Highway 101, Fortuna Downtown and Riverwalk Area Complete Streets and Connectivity Planning Study

Study Report

November 4, 2016

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Prepared for:
Humboldt County Association of Governments
City of Fortuna

In Partnership with:
Caltrans
County of Humboldt

Prepared by:
GHD Inc.

In Association with:
Morrison Structures
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Redwood Community Action Agency
TrailPeople

Funded by:
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1. Introduction

1.1 Scope

This Project Report is a planning study modified from the Caltrans Project Study Report (PSR) format. It is intended to provide an assessment of design alternatives to improve connectivity between U.S. Highway 101 (US 101) and important destinations in the City of Fortuna (the City), including downtown and the Riverwalk Area. The goals of the design alternatives are to improve traffic flow and resolve existing conflicts between pedestrians, bicyclists and motorists. This report is the culmination of preliminary engineering, environmental, landscape architectural studies and community meetings conducted over an eight month period from January through August 2016. In addition to initial site assessment, the following project elements were also considered: right-of-way investigations, opportunities and constraints analyses, public outreach, design alternatives development and analysis, cost estimates, phasing, and timing.

To implement this project, in 2015, the City was awarded a Sustainable Communities Planning Grant, made possible by funding from the California Department of Transportation (Caltrans) to the Humboldt County Association of Governments (HCAOG). GHD Inc. (GHD) and key teaming partners were subsequently contracted by the City to conduct the work presented herein. The GHD project team included: Omni-Means, Trail People, Redwood Community Action Agency (RCAA), Ontiveros & Associates, and Morrison Structures.

The process for the study follows the steps established in Figure 1. After collecting data and investigating the site, the Project Team analyzed existing conditions with consideration of current design standards and project goals. Opportunities and constraints were observed, and alternatives to achieve project goals were proposed. These were presented at a community meeting. These concepts were refined and presented at a second community meeting. The findings of this work are then summarized in the Project Report. Final presentations will be made to the City and HCAOG.

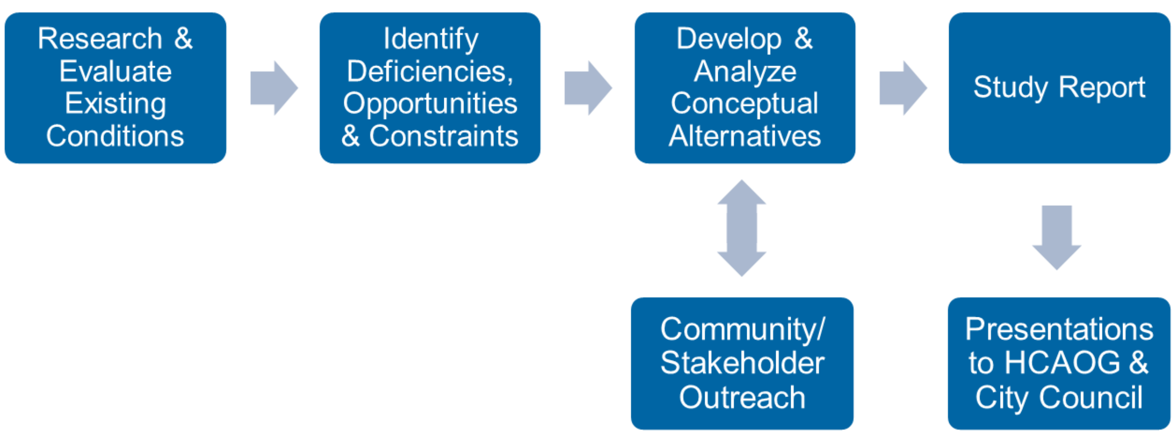


Figure 1: Study Process

2. Background

2.1 Caltrans Grants and HCAOG Funding

The City was successful in their application for a Caltrans Sustainable Communities Planning Grant and was awarded funding for the *US 101, Downtown, and Riverwalk Connectivity Planning Study*. Upon request from Caltrans, and agreement with the City, Humboldt County Association of Governments (HCAOG) agreed to be the lead applicant for this project with the City as a sub-applicant. This application arrangement was established in order to minimize the contracting process and administrative burden to the City. The project was supplemented with excess Rural Planning Assistance (RPA) funds awarded to HCAOG. In addition, the City contributed an in-kind match of staff time.

2.2 Recent Projects

In 2014, the City completed the John Campbell Memorial Greenway and Strongs Creek Trail Final Master Plan which outlined the proposed linear park along the bank of Strongs Creek. The concept includes a paved pedestrian and bicycle route through the city between US 101 and Rohnerville Road. The route is intended to provide convenient east-west connection from the southern end of the Riverwalk area to the Headwaters Forest Reserve and City destinations in between. The Master Plan includes a concept design for improving bike and pedestrian access through the Kenmar Road/US 101 undercrossing.

The City was awarded Safe Routes to School funding in 2014 for pedestrian and bike improvements near Ambrosini Elementary School and Toddy Thomas Middle School. The project's goals were to create safer, more pedestrian and bicycle friendly routes, and to encourage students to bike and walk to school. Proposed improvements included new sidewalks, curb ramps, and enhanced pedestrian crossings. In addition, proposed improvements included reducing the number of travel lanes on Ross Hill Road from two lanes in each direction to one lane in each direction, the addition of buffered bike lanes, and extending the northbound left turn lane at the intersection with Kenmar Road. As of October 2016, the construction phase of the project is expected to be awarded in December 2016 with construction planned for the summer of 2017.

2.3 Fortuna General Plan 2030 (2010)

The City of Fortuna General Plan 2030 (General Plan) formalizes a long-term vision for the City's physical development. It outlines policies, standards, and programs to guide day-to-day decisions concerning future development. This project is consistent with, and helps to implement, the following four vision statements from the plan:

- To establish a dynamic waterfront that is easily accessible, offers scenic and recreational opportunities, and provides development complementary to the riverfront.
- To provide convenient access to parks and recreational, community, and public facilities and services for all residents.
- To create extensive open space/trail network along the Eel River and creeks throughout the city.

- To promote a multi-modal transportation system (i.e., roadways, bike paths, sidewalks) that will provide strong connectivity among neighbourhood's and districts, is free of congestion, provides convenient transit opportunities, and greater safety for pedestrians and motorists.

One of the key issues identified in the General Plan is the need to enhance the relationship between the City and the Eel River Waterfront. The US 101/Riverwalk Area Connectivity Project is a direct response to this issue.

2.3.1 Policies

This project fulfils or meets many policies set forth in the General Plan, including specific direction to improve interchanges within the study area. These policies are detailed below.

Roadways and Highways

Policy TC-1.1 Reducing Mode Conflicts. The City shall seek to minimize conflicts between pedestrians, automobiles, and bicycles.

Policy TC-1.2 New Roadway Improvements. The City shall design and phase roadway improvements so that a level of service (LOS) C or better is maintained on all City streets, except that LOS D or better shall be maintained on Main Street.

Policy TC-1.3 Balanced Transportation System. The City shall strive to meet the level of service standard through a balanced transportation system that provides alternatives to the automobile and by promoting pedestrian, bicycle, and transit connections between employment areas and major residential and commercial areas.

Policy TC-1.4 Improved LOS. The City shall identify economic, design, and planning solutions to improve levels of service currently below LOS C. Where physical mitigation is infeasible, the City shall consider developing programs that enhance alternative access or otherwise reduce automobile travel demand.

Policy TC-1.15 Interchange Improvements. The City, through HCAOG in cooperation with Caltrans, shall allocate the costs for funding interchange improvements to areas of benefit and assign proportionate share costs to individual projects.

Policy TC-1.20 Interchange Improvements. The City shall encourage the realignment of the US 101 southbound on- and off-ramps, together with Riverwalk Drive and Dinsmore Drive at the 12th Street interchange as new development increases the level of traffic.

Bicycle and Trail Facilities

Policy TC-5.2 Bicycle System. The City shall develop and maintain a safe, convenient, and effective bicycle system that encourages increased bicycle use.

Policy TC-5.5 Rails-to-Trails. The City shall explore the concept of converting any abandoned railroad rights-of-way into multi-use bike and pedestrian paths for local and regional use per Sections 2540 through 2549 of the Streets and Highways Code.

Pedestrian Facilities

Policy TC-4.2 New Developments. The City shall continue to require new development to finance and install sidewalks and pedestrian pathways connecting them to existing sidewalks or widening the right-of-way fronting the development to accommodate new sidewalks.

Policy TC-4.3 Specific Plans. The City shall encourage specific development plans to include design continuity of pedestrian access that enables residents to walk from their homes to places of work, recreation, and shopping.

Policy TC-4.7 Pedestrian Trails Interconnection. Where feasible, the City shall loop and interconnect pedestrian trails.

The General Plan proposes a Class I bike path on Kenmar Road west of the interchange, a trail along the existing rail corridor, and a Class I bike path near Eel River Drive. Class II bike lane routes are proposed at the 12th Street interchange, 12th Street and Riverwalk Drive. The "rail with trail" in which a bike trail runs parallel to a rail road is proposed to cross 12th Street at the 12th Street near Newburg Road.

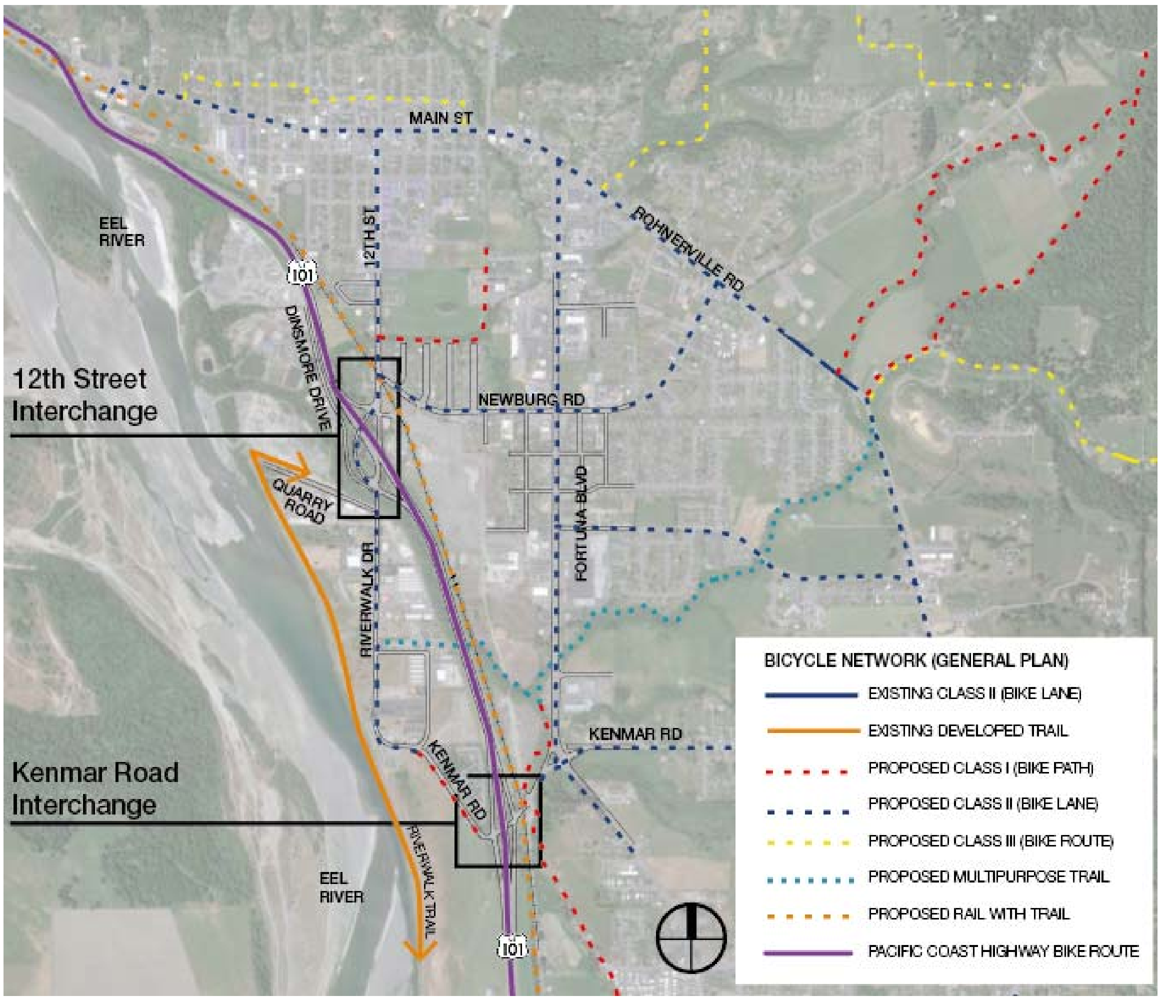


Figure 2: Bicycle Network

2.3.2 Land Use Designations

The City General Plan land use designations in the vicinity of the Kenmar Road area include agriculture, public open space and commercial, mixed use development in the Mill District. The land use designations around the Riverwalk Drive and 12th Street area include the Riverwalk Area, industrial, and Mill District. Specific land uses are identified in Section 4.

Mill District

The General Plan describes Mill District as “designated for single-use and vertical and horizontal mixed-use development as part of a large, integrated center. Uses may include large-scale retail and services, restaurants, entertainment venues, professional and administrative offices, residential units, compatible light-industry, public and quasi-public, and similar and compatible uses.”

Riverwalk District

The General Plan describes the Riverwalk District as "designated for single-use and mixed-use development oriented toward the Eel River. Uses may include retail and service establishments, hotels and conference centers, restaurants, entertainment venues, professional and administrative offices, public and quasi-public uses, and similar and compatible uses."

3. Purpose and Need

3.1 Purpose

The goals of the planning study are to

- Improve access to Riverwalk area for all users (motorized & non-motorized)
- Increase capacity and reduce vehicle queuing/delays
- Improve safety for all users
- Apply Complete Streets concepts and create an entry statement/gateway
- Ready project for next steps in project development

3.2 Need

Humboldt County's most significant regional thoroughfare for economic, tourist, recreational and commuting activity is US 101. The City is divided by US 101, which parallels the Eel River, and separates the river and the Riverwalk Area from the majority of the City. The City and HCAOG desire to enhance the connectivity at two US 101 interchanges to facilitate better access to the City, downtown, and the Riverwalk Area.

These interchanges could act as gateways for the City, introducing and orienting visitors to the City and its amenities, but their complex configuration is challenging for visitors to navigate. The interchanges are significant barriers to bicycle and pedestrian circulation. These interchanges were not designed according to current standards and are either experiencing operational problems, or are unable to accommodate the future travel needs of roadway users. The interchanges also lack directional legibility, making it difficult for visitors to access the City's existing amenities.

Downtown and the Riverwalk Area are valued city districts. By enhancing the legibility of gateways and improving 12th Street between Downtown and the Riverwalk Area, US 101 users will gain better and safer access to these areas, and be more likely to include downtown in their visit, benefiting local businesses. Local residents will benefit in terms of transportation alternatives and active living opportunities. The potential exists for these areas to better serve users, and to mutually support the fulfillment of the economic development and land use goals of the General Plan.

4. Existing Conditions

4.1 Study Area

The study area (Figure 3) is comprised of two units:

- 12th Street near the US 101 interchange
- the Kenmar Road and US 101 interchange

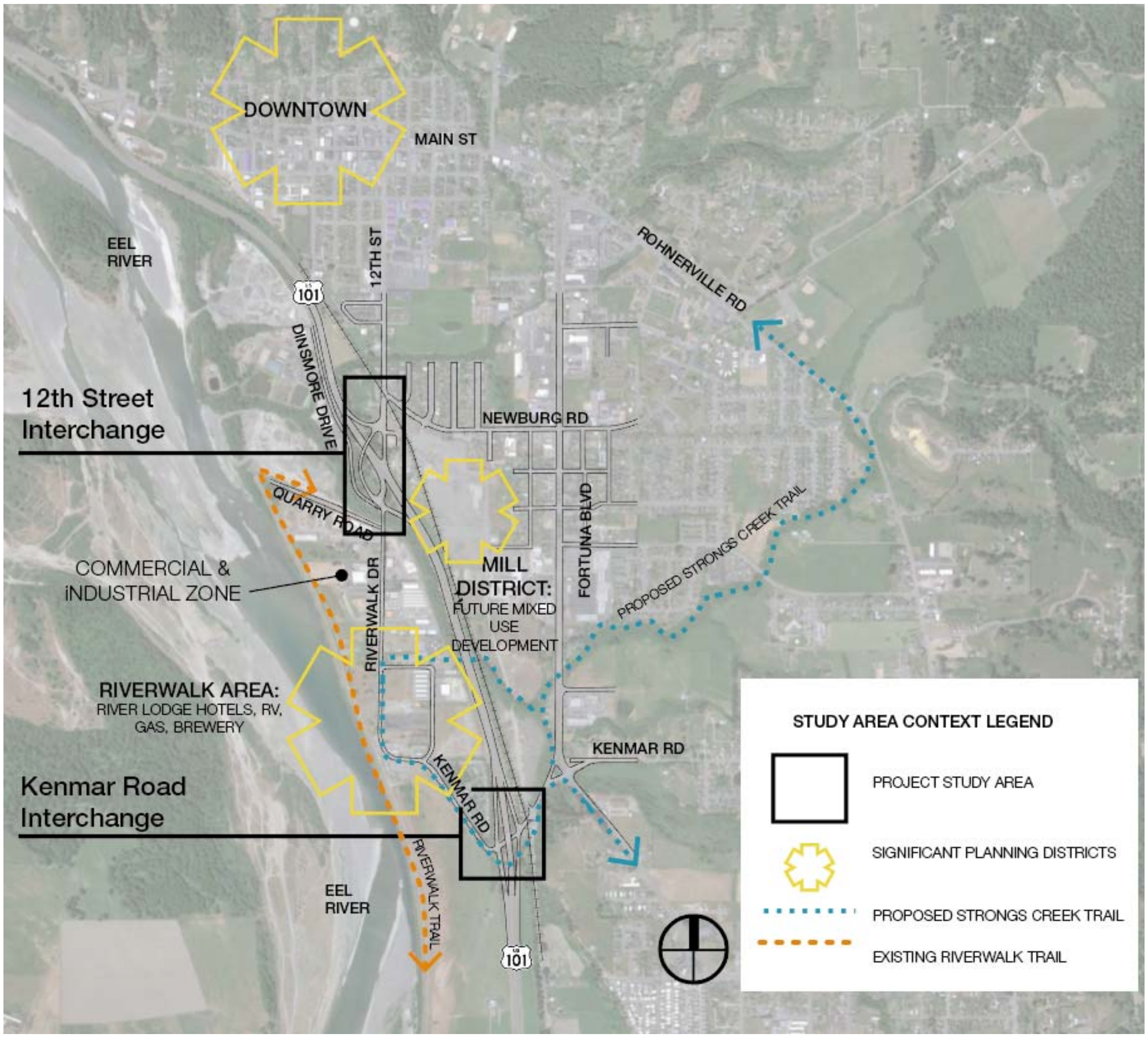


Figure 3: Study Areas Context Map

112th Street Interchange Study Area Description

The 12th Street Interchange study area (Figure 4) includes a reach of 12th Street from north of Newburg Road to Riverwalk Drive south of the US 101 interchange. 12th Street crosses US 101 via a curving 32-foot wide over-crossing, with two 14-foot lanes and two two-foot raised concrete shoulders. The interchange at 12th Street has a significant distance between the southbound (SB) and northbound (NB) ramps intersections. However, the corridor on the south side of US 101 has several closely spaced intersections.

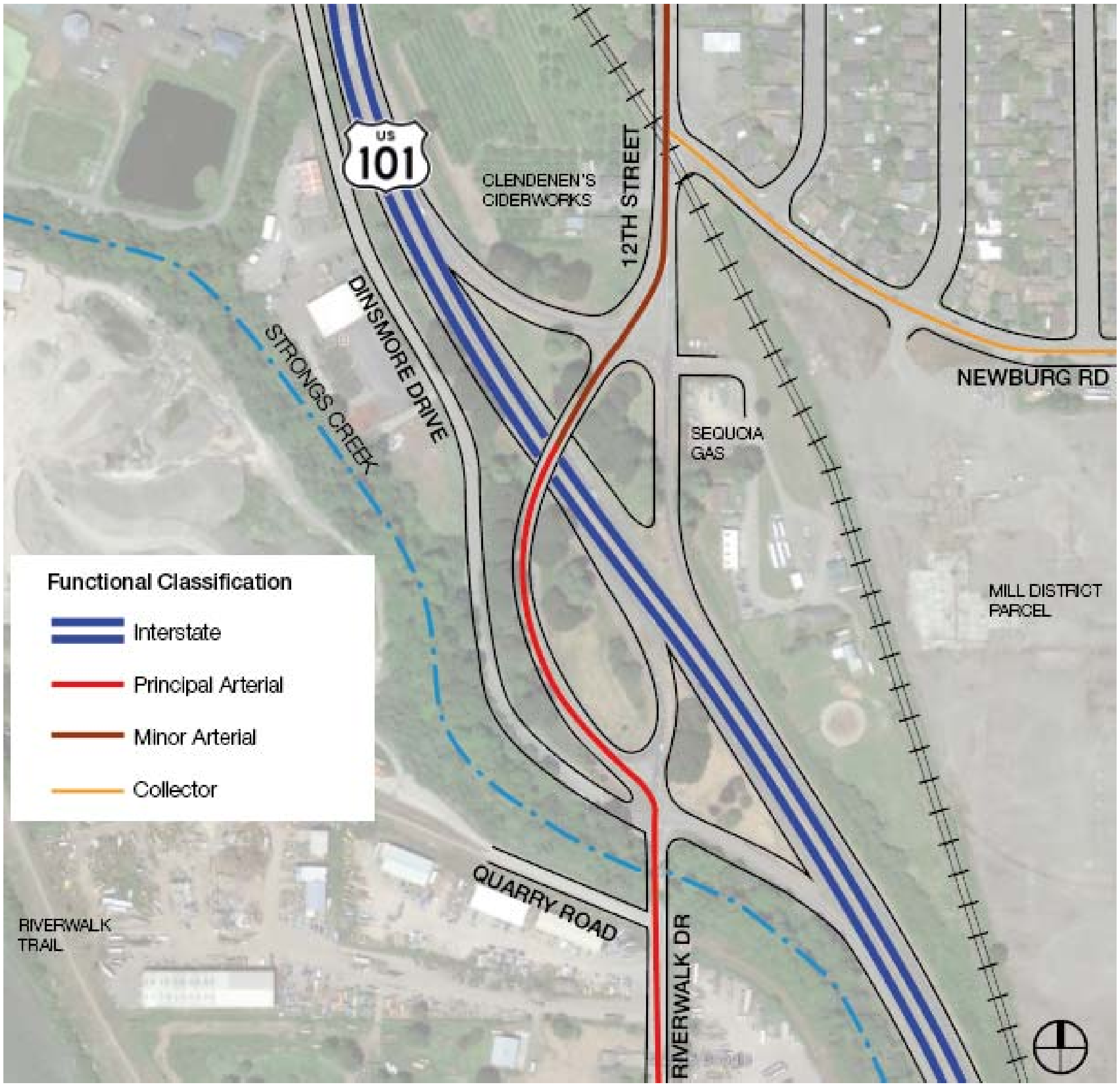


Figure 4: 12th Street Study Area and Functional Classification

Riverwalk Drive is a north-south principal arterial with intersections at private driveways, Dinsmore Drive, and US 101 SB ramps. The close proximity of Dinsmore, 12th Street, the US 101 SB on-ramp, and Strongs Creek create wayfinding confusion. These intersections could be interpreted as one five-leg intersection. There are no bike or pedestrian facilities in or around the intersections along Riverwalk Drive, with the exception of a stretch of sidewalk on the east side south of Strong's Creek. Riverwalk Drive transitions into 12th Street and crosses over US 101. This overcrossing is approximately 28-feet wide with no shoulders or sidewalks.

On the north side of US 101, there are a series of complex intersections with an at-grade railroad crossing. 12th Street branches off to intersect the US 101 NB off-ramp with Pond Street and intersects the US 101 NB on-ramp at a separate intersection approximately 100 feet to the west. There is a short length of Pond Street that connects these two intersections. Newburg Road intersects 12th Street approximately 500 feet to the north. There are no bike or pedestrian facilities in or around these intersections, with the exception of the sidewalk at the northeast corner of 12th Street and Newburg Road. Utility poles and vegetation sporadically reduce the usable area of the sidewalk to approximately three feet in width. 12th Street from just north of Newburg Road to Main Street is an approximately 48-foot wide two lane road with on street parking and five-foot curb and sidewalks. South of US 101, Riverwalk Drive is a two lane street with parking and a sidewalk on the east side. North of the freeway, 12th Street widens to have two lanes with parking and sidewalks on both sides.

Access roads and driveways are associated with this length of 12th Street: the Clendenen's Ciderworks, Tom's Pizza, Oil Well Lube Center, Mercer Fraser Company, Eel River levee road, and Eel River Scrap and Salvage.

Riverwalk Drive between the Kenmar and 12th Street interchanges is approximately 36 feet wide, consisting of two lanes with 12 foot striped shoulders and parking on the east side, and a 14 foot lane with no striped shoulder on the west. There are intermittent segments of five foot wide sidewalks. The existing NB off-ramp and on-ramp meet to form a large asphalt triangle with 12th Street. The SB on-ramp and off-ramp at 12th Street lacks directional clarity. This stretch of road also lacks sense of place, co.

Caltrans's California Road System (CRS) maps show that 12th Street is classified as a minor arterial which connects to Riverwalk Drive, a major collector. 12th Street connects the Riverwalk Area to the City's south,and to downtown, including Main Street area and schools. The 12th Street arterial also connects Riverwalk Drive to residential areas to the north.

Kenmar Interchange Study Area

The Kenmar study area is focused on Kenmar Road from about 250 feet west of the US 101 SB off-ramp to about 365 feet north east of the NB off-ramp (Figure 6). Kenmar Road crosses under US 101, where the highway occupies parallel SB and NB bridges above grade. Within a short distance (approximately 500 feet), Kenmar Road has three intersections: at the SB on and off-ramps, the NB on and off-ramps, and at Eel River Drive. The Fortuna Park and Ride, which includes a bus stop for the Redwood Transit Main Line, is off Eel River Drive. A railroad crosses the road on the east side of US 101 between the NB on-ramp and off-ramp, and Eel River Drive intersection.

Figure 5: View of Kenmar Road Undercrossing

Kenmar Road consists of one vehicular travel lane in each direction with paved shoulders. The road varies in right-of-way and geometry due to intersections with Eel River Drive and South Fortuna Boulevard within 900 feet east of the Kenmar interchange. The current roadway configuration of the underpass consists of two 12 foot lanes, with eight foot shoulders, and a guard rail. The current roadway configuration is shown inFigure 5.

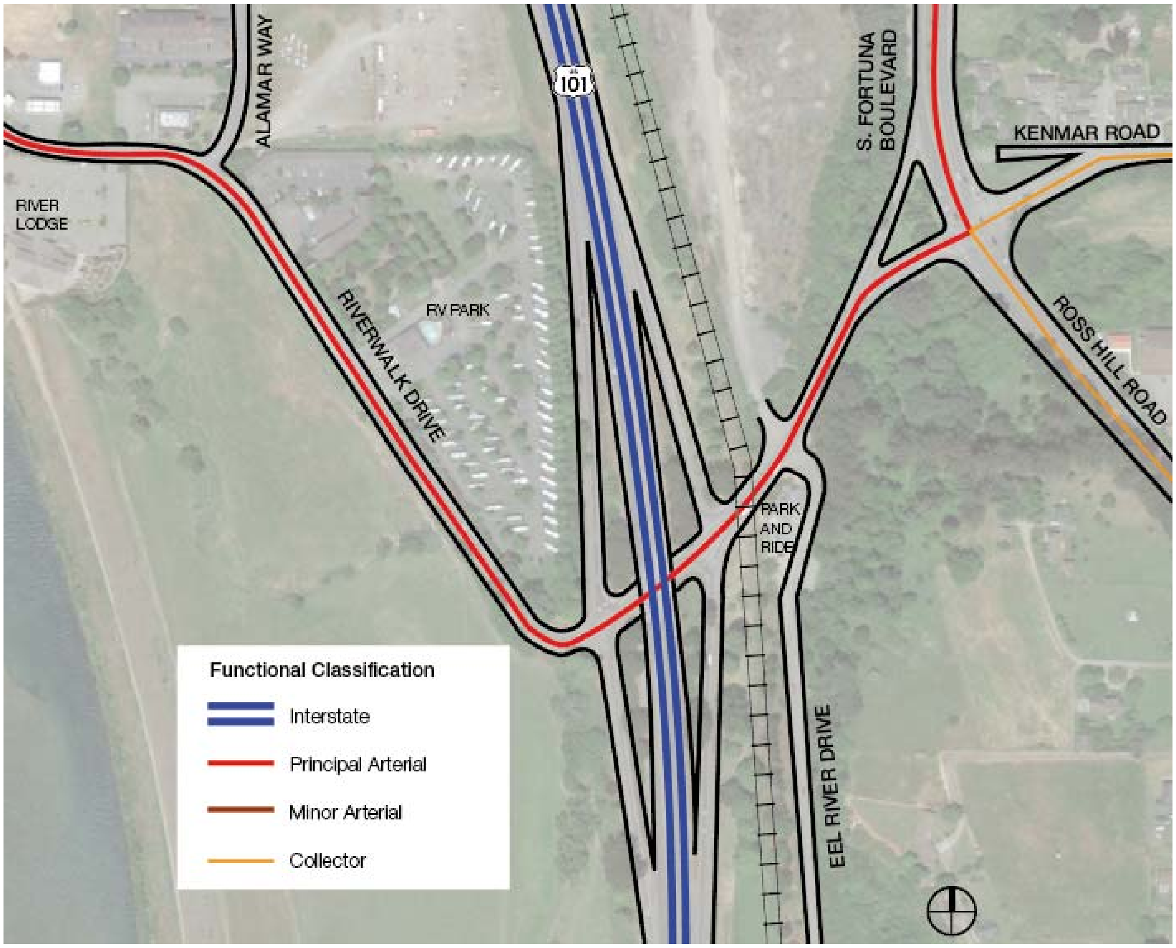


Figure 6: Kenmar Road Study Area and Functional Classification

There are no designated pedestrian or bicycle facilities through the Kenmar Road corridor. However, there is a well-worn path behind the guardrail on the north side of the Kenmar Road underpass. This indicates that this area would benefit from the provision of an accessible path or sidewalk. The intersection of Kenmar Road and US 101 SB Ramps is stop-controlled for the US 101 SB off-ramp and the eastbound approach of Kenmar Road. Left turns at the US 101 NB off ramp at Kenmar Road is stop controlled, with yield control only for the right turn.

There is a significant grade differential between Kenmar Road and the agricultural field to the south around the horizontal curve; guardrail is currently provided at the edge of travel way.

The US 101 interchange at Kenmar Road is at the southern boundary of the City. Many tourists first experience the City from this exit, but there is no immediate sense of City identity or entry. Also, pedestrian and bicycle infrastructure is mostly absent from this area, except for bike lanes at the Kenmar Road underpass. The bike lanes at this location have no signage, control or connection to continuing facilities. Kenmar Road at the Kenmar Interchange is classified as a principal arterial according to the CRS maps, connecting to Riverwalk Drive west of the interchange.

4.2 Right-of-Way and Property Ownership

Road widths, rights-of-way, adjacent parcel ownerships and maintenance responsibilities all play roles in identifying feasible design solutions. These factors were researched and mapped to the extent practicable for this study. In some cases it was difficult to confirm ownership of a parcel or otherwise obtain information to ascertain right-of-way widths. Comprehensive rights-of-way for design purposes will require additional investigation.

Research indicates that street widths within the study area vary along their lengths. The findings are summarized in this Section, and are presented in detail in Appendix A. The various rights-of-way associated with the study areas are depicted in Figure 7 and Figure 8. Permissions related to rights-of-way will need to be obtained, as the project moves forward.

12th Street Interchange Study Area

Right-of-way Widths

North of the railroad tracks, 12th Street right-of-way is 60 feet wide. South of the railroad tracks, the street is indicated to be 75 feet wide. Newburg Road varies in width from 40 to 50 feet.

Ownership

A railroad corridor owned by the North Coast Railroad Authority (NCRA) cuts through the project site. While Caltrans owns 12th Street from the interchange to just south of the railroad, Humboldt County has a pavement maintenance agreement from 50 feet south of the railroad to Dinsmore Drive. Dinsmore Drive at the north end of Riverwalk Drive is indicated as being in Humboldt County ownership. However, there is also documentation describing annexation of Strong's Creek Road (Dinsmore Drive) by the City. The ownership of Strong's Creek bridge and exact limits of this annexation will need to be determined in the future as the project develops.

The rights-of-way through the 12th Street interchange are largely publicly held by the City, County, or State. Dinsmore Drive provides access to the public Fortuna Dog Park and industrial land uses such as the Fortuna Waste Water Treatment Plant. The northeast quadrant of the interchange is designated for industrial land use and is owned and occupied by Sequoia Gas Company. Clendenen's Cider works, an agricultural land use, is located on the northwest quadrant.

Kenmar Interchange Study Area

Right-of-way Widths

The width of Riverwalk Drive right-of-way west of US 101 has been determined to be 50-feet between the back of the walk on the east side and top of slope on the west side.

Ownership

The right-of-way at the Kenmar Road interchange is mostly owned by public entities: the City, County of Humboldt (the County), and Caltrans. The underpass is owned by Caltrans and maintained by the County. The undeveloped Mill District Parcel is privately owned and accessed from the northern leg of Eel River Drive. Commercial land use (Riverwalk RV Park) is located southwest of the interchange. The railroad crosses Kenmar Road between the northbound ramps and the Eel River Drive intersection. This railroad is owned by the NCRA. Caltrans owns a small park and ride lot on the corridor. No definitive documentation of ownership for Kenmar Road east of US 101 could be located.

There are an array of agreements and surveys which have allowed paving projects and other activities to occur, however additional research and surveying for Kenmar Road and Eel River Drive and will be needed to determine right-of-way location. The east side of Riverwalk Drive is indicated to be in County ownership. The ownership of the west side of Riverwalk Drive is undetermined.

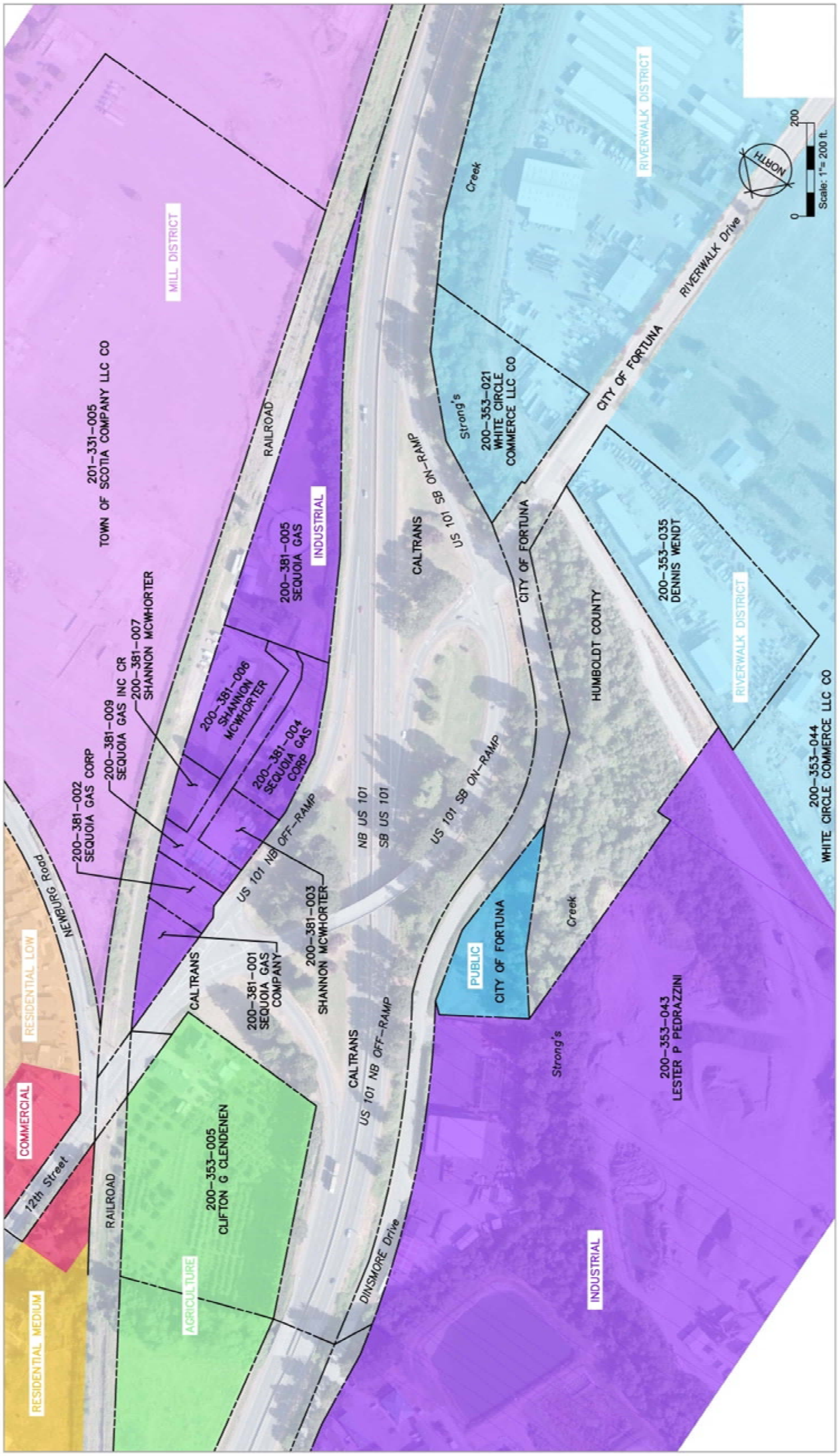


Figure 7: 12th Street Study Area Parcels

Figure 8: Kenmar Road Study Area Parcels

4.3 Environmental Conditions

An environmental reconnaissance study was conducted for the study area. The findings of the environmental study are reported in the Environmental Constraints Analysis. The Environmental Constraints Analysis is included in Section 9 Environmental Determination and Appendix B. This study included review of existing environmental literature and data from the California Natural Diversity Database (CNDDB) and California Native Plant Society (CNPS) Inventory of Rare and Endangered Vascular Plants, National Wetlands Inventory, and other mapping and data sources. A field investigation was also conducted for the study areas which visually documented potential wetlands or areas where special status species might be present.

The Environmental Constraints Analysis described the environmental setting of the 12th Street and Kenmar study areas, and detailed likely special status plants, animals, or habitats present in the area. A descriptive list of potential permits that may be needed to complete the project is also included in the Environmental Constraints Analysis.

The Strong's Creek through the 12th Street study area is a riparian area and protected habitat. A potential wetland within the freeway interchange was also noted for future investigation. Rohner Creek is near, but beyond the study area.

Within the Kenmar study area, riparian habitat is noted along the US 101 southbound off/on-ramp and Kenmar Road. A small potential wetland was identified in a landscape area near the railroad tracks on the south side of Kenmar Road between the US 101 northbound off-ramp and the Fortuna Park and Ride. Additionally, several redwood trees (*Sequoia sempervirens*) were identified

4.4 Roadway and Traffic Assessment

This section discusses the Level of Service (LOS) assigned to study area roadways, projected traffic needs, and data relevant to planning and integrating multi-modal facilities into the road infrastructure. Level of Service is a qualitative measure of traffic operating conditions, whereby a letter grade A through F is assigned to an intersection or roadway segment representing progressively worsening traffic conditions. For signalized intersections and All-Way Stop-Controlled (AWSC) intersections, the intersection delays and LOS are calculated average values for all intersection approaches and movements. For Two-Way Stop-Controlled (TWSC) intersections, the intersection delays and LOS is based on the calculated average delay for all movements of the worst-performing approach.

4.4.1 Traffic Analysis Methodologies

Intersection LOS Methodologies

The LOS for all intersection control types were calculated using the methods documented in the Transportation Research Board Publication Highway Capacity Manual, 2010. LOS definitions for different types of intersection controls are outlined in Table 1.

Table 1: Level of Service Criteria and Definitions for Intersections

Level of Service	Type of Flow	Delay	Maneuverability	Delay in Seconds	
				Signalized Roundabout	Unsignalized
A	Stable Flow	Very slight delay. Progression is very favorable, with most vehicles arriving during the green phase not stopping at all.	Turning movements are easily made, and nearly all drivers find freedom of operation.	< 10.0	< 10.0
B	Stable Flow	Good progression and/or short cycle lengths. More vehicles stop than for LOS A, causing higher levels of average delay.	Vehicle platoons are formed. Many drivers begin to feel somewhat restricted within groups of vehicles.	>10.0 and < 20.0	>10.0 and < 15.0
C	Stable Flow	Higher delays resulting from fair progression and/or longer cycle lengths. Individual cycle failures may begin to appear at this level. The number of vehicles stopping is significant, although many still pass through the intersection without stopping.	Back-ups may develop behind turning vehicles. Most drivers feel somewhat restricted	>20.0 and < 35.0	>15.0 and < 25.0
D	Approaching Unstable Flow	The influence of congestion becomes more noticeable. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high volume-to-capacity ratios. Many vehicles stop, and the proportion of vehicles not stopping declines. Individual cycle failures are noticeable.	Maneuverability is severely limited during short periods due to temporary back-ups.	>35.0 and < 55.0	>25.0 and < 35.0
E	Unstable Flow	Generally considered to be the limit of acceptable delay. Indicative of poor progression, long cycle lengths, and high volume-to-capacity ratios. Individual cycle failures are frequent occurrences.	There are typically long queues of vehicles waiting upstream of the intersection.	>55.0 and < 80.0	>35.0 and < 50.0

F	Forced Flow	Generally considered to be unacceptable to most drivers. Often occurs with over saturation. May also occur at high volume-to-capacity ratios. There are many individual cycle failures. Poor progression and long cycle lengths may also be major contributing factors.	Jammed conditions. Back-ups from other locations restrict or prevent movement. Volumes may vary widely, depending principally on the downstream back-up conditions.	> 80.0	> 50.0

Reference: 2010 Highway Capacity Manual

Traffic Modeling Methodology

Existing turning movement count data and segment average daily traffic (ADT) were collected by NDS for weekday AM and PM peak hours which were used to develop the project Synchro files. presents the study locations and intersection geometries. presents the existing peak hour volumes at the study intersections.

The no build and signal alternatives were analyzed using Synchro/Sim-traffic traffic analysis software, and the roundabout alternatives were analyzed using Signalised and unsignalized Intersection Design and Research Aid SIDRA analysis software. Synchro version 9 software (Trafficware) was used in the analysis and includes the latest methodology from Transportation Research Board Publication Highway Capacity Manual, Fourth Edition, 2010 (HCM 2010).

Synchro software also includes the SimTraffic software application, which simulates the Synchro models. For this project, SimTraffic is used to provide the queuing analysis. SimTraffic data is seeded into the network for 15 simulated minutes, and then recorded five runs of 60 simulated minutes. The 95th percentile queue lengths were determined for each lane group based on an average of the five recorded runs. The 95th-percentile queue is defined to be the queue length (in feet) that has only a 5-percent probability of being exceeded during the analysis time period. It is a useful parameter for determining the appropriate length of turn pockets.

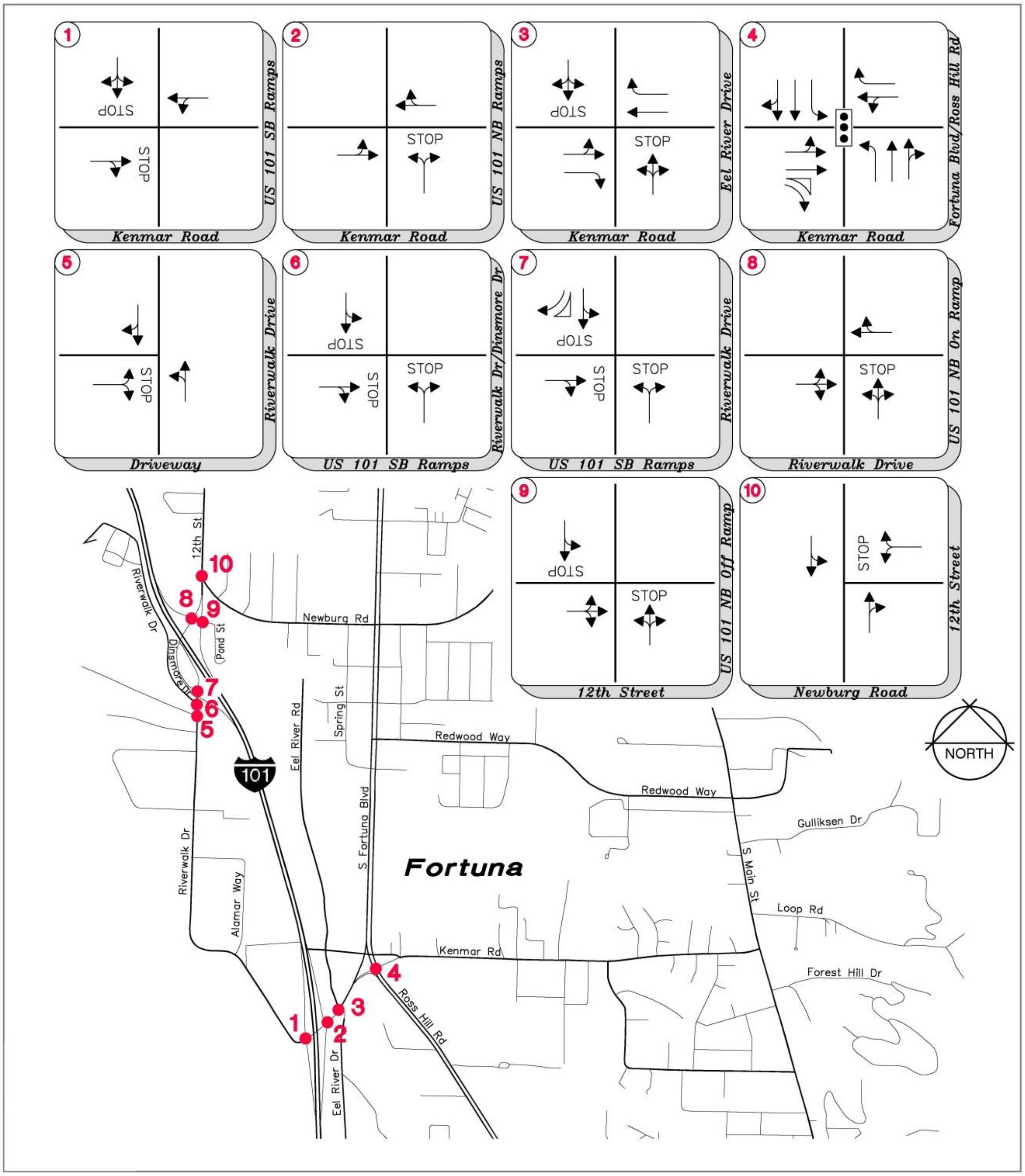


Figure 9: Existing Lane Geometrics

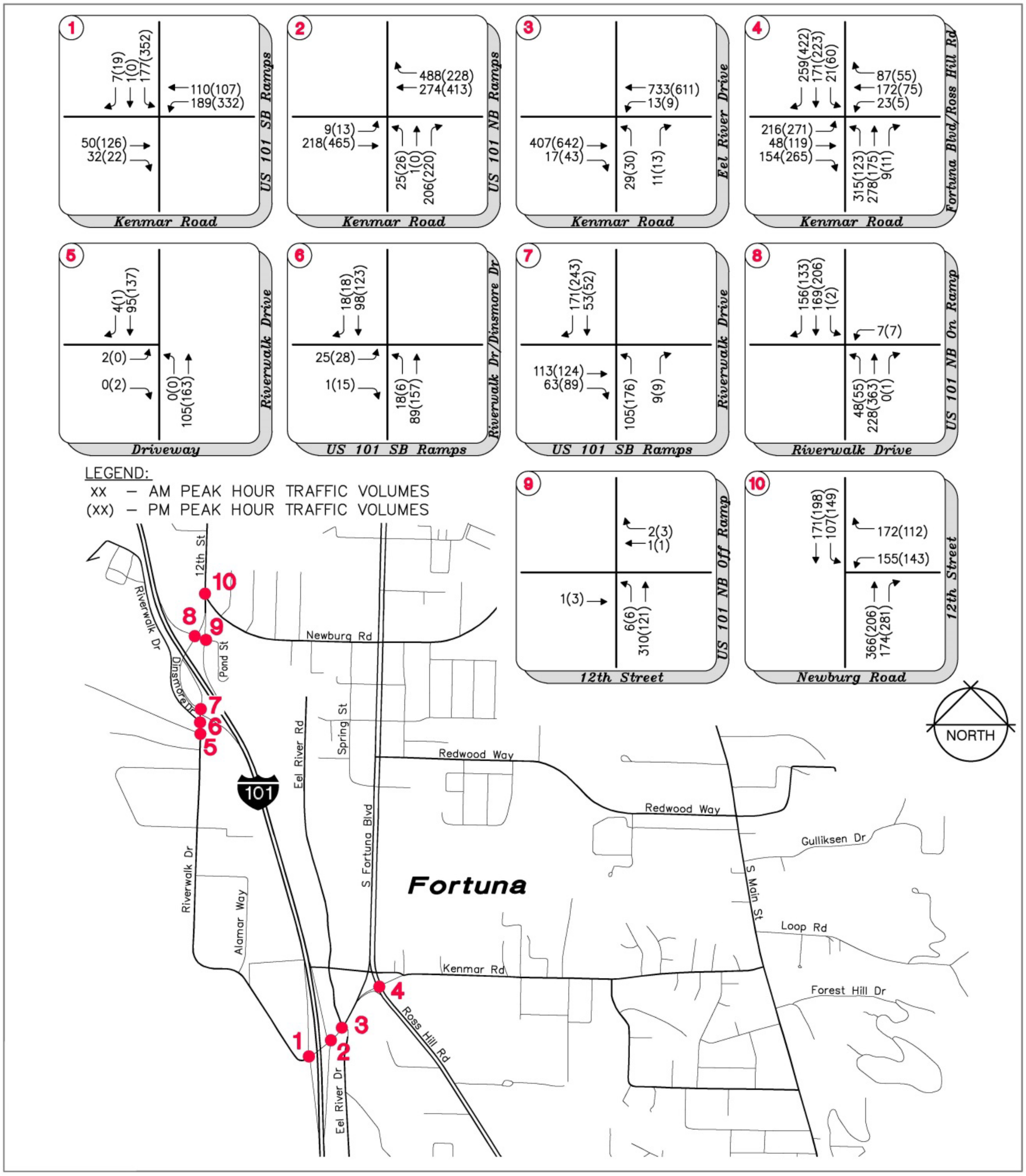


Figure 10: Existing Peak Hour Traffic Volumes

Consistent with Caltrans policies and City policies, LOS “C” has been taken as the general threshold for acceptable operations at study intersections and roadway segments maintained by the City, and the transition between LOS “C” and LOS "D" for acceptable operations at study intersections and roadways maintained by the State.

4.4.2 Study Locations

As shown on Figure 9 and Figure 10, the study intersections analyzed as a part of this project are:

1. Kenmar Road and US 101 Southbound Ramps

2. Kenmar Road and US 101 Northbound Ramps
3. Kenmar Road and Eel River Drive
4. Kenmar Road and S Fortuna Boulevard/Ross Hill Road
5. Riverwalk Drive and Private Driveway
6. Riverwalk Drive and Dinsmore Drive
7. Riverwalk Drive and US 101 Southbound Ramps
8. Riverwalk Drive/12th Street and US 101 Northbound On-ramp/Pond Street
9. 12th Street/US 101 Northbound On-ramp and Pond Street
10. 12th Street and Newburg Road

4.4.3 Counts

The AM and PM peak hour intersection turn movement traffic counts were collected by NDS at all study intersections in March 2016. The AM peak hour is defined as one-hour of peak traffic flow counted between 7:00 am and 9:00 AM. The PM peak hour is defined as one-hour of peak traffic flow counted between 4:00 pm and 6:00 PM.

4.4.4 Intersection Operations

Existing Weekday AM and PM peak hour intersection traffic operations were quantified utilizing the exiting traffic volumes and existing intersection lane geometrics and control. The following intersections are currently found to operate below the LOS C target:

- Kenmar Road and US 101 SB Ramps
- Kenmar Road and Eel River Drive
- 12th Street and Newburg Road

Table 2 provides a summary of the existing vehicular AM and PM peak hour intersection delay and LOS. The following intersections are currently found to operate below the LOS C target:

- Kenmar Road and US 101 SB Ramps
- Kenmar Road and Eel River Drive
- 12th Street and Newburg Road

Table 2: Existing Levels of Service (LOS)

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	**Kenmar Road and US 101 SB Ramps**	**TWSC**	**C**	**17.6**	**C**	**189**	**F**
2	Kenmar Road and US 101 NB Ramps	TWSC	C	10.8	B	14.4	B
3	**Kenmar Road and Eel River Drive**	**TWSC**	**C**	**37.9**	**E**	**37.7**	**E**
4	Kenmar Road and South Fortuna Boulevard/Ross Hill Road	Signal	C	30.8	C	19.2	B
5	Riverwalk Drive and Private Driveway	TWSC	C	10.1	B	9.1	A
6	Riverwalk Drive and Dinsmore Drive	TWSC	C	10.4	B	10.3	B
7	Riverwalk Drive and US 101 SB Ramps	AWSC	C	9.3	A	10.2	B
8	Rivewalk Drive/12th Street and US 101 NB On-Ramp/Pond Street	TWSC	C	16.7	C	16.1	C
9	US 101 NB Off-Ramp/12th Street and Pond Street	TWSC	C	11.8	B	9.8	A
10	**12th Street and Newburg Road**	**TWSC**	**C**	**106**	**F**	**26.6**	**D**
Notes:							
1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control							
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC and Signal							

4.5 Bicycle and Pedestrian Counts

HCAOG conducted bicycle and pedestrian counts for the project study area. The findings are presented in Figure 11, Figure 12, Table 3, and Table 4.

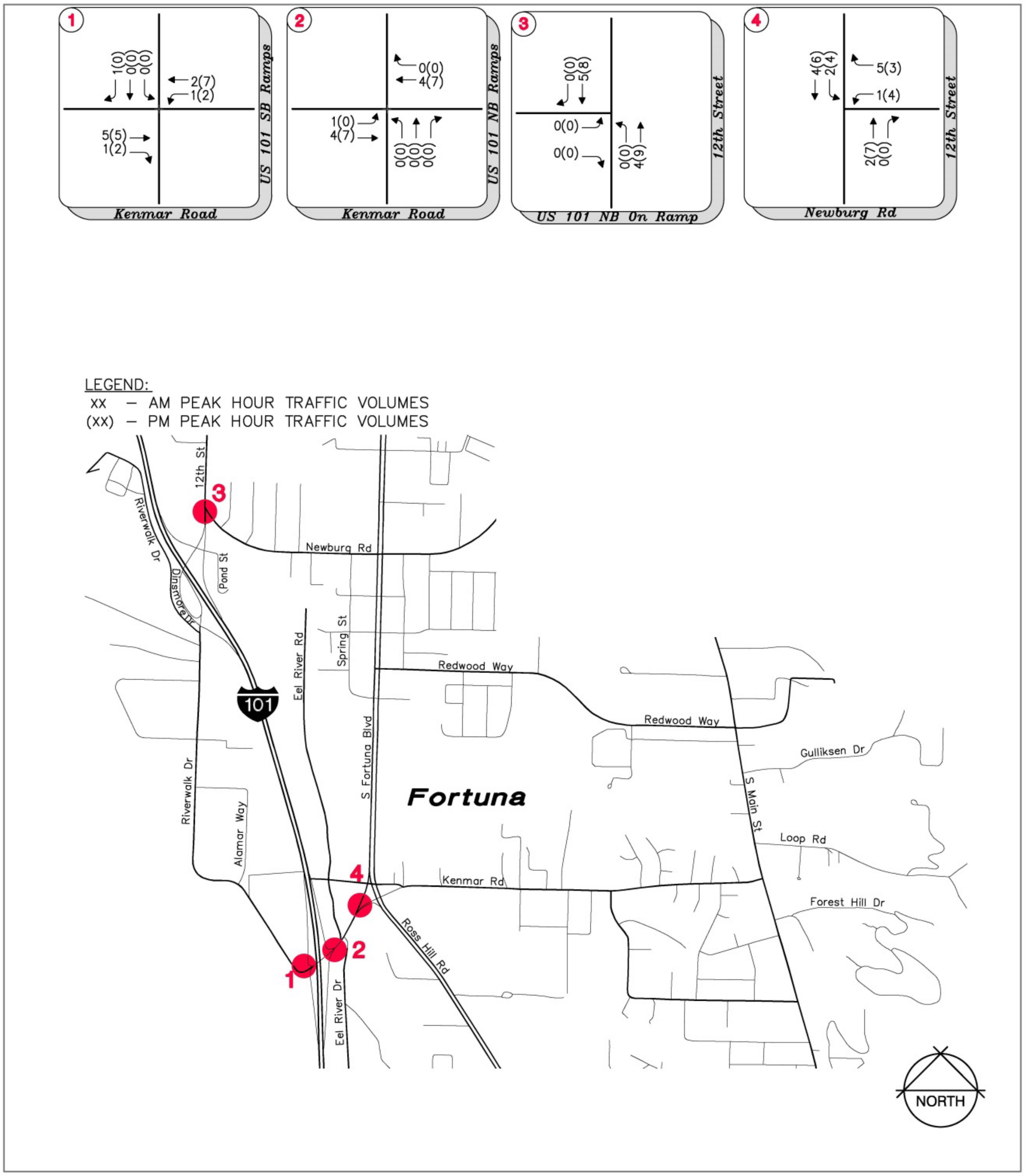


Figure 11: Existing Peak Hour Bike Traffic Volumes

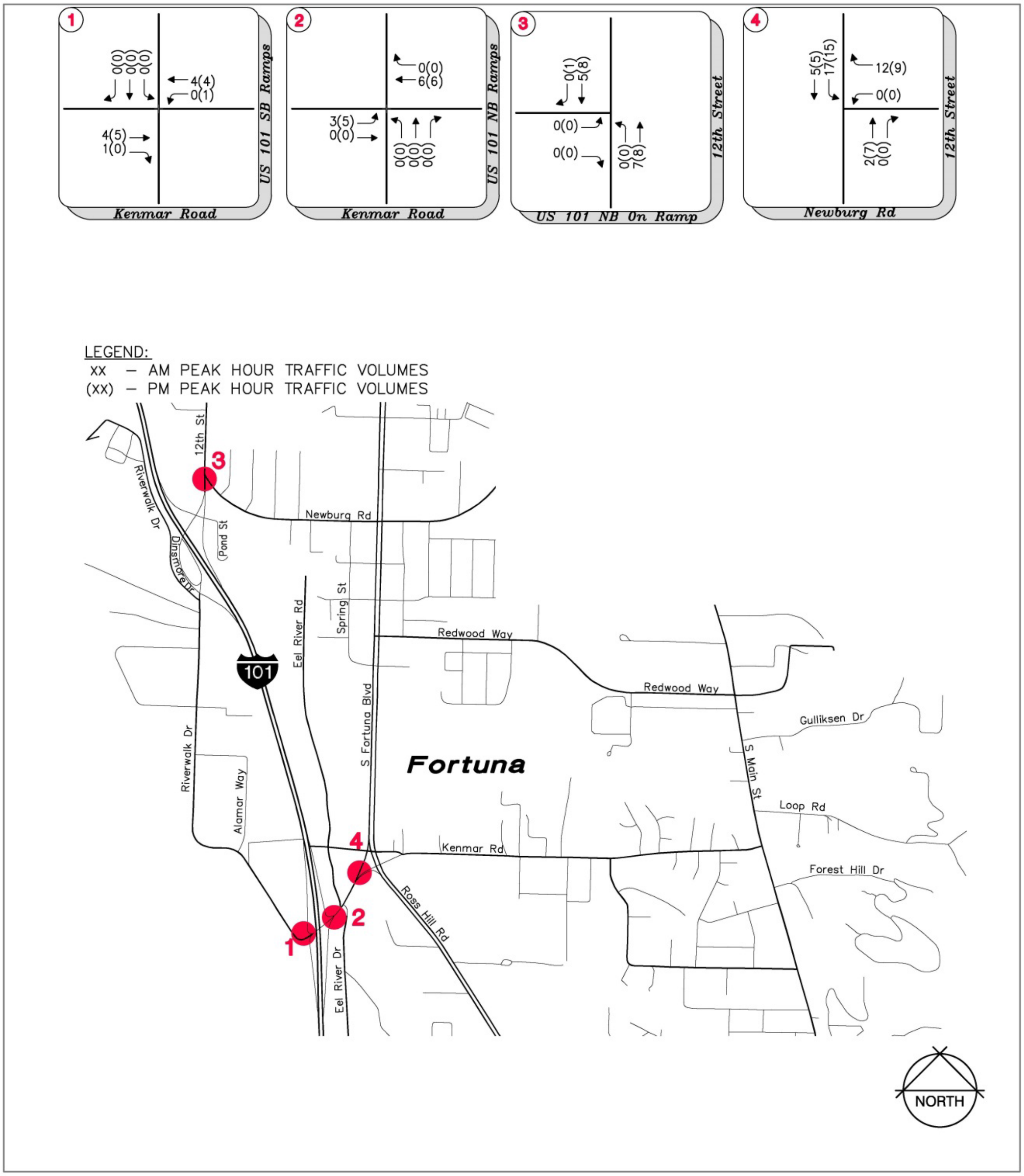


Figure 12: Existing Peak Hour Pedestrian Traffic Volumes

Table 3: Average Total Daily Bike Counts

Intersection #	Intersection Name	Average Daily Count
1	Kenmar Road/US 101 SB	22
2	Kenmar Road/US 101 NB	23
3	12th Street/US 101 NB On-Ramp	25
4	Newburg Road/12th Street	35

Table 4: Average Total Daily Pedestrian Counts

Intersection #	Intersection Name	Average Daily Count
1	Kenmar Road/US 101 SB	20
2	Kenmar Road/US 101 NB	18
3	12th Street/US 101 NB On-Ramp	27
4	Newburg Road/12th Street	69

Kenmar Road, 12th Street, and Newburg Road are used by bicyclists and pedestrians, despite the existing lack of infrastructure and the presence of hazards to such non-vehicular users. The addition of pedestrian facilities to these areas is likely to increase usership.

5. Site Analysis

Site Analysis consists of assessing the project site based upon the data collected, visual assessments, and public input. The purpose is to identify how well the road system is working for different user groups, to assess its conformance with current transportation design standards, and to identify constraints and opportunities for design solutions. Discussion of public input, which contributed to site analysis, is covered in Section 8.

5.1 Traffic Operations and Geometric Design Deficiencies

5.1.1 Level of Service - Cumulative Conditions

Operational deficiencies were estimated using future traffic volumes estimated using the travel demand model (TRAFFIX) prepared for the City's General Plan update. Additional trips generated by full buildout over 20 years in accordance to the General Plan were added to the traffic counts obtained as part of this study. This "no build" scenario both establishes these cumulative conditions and also serves as a design alternative against which to compare other alternatives.

No Build Scenario

This section provides a summary of intersection operations associated with build out of the General Plan land use designations. This alternative assumes no intersection improvements at any study location after approximately 20 years of growth. Table 5 provides a summary of the No Build intersection LOS. Intersections in bold are projected to fail to meet LOS criteria.

Table 5: Projected Future No Build Intersection Level of Service

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	**Kenmar Road and US 101 SB Ramps**	**TWSC**	**C**	**94.5**	**F**	**OVR**	**F**
2	**Kenmar Road and US 101 NB Ramps**	**TWSC**	**C**	**14.9**	**B**	**136.9**	**F**
3	**Kenmar Road and Eel River Drive**	**TWSC**	**C**	**181.2**	**F**	**OVR**	**F**
4	**Kenmar Road and South Fortuna Boulevard/Ross Hill Road**	**Signal**	**C**	**67.8**	**E**	**168.5**	**F**
5	Riverwalk Drive and Private Driveway	TWSC	C	13.3	B	10.4	B
6	Riverwalk Drive and Dinsmore Drive	TWSC	C	14.2	B	18.5	C
7	**Riverwalk Drive and US 101 SB Ramps**	**AWSC**	**C**	**19.0**	**C**	**65.1**	**F**
8	**Rivewalk Drive/12th Street and US 101 NB On-Ramp/Pond Street**	**TWSC**	**C**	**35.7**	**E**	**OVR**	**F**
9	US 101 NB Off-Ramp/12th Street and Pond Street	TWSC	C	12.0	B	10.7	B
10	**12th Street and Newburg Road**	**TWSC**	**C**	**OVR**	**F**	**95.3**	**F**
Notes:							
1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control							
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC and Signal							

As shown in Table 5 above, the intersections that are projected to operate below acceptable LOS under the build-out assumptions of the General Plan are:

- Kenmar Road and US 101 SB Ramps
- Kenmar Road and US 101 NB Ramps
- Kenmar Road and Eel River Drive
- Kenmar Road and S Fortuna Boulevard/Ross Hill Road

- Riverwalk Drive and US 101 SB Ramps
- Riverwalk Drive/12th Street and US 101 On-ramp/Pond Street
- 12th Street and Newburg Road

This is consistent with the findings from the General Plan for the intersections of Riverwalk Drive/Dinsmore Drive and Riverwalk Drive/US 101 SB Ramps.

5.1.2 Geometric Design Deficiencies

A reconnaissance level investigation of observable features evaluated the site for conformity with current standards of the site's transportation infrastructure. The evaluation was intended to serve as a planning tool to provide additional information to be considered when recommending improvement alternatives. The primary factors investigated included horizontal alignment, geometric cross section, design vehicles (maximum size vehicle to safely use the facility), vertical and horizontal clearances, and sight distance. The findings are summarized in Table 6 and Table 7. A detailed memo can be found in Appendix C.

Table 6: 12th Street and US 101 Interchange Geometric Design Deficiencies

Design Standard	Reference to Standard	Riverwalk Drive/12th Street	Newburg Road	Dinsmore Drive	US 101 NB (On and On-ramps)	US 101 SB (On and On-ramps)
Facility Type	HDM 101.1	Local Facility	Local Facility	Local Facility	Freeway/ Expressway	Freeway/ Expressway
Functional Classification	CRS	Minor Arterial/ Major Collector	Major Collector	Local Road	Freeway/ Expressway	Freeway/ Expressway
Number of Lanes	N/A	2	2	2	1	1
Rural/Urban	HDM 101.2	Rural	Rural	Rural	Rural	Rural
Bike Facilities (Y/N)	N/A	N	N	N	N	N
Pedestrian Facilities (Y/N)	N/A	N	Y (North side only)	N	N	N
Posted Speed/ Design Speed	HDM 101.1	30/35	25/30	25/30	35/40	25/30
Lane Width (ft)	HDM Index 301.1/ AASHTO	Y	Y	Y	Y	Y
Overcrossing Width (ft)	HDM Index 308.1	N	N/A	N/A	N/A	N/A

Right Shoulder Width (ft)	HDM Index 302.1 & 308.1	N	Y	Y	Y	Y
Curve Radii (ft)	HDM Index 203.2	N	Y	Y	N	Y
Decision Sight Distance (ft)	HDM Index 201.7	N	Y	Y	N	Y
Intersection Spacing (ft)	HDM Index 504.3	N	N/A	N/A	N	N
Angle of Intersection (Degree)	HDM Index 403.3	Y	N	Y	Y	Y
Horizontal Clearance (ft)	HDM Index 309.1	Y	N	N	Y	Y
Vertical Clearance (ft in)	HDM 309.2	N	N/A	N	N/A	N/A
Stopping Sight Distance (ft)	HDM Index 201.1	Y	Y	Y	Y	Y
Design Vehicle	HDM Index 404.4	Cal Legal-50	Cal Legal-50	Cal Legal-50	STAA	STAA

Table 7: Kenmar Road and US 101 Interchange Geometric Design Deficiencies

Design Standard	Reference to Standard	Kenmar Road	Eel River Drive	US 101 NB (On and On-ramps)	US 101 SB (On and On-ramps)
Facility Type	HDM 101.1	Local Facility	Local Facility	Freeway/ Expressway	Freeway/ Expressway
Functional Classification	CRS	Other Principal Arterial/ Major Collector	Major Collector	Freeway/ Expressway	Freeway/ Expressway
Number of Lanes	N/A	2	2	1	1
Rural/Urban	HDM 101.2	Rural	Rural	Rural	Rural
Bike Facilities (Y/N)	N/A	N	N	N	N
Pedestrian Facilities	N/A	N	N	N	N

(Y/N)					
Posted Speed/ Design Speed	HDM 101.1	35/40	30/35	35/40	35/40
Lane Width (ft)	HDM Index 301.1/ AASHTO	Y	Y	Y	Y
Right Shoulder Width (ft)	HDM Index 302.1 & 308.1	Y	Y	Y	Y
Curve Radii (ft)	HDM Index 203.2	N	N	Y	Y
Decision Sight Distance (ft)	HDM Index 201.7	N	N	Y	Y
Intersection Spacing (ft)	HDM Index 504.3	N/A	N	Y	Y
Angle of Intersection (Degree)	HDM Index 403.3	Y	Y	Y	Y
Horizontal Clearance (ft)	HDM Index 309.1	Y	Y	Y	Y
Vertical Clearance (ft in)	HDM 309.2	N	N/A	N/A	N/A
Stopping Sight Distance (ft)	HDM Index 201.1	N	Y	Y	Y
Design Vehicle	HDM Index 404.4	Cal Legal-50	Cal Legal-50	STAA	STAA

5.2 Complete Streets Opportunities and Constraints

The Opportunities and Constraints analysis identified potential challenges and optimal areas to best meet the project's goals. Existing conditions, including operational and design deficiencies, were factored into this analysis

5.2.1 12th Street

12th Street and US 101.

Figure 13 and Figure 14 shows the opportunities and constraints along 12th Street on the north side of the 101 interchange, where northbound on and offramps intersect 12th Street. Newburg Road is on the north end of this area. The 12th Street bridge (overcrossing US 101) is on the south end of this area. Significant considerations include:

Multimodal Circulation

- The NB on-ramp to US 101 has a short merge area and limited visibility. Landscape areas within public ownership may afford opportunities to lengthen the on-ramp.
- The US 101 SB on-ramp provides minimal and confusing wayfinding. There is an absence of "placemaking" and a general feel of being "nowhere".
- The Newburg Road intersection with 12th Street could be improved by creating a perpendicular interface but would require traversing undeveloped private property as well as creating a new railroad crossing.
- There is sufficient undeveloped land to accommodate roundabouts on 12th Street. Land ownership would need to be confirmed and related permissions obtained.
- Dinsmore Drive and 12th Street south of the US 101 overcrossing run parallel with close intersections to Riverwalk Drive, creating a confusing series of intersections from Riverwalk Drive or US 101. There is adequate width to better accommodate bicyclists and pedestrians. Road realignment and/or signage would improve wayfinding and reduce hazards.
- Strongs Creek bridge is narrow and has low guardrails, presenting hazards and limiting bicycle and pedestrian improvements. Improvements to Strongs Creek bridge must factor environmental mitigation and permitting.
- The Newburg Road inters 12th Street at an acute angle, creating an excessively wide (+/- 150 ft) and poorly defined interface. The railroad crossing contributes to this, and adds safety challenges, especially for bicyclists. There are opportunities for realignment to improve intersection legibility, reduce hazards, and improve bicycle and pedestrian circulation. These opportunities could be constrained by future railroad operations, and would require approvals from both the NCRA and the California Public Utilities Commission.
- Pond Street serves one facility, Realigning access could to simplify the intersection.
- Bike facilities may be improved where on-street parking can be sacrificed.
- Existing street infrastructure, such as utility poles, and unmanaged landscaping encroach upon sidewalks (where they exist), reducing walkable area. Relocation of utilities would be expensive.
- Bicycle and pedestrian facilities do not exist in significant portions of the study area. South of the railroad crossing a large expanse of asphalt presents opportunities for facilities; further south the narrower roadway at the overcrossing presents fewer opportunities.

Wayfinding and Placemaking

- An unattractive wide asphalt expanse at US 101 NB on-ramp could become a major gateway to the City.
- Place-making through landscape, signage, placement of parking, and framing of sightlines and views should highlight interesting and useful Fortuna businesses and destinations, including Clendenen's Cider Works, River Lodge, Riverwalk Trail, Eel River Brewery, etc.
- Redwoods and other mature trees provide aesthetic benefits but also impact sightlines on the street. To the extent that these trees do not contribute to hazards, they should be preserved.
- There are underutilized areas near US 101 on and on-ramps and by Sequoia Gas that could be improved with landscaping and entry or identity signage.

- The SB offramp feels like “nowhere” but is framed by attractive riparian vegetation along Strongs Creek. Wayfinding signage and street furnishings that are part of a consistent branding standard would establish sense of place and improve circulation.
- A vacant lot has potential as a park on the west side of Riverwalk Drive. There is an opportunity to have a Class I bike path through this site.
- Industrial activities on the west side of Riverwalk Drive detract from the visual environment and branding of the Riverwalk Area as a recreational and tourist amenity. There may be opportunities to enhance the frontage of the facility through landscaping or decorative fencing in the public right-of-way.

5.2.2 Kenmar Road

Figure 15 shows the opportunities and constraints at the Kenmar Road/US 101 interchange, where Kenmar Road intersects with both north and southbound on and on-ramps. The NCRA railroad and Eel River Road also intersect Kenmar to the east of US 101. Significant considerations include:

Multimodal circulation

- Conflicts between turning traffic and through traffic cause backups during peak times. Traffic signalization or roundabouts can improve turning and traffic flow.
- The absence of safe bicycle or pedestrian facilities, including at the US 101 interchange, including on and on-ramps, creates hazards for users. Kenmar Road is fairly constrained to accommodate bicycle and pedestrian facilities in its current alignment. There is undeveloped land to expand the road prism but may require engaging multiple landowners, including the NCRA.
- Kenmar Road’s curvature limits sightlines. The striped shoulder on the west side is limited to three to four feet.
- Railroad crossing is hazardous for bicycles due to the angle of crossing. Realignment of bike facilities approach or otherwise addressing the hazard is needed.
- Wide intersections at Eel River Drive and Kenmar Road creates additional hazards for non-motorized traffic and creates a lack of legibility or place-making for the intersection. There is the opportunity to create a more legible intersection with improved traffic flow, bicycle and pedestrian facilities, and wayfinding. A major signalized intersection at S. Fortuna Blvd./Ross Hill Road (4 lanes) out of the study area impacts Kenmar Road in the study area. Additionally, there are crosswalks on the east, west and north legs, with “walk” lights and buttons These crosswalks do not all connect to sidewalks. There is only a sidewalk on the northwest corner. Addressing this intersection is a recommended future activity. In the short term, providing adequate pedestrian and bicycle facilities to connect to the northwest corner sidewalk should be a priority.
- Kenmar Road has 5’ sidewalks on the north side of Kenmar Road starting at the Riverwalk RV Park and heading towards Riverlodge. From the RV park to the interchange there is a 5’ striped shoulder which is in places faded. This existing infrastructure provides an opportunity to tie in new facilities, especially where physical constraints may require a decision to provide sidewalks on only one side of the road.
- There is no parking on the north side of Kenmar Road. The south side of the road has an intermittent asphalt curb, with faded striping at the shoulder. Parking is allowed but it conflicts

with bike use. Creating a separated bike trail would facilitate parking to remain; otherwise design should consider how to safely accommodate both.

- Proposed Class I Trail alignments from the 2014 Strongs Creek Trail Master Plan included:
  - An alignment under the US 101 /Kenmar Road interchange
  - An alignment over US 101 along Alamar Way

  The undercrossing alignment requires significant grading and structural walls. The overcrossing alignment could introduce strangers into a California Conservation Corps youth housing area.

The Master Plan, preceding this plan, did not consider possible changes to the interchange. This design process should consider the intent of the Strongs Creek Trail Master Plan.

Wayfinding and Placemaking

- Place-making through landscape, signage, placement of parking, and framing of sightlines and views should highlight interesting and useful Fortuna businesses and destinations, including parks, the River Lodge and other visitor-serving commercial activities. On-ramp areas are natural gateways to be developed for this purpose.
- Redwoods and other mature trees provide aesthetic benefits but also impact sightlines on the street. To the extent that these trees do not contribute to hazards, they should be preserved. There is ample space for additional plantings.

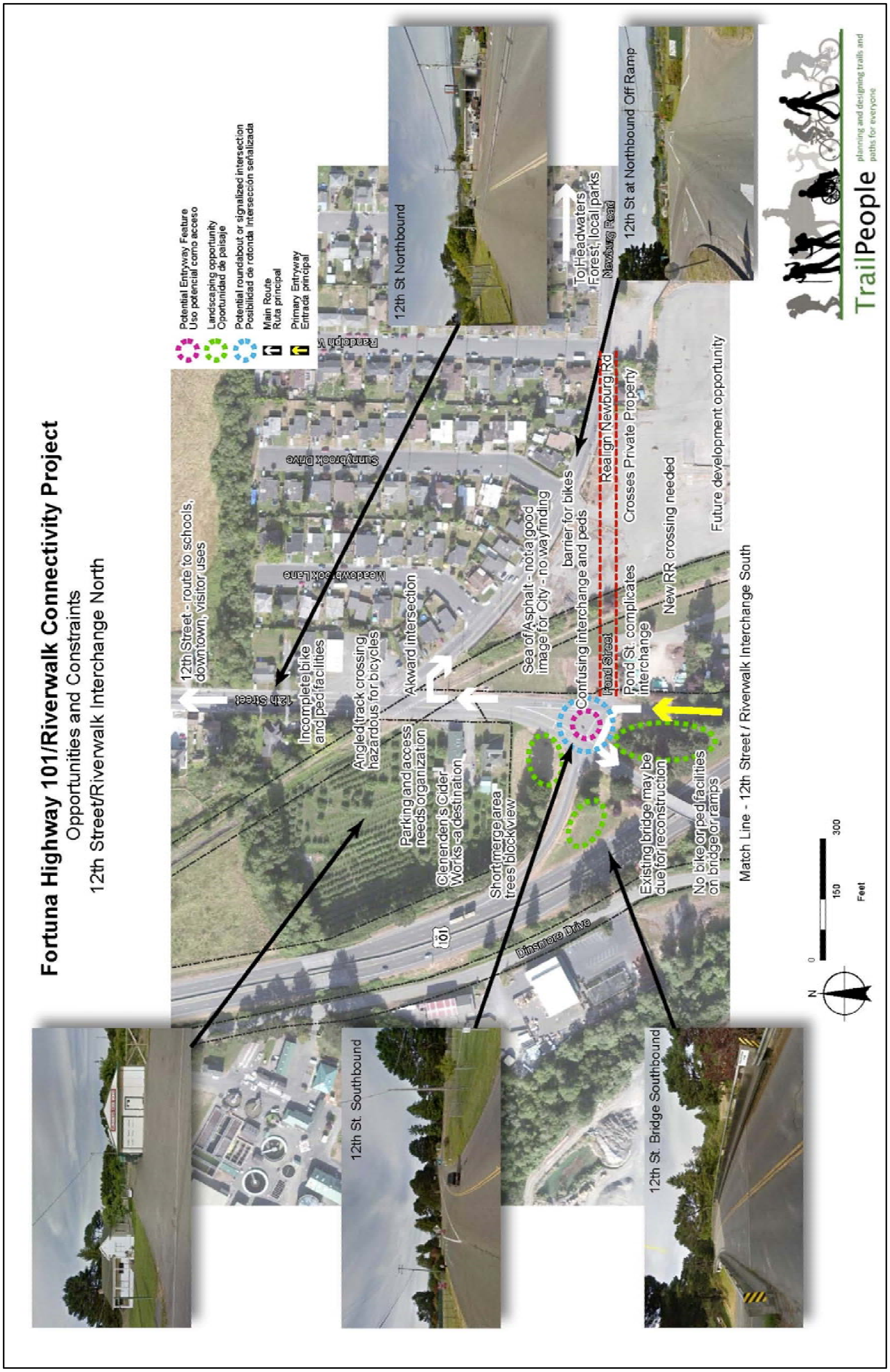


Figure 13: 12th Street North Opportunities and Constraints

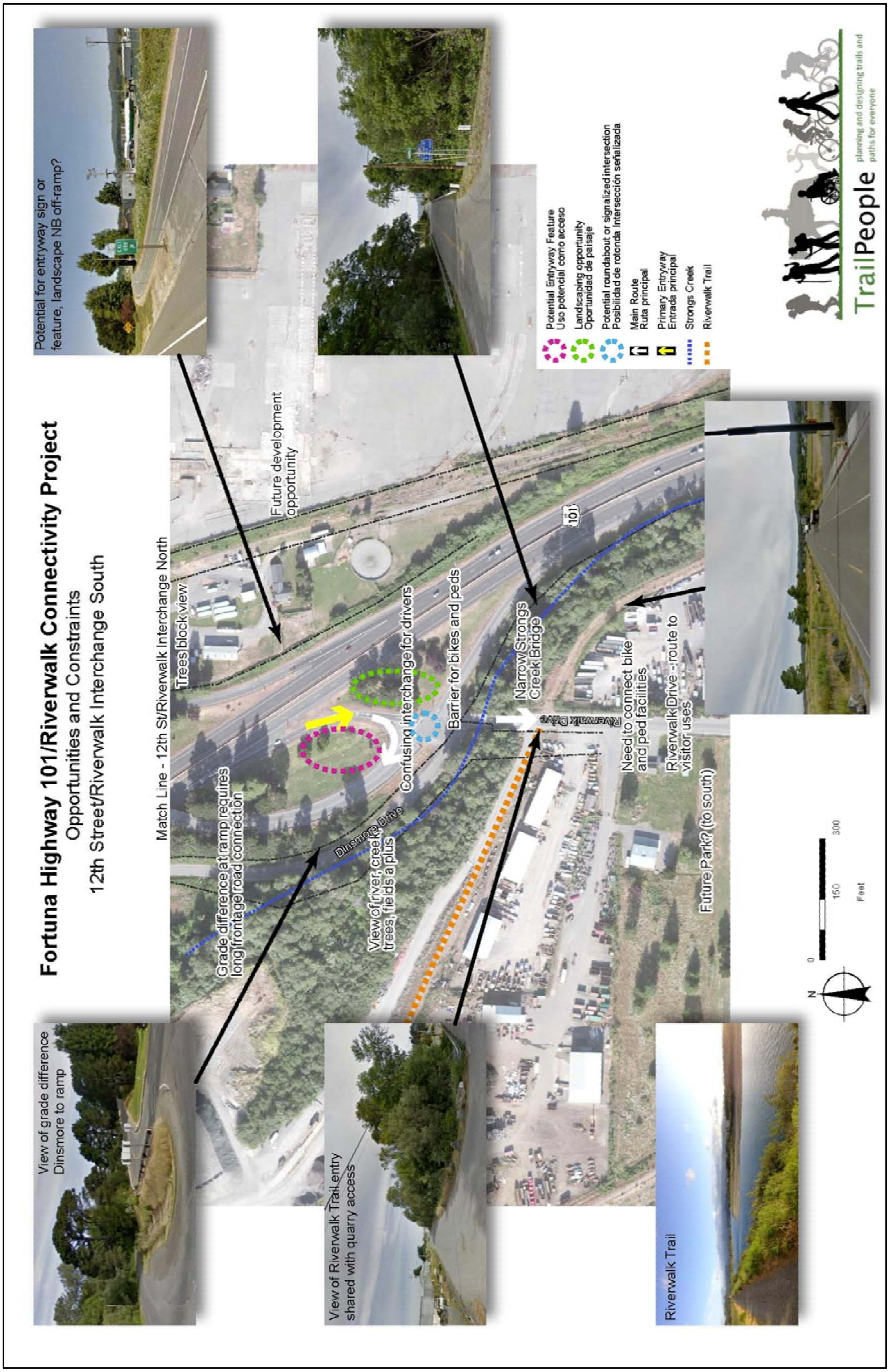


Figure 14: 12th Street South Opportunities and Constraints

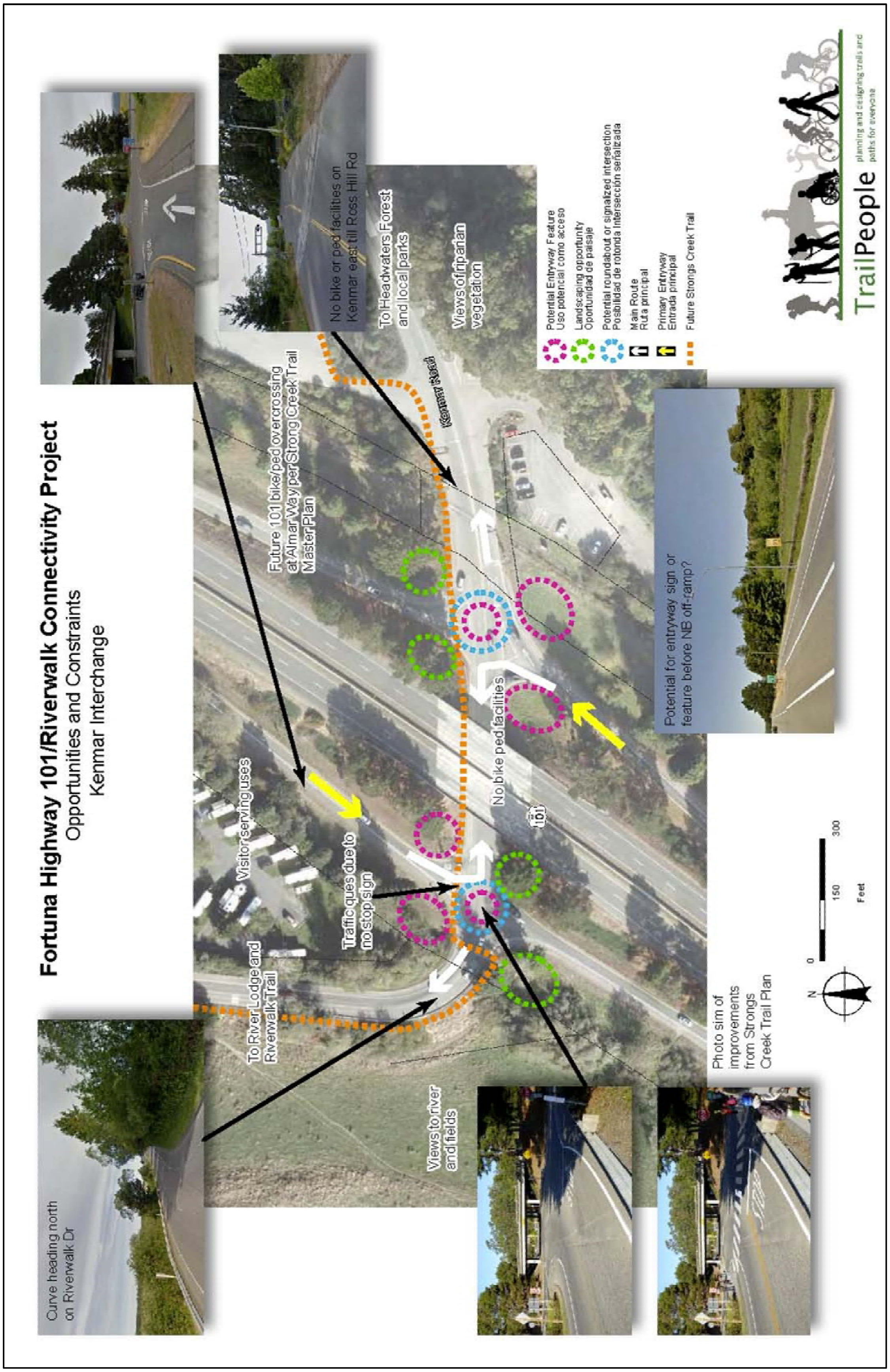


Figure 15: Kenmar Road Opportunities and Constraints

6. Design Standards and Guidelines

6.1 Summary of Public Standards and Regulations

Local

A discussion of the standards and guidelines related to the the City's General Plan is provided in Section 2.3.

State of California

Caltrans Highway Design Manual – This manual was developed by Caltrans to establish uniform policies and procedures to carry out the State highway design functions of the department. Design standards include items such as roadway geometry, pavement engineering, drainage, bicycle transportation and other miscellaneous design standards.

California Manual on Uniform Traffic Control Devices (CA MUTCD) – This manual provides uniform standards and specifications for all official traffic control devices in California. Design standards include items such as signs, markings, signal and temporary traffic control for vehicular, rail and bicycle facilities. The CA MUTCD is based on Federal Highway Administrations (FHWA) *2009 National Manual on Uniform Traffic Control Devices* with California revisions and amendments.

Federal

AASHTO Geometric Design of Highways and Streets – Similar to the Highway Design Manual, these guidelines are intended to provide roadway design standards with operational efficiency, comfort, safety and convenience of the motorist in mind. Design standards include items such as highway function, design controls and elements of design for various functional classifications of roadways (freeways, arterials, collectors, local roads, etc.).

US Department of Justice's ADA Standards for Accessible Design – These standards are based on the Americans with Disabilities Act(ADA) of 1990 and provide standards to prohibit discrimination and ensure equal opportunity for persons with disabilities. Design elements include standards for accessible routes, general site and building elements (residential and commercial) and recreational facilities.

AASHTO Guide for the Development of Bicycle Facilities – This manual was developed to provide an overview of planning and design considerations, as well as recommendations for operation and maintenance of various types of bicycle facilities.

NACTO Urban Bikeway Design Guide – Similar to the AASHTO Guide for the Development of Bicycle Facilities, this manual was developed to provide guidance for the planning and design of bicycle facilities. This manual however, was developed by cities for cities based on the experience of the best cycling cities in the world.

6.2 Best Practices Design Toolbox

The existing landscape of river, forest and fields is a scenic backdrop for US 101 and these important entries to the City. The interchanges themselves are confusing and constrained for motorists, are significant barriers for bicyclists and pedestrians, and don't highlight either the native landscape or the community features and character that make Fortuna unique. There are a range of options to reorganize the intersections and improve the overall infrastructure and landscape at these important gateways to the city. The following figures provide best practices for design related to the study area.

Vehicular

Stop Controlled. Entrance into intersection from one or more approaches is control by stop sign. Vehicles proceed through intersection after stopping and only when clear to do so.

All-Way Stop Control - at intersections where all approaches are controlled by a stop sign. Intersection right-of-way is determined by the order in which users reach the intersection.

Minor Road Stop Control - intersection having at least one approach (typically, the lower-volume, minor road) under the control of a stop sign and at least one approach not controlled by a stop sign.

The minor road stop control can result in less congestion compared to an all-way stop as it allows higher volume roads to operate more freely. However drivers on the lower-designation road may experience queuing as they wait opportunities to enter the intersection. These intersections also pose more challenges for bicyclists and pedestrians, as the uncontrolled direction of traffic is less likely to recognize their presence.

For stop controlled intersections, accidents that result from breaking the order of turning, or otherwise moving out of turn, can be severe. Because all motorists stop at all way stop intersections, bicyclists and pedestrians have a better chance of being acknowledged included properly in traffic flow, resulting in fairer access.

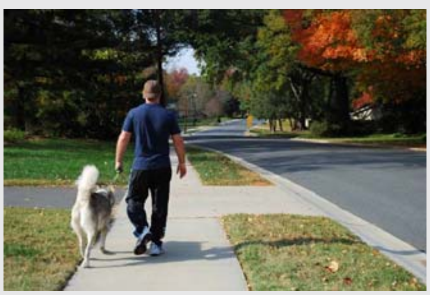
Signalized Intersection.

Signalized intersections utilize traffic lights alternate the right-of-way accorded to users by displaying lights of a standard color (red, amber (yellow), and green). By alternately assigning right-of-way to various traffic movements, signals provide for the orderly movement of conflicting flows. Traffic signals can reduce the number of angle collisions at an intersection, however the frequency of rear-end collisions can increase.

Roundabout. Roundabouts allow continuous traffic flow for traffic entering the intersection from all directions. It creates continuous, smooth turning movements. Incoming traffic yields to traffic that is within the circle. Traffic rarely stops but normally slows as it enters the circle. Pedestrian crossings are striped outside of the traffic circle, in the zone where vehicles are slowing down, increasing pedestrian visibility. Bicyclists enter the roundabouts in the same manner as automobiles. Because left turns and opposing traffic movements are mediated through the circular motion of the roundabout, head on and t-bone accidents are eliminated, resulting in fewer severe collisions.

Sidewalks and Ped Paths

Standard sidewalks. Conventional five-feet sidewalks (avoid conflicts with utility poles to maintain minimum three-feet of clear width).



Sidewalks with planting strip/buffer. Buffer or planting strip of three- to four-feet. Set sidewalks back where available right-of-way allows; allows planting of street trees for traffic calming and aesthetics.

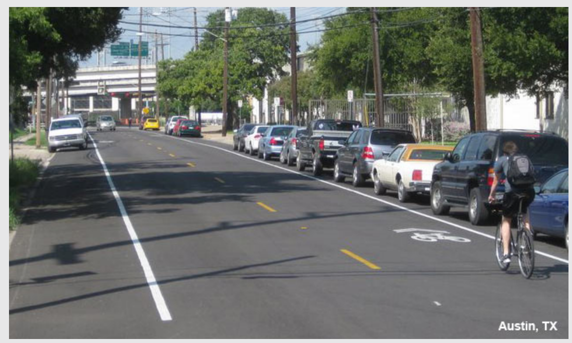
Wide sidewalk. Wider sidewalk of six- to eight-feet or more where current or anticipated future use is significant

Rural style sidewalk. Colored and/or textured concrete curb and gutter and sidewalks, or asphalt path rather than concrete for more rural aesthetic

Informal path. Decomposed granite, quarry fines, or wood chip surface for walking, as an interim improvement or in informal setting

Bike Facilities

Shared lane (Class III bike facility). Typically only appropriate on low volume/low speed roads – marked with "sharrows" and signs.



Basic bike lane (Class II bike facility). A minimum of four-feet wide, five- to six- desirable. Usually marked and signed, but a striped paved shoulder is the most important element. Also accommodates pedestrians when there is no sidewalk.

Buffered bike lane. Provide buffered bike lanes to reduce proximity to passing cars and/or potential for "dooring" from parked cars (requires reducing lane widths or eliminating parking on one side)

Skip Stripes. Provide bike lane “skip striping” at roadway and wide shoulder crossings to delineate bike route of travel and highlight for motorists

Green bike lane. Provide green bike lanes and/or green bike lane “skip striping” at roadway and wide shoulder crossings to further highlight

Class I path/bike facility. Class I shared bike/ped path (min. eight-feet wide but ideally 12 -feet) on one side of the road (typically in lieu of sidewalk on that side but ideally have shoulder or bike lane too)

Cycle track or Class IV bike facility. “Cycle track” on one side of road, buffered from lane, typically in lieu of bike lane (requires separate sidewalk if pedestrian access needed on that side)

Crosswalks and Crossing Features

Basic. Simple striped crosswalks at roadway crossings, with warning signs for motorists

Ladder or international style. Higher visibility “ladder style” crosswalks

Raised/table style. Raised crosswalks (for better visibility – especially if crosswalk is at a low point

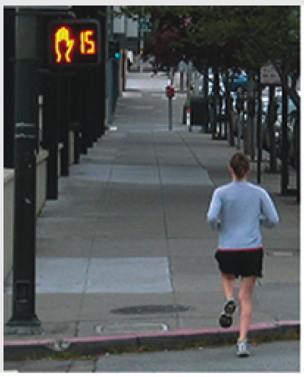
Decorative. Decorative paved crosswalks enhance traffic calming and well as aesthetics. Example has a refuge island in the center – a good idea on a busy wide street or where there is heavy crosswalk use.

Cross-Bike. Striped/marked crossing that accommodate bikes riding across (typically a continuation of a class I path or a cycle track)

Bump Out. Curb “bump outs” or “bulbouts” at roadway crossings and connections to reduce the crossing distance for pedestrians and bicyclists (and provide more greenspace and potential entry features); requires reducing curve radius – a potential constraint for trucks

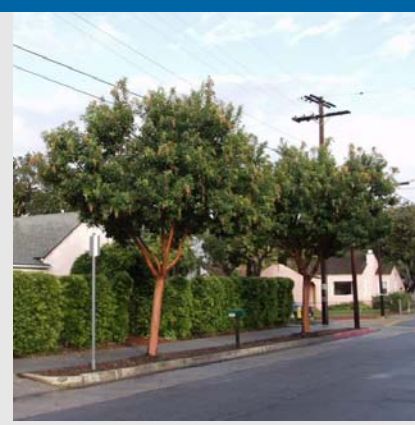
Paddle Signs. Higher-visibility “state law – yield to pedestrians” paddle signs at key intersections

RRFB lights/sign. User-activated “rectangular rapid flashing beacon” (RRFB) at major crossings



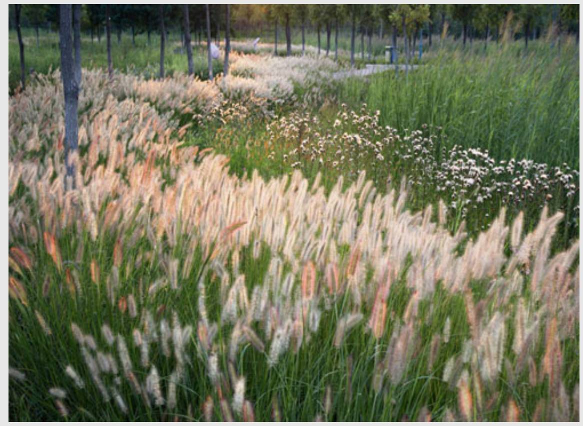
User-activated signals (ped heads). User-activated bicycle/pedestrian signals at intersections (typically only major)

Landscaping



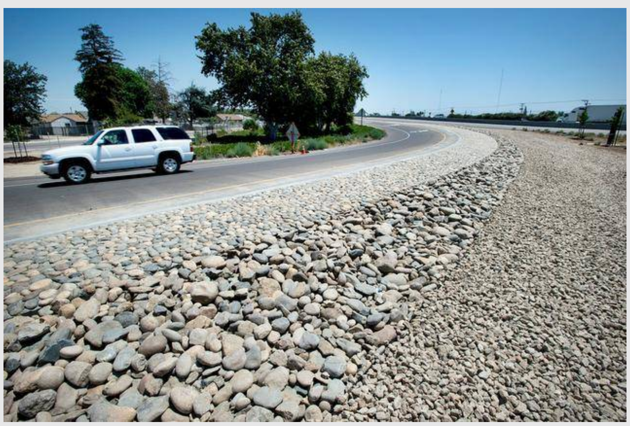
Street trees. Trees are shown to calm traffic as well as create a more pleasant bicycling and pedestrian experience. Fortuna’s highway and interchanges feature many mature trees and shrubs that provide a beautiful backdrop. Trees and landscaping need to be appropriately situated. Extending redwoods and other riparian vegetation into median islands and other narrow spaces along the roadway is not practical, but planting smaller street trees, such as the Arbutus ‘Marina” hybrids used elsewhere in the City will extend the greenery and convey a pride of place.

Native/drought tolerant shrubs and grasses.



Large interchanges inevitably have a significant amount of leftover space. Native and naturalized plants can make this space attractive while minimizing watering and maintenance.

Rock and stone. This is a practical way to maintain an attractive low/no maintenance landscape in interchanges and streetscapes, and in this case can evoke the braided bed of the Eel River.



Signage and Entry Features

Entryway monument signs and features. Are important to community identity and "branding". They should reflect local values and amenities and be part of an overall system of directional or wayfinding signage and natural or introduced landscape that gives a great impression of Fortuna and makes these interchanges pleasant places to drive, walk or bike through.

Wayfinding signage – vehicular. These must be well organized, visible, and compliant with the Manual of Uniform Traffic Control Devices. Wayfinding signage for roundabouts is particularly important to resolve.

Wayfinding signage – bicyclist and pedestrian. Vehicular-scale signage can guide bicyclists and pedestrians too, but often there are different routes and choices, and a special smaller-scale system of signage is needed.

7. Design Concepts & Alternatives Analysis

This section summarizes the development of preliminary concept layouts of the signal and roundabout alternatives. The layouts are useful for determining preliminary structure and right-of-way needs for each alternative and also to illustrate truck turning movements. As identified in Section 6, nearly all of the study intersections fail under cumulative traffic conditions with the no build alternative; therefore, two improvement alternatives were developed for the study corridors of the Kenmar Road interchange and 12th Street interchange.

This section is organized accordingly:

- Section 7.1 reviews design criteria for geometric design of the roadways
- Section 7.2 discusses signalization and roundabout design concept alternatives on 12th Street, including brief descriptions of landscape opportunities.
- Section 7.3 discusses signalization and roundabout design concept alternatives on Kenmar Road, including brief descriptions of landscape opportunities.
- Section 7.4 presents the intersection operations analysis for these design alternatives
- Section 7.5 discusses pedestrian and bicycle accommodations with each proposal
- Section 7.6 identifies options for bridges and other structures related to 12th Street improvements
- Section 7.7 identifies options for bridges and other structures related to Kenmar Road improvements
- Section 7.8 analyzes the right-of-way requirements for each design alternative
- Section 7.9 communicates a vision for Complete Streets at the project locations
- Section 7.10 presents a summary comparison of the design alternatives.

7.1 Design Criteria

7.1.1 Traffic Signalization Design Criteria

The following design criteria were used to analyze the geometrics and safety performance of the proposed signalization concepts:

- Criteria and methodologies to be consistent with Caltrans Highway Design Manual.
- US 101 is a designated STAA terminal access route as part of the National Truck Network; therefore, the design truck vehicle from Caltrans Highway Design Manual shall be a STAA-STD-56 for all movements to and from US 101 Ramps. The truck turn exhibits are included in Appendix H.
- The design truck vehicle from Caltrans Highway Design Manual shall be a California Legal 50 for all movements. The truck turn exhibits are included in Appendix H.

- Accessible accommodations for all users will be provided through the interchange, but not on all legs of each intersection. Pedestrian and bicycle facilities will be provided in accordance with the City of Fortuna's General Plan's Circulation Element.

7.1.2 Roundabout Design Criteria

The following design criteria were used to analyze the geometrics and safety performance of the proposed roundabout concepts:

- Criteria and methodologies to be consistent with Caltrans Highway Design Manual and Report 672 of the National Cooperative Highway Research Program (NCHRP) titled Roundabouts: An Informational Guide (Second Edition). This document supersedes the original roundabout guide published by the FHWA in 2000.

- US 101 is a designated STAA terminal access route as part of the National Truck Network; therefore, the design truck vehicle from Caltrans Highway Design Manual shall be a STAA-STD-56 for all movements to and from US 101 Ramps. The swept paths from the STAA 56 determined the size of the truck aprons, while allowing for truck trailers' back tires to mount the apron.

- The design truck vehicle from Caltrans Highway Design Manual shall be a California Legal 50 for all movements. The swept paths from the CA Legal 50 determined the size of the truck aprons, while allowing for truck trailers' back tires to mount the apron.

- Fastest path entry speeds on single lane roundabout approaches are 25 mph or less.

- Fastest path entry speeds on multi-lane roundabout approaches are 30 mph or less.

- Accessible accommodations for all users will be provided through the interchange, but not on all legs of each roundabout. Pedestrian and bicycle facilities will be provided in accordance with the City of Fortuna's General Plan's Circulation Element. Bicycle lanes will terminate on the approaches approximately 100' from the circulatory roadway at "exit" ramps to 10' wide shared-use paths that cross at pedestrian crosswalks.

- The target width for landscaped buffers is five feet minimum between the roadway and shared-use paths to discourage pedestrian crossings at unmarked locations.

The truck turn exhibits are included in Appendix H. Fastest path exhibits are included in Appendix I.

7.2 12th Street Interchange Design Alternatives

The 12th Street interchange corridor was analyzed for the following concepts:

- Traffic Signal Concept
- North Interchange Roundabout Concept
- South Interchange Roundabout Concept 1
- South Interchange Roundabout Concept 2 (a, b & c)

7.2.1 12th Street Interchange Traffic Signal Concept

For the signal concept, the Riverwalk Drive/12th Street corridor would require the removal of the existing structure over US 101, the construction of a new overcrossing, realignment of Dinsmore Drive with a new bridge over Strong's Creek, and widening from the intersection of Riverwalk Drive and US 101 SB Ramps to the intersection of 12th Street and Newburg Road. The current two lane roadway would require expansion to four lanes throughout the corridor to accommodate the projected growth. The existing two-lane structure over Strong's Creek would need to be replaced. The freeway ramps to US 101 will need to be reconstructed and existing Rohner Creek Bridge on US 101 widened. The signal concept for the Riverwalk Drive/12th Street corridor is shown on Figure 16.

After analyzing the forecasted traffic volumes with Synchro, the lane geometry was determined for each intersection as shown on the figure. Left-turn and right-turn pocket lengths were based on the 95th percentile queue length.

According to the City's General Plan, Riverwalk Drive, 12th Street, and Newburg Road are to have Class II bike lanes, and there is a planned "rail with trail" along the existing railroad property. Sidewalks on both sides would connect to the planned rail with trail.

Landscaping

Landscaping opportunities associated with the traffic signal concept focus on extensive plantings within the new rights-of-way around the on and off ramps. A major gateway feature is proposed at the intersection of Newburg Road and 12th Street, with directional signage and minor gateway features at the other on and off ramps.

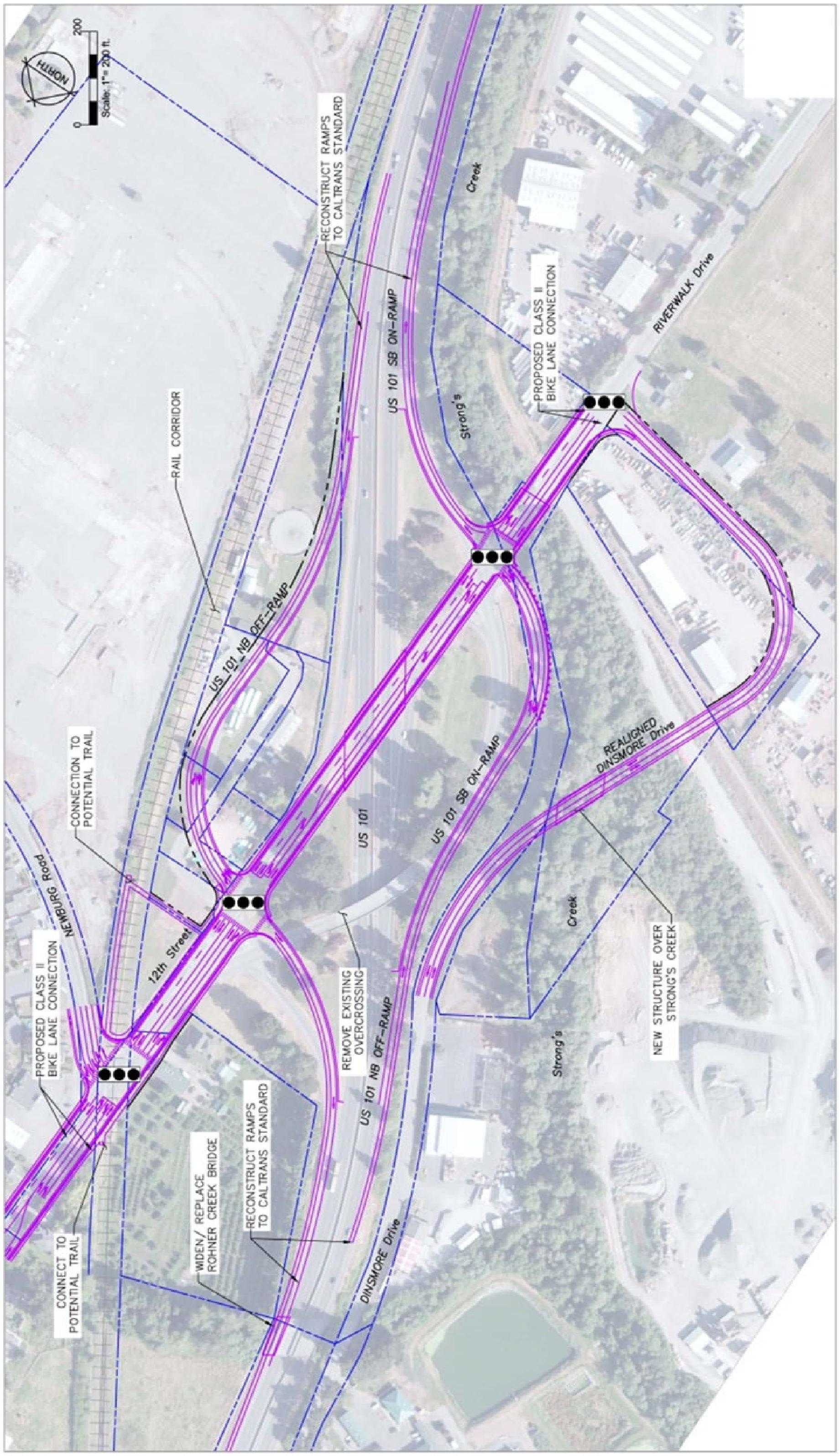


Figure 16: 12th Street Interchange Traffic Signal Concept

7.2.2 12th Street North Interchange Roundabout Concept

Figure 17 illustrates a five leg roundabout at the 12th Street/US 101 NB Ramps intersection that incorporates a realigned Newburg Road as the fifth leg. The existing Newburg Road connection to 12th Street would be closed by creating a cul-de-sac. The NB ramps will need to be reconstructed to Caltrans standards. According to the City's General Plan, 12th Street and Newburg Road are to have Class II bike lanes, and there is a planned "rail with trail" along the existing railroad corridor.

After analysing the forecasted traffic volumes with the Sidra software, it was determined that the five-way intersection would operate at an acceptable level of service as a multi-lane roundabout. Newburg Road was realigned beginning near the intersection with Sunnybrook Drive. The concept shows connections to the planned rail with trail and the bike lanes on 12th Street and Newburg Road. The Class I Bike Path will provide bike and pedestrian connectivity across US 101. Since the existing overcrossing is not wide enough to accommodate bike path, the bridge structure would require widening. Section 7.6 describes required bridge improvements. See Section 7.9 for more information on right-of-way needs.

Landscaping

This concept creates a major focal point by establishing a five-way roundabout to manage the intersection of traffic at 12th Street, Newburg Road, Pond Street, and US 101 northbound on and offramps. The center of the roundabout provides an opportunity for a significant gateway feature including art and landscaping. Each road entering and exiting the roundabout can also feature wayfinding signage. The relatively centralized and compact form of this solution provides spatial clarity. See Appendix K for landscape concepts.

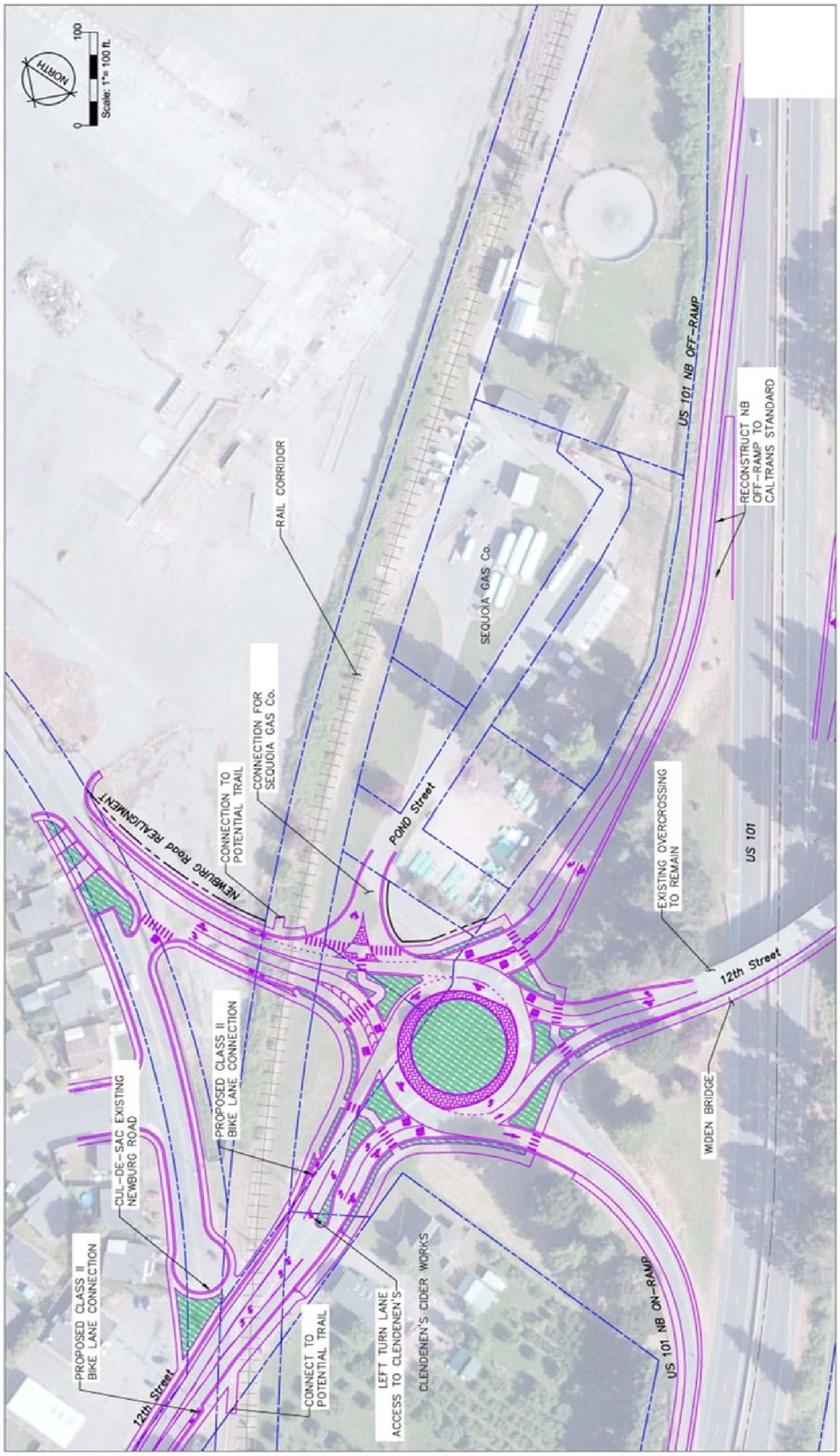


Figure 17: 12th Street North Interchange Roundabout Concept

7.2.3 12th Street South Roundabout Concepts

12th Street South Interchange Roundabout Concept Option 1

This alternative (Figure 18) uses the “dog bone” roundabout concept to route traffic through two closely spaced intersections. Southbound US 101 on and offramps, and 12th Street traffic meet in the northern roundabout.

Left hand turns to and from Dinsmore Drive would be prohibited, so traffic would need to navigate both roundabouts for some movements (e.g. northbound Riverwalk Drive to Dinsmore Drive, or Dinsmore Drive to 12th Street).

This alternative’s southerly roundabout extends over Strongs Creek and requires replacement of the Strongs Creek bridge.

The concept includes bike lanes and sidewalks on Riverwalk Drive south of the roundabout with connections to 10' wide shared use paths through the roundabouts, which would connect over the 12th Street/US 101 bridge.

After analyzing the forecasted traffic volumes with Sidra, it was determined that the roundabout south of Strongs Creek would operate at an acceptable level of service as a single lane roundabout. However, the SB off-ramp and Riverwalk Drive approaches to the northern intersection need dedicated right-turn lanes to operate at an acceptable levels of service.

Landscaping

Major gateway features can be accommodated within each roundabout, with directional signage at all points of entry to the roundabouts. See Appendix K for landscape concepts.

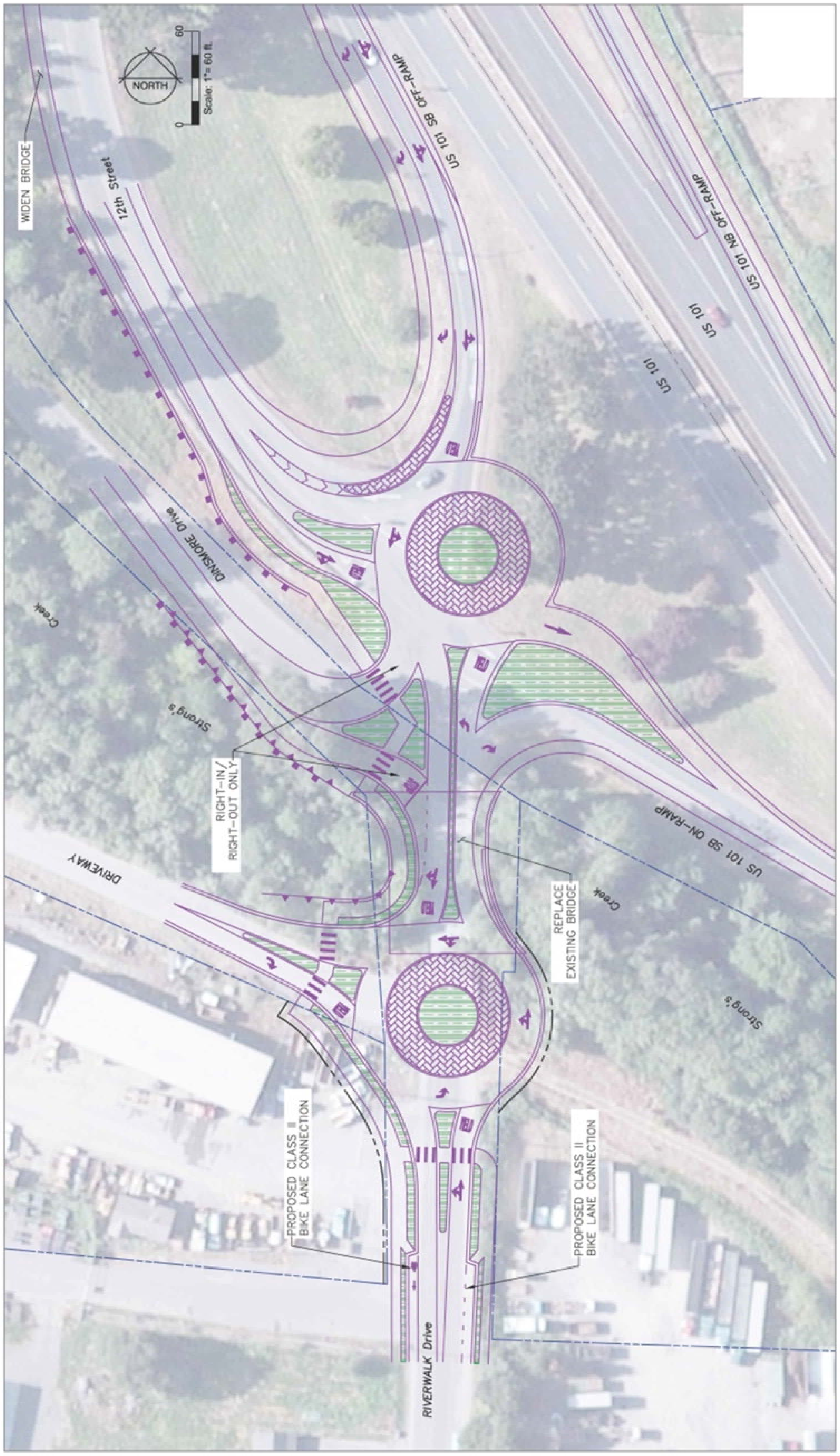


Figure 18: 12th Street South Interchange Roundabout Concept - Option 1

12th Street South Interchange Roundabout Concept Option 2 (a, b & c)

This alternative uses a single roundabout at the southbound ramp intersection and a realigned Dinsmore Drive. The roundabout is placed on the north side of Strongs Creek and directs traffic from 12th Street, Riverwalk Drive, and the southbound US 101 on and offramps.

Three different Dinsmore Drive realignments options were developed:

- **Option 2a**, as shown on Figure 19 realigns Dinsmore Drive across Strong's Creek through private property, collects adjacent driveways, and intersects Riverwalk Drive to the south with a minor street stop controlled intersection. The private driveay south of Strongs Creek is also directed onto Dinsmore Drive.
- **Option 2b**, as shown on Figure 20, avoids the Strong's Creek crossing with a less signficant realignment of Dinsmore Drive, bringing it into 12th Street north of the roundabout. This reduces impacts to Strongs Creek and private property.
- **Option 2c**, as shown on Figure 21, proposes a similar roundabout solution as Option 2b, but realigns Dinsmore Drive to connect to 12th Street closer to the US 101 bridge.

All of the Option 2 concepts include bike lanes on Riverwalk Drive with connections to 10' wide shared use paths through the roundabouts, which would connect over the 12th Street/US 101 bridge (see Section 7.6 for more information on required bridge widening). See Section 7.9 for more information on right-of-way needs.

Landscaping

Landscaping opportunities include a major gateway feature including art and plantings within the roundabout, and minor landscaping in interstitial spaces between access lanes to and from the roundabout. Signage could be also be placed at these locations. See Appendix K for landscape concepts.

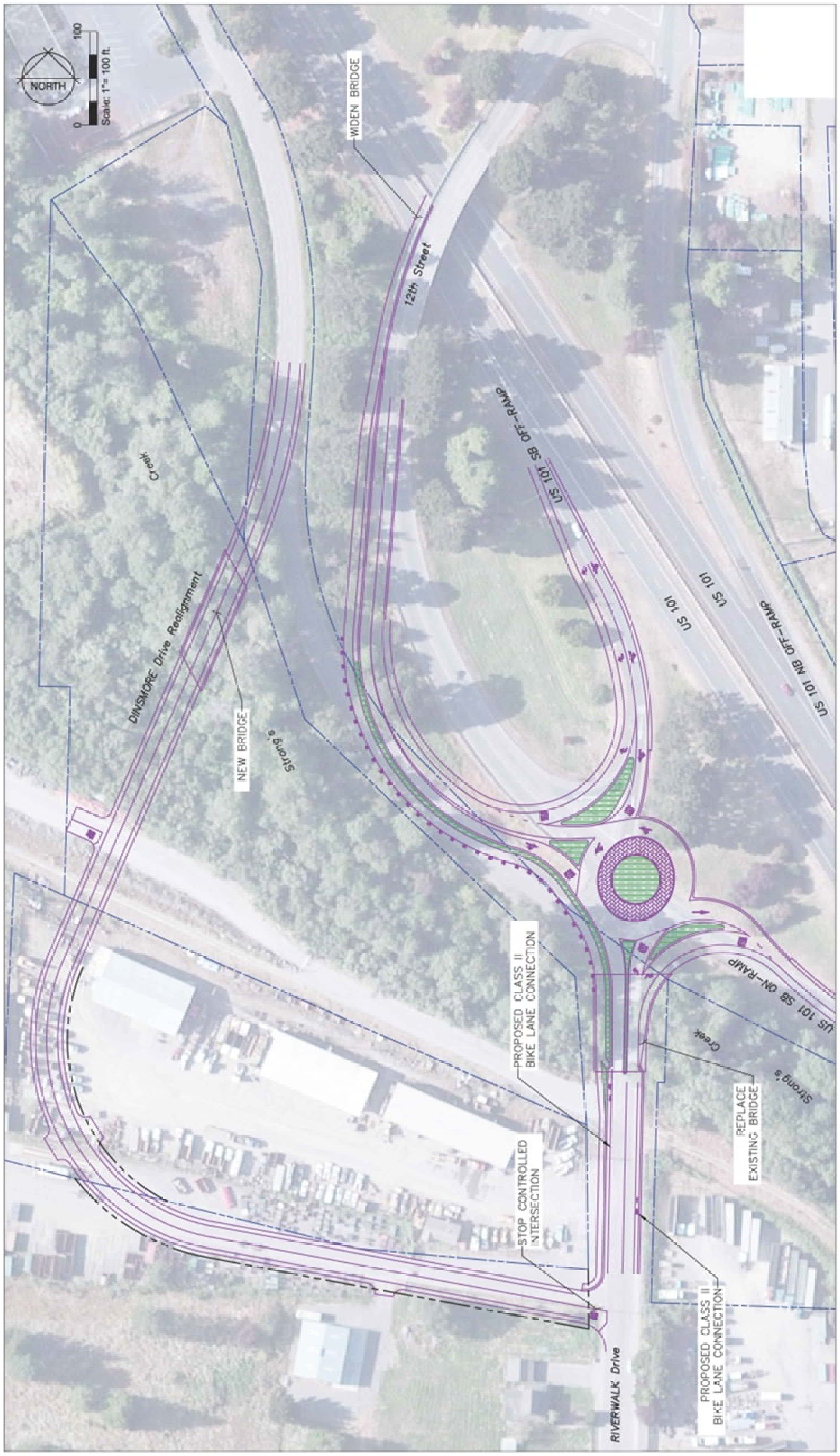


Figure 19: 12th Street South Interchange Roundabout Concept - Option 2a

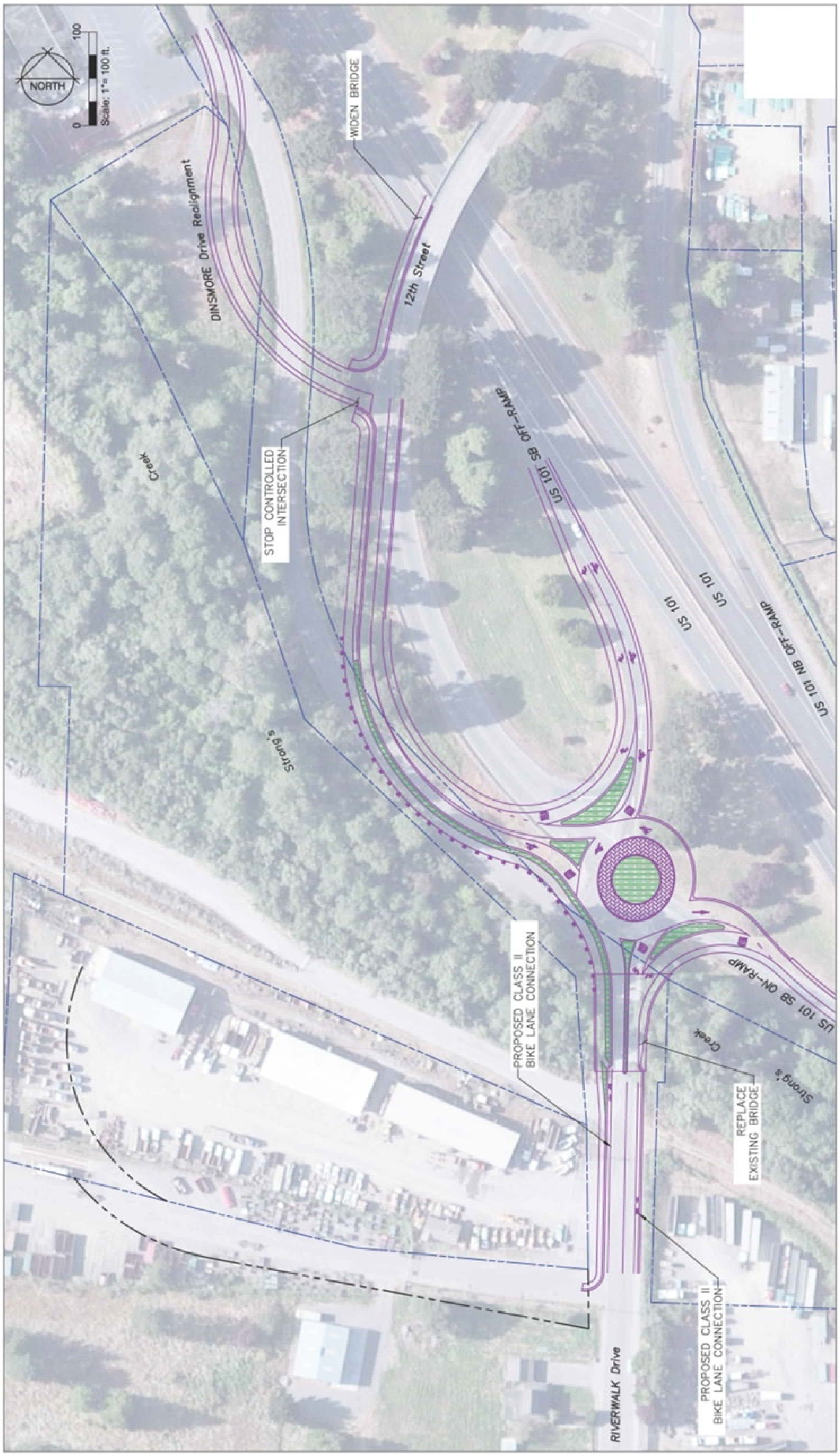


Figure 20: 12th Street South Interchange Roundabout Concept - Option 2b

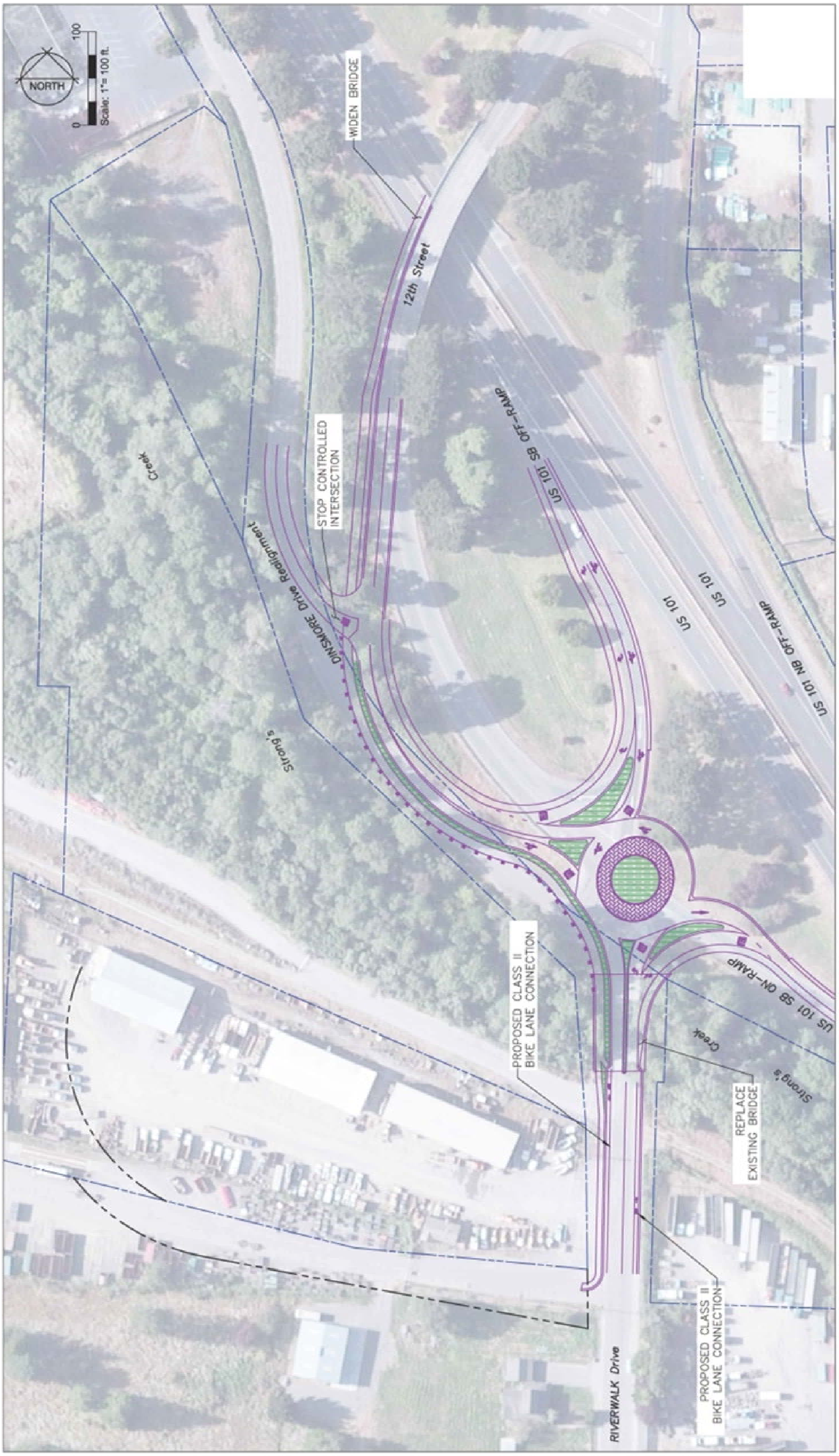


Figure 21: 12th Street South Interchange Roundabout Concept - Option 2c

7.3 Kenmar Interchange Design Alternatives

The Kemar interchange corridor was analyzed for the following concepts:

- Traffic Signal Concept
- Roundabout Concept 1 (a & b)
- Roundabout Concept 2

According to the City's General Plan, Kenmar Road through the interchange is not planned to have any bike facilities along it. However, there is a proposed Class I (Bike Path) on Eel River Drive and a propose "rail with trail" in the railroad right-of-way. There is also a planned Class I bike path on Kenmar Road from the SB ramps intersection to the River Lodge Conference Center.

7.3.1 Kenmar Intersection Traffic Signal Concept

This signalized intersection concept proposes three signals in close succession on Kenmar Road at the northbound on/offramp, southbound on/offramp, and at Eel River Drive. This alternative proposes a mix of Class I and Class II bike facilities and a 7' wide sidewalk on the north side with connections to the three planned paths.

After analyzing the forecasted traffic volumes with Synchro, the lane geometry was determined for each intersection as shown on the figure. Left-turn and right-turn pocket lengths were based on the 95th percentile queue lengths.

For the signal concept, the Kenmar Road corridor would require widening from the intersection of Kenmar Road and US 101 SB Ramps to the intersection of Kenmar Road and Fortuna Boulevard/Ross Hill Road. The current two lane roadway would require expansion to five lanes throughout the corridor to accommodate the projected growth. The intersection of Kenmar Road and South Fortuna Boulevard/Ross Hill Road is projected to operate at unacceptable LOS in the Cumulative No Build alternative and was mitigated to acceptable LOS but no concept was developed. The signal concept for the Kenmar Road corridor is shown on Figure 22.

Landscaping

Landscaping can include a major gateway feature in the landscape area between the northbound offramp and US 101 at Kenmar Road. Directional signage can be placed at each intersection. See Appendix K for landscape concepts.

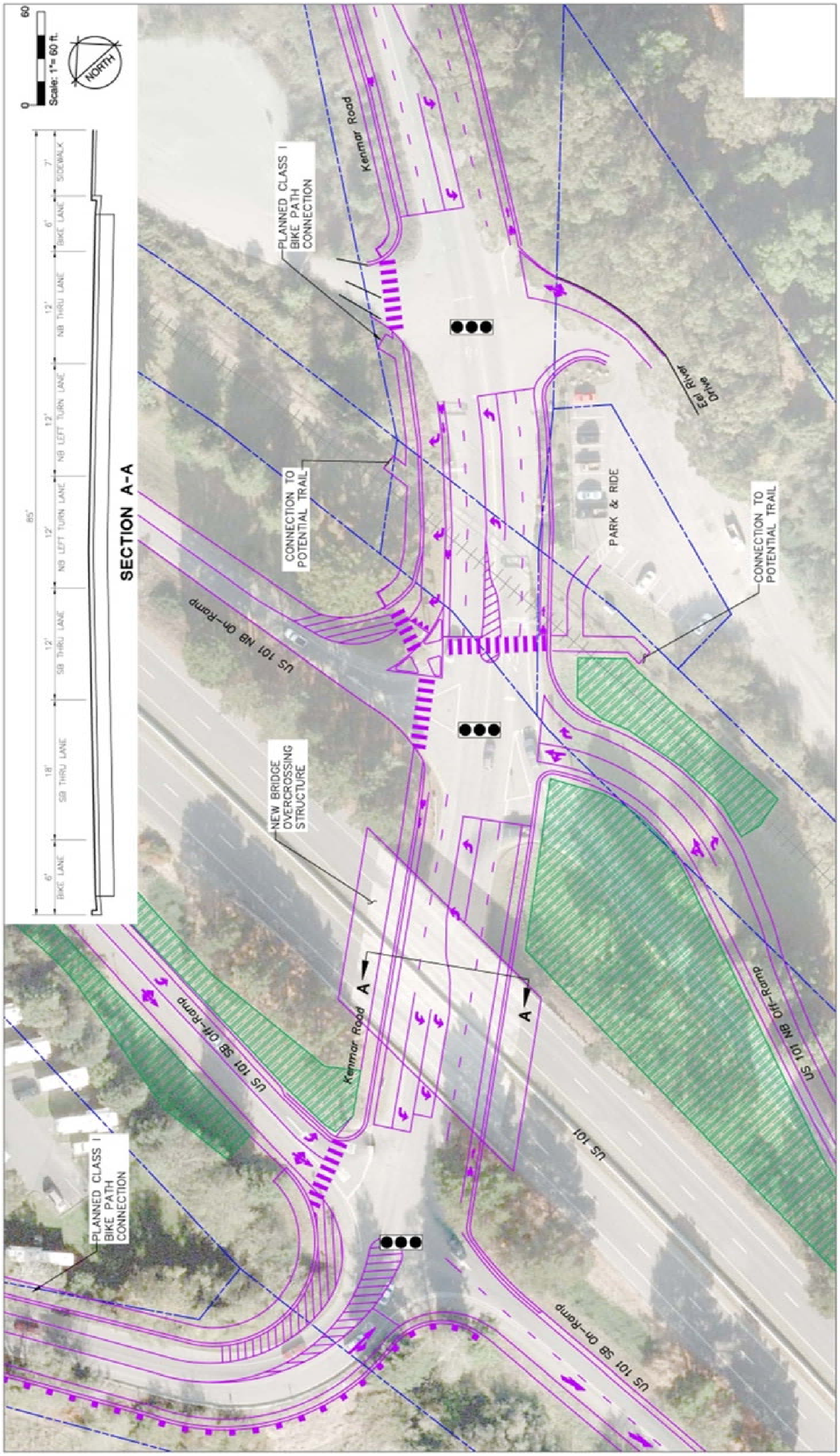


Figure 22: Kenmar Road Interchange Signal Concept

7.3.2 Kenmar Road Interchange Roundabout Concept Option 1 (a &b)

This alternative uses roundabouts at the southbound and northbound on/off-ramps and two different options for the intersection with Eel River Drive:

- **Option 1a**, as shown on Figure 23, a third roundabout is included a the intersection with Eel River Drive.
- **Option 1b**, as shown on Figure 24, Eel River Drive is stop controlled with left turn movements onto and off Kenmare Road prohibited. Drivers desiring to make this movement would need to make a u-turn at the downstream intersections.

After analyzing the forecasted traffic volumes with Sidra, it was determined that the NB Ramps intersection would operate at acceptable levels of service as a single lane roundabout with a westbound right-turn only lane. The SB off-ramp and EB Kenmar Road approaches the SB ramps intersection needed a dedicated right-turn lane to operate at an acceptable level of service.

Both Option 1a and 1b include a 10' wide shared use path on the north side with connections to the three planned paths. Eel River Drive is a minor street; therefore, a delivery truck was used as the design vehicle for the turning movements. The California Legal can drive through the roundabout in the eastbound and westbound directions only.

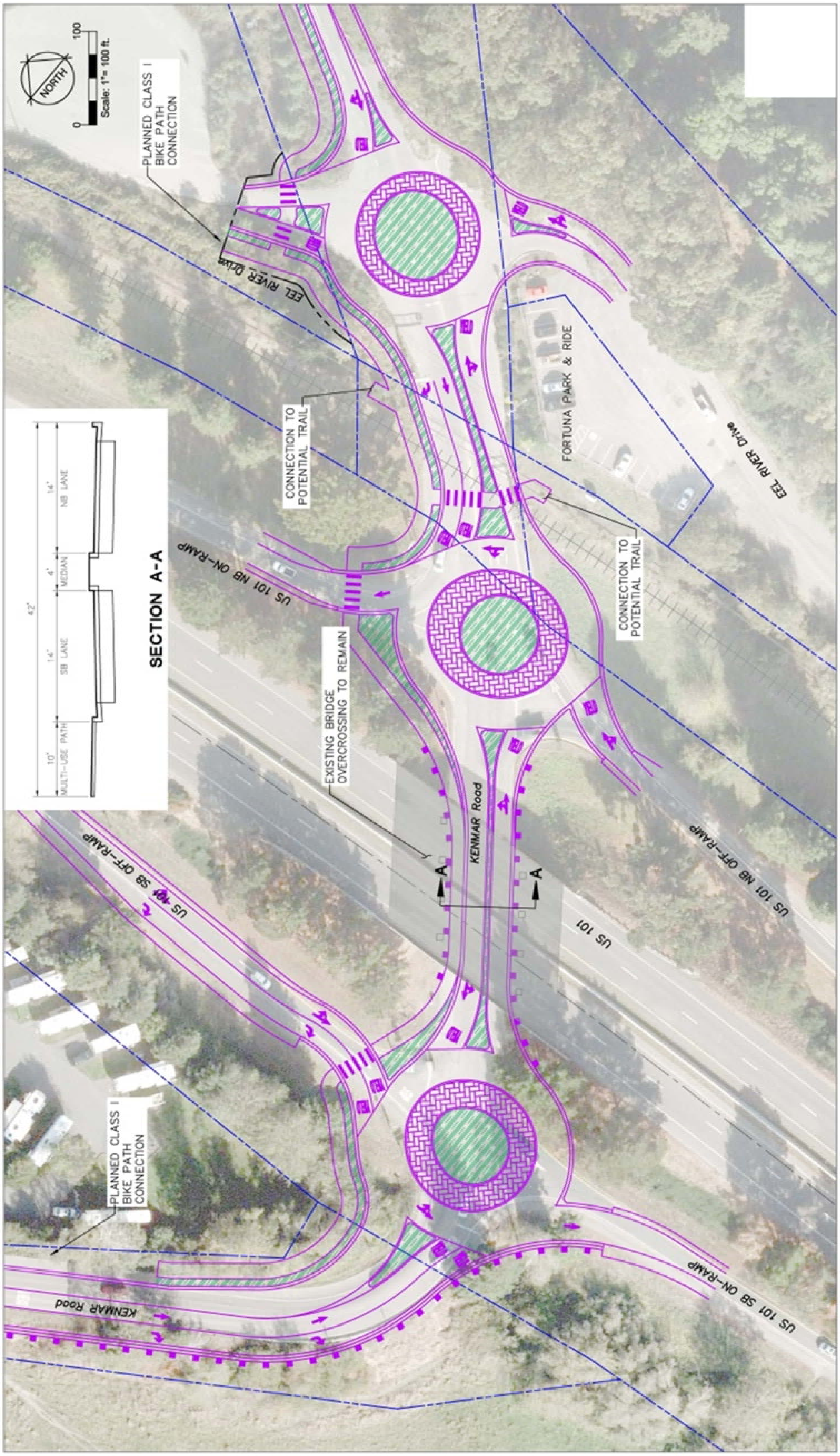


Figure 23: Kenmar Road Interchange Roundabout Concept - Option 1a

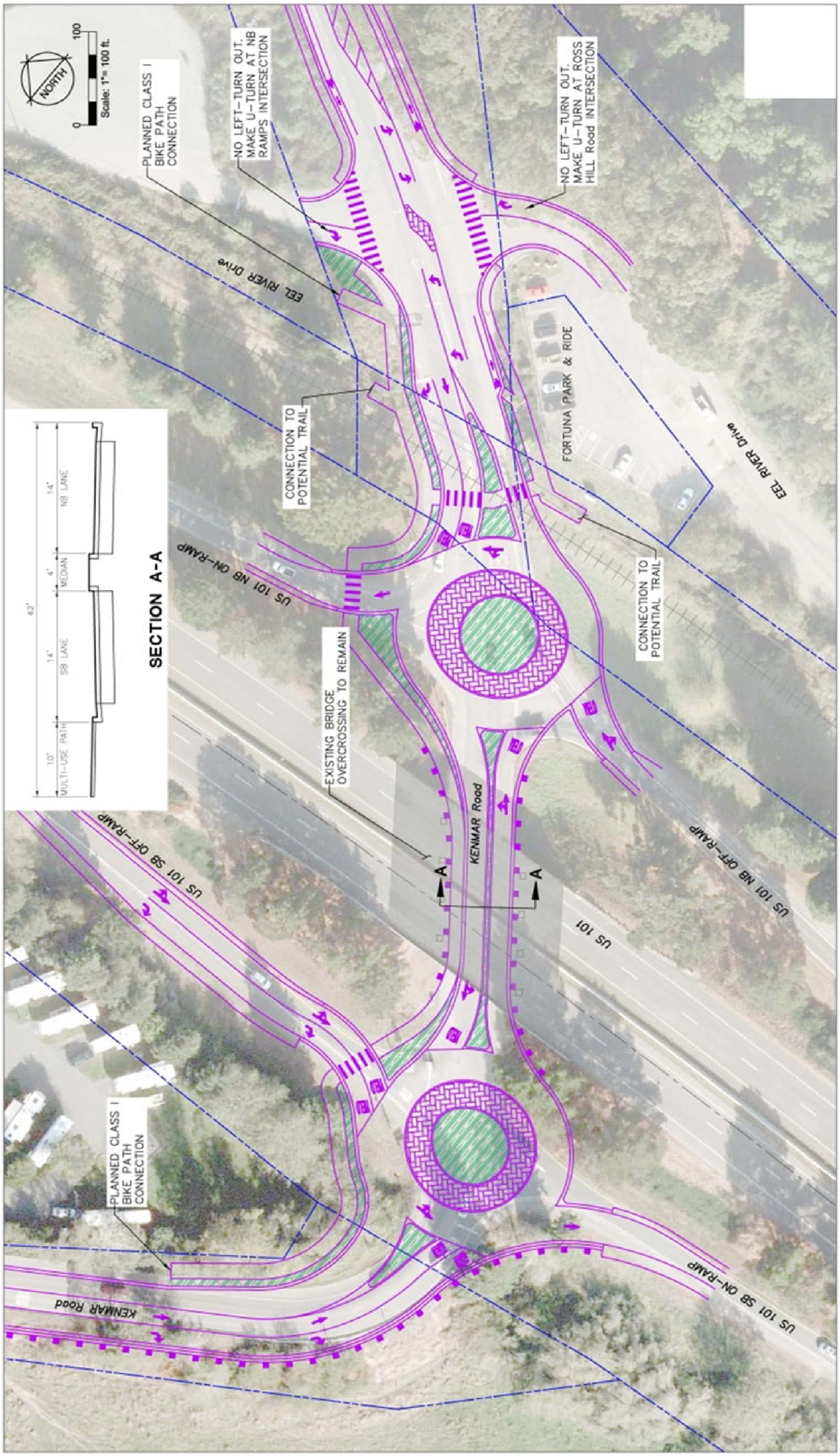


Figure 24: Kenmar Road Interchange Roundabout Concept - Option 1b

7.3.3 Kenmar Road Interchange Roundabout Concept Option 2

A “dog bone” roundabout concept would place roundabouts on each side of US 101. The westerly roundabout accommodates traffic to and from the US 101 southbound offramp, Kenmar Road, and the southbound US 101 onramp. The easterly roundabout manages traffic from Kenmar Road, the southerly reach of Eel River Drive, and northbound US 101 on and offramps. The northern portion of Eel River Drive is realigned to cross the railroad and connect directly into the new roundabout located east of US 101. This design alternative includes a separated bike and walking path with connections to potential trails, as well as pedestrian facilities throughout the system.

After analyzing the forecasted traffic volumes with Sidra, it was determined that the five-leg intersection would operate at an acceptable level of service as a single lane roundabout with a westbound right-turn only lane. The SB off-ramp and EB Kenmar Road approaches to the SB ramps intersection needed a dedicated right-turn lane to operate at an acceptable level of service. The concept includes 8' shoulders on each side of Kenmar Road under the existing freeway structure. The 10' wide shared use path on the north side is shown behind the existing structure columns. A retaining wall would need to be constructed beneath the structure to retain the fill slopes, similar to what's shown on Figure 25. Connections to the three planned paths are incorporated into the concept. The realignment of Eel River Drive may allow for additional parking to be added to the park and ride lot, and access could be provided via a driveway on the realigned Eel River Drive or on Kenmar Road. The Roundabout Concept Option 2 for Kenmar Road is shown on Figure 26.

Landscaping

Landscaping concepts include major gateways with art and plantings within the roundabouts, and signage at all points of entry and exit at the roundabouts. See Appendix K for landscape concepts.

Figure 25: Example of path behind existing structure columns

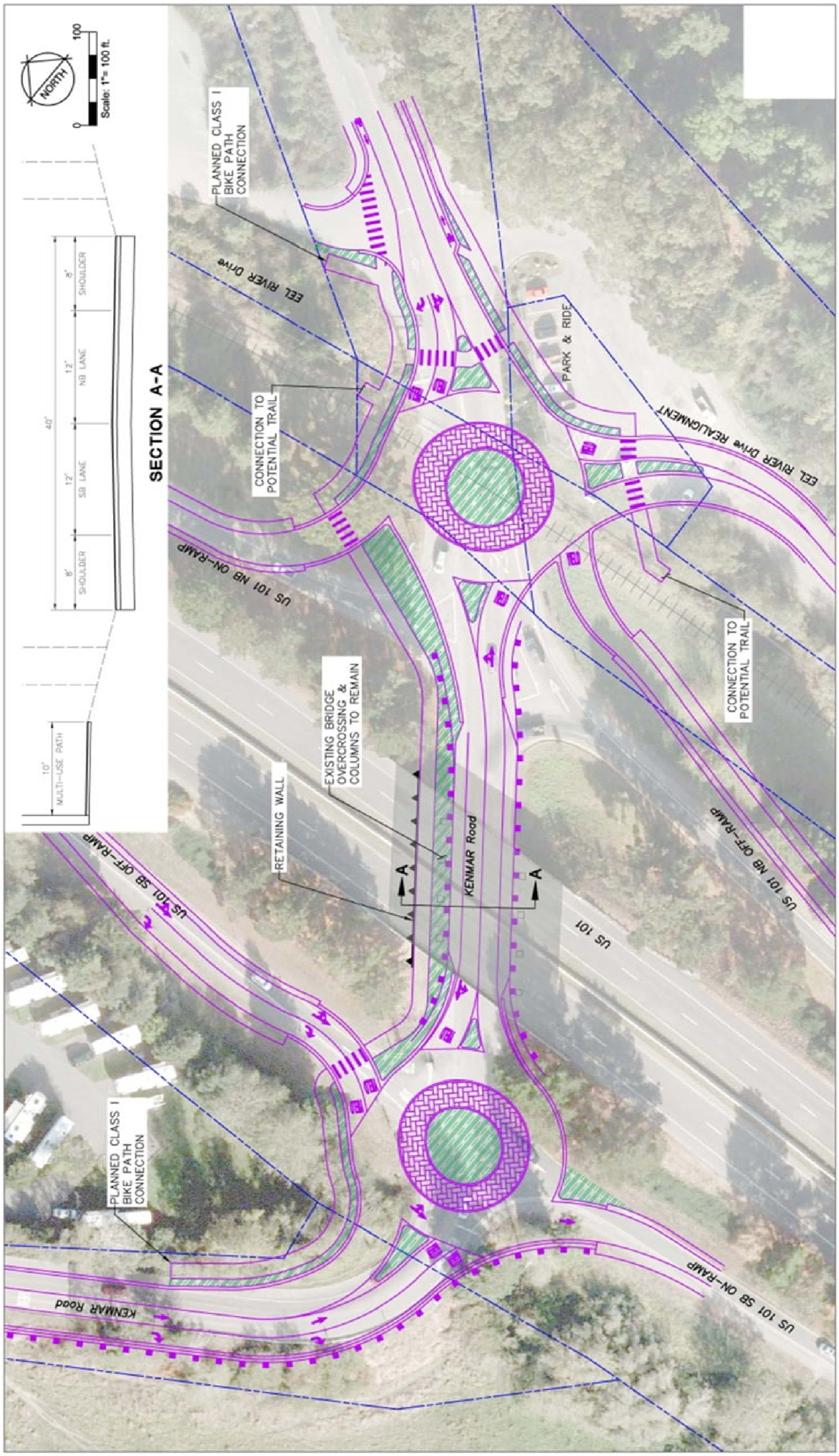


Figure 26: Kenmar Road Interchange Roundabout Concept - Option 2

7.4 Intersection Operations

7.4.1 Signalized Intersection Operations

Table 8 provides a summary of the intersection LOS for the signal concept along Kenmar Road and Riverwalk Drive/12th Street. Figure 27 presents the cumulative peak hour volumes at the study intersections.

Table 8: Signal Concept Intersection Level of Service

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	Kenmar Road and US 101 SB Ramps	Signal	C	21.8	C	31.2	C
2	Kenmar Road and US 101 NB Ramps	Signal	C	14.5	B	13.9	B
3	Kenmar Road and Eel River Drive	Signal	C	3.0	A	13.0	B
4	Kenmar Road and South Fortuna Boulevard/Ross Hill Road	Signal	C	30.8	C	23.1	B
5	Riverwalk Drive and Private Driveway	TWSC	C	15.5	C	14.9	B
6	Riverwalk Drive and Dinsmore Drive	Intersection Eliminated					
7	Riverwalk Drive and US 101 SB Ramps	Signal	C	7.7	A	32.6	C
8	Rivewalk Drive/12th Street and US 101 NB On-Ramp/Pond Street	Signal	C	19.8	B	21.0	C
9	US 101 NB Off-Ramp/12th Street and Pond Street	Intersection Eliminated					
10	12th Street and Newburg Road	Signal	C	17.7	B	26.0	C
Notes:							
1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control							
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC and Signal							

As shown in Table 8, all intersections are projected to operate at or above the threshold LOS with the proposed signal improvements. The intersections of Riverwalk Drive/Dinsmore Drive and 12th Street/US 101 NB On-ramp/Pond Street would be eliminated with the signal alternative.

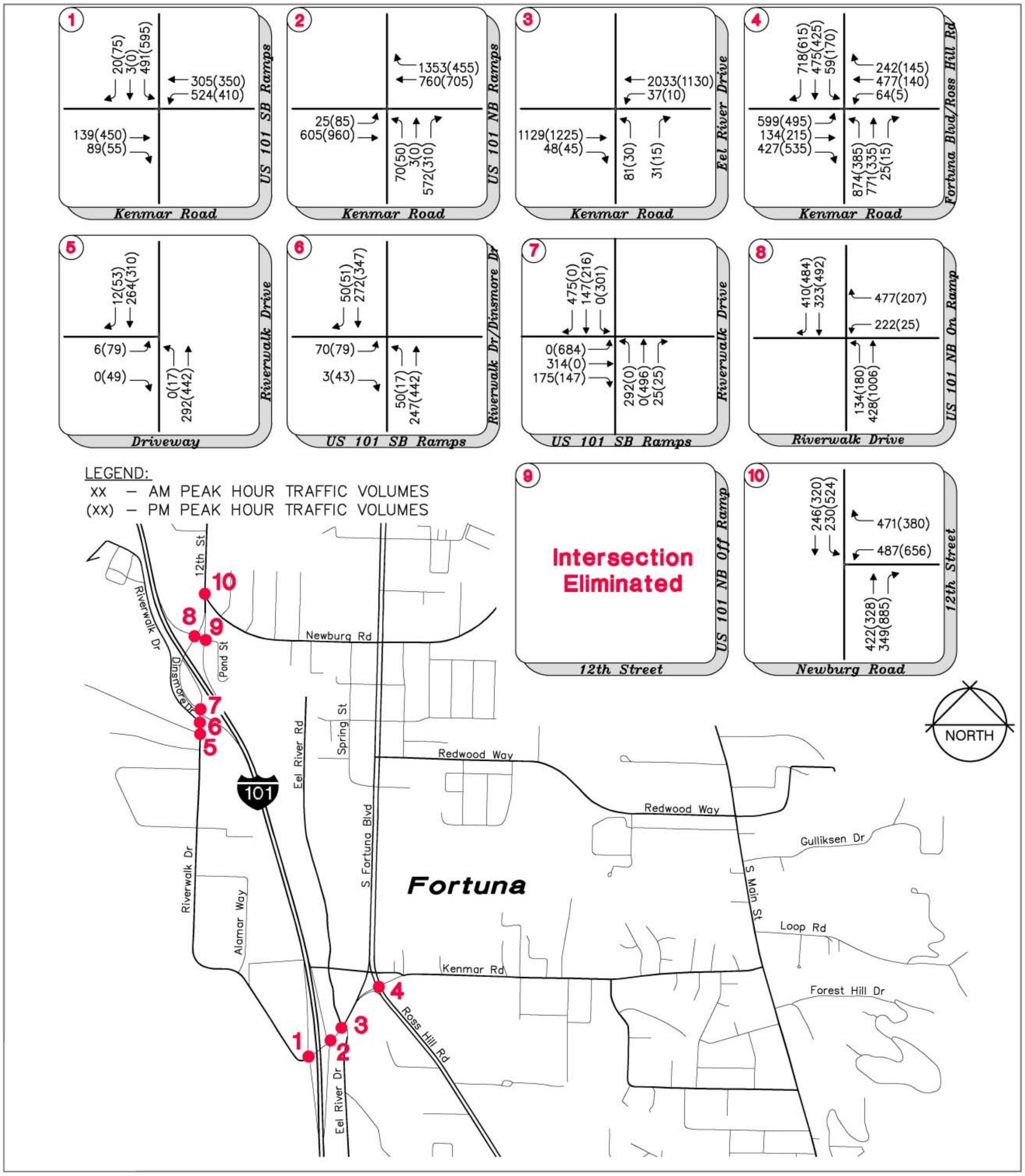


Figure 27: Cumulative Peak Volumes - Signalized Intersections

7.4.2 Roundabout Intersection Operations

Table 9 provides a summary of the intersection LOS for the roundabout concept along Kenmar Road and Riverwalk Drive/12th Street with the five-legged roundabout alternative. Figure 28 presents the cumulative peak hour volumes at the study intersections.

Table 9: Roundabout Concept Intersection Level of Service

#	Intersection	Control Type[1,2]	Target LOS	AM Peak Hour		PM Peak Hour	
				Delay	LOS	Delay	LOS
1	Kenmar Road and US 101 SB Ramps	RNDBT	C	8.4	A	16.6	B
2	Kenmar Road and US 101 NB Ramps	RNDBT	C	5.3	A	8.3	A
3	Kenmar Road and Eel River Drive	RNDBT	C	5.4	A	8.3	A
4	Kenmar Road and South Fortuna Boulevard/Ross Hill Road	RNDBT	C	11.0	B	18.0	B
5	Riverwalk Drive and Private Driveway	RNDBT	C	4.3	A	4.3	A
6	Riverwalk Drive and Dinsmore Drive	TWSC	C	10.5	B	11.4	B
7	Riverwalk Drive and US 101 SB Ramps	RNDBT	C	6.6	A	10.7	B
8	Rivewalk Drive/12th Street and US 101 NB On-Ramp/Pond Street	RNDBT	C	8.7	A	19.9	B
9	US 101 NB Off-Ramp/12th Street and Pond Street	Intersection Eliminated					
10	12th Street and Newburg Road	Intersection Eliminated					
Notes:							
1. AWSC = All Way Stop Control; TWSC = Two Way Stop Control							
2. LOS = Delay based on worst minor street approach for TWSC intersections, average of all approaches for AWSC and Signal							

As shown in Table 9, all intersections are projected to operate at or above the threshold LOS with the proposed roundabout improvements. The intersections of 12th Street/US 101 NB On-ramp/Pond Street and 12th Street/Newburg Road would be eliminated with the roundabout alternative.

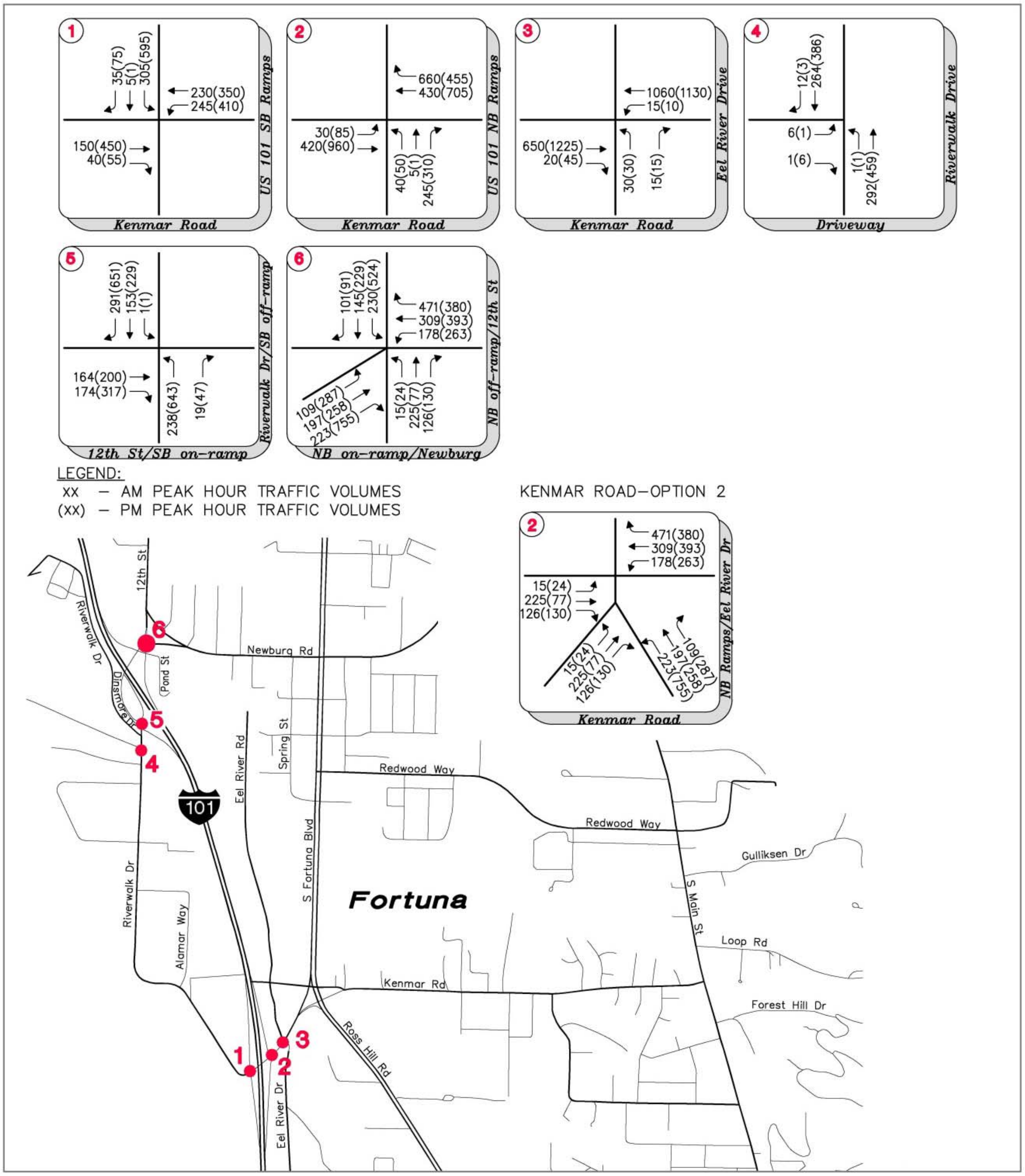


Figure 28: Cumulative Peak Volumes – Roundabouts

7.5 Pedestrian and Bike Accommodation

It is a key objective of the proposed improvements to improve access and safety for cyclists and pedestrians at the interchanges which, currently, does not meet existing standards. Other needs related to modal interrelationships and social considerations have been identified, including the need to preserve the park and ride lot, and the needs expressed by residents and businesses regarding ingress and egress to properties adjacent to the study area. The accommodation of bicycles and pedestrians through the interchange corridors and connections to various planned trails are incorporated into the design of all alternatives.

7.5.1 12th Street Interchange

Signalized Concept

The 12th Street Interchange Signal Alternative accommodates pedestrians and bicycles with standard Class II bike lanes, sidewalks, and intersection crossings along 12th Street, US 101 ramps, and Newburg Road. Each crossing is 10’ wide and extends across the entire intersection length. Due to the number of lanes at each approach, long crosswalks will increase pedestrian crossing times and will affect the traffic signal timing to ensure that pedestrians can safely cross the roadway.

Roundabout Concepts

Pedestrian crossings are provided on all legs for the 12th Street North Interchange Roundabout Concept. Crossings are 10 feet in width and set back a minimum of 20 feet from the roundabout’s circulating roadway. Where crosswalks intersect splitter islands or medians, a 6 foot long minimum paved pathway is provided between the travel lanes for safety and refuge when waiting to cross. Shared-use pathways, 10 feet in width and located outside of the roundabout, are setback a minimum of 5 feet from the circulatory road with a landscape strip to increase accessibility and discourage pedestrians from crossing into the central traveled way.

Bicycles are accommodated by navigating through the roundabouts in two ways. Cyclists may choose to take the travel lane and travel through the roundabout as a vehicle or may choose to take the separated bike ramp / shared use path and travel around the roundabout as a pedestrian.

Pedestrian crossings are provided along Riverwalk Drive, Dinsmore Drive, and 12th Street for 12th Street South Interchange Roundabout Concepts. Crossings are 10 feet in width and set back a minimum of 20 feet from the roundabouts' circulating roadways. Where crosswalks intersect splitter islands or medians, a 6 foot long minimum paved pathway is provided between the travel lanes for safety and refuge when waiting to cross. Shared-use pathways, 10 feet in width and located outside of the roundabouts, are setback a minimum of 5 feet from the circulatory road with a landscape strip to increase accessibility and discourage pedestrians from crossing into the central traveled way.

7.5.2 Kenmar Interchange

Signalized Intersection

The Kenmar Road Interchange Signal Alternative accommodates pedestrians and bicycles with standard Class II bike lanes, sidewalks, and intersection crossings along Kenmar Road and US 101 ramps. Each crossing is 10’ wide and extends across the entire intersection length. Due to the number of lanes at each approach, long crosswalks will increase pedestrian crossing times and will affect the traffic signal timing to ensure that pedestrians can safely cross the roadway.

Roundabouts

Pedestrian crossings are provided along Kenmar Road and US 101 ramps for Kenmar Road Interchange Roundabout Concepts. Crossings are 10 feet in width and set back a minimum of 20 feet from the roundabouts' circulating roadways. Where crosswalks intersect splitter islands or medians, a 6 foot long minimum paved pathway is provided between the travel lanes for safety and refuge when waiting to cross. Shared-use pathways, 10 feet in width and located outside of the roundabouts, are setback a minimum of 5 feet from the circulatory road with a landscape strip to increase accessibility and discourage pedestrians from crossing into the central traveled way.

Bicycles are accommodated by navigating through the roundabouts in two possible ways. Cyclists may choose to take the travel lane and travel through the roundabouts as a vehicle or may choose to take the separated bike ramp / shared use path and travel through the corridor as a pedestrian.

7.6 Structure Alternatives - 12th Street Interchange

A preliminary structural analysis was prepared to determine preliminary scope, feasibility, rough cost range, and a list of potential project risks required for proposed structural improvements.

The 12th Street Overcrossing Bridge (Br. No. 04-0130) spans over Route US 101 at the interchange (Figure 29). The bridge is on curved alignment with supports skewed and parallel to US 101. The structure is a 34-foot-wide, 4-span, 197-foot-long, concrete tee-beam structure, with a span arrangement of 44, 65, 53, and 35 feet. The structure was constructed in 1962. End supports are short seat abutments on concrete pile foundations, and intermediate supports are 2-column bents on concrete pile foundations. US 101 currently passes under the spans 2 and 3 with a 15-foot 5-inch vertical clearance over northbound lanes and 15-foot 6-inch vertical clearance over southbound lanes. The 34-foot-width currently carries two 12-foot travel lanes, two 2-foot shoulders, and two 3-foot-wide Type 2 Barrier railings. The clear width between barrier railings is 28 feet.

Figure 29: 12th Street Overcrossing - Looking East

The Overcrossing is State-owned, on the National Highway System, and rated adequate for permit loads. The structure is in good condition with a health index of 100, but the sufficiency rating (SR) is 80.1 because of the bridge's narrow width and ADT. When originally built, the ADT was much lower and the 28 feet width was adequate. Based on our discussions with Caltrans, this structure is not eligible for funding under the Federal Highways Bridge Program. Structures with sufficiency ratings below 80 are eligible for rehabilitation and must have a structurally deficient status. This structure does not have any structural deficient status and the sufficiency rating is above 80. However, funds from the US Department of Transportation surface transportation funding programs may be available to assist with costs of widening depending on program and eligibility requirements. Two alternatives to provide for the pedestrian/bicycle facility at 12 Street Overcrossing are to widen the existing bridge or to construct a new independent pedestrian/bicycle overcrossing close to the existing bridge along the north side.

7.6.1 12th Street Overcrossing Bridge – Replace Structure

The 12th Street Interchange Traffic Signal Concept requires the replacement of the existing bridge structure over US 101. Based on the conditions at the site and the interchange geometrics, a new 12th Street Overcrossing will be approximately 200 feet in length. The most economical structure type will likely be a 4-span, precast, prestressed, concrete girder structure with a 4.3 foot structure depth. Approximate span configuration will be 58 feet, 82 feet, 82 feet, and 58 feet. End supports will be short-seat concrete abutments and interior supports will be 5-column bents. All supports will be pile supported. Clear roadway width will be 58 feet between 8-foot-wide Type 732SW barriers. Chain link railing will be mounted on the barrier walls above the interior spans and tubular handrailing will be mounted to the barrier wall above the end spans. Falsework is not necessary to erect this type of girder structure. Girders will be set in place from US 101 using traffic closures.

7.6.2 12th Street Overcrossing Bridge – Widen Structure or New Standalone Bicycle/Pedestrian Overcrossing

In order to provide bicycle and pedestrian connectivity for the 12th Street Roundabout Concepts, either the existing US 101 bridge structure will need to be widened, or a new standalone bicycle/pedestrian overcrossing will need to be provided. Both options are estimated to cost approximately $950,000, therefore further analysis is needed as the project develops to determine which option would be most preferred.

Widen Structure

The proposed bridge widening will consist of constructing a 197-foot-long, 9.7-foot-wide, 4-span, precast, prestressed concrete girder addition along the north side of the existing Overcrossing. The widening would provide a clear width of 10’-0” between barriers and match the existing bridge structure depth, structure type, profile, and pile foundation supports. Both the east and west approaches to the bridge will be on widened fill embankment closely matching existing conditions. Vertical clearance from the soffit of the widened bridge to the surface of US 101 below will not be affected.

The existing barrier and deck slab along the north side of the Overcrossing would need to be removed and replaced. Traffic control and temporary barriers along the 12th Street roadway would be required to construct the widening. Additionally, traffic control systems would be required on US 101 to construct pile foundations and widen the existing column bents. Falsework is not necessary to erect this type of girder structure. Girders will be set in place from US 101 using traffic closures.

Overall width of the widened structure would be 43-feet 8-inches. Clear vehicular roadway width would be 28 feet between the existing Type 3 concrete barrier along the south edge of the existing bridge and a new Type ST-30 bridge rail located to separate the 10-foot-wide pedestrian/bicycle facility from the vehicular traffic. A Type 732SW (modified) barrier with chain link railing mounted on the barrier wall would bound the pedestrian/bicycle facility along the north edge of the widened structure. See Figure 30 for a concept of how the bridge widening would be achieved.

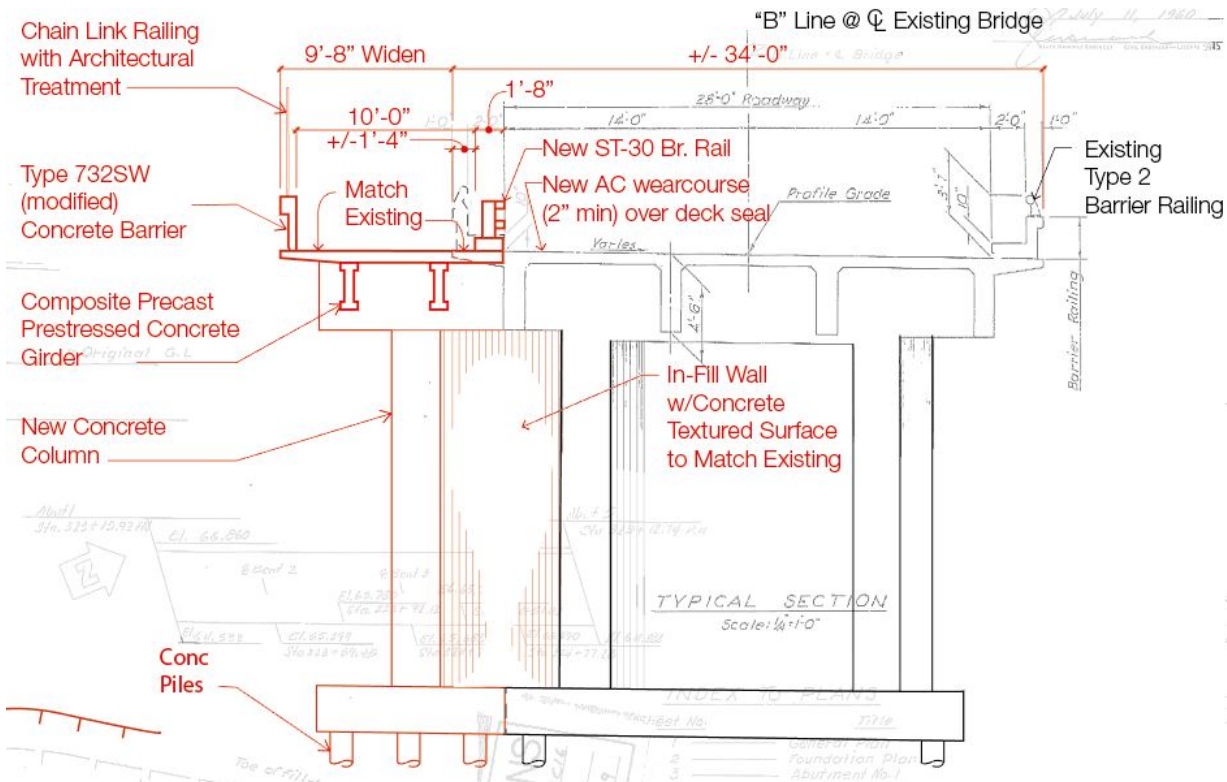


Figure 30: 12th Street overcrossing bridge widening concept

New Standalone Bicycle/Pedestrian Overcrossing

A new pedestrian/bicycle overcrossing will consist of constructing a 203-foot-long, 12-foot-wide, 4-span, precast, prestressed concrete girder structure along the north side and close to the existing Overcrossing. The new structure would provide a clear width of 10'-0" between barriers and match the existing bridge structure depth, structure type, profile, and pile foundation supports. Both the east and west approaches to the bridge will be on widened fill embankment closely matching existing conditions. Vertical clearance from the soffit of the new bridge to the surface of US 101 below should maintain approximately 16 feet.

The existing barrier and deck slab along the north side of the Overcrossing would need to be removed and replaced. Traffic control and temporary barriers along the 12th Street roadway will be required to construct the new structure. Additionally, traffic control systems would be required on US 101 to construct pile foundations and column bents. Falsework is not necessary to erect this type of girder structure. Girders will be set in place from US 101 using traffic closures.

Type 732SW (modified) barriers with chain link railing mounted on the barrier wall would bound the pedestrian/bicycle facility along both edges of the new structure.

7.6.3 Strongs Creek Bridge on Riverwalk Drive – Replace Structure

The 12th Street South Interchange Roundabout Concept Option 1 and 2 (a, b & c) all require the existing Strongs Creek bridge be replaced with a new structure. The existing Strongs Creek Bridge on Riverwalk Drive (Br. No. 04C-0085) is a County-owned, 99-foot-long, continuous 3-span, concrete flat slab structure constructed in 1962 with a clear roadway width of 28 feet (Figure 31). The roadway is classified as an urban collector and current average daily traffic (ADT) is approximately 2300 vehicles per day. Two steel pipelines are carried on the bridge, one on each edge. The structure is in fair condition with a health index of 100, but the sufficiency rating (SR) is 72.4 because of the bridge's narrow width and ADT. When originally built, the ADT was much lower and the 28 feet width was adequate.

Figure 31: Strongs Creek Bridge on Riverwalk Drive - Looking East

Based on our discussions with Caltrans, the Highway Bridge Program funding from Federal Highways may be available to assist in the costs of widening or replacing the bridge. Structures with sufficiency ratings below 80 are eligible for rehabilitation and widening. Additionally, the US Department of Transportation has programs that can assist with costs of widening as discussed above. If cost of total bridge replacement is expected to be less than 50 percent of cost associated with widening, then total replacement of the bridge is usually the preferred option.

Based on the conditions at the site and the proposed roadway geometrics, the bridge width required at Strongs Creek on Riverwalk Drive will need to vary from about 58 feet at the west abutment (west creek bank) to about 76 feet at the east abutment (east creek bank). The existing 99-foot-long bridge length is adequate. Because proposed bridge width is more than twice the existing 28 feet, it will be most economical to replace the entire structure rather than to widen it.

The most economical replacement structure type would likely be a continuous 3-span, concrete flat slab structure with a 1.5 foot structure depth. Approximate span configuration would be 33.5 feet, 32 feet, and 33.5 feet. End supports will be concrete diaphragm abutments supported on concrete piles and interior supports would be concrete pile bents. Bridge width varies, (58 feet at the west abutment to 76 feet at the east abutment) and the bridge carries Type 732SW (modified) barriers, a 10-foot-wide pedestrian/bicycle facility, and 12-foot eastbound and westbound travel lanes, shoulders, and edge and road medians of varying widths. Tubular hand railing would be mounted to the barrier walls. Falsework is necessary to erect this type of slab structure. The pipeline utilities would have to be relocated and supported on the new bridge or buried in the stream bottom.

7.6.4 Strongs Creek Bridge (New Bridge) on Dinsmore Drive

The 12th Street Interchange Traffic Signal Concept and the Roundabout Concept 2a both require a new bridge over Strongs Creek to accommodate the realigned Dinsmore Drive. Based on the conditions at the site and the proposed roadway geometrics, the new Strongs Creek Bridge on Dinsmore Drive will be approximately 157 feet in length and 38-feet-wide. The most economical structure type will likely be a continuous 5-span, concrete flat slab structure with a 1.5 foot structure depth. Approximate span configuration will be 27.5 feet, 34 feet, 34 feet, 34 feet, and 27.5 feet. End supports will be concrete diaphragm abutments supported on concrete piles and interior supports will be concrete pile bents. Supports will be parallel to the channel and skewed approximately 60 degrees from normal to the roadway. Clear roadway width will be 24 feet between 7-foot-wide Type 732SW barriers. Tubular handrailing will be mounted to the barrier walls. Falsework is necessary to erect this type of slab structure.

7.6.5 Rohner Creek Bridge on U.S. Highway 101

The 12th Street Interchange Traffic Signal Concept requires the existing Rohner Creek bridge on US101 be widened to accommodate the extended NB onramp. The existing Rohner Creek Bridge on U.S. 101 (Br. No. 04-0108) is a pile supported, 87-foot-long, 74-feet-wide, continuous 3-span, concrete flat slab structure constructed in 1962. The structure is in good condition with a sufficiency rating (SR) of 95.9.

Based on the conditions at the site and the proposed roadway geometrics, the existing bridge will need to be widened on its east edge approximately 16 feet to accommodate the proposed 12th Street/U.S. 101 IC northbound on-ramp widening. The widening will match the existing bridge type and will be a continuous 3-span, concrete flat slab structure with a 1.33 foot structure depth. Approximate span configuration will be 29.5 feet, 28 feet, and 29.5 feet. End supports will be concrete diaphragm abutments supported on concrete piles and interior supports will be concrete pile bents. Supports will be parallel to the channel and skewed approximately 20 degrees from normal to the roadway. A Type 742 concrete barrier will be mounted along the new right edge of deck. Falsework is necessary to erect this type of slab structure.

7.7 Structure Alternatives - Kenmar Road Interchange

US 101 spans over Kenmar Road on a bridge (Kenmar Road Undercrossing, Br. No. 04-0128) at the interchange as shown in Figure 32. The bridge is skewed approximately 34 degrees to the right and is a 3-span, 133-foot-long, concrete tee-beam structure, with a span arrangement of 34, 64, and 34 feet. The structure was constructed in 1962. End supports are diaphragm abutments on concrete pile foundations, and intermediate supports are 4-column bents on concrete pile foundations. The structure is in good condition with sufficiency rating equal to 98 and health index equal to 100. Kenmar Road currently passes under the 65 foot main span with a 14-foot 10-inch vertical clearance. The 40-foot-width of Kenmar Road currently accommodates two 12 foot travel lanes and two 8-foot shoulders. There are no sidewalks along either side of Kenmar Road.

Figure 32: Kenmar Road Undercrossing Looking West

7.7.1 Kenmar Road Undercrossing – Replace Structure

The Kenmar Road Interchange Traffic Signal Concept will add traffic signals and improve Kenmar Road in the City of Fortuna by widening the roadway, maintain profile grade, and adding a pedestrian sidewalk along the north side of the roadway. The widening would accommodate five 12-foot traffic-lanes, 5-foot shoulders each side of the roadway and a 7-foot-wide sidewalk along the north side of the road. The overall width of Kenmar Road improvement is approximately 77 feet including the sidewalk. In order to provide for widening and improving Kenmar Road to this extent, it will be necessary to replace the existing 3-span undercrossing. The existing bridge is in fair condition, however its' main span is insufficient dimension to accommodate the Kenmore Road improvements.

Based on the conditions at the site and the interchange geometrics, the new undercrossing will be a single-span, approximately 114 feet in length. The most economical structure type will likely be a precast, prestressed, concrete girder structure with a 6-foot structure depth. Supports would be high-cantilever wall type abutments founded on concrete piling. An increase in elevation of U.S. 101 on the order of 2 feet will be necessary to allow for a minimum 15 feet vertical clear distance from the bottom of soffit to Kenmar Road. The undercrossing will be designed to accommodate a Type 742 concrete left barrier, a minimum 10-foot left shoulder, two 12-foot lanes of southbound traffic, 5-foot southbound median shoulder, a Type 60 median barrier, a 5-foot northbound median shoulder, two 12-foot lanes northbound traffic, a 10-foot right shoulder, and a Type 742 concrete right barrier. Falsework is not necessary to erect this type of girder structure.

The new undercrossing can be constructed in two phases. The initial phase would likely be to remove and construct approximately the west half of the new bridge, while U.S. 101 traffic utilizes the east half of the existing bridge. The final phase would be to reroute U.S. 101 traffic to the new west half and remove and construct the east half of the new structure and a 3-foot wide deck closure pour.

7.7.2 Kenmar Road Undercrossing – Retaining Wall

The Kenmar Road Roundabout Concepts will require a permanent retaining wall parallel to and in front of the north abutment of the existing Kenmar Road Undercrossing (Abutment 4) and to add traffic roundabouts each side of the interchange on Kenmar Road. The retaining wall in front of the abutment is to accommodate a 10-foot-wide pedestrian/bicycle facility under the structure. The total length of proposed wall will be approximately 180 feet.

The proposed wall layout line is 15 feet from the face of the existing columns; however, the layout line could be located as close as 10 feet from the face of existing columns. We considered using a Caltrans Type 7 retaining wall for the proposed structure for the layout line 10 feet from the existing columns and the excavation for a Type 7 wall would likely be outside the influence zone of the Abutment 1 diaphragm. If the wall layout line is located more than 10 feet from the existing column face, then the new wall will need to be a permanent tie-back (ground anchor) diaphragm wall constructed from top down in a minimum of three lifts. The maximum wall height above the pedestrian surface will be approximately 12 feet depending on layout. The wall foundations will extend 2 to 3 feet below finish grade. Cable railing will be mounted on top of the wall. Permanent tie-backs will require a permanent construction easement.

7.8 Compatibility with Railroad

The railroad corridor roughly parallels the east side of US 101 and crosses through the 12th Street and Kenmar Road project areas. The NCRA is the public agency that owns right-of-way and the Northwestern Pacific Railroad (NWPRR) is the contract operator of the railroad. Together they have the responsibility for the safety, operation and maintenance of the railroad. Any modifications to railroad crossings at roadway intersections will require the approval of the California Public Utilities Commission (CPUC) under General Order 88-B. As the project moves forward to project development, close coordination with the NCRA, NWPRR and the CPUC will be required to ensure that railroad operations are not impeded by interchange improvements. Figure 33 presents an example of a planned five-way roundabout in Healdsburg, CA, which was integrated to operate with active railroad corridor.

Figure 33: Example of five-way roundabout integrated with active railroad

7.9 Right-of-Way Needs

Generally, the property through and near the two interchanges are owned by public entities: Caltrans, the County of Humboldt, and the City of Fortuna. Table 10 summarizes all other right-of-way impacts for each alternative. Several alternatives do not impact any privately held properties, while others have significant impacts on several. Figure 34-Figure 38 illustrate the impact of each alternative that on private property.

Table 10: Right-of-way Impacts

Alternative	APN #	Right-of-Way Acquisition	
		SQFT	Acre
Kenmar Road Interchange Signal Concept		**N/A**	**N/A**
		N/A	N/A
Kenmar Road Interchange Roundabout Concept - Option 1a		**3,772.58**	**0.09**
	201-331-005	3,772.58	0.09
Kenmar Road Interchange Roundabout Concept - Option 1b		**N/A**	**N/A**
		N/A	N/A
Kenmar Road Interchange Roundabout Concept - Option 2		**N/A**	**N/A**
		N/A	N/A
12th Street Interchange Signal Concept		**215,894.35**	**4.96**
	200-353-035	26,670.74	0.61
	200-353-044	25,114.00	0.58
	200-353-005	2,786.18	0.06
	200-381-001	18,310.17	0.42
	200-381-002	2,165.86	0.05
	200-381-003	15,607.09	0.36
	200-381-004	31,722.53	0.73
	200-381-005	34,852.14	0.80
	200-381-006	28,621.34	0.66
	200-381-007	7,855.50	0.18
	200-381-009	22,943.46	0.53
12th Street South Interchange Roundabout Concept - Option 1		**5,077.99**	**0.12**
	200-353-021	2,467.25	0.06
	200-353-035	2,610.74	0.06
12th Street South Interchange Roundabout Concept - Option 2a		**51,030.08**	**1.17**
	200-353-035	25,916.08	0.59
	200-353-044	25,114.00	0.58
12th Street South Interchange Roundabout Concept - Option 2b		**N/A**	**N/A**
		N/A	N/A
12th Street South Interchange Roundabout Concept - Option 2c		**N/A**	**N/A**
		N/A	N/A
12th Street North Interchange Roundabout Concept		**51,687.33**	**1.19**
	200-381-001	18,311.54	0.42
	200-381-002	11,851.79	0.27
	200-381-009	199.22	0.004
	201-331-005	21,324.78	0.49

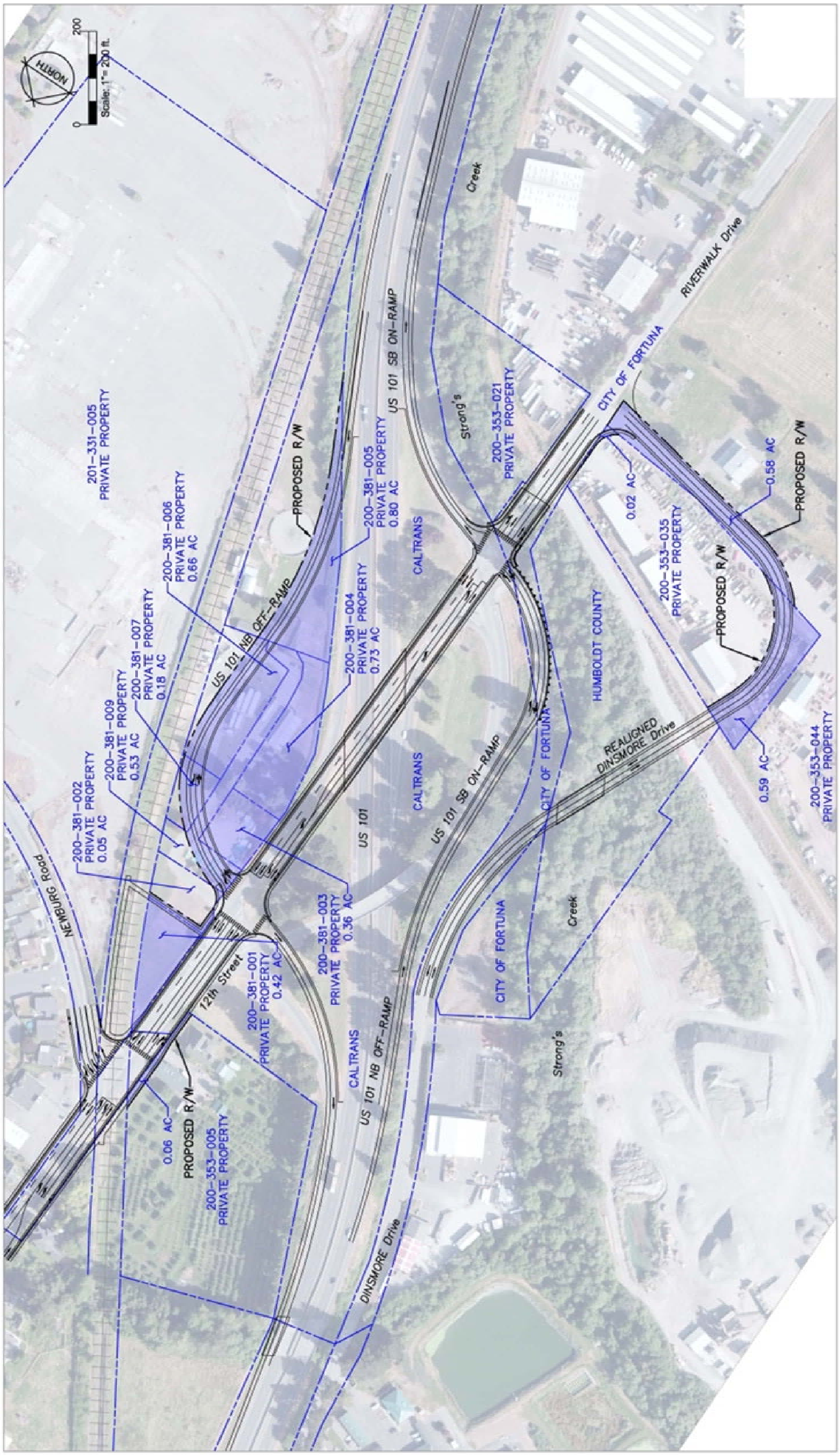


Figure 34: 12th Street Traffic Signal Right-of-way Impacts

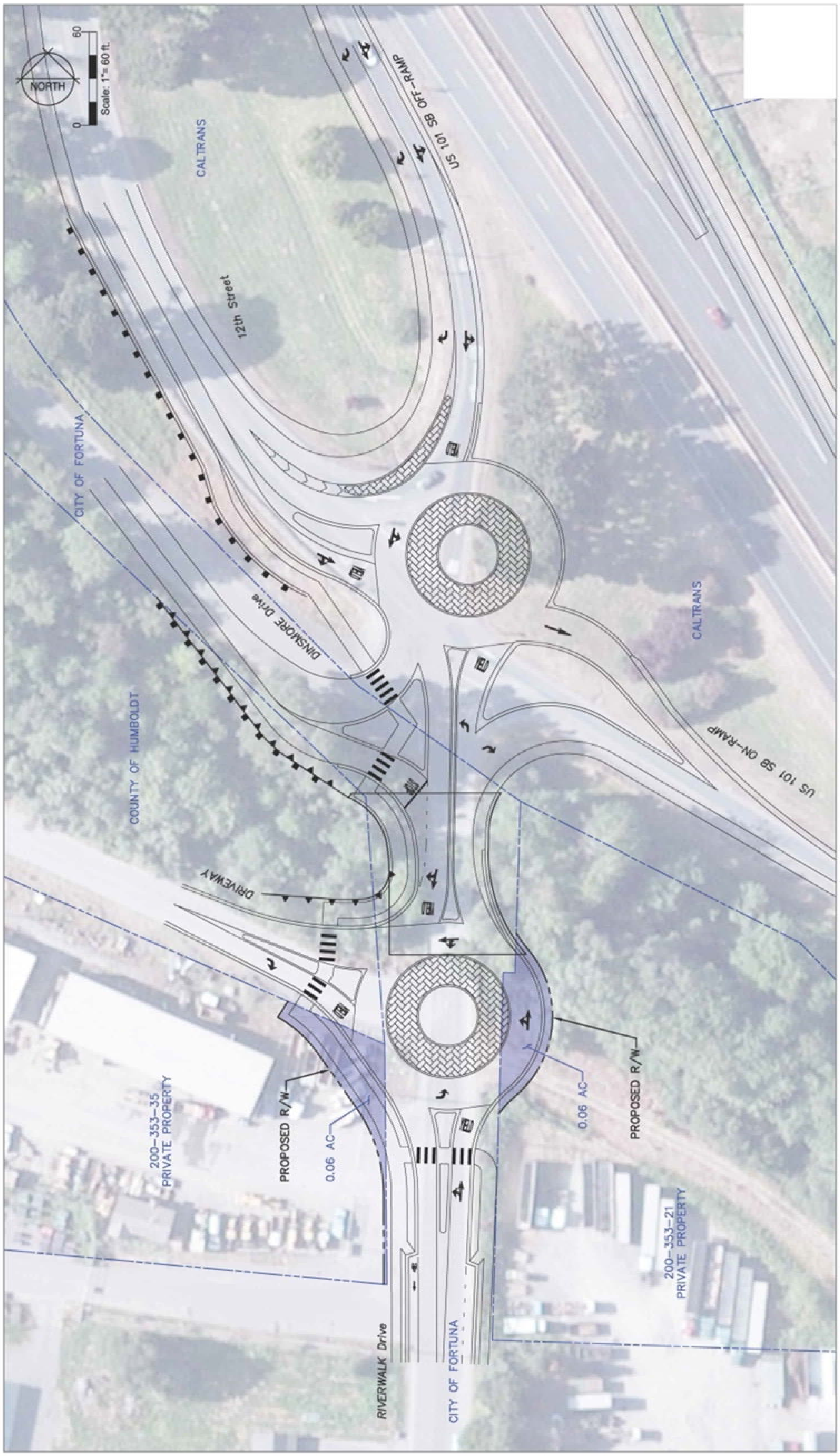


Figure 35: 12th Street South Option 1 Right-of-way Impacts

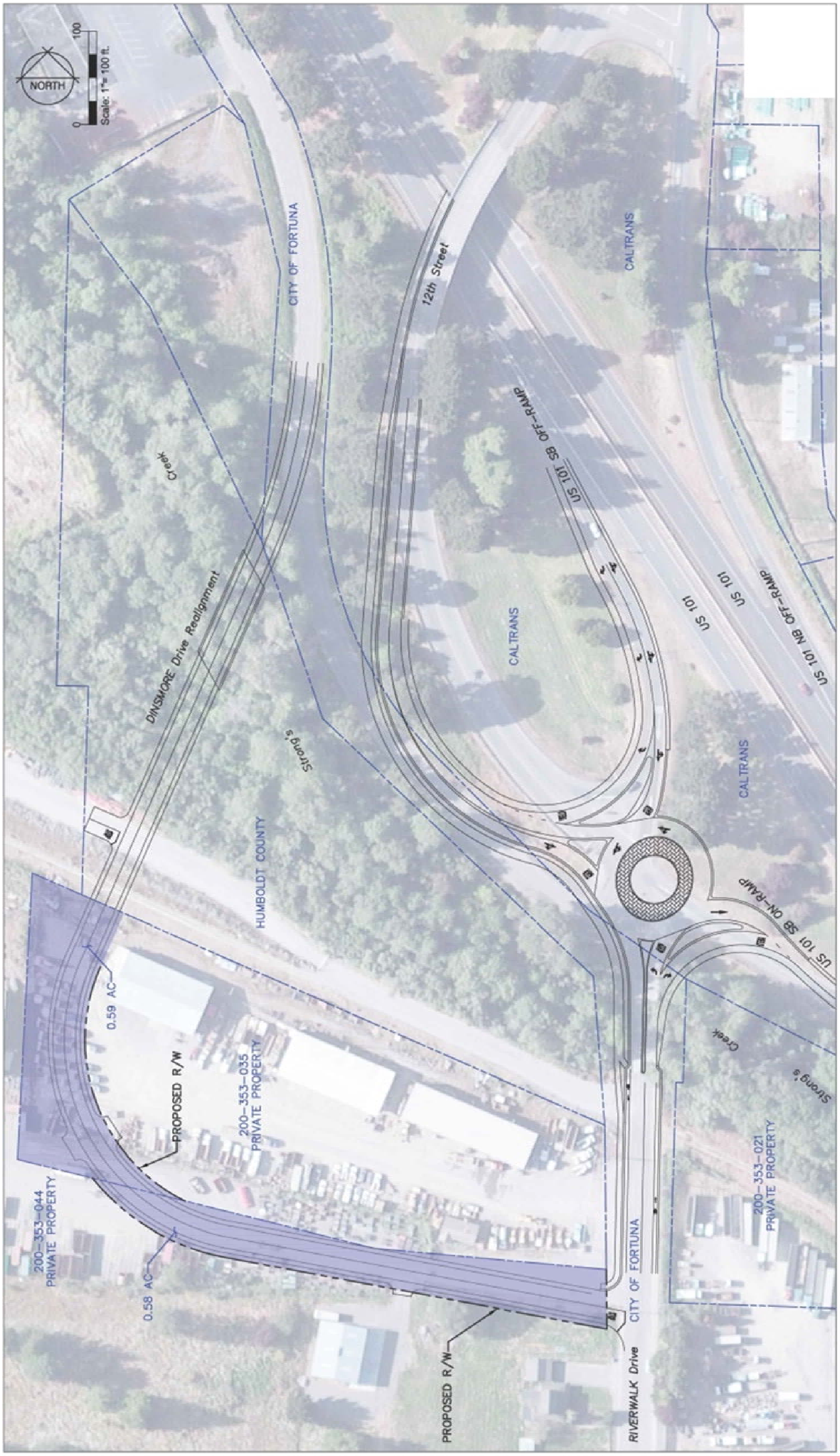


Figure 36: 12th Street South Option 2a Right-of-way Impacts

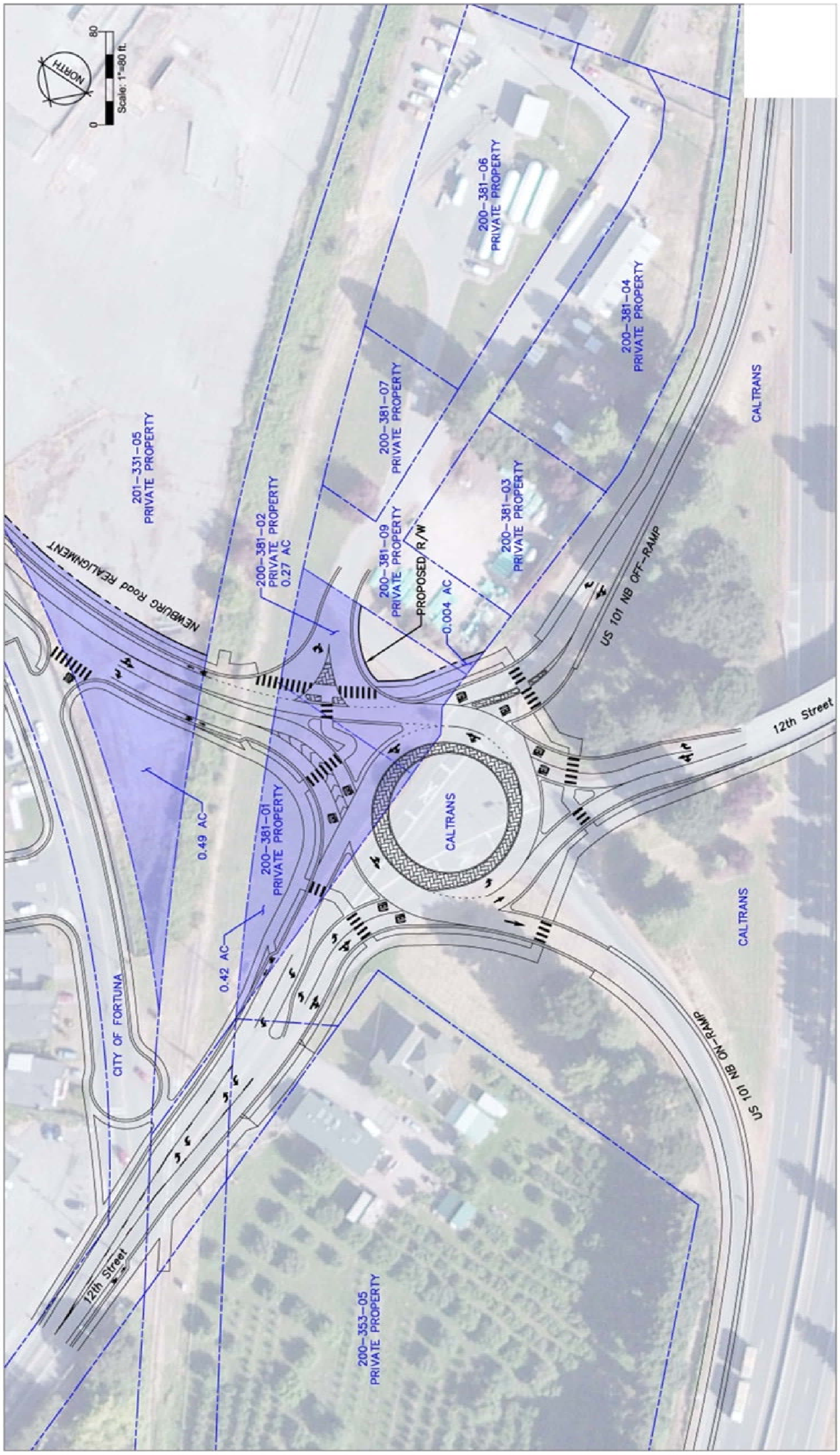


Figure 37: 12th Street North Right-of-way Impacts

Figure 38: Kenmar Road Option 1a Right-of-way Impacts

The 12th Street interchange signal concept will require nearly 5 acres of right-of-way acquisition, impacting eleven different properties. The 12th Street South roundabout concept option 1 will impact two properties to construct the southern roundabout. Option 2a will impact two properties with the realignment of Dinsmore Drive. The 12th Street North roundabout concept will require the full acquisition of at least one parcel, and will impact three other properties.

For the Kenmar Road interchange, only Roundabout Concept Option 1a requires right-of-way (less than a tenth of an acre) to construct the northern leg of the Eel River Drive roundabout.

7.10 Vision of Complete Streets

Figure 39 through Figure 41 shows before and after simulations at key project locations to convey what improvements may look like if intersection improvement coupled with complete streets concepts are constructed. These are intended to convey a general sense of the future, rather than decisions on the specific design elements. The final design will need to be resolved as the projects move forward through planning and design stages.

Figure 39: 12th Street Interchange Northbound – Current Condition and Vision

Figure 40: 12th Street Interchange Southbound – Current Condition and Vision

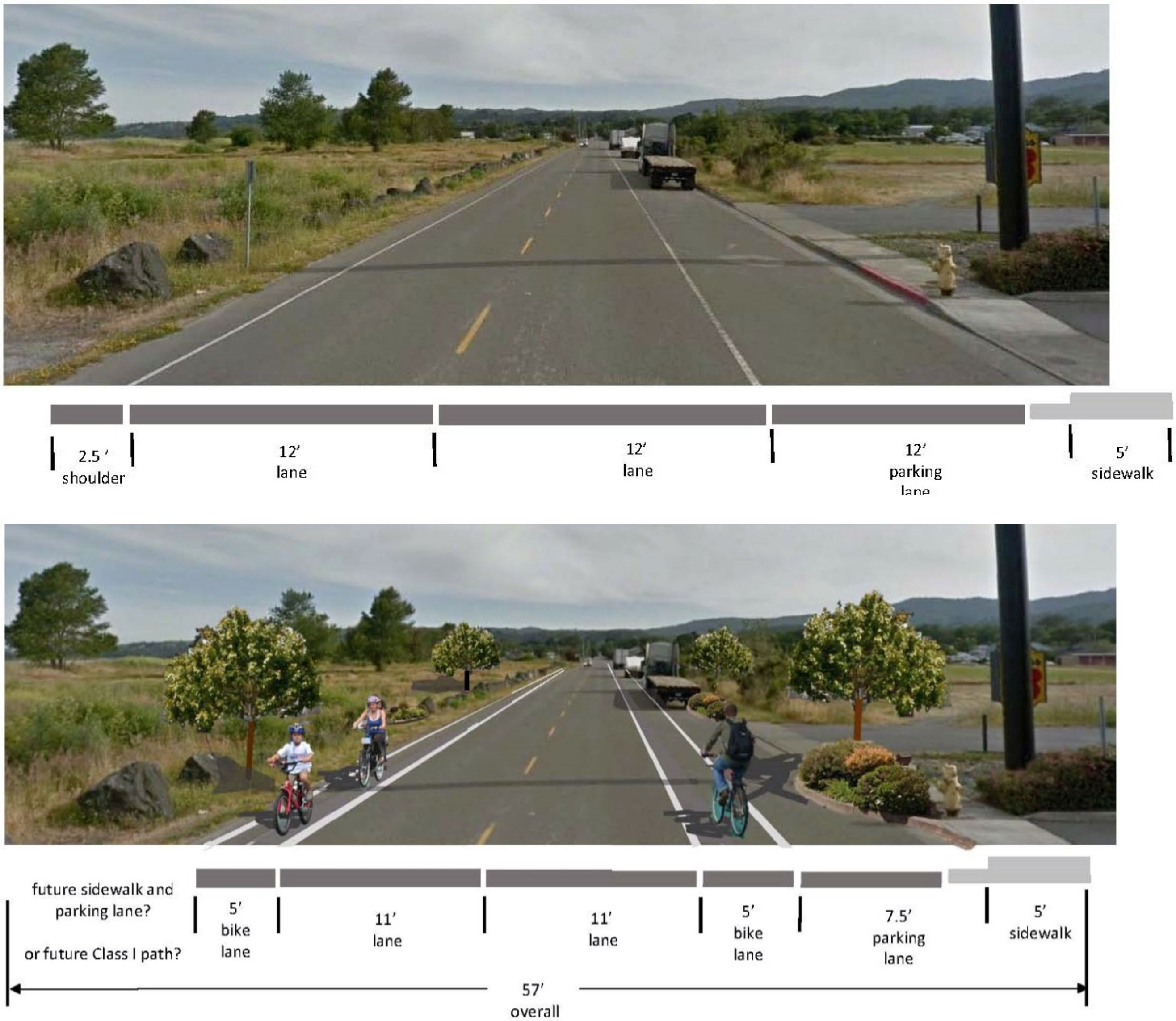


Figure 41: Riverwalk Drive Northbound – Current Condition and Vision

Wayfinding, gateway aesthetics and planting can be featured in each alternative in undeveloped open space along or within each intersection. Roundabouts, with their central landscape areas, lend themselves to focal points with artistic gateway treatments.

7.11 Alternatives Comparison

Several geometric design features need to be considered for both roundabout and a signal design. Below are the descriptions of the design features that are most important for this project.

7.11.1 Guide Signing

Guide signing is critical for providing proper direction to drivers as they approach any type of intersection or diverging roadway. Due to the project's proximity to US 101, downtown and the Riverwalk area, guide signing is critical for motorists to select the proper lane as they approach the intersection.

In the existing condition, Caltrans standard roadside guide signing is provided. For each of the proposed alternatives, guide signing will conform to existing conditions and standards.

The signal and roundabout alternatives were compared based on the complexity of the guide signing needed to support the proposed geometric configurations. At Kenmar Road interchange, signing for the signal alternative will be simpler due to the fact that this alternative will mimic existing movements throughout the study area. The signalized alternative for the 12th Street corridor will require new, more robust guide signing, due to the fact that the interchange will undergo significant geometric changes. The roundabout alternatives will require additional guide signage at the approaches and exits to ensure drivers traverse the intersection in the correct lane to safely and efficiently reach their destination.

7.11.2 Truck Accommodation

The design vehicles for both interchanges are the STAA-Standard truck and California Legal truck. Attempts were made to accommodate movements among all legs by the design truck's template from the 2014 Caltrans Highway Design Manual. For the roundabout alternative, the truck turn templates are illustrated allowing truck aprons to be mounted only by the truck trailer and not the tractor. The exhibits showing the truck turning movements are located in Appendix H.

The signal and roundabout alternatives were compared based on the ability to adequately serve the required design vehicle for all movements. Both the signal and roundabout alternatives serve the STAA Standard truck for all movements; therefore, both concepts equally satisfy the performance criteria for accommodating trucks.

7.11.3 Safety Considerations

Safety is a key evaluation factor, as one of the overall project objectives is to improve safety and reduce the number of accidents at all intersections adjacent to the Kenmar and 12th Street interchanges.

Crash Modification Factors

The technical report publication titled “Desktop Reference for Crash Reduction Factor” by the FHWA documents Crash Modification Factors (CMF). The publication contains CMF values for conversion of an all-way stop control or two-way stop control to a roundabout or traffic signal. The existing condition at the ten study intersections are as follows:

1.	Kenmar Road/US 101 SB Ramps:	Two-way stop control
2.	Kenmar Road/US 101 NB Ramps:	Two-way stop control
3.	Kenmar Road/Eel River Drive:	Two-way stop control
4.	Kenmar Road/Fortuna Boulevard/Ross Hill Road:	Signal
5.	Riverwalk Drive/Driveway:	Two-way stop control
6.	Riverwalk Drive/Dinsmore Drive:	All-way stop control
7.	Riverwalk Drive/12th Street/US 101 SB Ramps:	All-way stop control
8.	12th Street/US 101 NB On-Ramp:	Two-way stop control
9.	12th Street/US 101 NB Off-Ramp:	Two-way stop control
10.	Newburg Road/12th Street:	Two-way stop control

The CMF factors for both Total Collisions and Fatal/Severe Injury Collisions are reproduced below:

Total Collisions

- CMF for converting two-way stop control to a roundabout: 56% with +/- 6% standard error
- CMF for converting all-way stop control to a roundabout: 72% with +/- 6% standard error
- CMF for converting two-way/all-way stop control to signal: -17%

Fatal/Severe Injury Collisions

- CMF for converting two-way stop control to a roundabout: 78% with +/- 7% standard error.
- CMF for converting all-way stop control to a roundabout: 88% with +/- 8% standard error.
- CMF for converting all-way stop control to signal: -23% with +/- 22% standard error.

As noted above, the CMF for converting the intersections to a roundabout is higher when compared to converting it to a signal. The higher CMF directly correlates to a greater reduction in collision rates.

Number of Conflicting Points

CMF factors do not account for the number of conflicting points within an intersection, which directly correlates to the risk of an incident, especially at intersections. Conflicting points are locations at which a roadway user can cross, merge, diverge, etc. with another roadway user. A diagram of conflict locations at typical intersections are provided in Figure 42.

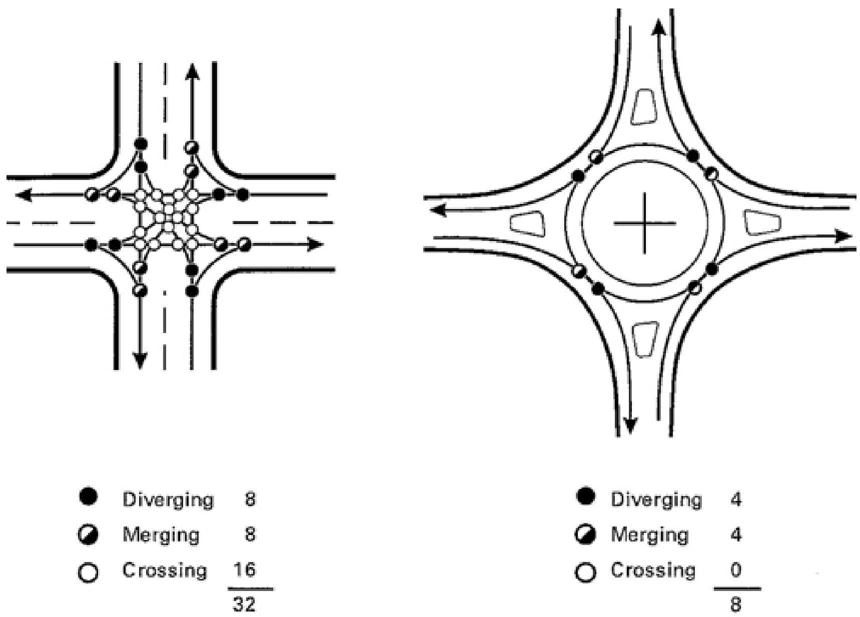


Figure 42: Typical Conflict Points at Typical Intersections

Figure 42 illustrates the advantages that the roundabout alternatives provide by significantly reducing the number of conflict points between vehicles and further justifies the higher CMF values as the exposure to risk is significantly reduced at roundabout intersections.

Reduced Speed Potential

Typically the roundabout geometric design requires the driver to reduce the speed in the intersection to 15-25 MPH. Conversely, drivers can travel through a signalized intersection at speeds higher than posted speed limits due to lack of geometric constraints. Due to reduced travel speeds through the intersection and expected reduction in crashes, the roundabout alternatives are likely to eliminate most severe crash types.

Pedestrian and Bike Safety

A key component of roundabout design focuses on non-motorized vehicle facilities through shared-use paths and two-stage crossings. The shared-use path provides the opportunity for cyclists to ride with vehicle traffic through the roundabout or to exit the roadway via a bike ramp and navigate the intersection on the shared-use path. Crosswalks are split into two separate crossings through the provision of pedestrian refuges at the splitter islands. These two-stage crossings reduce the amount of sustained time a pedestrian is in potential conflict with motorized vehicles by limiting the length of each crossing, and limit each crossing to one direction of vehicle travel at a time.

The performance of the signal and roundabout alternatives were compared based on the ability to accommodate pedestrians and cyclists through the corridors. In general, all alternatives provide an acceptable level of accommodation and safety; however, the roundabout alternatives provide better safety as the vehicle/pedestrian/cyclist interactions are limited to crossing locations and are separated from the travelled way by a landscape buffer.

7.11.4 Complete Streets Objectives

The bicycle and pedestrian improvements, along with traffic calming, landscaping, wayfinding, and other “complete streets” amenities, will respond to any reconfiguration of the highway interchanges and connecting streets either as more organized signalized intersections, or as roundabouts. In either case the same basic objectives apply.

- **Bicycle and Pedestrian Circulation Objective** - Provide complete bicycle and pedestrian connections through the interchanges to all the major directions and destination points.
- **Entryway Signs and Features Objective** - Provide memorable entryway signs and features that let visitors know they have arrived in Fortuna and community values and amenities.
- **Wayfinding Sign Objective** - Provide clear and complete signage for motorists, bicyclist and pedestrians to local destinations.
- **Pathway Lighting Objective -** Provide adequate lighting along the bicycle and pedestrian connections to support safe night time use.
- **Landscape Objective -** Provide naturalistic landscaping in the interchanges that is scenic, low maintenance and complements the natural landscape in Fortuna.

7.11.5 Summary of Findings

Table 11 summarizes the performance for the 12th Street interchange improvement alternatives.

Table 11: 12th Street Interchange Alternatives Comparison

Performance Measure	Signal Alt	Roundabout South Alt 1	Roundabout South Alt 2c	Roundabout North
Cumulative Condition Operations				
Delay - All approaches LOS "D" or better LOS A will be rated at 5 and E will be rated at 1.	3.2	4.7 ✓	4.3	3.5 ✓
Capacity - All signal approaches 1.0 V/C or better, All roundabout approaches 0.85 V/C or better	✓	✓	✓	
95th Percentile Queue - Adequate queue storage		✓	✓	
Costs				
Total Estimated Cost	$42,000,000	$10,050,000	$10,650,000	$12,370,000
Truck Accommodations				
Serves design vehicle for all movements	100% ✓	100% ✓	100% ✓	100% ✓
Safety				
Pedestrian Safety - Exposure to traffic in terms of number of conflict points	32	6	0 ✓	16 ✓
Bicycle Safety - Exposure to traffic in terms of number of lanes, conflict points, and speed differential		✓		✓
Local Access				
Maintains local access and circulation	✓	✓	✓	✓
Complete Streets				
Meets complete street objectives	✓	✓	✓	✓
Environmental Impacts				
Pavement Area (acre)	8.34	2.36	1.94 ✓	3.78 ✓
Impacts to sensitive areas (acres)	0.42	0.30 ✓	0.37	0 ✓
Right-of-Way Impacts				
Right-of-way acquisition area (acres)	4.96	0.12	0 ✓	1.19 ✓
Number of parcels affected	11	2	0 ✓	4 ✓
Public Input				
Meets public desires expressed during public workshops			✓	✓
Purpose and Need				
Meets purpose and need	✓	✓	✓	✓
Total Performance Measures Met	**5**	**9**	**11***	**12***

Notes
✓= meets or best meets performance criteria
***** = alternative that meets most performance criteria

Note: Roundabout North receives a checkmark if it performs better than the signal alternative.

As shown in above, Roundabout Option 2c meets more performance measures than Option 1. The only two that Option 1 meets that Option 2c doesn't meet are for delay and bicycle safety. Option 1 has a slightly higher average level of service, and the bicycle crossings are easier to navigate.

For the whole interchange, it's clear to see that a roundabout corridor meets significantly more performance measures than the signalized alternative. The only performance measure that the signal performs better at is capacity.

Table 12 summarizes the performance for the Kenmar Road interchange improvement alternatives.

Table 12: Kenmar Road Interchange Alternatives Comparison

Performance Measure	Signal Alt	Roundabout Alt 1A	Roundabout Alt 1B	Roundabout Alt 2
Cumulative Condition Operations				
Delay - All approaches LOS "D" or better LOS A will be rated at 5 and E will be rated at 1.	3.7 ✓	4.1 ✓	4.2 ✓	3.8 ✓
Capacity - All signal approaches 1.0 V/C or better, All roundabout approaches 0.85 V/C or better	✓		✓	✓
95th Percentile Queue - Adequate queue storage		✓	✓	✓
Costs				
Total Estimated Cost	$20,870,000	$6,000,000	$5,790,000	7,720,000
Truck Accommodations				
Serves design vehicle for all movements	100% ✓	100% ✓	100% ✓	100% ✓
Safety				
Pedestrian Safety - Exposure to traffic in terms of number of conflict points	14	8 ✓	9	11
Bicycle Safety - Exposure to traffic in terms of number of lanes, conflict points, and speed differential		✓		
Local Access				
Maintains local access and circulation	✓	✓		✓
Complete Streets				
Meets complete streets objective	✓	✓	✓	✓
Environmental Impacts				
Pavement Area (acre)	4.15	2.20 ✓	2.33	2.58
Impacts to sensitive areas (acres)	0.16	0.15	0.14 ✓	0.16
Right-of-Way Impacts				
Right-of-way acquisition area (acres)	0 ✓	0.09	0 ✓	0 ✓
Number of parcels affected	0 ✓	1	0 ✓	0 ✓
Public Input				
Meets public desires expressed during public workshops				✓
Purpose and Need				
Meets purpose and need	✓	✓	✓	✓
Total Performance Measures Met	**8**	**9**	**9**	**10***

Key
✓ = meets or best meets performance criteria
***** = alternative that meets most performance criteria

As shown in above, Roundabout Option 1b and 2 meets the most performance measures. However, Option 2 allows left turns for Eel River Drive, whereas Option 1b restricts these turns, requiring downstream U-turns. Additionally, the public expressed a preference for Option 2, Option 1b was developed after the public meetings and has not been reviewed publicly. Option 1b also missed points on pedestrian and bicycle safety by having additional conflict points. Moreover, this alternative has a larger impervious footprint, which could increase storm water runoff.

8. Stakeholder/Community Involvement

The project concepts were developed and vetted through a public process that included the formation and regular meeting of a Technical Advisory Group (TAG) and two public meetings. This section discusses the results of these stakeholder processes on project design.

8.1 Technical Advisory Group (TAG)

A TAG was convened on January 2016 to kick off the project. The purpose of the TAG was to provide technical information relevant to the project, to coordinate with local agencies, and to act as the “eyes and ears” of the community to guide the project. Group members included representatives from HCAOG, the City of Fortuna, the Humboldt County Department Public Work, Caltrans, and the project team.

The January 2016 kickoff meeting was focused on reviewing the project goals and objectives, and the various tasks required to complete the project. TAG members provided input on City and community needs and preferences.

In April 2016, the TAG convened to review the results of the right-of-way analysis, the environmental constraints analysis, the safety and design standards memorandum, and to prepare for the first community workshop.

The June 2016 TAG meeting convened to discuss the input received at the first community meeting, review the results of the traffic operations analysis (including growth rates, LOS, and bicycle/pedestrian. counts), review the draft conceptual designs, and prepare for the second community meeting. TAG members identified potential issues for design concepts and provided feedback to the project team about the community meeting.

In August 2016 the TAG met and reviewed the feedback received at the second public meeting, discussed the format of the project report and reviewed the schedule to complete the project.

The final TAG meeting in October 2016 was focused on reviewing the draft project report. TAG members contributed edits and guidance regarding next steps.

Written minutes from the TAG meetings are in Appendix D.

8.2 Community Meetings

Two workshops were held in March and July of 2016 to obtain public input into the project assessment and design. Outreach for the project was conducted with flyers, emails, radio public service announcements on six or more stations, social media posts, and targeted in-person outreach to colleagues and residents. Each workshop offered food, a child-friendly space with activities, and Spanish-English interpretation.

8.2.1 March 14, 2016 Workshop

The goals of this first workshop were:

- To understand how residents are currently navigating the Riverwalk area
- What concerns people have

- What potential design treatments successful in other small towns could be incorporated in the study area.

This workshop consisted of an open house with visuals detailing the study area and project goals, maps of the study area, a menu of design options, an overview Microsoft PowerPoint presentation by the project team, and a facilitated small group design session and discussion focusing on attendee's design preferences for roadway and intersection improvements. The workshop provided locally made Mexican food and beverages, Spanish-English interpretation, and supervised childcare available.

Figure 43: Flyer from First Community Workshop

Attendees included: residents of Fortuna, individuals who work in Fortuna, bicycle commuters, California Conservation Corps (CCC) staff, City staff, a Humboldt County Supervisor, Caltrans representatives, and staff from several local agencies. There were a total of 24 attendees. These attendees participated enthusiastically in the small group design session and other feedback opportunities.

The public indicated that they appreciated the study area for the following amenities: its nature views and experiences, the connection to the River Lodge and Eel River trail, and the related amenities such as the brewery. The attendees identified many challenges for pedestrians and bicyclists, including dark areas under crossings, narrow or virtually non-existent shoulders, and challenging road crossings. Participants used words like "hazardous" and "scary" to communicate how they felt about various aspects of the study area. Confusing intersections and inadequate parking were mentioned as issues for drivers. Landscaping, good signage, and general "beautification" were concepts desired at on and on-ramps, and participants would like visitors to feel welcomed, and make use of the town as a multi-modal destination.

Meeting participants showed a preference for design alternatives involving roundabouts. Signalized intersection alternative comments were mostly mildly negative. Roundabout options with fewer roundabouts, and fewer bicycle/pedestrian crossings were preferred. Signage with a rustic theme, art with salmon themes, and landscaping with native vegetation and river rock were mostly favoured by the public participants as shown in Figure 44.

This input provided valuable context for further development of design alternatives and findings of this report. Detailed comments can be found in Appendix E.

Figure 44: Voting results from First Workshop.

Figure 45: Attendees Participating in the Design Session at First Workshop

8.2.2 July 20, 2016 Workshop

The second workshop, conducted on July 20, 2016, solicited community feedback on several alternative designs for the 12th Street and Kenmar interchanges. This workshop consisted of an open house-style layout with large printouts of design alternatives posted around the room, an overview Microsoft Powerpoint presentation including a detailed analysis of the alternatives, and multiple opportunities to write input directly on the design sheets, on comment cards or by relaying it to a project team member. Spanish-English interpretation was offered at the meeting and a children's activity table was also available.

Attendees included members of the Fortuna Chamber of Commerce, city residents, CCC staff, City staff, Caltrans representatives and other members of the public. There were a total of 19 attendees.

The second workshop was aimed primarily at showcasing design alternatives, answering questions, and soliciting feedback. There was a clear preference for certain alternatives including the roundabout Option 2 for Kenmar Road and roundabout Option 2 at 12th Street. The workshop also included a summary of the prior workshop attendees' input, since there was some variation in who attended each workshop.

Figure 46: Presentations at the Second Workshop

8.2.3 Successes and lessons learned

Both workshops resulted in specific and helpful feedback from stakeholders who were directly connected to the study area in some way. The venue, food, accommodations for Spanish speakers and children, punctuality, staying on agenda, and thoroughness of the project team were highlights that attendees noted.

9. Environmental Determination

The project will be evaluated for potential impacts on the environment in compliance with the California Environmental Quality Act (CEQA). Compliance with the National Environmental Policy Act (NEPA) is required whenever there is federal involvement in the project, including federal funding. Feasible opportunities to avoid or reduce impacts will be pursued and mitigation measures will be developed to reduce potentially significant impacts as appropriate. The draft CEQA document will be made available to the public for review and comment. If the project does not qualify for a Categorical Exclusion (CE) or Programmatic Categorical Exclusion (PCE), additional environmental documentation under NEPA may be necessary prior to project approval for funding by a federal agency. Caltrans will most likely be the NEPA lead agency for the project.

The wetland and riparian habitats identified in Section 4.3 have a moderate to high likelihood of supporting listed reptile, frog and fish species including Western Pond Turtle *Emys (Actinymys) marmorata*, Northern Red-legged Frog *Rana aurora,* Foothill Yellow-legged Frog *Rana boylii*, Northern California Steelhead Trout *Oncorhynchus mykiss,* Coho Salmon *Oncorhynchus kisutch,* and Chinook Salmon *Oncorhynchus tshawytscha.* Several sensitive plant species also have a moderate likelihood of occurring in the study area.

Subsequent environmental investigations including a wetland delineation will be needed to address potential sensitive species identified and address any impacts to protected habitats. Additionally, a variety of permits and related environmental review will be necessary for project planning and design.

Table 13: Environmental Permit Summary

Law/Regulation	Permit/Approval	Authority
CEQA	Mitigated Negative Declaration or Environmental Impact Report	Lead Agency
NEPA	TBD	Caltrans on behalf of Federal Highways Administration
Clean Water Act Section 404	Nationwide Permit	US Army Corps of Engineers
Endangered Species Act	Biological Opinions (or Letters of Concurrence)	US Fish and Wildlife Service
Porter-Cologne/Clean Water Act Section 401	401 Certification and/or Waste Discharge Requirements (WDR)	North Coast Regional Water Quality Control Board
Fish and Game Code	Streambed Alteration Agreement	California Department of Fish and Wildlife
National Historic Preservation Act	Letter of Concurrence	State Historic Preservation Office Tribal Historic Preservation Office

A Preliminary Environmental Study (PES) should be developed when the NEPA process begins. The following technical studies and plans are anticipated:

- Natural Environmental Study of biological resources
- Wetland delineation
- Rare Plant survey

- Initial site assessment of hazardous materials
- Visual impact assessment
- Floodplain evaluation
- Geotechinical evaluation
- Drainage study
- Historic property survey report
- Archeological survey report
- Wetland mitigation and monitoring plan
- Stormwater pollution prevention plan
- Corridor management plan (including safety plan)

In general, agencies are more supportive of projects when they are a part of the early planning and collaboration process. Currently, the proposed project will occur mostly within already disturbed areas, and environmental impacts are most likely if design features cross wetland or riparian areas. Any work within the identified creek crossings or wetlands will also trigger various permit requirements.

10. Phasing Recommendations

10.1 Phasing

The intersection of Kenmar Road and the southbound ramps is operating at a level of service F under existing PM peak hour conditions. The 12th Street/Newburg Road/northbound ramps/Pond Street intersection operates at levels of service F and D under existing AM and PM peak hour conditions, respectively. Improvements to Kenmar Road/US 101 SB Ramps and 12th Street/US 101 NB Ramps/Pond Street/Newburg Road intersections should be first priority.

10.2 Potential Interim Bicycle and Pedestrian Improvements

There may be a long time horizon before major interchange redesign can be funded and implemented. In the interim there is significant potential for improving bicycle and pedestrian connectivity, clarity of directions and destinations for motorists as well as bicyclists and pedestrians, and enhancing the aesthetics and unique Fortuna identity conveyed at these interchanges. These improvements could be made through relatively inexpensive striping of bike lanes, trimming and clearing for informal roadside paths, low maintenance landscaping and placement of entry and wayfinding signage.

The yellow lines on Figure 47 and Figure 48 represent routes where walking could be facilitated – often by simply trimming encroaching weeds and shrubs. Beyond a simple dirt track that will tend to get muddy in wet weather, the path could be surfaced with wood chips, or paved with asphalt as in the example illustrated. The most basic part of this work could be done by volunteers, or by CCC crews, who will directly benefit from some of the improved access.

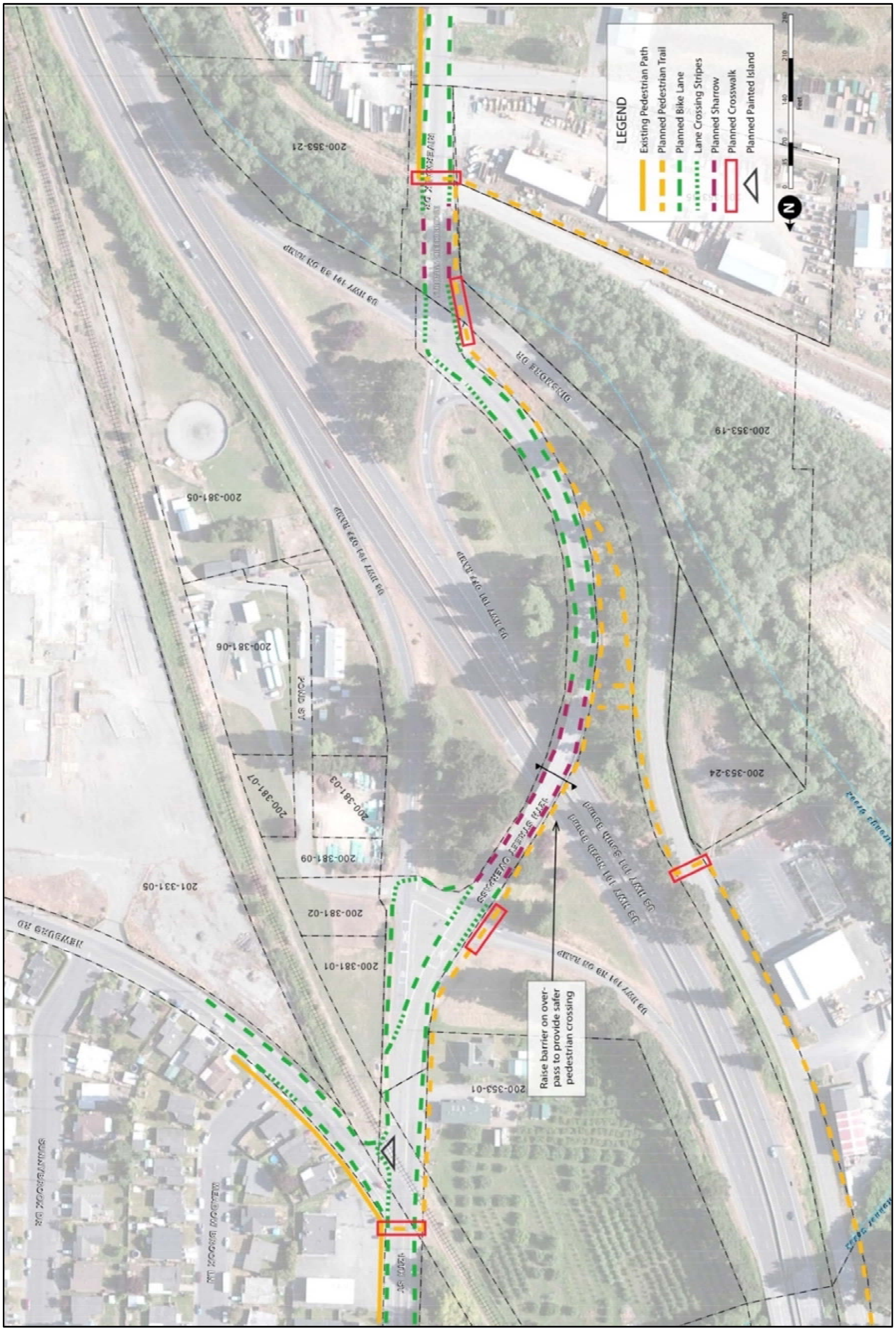


Figure 47: 12th Street/Riverwalk Drive Interim Bike/Ped Improvement Concepts

Figure 48: Kenmar Drive Interim Bike/Ped Improvement Concepts

The green lines on the map represent bike lanes or striped shoulders, with shorter dashed lines where "skip striping" could be placed to define and highlight bike routes through these broad intersections and challenging merge points. The red boxes indicate locations where crosswalks are desirable. These should be high visibility striping with associated signs and lights to warn motorists of their presence.

Most entry gateway features, signs or other wayfinding could be installed as interim features, and potentially removed and reinstalled when the permanent improvements took place.

The challenge of bikes crossing the very skewed angle of the railroad could be addressed by striping a more perpendicular crossing into a striped island as illustrated in Figure 49. Ultimately this configuration should be incorporated in the long-term interchange design, if the skewed crossing remains.

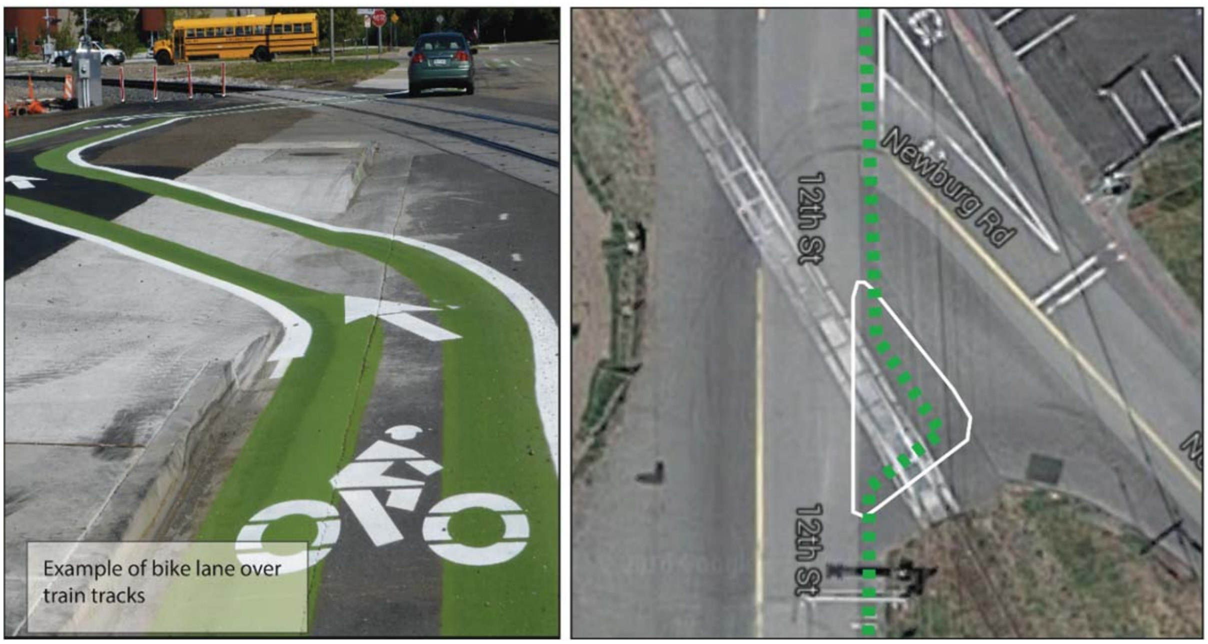


Figure 49: Concept for Bike Crossing of Railroad

The purple dashed lines on the maps represent places where there is insufficient room to create bike lanes. The only way to formalize a bike route on these segments is to stripe and sign them as shared Class III routes. This includes the 12th Street/Riverwalk US 101 overcrossing, the Strongs Creek Bridge and the southbound direction at the south end of Riverwalk Drive.

The existing overcrossing has generous 14' lanes and only a two-feet walkway on either side (see Figure 50). If the lanes were narrowed to 12', an additional four-feet of concrete sidewalk could be added on the west side. With addition of a debris screen for motorist and pedestrian safety, this will create a much more comfortable pedestrian facility at minimal expense.

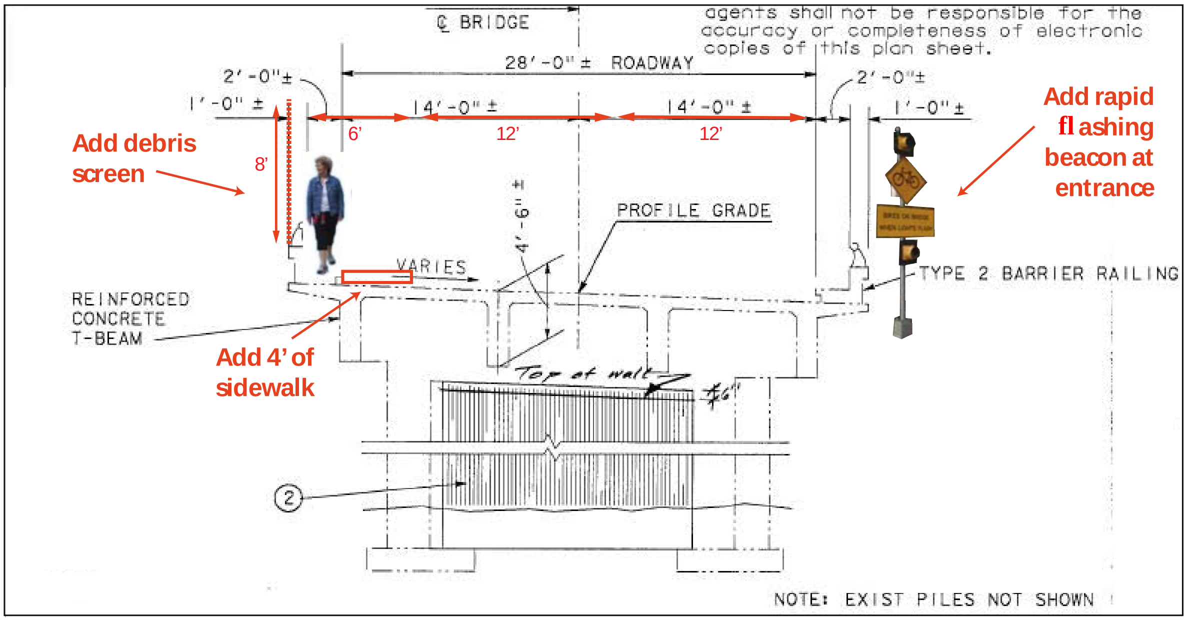


Figure 50: Potential Interim Improvements - 12th St/Riverwalk US 101 Overcrossing

Bicyclists will still have to share the lanes with motorists, but the narrower lanes will tend to slow traffic. In similar settings a "bikes on bridge" warning light (see Figure 51) that can be activated by users has been used.

Figure 51: Example Activated Warning Signage Indicating Bikes on Bridge

Strongs Creek Bridge is only 28' wide with no pedestrian or bike facilities (Figure 52). Though it is short, with good visibility, it puts bicyclists and pedestrians in the roadway in a location that has frequent large truck traffic.

Figure 52: Strongs Creek Bridge on Riverwalk Drive, Looking South

If replacing the bridge is not an option, Figure 53 shows a potential concept to narrow the lanes to 11’-6” (minimal for large trucks) to add a barrier and a narrow three-feet pedestrian space. Bicyclists will still have to share the lanes, but the narrower lanes have been shown to tend to reduce traffic speed.

Figure 54 shows a similar concept but without the barrier, allowing a five-foot sidewalk. In either case a taller railing/fence will be required on the creek side for safety. As suggested for the overcrossing, a user activated “bikes on bridge” warning sign might be an option.

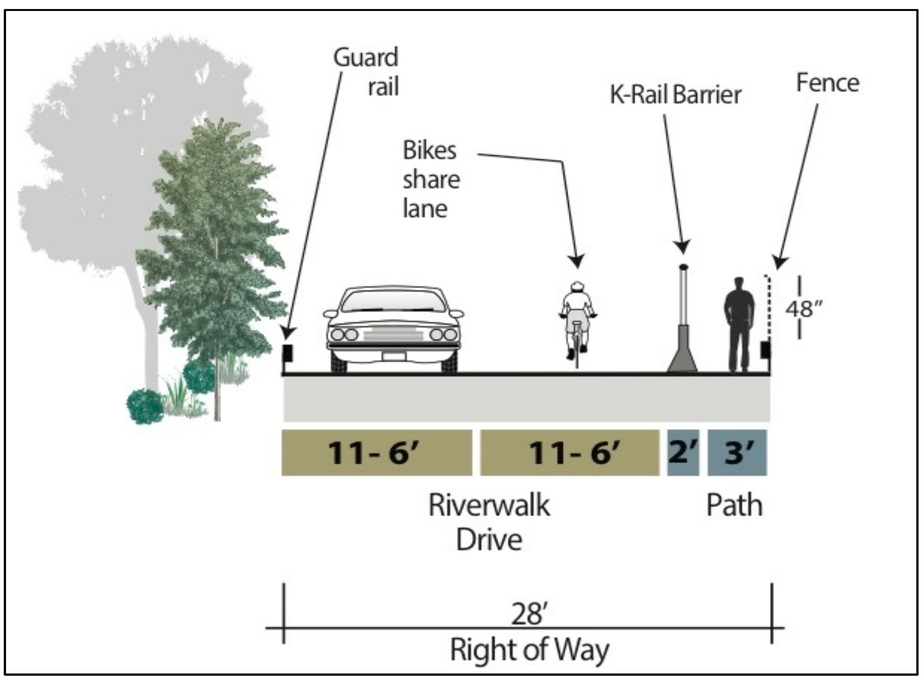


Figure 53: Strongs Creek Bridge with Barrier and Path

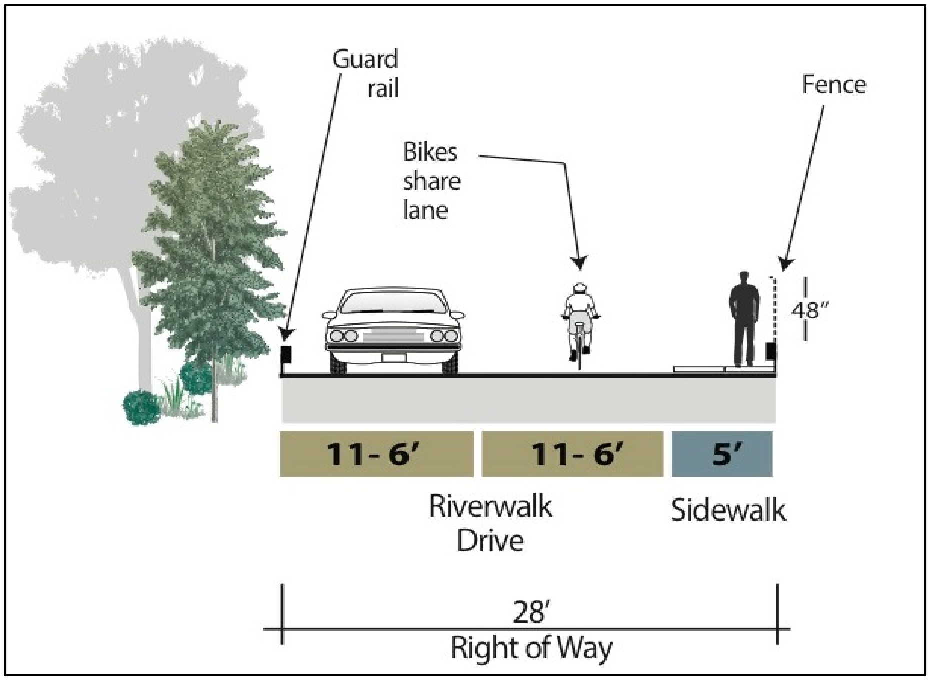


Figure 54: Strongs Creek Bridge with Sidewalk

Figure 55 shows the solution of a parallel bicycle/pedestrian bridge adjacent to the vehicular bridge. This separation increases bicyclist and pedestrian safey, but brings the challenge of connecting to the bike lane on the other side of the road. This will not be a problem on the north side, as a short Class I path connection from a crosswalk on the south leg of the intersections could connect to the bridge. On the south side a short Class I leg to a crosswalk at the entrance to the Riverwalk Trail will address this issue.

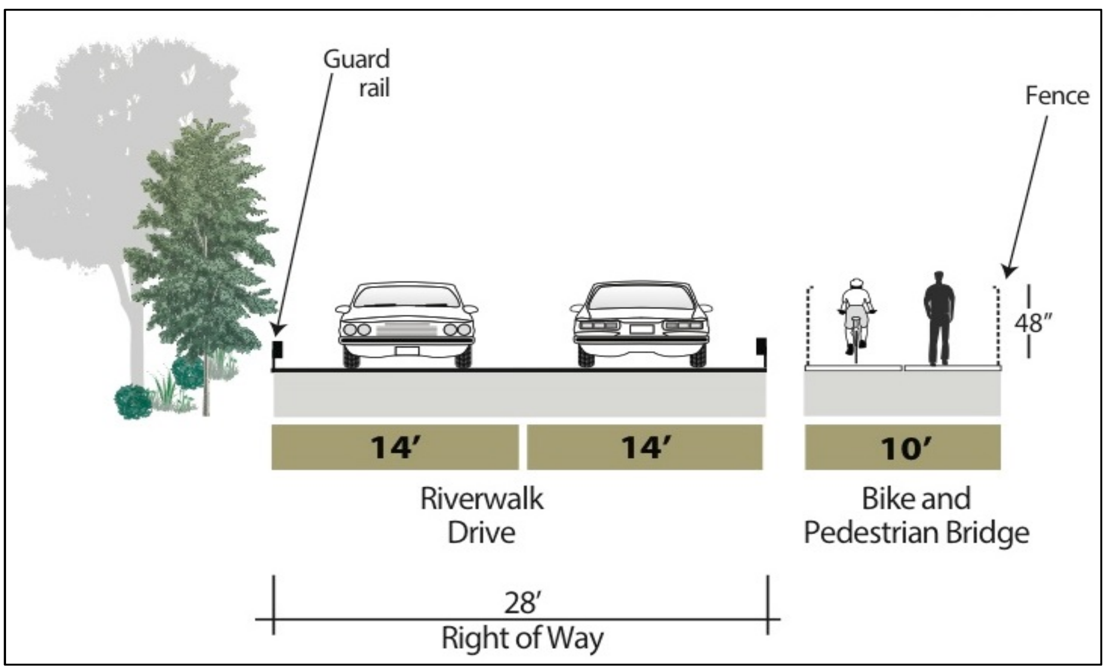


Figure 55: Strongs Creek Bridge with Parallel Bike/Ped Bridge

11. Funding and Estimate

11.1 Funding

Funding for future phases of work has not been programmed and no specific funding sources have been identified. Potential funding sources include:

- the state Active Transportation Program (ATP)
- Caltrans State Highway Operations and Protection Program (SHOPP)
- the federal Highway Bridge Program
- the federal TIGER program
- federal Highway Safety Improvement Program (HSIP)
- future STIP cycles
- local City funding including transportation development fees
- and private fundraising.

11.2 Estimate

Based on public open house workshops, past studies and plans, direction from City staff and technical evaluation, planning level cost estimates were developed to provide approximate calculations of funding that will be required to implement projects along the Kenmar Road and 12th Street interchange corridors.

11.2.1 Cost Assumptions

Estimated probable opinions of cost were developed by providing typical costs for removing items, pavement, structures, curb, gutter, sidewalk, drainage, pavement delineation, electrical, and landscaping and applying current cost for estimated quantities. For all alternatives all paving within the project footprint was assumed to be replaced, and right-of-way acquisition was only quantified for privately owned parcels. Removing or modifying railroad tracks and signal equipment was not included in the preliminary costs. Utility impacts are unknown at this point; therefore a placeholder of $200,000 was assumed for all opinion of probably cost alternatives.

11.2.2 Cost Estimate Summary

Capital, support, and total estimated costs for each alternative are summarized in Table 14. The detailed estimates are included in Appendix F. The total capital costs include traffic control, mobilization, right-of-way, utility relocation, and contingencies. The total support costs include costs for environmental clearance, plans, specifications, and estimates (PS&E), right-of-way engineering and acquisition, and construction support and management.

Table 14: Cost Estimate Summary

Improvement	Total Capital Cost	Total Support Cost	Total Estimated Cost (Rounded)
Kenmar Road Interchange Signal Concept	$14,951,000	$5,910,500	$20,870,000
Kenmar Road Interchange Roundabout Concept - Option 1a	$4,330,500	$1,660,700	$6,000,000
Kenmar Road Interchange Roundabout Concept - Option 1b	$4,180,100	$1,602,300	$5,790,000
Kenmar Road Interchange Roundabout Concept - Option 2	$5,561,800	$2,154,800	$7,720,000
12th Street Interchange Signal Concept	$31,075,700	$11,124,100	$42,200,000
12th Street South Interchange Roundabout Concept - Option 1	$7,215,800	$2,830,700	$10,050,000
12th Street South Interchange Roundabout Concept - Option 2c	$7,654,600	$2,992,000	$10,650,000
12th Street North Interchange Roundabout Concept	$9,069,800	$3,296,100	$12,370,000

12. Next Steps and Delivery Schedule

12.1 Next Steps

As shown in Figure 56, this planning study represents the first of several steps necessary to complete improvements to the 12th Street and Kenmar Road interchanges. Most transportation programs do not allow for the programing of funds until a Project Initiation Document (PID) is completed. Caltrans may also require PID approval in order for the project to proceed to PA&ED. The PID will likely be in the form of a Project Study Report (PSR) or Project Study Report-Project Development Support (PSR-PDS). The advantage of a PSR-PDS is that it reduces the level of effort and information needed in the PID phase by deferring extensive work and studies to the PA&ED phase. As part of the PID process, several initial engineering studies may be required, including but not limited to:

- Intersection Control Evaluation (ICE)
- Preliminary Environmental Analysis Report (PEAR)
- Structure PSR-PDS Cost Estimates

Most of the information required for these initial engineering studies is included in this report although Caltrans may require some additional information. The City should work with Caltrans to identify formal requirements necessary to complete the PID.

Following the completion of the PID, the funding for PA&ED, PS&E, R/W and Construction can be sought by the City.

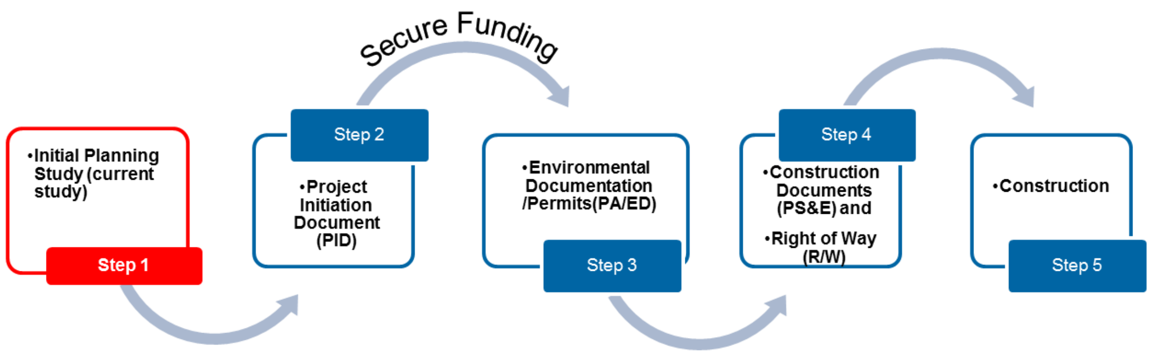


Figure 56: Project Development Process

12.2 Delivery Schedule

A delivery schedule for significant project milestones is not known at this time. For practical purposes the following schedule shows the amount of time anticipated to complete the project milestones:

- PA&ED – 24 months
- PS&E – 24 months
- Right-of-Way – 12-18 months
- Construction – 24 months
- Note: Phases may overlap with one another

Appendices

Appendix A Right-of-Way and Property Ownership

Appendix B Environmental Constraints Analysis

Appendix C Review of Geometric Design Standards

Appendix D TAG Meeting Minutes

Appendix E Community Meeting Comments

Appendix F Cost Estimates

Appendix G Conceptual Designs

Appendix H Truck Turning Analysis

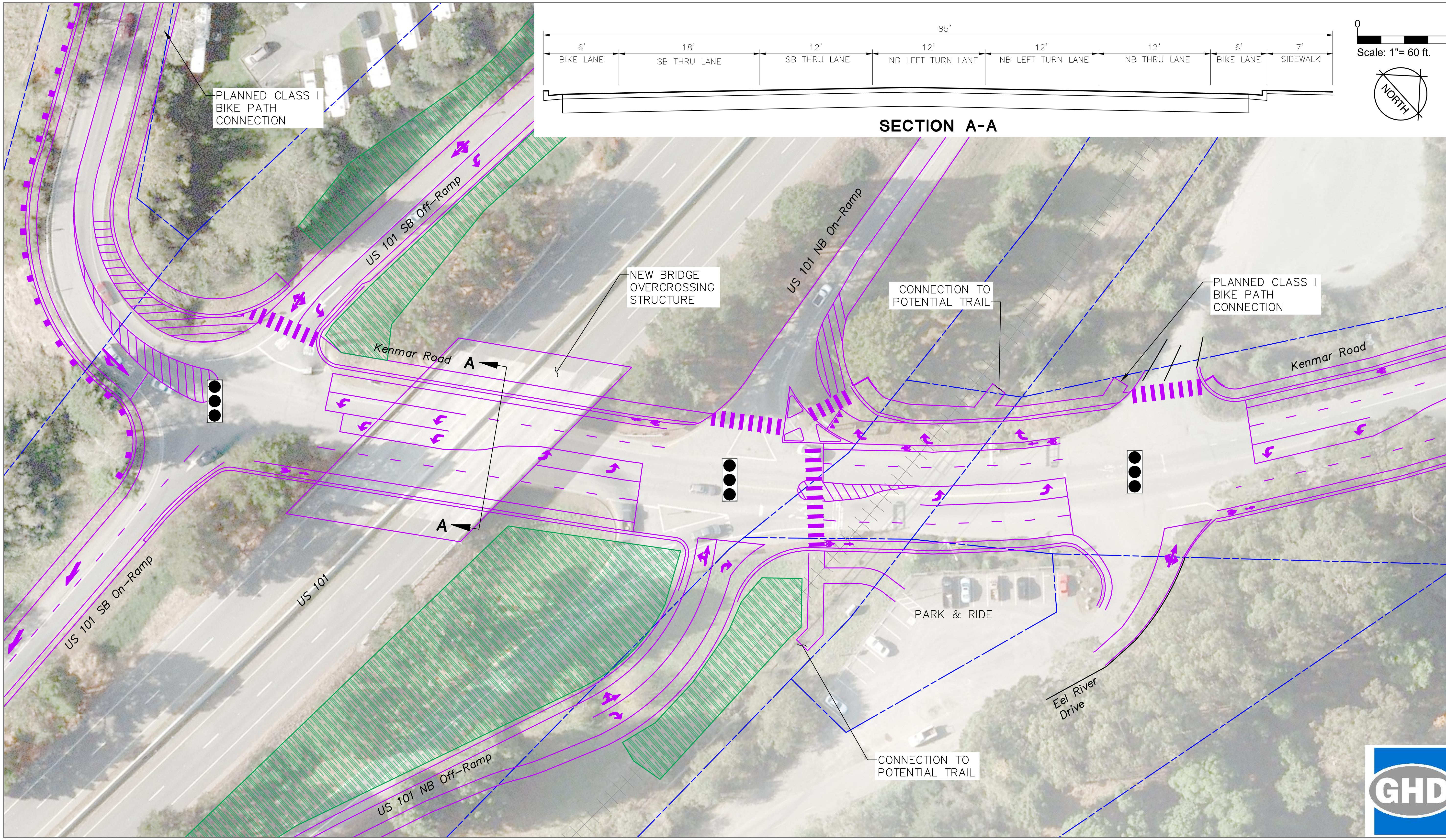
Appendix I Fast Path Exhibits

Appendix J Traffic Counts and LOS Analyses

Appendix K Landscape Concepts

Appendix G
Conceptual Designs

KENMAR Road INTERCHANGE SIGNAL CONCEPT



US 101/RIVERWALK AREA CONNECTIVITY PROJECT Figure 7.1

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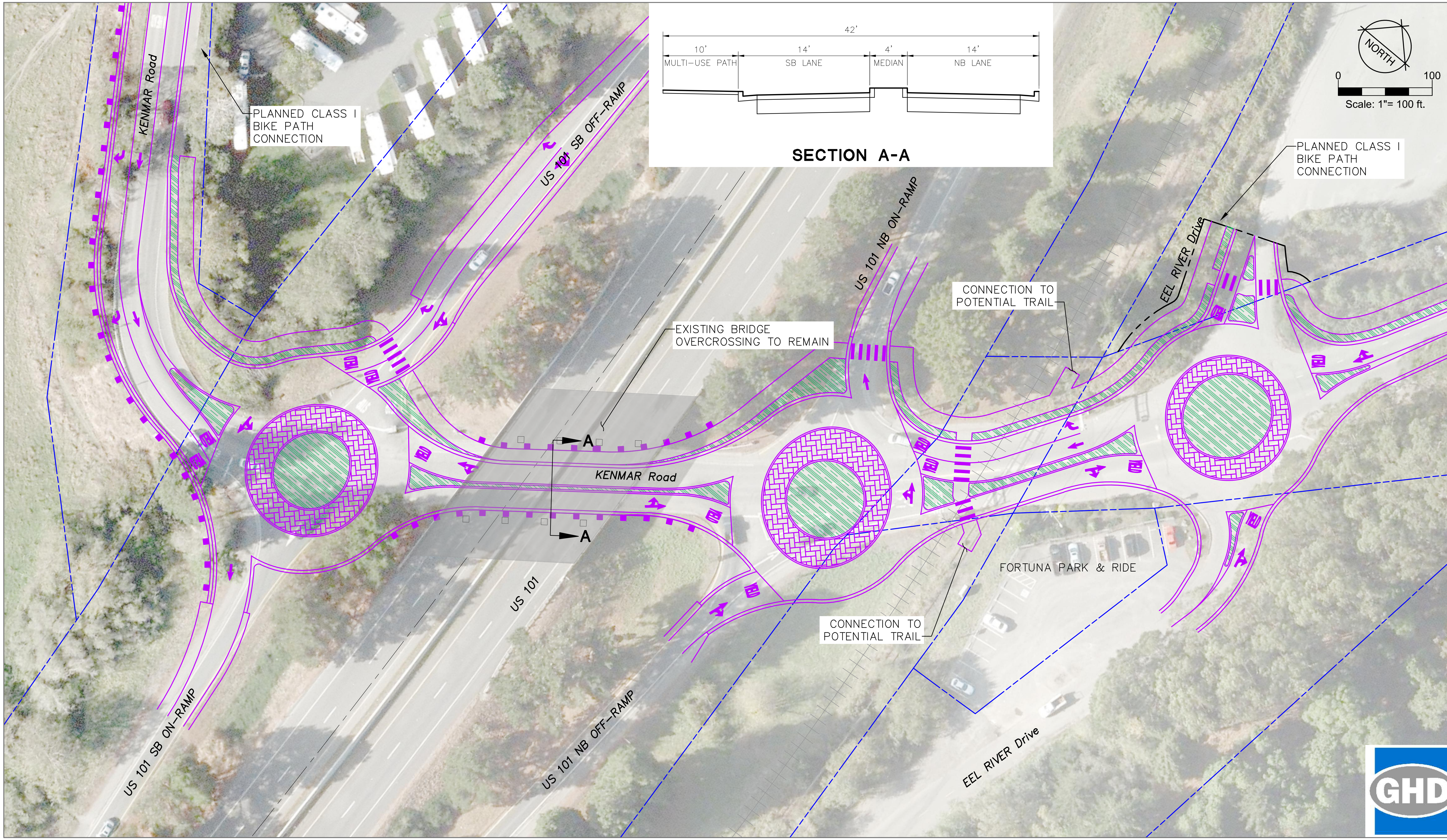
KENMAR Rd. INTERCHANGE ROUNDABOUT CONCEPTS - Option 1a



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US 101/RIVERWALK AREA CONNECTIVITY PROJECT Figure 7.4

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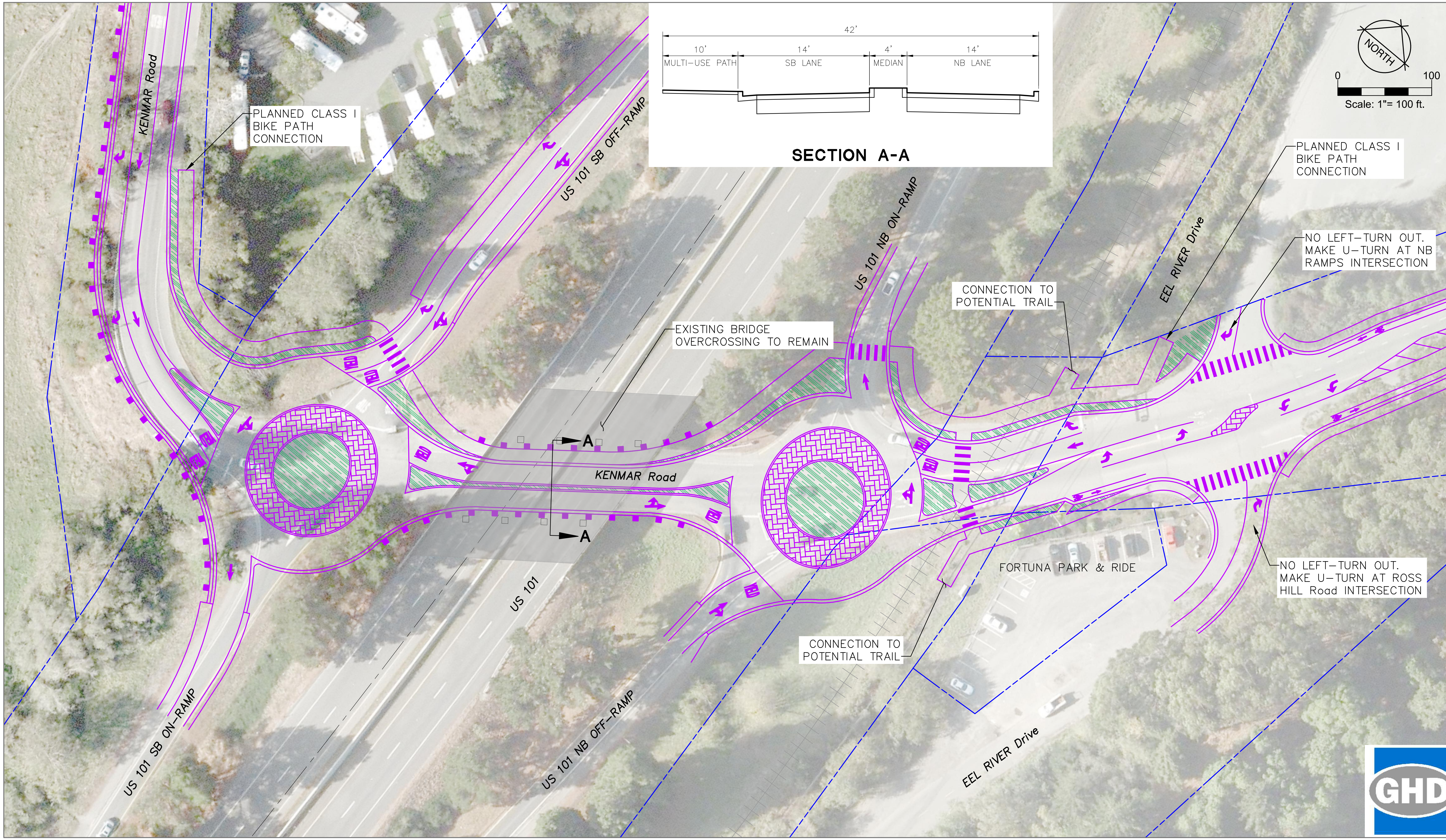
KENMAR Rd. INTERCHANGE ROUNDABOUT CONCEPTS - Option 1b



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US 101/RIVERWALK AREA CONNECTIVITY PROJECT Figure 7.5

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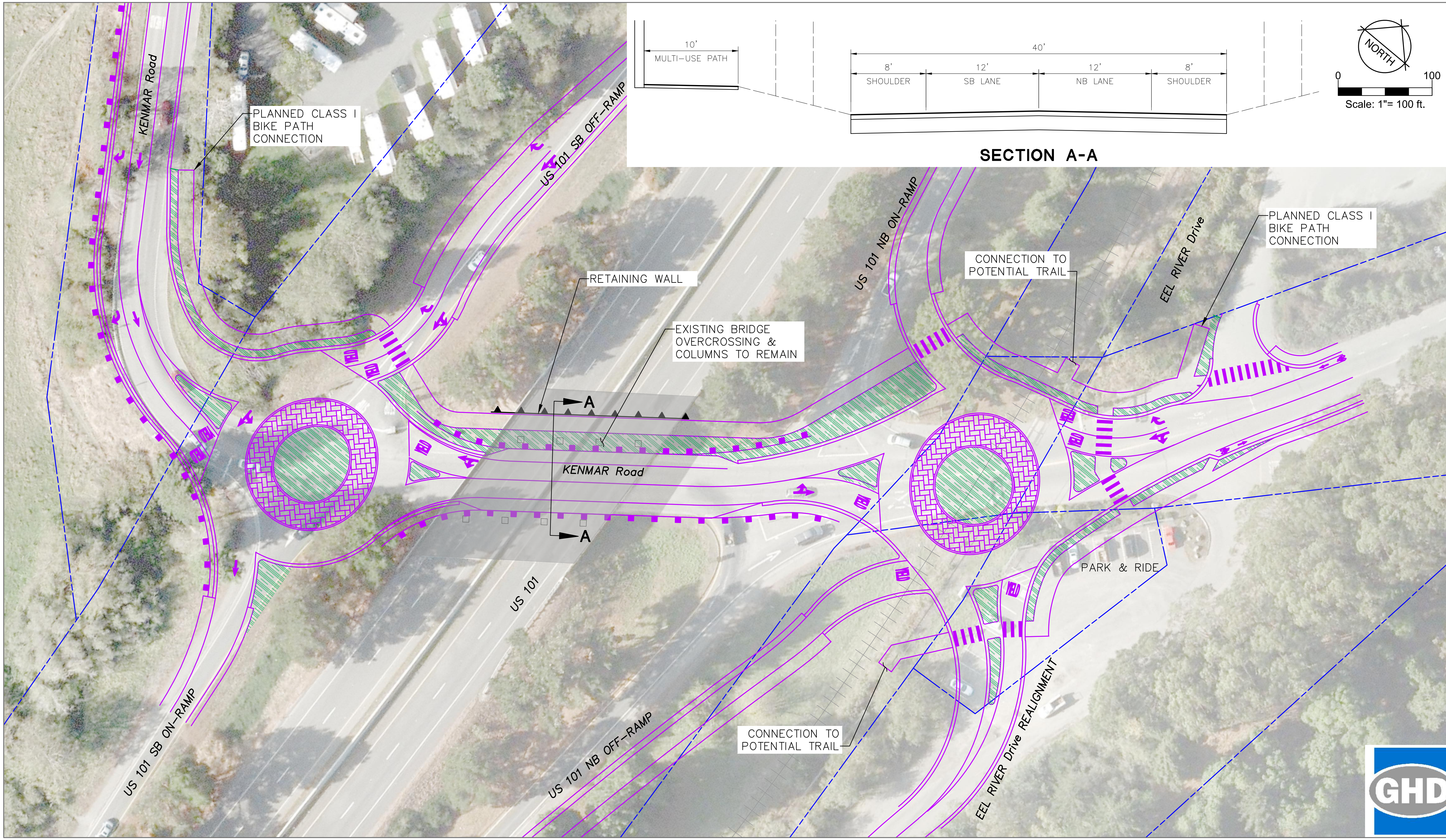
KENMAR Rd. INTERCHANGE ROUNDABOUT CONCEPTS - Option 2



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12th Street INTERCHANGE TRAFFIC SIGNAL CONCEPT

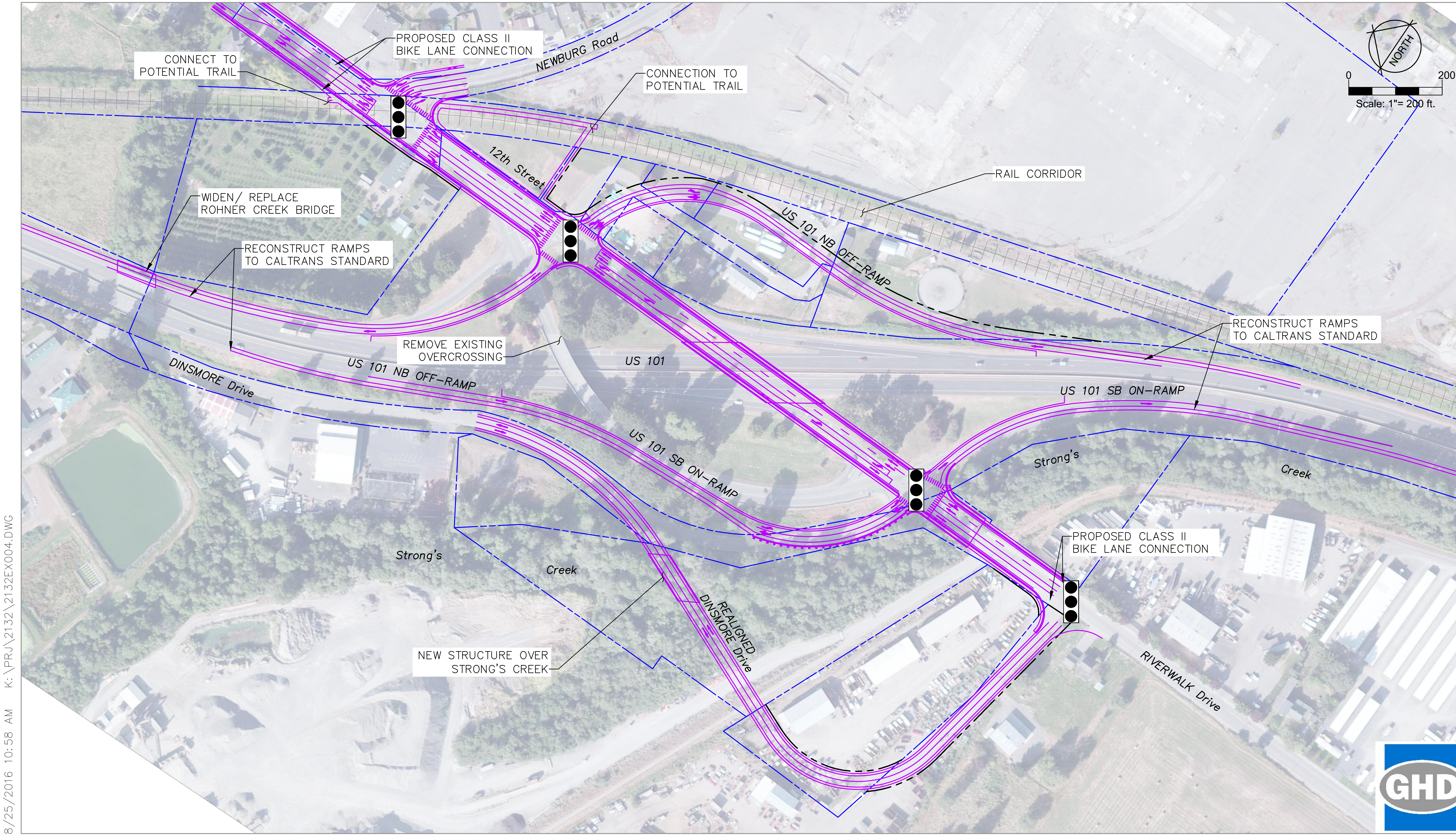

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Figure 7.2

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12th St. SOUTH INTERCHANGE ROUNDABOUT CONCEPT-Option 1

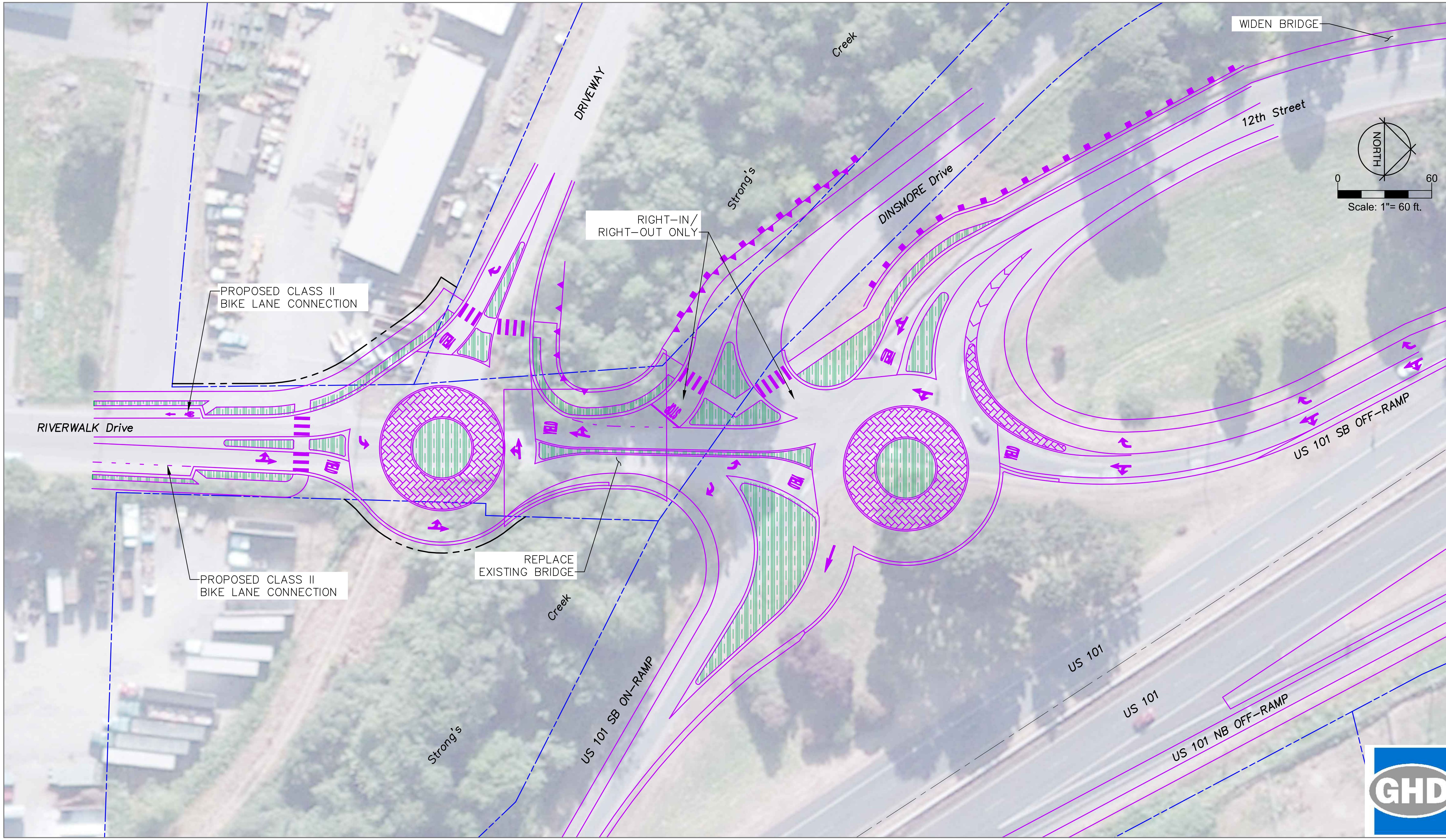

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Figure 7.7

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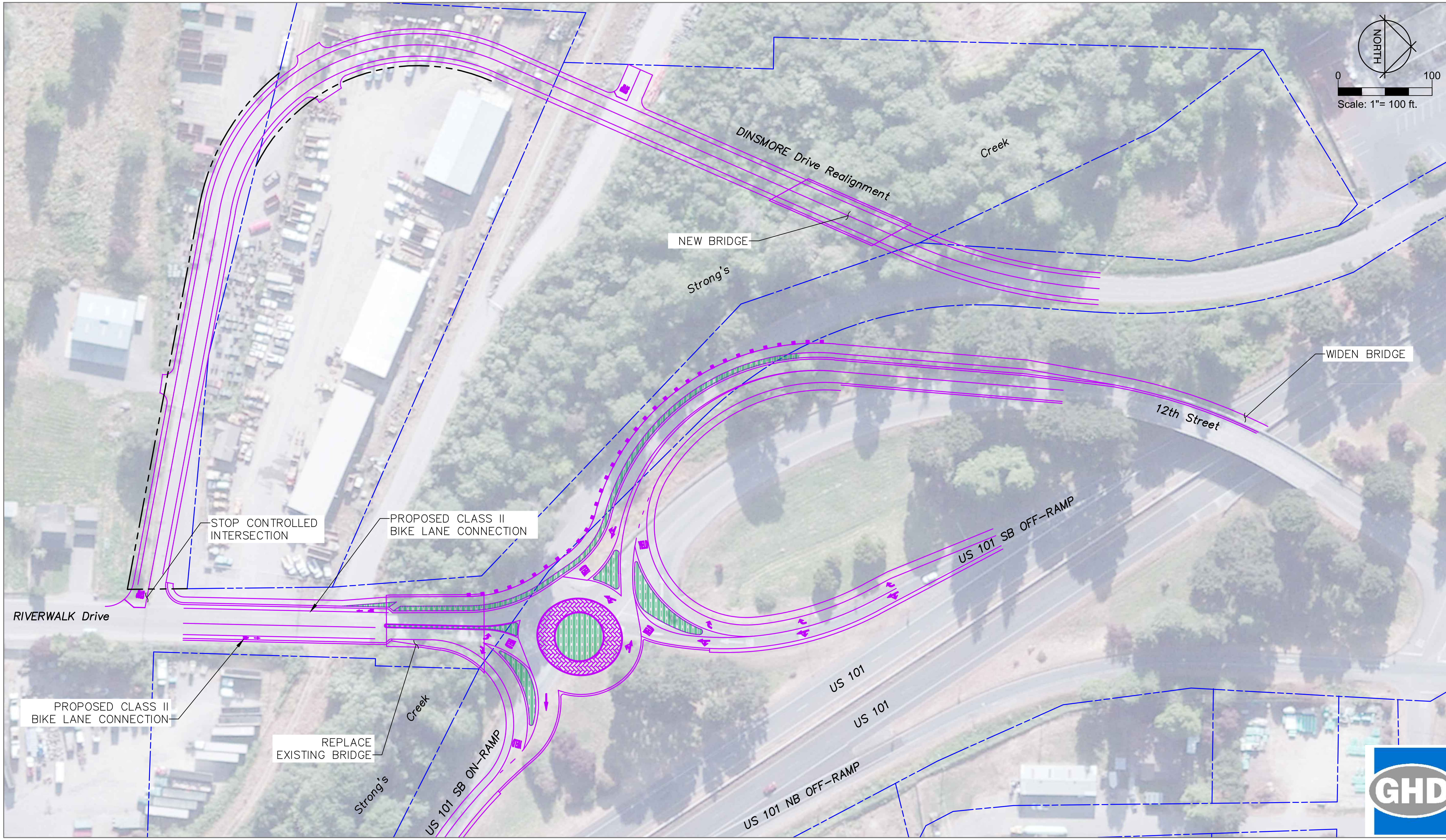
12th St. SOUTH INTERCHANGE ROUNDABOUT CONCEPT - Option 2a



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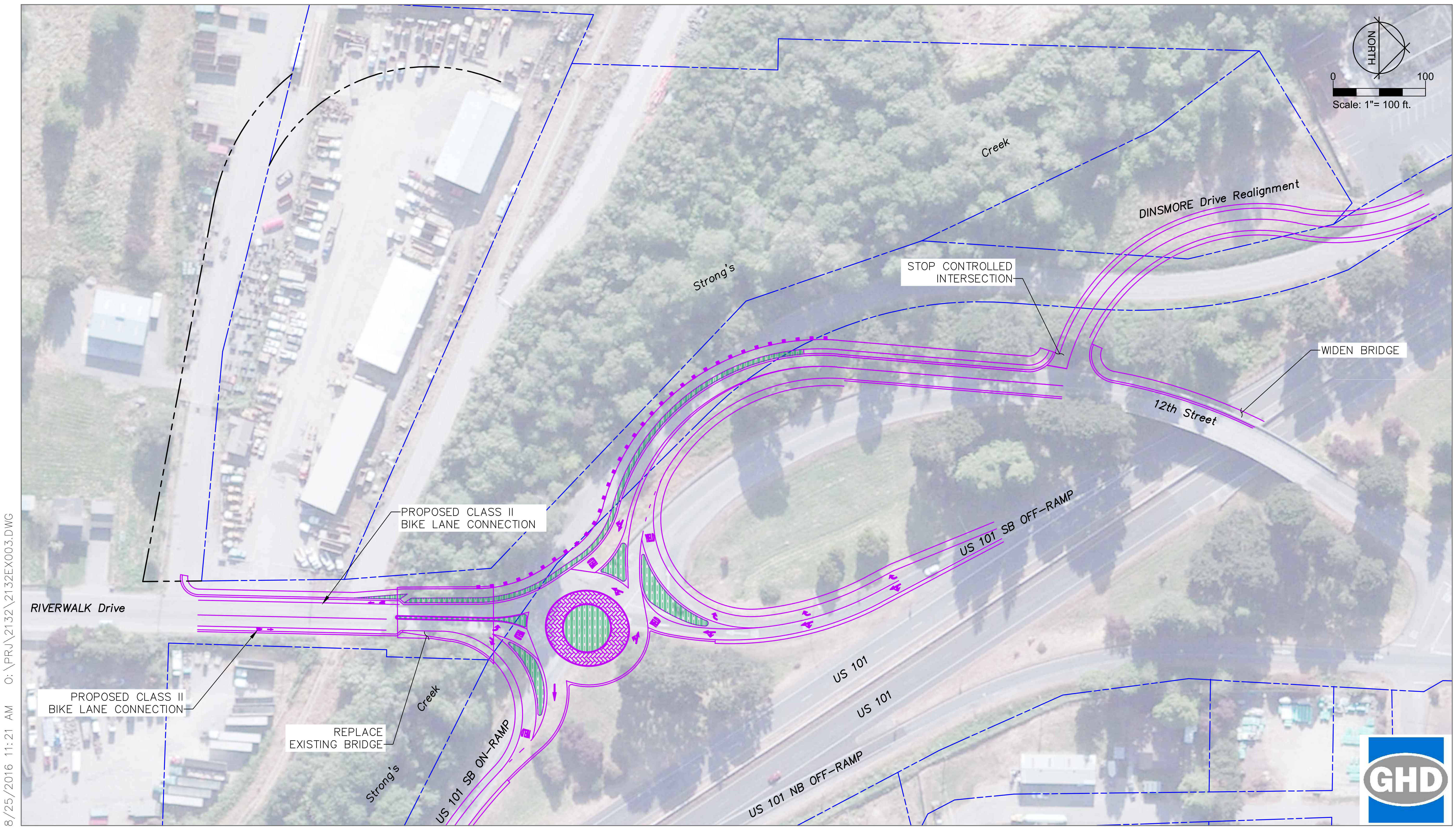
12th St. SOUTH INTERCHANGE ROUNDABOUT CONCEPT - Option 2b



US 101/RIVERWALK AREA CONNECTIVITY PROJECT Figure 7.9

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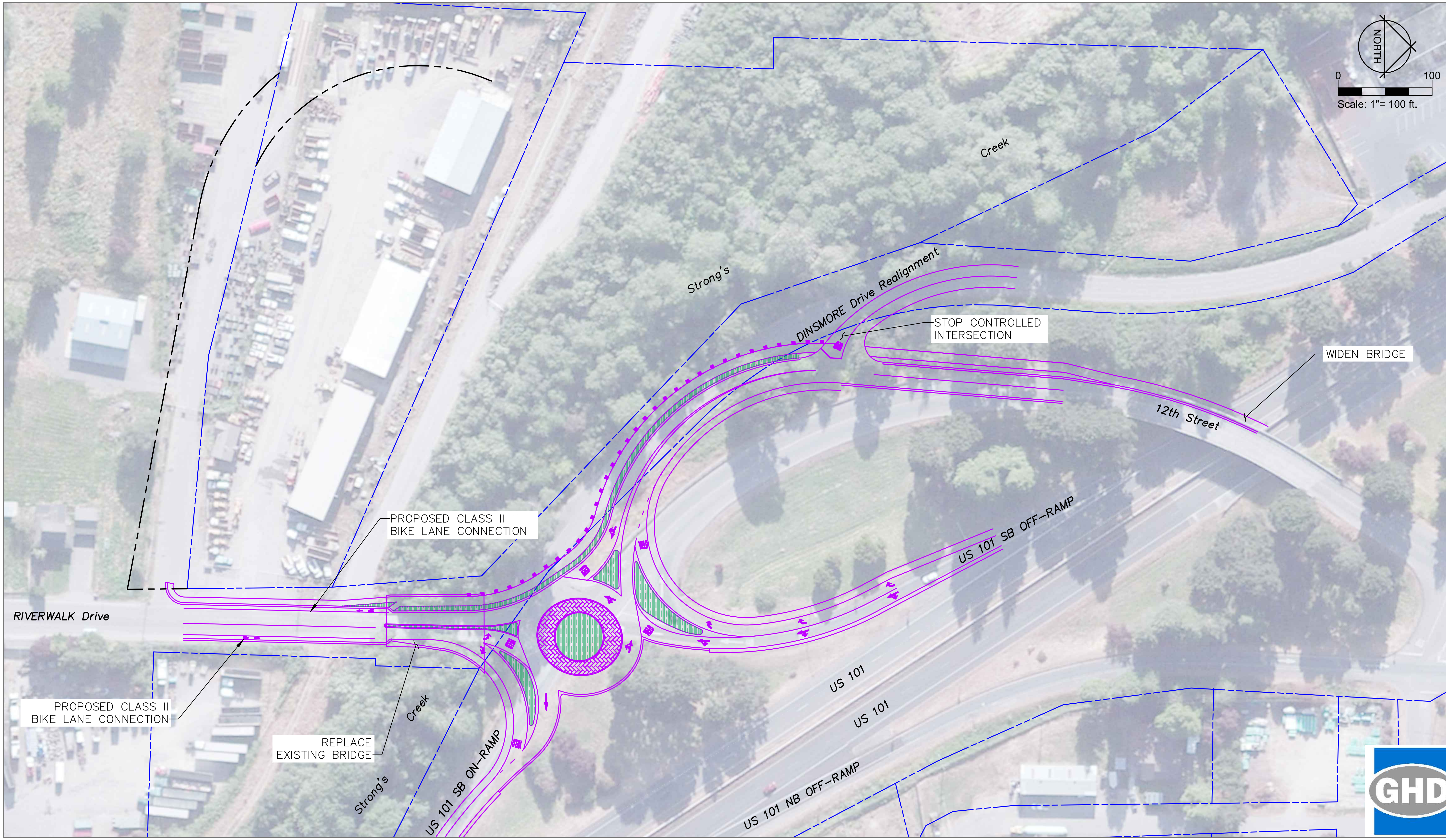
12th St. SOUTH INTERCHANGE ROUNDABOUT CONCEPT - Option 2c



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US 101/RIVERWALK AREA CONNECTIVITY PROJECT Figure 7.10

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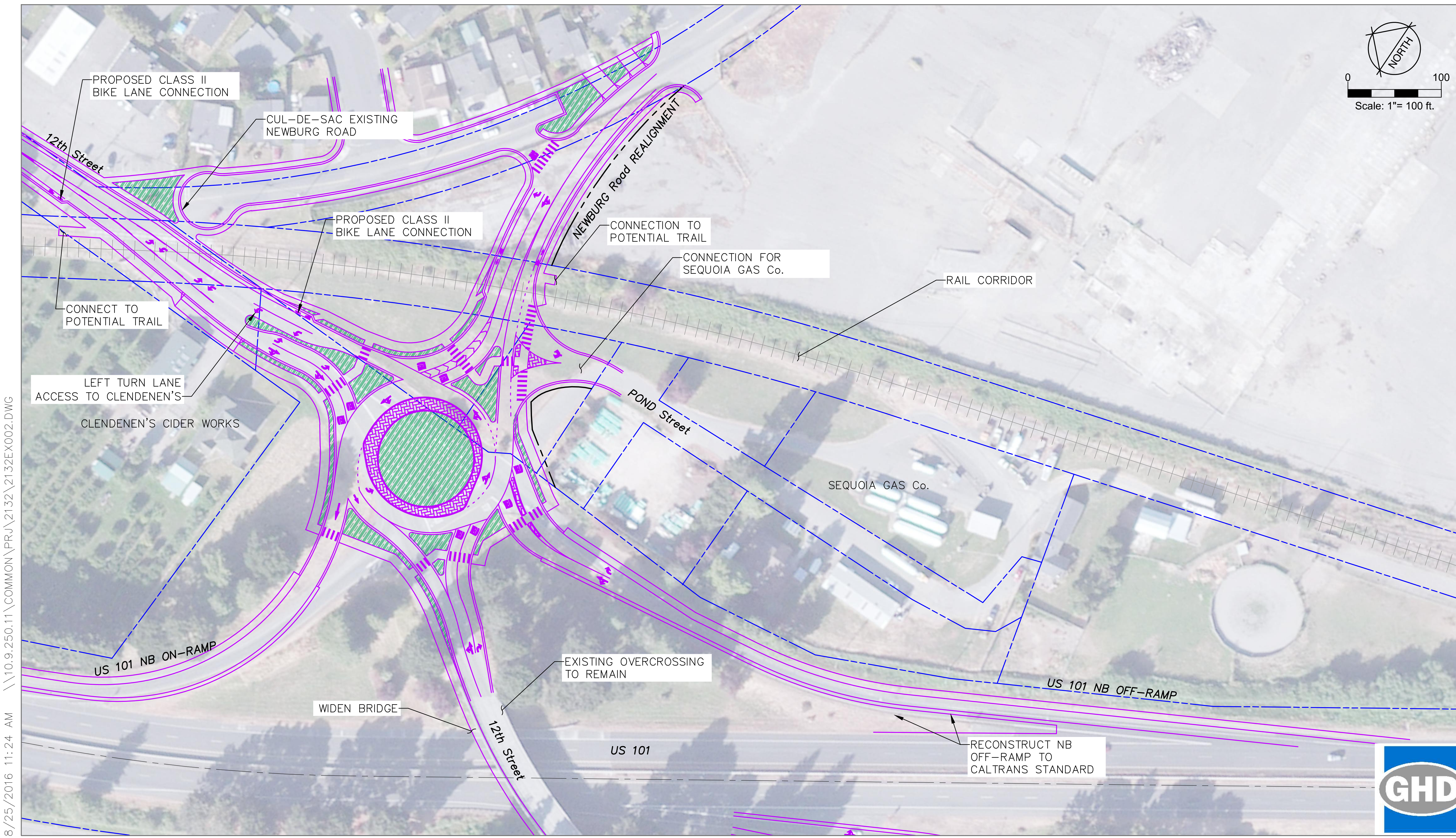
12th St. NORTH INTERCHANGE ROUNDABOUT CONCEPT



US 101/RIVERWALK AREA CONNECTIVITY PROJECT Figure 7.11

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