



**ORINDA**  
CALIFORNIA

City of Orinda

# Evacuation Analysis

January 2023



PLACEWORKS







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## 1 Introduction

The City of Orinda is updating the Safety Element of the Orinda General Plan. As a part of this work, the City has prepared a study to analyze segments and intersections along identified possible evacuation routes that are likely to be the most congested during an evacuation event, as well as residential areas that are the most vulnerable to traffic congestion along the identified constrained routes. This analysis also considers where there are residents in Orinda who may face other barriers to evacuation due to factors like limited access to a vehicle, internet, or phone service, disabilities, and/or language barriers. The report concludes with recommendations for reducing traffic congestion along congested evacuation route segments and intersections during a city-wide evacuation event, recommendations for evacuating vulnerable populations, and recommendations for reducing landslide risk along evacuation routes. This report also evaluates General Plan Housing Element Opportunity Sites and Downtown Precise Plan sites for evacuation constraints and finds that several Housing Element Sites are potentially constrained during an evacuation event due to expected traffic congestion on Moraga Way north-west-bound, although the increased traffic congestion pressure expected from development at these locations does not significantly change the overall results of the analysis in terms of the level of expected congestion at key intersections and the distribution of relative constraint across residential areas in Orinda. The Opportunity Sites found to be constrained are (in order from most constrained to least constrained): the Housing Opportunity Site on a portion of the Miramonte High School property, the St. John Orthodox Church Housing Opportunity Site, the St. Mark's Church Housing Opportunity Site, and the Holy Shepherd Lutheran Church. Downtown Precise Plan Housing Opportunity Sites are not likely to face substantial evacuation constraints primarily because they are located close to SR-24 entrances. These results and implications are discussed in the Cumulative Constraint Analysis Results and Discussion section.

This analysis is consistent with California Government Code Section 65302.15, which requires that a Safety Element assess possible evacuation routes and their capacity, safety, viability, and evacuation locations under different emergency scenarios. It is important to note that this study is a citywide, programmatic-level assessment of potentially vulnerable areas, and is meant to guide and inform future evacuation planning efforts. This study includes information that can support project-level evacuation and analysis, consistent with direction and guidance from the California Office of the Attorney General and other sources, but this study does not itself constitute an evacuation plan and is not a resource that residents should use for immediate guidance during an actual evacuation event. The City of Orinda, Contra Costa County Office of Emergency Services, Lamorinda Community Emergency Response Team (Lamorinda CERT), and the Moraga-Orinda Fire Department (MOFD) all offer resources to help residents and community members plan for emergencies and be prepared in the event of an evacuation. The Orinda Fire Evacuation Guide and General Information flyer is attached in the appendix of this report.

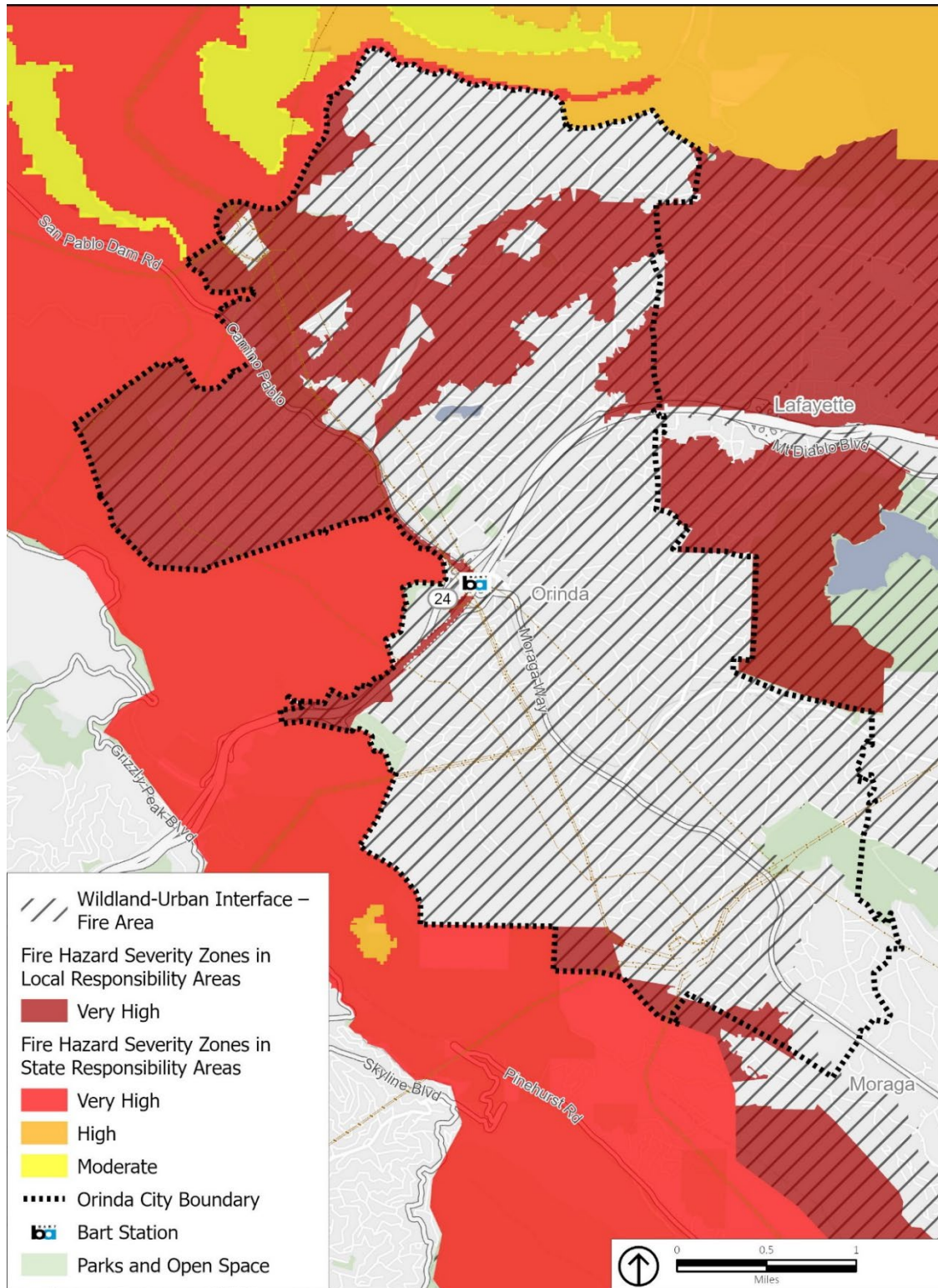
This analysis evaluates three citywide evacuation scenarios, as well as potential landslide risk along possible evacuation routes. Wildfire is the most likely hazard scenario requiring a citywide evacuation or evacuation of large areas of Orinda, whereas a landslide-related evacuation is likely to be more localized, so methods for evaluating a citywide evacuation in this analysis differ from methods for



evaluating evacuation in the event of a landslide. The methodology differs also because the spread of wildfire risk and potential severity are in specific areas in and around Orinda, as shown in Figure 1. By contrast, landslide risk is much more dispersed throughout the entire city and surrounding areas, as shown in Figure 2.

The first sections of this report describe the methodologies used for the citywide evacuation analysis followed by the methodologies used for landslide evacuation analysis. The subsequent sections discuss results and recommendations for the citywide evacuation analysis followed by the results and recommendations for the landslide evacuation analysis.

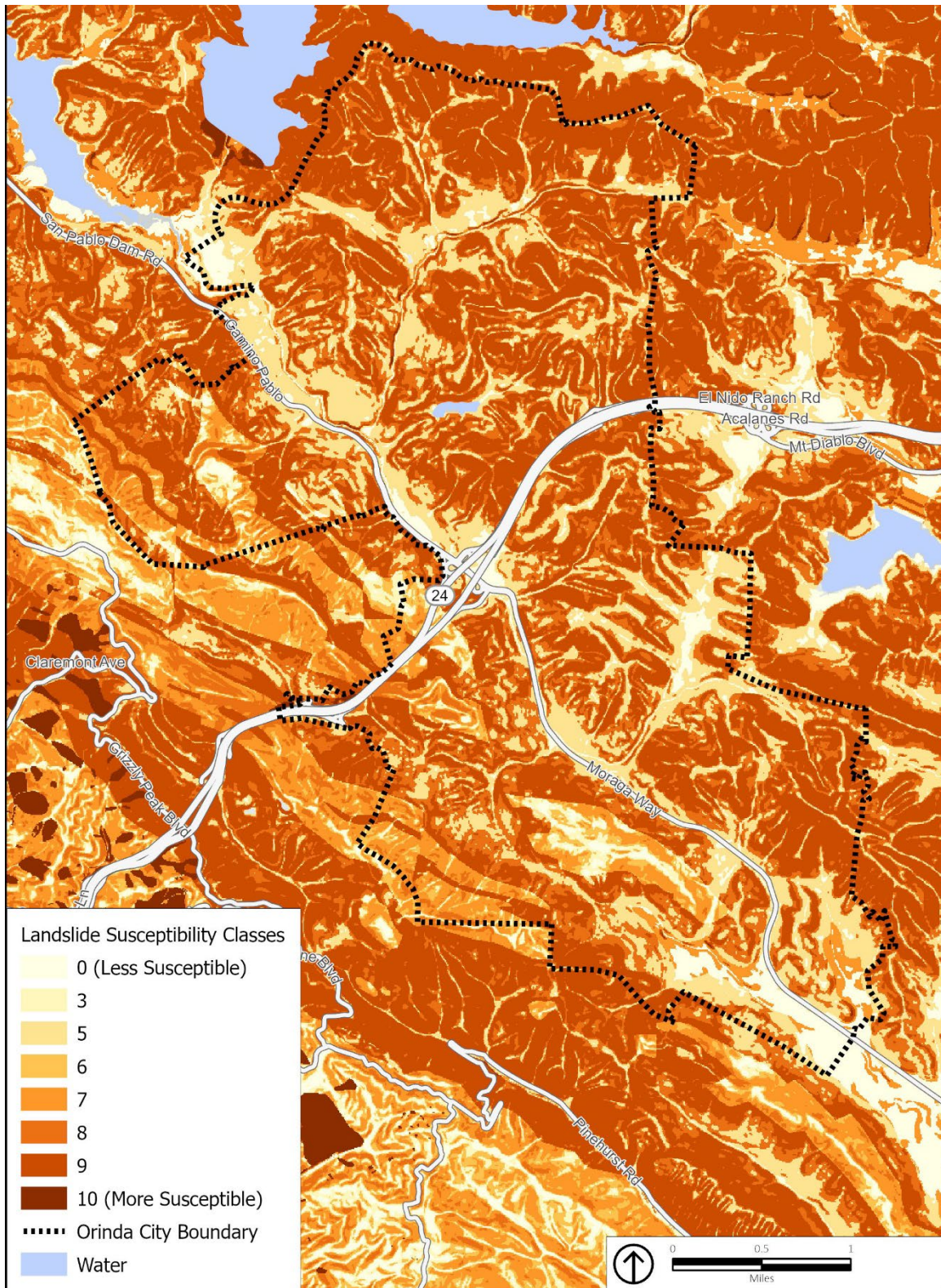
**FIGURE 1: WILDFIRE HAZARD SEVERITY ZONES AND LOCALLY ADOPTED WILDLAND URBAN INTERFACE – FIRE AREA**



Source: CalFire, 2009; MOFD, 2020; PlaceWorks, 2022.



FIGURE 2: LANDSLIDE RISK



Source: CGS, 2018; PlaceWorks, 2022.



## 2 Citywide Evacuation Analysis Methodology

The goal of this analysis is to identify evacuation routes that are most likely to be congested in a citywide emergency, as well as the residential areas that are likely to face the most evacuation constraints. This section details the method and assumptions used to identify these routes and areas.

### Assumptions

The citywide evacuation analysis considers three scenarios which differ in terms of their hazard area location. The generalized hazard area for each scenario is informed primarily from MOFD recommendations of where wildfires that would affect Orinda are most likely to originate, although the hazard area in each scenario is not an specific wildfire origin, spread, or perimeter. Instead, the hazard area in each scenario is defined by which evacuation routes out of Orinda are considered safe to use, based on their proximity to the following three hazard areas:

1. Hazard area is south or west of Orinda, spanning from San Pablo Dam Road in the north to open spaces southwest of Orinda.
2. Hazard area is Lafayette Reservoir immediately east of Orinda.
3. Hazard area is north of Orinda, spanning from the Berkeley Hills to Briones Regional Park.

All three scenarios assume all residents are evacuating out of Orinda, and the analysis does not model wildfire behavior or make any assumptions about the potential timing of when evacuation routes would be impacted. Scenario 1, in which the hazard area spans the open spaces west of Orinda, is the most restrictive. It assumes only SR-24 westbound towards the Caldecott Tunnel, SR-24 eastbound towards Walnut Creek, and Mt. Diablo Boulevard eastbound towards Walnut Creek, are the only safe evacuation routes leading out of Orinda. Under this scenario, San Pablo Dam Road northbound, Grizzly Peak Boulevard westbound, Canyon Road westbound (via Pinehurst Road northbound), and Pinehurst Road southbound are not safe to use. Scenario 2, in which the hazard area covers Lafayette Reservoir open spaces, is the least restrictive in that it assumes any evacuation route leading out of Orinda is safe to use. Scenario 3, in which the hazard area spans the open space areas north of Orinda, strikes the middle between Scenarios 1 and 2, by assuming that San Pablo Dam Road northbound and Grizzly Peak Boulevard westbound are not safe to use, but that Canyon Road and Pinehurst Road are both safe to use. The purpose of these assumptions is to analyze different scenarios where routes may be obstructed and to test how sensitive evacuation outcomes are to the availability of alternative routes to SR-24. Results from previous studies conducted by MOFD in partnership with UC Berkeley researchers indicate that a wildfire starting in Briones Regional Park and open space north of Orinda is most likely, which could obstruct San Pablo Dam Road. MOFD staff have also noted that Pinehurst Road and Canyon Road have high potential for extreme fuel loading and spot fires which may preclude their availability during an actual evacuation event. Scenario 1 captures this by assuming these routes are unavailable.

In addition to Orinda residents, all three scenarios consider residents in Lafayette, Moraga, and unincorporated Contra Costa County that might use the Orinda roadway network to evacuate. The method for considering which households are included in the study area is discussed further in the subsection describing wildfire evacuation analysis methodology steps.

The methodology used in this analysis assigns cumulative constraint index scores to residential areas using Geographic Information Systems (GIS) software based on component indices capturing the following:

- how far Orinda residents must travel through Orinda to reach the nearest safe destination,
- what intersections and roadway segments along Orinda’s evacuation route are expected to be congested, and how many congested intersections each household must travel through to reach the nearest safe destination,
- and demographic characteristics identifying households that may need extra time or that may have specific requirements to evacuate quickly.

Project staff ran this analysis assuming one vehicle per household, and again assuming 1.5 vehicles per household. While overall traffic volumes are more severe using the assumption of 1.5 vehicles traveling from each household, the *relative* results in terms of which roadway segments and residential areas are most constrained in Orinda remain the same in both cases. Additionally, there is a large gap in expected vehicle volumes between the most constrained intersections (mostly arterial roadways with many local roads and minor collectors feeding into them) and the second most constrained intersections, which are more minor collector roads with less than half of the expected traffic volumes as the most constrained arterial intersections along evacuation routes (see Figures 7, 8, and 9). Consequently, increasing the assumption of vehicles evacuating per household from 1 to 1.5 does not change which roadway segments and intersections are identified as the most constrained in Orinda based on thresholds for LOS F used in the analysis. Results in this report are discussed using the assumption of one vehicle evacuating per household.

This analysis also uses residential parcels as the source of vehicle trips leaving Orinda in all three evacuation scenarios, which most closely resembles a scenario occurring during the evening or nighttime when Orinda’s population is comprised primarily of residents at home. Most non-residential land uses in Orinda, like offices and commercial areas, are concentrated in Downtown Orinda near the on-ramps to SR-24 and around BART. These areas are the least constrained given their proximity to high-capacity routes out of Orinda. Besides commercial or office uses, other non-residential uses include schools, other public facilities like the Orinda Community Center, and residential care facilities. Although the methodology does not include daytime land uses or residential care facilities as evacuation origin points in the constrained intersection analysis, this report includes specific recommendations to address evacuation concerns for these non-residential uses.

Finally, to estimate the level of congestion at intersections, the index-scoring approach uses intersection capacities expressed in vehicles per one hour. It is much more likely that Orinda residents would have more time than one hour to evacuate, particularly if, for example, a wildfire were to originate further out in the northern Briones or southwest open spaces beyond Orinda City Limits rather than adjacent to or within Orinda. Additionally, a phased evacuation by zone would prevent ‘worst-case-scenario’ traffic volumes that would likely occur within a one-hour simultaneous evacuation. However, evaluating this worst-case scenario produces results that illustrate what the worst-case scenario might look like and therefore how it can be avoided, while still identifying

intersections that may be congested even during a phased evacuation. An example of a recent simultaneous evacuation order occurred during the 2018 Camp Fire. The Town of Paradise had an existing phased evacuation plan in the Town's adopted Emergency Plan. By 8:15 a.m. on November 8, 2018, Paradise public safety staff began giving phased evacuation orders to selected evacuation zones after the fire had been burning since approximately 6:15 a.m. By 8:30 a.m., just 15 minutes after the first phase evacuation order was given, Paradise public safety staff deemed the phased evacuation plan in the town's Emergency Plan unworkable and ordered the rest of Paradise to evacuate at the same time regardless of zone, approximately 1 hour and 15 minutes after public safety was first alerted to the wildfire. Although the fire dynamics in Orinda are not the same as in Paradise, to take the conservative approach, and because the scenario in which all residents are simultaneously evacuating is one that has occurred in California in the recent past, this analysis assumes all Orinda residents are evacuating within the same hour. However, the results of this analysis generate drive time contours and groupings of households that are all evacuating towards the same safety gateway in the same direction (e.g., 'traffic-sheds'), which are used to inform recommendations for potential phased evacuation approaches.

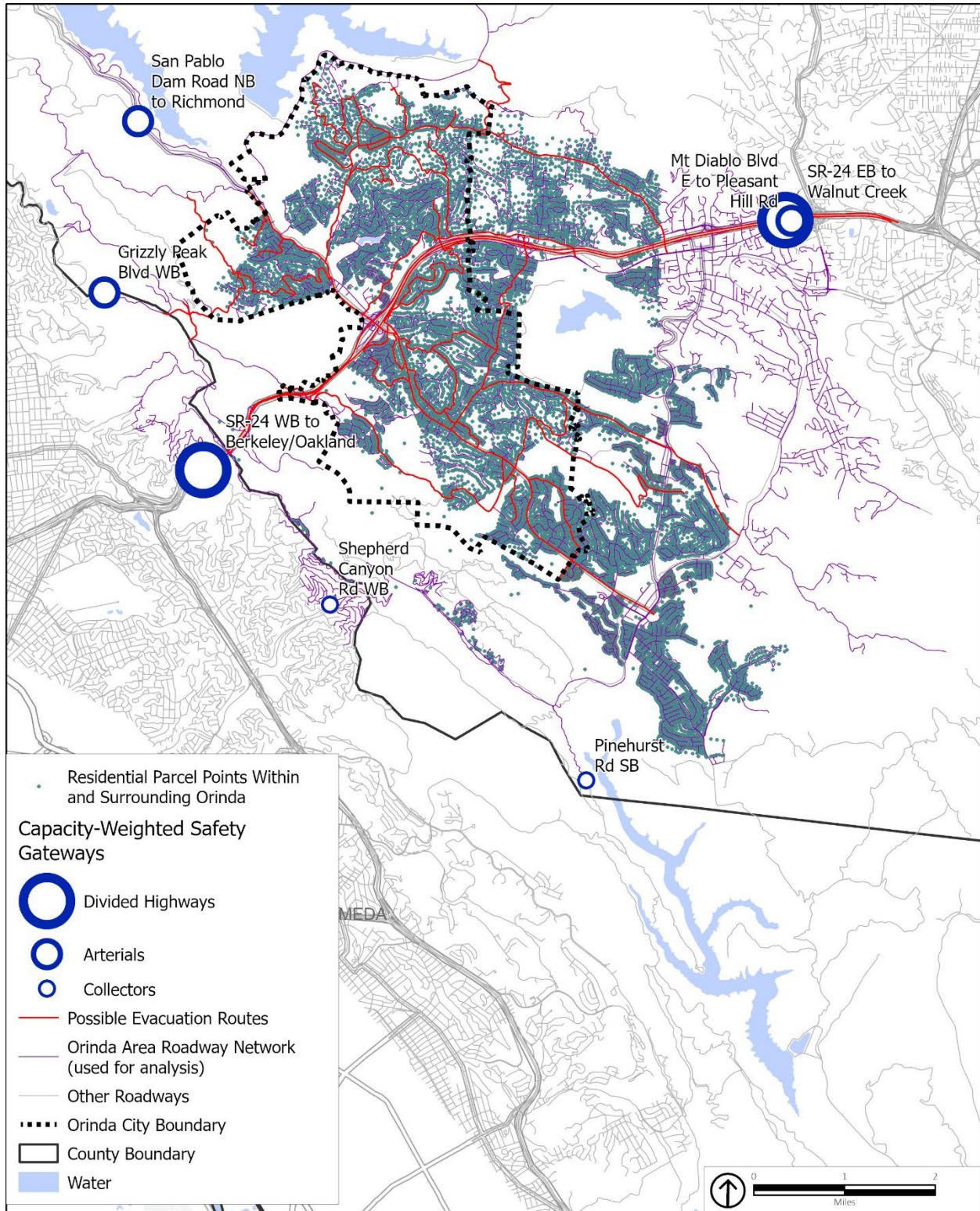
### Citywide Evacuation Analysis Methodology Inputs

This analysis begins with the following data inputs, shown in Figure 3:

- The first step in the analysis uses the entire roadway network in Orinda, and the second step focuses specifically on intersections along Orinda's likely evacuation routes, shown in red in Figure 3 below. Likely evacuation routes were developed in coordination with Orinda Police Department and are consistent with the possible evacuation routes included in the Orinda Safety Element. Other roadways in Orinda, besides the possible evacuation routes, are shown in light purple in Figure 3.
- Residential parcel center points representing origin locations of residents for all evacuation scenarios, sourced from the Contra Costa County tax assessor. Note that this initial set of 15,104 parcel origin points encompasses a much larger set of residential parcels surrounding Orinda rather than just those within Orinda city limits. This set of parcels is large enough to encompass *any* households that might use the evacuation network in Orinda (e.g., Moraga and Canyon), such that traffic counts capture potential congestion during an evacuation along Orinda's evacuation roadway network as comprehensively as possible.
- Safety gateways, which are representative points outside of Orinda along evacuation corridors at which evacuees from Orinda can consider themselves safely evacuated. Safety gateways are not ultimate destinations to which evacuees are traveling, but instead are points along roadways where evacuees can consider themselves safely evacuated once they have reached these points, while continuing to travel in any direction after reaching this point. The western mouth of the Caldecott Tunnel is one example: evacuees heading westbound on State Route (SR-) 24 can consider themselves safely evacuated from Orinda once they have crossed this point but would continue to travel in any direction from there to reach ultimate destinations of refuge.



**FIGURE 3: ORINDA CITYWIDE EVACUATION ANALYSIS INPUT DATA**



Source: City of Orinda, 2022; Contra Costa County, 2022; Esri, 2022; PlaceWorks 2022.

Safety gateways, shown in Figure 3 as blue circles, were chosen based on an evaluation of all roadways with egress out of Orinda, that do not dead-end and that are entirely in the public right-of-way. Each safety gateway was assigned a maximum service flow rate (MSF), which is the number of vehicles that can flow through a point along a roadway during a one-hour period to maintain a traffic level of service (LOS) C, the threshold at which traffic begins to slow due to congestion according to the U.S. Highway Capacity Manual. This weight is expressed in passenger cars per hour per lane (pcphpl), which is derived from the maximum allowable speed and roadway classification for the roadway on which that point lies.

For example, SR-24 has a maximum speed of 65 miles per hour (MPH) and four lanes in either direction. According to the U.S. Highway Capacity Manual, MSF (in pcphpl) to maintain LOS level C at the 65 MPH max speed is 1,548 passenger cars per hour per lane (1,040 to maintain LOS level B, which is completely free-flowing traffic). Therefore, to maintain traffic level C in one direction on SR-24, the capacity is  $1,548 * 4 \text{ lanes} = 6,192$  in each direction over the course of one hour.

Table 1 describes each of the seven safety gateway points shown in Figure 3, and the associated capacity from the U.S. Highway Capacity Manual to maintain LOS C.

**TABLE 1: SAFETY GATEWAYS AND ASSOCIATED CAPACITIES TO MAINTAIN LOS LEVEL C**

Scenarios Included	Safety Gateway Description	Speed Limit at Point (MPH)	Number of Lanes per Direction	Pcphpl for LOS Level C
1, 2, 3	SR-24 EB to Walnut Creek	65	4	4,160
1, 2, 3	SR-24 WB to Berkeley/Oakland	65	4	4,160
1, 2, 3	Mt Diablo Blvd E to Pleasant Hill Rd	35	2	3,400
2, 3	Pinehurst Rd SB	35	1	1,700
2	Grizzly Peak Blvd WB	35	1	1,700
2	San Pablo Dam Road NB to Richmond	35	1	1,700
2, 3	Canyon Rd WB (via Pinehurst Rd NB)	25	1	850

### Citywide Evacuation Analysis Methodology Steps and Results

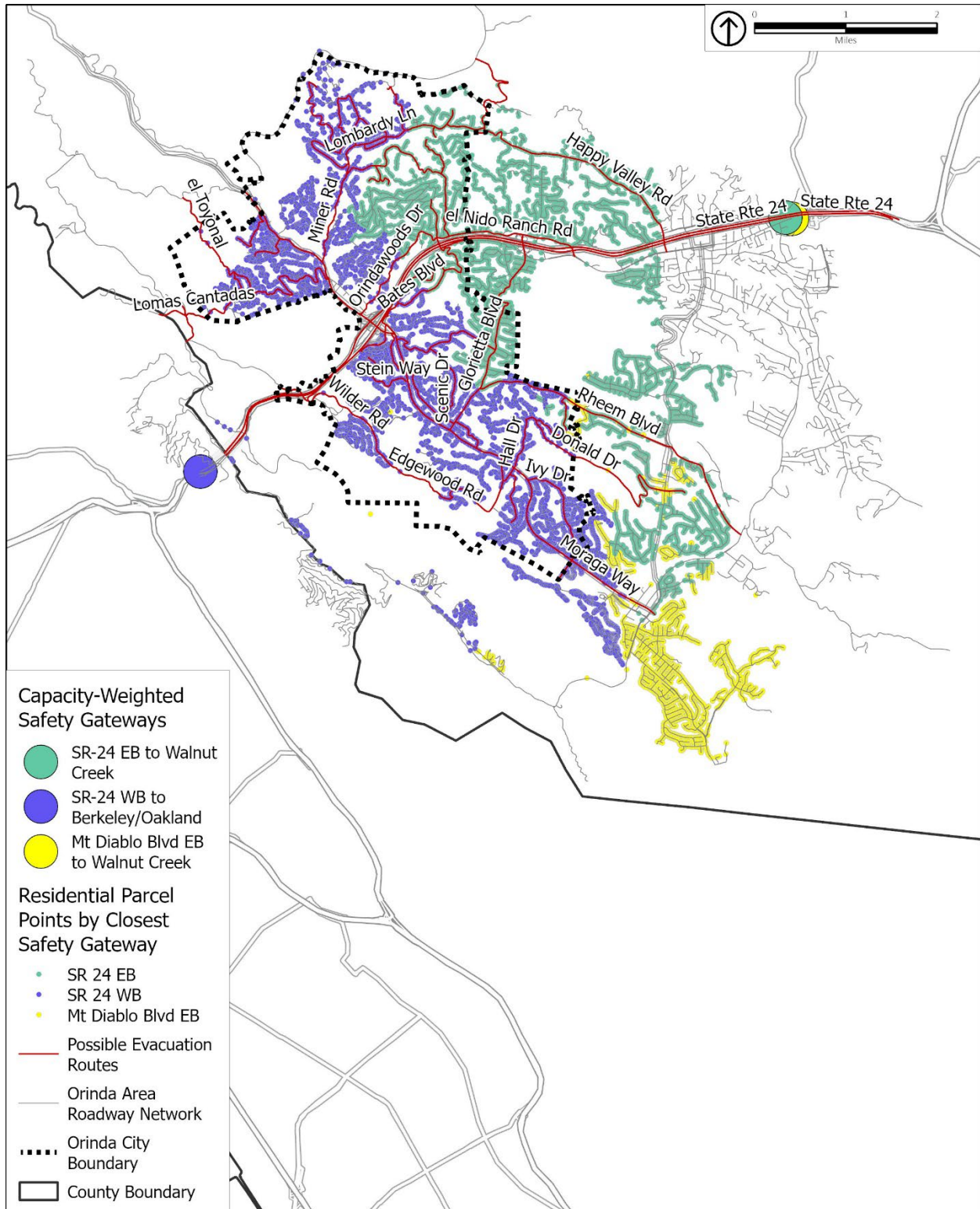
The following steps describe the methodology used to evaluate potentially congested intersections and roadways as well as where households are that are most likely to experience congestion during an evacuation event. The steps described herein are repeated for all three scenarios.

#### Step One

The first step establishes the closest safety gateway and fastest route for each household along the street network. Figures 4, 5, and 6 show the assignment of household origin points to their nearest safety gateway in each scenario. The fastest route calculation also establishes which roadways each household would likely travel on to reach their closest safety gateway, which also establishes which households are likely to use Orinda's roadway network to evacuate. The resulting set of households likely to use Orinda's possible evacuation network, regardless of whether they are within Orinda City Limits or not, are then used as inputs to the congested intersection analysis described in subsequent steps.

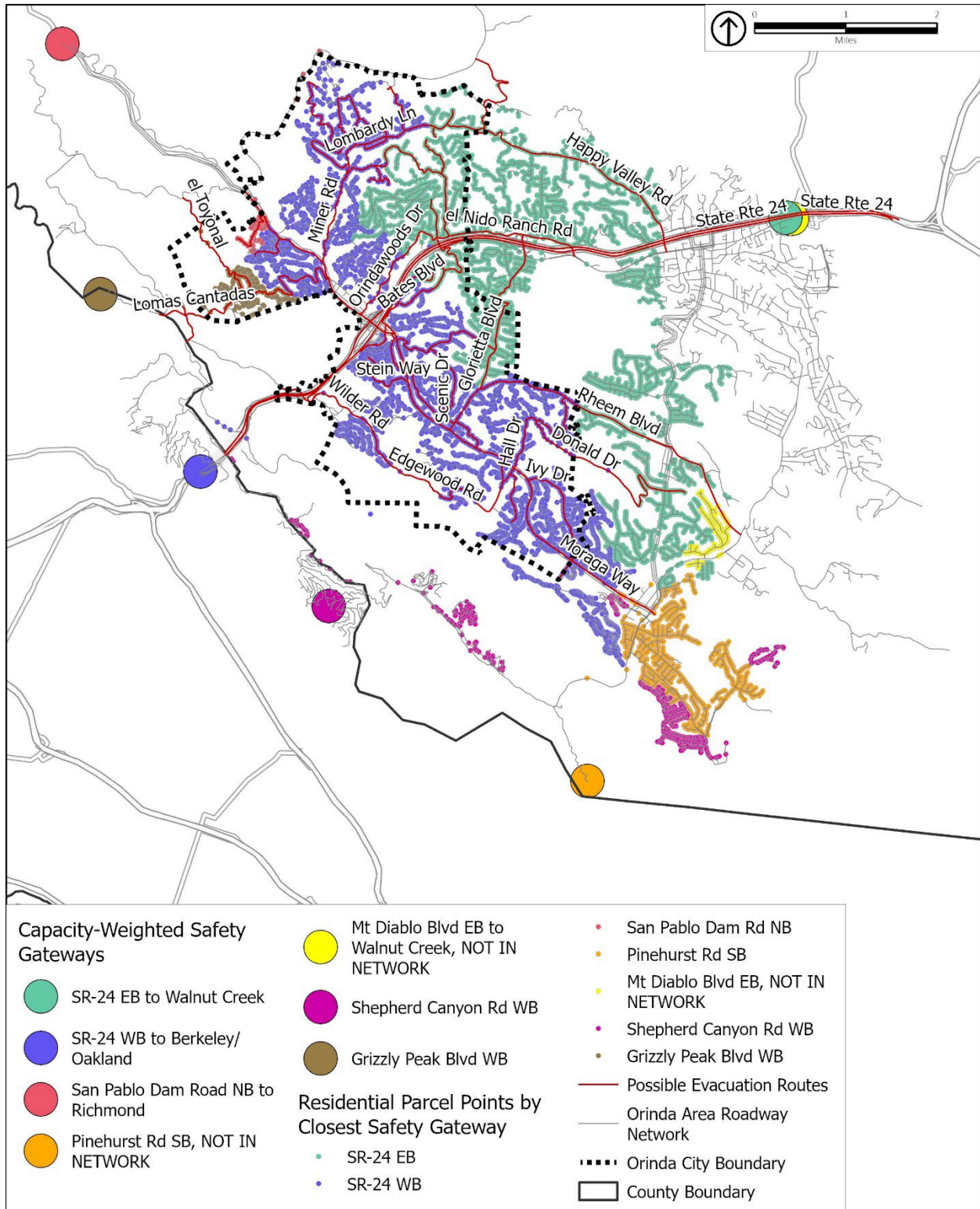


**FIGURE 4: SCENARIO 1, STEP ONE: RESIDENTIAL PARCELS POINTS AND CLOSEST SAFETY GATEWAYS**



Source: City of Orinda, 2022; Contra Costa County, 2022; Esri, 2022; PlaceWorks 2022.

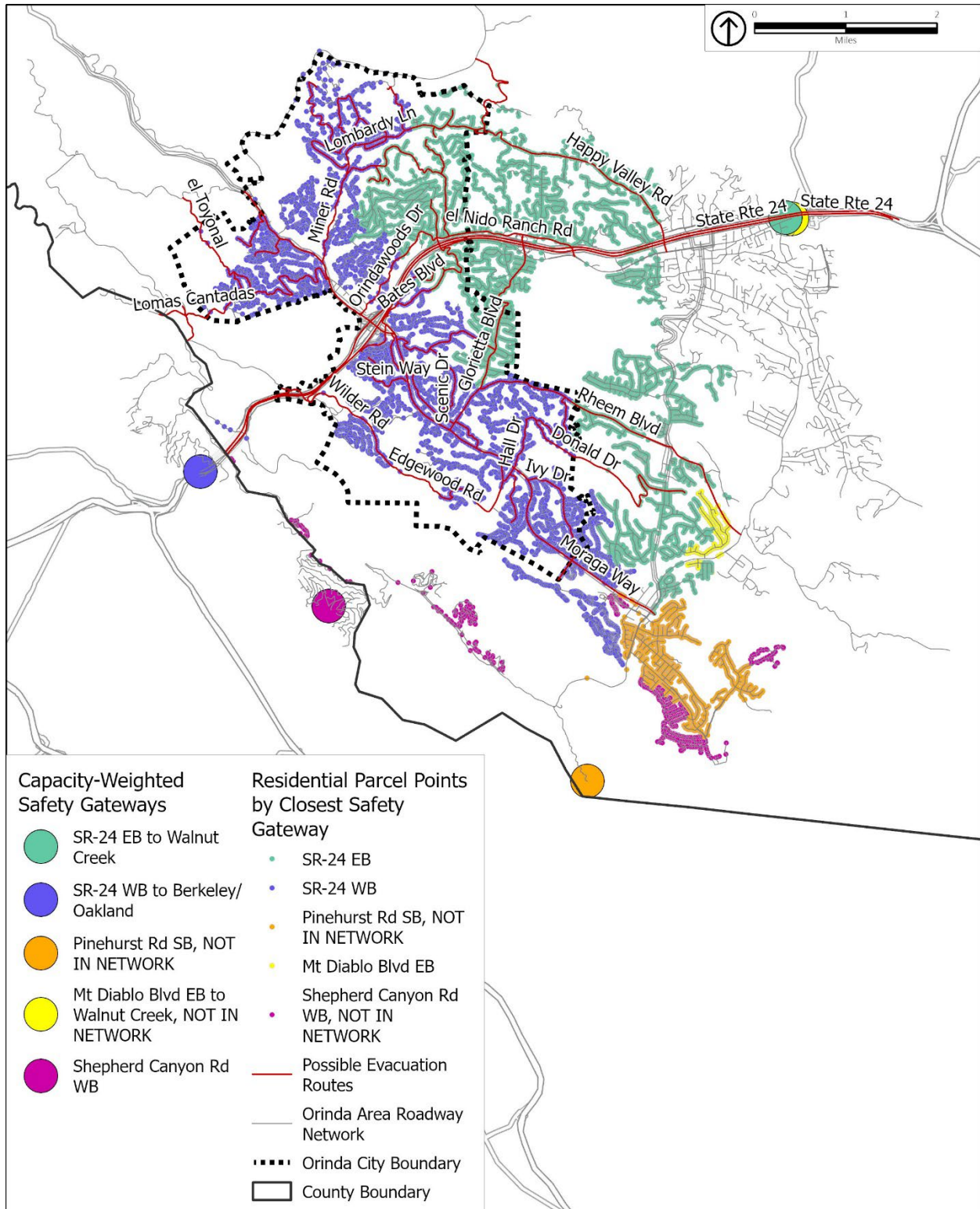
**FIGURE 5: SCENARIO 2, STEP ONE: RESIDENTIAL PARCELS POINTS AND CLOSEST SAFETY GATEWAYS**



Source: City of Orinda, 2022; Contra Costa County, 2022; Esri, 2022; PlaceWorks 2022.



**FIGURE 6: SCENARIO 3, STEP ONE: RESIDENTIAL PARCELS POINTS AND CLOSEST SAFETY GATEWAYS**



Source: City of Orinda, 2022; Contra Costa County, 2022; Esri, 2022; PlaceWorks 2022.

Figures 4, 5, and 6 show that in all three scenarios, the fastest route for most Orinda residents from their home to safety is towards SR-24 westbound towards the Caldecott Tunnel, particularly to the westbound on-ramps from Camino Pablo.

The legends in Figures 4, 5, and 6 also label some residential origin points and their corresponding safety gateways as 'NOT IN NETWORK'. These residences do not use the Orinda evacuation network at all. For some safety gateways in some scenarios, any households routed towards them do not use the Orinda roadway network, in which case the gateway itself is also labeled as 'NOT IN NETWORK' in the legend. For example, households routed to Mt. Diablo Boulevard in Scenarios 2 and 3 use Moraga Road, which is not in the Orinda evacuation network, and so these households and the Mt. Diablo Boulevard safety gateway are both labeled 'NOT IN NETWORK' in Figures 5 and 6. Out-of-network residences and safety gateways are not considered further in this analysis for those scenarios. Importantly, however, Figures 4, 5, and 6 show that residents of Moraga Country Club outside of Orinda City Limit boundaries to the south would likely evacuate towards SR-24 via Moraga Way northbound through Orinda, so these households are included in the subsequent steps estimating traffic volumes at intersections along Orinda's possible evacuation routes.

### Step Two

The second step sums expected vehicle counts at each intersection in the direction of travel towards the nearest safety destination, resulting in the total cumulative estimated traffic volume for each intersection, which is compared to the intersection's associated capacity to maintain LOS C, the level at which traffic speeds begin to slow due to congestion. The ratio of expected traffic volumes to capacity (Volume-to-Capacity or V/C ratio) to maintain each LOS is summarized in Table 2. Because this report does not model the behavior of any specific hazard (like wildfire) over time, the analysis assumes that if a roadway segment is assumed safe to use in each scenario, then all intersections along that roadway are fully operational during an evacuation, and that there are no partial signal disruptions. Step three analyzes potential drive times assuming 5 mph on all roads to evaluate a potential severe congestion scenario that could be caused by a variety of factors like potential traffic signal disruptions.

**TABLE 2: LEVEL OF SERVICE AND ASSOCIATED VOLUME TO CAPACITY RATIO AND DESCRIPTION**

LOS	V/C Ratio	Description	Control Delay per Vehicle (sec/veh) Signalized Intersections	Control Delay per Vehicle (sec/veh) Non-Signalized Intersections
A	<0.60	Traffic flows at or above speed limit; complete mobility between lanes	0 - 10	0 - 10
B	>0.61 to 0.70	Slightly more congested than free-flow, with almost no limits to lane-changing mobility	10 - 20	10 - 15
C	>0.71 to 0.80	Stable flow where posted speed is maintained. Ability to pass or change lanes is somewhat limited.	21 - 35	15 - 25
D	>0.81 to 0.90	Approaching unstable flow, speeds somewhat reduced from posted limit with vehicles close together	36 - 55	26 - 35
E	>0.91 to 1.00	Flow becomes unstable (stop and go); consistent with volume to capacity (V/C) ratios of 0.9 and greater	56 - 80	36 - 50
F	>1.00	Stopped traffic idling for up to minutes at a time	>80	>50

Table 2 shows how each Level of Service (A through F) is associated with a range of V/C ratios. Project staff assigned intersection capacity thresholds (the 'C' in V/C ratio) to possible evacuation route intersections based on traffic capacities measured for the Moraga Way and Glorietta Boulevard intersection in a 2015 Transportation Impact Analysis conducted by Abrams Associates Traffic Engineering Inc. for the City of Orinda's 5th Cycle Housing Element. This critical intersection along the Orinda evacuation network is a standard signalized four-way intersection with left and right turns allowed in all directions and is comparable to other arterial intersections along Moraga Way and Camino Pablo that connect to SR-24 with residential streets and minor collectors feeding into it. This AB-747 evacuation study uses the estimated capacity for the Glorietta Boulevard/Moraga Way intersection in the northwest-bound direction towards SR-24 (in the direction of evacuation for all three scenarios) as the baseline traffic capacity for similar intersections along Orinda's possible evacuation network. This is 912 vehicles per hour to maintain LOS C according to the 2015 Abrams Associates study. While the volume of traffic using Orinda intersections (the 'V' in V/C ratio) has very likely increased since 2015, this evacuation analysis only relies on the 2015 study to establish roadway capacity (the 'C' in V/C ratio), which reflects the infrastructural capacity of the intersection and has largely remained constant since 2015. This evacuation analysis generates roadway volume based on 2022 Contra Costa County tax assessor datasets and a network analysis of Orinda's roads.

Project staff assigned LOS thresholds to each arterial intersection in the Orinda evacuation network by applying the V/C ratios listed in the second column of Table 2 to the baseline LOS C capacity of 912 vehicles per hour derived from the 2015 Abrams Associates study. These thresholds are summarized below:

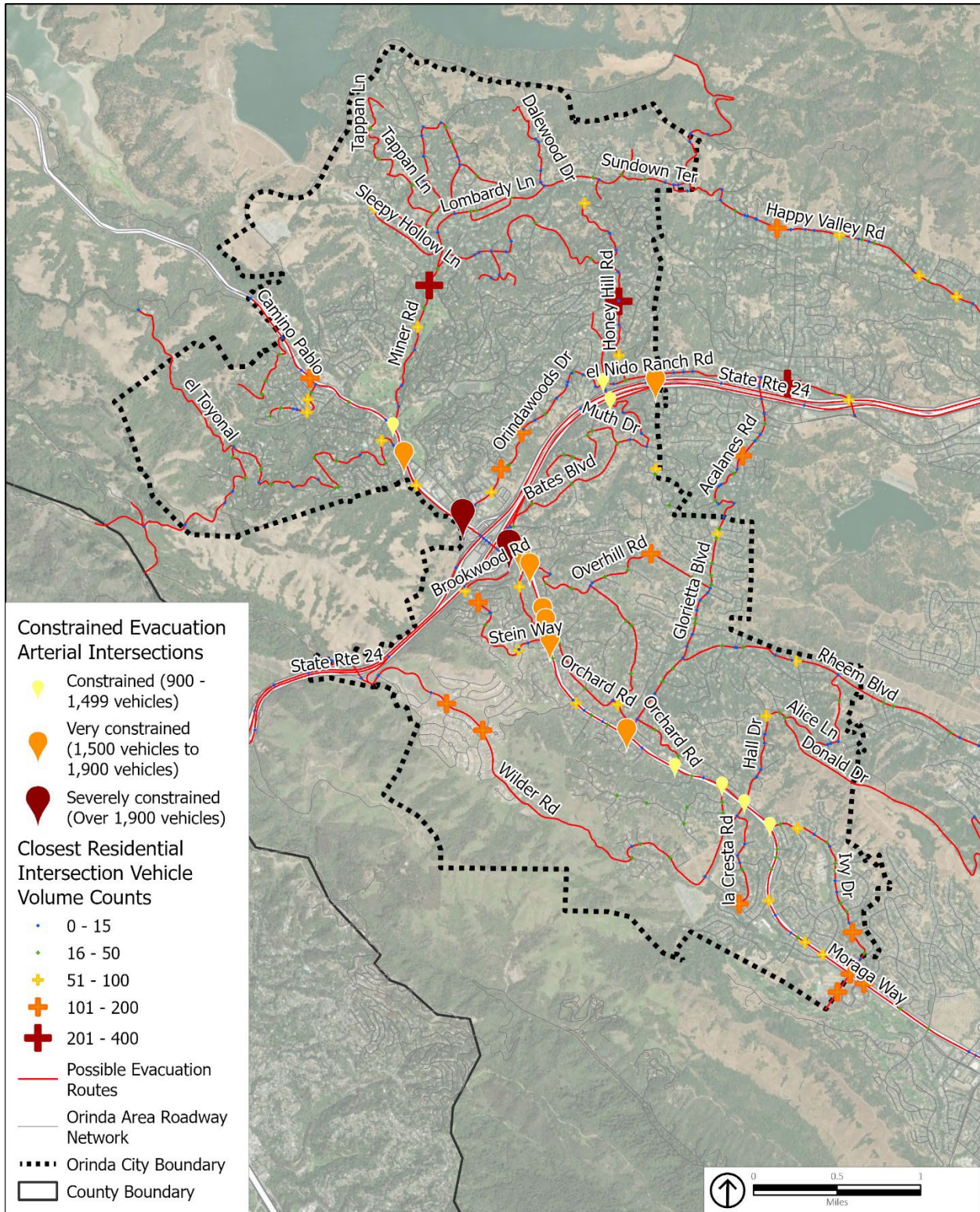
- Less than 549 vehicles = LOS A
- 549 -638 vehicles = LOS B
- 639 -728 vehicles = LOS C
- 729 -818 vehicles = LOS D
- 819 -899 vehicles = LOS E
- Over 900 vehicles = LOS F

One important arterial roadway segment in the Orinda evacuation network, Camino Pablo between Moraga Way and Miner Road, has two lanes in both directions instead of one lane, which could translate to increased capacity along this segment compared to the LOS thresholds derived from Moraga Way at Glorietta Boulevard which has only one lane in each direction. Within the two-lane segment of Camino Pablo, however, evacuees are either heading northwest-bound from Moraga Way to turn right and merge onto the SR-24 cloverleaf on-ramp, or evacuees are heading southbound on Camino Pablo from Miner Road to turn right onto the SR-24 westbound on-ramp from the southbound approach. In both cases, traffic lanes merge from two lanes into one on-ramp with no signal timing infrastructure, which could likely create bottlenecks that decrease the capacity of intersections within this roadway segment as vehicles merge into one lane at the freeway access ramps. For this reason, project staff conservatively assigned the same capacity of 912 vehicles per hour to intersections in this two-lane segment of Camino Pablo. All other intersections at arterials along the Orinda roadway network have the same relevant characteristics and are therefore assigned the same vehicle volume capacities that were observed for the Glorietta Boulevard and Moraga Way intersection.

Project staff estimated traffic volume counts at each intersection in Orinda's possible evacuation roadway network based on the number of households traveling towards each safety gateway depicted in Figures 4, 5, and 6, and the associated fastest route for each household origin point. The methodology aggregates cumulative vehicle counts for arterial intersections along the possible evacuation network and compares them to their assigned capacities of 912 vehicles per hour to estimate LOS. Figures 7, 8, and 9 below depict intersection counts, with plus-sign or cross-shaped symbols showing minor roadway intersection counts, and inverse tear drop-shaped icons showing the cumulative counts for arterial intersections. These figures show arterial intersections expected to meet or exceed 900 vehicles (LOS F) as 'Constrained', intersections expected to meet or exceed 1,500 vehicles as 'Very Constrained' and intersections expected to meet or exceed 1,900 vehicles as 'Extremely Constrained'.



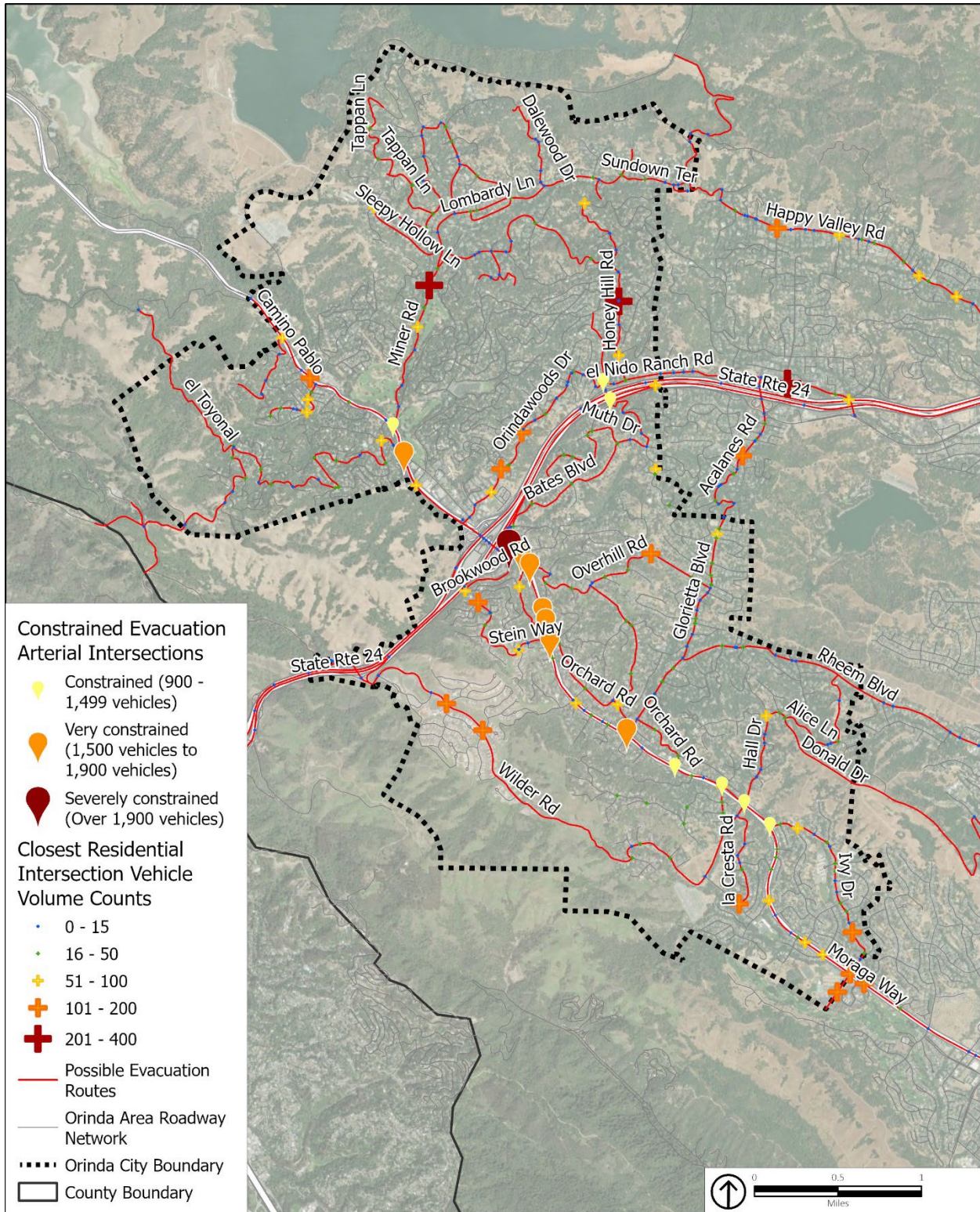
FIGURE 7: EVACUATION SCENARIO 1, STEP TWO: INTERSECTION COUNTS



Source: City of Orinda, 2022; Contra Costa County, 2022; Esri, 2022; PlaceWorks 2022.



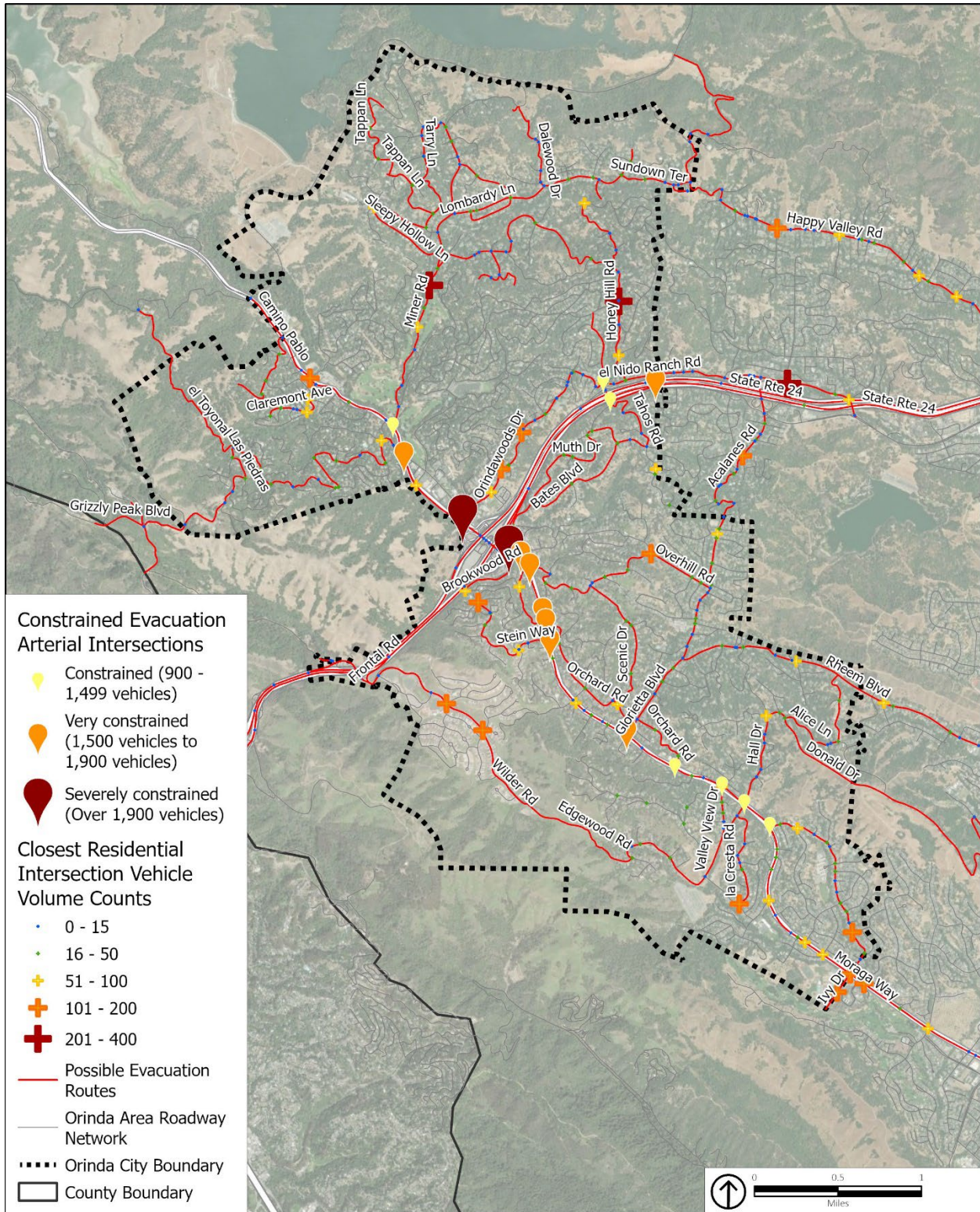
FIGURE 8: EVACUATION SCENARIO 2, STEP TWO: INTERSECTION COUNTS



Source: City of Orinda, 2022; Contra Costa County, 2022; Esri, 2022; PlaceWorks 2022.



FIGURE 9: EVACUATION SCENARIO 3, STEP TWO: INTERSECTION COUNTS



Source: City of Orinda, 2022; Contra Costa County, 2022; Esri, 2022; PlaceWorks 2022.



Figures 7, 8, and 9 show that several major evacuation arterial routes are likely to be constrained in all three scenarios based on the extent to which expected traffic volumes exceed estimated capacities. These are:

- Moraga Way northbound from Ivy Drive to Camino Pablo and the SR-24 westbound on-ramps from Camino Pablo northbound,
- And Camino Pablo Southbound from Miner Road to the SR-24 westbound on-ramps.

In addition, the following two intersections result in the highest V/C ratio and are therefore considered to be the most constrained intersections:

- Camino Pablo southbound/Santa Maria Way westbound and the SR-24 westbound on-ramps,
- And the Camino Pablo and Brookwood Road intersection, just before the right-turn cloverleaf on-ramp to SR-24 westbound from Camino Pablo Northbound.

The final step in the methodology uses these results to assign increasing ‘congestion index’ points to households traveling through increasing numbers of constrained arterial intersections shown in Figures 7, 8, and 9, with additional weight for increasing expected cumulative LOS for each intersection beyond level C. The resulting implications for households traveling through these intersections are discussed in more detail in the Wildfire Evacuation Analysis Results and Discussion section.

### Step Three

Project staff generated travel distance contours to the closest safety gateways along Orinda’s roadway network for each scenario and assigned increasing index points to households based on their location within increasing distance intervals away from the nearest safety gateway. Project staff generated the first set of contours assuming maximum allowable speeds on all roadways to establish the baseline travel times, and then again using an assumption of an average speed of 5 miles per hour (mph) on all roadways to model a potential scenario with significant congestion. While the previous step identifies constraints from traffic congestion, this step identifies constraints based on distance expressed as driving times under the two different speed assumptions. The 5 mph scenario captures the effects of a range of potential external factors that could result in slower traffic speeds but that are not modeled directly due to their specific and dynamic probabilities of occurring. This includes decreased visibility from wildfire smoke, decreased signal functionality due to wildfire or seismic impacts, roadway vehicle accidents, and/or temporary right-of-way yields to emergency vehicles traveling ‘upstream’ towards hazard areas. Figures 10, 11, and 12 depict baseline drive time contours to the nearest safety gateway side by side with 5 mph scenario drive time contours for all three scenarios.

Under Scenario 1, which has the fewest accessible safety gateways, modeling an average driving speed of 5 mph on all roadways indicates that some residential areas that are furthest away from their nearest safety gateway (e.g., around Miramonte High School) could require up to two hours (120 minutes) to evacuate, as shown in Figure 10. Under this scenario, the second-furthest areas from their respective safety gateways could require up to 90 minutes to evacuate. Under Scenarios 2 and

3, modeling an average driving speed of 5 mph indicates that all areas in Orinda could likely evacuate within an hour and a half (90 minutes), and most within one hour, as shown in Figures 11 and 12, respectively.

Figures 10, 11 and 12 show 5 mph drive time contours for comparison with the baseline maximum drive times. However, index points for the purposes of cumulative constraint index scoring are assigned to residential parcels based on the baseline maximum speed drive time contours and not the 5 mph contours. This is because Step 2 captures traffic congestion impacts already, such that using the 5 mph contours to assign index points would double-count the effects of traffic congestion.

#### Step Four

Project staff assigned an additional index point to residential areas with only one point of ingress or egress, based on an earlier analysis conducted for the Orinda General Plan Safety Element Update in compliance with California Senate Bill 99. These are neighborhoods along single-access roads or within a cul-de-sac of 10 or more parcels, shown in Figure 13.

FIGURE 10: WILDFIRE SCENARIO 1, STEP THREE: BASELINE AND CONSTRAINED TRAVEL TIME CONTOURS

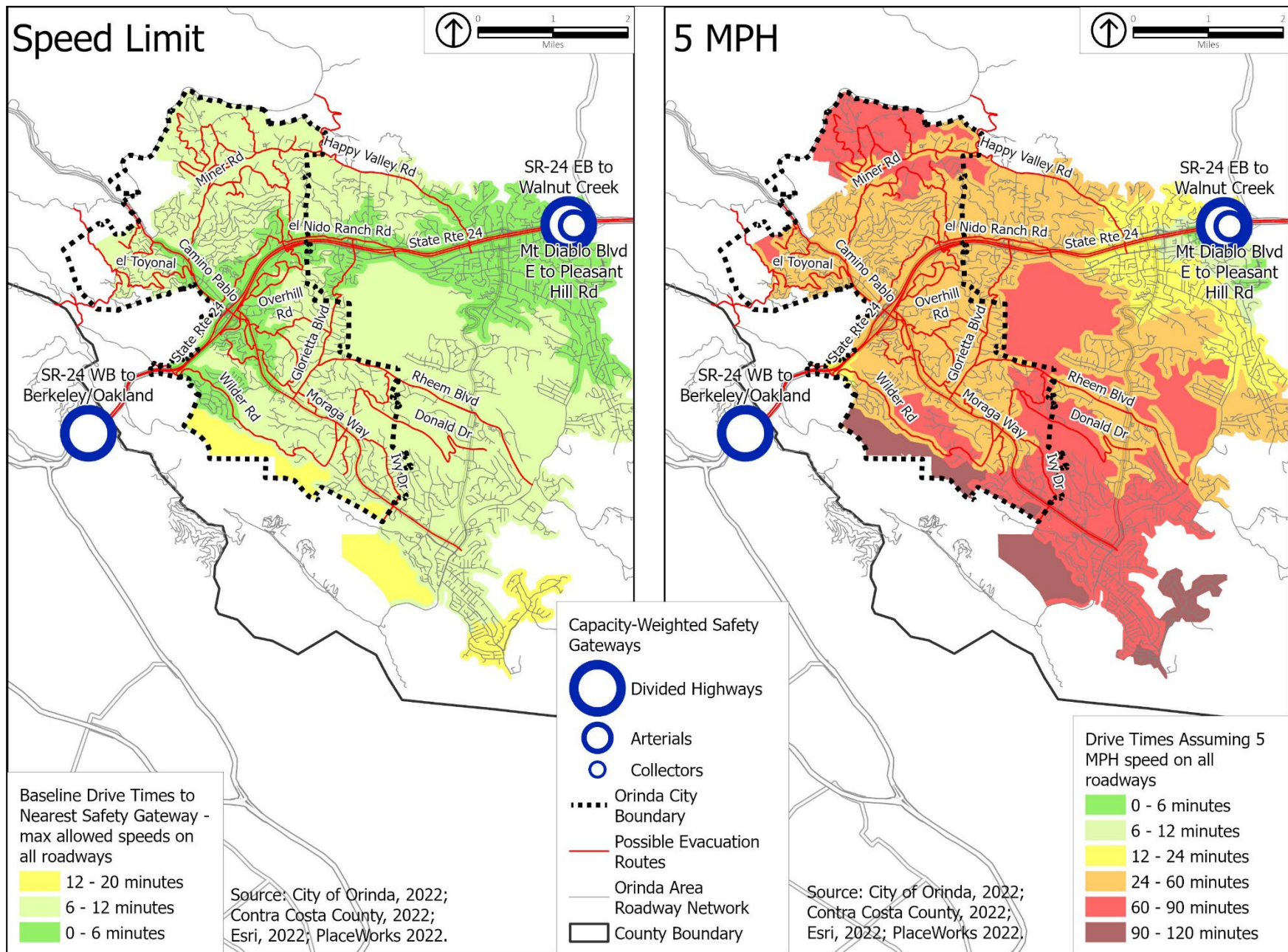




FIGURE 11: WILDFIRE SCENARIO 2, STEP THREE: BASELINE AND CONSTRAINED TRAVEL TIME CONTOURS

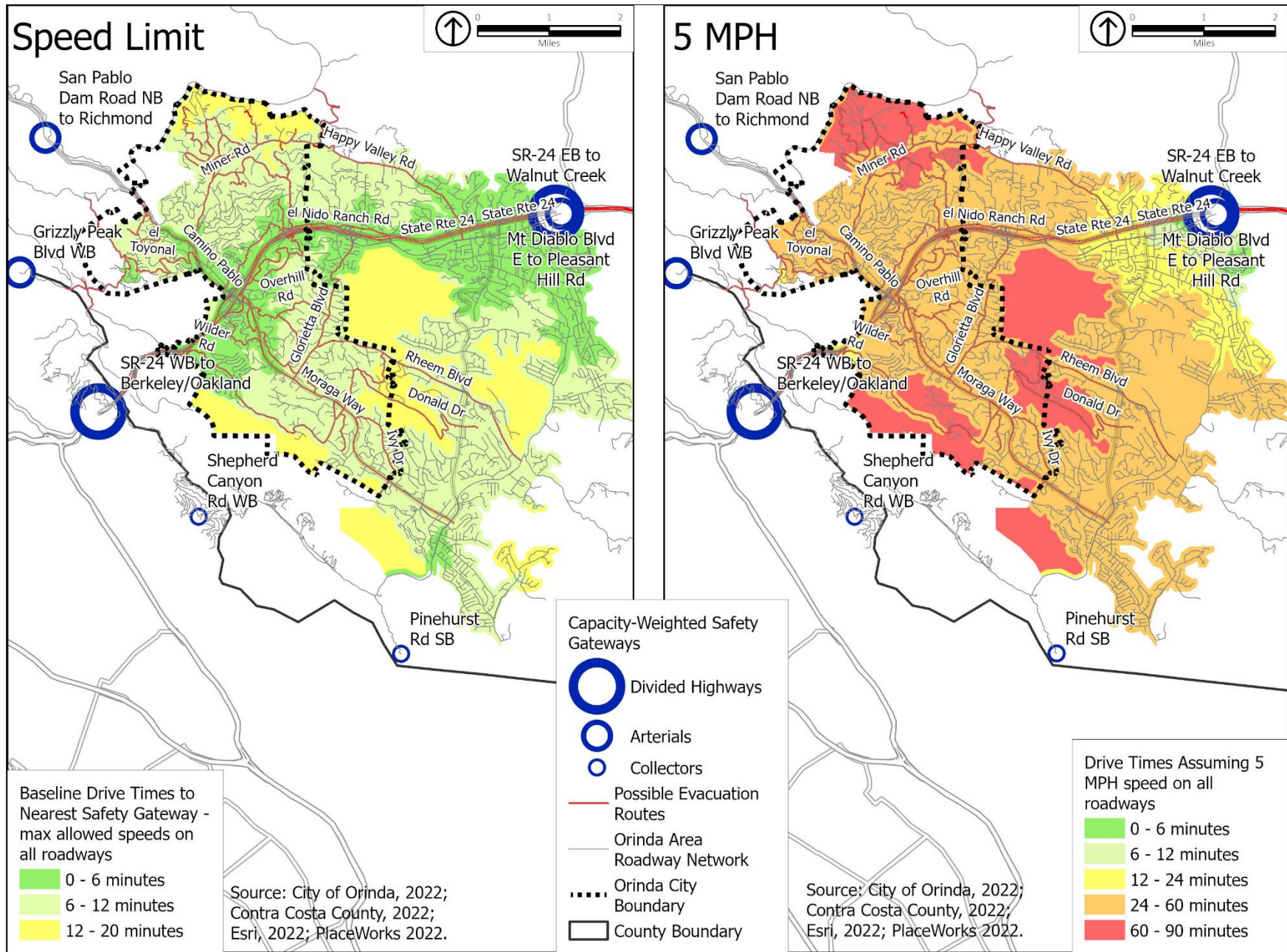
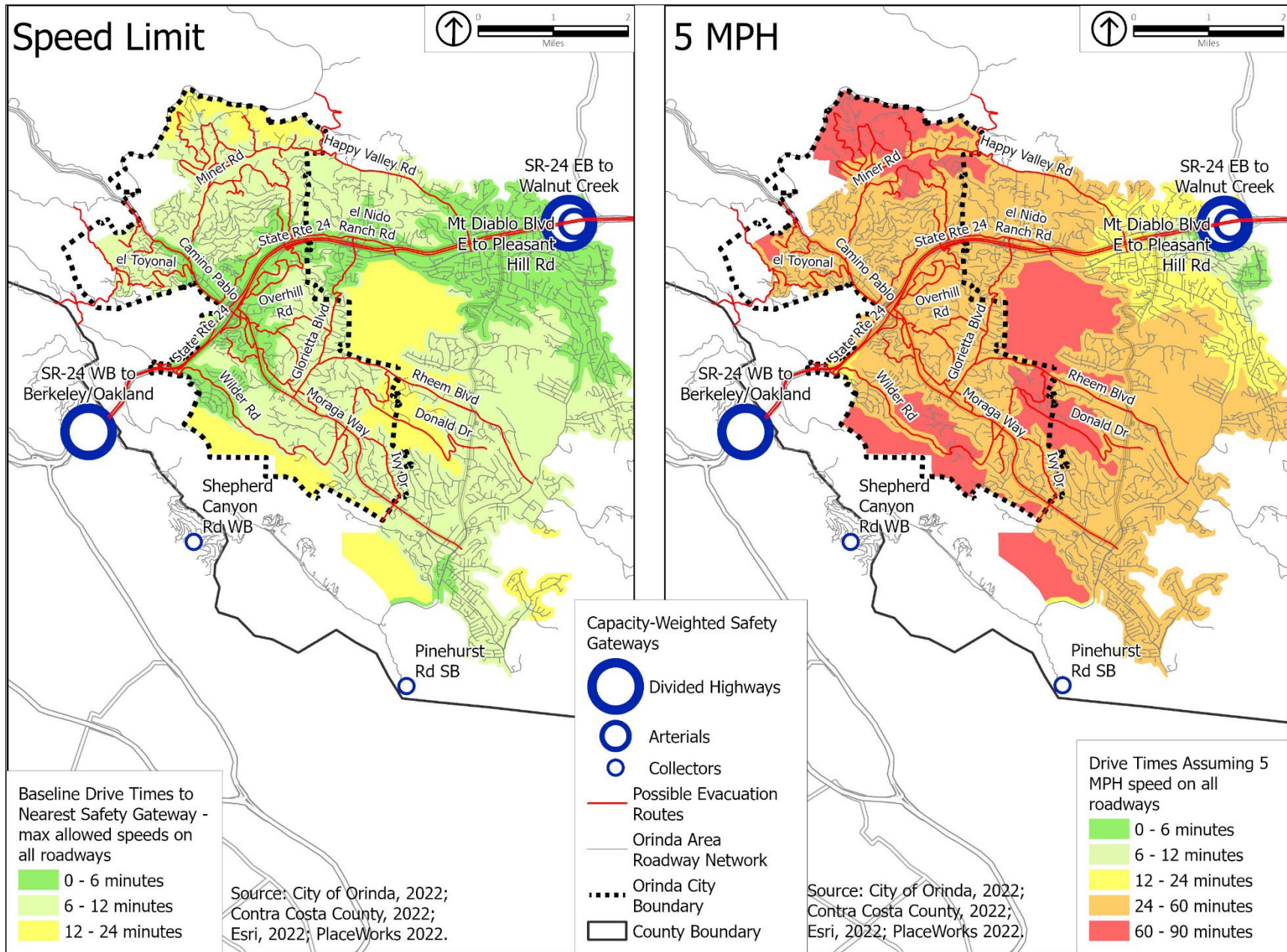
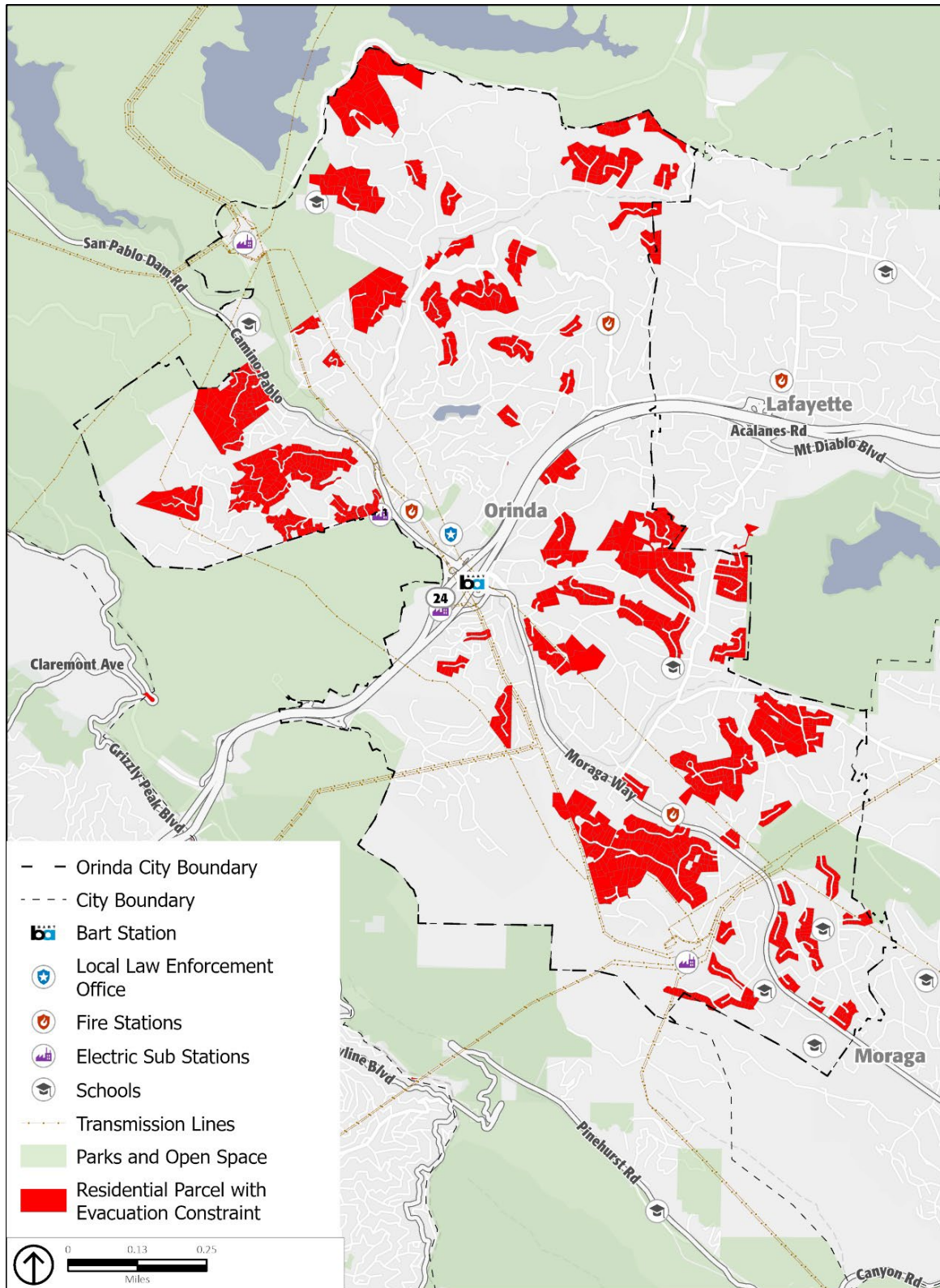




FIGURE 12: WILDFIRE SCENARIO 3, STEP THREE: BASELINE AND CONSTRAINED TRAVEL TIME CONTOURS



**FIGURE 13: STEP FOUR (ALL SCENARIOS): RESIDENTIAL AREAS WITH A SINGLE POINT OF INGRESS OR EGRESS**



Source: Evacuation analysis by PlaceWorks and City of Orinda, 2022.



The final step in the wildfire evacuation constraint methodology adds additional constraint index points to the cumulative constraint index score if households are within census tracts with high percentages of populations or households having demographic characteristics that could pose as barriers to evacuating. Specifically, the methodology identifies tracts where the share of the population or households meet or exceed the Contra Costa County average share for the following factors based on American Community Survey (ACS) 2020 data:

- Share of senior citizen (65 years of age or more) householders living alone
- Share of households with adults speaking limited English
- Share of households with limited access to phone and/or internet
- Share of low-income households
- Share of households with children under 6 years of age
- Share of households with limited access to vehicles
- Share of the population with a disability

The project team assigned a demographic vulnerability index point to households within census geographies that meet or exceed the average countywide share for each of these factors, with multiple points assigned to households with multiple characteristics above the countywide average share threshold. The team added this additional demographic evacuation barrier score to households' cumulative traffic constraint score to assess areas in Orinda where households may face both traffic constraints and demographic barriers to evacuation. This report summarizes the demographic analysis separately from the traffic analysis results, since recommendations for mitigating traffic congestion impacts are different than recommendations for assisting specific populations that may face barriers to evacuation. Efforts to reduce traffic congestion may include traffic interventions like contra-flow lanes, which are lanes converted to the opposite direction temporarily to facilitate increased traffic flow in that direction, while evacuation recommendations for specific populations may involve improved notification systems or chartering buses to assist with evacuating people who do not have access to a vehicle. The ACS data is based on households, so it does not include people living in group quarters such as senior citizen nursing facilities. This report includes recommendations to address the specific evacuation needs of senior facilities.

### Cumulative Wildfire Evacuation Constraint Index Scoring Summary

The overall constraint scores for residential parcels in a wildfire evacuation event are calculated for each scenario based on the formula discussed above and summarized in the list below.

#### LOS C Index

- 0.25 point assigned to a parcel for each intersection traveled through with LOS C or D

#### LOS D Index

- 0.5 index point assigned to a parcel for each intersection traveled through with LOS D or E

**LOS E Index**

- 1 index point assigned to a parcel for each intersection traveled through with LOS E or F

**LOS F Index**

- 1.5 index points assigned to a parcel for each intersection traveled through that exceeds LOS F by 100
- 2 index points assigned to a parcel for each intersection traveled through that exceeds LOS F by 600
- 2 index points assigned to a parcel for each arterial intersection traveled through that exceeds LOS F by more than 600 but that has two lanes

**Travel Time Contour Index**

- 0 index points assigned to a parcel if it is within the 0 – 5-minute baseline drive time contour
- 1 index point assigned to a parcel if it is within the 10 – 15-minute baseline drive time contour
- 2 index points assigned to a parcel if it is within the 16 – 20-minute baseline drive time contour

**Limited Egress Index**

- 1 index point if parcel is in a limited egress area

**Senior Householder (65+) Living Alone Index**

- 1 index point assigned to households within census tracts that have a higher percentage than countywide average

**Limited-English Speaking Household Index**

- 1 index point assigned to households within census tracts that have a higher percentage than countywide average

**Limited Access to Lifelines Index (phone and/or internet)**

- 1 index point assigned to households within census tracts that have a higher percentage than countywide average

**Low-Income Household Index**

- 1 index point assigned to households within census tracts that have a higher percentage than countywide average

**Households with Children Under 6 Index**

- 1 index point assigned to households within census tracts that have a higher percentage than countywide average

**Limited Access to a Vehicle Index**

- 1 index point assigned to households within census tracts that have a higher percentage than countywide average

### Disabled Population Index

- 1 index point assigned to households within census tracts that have a higher percentage than countywide average

The goal of this index weighting approach is to apply relatively equal weight to all constraint factors, plus additional weight to capture the level by which intersections exceed LOS F based on their expected traffic volume-to-capacity ratios. The weighting scale acts as a standardized numeric ranking index that evaluates the relative constraint and vulnerability of residential areas within Orinda compared to each other. This approach is like the vulnerability index score used in the Orinda General Plan Safety Element Vulnerability Assessment in that it is an index of multiple factors with different scales that are standardized into a score and ranked based on the number of factors that apply. However, this approach is targeted more towards assessing vulnerabilities related to traffic and ability to evacuate during an acute emergency in Orinda.

## 3 Landslide Evacuation Analysis Methodology

This report uses a different approach to evaluate landslide evacuation scenarios compared to the methods used to evaluate wildfire evacuation scenarios, primarily because the geographic spread of impacts and associated number of people who would need to evacuate immediately during a wildfire could potentially be much larger than the geographic spread of impacts and associated number of immediate evacuees during a landslide. For example, the Zander Drive landslide in 2008 measured 200 feet across, 115 feet in depth, and extended 1,000 feet in length from Zander Drive down the slope to San Pablo Creek, covering almost five acres in surface area. The 1991 Oakland Tunnel and 1998 Sibley Fires, by comparison, had burn areas measuring 1,622 acres and 200 acres, respectively.

Because of the typically more localized nature of landslides compared to wildfires in California, the possible evacuation ‘network’ for a landslide event is specific to the local area in which it occurs, such that recommendations for evacuation in one localized area or neighborhood are not necessarily relevant for other areas or neighborhoods.

For these reasons, this report evaluates evacuation risk specifically along Orinda’s network of possible evacuation routes in GIS by intersecting the possible evacuation routes data layer with the landslide risk data layer shown in Figure 2, and summarizes recommendations based on segments of the possible evacuation network that are at the highest landslide susceptibility class.

## 4 Citywide Evacuation Analysis Discussion and Recommendations

As discussed in the introduction, Scenario 1 assumes that alternative evacuation routes to SR-24 spanning the western side of Orinda from south to north are not usable. These include: San Pablo Dam Road northbound, Grizzly Peak Boulevard westbound, Canyon Road westbound (via Pinehurst Road northbound), and Pinehurst Road southbound. Scenario 2, where the hazard area is the open spaces surrounding Lafayette Reservoir, assumes that all evacuation gateways are safe to use. Scenario 3 assumes that evacuation routes in the northern part of Orinda are not safe to use, which include San Pablo Dam Road northbound and Grizzly Peak Boulevard westbound.



Figures 7, 8, and 9 show that both Moraga Way northwest-bound and Camino Pablo southeast-bound are still likely to be congested above LOS F in all three scenarios, even under Scenario 2 with all evacuation gateways available. This is because most residents will still evacuate towards SR-24 because it has a much higher vehicle capacity than any alternative routes (illustrated in Table 1), and Camino Pablo and Moraga Way are the only arterial roadways in Orinda that lead to SR-24 on-ramps, so most traffic bound for SR-24 ultimately travels along these routes.

### Recommendations for Reducing Traffic Congestion during Evacuation

Recommendations provided in this report are grouped into themes, based on the major evacuation routes found to be potentially most constrained by traffic congestion in Section 2 of this report. The first set of recommendations focuses on facilitating additional traffic capacity in the northwest-bound direction along Moraga Way/Camino Pablo towards SR-24 access ramps, which the constrained intersection analysis finds likely to be the most congested for all three scenarios. The second set of recommendations focuses on facilitating additional evacuation traffic in the southbound direction along Miner Road towards SR SR-24 on-ramps, which the analysis found likely to be the second most congested in all three scenarios. The third set provides recommendations for reducing traffic congestion along all other roadway segments that have a clear direction of travel towards safety for all three scenarios and that are potentially constrained during an evacuation. The fourth set offers other recommendations to facilitate timely evacuation procedures citywide, particularly at major access ramps to SR-24 from Camino Pablo in both directions. The fifth and final set of recommendations focuses on measures to reduce the number of vehicles evacuating overall.

Many of the recommendations listed below include recommendations for both contra-flow lanes and red flag parking restrictions on specific roadways to facilitate additional travel in specific directions during an evacuation. Contra-flow lanes are roadway lanes converted to the opposite direction temporarily to facilitate increased traffic flow in that direction. The City of Orinda has already implemented policies to allow contra-flow lanes on Miner Road, converting northbound lanes into additional southbound lanes towards SR-24 during an evacuation event. During Red Flag Days, on-street parking and stopping is prohibited to keep roadways clear for potential evacuation and fire vehicle access. The National Weather Service may declare a Red Flag Day, indicating a high risk of wildfires, given humidity levels, wind speeds, and the possibility of dry lightning. MOFD may also declare a Red Flag Day under similarly dangerous conditions. The City has implemented Red Flag Day parking restrictions along several key evacuation routes, including along El Toyonal and other areas north of SR-24.

#### Recommendations for Moraga Way/Camino Pablo Northbound

1. Consider expanding Red Flag Day parking restrictions to include Moraga Way between Ivy Drive and Camino Pablo, and from Camino Pablo northwest-bound to SR-24 westbound on-ramps.
2. In addition to parking restrictions on the segment of Moraga Way between Ivy Drive and Camino Pablo, study the feasibility of implementing contra-flow lanes that convert the southeast-bound lane on Moraga Way into an additional northwest-bound lane towards SR-24 during an evacuation.
3. Consider implementing an evacuation signal timing plan for the following intersections along Moraga Way and the segment of Camino Pablo south of SR-24 to allow only the northwest-

bound through direction as well as turning movements onto Moraga Way and Camino Pablo northwest-bound to SR-24:

- Brookwood Road/ Camino Pablo
  - Moraga Way/ Camino Pablo
  - Glorietta Boulevard/ Moraga Way
  - El Camino Moraga/ Moraga Way
  - Coral Drive/ Moraga Way
  - Ivy Drive/ Moraga Way
4. In addition to preferential signal timing at the intersections listed in item 3 above, consider stationing staff or volunteers to direct traffic at the above key intersections during an evacuation event, or use automated signals as feasible.
  5. Consider staging staff or volunteers where Moraga Way Northbound splits into Moraga Way and Camino Pablo to encourage evacuees in the right-most lane on Moraga Way northbound to use the Moraga Way/Bryant Way SR-24 eastbound ramps instead of continuing to the westbound ramps further north from Camino Pablo.
  6. There are two Emergency Vehicle Access (EVA) roads, otherwise known as fire roads, that connect Moraga Way with Wilder Road, and that could be studied for residential access during an evacuation event to relieve traffic pressure along Moraga Way northbound towards SR-24. The northern of these two EVAs connects Brookside Road (at the intersection with Sunrise Hill Road) with Boeger Ranch Road, and the southern of the two EVAs connects Edgewood Road to the southern end of Wilder Road. This report recommends that Orinda staff, in coordination with MOFD, study the feasibility of using both EVAs for residential use during an evacuation to relieve expected traffic pressure on Moraga Way towards SR-24. MOFD has noted that the Edgewood Road/Wilder Road EVA may require significant improvements to safely support residential use during an evacuation, such as grading, paving, and traffic controls, whereas the Brookside Road/Boeger Ranch Road EVA would only require gate removal at the time of evacuation. Any plans to convert EVAs to public access during an evacuation would require coordination with MOFD to ensure staff provide emergency vehicles with priority access to these routes as necessary before making them publicly accessible.
  7. Consider entering into an agreement with unincorporated county, and any other stakeholders to implement contra-flow lanes along San Pablo Dam Road in the northbound direction from Bear Creek Road to the intersection with Valley View Road in El Sobrante.
  8. Finally, consider entering into an agreement with Caltrans and other stakeholders to implement contra-flow lanes in the westbound direction along the reversible lanes available on SR-24 in the event of a wildfire in the MOFD jurisdiction.

#### Recommendations for Miner Road/Camino Pablo Southbound

1. In addition to the contra-flow lanes Orinda has already established along Miner Road, consider also implementing contra-flow lanes on Camino Pablo from Miner Road to the SR-24 on-ramps, converting the northbound lanes into additional southbound lanes during an evacuation.

2. Consider implementing an evacuation signal timing plan for the following intersections along Camino Pablo to allow only the southbound through direction as well as turning movements onto Camino Pablo southbound:
  - Miner/ Camino Pablo
  - El Toyonal/ Orinda Way/ Camino Pablo
  - Camino Sobrante/ Camino Pablo
  - Orinda Way/ Altarinda/ Santa Maria
  - Santa Maria/ Camino Pablo
3. There is an additional EVA connecting the northern segment of El Toyonal with Wildcat Canyon Road. This report recommends that Orinda staff coordinate with MOFD to make necessary roadway improvements to this segment of El Toyonal, like bridge upgrades and gate removal, that would make this roadway accessible for public access during an evacuation. This additional access route could enable more residents in the El Toyonal neighborhood to evacuate via Wildcat Canyon Road and potentially relieve additional congestion pressure along Camino Pablo southbound towards SR-24.
4. Finally, consider contra-flow lanes, red flag parking restriction policies, and preferred signal timing on St. Stephens Drive between Las Vegas Road/Via Las Cruces and the SR-24 access ramps during an evacuation event, enabling additional traffic to flow southbound towards SR-24. This roadway segment is adjacent and parallel to Honey Hill Rd/Charles Hill Rd. Implementing contra-flow lanes, red flag parking restrictions, and preferred signal timing on both this segment and on Honey Hill Rd/Charles Hill Rd in the southbound direction could help alleviate potential southbound congestion towards SR-24 access ramps on both streets.

#### Recommendations for Collector Roadways Serving as Potential Evacuation Routes

Table 3 below lists minor collector intersections that could be potentially constrained, with 100 or more vehicles traveling through them during the first phases of evacuation as residents exit their homes. Table 3 describes each intersection, the estimated vehicle count based on the sum of closest households, and associated recommendations for alleviating traffic congestion at these intersections.

Any roadway segment recommended for contra-flow lanes in Table 3 should also be considered for expansion of red flag parking restriction days other than where Red Flag Day parking restrictions are implemented already. Current red flag parking restricted areas include Loma Vista Drive and El Toyonal between Camino Pablo and Vista Orinda in the northeast El Toyonal neighborhood of Orinda.



**TABLE 3: POTENTIALLY CONSTRAINED MINOR INTERSECTIONS: ALL THREE WILDFIRE SCENARIOS**

ID	Intersection Name	Intersection Type	Vehicle Count <sup>1</sup>	Proposed Potential Congestion Reduction Measure
L1	Honey Hill Road and Via Las Cruces	Local Street to Collector	265	<ul style="list-style-type: none"> <li>Consider implementing contra-flow lanes in the southbound direction on Honey Hill Road/Charles Hill Road Southbound towards SR-24.</li> <li>Consider implementing contra-flow lanes in the eastbound direction on Hidden Valley Road between St Stephens Drive and the SR-24 eastbound on-ramp.</li> </ul>
L2	Miner Road and Camino Sobrante	Local Street to Collector	252	<ul style="list-style-type: none"> <li>If San Pablo Dam Road northbound is not a safe possible evacuation route, then Camino Pablo could be considered for contra-flow in the southbound direction starting from Bear Creek Road.</li> <li>Consider encouraging residents along Camino Sobrante round the north side of Lake Cascade to evacuate south via Camino Sobrante towards Orinda Way, instead of north to the Miner Road intersection.</li> </ul>
L3	Happy Valley Road and Upper Happy Valley Road	Local Street to Collector	163	<ul style="list-style-type: none"> <li>Same recommendation as L2</li> </ul>
L4	Overhill Road and Tara Road	Local Street to Collector	129	<ul style="list-style-type: none"> <li>Consider implementing contra-flow lane in the westbound direction along Overhill Road between Tara Road and Moraga Way.</li> </ul>
L5	Arroyo Drive and Ivy Drive	Local Street to Collector	132	<ul style="list-style-type: none"> <li>See more general recommendations above for implementing contra-flow lane(s) along Moraga Way in the northwest-bound direction.</li> </ul>
L6	Orinda Woods Drive and Kite Hill Road	Local Street to Collector	121	<ul style="list-style-type: none"> <li>Encourage residents in this area to prepare to check two potential safety destinations to program into mobile direction applications (like Google or Apple Maps): Walnut Creek and Caldecott Tunnel, to evaluate whether SR-24 eastbound or westbound is faster given real-time traffic conditions.</li> </ul>
L7	Orinda Woods Drive and Village Gate Road	Local Street to Collector	112	<ul style="list-style-type: none"> <li>Same recommendation as Intersection L6.</li> </ul>

<sup>1</sup>Note: this value is the same in all three scenarios for these routes.

Note that while collector intersections listed in Table 3 were found to have higher traffic volumes than comparable intersections in Orinda, no constraint index points were assigned to residential parcels based on the number of local or collector intersections they must travel through. Residential parcel points were assigned index points only based on the number of constrained *arterial* intersections they must pass through to reach their closest capacity-weighted safety gateway. This is for ease and accuracy of calculation since arterials have a clear flow of traffic in the direction of the nearest safety gateways, whereas the collector intersections and routes typically have alternatives that lead to the same safety gateway.

#### General Recommendations for Facilitating a Citywide Evacuation

1. Implementing contra-flow lanes and signal timing preferences along Moraga Way, Miner Road, and Camino Pablo is likely to significantly ease congestion along major arterials leading to SR-24 access ramps by doubling the capacity of these arterials in the direction of evacuation. However, access ramps onto SR-24 from Camino Pablo merge into one lane without shoulders or signal timing infrastructure, which is likely to create bottlenecks even if arterials leading to the access ramps have additional contra-flow lanes. This report therefore recommends that Orinda staff coordinate with Caltrans to study the feasibility of implementing potential capital improvements to the SR-24 westbound on-ramps from Camino Pablo northbound and southbound, like signal timing infrastructure, that could improve the flow of traffic at these on-ramps.
2. This report also recommends that Orinda staff coordinate with a traffic consultant to identify and study the feasibility of more minor capital improvements that could facilitate increased traffic flow onto SR-24 on-ramps from Camino Pablo during an evacuation. For example, removing part of the concrete median and allowing left turns onto eastbound freeway access ramps from Camino Pablo northbound near Brookwood Road, rather than requiring vehicles traveling northbound on Camino Pablo to use Bryant Way to access SR-24 eastbound on-ramps. Allowing this left turn from Camino Pablo northbound during an emergency could relieve traffic pressure onto the westbound SR-24 on-ramp from Moraga Way/Camino Pablo northbound. During an evacuation.
3. Encourage all residents on the east side of Moraga Way (e.g., with mailers or electronic notifications) to be prepared to check traffic (on Google Maps, Apple Maps, Waze, or other mobile direction application) for both directions along SR-24 during an evacuation event. Residents could enter 'Walnut Creek' as their destination and view the routing, travel time, and traffic estimates for the eastbound direction, and then entering 'BART Rockridge' or other equivalent destination to compare conditions in the westbound direction.
4. Consider expanding emergency plans to use dynamic signage (e.g., digital screens at bus stops or along major arterials) that can be used to display messages during an evacuation event directing traffic to alternative routes. Currently, dynamic signage is recommended on Miner Road. For example, a dynamic sign could be deployed at Valley View Drive and Moraga Way encouraging evacuees to use Valley View Drive to Edgewood Fire Road towards SR-24 westbound. Dynamic signage can be temporary and deployed only during the time of evacuation.

5. Finally, this report recommends that any traffic-related interventions like contra-flow lanes should be supplemented with thorough public information dissemination to inform Orinda community members on what to expect when contra-flow lanes and other traffic policies are implemented during an emergency. Public information campaigns can include pages on the Orinda City website like the current web page with information on red flag parking day restrictions, short educational videos hosted on YouTube, and flyers containing relevant information and links hosted electronically on the City website and mailed as hard copies to residents, like the Orinda Fire Evacuation Guide and General Information flyer provided in the appendix of this report. Dynamic signage could also include messaging to reduce confusion when contra-flow lanes are implemented.

#### Recommendations to Reduce Overall Number of Vehicles Evacuating Citywide

1. Consider implementing a plan for coordinated car/van/or bus pool evacuation procedures for Miramonte Gardens and other larger multifamily housing developments, especially that are evacuating via Moraga Way in the northwest-bound direction towards SR-24 westbound on-ramps.
2. Coordinate with MOFD to develop fire safe standards as part of the Fire Code for new residential developments in constrained residential areas, such that sheltering in place is a viable alternative plan if evacuation routes become too congested to preclude timely evacuation during an emergency or if other circumstances prevent evacuation, as sheltering in place should only be considered if evacuation is not feasible. Housing Element Opportunity Sites in relatively constrained residential areas (based on their constraint index score) are shown in Figures 14, 15, and 16 and discussed in further detail in the subsection discussing. Design and building requirements related to fire safety are discussed in Chapter 14.4 of the Orinda General Plan EIR, which designates the J&J Ranch and Wilder residential developments as Shelter-in-Place locations based on these standards. Shelter in Place communities are defined in the EIR as ‘entire community or subdivision designed to withstand heat and flames from an approaching wildfire’.
3. Consider using Orinda Community Center as a potential emergency shelter location, which is also northwest of the SR-24 westbound on-ramps from Camino Pablo northwest-bound. If the west-bound on-ramps to SR-24 from Camino Pablo are severely congested, evacuees can alternatively continue straight and head to the Orinda Community Center.
4. Develop evacuation plan with BART to evacuate workers in the Downtown area. Include potential measures for deploying traffic control personnel in the Orinda BART station area and surrounding intersections to coordinate evacuee transfer to BART stations. Also consider coordinating with commercial property owners near Orinda BART to use parking lots for additional BART parking and disseminate public safety awareness campaigns that encourage Orinda residents to make an alternative plan to evacuate via BART.
5. Consider adopting a phased evacuation approach, using Zonehaven or other applicable tools, that prioritizes improving accessibility along Moraga Way in the northwest-bound direction particularly for residents living in southeast Orinda south of Hall Drive.



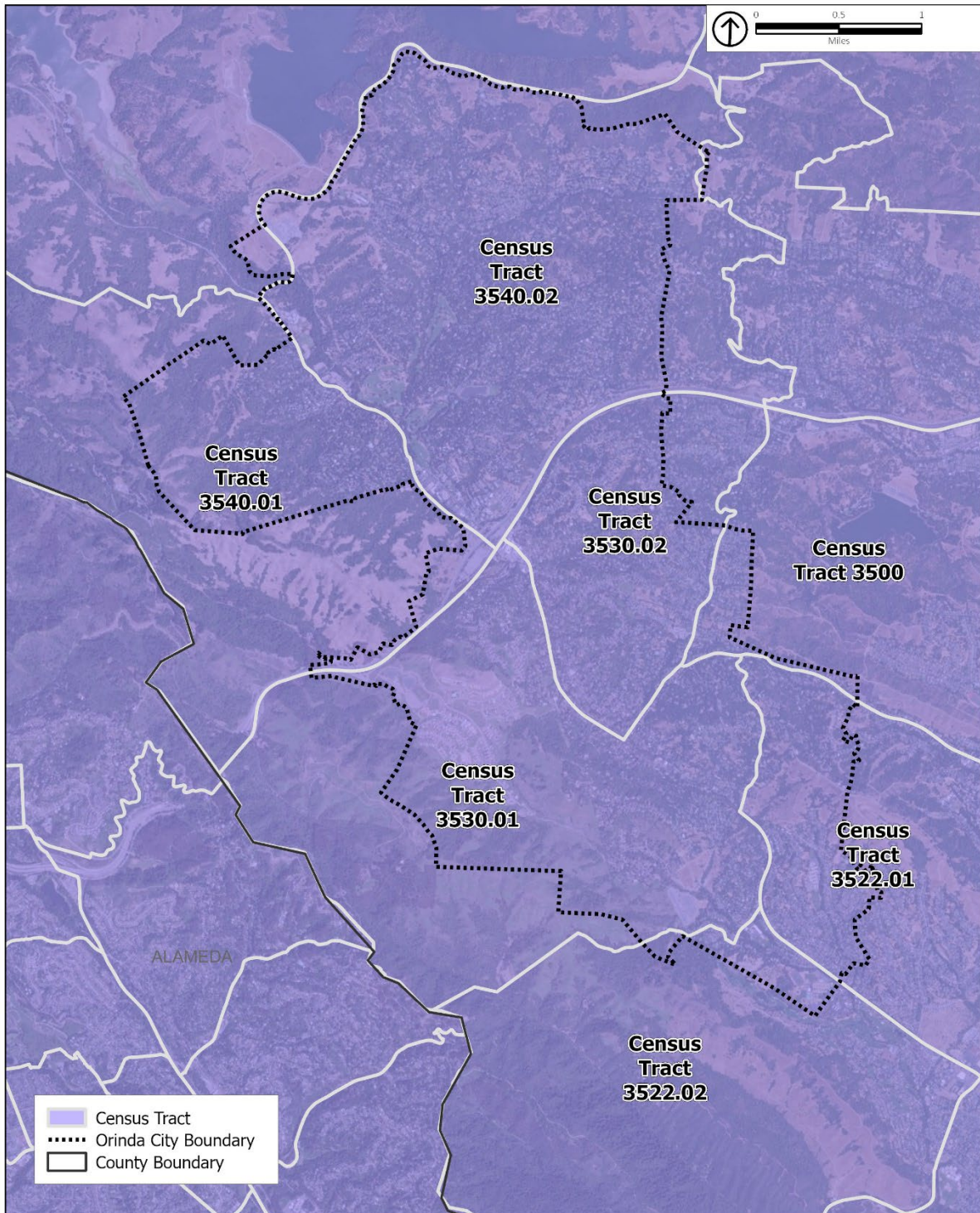
## 5 Demographic Analysis Results and Discussion

Even within an area of similar traffic constraints for evacuation, the constraints are not likely to be felt equally. Some community members are likely to need more time to evacuate, particularly given mobility challenges or difficulty getting information. The demographic analysis evaluates the following key demographic characteristics representing potential barriers to evacuation:

- Share of senior citizen (65 years of age or more) householders living alone
- Share of households with adults speaking limited English
- Share of households with limited access to phone and/or internet
- Share of low-income households
- Share of households with children under 6 years of age
- Share of households with limited access to vehicles
- Share of the population with a disability

For each census tract in Orinda shown in Figure 14, the analysis compares the census tract average for each indicator with the countywide average and assigns demographic constraint index points to residential parcels within census tracts that meet or exceed the countywide averages.

FIGURE 14: ORINDA CENSUS TRACTS



Source: City of Orinda, 2022; Contra Costa County, 2022; Esri, 2022; PlaceWorks 2022.

Census Tract 2450.02 in northeast Orinda encompasses the most area in Orinda of any other census tract. This tract includes all neighborhoods bounded by Camino Pablo to the west, SR-24 to the south, and Orinda City Limits to the north and east, including Charles Hill, Orinda Downs, Orinda View, and Sleepy Hollow. It also includes some areas in Lafayette. Census Tract 3540.01 primarily encompasses the El Toyonal neighborhood in northwest Orinda. Census Tract 3530.02 encompasses most of southwestern Orinda south of SR-24 and west of Moraga Way, and includes the Knickerbocker, Lost Valley, and Wilder Neighborhoods. Census Tract 3530.02 encompasses the area bounded by SR-24 to the north, Moraga Way to the southwest, and Glorietta Boulevard to the east. It includes the Northwood Tara and Silverwood neighborhoods. Census Tract 3522.01 encompasses a large sliver in Southeast Orinda and includes the Corliss and Donald neighborhoods but is otherwise mostly within Moraga. Census Tract 3522.02 encompasses only a small sliver of South Orinda that includes Miramonte Gardens, and otherwise is mostly within unincorporated Contra Costa County.

The project team compared these census tracts were to countywide averages for the demographic vulnerability characteristics of interest, listed below.

**Senior Householders (65+) Living Alone**

- 10.2 percent of households Countywide

**Limited-English Speaking Households**

- 14.5 percent of adults Countywide

**Limited Access to Lifelines (phone and/or internet)**

- 5.5 percent of households Countywide

**Low-Income Households (living below the Federal Poverty Line or FPL)**

- 8.2 percent of households Countywide

**Households with Children Under 6**

- 19 percent of households Countywide

**Households with Limited Access to a Vehicle**

- 5.3 percent of households Countywide

**Disabled Population**

- 11.2 percent Countywide (31 percent for population over 65 years of age)

The following summarizes findings related to each Orinda census track as it compares to the Countywide average for each characteristic.

**Census Tract 3522.01**

- Highest percentage of the population living below the federal poverty line (9.5 percent), which is greater than the Countywide average of 8.2 percent.



- Highest percentage of adults in limited English-speaking households at nearly 9 percent, which is less than the Countywide average.

**Census Tract 3522.02**

- Highest percentage of householders over 65 living alone (10.4 percent), which is just over the Countywide average.
- Highest percentage of disabled residents in Orinda (10 percent), which is less than the Countywide average.

**Census Tract 3540.01**

- No demographic factors exceed the Countywide average for this Census Tract.

**Census Tract 3540.02**

- Highest percentage of households with no internet access (5.6 percent) and no smartphone, tablet, or computer (5.3 percent), which is at or slightly above the Countywide average.
- Highest percentage of households with no vehicle in Orinda (5.7 percent), which is greater than the countywide average.
- Census Tract 3540.02 also includes Orinda's two senior residential communities: Orinda Senior Village and Monteverde Senior Apartments. These two locations are not included in census definitions of seniors living alone because they are both considered 'group quarters' and not households by the ACS, but recommendations below include

**Census Tract 3530.01**

- Highest percentage of households with children under 6 in Orinda (15 percent), which is less than the countywide average.

**Census Tract 3530.02**

- No demographic factors exceed the countywide average for this Census Tract.

Based on these results, households were assigned one demographic constraint index point if they were within Census Tracts 3522.01 or 3530.01, one index point if they were within Census Tract 3522.02, and two index points if they were within Census Tract 3540.02. Households were not assigned any points if they are located within Census Tract 3530.01, because although it contains the highest percentage of families with children under six, the percentage is still below the countywide average of 19%.

Census Tract 3540.02 also includes Orinda's two senior residential communities: Orinda Senior Village and Monteverde Senior Apartments. These two residential facilities are not counted in the population of seniors living alone because they are both considered to be group quarters rather than households by the ACS, but they are home to much of Orinda's senior population who may need extra time or specific assistance during an evacuation. Recommendations discussed in the section below include potential measures pertaining to these two communities.

## Recommendations for Evacuating Potentially Vulnerable Populations

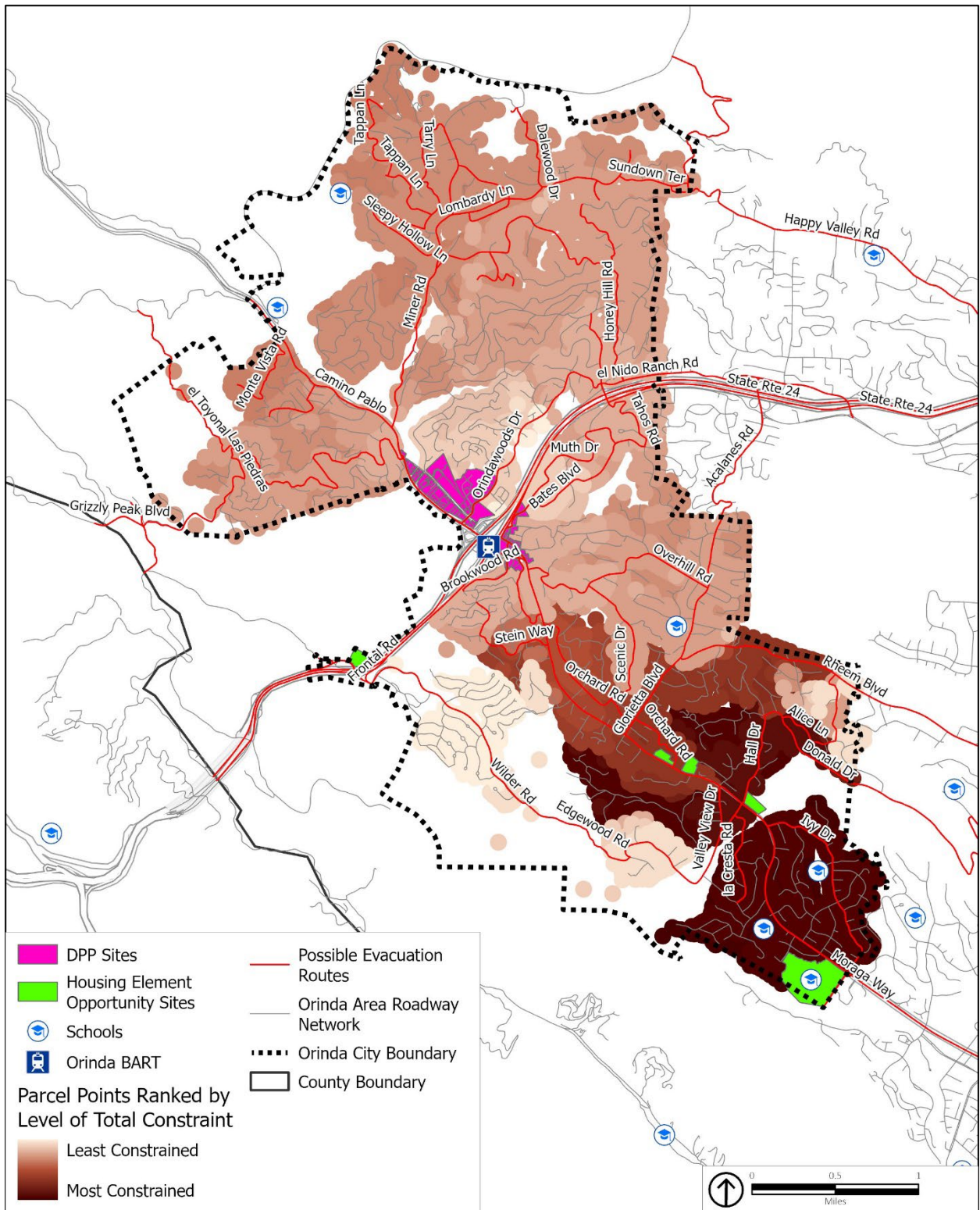
The following are recommendations for evacuating potentially vulnerable populations:

1. Prioritize in-person door knocking to disseminate evacuation notices/orders to residents within the tract where phone and/or internet access is at or lower than the county average.
2. Develop an early evacuation plan for Orinda Senior Village, Monteverde Senior Apartments, the future Countryhouse Memory Care facility at 1 Wilder Road, and any future assisted living facilities or senior living communities. Plans for these locations should include measures for deploying school buses, or paratransit vehicles, or maintaining designated van or bus fleets located on-site to evacuate multiple residents per vehicle.
3. Study the feasibility of designating Orinda Senior Village and Monteverde Senior Apartments as Shelter in Place locations as well as the nearby Orinda Community Center. If Orinda Senior Village and Monteverde are not feasible as shelter-in-place locations, but the nearby Orinda Community Center is, then direct residents of these two residential facilities to the Community Center in the event that early evacuation is not feasible, and develop a shelter plan for the Community Center that accommodates the needs of sheltering seniors, e.g., that includes measures for procuring and maintaining back-up generators which are capable of powering medical equipment continuously.
4. Implement Orinda General Plan Safety Element Policy S-10, to develop and implement an evacuation assistance program, in coordination with Contra Costa County Transportation Authority, Seniors Around Town, and paratransit and dial-a-ride agencies to help those with limited mobility or lack of access to a vehicle evacuate safely. Mailers with information about this program can be prioritized for residents in Census Tract 3540.02 (where the highest percentage of residents in Orinda are that do not have access to a vehicle and that do not have phone and/or internet service), and Census Tract 3522.02 in South Orinda.
5. Continue to coordinate and expand on existing efforts with schools to develop emergency operations protocols and early evacuation plans. School buses can be used if evacuation occurs during school hours, but evacuation plans should include coordination with Contra Costa County Transportation Authority and the Contra Costa County Office of Emergency Services to deploy buses and other high-capacity vehicles to evacuate children in schools during time periods when school buses are out picking up or dropping off students.

## 6 Cumulative Constraint Analysis Results and Discussion

Figures 15, 16, and 17 show cumulative constraint index scores for households as well as Housing Element (HE) Opportunity Sites and Downtown Precise Plan (DPP) sites.

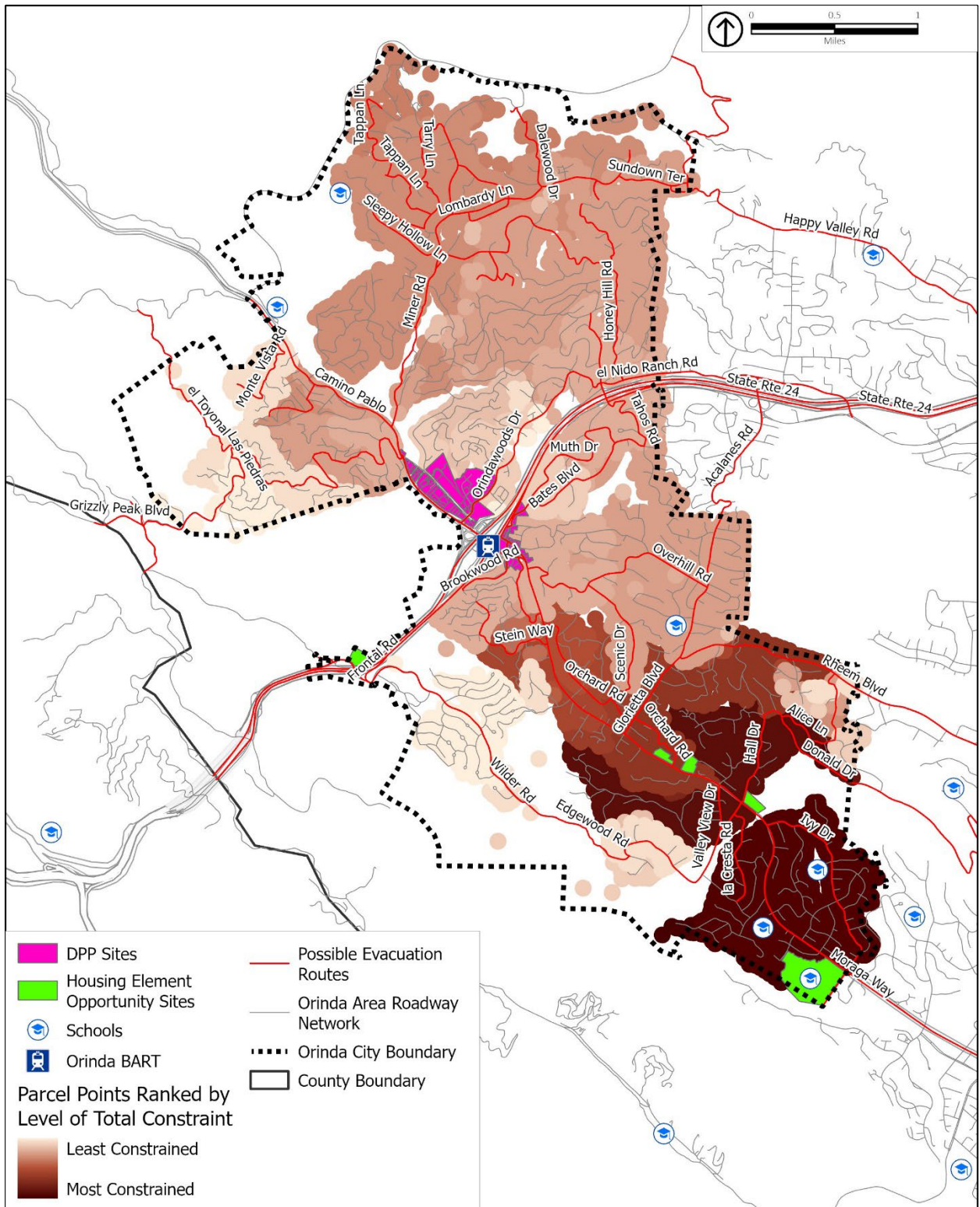
FIGURE 15: CONSTRAINED RESIDENTIAL AREAS—SCENARIO 1



Source: City of Orinda, 2022; Contra Costa County, 2022; Esri, 2022; PlaceWorks 2022.

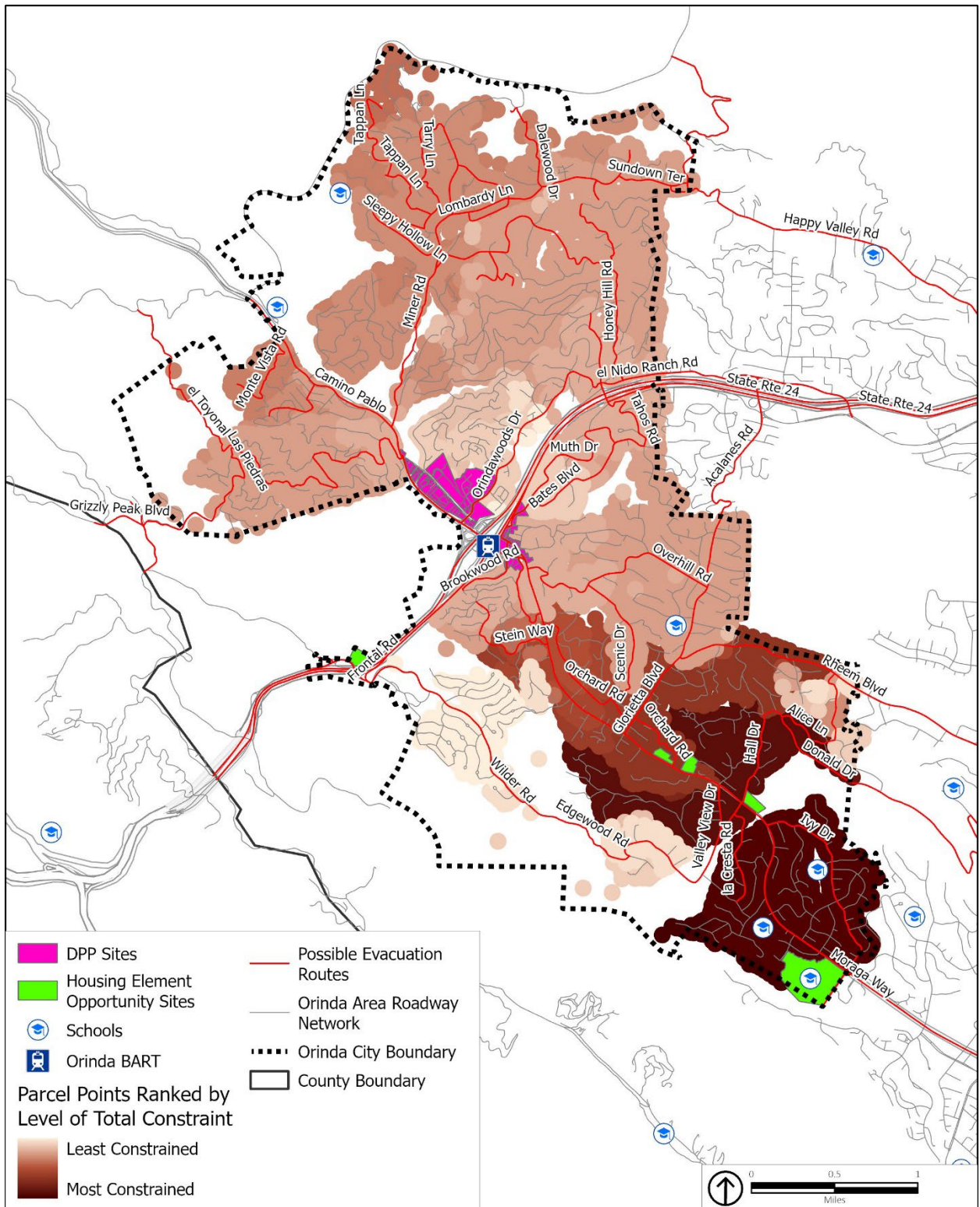


FIGURE 16: CONSTRAINED RESIDENTIAL AREAS—SCENARIO 2



Source: City of Orinda, 2022; Contra Costa County, 2022; Esri, 2022; PlaceWorks 2022.

FIGURE 17: CONSTRAINED RESIDENTIAL AREAS—SCENARIO 3



Source: City of Orinda, 2022; Contra Costa County, 2022; Esri, 2022; PlaceWorks 2022.



First, the parcel points ranked by level of constraint layer in figures 15, 16, and 17 show that the constrained areas differ only slightly under the three different scenarios. Residential areas close to San Pablo Dam Road and Grizzly Peak Boulevard are less constrained under Scenario 2 because these roadways can be used for evacuation (although their capacity is limited). Nearly all other households in Orinda maintain the same level of constraint across all three scenarios, consistent with the findings discussed in the constrained intersection analysis results section of this report. The finding that Moraga Way northwest-bound and Miner Road/Camino Pablo southbound towards SR-24 are likely to be congested regardless of the hazard area location emphasizes the importance of timed evacuation procedures.

Figures 15, 16, and 17 also show that the sites in the Downtown Precise Plan area as well as the Caltrans gateway site at Shakespeare Theater Way are relatively unconstrained due to their proximity to SR-24 on-ramps. The DPP sites combined constitute the highest capacity for new housing units in Orinda (644 units total at maximum), and the Caltrans gateway site has the highest maximum number of allowed housing units on any single Housing Element Opportunity Site (408 units at maximum). However, the Opportunity Site at Miramonte High School has the second highest maximum allowable units (234 units) and is the most constrained Housing Element Opportunity Site. The Opportunity Site at St. John Orthodox Church (501 Moraga Way) is also highly constrained. The Holy Shephard Lutheran Church and St. Mark's Church Housing Element Opportunity Sites are moderately constrained. Constrained Housing Element Opportunity Sites are all located along Moraga Way and would likely use this arterial to evacuate based on this analysis. These results underscore the potential benefit to allowing public access on the Brookside Road/Boeger Ranch Rd EVA (in the short term), and Edgewood/Wilder EVA (in the long term, if feasible) towards SR-24 from southern Orinda during an evacuation event as an alternative to Moraga Way. Secondly, while evacuees should only shelter in place when evacuation is not feasible, Orinda staff could additionally coordinate with MOFD to establish fire code standards for new developments on any constrained Housing Element Opportunity Site which enable them serve as shelter-in-place locations during a wildfire event only if evacuation becomes infeasible, similarly to the J&J Ranch and Wilder developments discussed in Chapter 4.14 of the Orinda General Plan EIR.

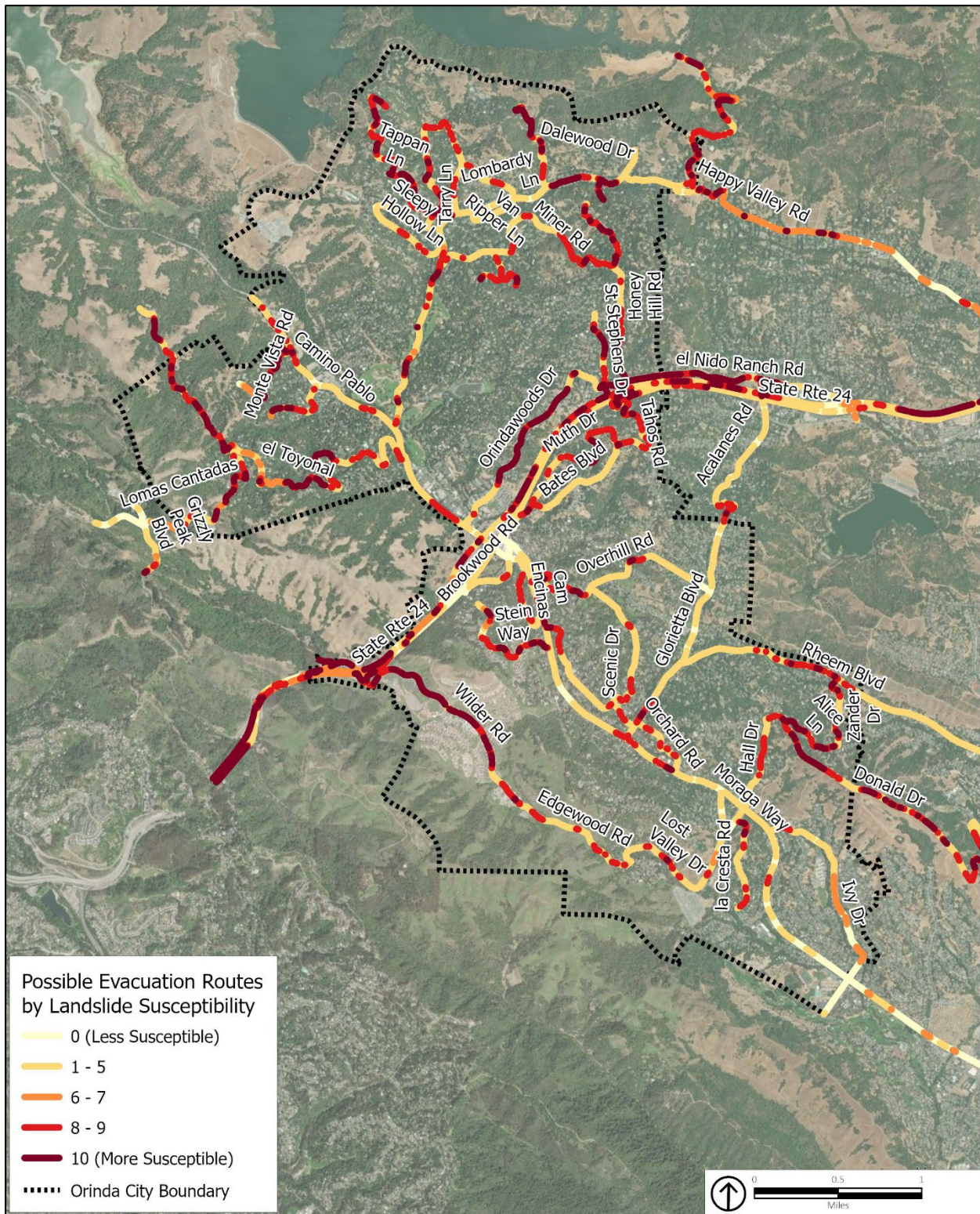
## 7 Landslide Evacuation Analysis Results and Discussion

Because of the typically more localized nature of landslides compared to wildfires, particularly in California, the possible evacuation 'network' for a landslide event is specific to the local area in which it occurs, such that recommendations for evacuation in one localized area or neighborhood are not necessarily relevant for other areas or neighborhoods.

For these reasons this methodology analyzes evacuation risk specifically along Orinda's network of possible evacuation routes in GIS and summarizes recommendations based on segments of the possible evacuation network that are at the highest risk of landslide. The results are shown in Figure 18 below.



FIGURE 18: LANDSLIDE SUSCEPTIBILITY ON POSSIBLE EVACUATION ROUTES



Source: City of Orinda, 2022; Contra Costa County, 2022; Esri, 2022; PlaceWorks 2022.

Results indicate that much of Orinda's primary evacuation route: SR-24, is in highly susceptible landslide areas, particularly in the following locations:

- Eastbound and westbound lanes in the Caldecott Tunnel,
- Westbound lanes northwest of the Orinda BART station,
- Large swaths of both eastbound and westbound lanes of the length between Camino Pablo and El Nido Ranch Road, but mostly in the westbound lanes,
- And the following On-Ramps:
  - Wilder Road/Gateway Boulevard eastbound and westbound on-ramps from all approaches
  - Eastbound and westbound lanes in the Caldecott Tunnel
  - On-ramps from Wilder Road, El Nido Ranch Road, and Charles Hill Road

Other segments of Orinda's possible evacuation network located in highly susceptible landslide areas are listed below:

**Possible Evacuation Network Segments Susceptible to Landslides South of SR-24**

- La Cresta Road southeast of the intersection with Woodland Road
- Donald Drive between Hall Drive and the Orinda city limit
- Alice Lane between Donald Drive and Zander Drive
- Zander Drive just north of the intersection with Alice Lane and between Zander Court and Rheem Boulevard
- Rheem Boulevard between Zander Drive and west of Calvin Drive
- Portions of Lost Valley Drive
- Glorietta Boulevard between Orchard Road and Virginia Drive
- Most of Wilder Road
- Most of Stein Way and Knickerbocker Lane
- Orchard Road between Moraga Way and Oakwood Road
- A portion of Overhill Road between Broadview Terrace and Tara Road
- Tahos Road between Bates Boulevard and north of St. Hill Road
- Muth Drive between Wanda Lane and Warford Terrace
- Portions of Bates Boulevard between Muth Drive and Davis Road
- Gateway Boulevard and Frontal Road on-ramps to SR-24 (westbound and eastbound, respectively)
- Hidden Valley Road between Tahos Road and the SR-24 eastbound on ramp west of Juniper Drive
- The intersection with El Nido Ranch Road, Muth Drive, and Orinda Woods Drive



**Possible Evacuation Network Segments Susceptible to Landslides North of SR-24**

- El Nido Ranch Road between St. Stephens Drive and the city limit
- East Altarinda Drive between Altarinda circle and St. Stephens Drive
- St Stephens Drive between Aqua Vista and SR-24 overpass to Tahos Road.
- Orinda Woods Drive between East Altarinda Drive and Wild Plum Way
- Happy Valley Road between Orinda View Road and Sundown Terrace
- Most of Dalewood Drive
- Dalewood Terrace
- Tarry Lane between Bear Ridge Road and Tappan Lane
- Most of Tappan Lane
- Valley View Lane
- Miner Road between Sycamore Road and Canyon View Drive, between Lombardy Lane and Camino Sobrante, and sections between Camino Lenada and Camino Don Miguel
- Claremont Avenue between Holly Lane and California Avenue
- Most of Monte Vista Ridge Road and Monte Vista Road
- El Toyonal between the city limit and Vis del Orinda, between La Encinal and Vallecito Lane, and between El Rincon and Loma Vista Drive

It should be noted that the Wilder Ranch neighborhood along Wilder Road is a newer development in Orinda and has a Development Plan from 2005 describing the developer's grading efforts to significantly reduce the landslide risk in the Wilder area and along Wilder Road. These are described in the Development Plan beginning on page 31. Other areas listed above may also have similar interventions, like retaining walls and grading, to reduce the landslide risk along those routes.

**Recommendations for Reducing Landslide Risk Along Possible Evacuation Routes**

Based on these results, this report recommends that Orinda consider maintaining an inventory (e.g., in excel, or GIS) of evacuation route segments susceptible to landslides, as well as corresponding information about site characteristics, any recommended infrastructure improvements collected through geotechnical studies, and potentially also maintenance and/or development status of existing and planned infrastructure improvements for landslide-susceptible evacuation route segments inventoried in the database.

In addition, this report recommends pursuing policies S-19 through S23 in the Orinda General Plan Safety Element, listed below:

**Policy S-20** A geotechnical investigation and report shall be required for all new development in landslide and liquefaction zones. Any other facility that could create a geologic hazard, such as a road on hillside terrain, must also conduct such an investigation. Evidence of probable geologic hazard shall require a geotechnical study by a registered soil engineer



or registered geologist that shall be reviewed by geotechnical consultants selected by the City.

- Policy S-21** Require new development in areas prone to geologic hazards (e.g., landslides, steep topography, slope instability), including the Orinda Geologic Hazard Abatement District, to be designed to adequately reduce these hazards, including minimizing the loss of native vegetation. Grading plans; environmental assessments; engineering and geologic technical reports; and irrigation and landscaping plans, including ecological restoration and revegetation plans, shall be required as appropriate to ensure the adequate demonstration of a project's ability to mitigate these potential impacts.
- Policy S-22** Require new development in hillside areas to prepare drainage plans to direct runoff and drainage away from potentially unstable slopes.
- Policy S-23** Encourage retrofits to existing buildings that improve resiliency to geologic and seismic hazards.



8 Appendix: Orinda Fire Evacuation Guide & General Information







# ORINDA FIRE EVACUATION Guide & General Information


For life threatening  
emergencies, call:


**911**

## Non-emergency numbers:

 Orinda Police  
(925) 254-6820

 Moraga-Orinda Fire District  
(925) 933-1313

 Contra Costa Animal Control  
(925)-608-8400

 Red Cross  
(415) 427-8000

## Register online:

[www.cwsalerts.com](http://www.cwsalerts.com)  
(Contra Costa County)

[www.nixle.com](http://www.nixle.com)  
(use zip code 94563)

[www.cityoforinda.org](http://www.cityoforinda.org)  
(use the Notify Me button)

[www.nextdoor.com](http://www.nextdoor.com)

## Know Your Zone!

Go online to [Community.Zonehaven.com](http://Community.Zonehaven.com) & search for your address.

## EVACUATING

- > **If you feel you are in danger**, don't wait for an evacuation order—leave immediately.
- > **If you need extra time**, evacuate at the time of an evacuation warning—don't wait for an evacuation order.

**Primary evacuation point:**  
**Highway 24, then leave the Lamorinda area.**

- > **When evacuations are ordered**, quickly depart the area with your Go-Bag.
- > **Take only one vehicle.**
- > **Make room for emergency personnel**, such as fire engines, ambulances, and law enforcement. Follow directions of Public Safety Officers, City Staff, or other Emergency Services Workers during the evacuation process.
- > **Residents should plan ahead for primary and contingency routes** to the freeway for use during an evacuation. Find your direct route from your portion of the neighborhood to the primary evacuation point, Highway 24.

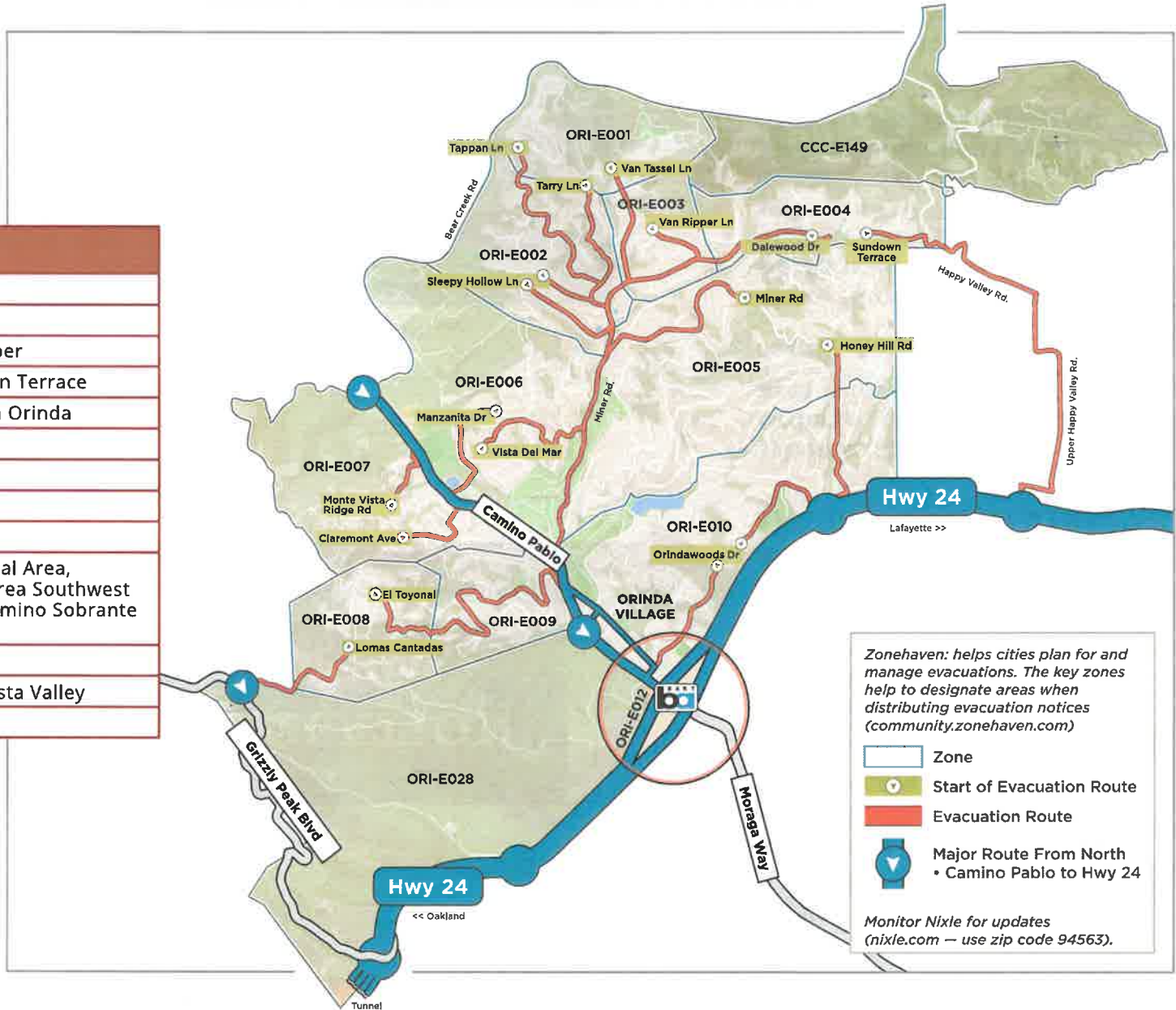


# KNOW YOUR ZONE!

Use the QR code (or go online to [Community.Zonehaven.com](http://Community.Zonehaven.com)) and enter your address to find your zone. Your zone shows status, evacuation information, and more.

## NORTH

Areas commonly known as:	
ORI-E001	Sand Hill/Sunnyside
ORI-E002	Sleepy Hollow
ORI-E003	Lombardy Lane/Van Ripper
ORI-E004	Dalewood Drive/Sundown Terrace
ORI-E005	Upper Miner Road/North Orinda
ORI-E006	Manzanita Dr
ORI-E007	Monte Vista
ORI-E008	Upper El Toyonal
ORI-E009	Lower El Toyonal
ORI-E010	Orinda Village Commercial Area, Orinda Woods and the area Southwest of Lake Cascade from Camino Sobrante to Charles Hill Rd
ORI-E012	Orinda BART Station
ORI-E028	De Laveaga Trail and Siesta Valley
CCC-E149	Orinda View



# SOUTH

## Areas commonly known as:

ORI-E011	North East Orinda, South of HWY 24 including Tahos Rd, Bates Blvd, Muth Dr to the Orinda Cross Roads Area.
ORI-E012	Orinda BART Station
ORI-E013	Overhill Rd and Tara Rd
ORI-E014	Brookwood Rd, and Stein Way area East of HWY 24
ORI-E015	Wilder Development
ORI-E016	Northern portion of Glorietta Blvd to Lafayette Reservoir Boundary
ORI-E017	Orchard Rd, Estates Dr, Scenic Dr
ORI-E018	Crestview Drive, Central Moraga Way
ORI-E019	Eastern Sibley Volcanic Regional Park
ORI-E020	Lost Valley
ORI-E021	West Donald Drive and Orchard Rd
ORI-E022	Western portion of Rheem Blvd to the Hall roundabout
ORI-E023	Donald Dr to Mulholland Ridge and Hall Dr
ORI-E024	Orinda Oaks Open Space and Mulholland Ridge
ORI-E025	Ivy Drive
ORI-E026	Miramonte High School
ORI-E027	La Cresta Rd and Don Gabriel Way



Monitor Nixle for updates  
([nixle.com](http://nixle.com) — use zip code 94563).



## GET CONTRA COSTA COUNTY ALERTS

Register online at: [www.CWSalerts.com](http://www.CWSalerts.com)

Safety tip: add CWS Alerts "925-655-0195" to your phone's "Do Not Disturb" bypass settings.



# BEING PREPARED

Be prepared to evacuate with a go bag based on weather and other advisories.

**Don't delay, leave immediately!**

## GETTING READY TO LEAVE

**Do not let these actions delay your departure.**

- Gather valuables and important documents in your vehicle.
- Close all shutters, windows, and curtains in your home. Remove flammables from around your house. Turn on exterior lights.
- Post your "EVACUATED" sign where first-responders can see it.

# IF YOU ARE TRAPPED...

## ...in your home:

- Stay indoors until fire passes.
- Close all exterior doors and windows; keep doors unlocked and lights on.
- Close heavy drapes but remove sheer curtains that could ignite from radiant heat.
- Move flammable items away from vents and windows.

## IF YOU FAIL TO EVACUATE IN A TIMELY MANNER:

- Heavy traffic may slow your evacuation or block roads.
- Smoke from the wildfire can obscure vision, cause accidents and block escape routes.
- Downed power lines can block roads and make escape on foot deadly.
- Firefighting equipment can block in vehicles behind the fire.
- High winds can cause fire-weakened trees to fall and block roads.
- First responders may not be available to assist you.

**Leave early to avoid these hazards. Don't make your evacuation part of the emergency.**

## ...in your car:

- Park away from vegetation.
- Roll up windows, don't run your AC.
- Cover self with blanket or jacket.
- If flames surround your car, remain inside until the fire passes.
- Don't drive if smoke obscures the roadway.

## EVACUATION ZONE FOR THIS ADDRESS:

(search address online at: [Community.Zonehaven.com](http://Community.Zonehaven.com))

   -   

## OUT-OF-AREA EMERGENCY CONTACT PERSON IS:

Name: \_\_\_\_\_

Relationship: \_\_\_\_\_

Phone 1: \_\_\_\_\_

Phone 2: \_\_\_\_\_

Email: \_\_\_\_\_

## WHEN WE HAVE TO EVACUATE, WE WILL MEET AT:

\_\_\_\_\_

\_\_\_\_\_



## After fire has passed:

- Make sure everyone is okay.
- Check roof and exterior of your home and extinguish all sparks and embers.
- Check attic and crawlspace for hidden embers.
- Check yard for burning wood piles, trees, and other materials.
- Leave the area when safe to do so.
- Check evacuation and re-entry status at [Community.Zonehaven.com](http://Community.Zonehaven.com)



**ORINDA**  
CALIFORNIA





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