



Sonoma County Transportation Authority

MODE SHIFT PLAN Bike Share Feasibility

November 2016



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BIKE SHARE FEASIBILITY STUDY

GOALS

The Mode Shift Plan has eight established objectives. **Figure 1** describes how bike share could further Sonoma County’s progress toward these objectives.

Figure 1 Bike Share Contribution to Mode Shift Goals

Mode Shift Action Plan Goals	Potential to impact short urban trips, such as between errand destinations or from SMART to and from workplaces
Reduce single occupancy vehicles (SOVs) mode share	Bike share could provide an alternative to short car trips.
Increase average vehicle occupancy	Not directly applicable, although bike share may decrease short SOV trips where available.
Increase transit mode share	As a form of public transit, bike share has potential to support fixed-route transit use, particularly through first/last-mile connections, especially around the most urban SMART stations.
Increase walk and bike commute mode share	For commute trips, bike share may improve first/last-mile connections between SMART stations and employment destinations that are located a bit too far for substantial pedestrian connections.
Increase overall walk and bike mode share	For overall walk and bike trips (non-commute trips), bike share may appeal to users for short errands and recreational trips, providing connections to non-work destinations. It could also be available to tourists and visitors to support park-once trips with multiple destinations scattered through the bike share service area.
Increase share of children walking and biking to school	Bike share systems typically limit membership to individuals age 16 or older, and the service area may not include neighborhood schools in Sonoma County.
Reduce transportation costs by improving access to alternative modes	With an annual membership, bike share can be an extremely affordable transportation option in the most urban areas of the county. There may be limitations for individuals who do not have credit cards.
Incentivize job growth and economic vitality in priority development areas (PDAs) through mobility options	Bike share makes short trips easier, particularly in downtown business districts where parking is challenging. In this way, it supports a vibrant business district.

EVALUATION OF POTENTIAL OPERATING MODELS

Bike share systems provide access to bicycles for short trips at a low cost and eliminate the barriers to owning and maintaining or traveling with a personal bike. These systems have existed in some countries for decades. Over the years, the industry has evolved a variety of operational models and new technologies. This section describes several options for non-motorized bike share systems being implemented today. While this study focuses on human-powered bicycles, a brief overview of electric assist bicycle “pedelec” share systems is provided in **Appendix C**.

Equipment Vendor Types

Since bike share’s emergence in North America in the last decade, most formal bike share systems have been dock-based, where fixed docks are distributed throughout the service zone and all trips must start and end at a dock. This model requires that a kiosk be placed at each dock station and that payment, locking, and GPS technologies are built into the dock station to track usage and facilitate payment.

Recent advances in technology have expanded options for equipment tracking, locking, customer access, and payment facilitation. Flexible hub “smart-bike” systems offer a new bike share equipment model that allows more flexibility by removing the need for a docking station. In this case, all the technology is built into the bikes themselves, and the provided smart locks allow bikes to be locked to any publicly available bike parking space at the end of a trip. This enables trips to start and end at any location. Because the bicycles have GPS units attached, a smartphone app and website can display the exact location of available bikes, no matter where they are parked. Some technologies allow providers to integrate a reservation tool on the bike itself to allow passers-by convenient access to bike share bikes. Pricing structure can be designed to incentivize short trips within core zones. **Figure 2** illustrates these two models.

Figure 2 Bike Share Equipment by Operational Model



Capital Bikeshare (Washington, DC) Source: NelsonNygaard

Scenario 1: Fixed dock system with technology built into the docking station



Social Bicycles (Source: NelsonNygaard)

Scenario 2: An emerging flexible hub system with technology built into the bicycles themselves

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Dock-based bike share systems—the dominant form of bike share in most U.S. cities—provide customers a network of stations with payment kiosks and map panels attached to a series of docks. The rental exchange occurs at the docking point as station-based technology allows users to access a bicycle with an access code following the purchase of a pass at the bike share kiosk (memberships can also be purchased online and members are issued a card or key fob that allows them to bypass the kiosk and go right to a dock with an available bike). Bicycles are then returned to another docking point across a network of stations. Each dock is wired to the payment kiosk along the station’s base plate, and is enabled with wireless communications to transmit the usage and payment data back to a central hub. **Figure 3** summarizes the key advantages and challenges associated with this service model, including specific strengths and weaknesses for Sonoma County.

Figure 3 Advantages and Challenges of the Dock-Based Systems

Advantages	Challenges/Issues
<ul style="list-style-type: none"> ▪ Proven technology backed by over seven years of performance data ▪ Operations is well understood by bike share operators ▪ High visibility advertising space (the kiosk) ▪ Docks are clearly identifiable for wayfinding and access/use ▪ Iconic, predictable, and reliable station locations ▪ Familiar to tourists from other cities 	<ul style="list-style-type: none"> ▪ Higher capital cost ▪ Less flexibility in where users can dock bicycles (relies on dense network of stations) ▪ Can require substantial rebalancing effort with high commuter use during peak periods ▪ Potential for proprietary issues with docks, bicycles, and technology equipment (e.g. kiosks, mobile apps, etc.) ▪ Wireless internet connectivity outages and solar power disruptions can interrupt an entire station ▪ May be less suitable for a lower-density setting with fewer prominent trip generators ▪ GPS technology can be added on bikes for an additional cost

Originally introduced in Europe, smart-bike systems utilize GPS tracking and an integrated fare payment and locking mechanism built into the bicycles’ frame. The lock is compatible with public bike racks (e.g., U-Racks) that can be shared with private bicycles. Bike corrals can be installed to create designated hubs for bike share bicycle parking only at higher demand locations where clusters of bike share bikes are desired; depending on the flexible system employed, at the end of their trip, users can either return bicycles to any available bicycle parking location within a designated zone (e.g. Social Bicycles) or must return to designated hubs (e.g. Zagster).

Networking occurs on the bicycle rather than at a docking station, providing an opportunity for users to park bikes at publicly accessible bike racks within the service area during use. Allowing bicycles to be returned to any bike rack within a zone, like in the Social Bicycles model, could make bicycle rebalancing more of a challenge, and bicycle access may be less predictable. Many localities overcome the rebalancing challenge by customizing pricing schemes to incentivize returns to a designated area while still allowing for flexibility. These flexible systems specify designated hubs, similar to bike share docking stations, which allow for variation in amenities at different pickup and return locations. Hubs can be outfitted with bicycle rack plates and map panels, mirroring the look and feel of a dock-based system. Payment kiosks can also be added to provide an option for non-member payment, and local merchants can serve as sign-up locations.

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If parking is permitted at both designated hubs and publicly available bike racks, the payment model can be designed to incentivize members to return bikes to hub locations by charging an additional fee to park a bike outside of a designated hub and provide a discount for picking up a bike parked outside of a hub and returning it to a bike share hub.

Flexible bike share systems are a relatively new concept in the U.S. and domestic systems are still being tested. That said, these operational models have become increasingly popular in smaller cities including Cleveland, Ohio; Carmel, Indiana; Santa Monica, California; Orlando, Florida; and Boise, Idaho, as well as at universities, large residential or mixed-use properties, and lower-density locations.

Figure 4 Advantages and Challenges of the Smart-Bike Systems

Advantages	Challenges/Issues
<ul style="list-style-type: none"> ▪ Flexible fleet management for operators ▪ Flexible, modular hub design can include kiosks, map/advertising panels, or just the rack itself ▪ Lower capital costs (between 25-50% cost savings) ▪ Lower cost to implement and maintain by removing the need for docking stations and reducing the amount of kiosks in a system ▪ Allows for easy expansion of the system as demand increases ▪ Opportunity to trip chain with lower costs (i.e., park a bike outside of a hub location to make quick stops) ▪ Eliminates the risk of docking stations being at capacity and not having space for riders to park (dock-blocking) by allowing users to park at any public bike rack ▪ GPS data gathering allows the system operator to use data for system planning, assess infrastructure needs, and locate missing equipment 	<ul style="list-style-type: none"> ▪ Costly wireless connectivity fees as the number of internet connections scales directly with the fleet size (direct impact on operating cost) ▪ Limited experience in the U.S. and almost no data available ▪ Rebalancing could be complicated and unpredictable if out-of-hub parking is allowed ▪ 3G wireless internet connectivity outages can disrupt an entire fleet rather than one hub location (could be a concern in parts of Sonoma County) ▪ Out-of-hub parking may limit reliable access to the system and complicate rebalancing, more so than with station-based systems ▪ Less tested technology for U.S. cities ▪ Lack of existing bicycle rack facilities (only a challenge if docking is permitted outside of hubs)

Infrastructure Requirements

Walkability and bicycle safety and infrastructure are essential components to a successful bike share system. Distances between bike share pick-up and drop-off locations and members' origin and destination locations should be easy and convenient. It is recommended that bikes be available every 1,000 feet (approximately two blocks), which is the distance that people are willing to walk to find a bike, and provide even coverage around an area.¹ Establishing a safe and convenient bicycle network will support decisions to rely on bicycles for short trips, contributing to mode shift in the county.

Dock-based systems require bike docking stations either on sidewalks or in streets. The size and configuration of these docking stations can vary greatly.

¹ NACTO, Walkable Station Spacing is Key to Successful, Equitable Bike Share, accessed March 2016, <http://nacto.org/2015/04/28/walkable-station-spacing-is-key-to-successful-equitable-bike-share/>.

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Figure 5 Small Docking Station Dimensions – 10 to 20 bicycles

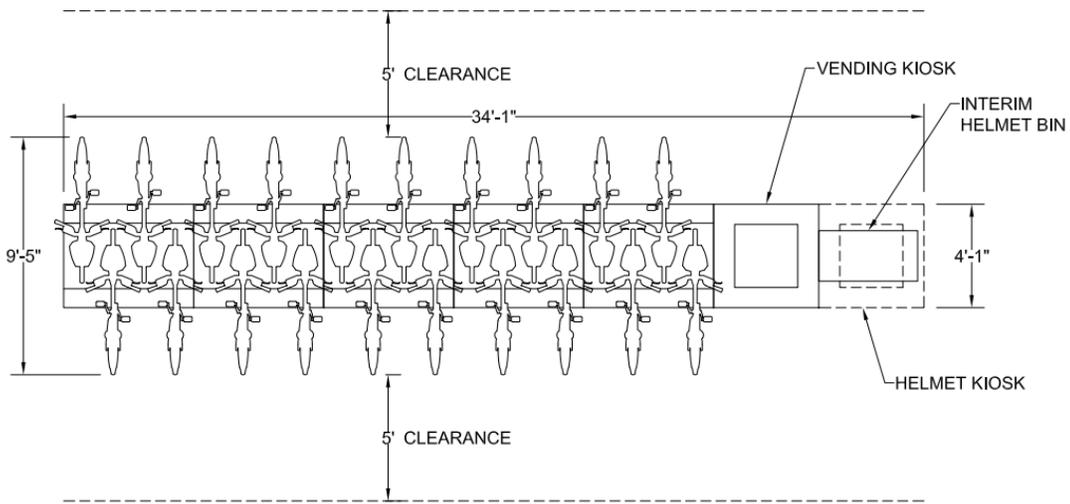
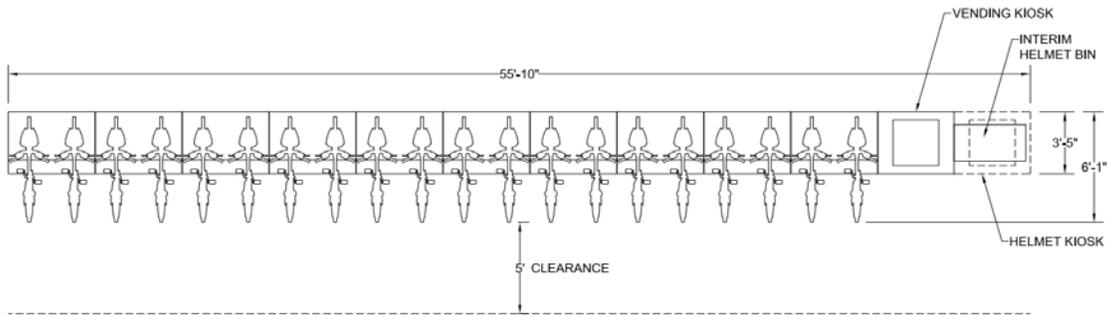


Figure 6 Large Docking Station Dimensions – 20 bicycles

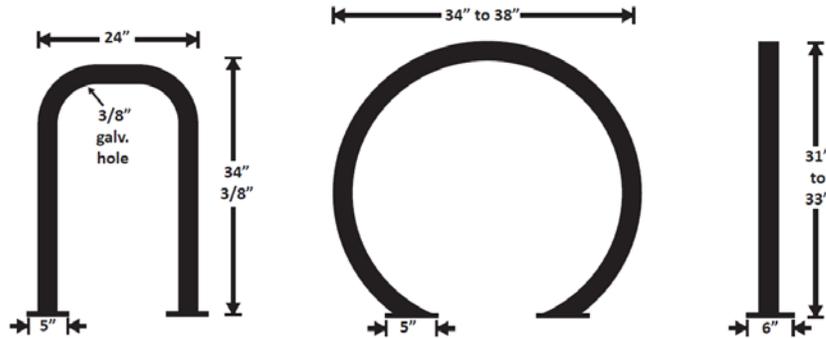


Flexible bike share systems can use standard bike parking racks placed on sidewalks or in a bike corral to establish designated bike share hubs. Inverted-U or circular racks are the best option for bike racks as they provide the greatest combination of security, utility, ease-of-use and aesthetics. Circular racks hold two bikes apiece, offering two separate points of support for each bike leaned parallel to the rack. The bike's frame and one wheel can be easily secured with a single U-lock.²

² San Francisco Municipal Transportation Agency, Bike Parking: Standards, Guidelines, and Recommendations, 2015.

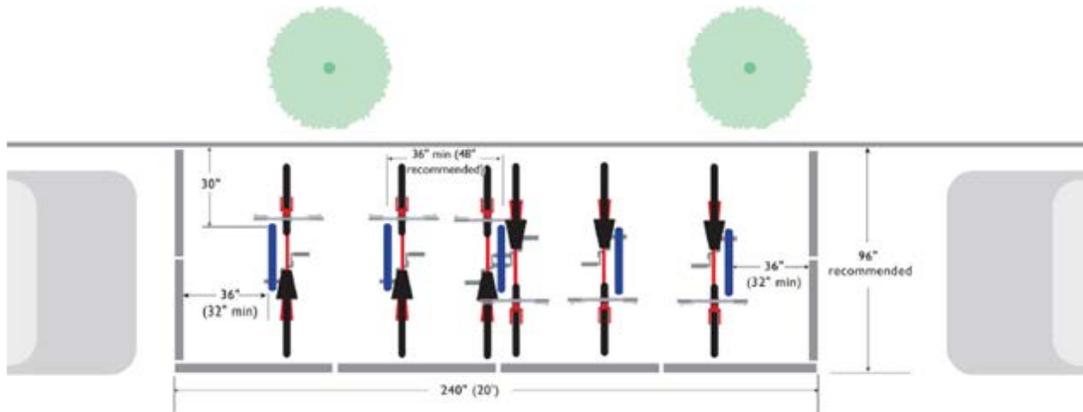
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Figure 7 Inverted-U Rack (Left) and Circular Rack (Right) Design and Dimensions



If designated bike share hubs are not established, bike corrals can be implemented to provide bike parking that does not impede the pedestrian traffic flow on sidewalk space. Bike corrals are placed on street and require the conversion of vehicle parking spaces. **Figure 8** shows standard dimensions for a bike corral that is one vehicle parking space long, and provides space for 10 bicycles.³ To create a longer corral space, multiple, neighboring vehicle parking spaces can be converted. To maintain safety for users, bike corral areas should be highly visible at all times of the day and should include added features to protect bicyclists from vehicle traffic.

Figure 8 Bike Corral Dimensions and Spacing



Organizational and Associated Funding Models

Figure 9 summarizes several organizational models for bike share and their applicability to Sonoma County. Organizational models differ in the entities that administer, operate, and own the system. Depending on the model, the financial risk of bike share can be borne by a public, private, or non-profit entity. A detailed description of responsibilities for each model is provided in **Appendix A - Organizational Models Explained**. In the case of Sonoma County, bike share could be implemented by SCTA, one of the county's municipalities, and/or any one of its major employers, universities, or mixed-use developments.

³ Association of Pedestrian and Bicycle Professionals, Bike Parking Guidelines: 2nd Edition, 2010.

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Figure 9 Organizational and Associated Funding Models for Bike Share

Organizational Structure	Financial Risk/Liability	Funding Sources	Operating Responsibility	Capital Ownership	Level of Public Staff Involvement	Peer Example(s)	Applicability to and Consideration for Sonoma County*
Publicly owned, privately operated	Financial risk assumed by public entity; turnkey operator takes on liability risk/coverage	Public grants, county sales tax revenue, membership revenue, sponsorship, advertising revenue depending on the jurisdiction	Private turnkey operator	Public entity owns equipment	Medium	Washington D.C. (Capital Bikeshare) San Francisco, CA (Bay Area Bike Share)	Public entities that could serve in this role: <ul style="list-style-type: none"> ▪ Sonoma County Transportation Authority ▪ Local municipality ▪ Santa Rosa Junior College ▪ Sonoma State University
Non-profit owned and operated	Financial risk assumed by the non-profit entity	Fundraising opportunities, public grants, membership revenue, advertising revenue depending on the jurisdiction	Non-profit	Non-profit	Low	Minneapolis, MN (Nice Ride Minnesota)	Potential role for Sonoma County Bicycle Coalition (SCBC); bike share ownership/operations would be beyond the scope and capacity of SCBC's existing operational strategies
Administrative non-profit	Financial risk assumed by non-profit	Fundraising opportunities, public grants, membership revenue, possible advertising revenue depending on the jurisdiction	Private turnkey operator	Non-profit	Low	Denver, CO (Denver B-Cycle)	Potential role for Sonoma County Bicycle Coalition; administration beyond the scope of existing Operational Strategies
Privately owned and operated	Financial risk assumed by private company	Fundraising opportunities, sponsorships, membership revenue, possible advertising revenue depending on the jurisdiction	Private turnkey operator	Private turnkey operator	Low	Miami Beach, FL (DecoBike) Albuquerque, NM (BICI) <i>Developer led bike share fleet</i>	Would need to identify a large private entity interested in sponsoring such a system; private developers of large residential projects and/or hotels may be interested in financing semi-public bike share systems Note that this model limits the public sector's ability to determine equitable station distribution and system growth
Publicly-owned and operated	Financial risk assumed by the public entity	Public grants, county sales tax revenue, membership revenue, possible advertising revenue depending on the jurisdiction	Public entity	Public entity	High	Various European/Asian systems	Public entities that could serve in this role: <ul style="list-style-type: none"> ▪ Sonoma County Transportation Authority ▪ Local municipality ▪ Santa Rosa Junior College
Transit agency owned, privately operated	Financial risk assumed by transit agency	Public grants, county sales tax revenue, membership revenue, advertising revenue depending on the jurisdiction	Private turnkey operator	Transit agency owns equipment	Medium	Systems in Germany (Call a Bike) and the Netherlands (OV-fiets)	Relevant transit agencies include: Santa Rosa CityBus, the Sonoma-Marin Area Rail Transit District, Sonoma County Transit, Petaluma Transit

*No agencies or outside organizations have been polled on their interest in or willingness to partner with local agencies on the implementation, administration, operation, or ownership of a potential future bike share system.

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MARKET ANALYSIS INDICATORS

Bike share is a low-cost, flexible public transportation service that provides on-demand access to a network of publicly-rentable bicycles. Depending on the operational model employed, bicycles are either distributed across a defined service area at fixed smart docking station locations; in flexible hub locations; or at individual public bike racks. Due to the speed and distance limitations presented by bicycle travel, this form of public transportation usually replaces short auto and transit trips. In established systems, trip lengths typically average between one and three miles, or 15 to 30 minutes.

This market analysis combines quantitative and qualitative factors to identify potential bike share trip types, user groups, and areas with highest potential to support bike share trips. Qualitative factors include lessons from peer systems, stakeholder feedback, and station siting considerations.

Potential User Markets

Sonoma County is marked by its rural and agricultural character, with most of its residential and employment population located in its cities along the U.S. 101 corridor. Other notable characteristics of the county are its wineries and coastal boundary, which generate significant tourism, but tend to be located in less dense areas and away from enhanced bicycle networks.

By its nature, bike share is suited to markets where short trips are feasible and bicycle infrastructure provides for safe, comfortable riding. Given the character of the county, user markets with the highest potential for bike share use likely include employment centers with residential density and locations immediately surrounding high-volume transit stops such as:

- The Santa Rosa Transit Mall
- SMART Stations, such as in Santa Rosa and Airport Boulevard
- Petaluma River Walk
- Santa Rosa Junior College and Sonoma State University

Other strategies—such as daily or long-term bicycle rental and increased off-street bicycle facilities—may encourage bicycle use among tourists, however these strategies are not the focus of this study.

Peer Systems

To inform the market analysis and put into context what a system in Sonoma County might achieve, this section provides a brief overview of several peer systems and the types of trips made using these systems. Many of these peers use a flexible bike share model, which is an operational structure that allows the system to function without relying entirely on specific bike share docking stations and instead allows flexibility for trip origins and destinations. This model can be appropriate in locations with less density of demand because it provides flexibility for the user, requires lower start-up costs, and is easy to expand as demand increases. These benefits will likely be important considerations for many of Sonoma County's smaller municipalities.

The peer systems were chosen primarily to illustrate characteristics of smaller systems with operational models appropriate for lower-density markets. Notable features of these systems particularly applicable to Sonoma County include:

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- Trip time limits range from 30 minutes to four hours depending on market characteristics
- Relatively smaller systems, with one system as small as 10 bicycles
- Hub-based smart-bike systems provide more flexibility in usage rules
- Specific trip types, located within a primary service area zone or returning to designated hubs, can be encouraged using price incentives

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Figure 10 Peer Systems Review

Peer	Stations	Bicycles	Usage Statistics	Membership Pricing and Rental Fees	Trip Time Limits	Markets Served	Funding	Ownership Model	Operating Model
Carmel, IN (Carmel Bike Share) ⁴	8	65	<ul style="list-style-type: none"> 860 trips first 3 months 500 trips July 2015 	<ul style="list-style-type: none"> \$3/hr pay-as-you-go \$15 monthly membership \$75 annual membership 	<ul style="list-style-type: none"> <1-hour trips free for members 	<ul style="list-style-type: none"> Employment and mixed-use districts Seniors or those with minor mobility impairments (tricycles available) 	<ul style="list-style-type: none"> User fees—City pays Zagster a fixed amount per year per bike, which is partially funded by farebox revenue 	Managed by City of Carmel; operated by Zagster; other organizations can contract directly with Zagster for expansion sites	Flexible smart-bike
Hastings, MN (Zagster) ⁵	1	10	None known (launch fall 2015)	<ul style="list-style-type: none"> \$3/hr after 4 hours 	<ul style="list-style-type: none"> <4-hour trips free for all 	<ul style="list-style-type: none"> Residents and visitors; long/multiple-destination trips 	<ul style="list-style-type: none"> City of Hastings, United Way, and AHHA partnership (1-yr pilot funding) 	Managed by City of Hastings; operated by Zagster	Flexible smart-bike
Boise, ID (GreenBike) ⁶	15	114	<ul style="list-style-type: none"> 10,000 trips summer 2015 32 min weekday avg trip length 56 min weekend avg trip length 0.18 trips/bike/day winter 2015 	<ul style="list-style-type: none"> \$4/hr pay-as-you-go \$15 monthly membership \$70 annual membership (\$46 for students) Additional \$2 fee for ending trip out-of-dock; \$1 credit for picking up an out-of-dock bike 	<ul style="list-style-type: none"> <1-hour trips free for members 	<ul style="list-style-type: none"> Downtown Boise Boise State University Short trips 	<ul style="list-style-type: none"> Federal (capital) User fees, sponsorships, advertising (operating) 	Managed by Valley Regional Transit; operated by Social Bicycles	Flexible smart-bike
Buffalo, NY (Buffalo Bike Share) ⁷	6 (Downtown) 14 (University)	40 (Downtown) 40 (University)	<ul style="list-style-type: none"> University system: <ul style="list-style-type: none"> 1,741 trips/yr 2,215 miles/yr 7.73 trips/day 1.27 miles/trip 21.7 min/trip 	<ul style="list-style-type: none"> \$0.05/min plus \$10 annual fee (Roller Plan) \$65 unlimited trips for 90 days (Unlimited Plan) \$15/yr for University students, faculty, staff; up to 1 hour free/day \$5 fee for ending trip out-of-hub and \$100 fee for ending trip out-of-system boundaries 	<ul style="list-style-type: none"> 1-hr limit for student, faculty, staff plan 	<ul style="list-style-type: none"> Downtown Buffalo University of Buffalo-Main Campus University of Buffalo-Medical Campus Buffalo Niagara Medical Campus 	<ul style="list-style-type: none"> Start-up funding from NY State Energy Research and Development Agency, NY State DOT, Seneca Nation Buffalo Creek Development Fund 	Managed by non-profit Shared Mobility Inc; operated by Social Bicycles	Flexible smart-bike
Aspen, CO (WE-Cycle) ⁸	16	100	<ul style="list-style-type: none"> 17,791 rides 2014 season 103 trips/day 12 min/trip 	<ul style="list-style-type: none"> \$9 – 24-hr pass \$22—3-day pass \$40—30-day pass \$50—season pass 	<ul style="list-style-type: none"> 30-minute trip limit, then overtime fees apply <ul style="list-style-type: none"> \$4 - 31 min-1 hr \$12 – 1 hr – 1.5 hr \$20 – 1.5 hr – 2 hr \$8 - each additional 30 min over 2 hr \$124 – 8+ hours 	<ul style="list-style-type: none"> Downtown Aspen Tourists (mountain resorts) Short trips 	<ul style="list-style-type: none"> Start-up funding through public and private partnerships Operations funded through user fees and sponsorships 	Owned and operated by WE-cycle, a non-profit	Station-to-station

⁴ Carmel: <http://zagster.com/carmel/>; <http://www.indystar.com/story/news/local/hamilton-county/2015/08/08/carmel-expands-zagster-bikes/31342759/>; <http://wishtv.com/2015/10/01/carmel-expands-bikeshare-to-clay-terrace/>; <http://www.carmel.in.gov/index.aspx?recordid=1111&page=25>

⁵ Hastings: <http://zagster.com/hastings/>; http://www.twincities.com/localnews/ci_28398348/year-later-bike-share-program-rolled-out-downtown

⁶ Boise: <http://boise.greenbike.com/>; <http://boisestatepublicradio.org/post/boise-greenbike-faces-fewer-riders-during-winter>; <http://www.ktvb.com/story/news/local/2015/05/29/boise-greenbike/28178097/>

⁷ Buffalo: <https://buffalo.socialbicycles.com/>; <http://artvoice.com/issues/v14n22/cycling>; https://www.buffalo.edu/content/shared/university/news/ub-reporter-articles/stories/2015/06/bike_share/_jcr_content/par/image_0.img.original.png/1435168854906.png

⁸ Aspen: <https://www.we-cycle.org/>; <https://www.we-cycle.org/images/docs/2014ReportCard.pdf>

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Implementing a flexible bike share system allows the fleet to be expanded more easily, as demand increases. This will reduce the likelihood of over supplying bikes and allow for customized distribution so all bicycles are used on a regular basis. Flexible systems can also be easily adjusted or expanded as necessary to respond to changing demands after the first few months as the bike share system matures and is used more consistently.

Potential Geographic Service Areas

The goal of this section is to move from the county level to the specific cities and neighborhoods where bike share may be most feasible. A series of three maps highlight the opportunities:

- A map illustrating local trip making patterns highlights areas of the county where shorter trips—appropriate for biking distances—are more common.
- A composite analysis of several factors suggests potential for bike share demand across the county and in specific neighborhoods.
- A “communities of concern” map shows areas of the county where bike share could help the county make progress on its goals related to equity and economic opportunity.

The methodologies for these analyses are described below.

Local Trip Patterns

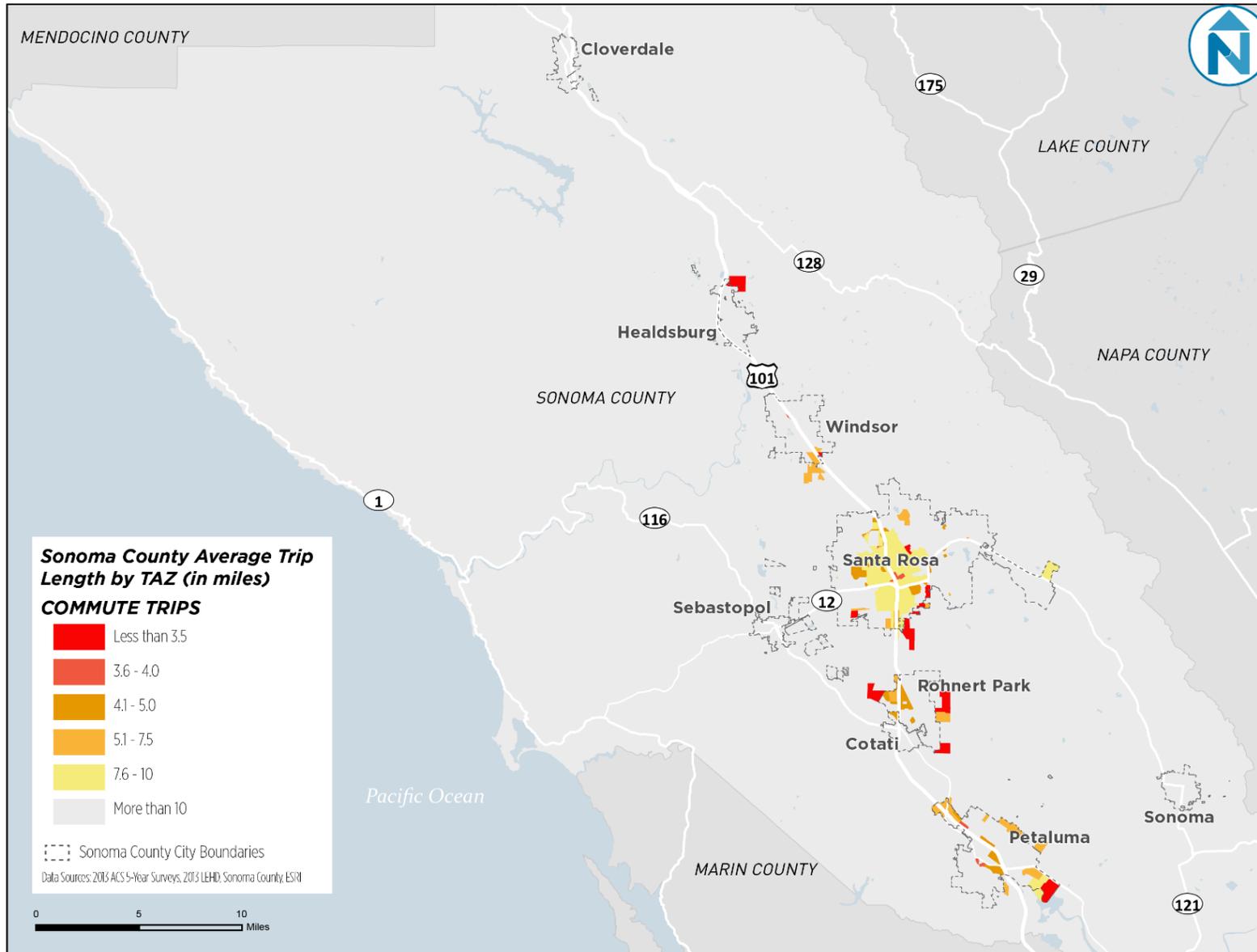
Sonoma County Transportation Authority (SCTA) collects data on regional trip making between traffic analysis zones (TAZs)—geographic areas with roughly similar populations. TAZs with lower average trip distances represent locations *to or from* which people tend to travel from a short distance (e.g. less than 3.5 miles). TAZs with longer average trip distances represent locations *to or from* which people tend to travel from a farther distance. As a rural county, it is unsurprising the most TAZs exhibit longer average trip distances than typical biking distances (for both commute trips and all trips).

Figure 11 shows commute trip lengths and **Figure 12** shows the length of all trips within the Santa Rosa TAZ. Commute trip patterns in Santa Rosa appear longer than the patterns for all trips within the area. As Santa Rosa is a significant job center for the region, it is likely that it draws a significant number of commuters from around the county and region. Therefore, the longer commute trip patterns reflect commute distances from all commuters that travel to Santa Rosa, not just those who commute within Santa Rosa. This is supported by the shorter trip lengths for all trips within the Santa Rosa TAZ. These trips tend to take place within the city limits, and near Santa Rosa Junior College and Downtown Santa Rosa in particular. These off-peak or other non-work trips connecting the college with downtown businesses and amenities or future rail trip patterns, along with the commute trips that stay within Santa Rosa, highlight a potential market for bike share.

Other areas in the county with short average trip lengths for both trip categories are near Sonoma State University in Rohnert Park, where the significant student population is located within or very close to campus, and in central Petaluma. These are also areas with high concentrations of potential bike share users and compatible trip types.

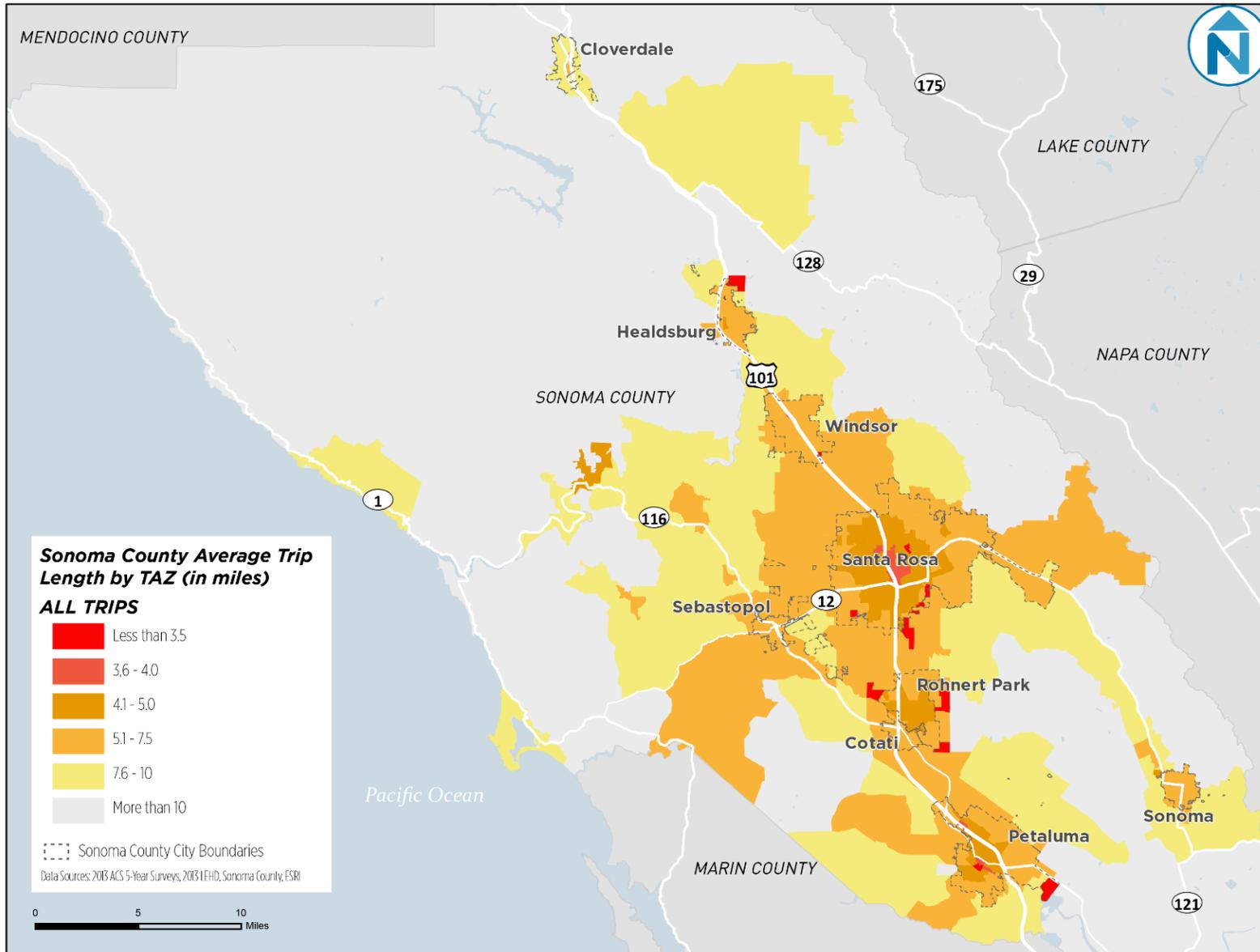
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Figure 11 Average Trip Length throughout Sonoma County (Commute Trips Only)



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Figure 12 Average Trip Length throughout Sonoma County (All Trips)



Communities of Concern

As part of its Mode Shift goals, SCTA is interested in equitable access to transportation options. National travel data illustrate that members of low-income households are more likely to use a bicycle for commutes than higher income individuals.⁹ Communities of concern—defined separately by SCTA and the San Francisco Bay Area’s Metropolitan Transportation Commission (MTC)—are geographically spread throughout Sonoma County. MTC’s communities of concern are based on eight different factors—including income—and tend to be located in more urban areas of Sonoma County. MTC is in the process of updating its Equity Framework for Plan Bay Area 2040, which may result in changes to its communities of concern. To understand the County’s vulnerable rural residents, SCTA identified its own communities of concern measures. For the purposes of bike share, which is most feasible in more dense, urban settings, this study focuses on MTC’s measures (**Figure 13**).

The geographic overlap between communities of concern and trip distance patterns reveals two particular areas as potential opportunities where bike share could both be well used and meet its economic opportunity goals:

- In Santa Rosa along U.S. 101 to the north and south of Highway 12
- Downtown Petaluma, with connections to the residential district east of U.S. 101

This overlap of short trip lengths and concentration of communities of concern is highlighted in the following analysis, which uses an independent set of factors to identify locations with high potential for bicycling demand.

Priority Development Areas

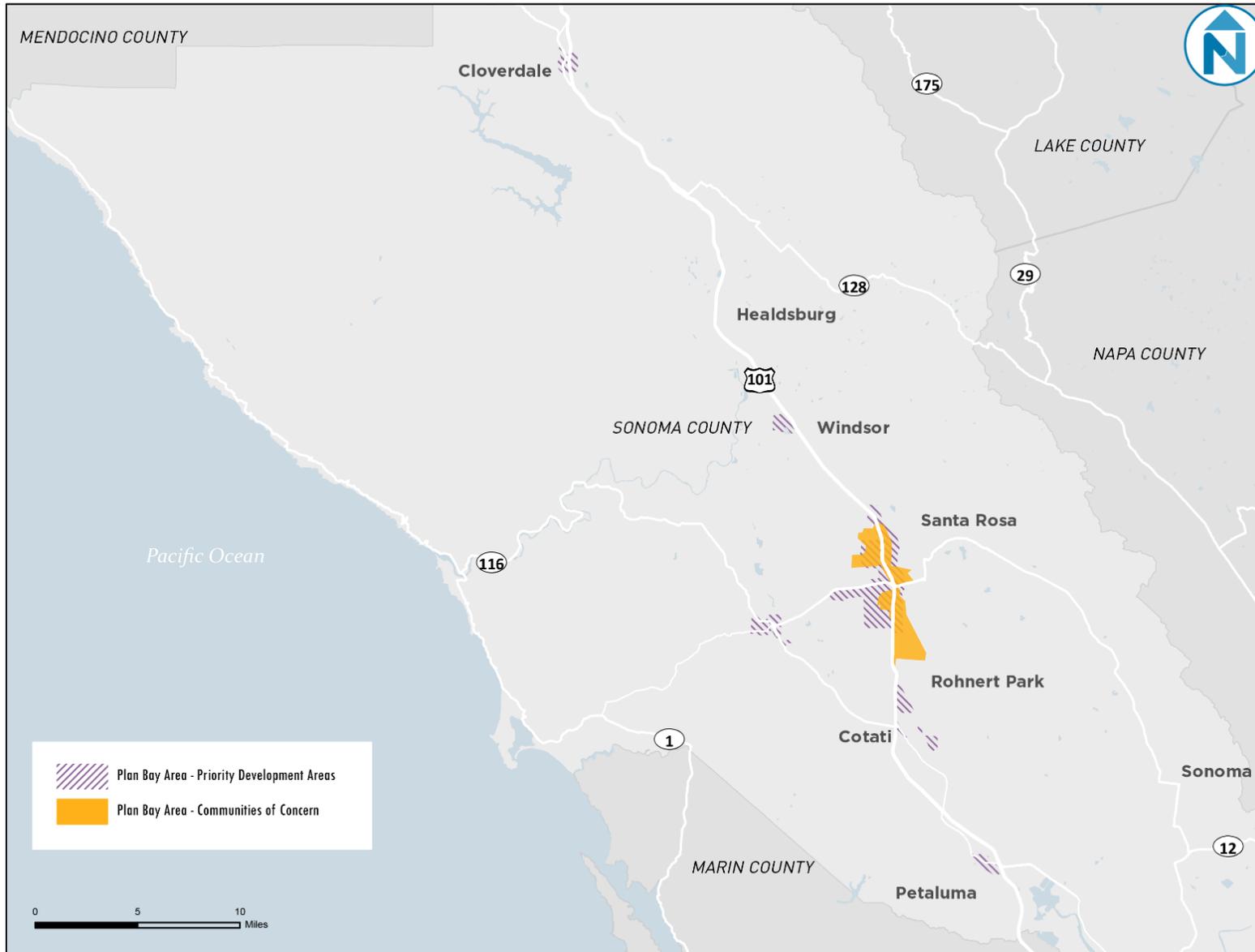
Plan Bay Area was approved by the Association of Bay Area Governments and the Metropolitan Transportation Commission (MTC) in 2013 and serves as a regional plan for sustainable communities. Essential to this plan are priority development areas (PDAs), where new development will support transit-oriented development and the day-to-day needs of residents and workers.¹⁰ Concentrated job and housing growth in PDAs would support future demand for bike share systems.

⁹ <http://www.citylab.com/commute/2015/10/the-poor-bike-the-rich-bike-share/413119/>

¹⁰ Plan Bay Area

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Figure 13 Communities of Concern and Priority Development Areas



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Bike Share Demand Analysis Methodology

Figure 14 presents the demand analysis inputs for bike share feasibility. These inputs were chosen based on known factors that impact bike share ridership within the constraints of available data. Relative weighting was developed based on local market conditions and ridership trends in existing systems.

Figure 14 Bike Share Feasibility Factors and Weights

Factor	Weight	Description	Source
Population Density	High (3 points)	Higher population densities support bike share through two effects: by generating a larger pool of bike share riders per station area and by being associated with areas of lower vehicle ownership	<ul style="list-style-type: none"> • 2013 ACS 5 Year Surveys • Census Block Groups
Employment Density	High (3 points)	Higher employment densities support bike share by generating trip destinations and balancing demand with residential areas	<ul style="list-style-type: none"> • 2013 LEHD • Census Blocks
Hotel	High (3 points)	Tourists are a potential bike share market (note, this factor will not register where no hotels are not present)	<ul style="list-style-type: none"> • ½-mile distance from hotel designated land uses • Land Use code = 'HOT'
Parks (Common, open, and recreational spaces)	Low (1 point)	As neighborhood and regional destinations for active individuals, parks generate some bike share demand	<ul style="list-style-type: none"> • ½-mile distance • Land Use Codes = 'COMMON', "OPN", "PROT_OPN", "REC"
Retail/Commercial	High (3 points)	Commercial areas generate frequent, often local, trips—an ideal market for bike share	<ul style="list-style-type: none"> • ½-mile distance • Land Use Codes = 'STC", "SC"
Bike Network	Low (1 point)	Proximity to the bike network facilitates safe and comfortable use of bike share and indicates locations where people commonly ride a bike; the bike network does not generate demand so much as indicate a likelihood of demand	<ul style="list-style-type: none"> • Proposed 2014 Sonoma County Bike Network
Slopes	Low (1 point)	Steep slopes inhibit bicycle trips; flat topography encourages bicycle trips	<ul style="list-style-type: none"> • National Elevation Dataset
Proximity to Bus Stop	Low (1 point)	Bike share serves as a first/last-mile connection to transit; bus transit generates lower demand than rail transit	<ul style="list-style-type: none"> • ½-mile distance • Golden Gate Transit, Santa Rosa CityBus, and Sonoma County Transit Bus Stops
Proximity to Rail Stop	High (3 points)	Bike share serves as a first/last-mile connection to transit; rail transit generates higher demand than bus transit	<ul style="list-style-type: none"> • ½-mile distance • SMART Rail Stations

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Factor	Weight	Description	Source
Universities	Low (1 point)	Universities generate a high number of trips from nearby neighborhoods that contain student housing and to supporting commercial areas.	<ul style="list-style-type: none"> Schools from Sonoma County GIS

Bike Share Demand Analysis Results

As illustrated in **Figures 15** through **18**, four key areas of Sonoma County stand out as higher potential for generating bicycle trips:

- Santa Rosa
- Airport Boulevard / SMART Station Area Development
- Petaluma
- Rohnert Park/Cotati

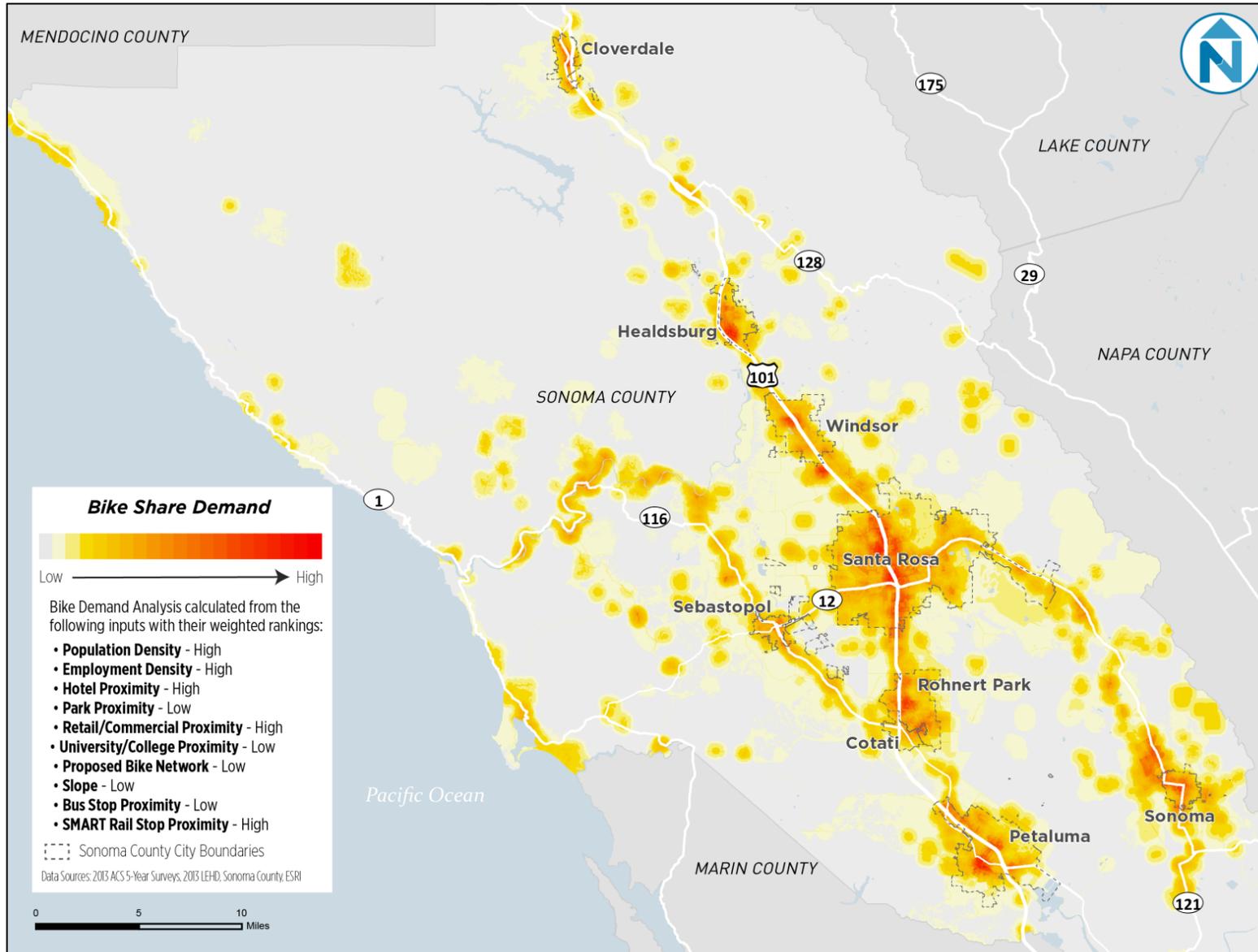
Santa Rosa—particularly the zone surrounding downtown and Santa Rosa Junior College with connections to both SMART rail stations—demonstrates the highest potential bike share demand of the four locations identified above. The geographic zone where bike share demand is likely to be high in Santa Rosa is relatively larger than in the other cities and has a greater diversity of land uses.¹¹

Other areas of the county that demonstrate higher levels of demand (indicated with darker colors on the map, such as the cities of Sonoma, Cloverdale, Healdsburg, Windsor and Sebastopol) are more isolated and cover smaller geographic areas. Detailed maps showing the potential demand in these cities are presented in **Figures 19** through **23**. Although these areas do demonstrate small pockets of potential bike share demand, bike share relies on a network of demand to support short trips and shared use of bicycles. Therefore, these markets for bike share are not focused on for initial phases, though they may be considered for future phases of bike share if demand warrants expansion or if larger subsidies are available for locally serving hubs. As mentioned previously, other strategies may be available to increase the use of bicycles for tourism-related trips. These could include daily or long-term bicycle rental programs, shared bicycle fleets offered by groups of wineries or hotels, and enhanced off-street bicycle facilities in areas farther from city centers.

¹¹ Recommended station density is approximately 28 stations per square mile, with stations located approximately 5 minutes' walk apart (<http://nacto.org/2015/04/28/walkable-station-spacing-is-key-to-successful-equitable-bike-share/>)

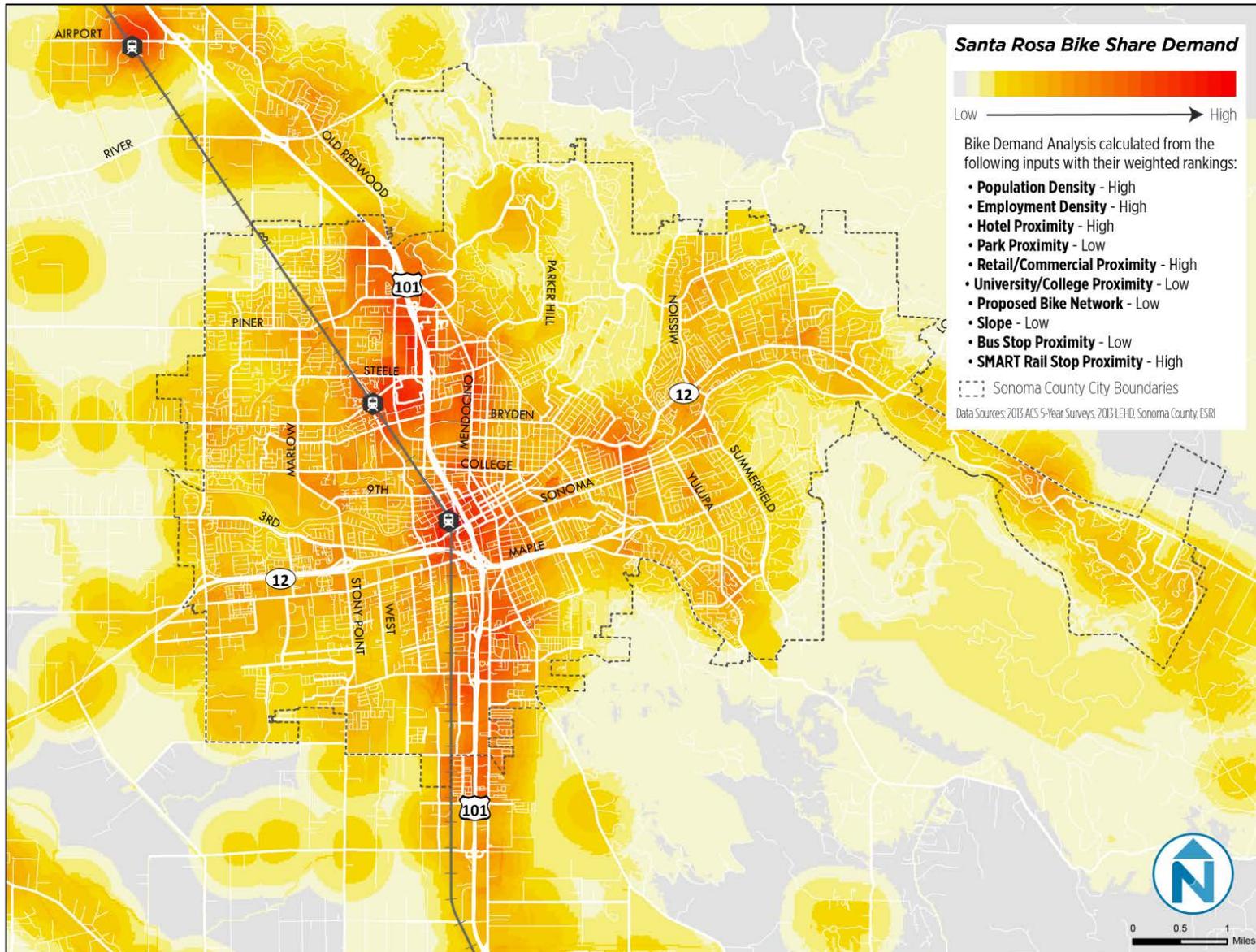
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Figure 15 Countywide Bike Share Demand Analysis



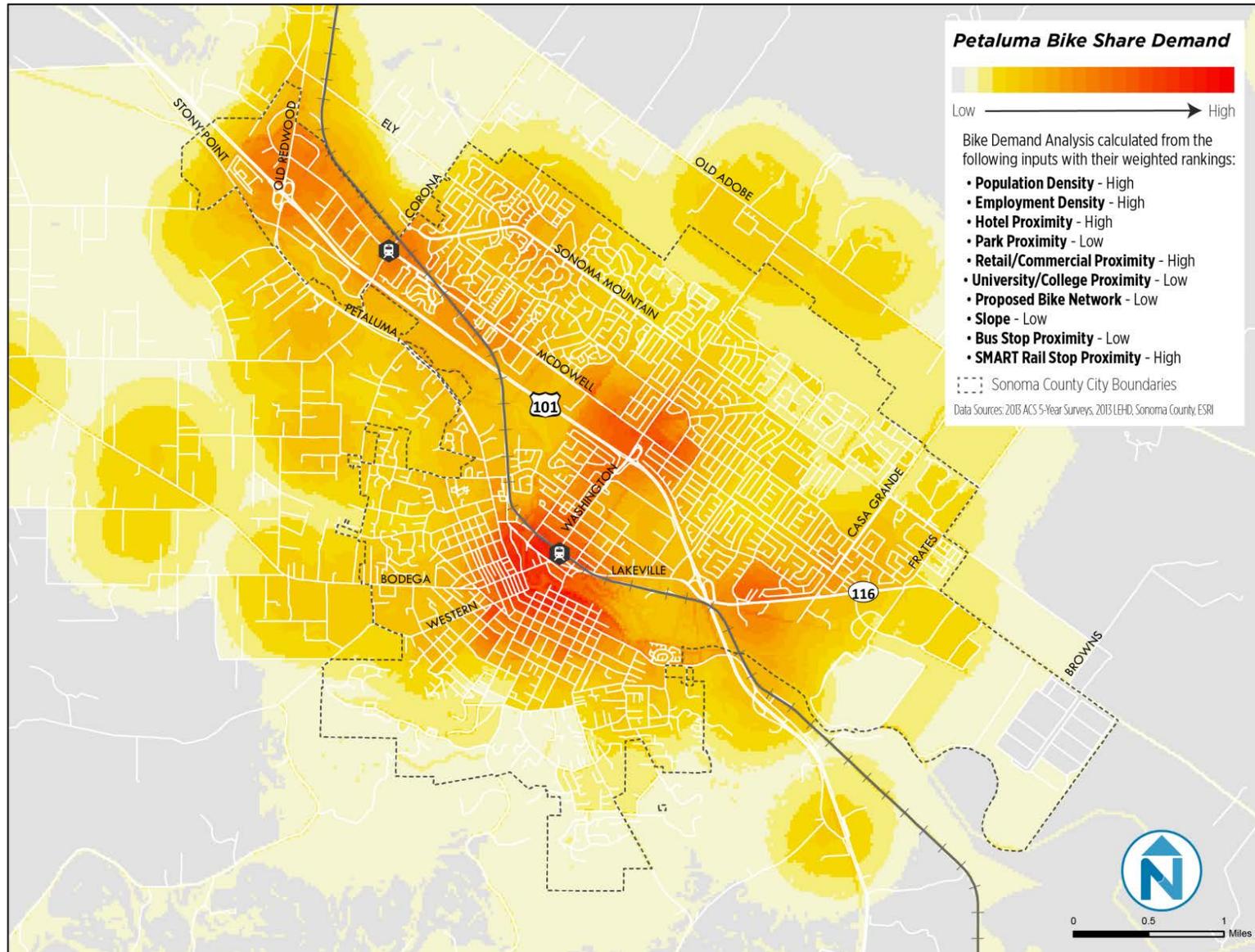
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Figure 16 Santa Rosa Bike Share Demand Analysis



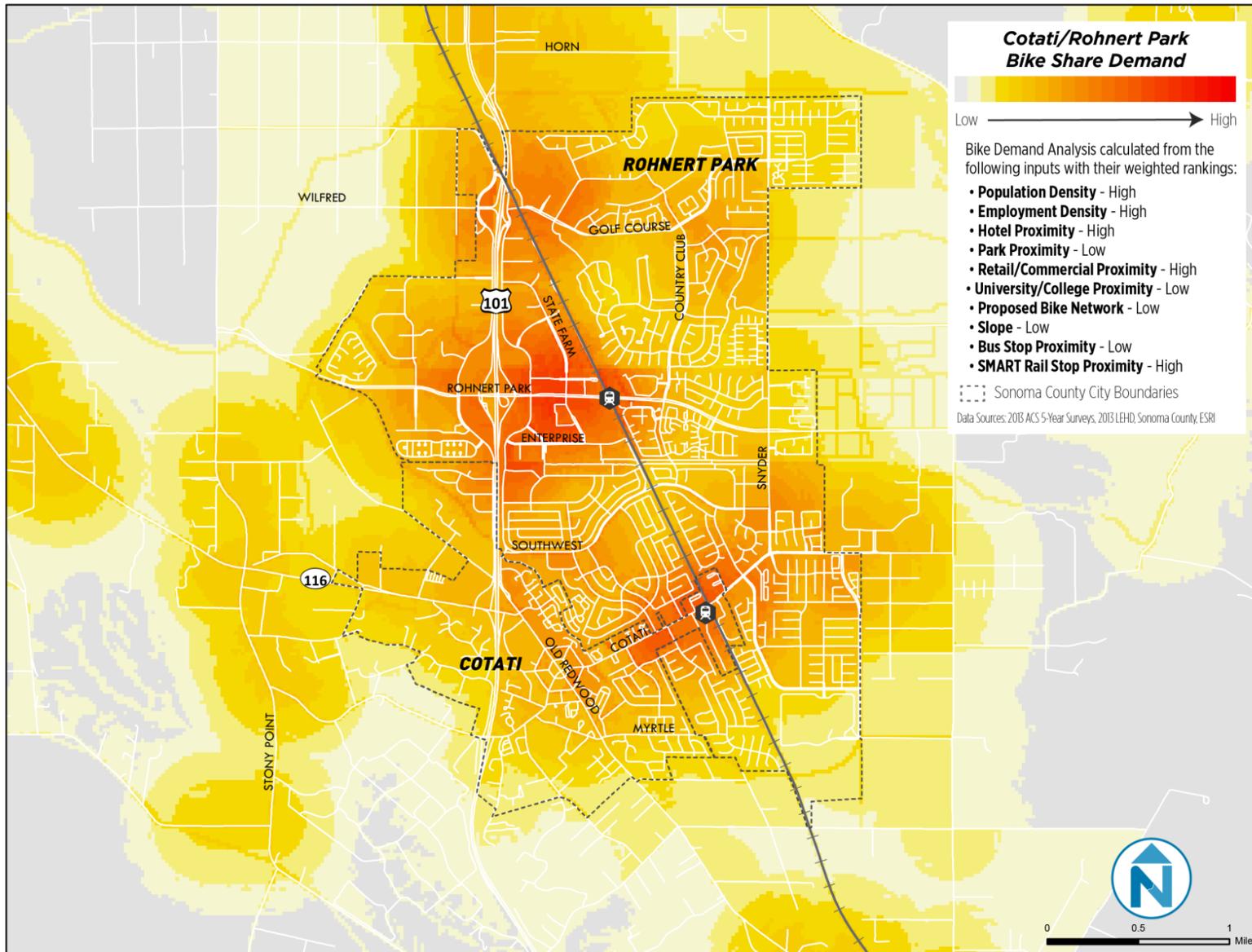
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Figure 17 Petaluma Bike Share Demand Analysis



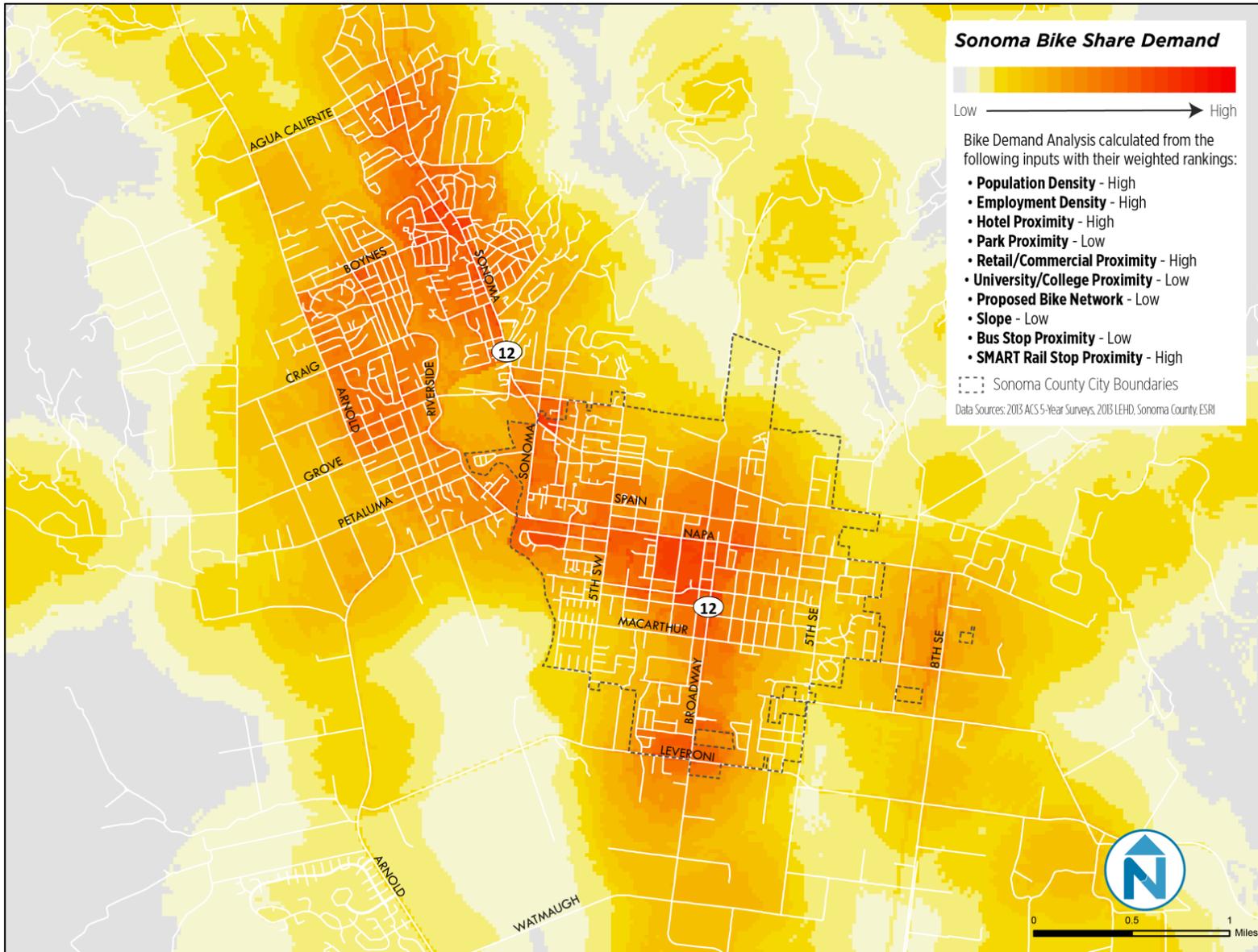
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Figure 18 Cotati/Rohnert Park Bike Share Demand Analysis



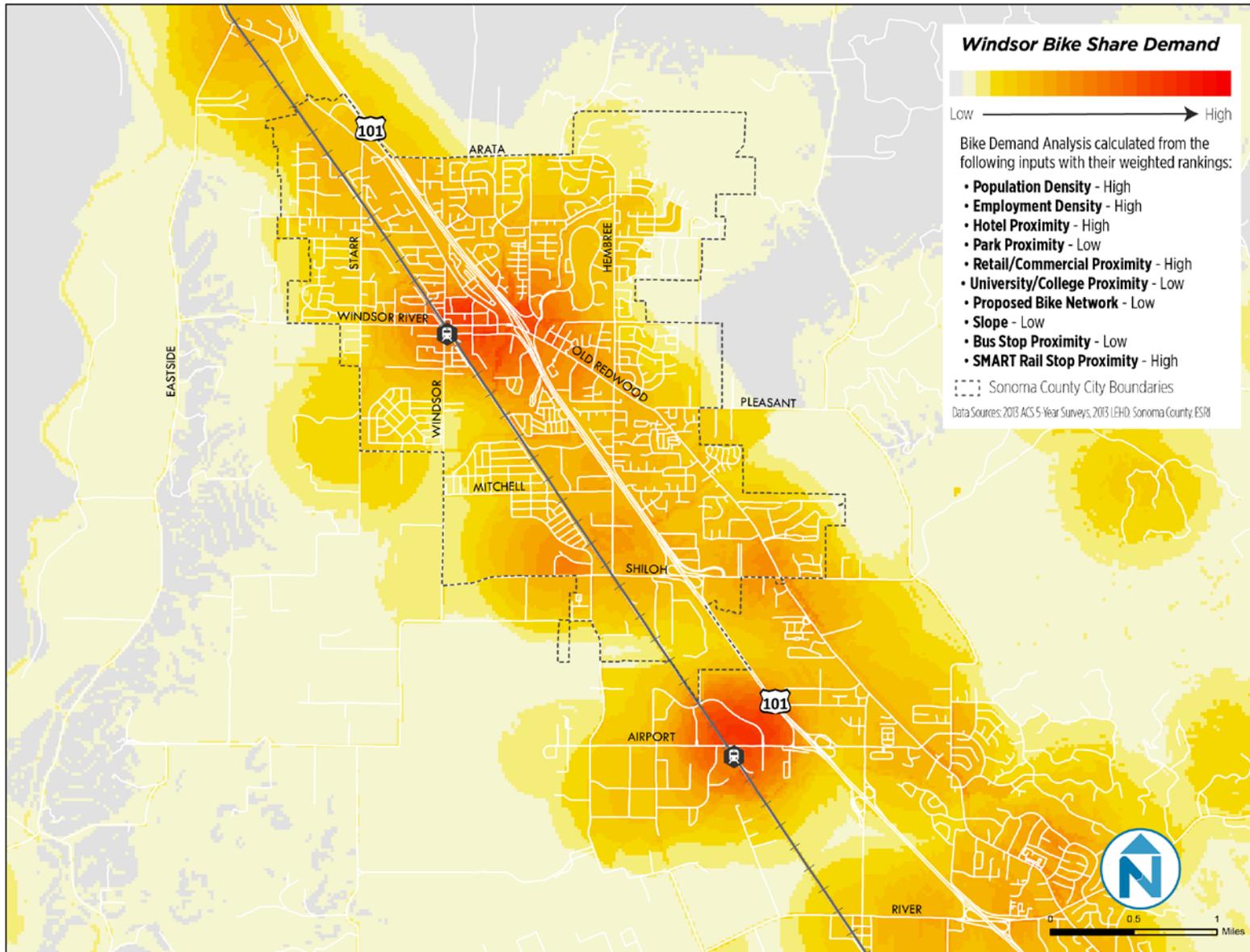
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Figure 19 City of Sonoma Bike Share Demand Analysis



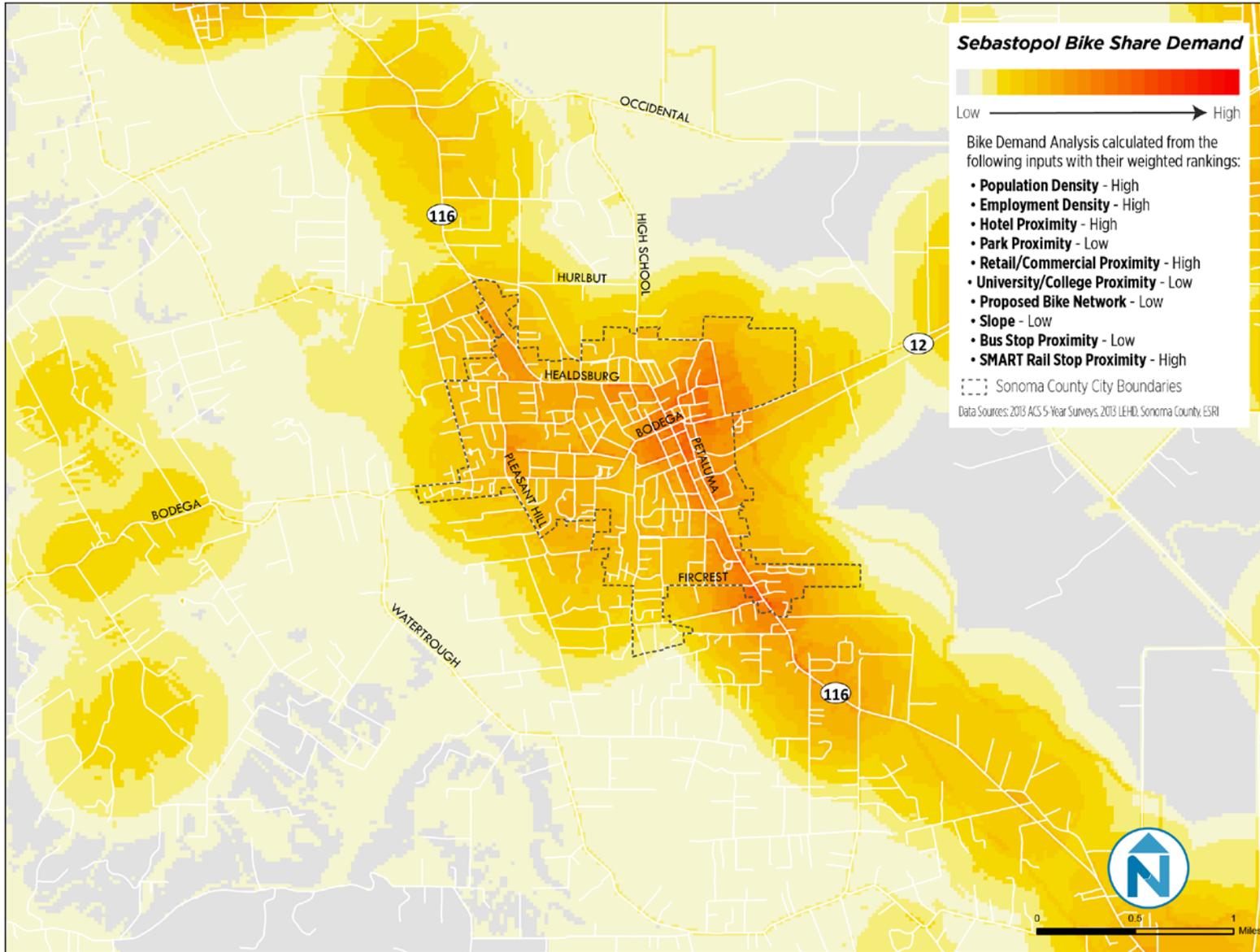
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Figure 20 Windsor Bike Share Demand Analysis



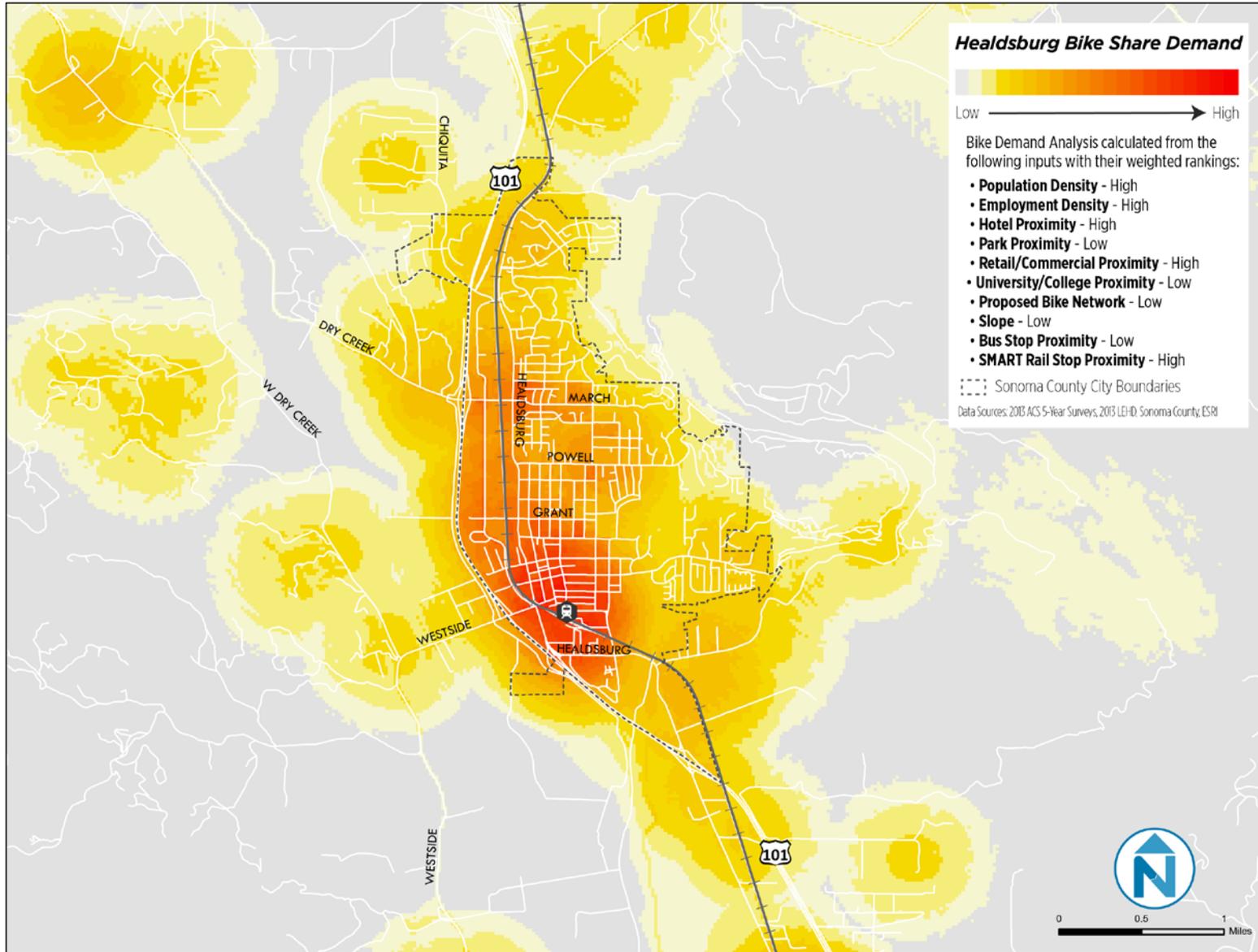
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Figure 21 Sebastopol Bike Share Demand Analysis



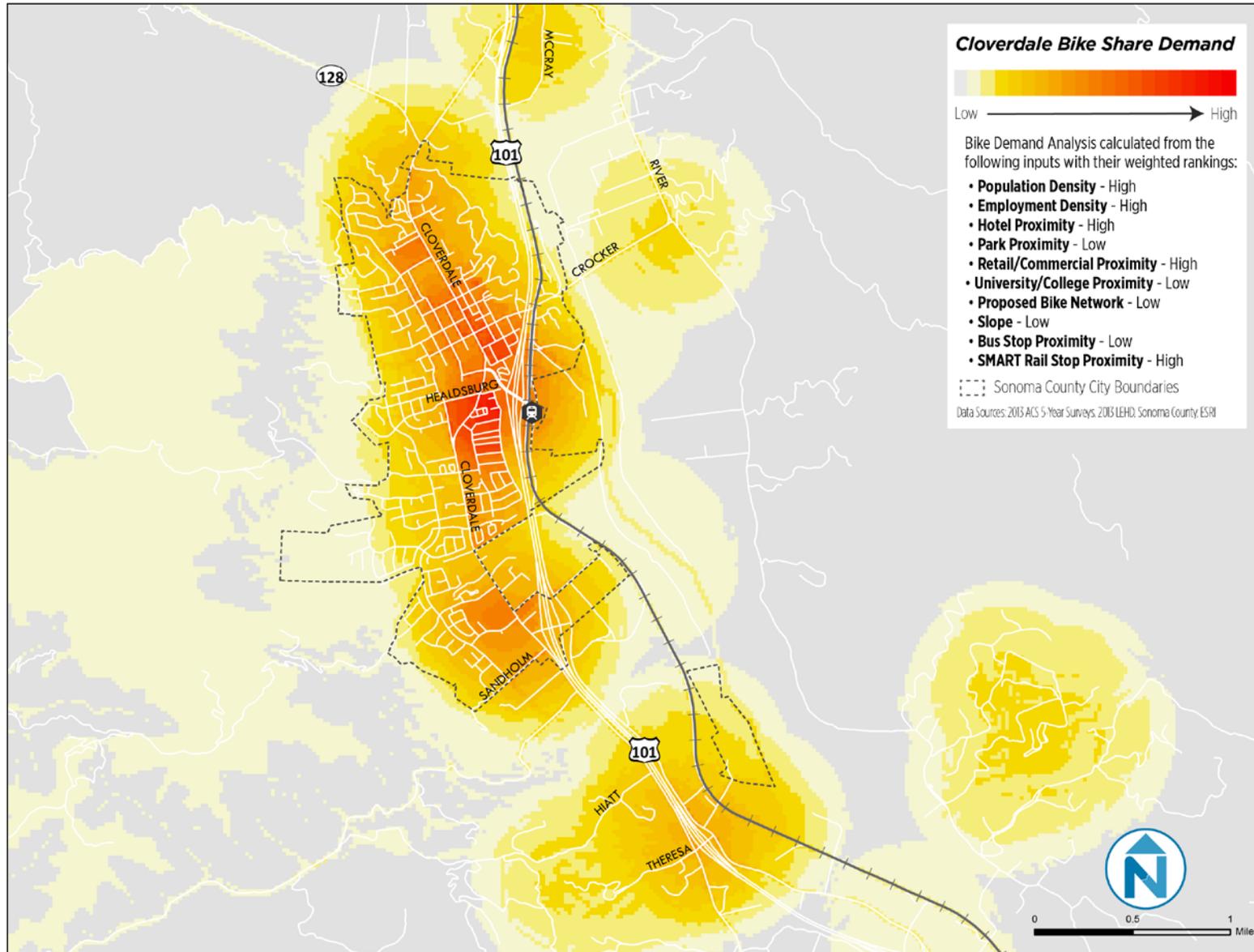
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Figure 22 Healdsburg Bike Share Demand Analysis



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Figure 23 Cloverdale Bike Share Demand Analysis



Bike Share and Equity

Many bike share programs across the country have taken steps to ensure equitable access to the system and services; however, utilization of bike share among low-income and minority residents appears to lag far behind their proportional numbers in the population at large.

Bike share itself addresses some of the obstacles to bicycling identified by communities of concern. Bike share is generally low-cost and removes the financial burden of owning a bicycle. Bicycles are maintained by the operator, alleviating maintenance and vehicle reliability concerns. Bike share also provides a safe and secure location for bicycle parking and storage.

Bike share does not passively address personal safety concerns that are often raised by women and people of color. Although bike share bicycles are among the safest and sturdiest on the road, bike share systems generally are not responsible for establishing bicycle facilities such as bike lanes, trails, or protected cycle tracks. Bike share systems may include sensitivity campaigns for drivers to improve their awareness of and response to cyclists; however, education is usually directed at the bike share user rather than at drivers. Many cities support bike share use and successful implementation with increased investment in their bicycle networks. Bike share is generally not designed for use by children and therefore often does not address desires or needs for family bicycling.

Other aspects of many bike share systems may also inadvertently challenge use and access by low-income or minority residents:

Station locations: To be financially viable, bike share stations must have a high rate of utilization. This generally occurs in high-activity and high-density areas, which tend to also be high cost areas where lower income residents cannot afford to live. The experience of several systems that have located stations in areas with lower income populations and/or areas with more dispersed destinations and land uses that are less supportive of bicycling (e.g. auto services) is that these stations, although necessary and desired, have relatively low utilization rates and low productivity. As a result, the majority and higher concentrations of stations are typically located in higher productivity areas.

Membership costs: Although bike share membership is relatively inexpensive (typically \$50 to \$85 per year) compared to other annual transportation costs, a lump sum payment of this amount can be too great for many low-income workers or travelers to afford. Many systems have offered alternative membership arrangements to circumvent this obstacle including installment payments and free or dramatically reduced cost memberships.

Membership requirements: Many systems have been challenged in finding workarounds for other membership requirements – principally the need to securitize bicycle usage. Early systems required a credit hold to borrow a bicycle – thus requiring sufficient credit or personal account resources to provide. Increasingly, systems have eliminated this credit hold, but most still require some access to a user's financial profile or accounts. Many still require even low-income users to bear the cost of bicycle replacement in the event of loss or theft. Some have found third-party (e.g. social services agencies) partners to cover bicycle replacement risk; however, even in these instances, users must provide sufficient financial deposits to cover any use overages (when the user exceeds the allowed "free" period of bicycle use). Because many low-income residents lack access to credit, debit, or sufficient stored-value card accounts, this can present a significant obstacle.

Web-based system information: Most systems provide users with real-time information on the availability of bicycles in the system. This information is primarily accessed through smart phone apps, although it is also available online through traditional web pages. While this is a great convenience to smartphone users with mobile data plans and internet access, it provides little benefit to those who rely primarily on text (SMS) communication. This is common among lower income and immigrant residents as text-and-phone plans meet their communication needs and are more affordable than data plans.

Summary and Findings

The scale of bike demand across Sonoma County is below what has been observed in peer cities’ bike share systems. However, the above analysis indicates that key areas in Santa Rosa, Petaluma, and Rohnert Park/Cotati could potentially generate a volume of bicycle demand making bike share feasible. The City of Sonoma demand analysis indicates that there are no clear hubs and that destinations are not concentrated enough to generate a network of demand.

While each area in Figure 24 was selected due to a combination of factors—predicted bike demand, trip making patterns, and equity—they present different opportunities and considerations for different bike share operational models. For example, in Petaluma, there is potential for mode shift with either the dock-based or flexible system models, but due to the small service area, the mode shift likely would not result in significant vehicle miles traveled reduction. In Rohnert Park/Cotati, the local road network has low connectivity and limited bicycle infrastructure, which would require longer bike trips on higher stress routes—a challenge for either type of system.

Regardless of location, both dock-based and flexible systems offer partnership opportunities with transit systems that include physical integration strategies, advertising opportunities, and capital and operational funding. The implementation of a dock-based system in Sonoma County may benefit from its similarity to Bay Area Bike Share and other major systems across the country, potentially making its use more intuitive and familiar to locals and tourists. With that in mind, a flexible system may require additional marketing and education to reach a broad base of users.

The table below summarizes additional considerations for dock-based and flexible bike share models for each of the three locations where bike demand is highest.

Figure 24 Operational Model Considerations and Evaluation Summary for Sonoma County

Locations	Dock-based System	Flexible System
Santa Rosa – Downtown/Railroad Square/SRJC	<ul style="list-style-type: none"> ▪ Large enough potential service area for a network of stations 	<ul style="list-style-type: none"> ▪ Lower station profile than dock-based system (inverted-U racks only); may be more applicable in Railroad Square/Downtown area where there are narrower streets and competing space needs (e.g. auto parking) ▪ Lower up-front cost; potential to pilot in downtown and expand to SRJC and include partnering sponsorships
Petaluma	<ul style="list-style-type: none"> ▪ Smaller service area than Santa Rosa; there is lower predicted demand at a higher cost with dock-based system ▪ Destinations are more dispersed; identifying station locations to form a dense network will be more challenging 	<ul style="list-style-type: none"> ▪ Addresses the challenge of station location feasibility—bicycles could be parked through entire limited service area
Rohnert Park/Cotati	<ul style="list-style-type: none"> ▪ Smaller service area than Santa Rosa; there is lower predicted demand at a higher cost with dock-based system 	<ul style="list-style-type: none"> ▪ Addresses the challenge of station location feasibility—bicycles could be parked through entire limited service area

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Locations	Dock-based System	Flexible System
	<ul style="list-style-type: none"> ▪ Destinations are more dispersed; identifying station locations to form a dense network will be more challenging 	
<p>Overall Assessment: Santa Rosa appears to be the most feasible initial implementation zone, with the greatest potential for mode shift given the likelihood of short trips. The organizational model chosen will depend on the interest of local partners. A flexible bike share system appears more opportune for this setting, given its lower capital costs and operational flexibility for a lower-density setting. It may free up resources to expand to other cities as demand grows, and addresses the challenge of low-density destinations in other cities.</p>		

SITE IDENTIFICATION

Station Siting Considerations

The bike share demand analysis highlights key areas of the county that could be feasible for bike share implementation. Within those areas, several factors help determine specific opportune sites for bike share stations. Station distribution needs to balance proximity to demand-generating sites while maintaining a station density supportive of short trips. The process for selecting sites could be aided by dividing system areas into 1,000-square foot grid squares and enumerating the number of transit stations, community centers, retail centers, high-density residential areas, or other characteristics within each square. Squares with the highest scores can then be examined in more detail to determine specific hub and bike parking locations (e.g. available sidewalk space, available on-street space, etc.).

Depending on the bike share system, docking locations or hubs may require less space than traditional point-to-point systems. These guidelines were gleaned from several reports and other city guidelines, including the 2012 FHWA report *Bike Sharing in the United States*; Appendix B in *NYC Bike Share: Designed by New Yorkers*; *Pronto Cycle Share Station Siting Criteria* (Seattle); and *The Bike-Sharing Planning Guide* by the Institute for Transportation & Development Policy. The following describes best practices for selecting bike share parking sites:¹²

General Requirements

- Sites must have unrestricted access to the public 24 hours per day, 7 days per week
- Sites should be highly visible and well-lit at nighttime
- Sites must not impede through-travelers on other modes, block fire hydrants, or otherwise obstruct sidewalk furniture, public utilities, or other amenities meant to be publicly accessible at all times
- Sites should be located on relatively flat surfaces, though moderate slopes can be accommodated
- Sites should provide adequate clearance from driveways

¹² Bear in mind that some bike share systems' docking locations require less space than traditional point-to-point systems. Further information on the different bike share operating models is provided in the next section. These guidelines were gleaned from several reports and other city guidelines, including the 2012 FHWA report *Bike Sharing in the United States*; Appendix B in *NYC Bike Share: Designed by New Yorkers*; *Pronto Cycle Share Station Siting Criteria* (Seattle); and *The Bike-Sharing Planning Guide* by the Institute for Transportation & Development Policy.

Sidewalk Site Requirements

- To maintain appropriate right-of-way, only sidewalks with sufficient width should be identified as potential sites
 - Docks or racks with parked bicycles extend approximately 6 to 8 feet from front to back; bicycles must also be provided with an approximately 4-foot access zone that does not impede pedestrian activity. The pedestrian right-of-way must be in addition to this 10 to 12-foot cross section.
- Dock facilities should be located at least 3 feet from the curb to allow for a door zone from parked cars and may be placed between planters or tree wells

On-Street Site Requirements

- As often as possible, locate bike share stations on the bicycle network in close proximity to facilities (but do not obstruct or impede bicycle traffic)
- Minimum curb-lane width for use as a bike share dock location: 8 feet
 - Encroachment permits are required in the Public Right of Way
- Do not place docking locations in on-street lanes that are used for through-driving at certain times
- Stations may be placed in non-parking areas of curb lanes, such as at intersections or other areas with otherwise unused curb space
- On-street sites should be limited to streets with lower traffic volumes and speeds (e.g. < 30 miles per hour); provide additional buffer space for higher volume or speed streets

Transit Station/Stop Requirements

- Sites should be located as close as possible to station/stop ingress/egress points without obstructing pedestrian paths of travel, loading zones, or parking spaces (preferably within 15 feet of bus shelters or rail stations)
- Location in proximity to transit stations is highly encouraged

Park Site Requirements

- Docks on park sites must receive approval from the appropriate agency (City, County, or otherwise)

Private Property Requirements

- Sites may be on private property at the discretion of the property owner

Preliminary Bike Share Designated Hub Locations

This section describes a selection of potential sites that pass preliminary screening criteria for designated bike share hubs in areas of Sonoma County estimated to have the highest bicycle demand and, therefore, best feasibility for a flexible bike share system. This assessment is focused on the three communities found to have the highest potential for generating bicycle trips: Santa Rosa, Petaluma, and Rohnert Park/Cotati. Each of these communities is situated along the SMART commuter rail corridor, which is expected to commence service in late 2016. Based on input from County staff, the potential for establishing designated hubs at the Airport Business Park/SMART station area where significant future development is planned, is also examined.

In addition to relying on local knowledge of the region, this study also looked at population density, employment density, proximity of hotels and parks, retail/commercial proximity,

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existing and planned bicycle networks, proximity to major bus routes/stops, and SMART stations to identify and prioritize potential sites. When determining specific locations for potential designated hubs, consideration was also given to existing lighting in the area, visibility to users disembarking bus and rail transit at major transit stops, and proximity to street crossings with dedicated pedestrian/bicycle facilities.

Figure 25 lists the number of bike share sites identified in each service zone for two phases. Phase 1 locations were determined based on the potential demand that currently exists or is anticipated in the near future (such as upon initiation of SMART rail service). Phase 2 locations were determined based on anticipated land use and circulation network changes as envisioned by General Plans, Specific Plans, and corridor plans that have been adopted in each of the jurisdictions. Several of the Phase 2 locations could also be implemented once the bike share program is up and running and a proven demand for bike share has been established at nearby Phase 1 locations.

Figure 25 Bike Share Site Summary

Service Zone	Potential Phase I Sites	Potential Phase II Sites
Santa Rosa	8	5
Rohnert Park/Cotati	5	4
Petaluma	4	7
Airport Business Park	0	2

A full list and description of potential designated hubs is available in **Appendix B**. The table identifies location, nearest cross street, benefits to the location, proximity to bike facilities and transit, potential users, and phasing. An interactive map of such locations is available at the following link: <https://goo.gl/SzzJzZ>

RECOMMENDATIONS AND NEXT STEPS

Based on the analysis outlined in this report a flexible bike share model is recommended for Sonoma County. An initial phase is recommended in central zones within Santa Rosa, Petaluma, Rohnert Park, and Cotati. Designated hubs should be established at key destinations and areas where demand is expected to be the highest, and flexible bike share parking should be allowed at publicly accessible bike racks within the service area.

To encourage members to use bike share for trips within the highest demand core of the service area and to help with balancing out the bicycle supply, Santa Rosa could be divided into two zones. Zone 1 would be the central area with the most destinations that encourage bike trips, and Zone 2 would be a buffer around this central area where lower density and existing land uses create a potentially smaller demand for bicycle activity. The pricing model used for the flexible bike share system should charge a penalty for trips that end outside of Zone 1, and provide a financial incentive for trips that start in Zone 2 to end in Zone 1. This model could also be used in other cities with a larger geographical service area.

Bike share in the Airport Business Park also showed high demand; however, it is likely that use would primarily be for work commute trips from the SMART station. The need for a guaranteed two-way trip to and from work would require either a very large number of bicycles or a model

that allows for all-day reservations. This area is therefore recommended in Phase II or for further consideration of an alternative service model with employer subsidies.

Setting the Stage for Bicycle Mode Shift

To move forward with bike share in Sonoma County, project sponsors need to make a decision regarding desired organizational models. Efforts to improve the bicycle environment in Sonoma County should continue to support a comprehensive bicycle network.

- **Identify available funding.**
- **Gauge partnership/sponsorship interest from transit operators, local businesses, and non-profits.** To determine the organizational model for bike share, project sponsors should engage potential partners and gauge their level of interest for administration, operation, and ownership of a bike share system.
- **Gage interest from flexible bike share vendors.** Conversations with potential vendors should take place to see if there is interest in establishing a bike share system in the identified areas of Sonoma County. This effort will allow the project sponsor to better determine the level of subsidy that will be needed to implement a flexible bike share system.
- **Reduce parking requirements for local developers that purchase bike share stations and fund operations.** Cities could establish a zoning mechanism that reduces parking requirements for developers that purchase a bike share station and cover annual operating funds for that station, especially if implemented in areas such as downtown Santa Rosa and Petaluma where growth is planned and parking is constrained. Requiring the station to be sited at the development site will give tenants/patrons additional transportation options and reduce parking demand at the site. A guaranteed contribution to the annual operating fund may be tied to developer conditions of approval.
- **Consider shared mobility hubs at transit centers and in peripheral neighborhoods.** Bike share should be viewed not as a standalone mode, but as part of a broader suite of mobility options. To that end, partners could consider a network of integrated mobility hubs equipped with bike share, transit, and car share facilities (such as in Railroad Square or the Transit Mall in Santa Rosa). Mobility hubs are best suited in transit rich centers, but also in peripheral neighborhoods that have gaps in transit service.
- **Extend bicycle infrastructure.** Providing a well-connected network of safe and comfortable bikeways is important to enable more casual, occasional riders and lay the groundwork for long-term ridership. Many cities couple bike share implementation with a commitment to completing projects that eliminate gaps in the existing bikeway network to establish continuous connectivity, which are outlined in the County's and cities' bicycle plans. Wayfinding improvements could also help orient new bicycle riders.
- **Develop an Education, Safety and Awareness Campaign.** Given its development patterns, Sonoma County has a high reliance on automobile use. As such, the needs of people on bicycles may not be generally understood by the broader public. A robust education and awareness campaign supported by the county, cities, and in partnership with key stakeholders such as the Bicycle Coalition should work to change this perception and support new riders.

Flexible Bike Share System Implementation

Assuming the desired implementation occurs in Santa Rosa under a flexible bike share system, the following are next steps to get started:

- **Issue separate vendor and operator RFPs.** Selecting a vendor and operator is an important step in establishing the bike share system. Negotiating the details of service, performance, and roles will influence the relationship between the implementation partners and between the users and the service. The RFP stipulates the needs of the program and sets basic expectations for the future contract vendor/operator. Requirements may include vendor responsibility for fundraising, marketing, detailed station site design, and performance monitoring, as well as bicycle design, payment and transactional requirements, thresholds for local staffing, and even opportunities to experiment with new technology and station or hub location design. The contract should include specific language requiring the operator to collect basic performance information. The operator should be required to provide a performance reporting web platform accessible to the public. This information should be linked to established performance metrics. The contracts may be tied to attainment of performance metrics.
- **Develop a pre-implementation promotional demonstration.** Could be coupled with a local summertime event.
- **Design and implement initial kiosk/hub location planning and siting process.** Station siting and outreach to local communities and property owners represents one of the most time-intensive elements of the bike share implementation process. The siting process should identify potential impacts including parking loss, sidewalk furniture zone needs, and coordination with bike infrastructure. The technical team would need to include specialists in business engagement and education.
- **Identify a highly visible and generally respected public figure or local leader as a spokesperson and champion for the system.**

Costs

Seventeen preliminary sites have been identified for Phase 1 designated bike share hubs. A more detailed bike share operational assessment, in addition to site-specific engineering analysis, would be necessary to estimate the quantity of actual bicycle parking spaces needed to ensure the viability of a flexible bike share system. Therefore, a specific cost estimate for implementation is not readily available. However, unit costs for the various system components are shown in **Figure 26** and unit costs for capital investments required for a flexible bike share system are shown in **Figure 27**. Annual operating costs depend on the size of the system; decisions regarding the service area size, number of bikes included, and number of hubs designated would be made in a later phase.

Figure 26 Bike Share Unit Costs

Flexible Bike Share Component	Approximate Cost
Inverted-U bicycle racks	\$175 - \$200 / rack ¹³
Smart bikes	\$1,200

¹³ http://www.railstotrails.org/resources/documents/whatwedo/atfa/ATFA_20081020.pdf and <http://help.socialbicycles.com/hc/en-us/articles/201117319--Why-Choose-Social-Bicycles->

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Flexible Bike Share Component	Approximate Cost
Kiosks (sign-up locations; potential for local businesses to serve this function)	\$10,000 - \$13,000
Operations	\$500,000/year

Figure 27 presents estimated unit costs for capital investments required for a flexible bike share system. Annual operating costs depend on the size of the system; decisions regarding the service area size, number of bikes included, and number of hubs designated would be made in a later phase.

Figure 27 Flexible Bike Share Capital Costs by Unit

Cost Element	Unit Cost
Freestanding Info/Map Panel	\$2,000
Freestanding Payment Kiosk	\$10,000
Custom, Branded Rack	\$175
Rack Base Plate (per rack)	\$90
Bikes	\$1,200
Hub Assembly (per hub)	\$600
Station Deployment Vehicle Costs (per hub)	\$200
Bike Assembly (per bike)	\$75
Map Production/Printing (per hub)	\$75
Bike Spare Parts (per bike)	\$120
Kiosk/Map Panel Spare Parts (per hub)	\$1,000
On-Street Bike Maintenance Vehicles	\$3,000

Opportunities for Integration with Fixed-Route Transit

Bike share is a form of public transit. With the expectation of drawing regional commuters who need connections to local employment hubs, the SMART train, Sonoma County Transit, Santa Rosa City Bus, and Golden Gate Transit could be appropriate partners with mutual interests in providing first/last-mile connections. For transit systems with compact service areas, such as Petaluma Transit, a bike share system is less about connecting the first- and last-mile and more about enhancing the localized multimodal transportation network—travelers can use transit on one leg of their journey and a bicycle for the next; they can also rely on bicycles during times when transit is infrequent. Together, bike share and compact transit systems create more flexibility for localized travel.

Co-location is only part of bike share-transit integration. The three main types include:

- Physical integration (e.g. station colocation)
- Fare and fare media integration
- User experience integration – e.g. wayfinding, branding, marketing

Experience in other cities suggests that fare integration can involve a lengthy process, particularly in the Bay Area where transit service uses Clipper. Clipper is run on closed-system technology, which makes it particularly difficult to link to other systems. Further, Clipper is undergoing a planning process for its next phase—Clipper 2.0—rendering any potential integration work on Clipper 1.0 unjustified. The potential for integrating bike share fare payments with Clipper 2.0 is currently unknown.

Therefore, physical and user experience integration would be the most appropriate strategies for Sonoma County. This could involve placing bike share hubs near, or on the same property as, major transit stops. User information could also be provided at transit locations to increase awareness of bike share and promote the use of the system for short, connecting trips between transit and key destinations.

Education

Educating the public about what bike share is and how it works is necessary for any bike share program, as there are many concepts to explain, including pricing (memberships and usage fees), how to check bikes in and out, what is the service area, and others. The ability to drop bikes off at any location within a specified zone (and the associated fees for dropping the bikes off outside of the service area) would be part of the same education about how this particular bike share program works.

Like Bay Area Bike Share and other bike share programs across the country, vendors who provide flexible hub (vs. fixed dock) systems also offer mobile apps and mobile websites to guide use of the system. These apps and sites provide clear, real-time information about bicycle availability, hub locations, and zone boundaries, so users can easily understand whether their current location is inside or outside the service area, and whether or not they are at a designated hub.

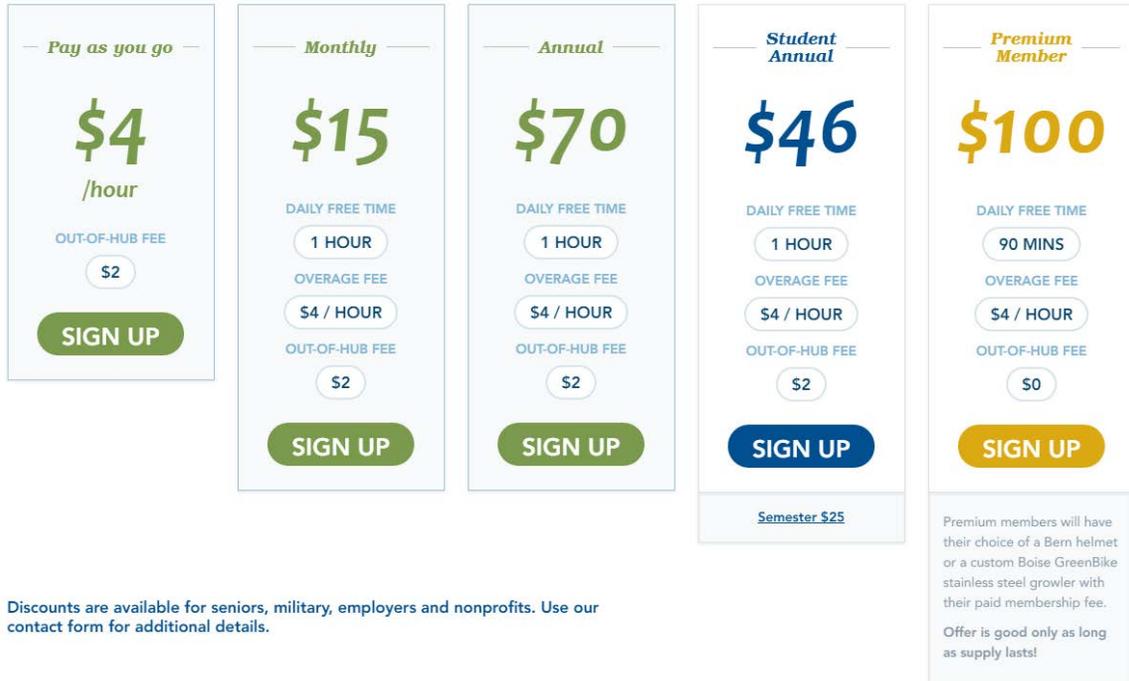
Regardless of which type of bike share system is implemented, many people do not understand the fee structure at first and are surprised when they incur large fees for keeping bikes out too long. Refunding these fees for new users that did not understand the structure is common and appropriate and should be anticipated.

Enforcement

Enforcement is achieved through pricing, and this has proven to be a successful strategy. The pricing model has a few components to require that bikes stay within the service area (typically \$20 to \$100 penalty), to encourage short trips (increased hourly fees beyond 30-60 free minutes), and to encourage that bikes be returned to hubs (typically \$1 to \$5 extra for non-hub locations). See **Figure 28** for one example pricing scheme.

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Figure 28 Boise Green Bike Pricing Structure



Regarding the level of effort required for rebalancing the system throughout the day, there is limited evidence to show that price incentives significantly reduce operating costs. However, a major barrier for users is concern that the hub nearest the users' destination will be "blocked"—full of parked bicycles—upon arrival. A flexible system mitigates this by allowing users to park bikes at any available bike parking location within the service area. Rebalancing is still needed, but can be done more strategically rather than responding to crisis. This may reduce calls to customer service.

Density and Usage

Density is not necessarily the deciding factor for choosing a bike share model, however systems in mixed-use environments with good bike infrastructure tend to perform the best. Flexible systems have an embedded benefit that allows for fewer hubs within a given area, given that users are allowed to park anywhere within that area. Dock-based systems, like Bay Area Bike Share, require a station density of about one every 1,000 feet, located near high activity uses—something that may be less feasible in lower density environments.

Dock-based systems are the most common in the U.S. at present (including small and large cities), but areas of all sizes are also beginning to use flexible systems, with technology built into the bike rather than the dock. As such, there is more data about dock-based systems while the flexible integrated lock model is still emerging.

Appendix A Organizational Models Explained

Publicly owned, privately operated. In this case, a city or region contracts with a private turnkey operator, where the operator takes all responsibility for capital and implementation, and requires only funding from the public owner. The public entity managing the system often owns the capital (bikes, stations, etc.) and is responsible for establishing a sustainable funding strategy. Funding sources include public grants, sales tax revenue, membership revenue, and advertising revenue. Decision-making is typically guided by an advisory committee, but is managed through a conventional municipal governance process. Financial risk is assumed by the public entity, while liability coverage is typically assumed by the private turnkey operator. This structure would require limited staff involvement or expertise from the public entity since the main operating functions would be assumed by the private operator. Public agency staff would be required to manage the contract with the turnkey operator, secure startup funding, and manage/coordinate a decision-making committee internally. Capital Bikeshare in Washington, DC operates under this model.

Non-profit owned and operated. Under this model, a private, non-profit organization (either pre-existing or established specifically for bike share administration) manages, owns, and operates the bike share system. The non-profit organization manages a customer service call center, remote system surveillance, and redistribution efforts, maintains bicycle and station maintenance, and provides administrative services, marketing, fundraising, etc. Decision-making is handled by a Board of Directors, which could include major private sector sponsors and elected leaders. The non-profit model can retain both public funding and also fundraise from private sources. Nice Ride Minnesota is an example of a statewide non-profit owner/operator.

Administrative non-profit. Another example of a non-profit structure is one that owns and administers the system, but does not operate it. In this case, a non-profit is formed to oversee all duties, except for day-to-day operations. The only difference between this and the *non-profit owned and operated* model described above is that the administrative non-profit does not operate the system. Instead, the non-profit often leads all fundraising efforts, prepares purchase orders for bike share equipment, and markets bike share services. The non-profit contracts with a private operator to implement the system roll out and operate the system. That said, the non-profit may be able to require the operator or a third party specialist to fulfill any of the administrative tasks as part of the service agreement. Under this structure, a sponsoring public agency would require limited staff involvement and expertise since the main management and operating functions would be assumed by the non-profit and private operator. Strategic decision-making is handled by a Board of Directors under the non-profit. Denver B-Cycle is an example of this business model.

Privately owned and operated. In this case, a private operator is procured to operate the system and maintains control of the capital. This operating arrangement has been implemented in Miami Beach (DecoBike). The private operator also takes ownership of fundraising, if necessary. A private operation offers public agencies less control of system size and growth; this depends largely on the private operator's ability to generate revenue and their strategy to turn a profit. This model offers public agencies limited requirement for staff time dedicated to bike share and completely transfers risk to the private operator. A potential drawback for Sonoma County is

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this model's conflict with a desire to equitably distribute the system and the likely reliance on subsidy or low profit margins in the county's lower-density setting.

Publicly owned and operated. In this case, the public agency—be it a city, regional government, transit agency, or state entity—procures and owns the bike share bikes, docking stations, and supporting equipment and manages the day-to-day operations of the system. This includes managing a customer service call center, remote system surveillance, and redistribution efforts, maintaining bicycle and station maintenance, and providing administrative services, marketing, fundraising, etc. This operating model has been used in European and Asian cities (most notably in Guangzhou, China) due to their ability to secure greater public monies to support bike share as a core urban transportation service. There are no North American examples.

Transit agency owned, privately operated. In this case, a transit agency contracts with a private operator. The transit agency managing the system often owns the capital (bikes, stations, etc.) and is responsible for establishing a sustainable funding strategy. Funding sources include public grants, sales tax revenue, membership revenue, and advertising revenue. Decision-making is typically guided by an advisory committee, and, depending on the structure of the transit agency, may be managed through a quasi-governance process. Financial risk is assumed by the transit agency, while liability coverage is assumed by the operator. This can be an appealing model given that a transit agency's top priority is to provide useful transit service, rather than generate revenues. This model is not currently being deployed in the U.S.; however there are numerous European examples including Deutsche Bahn, the rail company in Germany, Dutch Railways in the Netherlands, and Veloway (Veolia).

Appendix B Potential Designated Bike Share Hub Locations

Location	Cross Streets	Benefits	Bike Facilities	Transit Providers	Potential Trip Purposes
Airport Business Park					
<i>Phase 2</i>					
ABP 1	Airport Blvd/ SMART	<ul style="list-style-type: none"> • SMART station • Adjacent to large employment center • Biking distance to airport NIN mapping indicates high demand	SMART path, Airport Blvd Class II bike lanes	SMART, SCT	Commuter
ABP 2	Aviation Blvd between Brickway & Concourse	<ul style="list-style-type: none"> • Central to major employment area with future employment growth Bikeable to retail/service areas	SMART path, Airport Blvd Class II bike lanes	SCT	Commuter, midday trips
ABP 3	Sonoma County Airport	<ul style="list-style-type: none"> • Airport terminal with continued passenger growth expected • Bikeable to major employment area Proximity to SMART station and path	Airport Blvd Class II bike lanes	SCT	Commuter

Notes: SCT = Sonoma County Transit; GGT = Golden Gate Transit; SMART = Sonoma Marin Area Rail Transit

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Location	Cross Streets	Benefits	Bike Facilities	Transit Providers	Potential Trip Purposes
Santa Rosa					
SR 1	4 th St/ SMART	<ul style="list-style-type: none"> • SMART station • Future high-density residential, employment 	SMART path, Joe Rodota Trail, Prince Memorial Greenway	SMART, Santa Rosa CityBus	Commute, shopping, tourism
SR 2	Santa Rosa Ave/ Third St	<ul style="list-style-type: none"> • Adjacent to Santa Rosa Transit Mall • Central to Santa Rosa Downtown • Next to signalized crossing 	Prince Memorial Greenway & bike network	Santa Rosa CityBus, SCT, GGT	Commute, school, shopping, tourism
SR 3	Guerneville Rd/ SMART	<ul style="list-style-type: none"> • SMART station • Adjacent to high-density housing • Adjacent to major shopping center • Close to signalized crossing • Future housing/employment growth anticipated 	SMART path, Guerneville Rd bike lanes	SMART, Santa Rosa CityBus	Commute, shopping, recreational
SR 4	Mendocino Ave/ McConnell Ave	<ul style="list-style-type: none"> • Close to Santa Rosa Junior College bus stop • Adjacent to enhanced pedestrian crossing on Mendocino Ave (rapid rectangular flashing beacon) • Proximity to signalized intersection/safe crossing • High pedestrian activity area • Existing street lighting 	Humboldt Bike Blvd, Mendocino Ave bike lanes	Santa Rosa CityBus, SCT, GGT	Commute, school

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Location	Cross Streets	Benefits	Bike Facilities	Transit Providers	Potential Trip Purposes
SR 5	Sebastopol Rd/ West Ave	<ul style="list-style-type: none"> Community of concern with low automobile ownership Many in community are frequent users of pedestrian/bike facilities Adjacent to signalized intersection Close to signalized crossing Adjacent to site of future plaza and affordable multifamily housing 	Joe Rodota Trail	Santa Rosa CityBus	Commute, school, shopping,
SR 6	D St/ First St	<ul style="list-style-type: none"> Proximity to major employers (City Hall, State of California) 	Sonoma Ave bike lanes	GGT	Commute, shopping, midday trips
SR 7	Mendocino Ave/ 7 th St	<ul style="list-style-type: none"> Proximity to major employers (County of Sonoma, northern downtown) Adjacent to residential, including affordable multi-family housing 	Humboldt Bike Blvd	Santa Rosa CityBus, SCT, GGT	Commute, shopping, school, midday trips
SR 8	Montgomery Dr/ Sotoyome St	<ul style="list-style-type: none"> At Memorial Hospital and adjacent to numerous medical offices Major employment-visitor base Bikeable to many destinations and downtown At signalized crossing 	Sonoma Ave Class II bike lanes	Santa Rosa CityBus, SCT	Commute, midday trips
Phase 2					
SR 9	Range Ave/ Jennings Ave	<ul style="list-style-type: none"> Surrounded by high density housing Adjacent to planned bike boulevard 	Planned: Jennings Bike Blvd, SMART path	-	Commute, school, shopping, recreational

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Location	Cross Streets	Benefits	Bike Facilities	Transit Providers	Potential Trip Purposes
SR 10	TBD	<ul style="list-style-type: none"> • Within Southeast Greenway plan area on land formerly designated for Highway 12 freeway • Southeast Greenway plan about to commence; vision may include separate bike/ped facilities along greenway with mixed-use node at Hoen Avenue 	-	Santa Rosa CityBus	Commute, recreational
SR 11	Stony Point Rd/ West 9 th St	<ul style="list-style-type: none"> • Adjacent to large employment center (Sonoma County) • Proximity to high density housing • Next to signalized crossing 	Class II bike lanes on Stony Point Rd, Santa Rosa Creek trail	Santa Rosa CityBus	Commute, shopping, midday trips
SR 12	Range Ave/ State Farm Dr	<ul style="list-style-type: none"> • Surrounded by high density housing • Bikeable distance to retail/services • NIN mapping indicates high demand 	Class II bikes lanes on Range Ave	Santa Rosa CityBus, SCT	Commute, shopping, school
SR 13	3 rd St/ Wilson St-Railroad St (Hyatt Hotel)	<ul style="list-style-type: none"> • Major hotel with conference facilities • Future growth of hotel planned plus another hotel across the street 	Prince Memorial Greenway path, bike network	Santa Rosa CityBus	Tourism, recreational

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Location	Cross Streets	Benefits	Bike Facilities	Transit Providers	Potential Trip Purposes
Rohnert Park					
RP 1	Sonoma State University (SSU)	<ul style="list-style-type: none"> 9,400 student enrollment Planned growth to 20,000 students 3,000 students live on campus, many without cars 	Class II bike lanes on E Cotati Ave, Copeland Creek trail	SCT	Commute, shopping, recreational
RP 2	Rohnert Park Expressway/ SMART	<ul style="list-style-type: none"> SMART station Adjacent to future high-density housing and mixed-use Adjacent to major shopping center NN mapping indicates high demand 	Class I bike paths along Rohnert Park Expressway & Copeland Creek, SMART path	SMART, SCT	Commute, school, shopping, recreational
RP 3	State Farm Dr/ Professional Center Dr	<ul style="list-style-type: none"> Large employment core More than 0.5 miles from shopping center but bikeable 	Hinebaugh Creek bike trail	SCT	Commute, shopping, midday trips
RP 4	Commerce Blvd/ Avram Ave	<ul style="list-style-type: none"> At City Hall Adjacent to high density residential Creek trails nearby 	Class II bike lanes on Commerce Blvd, Creek trail	SCT	Commute, shopping, recreational, midday trips
Phase 2					
RP 5	State Farm Dr/ Padre Pkwy	<ul style="list-style-type: none"> Mixed-use area Planned for additional mixed-use growth 	Hinebaugh Creek bike trail	SCT	Commute, school, shopping
RP 6	Doubletree Hotel	<ul style="list-style-type: none"> Major hotel with conference facilities Easily accessible to future SMART multi-use path, bikeable to Central Rohnert Park area 	Future SMART path, Class II bike lanes on Golf Course Dr		Tourism, recreational

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Location	Cross Streets	Benefits	Bike Facilities	Transit Providers	Potential Trip Purposes
Cotati					
COT 1	E Cotati Ave/ SMART	<ul style="list-style-type: none"> • SMART station • Adjacent to high-density housing and future infill multifamily housing • NNN mapping indicates high demand 	Class II bike lanes on E Cotati Ave, SMART path	SMART, SCT	Commuter, school, shopping
<i>Phase 2</i>					
COT 2	Old Redwood Hwy/ Charles St	<ul style="list-style-type: none"> • Small downtown core • Future mixed-use growth 	Class II bike lanes on E Cotati Ave & Old Redwood Hwy	SCT, GGT	Shopping, recreational
COT 3	Old Redwood Hwy/ William St	<ul style="list-style-type: none"> • Future mixed use growth and higher density housing envisioned by Downtown Specific Plan 	Class II bike lanes on E Cotati Ave and Old Redwood Hwy	SCT, GGT	Shopping, recreational

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Location	Cross Streets	Benefits	Bike Facilities	Transit Providers	Potential Trip Purposes
Petaluma					
PET 1	Lakeville St/ E Washington St	<ul style="list-style-type: none"> • SMART station • In vicinity of residential and retail • Adjacent to signalized intersections 	Class II bikes lanes on Lakeville St	SMART, Petaluma Transit, SCT, GGT	Commute, shopping, tourism, recreational
PET 2	Petaluma Blvd/ Western Ave	<ul style="list-style-type: none"> • Downtown core, retail and employment • Central activity area • NNN mapping indicates high demand 	Class III bike route on Petaluma Blvd, Planned future off-street paths around turning basin	Petaluma Transit, GGT, SCT	Commute, shopping, tourism, recreational, midday trips
PET 3	D St/ First St	<ul style="list-style-type: none"> • Near multi-family housing and employment • Convenient to south downtown area • NNN mapping indicates high demand • Next to signalized intersection 	Class III bike route on D Street	-	Shopping, recreational, midday trips
PET 4	4 th St/ D St	<ul style="list-style-type: none"> • At Post Office • Serves portion of downtown employment • Adjacent to residential areas • NNN mapping indicates high demand 	-	GGT, SCT, Petaluma Transit	Commute, shopping
Phase 2					
PET 5	Corona Rd/ SMART	<ul style="list-style-type: none"> • Future SMART station • Adjacent to future multi-family housing • Bikeable to significant employment in Redwood Business Park area 	SMART path	SMART, SCT	Commute, shopping

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Location	Cross Streets	Benefits	Bike Facilities	Transit Providers	Potential Trip Purposes
PET 6	TBD	<ul style="list-style-type: none"> Central to future multi-family housing development (several hundred units) Bikeable to SMART station 	Lynch Creek Path (major east-west crosstown bike trail)	SCT, GGT, Petaluma Transit	Commute, school, shopping
PET 7	Second St/ H St	<ul style="list-style-type: none"> Foundry Wharf area Core of residential and employment Expected increase in density Adjacent cafe popular with biking community 	-	-	Commute, school, shopping, midday trips
PET 8	Copeland St between E Washington & East D	<ul style="list-style-type: none"> At bus transit/transfer center Proposed adjacent high density housing/mixed use Developer expressed interest in bike share 	-	Petaluma Transit, SCT, GGT	Commute, shopping
PET 9	N McDowell Blvd north of Willowbrook Creek	<ul style="list-style-type: none"> Central to several corporate campuses Bikeable to retail/services NN mapping indicates high demand 	Class II bike lanes on Old Redwood Hwy	SCT	Commute, shopping, midday trips
PET 10	Near Caulfield Ln & Hopper St	<ul style="list-style-type: none"> Future mixed-use development including office, hotel, multi-family residential Adjacent to bike facilities and future bridge over Petaluma River Bikeable to downtown and SMART station 	Future SMART path	-	Commute, school, shopping, recreational
PET 11	Near Lakeville Hwy/ Baywood Dr	<ul style="list-style-type: none"> Petaluma Marina - boat ramp and recreational boaters Potential for bike trips to be made to downtown Large existing office and major hotel with proposed infill onsite (90 units of multi-family) Connectivity to bike trails (planned) 	Bike trails (planned)	SCT, Petaluma Transit	Tourism, recreational, midday trips

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Appendix C Electric Bicycle Share Systems

Overview

Electric bike share systems operate just like a regular bike share, but with electric motors that kick in to help with pedaling. Electric assist bicycles “pedelecs” allow more people to travel further, especially in hilly terrain. Because of the need to recharge, existing pedelecs systems use fixed dock-based systems. Organizational and funding model options for non-motorized systems also apply to pedelecs share systems; however, infrastructure requirements and faster speeds add variables to bike share considerations.

Advantages and Challenges to Electric Bike Share Systems

Advantages	Challenges/Issues
<ul style="list-style-type: none"> ▪ Pedelecs appeal to those who prefer not to break a sweat or who may have physical challenges that prohibit them from riding a non-motorized bike. ▪ Pedelecs offer solutions for longer trips and may appeal to a wider array of users. While non-motorized bike share systems target geographic areas where average trip distances average under 3.5 miles, pedelec share systems can cover larger service areas. ▪ The ability to travel at faster speeds and with less physical demand on pedelecs make trips in areas with more dispersed land use patterns more convenient. 	<ul style="list-style-type: none"> ▪ Pedelecs travel much faster than regular bikes but can look very similar, which could pose a danger to pedestrians other bikers. ▪ A pedelec share system may need to consider the logistics of lending helmets with e-bikes, due to a California state law requiring helmets for e-bike riders. ▪ Pedelec bike share systems are more expensive than the non-motorized systems, with added costs for charging stations and the bikes themselves. ▪ Charging dock stations must have a power source, which could cost more and require construction. ▪ Like all electric vehicles, pedelecs have a limited range requiring trips and charge time to be planned accordingly.

Peer Systems

While electric bike share systems are not yet widespread in the United States, two large-scale systems have recently emerged. In 2015, Zyp BikeShare in Birmingham started with 40 stations and 400 bikes, 100 of which are pedelec bikes made by Bewegen. Baltimore Bike Share launched a system with a combined fleet of 300 standard and 200 Bewegen electric bikes at 50 stations in 2016.

Electric Bike Share Docking and Charging Station

