# Climate Vulnerability and Adaptation Report for Santa Rosa, California

2021


EcoAdapt™
Meeting the challenges of climate change

Cover photo: Restaurants and other retail stores occupy several historic buildings in Santa Rosa's Railroad Square district in the downtown area, including these along Fourth Street. Public domain photo by Anlace via Wikimedia Commons (https://commons.wikimedia.org/wiki/File:Rrsqrazorback.jpg).

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# Introduction

Climate changes are already affecting Santa Rosa and will continue for decades to come, and include higher average temperatures and more extreme heat events, altered precipitation patterns and increased risk of flooding, more frequent and/or severe drought, and more frequent and/or intense wildfires. Climate-related changes, coupled with pre-existing challenges such as homelessness and lack of affordable housing, racial inequity, air and water pollution, and aging infrastructure, have significant implications for the people, infrastructure, and environment of Santa Rosa.

The purpose of this report is to improve understanding about local climate change impacts and vulnerabilities and present adaptation responses that can help reduce community vulnerability and/or increase resilience. The report synthesizes the results of a three-part virtual workshop series held in January 2021, which brought together over 40 stakeholders from across Santa Rosa to evaluate community vulnerability and develop adaptation strategies for eight elements of the community's General Plan: (1) land use, (2) economic vitality, (3) housing, (4) environmental justice, (5) transportation, (6) noise & safety, (7) public services, and (8) open space.

The **Project Methods and Workshop Activities** section of this report provides an overview of the climate adaptation planning process, workshop series, and selection of pre-existing conditions and climate stressors.

The **Overview of Climate Trends and Projections** section presents a summary of current and projected climate changes for the community.

The **Vulnerability Assessment and Adaptation Planning Results** section summarizes vulnerability and adaptation information for each of the eight elements considered.

Finally, the **Conclusions** section highlights common concerns, impacts, and adaptation strategies across the different elements.

# Project Methods and Workshop Activities

## Climate Adaptation Planning Overview

Climate change adaptation refers to how we prepare for, respond to, and recover from changes we are already experiencing and/or are expected to experience. *Adaptation*, which focuses on managing the impacts of climate change, can be distinguished from *mitigation*, which refers to efforts intended to decrease the potential for climate change itself (i.e., by reducing greenhouse gas emissions or enhancing carbon sequestration). The adaptation planning process (Figure 1) intentionally integrates the consideration of climate change into plans, programs, projects, and operations, and is meant to be iterative.

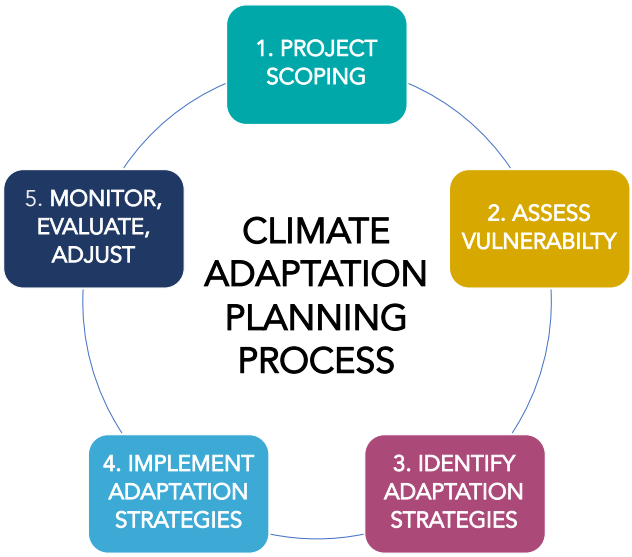


**Figure 1.** Steps in a basic climate adaptation planning process.

While there are many different climate adaptation planning frameworks, they generally consist of the same steps: (1) define project scope, (2) assess vulnerability, (3) identify adaptation strategies, (4) implement strategies, and (5) monitor, evaluate, and adjust strategies, as needed.

(1) **Define Project Scope**. This step includes identifying goals and desired outcomes of the process, establishing the geographic boundaries and timeframe of interest (e.g., near-term: 10-20 years; mid-term: 25-50 years; long-term: 50+ years), identifying and engaging with key stakeholders and partners, and identifying key climate stressors and pre-existing conditions (i.e., stressors that already impact a community). Completion of this step is critical to provide the foundation for a clear and efficient adaptation planning process.

(2) **Assess Vulnerability**. Vulnerability assessments improve understanding of how climate change is likely to impact a community and its ability to respond to those changes. Vulnerability assessments include consideration of the likelihood of exposure to climate change, the consequence of those changes, and the community's capacity to adapt to those changes. These assessments include consideration of the following three components of vulnerability:

- **Likelihood** is the degree to which a community is exposed to significant changes in climate, and considers both the anticipated direction and magnitude of change.
- **Consequence** is the degree to which a community is affected by exposure to a changing climate, and considers both the anticipated impacts of climate stressors as well as the impacts of pre-existing conditions.
- **Adaptive capacity** is the ability to adjust to climate change to minimize potential damages, take advantage of opportunities, or cope with consequences.

Likelihood and consequence together give an estimation of risk which, when combined with adaptive capacity, provides an overall picture of vulnerability (Figure 2). It is important to evaluate all three components – likelihood, consequence, and adaptive capacity – in order to gain a holistic perspective on the factors that are driving vulnerability.

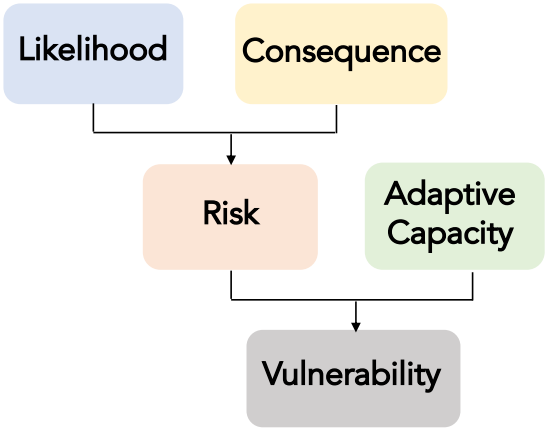


**Figure 2.** Components of vulnerability.

The vulnerability assessment step of the adaptation planning process includes evaluating the impacts of climate change on a community; characterizing the community's ability to minimize or cope with impacts; assigning likelihood, consequence, and adaptive capacity rankings; and summarizing overall vulnerability based on rankings, impacts, and adaptive capacity information.

(3) **Identify Adaptation Strategies**. Adaptation strategies aim to reduce the negative effects or take advantage of the opportunities provided by climate change. The goal of this step is to identify adaptation strategies that reduce risk (limit exposure or minimize consequence) and/or enhance resilience (increase

adaptive capacity). Understanding what drives vulnerability to climate change (e.g., likelihood, consequence, adaptive capacity, or some combination of these) provides a good starting point for identifying possible adaptation strategies. General types of adaptation strategies that may be considered include programmatic; capital improvement and infrastructure; coordination and/or collaboration; knowledge and evaluation; and plans, regulations, and policies. To help decide which actions to prioritize for implementation, it can be helpful to articulate co-benefits (e.g., greenhouse gas reduction, public health improvement, water quality improvement, etc.) and conflicts or challenges (e.g., unintended consequences on people or community assets).

(4) Implement Adaptation Strategies. Once a list of adaptation strategies has been generated and prioritized, they must be put into action. Developing an adaptation implementation plan for each prioritized strategy helps communities articulate how and when (e.g., immediately, within the next 5 years, etc.) the strategy should be implemented, leads and partners responsible for implementation, existing resources and those that are still needed, and potential barriers to implementation.

(5) Monitor, Evaluate, and Adjust. Climate change adaptation planning should be an iterative process, and monitoring and evaluation are essential components that allow communities to make progress while also adjusting actions based on project outcomes and new information. For instance, post-implementation monitoring of adaptation strategies helps to determine whether the strategies are having their intended effect and when or where adjustments may be needed. Developing a monitoring and evaluation plan is critical to minimize wasted time, money, and effort, and these plans should include identification of desired outcomes, parameters to monitor and the method to do so, thresholds that may signal desired outcomes are not being met, and possible alternative strategies to pursue if these thresholds are crossed.

## Tools Used in the Workshop

### *Climate Change Adaptation Certification Tool*[1]

The Climate Change Adaptation Certification Tool (CCAC) is intended for use during regulatory or procedural review processes being carried out as part of routine community functions. The CCAC can be applied to decisions about any project or proposal that will involve the use of public funds, has a life cycle of greater than five

[1] http://ecoadapt.org/data/documents/2018EcoAdaptCCACToolFINAL_SINGLES_CAversion.pdf

years, and can impact public good (e.g., fiscal expenditures, capital planning, permitting, infrastructure design and siting). Applying the CCAC to these decisions allows explicit evaluation of future conditions on project function and longevity, increases understanding of the long-term sustainability of a project at the funding or permitting phase, and considers how to reduce community risk that could arise from actions that become a liability under future conditions. The CCAC process includes three steps: (1) identification of climate change risk factors, (2) evaluation of climate impact on a project, and (3) determination of project review.

### *Rapid Vulnerability and Adaptation Tool*[2]

The Rapid Vulnerability and Adaptation Tool for Climate-Informed Community Planning (RVAT) was developed to make climate adaptation planning a simple, direct, and feasible process for communities. The purpose of the tool is to improve understanding of community vulnerability to climate impacts and to develop implementable solutions that reduce vulnerability and/or increase resilience. The RVAT is designed to cover the major steps of a basic climate adaptation planning process, which include: (1) project scoping, (2) vulnerability assessment, (3) adaptation strategies, and (4) adaptation implementation.

## Workshop Series

The Santa Rosa Climate Change Adaptation Workshop series was held on January 19, 21, and 27, 2021 from 9am-1pm each day.[3] The first day of the workshop was focused on understanding climate impacts, the second on assessing vulnerability, and the third on developing adaptation strategies. Workshop activities for each day are discussed in more detail below.

### *Climate Adaptation Workshop Activities: Day 1*

The first day focused on orienting participants to the workshop series, introducing climate adaptation planning and the steps involved, identifying and prioritizing pre-existing conditions (i.e., stressors that currently impact the community), presenting climate change projections and discussing impacts, introducing and completing the first step of the CCAC, and completing the first step of the RVAT (prioritizing pre-existing conditions and climate stressors, evaluating adaptive capacity). To aid in the adaptive capacity evaluation, workshop participants were provided with a network mapping tool (https://network-mapping-41fb1.web.app/), which shows the existing

[2] http://ecoadapt.org/data/documents/EcoAdapt_RVAT_FillableWorksheets.pdf

[3] The workshop support page (http://ecoadapt.org/workshops/santa-rosa-adaptation-workshop) includes links to presentation slides and all other workshop materials.

relationships among local government departments, agencies, and/or community organizations and how each links to different elements.

Workshop activities were divided between presentations, large group discussions, and breakout group activities. Workshop participants were divided into four small groups, with each group exploring two elements:

Group 1: Land Use and Economic Vitality
Group 2: Transportation and Noise & Safety
Group 3: Housing and Environmental Justice
Group 4: Public Services and Open Space

Workshop participants, including affiliations and breakout group assignments, can be found in Appendix A.

### Pre-Existing Conditions and Climate Stressors

As part of the first step of the RVAT, workshop participants were asked to identify pre-existing conditions for Santa Rosa (i.e., stressors that already impact the community). Participants identified over 25 pre-existing conditions which, through group discussion and ranking, was narrowed down to a list of 11 priority conditions. These included insufficient staffing/funding, disadvantaged communities, racial inequity, community health challenges (e.g., dental health, asthma, COVID-19), climate/environmental youth education, homelessness/lack of affordable housing, earthquakes and other geologic hazards, air pollution, water pollution, aging infrastructure, and limited water supply. Key climate stressors for Santa Rosa were pre-identified by workshop facilitators, and included air temperature, extreme/prolonged heat events, precipitation changes, extreme storm events, drought, flooding, and wildfire. The pre-existing conditions and climate stressors identified provided the basis for the vulnerability assessment.

### *Climate Adaptation Workshop Activities: Day 2*

The second day focused primarily on assessing the vulnerability of all eight elements to pre-existing conditions and climate stressors. Much of the time was spent in small groups applying the second step of the RVAT, which included discussing the impacts of pre-existing conditions and climate stressors on a given element, identifying impacts of greatest concern, and assigning vulnerability rankings to priority impacts. Participants then engaged in a large group discussion to share the findings of the vulnerability assessment. Facilitators also gave presentations on developing adaptation strategies and introducing the second step of the CCAC. Workshop participants were asked to complete the second step of the CCAC as homework, and then send it to workshop facilitators prior to the start of the third day.

### *Climate Adaptation Workshop Activities: Day 3*

The third day focused on small group work to identify adaptation strategies that would reduce impacts of greatest concern for each element and then develop implementation plans for priority strategies (steps 3 and 4 of the RVAT, respectively). Summary presentations concluded the day, with one presentation reviewing the results of the CCAC homework and discussing how the results of the workshop could be used in the General Plan update and the other sharing adaptation strategies for elements as well as next steps and what to expect for final products.

## Overview of Climate Projections and Impacts

The following summaries provided foundational information for the workshops about current and projected future climate changes. A table of observed and projected climatic changes can be found in Appendix B.[4]

### Air Temperature and Extreme Heat

By 2050, minimum annual average temperature (i.e., minimum daily temperatures averaged across the whole year) in Santa Rosa are likely to increase by 4.4°F from the observed average of 43°F from 1961–1990, and then increase by 8.1°F by 2100. Increases in maximum annual average temperatures are projected to increase by 4.3°F from the observed average of 71.1°F. By 2100, 7.5°F increases are expected to occur in maximum temperatures.

Extreme heat events are also likely to increase significantly. Days with maximum temperatures over 98.1°F are likely to increase from the current average of 4 days per year to 14 days per year by 2050 and 24 days per year by 2100. Heat wave duration (i.e., longest consecutive stretch of days each year with maximum temperatures over 98.1°F) is expected to roughly double by 2050, from the current average of 2.3 days to 4.8 days. By 2100, heat wave duration will have increased to 6.4 days.

Frost-free nights (nights when low temperatures do not dip below 32°F) are expected to increase from a current average of 333 nights per year to 362 nights per year, meaning that there will only be an average of 3 nights of frost annually.

### Precipitation

Precipitation in Santa Rosa is highly variable on seasonal, annual, decadal, and multidecadal scales, which contributes to a wide range of projections that disagree on both the direction and magnitude of change (i.e., some models project overall increases and others show decreases). By 2050, the average of four model projections for annual precipitation in Santa Rosa suggests an increase of 16% (5.5 inches), based on an observed average of 34.9 inches per year from 1961–1990. By 2100, an increase of 28% (9.9 inches) is projected. It is likely that a larger proportion of annual rainfall will occur during a shorter and more intense wet season, while the dry season becomes even longer and drier. It is also highly likely that precipitation totals will be even more variable from year to year (Swain et al. 2018).

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[4] Projections for air temperature, extreme heat, annual precipitation, extreme precipitation, and annual area burned were obtained from Cal-Adapt (http://cal-adapt.org) using high-emissions scenario for 2050/mid-century (average of 2035–2064) and 2100/late-century (average of 2070–2099) time periods compared to average conditions between 1961–1990.

## Extreme Precipitation and Flooding

Extreme precipitation, which is the main factor associated with flooding, is likely to increase in both intensity and frequency over the coming century. Between 1961 and 1990, 2-day rainfall totals in Santa Rosa only exceeded 9.4 inches every 20 years on average. Although little change is expected to occur in this amount by 2050 (increase of 0.3 inches or 3%), by 2100 the amount of rain that falls during a 20-year-event is likely to increase 20% to 11.3 inches.

Extreme precipitation events are also expected to occur roughly twice as frequently by the end of the century, although model projections also vary for this metric. Events with a 2-day rainfall total of 1.99 inches currently happen about 3 times per year, but the model average suggests they are likely to increase to 5 times per year by 2050 and 6 times per year by 2100.

## Drought

Warmer temperatures are expected to increase evapotranspiration (i.e., the amount of water that is lost to the atmosphere through evaporation and plant transpiration), resulting in an overall net loss of water within the ecosystem even if precipitation increases. Thus, there is high certainty that drought risk will increase very significantly, with the risk of any given year being a drought year doubling by 2050 (Cook et al. 2015). By the end of the century, severe droughts that now occur once every 20 years may occur once every 10 years, and once-in-a-century droughts may occur once every 20 years (Pierce et al. 2018).

## Wildfire

Annual area burned in Santa Rosa is projected to increase 9.7% by 2050 and 18% by 2100, compared to an average of 230 acres per year from 1961–1990 (range of 50–550 acres). Across the state, very large fires (>25,000 acres) are likely to become 50% more frequent by 2100 (Westerling 2018), and more days of extreme fire weather are projected to occur (Goss et al. 2020).

## Summary of Potential Impacts[5]

**Higher average temperatures** and **more extreme heat events** can lead to:

- Reduced growth and productivity of agricultural crops and native vegetation due to heat stress and increases in evapotranspiration

[5] Sources: California Adaptation Clearinghouse (https://resilientca.org/); California Governor's Office of Emergency Services, "California Adaptation Planning Guide" (Cal OES, Mather, CA, 2020); Sonoma County Regional Climate Protection Authority, "Climate Action 2020 and Beyond: Sonoma County Regional Climate Action Plan" (Sonoma County RCPA, Santa Rosa, CA, 2016)

- Potential increase in insect pests and disease vectors (e.g., mosquitoes, rodents), with associated impacts to agriculture, public health, and native plants and wildlife
- Increased heat-related illness and death, particularly among vulnerable populations
- Greater demand for emergency services, public spaces that provide relief from extreme heat (e.g., libraries, community centers), and water-dependent recreation

Altered precipitation patterns and increased risk of flooding may cause:

- Reduced growth and productivity of agricultural crops and native vegetation due to a longer dry season
- Increased runoff during heavy rainfall events that follow dry periods, resulting in greater risk of landslides and flash floods
- Increased risk of injuries/death and property damage or loss during extreme flooding
- Damage to roadways and/or temporary loss of access to isolated neighborhoods
- Interruption of public services and possible public health impacts following damage to utilities
- Economic impacts of damage to businesses and agricultural operations

More frequent and/or severe drought can result in:

- Reduced water availability due to declining surface water supplies and groundwater recharge combined with increased demand for agricultural and household use
- Increased stress and mortality in agricultural crops and native vegetation
- Increased cost of food and water
- Economic losses due to crop failures and loss of tourism associated with water-dependent activities

More frequent and/or intense wildfires can cause:

- Increased risk of injuries and death due to burns and smoke inhalation, as well as longer-term health impacts related to eye and respiratory issues
- Damage and loss of homes, businesses, and other infrastructure, particularly within the wildland-urban interface (WUI)
- Possible disruption of critical supply chains, access to public services, and other linkages

- Economic losses due to direct damages (i.e., to businesses) as well as declines in tourism and recreation following fire
- Increased frequency of preemptive power outages for wildfire prevention, resulting in the loss of air conditioning, greater risk of food/medication spoilage, disruptions to public services, and other impacts

# Vulnerability Assessment and Adaptation Strategies for General Plan Elements

The following sections summarize the vulnerability and adaptation information for each of the eight elements covered in this workshop series. The information presented is based on the discussions and input of workshop participants during breakout group activities.

## Land Use

This element considers planned future patterns of community land use, including existing and new development. The timeframe considered for this assessment was the life of the General Plan (i.e., next 25–30 years) as well as the longer time horizons (i.e., 50–100 years) of some of the results of the Plan and local land use planning (e.g., infrastructure, facilities, natural habitat management).

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### VULNERABILITY ASSESSMENT

#### *Summary of observed and/or anticipated effects of climate stressors and pre-existing conditions*

**Extreme storm events/flooding**, **drought and extreme/prolonged heat**, and **wildfire** were identified by breakout group participants as the climate stressors that have the most significant impacts on Land Use.

**Limited water supply**, **insufficient staffing/funding**, and **homelessness/lack of affordable housing** were identified by participants as the primary pre-existing conditions that impact Land Use.

#### Climate stressors[6]

*Extreme storm/precipitation events* are likely to lead to flooding of developed areas and infrastructure, cause slope instability, and affect transportation connectivity (e.g., Hwy 37 and Hwy 101 both close due to flooding). Additionally, it may become more difficult to retain runoff on-site (e.g., in rain gardens or detention areas).

*Drought and extreme/prolonged heat* are likely to lead to power outages, increase use of or demand for water, and change natural habitats (e.g., terrestrial, aquatic) as they are forced to adapt to less water, with implications for urban forests.

[6] The information described in this section comes directly from discussions during breakout group activities.

*Wildfire* is likely to impact open space (e.g., parks, natural habitat), shift development to urban areas (i.e., out of the wildland-urban interface), result in exodus of people from the area, and lead to revised building codes and zoning changes.

### Pre-existing conditions[7]

*Limited water supply* causes reduced water availability for landscape irrigation and housing developments, leading to increased costs; it also alters the natural landscape and makes current building codes insufficient (e.g., need for greater efficiency, grey water reuse systems).

*Insufficient staffing/funding* causes limited ability to implement solutions and increases legal vulnerability.

*Homelessness/lack of affordable housing* makes it difficult to find appropriate locations for housing and services (e.g., city-centered rather than sprawl as increased density has historically been used to address need), results in the need for new land acquisition or land use change, and enhances NIMBY ('not in my backyard') sentiments.

### Combined impacts of pre-existing conditions and climate stressors[8]

Climate change is likely to exacerbate the impacts of or be exacerbated by all three pre-existing conditions for Land Use. Breakout group participants identified challenges including:

- Limited water supply combined with flooding and/or drought will impact local water quality, watershed condition, regenerative agriculture, and groundwater recharge, and increase erosion.
- Limited water supply will likely increase the potential for dry fuel, leading to more wildfires. Additionally, limited water supply will constrain firefighting when wildfires do occur, and could lead to more regulations for structure protection (e.g., design, location, access).
- Insufficient staffing/funding combined with climate stressors will likely lead to staff reallocations and an increased need for coordination (i.e., because staff are shifted to address immediate challenges), further reducing institutional capacity, as well as unfunded capital improvement projects and lack of staff for the climate action implementation team.
- Insufficient staffing/funding combined with increased wildfire makes it increasingly difficult to protect WUI with the resources currently available.

[7] The information described in this section comes directly from discussions during breakout group activities.

[8] The information described in this section comes directly from discussions during breakout group activities.

- Increased wildfires are likely to result in loss of tax base from destruction of property, exacerbating current staffing/funding challenges.
- Homelessness/lack of affordable housing combined with climate stressors such as increased flooding and/or wildfire is likely to lead to more locations becoming inappropriate for future development as well as increased homelessness and/or increased need for housing due to displacement of people, which could increase housing costs.
- Drought and extreme/prolonged heat could make the costs for energy and water become unaffordable, increase the need for air conditioning and cooling centers, and lead to rolling black-outs and loss of power.
- Increased wildfires could create an opportunity to prioritize low-income housing.

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*Summary of adaptive capacity*

Overall, breakout group participants evaluated the adaptive capacity of City of Santa Rosa departments and organizations relevant to Land Use as **moderate**. While not ranked for adaptive capacity, several additional organizations were identified that play a role in Land Use, including Sonoma County Planning Department, Fire, and Sustainability Office; utilities (PG&E, Sonoma Clean Power, Sonoma Water); Greenbelt Alliance; Sonoma County Transportation and Land Use Coalition; The Climate Center; Regional Climate Protection Authority (RCPA); Metropolitan Transportation Commission Association of Bay Area Governments (MTC ABAG); Cal Trans; Alliance for a Just Recovery; and North Bay Organizing Project.

### Organizational potential

Overall, the organizational potential of the City of Santa Rosa was evaluated as moderate. Organization **responsiveness** and **existing stakeholder relationships** were both evaluated as moderate-high, while stability/longevity was moderate. Existing **staff capacity** received an overall low-moderate ranking, due to moderate-high staff training but low time availability for staff to apply what they learned in training.

### Management potential

Overall, the management potential for the City of Santa Rosa was evaluated as moderate. Multiple factors received moderate-high or high rankings, including having an **existing mandate**, the organization's **ability to learn and change**, and **partner relationships**. **Monitoring & evaluation capacity** received a low adaptive capacity ranking while **science/technical support** and **implementation ability** received moderate rankings.

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### *Overall vulnerability*

Altered natural habitats, increased water use/demand and power outages, and increased need for coordination were ranked by breakout group participants as having high vulnerability due to extreme risk (*almost certain likelihood x major consequence*) and moderate adaptive capacity. Limited locations to build affordable housing due to more areas in fire/flood hazard zones received a moderate vulnerability ranking (*high risk x moderate adaptive capacity*), which was primarily driven by a moderate consequence ranking (see Table 1 for comparison of vulnerability rankings).

**Table 1.** Vulnerability assessment ranking results for effects/impacts of greatest concern for Land Use.

| Effects/Impacts of Greatest Concern | Likelihood | Consequence | Risk | Adaptive Capacity | Vulnerability |
|---|---|---|---|---|---|
| Altered natural habitats (e.g., terrestrial, aquatic), with implications for urban forests | Almost Certain | Major | Extreme | Moderate | High |
| Increased water use and demand and power outages | Almost Certain | Major | Extreme | Moderate | High |
| Increased need for coordination (prevention, response, recovery), which is expensive and time-consuming and further taxes staff capacity | Almost Certain | Major | Extreme | Moderate | High |
| Limited locations to build affordable housing due to more areas in fire/flood hazard zones | Almost Certain | Moderate | High | Moderate | Moderate |

## PROPOSED ADAPTATION STRATEGIES AND IMPLEMENTATION PLANS

### *Adaptation strategies for effects of greatest concern*

Breakout group participants identified adaptation strategies for Land Use ranging from **programmatic** (e.g., implementing micro-grids) to **improving knowledge** (e.g., mapping

natural habitat and hazards and overlaying with development and planning) to **creating new regulations** (e.g., require rooftop solar on all new buildings to be net zero energy use). The following table summarizes possible adaptation strategies in response to effects of greatest concern identified by breakout group participants (Table 2).

**Table 2.** Identified effects of greatest concern and possible adaptation strategies for Land Use.

| Effects of greatest concern | Adaptation strategies to reduce vulnerabilities |
|---|---|
| Altered natural habitats (e.g., terrestrial, aquatic), with implications for urban forests | • Plant with climate ready species, as needed and appropriate<br>• Promote more planting with climate ready species<br>• Map natural habitat & hazards and overlay with development and planning; pair with hazard mitigation plan, CEQA |
| Increased water use and demand and power outages | • Implement micro-grids (under 30 homes), starting with remote areas<br>• Implement water conservation and land use design that supports water conservation<br>• Ensure utilities have greater priority on energy grid (e.g., water delivery)<br>• Utilize finer-scale rolling blackouts to avoid vulnerable or hazardous locations (e.g., smart grid reclosure system - disconnect pole at neighborhood level)<br>• Increase municipal utility ownership of power infrastructure<br>• Require rooftop solar on all new buildings to be net zero energy use<br>• Apply distributed utility concept to water, locally recycled water, capture, and storage (e.g., cisterns) |
| Increased need for coordination (prevention, response, recovery), which is expensive and time-consuming and further taxes staff capacity | • Designate City climate lead with standing climate team representing all departments and engaging in regular public meetings with policymakers<br>• Join Urban Sustainability Directors Network (USDN), ICLEI-Local Governments for Sustainability, and/or Water Utility Climate Alliance (WUCA)<br>• Review all project programs to synergize between them, including coordinating and leveraging outreach events |
| Limited locations to build affordable housing due to | • Map natural habitat & hazards and overlay with development and planning; pair with hazard mitigation plan, CEQA |

| | |
|---|---|
| more areas in fire/flood hazard zones | |

### *Implementation plans for priority strategies*

Breakout group participants selected five priority adaptation strategies, and developed implementation plans for each:

1. Plant with climate ready species, as needed and appropriate.

   *How to implement*: As part of infrastructure renewal, create complete streets with more plantings; consider/implement Water Efficient Landscape Ordinance (WELO) rule enhancements to include climate-adapted species

   *Leads & partners*:

   *Leads*: Public Works, Planning & Economic Development, Water

   *Partners*: Landscape architects, environmental consultants, California Department of Water Resources (WELO), Daily Acts (planting)

   *Resources & barriers*: Species list (including research to back it up), planting and maintenance guidance, explore possibility of creating a new department to lead

   *Efficacy*: High

   *Potential for Success*: High

2. Designate City climate lead with standing climate team representing all departments and engaging in regular public meetings with policymakers

   *How to implement*: City department present case to City Council for adding a position; part of a sustainable staff funding solution

   *Leads & partners*:

   *Leads*: City Manager's Office or Planning & Economic Development

   *Partners*: All other City departments, Friends of the Climate Action Plan, Regional Climate Protection Authority (RCPA)

   *Resources & barriers*: Provision in the 2012 Community Climate Action Plan designating this position plus implementation team (Brown Act challenged a previous iteration of this team)

   *Efficacy*: High

   *Potential for Success*: Moderate to High (funding is a limited factor)

3. Implement micro-grids

   *How to implement*: Integrate into Land Use, Public Services, Economic Vitality elements of the General Plan; add code requirement in new development (multi-family or subdivision); offer tax credits for contributing to a micro-grid; create Santa Rosa Municipal Micro-grid, perhaps as part of a municipal utility

   *Leads & partners*:

   *Leads*: City, County, Sonoma Clean Power

   *Partners*: Healdsburg Municipal Utility (can provide advice or expansion), PG&E, other micro-grids

   *Resources & barriers*: Santa Rosa Junior College already creating a micro-grid

   *Efficacy*: High

   *Potential for Success*: High

4. Map natural habitats and hazards and overlay with development and planning, including affordable housing, in order to identify where and where not to build

   *How to implement*: Use to inform retrofitting priorities or elevated code requirements

   *Leads & partners*:

   *Leads*: Planning & Economic Development, IT (GIS mapping), Santa Rosa Fire

   *Partners*: Sonoma County (Hazard Mitigation Plan), consultants and researchers, Metropolitan Transportation Commission Association of Bay Area Governments (MTC ABAG; housing and hazard areas), CAL FIRE

   *Resources & barriers*: Likely challenges regarding takings, but having layers mapped will help inform priorities

   *Efficacy*: High

   *Potential for Success*: High

5. Develop strategy to address buy-outs or Transfer of Development Rights credits to property owners in hazard zones

   *How to implement*: Land Use element of General Plan; upgrades funds from "offsets"

   *Leads & partners*:

   *Leads*: Planning & Economic Development, City attorney's office

   *Partners*: Developers, advocacy groups to promote and publicize

*Resources & barriers*: Funding, political support (barrier/challenge)

*Efficacy*: High

*Potential for Success*: Low to Moderate

## Economic Vitality

This element considers economic activity and opportunities, including employment, housing, and retail, office, industrial, hotel, and other markets. The timeframe used for this assessment was the life of the General Plan (i.e., next 25–30 years) as well as the longer time horizons (i.e., 50–100 years) of some of the results of the Plan and local land use planning (e.g., infrastructure, facilities).

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### VULNERABILITY ASSESSMENT

#### *Summary of observed and/or anticipated effects of climate stressors and pre-existing conditions*

**Extreme storm events/flooding**, **drought and extreme/prolonged heat**, and **wildfire** were identified by breakout group participants as the climate stressors that have the most significant impacts on Economic Vitality.

**Aging infrastructure**, **disadvantaged communities/racial inequity**, and **homelessness/lack of affordable housing** were identified by participants as the primary pre-existing conditions that impact Economic Vitality.

#### Climate stressors[9]

*Extreme storm events and flooding* are likely to disrupt commercial activity and commuting and deplete community financial resources and reserves, further exacerbating staffing issues. Additionally, participants identified that litigation of disaster events is not sustainable in the long-term.

*Drought and extreme/prolonged heat* are likely to lead to altered food production at the regional level and deplete community financial resources and reserves.

*Wildfire* is also likely to deplete community financial resources and reserves and have significant impacts on agriculture and tourism.

#### Pre-existing conditions[10]

*Aging infrastructure* causes disruptions to businesses (e.g., from failure and during repairs) and increases costs of development. Additionally, there is a lack of funding for

[9] The information described in this section comes directly from discussions during breakout group activities.

[10] The information described in this section comes directly from discussions during breakout group activities.

retrofits, there are gaps between past and current needs, and technical personnel is needed for redesign and maintenance.

*Disadvantaged communities/racial inequity* results in lack of access to capital for businesses and residents in disadvantaged communities, resulting in decreased services, lack of work opportunities, and burden of access to services falling to disadvantaged individuals and communities.

*Homelessness/lack of affordable housing* makes it difficult to find appropriate locations for housing and services (e.g., city-centered rather than sprawl as increased density has historically been used to address need), enhances NIMBY ('not in my backyard') sentiments, and can lead to a mismatch between the workers needed and the housing available.

### Combined impacts of pre-existing conditions and climate stressors[11]

Climate change is likely to exacerbate the impacts of or be exacerbated by all three pre-existing conditions for Economic Vitality. Breakout group participants identified challenges including:

- Extreme events (e.g., flooding, fire, drought) combined with aging infrastructure will exacerbate existing damages, failures, and/or insufficiencies (e.g., with water, roads, or communications infrastructure).
- Extreme events combined with any of the pre-existing conditions will result in funds being used to address response rather than ameliorating pre-existing conditions.
- Increased drought and extreme/prolonged heat will increase demands on an aging electric grid, resulting in no electricity to operate wells and loss of internet and communications to support businesses and the economy.
- Increased frequency of wildfires will lead to more exposure to smoke, direct injury, and/or increased medical costs for disadvantaged communities.
- Increased frequency extreme events (e.g., flooding, fire) could lead to increased costs of building after the event, making it harder to build affordable housing.
- Increased drought and extreme/prolonged heat will place a greater demand on services already lacking in disadvantaged communities, including homeless (e.g., cooling centers, medical, public libraries, businesses, fairgrounds/veterans building) and lead to increased cost of cooling in affordable housing units, making them unaffordable.

[11] The information described in this section comes directly from discussions during breakout group activities.

- Increased drought and extreme/prolonged heat will result in fewer hours of work for outside workers and could increase medical costs (e.g., due to heat-related illness or injury).
- Increased extreme events/flooding will significantly impact disadvantaged communities and homeless populations, as they are often located in hazard areas. Disadvantaged communities that experience repeated hazards and subsequent rebuilding further lowers the wealth of those communities.

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*Summary of adaptive capacity*

Overall, breakout group participants evaluated the adaptive capacity of Santa Rosa departments and organizations relevant to Economic Vitality as **moderate**. While not ranked for adaptive capacity, many additional organizations were identified that play a role in Economic Vitality, including Santa Rosa Metro Chamber, Hispanic Chamber of Commerce of Sonoma County, downtown developers (e.g., Cornerstone, Futrell), major employers (e.g., Sonoma County, Santa Rosa Junior College [SRJC], Keysight, Kaiser/Sutter/Providence Health, cannabis), affordable housing developers (e.g., Burbank Housing, Bridge Housing), Sonoma Land Trust, Sonoma County Agricultural Preservation & Open Space District, Sonoma Clean Power, Metropolitan Transportation Commission Association of Bay Area Governments (MTC ABAG), Regional Climate Protection Authority and Sonoma County Transportation Authority Measure DD funds, education and re-training programs (e.g., SRJC, union and non-union apprenticeship programs, Bay Area Council), The Great Day Labor Center, and North Bay Jobs with Justice.

### Organizational potential

Overall, the organizational potential of the City of Santa Rosa was evaluated as moderate. Organization **responsiveness** and **existing stakeholder relationships** were both evaluated as moderate-high, while stability/longevity was moderate. Existing **staff capacity** also received an overall moderate ranking, but participants highlighted the difference between staff time (low ranking) compared with training (moderate-high ranking).

### Management potential

Overall, the management potential for the City of Santa Rosa was evaluated as moderate. Multiple factors received moderate-high or high rankings, including having an **existing mandate**, the organization's **ability to learn and change**, and **partner relationships**. **Monitoring & evaluation capacity** received a low adaptive capacity ranking while **science/technical support** and **implementation ability** received moderate rankings.

### *Overall vulnerability*

Increased cost of building after flooding/fire, greater demand on services already lacking in disadvantaged communities, altered food production, and depletion of community financial resources and reserves were ranked by breakout group participants as having high vulnerability due to extreme risk (*almost certain likelihood x major consequence*) and moderate adaptive capacity. Damage to infrastructure received a moderate vulnerability ranking (*high risk x moderate adaptive capacity*), which was primarily driven by a moderate consequence ranking (see Table 3 for comparison of vulnerability rankings).

**Table 3.** Vulnerability assessment ranking results for effects/impacts of greatest concern for Economic Vitality.

| Effects/Impacts of Greatest Concern | Likelihood | Consequence | Risk | Adaptive Capacity | Vulnerability |
|---|---|---|---|---|---|
| Increased cost of building after flooding/fire makes it more difficult to build affordable housing | Almost Certain | Major | Extreme | Moderate | High |
| Greater demand on services already lacking in disadvantaged communities (cooling center, medical, public libraries, businesses, fairgrounds/veterans building) | Almost Certain | Major | Extreme | Moderate | High |
| Damage to infrastructure, including roads, utilities, water system, and communication | Almost Certain | Moderate | High | Moderate | Moderate |

| Effects/Impacts of Greatest Concern | Likelihood | Consequence | Risk | Adaptive Capacity | Vulnerability |
|---|---|---|---|---|---|
| Altered food production at the regional level (i.e., increased food cost and GHG footprint; damage to cannabis, wine production, and culinary centers; decreased tourism) | Almost Certain | Moderate to Major | High to Extreme | Moderate | High |
| Depletion of community financial resources and reserves, which further exacerbates staffing issues and ability to respond to impacts | Almost Certain | Major | Extreme | Moderate | High |

## PROPOSED ADAPTATION STRATEGIES AND IMPLEMENTATION PLANS

### *Adaptation strategies for effects of greatest concern*

Breakout group participants identified adaptation strategies for Economic Vitality ranging from **programmatic** (e.g., use churches, schools, or electric school buses as cooling centers) to **improving knowledge** (e.g., conduct a regional agricultural economic assessment to identify where the climate is shifting and what should be the new regional focus) to **creating new policies** (e.g., require infrastructure efficiency assessment prior to development). The following table summarizes possible adaptation strategies in response to effects of greatest concern identified by breakout group participants (Table 4).

**Table 4.** Identified effects of greatest concern and possible adaptation strategies for Economic Vitality.

| Effects of greatest concern | Adaptation strategies to reduce vulnerabilities |
|---|---|
| Increased cost of building after flooding/fire makes it more difficult to build affordable housing | • Map natural habitat and hazards and overlay with development and planning, including affordable housing, to identify where and where not to build |

| | |
|---|---|
| | • Develop strategy to address buy-out or transfer of development right (TDR) credits to property owners in hazard zones<br>• Incentivize or simplify safe space development to disincentivize building in hazard-prone locations |
| Greater demand on services already lacking in disadvantaged communities (cooling center, medical, public libraries, businesses, fairgrounds/veterans building) | • Prioritize placement of services where needed most, and place more anchor institutions in those locations or increase capacity of existing institutions<br>• Reduce impact fees, streamline permits or other incentives for private development, and explore additional incentives to support local business by community members<br>• Use churches, schools, or electric school buses as cooling centers, and include cooling in community centers in affordable housing developments |
| Damage to infrastructure, including roads, utilities, water system, and communication | • Implement micro-grids<br>• Keep infrastructure out of harm's way<br>• Design rebuilds to mitigate future risk of damage and meet future need<br>• Require total cost of ownership over lifetime (build, maintenance, secondary effects)<br>• Require infrastructure efficiency assessment prior to development (water, energy, transit), with review across departments |
| Altered food production at the regional level (i.e., increased food cost and GHG footprint; damage to cannabis, wine production, and culinary centers; decreased tourism) | • Facilitate gleaning for local economic vitality (e.g., value added products) and food security<br>• Conduct a regional agricultural economic assessment to identify where the climate is shifting and what should be the new regional focus |
| Depletion of community financial resources and reserves, which further exacerbates staffing issues and ability to respond to impacts | • Foster entrepreneurial solutions to addressing challenges related to depletion of community financial resources and reserves<br>• Identify public-private partnership opportunities<br>• Public and community entities re-establish reserves |

### *Implementation plans for priority strategies*

Breakout group participants selected five priority adaptation strategies, and developed implementation plans for each:

1. Prioritize placement of services where most needed

   *How to implement*: Through General Plan and/or Zoning Code amendments and financial incentives (e.g., see "reduce impact fees, streamline permits or other incentives" strategy).

   *Leads & partners*:

   *Leads*: Planning & Economic Development, Housing & Community Services

   *Partners*: non-profits that provide services for underserved people, consultants working on ERIs

   *Resources & barriers*: GIS mapping to identify location of current services overlaid with climate hazard vulnerability (regularly updated)

   *Efficacy*: Moderate to High

   *Potential for Success*: High

2. Design rebuilds to ameliorate future risk of damage and meet future need

   *How to implement*: Public Services, Transportation/Circulation, Noise & Safety elements; local hazard mitigation plans; Measure DD transportation funds should include this in application

   *Leads & partners*:

   *Leads*: City, County, and State agencies; private utilities

   *Partners*: federal funding and guidelines for funding, insurance companies, foundation grants

   *Resources & barriers*: local hazard mitigation plans should have identified risks; Public Works and Water Departments are assessing (good to share resources when completed); need funds and code to create; new FEMA hazard mitigation funds

   *Efficacy*: High

   *Potential for Success*: Moderate (political will exists but lacks funding)

3. Require total cost of ownership over lifetime (build, maintenance, secondary effects)

   *How to implement*: The City could require this as part of permitting or expenditure release; need to create formula (State has some and Sonoma and Santa Rosa Water

have to do this already); Council mandates; leverage/use for accountability and tax changes

*Leads & partners*:

*Leads*: Public Works, Planning & Economic Development, Finance, developers, City Council has to mandate

*Partners*: developers

*Resources & barriers*: need policy development to include ramifications of the assessment results and how it affects decision making; consider examples such as: do we need new gas stations?; include bonds for decommissioning and clean up, and rapid chargers

*Efficacy*: Moderate to High

*Potential for Success*: Moderate

4. Reduce impact fees, streamline permits or other incentives for private development, create additional incentives to support local businesses by community members

*How to implement*: Land Use and Economic Vitality elements; economic development organization in coordination with permitting office

*Leads & partners*:

*Leads*: economic development organization in coordination with permitting office

*Partners*: City Council, private developers, public

*Resources & barriers*: need economic assessment that demonstrates the benefits of reducing impact fees and other incentives; public-private partnership development with federal funding

*Efficacy*: High

*Potential for Success*: High (has been used to develop downtown)

5. Conduct a regional agricultural economic assessment to identify where the climate is shifting and what should be the new regional focus

*How to implement*: Partnership between local colleges, Regional Climate Protection Authority, and County agriculture; Santa Rosa Economic Development Team; Economic Vitality element (do this type of climate assessment on a decadal basis, maybe even in County Hazard Plan or General Plan)

*Leads & partners*:

*Leads*: partnership between local colleges, Regional Climate Protection Authority, and County agriculture; Santa Rosa Economic Development Team

*Partners*: agricultural businesses, agriculture affinity group (including wine, cannabis), environmental groups, worker groups, job development groups, Daily Acts

*Resources & barriers*: carbon districts to support regenerative agriculture

*Efficacy*: Moderate

*Potential for Success*: Moderate (limiting factor: staffing) to High (if outside lead)

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## Housing

This element considers housing availability (including availability of affordable housing), as well as access to residential areas and maintenance of necessary utilities and comfortable conditions in and around housing units. The timeframe used for this assessment was the life of the General Plan (i.e., next 25–30 years) although longer time horizons (i.e., 50–100 years) were also considered.

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### VULNERABILITY ASSESSMENT

#### *Summary of observed and/or anticipated effects of climate stressors and pre-existing conditions*

**Extreme/prolonged heat, extreme storm events and flooding**, and **wildfire** were identified by breakout group participants as the climate stressors that have the most significant impacts on Housing.

**Public services**, **disadvantaged/vulnerable communities**, and **racial inequity** were identified by participants as the primary pre-existing conditions that impact Housing.

#### Climate stressors[12]

*Extreme/prolonged heat* is likely to increase the need for cooling centers and trees or other shade cover around homes, particularly for residents who do not have access to air conditioning and/or households whose power is shut off. Water use may increase during periods of extreme heat, creating or exacerbating conflicts between residential water needs and water needed for other uses (like agriculture). Extreme heat is also associated with increased risk of wildfire.

*Extreme storms and flooding* are likely to cause damage or loss of homes, requiring significant resources to help with clean up as well as replacement of stored food and other items. Loss of jobs or business income associated with extreme events may also increase housing insecurity in the community.

*Wildfire* is likely to cause direct loss of housing units, and more frequent fires may dissuade future development due to increased risk. Following severe fires, repair and/or replacement of homes may be delayed due to lack of workers/contractors and building supplies; residents may also be vulnerable to fraudulent contractors and rent gouging. Smoke can significantly impact homes without adequate air

[12] The information described in this section comes directly from discussions during breakout group activities.

filtration/ventilation, and wildfire is likely to be associated with increased respiratory illnesses and other physical or mental health problems.

### Pre-existing conditions[13]

*Public services (e.g., utilities, public transportation)* are critical to maintain power supply to residential areas, provide community centers/shelters during extreme events, and allow residents to evacuate if needed.

*Disadvantaged/vulnerable communities (in terms of age, race, health, income, education, and other factors)* often have less access to health care, fewer financial and material resources (i.e., for home repair), and may lack transportation. These existing inequities mean that people within disadvantaged communities are more likely to have chronic health issues. They are also likely to be more dependent on community centers/shelters, though language barriers may pose a problem for some people trying to access needed community resources and services.

*Racial inequity* results in discriminatory practices related to lending and rental opportunities, among other impacts.

### Combined impacts of pre-existing conditions and climate stressors[14]

Climate change is likely to exacerbate the impacts of or be exacerbated by all three pre-existing conditions for Housing. Breakout group participants identified challenges including:

- Flooding and wildfire are likely to exacerbate existing housing instability, particularly for disadvantaged communities that may lack insurance and be less able to repair or replace damaged homes and belongings. Disadvantaged communities are also more likely to experience rent gouging due to language barriers or other factors.
- More extreme events (e.g., heat, storms/flooding, wildfire) may cause disruptions in water and power supplies, and are likely to increase the need for public services (e.g., cooling centers and emergency shelters, access to parks/shaded areas).
- Damage to roads or other transportation infrastructure as a result of flooding or other extreme events may affect emergency access and evacuation routes, particularly for isolated neighborhoods. Disadvantaged communities may also

[13] The information described in this section comes directly from discussions during breakout group activities.

[14] The information described in this section comes directly from discussions during breakout group activities.

not have access to transportation when they need to evacuate, and may not have the financial resources to pay for temporary accommodations like a hotel.
- Within evacuation shelters, some communities may experience discrimination and racism (e.g., LGBTQ communities, undocumented immigrants). Additionally, evacuation materials and other resources may not be translated into other languages, preventing non-English speakers from easily accessing emergency resources.
- Existing healthcare inequities related to race or other factors may result in more physical and mental health issues in people whose housing is impacted by extreme events (i.e., due to less access to care).
- Existing patterns of inequity mean that many communities have less access to resources that would help them deal with extreme heat.
- Generally, a lack of partners (e.g., community agencies and other sources of information) that are trusted by disadvantaged communities increases vulnerability to extreme events.

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*Summary of adaptive capacity*

Overall, breakout group participants evaluated the adaptive capacity of Santa Rosa departments and organizations relevant to Housing as **high**. While not ranked for adaptive capacity, several additional organizations were identified that play a role in Housing, including Santa Rosa Together, Santa Rosa Fire Department, Daily Acts, North Bay Organizing Project Tenant's Union, Housing Action, and Generation Housing.

### Organizational potential

Overall, the organizational potential of the City of Santa Rosa was evaluated as moderate. Organization **stability/longevity** was evaluated as high, while **staff capacity** and **responsiveness** were both evaluated as moderate. Existing **stakeholder relationships** received a low ranking.

### Management potential

Overall, the management potential for the City of Santa Rosa was evaluated as high. Multiple factors received high rankings, including having an **existing mandate**, **capacity for monitoring and evaluation**, the organization's **ability to learn and change**, and **science/technical support**. The only factor that received a moderate ranking was **partner relationships**.

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### *Overall vulnerability*

Loss of housing units and lack of power/disruption of power supply were ranked by breakout group participants as having moderate vulnerability. Risk was ranked as extreme for loss of housing units (*almost certain likelihood x major consequence*) and as high lack of power/disruption of power supply (*almost certain likelihood x moderate consequence*). Exacerbation of existing housing instability for disadvantaged communities received a low vulnerability ranking (*moderate risk x high adaptive capacity*), due to a moderate risk ranking *(likely x moderate consequence)* and high adaptive capacity (see Table 5 for comparison of vulnerability rankings).

**Table 5.** Vulnerability assessment ranking results for effects/impacts of greatest concern for Housing.

| Effects/Impacts of Greatest Concern | Likelihood | Consequence | Risk | Adaptive Capacity | Vulnerability |
|---|---|---|---|---|---|
| Loss of housing units | Almost Certain | Major | Extreme | High | Moderate |
| Lack of power/disruption of power supply | Almost Certain | Moderate | High | High | Moderate |
| Exacerbation of existing housing instability for disadvantaged communities | Likely | Moderate | Moderate | High | Low |

## PROPOSED ADAPTATION STRATEGIES AND IMPLEMENTATION PLANS

### *Adaptation strategies for effects of greatest concern*

Breakout group participants identified adaptation strategies for Housing ranging from **programmatic** (e.g., creating resilience hubs) and **regulatory** (e.g., revising zoning and building codes to reflect climate-driven increases in risk) to **improving collaboration** (e.g., working with partners across the region to ensure that vulnerable people are not pushed out of the community following extreme events). The following table summarizes possible adaptation strategies in response to effects of greatest concern identified by breakout group participants (Table 6).

**Table 6.** Identified effects of greatest concern and possible adaptation strategies for Housing.

| Effects of greatest concern | Adaptation strategies to reduce vulnerabilities |
|---|---|
| Loss of housing units | • Revise zoning and building codes to reflect climate-driven increases in risk and promote solutions<br>  o Require appropriate construction/defensive measures in residential areas<br>  o Discourage (e.g., through disincentives such as increased taxes or higher insurance costs) and/or prohibit new development in high-risk areas<br>  o Increase density rather than urban footprint to limit increases in fire danger (e.g., "build up not out) and ensure new development is near existing transit<br>  o Support managed retreat from high-risk areas by creating incentive<br>• Conduct public education/outreach campaign for city residents to learn about defensible space, rain gardens, etc. to support adoption of these measures for areas that are already at higher risk<br>• Increase public awareness of existing programs that help residents fund housing retrofits that increase resilience to fires and floods (e.g., elevate homes in flood zones)<br>• Ensure adequate fire response and water availability in high-risk areas<br>• Promote the use of native plants that are better suited for water absorption, fire, etc.<br>• Create additional parks in beautiful areas that are at high risk of wildfire in order to increase accessibility of those lands for all rather than just the wealthy that can afford to live there as true costs increase |
| Lack of power/disruption of power supply | • Decentralize power supplies (e.g., through microgrids, more places to plug in)<br>• Continue to expand policies and programs (e.g., Sonoma County PACE Financing) that help finance on-site battery storage for residential solar arrays<br>• Underground power lines to reduce risk of wildfire<br>• Support community solar grids<br>• Create resilience hubs (e.g., in schools, hospitals) |

| | |
|---|---|
| Exacerbation of existing housing instability for disadvantaged communities | • Ensure that programs meant to house people consider availability of transportation and other services that will enable people to evacuate and respond to extreme events (ex: tiny house community designed for homeless community did not have transportation access to evacuate during fire)<br>• Improve regional collaboration to ensure that vulnerable people are not just pushed out of the community and into a different one |

### *Implementation plans for priority strategies*

Breakout group participants selected three priority adaptation strategies, and developed implementation plans for each:

1. Revise zoning and building codes to reflect climate-driven increases in risk and promote solutions

   *How to implement*: Possible approaches include:

   a. Require appropriate construction/defensive measures in residential areas
   b. Discourage (e.g., through disincentives such as increased taxes or higher insurance costs) and/or prohibit new development in high-risk areas
   c. Increase density rather than urban footprint to limit increases in fire danger (e.g., "build up not out"), and ensure new development is near existing transit
   d. Support managed retreat from high-risk areas by creating incentives for residents who relocate from high wildfire risk areas

   *Leads & partners*:

   *Partners*: Planning Division; Sustainability Coordinator in the Water Department (possibly); Fire Department; Building Division; City Council; Sonoma County Regional Climate Protection Authority (RCPA)

   *Resources & barriers*: Would connect with the existing Community Wildfire Protection Plan, Hazard Mitigation Plan, and sections of the Zoning Code related to environmental issues; requires coordination across City departments and approval by City Council (politics may prove to be a barrier to these processes)

   *Efficacy*: High

   *Potential for Success*: Moderate to High (depending on political will)

2. Decentralize power supplies

   *How to implement*: Use microgrids, install more places to plug in

   *Leads & partners*:

   *Partners*: Sonoma County Property Assessed Clean Energy (PACE) Financing; Sonoma Clean Power; Sonoma County RCPA

   *Resources & barriers*: Climate Center may act as a resource

   *Efficacy*: High

   *Potential for Success*: Moderate

3. Ensure that programs meant to house people consider availability of transportation and other services that will enable people to evacuate and respond to extreme events

   *How to implement*: Local/state/federal representatives could lobby for funding

   *Leads & partners*:

   *Partners*: Sonoma County RCPA; Sonoma County Transportation Authority (SCTA); CityBus; school bus system; fairgrounds

   *Resources & barriers*: Santa Rosa Junior College already creating a micro-grid

   *Efficacy*: Moderate to High

   *Potential for Success:* Moderate

## Environmental Justice

The environmental justice element identifies objectives and policies that reduce the health risks in disadvantaged communities; promotes civic engagement in the public decision-making process; and prioritizes improvements and programs that address the needs of disadvantaged communities. The timeframe used for this assessment was the life of the General Plan (i.e., next 25–30 years) although longer time horizons (i.e., 50–100 years) were also considered.

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### VULNERABILITY ASSESSMENT

#### *Summary of observed and/or anticipated effects of climate stressors and pre-existing conditions*

**Extreme/prolonged heat, extreme storm events/flooding**, and **wildfire** were identified by breakout group participants as the climate stressors that have the most significant impacts on Environmental Justice.

**Public services (e.g., utilities, public transportation)**, **community health**, and **racial inequity** were identified by participants as the primary pre-existing conditions that impact Environmental Justice.

#### Climate stressors[15]

*Extreme/prolonged heat* is likely to exacerbate the impacts of air pollution on hot days, which is likely to disproportionately affect disadvantaged communities. Members of disadvantaged communities are more likely to have outdoor jobs where exposure to extreme heat (and air pollution) is higher. Residential areas within these communities tend to have fewer sidewalks and less shade/tree cover, creating urban heat islands.

*Extreme storms and flooding* are likely to exacerbate existing housing instability, and disadvantaged communities are more vulnerable to sudden financial disruption due to unexpected home repairs, job losses, or other costs associated with storm/flood damage. More frequent extreme events would also likely result in additional school closures, which increase stress for young people.

*Wildfire* is likely to increase exposure to smoke in people who work outdoors or who have inadequate ventilation systems, in addition to all of the impacts noted above for extreme storms and flooding.

[15] The information described in this section comes directly from discussions during breakout group activities.

### Pre-existing conditions[16]

*Public services (e.g., utilities, public transportation)* are critical for disadvantaged communities, who may be more reliant on these services. For instance, many people lack cars, and so are impacted to a greater degree by public transportation systems that are slow or inefficient (e.g., do not take people where they need to go). Disadvantaged communities may also have more difficulty paying for utilities and have less access to parks and other green spaces. Students learning from home (particularly during COVID) may lack broadband access, limiting their ability to participate in school.

*Community health (including physical and mental health)* is impacted by disproportionate amounts of stress and trauma experienced by disadvantaged communities, which can result from factors such as reduced access to healthy food, increased exposure to air pollution (particularly near major transport corridors or industrial areas), increased likelihood of job-related exposure to pesticides and other hazards, and difficulty accessing health care. Members of disadvantaged communities may also deal with additional stigma around accessing mental health services. COVID-19 has caused additional pressures (including mental health problems) for young people in the community, particularly those who lack broadband access and people who may not have access to food when school meals are not available. Some young people in disadvantaged communities are also facing overcrowding within homes where there is no quiet place to learn and disease may spread more easily.

*Racial inequity* contributes to a general lack of trust by communities of color that have been targeted or discriminated against within the City or region. People of color also often experience disenfranchisement and lack of representation within decision-making processes.

### Combined impacts of pre-existing conditions and climate stressors[17]

Climate change is likely to exacerbate the impacts of or be exacerbated by all three pre-existing conditions for Environmental Justice. Breakout group participants identified challenges including:

- Greater health impacts during extreme events (e.g., heat waves, flooding, wildfire) for people with chronic/pre-existing health issues due to environmental

[16] The information described in this section comes directly from discussions during breakout group activities.

[17] The information described in this section comes directly from discussions during breakout group activities.

exposure, stress, or trauma. For instance, respiratory illnesses may become more problematic for outdoor workers who are exposed to smoke.

- Increased exposure to extreme heat for people dependent on public transportation, as well as those that lack air conditioning in their home and/or access to cooling centers. Low-income households are also more vulnerable to high electricity bills and/or utility shutoffs due to non-payment, and are likely to experience greater financial and health impacts if food and medications are lost during power outages.
- People who are dependent on public transportation may have difficulty evacuating during severe floods, and disadvantaged communities are more likely to be impacted by declines in water quality following major flood events.
- People within rental homes that are not maintained properly are more vulnerable to mold, which will likely increase as flood events become more frequent and more severe.
- Some community members may be hesitant to use community shelters or other services during extreme events due to concerns about being targeted or discriminated against (i.e., due to race or immigration status, among other possibilities).

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### *Summary of adaptive capacity*

Overall, breakout group participants evaluated the adaptive capacity of Santa Rosa departments and organizations relevant to Environmental Justice as **high**. While not ranked for adaptive capacity, several additional organizations were identified that play a role in Environmental Justice, including North Bay Organizing Project, Alliance for a Just Recovery, Sonoma County Conservation Council, Sonoma County Conservation Action, Land Paths, Generation Housing, and Latinx service providers generally.

#### Organizational potential

Overall, the organizational potential of the City of Santa Rosa was evaluated as moderate. Organization **stability/longevity** and **staff capacity** were evaluated as high, while **responsiveness** was evaluated as moderate. Existing **stakeholder relationships** received a low ranking.

#### Management potential

Overall, the management potential for the City of Santa Rosa was evaluated as high. Multiple factors received high rankings, including having an **existing mandate**, **capacity for monitoring and evaluation**, the organization's **ability to learn and change**, and **science/technical support**. The only factor that received a moderate ranking was **partner relationships**.

### *Overall vulnerability*

Increased vulnerability to sudden financial disruption, stress related to school closures, impacts of stress and trauma on people with chronic/pre-existing health conditions, loss of food/medication during fires/power outages, and hesitancy to use community resources were all ranked by breakout group participants as having moderate vulnerability due to extreme risk (*almost certain likelihood x major consequence*) and high adaptive capacity (see Table 7 for comparison of vulnerability rankings).

**Table 7.** Vulnerability assessment ranking results for effects/impacts of greatest concern for Environmental Justice.

| Effects/Impacts of Greatest Concern | Likelihood | Consequence | Risk | Adaptive Capacity | Vulnerability |
|---|---|---|---|---|---|
| Increased vulnerability to sudden financial disruption following floods and fires due to unexpected home repair, job loss, etc. | Almost Certain | Major | Extreme | High | Moderate |
| School closures and associated increases in stress for young people during high fire risk | Almost Certain | Major | Extreme | High | Moderate |
| Greater impact of stress and trauma on people with chronic/preexisting health issues | Almost Certain | Major | Extreme | High | Moderate |
| Loss of food and medications during fires or associated power outages | Almost Certain | Major | Extreme | High | Moderate |
| Hesitancy to use community resources (e.g., services, shelters) due to concerns about being targeted for | Almost Certain | Major | Extreme | High | Moderate |

| | | | | | |
|---|---|---|---|---|---|
| discrimination or immigration status | | | | | |

## PROPOSED ADAPTATION STRATEGIES AND IMPLEMENTATION PLANS

### *Adaptation strategies for effects of greatest concern*

Breakout group participants identified adaptation strategies for Environmental Justice ranging from **programmatic** (e.g., providing quiet study locations for young people) and **policy-related** (e.g., advocate for improved management of state-level job loss programs) to **improving collaboration** (e.g., strengthen linkages with local organizations that are connected to vulnerable communities). The following table summarizes possible adaptation strategies in response to effects of greatest concern identified by breakout group participants (Table 8).

**Table 8.** Identified effects of greatest concern and possible adaptation strategies for Environmental Justice.

| Effects of greatest concern | Adaptation strategies to reduce vulnerabilities |
|---|---|
| Increased vulnerability to sudden financial disruption following floods and fires due to unexpected home repair, job loss, etc. | • Identify vulnerable individuals to allow neighborhood groups to reach out and check on them<br>• Advocate for improved management of state-level job loss programs (e.g., need timely unemployment checks)<br>• Reach out to vulnerable populations to help them understand available resources and how to access them |
| School closures and associated increases in stress for young people during high fire risk | • Provide quiet study locations for young people to receive support and access the internet<br>• Make libraries more welcome to young people (esp. high school students) |
| Greater impact of stress and trauma on people with chronic/preexisting health issues | • Ensure access to shelters and health care (mental and physical)<br>• Identify vulnerable individuals (e.g., people with chronic health issues) to allow neighborhood groups to reach out and check on them |
| Loss of food and medications during fires or associated power outages | • Identify vulnerable individuals (e.g., people with chronic health issues) to allow neighborhood groups to reach out and check on them |
| Hesitancy to use community resources (e.g., services, | • Strengthen linkage with non-profits, faith organizations, food banks, community gardens, neighborhood |

| | |
|---|---|
| shelters) due to concerns about being targeted for discrimination or immigration status | associations, schools, and other local organizations that are connected to vulnerable communities and can work together to increase climate resilience<br>• Identify vulnerable individuals (e.g., people with chronic health issues) to allow neighborhood groups to reach out and check on them<br>• Tailor method of communication to the community (e.g., expand beyond email to WhatsApp and other methods that are already used and accepted)<br>• Reach out to vulnerable populations to help them understand available resources and how to access them |

### *Implementation plans for priority strategies*

Breakout group participants selected five priority adaptation strategies, and developed implementation plans for each:

1. Provide quiet study locations for young people to receive support and access the internet

   *How to implement*: Consider utilizing churches, community centers, restaurants, libraries, and/or parks to provide meals and space; ensure that in-person services are being provided. It is also critical to communicate using channels that will reach young people, and to involve youth in the process of developing these programs and locations in order for it to be successful.

   *Leads & partners*:

   *Leads*: City of Santa Rosa (might be able to coordinate partners)

   *Partners*: Community Engagement Department, Regional Library Commission, Sonoma County Office of Education, Sonoma County Regional Parks, Boys and Girls Club, school districts, internet providers (public-private partnership)

   *Resources & barriers*: It is important to understand that one size does not fit all (e.g., remote learning works great for some and terribly for others), so a strategy like this will not be the best option for every student. There is an existing program through the Parks and Recreation Department, but it has a fee-based structure so it is not available to everyone due to cost and/or need for transportation.

   *Efficacy*: High (if youth are involved in the process)

   *Potential for Success*: High

2. Strengthen linkage with non-profits, faith organizations, food banks, and community gardens that are connected to vulnerable communities

   *How to implement*: Identify whether there is a point person whose job it is to coordinate this effort.

   *Leads & partners*:

   *Leads*: Community Engagement Department (possibly)

   *Partners*: Non-profits, faith organizations, food banks, community gardens, neighborhood associations, schools

   *Resources & barriers*: A new Healthy Planner position is being hired through recent Kaiser grant, and this person will be tasked with helping to incorporate environmental justice/community health into all City policies/programs.

   *Efficacy*: High

   *Potential for Success*: High

3. Identify vulnerable individuals to allow neighborhood groups to reach out and check on them

   *How to implement*: Tailor outreach efforts to the neighborhood and/or specific needs like language access; partner with existing neighborhood-based groups that are trusted by the community to identify vulnerable individuals (e.g., houseless people, those with chronic health conditions, and people with critical medications that would be lost in a power outage). In order to ensure longevity, this effort must not be overly dependent on individuals. Funding could be offered to partners (e.g., Grayton Day Laborer Center) in order to support their ability to lead or participate in this work.

   *Leads & partners*:

   *Leads*: Community Engagement Department (possibly)

   *Partners*: Neighborhood associations, County Human Services/Health Department/Agency on Aging; all county/city departments and organizations involved in the Point In Time survey; Grayton Day Laborer Center

   *Resources & barriers*: The Point in Time survey already identifies the number of houseless individuals and their current locations (though this community moves around frequently); the existing COPE program also has volunteers that check on vulnerable individuals. Funding would be a likely limitation for this strategy, particularly for non-profits that are already constrained by limited budgets

   *Efficacy*: Moderate

*Potential for Success*: Moderate

4. Tailor method of communication to the community that needs to be reached

   *How to implement*: Determine which communication methods are already used in the emergency management system (e.g., email) and what improvements need to be made; consider using Facebook, Twitter, WhatsApp, NextDoor, and others.

   *Leads & partners*:

   *Partners*: Community Engagement Department; City Communications Team (especially marketing/outreach), public information officer

   *Efficacy*: High

   *Potential for Success*: High

5. Reach out to vulnerable populations to help them understand available resources and how to access them

   *How to implement*: Use information obtained during the identification process (see above strategy) to locate vulnerable individuals; survey existing resources to create a full list that could be provided to community members (City coordinator of this effort could reach out to different groups and find out if they could be part of this network of resources; create Family Resource Centers where information and resources could be provided (similar to those in San Joaquin County); consider working with apartment managers within affordable housing complexes so that they could connect residents with information and resources; ensure that information repository is available in different languages.

   *Leads & partners*:

   *Partners*: Apartment managers, existing resource centers (e.g., 211), Undocufund, Grayton Day Laborer Center, Jobs with Justice

   *Resources & barriers*: The Point in Time survey already identifies the number of houseless individuals and their current locations (though this community moves around frequently), and 211 currently serves an information provider role. The existing COPE program has volunteers that check on vulnerable individuals, and Undocufund raises and gives out money in Sonoma County to help community members with rent and other expenses. Funding would be a likely limitation for this strategy, particularly for non-profits that are already constrained by limited budgets

   *Efficacy*: High

   *Potential for Success*: High

*Overall, breakout group participants noted that it is critical to have the right person lead all of these efforts (e.g., getting them off the ground and keeping them going, even if they do not do all of the work). The work should be led by trusted organizations (or a coalition that includes those organizations). Finally, it is critical to consider the needs of LGBTQ youth and young people that have aged out of foster care.*

## Transportation

This element generally considers the transportation and circulation, including public transportation systems, bicycle and pedestrian routes, as well as appropriate ingress/egress for all neighborhoods. The timeframe used for this assessment was the life of the General Plan (i.e., next 25–30 years) as well as the longer time horizons (i.e., 50–100 years) of infrastructure.

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### VULNERABILITY ASSESSMENT

#### *Summary of observed and/or anticipated effects of climate stressors and pre-existing conditions*

**Wildfire, extreme/prolonged heat**, and **extreme storm events** were identified by breakout group participants as the climate stressors that can have the most significant impacts on Transportation.

**Aging infrastructure**, **disadvantaged communities**, and **earthquakes/seismic hazards** were identified by participants as the primary pre-existing conditions related to Transportation that were of the highest concern.

#### Climate stressors[18]

*Wildfire* is a significant danger to the city and is likely to damage roads, reduce public transport availability, and limit electric vehicle charging and prevent gas pumps from operating due to power outages; these impacts severely hamper basic mobility and are likely to isolate some communities.

*Extreme/prolonged heat* reduces the potential for residents to walk or bike, increasing the use of cars and associated demands on transportation systems. Extreme temperatures may also cause road surface damage and place stress on power systems, limiting public transportation (e.g., electric buses), traffic light operation, electric vehicle charging, etc.

*Extreme storm events* often cause localized street flooding (impassible by pedestrians and bicycles), fallen trees and branches that block roads, and loss of power, which prevents electric vehicles and buses from charging.

[18] The information described in this section comes directly from discussions during breakout group activities.

### Pre-existing conditions[19]

*Aging infrastructure* impacts public transit options and expanded use of electric vehicles (e.g., due to power infrastructure limitations). In many areas, transport infrastructure is not well connected, isolating some communities, and does not encourage walking and cycling.

*Disadvantaged communities* are often dependent on public transportation, which may not meet basic needs and carries high rider costs.

*Earthquakes/seismic hazards* cause collapse of road structures, bridges, culverts, and overpasses, isolating communities where infrastructure is severely damaged.

### Combined impacts of pre-existing conditions and climate stressors[20]

Climate change is likely to exacerbate the impacts of or be exacerbated by all three pre-existing conditions for Transportation. Breakout group participants identified challenges including:

- Wildfire is likely to cause more significant damage to aging infrastructure, limiting options for evacuation and response to extreme events. Similarly, inadequate power infrastructure is likely to experience more frequent outages, and older roads may sustain more surface damage from extreme heat.
- Inadequate stormwater infrastructure is likely to contribute to more frequent localized flooding during storms, and aging/unhealthy tree canopies may also cause more downed trees.
- Disadvantaged communities are more likely to live in locations where fire risk is lower and evacuation easier, however more frequent fires or extreme temperatures are likely to cause greater risk for community members that still must report to work (particularly those that rely on public transportation). Members of disadvantaged communities may also have greater need for cooling centers, storm shelters and transportation that allows access.
- The co-occurrence of severe wildfires and earthquakes would be a worst-case scenario, resulting in road closures and blocked evacuation routes and limit communication. Any extreme events that co-occur with an earthquake (wildfire, heat wave, storm) are likely to cause additional barriers to travel for emergency response teams and other members of the workforce trying to report for duty.

[19] The information described in this section comes directly from discussions during breakout group activities.

[20] The information described in this section comes directly from discussions during breakout group activities.

### *Summary of adaptive capacity*

Overall, breakout group participants evaluated the adaptive capacity of City of Santa Rosa departments and organizations relevant to Transportation as **moderate**. While not ranked for adaptive capacity, several additional organizations were identified that play a role in Transportation, including Cal Trans, Bay Area Rapid Transit, Bay Area Infrastructure Financing Authority, Sonoma County Transportation Authority, Sonoma County Metropolitan Transportation Commission, Land Use Alliance, Sonoma County Bicycle Coalition, and City/County Bicycle Pedestrian Advisory Committee.

#### Organizational potential

Overall, the organizational potential of the City of Santa Rosa was evaluated as moderate. Organization **staff capacity** was evaluated as high, while **responsiveness**, existing **stakeholder relationships**, and **staff capacity** were all evaluated as moderate.

#### Management potential

Overall, the management potential for the City of Santa Rosa was evaluated as moderate. All factors within this category received this ranking, including having an **existing mandate**, **capacity for monitoring and evaluation**, the organization's **ability to learn and change**, **partner relationships**, and **science/technical support**.

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### *Overall vulnerability*

Reduced access to transit in all communities (especially disadvantaged ones) and isolation/lack of mobility following multiple co-occurring extreme events were ranked by breakout group participants as having high vulnerability (*extreme risk x moderate adaptive capacity*). While both impacts were ranked as having extreme risk, reduced access to transit in all communities was ranked by workshop participants as having an almost certain likelihood and major consequences. Isolation/lack of mobility following multiple co-occurring extreme events was ranked as being likely, with catastrophic consequences (see Table 9 for comparison of vulnerability rankings).

**Table 9.** Vulnerability assessment ranking results for effects/impacts of greatest concern for Transportation.

| Effects/Impacts of Greatest Concern | Likelihood | Consequence | Risk | Adaptive Capacity | Vulnerability |
|---|---|---|---|---|---|
| Reduced access to transit in all communities, especially disadvantaged ones, | Almost Certain | Major | Extreme | Moderate | High |

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|---|---|---|---|---|---|
| limiting access to jobs, health care, etc. | | | | | |
| Isolation and lack of mobility due to roadway blockages and loss of public transit following multiple co-occurring extreme events (e.g., earthquake and wildfire) | Likely | Catastrophic | Extreme | Moderate | High |

## PROPOSED ADAPTATION STRATEGIES AND IMPLEMENTATION PLANS

### *Adaptation strategies for effects of greatest concern*

Breakout group participants identified adaptation strategies for Transportation ranging from **programmatic** (e.g., reduce or eliminate bus fares) and **infrastructure projects** (e.g., improve reliability and redundancy of communication technology such as cell towers) to **improving collaboration** (e.g., organize community response for self-rescue and resources). The following table summarizes possible adaptation strategies in response to effects of greatest concern identified by breakout group participants (Table 10).

**Table 10.** Identified effects of greatest concern and possible adaptation strategies for Transportation.

| Effects of greatest concern | Adaptation strategies to reduce vulnerabilities |
|---|---|
| Reduced access to transit in all communities, especially disadvantaged ones, limiting access to jobs, health care, etc. | • Increase public transport options for disadvantaged communities<br>• Increase bicycle and walking<br>• Reduce or eliminate bus fares<br>• Increase shading on walkways/bikeways<br>• Ensure that backup is available for periods of increased demand<br>• Leverage technological options (e.g., increase use of small self-driving shuttles)<br>• Improve bus stops and other waiting areas with shade and seating |

| | |
|---|---|
| Isolation and lack of mobility due to roadway blockages and loss of public transit following multiple co-occurring extreme events (e.g., earthquake and wildfire) | • Organize community response for self-rescue and resources (e.g., doctors, chain saws)<br>• Conduct drills for community members<br>• Plan backup pedestrian escape routes<br>• Improve reliability and redundancy of communication technology (mobile and neighborhood cell towers)<br>• Use a mobile battery truck for powering neighborhoods and buildings<br>• Designated evacuation points (helicopter, etc.)<br>• Increase number of and capacity of cooling locations<br>• Plan for resilient development expansion (e.g., compact, higher-density areas) |

### *Implementation plans for priority strategies*

Breakout group participants selected three priority adaptation strategies, and developed implementation plans for each:

1. Increase walking/bicycling (and other forms of microtransit) by increasing the interconnectivity of paths and transit options, enhancing secondary "road" systems, and implementing a Complete Streets approach

   *How to implement*: Consider linkages with other Plan elements (e.g., Land Use, Housing, Environmental Justice, Economic Vitality, Public Safety). For instance, these improvements could be considered within the hazard mitigation plan and provide improved transit options for disadvantaged neighborhoods.

   *Leads & partners*: Will require leads and location-based partners from multiple jurisdictions, depending on the project being considered.

   *Leads*: City of Santa Rosa Planning and Economic Development and Transportation & Public Works Departments

   *Partners*: Santa Rosa Pedestrian Bicycle Advisory Board, Sonoma County Bicycle Coalition, Santa Rosa Transit, Sonoma County Transportation Authority (SCTA), Sonoma County Public Works and Transportation Departments, Permit Sonoma, Cal Trans, Sonoma County Regional Parks, Sonoma-Marin Area Rail Transit (train), Sonoma County Transportation and Land Use Coalition (SCTLC)

   *Resources & barriers*: Cal Trans and the Metropolitan Transportation Commission are major existing funders. Existing car traffic, bicycling, and pedestrian data and modeling could be used to inform projects. Learn from other cities; for example, where "Smart City" planning approaches were used in Ventura County. Barriers may include competing interests/priorities among agencies, political will, funding,

engagement challenges, and stress on public infrastructure related to needs of the existing homeless population.

*Efficacy*: High (proactive community helps though driving remains too inexpensive)

*Potential for Success*: Moderate (large-scale) to High (limited scale) within a 2050 timeframe

2. Improve public transit by reducing/eliminating fares (use zones), improving bus stops, and increasing service frequency

   *How to implement*: Consider linkages with other Plan elements (e.g., Land Use, Housing, Environmental Justice, Economic Vitality, Public Safety). For instance, these improvements could be considered within the hazard mitigation plan and provide improved transit options for disadvantaged neighborhoods.

   *Leads & partners*:

   *Leads*: City of Santa Rosa Planning and Economic Development Department and Transportation and Public Works Department, Sonoma County Transit

   *Partners*: Sonoma County Transportation Authority (SCTA), Sonoma County Public Works and Transportation Departments, Permit Sonoma, Cal Trans, Sonoma County Regional Parks, Sonoma-Marin Area Rail Transit (train), Sonoma County Transportation and Land Use Coalition (SCTLC), disability rights center, housing development planning

   *Resources & barriers*: State of California and the Metropolitan Transportation Commission are major existing funders. Business association funding could potentially be used for fare reduction (was for downtown parking). Existing car traffic, bicycling, and pedestrian data could be used to inform projects, in addition to traffic modeling from the SCTA. Learn from other cities; for example, where "Smart City" planning approaches were used in Ventura County.

   *Efficacy*: High (when linked to higher housing density)

   *Potential for Success*: Moderate (large-scale) to High (limited scale)

## Noise & Safety

This element considers control and abatement of environmental noise as well as minimization of potential hazards and public safety concerns. The timeframe used for this assessment was the life of the General Plan (i.e., next 25–30 years) although longer time horizons (i.e., 50–100 years) were also considered.

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### VULNERABILITY ASSESSMENT

#### *Summary of observed and/or anticipated effects of climate stressors and pre-existing conditions*

**Wildfire, extreme/prolonged heat**, and **extreme storm events/flooding** were identified by breakout group participants as the climate stressors that have the most significant impacts on Noise and Safety.

**Disadvantaged communities**, **earthquakes/seismic hazards**, and **aging infrastructure** were identified by participants as the primary pre-existing conditions related to Noise and Safety that were of the highest concern.

#### Climate stressors[21]

*Wildfire* is a significant danger to the City; reduces air quality; can impact power, water, and gas systems; and increases risk from stored hazardous materials. During fire events, evacuation can be hampered by reduced visibility or blocked escape routes. Because fires are often very unpredictable, response decisions can be difficult. Additionally, existing capacity to deal with wildfires above a certain scale is inadequate. Economic impacts from severe fires can also be significant.

*Extreme/prolonged heat* increases the need for cooling centers, as well as the demand for emergency and medical services (including mental health treatment). Periods of extreme heat also burden the power system/infrastructure, and can have economic impacts.

*Extreme storms and flooding* increase the risk of landslides and falling trees; challenge drainage systems; impact surface water quality; impair drinking water systems and sewage treatment plants; and can lead to increases in pests, mosquitos, and disease where standing water persists. Emergency response time is affected when roads are

[21] The information described in this section comes directly from discussions during breakout group activities.

inundated. Like wildfire, there is increased risk associated with stored hazardous materials, and economic impacts to the community can occur.

### Pre-existing conditions[22]

*Disadvantaged communities* are disproportionately burdened by stressors such as noise, air quality, and exposure to toxins. For instance, hazardous materials are more likely to be stored in disadvantaged communities. These communities are also likely to experience greater impacts from planned or unexpected power disruptions.

*Earthquakes/seismic hazards* are likely to damage important infrastructure (e.g., water, power, gas) and impair routes needed for evacuation and response to events. Housing in disadvantaged communities is often less resilient, however these communities are less vulnerable to landslides (e.g., away from hills).

*Aging infrastructure* is more likely to fail. In general, bicycling has been an afterthought in design, and communication technology is inadequate for the community's needs.

### Combined impacts of pre-existing conditions and climate stressors[23]

Climate change is likely to exacerbate the impacts of or be exacerbated by all three pre-existing conditions for Noise & Safety. Breakout group participants identified challenges including:

- Wildfires remove trees, which reduces overburden and can increase the frequency of earthquakes. Loss of groundcover also leads to landslides. Conversely, seismic events can trigger wildfire.
- Aging infrastructure and lack of alternative routes can limit response to wildfire; for instance, older water systems may lack the pressure needed for fire response, and there are few escape routes by foot or bicycle. Above-ground wiring for communications and utilities are also at risk due to fire.
- Disadvantaged communities are less likely to have air conditioning or sufficiently insulated housing to cope with more extreme heat, and generally have fewer options to find relief from these events. Because of these pre-existing vulnerabilities, they will likely suffer greater impacts from extreme heat events.
- Earthquakes can damage cooling stations, leading to increased exposure of community members to extreme heat. They also could result in damage to drinking water systems and loss of power, impacting people's ability to stay cool.

[22] The information described in this section comes directly from discussions during breakout group activities.

[23] The information described in this section comes directly from discussions during breakout group activities.

- Aging power systems and drinking water systems are less equipped to handle increased demand during periods of extreme heat. Stress may also overwhelm older HVAC systems. It is challenging to update infrastructure with a geographically spread-out population.
- Disadvantaged communities are often located in areas that are more likely to flood, more vulnerable to impacts in water quality, and reside in homes that are less resilient to storms and flood events. Power and drinking water disruptions may also impact these communities to a greater degree.
- Extreme storm and flood events increase the risk of landslides and sinkholes. Earthquakes also increase the vulnerability of communities to storm/flood events, as they can damage dams (and could cause complete failure in a worst-case scenario) and other infrastructure. More housing may also be lost due to liquefaction.
- Storms and associated floods may overwhelm drainage capacity and increase blockages in older stormwater systems, inundating roads. In general, backup systems and generators used may impact noise/pollution and safety issues.

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*Summary of adaptive capacity*

Overall, breakout group participants evaluated the adaptive capacity of Santa Rosa departments and organizations relevant to Noise and Safety as **moderate**. While not ranked for adaptive capacity, several additional organizations were identified that play a role in Noise and Safety, including Cal OSHA, Cal Fire, Sonoma County Transportation Authority, County Health Department, Sonoma County Bicycle Coalition, and the State Air Resources Board.

### Organizational potential

Overall, the organizational potential of the City of Santa Rosa was evaluated as moderate. **Staff capacity** was evaluated as high, while organization **stability/longevity, responsiveness,** and existing **stakeholder relationships** were all received a moderate ranking.

### Management potential

Overall, the management potential for the City of Santa Rosa was evaluated as moderate. All the factors within this category received a ranking of moderate, including having an **existing mandate**, **capacity for monitoring and evaluation**, **partner relationships**, and **science/technical support** (the organization's ability to learn and change was not scored by breakout group participants).

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### *Overall vulnerability*

Loss of power and damage to utilities/water supply/communication systems, and overwhelmed response services were all ranked by breakout group participants as having high vulnerability (*extreme risk x moderate adaptive capacity*). For loss of power and damage to utilities/water supply/communication systems, extreme risk ranking was due to almost certain likelihood and major/catastrophic consequence. For overwhelmed response services, extreme risk ranking came from a likelihood of almost certain together with catastrophic consequences (see Table 11 for comparison of vulnerability rankings).

**Table 11.** Vulnerability assessment ranking results for effects/impacts of greatest concern for Noise and Safety.

| Effects/Impacts of Greatest Concern | Likelihood | Consequence | Risk | Adaptive Capacity | Vulnerability |
|---|---|---|---|---|---|
| Loss of power that impacts ability of community to cope/respond to extreme events | Almost Certain | Major/ Catastrophic | Extreme | Moderate | High |
| Damage to utilities, water supply, communication systems | Likely/ Almost Certain | Major/ Catastrophic | Extreme | Moderate | High |
| Overwhelmed response services due to both number of requests and lack of access to communities | Almost Certain | Catastrophic | Extreme | Moderate | High |

## PROPOSED ADAPTATION STRATEGIES AND IMPLEMENTATION PLANS

### *Adaptation strategies for effects of greatest concern*

Breakout group participants identified adaptation strategies for Noise and Safety ranging from **programmatic** (e.g., creating community resilience centers) and **planning** (e.g., plan for water pressure demands in future infrastructure expansion and retrofits) to **improving collaboration** (e.g., organize community response to self-rescue and resources). The following table summarizes possible adaptation strategies in response to effects of greatest concern identified by breakout group participants (Table 12).

Table 12. Identified effects of greatest concern and possible adaptation strategies for Noise and Safety.

| Effects of greatest concern | Adaptation strategies to reduce vulnerabilities |
|---|---|
| Loss of power that impacts ability of community to cope/respond to extreme events | • Mobile battery trucks – building scale<br>• Neighborhood-scale cell towers<br>• Portable/mobile cell towers<br>• Community and city micro-grids and storage/backup (require solar on new development to supply community backup batteries)<br>• Create community resilience centers that can charge cell phones, electric cars, etc. |
| Damage to utilities, water supply, communication systems | • Plan for water pressure demands in future infrastructure expansion and retrofit<br>• Plan for increased resilience in systems<br>• Additional water storage<br>• Neighborhood-scale cell towers<br>• Portable/mobile cell towers<br>• Support individual home retrofits to facilitate local function with reduced utilities; reduce water and water demand (gray water systems) – building code requirement<br>• Increase water efficiency by using tiered rates as incentives<br>• Increase number of cooling stations (e.g., splash pads, drinking fountains, and community pools), which would require policy changes for them to remain open during droughts |
| Overwhelmed response services due to both number of requests and lack of access to communities | • Organize community response & practice/drills to increase public safety<br>• Organize community response to self-rescue and resources (e.g., doctors, chain saws); shift expectations<br>• Promote co-housing and community<br>• Create and expand mutual aid networks across the region and state, (public safety, emergency response)<br>• Create a network of resources and skills (local, regional, state, beyond); think beyond EMS to private sector that could assist in emergencies (e.g., construction companies)<br>• Community gardens for local food and safe gathering locations<br>• Distributed fire, police, stations, etc. |

| | |
|---|---|
| | • Ensure adequate firefighting staff and equipment<br>• Emergency communications systems to the public; improved and clear communications; coordination between city and county |

### *Implementation plans for priority strategies*

Breakout group participants selected five priority adaptation strategies, and developed implementation plans for each:

1. Community and city micro-grids and storage/backup (require solar on new development to supply community backup batteries)

   *How to implement*: Expand residential and community backup systems (islanding); work with power provider on micro-grid options; expand solar beyond residential roofs to parking lots, etc. Strategy would also connect to Environmental Justice and Housing elements.

   *Leads & partners*:

   *Leads*: Sonoma Clean Power; PG&E

   *Partners*: Sonoma County Regional Climate Protection Authority (RCPA); The Climate Center; Friends of Climate Action Plan; air quality districts

   *Resources*: Rate payers/customers, spread costs; solar providers; private industry, technology, and ingenuity

   *Efficacy*: High

   *Potential for Success*: High at a limited scale (short-term, based on public interest and funding); Moderate at a larger scale

2. Plan for water pressure demands in future infrastructure expansion and retrofit

   *How to implement*: Require stronger more resilient pipes; include guidance in infrastructure updating and expansion; make it a community safety issue

   *Leads & partners*:

   *Leads*: Public Works Department

3. Increase number of Cooling stations: Splash pads, drinking fountains, community pools

   *How to implement*: Parks Department; also consider low-tech/low-profile solutions (e.g., misters)

*Resources & barriers*: Space is available, but there are funding challenges; requires flexibility and changes in state policies to keep pools open during periods of drought

*Efficacy*: Moderate to High

*Potential for Success*: Moderate

4. Create a network of resources and skills (local, regional, state, beyond); think beyond EMS to private sector that could assist in emergencies (e.g., construction companies)

   *How to implement*: Learn from other regions with successful networks; learn about public/private partnerships and needed legal structure

5. Community gardens for local food source and safe gathering places

   *How to implement*: Understand what land is already owned by public entities and how to support this use in policies; create policy change to avoid selling off surplus city land until this need is considered (i.e., redirection to community garden use)

   *Leads & partners*:

   *Leads*: Daily Acts; Santa Rosa Parks & Recreation Department; Sonoma County Water Agency (landowner)

   *Partners*: Land Paths; Land Trust; ag and open space district; Southeast Green Way; Food Systems Alliance; Resource Conservation Districts

   *Resources & barriers*: Existing vacant land owned by city; funding from agriculture open space district mini grant program; need education and outreach

   *Efficacy*: Moderate (depends on scale; can be part of an overall solution); High (community building and community support)

   *Potential for Success*: High

## Public Services

This element considers water, wastewater, and other services such as recreation. The timeframe used for this assessment was the life of the General Plan (i.e., next 25–30 years) as well as the longer time horizons (i.e., 50–100 years), which is representative of the lifespan of some infrastructure.

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### VULNERABILITY ASSESSMENT

#### *Summary of observed and/or anticipated effects of climate stressors and pre-existing conditions*

**Extreme storm events/flooding**, **drought and extreme/prolonged heat**, and **wildfire** were identified by breakout group participants as the climate stressors that have the most significant impacts on Public Services.

**Aging infrastructure**, **insufficient staffing/funding**, and **community health challenges** were identified by participants as the primary pre-existing conditions that impact Public Services.

#### Climate stressors[24]

Increased intensity and frequency of *extreme events* is likely to damage infrastructure and increase repair costs, interrupt services, and cause staff to be reallocated to address emergency issues, resulting in further delays to regularly scheduled maintenance and repairs. Additionally, more extreme events may lead to displacement of people from homes, resulting in reduced use of services and consequently, reduced revenue/funding for the City.

*Drought and extreme/prolonged heat* are likely to increase use of or demand for water, decrease the amount of recycled water that could be delivered to geysers, and lead to loss of renewable energy and under-watered sports fields, parks, and landscaping. Additionally, it could increase the need for City funding to purchase additional water supply and/or incentivize customers to conserve water, which would result in increased rate costs for customers.

Increased frequency of *wildfire* is likely to damage infrastructure, lead to interruptions in service, increase potential for landslides and floods, increase water use (i.e., for fighting fires), and reduce overall water quality. Additionally, it will increase the need

[24] The information described in this section comes directly from discussions during breakout group activities.

for resources to help natural and human systems recover following fires (e.g., planting trees, rebuilding).

### Pre-existing conditions[25]

*Aging infrastructure* can lead to loss of services and utilities, public health hazards, non-compliance with state and federal regulations, and increased investment costs to update.

*Insufficient staffing/funding* reduces services, leads to delayed repairs and aging infrastructure, decreases staff morale and results in poor customer service, and results in increased unknowns (e.g., do not have the funding or capacity to do studies necessary to prevent challenges in the long-term).

Existing *community health challenges* can result in loss of access to services, reduced revenue (because people are not using services), and increased expenditures.

### Combined impacts of pre-existing conditions and climate stressors[26]

Climate change is likely to exacerbate the impacts of or be exacerbated by all three pre-existing conditions for Public Services. Breakout group participants identified challenges including:

- Aging infrastructure combined with increased drought and extreme/prolonged heat will result in a reduction in revenue (e.g., because degraded condition of parks and sports fields), increase demand on aquatic centers and swimming pools already in need of repairs, and increase the demand for electricity, leading to grid instability.
- Aging infrastructure combined with increased frequency and intensity of extreme events will lead to further degradation of infrastructure, reduced water quality and an inability to meet compliance metrics, damage to the ecosystem, and a decrease in the ability to provide services.
- Increased frequency of wildfires combined with aging infrastructure issues will result in a reduction of revenue (i.e., due to loss of services), and delay scheduled repairs, maintenance, and replacement.
- Insufficient staffing/funding combined with climate stressors will further reduce staff morale and increase staff burnout, result in staff getting reallocated to emergency response rather than regular maintenance and upkeep, and reduce services and delay repairs. Climate stressors have the potential to significantly

[25] The information described in this section comes directly from discussions during breakout group activities.

[26] The information described in this section comes directly from discussions during breakout group activities.

exacerbate insufficient funding challenges as they can result in reduced revenue for extended periods of time.

- Community health challenges combined with climate stressors such as increased drought and extreme/prolonged heat, increased frequency of wildfires, and increased intensity and frequency of extreme events are likely to exacerbate reduced revenue streams, loss of access to services, and increased expenditures.

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### *Summary of adaptive capacity*

Overall, breakout group participants evaluated the adaptive capacity of Santa Rosa departments and organizations relevant to Public Services as **moderate**. While not ranked for adaptive capacity, several additional organizations were identified that play a role in Public Services, including Sonoma County, CAL FIRE, Sonoma County Water Agency, Sonoma Clean Power, and PG&E.

#### Organizational potential

Overall, the organizational potential of the City of Santa Rosa was evaluated as moderate. Organization **stability/longevity** was evaluated as high, while **staff capacity** and **stakeholder relationships** were evaluated as moderate and **responsiveness** as low.

#### Management potential

Overall, the management potential for the City of Santa Rosa was evaluated as moderate. Two factors received moderate-high or high rankings, including having an **existing mandate** and **partner relationships**. Remaining factors – **monitoring & evaluation capacity**, **ability to learn and change**, and **science/technical support** – received moderate adaptive capacity rankings.

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### *Overall vulnerability*

Breakout group participants identified three impacts of greatest concern, with high, high, and moderate vulnerability rankings, respectively (see Table 13 for comparison of vulnerability rankings):

1. **Changes in staff availability in the short-, medium-, and long-term due to staff reallocation to emergency response (short-term), followed by necessary repairs (medium-term), which results in existing infrastructure repairs and replacements getting further delayed and leaving no time for planned preventative measures**: This impact was ranked as having **high vulnerability** due to extreme risk (*almost certain likelihood x major consequence*) and moderate adaptive capacity.
2. **Increased expenditures and reduced revenue due to climate-driven disruptions in services and/or reduced use of services**: This impact was also ranked as having **high**

vulnerability due to extreme risk (*almost certain likelihood x major consequence*) and moderate adaptive capacity.

3. Loss of services and/or lack of access to services due to climate-driven impacts: This impact received a moderate vulnerability ranking, which was primarily driven by a moderate consequence ranking.

**Table 13.** Vulnerability assessment ranking results for effects/impacts of greatest concern for Public Services.

| Effects/Impacts of Greatest Concern | Likelihood | Consequence | Risk | Adaptive Capacity | Vulnerability |
|---|---|---|---|---|---|
| Changes in staff availability in the short-, medium-, and long-term, resulting in delayed infrastructure repairs and replacements as well as lack of time for planned preventative measures | Almost Certain | Major | Extreme | Moderate | High |
| Increased expenditures and reduced revenue due to climate-driven disruptions in services and/or reduced use of services | Almost Certain | Major | Extreme | Moderate | High |
| Loss of services and/or lack of access to services due to climate-driven impacts | Almost Certain | Moderate | High | Moderate | Moderate |

## PROPOSED ADAPTATION STRATEGIES AND IMPLEMENTATION PLANS

### *Adaptation strategies for effects of greatest concern*

Breakout group participants identified adaptation strategies for Public Services ranging from **infrastructure projects** (e.g., implementing system redundancy in water supply and water use efficiency) to **improving knowledge** (e.g., conducting a fee survey/study across all services) to **enhancing collaboration** (e.g., creating cross-training opportunities to reduce silos among departments and backfill during times of need

and/or emergency). The following table summarizes possible adaptation strategies in response to effects of greatest concern identified by breakout group participants (Table 14).

**Table 14.** Identified effects of greatest concern and possible adaptation strategies for Public Services.

| Effects of greatest concern | Adaptation strategies to reduce vulnerabilities |
|---|---|
| Changes in staff availability in the short-, medium-, and long-term, resulting in delayed infrastructure repairs and replacements as well as lack of time to implement planned preventative measures | • Fill vacant positions and hire more staff to support emergency response and implement planned preventative measures/maintenance; target hiring of Spanish-speaking staff<br>• Hire outside consultants to do infrastructure repair and planned/preventative measures<br>• Conduct a fee survey/study across all services and explore opportunities to improve funding for the City (e.g., different taxes, measures, grants) as well as fee-based programming (e.g., recreation)<br>• Look for and create cross-training opportunities that make sense and identify ways to reduce silos among departments to backfill during times of need and/or emergency |
| Increased expenditures and reduced revenue due to climate-driven disruptions in services and/or reduced use of services | • Conduct a fee survey/study across all services and explore opportunities to improve funding for the City (e.g., different taxes, measures, grants) as well as fee-based programming (e.g., recreation)<br>• Explore potential for City-wide or County measure to raise funding for climate adaptation (e.g., climate fee and dividend)<br>• Finalize and maintain water shortage contingency plan |
| Loss of services and/or lack of access to services due to climate-driven impacts | • Analyze what services and programs could be impacted and how during different kinds of climate-driven emergencies (e.g., if a community center becomes used as a shelter, which takes funding away from recreation) and explore alternatives<br>• Using state-of-the-art techniques that require less maintenance, implement system redundancy in water supply and water use efficiency, and reduce water loss (e.g., by making sure pipes are not leaking); for example, create/use additional reservoirs, emergency wells, and storage facilities, and update infrastructure (e.g., pumping stations) |

### *Implementation plans for priority strategies*

Breakout group participants selected three priority adaptation strategies, and developed implementation plans for each:

1. Fill vacant positions and hire more staff to support emergency response and implement planned/preventative measures (target hiring of Spanish-speaking staff); hire outside consultants to do infrastructure repair and planned/preventative measures

   *How to implement*: Implement across all elements, and use the Capital Improvement Project Plan and Urban Water Management Plan

   *Leads & partners*:

   *Leads*: City of Santa Rosa – Water, Recreation, Facilities, and Parks departments

   *Partners*: Public Works, Billing Department, Public Information Office, consultants, unions

   *Resources & barriers*: Funding and qualified staff candidates (needed)

2. Conduct a fee survey/study across all services and explore opportunities to improve funding for the City (e.g., through different taxes, measures, grants) as well as fee-based programming

   *How to implement*: Implement across all elements

   *Leads & partners*:

   *Leads*: Water Department, Recreation Department, Finance, City Council, City Executive Team, Board of Public Utilities

   *Partners*: Santa Rosa community, non-profits that could help subsidize recreational fees, Visitors Bureau, and funders (e.g., California Department of Water Resources, Bureau of Reclamation, Army Corps of Engineers, Santa Rosa Foundation)

   *Resources & barriers*: Centralized grant department and legislation or measures to provide funding (needed)

3. Using state-of-the-art techniques that require less maintenance, implement system redundancy in water supply and water use efficiency, and reduce water loss (e.g., by making sure pipes are not leaking); for example, create/use additional reservoirs, emergency wells, and storage facilities, and update infrastructure (e.g., pumping stations)

   *How to implement*: Integrate into Public Services, Capital Improvement Project Plan and Urban Water Management Plan

   *Leads & partners*:

   *Leads*: Water Department

   *Partners*: Sonoma Water, Sonoma Marin Saving Water Partnership, various non-profits (e.g., Master Gardeners, Daily Acts), marketing and public information, Public Information Officer, Community Engagement

   *Resources & barriers*: AB1668 and SB606 (water conservation); SB555 (requires water loss action)

# Open Space

This element considers open space and green space within and surrounding the City of Santa Rosa. The timeframe used for this assessment was the life of the General Plan (i.e., next 25–30 years) as well as longer time horizons (i.e., 50–100 years).

## VULNERABILITY ASSESSMENT

### *Summary of observed and/or anticipated effects of climate stressors and pre-existing conditions*

**Extreme weather events**, **drought**, and **wildfire** were identified by breakout group participants as the climate stressors that have the most significant impacts on Open Space.

**Insufficient staffing/funding**, **homelessness and disadvantaged communities**, and **limited water supply** were identified by participants as the primary pre-existing conditions that impact Open Space.

#### Climate stressors[27]

Increased frequency of *extreme events* and *wildfire* is likely to damage infrastructure and habitat, reduce water and air quality, decrease use of open space by the public, and increase the potential for flooding, erosion, and landslides.

*Drought* is likely to increase the availability of fine fuels, increasing the potential for wildfires and longer fire seasons. It can also lead to shifts in plant species, including invasive species, and result in significant impacts on habitats and wildlife.

#### Pre-existing conditions[28]

*Insufficient staffing/funding* reduces services, compromises the quality of open space and infrastructure (e.g., roads, trails, pathways), and leads to environmental degradation.

*Homelessness* can result in pollution, water quality, and public health impacts. *Disadvantaged communities* may lack access to open space, affecting mental and physical health.

[27] The information described in this section comes directly from discussions during breakout group activities.

[28] The information described in this section comes directly from discussions during breakout group activities.

*Limited water supply* leads to environmental degradation, loss of trees and reduced tree health, impacts on fish and wildlife, and an overall reduction in available habitat and quality of open space. It also increases the need for supplemental irrigation and can lead to increased risk of wildfire. Environmental degradation can lead to a loss of ecosystem services as well as loss or impacts to recreation opportunities.

### Combined impacts of pre-existing conditions and climate stressors[29]

Climate change is likely to exacerbate the impacts of or be exacerbated by all three pre-existing conditions for Open Space. Breakout group participants identified challenges including:

- Insufficient staffing combined with increased drought will result in reduced ability for staff to manage dry fuels; additionally, increased drought will exacerbate issues with insufficient funding because people will be using less water, which reduces revenue.
- Increased frequency of wildfires and/or extreme events combined with insufficient staffing/funding will lead to slower response times and delays in fixing damaged resources and reduces the ability of staff to monitor, restore, and implement preventative measures in open spaces. Further, there are budget and staff time impacts that result from importing first responders from outside the City.
- Limited water supply along with climate stressors exacerbates all existing challenges that limited water supply presents to open space: environmental degradation, loss of trees and reduced tree health, impacts on fish and wildlife, overall reduction in available habitat and quality of open space, increased risk of wildfire, loss of ecosystem services, and loss or impacts to recreation opportunities.
- Homelessness combined with increased drought can lead to concentrated use of water sources, proliferation of encampments throughout the City, and increased camping along waterways, leading to increased pollution and/or trash.
- Increased wildfires and extreme events could increase homelessness and migration of homeless. Additionally, these climate stressors increase the vulnerability of the homeless, resulting in increased pressure on the City to manage impacts.
- Increased wildfires and extreme events can exacerbate issues of access to open space for disadvantaged communities.

[29] The information described in this section comes directly from discussions during breakout group activities.

- Increased drought will lead to water rate increases, making it harder for disadvantaged communities to afford their water bill, which in turn affects the City's ability to provide programs to help people pay for their water bill.

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*Summary of adaptive capacity*

Overall, breakout group participants evaluated the adaptive capacity of Santa Rosa departments and organizations relevant to Open Space as **moderate**. While not ranked for adaptive capacity, several additional organizations were identified that play a role in Open Space, including Sonoma County Regional Parks, Regional Open Space District, Sonoma County Conservation Action, and Daily Acts.

### Organizational potential

Overall, the organizational potential of the City of Santa Rosa was evaluated as moderate. Organization **stability/longevity** was evaluated as high, while **responsiveness** and **stakeholder relationships** were evaluated as moderate and **staff capacity** as low.

### Management potential

Overall, the management potential for the City of Santa Rosa was evaluated as moderate. One factor received a moderate-high ranking – **partner relationships**, while **monitoring & evaluation capacity**, **ability to learn and change**, and **science/technical support** received moderate rankings. **Existing mandate** received a low adaptive capacity ranking.

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*Overall vulnerability*

Increased vulnerability of homeless to extreme events was ranked by breakout group participants as having high vulnerability due to extreme risk (*almost certain likelihood x major consequence*) and moderate adaptive capacity. Increased damage to the ecosystem, reduced ability for staff to assess and restore open space, and loss of access to open space all received moderate vulnerability rankings due to high risk and moderate adaptive capacity (see Table 15 for comparison of vulnerability rankings).

**Table 15.** Vulnerability assessment ranking results for effects/impacts of greatest concern for Open Space.

| Effects/Impacts of Greatest Concern | Likelihood | Consequence | Risk | Adaptive Capacity | Vulnerability |
|---|---|---|---|---|---|
| Increased damage to the ecosystem, including habitat, wildlife, and fish, and resulting impacts on ecosystem services | Likely | Major | High | Moderate | Moderate |
| Increased vulnerability of homeless to extreme events, increasing pressure on the City to manage impacts | Almost Certain | Major | Extreme | Moderate | High |
| Reduced ability for staff to assess, restore, and monitor open space | Almost Certain | Moderate | High | Moderate | Moderate |
| Loss of access to open space due to wildfires, flooding, and other events, with impacts on community mental and physical health | Almost certain | Moderate | High | Moderate | Moderate |

## PROPOSED ADAPTATION STRATEGIES AND IMPLEMENTATION PLANS

### *Adaptation strategies for effects of greatest concern*

Breakout group participants identified adaptation strategies for Open Space ranging from **programmatic** (e.g., creating a program to provide homeless with jobs in Open Space) to **updating regulations and guidelines** (e.g., expanding tree protection ordinance to prevent planting of fire-prone trees) to **enhancing collaboration** (e.g., partnering with agencies, businesses, and organizations to help get the work done). The following table summarizes possible adaptation strategies in response to effects of greatest concern identified by breakout group participants (Table 16).

**Table 16.** Identified effects of greatest concern and possible adaptation strategies for Open Space.

| Effects of greatest concern | Adaptation strategies to reduce vulnerabilities |
|---|---|
| Increased damage to the ecosystem, including habitat, wildlife, and fish, and resulting impacts on ecosystem services | • Encourage climate-informed landscape architecture in order to reduce pressure on the City to actively manage habitat<br>• Increase protection and restoration of open space, preventing further urban encroachment<br>• Increase environmentally-sound, climate-informed planning and stewardship of the land, including increasing climate-informed design of trails and amenities<br>• Improve management of heavily used areas such as trails and amenities<br>• Explore innovative ways to manage the land (e.g., use different grazing techniques)<br>• Expand tree protection ordinance to prevent people from planting fire-prone trees, and revise the policy to take into account other climate considerations (e.g., drought) |
| Increased vulnerability of homeless to extreme events, increasing pressure on the City to manage impacts | • Explore ways to create a footprint for homeless to reside away from creeks and waterways<br>• Partner with agencies, businesses, community organizations, and others that have similar goals in mind (e.g., find opportunities to leverage volunteers to get the work done)<br>• Create a program to provide homeless with jobs in Open Space (e.g., clean ups, plantings, etc.)<br>• Increase available housing, affordable housing opportunities, vouchers, etc. |
| Reduced ability for staff to assess, restore, and monitor open space | • Fill vacant positions and identify places where new staffing is needed<br>• Partner with agencies, businesses, community organizations, and others that have similar goals in mind (e.g., find opportunities to leverage volunteers to get the work done) |
| Loss of access to open space due to wildfires, flooding, and other events, with impacts on community mental and physical health | • Increase protection and restoration of open space, preventing further urban encroachment<br>• Re-evaluate and revise insurance requirements and policies currently in place that restrict opportunities for |

| Effects of greatest concern | Adaptation strategies to reduce vulnerabilities |
|---|---|
| | agencies, private organizations, businesses, and others do work on City property<br>• Expand and/or establish a training program and certification (or explore potential for release waivers) for individuals or groups that can do work on City property, and do marketing to increase awareness about this opportunity<br>• Create matrix of criteria and prioritize areas to be opened up first and identify a suite of alternative areas to direct people to |

### *Implementation plans for priority strategies*

Breakout group participants selected five priority adaptation strategies, and developed implementation plans for each:

1. Fill vacant positions and identify places where new staffing is needed and hire for those positions

   *How to implement*: Implement across all elements

   *Leads & partners*:

   *Leads*: City Executive Team, City Council, Finance, Human Resources, individual departments

   *Partners*: Unions, hire outside consultant to look at staff classifications and where things can be moved around

2. Re-evaluate and revise insurance requirements and policies that are currently in place that restrict opportunities for private businesses, organizations, and others to help get work done on City property

   *How to implement*: Implement across all elements

   *Leads & partners*:

   *Leads*: City Executive Team, City Council

   *Partners*: City Attorney, Parks, unions, local fire departments, federal land management agencies, CAL FIRE, U.S. EPA, California Department of Fish & Wildlife

3. Increase environmentally sound, climate-informed planning and stewardship of the land

   *How to implement*: Integrate into Open Space, Land Use, Climate, and Environmental Justice elements

   *Leads & partners*:

   *Leads*: Parks, Public Works, Planning, Outreach/Community Engagement

   *Partners*: Regional Open Space District, Sonoma County Regional Parks (and others listed under "partner with agencies, businesses, community organizations, and others that have similar goals in mind"), Pepperwood Preserve, Carbon Cycle Institute, Community Alliance for Family Farmers, UC Co-op Extension, Regional Conservation Districts, Sonoma Water

4. Increase use of climate-informed landscape architecture and design (e.g., of trails, amenities) in order to reduce pressure on City to actively manage habitat

   *How to implement*: Integrate into Open Space, Land Use, Environmental Justice, and Public Services elements, as well as in jurisdictions required to address climate. The Climate Action Plan update as well as the Regional Climate Protection Authority Climate Mobilization Strategy also provide opportunities to incorporate this strategy.

   *Leads & partners*:

   *Leads*: Planning, Planning Commission, City Council, Climate Action Subcommittee

   *Partners*: Regional Climate Protection Authority, Sonoma Land Trust, Sonoma County Master Gardeners, consultants involved in specific plans

5. Partner with agencies, businesses, community organizations, and others that have similar goals in mind to help assess, restore, and monitor open space (e.g., find opportunities to leverage volunteers to get the work done)

   *How to implement*: Integrate into Open Space element specifically, but could be implemented across all elements. Find ways to involve more businesses in volunteer days.

   *Leads & partners*:

   *Leads*: Parks, City Council, Climate Action Subcommittee

   *Partners*: Regional Open Space District, Sonoma County Regional Parks, Sonoma Water, Santa Rosa Junior College, Fire Department, Sonoma State, Sonoma Ecology Center, Pepperwood Preserve, Sonoma Land Trust, Land Path, Greenway, Sonoma Trails Council and North Bay Conservation Corps, Chamber

of Commerce, businesses with volunteer days (e.g., Keysight, Kendall Jackson), Regional Climate Protection Authority

## Conclusions

The virtual workshop series and resulting report improve understanding of how community elements in Santa Rosa are vulnerable to changing climate conditions and presents possible adaptation strategies as well as adaptation implementation plans designed to minimize vulnerabilities and/or increase resilience of each element.

Many similarities emerged across elements, including:

- *Climate stressors*: extreme storm events/flooding, drought and extreme/prolonged heat, and wildfire were the most commonly selected climate stressors
- *Pre-existing conditions*: disadvantaged communities, homelessness and lack of affordable housing, insufficient staffing/funding, and aging infrastructure were the most commonly selected pre-existing conditions
- *Combined impacts of pre-existing conditions and climate stressors*:
    - Climate stressors (e.g., drought, flooding) are likely to exacerbate existing challenges related to limited water supply: reduced water quality and groundwater recharge, loss of trees and reduced tree health, decreased available habitat and quality of open space, increased risk of wildfire, loss of ecosystem services, and loss or impacts to recreation opportunities and agriculture.
    - Insufficient staffing combined with increased drought will result in reduced ability for staff to manage dry fuels. Limited water supply due to increased drought will make containing wildfires more difficult and could lead to more regulations for structure protection (e.g., design, location, access).
    - Insufficient staffing/funding combined with climate stressors (e.g., drought, wildfire, flooding) will likely lead to staff and funding reallocations and an increased need for coordination (i.e., because staff are shifted to address immediate challenges), further reducing institutional capacity and services and delaying repairs.
    - Extreme events (e.g., flooding, fire, drought) combined with aging infrastructure will exacerbate existing damages, failures, and/or insufficiencies (e.g., with water, roads, or communications infrastructure), reducing the City's ability to provide services.
    - Homelessness/lack of affordable housing combined with climate stressors such as increased flooding and/or wildfire is likely to lead to more locations becoming inappropriate for future development; increased homelessness, forced migration of homeless, and/or increased need for housing due to displacement of people; and increased costs to rebuild,

making it more challenging to build affordable housing and repair damaged homes.
    - Low-income households and disadvantaged communities are more vulnerable to climate stressors such as increased drought and extreme/prolonged heat events as these households are less likely to have air conditioning or sufficiently insulated walls to cope with extreme heat, leading to increased energy and water costs and/or utility shut-offs.
    - Increased drought and extreme/prolonged heat will place a greater demand on services already lacking in disadvantaged communities (e.g., cooling centers, medical, public libraries, businesses, fairgrounds/ veterans building) and lead to increased cost of cooling.
    - Climate stressors including increased drought, extreme/prolonged heat, and wildfires will result in fewer hours of work for outside workers and could increase medical costs (e.g., due to heat-related illness or injury or smoke inhalation) and lead to greater health impacts for people with chronic/pre-existing health issues due to stress or trauma.
    - Damage to roads or other transportation infrastructure as a result of flooding or other extreme events may affect emergency access and evacuation routes and limit response ability.

Many of the combined impacts of pre-existing conditions and climate stressors listed above were also identified by breakout groups as their impacts of greatest concern, including:

- Altered and/or damaged natural habitats (Land Use, Open Space)
- Loss/lack of power (Land Use, Environmental Justice, Housing, Transportation)
- Limited locations to build affordable housing, loss of housing units, and increased cost to build (Land Use, Housing, Economic Vitality)
- Greater demand and/or need for services in disadvantaged communities (Environmental Justice, Economic Vitality)
- Damage to utilities and infrastructure and loss of services and/or lack of access to services (Transportation, Public Services, Economic Vitality, Noise & Safety)
- Increased vulnerability of disadvantaged communities, homeless, and vulnerable populations, with implications for mental and physical health and well-being (Open Space, Transportation, Environmental Justice)

The similarities in impacts of greatest concern also resulted in many overlapping adaptation strategies, such as:

- Promote the use of native plants better suited for anticipated conditions (increased drought, wildfire) and/or plant with climate ready species

- Implement climate-informed planning and stewardship of the land, including conducting public education and outreach campaigns for residents to learn about climate-informed measures (e.g., rain gardens, defensible space, avoiding planting fire-prone trees, etc.)
- Create more and/or increase protection and restoration of open space, preventing further urban encroachment and increasing accessibility of areas for disadvantaged communities
- Decentralize power supplies, for example, by implementing community and city micro-grids and storage/backup and/or supporting community solar grids
- Improve reliability and redundancy of communication technology (e.g., mobile and/or neighborhood cell towers, mobile battery trucks for neighborhoods and buildings)
- Create community resilience centers/hubs, including organizing community response for self-rescue and resources and identifying vulnerable individuals so that neighborhood groups can reach out and check on them during power outages and other extreme events
- Improve outreach and communication with vulnerable populations to increase understanding of available resources and how to access them
- Increase number and capacity of cooling centers, and include cooling in community centers in affordable housing developments
- Create and expand mutual aid networks as well as resource/skill networks to think beyond emergency management services to those in the private sector that could assist in emergencies
- Incentivize or simplify safe space development, plan for resilient development expansion (e.g., compact, higher-density areas), require appropriate construction/defensive measures in residential areas, and disincentivize/prohibit building in hazard-prone locations
- Implement appropriate construction/defensive measures in residential areas, including helping fund residents to retrofit housing to increase resilience to fire and floods and ensuring adequate fire response and water availability in high-risk areas
- Ensure new and existing developments take into account availability of transportation and other services that enable people to evacuate and/or access resources during extreme events (e.g., heat, wildfire, flooding)
- Support managed retreat from high-risk areas by creating incentives and/or develop a strategy to address buy-out or transfer of development right credits to property owners in hazard zones
- Improve water use efficiency and storage and reduce water loss in homes and city services (water, wastewater)

This report can be used as a reference for decision-makers as they plan for and commit resources to create a more sustainable and resilient community. The adaptation strategies listed above are likely priorities for the City of Santa Rosa to pursue for implementation as they advance resiliency and may present opportunities to leverage resources across multiple elements. Because climate adaptation is an iterative process and new research and modeling on projected climate changes and impacts is regularly released, it is important to revisit and/or revise the vulnerability assessments and adaptation strategies on a regular basis (e.g., every 5-10 years).

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# Appendix A. Workshop Participants, Affiliations, and Breakout Group Assignments

| Participant Name | Affiliation | Breakout Group |
|---|---|---|
| Adams, Nancy | City of Santa Rosa, Transportation and Public Works Department | Transportation/Noise & Safety |
| Amador, B | City of Santa Rosa, Water Department | Land Use/Economic Vitality |
| Amato, Thomas | Oakmont Democratic Club | Housing/Environmental Justice |
| Anderson, Kevin | Daily Acts | Housing/Environmental Justice |
| Birdlebough, Steve | Transportation & Land-Use Coalition of Sonoma County | Transportation/Noise & Safety |
| Bladow, Terri | City of Santa Rosa, Recreation and Parks Department | Transportation/Noise & Safety |
| Capps, BC | Sonoma County Regional Climate Protection Authority (RCPA) | Public Services/Open Space |
| Condon Monroe, Cecily | County of Sonoma, Permit & Resource Management Department | Land Use/Economic Vitality |
| Conway, Kevin | Friends of the Climate Action Plan | Land Use/Economic Vitality |
| Doyle, Ginny | Santa Rosa Together | Housing/Environmental Justice |
| Elias, Jane | County of Sonoma, Energy and Sustainability Division | Transportation/Noise & Safety |
| Englehorn, Dale | Independent Contractor | Land Use/Economic Vitality |
| Frankl, Philip | Academy of Art University | Land Use/Economic Vitality |
| Gabor, Katharine | Self-employed | Housing/Environmental Justice |
| Gage, Eric | County of Sonoma, Permit & Resource Management Department | Land Use/Economic Vitality |
| Gang, Pete | Climate Reality Leaders | Public Services/Open Space |
| Gustavson, Andy | City of Santa Rosa, Planning and Economic Development Department | Transportation/Noise & Safety |

| Participant Name | Affiliation | Breakout Group |
|---|---|---|
| Guzman, Jesus | Generation Housing | Housing/Environmental Justice |
| Hardage, Ian | City of Santa Rosa, Fire Department | Transportation/Noise & Safety |
| Hensel, Thea | Santa Rosa Southeast Greenway | Public Services/Open Space |
| Jewett, Aaron | City of Santa Rosa, Recreation Department | Public Services/Open Space |
| Liebman, David | Sonoma County Junior College District | Land Use/Economic Vitality |
| Lowenthal, Paul | City of Santa Rosa, Fire Department | Housing/Environmental Justice |
| Lyle, Amy | City of Santa Rosa, Advance Planning | Housing/Environmental Justice |
| Meads, Shari | City of Santa Rosa, Planning and Economic Development Department | Housing/Environmental Justice |
| Morgan, Angela | City of Santa Rosa, Housing and Community Services Department | Housing/Environmental Justice |
| Mortensen, Mark | Friends of the Climate Action Plan | Transportation/Noise & Safety |
| Moulton, Barbara | Citizens' Climate Lobby; League of Women Voters | Transportation/Noise & Safety |
| Myers, Claire | City of Santa Rosa, Water Department | Public Services/Open Space |
| Nicholson, Amy | City of Santa Rosa, Planning and Economic Development Department | Land Use/Economic Vitality |
| Nordlie, Claire | City of Santa Rosa, Water Department | Public Services/Open Space |
| Petritz, David | Sonoma County Conservation Action | Land Use/Economic Vitality |
| Shore, Teri | Greenbelt Alliance | Public Services/Open Space |
| Thompson, Chris | Oakmont Democratic Club | Housing/Environmental Justice |

# Appendix B. Climate Changes and Impacts Table


| | CLIMATE VARIABLE | METRIC | TREND | PROJECTED CHANGES |
|---|---|---|---|---|
| *DIRECT CLIMATE CHANGES* | Air temperature | Minimum temperature | ▲ | +4.4°F by 2050 and +8.1°F by 2100<br>COMPARED TO OBSERVED ANNUAL AVERAGE OF 43°F FROM 1961–1990 |
| | | Maximum temperature | ▲ | +4.3°F by 2050 and +7.5°F by 2100<br>COMPARED TO OBSERVED ANNUAL AVERAGE OF 71.1°F FROM 1961–1990 |
| | Precipitation | Annual precipitation | ● | +5.5 inches per year (+16%) by 2050 and +9.9 inches per year (+28%) by 2100, but model projections vary widely<br>COMPARED TO OBSERVED AVERAGE OF 34.9 INCHES FROM 1961–1990 |
| | | Seasonality | ▲▼ | Shorter/more intense wet season, with later onset of fall rains and earlier onset of the dry season; more pronounced interannual variability |
| *INDIRECT CLIMATE CHANGES* | Extreme heat | Extreme heat days<br>MAXIMUM TEMPERATURES OVER 98.1°F | ▲▲ | +10 days per year (+250%) by 2050 and +20 days per year (+500%) by 2100<br>COMPARED TO OBSERVED AVERAGE OF 4 DAYS PER YEAR FROM 1961–1990 |
| | | Heat wave duration<br>MOST CONSECUTIVE EXTREME HEAT DAYS PER YEAR | ▲▲ | +2.5 days per year (+109%) by 2050 and +4 days per year (+174%) by 2100<br>COMPARED TO OBSERVED AVERAGE OF 2.3 DAYS PER YEAR FROM 1961–1990 |
| | Extreme precipitation | Intensity of extreme events<br>2-DAY TOTAL EXCEEDED ONCE IN 20 YEARS | ▲ | +0.3 inches (+3%) by 2050 and +1.9 inches (+20%) by 2100<br>COMPARED TO OBSERVED 20-YEAR RETURN LEVEL OF 9.4 INCHES FROM 1961–1990 |
| | | Frequency of extreme events<br># OF EVENTS WITH 2-DAY TOTAL OVER 1.99 INCHES | ● | +2 events per year (+67%) by 2050 and +3 events per year (+100%) by 2100, but model projections vary widely<br>COMPARED TO OBSERVED AVERAGE FREQUENCY OF 3 EVENTS PER YEAR FROM 1961–1990 |
| | Wildfire | Annual area burned | ▲ | +9 hectares per year (+9.7%) by 2050 and +16.9 hectares per year (+18%) by 2100<br>COMPARED TO OBSERVED ANNUAL AVERAGE OF 93.1 HECTARES (RANGE OF 20–220) FROM 1961–1990 |
| | Drought | Risk of drought years | ▲▲ | Drought years are twice as likely to occur in any given year by 2050 |
| | | Drought severity | ▲▲ | Severe droughts that now occur every 20 years will occur once every 10 years, while 100-year droughts will occur every 20 years by 2100 |