8	Benson Road extension, Rice Street to Big Sioux Trail extension (Sioux Falls)	0.26	Sidepath on south side of Benson Road overpass over Rice Street and railroads, with grade level access to extended Big Sioux Trail at future Benson Road river crossing.
Prairie Vista Alternate	PV1	Existing Big Sioux Bike Trail, City Trail Spur to Suspension Bridge	0.79	Existing paved trail in Big Sioux Recreation Area, with paved trail spur to suspension bridge over the river. Cyclists should walk over suspension bridge because of width limitation.
Prairie Vista Alternate	PV2	Prairie Vista Trail, Suspension Bridge to north point of existing trail	0.73	Surfaced, multi-use trail generally following level alignment of the existing nature trail.
Prairie Vista Alternate	PV3	Prairie Vista North, current north point to Holly Boulevard	0.66	Multi-use trail, continuing on highest available level ground along the Big Sioux River in Big Sioux Recreation Area's new expansion. May follow part of the north-south segment of the Bluffs sewer easement.
Prairie Vista Alternate	PV4	Holly Boulevard, lift station to edge of the Bluffs development	0.52	Continued two-way sidepath on south side of Holly Boulevard.
Prairie Vista Alternate	PV5	Holly Boulevard to Creek	0.25	Multi-use trail on edge of private property, along the edge of multi- and single-family development in the Bluffs subdivision. Alignment is level and has no impact on agricultural operation. Trail continues along creek on the main route.
Holly Alternate	HB1	Holly Blvd, Big Sioux to edge of Bluffs development	0.54	Two-way sidepath on south side of Holly Blvd. in place of routing on Bluffs sewer easement. Existing shoulders on Holly Boulevard should be retained.
Holly Alternate	HB2	Holly Boulevard to Creek	0.25	Multi-use trail on edge of private property, along the edge of multi- and single-family development in the Bluffs subdivision. Same as segment PV5. Alignment is level and has no impact on agricultural operation. Trail continues along creek on the main route.

BIG SIOUX/BRANDON TO GREAT BEAR - Concept One



Creekside Alternate

Map Key	Segment	Mileage	Description
CS1	Existing Big Sioux Bike Trail, City Trail Spur to Suspension Bridge	0.79	Existing paved trail in Big Sioux Recreation Area, with paved trail spur to suspension bridge over the river. Cyclists should walk over suspension bridge because of width limitation. Same as PV1.
CS2	Prairie Vista Trail, Suspension Bridge to north point of trail	0.73	Surfaced, multi-use trail generally following level alignment of the existing nature trail. Same as PV2
CS3	Creek/sewer alignment, Prairie Vista Trail to Bluffs development		Follows creek and sewer easement at base of hills to main route. While this route uses the easement over private property, it avoids disruption of existing agricultural uses.

BIG SIOUX/BRANDON TO GREAT BEAR - Concept Two

Rail with Trail

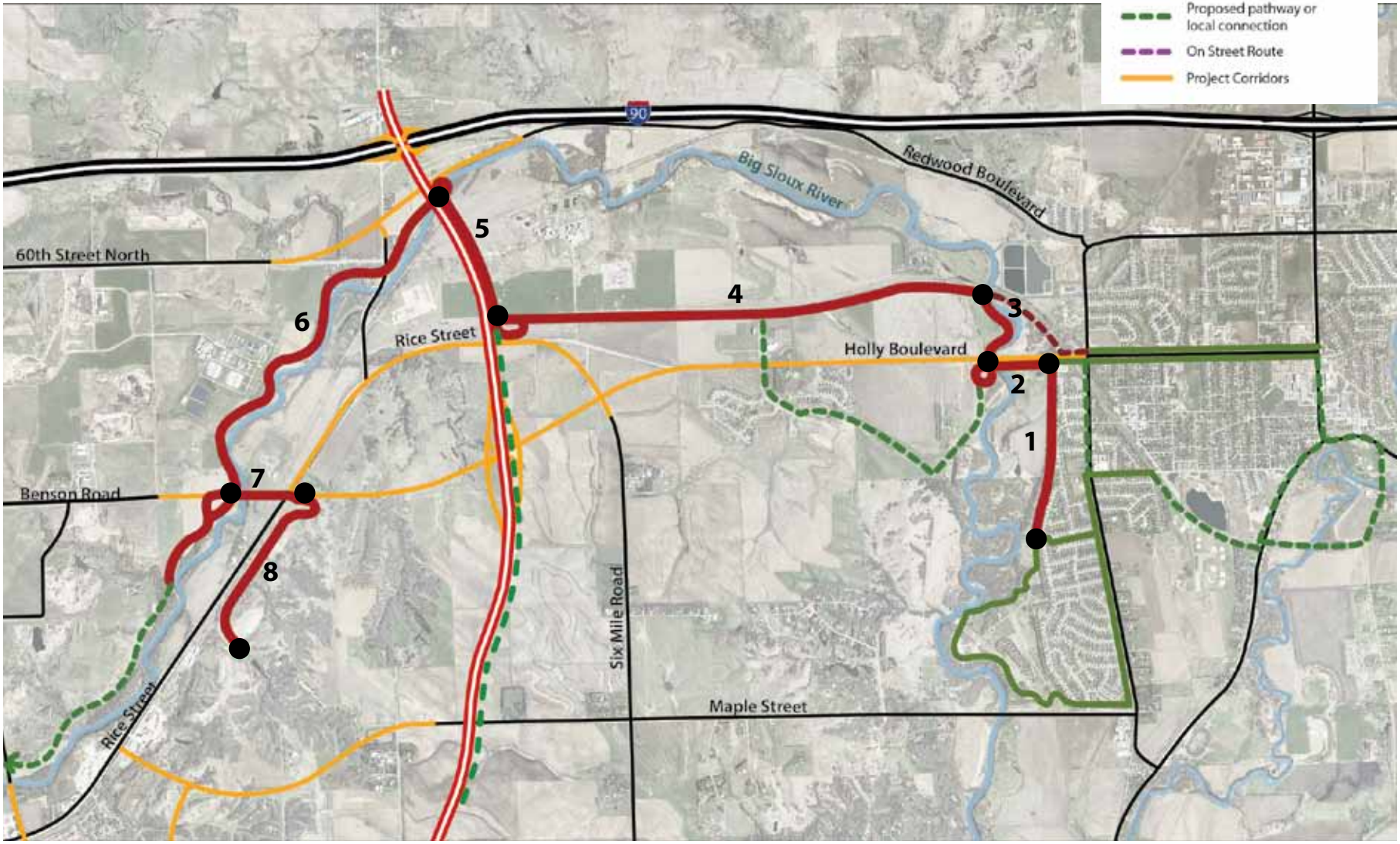
From Brandon, this option:

- Uses the eastern edge of the expanded Big Sioux Recreation Area to Holly Boulevard, in common with Concept 1.
- Follows the southern edge of the Ellis & Eastern Railroad as a "rail-with-trail" to the future SD 100.
- Uses the proposed pathway along SD 100 to the Big Sioux River, with a link to Great Bear Recreation Area.

Table 3.3: **Big Sioux/Brandon Concept Two**

Map Key	Segment	Mileage	Description
1	City Trail Spur to Holly Boulevard	0.79	Multi-use trail follows a level shelf and access road on the eastern edge of newly acquired Big Sioux Recreation Area expansion.
2	Holly Boulevard Sidepath, Big Sioux expansion to west riverbank	0.25	Two-way sidepath on south side of Holly Boulevard and over Big Sioux river bridge. Segment is free of intersecting streets and driveway crossings. Existing bridge shoulder is about 15 feet wide, adequate for two-way trail traffic and a residual road shoulder, with vertical barrier between roadway and path. A widening of Holly Boulevard into existing shoulders requires construction of a new pathway bridge.
3	Big Sioux River, Holly Blvd. to Ellis & Eastern	0.50	Ramp from sidepath to riverbank, passing under existing Holly Blvd. bridge to south side of E&E right-of-way.
4	Ellis & Eastern, Big Sioux River to SD 100	2.06	Multi-use rail-with-trail on south side of low-volume short line. Trail corridor may be on private property immediately adjacent to railroad ROW.
5	SD 100, Ellis & Eastern to Big Sioux River	0.60	Uses planned sidepath along SD 100. Includes access ramp from grade to SD 100 overpass over railroad. Follows SD 100 over Big Sioux River to north bank.
6	Big Sioux River, SD 100 to Benson Road extension	1.86	Multi-use trail on north bank of Big Sioux River, with extensive use of public property, including Sioux Falls wastewater treatment plant.
7	Benson Road extension, Big Sioux River to Rice Street	0.26	Sidepath on south side of Benson Road overpass over Rice Street and railroads, with grade level access to Rice Street. Includes access ramps to grade. Big Sioux Trail (Sioux Falls) continues south and west from this point to current trail at Diversion Channel.
8	Rice Street/E&E corridor, Benson Road extension to Great Bear entrance	0.35	Ramp from Benson Road grade separation and multi-use trail along eastern side of Ellis & Eastern right-of-way.

BIG SIOUX/BRANDON TO GREAT BEAR - Concept Two



BIG SIOUX/BRANDON TO GREAT BEAR - Concept Three

Holly/Rice Sidepath

From Brandon, this option:

Uses the eastern edge of the expanded Big Sioux Recreation Area to Holly Boulevard, in common with Concepts 1 and 2

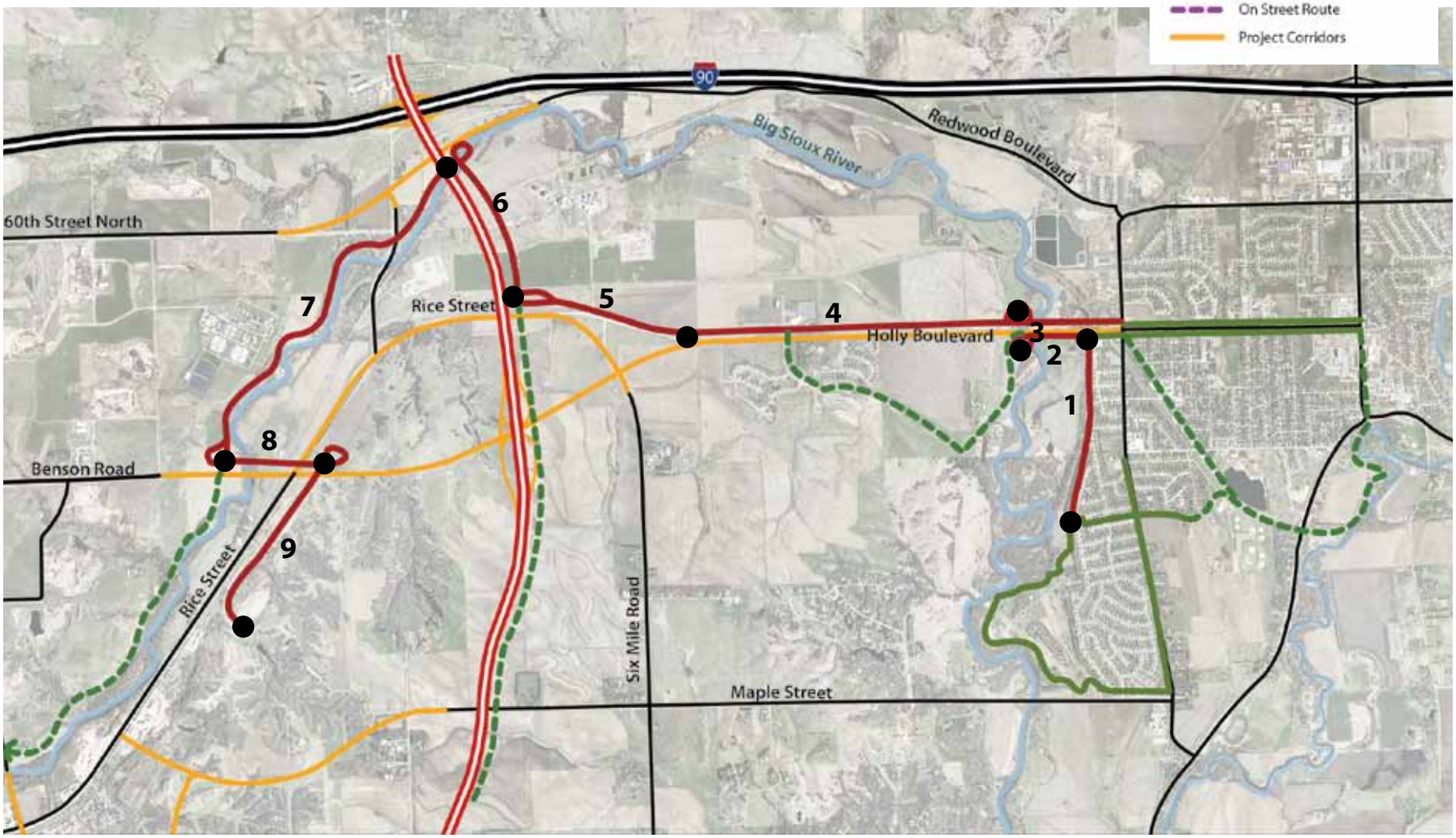
Follows Holly Boulevard and Rice Street to SD 100

Follows the proposed pathway along SD 100 to the river, with a link to Great Bear Recreation Area, similar to the previous concepts.

Table 3.4: **Big Sioux/Brandon Concept Three**

Map Key	Segment	Mileage	Description
1	City Trail Spur to Holly Boulevard	0.79	Multi-use trail follows a level shelf and access road on the eastern edge of newly acquired Big Sioux Recreation Area expansion.
2	Holly Boulevard Sidepath, Big Sioux expansion to west riverbank	0.25	Two-way sidepath on south side of Holly Boulevard and over Big Sioux river bridge. Segment is free of intersecting streets and driveway crossings. Existing bridge shoulder is about 15 feet wide, adequate for two-way trail traffic and a residual road shoulder, with vertical barrier between roadway and path. A widening of Holly Boulevard into existing shoulders requires construction of a new pathway bridge.
3	Big Sioux River underpass under existing bridge	0.10	Ramp from sidepath to riverbank, passing under existing Holly Blvd. bridge to north side of Holly.
4	Holly Boulevard, Big Sioux River to Benson Road divergence	1.35	Two-way sidepath on north side of Holly Boulevard. Two way travel assumes controlled access along north side, with a limitation of 6 to 8 points of access. More frequent access points may require one-way sidepaths for travel with traffic. Existing shoulders on Holly Boulevard should be retained.
5	Vacated Holly Boulevard right-of-way, Benson Road divergence to SD 100	0.70	Multi-use trail on existing Rice Street right-of-way, vacated with realignment and connection of Rice Street and Six Mile Road
6	SD 100, Vacated Rice Street to Big Sioux River	0.60	Uses planned sidepath along SD 100. Includes access ramp from grade to SD 100 overpass over railroad. Follows SD 100 over Big Sioux River to north bank.
7	Big Sioux River, SD 100 to Benson Road extension	1.86	Multi-use trail on north bank of Big Sioux River, with extensive use of public property, including Sioux Falls wastewater treatment plant.
8	Benson Road extension, Big Sioux River to Rice Street	0.26	Sidepath on south side of Benson Road overpass over Rice Street and railroads, with grade level access to Rice Street. Includes access ramps to grade. Big Sioux Trail (Sioux Falls) continues south and west from this point to current trail at Diversion Channel.
9	Rice Street/E&E corridor, Benson Road extension to Great Bear entrance	0.35	Ramp from Benson Road grade separation and multi-use trail along eastern side of Ellis & Eastern right-of-way.

BIG SIOUX/BRANDON TO GREAT BEAR - Concept Three



BIG SIOUX/BRANDON TO GREAT BEAR - Concept Four

River Route

From Brandon, this option:

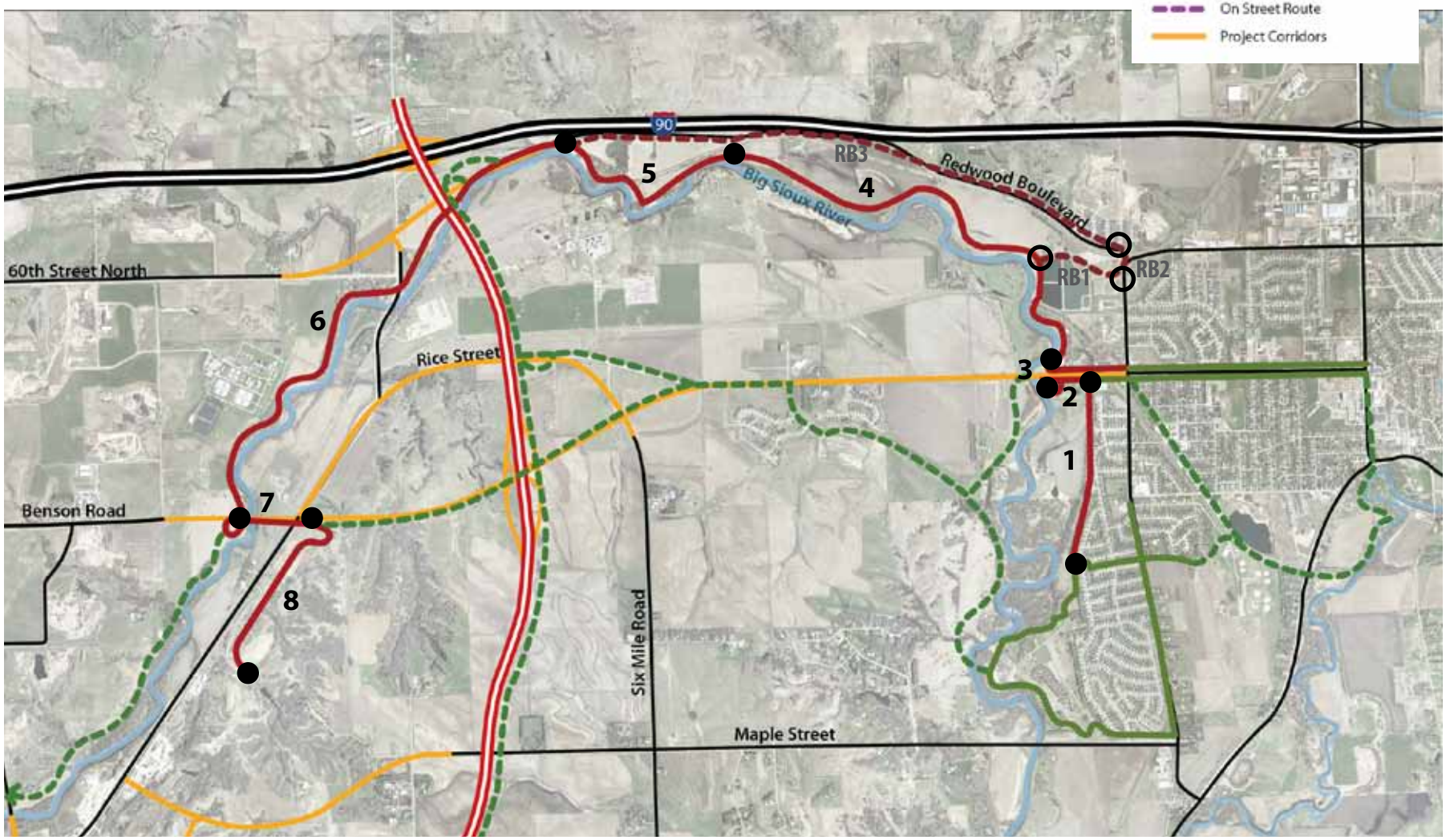
- Uses the eastern edge of the expanded Big Sioux Recreation Area to Holly Blvd.
- Continues along the north bank of the Big Sioux River, with an alternative route along an improved Redwood Boulevard.
- Links back to Great Bear Recreation Area on the Benson Road extension bridge.

Table 3.5: **Big Sioux/Brandon Concept Four**

Map Key	Segment	Mileage	Description
1	City Trail Spur to Holly Boulevard	0.79	Multi-use trail follows a level shelf and access road on the eastern edge of newly acquired Big Sioux Recreation Area expansion.
2	Holly Boulevard Sidepath, Big Sioux expansion to east riverbank	0.25	Two-way sidepath on south side of Holly Boulevard and over Big Sioux river bridge. Segment is free of intersecting streets and driveway crossings. Existing bridge shoulder is about 15 feet wide, adequate for two-way trail traffic and a residual road shoulder, with vertical barrier between roadway and path. A widening of Holly Boulevard into existing shoulders requires construction of a new pathway bridge. A north side would also be developed from Sioux Blvd. to the eastern bridge approach.
3	Big Sioux River underpass under existing bridge	0.10	Ramp from sidepath to riverbank, passing under existing Holly Blvd. bridge.
4	Big Sioux Riverfront, Holly Boulevard to BNSF bridge	2.56	Multi-use trail along north side of river. Southern part is located on the edge of Brandon's wastewater treatment facility. Beyond that, the riverfront is privately owned, requiring property owner agreement and grant or sale of easement or trail ROW.
5	Big Sioux Riverfront, BNSF Bridge to Redwood Blvd.	0.45	Multi-use trail along north side of river with underpass under BNSF tracks. Segment extends to convergence with Redwood Blvd., where redwood runs along riverbank.
6	Big Sioux Riverfront, Redwood Blvd. to Benson Road extension	2.25	Multi-use trail on north bank of Big Sioux River, with extensive use of public property, including Sioux Falls wastewater treatment plant. Big Sioux Trail (Sioux Falls) continues south and west from this point to current trail at Diversion Channel. Includes grade separation and ramp access to SD 100 sidepath
7	Benson Road extension, Big Sioux River to Rice Street	0.26	Sidepath on south side of Benson Road overpass over Rice Street and railroads, with grade level access to Rice Street. Includes access ramps to grade.
8	Rice Street/E&E corridor, Benson Road extension to Great Bear entrance	0.35	Ramp from Benson Road grade separation and multi-use trail along eastern side of Ellis & Eastern right-of-way.
RB1	Big Sioux River at Brandon wastewater facility to Sioux Boulevard	0.38	Multi-use trail on north periphery of treatment plant.
RB2	Sioux Blvd. Underpass to Redwood Blvd.	0.05	Sidepath on west side of street and shared roadway with sharrows on street.
RB3	Redwood Blvd., Sioux Blvd. to river convergence	2.45	Complete street treatment of Redwood Blvd., with paving a two or three-lane section, bicycle lanes/ shoulders, and a two-way sidepath. South side sidepath has superior views and relationship to the river, but is adjacent to the railroad on its east end and may include some access interruptions. North side sidepath is uninterrupted because of parallel I-90 right-of-way, but requires street crossings.

Redwood Alternate

BIG SIOUX/BRANDON TO GREAT BEAR - Concept Four



BIG SIOUX/BRANDON TO GREAT BEAR - Concept Five

Maple Street

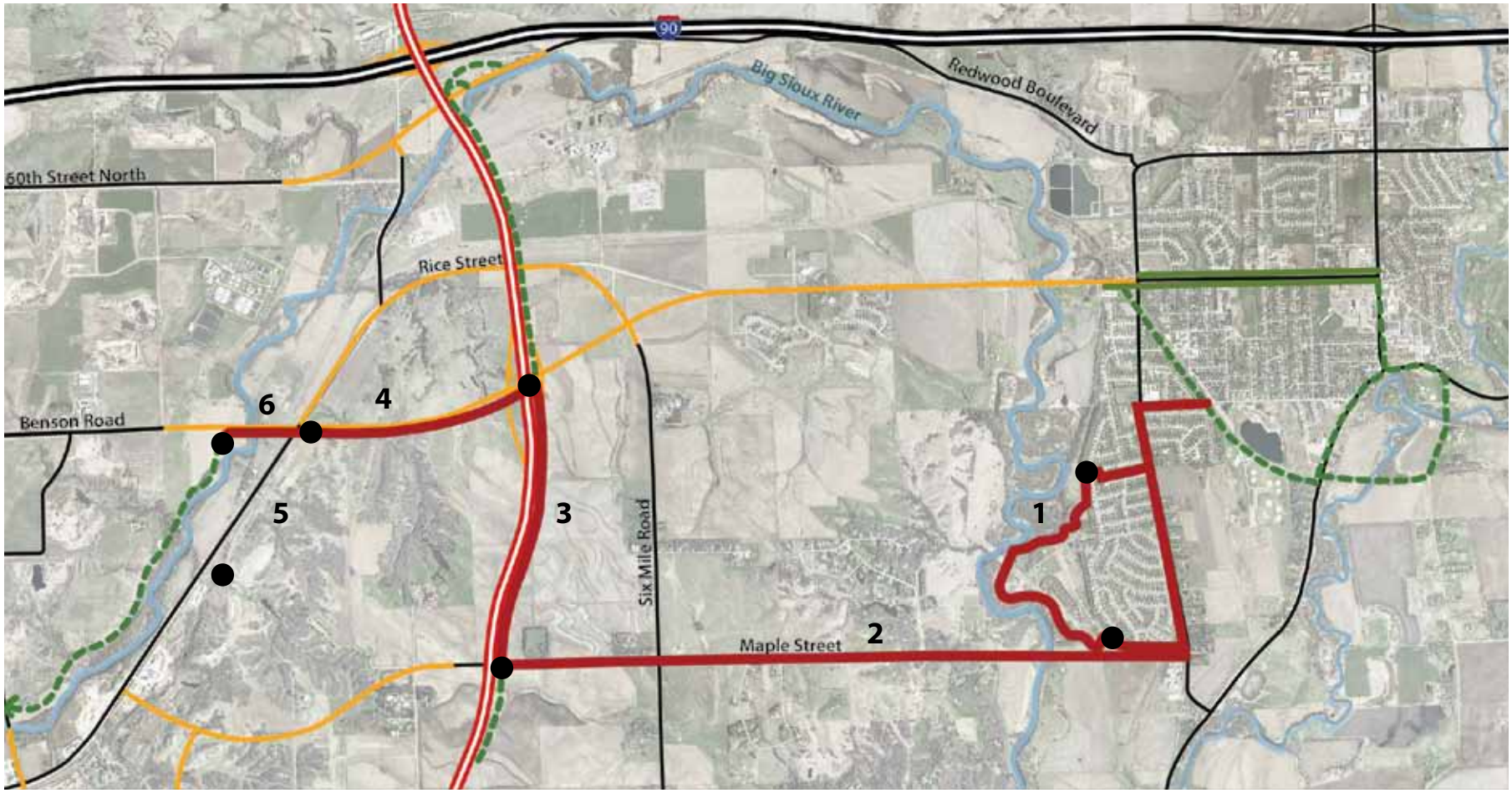
From Brandon, this option:

- Uses the existing Big Sioux bike trail to its trail head on Park Street.
- Continues west along an improved Maple Street to SD 100.
- Uses SD 100 and the Benson Road extension to connect to Great Bear and the Big Sioux Trail.

Table 3.6: **Big Sioux/Brandon Concept Five**

Map Key	Segment	Mileage	Description
Map Key	Segment	Length (mi)	Comments and Special Requirements
1	Big Sioux Recreation Area bike trail, City Trail Spur to Park Street trailhead	1.55	Existing multi-use trail, connecting to sidepath system on Park Street and Sioux Boulevard.
2	Maple Street, Park Street access to SD 100	2.55	Long-term improvement of Maple Street to complete street standards, with three-lane section, bike lanes, and a two-way sidepath, probably on north side of street. Two-way sidepath requires managed access. Current grade is steep proceeding westbound out of Big Sioux floodplain.
3	SD 100, Maple Street to Benson Road extension	1.1	SD 100 routing uses a programmed facility and avoids a difficult grade and railroad crossing issues on the route of extended Maple Street to Rice Street. Access to Benson Road through ramp and across single point urban interchange.
4	Benson Road Extension, SD 100 to Rice Street/Ellis & Eastern corridor	1.00	Two-way sidepath on south side of Benson Street extension, with access to the SD 100 sidepath. Requires access management on Benson Road and ramp to Rice Street corridor from overpass.
5	Rice Street/E&E corridor, Benson Road extension to Great Bear entrance	0.35	Ramp from Benson Road grade separation and multi-use trail along eastern side of Ellis & Eastern right-of-way.
6	Benson Road extension, Rice Street to Big Sioux Trail extension (Sioux Falls)	0.26	Sidepath on south side of Benson Road overpass over Rice Street and railroads, with grade level access to extended Big Sioux Trail at future Benson Road river crossing.

BIG SIOUX/BRANDON TO GREAT BEAR - Concept Five



BIG SIOUX/BRANDON TO GREAT BEAR - Evaluation

Table 3.7 summarizes the evaluation of these five options based on the ten criteria described in Part Two. This evaluation then is used to identify the most feasible concept.

Key:
++ Very high score on criterion
+ High score on criterion
o Neutral score on criterion
- Low score on criterion
-- Very low score on criterion

Most Feasible Concept

The Most Feasible Concept combines elements of Concepts 1 and 3. The MFC:

- Extends the existing Big Sioux bike trail north to Holly Boulevard along the eastern edge of the expanded recreation area property.
- Crosses the Big Sioux River with a buffered, two-way sidepath on the existing Holly Boulevard shoulder.
- Follows the sanitary sewer easement or an extension of the Prairie Vista Trail on new Big Sioux property to the sanitary sewer easements serving the Bluffs development.
-
- Continues along the creek to Van Buskirk Park in the Bluffs development, follows the planned greenway in the Bluffs to the WAPA power line, and continues along the WAPA right-of-way, turning north to the eastern edge of Rice Street right-of-way that will be vacated with the Rice/Six Mile realignment.
- Uses the vacated Rice Street right-of-way and SD 100 to reach the north bank of the Big Sioux River.
- Follows the Big Sioux to Benson Road, continuing south along the river to Sioux Falls, or connecting to Great Bear via the new Benson Road.

Under current conditions, this option can only be fully implemented with the development of the property between the Big Sioux expansion and the Bluffs. The current owner, who uses the land for agricultural purposes, is unlikely to make the easement available for trail development. If implementation takes place before a change in use or development of this property, the Prairie Vista option, using Big Sioux property north to Holly Boulevard, offers the most probable choice. The Creekside alternative, which follows the sewer easement but does not interfere with agricultural operations, may be acceptable to the property owner and is a better option because it avoids a very close approach to the river, and the resulting likelihood of flooding.

In addition, a possible Redwood Boulevard improvement as part of the SD 100 project or its eventual connection to North 60th Street should be done to complete street standards, including bike lanes and a pedestrian path on at least one side of the street. All property owners along the riverfront are unlikely to agree to selling property or granting an easement for a trail, and an upgraded and paved Redwood Boulevard would offer a scenic option with good riverfront visibility.

Local Connections

While not specifically part of the MPO's regional trail program, local connections add to the usefulness of the

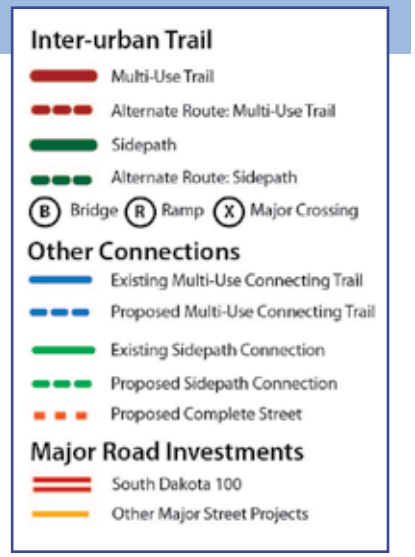
	Directness	Experience	Time Frame	Multiple Funding	Safety/Security	Neighborhood Services	Ease of Acquisition	Cost/ Constructability	Connectivity	Response to Users	Average Score (out of 65)	Rank
1 Bluffs Easement	+	+	+	+	++	++	- (main toute) + (alternates)	+	+	+	41.9	1
2 Rail with Trail	+	o	+	o	o	o	+	+	+	+	38.0	3
3 Holly/Rice Sidepath	+	--	++	+	+	+	++	++	+	o	38.7	2
4 River Route	--	++	--	-	o	--	--	-	+	++	35.4	4
5 Maple Street	++	-	--	+	+	-	++	o	+	-		

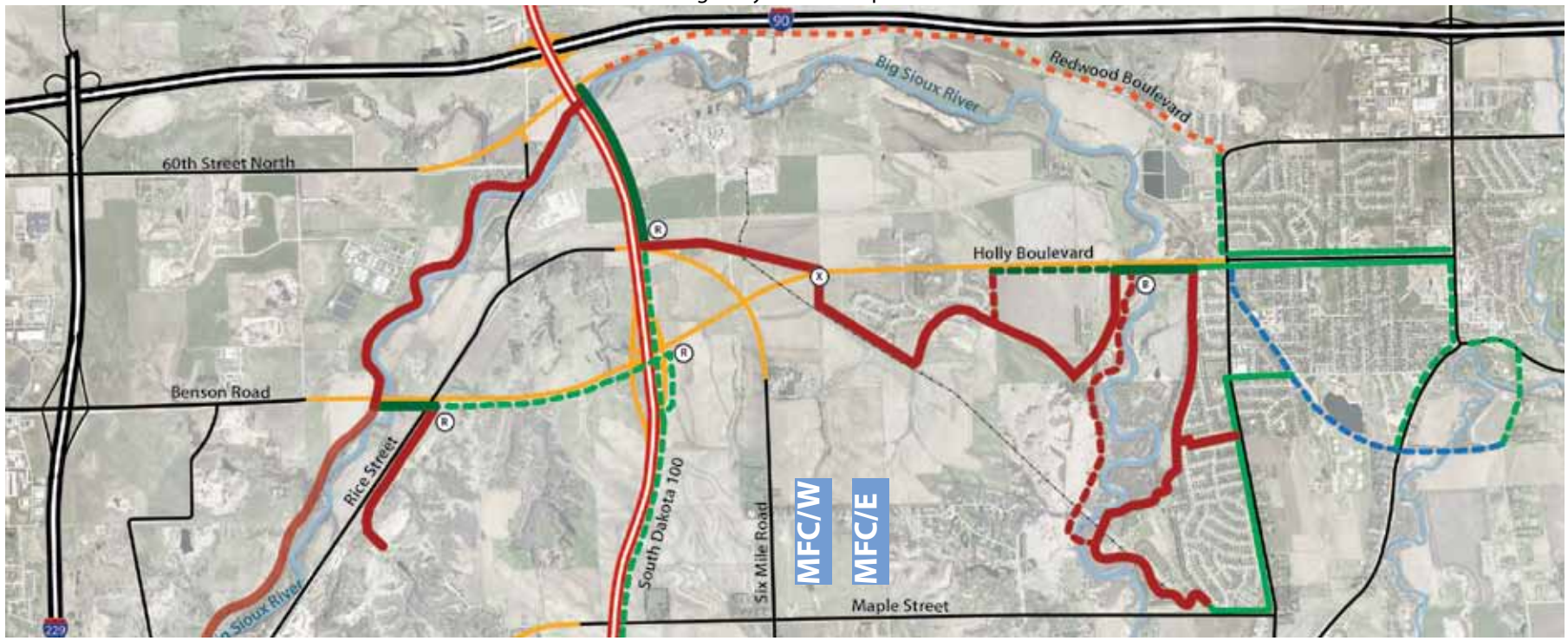
BIG SIOUX/BRANDON TO GREAT BEAR- Most Feasible Concept

inter-urban trails, assuring that local residents can get to them safely, and connecting regional users with local destinations and services. Brandon's existing trail loop, consisting of Big Sioux's paved bike trail, sidepaths on Parks Street and Sioux Boulevard, and the trail spur west of Sioux Boulevard, is an excellent start. Other potential local opportunities include:

- Linking the existing Big Sioux loop to Aspen and McHardy Parks. Aspen Boulevard has a wide sidewalk on its south side, connecting the Sioux Boulevard sidepath to Aspen Park Drive. The street and sidewalk should be upgraded to complete street standards to the Ellis & Eastern right-of-way. The unused railroad should be converted to interim trail use, and paved through Aspen Park and McHardy Park, using the railroad tunnel under SD 11 and converting the bridge over Split Rock Creek. Use of the rail corridor could include an agreement with the Ellis & Eastern to allow the railroad to reinstate rail operations without contest but with sufficient notice.

- Upgrading SD 11/Split Rock Boulevard as a complete street corridor from the railroad tunnel north. SD 11 has paved shoulders to the SD 264 junction and a sidepath connecting to the proposed trail along the E&E could complement the on-road facility. North of SD 264, frequent access drives suggest application of the one-way sidepath concept with separate sidewalk (see standards in Part Seven), connecting to the existing Holly Boulevard path.





BRANDON MFC/W

Inter-urban Trail

- Multi-Use Trail
- Alternate Route: Multi-Use Trail
- Sidepath
- Alternate Route: Sidepath
- (B) Bridge (R) Ramp (X) Major Crossing

Other Connections

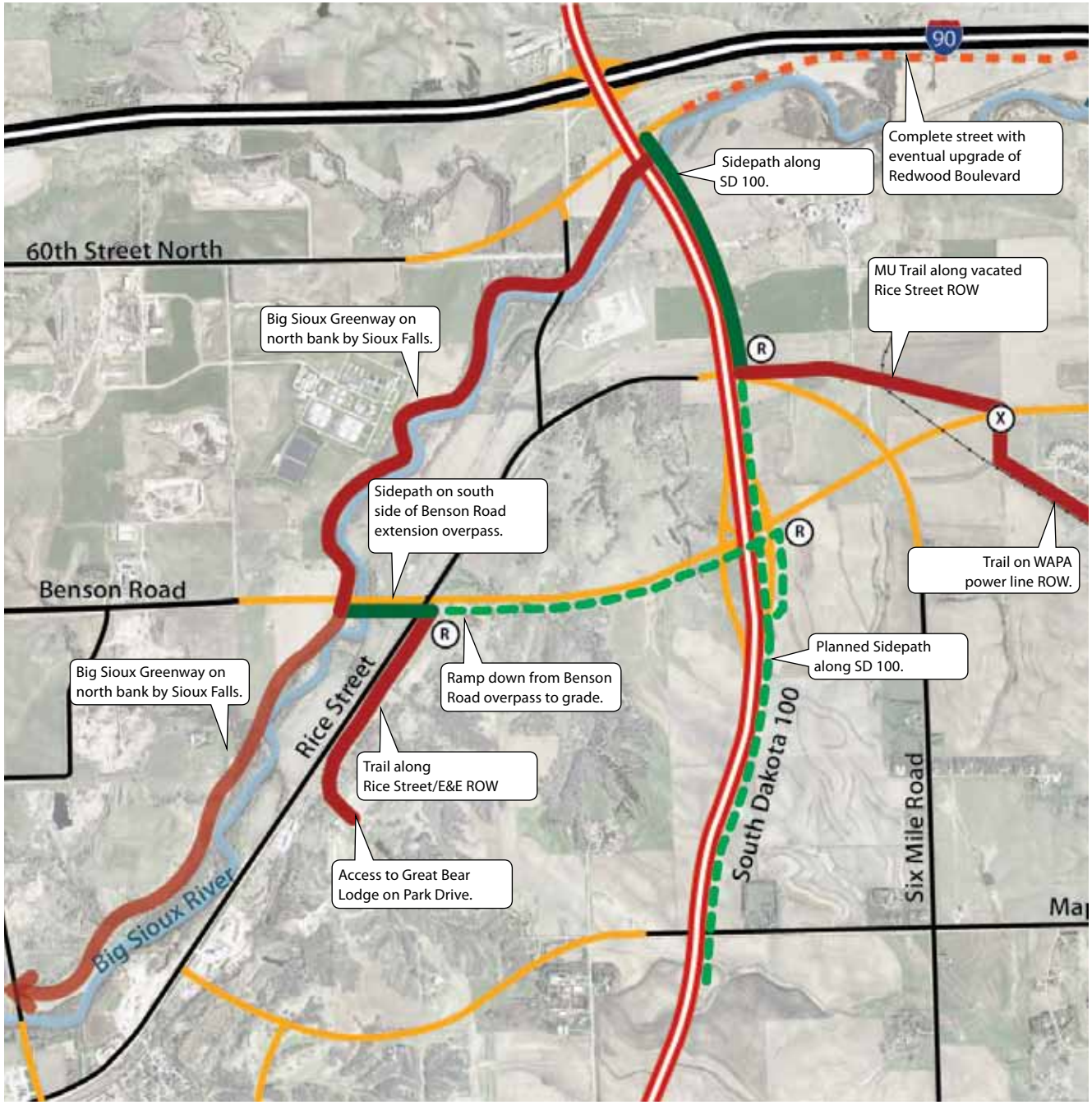
- Existing Multi-Use Connecting Trail
- Proposed Multi-Use Connecting Trail
- Existing Sidepath Connection
- Proposed Sidepath Connection
- Proposed Complete Street

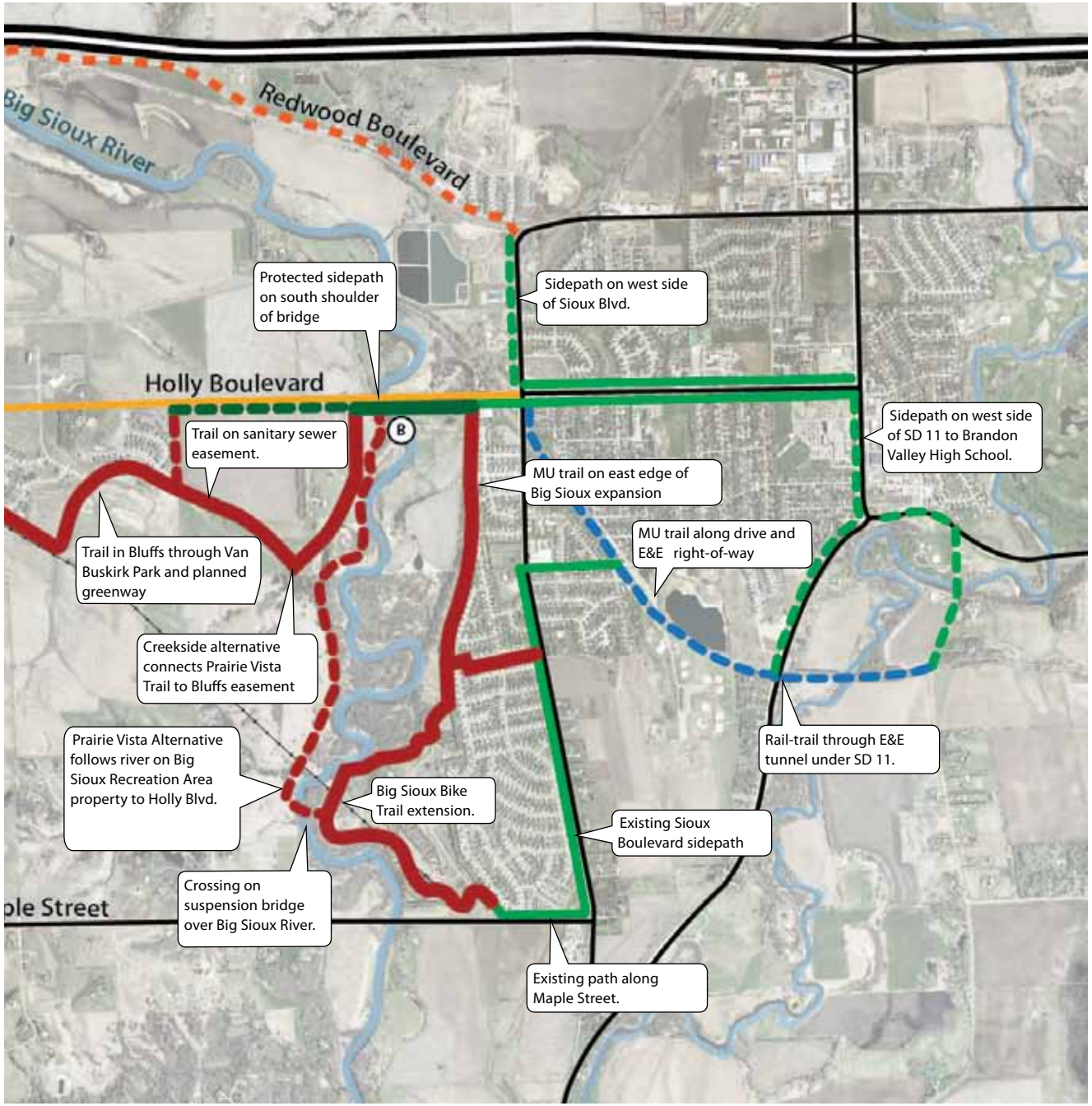
Major Road Investments

- South Dakota 100
- Other Major Street Projects

- Extending the Holly Boulevard sidepaths. These paths on both sides of the street would be extended to the Big Sioux River, where they intersect the inter-urban trail.

- Using green space adjacent to the Ellis & Eastern. A multi-use trail could be developed on the wide greenway adjacent to the Ellis & Eastern track, extending diagonally to Holly Boulevard.





BRANDON MFC/E

Inter-urban Trail

- Multi-Use Trail
- Alternate Route: Multi-Use Trail
- Sidepath
- Alternate Route: Sidepath
- (B) Bridge (R) Ramp (X) Major Crossing

Other Connections

- Existing Multi-Use Connecting Trail
- Proposed Multi-Use Connecting Trail
- Existing Sidepath Connection
- Proposed Sidepath Connection
- Proposed Complete Street

Major Road Investments

- South Dakota 100
- Other Major Street Projects

CHAPTER 4 | HARRISBURG TO YANKTON TRAIL PARK

This study corridor connects Harrisburg to the existing and proposed southern trail network in Sioux Falls. The Sioux Falls Trail Master Plan (2007) proposed the Diamond Creek Trail system, a network of on- and off-street routes that connects developing neighborhoods north of 85th Street to the Big Sioux Trail at Yankton Trails Park. This chapter of the MPO Multi-Use Trail Study considers options for linking the growing town of Harrisburg, southeast of Sioux Falls, to the Diamond Creek and Big Sioux systems.

A Sioux Falls to Harrisburg inter-urban connection serves both recreational and commuter audiences, and anticipates future development in the Harrisburg area. Unlike the Brandon-Sioux Falls corridor, topography in the Harrisburg study area is flat and the existing fabric is defined the grid of section-line roads. Harrisburg itself has not developed a local trail system, although it has plans for an extensive pathway network. Therefore, local access and connections to a regional system become very significant.

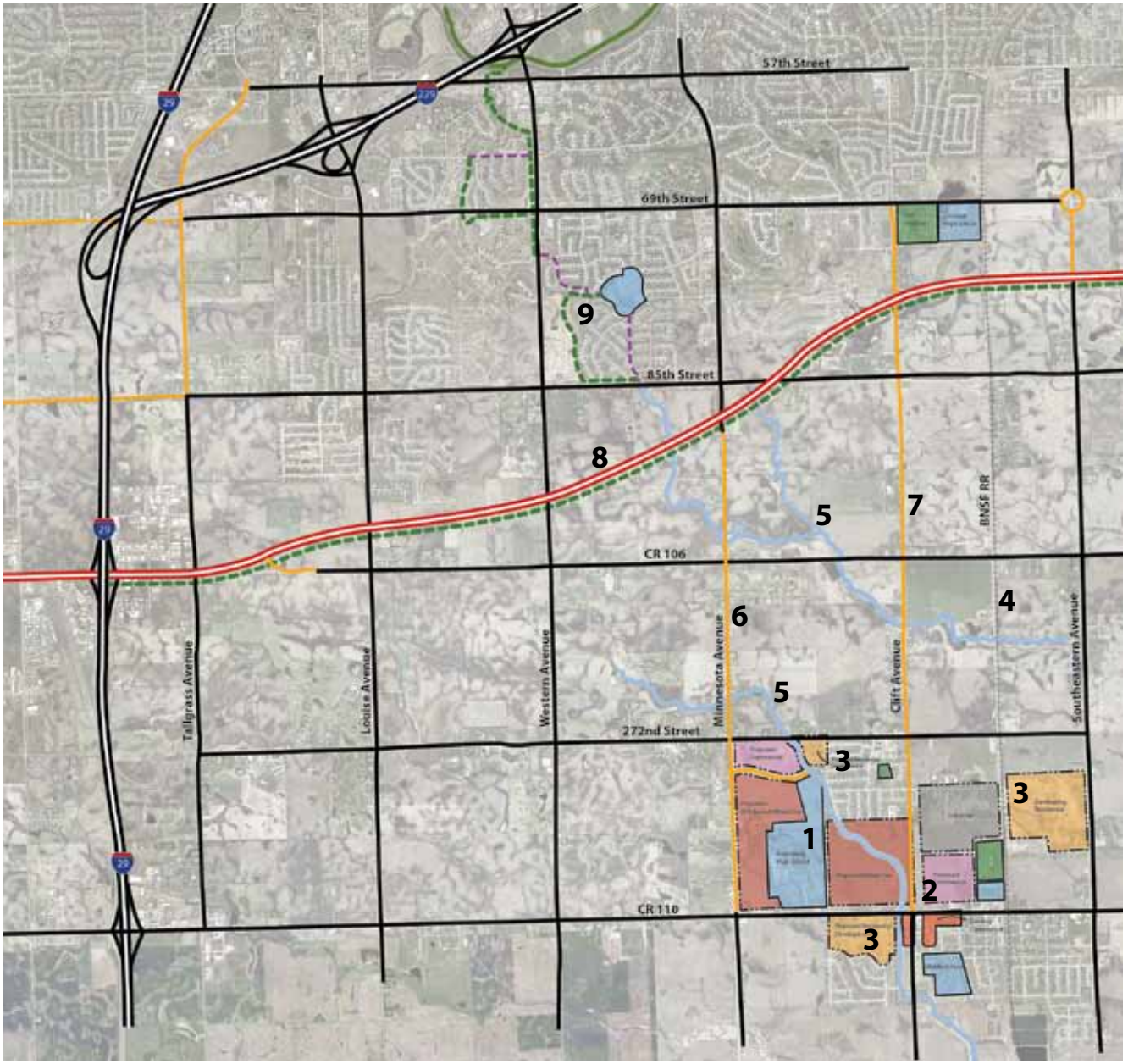
HARRISBURG TO YANKTON TRAIL PARK - Trail Determinants

The future South Dakota 100 ring road has a significant impact on transportation planning in the Harrisburg area, and also affects alternatives for a Harrisburg-Sioux Falls trail connection. The 2009 MPO plan identifies two potential connecting corridors, both of which bisect existing agricultural land and follow subtle drainage courses in a general southeast to northwest direction. The Trail Determinant Map identifies actions and issues that direct trail planning for this area, keyed to explanations in the table below.

Table 4.1: **Harrisburg Trail Determinants**

Map Key	Segment	Description
1	Harrisburg school development	The new Harrisburg High School occupies the southern part of a 100 acre parcel on Willow Street (CH 110) between Cliff and Minnesota Avenues. Currently, a new elementary school is under construction north of the high school parcel.
2	Cliff and Willow Node	The Cliff and Willow intersection is emerging as the town's primary commercial node. Existing commercial development is concentrated on the southeast corner. A mixed use commercial project has been announced on the northeast corner, and developer interest also exists on the northwest corner.
3	Residential Development	Near-term residential development is planned along Southeastern Avenue between Willow and 272nd Street; south of Willow and west of Cliff; and north of the new elementary school, completing an existing subdivision.
4	BNSF Railroad	The Burlington Northern & Santa Fe main line into Sioux Falls follows the half-section line between Southeastern and Cliff Avenues.
5	Regional Drainage	Land in the Harrisburg study area is flat and stormwater tends to pond, making treatment of drainage corridors especially important as development continues. The area straddles a drainage divide that runs roughly between 272nd Street and County Highway 106. Land to the south drains toward Nine Mile Creek, south of town; land to the north drains into the Diamond Creek system and ultimately to the Big Sioux River. North of 85th Street, this drainage pattern becomes the spine of the proposed pathway network for southern Sioux Falls.
6	Minnesota Avenue	Minnesota Avenue (South Dakota 115) has been improved to a four-lane divided section to a point south of 85th Street. The section also includes paved shoulders and conventional sidewalks. An upgrade of the existing two-lane, rural section road to CH 110 is scheduled.
7	Cliff Avenue	Cliff Avenue, which connects Harrisburg to I-229 and central Sioux Falls, is a very busy commuter corridor, and serves Harrisburg's industrial and commercial centers. The street is currently a two-lane rural section county road and will need improvement in the relatively near future. A three-lane facility is probably the most likely option for the foreseeable future.
8	South Dakota 100	The SD 100 corridor runs in a generally east-west direction through the Harrisburg study area, between the 77th Street alignment and CH 106, and crossing 85th Street near Minnesota Avenue. The SD 100 project includes a sidepath, on the south side of this controlled access facility. Intersections with SD 100 are at grade through the study area; 85th Street is grade separated without access.
9	Diamond Creek Trail Network	The Sioux Falls Trail Master Plan (RDG, 2007) proposed a Diamond Creek trail network composed of multi-use trails, sidepaths, and on-street routes to connect growing residential areas north of 85th Street to the Big Sioux system at Yankton Trail Bridge. Development of part of this system completes the Harrisburg link to Sioux Falls.

HARRISBURG TO YANKTON TRAIL PARK - Trail Determinants



Determinants Legend

- Highway
- Existing road
- Existing railroad
- Proposed alignment
- Proposed limited access highway
- Existing trail and pathways
- Proposed local connection
- On street connection
- Vacated right-off-way
- Existing nature trail

HARRISBURG TO YANKTON TRAIL PARK - Concept One

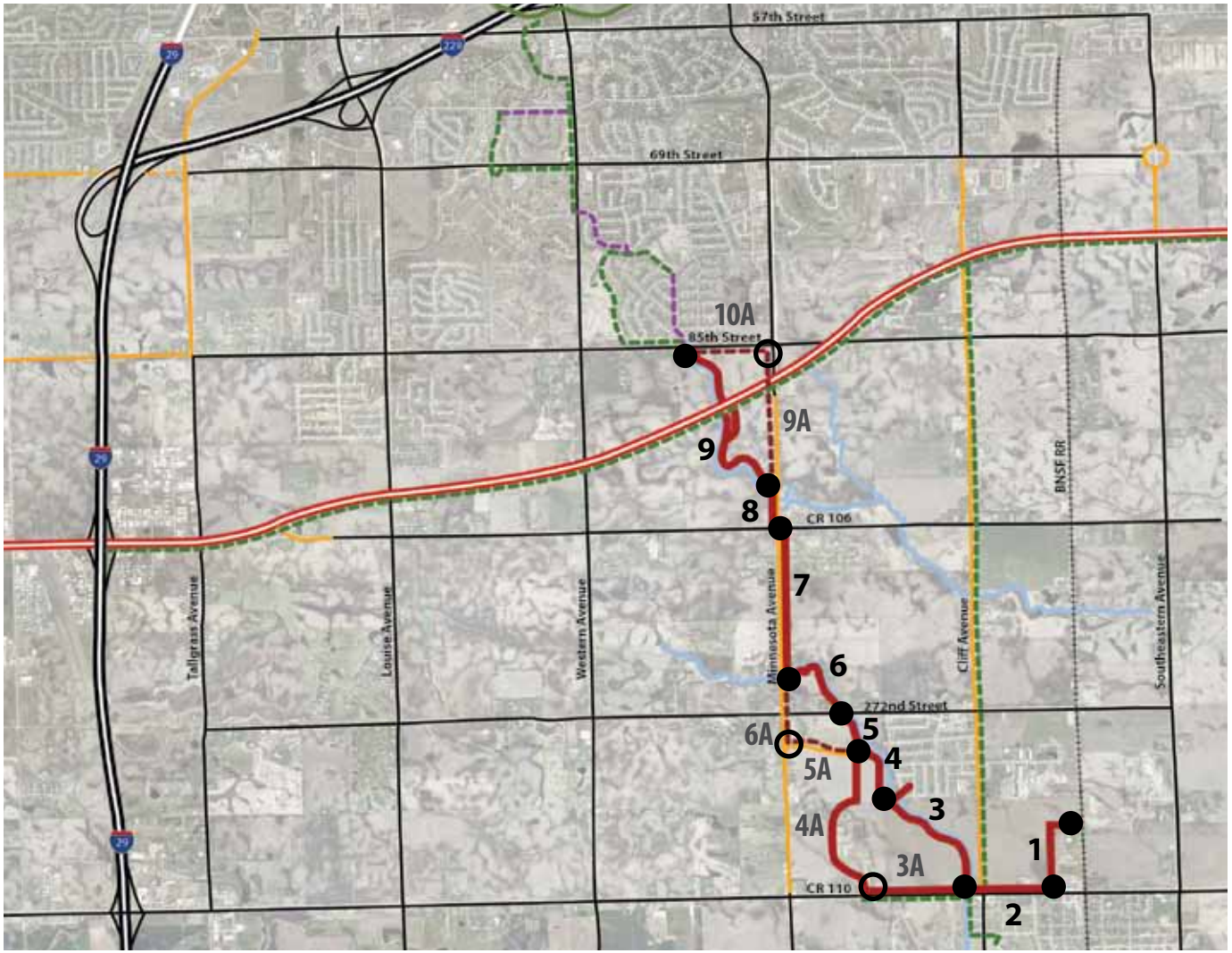
Watercourse Route

From Harrisburg, this option:

- Begins at Harrisburg's sports fields and Liberty Elementary School, connecting to the Harrisburg High School campus along Willow Street.
- Continues around the perimeter of the Harrisburg High School and new elementary school campuses.
- Follows drainageways (with a sidepath alternative along streets) to Minnesota Avenue.
- Continues north along Minnesota Avenue, taking advantage of a near-term improvement project.
- Follows drainageways to 85th Street, connecting to Sioux Falls' proposed Diamond Creek trail network leading to the Big Sioux Trail at Yankton Trail Bridge.

Map Key	Segment	Mileage	Description
1	Playing fields and Liberty School campus to Willow Street.	0.36	Multi-use trail on north and western edges of fields and Freedom School campus, on the west side of Columbia Street. Routing serves school and park.
2	Willow Street, Columbia Street to Watercourse	0.45	Complete street improvement along Willow Street, currently a two-lane rural section facility. Probable section should be three lanes with bike lanes. A two-way sidepath with access management should be included on the north side of the street, with exact alignments incorporated into development projects on the northeast and northwest corners of Willow and Cliff. Special intersection crossing design required at the Cliff Avenue crossing.
3	Watercourse, Willow Street to Freedom School site	0.76	Multi-use trail along west side of watercourse, incorporated into future private mixed use development. Trail connects to southeast corner of new Freedom School site on the back part of a city-owned lot. Includes a trail bridge to a city lot on United Avenue, connecting a residential area to the schools and inter-urban trail.
4	Periphery of Freedom School site	0.36	Multi-use trail along on eastern and northern edges of Freedom School site. Route diverges from watercourse because private residential lots fronting United Avenue extend across the creek.
3A	Willow Street, Watercourse to High School campus	0.55	Alternative or complementary project continuing Willow Street complete street design and sidepath to west side of high school entrance drive. Willow Street project is needed to provide pedestrian/bicycle access to high school.
4A	High School/school land periphery to Freedom School site	1.37	Multi-use trail on western and northern edge of school property, connecting to watercourse at southeast corner of Freedom School site.
5	Watercourse, north side of Freedom School to 272nd Street	0.28	Multi-use trail along west side of creek.
6	Watercourse, 272nd Street to Minnesota Avenue	0.45	Surface trail crossing or undercrossing with future reconstruction of 272nd Street. Multi-use trail along west and south of watercourse. Trail along drainageway requires voluntary acquisition of easement or right-of-way.
5A	Future Tom Sawyer Drive, school to Minnesota Avenue	0.41	Alternative if watercourse right-of-way is unavailable. Sidepath along north side of access road.
6A	Minnesota Avenue, Tom Sawyer Drive to watercourse	0.38	Alternate if watercourse right-of-way is unavailable. Minnesota Avenue (SD 115) improvement, planned as a 4-lane divided facility with paved shoulders. Two-way sidepath along east side of roadway in place of conventional sidewalk; access control along Minnesota Avenue corridor makes two-way sidepath feasible.
7	Minnesota Avenue, watercourse to County Highway 106	0.80	Minnesota Avenue (SD 115) improvement, planned as a 4-lane divided facility with paved shoulders. Two-way sidepath along east side of roadway in place of conventional sidewalk; access control along Minnesota Avenue corridor makes two-way sidepath feasible. Path crosses to west side of Minnesota at CH 106 intersection.
8	Minnesota Avenue, CH 106 to Diamond Creek tributary	0.10	Minnesota Avenue (SD 115) improvement. Two-way sidepath along west side of roadway in place of conventional sidewalk
9	Diamond Creek tributary, Minnesota Avenue to 85th Street	1.25	Multi-use trail along east side of drainageway, to be incorporated into future development design. Trail includes access to the SD 100 sidepath on the south side of the arterial; SD 100 design should provide clearance for the trail under the road. Trail aligns with Grange Avenue, which provides direct access to Journey School.

HARRISBURG TO YANKTON TRAIL PARK - Concept One



- Primary route
- Sidepath Alternates
- Creekside Alternate
- Proposed South Dakota 100
- Existing trail and pathways
- Proposed pathway or local connection
- On Street Route
- Project Corridors

Map Key	Segment	Mileage	Description
9A	Minnesota Avenue, Diamond Creek tributary to 85th Street	0.90	Alternative if watercourse right-of-way is unavailable. Continuation of sidepath on west side of improved Minnesota Avenue.
10A	85th Street, Minnesota Avenue to Grange Avenue	0.45	Two-way sidepath on south side of 85th Street. Future upgrade to 85th should be to complete street standards, with bicycle lanes.

HARRISBURG TO YANKTON TRAIL PARK - Concept Two

Railroad Corridor

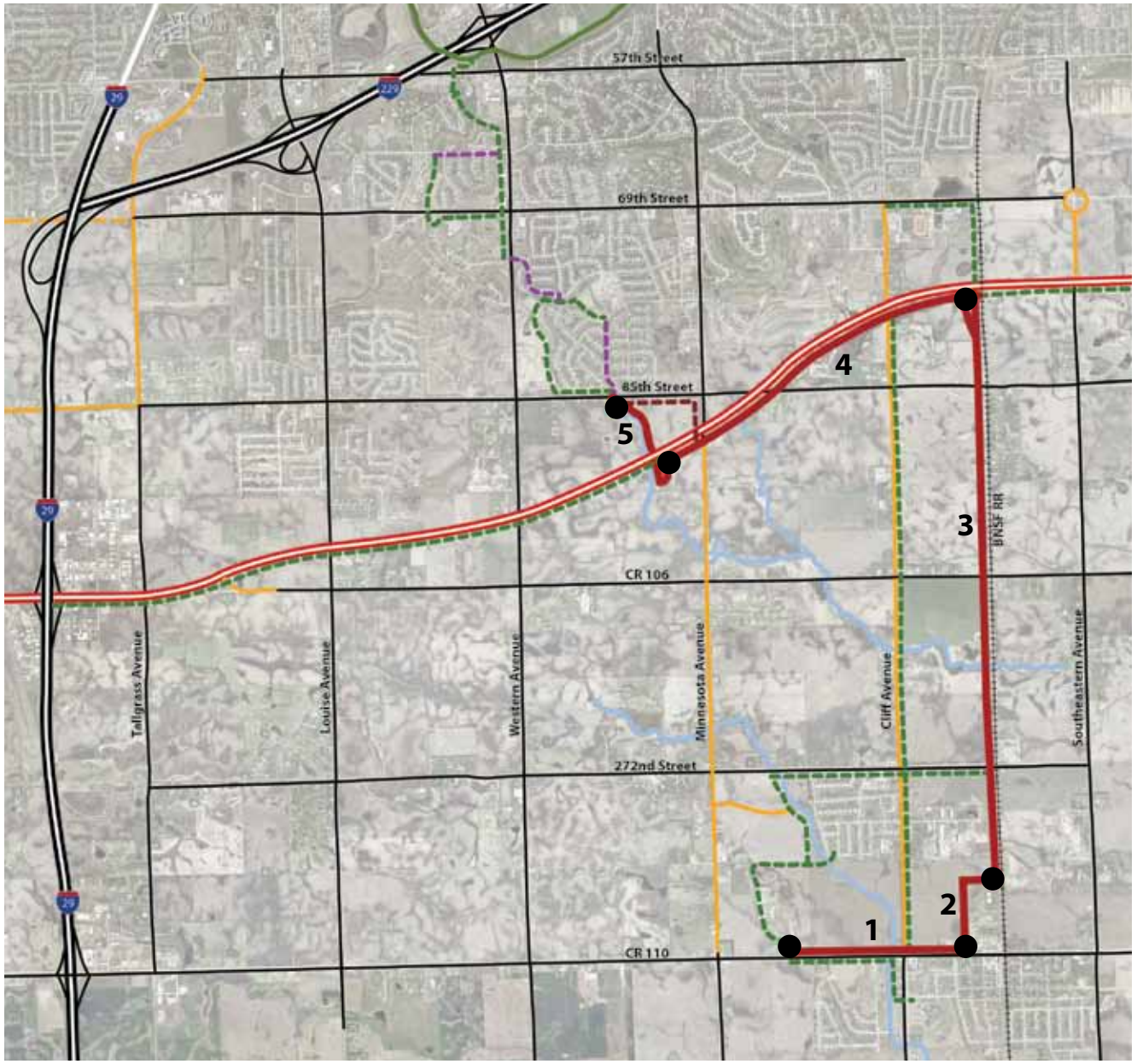
From Harrisburg, this option:

- Begins at the high school and establishes two legs of a Harrisburg Loop that connects sports fields and schools together.
- Follows right-of-way adjacent to the BNSF corridor to the proposed SD 100.
- Continues on the SD 100 path to drainageway west of Minnesota Avenue, with sidepath alternatives.

Table 4.3: Harrisburg Concept Two

Map Key	Segment	Mileage	Description
1	Willow Street, High School to Columbia Street	0.45	Complete street improvement along Willow Street, currently a two-lane rural section facility. Probable section should be three lanes with bike lanes. A two-way sidepath with access management should be included on the north side of the street, with exact alignments incorporated into development projects on the northeast and northwest corners of Willow and Cliff. Special intersection crossing design required at the Cliff Avenue crossing.
2	Columbia Street and playing fields, Willow Street to BNSF	0.50	Multi-use trail on north and western edges of fields and Freedom School campus, on the west side of Columbia Street. Routing serves school and park.
3	BNSF Corridor, playing fields to SD 100 corridor	3.17	Multi-use trail adjacent and on the west side of BNSF right-of-way. Requires grade crossing at siding into Harrisburg Industrial Park south of 272nd Street. Ramp extends from trail corridor to SD 100 sidepath. Although not part of the Harrisburg-Sioux Falls inter-urban trail, the BNSF multi-use trail should continue to 69th Street for access to the Christian High School and USF Stadium.
4	SD 100, BNSF to Diamond Creek tributary	2.00	Sidepath on south side of SD 100. Cliff and Minnesota Avenue intersections are at grade, requiring special design for safe sidepath passage. Segment includes access from sidepath to trail proceeding north along Diamond Creek tributary.
5	Diamond Creek tributary, SD 100 to 85th Street	0.27	Multi-use trail along east side of drainageway, to be incorporated into future development design. Trail includes access to the SD 100 sidepath on the south side of the arterial; SD 100 design should provide clearance for the trail under the road. Trail aligns with Grange Avenue, which provides direct access to Journey School.

HARRISBURG TO YANKTON TRAIL PARK - Concept Two



- Primary route
- Sidepath Alternates
- Creekside Alternate
- Proposed South Dakota 100
- Existing trail and pathways
- Proposed pathway or local connection
- On Street Route
- Project Corridors

HARRISBURG TO YANKTON TRAIL PARK - Concept Three

Minnesota Avenue

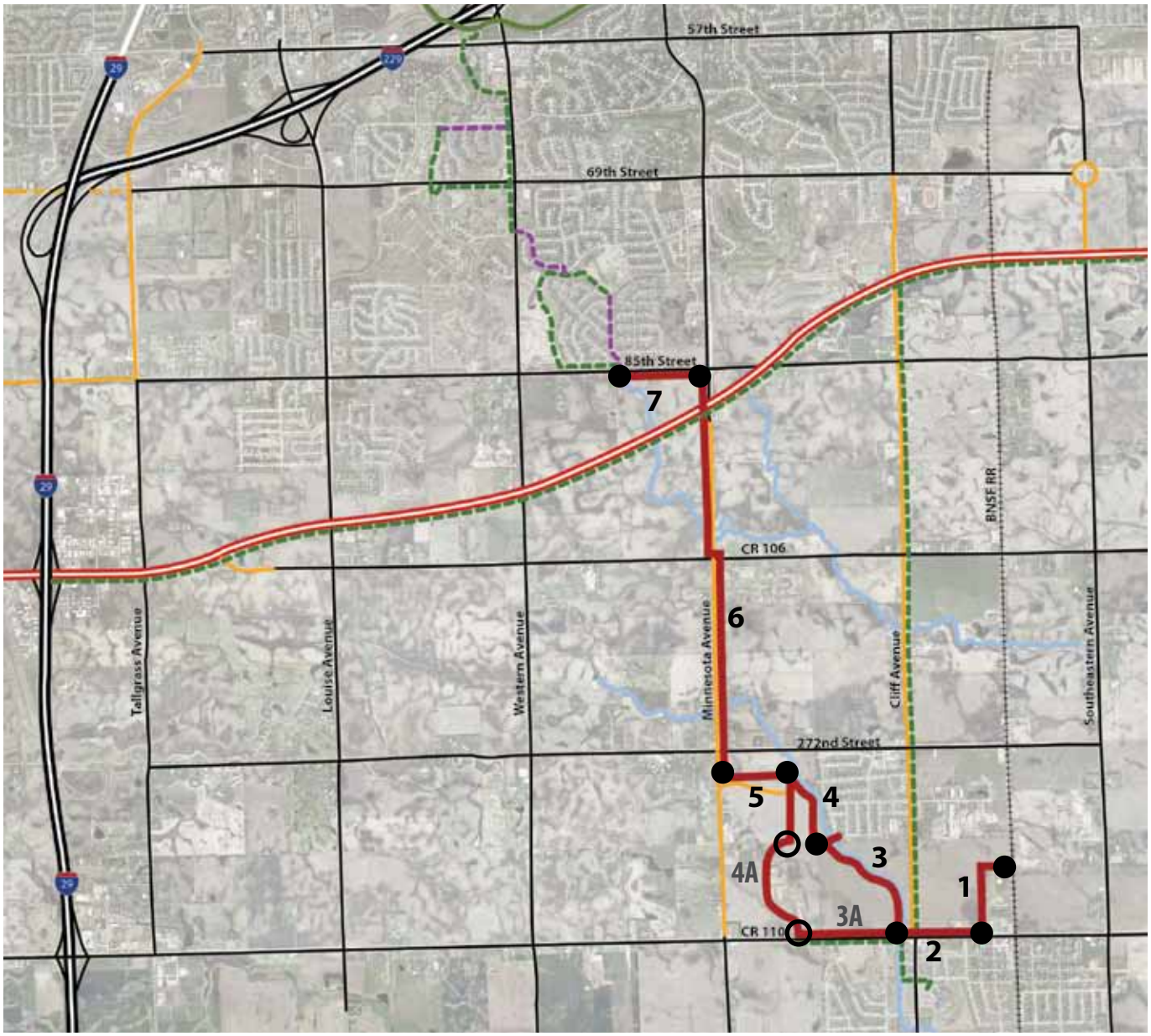
This concept is similar to Concept One, but follows Minnesota Avenue instead of watercourses for the majority of the route. From Harrisburg, it:

- Like Option One, begins at Harrisburg's sports fields and Liberty Elementary School, connecting to the Harrisburg High School campus along Willow Street.
- Includes a loop that follows a watercourse and the perimeters of the Harrisburg High school and new Freedom School campuses, with a link to United Avenue.
- Makes minor modifications to the pending Minnesota Avenue project to accommodate the inter-urban Harrisburg-Sioux Falls Trail.
- Follows drainageway or Minnesota/85th Street to connect to the Diamond Creek trail system and the Big Sioux Trail at Yankton Trail Bridge.

Table 4.4: **Harrisburg Concept Three**

Map Key	Segment	Mileage	Description
1	Playing fields and Liberty School campus to Willow Street.	0.36	Multi-use trail on north and western edges of fields and Freedom School campus, on the west side of Columbia Street. Routing serves school and park.
2	Willow Street, Columbia Street to Watercourse.	0.45	Complete street improvement along Willow Street, currently a two-lane rural section facility. Probable section should be three lanes with bike lanes. A two-way sidepath with access management should be included on the north side of the street, with exact alignments incorporated into development projects on the northeast and northwest corners of Willow and Cliff. Special intersection crossing design required at the Cliff Avenue crossing.
3	Watercourse, Willow Street to Freedom School site	0.76	Multi-use trail along west side of watercourse, incorporated into future private mixed use development. Trail connects to southeast corner of new Freedom School site on the back part of a city-owned lot. Includes a trail bridge to a city lot on United Avenue, connecting a residential area to the schools and inter-urban trail.
4	Periphery of Freedom School site	0.36	Multi-use trail along on eastern and northern edges of Freedom School site. Route diverges from watercourse because private residential lots fronting United Avenue extend across the creek.
3A	Willow Street, Watercourse to High School campus	0.55	Alternative or complementary project continuing Willow Street complete street design and sidepath to west side of high school entrance drive. Willow Street project is needed to provide pedestrian/bicycle access to high school.
4A	High School/school land periphery to Freedom School site	1.37	Multi-use trail on western and northern edge of school property, connecting to watercourse at southeast corner of Freedom School site.
5	Transmission line easement, Freedom School to Minnesota Avenue	0.43	Multi-use trail along electric transmission line easement. Alternatives include Freedom School access road and sidepath along 272nd Street.
6	Minnesota Avenue, transmission line south of 272nd Street to 85th Street	2.21	Minnesota Avenue (SD 115) improvement, planned as a 4-lane divided facility with paved shoulders. Two-way sidepath along east side of roadway in place of conventional sidewalk; access control along Minnesota Avenue corridor makes two-way sidepath feasible. Path crosses to west side of Minnesota at CH 106 intersection.
7	85th Street, Minnesota Avenue to Grange Avenue	0.45	Two-way sidepath on south side of 85th Street. Future upgrade to 85th should be to complete street standards, with bicycle lanes.

HARRISBURG TO YANKTON TRAIL PARK - Concept Three



- Primary route
- Sidepath Alternates
- Creekside Alternate
- Proposed South Dakota 100
- Existing trail and pathways
- Proposed pathway or local connection
- On Street Route
- Project Corridors

HARRISBURG TO YANKTON TRAIL PARK - Concept Four

Southeastern Avenue

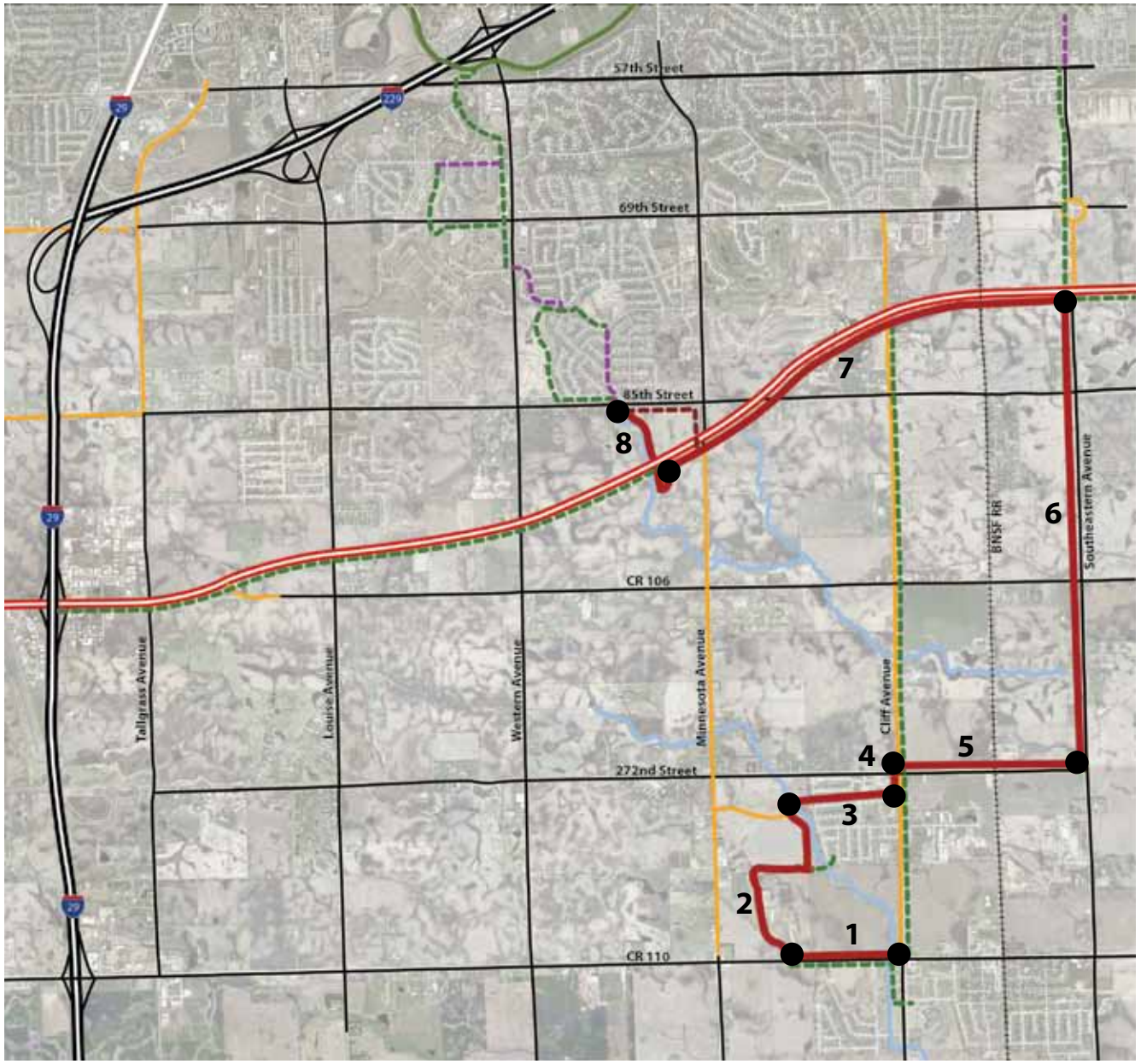
This option is similar to Concept Two, but uses Southeastern Avenue as its main line to Sioux Falls in place of the railroad corridor. From Harrisburg, this route:

- Begins at Willow and Cliff node, using high school and elementary school sites to reach the east-west transmission line that roughly parallels 272nd Street.
- Follows the utility right-of-way and 272nd Street across the northern part of the city to Southeastern.
- Uses the SD 100 sidepath to connect to Minnesota Avenue and 85th, ultimately linking to the Diamond Creek network and Big Sioux Trail.
- Provides an additional on-street connection on Southeastern to the Big Sioux Trail at 49th Street.

Table 4.5: **Harrisburg Concept Four**

Map Key	Segment	Mileage	Description
1	Willow Street, Cliff Avenue to High School	0.66	Two-way sidepath on north side of street and complete street improvement along Willow Street, currently a two-lane rural section facility. Probable section should be three lanes with bike lanes. Access management should be included on the north side of the street. Exact access alignment determined with development on northwest corner of Cliff and Willow.
2	High School/school land periphery to Freedom School site	1.37	Multi-use trail on western and northern edge of school property, connecting to watercourse at southeast corner of Freedom School site. Access to United Avenue and surrounding neighborhood is provided with a trail spur using a city lot and a bridge over the intervening creek.
3	Transmission line easement, school property to Cliff Avenue	0.72	Multi-use trail along electric transmission line easement. Corridor runs through residential area between school site and Cliff Avenue, and includes a creek bridge.
4	Cliff Avenue, transmission easement to 272nd Street	0.13	Short two-way sidepath to 272nd Street on west side of street. Cliff Avenue should eventually be upgraded to complete street standards.
5	272nd Street, Cliff to Southeastern	1.0	Two-way sidepath on north side of 272nd Street with required access management. Path crossing must negotiate a siding turnout and single main line track at BNSF crossing.
6	Southeastern, 272nd to SD 100	2.50	Future upgrade to complete street standards with bike lanes/shoulders. Project includes two-way sidepath, probably on west side of corridor, particularly if ultimate section is three lanes. Southeastern north of 69th Street is a four-lane divided section. One-way sidepaths are advisable with four or more lanes and relatively unrestricted access. Surface access will be included to SD 100 sidepath. On-street or sidepath access should be continued north of 85th Street, connecting to the Big Sioux Trail at 49th and Southeastern.
7	SD 100, Southeastern to Diamond Creek tributary	2.50	Sidepath on south side of SD 100. Cliff and Minnesota Avenue intersections are at grade, requiring special design for safe sidepath passage. Segment includes access from sidepath to trail proceeding north along Diamond Creek tributary.
8	Diamond Creek tributary, SD 100 to 85th Street.	0.27	Multi-use trail along east side of drainageway, to be incorporated into future development design. Trail includes access to the SD 100 sidepath on the south side of the arterial; SD 100 design should provide clearance for the trail under the road. Trail aligns with Grange Avenue, which provides direct access to Journey School.

HARRISBURG TO YANKTON TRAIL PARK - Concept Four



- Primary route
- Sidepath Alternates
- Creekside Alternate
- Proposed South Dakota 100
- Existing trail and pathways
- Proposed pathway or local connection
- On Street Route
- Project Corridors

HARRISBURG TO YANKTON TRAIL PARK - Concept Five

Cliff Avenue Complete Street

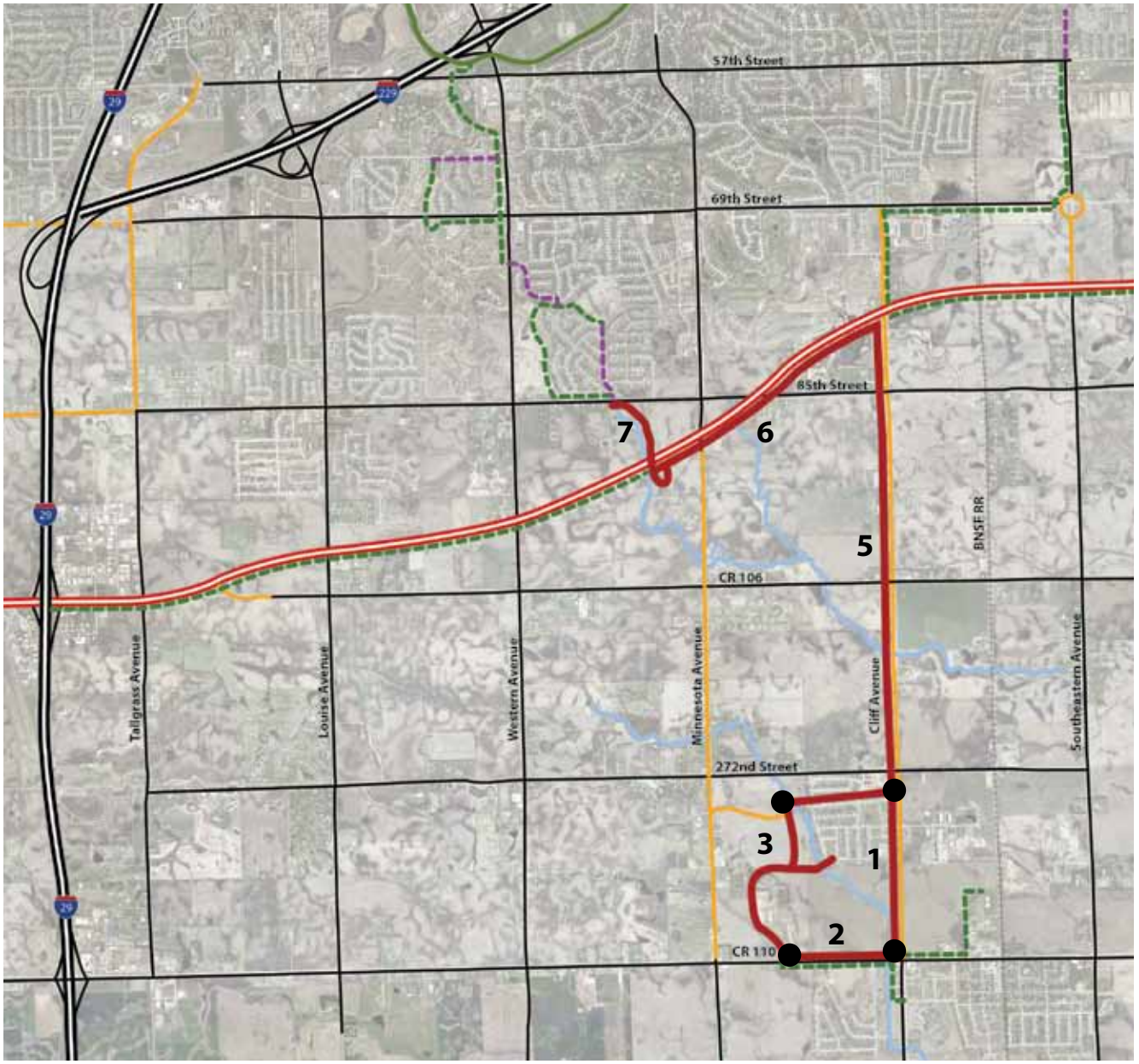
This concept uses a probable future upgrade of Cliff Avenue as the connecting route between Harrisburg and Sioux Falls. From Harrisburg, this route:

- Includes a loop that connects the High School campus to the main trail.
- Envisions an improved Cliff Avenue as a complete street, becoming the principal north-south link between Harrisburg and Sioux Falls.
- Uses SD 100 to link Cliff with the Diamond Creek system.
- Continues a path along Cliff Avenue north of SD 100 to the Christian High School campus and USF stadium.

Table 4.6: **Harrisburg Concept Five**

Map Key	Segment	Mileage	Description
1	Cliff Avenue, Willow Street to transmission easement	0.87	Widening of Cliff Avenue as a three-lane section with bicycle lanes/shoulders and a two-way sidepath on the west side of the street. Configuration of adjacent development reduces interruptions on west side of corridor. A wider street section merits consideration of one-way sidepaths.
2	Willow Street, Cliff Avenue to High School	0.66	Two-way sidepath on north side of street and complete street improvement along Willow Street, currently a two-lane rural section facility. Probable section should be three lanes with bike lanes. Access management should be included on the north side of the street. Exact access alignment determined with development on northwest corner of Cliff and Willow.
3	High School/school land periphery to Freedom School site	1.37	Multi-use trail on western and northern edge of school property, connecting to watercourse at southeast corner of Freedom School site. Access to United Avenue and surrounding neighborhood is provided with a trail spur using a city lot and a bridge over the intervening creek.
4	Transmission line easement, school property to Cliff Avenue	0.72	Multi-use trail along electric transmission line easement. Corridor runs through residential area between school site and Cliff Avenue and includes a creek bridge.
5	Cliff Avenue, transmission easement to SD 100	2.47	Continuation of Cliff Avenue complete street upgrade, with both bicycle lane/shoulders and sidepath.
6	SD 100, Cliff to Diamond Creek tributary	1.50	Sidepath on south side of SD 100. Minnesota Avenue intersections is at grade, requiring special design for safe sidepath passage. Segment includes access from sidepath to trail proceeding north along Diamond Creek tributary.
7	Diamond Creek tributary, SD 100 to 85th Street	0.27	Multi-use trail along east side of drainageway, to be incorporated into future development design. Trail includes access to the SD 100 sidepath on the south side of the arterial; SD 100 design should provide clearance for the trail under the road. Trail aligns with Grange Avenue, which provides direct access to Journey School.

HARRISBURG TO YANKTON TRAIL PARK - Concept Five



Most Feasible Concept

The Most Feasible Concept for the Harrisburg to Sioux Falls route is clearly Concept One, using watercourses where possible to create both a good off-road user experience and the most direct possible alignment. The Minnesota Avenue project provides a near-term opportunity to complete a major segment of the route through the use of Surface Transportation Program (STP) funds. Short sidepath alternatives can be substituted for watercourse routes if those rights-of-way are not available, or cannot be secured when trail development is funded.

Local Connections

Local connections of the inter-urban trail on both the Harrisburg and Sioux Falls ends are very important to the ability of this facility to meet its objectives. Harrisburg connections are necessary to link major community features to each other and the regional trail system; Sioux Falls connections navigate users safely and comfortably to the Big Sioux system.

Harrisburg Connections. The most feasible concept includes two important local features. First, a complete street improvement and sidepath along Willow Street will connect Harrisburg's playing fields and the existing Freedom School, the emerging commercial node at Cliff Avenue, and the high school campus. Second, it creates a very functional loop along the watercourse that runs northwest from Cliff and Willow and the periphery of the High School and new Freedom School campus, with a connection to the residential neighborhood along United Avenue. While Harrisburg has an ambitious pathway development system that should be incorporated into future development, the following additional links can be especially important in the short term:

- A sidepath on the south side of Willow Street. This would cross to the high school campus at a controlled intersection at the high school entrance, and extend to Cliff Avenue, replacing an existing gravel path.

- A connection to the Middle School and south part of Harrisburg. This connection would follow the drainageway immediately west of Cliff Avenue and turn east to Cliff on the alignment of Maple Street, crossing at this intersection to the Middle School. Maple Street should be reconfigured as a bicycle boulevard with sidewalk continuity between Southeastern and Cliff Avenues.

- A northside connection using the transmission line right-of-way from the inter-urban trail north of the new Freedom School site to Cliff Avenue.

- A path along Cliff Avenue between the power line and Willow Street.

Sioux Falls Connections. The north end connections, using the Diamond Creek trail system, close the gap from 85th Street to the Big Sioux Trail. The most readily available option includes the following elements:

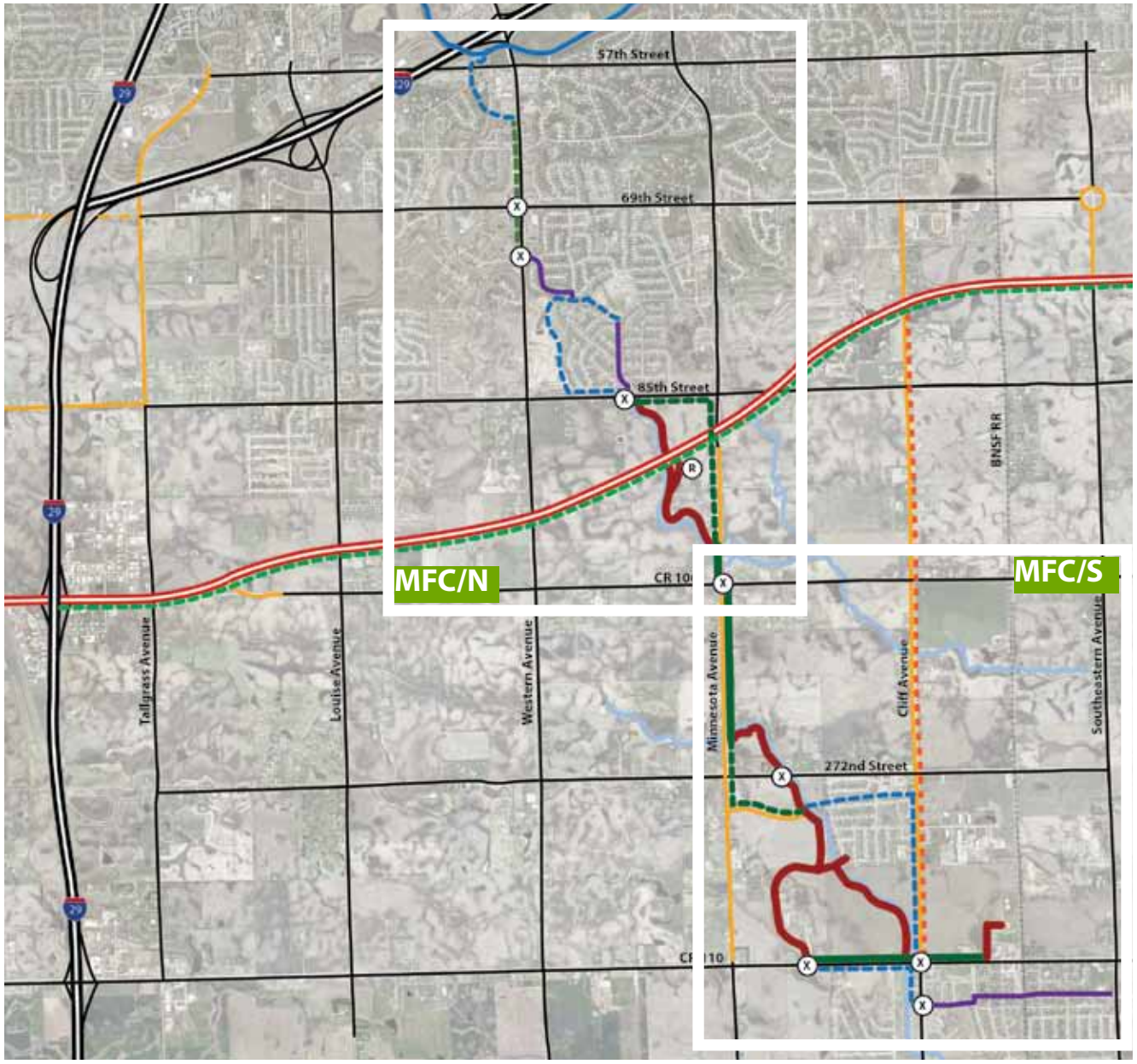
• A crossing of 85th Street at Grange Avenue, with an adaptation of Grange for bicycle access between 85th and

Table 4.7 summarizes the evaluation of these five options based on the ten criteria described in Part Two. This evaluation then is used to identify the most feasible concept.

Key:
++ Very high score on criterion
+ High score on criterion
o Neutral score on criterion
- Low score on criterion
-- Very low score on criterion

	Directness	Experience	Time Frame	Multiple Funding	Safety/Security	Neighborhood Services	Ease of Acquisition	Cost/ Constructability	Connectivity	Response to Users	Average Score (out of 65)	Rank
1 Watercourses	++	+	+	+	++	+	o (main) ++ (alternat	+	+	+	46.0	1
2 Railroad	o	o	o	o	o	o	--	+	+	+	32.5	5
3 Minnesota Avenue	++	o	++	++	+	+	++	++	+	o	44.1	2
4 Southeastern Avenue	--	o	--	o	+	-	+	+	+	o	34.1	4
5 Cliff Avenue Complete Street	+	o	-	++	+	+	++	+	+	o	36.5	3

HARRISBURG TO YANKTON TRAIL PARK - Most Feasible Concept



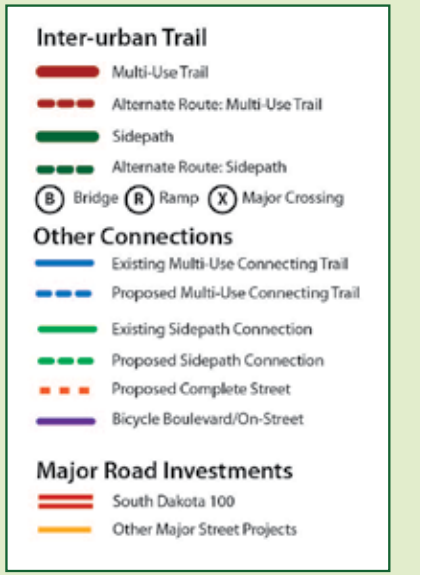
Journey School. Grange is about 40 feet wide curb to curb, adequate for bike lanes in both directions and single-sided parking. Grange will have sidewalks on both sides of the street with build-out of adjacent lots.

• A path across the Journey School site to Laquinta Street.

• Adaptation of Laquinta as a bicycle boulevard between the school and Western Avenue. This includes the use of shared lane markings and traffic calmers, appropriate on a continuous residential street near a school.

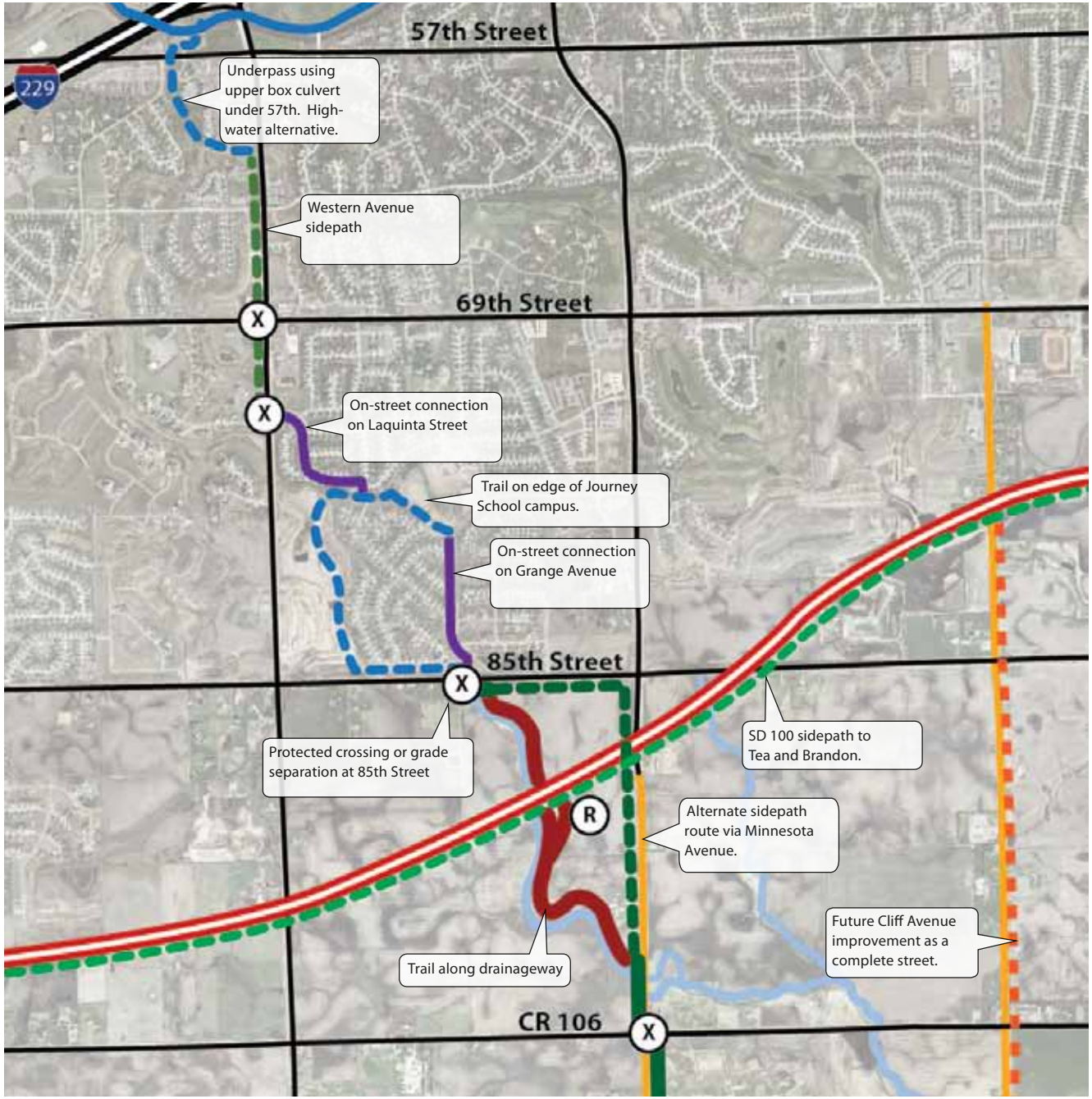
• A protected crossing at Laquinta and Western and a west side, two-way

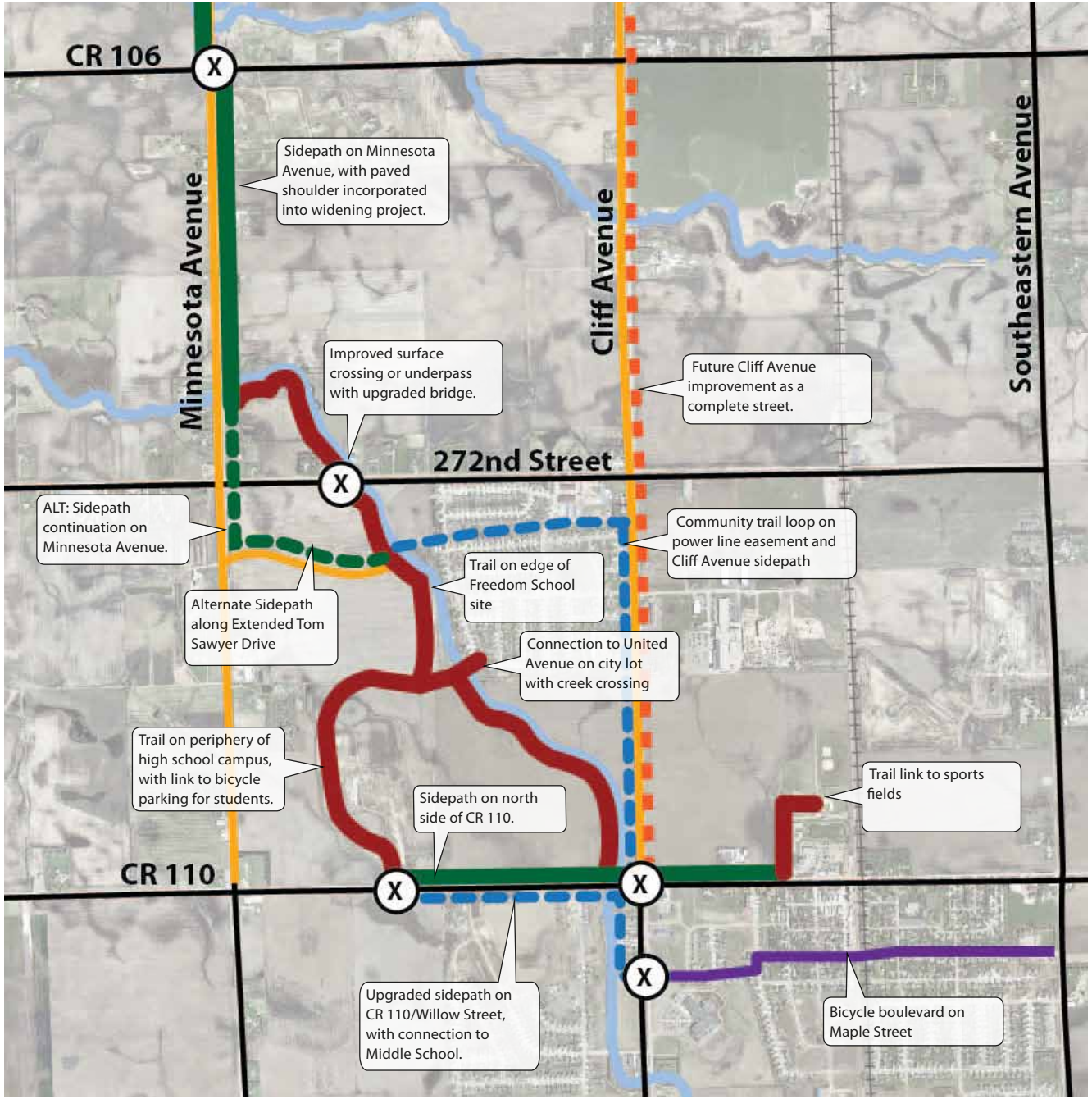
HARRISBURG MFC/N



sidepath along Western. This extends across 69th Street, and continues to the drainageway south of the Bridges.

• A multi-use trail, as proposed for the Diamond Creek system, along west and north along the greenway corridor, under 57th Street through an existing box culvert, and over the historic Yankton Trail bridge to the Big Sioux Trail.





HARRISBURG MFC/S

Inter-urban Trail
- Multi-Use Trail
- Alternate Route: Multi-Use Trail
- Sidepath
- Alternate Route: Sidepath
- (B) Bridge (R) Ramp (X) Major Crossing

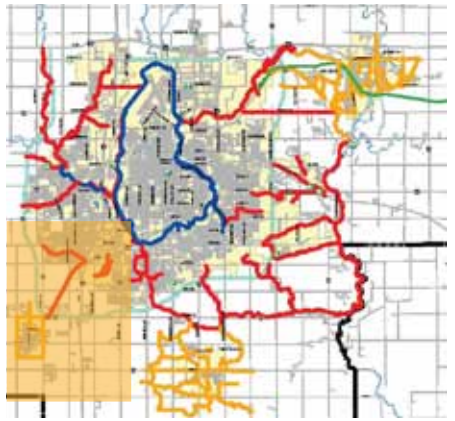
Other Connections
- Existing Multi-Use Connecting Trail
- Proposed Multi-Use Connecting Trail
- Existing Sidepath Connection
- Proposed Sidepath Connection
- Proposed Complete Street
- Bicycle Boulevard/On-Street

Major Road Investments
- South Dakota 100
- Other Major Street Projects

CHAPTER 5 | TEA TO SIOUX FALLS

This study corridor connects Tea to Sioux Falls and the Big Sioux system. Perhaps more than the other two corridors, the Tea connection will serve commuting cyclists going to the city and road cyclists seeking a pleasant and safe route out of Sioux Falls. The city itself is in the process of developing the "Trail Around Tea" (TAT), a loop that will serve many local destinations and meet the needs of many local recreational users. Like the Brandon to Great Bear connection, the Tea study area, at the other end of SD 100 corridor, is also strongly affected by proposed transportation investments.

The 2009 MPO plan proposes using an abandoned railroad grade from Tea toward Sioux Falls, but the I-29/229 interchange, extensive development, and other conditions make an all-trail connection to Sioux Falls very challenging. The Tea connection also has two potential points of connection with the Sioux Falls network – a route to the emerging Cherry Creek system, proposed in the 2007 Sioux Falls Trail Master Plan, at Legacy Park at 12th and Sertoma; and an eastside connection to the Big Sioux loop at Yankton Trail Park.



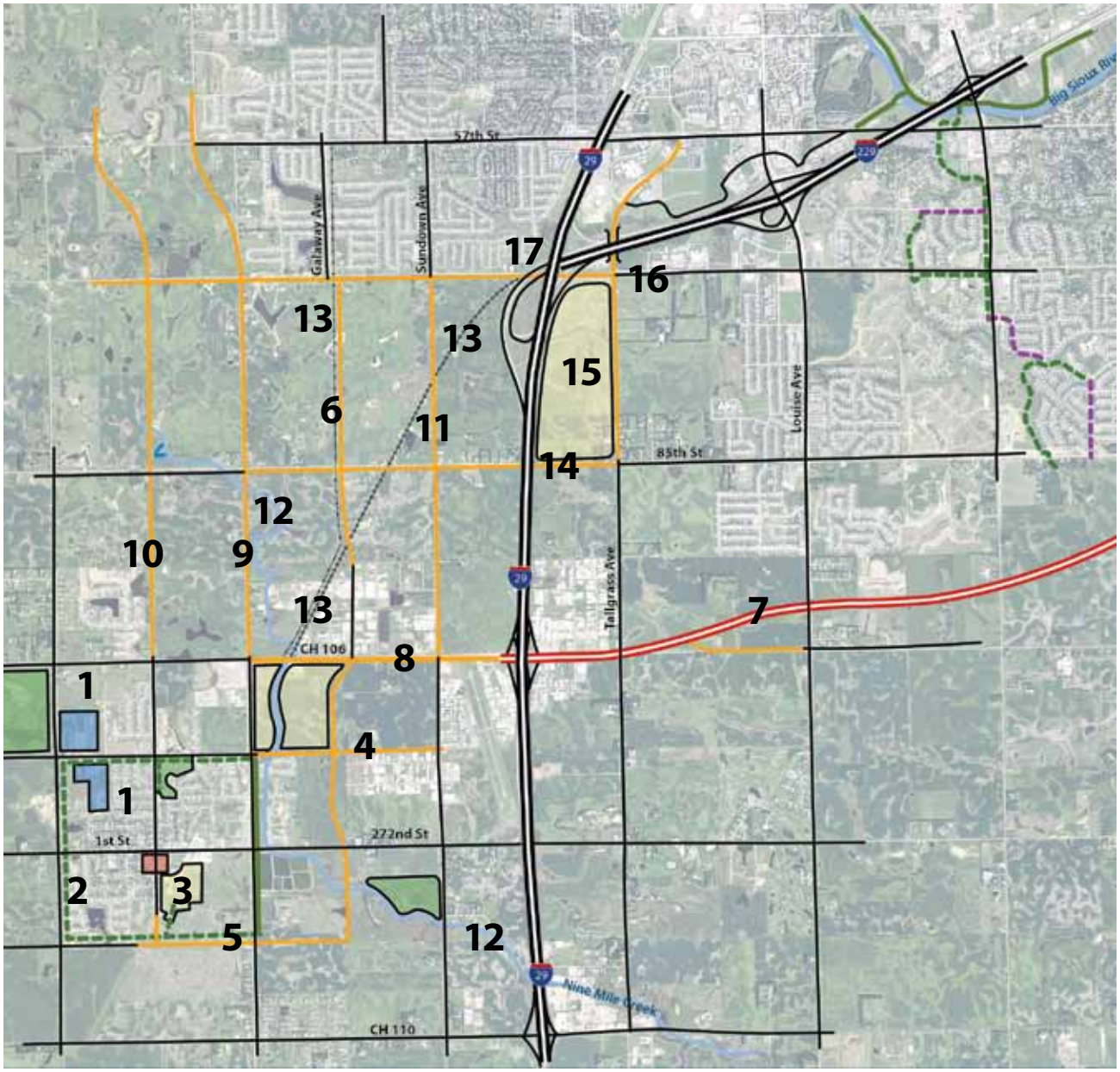
TEA TO SIOUX FALLS - Trail Determinants

The future South Dakota 100 ring road has a significant impact on transportation planning in the Tea area, and also affects alternatives for Tea-Sioux Falls and Tea-Harrisburg trail connections. The 2009 MPO plan identifies two potential connecting corridors, both of which bisect existing agricultural land and follow subtle drainage courses in a general southeast to northwest direction. The Trail Determinant Map identifies actions and issues that direct trail planning for this area, keyed to explanations in the table below.

Table 5.1: Tea Trail Determinants

Map Key	Segment	Description
1	Tea School Campuses	Tea Area High School, Middle School, Community Library, and sports complex are on opposite sides of Brian Street at 468th Avenue at the western edge of town. The TAT will serve these sites.
2	Trail Around Tea (TAT)	This circumferential trail will be composed of the just completed sidepath along CH 111, with other legs along Brian Street, 468th Avenue, and 9th Street.
3	New Sports Complex	Tea is expanding its existing ballfields into a new city sports complex south of its traditional town center along Main Avenue south of 3rd Street.
4,5,6	Tea Street System Extensions	Tea has programmed significant expansions of its street system, including Brian Street between CH 111 and Sundowner (4), 9th Street between 468th and 469th Avenues (5), and a collector (Galway Avenue extended) on the half-section line between Sundowner and CH 111(6).
7	South Dakota 100	The South Dakota 100 ring road terminates at the recently completed single-point urban interchange (SPUI) with I-29 at Exit 73. County Road 106 from the east is realigned into a T-intersection with SD 100, which becomes the primary east-west movement.
8	County Highway 106	The Westside corridor extends the circumferential along CH 106, which will be widened and is likely to include a sidepath. The existing CH 106 section is two lanes with paved shoulders.
9	Tea-Ellis Road	An upgraded Tea-Ellis Road (CH 111) will form the western leg of the circumferential highway. A current jog in the alignment of Tea-Elis at 57th Street will be removed with a smooth transition curve between 57th and 69th Streets.
10	West Parkway	The westside transportation plan envisions a landscaped “green street” with pedestrian and bicycle accommodation parallel to and west of Tea-Ellis Road. West parkway aligns with Main Avenue in Tea.

TEA TO SIOUX FALLS - Trail Determinants



Determinants Legend

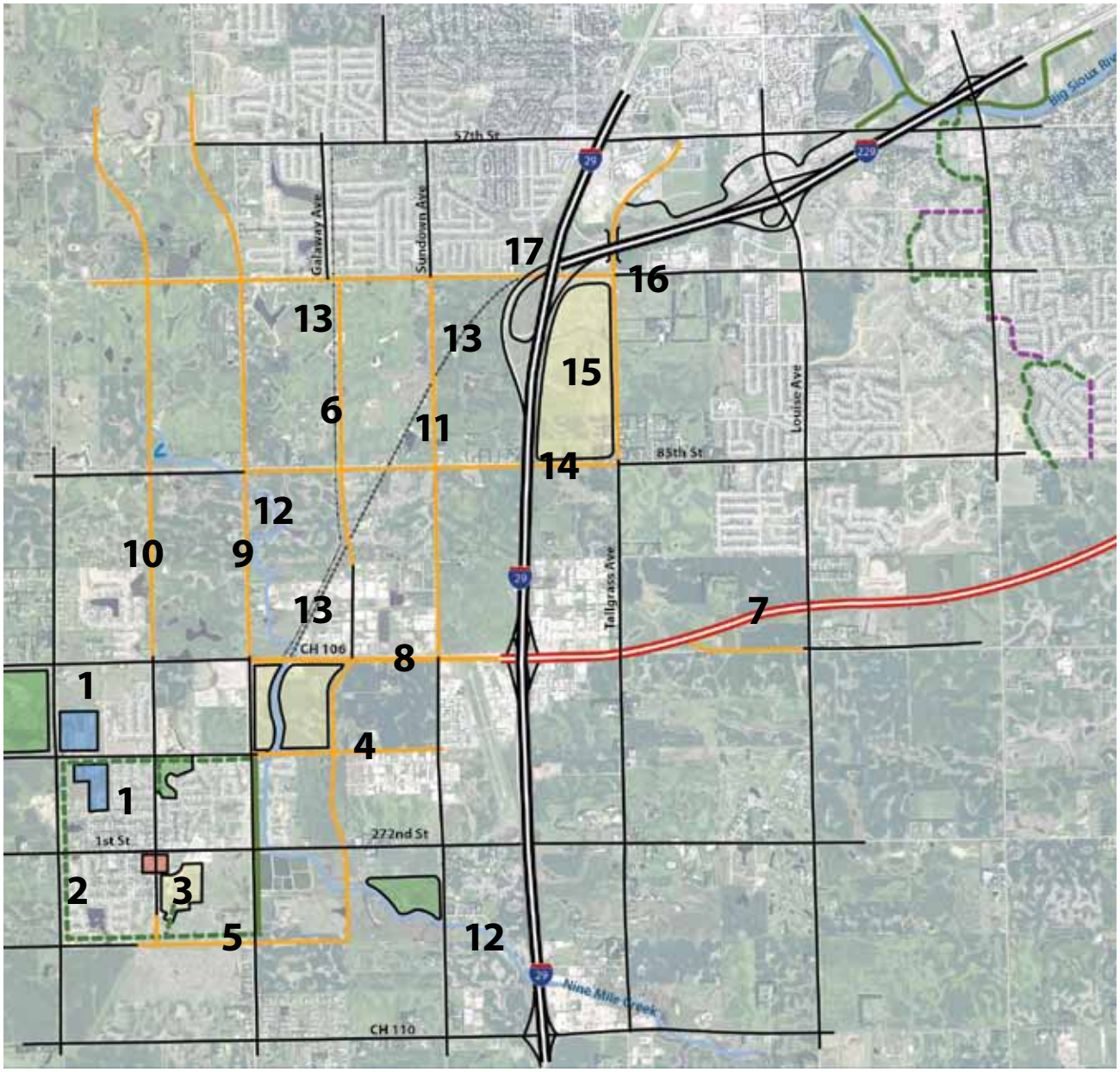
- Highway
- Existing road
- Existing railroad
- Proposed alignment
- Proposed limited access highway
- Existing trail and pathways
- Proposed local connection
- On street connection
- Vacated right-off-way
- Existing nature trail

TEA TO SIOUX FALLS - Trail Determinants

Table 5.1: **Tea Trail Determinants**

Map Key	Segment	Description
11	Sundowner Avenue	Sundowner is the first section line road west of I-29 and is unpaved between CH 106 and 69th Street. Tea plans to pave the street in sections in the near to medium-term future.
12	Nine Mile Creek	This principal drainageway begins north of 85th Street and runs approximately parallel and just east of CH 111 before turning southeast toward Harrisburg just south of 1st Street (272nd Street in the county). Along the way, the stream crosses a potential wetland/nature park southeast of Tea Ellis Road and 85th (13a) and a slough south of 272nd Street (13b).
13	Rail grade and transmission line	A rail line once ran diagonally southwest to northeast through Tea, beginning at about 9th and Main, crossing CH 106 near Nine Mile Creek, and continuing to the present I-29/229 interchange. It then followed the north side of the present I-229. The grade is faintly visible in some places, and is clearest for a half-mile immediately north of CH 106. Here it parallels an electrical transmission corridor, which continues north on the half-section line between Tea-Ellis and Sundowner (13a).
14	85th Street	This unpaved, section line road is interrupted by I-29. Future plans will upgrade this to at least a minor arterial corridor, including at least an overpass at the interstate. Debate continues about a possible I-29 interchange at 85th, supporting both local access and a research campus between I-29 and Tallgrass Avenue north of 85th. The close spacing of the existing I-29/I-229 interchange and a future 85th Street interchange create serious weaving and merge problems.
15	Tallgrass Avenue and adjacent development site	Tallgrass Avenue is scheduled for paving between 69th and 85th Streets. The adjacent site to the west has been proposed for a major medical research campus. Plans for that project are currently uncertain.
16	Solberg Avenue Bridge	A new bridge over I-229, along with a sidepath, is scheduled for construction, linking Tallgrass and Solberg Avenue, north of the interstate. Solberg continues north to 49th Street, leading to Empire Mall.
17	69th Street	A connection of the east and west legs of 69th Street at the I-29/229 interchange is programmed. Nature of the crossing and future design of the interchange are undecided as of January, 2011.

TEA TO SIOUX FALLS - Trail Determinants



Determinants Legend

- Highway
- Existing road
- Existing railroad
- Proposed alignment
- Proposed limited access highway
- Existing trail and pathways
- Proposed local connection
- On street connection
- Vacated right-off-way
- Existing nature trail

TEA TO SIOUX FALLS - Concept One

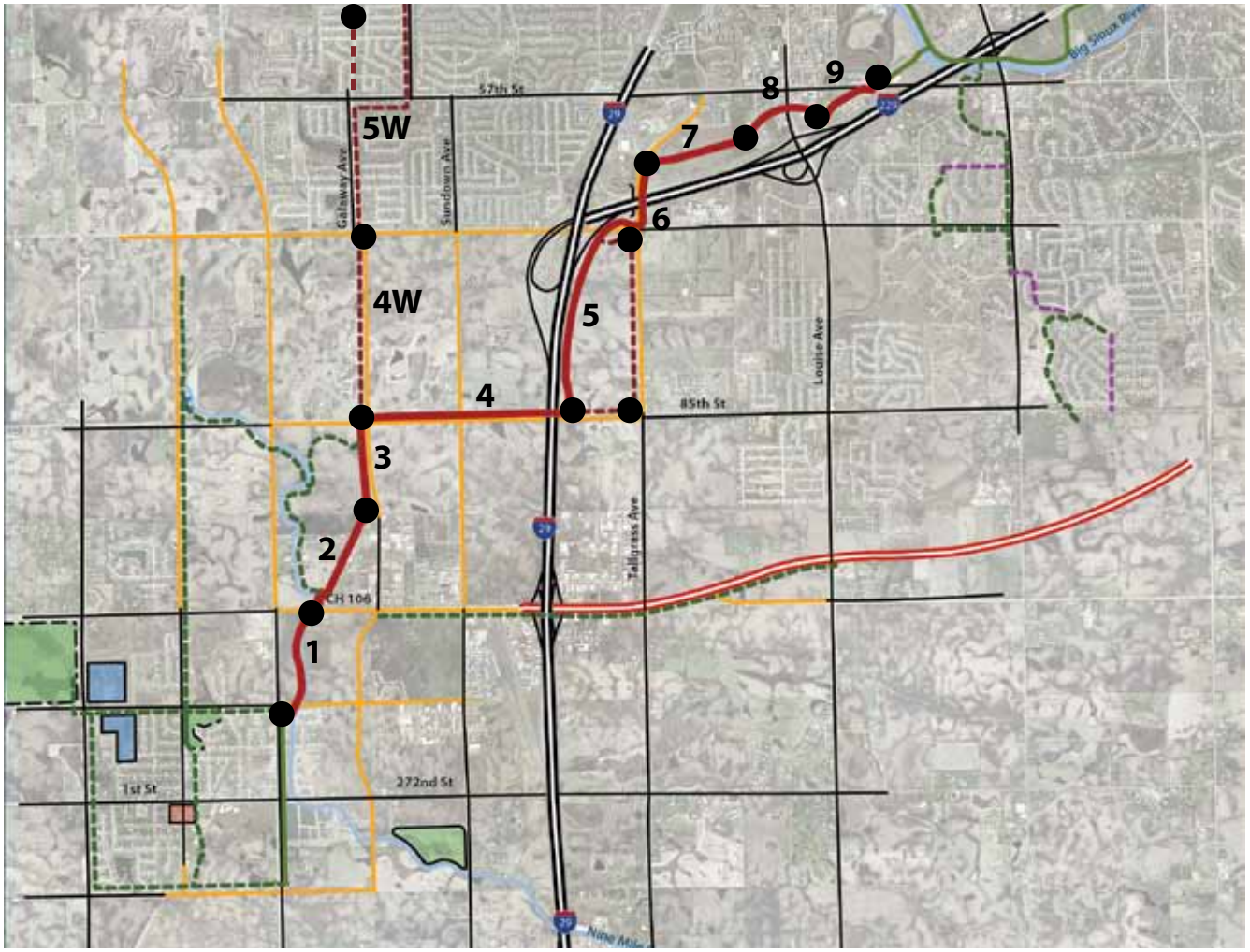
Powerline/85th Street

This concept begins at the corner of CH 111 and Brian Street. From Tea, this route:

- Follows the west side of Nine Mile Creek to CH 106, and crosses the highway at or near that point.
- Continues along abandoned railroad grade and power line easement to 85th Street.
- Uses a sidepath along an upgraded 85th Street to Tallgrass Avenue, crossing I-29 along a new 85th Street crossing.
- Continues to Tallgrass Avenue using a path along the street or within a new development to the Solberg overpass over I-229.
- Crosses I-229 at Solberg, and uses existing paths, streets, and the railroad trace to reach the Big Sioux Trail.
- Includes an on-street connection to Sertoma Avenue via Galway Avenue.

Map Key	Segment	Mileage	Description
1	Nine-Mile Creek, Brian to CH 106	0.63	Multi-use trail on west side of Nine-Mile Creek, incorporated into proposed mixed use development. Protected at-grade crossing across CH 106, depending on design of eventual upgrade of this corridor as part of the westside corridor project; a preferred alternative would be incorporating a trail underpass with a bridge over the drainageway.
2	Railroad grade, CH 106 to half-section line	0.56	Multi-use trail on diagonal rail grade and power line easement, behind industrial properties.
3	Power-line easement, half-section to 85th Street	0.76	Multi-use trail along power line. Trail alignment can run between twin lines to avoid impact on adjacent development. City of Tea's proposed half-section line collector is also likely to follow this corridor.
4	85th Street, power line to Tallgrass	1.46	Complete street with bicycle lanes and two-way sidepath, probably on south side of 85th Street. North side has extensive large lot single-family development with driveway interruptions. South line allows better prospect for access control. One-way sidepaths in the direction of traffic should also be considered, depending on adjacent land use patterns with development. Segment also includes a new overpass over I-29.
5	Tallgrass, 85th to I-229	1.09 (assuming Tallgrass sidepath)	Two-way sidepath on west side of Tallgrass, with access management feasible because of coordinated development of adjacent parcel. A preferred alternative would be integration of a multi-use trail into a common development, with the trail possibly being on the periphery of the project, adjacent to I-29. If 85th Street sidepath is on south side, an 85th Street overpass should be designed with clearance to permit a trail crossing under the overpass structure.
4W	Power line easement, 85th to 69th	1.00	Westside connection: Multi-use trail along power line. Trail alignment can run between twin lines to avoid impact on adjacent development. Proposed half-section line collector is also likely to follow this corridor.
5W	Galway Avenue, 69th to 41st with alternatives	2.00	Bicycle boulevard, adapting 36 to 40 foot street channel to bicycle and pedestrian use. Bicycle boulevard would include traffic calmers to slow or discourage through motor vehicle traffic. Galway alignment from 49th Street alignment to 41st is through an undeveloped quartersection. Alternatives to the bicycle boulevard concept here would be a multi-use trail integrated into development, extending to 41st and Sertoma.
6W	Sertoma, 41st to 12th	2.03	Sertoma complete street with bicycle lanes and two-way sidepath on west side of street. West side pedestrian path exists and is relatively free of interruptions. Bicycle lanes are installed between 26th and 12th. A short multi-use trail link on the south side of 12th connects to Legacy Park and the Big Sioux and Cherry Creek trail networks. Trail connection to the Big Sioux from the park is complete. Cherry Creek system, when complete, extends to USD local campus south of North 60th Street.
6	Solberg Avenue, I-229 to Broadband Lane	0.30	Sidepath on east side of new overpass, continuing to intersection.
7	Broadband Lane/59th Street, Solberg to Tennis Lane	0.50	Bicycle lanes with sidewalk. Current width accommodates bicycle lanes with curbside parking prohibition. Curb parking is unnecessary because of extensive off-street parking in office/commercial complex. Modification of 59th/Louise intersection to provide right turn only lanes outside of the bicycle lane. Sidewalk continuity is provided across Louise. Alignment assumes closing of street gap between Broadband and 59th, currently graded.

TEA TO SIOUX FALLS - Concept One



Map Key	Segment	Mileage	Description
8	Railroad Trace, Tennis Lane to 57th/Bur Oak	0.37	Multi-use trail on railroad trace, from Tennis Lane north of Van Eide Honda dealership to 57th and Bur Oak. Includes protected trail crossing at Bur Oak Drive to existing trail spur.
9	Big Sioux Trail Spur, 57th/Bur Oak to Big Sioux Trail	0.42	Existing multi-use trail with bridge over Big Sioux River at Sertoma Park.

TEA TO SIOUX FALLS - Concept Two

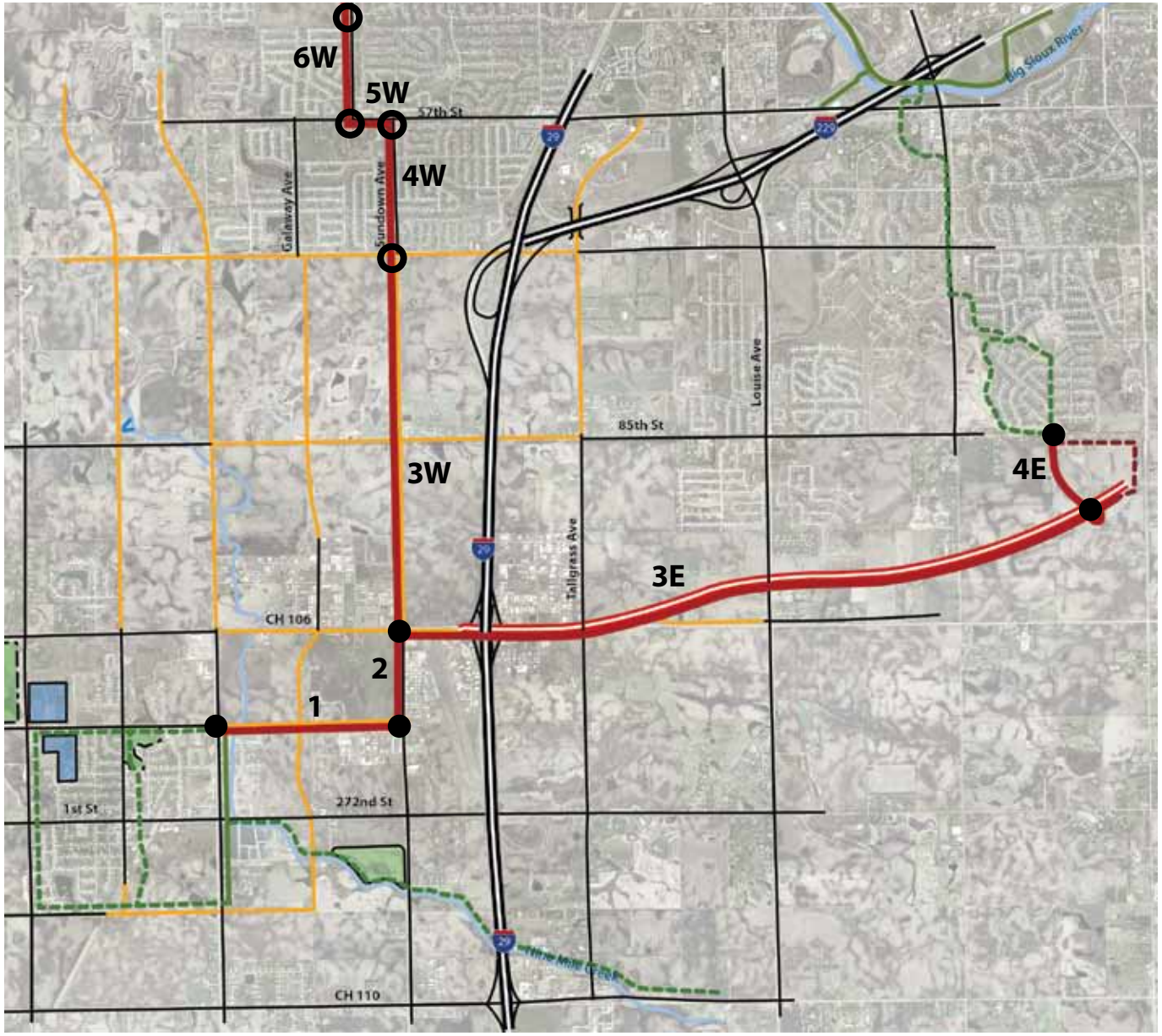
Sundowner/SD100

Like Concept One, this concept begins at the northeast corner of the TAT loop at CH 111 and Brian Street. From Tea, the route:

- Follows Brian Street extension to Sundowner.
- Continues north on Sundowner as a "complete street" with bike lanes/ sidepath to 59th Street and Sertoma.
- Uses the SD 100 sidepath as an eastern link, connecting with the Harrisburg-Diamond Creek Trail near the Minnesota Avenue intersection.
- Includes an on-street connection to Sertoma Avenue via 57th Street.

Map Key	Segment	Mileage	Description
1	Brian Street, CH 111 to Sundowner	1.00	Complete street with bicycle lanes and two-way sidepath to align with Brian Street Path in Tea. Development pattern on south side of Brian controls direct access from adjacent sites.
2	Sundowner, Brian to CH 106/SD 100	1.00	Complete street with bicycle lanes and two-way sidepath on east side with access management. Sundowner section includes paved shoulders for on-street cyclists. CH 106 intersection requires redesign to include right-turn only lane and through bicycle lanes.
3E	CH 106/South Dakota 100, Sundowner to Diamond Creek tributary	3.75	Sidepath on south side of road. Access management is critical on the CH 106 segment. Crossing design at the I-29 SPUI is critical and should include an individual bike/pedestrian signal cycle.
4E	Diamond Creek tributary, SD 100 to 85th Street	0.27	Multi-use trail along east side of drainageway, to be incorporated into future development design. Trail includes access to the SD 100 sidepath on the south side of the arterial; SD 100 design should provide clearance for the trail under the road. Trail aligns with Grange Avenue, which provides direct access to Journey School. Common segment with Harrisburg-Sioux Falls inter-urban trail.
3W	Sundowner, CH 106 to 69th Street	2.00	Complete street with bicycle lanes and two-way sidepath, probably on east side with access management.
4W	Sundowner, 69th to 57th Street	1.00	Bicycle boulevard, adapting 36-foot street channel to bicycle and pedestrian use. Bicycle boulevard would include traffic calmers to slow or discourage through motor vehicle traffic.
6W	57th Street, Sundowner to Sertoma	0.10	Two-way sidepath on north side of 57th Street. Lots back up to 57th, with north side uninterrupted between the two streets. Bicycle lanes should be incorporated into any widening of 57th Street.
7W	Sertoma, 57th to 12th	2.03	Sertoma complete street with bicycle lanes and two-way sidepath on west side of street. West side pedestrian path is present continuously north of 41st Street and is relatively free of interruptions. Bicycle lanes are installed between 26th and 12th. A short multi-use trail link on the south side of 12th connects to Legacy Park and the Big Sioux and Cherry Creek trail networks.
6	Solberg Avenue, I-229 to Broadband Lane	0.30	Sidepath on east side of new overpass, continuing to intersection.
7	Broadband Lane/59th Street, Solberg to Tennis Lane	0.50	Bicycle lanes with sidewalk. Current width accommodates bicycle lanes with curbside parking prohibition. Curb parking is unnecessary because of extensive off-street parking in office/commercial complex. Modification of 59th/Louise intersection to provide right turn only lanes outside of the bicycle lane. Sidewalk continuity is provided across Louise. Alignment assumes closing of street gap between Broadband and 59th, currently graded.

TEA - Alternative Concept 2



TEA TO SIOUX FALLS - Concept Three

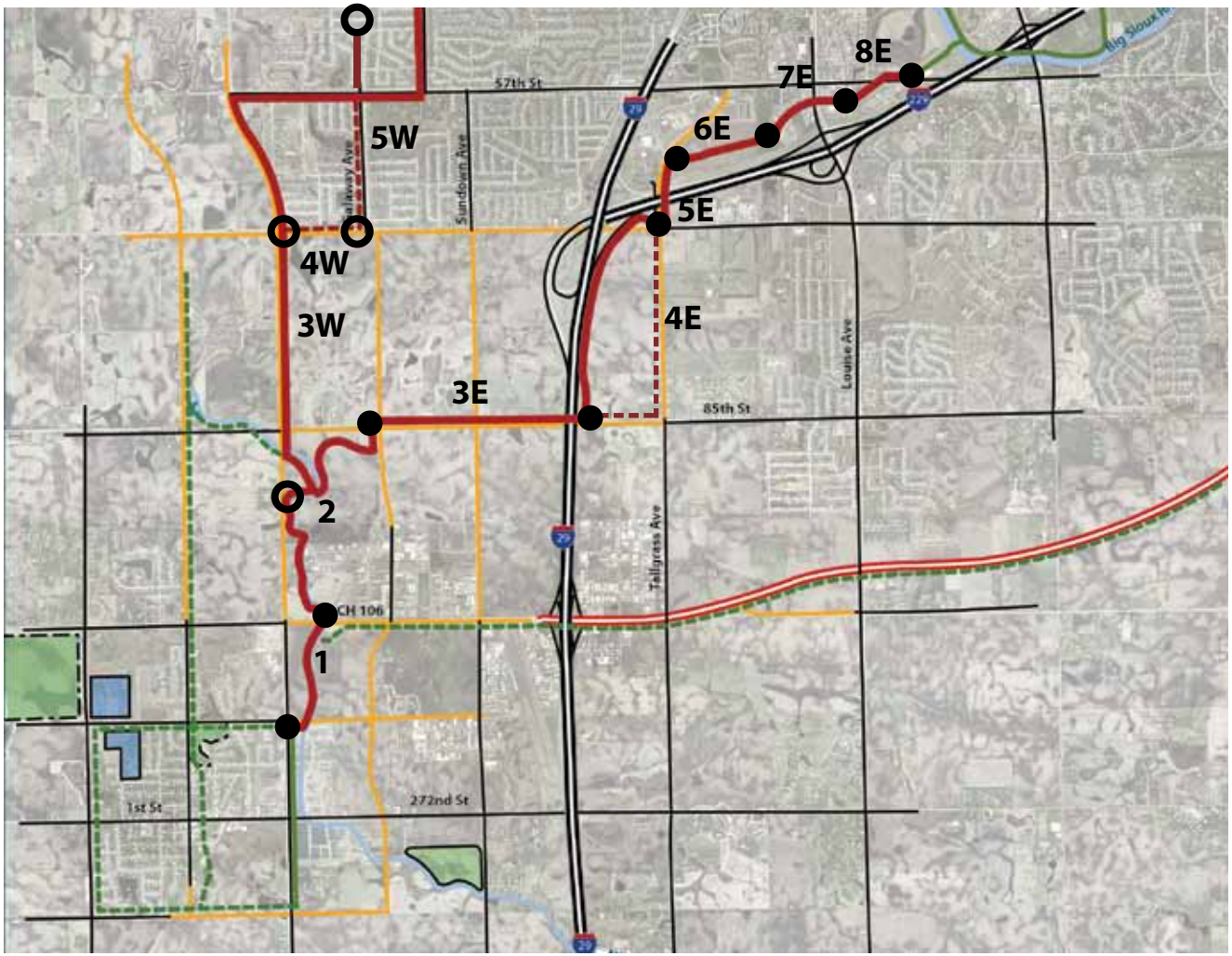
Nine Mile/Tea-Ellis Road

Concept Three completes its west connection with Nine Mile Creek and an upgraded Tea-Ellis corridor, while using a similar alignment to Concept One for access to the Big Sioux Trail. From Tea, the route:

- Follows west side of Nine Mile Creek from "Trail around Tea" to CH 106 and continues along the creek to 85th Street. This crosses through land that the City of Tea is considering as part of a passive recreational park and preserve area.
- Like Option One, uses a sidepath along an upgraded 85th Street to Tallgrass Avenue and crosses I-29 along a new 85th Street crossing. Continues along Tallgrass Avenue to the Solberg overpass over I-229.
- Uses existing paths, abandoned rail grades, and 58th Street to reach the Big Sioux Trail at Sertoma Park.
- Includes an on-street connection to Sertoma Avenue via Tea-Ellis Road, 69th, and Galway Avenue.

Map Key	Segment	Mileage	Description
1	Nine Mile Creek, Brian to CH 106	0.63	Multi-use trail on west side of Nine-Mile Creek, incorporated into proposed mixed use development. Protected at-grade crossing across CH 106, depending on design of eventual upgrade of this corridor as part of the westside corridor project; a preferred alternative would be incorporating a trail underpass with a bridge over the drainageway.
2	Nine Mile Creek and tributary drainage, CH 106 to 85th Street	1.41	Multi-use trail on west side of Nine Mile Creek. Requires agreement with adjacent property owners. Joins 85th Street near power line easement.
3E	85th Street, power line to Tallgrass	1.46	Complete street with bicycle lanes and two-way sidepath, probably on south side of 85th Street. North side has extensive large lot single-family development with driveway interruptions. South line allows better prospect for access control. One-way sidepaths in the direction of traffic should also be considered, depending on adjacent land use patterns with development. Segment also includes a new overpass over I-29.
4E	Tallgrass, 85th to I-229	1.09 (assuming Tallgrass sidepath)	Two-way sidepath on west side of Tallgrass, with access management feasible because of coordinated development of adjacent parcel. A preferred alternative would be integration of a multi-use trail into a common development, with the trail possibly being on the periphery of the project, adjacent to I-29. If 85th Street sidepath is on south side, an 85th Street overpass should be designed with clearance to permit a trail crossing under the overpass structure.
3W	Tea-Ellis Road, Nine Mile Creek to 69th Street	1.35	Westside connection: Sidepath on east side of upgraded Tea-Ellis Road, with access management. Parallel West Parkway would be developed as a complete street with bicycle lanes as part of the Westside Corridor Plan.
4W	69th Street, Tea-Ellis to Galway Avenue	0.50	Complete street with bicycle lanes and two-way sidepath on north side of street.
5W	Galway Avenue, 69th to 41st with alternatives	2.00	Bicycle boulevard, adapting 36 to 40 foot street channel to bicycle and pedestrian use. Bicycle boulevard would include traffic calmers to slow or discourage through motor vehicle traffic. Galway alignment from 49th Street alignment to 41st is through an undeveloped quartersection. Alternatives to the bicycle boulevard concept here would be a multi-use trail integrated into development, extending to 41st and Sertoma.
6W	Sertoma, 41st to 12th	2.03	Sertoma complete street with bicycle lanes and two-way sidepath on west side of street. West side pedestrian path exists and is relatively free of interruptions. Bicycle lanes are installed between 26th and 12th. A short multi-use trail link on the south side of 12th connects to Legacy Park and the Big Sioux and Cherry Creek trail networks. Trail connection to the Big Sioux from the park is complete. Cherry Creek system, when complete, extends to USD local campus south of North 60th Street.
5E	Solberg Avenue, I-229 to Broadband Lane	0.30	Sidepath on east side of new overpass, continuing to intersection.
6E	Broadband Lane/59th Street, Solberg to Tennis Lane	0.50	Bicycle lanes with sidewalk. Current width accommodates bicycle lanes with curbside parking prohibition. Curb parking is unnecessary because of extensive off-street parking in office/commercial complex. Modification of 59th/Louise intersection to provide right turn only lanes outside of the bicycle lane. Sidewalk continuity is provided across Louise. Alignment assumes closing of street gap between Broadband and 59th, currently graded.

TEA TO SIOUX FALLS - Concept Three



Map Key	Segment	Mileage	Description
7E	Railroad Trace, Tennis Lane to 57th/ Bur Oak	0.37	Multi-use trail on railroad trace, from Tennis Lane north of Van Eide Honda dealership to 57th and Bur Oak. Includes protected trail crossing at Bur Oak Drive to existing trail spur.
8E	Big Sioux Trail Spur, 57th/Bur Oak to Big Sioux Trail	0.42	Existing multi-use trail with bridge over Big Sioux River at Sertoma Park.

TEA TO SIOUX FALLS - Concept Four

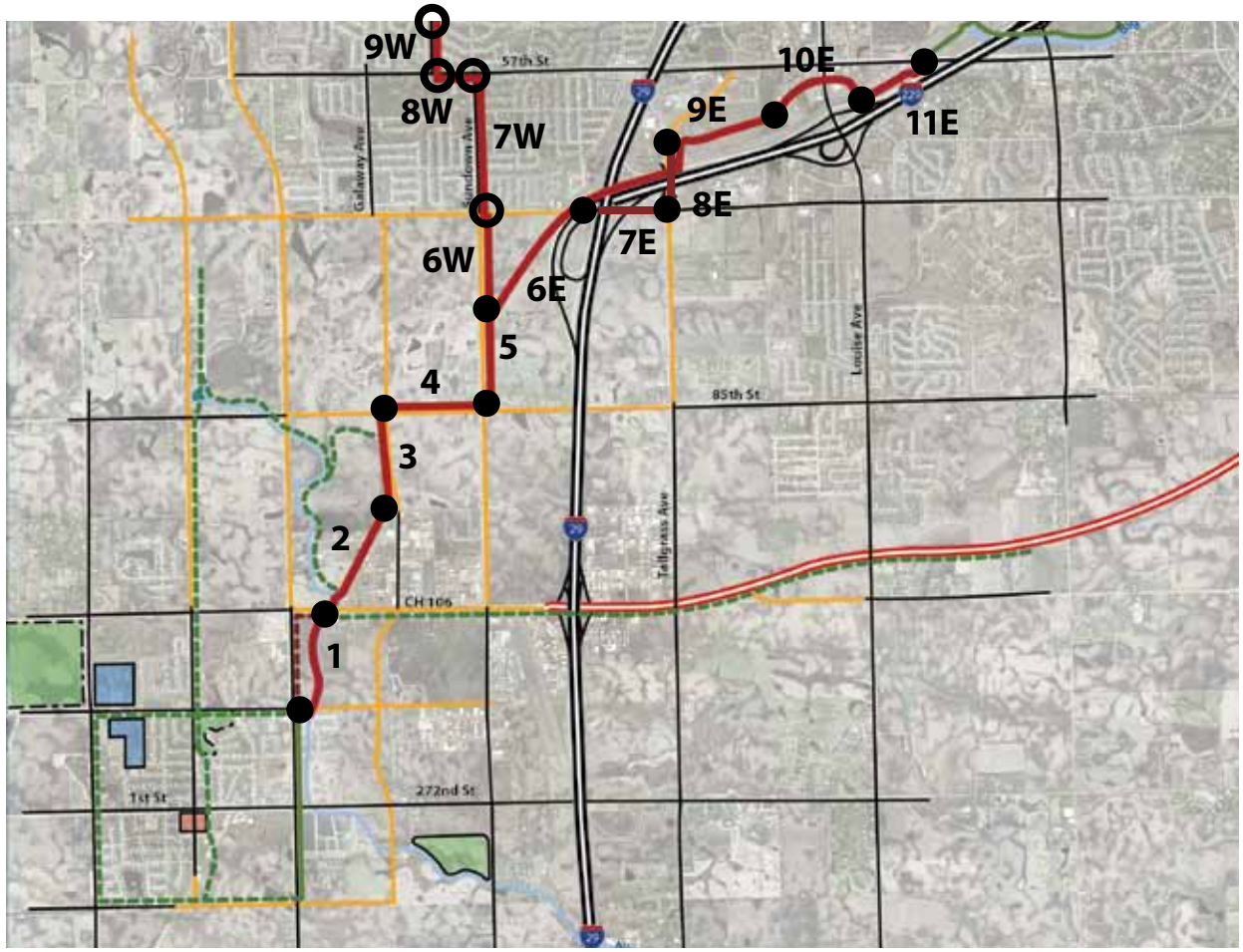
Rail Grade/69th

Concept Four forms a direct diagonal route to the Big Sioux trail by using the diagonal railroad trace in the Tea area and directing a connection around or through a redesigned I-29/I-229 interchange with connection of the east and west legs of 69th Street. From Tea, the route:

- Follows the west side of Nine Mile Creek from "Trail around Tea" to CR 106. Continues along the railroad grade and power line to 85th Street.
- Continues along 85th Street to Sundowner, continuing north along Sundowner and continuing northeast along the railroad grade to 69th Street and the I-29/229 convergence.
- Depending on the interchange/69th Street design, crosses on the 69th Street connection, and uses the Solberg/58th Street route to Sertoma Park.
- Uses the Sundowner route for the west side connection.

Map Key	Segment	Mileage	Description
1	Nine-Mile Creek, Brian to CH 106	0.63	Multi-use trail on west side of Nine-Mile Creek, incorporated into proposed mixed use development. Protected at-grade crossing across CH 106, depending on design of eventual upgrade of this corridor as part of the westside corridor project; a preferred alternative would be incorporating a trail underpass with a bridge over the drainageway.
2	Railroad grade, CH 106 to half-section line	0.56	Multi-use trail on diagonal rail grade and power line easement, behind industrial properties.
3	Power-line easement, half-section to 85th Street	0.76	Multi-use trail along power line. Trail alignment can run between twin lines to avoid impact on adjacent development. City of Tea's proposed half-section line collector is also likely to follow this corridor.
4	85th Street, power line to Sundowner	0.50	Complete street with bicycle lanes and two-way sidepath, probably on south side of 85th Street. South side allows better prospect for access control. One-way sidepaths in the direction of traffic should also be considered, depending on adjacent land use patterns with development. Segment also includes a new overpass over I-29.
5	Sundowner, 85th to railroad grade	0.45	Complete street with bicycle lanes and two-way sidepath, probably on east side with access management.
6W	Sundowner, railroad grade to 69th	0.55	Westside connection: Complete street with bicycle lanes and two-way sidepath, probably on east side with access management.
7W	Sundowner, 69th to 57th	1.00	Bicycle boulevard, adapting 36-foot street channel to bicycle and pedestrian use. Bicycle boulevard would include traffic calmers to slow or discourage through motor vehicle traffic.
8W	57th Street, Sundowner to Sertoma	0.10	Two-way sidepath on north side of 57th Street. Lots back up to 57th, with north side uninterrupted between the two streets. Bicycle lanes should be incorporated into any widening of 57th Street.
9W	Sertoma, 57th to 12th	2.03	Sertoma complete street with bicycle lanes and two-way sidepath on west side of street. West side pedestrian path is present continuously north of 41st Street and is relatively free of interruptions. Bicycle lanes are installed between 26th and 12th. A short multi-use trail link on the south side of 12th connects to Legacy Park and the Big Sioux and Cherry Creek trail networks.
6E	Railroad grade, Sundowner to 69th/I-29 and I-229 interchange	0.75	Multi-use trail along railroad trace with property owner participation. Actual route feasibility depends on ultimate design of 69th Street connection, 85th Street access or overpass, and interchange design. This option assumes integrating a pathway into a future 69th Street connection.
7E	69th Street Connection, to Solberg Avenue	0.53	Trail or two-way sidepath either around a redesigned interchange or along a 69th Street crossing. Nature of the path depends on the eventual design of this facility. If the path follows 69th Street, this segment includes a link to a sidepath on the Solberg Avenue overpass.
8E	Solberg Avenue, I-229 to Broadband Lane	0.30	Sidepath on east side of new overpass, continuing to intersection.

TEA TO SIOUX FALLS - Concept Four



Map Key	Segment	Mileage	Description
9E	Broadband Lane/59th Street, Solberg to Tennis Lane	0.50	Bicycle lanes with sidewalk. Current width accommodates bicycle lanes with curbside parking prohibition. Curb parking is unnecessary because of extensive off-street parking in office/commercial complex. Modification of 59th/Louise intersection.
7E	Railroad Trace, Tennis Lane to 57th/ Bur Oak	0.37	Multi-use trail on railroad trace, from Tennis Lane to 57th and Bur Oak. Includes protected trail crossing at Bur Oak Drive to existing trail spur.
8E	Big Sioux Trail Spur, 57th/Bur Oak to Big Sioux Trail	0.42	Existing multi-use trail with bridge over Big Sioux River at Sertoma Park.

Most Feasible Concept

All of the Tea options exhibited strengths, but also received relatively low overall rankings from the project committee, partially because many critical decisions that affect the design and feasibility of the trail are still pending. The committee was also concerned about the Solberg/58th Street connection on the north side of I-229, primarily because of traffic volume and potential hazards at the 58th and Louise intersection. This led the committee toward a hybrid route that combines the Nine Mile Creek option north of Tea with use of sidepaths on 85th and Western to reach the Big Sioux Trail. The 85th Street corridor includes a water pipeline easement in favor of the Lewis and Clark Rural Water System (LCRWS) that typically extends about 40 feet beyond the right-of-way line. The water district will permit construction of a path on or near its line as long as access is permitted on demand.

The west side connection could reasonably use either the Sundowner or Galway routes. The Galway Avenue option, using the power line alignment to 69th Street, and continuing along a Galway bicycle boulevard to 41st Street is selected as a somewhat more direct option, with more opportunities for development of true multi-use trails.

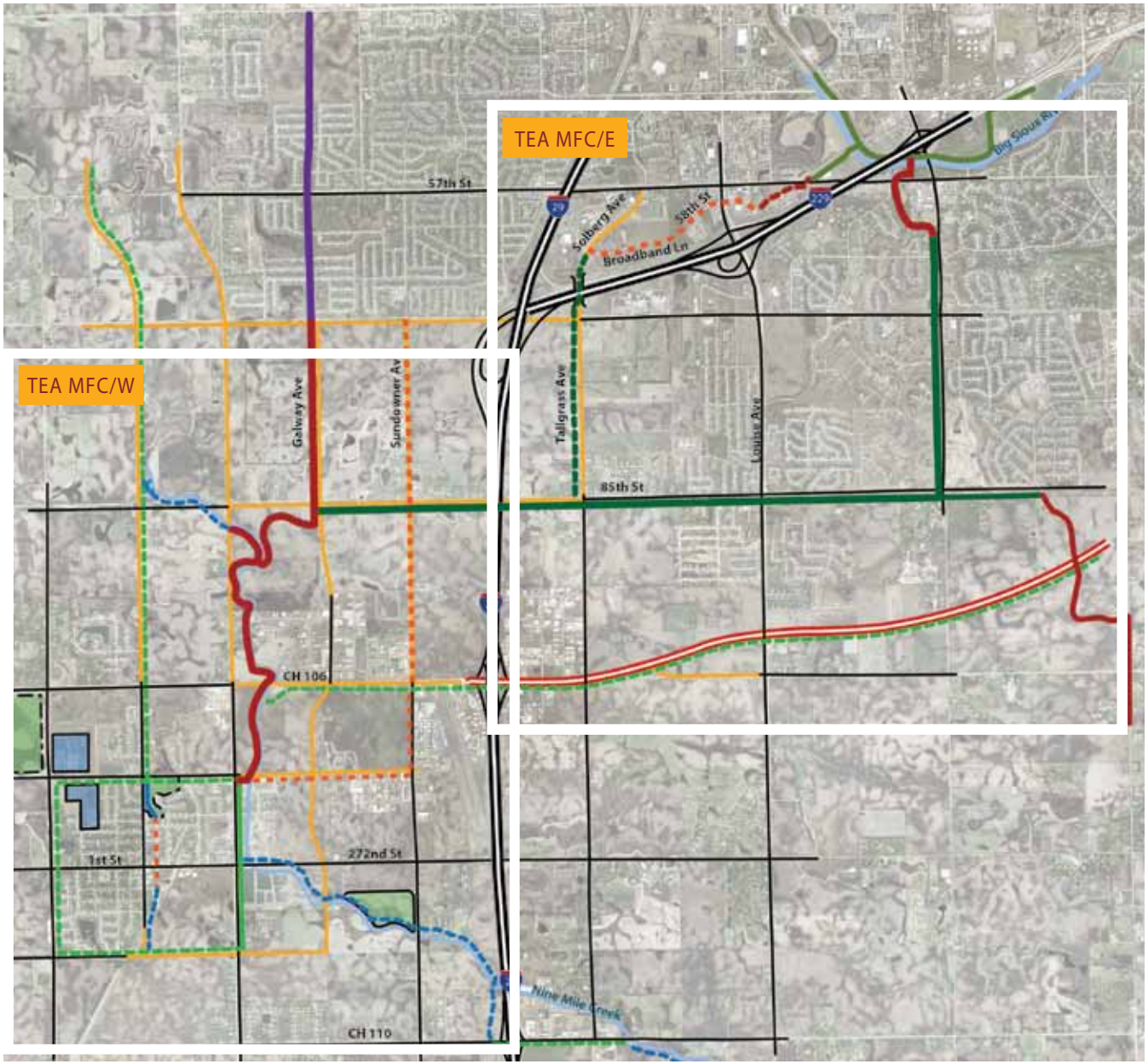
While this route was selected as the most feasible concept, the consultant team and committee have substantial concerns about the quality of the experience offered by a route so dependent on sidepaths. The eventual improvement of 85th Street should be as a "complete street," offering both a protected on-road option through bike lanes, and a well-designed sidepath for less experienced cyclists. However, the Tallgrass/Solberg/58th Street option provides a more direct route and, in many ways, a better experience for commuters and many cyclists. Its principal problems are on-road portions along Broadband Lane and 58th Street. However, these issues can be resolved for road cyclist by configuring the existing streets with bicycle lanes, and widening the 58th and Louise intersections to include a right-turn only lane to the curbside of bicycle lanes. This option also requires a protected crossing of 57th Street at Bur Oak, an access road from a building complex on the south side of 57th Street. This direct option to Sioux Falls remains feasible and should be pursued as the priority route if at all possible.

Table 5.7 summarizes the evaluation of these five options based on the ten criteria described in Part Two. This evaluation then is used to identify the most feasible concept.

Key:
++ Very high score on criterion
+ High score on criterion
o Neutral score on criterion
- Low score on criterion
-- Very low score on criterion

	Directness	Experience	Time Frame	Multiple Funding	Safety/Security	Neighborhood Services	Ease of Acquisition	Cost/ Constructability	Connectivity	Response to Users	Average Score (out of 65)	Rank
1 Power line/85th	++	o	o	+	+	+	-	o	+	+	34.9	3
2 Sundowner/SD 100	-	-	+	++	+	o	+	+	o	o	35.6	2
3 Nine Mile/Tea-Ellis	o	+	+	o	o	-	+	+	o	+	38.5	1
4 Rail Grade/69th	++	o	--	+	o	+	-	-	+	+	32.5	4

TEA - Most Feasible Concept



Inter-urban Trail

- Multi-Use Trail
- Alternate Route: Multi-Use Trail
- Sidepath
- Alternate Route: Sidepath
- (B) Bridge (R) Ramp (X) Major Crossing

Other Connections

- Existing Multi-Use Connecting Trail
- Proposed Multi-Use Connecting Trail
- Existing Sidepath Connection
- Proposed Sidepath Connection
- Proposed Complete Street
- Bicycle Boulevard/On-Street

Major Road Investments

- South Dakota 100
- Other Major Street Projects

TEA MFC/W

Inter-urban Trail

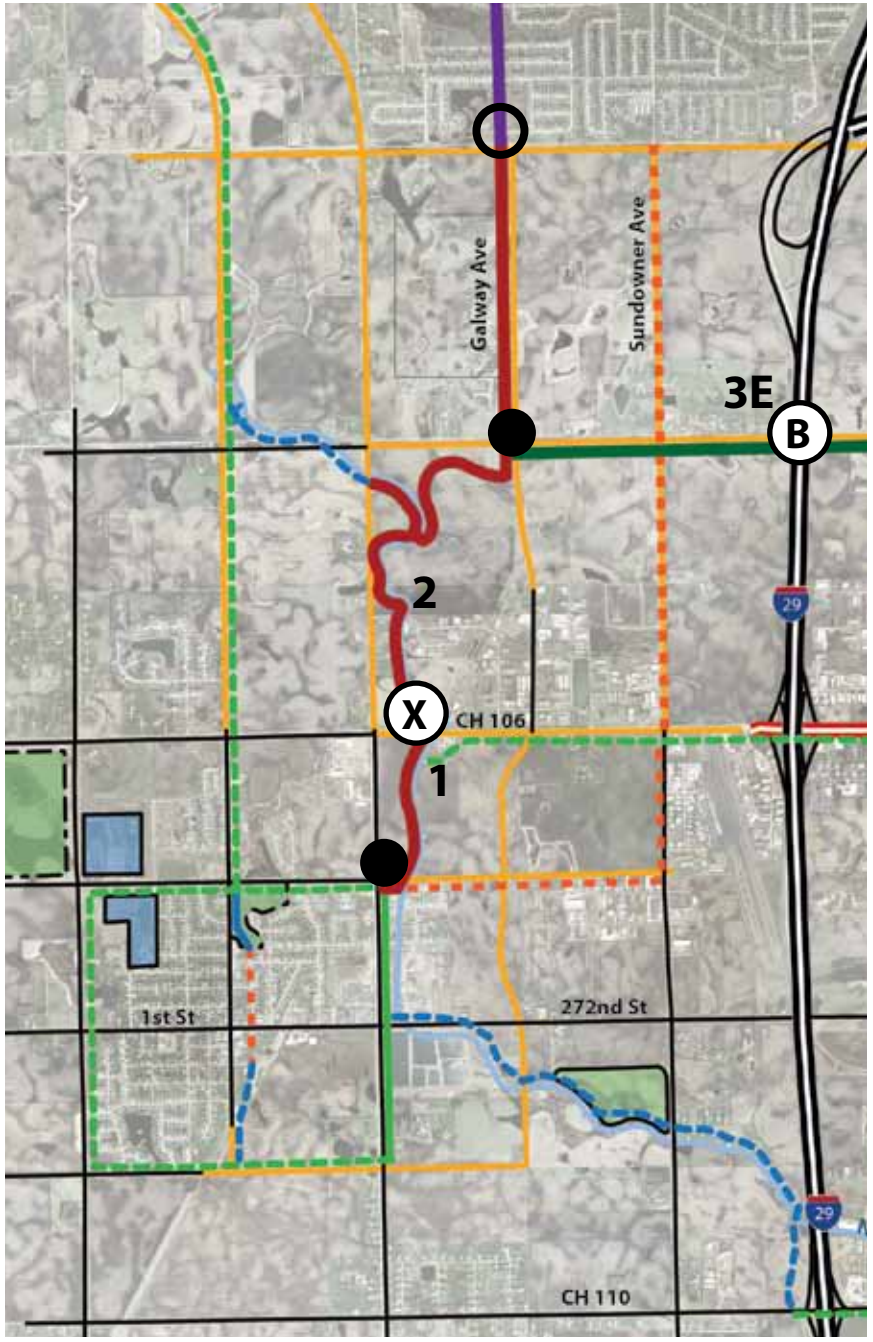
- Multi-Use Trail
- Alternate Route: Multi-Use Trail
- Sidepath
- Alternate Route: Sidepath
- (B) Bridge (R) Ramp (X) Major Crossing

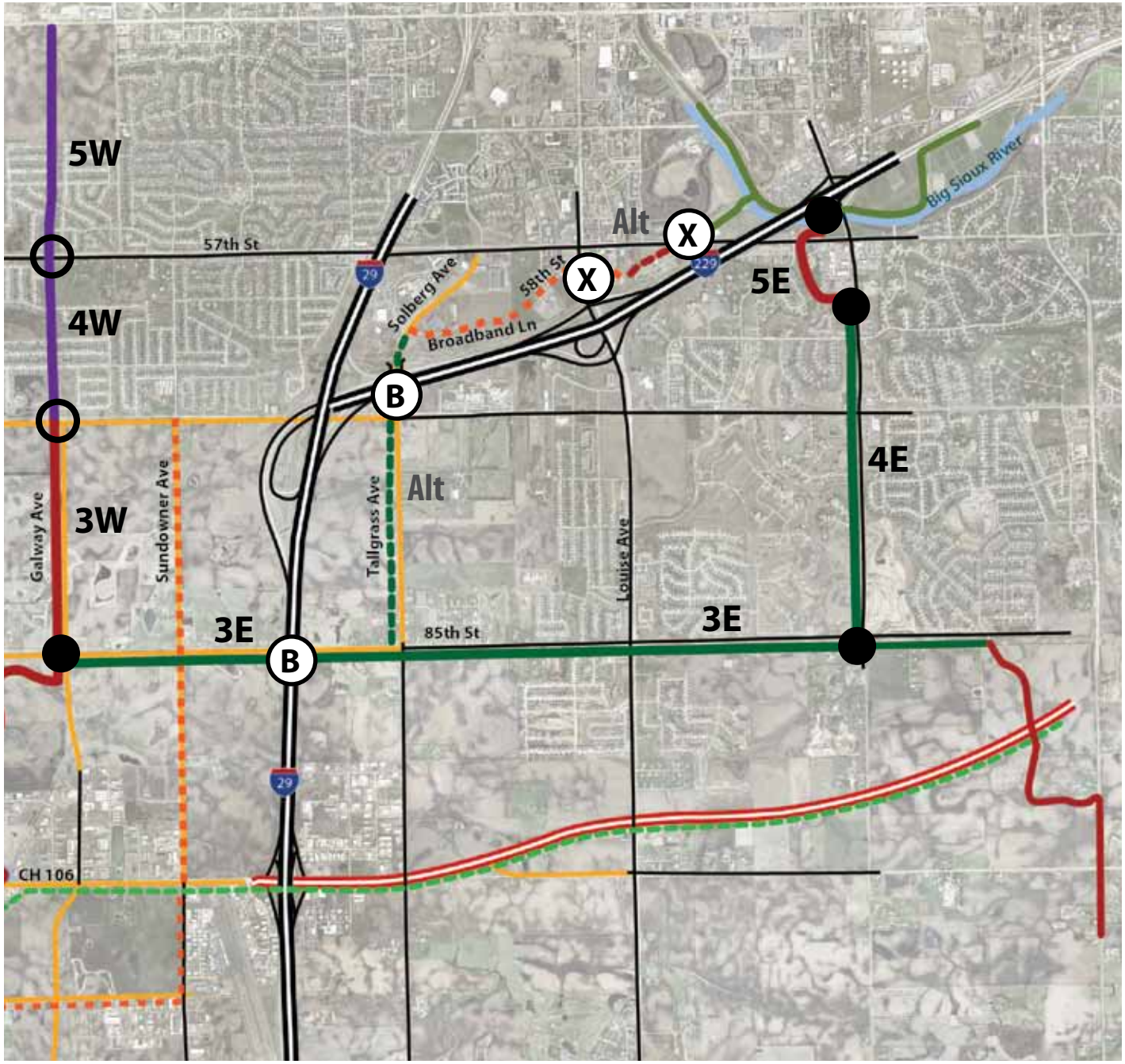
Other Connections

- Existing Multi-Use Connecting Trail
- Proposed Multi-Use Connecting Trail
- Existing Sidepath Connection
- Proposed Sidepath Connection
- Proposed Complete Street
- Bicycle Boulevard/On-Street

Major Road Investments

- South Dakota 100
- Other Major Street Projects





TEA MFC/E

Inter-urban Trail

- Multi-Use Trail
- Alternate Route: Multi-Use Trail
- Sidepath
- Alternate Route: Sidepath
- (B) Bridge (R) Ramp (X) Major Crossing

Other Connections

- Existing Multi-Use Connecting Trail
- Proposed Multi-Use Connecting Trail
- Existing Sidepath Connection
- Proposed Sidepath Connection
- Proposed Complete Street
- Bicycle Boulevard/On-Street

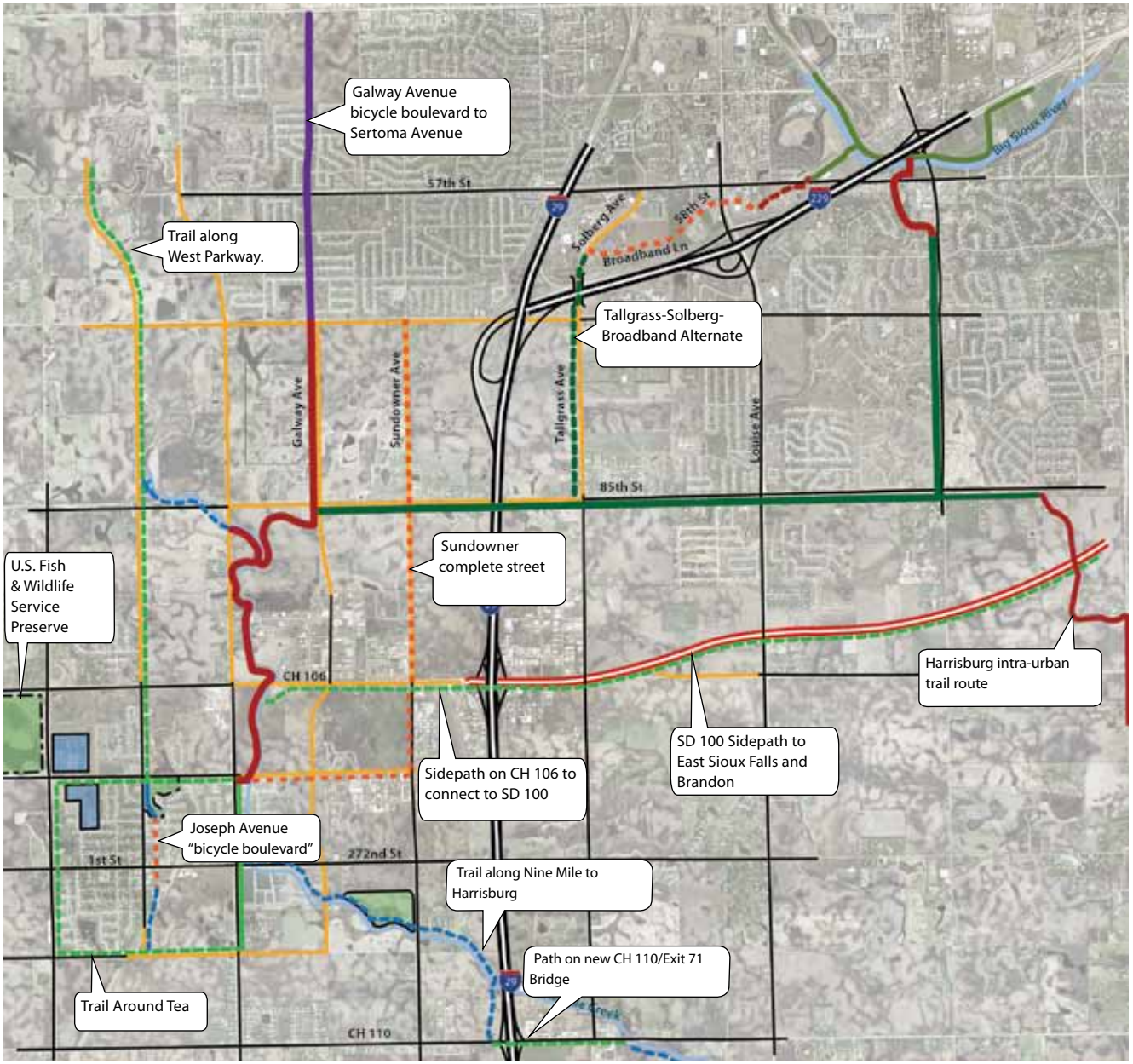
Major Road Investments

- South Dakota 100
- Other Major Street Projects

TEA - Most Feasible Concept

Map Key	Segment	Mileage	Description
1	Nine Mile Creek, Brian to CH 106	0.63	Multi-use trail on west side of Nine-Mile Creek, incorporated into proposed mixed use development. Protected at-grade crossing across CH 106, depending on design of eventual upgrade of this corridor as part of the westside corridor project; a preferred alternative would be incorporating a trail underpass with a bridge over the drainageway.
2	Nine Mile Creek and tributary drainage, CH 106 to 85th Street	1.41	Multi-use trail on west side of Nine Mile Creek. Requires agreement with adjacent property owners. Joins 85th Street near power line easement.
3E	85th Street, power line to Western	3.50	Complete street with bicycle lanes and two-way sidepath, on south side of 85th Street to take advantage of the potential for access management and the possible availability of the LCRWS easement. One-way sidepaths in the direction of traffic may also be considered. This segment includes the new overpass over I-29.
4E	Western Avenue, 85th to drainage south of the Bridges	1.50	Two-way sidepath on west side of Western, with access management feasible because of adjacent development patterns. Design of 69th Street intersection requires special care to alert both motorists and trail users of potential hazards. The sidepath route is shared by the Harrisburg trail connection north of Laquinta Street.
5E	Watercourse, Western Avenue to Yankton Trail Bridge	0.55	Multi-use trail along drainageway proposed in Sioux Falls Trail Master Plan, crossing under 57th Street through one aperture of a triple box culvert, and connecting to the Big Sioux Trail via the historic Yankton Trail Bridge.
3W	Power line easement, 85th to 69th	1.00	Multi-use trail between twin transmission lines that will also be the route of a planned collector street on the half-section line. This trail aligns with Galway Avenue north of 69th Street.
4W	69th Street, Tea-Ellis to Galway Avenue	0.50	Complete street with bicycle lanes and two-way sidepath on north side of street.
5W	Galway Avenue, 69th to 41st with alternatives	2.00	Bicycle boulevard, adapting 36 to 40 foot street channel to bicycle and pedestrian use. Bicycle boulevard would include traffic calmers to slow or discourage through motor vehicle traffic. Galway alignment from 49th Street alignment to 41st is through an undeveloped quartersection. Alternatives to the bicycle boulevard concept here would be a multi-use trail integrated into development, extending to 41st and Sertoma.
6W	Sertoma, 41st to 12th	2.03	Sertoma complete street with bicycle lanes and two-way sidepath on west side of street. West side pedestrian path exists and is relatively free of interruptions. Bicycle lanes are installed between 26th and 12th. A short multi-use trail link on the south side of 12th connects to Legacy Park and the Big Sioux and Cherry Creek trail networks. Trail connection to the Big Sioux from the park is complete. Cherry Creek system, when complete, extends to USD local campus south of North 60th Street.
Alt	Tallgrass/Solberg/Broadband Lane Route	3.18	• Two-way sidepath on west side of Tallgrass,with possible integration into research/office park project. • Sidepath on new Solberg Avenue Bridge. • Bicycle lanes with sidewalk on Broadband Lane extended to 58th. • Bicycle lanes with sidewalk on 58th with right-turn only lane at Louise. • Multi-use trail on railroad trace at end of 58th to 57th. • Protected crossing at 57th and Bur Oak. • Existing trail and bridge to Yankton Trail Park and Big Sioux Trail.

TEA - Other Connections



Local and Regional Connections

The Trail Around Tea is already in the community's development program and is the primary local connection for this inter-urban trail. Other potential local and regional connection possibilities include:

• *Joseph Avenue bicycle boulevard.* A short off-road trail parallels Main Avenue through City Park and Pool. This trail should connect to Joseph Avenue, which should be developed as a bicycle boulevard between City Park north of Kevin Drive and the new athletic complex. A short trail should continue through the complex to the south leg of the TAT along 9th Street.

• *West Parkway.* The westside transportation study envisioned West Parkway as a complete street, with bicycle lanes and parallel trails. This becomes Main Avenue south of Brian Street. A trail spur along Nine Mile Creek would connect a future West Parkway route to the Tea-Sioux Falls Trail presented above.

• *Fish and Wildlife property.* A US Fish and Wildlife preserve west of 468th Avenue and north of Brian should be served by a spur from the TAT loop.

• *Nine Mile Creek to Harrisburg.* A long term regional project would continue the Nine Mile Creek segment of the Tea-Sioux Falls Trail south and east along Nine Mile Creek, extending to Harrisburg.

CHAPTER 6 | THE METROPOLITAN SYSTEM

The three inter-urban trails presented in the preceding chapters become important parts of an emerging metropolitan trail and bicycle route system which can take a place among the nation's best urban trail networks. The map on the facing page illustrates this emerging system, which includes the following components:

The existing Sioux Falls trail system. This includes the core Big Sioux River Loop with extensions along Southeastern Avenue and eastward from Legacy Park near 12th and La Mesa on the west side of the city. Both Tea and Brandon have significant local paths that are integrated into the inter-urban system. The critical remaining gap in the continuity of this core system is completing the connection between the westside trail from Legacy Park to the Big Sioux Loop.

Major Sioux Falls trail corridors programmed for completion during the next ten years. These include the northeastern extension of the Big Sioux Trail toward Great Bear Recreation Area and Brandon that connects with the Brandon/Big Sioux Trail presented in Chapter Three. The other three major planned Sioux Falls corridors were the subjects of the 2007 Trail Master Plan and include:

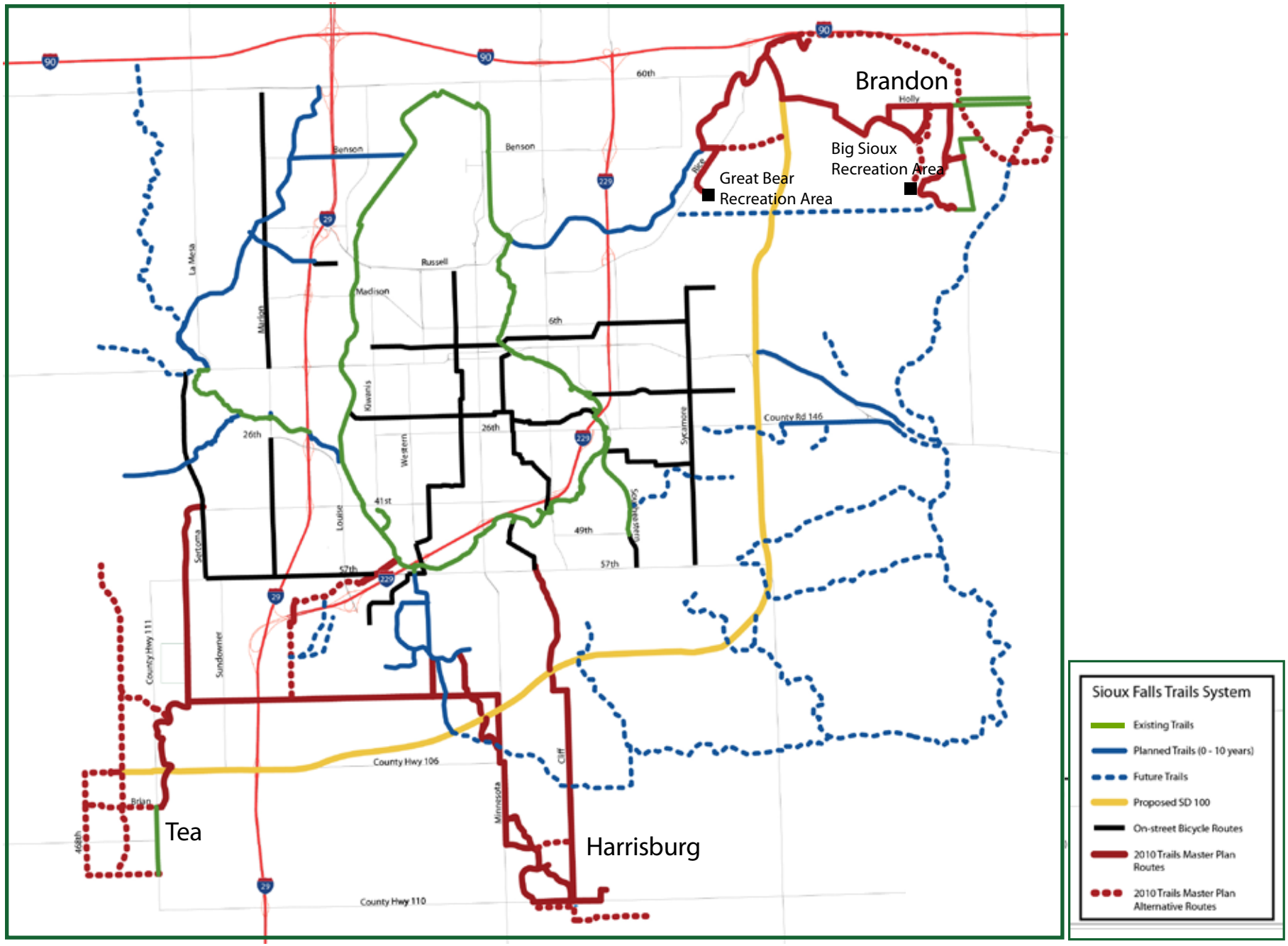
- The Cherry Creek (Westside) Trail from Legacy Park northeast along Cherry Creek and tributaries to the new educational campus near I-29 and 60th Street North. This greenway becomes a major organizing element for development in the northwestern sector of the city.
- The Diamond Creek Trail network from the Big Sioux Trail at Yankton Trail Park to 85th Street. The Harrisburg Trail presented in Chapter Four uses part of this network on its way to Sioux Falls.
- The Arrowhead Trail, extending roughly parallel to South Dakota Highway 42 from the future South Dakota 100 to Arrowhead Park and the Minnehaha County's Perry Arboretum.

South Dakota 100. This controlled access ring road will also be a ring pathway, connecting Brandon, Harrisburg, and Tea, and knitting the inter-urban trails together. While SD 100 may not present a bucolic trail experience, its sidepath will be an enormously important part of the metropolitan system.

The three inter-urban trail corridors that are the subject of this study. Chapter Eight presents a detailed implementation program, including an initial phase for each corridor that can put a facility in service within the five to seven year future.

Sioux Falls' on-street system of numbered routes. In addition to designating these destination-based routes, the city has been steadily improving this system with sharrows, bicycle lanes, and defined parking lanes.

Longer-term trails, envisioned for eventual development beyond ten years. A notable segment would be another extension along the Big Sioux south from Brandon and the Big Sioux Recreation Area to the Arboretum.


Brandon
Holly
Big Sioux
Recreation Area
Great Bear
Recreation Area
Tea
Harrisburg
60th
Benson
Russell
Madison
6th
26th
41st
49th
57th
County Rd 146
County Hwy 106
County Hwy 110
Sioux Falls Trails System
Existing Trails
Planned Trails (0 - 10 years)
Future Trails
Proposed SD 100
On-street Bicycle Routes
2010 Trails Master Plan Routes
2010 Trails Master Plan Alternative Routes

CHAPTER 7 | DESIGN GUIDELINES FOR INTER-URBAN TRAILS



This chapter presents recommended design guidelines and concepts for the various trail types and contexts proposed for the intra-urban trail networks linking Brandon, Harrisburg, and Tea to the Sioux Falls system. It also considers some unusual situations included within the proposed most feasible concepts. These guidelines address trail and other bicycle facilities, intersections, and endpoints, including the following contexts introduced in Chapter Two:

- Multi-use trails on separated right-of-way
- Sidepaths
- Bicycle lanes and shoulders
- Complete streets
- Bicycle boulevards
- Shared routes

Some of this material was previously developed for the Sioux Falls Trail Master Plan (2007) by RDG Planning & Design and the Sioux Falls MPO Bicycle Plan. This is updated with new information from both consultant team members and other sources, including the draft AASHTO Guide for the Planning, Design, and Operation of Bicycle Facilities (February, 2010), the Pedestrian and Bicycle Information Center, design manuals and reports by the Florida and New Jersey Departments of Transportation, and other material. These guidelines are meant to offer both guidance to designers of specific facilities and a degree of common expectations throughout the system. They do not anticipate every situation that will arise during the detailed design process, and should absolutely not prevent others from developing and implementing other effective solutions

Multi-Use Trails on Separated Right-of-way

Context

While Sioux Falls has made major strides in adapting streets to bicycle use, multi-use trails separated from motorized traffic are the nucleus of the city's bicycle and pedestrian transportation and recreation system, and the focus of the intra-urban system proposed in this study. This document separates these trails into two categories: trails on their own right-of-way, and trails or sidepaths that parallel road corridors.

In the concepts presented in Chapters 3, 4, and 5, multi-use trails on separated right of way are used along streams and watercourses, power line right-of-way or easements, parks, school campuses, public facilities, and adjacent to low-use railroad corridors. These trails may follow streets without interruption in situations requiring short links. The intra-urban trails proposed in this plan will ultimately be paved, although soft surfaces may be used to reserve right-of-way and establish patterns of use in advance of development. Paved trails accommodate a variety of users, including walkers, runners, bicyclists, and in-line skaters, and provide

vest accessible to people with disabilities.

General Design Standards:

Trails should comply with American Association of Street and Highway Transportation Officials (AASHTO) standards and Uniform Federal Accessibility Standards and the "Americans with Disabilities Act Accessibility Guidelines." The new AASHTO manual is still in the review process and is scheduled for release in 2011.

Materials:

Table 7.1 reviews attributes of various trail surface materials. Most of Sioux Falls' current trails are surfaced with asphalt, and major segments of the Big Sioux Trail were resurfaced in 2010. Asphalt provides an excellent surface when new and is somewhat less expensive than concrete. Concrete provides a more durable, longer-lived surface, particularly in climates with freeze-thaw cycles, and can be replaced panel by panel if necessary. Without prescribing specific regional standards, AASHTO 2010 recommends a six inch minimum depth, including both surface and base courses, over a compacted subgrade. A stable sub-base is especially important to the durability of both materials. This is especially important around drainageways, where stream banks tend to slough off and produce serious cracking and deterioration.

Trail Width and Clearances:

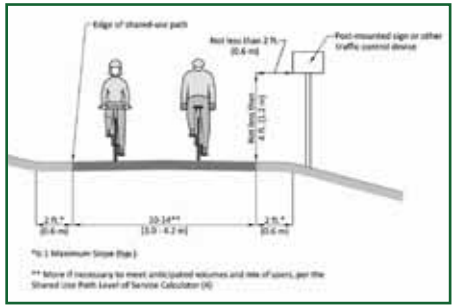
- The accepted minimum width for two-way trails is 10 feet. Eight feet may be adequate for secondary segments in areas with severe right-of-way limits. Eight feet does not safely accommodate passing movements by types of users who require greater width than narrow profile road bicycles, including in-line skaters, bicyclists with child trailers, and recumbents.
- A two-foot minimum shoulder (3-5 feet is more desirable) with a maximum 6:1 cross-slope should be provided as a recovery zone adjacent to trails.

Figure 7.1: Trail Surface Comparisons

Surface	Advantages	Disadvantages
Soil Cement	Natural materials, more durable than soil, low cost, relatively smooth surface	Uneven wear, erodible, difficulty in achieving correct mix.
Granular Stone	Natural material, firm and smooth surface, moderate cost, multiple use	Erodible in storms, needs regular maintenance to maintain surface, discourages on-line skaters and some wheeled users
Asphalt	Hard surface, smooth with low resistance, stable, low maintenance when properly installed, multiple use	Relatively high installation cost, requires periodic resurfacing, freeze/thaw vulnerability, petroleum based material, construction access and impact
Concrete	Hardest surface, easy to form, lowest maintenance, best cold weather surface, freeze-thaw resistance	Highest installation and repair cost, construction access and impact
Native Soil	Natural material, very low cost, low maintenance, easy for volunteers to build and maintain	Dusty, ruts, limited use, unsightly if not maintained, not accessible
Wood Chips	Natural material, good walking surface, moderate cost	Decomposes when wet, requires regular maintenance and replenishment, not accessible
Recycled Materials	Good use of materials, surface can be adequate	High cost, uncertain performance

Source: Adapted from *New Jersey DOT Bicycle Compatible Roadways and Bikeways-Planning and Design Guidelines*

- Signs or other traffic control or information devices should be at least two feet from the edge of the trail surface. The bottom edge of any sign should be at least 4 feet from the grade of the trail surface.
- A soft surfaced two-foot extension to a paved trail can improve conditions for walkers and runners because of its resilience and lower impact.
- Minimum vertical clearance for trails is 8 feet; 10 feet is recommended unless clearance is limited. When conditions, like the height of a culvert or bottom of a bridge structure, further limits clearance, cyclists must be advised to walk bicycles.



Source: *AASHTO 2010*

Grades and Grade Changes:

Most grades on the intra-urban system are relatively easy,

Some segments (such as those along the WAPA right-of-way east of the Bluffs of Brandon) or at underpasses or ramps may include substantial, if short, grade changes.

- Recommended maximum grades for multi-use trails are 5% for any distance, 8.3% for distances up to 200 feet, and 10% for distances up to 30 feet (bicycles only).
- Grades over 5% must include landings and handrails compliant with the Americans with Disabilities Act.
- Ramps, bridges, and landings adjacent to abrupt grade changes must include 42-inch handrails, designed to meet AASHTO recommendations. Ramp surfaces should be slip-resistant.
- When underpasses require slopes over 5%, consider an alternate accessible route with reduced grades if possible, even if this route requires a grade crossing.
- Warning signs for trail users should be used on grades approaching 5% and greater.
- AASHTO 2010 recommends avoiding grades less than 0.5% because of ponding problems.

Subsurface and Drainage:

- Typically 4 to 8-inch compacted, smooth, and level. Individual conditions may require special design.
- Trail cross-section should provide adequate cross-drainage and minimize debris deposited by runoff. Typically, this involves a cross slope between 1% and 2%.
- When trails are adjacent to or cut into a bank, design should catch drainage on the uphill side of the trail to prevent slope erosion and deposits of mud or dirt across the trail.

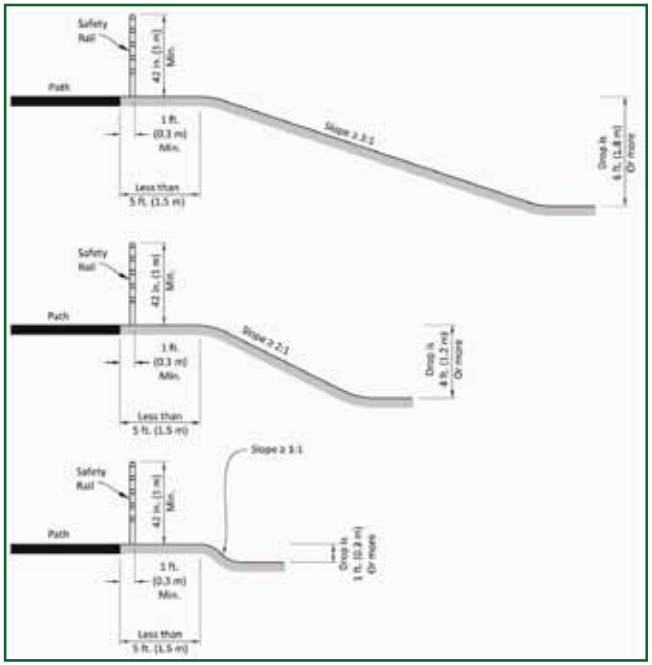


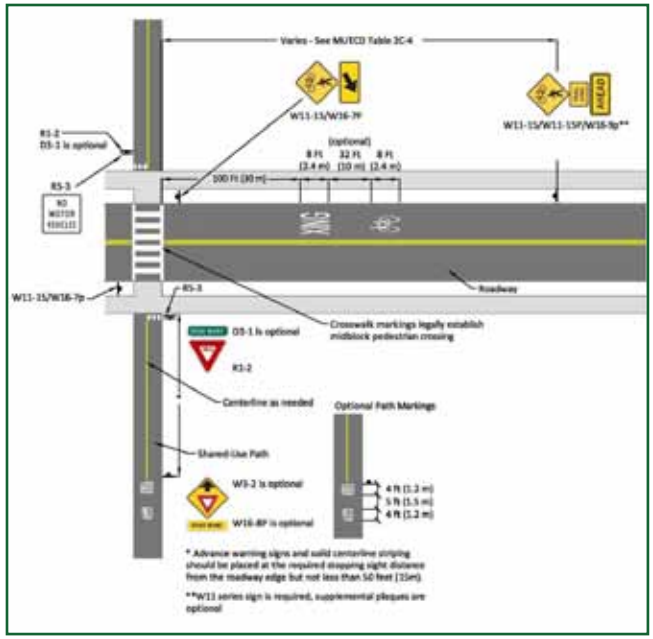
Figure 7.2. Railings and Trail Separations from Adjacent Steep Slopes
Source: *AASHTO 2010*

Intersection Design:

- Establish a typical design speed of 20 mph, with horizontal and vertical geometrics and stopping sight distances consistent with AASHTO 2010 standards, as published.
- In most cases, trail traffic will be subordinate to motor vehicles on intersecting roads. Figure 7.2 illustrates crossing treatments at mid-block intersections.
- Align or widen trail at railroad intersections to permit perpendicular crossing of tracks.

Crosswalk Delineation

- The crossing surface should clearly delineate the trail right-of-way.



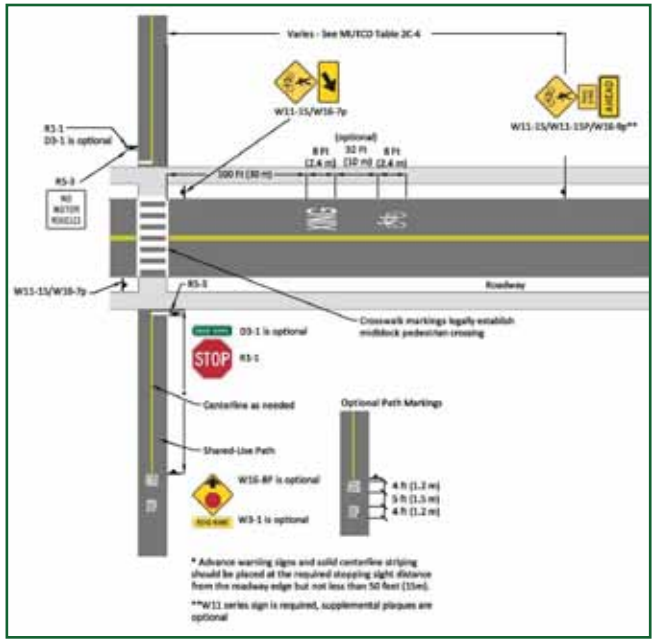


Figure 7.3. Intersection Conditions for Midblock Trail/Road Intersections: Yield and Stop Controlled
Source: *AASHTO 2010*

- Trail crossings should be delineated with standard pavement markings, such as the "ladder" or "zebra" patterns. Another option is providing a contrasting surface that clearly defines the trail domain. These may include the use of stamped concrete, colored concrete, or pavement marking or patterning products such as StreetPrint or others.

- At midblock crossings of multi-lane roads, refuge medians should be used to reduce the distance that trail users must negotiate at one time.

Curb Cuts and Trail Access Points

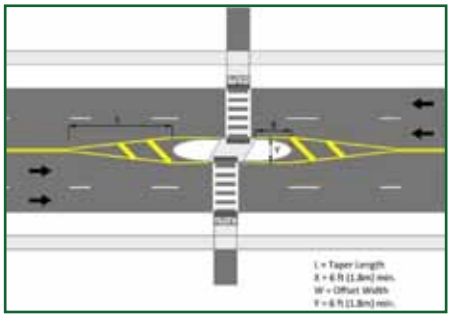
- Avoid the use of bollards or obstacles at grade-level intersections unless operations prove they are needed. If necessary, use entrances with a median separating directional movements in place of bollards. Medians should be placed about 25 feet in from the edge of the roadway to permit space for cyclists to clear the intersection before slowing.

- When bollards or gateway barriers are used, provide a minimum opening of five feet, adequate to permit adequate clearance for all bicycles. Avoid poorly marked cross barriers that can create hazards for entering bicyclists, particularly in conditions of darkness.

- At midblock crossings of multi-lane roads, refuge medians should be used to reduce the distance that trail users must negotiate at one time.

- The bottom of the curb cut should match the gutter grade and have a minimal lip or bump at the seam. Truncated domes should be used to alert visually impaired users to the street crossing.

Source: *RDG Planning & Design*



Source: *AASHTO 2010*

Midblock Refuge Medians. A crossing median provides refuge to trail users at mid-block crossings, reducing the distance that pedestrians and cyclists are exposed to traffic.

HAWK Beacon. The HAWK beacon was developed in Tucson and is being deployed on an experimental basis around the country. The HAWK functions somewhat like school bus warning signals. It is dark when not in use. When actuated by a pedestrian, a flashing and then solid yellow light warns motorists to slow; a solid red light paired with a walk signal stops traffic and gives the right-of-way to the pedestrian. Users report a high degree of motorist compliance and a positive effect on pedestrian safety. It has major potential at difficult surface crossings on the Sioux Falls metropolitan system.

- The bottom width of the curb cut should be full width of the intersecting trail.

Signage

- Provide regulatory and warning signs consistent with the 2009 Edition of the Manual of Uniform Traffic Control Devices (MUTCD).
- Standard trail crossings signs, typically a bicycle in a diamond, should always be used to alert motorists of the trail crossing. See Figure 7.3 for suggested sign placement.

Traffic Control

- Right-of-way should be clearly established. Ordinarily, the trail will be stopped with right-of-way preference given defensively to the motorist.
- Controls for pedestrian signals should be easily accessible to trail users and should not require cyclists to dismount or move out of their normal path.
- New crossing technologies such as the HAWK (High Intensity Activated Crosswalk) apply well to trail crossings and should be considered at mid-block locations. The HAWK sequence is similar to warning signalization used on school buses.
- At intersections with pedestrian actuated signals, the signal control should be readily accessible from the trail surface.

Design for Maintenance:

- Provide adequate turning radii and trailhead access to maintenance and emergency vehicles.

Information and Support Facilities:

- Establish a consistent informational sign system that includes a Sioux Falls metropolitan trail system logo, an identifying trail name, trail maps at regular intervals, mileage markers for reference and locating emergency situations, directional signage to destinations, and safety rules and advisories.
- Provide periodic minor rest stops, including benches, shaded areas, picnic areas, and informational signing. Ensure reasonable access to water, restrooms, and shelter.

Sidepaths

Sidepaths, or multi-use pathways built along a road, are controversial and have traditionally been discouraged in design practice and criticized within the cycling community for a number of reasons, among which are:

- Hazards at sidepath intersections. On two-way sidepaths, motorists do not expect, and often do not see, bicyclists in the counterflow direction. Right-turning motorists in many cases ignore path users moving straight ahead, creating the possibility of a crash. This always places path users on the defensive.
- Right-of-way ambiguities at driveways and intersections. Usually, cyclists on a sidepath along a major street are forced to yield to intersecting traffic. Cyclists traveling on streets, on the other hand, have the same right of way rights as motorists.
- Path blockages. Cross traffic on driveways and intersecting streets frequently blocks the sidepath by stopping across it.

As a result, experienced cyclists prefer on-road facilities to sidepaths. Yet, sidepaths, despite their shortcomings, are used frequently and remain popular with many users. Many cyclists fear rear-end crashes or distracted drivers wandering into even a well-designed bicycle lanes. Sidepaths also accommodate pedestrians and other wheeled users who cannot use streets. They also provide continuous routes where other alternatives, including trails or parallel local

streets, are not available. Indeed, sidepaths are integral to the national bicycle system of the Netherlands, one of the world's premier cycling countries, and work because of careful design and motorist respect and acceptance of bicyclists. Sidepaths are by necessity important to the Brandon, Harrisburg, and Tea intra-urban routes.

The guidelines presented here are based on three general principles:

- Sidepaths should in most cases complement rather than replace on-road facilities, except along limited access roads like SD 100. Therefore, in most cases, both on- and off-road options should be offered.
- The objective of sidepath design guidelines should be to make these facilities as safe as possible, specifically by addressing the most hazardous situations -- road and driveway intersections.
- Sidepaths are safest when driveway and cross-street interruptions are fewest. Therefore, access management becomes especially important.

Access Management:

Access management makes sidepaths safer. There is no one clear standard for frequency of access points. Reasonable guidance is provided by the Idaho Department of Transportation, recommending a maximum of eight crossings per mile, with a preferred maximum of five crossings per mile. This access management policy should apply to the primarily arterial streets proposed for these three corridors.

On-Road Facilities:

Roads proposed for sidepaths should also provide on-road bicycle facilities, specifically:

- New or substantially new roads (e.g. Minnesota Avenue, 85th Street, Tallgrass Avenue) proposed for sidepaths should also include bicycle lanes or shoulders within their design.
- Roads proposed for sidepaths that are in their probable end state for the foreseeable future should include an on-street option through shared use lanes or, if possible, reconfiguration to include at least a single directional bicycle lane, with a shared lane in the opposite direction. The bicycle lane should be used on the uphill side.

Pathway Standards:

Structure and materials of sidepaths are the same as for multi-use trails on separated right-of-way.

Pathway Setback:

As discussed in Chapter Two, research conducted for the Florida Department of Transportation indicates that, to maximize safety, separation of the sidepath from a roadway should increase as road speeds increase. The Florida data suggest that at lower adjacent road speeds, a smaller separation produces crash rates lower than those of the adjacent road, while that threshold is reached at greater separations for high speed facilities. AASHTO 2010 recommends a minimum separation of five feet without a physical barrier. Figure 7.4 displays a standard separation for Sioux Falls area trails based on the Florida findings.

Figure 7.4. **Sidepath Separation from Roadway**

Adjacent Road Speed Limit (mph)	Recommended Sidepath Separation (feet)
35	5-8
45	12-14
55	20-24

Sidepath Separation. On a multi-lane road, sidepath maintains an appropriate separation from 45 mph arterial. At intersection, the path moves toward the roadway edge for maximum visibility.

Sidepath Concepts and Adjacent Roadway Character:

Almost all sidepaths in this country are two-way facilities, setting up an unexpected counterflow direction that creates the possibility of crashes. Florida DOT research indicates that two-way sidepaths appear safer along 2- and 3-lane roadways and less safe along multi-lane roads with 2 or more lanes in each direction. In addition to the higher speeds typical of wider roads, this phenomenon can be explained by:

- The field of vision of motorists opposite the sidepath. On wider roadways, motorists cannot see or are less aware of a sidepath on the opposite side, creating a particular crash hazard between path users and left-turning traffic.

- Motorists exiting intersecting driveways or streets are looking for oncoming traffic at a shallower angle because of the greater street width, directing attention away from the already unexpected sidepath traffic to their right.

A sidepath concept that can address these issues, preferably with bicycle lanes or shoulders on the adjacent road, is a one-way cyclepath in the direction of traffic on either side of the street. (Figure 7.5) The cyclepath is separated from the pedestrian walk by a painted line and, potentially, a change in pavement color, and delineated by a directional bicycle marking. Before reaching a major intersection, the cyclepath is directed to and merges into the bicycle lane which, at major intersections, is located to the left of a right-turn only (RTO) lane. Inexperienced bicyclists have the option of becoming pedestrians and using the crosswalk. The one-way sidepath concept combines the relative mid-block security of the sidepath to many users with the safer options of behaving like other vehicles or as pedestrians at street intersections.

The one-way sidepath should be considered:

- Along four-lane divided or five-lane corridors with local street accesses.

- When a sidepath is recommended but, for various reasons, access cannot be closely managed.

The connection of the one-way sidepath to a bicycle lane at intersections will tend to discourage wrong-way use of the system.

Design of In-line Crossings at Driveways and Streets

Many of the design guidelines presented above for mutli-use trails on separated right-of-way are also applicable to these intermediate crossings. Additional recommenda-

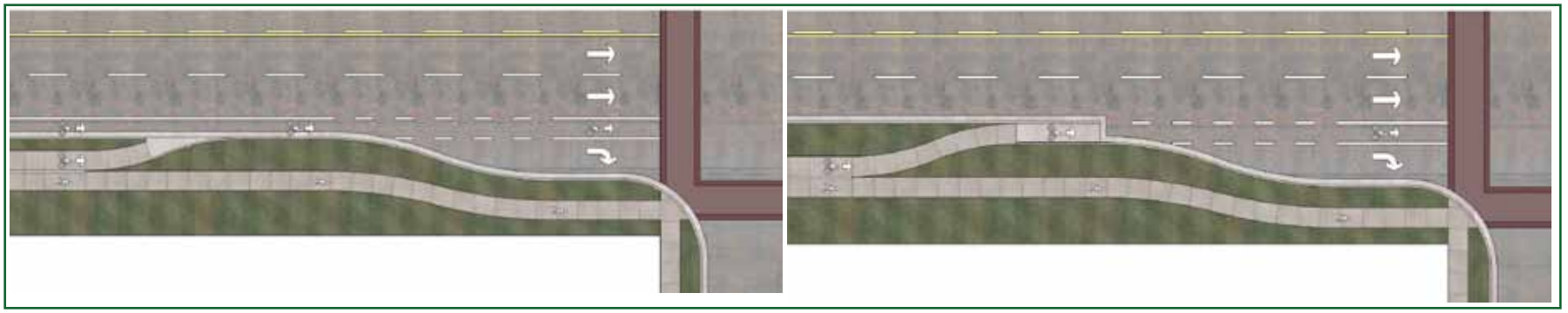


Figure 7.5. One-Way Sidepath Concept. A system of paired one-way sidepaths can minimize some of the operating hazards of two-way paths in certain settings. The one-way sidepath concept can be used both on streets both with and without bike lanes, illustrated below on the left and right respectively.

tions adapted to the special conditions presented by sidepath crossings are presented here.

Ramp Design

- Curb/intersection cuts or ramps must be logical and in the direct travel line of bicyclists.
- A design that places a curb in the direct travel line of bicyclists is hazardous. The intersection area must be free of obstructions, such as poles for traffic signal mast arms or lighting standards.

Separation Distance

The separation of the trail crossing from the edge of the roadway is a troublesome issue. Some sidepath designs put users in serious jeopardy by placement that either provides poor visibility or inadequate reaction time. Based on specifications in Finland and the Netherlands, where sidepaths are prevalent, the Florida DOT's path intersection design manual proposes three discreet and mutually exclusive separation distance categories:

- 1-2 meters
- 5-10 meters
- more than 30 meters

These distances are based on the interaction of five variables: motor vehicle turning speed, stacking distance, driver and/or pathway user awareness, and chance of pathway right-of-way priority. These categories are designed to prevent awkward conditions that may impair visibility and not give either the trail user or motorist opportunity to respond. Figure 7.6 summarizes the relative performance of each placement for these variables.

Crossing Definition

- All crossings across streets and driveways should be defined. Street intersection markings should utilize standard zebra or ladder markings incorporated at mid-block crossings and other major intersections. Colored concrete or asphalt surface treatments may also be used. A simpler dashed crosswalk boundary may be used as a convention at driveway crossings.
- Stop bars should be provided for motor vehicles ahead of the crosswalk to discourage motorists from obstructing the path. Surface triangles that indicate a motorist yield may be used in place of stop bars. Unfortunately, many American motorists do not understand this marking.

Signage

Use warning signs along roads with sidepaths similar to advisories for parallel railroad tracks. This provides motorists with a background awareness of the parallel sidepath.

Right-of-Way Assignment

Generally, pathway users paralleling a street with right-of-way priority should share that priority. That said, sidepath users must be advised to ride defensively, and assume that they will often be forced to yield the right-of-way.

Overly frequent stop signs will cause many path users to ignore the traffic control entirely. The Florida manual states

Sidepath Advisory Sign. Variation of the MUTCD's Railroad Advance Warning Sign, modified as a sidepath advisory. This sign should be used on both sides of a road with sidepaths. This installation is on Speer Boulevard in Denver, advising of the parallel Cherry Creek Trail. Florida DOT advises a similar sign.

Figure 7.6. **Sidepath Separation from Roadway: Performance at Intersections**

Parameter	1-2m 0-6.56 feet	5-10m 16.4-32.8 feet	over 30m over 98.4 feet
Motor vehicle turning speed	Lowest	Higher	Highest
Motor vehicle stacking space	None	Yes, better at higher separation	Yes
Driver awareness of path user	Higher	Lower	High or Low
Path user awareness of driver	Higher	Lower	Highest
Chance of pathway ROW priority	Higher	Lower	Lowest

Source: *Intersection Design Manual, Florida Department of Transportation*

that path users may be intolerant to delay, wish to maintain momentum, or have limited traffic knowledge. When stop signs are installed on a path at extremely low volume intersections or even driveways, path users have a propensity to disregard them. The wheeled user cyclist or skater is, in effect, being taught this dangerous behavior by these "crying wolf" signs since he or she thinks there is little chance of cross traffic.

Intersection Geometrics

In addition to crossing visibility and access management techniques, AASHTO 2010 advises the following design measures to address intersection and driveway crossing safety:

- Intersection and driveway design to reduce speed and heighten driver awareness of path users through tighter corner radii, avoidance of high-speed free flow movements, median refuge islands, and good sight lines.
- Design measures to reduce pathway user speed at intersection approaches, being certain that designs do not create hazards.
- Calming traffic speeds on the adjacent roadway.
- Designs that encourage good cyclist access between roadway and sidepaths at intersections.
- Keep approaches to sidepaths clear of obstructions, including stopped motor vehicles, through stopbars and yield markings.

Signal Cycles

- Avoid permissive left turns on busy parallel roads and sidepath crossings. Use a protected left-turn cycle with a sidepath-oriented bicycle/pedestrian signal, giving a red signal to the sidepath user when left turns are permitted.
- Prohibit right turns on red at intersections with a major sidepath crossing.

Bicycle Lanes and Shoulders

Bicycle lanes provide reserved space for cyclists operating within the street channel. Bicycle lanes always provide for one-way movement, moving in the same direction as motor vehicles. On-road facilities like bicycle lanes should *always* be available on segments of the intra-urban system that also use sidepaths. Within these systems, reserved bicycle lanes are proposed in the following contexts:

- New streets to be constructed to "complete street" standards. These include:

  - In the Brandon network, Redwood Boulevard and segments of Benson Road.

  - In the Harrisburg network, Minnesota Avenue and Cliff Avenue.

  - In the Tea network, 85th Street, Sundowner Avenue, and Western Avenue.

  The design of these streets should add bicycle lanes or shoulders to the proposed number of traffic lanes.

- Connecting streets or multi-lane streets with the capacity to accommodate or be converted to provide bicycle lanes.

Bicycle Lane Standards

- Minimum unobstructed bicycle lane width is 5 feet. On urban streets without parking, this width is measured from the inside edge of the gutter pan to the edge of the nearest moving lane.
- Where conditions permit, a buffered bicycle lane or wider lane provides an extra measure of safety and security to

users. These lanes provide a two-foot additional separation buffer between travel lanes and bicycle lanes. These are especially appropriate on roads that operate at higher speeds, and also insulates bicyclists from a wind blast effect from passing motor vehicles.

- Minimum desirable motorized travel lane widths are 11 feet.

Intersection Design

- Bicycle lane markings should continue to the stop bar at controlled intersections or to the right-of-way line extended at uncontrolled intersections.
- When right turning traffic crosses the bicycle lane, putting moving traffic to the right of the lane, the conflict zone should be highlighted with a traffic green color.
- Bicycle-sensitive signal sensor loops should be placed appropriately in the bicycle lane.

Complete Streets

Complete streets in the three intra-urban corridors are multi-modal streets that include travel lanes, bicycle lanes, and sidewalks or sidepaths, depending on the situation. Figure 7.9 displays typical dimensions and right-of-way requirements for situations that are likely to arise in the system and its connections, while Figures 7.10-7.16 provide diagrams of these typical street sections. The design of individual projects should incorporate these general guidelines and dimensions.

Shared Routes

Shared routes without dedicated bicycle lanes are used as connecting segments in the three intra-urban corridors.

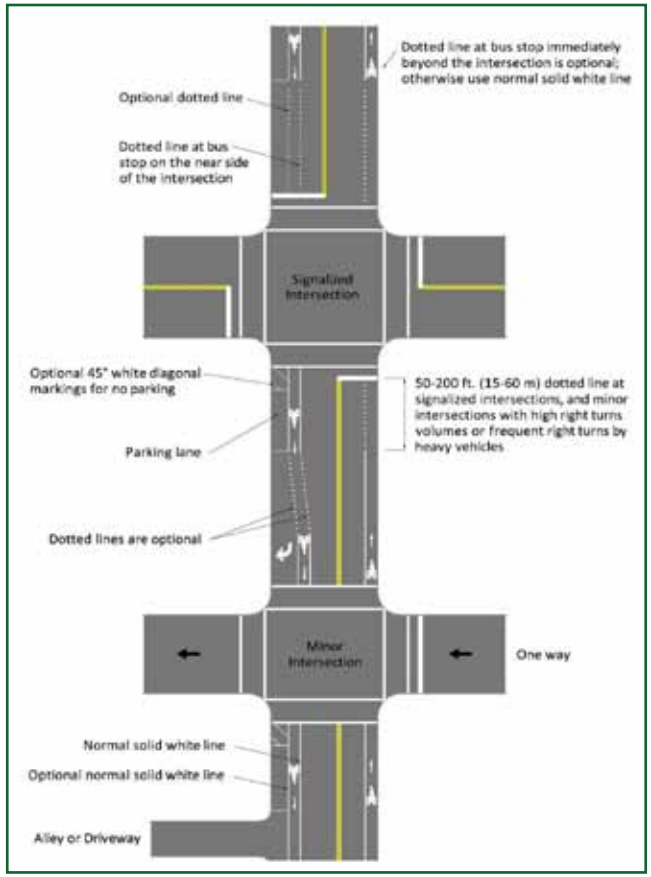


Figure 7.7. **Bike Lane Pavement Markings.**
Source: *AASHTO 2010*

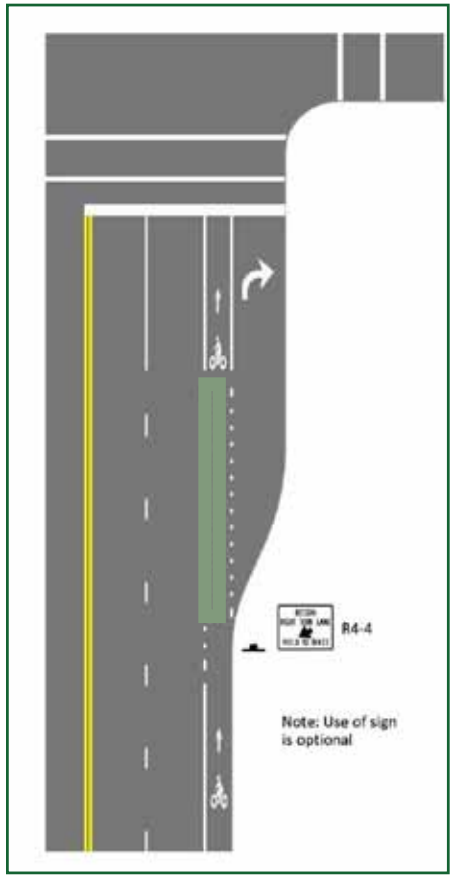


Figure 7.8. **Bike Lane Pavement Markings at RTO Lane.** Right-turning traffic crosses the direct bicycle lane to the right turn only lane. This condition may arise at major street intersections in the intra-urban system.
Source: *AASHTO 2010*

Buffered bicycle lane. Separation is provided by a cross-hatched neutral ground in this application in New York City.

Figure 7.9. **Typical Complete Street Sections, Intra-Urban Trail Corridors**								
Section Type	Sidewalk/ Sidepath	Parkway Setback	Bicycle Lane or Shoulder	Cartway	Bicycle Lane or Shoulder	Parkway Setback	Sidewalk/ Sidepath	Total Minimum ROW
2 lane divided with sidepath	10	6	5	40	5	6	5	76
3 lane, no sidepath (35 mph)	5	6	5	33	5	6	5	65
3 lane, 1-way sidepaths (35 mph)	10	6	5	33	5	6	10	75
3 lane, 2-way sidepath (35 mph)	10	6	5	33	5	6	5	70
4 lane divided, 2-way sidepath (45 mph)	10	12	7	64	7	12	5	117
5-lane, no sidepath (35 mph)	5	8	5	55	5	8	5	91
5-lane, 1-way sidepaths (35 mph)	10	8	5	55	5	8	5	101
5-lane, 2-way sidepath (35 mph)	10	8	5	55	5	8	5	96

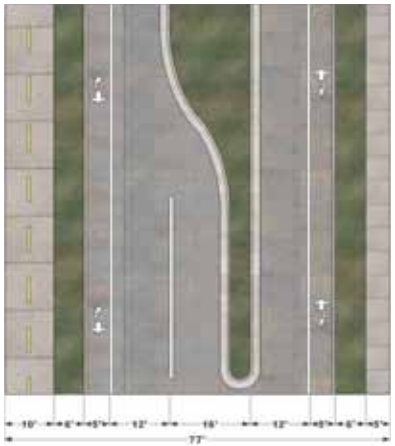
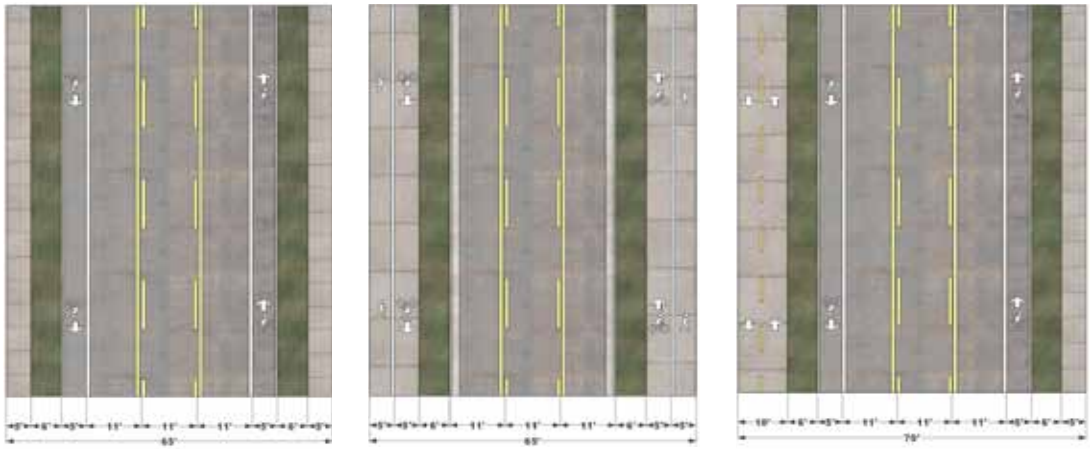


Figure 7.9. (left) **Two-lane divided section with sidepath**

Figure 7.10. (right) **Three-lane sections:** From left, bike lanes; one-way sidepath without bike lanes; and two-way sidepath with bike lanes.



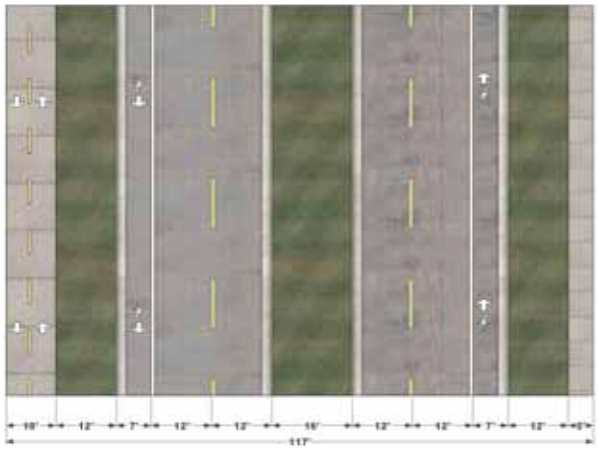
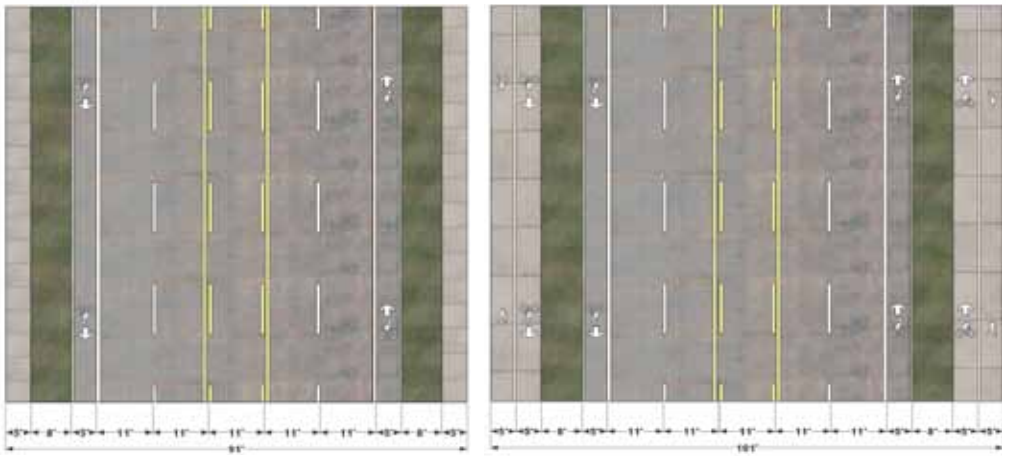


Figure 7.11. (left) **Four-lane divided section with sidepath**

Figure 7.12. (right) **Five-lane sections:** From left, bike lanes; and one-way sidepaths with bike lanes.



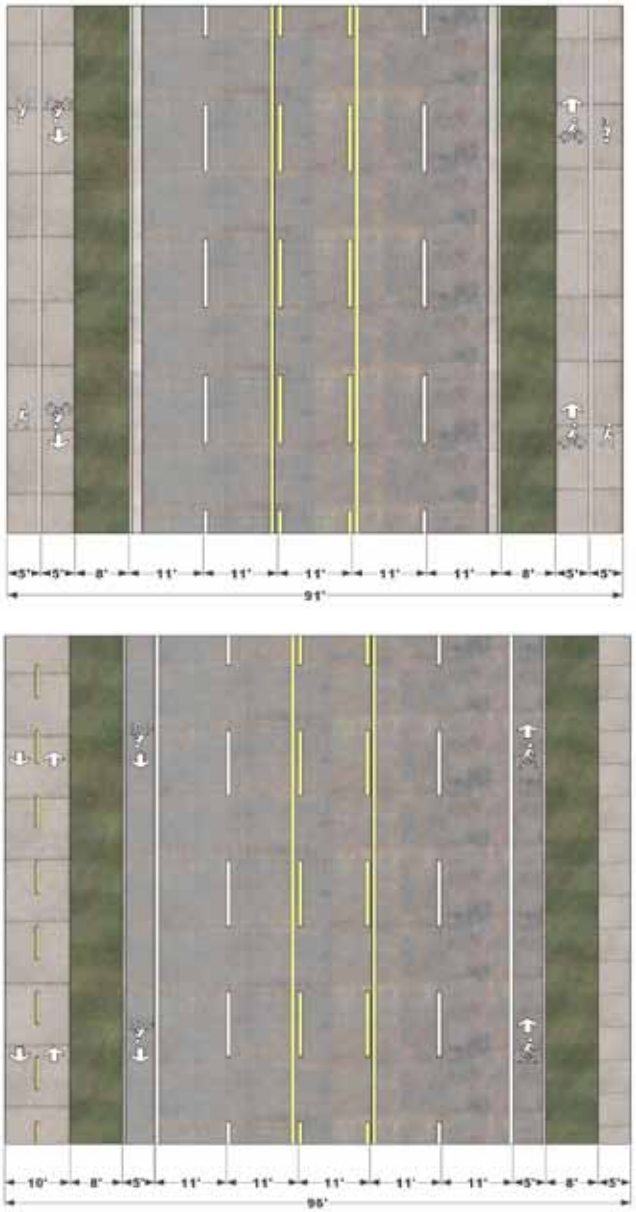


Figure 7.12. (continued) **Five-lane sections:** Top, one-way sidepaths without bike lanes; above, two-way sidepath with bike lanes

They typically link the main trail to community features or to the Big Sioux Trail. Parking is typically provided on at least one side of the street. However, the typical 38-foot street channel used in these corridors does not accommodate both parking and exclusive bicycle lanes. Examples of these shared routes are Grange Avenue and Laquinta Street in the Harrisburg corridor, connecting the trail at 85th and Grange to the Big Sioux Trail at Yankton Trail Park.

Shared Route Guidelines: Parking on Both Sides:

- Parking lanes are striped at 8 feet from the curb line, leaving a 22 foot travel channel (2 11-foot travel lanes)
- A shared lane marking (sharrow) is used, painted a minimum of 11 feet from the face of the curb.
- Some cyclists may feel more secure riding to the right

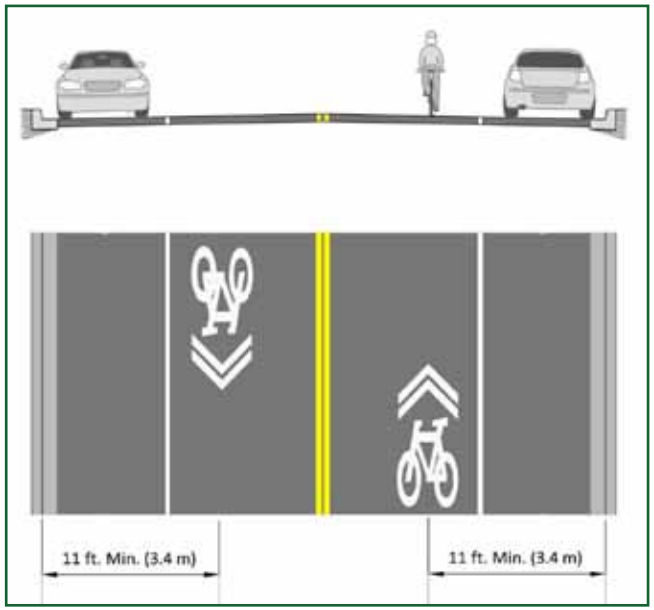


Figure 7.13. **Sharrow (shared lane marking).** Situation shown here maintains parking on both sides of the street. Source: *AASHTO 2010*

Sharrows. Top: Bicycle lane in one direction with opposite side sharrow, Seattle. Above: Sharrow and striped parking lane, Omaha.

Bicycle Boulevard Features. Top: A diverter that permits bicycle and pedestrian traffic, but breaks the through street into shorter segments. Middle: Mini-roundabout. Below: Identifying sign.

of the parking lane line when most of the parking lane is vacant, but the lane is not designated as a bicycle lane.

Shared Shoulder and Bicycle Lane Standards: Parking on One Side:

- Parking lane is striped at 8 feet from the curb line.
- One 5-foot bicycle lane is marked on the side of the street without parking. The bicycle lane should be located in an upgrade direction if possible.
- A shared lane marking (sharrow) is used on the side with the parking lane, painted a minimum of 11 feet from the face of the curb.
- Travel channel is 22-feet between marking lines.
- Some cyclists may feel more secure riding to the right of the parking lane line when most of the parking lane is vacant, but the lane is not designated as a bicycle lane.

Conversion with No Parking

If parking is removed, bicycle lanes should be installed on both sides of the street.

Signage and Signals:

- Share-the-road signage provided.
- Bicycle-sensitive signal detection loops should be placed appropriately, with a bicycle marking indicating the location where bicycles will actuate the sensor.

Bicycle Boulevards

Bicycle boulevards are local streets modified to serve as convenient through streets for bicycles and pedestrians, while incorporating features that calm or even discourage through motor vehicle traffic. As such, they can be very popular with neighborhoods who want to encourage low-impact access wile discouraging unwanted through traffic.

In the intra-urban corridors, bicycle boulevards are used for local connections to community features or major trails. Examples include Joseph Avenue in Tea and Galway Avenue in Sioux Falls. Bicycle boulevards may use some of the pavement parking conventions described for shared routes.

Bicycle boulevard techniques include:

- Traffic calming features such as diverters, neck-downs, mini-roundabouts and other features that slow motor vehicles.
- Wayfinding and identifying signage.
- Crossing improvements at major intersections, including bicycle sensitive detection loops, signals (including HAWK beacons), clear crossings, four-way stops, or other features.
- Traffic controls like stop sign orientation that give priority to the bicycle boulevard.
- Shared use pavement markings.

CHAPTER 8 | IMPLEMENTATION

The three inter-urban trail corridors will be completed incrementally over a long period. Establishing principles and a structure to guide this long-term process is particularly important, given the involvement of multiple jurisdictions and both public and private stakeholders. This chapter:

- Establishes principles to guide the gradual completion of the system.
- Provides a program for initial development and later phase completion of each inter-urban corridor.
- Considers financing options for various trail contexts.
- Recommends a basic trail maintenance scope.
- Reviewing administrative options for these multi-jurisdictional trails.

Principles for Gradual Development

Creating useful facilities that accommodate trail users and successfully connect Brandon, Harrisburg, and Tea is especially challenging because construction funds are limited, adjacent private development is subject to market uncertainty and the priorities of individual owners, and associated large transportation projects like South Dakota 100, 85th Street, and the Benson Road extension are long-term. The following principles should guide the gradual execution of these intercity connections:

• **Use opportunities as they arise.** Transportation projects, as they are scheduled and funded, provide excellent opportunities for completing trail segments. For example, the near term widening of Minnesota Avenue can complete a sizeable portion of the Harrisburg to Sioux Falls route, as can short-term local projects such as the improvement of Sundowner Avenue and construction of a half-section line collector on the Galway Avenue corridor in the Tea area.

• **Set trail priorities based both on safety issues and the need to establish initial, serviceable inter-urban connections.** Clearly, safety priorities are paramount. For example, a path segment like Willow Street in Harrisburg or a linkage of the Bluffs area to schools and commercial development in the center of Brandon both have major safety and community transportation benefits. Metropolitan municipalities should not have to wait 10 to 15 years for the completion of complex transportation projects when short-term segments can create reasonable, if not optimum, connections.

• **Execute transportation projects consistent with their ultimate role in the system.** This document should serve as a planning tool for agencies upgrading roads that are included in this plan. Right-of-way acquisition, access management, and project design construction should be consistent with the eventual multi-modal role of these streets.

• **Maintain path continuity.** Each corridor will evolve from an initial route, progressively improving and serving a broader user base. New segments should be integrated into the continuous route to the greatest degree possible. Trail segments that are disconnected and have limited utility should be avoided, unless they represent a major opportunity that must be used to provide long-term connectivity.

• **Infill trail segments incrementally.** Because opportunities emerge at different times, it is possible that completed parts of trail corridors will have gaps between them. As the trails evolve, filling these gaps will rise in priority, and should be completed on a regular schedule.

• **Consider low-cost interim surfaces when necessary.** Land for some segments will be dedicated only as adjacent property is platted into subdivisions. Much of this right-of-way occurs along drainageways, which are reserved as public land for the purpose of stormwater management and flood control. It is important to establish the integrity of these trail corridors at the beginning of the

development process, so that subsequent homeowners anticipate the future trail and do not view this public land as an extension of their own property.

The ideal solution is to build trails when streets are also built and lots begin to sell. This chapter explores concepts to finance early stage construction. However, implementing agencies should also consider using temporary, low-cost surfaces that both define the trail and establish a pattern of use. Chapter Seven compares the performance of various types of non-paved trail surfaces, ranging from mowing and staking a footpath or single-track trail to more elaborate granulated stone that can serve for a relatively long time. Selection of the appropriate interim surface depends on such factors as time of service until ultimate completion, slopes, drainage characteristics, soil conditions, and development design.

Trail Development in Phases

The most feasible concepts for the three inter-urban corridors present mature solutions that take advantage of long-term transportation projects like South Dakota 100 and the Benson Road extension that will not be complete for many years. Other trail segments depend on adjacent private development, the timing of which depends on unpredictable factors. Trail corridors should be more than lines on a map to be realized only in the indefinite future.

Therefore, it is important to establish initial trail corridors that can be placed in service within five to seven years. While these routes will not be optimum, and will not meet the all needs of all users, they will create valuable facilities that are the foundation for completion of the ultimate corridor. They also help the MPO, the four participating cities, and the two counties determine trail priorities and funding applications and processes. Typically, major capital improvements such as paved trails are part of the permanent system; route segments that will be replaced in the future use low-cost interim solutions such as unpaved trails, signage, and pavement markings.

Later phases should be opened gradually, with many of the largest projects completed along with associated major transportation investments such as South Dakota 100. Because these projects must address pedestrian and bicycle transportation, trail or sidepath improvements will be part of their basic funding rather than an add-on "enhancement."

The following pages present initial and later phase development programs for each of the three inter-urban corridors. These programs also include opinions of probable cost for trail segments based on the design guidelines presented in Chapter Seven and the unit cost factors presented in Figure 8.1.

Interim Surfaces. Lower-cost surfaces can establish a pattern of trail use if full funding is unavailable for a period of time.

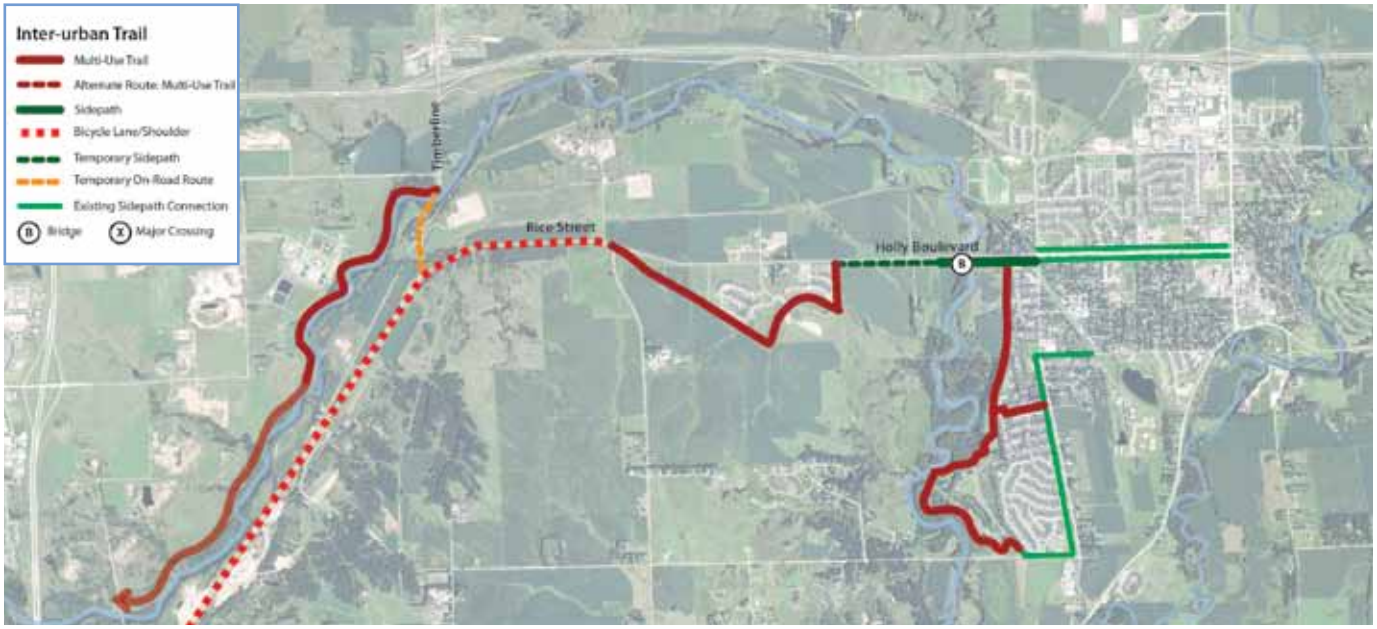
Figure 8.1: Typical Trail Facility Costs, 2011 Dollars

Trail Type	Cost/Unit
10-foot asphalt trail on separated right-of-way	$264,000/mile
10-foot concrete trail on separated right-of-way	$385,000/mile
10-foot two-way concrete sidepath	$302,500/mile
5-foot one-way concrete sidepaths (including full installation on both sides of the street)	$330,000/mile
Mid-block or mid-section crossing with center refuge median	$25,000 each
12-foot wide prefabricated bridge	$1,320/foot
5-foot bicycle lanes (incremental cost for new street construction projects (single side)	$77,000/mile asphalt $137,500/mile concrete
Bicycle lane pavement markings on existing streets	$15,000/mile
Shared route markings (sharrows plus signage) on existing streets	$7,500/mile
Bicycle boulevard conversion*	$140,000/mile

Includes 10% allowance for design fees and 15% contingency.
*Assumes two to three traffic calming treatments per mile (such as circles, speed tables, curb extensions, etc.)

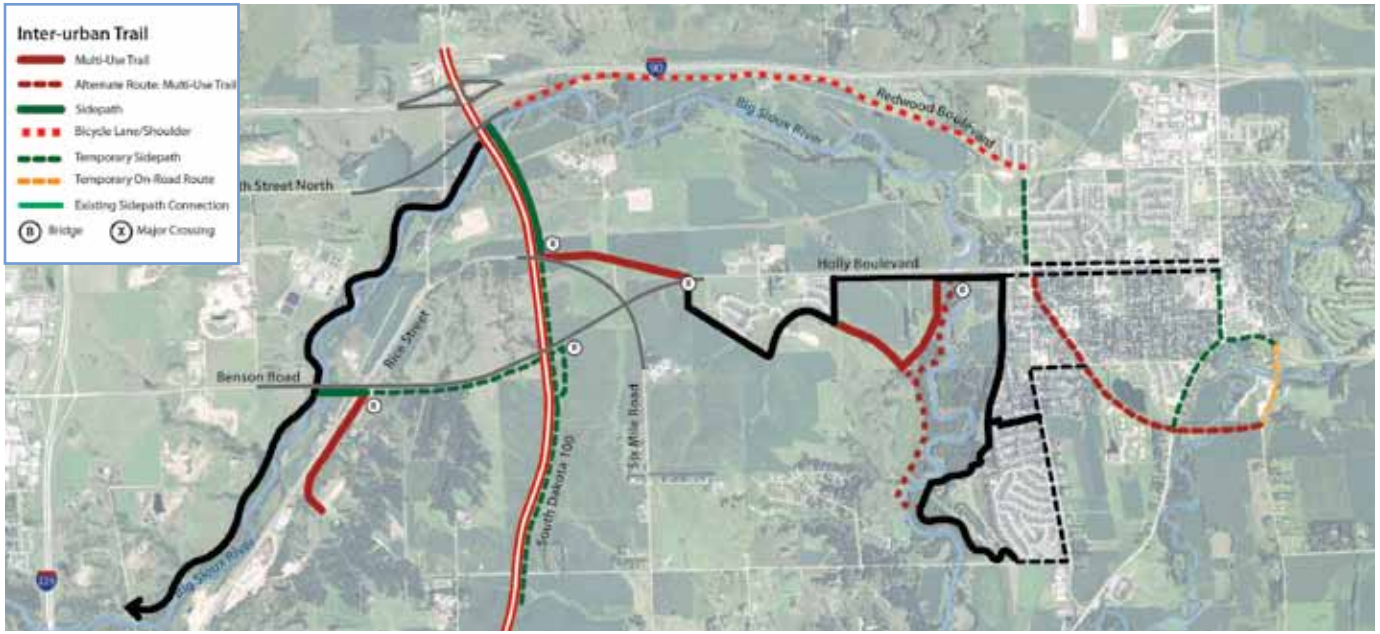
BIG SIOUX/BRANDON TO GREAT BEAR - Initial Phase

The initial Brandon route assumes completion by the City of Sioux Falls of the Big Sioux River Trail to the Timberline Road and connects Brandon to Sioux Falls before completion of SD 100 and Benson Road. Adaptation of shoulders along Rice Street to bicycle lane standards provides a Sioux Falls connection if the river trail is delayed. The initial phase connects the Bluffs, Brandon's primary developing area, to the main part of Brandon.



Segment	Mileage	Facility Description	Cost
Brandon City Trail to Holly Boulevard	0.79	10-foot paved trail on the eastern edge of newly acquired Big Sioux Recreation Area property.	$208,560
Holly Boulevard, Sioux Boulevard to Big Sioux River Bridge	0.35	10-foot paved sidepath on south side of Holly Boulevard.	105,875
Big Sioux River Bridge	430 feet	Adaptation of south side shoulder for two-way, 8- to 10-foot wide sidepath with vertical concrete barrier, with possible restriping to equalize shoulders.	26,000
Holly Boulevard, Big Sioux Bridge to eastern edge of the Bluffs	0.56	Temporary 8- to 10-foot granulated stone sidepath. Adaptation of existing paved shoulders on Holly Boulevard with bike lane pavement markings and painted buffer, providing visual separation while maintaining shoulders for emergency use by motor vehicles.	92,400
Eastern edge of the Bluffs to sewer easement.	0.25	10-foot paved trail on the eastern edge of the Bluffs, on boundary with Metz property.	66,000
Sewer easement and greenway, Van Buskirk Park to WAPA right-of-way	0.55	10-foot paved trail through new city park and along designated greenway in the Bluffs to power line easement.	145,200
WAPA right-of-way, Bluffs greenway to Rice Street via road on west edge of Bluffs	0.57	10-foot paved trail along WAPA right-of-way to Six Mile Road intersection, or other possible connection to Rice Street.	150,480
Rice Street, Bluffs to Timberline Road	1.38	Adaptation of existing paved shoulder with bike lane pavement markings.	20,700
Timberline, Rice Street to Big Sioux Trail extension	0.55	Shared lane markings (sharrows) and signage.	4,200
Total	**5.10**		**$819,415**

BIG SIOUX/BRANDON TO GREAT BEAR - Later Phases

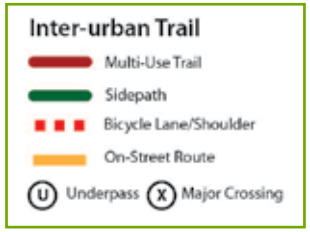


Later phases complete the separated multi-use trail connection between Brandon and Van Buskirk Park, using either the Bluffs sewer easement or alternative routes that avoid existing private property. It uses sidepaths along South Dakota 100 and the Benson Road extension, and a trail along vacated Rice Street right-of-way. A trail connection back to Great Bear Recreation Area depends on the Benson Road extension. A connection of 60th Street North to Redwood Boulevard increases the possibility that Redwood may be paved to Brandon. If so, Redwood should include bicycle lanes or shoulders. Costs below include the easement route to the Bluffs of Brandon. However, this route should only be used with the agreement of the property owner or as part of eventual development of the area.

Segment	Mileage	Facility Description	Cost
Big Sioux Trail Bridge	430 feet	12-foot wide prefabricated trail bridge over the Big Sioux River. This may be required if the interim configuration proposed for the Holly Boulevard bridge does not meet user or traffic demands. Alternatively, a trail track could be incorporated into a replacement bridge.	$567,600
Bluffs Sewer Easement, Holly Boulevard lift station to creek	0.54	10-foot paved multi-use trail	142,560
Bluffs Sewer Easement, to edge of Bluffs development area	0.44	10-foot paved multi-use trail	116,160
Vacated Rice Street right-of-way, WAPA power line easement to SD 100	0.70	10-foot paved multi-use trail	184,800
SD 100, Rice Street to north bank of Big Sioux River	0.60	10-foot sidepath, cost incorporated into SD 100 project	NA
Benson Road, west shore of Big Sioux River to east side of Ellis & Eastern right-of-way	0.26	10-foot sidepath, incorporated into projected cost of Benson Road extension. Benson Road project would include trail accesses at both ends of the segment	78,520
Rice Street/E&E corridor, Benson Road extension to Great Bear entrance	0.35	10-foot paved multi-use trail	92,400
Total	**3.00**		**$1,182,040**

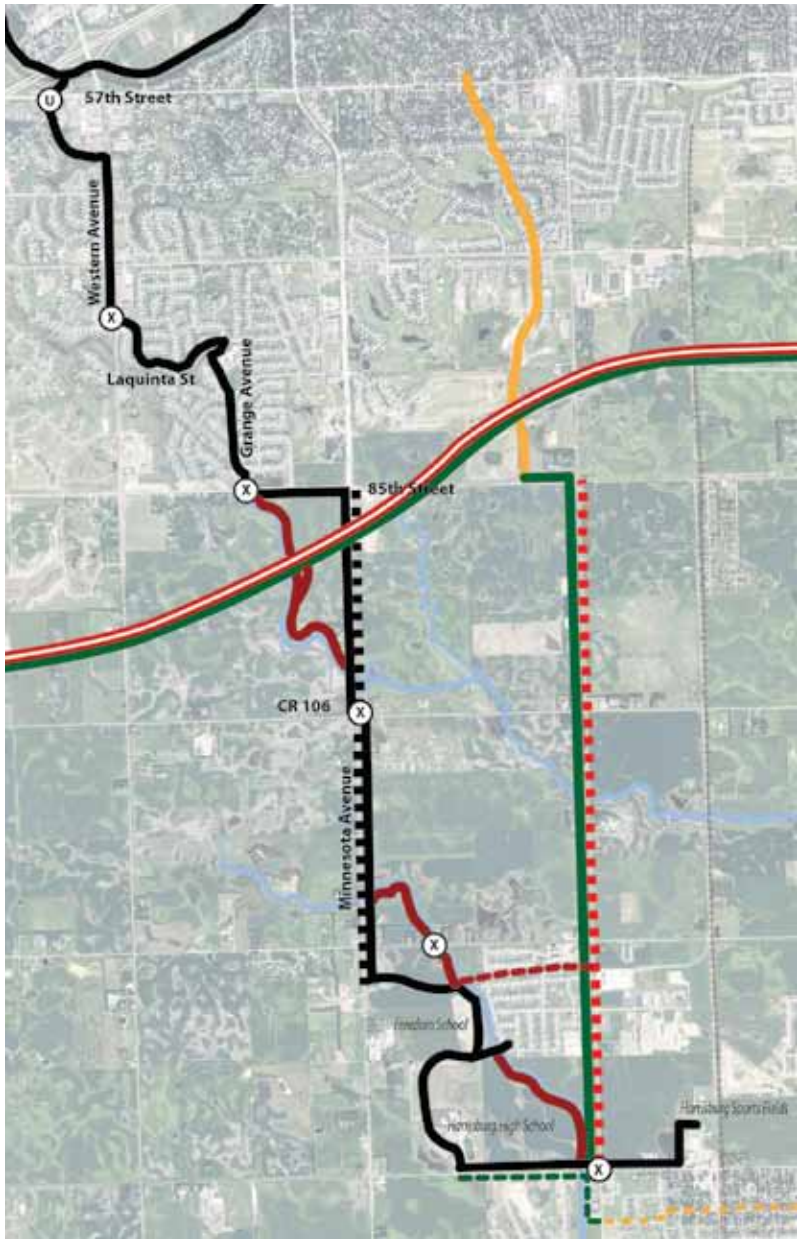
HARRISBURG TO YANKTON TRAIL PARK - Initial Phase

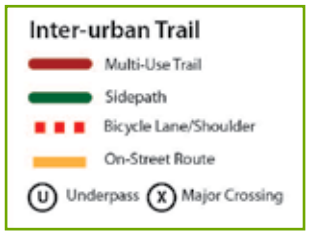
The initial Harrisburg route takes advantage of the short-term improvement of Minnesota Avenue to provide a continuous connection to Sioux Falls. The regional portion of the route extends to 85th and Grange Avenue, where it connects to facilities of Sioux Falls' Diamond Creek trail network. The connecting system in Sioux Falls uses a combination of on-street routes, sidepaths, and separated trails to Yankton Trail Park, as presented in Part Five. The Harrisburg Trail also assumes a near-term upgrade of Willow Street, as proposed in the city's new transportation master plan.



Segment	Mileage	Facility Description	Cost
Columbia Street, Sports Fields to Willow Street	0.36	10-foot paved trail and sidepath, using west side of Columbia Street	$108,000
Willow Street, Columbia Street to Harrisburg High School entrance	1.00	Two-lane divided street section with five-foot minimum bike lanes, 8- to 10-foot paved sidepath on north side of street. Cost is for added cost of sidepath.	302,500
High School and Freedom School campuses, Willow Street to proposed Tom Sawyer Drive	1.37	10-foot paved trail on periphery of school campuses.	361,680
Tom Sawyer Drive or power line alignment, creek to Minnesota Avenue	0.41	10-foot paved trail along power line easement or adjacent to route of future street connection.	108,240
Minnesota Avenue, Tom Sawyer to 85th Street	2.38	8 to 10-foot sidepath (10-foot preferred) with paved shoulders with bike lane markings. Continuation of four-lane divided section with shoulders established north of 85th Street. Cost is for incremental cost of sidepath.	719,950
85th Street, Minnesota to Grange Avenue	0.45	10-foot sidepath on south side of 85th to Grange Avenue.	136,125
85th and Grange intersection		Intersection with crossing refuge and possible HAWK signalization at Grange Avenue	25,000
Total	**5.97**		**$1,761,495**

HARRISBURG TO YANKTON TRAIL - Later Phases



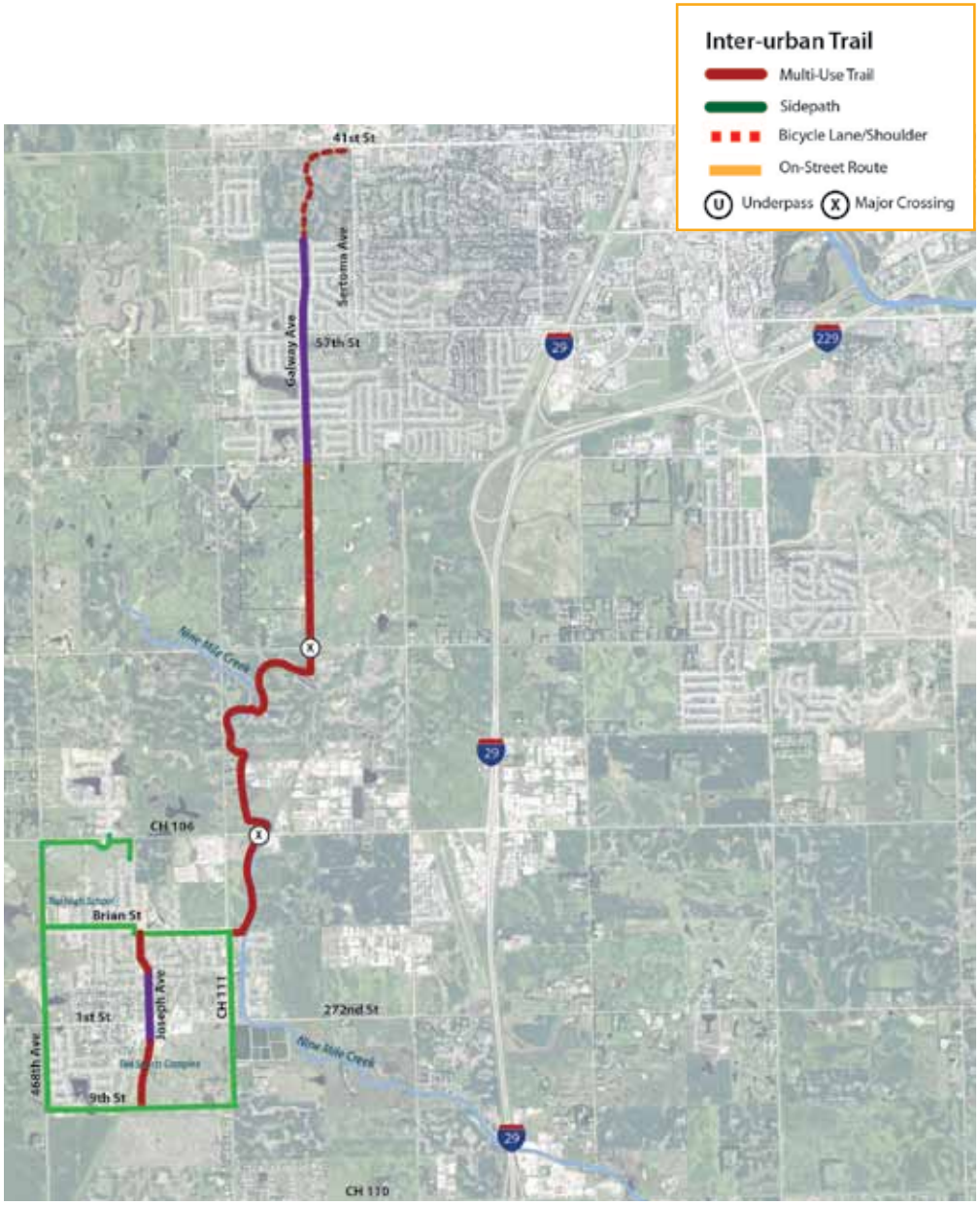


Later phases of the Harrisburg-Sioux Falls Inter-urban Trail add to the length of trails on separated right-of-way by following drainageways on the way to Sioux Falls. Future development also anticipates improvement of Cliff Avenue to complete street standards with both bicycle lanes and a sidepath, as proposed in Harrisburg's transportation master plan, and an additional on-road route to the Sioux Falls system via Tomar Avenue.

Segment	Mileage	Facility Description	Cost
Watercourse, Willow Street to Freedom School	0.76	10-foot paved multi-use trail	$200,640
Watercourse, north side of Freedom School campus to 272nd Street	0.28	10-foot paved multi-use trail	73,920
Mid-block trail crossing at 272nd Street		Crossing median refuge, defined crosswalks, signage	25,000
Watercourse, 272nd Street to Minnesota Avenue	0.45	10-foot paved multi-use trail	118,800
Diamond Creek tributary, Minnesota Avenue to 85th Street	1.25	10-foot paved multi-use trail	330,000
Cliff Avenue bicycle lanes/shoulder, Willow Street to 85th Street	3.00	5-foot bike lane; incorporated into a paved shoulder as part of a transportation improvement project to complete street standards	NA
Cliff Avenue sidepath, Willow Street to 85th Street	3.00	10-foot, 2-way sidepath, part of a transportation improvement project to complete street standards	792,000
85th Street, Cliff Avenue to Tomar Avenue	0.25	10-foot, 2-way sidepath	75,625
Tomar Avenue on-street adaptations	2.40	Sharrow pavement markings and signs	18,000
Total	**8.39**		**$1,633,985**

TEA TO SIOUX FALLS - Initial Phase

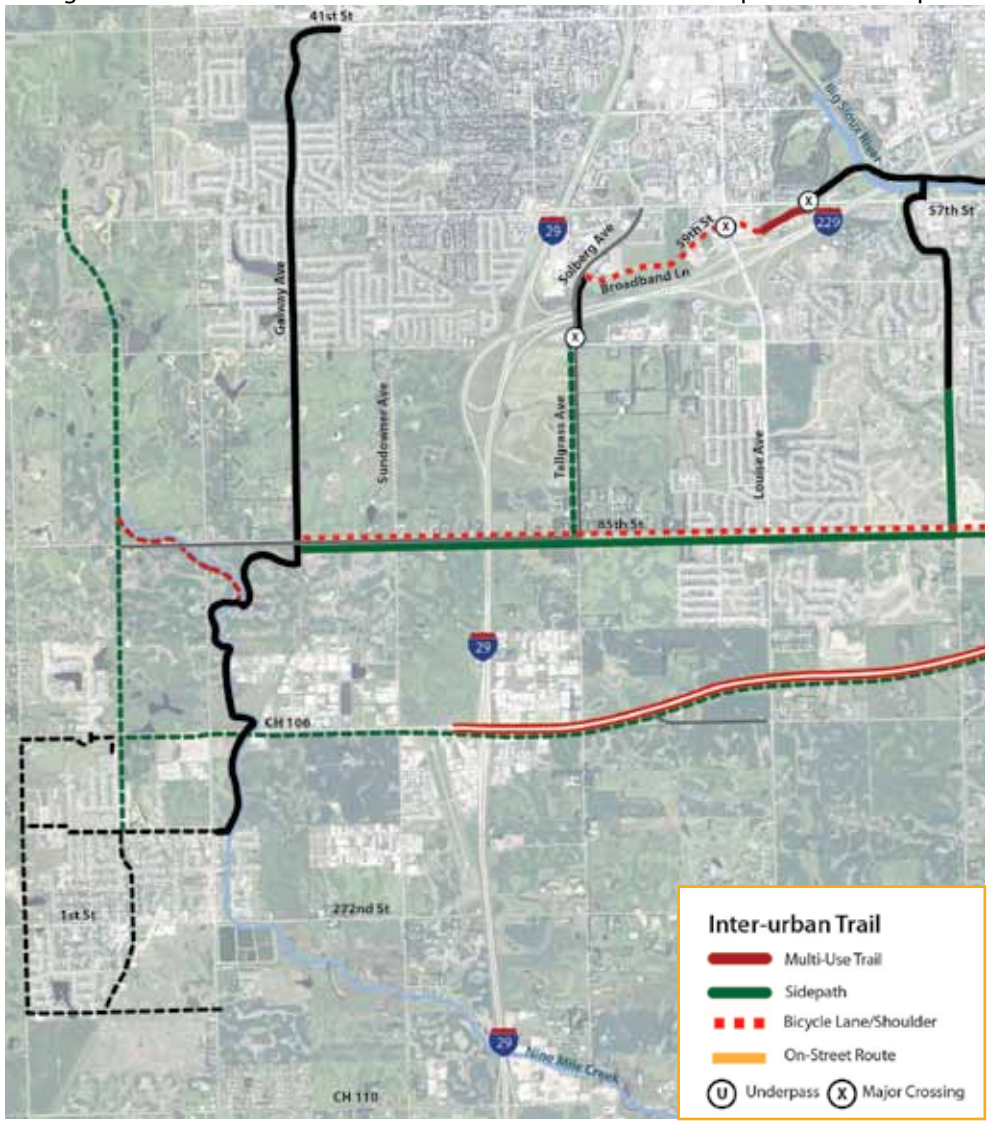
The full Tea to Sioux Falls route includes both westside and eastside connections to the Big Sioux Trail system. While the eastside connection at Sertoma Park is ultimately the critical connection, it depends on several major long-term projects, including resolution and construction of the 85th Street crossing of I-29 and the improvement of 85th Street. The most likely short-term option connects Tea to the Sioux Falls system at Legacy Park on West 12th Street. The route within Sioux Falls adapts Galway Avenue north of 69th Street as a bicycle boulevard, connecting to Sertoma Avenue at 41st Street. Subsequent project development would complete the eastside link, as discussed in Part Five.



Segment	Mileage	Facility Description	Cost
Nine Mile Creek, CH 111 and Brian Street to CH 106.	0.63	10-foot paved trail on west side of creek.	$166,300
CH 106 crossing		Midblock intersection with crossing refuge median and defined crosswalks. Crossing would be monitored for trail-actuated signal.	125,000
Nine Mile Creek and tributary, CH 106 to 272nd Street	1.41	10-foot paved trail on west side of Nine Mile Creek, following tributary drainage to power line easements at 85th Street.	372,240
Galway Avenue (power line corridor), 85th to 69th Streets	1.00	10-foot paved trail between power lines or in connection with construction of a half-section line collector on the Galway alignment.	264,000
Galway Avenue, 69th to 49th Street	2.00	Bicycle boulevard conversion	280,000
Development site, 49th and Galway to 41st and Sertoma	1.25	10-foot paved trail, with alignment determined as part of development design.	330,000
Total	**6.29**		**$1,573,540**

TEA TO SIOUX FALLS - Later Phases

Later phases of the Tea-Sioux Falls Inter-urban Trail complete the eastside connections and depend on the improvement of 85th Street with a crossing over I-29. 85th Street improvement includes a path on the Lewis and Clark Regional Water System easement along the south side of the street to Western Avenue. Later development also completes the Tallgrass-Solberg commuter route, providing a more direct connection to the Big Sioux Trail and access to emerging office and commercial employment centers between 57th Street and I-229.



Segment	Mileage	Facility Description	Cost
85th Street, Galway to Grange	4.0	10-foot, 2-way sidepath (may substitute one-way sidepaths depending on adjacent land use and access patterns), incorporated into eventual project to upgrade 85th Street. Includes sidepath on new I-29 bridge. Connects with Harrisburg-Sioux Falls route at 85th and Grange.	$1,210,000
85th Street, Galway to Grange	4.0	5-foot bike lane; incorporated into a paved shoulder as part of a transportation improvement project to complete street standards.	NA
Western Avenue, 85th to Laquinta	0.75	10-foot, 2-way sidepath on west side of street	226,875
Tallgrass Avenue, 85th to Solberg Avenue overpass at I-229.	1.00	10-foot, 2-way sidepath or paved multi-use trail incorporated into development along west side of Tallgrass	302,500
Broadband/59th Street, Solberg to Grand Circle	0.78	Bike lane or shared route adaptation to existing street, with continuation of existing 6-foot sidewalk. Assumes closing street gap from Broadband to 59th.	11,700
59th and Louise intersection, Grand Circle to Tennis Lane	0.25	5-foot bike lanes incorporated into future intersection widening to provide additional turn capacity. Cost reflects bike lane share of widening.	68,750
Railroad trace, Tennis Lane to 57th and Bur Oak Place	0.37	10-foot paved multi-use trail	97,680
57th and Bur Oak crossing	250 ft.	Defined surface crossing of 57th Street on east leg of intersection. Cost does not include signalization.	25,000
Total	**11.15**		**$1,942,505**

Funding Strategies

For funding purposes, individual trail projects in the inter-urban system include:

- Elements of major transportation investments such as South Dakota 100.
- Stand-alone paths on public right-of-way or public property such as parks, utility easements, school sites, or public facilities that are not part of major street improvements.
- Paths built on dedicated land within or part of private development projects, typically floodplains or drainageways within existing or future subdivisions.
- Adaptation of existing streets to incorporate bicycle lanes or shared-use lanes.

Table 8.7 summarizes potential funding sources for each of these categories

Trails and Paths in Major Street Projects

These projects implement the current US Department of Transportation mandate to consider pedestrian, bicycle, and public transportation as part of the design of major roadway projects. For example, South Dakota 100 includes a sidepath for its entire length, critical to the metropolitan trail program for its ability to connect the Brandon, Harrisburg, and Tea Trails together, and the recent widening of County Highway 111 through Tea includes a sidepath. Other major projects that should be designed with multi-modal facilities are Minnesota Avenue and Willow Street in the Harrisburg corridor, Benson Road in the Brandon corridor, and 85th Street in the Tea corridor.

Conventional urban streets (excluding limited access facilities such as SD 100) will offer both on- and off-road facilities – sidepaths for pedestrians and cyclists uncomfortable with street riding, and bicycle lanes for other cyclists. These features should be designed according to the guidelines presented in this study and other sources, including new AASHTO 2010 standards. They should be incorporated into basic project design and funded by basic transportation funding sources such as the Surface Transportation Program (STP) and transportation bonds.

Table 8.7: **Funding Sources by Project Category**

Project Category	Examples	Funding Sources
Major transportation investments	Minnesota Ave, Willow Street, Benson Road, 85th Street	STP, local street bonds
Stand-alone paths on public right-of-way property without street improvements	Harrisburg High School, Big Sioux Recreation Area, power line easements	Transportation Enhancements, Safe Routes to Schools, STP Safety funds, Recreational Trails Program, recreation or transportation bond issues, philanthropy
Paths on dedicated right-of-way within or part of development projects	Nine Mile Creek, Harrisburg watercourses	Benefit-based shared funding through special assessments, Transportation Enhancement, developer funding, recreation or transportation bond issues, philanthropy
Street Adaptations	Broadband Avenue, Grange Avenue, Laquinta Street, Galway Avenue	General revenues and street maintenance programs, Transportation Enhancements, Safe Routes to Schools

Stand-Alone Paths on Public Right-of-Way or Property

Conventional funding sources for off-road trail projects are well-known, and have largely depended on the Transportation Enhancements (TE) program of SAFETE-LU and predecessor federal transportation bills. However, other related programs are applicable to specific segments of the inter-urban system. Recreational Trails Program (RTP) funds address projects that emphasize recreational rather than transportation use, and are applicable to system components such as trails within Big Sioux Recreation Area, and local connections to and within city parks. Safe Routes to Schools funding can assist projects such as a Willow Street sidepath in Harrisburg or the connection between Union Avenue and the Tea-Sioux Falls Trail in Tea. STP safety funds can provides safety enhancements and signalization at key mid-block crossings. Finally, private fund-raising and philanthropy can be an important part of the funding picture. For example, the 25-mile High Trestle Trail, developed by the Iowa Natural Heritage Foundation between Ankeny and Woodward, Iowa, received contributions from over 800 donors.

Paths through Private Development

Reserving land and completing trails through private development projects has challenged trail execution in the Sioux Falls area. While communities control flood plain land and major drainageways, trail funding and construction typically lags residential development. As a result, adjacent residents sometimes incorporate this land into their lots, or oppose trail projects out of concern for privacy or security and lack of awareness of studies and anecdotal experiences that prove otherwise. Consequently, it is important to establish a mechanism for both claiming the trail corridor in advance of development and ideally, providing a mechanism for completing the route in advance of home or commercial construction. The idea of interim, low-cost trails that establish public use was presented earlier in this chapter. Easily maintainable treatments include mowed grass or single-track paths with stakes to define public right-of-way. Shorter segments could be maintained by volunteer groups.

However, a better solution involves building the trail in advance of development, requiring techniques that provide construction funding at the beginning of the process. Purely public sources such as TE could be targeted to such projects to take advantage of emerging opportunities. Another concept involves shared funding that recognizes that local trail projects have both special and general benefits. Even on a regional or inter-urban trail, people in adjacent neighborhoods use the facility most frequently and a number of studies have indicated that nearby trails improve marketability and increase residential property values. It is reasonable to assign a special/general benefit split based on quality of life and economic benefits to area residents. For example, if 40% of the users of a trail segment are likely to be residents of the adjacent development, it is reasonable to assess a related percentage of the cost to properties within the overall district. This cost share would be funded by the municipality issuing revenue bonds and paid back through special assessments on all properties within the benefit district. This differs from more conventional assessments because it distributes costs throughout a benefitted district.

Street Adaptations

Street adaptations in most cases do not involve major capital costs, but make minor additions to signage and pavement markings. These can normally be absorbed within normal street operations budgets. More extensive projects such as bicycle boulevards may include limited capital projects, such as traffic calming devices and bicycle sensitive sensors. These may be funded using some of the programs discussed earlier.

Operations and Maintenance

Significant issues for a regional trail system include expectations of maintenance and the organizational identity and nature that will manage and maintain the facilities. This is particularly challenging because of the cross-jurisdictional character of the system. This discussion will establish a basic level of maintenance for the three inter-urban corridors, and consider management alternatives.

Recommended Maintenance Program

Trail users should expect a consistent and predictable level of maintenance among the three trail corridors, and management agencies should establish a basic and consistent standard of maintenance for these facilities. A recommended basic maintenance program, derived largely from the recommendations of AASHTO 2010, follows:

Sweeping and maintaining bicycle lanes. Bicycle lanes and shoulders tend to accumulate gravel, broken glass, debris, and other hazards, particularly in winter climates. These on-road facilities should be swept on a regular schedule, adjusted for seasonal needs. Debris along urban sections with curb and gutter should be removed, and can be swept off the road along rural sections. Driveway approaches on streets with bike lanes or shoulders or with parallel sidepaths should always be paved to avoid loose gravel.

Trail surface repair. A relatively smooth and well-maintained trail or bike lane surface is especially important for user safety. Based on ASHTO guidelines, a trail repair program should include:

- Designing and building trails for long-term durability.
- Regular inspection of surface irregularities and a mechanism, ideally on-line, for users to supplement inspections with observed problems.
- Establishing a prompt repair process, with priority to hazardous conditions such as serious longitudinal cracking.
- Preventing surface repairs from running longitudinally through a bike lane or shoulder.
- Implementing as preventive maintenance program, including keeping drains in good operating condition and eliminating tree roots.
- Instituting a pavement preservation program.

Managing vegetation. Vegetation should be cut off to prevent encroachment onto the trail and its buffering shoulders, or into bike lanes or shoulders. Trees should be located to avoid intrusion of roots, and roots should be cut back to avoid compromising trail surfaces.

Stormwater management. Mud accumulating on trails can produce special dangers on trails because of rutting. Good drainage and erosion prevention practices should be incorporated into trail design. Mud hazards should be cleared as soon as possible after storm events.

Maintaining signs and pavement markings. Signs and markings should be kept in readable condition. This includes inspecting signs and markings on a regular basis, replacing damaged signs as soon as practical, and restoring pavement markings as part of a regular street maintenance schedule.

Snow clearance. In the Sioux Falls metropolitan area, snow removal is an important issue, with different expectations by various constituencies about appropriate levels of service. While trails continue to be used for local recreation during the Sioux Falls winter, the number of longer distance but still casual users will drop substantially. A basic snow policy will:

- Clear snow from on-street routes, including bicycle lanes, shoulders, and on-street routes, as part of regular snow clearance programs.
- Clear snow on inter-urban trails and path segments within municipal boundaries that provide critical transportation functions, such as routes to school.
- Typically not clear snow on recreational portions of the trail, such as the segment of the system through Big Sioux Recreation Area. These trails may fill winter recreational needs like cross-country skiing and snow-shoeing.
- For sidepaths, follow clearance requirements that apply to sidewalks.
- Cities can exceed these snow clearance standards at their own discretion.

Trail Management Alternatives

An additional issue is determining the trail operating agency or agencies best positioned to complete this scope of maintenance responsibilities. Because the inter-urban system crosses jurisdictional lines, several management options are available. Table 8.8 summarizes these alternatives.

While each option has advantage and disadvantages, extraterritorial operation by the four participating cities, using a consistent, agreed-upon school appears to be the most feasible managemnet option. City residents are the primary users and beneficiaries of the trails, and areas that are currently outside of corporate limits will eventually be annexed. Cities with both parks and public works departments have experience with trail maintenance, and either own local trail facilities or plan to develop them.

Table 8.8: **Trail Management Alternatives**

Management Alternative	Advantages	Disadvantages
City maintenance within municipal boundaries, county maintenance in unincorporated areas	Most similar to status quo	• Different standards. • Maintenance could stop at city boundaries. • County interest or capacity.
County operation and maintenance with proportionate municipal contributions	Uniform maintenance	• Requires major operational change. • Counties are not central stakeholders.
Extra-territorial city operation and maintenance	• Responsibility goes to primary stakeholders and beneficiaries • Cities have established trail maintenance capacity and experience	• Requires inter-local agreements. • Political issue of incurring cost outside of jurisdiction
Regional park/trail district through county, MPO, or other operating agency	Uniform regional maintenance and development	Requires reorganization or places a new responsibility on an existing agency