Chapter 3

Chapter 3: Bicycle Network Recommendations

Chapter 3 presents the recommended network of on-street bicycle facilities that will help Bellingham meet the goals of this Plan. It describes the methodology used to develop the proposed network and suggests facility types for each street segment in the network. This chapter also provides a prioritized list of recommendations to facilitate strategic and timely implementation of the Plan.

Network Opportunities and Constraints

The City of Bellingham street system presents both opportunities and constraints for developing an on-street, city-wide bicycle network that safely connects all major destinations for bicyclists of all skill levels. In areas of the City that have a traditional street grid pattern, such as Downtown, Fairhaven, and neighborhoods west of Interstate 5 (I-5), there are strong opportunities on local and arterial streets to develop a system of well-connected bicycle facilities. In newer sections of the City, particularly to the east and north of I-5, there are more dead-end streets and larger blocks, making it harder to develop an extensive network of bicycle facilities in these areas. Many of these areas with limited connectivity were built under the current land use and local, State, and federal environmental regulations, which are much more restrictive than in the past and can make street and trail construction - and associated environmental impact mitigation - very expensive.

One of the most significant challenges for creating a connected bicycle network is I-5. There are currently eleven arterial streets that cross I-5 over a nine-mile stretch and many of these are intimidating to novice and intermediate bicyclists. There are also currently two bicycle and pedestrian-only bridges across I-5. A new grade-separated arterial street with on-street bicycle lanes and an adjacent off-street multiuse trail are both currently under design in the central portion of Bellingham. The interstate severely limits east/west and north/south bicycle travel options and isolates many destinations in the City. Addressing major barriers such as I-5 through improved connectivity is central to the goals and objectives of this Plan.

Another challenge is determining how to proceed with planning for bicycle facilities within the Urban Growth Area (UGA). In more developed areas where streets have been platted, on-street bicycle facilities that tie into the larger network can be identified and recommended. However, in less developed areas of the UGA, planning for bicycle facilities will need to be incorporated into the platting and design of new streets. Under modern land use and environmental regulations and mitigation requirements, street connectivity in the Bellingham UGA will be very challenging to accomplish due to the presence of significant environmental features, including streams, wetlands, steep slopes, and wildlife habitat.

Off-street facilities such as trails, side paths, and widened sidewalks, while not evaluated in this Plan, help to complete the on-street bicycle network by providing parallel routes or short, critical connections

where there is not an on-street option. For example, The Railroad Trail serves as an off-street alternative to help address the lack of on-street bicycle facilities on the north side of Alabama Hill. In cases where off-street facilities cross major arterials, additional improvements may be needed to help trail-users safely cross the street.

Network Development

The bicycle facility network was developed in three phases: 1) a study network was developed using existing plans and input from public and agency stakeholders; 2) a technical demand analysis was completed to identify key destinations, and; 3) a field review and calibration procedure was completed to refine the network. From the beginning, it was recognized that there was a need for a network that would accommodate both experienced and less experienced bicyclists. This emphasis is based on previous work completed in conjunction with the Transportation Element of the Comprehensive Plan, input received from the public, and guidance in the new 2012 AASHTO Guide for the Development of Bicycle Facilities (AASHTO Bike Guide).

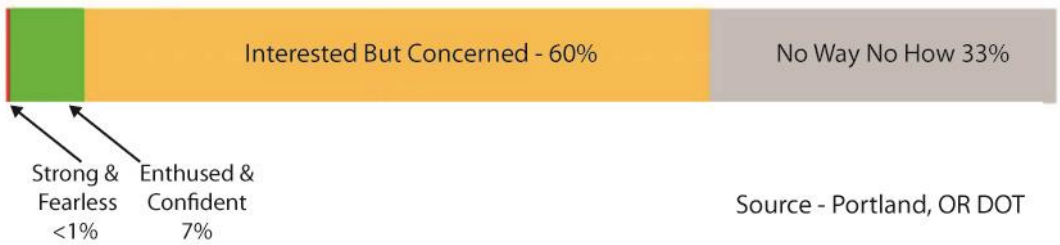
The 2012 AASHTO Bike Guide discusses the different ways in which bicyclists can be classified, according to *skill level*, *comfort level*, *physical ability*, and *trip purpose*. It recommends *skill level* as one of the most important factors to consider when developing a bicycle network. The AASHTO Bike Guide categorizes bicyclists by *skill level* as “experienced and confident” and “casual and less confident.” The majority of the population will fall into the latter category, including children, recreational riders and individuals who prefer off-street facilities or those on low-traffic streets. Table 3.1, taken from the AASHTO Bike Guide, summarizes the common characteristics of experienced versus casual bicyclists.

Table 3.1: Bicyclists of Different Skill Levels Use of On- and Off-Street Bicycle Facilities

Experienced/Confident Riders	**Casual/Less Confident Riders**
Most are comfortable riding with vehicles on streets, and are able to negotiate streets like a motor vehicle, including using the full width of a narrow travel lane when appropriate and using left turn lanes.	Prefer shared use paths, bike boulevards, or bike lanes along low-volume, low-speed streets.
While comfortable on most streets, some prefer on-street bike lanes, paved shoulders or shared use paths when available.	May have difficulty gauging traffic and may be unfamiliar with rules of the road as they pertain to bicyclists; may walk bike across intersections.
Prefer a more direct route.	May use less direct route to avoid arterials with heavy traffic volume.
Avoid riding on sidewalks. Ride with the flow of traffic on streets.	If no on-street facility is available, may ride on sidewalks.
May ride at speeds up to 20 mph on flat ground, up to 45 mph on steep descents.	May ride at speeds around 8 to 12 mph.
May cycle longer distances.	Cycle shorter distances: 2 to 5 miles is a typical trip distance.

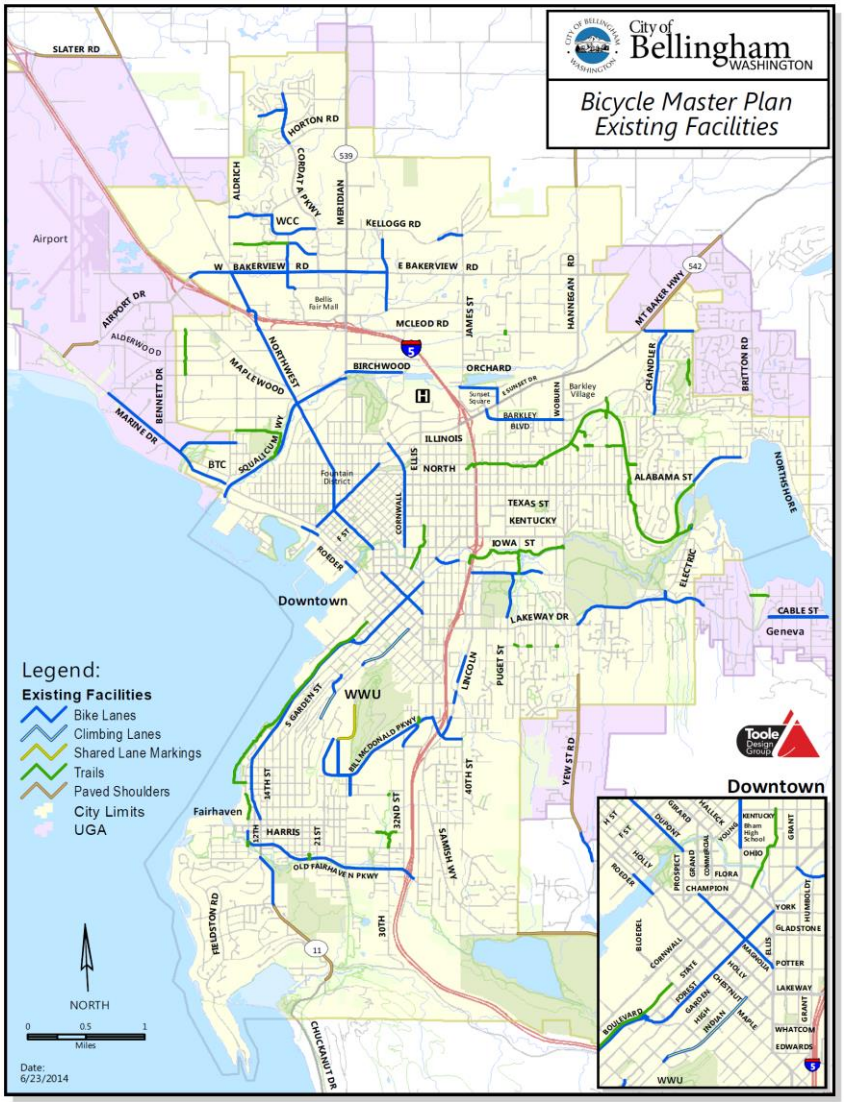
Another way to categorize bicyclists was developed by the Portland Department of Transportation. The following figure (3.2) illustrates categories of bicyclists and also estimates the percent of the total population who fall into each category. The "interested but concerned" group is estimated to represent 60 percent of the population and, because they have a desire to bicycle more if certain barriers were removed, they are often viewed as the target audience for bicycle improvements like those recommended in this Plan.

Figure 3.2: Four Types of Cyclists by Proportion of Population



Development of the Study Network

Figure 3.3: Bicycle Master Plan Existing Facilities

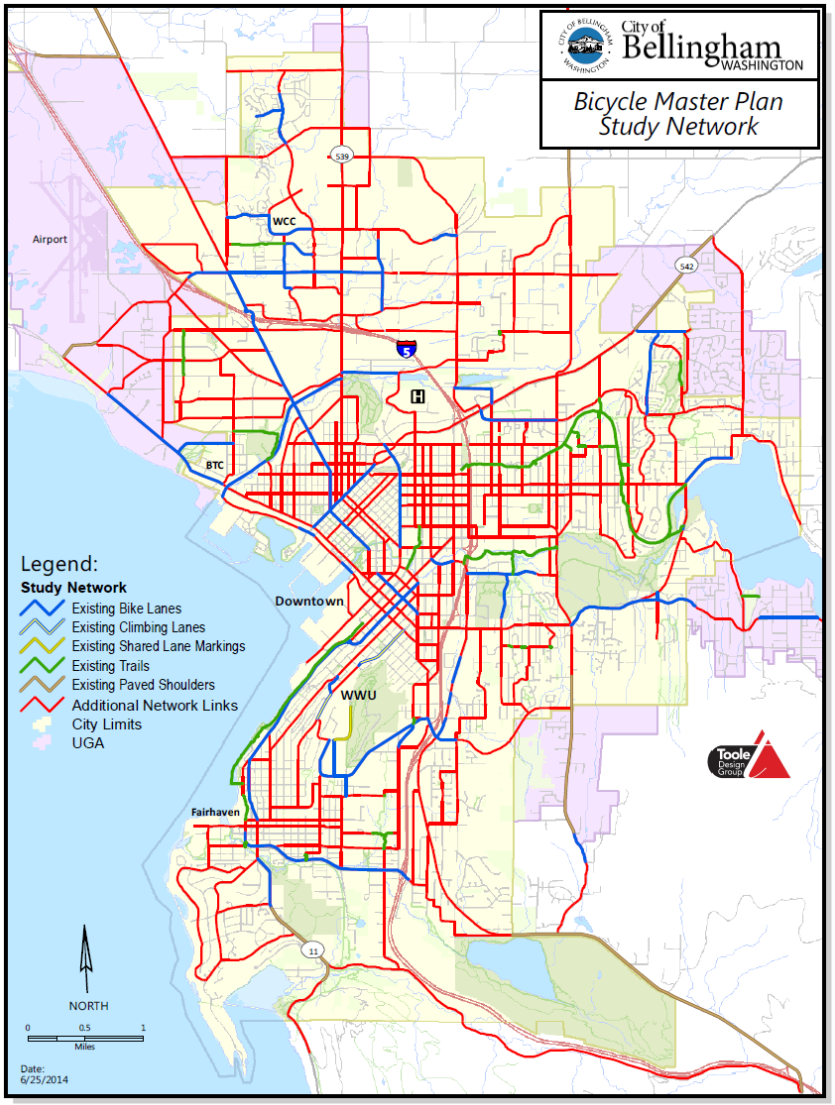


The study network served as the basis for subsequent field work and the development of a final recommended network. Network development followed a logical progression of data gathering, public input, analysis, evaluation, verification, adjustment, and final recommendations. The process included input from the public, the steering committee, staff, and consultants. The modeling effort made use of a hybrid approach using current cutting-edge GIS geo-processing techniques, supplemented with oversight and manual adjustment from staff and consultant experts. The map of the study network shown in Figure 3.4 was developed using the following sources:

- Existing bicycle facilities (shown in Figure 3.3)
- Planned bicycle facilities as identified in the Transportation Element of the Bellingham Comprehensive Plan
- Projects identified in the City's 2014-2019 6-Year Transportation Improvement Plan
- Projects identified on the Bellingham Transportation Commission project list
- Projects identified in the Greenstreets Committee report
- Recommendations received at the public open house, through the on-line survey and interactive map, and focus group discussions
- Recommendations received from the project Steering Committee
- Recommendations received from the Plan project team; Public Works, Planning and Community Development, and Parks and Recreation departments

Completion of Demand Analysis

Figure 3.4: Bicycle Master Plan Study Network

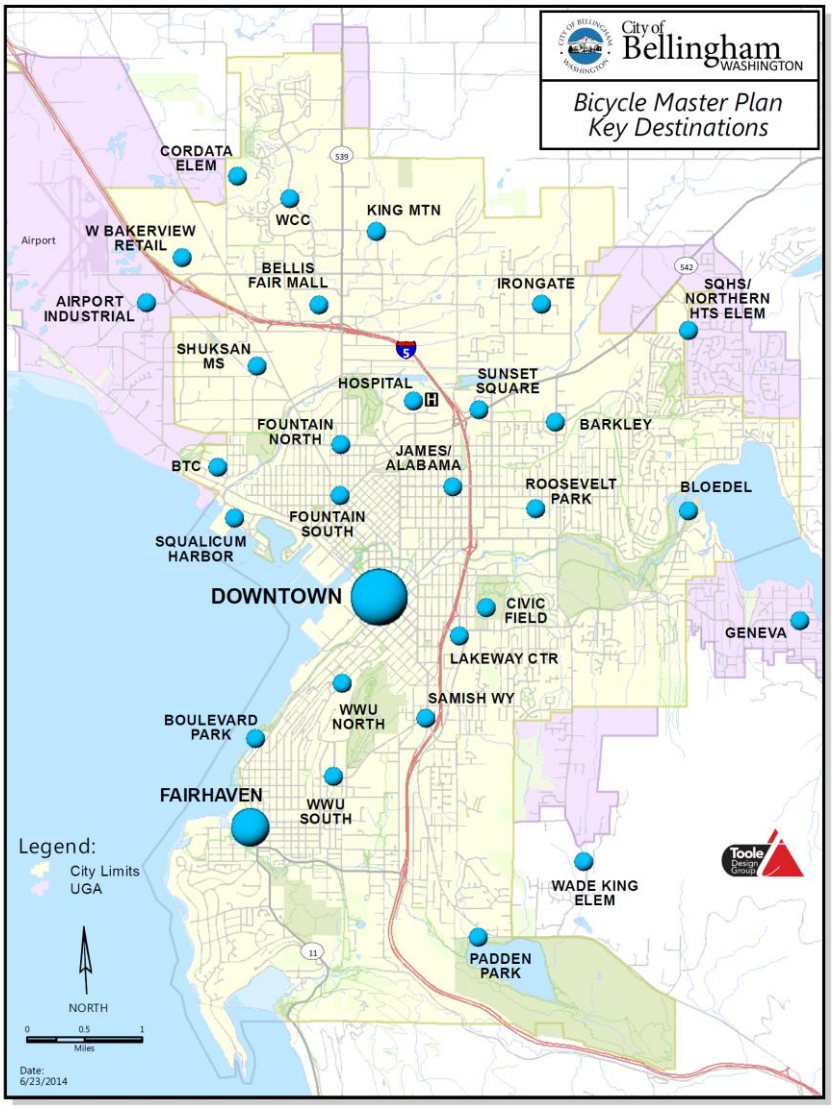


To evaluate the effectiveness of the network a demand analysis was conducted identifying key destinations across the city. The analysis made use of ViaCity[1], a proprietary GIS-based tool developed by Transpo Group, Inc. ViaCity uses traffic data along with parcel-based land use and demographic data to determine likely destinations for bicyclists. Destinations are typically areas with high concentrations of housing, jobs, or services. GIS data used in the ViaCity model included a population density layer created using the City's 2013 housing unit inventory with occupancy rates from the latest US Census Bureau data; an employment density layer derived from the City's address-based 2010 InfoUSA employment database; and a common destinations layer including all public K-12 and higher education schools, most private or alternative schools, grocery stores, public assistance providers, major parks and recreation facilities, government offices, health care providers, community centers, museums, libraries, theaters, churches, transportation centers, and other public institutions. Additional destinations identified by the public at the Open House, the online Interactive Map, and the online Survey were also included. The two density layers, the common destinations, and network traffic data were combined and evaluated to derive 30 key destinations for evaluating network connectivity. These destinations cover a range of locations like Downtown, the urban villages, St Joseph's Hospital, WWU, WCC, BTC, the larger K-12 schools, larger retail/shopping areas, and major employers. It is important to note that these destinations were selected based on a balance of relative

[1] http://www.viacity.info/

importance and spatial distribution. Some key destinations were not selected for the demand analysis due to their adjacency with other key destinations. The intensive nature of the data-processing required for network modeling necessitated a limited selection of locations and a broad distribution of destinations across the city rather than modeling trips to every destination of significance. Because of these factors the destinations depicted in the demand model should not be viewed in light of their value from a policy perspective, but rather as being spatially representative of locations spanning the entire network. If development of a ranked list of network destinations becomes a priority, then that effort could make use of the initial common destinations data, but should be conducted separately from the network demand analysis. The thirty destinations identified using the ViaCity tool were placed on the draft network map (depicted as blue circles in Figure 3.5 below). The study network was then adjusted to ensure it served all of the identified destinations.

Figure 3.5: Bicycle Master Plan Key Destinations



The final step in the demand analysis involved running the ViaCity model to establish baseline connectivity values for each portion of the study network. These values, expressed as a route directness index (RDI), quantify the relative value of each portion of the network when modeling cyclist trips between each of the thirty identified destinations. Before the model could be run, individual network segments were grouped into logical projects. These groupings fell into two general classes. Citywide projects were longer corridors spanning multiple neighborhoods and serving a broader connectivity function. Neighborhood projects were shorter corridors typically within a neighborhood and serving local connectivity, or feeding into citywide projects.

The ViaCity model was designed so that the network function of each project was weighted with factors relevant to bicycle travel. These factors included a vehicle presence score comprised of each street's traffic volume and posted speed; a

multiplier for segments with moderate or steep slopes; and factors for existing facility types with priority weighting given to lower-stress facilities that keep cyclists separated from vehicle traffic. The practice of incorporating cycling stress level as a factor in bicycle network planning has emerged in recent years as a useful modeling tool. This technique, developed most notably by the Mineta Transportation Institute, is predicated on the assumption that "for a bicycling network to attract the widest possible segment of the population, its most fundamental attribute should be low-stress connectivity, that is providing routes between people's origins and destinations that do not require cyclists to use links that exceed their tolerance for traffic stress, and that do not involve an undue level of detour."[2] The resulting model operates on the logic that between any two destinations, routes of roughly equal linear distance can have different relative values based on their stress level for cyclists. Lower stress routes (lower vehicle presence, and flatter terrain) are effectively shortened, and higher stress routes (higher vehicle presence, and steeper terrain) are effectively lengthened. This initial baseline connectivity model run measured the study network under existing conditions.

Field Review and Network Refinement

The study network with the baseline connectivity scores was then reviewed, and evaluated by the BMP consultant, the Steering Committee, and City staff. The consultant team conducted a field review in order to address gaps in the study network, especially in areas with low street connectivity where there are fewer roads that have potential for bicycle improvements. Duplicative facilities were eliminated and others were added. The team also identified off-street trail segments that were needed to serve key destinations. Guiding these actions were the policy priorities set in place by the BMP Steering Committee. Two of the highest policy priorities were providing facilities that create safe, comfortable routes for the large segment of the population that is willing to try cycling, but reluctant to do so in areas with high vehicle traffic; and providing network elements that cross the Interstate 5 barrier.

The initial draft recommended network was then subjected to an iterative QA/QC calibration process where City staff and the BMP consultant examined each network segment and recommended facility types. The goal of this process was to ensure recommended facilities either fit the existing street profile, or that choices for lane re-channelization, lane or road diets, or parking removal were reasonable, achievable, and provided a benefit to the overall network. As a result, adjustments were made where appropriate, and a final recommended network was developed.

Recommended Network

The recommended network is a comprehensive, safety-focused, convenient, and comfortable network designed to accommodate both experienced and less experienced bicyclists while promoting bicycling as a practical form of transportation throughout the City. The recommended network includes 134 miles of on-street bicycle lanes, bicycle boulevards, shared lane markings, and a cycle track in addition to the 39

[2] Mineta Transportation Institute. Low-Stress Bicycling and Network Connectivity - MTI Report 11-19.

miles of existing on-street bicycle facilities for a total of 169 miles (see note in Table 3.6). The mileage for each type of facility is summarized in Table 3.6.

Table 3.6: Existing and Recommended Facility Types for the Full Bicycle Network

	Existing Network Miles	Percent	Total New Recommended Miles	Percent	Complete Network (Existing + New Recommended)	Percent
On-Street Facilities						
Bike Lanes	31.9*	82%	45.7*	34%	73.7*	44%
Buffered Bike Lanes	0	0%	4.0*	3%	4.0*	2%
Shared Lane Markings	0.4	1%	6.9	5%	7.3	4%
Climbing Lane	0.7	2%	7.9	6%	8.6	5%
Bicycle Boulevard	0	0%	52.1	39%	52.1	31%
Paved Shoulder	5.7	15%	0	0%	5.7	3%
Cycle Track	0	0%	0.8	<1%	0.8	<1%
Further Study	0	0%	9.4	7%	9.4	6%
Marked Route	0		7.8	6%	7.8	5%
TOTAL	**38.7**	**100%**	**134.6***	**100%**	**169.4***	**100%**

**Note: There are 3.9 miles of existing bike lanes on streets with curb-to-curb profiles able to accommodate buffered bike lanes. The mileage for these facilities is expressed in both the existing and recommended columns, but is only counted once in the complete network column.*

The recommended bicycle network is designed to connect all neighborhoods and to provide access to the key destinations identified by the Steering Committee, through public input and using the GIS-based ViaCity analysis. Consistent with the vision of the Plan to provide a well-connected network for bicyclists of all ages and abilities, the recommended network includes a variety of facility types. The lower-stress bicycle boulevards use local streets that are already conducive to casual, lower speed bicycling. Traffic calming, wayfinding and crossing improvements at intersections with arterial streets can help to create a more comfortable riding environment on bicycle boulevards.

At the same time, it is equally important to continue to develop facilities that appeal to more experienced bicyclists, for example by providing bike lanes on arterial streets. Arterial streets provide more direct routes, improving the connectivity of the overall network. They can provide a convenient connection between destinations for many types of bicyclists, including commuters, recreational and casual/occasional riders. Additionally, as bicycling continues to increase in Bellingham, a growing number of novice riders will gain enough confidence to feel comfortable riding in bike lanes on busy, arterial streets. Table 3.7 describes the different facility types recommended for the citywide bicycle network.

Table 3.7: Definitions of the bicycle facility types that make up the existing and recommended network

Facility Type	Definition
 Bike Lane	Marked space along a length of roadway designated for use by bicyclists
 Buffered Bike Lane	A bike lane with additional buffer space between the bike lane and the auto lane or parked cars, used on high-volume or high-speed roads, or roadways with high parking turnover.
 Shared Lane Marking	A pavement marking symbol that indicates appropriate bicycle positioning in a shared lane (typically on downhill or connector areas).
 Climbing Lane	On a sloped roadway: a bicycle lane on the up-hill side to provide space for slow climbing bicycles and shared lane marking on the downhill side.
 Bicycle Boulevard	A low-volume and low-speed street or series of streets that have been optimized for bicycle travel while discouraging or calming through automobile travel. Local access is maintained.
 Paved Shoulder	The portion of the roadway between the travel way and the edge of pavement, for accommodation of stopped vehicles, emergency use and often used by cyclists where paved.
 Cycle Track	A portion of a right-of-way which has been designated by pavement markings, curb, cross-hatched paint, planting strip or parked cars for the exclusive use of bicyclists. Cycle tracks are typically one-way (not always). Cycle tracks can be adjacent to the sidewalk.

Recommended Network Maps

The recommended network is shown in Figures 3.8 through 3.13. The incorporated areas within Bellingham have a yellow background, and the current Urban Growth Areas are shown with a lavender background. The maps show recommended facilities for each on-street section of the bicycle network. Twenty-one on-street network links and twenty-six intersections require further analysis before a specific facility type can be identified. They are identified on the maps as "further study needed" projects. Figure 3.8 shows the entire City and the subsequent five maps zoom in on the northeast, northwest, southeast and southwest quadrants of Bellingham, as well as downtown.

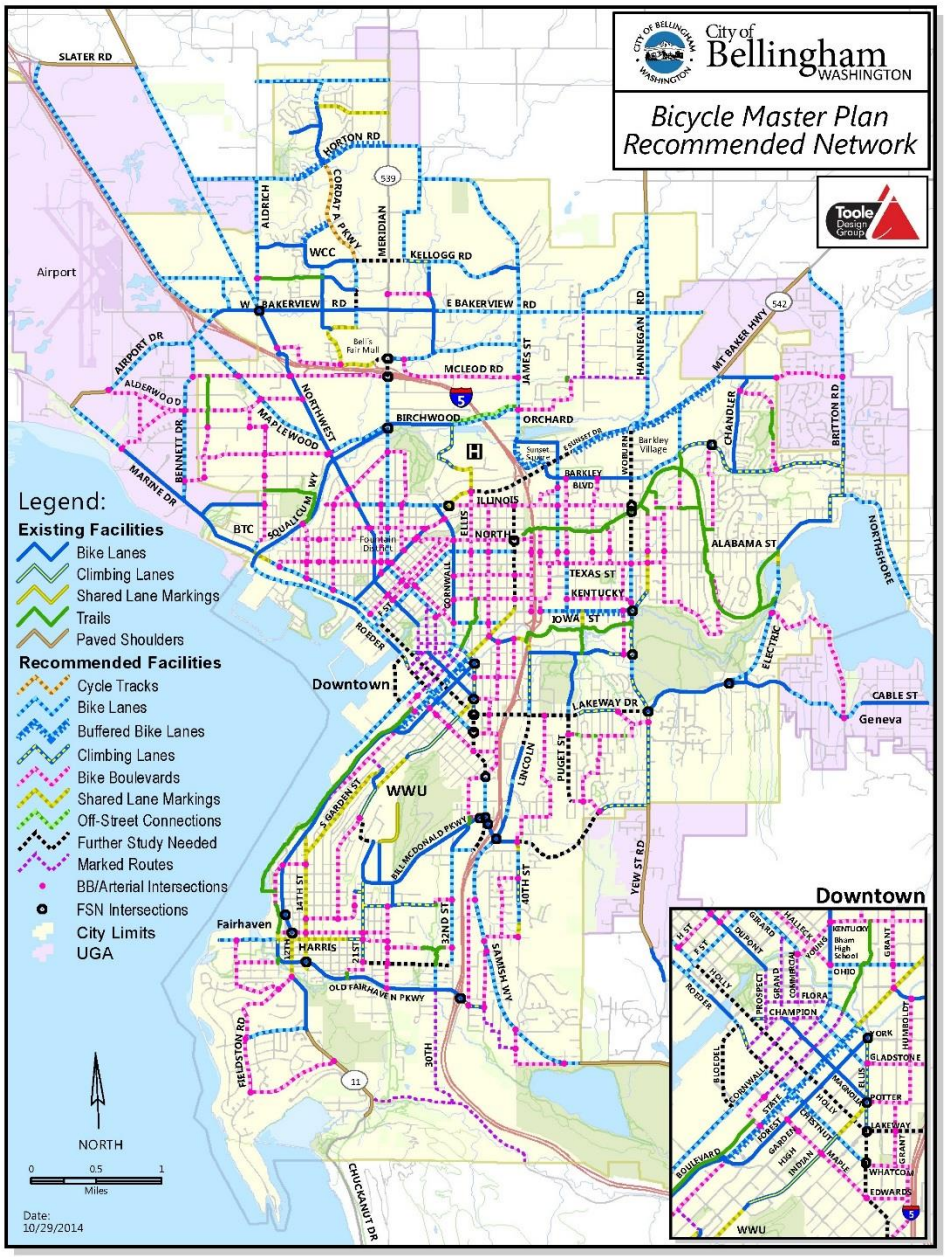
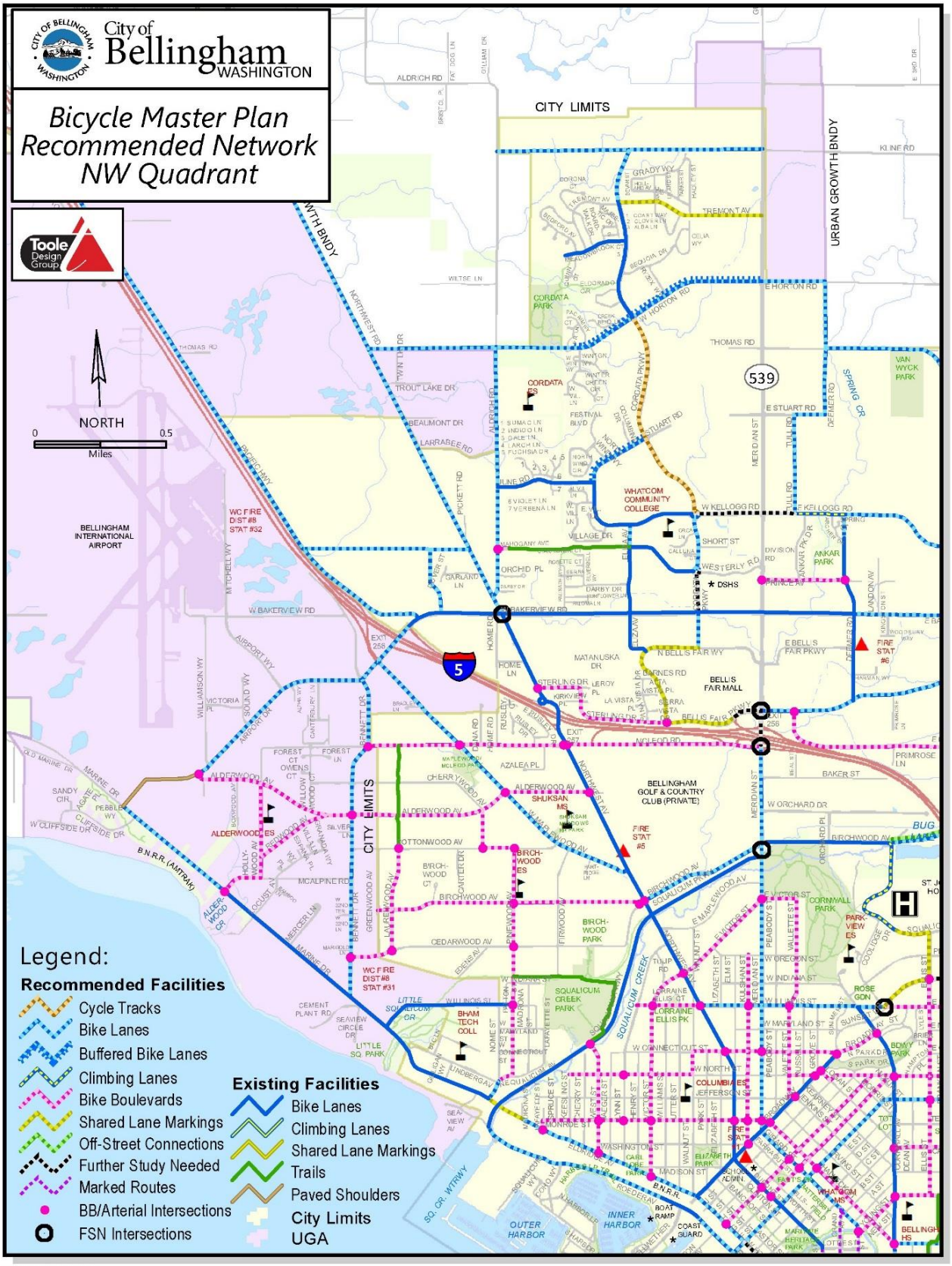


Figure 3.9: Bicycle Master Plan Recommended Network NW Quadrant



Date: 10/29/2014

Figure 3.10: Bicycle Master Plan Recommended Network NE Quadrant

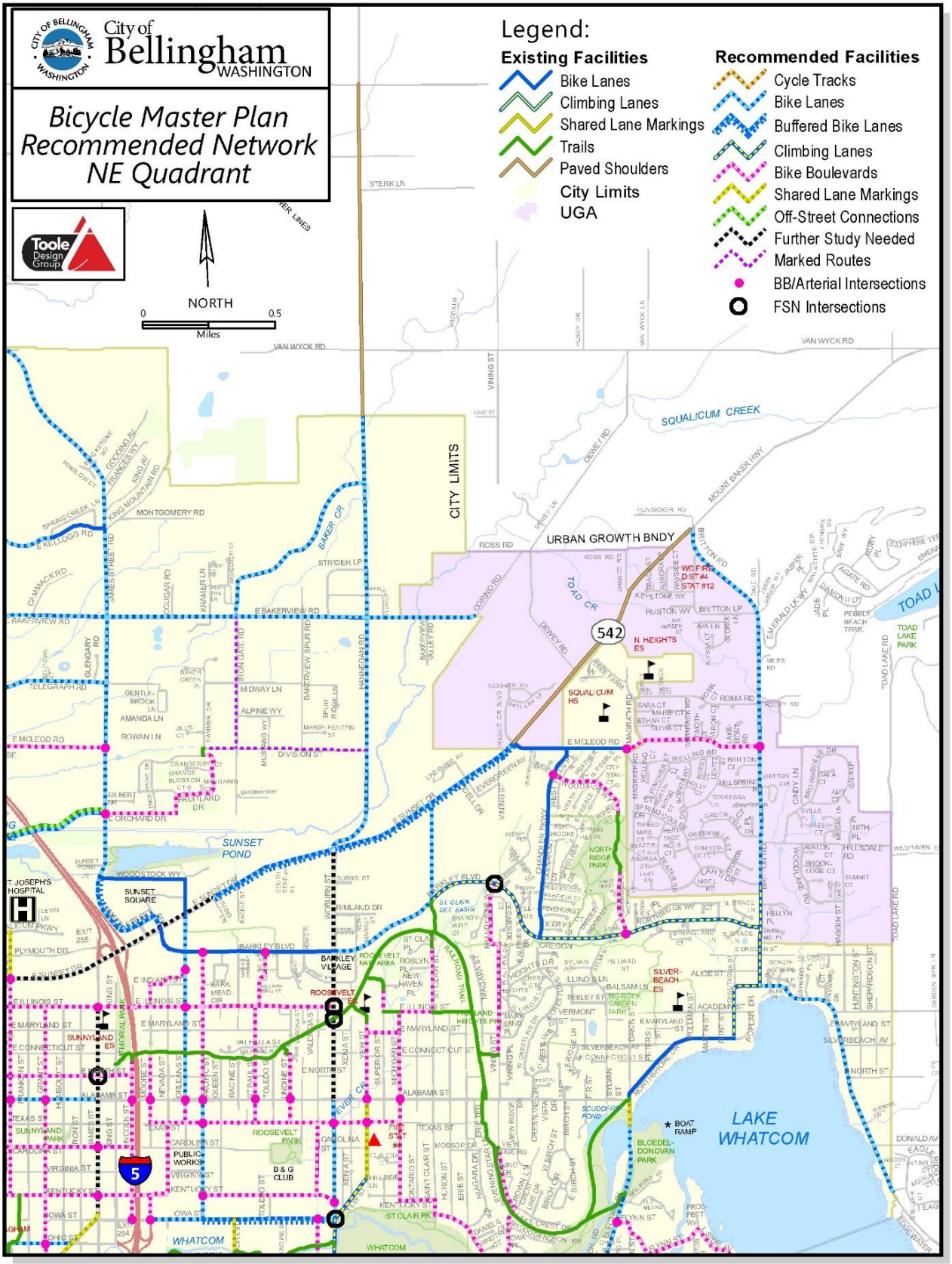


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Figure 3.11: Bicycle Master Plan Recommended Network SE Quadrant

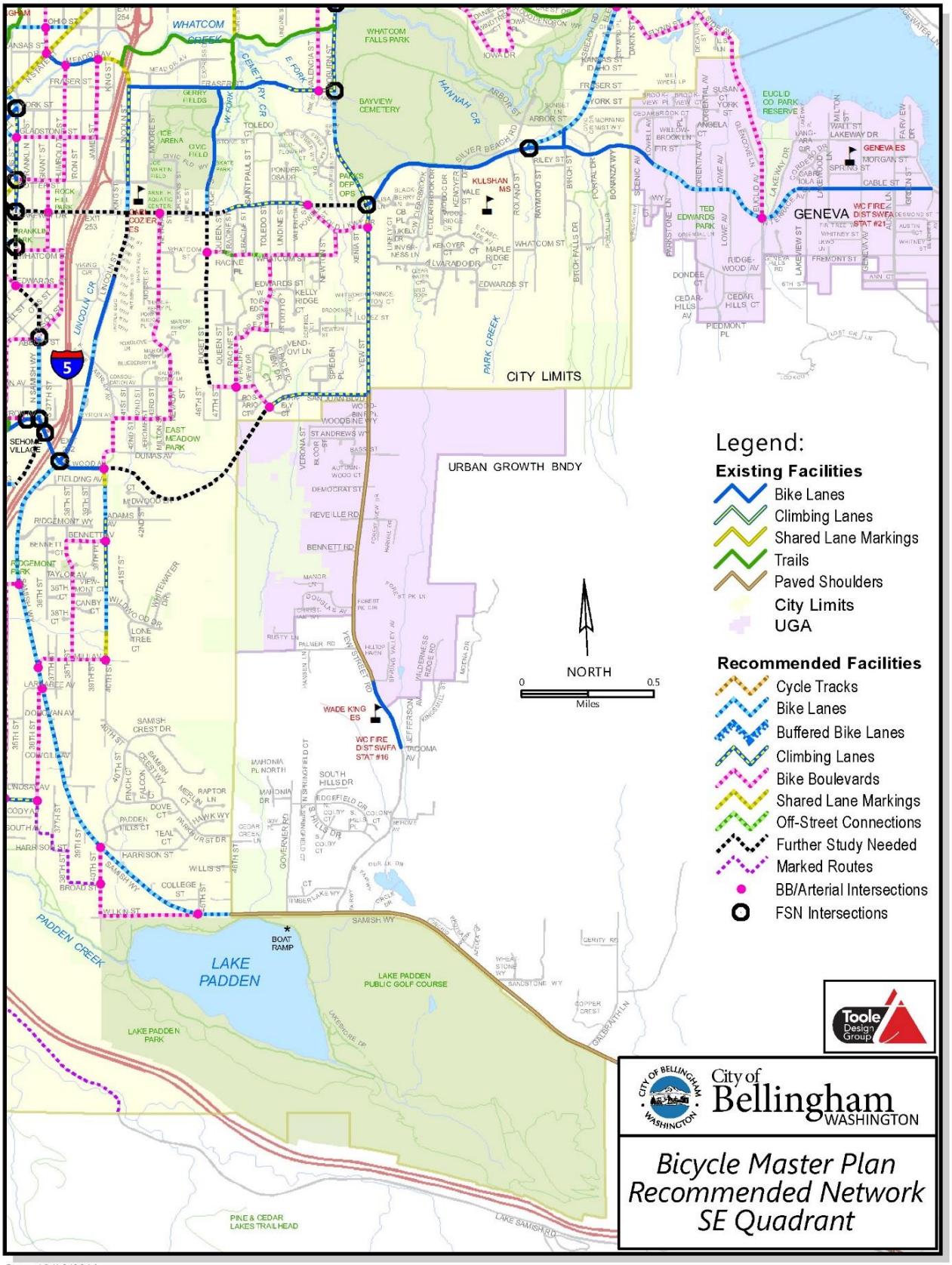

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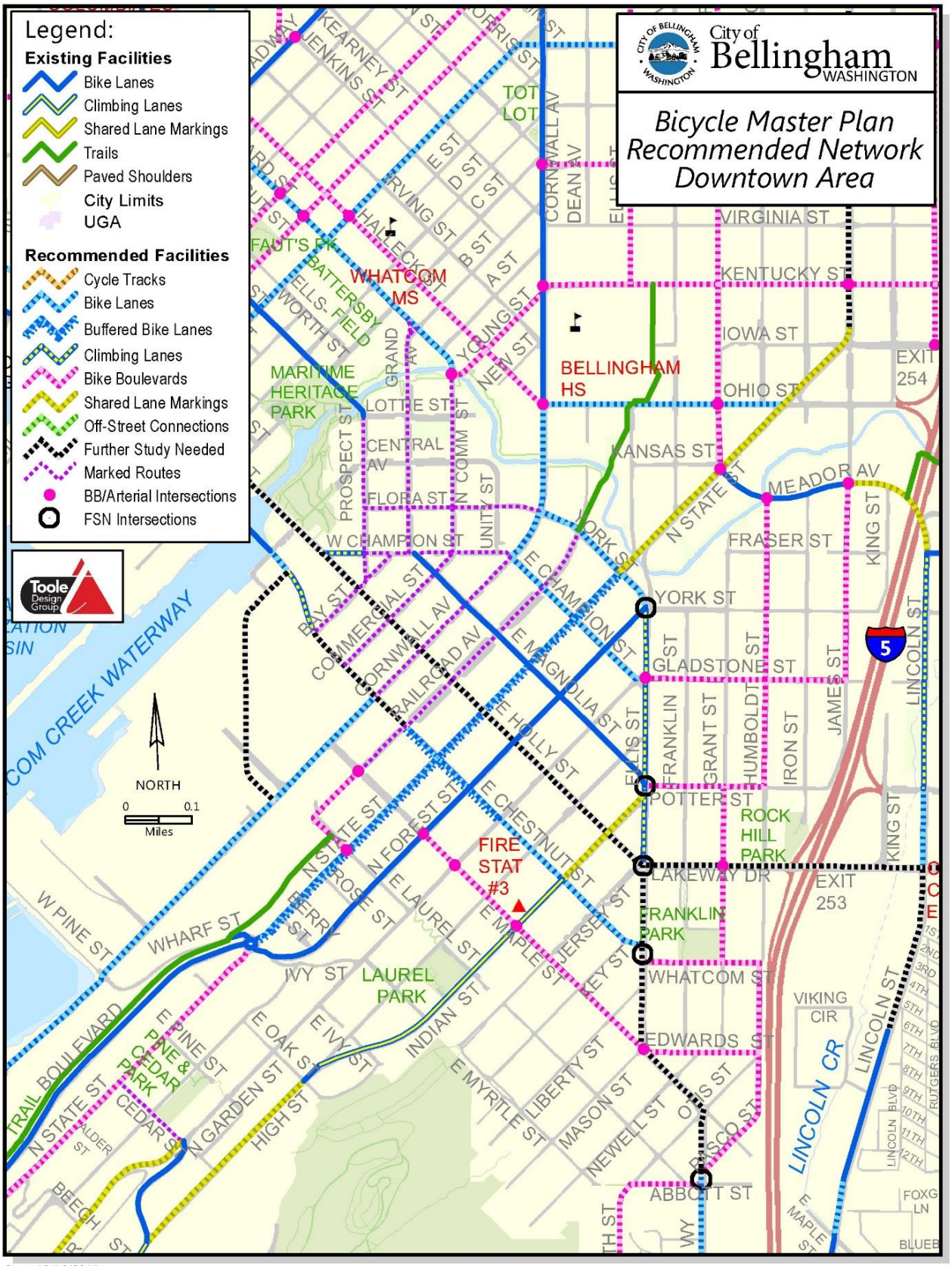
Figure 3.12: Bicycle Master Plan Recommended Network SW Quadrant

Figure 3.13: Bicycle Master Plan Recommended Network Downtown Area



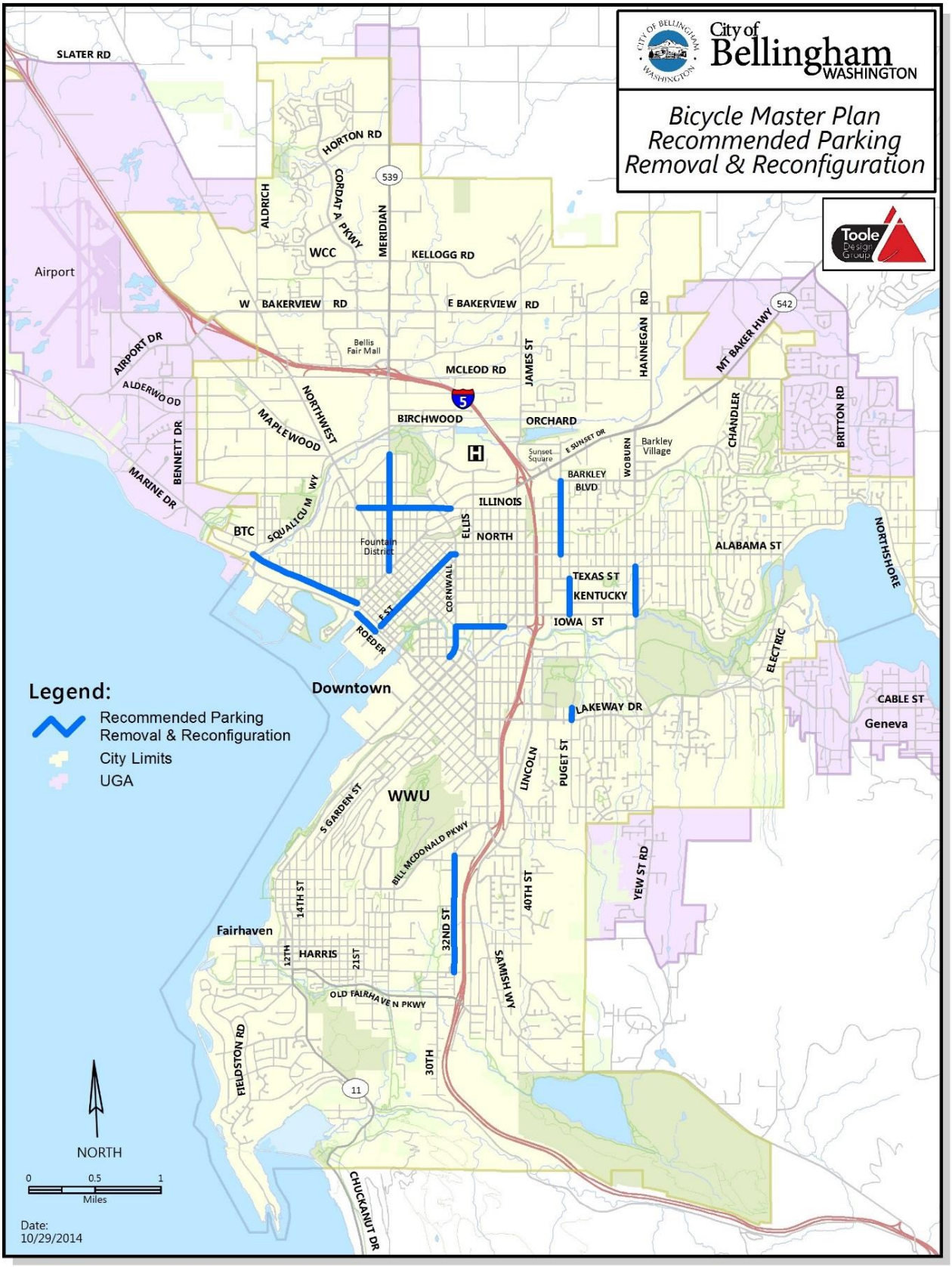
On-Street Parking Removal and Reconfiguration

In order to fully implement the recommended citywide bicycle network, there are some network links that will require on-street parking to be reconfigured or removed from one or both sides of the street in order to accommodate the recommended bicycle facility. Table 3.14 and Figure 3.15 illustrate the network links that will require on-street parking removal to allow implementation of the recommended bicycle facility. Any proposal for on-street parking removal on arterial streets can be controversial and will require a parking use analysis as well as City Council legislative action to remove the on-street parking to accommodate bicycle facilities.

Table 3.14: Recommendations for Parking Removal & Reconfiguration to Accommodate Bike Lanes

Recommendations for Arterial Street Parking Removal & Reconfiguration					
Arterial Street	**From**	**To**	**Asphalt Curb to Curb**	**Recommended Change to On-Street Parking**	**Recommended Cross-section**
Roeder	F	400' NW Hilton	44 feet	Remove parking on west side	5_11.5_11_11.5_5 = 44
32nd	Fielding	Taylor	40 feet	Remove east side; 7' parking west side	7_6_11_11_5 = 40
32nd	Taylor	Donovan	34 Feet	Remove parking both sides	5_12_12_5 = 34
Puget	Lakeway	500' N Lakeway	40 feet	Delineate 7' parking west side	7_6_11_11_5 = 40
Woburn	Iowa	Texas	40 feet	Remove west side; 7' parking east side	5_11_11_6_7 = 40
Illinois	Cornwall	Sunset	40 feet	Remove south side; 7' parking north side	7_6_11_11_5 = 40
Pacific	Iowa	Texas	40 feet	Remove east side; 7' parking west side	7_6_11_11_5 = 40
Illinois	Northwest	Cornwall	40 feet	Remove south side; 7' parking north side	7_6_11_11_5 = 40
Ohio	Cornwall	State	40 feet	Remove parking from one or both sides	7_6_11_11_5 = 40
Meridian	Broadway	East Victor	44 feet	Delineate 7' parking both sides	7_5_10_10_5_7 = 44
Orleans	Alabama	Barkley	40 feet	Remove parking east side	7_6_11_11_5 = 40
Cornwall	Ohio	Champion	50 feet	Remove west side from Ohio to York, and east side from York to Champion, 7' parking	5_10.5_10.5_10.5_6_7 = 49.5
F	Holly	Cornwall	40-42 feet	Remove NW side; 7' parking SE side	5_11_11_6_7 = 40
Eldridge	Broadway	Squalicum	34-36 feet	Remove parking from both sides	6_12_12_6 = 36

Figure 3.15: Bicycle Master Plan Recommended Parking Removal



Further Study Needed

Network Links

Over 9 miles, or 7%, of the Recommended Bicycle Network is listed as "Further Study Needed," which means that a specific facility type cannot be identified until further analysis of the link is conducted by City staff. These projects are listed below in Table 3.16. Some of these links score very high when compared to other links in the recommended network due to benefits in bicycle connectivity, safety, and mobility. In light of this, the City should commit annual funding to complete the additional studies necessary to identify viable improvement options. Descriptions for each of the network links requiring further study are listed in Appendix C.

Table 3.16: Recommended Bicycle Network Links Needing Further Study

Bellingham Bicycle Network Link	Bicycle Master Plan Prioritization Score	Priority Rank (Out of 186)
Lakeway Drive (Queen to Ellis)	57.312	2
Holly (Ellis to Bay)	46.140	5
Chestnut (Bay to Railroad)	46.140	6
James Street (E. Illinois to Iowa)	42.037	8
Meridian Street *[SR 539]* (McLeod to Telegraph)	34.868	17
Lincoln Street (Lakeway to S Fred Meyer driveway)	28.623	28
Donovan Avenue (32nd to 21st)	23.947	45
West Holly Street (Bay to F)	23.760	48
Lakeway Drive (Old Lakeway to Woburn)	22.131	62
Ellis/Maple/N. Samish (Lakeway to Pasco)	21.671	65
Sunset Drive *[SR 542]* (James to Studio Ln)	19.078	88
Puget Street (Lakeway to Consolidation)	18.671	90
West College Way (Highland to Bill McDonald)	17.993	97
W Telegraph (SR 539 to I-5 northbound off-ramp)	17.326	101
Woburn Street (Sunset to Alabama)	17.218	104
36th (Fielding to Samish)	16.454	110
Kellogg Road (Tull to Cordata)	16.019	115
San Juan Boulevard (40th to Pacificview)	15.520	119
Cordata Parkway (Westerly to Bakerview)	14.573	126
Sunset Drive (Ellis to James)	13.631	139
Granary-Bloedel Avenue (through the Waterfront)	10.661	163

Intersections

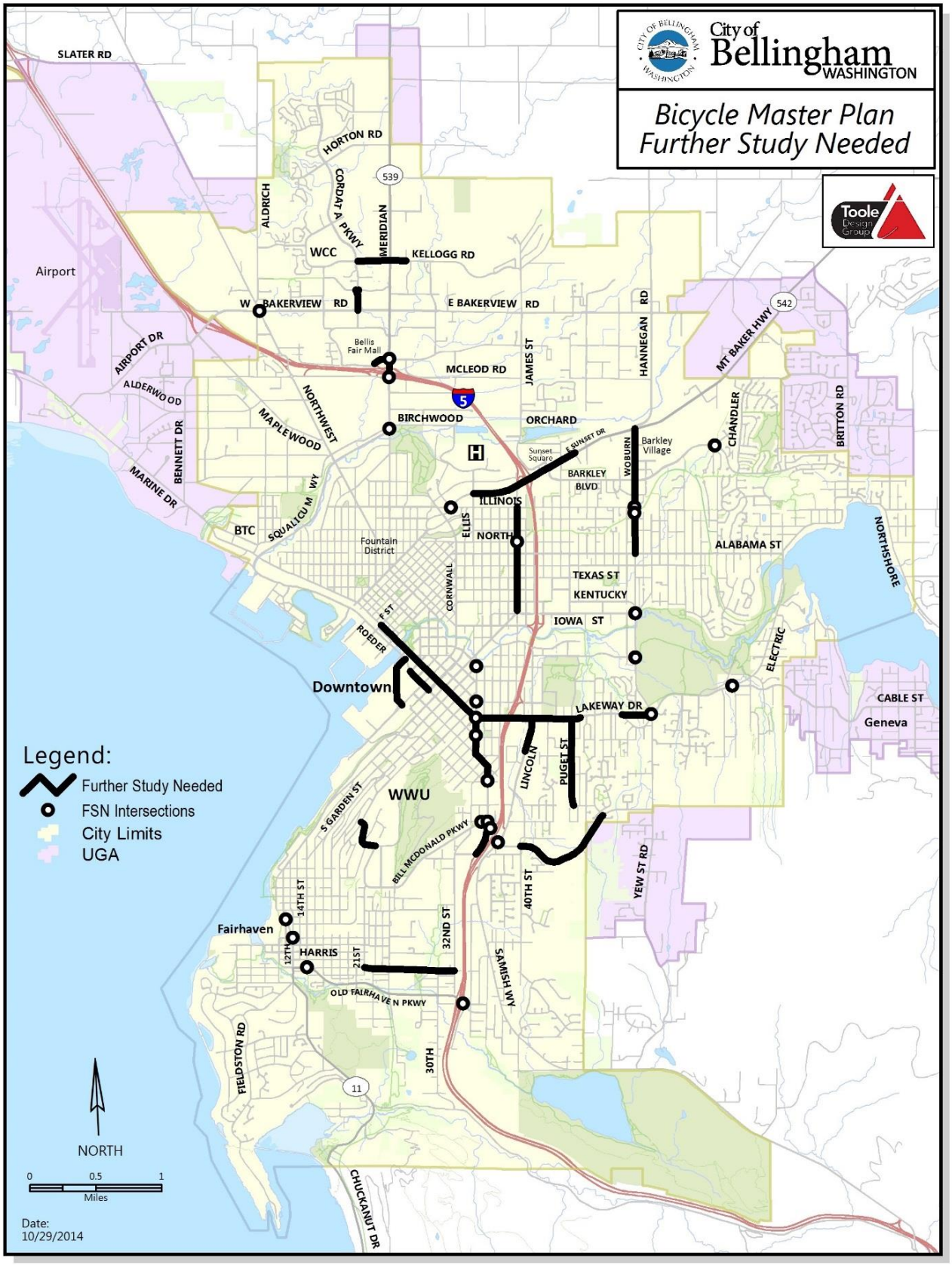
The Plan identifies twenty-six intersections where further study is needed to assess the need for crossing improvements (black circles on the network maps). Many are locations where bicycle boulevards or trails cross busy arterial streets. Possible crossing improvements include marked crosswalks, warning and regulatory signs, bulb-outs, green bike lanes, crossing islands, rapid-flash beacons, high-intensity activated crosswalk (HAWK) signals, and full signalization. Determination of the

appropriate crossing treatment should be consistent with Bellingham's Crossing Treatment Guidelines, which consider traffic volumes, speed, number of travel lanes, lines of sight, proximity of other crossing treatments (e.g. signals) and on-street parking. Table 3.17 lists the intersections identified for futher study.

Table 3.17: Intersections Recommended for Further Study

11th St/Finnegan Wy/Knox Av
12th St/Hawthorn Rd/Chuckanut Dr
12th St/Mill Av
14th St/Old Fairhaven Pkwy
Abbott St/Samish Wy
Barkley Blvd/Sussex Dr/Brandywine Wy
Bill McDonald Pkwy/34th-35th St
Chestnut St/Ellis St
Connelly Ave/I-5
Ellis St/York St/Forest St
Holly St/Lakeway Dr/Ellis St
Lakeway Dr/Electric Av
Magnolia St/Ellis St/Potter St
Meridian St/Mcleod Rd
Meridian St/Telegraph Rd
North St/James St
Northwest Ave/W Bakerview Rd
Samish Wy/36th St
Samish Wy/Bill McDonald Pkwy/Byron Av
Squalicum Wy/Birchwood Ave/Meridan St
Sunset Drive/Illinois St
Woburn St/Illinois St
Woburn St/Lakeway Dr/Yew St
Woburn St/Railroad Trail
Woburn St/Fraser St
Woburn St/Iowa St/Yew St

Figure 3.18: Bicycle Master Plan Further Study Needed



I-5 Corridor

The Interstate 5 (I-5) corridor is a significant physical and psychological barrier to intracity bicycle travel, literally dividing the City of Bellingham in half (see map). Creating better crossing conditions along this nine mile segment of freeway is absolutely essential to implementing a complete and connected bicycle network.

There are currently only eleven arterial streets that cross I-5 over a nine-mile stretch. Many of these are intimidating to novice and intermediate bicyclists due to high vehicle speeds, heavy automobile and truck traffic congestion, and a lack of dedicated bicycle facilities. There are also currently two bicycle and pedestrian-only bridges across I-5 between Alabama and Sunset. Bellingham is currently designing a new grade-separated Orchard Drive arterial street with on-street bicycle lanes and an adjacent off-street Bay to Baker multiuse trail in the central portion of Bellingham between Sunset and Meridian.

The following section provides a brief description of each of the existing and proposed bicycle crossings of I-5. In the short-term, wayfinding signage and roadway markings should be utilized to direct cyclists to the safest crossings, and to legitimize bicyclists' presence in an automobile dominated environment. In the long-term, the addition of new I-5 crossings, improvements to access ramps, and the installation of on- and off-street infrastructure will better connect the east and west sides of Bellingham.

It is important to note that I-5 and the associated interchanges are federal highway facilities, operated by WSDOT. This presents both opportunities and constraints for the City as it moves toward the implementation of these recommendations. In 2008 WSDOT published an analysis of current and future traffic conditions on I-5 from Fairhaven Parkway to Slater Road (north of the City).[3] The report is out of date and some of the recommendations have been acknowledged as not constructible. However, it does provide recommendations for upgrading interchanges and surrounding streets, some of which serve as the foundation for the proposed improvements described below.

I-5 Intersections

Existing and proposed bicycle crossings of I-5 are presented here in order from north to south.

Bakerview Road

WSDOT's 2008 I-5 Master Plan recommends that this entire interchange be reconstructed as a Single Point Urban Interchange (SPUI) at an estimated cost of $45-50 million. Currently, there is no funding for this level of improvement, but several lower cost improvement options were identified in WSDOT's 2011 Bakerview/I-5 Value Planning Study Technical Report[4]. As a result of this study, Bellingham formed a

[3] http://www.wsdot.wa.gov/projects/i5/fairhaventoslater/

[4] http://www.wsdot.wa.gov/NR/rdonlyres/8E708C78-5AD3-445A-A206-7D006F4588DA/0/I5BakerviewPlanningStudyApril_25_11.pdf

public-private partnership and made $3.2 million in improvements to the West Bakerview/I-5 overpass in 2013, which added a new westbound lane to reduce traffic back-ups across the bridge, as well as a 6-foot wide sidewalk on the north side of the bridge. Further improvements include constructing a new northbound on-ramp on the east side of I-5 (est. $8 - 10 million), as well as reconstruction of the overpass bridge (est. $8-10 million) to include dedicated bicycle facilities.

Northwest Avenue

The City constructed two roundabouts on Northwest Avenue at I-5, accommodating bicyclists through a combination of bike lanes, side paths, and marked crossings. Bicyclists have the option of taking the lane and riding through the roundabout or riding onto the sidewalk and using the crosswalks as a pedestrian. Some bicyclists prefer to use the roadway while others are more comfortable using the sidewalk. A combination of roundabout bicycle facility education and the installation of shared lane markings at the entrance to the roundabouts should be considered for these locations.

Meridian Street

Meridian is Bellingham's busiest I-5 crossing and requires a long-term approach to integrate bicycles into an already heavily trafficked route. In the long term, all I-5 ramps should be upgraded to accommodate pedestrians and bicycles. Upgrades should include high visibility markings at all crossings, and the striping of bike lanes through the intersections. The Orchard Drive Extension (below) will relieve some traffic congestion at I-5/Meridian. WSDOT's 2008 I-5 Master Plan recommends that this entire interchange be reconstructed as a Single Point Urban Interchange (SPUI) at an estimated cost of $45-50 million.

Orchard Drive

The Orchard Drive Extension is currently being designed and right-of-way is being purchased to accommodate a new east-west arterial street between Meridian Street and James Street. This is the last opportunity within the city limits of Bellingham to create a multimodal grade-separated crossing of Interstate 5. The arterial street will have marked bicycle lanes and the associated "Bay to Baker" multi-use trail will offer an off-street pathway for bicyclists. Both the street and the trail will be constructed along the north side of a re-routed Squalicum Creek flowing between Sunset Pond Park and Bug Lake. When completed, the Orchard Drive Extension and the Bay to Baker Trail will allow bicyclists, pedestrians, future transit busses, and vehicles to avoid the congested interchanges at both I-5/Sunset and I-5/Meridian, while also providing transportation benefit to I-5, SR 539 (Guide-Meridian), and SR 542 (Sunset Drive-Mt. Baker Highway).

Sunset Drive

Sunset Drive is the second most heavily trafficked I-5 intersection in Bellingham. It is also a vital connection for bicyclists due to the limited number of crossings to the north and the access it provides between neighborhoods, the hospital and Sunset Square. WSDOT's 2008 I-5 Master Plan recommends that this entire interchange be reconstructed as a Single Point Urban Interchange (SPUI) at an estimated cost of $45-50 million. In the short-term, shoulders on the overpass should be studied for upgrade to bike lanes, connecting to the dedicated bicycle facilities that already exists to the east. Additionally, I-5

access ramps should be improved for pedestrians and bicyclists, including high visibility markings at all crossings, possible reductions to the curb radii, and the striping of bike lanes through the interchange.

Illinois Street

The bicycle and pedestrian bridge over I-5 at Illinois Street provides a high-quality, low-stress, and grade-separated travel connection for bicyclists. To increase awareness of this crossing, wayfinding signs should be installed that direct bicyclists from the proposed Illinois bicycle boulevard to the Barkley Trail via Moore Street; and to Barkley Boulevard and Sunset Drive.

Railroad Trail

The multiuse Railroad Trail is a very heavily used east-west gravel trail, which takes advantage of an old grade separated railroad bridge spanning I-5 to provide bicyclists and pedestrians with a low stress travel option across I-5 along the Connecticut Street alignment between Illinois and Alabama. This crossing ties into both the Lincoln Street and the Moore Street bicycle boulevards identified in this plan.

Alabama Street

The Alabama Street crossing of I-5 is not a freeway access point. Unfortunately, without implementation of a 4-to-3-lane "road diet" of the Alabama corridor, it is not possible to install bike lanes on this bridge across I-5. Crossing enhancements are recommended at the intersection of Alabama and Moore on the east side of the bridge, to allow bicyclists on the Texas Street bicycle boulevard to safely cross Alabama and proceed two blocks north to the Railroad Trail crossing of I-5 (above).

Texas Street

The Bellingham Pedestrian Master Plan recommends a new bicycle-pedestrian crossing of Interstate 5 along the Texas Street alignment. This would support the recommended bicycle boulevard improvements to Texas Street and provide an alternative to crossing I-5 at Alabama Street.

Kentucky Street

Kentucky Street passes beneath an I-5 bridge from Lincoln Street to Moore Street where it connects to a very short section of multiuse trail to Nevada Street. Wayfinding and sight distance improvements are recommended for Kentucky to enhance safety and comfort for bicyclists.

Iowa Street

Iowa Street is an important east-west arterial street, but presents a challenge for cyclists due to significant volumes of traffic entering and exiting I-5. WSDOT's 2008 I-5 Master Plan recommends that this entire interchange and associated I-5 bridges over Kentucky and Moore Streets be reconstructed at an estimated cost of $135 million. The installation of wayfinding signage to the Kentucky Street underpass, one block to the north, would allow cyclists to safely bypass the Iowa Street interchange. Additionally, by following this route, bicyclists can access the Kentucky Trail, which provides access to Nevada Street.

Meador Avenue

Meador Avenue is an important east-west bicycle connection that passes beneath I-5 from James Street to Fraser Street, but does not have enough curb-to-curb width to install bicycle lanes. If curb ramps were installed, the wide sidewalks that exist on Meador could function as shared use sidepaths, which would tie into the dedicated bicycle lanes on both Meador west of James and on Fraser Street, as well as the recommended uphill climbing lane/downhill shared lane on Lincoln Street, thus improving bicycle accessibility in this area. There is also a need for improved connections between Meador Avenue and the Whatcom Creek Trail. Making the side paths and trail accessible to cyclists will provide additional connectivity to Lakeway Drive, Fraser Street, and Woburn Drive.

Lakeway Drive

Lakeway Drive is the third busiest I-5 crossing in Bellingham (25,000 vehicles per day), but is also a critical connection for residents to access downtown services and other popular cultural destinations, including Civic Field, Whatcom Falls Park, and Lake Whatcom to the east. Due to the lack of an on-street bicycle facility, many cyclists currently utilize the narrow sidewalk, generating discomfort for pedestrians as well as cyclists. WSDOT's 2008 I-5 Master Plan recommends that access to I-5 at Lakeway be eliminated to meet the FHWA interchange spacing guidelines in conjunction with the construction of a set of parallel "collector-distributor" streets on either side of I-5 leading to a reconstructed Iowa/I-5 interchange and a newly constructed interchange at Maple/I-5 to replace the existing Samish/I-5 interchange. It is extremely unlikely that WSDOT's I-5 plan will be implemented and in the short-term, Bellingham should allocate transportation funds to study and determine feasible options to install dedicated bicycle facilities through the I-5 underpass on Lakeway Drive.

Maple Street/Consolidation Avenue

A relatively low section of Interstate 5 may offer an opportunity for a new bicycle and pedestrian overpass at either Maple Street or Consolidation Avenue, which would provide an alternative to the busy I-5 crossings at Lakeway Drive and Samish Way. While this could be an expensive option, a bicycle-pedestrian overpass in this location would complement the existing WWU Lincoln Street Park-N-Ride facility, which is served by high-frequency WTA transit busses, as well as several hundred student apartments that are currently being constructed at Lincoln/Maple. Bellingham will be constructing sidewalk along the WWU Park-N-Ride facility in 2015 and is working with private developers to ensure that the Lincoln/Maple intersection is improved with ADA crosswalks and preparation for future signalization. Bellingham should allocate transportation funds to work with WSDOT to study the feasibility of constructing a bicycle-pedestrian overpass in this location.

Samish Way

Samish Way is a key crossing from Lincoln Street into the Samish Way Urban Village and the main access to Western Washington University along Bill McDonald Parkway. The nearby WWU Lincoln Street Park and Ride, Sehome Village, and Lakeway commercial area are important destinations for University students and other local residents. In order to improve bicycle access in this area, the existing bike lanes on Samish Way should be upgraded to buffered bike lanes and pavement markings should extend through the intersections. Green bike lanes should be considered between travel lanes on the west side of the interchange to denote a vehicle-bicycle mixing zone and to enhance bicyclists' safety.

Old Fairhaven Parkway

The southernmost I-5 crossing connects the Samish neighborhood on the east to western destinations including Happy Valley, Fairhaven, and the Interurban Trail. This crossing is also significant due to its proximity to the heavily utilized Lake Padden Park. While bike lanes already exist on Old Fairhaven Parkway, they should be expanded from 4 to 5 feet wide. The crossing would be further improved by adding a climbing lane eastbound on Connelly Avenue, striping bike lanes through intersections, adding green bike lanes should be considered between travel lanes on the west side of the interchange to denote a vehicle-bicycle mixing zone and to enhance bicyclists' safety, and constructing a traffic signal at the currently off-set Connelly intersections for the northbound I-5 on-/off-ramps.

Project Prioritization

The BMP prioritization methodology was developed to evaluate the recommended network as a series of corridor projects to be scored on a set of criteria matching the BMP policy goals. These goals were defined through the public input process (open house, focus groups, and online survey), through existing City policy documents, and with guidance from the BMP Steering Committee. The goals were represented by four weighted variables: safety, connectivity, demand, and equity. The variable weighting and metrics that comprise each variable are summarized in Table 3.19 below.

The GIS methodology for applying these variables to each project was a two-step hybrid process involving a second run of the ViaCity model to establish new, post-construction network connectivity values; and a geo-processing technique called "heat-mapping" which summarized the safety, demand, and equity variables.

Table 3.19: Project Prioritization Methodology

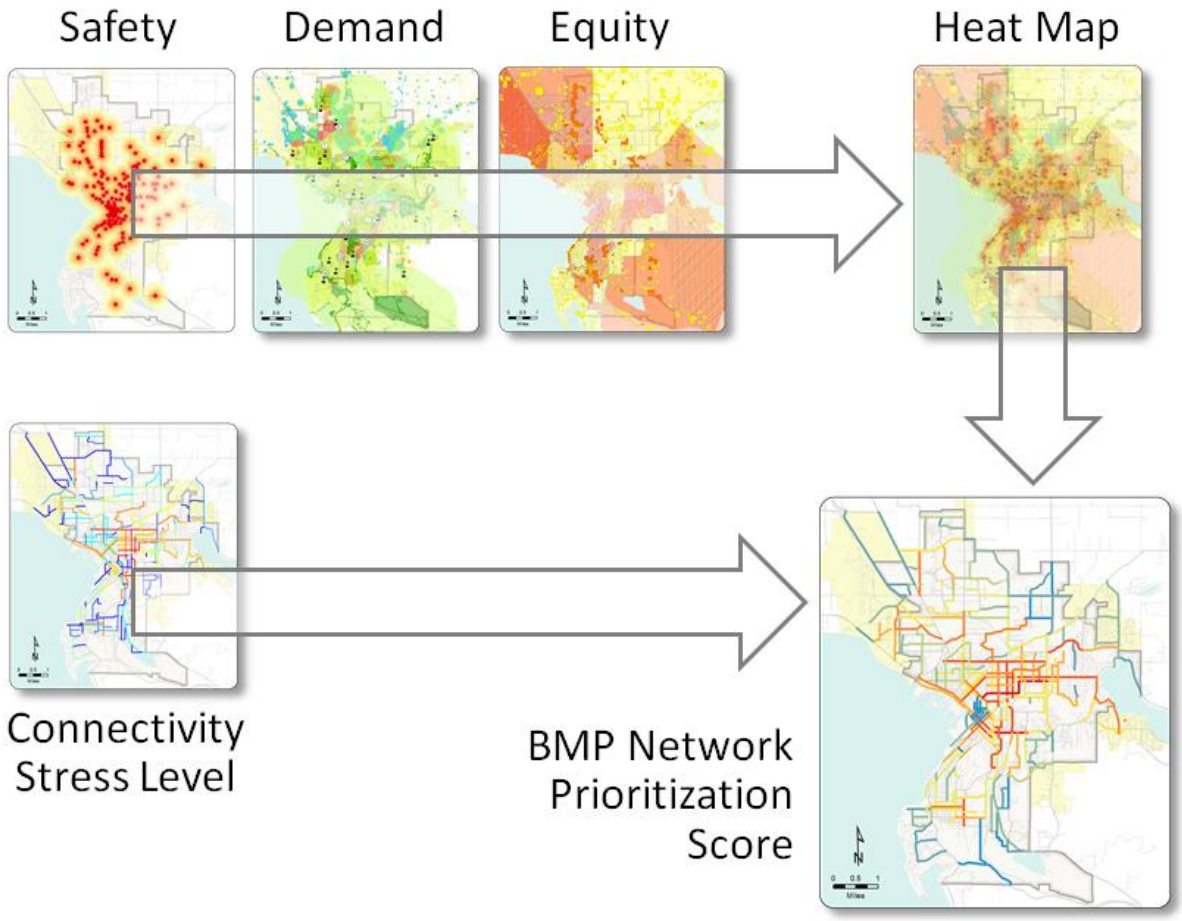
Variables	Metric
Safety - 15%	• Bike Crashes 2006-2010
Connectivity - 45%	• Route Level of Stress and Directness • I-5 Barriers
Demand - 25%	• Density of Employment • Density of Population • Locations Near Schools • Bike Count Volumes • Locations Near Trail Access Points • Locations Near Parks
Equity - 15%	• High Concentration of Population Under 18 • High Concentration of Low income Population

The second run of the ViaCity model determined the relative difference each new bicycle infrastructure project would make on connectivity across the entire network. For instance, in the initial "baseline" run of ViaCity, a street corridor with no bicycle facilities would have been identified as a bicycle network segment connecting important destinations or parts of the network. It would have received a connectivity score based on the combination of the directness of the route between those destinations, and the likelihood that cyclists would use that street segment. That likelihood would have been influenced by the vehicle presence and terrain weighting scores (the cycling "stress level"). In the second run of the ViaCity model, the weighting of that street segment would have been modified based on the type of bicycle network facility that had been recommended and how it served to provide a more comfortable and lower-stress experience for cyclists, thereby increasing the relative connectivity value to the entire network. The difference between these two model runs is the change in RDI (route

directness index) for each project. As seen in the prioritization matrix above, this value was weighted as 45% of the overall prioritization score for each project (the single largest scoring component).

The "heat-mapping" technique employed to summarize the safety, demand, and equity variables used a common GIS procedure of taking geographically co-incident layers of statistical data for different topics, converting them to raster layers showing relative density at a common resolution (i.e. 100 x 100 foot cells), standardizing the range of values for each layer (i.e. 1-10), and then adding the layers together using a map algebra expression (i.e. Layer A + Layer B + Layer C) to derive a composite value or score for each location across the landscape. For the BMP prioritization process the layers referenced in the column of metrics in Table 3.19 were converted to raster density layers, ranked on a common scale, aggregated together to represent each policy variable, and then given the relative percentage weight shown in the table. The final safety, demand, and equity layers were then added together to derive a final "heat map" score. The street segments for each project were then sampled at regular intervals along each street (i.e. every 100 ft) to translate the "heat map" score from a raster surface back to a linear street segment-based project. This safety/demand/equity score was then added together with the connectivity difference score from the two runs of the ViaCity model to determine the overall project prioritization score. Figure 3.20 below illustrates the prioritization process.

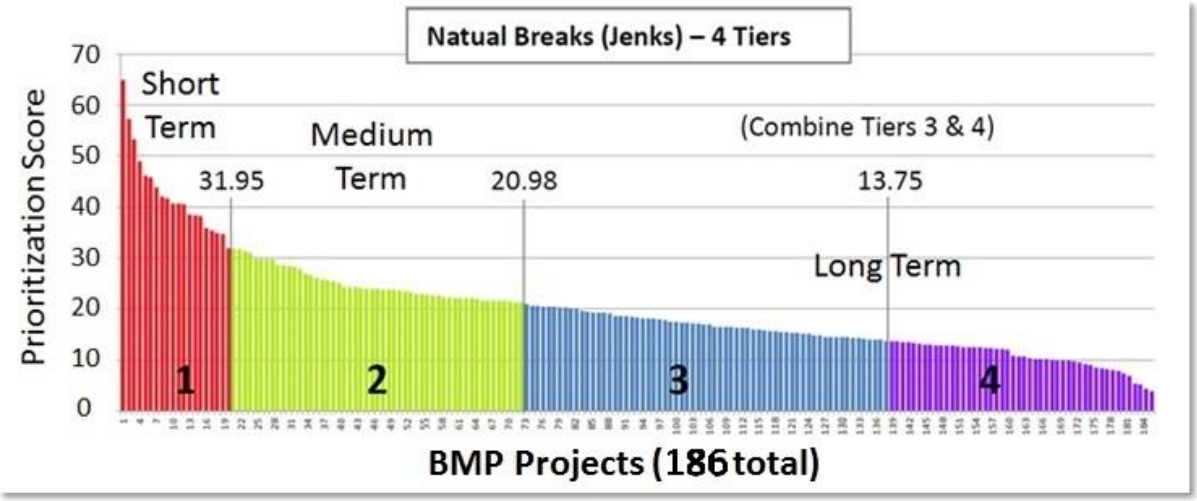
Figure 3.20: Project Prioritization Process



Following the initial scoring process, the project prioritization list went through a calibration process where City staff evaluated the priority assigned each recommended facility; confirmed the ranking criteria fit the geography of the facility corridor; and if necessary, made appropriate adjustments to baseline ranking criteria layers before re-running the prioritization model. Typical examples of adjustments made were to add weight to the equity layer where concentrations of subsidized housing have been built since Census Data was collected, or where facilities serving low-income populations are located (Food Bank, Opportunity Council, homeless shelters, etc.); and to adjust the resolution and completeness of the safety layer where bicycle-related accidents were under-represented on WA State DOT layers, by adding data from City Police Department records.

The final step for project prioritization was to sort the entire 186 project list by descending order of priority and to group projects into short, medium, and long-term classes. The class breaks were determined using a Jenks "natural breaks" classification with an initial 4-class breakout. This standard statistical method seeks to minimize each class' average deviation from the class mean, while maximizing each class' deviation from the means of the other groups (creating the most distinction between classes, and the most commonality within classes). The 1st and 2nd classes became the short and medium term lists, and the 3rd and 4th classes were aggregated to become the long term list. Figure 3.21 below illustrates the distribution of prioritization values and the resulting class structure.

Figure 3.21: Distribution of Project Prioritization Results



Prioritized Recommendations

The full prioritized list of projects can be found in Appendix B. The list should be used by the City to help determine where to target investments and should be reevaluated over time. Although this prioritization method provides a useful framework for implementation, the City should also look for opportunities to implement all the projects in the recommended network, regardless of their priority level, if they can be accomplished as part of a larger road redesign, repaving, construction or development project.

Short-Term Projects

Approximately 20 miles of short-term projects have been identified and are listed below in Table 3.22. Short-term projects are those that provide critical access to key destinations and improve the continuity of the existing network. Short-term projects are expected to provide a high return on investment in terms of ridership.

Table 3.22: Proposed Short-Term Bicycle Projects

Street	From	To	Improvement
Young/Kentucky / Nevada / Texas	Halleck	Woburn	Bicycle Boulevard
Lakeway	Queen	Ellis	Further Study Needed
Lincoln St/Meador/Grant/Ohio	Lakeway	Cornwall	Mixed*
Illinois	Woburn	Lynn	Mixed*
Holly	Ellis	Bay	Further Study Needed
Chestnut	Ellis	Bay	Mixed*
24th	Old Fairhaven Parkway	Douglas	Bicycle Boulevard
James	Illinois	Ohio	Further Study Needed
Byron/34th/Abbott/Pasco/Humboldt/ Whatcom/Grant/Potter/Humboldt	Bill McDonald	Gladstone	Bicycle Boulevard
Barkley/Chandler/Mcleod	Woburn	Magrath	Upgrade Existing Bike Lane
Lincoln	North	Iowa	Bicycle Boulevard
F	Roeder	Cornwall	Bike Lane
Mill	12th	24th	Bicycle Boulevard
Maplewood/Alderwood/Bennett	Northwest	Airport	Mixed*
Holly/Eldridge/Nequalicum	F	Nome	Mixed*
Aldrich/Northwest	Horton	Bakerview	Bike Lane
Meridian	McLeod	Telegraph	Further Study Needed
Fruitland/Orchard/Squalicum/Ellis	Fruitland/Division Trail Connection	Illinois	Mixed*
Meridian	McLeod	Squalicum	Bike Lane

*Mixed projects combine more than one facility type (e.g. bike lane, bike boulevard, shared lane marking)

Medium- and Long-Term Projects

Approximately 33 miles of medium-term projects have been identified. These projects will help link key facilities identified as short-term projects and begin to complete a comprehensive network of bicycle facilities that serve all ages and abilities. Current long-term projects envision an additional 74 miles of bicycle facilities being constructed. Long-term projects will fill remaining gaps and expand Bellingham's bicycle network into new developments within the City (particularly to the north and east of I-5). A full list of medium- and long-term projects can be found in Appendix B.

Updates to Project Lists

It is expected that as the bicycle network is implemented and as new development occurs in the City, additional bicycle projects will be identified and project prioritization will need to be reevaluated. It is recommended that this list be reassessed and updated as part of the Comprehensive Plan update cycle (every ten years), using similar criteria and revising the results based on current conditions.