



2040 General Plan

Public Health and Safety Element

Background Report



TOWN OF WINDSOR

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Adopted August 16, 2023

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Public Health and Safety - Background

Purpose, Scope, and Content

The Public Health and Safety Element is a state-mandated General Plan element that must identify potential natural and human-created hazards that could affect the Town of Windsor's (Town's) residents, businesses, and services. The purpose of the Public Health and Safety Element is to establish a framework that anticipates these hazards and prepares the community to mitigate exposure to these risks. This document provides additional detail about the issues discussed in the Public Health and Safety Element.

The Public Health and Safety Element conveys the Town's goals, policies, and actions to minimize public safety hazards in and around Windsor. It identifies the natural and human-caused hazards that affect existing and future development, describes present and expected future conditions, and sets policies and standards for improved public health and safety. The Public Health and Safety Element also seeks to minimize physical harm to the buildings and infrastructure in and around Windsor to reduce damage to local economic systems, community services, and ecosystems.

Some degree of risk is inevitable because the potential for many disasters cannot be completely eliminated and the ability to predict such disasters is limited. The goal of the Public Health and Safety Element is to reduce as much as possible the risk of injury, death, property loss, and other hardships.

The Public Health and Safety Element serves the following functions:

- Develops a framework by which safety considerations are introduced into the land use planning process.
- Facilitates the identification and mitigation of hazards for new development, and thus strengthens existing codes, project review, and permitting processes.
- Presents policies directed at identifying and reducing hazards in existing development.
- Strengthens earthquake, flood, inundation, and wildland fire preparedness planning and post-disaster reconstruction policies.
- Identifies how hazards are likely to increase in frequency and intensity in the future and provides policies to increase community resilience.

Safety is essential to the resiliency of any community. Windsor is susceptible to the effects of disasters, both natural and man-made, which can jeopardize the welfare of the Town and compromise the overall public health and safety of its citizens.

The Town is situated in the northern portion of the Santa Rosa Plain, which occupies a depression in the southern part of the Coastal Ranges, north of the San Francisco Bay. The Town is bounded on the east by the Mayacama Mountains, and on the west by the Russian River and is located between several major fault zones, including the San Andreas Fault west of Windsor, the Healdsburg-Rodgers Creek Fault Zone directly to the east, and the Mayacama Fault Zone to the

far east. Faults in the region are considered active and have the capability and history of producing major earthquakes, affecting Windsor directly with ground shaking and surface rupture.

Windsor is located within the Russian River Watershed, at the northern end of the Laguna de Santa Rosa sub-watershed (Laguna), the largest tributary of the Russian River. Windsor Creek and Pool Creek are the main streams that flow from the eastern foothills through the Town and into Mark West Creek, which is located at the northern end of the Laguna. The Laguna itself is the center of a significant floodplain that can pose a risk for flooding in Windsor during the rainy winter and spring months when severe weather commonly occurs.

In the last 50 years, the growing effects of climate change have increased the frequency of natural hazards, such as droughts, heat waves, and wildfires in and around Windsor. Human-caused hazards, such as a release of hazardous materials, also pose a threat to residents and property. Additionally, impacts from excessive noise can affect overall well-being. While these hazards are impossible to avoid, there are ways to educate, prepare, and mitigate the potential impacts to reduce the loss of property, injury, life, and other hardships.

Regulatory Framework

Under state law, all counties and incorporated communities in California must prepare a General Plan, which must address several topics, one of which is public health and safety. The Public Health and Safety Element addresses this topic in accordance with state requirements, which are laid out in California law, particularly Section 65302(g) of the California Government Code. State law requires that the Public Health and Safety Element address the following:

- Protect the community from risks associated with a variety of hazards, including seismic activity, landslides, flooding, and wildfire, as required by the California Government Code Section 65302(g)(1).
- Map and assess the risk associated with flood hazards, develop policies to minimize the flood risk to new development and essential public facilities, and establish effective working relationships among agencies with flood-protection responsibilities, as required by California Government Code Section 65302(g)(2).
- Map and assess the risk associated with wildfire hazards, develop policies to reduce the wildfire risk to new land uses and essential facilities, ensure there is adequate road and water infrastructure to respond to wildfire emergencies, and establish cooperative relationships between wildfire protection agencies, as required by California Government Code Section 65302(g)(3).
- Assess the risks associated with climate change on local assets, populations, and resources. Note existing and planned development in at-risk areas and identify agencies responsible for providing public health and safety and environmental protection. Develop goals, policies, and objectives to reduce the risks associated with climate change impacts, including locating new public facilities outside of at-risk areas, providing adequate infrastructure in at-risk areas, and supporting natural infrastructure for climate adaptation, as required by California Government Code Section 65302(g)(4).
- Identify residential developments in any hazard area identified that do not have at least two emergency evacuation routes, as required by California Government Code Section 65302(g)(5).

- On the next update to the Hazard Mitigation Plan, identify evacuation routes and assess the capacity, safety, and viability of those routes and associated emergency shelters under a range of emergency scenarios, as required by California Government Code Section 65302.15(a).

Relationship to Other Documents

The Windsor Public Health and Safety Element does not exist in a vacuum but is instead one of several plans that address public safety and related topics. The Public Health and Safety Element must be consistent with these other plans to minimize conflicts between documents and ensure that the Town has a unified strategy to address public safety issues. The Public Health and Safety Element incorporates information, technical analyses, and policies from these other documents where appropriate to help support this consistency.

Other General Plan Elements

The Public Health and Safety Element is one of several elements of the Windsor General Plan. Other social, economic, political, and aesthetic factors must be considered and balanced with safety needs. Rather than compete with the policies of related elements, the Public Health and Safety Element provides policy direction and designs safety improvements that complement the intent and policies of other General Plan elements. Crucial relationships exist between the Public Health and Safety Element and the other General Plan elements. How land uses are determined in areas prone to natural hazards, what regulations limit development in these areas, and how hazards are mitigated for existing development, are all among issues that tie the elements together. For instance, the Land Use and Community Design Element diagrams and policies must consider the potential for various hazards identified in the Public Health and Safety Element and must be consistent with the policies to address those hazards. The Environmental Resources Element is also closely tied to the Public Health and Safety Element. Floodplains, for example, are not only hazard areas, but often serve as sensitive habitat for threatened or endangered species or provide recreation or passive open space opportunities for residents and visitors. As such, flood and inundation policies must both address the need to protect public health and safety and the need to protect habitat and open space. Public Health and Safety Element policies, especially those concerning evacuation routes and critical facilities, must also be consistent with those of the Transportation and Mobility Element. Highway 101 is Windsor's primary evacuation route, supported by routes designated as major or primary arterials in the Town's circulation system. Policies and information in this Public Health and Safety Element should not conflict with those in other elements.

Sonoma County Multi-Jurisdictional Hazard Mitigation Plan

The Town of Windsor has assisted in the preparation of a Multi-Jurisdictional Hazard Mitigation Plan (MJHMP). The MJHMP is a plan to identify and profile hazard conditions, analyze risks to people and facilities, and develop mitigation measures to reduce or eliminate hazard risks in Sonoma County. The Town participated with other jurisdictions to prepare the MJHMP in accordance with the federal Disaster Mitigation Act of 2000 and the Federal Emergency Management Agency's (FEMA's) hazard mitigation plan guidance. The mitigation actions in the MJHMP include both short-term and long-term strategies, and involve planning, policy changes, programs, projects, and other activities. The MJHMP and Public Health and Safety Element address similar issues, but the Public Health and Safety Element provides a higher-level framework and set of policies, while the MJHMP focuses on more specific mitigation, often short-term, actions. The MJHMP, as its name implies, focuses on mitigation-related actions, while the Public Health and Safety Element also includes policies related to emergency response, recovery, and preparation activities. The Town's Public Health and Safety Element of the General Plan incorporates by reference the MJHMP, approved by FEMA in December 2021, ensuring a coordinated approach to

public safety and qualifying the Town for additional funding opportunities (consistent with California Government Code Section 65302.6). Additional funding opportunities include being eligible for more disaster relief funding under the California Disaster Assistance Act. Financial assistance is provided from the State of California for costs incurred by local governments as a result of a disaster event. The California Disaster Assistance Act authorizes the California Governor's Office of Emergency Services to administer a program that provides for the reimbursement of local government costs associated with certain emergency activities undertaken in response to a state of emergency proclaimed by the Governor. An active MJHMP may also make the Town eligible for state or federal grant programs or make the Town more competitive in grant applications.

Climate Change Vulnerability

Changes to the global climate system are expected to affect future occurrences of natural hazards in and around Windsor. Many hazards are projected to become more frequent and more intense in coming years and decades, and in some cases, these trends have already begun. According to California's Fourth Climate Change Assessment[1] and the Town's Climate Resilience Plan,[2] Windsor can expect to experience various changes related to climate-related hazard events.

- Both droughts and floods are expected to become more frequent as precipitation is expected to occur in fewer, more intense storms due to climate change.
- Warmer temperatures are projected to cause an increase in extreme heat events, with extreme heat events rising from an average of four annually to as high as 23 annually.
- Climate change can increase the rates of infection for various diseases because many of the animals that carry diseases are more active during warmer weather. There are a number of diseases that are linked to climate change and can be harmful to the health of Windsor community members, such as hantavirus pulmonary syndrome, Lyme disease, and West Nile fever. Many of these diseases are carried by animals, such as mice and rats, ticks, and mosquitos, which are usually seen as pests even if they do not cause infections. Warmer temperatures earlier in the spring and later in the winter can cause these animals to be active for longer periods, increasing the time that these diseases can be transmitted.
- Hotter, drier weather because of climate change is expected to lead to an increase in wildfires in the surrounding area and across Sonoma County. Climate change is expected to cause an extended wildfire season, with dry conditions earlier in the year, leaving most of the region in moderate to extreme drought conditions prior to summer. These continued dry conditions with above-normal temperatures through fall will leave fuel moisture levels lower than normal, increasing the potential for wildfire activity. Increased winds may result in more erratic fire behavior, making fires harder to control and increasing the likelihood that wildfires will travel into Windsor. Ember casting, which occurs when winds distribute embers far away from the main fire that can potentially spark new fires, exacerbates this risk. Furthermore, an extended wildfire season increases the likelihood that Diablo wind events coincide with wildfires, which can allow wildfires to spread more rapidly. Across the region, more frequent and intense wildfires may also create poor air quality for Windsor.

[1] Bedsworth, Louise, Dan Cayan, Guido Franco, Leah Fisher, Sonya Ziaja. (California Governor's Office of Planning and Research, Scripps Institution of Oceanography, California Energy Commission, California Public Utilities Commission). 2018. *Statewide Summary Report. California's Fourth Climate Change Assessment.* Publication number: SUMCCCA4-2018-013.

[2] Available at https://windsorready.com/summary.

Overall, Windsor residents, homes, and critical facilities are highly vulnerable to wildfires.

- Severe weather events, such as strong storms and high winds, may become more frequent and intense due to climate change. Climate change is expected to cause an increase in intense rainfall, which is usually associated with strong storm systems. Heavy rainfall may also contribute to an increased risk of landslides in the hills around Windsor. Most severe weather events in Windsor consists of atmospheric rivers or high winds. Although connection between climate change and severe weather is not as well established as other hazards, severe winds such as the Diablo winds, which tend to be most frequent during the fall and winter months, may coincide more frequently with wildfire conditions. This can cause fires to grow and spread more rapidly as well as Public Safety Power Shutoffs to occur to prevent wildfires from sparking.

Vulnerability Assessment Results

Under California law, the Public Health and Safety Element is required to include a vulnerability assessment that looks at how people, buildings, infrastructure,, community services, and other key community assets may be affected by climate change. The Town prepared a Community Vulnerability Assessment (CVA) in 2021 as part of the Climate Resilience Plan[2]. The CVA identifies four primary hazards in Windsor: extreme heat, wildfire, drought, and flooding. The CVA also identified increased wildfire smoke, impacts to water quality, and changes to landslide risks as secondary impacts of these hazards.

The CVA analyzed the vulnerability of people, buildings, infrastructure, natural systems, and economic drivers in Windsor based on their sensitivity to the projected changes and their adaptive capacity (ability to respond to changes). Vulnerability is graded on a four-point scale from Low to Extreme. Low sensitivity and high adaptive capacity results in low vulnerability, while high sensitivity and low adaptive capacity translates to extreme vulnerability. This section summarizes key findings from the CVA.

Populations

In general, populations are scored at medium vulnerability, although communities of concern (including persons with disabilities, older adults, linguistically isolated persons, and lower-income households) are scored as high vulnerability. Wildfire is of particular concern, given the sensitivity that some populations have to wildfire smoke and limited evacuation routes out of the Town. Extreme heat is also an issue of substantial concern to some groups, including senior citizens, who face health impacts from very high temperatures.

Homes and Critical Facilities

Homes and critical facilities (schools, hospitals, fire stations, etc.) are scored as being highly vulnerable. Homes may be located in areas with higher exposure to hazards, while critical facilities are susceptible due to their importance to the community and potential lack of feasible alternative properties.

Infrastructure Systems

Infrastructure systems are scored as having medium vulnerability. They are susceptible to damage from wildfires, flooding, and landslides. Additionally, extreme heat can cause stress and damage to electricity networks. Although many infrastructure networks in the Town are redundant, chokepoints and other bottlenecks create vulnerable points in the system. It is also difficult, expensive, and time-consuming to relocate infrastructure networks to less vulnerable locations.

Damage to infrastructure systems can create indirect negative effects throughout the Town, including affecting public health and safety and economic activity.

Natural Systems

Natural systems are scored as having medium vulnerability. While they are adapted to some natural conditions in the area, such as regular wildfire and drought events, changes to the frequency and intensity of natural hazards may exceed their tolerance of these events. Changing climate conditions and natural disasters can also increase the risk of invasive species, which may outcompete natural systems.

Local Economy

Windsor's economy is scored as having medium vulnerability. Tourism, agriculture, and viticulture are all susceptible to disruption from natural disasters, including secondary impacts such as wildfire smoke or loss of power. Long-term changes in natural hazards may cause visitors to be more concerned about visiting the Town. Many businesses may have a medium or high adaptive capacity, which can help improve resilience, but long-term economic stresses may remain.

For more details about the findings from the CVA, consult the full document, available as part of the Windsor Resilience Plan.

The 2021 Sonoma County MJHMP also includes a limited discussion of climate change vulnerability. This section of the MJHMP mentions three specific vulnerabilities that are unique to the town of Windsor: (1) localized flooding, (2) spread of wildfire along riparian corridors, (3) narrow bridges that could impede emergency access and evacuation during hazard events, and (4) neighborhoods with only one point of access.

Localized Flooding

During rain and storm events, localized flooding occurs in several areas throughout Windsor, including Pool Creek at Windsor Road, Dawn Way near the intersection with Old Redwood Highway, and the intersections of Arata Lane/Highway 101, Shiloh Road/Caletti Avenue, and Shiloh Road/Highway 101 southbound on-ramp.

Wildfire Spread Along Riparian Corridors

Based on recent fires in the Town, riparian corridors have been identified as areas that can provide a pathway for the spread of wildfire through Windsor, especially if regular fuel management is not occurring in these areas. Most of the creeks in Windsor are bordered by residential development on both sides, placing people and homes at risk.

Narrow Bridges

Narrow, two-lane bridges are in several areas throughout Windsor, including Caletti Lane, Hembree Lane, Conde Lane, Windsor Road at Pool Creek, and Old Redwood Highway between Billington Lane and Deanna Place. The bridge on Caletti Avenue is a wooden bridge that serves as the access point for Windsor's industrial area. Hembree Lane and Old Redwood Highway are primary crosstown streets that provide access to Highway 101. Impeded access in these areas would limit emergency access and evacuation. Conde Lane is also a crosstown street that provides access to Highway 101 via Shiloh Road.

Single Point-of-Access Areas

Much of Windsor was developed when it was standard practice to develop neighborhoods with a curvilinear street design with cul-de-sacs, rather than on a grid system that provides multiple points of access and better connectivity. For some areas, because of the number of homes served by a

single point of access, this could impede emergency access to these locations and evacuation if the access is blocked.

The Public Health and Safety Element includes goals, policies, and implementation programs to increase community resilience and help minimize impacts from these hazards.

Emergency Response and Preparedness

Windsor's Emergency Management Organization (EMO) leads emergency relief efforts during a major emergency or disaster. The Town of Windsor/Operational Area Emergency Operations Plan (EOP) addresses the planned response to extraordinary emergency situations associated with large-scale disasters, including,but not limited to, major earthquakes, wildland fires, and flooding affecting the Town of Windsor Operational Area.

The Town uses multiple notification and warning systems to ensure that emergency alerts are delivered to the community. The Town of Windsor uses SoCoAlert, a phone system issued by the County of Sonoma, to notify residents who are affected, threatened, or might be endangered by an emergency event or a disaster. SoCoAlert notifications issued by the County of Sonoma are powered by CodeRED. The Town uses the Wireless Emergency Alert (WEA) System, a public safety system that allows customers who own compatible mobile devices to receive geographically targeted, text-like messages alerting them of imminent threats to safety in their area. The Town also uses Nixle, a community information service managed by Sonoma County Fire District and Sonoma County Sheriff's Office to send email and/or text message notifications related to public safety.

Other systems include the Emergency Alert Systems (EAS) and the Emergency Digital Information System (EDIS). The EAS is a national public warning system commonly used by state and local authorities to deliver important emergency information, such as weather and AMBER alerts, to affected communities. EAS participants – radio and television broadcasters, cable systems, satellite radio and television providers, and wireline video providers. FEMA, the Federal Communications System, and the National Oceanic and Atmospheric Administration's (NOAA's) National Weather Service work collaboratively to maintain the EAS and Wireless Emergency Alerts, which are the two main components of the national public warning system and enable authorities at all levels of government to send urgent emergency information to the public. The EDIS is a wireless emergency and disaster information service operated by the State of California Governor's Office of Emergency Services and is an enhancement to the EAS. These systems are available in multiple languages. Local cellular towers can support many emergency communications and alert systems, but they may be vulnerable to damage or being overwhelmed during emergency events.

With advanced warning, evacuation can be effective in reducing injury and loss of life during a catastrophic event. Figure PHS-1 shows residential parcels with evacuation constraints. All parcels with an evacuation constraint are in at least one hazard-prone area and may have only one emergency evacuation route. The lack of multiple emergency access points limits roadway access for these properties, which may create difficulties if there is a need to evacuate. Figure PHS-2 shows the evacuation routes throughout the Town.

Primary emergency access and evacuation routes include Highway 101, which intersects the Town from northwest to southeast. The highway provides north-south access to other communities in Sonoma County and beyond. The primary surface street in Windsor that can serve as an evacuation route is Old Redwood Highway, which runs roughly parallel to Highway 101 between the northwest and the southeast parts of Windsor. Other potential evacuation routes include Windsor River Road, Starr Road, Hembree Lane, Conde Lane, and Shiloh Road, although these routes may be better suited to small-scale evacuations rather than situations that require a community-wide evacuation.

In preparation for wildfires and other disasters, the Town has an established evacuation zone map with standardized evacuation zones. The Town has four primary evacuation zones (i.e., WI-A, WI-B, WI-C, and WI-D), with several subzones among each respective primary zone. Figure PHS-2 shows the Town's evacuation zones. The Town's website has an interactive evacuation map lookup tool that allows residents to find possible evacuation routes based on their address and respective zone.

Figure PHS-2 shows the potential evacuation routes through the Town, which includes Highway 101 and key surface streets, such as the Old Redwood Highway. All evacuation routes in Windsor face a potential disruption from a flooding, wildfire, earthquake or other hazard event, which may block roadways, damage the roadway surface, or collapse bridges and overpasses. In the event of widespread disruption to local evacuation routes, remaining evacuation routes may become congested, slowing down evacuation of the community or specific neighborhoods. This issue may be compounded since the primary evacuation route (i.e., Highway 101) for Windsor will also likely serve as an evacuation route for surrounding communities, and so potential disruptions may have regional effects.

Disaster Preparedness

The County of Sonoma is required under state law to prepare and maintain a Standardized Emergency Management System (SEMS) Multi-hazard Functional Plan. The California Governor's Office of Emergency Services has extensive guidelines outlining the requirements of the Sonoma County SEMS. The Department of Emergency Management is the lead agency for the Sonoma County Operational Area. The Sonoma County Operational Area consists of nine incorporated communities, including the Town of Windsor, Sonoma State University, the Sonoma County Junior College District, and other special districts within the county's geographical boundary. Under the State of California's SEMS, the Operational Area is the primary level of coordination for response and recovery activities following an emergency or disaster. The Department of Emergency Management provides the umbrella under which all response agencies may function in an integrated fashion.

Automatic Aid/Mutual-Aid Agreements

The California Master Mutual-Aid Agreement has been adopted by the State's SEMS and is designed to ensure that adequate resources, facilities, and other support are provided to jurisdictions whenever their own resources are insufficient to cope with the needs of a given emergency. The Town of Windsor participates in the California Master Mutual-Aid Agreement. The California Office of Emergency Services Coastal Region (Mutual Aid Region II) serves the mutual aid region that encompasses Sonoma County. The Sonoma County Fire District also has automatic-aid agreements with CAL FIRE.

FIGURE PHS-1: RESIDENTIAL PARCELS WITH EVACUATION CONSTRAINTS

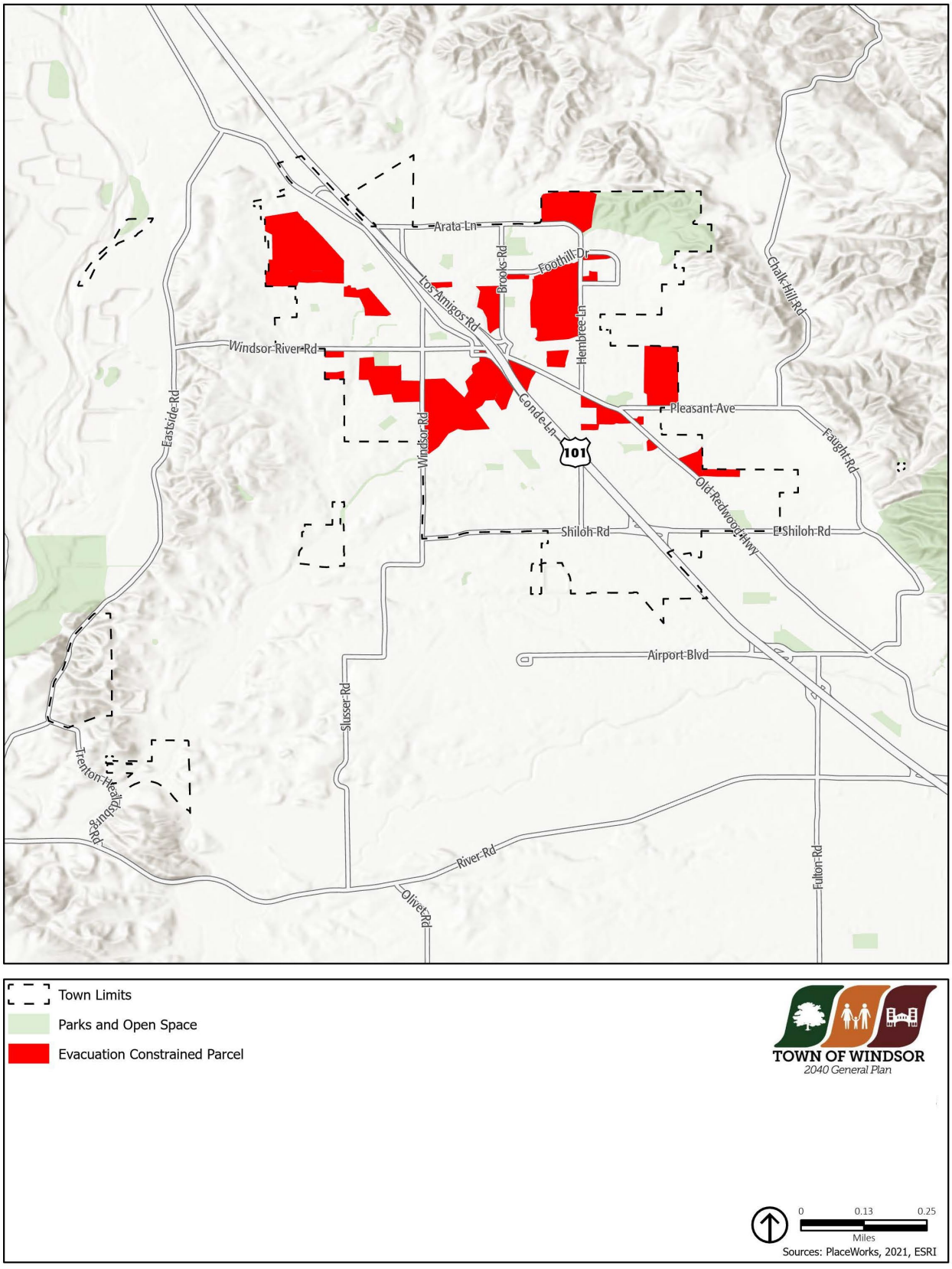


FIGURE PHS-2: EVACUATION ZONES

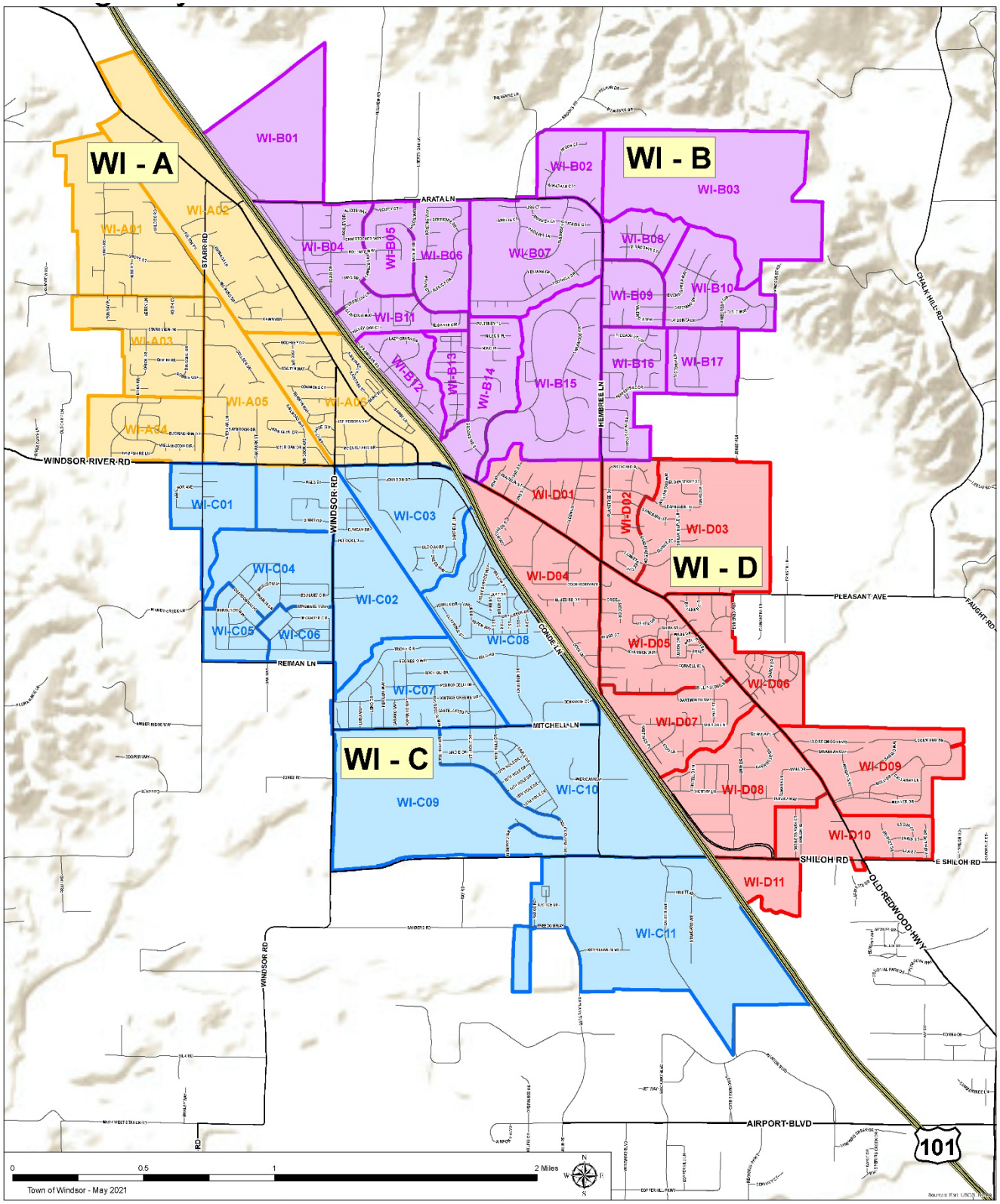
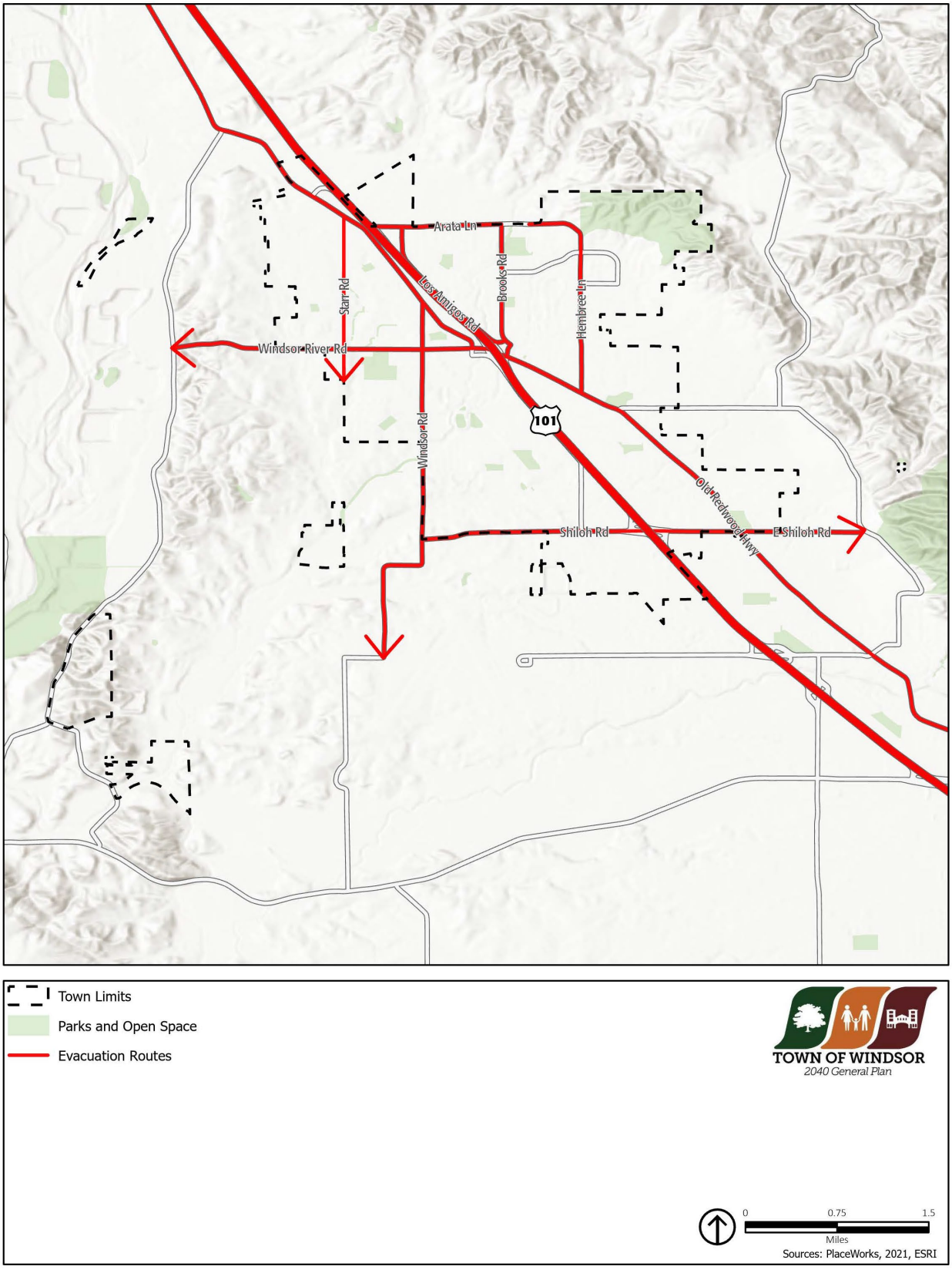


FIGURE PHS-3: EVACUATION ROUTES



Seismic and Geologic Hazards

Seismic and geologic hazards are risks caused by the movement of different parts of the Earth's crust, or surface. Seismic hazards include earthquakes and hazardous events caused by them. Geologic hazards are other hazards involving land movements that are not directly linked to seismic activity and are capable of inflicting harm to people or property. The ability to minimize risks associated with seismic and geologic hazards is essential to preserving life and property. Earthquakes occur along fault lines and in zones that are buried beneath the surface. Windsor is in a very seismically active region, where faults have the capability of producing strong ground shakingfrom a major earthquake, potentially causing significant damage. Because of Windsor's location and geologic setting, the town is subject to a variety of seismic and geologic hazards, including surface rupture, ground shaking, and liquefaction.

Seismic Hazards

Seismic activity occurs along boundaries in the Earth's crust, called faults. Pressure along the faults build over time and is ultimately released, resulting in ground shaking that we refer to as an earthquake. Earthquakes can also trigger other hazards, including surface rupture (cracks in the ground surface), liquefaction (causing loose soil to lose its strength), landslides, and subsidence (sinking of the ground surface). Earthquakes and other seismic hazards often damage or destroy property and public infrastructure, including utility lines, and falling objects or structures pose a risk of injury or death.

While Windsor is at risk from many natural and human-caused hazards, the event with the greatest potential for loss of life or property and economic damage is an earthquake. This is true for most of the Bay Area, since damaging earthquakes affect widespread areas and often trigger many secondary effects that can overwhelm the ability of local jurisdictions to respond. These secondary effects may include landslides, urban fires, dam failures, and toxic chemical releases.

Surface rupture only affects areas immediately adjacent to the fault, so only faults that run through Windsor are at risk of causing a surface rupture hazard. Surface rupture (or ground rupture) is the visible offset of the ground surface when an earthquake rupture along a fault affects the Earth's surface. The one fault in the Town is the Rodgers Creek-Healdsburg Fault, which extends from the northern edge of the San Pablo Bay northwest to Cloverdale, passing through northeastern Windsor in the process. The fault is likely an extension of the Hayward Fault, which runs along the eastern shore of the San Francisco Bay. Earthquake risk is very high in Sonoma County, including the Town of Windsor, due to the presence of several active faults in the region. Several major faults in the area, listed in Table PHS-1, could cause earthquake events. Figures PHS-4 and PHS-5 show the seismic shaking potential in the region and locally around Windsor.

TABLE PHS-1: MAJOR FAULTS NEAR WINDSOR	
Fault Name	**Approximate Distance from Windsor**
Rodgers Creek-Healdsburg	0 miles
Mayacama	7 miles
Bennett Valley	10 miles
West Napa	18 miles
San Andreas	19 miles
Hunting Creek-Berryessa	25 miles
Hunting Creek-Bartlett Springs	26 miles
Hayward	31 miles
Contra Costa	41 miles
Franklin	41 miles
Great Valley	41 miles
San Gregorio	43 miles

A major earthquake along any of these faults could result in substantial casualties and damage resulting from collapsed buildings, damaged roads and bridges, fires, flooding, and other threats to life and property. Most of the loss of life and injuries from earthquakes are from damage and collapse of buildings and structures. Building codes for new construction have generally been made more stringent following damaging earthquakes. However, in Windsor, structures built prior to the enactment of these improved building codes have generally not been upgraded to current standards and are vulnerable in earthquakes.

Manufactured housing, particularly older manufactured housing, can be very susceptible to damage because the foundation systems are not often braced for earthquake motions given that most are installed on a pier-and-post system. However, some manufactured housing is braced that keeps the home from shifting off the pier-and-post foundation. In the event of an earthquake, a structure will be simultaneously subjected to vertical and horizontal accelerations. The weight of a manufactured home on its foundation is not sufficient to resist a moderate or severe earthquake. For a manufactured home installed on a foundation system, providing adequate resistance to lateral movement, uplift, and rotation is very important. It is also necessary to provide tensile connections between the main frame and the piers supporting the home to resist all seismic forces. Earthquake-resistant bracing systems (ERBSs) can be installed to minimize damage to the home, but they do not provide the protection of a seismic-resistant foundation system. ERBSs are secondary supports that do not resist seismic forces, but rather allow the home to fall from its primary supports and "catch" it before it hits the ground.

There has been no surface fault rupture on the Rodgers Creek-Healdsburg Fault in recorded history, since 1824 and likely since 1776. Scientists have determined that the last major earthquake on the fault likely occurred between 1715 and 1776, potentially as early as 1690. Evidence suggests that this event likely resulted in surface rupture, and the slip size from this event is estimated at approximately 7 feet or more. However, the specific fault rupture amount in modern-day Windsor itself from this event is not known.

Portions of the Town are susceptible to liquefaction, which is a potentially destructive secondary effect of strong seismic shaking. Liquefaction occurs primarily in saturated, loose, fine- to medium-grained soils in areas where the groundwater table is within approximately 50 feet of the surface. Shaking causes the soils to lose strength and behave as liquid. Excess water pressure is vented

upward through fissures and soil cracks and can result in a water-soil slurry flowing onto the ground surface. This subsurface process can lead to near-surface or surface ground failure that can result in property damage and structural failure. The closer to the surface the groundwater table is, the greater the liquefaction risk. Liquefaction-related effects include loss of bearing strength, ground oscillations, lateral spreading, and flow failures or slumping. Site-specific geotechnical studies are the only practical and reliable way of determining the specific liquefaction potential of a site; however, a determination of general risk potential can be provided based on soil type and depth of groundwater.

The high and very high liquefaction risk zones in Windsor are along the beds of Windsor Creek, Pool Creek, and Pruitt Creek. Much larger sections of the Town are in medium liquefaction zones, including the north and east parts of Windsor and a broader area along Windsor Creek.

Figures PHS-6 and PHS-7 show the faults and liquefaction zones in the region and locally around Windsor.

FIGURE PHS-4: REGIONAL SEISMIC SHAKING POTENTIAL

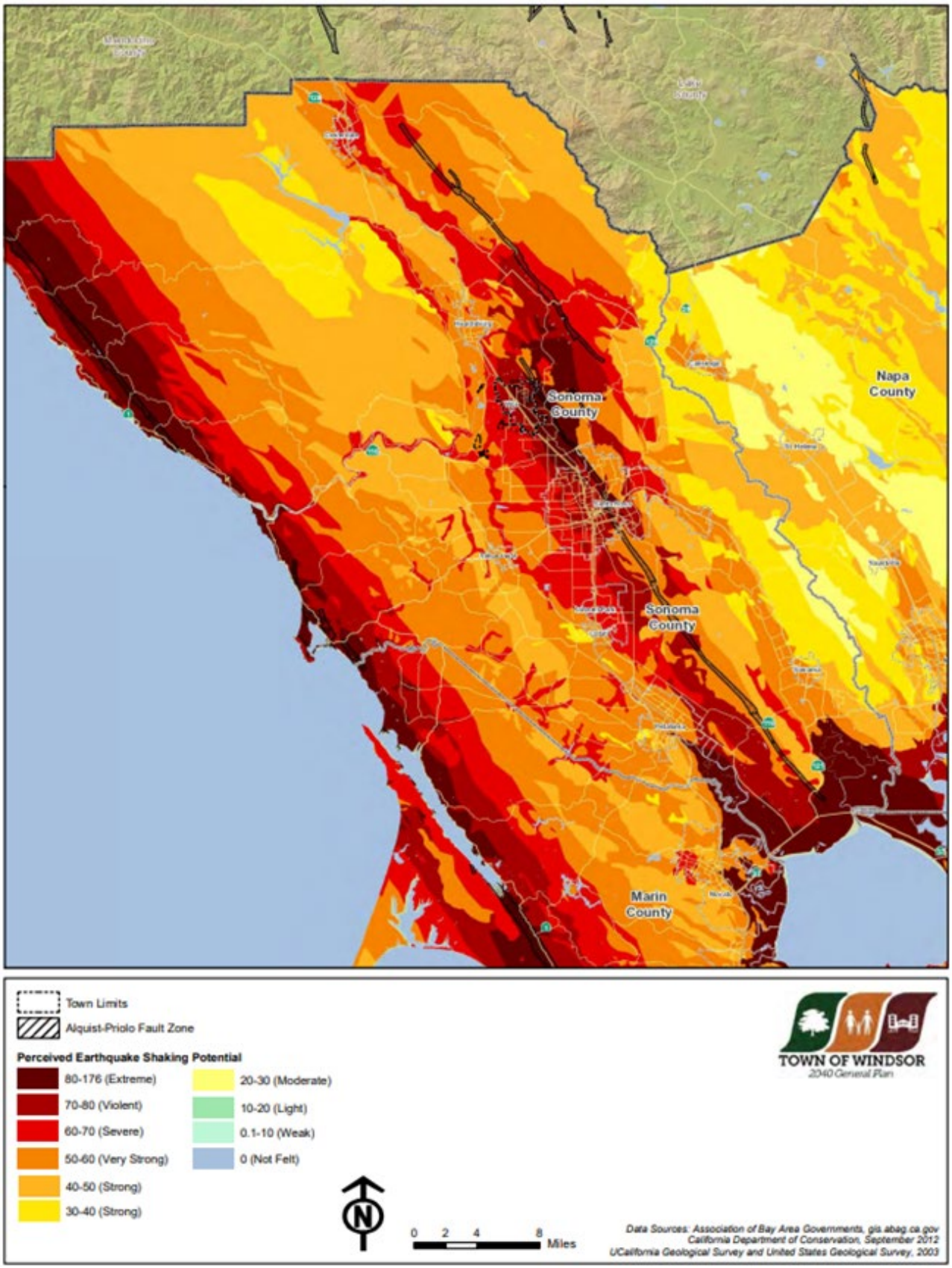


FIGURE PHS-5: LOCAL SEISMIC SHAKING POTENTIAL

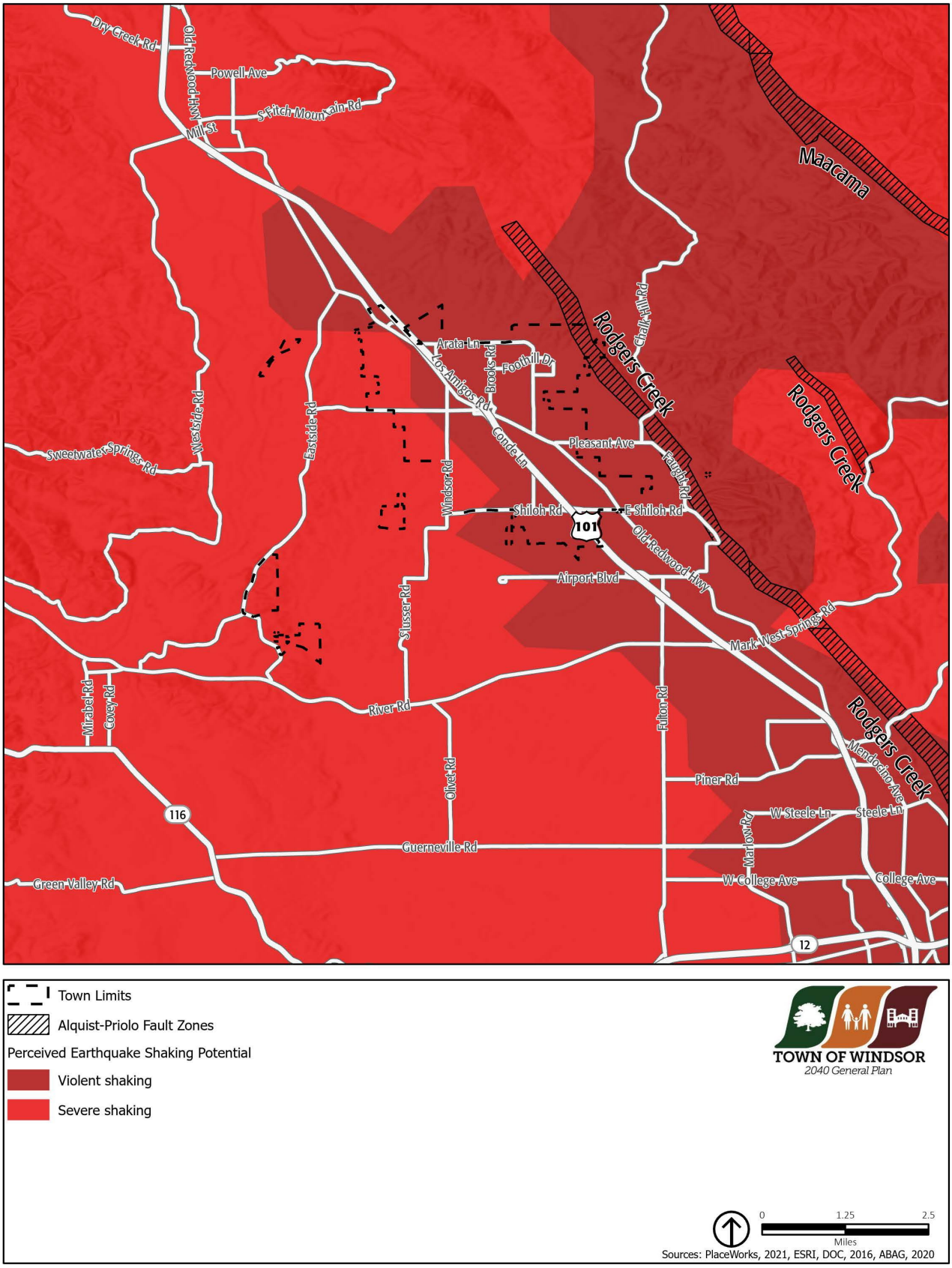


FIGURE PHS-6: REGIONAL FAULT LINES AND LIQUEFACTION ZONES

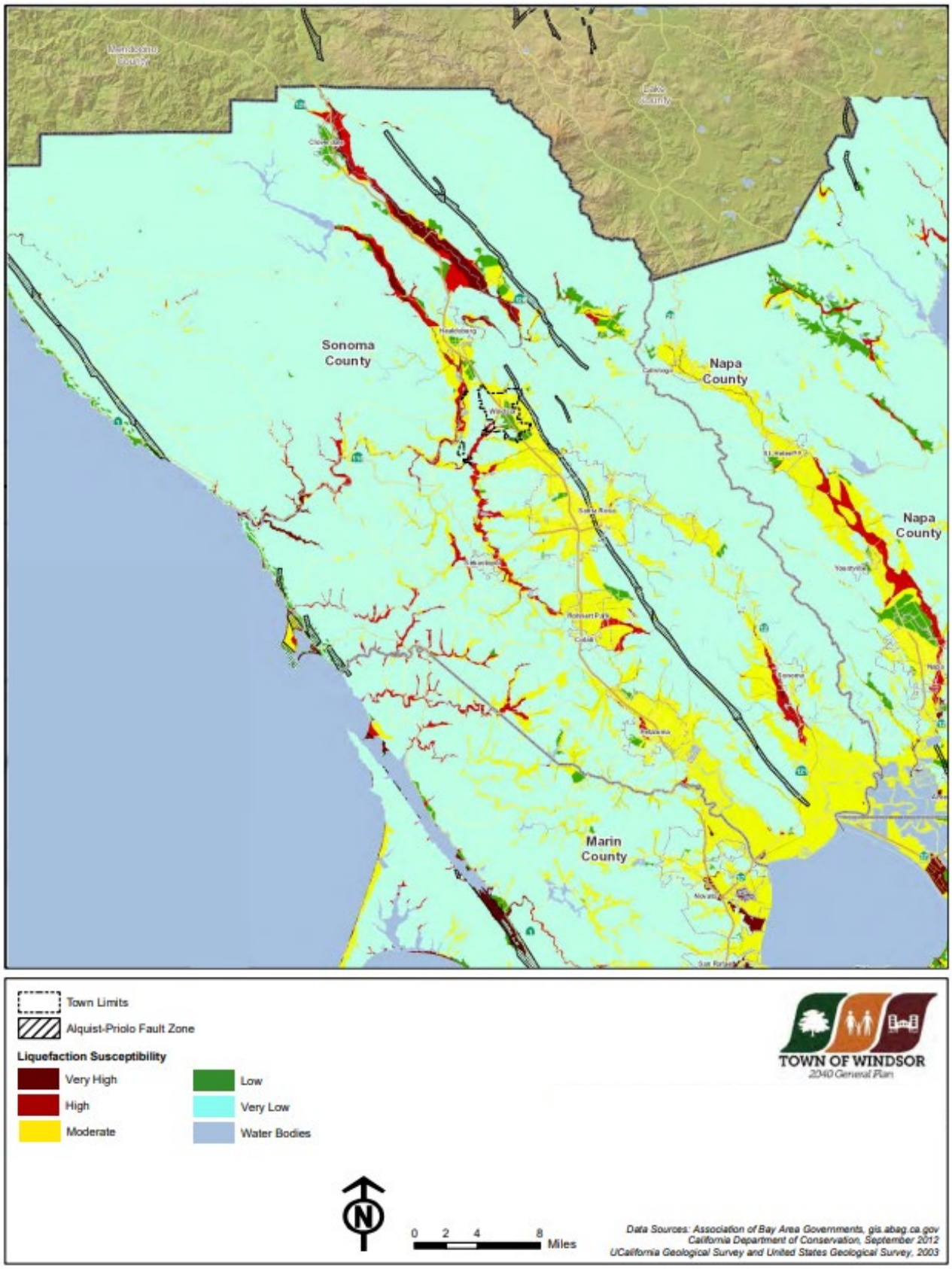
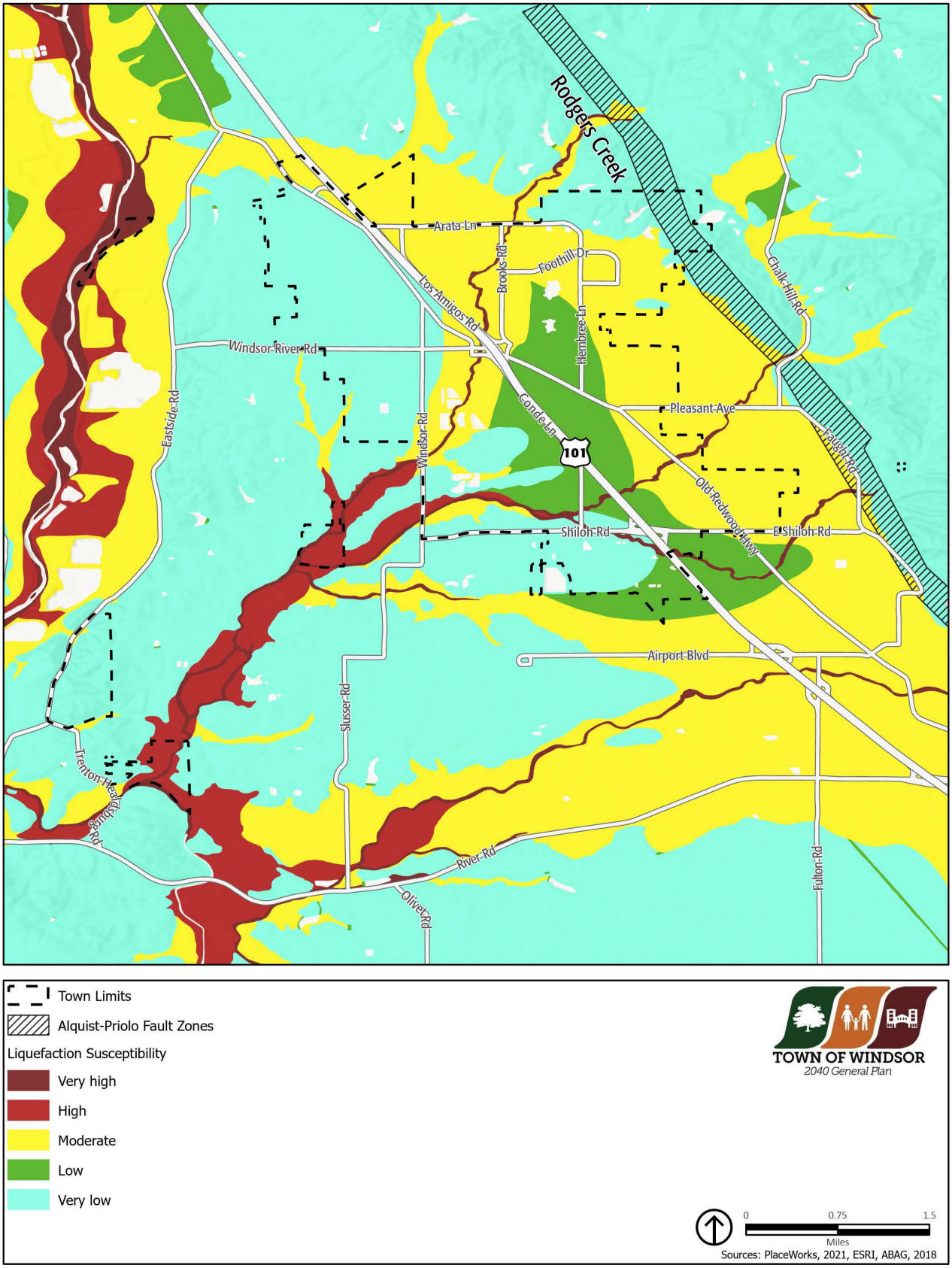


FIGURE PHS-7: LOCAL FAULT LINES AND LIQUEFACTION ZONES



Geologic Hazards

Geologic hazards, such as landslides and erosion, depend on the geologic composition of the area. Landslides and rock falls may occur in sloped areas, especially areas with steep slopes, and usually in areas of loose and fragmented soil. Landslides, rockfalls, and debris flows occur continuously on all slopes; some processes act very slowly, while others occur very suddenly, with potentially disastrous results. They often occur as a consequence of seismic activity or heavy rainfall, either of which may cause slopes to lose structural integrity and slide. Slope stability is dependent on many factors and interrelationships, including rock type, pore water pressure, slope steepness, and natural or human-made undercutting. Landslides are not a hazard of significant concern in Windsor. The substantive landslide risk within Windsor's limits is very small, limited to a section of Foothill Regional Park. Large sections of Windsor west of Highway 101 face a low but real landslide risk. There are areas of substantive landslide risk north, east, and southwest of the Town.

Windsor is susceptible to hazards related to erosion, or the geological process in which earthen materials are worn away and transported by natural forces such as water or wind, causing the soil to deteriorate. Eroded topsoil can be transported into streams and other waterways. Water erosion is the removal of soil by water and transportation of the eroded materials away from the point of removal. The severity of water erosion is influenced by slope, soil type, soil water storage capacity, nature of the underlying rock, vegetation cover, and rainfall intensity and period. The impact of soil erosion on water quality becomes significant, particularly as soil surface runoff. Highly erosive soils can damage roads, bridges, buildings, and other structures.

Past Occurrences

Several major earthquakes have occurred near Windsor in recorded history. The most recent major earthquake was the 2014 South Napa earthquake on the West Napa fault, centered approximately 36 miles southeast of Windsor. The earthquake had a magnitude (M_w) of 6.0, killed one person, injured approximately 200, and caused extensive damage in the southern Napa Valley region. Shaking in Windsor itself was mild, measuring IV (light shaking) on the 10-point Modified Mercalli Intensity (MMI) scale.

Another major event in the region was the 1989 Loma Prieta earthquake, which killed 63 people, injured close to 3,800, and caused as much as $6 billion in damage. It was near Santa Cruz, 116 miles from Windsor, but was still sufficient to register MMI V (moderate shaking) in the Town, on the ten-point Modified Mercalli Intensity (MMI) scale. The earthquake measured M_w 7.2 and had a maximum MMI of IX (violent shaking) near its epicenter. The closest major earthquake event to Windsor occurred in 1969, when two distinct earthquakes (M_w 5.6 and M_w 5.7) occurred approximately 7 miles southeast of the Town. The greatest damage occurred in Santa Rosa, and while specific damage is Windsor is unknown, it is likely that this event caused some damage in the Town. More recently, a M_w 4.4 earthquake occurred in September 2022 with an epicenter in Santa Rosa, with an MMI of IV (light) in Windsor.

There is no recorded history of liquefaction events in Windsor, although it is possible that past earthquake events in the Town have resulted in liquefaction. Given that the areas of high or very high liquefaction potential are in creek beds, liquefaction events may have occurred in these areas but largely escaped notice because they did not affect buildings or infrastructure.

Windsor does not have a history of substantive landslide events. Geologic risks, such as landslides, are rare occurrences in Windsor. Landslides have occurred elsewhere in Sonoma County, including near Rio Nido, Monte Rio, and Healdsburg along the Russian River.

Potential Changes to Geologic and Seismic Risk in Future Years

Likelihood of Future Occurrence

Seismic Risk

Earthquakes are likely to continue to occur on an occasional basis and are likely to be small. Most are expected to cause no substantive damage and may not even be felt by most people. Major earthquakes, although rare, will almost certainly occur in the future. Earthquakes are the highest concern for the Town given the proximity to the Rodgers Creek-Healdsburg Fault, as well as the presence of several active faults in the region and liquefaction potential. Based on historical data and the location of Windsor relative to active and potentially active faults, the Town will likely experience a significantly damaging earthquake. The liquefaction risk in Windsor is expected to continue in the future. Given past trends, significant liquefaction events in the Town are likely to remain rare. The areas with the greatest risk of liquefaction are expected to remain in creek beds or immediately adjacent to them.

Geologic Risk

The risk of future substantive landslides in the Town is likely to remain low, given the absence of high landslide hazard zones in the Windsor Town's limits. There is a possibility of small-scale landslides west of Highway 101. With significant rainfall, additional failures are likely in the community's limited landslide hazard areas and minor landslides will likely continue to impact the area when heavy precipitation occurs, as they have in the past.

Climate Change and Geologic and Seismic Hazards

While climate change is unlikely to increase earthquake frequency or strength, the threats from seismic and geologic hazards are expected to continue. Climate change is expected to result in precipitation extremes (i.e., wetter rainfall periods and drier dry periods). While total average annual rainfall may not change significantly, rainfall may be concentrated in more intense precipitation events. Heavy rainfall could cause an increase in the number of landslides or make landslides larger than normal. Increased wildfire frequency can destabilize hillsides due to loss of vegetation and changes in soil composition, which can contribute to greater runoff and erosion. The combination of more droughts and wildfires, along with an increased risk of extreme rainfall, is likely to cause more mudslides and landslides. Impacts from these conditions would compound landslide potential for the most susceptible locations.

Flood Hazards

Flooding is the rising and overflowing of a body of water onto normally dry land. History highlights floods as one of the most frequent natural hazards impacting communities in Sonoma County. Floods are among the costliest natural disasters in terms of human hardship and economic loss nationwide, causing substantial damage to structures, landscapes, and utilities, as well as life and safety issues. Flooding can be extremely dangerous, and even six inches of moving water can knock a person over given a strong current. Floodwaters can transport large objects downstream, which can damage or remove stationary structures, such as dam spillways. Ground saturation can result in instability, collapse, or other damage. Objects can be buried or destroyed through sediment deposition. Floodwaters can break utility lines and interrupt services. Standing water can also cause damage to roads, foundations, and electrical circuits. Other problems connected with flooding and stormwater runoff include erosion, sedimentation, degradation of water quality, losses of environmental resources, and certain health hazards.

Floods are usually caused by large amounts of precipitation, either from a period of very intense precipitation or a long period of steady precipitation. Historically, Windsor has been at risk of flooding primarily during the winter and spring months when stream systems swell with heavy rainfall. This type of flood results from prolonged, heavy rainfall and is characterized by high peak flows of moderate duration and by a large volume of runoff. Flooding is more severe when prior rainfall has resulted in saturated ground conditions. There are seven creeks and streams within the Town of Windsor that increase thepotential for local and regional flooding during significant rain events. Flooding susceptibility in Windsor is primarily associated with Starr Creek, Windsor Creek, and Pool Creek. Occasionally, flash flooding from short-duration, high-intensity precipitation events (often during summer thunderstorms) may occur. Localized flooding also occurs in Windsor at various times throughout the year.

Developments create impermeable surfaces and reduce the total surface area that can absorb water. Stormwater runoff is augmented by water flows from development contributing to street flooding. Moreover, developed areas generate irrigation water runoff from landscaping, which may channel stormwater and other runoff flows into nearby underdeveloped areas and street gutters.

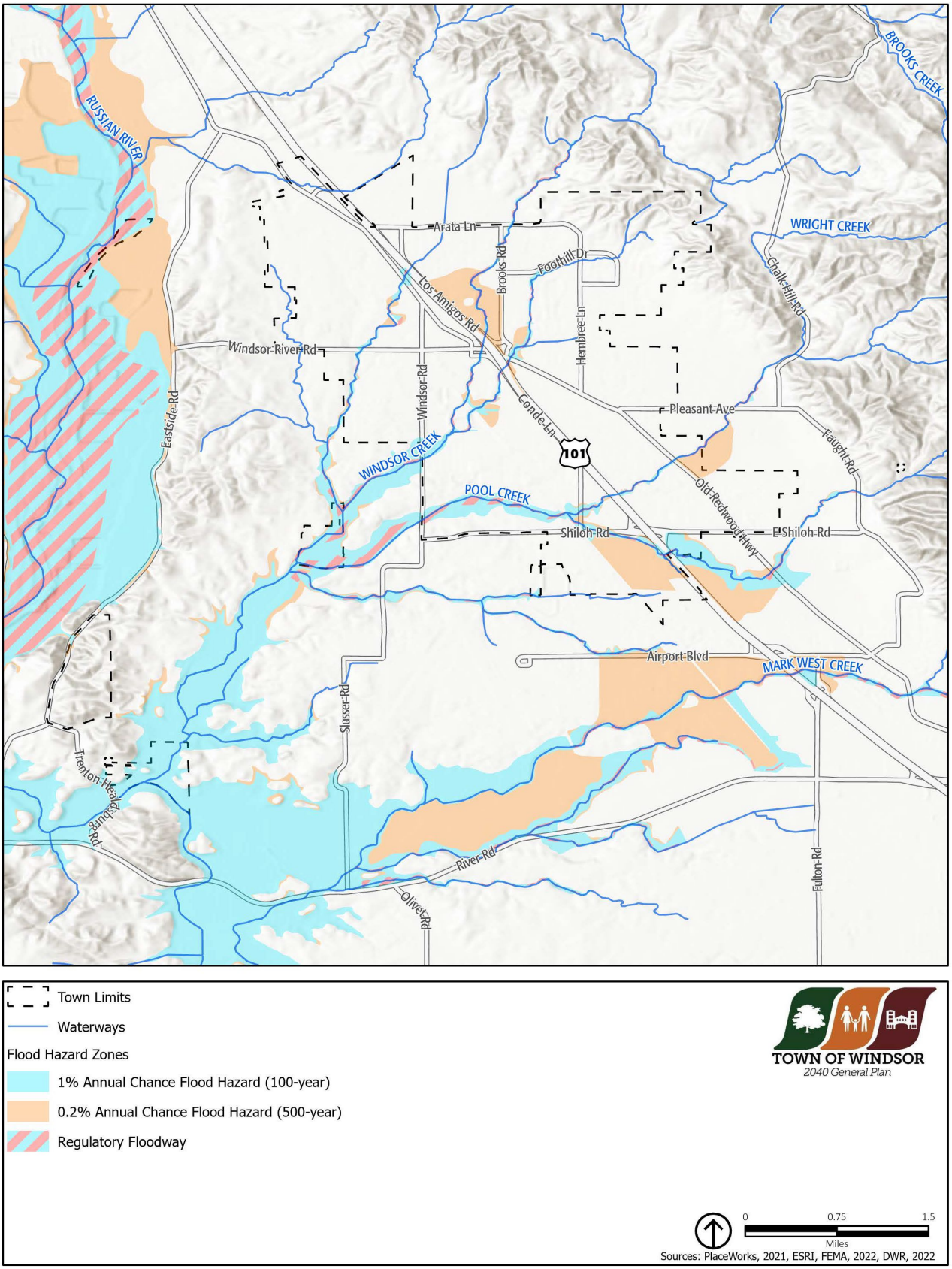
Areas at an elevated risk of flooding are generally divided into 100- and 500-year flood zones. A 100-year flood zone has a 1-percent chance of experiencing a major flood in any given year and a 500-year flood zone has a 0.2-percent chance of flooding in any given year. Figure PHS-8 shows the 100- and 500-year flood zones in and around Windsor.

The culmination of these waterways, specifically in the southern portion of Town, is a significant flooding hazard to the community. This southern portion is within the 100-year flood zone, which flanks either side of Windsor Creek. Much of the area south of Shiloh Road is also within the 100- or 500-year floodplain. Parts of the Town near Shamrock Circle, and a large section of Windsor bordered by Highway 101 and Brooks Road, are also within the 500-year floodplain. During heavy rainfall events, the Town is subject to localized flooding in several areas throughout Windsor, including Pool Creek at Windsor Road, Dawn Way near the intersection with Old Redwood Highway, and the intersections of Arata Lane/Highway 101, Shiloh Road/Caletti Avenue, and Shiloh Road/Highway 101 southbound on-ramp. Although not within the Town limits, there are also extensive 100-year floodplains southwest and west of Windsor.

Agencies responsible for flood control in Windsor include Sonoma County Water Agency (SCWA), the United States Army Corps of Engineers (USACE), the Federal Emergency Management Agency (FEMA), the Federal Insurance Administration (FIA), and the Department of Water Resources (DWR).

- SCWA provides flood control and protection for the county. SCWA is partnered with federal agencies to build and manage flood control protection projects, including Warm Springs Dam as well as other dams and reservoirs. SCWA owns, operates, and maintains the Warms Springs Dam Hydropower Facility and is responsible for managing the reservoir releases when the water levels are below the flood level elevations.
- The USACE identifies the need for and constructs major flood-control facilities. It also develops flood and dam inundation maps and reports. The USACE owns and operates the Warm Springs Dam and is responsible for controlling the releases when the water levels exceed flood level elevations.
- FEMA manages the National Flood Insurance Program (NFIP), providing insurance to the public in communities that participate in the program. FEMA is the main federal government agency contact during natural disasters and publishes the Flood Insurance Rate Maps (FIRM), which identify the extent of flood potential in flood-prone communities based on a 100-year flood (or base flood) event.
- The FIA is the primary agency that delineates potential flood hazard areas and floodways through the FIRMs and the Flood Boundary and Floodway Map. Flood insurance is required of all homeowners who have federally subsidized loans.
- DWR is responsible for managing and protecting California's water. DWR works with other agencies to benefit the state's people, and to protect, restore, and enhance the natural and human environments. DWR also works to prevent and respond to floods, droughts, and catastrophic events that would threaten public safety, water resources and management systems, the environment, and property.

FIGURE PHS-8: FLOOD HAZARD ZONES



Dam Failure

A dam failure is an uncontrolled release of water from a reservoir through a dam as a result of structural failures or deficiencies in the dam. Dam failures can range from fairly minor to catastrophic and can potentially harm human life and property downstream from the failure. In addition, ecosystems and habitats are destroyed as a result of flood waters . Dam failure poses a risk to the Town of Windsor from the following:

- Airport Reservoir
- Airport Storage Pond
- Airport Storage Pond 2
- Bosch No. 2
- Donovan
- Greeott
- Warm Springs Dam
- Lagunita Dam
- Foothill Regional Park Dam
- Shiloh Ranch Dam

The Airport Storage Pond Dam and Airport Storage Pond 2 Dam are located in the southern portion of the Town. These dams are owned by SCWA. Although most of the hazard zone for the Airport Storage Pond 2 Dam is outside of Windsor, a very small section of the area east if Skylane Boulevard is within the dam inundation zone. Similarly, a significant proportion of the hazard zone for the Airport Storage Pond Dam is outside of Windsor. However, much of the remaining hazard zone encompasses the Windsor Golf Course.

The Bosch No. 2 Dam is a privately owned dam located to the northeast of Windsor. Its inundation area covers the area around the bed of Pool Creek. The Donovan Dam is a privately owned dam located to the northeast of Windsor. A majority of the hazard zone for the Donovan Dam is outside of Windsor. However, its hazard zone within the Town encompasses the area around the bed of Windsor Creek. Similarly, the Greeott Dam is a privately owned dam located to the northeast of Windsor. A majority of the hazard zone for the Greeott Dam is outside of Windsor. However, its hazard zone within the Town encompasses the area around the bed of Windsor Creek.

The largest of these is the Warm Springs Dam, which holds back Lake Sonoma and is approximately 16 miles northwest of the Town. The dam was constructed in 1982 and stands 519 feet tall. It can hold back a maximum of 381,000 acre-feet of water, or approximately 124 billion gallons. The dam is owned by the USACE and was built for flood control and water supply purposes. The western half of Windsor lies within the inundation hazard area for the Warm Springs Dam.

The Lagunita Dam is on Windsor Creek, less than a mile north of the Town itself. It was constructed in 1954 and holds back 133 acre-feet of water (approximately 43 million gallons). It is privately owned and stands 49 feet tall. Its inundation area covers the north-central section of Windsor, as well as the bed of Starr Creek and the area around the bed of Windsor Creek.

The Foothill Regional Park Dam, in Foothill Regional Park in northeastern Windsor, holds back East Windsor Creek. If the dam fails, it could inundate properties around East Windsor Creek and parts of Windsor Creek.

The Shiloh Ranch Dam is in Shiloh Ranch Regional Park southeast of the Town. Although most of the hazard zone is outside of Windsor, a very small section of the area around Pruitt Creek in southeastern Windsor is within the dam inundation zone.

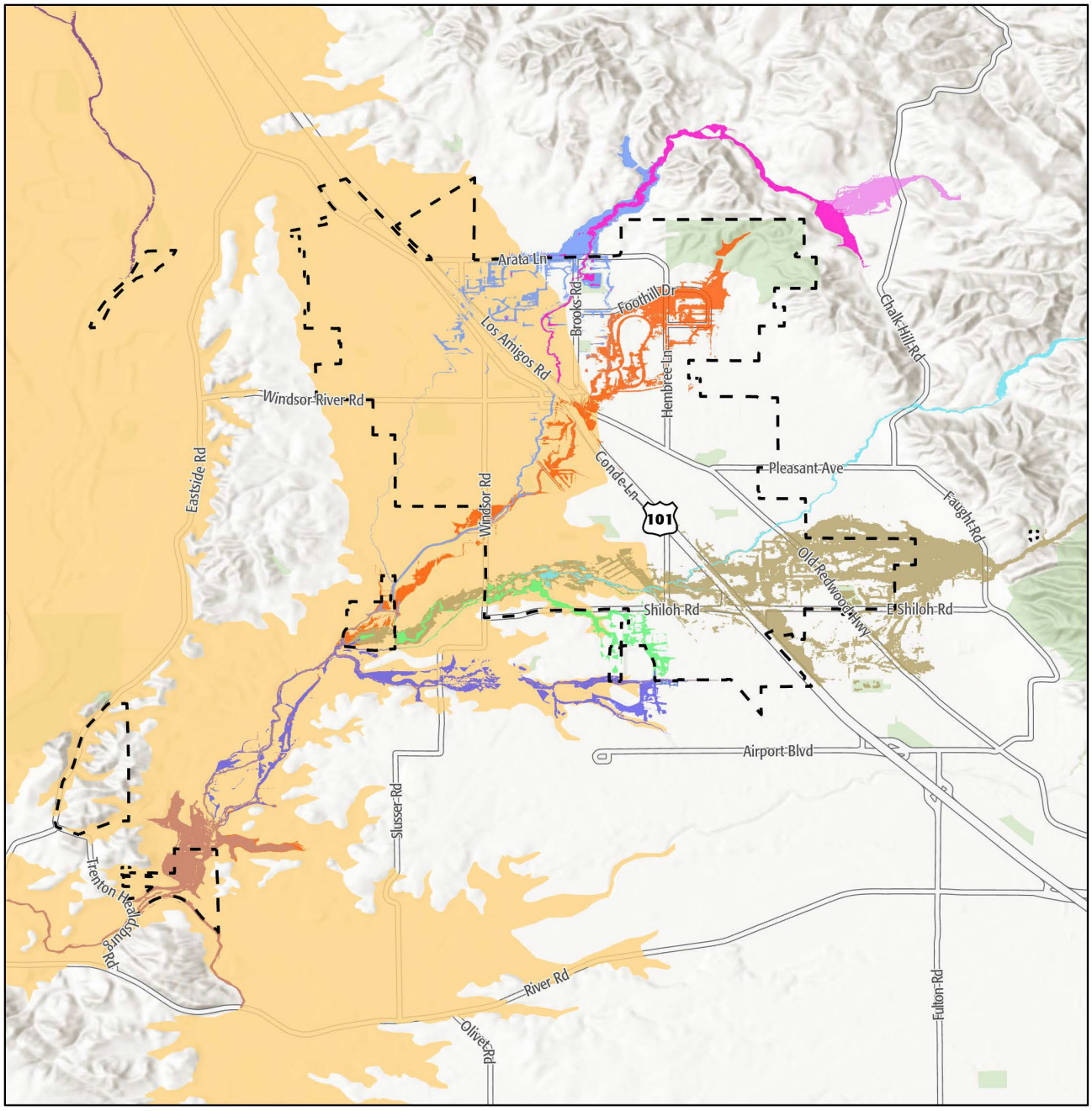
Failure of these dams is generally considered a very unlikely event, although such events are not unprecedented. Additionally, the older that dams get, the more potential exists for catastrophic dam failures. The Warm Springs Dam, and the much smaller irrigation reservoirs within Foothills Regional Park, have the potential to cause widespread flooding in Town in the unlikely event of dam failure. Areas in the Town that would be affected by inundation of these dams are illustrated in Figure PHS-9.

Dam break floods are usually associated with intense rainfall or prolonged flood conditions, although they may also be caused by mechanical or structural defects or a combination of these factors. In a dam failure scenario, the greatest threat to life and property typically occurs in those areas immediately below the dam since flood depths and discharges generally decrease as the flood wave moves downstream. The primary danger associated with dam failure is the high-velocity flooding downstream of the dam and limited warning times for evacuation.

The Federal Energy Regulatory Commission, as required by federal law, has reviewed and approved comprehensive emergency action plans (EAPs) for each of these dams. The EAP minimizes the threat to public safety and the response time to an impending or actual sudden release of water from project dams. The EAP is also designed to provide emergency notification when flood water releases may present the potential for major flooding.

As mandated by the National Dam Inspection Act, the USACE has the authority and responsibility for conducting inspections of all dams. The purpose of these inspections is to check the structural integrity of the dam and associated appurtenant structures, ensuring protection of human life and property. Periodic inspections disclose conditions that might disrupt operation or dam safety.

FIGURE PHS-9: DAM INUNDATION



Past Occurrences

Floods are a regular feature in California and are the cause of the second-greatest number of disaster declarations in the state. Windsor has seen a series of major storms in the past, including during the wet season of 2005-2006. A series of storms from December 17, 2005, to January 12, 2006, caused extensive flooding throughout Northern California, especially around Windsor and in other communities in the Russian River basin. A single storm in January dropped almost 7 inches of rain at once, causing flooding in the southern part of the Town. Flooding in January 2010 knocked out power for over 4,500 Windsor residents and put the Windsor Golf Club under water. Another set of storms in late 2012 caused flooding in Windsor and surrounding communities. In February 2019, storms caused severe flooding along the Russian River, the Town of Windsor, and several other communities throughout the county. Flooding impacted a total of 578 commercial buildings and businesses throughout the county.

Potential Changes to Flood Risk in Future Years

Likelihood of Future Occurrence

Historically, extended heavy rains have resulted in floodwaters that exceed normal high-water boundaries and cause damage in Windsor. Flooding has occurred both within the 100- and 500-year floodplains and in other localized areas. As land uses and climate conditions shift and as improvements are made to flood-control channels, the size of these flood zones is likely to change. The potential for a dam failure event in Windsor is likely to remain a risk in future years, although the odds of such events are expected to remain very low. The Warm Springs Dam, which poses the primary dam failure hazard in Windsor, was evaluated in 2006 and rated IV on the USACE's Dam Safety Action Class system. A rating of IV is considered low urgency and is the second-lowest rank in the five-point Dam Safety Action Class system. It means that the dam is inadequate and may not meet all essential engineering guidelines, but the risk of failure and the consequences of failure are low. The other dams around Windsor are not evaluated under the Dam Safety Action Class due to SCWA or private ownership, and the failure risk of these three dams is unknown.

Climate Change and Flooding

Floods are among the most damaging natural hazards in Sonoma County, and climate change is expected to make flood events worse. Although climate change may not change average precipitation levels significantly, scientists expect that it will cause more years with extreme precipitation events. This means that more years are likely to see particularly intense storm systems that drop enough precipitation over a short enough period to cause flooding. Because of this, floods are expected to occur more often in Windsor and climate change may expand the parts of the Town that are considered flood-prone. Although there are no specific flooding projections for the Town, flood events are expected to become more frequent, and it is possible that the areas subject to flooding will expand. There are some indirect effects of climate change that may also increase flooding in the Town. Climate change is expected to increase the frequency and severity of droughts that cause soil to dry out and become hard. When precipitation does return, more water runs off the surface than is absorbed into the ground, which can lead to floods.

Fire Hazards

Fire hazards include both wildfires and urban fires. California is recognized as one of the most fire-prone and consequently fire-adapted landscapes in the world. The combination of complex terrain, Mediterranean climate, and productive natural plant communities, along with ample natural ignition sources, has created conditions for extensive wildfires. Wildfire is a high concern for the Town of Windsor. Generally, the fire season extends from early summer through late fall of each year during the hotter, dryer months. Wildfire conditions arise from a combination of high temperatures, low-moisture content in the air and plant matter, an accumulation of vegetation, and high winds.

Three types of fires are of concern to Windsor: (1) wildfires, (2) wildland-urban interface fires, and (3) structural fires.

Wildfires

Wildfires occur on mountains, hillsides, and grasslands. Vegetation, wind, temperature, humidity, and slope are all factors that affect how these fires spread. In Windsor, grassland and woodland habitat provide highly flammable fuel that is conducive to wildfires. Windsor is surrounded by wildland, agriculture, and open space that contributes to its aesthetic quality and small-town charm. However, some of these natural resources also make the Town vulnerable to wildfires. The climate of Windsor keeps the grass dry and more readily combustible during fire season. Seasonal drought conditions exacerbate fire hazards.

Wildfire potential for Sonoma County is typically greatest in the months of August, September, and October, when dry vegetation coexists with hot, dry winds, known as Diablo winds. Diablo winds come from the north and northeast, carrying extremely dry air at a high velocity, usually in the San Francisco Bay Area. These hot, dry winds can quickly desiccate vegetation and other combustible materials and can push a fire down or up a slope at very high speeds. These winds often occur between the spring and fall but are especially dangerous in the driest months of late summer and fall. During these times, controlling a fire becomes far more difficult. Seasonal drought conditions exacerbate fire hazards.

Grassland fires are easily ignited, particularly in dry seasons. These fires are relatively easily controlled if they can be reached by fire equipment, although after a fire, the burned slopes are highly subject to erosion and gullying. While brush-lands are naturally adapted to frequent small fires, fire protection in recent decades has resulted in heavy fuel accumulation on the ground. Brush fires, particularly near the end of the dry season, tend to burn fast and very hot, threatening homes and leading to serious destruction of vegetative cover. A brush fire that spreads to a woodland can generate a destructive crown fire, which burns materials at the top of trees and jumps from treetop to treetop. Crown fires can be very intense and difficult to contain. High-intensity fires increase the likelihood of a fire growing and spreading quickly. Furthermore, production of burning embers carried through the wind (also referred to as ember cast) can lead to spot fires beyond the immediate perimeter, and these are often the primary cause of ignition for structures. Ember cast and spot fires present one of the greatest fire risks to the Town of Windsor.

Many species of oaks are tolerant to fire and are known to be part of California's fire-dependent ecosystem. In general, oak woodlands are well adapted to periodic fire in the landscape. However, fire suppression in the 20th century led to the buildup of a dense understory of conifers, hardwoods, and shrubs in woodlands throughout the region. The buildup of dense understories and the higher density of small trees, especially conifers, enhance the risk of high-severity fires under hot, dry, and windy conditions. The combustibility of the fuel depends on its moisture content, physical structure, and chemical content. The drier the fuel, the more flammable it will be.

Regardless, all vegetation in the region reaches some degree of combustibility during the dry summer months and, under certain conditions, during the winter months.

In addition, tree mortality due to drought and sudden oak death have increased densities of dead fuels and likely contributed to higher fire risk in the Bay Area. Under moderate drought conditions, oak woodlands generally present low fire risk, and treatments that remove understory fuels further reduce risk of high-severity fire.

In Windsor, an oak woodland wildfire has the potential to spread rapidly and may be very difficult to contain due to the community's steep topography to the north and east, fuel load, and climatic conditions during the summer and fall.

Wildfire Smoke

Increasing regional fire frequency can create recurring air quality degradation events leading to respiratory health effects. Wildfire smoke consists of a mix of gases and fine particulate matter from burning materials. The pollutant of most concern from wildfire smoke is fine particulate matter ($PM_{2.5}$). $PM_{2.5}$ from wildfire smoke is damaging to human health because of its ability to deeply penetrate lung tissue and affect the heart and circulatory system. Although wildfire smoke presents a health risk to everyone, sensitive groups may experience more severe acute and chronic symptoms from exposure to wildfire smoke, such as children, older adults, or people with chronic respiratory or cardiovascular disease.

Wildland-Urban Interface Fires

The wildland-urban interface (WUI) is an area where buildings and infrastructure (e.g., cell towers, schools, water supply facilities) mix with areas of flammable wildland vegetation. Human-caused fires are the leading cause of wildland fires, and with thousands of people living near and visiting wildland areas, the probability of human-caused fires is growing.

In the WUI, efforts to prevent ignitions and limit wildfire loss hinge on hardening structures and creating defensible space through a multi-faceted approach, which includes engineering, enforcement, education, emergency response, and economic incentive. Different strategies in the defense and threat zones of the WUI help to limit the spread of fire and reduce the risk to people and property.

Structural Fires

Windsor is at risk from structural fires. A structural fire is a fire involving the structural components of residential buildings ranging from single-family detached homes and townhouses to apartments and tower blocks, or various commercial buildings ranging from offices to shopping malls. These fires occur in built-up environments, destroying buildings and other human-made structures. These disasters are often due to faulty wiring or mechanical equipment, or combustible construction materials. The absence of fire alarms and fire sprinkler systems often exacerbate the damages associated with a structural fire. Structural fires are largely from human accidents, although deliberate fires (arson) may be a cause of some events. Older buildings that lack modern fire safety features may face greater risk of damage from fires. To minimize fire damage and loss, the Town's Fire and Building Codes, based on the California Fire and Building Codes, sets standards for building and construction. It requires the provision of adequate water supply for firefighting, fire-retardant construction, and minimum street widths, among other things. Fire prevention awareness programs and fire drills are conducted to train residents to respond quickly and correctly to reduce injury and losses during fires.

Fire Hazard Severity Zones

CAL FIRE establishes Fire Hazard Severity Zones (FHSZ), designating each as moderate, high, or very high severity. CAL FIRE only designates very high fire hazard severity zones within LRAs. Incorporated areas, such as Windsor, are considered Local Responsibility Areas (LRAs) and only have designations of very high fire hazard severity zones within the Town's limits. Figure PHS-10 shows the wildfire hazard severity zones and wildland-urban interface in and around Windsor.

There are no Very High Fire Hazard Severity Zones in the Town. However, areas adjacent to the Town that are susceptible to wildfires are also of concern as these conditions could exacerbate vulnerabilities within the Town. The area southeast of Windsor is considered a moderate fire hazard severity zone. There are also areas of moderate fire hazard severity along the Town's northeastern border. The nearest identified High and Very High FHSZs are in the Armstrong Redwoods State Natural Reserve to the west, and Del Rio Woods Regional Park to the north, adjacent to Healdsburg. A combination of factors, including weather, topography, and vegetation put these areas at a high risk.

Areas of wildland/urban interface, where high-value structures such as homes meet highly flammable native vegetation, are more vulnerable and, as a result of serious wildland fires throughout the state in recent years, are more stringently subject to fire-prevention regulations on development.

Residential development in the WUI, the introduction and proliferation of exotic species, accumulated fuel because of the exclusion of naturally occurring fire, and climate-change-driven compression of the historical rainy season exacerbate the fire problem. Taken together, these factors result in more people, property, critical infrastructure, and natural resources in harm's way on a more frequent basis. Though large-scale wildfires do not occur every year, wildfire incidents driven by extreme weather conditions have repeatedly been difficult to contain.

Research shows that home loss in wildland fires is primarily driven by two important factors:

- Embers cause 80 percent of wildland fire home ignitions. The following elements are most vulnerable to embers but can be retrofitted on existing homes to reduce risk of ignition:
    - Non-Class A roofs[3]
    - Roof edges and soffits
    - Combustible plants and materials within 5 feet of house walls
    - Non-WUI approved venting products that allow for ember entry into structures
    - Wooden attachments, such as fences and decks
    - Non-WUI rated windows
    - Siding

[3] To achieve a Class A rating, the roof must be effective against severe fire exposure. This is proven if it can:

- Experience maximum flame spread of 6 feet
- Withstand a burning brand measuring 12" x 12" and weighing 2,000 grams
- Last 2 to 4 hours before ignition
- Resist 15 cycles of a gas flame turned on and off

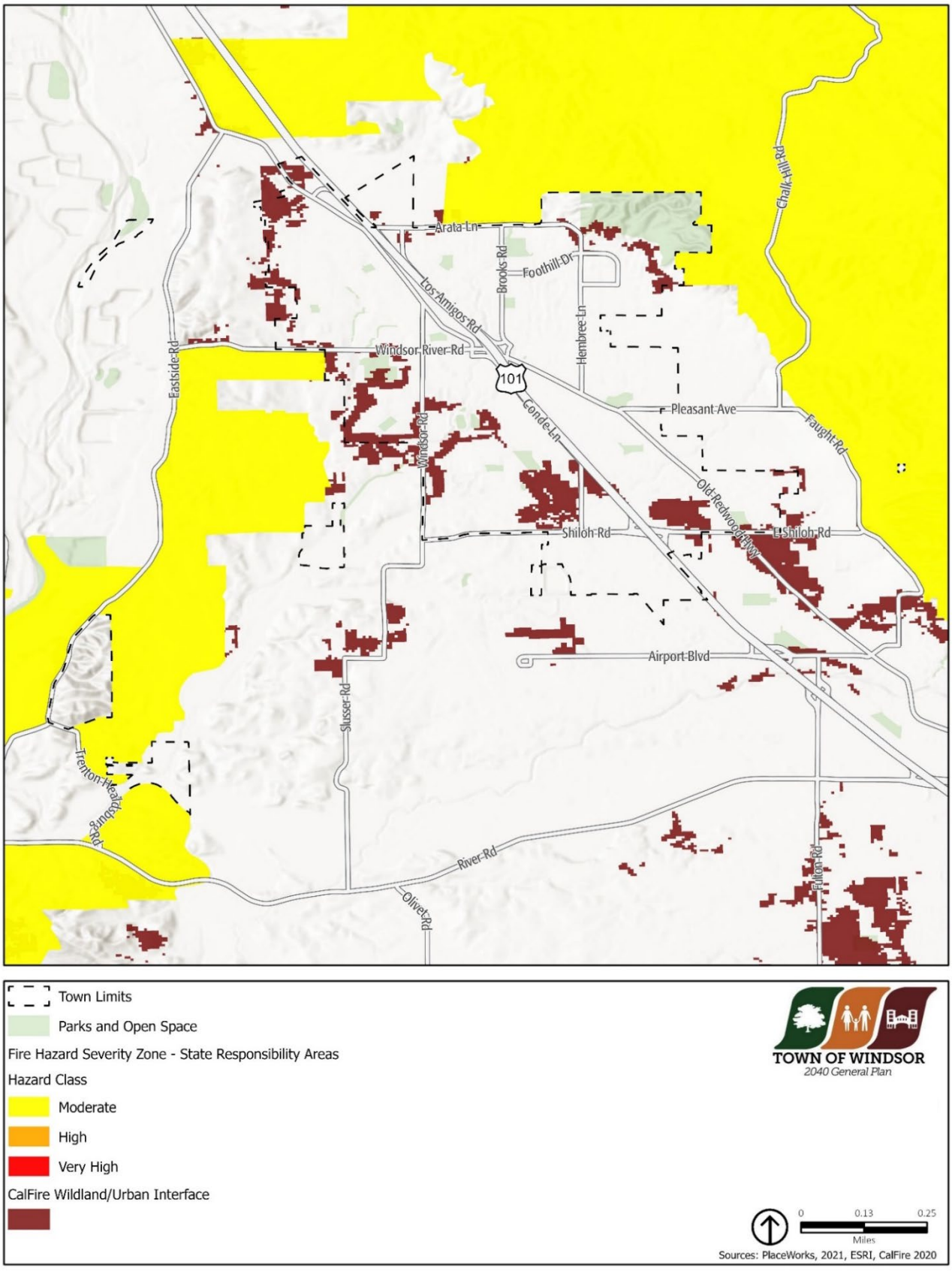
Common stand-alone Class A roof coverings include clay tiles, slate, asphalt glass fiber composition shingles, and concrete tiles. Assembly-rated Class A roof coverings are those that meet Class A standards when combined with other elements. Some materials have a "by assembly" Class A fire rating which means, additional materials must be used between the roof covering and sheathing to attain that rating. Examples of roof coverings with a "by assembly" fire rating include aluminum, recycled plastic and rubber and some fire-retardant wood shake products.

- The vegetative fuels within 100 feet of structures (the area referred to as defensible space)—Good defensible space, wherein vegetation has been reduced to reduce fire intensity and spread, is critical to reduce ignition.

Outside of the home and the 100-foot defensible space zone, surrounding wildland fuels can play a role in home destruction, as fire and embers can spread from nearby wildland areas into communities.

Although Windsor is outside of a fire hazard severity zone, the close presence of these areas means that wildfires may still occur in the Town, although the chance of such events happening is somewhat lower.

FIGURE PHS-10: WILDFIRE HAZARD SEVERITY ZONES



Fire Protection

Fire protection in and around Windsor is provided by the Sonoma County Fire District (SCFD). SCFD is governed by a Board of Directors and provides services within Town of Windsor boundaries, as well as to surrounding rural and/or unincorporated areas. SCFD also has automatic-aid agreements with CAL FIRE. The Town of Windsor is signatory to the California Mutual Aid Fire Protection System. This agreement was established to aid with major emergency incidents anywhere in the state.

SCFD has two stations in the Town:

- 8200 Old Redwood Highway (Station 1)
- 8600 Windsor Road (Station 3)

Past Occurrences

There are no historical records of wildfires occurring in Windsor, although some wildfire events have occurred nearby. The largest, the Hanley Fire, occurred in 1964. It burned 55,960 acres east of Windsor, south to Santa Rosa, and as far east as Calistoga in Napa County. A smaller fire, of approximately 1,130 acres, burned an area east of Foothill Regional Park in 1950. Other regional fire events include the 540-acre Porter Creek Fire in 1996 near Chalk Mountain, the 20-acre Oceguera Fire in 2004 near Redwood Hill, and a 13,170-acre wildfire in 1965 northeast of the Town.

In October 2017, the Tubbs Fire forced residents in Windsor to evacuate. The fire became an urban conflagration fire, as embers from wildland areas carried across Highway 101 to ignite businesses and the community of Coffey Park, where approximately 1,300 homes were lost along with commercial buildings. One active area of the fire was east of Windsor, with the fire burning from Shiloh Ridge to Chalk Hill Road and Knights Valley, although the fire did not burn areas inside the Town limits. The fire burned approximately 36,807 acres and 5,643 structures. At least 24 people in Sonoma County were believed to have been killed by the fire. The Tubbs Fire was the most destructive wildfire in California history when it occurred, burning parts of Napa, Sonoma, and Lake counties. The greatest losses were in the city of Santa Rosa. Santa Rosa's economic loss from the Tubbs Fire was estimated at $1.2 billion, with 5 percent of the city's housing stock destroyed. The fire incurred $100 million in fire suppression costs.

In October 2019, the Kincade Fire started northeast of Geyserville in the Mayacamas Mountains and burned 77,753 acres and 371 structures before it was fully contained on November 6, 2019. The fire threatened over 90,000 structures and caused widespread evacuations (198,785 residents) throughout Sonoma County, including the communities of Geyserville, Healdsburg, and Windsor. The fire resulted in spot fires in Town limits due to the production of burning embers carried through the wind. All of Windsor was potentially threatened. The fire was the largest of the 2019 California wildfire season, and the largest ever in Sonoma County.

On August 17, 2020, the Walbridge Fire resulted in the northwestern area of Windsor being under an evacuation warning. The Walbridge Fire was part of the Lightning Complex Fire which started following a series of very hot days, thunderstorms hit California. Within the next 72 to 96 hours, over 12,000 lightning strikes were recorded over Northern California. These lightning strikes sparked up to 585 wildfires, many of which grew to be very large at a rapid pace due to parched brush. The Walbridge Fire burned approximately 55,209 acres and contributed to the loss of 303 structures within Sonoma County.

Potential Changes to Fire Risk in Future Years

Likelihood of Future Occurrence

The wildfire season in Sonoma County typically lasts from June through October. Extreme weather conditions during periods of low humidity, low fuel moisture, and high winds also contribute to the severity of any potential wildfires. Fires occurring during these times typically burn hot and fast and are difficult to control unless initial suppression occurs immediately. Higher wind speeds can carry burning embers further from the immediate perimeter and at a faster rate, contributing to rapid spread of wildfires and making them harder to control. When the heat generated by an intense wildfire is combined with wind, small burning embers can travel several miles away from the fire perimeter, potentially sparking new fires. This has been an issue of concern in and around Windsor during recent fire events.

Wildfire risk and smoke impacts from regional wildfires are likely to continue to be problematic due to the surrounding areas at risk. As urban development extends towards the foothills and into areas with highly flammable vegetation, the likelihood of accidental wildland fires becomesmore prominent. Wildland fires are difficult to suppress and can spread rapidly, requiring property owners and the public to be aware and ready to implement preventive measures in areas of high risk.

Climate Change and Wildfire

Changing climate conditions are expected to increase the fire risk in and around Windsor. Warmer temperatures brought on by climate change can exacerbate drought conditions. Droughts can kill or dry out plants, creating more fuel for wildfires. Warmer temperatures are also expected to increase the number of pest outbreaks, such as the western pine beetle, killing and weakening trees, and increasing fuel load. Warmer temperatures are also expected to occur during more of the year, extending the wildfire season, which is likely to begin earlier in the year and extend later than it has historically. While wildfire frequency around the Town is expected to remain relatively constant through the middle of the century, it is possible that the Windsor area may see up to a 20-percent increase in burnt areas by 2085.

Wildfires occurring later or earlier in the year are more likely to occur during Diablo wind events, which can cause wildfires to move more quickly and increase the likelihood of burning in the WUI areas. Severe weather events, such as high winds, may become more frequent and intense due to climate change. High winds can push flames quickly into new areas, contributing to rapid spread of wildfires and making them harder to control.

The policies in this section provide guidance for preventative measures and practices to avoid wildfires and supportongoing coordination between SCFD and CAL FIRE.

Hazardous Materials

Hazardous materials are materials that pose a significant risk to public safety or human or environmental health. Hazardous materials include all toxic flammable, combustible,corrosive, poisonous, and radioactive substances, which possess the potential to bring harm to the public or the environment. They can be released through human error, malfunctioning or broken equipment, or as an indirect consequence of other emergencies (e.g., if a flood damages a hazardous material storage tank). Hazardous materials can also be released accidentally during transportation, as a consequence of vehicle accidents. Protection from hazardous materials is essential to providing a safe environment forresidents and visitors.

A release or spill of bulk hazardous materials could result in fire, explosion, toxic cloud, or direct contamination of water, people, and property. The effects may involve a local site or many square miles. Health problems may be immediate, such as corrosive effects on skin and lungs, or gradual,

such as the development of cancer from a carcinogen. Damage to property could range from immediate destruction by explosion to permanent contamination by a persistent hazardous material. The improper use and disposal of hazardous materials can contaminate soil and groundwater resources and compromise the health and quality of life of residents. Accidents involving the transportation of hazardous materials can also cause explosions or spills that endanger the lives and property of nearby residents and businesses.

Most hazardous materials in the region are being transported on truck routes along major roadways, such as Highway 101 that passthrough Windsor. The most vulnerable areas along this route are considered the on-/off-ramps and interchanges. Since 1970, there have been four reported roadway hazardous materials incidents. Information regarding these incidents is described below in Table PHS-2.

TABLE PHS-2:
HAZARDOUS MATERIALS INCIDENTS IN WINDSOR

Date of Incident	Carrier Reporter Name	Incident Route	Mode of Transportation	Commodity Name	Causes of Failure
5/7/2021	FedEx Ground Package System, Inc.	500 Caletti Avenue	Highway	Corrosive Liquid, Basic, Inorganic, N.O.S.	Abrasion
3/27/2009	FedEx Ground Package System, Inc.	500 Caletti Avenue	Highway	Fire Extinguishers Containing Compressed or Liquefied Gas.	Inadequate Preparation for Transportation
3/14/2007	FedEx Ground Package System, Inc.	5900 Pruitt Avenue #164	Highway	Compounds, Cleaning Liquid.	Human Error
8/22/2006	FedEx Ground Package System, Inc.	5900 Pruitt Avenue	Highway	Corrosive Liquid, Basic, Organic, N.O.S.	Dropped

Source: U.S. Department of Transportation. 2022, March. Incident Statistics.

Hazardous materials and waste within Windsor are managed by the Certified Unified Program Agency (CUPA), a local administrative agency within the County of Sonoma Hazardous Materials Division. The CUPA consolidates, coordinates, and makes consistent the regulatory activities of several hazardous materials and hazardous waste programs, including Hazardous Materials Management, California Accidental Release Prevention, Hazardous Waste Management, Underground Storage Tanks, Aboveground Storage Tanks, and Emergency Response.

Several state agencies monitor hazardous materials/waste facilities. Potential and known contamination sites are monitored and documented by the Regional Water Quality Control Board (RWQCB) and the Department of Toxic Substances and Controls (DTSC). A review of the leaking underground storage tank list produced by the RWQCB and the DTSC EnviroStor database indicates 10 cleanup sites and 16 leaking underground storage tank sites throughout the Town.

If a hazardous material spill poses an imminent public health threat, the Town will support local regulating agencies in notifying the public. The transport of hazardous materials/wastes and explosives through the Town is regulated by the California Department of Transportation (Caltrans). Highway 101 is open to vehicles carrying hazardous materials/wastes. Transporters of hazardous wastes are required to be certified by the United States Department of Transportation (DOT) and manifests are required to track the hazardous waste during transport. The danger of hazardous materials/waste spills during transport does exist and will potentially increase as transportation of these materials increase on Highway 101. The SCFD and the County of Sonoma Hazardous Materials Division are responsible for hazardous materials accidents at all locations within the Town.

Potential Changes to Hazardous Materials Risk in Future Years

Likelihood of Future Occurrence

Given that there have been four hazardous materials incidents in transport through the Town in the past 50 years, it is unlikely a hazardous materials incident will occur in Windsor on a frequent basis. Moreover, according to Caltrans, most incidents are related to releases of fluids from the transporting vehicles themselves and not the cargo, thus the likelihood of a significant hazardous materials release within the Town is more limited and difficult to predict.

Climate Change and Hazardous Materials

Climate change is unlikely to substantially affect hazardous materials transportation incidents. However, increases in the frequency and intensity of hazards, such as floods, landslides, earthquakes, wildfires, and severe storms, may create a greater risk of hazardous materials releases during these events.

Airport Safety

SB 379 requires the General Plan address climate adaptationand resiliency strategies based on a vulnerability assessment that identifies the risks that climate change poses to the local government. This requirement can also be met through a Local Hazard Mitigation Plan or other climateadaptation plan. The Town has prepared a Community Resilience Plan that contains a climate vulnerability assessment and strategies to address climate change adaptation. The Town's Local Hazard Mitigation Plan (LHMP) also includes some discussion of climate vulnerability. The LHMP is incorporated in the Public Health and Safety Element by reference. The Community Resilience Plan and LHMP fulfill the requirements of SB 379.

The Charles M. Schulz-Sonoma County Airport (STS) is located less than one-halfmile south of Windsor. The airport is operated by the County of Sonoma Department of Transportation and Public Works and serves many different types ofaircraft including propeller aircraft, turbine aircraft, jets, helicopters, and hot air balloons. The airport currently covers approximately 1,048 acres and features two runways that have direct flight paths over Windsor. The Airport Land Use Commission (ALUC) oversees potential development and regulation that can affectairport expansion and the compatibility with surrounding land uses. The ALUC governs the Sonoma County Airport through the Comprehensive Airport Land UsePlan (CALUP). The CALUP promotes the safety and welfare of residents near the public use airports in the county, as well as airport users.

Additional Hazards and Climate Change Adaptation

Global climate change refers to changes in the average climatic conditions on earthas a whole, including changes in temperature, wind patterns, precipitation, and storm severity. Potential climate change impacts in Windsor include increased frequency and severity of extreme heat days, increased drought caused by decreased rainfall, increased risk of wildfires, and decreased water availability. The Town has actively participated in and supported the effort to reduce greenhouse gas emissions. The policies in this section demonstrate the Town's dedication to respond and adapt toclimate change, including the effects of climate change on natural hazards not previously included in this Element. Policies in the Environmental Resources Element address the reduction of greenhouse gas emissions, which are the leading cause of climate change.

Drought

A drought is a long period when precipitation levels are well below normal. This makes less water available for people (especially if the local water supply depends on surface water) and natural systems.

The Town of Windsor may experience water shortages during drought conditions, which could lead to mandatory water use restrictions. Less snow falling in mountainous areas causes water levels in lakes and reservoirs to drop, which can affect recreation activities. Local ecosystems that are not well adapted to drought conditions can be more easily harmed by it. During drought events, the flow of water in creeks and streams is reduced, creating more slow-moving or standing water. This can concentrate sediment and toxins in the low water levels, causing harm to plants and animals. Many fish species also prefer specific stream flow speeds, especially for spawning and egg incubation, and changes to stream velocity as a result of drought conditions can affect reproduction. Droughts can also indirectly lead to more wildfires, and the stress caused by water shortages can weaken plants, making them more susceptible to pests and diseases.

The U.S. Drought Monitor recognizes a five-point scale for drought events: D0 (abnormally dry), D1 (moderate drought), D2 (severe drought), D3 (extreme drought), and D4 (exceptional drought). According to the U.S. Drought Monitor, the most intensive drought conditions in recent years occurred during most of 2014, when all of Sonoma County was classified as being in "extreme" drought. As of December 2021, Sonoma County, including Windsor, was classified as being in "extreme" drought.

The Town of Windsor manages its own water supply for the community and for a small number of people and businesses outside of the Town limits. Approximately 85 percent of the Town's potable water supply comes from the nearby Russian River, while the remaining 15 percent is purchased by SCWA. SCWA water itself comes primarily from the Russian River and its tributaries, with a small amount from local groundwater basins. The Town also pumps some groundwater for non-potable uses and produces recycled water (used predominately for irrigation) at the local Windsor Wastewater Treatment Reclamation and Disposal Facility. Thus, the Town's water comes entirely from local sources. This dependence on local water supplies means that Windsor's water supply will likely not be affected by droughts in other parts of the state, but that the Town is highly vulnerable to droughts that occur in the region.

Potential Changes to Drought Risk in Future Years

Likelihood of Future Occurrence

Drought is different than many of the other natural hazards in that it is not a distinct event and usually has a slow onset. Drought can severely impact a region both physically and economically, affecting different sectors in different ways and with varying intensities. Adequate water is the most critical issue for commercial and domestic use. As the population in the Town continues to grow, so will the demand for water.

Based on historical information, the occurrence of drought in California, including Sonoma County, is cyclical, driven by weather patterns. Drought has occurred in the past and will occur in the future. Periods of actual drought with adverse impacts can vary in duration, and the period between droughts is often extended. Although an area may be under an extended dry period, determining when it becomes a drought is based on impacts to individual water users. The impacts from drought include reduction in water supply and an increase in dry fuels. Droughts are likely to increase and become more severe, which may lead to lower volumes of available water provided by the Russian River and its tributaries. Groundwater supplies are usually buffered from shorter-term drought conditions, although long-term chronic drought conditions can cause a decline in groundwater levels.

Climate Change and Drought

Although droughts are a regular feature of California's climate, scientists expect that climate change will lead to more frequent and more intense droughts statewide. Overall, precipitation levels are expected to stay similar, and may even increase in some places. However, the state's current data say that there will be more years with extreme levels of precipitation, both high and low, as a result of climate change. This is expected to cause more frequent and intense droughts compared to historical norms. Higher air temperatures are expected to increase evaporation, causing more water loss from lakes and reservoirs, exacerbating drought conditions.

Extreme Heat

While there is no universal definition of extreme heat, California guidance documents define extreme heat as temperatures that are hotter than 98 percent of the historical high temperatures for the area, as measured between April and October of 1961 to 1990. Days that reach this level are called extreme heat days. In Windsor, the extreme heat threshold is 94 degrees Fahrenheit (°F). An event with five extreme heat days in a row is called a heat wave.

Health impacts are the primary concern with this hazard, though economic impacts are also an issue. The Centers for Disease Control and Prevention (CDC) recognizes extreme heat as a substantial public health concern. Historically, NOAA data indicates that about 175 Americans succumb to the demands of summer heat, although this number has increased in recent years. From 2004 to 2018, studies by the U.S. Department of Health and Human Services indicate that there is an average of 702 deaths annually that are directly or indirectly linked to extreme heat.

Extreme heat events are dangerous because people exposed to extreme heat can suffer a number of heat-related illnesses, including heat cramps, heat exhaustion, and (most severely) heat stroke. Elderly persons, small children, persons with chronic illnesses, those on certain medications or drugs, and persons with weight and alcohol problems are particularly susceptible to heat reactions. Occupants of nursing homes and elder-care facilities are especially vulnerable to extreme heat events if power outages occur, and air conditioning is not available. In addition, individuals below the poverty level may be at increased risk to extreme heat if use of air conditioning is not affordable. Areas with lower extreme heat thresholds are not necessarily at lower risk, as persons and community assets used to cooler temperatures may be less prepared for extreme heat events.

Very high temperatures can harm plants and animals that are not well adapted to them, including natural ecosystems. Extreme heat can increase the temperature of water in lakes, streams, creeks, and other water bodies, especially during drought events when water levels are lower. In some cases, water temperatures may exceed comfortable levels for a number of plants and animals, causing ecological harm. Outdoor workers in construction or landscaping are also much more exposed to the elements than most people, so they are more susceptible to extreme heat conditions and the potential illnesses associated with very high temperatures.

Indirectly, extreme heat puts more stress on power lines, causing them to run less efficiently. The heat also causes more demand for electricity (usually to run air conditioning units), and in combination with the stress on the power lines, may lead to brownouts and blackouts.

Potential Changes to Extreme Heat in Future Years

Likelihood of Future Occurrence

Extreme heat tends to occur on an annual basis and is likely to continue occurring annually. As Windsor is in northern Sonoma County and at relatively low elevation, extremely high temperatures will continue to be a more common occurrence.

Climate Change and Extreme Heat

The warmer temperatures brought on by climate change are likely to cause an increase in extreme heat events. Depending on the location and emissions levels, the state Cal-Adapt database indicates the number of extreme heat days is expected to rise from a historical annual average of up to 13 by the middle of the century (2035 to 2064), and an average of up to 22 by the end of the century (2070 to 2099).

Overall, Windsor is expected to see an increase in the average daily high temperatures. Although the temperature increases may appear modest, the projected high temperatures are substantially greater than historical norms. These increases also make it more likely that an above-average high temperature will cross the extreme heat threshold. As temperatures increase, Windsor community members will face increased risk of death from dehydration, heat stroke, heat exhaustion, heart attack, stroke, and respiratory distress caused by extreme heat.

Severe Weather

Severe weather is generally any destructive weather event, but usually occurs in Windsor as localized storms that bring heavy rain, hail, lightning, and strong winds. Severe weather is usually caused by intense storm systems, although certain types of strong winds can occur without a storm. The types of dangers posed by severe weather vary widely and may include injuries or deaths, damage to buildings and structures, fallen trees, roads and railways blocked by debris, and fires sparked by lightning. Severe weather often produces high winds and lightning that can damage structures and cause power outages. Lightning from these storms can ignite wildfires and structure fires that can cause damage to buildings and endanger people. Objects such as vehicles, unprotected structures (e.g., bus stops and car ports), fences, telephone poles, or trees can also be struck directly by lightning, which may result in an explosion or fire. High winds, often accompanying severe storms, can cause significant property damage, threaten public safety, and have adverse economic impacts from business closures and power loss.

All wind events pose several different types of threats. By themselves, the winds pose a threat to the health of people and structures in the county. Dust and plant pollen blown by the wind can create breathing problems. The winds can blow roofs off buildings and cause tree limbs to fall on structures. High winds also increase the threat of wildfires. Winds may dry out brush and forest areas, increasing the fuel load in fire-prone areas. Winds may spark wildfires by knocking down power lines or causing them to arc. If wildfires do start, high winds can carry burning embers further from the immediate perimeter and push flames quickly into new areas, contributing to rapid spread of wildfires and making them harder to control. When the heat generated by an intense wildfire is combined with wind, small burning embers can travel several miles away from the fire perimeter. This can also affect the air quality in Windsor and may disrupt regional infrastructure networks.

Potential Changes to Severe Weather in Future Years

Likelihood of Future Occurrence

According to historical hazard data, severe weather is an annual occurrence in Sonoma County. Damage and disaster declarations related to severe weather have occurred and will continue to occur in the future.

Climate Change and Severe Weather

Climate change is expected to cause an increase in intense rainfall and strong winds, which is usually associated with strong storm systems. However, strong winds may still occur in the absence of storms. This means that Windsor could see more intense weather resulting from these storms in the coming years and decades, although such an increase may not affect all forms of severe weather. While average annual rainfall may increase only slightly, climate change is expected to cause an increase in the number of years with intense levels of precipitation. Heavy rainfall can increase the frequency and severity of other hazards, including flooding.